MET Laboratories, Inc. ***Safety Certification - EMI - Telecom Environmental Simulation***
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

June 2, 2011

Ubiquiti Networks, Inc.
91 E. Tasman
San Jose, CA 95134

Dear Jennifer Sanchez,

Enclosed is the EMC test report for compliance testing of the Ubiquiti Networks, Inc., NanoStationLocoM2, 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, Inc. \ EMC30565-ETS489)

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372

Electromagnetic Compatibility
Test Report

For the

Ubiquiti Networks, Inc.
NanoStationLocoM2

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: EMC30565-ETS489

June 2, 2011

Prepared For:

Ubiquiti Networks, Inc.
91 E. Tasman
San Jose, CA 95134

Prepared By:
MET Laboratories, Inc.
3162 Belick Street
Santa Clara, CA 95054

Electromagnetic Compatibility
Test Report

For the

Ubiquiti Networks, Inc.
NanoStationLocoM2

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: EMC30565-ETS489

Lionel Gabrillo
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
∅	June 2, 2011	Initial Issue.

Table of Contents

1.0 Introduction 1
1.1 Overview 1
1.2 Test Site 1
1.3 General Performance Criteria 1
1.4 Testing Summary 2
1.5 Modifications to the Test Standard 3
1.6 References 3
2.0 Equipment Under Test 4
2.1 Description of Test Sample 4
2.2 Equipment Configuration 6
2.3 Support Equipment 6
2.4 Ports and Cabling Information 6
2.5 Mode of Operation 7
2.6 Method of Monitoring EUT Operation 7
2.7 Modifications to the EUT 7
2.8 Disposition of EUT 7
3.0 Electromagnetic Compatibility Emission Criteria 8
3.1 AC Mains Power Input/Output Ports: Limits for Conducted Emissions 8
3.2 Harmonic Current Emissions 14
3.3 Voltage Fluctuations (Flicker) 18
3.4 Telecommunications Ports 21
4.0 Electromagnetic Compatibility Immunity Criteria 25
4.1 Radio Frequency Electromagnetic Field 25
4.2 Electrostatic Discharge 28
4.3 Fast Transient, Common Mode 33
4.4 Radio Frequency, Common Mode 37
4.5 Voltage Dips and Short Interruptions 40
4.6 Surges 43
5.0 Test Equipment 47

List of Tables

Table 1. Summary of Compliance Testing 2
Table 2. Test References 3
Table 3. Equipment Configuration 6
Table 4. Support Equipment 6
Table 5. Ports and Cabling Information 6
Table 6. Limits of Conducted Disturbance at AC Mains Power Input/Output Ports 8
Table 7. Conducted Emissions, AC Power, Phase Line, CETUS Power Supply 9
Table 8. Conducted Emissions, AC Power, Neutral Line, CETUS Power Supply 10
Table 9. Conducted Emissions, AC Power, Phase Line, GME Power Supply 11
Table 10. Conducted Emissions, AC Power, Neutral Line, GME Power Supply 12
Table 11. Harmonic Current Emission Limits from Section 7 of EN 61000-3-2 14
Table 12. Harmonics, Test Results, CETUS Power Supply 16
Table 13. Harmonics, Test Results, GME Power Supply 16
Table 14. Flicker, Test Results, CETUS Power Supply 19
Table 15. Flicker, Test Results, GME Power Supply 19
Table 16. Limits of Conducted Common Mode (Asymmetric Mode) Disturbance at Telecommunication Ports from Clause 5.2 of EN 55022 Class B 21
Table 17. Conducted Disturbance at Telecommunication Ports Test Results, LAN, CETUS Power Supply 22
Table 18. Conducted Disturbance at Telecommunication Ports Test Results, LAN, GME Power Supply 23
Table 19. Radiated Immunity, Test Results, CETUS Power Supply 26
Table 20. Radiated Immunity, Test Results, GME Power Supply 26
Table 21. Electrostatic Discharge, Test Results, CETUS Power Supply 29
Table 22. Electrostatic Discharge, Test Results, GME Power Supply 29
Table 23. Fast Transient, Test Results, CETUS Power Supply 35
Table 24. Fast Transient, Test Results, GME Power Supply 35
Table 25. Conducted Immunity, Test Results, CETUS Power Supply 38
Table 26. Conducted Immunity, Test Results, GME Power Supply 38
Table 27. Voltage Dips and Short Interruptions Limits 40
Table 28. Voltage Dips and Interruptions, Test Results, CETUS Power Supply 41
Table 29. Voltage Dips and Interruptions, Test Results, GME Power Supply 41
Table 30. Combination Wave Generator Test Parameters for EN 61000-4-5 43
Table 31. Surges, Test Results, CETUS Power Supply 45
Table 32. Surges, Test Results, GME Power Supply 45

List of Figures

Figure 1. Block Diagram of Test Configuration 5
Figure 2. Test Circuit for EN 61000-3-3 18
Figure 3. EN 61000-4-4 Test Waveform 34
Figure 4. EN 61000-4-5 Surge Test Waveforms 44

List of Photographs

Photograph 1. Ubiquiti Networks NanoStationLocoM2 4
Photograph 2. AC Mains Power Input/Output Ports, Conducted Disturbance, Test Setup 13
Photograph 3. Harmonic Current Emissions, Test Setup 17
Photograph 4. Voltage Fluctuations (Flicker), Test Setup 20
Photograph 5. Limits for Conducted Disturbance at Telecommunication Ports 24
Photograph 6. Radio Frequency Electromagnetic Field, Test Setup, 80 MHz – 1 GHz 27
Photograph 7. Radio Frequency Electromagnetic Field, Test Setup, 1.4 GHz – 2.7 GHz 27
Photograph 8. ESD, Test Points, Antenna Front 30
Photograph 9. ESD, Test Points, Antenna Back 30
Photograph 10. ESD, Test Points 1 31
Photograph 11. ESD, Test Points 2 31
Photograph 12. Electrostatic Discharge, Test Setup 32
Photograph 13. Fast Transient, Common Mode, Test Setup, AC Mode 36
Photograph 14. Fast Transient, Common Mode, Test Setup, I/O Cables 36
Photograph 15. Radio Frequency, Common Mode, Test Setup, Power Line 39
Photograph 16. Radio Frequency, Common Mode, Test Setup, I/O Line 39
Photograph 17. Voltage Dips and Interruptions, Test Setup 42
Photograph 18. Surges, Test Setup, I/O Line 46
Photograph 19. Surges, Test Setup, Power Line 46

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**H**enry**
µF	**micro**F**arad**
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, Inc. to perform testing on the NanoStationLocoM2, under Ubiquiti Networks, Inc. purchase order number US100132.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the NanoStationLocoM2.

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

Model(s) Tested:	NanoStationLocoM2
Model(s) Covered:	NanoStationLocoM2
EUT Specifications:	Primary Power: 12 VAC
	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:	Lionel Gabrillo
Report Date(s):	June 2, 2011

1.2 Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, 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:

- 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 not an Ancillary Equipment.
DC Power Input/Output Ports	ETSI EN 301 489-1, Section 8.3	EN 55022 (2006)	Not Applicable - EUT is AC 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)	Compliant
Voltage Fluctuations and Flicker (AC Mains Input Port)	ETSI EN 301 489-1, Section 8.6	EN 61000-3-3 (1995)	Compliant
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 - Not an Automotive EUT.
Voltage Dips and Interruptions	ETSI EN 301 489-1, Section 9.7	EN 61000-4-11 (2004)	Compliant
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 V2.1.1(2009-05)	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 NanoStationLocoM2, Equipment Under Test (EUT) for the remainder of this document, is a 2.4GHz Hi Power 2x2 MIMO.

Photograph 1. Ubiquiti Networks NanoStationLocoM2

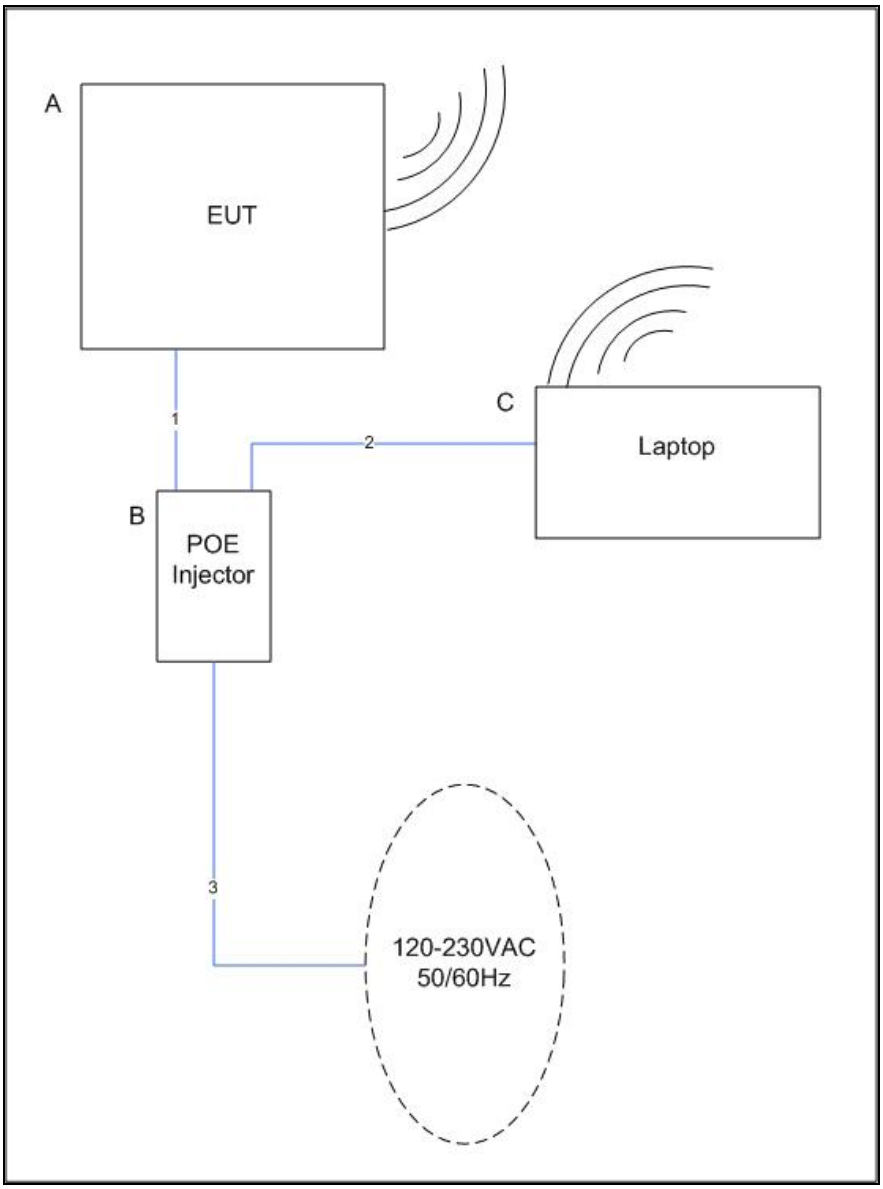


Figure 1. Block Diagram of Test Configuration

2.2 Equipment Configuration

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

Name / Description	Model Number	Serial Number
Power Supply (Cetus)	CPWA240500US	POEZC101126181008
Power Supply (GME)	UBI-POE-24-5	0912-0009854
LocoM2	M2L	00156D9E19BF

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.

Name / Description	Manufacturer	Model Number	Serial Number
Laptop	Dell	Vostro 1510	4953929473

Table 4. Support Equipment

2.4 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	Main	Ethernet	1	10	Y	PSU – POE port
1	PSU - POE	Ethernet	1	10	Y	A, Main
2	PSU - LAN	Ethernet	1	10	Y	Laptop
3	AC port	AC Cable	1	0.5	Y	100-240VAC Source

Table 5. Ports and Cabling Information

2.5 Mode of Operation

Transmit 1-11Mbps at 802.11b mode and 6-54Mbps at 802.11g/n modes @2.4GHz.

