Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, MI 49047

EMC Test Report

#090123FX
Issued 8/24/09

Regarding the FCC 15.249 testing of

End Unit

Model Number: 31570001

Category: **2.4 GHz Intentional Radiating Transceiver Device**

Judgments: **FCC Article 15.249, FCC Part 15 Class B – Compliant**

NVLAP LAB CODE 200129-0

Prepared for: *Bob Porter*
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Test Date(s): 3/17/09-8/12/09

Report prepared by:

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Gordon Helm, NCE
Test Engineer, AHD

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Statements concerning this report

NVLAP Accreditation: NVLAP Lab Code 200129-0
The scope of AHD accreditation are the test methods of:

IEC/CISPR 22:	Limits and methods measurement of radio disturbance characteristics of information technology equipment.
FCC Method – 47 CFT Part 15:	Digital Devices.
AS/NZS 3548:	Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment.
IEC61000-4-2 and Amend.1:	Electrostatic Discharge Immunity
IEC61000-4-5:	Surge Immunity

Test Data:
This test report contains data included in the scope of NVLAP accreditation.

Subcontracted Testing:
This report contains data recorded at the University of Michigan Radiation Laboratory. The University of Michigan test facility is located at 8501 Beck Road, Belleville, Michigan 48111. This test facility has been fully described and accepted by the FCC and Industry Canada. This facility was utilized to measure emissions occurring at frequencies greater than 6GHz.

Test Traceability:
The calibration of all measuring and test equipment and the measured data using this equipment are traceable to the National Institute for Standards and Technology (NIST).

Limitations on results:
The test results contained in this report relate only to the Item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require an evaluation to verify continued compliance.

Limitations on copying:
This report shall not be reproduced, except in full, without the written approval of AHD.

Limitations of the report:
This report shall not be used to claim product endorsement by NVLAP, FCC, or any agency of the US Government.

Statement of Test Results Uncertainty:
Following the guidelines of NAMAS publication NIS81 and NIST Technical Note 1297, the Measurement Uncertainty at a 95% confidence level is determined to be: +/-1.4 dB

Retention of Records:
For equipment verified to comply with FCC regulations, the manufacturer is obliged to retain this report with the product records for ten years following the manufacture of the equipment that was tested.

For equipment verified to comply with RSS-210, the manufacturer is obliged to retain this report with the product records for as long as the model is being marketed in Canada.

FCC Required user statements:

Applies to: [Class B Digital Device or Peripheral].

For products satisfying the FCC Part 15 Class B requirements the following are to be satisfied:

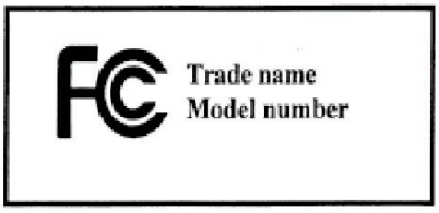
1. The following statement is required to be labeled on the product or, if the device is too small, in the user's manual:

   This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2. A statement is required to be placed in the User's Manual shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
3. The User's Manual shall include this or similar statement:

   NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
   - *Reorient or relocate the receiving antenna.*
   - *Increase the separation between the equipment and receiver.*
   - *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
   - *Consult the dealer or an experienced radio/TV technician for help.*

4. For products certified using the Declaration of Conformity approach,
   a. The FCC conformity LOGO is to be placed on the Class B Digital Device.



   b. The FCC requires a Compliance Information statement (Declaration of Conformity) to accompany each product to the end user.

Summary of Results

1. The device model number 31570001 was tested for compliance with FCC Regulations, Part 15, SubPart C.
2. The system tested is compliant to the requirement of CFR 47, FCC Part 15, SubPart C for operation in the 2400-2483.5 MHz frequency band, (Article 15.249).
3. These tests were performed at AHD EMC Laboratory following the procedures outlined in ANSI C63.4.
4. The test results apply to model 31570001
5. The equipment under test was received on 3/17/09 and this test series commenced on 03/17/09.
6. In 120VAC 60Hz operation, the conducted emission level nearest the limit during normal tx / rx operation occurred at 160 KHz. The signal was measured to be 9.15 dB below the Class B Quasi-Peak limit and 37.61 dB below the Class B Average limit when measuring neutral to ground.
7. The spurious radiated emission level nearest the limit during normal tx / rx operation occurred at 71.78 MHz vertically polarized. This signal was measured to be 6.56 dB below the Class B Quasi-peak limit.
8. The radiated fundamental Local Oscillator emission level nearest the limit occurred at 2410 MHz. The signal was measured to be 25.50 dB below the FCC class B quasi-peak limit.
9. The radiated harmonic Local Oscillator emission level nearest the limit occurred 4948 MHz. This signal was measured to be 9.10 dB below the FCC class B quasi-peak limit.
10. All radiated fundamental signals were measured within the FCC 15.249 band limits of 2400 MHz and 2483 MHz.
11. A maximized data rate mode was used to measure transmit power in peak detector mode, therefore a correction factor corresponding to the normal operational duty cycle is required to correlate peak measurements to the limits expressed in terms of average detection. The width of a transmitted packet was measured to be 12.17 mSec. The time period from one packet to the next was measured to be 353.64 mSec. Over the FCC 15.35c specified 100 mSec period, the packet width represents a 12.17% duty cycle, or –18.29 dB. The manchester encoding scheme used within the data packet further reduces the duty cycle to 6.09%, leaving a –24.29 dB attenuation factor. This excedes the maximum allowed peak to average limit of 20 dB (FCC 15.35b), so a -20 dB correction factor is used to calculate average values from peak measurements.
12. The radiated fundamental transmit emission level nearest the limit occurred at 2409.95 MHz. The field strength level of the fundamental was observed to be 8.07 dB below the average limit of 94dBuV/m (50,000uV/m). The EUT was positioned on the END orientation and the receive antenna oriented in the Vertical polarization.
13. The worst case average transmit measurement at 2409.95 MHz of 85.93dB minus 50dB equals 35.93dB. This represents greater attenuation than the spurious limit of 54dB.

Therefore the spurious limit of 54 dB is used for determining compliance of band edge signals to the FCC 15.249d standard.

