MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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January 13, 2010

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Dear Robert Pera,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, M2G, tested to the requirements of ETSI EN 301 489-1 with ETSI EN 301 489-17 (Article 3.1(b) of R&TTE Directive).

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\ Ubiquiti Networks \ EMCS81790A-ETS489)

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Electromagnetic Compatibility
Test Report

For the

Ubiquiti Networks
M2G

Tested for Compliance with

ETSI EN 301 489-1
With ETSI EN 301 489-17 (Article 3.1(b) of R&TTE Directive)

MET Report: EMCS81790A-ETS489

January 13, 2010

Prepared For:

Ubiquiti Networks
91 E. Tasman
San Jose, CA 95134

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

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MET Report: EMCS81790A-ETS489

Anderson Soungpanya, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of ETSI EN 301 489-1 with ETSI EN 301 489-17 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 13, 2010	Initial Issue.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
CISPR	**C**omite **I**nternational **S**pecial des **P**erturbations **R**adioelectriques (International Special Committee on Radio Interference)
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**H**ert**z**
kPa	**k**ilo**Pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**H**ertz
µH	**micro**Henry
µF	**micro**Farad
µs	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

1.0 Introduction

1.1 Overview

MET Laboratories, Inc. was contracted by Ubiquiti Networks to perform testing on the M2G, under Ubiquiti Networks purchase order number 908026.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the M2G.

1.2 Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick St., Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

1.3 General Performance Criteria

The performance criteria cited in EN 301 489-17 V1.3.2 (2008-04):

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

Note: For specific details on performance criteria, see subclause 6.2 of EN 301 489-17.

1.4 Testing Summary

Emissions

Descriptive Name	Requirement	Test Method	Result
Enclosure of Ancillary Equipment Measured on a Stand Alone Basis	ETSI EN 301 489-1; Section 8.2	EN 55016-2-3 (2006)	Not Applicable – EUT is a stand alone unit.
DC Power Input/Output Ports	ETSI EN 301 489-1; Section 8.3	EN 55022 (2006)	Not Applicable – EUT is POE powered.
AC Mains Power Input/Output Ports	ETSI EN 301 489-1; Section 8.4	EN 55022 (2006)	Compliant
Harmonic Current Emissions (AC Mains Input Port)	ETSI EN 301 489-1; Section 8.5	EN 61000-3-2 +A1 (2006)	Not Applicable – EUT is POE powered.
Voltage Fluctuations and Flicker (AC Mains Input Port)	ETSI EN 301 489-1; Section 8.6	EN 61000-3-3 (1995)	Not Applicable – EUT is POE powered.
Telecommunication Ports	ETSI EN 301 489-1; Section 8.7	EN 55022 (2006)	Compliant

Immunity

Descriptive Name	Requirement	Test Method	Result
Radio Frequency Electromagnetic Field (80 MHz – 1000 MHz and 1400 MHz to 2700 MHz)	ETSI EN 301 489-1; Section 9.2	EN 61000-4-3 (2006)	Compliant
Electrostatic Discharge (ESD)	ETSI EN 301 489-1; Section 9.3	EN 61000-4-2 (2001)	Compliant
Fast Transient, Common Mode	ETSI EN 301 489-1; Section 9.4	EN 61000-4-4 (2004)	Compliant
Radio Frequency, Common Mode	ETSI EN 301 489-1; Section 9.5	EN 61000-4-6 (2005)	Compliant
Transient & Surges in the Vehicular Environment	ETSI EN 301 489-1; Section 9.6	ISO 7637-2 (2004) (12/24 VDC)	Not Applicable – EUT is a Fixed Equipment.
Voltage Dips and Interruptions	ETSI EN 301 489-1; Section 9.7	EN 61000-4-11 (2004)	Not Applicable – EUT is POE powered.
Surges	ETSI EN 301 489-1; Section 9.8	EN 61000-4-5 (2006)	Compliant

Table 1. Summary of Compliance Testing

1.5 Modifications to the Test Standard

No modifications were made to the test standard.

1.6 References

ETSI EN 301 489-1 V1.8.1 (2008-04)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN301 489-17 V1.3.2 (2008-04)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Wideband data and HIPERLAN equipment
EN 55022	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement, 2006
EN 61000-3-3	Electromagnetic Compatibility (EMC) Part 3-3: Limits – Limitation of Voltage Changes, Voltage Fluctuations and Flicker in Public Low-Voltage Supply Systems, for Equipment with Rated Current ≤ 16 A per Phase and Not Subject to Conditional Connection, 1995
EN 61000-4-2	Electromagnetic Compatibility (EMC) Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test, 2001
EN 61000-4-3	Electromagnetic compatibility (EMC) Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test, 2006
EN 55016-2-3	Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods – Part 2-3: Methods of Measurement of Disturbances and Immunity – Radiated Disturbance Measurements, 2006
EN 61000-4-4	Electromagnetic Compatibility (EMC) Part 4-4: Testing and Measurement Techniques – Electrical Fast Transient/Burst Immunity Test, 2004
EN 61000-4-5	Electromagnetic Compatibility (EMC) Part 4-5: Testing and Measurement Techniques – Surge Immunity Test, 2006
EN 61000-4-6	Electromagnetic Compatibility - Part 4-6: Testing and Measurement Techniques Section – Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields, 2005
EN 61000-4-11	Electromagnetic Compatibility - Part 4-11: Testing and Measurement Techniques – Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests, 2004
ISO 7637-2	Road Vehicles – Electrical Disturbances from Conduction and Coupling – Part 2: Electrical Transient Conduction Along Supply Lines Only, 2004
EN 61000-3-2/Amendment 1	Electromagnetic Compatibility (EMC) – Part 3-2: Limits – Limits for Harmonic Current Emissions (Equipment Input Current Up to and Including 16 A per Phase, 2006

Table 2. Test References

2.0 Equipment Under Test

2.1 Description of Test Sample

The results obtained relate only to the item(s) tested.

Model(s) Tested:	M2G
Model(s) Covered:	M2G
EUT Specifications:	Primary Power: 5 VDC, 1A
	Secondary Power: N/A
	Equipment Emissions Class: The radio equipment and/or associated ancillary equipment under test are classified as equipment for fixed use.
Lab Ambient Test Conditions:	Temperature: 15-35º C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Evaluated by:	Anderson Soungpanya
Report Date(s):	January 13, 2010

The Ubiquiti Networks M2G, Equipment Under Test (EUT), is an outdoor 2.4GHz CPE device.

