CE
EMC DIRECTIVE (2004/108/EC)
TEST REPORT

FCC,
EN55022 CLASS B, EN 61000-3-2,
EN 61000-3-3 and EN55024
TEST REPORT
for

SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220

Prepared for

ADI ENGINEERING
1758 WORTH PARK
CHARLOTTESVILLE, VA 22911

Prepared by: _____

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DATE: MAY 7, 2015

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GENERAL REPORT SUMMARY

This electromagnetic emission and immunity test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form except in full, without the written permission of Compatible Electronics.

This report must not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Device Tested:	Single Board Computer (SBC) Model: DFF-2220 S/N: 0112150012
Product Description:	Single Board Computer (SBC). Can be used for multiple customer applications, including both generic computing and network security.
Modifications:	The EUT was not modified during the testing.
Manufacturer:	ADI Engineering. 1758 Worth Park Charlottesville, VA 22911
Test Dates:	May 6 and 7, 2015
Test Specifications:	Emissions and Immunity requirements European Standards EN55022 EN 61000-3-3, EN 61000-3-2 and EN55024. CISPR 22 FCC Part 15 Subpart B

The specification EN55024 is a product family EMC standard which references the following specifications:

EN 61000-4-2
EN 61000-4-3
EN 61000-4-4
EN 61000-4-5
EN 61000-4-6
EN 61000-4-8
EN 61000-4-11

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz – 30 MHz.	Complies with the **Class B** limits of CISPR 22. See section 6.4 for Measurement Uncertainty
2	Conducted RF Emissions – Telecom Lines 150 kHz – 30 MHz.	Complies with the **Class B** limits of CISPR 22. See section 6.4 for Measurement Uncertainty
3	Radiated RF Emissions, 30 MHz – 1000 MHz.	Complies with the **Class B** limits of CISPR 22. See section 6.4 for Measurement Uncertainty
4	Direct ESD, Air Discharge, ±2 kV, ±4 kV and ±8 kV (insulated surfaces).	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
5	Direct ESD, Contact Discharge, ±2 kV and ±4 kV (conductive surfaces).	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
6	Indirect ESD, ±2 kV and ±4 kV (HCP & VCP).	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
7	Radio-Frequency Electromagnetic Field, 80 MHz to 1000 MHz, 3 V/m with an amplitude modulated 1 kHz sine wave at 80%.	Complies with the requirements of EN55024. The unit operates within its specifications. *See XX below for uncertainty notes. Variations of measured field strength due to reflections from the EUT are not included in the uncertainty calculations.
8	Fast Transients Common Mode, ±1.0 kV on AC Power lines and ±0.5 kV on data lines.	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
9	Surge Immunity Test Differential Mode, ±1.0 kV and common mode ±2.0 kV on power lines.	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
10	Surge Immunity Test Telecommunication Lines ±0.5 kV and ± 1.0 kV	The EUT has no telecommunication cables that connect directly to outdoor cables; therefore this test was deemed unnecessary. *See XX below for uncertainty notes.
11	Radio-Frequency Electromagnetic Conducted Field, 0.150 MHz to 80 MHz, 3Vrms with an amplitude modulated 1 kHz sine wave at 80%.	Complies with the requirements of EN55024. The unit operates within its specifications. *See XX below for uncertainty notes.
12	Power Frequency Magnetic Field Susceptibility, 1 A/m @ 50 & 60Hz, X, Y, & Z-axis.	Complies with the requirements of EN55024. The unit operates within its specifications. *See XX below for uncertainty notes.

SUMMARY OF TEST RESULTS continued

TEST	DESCRIPTION	RESULTS
13	Voltage Dips and Voltage Variations, Short Interrupts, >95%@10ms, 30%@500ms, and >95%@5sec reduction of rated voltage.	Complies with the relevant requirements of EN55024. The unit operates within the specifications. *See XX below for uncertainty notes.
14	Current Harmonics Test 230V@50Hz, 39th Odd Harmonics and 40th Even harmonics.	The EUT is rated less than 75 watts; therefore this test was deemed unnecessary and thus was not performed.
15	Voltage Fluctuation and Flicker Test 230V@50Hz.	The EUT is not likely to produce flicker; therefore this test was deemed unnecessary and thus was not performed.
XX	Note that for all immunity tests above, It has been demonstrated that the generator and or the test configuration meets the specified requirements in the relevant technical standard. Calibration data is on file at the lab.	

reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2

1. PURPOSE

This document is a Qualification test report based on the Emissions and Immunity tests performed on the Single Board Computer (SBC) Model: DFF-2220. The emissions measurements were performed according to the measurement procedure described in EN55022, EN 61000-3-2 and EN 61000-3-3. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the **Class B** specification limits defined in EN55022 (Limits and methods of measurement of radio disturbance characteristics of information technology equipment), EN 61000-3-2 (Electromagnetic Compatibility: Part 3: Limits. Section 2: Limits for harmonic current emissions) and EN 61000-3-3 (Electromagnetic Compatibility: Part 3: Limits. Section 3: Limitation of voltage fluctuations and flicker). Under paragraph G of Section 15.109 of the Code of Federal Regulations Title 47, part 15 of the FCC rules, the FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

The immunity tests were performed according to the measurement procedure described in EN55024 - (Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurement). These tests were performed in order to determine whether the EUT would accept any interference and still perform within the performance criteria described in section 4.2.1 of this report. The tests were performed by Compatible Electronics personnel; also the unit was operated and monitored for susceptibility by Compatible Electronics personnel.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The emissions and immunity tests described herein were performed at the test facility of Compatible Electronics, 20621 Pascal Way, Lake Forest, California 92630.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST). For equipment used for immunity testing, refer to the applicable calibration certificates for tolerance and uncertainty information, which is on file at the location of the test.

2.3 Cognizant Personnel

ADI Engineering.

Terri Danowski	Program Manager

Compatible Electronics, Inc.

Torey Oliver	Test Technician
Matt Harrison	Test Technician
Jeff Klinger	Director of EMC

2.4 Date Test Sample was received

The test sample was received on May 6, 2015.

2.5 Disposition of the Test Sample

The test sample was not returned to ADI Engineering as of the date on this report.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

EFT	Electrical Fast Transients
RF	Radio Frequency
ESD	Electrostatic Discharge
EMI	Electromagnetic Interference
EMC	Electromagnetic Compatibility
VCP	Vertical Coupling Plane
HCP	Horizontal Coupling Plane
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this test report.

SPEC	TITLE
CISPR 22 2008	Limits and methods of measurement of radio interference characteristics of information technology equipment.
FCC CFR Title 47, Subpart B.	FCC Rules - Radio frequency devices (including digital devices).
EN 55022: 2010	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
EN 55024: 2010	Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurement
CISPR 16-1-4 2008	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-4 radio disturbance and immunity measuring apparatus – Ancillary Equipment – Radiated Disturbances
EN 61000-3-2 2006 +A1: 2009 +A2: 2009	Electromagnetic compatibility – Part 3: Limits – Section 2: Limits for harmonic current emissions (equipment input current <= 16 A per phase)
EN 61000-3-3 2008	Electromagnetic compatibility – Part 3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <= 16 A
EN 61000-4-2 2009	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test
EN 61000-4-3 2006 +A1: 2008 +A2: 2010	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency electromagnetic field test
EN 61000-4-4 2004	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test
EN 61000-4-5 2006	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 5: Surge immunity test
EN 61000-4-6 2009	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, Induced by radio-frequency fields
EN 61000-4-8 2010	Electromagnetic compatibility – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test
EN 61000-4-11 2004	Electromagnetic Compatibility. Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage variations immunity tests

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration – (Emissions)

The EUT was setup in a tabletop configuration. The EUT was connected to the laptop via USB mini port. The EUT was looped back onto itself via Ethernet port. The laptop was connected to the laptop power supply via power port and a mouse via USB port. A USB thumb drive was connected to the USB port on the EUT. The EUT was being exercised by running a program that write and read data from one port to another and logs any errors that occur.

The cables were moved to maximize the emissions. The final conducted and radiated data was taken in the continuously exercising mode of operation. All initial investigations were performed with the EMI Receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix D.

4.1.1 Photograph of Test Configuration – (Emissions)

4.1.2 Cable Construction and Termination

Cable 1

This is a 2.0 meter, braid shielded, communication cable that connects the EUT to the Laptop. The cable has a USB mini connector at the EUT end and a USB connector at the laptop end. The shield of the cable was grounded to the chassis via the connectors. The cable was in a 1 meter bundle.

Cable 2

This is a 0.5 meter, unshielded cable that loops the EUT back onto itself. The cable has a RJ-45 connector at both ends of the cable.

Cable 2

This is a 1.0 meter, foil shielded cable that connects the mouse to the EUT. The cable is hardwired into the mouse and has a USB type A connector at the EUT end of the cable. The shield of the cable was grounded to the chassis via connectors. The cable was not bundled.

4.2 Description of the Test Configuration – (Immunity)

The EUT was operating as described in section 4.1 of this report. The EUT was monitored for susceptibility through any errors or disconnections of the ports that were constantly reading and writing data from one to another.

4.2.1 Susceptibility Criteria

TEST	PERFORMANCE CRITERIA
Electrostatic Discharge	B
Radio-Frequency Electromagnetic Field	A
Fast Transients Common Mode	B
Surge Immunity Test	B
Conducted Disturbances Induced by RF Fields	A
Power Frequency Magnetic Field Susceptibility	A
Voltage Dips and Voltage Interruptions and Short Interruptions	B & C

Performance criteria A: The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

4.2.2 Susceptibility Criteria (Continued)

Performance criteria B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criteria C: Temporary loss of function is allowed, provided the loss of function is self-recoverable or can be restored by the operation of the controls.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

#	EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER
1	SINGLE BOARD COMPUTER (SBC) (EUT)	ADI ENGINEERING	DFF-2220	0112150012
3	LAPTOP COMPUTER	ACER	PP04X	4S33X01
4	LAPTOP POWER SUPPLY	ACER	HA65NS1-00	NONE
5	USB THUMB DRIVE	KINGSTON	DTR3.0 G2	NONE
6	MOUSE	GENERIC	NONE	NONE

5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Computer	Compatible Electronics	NONE	NONE	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESIB40	100219	9/5/2014	9/5/2015
Antenna, CombiLog	Com Power	AC-220	25857	5/21/2014	5/21/2015
Antenna, Horn	Com Power	AH-118	071250	7/1/2014	7/1/2016
Preamplifier	Com Power	PAM-118	443013	4/24/2015	4/24/2016
Preamplifier	Com Power	PAM-118	443011	4/24/2015	4/24/2016
LISN (EUT)	Com Power	LI-215	191937	4/6/2015	4/6/2016
LISN (ACC)	Com Power	LI-215	191944	4/6/2015	4/6/2016
ISN T8	Teseq	ISN T800	36172	6/27/2014	6/27/2015
Mast, Antenna Positioner	Sunol Science Corporation	SC104V	081309-1	N/A	N/A
Antenna Mast	Sunol Science Corporation	TWR 95-4	081309-3	N/A	N/A
Turntable	Sunol Science Corporation	FM2011VS	NONE	N/A	N/A

5.3 Immunity Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
GENERAL TEST EQUIPMENT USED FOR ALL TESTS					
Barometer	Abbeon	BAR 130 B	#2503	7/22/2014	7/22/2015
Hygrometer	Abbeon	HTAB169B	#2499	7/25/2014	7/25/2015
Computer Test Station	Hewlet Packard	Pavilion 4530	US92010480	NCR	NCR
TEST EQUIPMENT USED FOR ELECTROSTATIC DISCHARGE TESTS					
Simulator ESD	Thermo Keytek	MINIZap	702261	6/27/2014	6/27/2015
TEST EQUIPMENT USED FOR RF RADIATED ELECTROMAGNETIC IMMUNITY TESTS					
Amplifier, RF Power	OPHIR	XRF761	1002	NCR	NCR
Antenna, Hybrid Log Periodic	TDK	HLP-2603	130534	NCR	NCR
Field Probe, Monitor	Amplifier Research	FM2000	#3150	NCR	NCR
Field Probe, Isotropic	Amplifier Research	FP2080	24790	1/8/2015	1/8/2017
Generator, RF Signal	Com Power	SIG-200	2173	1/5/2015	1/5/2016
TEST EQUIPMENT USED FOR ELECTRICAL FAST TRANSIENTS AND SURGE TESTS					
Immunity Test System	Keytek	EMCproPLUS	0708238	9/30/2014	9/30/2015
Clamp, Capacitive Coupling	Keytek	CCL-4/S	9301370	NCR	NCR
TEST EQUIPMENT USED FOR RF CONDUCTED ELECTROMAGNETIC IMMUNITY TESTS					
Amplifier RF Power	Amplifier Research	100A250	24698	NCR	NCR
CDN M3 (EUT)	Com Power	CDN M3-25	521011	3/14/2015	3/14/2016
CDN M3 (ACC)	Com Power	CDN M3-25	521012	NCR	NCR
Probe, Bulk Currrent Injection	TEGAM	95236-1	10669	NCR	NCR
Coupler Directional	Werlatone	C6021	8915	NCR	NCR
Generator RF Signal	Com Power	SIG-200	2173	1/5/2015	1/5/2016

5.3.1 Immunity Test Equipment (Continued)

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
TEST EQUIPMENT USED FOR POWER FREQUENCY MAGNETIC FIELD IMMUNITY TESTS					
Antenna H-Field	Compatible Electronics	NONE	NONE	NCR	NCR
Multimeter	Fluke	73	77650234	4/20/2015	4/20/2016
Power Source – Analyzer AC	Agilent Technologies	6813B	US38390530	NCR	NCR
Transformer, Step-down	Compatible Electronics	CE-H101	003	NCR	NCR

5.4 Test Software

LAB(S)	SOFTWARE TITLE	MANUFACTURER	VERSION
Q	E-Field Software Program (Field Uniformity)	Compatible Electronics	1.0, FUTA100
Q	AutoSigGen	Compatible Electronics	SEGI
S,Q	CEWare	Keytek	4.00.950
Q	Measurement and Automation Software	National Instruments	1.0.1 Build 29
P, R	Measurement and Automation Software	TDK TestLab	5.53

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

All the radiated & conducted emissions measurements were performed in a semi-anechoic chamber. All RF immunity tests were performed in a shielded enclosure 23 feet wide, 23 feet long and 12 feet high. Please refer to section 2.1 and 7.1 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

For all tests except for ESD, EFT, and the Conducted Immunity tests, the EUT was set up on a 1.0 by 1.5 by 0.8 meter high non-conductive table, which was placed on the ground plane. For ESD testing, the unit was mounted 0.5 millimeters above the 0.8 meter by 1.6 meter horizontal coupling plane. For the Conducted Immunity tests and EFT, the EUT was mounted 10cm above the GRP.

The EUT was grounded through the AC power cord.

6.3 Facility Environmental Characteristics

When applicable refer to the data sheets in Appendix E for the relative humidity, air temperature and barometric pressure.

6.4 Measurement Uncertainty

"Compatible Electronics' U_{lab} value is less than U_{cispr}, thus based on this − compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.

$$u_c(y) = \sqrt{\sum_i c_i^2 \; u^2(x_i)}$$

Measurement		U_{cispr}	U_{lab} = 2 *uc* (*y*)
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3,6 dB	2.88
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	5,2 dB	4.04

7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A 10 dB attenuation pad was used for the protection of the EMI Receiver input stage. All factors associated with attenuator and cables were recorded into the EMI Software Program accordingly to display the actual corrected measured level. The LISN output was connected to the input of the EMI Receiver. The output of the second LISN was terminated with 50-ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in EN55022. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.15 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the computer in several overlapping sweeps by running the EMI Receiver at a minimum scan rate of 10 seconds per octave. The six highest emissions are listed in tables 1 & 2.

7.1.2 Conducted Emissions Test on Telecommunication Lines

The EMI Receiver was used as a measuring meter. All factors associated with attenuator and cables were recorded into the EMI Software Program accordingly to display the actual corrected measured level. The current probe output was read by the EMI Receiver. The effective measurement bandwidth used for the conducted emissions test was 9 kHz. The initial test data was taken while scanning the frequency ranges of 0.15 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable placement.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was set up with the minimum distances from any conductive surfaces as specified in EN 55022.

The EUT complies with the requirements of EN55022. The test results are located in Appendix E. The six highest emissions are listed in table 3.

7.1.3 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. A preamplifier was used to increase the sensitivity of the instrument. The EMI Receiver was used in the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. A quasi-peak reading was taken only for those readings, which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured (120 kHz for 30 MHz to 1 GHz and 1 MHz for 1 GHz and above).

Broadband Combilog Antenna and horn antennas were used as transducers during the measurement. The Combilog Antenna was used from 30 MHz to 1000 MHz and the horn was used above 1 GHz. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

The TDK FAC-3 shielded test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is set up according to CISPR 16. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The EUT was tested at a 3 meter test distance from 30 MHz to 1 GHz, and at a 3 meter test distance above 1 GHz to obtain final test data. The six highest emissions are listed in table 4.

7.1.4 RF Emissions Test Results

Table 1.0 CONDUCTED EMISSION RESULTS 120V
SINGLE BOARD COMPUTER (SBC) Model: DFF-2220

Frequency MHz	Corrected Reading* dBuV	Specification Limit dBuV	Delta (Cor. Reading – Spec. Limit) dB
0.15 N	56.93 #	65.78	-8.85
0.15 L	56.79 #	65.78	-8.99
0.16 L	55.01 #	65.36	-10.35
0.17 L	53.16 #	64.77	-11.61
0.18 N	52.37 #	64.58	-12.21
0.19 L	51.03 #	64.04	-13.01

Table 2.0 CONDUCTED EMISSION RESULTS 240V
SINGLE BOARD COMPUTER (SBC) Model: DFF-2220

Frequency MHz	Corrected Reading* dBuV	Specification Limit dBuV	Delta (Cor. Reading – Spec. Limit) dB
0.16 L	54.69 #	65.36	-10.67
0.16 N	54.70 #	65.57	-10.87
0.17 L	53.15 #	64.77	-11.62
0.18 L	52.13 #	64.39	-12.26
0.18 N	51.29 #	64.39	-13.11
0.21 L	50.17 #	63.37	-13.19

Notes:

* The complete emissions data is given in Appendix E of this report.