2.6 Method of Monitoring EUT Operation

IP connectivity is maintained with the EUT. If IP connectivity is lost, EUT connectivity shall be re-established upon power up or re-boot.

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, Inc. 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 2). 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. Measured emissions were below applicable limits.

Test Engineer(s): Anderson Soungpanya

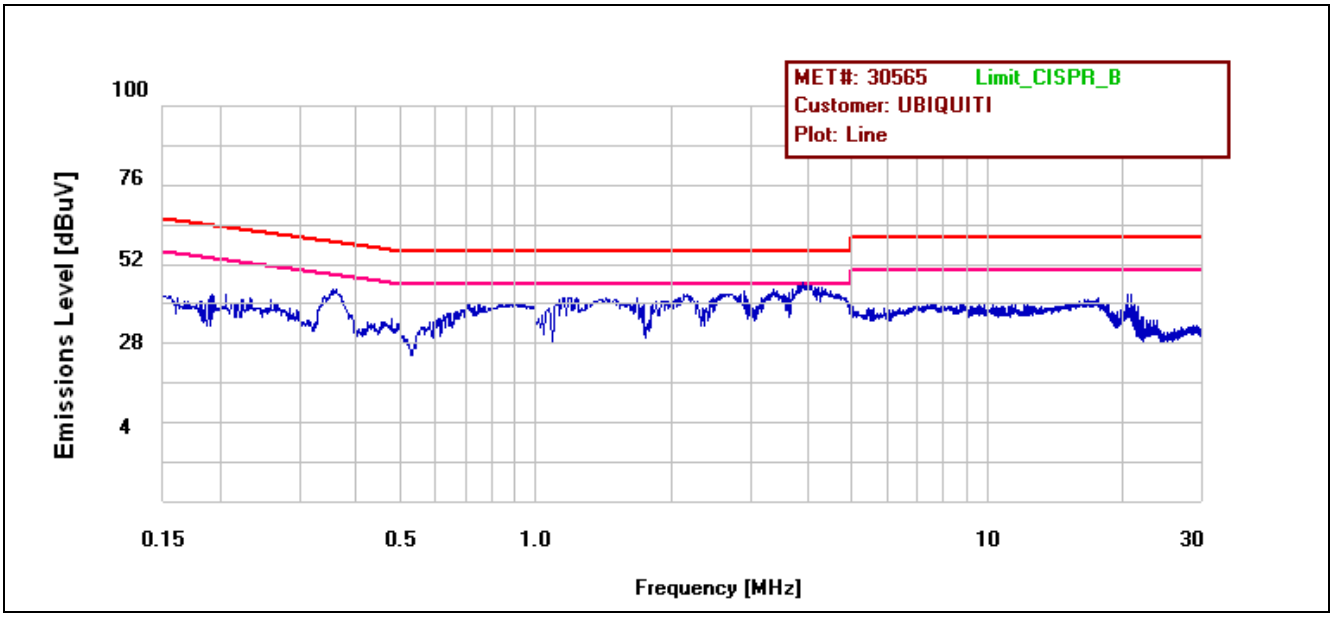
Test Date(s): 03/23/11

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	.150	52.24	66	-13.76	Pass	34.48	56	-21.52	Pass
Line	.170	51.84	64.963	-13.123	Pass	40.82	54.963	-14.143	Pass
Line	.202	48.6	63.535	-14.935	Pass	36.7	53.535	-16.835	Pass
Line	.354	52.42	58.888	-6.468	Pass	43.33	48.888	-5.558	Pass
Line	.222	48.36	62.753	-14.393	Pass	40.54	52.753	-12.213	Pass
Line	3.94	39.61	56	-16.39	Pass	30.12	46	-15.88	Pass
Line	3.75	41.75	56	-14.25	Pass	32.57	46	-13.43	Pass

Table 7. Conducted Emissions, AC Power, Phase Line, CETUS Power Supply



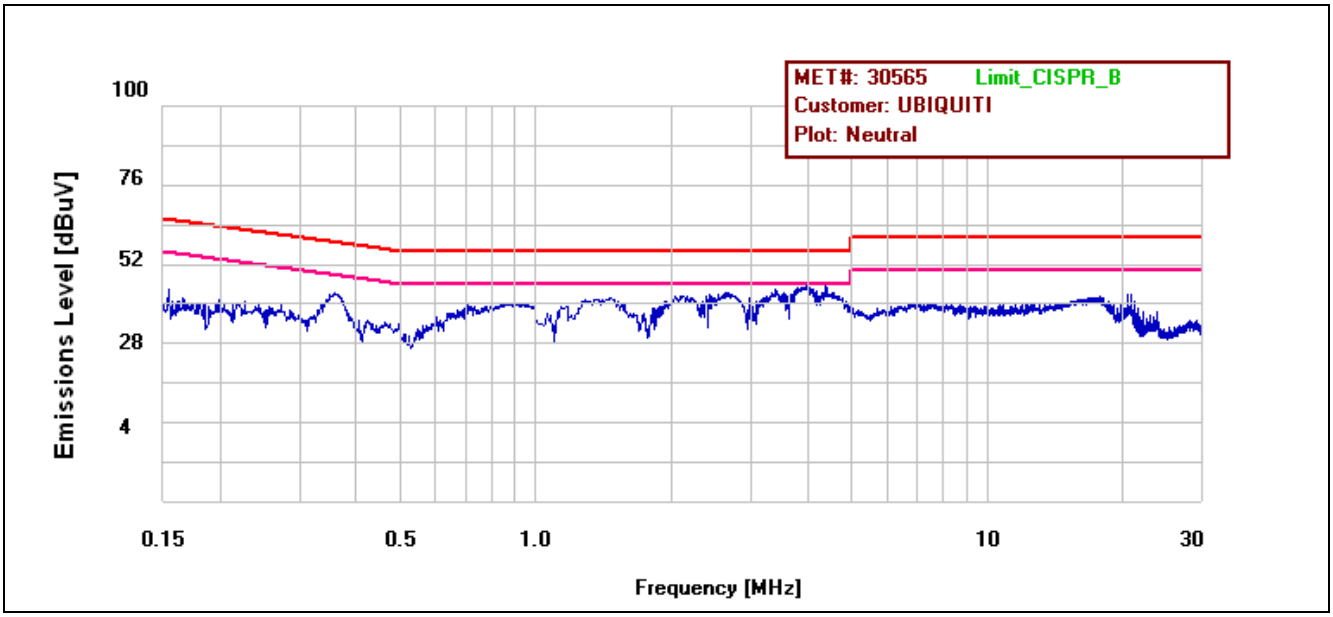
Plot 1. Conducted Emission Limits, Phase Line Plot, CETUS Power Supply

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
Neutral	.178	46.84	64.582	-17.742	Pass	29.43	54.582	-25.152	Pass
Neutral	.166	51.44	65.16	-13.72	Pass	40.04	55.16	-15.12	Pass
Neutral	.358	51.87	58.794	-6.924	Pass	43.47	48.794	-5.324	Pass
Neutral	3.66	43	56	-13	Pass	34.83	46	-11.17	Pass
Neutral	1.61	35.77	56	-20.23	Pass	23.21	46	-22.79	Pass
Neutral	.850	42.88	56	-13.12	Pass	32.68	46	-13.32	Pass

Table 8. Conducted Emissions, AC Power, Neutral Line, CETUS Power Supply



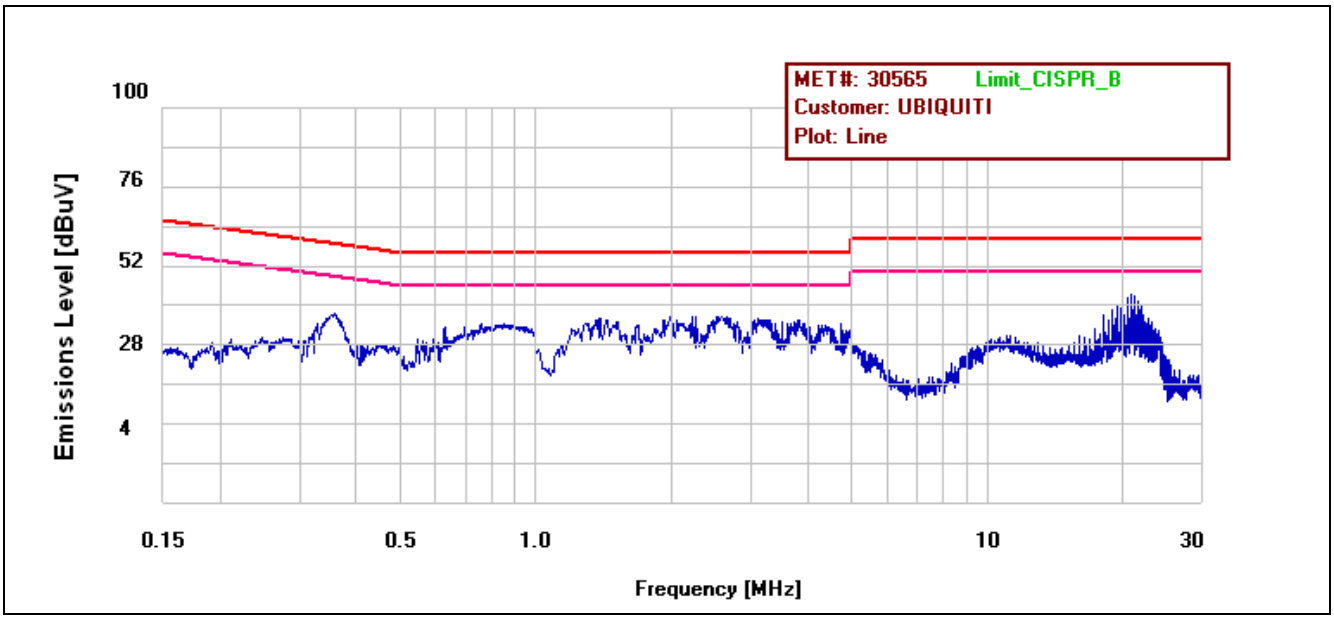
Plot 2. Conducted Emission Limits, Neutral Line Plot, CETUS Power Supply

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	.150	38.73	66	-27.27	Pass	31.15	56	-24.85	Pass
Line	.354	42.77	58.888	-16.118	Pass	32.05	48.888	-16.838	Pass
Line	20.75	41.45	60	-18.55	Pass	39.12	50	-10.88	Pass
Line	.254	38.18	61.637	-23.457	Pass	26.83	51.637	-24.807	Pass