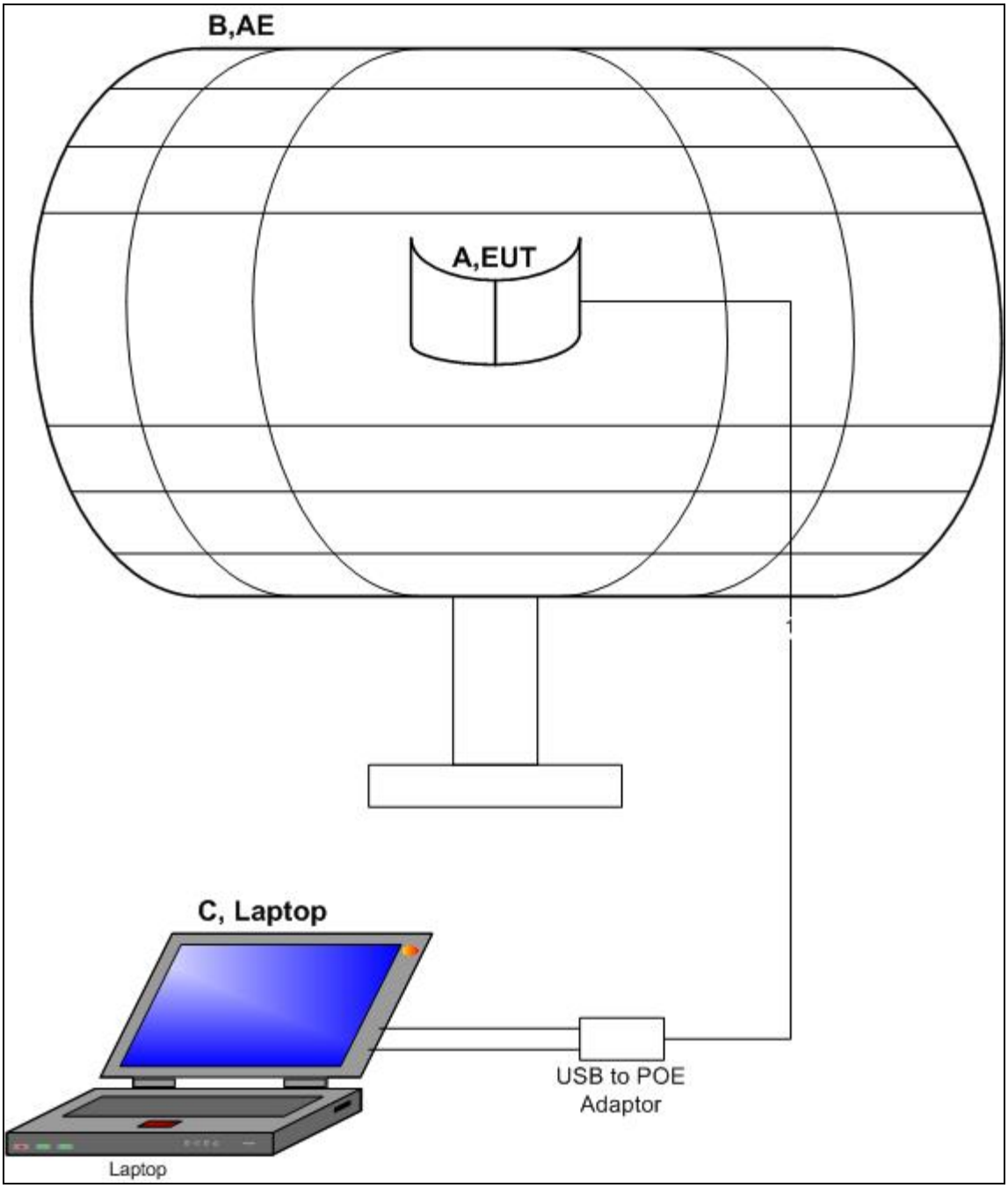


Figure 1. Block Diagram of Test Configuration with Grid Antenna

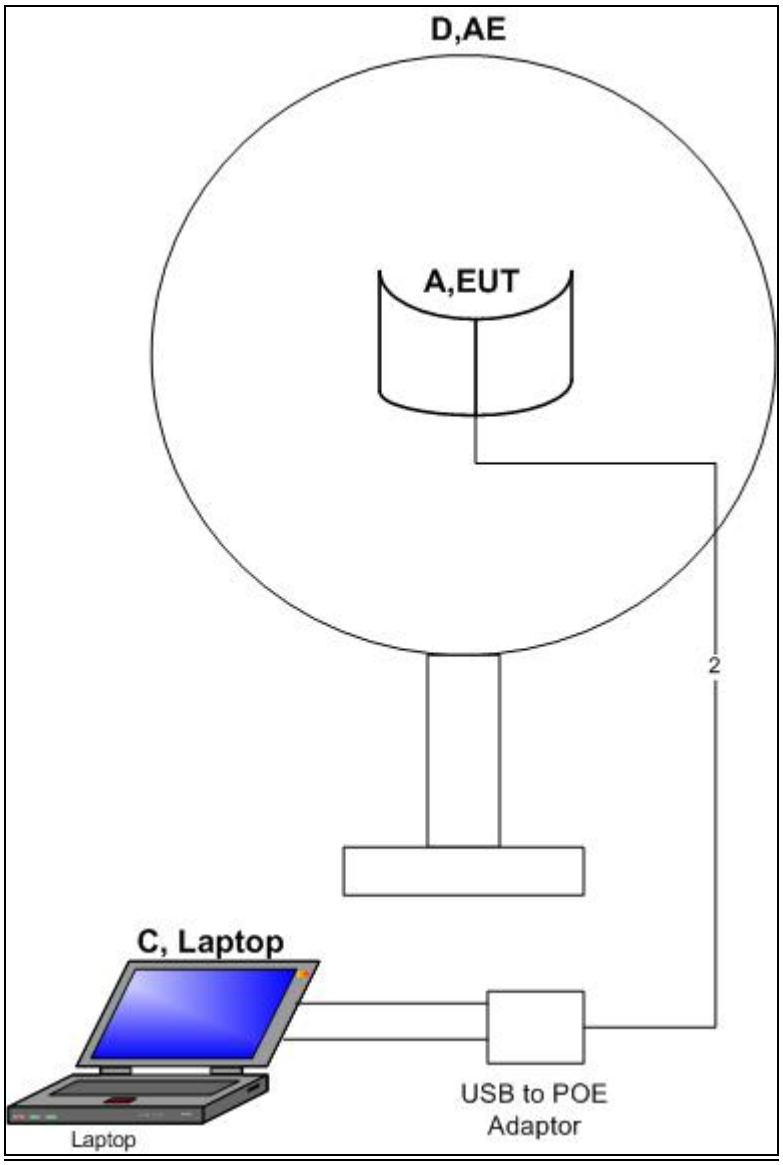


Figure 2. Block Diagram of Test Configuration with Dish Antenna

2.2 Equipment Configuration

The EUT was set up as outlined in Figure 1 and Figure 2. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
A	2GHz Radio	M2G	0923

Table 3. Equipment Configuration

2.3 Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
B	Grid Antenna	Ubiquiti	2009-8-13
C	Laptop	Dell	Vastro 1000
D	Dish Antenna	Ubiquiti	Proto 1

Table 4. Support Equipment

2.4 Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
Configuration with Grid Antenna						
1	A,EUT	CAT 5E	1	3	Y	C, Laptop
Configuration with Dish Antenna						
2	A,EUT	CAT 5E	1	3	Y	C, Laptop

Table 5. Ports and Cabling Information

2.5 Mode of Operation

The EUT operates in OFDM mode.

2.6 Method of Monitoring EUT Operation

A Spectrum Analyzer and a Power Meter was use to monitor the EUT's transmitter channel and power output.

2.7 Modifications to the EUT

No modifications were made to the EUT.

2.8 Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Ubiquiti Networks upon completion of testing.

3.0 Electromagnetic Compatibility Emission Criteria

3.1 AC Mains Power Input/Output Ports: Limits for Conducted Emissions

Test Requirement(s): **ETSI EN 301 489-1, Clause 8.4:**

In accordance with *EN 55022 Clause 5.1*, the EUT shall meet the Class B limits shown in Table 6:

Limits for Conducted Emissions of Equipment				
Frequency Range (MHz)	**intended for use in telecommunication centres only [EN 55022Class A Limits] (dBµV)**		**[EN 55022 Class B Limits] (dBµV)**	
	Quasi-Peak	**Average**	**Quasi- Peak**	**Average**
0.15 - 0.5	79	66	66 to 56	56 to 46
0.5 - 5	73	60	56	46
5 - 30	73	60	60	50

Table 6. Limits of Conducted Disturbance at AC Mains Power Input/Output Ports

Note: The lower limit shall apply at the transition frequencies. The limits decrease linearly with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

Test Procedure: The EUT was placed on a non-metallic table located in a shielded enclosure (See Photograph 1). The measurement was performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Clause 9* of *EN 55022* were used. The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω / 50 µH as the input transducer to an EMC field intensity meter. The tests were conducted in a RF-shielded enclosure.

Test Results: The EUT was compliant with the specified requirements of Clause 8.4.

Test Engineer(s): Anderson Soungpanya

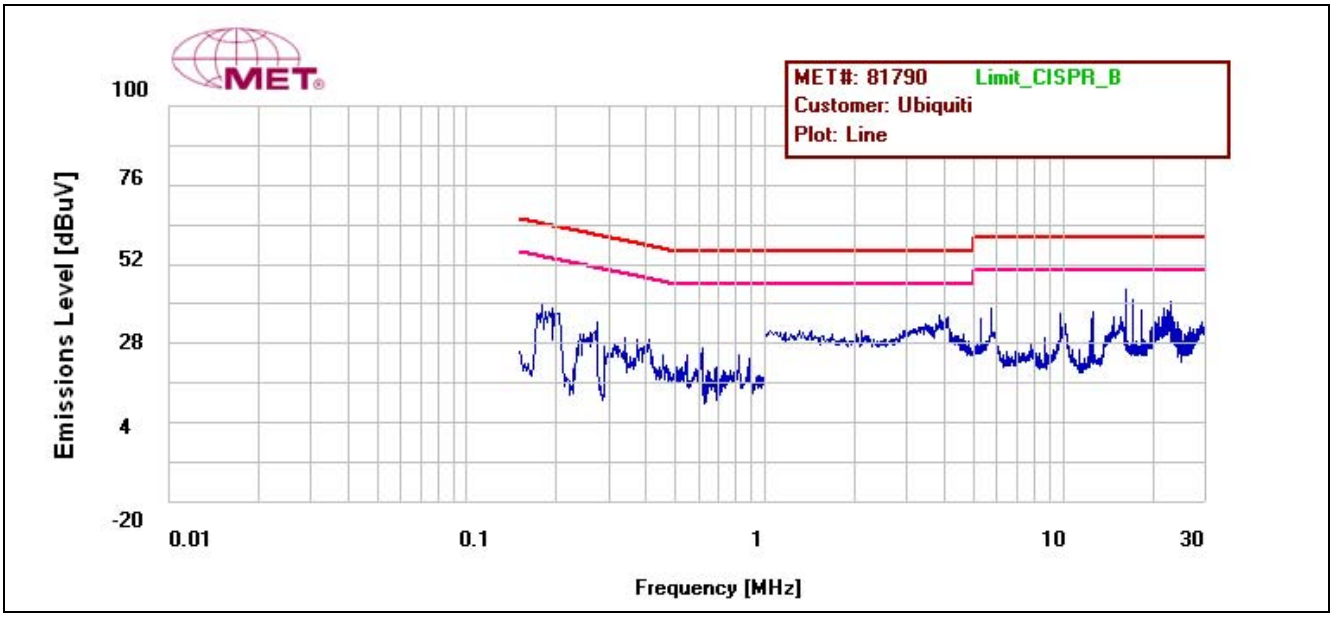
Test Date(s): 09/14/09

Electromagnetic Compatibility Emission

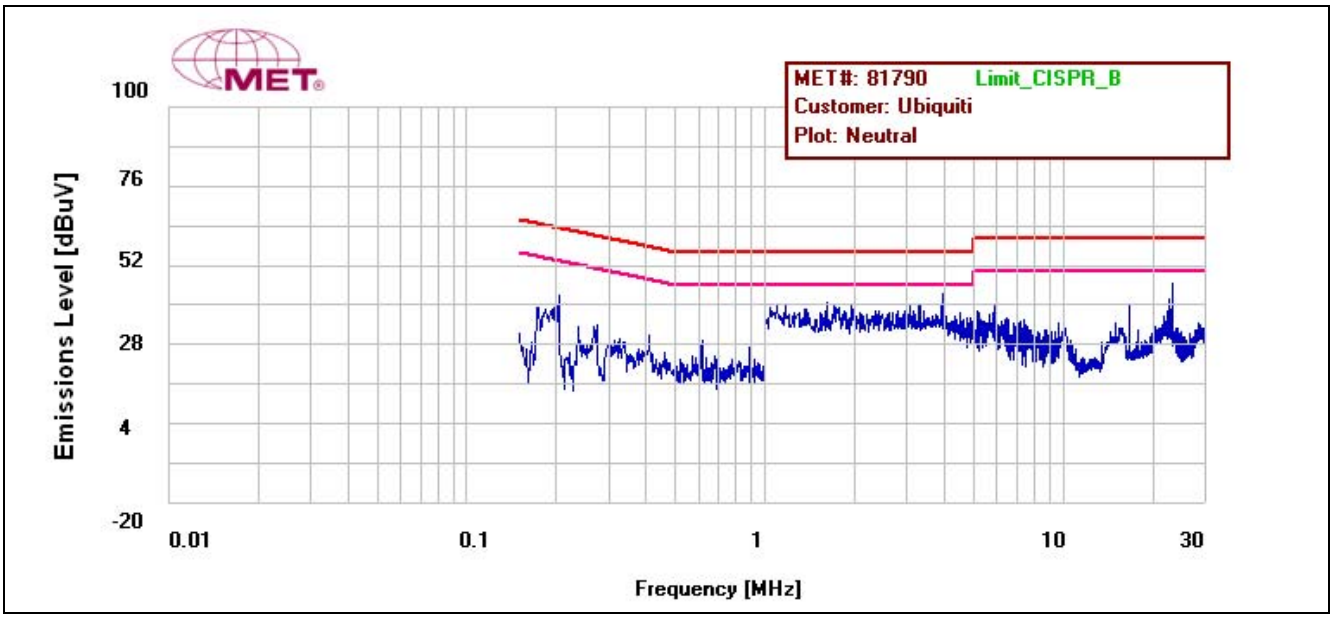
AC Mains Power Input/Output Ports: Limits for Conducted Emissions

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
Line	.196	43.05	63.784	-20.734	Pass	28.44	53.784	-25.344	Pass
Line	3.89	26.46	56	-29.54	Pass	17.9	46	-28.1	Pass
Line	23.11	39.33	60	-20.67	Pass	33.53	50	-16.47	Pass
Neutral	.172	43.52	64.866	-21.346	Pass	28.92	54.866	-25.946	Pass
Neutral	3.98	30.97	56	-25.03	Pass	21.32	46	-24.68	Pass
Neutral	23.10	42.22	60	-17.78	Pass	36.93	50	-13.07	Pass

Table 7. Conducted Emissions - Voltage, Worst Case Emissions, AC Power



Plot 1. Conducted Emission Limits, Phase Line Plot



Plot 2. Conducted Emission Limits, Neutral Line Plot

Electromagnetic Compatibility Emission

AC Mains Power Input/Output Ports: Limits for Conducted Emissions

Photograph 1. AC Mains Power Input/Output Ports, Conducted Disturbance, Test Setup

Photograph 2. AC Mains Power Input/Output Ports, Conducted Disturbance, Test Setup, Side View

Electromagnetic Compatibility Emission

3.2 Telecommunications Ports

Test Requirement(s): **ETSI EN 301 489-1, Clause 8.7:**

The EUT must be in accordance with EN 55022 (2006), Section 5.2.

