

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST
CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE)
CB SCHEME

SYSTEME CEI D'ACCEPTATION MUTUELLE DE
CERTIFICATS D'ESSAIS DES EQUIPEMENTS
ELECTRIQUES (IECEE) METHODE OC

CB TEST CERTIFICATE

CERTIFICAT D'ESSAI OC

Product
Produit

Ethernet Microwave Transmission Unit

Name and address of the applicant
Nom et adresse du demandeur

DragonWave Inc.
411 Legget Dr. Suite 600, Kanata, Onatrio CANADA K2K 3C9

Name and address of the manufacturer
Nom et adresse du fabricant

Same as Applicant.

Name and address of the factory
Nom et adresse de l'usine

Same as Applicant.

 Additional Information on page 2

Note: When more than one factory, please report on page 2
Note: Lorsque il y plus d'une usine, veuillez utiliser la 2^{ème} page

Ratings and principal characteristics
Valeurs nominales et caractéristiques principales

48Vdc, 1A

Trademark (if any)
Marque de fabrique (si elle existe)



Type of Manufacturer's Testing Laboratories used
Type de programme du laboratoire d'essais constructeur

N/A

Model / Type Ref.
Ref. De type

Horizon Compact Plus, HC+

Additional information (if necessary may also be reported
on page 2)
Les informations complémentaires (si nécessaire,, peuvent
être indiqués sur la 2^{ème} page

 Additional Information on page 2

A sample of the product was tested and found
to be in conformity with
Un échantillon de ce produit a été essayé et a été
considéré conforme à la

IEC 60950-1:2005 (Second Edition) + Am 1:2009 and EN
60950-1:2006 including A11:2009, A1:2010 and/or A12:2011
The national differences for the following countries were
considered: CA, DE, DK, FI, GB, IL, KR, SE, SI and US. Refer
to Attachment 1A and 1B of report for National Deviations.

As shown in the Test Report Ref. No. which forms part of
this Certificate
Comme indiqué dans le Rapport d'essais numéro de
référence qui constitue partie de ce Certificat

CB 215348-2522648

This CB Test Certificate is issued by the National Certification Body
Ce Certificat d'essai OC est établi par l'Organisme **National de Certification**



CSA Group, Certification and Testing Division
178 Rexdale Boulevard
Toronto, ON M9W 1R3



Date: 2012-12-19

Signature: Tiki Wong, P.Eng.

General product information:

Subject Model, Horizon Compact Plus or HC+, is a metal enclosed Ethernet modem, with wireless data TX/RX in microwave frequencies. Subject model is designed for use in outdoors environments with IP66 ratings, and was evaluated to IEC 60950-22 requirements. Power Over Ethernet (POE) provides the 48Vdc via a separately approved AC/DC adapter evaluated to POE requirements. The chassis is provided with protective earth terminal for permanent connection to protective earth. All internal circuits operate at SELV and powered by the POE input, which is also considered Limited Power Source.

The POE, for isolation purposes, is considered as TNV-1 circuit. The SELV ground plane was tested at 20A for bonding resistance.

Manufacturer's rated Operating Temperature: -40°C to +60°C.


Note:

Subject model is rated at altitude of up to 4500 m, additional clearance was deemed not necessary. No additional correction factor to IEC 60664 was applied, as subject model requires only functional insulation.

Conditions of acceptability:

1. The acceptability of this report in countries that have not declared national differences to IEC 60950-1:2005+A1:2009 at the time this report was issued will be up to the discretion of the Recognizing NCB upon submittal of this report.
2. Subject model shall be connected to protective earth according to local electrical authority.
3. EMC compliance and RoHS compliance is not part of this evaluation. Manufacturer shall supply recognizing NCB, as applicable, objective evidence to support prove of compliance.
4. Input shall be connected to an approved type power supply according to Power Over Ethernet requirements, meeting the requirements for Limited Power Source.
5. Ethernet output connector P1, shall be connected to SELV circuit only.
6. Mounting hardware and the suitability of the structure is to be evaluated at the end installation.
7. All safety related information shall be provided in a language acceptable for country of use.
8. CAT 5 cable, suitable for outdoor use, shall be provided at the end installation.
9. Only Approved type Class 1 Laser transceiver shall be used.
10. Upstream breaker, maximum 10A, shall be provided in end installation.



11. The symbol (IEC 60417-5041 (DB:2002-10)): , shall be placed on the enclosure at a prominent position, such that the user and serviceman can easily see the symbol.

Additional information (if necessary)**Information complémentaire (si nécessaire)**

Date: 2012-12-19

Signature: Tiki Wong, P.Eng.



Test Report issued under the responsibility of:



TEST REPORT
IEC 60950-1
Information technology equipment – Safety –
Part 1: General requirements

Report Number : CB 215348-2522648
Date of issue : 2012-12-11
Total number of pages : 48 pages

CB Testing Laboratory : CSA International
Address : 178 Rexdale Blvd, Toronto, Ontario CANADA, M9W 1R3

Applicant's name : DragonWave Inc.
Address : 411 Legget Dr. Suite 600, Kanata, Onatrio CANADA K2K 3C9

Manufacturer's name : DragonWave Inc.
Address : 411 Legget Dr. Suite 600, Kanata, Onatrio CANADA K2K 3C9

Test specification:
Standard..... : IEC 60950-1:2005 (Second Edition) + Am 1:2009
EN 60950-1:2006 + A11:2009, A1:2010 and/or A12:2011

Test procedure : CB Scheme
Non-standard test method..... : N/A

Test Report Form No. : IEC60950_1C
Test Report Form(s) Originator..... : SGS Fimko Ltd
Master TRF : Dated 2012-08

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If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description : Ethernet Microwave Transmission Unit

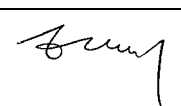

Trade Mark :



Manufacturer : DragonWave Inc.

Model/Type reference..... : Horizon Compact Plus, HC+

Ratings..... : 48V DC, 1A

Testing procedure and testing location:		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	CSA International
Testing location/ address		178 Rexdale Blvd, Toronto, Ontario CANADA, M9W 1R3
<input type="checkbox"/>	Associated CB Laboratory:	
Testing location/ address		
Tested by (name + signature)..... :		Eric Wong 
Approved by (name + signature)		Eddie Chau 
<input type="checkbox"/>	Testing procedure: TMP	
Testing location/ address		
Tested by (name + signature)..... :		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: WMT	
Testing location/ address		
Tested by (name + signature)..... :		
Witnessed by (name + signature).... :		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: SMT	
Testing location/ address		
Tested by (name + signature)..... :		
Approved by (name + signature)		
Supervised by (name + signature)... :		
Approved by (name + signature)		
<input type="checkbox"/>	Testing procedure: RMT	
Testing location/ address		
Tested by (name + signature)..... :		
Approved by (name + signature)		
Supervised by (name + signature)... :		

List of Attachments (including a total number of pages in each attachment):

Attachments are as listed under the following **CB Report Contents** page.

Note: The **CB Report Contents** and **Report Revision Record** have been added by CSA Group.

CB Report Contents

CB Report	<i>48 pages</i>
Cover Pages	<i>Page 1 to 3</i>
Contents	<i>Page 4</i>
Report Revision Record	<i>Page 5</i>
Summary of testing and Summary of compliance with National Differences	<i>Page 6</i>
Copy of marking plate	<i>Page 7</i>
Test item particulars	<i>Page 8</i>
Manufacturer's Declaration per sub-clause 6.2.5 of IEC 02, and Name and address of factory (ies)	<i>Page 9</i>
General product information & Conditions of acceptability	<i>Page 10</i>
Report Check List	<i>Page 11 to 48</i>

Attachments

1	IEC 60920-22 report (CSA Report No. CB 215348-2522741, Attachment 1)	<i>38 pages</i>
1A	European Group Differences & National Differences Checklist EN 60950-1:2006+A11:2009+A1:2010 and/or A12:2011	<i>17 pages</i>
1B	National Deviation Checklist IEC 60950-1:2005 (2nd Edition); Am1:2009	<i>12 pages</i>
2	Photographs	<i>8 pages</i>
3	Schematic Diagrams (Retained at CSA under project 2522741)	<i>46 pages</i>
4	User's manual	<i>102 pages</i>
5	DC/DC converter report	<i>40 pages</i>
6	Enclosure details	<i>10 pages</i>

Note: Number of pages in the printed report may vary due to the use of different print driver.

Report Revision Record

Edition 1: 2012-12-11 CSA Application No. CB 215348-2522648 (Toronto Office)

Issued by Eric Wong; Reviewed by Eddie Chau

CB Certificate CA/14890/CSA issued.

Summary of testing:
Tests performed (name of test and test clause):
Clause 1.6.2 – Input
Clause 1.7.11 – Marking durability
Clause 2.6.3.4 - Resistance of Earthing
Clause 4.2 – Mechanical Strength
Clause 4.5.2 – Temperature Tests
Clause 6.2.2.2 – TVN(Steady State Test)
Testing location:
CSA International

 178 Rexdale Blvd, Toronto, Ontario CANADA,
M9W 1R3

Summary of compliance with National Differences

The national differences for the following countries were considered: CA, DE, DK, FI, GB, IL, KR, SE, SI and US.

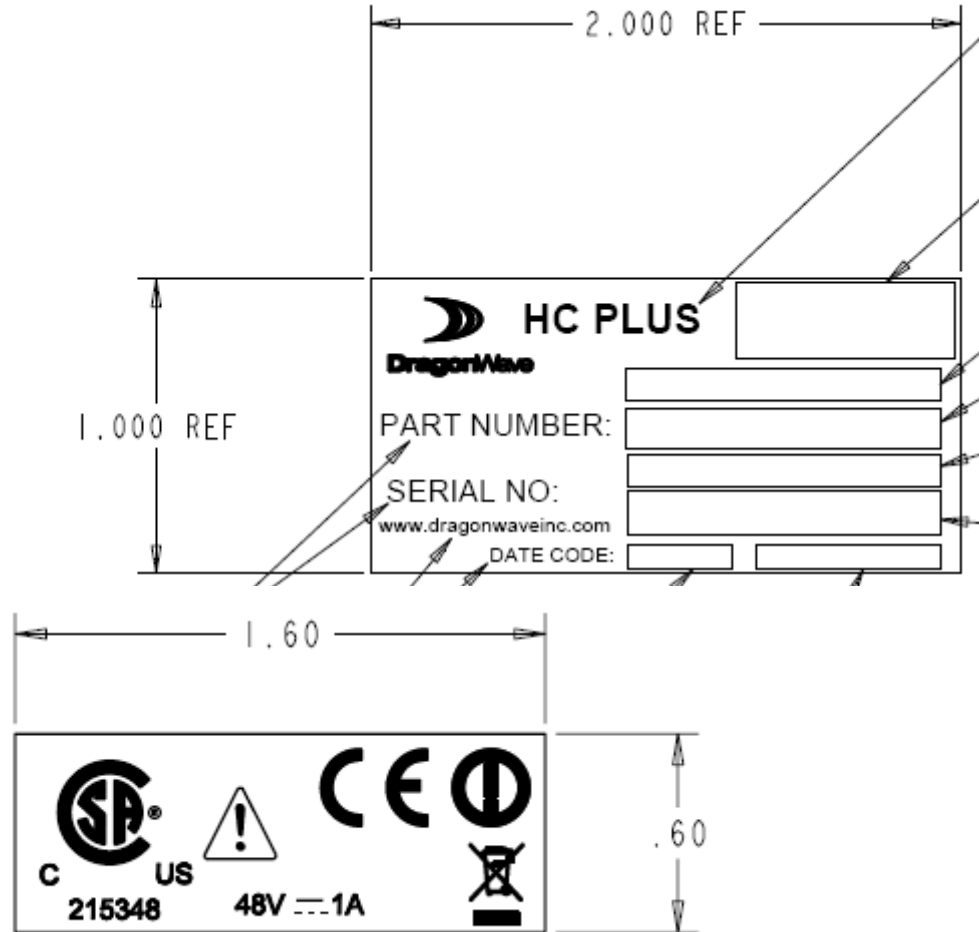
The product also fulfils the requirements of EN 60950-1:2006 including A11:2009, A1:2010 and/or A12:2011 as deemed applicable and group differences and special national conditions for the following countries: AT, BE, BG, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IS, IE, IT, LV, LT, LU, MT, NL, NO, PL, PT, RO, SK, SI, ES, SE, CH, GB, TR (see Att1A - European Group Differences).

Note: The above National Differences, Group Differences and Special National Conditions were verified to be as indicated on the IECEE Website <http://members.iecee.org/iecee/ieceemembers.nsf> at the time this report was issued.

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

(Additional requirements for markings. See 1.7 NOTE)



Test item particulars.....:	
Equipment mobility	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input type="checkbox"/> transportable <input checked="" type="checkbox"/> stationary <input type="checkbox"/> for building-in <input type="checkbox"/> direct plug-in
Connection to the mains.....	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> type A <input type="checkbox"/> type B <input type="checkbox"/> permanent connection <input type="checkbox"/> detachable power supply cord <input type="checkbox"/> non-detachable power supply cord <input checked="" type="checkbox"/> not directly connected to the mains
Operating condition	<input checked="" type="checkbox"/> continuous <input type="checkbox"/> rated operating / resting time:
Access location	<input type="checkbox"/> operator accessible <input checked="" type="checkbox"/> restricted access location
Over voltage category (OVC)	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV <input checked="" type="checkbox"/> other: POE is considered TNV-1
Mains supply tolerance (%) or absolute mains supply values	Not connected to Mains
Tested for IT power systems	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
IT testing, phase-phase voltage (V)	
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified
Considered current rating of protective device as part of the building installation (A)	
Pollution degree (PD)	<input type="checkbox"/> PD 1 <input checked="" type="checkbox"/> PD 2 <input type="checkbox"/> PD 3
IP protection class	IP56 declared in user's manual.
Altitude during operation (m)	4500
Altitude of test laboratory (m)	173
Mass of equipment (kg)	3.4
Possible test case verdicts:	
- test case does not apply to the test object.....	: N/A
- test object does meet the requirement	: P (Pass)
- test object does not meet the requirement	: F (Fail)
Testing	
Date of receipt of test item.....	: 2012-04-16
Date(s) of performance of tests.....	: 2012-06-07 to 2012-11-15
General remarks:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.	
Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided: Yes Not applicable

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies):

Plexus Manufacturing
Bayan Lepas Free Industrial Zone
11900 Bayan Lepas
Penang, Malaysia

General product information:

Subject Model, Horizon Compact Plus or HC+, is a metal enclosed Ethernet modem, with wireless data TX/RX in microwave frequencies. Subject model is designed for use in outdoors environments with IP66 ratings, and was evaluated to IEC 60950-22 requirements. Power Over Ethernet (POE) provides the 48Vdc via a separately approved AC/DC adapter evaluated to POE requirements. The chassis is provided with protective earth terminal for permanent connection to protective earth. All internal circuits operate at SELV and powered by the POE input, which is also considered Limited Power Source.

The POE, for isolation purposes, is considered as TNV-1 circuit. The SELV ground plane was tested at 20A for bonding resistance.

Manufacturer's rated Operating Temperature : -40°C to +60°C.


Note:

Subject model is rated at altitude of up to 4500 m, additional clearance was deemed not necessary. No additional correction factor to IEC 60664 was applied, as subject model requires only functional insulation.

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9. Only Approved type Class 1 Laser transceiver shall be used.
10. Upstream breaker, maximum 10A, shall be provided in end installation.



11. The symbol (IEC 60417-5041 (DB:2002-10)):  , shall be placed on the enclosure at a prominent position, such that the user and serviceman can easily see the symbol.

Abbreviations used in the report:

- normal conditions	N.C.	- single fault conditions	S.F.C
- functional insulation	OP	- basic insulation	BI
- double insulation	DI	- supplementary insulation	SI
- between parts of opposite polarity	BOP	- reinforced insulation	RI

Indicate used abbreviations (if any)

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
1	GENERAL		P
1.5	Components		P
1.5.1	General		P
	Comply with IEC 60950-1 or relevant component standard	(see appended tables 1.5.1)	P
1.5.2	Evaluation and testing of components		P
1.5.3	Thermal controls		N/A
1.5.4	Transformers	Evaluated in approved DC/DC converter for Basic Insulation.	P
1.5.5	Interconnecting cables		P
1.5.6	Capacitors bridging insulation	TNV 1 to SELV, functional only.	N/A
1.5.7	Resistors bridging insulation		N/A
1.5.7.1	Resistors bridging functional, basic or supplementary insulation		N/A
1.5.7.2	Resistors bridging double or reinforced insulation between a.c. mains and other circuits	No double or Reinforced Insulation.	N/A
1.5.7.3	Resistors bridging double or reinforced insulation between a.c. mains and antenna or coaxial cable		N/A
1.5.8	Components in equipment for IT power systems	No AC Mains connections.	N/A
1.5.9	Surge suppressors		P
1.5.9.1	General		P
1.5.9.2	Protection of VDRs	PTC provided.	P
1.5.9.3	Bridging of functional insulation by a VDR	TNV-1 to SELV	P
1.5.9.4	Bridging of basic insulation by a VDR		N/A
1.5.9.5	Bridging of supplementary, double or reinforced insulation by a VDR		N/A
1.6	Power interface		P
1.6.1	AC power distribution systems		N/A
1.6.2	Input current	(see appended table 1.6.2)	P
1.6.3	Voltage limit of hand-held equipment		N/A
1.6.4	Neutral conductor		N/A
1.7	Marking and instructions		P
1.7.1	Power rating and identification markings		P
1.7.1.1	Power rating marking		P

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
	Multiple mains supply connections.....:		N/A
	Rated voltage(s) or voltage range(s) (V)	48Vdc	P
	Symbol for nature of supply, for d.c. only		P
	Rated frequency or rated frequency range (Hz) ...:		N/A
	Rated current (mA or A)	1.0A	P
1.7.1.2	Identification markings		P
	Manufacturer's name or trade-mark or identification mark		P
	Model identification or type reference	Horizon Compact Plus, HC+	P
	Symbol for Class II equipment only		N/A
	Other markings and symbols		N/A
1.7.2	Safety instructions and marking		P
1.7.2.1	General		P
1.7.2.2	Disconnect devices	Not connected to AC mains.	N/A
1.7.2.3	Overcurrent protective device	Connection to POE via RJ45	N/A
1.7.2.4	IT power distribution systems		N/A
1.7.2.5	Operator access with a tool		N/A
1.7.2.6	Ozone		N/A
1.7.3	Short duty cycles		N/A
1.7.4	Supply voltage adjustment		N/A
	Methods and means of adjustment; reference to installation instructions		N/A
1.7.5	Power outlets on the equipment		N/A
1.7.6	Fuse identification (marking, special fusing characteristics, cross-reference)	None provided.	N/A
1.7.7	Wiring terminals		N/A
1.7.7.1	Protective earthing and bonding terminals	IEC 60417-5019 adjacent to terminal	P
1.7.7.2	Terminals for a.c. mains supply conductors		N/A
1.7.7.3	Terminals for d.c. mains supply conductors		N/A
1.7.8	Controls and indicators	No Safety Related Controls or Indicators	N/A
1.7.8.1	Identification, location and marking		N/A
1.7.8.2	Colours		N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
1.7.8.3	Symbols according to IEC 60417		N/A
1.7.8.4	Markings using figures		N/A
1.7.9	Isolation of multiple power sources		N/A
1.7.10	Thermostats and other regulating devices		N/A
1.7.11	Durability		P
1.7.12	Removable parts		N/A
1.7.13	Replaceable batteries		N/A
	Language(s)		—
1.7.14	Equipment for restricted access locations.....		N/A
2	PROTECTION FROM HAZARDS		P
2.1	Protection from electric shock and energy hazards		P
2.1.1	Protection in operator access areas	POE input is considere as TNV-1, enclosure is provided with permanent earth terminal. >240VA input.	N/A
2.1.1.1	Access to energized parts	Only earthed chassis and SELV circuits are accessible.	P
	Test by inspection		P
	Test with test finger (Figure 2A)		P
	Test with test pin (Figure 2B)		P
	Test with test probe (Figure 2C)		N/A
2.1.1.2	Battery compartments	No Battery	N/A
2.1.1.3	Access to ELV wiring		N/A
	Working voltage (V _{peak} or V _{rms}); minimum distance through insulation (mm)		—
2.1.1.4	Access to hazardous voltage circuit wiring		N/A
2.1.1.5	Energy hazards	No hazardous energy available.	N/A
2.1.1.6	Manual controls	No Hazardous Voltage	N/A
2.1.1.7	Discharge of capacitors in equipment	Nominal 48Vdc only	N/A
	Measured voltage (V); time-constant (s).....		—
2.1.1.8	Energy hazards – d.c. mains supply		N/A
	a) Capacitor connected to the d.c. mains supply ...		N/A
	b) Internal battery connected to the d.c. mains supply		N/A
2.1.1.9	Audio amplifiers		N/A
2.1.2	Protection in service access areas	Nominal 48Vdc only	N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
2.1.3	Protection in restricted access locations	Nominal 48Vdc only	N/A
2.2	SELV circuits		P
2.2.1	General requirements	Evaluated in approved DC/DC converter.	P
2.2.2	Voltages under normal conditions (V)	Evaluated in approved DC/DC converter.	P
2.2.3	Voltages under fault conditions (V)	Evaluated in approved DC/DC converter.	P
2.2.4	Connection of SELV circuits to other circuits	SELV only	P
2.3	TNV circuits		P
2.3.1	Limits		N/A
	Type of TNV circuits	PoE input is considered as TNV-1, seperated approved.	—
2.3.2	Separation from other circuits and from accessible parts	Accessible Chassis is provided with earth terminal for permanent connection to safety earth.	P
2.3.2.1	General requirements	No connection to TNV circuits	N/A
2.3.2.2	Protection by basic insulation		N/A
2.3.2.3	Protection by earthing	Accessible Chassis is provided with earth terminal for permanent connection to safety earth.	P
2.3.2.4	Protection by other constructions		N/A
2.3.3	Separation from hazardous voltages		N/A
	Insulation employed		—
2.3.4	Connection of TNV circuits to other circuits	PoE is considered TNV-1	P
	Insulation employed	Functional	—
2.3.5	Test for operating voltages generated externally		N/A
2.4	Limited current circuits		N/A
2.4.1	General requirements		N/A
2.4.2	Limit values		N/A
	Frequency (Hz).....		—
	Measured current (mA)		—
	Measured voltage (V)		—

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
	Measured circuit capacitance (nF or μ F)		—
2.4.3	Connection of limited current circuits to other circuits		N/A
2.5	Limited power sources		N/A
	a) Inherently limited output	Input shall be approved type POE	N/A
	b) Impedance limited output		N/A
	c) Regulating network limited output under normal operating and single fault condition		N/A
	d) Overcurrent protective device limited output		N/A
	Max. output voltage (V), max. output current (A), max. apparent power (VA)		—
	Current rating of overcurrent protective device (A) ..		—
	Use of integrated circuit (IC) current limiters		
2.6	Provisions for earthing and bonding		P
2.6.1	Protective earthing		P
2.6.2	Functional earthing		N/A
2.6.3	Protective earthing and protective bonding conductors		N/A
2.6.3.1	General		P
2.6.3.2	Size of protective earthing conductors	Refer to Conditions of Acceptability.	N/A
	Rated current (A), cross-sectional area (mm^2), AWG		—
2.6.3.3	Size of protective bonding conductors		N/A
	Rated current (A), cross-sectional area (mm^2), AWG		—
	Protective current rating (A), cross-sectional area (mm^2), AWG		
2.6.3.4	Resistance of earthing conductors and their terminations; resistance (Ω), voltage drop (V), test current (A), duration (min)	0.008ohm, 0.320V, 40A, 2 minutes from Earth terminal to chassis. 0.005ohm, 95mV, 20A, 2 minutes. From SELV ground plane to chassis.	P
2.6.3.5	Colour of insulation	End installation consideration.	N/A
2.6.4	Terminals		P
2.6.4.1	General		P

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
2.6.4.2	Protective earthing and bonding terminals		P
	Rated current (A), type, nominal thread diameter (mm)	6 AWG ground wire to be connected to earth terminal, refer to installation Instructions. Terminal accept M6 screw/bolt.	—
2.6.4.3	Separation of the protective earthing conductor from protective bonding conductors		N/A
2.6.5	Integrity of protective earthing		P
2.6.5.1	Interconnection of equipment		N/A
2.6.5.2	Components in protective earthing conductors and protective bonding conductors		N/A
2.6.5.3	Disconnection of protective earth		N/A
2.6.5.4	Parts that can be removed by an operator		N/A
2.6.5.5	Parts removed during servicing		N/A
2.6.5.6	Corrosion resistance	Protective Earthing Conductor to be provided in end installation. Refer to Conditions of Acceptability.	N/A
2.6.5.7	Screws for protective bonding	Enclosure thickness is suitable.	P
2.6.5.8	Reliance on telecommunication network or cable distribution system		N/A
2.7	Overcurrent and earth fault protection in primary circuits		N/A
2.7.1	Basic requirements	No connections to primary circuits.	N/A
	Instructions when protection relies on building installation		N/A
2.7.2	Faults not simulated in 5.3.7		N/A
2.7.3	Short-circuit backup protection		N/A
2.7.4	Number and location of protective devices		N/A
2.7.5	Protection by several devices		N/A
2.7.6	Warning to service personnel		N/A
2.8	Safety interlocks		N/A
2.8.1	General principles		N/A
2.8.2	Protection requirements		N/A
2.8.3	Inadvertent reactivation		N/A
2.8.4	Fail-safe operation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Protection against extreme hazard		N/A
2.8.5	Moving parts		N/A
2.8.6	Overriding		N/A
2.8.7	Switches, relays and their related circuits		N/A
2.8.7.1	Separation distances for contact gaps and their related circuits (mm)		N/A
2.8.7.2	Overload test		N/A
2.8.7.3	Endurance test		N/A
2.8.7.4	Electric strength test		N/A
2.8.8	Mechanical actuators		N/A
2.9	Electrical insulation		P
2.9.1	Properties of insulating materials		P
2.9.2	Humidity conditioning	Evaluated in Approved DC/DC converter.	P
	Relative humidity (%), temperature (°C)		—
2.9.3	Grade of insulation	Basic and Functional	P
2.9.4	Separation from hazardous voltages		N/A
	Method(s) used		—
2.10	Clearances, creepage distances and distances through insulation		P
2.10.1	General	Evaluated in Approved DC/DC converter.	P
2.10.1.1	Frequency		P
2.10.1.2	Pollution degrees	2	P
2.10.1.3	Reduced values for functional insulation		N/A
2.10.1.4	Intervening unconnected conductive parts		N/A
2.10.1.5	Insulation with varying dimensions		N/A
2.10.1.6	Special separation requirements		N/A
2.10.1.7	Insulation in circuits generating starting pulses		N/A
2.10.2	Determination of working voltage		P
2.10.2.1	General		P
2.10.2.2	RMS working voltage	Evaluated in Approved DC/DC converter.	P
2.10.2.3	Peak working voltage	Evaluated in Approved DC/DC converter.	P
2.10.3	Clearances		P

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Clause	Requirement + Test	Result - Remark	Verdict
2.10.3.1	General		P
2.10.3.2	Mains transient voltages	Not connected to AC mains. TNV-1 is considered for the PoE input.	N/A
	a) AC mains supply		N/A
	b) Earthed d.c. mains supplies		N/A
	c) Unearthed d.c. mains supplies		N/A
	d) Battery operation		N/A
2.10.3.3	Clearances in primary circuits		N/A
2.10.3.4	Clearances in secondary circuits	TNV-1 to ground functional insulation. TNV-1 to unearthed SELV, basic considered in approved DC/DC converter.	P
2.10.3.5	Clearances in circuits having starting pulses		N/A
2.10.3.6	Transients from a.c. mains supply		N/A
2.10.3.7	Transients from d.c. mains supply		N/A
2.10.3.8	Transients from telecommunication networks and cable distribution systems	TNV-1 is considered for the PoE input. Provisioned for Permanent Earth connection.	P
2.10.3.9	Measurement of transient voltage levels		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply		N/A
	For a d.c. mains supply		N/A
	b) Transients from a telecommunication network :		N/A
2.10.4	Creepage distances	Basic insulation evaluated in approved DC/DC converter.	P
2.10.4.1	General		P
2.10.4.2	Material group and comparative tracking index		P
	CTI tests	Material group IIIb is assumed to be used	—
2.10.4.3	Minimum creepage distances	(see appended table 2.10.3 and 2.10.4)	P
2.10.5	Solid insulation		N/A
2.10.5.1	General		N/A
2.10.5.2	Distances through insulation		N/A
2.10.5.3	Insulating compound as solid insulation		N/A
2.10.5.4	Semiconductor devices		N/A
2.10.5.5.	Cemented joints		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
2.10.5.6	Thin sheet material – General		N/A
2.10.5.7	Separable thin sheet material		N/A
	Number of layers (pcs).....:		—
2.10.5.8	Non-separable thin sheet material		N/A
2.10.5.9	Thin sheet material – standard test procedure		N/A
	Electric strength test		—
2.10.5.10	Thin sheet material – alternative test procedure		N/A
	Electric strength test		—
2.10.5.11	Insulation in wound components		N/A
2.10.5.12	Wire in wound components		N/A
	Working voltage		N/A
	a) Basic insulation not under stress		N/A
	b) Basic, supplementary, reinforced insulation		N/A
	c) Compliance with Annex U		N/A
	Two wires in contact inside wound component; angle between 45° and 90°		N/A
2.10.5.13	Wire with solvent-based enamel in wound components		N/A
	Electric strength test		—
	Routine test		N/A
2.10.5.14	Additional insulation in wound components		N/A
	Working voltage		N/A
	- Basic insulation not under stress		N/A
	- Supplementary, reinforced insulation		N/A
2.10.6	Construction of printed boards		P
2.10.6.1	Uncoated printed boards		P
2.10.6.2	Coated printed boards		N/A
2.10.6.3	Insulation between conductors on the same inner surface of a printed board		P
2.10.6.4	Insulation between conductors on different layers of a printed board	Basic insulation Evaluated in Approved DC/DC converter.	N/A
	Distance through insulation		N/A
	Number of insulation layers (pcs).....:		N/A
2.10.7	Component external terminations		N/A
2.10.8	Tests on coated printed boards and coated components		N/A
2.10.8.1	Sample preparation and preliminary inspection		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
2.10.8.2	Thermal conditioning		N/A
2.10.8.3	Electric strength test		N/A
2.10.8.4	Abrasion resistance test		N/A
2.10.9	Thermal cycling		N/A
2.10.10	Test for Pollution Degree 1 environment and insulating compound		N/A
2.10.11	Tests for semiconductor devices and cemented joints		N/A
2.10.12	Enclosed and sealed parts		N/A

3	WIRING, CONNECTIONS AND SUPPLY		P
3.1	General		P
3.1.1	Current rating and overcurrent protection	Input is PoE, Limited Power Source.	P
3.1.2	Protection against mechanical damage	No sharp edges, no moving parts.	P
3.1.3	Securing of internal wiring		P
3.1.4	Insulation of conductors	Functional only.	P
3.1.5	Beads and ceramic insulators		N/A
3.1.6	Screws for electrical contact pressure		N/A
3.1.7	Insulating materials in electrical connections		N/A
3.1.8	Self-tapping and spaced thread screws		N/A
3.1.9	Termination of conductors		N/A
	10 N pull test		N/A
3.1.10	Sleeving on wiring		N/A

3.2	Connection to a mains supply		N/A
3.2.1	Means of connection	Not connected to mains.	N/A
3.2.1.1	Connection to an a.c. mains supply		N/A
3.2.1.2	Connection to a d.c. mains supply		N/A
3.2.2	Multiple supply connections		N/A
3.2.3	Permanently connected equipment		N/A
	Number of conductors, diameter of cable and conduits (mm)		—
3.2.4	Appliance inlets		N/A
3.2.5	Power supply cords		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
3.2.5.1	AC power supply cords		N/A
	Type		—
	Rated current (A), cross-sectional area (mm ²), AWG		—
3.2.5.2	DC power supply cords	Provided at end installation.	N/A
3.2.6	Cord anchorages and strain relief		N/A
	Mass of equipment (kg), pull (N)		—
	Longitudinal displacement (mm)		—
3.2.7	Protection against mechanical damage		N/A
3.2.8	Cord guards	Connectorized input.	N/A
	Diameter or minor dimension D (mm); test mass (g)		—
	Radius of curvature of cord (mm)		—
3.2.9	Supply wiring space		N/A

3.3	Wiring terminals for connection of external conductors		N/A
3.3.1	Wiring terminals	No wiring terminals	N/A
3.3.2	Connection of non-detachable power supply cords		N/A
3.3.3	Screw terminals		N/A
3.3.4	Conductor sizes to be connected		N/A
	Rated current (A), cord/cable type, cross-sectional area (mm ²)		—
3.3.5	Wiring terminal sizes		N/A
	Rated current (A), type, nominal thread diameter (mm)		—
3.3.6	Wiring terminal design		N/A
3.3.7	Grouping of wiring terminals		N/A
3.3.8	Stranded wire		N/A

3.4	Disconnection from the mains supply		N/A
3.4.1	General requirement	Not connected to Mains	N/A
3.4.2	Disconnect devices		N/A
3.4.3	Permanently connected equipment		N/A
3.4.4	Parts which remain energized		N/A
3.4.5	Switches in flexible cords		N/A
3.4.6	Number of poles - single-phase and d.c. equipment		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
3.4.7	Number of poles - three-phase equipment		N/A
3.4.8	Switches as disconnect devices		N/A
3.4.9	Plugs as disconnect devices		N/A
3.4.10	Interconnected equipment		N/A
3.4.11	Multiple power sources		N/A

3.5	Interconnection of equipment		P
3.5.1	General requirements		P
3.5.2	Types of interconnection circuits	TNV-1 to SELV, SELV to SELV	P
3.5.3	ELV circuits as interconnection circuits		N/A
3.5.4	Data ports for additional equipment	Ethernet signal only, RJ45	P

4	PHYSICAL REQUIREMENTS		N/A
4.1	Stability		N/A
	Angle of 10°	Fixed equipment, mounted in end installation.	N/A
	Test force (N)		N/A

4.2	Mechanical strength		P
4.2.1	General		P
	Rack-mounted equipment.		N/A
4.2.2	Steady force test, 10 N		P
4.2.3	Steady force test, 30 N		N/A
4.2.4	Steady force test, 250 N		P
4.2.5	Impact test		P
	Fall test		P
	Swing test		P
4.2.6	Drop test; height (mm)		N/A
4.2.7	Stress relief test	Metal Enclosure	N/A
4.2.8	Cathode ray tubes		N/A
	Picture tube separately certified		N/A
4.2.9	High pressure lamps		N/A
4.2.10	Wall or ceiling mounted equipment; force (N)	Mounting was not evaluated, shall be part of end installation evaluation.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict

4.3	Design and construction		P
4.3.1	Edges and corners		P
4.3.2	Handles and manual controls; force (N)		N/A
4.3.3	Adjustable controls		N/A
4.3.4	Securing of parts		P
4.3.5	Connection by plugs and sockets	RJ45 and BNC only	P
4.3.6	Direct plug-in equipment		N/A
	Torque		—
	Compliance with the relevant mains plug standard		N/A
4.3.7	Heating elements in earthed equipment		N/A
4.3.8	Batteries		N/A
	- Overcharging of a rechargeable battery		N/A
	- Unintentional charging of a non-rechargeable battery		N/A
	- Reverse charging of a rechargeable battery		N/A
	- Excessive discharging rate for any battery		N/A
4.3.9	Oil and grease		N/A
4.3.10	Dust, powders, liquids and gases		N/A
4.3.11	Containers for liquids or gases		N/A
4.3.12	Flammable liquids		N/A
	Quantity of liquid (l)		N/A
	Flash point (°C)		N/A
4.3.13	Radiation	EMC is not part of this evaluation.	N/A
4.3.13.1	General		N/A
4.3.13.2	Ionizing radiation		N/A
	Measured radiation (pA/kg)		—
	Measured high-voltage (kV)		—
	Measured focus voltage (kV)		—
	CRT markings		—
4.3.13.3	Effect of ultraviolet (UV) radiation on materials		N/A
	Part, property, retention after test, flammability classification		N/A
4.3.13.4	Human exposure to ultraviolet (UV) radiation		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4.3.13.5	Lasers (including laser diodes) and LEDs		N/A
4.3.13.5.1	Lasers (including laser diodes)		N/A
	Laser class		—
4.3.13.5.2	Light emitting diodes (LEDs)		
4.3.13.6	Other types	Subject model is a Microwave Emitter, EMC is not part of this evaluation.	N/A

4.4	Protection against hazardous moving parts		N/A
4.4.1	General	No Moving Parts.	N/A
4.4.2	Protection in operator access areas		N/A
	Household and home/office document/media shredders		N/A
4.4.3	Protection in restricted access locations		N/A
4.4.4	Protection in service access areas		N/A
4.4.5	Protection against moving fan blades		N/A
4.4.5.1	General		N/A
	Not considered to cause pain or injury. a).....:		N/A
	Is considered to cause pain, not injury. b)		N/A
	Considered to cause injury. c)		N/A
4.4.5.2	Protection for users		N/A
	Use of symbol or warning		N/A
4.4.5.3	Protection for service persons		N/A
	Use of symbol or warning		N/A

4.5	Thermal requirements		P
4.5.1	General		P
4.5.2	Temperature tests		P
	Normal load condition per Annex L		—
4.5.3	Temperature limits for materials	(see appended table 4.5)	P
4.5.4	Touch temperature limits	(see appended table 4.5) Hot Symbol required on Enclosure, see Conditions of Acceptability.	P

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Clause	Requirement + Test	Result - Remark	Verdict
4.5.5	Resistance to abnormal heat	No primary parts.	N/A
4.6	Openings in enclosures		P
4.6.1	Top and side openings	No Openings.	P
	Dimensions (mm)		—
4.6.2	Bottoms of fire enclosures	No Openings.	P
	Construction of the bottom, dimensions (mm)		—
4.6.3	Doors or covers in fire enclosures		N/A
4.6.4	Openings in transportable equipment	Fixed equipment.	N/A
4.6.4.1	Constructional design measures		N/A
	Dimensions (mm)		—
4.6.4.2	Evaluation measures for larger openings		N/A
4.6.4.3	Use of metallized parts		N/A
4.6.5	Adhesives for constructional purposes		N/A
	Conditioning temperature (°C), time (weeks).....		—
4.7	Resistance to fire		P
4.7.1	Reducing the risk of ignition and spread of flame		P
	Method 1, selection and application of components wiring and materials	(see appended table 4.7)	P
	Method 2, application of all of simulated fault condition tests	(see appended table 5.3)	N/A
4.7.2	Conditions for a fire enclosure		P
4.7.2.1	Parts requiring a fire enclosure		P
4.7.2.2	Parts not requiring a fire enclosure		N/A
4.7.3	Materials		P
4.7.3.1	General		P
4.7.3.2	Materials for fire enclosures	Cast Aluminum	P
4.7.3.3	Materials for components and other parts outside fire enclosures		N/A
4.7.3.4	Materials for components and other parts inside fire enclosures	Components mounted on PCB rated UL 94V-0.	P
4.7.3.5	Materials for air filter assemblies		N/A
4.7.3.6	Materials used in high-voltage components		N/A
5	ELECTRICAL REQUIREMENTS AND SIMULATED ABNORMAL CONDITIONS		N/A
5.1	Touch current and protective conductor current		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.1.1	General	DC input.	N/A
5.1.2	Configuration of equipment under test (EUT)		N/A
5.1.2.1	Single connection to an a.c. mains supply		N/A
5.1.2.2	Redundant multiple connections to an a.c. mains supply		N/A
5.1.2.3	Simultaneous multiple connections to an a.c. mains supply		N/A
5.1.3	Test circuit		N/A
5.1.4	Application of measuring instrument		N/A
5.1.5	Test procedure		N/A
5.1.6	Test measurements		N/A
	Supply voltage (V)		—
	Measured touch current (mA)		—
	Max. allowed touch current (mA)		—
	Measured protective conductor current (mA)		—
	Max. allowed protective conductor current (mA)....		—
5.1.7	Equipment with touch current exceeding 3,5 mA		N/A
5.1.7.1	General		N/A
5.1.7.2	Simultaneous multiple connections to the supply		N/A
5.1.8	Touch currents to telecommunication networks and cable distribution systems and from telecommunication networks		N/A
5.1.8.1	Limitation of the touch current to a telecommunication network or to a cable distribution system		N/A
	Supply voltage (V)		—
	Measured touch current (mA)		—
	Max. allowed touch current (mA)		—
5.1.8.2	Summation of touch currents from telecommunication networks		N/A
	a) EUT with earthed telecommunication ports		N/A
	b) EUT whose telecommunication ports have no reference to protective earth		N/A
5.2	Electric strength		P
5.2.1	General	TNV1 input to Permanently earth chassis, and TNV1 to SELV is functional only.	P

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Clause	Requirement + Test	Result - Remark	Verdict
5.2.2	Test procedure		P
5.3	Abnormal operating and fault conditions		P
5.3.1	Protection against overload and abnormal operation	Evaluated in DC/DC converter.	P
5.3.2	Motors		N/A
5.3.3	Transformers	Evaluated in DC/DC converter.	P
5.3.4	Functional insulation.....:		N/A
5.3.5	Electromechanical components		N/A
5.3.6	Audio amplifiers in ITE		N/A
5.3.7	Simulation of faults	Input is PoE, LPS, SELV, provided with Fire Enclosure, with components mounted on 94V-0 PCB.	N/A
5.3.8	Unattended equipment		N/A
5.3.9	Compliance criteria for abnormal operating and fault conditions		N/A
5.3.9.1	During the tests		N/A
5.3.9.2	After the tests		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

6	CONNECTION TO TELECOMMUNICATION NETWORKS		P
6.1	Protection of telecommunication network service persons, and users of other equipment connected to the network, from hazards in the equipment		P
6.1.1	Protection from hazardous voltages		P
6.1.2	Separation of the telecommunication network from earth		P
6.1.2.1	Requirements		N/A
	Supply voltage (V)		—
	Current in the test circuit (mA)		—
6.1.2.2	Exclusions	Permanently earthed .	P

6.2	Protection of equipment users from overvoltages on telecommunication networks		P
6.2.1	Separation requirements		P
6.2.2	Electric strength test procedure		P
6.2.2.1	Impulse test		N/A
6.2.2.2	Steady-state test	(see appended table 5.2)	P
6.2.2.3	Compliance criteria		P

6.3	Protection of the telecommunication wiring system from overheating		N/A
	Max. output current (A)		—
	Current limiting method		—

7	CONNECTION TO CABLE DISTRIBUTION SYSTEMS		N/A
7.1	General		N/A
7.2	Protection of cable distribution system service persons, and users of other equipment connected to the system, from hazardous voltages in the equipment		N/A
7.3	Protection of equipment users from overvoltages on the cable distribution system		N/A
7.4	Insulation between primary circuits and cable distribution systems		N/A
7.4.1	General		N/A
7.4.2	Voltage surge test		N/A
7.4.3	Impulse test		N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
A	ANNEX A, TESTS FOR RESISTANCE TO HEAT AND FIRE		N/A
A.1	Flammability test for fire enclosures of movable equipment having a total mass exceeding 18 kg, and of stationary equipment (see 4.7.3.2)		N/A
A.1.1	Samples		—
	Wall thickness (mm).....		—
A.1.2	Conditioning of samples; temperature (°C)		N/A
A.1.3	Mounting of samples		N/A
A.1.4	Test flame (see IEC 60695-11-3)		N/A
	Flame A, B, C or D		—
A.1.5	Test procedure		N/A
A.1.6	Compliance criteria		N/A
	Sample 1 burning time (s).....		—
	Sample 2 burning time (s).....		—
	Sample 3 burning time (s).....		—
A.2	Flammability test for fire enclosures of movable equipment having a total mass not exceeding 18 kg, and for material and components located inside fire enclosures (see 4.7.3.2 and 4.7.3.4)		N/A
A.2.1	Samples, material		—
	Wall thickness (mm).....		—
A.2.2	Conditioning of samples; temperature (°C)		N/A
A.2.3	Mounting of samples		N/A
A.2.4	Test flame (see IEC 60695-11-4)		N/A
	Flame A, B or C		—
A.2.5	Test procedure		N/A
A.2.6	Compliance criteria		N/A
	Sample 1 burning time (s).....		—
	Sample 2 burning time (s).....		—
	Sample 3 burning time (s).....		—
A.2.7	Alternative test acc. to IEC 60695-11-5, cl. 5 and 9		N/A
	Sample 1 burning time (s).....		—
	Sample 2 burning time (s).....		—
	Sample 3 burning time (s).....		—
A.3	Hot flaming oil test (see 4.6.2)		N/A
A.3.1	Mounting of samples		N/A
A.3.2	Test procedure		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
A.3.3	Compliance criterion		N/A
B	ANNEX B, MOTOR TESTS UNDER ABNORMAL CONDITIONS (see 4.7.2.2 and 5.3.2)		N/A
B.1	General requirements		N/A
	Position		—
	Manufacturer		—
	Type		—
	Rated values		—
B.2	Test conditions		N/A
B.3	Maximum temperatures		N/A
B.4	Running overload test		N/A
B.5	Locked-rotor overload test		N/A
	Test duration (days)		—
	Electric strength test: test voltage (V)		—
B.6	Running overload test for d.c. motors in secondary circuits		N/A
B.6.1	General		N/A
B.6.2	Test procedure		N/A
B.6.3	Alternative test procedure		N/A
B.6.4	Electric strength test; test voltage (V)		N/A
B.7	Locked-rotor overload test for d.c. motors in secondary circuits		N/A
B.7.1	General		N/A
B.7.2	Test procedure		N/A
B.7.3	Alternative test procedure		N/A
B.7.4	Electric strength test; test voltage (V)		N/A
B.8	Test for motors with capacitors		N/A
B.9	Test for three-phase motors		N/A
B.10	Test for series motors		N/A
	Operating voltage (V)		—
C	ANNEX C, TRANSFORMERS (see 1.5.4 and 5.3.3)		N/A
	Position		—
	Manufacturer		—
	Type		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Rated values		—
	Method of protection		—
C.1	Overload test		N/A
C.2	Insulation		N/A
	Protection from displacement of windings		N/A
D	ANNEX D, MEASURING INSTRUMENTS FOR TOUCH-CURRENT TESTS (see 5.1.4)		N/A
D.1	Measuring instrument		N/A
D.2	Alternative measuring instrument		N/A
E	ANNEX E, TEMPERATURE RISE OF A WINDING (see 1.4.13)		N/A
F	ANNEX F, MEASUREMENT OF CLEARANCES AND CREEPAGE DISTANCES (see 2.10 and Annex G)		N/A
G	ANNEX G, ALTERNATIVE METHOD FOR DETERMINING MINIMUM CLEARANCES		N/A
G.1	Clearances		N/A
G.1.1	General		N/A
G.1.2	Summary of the procedure for determining minimum clearances		N/A
G.2	Determination of mains transient voltage (V)		N/A
G.2.1	AC mains supply		N/A
G.2.2	Earthed d.c. mains supplies		N/A
G.2.3	Unearthed d.c. mains supplies		N/A
G.2.4	Battery operation		N/A
G.3	Determination of telecommunication network transient voltage (V)		N/A
G.4	Determination of required withstand voltage (V)		N/A
G.4.1	Mains transients and internal repetitive peaks		N/A
G.4.2	Transients from telecommunication networks		N/A
G.4.3	Combination of transients		N/A
G.4.4	Transients from cable distribution systems		N/A
G.5	Measurement of transient voltages (V)		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply		N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
	For a d.c. mains supply		N/A
	b) Transients from a telecommunication network		N/A
G.6	Determination of minimum clearances		N/A
H	ANNEX H, IONIZING RADIATION (see 4.3.13)		N/A
J	ANNEX J, TABLE OF ELECTROCHEMICAL POTENTIALS (see 2.6.5.6)		N/A
	Metal(s) used	Enclosure is aluminum, Earth Conductor and mounting hardware is provided in end system.	—
K	ANNEX K, THERMAL CONTROLS (see 1.5.3 and 5.3.8)		N/A
K.1	Making and breaking capacity		N/A
K.2	Thermostat reliability; operating voltage (V)		N/A
K.3	Thermostat endurance test; operating voltage (V) :		N/A
K.4	Temperature limiter endurance; operating voltage (V)		N/A
K.5	Thermal cut-out reliability		N/A
K.6	Stability of operation	(see appended table 5.3)	N/A
L	ANNEX L, NORMAL LOAD CONDITIONS FOR SOME TYPES OF ELECTRICAL BUSINESS EQUIPMENT (see 1.2.2.1 and 4.5.2)		P
L.1	Typewriters		N/A
L.2	Adding machines and cash registers		N/A
L.3	Erasers		N/A
L.4	Pencil sharpeners		N/A
L.5	Duplicators and copy machines		N/A
L.6	Motor-operated files		N/A
L.7	Other business equipment		P
M	ANNEX M, CRITERIA FOR TELEPHONE RINGING SIGNALS (see 2.3.1)		N/A
M.1	Introduction		N/A
M.2	Method A		N/A
M.3	Method B		N/A
M.3.1	Ringing signal		N/A
M.3.1.1	Frequency (Hz)		—

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
M.3.1.2	Voltage (V)		—
M.3.1.3	Cadence; time (s), voltage (V)		—
M.3.1.4	Single fault current (mA)		—
M.3.2	Tripping device and monitoring voltage		N/A
M.3.2.1	Conditions for use of a tripping device or a monitoring voltage		N/A
M.3.2.2	Tripping device		N/A
M.3.2.3	Monitoring voltage (V)		N/A
N	ANNEX N, IMPULSE TEST GENERATORS (see 1.5.7.2, 1.5.7.3, 2.10.3.9, 6.2.2.1, 7.3.2, 7.4.3 and Clause G.5)		N/A
N.1	ITU-T impulse test generators		N/A
N.2	IEC 60065 impulse test generator		N/A
P	ANNEX P, NORMATIVE REFERENCES		—
Q	ANNEX Q, Voltage dependent resistors (VDRs) (see 1.5.9.1)		N/A
	a) Preferred climatic categories		N/A
	b) Maximum continuous voltage		N/A
	c) Pulse current		N/A
R	ANNEX R, EXAMPLES OF REQUIREMENTS FOR QUALITY CONTROL PROGRAMMES		N/A
R.1	Minimum separation distances for unpopulated coated printed boards (see 2.10.6.2)		N/A
R.2	Reduced clearances (see 2.10.3)		N/A
S	ANNEX S, PROCEDURE FOR IMPULSE TESTING (see 6.2.2.3)		N/A
S.1	Test equipment		N/A
S.2	Test procedure		N/A
S.3	Examples of waveforms during impulse testing		N/A
T	ANNEX T, GUIDANCE ON PROTECTION AGAINST INGRESS OF WATER (see 1.1.2)		P
		See separate test report, IP66	—

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict
U	ANNEX U, INSULATED WINDING WIRES FOR USE WITHOUT INTERLEAVED INSULATION (see 2.10.5.4)		N/A
		See separate test report	—
V	ANNEX V, AC POWER DISTRIBUTION SYSTEMS (see 1.6.1)		N/A
V.1	Introduction		N/A
V.2	TN power distribution systems		N/A
W	ANNEX W, SUMMATION OF TOUCH CURRENTS		N/A
W.1	Touch current from electronic circuits		N/A
W.1.1	Floating circuits		N/A
W.1.2	Earthed circuits		N/A
W.2	Interconnection of several equipments		N/A
W.2.1	Isolation		N/A
W.2.2	Common return, isolated from earth		N/A
W.2.3	Common return, connected to protective earth		N/A
X	ANNEX X, MAXIMUM HEATING EFFECT IN TRANSFORMER TESTS (see clause C.1)		N/A
X.1	Determination of maximum input current		N/A
X.2	Overload test procedure		N/A
Y	ANNEX Y, ULTRAVIOLET LIGHT CONDITIONING TEST (see 4.3.13.3)		N/A
Y.1	Test apparatus		N/A
Y.2	Mounting of test samples		N/A
Y.3	Carbon-arc light-exposure apparatus		N/A
Y.4	Xenon-arc light exposure apparatus		N/A
Z	ANNEX Z, OVERVOLTAGE CATEGORIES (see 2.10.3.2 and Clause G.2)		N/A
AA	ANNEX AA, MANDREL TEST (see 2.10.5.8)		N/A
BB	ANNEX BB, CHANGES IN THE SECOND EDITION		—
CC	ANNEX CC, Evaluation of integrated circuit (IC) current limiters		N/A
CC.1	General		N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

CC.2	Test program 1.....:		N/A
CC.3	Test program 2.....:		N/A

DD	ANNEX DD, Requirements for the mounting means of rack-mounted equipment		N/A
DD.1	General		N/A
DD.2	Mechanical strength test, variable N.....:		N/A
DD.3	Mechanical strength test, 250N, including end stops.....:		N/A
DD.4	Compliance.....:		N/A

EE	ANNEX EE, Household and home/office document/media shredders		N/A
EE.1	General		N/A
EE.2	Markings and instructions		N/A
	Use of markings or symbols.....:		N/A
	Information of user instructions, maintenance and/or servicing instructions.....:		N/A
EE.3	Inadvertent reactivation test.....:		N/A
EE.4	Disconnection of power to hazardous moving parts:		N/A
	Use of markings or symbols.....:		N/A
EE.5	Protection against hazardous moving parts		N/A
	Test with test finger (Figure 2A)		N/A
	Test with wedge probe (Figure EE1 and EE2)		N/A

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

1.5.1	TABLE: List of critical components					P
Object/ part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity ¹⁾	
Enclosure	Various	Aluminum Alloy, Refer to Attachment 6 for details	Refer to Attachment 6 for details	-	-	
Power PCB, Control PCB	Various	Various	UL 94V-0	UL 94	UR	
PTC (F1)	Tyco/Raychem	RXE300	72V, 3A @20degC, 1.5A @85degC	UL 1434	UR E74889	
MOV (V1,V2)	SET	TFMOV- 10S820X or TFMOV- 15S820X	5000A or better, 135V clamping	UL 1449	E322662 UR, URc	
Laser Transceiver.	Various	Various	Class 1, 850nm, or 1310nm	IEC/UL/CSA 60825-1	UR, TUV	
DC/DC Converter	NetPower	ERS312series	18-75Vdc input Output rated 12Vdc, 6A; Basic Insulation.	IEC 60950-1 2 nd Edition.	UR, TUV	
PoE isolating transformer T1, T2	HALO/PBL	TG111- HRPE33NYRL	1500Vrms isolation	IEC 60950-1 2 nd edition	Hi-Pot tested in for 1414Vdc in end product.	
Supplementary information:						
¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.						

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

1.5.1	TABLE: Opto Electronic Devices	N/A
Manufacturer		
Type.....		
Separately tested.....		
Bridging insulation		
External creepage distance.....		
Internal creepage distance		
Distance through insulation		
Tested under the following conditions.....		
Input.....		
Output.....		
supplementary information		

1.6.2	TABLE: Electrical data (in normal conditions)	P				
U (V)	I (A)	I _{rated} (A)	P (W)	Fuse #	I _{fuse} (A)	Condition/status
40.8	1.08	-	-	-	-	Normal Operation.
48	0.92	1.0	-	-	-	Normal Operation.
57.6	0.78	-	-	-	-	Normal Operation.
Supplementary information:						

2.1.1.5 c) 1)	TABLE: max. V, A, VA test	N/A		
Voltage (rated) (V)	Current (rated) (A)	Voltage (max.) (V)	Current (max.) (A)	VA (max.) (VA)
supplementary information:				

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

2.1.1.5 c) 2)	TABLE: stored energy		N/A
Capacitance C (μ F)	Voltage U (V)	Energy E (J)	
supplementary information:			

2.2	TABLE: evaluation of voltage limiting components in SELV circuits			N/A
Component (measured between)	max. voltage (V) (normal operation)		Voltage Limiting Components	
	V peak	V d.c.		
Fault test performed on voltage limiting components	Voltage measured (V) in SELV circuits (V peak or V d.c.)			
supplementary information:				

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

2.5	TABLE: Limited power sources					N/A
Circuit output tested:						
Note: Measured Uoc (V) with all load circuits disconnected:						
Components	Sample No.	Uoc (V)	I _{sc} (A)		VA	
			Meas.	Limit	Meas.	Limit
supplementary information:						
Sc=Short circuit, Oc=Open circuit						

2.10.2	Table: working voltage measurement			N/A
Location	RMS voltage (V)	Peak voltage (V)	Comments	
supplementary information:				

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

2.10.3 and 2.10.4	TABLE: Clearance and creepage distance measurements						N/A
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)	
Functional:							
Basic/supplementary:							
Reinforced:							
Supplementary information: Input (PoE is considered TNV-1) and earthed SELV is functional only. Passed Hi-Pot tests.							

2.10.5	TABLE: Distance through insulation measurements					N/A
Distance through insulation (DTI) at/of:	U peak (V)	U rms (V)	Test voltage (V)	Required DTI (mm)	DTI (mm)	
Supplementary information:						

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

4.3.8	TABLE: Batteries								N/A
The tests of 4.3.8 are applicable only when appropriate battery data is not available									
Is it possible to install the battery in a reverse polarity position?									
	Non-rechargeable batteries			Rechargeable batteries					
	Discharging		Un-intentional charging	Charging		Discharging		Reversed charging	
	Meas. current	Manuf. Specs.		Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.
Max. current during normal condition									
Max. current during fault condition									
Test results:								Verdict	
- Chemical leaks									
- Explosion of the battery									
- Emission of flame or expulsion of molten metal									
- Electric strength tests of equipment after completion of tests									
Supplementary information:									

4.3.8	TABLE: Batteries								N/A
Battery category		(Lithium, NiMh, NiCad, Lithium Ion ...)							
Manufacturer									
Type / model									
Voltage									
Capacity		mAh							
Tested and Certified by (incl. Ref. No.)									

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

Circuit protection diagram:

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MARKINGS AND INSTRUCTIONS (1.7.13)	
Location of replaceable battery	
Language(s)	
Close to the battery	
In the servicing instructions	
In the operating instructions	

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

4.5	TABLE: Thermal requirements						P
	Supply voltage (V)	40.8	48.0	57.6			—
	Ambient T _{min} (°C)	22.2	24.0	24.3			—
	Ambient T _{max} (°C)	23.2	24.0	24.3			—
Maximum measured temperature T of part/at::		T (°C)				Allowed T _{max} (°C)	
Heatsink DC/DC converter		46.3	47.0	47.3			58.2
Enclosure Touchable Surfaces (Top)		44.0	44.9	44.9			33.2
Enclosure Touchable Surfaces (Bottom)		46.3	46.9	46.9			33.2
Supplementary information:							
Temperature T of winding:	t ₁ (°C)	R ₁ (Ω)	t ₂ (°C)	R ₂ (Ω)	T (°C)	Allowed T _{max} (°C)	Insulation class
Supplementary information: Touchable surfaces exceed limit, Hot Symbol shall be applied on Enclosure, refer to Conditions of Acceptability.							

4.5.5	TABLE: Ball pressure test of thermoplastic parts						N/A
	Allowed impression diameter (mm)	≤ 2 mm					—
Part			Test temperature (°C)		Impression diameter (mm)		
Supplementary information:							

4.7	TABLE: Resistance to fire					P
Part	Manufacturer of material	Type of material	Thickness (mm)	Flammability class	Evidence	
Enclosure	Various	Cast Aluminum	3mm	-	Accepted	
Supplementary information: Input is LPS. Complete metal Enclosure with no openings.						

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

5.1	TABLE: touch current measurement			N/A
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions	
supplementary information:				

5.2	TABLE: Electric strength tests, impulse tests and voltage surge tests			P
Test voltage applied between:	Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No	
Functional:				
P2 (48Vdc input, TNV-1) to earthed SELV	DC	707V	No	
P2 to BNC inner conductor	DC	707V	No	
P2 to Chassis	DC	707V	No	
Basic/supplementary:				
Reinforced:				
Supplementary information: Chassis and BNC connector shield is permanently earthed.				

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

5.3	TABLE: Fault condition tests		N/A
	Ambient temperature (°C)		—
	Power source for EUT: Manufacturer, model/type, output rating		—

Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation

Supplementary information:

IEC 60950-1/Am1			
Clause	Requirement + Test	Result - Remark	Verdict

List of test equipment used:

The Equipment used list filed at CSA under Project 2522741, Test data folder.



Test Report issued under the responsibility of:

CSA Group
178 Rexdale Boulevard, Toronto, ON, Canada
M9W 1R3

TEST REPORT
IEC 60 950-22
Information technology equipment
Safety – Part 22: Equipment to be installed outdoors

Report Reference No. : CB 215348-2522741, Attachment 1
Date of issue : 2012-11-12
Total number of pages : 21

Testing Laboratory : CSA Group
Address : 178 Rexdale Boulevard, Toronto, ON, Canada M9W 1R3

Applicant's name : Dragonwave Inc.
Address : 600-411 Legget Drive, Ottawa, Ontario, Canada, K2K 3C9

Test specification:
Standard : IEC 60 950-22 : 2005 (1st Edition)
Test procedure : CB / CCA
Non-standard test method : N/A

Test Report Form No. : IEC60950_22A
Test Report Form(s) Originator : The Standards Institution of Israel Ltd.
Master TRF : Dated 2007-03

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This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description : Ethernet Microwave Transmission Unit



Manufacturer : DragonWave Inc.
Model/Type reference : Horizon Compact Plus / HC+
Ratings : 48V DC, 1A

Testing procedure and testing location:	
<input checked="" type="checkbox"/> Testing Laboratory: Testing location/ address :	CSA Group 178 Rexdale Boulevard, Toronto, ON, Canada M9W 1R3
<input type="checkbox"/> Associated CB Test Laboratory: Testing location/ address :	
Tested by (name + signature) :	Eric Wong 
Approved by (+ signature) :	Tiki Wong 
<input type="checkbox"/> Testing procedure: TMP Tested by (name + signature) : Approved by (+ signature) : Testing location/ address :	
<input type="checkbox"/> Testing procedure: WMT Tested by (name + signature) : Witnessed by (+ signature) : Approved by (+ signature) : Testing location/ address :	
<input type="checkbox"/> Testing procedure: SMT Tested by (name + signature) : Approved by (+ signature) : Supervised by (+ signature) : Testing location/ address :	
<input type="checkbox"/> Testing procedure: RMT Tested by (name + signature) : Approved by (+ signature) : Supervised by (+ signature) : Testing location/ address :	

Attachments		
1-1	CSA Attestation report No. 215348-2511273	<i>17 pages</i>
1-2	Nemko Attestation report No. 191467TRFSAF Retained at CSA under project 2522741	<i>32 pages</i>
1-3	Gasket Specifications	<i>2 pages</i>

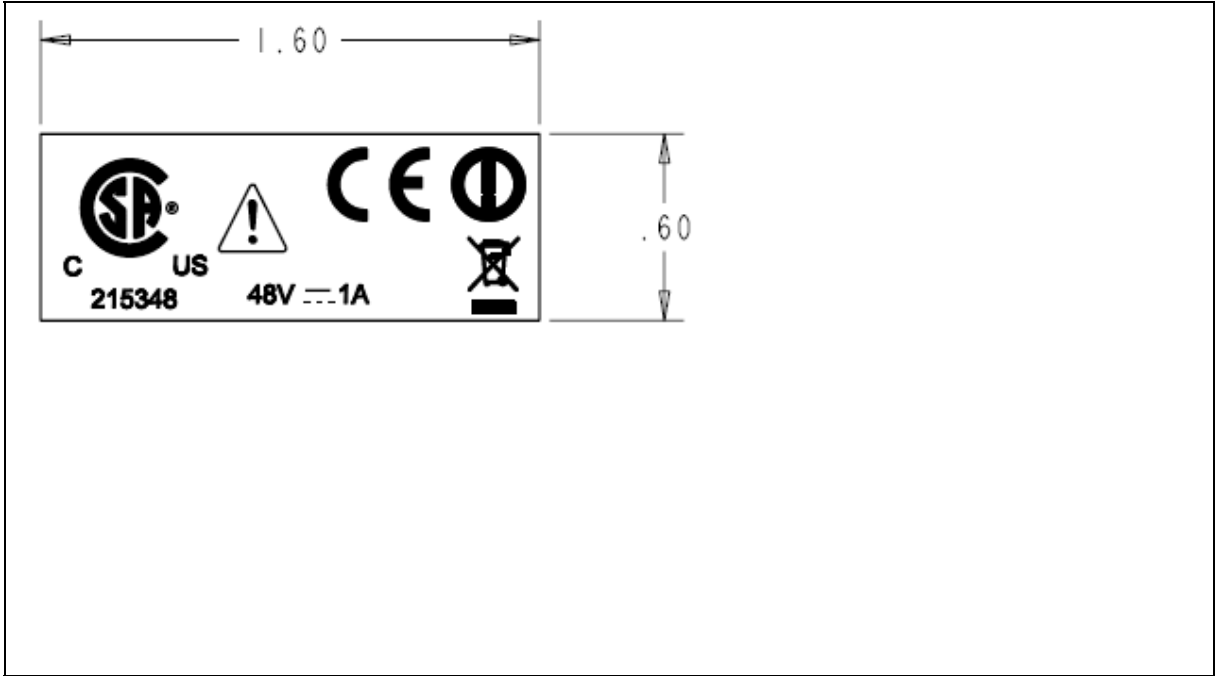
Note: Number of pages in the printed report may vary due to the use of different print driver.

Report Revision Record

Edition 1: 2012-11-12; CSA Application No. CB 215348-2522741, Attachment 1 (Toronto Office)

Issued by Eric Wong; Reviewed by Tiki Wong

Summary of testing:	
Tests performed (name of test and test clause): Annex D D.2 Tensile Strength and Elongation tests D.3 Compression test Note: all other applicable tests were evaluated and described in below reports: Attachment 1-1 (CSA Attestation report No. 215348-2511273) Attachment 1-2 (Nemko Attestation report No. 191467TRFSAF)	Testing location: CSA Group 178 Rexdale Boulevard, Toronto, ON, Canada M9W 1R3
Summary of compliance with National Differences:	
Complies with Canada and US National Differences, Subject model was tested according to CSA No. 94-M91, Clause 6.8.2 Hose Down (for type 4 and 4X)	
Copy of marking plate	
<p><i>Note: The marking plate artwork appended to this CBTR is only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.</i></p>	



Test item particulars	
Temperature range	
Overvoltage category	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
IP protection class	
Possible test case verdicts:	
- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Testing	
Date of receipt of test item	2012-05-29
Date (s) of performance of tests	2012-08-23
General remarks:	
<p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a point is used as the decimal separator.</p> <p>This Test Report Form is intended for the investigation of safety of equipment to be installed outdoors in accordance with IEC 60950-22. It can only be used together with the IEC 60950-1 requirements.</p>	
General product information:	
<p>Subject Model, Horizon Compact Plus or HC+, is a metal enclosed Ethernet modem, with wireless data TX/RX in microwave frequencies. Subject model is designed for use in outdoors environments with IP56 ratings. Power Over Ethernet (POE) provides the 48Vdc via a separately approved AC/DC adapter evaluated to POE requirements. The chassis is provided with protective earth terminal for permanent connection to protective earth. All internal circuits operate on SELV and powered by the POE input, which is also considered Limited Power Source. The POE input, for isolation purposes, is considered as TNV-1 circuit.</p>	
<u>Conditions of Acceptability:</u>	
1. Not evaluated for use in Finland, Norway and Sweden.	

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict
4	CONDITIONS FOR OUTDOOR EQUIPMENT		P
4.1	Ambient air temperature		P
	Suitability for use at any temperature in the range specified by the manufacturer. If not specified by the manufacturer, the range is taken as -33°C to +40°C	-40°C to +50°C -40°C to +60°C with heat shield. The Operating Temperature ranges are manufacturer's claims in User's manual and has not been verified by CSA Group.	P
4.2	AC mains supply		N/A
	Suitability for the highest Overvoltage Category expected in the installation location	Powered by POE	N/A
	Components used to reduce the Overvoltage Category comply with IEC 61643-series		N/A
	Reference to installation instructions		N/A
4.3	Rise of earth potential		P
	Special earthing conditions	Subject model is provisioned for permanent earth connection.	P
	Reference to installation instructions	Warning provided in User's manual.	P
5	MARKING AND INSTRUCTIONS		P
	Special installation features for protection from conditions in the OUTDOOR LOCATION (see 1.7.2 of IEC 60950-1)	Warning provided in User's manual.	P
	OUTDOOR ENCLOSURE classification according to IEC 60529 (IP Code)	IP 56 declared in User's manual. Evaluated under Attachment 1-1.	P
6	PROTECTION FROM ELECTRICAL SHOCK IN AN OUTDOOR LOCATION		P
6.1	Voltage limits of user-accessible parts in OUTDOOR LOCATIONS (2.2.2 and 2.2.3 of IEC 60950-1 with voltage limits of IEC60950-22)		
	Voltages under normal conditions (V)	Evaluated in approved DC/DC converter. 12Vdc.	P
	Voltages under fault conditions (V).....	Evaluated in approved DC/DC converter. 12Vdc max.	P
6.2	Limited current circuits in outdoor locations		P

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict
	The requirements of 2.4 of IEC60950-1 apply without change	Approved type POE input source.	P
7	WIRING TERMINALS FOR CONNECTION OF EXTERNAL CONDUCTORS		N/A
	The mains supply terminations powered via the normal building installation wiring are as specified in 3.3 of IEC 60950-1	POE input only.	N/A
	The mains supply terminations powered directly from the mains distribution system are as specified in IEC 60364		N/A
8	CONSTRUCTION REQUIREMENTS FOR OUTDOOR ENCLOSURES		P
8.1	General		P
	Protection against corrosion by use of suitable materials or by application of a protective coating	Refer to Attachment 2 for details.	P
	Parts serving as a functional part of an OUTDOOR ENCLOSURE (e.g., dials, connectors, etc.) comply with the same environmental protection requirements as for the OUTDOOR ENCLOSURE		P
	Use of OUTDOOR ENCLOSURE to carry current during normal operation		P
	Connection of a conductive part of an OUTDOOR ENCLOSURE to protective earth for carrying fault currents (see 2.6 of IEC 60950-1 and 8.3 of this standard)	0.008ohm, 0.320V, 40A, 2 minutes.	P
8.2	Resistance to ultra-violet radiation		N/A
	Resistance of non-metallic parts of an OUTDOOR ENCLOSURE to degradation by ultra-violet (UV) radiation	No non metallic parts covering an opening that is considered safety critical.	N/A
	Parts providing mechanical support:		N/A
	Tensile strength test (ISO 527)		N/A
	Flexural strength test (ISO 178)		N/A
	Parts providing impact resistance:		N/A
	Charpy impact test (ISO 179)		N/A
	Izod impact test (ISO 180)		N/A
	Tensile impact test (ISO 8256)		N/A
	All parts:		N/A
	Flammability classification (1.2.12 and annex A of IEC 60950-1)		N/A
8.3	Resistance to corrosion		P

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.1	General		P
	Resistance of metallic parts of an OUTDOOR ENCLOSURE to the effects of water-borne contaminants		P
	Alternate method for 8.3.2-8.3.4 (IEC 61587-1)		N/A
8.3.2	Test apparatus		P
	Salt-spray test (IEC 60068-2-11)		P
	Test in a water-saturated sulphur dioxide atmosphere (water-saturated sulphur dioxide atmosphere as described in Annex A; chamber as described in ISO 3231)		P
8.3.3	Test procedure	Refer to Attachment 2 for details	P
8.3.4	Compliance criteria		P
8.4	Bottoms of FIRE ENCLOSURES		P
	Comply with 4.6.2 of IEC 60950-1		P
	Bottom of FIRE ENCLOSURE of OUTDOOR EQUIPMENT mounted directly and permanently on a non-combustible surface (e.g., concrete or metal)		N/A
8.5	Gaskets		P
	If gaskets are used as the method for protection against the ingress of potential contaminants, requirements of 8.5.1 through 8.5.3 apply		P
8.5.1	General		P
8.5.2	Oil resistance		N/A
8.5.3	Securing means		P
9	PROTECTION OF EQUIPMENT WITHIN AN OUTDOOR ENCLOSURE		P
9.1	Protection from moisture (see Table 2)	Passed tests for IP56 rating, refer to Attachment 1-1 for details.	P
9.2	Protection from plants and vermin		N/A
9.3	Protection from excessive dust		P

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict
10	MECHANICAL STRENGTH OF ENCLOSURES		P
10.1	General		P
10.2	Impact test (4.2.5 of IEC 60950-1)		P
	Compliance criteria:		P
	- after test the level of protection remains in accordance with 9.1 of this standard		P
	- after test the requirements of 4.2.1 of IEC 60950-1 are met		P
11	OUTDOOR EQUIPMENT CONTAINING VENTED BATTERIES		N/A
	Adequate ventilation in the compartment housing a vented battery, where gassing is possible during normal usage or over-charging		N/A
	Protection against the risk of ignition of local concentrations of hydrogen and oxygen in a compartment containing both a battery and electrical components		N/A
	Hydrogen gas concentration measurement test		N/A
	Measured hydrogen gas concentration (% by volume)		—
	Max. allowed gas concentration for the mixture location in proximity to an ignition source (% by volume)	≤ 1% by volume	—
	Max. allowed gas concentration for the mixture location not in proximity to an ignition source (% by volume)	≤ 2% by volume	—
	Overcharging of rechargeable battery (see 4.3.8 of IEC 60950-1)	(see separate test report IEC 60950-1)	N/A
A	ANNEX A, WATER-SATURATED SULPHUR DIOXIDE ATMOSPHERE (see 8.3.2 and 8.3.3)		P
B	ANNEX B, WATER SPRAY TEST (see 9.1)		P
C	ANNEX C, ULTRAVIOLET LIGHT CONDITIONING TEST (see 8.2)		N/A
C.1	Test apparatus		N/A
C.2	Mounting of test samples		N/A
C.3	Carbon-arc light-exposure apparatus		N/A
C.4	Xenon-arc light-exposure apparatus		N/A

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict
D	ANNEX D, GASKET TESTS (see 8.5)		P
D.1	Gasket tests		P
D.2	Tensile strength and elongation tests (for gaskets that can stretch)		P
	Tensile strength (%)	>90%	P
	Elongation (%)	>90%	P
	Visible deterioration, deformation, melting, cracking or hardening of the material	No visible deterioration.	P
D.3	Compression test (for gaskets with closed cell construction)	S70-70 / S70-S570-70 Durometer Silicone Compound	P
	Initial thickness of the specimen (mm)	0.85mm /3.55mm, >90%	P
	Thickness of the specimen after test a) (mm), compression set after test a) (%)	0.82mm/3.52mm, >90%	P
	Thickness of the specimen after test b) (mm), compression set after test b) (%)	0.84mm/3.52mm, >90%	P
	Thickness of the specimen after test c) (mm), compression set after test c) (%)	0.83mm/3.52mm, >90%	P
	Visible cracks or deterioration	none	P
D.4	Oil immersion test		N/A
	Swelling (%).....		N/A
	Shrinking (%).....		N/A
E	ANNEX E, RATIONALE		—
E.1	General		—
E.2	Electric shock		—
E.3	Energy related hazards		—
E.4	Fire		—
E.5	Mechanical hazards		—
E.6	Heat related hazards		—
E.7	Radiation		—
E.8	Chemical hazards		—
E.9	Biological hazards		—
E.10	Explosion hazards		—

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict

IEC 60950-22:2005 – COMMON MODIFICATIONS			
Contents	Add the following annexes: Annex ZA (normative) Normative references to international publications with their corresponding European publications Annex ZB (normative) Special national conditions		P
General	Delete all the “country” notes in the reference document according to the following list: 4.1 Note 3 4.3 Note 8.5 Note 10.2 Note D.3 Note D.4 Note		P

ZA	NORMATIVE REFERENCES TO INTERNATIONAL PUBLICATIONS WITH THEIR CORRESPONDING EUROPEAN PUBLICATIONS		—
----	---	--	---

ZB	SPECIAL NATIONAL CONDITIONS		N/A
4.1	In Finland, Norway and Sweden , the temperature in winter may be extremely low. For OUTDOOR EQUIPMENT this will demand special design so that the equipment can withstand transport, erection and operation/service at temperatures down to -50°C	Not evaluated.	N/A
10.2	In Finland, Norway and Sweden there are additional requirements for the minimum ambient temperature. See 4.1 of this annex.		N/A
D.3	In Finland, Norway and Sweden there are additional requirements for the minimum ambient temperature. See 4.1 of this annex.		N/A

IEC 60950-22

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

8.2	TABLE: Resistance to ultra-violet radiation		
8.2c)	Charpy impact test (ISO 179) - unnotched		N/A
Material identification (manufacturer, type designation)			—
Shape and dimensions of test samples.....			—
Conditioning for Set 1 of samples.....			—
Conditioning for Set 2 of samples (including Annex C)			—
Test method (according to Tables 2 and 3 of ISO 179)			—
Test conditions (T °C, RH %)			—
Set 1 (without Annex C conditioning)		Set 2 (after Annex C conditioning)	
Test sample #	Charpy impact strength (kJ/m ²)	Test sample #	Charpy impact strength (kJ/m ²)
Arithmetic mean for Set 1 (kJ/m ²).....			
Arithmetic mean for Set 2 (kJ/m ²).....			
Retention (%).....			
Supplementary information:			

IEC 60950-22

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

8.2	TABLE: Resistance to ultra-violet radiation		
8.2d)	Charpy impact test (ISO 179) - notched		N/A
Material identification (manufacturer, type designation)			—
Shape and dimensions of test samples.....			—
Conditioning for Set 1 of samples.....			—
Conditioning for Set 2 of samples (including Annex C)			—
Test method (according to Tables 2 and 3 of ISO 179)			—
Test conditions (T °C, RH %)			—
Set 1 (without Annex C conditioning)		Set 2 (after Annex C conditioning)	
Test sample #	Charpy impact strength (kJ/m ²)	Test sample #	Charpy impact strength (kJ/m ²)
Arithmetic mean for Set 1 (kJ/m ²).....			
Arithmetic mean for Set 2 (kJ/m ²).....			
Retention (%).....			
Supplementary information:			

IEC 60950-22

Clause	Requirement + Test	Result - Remark	Verdict
--------	--------------------	-----------------	---------

8.2	TABLE: Resistance to ultra-violet radiation		
8.2e)	Izod impact test (ISO 180) - unnotched		N/A
Material identification (manufacturer, type designation)			—
Shape and dimensions of test samples.....			—
Conditioning for Set 1 of samples.....			—
Conditioning for Set 2 of samples (including Annex C)			—
Test method (according to Table 1 of ISO 180)			—
Test conditions (T °C, RH %)			—
Set 1 (without Annex C conditioning)		Set 2 (after Annex C conditioning)	
Test sample #	Izod impact strength (kJ/m ²)	Test sample #	Izod impact strength (kJ/m ²)
Arithmetic mean for Set 1 (kJ/m ²).....			
Arithmetic mean for Set 2 (kJ/m ²).....			
Retention (%).....			
Supplementary information:			

IEC 60950-22			
Clause	Requirement + Test	Result - Remark	Verdict

List of test equipment used:

(Note: This is an example of the required attachment. Other forms with a different layout but containing similar information are also acceptable.)

Test equipment information is filed at CSA under project folder 2522741.



Letter of Attestation

Document: 2511273

Master Contract: 215348

Project: 2511273

Date Issued: 2012-04-13

Issued to: DragonWave Inc.

**CSA International hereby confirms that it has completed an evaluation of
Component Ethernet Microwave Transmission unit, model: Horizon Compact +**

**CSA International hereby attests that the products identified above and described in test report 215348-
2511273 dated 2012-04-13**

complies with the following standards and clauses, to the extent applicable:

CSA 60529:05; IEC 60529(edition 2.1),

- **Cl. 14.2.6 Test for second characteristic numeral 6 with 12.5mm nozzle**
- **Cl. 13.4 Dust test for first characteristic numerals 5 and 6 (test for Category 2 for IP 5X only, Category 1 for IP 6X per Cl. 13.6)**

CSA No. 94-M91

- **Cl. 6.8.2 Hose Down (for type 4 and 4X)**

Issued by: Eric Wong

Signed: _____

THIS LETTER OF ATTESTATION DOES NOT AUTHORIZE THE USE OF THE CSA MARK ON THE SUBJECT PRODUCTS.

QUOTATIONS FROM THE TEST REPORT OR THE USE OF THE NAME OF THE CANADIAN STANDARDS ASSOCIATION AND CSA INTERNATIONAL OR ITS REGISTERED TRADEMARK, IN ANY WAY, IS NOT PERMITTED WITHOUT PRIOR WRITTEN CONSENT OF THE CANADIAN STANDARDS ASSOCIATION OR CSA INTERNATIONAL.



Attestation Report and Test Results

MASTER CONTRACT: 215348

REPORT: 2511273

PROJECT: 2511273

Edition 1: April 13, 2012; Project 2511273 – Toronto
Issued by Eric Wong

Contents: Letter of Attestation - Page 1 to 1
Description and Tests – Pages 1 to 4
Photos – Pages 5 to 9
Membrane Vent Specifications – Att 1 – 2 pages
Gasket Materials Specifications – Att 2 – 2 pages
Dimensions – Att 3 – 1 page

PRODUCTS

Component Ethernet Microwave Transmission unit, model: Horizon Compact +

APPLICABLE REQUIREMENTS

CSA 60529:05; IEC 60529(edition 2.1),

- **Cl. 14.2.6 Test for second characteristic numeral 6 with 12.5mm nozzle**
- **Cl. 13.4 Dust test for first characteristic numerals 5 and 6 (test for Category 2 for IP 5X only, Category 1 for IP 6X per Cl. 13.6)**

CSA No. 94-M91

- **Cl. 6.8.2 Hose Down (for type 4 and 4X)**

Conditions of acceptability:

Mating connectors with matching IP ratings shall be used in end installation.

This report shall not be reproduced, except in full, without the approval of CSA International.

178 Rexdale Boulevard, Toronto, ON, Canada M9W 1R3
Telephone: 416.747.4000 1.800.463.6727 Fax: 416.747.4149 www.csa-international.org

MASTER CONTRACT: 215348

REPORT: 2511273

PROJECT: 2511273

Page No: 2

Date Issued: April 13, 2012

Referenced Standard/Clause

CSA 60529:05; IEC 60529(edition 2.1),

- **Cl. 14.2.6 Test for second characteristic numeral 6 with 12.5mm nozzle**

Test Conditions:

The sample under test was mounted as intended, and was sprayed from all practicable directions with a steam of water from a standard test nozzle as shown in IEC 60529 Fig 6.

Internal diameter of nozzle: 12.5 mm

Delivery rate: 100 L/min. (+/-5%)

Distance from nozzle: 2.5m to 3.0m

Test duration: 3 min.

Result: No water entered the Electronics enclosure.

Notes:

1. Sample enclosure housing end-caps was tested as received.
2. Antenna housing enclosure screws were tightened to the case with a torque of 25 in lb.
3. Sample under test was mounted as per manufacture instruction.
4. Sample tested with Antenna installed.

MASTER CONTRACT: 215348

REPORT: 2511273

PROJECT: 2511273

Page No: 3

Date Issued: April 13, 2012

Referenced Standard/Clause

CSA 60529:05; IEC 60529(edition 2.1),

- **Cl. 13.4 Dust test for first characteristic numerals 5 and 6 (test for Category 2 for IP 5X only, Category 1 for IP 6X per Cl. 13.6)**

Test Conditions:

Dust Test Category 1.

The sample under test was placed in a chamber in which talcum powder was maintained in suspension. The talcum powder used shall be able to pass through a square-meshed sieve which has a nominal wire diameter of 50 micrometers and a nominal distance between wires of 75 micrometers.

By means of depression (maximum 20 mbar, 8 inches of H₂O), a volume of air 80 times the volume of the sample enclosure being tested shall be drawn into the enclosure without exceeding an extraction rate of 60 volumes per hour.

If an extraction rate of 40 to 60 volumes per hour is obtained the duration of the test will be 2 hours.

If, with a maximum depression of 20 mbar (8 inches of H₂O), the extraction rate is less than 40 volumes per hour, the test is continued until 80 volumes of air have been drawn through or 8 hours have elapsed.

Enclosure Int. Volume : 4.0L

Location of Suction Connection : a hole was drilled to the enclosure.

Measured Stabilized Flow Rate : 0.12L/min. (extraction rate = 1.8 volumes per hour)

Depression : 8 inches of water (20mbar)

Duration of Test : 8 hours

Result: No dust entered the Electronics enclosure.

Notes:

1. Sample enclosure housing end-caps was tested as received.
2. Antenna housing enclosure screws were tightened to the case with a torque of 25 in lb.
3. Sample under test was mounted as per manufacture instruction.
4. Sample tested without Antenna installed.

MASTER CONTRACT: 215348

REPORT: 2511273

PROJECT: 2511273

Page No: 4

Date Issued: April 13, 2012

Referenced Standard/Clause

CSA No. 94-M91

- **Cl. 6.8.2 Hose Down (for type 4 and 4X)**

Test Conditions:

The sample under test is mounted as intended, and the spray of water is directed at all points of potential water entry such as seams, joints, external operating mechanisms and such. The nozzle then moved along each test point one time at a uniform normal rate of 6 mm/sec.

Internal diameter of nozzle: 25 mm

Delivery rate: 240/L

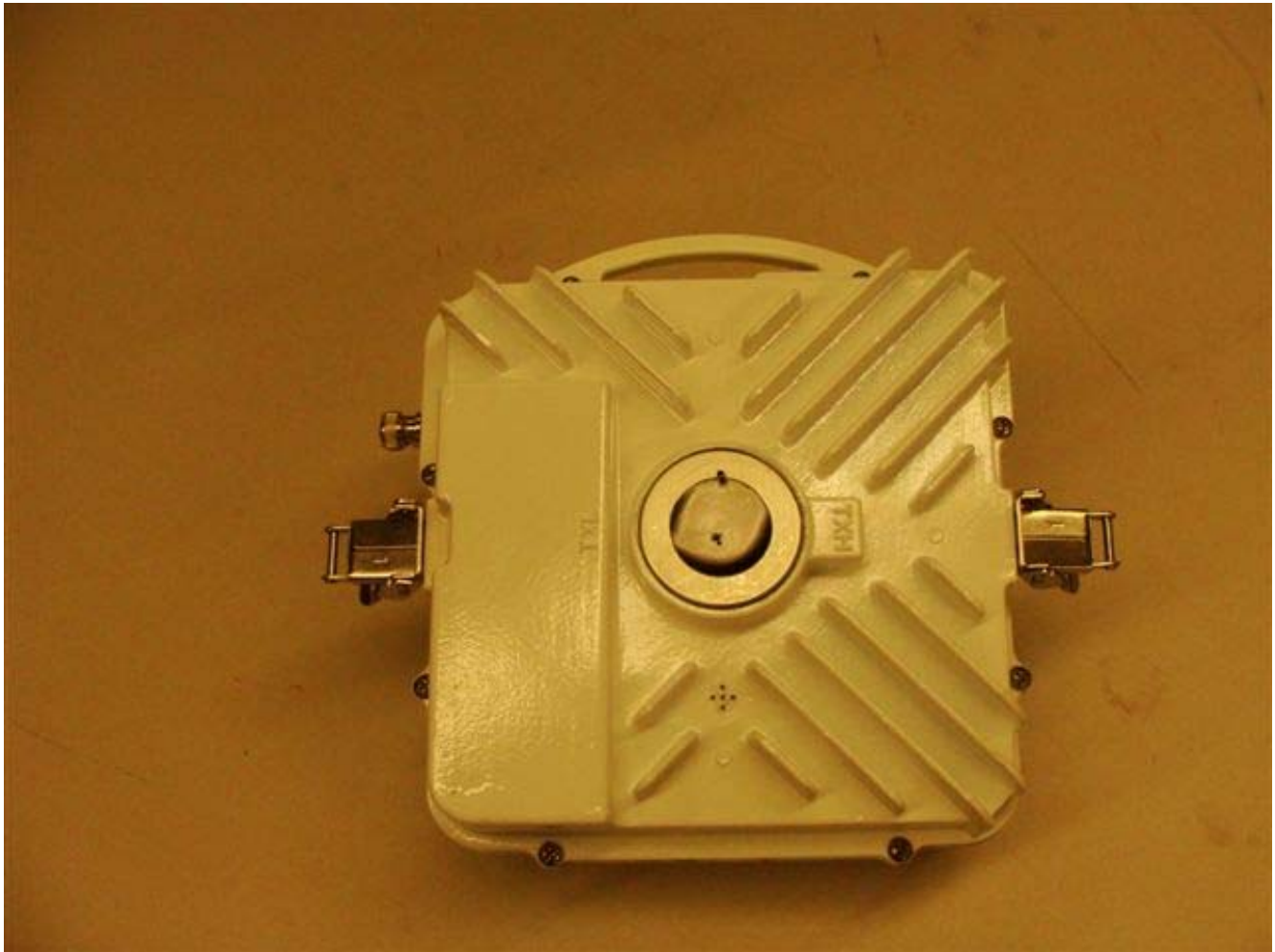
Distance from nozzle: 3.0 to 3.5m

Test duration: 5 min.

Result: No water entered the Electronics enclosure.

Notes:

1. Sample enclosure housing end-caps was tested as received.
2. Antenna housing enclosure screws were tightened to the case with a torque of 25 in lb.
3. Sample under test was mounted as per manufacture instruction.
4. Sample tested with Antenna installed.

MASTER CONTRACT: 215348**REPORT:** 2511273**PROJECT:** 2511273**Page No:** 5**Date Issued:** April 13, 2012

Top View without Antenna

Note(Top, Bottom, Side may be interchanged on the descriptions depending on orientation of final installation.)

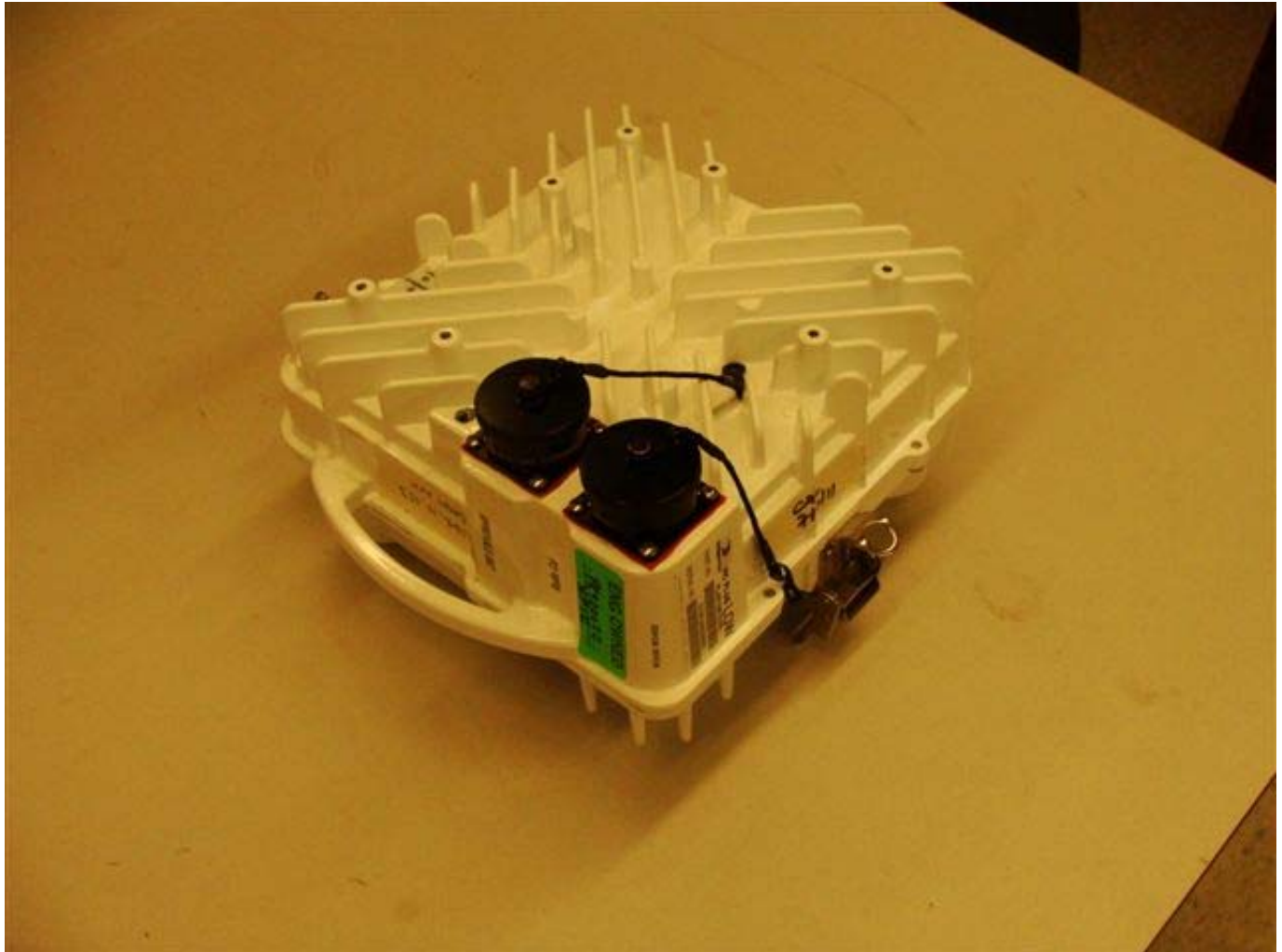
MASTER CONTRACT: 215348

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Date Issued: April 13, 2012



Bottom View

MASTER CONTRACT: 215348

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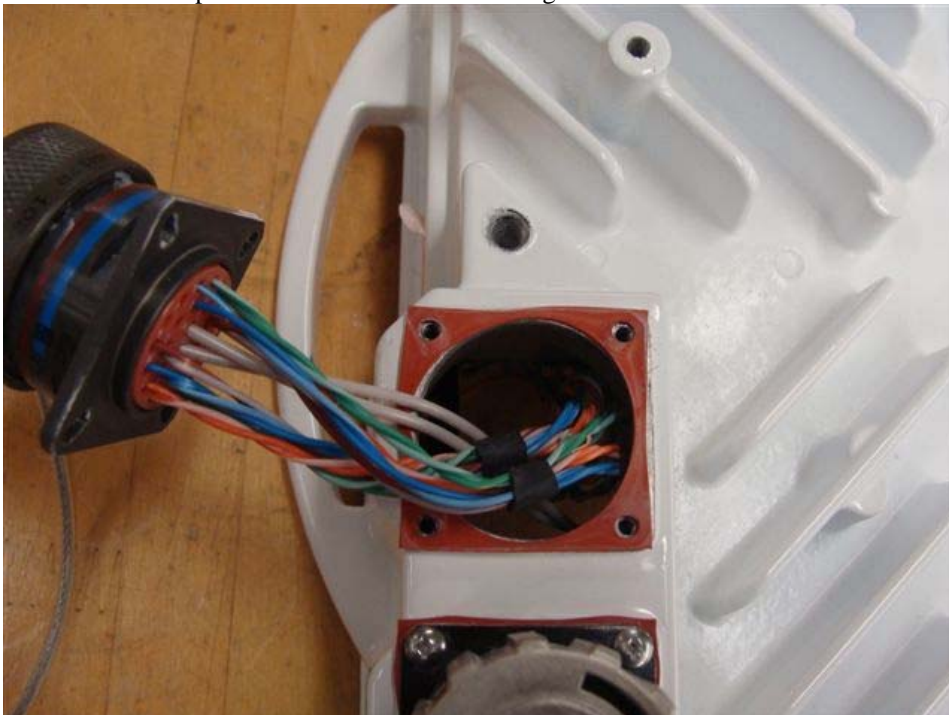
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Side view With Antenna mounted.