Table 9. Conducted Emissions, AC Power, Phase Line, GME Power Supply



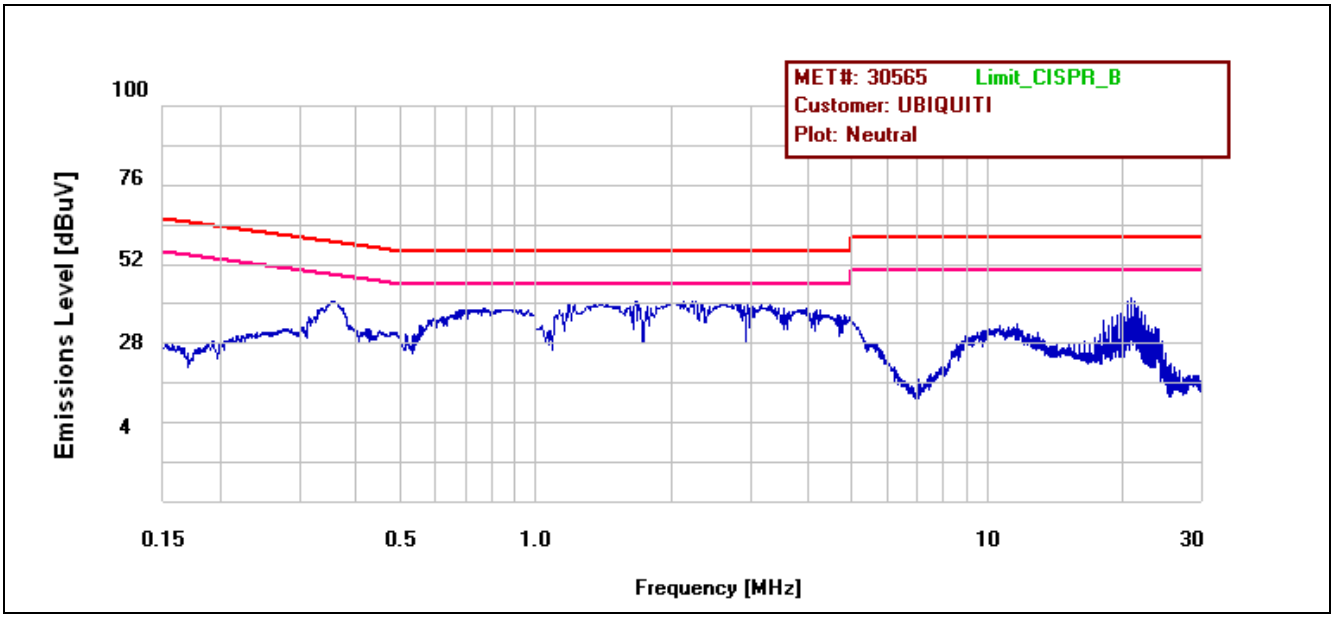
Plot 3. Conducted Emission Limits, Phase Line Plot, GME Power Supply

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
Neutral	.346	49.75	59.077	-9.327	Pass	41.85	49.077	-7.227	Pass
Neutral	1.36	40.55	56	-15.45	Pass	32.67	46	-13.33	Pass
Neutral	21.11	39.91	60	-20.09	Pass	38.12	50	-11.88	Pass

Table 10. Conducted Emissions, AC Power, Neutral Line, GME Power Supply



Plot 4. Conducted Emission Limits, Neutral Line Plot, GME Power Supply

Electromagnetic Compatibility Emission

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

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

Electromagnetic Compatibility Emission

3.2 Harmonic Current Emissions

Test Requirement(s): **ETSI EN 301 489-1, Clause 8.5:**

Per *EN 61000-3-2+A1, Clause 7,* the EUT must not produce harmonic currents, which exceed the limits expressed in Table 11.

Harmonic Order	Maximum Permissible Harmonic Current (in Amperes)
Odd Harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 < n < 39	0.15 - 15/n
Harmonic Order	**Maximum Permissible Harmonic Current (in Amperes)**
Even Harmonics	
2	1.08
4	0.43
6	0.30
8< n <40	0.23 - 8/n

Table 11. Harmonic Current Emission Limits from Section 7 of EN 61000-3-2

Test Procedure: The EUT was placed on a non-metallic table located in a shielded enclosure (See Photograph 3). The measurement was performed using normal operation of the equipment. The method of testing, test conditions, and test procedures of *EN 61000-3-2+A1*.

Electromagnetic Compatibility Emission

Harmonic Current Emissions

Test Procedure (Con't): ITE is tested with the equipment configured to its rated current. In this case, the equipment, if necessary, may be configured with its power supplies loaded with additional load (resistive) boards to simulate rated current conditions. For ITE systems designed for use with a manufacturer-supplied power distribution system, e.g. transformers, UPS, power conditioner, etc., compliance with the limits of this standard shall be met at the input to the power distribution system.

Test Results: The EUT was found compliant with the specified requirements of Clause 8.5. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo and Kenshi Chung

Test Date(s): 02/15/11 and 03/22/11

Class (A, B, C, D)	Voltage (V)	Current (A)	Frequency (Hz)	Total Harmonic Distortion (%)
A	243.29	.03421	49.99	186.11
Harmonic Odd #	**Measured (A)**	**Class A Limit (A)**	**Results**	**Notes**
3	0.01507	2.300	PASS	None
5	0.01389	1.140	PASS	None
7	0.01260	0.770	PASS	None
9	0.01053	0.400	PASS	None
11	0.00919	0.330	PASS	None
13	0.00751	0.21	PASS	None
15-39	0.00563 – 0.00043	0.150- 0.058	PASS	None
Harmonic Even #	**Measured (A)**	**Class A Limit (A)**	**Results**	**Notes**
2	0.00300	1.080	PASS	None
4	0.00278	0.430	PASS	None
6	0.00256	0.300	PASS	None
8-40	0.00219 - 0.00042	0.230- 0.046	PASS	None

Table 12. Harmonics, Test Results, CETUS Power Supply

Class (A, B, C, D)	Voltage (V)	Current (A)	Frequency (Hz)	Total Harmonic Distortion (%)
A	241.71	0.053	50.001	277.38
Harmonic Odd #	**Measured (A)**	**Class A Limit (A)**	**Results**	**Notes**
3	0.01507	2.300	PASS	No Anomalies Observed
5	0.01389	1.140	PASS	No Anomalies Observed
7	0.01260	0.770	PASS	No Anomalies Observed
9	0.01053	0.400	PASS	No Anomalies Observed
11	0.00919	0.330	PASS	No Anomalies Observed
13	0.00751	0.21	PASS	No Anomalies Observed
15-39	0.00563 – 0.00043	0.150- 0.058	PASS	No Anomalies Observed
Harmonic Even #	**Measured (A)**	**Class A Limit (A)**	**Results**	**Notes**
2	0.00300	1.080	PASS	No Anomalies Observed
4	0.00278	0.430	PASS	No Anomalies Observed
6	0.00256	0.300	PASS	No Anomalies Observed
8-40	0.00219 - 0.00042	0.230- 0.046	PASS	No Anomalies Observed

Table 13. Harmonics, Test Results, GME Power Supply

Electromagnetic Compatibility Emission

Harmonic Current Emissions

Photograph 3. Harmonic Current Emissions, Test Setup

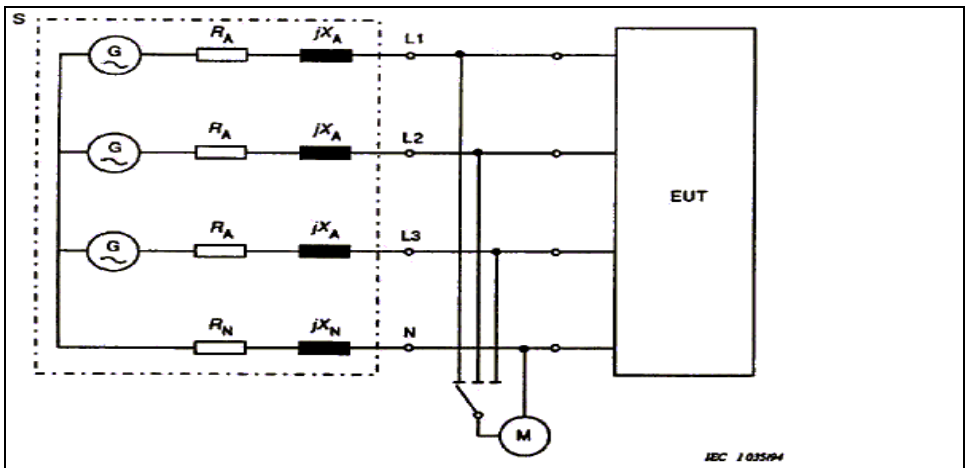
Electromagnetic Compatibility Emission

3.3 Voltage Fluctuations (Flicker)

Test Requirement(s): **ETSI EN 301 489-1, Clause 8.6:**

The EUT must not produce voltage fluctuations and/or flicker at the supply terminals as measured or calculated according to clause 4, according to limits expressed in *Clause 5*, under test conditions described in *Clause 6* and *Annex A* of *EN 61000-3-3*.

Test Procedure: The EUT was placed on a non-metallic table inside a shielded enclosure (See Photograph 4). The EUT was situated such that the sides of the EUT were no closer than 2.0 m from the walls of the shielded enclosure. The EUT was operated with an AC main source at 220 V. Tests to prove the compliance of the EUT with the limits of *EN 61000-3-3, Section 5* were made using the test circuit provided in Figure 2 of *EN 61000-3-3*. The test circuit consisted of the test power supply, the reference impedance, the EUT, and a flickermeter. The test supply voltage (open-circuit voltage) was the rated voltage of the equipment. The test voltage was maintained within ± 2% of the nominal value. The frequency was 50 Hz ± 0.5%. The total harmonic distortion of the supply voltage was less than 3%. The limits applicable to voltage fluctuations and flicker at the supply terminals of the EUT were automatically measured with the analyzer.



EUT equipment under test

M measuring equipment

S supply source consisting of the supply voltage generator G and reference impedance Z with the elements:

R_A = 0,24 Ω; jX_A = 0,15 Ω at 50 Hz;

R_N = 0,16 Ω; jX_N = 0,10 Ω at 50 Hz.

The elements include the actual generator impedance.

When the source impedance is not well defined, see 6.2.

G voltage source in accordance with 6.3.

NOTE – In general, three-phase loads are balanced, and R_N and X_N can be neglected, as there is no current in the neutral wire.

Figure 2. Test Circuit for EN 61000-3-3

Electromagnetic Compatibility Emission

Voltage Fluctuations (Flicker)

Test Results: The EUT was found compliant with the specified requirements of Clause 8.6. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo and Kenshi Chung

Test Date(s): 02/15/11 and 03/22/11

Voltage (V)	Current (A)	Frequency (Hz)	Power Factor
243.3	0.034444	49.997	0.434

Average (Is) relative voltage Drop		**d(t)**	0.002 %
Relative voltage fluctuation (3s)		**Dpp**	0.001 %
d(t) at steady - state level		**YES /NO**	Yes
Last relative steady - state level change		**Dc**	0.000 %
Last transition swing		**Dmax**	--
Normalized peak flicker (3s)		**Pp**	0.000

Parameter		**Observation Period**		**Limit**
		Short	**Long**	
Observation Time	**Tp**	10 min	120 min	
Maximum relative voltage change	**dmax**	0	0	4
Max rel. steady-state voltage change	**dc**	0	0	3
Duration of d(t) > 3 %	**t**	0	0	0.2
Short term flicker severity	**Pst**	0	0	1.0
Long term flicker severity	**Plt**	NA	0	0.65

Table 14. Flicker, Test Results, CETUS Power Supply

Voltage (V)	Current (A)	Frequency (Hz)	Power Factor
239.0	0.0522	49.997	0.0281

Average (Is) relative voltage Drop		**d(t)**	0.002 %
Relative voltage fluctuation (3s)		**Dpp**	0.002 %
d(t) at steady - state level		**YES /NO**	YES
Last relative steady - state level change		**Dc**	0.000 %
Last transition swing		**Dmax**	--
Normalized peak flicker (3s)		**Pp**	0.00

Parameter		**Observation Period**		**Limit**
		Short	**Long**	
Observation Time	**Tp**	10 min	120 min	
Maximum relative voltage change	**dmax**	0	0	4
Max rel. steady-state voltage change	**dc**	0	0	3
Duration of d(t) > 3 %	**t**	0	0	0.2
Short term flicker severity	**Pst**	0	0	1.0
Long term flicker severity	**Plt**	NA	0	0.65

Table 15. Flicker, Test Results, GME Power Supply

Electromagnetic Compatibility Emission

Voltage Fluctuations (Flicker)

Photograph 4. Voltage Fluctuations (Flicker), Test Setup

Electromagnetic Compatibility Emission

3.4 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 16:

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 16. 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 5). 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:	32 %

Test Results: The EUT was found compliant with the requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Joe Vang