** The factors for the antenna are attached in Appendix D of this report.

\# Quasi-Peak Reading

A Average Reading

Table 3.0 CONDUCTED TELECOMMUNICATION EMISSION RESULTS
SINGLE BOARD COMPUTER (SBC) Model: DFF-2220

Frequency MHz	Emission Level* dBuV	Specification Limit dBuV	Delta (Spec limit-Emission) dB
25.60 T2	46.30 #	64.00	-27.70
26.49 T2	46.14 #	64.00	-27.86
27.02 T2	45.92 #	64.00	-28.08
25.97 T2	45.91 #	64.00	-28.09
24.96 T2	45.87 #	64.00	-28.13
25.98 T1	45.13 #	64.00	-28.87

Table 4.0 RADIATED EMISSION RESULTS
SINGLE BOARD COMPUTER (SBC) Model: DFF-2220

Frequency MHz	Corrected Reading* dBuV	Specification Limit dBuV	Delta (Cor. Reading – Spec. Limit) dB
360.00 H	39.43 #	47.45	-8.02
375.00 H	38.12 #	47.45	-9.33
1125.00 H	40.15 A	50.00	-9.85
1000.00 H	37.09 A	50.00	-12.91
95.50 V	22.58 #	40.45	-17.87
1150.00 H	32.00 A	50.00	-18.00

Notes:

* The complete emissions data is given in Appendix E of this report.

** The factors for the antenna and preamplifier gain are attached in Appendix D of this report.

\# Quasi-Peak Reading

A Average Reading

7.2 Electrostatic Discharge Tests

An ESD Generator was used for this test. The characteristics consist of an energy storage capacitor: 150pF; discharge resistance: 330 Ohms; charging resistor: 100 Megaohms; tolerance of voltage indication: ±5%; polarity of output voltage: positive and negative. The waveshape conforms to EN 61000-4-2.

7.2.1 Direct ESD - Air Discharge

In the Air ESD test, the EUT was exposed to a direct air discharge at all user accessible surfaces. The ESD arc was drawn directly to any insulated or conductive point on the EUT. The test simulated a situation in which any person or object carrying an electrostatic charge discharges it to any point on the equipment. The ground strap of the ESD generator was connected to the earth ground (shield room ground reference plane) and was a minimum of 0.2 m away from the EUT.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment, and EUT setup during the test are in Appendix D. The data sheets are in Appendix E.

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. The test point locations were selected based on an exploratory test of inducing 20 discharges per second onto all surfaces of the unit. The test point locations selected for the final test are listed in the data sheets attached in Appendix E.

The test voltages were increased from 2.0 kV to 8.0 kV at 2.0 kV increments, in order to eliminate errors related to the "window" effect associated with ESD testing. Also, testing in increments helps determine the voltage threshold without severely damaging the unit. The final test was performed with 10 single shot discharges on each selected point in each polarity. The rounded discharge probe was used for the test. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024. The unit operates within the specifications for air discharge at ±2.0 kV, ±4.0 kV and ±8.0 kV (insulated surfaces).

7.2.2 Direct ESD - Contact Discharge

In the contact ESD test, the EUT was exposed to a direct contact discharge at all conductive user accessible surfaces. The ESD arc was drawn directly to any conductive point on the equipment under test. The test provides a repeatable method to determine immunity of the EUT to electrostatic discharges. The ground strap of the ESD generator was connected to the earth ground (shield room ground reference plane) and was a minimum of 0.2 m away from the EUT.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are in Appendix D. The data sheets are in Appendix E.

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. The test point locations were selected based on the exploratory test of inducing 20 discharges per second onto all surfaces of the unit. The test point locations selected for the final test are listed in the data sheets attached in Appendix E.

The test voltages were ±2.0 kV and ±4.0 kV in order to eliminate errors related to the "window" effect associated with ESD testing. Also, testing in increments helps determine the threshold without severely damaging the unit. The final test was performed with single shot discharges on all the selected points.

The pointed discharge probe was touching the conductive surface of the unit before initiating the discharge. For painted surfaces, the sharp tip of the probe was used to penetrate the paint before providing discharge to the EUT. At least 25 discharges (in both polarities) were applied at each test point. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024. The unit operates within the specifications for contact discharge at ±2.0 kV and ±4.0 kV (conductive surfaces).

7.2.3 Indirect Electrostatic Discharge Test - Vertical Coupling Plane

For indirect electrostatic discharges, the vertical coupling plane (0.5 m x 0.5 m) was tied to the ground reference plane through braid and a series of two 470 kΩ resistors one at each end of the braid.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are in Appendix D. The data sheets are in Appendix E.

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. A distance of one meter was maintained between the EUT and the shield room walls or any other metallic structures. The ground strap of the ESD generator was connected to the earth ground (shield room ground reference plane) and was a minimum of 0.2 m away from the EUT. The coupling plane was placed 0.1 meters from each side of the EUT, and at a height close to the center of the EUT. The discharges were applied to the edge of the VCP. Ten discharges were applied to the VCP at each test level in each polarity on each side of the unit. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024. The unit operates within the specifications for indirect discharges to the VCP at ±2.0 kV and ±4.0 kV.

7.2.4 Indirect Electrostatic Discharge Test - Horizontal Coupling Plane

For indirect electric discharges the horizontal coupling plane (1.0 m x 1.0 m) was tied to the ground reference plane through braid and a series of two 470 kΩ resistors at each end of the braid.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are in Appendix D. The data sheets are in Appendix E.

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. A distance of one meter was maintained between the EUT and the shield room walls or any other metallic structures. The ground strap of the ESD generator was connected to the earth ground (shield room ground reference plane) and was a minimum of 0.2 m away from the EUT. The discharges were applied to the center of the front edge of the HCP 10cm in front of the EUT at each test level in each polarity. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024. The unit operates within the specifications for indirect discharges to the HCP at ±2.0 kV and ±4.0 kV.

7.3 Radio-Frequency Electromagnetic Field

For this test, the Hybrid Log Periodic was used to radiate the energy onto the EUT at the specified test level. The field uniformity was established by means of the computer software program prior to the test and without injecting modulation. The transmitting antenna was placed in a fixed location and distance during both calibration and test.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are included in Appendix D. The data sheets are located in Appendix E.

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. The RF energy was radiated using the hybrid log from 80 - 1000 MHz. The signal was amplitude modulated at 80% with a 1 kHz sine wave for the entire frequency range. The frequency was adjusted by 1% increments beginning with the start frequency and increasing by 1% of each subsequent frequency, the dwell time was 1 sec. In certain cases the dwell time may be extended due to the operating duty cycle of the EUT, but in any event, the dwell time is sufficiently long to encompass the entire duty cycle of the EUT.

A solitary probe was placed next to the EUT for field verification only. The computer software program performed the test. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024 as per the test procedures described in EN 61000-4-3. The unit operates within the specifications.

7.4 Fast Transient Common Mode Tests

The test was performed as per EN 61000-4-4. The burst duration was 15 ms, with 300 ms burst period. The individual impulse had a 5ns rise time and a 50ns decay time and a 5 kHz frequency. The EMC immunity test system was used for the test. Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was operated and configured as described in section 4.2 of this report. The coupling/decoupling network was placed 0.5 meter away from the EUT. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are included in Appendix D.

7.4.1 Power Lines

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. The transient energy was injected onto the power line through the use of a coupling/decoupling network. Bursts of pulse trains were injected onto the power line, in both positive and negative polarities. The test level was 1.0 kV. The test was run for one minute on each lead and each lead combination. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024 as per the test procedures described in EN 61000-4-4. The unit operates within specifications during and after bursts of transients of ±1.0 kV on power lines.

7.4.2 Data Lines

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. The transient energy was coupled from the EMC immunity test system to the signal lines through the use of the capacitive coupling clamp. The clamp meets the requirements of EN 61000-4-4. The clamp was placed on the ground plane, and the data lines were placed inside the clamp. Bursts of pulse trains were injected onto the signal lines, in both positive and negative polarities. The test level was ±0.5 kV. The test was run for two minutes on each cable. After completion of the test, a functional test was performed on the EUT to ensure proper operation.

Test Results:

The EUT complies with the relevant requirements of EN55024 as per the test procedures described in EN 61000-4-4. The unit operates within specifications during and after bursts of transients of ±0.5 kV on data lines.

7.5 Surge Immunity Test

7.5.1 Power Lines

The EMC Test Immunity System was used to provide the "Combination Wave" as specified in EN 61000-4-5 Voltage waveform for high impedance - Rise time to crest voltage: 1.2 uS approx. and Decay: 50 uS to 50% of peak voltage value. Current waveform for low impedance - Rise time to crest voltage: 8.0 uS approx. and Decay: 20 uS to 50% of peak current value. The amplitude was increased incrementally at the stated test levels contained in EN 61000-4-5 using the EMC Test Immunity System software, which was installed on the desktop computer. As per EN 61000-4-5, the selection of the voltage or current waveform depends on impedance offered by the EUT.

Test Results:

The EUT complies with the requirements of EN55024 as per the test procedures described in EN 61000-4-5. The unit operates within its specifications before and after Common mode Surges of ± 2.0 kV and Differential mode surges of ± 1.0 kV on power lines.

7.5.2 Telecommunication Lines

Test Results:
The EUT has no telecommunication cables that connect directly to outdoor cables; therefore this test was deemed unnecessary and thus was not performed. Had this test been applicable it would have been performed as described below.

The EMC Test Immunity System was used to provide the "Combination Wave" as specified in EN 61000-4-5 Voltage waveform for high impedance - Rise time to crest voltage: 1.2 uS approx. and, Decay: 50 uS to 50% of peak voltage value. Current waveform for low impedance - Rise time to crest voltage: 8.0 uS approx. and, Decay: 20 uS to 50% of peak current value. The amplitude was increased incrementally at the stated test levels contained in EN 61000-4-5 using the EMC Test Immunity System software, which was installed on the desktop computer. Surges were initiated on the telecommunication line through the external coupler/decoupler module from the EMC Test Immunity System. The telecommunication lines test was performed as per EN 61000-4-5.

7.6 Conducted disturbances induced by RF Electromagnetic Field Test

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. This test was performed as per EN 61000-4-6. For this test, a Coupling Decoupling Network was used to induce an RF-field current directly onto the AC lines. The signal was 80% AM modulated with a 1 kHz sine wave, with a field strength of 3Vrms, over the frequency range of 150 kHz to 80 MHz. The frequency range was covered with a 1% step size and the dwell time was 1 second. The EUT was placed 10 cm above the GRP with the Coupling Decoupling Network mounted and bonded to the GRP.

The EUT was grounded through the AC power cord. The EUT was operated as described in section 4.2 of this report. The EUT was set up as shown in Appendix D of this report. Photographs of the test equipment and EUT setup during the test are included in Appendix D.

Test Results:

The EUT complies with relevant requirements of EN55024 as per the test procedures described in EN 61000-4-6. The EUT operates within its specifications during exposure from 0.15 MHz - 80 MHz, 3Vrms with a 1 kHz sine wave AM modulation at 80%.

7.7 Power Frequency Magnetic Field Test

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. This test was performed to determine if the test sample was susceptible to Power Frequency Magnetic Fields which are generated by power frequency current in conductors and leaking transformers. The test was performed as per EN 61000-4-8. The magnetic field is applied by the immersion method to the EUT; in this method the EUT is placed in the center of an induction coil. The waveform is that of the typical power frequency either 50Hz or 60Hz. The Magnetic Field Strength is expressed in A/m; 1 A/m corresponds to free space induction of 1.26μTesla. A Square Induction coil, 1m by 1m with a coupling plane placed under the EUT, was used to induce the magnetic field. The test duration was 1 minute for each of the three Orthogonal Axes.

The EUT was set up as shown in Appendix D of this report.

Test Results:

The EUT complies with requirements of EN55024 as per the test procedures described in EN 61000-4-8. The unit operates within its specifications before; during, and after the Power Magnetic Field of 1 A/m was applied.

7.8 Voltage Dips, Short Interruptions, and Voltage Variations

Prior to the start of the test, a functional test was performed on the EUT to ensure proper operation. The EUT was also monitored during the test for any degradation of performance. This test was performed as per EN61000-4-11. The purpose of this test was to determine the immunity of the EUT when subjected to voltage dips, short interruptions, and voltage variations. The voltages of the EUT were varied and disrupted at various levels of the supplied voltages for a given period of time. At each level the test was performed 3 times. The voltage change-overs took place at zero degree crossings.

The EUT was set up as shown in Appendix D of this report.

Test Results:

The EUT complies with requirements of EN55024. The unit operates within its specifications during and after voltage level reductions of >95% for 10ms, 30% for 500ms, and >95% for 5 seconds.

7.9 Harmonics and Flicker Test

Test Results:

(The EUT is rated less than 75 watts and is not likely to produce flicker; therefore this test was deemed unnecessary and thus was not performed. If this test had been applicable it would have been performed as below)

The Harmonic/Flicker Test System was used as a measuring meter along with a desktop computer. The data was collected using the Harmonic/Flicker Test System with software control activated. The voltage settings were 230V at 50Hz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was set up with the minimum distances from any conductive surfaces as specified in EN55022.

8. TEST PROCEDURE DEVIATIONS

There were no deviations from the test procedures.

9. CONCLUSIONS

The Single Board Computer (SBC) Model: DFF-2220, as tested, meets all of the Class B requirements of the European Standards EN55022 (Limits and methods of measurement of radio disturbance characteristics of information technology equipment), EN 61000-3-2 (Electromagnetic Compatibility: Part 3: Limits. Section 2: Limits for harmonic current emissions), EN 61000-3-3 (Electromagnetic Compatibility: Part 3: Limits. Section 3: Limitation of voltage fluctuations and flicker) and EN55024 (Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurement). Under paragraph G of Section 15.109 of the Code of Federal Regulations Title 47, part 15 of the FCC rules, the FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

APPENDIX A

LABORATORY ACCREDITATIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

NVLAP LAB CODES 200063-0, 200528-0, 200527-0

For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025. Please follow the link to the NIST/NVLAP site for each of our facilities' NVLAP certificate and scope of accreditation

NVLAP listing links
Agoura Division / Brea Division / Silverado/Lake Forest Division

.Quote from ISO-ILAC-IAF Communiqué on 17025:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems — Requirements."

ANSI listing CETCB

Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for EMC under the US/EU Mutual Recognition Agreement (MRA).
US/EU MRA list NIST MRA site

Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for Taiwan/BSMI under the US/APEC (Asia-Pacific Economic Cooperation) Mutual Recognition Agreement (MRA).
APEC MRA list NIST MRA site

We are also listed for IT products by the following country/agency:

VCCI Support member: Please visit http://www.vcci.jp/vcci_e/

FCC Listing, from FCC OET site
FCC test lab search https://fjallfoss.fcc.gov/oetcf/eas/reports/TestFirmSearch.cfm

Industry Canada Industrie Canada Compatible Electronics IC listing can be found at:
http://www.ic.gc.ca/eic/site/ic1.nsf/eng/home

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made to the EUT.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	SINGLE BOARD COMPUTER (SBC) Model: DFF-2220 S/N: 0112150012

There were no additional models covered under this report.