MASTER CONTRACT: 215348**REPORT:** 2511273**PROJECT:** 2511273**Page No:** 8**Date Issued:** April 13, 2012

Opened showing o-ring gaskets , the black tape was used to indicate any dust entry. No dust entry visible after test.
Gasket Material Specifications on Attachment 2Page 2.



Flat Gaskets for connectors. Gasket Material Specifications on Attachment 2Page 1.

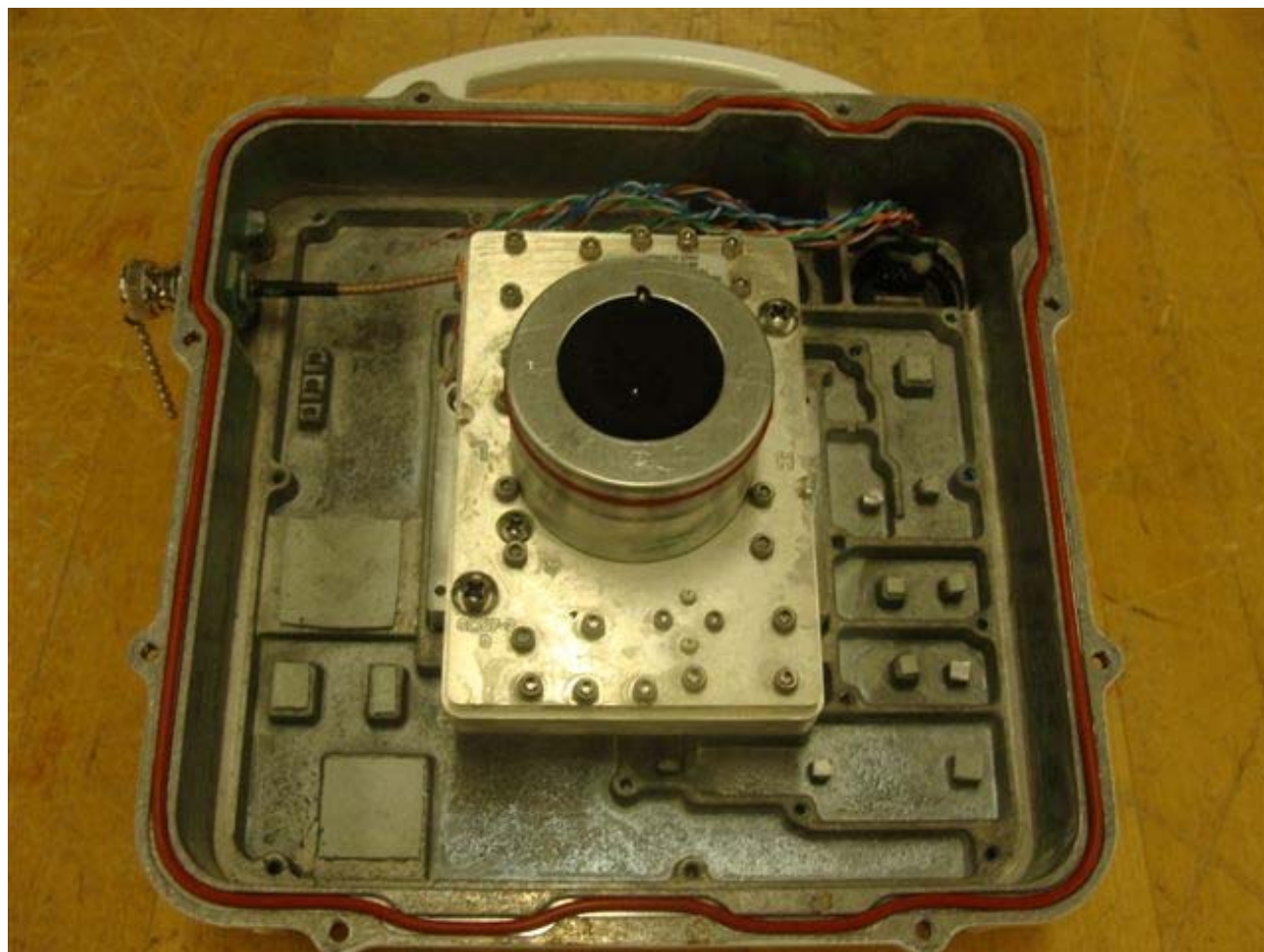
MASTER CONTRACT: 215348

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Page No: 9

Date Issued: April 13, 2012



No visible water entry observed after hose down test.



GORE™ MEMBRANE VENTS

Series QPE: Quick Pressure Equalization

As Effective as Hermetically Sealed ... at a Fraction of the Cost



GORE™ Membrane Vents Series QPE featuring high tack acrylic adhesive

GORE™ Membrane Vents Enhance the Reliability, Quality and Image of Your Products.

Designing an electronic device for use in a harsh, wet environment is a balance between protection, cost and serviceability.

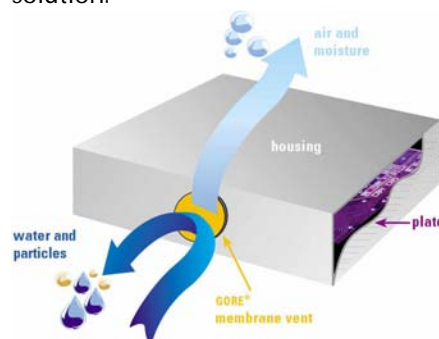
Hermetically sealing and potting are excellent sealing methods, but they make board level repairs or board swaps impossible. Gasketed enclosures provide the serviceability, but getting a water-tight housing and seal design can be difficult, especially in applications that will see thermal or altitude cycling.

GORE™ Membrane Vents are designed to enhance the ingress protection (IP) of gasketed enclosures. The microporous expanded polytetrafluoroethylene (ePTFE) membrane continuously allows the free passage of gases and vapors, equalizing the pressure differential between the enclosure and ambient before it builds to the point that a seal is compromised.

Water, dust, dirt, cleaning agents and most oils are repelled by the oleophobic membrane, thereby protecting expensive and sensitive electronics.

The free-flow of gases makes GORE™ Membrane Vents indispensable when it comes to designing a water proof battery powered device. By allowing hydrogen gas to diffuse through the membrane vent, the concentration of hydrogen inside the case is kept below potentially explosive levels.

With over 50 million vents installed worldwide in automotive and electronic applications, GORE™ Membrane Vents are proven to be a reliable, rugged and cost effective solution.



Typical enclosure with GORE Membrane Vent

- Water proof and dust proof to IP67, protecting sensitive electronics.
- High airflow allows pressure equalization to prevent stress on enclosure seals.
- Allows the continuous diffusion of gases, minimizing the possibility of explosive gas concentrations such as those given-off by rechargeable batteries.
- Water and oil repellent ePTFE membrane is inert, non-shedding, chemically resistant, UV resistant and backed by a tough non-woven PET layer ensuring a long trouble-free service life even in extreme conditions.
- Moisture vapor permeable to help aid in condensation and fogging reduction.
- High tack acrylic adhesive provides quick and simple installation on a wide range of enclosure materials.

All GORE™ Membrane Vents incorporate the unique GORE-TEX® expanded PTFE membrane from the world leaders in ePTFE technology, W. L. Gore & Associates.



GORE™ MEMBRANE VENTS

SERIES QPE: QUICK PRESSURE EQUALIZATION

Membrane Characteristic

Hydrophobic and Oleophobic

Oil Rating 4 (AATCC 118-1997ASTM)

Water entry pressure of the membrane $\geq 0,7$ bar/60 sec

Salt Spray Test (DIN 50-0-21)

No penetration of salt crystals through the membrane into the housing.

Ingress Protection of Vent System

IP65 - Water jets

IP67 - 1 meter water submersion for 30 minutes

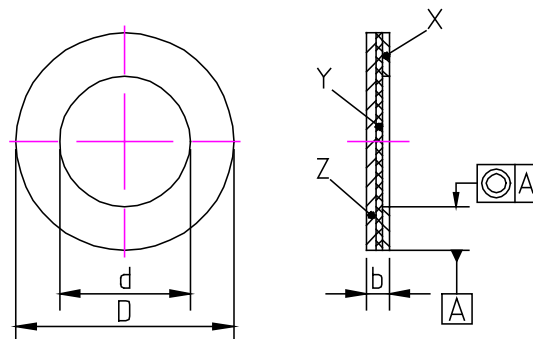
Temperature Resistance

QPE vents are designed for service temperature range of -40°C to 100°C .

Particle entry protection (@ 3,2 m/min)

> 99,997% efficient against $0,1\mu\text{m}$ particles

Design and Dimensions



Y = ePTFE Membrane

X = Pressure Sensitive Acrylic Adhesive GA2025

Z = Nonwoven White Polyester

b = Thickness max. 0,3 mm

A = Concentricity $\pm 0,4$ mm

Tolerances of diameters: $\pm 0,25$ mm

Recommended Installation

Installation inside the enclosure is recommended.

The bond of the adhesive to the enclosure wall is greatly dependent upon the enclosure material, surface finish and vent handling/installation. For general information on adhesive performance, please see Gore Technical Bulletin: GA2025, Surface Finish & Installation Instructions.

Available Designs

Part Number	Outer- (D) x Inner (vent) - (d) diameter in mm	Typical Airflow @ dp = 70mbar in ml/min	Parts Across Carrier	Carrier Width (mm)
VE60308	7,6 x 3,3	70	8	88
VE60510	10,2 x 5,5	190	5	69
VE60814	14,0 x 8,0	400	4	71
VE60919	19,1 x 8,9	500	6	136
VE61221	21,5 x 12,5	1000	2	52
VE62029	29,0 x 20,0	2500	2	67



For customized design please contact us

W. L. Gore & Associates

Gore Technical Venting Solutions
www.gore.com/ventsolutions
Email: vents@wgore.com

Sales & Customer Service Sites

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Germany	+49 (0) 89 4612 2211	UK	+44 (0) 1506 460123
Italy	+39 04 56 20 92 42	USA	+1 410 392 4440

Note: The optimal performance of any GORE™ Membrane Vent is dependent on how it is handled and incorporated into the final product. This includes such elements as the device design, sealing method and assembly method. While Gore is able to provide general guidelines based upon our experience with the GORE™ Membrane Vent, it is ultimately the responsibility of the device manufacturer to validate each product and its performance for its intended electronic application. Contact one of our technical sales associates today for assistance in determining the best GORE™ Membrane Vent for your specific electronic application. Specifications are subject to change without notice. GORE-TEX®, GORE® and designs are registered trademarks of W. L. Gore & Associates. All rights reserved. © Copyright 2002



Global Rubber Products Ltd.

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 TEL: (416) 293-1990 FAX: (416) 293-1286 EMAIL: info@globalrubber.com
 CANADA WIDE 1-800-838-1160

TECHNICAL REPORT

S70 - 70 DUROMETER SILICONE COMPOUND

ASTM D2000 M7GE705 A19,B37,EO16,EO36,F19,G11

ASTM DESIGNATION	ASTM D2000 SPECIFICATION	S70 TYPICAL PROPERTIES
ORIGINAL PROPERTIES		
	Hardness, Shore A Points	72
	Tensile Strength, psi (mpa)	1000 (6.9)
	Ultimate Elongation, %	250
HEAT AGING RESISTANCE (ASTM D573), 70 HRS. @ 225 C (437 F)		
A19	Hardness Change, Shore A Points	+5.0
	Tensile Strength Change, %	+16.0
	Ultimate Elongation Change, %	-20.0
COMPRESSION SET RESISTANCE (ASTM D395), 22 HRS. @ 175 C (347 F) Method B		
B37	% of Original Deflection	18
FLUID RESISTANCE (ASTM D471), 70 HRS. @ 150 C (302 F) ASTM #1 OIL		
EO16	Hardness Change, Shore A Points	-3.0
	Tensile Strength Change, %	-2.0
	Ultimate Elongation Change, %	-10.0
	Volume Change, %	+3.7
FLUID RESISTANCE (ASTM D471), 70 HRS. @ 150 C (302 F) ASTM OIL #3		
EO36	Hardness Change, Shore A Points	-25.0
	Volume Change, %	+37.0
LOW TEMPERATURE RESISTANCE Brittleness (ASTM D2137) Method A		
F19	3 minutes @-55 C (-67 F)	Passed
TEAR RESISTANCE (ASTM D624),		
G11	Tear Resistance Tear Die B kN/m	18



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 TEL: (416) 293-1990 FAX: (416) 293-1286 EMAIL: info@globalrubber.com
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TECHNICAL REPORT

S70 AND S570 - 70 DUROMETER SILICONE COMPOUND

Air Aging to MIL-G-21610C Type II

DESIGNATION	SPECIFICATION	S70 TYPICAL PROPERTIES	S570 TYPICAL PROPERTIES
ORIGINAL PROPERTIES			
Hardness, Shore A Points	60 to 75	71	70
Tensile Strength, psi	600 min	1273	814
Elongation, %	150 min	327	196
HEAT AGING			
168 HRS. @ 150 C (302 F)			
Hardness Change, Shore A Points	+10 max	+4	+3
Tensile Strength Retained,, %	80 min	95	82
Elongation Retained, %	80 min	86	57
Volume Change,%	+/-3	-2.2	No Data
COMPRESSION SET			
168 HRS. @ 150 C (302 F)			
Percent Set	40 max	12	22

Testing performed using the methodologies required by MIL-G-21610C for comparative data.
 Comparative testing - Reference only.



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 TEL: (416) 293-1990 FAX: (416) 293-1286 EMAIL: info@globalrubber.com
 CANADA WIDE 1-800-838-1160

TECHNICAL REPORT

S70 - 70 DUROMETER SILICONE COMPOUND

ASTM D2000 M7GE705 A19,B37,EO16,EO36,F19,G11

ASTM DESIGNATION	ASTM D2000 SPECIFICATION	S70 TYPICAL PROPERTIES
ORIGINAL PROPERTIES		
	Hardness, Shore A Points	72
	Tensile Strength, psi (mpa)	1000 (6.9)
	Ultimate Elongation, %	250
HEAT AGING RESISTANCE (ASTM D573), 70 HRS. @ 225 C (437 F)		
A19	Hardness Change, Shore A Points	+5.0
	Tensile Strength Change, %	+16.0
	Ultimate Elongation Change, %	-20.0
COMPRESSION SET RESISTANCE (ASTM D395), 22 HRS. @ 175 C (347 F) Method B		
B37	% of Original Deflection	18
FLUID RESISTANCE (ASTM D471), 70 HRS. @ 150 C (302 F) ASTM #1 OIL		
EO16	Hardness Change, Shore A Points	-3.0
	Tensile Strength Change, %	-2.0
	Ultimate Elongation Change, %	-10.0
	Volume Change, %	+3.7
FLUID RESISTANCE (ASTM D471), 70 HRS. @ 150 C (302 F) ASTM OIL #3		
EO36	Hardness Change, Shore A Points	-25.0
	Volume Change, %	+37.0
LOW TEMPERATURE RESISTANCE Brittleness (ASTM D2137) Method A		
F19	3 minutes @ -55 C (-67 F)	Passed
TEAR RESISTANCE (ASTM D624),		
G11	Tear Resistance Tear Die B kN/m	18



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 CANADA WIDE 1-800-838-1160

TECHNICAL REPORT

S70 AND S570 - 70 DUROMETER SILICONE COMPOUND

Air Aging to MIL-G-21610C Type II

DESIGNATION	SPECIFICATION	S70 TYPICAL PROPERTIES	S570 TYPICAL PROPERTIES
ORIGINAL PROPERTIES			
Hardness, Shore A Points	60 to 75	71	70
Tensile Strength, psi	600 min	1273	814
Elongation, %	150 min	327	196
HEAT AGING			
168 HRS. @ 150 C (302 F)			
Hardness Change, Shore A Points	+10 max	+4	+3
Tensile Strength Retained, %	80 min	95	82
Elongation Retained, %	80 min	86	57
Volume Change, %	+/-3	-2.2	No Data
COMPRESSION SET			
168 HRS. @ 150 C (302 F)			
Percent Set	40 max	12	22

Testing performed using the methodologies required by MIL-G-21610C for comparative data.
 Comparative testing - Reference only.



EUROPEAN GROUP DIFFERENCES & NATIONAL DIFFERENCES CHECKLIST

**Information Technology Equipment - Safety -
Part 1: General requirements
for**

**CB Reports to IEC 60950-1:2005 (2nd Edition); Am 1:2009,
with Differences according to
EN 60950-1:2006 including A11:2009, A1:2010 and/or A12:2011**

This document is based on and covers requirements for

- **National Deviations downloaded at the following IECCE CB Website:
<http://members.iecee.org/iecee/ieceemembers.nsf>**

ATTACHMENT 1A CB 215348-2522648

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**ATTACHMENT 1A - European Group Differences
& National Differences Checklist**

**ATTACHMENT TO TEST REPORT IEC 60950-1
EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES
Information technology equipment – Safety –
Part 1: General requirements**

Differences according to.....:	EN 60950-1:2006/A11:2009/A1:2010/A12:2011
Attachment Form No.....:	EU_GD_IEC60950_1B
Attachment Originator	SGS Fimko Ltd
Master Attachment	Date 2011-08
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EN 60950-1:2006/A11:2009/A1:2010/A12:2011 – CENELEC COMMON MODIFICATIONS

IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)				
Clause	Requirement + Test		Result - Remark	Verdict
Contents	Add the following annexes: Annex ZA (normative) Normative references to international publications with their corresponding European publications Annex ZB (normative) Special national conditions			P
General	Delete all the "country" notes in the reference document (IEC 60950-1:2005) according to the following list: 1.4.8 Note 2 1.5.1 Note 2 & 3 1.5.7.1 Note 1.5.8 Note 2 1.5.9.4 Note 1.7.2.1 Note 4, 5 & 6 2.2.3 Note 2.2.4 Note 2.3.2 Note 2.3.2.1 Note 2 2.3.4 Note 2 2.6.3.3 Note 2 & 3 2.7.1 Note 2.10.3.2 Note 2 2.10.5.13 Note 3 3.2.1.1 Note 3.2.4 Note 3. 2.5.1 Note 2 4.3.6 Note 1 & 2 4.7 Note 4 4.7.2.2 Note 4.7.3.1 Note 2 5.1.7.1 Note 3 & 4 5.3.7 Note 1 6 Note 2 & 5 6.1.2.1 Note 2 6.1.2.2 Note 6.2.2 Note 6.2.2.1 Note 2 6.2.2.2 Note 7.1 Note 3 7.2 Note 7.3 Note 1 & 2 G.2.1 Note 2 Annex H Note 2			P
General (A1:2010)	Delete all the "country" notes in the reference document (IEC 60950-1:2005/A1:2010) according to the following list: 1.5.7.1 Note 6.1.2.1 Note 2 6.2.2.1 Note 2 EE.3 Note			P

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
1.3.Z1	<p>Add the following subclause: 1.3.Z1 Exposure to excessive sound pressure The apparatus shall be so designed and constructed as to present no danger when used for its intended purpose, either in normal operating conditions or under fault conditions, particularly providing protection against exposure to excessive sound pressures from headphones or earphones.</p> <p>NOTE Z1 A new method of measurement is described in EN 50332-1, Sound system equipment: Headphones and earphones associated with portable audio equipment - Maximum sound pressure level measurement methodology and limit considerations - Part 1: General method for "one package equipment", and in EN 50332-2, Sound system equipment: Headphones and earphones associated with portable audio equipment - Maximum sound pressure level measurement methodology and limit considerations - Part 2: Guidelines to associate sets with headphones coming from different manufacturers.</p>		N/A
(A12:2011)	<p>In EN 60950-1:2006/A12:2011 Delete the addition of 1.3.Z1 / EN 60950-1:2006 Delete the definition 1.2.3.Z1 / EN 60950-1:2006 /A1:2010</p>		P
1.5.1	<p>Add the following NOTE: NOTE Z1 The use of certain substances in electrical and electronic equipment is restricted within the EU: see Directive 2002/95/EC</p>	Not part of this evaluation, manufacturer shall supply objective evidence for compliance.	N/A
1.7.2.1 (A1:2010)	In addition, for a PORTABLE SOUND SYSTEM, the instructions shall include a warning that excessive sound pressure from earphones and headphones can cause hearing loss.		N/A
1.7.2.1 (A12:2011)	<p>In EN 60950-1:2006/A12:2011 Delete NOTE Z1 and the addition for Portable Sound System. Add the following clause and annex to the existing standard and amendments.</p>		N/A
	Zx Protection against excessive sound pressure from personal music players		N/A

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>Zx.1 General</p> <p>This sub-clause specifies requirements for protection against excessive sound pressure from personal music players that are closely coupled to the ear. It also specifies requirements for earphones and headphones intended for use with personal music players.</p> <p>A personal music player is a portable equipment for personal use, that:</p> <ul style="list-style-type: none"> – is designed to allow the user to listen to recorded or broadcast sound or video; and – primarily uses headphones or earphones that can be worn in or on or around the ears; and – allows the user to walk around while in use. <p>NOTE 1 Examples are hand-held or body-worn portable CD players, MP3 audio players, mobile phones with MP3 type features, PDA's or similar equipment.</p> <p>A personal music player and earphones or headphones intended to be used with personal music players shall comply with the requirements of this sub-clause.</p> <p>The requirements in this sub-clause are valid for music or video mode only.</p> <p>The requirements do not apply:</p> <ul style="list-style-type: none"> – while the personal music player is connected to an external amplifier; or – while the headphones or earphones are not used. <p>NOTE 2 An external amplifier is an amplifier which is not part of the personal music player or the listening device, but which is intended to play the music as a standalone music player.</p> <p>The requirements do not apply to:</p> <ul style="list-style-type: none"> – hearing aid equipment and professional equipment; <p>NOTE 3 Professional equipment is equipment sold through special sales channels. All products sold through normal electronics stores are considered not to be professional equipment.</p>		


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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>– analogue personal music players (personal music players without any kind of digital processing of the sound signal) that are brought to the market before the end of 2015.</p> <p>NOTE 4 This exemption has been allowed because this technology is falling out of use and it is expected that within a few years it will no longer exist. This exemption will not be extended to other technologies.</p> <p>For equipment which is clearly designed or intended for use by young children, the limits of EN 71-1 apply.</p>		N/A
	<p>Zx.2 Equipment requirements</p> <p>No safety provision is required for equipment that complies with the following:</p> <p>– equipment provided as a package (personal music player with its listening device), where the acoustic output $L_{Aeq,T}$ is ≤ 85 dBA measured while playing the fixed “programme simulation noise” as described in EN 50332-1; and</p> <p>– a personal music player provided with an analogue electrical output socket for a listening device, where the electrical output is ≤ 27 mV measured as described in EN 50332-2, while playing the fixed “programme simulation noise” as described in EN 50332-1.</p> <p>NOTE 1 Wherever the term acoustic output is used in this clause, the 30 s A-weighted equivalent sound pressure level $L_{Aeq,T}$ is meant. See also Zx.5 and Annex Zx.</p> <p>All other equipment shall:</p> <p>a) protect the user from unintentional acoustic outputs exceeding those mentioned above; and</p> <p>b) have a standard acoustic output level not exceeding those mentioned above, and automatically return to an output level not exceeding those mentioned above when the power is switched off; and</p>		N/A

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>c) provide a means to actively inform the user of the increased sound pressure when the equipment is operated with an acoustic output exceeding those mentioned above. Any means used shall be acknowledged by the user before activating a mode of operation which allows for an acoustic output exceeding those mentioned above. The acknowledgement does not need to be repeated more than once every 20 h of cumulative listening time; and</p> <p>NOTE 2 Examples of means include visual or audible signals. Action from the user is always required.</p> <p>NOTE 3 The 20 h listening time is the accumulative listening time, independent how often and how long the personal music player has been switched off.</p> <p>d) have a warning as specified in Zx.3; and</p> <p>e) not exceed the following:</p> <ol style="list-style-type: none"> 1) equipment provided as a package (player with its listening device), the acoustic output shall be ≤ 100 dBA measured while playing the fixed "programme simulation noise" described in EN 50332-1; and 2) a personal music player provided with an analogue electrical output socket for a listening device, the electrical output shall be ≤ 150 mV measured as described in EN 50332-2, while playing the fixed "programme simulation noise" described in EN 50332-1. <p>For music where the average sound pressure (long term $L_{Aeq,T}$) measured over the duration of the song is lower than the average produced by the programme simulation noise, the warning does not need to be given as long as the average sound pressure of the song is below the basic limit of 85 dBA. In this case T becomes the duration of the song.</p> <p>NOTE 4 Classical music typically has an average sound pressure (long term $L_{Aeq,T}$) which is much lower than the average programme simulation noise. Therefore, if the player is capable to analyse the song and compare it with the programme simulation noise, the warning does not need to be given as long as the average sound pressure of the song is below the basic limit of 85 dBA.</p> <p>For example, if the player is set with the programme simulation noise to 85 dBA, but the average music level of the song is only 65 dBA, there is no need to give a warning or ask an acknowledgement as long as the average sound level of the song is not above the basic limit of 85 dBA.</p>		N/A

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>Zx.3 Warning</p> <p>The warning shall be placed on the equipment, or on the packaging, or in the instruction manual and shall consist of the following:</p> <ul style="list-style-type: none"> - the symbol of Figure 1 with a minimum height of 5 mm; and - the following wording, or similar: <p>“To prevent possible hearing damage, do not listen at high volume levels for long periods.”</p> <div style="text-align: center;">  </div> <p>Figure 1 – Warning label (IEC 60417-6044)</p> <p>Alternatively, the entire warning may be given through the equipment display during use, when the user is asked to acknowledge activation of the higher level.</p>		N/A
	<p>Zx.4 Requirements for listening devices (headphones and earphones)</p>		N/A
	<p>Zx.4.1 Wired listening devices with analogue input</p> <p>With 94 dBA sound pressure output $L_{Aeq,T}$, the input voltage of the fixed “programme simulation noise” described in EN 50332-2 shall be ≥ 75 mV.</p> <p>This requirement is applicable in any mode where the headphones can operate (active or passive), including any available setting (for example built-in volume level control).</p> <p>NOTE The values of 94 dBA – 75 mV correspond with 85dBA – 27 mV and 100 dBA – 150 mV.</p>		N/A

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>Zx.4.2 Wired listening devices with digital input</p> <p>With any playing device playing the fixed “programme simulation noise” described in EN 50332-1 (and respecting the digital interface standards, where a digital interface standard exists that specifies the equivalent acoustic level), the acoustic output $L_{Aeq,T}$ of the listening device shall be ≤ 100 dBA.</p> <p>This requirement is applicable in any mode where the headphones can operate, including any available setting (for example built-in volume level control, additional sound feature like equalization, etc.).</p> <p>NOTE An example of a wired listening device with digital input is a USB headphone.</p>		N/A
	<p>Zx.4.3 Wireless listening devices</p> <p>In wireless mode:</p> <ul style="list-style-type: none"> – with any playing and transmitting device playing the fixed programme simulation noise described in EN 50332-1; and – respecting the wireless transmission standards, where an air interface standard exists that specifies the equivalent acoustic level; and – with volume and sound settings in the listening device (for example built-in volume level control, additional sound feature like equalization, etc.) set to the combination of positions that maximize the measured acoustic output for the abovementioned programme simulation noise, the acoustic output $L_{Aeq,T}$ of the listening device shall be ≤ 100 dBA. <p>NOTE An example of a wireless listening device is a Bluetooth headphone.</p>		N/A
	<p>Zx.5 Measurement methods</p> <p>Measurements shall be made in accordance with EN 50332-1 or EN 50332-2 as applicable.</p> <p>Unless stated otherwise, the time interval T shall be 30 s.</p> <p>NOTE Test method for wireless equipment provided without listening device should be defined.</p>		N/A

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)									
Clause	Requirement + Test	Result - Remark	Verdict						
2.7.1	<p>Replace the subclause as follows:</p> <p>Basic requirements</p> <p>To protect against excessive current, short-circuits and earth faults in PRIMARY CIRCUITS, protective devices shall be included either as integral parts of the equipment or as parts of the building installation, subject to the following, a), b) and c):</p> <p>a) except as detailed in b) and c), protective devices necessary to comply with the requirements of 5.3 shall be included as parts of the equipment;</p> <p>b) for components in series with the mains input to the equipment such as the supply cord, appliance coupler, r.f.i. filter and switch, short-circuit and earth fault protection may be provided by protective devices in the building installation;</p>	POE powered.	N/A						
	<p>c) it is permitted for PLUGGABLE EQUIPMENT TYPE B or PERMANENTLY CONNECTED EQUIPMENT, to rely on dedicated overcurrent and short-circuit protection in the building installation, provided that the means of protection, e.g. fuses or circuit breakers, is fully specified in the installation instructions.</p> <p>If reliance is placed on protection in the building installation, the installation instructions shall so state, except that for PLUGGABLE EQUIPMENT TYPE A the building installation shall be regarded as providing protection in accordance with the rating of the wall socket outlet.</p>	POE powered.	N/A						
2.7.2	This subclause has been declared 'void'.		N/A						
3.2.3	Delete the NOTE in Table 3A, and delete also in this table the conduit sizes in parentheses.	POE powered	N/A						
3.2.5.1	<p>Replace "60245 IEC 53" by "H05 RR-F";</p> <p>"60227 IEC 52" by "H03 VV-F or H03 VVH2-F";</p> <p>"60227 IEC 53" by "H05 VV-F or H05 VVH2-F2".</p> <p>In Table 3B, replace the first four lines by the following:</p> <table border="0"> <tr> <td>Up to and including 6 </td> <td>0,75 ^{a)} </td> </tr> <tr> <td>Over 6 up to and including 10 </td> <td>(0,75) ^{b)} 1,0 </td> </tr> <tr> <td>Over 10 up to and including 16 </td> <td>(1,0) ^{c)} 1,5 </td> </tr> </table> <p>In the conditions applicable to Table 3B delete the words "in some countries" in condition ^{a)}.</p> <p>In NOTE 1, applicable to Table 3B, delete the second sentence.</p>	Up to and including 6	0,75 ^{a)}	Over 6 up to and including 10	(0,75) ^{b)} 1,0	Over 10 up to and including 16	(1,0) ^{c)} 1,5		N/A
Up to and including 6	0,75 ^{a)}								
Over 6 up to and including 10	(0,75) ^{b)} 1,0								
Over 10 up to and including 16	(1,0) ^{c)} 1,5								

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IEC 60950-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
3.3.4	In Table 3D, delete the fourth line: conductor sizes for 10 to 13 A, and replace with the following: Over 10 up to and including 16 1,5 to 2,5 1,5 to 4 Delete the fifth line: conductor sizes for 13 to 16 A		N/A
4.3.13.6 (A1:2010)	Replace the existing NOTE by the following: NOTE Z1 Attention is drawn to: 1999/519/EC: Council Recommendation on the limitation of exposure of the general public to electromagnetic fields 0 Hz to 300 GHz, and 2006/25/EC: Directive on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation).	EMC and RoHS compliance not part of this evaluation, refer to Conditions of Acceptability.	N/A
	Standards taking into account mentioned Recommendation and Directive which demonstrate compliance with the applicable EU Directive are indicated in the OJEC.		N/A
Annex H	Replace the last paragraph of this annex by: At any point 10 cm from the surface of the OPERATOR ACCESS AREA, the dose rate shall not exceed 1 µSv/h (0,1 mR/h) (see NOTE). Account is taken of the background level. Replace the notes as follows: NOTE These values appear in Directive 96/29/Euratom. Delete NOTE 2.	No ionizing radiation.	N/A
Bibliography	Additional EN standards.		—

ZA	NORMATIVE REFERENCES TO INTERNATIONAL PUBLICATIONS WITH THEIR CORRESPONDING EUROPEAN PUBLICATIONS	—
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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
1.2.4.1	In Denmark , certain types of Class I appliances (see 3.2.1.1) may be provided with a plug not establishing earthing conditions when inserted into Danish socket-outlets.	POE powered.	N/A
1.2.13.14	In Norway and Sweden , for requirements see 1.7.2.1 and 7.3 of this annex.	Not connected to Cable Distribution System.	N/A
1.5.7.1	In Finland, Norway and Sweden , resistors bridging BASIC INSULATION in CLASS I PLUGGABLE EQUIPMENT TYPE A must comply with the requirements in 1.5.7.1. In addition when a single resistor is used, the resistor must withstand the resistor test in 1.5.7.2.	POE powered.	N/A

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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
1.5.8	In Norway , due to the IT power system used (see annex V, Figure V.7), capacitors are required to be rated for the applicable line-to-line voltage (230 V).	POE Powered.	N/A
1.5.9.4	In Finland, Norway and Sweden , the third dashed sentence is applicable only to equipment as defined in 6.1.2.2 of this annex.	Permanently Earthed in end installation.	P
1.7.2.1	<p>In Finland, Norway and Sweden, CLASS I PLUGGABLE EQUIPMENT TYPE A intended for connection to other equipment or a network shall, if safety relies on connection to protective earth or if surge suppressors are connected between the network terminals and accessible parts, have a marking stating that the equipment must be connected to an earthed mains socket-outlet.</p> <p>The marking text in the applicable countries shall be as follows:</p> <p>In Finland: "Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan"</p> <p>In Norway: "Apparatet må tilkoples jordet stikkontakt"</p> <p>In Sweden: "Apparaten skall anslutas till jordat uttag"</p> <p>In Norway and Sweden, the screen of the cable distribution system is normally not earthed at the entrance of the building and there is normally no equipotential bonding system within the building. Therefore the protective earthing of the building installation need to be isolated from the screen of a cable distribution system.</p> <p>It is however accepted to provide the insulation external to the equipment by an adapter or an interconnection cable with galvanic isolator, which may be provided by e.g. a retailer.</p> <p>The user manual shall then have the following or similar information in Norwegian and Swedish language respectively, depending on in what country the equipment is intended to be used in:</p> <p>"Equipment connected to the protective earthing of the building installation through the mains connection or through other equipment with a connection to protective earthing – and to a cable distribution system using coaxial cable, may in some circumstances create a fire hazard. Connection to a cable distribution system has therefore to be provided through a device providing electrical isolation below a certain frequency range (galvanic isolator, see EN 60728-11)."</p>	POE Powered.	N/A

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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>NOTE In Norway, due to regulation for installations of cable distribution systems, and in Sweden, a galvanic isolator shall provide electrical insulation below 5 MHz. The insulation shall withstand a dielectric strength of 1,5 kV r.m.s., 50 Hz or 60 Hz, for 1 min.</p> <p>Translation to Norwegian (the Swedish text will also be accepted in Norway):</p> <p>“Utstyr som er koplet til beskyttelsesjord via nettplugg og/eller via annet jordtilkoplet utstyr – og er tilkoplet et kabel-TV nett, kan forårsake brannfare. For å unngå dette skal det ved tilkopling av utstyret til kabel-TV nettet installeres en galvanisk isolator mellom utstyret og kabel- TV nettet.”</p> <p>Translation to Swedish:</p> <p>”Utrustning som är kopplad till skyddsjord via jordat vägguttag och/eller via annan utrustning och samtidigt är kopplad till kabel-TV nät kan i vissa fall medföra risk för brand. För att undvika detta skall vid anslutning av utrustningen till kabel-TV nät galvanisk isolator finnas mellan utrustningen och kabel-TV nätet.”</p>		N/A
1.7.5	<p>In Denmark, socket-outlets for providing power to other equipment shall be in accordance with the Heavy Current Regulations, Section 107-2-D1, Standard Sheet DK 1-3a, DK 1-5a or DK 1-7a, when used on Class I equipment. For STATIONARY EQUIPMENT the socket-outlet shall be in accordance with Standard Sheet DK 1-1b or DK 1-5a.</p> <p>For CLASS II EQUIPMENT the socket outlet shall be in accordance with Standard Sheet DKA 1-4a.</p>	No power outlets.	N/A
2.2.4	<p>In Norway, for requirements see 1.7.2.1, 6.1.2.1 and 6.1.2.2 of this annex.</p>	POE powered. Permanently Earthed at end installation.	P
2.3.2	<p>In Finland, Norway and Sweden there are additional requirements for the insulation. See 6.1.2.1 and 6.1.2.2 of this annex.</p>	Provided with earth terminal for permanent connection to safety earth.	P
2.3.4	<p>In Norway, for requirements see 1.7.2.1, 6.1.2.1 and 6.1.2.2 of this annex.</p>		P
2.6.3.3	<p>In the United Kingdom, the current rating of the circuit shall be taken as 13 A, not 16 A.</p>		N/A

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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
2.7.1	In the United Kingdom , to protect against excessive currents and short-circuits in the PRIMARY CIRCUIT of DIRECT PLUG-IN EQUIPMENT, tests according to 5.3 shall be conducted, using an external protective device rated 30 A or 32 A. If these tests fail, suitable protective devices shall be included as integral parts of the DIRECT PLUG-IN EQUIPMENT, so that the requirements of 5.3 are met.	POE powered. Not connected to AC mains.	N/A
2.10.5.13	In Finland, Norway and Sweden , there are additional requirements for the insulation, see 6.1.2.1 and 6.1.2.2 of this annex.		N/A
3.2.1.1	<p>In Switzerland, supply cords of equipment having a RATED CURRENT not exceeding 10 A shall be provided with a plug complying with SEV 1011 or IEC 60884-1 and one of the following dimension sheets:</p> <p>SEV 6532-2.1991 Plug Type 15 3P+N+PE 250/400 V, 10 A</p> <p>SEV 6533-2.1991 Plug Type 11 L+N 250 V, 10 A</p> <p>SEV 6534-2.1991 Plug Type 12 L+N+PE 250 V, 10 A</p> <p>In general, EN 60309 applies for plugs for currents exceeding 10 A. However, a 16 A plug and socket-outlet system is being introduced in Switzerland, the plugs of which are according to the following dimension sheets, published in February 1998:</p> <p>SEV 5932-2.1998: Plug Type 25, 3L+N+PE, 230/400 V, 16 A</p> <p>SEV 5933-2.1998: Plug Type 21, L+N, 250 V, 16 A</p> <p>SEV 5934-2.1998: Plug Type 23, L+N+PE, 250 V, 16 A</p>	Not connected to AC mains.	N/A

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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
3.2.1.1	<p>In Denmark, supply cords of single-phase equipment having a rated current not exceeding 13 A shall be provided with a plug according to the Heavy Current Regulations, Section 107-2-D1.</p> <p>CLASS I EQUIPMENT provided with socket-outlets with earth contacts or which are intended to be used in locations where protection against indirect contact is required according to the wiring rules shall be provided with a plug in accordance with standard sheet DK 2-1a or DK 2-5a.</p> <p>If poly-phase equipment and single-phase equipment having a RATED CURRENT exceeding 13 A is provided with a supply cord with a plug, this plug shall be in accordance with the Heavy Current Regulations, Section 107-2-D1 or EN 60309-2.</p>		N/A
3.2.1.1	<p>In Spain, supply cords of single-phase equipment having a rated current not exceeding 10 A shall be provided with a plug according to UNE 20315:1994.</p> <p>Supply cords of single-phase equipment having a rated current not exceeding 2,5 A shall be provided with a plug according to UNE-EN 50075:1993.</p> <p>CLASS I EQUIPMENT provided with socket-outlets with earth contacts or which are intended to be used in locations where protection against indirect contact is required according to the wiring rules, shall be provided with a plug in accordance with standard UNE 20315:1994.</p> <p>If poly-phase equipment is provided with a supply cord with a plug, this plug shall be in accordance with UNE-EN 60309-2.</p>		N/A
3.2.1.1	<p>In the United Kingdom, apparatus which is fitted with a flexible cable or cord and is designed to be connected to a mains socket conforming to BS 1363 by means of that flexible cable or cord and plug, shall be fitted with a 'standard plug' in accordance with Statutory Instrument 1768:1994 - The Plugs and Sockets etc. (Safety) Regulations 1994, unless exempted by those regulations.</p> <p>NOTE 'Standard plug' is defined in SI 1768:1994 and essentially means an approved plug conforming to BS 1363 or an approved conversion plug.</p>		N/A

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ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
3.2.1.1	In Ireland , apparatus which is fitted with a flexible cable or cord and is designed to be connected to a mains socket conforming to I.S. 411 by means of that flexible cable or cord and plug, shall be fitted with a 13 A plug in accordance with Statutory Instrument 525:1997 - National Standards Authority of Ireland (section 28) (13 A Plugs and Conversion Adaptors for Domestic Use) Regulations 1997.		N/A
3.2.4	In Switzerland , for requirements see 3.2.1.1 of this annex.		N/A
3.2.5.1	In the United Kingdom , a power supply cord with conductor of 1,25 mm ² is allowed for equipment with a rated current over 10 A and up to and including 13 A.	Approved Type POE input is required. Cat 5 cable shall be used. See Conditions of Acceptability.	N/A
3.3.4	In the United Kingdom , the range of conductor sizes of flexible cords to be accepted by terminals for equipment with a RATED CURRENT of over 10 A up to and including 13 A is: • 1,25 mm ² to 1,5 mm ² nominal cross-sectional area.	No external wiring terminals.	N/A
4.3.6	In the United Kingdom , the torque test is performed using a socket outlet complying with BS 1363 part 1:1995, including Amendment 1:1997 and Amendment 2:2003 and the plug part of DIRECT PLUG-IN EQUIPMENT shall be assessed to BS 1363: Part 1, 12.1, 12.2, 12.3, 12.9, 12.11, 12.12, 12.13, 12.16 and 12.17, except that the test of 12.17 is performed at not less than 125 °C. Where the metal earth pin is replaced by an Insulated Shutter Opening Device (ISOD), the requirements of clauses 22.2 and 23 also apply.	Not direct plug-in equipment.	N/A
4.3.6	In Ireland , DIRECT PLUG-IN EQUIPMENT is known as plug similar devices. Such devices shall comply with Statutory Instrument 526:1997 - National Standards Authority of Ireland (Section 28) (Electrical plugs, plug similar devices and sockets for domestic use) Regulations, 1997.		N/A

**ATTACHMENT 1A - European Group Differences
& National Differences Checklist**

ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
5.1.7.1	<p>In Finland, Norway and Sweden TOUCH CURRENT measurement results exceeding 3,5 mA r.m.s. are permitted only for the following equipment:</p> <ul style="list-style-type: none"> • STATIONARY PLUGGABLE EQUIPMENT TYPE A that <ul style="list-style-type: none"> is intended to be used in a RESTRICTED ACCESS LOCATION where equipotential bonding has been applied, for example, in a telecommunication centre; and has provision for a permanently connected PROTECTIVE EARTHING CONDUCTOR; and is provided with instructions for the installation of that conductor by a SERVICE PERSON; • STATIONARY PLUGGABLE EQUIPMENT TYPE B; • STATIONARY PERMANENTLY CONNECTED EQUIPMENT. 	DC powered.	N/A
6.1.2.1 (A1:2010)	<p>In Finland, Norway and Sweden, add the following text between the first and second paragraph of the compliance clause:</p> <p>If this insulation is solid, including insulation forming part of a component, it shall at least consist of either</p> <ul style="list-style-type: none"> - two layers of thin sheet material, each of which shall pass the electric strength test below, or - one layer having a distance through insulation of at least 0,4 mm, which shall pass the electric strength test below. <p>Alternatively for components, there is no distance through insulation requirements for the insulation consisting of an insulating compound completely filling the casing, so that CLEARANCES and CREEPAGE DISTANCES do not exist, if the component passes the electric strength test in accordance with the compliance clause below and in addition</p> <ul style="list-style-type: none"> - passes the tests and inspection criteria of 2.10.11 with an electric strength test of 1,5 kV multiplied by 1,6 (the electric strength test of 2.10.10 shall be performed using 1,5 kV), and - is subject to ROUTINE TESTING for electric strength during manufacturing, using a test voltage of 1,5 kV. 		N/A

**ATTACHMENT 1A - European Group Differences
& National Differences Checklist**

ZB ANNEX (normative) SPECIAL NATIONAL CONDITIONS (EN)			
Clause	Requirement + Test	Result - Remark	Verdict
	<p>It is permitted to bridge this insulation with an optocoupler complying with 2.10.5.4 b).</p> <p>It is permitted to bridge this insulation with a capacitor complying with EN 60384-14:2005, subclass Y2.</p> <p>A capacitor classified Y3 according to EN 60384-14:2005, may bridge this insulation under the following conditions:</p> <ul style="list-style-type: none"> - the insulation requirements are satisfied by having a capacitor classified Y3 as defined by EN 60384-14, which in addition to the Y3 testing, is tested with an impulse test of 2,5 kV defined in EN 60950-1:2006, 6.2.2.1; - the additional testing shall be performed on all the test specimens as described in EN 60384-14: - the impulse test of 2,5 kV is to be performed before the endurance test in EN 60384-14, in the sequence of tests as described in EN 60384-14. 		N/A
6.1.2.2	<p>In Finland, Norway and Sweden, the exclusions are applicable for PERMANENTLY CONNECTED EQUIPMENT, PLUGGABLE EQUIPMENT TYPE B and equipment intended to be used in a RESTRICTED ACCESS LOCATION where equipotential bonding has been applied, e.g. in a telecommunication centre, and which has provision for a permanently connected PROTECTIVE EARTHING CONDUCTOR and is provided with instructions for the installation of that conductor by a SERVICE PERSON.</p>		N/A
7.2	<p>In Finland, Norway and Sweden, for requirements see 6.1.2.1 and 6.1.2.2 of this annex.</p> <p>The term TELECOMMUNICATION NETWORK in 6.1.2 being replaced by the term CABLE DISTRIBUTION SYSTEM.</p>		N/A
7.3	<p>In Norway and Sweden, for requirements see 1.2.13.14 and 1.7.2.1 of this annex.</p>		N/A
7.3	<p>In Norway, for installation conditions see EN 60728-11:2005.</p>		N/A



NATIONAL DEVIATION CHECKLIST

for
CB Reports to IEC 60950-1:2005 (2nd Edition); Am 1:2009

This document is based on and covers requirements for

- **National Deviations downloaded at the following IECEE CB Website:
<http://members.iecee.org/iecee/ieceemembers.nsf>**

ATTACHMENT 1B

CB 215348-2522648

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ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 1 of 6)
National Deviations for **CANADA and US**
(Clauses reference to CAN/CSA-C22.2 No. 60950-1-07, Amd 1:2011 and
UL 60950-1, Second Edition, Amd 1, December 19, 2011)

Canada and the United States of America have adopted a single, bi-national standard, CAN/CSA C22.2 No. 60950-1/UL 60950-1, Second Edition, which is based on IEC 60950-1, Second Edition. This bi-national standard should be consulted for further details on the national conditions and differences.

SPECIAL NATIONAL CONDITIONS

The following is a summary of the key national differences based on national regulatory requirements, such as the Canadian Electrical Code (CEC) Part 1 and the Canadian Building Code, which are referenced in legislation and which form the basis for the rules and practices followed in electrical and building installations.

Clause	Requirement + Test	Result - Remark	Verdict
1.1.1	All equipment is to be designed to allow installation in accordance with the National Electrical Code (NEC), ANSI/NFPA 70, the Canadian Electrical Code (CEC), Part I, CAN/CSA C22.1, and when applicable, the National Electrical Safety Code, IEEE C2. Also, unless marked or otherwise identified, installation is allowed per the Standard for the Protection of Electronic Computer/Data-Processing Equipment, ANSI/NFPA 75.		P
1.4.14	For Pluggable Equipment Type A, the protection in the installation is assumed to be 20A:	Not connected to AC mains.	N/A
1.5.5	For lengths exceeding 3.05 m, external interconnecting flexible cord and cable assemblies are required to be a suitable cable type (e.g., DP, CL2) specified in the CEC/NEC:	Cat 5 cable used for POE connection.	P
	For lengths 3.05 m or less, external interconnecting flexible cord and cable assemblies that are not types specified in the CEC/NEC are required to have special construction features and identification markings.		N/A
1.7.1	Equipment for use on a.c. mains supply systems with a neutral and more than one phase conductor (e.g. 120/240 V, 3-wire) require a special marking format for electrical ratings.	Not connected to AC mains.	N/A
	A voltage rating that exceeds an attachment plug cap rating is only permitted if it does not exceed the extreme operating conditions in Table 2 of CAN/CSA C22.2 No. 235, and if it is part of a range that extends into the Table 2 "Normal Operating Conditions." Likewise, a voltage rating shall not be lower than the specified "Normal Operating Conditions," unless it is part of a range that extends into the "Normal Operating Conditions."		N/A

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 2 of 6)			
National Deviations for CANADA and US			
Clause	Requirement + Test	Result - Remark	Verdict
1.7.7	Wiring terminals intended to supply Class 2 outputs in accordance with CEC Part 1 or NEC shall be marked with the voltage rating and "Class 2" or equivalent. Marking shall be located adjacent to the terminals and shall be visible during wiring.		N/A
2.5	Where a fuse is used to provide Class 2, Limited Power Source, or TNV current limiting, it shall not be operator-accessible unless it is not interchangeable.		N/A
2.6.3.3	The first column on Table 2D modified to require, "Smaller of the RATED CURRENT of the equipment or the PROTECTIVE CURRENT RATING of the circuit under consideration."		N/A
2.7.1	Suitable NEC/CEC branch circuit protection rated at the maximum circuit rating is required for all standard supply outlets and receptacles (such as supplied in power distribution units) if the supply branch circuit protection is not suitable. Power distribution transformers distributing power at 100 volts or more, and rated 10 kVA or more, require special transformer overcurrent protection.		N/A
3.2	Wiring methods (terminals, leads, etc.) used for the connection of the equipment to the mains shall be in accordance with the NEC/CEC.		N/A
3.2.1	Power supply cords are required to have attachment plugs rated not less than 125 percent of the rated current of the equipment.		N/A
3.2.1.2	Equipment connected to a centralized d.c. power system, and having one pole of the DC mains input terminal connected to the main protective earthing terminal in the equipment, is required to comply with special earthing, wiring, marking and installation instruction requirements.	POE powered.	N/A
3.2.3	Permanent connection of equipment to the mains supply by a power supply cord is not permitted, except for certain equipment, such as ATMs.		N/A

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 3 of 6)			
National Deviations for CANADA and US			
Clause	Requirement + Test	Result - Remark	Verdict
3.2.5	<p>Power supply cords are required to be no longer than 4.5 m in length.</p> <p>Minimum cord length is required to be 1.5 m, with certain constructions such as external power supplies allowed to consider both input and output cord lengths into the requirement.</p> <p>Flexible power supply cords are required to be compatible with Article 400 of the NEC, and Tables 11 and 12 of the CEC.</p>	Not mains connected.	N/A
3.2.9	Permanently connected equipment is required to have a suitable wiring compartment and wire bending space.		N/A
3.3	Wiring terminals and associated spacings for field wiring connections shall comply with CSA C22.2 No. 0	No wiring terminals for Mains connection.	N/A
3.3.3	Wire binding screws are not permitted to attach conductors larger than 10 AWG (5.3 mm ²).		N/A
3.3.4	Terminals for permanent wiring, including protective earthing terminals, are required to be suitable for Canadian/US wire gauge sizes, rated 125 percent of the equipment rating, and be specially marked when specified (1.7.7).	Treaded Earth connection provided, suitable for connection to 6AWG conductor.	P
3.3.5	First column of Table 3E revised to require "Smaller of the RATED CURRENT of the equipment or the PROTECTIVE CURRENT RATING of the circuit under consideration."		N/A
3.4.2	Motor control devices are required for cord-connected equipment with a motor if the equipment is rated more than 12 A, or if the motor has a nominal voltage rating greater than 120 V, or is rated more than 1/3 hp (locked rotor current over 43 A).		N/A
3.4.8	Vertically-mounted disconnect switches and circuit breakers are required to have the "on" position indicated by the handle in the up position.		N/A
3.4.11	For computer room applications, equipment with battery systems capable of supplying 750 VA for five minutes are required to have a battery disconnect means that may be connected to the computer room remote power-off circuit.		N/A
4.3.12	The maximum quantity of flammable liquid stored in equipment is required to comply with NFPA 30.		N/A
4.3.13.5	Equipment with lasers is required to meet the Canadian Radiation Emitting Devices Act, REDR C1370 and/or U.S. Code of Federal Regulations 21 CFR 1040		N/A

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 4 of 6)			
National Deviations for CANADA and US			
Clause	Requirement + Test	Result - Remark	Verdict
4.7	For computer room applications, automated information storage systems with combustible media greater than 0.76 m ³ (27 cu ft) are required to have a provision for connection of either automatic sprinklers or a gaseous agent extinguishing system with an extended discharge.		N/A
4.7.3.1	For computer room applications, enclosures with combustible material measuring greater than 0.9 m ² (10 sq ft) or a single dimension greater than 1.8 m (6 ft) are required to have a flame spread rating of 50 or less. For other applications, enclosures with the same dimensions require a flame spread rating of 200 or less.		N/A
Annex H	Equipment that produces ionizing radiation is required to comply with the Canadian Radiation Emitting Devices Act, REDR C1370 and/or U.S. Code of Federal Regulations, 21 CFR 1020		N/A
OTHER DIFFERENCES			
The following key national differences are based on requirements other than national regulatory requirements.			
1.5.1	Some components and materials associated with the risk of fire, electric shock, or personal injury are required to have component or material ratings in accordance with the applicable national (Canadian and/or U.S.) component or material standard requirements. These components include: attachment plugs, battery packs (rechargeable type, used with transportable equipment), cathode ray tubes, circuit breakers, communication circuit accessories, connectors (used for current interruption of non-LPS circuits), cord sets and power supply cords, direct plug-in equipment, enclosures (outdoor), flexible cords and cables, fuses (branch circuit), fuseholders, ground-fault current interrupters, industrial control equipment, insulating tape, interconnecting cables, lampholders, limit controls, printed wiring, protectors for communications circuits, receptacles, solid state controls, supplementary protectors, switches (including interlock switches), thermal cutoffs, thermostats, (multi-layer) transformer winding wire, transient voltage surge suppressors, tubing, wire connectors, and wire and cables.	See safety component list	P

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 5 of 6)			
National Deviations for CANADA and US			
Clause	Requirement + Test	Result - Remark	Verdict
1.6.1.2	A circuit for connection to the DC Mains Supply is classified as either a SELV Circuit, TNV-2 Circuit or Hazardous Voltage Circuit depending on the maximum operating voltage of the supply. This maximum operating voltage shall include consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked power rating of the equipment.	POE powered.	N/A
2.3.1	For TNV-2 and TNV-3 circuits with other than ringing signals and with voltages exceeding 42.4 V _{peak} or 60 V _{d.c.} , the maximum acceptable current through a 2000 ohm resistor (or greater) connected across the voltage source with other loads disconnected is 7.1 mA peak or 30 mA d.c. under normal operating conditions.		N/A
2.3.2.1	In the event of a single fault between TNV and SELV circuits, SELV Circuits and accessible conductive parts comply with the North American limits of 2.2.3.	POE powered.	P
2.6.3.4	Protective bonding conductors of non-standard protective bonding constructions (e.g., printed circuit traces) subjected to the additional limited short circuit test conditions specified, if required.		N/A
4.2.8.1	Enclosures around CRTs with a face diameter of 160 mm or more are provided with suitable enclosure to reduce the risk of injury due to the implosion of the CRT.		N/A
4.3.2	Equipment with handles is required to comply with special loading tests.	Fixed equipment.	N/A
5.1.8.3	Equipment intended to receive telecommunication ringing signals is required to comply with a special touch current measurement tests.		N/A
5.3.7	Internal (e.g., card cage) SELV circuit connectors and printed wiring board connectors that are accessible to the operator and that deliver power are to be overloaded. During abnormal operating testing, if a circuit is interrupted by the opening of a component, the test shall be repeated twice (three tests total) using new components as necessary.		N/A

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix CA/US (Page 6 of 6) National Deviations for CANADA and US			
Clause	Requirement + Test	Result - Remark	Verdict
6.4	Equipment intended for connection to telecommunication network outside plant cable is required to be protected against overvoltage from power line crosses in accordance with 6.4 and Annex NAC.	Not connected to TNV circuits.	N/A
Annex EE	Articulated accessibility probe (Fig EE.3) required for assessing accessibility to document/media shredders instead of the Figure 2A test finger. UL articulated accessibility probe (Fig EE.3) required for assessing accessibility to document/media shredders instead of the Figure 2A test finger.		N/A
M.2	Continuous ringing signals up to 16 mA only are permitted if the equipment is subjected to special installation and performance restrictions.		N/A
Annex NAD	Equipment connected to a telecommunication and cable distribution networks and supplied with an earphone intended to be held against, or in the ear is required to comply with special acoustic pressure requirements.		N/A

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix IL (Page 1 of 4) National Deviations for ISRAEL			
Clause	Requirement + Test	Result - Remark	Verdict
1.1.1	<p>Equipment covered by this standard</p> <p>This Standard is applicable to mains-powered or battery-powered information technology equipment, including electrical business equipment and associated equipment, with a rated voltage not exceeding 600 V.</p> <p>This standard is also applicable to the information technology equipment mentioned below:</p> <ul style="list-style-type: none"> - equipment designed for use as telecommunication terminal equipment and telecommunication network infrastructure equipment, independent of the source of power; - equipment designed and intended to be connected directly to, or used as infrastructure equipment in, a cable distribution system, independent of the source of power; - equipment designed to use the general a.c. mains supply as a communication transmission medium (see clause 6, Note 4 and subclause 7.1, Note 4). <p>This Standard is also applicable to components and subassemblies intended for incorporation in information technology equipment. It is not expected that such components and subassemblies comply with every aspect of the Standard, provided that the complete information technology equipment, incorporating such components and subassemblies, does comply.</p> <p>Note 1: Examples of aspects with which uninstalled components and subassemblies may not comply include the marking of the power rating and access to hazardous parts.</p> <p>Note 2: This Standard may be applied to the electronic parts of equipment even if that equipment does not wholly fall within its Scope, such as large-scale air conditioning systems and fire extinguishing systems. Different requirements may be necessary for some applications.</p> <p>This Standard specifies requirements intended to reduce risks of fire ignition, electric shock or bodily injury for the operator and layman who may come into contact with the equipment and, where specifically stated, for a service person.</p> <p>This Standard is intended to reduce such risks with respect to installed equipment, whether it consists of a system or interconnected units or independent units, subject to installing, operating and maintaining the equipment in the manner prescribed by the manufacturer.</p>		P

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix IL (Page 2 of 4) National Deviations for ISRAEL			
Clause	Requirement + Test	Result - Remark	Verdict
	Examples of equipment that is in the scope of this Standard are the following:		P
Generic product type	Specific examples of generic type		
Banking equipment	Monetary processing machines (counting, dispensing, etc.) for bills and coins, including automated teller machines (ATM)		
Data and text processing machines and associated equipment	Data preparation equipment, data processing equipment, data storage equipment, personal computers, plotters, printers, scanners, text processing equipment and visual display units		
Data network equipment	Bridges, data circuit terminating equipment, data terminal equipment and routers		
Electrical and electronic retail equipment	Cash registers, point of sale terminals including associated electronic scales		
Electrical and electronic office machines	Calculators, copying machines ^(A) , dictation equipment, document shredding machines, duplicators, erasers, micrographic office equipment, motor-operated files, paper trimmers (punchers, cutting machines, separators), paper jogging machines, pencil sharpeners, staplers and typewriters		
Other information technology equipment	Photoprinting equipment, public information terminals and multimedia equipment		
Postage equipment	Mail processing machines and postage machines		
Telecommunication network infrastructure equipment	Billing equipment, multiplexers, network powering equipment, network terminating equipment, radio base stations, repeaters, transmission equipment and telecommunication switching equipment		
Telecommunication terminal equipment	Facsimile equipment, key telephone systems, modems, PABXs ^(B) , pagers, telephone answering machines and telephone sets (wired and wireless)		
^(A) Commonly known as "copiers".			
^(B) PABX - private Automatic Branch Exchange.			
	Note 3: The requirements of Israel Standard SI 60065 ^(C) may also be used to meet safety requirements for multimedia equipment. See IEC Guide 112, Guide on the safety of multimedia equipment. The list of equipment (brought in the above table) is not intended to be comprehensive and exhaustive, and equipment that is not listed is not necessarily excluded from the Scope. Equipment complying with the relevant requirements in this Standard is considered suitable for use with process control equipment, automatic test equipment and similar systems requiring information processing facilities. However, this Standard does not include requirements for performance or function characteristics of equipment.	Noted.	P

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

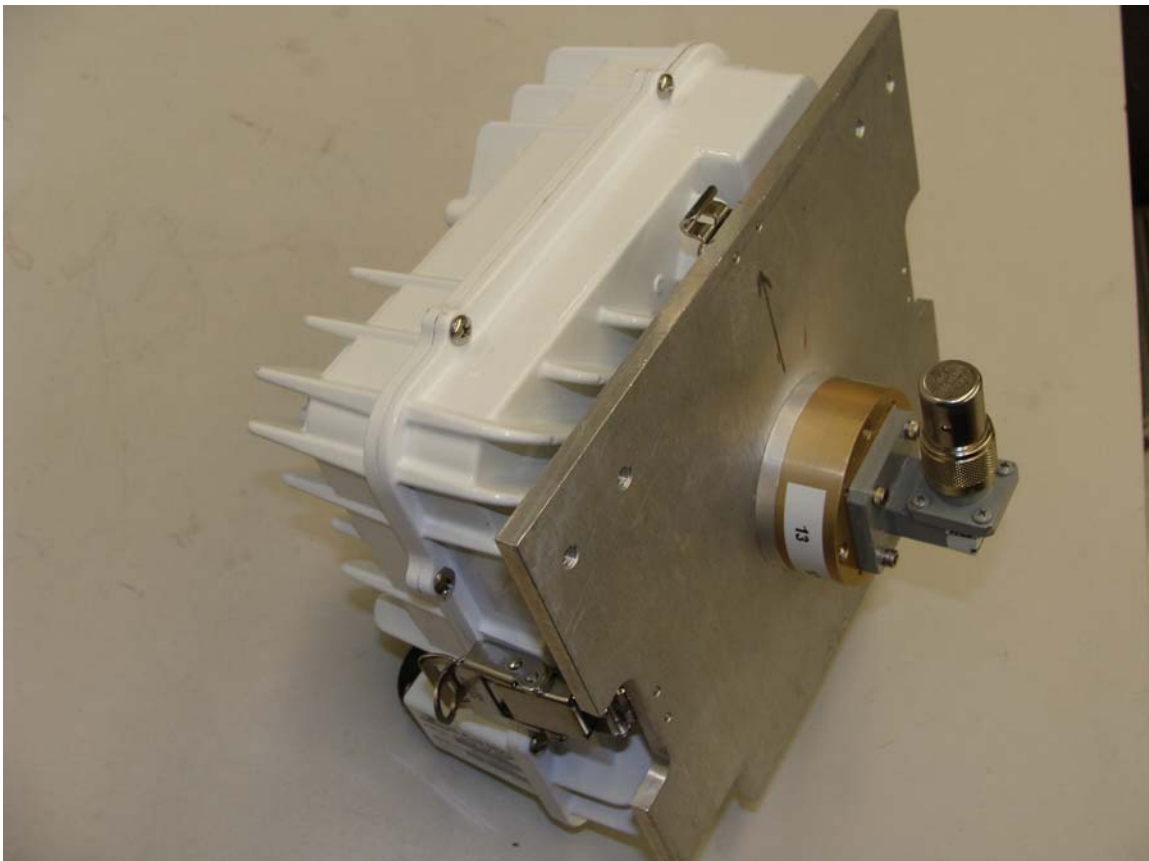
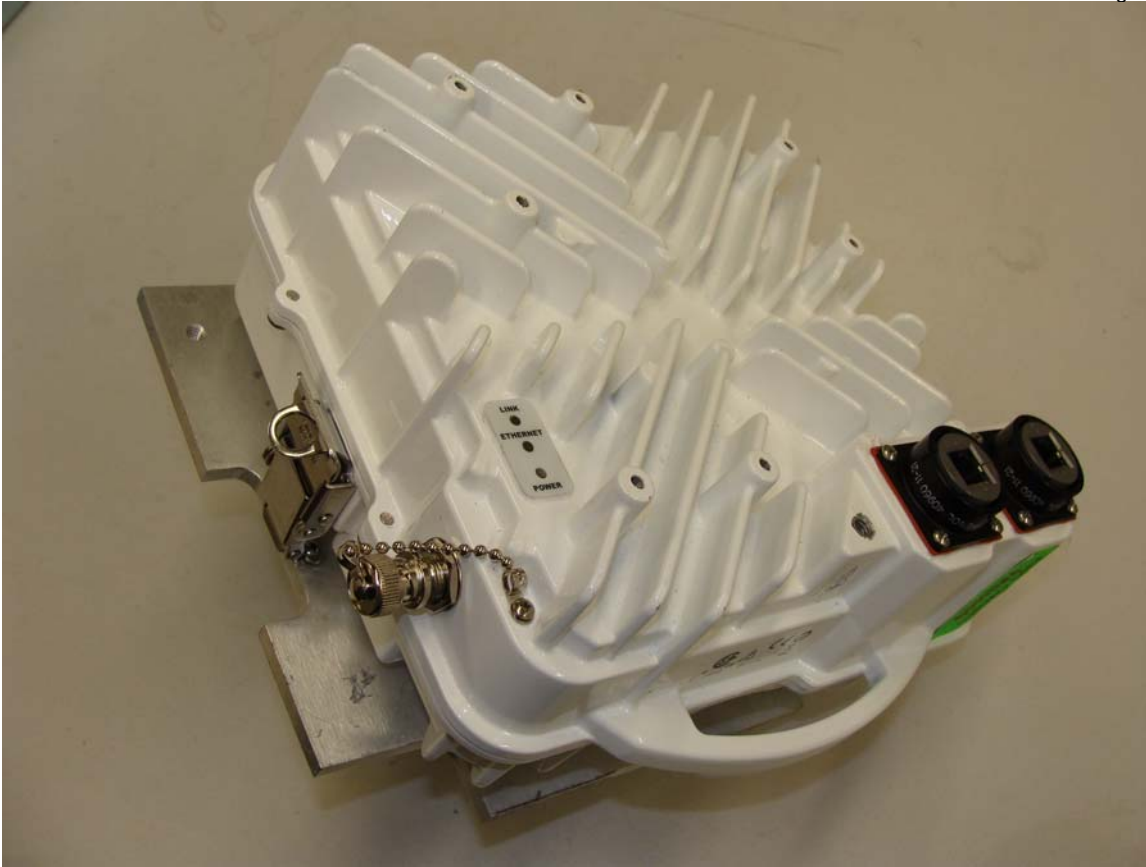
Appendix IL (Page 3 of 4) National Deviations for ISRAEL			
Clause	Requirement + Test	Result - Remark	Verdict
1.1.2	<p>Additional requirements: Requirements additional to those specified in this Standard may be necessary for:</p> <ul style="list-style-type: none"> - equipment intended for operation in special environments (for example, extreme of temperature; very high concentration of dust, moisture or vibration; flammable gases; and corrosive or explosive atmospheres); - electromedical applications with physical connections to the patient; - equipment intended to be used in vehicles, onboard ships or aircraft, in tropical countries, or at altitudes greater than 2,000 m. - equipment intended for use where ingress of water may be possible. For guidance on such requirements and on relevant testing, see Annex T. <p>Note: Attention is drawn to the fact that government authorities of some countries impose additional requirements.</p>	Passed tests for IP 56 Per IEC 60529	P
1.1.3	<p>Exclusions: This Standard does not apply to the following:</p> <ul style="list-style-type: none"> - power supply systems which are not an integral part of the equipment, such as motor-generator sets, battery backup systems and transformers; - building installation wiring; - devices requiring no electric power. 	Noted.	P
1.6.1	<p>AC Power distribution systems - A note shall be added to the clause as follows: Note: In Israel this clause is applicable subject to the Electricity Law, 1954, its regulations and revisions.</p>	Not connected to AC mains.	N/A
1.7.201	<p>Marking in the Hebrew language The marking in the Hebrew language shall be in accordance with the Consumer Protection Order (Marking of good), 1983. In addition to the marking required by clause 1.7.1, the following details shall be marked in the Hebrew language. The details shall be marked on the apparatus or on its package, or on a label properly attached to the apparatus or on the package, by bonding or dewing, in a manner that the label cannot be easily removed.</p> <ol style="list-style-type: none"> 1. Name of the apparatus and its commercial designation; 2. Manufacturer's name and address. If the apparatus is imported, the importer's name and address; 3. Manufacturer's registered trademark, if any; 4. Name of the model and serial number, if any; 5. Country of manufacture 	All safety related information shall be provided in a language acceptable for country of use.	P

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

Appendix IL (Page 4 of 4) National Deviations for ISRAEL			
Clause	Requirement + Test	Result - Remark	Verdict
1.7.2.1	The following shall be added to the clause: All the instructions and warnings related to safety shall also be written in the Hebrew language.		P
2.9.4	Separation from hazardous voltages The following shall be added at the beginning of the clause: In Israel, according to the Electricity Law, 1954, and the Electricity Regulations (Earthing and means of protection against electricity of voltages up to 1,000V) 1991, seven means of protection against electrocution are permitted, as follows: <ol style="list-style-type: none"> 1) TN-S - Network system earthing; TN-C-S - Network system earthing; 2) TT - Network system earthing; 3) IT - Network Insulation Terre; 4) Isolated transformer; 5) Safety extra low voltage (SELV or ELV) 6) Residual current circuit breaker (30 ma = IΔ); 7) Reinforced insulation; Double insulation (class II) 	Noted. Powered by approved POE supply.	P
2.201	Prevention of electromagnetic interference <ul style="list-style-type: none"> - Prior to carrying out the tests in accordance with the clauses of this Standard, the compliance of the apparatus with the relevant requirements specified in the appropriate part of the Standard series, SI 961, shall be checked. The apparatus shall meet the requirements in the appropriate part of the Standard series, SI 961. - If there are components in the apparatus for the prevention of electromagnetic interference, these components shall not reduce the safety level of the apparatus as required by this Standard. 	EMC compliance and RoHS compliance is not part of this evaluation. Refer to Conditions of Acceptability.	N/A
3.2.1.1	Connection to an a.c. mains supply After the note, the following note shall be added: Note: In Israel, the feed plug shall comply with the requirements of Israel Standard SI 32 Part 1.1.	Not connected to AC mains.	N/A
3.2.1.2	Connection to a d.c mains supply At the end of the first paragraph, the following note shall be added: Note: At the time of issue of this Standard, there is no Israel Standard for connection accessories to a d.c.	Powered by POE.	N/A
Annex P	Add the following to the Clause Israel Standards SI 32 Part 1.1 - Plugs and socket-outlets for household and similar purposes: Plugs and socket-outlets for single phase up to 16 A - general requirements SI 961, all parts - Electromagnetic compatibility Israel Documents Electricity Law, 1954, its regulations and revisions Kovetz Takanot 4465 dated 1983-02-24, Consumer Protection Order (Marking of goods), 1983	Noted.	P

ATTACHMENT 1B - NATIONAL DEVIATION CHECKLIST

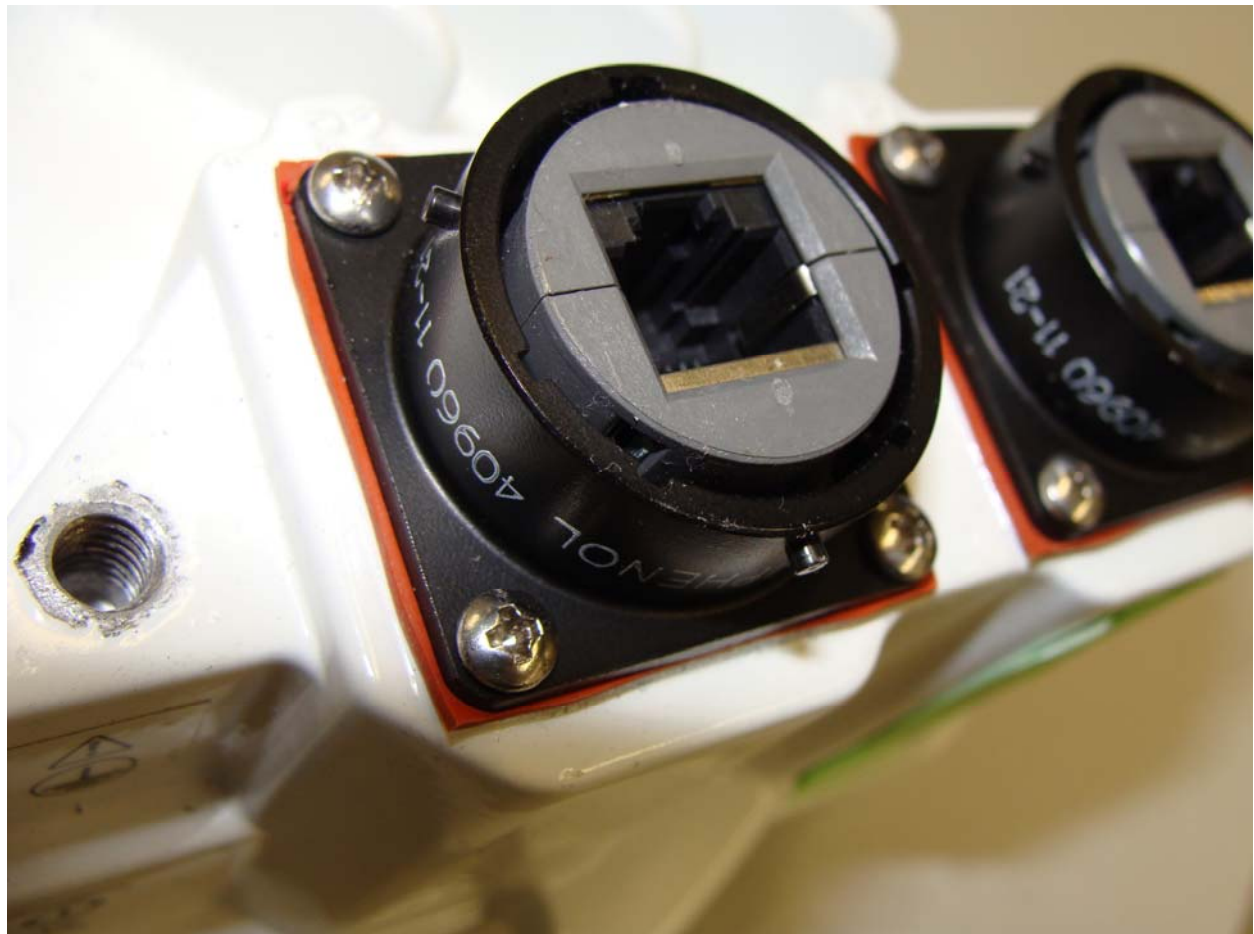
Appendix KR (Page 1 of 1) National Deviations for KOREA (KR National Deviations declared to IEC 60950-1:2005+A1:2009)			
Clause	Requirement + Test	Result - Remark	Verdict
1.5.101	Plugs for the connection of the apparatus to the supply mains shall comply with the Korean requirement (KSC 8305).	Not connected to AC mains.	N/A
8	EMC: The apparatus shall comply with the relevant CISPR standards.	EMC compliance and RoHS compliance is not part of this evaluation. Refer to Conditions of Acceptability.	N/A

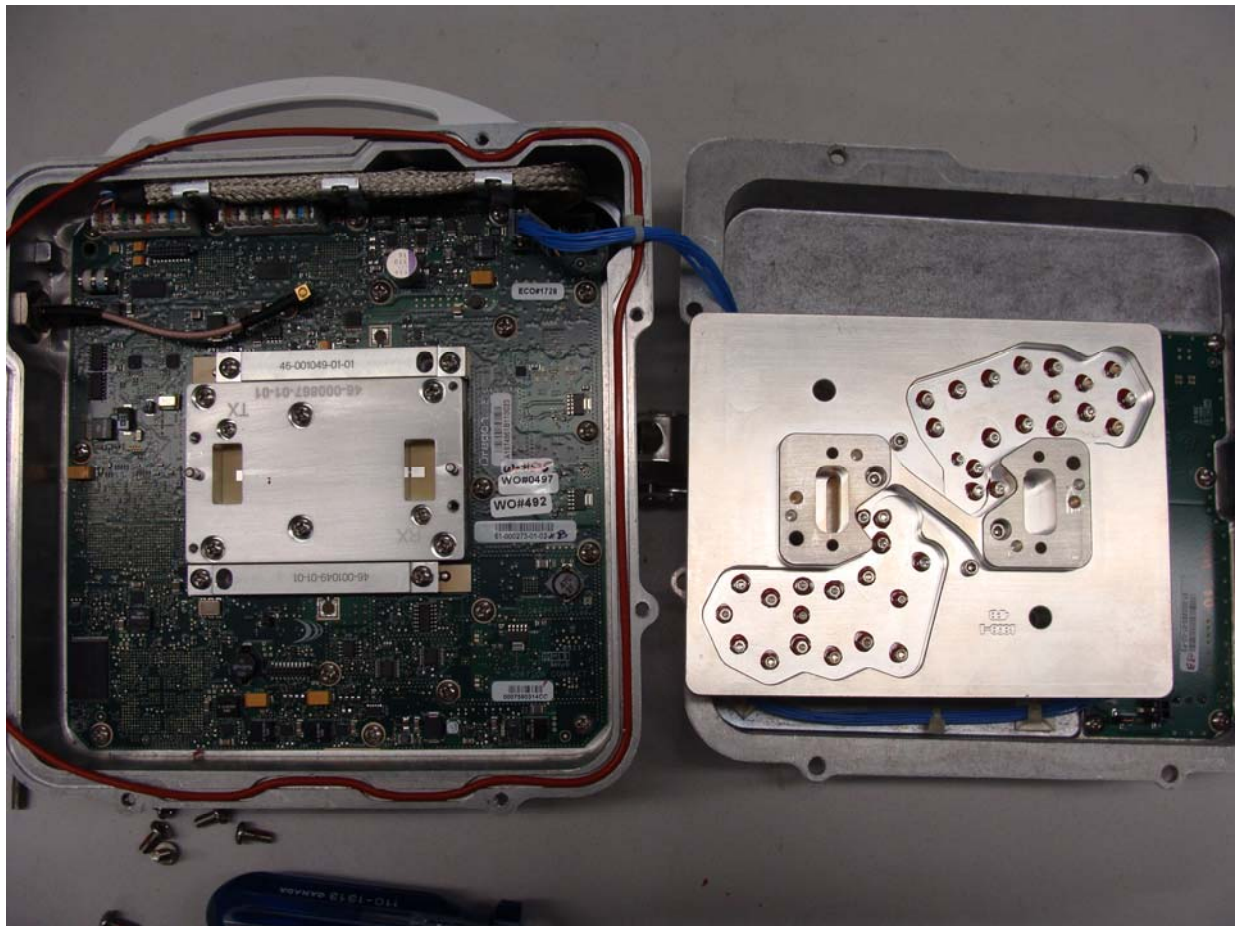
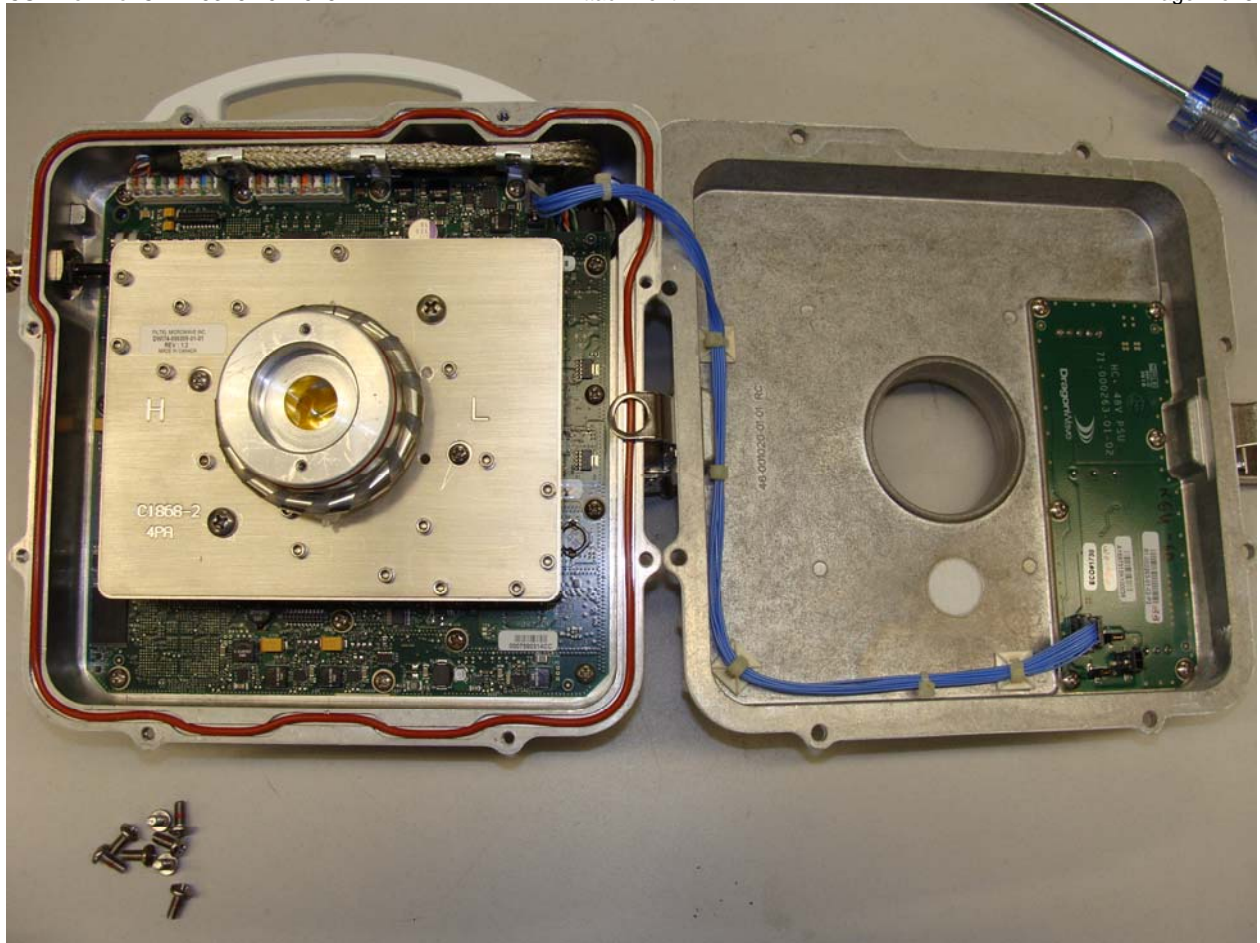


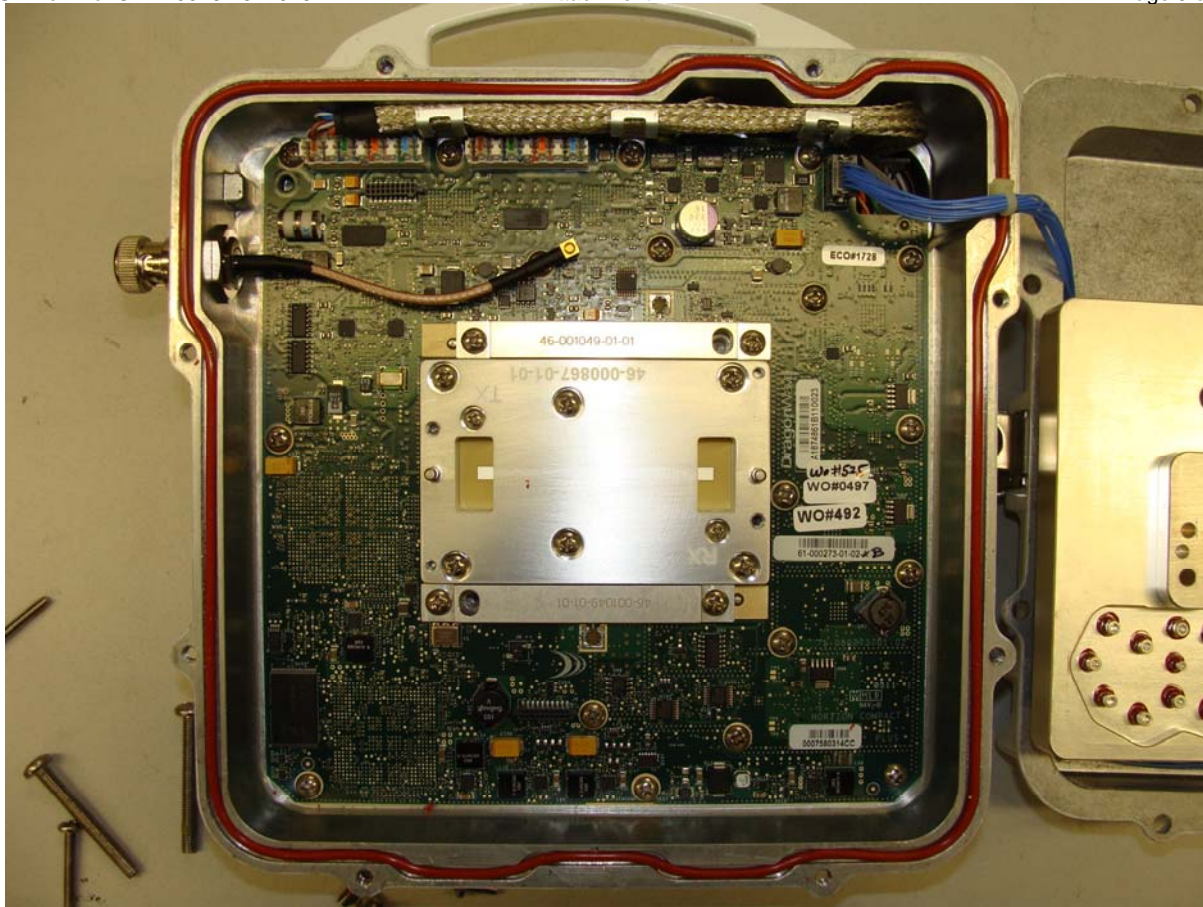
Shown with antenna attenuator attached.