14. The radiated band edge transmission level nearest the limit occurred at 2400 MHz. The field strength level was observed to be 6.4 dB below the average limit of 54 dBuV/m. The measurements were taken in the worst case END orientation and Vertical polarization.
15. The radiated second harmonic transmit emission level nearest the limit occurred at 4819.93 MHz. The field strength level was observed to be 11.9 dB below the average limit of 54dBuV/m (500uV/m). The EUT was positioned on the SIDE orientation and the receive antenna oriented in the Horizontal polarization.
16. The radiated upper level harmonic transmit emission level nearest the limit occurred at 12050 MHz. The field strength level was observed to be 30.64 dB below the average limit of 54 dBuV/m (500uV/m).
17. The Frequency Stability was measured to be within the limits of +/-.001% by a margin of +0.0005% over a temperature range of –11 deg C to + 50 deg C.
18. The Frequency Stability was measured to be within the limits of +/-.001% by a margin of +0.0009% over a supply voltage range of 48VDC to 12VDC.

Changes Made to Achieve Compliance:

1. 3 Ohm Resistor in Series with Power Supply
2. Test performed with 8 Ohm load configuration
3. Control software adjusted to support 192 Watt Max load dissipation
4. Sheet metal backing plate added to rear of unit

EUT Descriptions

Model: End Unit

Model number: 31570001

Serial/ID No: 0609K000087, 0609K000088

Description: Solar Array Management System End Unit

Antenna: Integrated on PCB

PCB: AMPT 3307003 Rev C

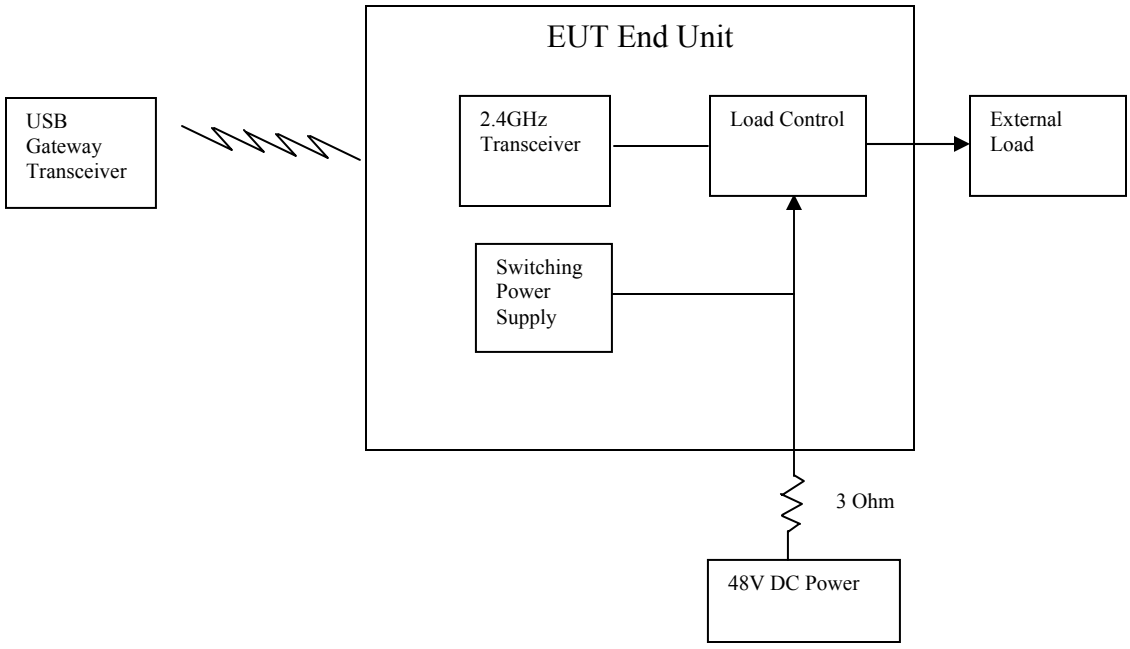
Specifications:

Input Power: 48 VDC

Outputs Signals: DC power to external load, 2.4 GHZ Transmit

Input Signals: 2.4 GHz Receive

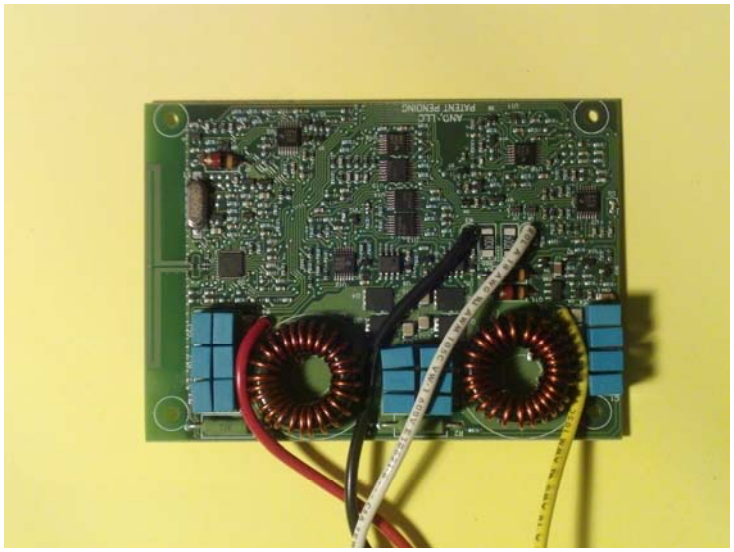
EUT Block Diagram:



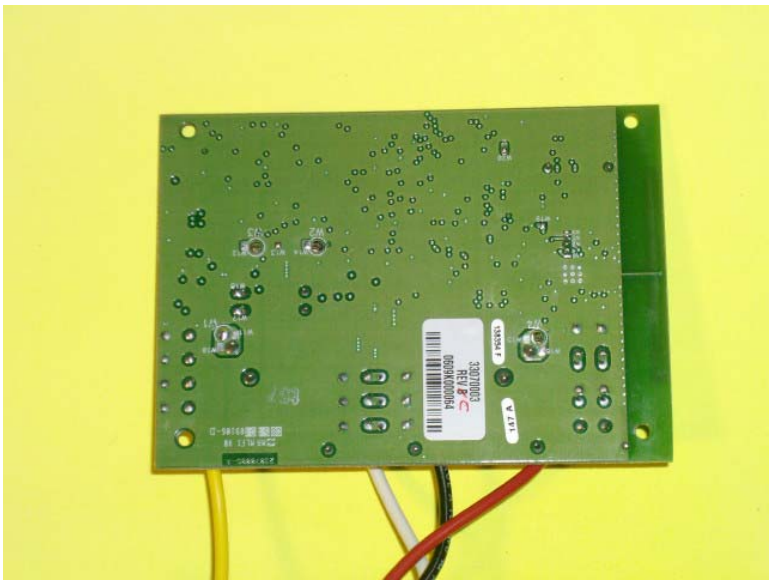
EUT Pictures

Exterior View

Interior PCB Top View

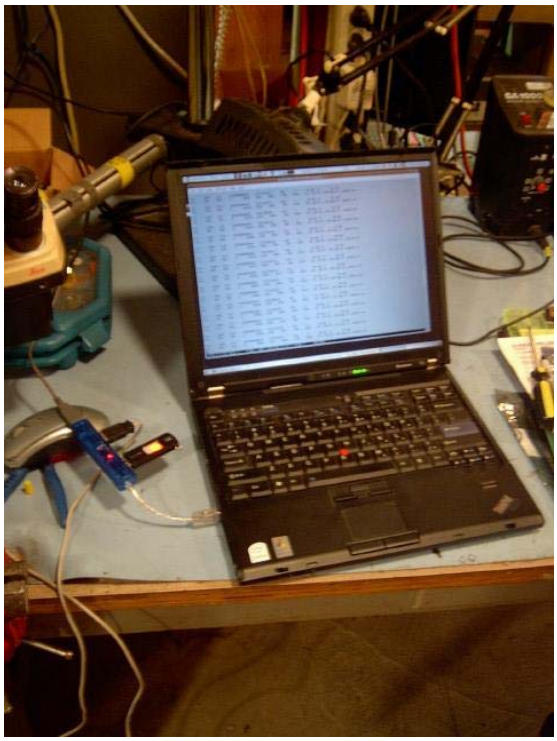


Interior PCB Bottom View



USB Gateway Device View

Gateway Control Application View

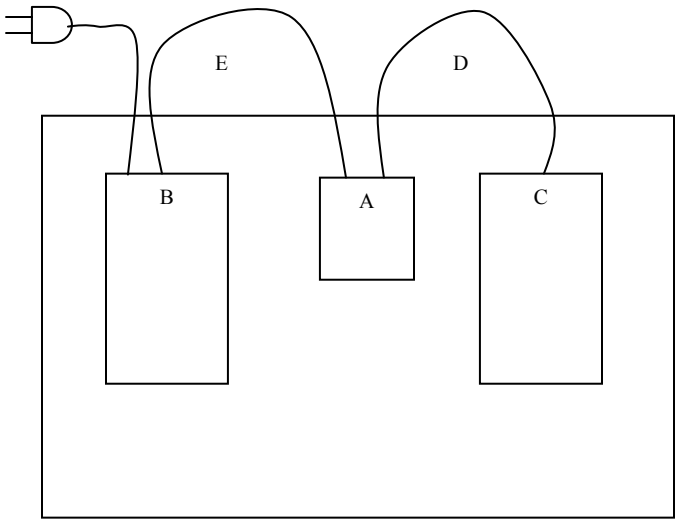


Equipment Test Setup:

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	End Unit Transceiver	31570001	0609K000087, 0609K000088	2.4 GHZ TRANSCEIVER
B	Power Supply	Kempco	ATE-55-5M	1 Meter Shielded
C	Load Unit	8 ea - Dale 1 Ohm Resistor Array	RE75G1R00	CAL RMC50030W 1%
D	Load Cable			2 Meters
E	Power Supply DC Cable			2 Meters