The EUT shall meet the Conducted Common Mode limits shown in Table 8:

Frequency Range (MHz)	Voltage Limits (dBµV)		Current Limits (dBµA)	
	Quasi-Peak	Average	Quasi- Peak	Average
0.15 - 0.5	84 to 74	74 to 64	40 to 30	30 to 20
0.5 - 30	74	64	30	20
Note: The limits decrease linearly with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz. The current and voltage disturbnace limits are derived for use with an ISN which presents a common mode (asymetric mode) impedance of 150 Ω to the telecommunication port under test (conversion factor is 20 Log_{10} 150/1 = 44 dB).				

Table 8. Limits of Conducted Common Mode (Asymmetric Mode) Disturbance at Telecommunication Ports from Clause 5.2 of EN 55022 Class B

Test Procedure: The EUT was placed on a non-metallic table located in a shielded enclosure (See Photograph 3). The measurements were performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *Clause 9* of *EN 55022* were used. The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using an ISN, Current Probe or Capacitive Voltage Probe as the input transducer to an EMC field intensity meter.

Environmental Conditions for Conducted Emission	
Ambient Temperature:	22°C
Relative Humidity:	54%

Test Results: The EUT was found compliant with the requirement(s) of this section.

Test Engineer(s): Anderson Soungpanya

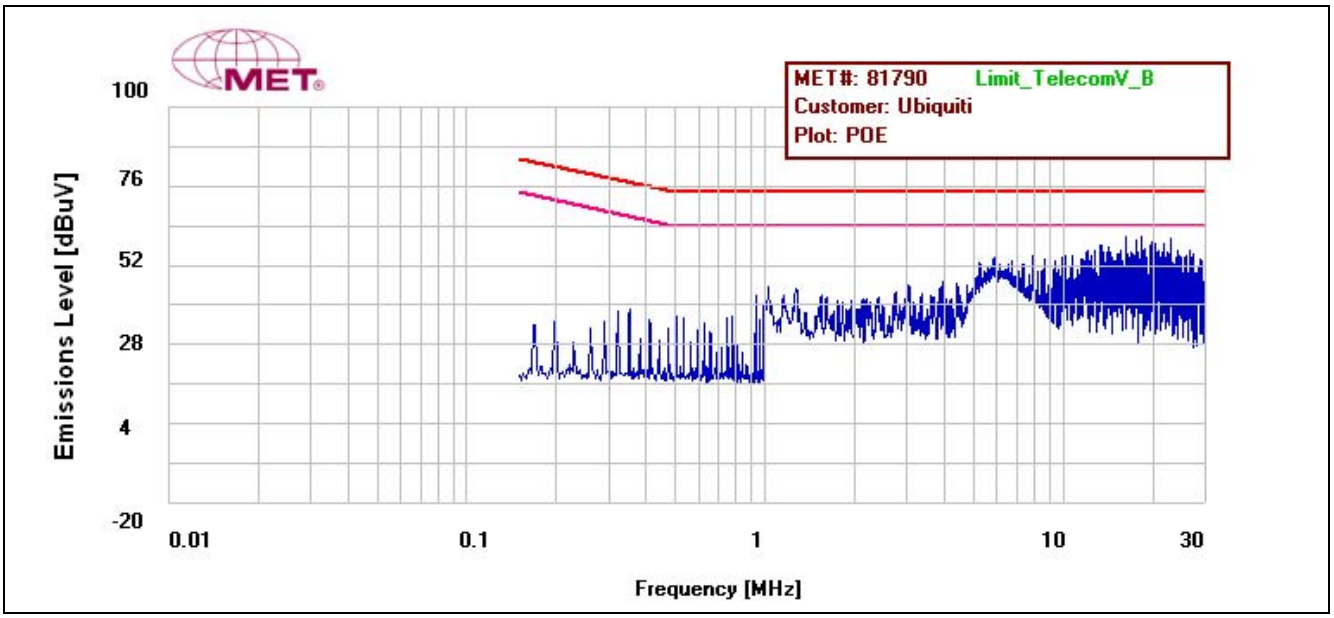
Test Date(s): 09/14/09

Limits for Conducted Disturbance at Telecommunication Ports

Conducted Emissions - Voltage for Telecommunication Ports, Worst Case Emissions, POE Line

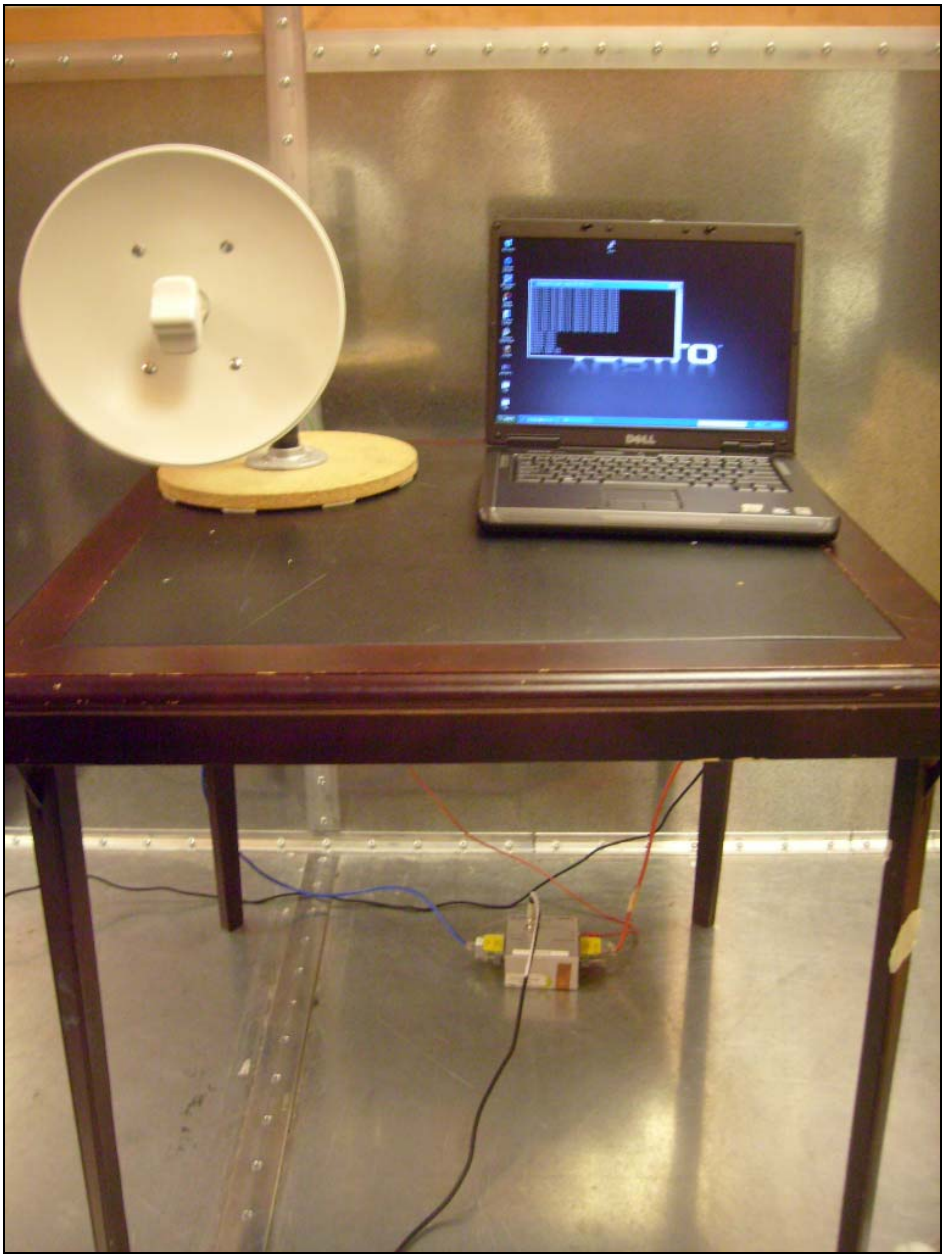
Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
POE	.201	36.87	81.569	-44.699	Pass	33.88	71.569	-37.689	Pass
POE	.931	40.88	74	-33.12	Pass	37.87	64	-26.13	Pass
POE	5.78	50.26	74	-23.74	Pass	45.16	64	-18.84	Pass
POE	13.41	46.19	74	-27.81	Pass	42.61	64	-21.39	Pass
POE	17.32	55.33	74	-18.67	Pass	49.32	64	-14.68	Pass
POE	23.31	58.83	74	-15.17	Pass	53.29	64	-10.71	Pass

Table 9. Limits for Conducted Disturbance at Telecommunication Ports Test Results, POE



Plot 3. Conducted Emission Limits for Telecommunications Ports, POE Plot

Limits for Conducted Disturbance at Telecommunication Ports



Photograph 3. Limits for Conducted Disturbance at Telecommunication Ports

4.0 Electromagnetic Compatibility Immunity Criteria

4.1 Radio Frequency Electromagnetic Field

Test Requirement(s): **ETSI EN 301 489-1, Clause 9.2:**

Per *EN 61000-4-3*, the EUT must not be susceptible to a radiated electromagnetic field of 3 V/m, 80% amplitude modulated, in the frequency range 80 MHz to 1000 MHz and 1400 MHz to 2000 MHz(EN 61000-4-3), and 3 V/m. Performance criterion A applies.

The EUT was placed on a non-metallic table in the center of a 20' x 12' x 8' enclosure, and the radiating antenna was placed 5 m in front of the EUT (See Photograph 4). Support equipment for the EUT was located outside of the test room. The EUT was exposed to the required immunity fields. The amplitude and frequency of the radiated interference was set by an automated, computer-controlled system.

The chamber and signal generation/amplification system is calibrated to insure a uniform RF field with no EUT present. The recorded signal is played back by the controlling computer with the EUT placed in the area of uniform field. The signal source was stepped through the applicable frequency range at a rate no faster than 1% of the fundamental, as recommended in EN 61000- 4-3 & ENV 50204 Section 8. The signal was amplitude modulated 80% over the frequency range 80 MHz to 1000 MHz at a level of 3 V/m. In the frequency range 895 MHz to 905 MHz a 3V/m signal was pulse modulated by a frequency of 200 Hz with a 50% duty cycle. Field presence was monitored during testing via a field probe placed in close proximity to the EUT. Throughout testing, the EUT was closely monitored for signs of susceptibility. The test was performed with the antennae oriented in both a horizontal and vertical polarization. Testing was performed in a semi-anechoic chamber.

Test Results: The EUT as tested was compliant with the requirements of Clause 9.2.