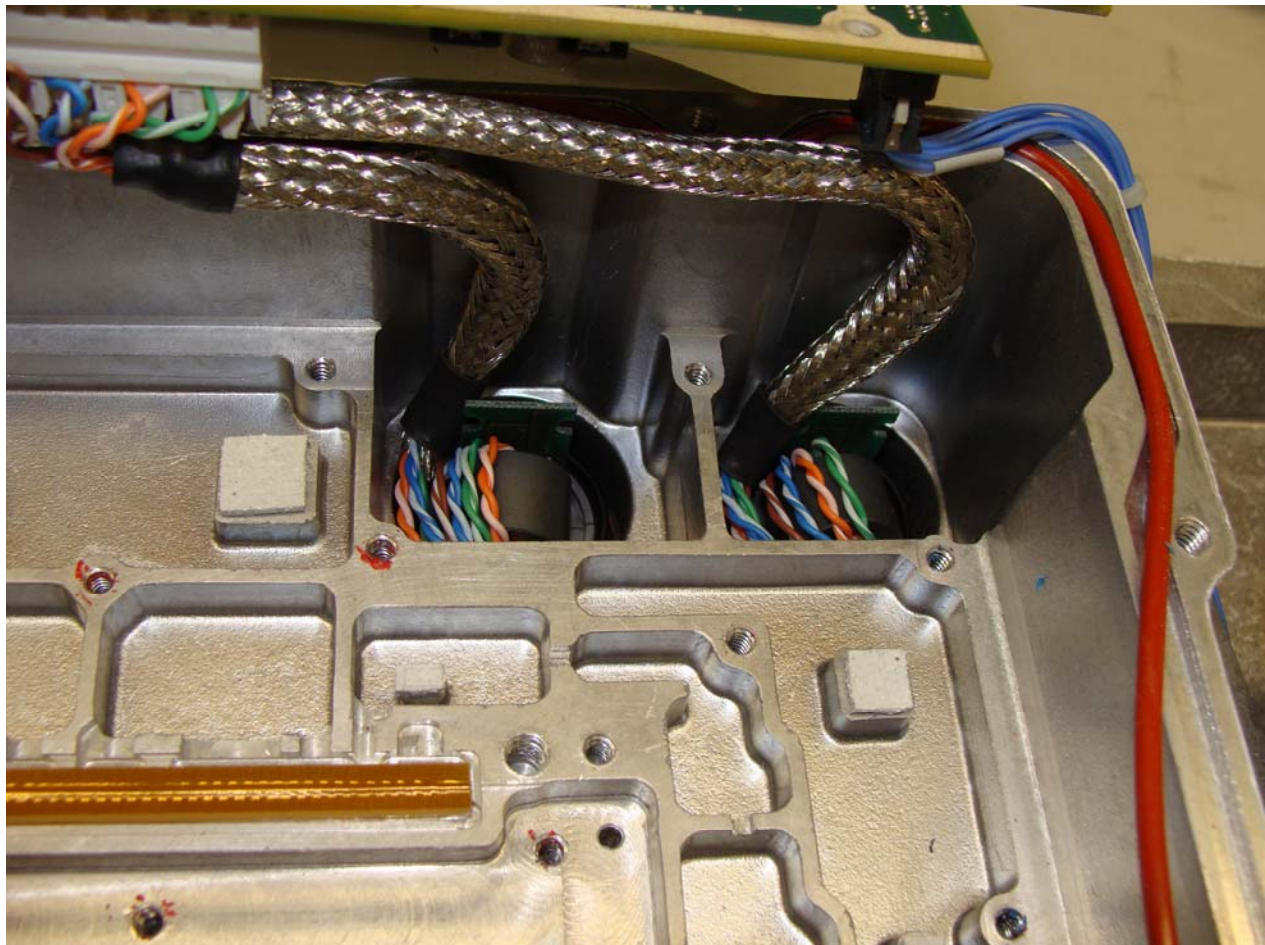
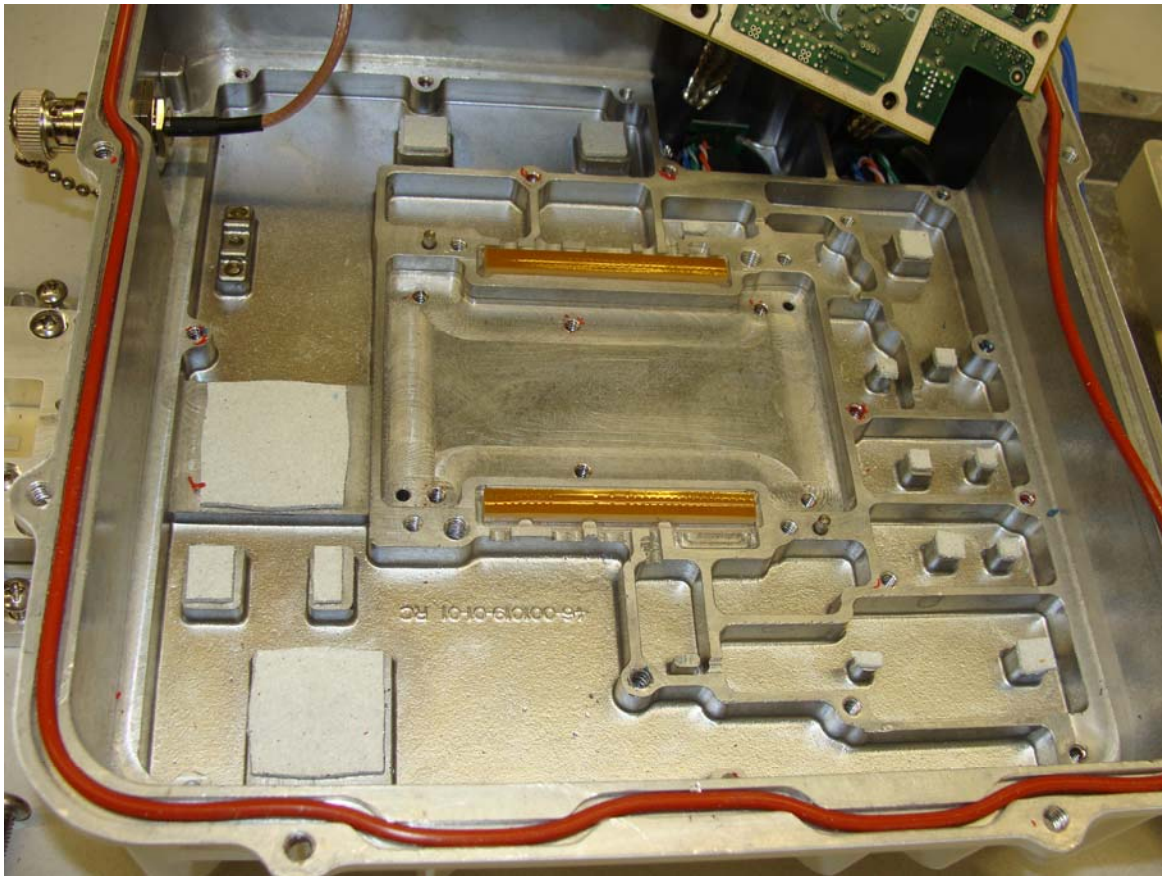


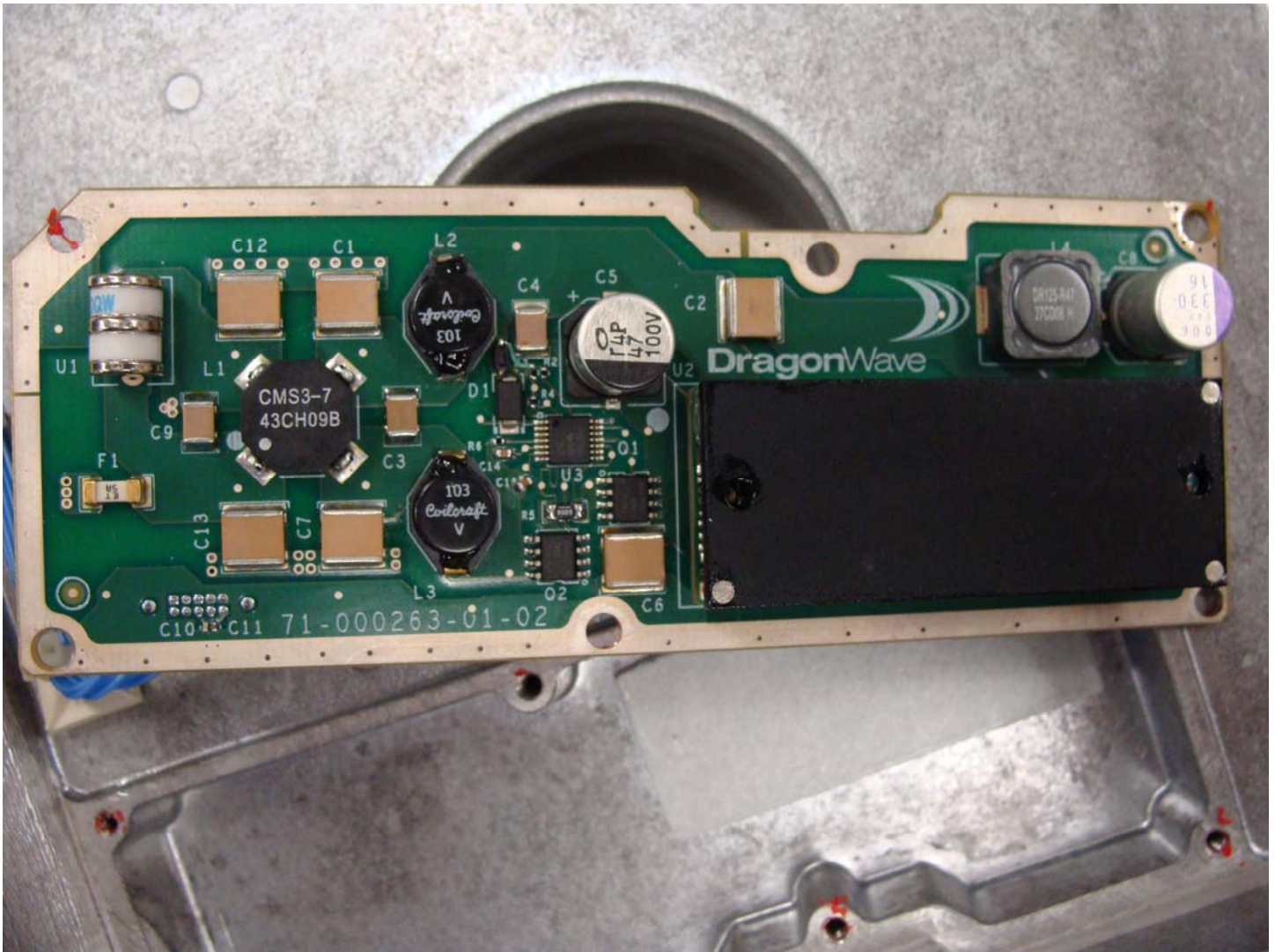
Close up Grounding terminal.











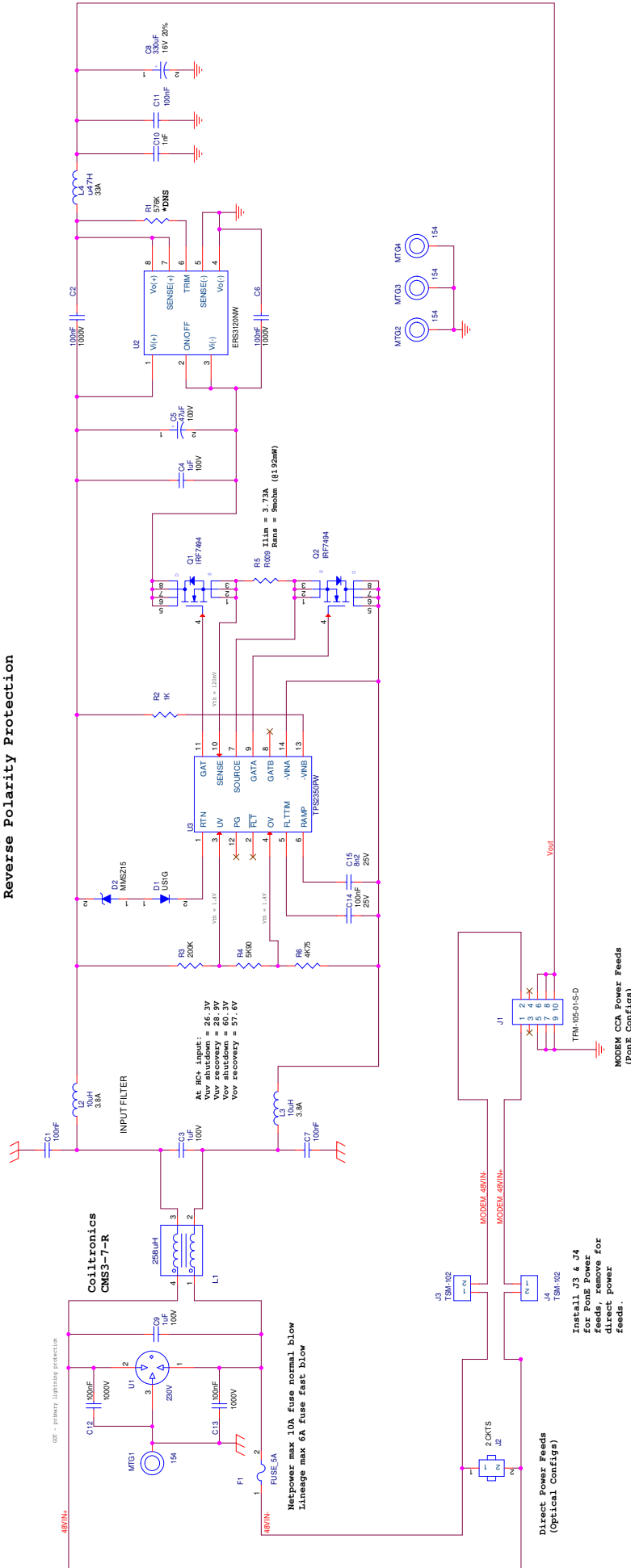
Power card



Optional optical input/output.

Input Transient Protection, Fuse, EMI Filter, Input Filter and Primary Converter 1500V Isolation Required

HotSwap Controller and Reverse Polarity Protection



REV	DESCRIPTION	DATE
D	ECO 17xx	Aug 19/11
C	ECO 1764	May 21/11
B	ECO 1730	Mar 21/11
A	ECO 1651	Oct 28/10
P2	ECO 1622	AUG 31/10
P1	PROTOTYPE RELEASE	JUN 23/10

REV	DESCRIPTION	DATE
<CORE DESIGN>		
DragonWave Inc.		
600-411 Leggett Drive Ontario CA 91764 (613) 896-9991		
HORIZON COMPACT PLUS 48V PWR CARD		
Rev	Drawn	Checked
C	DMG/NO	DMG/NO
SCH-61-000263-01		
Rev	Drawn	Checked
D	DMG/NO	DMG/NO

DragonWave

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Rev	Drawn	Checked
C	DMG/NO	DMG/NO
Friday, August 19, 2011		

NOTE: PARTS THAT ARE NOT STUFFED HAVE 'DNS' AS A VALUE.

Rev	Drawn	Checked
C	DMG/NO	DMG/NO

LAST USED REFDES

C15	U3
F1	D2
J4	O2
L4	
MTG1	
R6	

Install J3 & J4 for Pons Power feeds, remove for direct power feeds.

Direct Power Feeds (Optical Configs)

MODEM CCA Power Feeds (Pons Configs)

Horizon Midspan Power Injector and Lightning Protection Version 1.3

LAST USED REFDES

C60	R60
D14	S2
F5	T2
H1	TB1
J5	TP1
JMP3	U14
L13	
LED1	
Q2	

VAR02

NOTE: PARTS THAT ARE NOT STUFFED HAVE "DNS" AS A VALUE.

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DragonWave Inc.
600-411 Legget Drive
Ottawa Ontario
K2K 3C9
(613) 599-9991

Horizon Midspan Power Injector (POE) Mil/Optical Var.

REV	DESCRIPTION	DATE
C	ECO 1593	JUL 19/10
B	ECO 1587	Jun 17/10
A	PRODUCTION RELEASE	MAR 23/10

Size	DWG NO	Rev
B	SCH-61-000266-02	C
Scale		Sheet
		1 of 4

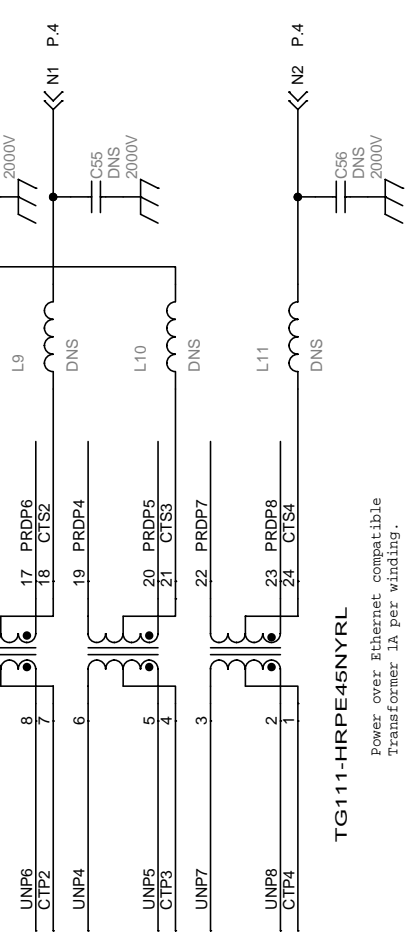
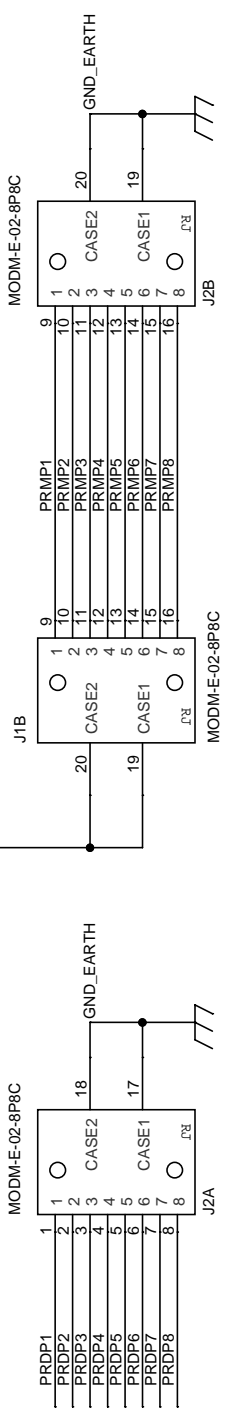
PAGE REV												
1	2	3	4	5	6	7	8	9	10	11	12	13
			A	C	A	C						

Protected Radio Management Port

Unprotected Radio Management Port

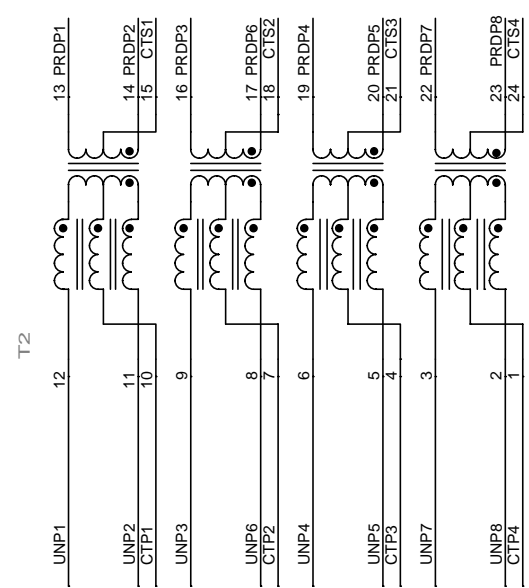
Protected Radio Data Port

Unprotected Network Port



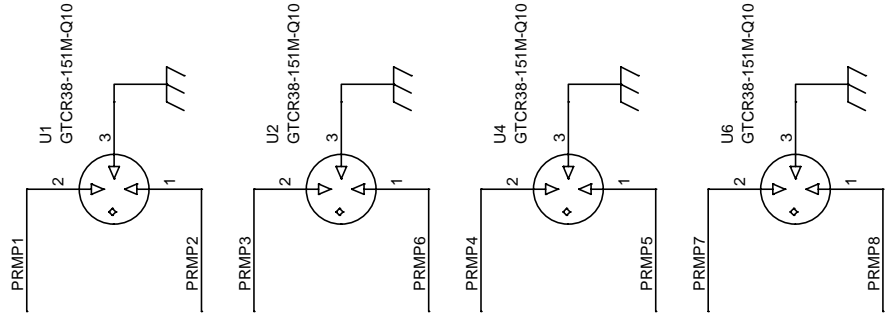
TG111-HRPE45NYRL

Power over Ethernet compatible Transformer 1A per winding.

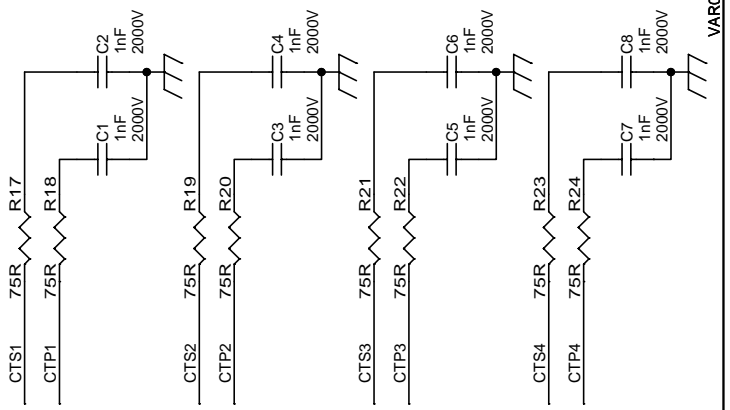


DNS

T1 & T2 Are double footprint options.



XFR Center tap termination



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REV	DESCRIPTION	DATE
A	PRODUCTION RELEASE	MAR 23/10

Horizon Midspan Power Injector (POE)	
Size	DWG NO
Custom	SCH-61-000266-02
Date	Thursday, June 17, 2010

Power input merge and filter. HOTSWAP CONTROLLER

Layout note: Place R28, L13 directly next to U14 pin 9 and 10.

TB1 is changed (manually on the BOM) to 30-001204-00-00 (a 4 pin connector for the copper variant '01. This is required since U9 must be removed to prevent lightning current from going through the PON manager IC.

40.5 to 57V input.

48V Power Input A
48V Power Input B

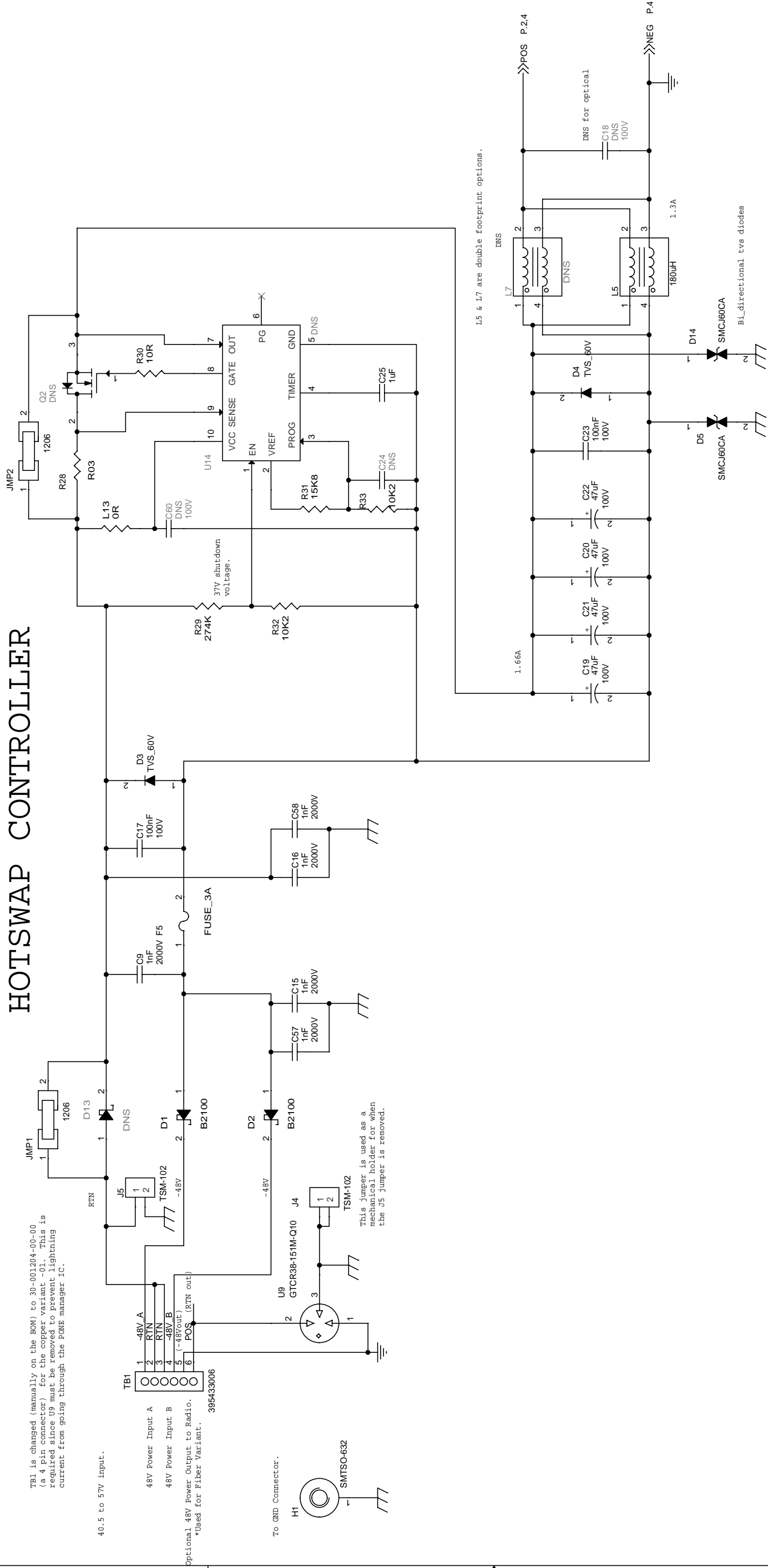
Optional 48V Power Output to Radio.
*Used for Fiber Variant.

395433006

To GND Connector.



This jumper is used as a mechanical holder for when the J5 jumper is removed.



L5 & L7 are double footprint options.

C	ECO 1593	JUL 19/10
B	ECO 1587	Jun 17/10
A	PRODUCTION RELEASE	MAR 23/10
REV	DESCRIPTION	DATE

VAR02

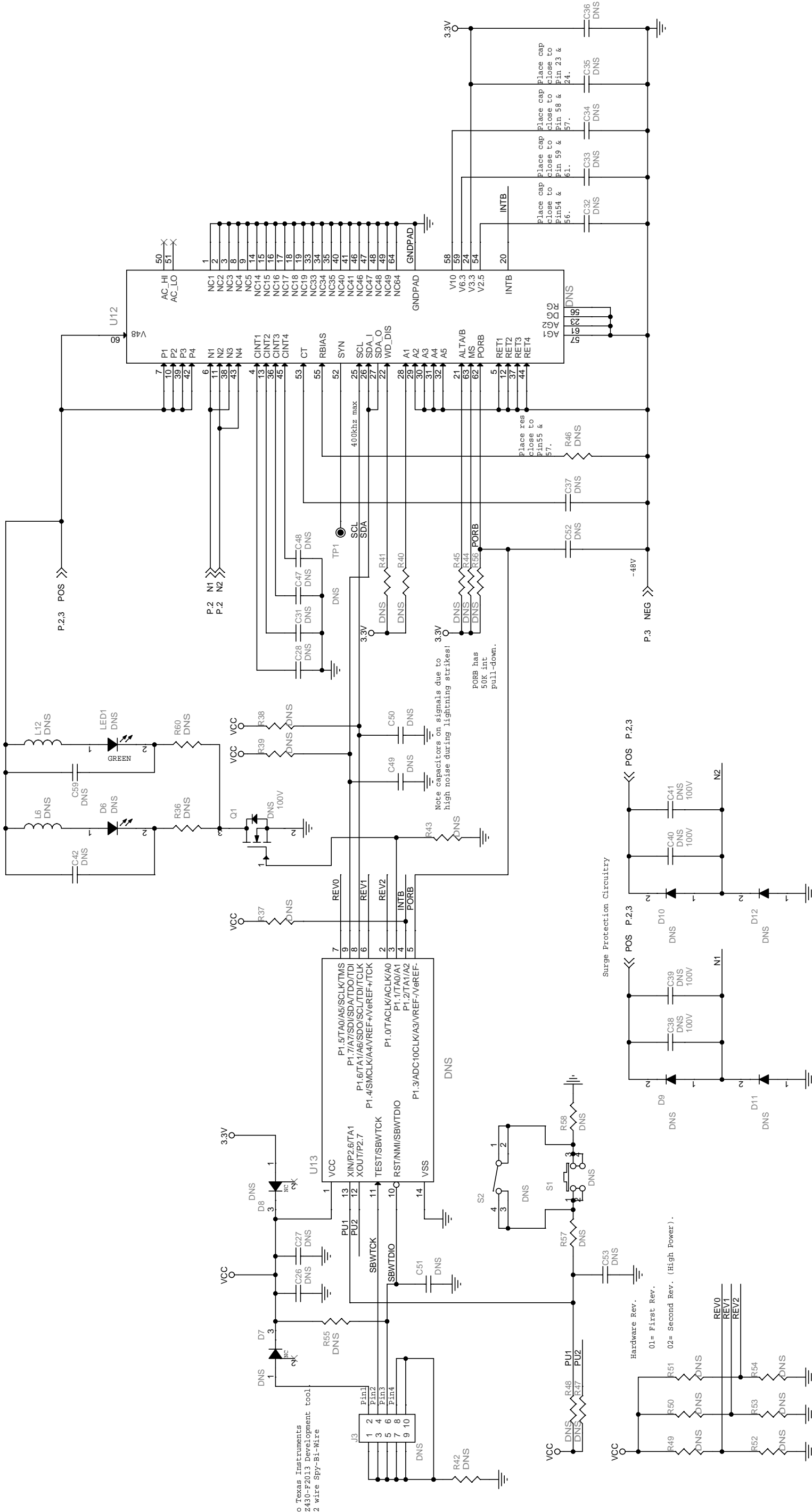
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Horizon Midspan Power Injector (POE)

Size	DWG NO	Rev
Custom	SCH-61-000266-02	C
Date	Monday, July 19, 2010	



POE Controller



VAR02	A	PRODUCTION RELEASE	MAR 23/10
REV	DESCRIPTION	DATE	
<p>Horizon Midspan Power Injector (POE)</p> <p>Size: Custom, Rev: A</p> <p>DWG NO: SCH-61-000266-02</p> <p>Date: Thursday, June 17, 2010</p> <p>Sheet 4 of 4</p>			

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Hardware Rev.	01= First Rev.	02= Second Rev. (High Power).
REV0	REV1	REV2

Horizon Compact Plus: Modem IF Card - XPIC Variant

- Page 1 - Title Page
- Page 2 - Processor, DDR2 Memory
- Page 3 - Processor, Ethernet (TSECs)
- Page 4 - Processor, PCI Bus
- Page 5 - Processor, Flash, UART, BDM Header, Local Bus, I2C
- Page 6 - Processor, Power
- Page 7 - Processor, I2C Parallel Port GPIO
- Page 8 - FPGA, Banks 1&2
- Page 9 - FPGA, Banks 3&4
- Page 10 - FPGA, Banks 5&6
- Page 11 - FPGA, Banks 7&8
- Page 12 - FPGA, Configuration
- Page 13 - FPGA, Power
- Page 14 - Ethernet Ports - PHY 1&2
- Page 15 - Ethernet Ports - Mag 1&2
- Page 16 - Ethernet Ports - PHY 3&4
- Page 17 - Ethernet Ports - Mag 3&4
- Page 18 - Ethernet Ports - SFP, LEDs
- Page 19 - Digital Clocks (SyncE Clocking)
- Page 20 - 25MHz & 50MHz Ref

- Page 21 - IF Block Diagram
- Page 22 - RF/IF Interface
- Page 23 - I/Q DACs
- Page 24 - Tx Lineup1, BB Filter & IF Mod
- Page 25 - Tx Lineup2, VVAs & IF Amp
- Page 26 - Tx IF Synth
- Page 27 - Rx IF Synth
- Page 28 - Rx Lineup1, IF Amp & AGC
- Page 29 - Rx Lineup2, IF Demod & Prog BB LPFs
- Page 30 - I/Q ADCs
- Page 31 - Drain Current Sensors 1,2,3
- Page 32 - Drain Current Sensors 4,5
- Page 33 - RF Gate Bias & Controls
- Page 34 - Misc Power & Controls
- Page 35 - Slow DACs and ADC
- Page 36 - LDO REGs +5V -5V +3.3V
- Page 37 - LO Nulling & BNC Interface
- Page 38 - Power +3.3V, +2.5V & +1.8V Converters
- Page 39 - Power +1.2V, +1.1V & +1.0V Converters
- Page 40 - Power +6V, -6V & +15V Converters
- Page 41 - Power Programmable Drain 1,2,3

LAST USED REFDES

AT4	Q3
C833	R870
D13	T2
E36	TB2
EF18	TP12
FL6	U122
J9	Y7
L79	
MTG21	

NOTE: PARTS THAT ARE NOT STUFFED HAVE 'DNS' AS A VALUE.

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DragonWave Inc.
 600-411 Legget Drive
 Ottawa, Ontario
 Canada
 (613) 589-9891

Horizon Compact Plus: Modem IF Card

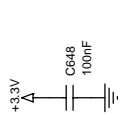
REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11
A	PRODUCTION RELEASE: ECO 1764	MAY 19/11

Variant02

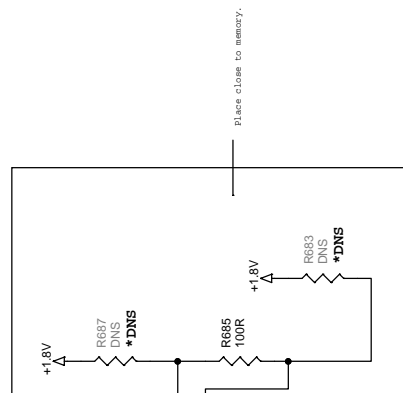
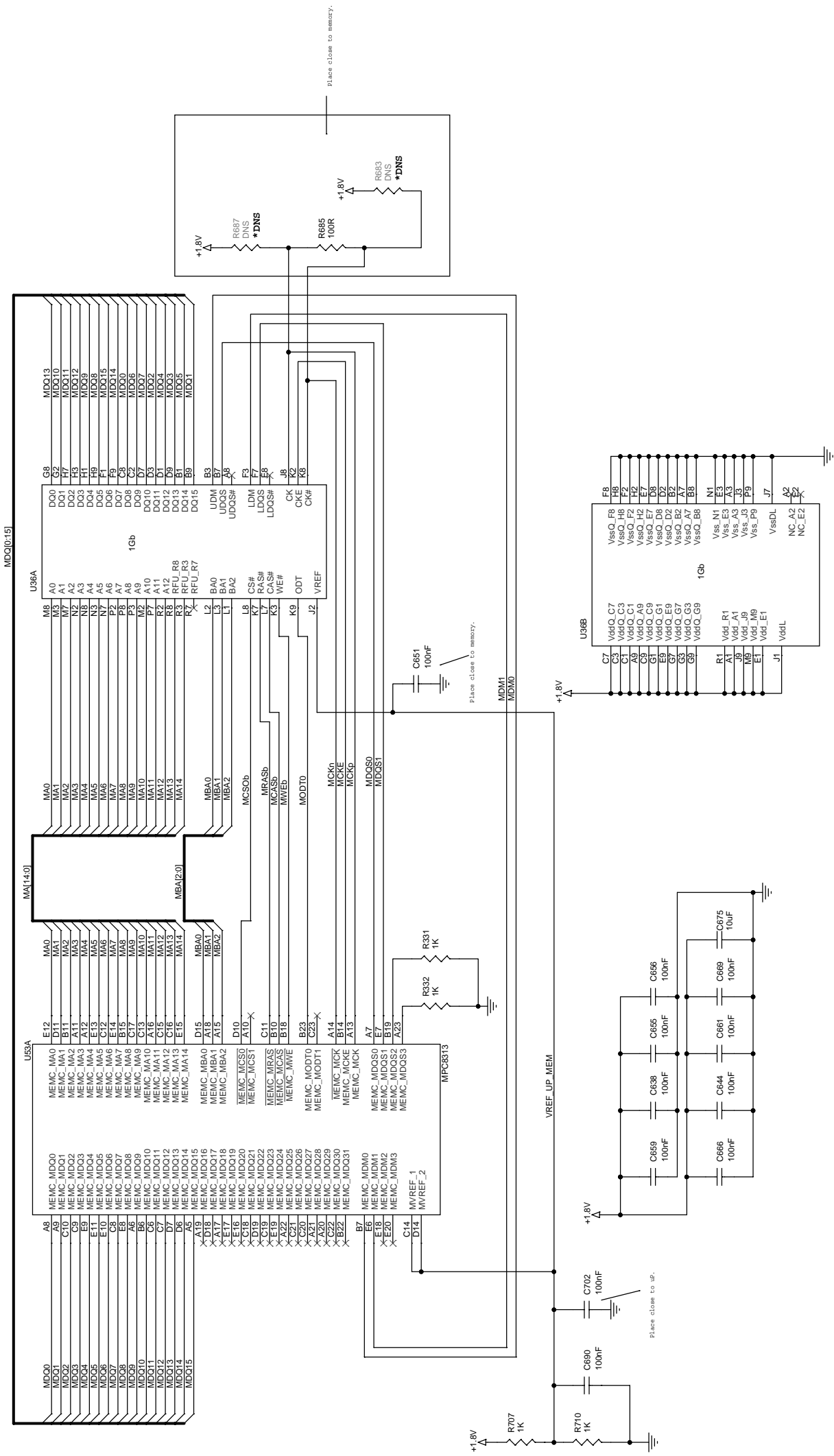
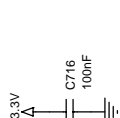
41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
B	B	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B

SCH-61-000273-02

Place chip under processor provides AC GND return path onto 3.3V plane



Place chip under processor provides AC GND return path onto 3.3V plane



REV	DESCRIPTION	DATE
1	Processor: DDR2 Memory	
2		

Size	Rev	Date
C	A	
DWG NO	SCH-61-000273-02	
Date	Tuesday, June 14, 2011	

DragonWave

Processor: DDR2 Memory

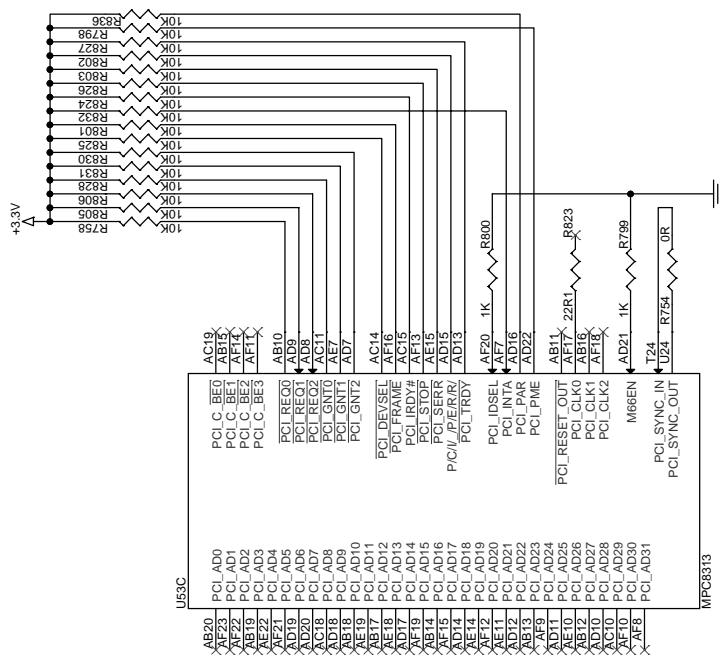
SCH-61-000273-02

Tuesday, June 14, 2011

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Variant02

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PCI Bus Arbiter must be ENABLED

PCI Bus Arbiter must be ENABLED

PCI_IDSEL tied low in host mode

Power Management not used, pull high

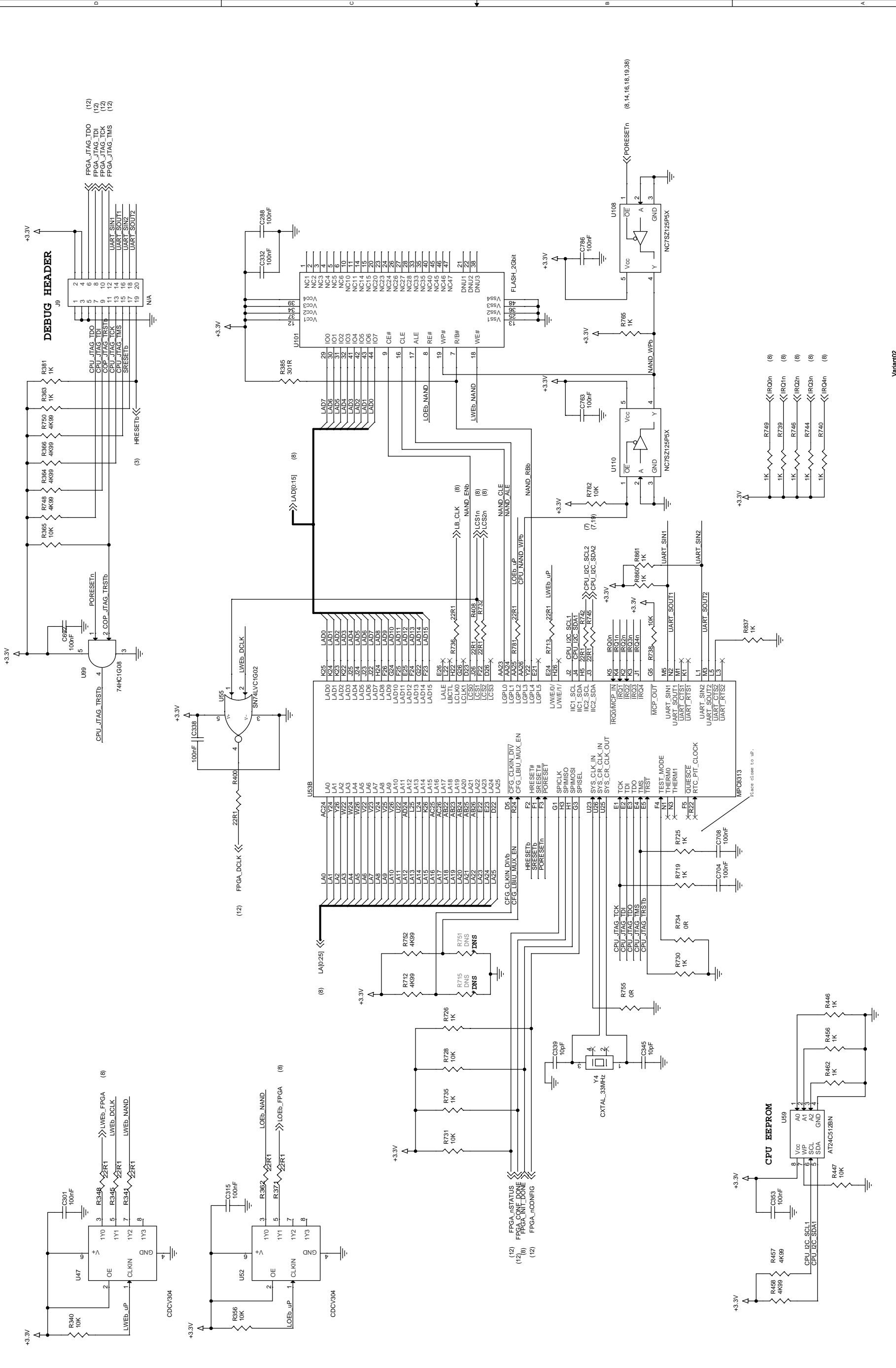
PCI Bus set to 33MHz

Variant02

REV	DESCRIPTION	DATE
C	Processor: PCI Bus	
D		
A		

Size	DragonWave
Rev	SCH-61-000273-02
Date	Tuesday, June 14, 2011
Sheet	4 of 41

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REV	DESCRIPTION	DATE
1	Processor: Local Bus, FLASH, UART	DragonWave
2		
3		
4		
5		

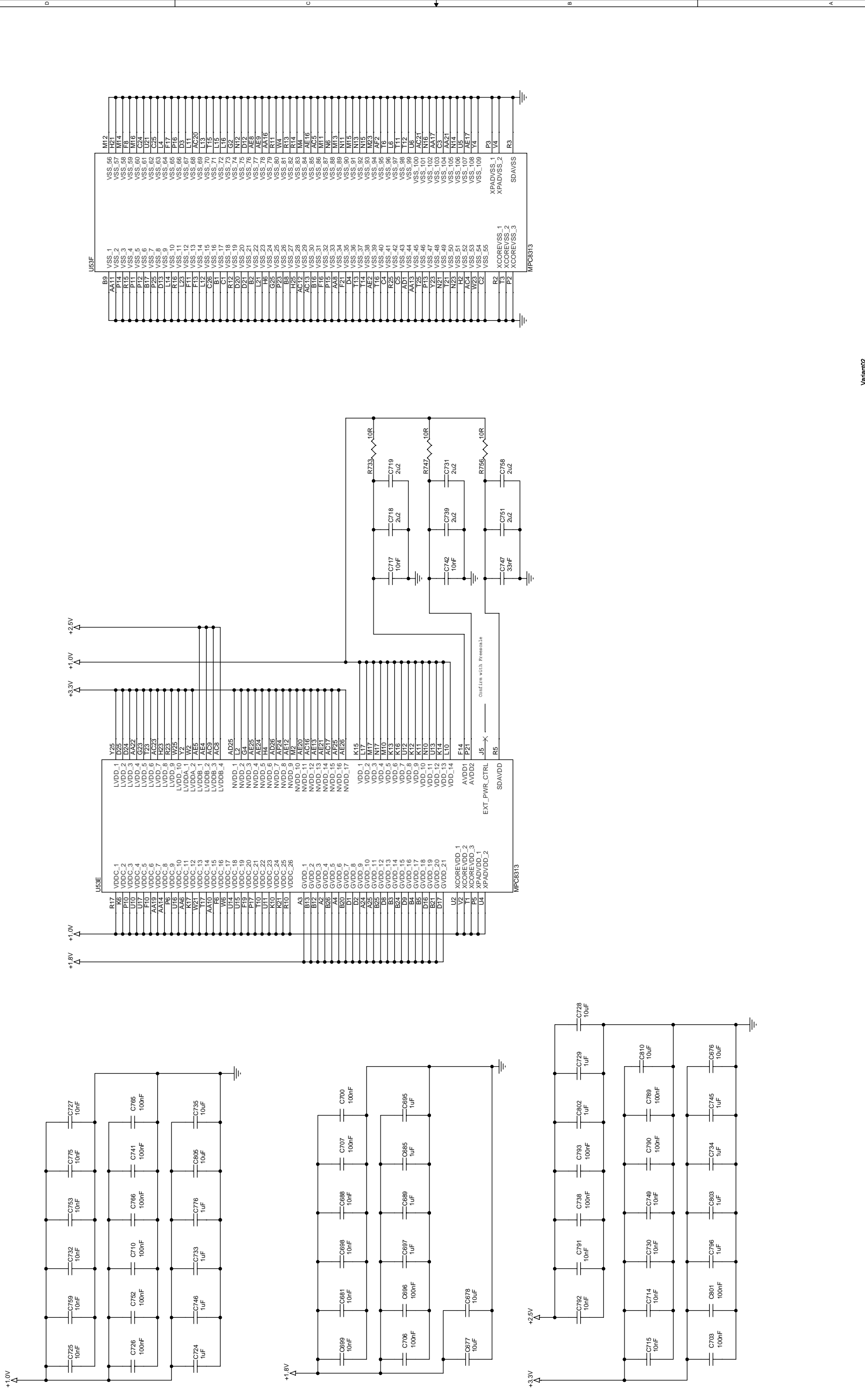
Variant02

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Tuesday, June 14, 2011

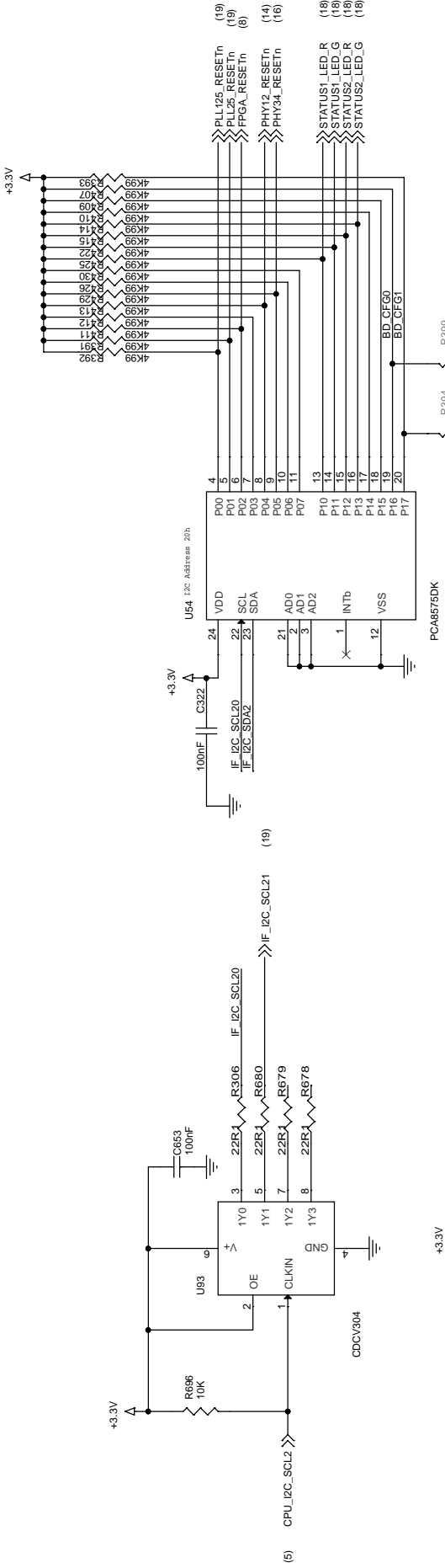
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REV	DESCRIPTION	DATE
1	Processor: Power	
2		
3		
4		
5		

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<p>DragonWave</p>	<p>SCH-61-000273-02</p>
<p>Rev</p>	<p>A</p>
<p>Date</p>	<p>Tuesday, June 14, 2011</p>
<p>Sheet</p>	<p>6 of 41</p>

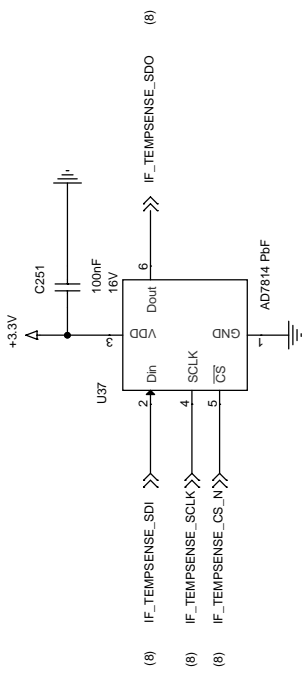
Variant02



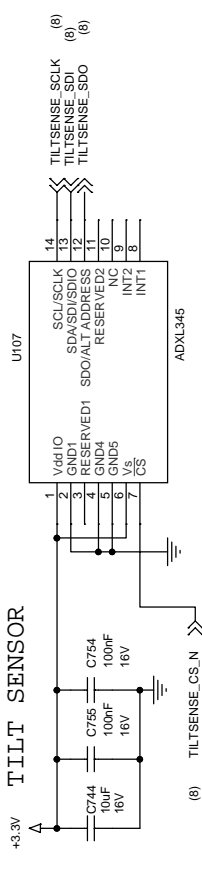
NOTE: The PCA8575 I/O power up as inputs and are pulled high. External pullups are used to strengthen the pullup.

Board Configuration (BD_CFG[1:0]):
 1 1 => HC+ Modem Card
 1 0 =>
 0 1 =>
 0 0 =>

TEMPERATURE SENSOR



TILT SENSOR

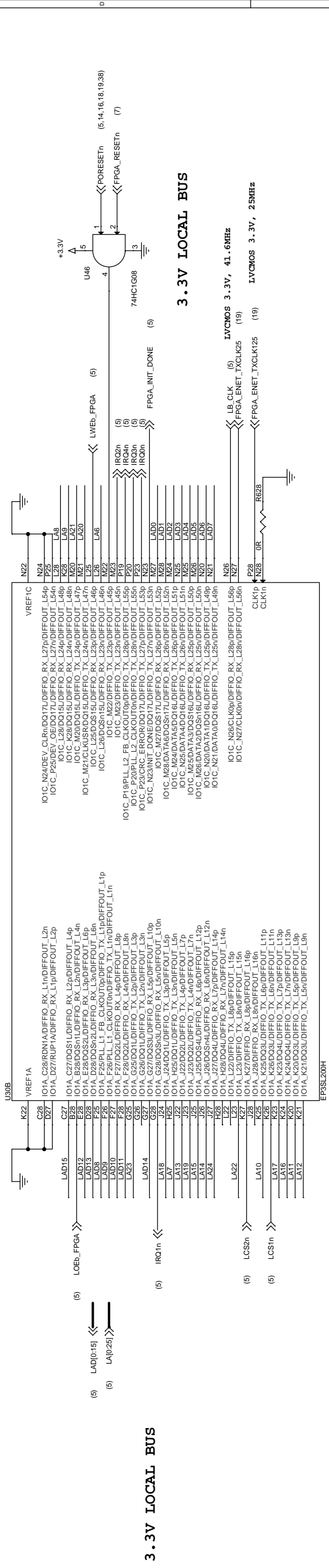


Variant02

REV	DESCRIPTION	DATE
C	Processor: I2C Control I/O	
Size	DWG.M3	
Rev	SCH-61-000273-02	
Date	Tuesday, June 14, 2011	
Sheet	7	of 41

DragonWave

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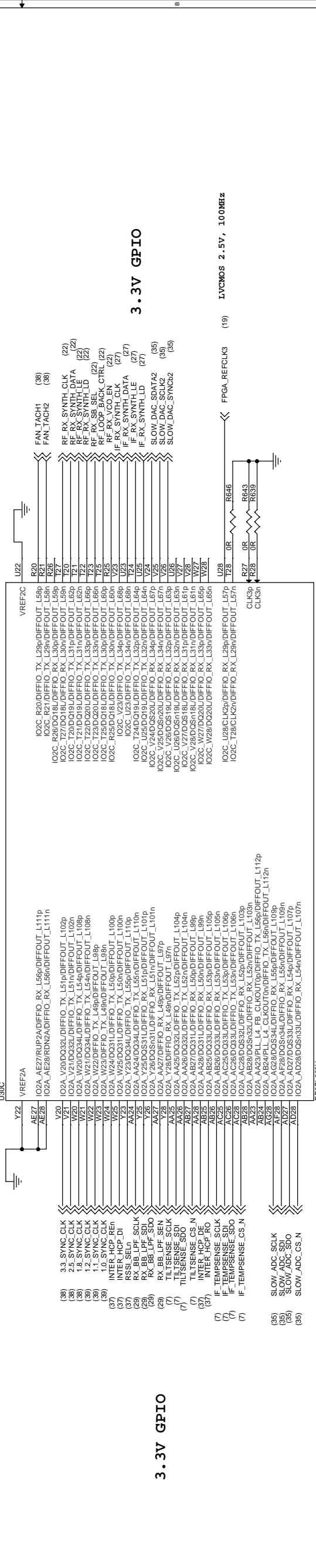
3.3V LOCAL BUS

3.3V LOCAL BUS

IOVCMS 3.3V, 41.6MHz

IOVCMS 3.3V, 25MHz

Encrypted FPGA P/N: 74-000320-01-01



3.3V GPIO

3.3V GPIO

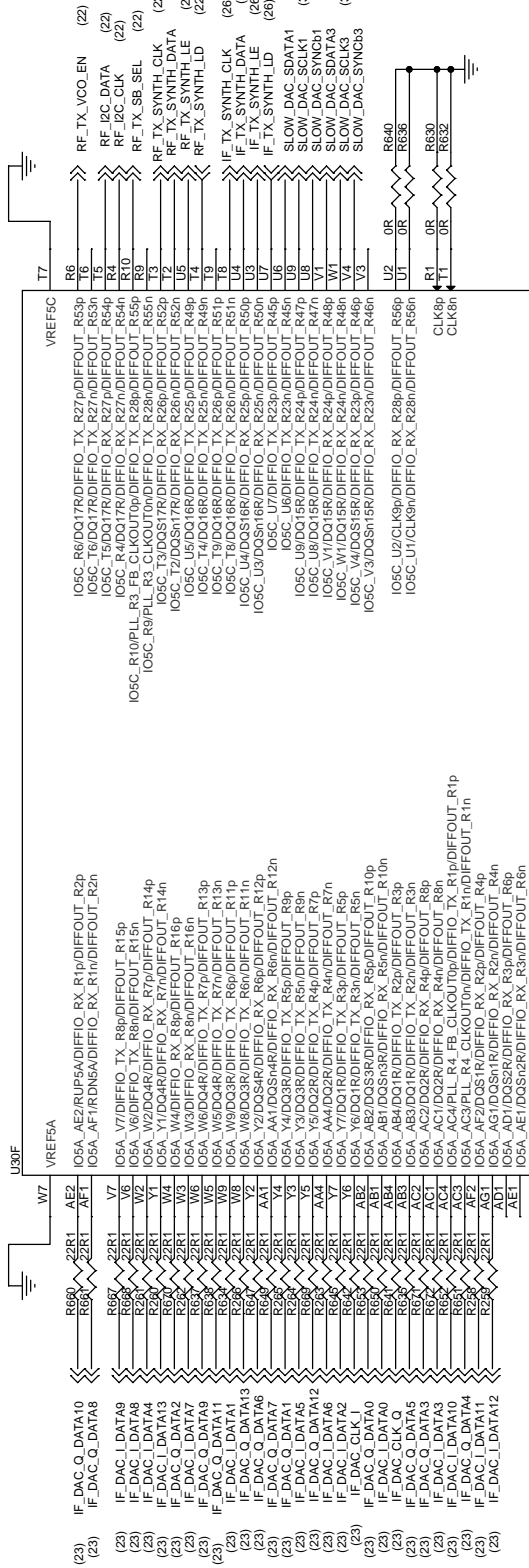
IOVCMS 2.5V, 100MHz

Variant02

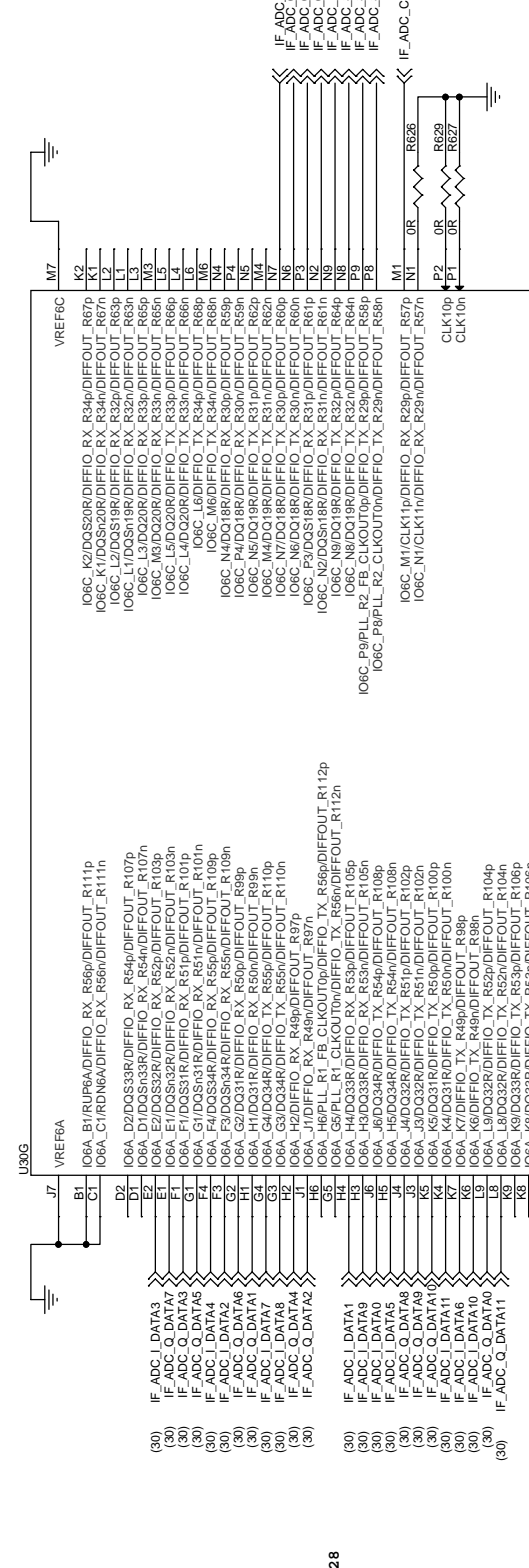
REV	DESCRIPTION	DATE
1	FPGA: Banks 1, 2	
2		
3		
4		
5		
6		
7		
8		
9		
10		

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DragonWave
 SCH-61-000273-02
 Tuesday, June 14, 2011
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3.3V DAC
 DAC is wired for 14 bits to 2) for 12 bit operation
 Only 12 bits are used by DAC562A
 Use highest order bits (13 to 2) for 12 bit operation
 Lowest order bits are added when going to larger number of bits.



1.8V ADC
 ADC is wired for 12bits
 Only 11 bits are used by 58C28
 Use MSB bits (11 to 1) for 11bit operation

3.3V GPIO

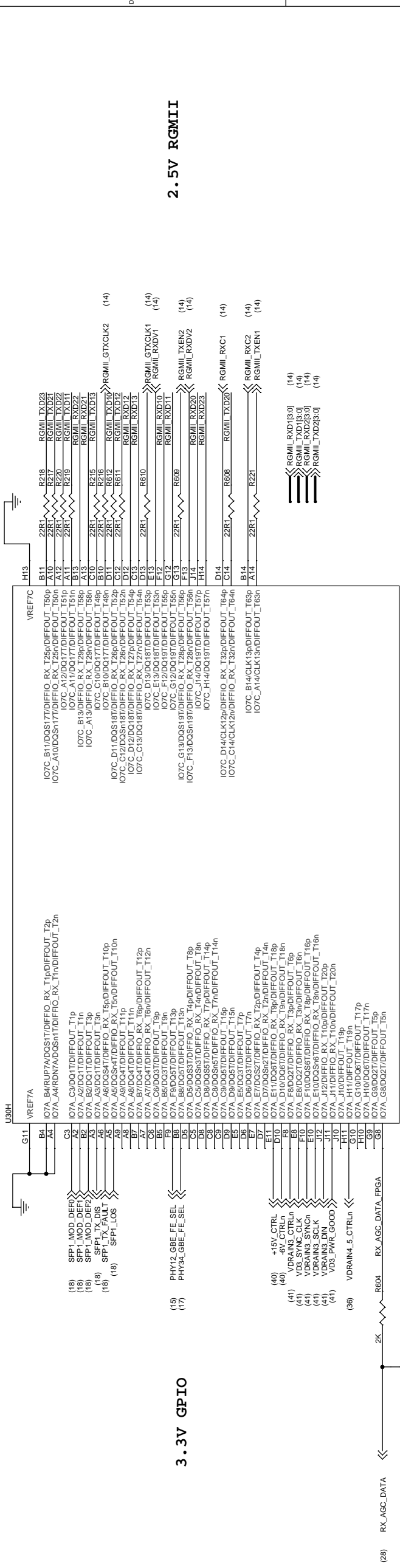
1.8V GPIO

Variant02

REV	DESCRIPTION	DATE
5	FPGA: Banks 5, 6	
4		
3		
2		
1		

Rev	DragonWave
Size	DWG.M3
Doc	SCH-61-000273-02
Date	Tuesday, June 14, 2011
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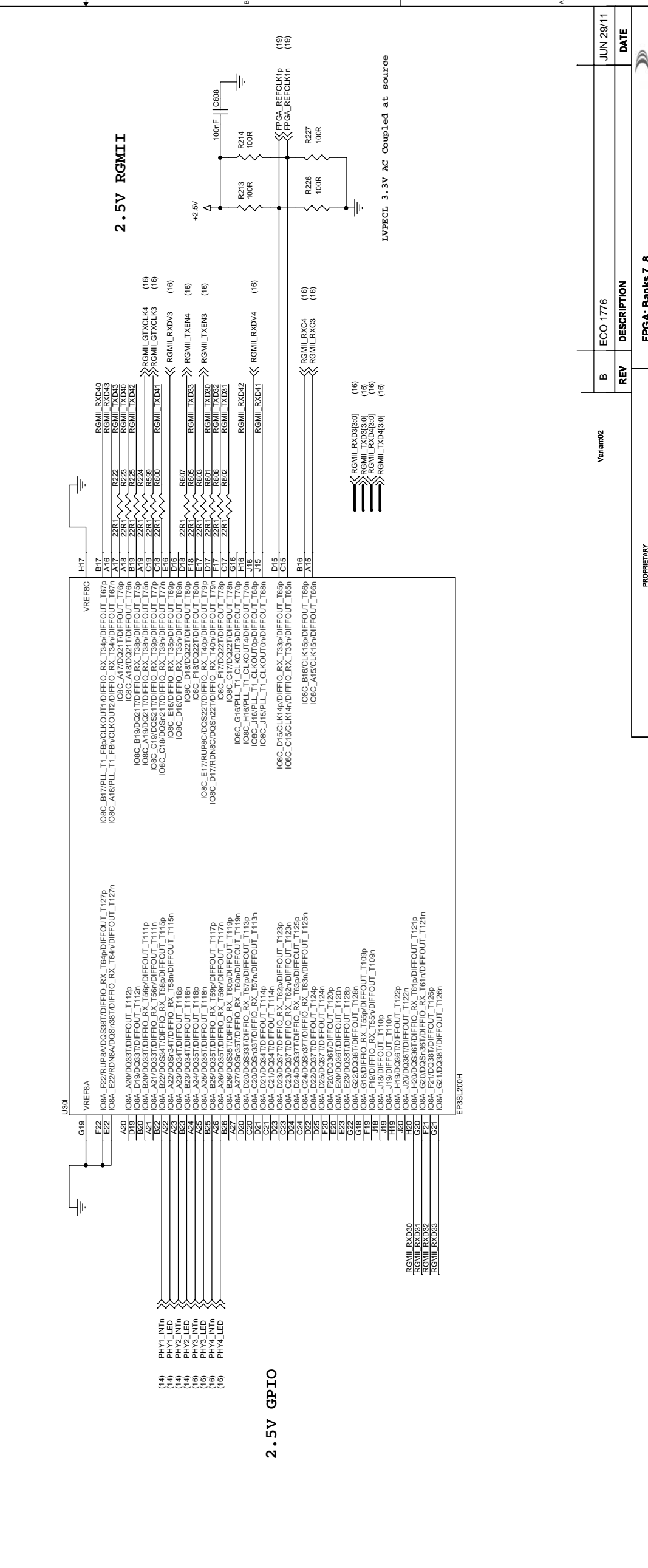


3.3V GPIO

B11	22R1	RGMI1_TXD23	(14)
A10	22R1	RGMI1_TXD21	(14)
A12	22R1	RGMI1_TXD22	(14)
A11	22R1	RGMI1_TXD20	(14)
A13	22R1	RGMI1_TXD24	(14)
B13	22R1	RGMI1_TXD25	(14)
C10	22R1	RGMI1_TXD13	(14)
B10	22R1	RGMI1_TXD12	(14)
C12	22R1	RGMI1_TXD11	(14)
C13	22R1	RGMI1_TXD14	(14)
E13	22R1	RGMI1_TXD10	(14)
F12	22R1	RGMI1_TXD15	(14)
G12	22R1	RGMI1_TXD16	(14)
F13	22R1	RGMI1_TXD17	(14)
F14	22R1	RGMI1_TXD18	(14)
D14	22R1	RGMI1_TXD19	(14)
B14	22R1	RGMI1_TXD26	(14)
A14	22R1	RGMI1_TXD27	(14)

2.5V RGMII

H13	100nF	RGMI1_RXD1[5:0]	(14)
H13	100nF	RGMI1_RXD2[5:0]	(14)
H13	100nF	RGMI1_TXD23[0]	(14)
H13	100nF	RGMI1_TXD23[1]	(14)
H13	100nF	RGMI1_TXD23[2]	(14)
H13	100nF	RGMI1_TXD23[3]	(14)
H13	100nF	RGMI1_TXD23[4]	(14)
H13	100nF	RGMI1_TXD23[5]	(14)



2.5V RGMII

H17	100nF	RGMI1_RXD40	(16)
B17	100nF	RGMI1_RXD43	(16)
A17	22R1	RGMI1_TXD43	(16)
A18	22R1	RGMI1_TXD40	(16)
B19	22R1	RGMI1_TXD41	(16)
C19	22R1	RGMI1_TXD42	(16)
C18	22R1	RGMI1_TXD44	(16)
E16	22R1	RGMI1_RXD43	(16)
D16	22R1	RGMI1_TXD45	(16)
E17	22R1	RGMI1_TXD46	(16)
E17	22R1	RGMI1_TXD47	(16)
F17	22R1	RGMI1_TXD48	(16)
C17	22R1	RGMI1_TXD49	(16)
J16	22R1	RGMI1_RXD42	(16)
J15	22R1	RGMI1_RXD41	(16)
D15	22R1	RGMI1_RXC4	(16)
C15	22R1	RGMI1_RXC3	(16)
A15	22R1	RGMI1_RXC4	(16)

2.5V GPIO

G19	2K	RGMI1_RXD30	(16)
E22	100nF	RGMI1_RXD31	(16)
A20	100nF	RGMI1_RXD32	(16)
D21	100nF	RGMI1_RXD33	(16)
D22	100nF	RGMI1_RXD34	(16)
D23	100nF	RGMI1_RXD35	(16)
D24	100nF	RGMI1_RXD36	(16)
D25	100nF	RGMI1_RXD37	(16)
F20	100nF	RGMI1_RXD38	(16)
E23	100nF	RGMI1_RXD39	(16)
G22	100nF	RGMI1_RXD40	(16)
G18	100nF	RGMI1_RXD41	(16)
F19	100nF	RGMI1_RXD42	(16)
J18	100nF	RGMI1_RXD43	(16)
J19	100nF	RGMI1_RXD44	(16)
J20	100nF	RGMI1_RXD45	(16)
H20	100nF	RGMI1_RXD46	(16)
G20	100nF	RGMI1_RXD47	(16)
F21	100nF	RGMI1_RXD48	(16)
G21	100nF	RGMI1_RXD49	(16)

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

REV	DATE
B	JUN 29/11

Variant02

FPGA: Banks 7, 8

Size: B

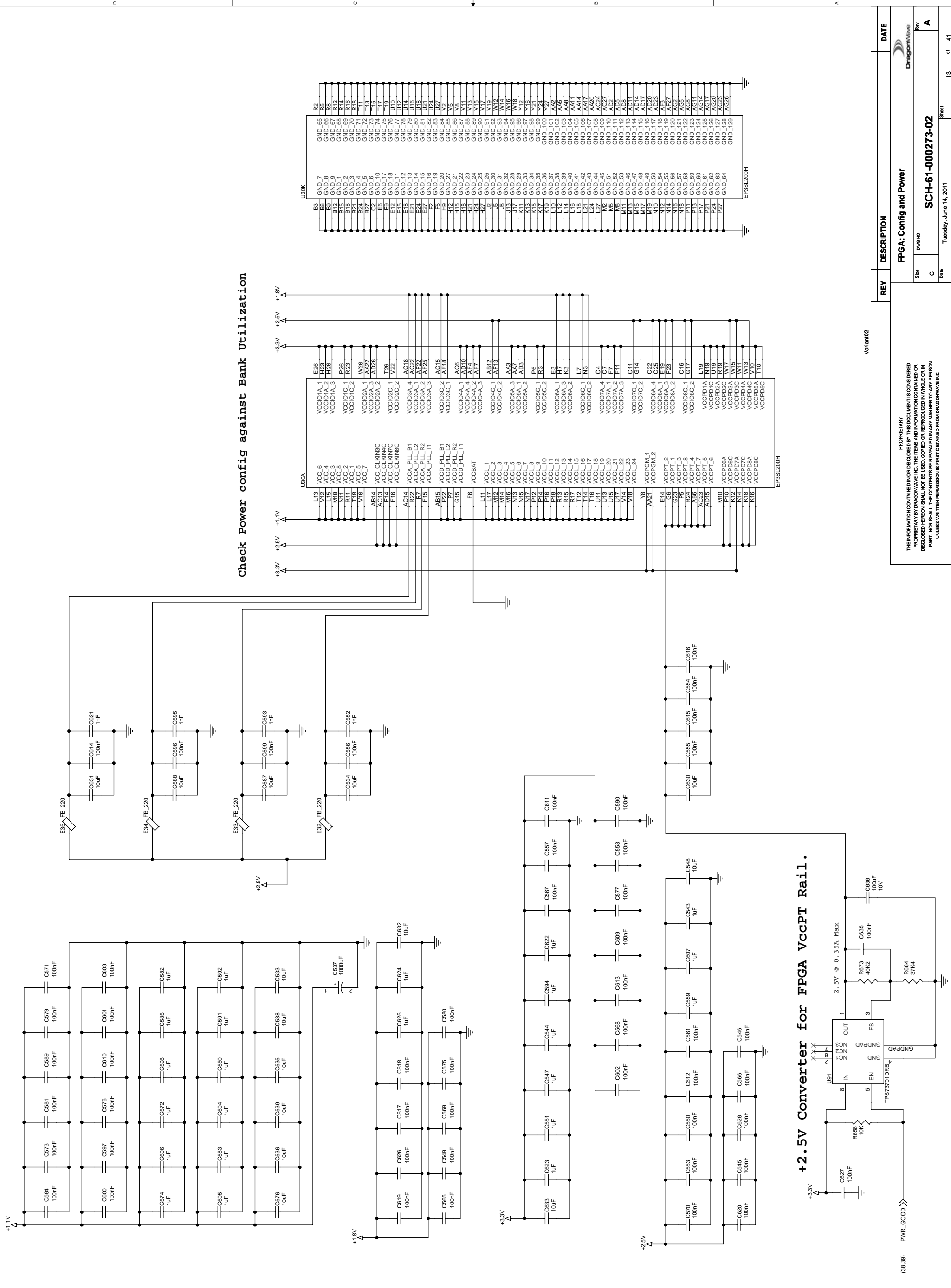
Part: SCH-61-000273-02

Date: Wednesday, June 29, 2011

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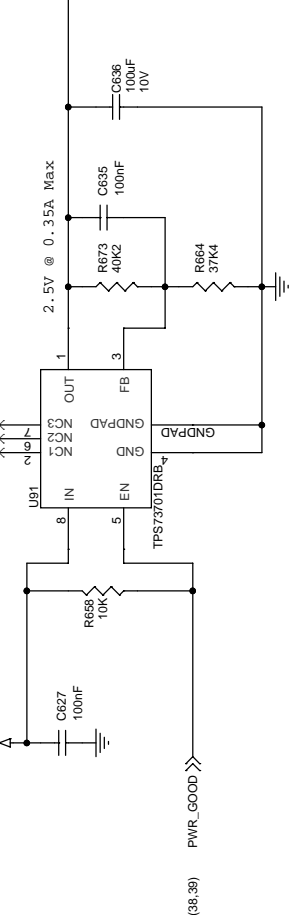
DragonWave

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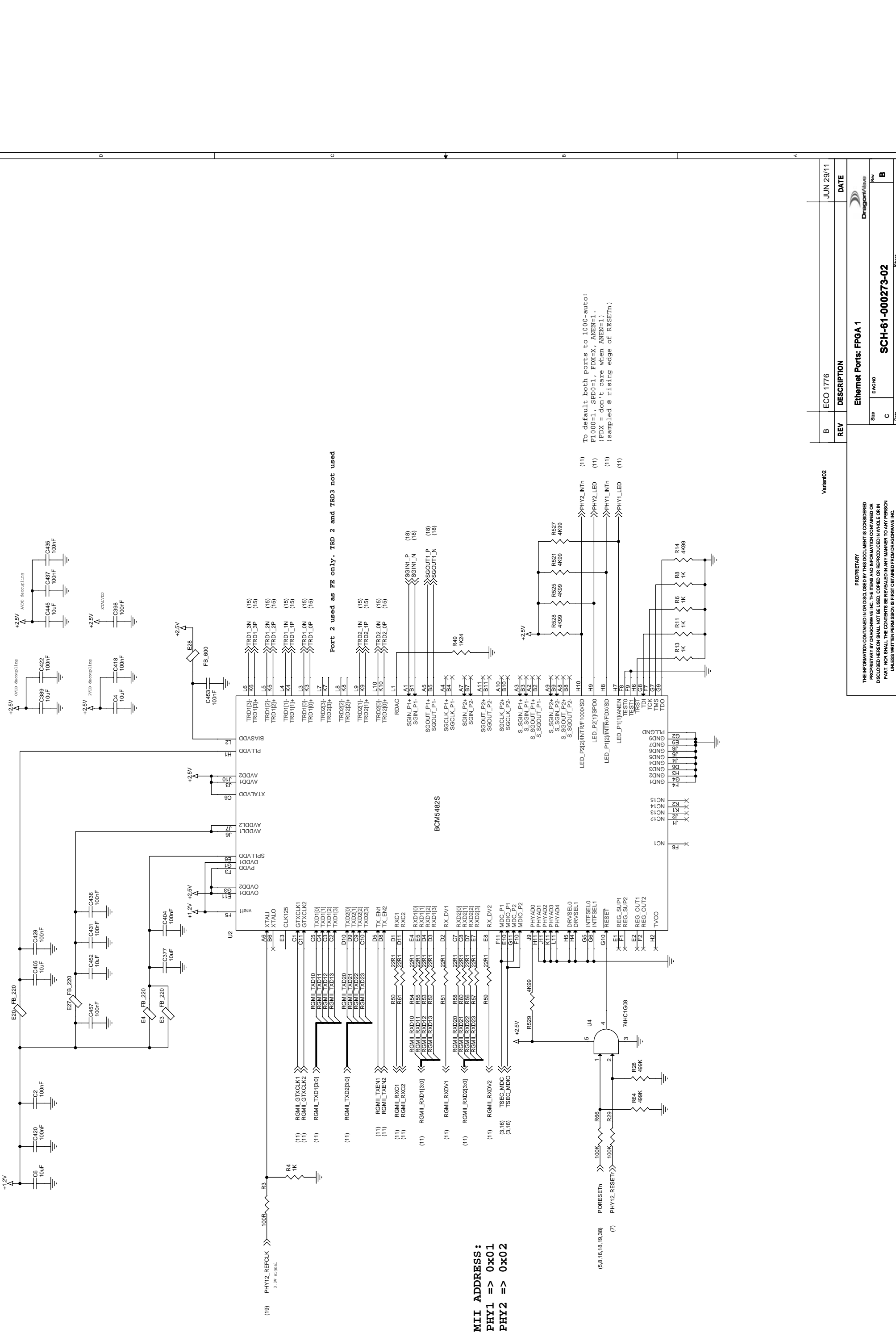
Check Power config against Bank Utilization

+2.5V Converter for FPGA VccPT Rail.



REV	DESCRIPTION	DATE
1	Variant02	
2		
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SCH-61-000273-02		DragonWave Rev A

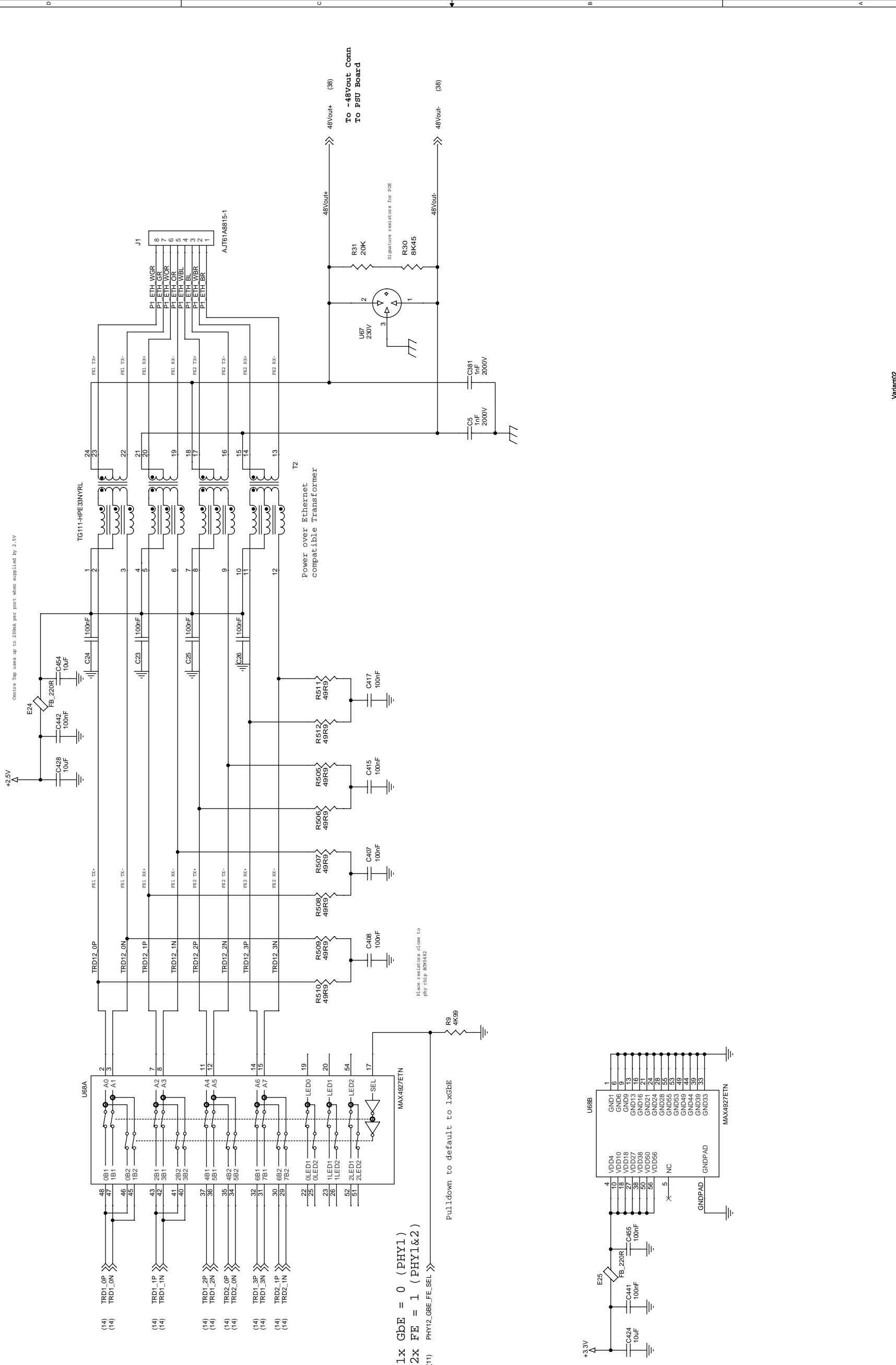


REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

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1x GbE = 0 (PHY1)
 2x FE = 1 (PHY1&2)
 (11) PHY12_GBE_FE_SEL

Pull-down to default to 1xGbE

Place resistors close to phy chip MAX482

REV	DESCRIPTION	DATE
1	Ethernet Ports: Magnetics 1&2	Tuesday, June 14, 2011
2		
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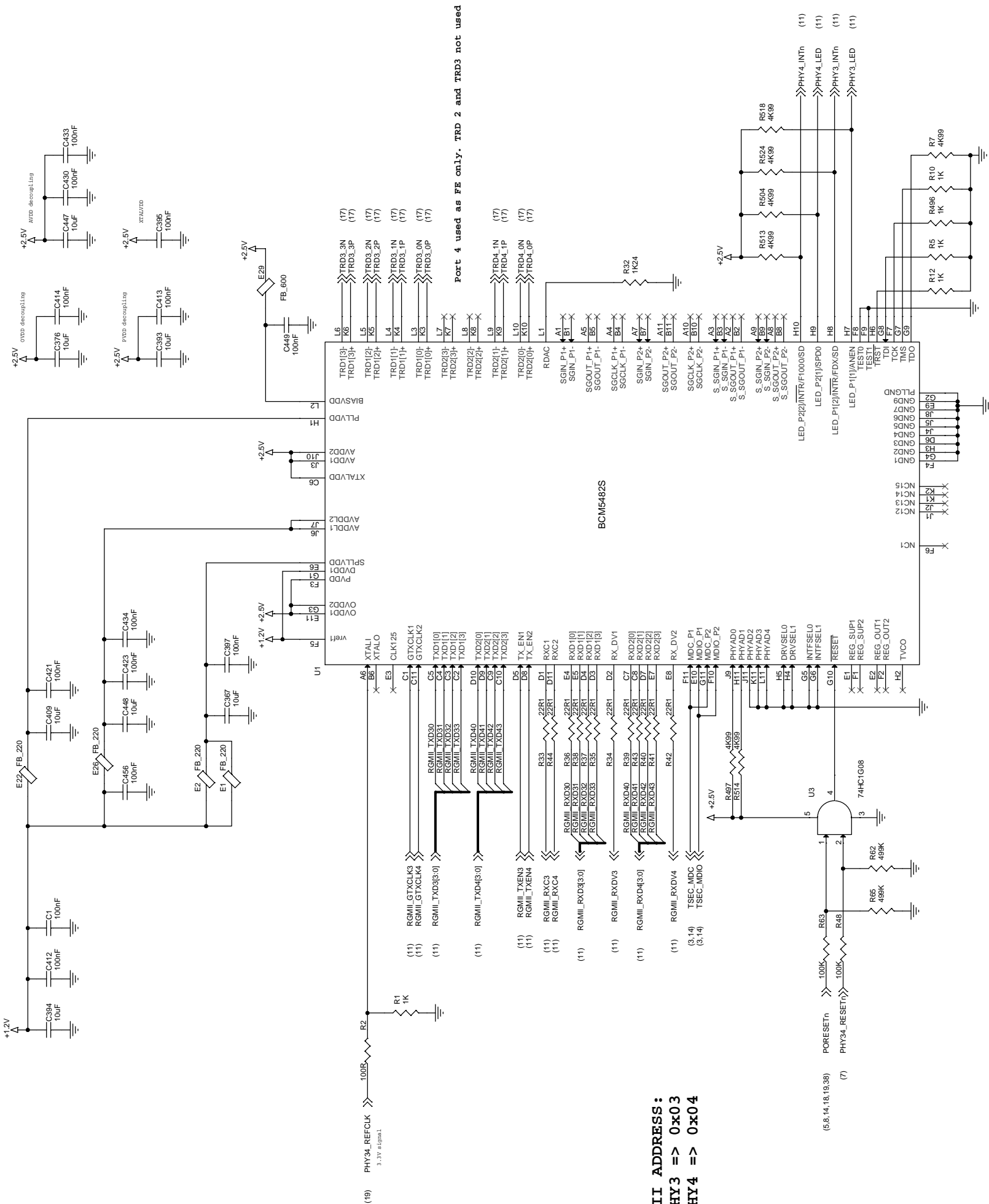
REV	DESCRIPTION	DATE
1	Ethernet Ports: Magnetics 1&2	Tuesday, June 14, 2011
2		
3		
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REV	DESCRIPTION	DATE
1	Ethernet Ports: Magnetics 1&2	Tuesday, June 14, 2011
2		
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REV	DESCRIPTION	DATE
1	Ethernet Ports: Magnetics 1&2	Tuesday, June 14, 2011
2		
3		
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Variant02

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Port 4 used as FE only. TRD 2 and TRD3 not used

MII ADDRESS:
PHY3 => 0x03
PHY4 => 0x04

To default both ports to 1000-auto:
F1000=1, SPD0=1, FDX=X, ANEN=1.
(FDX = don't care when ANEN=1.
(sampled @ rising edge of RESETn)

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

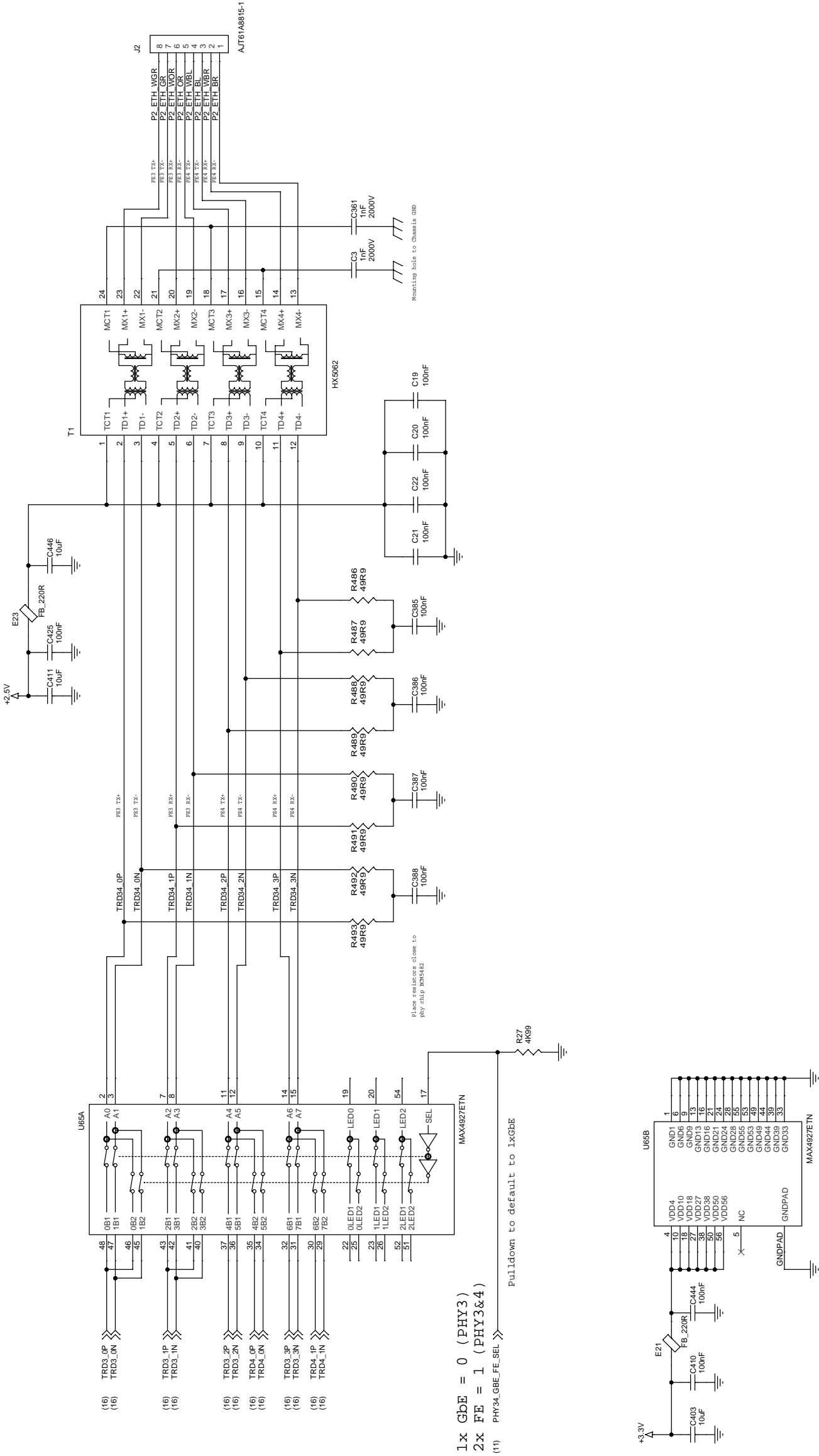
Size	Rev	DATE
C	C	Wednesday, June 29, 2011

Part No	Part Name	Sheet	of
SCH-61-000273-02	Ethernet Ports: FPGA 2	16	41

DragonWave

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Centre Tap uses up to 200mA per port when supplied by 2.5V

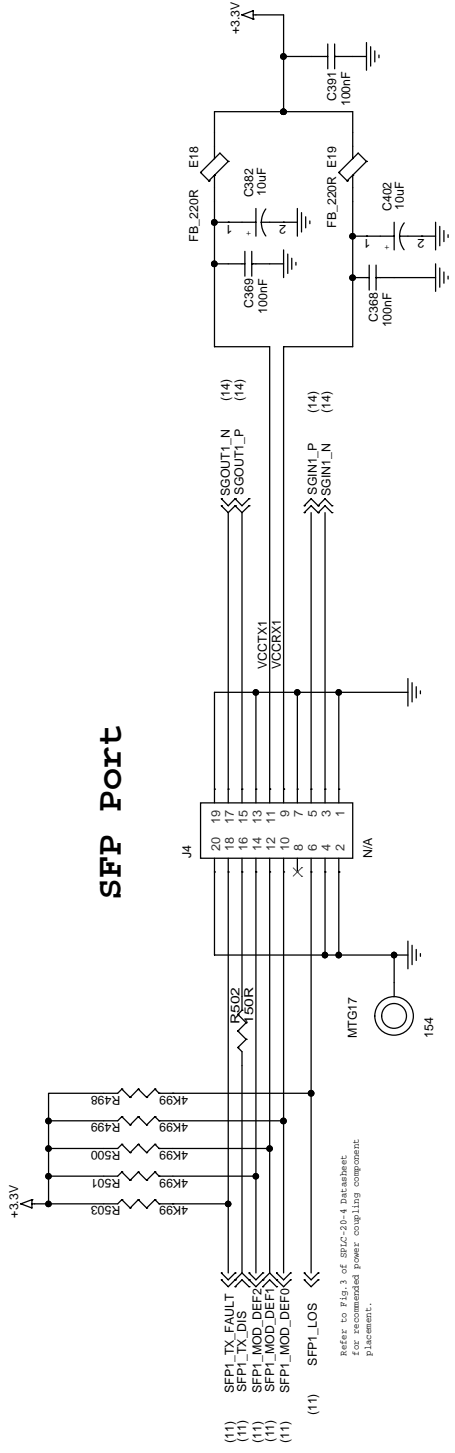


1x GbE = 0 (PHY3)
 2x FE = 1 (PHY3&4)
 (11) PHY34_GbE_FE_SEL >> Pulldown to default to 1xGbE

REV	DESCRIPTION	DATE
C	Ethernet Ports: Magnetics 3&4	
Size	DWG.M3	
Rev	SCH-61-000273-02	
Date	Tuesday, June 14, 2011	17 of 41

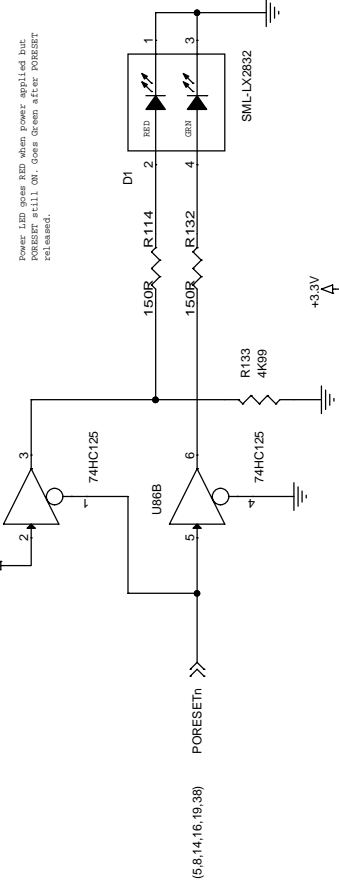
Variant02

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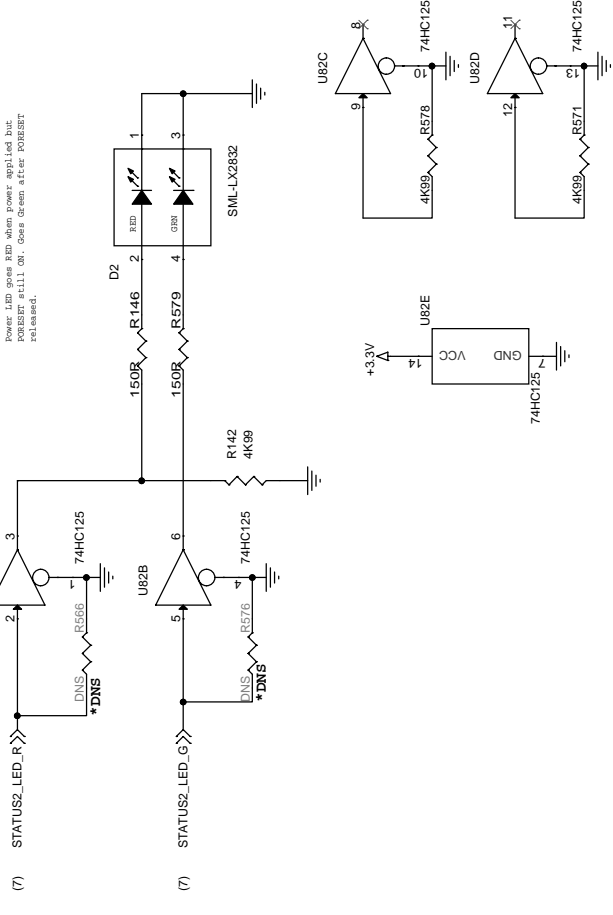


Refer to Fig. 3 of 892-2b-4 datasheet for recommended power coupling component placement.