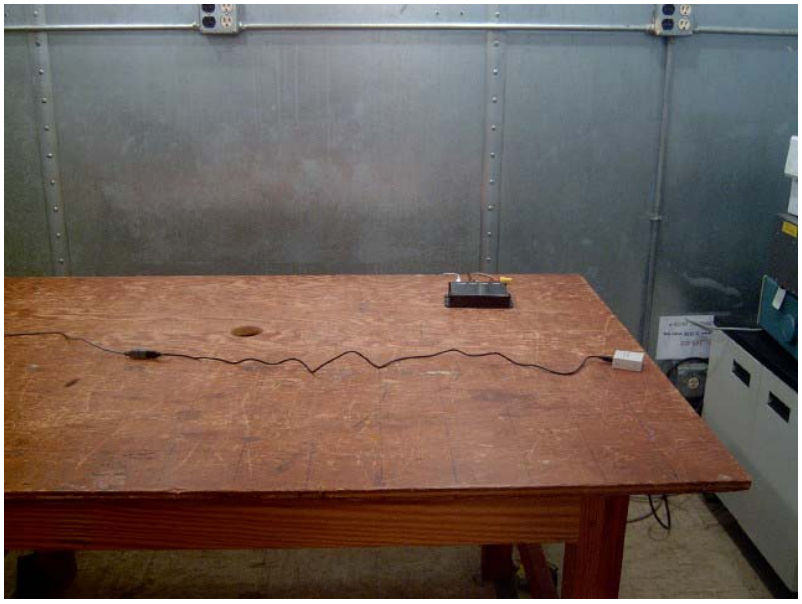
Block Diagram



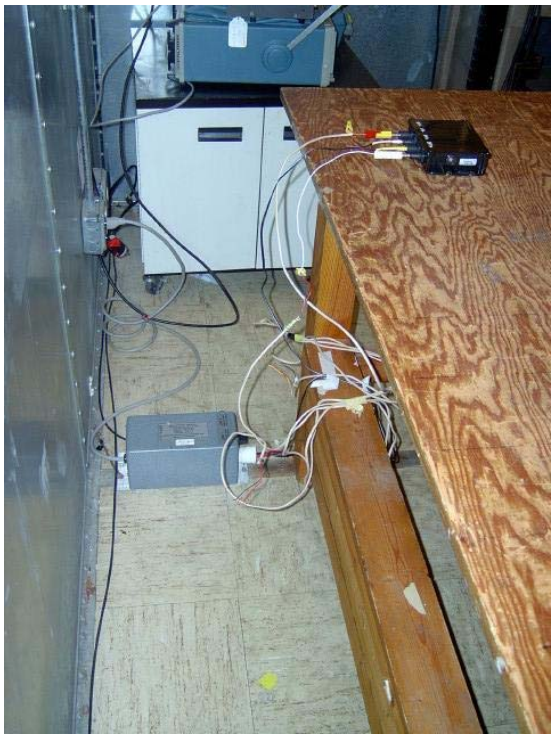
Setup Pictures

Spurious Radiated Prescreen Setup

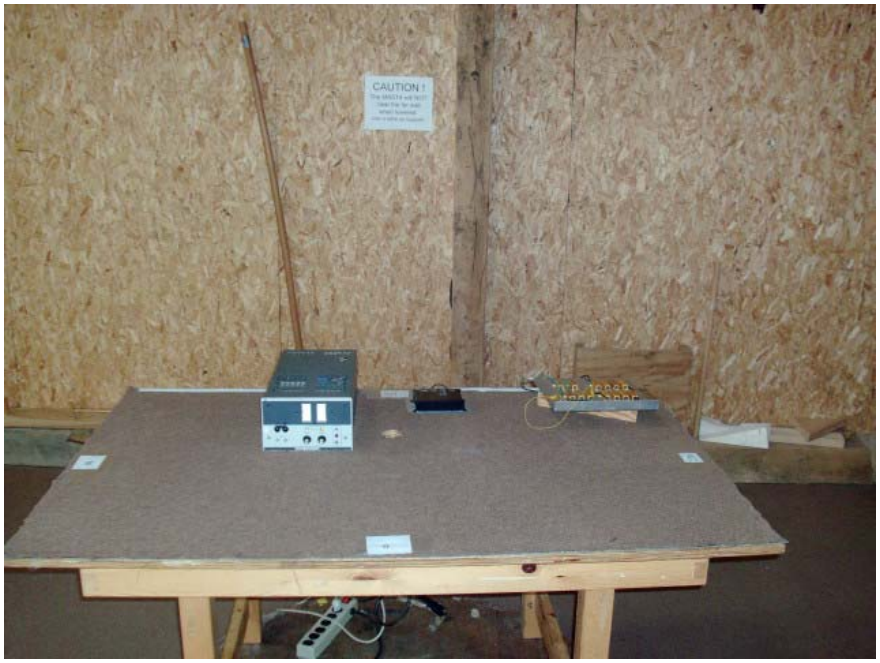
Conducted Setup Front View



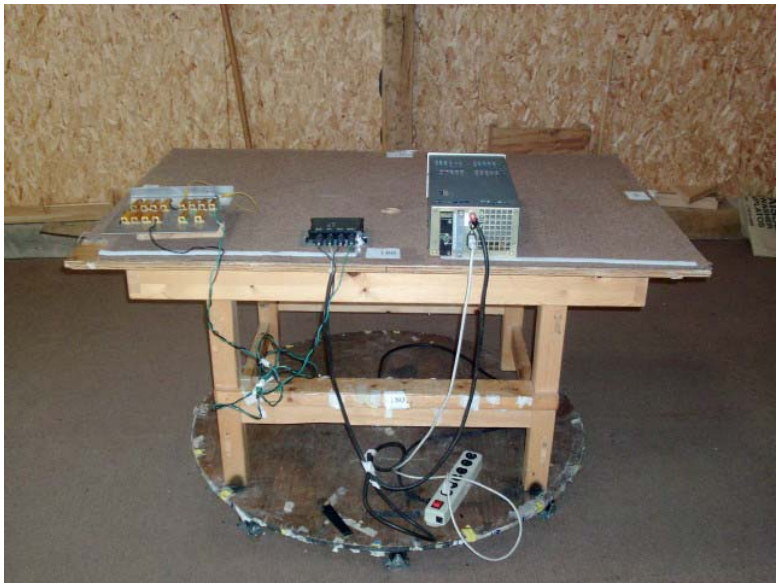
Conducted Setup Rear View



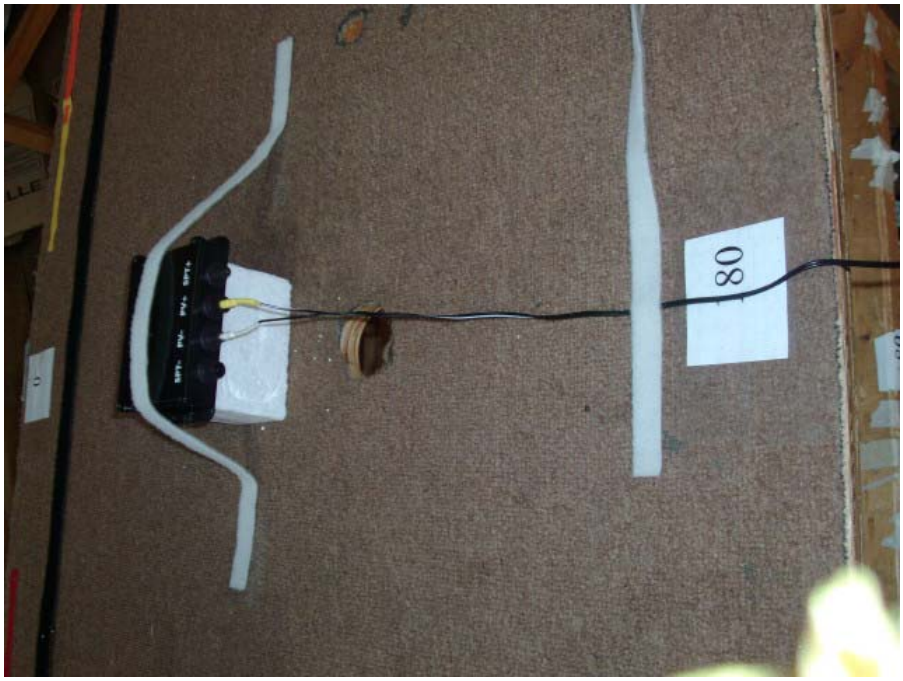
Spurious and Rx Radiated Setup Front View



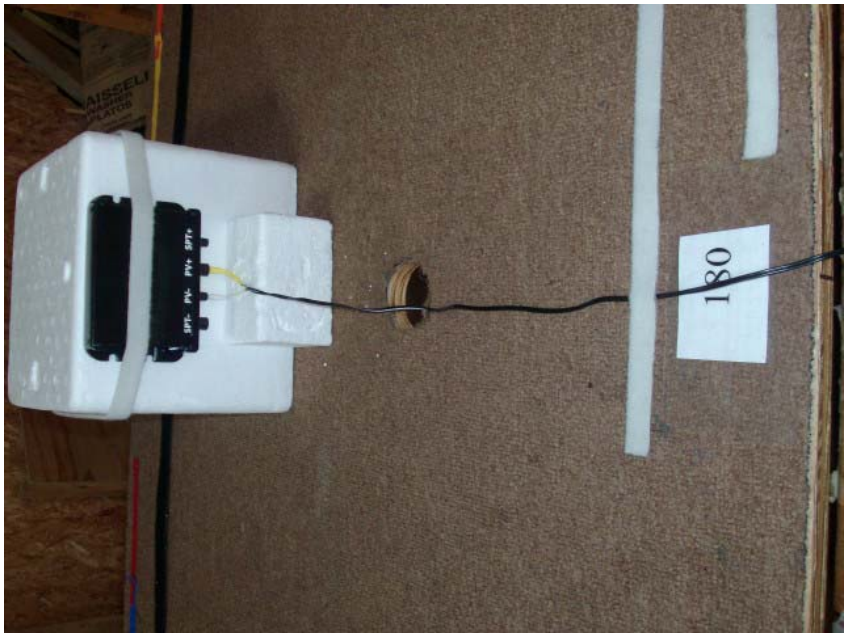
Spurious and Rx Radiated Setup Rear View