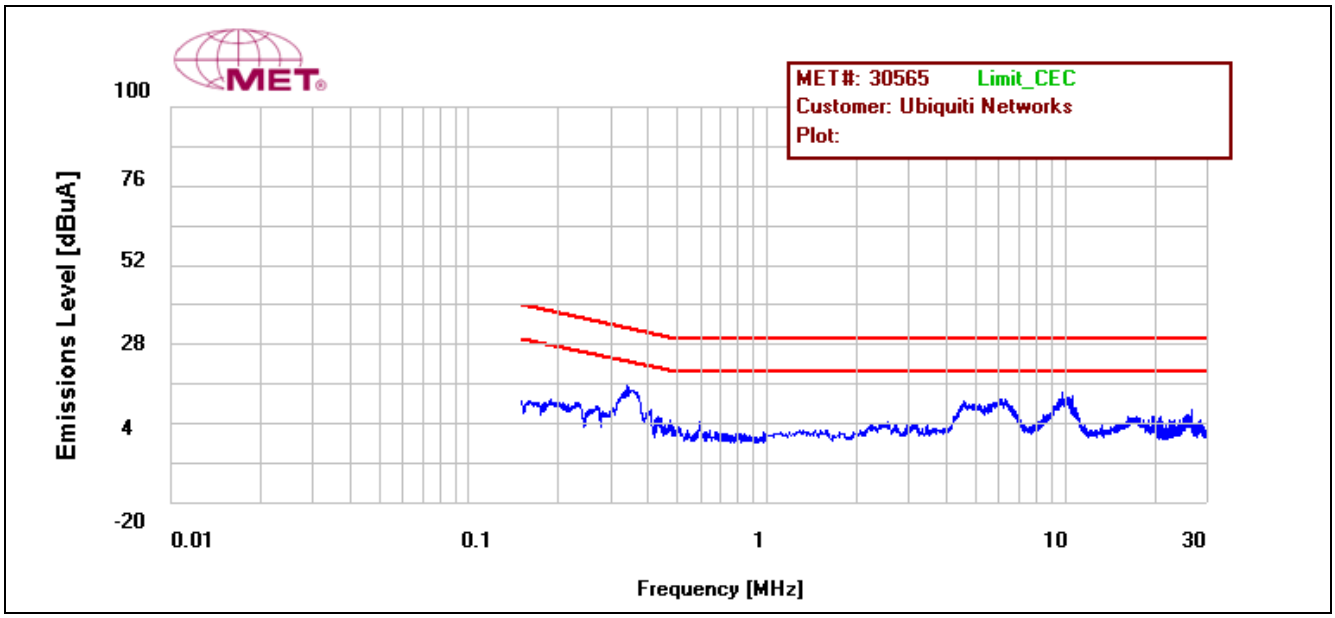
Test Date(s): 03/24/11

Limits for Conducted Disturbance at Telecommunication Ports

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

Line	Frequency (MHz)	Raw	QP Amplitude	QP Limit	Delta	Pass/Fail	Raw	Average Amplitude	Average Limit	Delta	Pass/Fail
LAN	.350	31.15	9.15	32.962	-23.812	Pass	21.41	-0.59	22.962	-23.552	Pass
LAN	4.478	23.82	1.82	30	-28.18	Pass	15.64	-6.36	20	-26.36	Pass
LAN	6.08	25.26	3.26	30	-26.74	Pass	17.81	-4.19	20	-24.19	Pass
LAN	9.8	24.35	2.35	30	-27.65	Pass	18.44	-3.56	20	-23.56	Pass
LAN	17.46	18	-4	30	-34	Pass	11.85	-10.15	20	-30.15	Pass
LAN	26.2	14.86	-7.14	30	-37.14	Pass	8.85	-13.15	20	-33.15	Pass

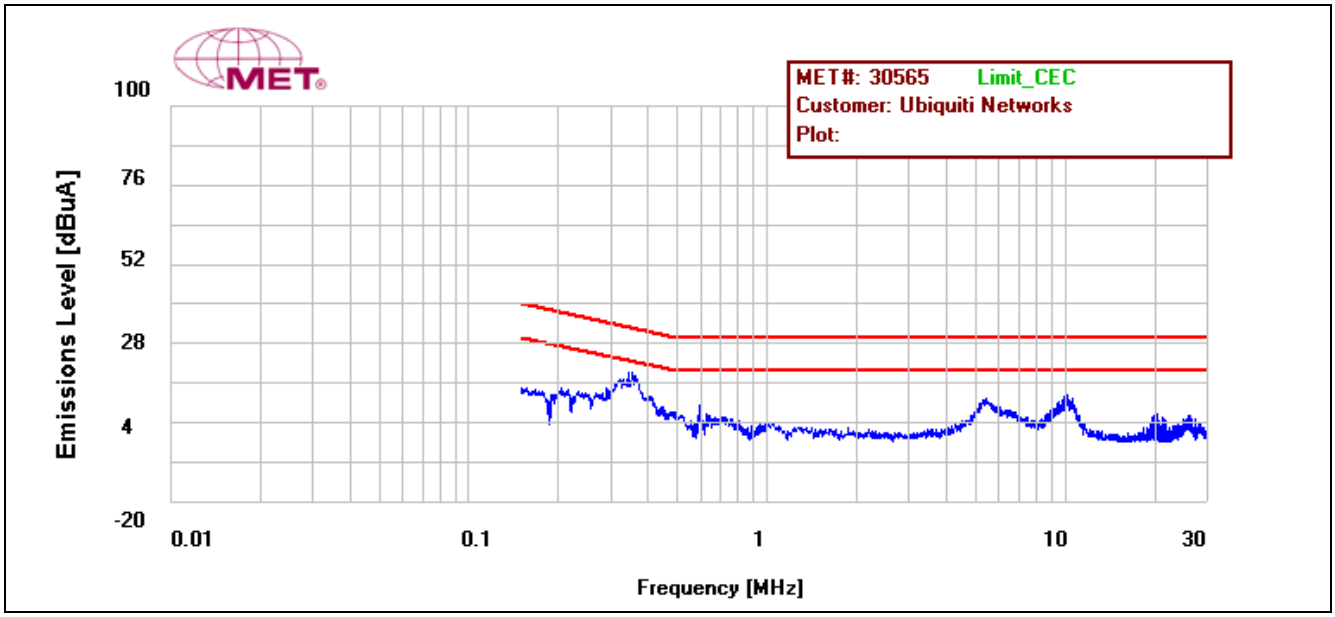
Table 17. Conducted Disturbance at Telecommunication Ports Test Results, LAN, CETUS Power Supply



Plot 5. Conducted Emission Limits for Telecommunications Ports, LAN Plot, CETUS Power Supply

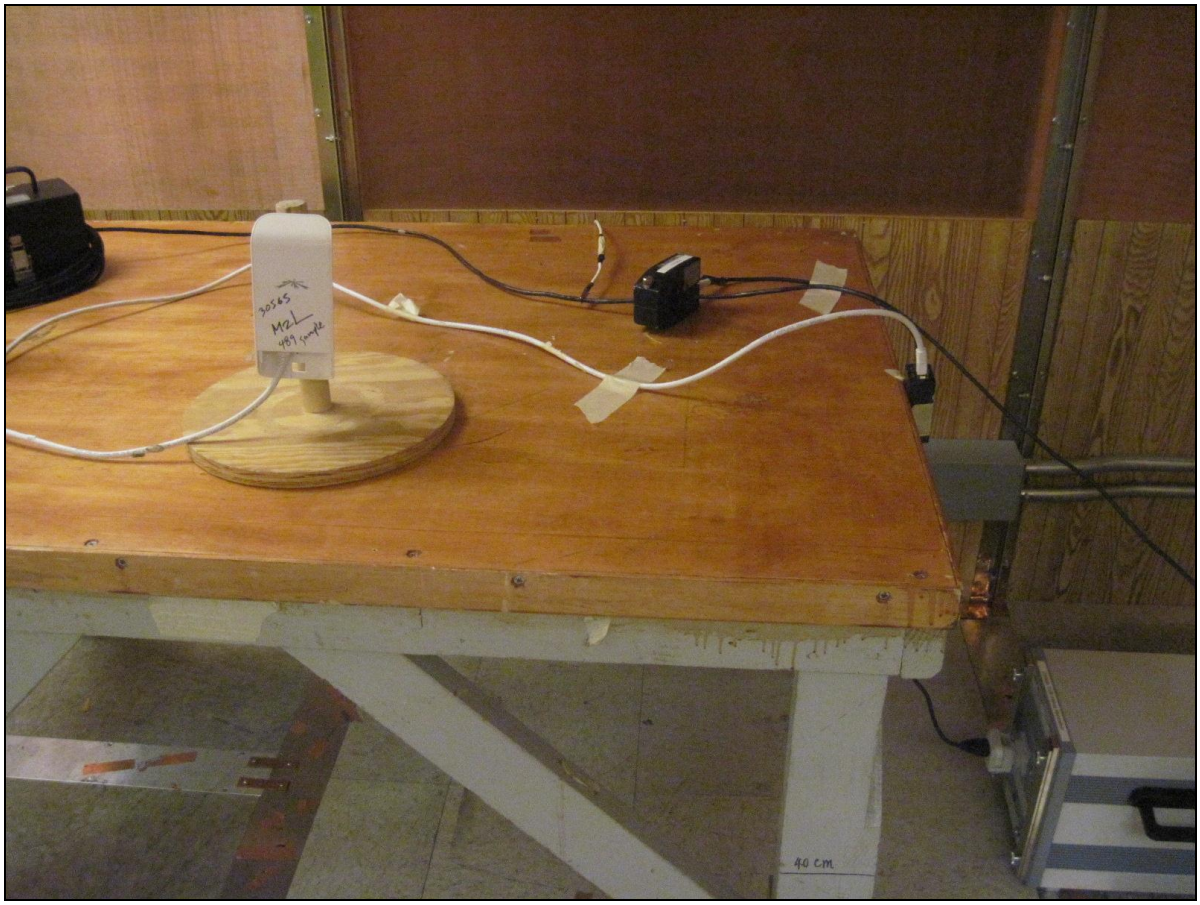
Line	Frequency (MHz)	Raw	QP Amplitude	QP Limit	Delta	Pass/Fail	Raw	Average Amplitude	Average Limit	Delta	Pass/Fail
LAN	.338	32.47	10.47	33.252	-22.782	Pass	25.33	3.33	23.252	-19.922	Pass
LAN	.503	19.76	-2.24	30	-32.24	Pass	12.26	-9.74	20	-29.74	Pass
LAN	5.49	24.6	2.6	30	-27.4	Pass	17.51	-4.49	20	-24.49	Pass
LAN	9.94	23.97	1.97	30	-28.03	Pass	17.36	-4.64	20	-24.64	Pass
LAN	19.71	22	0	30	-30	Pass	18.08	-3.92	20	-23.92	Pass
LAN	25.4	14.59	-7.41	30	-37.41	Pass	8.8	-13.2	20	-33.2	Pass

Table 18. Conducted Disturbance at Telecommunication Ports Test Results, LAN, GME Power Supply



Plot 6. Conducted Emission Limits for Telecommunications Ports, LAN Plot, GME Power Supply

Limits for Conducted Disturbance at Telecommunication Ports



Photograph 5. 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 – 2700 MHz (EN 61000-4-3). 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 3 m in front of the EUT (See Photograph 7). 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. The signal was amplitude modulated 80% over the frequency range 80 MHz to 1000 MHz and 1400 MHz to 2700 MHz at a level of 3 V/m. 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. Measured emissions were below applicable limits.