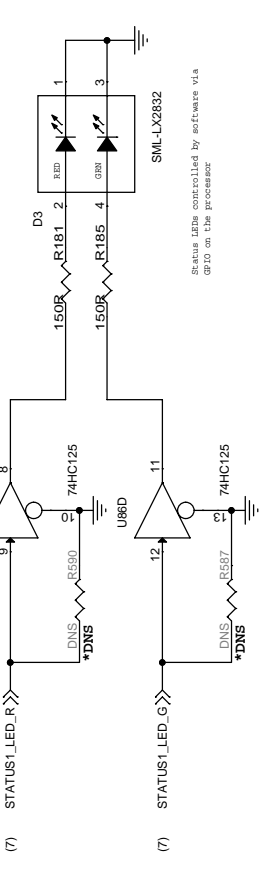
POWER "PWR"



STATUS 2 "STAT"



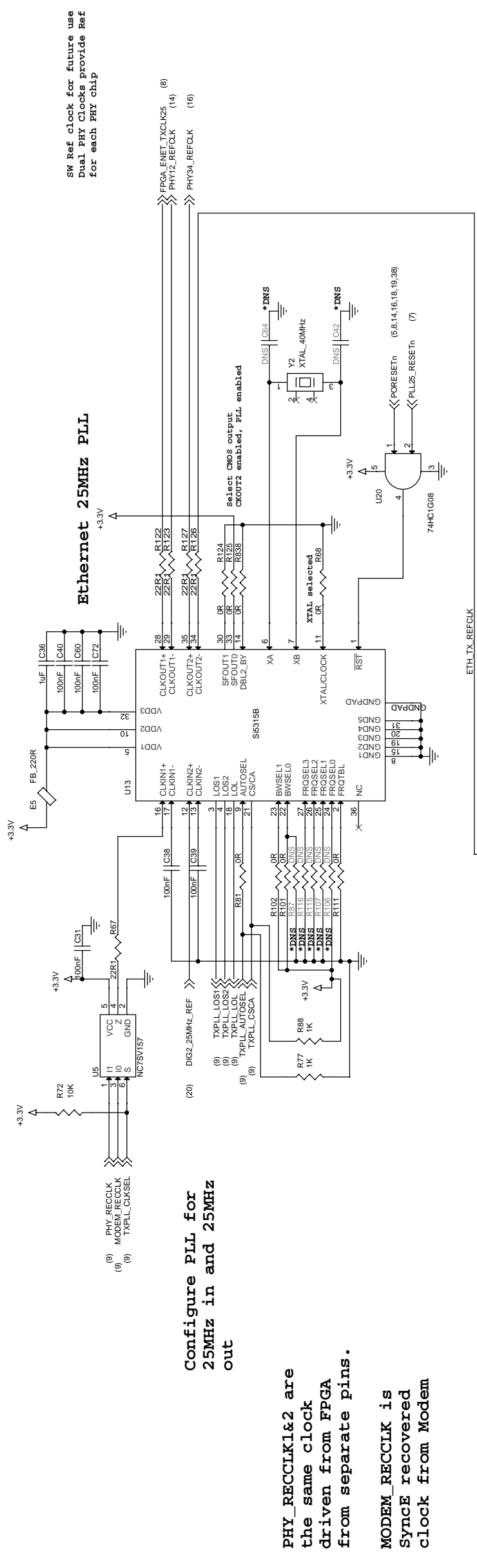
STATUS 1 "STAT"



Variant02

REV	DESCRIPTION	DATE
C	DRM	
A	SCH-61-000273-02	
Ethernet Ports - SFPs		
DragonWave		
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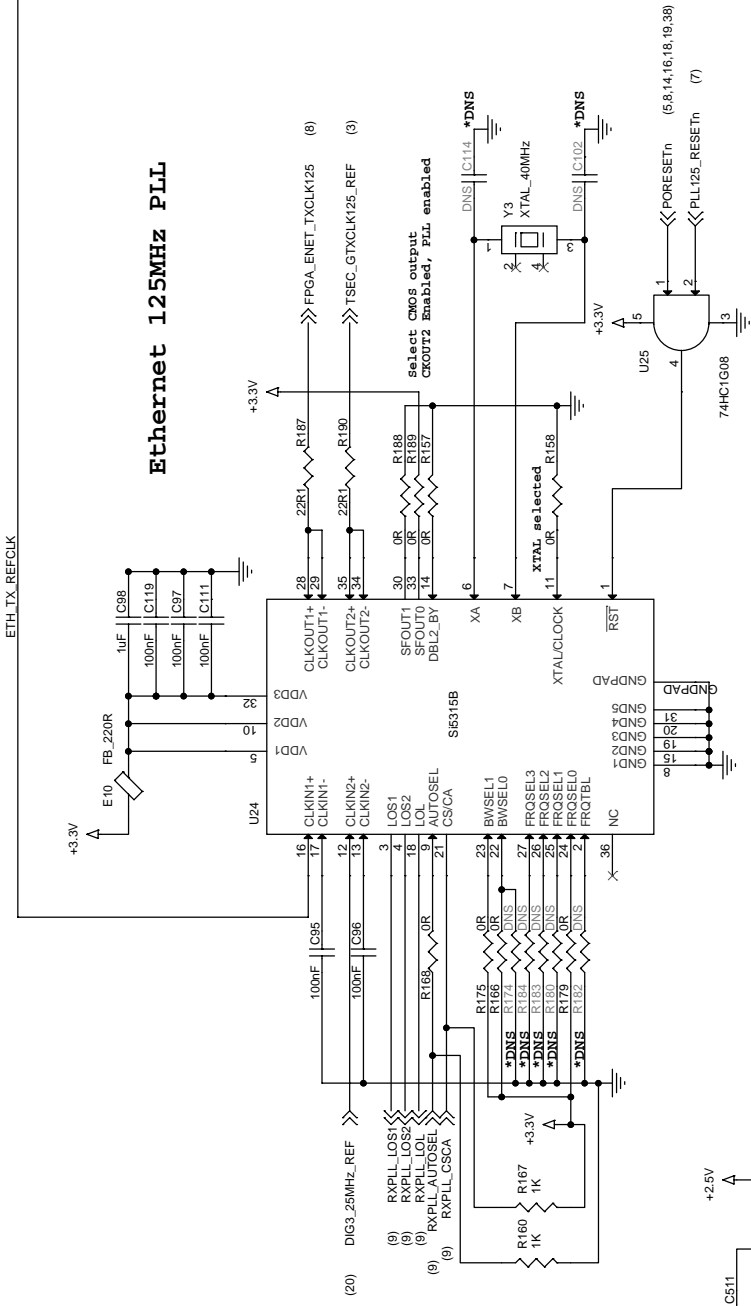
Ethernet 25MHz PLL

SW Ref clock for future use
Dual PHY Clocks provide Ref
for each PHY chip

**Configure PLL for
25MHz in and 25MHz
out**

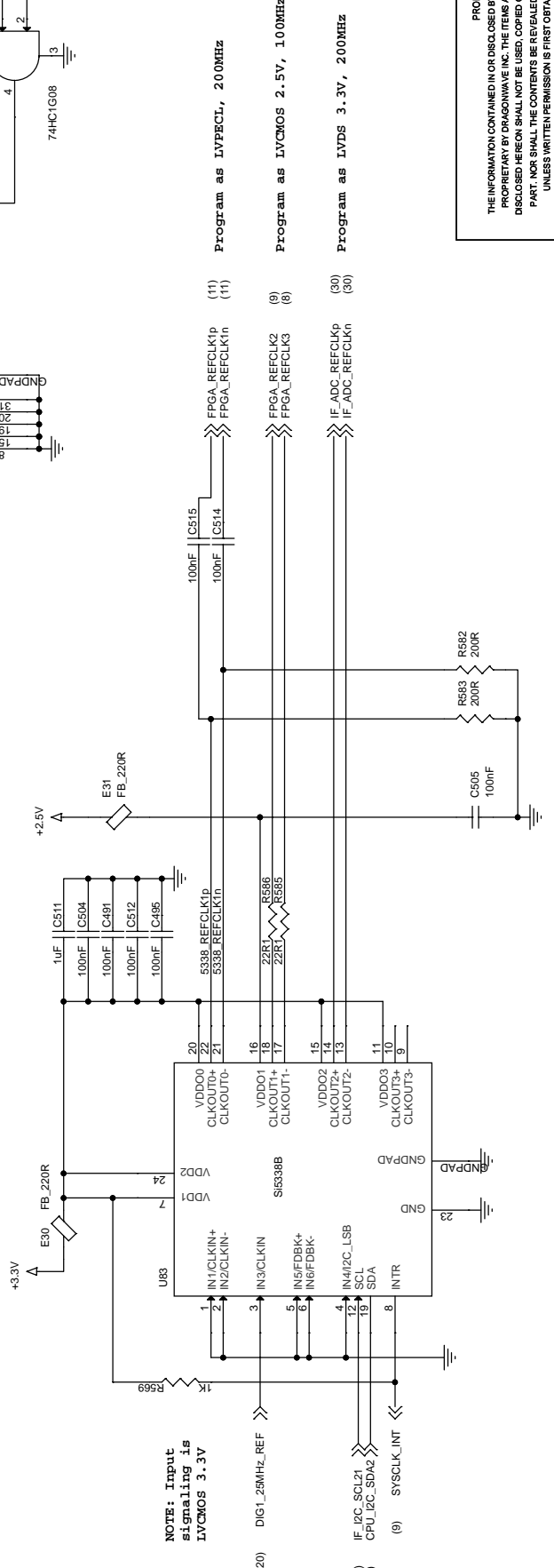
**PHY_RECCLK1&2 are
the same clock
driven from FPGA
from separate pins.**

**MODEM_RECCLK is
SyncE recovered
clock from Modem**



Ethernet 125MHz PLL

**Configure PLL for
25MHz in and 125MHz
out**



**NOTE: Input
signaling is
LVCMOS 3.3V**

(20) DIG1_25MHZ_REF

(7) IF_PC_SCL21
CPU_PC_SDA2

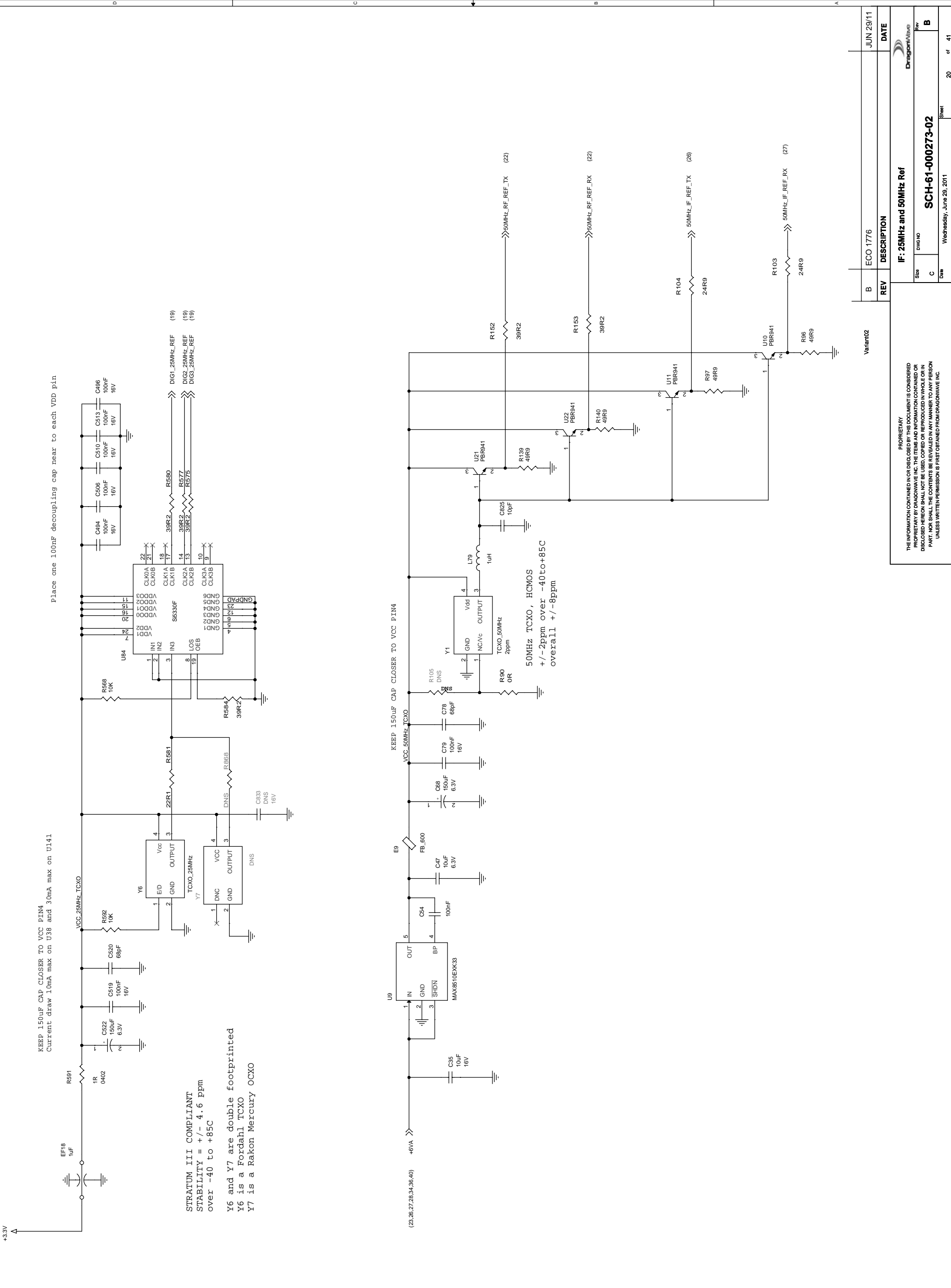
(57) SYSCLK_INT

REV	DESCRIPTION	DATE
1	Digital Clocks	
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Rev A

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Place one 100nF decoupling cap near to each VDD pin

KEEP 150uF CAP CLOSER TO VCC PIN4
Current draw 10mA max on U38 and 30mA max on U141

STRATUM III COMPLIANT
STABILITY = +/- 4.6 ppm
over -40 to +85C

Y6 and Y7 are double footprinted
Y6 is a Fordahl TCXO
Y7 is a Rakon Mercury OCXO

KEEP 150uF CAP CLOSER TO VCC PIN4

50MHz TCXO, HCMOS
+/- 2ppm over -40to+85C
overall +/- 8ppm

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

Variant02

IF: 25MHz and 50MHz Ref

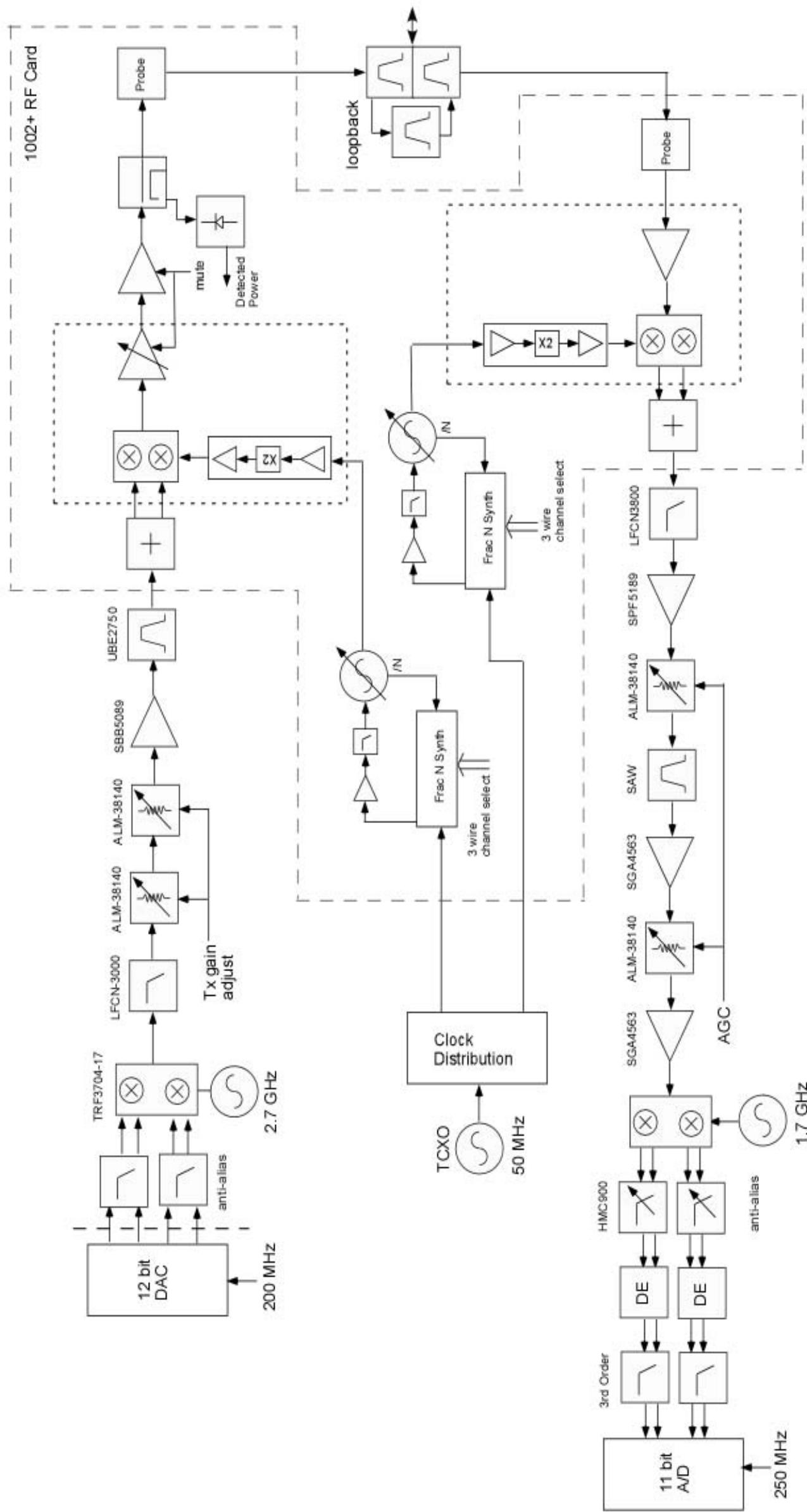
SCH-61-000273-02

DragonWave

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REV	DESCRIPTION	DATE
1	IF Block Diagram	
2		
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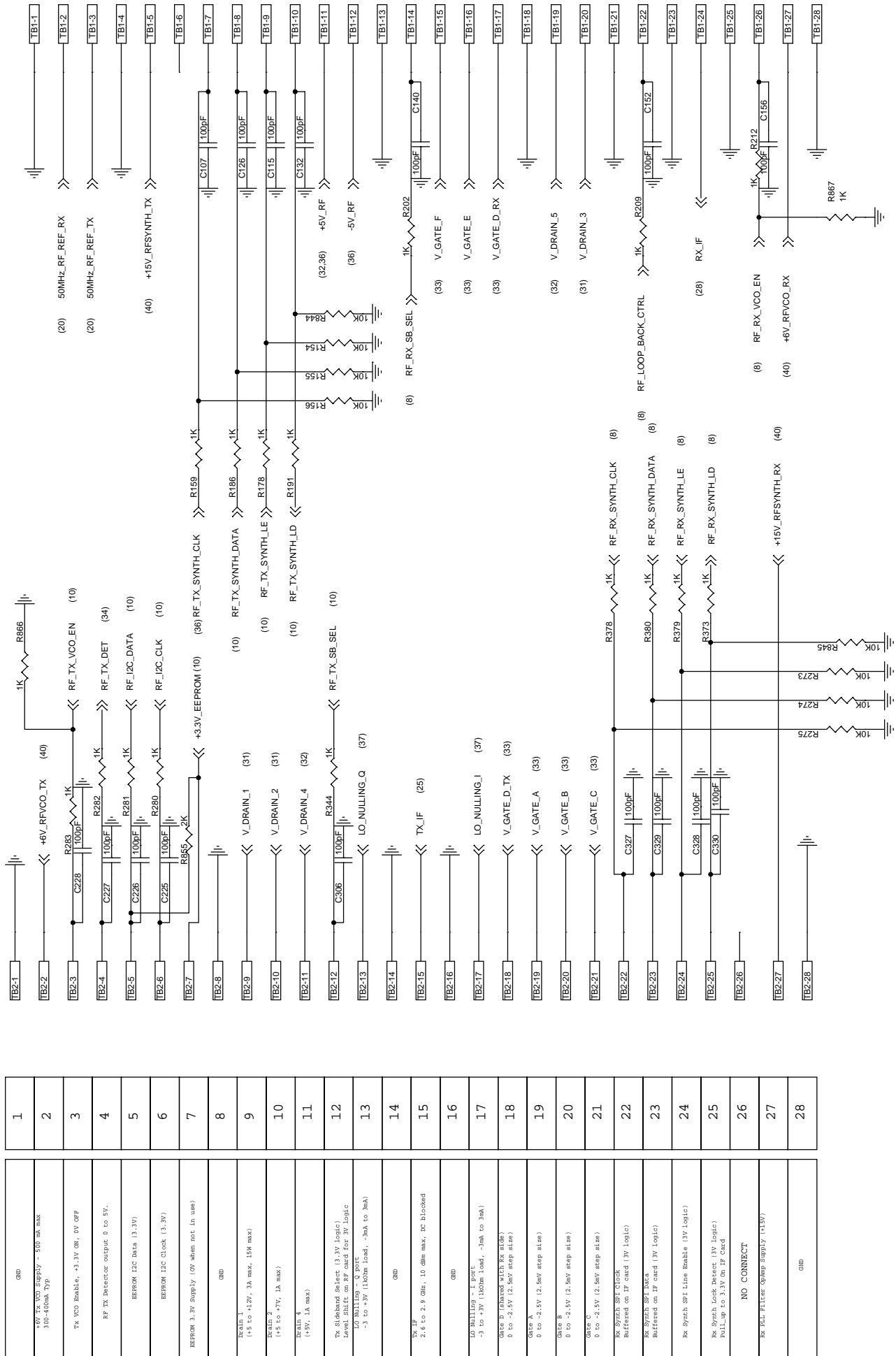
Size	DWG.MXD	Rev	A
Code	C	Date	Tuesday, June 14, 2011
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Variant02

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CONTACTS FOR RF MODULE INTERFACE

Place RC Filters at boundary of IF/RF section



29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	
RF Reference (30 MHz, 3V Logic)	TX Reference (30 MHz, 3V Logic)	NO CONNECT	Tx PLL Filter Output Supply (15V)	NO CONNECT	Tx Synch Clock Buffered on IF card (3V Logic)	Tx Synch Data Buffered on IF card (3V Logic)	Tx Synch Line Enable (3V Logic)	Tx Synch Lock Detect (3V Logic)	+5V, misc RF supply, always on, 500mA max	-5V, misc RF supply, always on, 500mA max	NO CONNECT	Rx Sideload Detect (0.7V Logic)	Gate A 0 to -2.5V (2.5mV step size)	Gate B 0 to -2.5V (2.5mV step size)	Gate C 0 to -2.5V (2.5mV step size)	Gate D 0 to -2.5V (2.5mV step size)	Gate E 0 to -2.5V (2.5mV step size)	Gate F 0 to -2.5V (2.5mV step size)	Gate G 0 to -2.5V (2.5mV step size)	Gate H 0 to -2.5V (2.5mV step size)	Gate I 0 to -2.5V (2.5mV step size)	Gate J 0 to -2.5V (2.5mV step size)	Gate K 0 to -2.5V (2.5mV step size)	Gate L 0 to -2.5V (2.5mV step size)	Gate M 0 to -2.5V (2.5mV step size)	Gate N 0 to -2.5V (2.5mV step size)	Gate O 0 to -2.5V (2.5mV step size)	Gate P 0 to -2.5V (2.5mV step size)

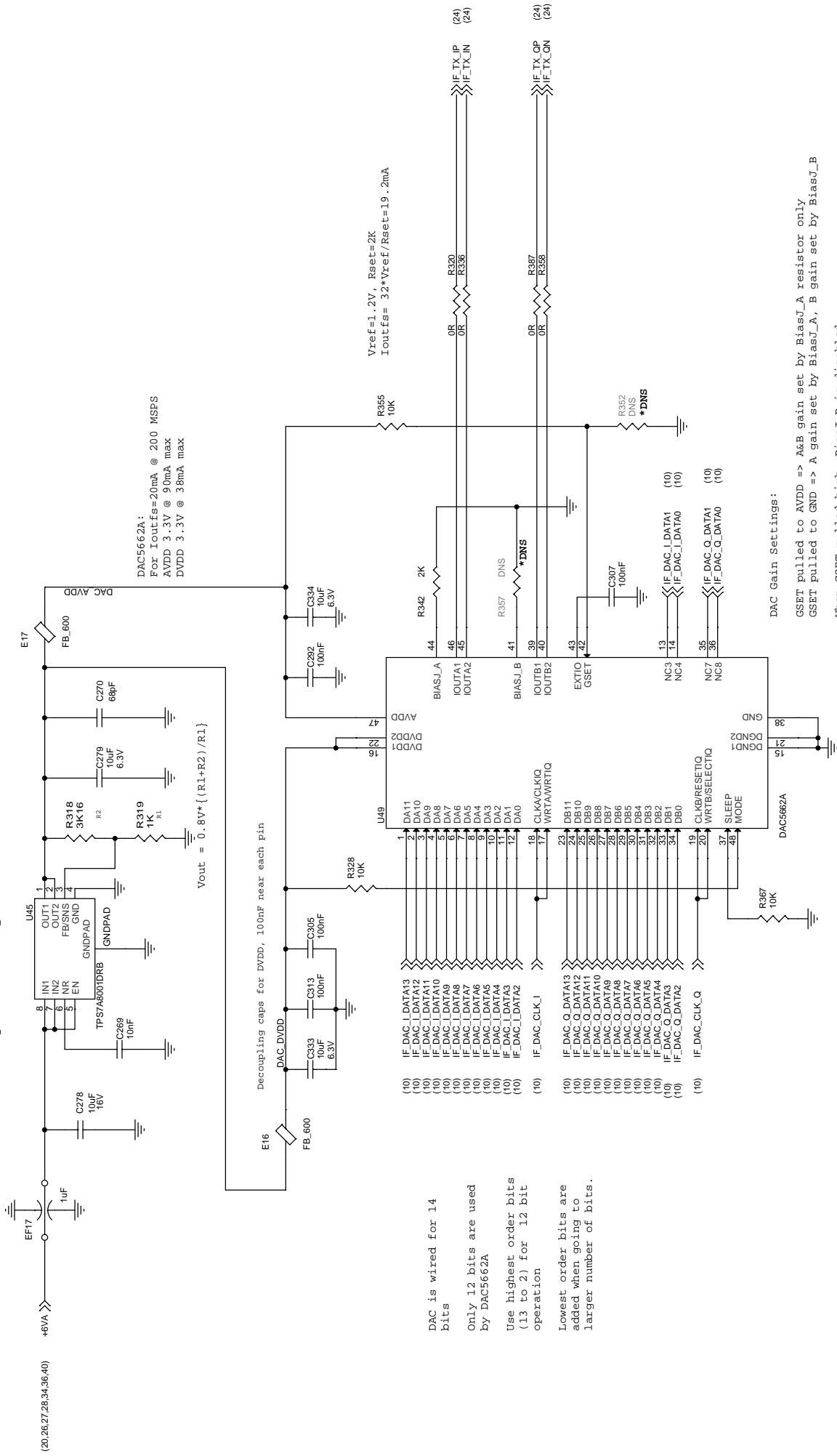
REV	DESCRIPTION	DATE
1	RF Module Interface	Friday, June 17, 2011
2		
3		
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Rev	DragonWave
Size	DWG.MXD
C	SCH-61-000273-02
Date	Friday, June 17, 2011
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Variant02

TPS7A80 max Vin=6.5V, max I=1A
PSRR >= 67dB upto 100KHz
Dissipation Rating 1W at +85C



DAC is wired for 14 bits
Only 12 bits are used by DAC5662A
Use highest order bits (13 to 2) for 12 bit operation
Lowest order bits are added when going to larger number of bits.

REV	DESCRIPTION	DATE
C	I/Q DACS	
Rev	DWG NO	
Size	SCH-61-000273-02	
Date	Tuesday, June 14, 2011	
Sheet	23	of 41

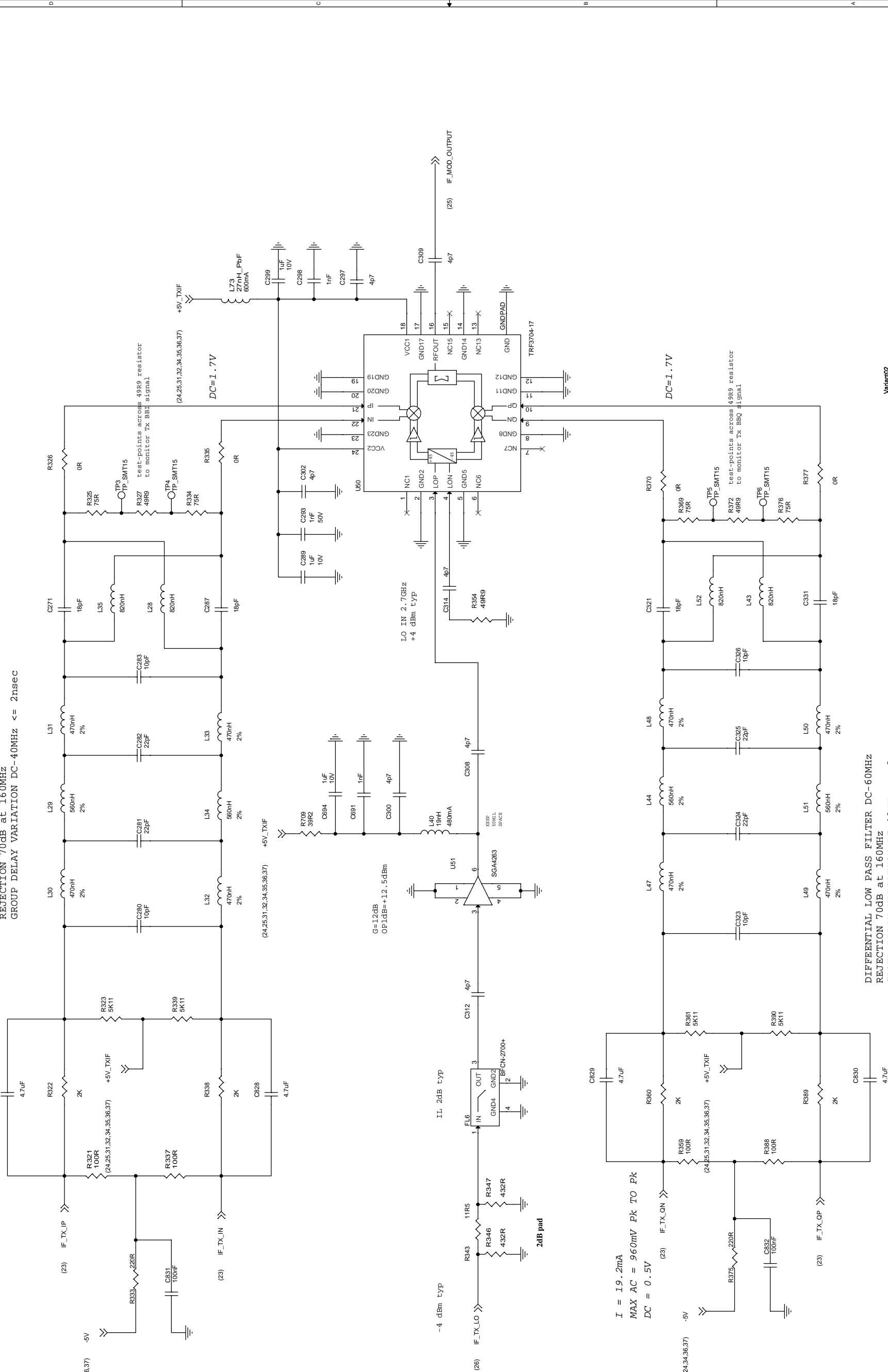
DragonWave

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Variant02

DIFFERENTIAL LOW PASS FILTER DC-60MHz
 REJECTION 70dB at 160MHz
 GROUP DELAY VARIATION DC-40MHz <= 2nsec

$I = 19.2mA$
 MAX AC = 900mV Pk TO Pk
 DC = 0.5V



$I = 19.2mA$
 MAX AC = 960mV Pk TO Pk
 DC = 0.5V

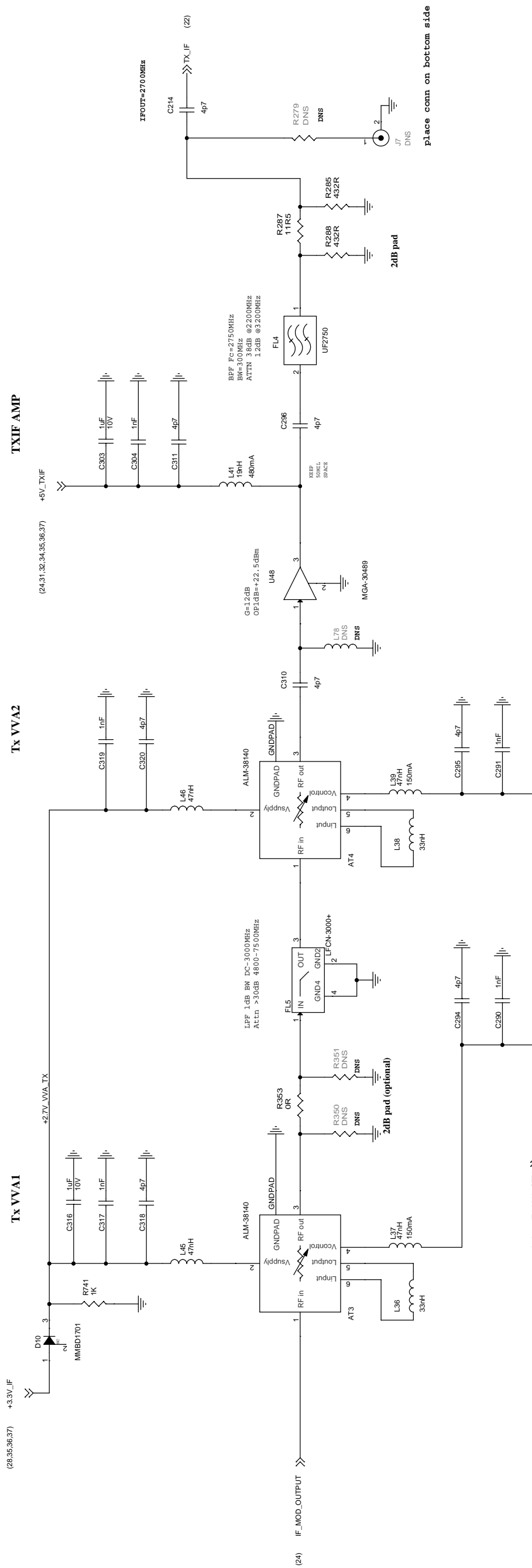
DIFFERENTIAL LOW PASS FILTER DC-60MHz
 REJECTION 70dB at 160MHz
 GROUP DELAY VARIATION DC-40MHz <= 2nsec

REV	DESCRIPTION	DATE
1	TX LINEUP1-TX MOD & BB FILTERS	
2		
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Variant02

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place conn on bottom side

REV	DESCRIPTION	DATE
1	TX LINEUP-2: WAS & IF Amp	
2		
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4		
5		

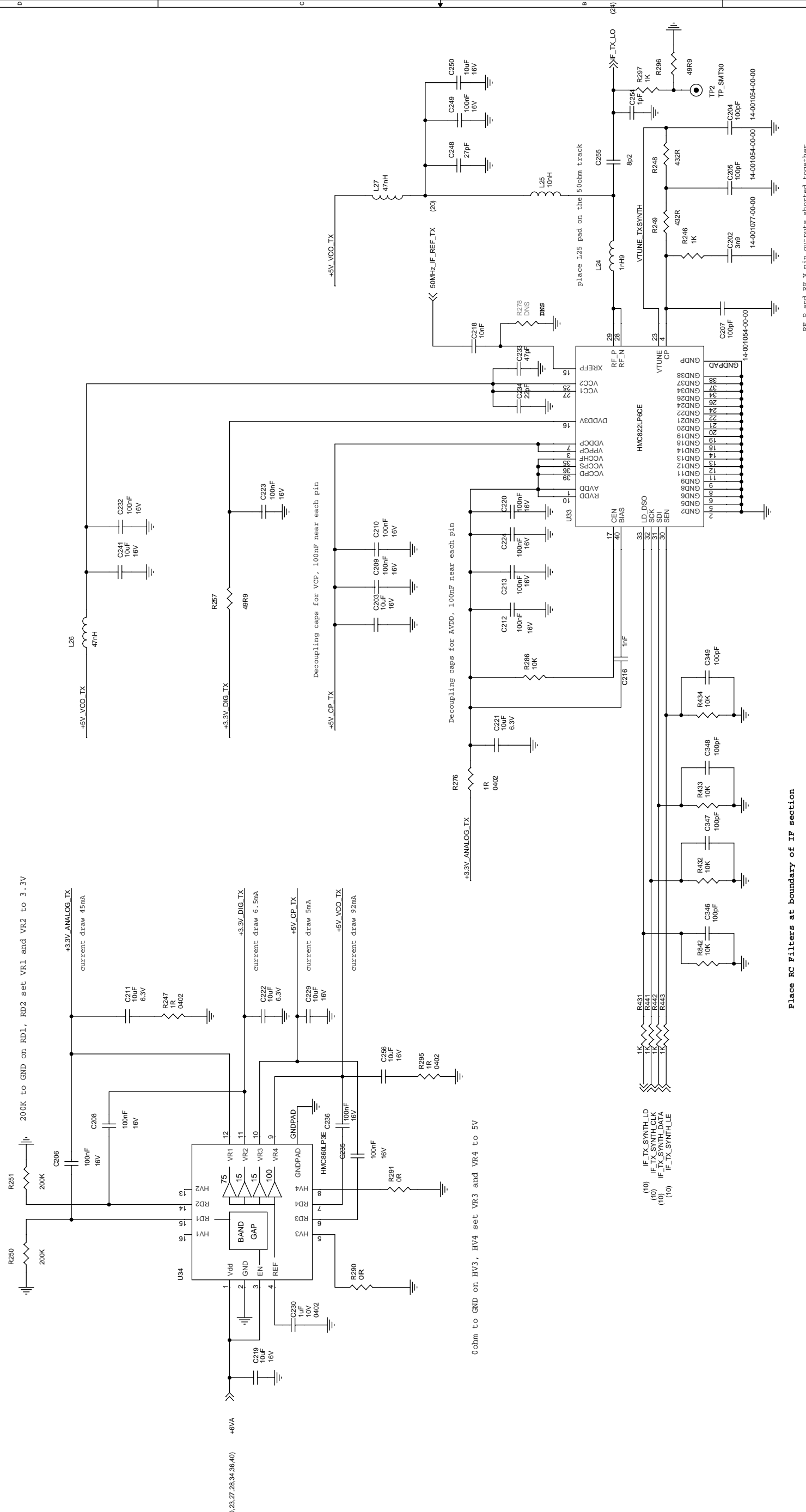
Size	Rev	DATE
C	A	Tuesday, June 14, 2011

Part No	Sheet	of
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Variant02

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DragonWave

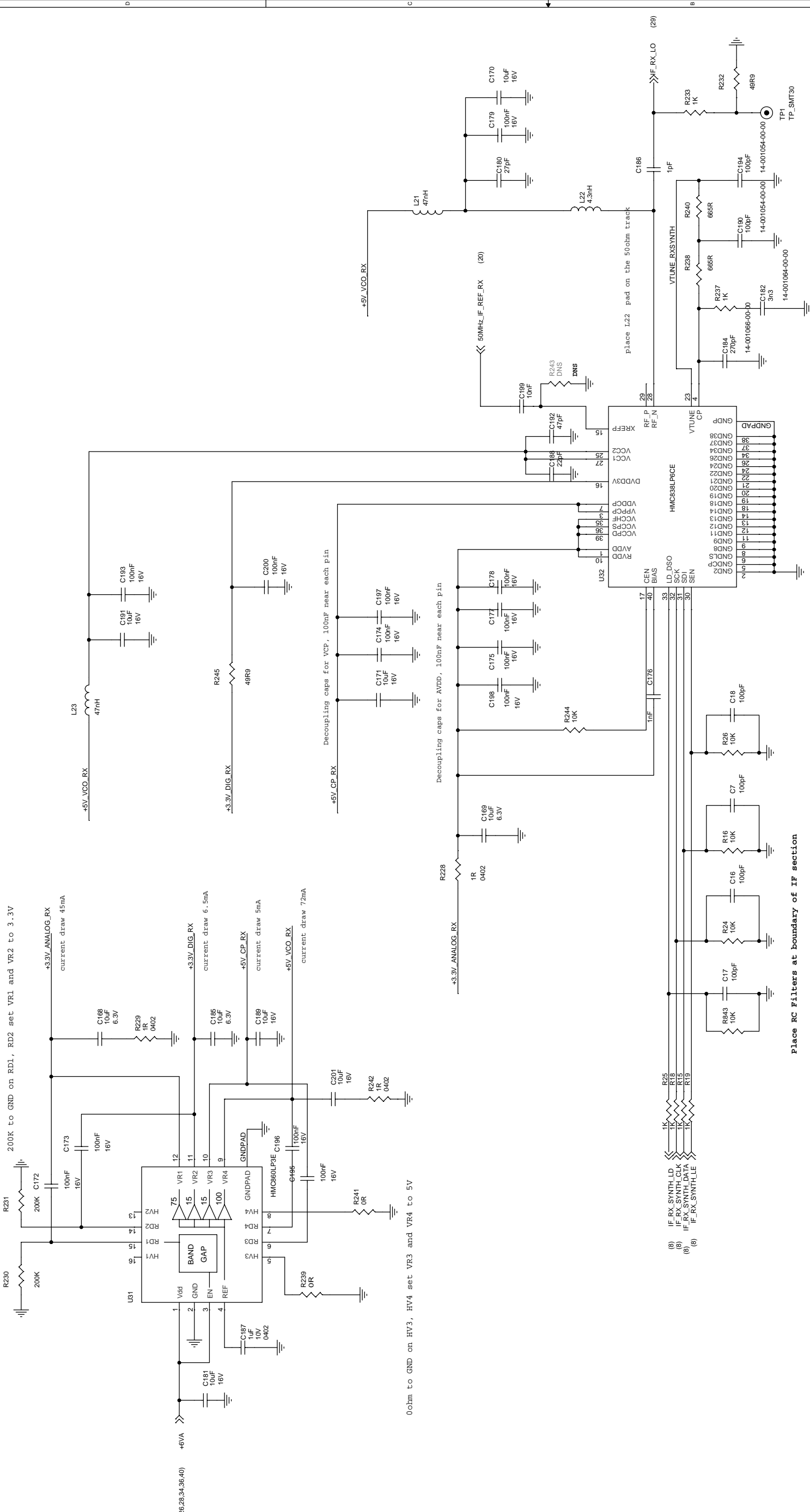


REV	DESCRIPTION	DATE
C	SCH-61-000273-02	Tuesday, June 14, 2011

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DRG134	A	26	41

Variant02

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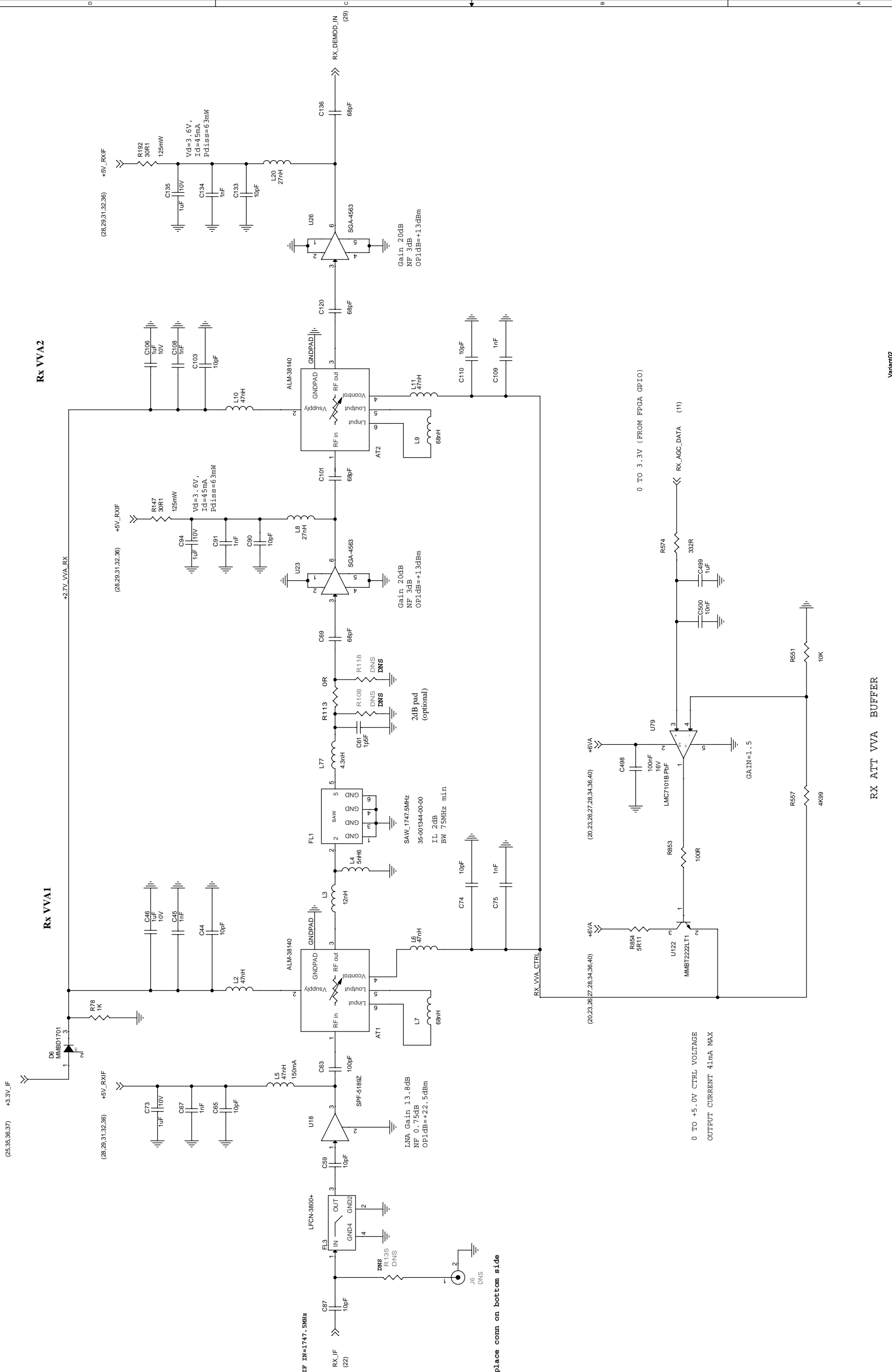
Place RC Filters at boundary of IF section

REV	DESCRIPTION	DATE
1	RX IF SYNTHESIZER	
2		
3		
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Proprietary	DragonWave
Size	Rev
C	A
Date	Sheet
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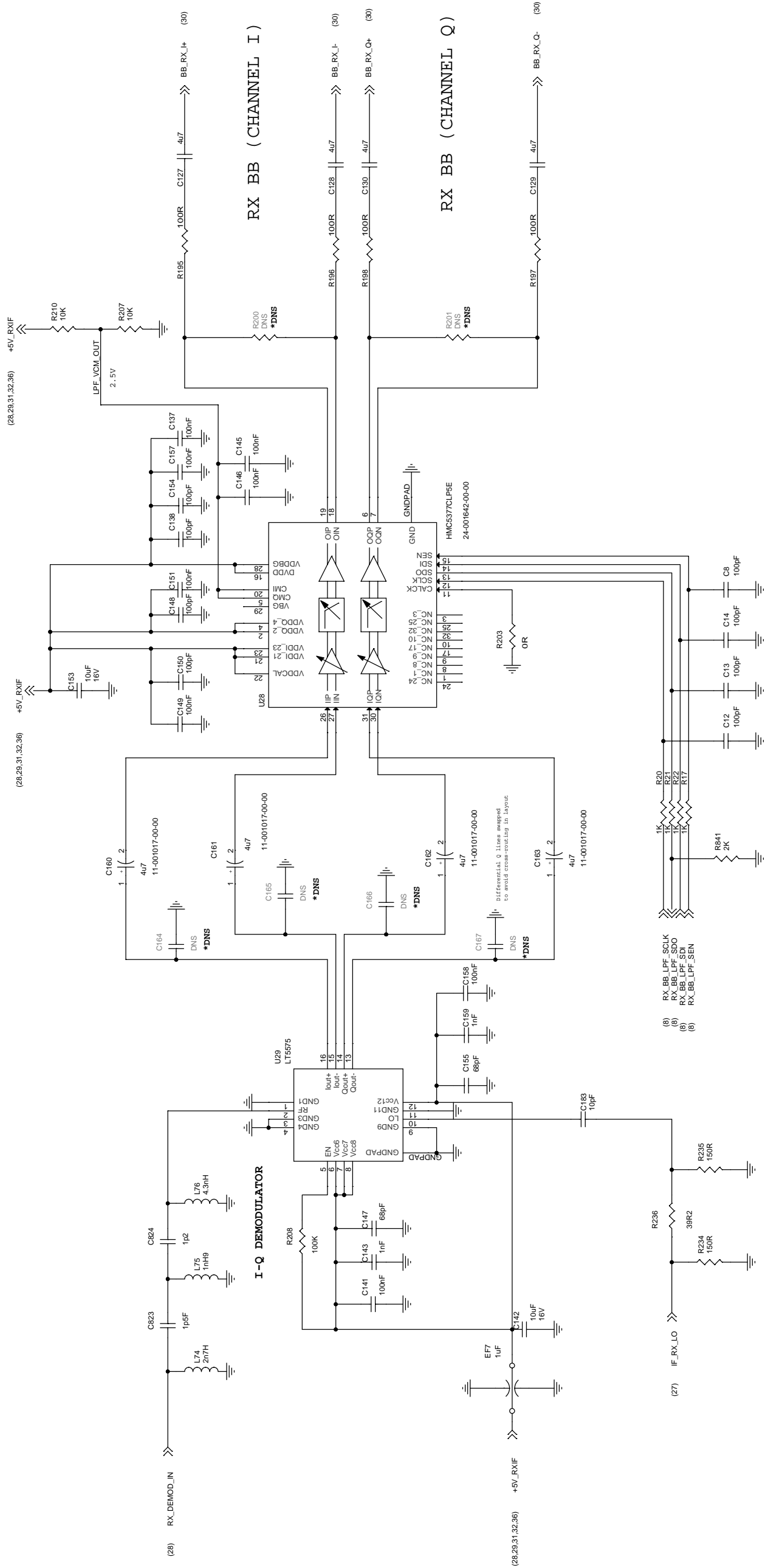


REV	DESCRIPTION	DATE
C	SCH-61-000273-02	Tuesday, June 14, 2011
Rev	DragonWave	
Size	28	of 41
Sheet		

Variant02

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I-Q LOWPASS FILTER
PROGRAMMABLE 3dB BW 3.5 to 50MHZ



Place RC Filters at boundary of IF section

REV	DESCRIPTION	DATE
1	RX LINEUP2 - IF DEMOD & PROG BB LPF	
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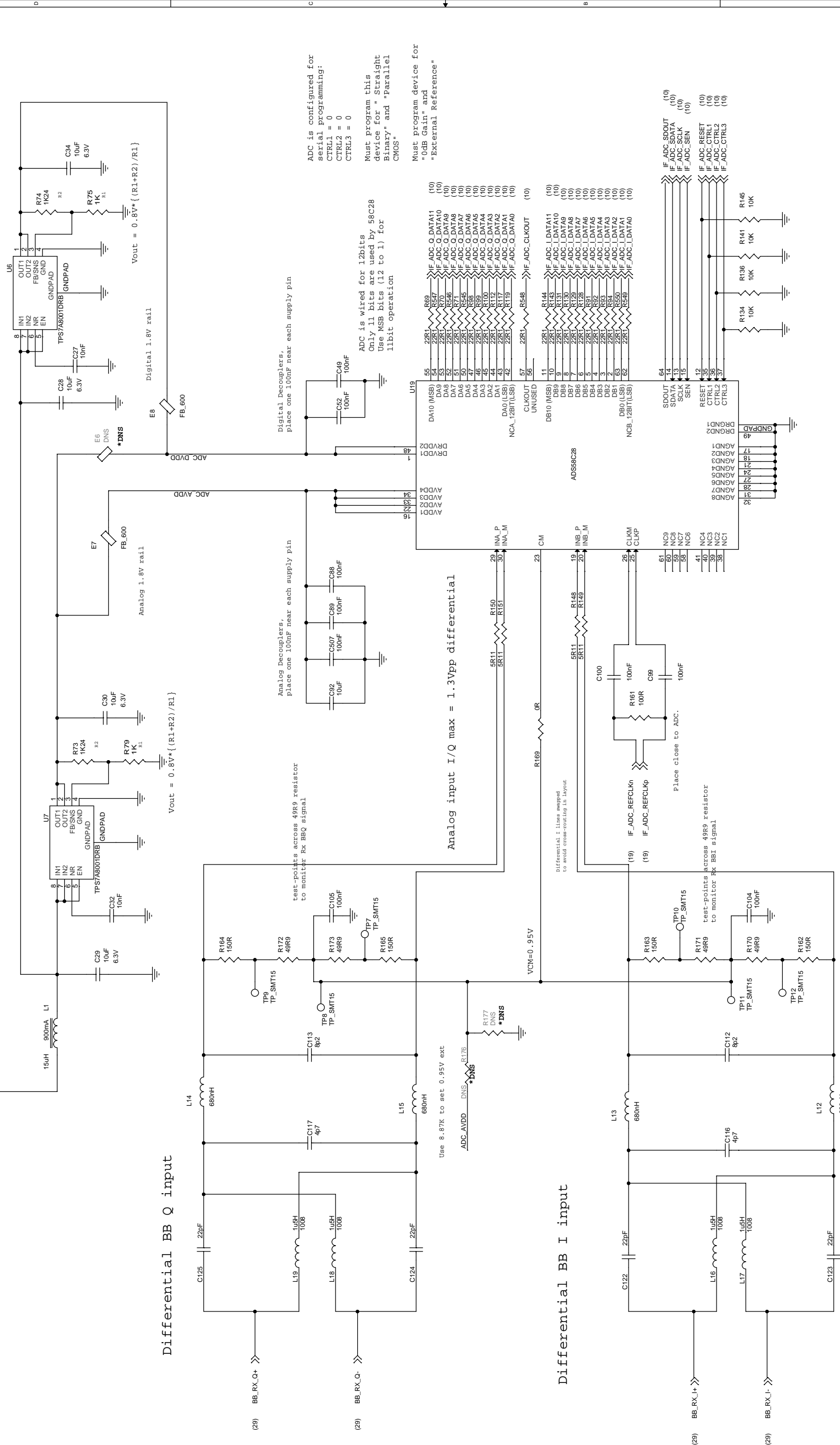
REV	DESCRIPTION	DATE
1	RX LINEUP2 - IF DEMOD & PROG BB LPF	
2		
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REV	DESCRIPTION	DATE
1	RX LINEUP2 - IF DEMOD & PROG BB LPF	
2		
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REV	DESCRIPTION	DATE
1	RX LINEUP2 - IF DEMOD & PROG BB LPF	
2		
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TPS7A80 max Vin=6.5V, max I=1A
 PSRR >= 67dB upto 100KHz
 Dissipation Rating 1W at +85C



ADC is configured for serial programming:
 CTRL1 = 0
 CTRL2 = 0
 CTRL3 = 0

Must program this device for "Straight Binary" and "Parallel CMOS"

Must program device for "0dB Gain" and "External Reference"

ADC is wired for 12bits
 Only 11 bits are used by 58C28
 Use MSB bits (12 to 1) for 11bit operation

Digital Decouplers, Place one 100nF near each supply pin

Analog Decouplers, Place one 100nF near each supply pin

Analog input I/Q max = 1.3Vpp differential

Differential I lines swaged to avoid cross-routing in layout

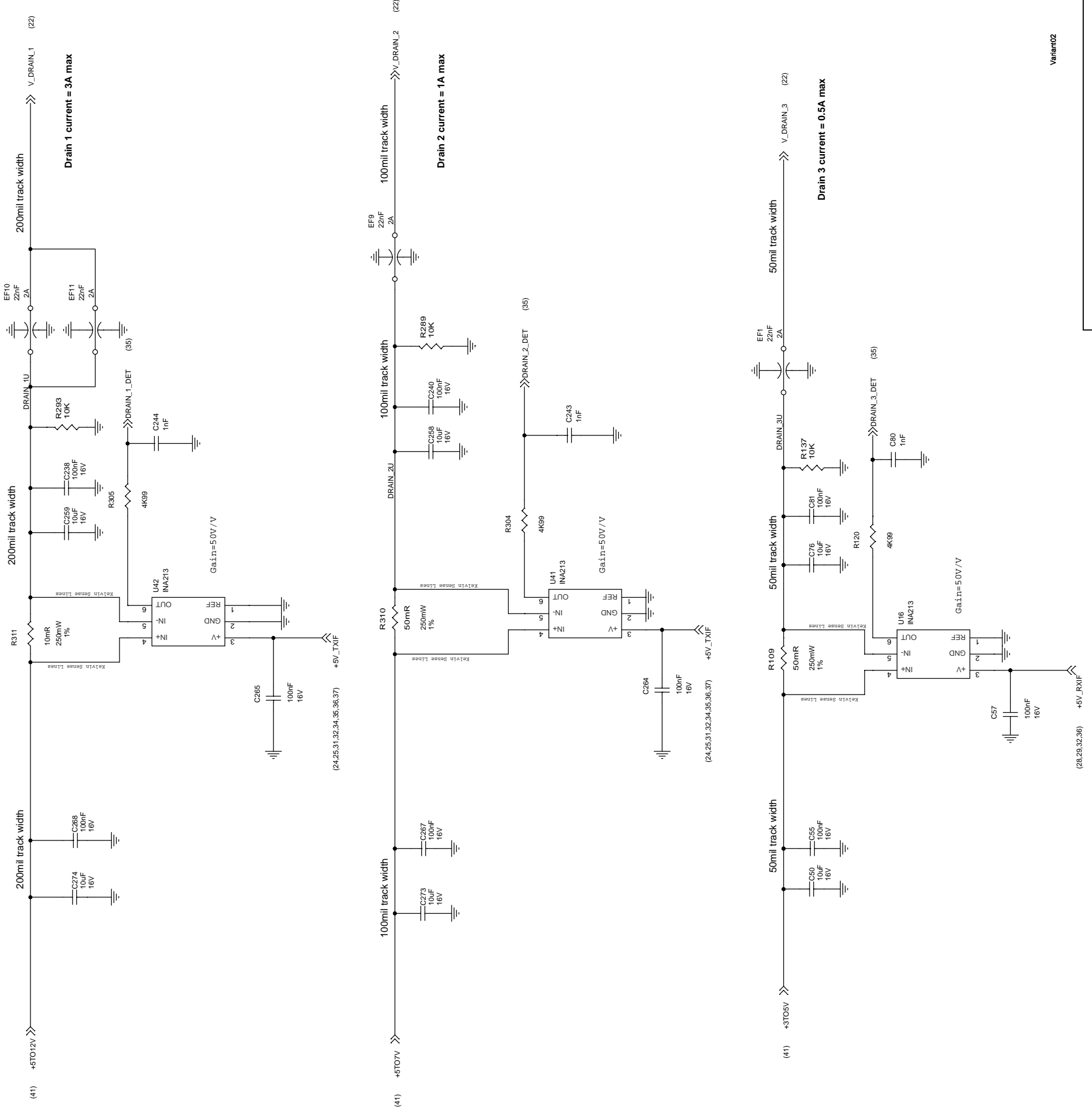
Place close to ADC.

test-points across 4989 resistor to monitor BBI signal

REV	DESCRIPTION	DATE
1	I/Q ADCs	
2		
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CURRENT SENSORS

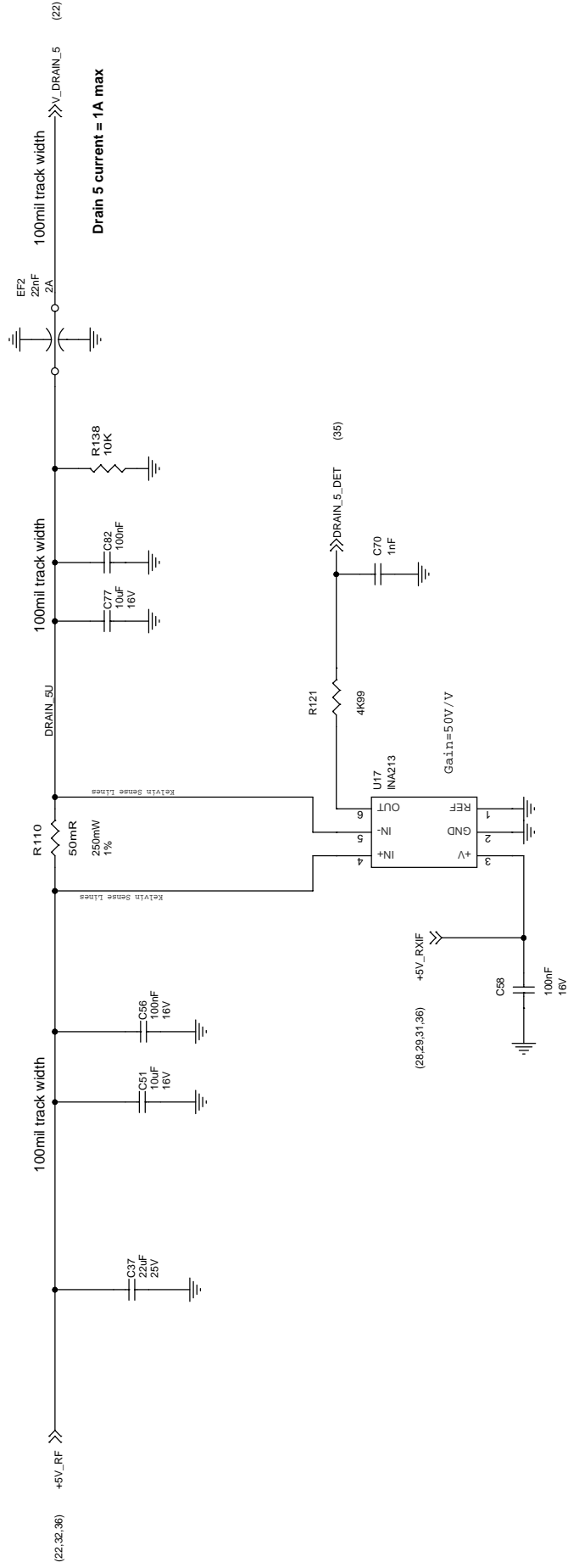
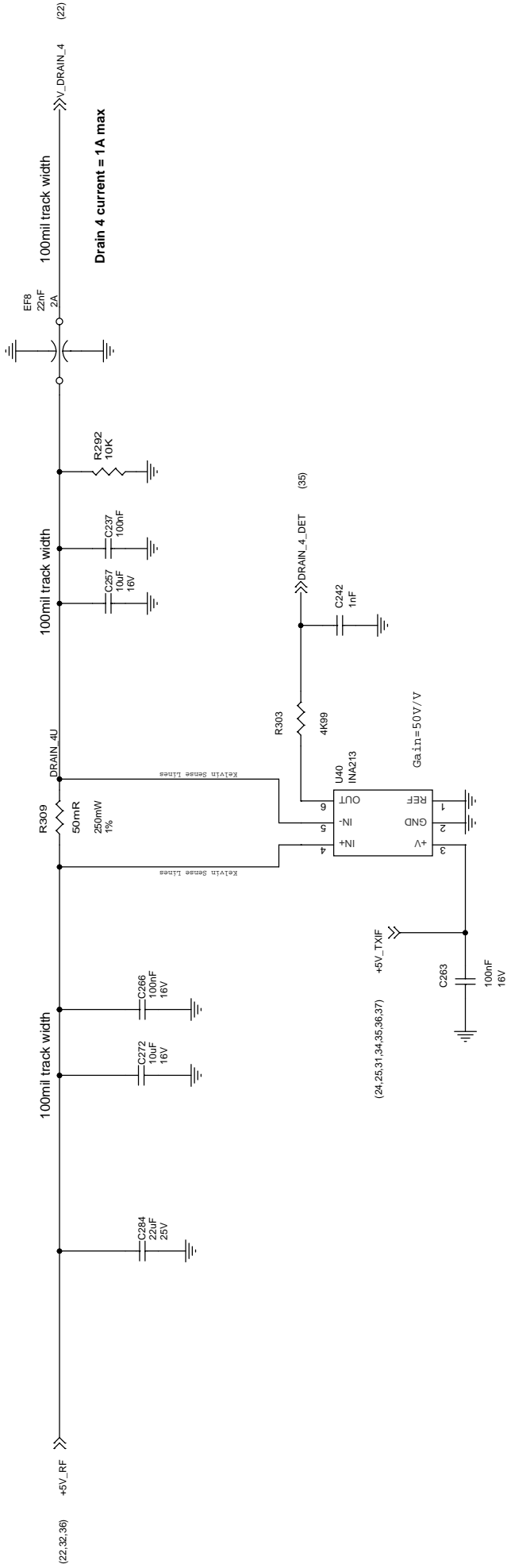


REV	DESCRIPTION	DATE
1	Current Sensors for Drain 1, 2, 3	
2		
3		
4		
5		

Size	DragonWave
Rev	
Part No	SCH-61-000273-02
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OTHER CURRENT SENSORS



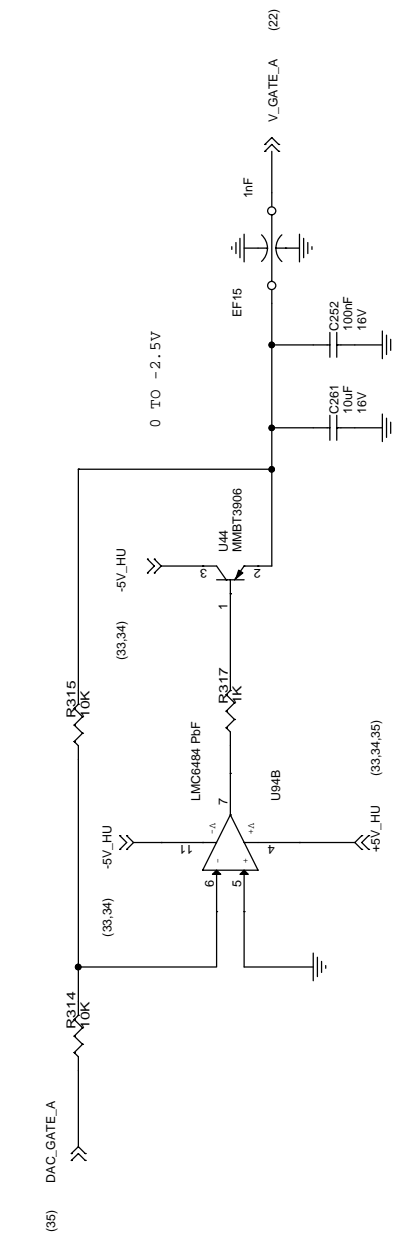
Variant02

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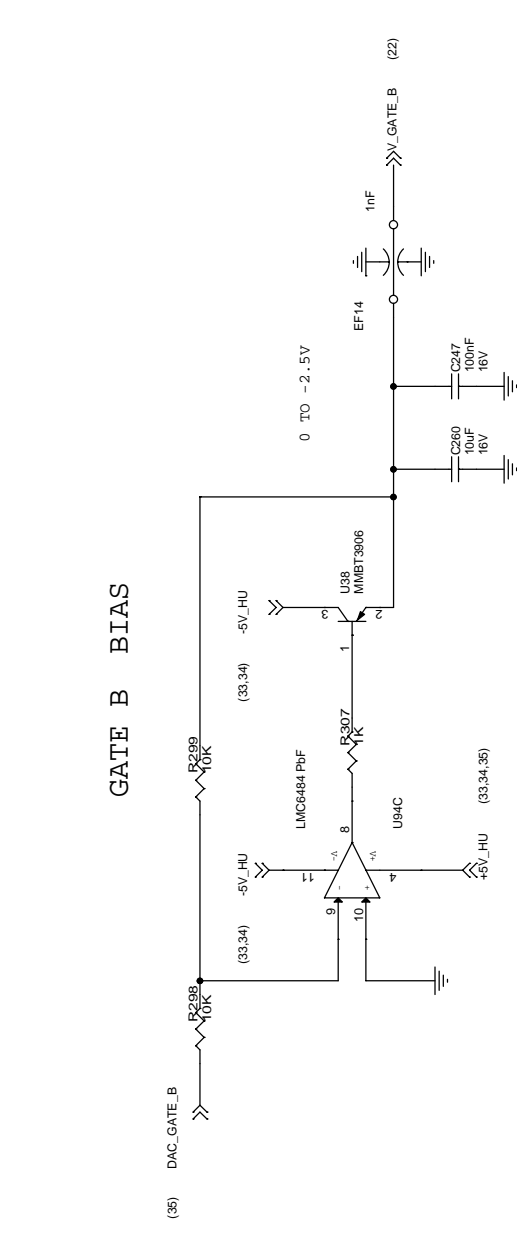
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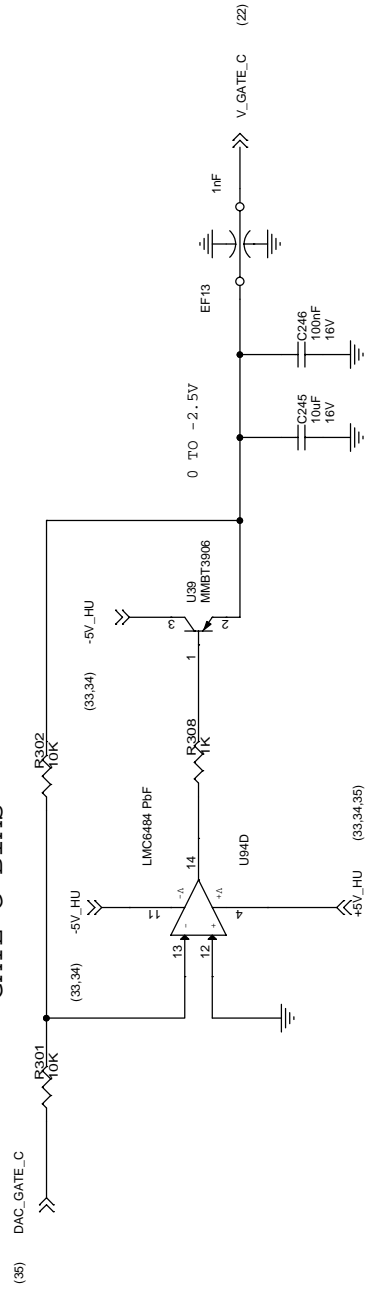
GATE A BIAS



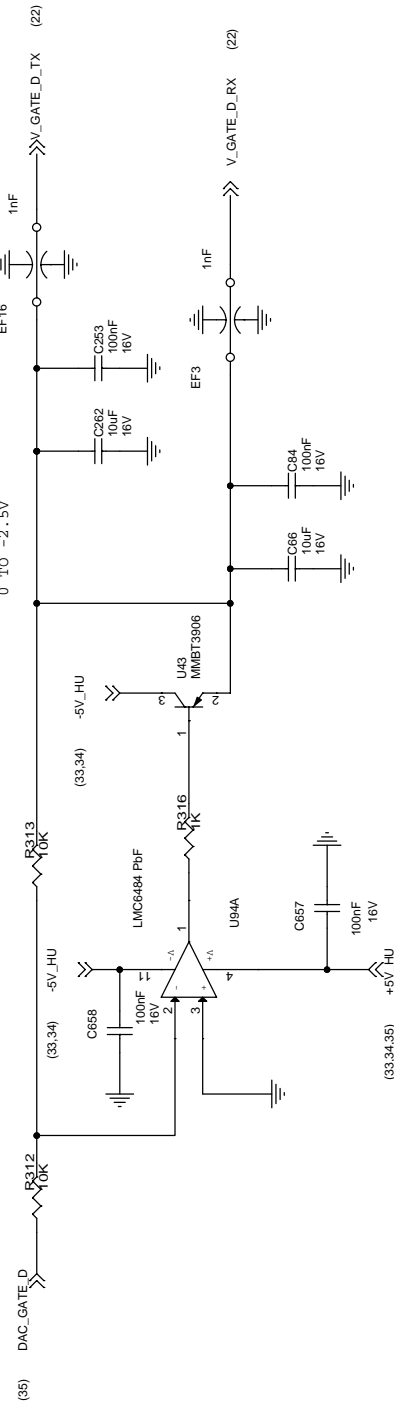
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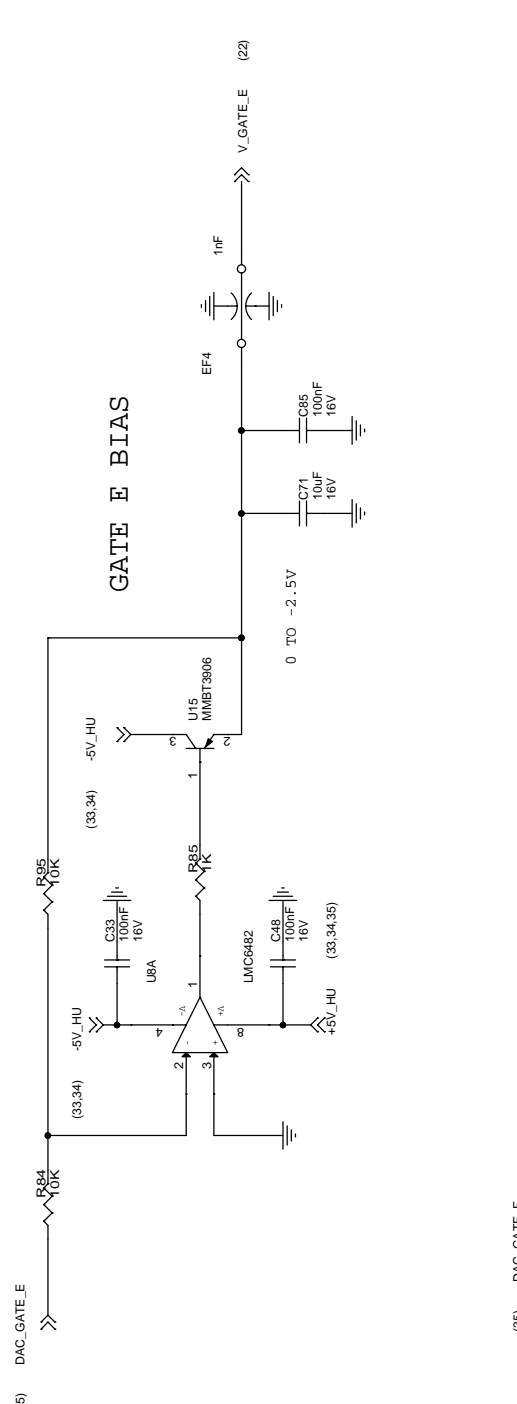
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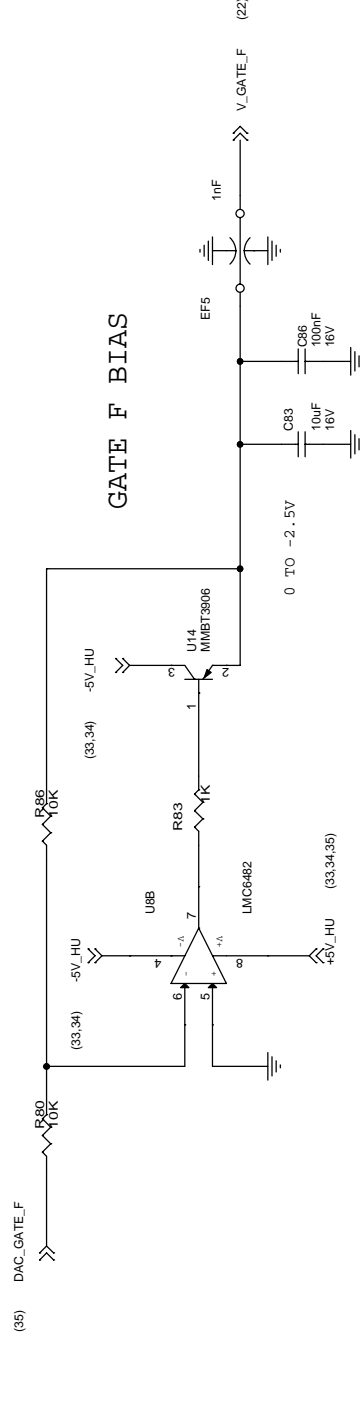
GATE D BIAS



GATE E BIAS



GATE F BIAS

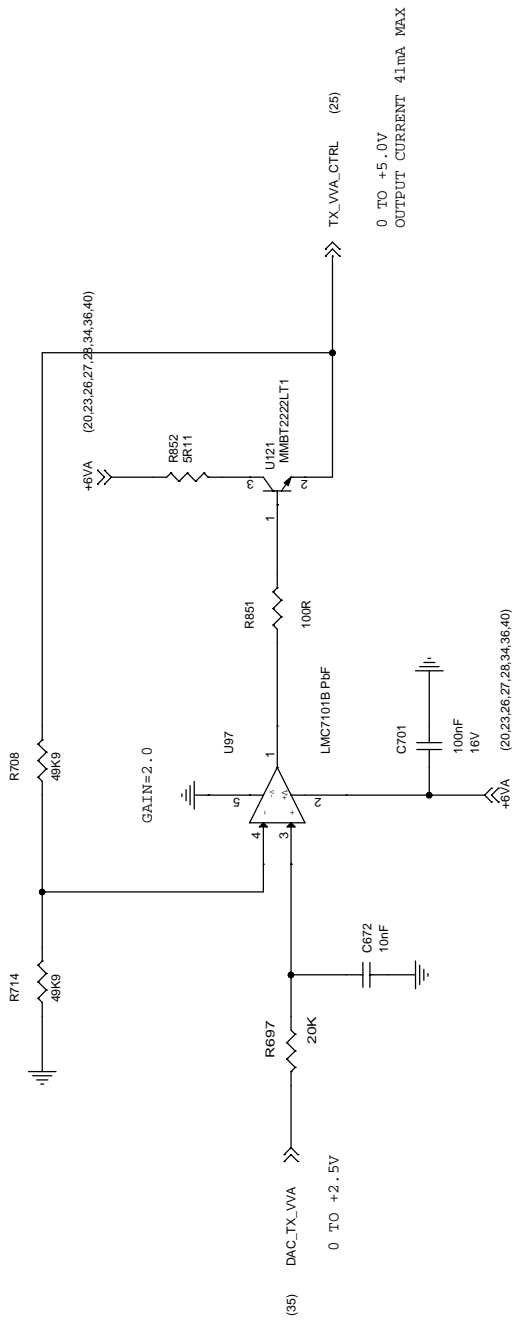


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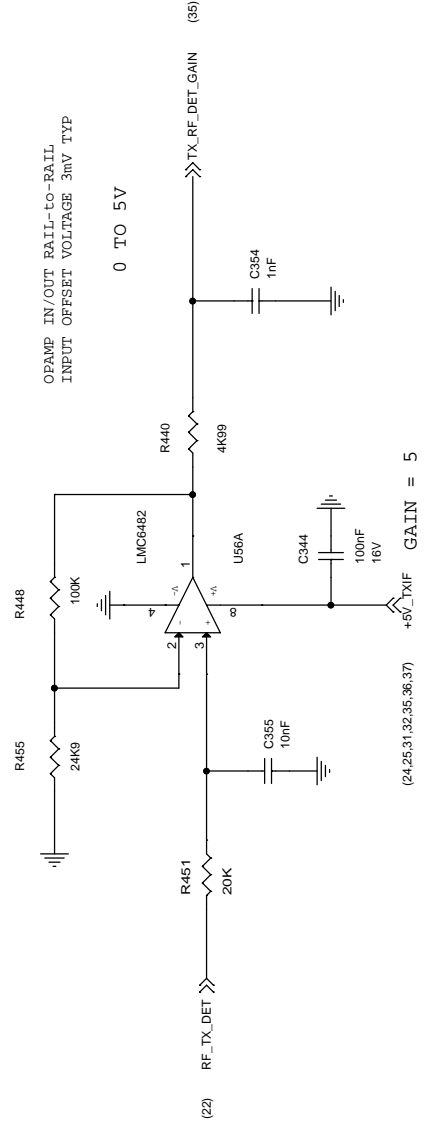
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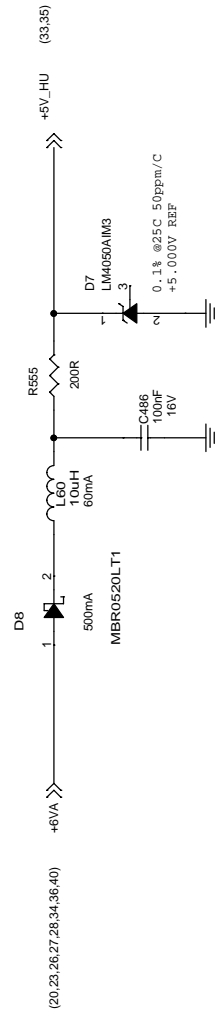
TX ATT VVA BUFFER



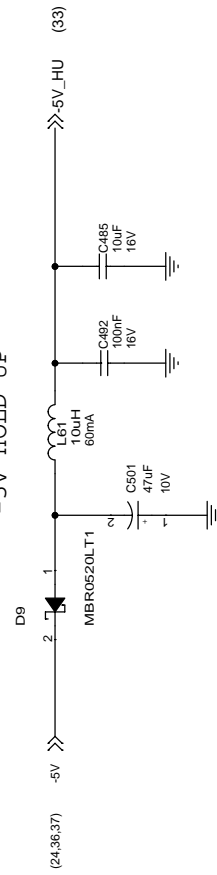
TX RF DETECTOR CONTROL



+5V HOLD UP



-5V HOLD UP



Variant02

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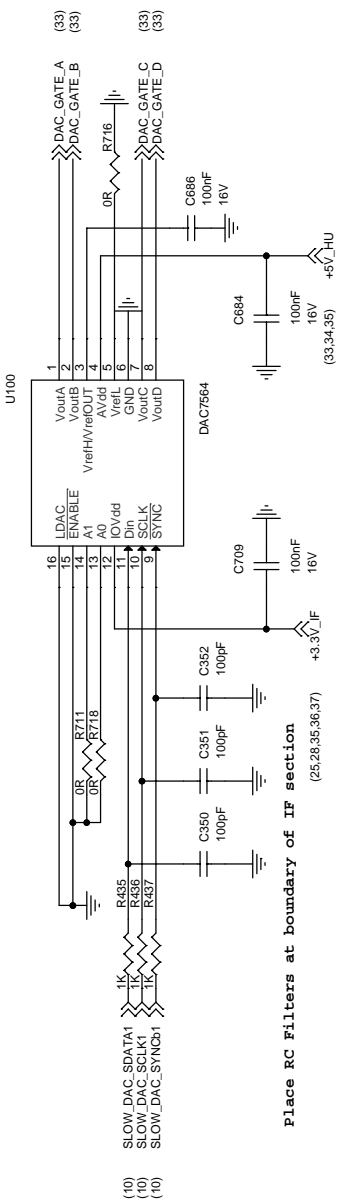
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MISC POWER & CONTROLS
SCH-61-000273-02

DATE
Tuesley, June 14, 2011

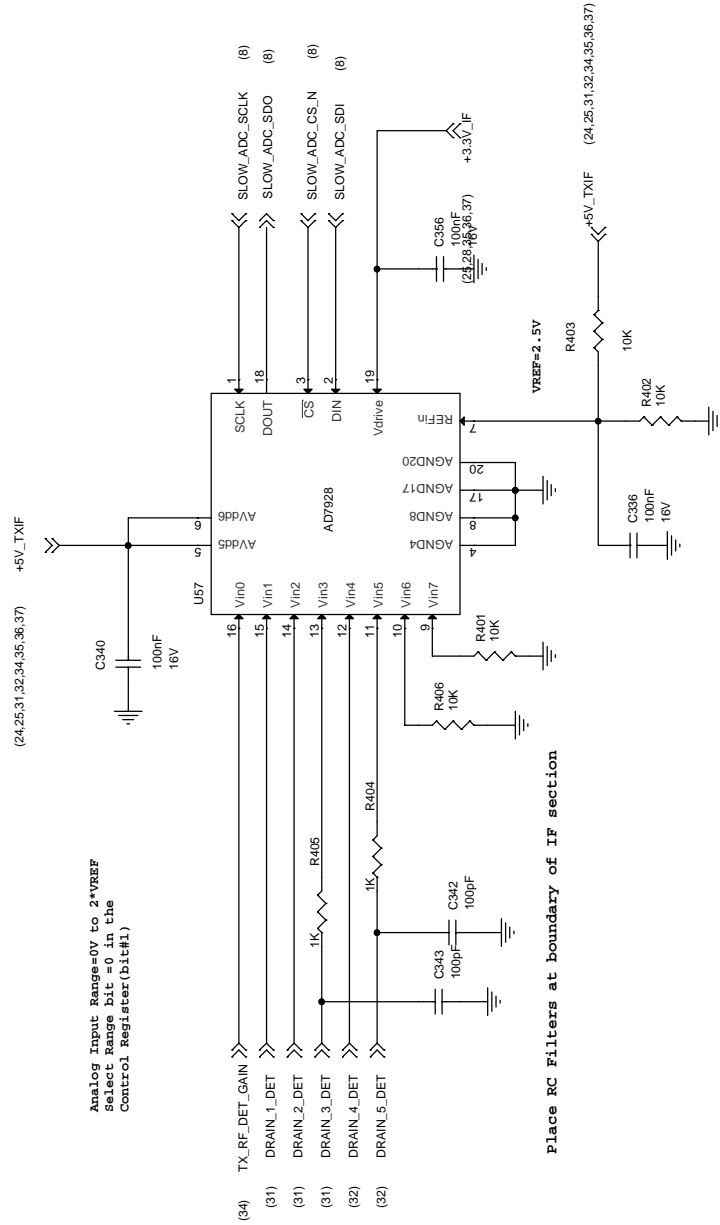
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QUAD 12 BIT DACS

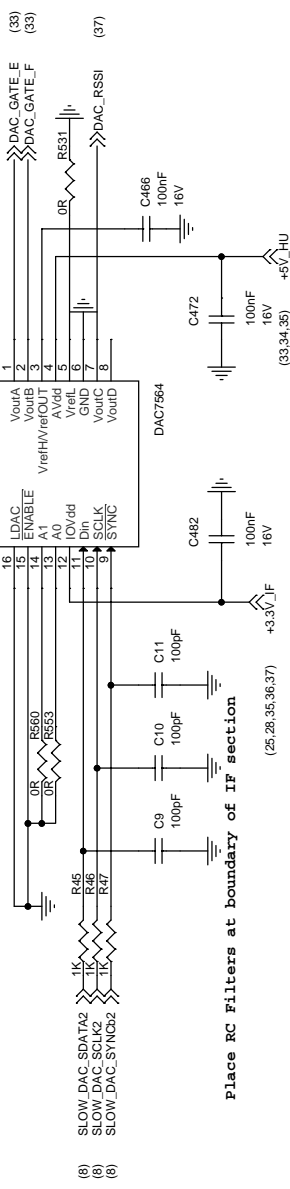


Place RC Filters at boundary of IF section
(25,28,35,36,37)

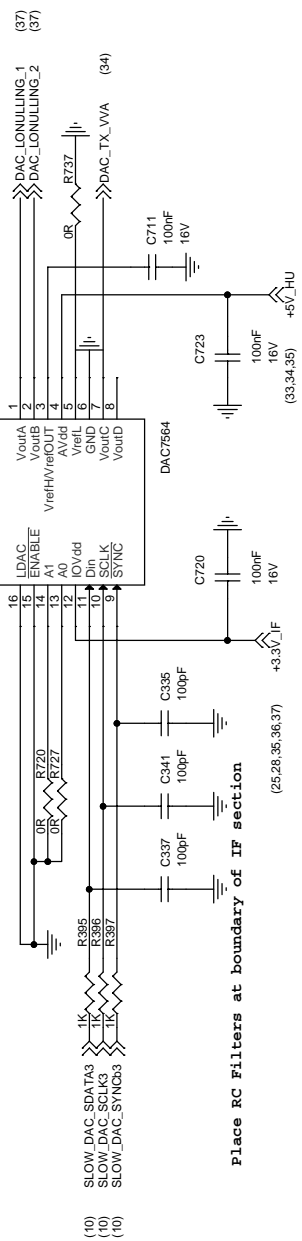
Analog Input Range=0V to 2*VREF
Select Range bit =0 in the
Control Register(bit#1)



Place RC Filters at boundary of IF section



Place RC Filters at boundary of IF section
(25,28,35,36,37)



Place RC Filters at boundary of IF section
(25,28,35,36,37)

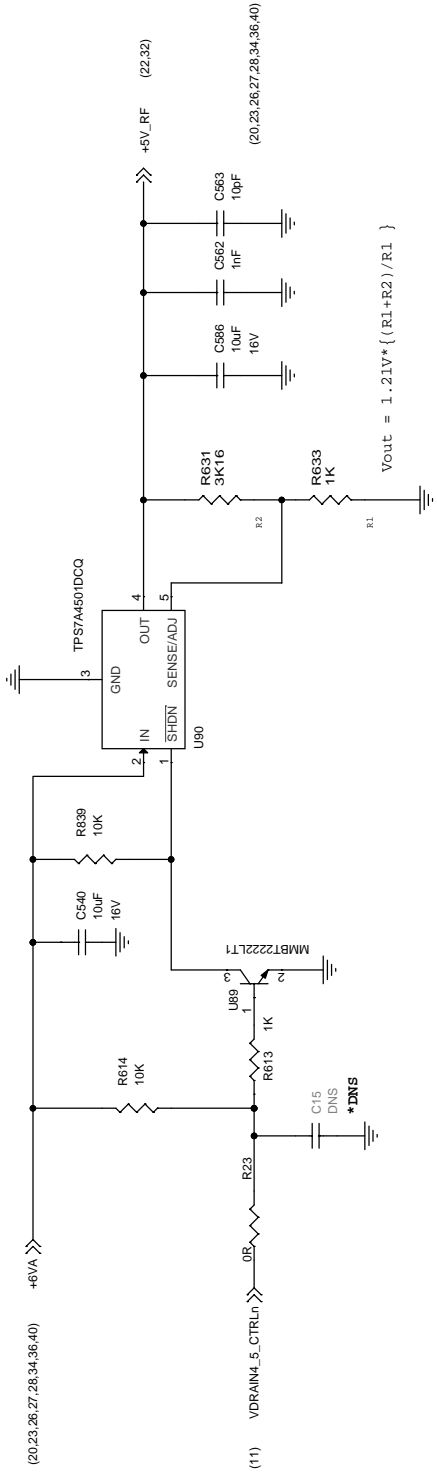
Variant02

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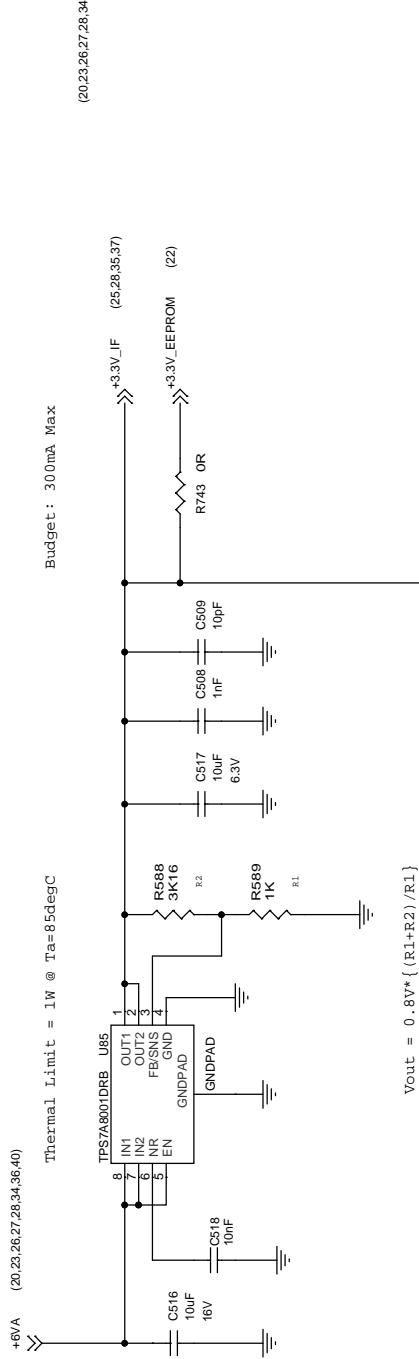
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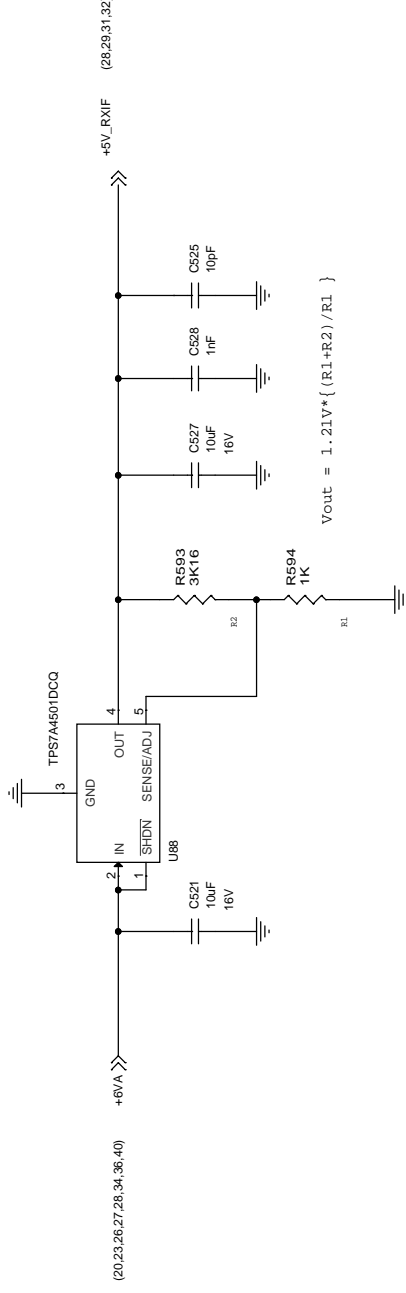
+5V RF REGULATOR