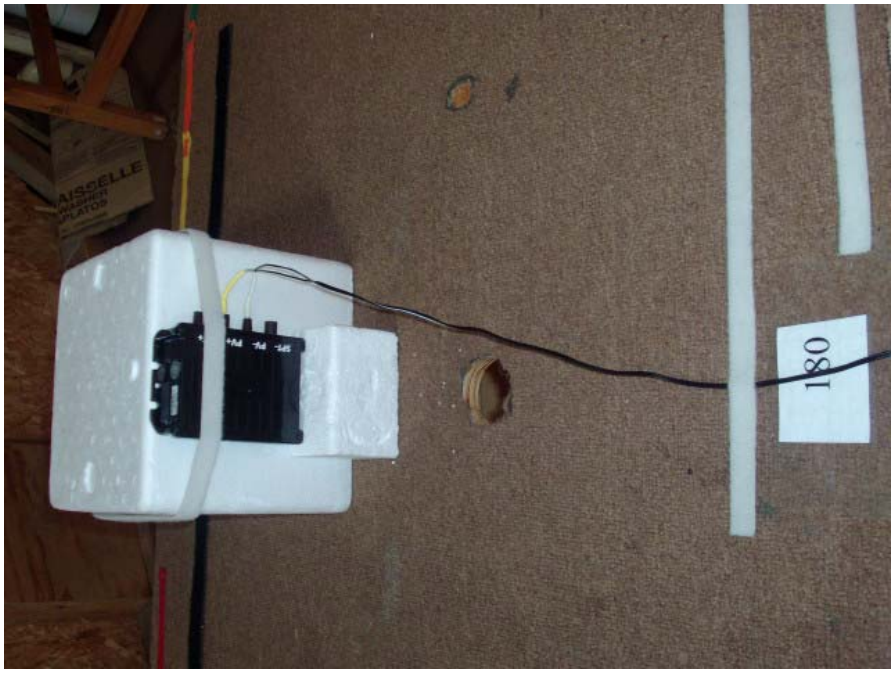
Transmit Setup Front Orientation



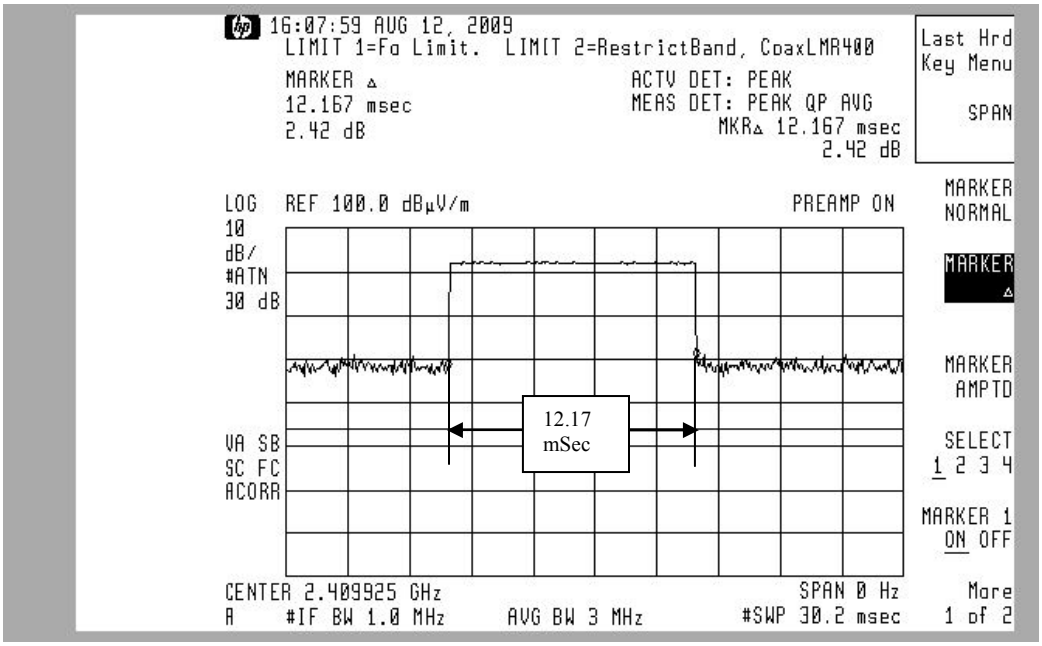
Transmit Setup End Orientation



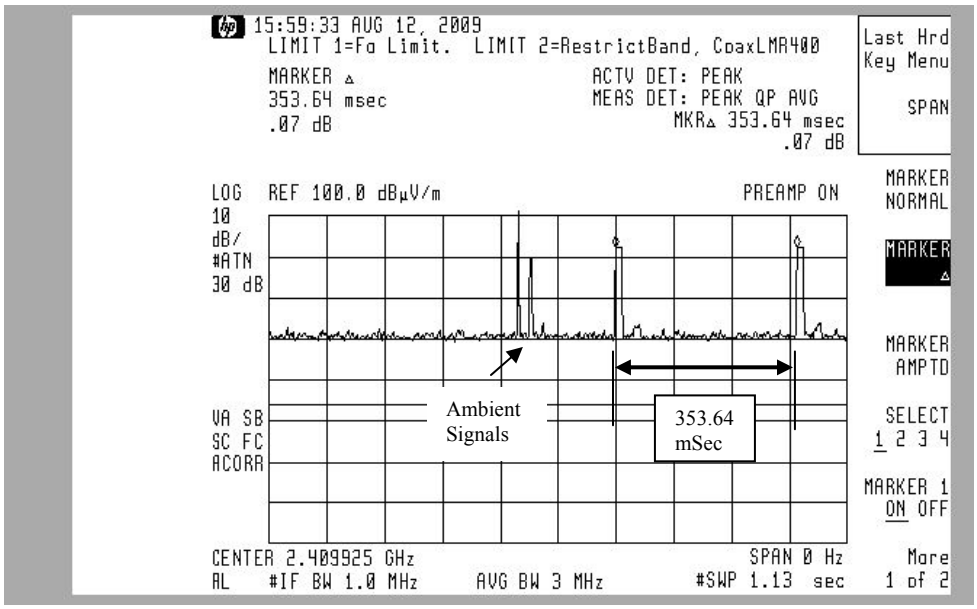
Transmit Setup Side Orientation



Transmit Duty Cycle Pulse Width Plot



Transmit Duty Cycle Period Plot



Measurement Report

Standards Applied to Test

ANSI C63.4 – 2003
CFR47 FCC Part 15, SubPart B, Class B limits
AHD/SEI test procedures TP0101-01, TP0102-01 / xxxxx

Equipment Configuration

For the testing, the placement of the EUT and the support equipment was selected to –

- Be a representation of a configuration typical of user installation, and
- Comply with the minimum system configuration of ANSI C63.4.