Test Engineer(s): Lionel Gabrillo

Test Date(s): 02/21/11 and 04/27/11

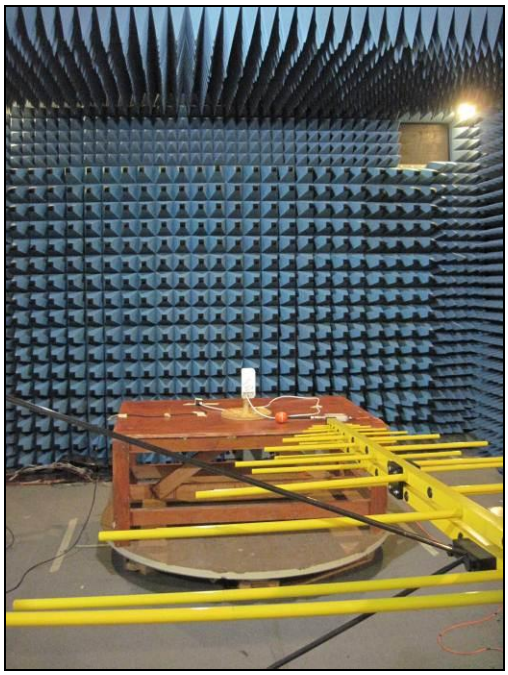
Start Frequency (MHz)	Stop Frequency (MHz)	Severity (V/m)	Polarity (H/V)	Modulation (Freq. & Type)	Results			
					Front	Back	Left	Right
80	1000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
80	1000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2700	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2700	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass

Table 19. Radiated Immunity, Test Results, CETUS Power Supply

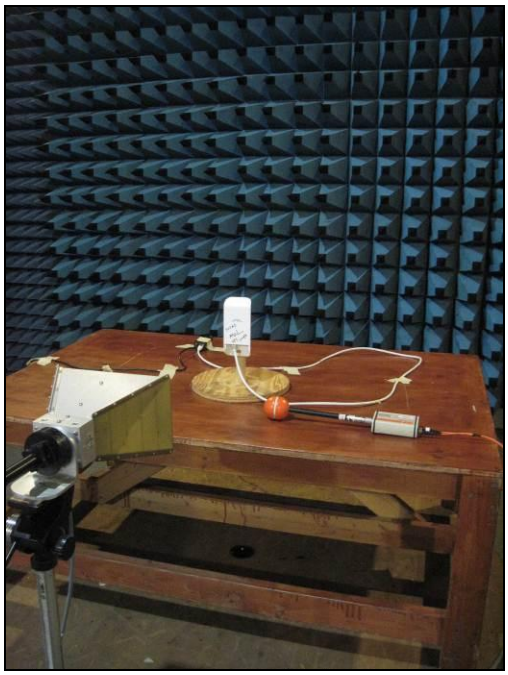
Start Frequency (MHz)	Stop Frequency (MHz)	Severity (V/m)	Polarity (H/V)	Modulation (Freq. & Type)	Results			
					Front	Back	Left	Right
80	1000	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
80	1000	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2700	3	V	1 kHz, 80%AM	Pass	Pass	Pass	Pass
1400	2700	3	H	1 kHz, 80%AM	Pass	Pass	Pass	Pass

Table 20. Radiated Immunity, Test Results, GME Power Supply

Radio Frequency Electromagnetic Field



Photograph 6. Radio Frequency Electromagnetic Field, Test Setup, 80 MHz – 1 GHz



Photograph 7. Radio Frequency Electromagnetic Field, Test Setup, 1.4 GHz – 2.7 GHz

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 12), 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:	24°C
Relative Humidity:	34%
Atmospheric Pressure:	101.3 kPa

Environmental Conditions during EN 61000-4-2 Testing, CETUS Power Supply

Ambient Temperature:	20.6°C
Relative Humidity:	30%
Atmospheric Pressure:	101.9 kPa

Environmental Conditions during EN 61000-4-2 Testing, GME Power Supply

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): 02/21/11 and 03/25/11

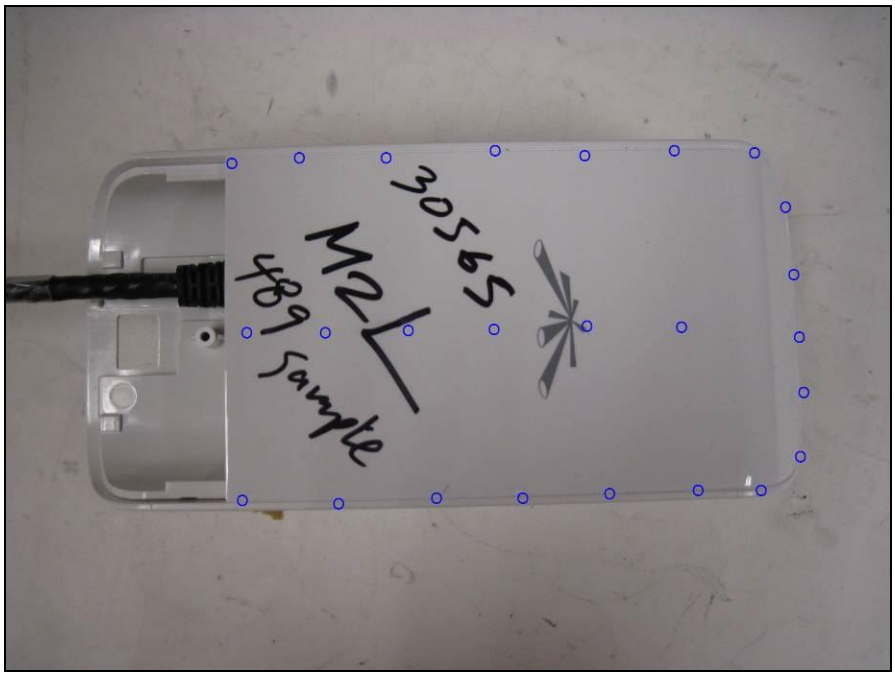
Discharge Type	Test Voltage (±kV)	Results				Anomalies
		Front	Back	Left	Right	
VCP	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	Random drop packets on LAN Line None
HCP	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	Random drop packets on LAN Line None
Contact Discharge	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	Random drop packets on LAN Line None
Air Discharge	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	Random drop packets on LAN Line
	6	PASS	PASS	PASS	PASS	Random drop packets on LAN Line
	8	PASS	PASS	PASS	PASS	Random drop packets on LAN Line

Table 21. Electrostatic Discharge, Test Results, CETUS Power Supply

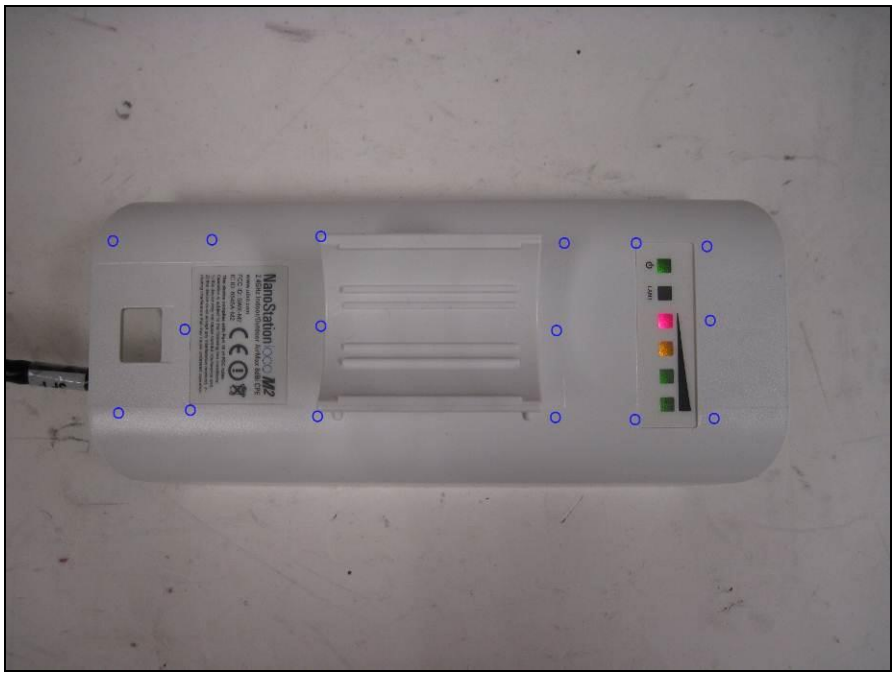
Discharge Type	Test Voltage (±kV)	Results				Anomalies
		Front	Back	Left	Right	
VCP	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	None
HCP	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	None
Contact Discharge	2	PASS	PASS	PASS	PASS	None
	4	PASS	PASS	PASS	PASS	None
Air Discharge	2	PASS	PASS	PASS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

Table 22. Electrostatic Discharge, Test Results, GME Power Supply

Electrostatic Discharge, Test Points



Photograph 8. ESD, Test Points, Antenna Front



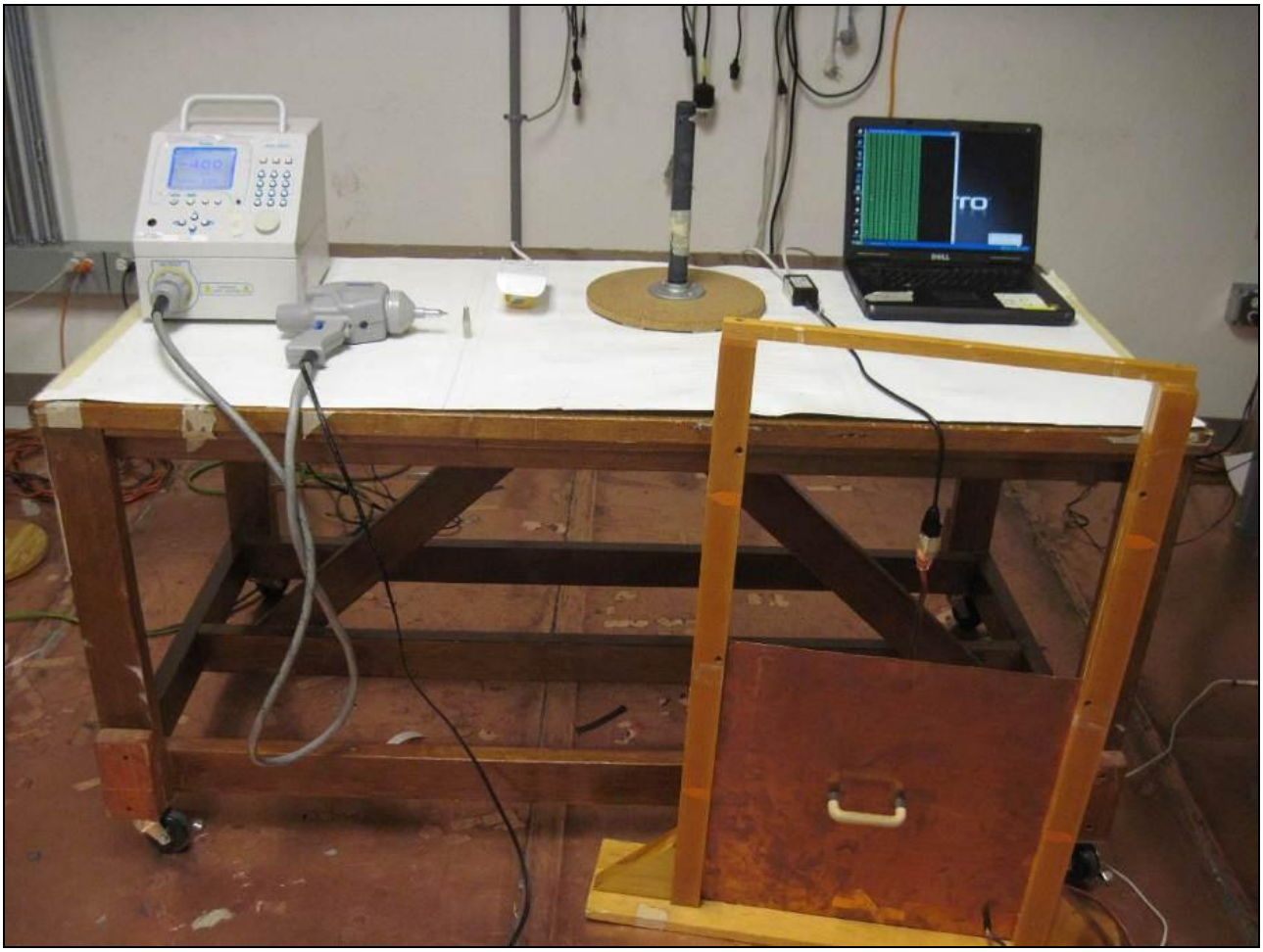
Photograph 9. ESD, Test Points, Antenna Back

O = Air Discharge

Photograph 10. ESD, Test Points 1

Photograph 11. ESD, Test Points 2

X = Contact Discharge



Photograph 12. Electrostatic Discharge, Test Setup

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 ± 1 kV applied to the AC power cables (plug type); ± 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 B 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 13). 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 EFT/B generator was operated to couple the required transient bursts to each line of the power input in common mode. Transient bursts were applied for a period not less than one minute with both positive transients and negative transients.