Test Engineer(s): Anderson Soungpanya and Charles Huang

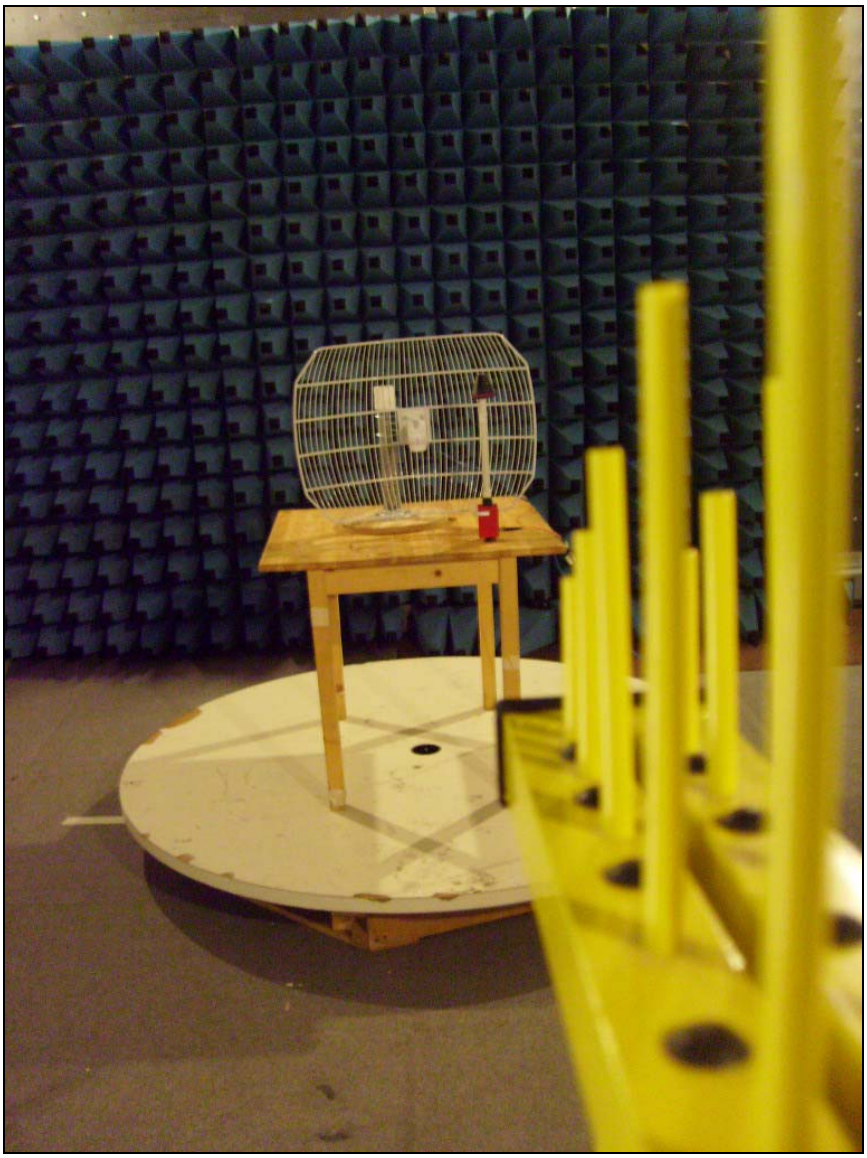
Test Date(s): 10/14/09

Start Frequency (MHz)	Stop Frequency (MHz)	Severity (V/m)	Polarity (H/V)	Modulation (Freq & Type)	Results			
					Front	Back	Left	Right
80	1000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
80	1000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass

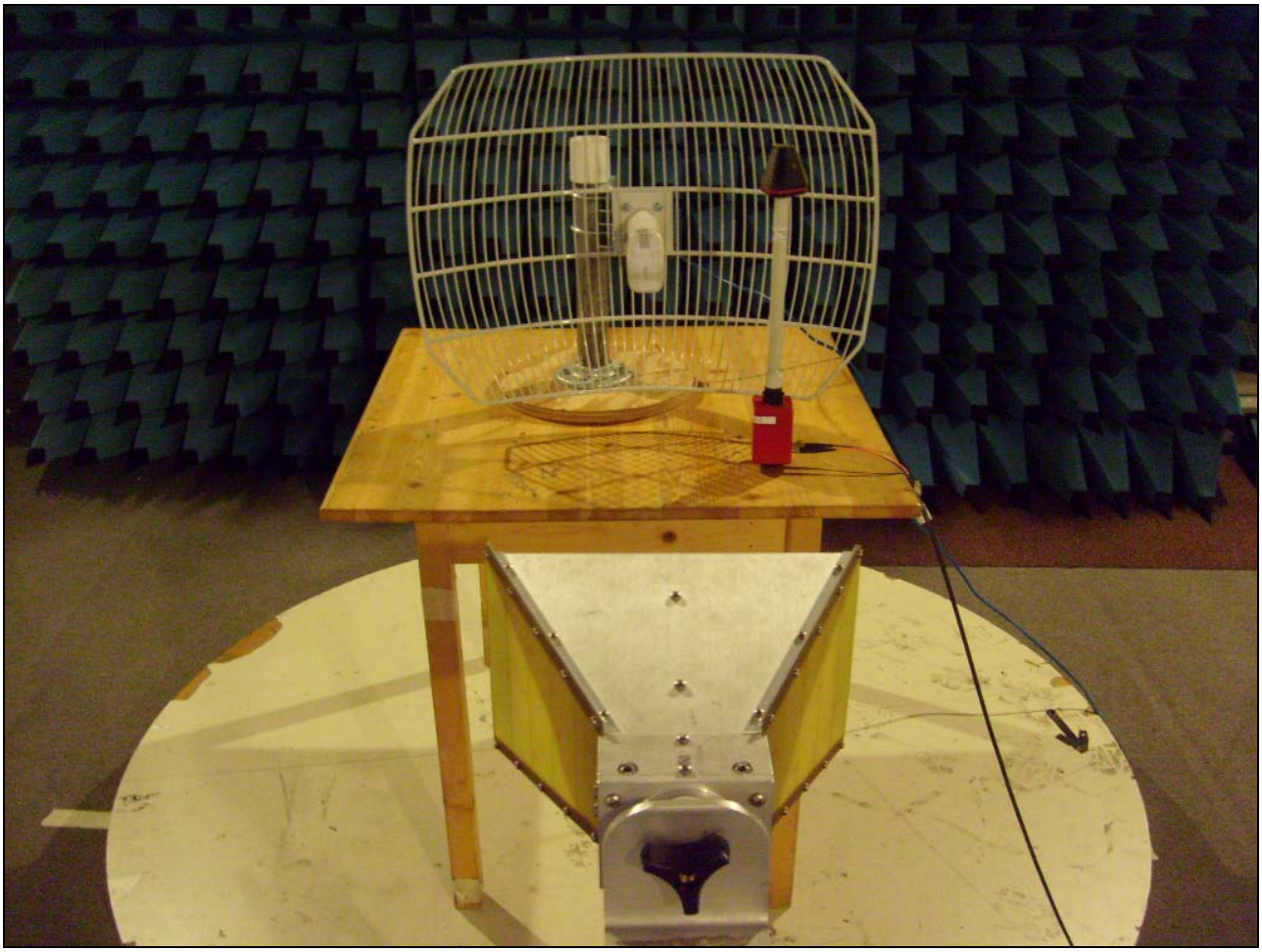
Table 10. Radiated Immunity, Test Results, Grid Antenna

Start Frequency (MHz)	Stop Frequency (MHz)	Severity (V/m)	Polarity (H/V)	Modulation (Freq & Type)	Results			
					Front	Back	Left	Right
80	1000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
80	1000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass

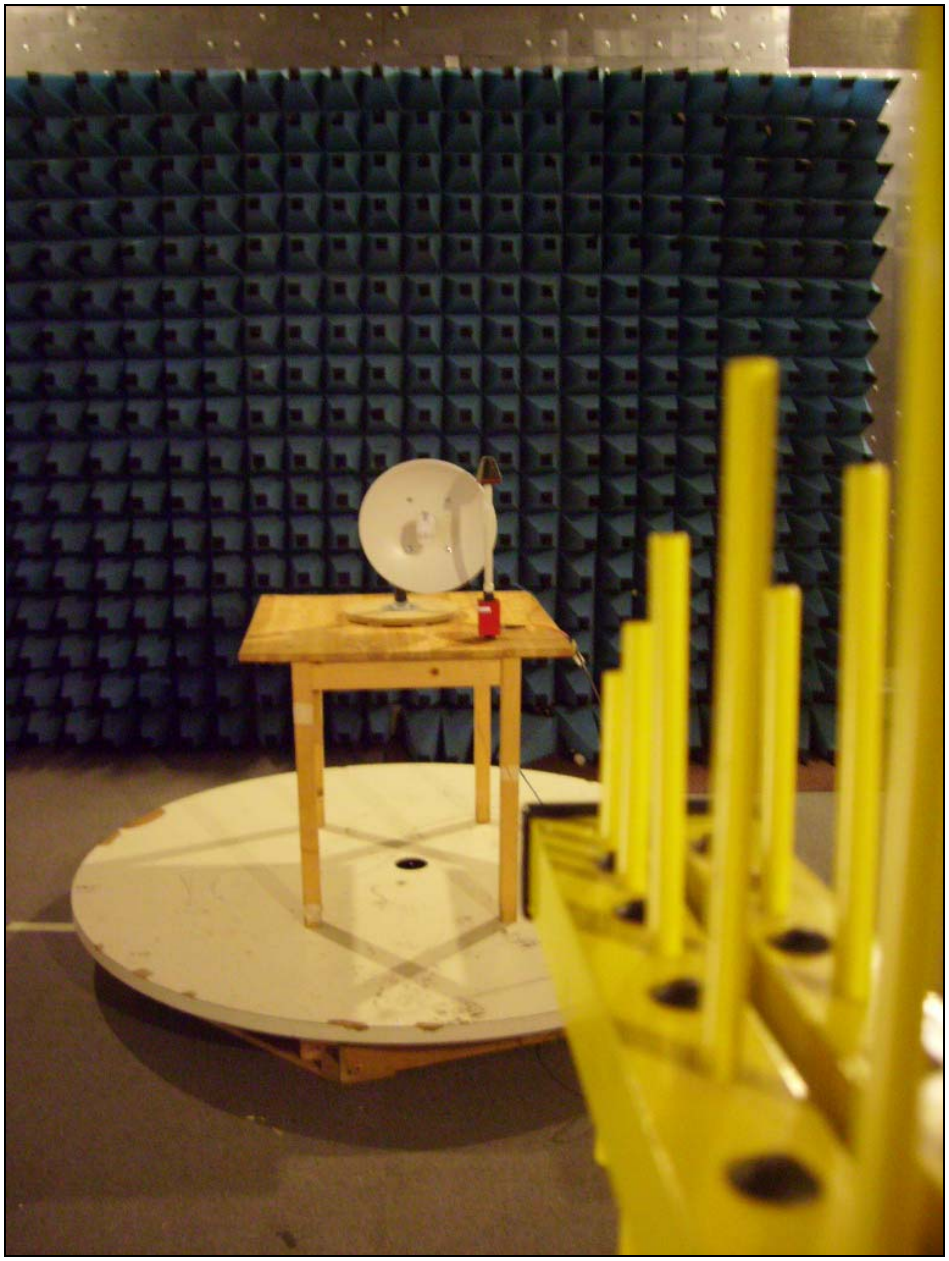
Table 11. Radiated Immunity, Test Results, Dish Antenna