APPENDIX D

DIAGRAMS, CHARTS AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

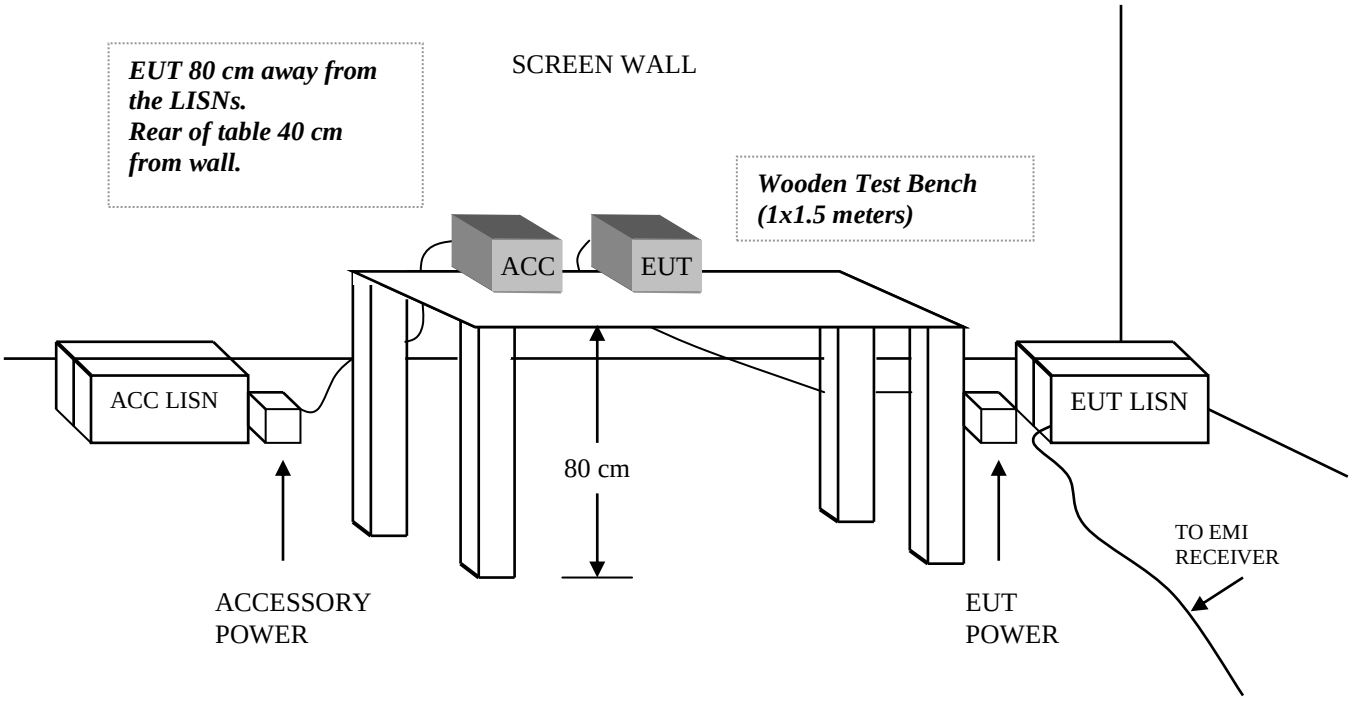
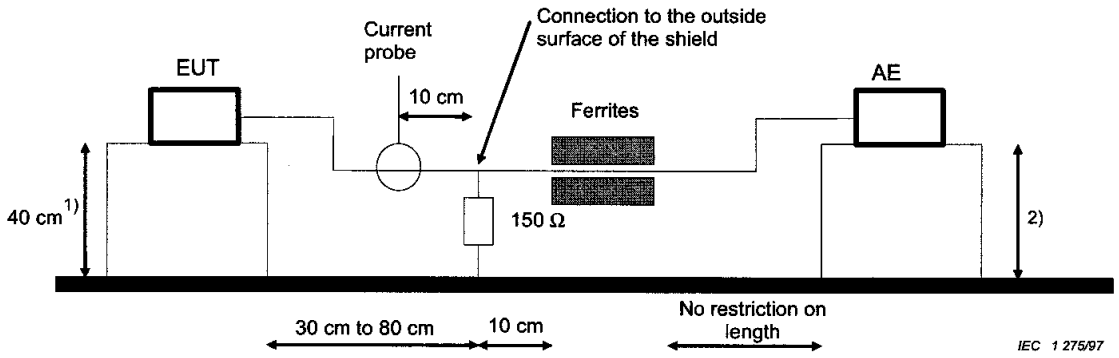


FIGURE 2: CONDUCTED EMISSIONS TEST SETUP FOR TELECOMMUNICATION LINES



AE = Associated equipment

EUT = Equipment under test

1) Distance to the reference groundplane (vertical or horizontal).

2) Distance to the reference groundplane is not critical.

Figure C.2 – Using a 150 Ω load to the outside surface of the shield ("in situ CDN/ISN")