Test Methodology

Line Conducted:

Detailed Line Conducted test methodology is located in Appendix A.

Conducted testing was performed in both transmit and receive modes.

The cable losses of the coax used in line conducted testing are charted in this appendix.

Radiated

Spurious, transmit, and receive radiated testing was performed at a 3 meter open field test site, and completed according to the procedures in FCC 15, SubPart B with supporting instructions from ANSI C63.4. Please reference Appendix A for further details on Test Methodology.

A scan of the EUT was made in a shielded room to study the emission profile of this EUT. This scan indicated low level spurious emissions from the unit.

The suspect spurious signals recorded in the shielded room prescan for each module were then measured at the 3-meter open area test site. Spurious radiated emissions were measured in normal operating tx/rx mode.

For transmit signal strength measurement, the EUT was configured to operate in a maximized packet rate mode and measurements were taken at the mid-range fundamental and second harmonic frequencies (2442, 4884 MHz) in two polarizations (horizontal, vertical) and three orientations (flat, side, and end.) This was done to determine the EUT orientation that maximized emissions.

Once positioned in the maximized orientation, the EUT was tested at the low (2410 MHz), mid range (2442 MHz), and high (2474 MHz) operating frequencies within the EUT's operating range.

Also while positioned in a maximized orientation, bandedge (2400 and 2483 MHz) measurements were taken to ensure compliance with FCC 15.249d requirements.

Because maximized packet rate mode was utilized to test the device, zero span (time scale) measurements were taken to determine PWM duty cycle attenuation over a 100 mSec period. Based on these findings, the maximized data rate mode (peak) measurements were then compensated –20dB to provide average transmit signal strength for comparison to FCC limits.

Upper level harmonics were measured to10 harmonics (24 GHz) over the total range of operating frequencies. Worst case signal conditions were recorded at harmonics of the low, mid, and high operating range frequencies.

For receive operation, the EUT was exercised at the low (2410 MHz), medium (2442 MHz), and high (2474 MHz) frequencies within the EUT's operating range, as well as 5 harmonics (12 GHz) of those frequencies. Averaging and peak detection methods were used and evaluated against averaging based limits. Worst case signal conditions were recorded.

Tx and Rx Harmonics over 6 GHz were measured at the U of M test Site (see Appendix.)

The frequency stability of the device was also measured within a temperature range of –20C to + 50C, and a voltage range of 48VDC down to 11 VDC .

The EUT under test was placed per ANSI C63.4

The EUT was exercised as follows:

1. Device was powered via external power supply
2. The device was activated via Gatway Transceiver Control Application
3. Receive Operation was evidenced by Local Oscillator signal
4. Transmit Operation was evidenced by Transmit Signal

The pictures, in the preceding pages, show the position of the equipment and cabling that produced the maximum signal level.

Variance from Test Procedure:

None

Test Data

Line Conducted:

NEUTRAL to Ground Measurement.
Class B Plot of Peak Values

NEUTRAL to Ground Conducted
Class B Tabulated Measurements

Frequency	dBuV Reading		FCC / EN55022 dBuV Class B Limit		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
0.16	**56.39**	**17.93**	65.54	55.54	9.15	37.61
0.18	**51.84**	**10.90**	64.34	54.34	12.50	43.44
0.22	**46.30**	**7.83**	62.67	52.67	16.37	44.84
0.33	**33.41**	**-1.65**	59.44	49.44	26.03	51.09
10.97	**34.34**	**31.60**	60.00	50.00	25.66	18.40
23.73	**21.36**	**16.12**	60.00	50.00	38.64	33.88

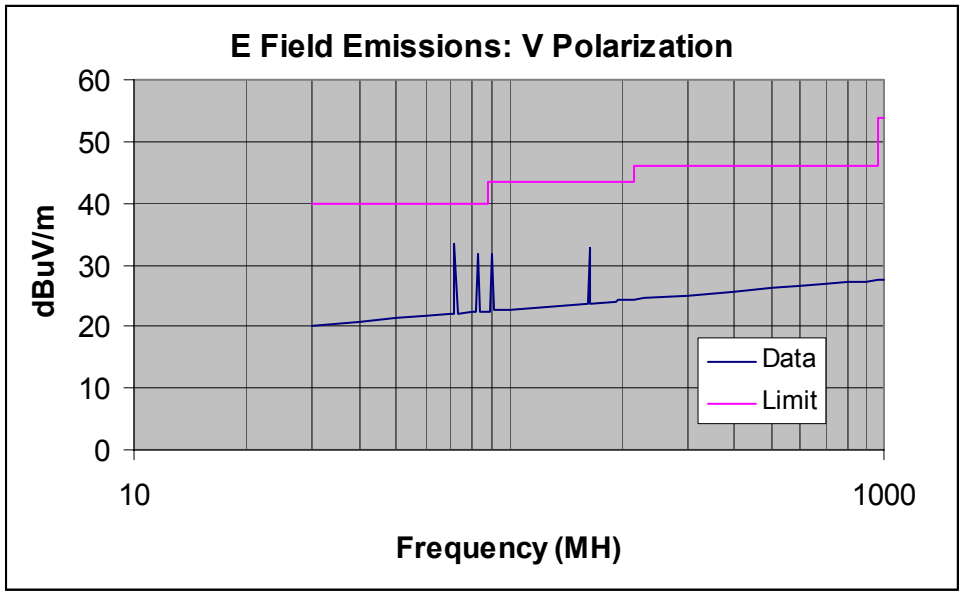
PHASE to Ground Measurement.
Class B Plot of Peak Values

PHASE to Ground Conducted
Class B Tabulated Measurements

Frequency	dBuV Reading		FCC / EN55022 dBuV Class B Limit		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
0.16	**55.19**	**14.55**	65.40	55.40	10.21	40.85
0.18	**52.04**	**11.27**	64.58	54.58	12.54	43.31
0.22	**46.58**	**8.27**	62.90	52.90	16.32	44.63
0.33	**31.65**	**0.85**	59.34	49.34	27.69	48.49
10.86	**32.86**	**29.71**	60.00	50.00	27.14	20.29
23.98	**29.34**	**24.79**	60.00	50.00	30.66	25.21