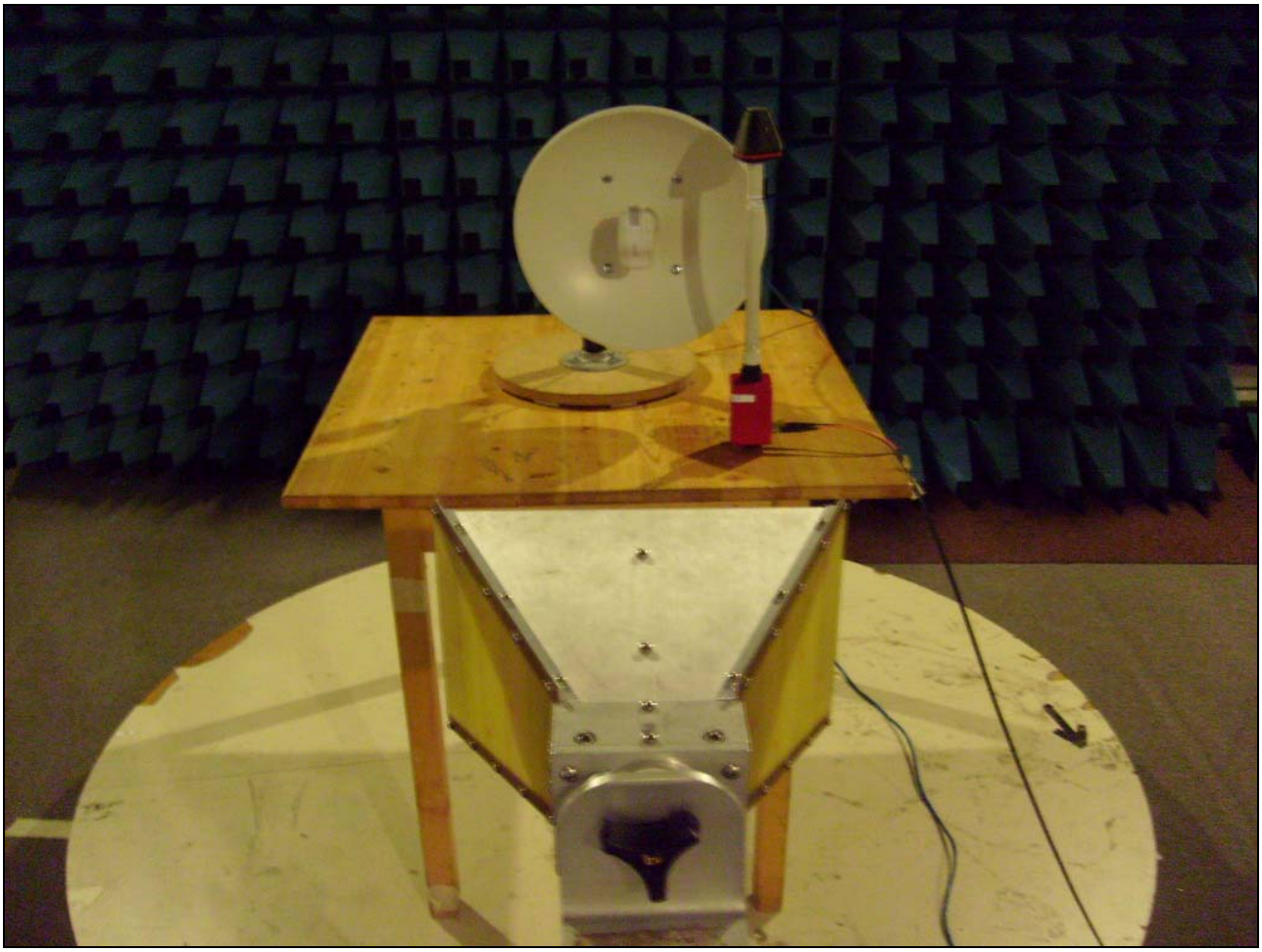
Photograph 4. Radio Frequency Electromagnetic Field, Grid Bilog



Photograph 5. Radio Frequency Electromagnetic Field, Grid Horn



Photograph 6. Radio Frequency Electromagnetic Field, Dish Bilog



Photograph 7. Radio Frequency Electromagnetic Field, Dish Horn

Electromagnetic Compatibility Immunity

4.2 Electrostatic Discharge

Test Requirement(s): **ETSI EN 300 489-1 Clause 9.3:**

Per *EN 61000-4-2*, the EUT was tested with air discharges of up to ± 8 kV, applied to non-conductive surfaces, and to contact discharges of up to ± 4 kV, applied to conductive surfaces of the EUT and the VCP. Performance Criterion B applies.

The EUT was placed on a non-metallic table located above a ground reference plane (GRP) (See Photograph 8), with a thickness of at least 0.25 mm, thus satisfying the requirements of *IEC 61000-4-2*:

> It [the GRP] shall be a metallic sheet (copper or aluminum) of 0.25 mm minimum thickness.... The minimum size of the reference plane is 1 m2, the exact size depending on the dimensions of the EUT. It shall project beyond the EUT or coupling plane by at least 0.5 m on all sides....

A horizontal coupling plane (HCP), 1.6 m x 0.8 m, shall be placed on the table. The EUT and cables shall be isolated from the coupling plane by an insulating support 0.5 mm thick.

A copper vertical coupling plane (VCP) measuring 0.5 m X 0.5 m was placed 0.1 m from the EUT. The VCP was connected to the GRP through two series 470 k Ω resistors. The GRP was connected to safety ground. The EUT was connected to the grounding system through its power cable only, in accordance with *EN 61000-4-2, Section 7.1*, *paragraph 4*:

> The EUT shall be connected to the grounding system in accordance with its installation specifications. No additional grounding connections are allowed.

Ambient Temperature:	22°C
Relative Humidity:	35%
Atmospheric Pressure:	101.9 kPa

Environmental Conditions during EN 61000-4-2 Testing

Electromagnetic Compatibility Immunity

Electrostatic Discharge

Test Procedure: Air discharges of up to ±. 8kV were applied to non-conductive surfaces. Contact discharges of up to ± 4 kV were applied to conductive surfaces of the EUT. Contact discharges of ±. 4 kV were applied to the VCP. Negative and positive discharges were applied at least ten times to each selected discharge point. The functionality of the EUT was determined during and after each discharge in accordance with Performance Criterion B.

Test Results: The EUT as tested was compliant with the requirements of Clause 9.3.

Test Engineer(s): Anderson Soungpanya

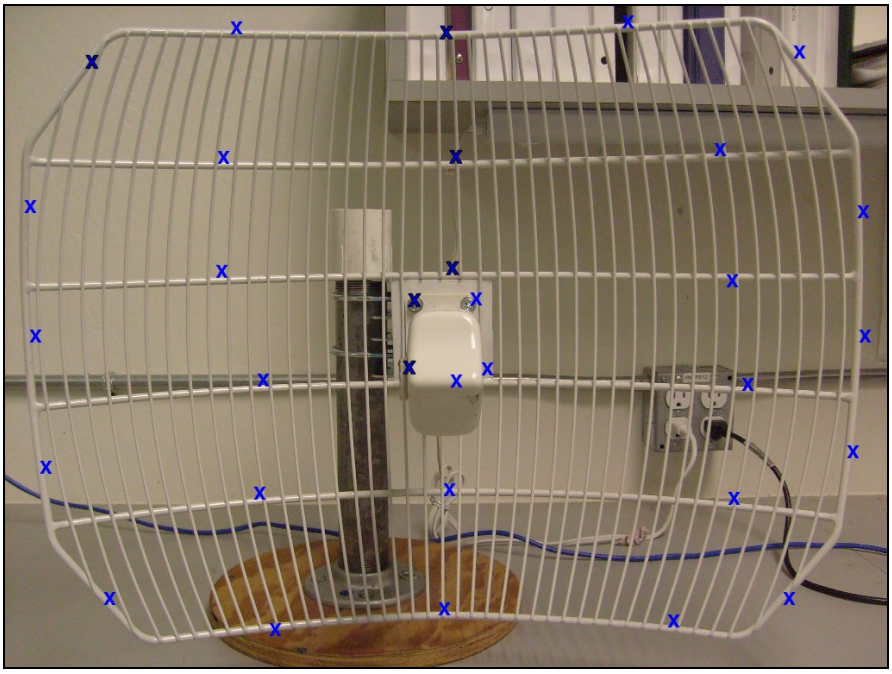
Test Date(s): 10/13/09

Discharge Type	Test Voltage (±kV)	Results				Anomalies
		Front	Back	Left	Right	
VCP	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
HCP	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
Contact Discharge	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
Air Discharge	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
	6	Pass	Pass	Pass	Pass	None
	8	Pass	Pass	Pass	Pass	None

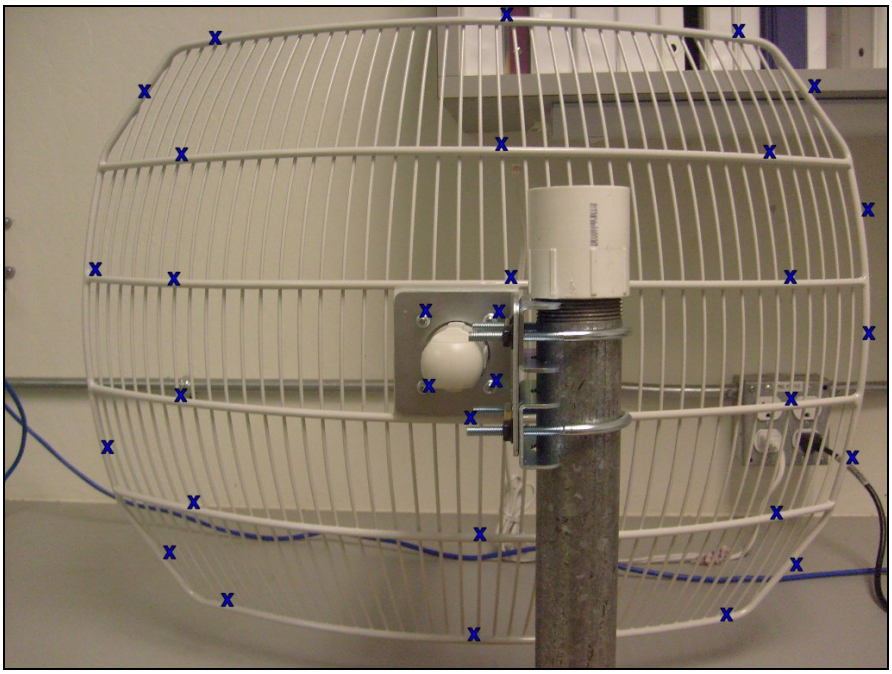
Table 12. Electrostatic Discharge, Test Results, Grid Antenna

Discharge Type	Test Voltage (±kV)	Results				Anomalies
		Front	Back	Left	Right	
VCP	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
HCP	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
Contact Discharge	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
Air Discharge	2	Pass	Pass	Pass	Pass	None
	4	Pass	Pass	Pass	Pass	None
	8	Pass	Pass	Pass	Pass	None