FIGURE 3: RADIATED EMISSIONS 3-METER SEMI-ANECHOIC TEST CHAMBER

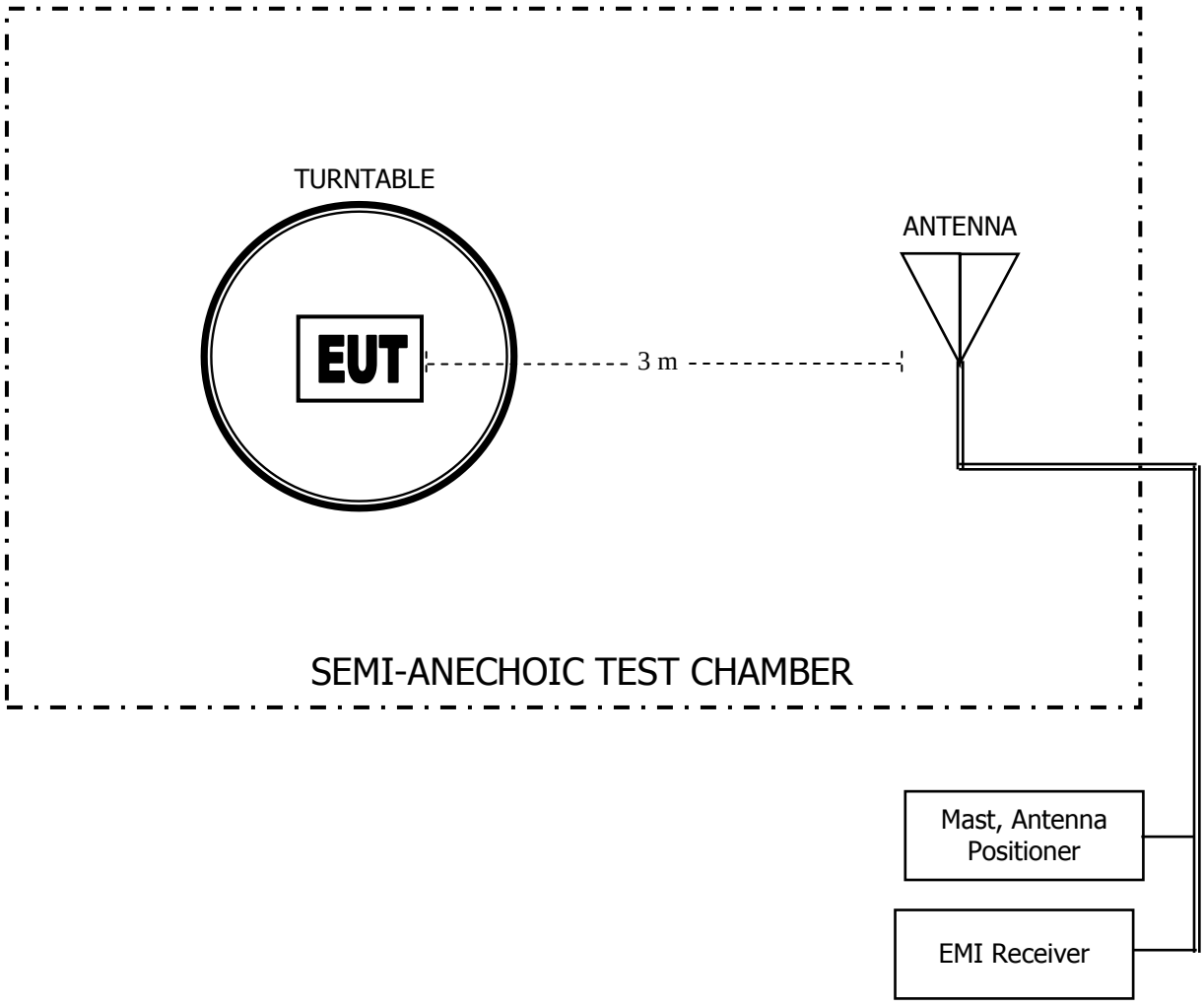


FIGURE 4: HIGH FREQUENCY TEST VOLUME

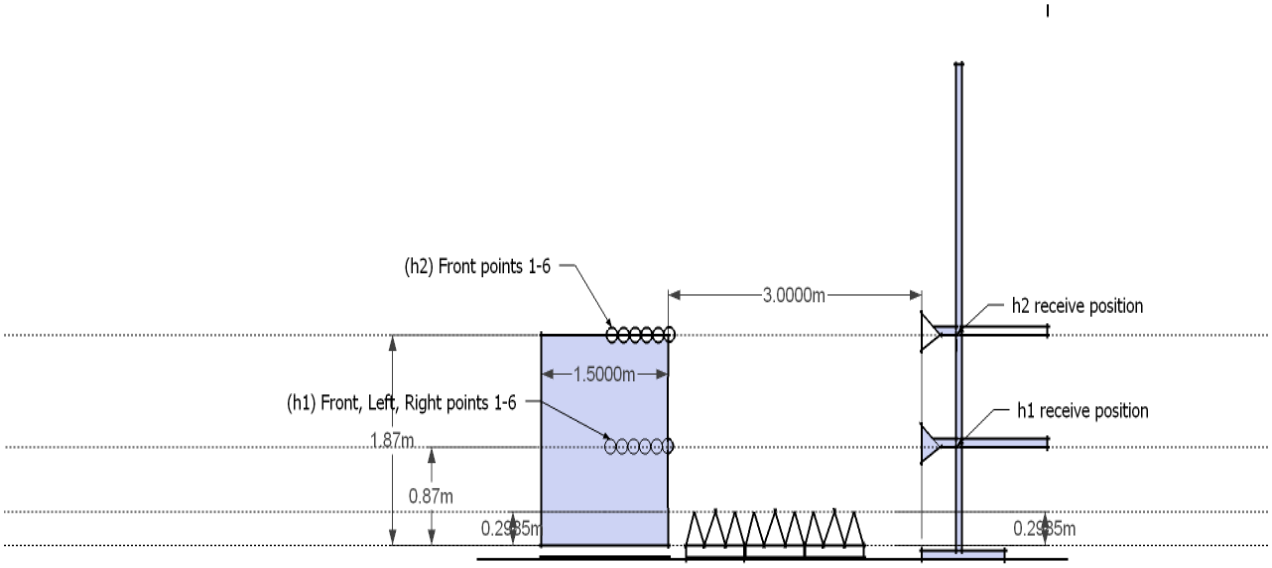


FIGURE 5: ELECTROSTATIC DISCHARGE

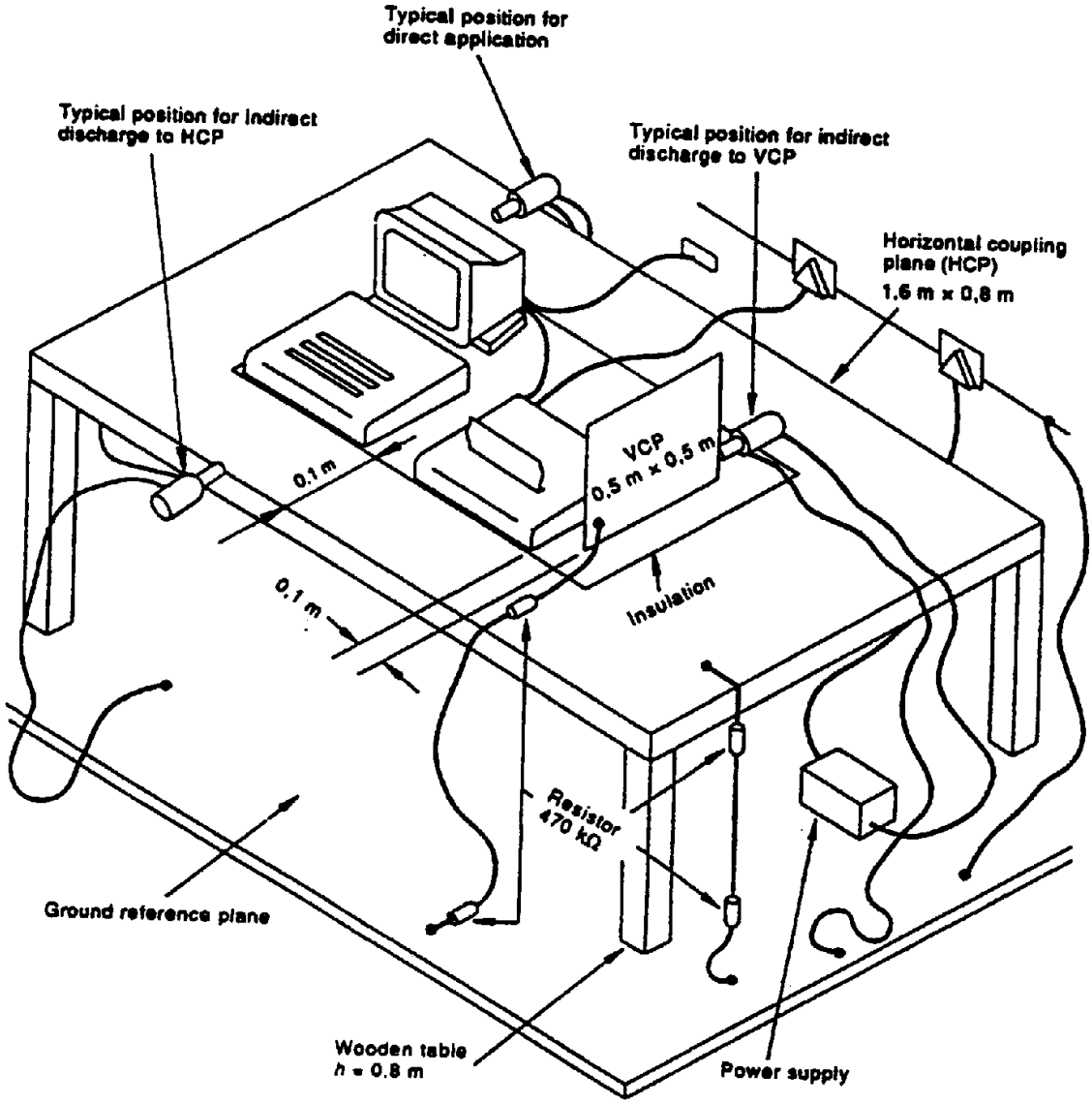


FIGURE 6: RADIATED SUSCEPTIBILITY SETUP

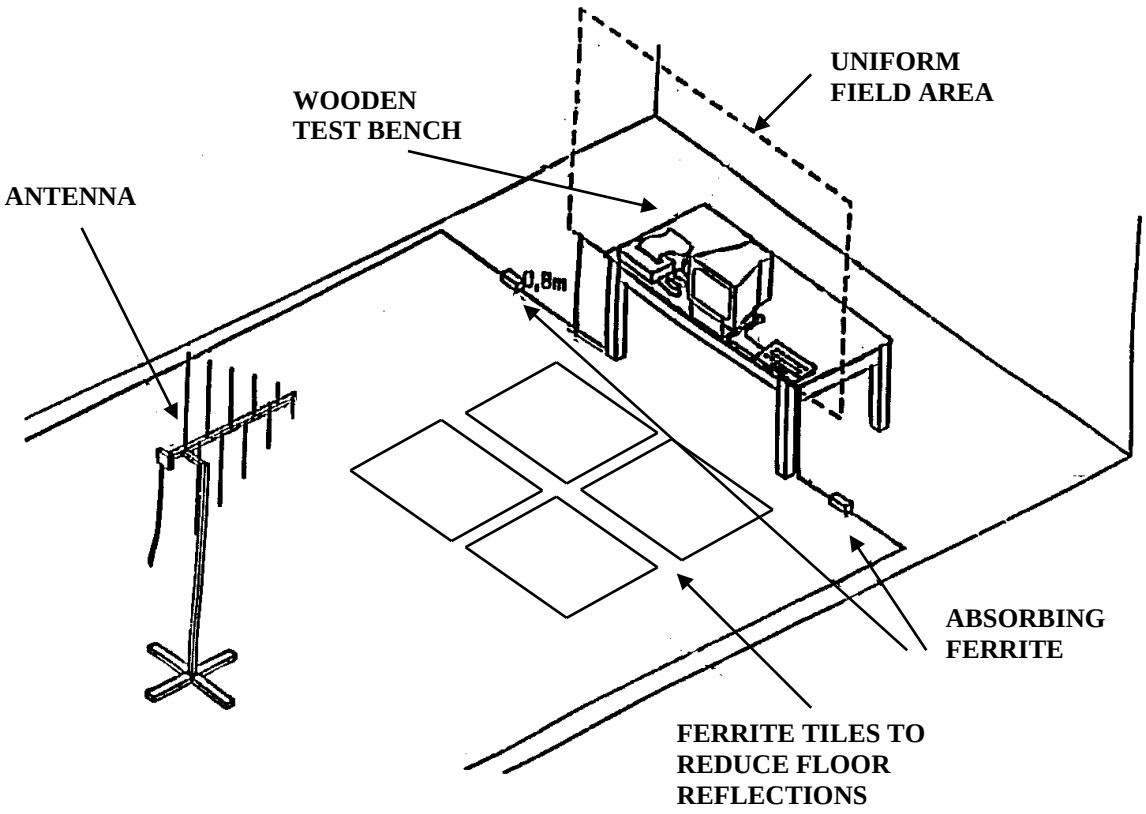


FIGURE 7: FAST TRANSIENTS COMMON MODE TEST SETUP

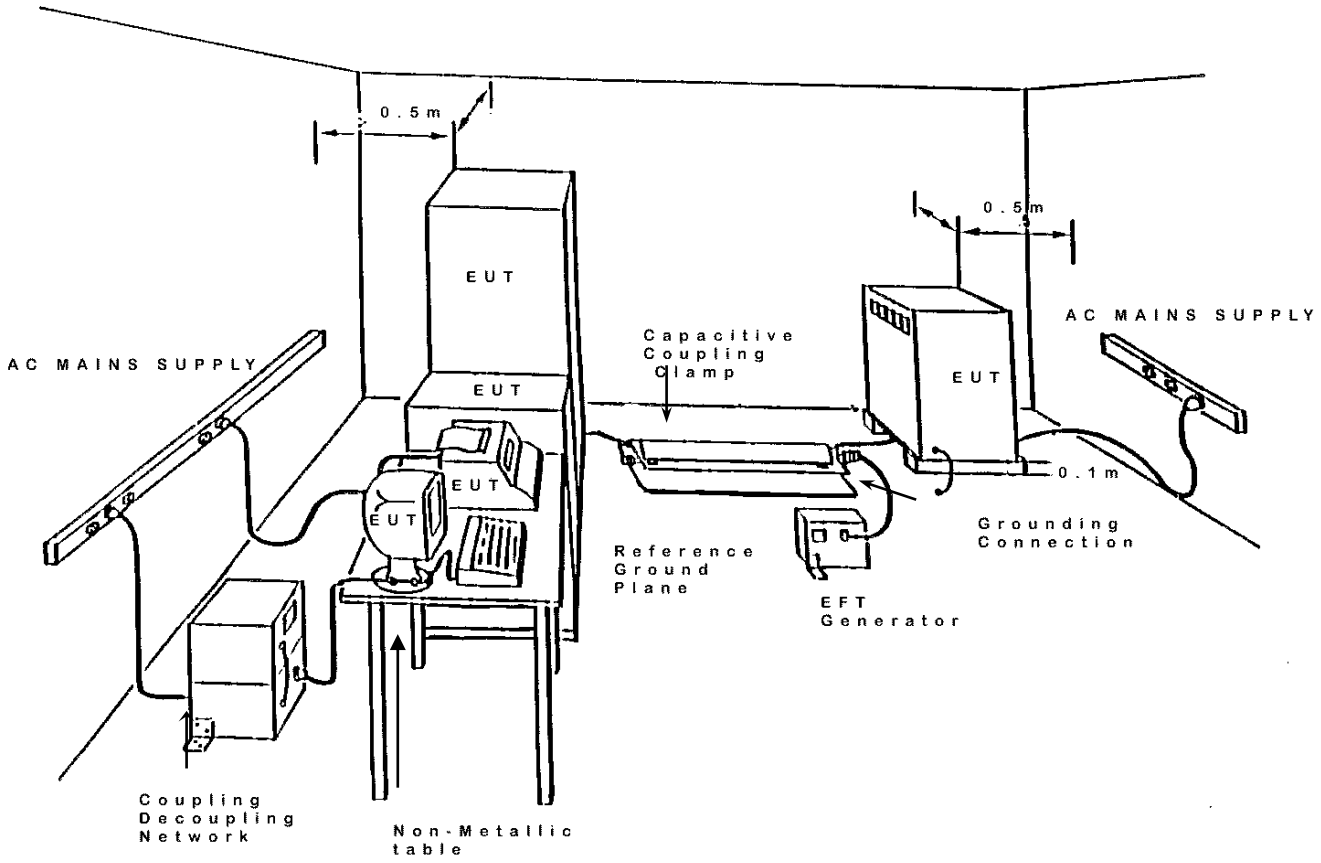


FIGURE 8: SURGE IMMUNITY TEST SETUP

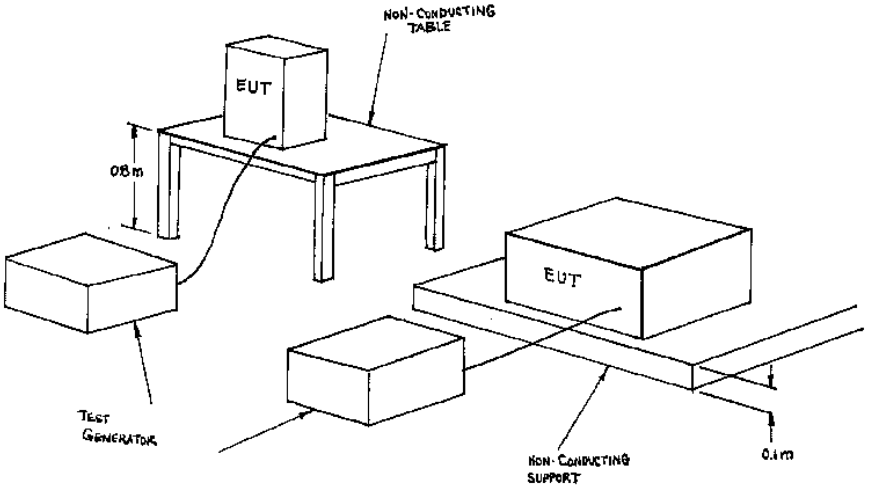


FIGURE 9: CONDUCTED DISTURBANCES INDUCED BY RF FIELDS TEST SETUP

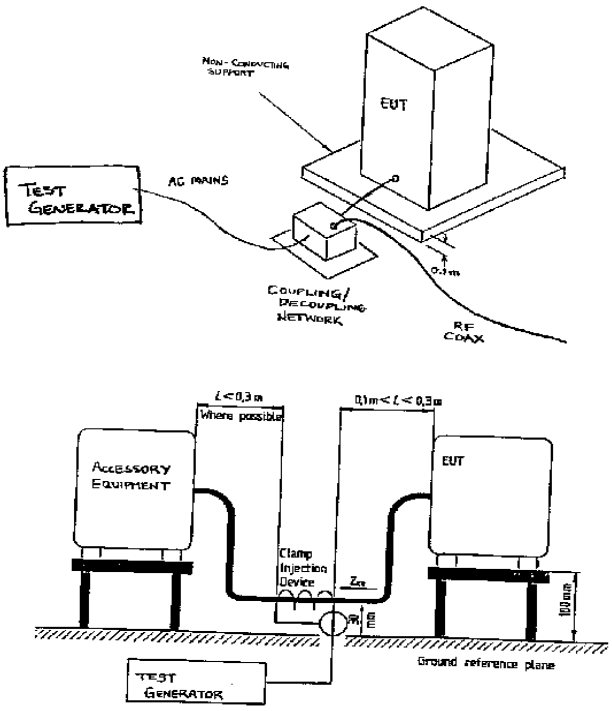


FIGURE 10: POWER FREQUENCY MAGNETIC FIELD TEST SETUP

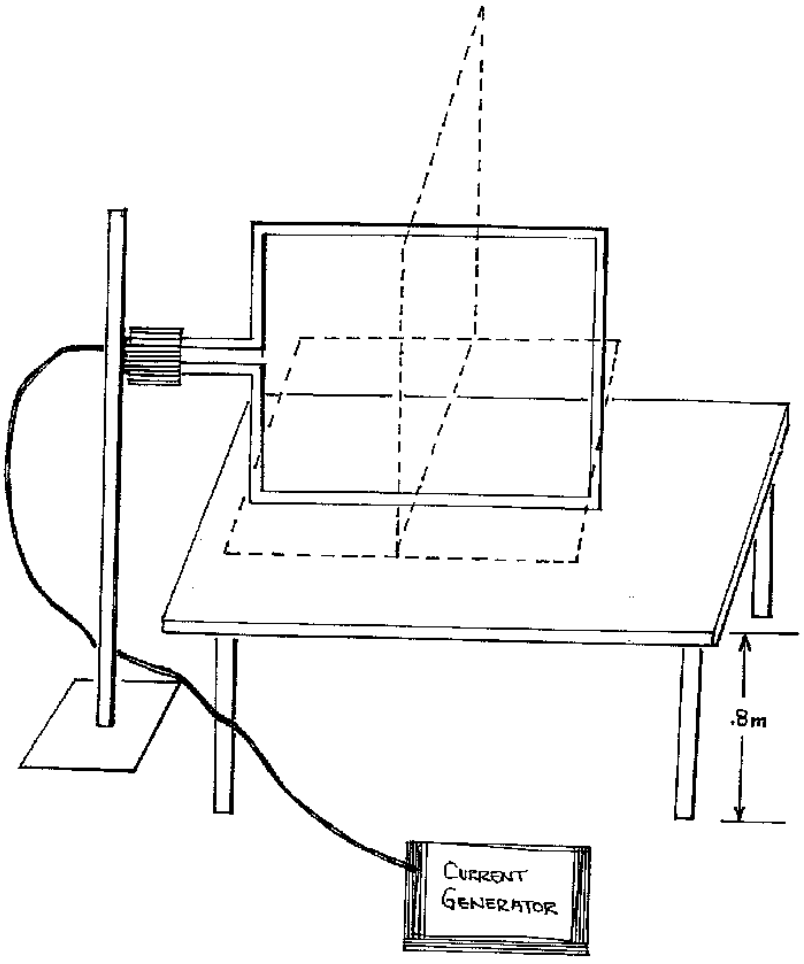
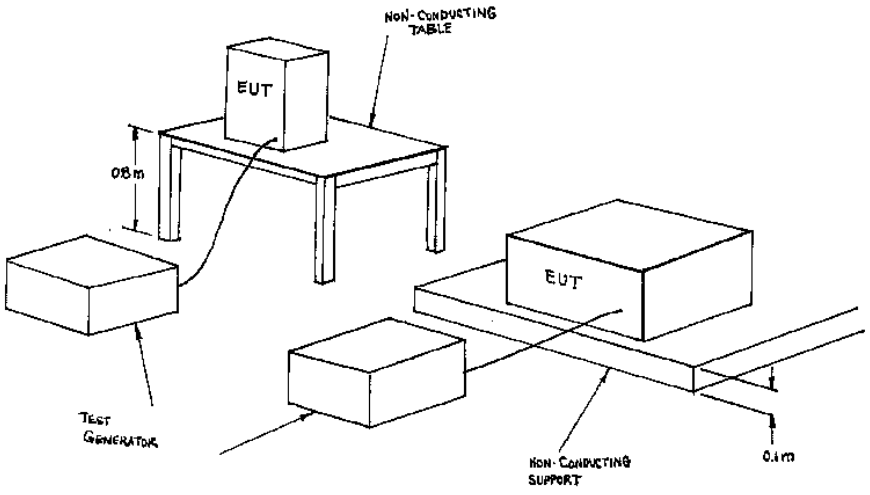


FIGURE 11: VOLTAGE DIPS & VOLTAGE VARIATIONS & SHORT INTERRUPTIONS



COM-POWER AC-220

LAB R - COMBILOG ANTENNA

S/N: 25857

CALIBRATION DUE: MAY 21, 2015

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	**160**	13.3
35	22.5	**180**	15.0
40	23.0	**200**	14.6
45	21.5	**250**	16.5
50	21.3	**300**	18.1
60	18.2	**400**	19.4
70	13.2	**500**	21.4
80	11.6	**600**	21.6
90	11.9	**700**	23.7
100	12.6	**800**	26.0
120	15.1	**900**	26.6
140	13.6	**1000**	28.5

COM-POWER AH-118

HORN ANTENNA

S/N: 071250

CALIBRATION DUE: JULY 1, 2016

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
1000	30.1	**9500**	44.2
1500	29.2	**10000**	43.4
2000	31.6	**10500**	44.6
2500	35.5	**11000**	45.1
3000	33.7	**11500**	45.7
3500	36.0	**12000**	46.2
4000	35.4	**12500**	45.4
4500	35.5	**13000**	44.8
5000	40.1	**13500**	46.7
5500	37.8	**14000**	47.8
6000	39.0	**14500**	46.4
6500	39.9	**15000**	47.2
7000	40.4	**15500**	45.5
7500	44.4	**16000**	45.0
8000	44.1	**16500**	44.5
8500	43.1	**17000**	47.0
9000	43.0	**17500**	47.8
		18000	44.2

COM-POWER PAM-118

1-18GHz - PREAMPLIFIER

S/N: 443013

CALIBRATION DUE: APRIL 24, 2016

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	26.2	**5500**	25.3
1000	25.6	**6000**	25.0
1100	25.9	**6500**	24.7
1200	25.9	**7000**	23.6
1300	26.3	**7500**	23.3
1400	26.5	**8000**	23.7
1500	26.3	**8500**	24.0
1600	26.1	**9000**	24.3
1700	26.2	**9500**	24.1
1800	26.3	**10000**	23.7
1900	25.8	**11000**	24.2
2000	26.0	**12000**	23.2
2500	26.0	**13000**	22.8
3000	25.8	**14000**	22.6
3500	25.9	**15000**	22.9
4000	26.4	**16000**	22.3
4500	26.0	**17000**	22.6
5000	25.6	**18000**	23.9

COM-POWER PAM-118

1-18GHz - PREAMPLIFIER

S/N: 443011

CALIBRATION DUE: April 24, 2016

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
0.500	27.2	**7.000**	23.8
1.000	26.6	**7.500**	23.9
1.500	27.0	**8.000**	24.4
2.000	27.0	**8.500**	25.2
2.500	27.4	**9.500**	26.2
3.000	27.6	**10.000**	25.8
3.500	27.5	**11.000**	25.5
4.000	27.3	**12.000**	25.4
4.500	27.3	**13.000**	25.1
5.000	27.5	**14.000**	24.6
5.500	26.3	**15.000**	24.1
6.000	26.1	**16.000**	25.1
6.500	25.4	**17.000**	25.2
		18.000	24.4

FRONT VIEW

ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - RADIATED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW
ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - RADIATED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B – RADIATED ABOVE 1GHZ EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW
ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B – RADIATED ABOVE 1GHZ EMISSIONS
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

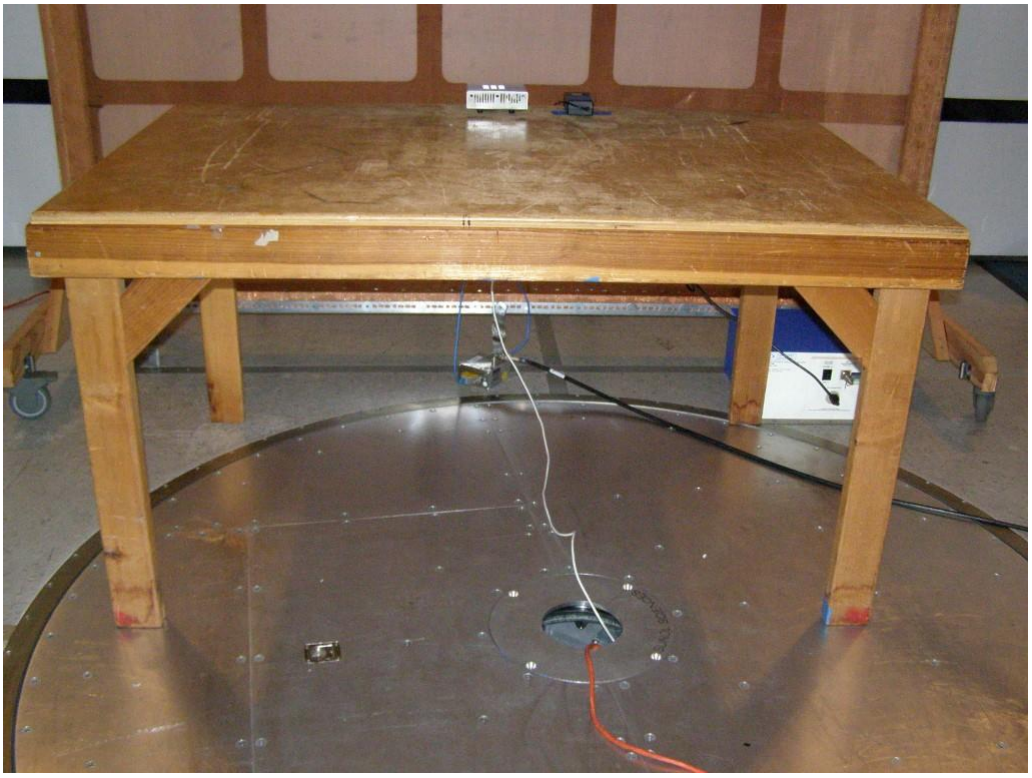
ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - CONDUCTED EMISSIONS

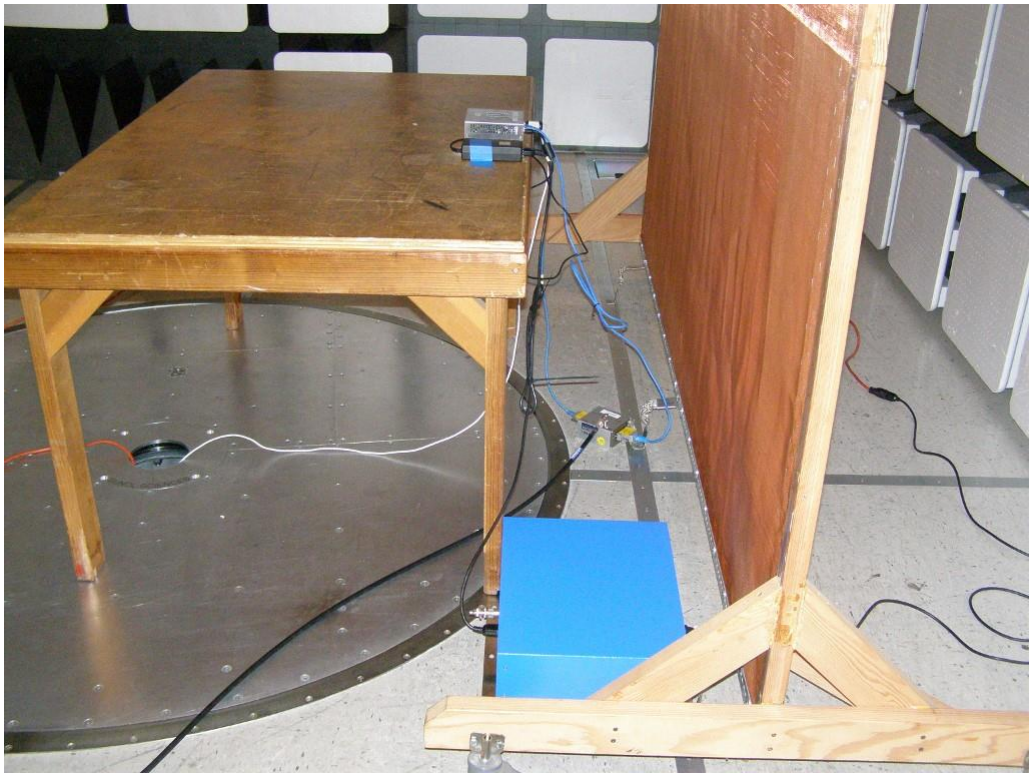
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - CONDUCTED TELECOM EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