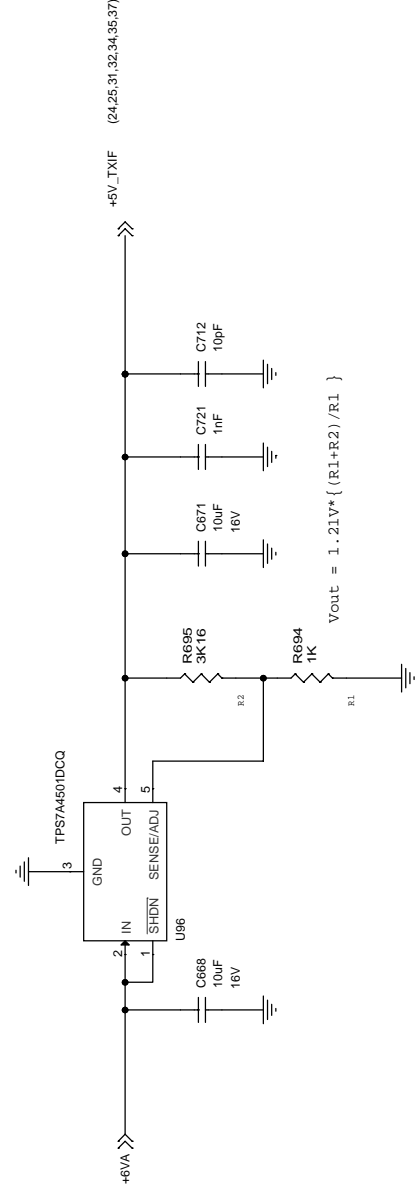
+3.3V IF REGULATOR



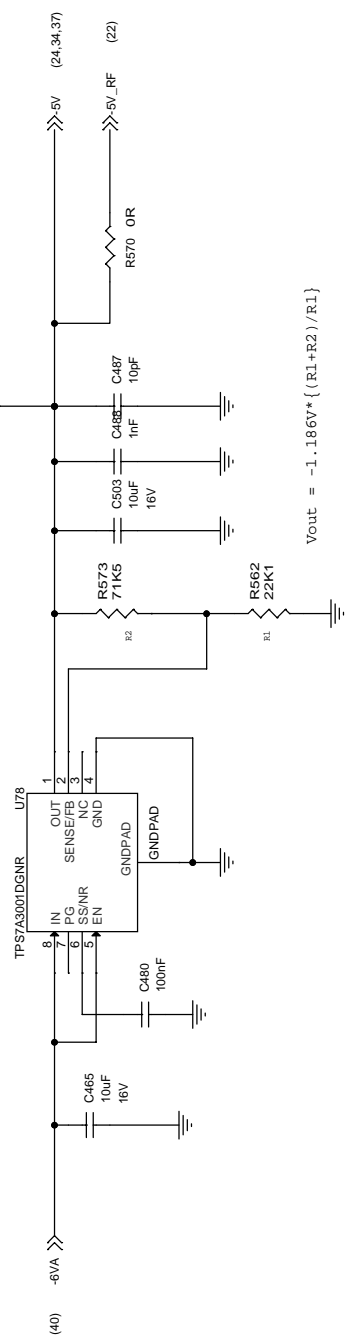
+5V RXIF REGULATOR



+5V TXIF REGULATOR

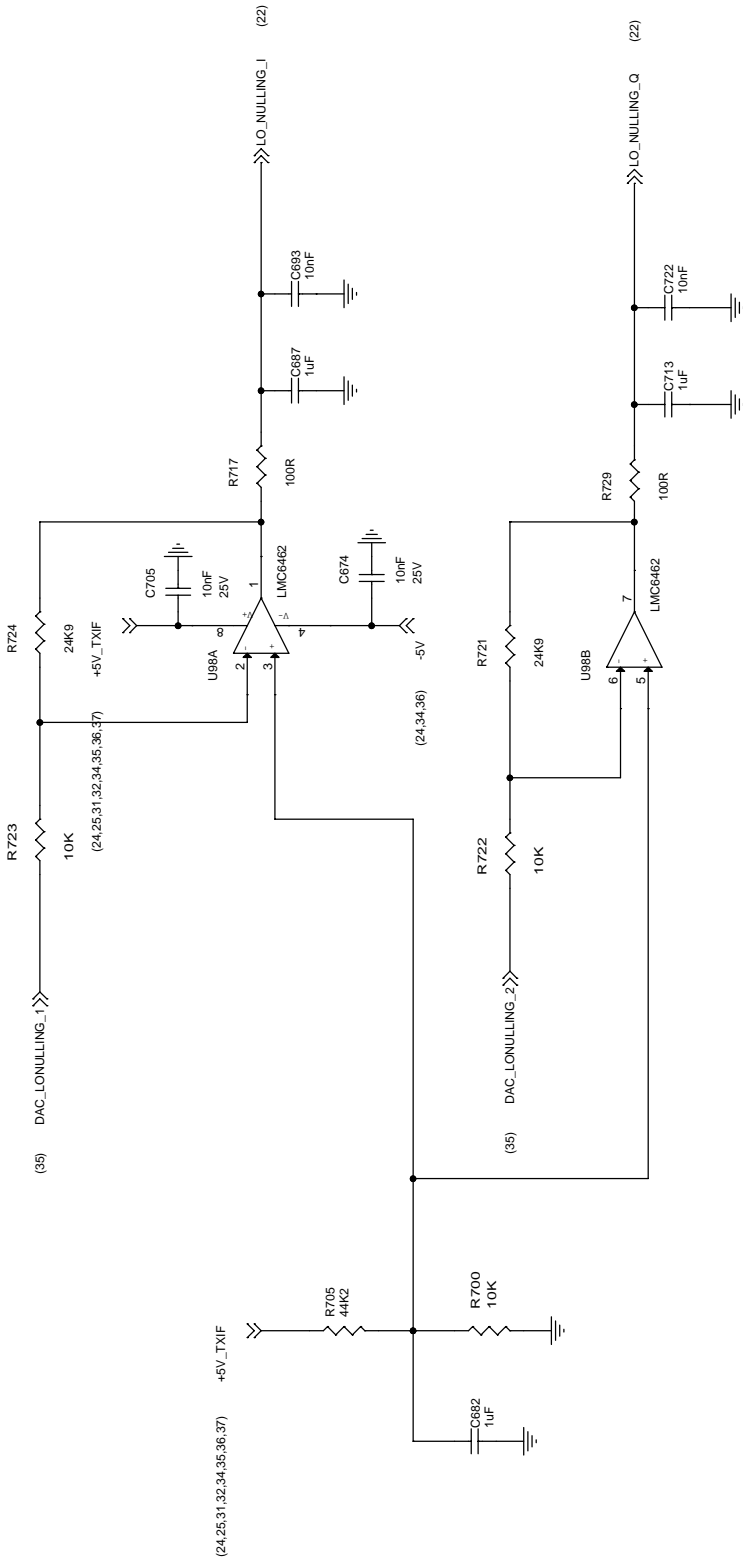


-5V REGULATOR

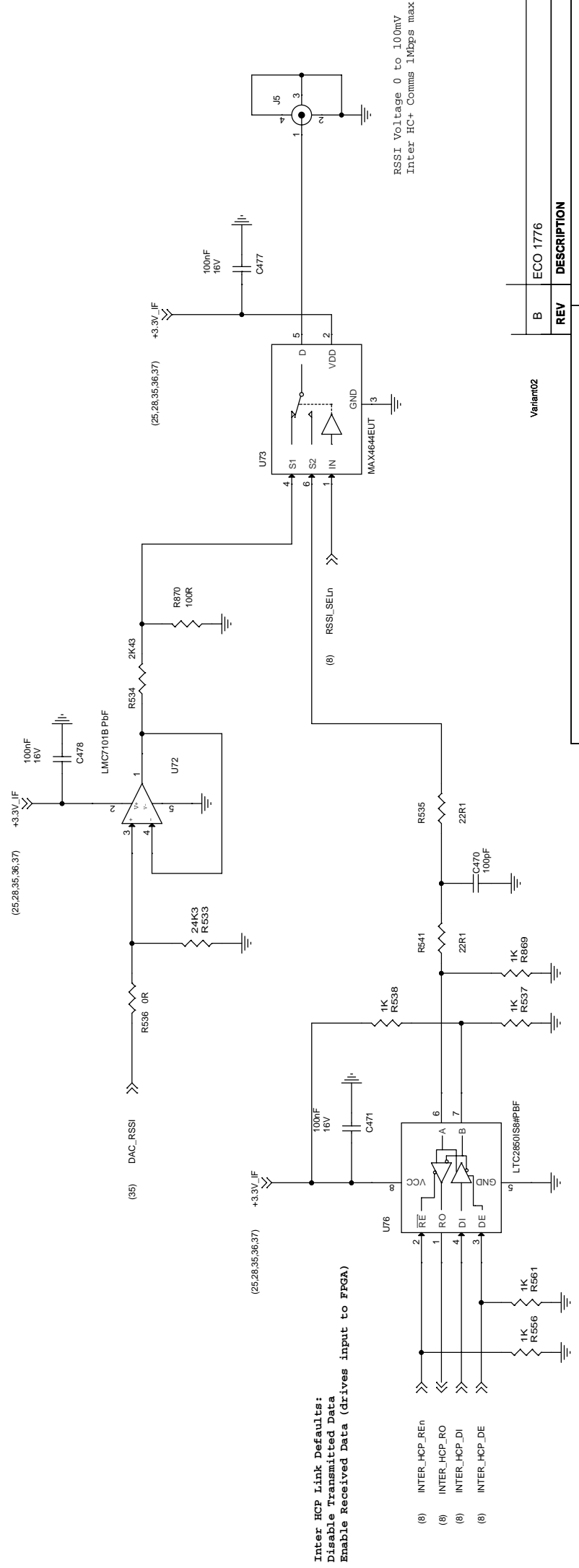


REV	DESCRIPTION	DATE
C	Variant02	
A	LDO REGULATORS +5V, -5V, +3.3V	
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LO Nulling Circuit



RSSI Interface AND Inter HC+ Comms Interface



Inter HCP Link Defaults:
 Disable Transmitted Data
 Enable Received Data (drives input to FPGA)

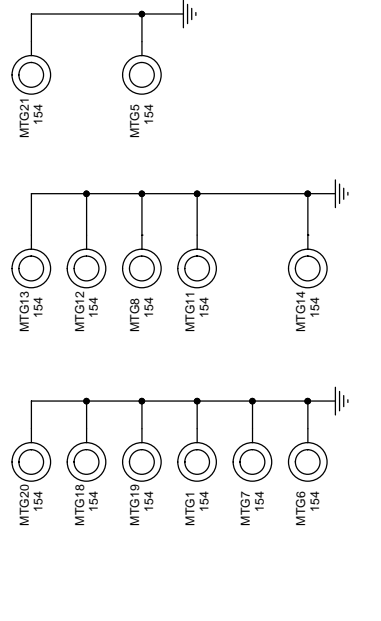
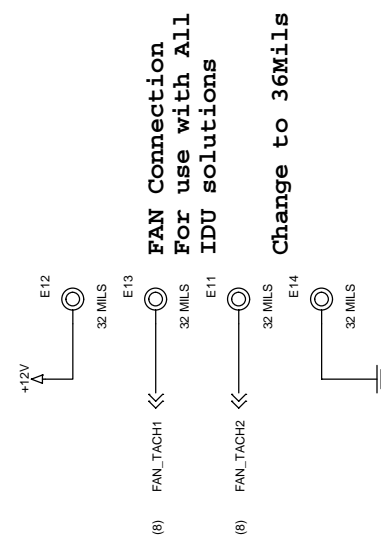
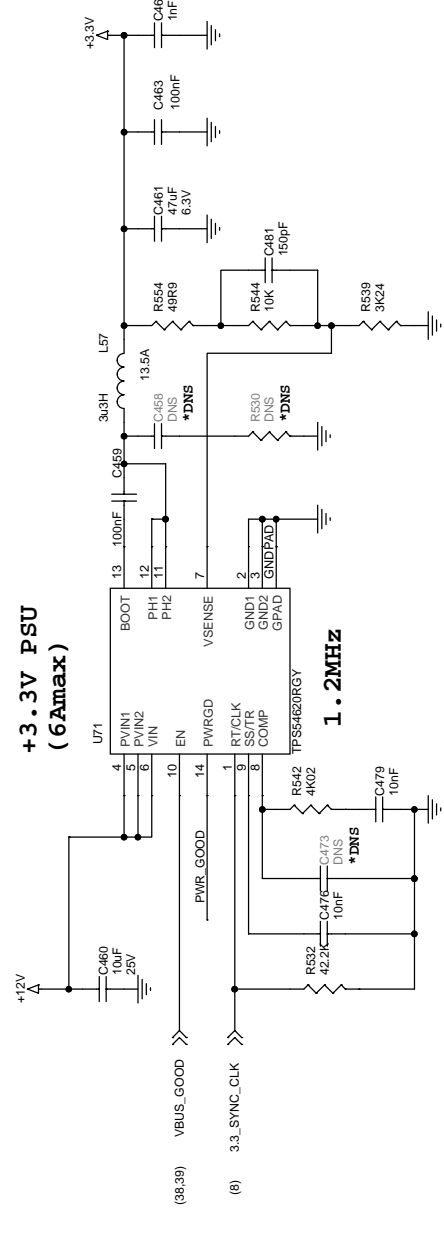
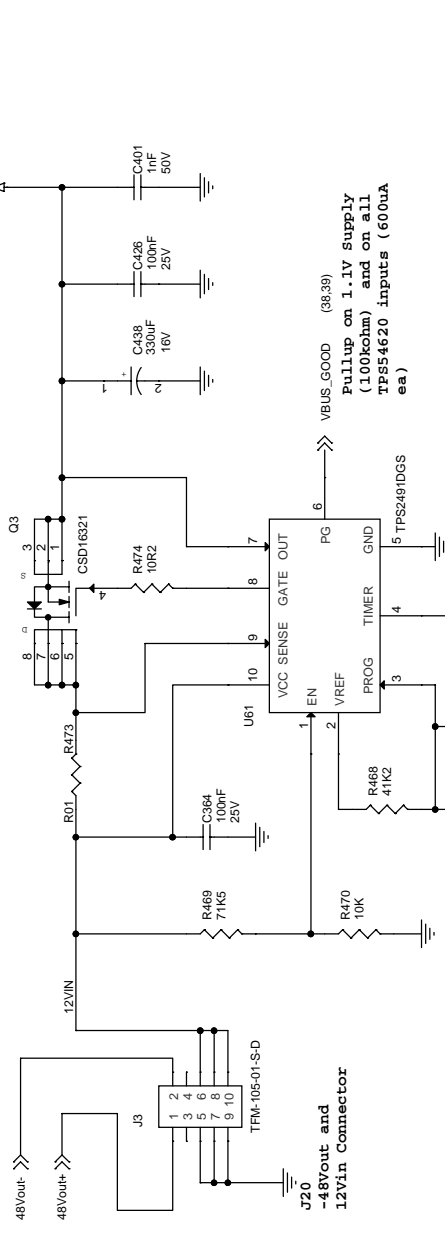
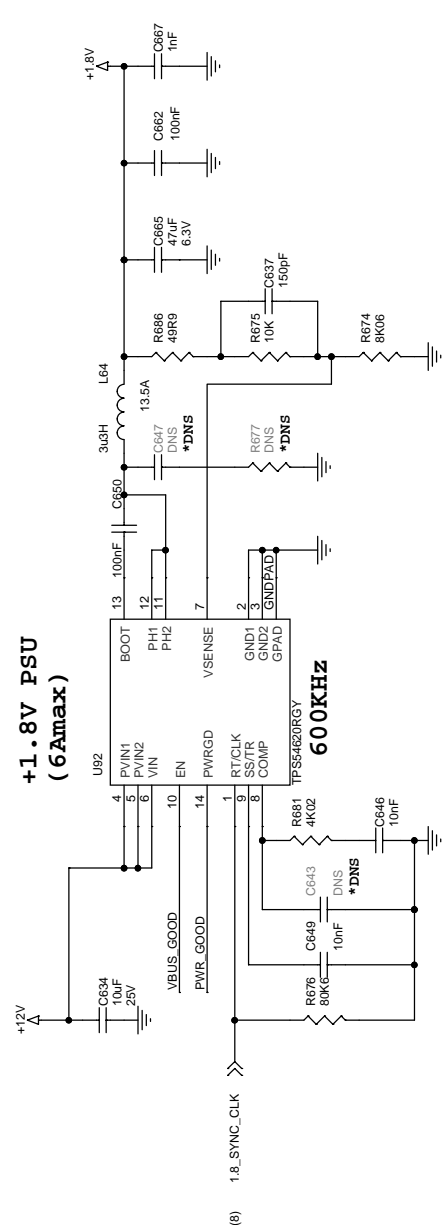
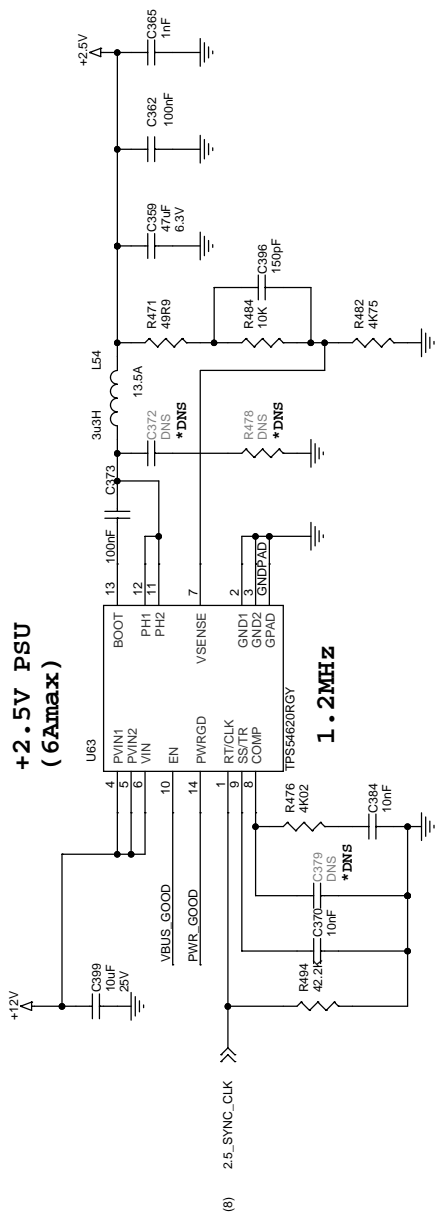
RSSI Voltage 0 to 100mV
 Inter HC+ Comms 1Mbps max

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

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 SCH-61-000273-02
 Wednesday, June 29, 2011

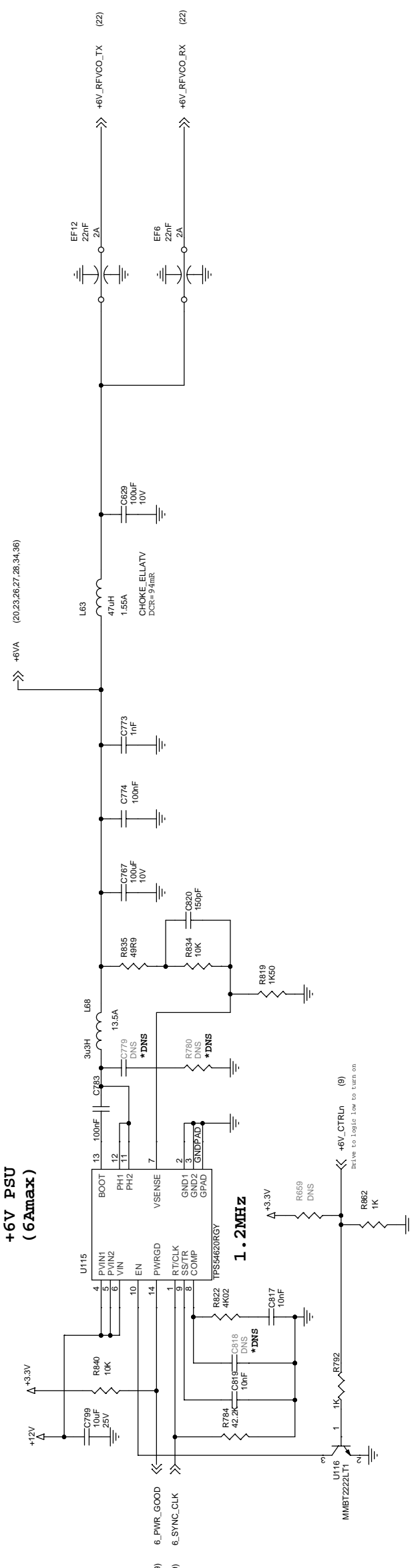
ECO 1776
 JUN 29/11



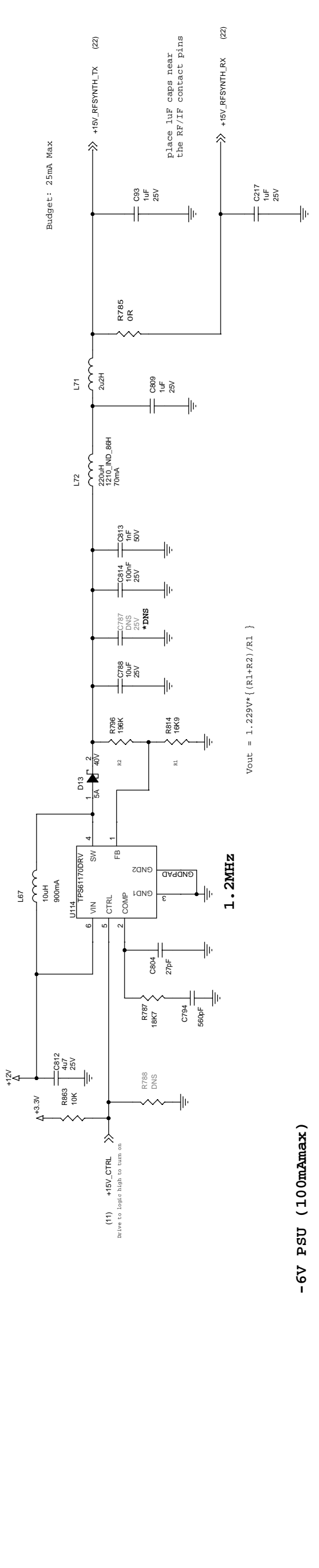
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DragonWave
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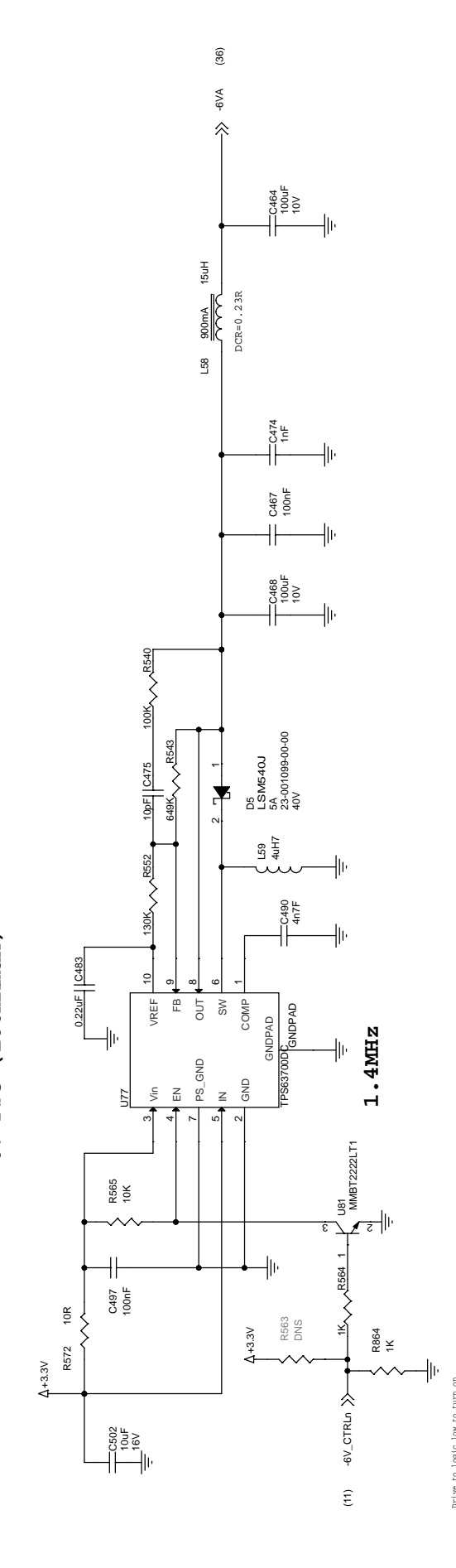
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+15V PSU (25mA max)



-6V PSU (100mAmax)



REV	DESCRIPTION	DATE
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C		
D		

Size	Rev	Part Number
C	B	SCH-61-000273-02

Variant02

Budget: 25mA Max

Place 1µF caps near the RF/IF contact pins

$V_{out} = 1.225V * \left(\frac{R1+R2}{R1} \right)$

ECO 1776

Power +6VA -6VA +15V

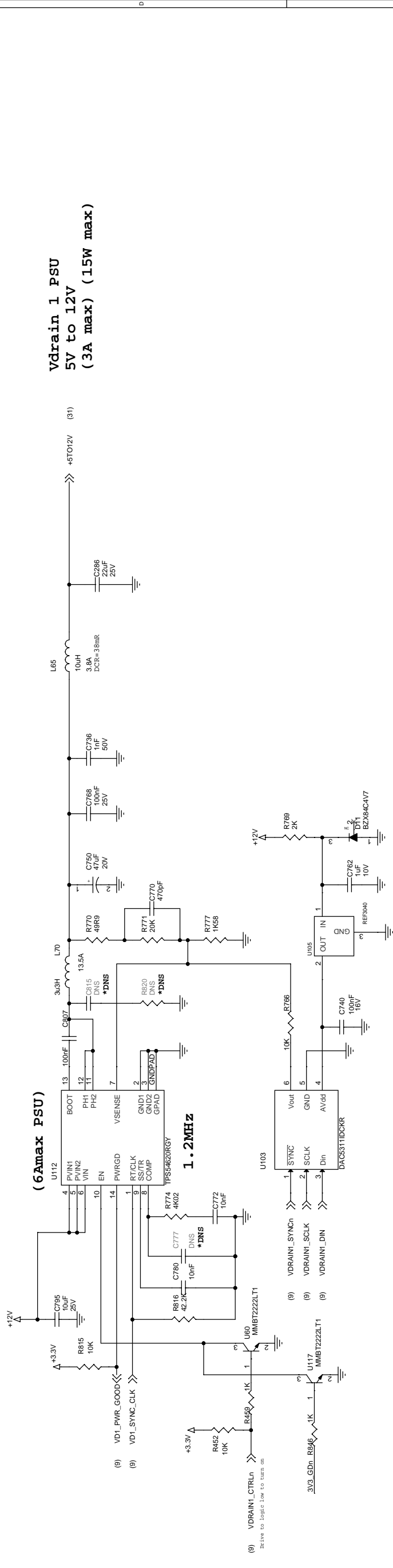
DragonWave

SCH-61-000273-02

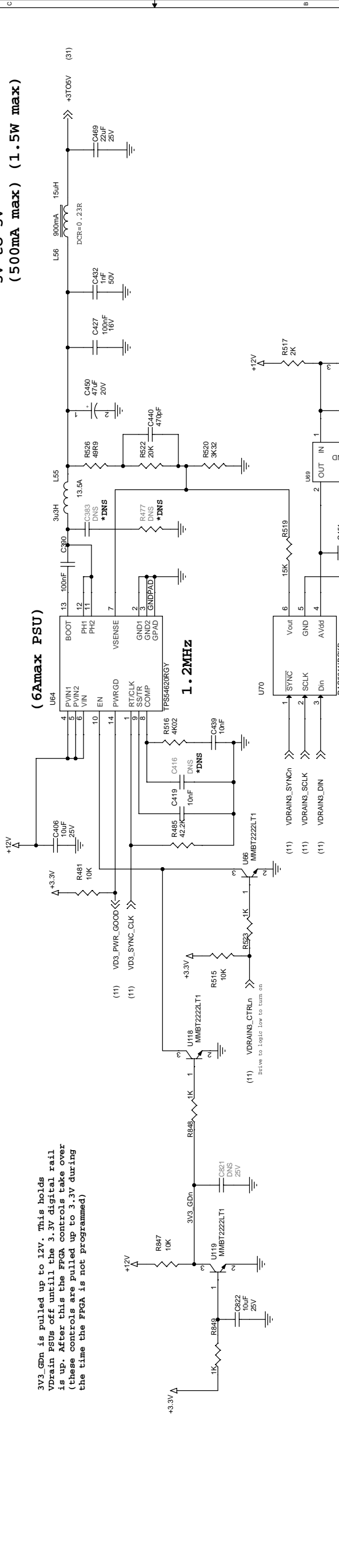
Wednesday, June 29, 2011

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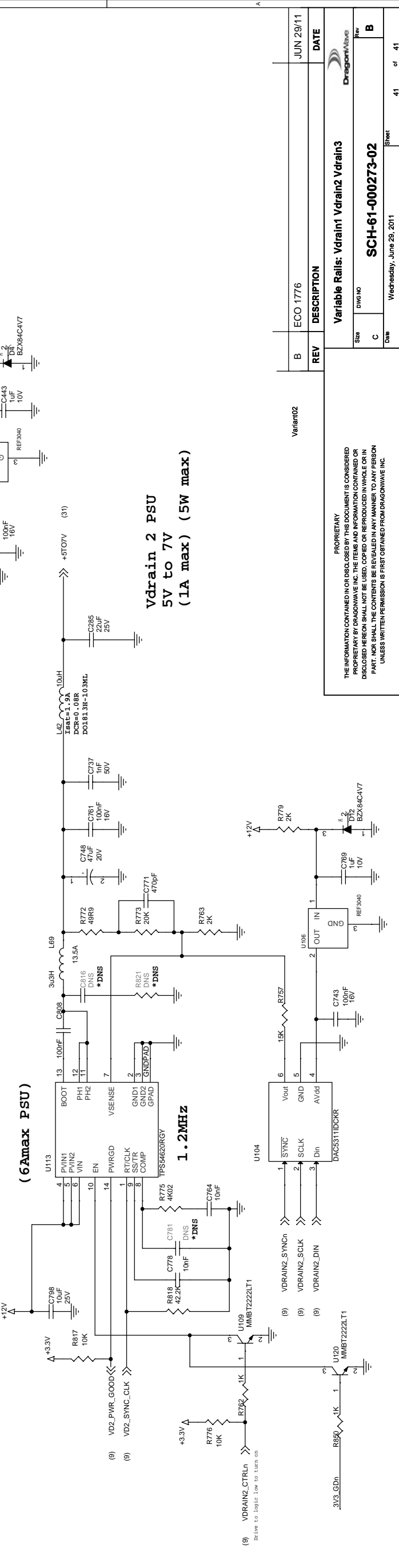
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Vdrain 1 PSU
 5V to 12V
 (3A max) (15W max)



Vdrain 2 PSU
 5V to 7V
 (1A max) (5W max)



Vdrain 3 PSU
 3V to 5V
 (500mA max) (1.5W max)

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

REV	DESCRIPTION	DATE
B	ECO 1776	JUN 29/11

Variable Rails: Vdrain1 Vdrain2 Vdrain3
 SCH-61-000273-02
 DragonWave
 Wednesday, June 29, 2011

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Horizon Compact+™

Wireless Ethernet
Release 1.1.0

Product Manual - Volume 1
Installation, Basic Configuration and Alignment
Version 2.0

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1.0 User Manual Structure

This user manual is divided into four volumes:

Volume 1 (this volume) – Contains an overview of the product, basic configuration, installation and the alignment procedures that are sufficient to set up a link and have it passing traffic. Also, a list of the advanced configuration features.

Volume 2 – includes step-by-step configuration details for the advanced configuration features that are listed in Volume 1

Volume 3 – contains a complete list of the frequency tables associated with the radio bands supported, and soon to be supported, by the Horizon Compact+

Volume 4 - contains configuration details relating to industry standard networking features.

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2.0 Introduction to Horizon Compact+

DragonWave's Horizon Compact+ is a next-generation, high capacity, native Ethernet, microwave system offering improved economics and simplified operations. Featuring zero-footprint, the radio and the modem are integrated into one, single, compact, out-door-unit. Increased capacity (800Mbps); simplified installation and operation; and improved troubleshooting mean lower lifecycle costs. This highly integrated, carrier grade solution for Ethernet backhaul uses licensed or unlicensed spectrum.

Build your own network, easily and cost effectively. Connect fixed and mobile services to your network fast. Extend the reach of your network for Ethernet services and add on the additional capacity as you need it. Or, bring new Ethernet services to your high-capacity customers easily and cost effectively while optimizing your investment in legacy technology and facilities.

High Capacity Native Ethernet Wireless Gigabit Ethernet

Designed as an Ethernet platform from the ground up, the DragonWave Horizon Compact+ meets the critical needs demanded by carrier class customers delivering a wireless GigE/100bT connection of up to 800 Mbps full duplex over licensed or unlicensed frequency allocations. With a native Ethernet design and ultra-low latency, the Horizon Compact+ is optimized for next generation services.

Fixed and Scalable Bandwidth Operations

The Horizon Compact+ is a flexible bandwidth radio platform designed specifically for customers with rapid scalability requirements. The DragonWave Horizon Compact+ scales from 10 to 400 Mbps via a simple software configuration. For higher bandwidth needs, two radios can be polarization multiplexed on a single antenna using a Dual Polarization Radio Mount (DPRM) to provide up to 800 Mbps of capacity in a single link.

Zero-Footprint Option

The Horizon Compact+ is a single, outdoor, compact, weatherproof unit requiring no indoor space and is available with optical and electrical GigE interface options.

Enhanced Network Management

Horizon Compact+ fully supports remote management via in-band or out-of-band management, using SNMP (v3, V2c or V1), CLI and Web GUI. Security is a critical feature with SSH, SSL, and Radius.

Improved Reach

Horizon Compact+ enables bandwidth extensions over extended distances by providing up to 112 dB system gain. Antennas sized up to six feet are also supported. This feature combination enables link lengths beyond 50 km/30 mi. In addition, DragonWave's dynamic modulation allows a link to be engineered to the highest availability, while maximizing throughput in good weather conditions.

Network Protection

Using DragonWave's Rapid Link Shutdown (RLS), Horizon Compact+ supports mesh and ring configurations with ~50 ms switching time, enabling 99.999% available carrier class services.

Product Features

6 -38 GHz Frequency Support	High power variants
800 Mbps full duplex capacity	100ms Adaptive Modulation
Transparent Gigabit Ethernet solution	100ms Ring/Mesh Switching
Integrated RF Loopback	"Zero-footprint", hardened outdoor unit

2.1 Applications

2.1.1 WiMax

DragonWave offers a high-capacity, carrier-grade, integrated solution for Ethernet backhaul using interference-free licensed spectrum. Horizon Compact+ enables rapid network expansion with remote scalability from 10 Mbps to 800 Mbps. With Horizon Compact+ the radio and modem are integrated into a single all-outdoor element attached directly to the antenna, allowing simple integration and eliminating any impact on the WiMAX base station footprint. Management integration into the base station EMS provides a single point of control for operations personal.

2.1.2 3G Cellular Backhaul / Ethernet Evolution

Meet the growing demand for increased capacity and data transport resulting from 3G cellular deployments. Horizon Compact+ provides Cost-effective, low capacity TDM services for base stations today. The DragonWave portfolio of products offers software controlled upgradeability to high-capacity native Ethernet and TDM services with ultra-low latency to enable 3G evolution with the minimum of network churn.

2.1.3 Leased Line Replacement

For many businesses, the only option for last mile access is the ILEC, provided on an aging copper infrastructure with long MTTR. Horizon Compact+ can replace leased services and eliminate recurring and expensive telecom Costs while at the same time improving service availability and enabling future growth and options for services with a scalable Ethernet network.

2.1.4 Last Mile Fibre Extension

The greatest demand for broadband services is within the core metro markets. Horizon Compact+ provides a superior complementary networking solution to rapidly extend high speed IP services from locations already attached to the service provider's network. The DragonWave portfolio of products is ideal for network hardening, disaster recovery and applications that require legacy TDM services and carrier-grade, high capacity native Ethernet systems.

2.2 Technical Specifications

Frequencies

6 GHz	FCC/IC/ETSI/ITU
7 GHz	ETSI/ITU/MX
8 GHz	ETSI/ITU
11 GHz	FCC/IC/ETSI/ITU
13 GHz	ETSI/AUS/NZ/ITU
15 GHz	IC/ETSI/AUS/NZ/MX/ITU
18 GHz	FCC/IC /ETSI/AUS/NZ/ITU
23 GHz	FCC/IC/ETSI/AUS/NZ/ITU/MX
24 GHz (UL)	FCC/IC/ETSI
24 GHz DEMS	FCC/IC
26 GHz	ETSI
28 GHz	FCC/ETSI
32 GHz	ETSI
38 GHz	FCC/ETSI/AUS/NZ/MX
60 GHz	ETSI/ITU/FCC

Mechanical

Radio/Modem (w/o antenna)	10.2 cm x 24.3 cm x 22.1 cm; 3.4kg (4 in x 9.6 in x 8.7 in; 7.5 lbs)
Antenna Wind Loading	112 kph (70 mph) Operational 200 kph (125 mph) Survival
Antenna Mount Adjustment	± 45° Az; ± 22° El

Payloads

Interface	1000/100/10 BaseT
Latency 100 BT	< 400µs, Typical < 200µs FastE
Latency GigE	< 200µs, Typical 120µs GigE
Frame Size	64 to 1600 Bytes, up to 9600 (GigE Mode)
Flow Control	Yes
802.1p	Yes – 8 levels served by 8 queues
802.1q	Yes
Modulation Shifting	Yes, hitless
Loopback	Yes, Microwave (Radio), Network

Power

Input	-40.5 VDC to -56 VDC, isolated
Optional Adapter	110/240 VAC
Consumption (GHz/Watts)	6/55, 7/80, 8/80, 13/47,15/47, 18/49, 23/48, 38/43, 60/37 (with 48V DC at PonE input & 30 M of CAT5 cable to HC Plus)

Connections

Power	-48V DC Nominal, PonE
Payload (+ Inband NMS)	Shielded RJ45 or optical LC
NMS (when out-of-band)	Shielded RJ45

Network Management (NMS)

Alarm Management	SNMP Traps, Enterprise MIB
NMS Compatibility	Any SNMP based network manager SNMP v1, v2 and v3
Security	3 Level Authentication
EMS	Web Based Management System, SSL HTTP,SSH, Radius, Telnet
Standard EOAM	802.1ag, 802.3ah, 802.1AB

Environmental

Operating Temperature	-40°C to + 50°C (-40°F to +122° F) With heat shield: -40°C to + 60°C (-40°F to +140° F)
Humidity	100 % Condensing
Altitude	4500 m (14,760 ft)
Water Tightness:	Nema4X, IP56 (directed hose test)
Operational Shock:	ETSI 300-019-1-4; 5g 11ms
Operational Vibration:	ETSI 300-019-1-4 Class 4m5, NEBS GR-63
Earthquake:	NEBS GR-63

Operating Mode	Modem Mode	Average Packet Throughput *(Mbps)	Max Tx Power (dBm)	Threshold (dBm) BER 10 ⁻⁶	Saturation (dBm) BER 10 ⁻⁶
HY56_71	QPSK PTCM2	71	23.7	-82.9	-13.1
HY56_166	16QAM PTCM2	166	21.1	-75.5	-16.8
HY56_214	32QAM PTCM2	214	21.4	-72.2	-18.5
HY56_261	64QAM PTCM2	261	20.0	-69.1	-20.0
HY56_308	128QAM PTCM2	308	19.4	-66.0	-21.6
HY56_356	256QAM PTCM2	356	19.5	-63.1	-23.0
HY56_380	256QAM 1	380	19.5	-60.6	-24.3

Table 2-1 Example of System Performance 18 GHz 55 MHz Channel ETSI/ITU Operating Modes

Note that system performance is a function of frequency and channel bandwidth.

*Average packet throughput is calculated using 64, 128, 256, 512, 1024, 1280, and 1518 bytes Ethernet frames.

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3.0 Physical Description

Horizon Compact+ is an integrated Ethernet modem and microwave radio transceiver, housed in a rugged weatherproof housing. It is provided with two weatherproof port connectors, Port 1 and Port 2. Port 1 can be configured as a single copper 1000 Base-t data port (GigE), or as two 10/100 Base-t (Fast Ethernet) data ports (p1 and p4). Port 1 may also be supplied with an optional optical interface. Port 2 can also be configured as a single copper 1000 Base-t data port (GigE), or as two 10/100 Base-t (Fast Ethernet) data ports (p2 and p3) (see Volume 2 of this manual for more details). All ports can be configured to carry either in-band or out-of-band management. A special Ethernet splitter is required to physically access the Fast Ethernet interfaces.

A BNC style connector, with protective cap, is provided for measuring field strength during the antenna alignment process. The output voltage is linear, giving 1 mV per dB values e.g. -30 mV = -30 dB. The BNC connector is also used for providing a radio muting signal in system redundancy applications.

A sun shield is available to increase the high temperature tolerance of the unit..

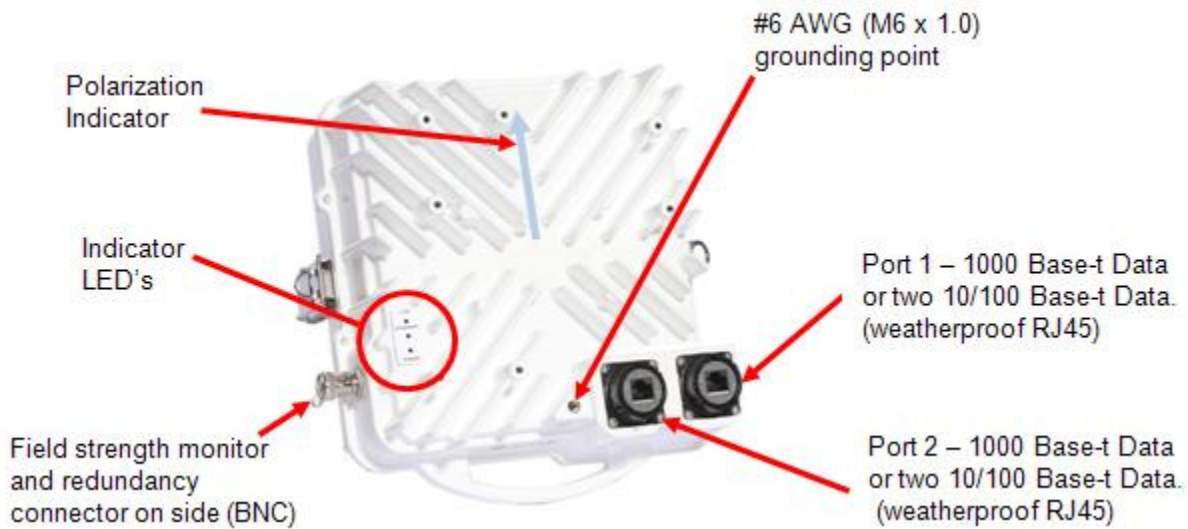


Figure 3-1 Horizon Compact+ - Copper Interface Variant

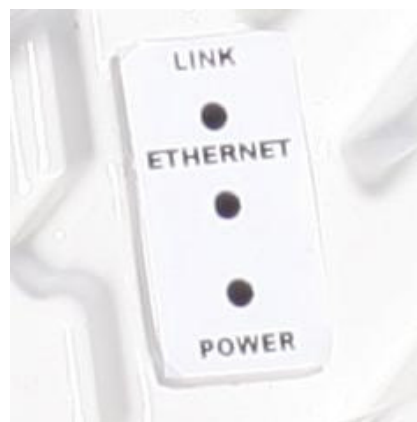


Figure 3-2 Horizon Compact+ LED indicators

**Table 3-1
 Horizon Plus LED Operation**

LED Status	Description						
Power LED							
OFF	No Power Applied						
Steady RED	Power applied, Not fully powered up, or internal power rail failure						
Steady GREEN	Power applied, all rails OK						
Link LED							
OFF	System Boot Up						
Steady RED	RF Transmitter and Modem Not Ready						
Slow RED Blink ²	RF Transmitter off, Modem LOS						
Steady Green	RF Transmitter ON, Modem OK						
Slow Alternate RED/GREEN ⁴	RF Transmitter ON, Modem LOS						
Ethernet LED	Copper			Fibre			
	P1/P4	P2	P3	P1 Tx	P1	P2	P3
OFF	Down	Down	Down	Off	Down	Down	Down
Steady RED	X	X	X	On	Down	Down	Down
Slow RED Blink ²	Down	Up	Down	On	Down	Up	Down
Fast RED Blink ¹	Down	Down	Up	On	Down	Down	Up
Steady GREEN	Up	Down	Down	On	Up	Down	Down
Fast GREEN Blink ¹	Up	Up	Down	On	Up	Any one is up	
Slow GREEN Blink ²	Up	Down	Up	Off	Down	Any one is up	
Slow Alternate RED/GREEN ⁴	Down	Up	Up	On	Down	Up	Up
Fast Alternate RED/GREEN ³	Up	Up	Up	Up	Up	Up	Up

X : Not applicable.

- 1) Blink Fast: ON for 0.5sec, OFF for 0.5sec.
- 2) Blink Slow: ON for 2sec, OFF for 2sec
- 3) Alternate Fast: RED ON for 0.5sec, OFF for 0.5sec, GREEN ON for 0.5sec, OFF for 0.5sec.
- 4) Alternate Slow: RED ON for 2sec, OFF for 2sec, GREEN ON for 2sec, OFF for 2sec.

3.1 Ethernet and Power Cabling



DO NOT coil excess Ethernet cable, but fold in a zig-zag fashion whilst observing a minimum bend radius of 2 inches. The effect of lightning induced current surges in the tower or conductors adjacent to the Ethernet cable will be minimized when the Ethernet cable is folded in this way.

Note: For more information on installation and cabling, refer to DragonWave Technical Note: HC-TN-001.4 Horizon Compact+ PoE.

Two options of copper interface cabling are supported along with an optical interface.

3.1.1 Copper Interface

Two, weatherproof, RJ45 Ethernet connectors (P1 and P2) provide data and management connections to the unit over CAT5E cabling. Power is provided to the unit via Port 1 (P1) using a DWI proprietary power feed over the Ethernet data cable - PoE (see Section 4.0). Ethernet cables **must** be wired for a straight through connection.

The two ports, P1 and P2 are GigE ports, but can each be configured as two Fast Ethernet ports (10/100 Base-t). A special Ethernet splitter is required to access the two physical Fast Ethernet ports when any one of the two GigE ports has been configured for Fast Ethernet. The splitter is connected on the network side of the PoE unit.



Ethernet Splitter

3.1.2 Optical Interface

A weatherproof, MIL specification, multi-pin, connector is provided for Port 2, which includes the power feed. Port 1 has a weatherproof optical fibre connector. Single mode and multimode fibre options are available. As with the copper variant, Port 1 supports data traffic and optional management traffic and Port 2 is for power input plus data traffic and optional management, or single wire 1+1 redundancy applications (redundancy is not supported in this release).

A composite power and Ethernet cable assembly is available, which is compatible with the Horizon Port 2 connector, which feeds power, data and optional management to the Horizon+.

Where distances prevent the use of the composite cable due to power feed loss, a special “Y” feed adaptor cable is available that allows customer provided, heavier duty, wires to be spliced into the power feed connection. The power feed wires (see Table 3-2 for recommended gauge) are spliced into the adaptor cable using weatherproof tap connectors. The power feed and Port 2 Ethernet cables (maximum length 100 m) are fed through a DragonWave Lightning Arrestor unit designed to protect power and network circuits from transients.

Table 3-2 Port 2 Power Cable Wire Gauge

These values are true for all radio variants and based on a minimum voltage of 35 V DC at the Horizon+.

Distance from Power Supply to Horizon+ Unit	50 m	100 m	200 m	300 m
Minimum wire gauge required (AWG)	20	16	14	12

Note that the power wires in the composite cable are comprised of two pairs of 20 AWG wire, which supports the maximum length (100 m) when out-of-band management is employed using the combined CAT5 cable.

3.2 Lightning Protection

Note: For effective protection against lightning-induced surges, proper grounding and shielding practices MUST be followed for the ENTIRE installation. Consult DragonWave Inc. Technical Note: HC-TN-001.4 Horizon Compact+ PonE and Quick Reference Guide before installation!

The Horizon Compact+ is protected from cable transients and power surges caused by lightning, or other sources, by means of internal lightning arrestor components and external housing grounding points (See Section 8.0).

For the Horizon Compact+, copper interface variant, protection of the connected network and power supply is provided by a proprietary DragonWave PonE power injector/Lightning Arrestor unit, into which the Ethernet cables and power feed are connected. There are two variants of the copper power injector/Lightning Arrestor unit.

- Copper interface, outdoor use (see Figure 3-3)
 - may be mounted on the outside wall of the network equipment building
- Copper interface, indoor use, wall or rack mountable (see Figure 3-4)
 - must be mounted inside the network equipment building



Figure 3-3 Outdoor Power injector/Lightning Arrestor



Figure 3-4 Indoor Power injector/Lightning Arrestor

For the Horizon Compact+, optical interface variant, or where PonE is not used to power the Horizon, protection of the power feed and the Ethernet connections is provided by a Lightning Arrestor unit of similar physical design to those described above. For correct installation procedures see Section 4.0.

3.3 Dual Polarization Radio Mount (DPRM)

The DPRM system allows two Horizon Compact+ units to be assembled to a single antenna. The antenna used is no different to that used for a single unit. One Horizon Compact+ unit is mounted for horizontal polarization and the other for vertical polarization. Both units can transmit and receive simultaneously. This allows a link to carry up to 800 Mbps of Ethernet traffic. Although both units can operate on the same frequency channels, with 30 dB isolation, it is recommended that different frequency channels be used for each unit.



Figure 3-5 Dual Polarization Radio Mount

3.4 Power Split Radio Mount (PSRM)

For redundancy purposes, the PSRM allows two Horizon Compact+ units to be mounted to a single antenna. Both units must be oriented for the same polarization and only one unit can transmit/receive at any one time. The PSRM looks similar to the DPRM shown in Figure 3-5, but has internal components that only allow one unit to transmit/receive at a time.

Note that redundant systems do not have to use the PSRM. Each may be separately mounted to their own antennas if desired.

The benefits of the PSRM are that only one antenna is required, reducing tower real estate requirements, reducing weight and minimizing wind loading.

Disadvantages include a 4 dB loss in signal when operating on the primary systems at each end of the link and an 8.5 dB loss in signal when a secondary radio is activated (one end running on Primary and other end operating on secondary).

Note that redundancy is not supported in this release.

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4.0 Installation Requirements

Note: For more information on installation and cabling, refer to DragonWave Technical Note: HC-TN-001.4 Horizon Compact+ PonE.

Various installation kits are available. Use the following key to build the desired kit part number:

CODE	DESCRIPTION
INK	Installation Kit
R1	Horizon Compact+ Release 1
CONNECTOR OPTIONS	
HCN	No Connectors or Cables
HCC	Copper Connectors, Out-of-Band Mgmt
HCI	Copper Connectors, In-band Mgmt
HCM	Military connector, Copper cables
HCF	Optical Fibre Interface
POWER OPTIONS	
AC	Alternating Current
DC	Direct Current ***
AD	½AC ½DC
LOCATION OPTIONS	
NA	North America
EU	Europe
GL	Global

*** Use ECO #1407 green jumper wire to connect 48V RTN to PonE ground internally when site has grounded 48 VDC return (positive)

Table 4-1 lists all the current ordering configurations, for various parts of the world.

Table 4-1 Parts Required

Kit Description	Part Number
Horizon Compact+, No connectors AC Install Kit (N. America)	A-INK-HCN-AC-NA-R1
Horizon Compact+, No Connectors AC Install Kit (Europe)	A-INK-HCN-AC-EU-R1
Horizon Compact+, No Connectors Half AC, Half DC Install Kit (N. America)	A-INK-HCN-AD-NA-R1
Horizon Compact+, No Connectors Half AC, Half DC Install Kit (Europe)	A-INK-HCN-AD-EU-R1
Horizon Compact+, No Connectors DC Install Kit (Global)	A-INK-HCN-DC-GL-R1
Horizon Compact+, Copper Connectors AC Install Kit (N. America) - Includes 4 Glands and 8 Connectors	A-INK-HCC-AC-NA-R1
Horizon Compact+, Copper Connectors AC Install Kit (Europe) - Includes 4 Glands and 8 Connectors	A-INK-HCC-AC-EU-R1
Horizon Compact+, Copper Connectors Half AC, Half DC Install Kit (N. America) - Includes 4 Glands and 8 Connectors	A-INK-HCC-AD-NA-R1
Horizon Compact+, Copper Connectors Half AC, Half DC Install Kit (Europe) - Includes 4 Glands and 8 Connectors	A-INK-HCC-AD-EU-R1
Horizon Compact+, Copper Connectors DC Install Kit (Global) - Includes 4 Glands and 8 Connectors	A-INK-HCC-DC-GL-R1
HC, Indoor PonE, Copper Connectors AC Install Kit (N. America) - Includes 4 Glands and 8 Connectors	A-INK-HIC-AC-NA-R1
HC, Indoor PonE, Copper Connectors AC Install Kit (Europe) - Includes 4 Glands and 8 Connectors	A-INK-HIC-AC-EU-R1
HC, Indoor PonE, Copper Connectors DC Install Kit (Global) - Includes 4 Glands and 8 Connectors	A-INK-HIC-DC-GL-R1

Horizon Compact+, Inband MGMT Copper Connectors AC Install Kit (N. America) - Includes 2 Glands and 4 Connectors	A-INK-HCI-AC-NA-R1
Horizon Compact+, Inband MGMT Copper Connectors AC Install Kit (Europe) - Includes 2 Glands and 4 Connectors	A-INK-HCI-AC-EU-R1
Horizon Compact+, Inband MGMT Copper Connectors Half AC, Half DC Install Kit (N. America) - Includes 2 Glands and 4 Connectors	A-INK-HCI-AD-NA-R1
Horizon Compact+, Inband MGMT Copper Connectors Half AC, Half DC Install Kit (Europe) - Includes 2 Glands and 4 Connectors	A-INK-HCI-AD-EU-R1
Horizon Compact+, Inband MGMT, Copper Connectors DC Install Kit (Global) - Includes 2 Glands and 4 Connectors	A-INK-HCI-DC-GL-R1
HC, Indoor PonE, Inband MGMT Copper Connectors AC Install Kit (N. America) - Includes 2 Glands and 4 Connectors	A-INK-HII-AC-NA-R1
HC, Indoor PonE, Inband MGMT Copper Connectors AC Install Kit (Europe) - Includes 2 Glands and 4 Connectors	A-INK-HII-AC-EU-R1
HC, Indoor PonE, Inband MGMT, Copper Connectors DC Install Kit (Global) - Includes 2 Glands and 4 Connectors	A-INK-HII-DC-GL-R1
Horizon Compact+, Mil Connectors AC Install Kit (N. America)	A-INK-HCM-AC-NA-R1
Horizon Compact+, Mil Connectors AC Install Kit (Europe)	A-INK-HCM-AC-EU-R1
Horizon Compact+, Mil Connectors Half AC, Half DC Install Kit (N. America)	A-INK-HCM-AD-NA-R1
Horizon Compact+, Mil Connectors Half AC, Half DC Install Kit (Europe)	A-INK-HCM-AD-EU-R1
Horizon Compact+, Mil Connectors DC Install Kit (Global)	A-INK-HCM-DC-GL-R1
HC, Indoor PonE, Mil Connectors AC Install Kit (N. America)	A-INK-HIM-AC-NA-R1
HC, Indoor PonE, Mil Connectors AC Install Kit (Europe)	A-INK-HIM-AC-EU-R1
HC, Indoor PonE, Mil Connectors DC Install Kit (Global)	A-INK-HIM-DC-GL-R1
Horizon Compact+, Fiber AC Install Kit (N. America)	A-INK-HCF-AC-NA-R1
Horizon Compact+, Fiber AC Install Kit (Europe)	A-INK-HCF-AC-EU-R1
Horizon Compact+, Fiber Half AC, Half DC Install Kit (N. America)	A-INK-HCF-AD-NA-R1
Horizon Compact+, Fiber Half AC, Half DC Install Kit (Europe)	A-INK-HCF-AD-EU-R1
Horizon Compact+, Fiber DC Install Kit (Global)	A-INK-HCF-DC-GL-R1
HC, Indoor PonE, Fiber AC Install Kit (N. America)	A-INK-HIF-AC-NA-R1
HC, Indoor PonE, Fiber AC Install Kit (Europe)	A-INK-HIF-AC-EU-R1
HC, Indoor PonE, Fiber DC Install Kit (Global)	A-INK-HIF-DC-GL-R1
INST KIT,HALF LINK,HORIZON,CAT5E CONN,AC,N.A.,R1	AH-INK-HCC-AC-NA-R1
INST KIT,HALF LINK,HORIZON,CAT5E CONN,DC,GLOBAL,R1	AH-INK-HCC-DC-GL-R1
INST KIT,HALF LINK,HORIZON,FIBER,AC,N.A.,R1	AH-INK-HCF-AC-NA-R1
INST KIT,HALF LINK,HORIZON,FIBER,DC,GLOBAL,R1	AH-INK-HCF-DC-GL-R1
PonE ASSY, RJ45	A-OPT-PONE-HC-01
SURGE PROTECTOR, HORIZON COMPACT+, BUNDLED CABLE/FIBER	A-OPT-BSRG-HC-01

4.1 Lightning Arrestor Units

The importance of protecting network and power systems from damaging voltage transients, induced by lightning and other sources, cannot be over emphasized.

DragonWave supplies four types of Lightning Arrestor Units.

- Outdoor rated Lightning Arrestor with integrated power on Ethernet (PonE)
- Indoor rated Lightning Arrestor with integrated power on Ethernet (PonE)
- Outdoor rated Lightning Arrestor only
- Indoor rated Lightning Arrestor only

All four provide protection for up to two Ethernet network cables plus redundant power feeds.

4.1.1 Outdoor Lightning Arrestor Units

The Outdoor units are housed in a weatherproof plastic enclosure employing gland nut seals for cable entry. Access to network and power terminals is via a gasket sealed lid, which is secured by four retaining screws. Figure 4-1 shows the Lightning Arrestor unit with integrated PonE, with lid removed.



Figure 4-1 Outdoor Lightning Arrestor Unit with Integrated PonE Supply Feed

4.1.2 Indoor Lightning Arrestor Units

The Indoor units are housed in a metal enclosure with an integral grounding lug and with direct access to network and power connection terminations.



Figure 4-2 Indoor Lightning Arrestor Unit with Integrated PonE Supply Feed

Mounting systems for the indoor units include a 19" rack mounting adapter, which accommodates up to two units within a 1U rack space, and wall mount brackets, allowing a single unit to be wall, or shelf, mounted as required (screw slots will accommodate 6mm (1/4") diameter screws on 7.2" centres, horizontally).

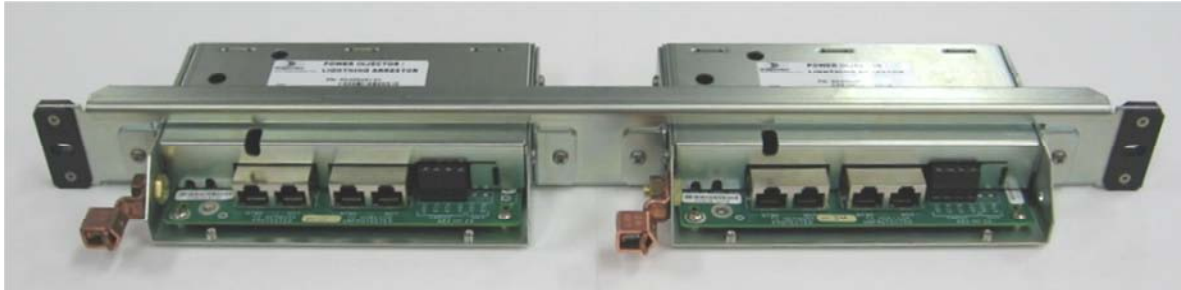


Figure 4-3 Two Indoor Units in Rack Mount Adapter

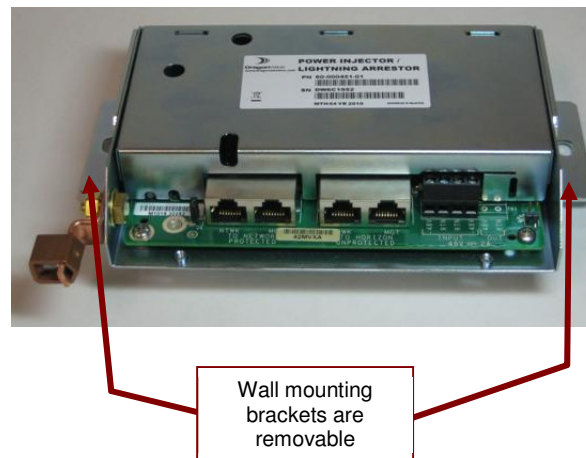


Figure 4-4 Indoor Unit with Wall Mount Brackets



Rack/cabinet in which Indoor units are installed must only be used for the purposes of housing lightning suppression equipment.

Rack/cabinet must be equipped, grounded and bonded for lightning suppression purposes.

Rack/cabinet must meet all local electrical and safety codes

Rack/cabinet must be certified by a qualified safety/lightning engineer.

DO NOT connect the grounding lug to AC power supply wiring ground!

DO NOT mix AC power supply option with site-supplied 48 VDC!

DO NOT connect the network to the RJ45 connectors marked "TO HORIZON UNPROTECTED". Damage to switches or routers may result



DO NOT mount the PonE unit to the tower!
The Outdoor rated PonE Injector/Lightning Arrestor **MUST** be mounted as close as possible to, and above, the building entry point (BEP) and its external grounding lug must be connected to the nearest lightning (LPS) ground with #6 AWG (minimum) grounding wire, avoiding loops and sharp bends.
DO NOT connect the grounding lug to AC power supply wiring ground!
DO NOT mix AC power supply option with site-supplied 48 VDC!
DO NOT connect the network to the RJ45 connectors marked "TO HORIZON UNPROTECTED". Damage to switches or routers may result

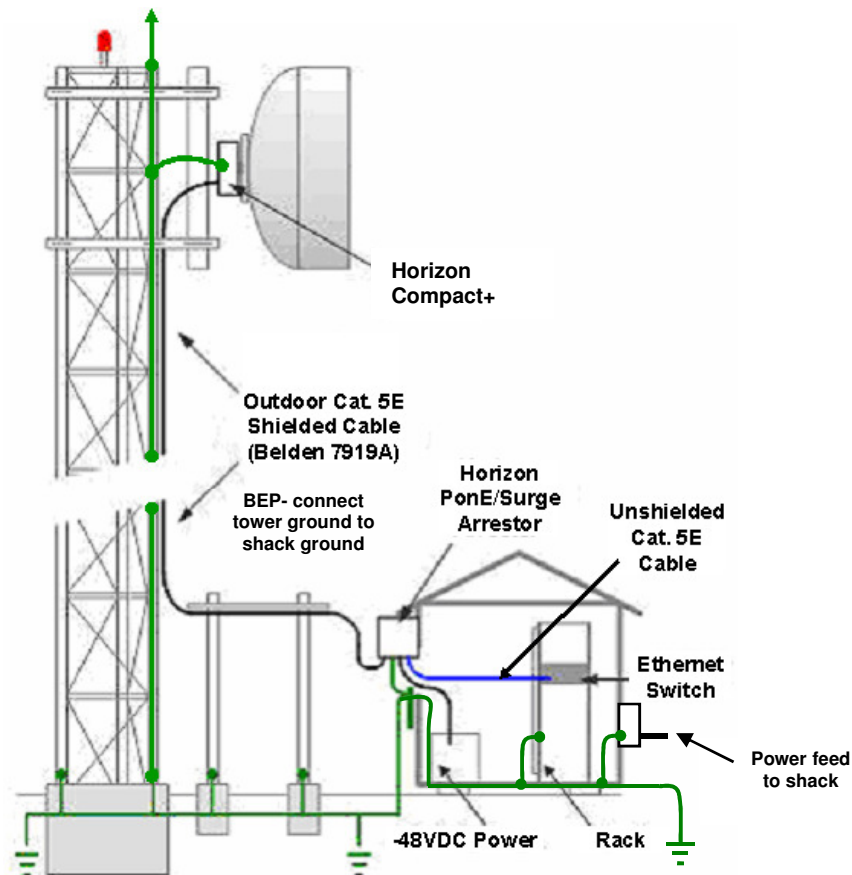


Figure 4-5 Horizon Compact+ Installation

4.2 Grounded Power Feeds

Where the **return** side of a site-supplied power feed is **grounded**, provision is made on all versions of the lightning arrestor units to link the return feed to the integral grounding lug on the unit. A shorting link is stored on J4. When grounding is required, this is transferred to J5 (see Figure 4-6).

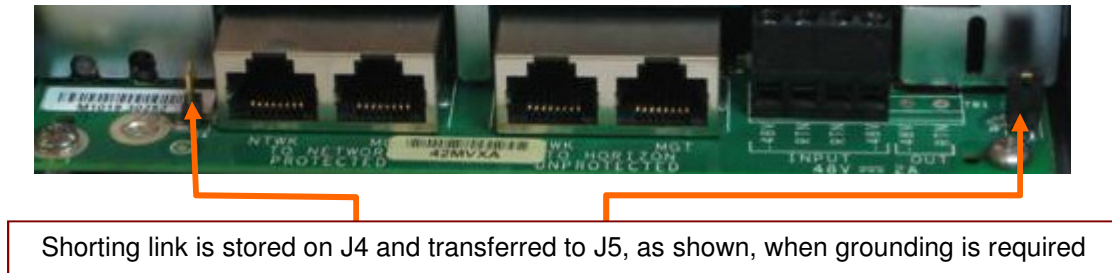


Figure 4-6 Grounded Power Return Link

On earlier models of both the indoor and outdoor lightning arrestors, the shorting link feature is not present. To ground the return side of the power supply for the earlier models, connect a shorting wire between the “RTN” connection on the power connection block and the grounding point on the PCB as shown in Figure 4-7.



Figure 4-7 Grounded Power Return Shorting Wire

4.3 Ethernet Cabling – Copper Interface



DO NOT coil excess Ethernet cable, but fold in a zig-zag fashion whilst observing a minimum bend radius of 2 inches. The effect of lightning induced current surges in the tower or conductors adjacent to the Ethernet cable will be minimized when the Ethernet cable is folded in this way.

For the copper interface, data cabling from the Horizon Compact+ unit to the PonE Power Injector/Lightning Arrestor consists of outdoor rated, shielded, CAT5E cables equivalent to Belden 7919A. The shielded cables require shielded RJ45 connectors. Use of standard indoor unshielded RJ45 connectors may result in a lack of lightning protection, poorly constructed cables, intermittent connections and data loss. Depending on the system configuration ordered and fielded, up to four shielded RJ45 and two unshielded RJ45 connectors are provided.

The cables terminate in a DWI Power on Ethernet (PonE) Power Injector/Lightning Arrestor unit located either outside of the building cable entry point (using the outdoor PonE unit) or inside the network equipment building (using the indoor PonE unit).

DO NOT CONNECT SHIELDED RJ45 CONNECTORS TO ETHERNET CABLES CONNECTING THE LIGHTNING ARRESTOR TO THE NETWORK SWITCH.

Note: Straight through Ethernet cables must be used between the PonE power injector and the Horizon Compact+. The use of a cross-over type, or incorrectly wired CAT5E cables, will cause the PonE power injector to go into an alarm condition and not power up the Horizon Compact+. A Status LED indicates the status of the PonE power injector (see Section 5.1.4)

The PonE unit contains Lightning Arrestors and must be grounded according to local or regional Electrical Codes. Unshielded Ethernet cables are connected between the PonE unit and the Ethernet switch or router. Power for the PonE unit is supplied by 2-wire 16 AWG electrical wiring, carrying 48 V DC (-48 V or +48 V) with a maximum current draw of 2 amperes.

If Port 2 is not being used, ensure that a protective weatherproof cap is fitted to the port receptacle.

4.3.1 Using Outdoor PonE Unit

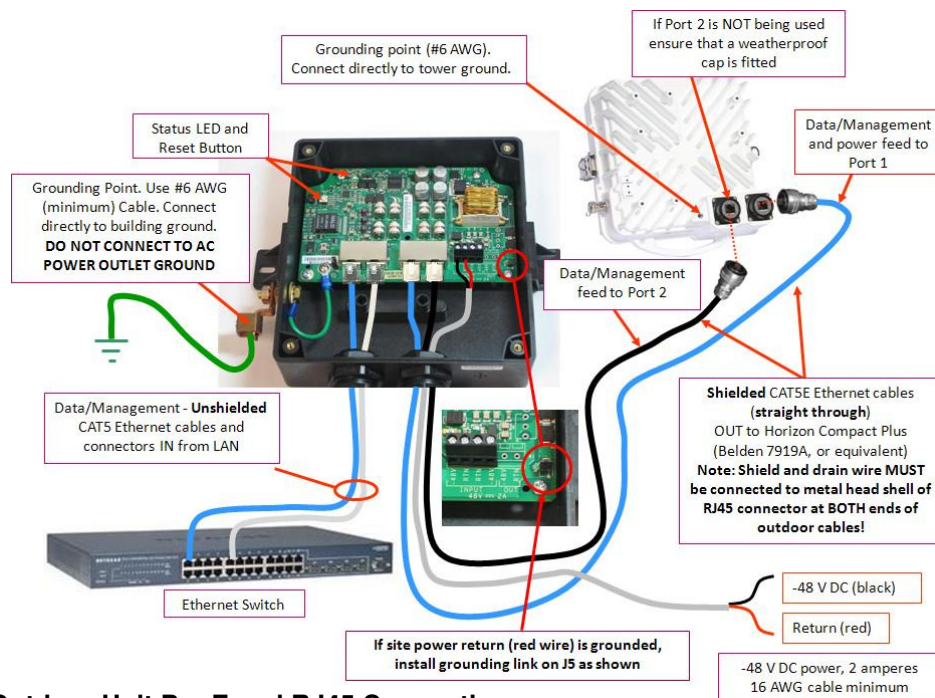


Figure 4-8 Outdoor Unit PonE and RJ45 Connections

4.3.2 Outdoor PonE Unit Weatherproof Grommet Seals

The cable entry points into the outdoor PonE unit are protected from moisture ingress by special rubber grommet seals. Each grommet has three holes to accommodate up to three cables (two CAT5 and one power). Rubber plugs are provided for holes that are not being used. Two holes, for CAT5, have a split side to allow pre-terminated cables to be easily inserted. The third hole, which is smaller, is not split but allows un-terminated power cables to be pushed through. A gland nut is used to secure the cables and create the seal. Ensure that the rubber plugs are in place for all holes not occupied by cables and that the grommet sits squarely in its receptacle before tightening the gland nut to secure the seal.

Note that any pre-terminated cables will need to have the connectors staggered, as shown, lower left, in Figure 4-9, in order for them to pass through the hole in the PonE unit housing

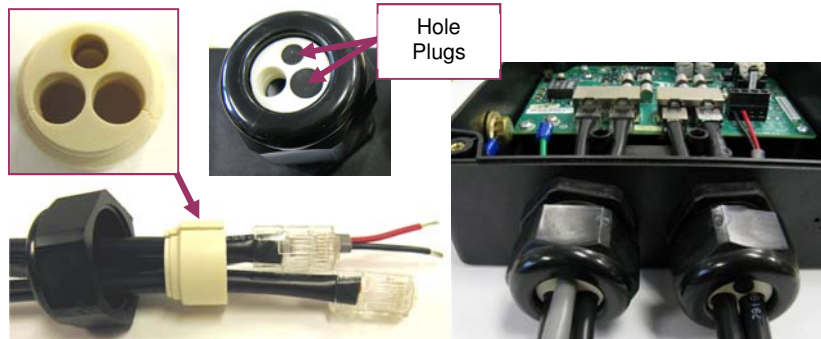


Figure 4-9 Weatherproof Grommet Seals

4.3.3 Using Indoor PonE Unit

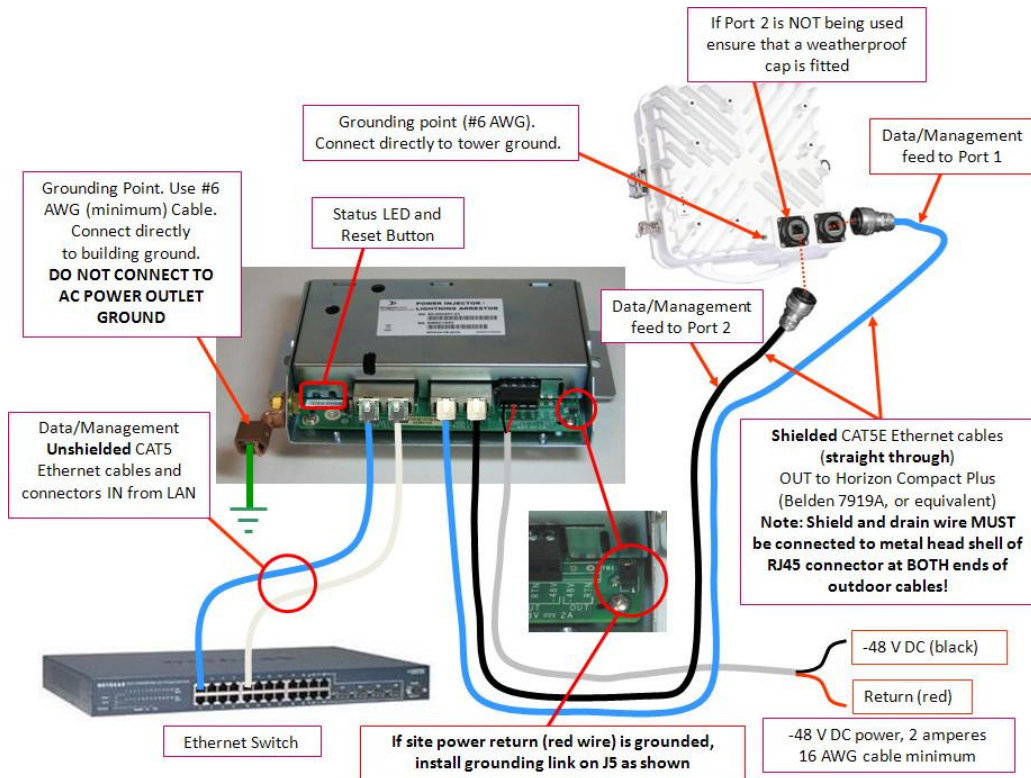


Figure 4-10 Indoor Unit PonE and RJ45 Connections

4.3.4 Assembling the RJ45 Connector

Shielded, weatherproof RJ45 connector shells are used for connecting the CAT5E cable, leading from the power-on-Ethernet power supply and network connections, to the Horizon Compact+.

Note: Shield and drain wire MUST be connected to metal head shell of RJ45 connector at BOTH ends of outdoor cable!

Two different styles of connector have been used in production, Amphenol and Conec. Both styles are not cross compatible.

Amphenol “Snap fit” Style

The connector shell must be assembled in a specific manner for it to correctly connect to the Horizon Compact+ unit. The CAT5E cable is terminated as a **straight through** connection with a **shielded** RJ45 connector. This RJ45 connector has to be assembled into the weatherproof connector shell oriented as shown in Figure 4-11.

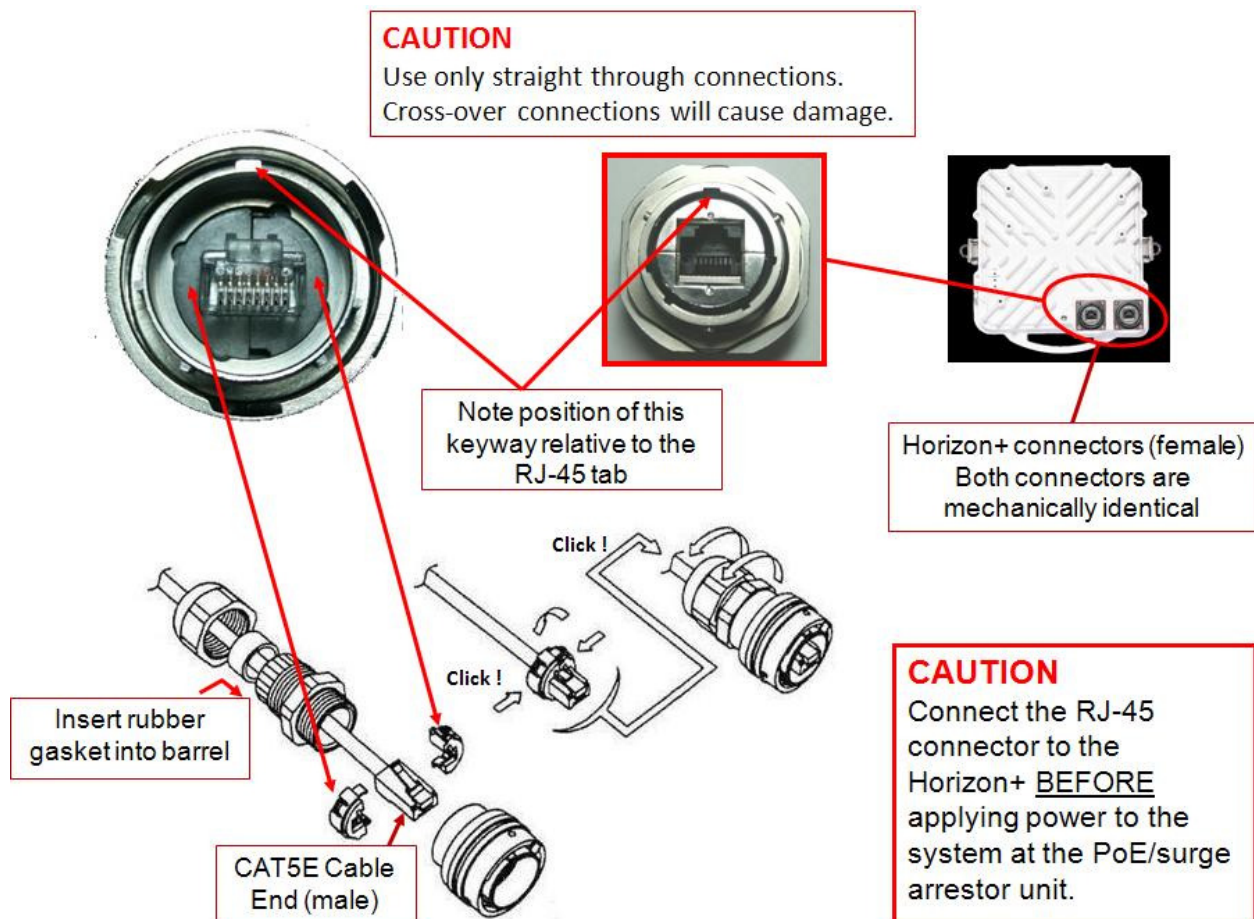


Figure 4-11 RJ45 Cable connector Amphenol “Snap fit” Style

For more information, refer to DragonWave Technical Note HCP-TN-008.0 - Assembly of Amphenol Environmental RJ45.pdf, which can be found on the DragonWave Inc. Customer Support Web page <http://www.dragonwaveinc.com/>

Conec “Push fit” Style

This connector relies on a gland nut to hold the assembly firmly together. The CAT5E cable is threaded through all the components of the connector housing (see Figure 4-12) before the cable is terminated as a **straight through** connection with a **shielded** RJ45 connector. Once terminated, the RJ45 connector slides back into the connector housing which accepts the tab on the RJ45 connector. Screw the ferrule into the connector housing as far as it will go, ensuring that the ‘O’ ring creates a tight seal with the connector housing. Slide the compression seal into the ferrule, noting that the keyways have to mate with channels in the ferrule. While ensuring that the RJ45 connector is firmly seated in the connector housing, tighten up the gland nut to secure the complete connector assembly.

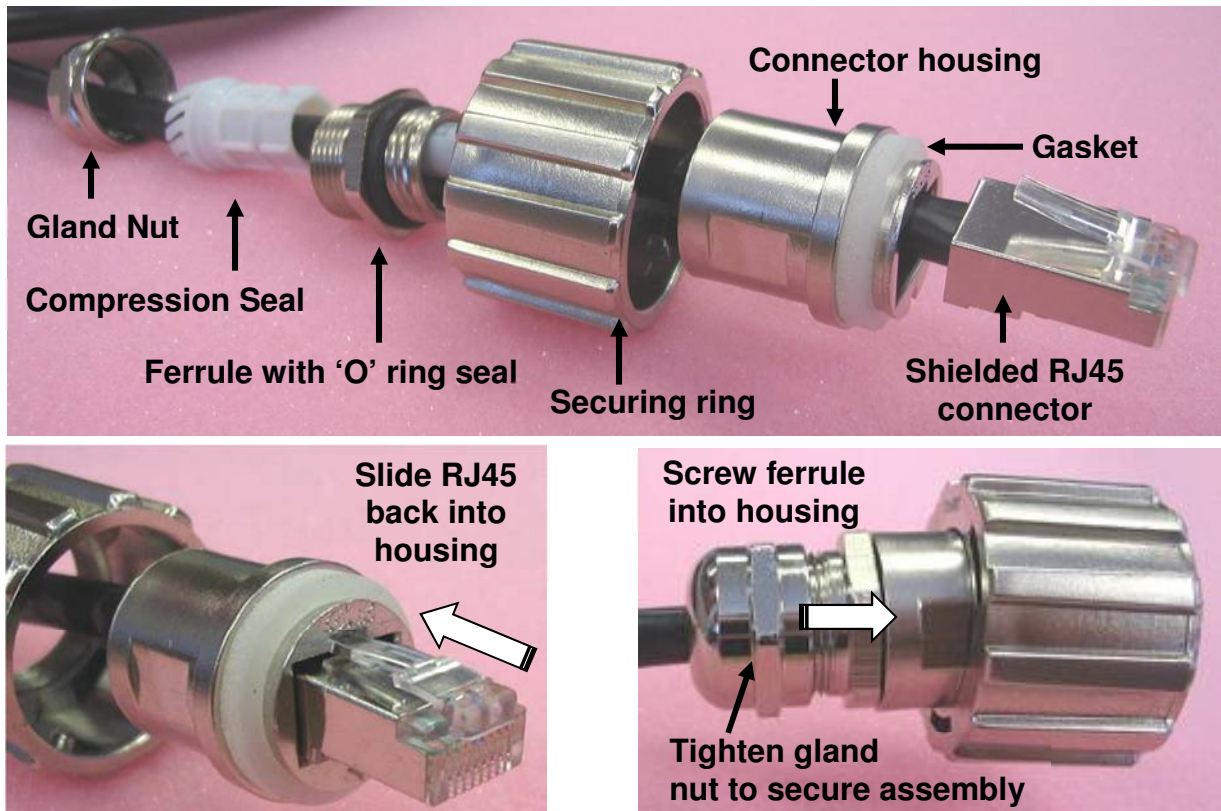


Figure 4-12 RJ45 Cable connector Conec “Push fit” Style

CAUTION
Using a cross-over connection will damage the Horizon Compact+. Only use straight through cable connections.

CAUTION
For Release 1.1 and earlier, connect the RJ45 connector to the Horizon Compact+ BEFORE applying power to the system at the PonE/surge unit. This does not apply to Release 1.2 of the PonE adapter.

CAUTION
Ensure that shield foil and drain wire of CAT5E outdoor cables are positively connected to the metal head shells of the RJ45 connectors at BOTH ends of the cable!

4.3.5 Using Outdoor Lightning Arrestor unit

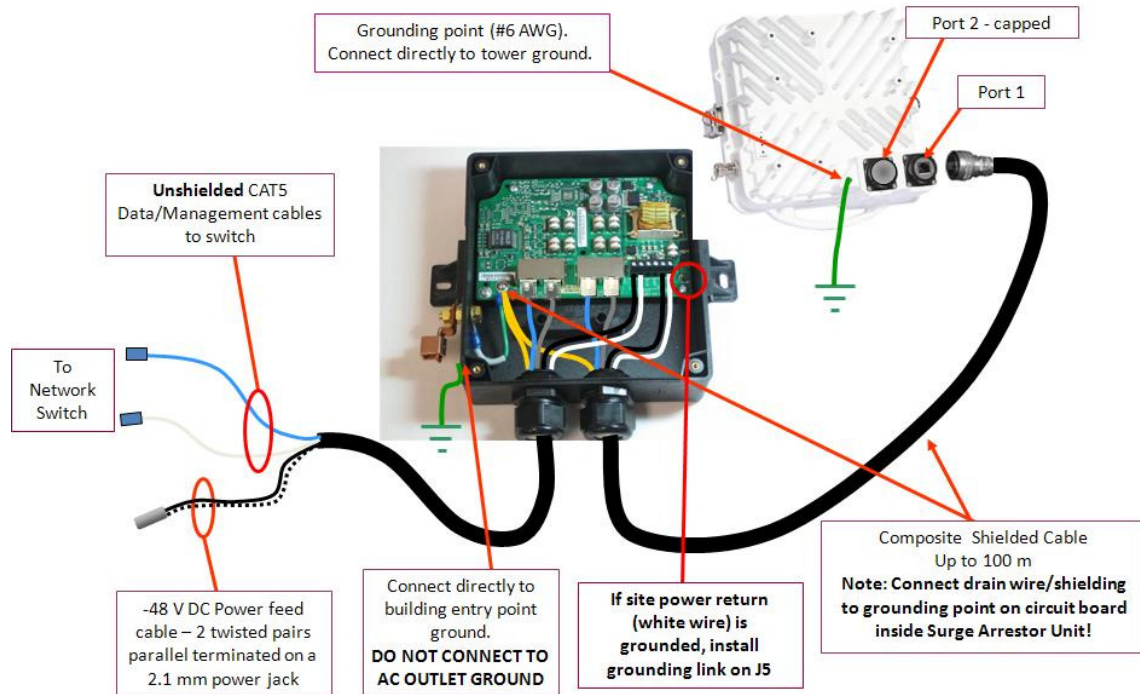


Figure 4-13 Outdoor Lightning Arrestor Unit Ethernet Cabling – Copper Interface

4.3.6 Using Indoor Lightning Arrestor Unit

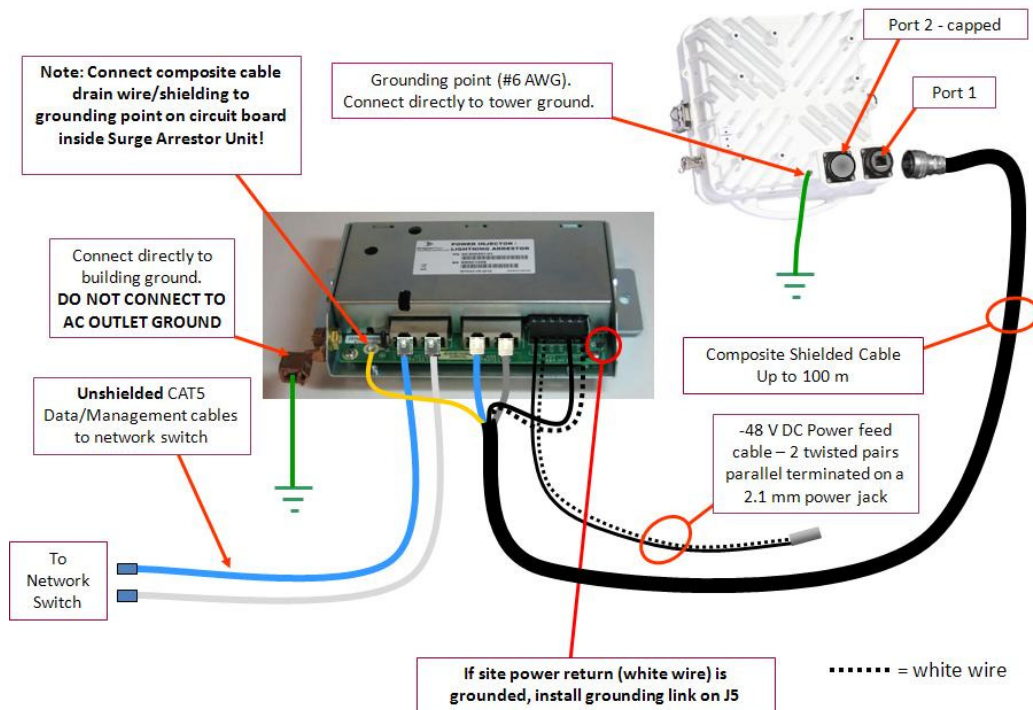


Figure 4-14 Indoor Lightning Arrestor Unit Ethernet Cabling – Copper Interface

4.3.7 Connecting Fast Ethernet Data Feeds

Both the P1 or P2 GigE data ports can each be configured as two Fast Ethernet ports. This requires an Ethernet splitter to feed the two Fast Ethernet data feeds into a single Cat5E cable feed to the P1 or P2 connection on the network side of the PonE unit. Figure 4-15 illustrates the physical connections required.

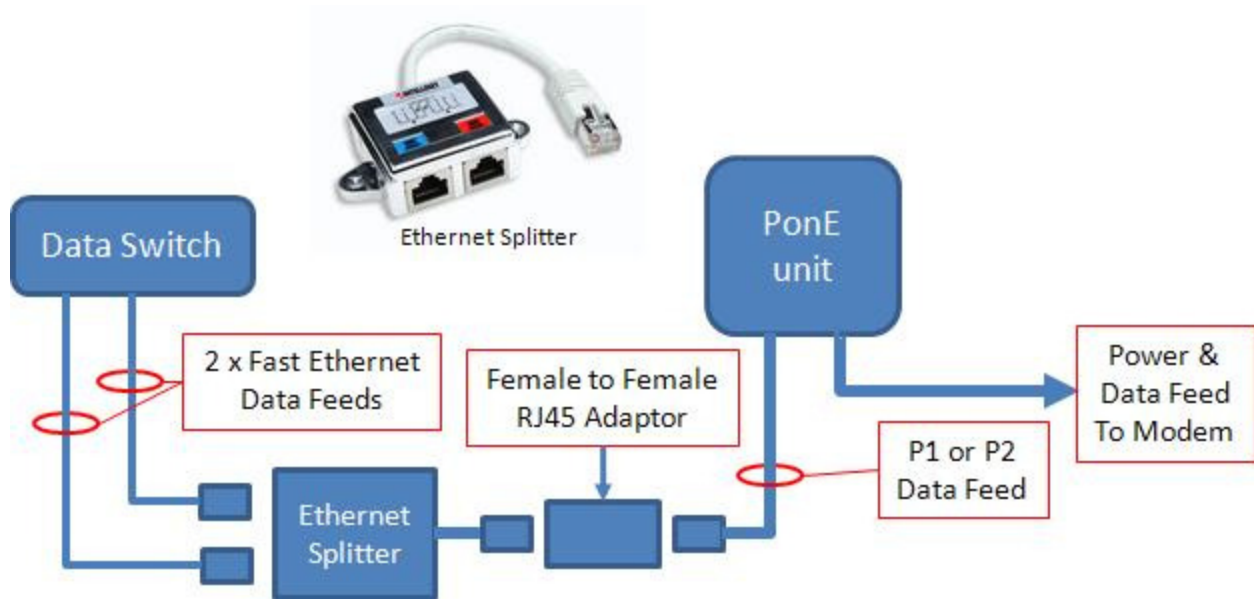


Figure 4-15 Fast Ethernet Physical Connections

5.0 Powering the Horizon Compact+

Before an active management session can be started on the Horizon Compact+, power needs to be provided to the unit. **Read this section completely before applying power to the Horizon Compact+.**



Caution : Ensure correct voltage polarity before connecting external DC supply to Horizon Compact+ Unit.