Table 13. Electrostatic Discharge, Test Results, Dish Antenna

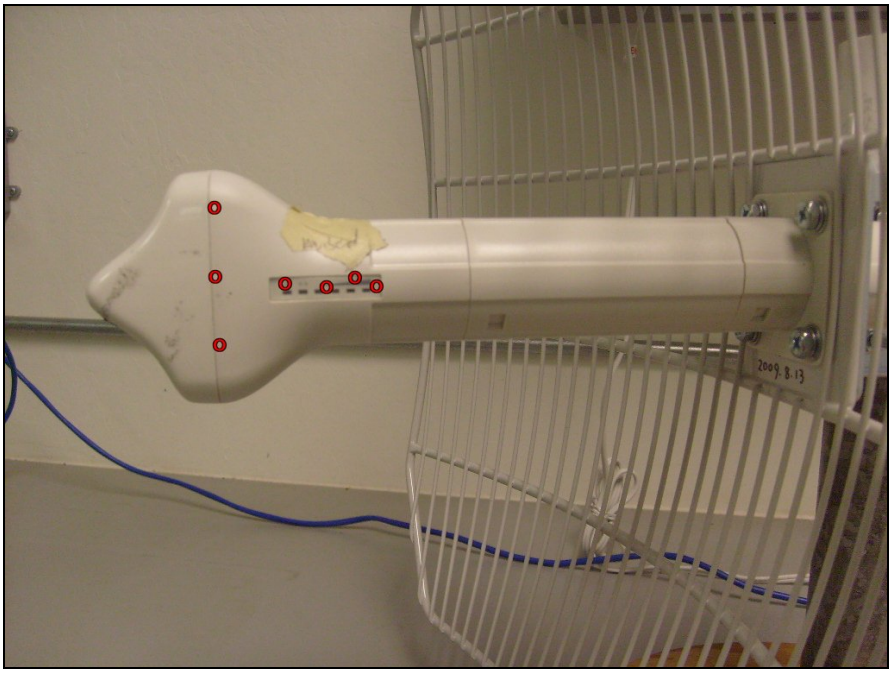


Photograph 8. Electrostatic Discharge, Grid Antenna, Front View

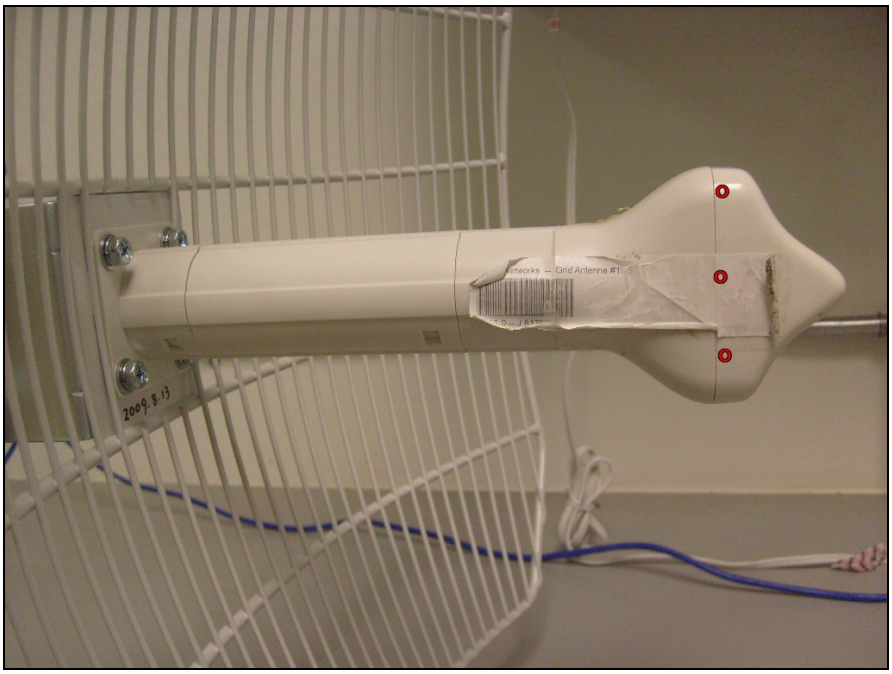


Photograph 9. Electrostatic Discharge, Grid Antenna, Rear View

X = Contact Discharge Test Points
O = Air Discharge Test Points

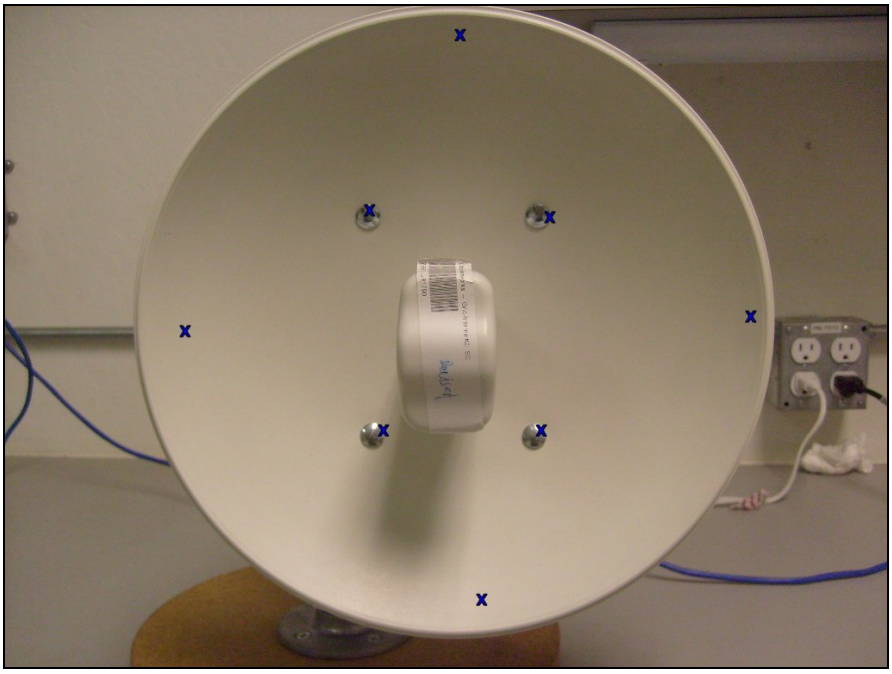


Photograph 10. Electrostatic Discharge, Grid Antenna, Left View

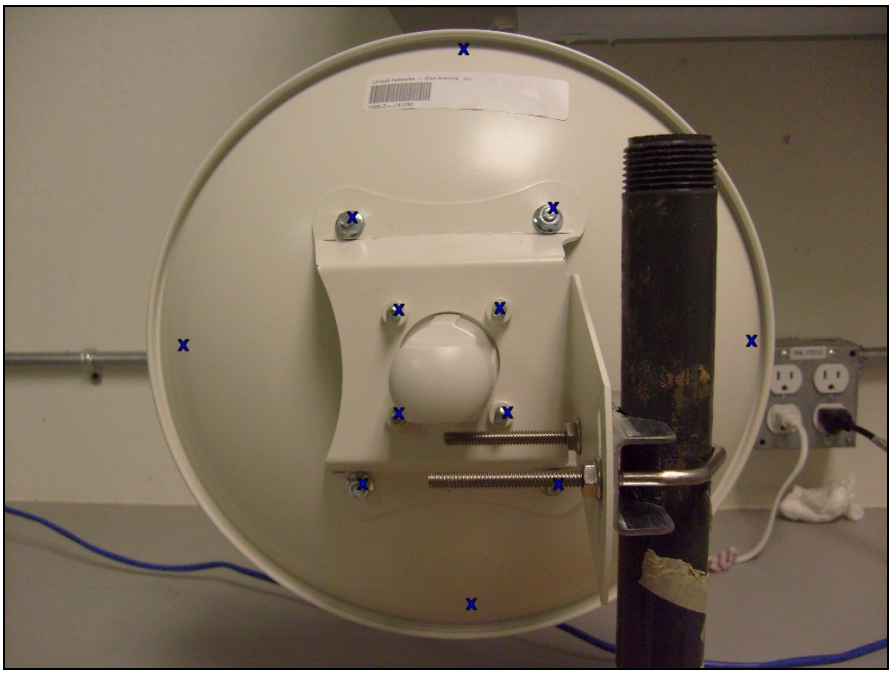


Photograph 11. Electrostatic Discharge, Grid Antenna, Right View

X = Contact Discharge Test Points
O = Air Discharge Test Points

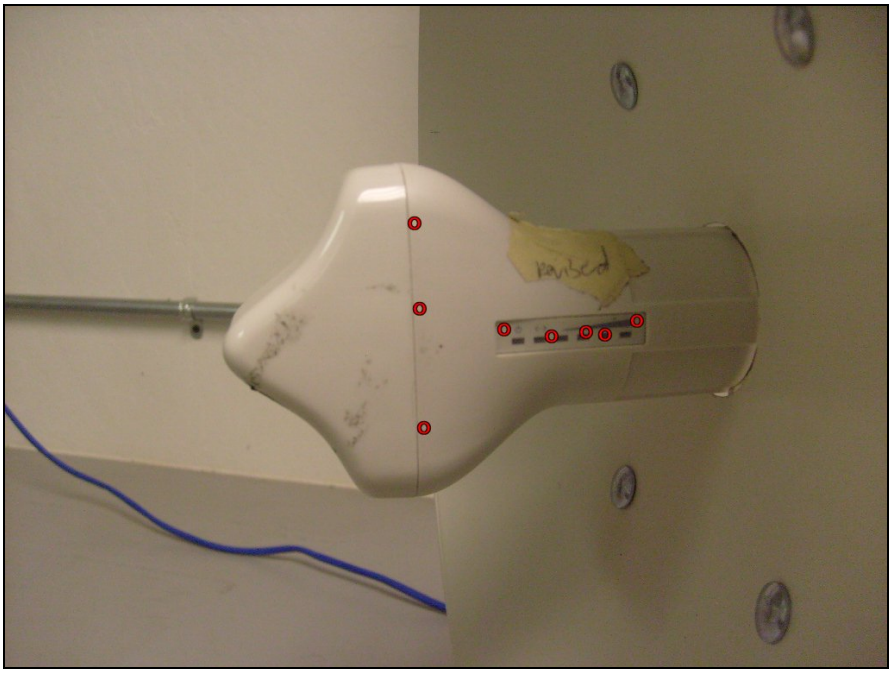


Photograph 12. Electrostatic Discharge, Dish Antenna, Front View



Photograph 13. Electrostatic Discharge, Dish Antenna, Rear View

X = Contact Discharge Test Points
O = Air Discharge Test Points



Photograph 14. Electrostatic Discharge, Dish Antenna, Left View

Photograph 15. Electrostatic Discharge, Dish Antenna, Right View

X = Contact Discharge Test Points
O = Air Discharge Test Points

Photograph 16. Electrostatic Discharge, Test Setup, Grid Antenna

Photograph 17. Electrostatic Discharge, Test Setup, Dish Antenna

Electromagnetic Compatibility Immunity

4.3 Fast Transient, Common Mode

Test Requirement(s): **ETSI EN 300 489-1, Clause 9.4:**

Per *EN 61000-4-4*, The EUT was tested with the electrical fast transients shown in Figure 3, having an amplitude of ± 0.5 kV applied to the DC power cables; ± 0.5 kV applied to I/O and data lines. Only cables that could potentially exceed 3 m in length in real-world application of the EUT need be tested. Performance criterion A applies for all tests.

Test Procedure: The EUT was placed on a non-metallic table above a GRP extending at least 1 m beyond all sides of the EUT (See Photograph 18). The Electrical Fast Transient/Burst (EFT/B) generator and the coupling clamp were mounted to the ground plane. For application of the fast transients to the power lines, power was supplied to the EUT through the EFT/B generator. For application of the fast transients to I/O, data and control lines, the cables were individually placed in the coupling clamp, which was also connected to the EFT/B generator.