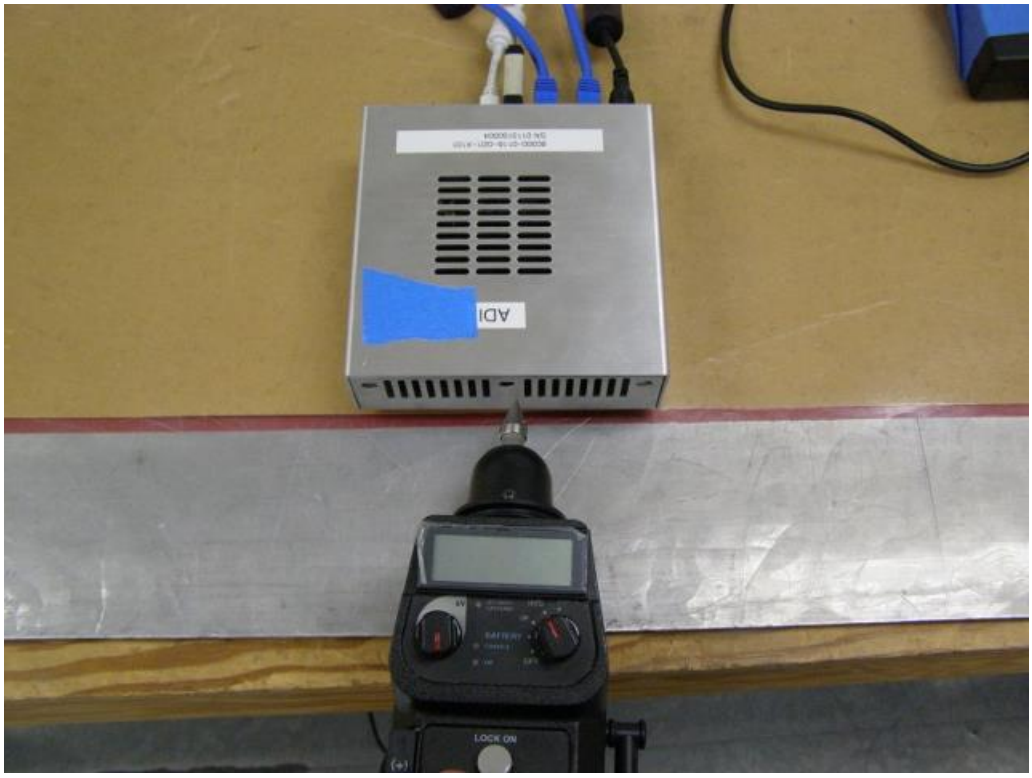


REAR VIEW

ADI ENGINEERING
SINGLE BOARD COMPUTER (SBC)
Model: DFF-2220
EN55022 CLASS B - CONDUCTED TELECOM EMISSIONS

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

ELECTROSTATIC DISCHARGE

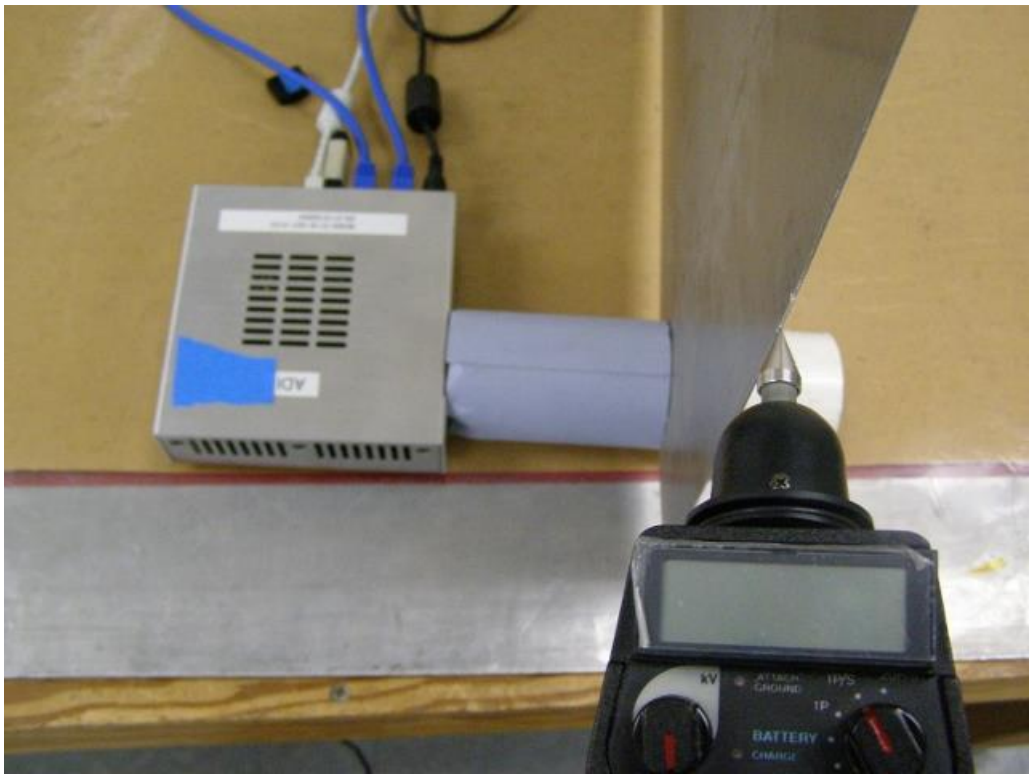


PHOTOGRAPH OF THE TEST SETUP FOR
DIRECT ELECTROSTATIC DISCHARGE TEST
(CONTACT DISCHARGE)

ELECTROSTATIC DISCHARGE

PHOTOGRAPH OF THE TEST SETUP FOR
INDIRECT ELECTROSTATIC DISCHARGE TEST
(HORIZONTAL COUPLING PLANE)

ELECTROSTATIC DISCHARGE

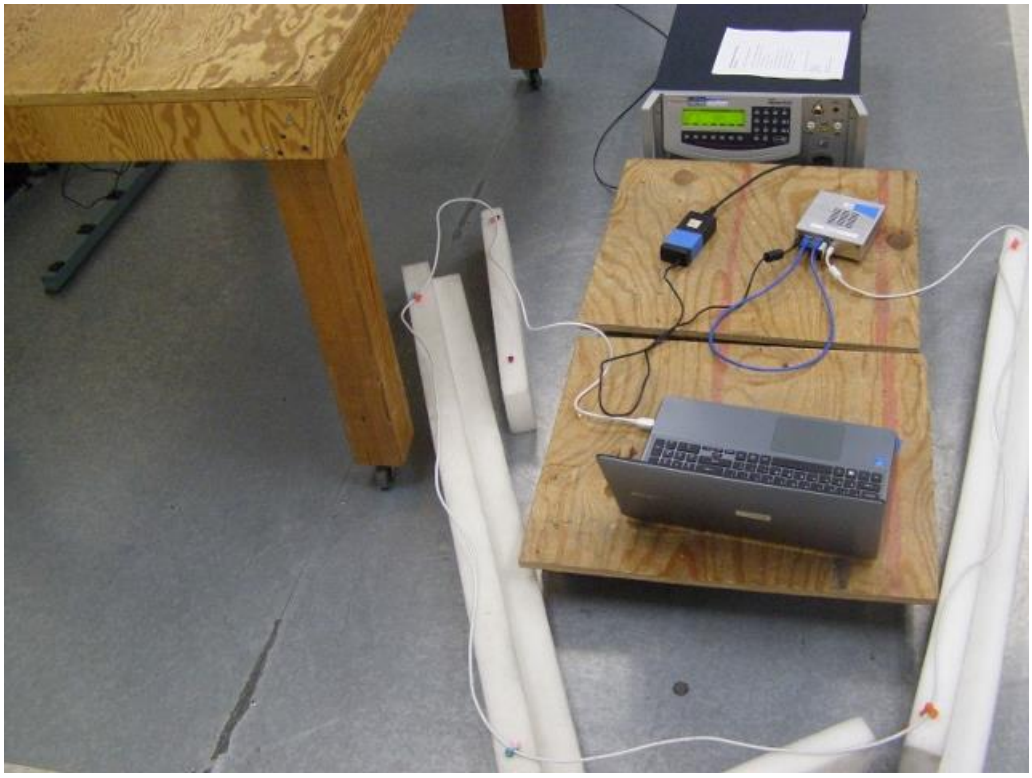


PHOTOGRAPH OF THE TEST SETUP FOR
INDIRECT ELECTROSTATIC DISCHARGE TEST
(VERTICAL COUPLING PLANE)

RADIO-FREQUENCY ELECTROMAGNETIC FIELD

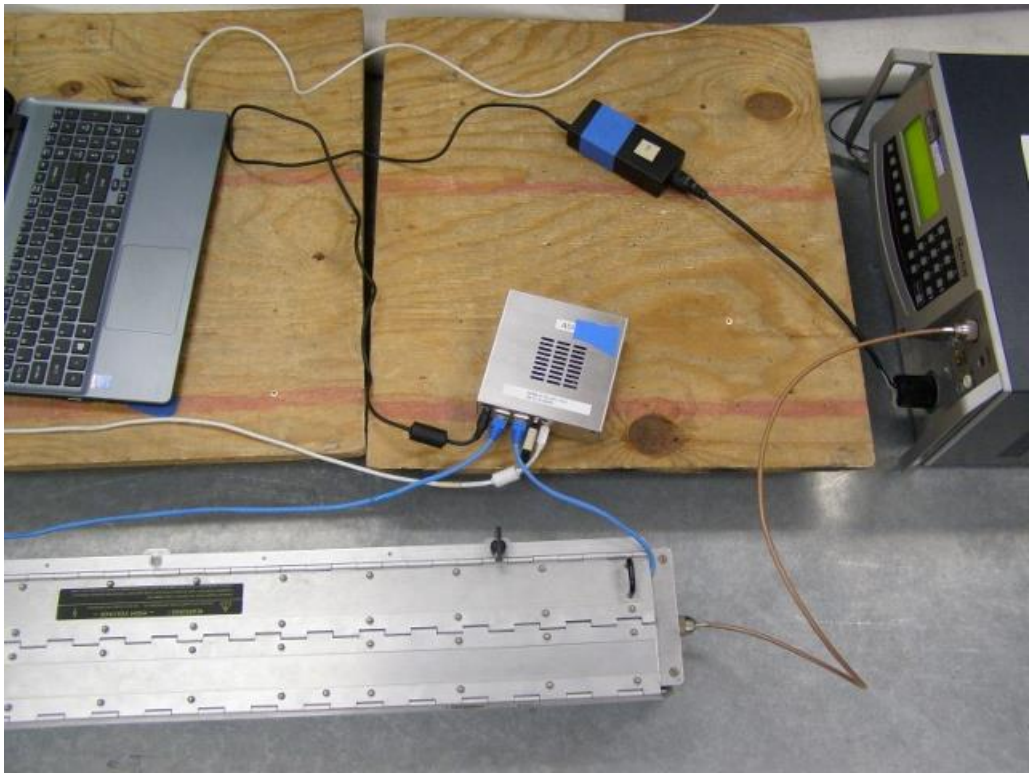
PHOTOGRAPH OF THE TEST SETUP FOR
RADIO-FREQUENCY ELECTROMAGNETIC FIELDS TEST

FAST TRANSIENTS COMMON MODE



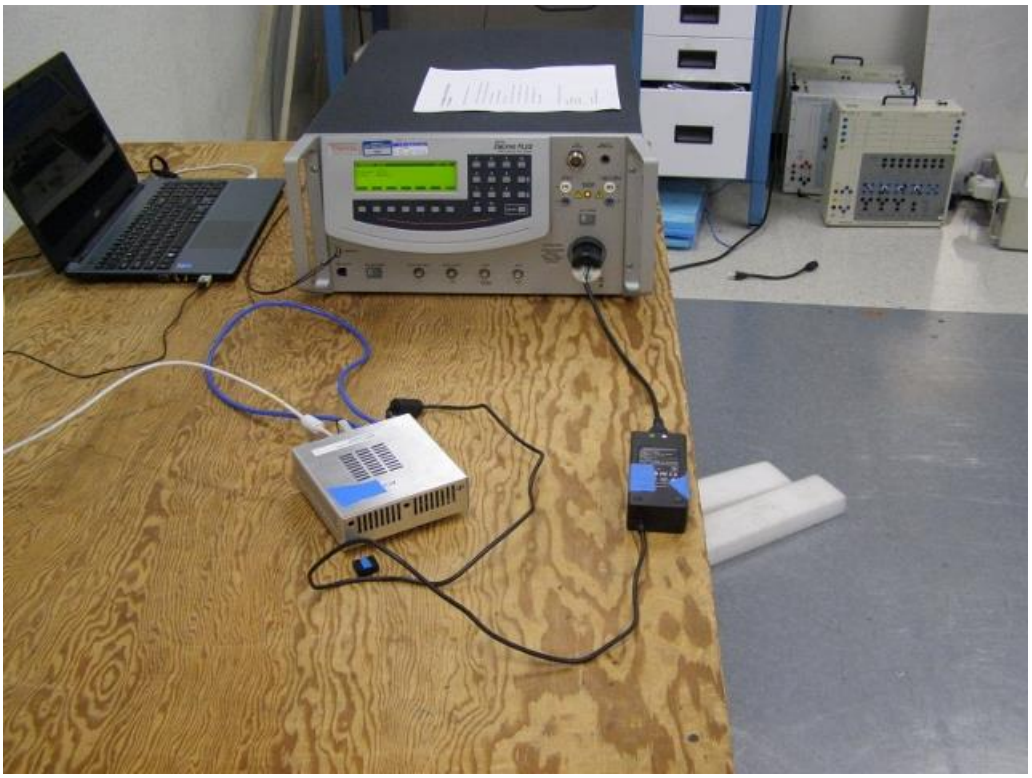
PHOTOGRAPH OF THE TEST SETUP FOR
FAST TRANSIENT COMMON MODE TEST
(POWER LINES)

FAST TRANSIENTS COMMON MODE



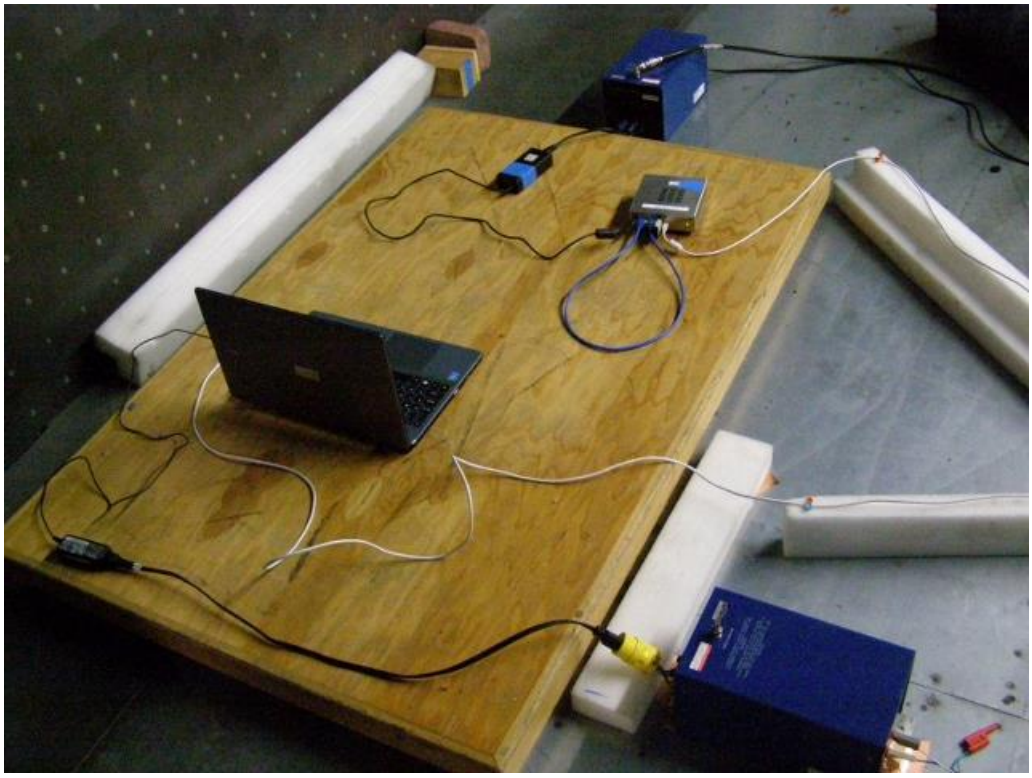
PHOTOGRAPH OF THE TEST SETUP FOR
FAST TRANSIENT COMMON MODE TEST
(DATA LINES)