The DC feed into the equipment shall be protected by a 3A rated over protection device provided as part of the building installation.

Do not mix AC/DC adapter and site 48 V DC supplies.

It is recommended to use an isolated $\pm 48\text{VDC}$ supply where both inputs are floating (neither side grounded), or the isolated AC/DC adapter option. In cases where the site supplied $\pm 48\text{VDC}$ is not isolated and has the +ve (return) side grounded, apply the shorting link to J5 (see Figure 4-6), or the green jumper wire provided, to connect the 48V “RTN” to the ground lug connection inside the PonE box (see Figure 4-7).

5.1 Copper Interface

The Horizon Compact+ with copper interface receives its power over the Ethernet connection to Port 1 using a DragonWave proprietary technique. To integrate the power onto the Ethernet cable requires the use of a DragonWave Power on Ethernet (PonE) power injector/Lightning Arrestor. There are two versions of this unit – an outdoor rated unit and an indoor rated unit. Both DragonWave PonE units also include transient and surge suppression components to protect the power supply and network from lightning induced surges and transients.

Note: The Horizon Compact+ PonE implementation is proprietary and does not follow IEEE standards.

CAUTION: Only use a straight-through Ethernet cable to connect the Horizon Compact+ to the PonE/surge unit. Incorrectly wired cables will cause an alarm condition on the PonE adapter and the Horizon Compact+ will not power up.

5.1.1 Using the Outdoor PonE Unit

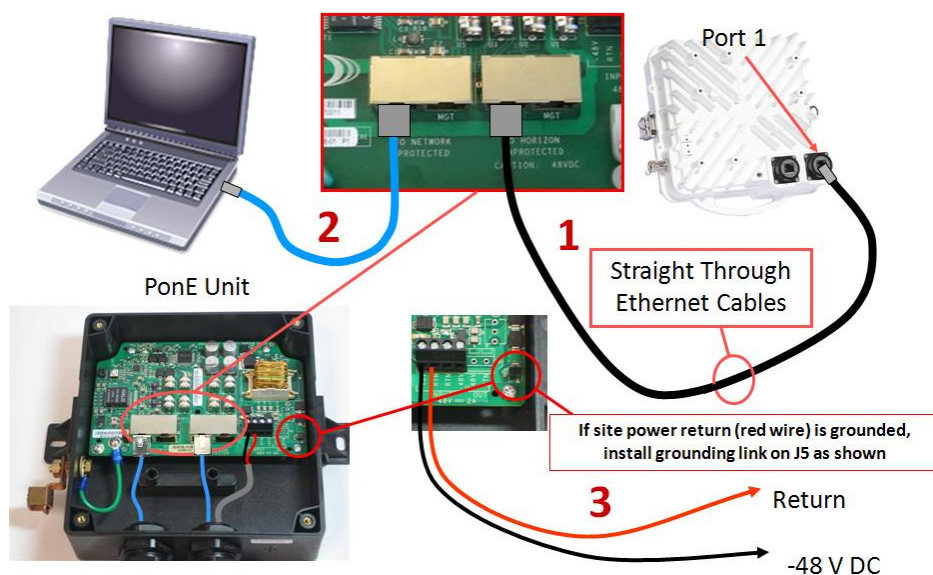


Figure 5-1 Connecting Power Using Outdoor PonE Unit – Copper Interface

5.1.2 Using the Indoor PonE Unit

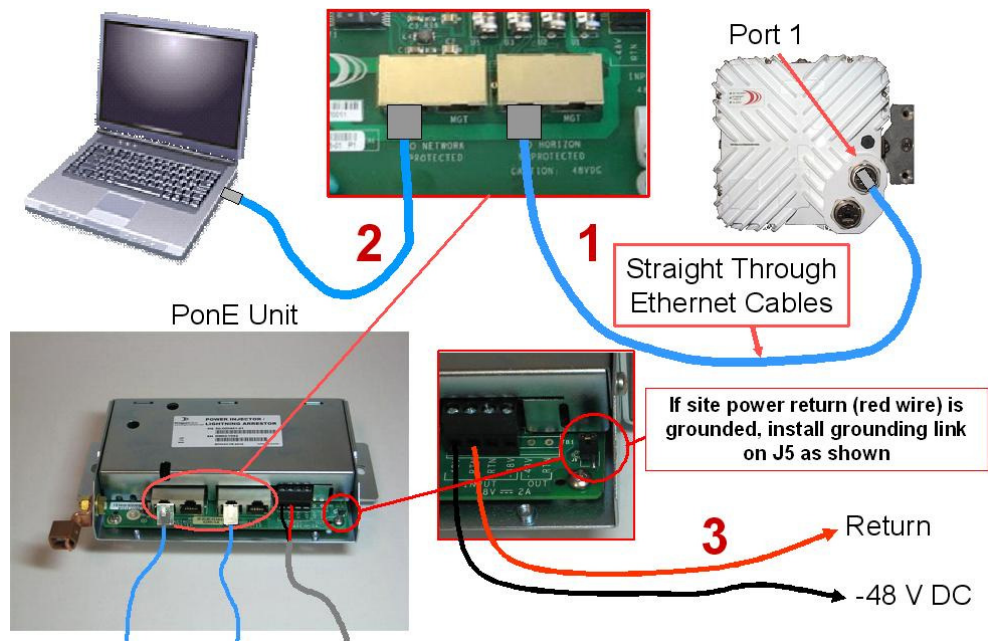


Figure 5-2 Connecting Power Using Indoor PonE Unit – Copper Interface


5.1.3 Steps to Connecting Power

1. Connect Port 1 of the Horizon Compact+ to the correct socket on the PonE/lightning arrestor using a straight through, shielded, Ethernet cable (see caution above).
2. Connect the Ethernet port on the PC to the network input socket on the PonE/lightning arrestor, using a straight through Ethernet cable, with an unshielded RJ45 connector.

Ensure that you have connected the PC and Horizon Compact+ to the correct RJ45 sockets on the PonE/lightning arrestor.

3. Once the PC and Horizon Compact+ are connected to the PonE/lightning arrestor, you may connect power to the PonE/lightning arrestor. This will supply power to the Horizon Compact+ unit. An incorrectly wired system will cause the PonE/lightning arrestor to prevent the Horizon Compact+ from powering up. This protects the Horizon Compact+ from incorrectly terminated power feeds.

Note that the PonE adapter supports redundant power supplies.



CAUTION
Do not mix AC/DC converter and site 48 V DC supplies for power redundancy. Use of ISOLATED 48 VDC supplies is recommended. For non-isolated site-supplied 48VDC where the “Return” (positive) side is grounded, transfer the shorting link from P4 to P5 (see Section 4.2).
For Release 1.1 and earlier, do not connect a PC or other network device (e.g. network switch) to the right hand RJ45 sockets on the PonE adapter. -48 V DC is present on these connectors which may destroy the connected device. Connect only a Horizon Compact+ unit to the right hand RJ45 connectors.

5.1.4 PonE Status LED

Both the Outdoor and Indoor rated PonE units have a green status LED (see Figure 5-3) which indicates the status of the power-up cycle. When power is applied to the PonE adapter, prior to it attempting to apply power to the Horizon Compact+, the PonE management system checks for under/over-voltage and open or short circuit conditions. If any such condition exists, then the PonE adapter will not apply power to the Horizon Compact+. The status LED signals the condition of the PonE system if this should occur (see Table 5-1). If the fault condition clears, the system will then attempt to provide power to the Horizon Compact+ unit, but the LED will continue to indicate that a current/voltage problem had occurred (Alarm history). The LED may be reset by pressing the Alarm Reset button or recycling the power feed to the PonE adapter. See Figure 5-3 for the locations of the LED and Alarm Reset Button.

Incorrectly wired CAT5E cables can cause open or short circuit conditions, so this feature protects the Horizon Compact+ from incorrectly applied power. The PonE power unit will also shut-down when the Horizon Compact+ is disconnected from the PonE adapter (NTWK to Horizon Compact+ port cable disconnected).

Table 5-1 PonE Status LED Function Key

LED	DESCRIPTION
OFF	No power or hardware fault.
1 sec. flash	DISCOVERY: 0.5 sec off and 0.5 sec on means: 48VDC input voltage is within specifications. Unit is in discovery mode waiting for a HC radio to be connected. 4-9V present on NTKW port.
ON	POWER ON: 48VDC input voltage is within specifications. Unit has detected and powered up the HC Radio.
0.5 sec. OFF/ Rapid/blink	DISCOVERY (ALARM history): 0.5 sec off and 0.5 sec rapid blink: 48VDC input voltage is within specifications. Unit is in discovery mode waiting for a HC radio to be connected following an alarm condition 4-9V present on NTKW port. The POnE unit will stay in ALARM (Rapid Blink) mode until either the 48VDC power is removed for at least 2 sec. or the Alarm Reset button has been pressed.
Rapid Blink.	POWER ON (ALARM history): The rapid blink (about 10 flashes/sec) indicated that an over current situation has occurred. The 48VDC input voltage is within specifications. Unit has detected and successfully re-powered up the HC Radio following an alarm condition. The POnE unit will stay in ALARM (Rapid Blink) mode until either the 48VDC power is removed for at least 2 sec. or the NTKW to Horizon port connector is removed for at least 1 sec. or the Alarm Reset button has been pressed.

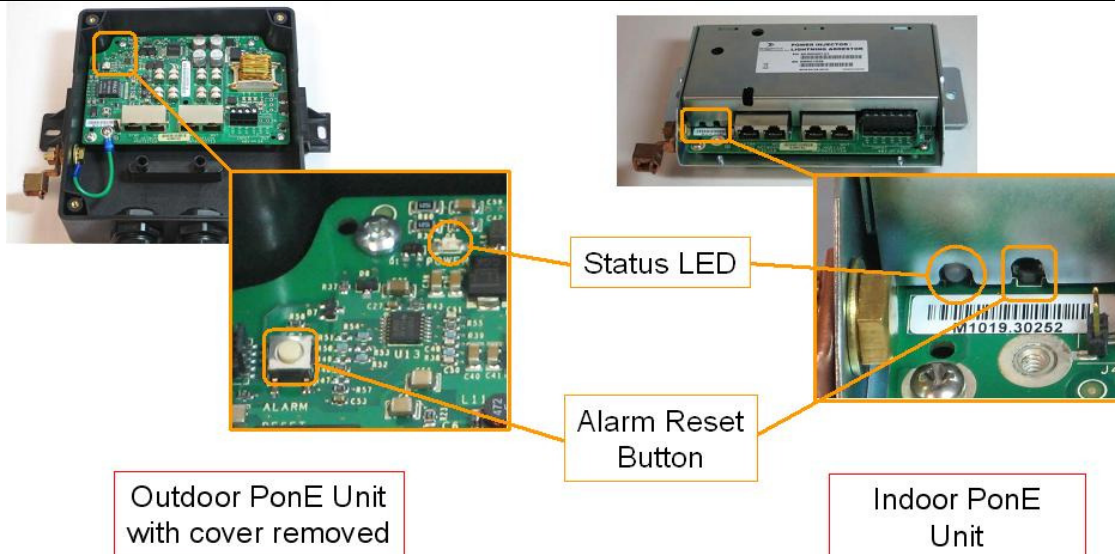


Figure 5-3 PonE Status LED and Alarm Reset Button

5.2 Optical Interface

In the copper interface version, power is fed to the Horizon Compact+ using PonE techniques via the Ethernet connection to Port 1. In the optical version, this is not possible, so power is fed via the connection to Port 2. Port 2, on the optical interface variant, is equipped with a weatherproof MIL style multi-pin connector, which incorporates an Ethernet connection and a power feed (NOT PonE) connection.

5.2.1 Using the Composite Cable

A composite cable is available that includes two CAT5E cables and power feed wires and is terminated at the Horizon end with the MIL style connector compatible with the Port 2 connection. One of the CAT5E cables (grey) provides an Ethernet connection to Port 2. The remaining CAT5E cable (blue) does not need to be terminated.

Note that the Ethernet connection (where used) and power feed to Port 2 must be fed via a DragonWave Lightning Arrestor Unit to protect the network and power systems from transients. Either the Indoor or Outdoor Lightning Arrestor unit may be used depending on the installation.

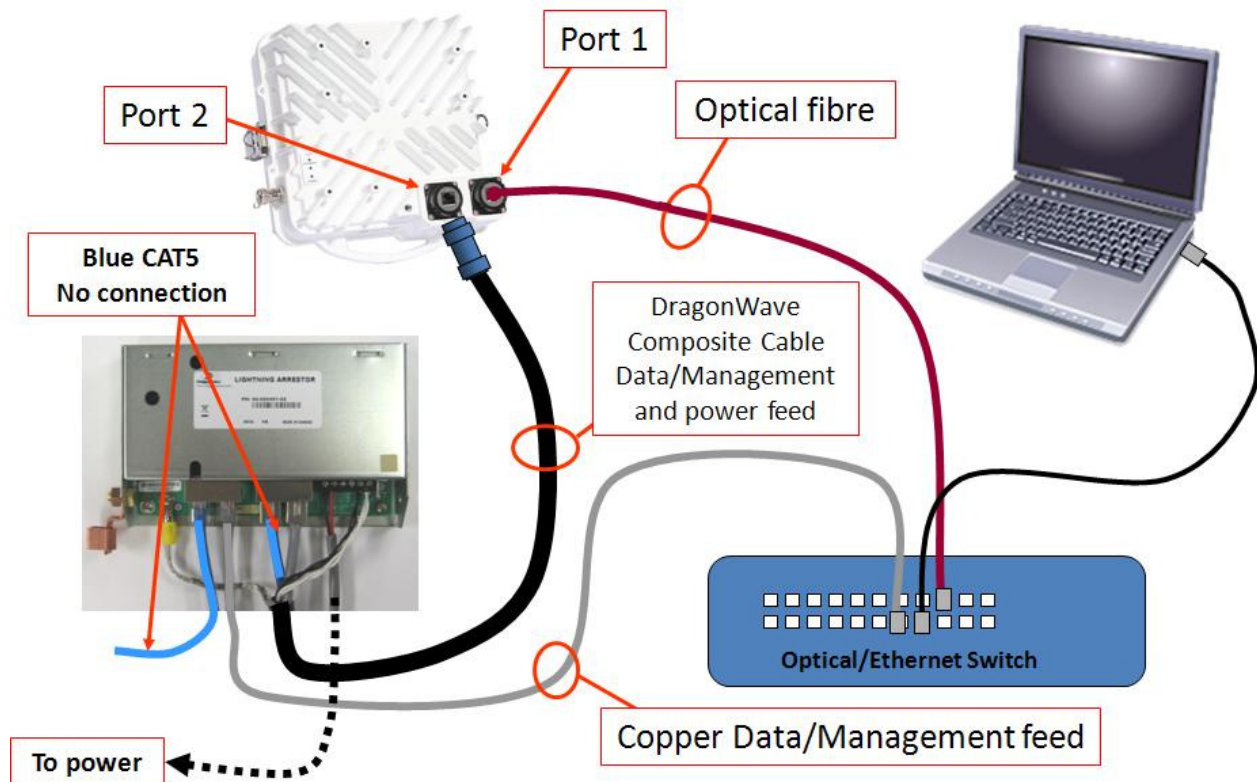


Figure 5-4 Connecting Power – Optical Interface - Indoor Lightning Arrestor Unit

5.2.2 Alternate Power Feed Option - “Y” Feed Adapter Cable

Where distances prevent the use of the composite cable due to power feed loss, a special “Y” feed adaptor cable is available that allows customer provided, heavier duty, wires to be spliced into the power feed connection. The gland fitting on the DragonWave Lightning Arrestor unit accepts and seals a round cable with a jacket diameter between 0.35 and 0.62 inches. The power terminal block will accept up to a maximum of 14 AWG wires. An RJ45 Ethernet port connection is also available on this “Y” adapter cable.

Note that the OOB management connection (where used) and power feed to Port 2 must be fed via a DragonWave Lightning Arrestor Unit to protect the network and power systems from transients. Either the Indoor or Outdoor Lightning Arrestor unit may be used depending on the installation.

Figure 5-5 shows this arrangement showing how network and power circuits are protected by using the DragonWave Outdoor Lightning Arrestor Unit. If the suppression unit is installed indoors, then the DragonWave Indoor Lightning Arrestor Unit may be substituted using the same connections.

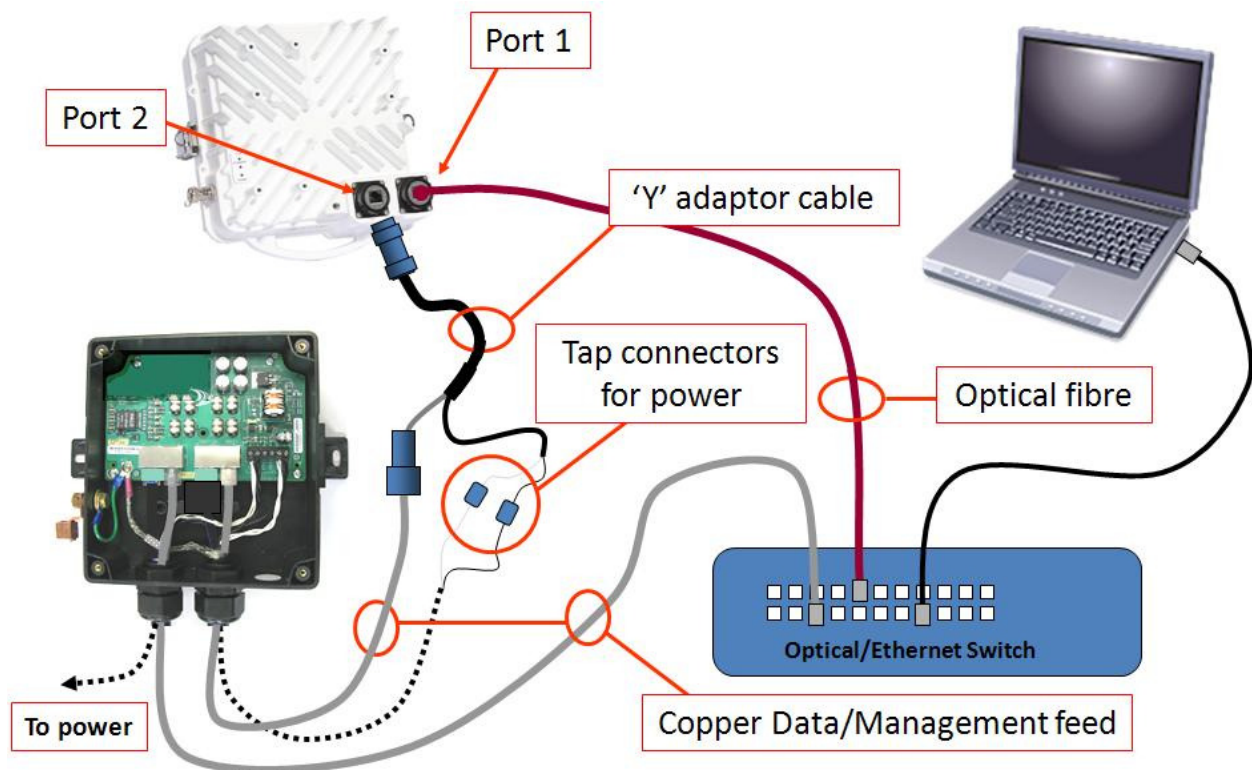
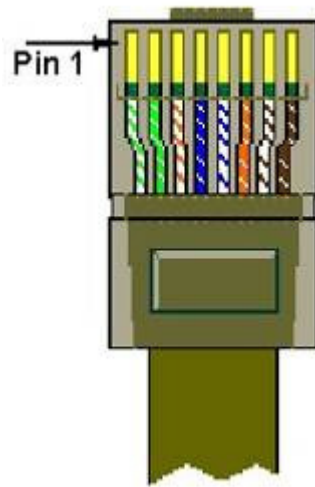


Figure 5-5 Optional External Power Feed - Outdoor Lightning Arrestor Unit



1000BaseTx – RJ45 pinout		
Pin	Signal	Color
1	TP0+	White/Green
2	TP0-	Green
3	TP1+	White/Orange
4	TP2+	Blue
5	TP2-	White/ Blue
6	TP1-	Orange
7	TP3+	White/Brown
8	TP3-	Brown

Figure 5-6 RJ45 connector pinout – Port 2 management

6.0 Initial Configuration

There are a number of configuration steps that need to be carried out before the Horizon Compact+ can become operational. It is recommended that these steps be performed prior to mounting the system on the tower. These steps relate to:

- radio bands
- frequency channels
- IP address information
- management interface

Once this information has been correctly entered, the Horizon Compact+ system is ready for installation and system alignment.

The Horizon Compact+ can be configured using a command line interface (CLI) using Telnet (See Appendix A for a list of CLI commands) or the Web interface.

6.1 Internet Protocol

Before attempting to log on you must configure the network parameters of your laptop, or PC, so that they match those of the Horizon Compact+. The Horizon Compact+ supports both IPv4 and IPv6 protocols

6.1.1 IPv4

For IPv4, the network parameters of your laptop, or PC, must be in the same domain as the Horizon Compact+ default IP address and subnet mask values.

By default, the IPv4 IP address of a Horizon Compact+ system is **192.168.10.100** and the subnet mask is set to **255.255.0.0**. Use this IP address to communicate with the unit using either Telnet or the Web browser.

6.1.2 IPv6

The Horizon Compact+ supports the newer IPv6 internet protocol. Including IPv6 capability enables the Horizon Compact+ to communicate with network products that employ either IPv4 or IPv6 protocol.

6.2 Physical Connection

For the copper interface, connect your laptop or PC Ethernet port to physical Port 2 (GigE port) on the Horizon Compact+ using a straight through Ethernet cable. By default the management option is set to “out-of-band”, which will allow management via p2. Note that ports p3 and p4 are disabled by default.

6.3 Secure Management Access.

Secure management access is controlled by a user name and password. The default Super User name is “**energetic**” and the default password is “**wireless**”. The system allows any format for user passwords (except the use of special characters), but does not allow a duplicate name or password. Also, an existing user name cannot be used as a password. The same rules apply for both Telnet and Web access.

The default the system allows DragonWave personnel unhindered access to the system using a proprietary access code. This may be necessary if default Super User parameters have been changed and have been forgotten, or remote access is required to troubleshoot the system.

6.4 Using Telnet

6.4.1 Logging on

On your laptop or PC, open the DOS Command Prompt, or open the Windows Run option. In either case type:

telnet 192.168.10.100 and press Enter.

Wait for the login prompt to appear in the Telnet window. Pressing Enter before the prompt appears may result in “Connection to host lost”.

When prompted, enter the Super User name and password. For the DragonWave default access option the Super User name is **“energetic”** and the password is **“wireless”**.

Successful logging on is indicated by the CLI cursor (->) being displayed.

Note that after 10 minutes of inactivity, you will be automatically logged off the system.

6.4.2 Context Sensitive Help

Full context sensitive help is available for all CLI commands. Type **?** followed by a partial command to return a list of all commands that match the entry, with an explanation as to how each command is used. Type a command followed by **?** to return a list of all variants of that command. See Appendix A – CLI Command List for an alphabetical list of CLI commands.

6.4.3 Configuring Radio Band and Frequency Channels

Both Horizon Compact+ units in a system (near and far end) have to be configured with the same radio band. Volume 3 of this manual lists all the radio bands supported by the Horizon Compact+ system. The radio band selected must match that for which the Horizon Compact+ units have been manufactured. Only those radio bands for which the radio can be configured are available for selection. The radio band will also be dictated in the wireless licensing documents.

Typical radio band configuration selections have the format “fcc23_3_50”, “etsi23_3_14” , “ul_fcc24_1_40” etc.


For licensed radio bands, the Horizon Compact+ units at each end of the link have different frequency banks allocated to them. One unit will be allocated the “LOW” bank and the other the “HIGH” bank. This is indicated on the label attached to each unit (LOW or HIGH). Wireless licensing documents will indicate at which end of the link each should be located. The radio part number, that is stored in the system, determines if it is a LOW or HIGH unit and automatically configures the correct frequency bank for each unit.

For unlicensed radio bands Horizon Compact+ units have the same type of radio at each end of the link and do not have a LOW or HIGH indication on their labels.

Each bank contains a number of frequency channels, of which only one will be selected. Once again the actual frequency channel will be dictated in the wireless licensing documents. Note that when using 2 Horizon Compact+ systems on the same data path, non-overlapping channels are required when operating above 16QAM. If, however, you must use co-channel operation, then consult DragonWave for installation guidance and installation mount enhancements that are required.

You also need to configure the system mode (determines modulation, bandwidth and throughput parameters).

Use Telnet access and the following procedure to configure the radio parameters:



WARNING:

These same commands may be used to change the radio configuration of an existing working link. If management of the far end Horizon Compact+ is only via the radio link, then configure the far end radio first. Otherwise, if you configure the near end radio first, you will lose the link to the far end radio and be unable to configure it.

Required Action	Steps
Login as the Super User	<p>Connect your PC/laptop to the default management port.</p> <p>On connecting to the management port you may have to press Enter to “wake up” the system. The system prompt for the user name will appear. Enter the default Super User name (energetic) and press Enter. You will then be prompted for a password. Use the default password (wireless). If the name and password are accepted you will see the system prompt (->).</p> <p>Sequence:</p> <p><i>Horizon Compact+, Release 1.0.0e (3496)</i> <i>Copyright 2002-2011 DragonWave Inc.</i> <i>All rights reserved.</i></p> <p><i>Username :energetic</i> <i>Password :</i> <i>-></i></p> <p>You are now logged onto the system.</p>

Required Action	Steps																																	
Configure the radio parameters	<p>This command leads you through the steps to configure the radio band, system mode and frequency channel. Sequence: set radio config press Enter The system responds: <i>#Press 'Ctrl-X' to exit config process</i> <i>#Press 'Enter' to retain previous value</i></p> <p><i>Radio Bands Available in the system :</i> <i>freqNone fcc18_1_10_R5</i> <i>fcc18_1_20_R5 fcc18_1_30_R5</i> <i>fcc18_1_40_R5 fcc18_1_50_R5</i> <i>test18_1_7_R5 braz18_1_14_R5</i> <i>braz18_1_28_R5 braz18_1_56_R5</i></p> <p><i>Enter new radio band [fcc18_1_50_R5]:</i> <i>System modes available in the system :</i> <i>cw_test hy50_66_qpsk hy50_154_16qam</i> <i>hy50_198_32qam hy50_241_64qam hy50_285_128qam</i> <i>hy50_329_256qam hy50_351_256qam</i></p> <p><i>Enter new system mode [hy50_285_128qam]:</i></p> <p><i>Available frequencies for the radio band:</i></p> <table border="1"> <thead> <tr> <th>Index</th> <th>TX RF</th> <th>RX RF</th> </tr> </thead> <tbody> <tr><td>1</td><td>17765000</td><td>19325000</td></tr> <tr><td>2</td><td>17815000</td><td>19375000</td></tr> <tr><td>3</td><td>17865000</td><td>19425000</td></tr> <tr><td>4</td><td>17915000</td><td>19475000</td></tr> <tr><td>5</td><td>17965000</td><td>19525000</td></tr> <tr><td>6</td><td>18015000</td><td>19575000</td></tr> <tr><td>7</td><td>18065000</td><td>19625000</td></tr> <tr><td>8</td><td>18115000</td><td>19675000</td></tr> </tbody> </table> <p><i>All Frequency in kHz</i> <i>Enter programmed frequency [2]:</i></p> <p><i>Would you like to save MIB ? Enter Y(Yes) or N(No):y</i></p> <p><i>Apply the setting to system immediately. This operation may cause the loss of current connection!</i> <i>Continue? Enter Y(Yes) or N(No)n</i> Note: Answering "Yes" (y) to the above request will cause any changes to take effect immediately and you will not get the prompt to save mib and reset system. <i>Save MIB and reset system for changes to take effect.</i></p> <p><i>Radio Band selected :fcc18_1_50_R5</i> <i>System mode set to :hy50_285_128qam</i></p> <p><i>Save MIB and reset system for changes to take effect.</i> <i>Programmed frequency selected:</i></p> <table border="1"> <thead> <tr> <th>Index</th> <th>TX RF</th> <th>RX RF</th> </tr> </thead> <tbody> <tr><td>2</td><td>17815000</td><td>19375000</td></tr> </tbody> </table> <p><i>All Frequencies in kHz</i> <i>Save MIB and reset system for changes to take effect.</i></p>	Index	TX RF	RX RF	1	17765000	19325000	2	17815000	19375000	3	17865000	19425000	4	17915000	19475000	5	17965000	19525000	6	18015000	19575000	7	18065000	19625000	8	18115000	19675000	Index	TX RF	RX RF	2	17815000	19375000
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2	17815000	19375000																																

6.4.4 Configuring IPv4 Address Values

When shipped from DragonWave, the Horizon Compact+ is configured with a default IPv4 address (192.168.10.100) and subnet mask (255.255.0.0). The default address is used to communicate with the Horizon Compact+ for initial configuration purposes, such as entering the IP address that the unit will have in the network to which it is to be connected. IP address information is entered in the following manner:

Required Action	Steps
Configure the IPv4 parameters	<p>The IPv4 parameters include the IP address, the subnet mask and default gateway. The example below shows how to change the IP address, subnet mask and default gateway. Sequence: set ip config press Enter The system responds:</p> <pre>#Press 'Ctrl-X' to exit config process #Press 'Enter' to retain previous value Ip Address (192.168.10.100) ? 172.16.18.100 Subnet Mask (255.255.0.0) ? 255.255.252.0 Default Gateway (0.0.0.0) ? 172.16.19.254 Would you like to save MIB ? Enter Y(Yes) or N(No):y Apply the setting to system immediately. This operation may cause the loss of current connection! Continue? Enter Y(Yes) or N(No)y Mib saved successfully. Config Name User Config Running Config ----- Ip Address : 172.16.18.100 172.16.18.100 Subnet Mask : 255.255.252.0 255.255.252.0 Default Gateway : 172.16.19.254 172.16.19.254 If you choose n (No) to the "Continue ?" prompt the response will be as follows: Continue? Enter Y(Yes) or N(No)n Reset system for changes to take effect. Mib saved successfully. Config Name User Config Running Config ----- Ip Address : 172.16.18.100 192.168.10.100 Subnet Mask : 255.255.252.0 255.255.0.0 Default Gateway : 172.16.19.254 0.0.0.0 The next time the system is reset the changes will be applied to the system.</pre>

Once the system has reset, you may not be able to communicate with it without changing your laptop or PC networking parameters to match the new IP address values programmed into the Horizon Compact+.

Note that the **reset system** command is not always required when making configuration changes, but the **save mib** command is always required. Commands that require a reset system will be indicated on the screen.

6.4.5 Configuring IPv6 Address Values

When shipped from DragonWave, the Horizon Compact+ is configured with a default IPv6 address. The default address is used to communicate with the Horizon Compact+ for initial configuration purposes, such as entering the IP address that the unit will have in the network to which it is to be connected. IP address information is entered in the following manner:

Required Action	Steps
Configure the IPv6 parameters	<p>The IP parameters include the IP address, the subnet mask and default gateway. The example below shows how to change the IP address, subnet mask and default gateway.</p> <p>Sequence: set ipv6 config press Enter The system responds:</p> <pre>#Press 'Ctrl-X' to exit config process #Press 'Enter' to retain previous value Ipv6 Address (fd7e:4e9d:b991:1:21e:fff:fe80:14c0) ? fd7e:4e9d:b991:1:21e:fff:fe80:14c0 Prefix Length (64) ? 64 Ipv6 Gateway (fe80::2e6b:f5ff:fe81:9380) ? fe80::2e6b:f5ff:fe81:9380 Would you like to save MIB ? Enter Y(Yes) or N(No):y Apply the setting to system immediately. This operation may cause the loss of current connection! Continue? Enter Y(Yes) or N(No):y Ipv6 Address User Config : fd7e:4e9d:b991:1:21e:fff:fe80:14c0/64 Running Config: fd7e:4e9d:b991:1:21e:fff:fe80:14c0/64 (Link-Local) : fe80::207:58ff:fe03:14c0/64 Ipv6 Gateway User Config : fe80::2e6b:f5ff:fe81:9380 Running Config: fe80::2e6b:f5ff:fe81:9380</pre> <p>If you choose n (No) to the “Continue ?” prompt the response will be as follows:</p> <pre>Reset system for changes to take effect. Ipv6 Address User Config : fd7e:4e9d:b991:1:21e:fff:fe80:14c0/64 Running Config: fd7e:4e9d:b991:1:21e:fff:fe80:14c0/64 (Link-Local) : fe80::207:58ff:fe03:14c0/64 Ipv6 Gateway User Config : fe80::2e6b:f5ff:fe81:9380 Running Config: fe80::2e6b:f5ff:fe81:9380</pre> <p>The next time the system is reset the changes will be applied to the system.</p>

6.4.7 User Accounts

User account names and passwords can only be configured using a Telnet session. Only the Super User can change or add user account names or passwords. There are three user account levels as shown in Table 6-1

Table 6-1 User Account Levels

Account Level	Number of Accounts Available	Functionality
Super User	1	Super User account has control over the usernames and passwords for both the NOC and Admin accounts. Can create backup file of NOC and Admin accounts onto an FTP server, restore system settings and load new software
noc	5	Network Operations Centre (NOC) accounts allow full control over the configuration of the Horizon Compact+ system, including setting the frequency and IP address. NOC accounts may also backup the Horizon Compact+ system settings to an FTP server and restore the system settings from an FTP server. NOC accounts cannot create or change user accounts, or issue any security related commands (ex: set http secure access)
admin	50	Admin accounts allow operational management of the Horizon Compact+ system but have some restrictions for changes to configuration

No default noc or admin user accounts are configured when the Horizon Compact+ leaves the factory. Account names and passwords are case sensitive. There can be no duplication of names or passwords across all user levels. A password cannot be the same as a user name.

6.4.8 Changing the Super User Name and Password

It is recommended that the default, or supplied, Super User name and password be changed as soon as the Horizon Compact+ system is aligned and operational.

Note: When you change the Super User name and/or password, record the new values in a safe place. If you forget the new values, there is no way of retrieving them from the system. If the Horizon Compact+ is supplied with the DragonWave default access option, you will have to contact DragonWave to arrange a Super User reset (24 hour support number 613-271-7010, or support@dragonwaveinc.com).
DragonWave Default Access

To change the Super User name and password use the CLI command **set super user** and press Enter. Follow the prompts.

When the new name and password have been accepted enter the CLI command **save mib** and press Enter. This will save the changes in non volatile memory. Failing to save the mib will result in changes being lost in the event of a power failure, or system reset.

6.4.9 Adding or Changing noc User Accounts

Up to five noc user accounts can be configured..

Required Action	Steps																																													
View user Login Accounts	<p>Five noc (network operations center) accounts are available. The username and password cannot be the same value.</p> <p>Log in as the super user.</p> <p>View current account settings.</p> <p>Sequence: get user accounts press Enter</p> <p>The system responds: ***** ADMIN ACCOUNTS *****</p> <table border="1"> <thead> <tr> <th><i>Index</i></th> <th><i>UserName</i></th> <th><i>Password</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Admin 1</td> <td>pwr1</td> </tr> <tr> <td>2</td> <td>Admin 2</td> <td>pwr2</td> </tr> <tr> <td>3</td> <td>Admin 3</td> <td>pwr3</td> </tr> <tr> <td>'</td> <td></td> <td></td> </tr> <tr> <td>'</td> <td></td> <td></td> </tr> <tr> <td>48</td> <td>Admin 48</td> <td>pwr4</td> </tr> <tr> <td>49</td> <td>Admin 49</td> <td>pwr5</td> </tr> <tr> <td>50</td> <td>Admin 50</td> <td>pwr6</td> </tr> </tbody> </table> <p>*****</p> <p>NOC ACCOUNTS *****</p> <table border="1"> <thead> <tr> <th><i>Index</i></th> <th><i>UserName</i></th> <th><i>Password</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>noc1</td> <td>nocpwd1</td> </tr> <tr> <td>2</td> <td>noc2</td> <td>nocpwd2</td> </tr> <tr> <td>3</td> <td>noc3</td> <td>nocpwd3</td> </tr> <tr> <td>4</td> <td>noc4</td> <td>nocpwd4</td> </tr> <tr> <td>5</td> <td>noc5</td> <td>nocpwd5</td> </tr> </tbody> </table> <p>-></p>	<i>Index</i>	<i>UserName</i>	<i>Password</i>	1	Admin 1	pwr1	2	Admin 2	pwr2	3	Admin 3	pwr3	'			'			48	Admin 48	pwr4	49	Admin 49	pwr5	50	Admin 50	pwr6	<i>Index</i>	<i>UserName</i>	<i>Password</i>	1	noc1	nocpwd1	2	noc2	nocpwd2	3	noc3	nocpwd3	4	noc4	nocpwd4	5	noc5	nocpwd5
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2	noc2	nocpwd2																																												
3	noc3	nocpwd3																																												
4	noc4	nocpwd4																																												
5	noc5	nocpwd5																																												

Required Action	Steps
Create a new noc account:	<p>Sequence:</p> <p>set noc user press Enter</p> <p>The system responds:</p> <p><i>Index:</i></p> <p>Enter the <index #> where <index #> is from 1 to 5 and represents one of the 5 available accounts.</p> <p>The system responds:</p> <p><i>UserName:</i></p> <p>Enter the desired username for this account.</p> <p>The system responds:</p> <p><i>Verify UserName:</i></p> <p>Re-enter the desired username for this account.</p> <p>The system responds:</p> <p><i>Password:</i></p> <p>Enter the desired password for this account.</p> <p>The system responds:</p> <p><i>Verify Password:</i></p> <p>Re-enter the desired password for this account.</p> <p>The system responds:</p> <p><i>User Accepted:</i></p> <p>If the usernames or passwords do not match the system will respond:</p> <p><i>nak</i></p> <p>Repeat for as many noc accounts as required (5 max).</p>
Save the settings	<p>save mib press Enter</p> <p>The system responds:</p> <p><i>MIB saved.</i></p> <p>Note: the new account settings must be saved, otherwise they will be lost after the next system reset. The user must perform the save mib command in order to save the changes.</p>

6.4.10 Adding or Changing Admin User Accounts

Up to 50 admin accounts can be configured.

Required Action	Steps
<p>Log in as the Super User View user accounts</p>	<p>50 Administrator accounts are available. The username and password cannot be the same value. Sequence: get user accounts press Enter The system responds: ***** <i>ADMIN ACCOUNTS</i> ***** <i>1 Admin 1 pwrd1</i> <i>2 Admin 2 pwrd2</i> <i>3 Admin 3 pwrd3</i> <i>'</i> <i>'</i> <i>48 Admin 48 pwrd4</i> <i>49 Admin 49 pwrd5</i> <i>50 Admin 50 pwrd6</i> ***** <i>NOC ACCOUNTS</i> ***** <i>Index UserName Password</i> <i>1 noc1 nocpwd1</i> <i>2 noc2 nocpwd2</i> <i>3 noc3 nocpwd3</i> <i>4 noc4 nocpwd4</i> <i>5 noc5 nocpwd5</i> -></p>

Required Action	Steps
Create a new Administrator account	<p>Sequence:</p> <p>set admin user press Enter</p> <p>The system responds:</p> <p><i>Index:</i></p> <p>Enter the <index #> where <index #> is from 1 to 50 and represents one of the 50 available accounts.</p> <p>The system responds:</p> <p><i>UserName:</i></p> <p>Enter the desired username for this account.</p> <p>The system responds:</p> <p><i>Verify UserName:</i></p> <p>Re-enter the desired username for this account.</p> <p>The system responds:</p> <p><i>Password:</i></p> <p>Enter the desired password for this account.</p> <p>The system responds:</p> <p><i>Verify Password:</i></p> <p>Re-enter the desired password for this account.</p> <p>The system responds:</p> <p><i>User Accepted:</i></p> <p>If the usernames or passwords do not match the system will respond:</p> <p><i>nak</i></p> <p>Repeat for as many admin accounts as required.</p>
Save the settings	<p>save mib press Enter</p> <p>The system responds:</p> <p><i>MIB saved.</i></p> <p>Note: the new account settings must be saved, otherwise they will be lost after the next system reset. The user must perform the save mib command in order to save the changes.</p>

6.4.11 Changing NOC and Admin User Passwords

The Super User may change a noc or admin user's password, by over-writing or re-entering the user's name and password using the same process for adding a new user.

6.4.12 Logging Out

When accessing the system via Telnet, log out of the system by using the CLI command *lo*.

When accessing using the Web browser, closing the browser will log you out of the system.

6.4.13 Session Time Out

After 10 minutes of inactivity, Horizon Compact+ units will automatically terminate the login session.

6.4.14 Recovery of IP Address and Serial Numbers

In the event that the Horizon Compact+ Super User name and password, or IP address has been lost, forgotten, or misconfigured, you will need to contact DragonWave (support@dragonwaveinc.com). DragonWave Technical Support will provide the Merlin recovery utility that, using a proprietary protocol, can recover the configured IP address parameters and/or reset the Super User name, Super User password and IP address parameters to the factory default values (energetic, wireless; 192.168.10.100, 255.255.0.0). In addition it reports the system serial number.

The Merlin utility runs on a PC running the Windows operating system and requires a one-time-use recovery key provided by DragonWave. Proof of ownership and proof of authority must be provided before the key will be issued. When Merlin is invoked, the Horizon Compact+ unit responds with the required information, which is saved in a text file, located in the same directory as the Merlin application.

6.5 Using the Web interface

The Horizon Compact+ Web interface is enabled by default.

Open a Web browser and, in the "Address" or URL field at the top of the page, enter the IP address of the Horizon Compact+ unit (default is 192.168.10.100) and press Enter. If your laptop or PC has been correctly set up, you will be prompted for the user name and password. Type in the Super User name and password. The same security access option selected when you purchased the system is also applied to the Web interface. For the DragonWave default option the Super User name is "energetic" and the password is "wireless".

The web page interface is intuitive and can be used to configure most of the basic configuration requirements and also some advanced features. However, it cannot be used to configure all features (e.g. system user accounts). Its best use is for monitoring the status of systems that are already configured and for making changes to the existing configuration. See Volume 2 of this manual to see a detailed description of the web interface.

7.0 Antenna Mounting and Tower Specifications

The Horizon Compact+ unit clip mounts onto a range of antennas, providing a variety of gain and range options. The same mounting system is used for all sizes of antenna. Where multiple Dragonwave radio systems are located on the same pole/tower, it is recommended that all radios be either TxHigh or TxLow.

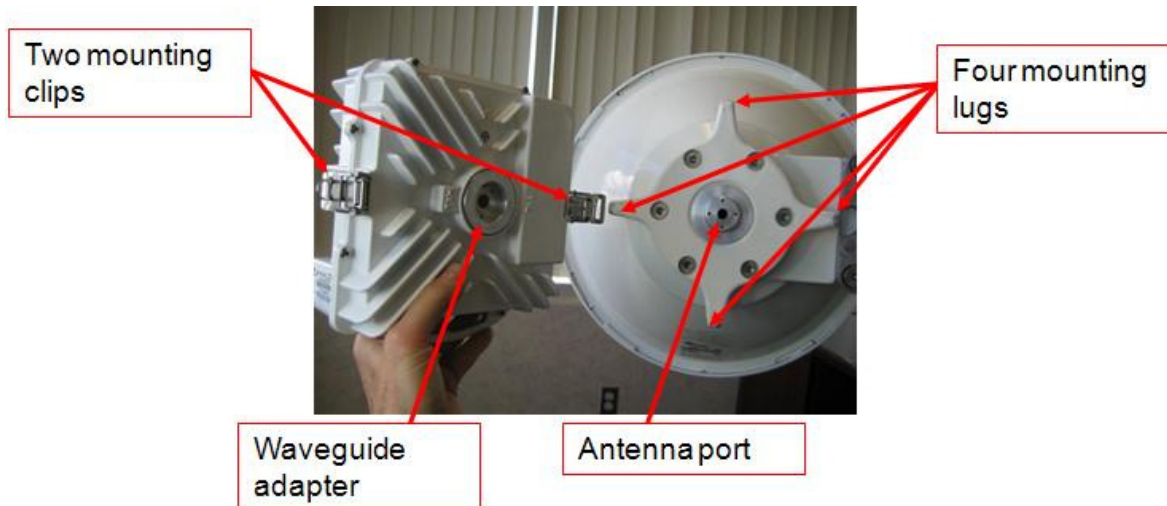



Figure 7-1 Horizon Compact+ showing clip mount features

The Horizon Compact+ unit has two, integral, spring loaded, mounting clips. DragonWave antennas have matching mounting lugs, to which the mounting clips attach. The antenna port and the waveguide adaptor of the Horizon Compact+ unit, fit together, and are weather-sealed with a lubricated 'O' ring located on the outside surface of the antenna port. See the step by step mounting instructions below:

	<p>Caution</p> <p>The interface between the antenna port and the waveguide adaptor is very tight and care must be taken both when mounting and removing the Horizon Compact+ to/from its antenna.</p>
---	---

1. Ensure O-Lube supplied with the product is applied to the O-ring prior to mating the Horizon Compact+ to the Waveguide adaptor.
2. With the Horizon Compact+ unit (waveguide side uppermost) resting on a firm, flat surface, carefully place the Antenna on the Horizon Compact+ and loosely engage the two clips into the mounting lugs. **DO NOT** try to force the antenna onto the Horizon Compact+ manually. **The concentric alignment of the Horizon Compact+ to the adaptor is critical during engagement to prevent damage and metal galling.**
3. Ensure that the drain holes in the antenna are positioned such that with the Horizon Compact+ in the vertical orientation, one drain hole points down.
4. Push down both clips on the Horizon Compact+, **at the same time**, drawing the Horizon Compact+ and adaptor together until they are fully seated.

Note: The waveguide interface to the antenna is circular. The antenna is not polarization specific. The polarization is determined by orientation of the Horizon Compact+ Unit. A visual polarization indicator (an "arrow") can be found on the Horizon Compact+ housing. If the Horizon Compact+ is installed with the polarization indicator in the vertical plane then the unit is in vertical polarization. Similarly, if the polarization indicator is in the horizontal plane then the unit is in horizontal polarization.


7.1 Polarization

Point-to-point Horizon Compact+ units that operate on licensed radio bands use a diplexer system to simultaneously handle transmitted and received signals to/from the dish/reflector. In this case, both transmit and receive radios must have the same signal polarization.

Horizon Compact+ units that operate in the licensed Local Multi-point Distribution Service (LMDS) radio band (31 GHz) and Horizon Compact+ units that operate in the 24 GHz unlicensed radio band, use an orthogonal mode transducer (OMT) to allow the radios to simultaneously transmit on one polarization and receive on the opposite polarization.

7.1.1 Point-to-point Licensed Radio Bands

Both Horizon Compact+ units must be mounted on the pole/tower oriented for the same polarization. i.e. both vertical polarization, or both horizontal polarization.

	<p>Caution</p> <p>Cross-polarized radios or antennas result in the signal strength being 20-30 dB below expected RSL levels! Ensure both radios have the same orientation (vertical or horizontal).</p>
---	---

The radio frequency polarization is indicated by an arrow molded into the Horizon Compact+ housing. Attach the Horizon Compact+ to the dish/reflector so that the arrow points either vertically or horizontally, as required, when the assembly is attached to the mounting post or tower. With the arrow horizontal (pointing to the left) – horizontal polarization; with the arrow vertical (pointing upwards) – vertical polarization. For licensed frequencies, the required radio polarization is defined in your licensing documentation.

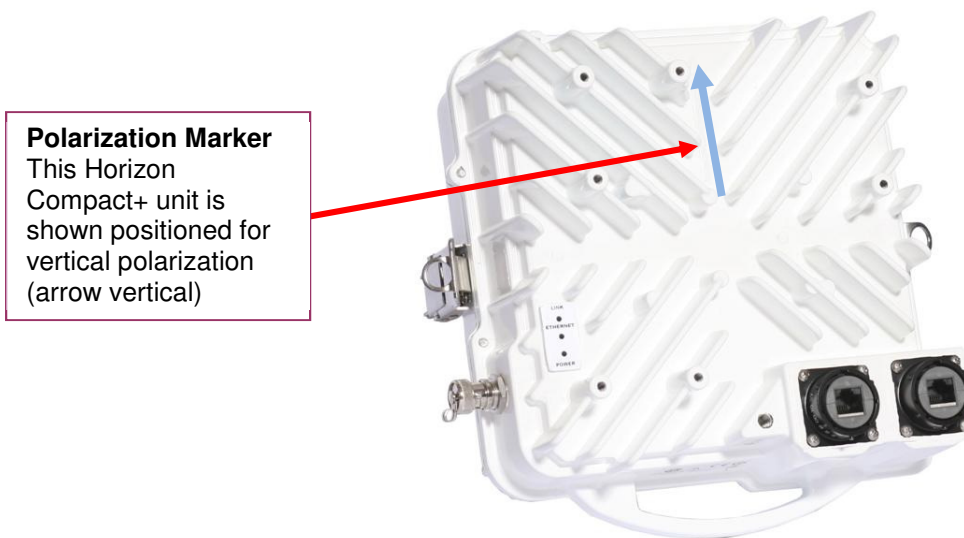



Figure 7-2 Horizon Compact+ polarization marker

7.1.2 LMDS and Unlicensed Radio Bands (UL24)

For 31 GHz licensed LMDS radio bands and the 24 GHz unlicensed radio bands, regulatory bodies require that radios in a system have to be cross-polarized. This means that the polarization of the transmitter signal at one end of the link, or distribution system, is vertical and the transmitter signal polarization at the other end is horizontal.

The radio at one end transmits with vertical polarization and receives with horizontal polarization, while the other end transmits with horizontal polarization and receives with vertical polarization.

The radio frequency polarization is indicated by an arrow molded into the Horizon Compact+ housing.

	<p>Caution</p> <p>For 31 GHz LMDS and 24 GHz Unlicensed Band, radios MUST be cross-polarized. i.e. Vertical polarization at one end and horizontal polarization at the other. For 24 GHz unlicensed band It does not matter at which end either radio is installed.</p>
---	---

Attach the Horizon Compact+ to the dish/reflector mount so that the arrow points either vertically or horizontally, as required, when the assembly is attached to the mounting post or tower. With the arrow horizontal (pointing to the left) – horizontal polarization; with the arrow vertical (pointing upwards) – vertical polarization. For LMDS and unlicensed frequencies, one end of the link has to have vertical polarization and the other horizontally polarization (cross-polarized). For unlicensed frequencies (24 GHz) it does not matter which end of the link has a specific polarization.

7.1.2.1 Unlicensed (UL24) Dish/Reflector Information

The 24 GHz unlicensed Horizon Compact+ has been designed to operate with the dish/reflector types listed in **Table 7-1**, and having a maximum gain of 43.7 dBi. Dish/reflectors not included in this list or having a gain greater than 43.7dBi **are strictly prohibited for use with this device.**

Table 7-1 Allowable Dish/Reflectors – Unlicensed Systems

24UL Dish/Reflector Data		
30 cm (1 foot)	Andrews VHLP1-26DW	36.2dBi
60 cm (2 foot)	Andrews VHLP2-26DW	40.8dBi
75 cm (2.5 foot)	Andrews VHLP2.5-26DW	43.7dBi

7.2 Pole and Tower Specifications

It is important that mounting posts or towers used meet the DragonWave specifications for rigidity to minimize the effects of twist and sway on the alignment of the link. Note that the maximum twist and sway angle allowable is equal to half of the antenna beam width.

Table 7-2
Twist and Sway Specifications – Selected Frequencies

Frequency	Antenna Diameter	3 dB Beamwidth (degrees)	Maximum Twist and Sway (degrees)
18 GHz	30 cm/12"	3	+/- 1.5
	60 cm/24"	2	+/-1
	90 cm/36"	1.3	+/- 0.65
	120 cm/48"	1	+/- 0.5
23 GHz	30 cm/12"	2.7	+/- 1.35
	60 cm/24"	1.7	+/- 0.85
	90 cm/36"	1.1	+/- 0.55
	120 cm/48"	0.8	+/- 0.4

Table 7-3
Mounting pole specifications

Antenna Diameter	Steel Pipe Nominal Outside Diameter	Max. Distance Above Last Rigid Attachment Point
30 cm/12"	7.5 cm/3 "	90 cm/36"
30 cm/12"	10 cm/4"	120 cm/48"
60 cm/24"	7.5 cm/3"	75 cm/30"
60 cm/24"	10 cm/4"	90 cm/36"
75 cm/30"	10 cm/4"	75 cm/30"
90 cm/36"	10 cm/4"	(tower mount recommended)
120 cm/48"	10 cm/4"	(tower mount recommended)
180 cm/72"	11.5 cm/4.5"	(tower mount recommended)

Twist and sway caused by wind or human activity can cause a link to fail. Using poles with specifications shown in Table 7-3 will result in a stable mounting system. Systems with antenna sizes of 90 cm/36" in diameter and greater, are recommended to be mounted on towers.

8.0 Grounding, Power and Lightning Arrestors

Note: For effective protection against lightning-induced surges, proper grounding and shielding practices MUST be followed for the ENTIRE installation. Consult DragonWave Inc. Technical Note: HC-TN-001 Horizon Compact+ PonE and Quick Reference Guide before installation!

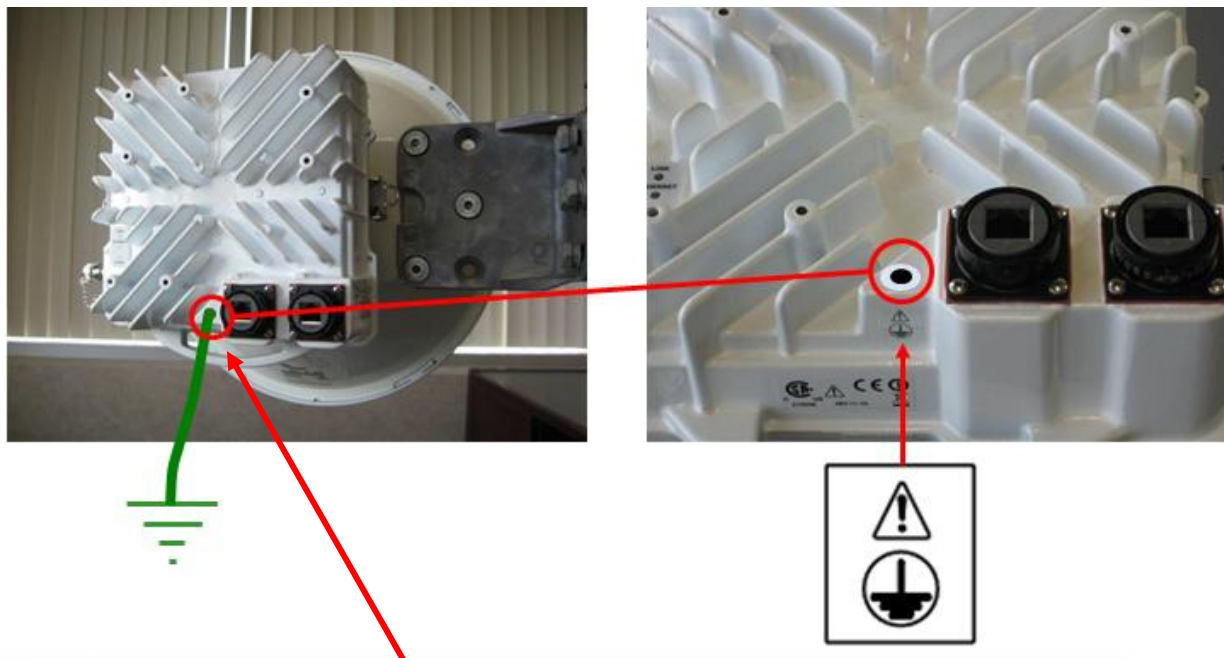
The Horizon Compact+ unit must be grounded using a minimum of 6 AWG copper wire attached to the metric thread (M6 x 1.0), grounding point as shown in Figure 8-1. Two 12 mm long bolts are supplied.

Lightning Arresters and lightning protection is built into the Horizon Compact+ unit.

The Ethernet and PonE cables must be properly protected at the end of their run as they enter the building. Before Ethernet cables enter buildings, voltages shall be clamped down to SELV by approved type primary protectors.

For the copper interface option, proper use of the DragonWave Horizon Compact+ PonE unit provides lightning and surge protection for the connected network. The PonE unit shall be installed according to local Electrical Safety Codes.

For the optical interface, proper use of the DragonWave Lightning Arrestor unit protects the optional management Ethernet connection (if used) and the power supply.



Grounding

Use 6 AWG or larger copper wire to connect from Horizon Compact Plus case grounding point to ground. There is one grounding point beside the Port 2 connector.

Note that the grounding point has a metric thread, M6 x 1.0. Two 12 mm long bolts are supplied.

Figure 8-1 Horizon Compact+ case grounding point

8.1 Power on Ethernet (PonE)

The copper interface variant of Horizon Compact+ operates on -48 VDC and employs a proprietary Power on Ethernet solution. The Horizon Compact+ Outdoor and Indoor Power on Ethernet Lightning Arrestor units provide integration of -48 VDC and data signals on the **straight through** Ethernet data cable. Power is not integrated onto the optional out-of-band management Ethernet cable.

Note: The Horizon Compact+ PonE implementation is proprietary and does not follow IEEE standards.

The Lightning Arrestor uses RJ45 connectors for the Ethernet cables and screw-terminals for the -48 VDC power connections. Dual -48 VDC power connectors are provided, allowing for the connection of redundant power supplies.

The Lightning Arrestor unit contains protection against cable transients and power surges caused by lightning or other sources. The Lightning Arrestor is installed at the opposite end of the CAT5E/PonE cables to that of the Horizon Compact+ unit and protects the network.

To ensure adequate lightning protection, the PonE Lightning Arrestor unit must be properly grounded.



CAUTION

For Release 1.1 and earlier, serious damage to network switches or routers can occur if the network is plugged into the connectors marked "TO HORIZON UNPROTECTED". Power is fed to the Horizon Compact+ unit along the same wires that carry Ethernet traffic to the Horizon Compact+ unit. Unless you have the Release 1.2 PonE adapter, do not, under any circumstances, plug cables connected to the network into the RJ45 connectors marked "TO HORIZON UNPROTECTED".

CAUTION

Only use straight through Ethernet cables to connect the PonE adapter to the Horizon Compact+. Using cross-over cables will result in damage to the Horizon Compact+ unit.

CAUTION

Use shielded CAT5E cables with shields and drain wires connected to metal head shells of RJ45 connectors, at BOTH ends of cable for all unprotected, outdoor cable runs to Horizon Compact+ Unit!

Use unshielded CAT5 cables and/or RJ45 connectors for protected-side cable runs to network equipment.

Horizon consumes a nominal 20 Watts (standard power), or 40 Watts (high power variant) from the -48 VDC supply. All eight of the wires in the Ethernet cable are used to carry power to the Horizon Compact+ unit. The Power on Ethernet Lightning Arrestor unit is rated at 2 amps.

The PonE unit has a protection feature that prevents power from being supplied to the Horizon Compact+ if it detects any under or over voltage/current conditions (see Section 5.1.4). Over or under voltage/current conditions can occur if cables are incorrectly terminated.

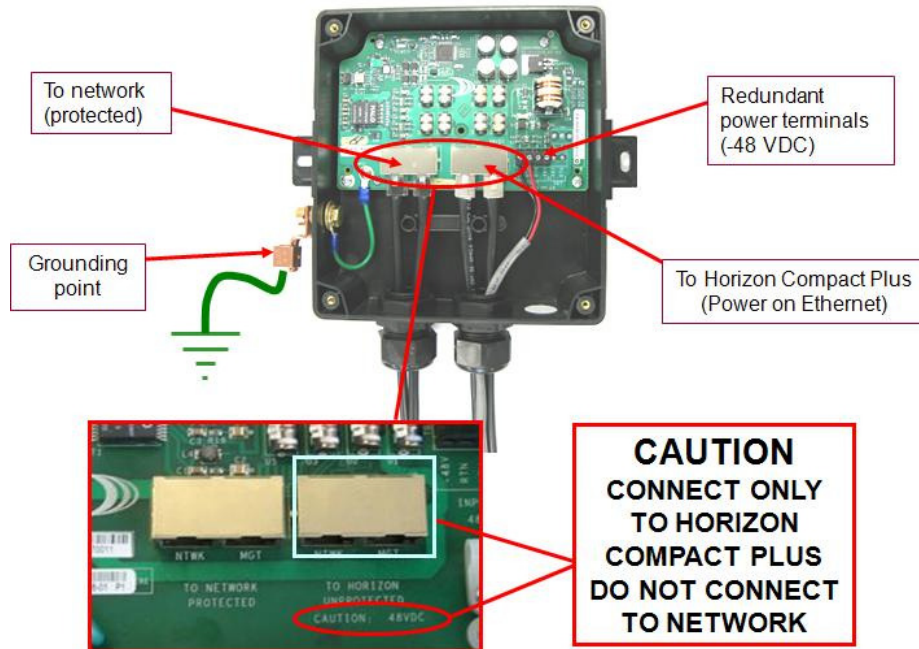


Figure 8-2 Outdoor Lightning Arrestor and Power injector

Cables are secured in the Outdoor PonE unit by means of the cable entry gland nuts. A special three-hole, rubber, grommet is provided to accommodate two CAT5 cables, plus a power feed cable (See Section 4.3.2). Cables with sheath diameters of between 0.35” and 0.62” can be accommodated when the special grommet is removed.

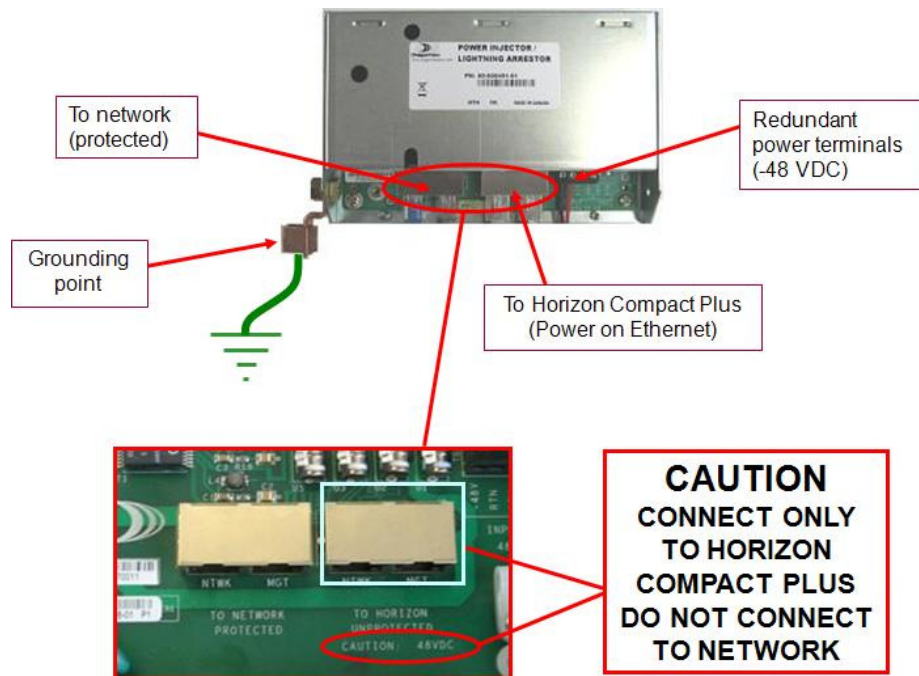


Figure 8-3 Indoor Lightning Arrestor and Power injector

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9.0 Locating Horizon Compact+ Systems

For both licensed and unlicensed systems, their location, relative to nearby obstacles, is an important factor to consider when planning an installation. For systems mounted on buildings, roof edges and parapets, the roof surface itself, air conditioning plant, other antenna systems, walls and overhead objects are all considered potential obstacles. On tower mounted systems you must consider the proximity of other antenna systems and mounting hardware.

You must also ensure that there is a clear line of sight (LOS) between the antennas of a Horizon Compact+ system link.

9.1 Near Field Effects

Near field effects, resulting from a number of minor radiation lobes normally found around antenna systems, can reflect off nearby objects and interfere with the normal reception of the radio. Reflected waves can also change their polarization. This is especially important for cross polarized LMDS and unlicensed systems.

Consider an LMDS system or an unlicensed installation that transmits with vertical polarization and receives with horizontal polarization. If the near field vertically polarized transmitted signal reflects off an obstacle located too close to the antenna system, then the reflected signal changes its polarization to horizontal, which is the same polarization as the receiver. This causes the receiver to “swallow” the transmitted signal, resulting in receiver “swamping”, excessive noise and the inability to receive the signal from the far end of the link. Ensuring that obstacles and objects are not too close to the antenna system will avoid this problem.

As a “rule of thumb”, for both co-polarized and cross-polarized installations, ensure that you maintain an angle of 45 degrees, or greater, between the far side of the highest part of an obstacle and the underside of the dish/reflector. The diagrams in Figure 9-1 illustrate this approach. Also, remember to apply this rule in all directions around the radio, above, below and to each side. An exception to this rule can be applied when the system is positioned 12.5 m (40 ft) or more from the edge of a roof clear of obstacles (a roof edge is considered an obstacle). In this case the system need not be higher than 2.5 m (8 ft) above the roof surface.

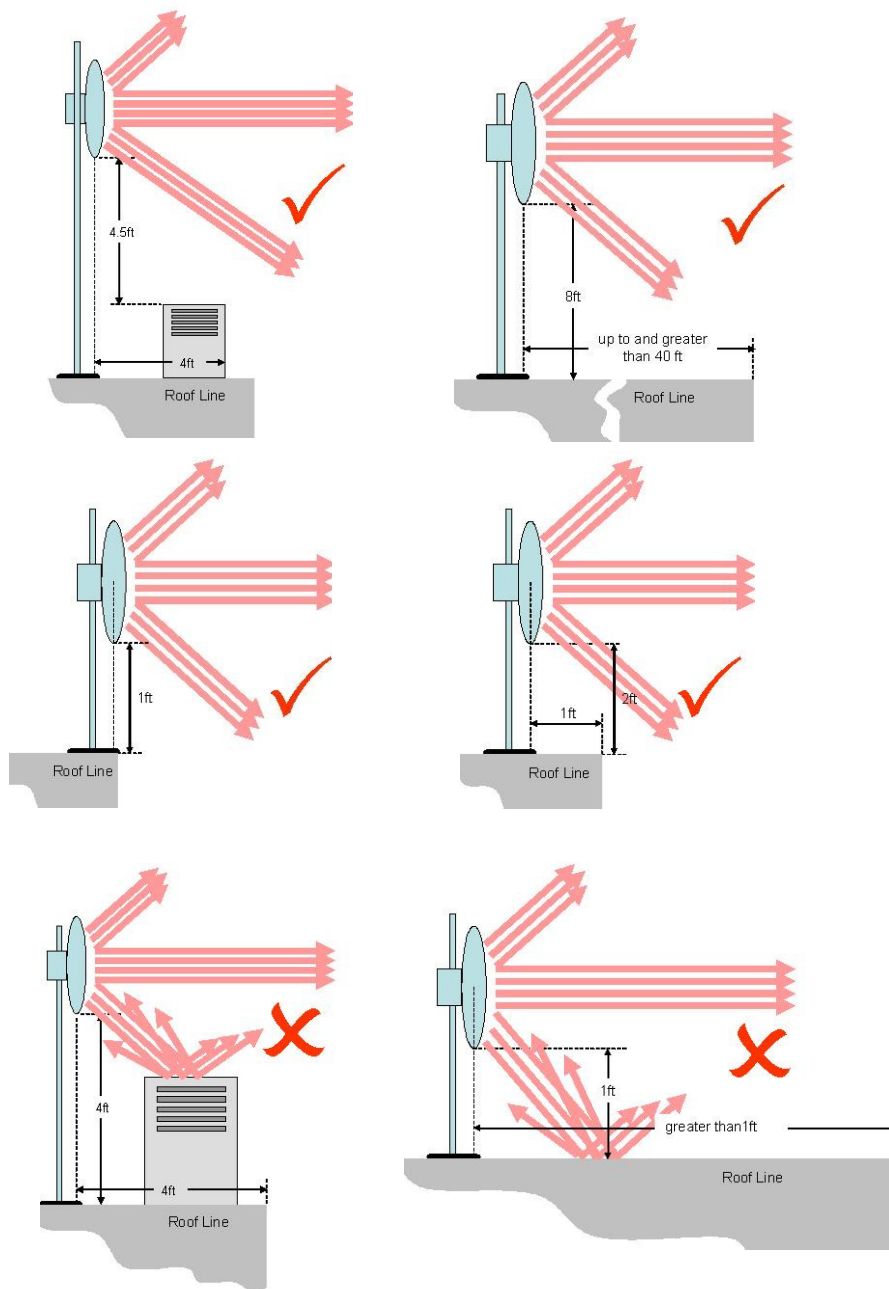
Table 9-1 shows the minimum antenna height requirements above obstacles for the 24 GHz Unlicensed frequency band.

Table 9-1 System Height vs Obstacle Distance for 24 GHz Unlicensed

Distance from Obstacle in cm (ft)	0 (0)	30 (1)	60 (2)	90 (3)	120 (4)	150 (5)	180 (6)	210 (7)	240 (8)	270 (9)	300 (10)	600 (20)	900 (30)	1200 (40)	>1200 (>40)
Minimum System Height above Obstacle in cm (ft)	30 (1)	60 (2)	90 (3)	120 (4)	131 (4.36)	134 (4.46)	137 (4.55)	139 (4.64)	142 (4.73)	145 (4.82)	147 (4.91)	175 (5.82)	202 (6.73)	229 (7.64)	240 (8)

The following figures illustrate examples of correct and incorrect system location.

Figure 9-1 Correct & Incorrect System Location



Near field effects are also experienced above and on each side of the front of a system. Ensure that these areas are also free of obstructions.

9.2 Clear Line of Sight (LoS)

The DragonWave Horizon Compact+ requires a clear LoS between the units at each end of the link. You must be able to see an unobstructed view of the antennas from each end. Avoid obstacles that are close to the LoS mid-way between antennas, but not blocking it, as this can have a negative impact on signal quality (Fresnel zone clearance).

The Fresnel zone is an area of the antenna radiation pattern that lies mid way between the two system antennas. The size of this area is dependant upon the frequency being used and the distance between antennas. You should avoid having any obstructions within the Fresnel zone. Note that you may be able to see the far end antenna without obstruction, but still have obstacles in the Fresnel Zone. Signal quality will deteriorate if obstacles encroach too deeply into the Fresnel zone. Encroaching up to the 60% mark is acceptable.

Also, ensure that antennas are mounted with adequate clearance from roof tops, roof edges, walls and other obstacles (e.g. air conditioning plant) to avoid problematic near field effects.

Figure 9-2 Obstruction of the Fresnel Zone

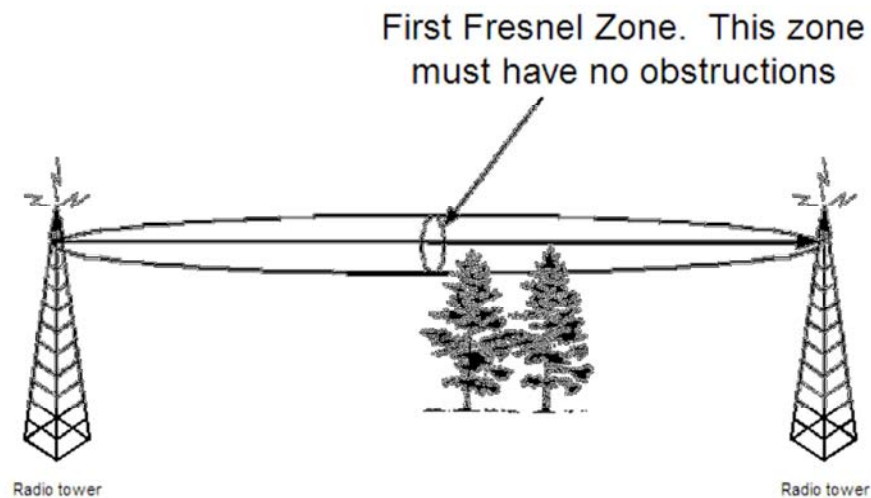
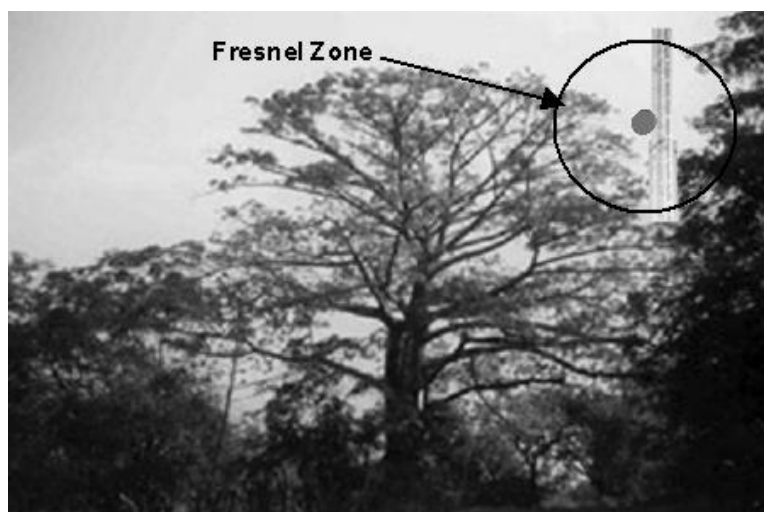


Figure 9-3 Trees within the Fresnel Zone Obstruct the Signal



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10.0 Preparing for Alignment

The Horizon Compact+ and antenna assembly is attached to the mounting post, or tower, with a specialized mounting bracket that allows fine orientation adjustment of the Horizon/antenna assembly. The same mounting bracket is used for all antenna sizes.

Visual alignment is achieved by rotating the assembly on the post, or tower, and positioning the assembly so that the antenna is visually aligned with the target system before tightening the mounting bracket clamp. Final alignment is achieved using the azimuth and elevation adjustment bolts. Once alignment is achieved, the adjustment mechanisms are locked in place with lock nuts.

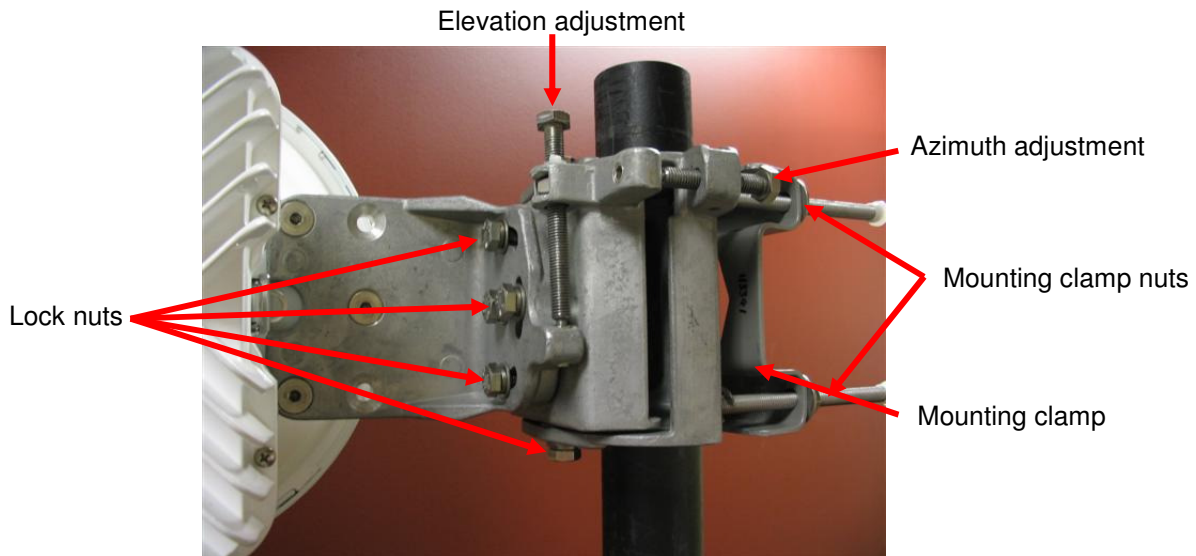


Figure 10-1 Mounting bracket with fine adjustment bolts

Final alignment is achieved by monitoring the received signal level (RSL) values as the system is adjusted for azimuth and elevation. The BNC Field Strength Monitor connection is used in conjunction with a voltmeter for RSL monitoring. See Section 10.1. Adjustments are made until the RSL value is at a maximum, which should be within ± 3 dB of the expected value (link budget figure).

10.1 Received Signal Level (RSL) Measurements

To accurately align the Horizon Compact+ to its far end peer, you need to monitor the received signal level (RSL). There are two recommended methods for monitoring RSL. These are:

1. Use the CLI command ***set alignment on*** to activate the alignment feature at the BNC connector located on the side of the unit. Connect a voltmeter to the BNC connector. The voltage at this connector is linearly related to RSL and is 1 mV per dB e.g. -45 mV = -45 dB. Note that the centre connection on the BNC connector is positive, so to read negative values (to correlate with the negative RSL values) connect the negative pole of the voltmeter to the centre connection.

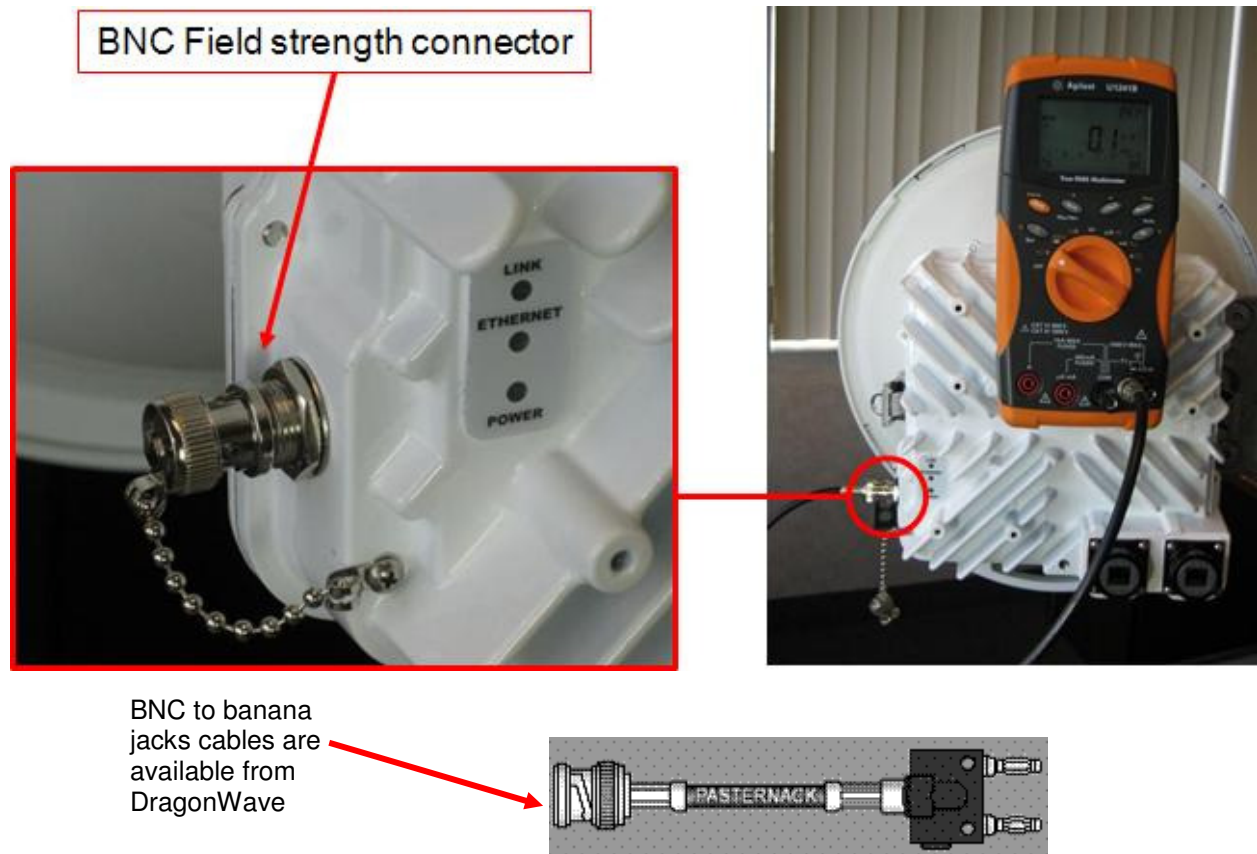


Figure 10-2 Voltmeter connections to BNC field strength monitoring connector

2. Alternatively, readings can be made remotely via the Web interface, using the Tools – Link Alignment menu option. An operator would then have to continually relay RSL readings, via a radio or cell telephone, to the rigger adjusting the positioning of the system.

10.2 Important Factors

When you prepare to align the radio antennas, you must consider three important factors:

1. the radiation patterns of dish antennas (main lobe and side lobes)
2. the need for a Clear Line of Sight (LoS) (see Section 0)
3. the sensitivity of the alignment adjustment

10.2.1 Antenna Radiation Patterns

Dish antennas radiate a primary signal (main lobe) and a number of secondary signals (side lobes). The main lobe is the strongest. When you align the radios, you must make sure to align to the main lobe of the signal. If you mistake the first side lobe for the main lobe during installation, there can be a 20-30 dB loss of signal strength. For example, if the Calculated RSL = -42 dB then the side lobe would be at approximately -62 dB, or 20 dB lower than the calculated level.

Table 10-1 Antenna Gains and Beam Widths – Selected Frequencies

Antenna Size	18 GHz Horizon		23 GHz Horizon	
	Beamwidth of main lobe (degrees, 3 dB)	Gain dBi	Beamwidth of main lobe (degrees, 3 dB)	Gain dBi
30 cm/12"	3.0 degrees	34	2.7 degrees	35.1
60 cm/24"	2.0 degrees	38.6	1.7 degrees	40.2
90 cm/36"	1.3 degrees	42.0	1.1 degrees	43.7
120 cm/48"	1.0 degrees	44.5	0.8 degrees	46.2

Although in most cases only the first two side lobes are detected, depending on dish antenna size and the distance between sites, it may be possible to “see” several side lobes (see Figure 10-3).

It is wise to pan the full 35 degrees available with the antenna alignment adjustment to locate all the lobes that may be present, so that the main lobe can be positively identified. As you pan through the signal, the side lobes will show up as peaks in the receive signal level (RSL), each peak getting stronger as you approach the main lobe. The main lobe will always be the strongest.

The size of the beamwidth for the Horizon Compact+ systems is approximately 2 degrees. Two degrees is approximately equivalent to a thumb's width when one's arm is fully extended. Align as closely to the centre of the 2-degree beamwidth as possible. It takes very little adjustment to swing past the main lobe, as can be seen in Figure 10-5. A beamwidth of 2 degrees is very narrow and alignment errors can occur when you lock onto a side lobe instead of onto the main lobe. If you align to one of the side lobes, your signal strength will be reduced. Make sure you align the system to the main lobe.

Note: Verify the RSL is within 2 – 4 dB of the calculated value.

Figure 10-3 Main and Side Lobes

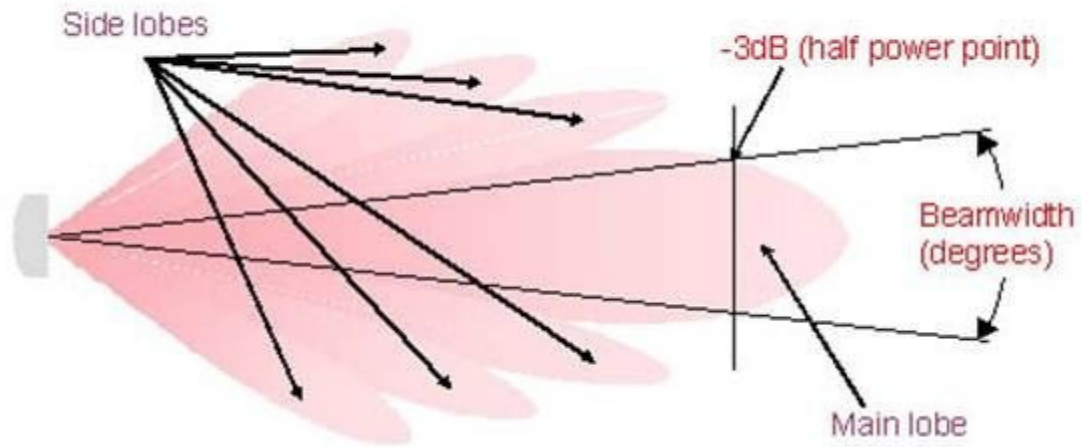


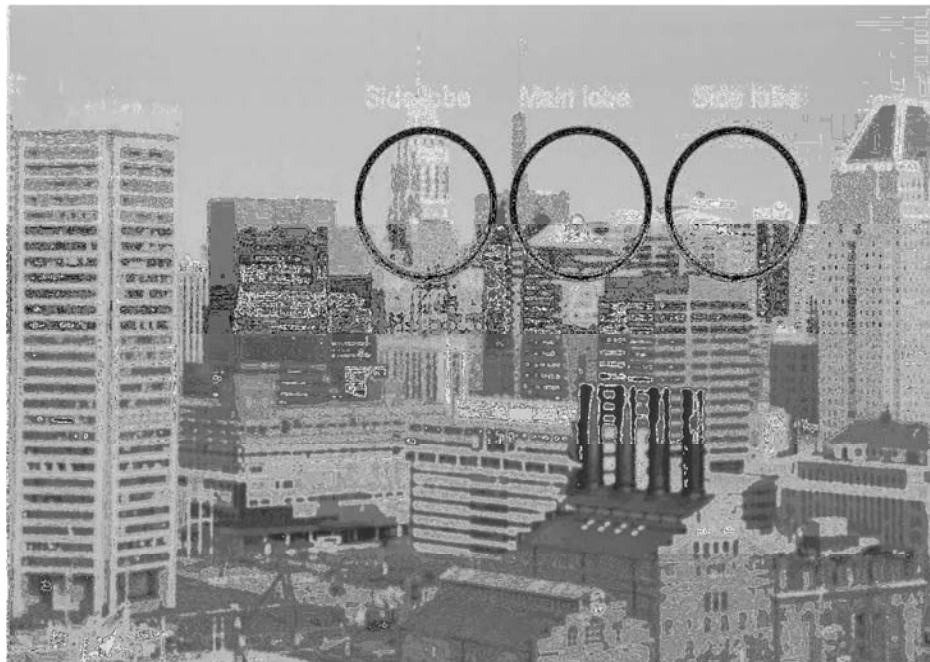
Figure 10-4 Typical main lobe coverage using 23 GHz Radio with 24" dish antenna



Table 10-2 Approximate size of beam at destination

Beamwidth	1 km	3 km	5 km	8 km	10 km
2° (18/24" antenna)	35m	105m	175m	280m	350m
1.3° (36" antenna)	23m	68m	114m	182m	227m
1° (48" antenna)	18m	54m	90m	144m	175m

Figure 10-5
Main lobe and side lobes (distance of approximately 4 km)



10.2.2 Clear Line of Sight

See Section 9.2 for more details.

10.2.3 Sensitivity of the Alignment Adjustment

When performing the RF alignment of the antennas it cannot be over emphasized that you must rotate the adjustment nut(s) 1/10th of a turn at a time between taking RSL readings (allow time for the RSL reading to update). Table 10-3 shows how many degrees the antenna will move when the adjustment nut(s) is rotated through one full turn. Error! Reference source not found. Table 10-1 shows that the beam width of the typical antenna is often less than the amount of movement available with one full turn of the aiming adjustment.

Table 10-3 Degrees per Revolution of Adjustment

Antenna Size	Change in Elevation (Tilt)	Change in Azimuth (Pan)
30 cm/12" and 60 cm/24"	2.2 ° per full turn of adjustment	1.6 ° per full turn of adjustment
90 cm/36" and 120 cm/48"	1.3 ° per full turn of adjustment	1.1 ° per full turn of adjustment

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11.0 Aligning the Antennas

Follow the steps of the alignment procedure shown below. **Note:** ensure that the CLI command **set alignment on** has been entered at both ends of the link if you are using the BNC connector to measure field strength.

The alignment process is carried out in two stages.

1. Visual alignment of the antennas
2. Radio frequency alignment of the antennas

11.1 Visual Alignment of the Antennas

This section details how to align the Horizon Compact+ antennas visually.

Procedure 11-1

Align the antennas visually

Before attempting to visually align the Horizon Compact+ systems, make sure that the aiming adjustment mechanisms (pan and tilt) on the mounting assembly are set to their mid positions. This ensures that there is adequate to and fro movement available from the adjustment mechanism for fine adjustment later. To visually align, loosen the clamping nuts and rotate the mounting assembly clamp on the mounting pole, then, securely tighten the clamp.

There are three methods that are recommended for visually aligning the systems. In each case the use of signaling mirrors, on a sunny day, or a powerful flashlight for dull days, may greatly assist in locating the other end of a link.

1. **If the far end site is visible**, aim the near end dish/reflector towards the far end site as accurately as possible. The beamwidth of the signal is approximately 2 degrees (or less), which is approximately equivalent to a thumb's width when the arm is fully extended. Align as closely to the centre of the 2-degree beamwidth as possible. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 11-1** for torque values. Repeat this for the far end site. This should provide you with a signal strong enough to perform an accurate alignment later.
2. **If the far end site is NOT visible (due to poor visibility), and the site locations appear on a map**, use a large scale map of the area and mark the positions of each end of the link. Draw a line on the map between each of the ends of the link. Locate a landmark which falls on the line that is visible from the near end and point the dish/reflector to the landmark. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 11-1** for torque values. At the far end of the link locate a second landmark, visible from the far end, that falls on the line and align the far end dish/reflector to that landmark. Clamp the mounting bracket as before. The systems should be aligned sufficiently to obtain a signal strong enough to perform an accurate alignment later.

Table 11-1
Torque Specifications for Antennas

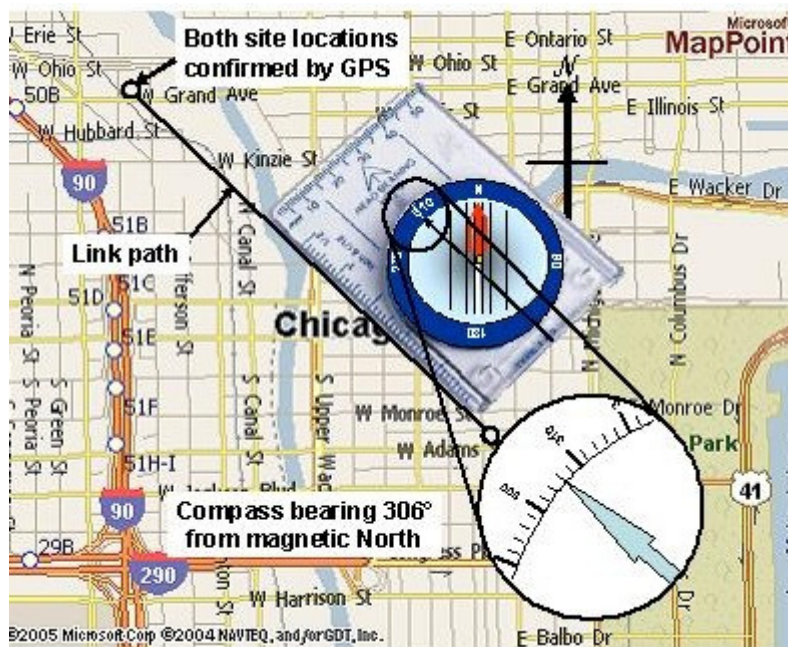
Bolt size (in inches)	Nut torque
¼	50 in-lb
5/16	102 in-lb
3/8	15 ft-lb
7/16	24 ft-lb
½	37 ft-lb
9/16	37 ft-lb

Figure 11-1
Aligning Systems Using Local Landmarks



3. If the far end site is NOT visible (due to poor visibility), and there are no visible land marks, use a GPS unit to obtain accurate coordinates for each end of the link. Plot these on a map of the area and draw a line between each site. Using a compass, physically align the map so that the magnetic North compass bearing marked on the map coincides with actual magnetic North shown on the compass. Use the compass to measure the bearing of the line drawn between each site relative to magnetic North. At each end of the link, use this compass bearing to aim your systems. Clamp the radio/antenna mounting brackets in place on the pole/tower torquing the nuts to specification. See **Table 11-1** for torque values. The systems should be aligned sufficiently to obtain a signal strong enough to perform an accurate alignment later.

Figure 11-2
Using GPS and Compass Bearings to Align Systems



This concludes the steps to align the radios visually.

11.2 Radio Frequency (RF) Alignment of the Antennas





This section describes how to perform the RF alignment of the Horizon Compact+ systems antennas.