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.

Electromagnetic Compatibility Immunity

Fast Transient, Common Mode

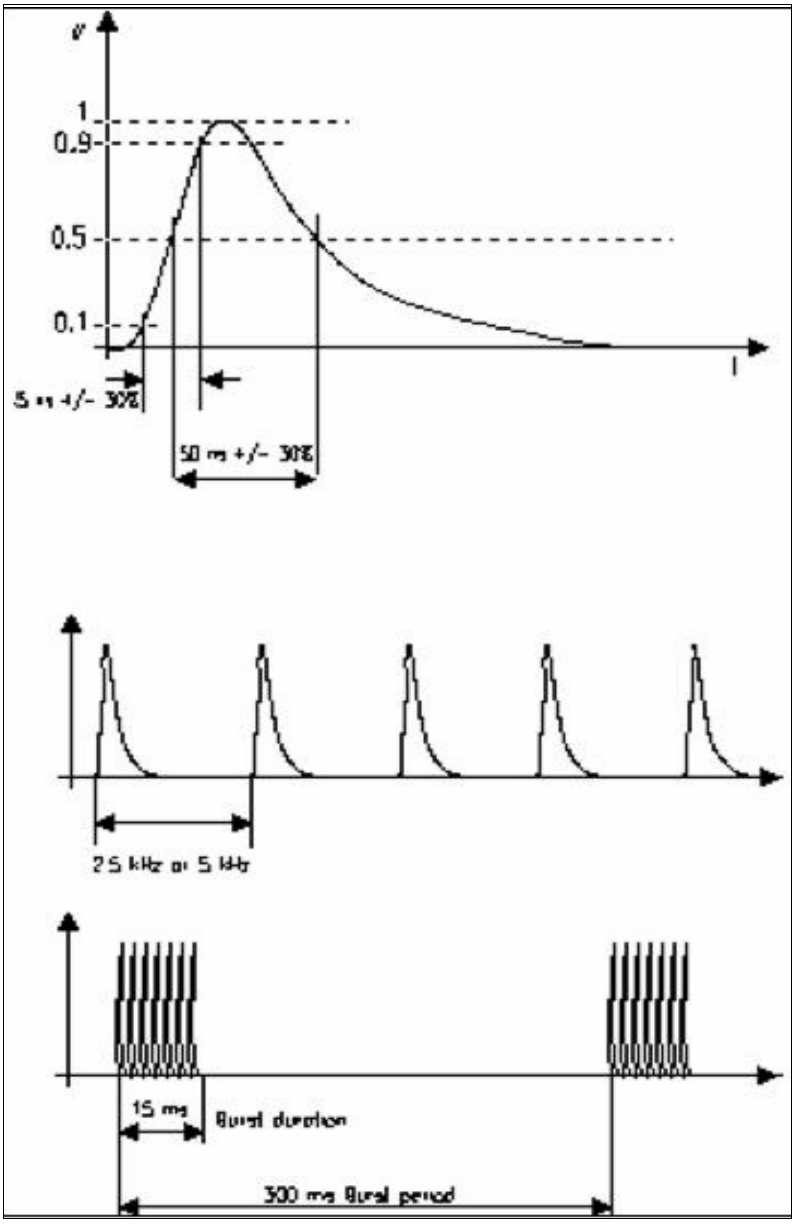


Figure 3. EN 61000-4-4 Test Waveform

Electromagnetic Compatibility Immunity

Fast Transient, Common Mode

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

Test Engineer(s): Lionel Gabrillo

Test Date(s): 04/05/11

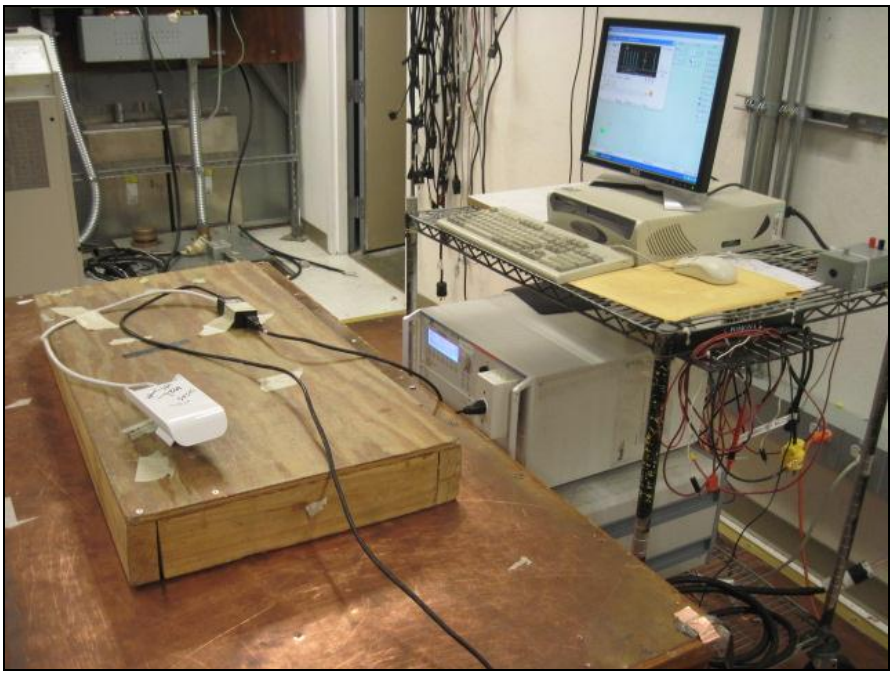
Port Name	Slot/EUT Side	Test Level	Result	Anomalies
AC Power				
Phase	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Neutral	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Ground	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Port Name	**Slot/EUT Side**	**Test Level**	**Result**	**Anomalies**
I/O Cables				
LAN Port	Bottom	±0.5 kV	Pass	No Anomalies

Table 23. Fast Transient, Test Results, CETUS Power Supply

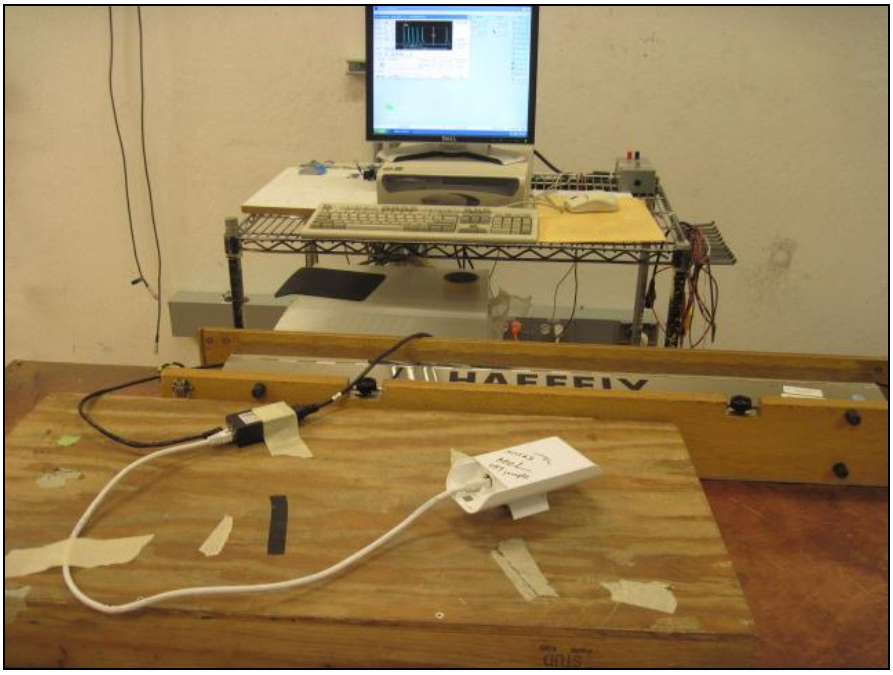
Port Name	Slot/EUT Side	Test Level	Result	Anomalies
AC Power				
Phase	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Neutral	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Ground	Bottom	±1 kV	Pass	Pinging stopped but came back to normal after the test.
Port Name	**Slot/EUT Side**	**Test Level**	**Result**	**Anomalies**
I/O Cables				
LAN Port	Bottom	±0.5 kV	Pass	No Anomalies

Table 24. Fast Transient, Test Results, GME Power Supply

Fast Transient, Common Mode



Photograph 13. Fast Transient, Common Mode, Test Setup, AC Mode



Photograph 14. Fast Transient, Common Mode, Test Setup, I/O Cables

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 15). 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): Joe Vang

Test Date(s): 04/20/11

Cable Ref. ID	Port Name On EUT	Severity (Vrms)	Modulation (Freq. & Type)	Results	Anomalies
	AC Port	3	1 kHz, 80%AM	Pass	No Anomalies
	PSU-LAN	3	1 kHz, 80%AM	Pass	No Anomalies

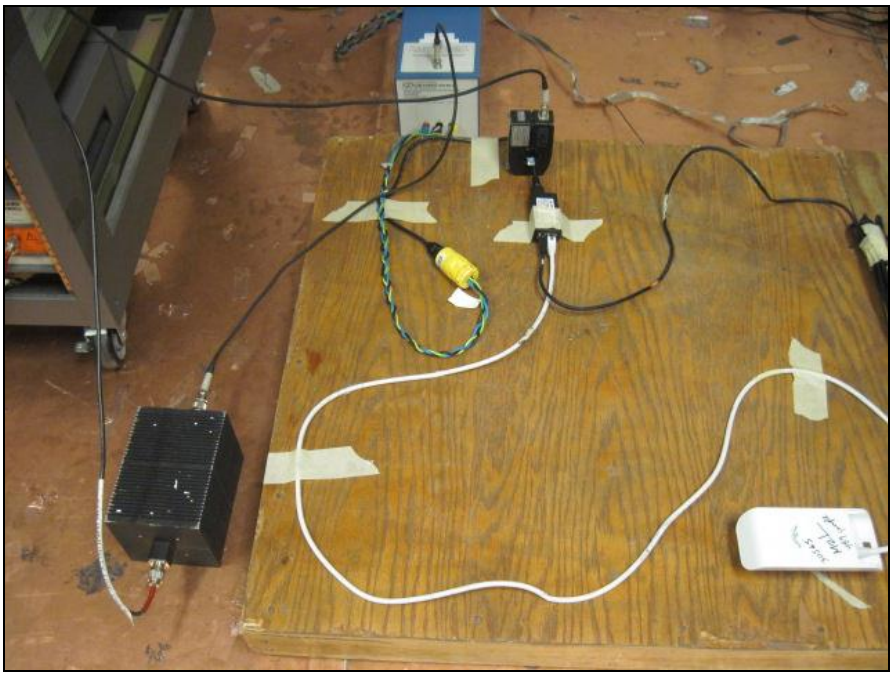
Table 25. Conducted Immunity, Test Results, CETUS Power Supply