Radiated Spurious Emissions

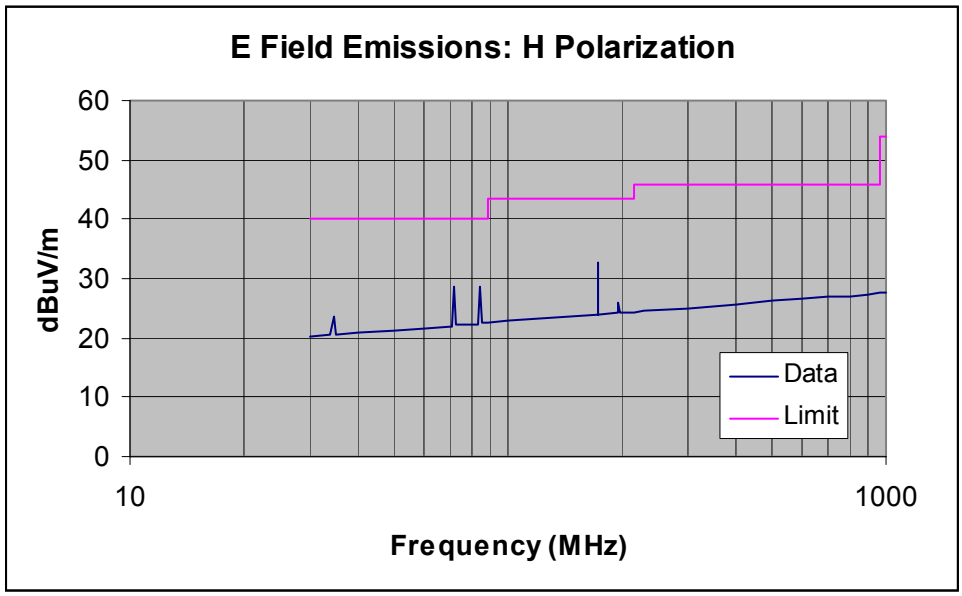
Vertically polarized
Class B Graph of Spurious Quasi-Peak Measurements



Mode Class B Tabulated Spurious Quasi-Peak Measurements

Frequency	Corrected Quasipeak Measurement	Turntable Azimuth	Antenna Height	FCC Class B Limit	Margin Class B
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
71.78	**33.44**	**270**	**1.0**	**40.00**	**6.56**
82.86	**31.66**	**270**	**1.0**	**40.00**	**8.34**
89.90	**31.93**	**270**	**1.0**	**43.50**	**11.57**
164.08	**32.90**	**100**	**1.0**	**43.50**	**10.60**
193.88	**23.22**	**0**	**1.0**	**43.50**	**20.28**

Horizontally Polarized
Class B Graph of Spurious Quasi-Peak Measurements



Class B Tabulated Quasi-Peak Measurements

Frequency	Corrected Quasipeak Measurement	Turntable Azimuth	Antenna Height	FCC Class b Limit	Margin
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
34.59	**23.62**	**0**	**2.0**	**40.00**	**16.38**
71.77	**28.74**	**260**	**2.7**	**40.00**	**11.26**
84.00	**28.60**	**240**	**2.3**	**40.00**	**11.40**
172.57	**32.53**	**260**	**1.0**	**43.50**	**10.97**
195.44	**26.00**	**240**	**1.7**	**43.50**	**17.50**

Radiated Receive Local Oscillator Emissions

Vertically Polarized
Class B Tabulated Quasi-Peak Measurements

Frequency	Corrected Peak Measurement	Turntable Azimuth	Antenna Height	FCC Class B Average Limit	Margin Class B
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
2410.00	**28.50**	**-**	**1.0**	**54.00**	**25.50**
2442.00	**27.93**	**-**	**1.0**	**54.00**	**26.07**
2474.00	**27.80**	**-**	**1.0**	**54.00**	**26.20**
4819.00	**44.66**	**-**	**1.0**	**54.00**	**9.34**
4884.00	**44.81**	**-**	**1.0**	**54.00**	**9.19**
4984.00	**44.90**	**-**	**1.0**	**54.00**	**9.10**

Frequency	Corrected Average Measurement	Turntable Azimuth	Antenna Height	FCC Class B Average Limit	Margin Class B
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
7230.00	**17.34**	**-**	**1.0**	**54.00**	**36.66**
7326.00	**17.12**	**-**	**1.0**	**54.00**	**36.88**
7422.00	**17.70**	**-**	**1.0**	**54.00**	**36.30**
9640.00	**23.52**	**-**	**1.0**	**54.00**	**30.48**
9768.00	**25.19**	**-**	**1.0**	**54.00**	**28.81**
9896.00	**24.46**	**-**	**1.0**	**54.00**	**29.54**
12050.00	**31.06**	**-**	**1.0**	**54.00**	**22.94**
12210.00	**32.16**	**-**	**1.0**	**54.00**	**21.84**
12370.00	**33.15**	**-**	**1.0**	**54.00**	**20.85**

Radiated Transmit Emissions

Fundamental Worst Case
Tabulated Measurements

Frequency	EUT orientation	Corrected Peak Measurement	Compensated Average Measurement	Turntable Azimuth	Antenna Height	Average FCC 15.249 limit	Margin Class B
MHz		dBuV/m	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
2409.95	**v-end**	**105.93**	**85.93**	**170**	**1.1**	**94.0**	**8.07**
2442.05	**v-end**	**105.49**	**85.49**	**220**	**1.1**	**94.0**	**8.51**
2474.59	**v-end**	**101.44**	**81.44**	**230**	**1.1**	**94.0**	**12.56**

Second Harmonic Worst Case
Tabulated Measurements

Frequency	EUT orientation	Corrected Peak Measurement	Compensated Average Measurement	Turntable Azimuth	Antenna Height	Average FCC 15.249 limit	Margin Class B
MHz		dBuV/m	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
4819.93	**h - side**	**62.10**	**42.10**	**240**	**1**	**54.0**	**11.90**
4884.18	**h - side**	**57.77**	**37.77**	**140**	**1**	**54.0**	**16.23**
4948.84	**h - side**	**56.49**	**36.49**	**150**	**1**	**54.0**	**17.51**

Upper Harmonic
Tabulated Measurement

Frequency	EUT orientation	Corrected Peak Measurement	Compensated Average Measurement	Turntable Azimuth	Antenna Height	Average FCC 15.249 limit	Margin Class B
MHz		dBuV/m	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
12050.0	**na**	**43.36**	**23.36**	**-**	**1.0**	**54.0**	**30.64**
12210.0	**na**	**34.16**	**14.16**	**-**	**1.0**	**54.0**	**39.84**
12370.0	**na**	**32.75**	**12.75**	**-**	**1.0**	**54.0**	**41.25**