SURGE IMMUNITY TEST



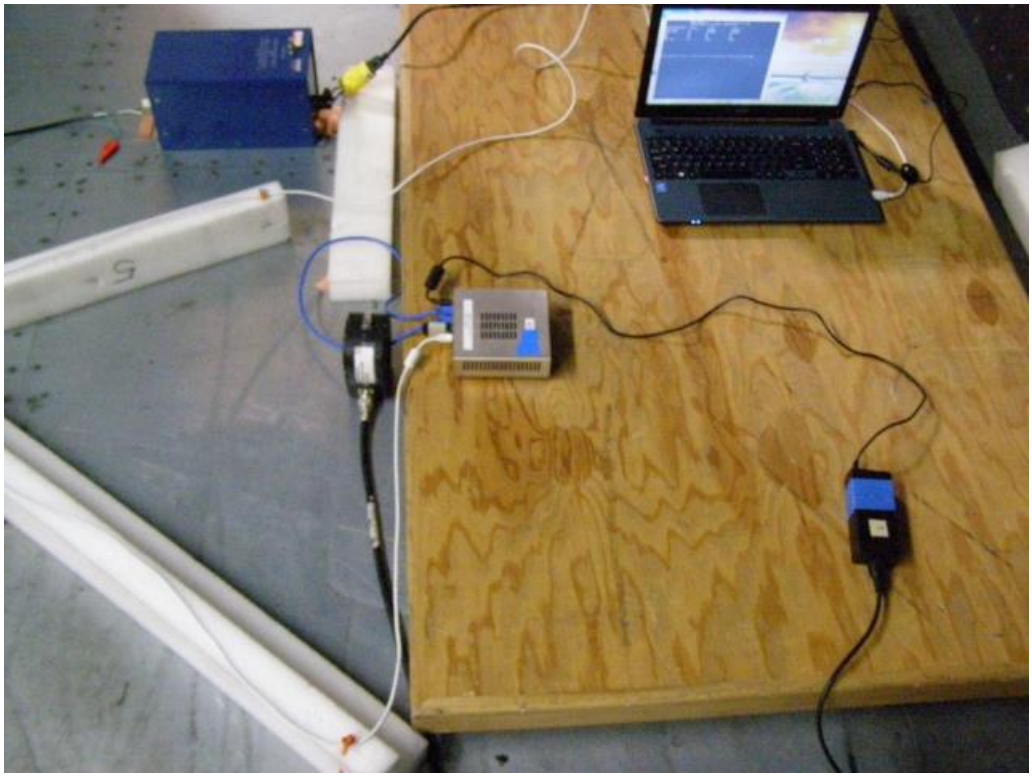
PHOTOGRAPH OF THE TEST SETUP FOR
SURGE IMMUNITY TEST
(AC INPUT)

CONDUCTED DISTURBANCES INDUCED BY RF FIELDS TEST



PHOTOGRAPH OF THE TEST SETUP FOR
CONDUCTED DISTURBANCES INDUCED BY RF FIELDS
(POWER LINES)

CONDUCTED DISTURBANCES INDUCED BY RF FIELDS TEST

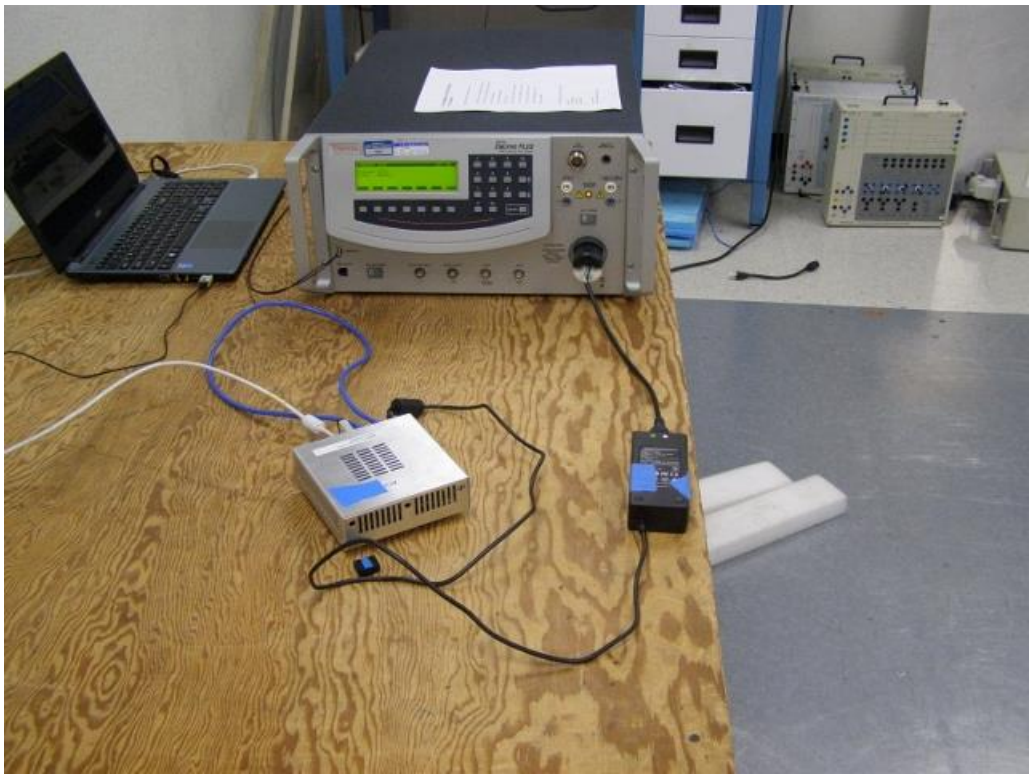


PHOTOGRAPH OF THE TEST SETUP FOR
CONDUCTED DISTURBANCES INDUCED BY RF FIELDS
(DATA LINES)

POWER FREQUENCY MAGNETIC FIELD SUSCEPTIBILITY

PHOTOGRAPH OF THE TEST SETUP FOR
POWER FREQUENCY MAGNETIC FIELD SUSCEPTIBILITY

VOLTAGE DIPS & VOLTAGE VARIATIONS AND SHORT INTERRUPTIONS



PHOTOGRAPH OF THE TEST SETUP FOR
VOLTAGE DIPS & VOLTAGE VARIATIONS AND SHORT INTERRUPTIONS

APPENDIX E

DATA SHEETS

ELECTROSTATIC DISCHARGE

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-2	**AIR TEMPERATURE:**	25° C
LEVEL:	±2.0 & ±4.0 kV Direct and Indirect Contact Discharges	**BAROMETRIC PRESSURE:**	103.6 kPa
PERFORMANCE CRITERIA:	B	**RELATIVE HUMIDITY:**	53 %

TEST POINT	TEST POINT DESCRIPTION	TEST POINT	TEST POINT DESCRIPTION
1	All Sides of Chassis	2	Connector Shells

TEST POINTS	LEVEL (kV)	DISCHARGES PER POLARITY	NO. OF FAILURES	COMMENTS
1-2	±2.0	15	0	Meets Applicable Performance Criteria
1-2	±4.0	15	0	Meets Applicable Performance Criteria
Horizontal	±2.0	15	0	Meets Applicable Performance Criteria
Coupling Plane	±4.0	15	0	Meets Applicable Performance Criteria
Vertical	±2.0	15	0	Meets Applicable Performance Criteria
Coupling Plane	±4.0	15	0	Meets Applicable Performance Criteria

RADIO-FREQUENCY ELECTROMAGNETIC FIELD

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-3	**AIR TEMPERATURE:**	24° C
LEVEL:	3 V/m, 1 kHz AM sine wave at 80%	**BAROMETRIC PRESSURE:**	103.6 kPa
PERFORMANCE CRITERIA:	A	**RELATIVE HUMIDITY:**	53 %

ALL FOUR SIDES OF THE EUT WERE EXPOSED TO THE FIELDS.

FREQ. RANGE (MHz)	POLAR-. IZATION	RESULT	THRESHOLD (V/m)	COMMENTS
80 - 1000	Horizontal	Passed	3 V/m	Meets Applicable Performance Criteria
80 - 1000	Vertical	Passed	3 V/m	Meets Applicable Performance Criteria

FAST TRANSIENTS COMMON MODE

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-4	**AIR TEMPERATURE:**	24° C
LEVEL:	± 0.5 & 1.0kV Power Lines	**BAROMETRIC PRESSURE:**	103.6 kPa
PERFORMANCE CRITERIA:	B	**RELATIVE HUMIDITY:**	53 %

TEST LEVEL (kV)	TEST DURATION (minutes)	TIME BETWEEN TESTS (seconds)
1.0	1.0	10.0

AC ENTRY DESIGNATION	LEVEL (kV)	RESULT	COMMENTS
L1	±0.5	Passed	Meets Applicable Performance Criteria
L1	±1.0	Passed	Meets Applicable Performance Criteria
L2	±0.5	Passed	Meets Applicable Performance Criteria
L2	±1.0	Passed	Meets Applicable Performance Criteria
PE	±0.5	Passed	Meets Applicable Performance Criteria
PE	±1.0	Passed	Meets Applicable Performance Criteria
L1-L2-PE	±0.5	Passed	Meets Applicable Performance Criteria
L1-L2-PE	±1.0	Passed	Meets Applicable Performance Criteria

FAST TRANSIENTS COMMON MODE

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-4	**AIR TEMPERATURE:**	24° C
LEVEL:	± 0.5 kV Data Lines	**BAROMETRIC PRESSURE:**	103.6 kPa
PERFORMANCE CRITERIA:	B	**RELATIVE HUMIDITY:**	53 %

TEST LEVEL (kV)	TEST DURATION (minutes)	TIME BETWEEN TESTS (seconds)
1.0	1.0	10.0

PORT DESIGNATION	LEVEL (kV)	RESULT	COMMENTS
Ethernet Port	±0.5	Passed	Meets Applicable Performance Criteria

SURGE IMMUNITY TEST

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-5	**AIR TEMPERATURE:**	24° C
LEVELS:	1.0 kV Differential Mode and 2.0 kV Common Mode	**BAROMETRIC PRESSURE:**	103.6 kPa
PERFORMANCE CRITERIA:	B	**RELATIVE HUMIDITY:**	53 %

ENTRY DESIGNATION	PHASE ANGLE				LEVEL (V)	RESULT	COMMENTS
L1 & L2	0	90	180	270	±500	Passed	Meets Applicable Performance Criteria
L1 & L2	0	90	180	270	±1000	Passed	Meets Applicable Performance Criteria “
L1 & Ground	0	90	180	270	±500	Passed	Meets Applicable Performance Criteria
L1 & Ground	0	90	180	270	±1000	Passed	Meets Applicable Performance Criteria
L1 & Ground	0	90	180	270	±2000	Passed	Meets Applicable Performance Criteria
L2 & Ground	0	90	180	270	±500	Passed	Meets Applicable Performance Criteria
L2 & Ground	0	90	180	270	±1000	Passed	Meets Applicable Performance Criteria
L2 & Ground	0	90	180	270	±2000	Passed	Meets Applicable Performance Criteria

CONDUCTIVE DISTURBANCES INDUCED BY RF ELECTROMAGNETIC FIELDS TEST

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN 61000-4-6	**AIR TEMPERATURE:**	26° C
LEVEL:	3Vrms, 1 kHz sine wave, AM Modulation at 80%	**BAROMETRIC PRESSURE:**	104.0 kPa
PERFORMANCE CRITERIA:	A	**RELATIVE HUMIDITY:**	51 %

PORT ENTRY	FREQ. RANGE (MHz)	RESULT	THRESHOLD (V)	COMMENTS
AC Mains	.150 – 80	Passed	3	Meets Applicable Performance Criteria
Ethernet Port	.150 – 80	Passed	3	Meets Applicable Performance Criteria

POWER-FREQUENCY MAGNETIC FIELD SUSCEPTIBILITY

COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-8	**AIR TEMPERATURE:**	26° C
LEVEL:	1 A/m, 50 and 60 Hz	**BAROMETRIC PRESSURE:**	104.0 kPa
PERFORMANCE CRITERIA:	A	**RELATIVE HUMIDITY:**	55 %

ALL THREE ORTHOGONAL AXES WERE TESTED

ORTHOGONAL AXIS	LEVEL A/m	RESULT	COMMENTS
X	1	Passed	Meets Applicable Performance Criteria
Y	1	Passed	Meets Applicable Performance Criteria
Z	1	Passed	Meets Applicable Performance Criteria

VOLTAGE DIPS, SHORT INTERRUPTIONS, and VOLTAGE VARIATIONS

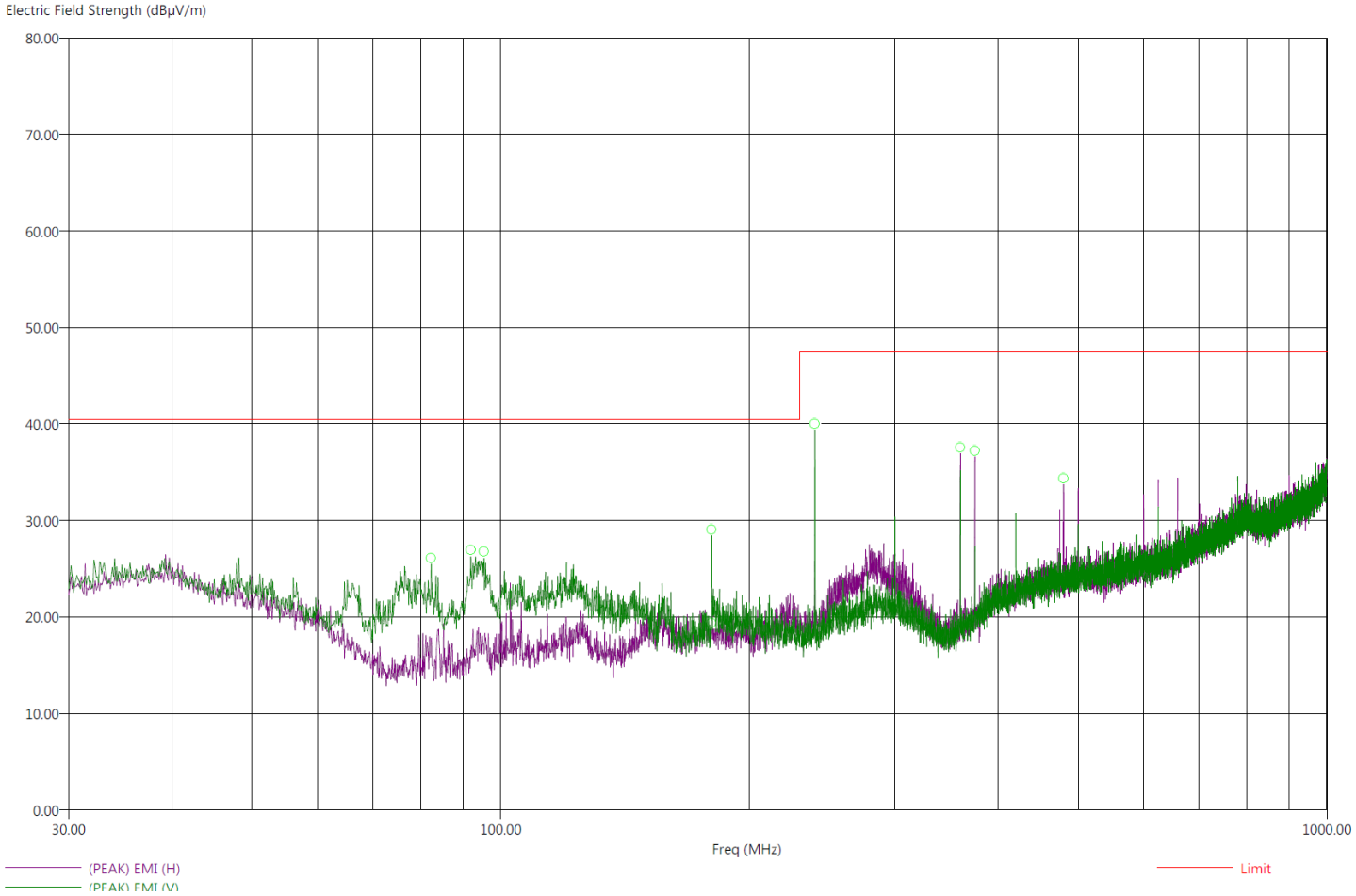
COMPANY:	ADI ENGINEERING	**DATE:**	5/7/2015
EUT:	SINGLE BOARD COMPUTER (SBC)	**ENGINEER:**	Torey Oliver
MODEL:	DFF-2220	**S/N:**	0112150012
SPEC.: **TEST PROC.:**	EN55024 EN61000-4-11	**AIR TEMPERATURE:**	26° C
LEVEL:	>95%@10ms, 30%@500ms, >95%@5sec reduction	**BAROMETRIC PRESSURE:**	104.0 kPa
PERFORMANCE CRITERIA:	B AND C	**RELATIVE HUMIDITY:**	55 %

TEST LEVEL (%)	NUMBER OF TEST REPETITIONS	TIME BETWEEN TESTS (seconds)
>95%, 30 %	3	10.0

DURATION	LEVEL (%)	RESULT	COMMENTS
10ms	>95	Passed	Meets Applicable Performance Criteria
500ms	30	Passed	Meets Applicable Performance Criteria
5 sec.	>95	Passed	Meets Applicable Performance Criteria

Title: CISPR 22 Class B 5/6/2015 9:23:59 AM
File: Radiated Pre-Scan 30-1000Mhz.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC- 3 (LAB R)