Cable Ref. ID	Port Name On EUT	Severity (Vrms)	Modulation (Freq. & Type)	Results	Anomalies
	AC Port	3	1 kHz, 80%AM	Pass	No Anomalies
	PSU-LAN	3	1 kHz, 80%AM	Pass	No Anomalies

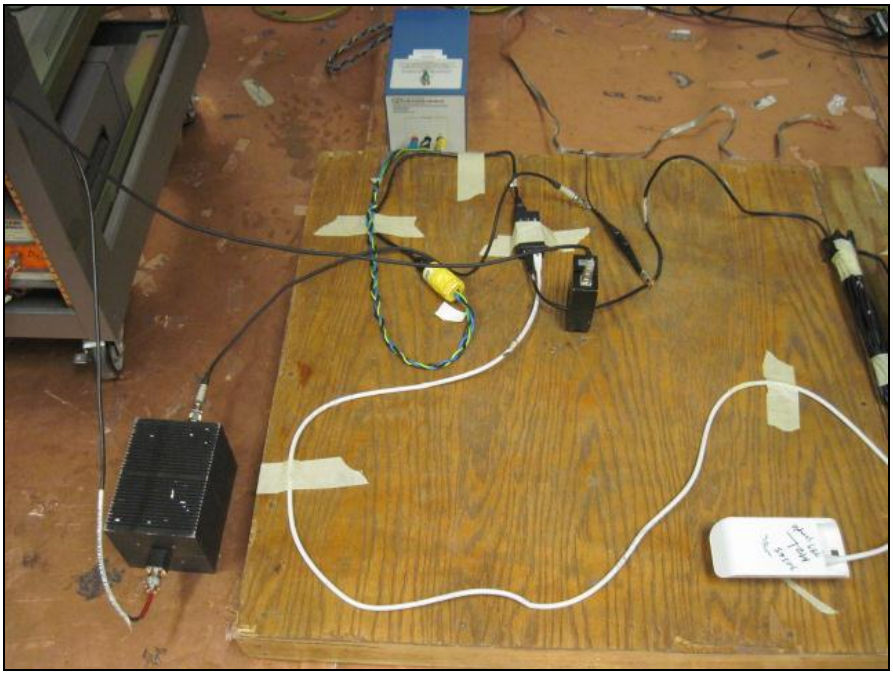
Table 26. Conducted Immunity, Test Results, GME Power Supply

Electromagnetic Compatibility Immunity

Radio Frequency, Common Mode



Photograph 15. Radio Frequency, Common Mode, Test Setup, Power Line



Photograph 16. Radio Frequency, Common Mode, Test Setup, I/O Line

Electromagnetic Compatibility Immunity

4.5 Voltage Dips and Short Interruptions

Test Requirement(s): **ETSI EN 300 489-1, Clause 9.7:**

Per *EN 61000-4-11*, the EUT shall be tested for the following voltage dips, interruptions and variations:

5.2.4.4 Voltage Dips and Short Interruptions		
Unit	**Test level and Characteristic**	**Performance Criterion**
Voltage reduction % Duration ms	>95 10	B
Voltage reduction % Duration ms	>95 20	B
Voltage reduction % Duration ms	30 500	C
Voltage reduction % Duration ms	>95 5000	C

Table 27. Voltage Dips and Short Interruptions Limits

Test Procedure: The EUT was placed on a non-metallic table and situated in the center of a GRP. The EUT was provided with AC power via the programmable power supply (See Photograph 17). The power supply was programmed to perform the applicable set of voltage dips, interruptions and variations. Each sequence was repeated three times to verify the results.

Results: The EUT as tested was found compliant with the requirements of Clause 9.7.

Test Engineer: Lionel Gabrillo

Test Date: 04/05/11

Test Type	Parameters	No of Rep.	Criterion Required	Criterion Achieved	Results	Anomalies
Voltage Dips	0% drop for 10 ms or 1/2 cycle	3	B	A	Pass	No Anomalies
Voltage Dips	0% drop for 20 ms or 1 cycle	3	B	A	Pass	No Anomalies
Voltage Dips	70% drop for 500 ms or 25 cycles	3	C	A	Pass	No Anomalies
Short Interrupts	0% drop for 5000 ms or 250 cycles	3	C	B	Pass	EUT turns off, but recovers with no intervention.

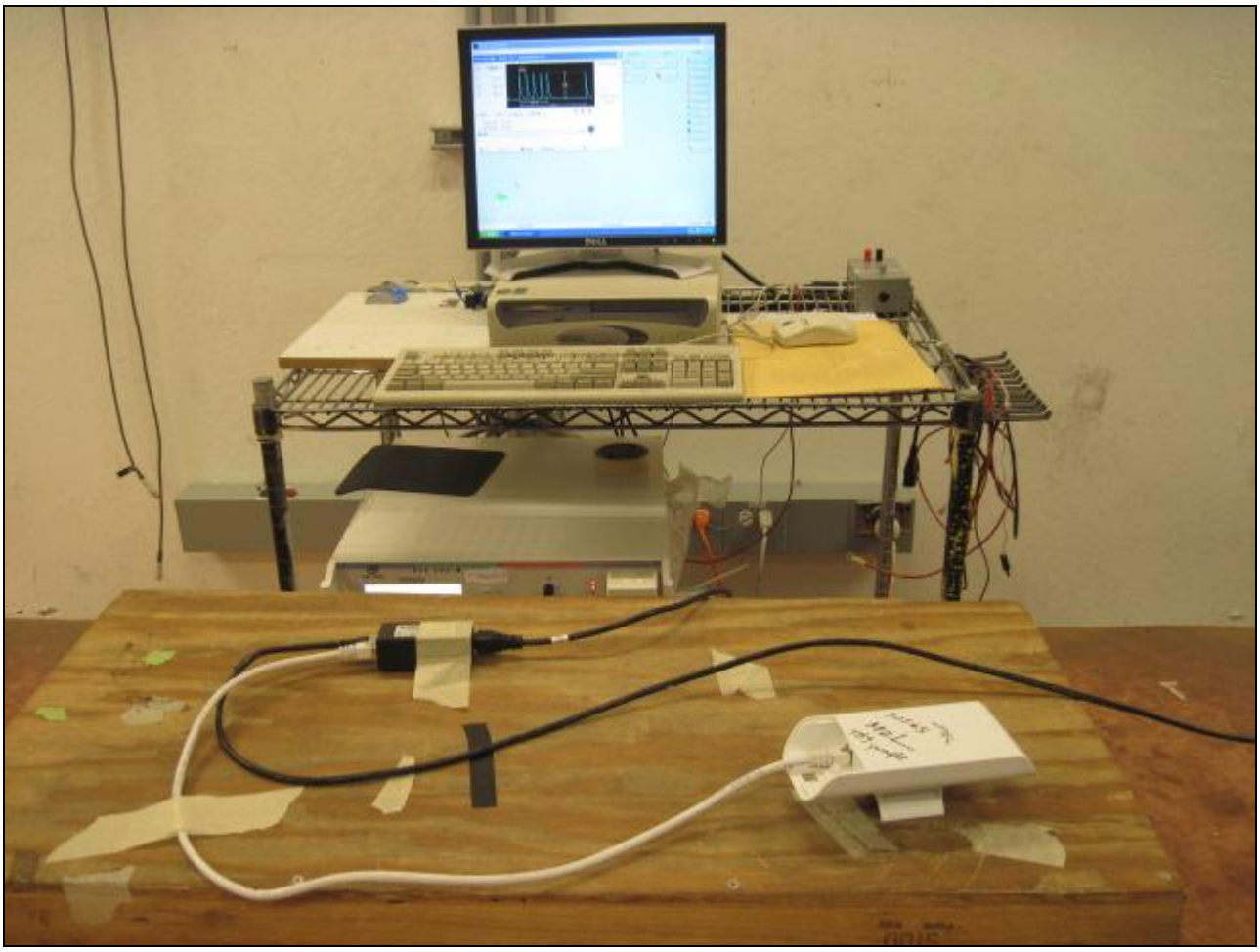
Table 28. Voltage Dips and Interruptions, Test Results, CETUS Power Supply

Test Type	Parameters	No of Rep.	Criterion Required	Criterion Achieved	Results	Anomalies
Voltage Dips	0% drop for 10 ms or 1/2 cycle	3	B	A	Pass	No Anomalies
Voltage Dips	0% drop for 20 ms or 1 cycle	3	B	A	Pass	No Anomalies
Voltage Dips	70% drop for 500 ms or 25 cycles	3	C	A	Pass	No Anomalies
Short Interrupts	0% drop for 5000 ms or 250 cycles	3	C	B	Pass	EUT turns off, but recovers with no intervention.

Table 29. Voltage Dips and Interruptions, Test Results, GME Power Supply

Electromagnetic Compatibility Immunity

Voltage Dips and Short Interruptions



Photograph 17. Voltage Dips and Interruptions, Test Setup

Electromagnetic Compatibility Immunity

4.6 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.

The EUT was tested with the surge waveforms shown on the following page, having an open circuit amplitude of ± 1 kV (differential mode), and ±2 kV (common mode) applied to the AC power cables. Performance Criterion A applies for AC power 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 18). 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.

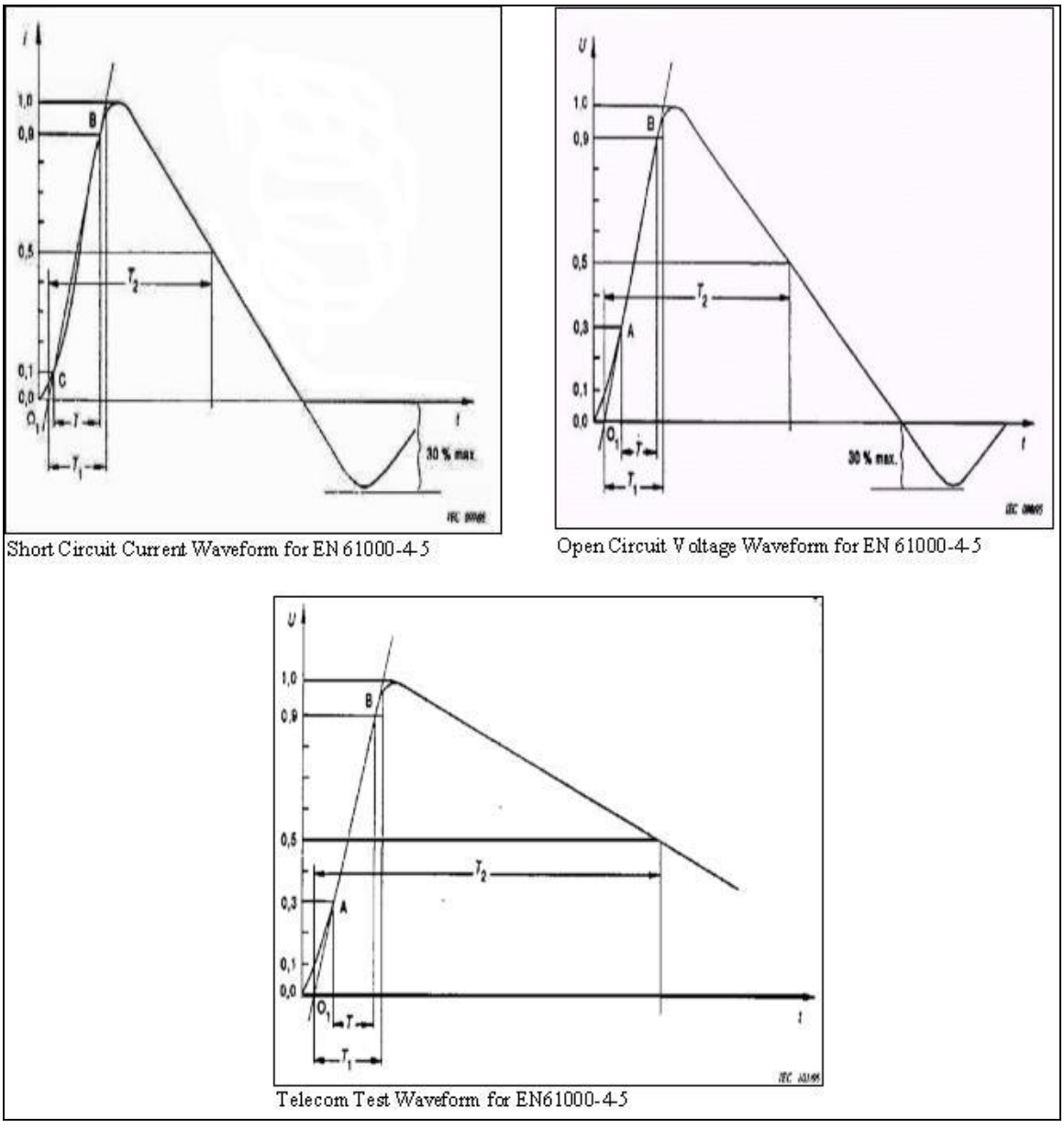
AC power [where applicable] was supplied to the EUT through the Combination Wave Generator. The combination wave generator was configured to produce the following output:

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 30. 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 Procedure (Continued): For AC power lines, the Combination Wave Generator was operated to couple the required surges between each EUT input power phase and ground, and from line to line. These three tests were performed with positive surges and negative surges, synchronized with the power input phase at 0°, 90°, and 270°. Throughout testing, the EUT was monitored closely for signs of susceptibility. For I/O port surges, surge waveforms were applied via a CDN, in accordance with *Section 7 of EN 61000-4-5*.

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

Test Engineer(s): Joe Vang

Test Date(s): 04/22/11

Port Name / Coupling	Phase	Test Level	Results	Anomalies
AC, Differential Mode				
Phase to Neutral	0, 90, 180, 270	±1.0 kV	pass	None
AC, Common Mode				
Phase to Ground	0, 90, 180, 270	±2.0 kV	pass	None
Neutral to Ground	0, 90, 180, 270	±2.0 kV	pass	None
Port Name / Coupling	Phase	Test Level	Results	Anomalies
IO, Differential Mode				
Phase to Neutral	n/a	±1.0 kV	pass	None

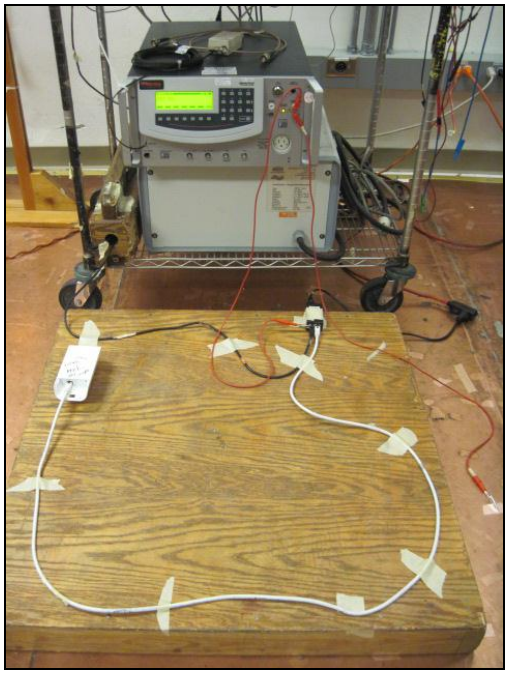
Table 31. Surges, Test Results, CETUS Power Supply

Port Name / Coupling	Phase	Test Level	Results	Anomalies
AC, Differential Mode				
Phase to Neutral	0, 90, 180, 270	±1.0 kV	pass	None
AC, Common Mode				
Phase to Ground	0, 90, 180, 270	±2.0 kV	pass	None
Neutral to Ground	0, 90, 180, 270	±2.0 kV	pass	None
Port Name / Coupling	Phase	Test Level	Results	Anomalies
IO, Differential Mode				
Phase to Neutral	n/a	±1.0 kV	pass	None

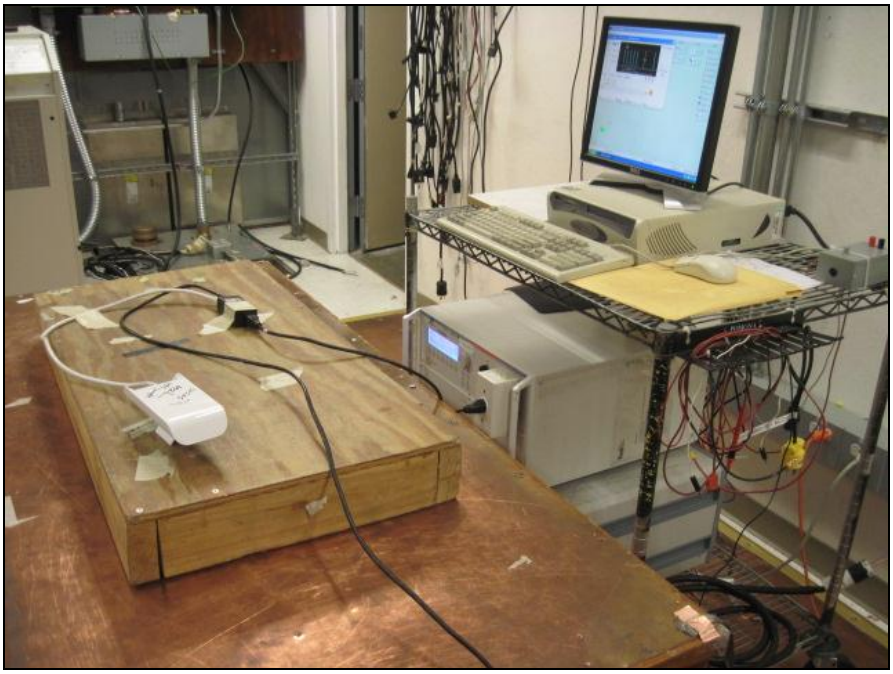
Table 32. Surges, Test Results, GME Power Supply

Electromagnetic Compatibility Immunity

Surges



Photograph 18. Surges, Test Setup, I/O Line



Photograph 19. Surges, Test Setup, Power Line

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): 03/23/11**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2671	TRANSIENT LIMITER	AGILENT TECHNOLOGIES	11947A	SEE NOTE	
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT	E4407B	07/13/2010	07/13/2011
1S2668	AMPLIFIER	SONOMA INSTRUMENTS	310 N	SEE NOTE	
1S2657	SCREEN ROOM	ETS LINDGREN	14W-2/2-0	SEE NOTE	
1S2507	LISN	SOLAR ELECTRONICS COMPANY	9252-50-R-24-BNC	02/17/2011	02/17/2012
Test Name: Harmonic Current Emissions Clause 8.5					**Test Date(s): 03/22/11**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2398	POWER MEASUREMENT UNIT	COMBINOVA	A300	03/31/2010	03/31/2011
Test Name: Voltage Fluctuations (Flicker) Clause 8.6					**Test Date(s): 03/22/11**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2398	POWER MEASUREMENT UNIT	COMBINOVA	A300	03/31/2010	03/31/2011
Test Name: Telecom Line Conducted Emissions Clause 8.7					**Test Date(s): 03/24/11**
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2671	TRANSIENT LIMITER	AGILENT TECHNOLOGIES	11947A	SEE NOTE	
1S2460	1-26GHZ SPECTRUM ANALYZER	AGILENT	E4407B	07/13/2010	07/13/2011
1S2668	AMPLIFIER	SONOMA INSTRUMENTS	310 N	SEE NOTE	
1S2657	SCREEN ROOM	ETS LINDGREN	14W-2/2-0	SEE NOTE	
1S2507	LISN	SOLAR ELECTRONICS COMPANY	9252-50-R-24-BNC	02/17/2011	02/17/2012
Test Name: Radiated Electromagnetic Field Clause 9.2					**Test Date(s): 04/27/11**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2576	AMPLIFIER (80M-1GHZ)	AMPLIFIER RESEARCH	500W1000A	SEE NOTE	
1S2264	CHAMBER 3	LINDGREN RF ENCLOSURES	IMMUNITY CHAMBER	07/29/2010	07/29/2011
1U0200	FIELD MONITOR	AR WORLDWIDE	FM 7004	SEE NOTE	
1S2674	FIELD PROBE	AMPLIFIER RESEARCH	FP7060	03/30/2011	03/30/2012
1S2401	BILOG ANTENNA	SCHAFFNER	CBL6140A	SEE NOTE	
1S2208	HORN ANTENNA	EMCO	3115	SEE NOTE	
1S2643	SIGNAL GENERATOR 40GHZ	ANRITSU	MG3694B	06/09/2010	06/09/2011
1S2478	TWT AMPLIFIER	COMM POWER INDUSTRIES	VZL6343J2	SEE NOTE	

Test Name: Electrostatic Discharge Immunity Clause 9.3					Test Date(s): 03/25/11
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2470	ESD DISCHARGE MODULE	NOISEKEN	ESS-2000	04/26/2010	04/26/2011
1S2491	GROUND PLANE #3	N/A	GROUND PLANE	SEE NOTE	
Test Name: Fast Transients Clause 9.4					**Test Date(s): 04/05/11**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2423	ULTRA COMPACT SIMLULATOR	EM TEST	UCS-500M-6A	SEE NOTE	
1S2490	GROUND PLANE 2	MET LABS	N/A	SEE NOTE	
1S2104	CLAMP, COUPLING, CAPACITIVE	HEAFELY	N/A	SEE NOTE	
Test Name: Radio Frequency, Conducted Continuous Clause 9.5					**Test Date(s): 04/20/11**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2491	GROUND PLANE 3	GROUND PLANE 3	GROUND PLANE 3	SEE NOTE	
1S2624	POWER LINE COUPLING DECOUPLING NETWORK	COM-POWER CORP.	CDN M3-25	SEE NOTE	
1S2514	3DB ATTENUATOR	JFW	50FH-003-300	SEE NOTE	
1S2390	SYNTHESIZED SIGNAL GENERATOR	GIGATRONICS	6061A	06/24/2010	06/24/2011
1S2578	AMPLIFER (10K-250MHZ)	AMPLIFIER RESEARCH	75A250A	SEE NOTE	
1S2394	CURRENT PROBLE	FCC	F-120-9A	11/22/2010	11/22/2011
1S2671	TRANSIENT LIMITER	AGILENT TECHNOLOGIES	11947A	SEE NOTE	
1S2649	SPECTRUM ANALYZER 9KHZ-1.5GHZ	AGILENT	E4401B	SEE NOTE	
1S2621	CI FIXTURE	MET LABS	N/A	11/22/2010	11/22/2011
Test Name: Voltage Dips and Short Interruptions Clause 9.7					**Test Date(s): 04/05/11**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2423	ULTRA COMPACT SIMLULATOR	EM TEST	UCS-500M-6A	SEE NOTE	
1S2490	GROUND PLANE 2	MET LABS	N/A	SEE NOTE	
Test Name: Surges Clause 9.8					**Test Date(s): 04/22/11**
MET Asset #	**Equipment**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
RENTAL	SURGE GENERATOR	THERMO SCIENTIFIC	EMC PRO PLUS GENERATOR	06/29/2010	06/29/2011
1S2604	OSCILLOSCOPE	TEKTRONIX	TDS7104	05/21/2010	05/21/2011
1S2490	GROUND PLANE 2	MET LABS	N/A	01/22/2010	01/22/2011

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