The EUT was then powered from an isolated circuit, and selected I/O, data and control cables were placed one at a time in the capacitive coupling clamp. The EFT/B generator was operated to inject the required bursts onto each selected cable via the coupling clamp.

Throughout testing, the EUT was monitored closely for signs of susceptibility.

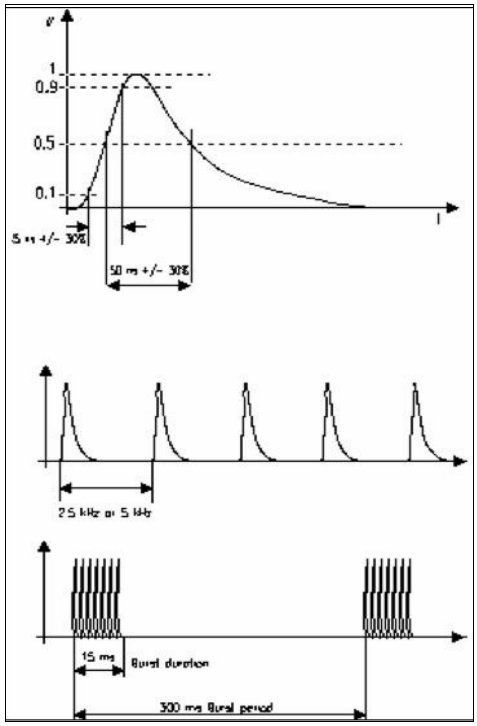


Figure 3. EN 61000-4-4 Test Waveform

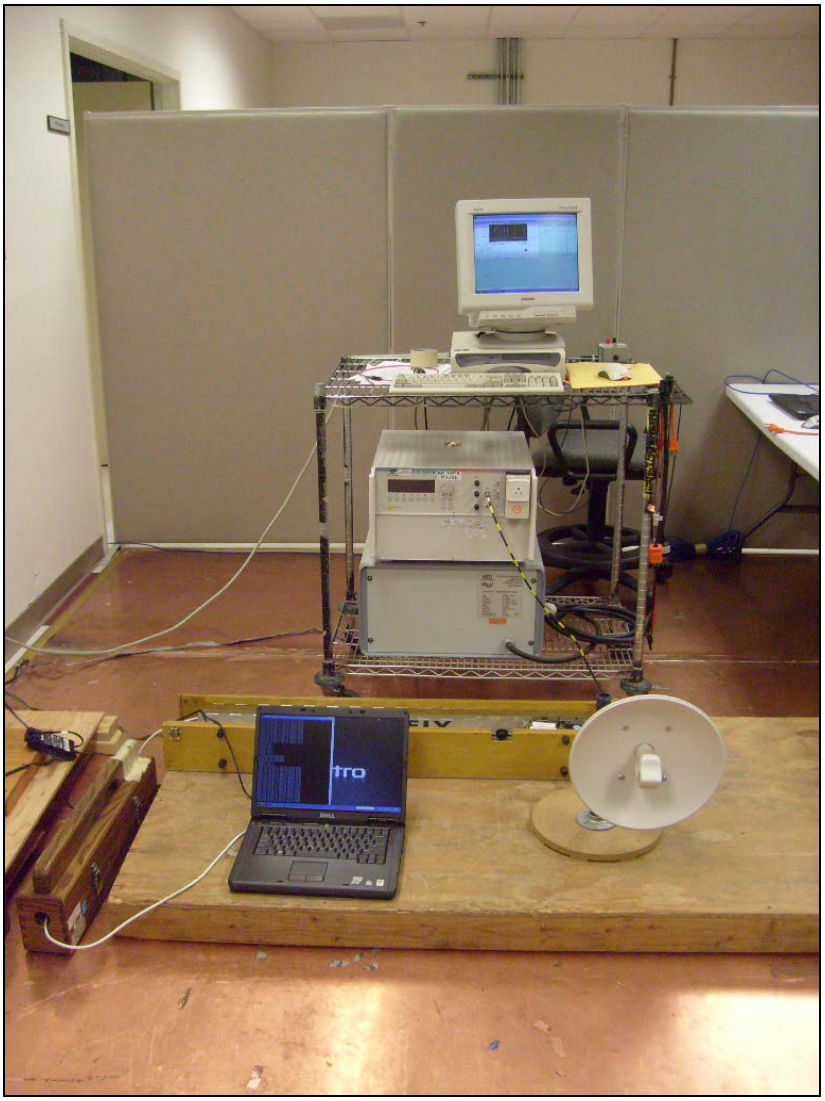
Test Results: The EUT as tested was found compliant with the requirements of Clause 9.4.

Test Engineer(s): Minh Ly

Test Date(s): 10/09/09

Port Name	Slot/EUT Side	Test Level	PASS	Anomalies
I/O Cables & DC Power				
Ethernet	RJ45/Back	±0.5 kV	Yes	No anomalies were observed

Table 14. Fast Transient, Test Results



Photograph 18. Fast Transient, Common Mode, Test Setup

Electromagnetic Compatibility Immunity

4.4 Radio Frequency, Common Mode

Test Requirement(s): **ETSI EN 300 489-1, Clause 9.5:**

Per *EN 61000-4-6*, all interconnecting cables on the EUT including AC power lines, data and control lines shall be tested for immunity to conducted radio frequencies in the range 0.15 MHz - 80 MHz. Using the bulk current injection method, I/O and data cables must be tested to a level of 3 Vrms. The injection voltage shall be amplitude modulated at 80% by a 1 kHz tone. Performance Criterion A applies for all tests.

Test Procedure: The EUT was placed on a non-metallic table above a GRP extending at least 1 m beyond all sides of the EUT (See Photograph 19). For power line cables, a Coupling Decoupling Network (CDN) was used. The CDN was initially calibrated in a calibration jig with a 50 Ω RF load and a 100 Ω matching resistor on one side, and a 100 Ω matching resistor and the receiver (spectrum analyzer) on the other. The injection voltage level was adjusted to maintain a monitored voltage of 3 Vrms across the frequency range (0.15 MHz to 80 MHz).

For cables other than the power line in the frequency range 0.15 MHz - 80 MHz, the BCI was initially calibrated in a calibration jig with a 50 Ω RF load and a 100 Ω matching resistor on one side, and a 100 Ω matching resistor and the receiver (spectrum analyzer) on the other. The injection voltage level was adjusted to maintain a monitored voltage of 3 Vrms across the frequency range (0.15 MHz to 80 MHz). The BCI was clamped around the cable under test at a distance of 0.1 to 0.3 m from the EUT.

Electromagnetic Compatibility Immunity

Radio Frequency, Common Mode

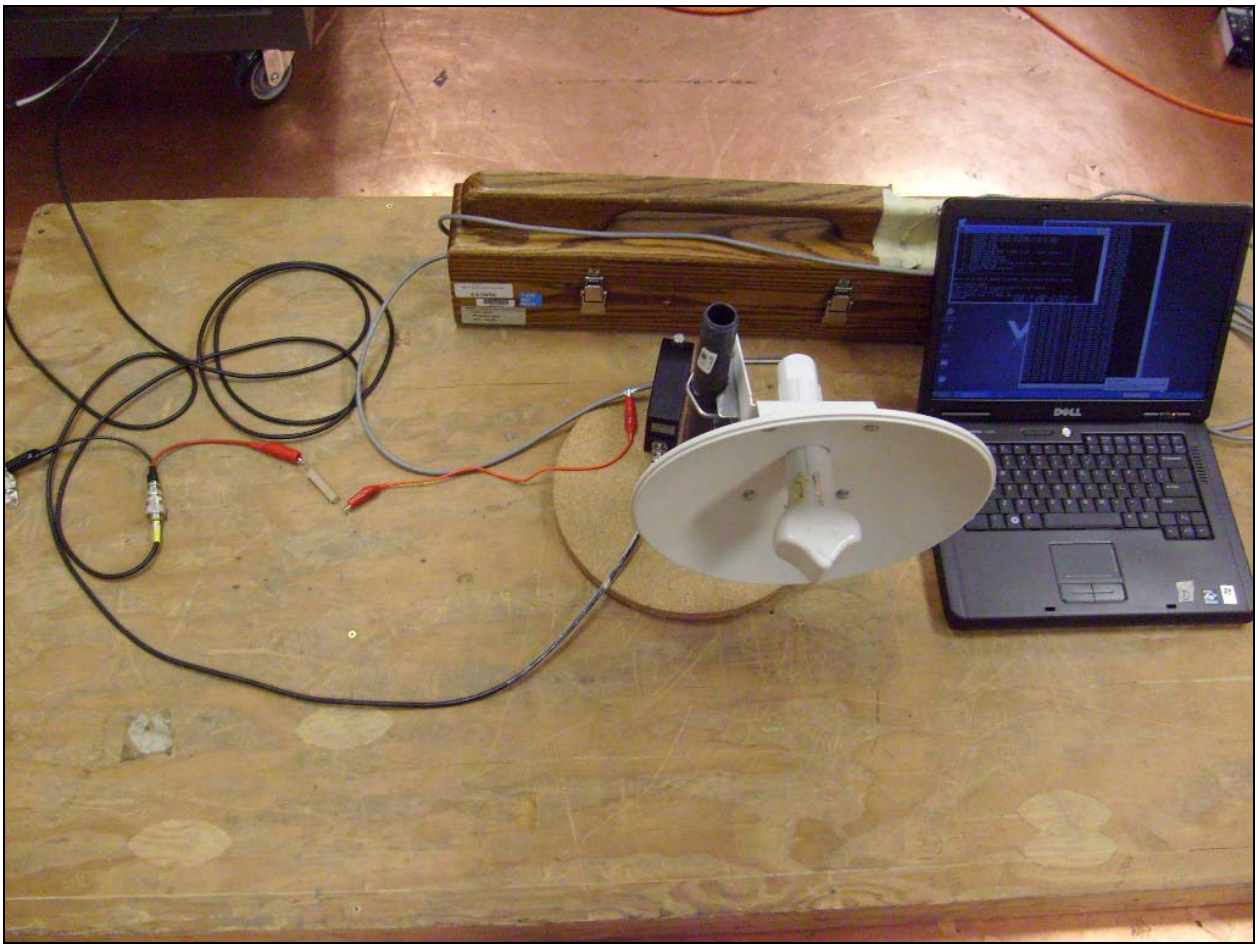
Test Results: The EUT as tested was found compliant with the requirements of Clause 9.5.

Test Engineer(s): Minh Ly

Test Date(s): 09/12/09

Slot/EUT Side	Port Name	Results / Anomalies
Ethernet/ Back	Ethernet/DC	No anomalies were observed

Table 15. Conducted Immunity, Test Results



Photograph 19. Radio Frequency, Common Mode, Test Setup

Electromagnetic Compatibility Immunity

4.5 Surges

Test Requirement(s): **ETSI EN 301 489-1, Clause 9.8:**

The EUT was tested with the surge waveforms shown on the following page, having an open circuit amplitude of ± 1.0 kV applied to the I/O interconnection cables. Performance criterion A applies for I/O cables.