Note: The Horizon Compact+ BNC Field Strength connector serves two purposes. It is used for RF alignment and for system redundancy purposes. When used for RF alignment it provides an output voltage of 1 mV DC per dB of signal strength. Connecting a digital voltmeter to this connector will provide you with a convenient way of measuring field strength and confirming system RF alignment. Use the CLI command **set alignment on** press Enter, to enable the field strength measuring option. When used for redundancy purposes (not supported in this release) ensure that the CLI command **set alignment off** is used.

The DragonWave Horizon Compact+ Web Interface may also be used for RF alignment. From the Home page, select Tools, then Link Alignment. The RSL readings displayed are continuously updated and the highest value reached is retained to facilitate the alignment procedure.

When you prepare to align the systems, you must consider the three important factors noted in Section 10.2 and repeated below:

1. The radiation pattern of the Horizon Compact+ antennas (main lobe and side lobes)
2. The need for a Clear Line of Sight (LOS) and avoiding the Fresnel zone
3. The sensitivity of the alignment adjustment – one tenth of a turn at a time

	<p>Caution</p> <p>Alignment of the Horizon Compact+ requires power to be supplied to the PoE and surge protector unit.</p>
	<p>Caution</p> <p>Proper alignment results in increased signal quality! Once the Horizon Compact+ units have been visually aligned, detailed alignment can begin. Pan across the entire beamwidth to ensure the alignment corresponds to the main lobe and not to a Side Lobe.</p>
	<p>Caution</p> <p>Transmission of radio signals results in a primary signal (main lobe) and secondary signals (side lobes) being sent towards the destination. During installation the side lobes can be mistaken for the main lobe, resulting in a 20-30 dB loss of signal strength. On a 12" / 30 cm dish/reflector, the entire beamwidth typically lies within a 5-degree span so it is critical to ensure alignment targets the main lobe and not the side lobes. Larger dish/reflectors have a narrower beam. For a 24"/60 cm dish/reflector, the entire beamwidth lies within a 3-degree span.</p>
	<p>Caution</p> <p>It is possible to get a "peak" reading during the system alignment process if one or both of the systems is aligned to a side lobe. In such a case, the measured receive level may be 20 dB or more lower than the calculated value. Be aware that the link may still function under these circumstances. If the readings are within 2 - 4 dB of the calculated levels, then the systems are most likely to be properly aligned.</p>

Follow the steps of the alignment procedure shown below:

Note: When loosening pan and tilt lock nuts, loosen only enough to allow the mechanism to move freely. If lock nuts are too loose the antenna will move out of alignment when the lock nuts are re-tightened.

At the first end:

incorrect antenna alignment - aligned to a side lobe and not main lobe
improper polarization of antennas – one end horizontal and the other vertical
path issues - obstructions such as trees, hills, or buildings within the beamwidth
path clearance issues such as diffraction, partial obstruction, Fresnel zone issues

1. Loosen the pan mechanism lock nuts
2. Pan or move the antenna horizontally across the entire range of adjustment to identify the main lobe and the side lobes. The main lobe is approximately 2 degrees in width (depends on frequency and antenna size). The two major side lobes are approximately 5 degrees apart. Adjust the antenna to the main lobe (approximately).
3. Tighten the pan mechanism lock nuts and loosen the tilt mechanism lock nuts.
4. Tilt or move the antenna vertically until you receive the strongest RSL reading.
5. Tighten the tilt mechanism lock nuts and loosen the pan mechanism lock nuts.
6. Pan or move the antenna horizontally to locate each of the lobes. Record the RSL values of each. Select the strongest RSL recorded and readjust the antenna to this strongest RSL reading.
7. Re-tighten the pan/tilt mechanism lock nuts to lock the antenna in place.

At the other end:

8. Repeat steps 1 through 7

Return to the first end:

9. Loosen the pan mechanism lock nuts.
10. Pan or move the antenna horizontally across the entire range of adjustment to identify the main lobe and the two major side lobes. Adjust the antenna to the main lobe (approximately).
11. Tighten the pan mechanism lock nuts and loosen the tilt mechanism lock nuts.
12. Tilt or move the antenna vertically until you receive the strongest RSL reading.
13. Tighten the tilt mechanism lock nuts and loosen the pan mechanism lock nuts.
14. Pan or move the antenna horizontally and locate the strongest RSL reading.
15. Re-tighten the pan/tilt mechanism lock nuts to lock the antenna in place.
16. Repeat steps 1 through 15 as necessary to obtain maximum RSL reading.

The RSL level should be within ± 3 dB of predicted levels. Factors that contribute to low RSL levels are:

11.3 Signs of a Healthy Link

You can be confident that a link is properly aligned and free of problems if the following readings are obtained during a Telnet or Web interface session with each end of the link :

No alarms – use the CLI command **get alarms** and press Enter to return a list of current alarms – should be none that cannot be explained by network status

Received signal level (RSL) within ± 3 dB of link budget figure in clear weather. Use the CLI command **get modem statistics** and press Enter to obtain the RSL reading. The Unchannelized power reading should be within 6 dB of the RSL reading. If the Unchannelized power drops below -75 dB, then it is likely that there is no signal being presented at the radio portion of Horizon Compact+. Check alarms.

Eb/No of 19 dB or higher – use the CLI command **get modem statistics** and press Enter to display the Eb/No value

Signal to Noise Ratio (SNR) of 24 dB or higher – use the CLI command **get modem statistics** and press Enter to display the SNR value

Equalizer Stress typically between 20 and 30, but never more than 150 - use the CLI command **get modem statistics** and press Enter to display the Equalizer stress value

Rx Block Error Rate 0.00e+00 – use the CLI command **get traffic statistics** and press Enter to display the Rx Block Error Rate. Rx Block errors are an indication of loss of data frames. Note that there are residual Rx Block errors as a result of the alignment process.

Transmit power typically set at the maximum for the radio band used – use the CLI command **get transmit power** and press Enter to return the configured transmit power and the actual transmit power

All sections operational – use the CLI command **get health** and press Enter to return the health status of all three sections of the system

The readings obtained using the CLI commands during a Telnet session can also be retrieved using the Web interface. All items listed here are available on the left-hand pane of the Web interface and appear on each Horizon Compact + web page.

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12.0 Advanced Configuration Features

DragonWave Horizon Compact+ has a number of optional advanced configuration features that may be applied if desired. It is recommended that they only be applied once the Horizon Compact+ is satisfactorily aligned and successfully carrying traffic. Note that some of these features may require a license obtainable from DragonWave Inc. The following lists the available configurable features:

Upgrade/Downgrade Licensed Features*	Configuring the Time Source (SNTP) *
Configuring Ethernet Ports 1 and 2 *	Adaptive Modulation *
RADIUS Server User Authentication *	System Redundancy/ Throughput Doubling *
Management VLAN Tagging *	System Management*
Quality of Service (QoS) *	Event and Performance Logging*
Pause Frames *	Radio and Network Loopback*
Bandwidth Management *	Network Management*
Adaptive Transmit Power Control (ATPC) *	Editing System Configuration Files*
Authentication *	EOAM **
Threshold Alarms *	LLDP **
Rapid Link Shutdown (RLS) *	ECFM **

Detailed configuration information for each can be found in the Horizon Compact+ Product Manual

* Volume 2 - Advanced Features

** Volume 4 - Networking Features

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13.0 Horizon Compact+ Management

The Horizon Compact+ system can be fully managed locally or remotely. Horizon Compact+ supports Telnet access, SNMP management and a Web interface accessible through the IP network. The entire Command Line Interface (CLI) command set is available through Telnet. The entire list of system parameters is available through SNMP access. The Web interface provides access to system configuration and performance parameters. In-band and out-of-band management options are available. Refer to Volume 2 for detailed system management procedures.

13.1 Alarms List

Use the CLI command **get alarms** to display a list of active alarms. Alternatively, alarms are listed on the Alarms page of the Web interface. Active alarms are clearly indicated.

The following list shows the various alarms available:

- Link down
- HAAM configuration mismatch
- ATPC configuration mismatch
- NTP server(s) unreachable
- Aggregate dropped frame threshold
- Bandwidth utilization threshold
- RLS configuration mismatch
- RLS queue based shutdown
- Modem SNR below threshold
- RSL below threshold
- Radio calibration table unavailable
- Radio power amplifier
- Redundancy configuration mismatch
- Operating in forced switch mode
- Active using partner wireless li
- Standby on primary
- BNC cable signal not detected
- SyncE lost lock
- Invalid system configuration
- Transmitter loss of sync
- SyncE configuration mismatch
- Crypto configuration mismatch
- Peer authentication failure
- HAAM operating in lower modulation
- ATPC auto disabled
- Frequency file invalid
- Queue dropped frame threshold
- Queue depth threshold
- RLS shutdown activated
- Modem receiver loss of signal
- Modem equalizer stress above limit
- Radio synthesizer lost lock
- Radio current out of limits
- Temperature out of limits
- Active on secondary
- Enet cross link active
- Standby wireless link is in use
- X2 delivering half the capacity
- Ethernet speed reduced
- SyncE secondary source in use
- MIB change not saved
- Radio linearity calibration error
- Crypto power up tests failed

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14.0 Configuration Backup and Restore

Horizon Compact+ provides a backup and restore facility for system configuration data and user account data. The backup and restore uses an FTP server to transfer files. It is recommended to have an FTP server at your network management site for use with the Horizon Compact+ backup and restore facilities. Note that the Super User or a noc user level can perform backup and restore functions.

14.1 System Configuration Backup

The Horizon Compact+ system configuration can be saved to an FTP server as a text file. All system configuration parameters are backed up, allowing the exact configuration to be replicated.

Log in as the Super User and use the CLI command:

```
config upload ftp://<ftpUserName>:<ftpPassword>@<ftpServerIp>/<hcpConfigFileName>
```

press Enter.

Where

- <ftpUserName>** is the user name for the ftp server
- <ftpPassword>** is the password for the ftp server
- <ftpServerIp>** is the IP address of the ftp server
- <hcpConfigFileName>** is the name of the configuration file, which can be any name

Note that the above command will save the file in the root directory of the ftp server. Adding the path information to the file name will allow you to save it in a specific directory on the ftp server.

14.2 System Configuration Restore

The Horizon Compact+ system configuration can be retrieved from the FTP server on which it was backed up. All system configuration parameters are restored, allowing the exact configuration to be replicated.

NOTE: When the user is restoring a configuration file to a node, you must disable any SNMP polling to that node from any network management system, before issuing the CLI command to download the config file (**config download ftp://etc....**). Otherwise, due to the SNMP interface also being used for the configuration file download process, there is the risk of the download failing.

Log in as the Super User and use the CLI command:

```
config download ftp://<ftpUserName>:<ftpPassword>@<ftpServerIp>/<hcpConfigFileName>
```

press Enter

Note that the command shown will retrieve the file from the root directory of the ftp server. Adding the path information to the file name will allow you to retrieve it from a specific directory on the ftp server.

Configuration files can be edited (**see Volume 2 of this manual for more information and notes relating to limitations associated with configuration restores**). If the file is not in its proper format it will be rejected. If the original file has been modified, the process will prompt for the user to confirm the change and the user has the option to proceed or cancel the operation. If one of the configuration items fails to load, the process will try to undo the previous changes. The last failed configured item and the last failed undo item (if any) will be listed at the end of the process.

After a successful restore, finish with CLI commands **save mib** and **reset system** to reboot the system and activate the restored configuration. Note that **reset system** is traffic affecting.

14.3 User Accounts Backup

The Horizon Compact+ system user accounts can be saved to an FTP server. All user account parameters are backed up, allowing the exact configuration to be replicated.

Use the CLI command: **save users ftp:<filename>** press Enter

where **<filename>** is the name of the file to be created on the FTP server. Follow the prompts.

Note that the above command will save the file in the root directory of the ftp server. Adding the path information to the file name will allow you to save it in a specific directory on the ftp server.

14.4 User Accounts Restore

The Horizon Compact+ system user accounts can be retrieved from an FTP server. All user account configuration parameters are restored, allowing the exact configuration to be replicated.

Use the CLI command: **copy ftp: <filename>** press Enter

where **<filename>** is the name of the file to restore to the Horizon Compact+.

Note that the above command will retrieve the file from the root directory of the ftp server. Adding the path information to the file name will allow you to retrieve it from a specific directory on the ftp server.

15.0 Software and Frequency File Upgrades

From time to time new software loads are made available that may add new features to the Horizon Compact+ system. You can download new software remotely using File Transfer Protocol (FTP).

Depending on the software load currently running in the system, there may be a requirement to load more recent versions before being able to load the latest software version successfully. Frequency file downloads will also be required to enable all new features. Certain existing features may also need to be disabled before software downloads are performed in order for them to be successfully upgraded.

Use the Command Line Interface (CLI) via Telnet and invoke the FTP with either a local FTP server that is on the same network as the Horizon+ system, or use DragonWave's FTP server site available through the Internet. The Horizon Compact+ can interact with the most popular FTP servers on a variety of operating systems. Anonymous FTP, as well as a user-supplied username and password are supported.

Ensure that the new software files required already resides on the FTP server, in a location that you can access.

Procedure 15-1 and Procedure 15-2 should be used to upgrade the system software (OMNI) or the Frequency File or both. The following subsections describe the concept of "Software Banks" and the behavior of the "commit", "copy" and "switch" commands in the context of upgrading the system software or the Frequency File.

15.1 Software Banks

The Horizon Compact+ system has two "banks" called "Bank A" and "Bank B" for the purpose of software upgrade and back-out. Each bank has one OMNI and a directory of configuration files (such as the frequency file and the MIB configuration file and previous versions of those files).

The system keeps track of which bank is "Active" and which bank will be the "Next Active". The "Active" bank is the bank from which the system was booted. The "Next Active" bank is the bank that the system will attempt to boot from the next time the system restarts.

The "Next Active" bank is governed by the "switch bank" command. The status of the "Active" and "Next Active" bank pointers can be determined from the **show sw inventory** command.

The "Backup Bank" is essentially impervious to change except when copying the OMNI or the Frequency File to the system. These two file types always get copied to the "Backup Bank" to enable a single reboot upgrade.

The basic principle of software upgrade is to upgrade the "Backup Bank" and then set the "Next Active" bank to the inactive bank and reboot.

15.2 Commit Command

The "commit" command will make the "Backup Bank" an exact copy of the "Active Bank". The OMNI image and all configuration files (including previous versions) are copied to the "Backup Bank". The MIB is saved as part of this process so that the backup bank has the latest MIB configuration file. After the commit has completed, the system can boot from either bank and exhibit the exact same behavior.

The software upgrade process begins by executing a "commit" command to make both banks identical. Ideally this should have already been done after the last successful upgrade. If anything goes wrong with the software upgrade process then the original system software and configuration can be restored using the "switch bank" command.

The "commit" command is useful outside the software upgrade procedure anytime a change is made to the system. By making sure the system is "committed" prior to experimentation, the user can always return to the previously known good state after experimenting with new configurations.

If the “commit” command is interrupted by a power failure then the “Backup Bank” may not have a complete copy of all of the configuration files. It is recommended to re-execute the “commit” command when power is restored.

15.3 Copy Command

The “copy” command is used to copy files from the specified URL to the system. The URL of the source file is of the form [ftp://\[userid\[:password\]@\]<ipaddress>/directory/<filename.filetype>](ftp://[userid[:password]@]<ipaddress>/directory/<filename.filetype>). Valid characters are [a-z][A-Z][0-9]{_-.}. Note that there is no destination per se; the system determines the destination within the system based on the filetype or the filename.

OMNI files and Frequency files are always copied to the “Backup Bank”. This is not user selectable. User files (.user) and Configuration files (.config) are always copied to the “Active Bank”. This is also not user selectable. It is a matter of practicality that this inconsistency exists. Since a single reboot is desirable when upgrading the system it becomes necessary to copy both the OMNI and Frequency File to the “Backup Bank” followed by a “switch bank” command to meet this requirement. The restoration of configuration and user lists is not typically part of the upgrade process and so it acts on the “Active Bank”.

The type of file is determined from the filetype and then the filename, if the filetype is not recognized. For example, the file [“frequencyFileHzhcp 1.00.08.txt”](#) is recognized as a Frequency File because the filename begins with “frequency”.

System files such as the Frequency File and the MIB configuration file are protected by CRC checks. When a file is written to the system, either locally or from an FTP server, the previous file is preserved and restored in the event of a copy error. For example, if the power fails while copying a file the system will delete the bad file exposing the previous file as the latest file again. This is true for all configuration files including the Frequency File. The exception is the OMNI file. There is only one copy of the OMNI image file per bank.

15.4 Switch Bank Command

The switch bank command is used to set the “Next Active” bank for the system to boot at the next system startup. In the context of a Software Upgrade, the switch command is used after the “Backup Bank” has been upgraded with a new OMNI and/or a new Frequency File.

The system validates the desired next-active bank to make sure the OMNI is valid before allowing the switch operation to proceed.

Procedure 15-3
Software Upgrades – OMNI and Frequency files together

Required Action	Steps
login	Log in using the Super user, or a NOC, user account.
Commit the software and configuration in the active bank to the back-up bank	<p>This command copies the software load in the active bank to the back-up bank, overwriting any other software version that was in the back-up bank. When the new software and Frequency File is loaded it will be loaded into the back-up bank, thus providing the ability to revert back to the original load if desired.</p> <p>Sequence: commit press Enter</p> <p>The system responds: <i>The commit operation will copy the active OMNI and saved configuration to the backup bank. You will not be able to switch back to the previous OMNI.</i></p> <p><i>Would you like to save MIB and commit? [y/n]: y</i></p> <p><i>Copying active bank (Bank B) to backup bank (Bank A)</i> <i>Validating OMNI in backup bank...</i></p> <p><i>Bank A and Bank B are now identical.</i></p> <p><i>Info: Successfully copied active bank config (MIB and SysConfig) to backup bank</i> <i>Info: System was committed successfully</i></p>
Copy the new software load onto the system using ftp protocol	<p>This command will copy (or download) a specified file to the system. There are four types of files that can be downloaded. Depending on the file type, the file is either copied to the active bank or the backup bank: The following example downloads an OMNI file.</p> <p>Sequence: copy ftp://hcp_omni_1.00.01.omni and press Enter</p> <p>You will be prompted for the FTP server IP address, user name and password. This command copies the omni file to the backup bank.</p> <p>Similarly, the following downloads a Frequency File.</p> <p>Sequence: copy ftp://frequencyFilehcp_1.00.08.txt and press Enter</p> <p>You will be prompted for the FTP server IP address, user name and password. This command copies the frequency file to the backup bank.</p>

Required Action	Steps
<p>Make the new software the active software</p>	<p>This command directs the system to use the software in the selected bank. New software is loaded into the bank which is not currently in use. This could be Bank A or Bank B. Use the CLI command get sw inventory to determine what bank is currently active. The example below assumes that the system is running from Bank A (active bank) and the new software is in Bank B (back-up bank). Once the switch bank command has been issued, you will need to reset the system before the bank becomes active.</p> <p>Sequence: switch bank b press Enter</p> <p>The system responds: <i>You must reset the system to make Bank B active</i> <i>Info: System was switched successfully: next active bank will be Bank B</i></p>
<p>Reset system</p>	<p>A system reset is required to activate this feature.</p> <p>Sequence reset system press Enter</p> <p>The system responds: <i>Are you sure you want to reset? Y(yes) or N(no)</i> press Y</p> <p>The system will proceed to reset. You will have to log on again to regain access.</p>

It is recommended that, after a new software file has been downloaded, the system should be tested. If the system is in a satisfactory operational state, then the system should be “committed” again. This will make both banks identical and provide a certain measure of redundancy.

Procedure 15-4
Software Upgrades – Frequency file only

Required Action	Steps
login	Log in using the Super user, or a NOC, user account.
Confirm that the current operating software release is at least 1.00.01.	<p>This command returns the current software release running on the system. Sequence: get sw version and press Enter The system responds: <i>Horizon Compact+, OMNI Release: 1.1.0 (2012-09-13 17:43:16)</i></p> <p><i>Software currently executing in system:</i></p> <pre> Component Version Validation -----+-----+----- Bootloader 1.2.0 Valid Frequency File 2.00.70e Valid MIB 2.0.0 Valid </pre>
Commit the software and configuration in the active bank to the back-up bank	<p>This command copies the software load in the active bank to the back-up bank, overwriting any other software version that was in the back-up bank. When the new Frequency File is loaded it will be loaded into the back-up bank, thus providing the ability to revert back to the original load if desired. Sequence: commit press Enter The system responds: <i>The commit operation will copy the active OMNI and saved configuration to the backup bank. You will not be able to switch back to the previous OMNI.</i></p> <p><i>Would you like to save MIB and commit? [y/n]: y</i></p> <p><i>Copying active bank (Bank B) to backup bank (Bank A)</i> <i>Validating OMNI in backup bank...</i></p> <p><i>Bank A and Bank B are now identical.</i></p> <p><i>Info: Successfully copied active bank config (MIB and SysConfig) to backup bank</i> <i>Info: System was committed successfully</i></p>

Required Action	Steps
Copy the new frequency file onto the system using ftp protocol	This command copies the required frequency file from the FTP server to the system. The following is an example: Sequence: copy ftp: frequencyFileHzhcp_1.00.08.txt and press Enter You will be prompted for the FTP server IP address, user name and password. This command copies the frequency file to the backup bank .
Make the new software the active software	This command directs the system to use the software in the selected bank. New software is loaded into the bank which is not currently in use. This could be Bank A or Bank B. Use the CLI command get sw inventory to determine what bank is currently active. The example below assumes that the system is running from Bank A (active bank) and the new software is in Bank B (back-up bank). Once the switch bank command has been issued, you will need to reset the system before the bank becomes active. Sequence: switch bank b press Enter The system responds: <i>You must reset the system to make Bank B active</i> <i>Info: System was switched successfully: next active bank will be Bank B</i>
Reset system	A system reset is required to activate this feature. Sequence reset system press Enter The system responds: <i>Are you sure you want to reset? Y(yes) or N(no)</i> press Y The system will proceed to reset. You will have to log on again to regain access.

15.5 Multiple Systems

A batch mode software upgrade program is available from DragonWave on request. This Unix based program uses a flat file listing of all IP addresses of units on a network. It will perform simultaneous upgrades of multiple units. The number capable of being upgraded simultaneously is limited only by the number of active FTP sessions allowed by the on-net FTP server.

Appendix A – CLI Command List

```

?
change password
clear atpc log
clear ecfm errors [domain <domain-name(1..20)>
  | levelid <level-id(0-7)>][switchname
  <context_name>]
clear ecfm frame delay buffer [switchname
  <context_name>]
clear ecfm loopback cache [switchname
  <context_name>]
clear ecfm maintenance-points remote [ {domain
  <domain-name(1..20)> | levelid <level-id
  (0-7)>}][switchname <context_name>]
clear ecfm mip-ccm-database [switchname
  <context_name>]
clear ecfm statistics [port <num<1-1>] [level<level-
  id(0-7)>] [vlan <vlan-id(1-4094)>]]
  [switchname <context_name>]
clear ecfm traceroute-cache [switchname
  <context_name>]
clear port eoam config [port <num(1-2)>]
clear port eoam event-log [port <num(1-2)>]
clear port eoam fault-management mib-variable
  response [port <num(1-2)>]
clear port eoam statistics [port <num(1-2)>]
copy [ftp:fileName]
create ssl certificate
crypto
crypto->activate
crypto->autokeygen
crypto->disable
crypto->enable
crypto->key
crypto->rekey [minutes]
crypto->status
delete ecfmmib [newest|both]
delete mib [newest|both]
delete radius server [index]
delete user
diagnose aam
diagnose haam [up/down]
downgrade system licensed speed
ecfm frame delay [start | stop] type {one-way | two-
  way }level <level-id(0-7)> [vlan <vlan-id(0-7)>]
  [port <port-num>] [direction {inward |
  outward}]{mepid <mpid(1-8191)> | mac
  <aa:aa:aa:aa:aa:aa>}
  [count<num_of_observations(1-8192)>]
  [interval <milliseconds(10-10000)>] [deadline
  <seconds(1-172800)>] [switchname
  <context_name>]]
ecfm ping ethernet mac {<aa:bb:bb:bb:bb:bb> |
  multicast } {domain <domain-name(1..20)> |
  level <level-id(0-7)>} [vlan <vlan-id(1-4094)>]
  [interface <interface-number>] [direction
  {inward | outward}] [data-pattern <string> | test-
  pattern null-signal-without-crc | null-signal-with-
  crc | prbs-without-crc | prbs-with-crc] [size
  <pdu-size(64-1400)> | variable-bytes][interval
  <milliseconds(1-600000)>] [count
  <num_of_msgs(1-8192)>] [deadline
  <seconds(1-172800)>] [switch <string(32)>]
ecfm ping ethernet mpid <id> {domain <domain-
  name(1..20)> | level <level-id(0-7)>} [vlan
  <vlan-id(1-4094)>] [interface <interface-
  number>] [direction {inward | outward}] [data-
  pattern <string> | test-pattern null-signal-
  without-crc | null-signal-with-crc | prbs-without-
  crc | prbs-with-crc] [size <pdu-size(64-1400)>]
  | variable-bytes][interval <milliseconds(1-
  600000)>] [count <num_of_msgs(1-8192)>]
  [deadline <seconds(1-172800)>] [switch
  <string(32)>]
ecfm traceroute ethernet mac <aa:aa:aa:aa:aa:aa>
  {domain <domain-name(1..20)> | level <level-
  id(0-7)>} [vlan <vlan-id(1-4094)>] [time-to-live
  <ttl-value(1-255)>]
ecfm traceroute ethernet mpid <id> {domain <domain-
  name(1..20)> | level <level-id(0-7)>} [vlan
  <vlan-id(1-4094)>] [time-to-live <ttl-value(1-
  255)>]
erase log
erase performance log
exit
get aam eoam option
get aam link monitor parameters
get aam status
get alarms
get alarms counter
get alignment
get antenna diameter
get atpc config
get atpc log
get atpc status
get authenticated peer
get backup ipconfig
get bandwidth record admin
get bandwidth record average period
get bandwidth record brief
get bandwidth record current
get bandwidth record instance[0-59]
get bandwidth record logging
get bandwidth record reporting period
get bandwidth record thresholds
get bandwidth record verbose
get bandwidth utilization status
get bandwidth utilization threshold
get config commands
get cos default value
get cos ecfm flow mapping

```

```
get cos expedite queue
get cos qinq itag
get cos qinq otag
get cos queue cbs
get cos queue cir
get cos queue mapping
get cos type
get cos wfq weight
get date time
get default gateway
get default ipconfig
get dropped frames threshold
get dw access
get ecfm bw-vsm
get ecfm configuration-errors [vlan <vlan-id(1-4094)>]
    [interface <interface-id>] [switchname
    <context_name>]
get ecfm default-domain [switchname
    <context_name>]
get ecfm domain [brief | domain-number(1-32)]
    [switchname <context_name>]
get ecfm error-log [domain <domain-name(1..20)> |
    levelid<level-id(0-7)>] [unaware | vlan <vlan-
    id(1-4094)>] [switchname <context_name>]
get ecfm errors [domain <domain-name(1..20)> |
    levelid <level-id(0-7)>] [switchname
    <context_name>]
get ecfm frame delay buffer [brief] [one-way | two-
    way] [level <level-id(0-7)>][unaware | vlan
    <vlan-id(1-4094)>] [interface <interface-
    number>][mac <peer-mac-address>]
get ecfm global information[switchname
    <context_name>]
get ecfm loopback cache [brief] [level <level-id(0-
    7)>][unaware | vlan <vlan-id(1-4094)>]
get ecfm maintenance-point local [mep | mip]
    [interface [<interface-number>] | domain
    <domain_name> | level<id(0-7)>]
get ecfm maintenance-points local detail
    {mpid<mepid(1-8092)> | mac
    <aa:aa:aa:aa:aa:aa>} [domain <domain_name>
    | level<level-id(0-7)>] [unaware | vlan
    <integer(1-4094)>]
get ecfm maintenance-points remote [domain
    <domain-name(1..20)> | levelid <level-id(0-7)>]
get ecfm maintenance-points remote crosscheck
    [mpid <id>] [domain <domain-name(1..20)> |
    level <level-id(0-7)>] [unaware | vlan<integer(1-
    8191)>][[domain <string(20)> | level <integer(0-
    7)>]][unaware | vlan<integer(1-4094)>]] [switch
    <string (32)>]
get ecfm maintenance-points remote detail {mpid id |
    mac <aa:aa:aa:aa:aa:aa>} [domain <domain-
    name(1..20)> | level <level-id(0-7)>] [unaware |
    vlan<vlan-id(1-4094)>]] [switchname
    <context_name>]
get ecfm mip-ccm-database [vlanid <vlan-id(1-4094)>]
    [macaddress <aa:aa:aa:aa:aa:aa>] [port <port-
    id>]
get ecfm port [{port <port-number>}] [switchname
    <context_name>]
get ecfm service [brief | service-number(1-32) ]
    [switchname <context_name>]
get ecfm statistics [port <port-number>] [level <level-
    id(0-7)>][<vlan-id(1-4094)>]] [switchname
    <context_name>]
get ecfm traceroute-cache
get enet address
get enet config
get enet speed alarm enable port1 | port2
get enet speed
get enet status
get eoam dwi-msg mode
get eoam fault-management global information
get eoam global information
get frequency bank
get frequency file status
get haam
get haam eoam option
get haam status
get haam system modes
get haam wtr
get health
get http secure access [Admin|Noc|Super]
get hw inventory
get install type
get ip address
get ipv6 config
get leds
get licensed speed count
get licensed speed downgrade information
get log entries
get logging
get maximum frame size
get modem modulation
get modem statistics
get network loopback
get network management interface
get network protocol strict
get omni file crc
get optical transmitter state
get pause state
get peer authentication failure action
get peer authentication group key
get peer authentication status
get peer authentication type
get peer authentication unique key
get performance log
get performance log interval
get performance logging
get port eoam event-log [port <1-2>]
get port eoam event-notifications [port <1-2>]
get port eoam fault-management config port <1-2>
get port eoam fault-management mib-variable
    response port <1-2>
get port eoam fault-management remote-loopback
    [port <1-2>] [current-session | last-session]
    [detail]
get port eoam local information [port <1- 2>]
get port eoam loopback capability[port <1-2>]
get port eoam neighbour information [port <1-2>]
get port eoam statistics [port <1-2>]
get programmed frequency
```

```

get qos
get qos policy
get queue utilization threshold
get radio band
get radio loopback
get radio statistics
get radio status
get radio transmitter state
get radius server deadtime
get radius server retransmit
get radius server timeout
get radius servers
get radius super user authentication
get redundancy link monitor parameters
get redundancy link switch parameters
get redundancy mode
get redundancy override
get redundancy partner information
get redundancy standby enet state
get redundancy status
get rls
get rls link control
get rls link enable
get rls link monitor parameters
get rls make rsl
get rls port groups
get rls shutdown policy
get rls signal fault parameters
get rls status
get rsl threshold
get sessions
get snmp access mode
get snmp managers
get snmp set request
get snmp trap hosts
get snmp traps
get snmpv3 managers
get snmpv3 trap hosts
get snr threshold
get sntp
get sntp offset
get ssh server
get ssh server fingerprint
get ssl certificate status
get subnet mask
get super user
get sw inventory
get sw version
get synce config
get synce status
get syslog forwarding host
get syslog forwarding status
get system mode
get system speed
get system summary
get telnet access
get traffic statistics
get transmit power
get user accounts
    get user session
get vlan tag
get vlan tagging

get web server
kill ssh sessions
list [ftp:file/directory/empty]
lo
ping [-w timeout][[-n count][[-t] abc.def.ghi.jkl]
remove frequency indexable
reset [resource id]
save config [ftp:fileName]
save ecfmmib
save log [ftp:fileName]
save mib
save performance log [ftp:fileName]
save users [ftp:fileName]
set aam [state <on/off>][[inter mode <on/off>]][[max Tx-
    Pwr <on/off>]
set aam eoam option [state <on/off>]
set aam link monitor parameters
set aam mode [system mode name/default]
set aam time [time in mseconds]
set admin user
set alarms counter [0]
set alignment [On | Off]
set antenna diameter [index of diameter]
set atpc config [on/off] [on/off] [0-10]
set bandwidth record logging[on | off]
set bandwidth record thresholds[thresh] [thresh]
    [thresh] [thresh] [thresh] [thresh] [thresh]
    [thresh] [thresh] [thresh]
set bandwidth utilization threshold [threshold] [time
    limit]
set cos default value [0 - 7]
set cos ecfm flow mapping [off]{on
    QC|Q1|Q2|Q3|Q4|Q5}
set cos expedite queue [on | off]
set cos qinq itag [protocol id]
set cos qinq otag [protocol id]
set cos queue cbs [committed burst size]
set cos queue cir [0 - 100, 0 - 100, 0 - 100, 0 - 100]
set cos queue mapping [1/2], ...
set cos type [cos_vlan | cos_qinq_itag |
    cos_qinq_otag | cos_dscp | cos_mplsexp]
set cos wfq weight [weight]
set date time [dd/mm/yyyy hh:mm:ss:ms]
set default gateway [aaa.bbb.ccc.ddd]
set dropped frames threshold [threshold] [time limit]
set dw access[on | off]
set dynamic config change [on/off]
set ecfm [on | off | start]
set ecfm associate vlan-id {vlan-id | vlan-list} primary-
    vlan-id <vlan-id(1-4094)>
set ecfm bw-vsm
set ecfm cc enable level [disable] {levelid | level-list}
    [vlan {vlanid | vlan-list}]
set ecfm cc level {<level-id(0-7)> | level-list} {<default
    [interval] [role]> | [vlan {<vlan-id(1-4094)> |
    vlan-list}] [interval {ten-sec | one-min | ten-
    min}]}}
set ecfm ccm-unicast-mac <aa:aa:aa:aa:aa:aa>
set ecfm default-domain global levelid <(0-7)>

```

```
set ecfm default-domain vlan <integer(1-4094)>
  ([level<integer(0-7)>][mip-creation-criteria
  {none | explicit | defer | default}][sender-id-
  permission {none | chassis | manage | chassis-
  mgt-address | defer }])
set ecfm disassociate vlan-id {vlan-id | vlan-list}
  primary-vlan-id <vlan-id(1-4094)>
set ecfm domain <domain-name(1..20)> level <level-
  id(0-7)> [delete]
set ecfm error-log [on | off] [size <entries(1-4096)>]
set ecfm mep archive-hold-time { <minutes(100-
  65535) | default }
set ecfm mep crosscheck {on | off} levelid <level-id |
  levellist> [vlan <vlan-id | vlanlist>] [switchname
  <context_name>]
set ecfm mep crosscheck mpid <integer(1-8191)>
  [delete|define] [vlan <integer(1-4094)>]
set ecfm mep crosscheck start-delay {default}{{start-
  delay<3-100>}}
set ecfm mep level [<0-7>] [delete] [inward] mpid
  <id(1-8191)> [vlan<vlan-id(1-4094)>] [active]

set ecfm mep-capability level {<level-id(0-7)> | level-
  list} [on|off] [vlan {<vlan-id(1-4094)> | vlan-
  list}][ping] [multicast-ping] [one-way-frame-
  delay] [multicast-test] [turnaround-delay][ais]
  [rdi])
set ecfm mip ccm-database caching {enable | disable}
set ecfm mip ccm-database hold-time [<hours>(24-
  48)]
set ecfm mip ccm-database size [<entries(1000-
  10000)>]
set ecfm mip dynamic evaluation {enable|disable}
set ecfm mip level [delete] <level-id(0-7)> vlan <vlan-
  id(1-4094)> [active]
set ecfm mip-creation-criteria {none | default | explicit}
set ecfm oui {<aa:aa:aa> | default}
set ecfm port port<1-1> [on|off]
set ecfm service <[config] <service_name> [{icc
  <icc_code> umc <umc_code>} [vlan <vlan-id(1-
  4094)>] [mip-creation-criteria {none | default |
  explicit | defer}] [sender-id-permission {none |
  chassis | manage | chassis-mgt-address |
  defer}]>] <[delete <service_name>]
set ecfm traceroute cache [ on|off | { holdtime { default
  | <integer(1-65535)} } ]
set ecfm y1731 [on | off ]
set enet config
set enet speed alarm enable port1 | port2 on|off
set eoam [on | off]
set eoam dwi-msg mode [eoam | bypass-eoam]
set eoam fault-management [on | off | start]
set eoam link-monitor event-resend [count(1-10)]
set eoam oui [<aa:aa:aa> | default]
set haam[on/off]
set haam eoam option
set haam manual mode[on|off]
set haam wtr[duration]
set http secure access [Admin|Noc|Super] [on/off]
set ip address [aaa.bbb.ccc.ddd]
set ipv6 config
set ip config

set lo nulling [on/off]
set logging [on/off]
set network loopback [nearend | farend | off] mac-
  address <queue N> <timeout>
set network management interface
  [p1-p4 or dp1-dp4]
set network protocol strict [on/off]
set noc user
set optical transmitter state [on/off]
set pause state [on/off]
set peer authentication failure [action]
set peer authentication group key [key]
set peer authentication type [authentication
  type]
set peer authentication unique key [key]
set performance log interval [hr:min:sec]
set performance logging
set port eoam [port <1-2>] [on | off]
set port eoam fault indication [port <1-2>] [critical-
  event | dying-gasp] [on | off]
set port eoam fault-management action [port <1-2>]
  [critical-event | dying-gasp | link-fault] [none |
  warning]
set port eoam fault-management link-monitor action
  [port <1-2>] [frame | frame-period | frame-sec-
  summary] [none | warning]
set port eoam fault-management mib-request [port
  <1-2>] <branchleaf:branchleaf:...>
set port eoam fault-management mib-variable count
  [port <1-2>] <count(1-100)>
set port eoam fault-management remote-loopback
  [port <1-2>] [test] [count <no of packets(1-
  1000)>] [packet <size(64-1500)>] [pattern
  <hex_string(8)>] [wait-time <integer(1-10)>]
set port eoam link-monitor [port <1-2>] [frame |
  frame-period | frame-sec-summary] [on | off]
set port eoam link-monitor default [port <1-2>] [frame |
  frame-period | frame-sec-summary] [threshold
  | window]
set port eoam link-monitor frame-sec-summary
  threshold [port <1-2>] [<count(0-900)>]
set port eoam link-monitor frame-sec-summary
  window [port <1-2>] [<size(100 - 9000)>]
set port eoam link-monitor threshold [port <1-2>]
  [frame |frame-period] [<count(1234..)>]
set port eoam link-monitor window [port <1-2>]
  [frame <size(10 - 600)> | frame-period
  <size(1100000 - 89000000)> ]
set port eoam mode [port <1-2>] [active | passive]
set port eoam remote-loopback [port <1-2>] [on | off |
  deny | permit]
set programmed frequency [IndexID]
set qos [on/off]
set qos policy [strict priority / wfq]
set queue utilization threshold [qid] [depth] [time]
set radio band [radioBandName]
set radio config
set radio loopback [on | off] <timeout> <network>
set radio transmitter state [on | off] [mute time
  (seconds)]
set radius server host [index] [server addr]
set radius server key [index] [key]
```

```

set radius super user authentication [On|Off]
set redundancy link monitor parameters
set redundancy link switch parameters
set redundancy mode
set redundancy override [primary | secondary |
    manual | auto ]
set redundancy standby enet state
set redundancy state switch
set rls [on/off] | [basic|advanced]
set rls link control [on/off]
set rls link enable [on/off]
set rls link monitor parameters [mk erred blks] [brk
    erred blks] [mk samples] [brk samples] [mk
    sample time] [brk sample time] [brk sample rst
    time]
set rls make rsl [make rsl threshold] [rsl mk sample
    time sec]
set rls port groups
set rls shutdown policy [port-down/eoam-msg]
set rls signal fault parameters [fault period msec] [fault
    threshold]
set rsl threshold [threshold] [time limit]
set snmp access mode [v1|v2c|off]
set snmp manager [Mgr Index] [ipAddress]
    [enable|disable] [communityString]
set snmp set request [on/off]
set snmp trap [trap#] [enable|disable]
set snmp trap host [host#] [ipAddress]
    [enable|disable] [communityString]
set snmpv3 manager
set snmpv3 trap host authentication [index]
    [none|md5|sha] [passwd]
]

set snmpv3 trap host disable [index]
set snmpv3 trap host enable [index]
set snmpv3 trap host ip [index] [ipAddress]
set snmpv3 trap host privacy [index] [none|des]
set snmpv3 trap host user [index] [userName]
set snmp [on|off]
set snmp default
set snmp offset
set snmp server
set ssh server
set snr threshold [SnrThreshold]
set subnet mask [aaa.bbb.ccc.ddd]
set super user
set synce forced holdover [on|off][time]
set synce member port [p1–p4|wp1|freerun]
set synce mode [off|manual|auto]
set synce primary source [p1–p4|wp1|freerun]
set synce revertive [on|off][time]
set synce secondary source [p1–p4|wp1|freerun]
set synce wander filter [option1|option2]
set syslog forwarding [on|off]
set syslog forwarding host [ipAddress]
set system current speed [speed]
set system mode [system mode name]
set telnet [on|off]
set traffic statistics [0]
set transmit power [powerLevel]
set vlan tag
set vlan tagging [on|off]
set web server [on|off]
upgrade system licensed speed [speed increment]
    [key]

```


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Appendix B – Safety Information

Safety Information for Radio Equipment

The Federal Communications Commission (FCC), with its action in ET Docket 96-8, has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC-certified equipment. DragonWave Horizon Compact+ meets the uncontrolled environmental limits found in OET-65, ANSI C95.1, 1991 and Health Canada Safety Code 6. Proper operation of this radio according to the instructions found in this manual or any other product manuals or user guides for the DragonWave family of products or equipment will result in user exposure that is substantially below the FCC/IC recommended limits.

1. Do not touch or move antenna(s) while the unit is transmitting or receiving.
2. Do not hold any component containing the radio in such a way that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while the unit is transmitting.
3. Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.

The design of the high-gain mast mount antennas is such that professional installation is required.

Information sur la sécurité de l'appareil radio

En vertu de l'ET Docket 96-8, la FCC a adopté une norme de sécurité sur l'exposition humaine à l'énergie électromagnétique de radiofréquence (RF) émise par le matériel homologué par la FCC. L'appareil Horizon Compact+ de DragonWave respecte les limites environnementales non contrôlées décrites dans le bulletin OET-65, dans la norme ANSI C95.1 de 1991 et Santé Canada – Code de Sécurité 6.

Si l'appareil radio est utilisé selon les instructions décrites dans le présent manuel ou tout autre manuel de nos produits ou dans le guide de l'utilisateur relatif à la ligne de produits ou équipement de DragonWave, résultera à des expositions aux champs électromagnétiques sensiblement moins élevés que les limites recommandées par la FCC/IC.

1. Ne jamais toucher ou déplacer la ou les antennes lorsque l'appareil fonctionne en mode de transmission ou de réception.
2. Lorsque l'appareil fonctionne en mode de transmission, tenir les éléments contenant la radio de manière que l'antenne ne soit pas trop proche des parties du corps exposées (surtout le visage ou les yeux) ou n'y touche pas.
3. Ne pas faire fonctionner un émetteur transportable à proximité de détonateurs non protégés ou dans un milieu explosif, à moins qu'il s'agisse d'un émetteur autorisé.

Les antennes à gain élevé montées sur mât sont conçues pour être installées par des professionnels.

Professional Installation

DragonWave Horizon Compact+ devices require professional installation. It is the responsibility of the installer to be sure that all building and safety codes are met and that the installation is complete and secure.

The Horizon Compact+ shall be installed according to local Electrical Safety Codes.

For Canadian installations, the entire equipment installation must comply with Canadian Standard CSA 22.2, No. 60950, Safety of Information Technology Equipment. For installations in the United States, the entire equipment installation must be in accordance with Article 810 of the United States National Electrical Code.

Installations Professionnel

Les appareils Horizon Compact+ de DragonWave doivent être installés par un personnel professionnel. Le personnel responsable doit s'assurer que l'installation est bien achevée, et qu'elle répond aux exigences de tous les codes de sécurité.

Une installation faite au Canada doit observer les normes 22.2, numéro 60950 du CSA, Sécurité des matériels de traitement de l'information. Une installation faite aux États-Unis doit être faite selon les stipulations de l'Article 810 du United States National Electrical Code.

Lightning Protection

When installed, this equipment is to be connected to a Lightning/Surge Protection Device that meets all applicable national safety requirements.

Before Ethernet cables enter buildings, voltages shall be clamped down to SELV by Approved type primary protectors.

Protection contre la foudre

L'installation exige aussi que l'appareil soit branché à un parafoudre qui répond à toutes les normes nationales de sécurité.

Electrocution Hazard



This product is intended to be connected to a -40.5 to -60V DC power source (power adapter supplied by DragonWave Inc.), which must be electrically isolated from any ac sources and reliably connected to Earth ground. Do not install DragonWave products near any type of power line. Should your antenna or related hardware come in contact with power lines, severe bodily harm or death could result!

Risque d'électrocution



Cet appareil est raccordée à une source de tension de -40.5 a -60V CD (adapteur fourni par DragonWave), qui doit être isolée de toute autre source de tension et raccordée à une mise à terre isolée. Les produits de DragonWave ne doivent pas être installés près de ligne à haute tension. Des dommages corporels sévères et même la mort peuvent survenir si l'antenne ou toute autre pièce viennent en contact avec des lignes de haute tension Dommage corporel.

Radio Frequency Safety

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF fields in excess of the general population limits as defined by FCC CFR 47, Part 2.1091, Radiofrequency radiation exposure evaluation for fixed devices & Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc.ca/rpb.

RF Radiation Safety Information

The antenna must be located such that humans will not approach within 10m of the forward transmitting direction of the antenna and 0.46m in all other directions. This distance provides additional safety margin for the product, as well as minimizing exposure to microwaves.

These calculations were done in accordance with:

1. FCC Radio Frequency Exposure Limits 1.1310
2. Health Canada Safety Code 6 / Industry Canada RSS 102
3. EMF Exposure Directive (99/519/EC)

Information sur la Sécurité des Radiations des FR

L'antenne doit être localisée de façon à ce que les humains ne puissent pas s'en approcher à moins de 10m dans l'axe de transmission à l'avant de l'antenne et de 0.46m dans toutes autres axes. Ceci la distance fournit une marge de sûreté additionnelle pour ce produit en minimisant l'exposition aux micro-ondes.

Ces calculs ont été faits selon :

1. L'Exposition De Fréquence Par radio de FCC Limite 1.1310
2. Industrie Canada RSS 102 / De l'Indicatif 6 De Sûreté Du Santé Canada
3. Le Directif d'Exposition De EMF (99/519/EC)

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Appendix C - Regulatory Compliance Information

This section contains information regarding regulatory compliance with the Federal Communication Commission, Department of Communications and the European Telecommunications Standards Institute applies to the Horizon Compact+ radio link.


Federal Communication Commission Declaration of Conformity Statement

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses and radiates radio-frequency energy, and if not installed and used in accordance with the instructions, can cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one of the following measures:

1. Reorient or relocate the receiving antenna;
2. Increase separation between the equipment and receiver; or
3. Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

	<p>Warning</p> <p>The Part 15 radio device operates on a non-interference basis with the other devices operating at this frequency. Any changes or modification to said product not expressly approved by DragonWave Inc. could void the user's authority to operate this device.</p>
---	---

Department of Communications – Canada - Compliance Statement

This class B Digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

This device complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions:

1. this device can not cause harmful interference; and
2. this device must accept any interference received, including interference that can cause undesired operation.

The use of this device in a system operating either partially or completely outdoors can require the user to obtain a license for the system according to Canadian regulations. For further information, contact your local Industry Canada office.

Ministère des Communications – Canada

Déclaration de conformité aux normes canadiennes

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Cet appareil est conforme à la norme RSS-210 d'Industrie Canada. Son exploitation est soumise aux deux conditions suivantes :

1. il ne doit pas provoquer de brouillage préjudiciable et
2. il doit tolérer le brouillage reçu, notamment le brouillage susceptible de perturber son fonctionnement.

Si l'appareil doit être utilisé dans un système qui fonctionne partiellement ou complètement à l'extérieur, l'utilisateur devra obtenir une licence à cet effet, conformément aux règlements canadiens. Pour de plus amples renseignements, communiquer avec le bureau local d'Industrie Canada.

Certification Note From Industry Canada for 24 GHz DEMS

CERTIFICATION NOTE FROM INDUSTRY CANADA: While this equipment meets the technical requirements for its operation in its rated paired block arrangement, this block arrangement is different than the 40+40 MHz block arrangement prescribed in documents RSS-191 and SRSP-324.25. The operation of this equipment IS NOT permitted if the out-of-band and spurious emission limits are not met at the edge of any contiguous licensed spectrum. It should be noted that all current relevant spectrum policies, licensing procedures and technical requirements are still applicable. For additional information, please contact the local Industry Canada office.

European Telecommunications Standards Institute Statement of Compliance

This equipment has been tested and found to comply with the European Telecommunications Standard ETS 300.328. This standard covers Wideband Data Transmission Systems referred to in CEPT Recommendation T/R 10.01.

This type of accepted equipment is designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy. If the equipment is not installed and used in accordance with the instruction manual, it can cause harmful interference to radio communications.



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Horizon Compact+™ Product Manual, 83-000094-01-02-00
Visit us on the Internet at:
<http://www.dragonwaveinc.com/>

Issue Date: 2011-01-20

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Report Reference #

E217682-A6-CB-2

	<p>Test Report issued under the responsibility of:</p> <p>Underwriters Laboratories Inc.</p>	 <p>Underwriters Laboratories</p>
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<p>TEST REPORT IEC 60950-1 Information technology equipment - Safety - Part 1: General requirements</p>	
Report Reference No	E217682-A6-CB-2
Date of issue	2011-01-20
Total number of pages	40
CB Testing Laboratory	Underwriters Laboratories Inc.
Address	333 Pfingsten Road, Northbrook, IL, 60062-2096, USA
Applicant's name	NETPOWER TECHNOLOGIES INC SUITE 200
Address	1680 PROSPECT DR RICHARDSON TX 75081 UNITED STATES
Test specification:	
Standard	IEC 60950-1:2005 (Second Edition)
Test procedure	CB Scheme
Non-standard test method	N/A
Test Report Form No.	IEC60950_1A
Test Report Form originator	SGS Fimko Ltd
Master TRF	2009-09
<p>Copyright © 2009 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</p> <p>This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copyright owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.</p> <p>If this test Report is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.</p> <p>This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.</p>	

Test item description	DC to DC Converter
Trade Mark	NetPower Technologies
Manufacturer	NETPOWER TECHNOLOGIES INC SUITE 200 1680 PROSPECT DR RICHARDSON, TX 75081, USA
Model/Type reference	ERS4150x008xxx, ERS4120x010xxx, ERS4050x020xxx, ERS4033x030xxx, ERS4025x035xxx, ERS4020x040xxx, ERS4018x040xxx, ERS4015x040xxx, ERS4012x040xxx, ERS4010x040xxx, EBS4120x014xxx, EBS4050x030xxx, EBS4033x040xxx. ERS2150xxxxxxx, ERS2120xxxxxxx, ERS2050xxxxxxx, ERS2033xxxxxxx, ERS2025xxxxxxx, ERS2015xxxxxxx, ERS2012xxxxxxx, ERS3150xxxxxxx, ERS3120xxxxxxx, ERS3050xxxxxxx, ERS3033xxxxxxx, ERS3025xxxxxxx, ERS3015xxxxxxx, ERS3012xxxxxxx, ERS4150xxxxxxx, ERS4120xxxxxxx, ERS4050xxxxxxx, ERS4033xxxxxxx, ERS4025xxxxxxx, ERS4015xxxxxxx, ERS4012xxxxxxx where non safety critical suffix "x" represents minor changes to SELV circuitry and/or mechanical design that does not affect safety * Eighth digit "x" may be "N" to denote Negative Enabling logic or "P" to denote Positive logic. * Twelveth digit "X" may be K, N, or R to denote Pin length. * Thirteenth digit "X" may be 0, 1, 2, or 3 to denote Electrical options, such as None, Current Sharing, Auto restart, or both, respectively. * Fourteenth digit "X" may be 0, 1, 2, 3, or 4 to denote mechanical options, such as None, Base plate, integrated Heat Sink, Baseplate with a case pin, or Integrated Heatsink with a case pin respectively.
Rating	Rated Input ERS4150x008xxx- 36-75 VDC, 5.5 A ERS4120x010xxx - 36-75 VDC, 5.5 A ERS4050x020xxx - 36-75 VDC, 4.5 A ERS4033x030xxx - 36-75 VDC, 4.5 A ERS4025x035xxx - 36-75 VDC, 4 A ERS4020x040xxx - 36-75 VDC, 4 A ERS4018x040xxx - 36-75 VDC, 3.5 A ERS4015x040xxx - 36-75 VDC, 3 A ERS4012x040xxx - 36-75 VDC, 2.5 A ERS4010x040xxx - 36-75 VDC, 2 A EBS4120x014xxx - 36 -55 VDC, 7.5 A EBS4050x030xxx - 36-55 VDC, 6.5 A EBS4033x040xxx - 36-55 VDC, 6 A ERS2150xxxxxxx, ERS2120xxxxxxx, ERS2050xxxxxxx, ERS2033xxxxxxx, ERS2025xxxxxxx, ERS2015xxxxxxx, ERS2012xxxxxxx: 18V - 36Vdc ERS3150xxxxxxx, ERS3120xxxxxxx, ERS3050xxxxxxx,

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ERS3033xxxxxxx, ERS3025xxxxxxx, ERS3015xxxxxxx,
ERS3012xxxxxxx: 18V - 75Vdc

ERS4150xxxxxxx, ERS4120xxxxxxx, ERS4050xxxxxxx,
ERS4033xxxxxxx, ERS4025xxxxxxx, ERS4015xxxxxxx,
ERS4012xxxxxxx: 36V - 75Vdc

Rated output -

ESR4150x008xxx - 15 V, 8 A
ESR4120x010xxx - 12 V, 10 A
ESR4050x020xxx - 5 V, 20 A
ESR4033x030xxx - 3.3 V, 30 A
ESR4025x035xxx - 2.5 V, 35 A
ESR4020x040xxx - 2 V, 40 A
ESR4018x040xxx - 1.8 V, 40 A
ESR4015x040xxx - 1.5 V, 40 A
ESR4012x040xxx - 1.2 V, 40 A
ESR4010x040xxx - 1 V, 40 A
EBS4120x014xxx - 12 V, 14 A
EBS4050x030xxx - 5 V, 30 A
EBS4033x040xxx - 3.3 V, 40 A

ERS2150xxxxxxx, ERS3150xxxxxxx, ERS4150xxxxxxx: output: 15V
dc, 8.8A max, 132W

ERS2120xxxxxxx, ERS3120xxxxxxx, ERS4120xxxxxxx: output: 12V
dc, 11A max, 132W

ERS2050xxxxxxx, ERS3050xxxxxxx, ERS4050xxxxxxx: output: 5V dc,
26.4A max, 132W

ERS2033xxxxxxx, ERS3033xxxxxxx, ERS4033xxxxxxx: output: 3.3V
dc, 40A max, 132W

ERS2025xxxxxxx, ERS3025xxxxxxx, ERS4025xxxxxxx: output: 2.5V
dc, 48A max, 120W

ERS2015xxxxxxx, ERS3015xxxxxxx, ERS4015xxxxxxx: output: 1.5V
dc, 70A max, 105W



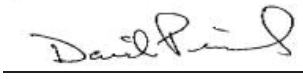
ERS2012xxxxxxx, ERS3012xxxxxxx, ERS4012xxxxxxx: output: 1.2V
dc, 80A max, 96W

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Testing procedure and testing location:		
<input type="checkbox"/>	CB Testing Laboratory	
	Testing location / address..... :	
<input type="checkbox"/>	Associated CB Test Laboratory	
	Testing location / address..... :	
	Tested by (name + signature)	_____
	Approved by (+ signature)	_____
<input type="checkbox"/>	Testing Procedure: TMP	
	Tested by (name + signature)	_____
	Approved by (+ signature)	_____
	Testing location / address..... :	_____
<input checked="" type="checkbox"/>	Testing Procedure: WMT	
	Tested by (name + signature)	Dr. Wei 
	Witnessed by (+ signature)..... :	Rupinderpal Dhadda 
	Approved by (+ signature)	Dave Picuch 
	Testing location / address..... :	NETPOWER TECHNOLOGIES INC SUITE 200 1680 PROSPECT DR RICHARDSON TX 75081, USA
<input type="checkbox"/>	Testing Procedure: SMT	
	Tested by (name + signature)	_____
	Approved by (+ signature)	_____
	Supervised by (+ signature)	_____
	Testing location / address..... :	_____
<input type="checkbox"/>	Testing Procedure: RMT	
	Tested by (name + signature)	_____
	Approved by (+ signature)	_____
	Supervised by (+ signature)	_____
	Testing location / address..... :	_____

List of Attachments
National Differences (25 pages)
Enclosures (35 pages)
Summary of Testing:
All Applicable tests according to the referenced standard(s) have been carried out
Summary of Compliance with National Differences:
List of countries addressed: AT, AU, BE, BG, BR, CA, CH, CN, CY, CZ, DE, DK, EE, ES, EU, FI, FR, GB,

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GR, HU, IE, IL, IS, IT, JP, KR, LT, LU, LV, MT, NL, NO, PL, PT, RO, SE, SG, SI, SK, UA, US

Issue Date: 2011-01-20

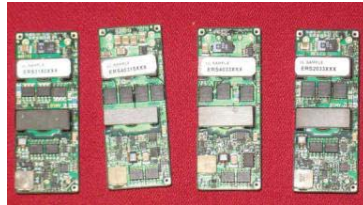
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Copy of Marking Plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



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Test item particulars :	
Equipment mobility	for building-in
Connection to the mains	for building-in
Operating condition	continuous
Access location	for building-in
Over voltage category (OVC)	OVC II
Mains supply tolerance (%) or absolute mains supply values :	No direct connection
Tested for IT power systems	No
IT testing, phase-phase voltage (V)	N/A
Class of equipment	Special Application - TNV-2
Considered current rating (A)	20A
Pollution degree (PD)	PD 2
IP protection class	IP X0
Altitude of operation (m)	2000m
Altitude of test laboratory (m)	2000m
Mass of equipment (kg)	0.10 kg
Possible test case verdicts:	
- test case does not apply to the test object	N / A
- test object does meet the requirement	P(Pass)
- test object does not meet the requirement	F(Fail)
Testing:	
Date(s) of receipt of test item	2010-12-21, 2009-07-31
Date(s) of Performance of tests	2009-07-31
General remarks:	
<p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p> <p>"(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.</p> <p>Throughout this report a point is used as the decimal separator.</p>	
Manufacturer's Declaration per SubClause 6.25 of IEC60950 02:	
The application for obtaining a CB Test Certificate includes more than one factory and a declaration form the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	Not Applicable
When differences exist, they shall be identified in the General Product Information section.	
Name and address of Factory(ies): NETPOWER TECHNOLOGIES INC SUITE 200	

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E217682-A6-CB-2

1680 PROSPECT DR
RICHARDSON, TX 75081,
USA

GENERAL PRODUCT INFORMATION:**Report Summary**

All applicable tests according to the referenced standard(s) have been carried out.

Product Description

The product unit is a DC to DC Converter for building in. It consists of a Printed wiring board with a planar transformer(s) and associated circuitry. The Electrical and Fire Enclosures are to be provided by the end product. The units are provided with Basic Insulation based on 75 VDC (TNV-2) between input and output.

Model Differences

The model nomenclature structure consist of 14 alphanumeric characters denoting as follows:

EBS or ERS denoting the series

4 denoting 48 Volts Nominal Input voltage.

XXX denoting output voltage (Ranging from 1.0 to 12 V for ERS and 3.3, 5.0, 12 V for EBS).(E.G. 033 for 3.3 Volts)

X denoting Enabling logic P for Positive and N for Negative.

XXX denoting rated output current (Ranging from 10 A to 40 A for ERS models.)

XXX represents minor changes to SELV circuit which includes Pin length, Current Option, and Mechanical Option.

All models are similar in construction except for, input, output rating, and model nomenclature. The Marking plate provided is representative of all models covered by the report.

Additional Information

This CB Report is a re-issue and upgrade to IEC/UL60950-1 2nd Edition (2005) of original CB Test Report Reference No. E217682-A6-CB-1 Per IEC/UL60950-1 1st Edition (2001), CB Test Ref Certificate No. US/10264A/UL. No testing was conducted under this investigation due to reissue. All required testing carried out under original investigation. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, it has been determined that the product continues to comply with the 60950-1 2nd Edition (2005) standard.

Technical Considerations

- The product was investigated to the following additional standards: EN 60950-1:2006+ A11:2009 (which includes all European national differences, including those specified in this test report).
- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of: 50 °C --

Engineering Conditions of Acceptability

When installed in an end-product, consideration must be given to the following:

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- The end product needs to supply 20 A in line fuse at the input of the unit.
- The input is an Energy Hazard.
- The investigated Pollution Degree is: 2
- The maximum investigated branch circuit rating is: 20 A , ,
- The following secondary output circuits are SELV: All
- The following secondary output circuits are at non-hazardous energy levels: All
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The following end-product enclosures are required: Electrical , Fire
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 88Vrms, 97 Vpk
- The maximum continuous power supply output (Watts) relied on forced air cooling from: External Forced Air Cooling: dc Fan rated 24V dc, 0.75A inside chamber_ approx 6.5inch above EUT, CFM approx 350. Units cannot operate/ hold rated current at higher Tma of 85°C for (very long) due to output current efficiency de-rating curves.
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing: planar transformer, inductor, PWB near Q101

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
1	GENERAL		Pass
1.5	Components		Pass
1.5.1	General		Pass
	Comply with IEC 60950-1 or relevant component standard	See appended table 1.5.1	Pass
1.5.2	Evaluation and testing of components	Components certified to IEC harmonized standard and checked for correct application. Components, for which no relevant IEC-Standard exist, have been tested under the conditions occurring in the equipment, using applicable parts of IEC 60950. Components not certified are used in accordance with their ratings and they comply with applicable parts of IEC 60950 and the relevant component Standard.	Pass
1.5.3	Thermal controls	No Thermal controls in equipment.	N/A
1.5.4	Transformers	Provided with Basic Insulation between input and output.	Pass
1.5.5	Interconnecting cables	No interconnecting cables.	N/A
1.5.6	Capacitors bridging insulation		N/A
1.5.7	Resistors bridging insulation		N/A
1.5.7.1	Resistors bridging functional, basic or supplementary insulation	No bridging capacitors	N/A
1.5.7.2	Resistors bridging double or reinforced insulation between a.c. mains and other circuits		N/A
1.5.7.3	Resistors bridging double or reinforced insulation between a.c. mains and antenna or coaxial cable	No bridging resistors	N/A
1.5.8	Components in equipment for IT power systems		N/A
1.5.9	Surge suppressors		N/A
1.5.9.1	General		N/A
1.5.9.2	Protection of VDRs		N/A
1.5.9.3	Bridging of functional insulation by a VDR		N/A
1.5.9.4	Bridging of basic insulation by a VDR		N/A
1.5.9.5	Bridging of supplementary, double or reinforced		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
	insulation by a VDR		
1.6	Power interface		Pass
1.6.1	AC power distribution systems		N/A
1.6.2	Input current	(see appended table 1.6.2) Representative sample of models with in the series.	Pass
1.6.3	Voltage limit of hand-held equipment	The unit is not a hand-held equipment.	N/A
1.6.4	Neutral conductor		N/A
1.7	Marking and instructions		Pass
1.7.1	Power rating		Pass
	Rated voltage(s) or voltage range(s) (V)	Refer to the Rating information at the beginning of this Test Report. Outputs: refer to the rating information at the beginning of this test report.	Pass
	Symbol for nature of supply, for d.c. only	dc	Pass
	Rated frequency or rated frequency range (Hz)....		N/A
	Rated current (mA or A)	Refer to the Rating information at the beginning of this Test Report.	Pass
	Manufacturer's name or trademark or identification mark.....	NetPower Technologies Inc.	Pass
	Model identification or type reference	Refer to the Model information at the beginning of this Test Report.	Pass
	Symbol for Class II equipment only		N/A
	Other markings and symbols.....		N/A
1.7.2	Safety instructions and marking	Unit is for building-in.	Pass
1.7.2.1	General		N/A
1.7.2.2	Disconnect devices	Unit is for build in, to be evaluated in the end product	N/A
1.7.2.3	Overcurrent protective device	Unit is for build in, to be evaluated in the end product	N/A
1.7.2.4	IT Power distribution systems		N/A
1.7.2.5	Operator access with a tool	Unit is for build in, to be evaluated in the end product	N/A
1.7.2.6	Ozone		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
1.7.3	Short duty cycles		N/A
1.7.4	Supply voltage adjustment	Equipment is auto-ranging.	Pass
	Method and means of adjustment; reference to installation instructions		N/A
1.7.5	Power outlets on the equipment		N/A
1.7.6	Fuse identification (marking, special fusing characteristics, cross-reference)	No fuses are provided.	N/A
1.7.7	Wiring terminals		N/A
1.7.7.1	Protective earthing and bonding terminals		N/A
1.7.7.2	Terminals for a.c. mains supply conductors		N/A
1.7.7.3	Terminals for d.c. mains supply conductors		N/A
1.7.8	Controls and indicators		N/A
1.7.8.1	Identification, location and marking		N/A
1.7.8.2	Colours		N/A
1.7.8.3	Symbols according to IEC 60417		N/A
1.7.8.4	Markings using figures.....		N/A
1.7.9	Isolation of multiple power sources		N/A
1.7.10	Thermostats and other regulating devices	No thermostats or similar regulating devices.	N/A
1.7.11	Durability	The marking withstood the required test.	Pass
1.7.12	Removable parts		N/A
1.7.13	Replaceable batteries	There are no lithium batteries in the equipment.	N/A
	Language(s)	Only English language reviewed.	-
1.7.14	Equipment for restricted access locations.....		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2	PROTECTION FROM HAZARDS		Pass
2.1	Protection from electric shock and energy hazards		N/A
2.1.1	Protection in operator access areas	Enclosure to be provided by the end product.	N/A
2.1.1.1	Access to energized parts	To be determined in the end product.	N/A
	Test by inspection..... :		N/A
	Test with test finger (Figure 2A) :		N/A
	Test with test pin (Figure 2B)..... :		N/A
	Test with test probe (Figure 2C)..... :		N/A
2.1.1.2	Battery compartments		N/A
2.1.1.3	Access to ELV wiring		N/A
	Working voltage (V _{peak} or V _{rms}); minimum distance through insulation (mm) :		-
2.1.1.4	Access to hazardous voltage circuit wiring		N/A
2.1.1.5	Energy hazards :	There is an Energy Hazard at the Input. Limit of accessibility should be determined in end product. Unit is for building in.	N/A
2.1.1.6	Manual controls		N/A
2.1.1.7	Discharge of capacitors in equipment		N/A
	Measured voltage (V); time-constant (s) :		-
2.1.1.8	Energy hazards - d.c. mains supply		N/A
	a) Capacitor connected to the d.c. mains supply .. :		N/A
	b) Internal battery connected to the mains supply :		N/A
2.1.1.9	Audio amplifiers :		N/A
2.1.2	Protection in service access areas	Unit for building in	N/A
2.1.3	Protection in restricted access locations	Unit is for building in	N/A
2.2	SELV circuits		Pass
2.2.1	General requirements		Pass
2.2.2	Voltages under normal conditions (V) :	The max voltage measured at the output was 12 V under normal condition.	Pass
2.2.3	Voltages under fault conditions (V) :	12 V	Pass
2.2.4	Connection of SELV circuits to other circuits :	SELV circuits are only connected to other secondary circuits. The SELV circuit does not exceed the SELV limits	Pass

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
		under normal and fault conditions.	
2.3	TNV circuits		Pass
2.3.1	Limits	Max 75 Vdc.	Pass
	Type of TNV circuits	Special Application - TNV-2 provides BI	-
2.3.2	Separation from other circuits and from accessible parts	Special Application - TNV-2 provides BI	Pass
2.3.2.1	General requirements	Special Application - TNV-2 provides BI	N/A
2.3.2.2	Protection by basic insulation	Special Application - TNV-2 provides BI	Pass
2.3.2.3	Protection by earthing		N/A
2.3.2.4	Protection by other constructions		N/A
2.3.3	Separation from hazardous voltages		N/A
	Insulation employed.....		-
2.3.4	Connection of TNV circuits to other circuits		N/A
	Insulation employed.....		-
2.3.5	Test for operating voltages generated externally		N/A
2.4	Limited current circuits		N/A
2.4.1	General requirements		N/A
2.4.2	Limit values		N/A
	Frequency (Hz)		-
	Measured current (mA).....		-
	Measured voltage (V)		-
	Measured circuit capacitance (nF or uF)		-
2.4.3	Connection of limited current circuits to other circuits		N/A
2.5	Limited power sources		N/A
	a) Inherently limited output		N/A
	b) Impedance limited output		N/A
	c) Regulating network limited output under normal operating and single fault condition		N/A
	d) Overcurrent protective device limited output		N/A
	Max. output voltage (V), max. output current (A), max. apparent power (VA).....		-
	Current rating of overcurrent protective device (A) :		-

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.6	Provisions for earthing and bonding		N/A
2.6.1	Protective earthing		N/A
2.6.2	Functional earthing		N/A
2.6.3	Protective earthing and protective bonding conductors		N/A
2.6.3.1	General		N/A
2.6.3.2	Size of protective earthing conductors		N/A
	Rated current (A), cross-sectional area (mm ²), AWG		-
2.6.3.3	Size of protective bonding conductors		N/A
	Rated current (A), cross-sectional area (mm ²), AWG		-
	Protective current rating (A), cross-sectional area (mm ²), AWG.....		-
2.6.3.4	Resistance of earthing conductors and their terminations; resistance (ohm), voltage drop (V), test current (A), duration (min)		N/A
2.6.3.5	Colour of insulation		N/A
2.6.4	Terminals		N/A
2.6.4.1	General		N/A
2.6.4.2	Protective earthing and bonding terminals		N/A
	Rated current (A), type, nominal thread diameter (mm)		-
2.6.4.3	Separation of the protective earthing conductor from protective bonding conductors		N/A
2.6.5	Integrity of protective earthing		N/A
2.6.5.1	Interconnection of equipment		N/A
2.6.5.2	Components in protective earthing conductors and protective bonding conductors		N/A
2.6.5.3	Disconnection of protective earth		N/A
2.6.5.4	Parts that can be removed by an operator		N/A
2.6.5.5	Parts removed during servicing		N/A
2.6.5.6	Corrosion resistance		N/A
2.6.5.7	Screws for protective bonding		N/A
2.6.5.8	Reliance on telecommunication network or cable distribution system		N/A
2.7	Overcurrent and earth fault protection in primary circuits		Pass

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.7.1	Basic requirements	.	Pass
	Instructions when protection relies on building installation	Unit is for building in.	N/A
2.7.2	Faults not covered in 5.3.7		Pass
2.7.3	Short-circuit backup protection		Pass
2.7.4	Number and location of protective devices :		N/A
2.7.5	Protection by several devices		N/A
2.7.6	Warning to service personnel..... :		N/A
2.8	Safety interlocks		N/A
2.8.1	General principles		N/A
2.8.2	Protection requirements		N/A
2.8.3	Inadvertent reactivation		N/A
2.8.4	Fail-safe operation		N/A
2.8.5	Moving parts		N/A
2.8.6	Overriding		N/A
2.8.7	Switches and relays		N/A
2.8.7.1	Contact gaps (mm) :		N/A
2.8.7.2	Overload test		N/A
2.8.7.3	Endurance test		N/A
2.8.7.4	Electric strength test		N/A
2.8.8	Mechanical actuators		N/A
2.9	Electrical insulation		Pass
2.9.1	Properties of insulating materials	Basic insulation based on 75 VDC between input and output. Natural rubber, materials containing asbestos and hygroscopic materials are not used as insulation.	Pass
2.9.2	Humidity conditioning		N/A
	Relative humidity (%), temperature (°C)..... :	--	-
2.9.3	Grade of insulation	Basic and functional	Pass
2.9.4	Separation from hazardous voltages		Pass
	Method(s) used..... :	Special Application - TNV-2 provides BI	-
2.10	Clearances, creepage distances and distances through insulation		Pass

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.10.1	General		Pass
2.10.1.1	Frequency..... :		N/A
2.10.1.2	Pollution degrees..... :	PD2	Pass
2.10.1.3	Reduced values for functional insulation		N/A
2.10.1.4	Intervening unconnected conductive parts		N/A
2.10.1.5	Insulation with varying dimensions		N/A
2.10.1.6	Special separation requirements		N/A
2.10.1.7	Insulation in circuits generating starting pulses		N/A
2.10.2	Determination of working voltage		Pass
2.10.2.1	General		Pass
2.10.2.2	RMS working voltage		Pass
2.10.2.3	Peak working voltage		Pass
2.10.3	Clearances	See Clause 5.3.4. and Table 2.10.3 and 2.10.4	Pass
2.10.3.1	General		Pass
2.10.3.2	Mains transient voltages	Assume 1500V	N/A
	a) AC mains supply		N/A
	b) Earthed d.c. mains supplies		N/A
	c) Unearthed d.c. mains supplies		N/A
	d) Battery operation		N/A
2.10.3.3	Clearances in primary circuits	Special Application - TNV-2 provides BI	N/A
2.10.3.4	Clearances in secondary circuits	Special Application - TNV-2 provides BI	Pass
2.10.3.5	Clearances in circuits having starting pulses		N/A
2.10.3.6	Transients from a.c. mains supply..... :		N/A
2.10.3.7	Transients from d.c. mains supply..... :		N/A
2.10.3.8	Transients from telecommunication networks and cable distribution systems		N/A
2.10.3.9	Measurement of transient voltage levels		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply		N/A
	For a d.c. mains supply		N/A
	b) Transients from a telecommunication network		N/A
2.10.4	Creepage distances	(see appended table 2.10.3 and 2.10.4) See Clause 5.3.4.	Pass

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.10.4.1	General		Pass
2.10.4.2	Material group and comparative tracking index		Pass
	CTI tests	Material group IIIb; 100 <= CTI < 175.	-
2.10.4.3	Minimum creepage distances		Pass
2.10.5	Solid insulation		Pass
2.10.5.1	General		Pass
2.10.5.2	Distances through insulation	(see appended table 2.10.5) Functional and Basic insulation does not have minimum distance through insulation requirement.	Pass
2.10.5.3	Insulating compound as solid insulation		N/A
2.10.5.4	Semiconductor devices		N/A
2.10.5.5	Cemented joints		N/A
2.10.5.6	Thin sheet material - General		N/A
2.10.5.7	Separable thin sheet material		N/A
	Number of layers (pcs)		-
2.10.5.8	Non-separable thin sheet material		N/A
2.10.5.9	Thin sheet material - standard test procedure		N/A
	Electric strength test		-
2.10.5.10	Thin sheet material - alternative test procedure		N/A
	Electric strength test		-
2.10.5.11	Insulation in wound components		N/A
2.10.5.12	Wire in wound components		N/A
	Working voltage		N/A
	a) Basic insulation not under stress		N/A
	b) Basic, supplementary, reinforced insulation.....		N/A
	c) Compliance with Annex U		N/A
	Two wires in contact inside wound component; angle between 45° and 90°		N/A
2.10.5.13	Wire with solvent-based enamel in wound components		N/A
	Electric strength test		-
	Routine test		N/A
2.10.5.14	Additional insulation in wound components		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Working voltage		N/A
	- Basic insulation not under stress		N/A
	- Supplementary, reinforced insulation		N/A
2.10.6	Construction of printed boards		Pass
2.10.6.1	Uncoated printed boards		Pass
2.10.6.2	Coated printed boards		N/A
2.10.6.3	Insulation between conductors on the same inner surface of a printed board		N/A
2.10.6.4	Insulation between conductors on different layers of a printed board		N/A
	Distance through insulation	Spacing between different traces of PWB is maintained by prepreg. since the planar transformer is being evaluated as having Basic insulation there is no through insulation distance requirement.	Pass
	Number of insulation layers (pcs)		N/A
2.10.7	Component external terminations		N/A
2.10.8	Tests on coated printed boards and coated components		N/A
2.10.8.1	Sample preparation and preliminary inspection		N/A
2.10.8.2	Thermal conditioning		N/A
2.10.8.3	Electric strength test		N/A
2.10.8.4	Abrasion resistance test		N/A
2.10.9	Thermal cycling		N/A
2.10.10	Test for Pollution Degree 1 environment and insulating compound		N/A
2.10.11	Tests for semiconductor devices and cemented joints		N/A
2.10.12	Enclosed and sealed parts		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
3	WIRING, CONNECTIONS AND SUPPLY		Pass
3.1	General		Pass
3.1.1	Current rating and overcurrent protection	to be evaluated in the end product	N/A
3.1.2	Protection against mechanical damage		N/A
3.1.3	Securing of internal wiring		N/A
3.1.4	Insulation of conductors		N/A
3.1.5	Beads and ceramic insulators		N/A
3.1.6	Screws for electrical contact pressure		N/A
3.1.7	Insulating materials in electrical connections		N/A
3.1.8	Self-tapping and spaced thread screws		N/A
3.1.9	Termination of conductors		N/A
	10 N pull test		N/A
3.1.10	Sleeving on wiring		N/A
3.2	Connection to mains supply		N/A
3.2.1	Means of connection		N/A
3.2.1.1	Connection to an a.c. mains supply		N/A
3.2.1.2	Connection to a d.c. mains supply		N/A
3.2.2	Multiple supply connections		N/A
3.2.3	Permanently connected equipment		N/A
	Number of conductors, diameter of cable and conduits (mm)..... :		-
3.2.4	Appliance inlets		N/A
3.2.5	Power supply cords		N/A
3.2.5.1	AC power supply cords		N/A
	Type..... :		-
	Rated current (A), cross-sectional area (mm ²), AWG :		-
3.2.5.2	DC power supply cords		N/A
3.2.6	Cord anchorages and strain relief		N/A
	Mass of equipment (kg), pull (N) :		-
	Longitudinal displacement (mm) :		-
3.2.7	Protection against mechanical damage		N/A
3.2.8	Cord guards		N/A
	Diameter of minor dimension D (mm); test mass (g) :		-

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Radius of curvature of cord (mm)..... :		-
3.2.9	Supply wiring space		N/A
3.3	Wiring terminals for connection of external conductors		N/A
3.3.1	Wiring terminals		N/A
3.3.2	Connection of non-detachable power supply cords		N/A
3.3.3	Screw terminals		N/A
3.3.4	Conductor sizes to be connected		N/A
	Rated current (A), cord/cable type, cross-sectional area (mm ²)..... :		-
3.3.5	Wiring terminal sizes		N/A
	Rated current (A), type and nominal thread diameter (mm)..... :		-
3.3.6	Wiring terminals design		N/A
3.3.7	Grouping of wiring terminals		N/A
3.3.8	Stranded wire		N/A
3.4	Disconnection from the mains supply		N/A
3.4.1	General requirement		N/A
3.4.2	Disconnect devices		N/A
3.4.3	Permanently connected equipment		N/A
3.4.4	Parts which remain energized		N/A
3.4.5	Switches in flexible cords		N/A
3.4.6	Number of poles - single-phase and d.c. equipment		N/A
3.4.7	Number of poles - three-phase equipment		N/A
3.4.8	Switches as disconnect devices		N/A
3.4.9	Plugs as disconnect devices		N/A
3.4.10	Interconnected equipment		N/A
3.4.11	Multiple power sources		N/A
3.5	Interconnection of equipment		N/A
3.5.1	General requirements		N/A
3.5.2	Types of interconnection circuits..... :		N/A
3.5.3	ELV circuits as interconnection circuits		N/A
3.5.4	Data ports for additional equipment		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4	PHYSICAL REQUIREMENTS		Pass
4.1	Stability		N/A
	Angle of 10°		N/A
	Test force (N)..... :		N/A
4.2	Mechanical strength		N/A
4.2.1	General		N/A
4.2.2	Steady force test, 10 N		N/A
4.2.3	Steady force test, 30 N		N/A
4.2.4	Steady force test, 250 N		N/A
4.2.5	Impact test		N/A
	Fall test		N/A
	Swing test		N/A
4.2.6	Drop test; height (mm)..... :		N/A
4.2.7	Stress relief test		N/A
4.2.8	Cathode ray tubes		N/A
	Picture tube separately certified :		N/A
4.2.9	High pressure lamps		N/A
4.2.10	Wall or ceiling mounted equipment; force (N) :		N/A
4.3	Design and construction		Pass
4.3.1	Edges and corners		Pass
4.3.2	Handles and manual controls; force (N)..... :		N/A
4.3.3	Adjustable controls		N/A
4.3.4	Securing of parts	The equipment does not have any supplementary or reinforced insulation.	N/A
4.3.5	Connection by plugs and sockets		N/A
4.3.6	Direct plug-in equipment		N/A
	Torque :		N/A
	Compliance with the relevant mains plug standard:		N/A
4.3.7	Heating elements in earthed equipment		N/A
4.3.8	Batteries		N/A
	- Overcharging of a rechargeable battery		N/A
	- Unintentional charging of a non-rechargeable battery		N/A
	- Reverse charging of a rechargeable battery		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- Excessive discharging rate for any battery		N/A
4.3.9	Oil and grease		N/A
4.3.10	Dust, powders, liquids and gases		N/A
4.3.11	Containers for liquids or gases		N/A
4.3.12	Flammable liquids..... :		N/A
	Quantity of liquid (l)..... :		N/A
	Flash point (°C)..... :		N/A
4.3.13	Radiation		N/A
4.3.13.1	General		N/A
4.3.13.2	Ionizing radiation		N/A
	Measured radiation (pA/kg) :		-
	Measured high-voltage (kV) :		-
	Measured focus voltage (kV)..... :		-
	CRT markings..... :		-
4.3.13.3	Effect of ultraviolet (UV) radiation on materials		N/A
	Part, property, retention after test, flammability classification :		N/A
4.3.13.4	Human exposure to ultraviolet (UV) radiation :		N/A
4.3.13.5	Laser (including LEDs)		N/A
	Laser class :		-
4.3.13.6	Other types :		N/A
4.4	Protection against hazardous moving parts		N/A
4.4.1	General		N/A
4.4.2	Protection in operator access areas..... :		N/A
4.4.3	Protection in restricted access locations :		N/A
4.4.4	Protection in service access areas		N/A
4.5	Thermal requirements		Pass
4.5.1	General		Pass
4.5.2	Temperature tests	(see appended table 4.5)	Pass
	Normal load condition per Annex L :	Operated in the most unfavorable way of operation given in the operating instructions until steady conditions established.	-
4.5.3	Temperature limits for materials		Pass
4.5.4	Touch temperature limits	to be evaluated in the end	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
		product	
4.5.5	Resistance to abnormal heat..... :	No parts at hazardous voltage are directly mounted on thermoplastic parts.	N/A
4.6	Openings in enclosures		N/A
4.6.1	Top and side openings	For building in.	N/A
	Dimensions (mm) :		-
4.6.2	Bottoms of fire enclosures		N/A
	Construction of the bottom, dimensions (mm)..... :		-
4.6.3	Doors or covers in fire enclosures		N/A
4.6.4	Openings in transportable equipment		N/A
4.6.4.1	Constructional design measures		N/A
	Dimensions (mm) :		-
4.6.4.2	Evaluation measures for larger openings		N/A
4.6.4.3	Use of metallized parts		N/A
4.6.5	Adhesives for constructional purposes		N/A
	Conditioning temperature (°C), time (weeks) :		-
4.7	Resistance to fire		Pass
4.7.1	Reducing the risk of ignition and spread of flame		Pass
	Method 1, selection and application of components wiring and materials		Pass
	Method 2, application of all of simulated fault condition tests		N/A
4.7.2	Conditions for a fire enclosure		Pass
4.7.2.1	Parts requiring a fire enclosure	The unit is for building-in, fire enclosure to be provided in the end product.	Pass
4.7.2.2	Parts not requiring a fire enclosure	Fire enclosure to be provided in the end product.	N/A
4.7.3	Materials		Pass
4.7.3.1	General		N/A
4.7.3.2	Materials for fire enclosures		N/A
4.7.3.3	Materials for components and other parts outside fire enclosures		N/A
4.7.3.4	Materials for components and other parts inside fire enclosures		Pass
4.7.3.5	Materials for air filter assemblies	The equipment does not have	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
		any air filters.	
4.7.3.6	Materials used in high-voltage components		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5	ELECTRICAL REQUIREMENTS AND SIMULATED ABNORMAL CONDITIONS		Pass
5.1	Touch current and protective conductor current		N/A
5.1.1	General		N/A
5.1.2	Configuration of equipment under test (EUT)		N/A
5.1.2.1	Single connection to an a.c. mains supply		N/A
5.1.2.2	Redundant multiple connections to an a.c. mains supply		N/A
5.1.2.3	Simultaneous multiple connections to an a.c. mains supply		N/A
5.1.3	Test circuit		N/A
5.1.4	Application of measuring instrument		N/A
5.1.5	Test procedure		N/A
5.1.6	Test measurements		N/A
	Supply voltage (V)	:	-
	Measured touch current (mA).....	:	-
	Max. allowed touch current (mA).....	:	-
	Measured protective conductor current (mA)	:	-
	Max. allowed protective conductor current (mA) ...	:	-
5.1.7	Equipment with touch current exceeding 3,5 mA		N/A
5.1.7.1	General		N/A
5.1.7.2	Simultaneous multiple connections to the supply		N/A
5.1.8	Touch currents to telecommunication networks and cable distribution systems and from telecommunication networks		N/A
5.1.8.1	Limitation of the touch current to a telecommunication network or to a cable distribution system		N/A
	Supply voltage (V)	:	-
	Measured touch current (mA).....	:	-
	Max. allowed touch current (mA).....	:	-
5.1.8.2	Summation of touch currents from telecommunication networks		N/A
	a) EUT with earthed telecommunication ports	:	N/A
	b) EUT whose telecommunication ports have no reference to protective earth		N/A
5.2	Electric strength		Pass
5.2.1	General	(see appended table 5.2)	Pass

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Clause	Requirement + Test	Result - Remark	Verdict
5.2.2	Test procedure	(see appended table 5.2)	Pass
5.3	Abnormal operating and fault conditions		Pass
5.3.1	Protection against overload and abnormal operation	(see appended table 5.3)	Pass
5.3.2	Motors		N/A
5.3.3	Transformers	Transformers are constructed in accordance with the applicable Clause and Annex C.	Pass
5.3.4	Functional insulation..... :	Method b and c	Pass
5.3.5	Electromechanical components	The equipment does not have any electromechanical components in the secondary.	N/A
5.3.6	Audio amplifiers in ITE..... :		N/A
5.3.7	Simulation of faults	Transformer temperatures measured for compliance with Annex C during test.	Pass
5.3.8	Unattended equipment	The equipment does not have any thermostats, temperature limiters, or thermal cut-outs.	N/A
5.3.9	Compliance criteria for abnormal operating and fault conditions	No fire, emission of molten metal or deformation was noted during the tests.	Pass
5.3.9.1	During the tests	No fire, emission of molten metal or deformation was noted during the tests. The maximum temperature of 300°C was not exceeded.	Pass
5.3.9.2	After the tests	Electric Strength tests performed after abnormal and fault tests.	Pass
6	CONNECTION TO TELECOMMUNICATION NETWORKS		N/A
7	CONNECTION TO CABLE DISTRIBUTION SYSTEMS		N/A
A	ANNEX A, TESTS FOR RESISTANCE TO HEAT AND FIRE		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
B	ANNEX B, MOTOR TESTS UNDER ABNORMAL CONDITIONS (see 4.7.2.2 and 5.3.2)		N/A
C	ANNEX C, TRANSFORMERS (see 1.5.4 and 5.3.3)		Pass
	Position	See Table 1.5.1 Main Transformer - Integral to PWB, See PWB Layout and Fabrication in enclosure	-
	Manufacturer	See Table 1.5.1	-
	Type.....	See Table 1.5.1	-
	Rated values.....	See Table 1.5.1	-
	Method of protection.....	Planar type. Main Transformer - Integral to PWB, See PWB Layout and Fabrication in enclosure	-
C.1	Overload test	(see appended table 5.3)	Pass
C.2	Insulation		Pass
	Protection from displacement of windings.....		N/A
D	ANNEX D, MEASURING INSTRUMENTS FOR TOUCH-CURRENT TESTS (see 5.1.4)		N/A
E	ANNEX E, TEMPERATURE RISE OF A WINDING (see 1.4.13)		N/A
F	ANNEX F, MEASUREMENT OF CLEARANCES AND CREEPAGE DISTANCES (see 2.10 and Annex G)		Pass
G	ANNEX G, ALTERNATIVE METHOD FOR DETERMINING MINIMUM CLEARANCES		N/A
H	ANNEX H, IONIZING RADIATION (see 4.3.13)		N/A
J	ANNEX J, TABLE OF ELECTROCHEMICAL POTENTIALS (see 2.6.5.6)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
K	ANNEX K, THERMAL CONTROLS (see 1.5.3 and 5.3.8)		N/A
L	ANNEX L, NORMAL LOAD CONDITIONS FOR SOME TYPES OF ELECTRICAL BUSINESS EQUIPMENT (see 1.2.2.1 and 4.5.2)		Pass
L.1	Typewriters		N/A
L.2	Adding machines and cash registers		N/A
L.3	Erasers		N/A
L.4	Pencil sharpeners		N/A
L.5	Duplicators and copy machines		N/A
L.6	Motor-operated files		N/A
L.7	Other business equipment		Pass
M	ANNEX M, CRITERIA FOR TELEPHONE RINGING SIGNALS (see 2.3.1)		N/A
N	ANNEX N, IMPULSE TEST GENERATORS (see 1.5.7.2, 1.5.7.3, 2.10.3.9, 6.2.2.1, 7.3.2, 7.4.3 and Clause G.5)		N/A
P	ANNEX P, NORMATIVE REFERENCES		Pass
Q	ANNEX Q, Voltage dependent resistors (VDRs) (see 1.5.9.1)		N/A
R	ANNEX R, EXAMPLES OF REQUIREMENTS FOR QUALITY CONTROL PROGRAMMES		N/A
S	ANNEX S, PROCEDURE FOR IMPULSE TESTING (see 6.2.2.3)		N/A
T	ANNEX T, GUIDANCE ON PROTECTION AGAINST INGRESS OF WATER (see 1.1.2)		N/A
U	ANNEX U, INSULATED WINDING WIRES FOR USE WITHOUT INTERLEAVED INSULATION (see 2.10.5.4)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
V	ANNEX V, AC POWER DISTRIBUTION SYSTEMS (see 1.6.1)		N/A
W	ANNEX W, SUMMATION OF TOUCH CURRENTS		N/A
X	ANNEX X, MAXIMUM HEATING EFFECT IN TRANSFORMER TESTS (see clause C.1)		N/A
Y	ANNEX Y, ULTRAVIOLET LIGHT CONDITIONING TEST (see 4.3.13.3)		N/A
Z	ANNEX Z, OVERVOLTAGE CATEGORIES (see 2.10.3.2 and Clause G.2)		N/A
AA	ANNEX AA, MANDREL TEST (see 2.10.5.8)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

1.5.1	TABLE: list of critical components					Pass
object/part or Description	manufacturer/ trademark	type/model	technical data	standard (edition/year)	mark(s) of conformity ¹⁾	
Optical Isolators (U100, U101)	NEC	PS-2801-1-V-F3-P	2500 V	UL1577/EN 60747-5 (VDE 0884)	UL, VDE (Licence attached)	
Optical Isolators Alternate (U100, U101)	Various	Various	2500 V	UL1577/EN6074 5-5	UL, --	
PWB	Various	Various	Rated min V-1, 130 C	UL 94/UL796	UL, --	
Transformer	Transtek	NCT1002	Class A, basic insulation provided , Planar transformer	IEC 60950-1, First Edition	Evaluated under this investigation., --	
Transformer Alternate	Various	Various	Class A, Basic insulation, Planar transformer	IEC 60950-1 First Edition	---, ---	
Marking Label	Identco identification Corporation	TT401 or TT403	Max temperature 175 C, Indoor use only	UL 969, IEC60950-1	UL, Evaluated under this investigation, ---	
ERS SERIES	--	--	See below details. E217682-A6-UL-1 and CB-1 Amendment # 1	Evaluated under this investigation to IEC 60950-1	--, --	
Main isolation (T100) Planar transformer	Various	Various	Netpower Technologies Design, Min. V-1, 130°C, multiple layers, with epoxy type film (FR-4) or (Prepreg) used to separate each layer.	UL 796	UL/cUL, Evaluated under this investigation to IEC 60950-1	
Inductor (L200)	Various	Various	Netpower Technologies Design, Planar type, 130 C, V-1 min	UL 796	UL/cUL, Evaluated under this investigation to IEC 60950-1	
Optical Isolators (U600)	NEC or RENESAS ELECTRONICS	PS2801-1 or 2801-4	provided Isolation 2500 V ac	UL1577/EN 60747-5 (VDE 0884)	UL/cUL, VDE (Licence attached)	
Capacitor (C104)	AVX	Style 1206 S C	Electrical ratings 1200pF, 1500V, XR7 type, 125°C	Evaluated under this investigation to IEC 60950-1	--, --	
Temperature	MURATA MFG	PRF18BA471++	PTC	UL1434,	UL/cUL, --	

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Clause	Requirement + Test	Result - Remark	Verdict

1.5.1	TABLE: list of critical components					Pass
object/part or Description	manufacturer/ trademark	type/model	technical data	standard (edition/year)	mark(s) of conformity ¹⁾	
regulator Thermistor (RT100)	CO LTD	+++ or PRF21BA471++ +++	Temperature Sensors - 32V dc, 30mA 125°C	Evaluated under this investigation to IEC 60950-1		
Marking Label	Identco identification Corporation	TT401 or TT403	Max temperature 175°C, Indoor use only	UL 969, IEC60950-1	UL, Evaluated under this investigation, ---	
Supplementary information: ¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.						