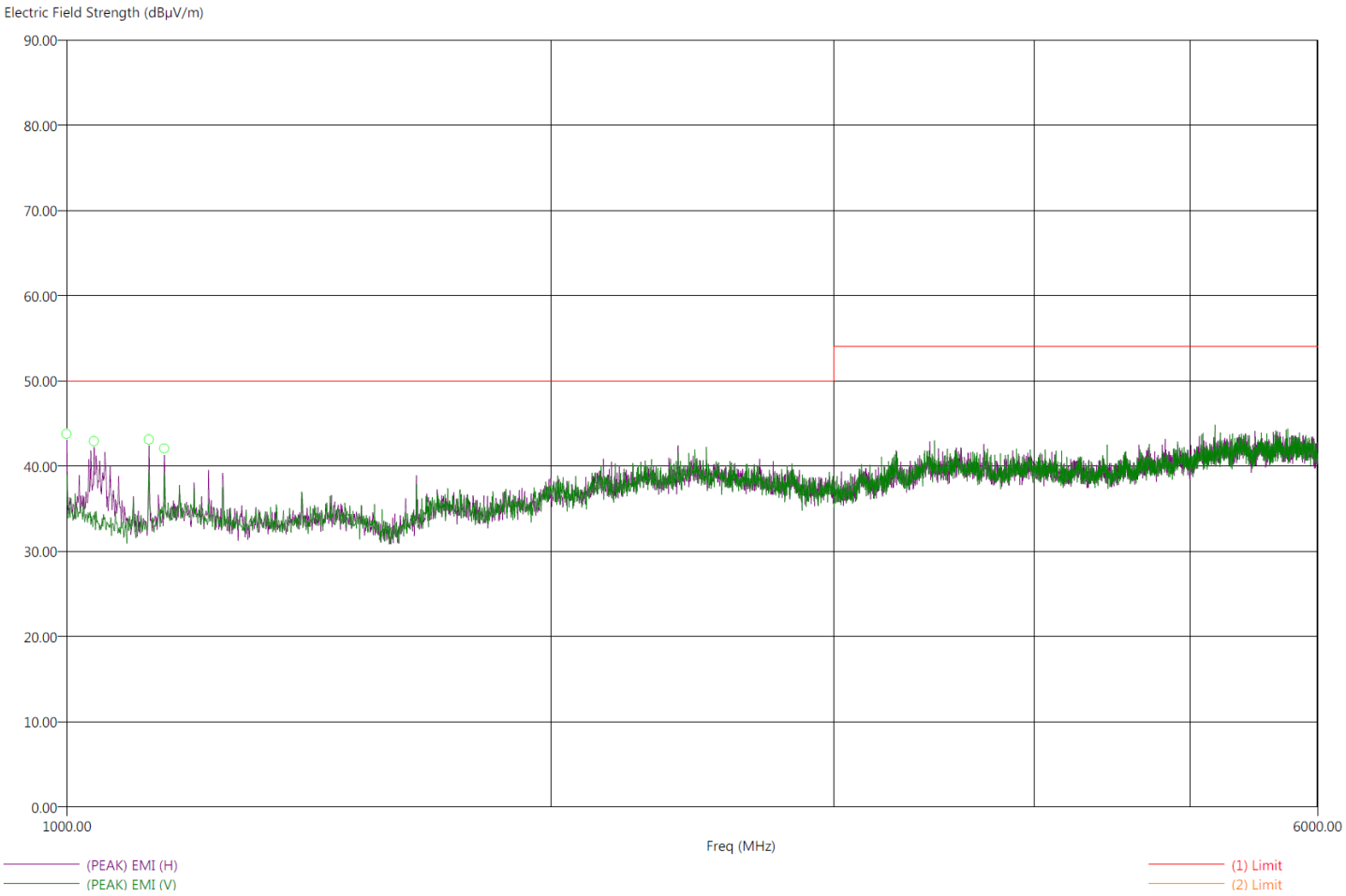
Title: CISPR 22 Class B 5/6/2015 9:39:32 AM
File: Radiated Final 30-1000Mhz.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC- 3 (LAB R)

Freq(MHz)	(QP) Margin (dB)	(QP)EMI (dBµV/m)	(PEAK) EMI (dBµV/m)	Limit (dBµV/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable (dB)
82.40	-22.00	18.45	24.19	40.45	V	230.00	190.31	11.67	0.50
92.00	-18.95	21.50	26.73	40.45	V	244.25	138.25	12.05	0.76
95.50	-17.87	22.58	28.30	40.45	V	238.75	138.25	12.29	0.69
180.10	-24.65	15.80	20.71	40.45	H	358.75	160.76	15.00	1.26
240.00	-29.51	17.94	22.85	47.45	V	180.00	134.01	16.15	1.60
360.00	-8.02	39.43	22.45	47.45	H	143.50	112.34	16.40	1.94
375.00	-9.33	38.12	39.64	47.45	H	182.50	107.38	17.56	2.00

Title: CISPR 22 Class B 5/6/2015 12:45:51 PM
File: Radiated Pre-scan 1-18GHz.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



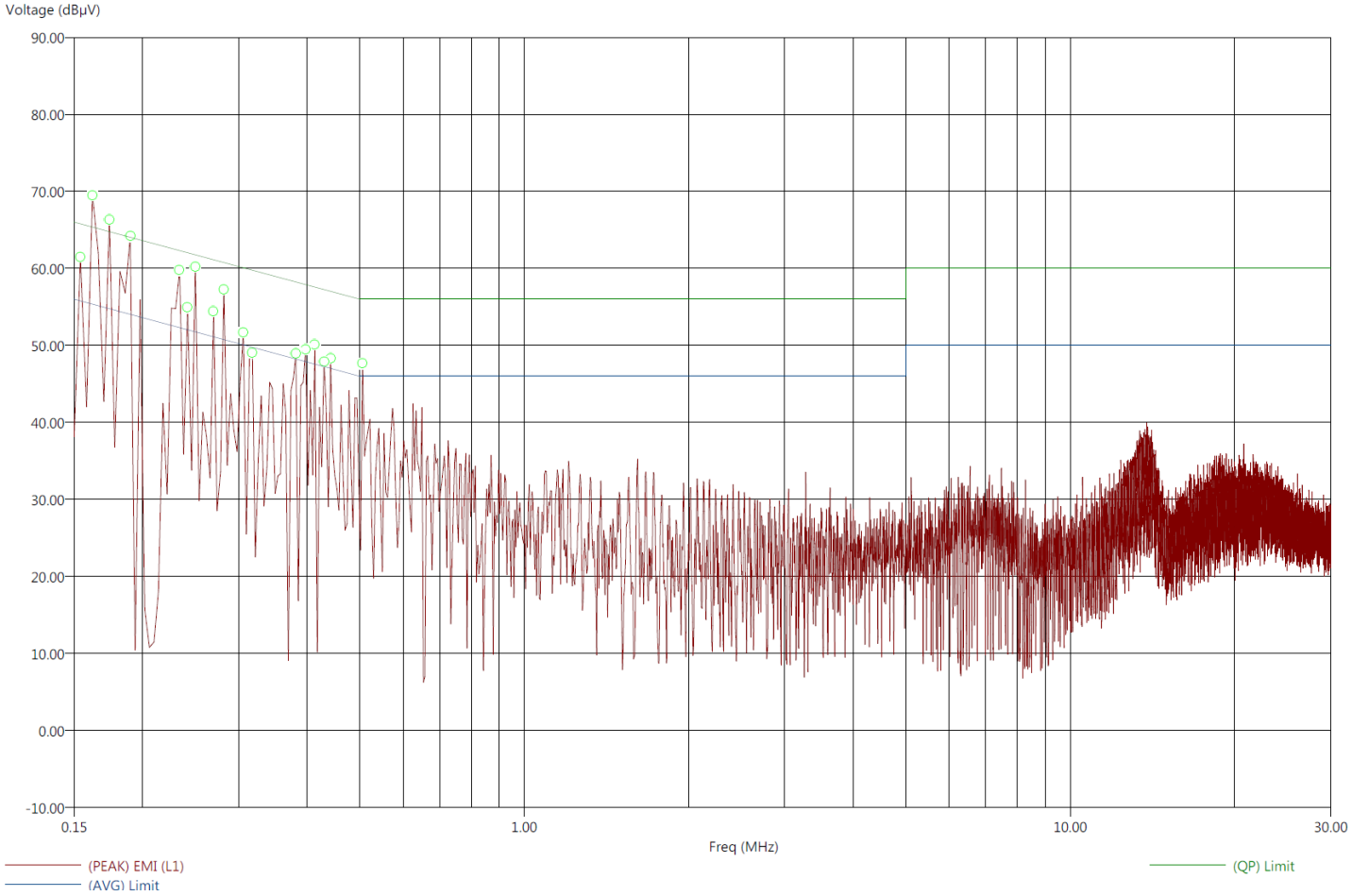
Title: CISPR 22 Class B 5/6/2015 1:04:40 PM
File: Radiated Final 1-18GHz_C.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(QP) Margin (dB)	(QP)EMI (dBµV/m)	(PEAK) EMI (dBµV/m)	Limit (dBµV/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable (dB)	Preamp (dB)
1000.00	-12.91	37.09	46.44	50.00	H	51.50	102.01	30.10	3.38	50.40
1040.00	-24.14	25.86	46.74	50.00	H	284.25	116.10	30.04	3.43	51.23
1125.00	-9.85	40.15	46.47	50.00	H	152.50	106.67	29.92	3.53	52.22
1150.00	-18.00	32.00	42.15	50.00	H	-0.25	149.17	29.88	3.57	52.00

Title: CISPR 22 Class B 5/6/2015 4:24:13 PM
File: Conducted Pre-Line.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



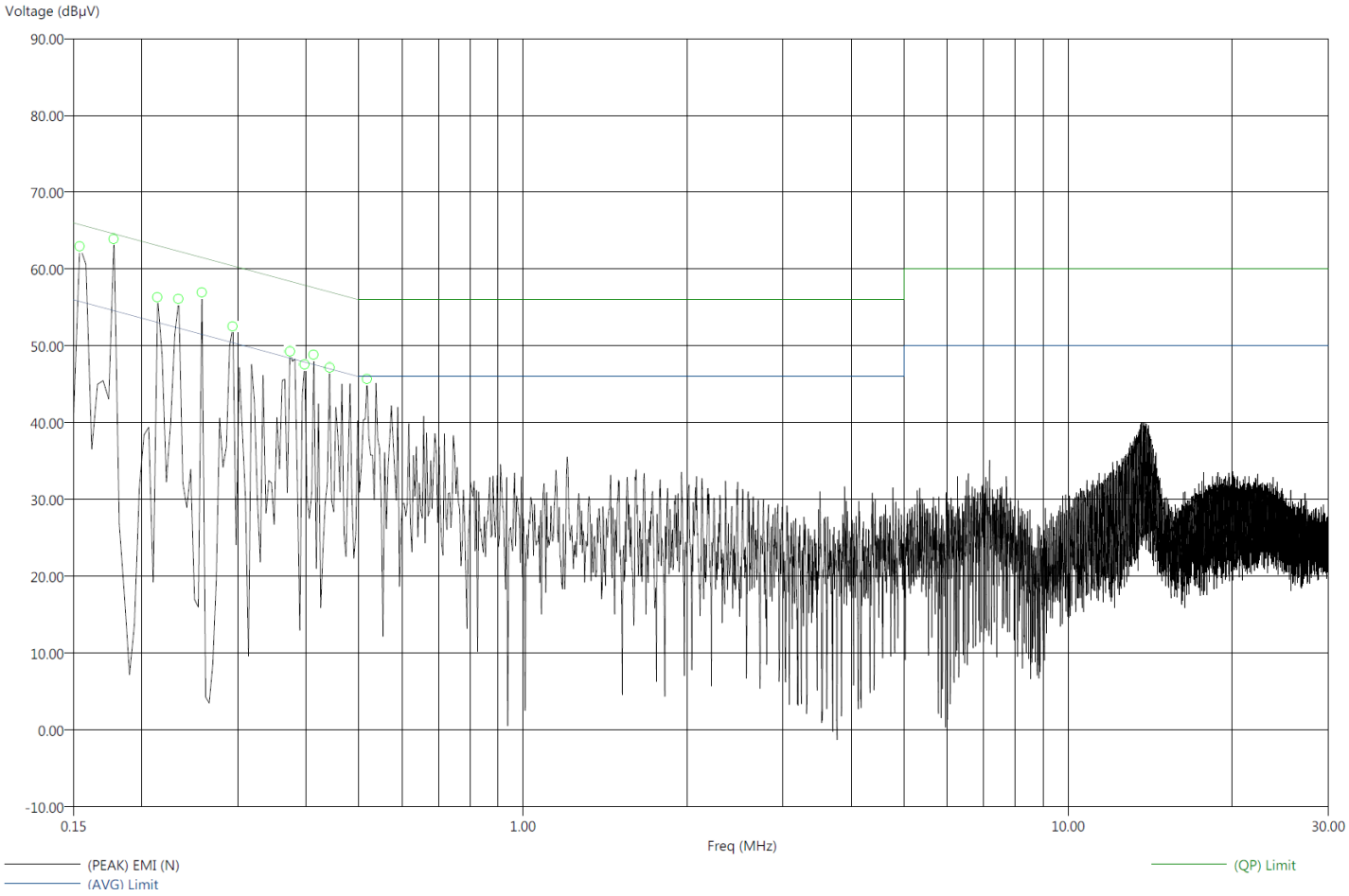
Title: CISPR 22 Class B 5/6/2015 4:29:29 PM
File: Conducted Final-Line.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(PEAK) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
0.15	-32.66	-8.99	23.12	56.79	70.41	55.78	65.78	0.44	0.19
0.16	-28.53	-10.35	26.83	55.01	68.94	55.36	65.36	0.41	0.21
0.17	-13.72	-11.61	41.05	53.16	68.02	54.77	64.77	0.38	0.24
0.19	-34.81	-13.01	19.23	51.03	66.66	54.04	64.04	0.34	0.28
0.23	-21.26	-14.33	31.05	47.98	62.62	52.31	62.31	0.24	0.25
0.24	-31.46	-15.73	20.57	46.30	61.10	52.03	62.03	0.22	0.24
0.25	-31.82	-15.77	19.94	45.99	60.80	51.76	61.76	0.20	0.23
0.27	-35.78	-17.15	15.33	43.97	58.48	51.12	61.12	0.17	0.20
0.28	-24.79	-16.49	25.97	44.26	58.79	50.76	60.76	0.14	0.19
0.31	-35.19	-18.40	14.89	41.67	57.15	50.08	60.08	0.11	0.16
0.32	-34.79	-18.40	14.97	41.36	56.54	49.76	59.76	0.09	0.15
0.38	-29.56	-18.32	18.68	39.92	52.60	48.24	58.24	0.04	0.09
0.40	-23.40	-19.57	24.49	38.33	52.53	47.90	57.90	0.04	0.07
0.41	-34.19	-20.50	13.37	37.07	51.27	47.57	57.57	0.04	0.06
0.43	-38.00	-21.49	9.26	35.76	50.09	47.25	57.25	0.04	0.05
0.44	-37.47	-22.53	9.55	34.50	51.67	47.02	57.02	0.04	0.04
0.51	-29.98	-22.97	16.02	33.03	47.78	46.00	56.00	0.02	0.00

Title: CISPR 22 Class B 5/6/2015 4:39:26 PM
File: Conducted Pre-Neutral.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



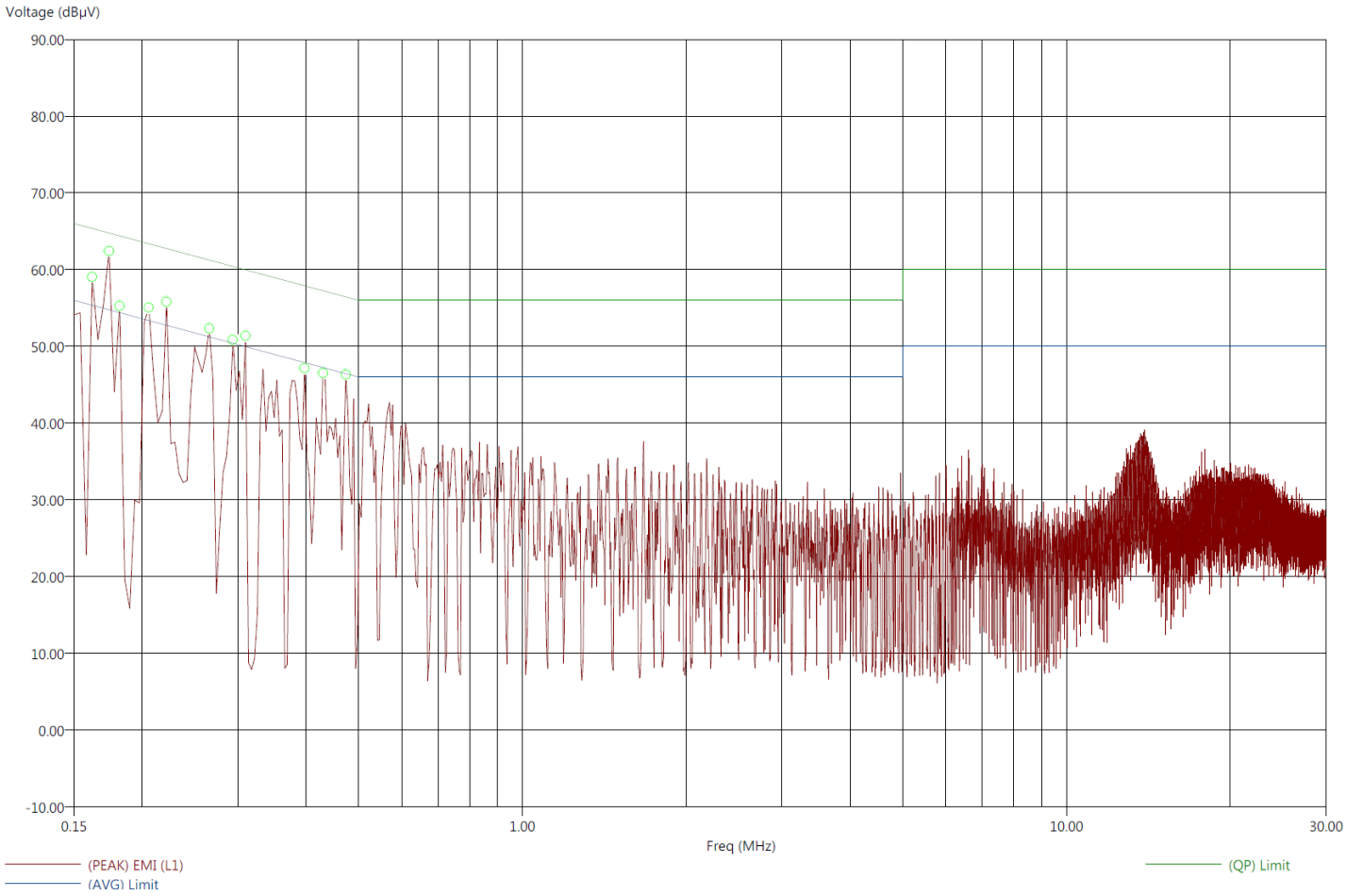
Title: CISPR 22 Class B 5/6/2015 4:42:12 PM
File: Conducted Final-Neutral.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
120V 60Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(PEAK) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
0.15	-32.95	-8.85	22.83	56.93	69.59	55.78	65.78	0.43	0.19
0.18	-20.44	-12.21	34.14	52.37	66.70	54.58	64.58	0.36	0.25
0.21	-35.19	-14.31	17.86	48.73	63.48	53.05	63.05	0.27	0.28
0.23	-22.15	-15.49	30.16	46.82	61.25	52.31	62.31	0.23	0.25
0.26	-35.33	-16.89	16.16	44.61	58.03	51.50	61.50	0.18	0.22
0.29	-26.57	-18.26	23.84	42.15	55.79	50.41	60.41	0.12	0.17
0.37	-34.65	-20.24	13.76	38.17	51.38	48.41	58.41	0.04	0.10
0.40	-25.28	-21.71	22.61	36.18	50.67	47.90	57.90	0.03	0.07
0.41	-35.82	-21.65	11.75	35.91	49.54	47.57	57.57	0.03	0.06
0.44	-35.98	-23.39	11.05	33.63	49.21	47.02	57.02	0.03	0.04
0.52	-9.03	-17.61	36.97	38.39	45.63	46.00	56.00	0.03	0.00