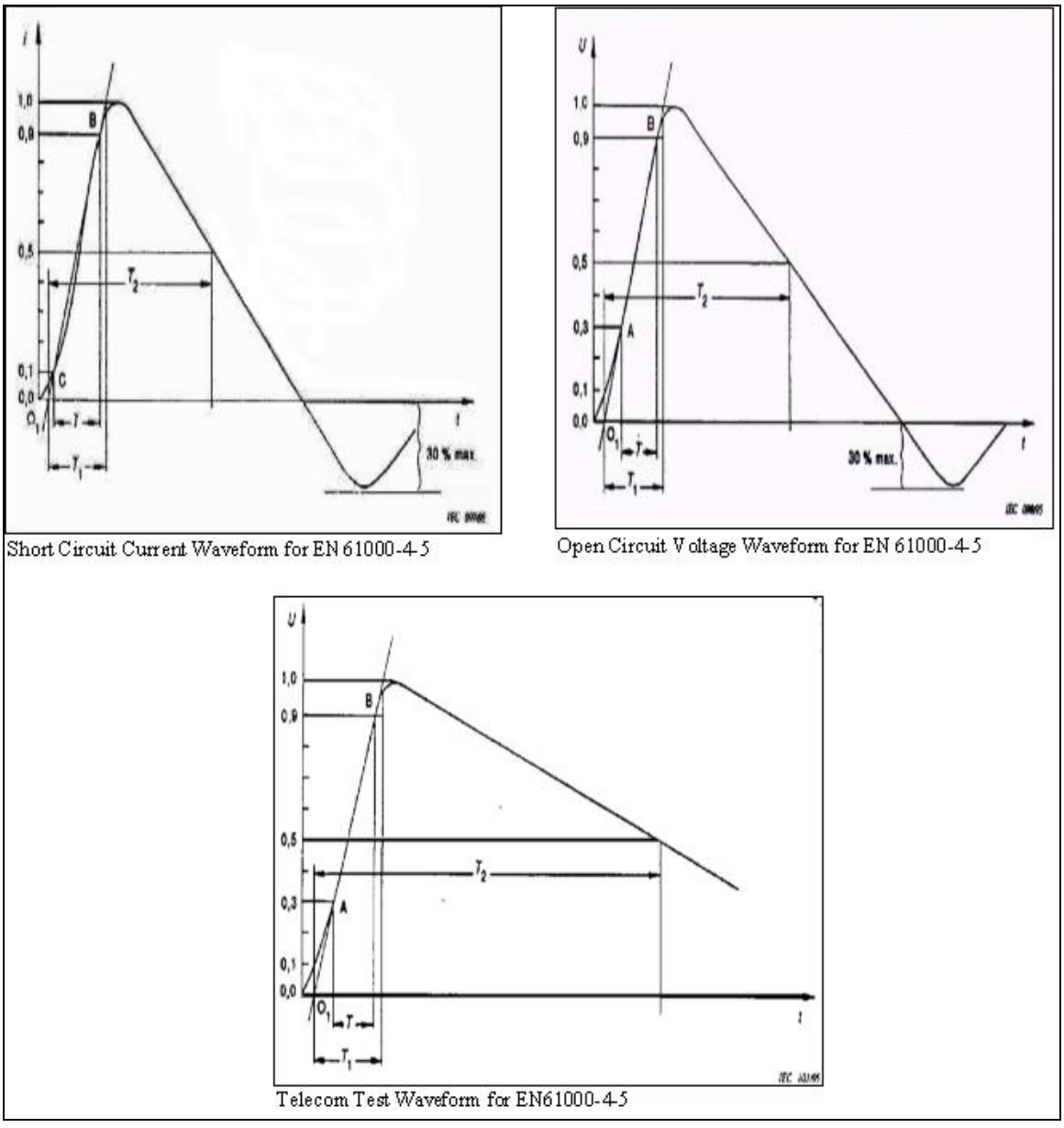
Test Procedure: The EUT was placed on a non-metallic table above a GRP extending at least 1 m beyond all sides of the EUT (See Photograph 20). For I/O port surges, For application of the fast transients to I/O, data and control lines, the cables were individually placed in the coupling clamp, which was also connected to the EFT/B generator. These three tests were performed with positive surges and negative surges.

Open Circuit Voltage:	Front Time = 1.2 μs Time to Half = 50 μs
Short Circuit Current:	Front Time = 8 μs Time to Half = 20 μs
Telecom wave parameters:	Front Time = 10 μs Time to Half = 700 μs

Table 16. Combination Wave Generator Test Parameters for EN 61000-4-5

Electromagnetic Compatibility Immunity

Surges



Short Circuit Current Waveform for EN 61000-4-5

Open Circuit Voltage Waveform for EN 61000-4-5

Telecom Test Waveform for EN61000-4-5

Figure 4. EN 61000-4-5 Surge Test Waveforms

Electromagnetic Compatibility Immunity

Surges

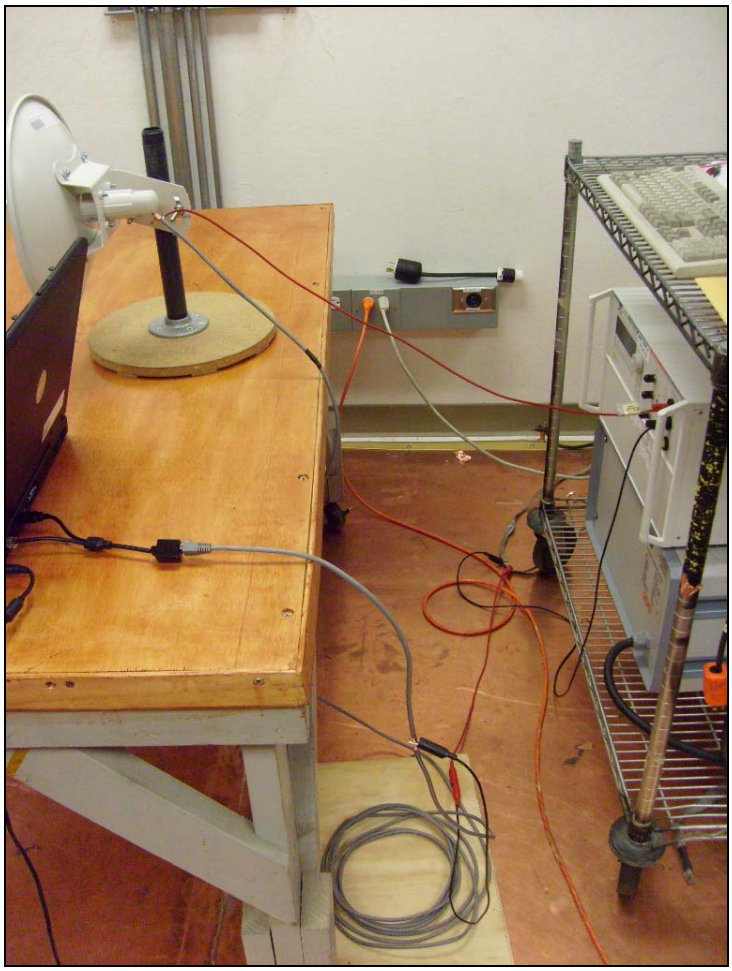
Test Results: The EUT as tested was found compliant with the requirements of Clause 9.8.

Test Engineer(s): Minh Ly

Test Date(s): 10/12/09

Port Name	Phase	Test Level	Results	Anomalies
IO				
Line to Ground	N/A	±1.0 kV	Pass	No anomalies were observed

Table 17. Surges, Test Results



Photograph 20. Surges, Test Setup

5.0 Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: AC Conducted Emissions Voltage Clause 8.4					Test Date(s): 09/14/09
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2607	SPECTRUM ANALYZER	AGILENT	E4407B	6/29/2009	6/29/2010
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2508	AC LISN	SOLAR ELECTRONICS	9252-50-R-24-BNC	6/8/2009	6/8/2010
1S2488	SCREEN ROOM	UNIVERSAL SHIELDING	NA	SEE NOTE	
Test Name: Telecom Line Conducted Emissions Clause 8.7					**Test Date(s): 09/14/09**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2607	SPECTRUM ANALYZER	AGILENT	E4407B	6/29/2009	6/29/2010
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2476	ISN	TESEQ	ISN T8	SEE NOTE	
1S2488	SCREEN ROOM	UNIVERSAL SHIELDING	NA	SEE NOTE	
Test Name: Radiated Electromagnetic Field Clause 9.2					**Test Date(s): 10/14/09**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT	E4407B	4/14/2009	4/14/2010
1S2576	AMPLIFIER (80-1000MHZ)	AMPLIFIER RESEARCH	500W1000A	SEE NOTE	
1S2478	TWT AMPLIFIER	COMM POWER INDUSTRIES	VZL6343J2	SEE NOTE	
1S2401	BILOG ANTENNA	SCHAFFNER	CBL6140A	SEE NOTE	
1S2208	PASSIVE HORN ANTENNA	EMC TEST SYSTEMS	3115	SEE NOTE	
1S2579	ISOTROPIC ELECTRIC FIELD PROBE	ETS-LINDGREN	HI-6053	9/28/2009	9/28/2010
1U0208	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMR20	1/28/2009	1/28/2010
Test Name: Electrostatic Discharge Immunity Clause 9.3					**Test Date(s): 10/13/09**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2470	ESD SIMULATOR	NOISEKEN	ESS-2000	4/14/2009	4/14/2010
1S2490	GROUND PLANE 2	MET LABS	NA	1/27/2009	1/27/2010
1S2521	THERMOMETER/HYGROMETER	FISCHER SCIENTIFIC	11-661-7D	11/14/2007	11/14/2009
Test Name: Fast Transients Clause 9.4					**Test Date(s): 10/09/09**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2518	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	1/21/2008	1/21/2010
1S2423	ULTRA COMPACT SIMLULATOR	AMPLIFIER RESEARCH	UCS-500M-6A	07/06/09	07/06/10
1S2490	GROUND PLANE 2	MET LABS	N/A	1/27/2009	1/27/2010
1S2104	CAPACITIVE COUPLING CLAMP	HEAFELY	N/A	SEE NOTE	

Test Name: Radio Frequency, Conducted Continuous Clause 9.5				Test Date(s): 09/12/09	
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2400	RF CURRENT PROBE	SOLAR ELECTRONICS	6741-1	01/30/09	01/30/10
1S2569	SPECTRUM ANALYZER	AGILENT	E4401B	1/19/2009	1/19/2010
1S2512	TRANSIENT LIMITER	AGILENT	11947A	SEE NOTE	
1S2578	AMPLIFIER (10K-250MHZ)	AMPLIFIER RESEARCH	75A250A	SEE NOTE	
1S2568	SYNTHESIZED RF SIGNAL GENERATOR	GIGATRONICS	6061A	11/17/2008	11/17/2009
1S2490	GROUND PLANE 2	MET LABS	N/A	1/27/2009	1/27/2010
1S2208	HORN ANTENNA	EMCO	3115	11/10/2008	11/10/2009
Test Name: Surges Clause 9.8				**Test Date(s): 10/12/09**	
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2519	DIGITAL THERMO/HYGROMETER	CONTROL COMPANY	11-661-7D	11/14/2007	11/14/2009
1S2490	GROUND PLANE 2	MET LABS	N/A	1/27/2009	1/27/2010
1S2423	ULTRA COMPACT SIMLULATOR	AMPLIFIER RESEARCH	UCS-500M-6A	7/6/2009	7/6/2010

Note: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.