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Clause	Requirement + Test	Result - Remark	Verdict

1.6.2	TABLE: electrical data (in normal conditions)						Pass
U (V)	I (A)	I rated (A)	P (W)	Fuse #	I fuse (A)	condition/status	
36Vdc	2.75A	4A	--	@ BC	20A	Model ERS4020x040xxx, Max load of 40 A	
75Vdc	1.8A	4A	--	@ BC	20A	Model ERS4020x040xxx, Max load of 40 A	
36Vdc	4.26A	6A	--	@ BC	20A	Model EBS4033x040, Max load of 40 A	
55Vdc	2.3A	6A	--	@ BC	20A	Model EBS4033x040xxx, Max load of 40 A	
--	--	--	--	--	--	--	
18V dc	8.6A	--	--	--	--	MNL ERS2033	
24V dc	6.36A	20A	--	@ BC	20A	MNL ERS2033	
36V dc	4.2A	--	--	--	--	MNL ERS2033	
--	--	--	--	--	--	--	
18V dc	8.1A	--	--	---	--	MNL ERS3150	
36V dc	4A	--	--	---	--	MNL ERS3150	
48V dc	3A	20A	--	@ BC	20A	MNL ERS3150	
60V dc	2.43A	--	--	--	--	MNL ERS3150	
75V dc	1.98A	--	--	---	--	MNL ERS3150	
--	--	--	--	--	--	-----	
36V dc	4.1A	--	--	---	--	MNL ERS4033	
48V dc	3.05A	20A	--	@ BC	20A	MNL ERS4033	
60V dc	2.44A	--	--	---	--	MNL ERS4033	
75V dc	1.97A	--	--	--	--	MNL ERS4033	
--	--	--	--	--	--	-----	
36V dc	3.65A	--	--	---	--	MNL ERS4015	
48V dc	2.73A	20A	--	@ BC	20A	MNL ERS4015	
60V dc	2.18	--	--	--	--	MNL ERS4015	
75V dc	1.76A	--	--	---	--	MNL ERS4015	
supplementary information:							
Output loaded per manufacturer provided rating. Load provided using electronic load, Tested on worktable with 12V dc, 0.45A dc fan, cfm approx 350, approx 6.5inch above EUT							

2.10.3 and 2.10.4	TABLE: clearance and creepage distance measurements						Pass
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)	
Worse case TNV-2 to SELV	Special Application - TNV-2 (assumed 75Vdc)	Special Application - TNV-2 (assumed 75Vdc)	1.0	2.2	1.4	2.2	
--	--	--	--	--	--	--	

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Clause	Requirement + Test			Result - Remark		Verdict
T1 pins T1_P1- to T1_S1+	97	82.2	1.3	2	1.5	2
Functional:						
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)
--	--	--	--	--	--	--
Basic/supplementary:						
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)
--	--	--	--	--	--	--
Reinforced:						
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)
--	--	--	--	--	--	--
supplementary information:						
Output loaded per manufacturer provided rating. Load provided using electronic load, Tested on worktable with 12V dc, 0.45A dc fan, cfm approx 350, approx 6.5inch above EUT						

2.10.5	TABLE: distance through insulation measurements					Pass
Distance through insulation (DTI) at/of:	U peak (V)	Urms (V)	Test voltage (V)	Required DTI (mm)	DTI (mm)	
SELV and TNV2 (basic)	75 Vdc	--	1414 Vdc	N/A	---	
supplementary information:						
--						

4.3.8	TABLE: Batteries								N/A
The tests of 4.3.8 are applicable only when appropriate battery data is not available.									
Is it possible to install the battery in a reverse polarity position?									
Non-rechargeable batteries			Rechargeable batteries						
Discharging		Un-intentional charging	Charging		Discharging		Reversed charging		
Meas. current	Manuf. specs.		Meas. current	Manuf. specs.	Meas. current	Manuf. specs.	Meas. current	Manuf. specs.	

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Clause	Requirement + Test					Result - Remark			Verdict
Max. current during normal operation									
Max. current during fault operation									
Test results:									Verdict
- Chemical leaks									
- Explosion of the battery									
- Emission of flame or expulsion of molten metal									
- Electric strength tests of equipment after completion of tests									
supplementary information:									

4.5	TABLE: Thermal requirements						Pass
	Supply voltage (V)..... :	36 Vdc	55 Vdc	36 Vdc	75 Vdc	--	—
	Ambient Tmin (°C)	50.1	51.9	50.8	51.5	--	—
	Ambient Tmax (°C)	50.1	51.9	50.8	51.5	--	—
Maximum measured temperature T of part/at:		T (°C)					allowed Tmax (°C)
T1 Transformer core		103.4	103.3	101.1	104.6	--	130
T1 Transformer coil		102.2	104	103.2	104.1	--	130
L200 core		103	101	101	100	--	130
L200 coil		102.1	101	99	92	--	130
Q200		99	102	95	94	--	130
Input trace		98	95	96	91	--	130
Output trace		88	102	96	89	--	130
Q100		64	51.9	61.2	60.3	--	130
Room Ambient		22.3	22.2	23.1	22.9	--	---
--		--	--	--	--	--	--
Models ERS2033. maximum temperature T of part/at:		T (°C) #1	T (°C) #2	T (°C) #3	--	--	allowed Tmax (°C)
---		18V	36V	18V	--	--	--

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Clause	Requirement + Test	Result - Remark			Verdict	
		dc; output @ 3.3Vdc , 40A	dc; output @ 3.3Vdc , 40A	dc; output @ 3.3Vdc , 25A		
1. T100 Core		97.9	84.7	116	--	130
2. T100 PWB trace		118.9	100.8	124.2	--	130
3. PWB at L200		97.2	87.9	108	--	130
4. PWB at L100		103	82	112	--	130
5. PWB at Q201		81.5	74.5	99.9	--	130
6. PWB at Q101		102.8	87.7	114.6	--	130
7. PWB by T101		112.3	93	118.2	--	130
8. PWB by IC105 hot spot		96.2	80.8	111.4	--	130
9. Input trace --- hot spot		91.7	75.4	109.1	--	130
10. Output trace hot spot		96.5	88.7	107.7	--	130
11. PWB near OPTO hot spot		78.3	67.2	105	--	130
12. Room Ambient (chamber)		26	25.8	85.2	--	--
Models ERS3150. maximum temperature T of part/at:		T (°C) #1	T (°C) #2	T (°C) #3	--	allowed Tmax (°C)
---		18V dc; output @ 15Vdc, 8.8A	75V dc; output @ 15Vdc, 8.8A	75V dc; output @ 15Vdc, 4A	--	--
1. T100 Core		65	75.2	106	--	130
2. T100 PWB trace		102.2	113.3	117.1	--	130
3. PWB at L200		69.4	101.5	104.7	--	130
4. PWB at L100		91.2	89.5	106.7	--	130
5. PWB at Q201		75.6	123.5	108.3	--	130
6. PWB at Q101		105.7	106	119.5	--	130
7. PWB by T101		111.4	111.2	114.5	--	130
8. PWB by IC105 hot spot		73.1	74.4	99.8	--	130
9. Input trace --- hot spot		78	79.1	102.6	--	130
10. Output trace hot spot		53.5	71.6	94.4	--	130
11. PWB near OPTO hot spot		83.6	88	105.7	--	130
12. Room Ambient (chamber)		22	22.4	85	--	--
Models ERS4015. maximum temperature T of part/at:		T (°C) #1	T (°C) #2	T (°C) #3	--	allowed Tmax (°C)
---		36V dc; output @ 1.5Vdc , 70A	75V dc; output @ 1.5Vdc , 70A	75V dc; output @ 1.5Vdc , 50A	--	--
1. T100 Core		84.6	82.7	117	--	130

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict

2. T100 PWB trace	97.4	93.5	123.7	--	--	130	
3. PWB at L200	84.9	83.4	116.5	--	--	130	
4. PWB at L100	77.5	73.5	111.5	--	--	130	
5. PWB at Q201	109.6	104.6	129	--	--	130	
6. PWB at Q101	84	82.6	115.1	--	--	130	
7. PWB by T101	89.2	85.6	119.8	--	--	130	
8. PWB by IC105 hot spot	88.3	87.7	117.5	--	--	130	
9. Input trace --- hot spot	66.5	65.4	106.1	--	--	130	
10. Output trace hot spot	82.2	81.5	114.8	--	--	130	
11. PWB near OPTO hot spot	72.5	70.1	111.3	--	--	130	
12. Room Ambient (chamber)	23.6	23.5	84.7	--	--	--	
temperature T of winding:	t ₁ (°C)	R ₁ (Ω)	t ₂ (°C)	R ₂ (Ω)	T (°C)	allowed T _{max} (°C)	insulation class
--	--	--	--	--	--	--	--

supplementary information:

The first two columns @ 36 Vdc and 55 Vdc are conducted using sample Model EBS4033x040xxx, representing EBS Series while the last columns @36 Vdc and 75 Vdc are conducted using sample model ERS4020x040xxx, representing ERS Series.

Output loaded per manufacturer provided rating. Load provided using electronic load. Test was conducted inside chamber.

Unit employs PTC Temperature Sensors RT100 a max temp protection, Thermal Shut down case = 125°C, Thermal auto recovery =120°C, per de-rating curve.

External Forced Air Cooling: dc Fan rated 24V dc, 0.75A inside chamber_ approx 6.5inch above EUT, CFM approx 350.

Units cannot operate/ hold rated current at higher Tma of 85°C (for very long) due to output current efficiency de-rating curves.

4.5.5	TABLE: Ball pressure test of thermoplastic parts		N/A
	allowed impression diameter (mm)	less than or equal to 2.0	—
part	test temperature (°C)	impression diameter (mm)	
supplementary information:			

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict

4.7	TABLE: resistance to fire				Pass
part	manufacturer of material	type of material	thickness (mm)	flammability class	Evidence
PWB	--	--	--	V-1, 130°C	
supplementary information:					
See table 1.5.1.					

5.2	TABLE: electric strength tests, impulse tests and voltage surge tests			Pass
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
Input to Ground		dc	1414 Vdc	No
Input to Output		dc	1414 Vdc	No
Input to Output (Models ERS3150, ERS4015, ERS4033, and ERS2033)		dc	1500Vdc	No
Functional:				
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
--		--	--	--
Basic/supplementary:				
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
--		--	--	--
Reinforced:				
Test voltage applied between:		Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
--		--	--	--
supplementary information:				
--				

5.3	TABLE: fault condition tests		Pass
	ambient temperature (°C)	50 C	—
	Power source for EUT: Manufacturer, model/type, output rating	ERS and EBS Series	—

Issue Date: 2011-01-20

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Report Reference #

E217682-A6-CB-2

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict

Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Q100 (ERS4020 X040)	Short Drain to source	75	25 min	-	20	NB, NC, NT, Unit cycles max temperature of T1 = 104 C.
T1 (ERS4020 X040)	Short Primary to Secondary	75	1 minute	-	20	NB, NC, NT, Unit shuts down, Repeated test three times.
R210 (ERS4020 X040)	Short	75	1 minute	-	20	NB, NC, NT, Unit shuts down, repeated test three times
C 100 (ERSS402 0X040)	Open	75	1 minute	-	20	NB, NC, NT, Unit shuts down, Repeated test three times
C100 (ERS4020 X040)	Short	75	30 Minutes	-	20	NB, NC, NT, Unit cycles, max temperature of T1=102C
Q102 (ERS4020 X040)	Short (Drain to Source)	75	1 minute	-	20	NB, NC, NT, Unit shuts down, Repeated test three times.
T1 (EBS4033X 040)	Short (Pri - Sec)	55	1 min	-	20	NB, NC, NT, Unit Shuts down, repeated test 3 times.
Q100(EBS 4033X040)	Short (Source to Drain)	55	15 min	-	20	NB, NC, NT, unit cycles, max temperature of T1 100 C.
R210 (EBS4033X 040)	Short	55	1 min	-	20	NB, NC, NT, Unit Shuts down, repeated test 3 times.
C100 (EBS4033X 040)	Open	55	1 min	-	20	NB, NC, NT, Unit shuts down, repeated test 3 times.
C100 (EBS4033X 040)	Short	55	1 min	-	20	NB, NC, NT, Unit shuts down repeated test 3 times.
Q102 (EBS4033X 040)	Short (Drain to Source)	55	1 min	-	20	NB, NC, N, Unit shuts down, repeated test 3 times.
Transformer Overload T1 (ERS)	Overload Output	75	25 min	-	20	NB, NC, NT, max temperature = 102 C
Power Supply output Short circuit Overload (EBS4033X	Short	55	30 Sec	-	20	NB, NC, NT, unis shuts down, component open, repeated 3 times.

Issue Date: 2011-01-20

Page 40 of 40

Report Reference #

E217682-A6-CB-2

IEC 60950-1						
Clause	Requirement + Test				Result - Remark	Verdict
040) Vout (+) to Vout (-)						
Vout (+) to Vout (-)	Overload	55	30 Sec	-	20	NB, NC, NT, Unit shuts down, component open. Repeated test 3 times.
Vout (+) to Vout (-) (ERS4020 X040)	Short	75	1 min	-	20	NB, NC, NT, Unit shuts down, Component open, repeated test 3 times. T1 temperature = 78 C
Vout (+) to Vout (-)	Overload	75	1 min	-	20	NB, NC, NT, Unit shuts down, component open, repeated test 3 times. T1 temperature = 89 C
--	--	--	--	--	--	--
ERS2033 - 3.3V dc output	OUTPUT SHORT-CIRCUIT	36V dc	Instantly	--	20A	Unit shut down Instantly, NB, NC
ERS3150 - 15V dc output	OUTPUT SHORT-CIRCUIT	75V dc	Instantly	--	20A	Unit shut down Instantly, NB, NC
ERS4015 - 1.5V dc output	OUTPUT SHORT-CIRCUIT	75V dc	Instantly	--	20A	Unit shut down Instantly, NB, NC
ERS2033 - 3.3V dc output	OUTPUT OVERLOAD TEST	18V dc	1:25hr	@B C	20A	Output loaded to 3.3V dc @ 41.5A. See attachment page 28a, NB, NC, CT
ERS3150 - 15V dc output	OUTPUT OVERLOAD TEST	75V dc	1hr	@B C	20A	Output loaded to 15V dc @ 9A. See attachment page 28b. NB, NC, CT
ERS4015 - 1.5V dc output	OUTPUT OVERLOAD TEST	36V dc	1.25hr	@B C	20A	Output loaded to 1.5V dc @ 75A. See attachment page 28c. NB, NC, CT
Component single fault, Model ERS3150	--	--	-	-	-	-
Q220 - D to S	Short	75V dc	--	--	--	Unit shut down Instantly, NB, NC
Q103 - D to S	Short	75V dc	--	--	--	Unit shut down Instantly, NB, NC
C122	Short	75V dc	--	--	--	Unit shut down Instantly, NB, NC
supplementary information:						

REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1631	10-09-30	
C	REVISED PER ECO 1674	10-11-25	
D	REVISED PER ECO 1850	11-09-28	

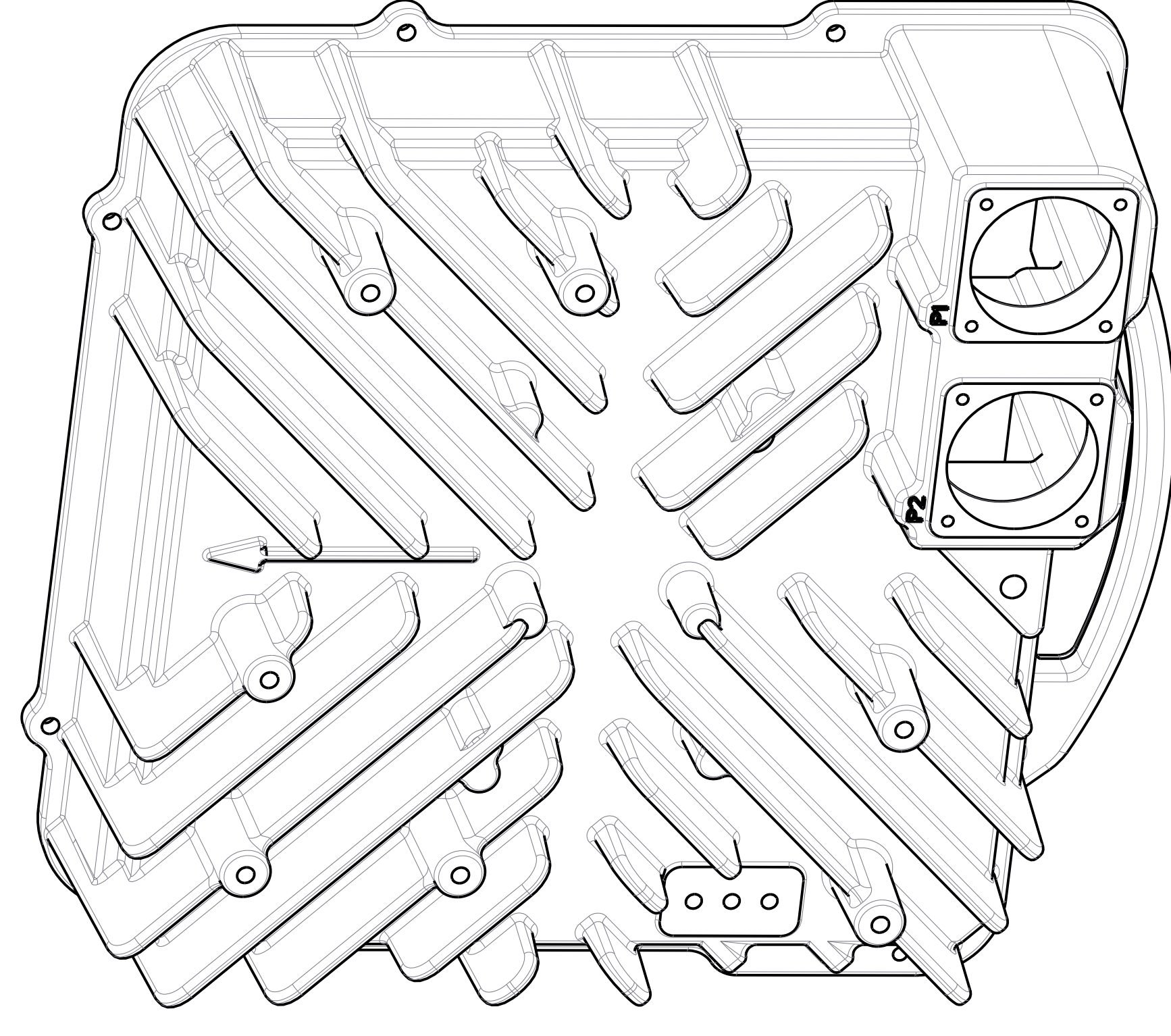
D

NOTES:

- MATERIAL: AL ALLOY A360 OR A356.2 PER ASTM B85-03.
- FINISH: CHEMICAL CONVERSION COATING PER REQUIREMENTS MIL-DTL-5541 TYPE 2 CLASS 3 (CLEAR), COMPLIANT TO ROHS DIRECTIVE 2002/95/EC. PAINT AS INDICATED USING TGIC POLYESTER POWDER, HIGH GLOSS WHITE, PROTECH COLOUR CODE PS-111-W2.
- UNLESS OTHERWISE SPECIFIED, CASTING SHALL MEET STANDARD CASTING TOLERANCE REQUIREMENTS PER ASTM B85-03.
- CASTING SHALL NOT BE SHOT BLASTED. UNLESS OTHERWISE SPECIFIED: CAST FILLETS, EDGES AND ROUNDS R .04 - .08. AS CAST SURFACE SHALL BE GRADE 2 PER NADCA GUIDELINES 6-6-6.
- MARK MANUFACTURER'S IDENTIFICATION AND PART NUMBER "46-001019-01-XX R Y" WHERE "XX" IS THE MFG CODE AND "Y" IS THE DRAWING REVISION (MFG CODE AND DRAWING REVISION ARE LOCATED IN THE DRAWING TITLE BLOCK ON SHEET 1) IN LOCATION INDICATED. MARKING METHOD MAY BE CAST OR RUBBER STAMPED AT MANUFACTURERS DISCRETION. IF CAST, CHARACTERS SHALL NOT BE RAISED MORE THAN .04 ABOVE SURFACE.
- GATES, RISERS, FLASH AND PARTING LINES SHALL BE TRIMMED FLUSH TO .015 MAX ABOVE THE ADJACENT SURFACE.
- USE MINIMUM DRAFT WHERE EVER FEASIBLE. DRAFT SHALL NOT BE GREATER THAN INDICATED ON DRAWING OR IN 3D ELECTRONIC FILE UNLESS OTHERWISE SPECIFIED.
- MARKS FROM PUSH-OUT PINS ARE PERMISSIBLE WITHIN ± 0.15 OF TRUE SURFACE. WHENEVER POSSIBLE LOCATE PUSH-OUT PINS ON SURFACES TO BE MACHINED, HOLE LOCATIONS, OR ON SURFACES INDICATED. EJECT PIN FLASH MUST BE REMOVED.
- IN-PROCESS WELDING OF CASTING IS PERMITTED.
- MACHINED SURFACES SHALL BE $\sqrt{125}$ UNLESS OTHERWISE SPECIFIED.
- REMOVE ALL BURRS AND SHARP EDGES.
- THE ITEM SHALL BE MANUFACTURED AND INSPECTED USING AN ELECTRONIC DATA FILE AND THE DRAWING AVAILABLE FROM DRAGONWAVE INC. THE FILENAMES AND TYPES OF ELECTRONIC FILES AVAILABLE FOR THE ITEM(S) ARE SHOWN IN TABLE A. OTHER FILE TYPES AND FORMATS AVAILABLE UPON REQUEST. UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN THE ELECTRONIC DATA FILE ARE BASIC WITH A TOLERANCE OF ±.005 FOR MACHINED FEATURES AND ±.010 UP TO 1.000 AND AN ADDITIONAL ±.001 FOR EACH ADDITIONAL 1.000 FOR CAST FEATURES. DIMENSIONS SHALL BE REFERENCED FROM DATUMS A, B, C. THE DRAWING PROVIDES A LIMITED NUMBER OF DIMENSIONS TO AID THE SUPPLIER IN DETERMINING THAT THE ITEM(S) MEET(S) ALL OF THE FEATURES OF THE ELECTRONIC DATA FILE.
- MACHINED SURFACES INDICATED SHALL BE FREE FROM VOIDS AND POROSITY THAT WOULD VIOLATE THE SURFACE FINISH REQUIREMENTS INDICATED. ANY VOIDS OR POROSITY THAT VIOLATE THE SURFACE FINISH REQUIREMENTS SHALL BE FILLED/REPAIRED USING ALUMINUM PUTTY PER DOD-C-24176 TYPE 11 OR MMM-A-1754.

TABLE A (ELECTRONIC DATA)

FILE NAME	DESCRIPTION / FORMAT
46001019RD.PDF	DRAWING / ADOBE PDF
46001019-01MCO1RD.IGS	3D SURFACES / IGES
46001019-01MCO1RD.STP	3D SURFACES / STEP



C

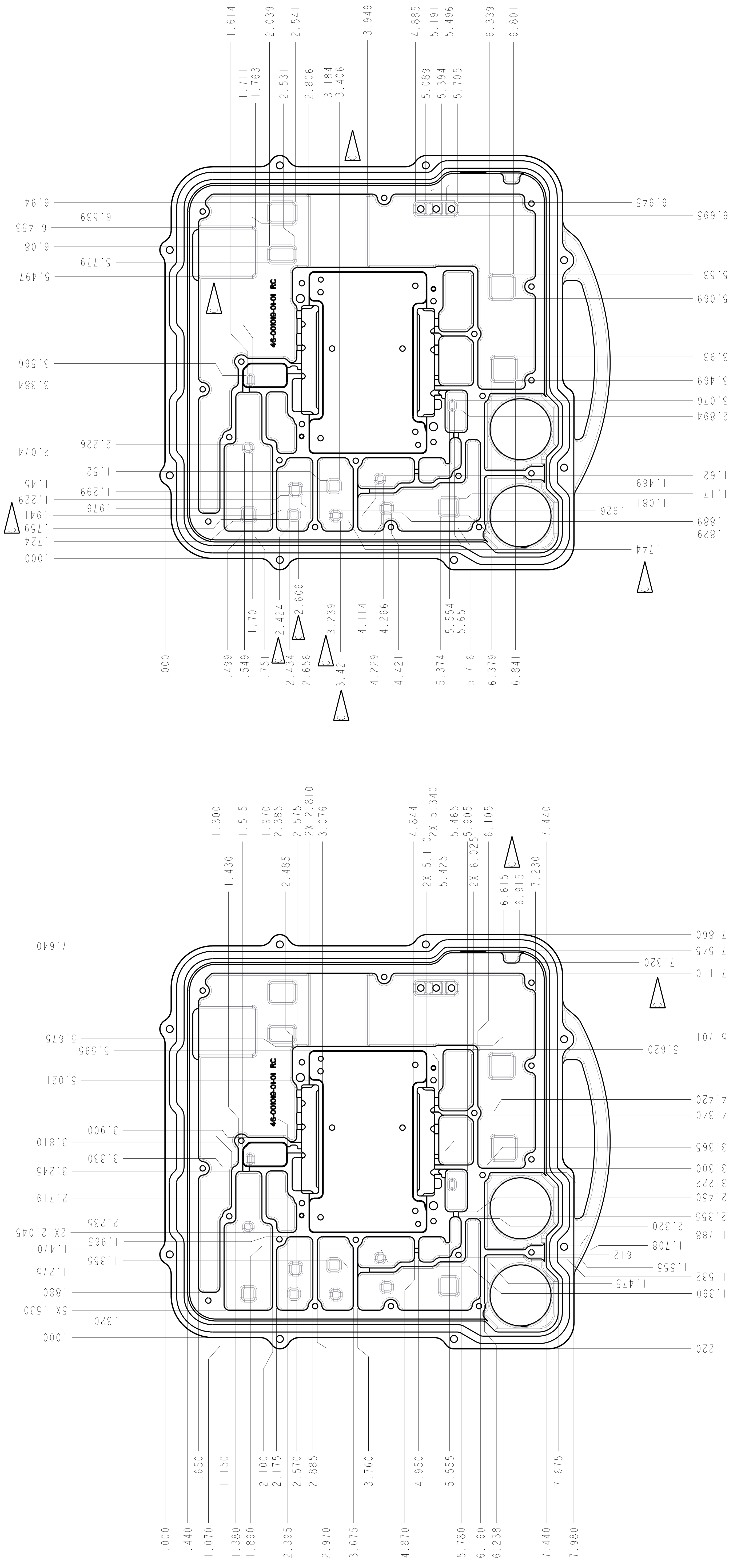
B

A

		411 LEGGET DRIVE, SUITE 600, KANATA, ONTARIO, K2K 3C9			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND APPLY AFTER FINISHING		DRAWN BY: KW DATE: 10-07-19		MFG CODE: REV 01 D	
TOLERANCES: XXX ± SEE XX ± NOTE X ± 12		CHECKER ELEC ENG	TITLE HOUSING, HC PLUS		DRAWING NO. 46-001019
ANGLES ± 2°		DES APPL	PRD		SCALE: 1/1
NEXT ASSY		USED ON	0A		SHEET 1 OF 6

D

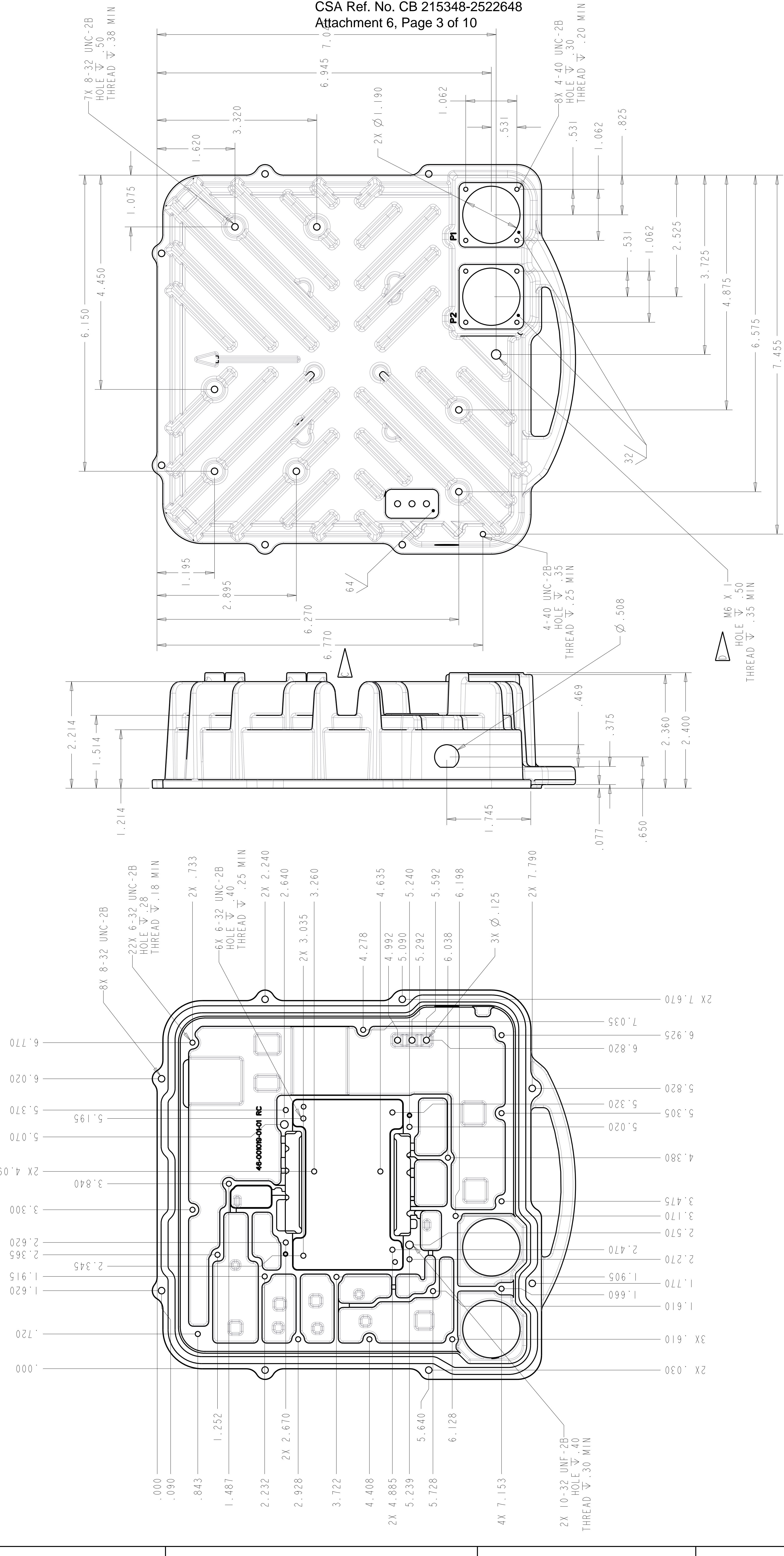
THE INFORMATION CONTAINED IN THIS DOCUMENT IS CONSIDERED PROPRIETARY BY DRAGONWAVE INC. THE ITEMS AND INFORMATION CONTAINED OR DISCLOSED HEREON SHALL NOT BE USED, COPIED OR REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF DRAGONWAVE INC. UNLESS OTHERWISE SPECIFIED.

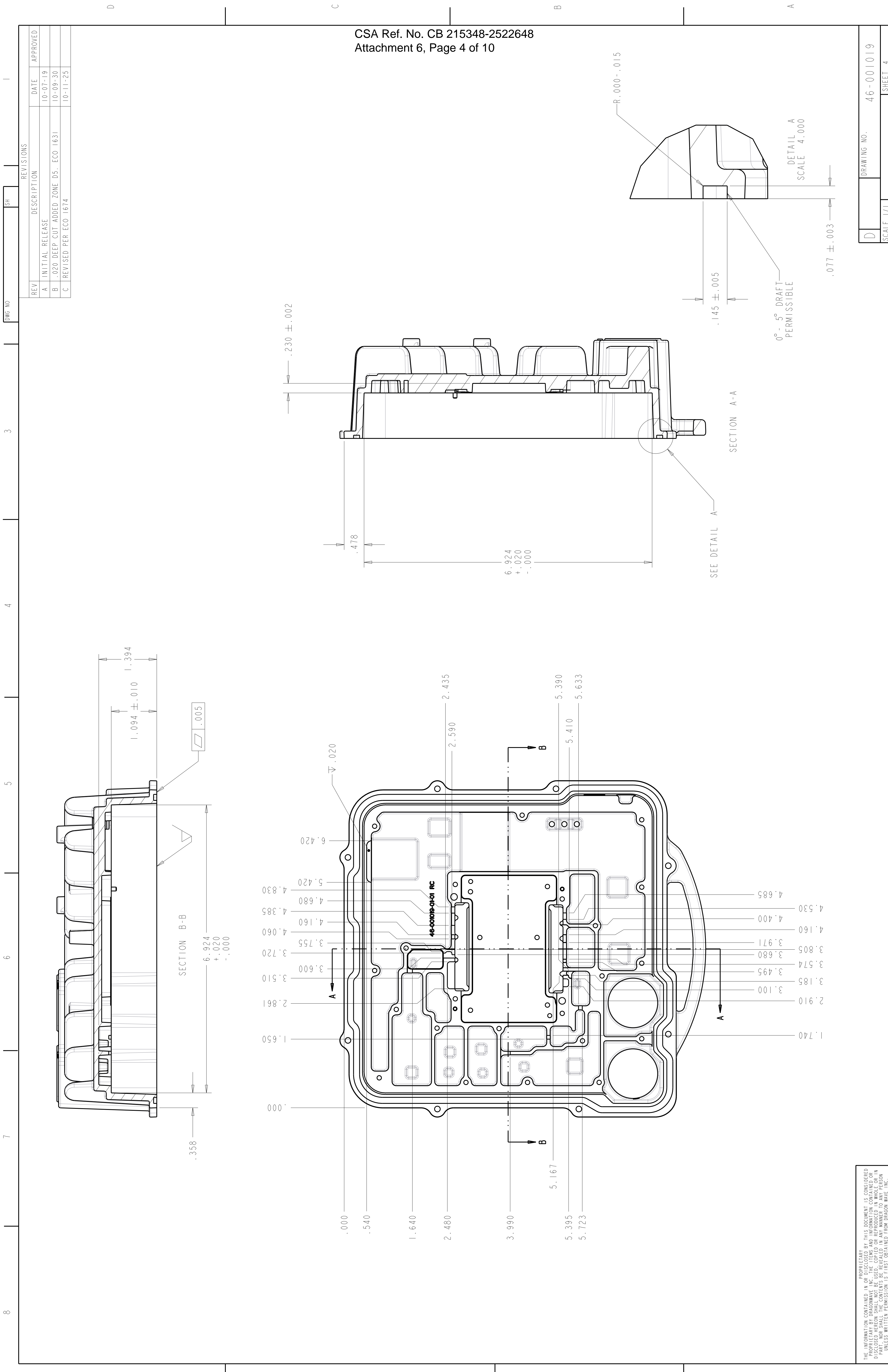


REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1631	10-09-30	
C	REVISED PER ECO 1674	10-11-25	

8 7 6 5 4 3 2 1

REV		DESCRIPTION		DATE		APPROVED	
A	INITIAL RELEASE			10-07-19			
B	REVISED PER ECO 1631			10-09-30			
C	REVISED PER ECO 1674			10-11-25			
D	REVISED PER ECO 1850			11-09-28			





REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	.020 DEEP CUT ADDED ZONE D5. ECO 1631	10-09-30	
C	REVISED PER ECO 1674	10-11-25	

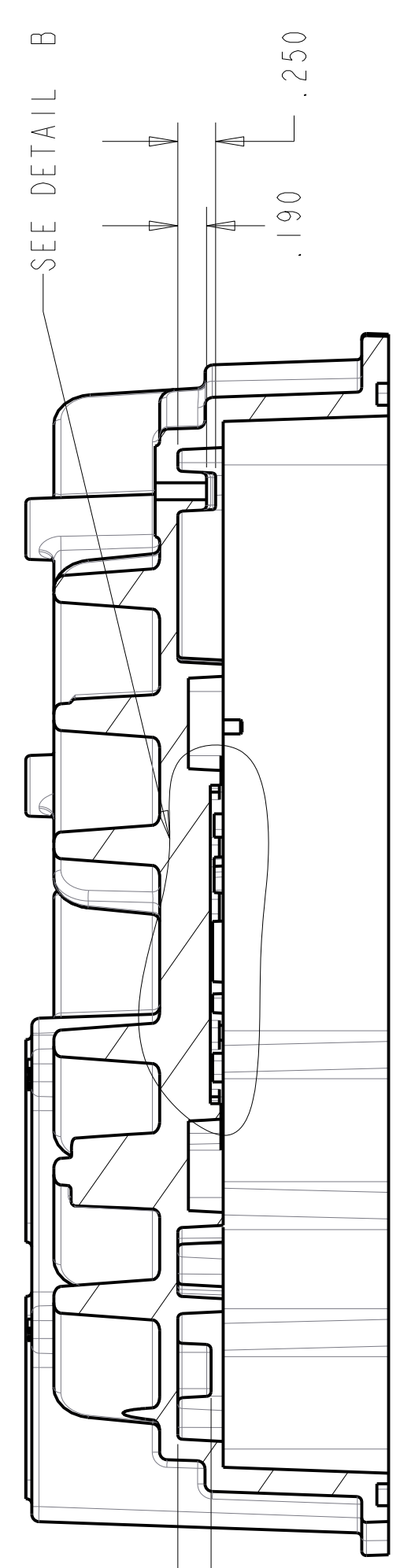
JWG NO	SH	1	2	3	4	5	6	7	8

D	DRAWING NO.	46-001019
	SCALE	1/1
		SHEET 4

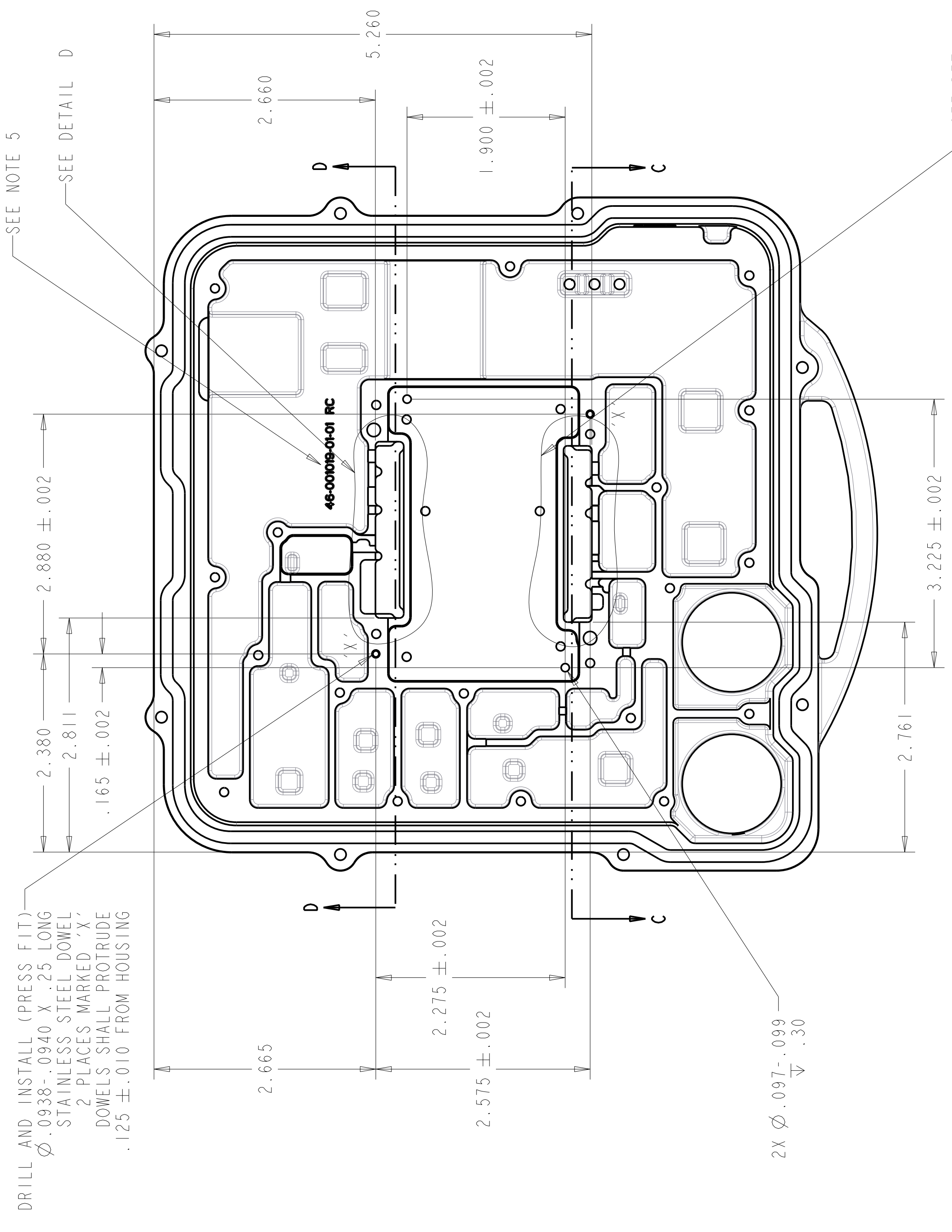
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REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-20	
B	REVISED PER ECO 1631	10-09-30	
C	REVISED PER ECO 1674	10-11-25	

CSA Ref. No. CB 215348-2522648
Attachment 6, Page 5 of 10



SECTION C-C



DRILL AND INSTALL (PRESS FIT)
∅ .0938 - .0940 X .25 LONG
STAINLESS STEEL DOWEL
2 PLACES MARKED 'X'
DOWELS SHALL PROTRUDE
.125 ± .010 FROM HOUSING

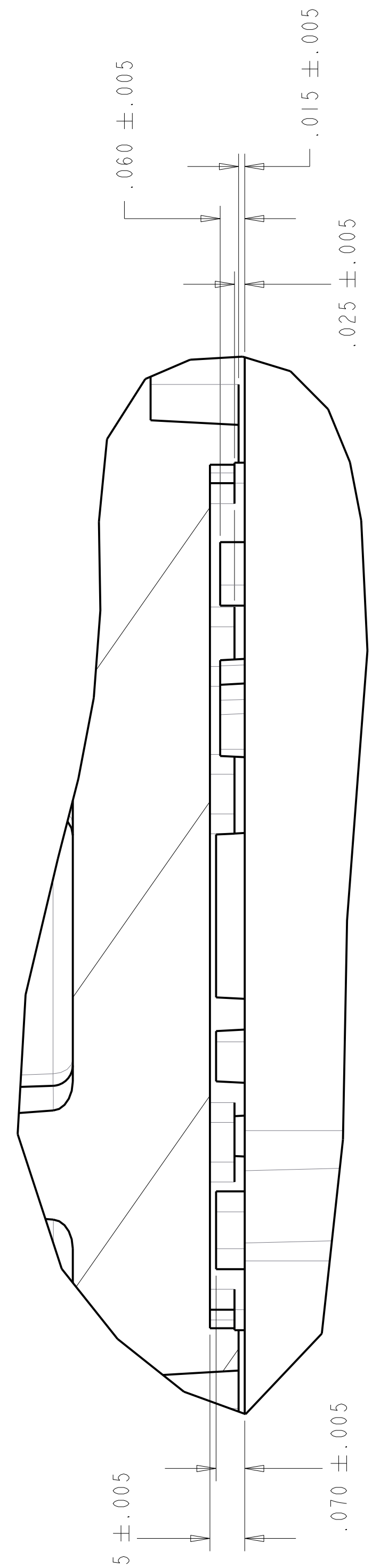
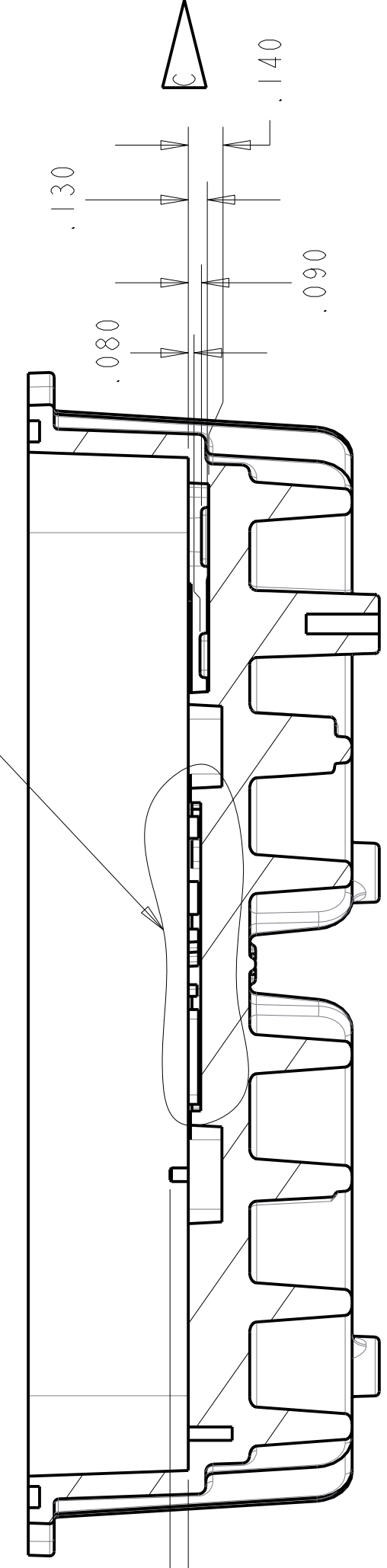
SEE NOTE 5

SEE DETAIL D

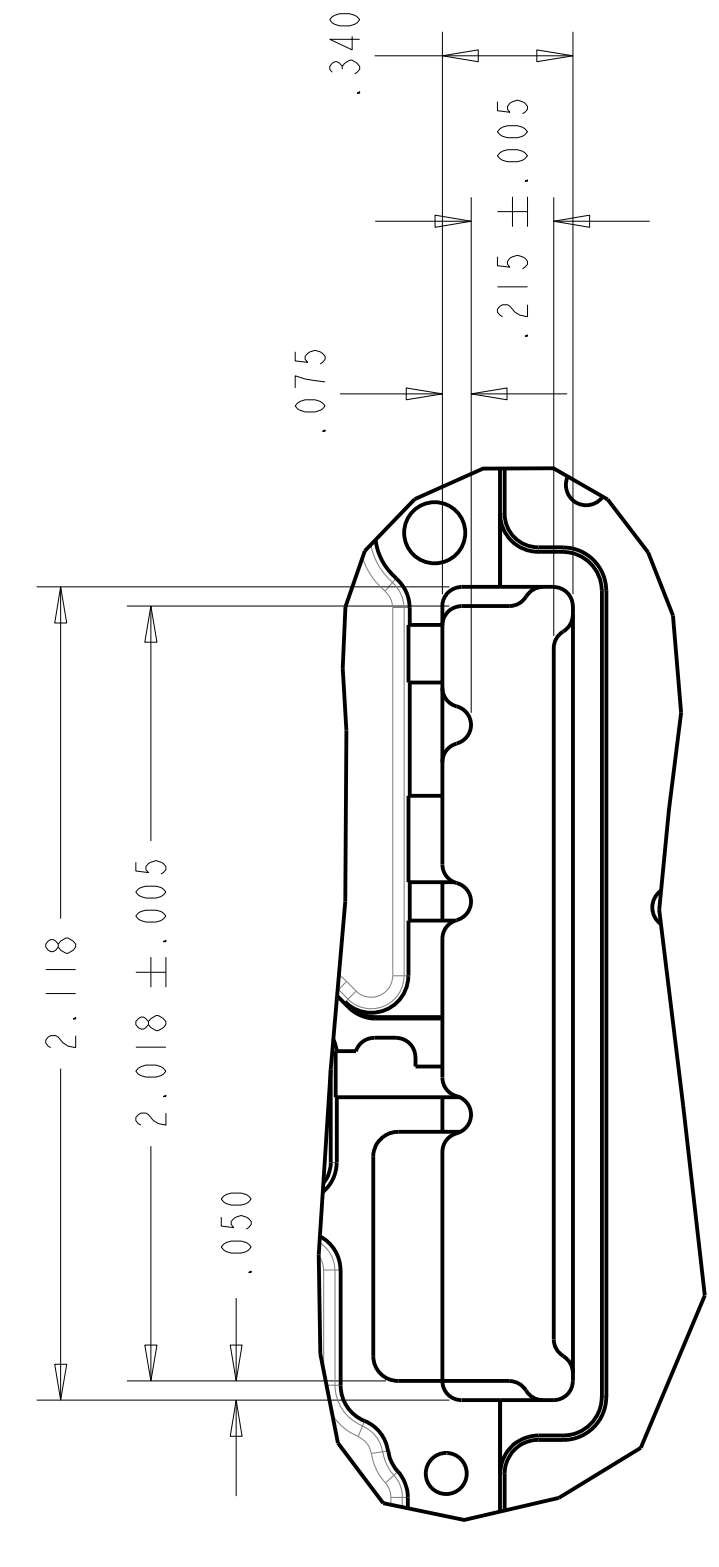
SEE DETAIL E

SEE DETAIL C

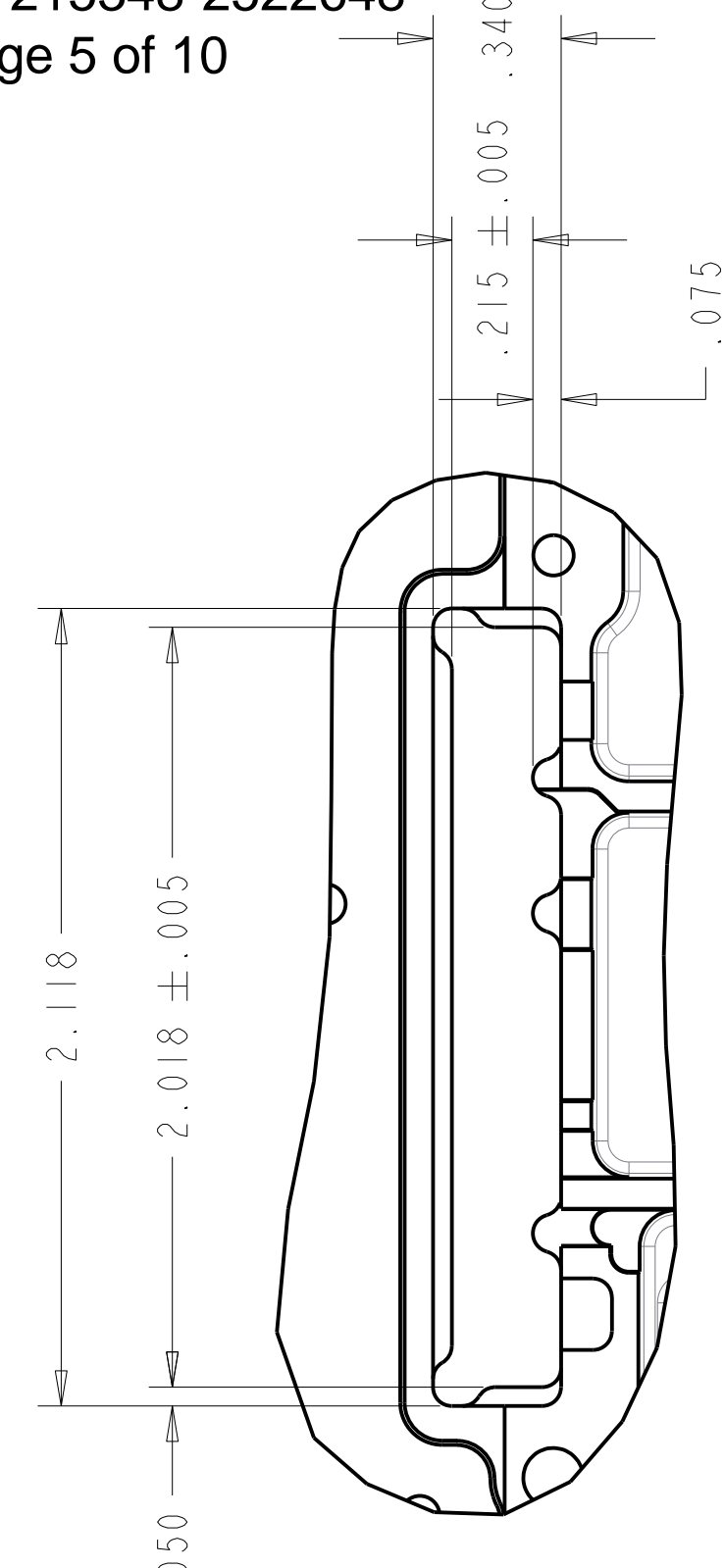
SECTION D-D



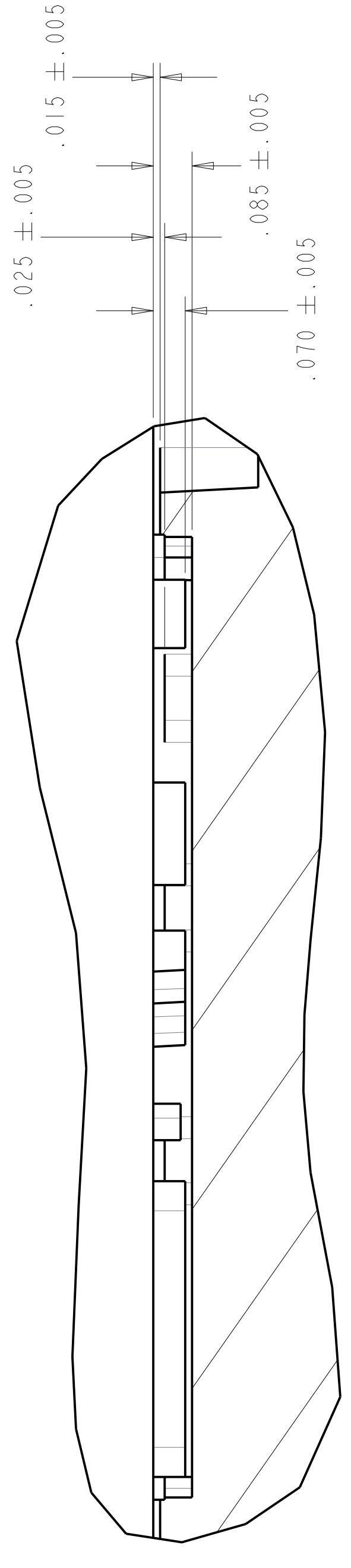
DETAIL B
SCALE 4.000



DETAIL D
SCALE 2.000



DETAIL E
SCALE 2.000



DETAIL C
SCALE 4.000

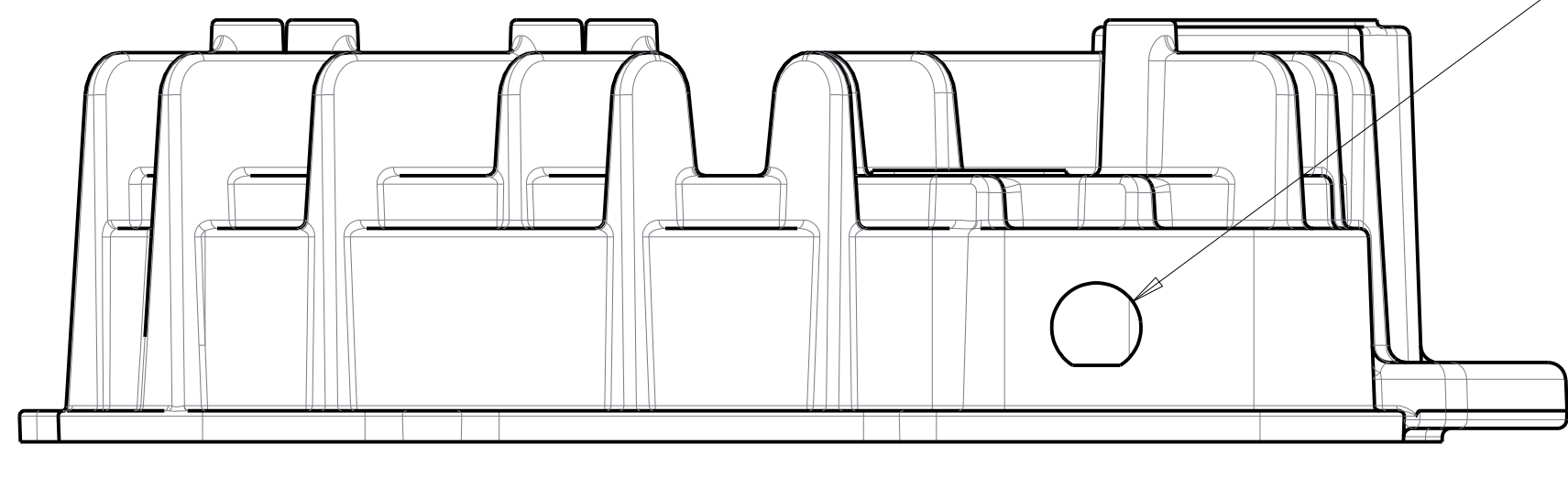
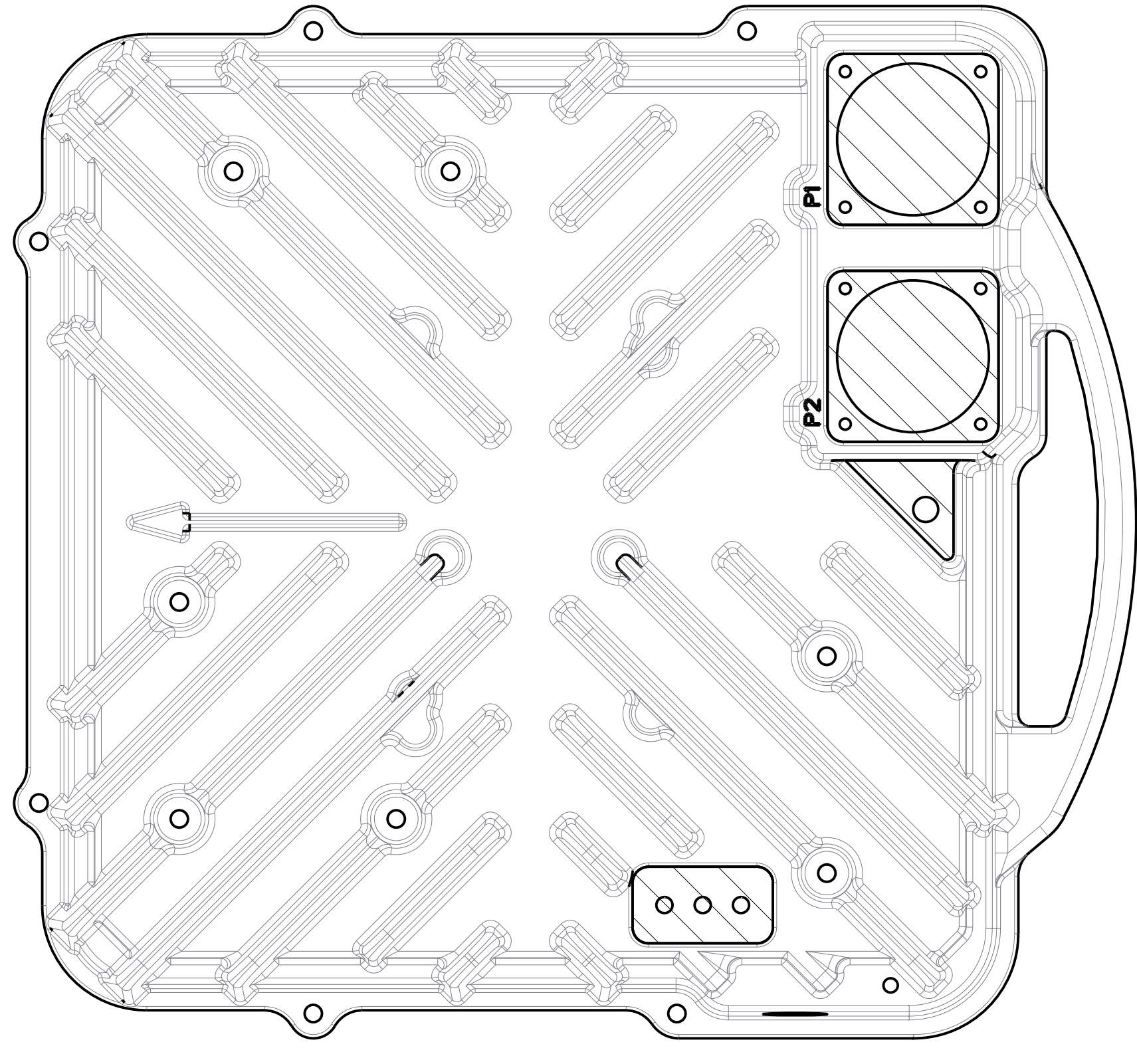
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D C B A

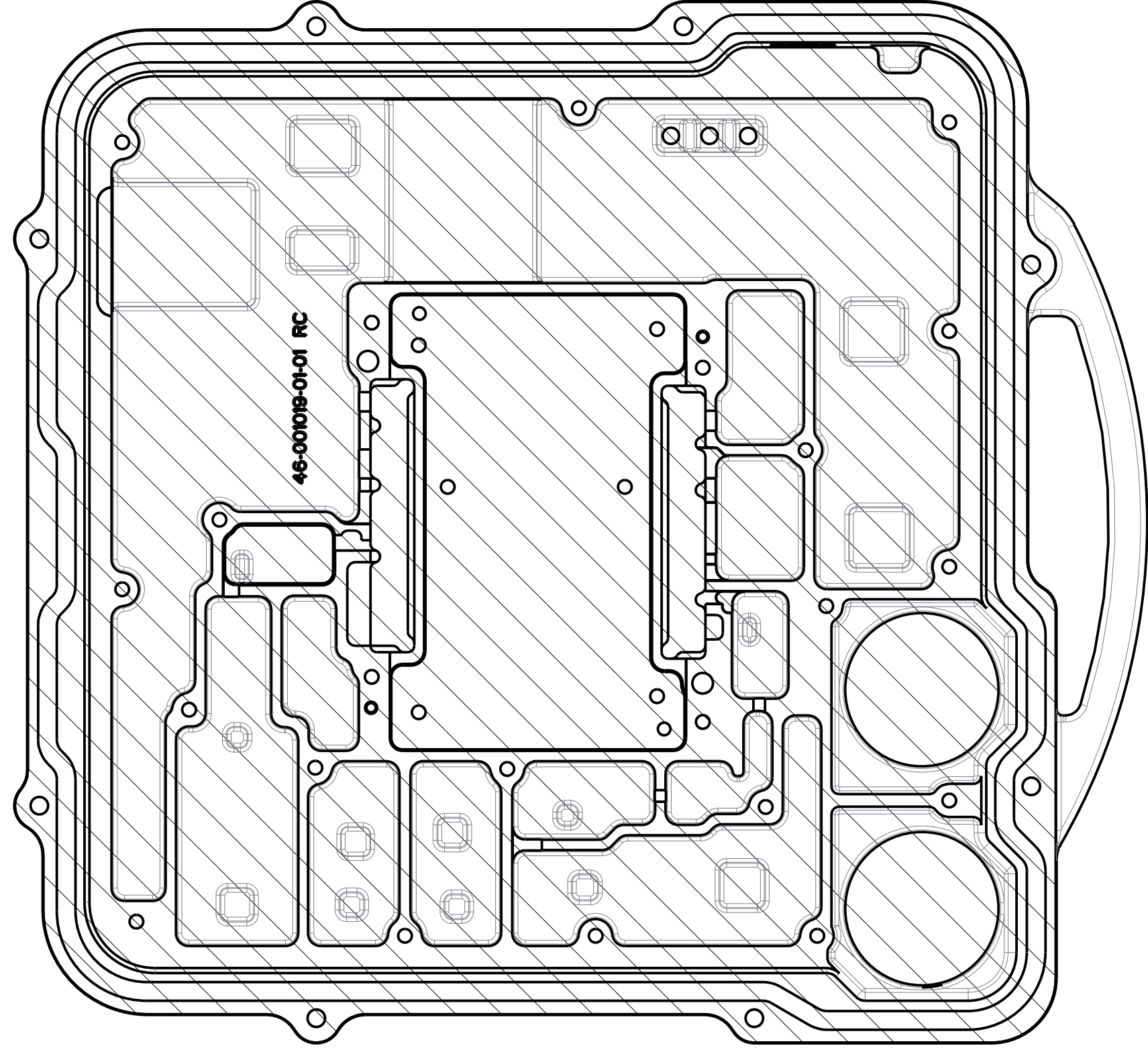
JWG NO. 3 4 5 6 7 8

SF I

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1631	10-09-30	
C	REVISED PER ECO 1674	10-11-25	



NO PAINT IN HOLE INTERIOR



THREADED HOLES AND HATCHED AREAS SHALL BE FREE OF PAINT

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D DRAWING NO. 46-001019
SCALE: 1/1 SHEET 6

D C B A

NOTES:

1. MATERIAL: AL ALLOY A360 OR A356.2 PER ASTM B85-03.
2. FINISH: CHEMICAL CONVERSION COATING PER REQUIREMENTS MIL-DTL-5541 TYPE 2 CLASS 3 (CLEAR), COMPLIANT TO ROHS DIRECTIVE 2002/95/EC. PAINT AS INDICATED USING TGIC POLYESTER POWDER, HIGH GLOSS WHITE, PROTECH COLOUR CODE PS-111-W2.
3. UNLESS OTHERWISE SPECIFIED, CASTING SHALL MEET STANDARD CASTING TOLERANCE REQUIREMENTS PER ASTM B85-03.
4. CASTING SHALL NOT BE SHOT BLASTED. UNLESS OTHERWISE SPECIFIED: CAST FILLETS, EDGES AND ROUNDS R .04 - .08. AS CAST SURFACE SHALL BE GRADE 2 PER NADCA GUIDELINES 6-6-6.
5. MARK MANUFACTURER'S IDENTIFICATION AND PART NUMBER "46-001020-01-XX R Y" WHERE "XX" IS THE MFG CODE AND "Y" IS THE DRAWING REVISION (MFG CODE AND DRAWING REVISION ARE LOCATED IN THE DRAWING TITLE BLOCK ON SHEET 1) IN LOCATION INDICATED. MARKING METHOD MAY BE CAST OR RUBBER STAMPED AT MANUFACTURERS DISCRETION. IF CAST, CHARACTERS SHALL NOT BE RAISED MORE THAN .04 ABOVE SURFACE.
6. GATES, RISERS, FLASH AND PARTING LINES SHALL BE TRIMMED FLUSH TO .015 MAX ABOVE THE ADJACENT SURFACE.
7. USE MINIMUM DRAFT WHERE EVER FEASIBLE. DRAFT SHALL NOT BE GREATER THAN INDICATED ON DRAWING OR IN 3D ELECTRONIC FILE UNLESS OTHERWISE SPECIFIED.
8. MARKS FROM PUSH-OUT PINS ARE PERMISSIBLE WITHIN ± 0.15 OF TRUE SURFACE. WHENEVER POSSIBLE LOCATE PUSH-OUT PINS ON SURFACES TO BE MACHINED, HOLE LOCATIONS, OR ON SURFACES INDICATED. EJECT PIN FLASH MUST BE REMOVED.
9. IN-PROCESS WELDING OF CASTING IS PERMITTED.
10. MACHINED SURFACES SHALL BE $\sqrt{125}$ UNLESS OTHERWISE SPECIFIED.
11. REMOVE ALL BURRS AND SHARP EDGES.
12. THE ITEM SHALL BE MANUFACTURED AND INSPECTED USING AN ELECTRONIC DATA FILE AND THE DRAWING AVAILABLE FROM DRAGONWAVE INC. THE FILENAMES AND TYPES OF ELECTRONIC FILES AVAILABLE FOR THE ITEM(S) ARE SHOWN IN TABLE A. OTHER FILE TYPES AND FORMATS AVAILABLE UPON REQUEST. UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN THE ELECTRONIC DATA FILE ARE BASIC WITH A TOLERANCE OF ±.005 FOR MACHINED FEATURES AND ±.010 UP TO 1.000 AND AN ADDITIONAL ±.001 FOR EACH ADDITIONAL 1.000 FOR CAST FEATURES. DIMENSIONS SHALL BE REFERENCED FROM DATUMS A, B, C. THE DRAWING PROVIDES A LIMITED NUMBER OF DIMENSIONS TO AID THE SUPPLIER IN DETERMINING THAT THE ITEM(S) MEET(S) ALL OF THE FEATURES OF THE ELECTRONIC DATA FILE.
13. MACHINED SURFACES INDICATED SHALL BE FREE FROM VOIDS AND POROSITY THAT WOULD VIOLATE THE SURFACE FINISH REQUIREMENTS INDICATED. ANY VOIDS OR POROSITY THAT VIOLATE THE SURFACE FINISH REQUIREMENTS SHALL BE FILLED/REPAIRED USING ALUMINUM PUTTY PER DOD-C-24176 TYPE 11 OR MMM-A-1754.
14. TXH AND TXL MARKING MAY BE ACHIEVED AS A PROTRUSION OR A DEPRESSION. PROTRUSION OR DEPRESSION SHALL NOT EXCEED .04 AND SHALL REMAIN READABLE AFTER PAINT APPLICATION.

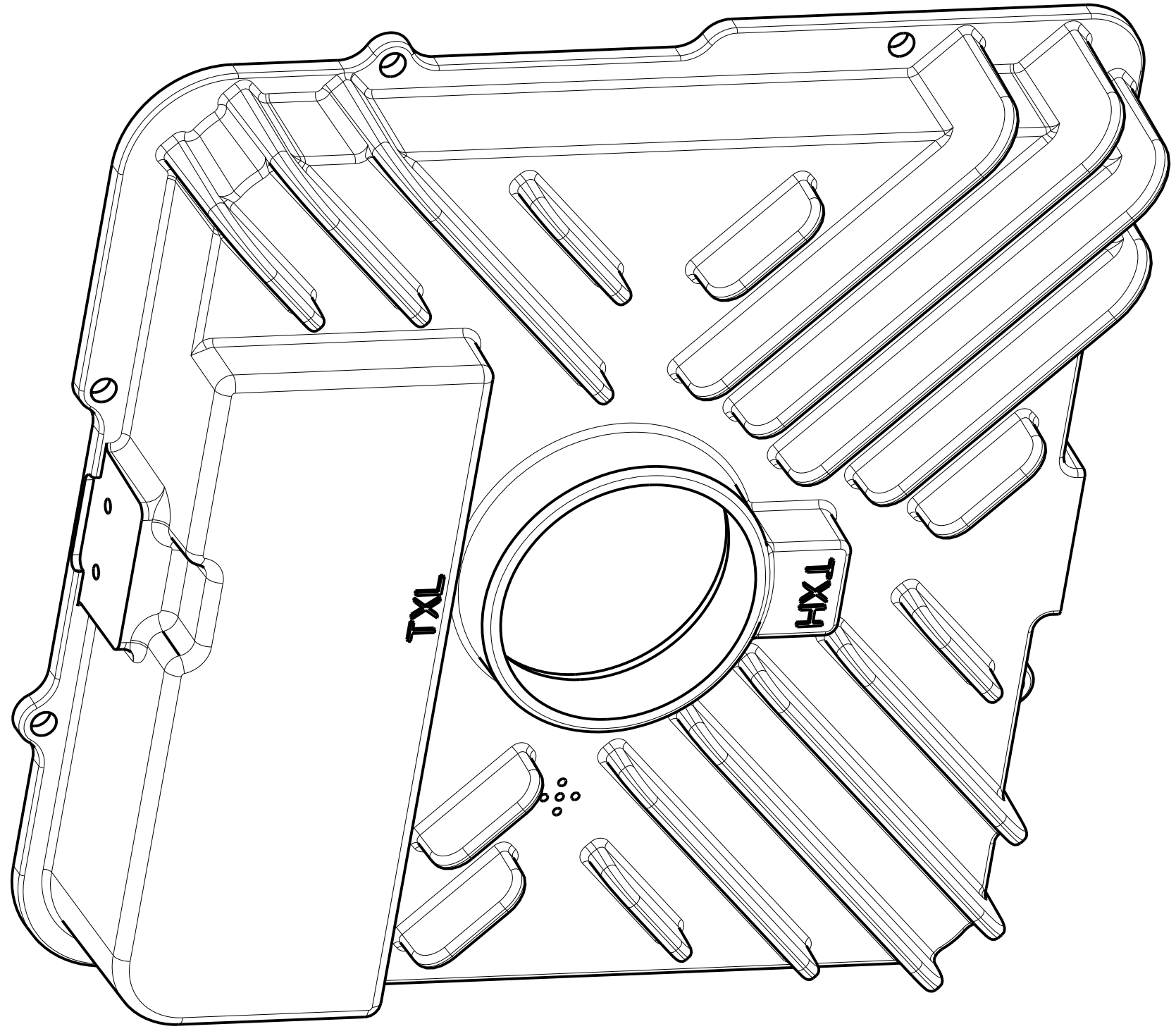


TABLE A (ELECTRONIC DATA)

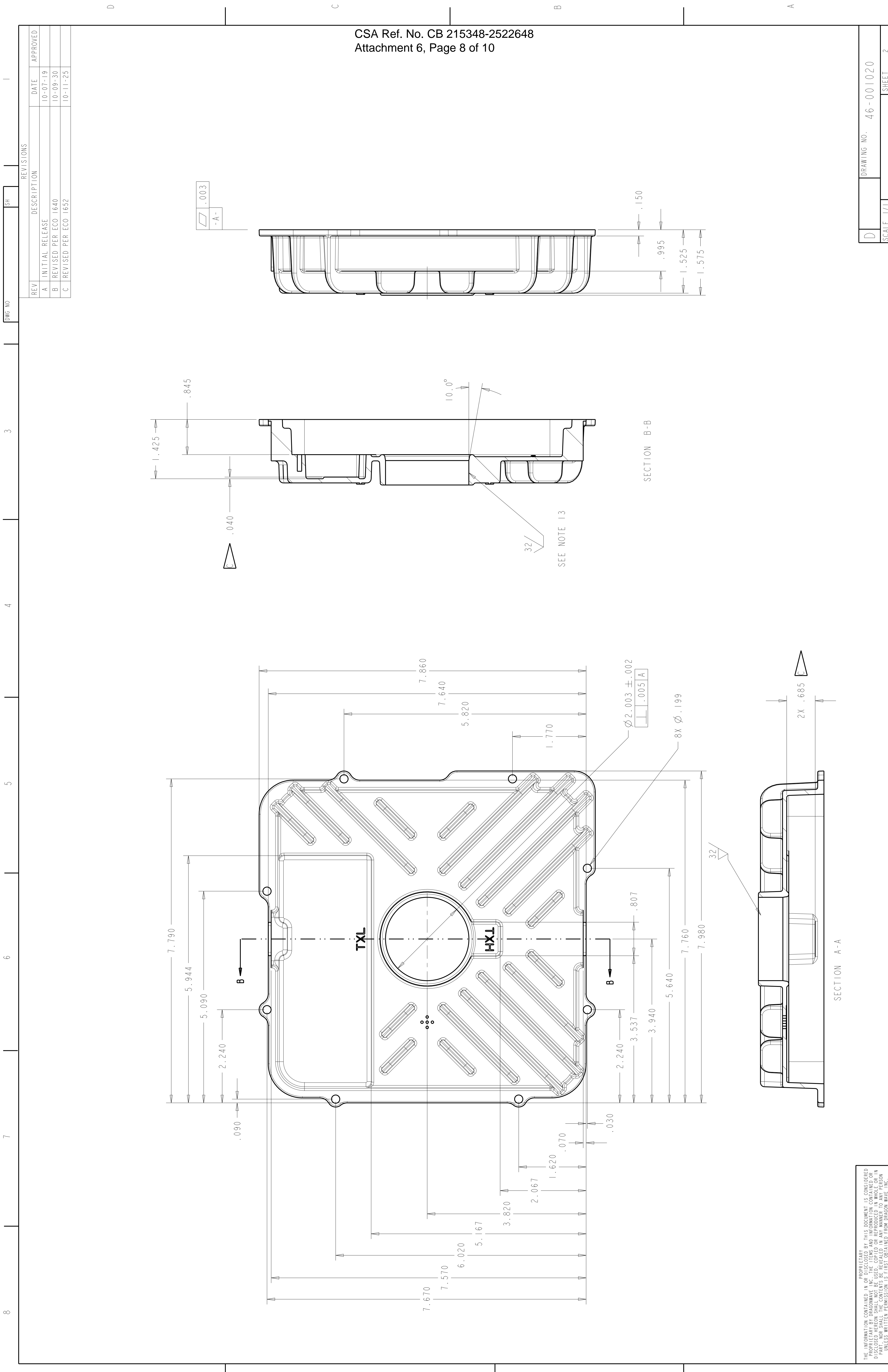
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46001020-01MCO1RC.IGS	3D SURFACES / IGES
46001020-01MCO1RC.STP	3D SURFACES / STEP

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REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-21	
B	REVISED PER ECO 1640	10-09-30	
C	REVISED PER ECO 1652	10-11-25	

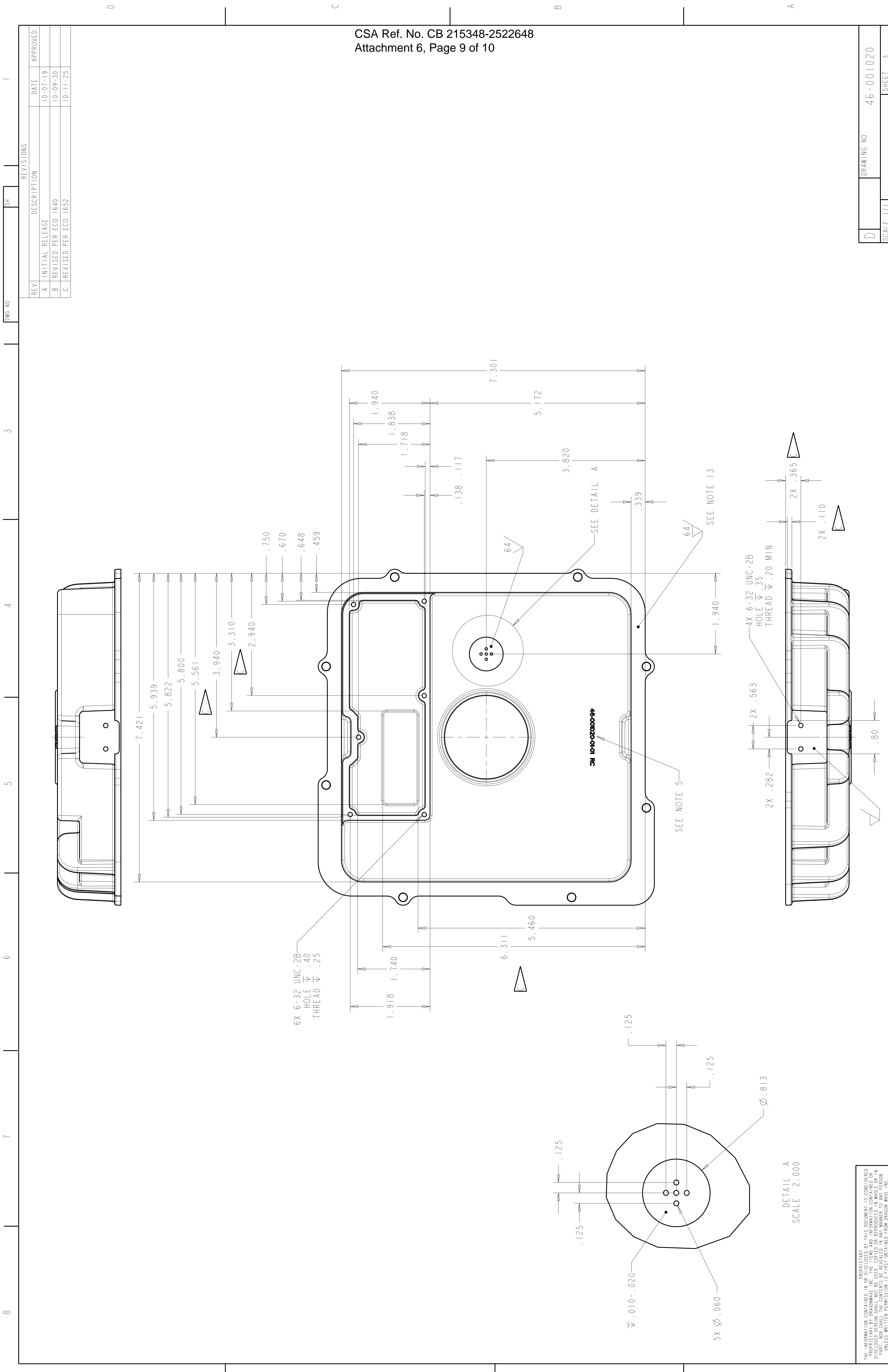
		411 LEGGET DRIVE, SUITE 600, KANATA, ONTARIO, K2K 3C9	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND APPLY AFTER FINISHING	DRAWN BY: KW DATE: 10-07-21	CHECKER: ELEC ENG	TITLE: COVER, HC PLUS
TOLERANCES: XXX ± SEE ANGLES XX ± NOTE ± 2° X ± 12	DES APPL	PRD	MFG CODE REV 01 C
NEXT ASSY USED ON	SCALE: 1/1	DRAWING NO: 46-001020	SHEET 1 OF 4

C	C	C	C	REV	REV
4	3	2	1	SHEET	STATUS
					OF SHEETS



REV	INITIAL RELEASE	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1640	10-09-30	
C	REVISED PER ECO 1652	10-11-25	

REV	DESCRIPTION	DATE	APPROVED



8 7 6 5 4 3 2 1

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1640	10-09-30	
C	REVISED PER ECO 1652	10-11-25	

DWG NO. 46-001020
DRAWING NO. 46-001020
SCALE: 1/1
SHEET 3

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6X 6-32 UNC-2B
HOLE ∇ .40
THREAD ∇ .25

DR 10-10-020004*

SEE NOTE 5

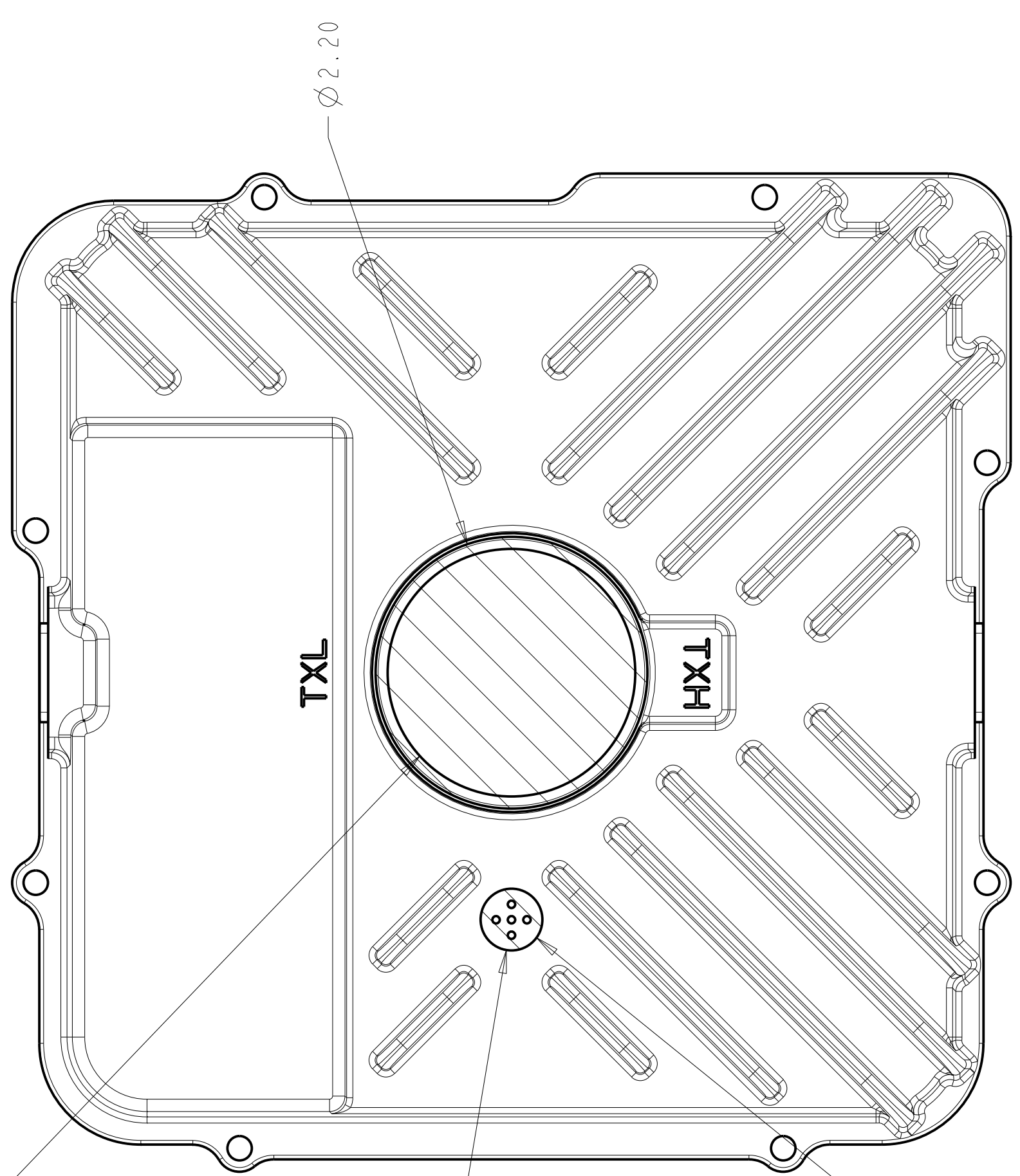
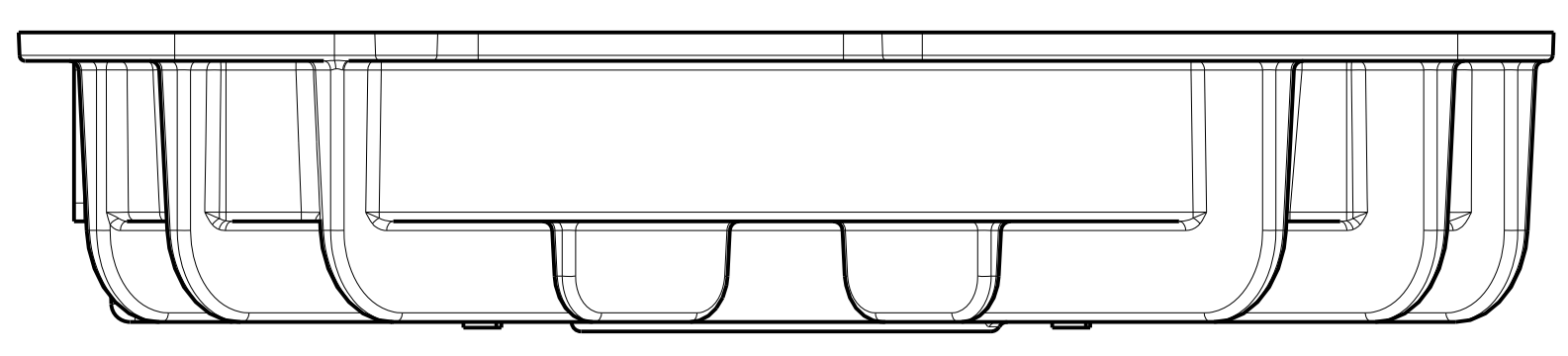
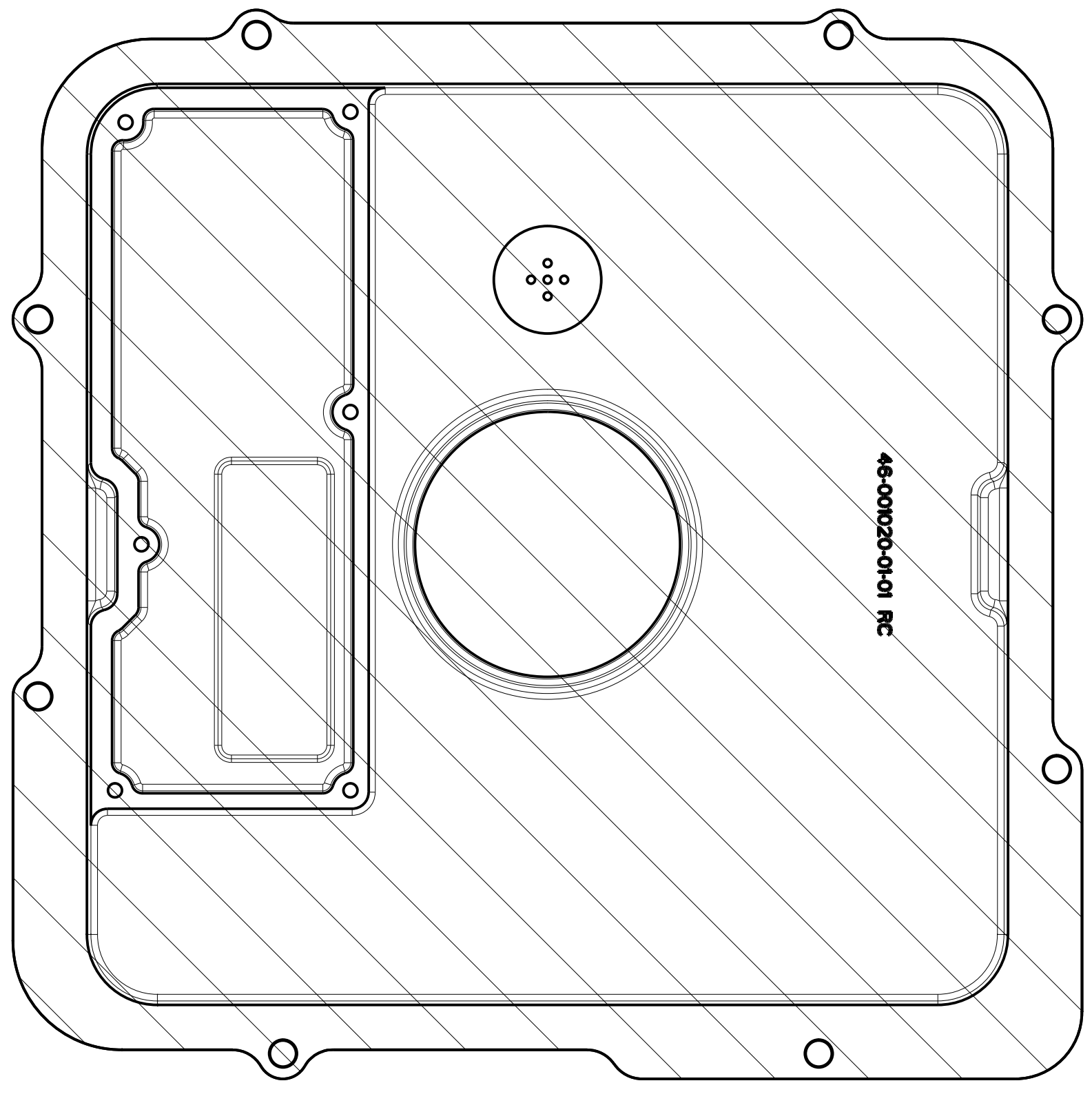
SEE NOTE 13

DETAIL A
SCALE 2.000

4X 6-32 UNC-2B
HOLE ∇ .35
THREAD ∇ .20 MIN

REV	INITIAL RELEASE	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1640	10-09-30	
C	REVISED PER ECO 1652	10-11-25	

REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	10-07-19	
B	REVISED PER ECO 1640	10-09-30	
C	REVISED PER ECO 1652	10-11-25	



INSIDE OF HOLE SHALL BE FREE OF PAINT. PAINT FREE AREA INDICATED IS PERMISSIBLE TO ENSURE PAINT DOES NOT ENTER HOLE

INSIDE OF HOLES TO BE FREE OF PAINT. PAINT FREE AREA INDICATED IS PERMISSIBLE TO ENSURE PAINT DOES NOT ENTER HOLES

THREADED HOLES AND HATCHED AREAS SHALL BE FREE OF PAINT

D	DRAWING NO.	46-001020
	SCALE	1/1
	SHEET	4

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