Title: CISPR 22 Class B 5/6/2015 4:49:59 PM
File: Conducted Pre-Line.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



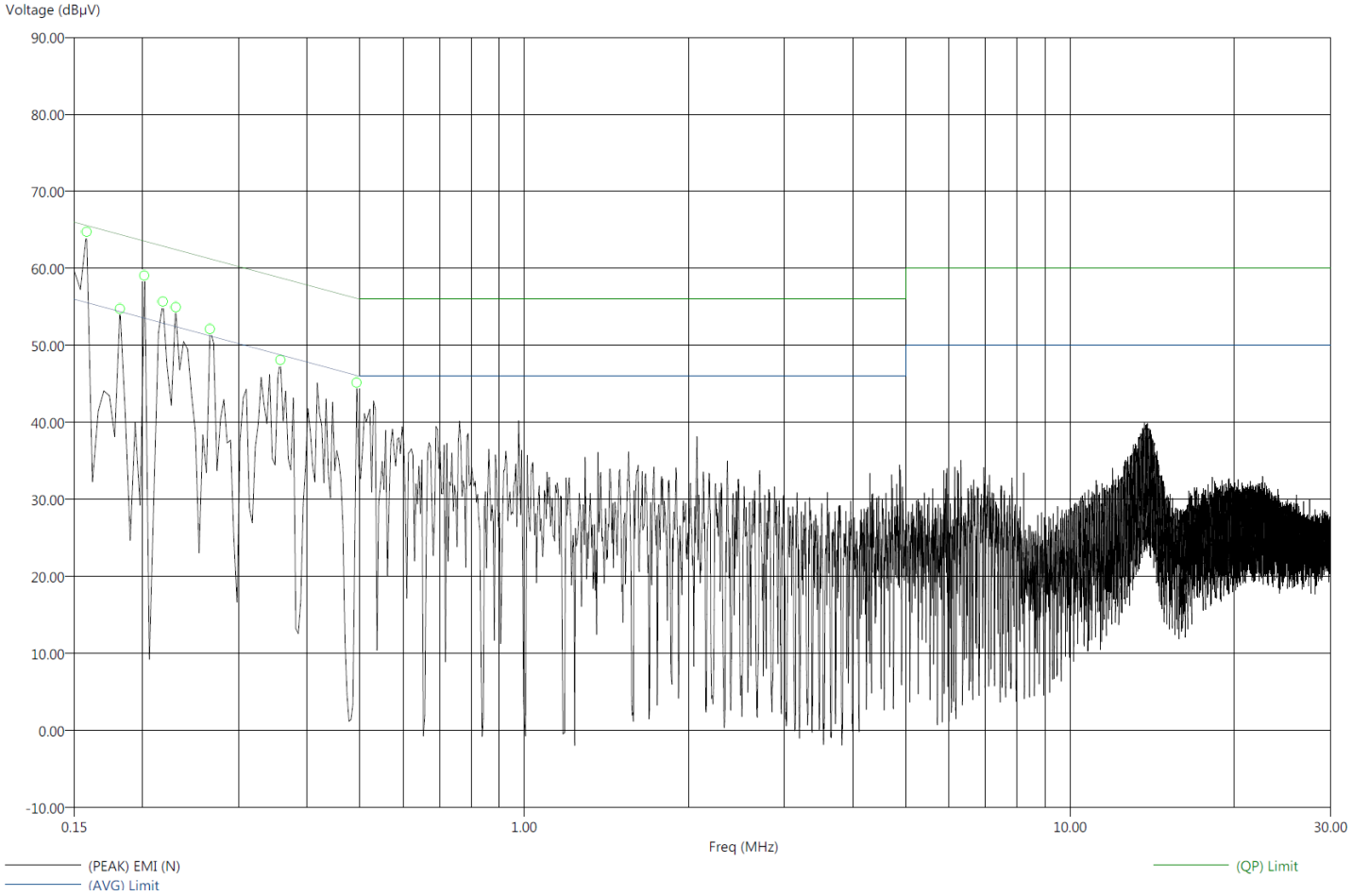
Title: CISPR 22 Class B 5/6/2015 4:52:49 PM
File: Conducted Final-Line.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(PEAK) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
0.16	-23.51	-10.67	31.85	54.69	65.10	55.36	65.36	0.41	0.21
0.17	-12.90	-11.62	41.87	53.15	65.35	54.77	64.77	0.38	0.24
0.18	-24.55	-12.26	29.84	52.13	64.30	54.39	64.39	0.36	0.26
0.21	-28.63	-13.19	24.73	50.17	62.17	53.37	63.37	0.30	0.29
0.22	-24.49	-14.94	28.26	47.80	60.76	52.74	62.74	0.26	0.27
0.27	-30.94	-16.96	20.30	44.28	56.46	51.24	61.24	0.17	0.21
0.29	-23.62	-17.89	26.79	42.52	55.31	50.41	60.41	0.12	0.17
0.31	-32.38	-17.96	17.60	42.01	53.95	49.97	59.97	0.10	0.16
0.40	-18.34	-19.09	29.55	38.81	48.45	47.90	57.90	0.04	0.07
0.43	-34.37	-20.26	12.88	36.99	48.03	47.25	57.25	0.04	0.05
0.47	-32.67	-19.25	13.78	37.19	47.56	46.44	56.44	0.03	0.02

Title: CISPR 22 Class B 5/6/2015 4:58:27 PM
File: Conducted Pre-Neutral.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



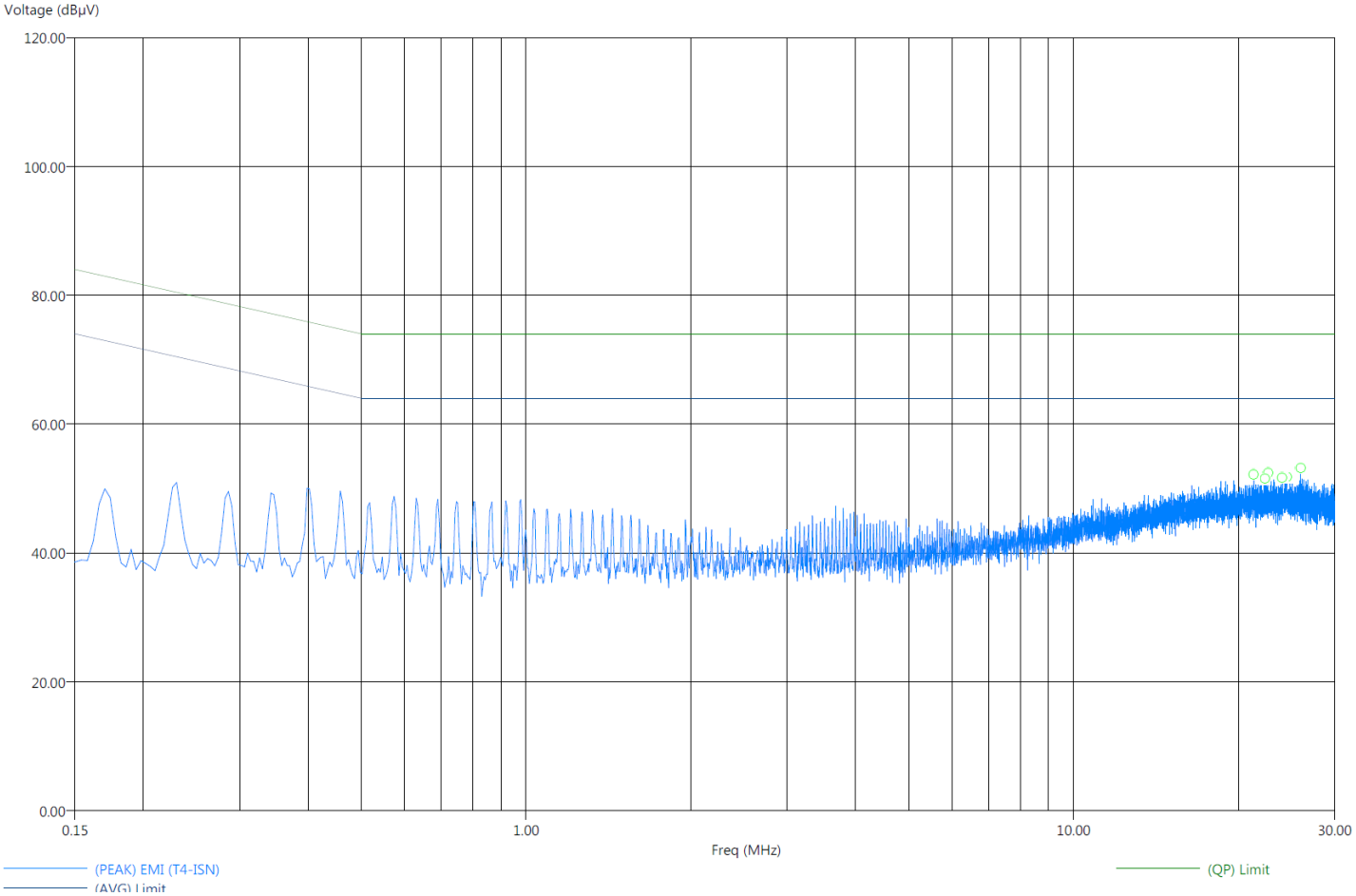
Title: CISPR 22 Class B 5/6/2015 5:01:02 PM
File: Conducted Final-Neutral.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004.
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(PEAK) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
0.16	-26.22	-10.87	29.35	54.70	66.18	55.57	65.57	0.41	0.20
0.18	-23.92	-13.11	30.47	51.29	62.99	54.39	64.39	0.35	0.26
0.20	-29.03	-14.55	24.50	48.98	60.74	53.53	63.53	0.30	0.30
0.22	-28.12	-15.59	24.77	47.31	61.26	52.89	62.89	0.26	0.27
0.23	-15.36	-16.97	37.09	45.48	57.27	52.45	62.45	0.24	0.25
0.27	-32.64	-17.60	18.60	43.64	55.01	51.24	61.24	0.17	0.21
0.36	-31.02	-19.58	17.76	39.20	46.72	48.77	58.77	0.04	0.11
0.49	-33.23	-23.23	12.87	32.87	45.07	46.10	56.10	0.03	0.00

Title: CISPR 22 Class B 5/6/2015 5:07:41 PM
File: Conducted Pre-T4-ISN_1.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004. (Port 1)
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



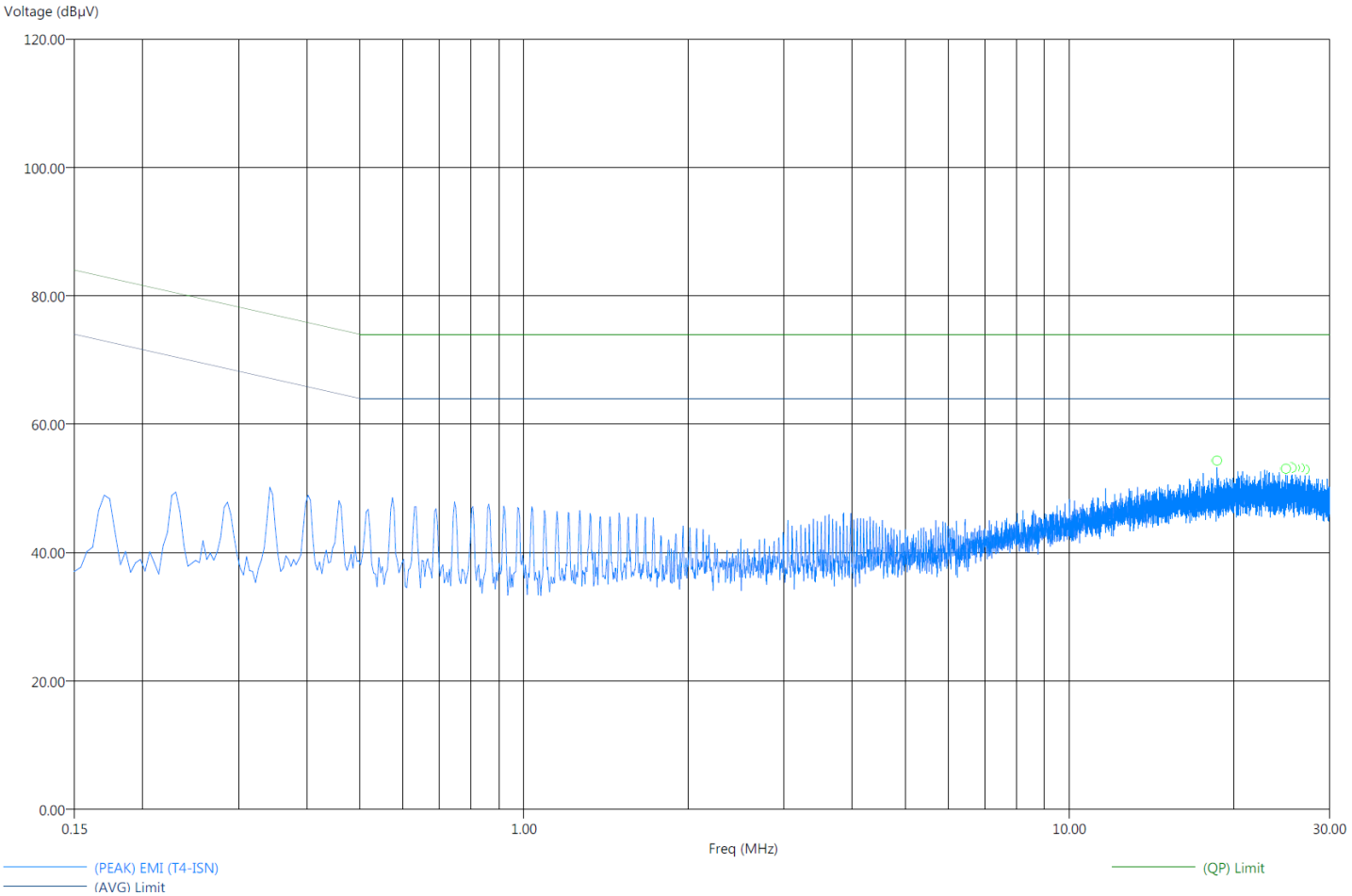
Title: CISPR 22 Class B 5/6/2015 5:10:07 PM
File: Conducted Final-T4-ISN_1.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004. (Port 1)
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
21.35	-33.83	-29.75	30.17	44.25	64.00	74.00	10.23	0.42
22.39	-29.59	-28.95	34.41	45.05	64.00	74.00	10.26	0.47
22.66	-29.04	-29.37	34.96	44.63	64.00	74.00	10.30	0.52
24.09	-32.66	-29.01	31.34	44.99	64.00	74.00	10.33	0.56
24.55	-29.25	-28.98	34.75	45.02	64.00	74.00	10.31	0.54
25.98	-29.25	-28.87	34.75	45.13	64.00	74.00	10.34	0.58

Title: CISPR 22 Class B 5/6/2015 5:14:53 PM
File: Conducted Pre-T4-ISN_2.set Sequence: Preliminary Scan
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004. (Port 2)
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)



Title: CISPR 22 Class B 5/6/2015 5:17:45 PM
File: Conducted Final-T4-ISN_2.set Sequence: Final Measurements
Operator: Matt Harrison
EUT Type: NET DFF2220 Board, SN: 0113150004. (Port 2)
EUT Condition: Continuously Running Ethernet and USB Ports.
Comments: Connected to Laptop, USB Stick, and Power Supply.
Temp: 69f
Hum: 44%
230V 50Hz

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq(MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dBuV)	(QP) EMI (dBuV)	(AVG) Limit (dBuV)	(QP) Limit (dBuV)	Transducer (dB)	Cable
18.66	-28.79	-28.87	35.21	45.13	64.00	74.00	10.18	0.44
24.96	-29.35	-28.13	34.65	45.87	64.00	74.00	10.33	0.56
25.60	-28.21	-27.70	35.79	46.30	64.00	74.00	10.32	0.55
25.97	-28.54	-28.09	35.46	45.91	64.00	74.00	10.34	0.58
26.49	-32.90	-27.86	31.10	46.14	64.00	74.00	10.33	0.57
27.02	-32.88	-28.08	31.12	45.92	64.00	74.00	10.37	0.62