Band Edge
Tabulated Measurement

Frequency	EUT orientation	Corrected Peak Measurement	Compensated Average Measurement	Turntable Azimuth	Antenna Height	Average FCC 15.249 limit	Average peak - 50dB	Margin Class B
MHz		dBuV/m	dBuV/m	deg	Mtr	dBuV/m	dBuV/m	dBuV/m
2400.00	**v-end**	**67.60**	**47.60**	**300**	**1.9**	**54.0**	**-**	**6.40**
2409.95	**v-end**	**105.93**	**85.93**	**220**	**1.1**	**NA**	**35.9**	**NA**
2483.00	**v-end**	**65.90**	**45.90**	**300**	**1.9**	**54.0**	**-**	**8.10**

Frequency Stability

Tabulated Frequency over Temperature Stability Measurement

Operating Frequency	Operating Temp	Test Frequency	Test Temp	Frequency Change	% Change	% Limit	% Margin
KHz	Deg C	KHz	Deg C	KHz		dBuV/m	
2409987	18	2409981	-11	-6	-0.0002%	0.0010%	0.0012%
2409987	18	2409998	50	11	0.0005%	-0.0010%	0.0005%

Tabulated Frequency over Voltage Stability Measurement

Operating Frequency	Operating Voltage	Delta Frequency	Delta Voltage	Frequency Change	% Change	% Limit	% Margin
KHz	DCV	KHz	DCV	KHz			
2409986	48	2409984	15	2	0.0001%	0.0010%	0.0009%

Measurement Facilities & Equipment

Test Site

The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 Michigan Hwy152, Sister Lakes, 49047. This test facility is NVLAP accredited (LabCode 200129-0). It has been fully described in a report filed with the FCC (No.90413) and Industry Canada (file:IC3161).

Measurement Equipment Used

Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8546A			
RF Filter Section	HP-85460A	3448A00283	25-Jul-09	12 months
RF Receiver Section	HP-85462A	3625A00342	25-Jul-09	12 months
EMCO BiconiLog Antenna	3142	1069	27-July-09	12 months
Solar LISN	8012-50-R-24-BNC	962137	17-July-08	12 months
Solar LISN	8012-50-R-24-BNC	962138	17-July-08	12 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	11-Mar-08	12 months
(3-m) LMR-400 Ultra Flex	LMR400	9812-11	19-Nov-08	6 months
(3-m) CS-3227 RG8	CS-3227	C060914	19-Nov-08	6 months
(10-m) Amelco 50ohm Coax	RG213U	9903-10ab	19-Nov-08	6 months
Double Ridged Horn	ONO91202-2	A00329	27-July-09	12 months
Keytek Surge	711B	8511854	05-Mar-08	12 months
Schaffner ESD	NSG432	01027	02-Mar-08	12 months
Polarad	MDS-21	81927	01-May-08	12 months
EMCO Loop	6502	2148	01-Sept-06	36 months

Test Site 2

The University of Michigan test facility is located at 8501 Beck Road, Belleville, Michigan 48111. This test facility has been fully described and accepted by the FCC and Industry Canada.
This facility was utilized to measure emissions occurring at frequencies greater than 6GHz.

Measurement Equipment Used

Equipment	Model	S/N	Last Cal Date	Calibration Interval
C-Band Std. Gain Horn	UM NRL design		calibration by design & physical inspection.	
XN-Band Std. Gain Horn	UM NRL design		calibration by design & physical inspection.	
X-Band Std. Gain Horn	SA 12-8.2	730	calibration by design & physical inspection.	
Avantek RF amplifier	AFT-12665		28-July-09	12 months
3ft LowLoss coax	RG142	-	with Avantek amp	
Spectrum Analyzer	HP 8593E	3412A01131	2-June-09	12 months

Environment

The test was performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 19.4 deg C, the relative humidity 44 %.

APPENDIX A

Measurement Procedures

Line Conducted

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm from the ground floor and 40cm from the vertical conducting plane in the prescribed setup per ANSI C63.4. This table is housed in a shielded enclosure to prevent the detection of unwanted ambients.

The EUT, or host unit if applicable, was connected to the LISN being monitored by the EMI Receiver. The remaining support devices requiring mains power were connected to a second LISN.

The EUT was continuously exercised by methods supplied by the manufacturer.

While monitoring the display of the EMI Receiver, via remote video monitor, the cables were manipulated to determine a position that maximized the emissions being observed. Once the highest amplitude relative to the limit was determined for the Phase current carrying line the procedure was repeated for the Neutral current carrying line.

The configuration that created an emission closest to the limit was used during the course of taking final measurements. Pictures of this final configuration are recorded in this report.

The principal settings of the EMI Receiver for line conducted testing include:

Bandwidth = 9KHz

Detector Function: scanning and signal search = Peak Detection Mode
measurements = Quasi Peak Detection and Average Detection

The cable losses of the coax used in line conducted testing are charted in this appendix.

Radiated

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm from the open field site ground plane in the prescribed setup per ANSI C63.4, Figure 9(c).

The table sits upon a remote controlled turntable. The receiving antenna, located at the appropriate standards distance of 3 or 10 meters from the table center, is also remote controlled.

The EUT was continuously exercised by software supplied by the manufacturer.

Preliminary tests were done at the 3 meter open field test site. The final tests are done at the appropriate standards distance of 3 or 10 meters. The "Biconical/Log Periodic" broadband antenna connected to an EMI Receiver, meeting CISPR 16, is used throughout the testing.

During the preliminary scans and while monitoring the display of the EMI Receiver, the turntable was rotated 360 degrees and the receiving antenna height varied from 1 to 4 meters to search out the highest emissions. At the significant emissions, the cables were manipulated to determine a position that maximized the emissions being observed. Once the cable position was determined that presented the highest amplitude relative to the limit for Vertical polarized emissions the procedure was repeated for the Horizontal polarization.

The configuration that created an emission closest to the limit was used during the course of taking final measurements. Pictures of this final configuration are recorded in this report.
The principal settings of the EMI Receiver for radiated testing include:

Bandwidth:	120kHz
Detector Function:	scanning and signal search = Peak Mode
	measurements = Quasi Peak Mode.
Search Range:	30MHz to 1000MHz or to 2GHz as appropriate

The cable loss of the coax used in radiated scanning is charted in this appendix.
The antenna factors, for the test distance used, are charted in this appendix.

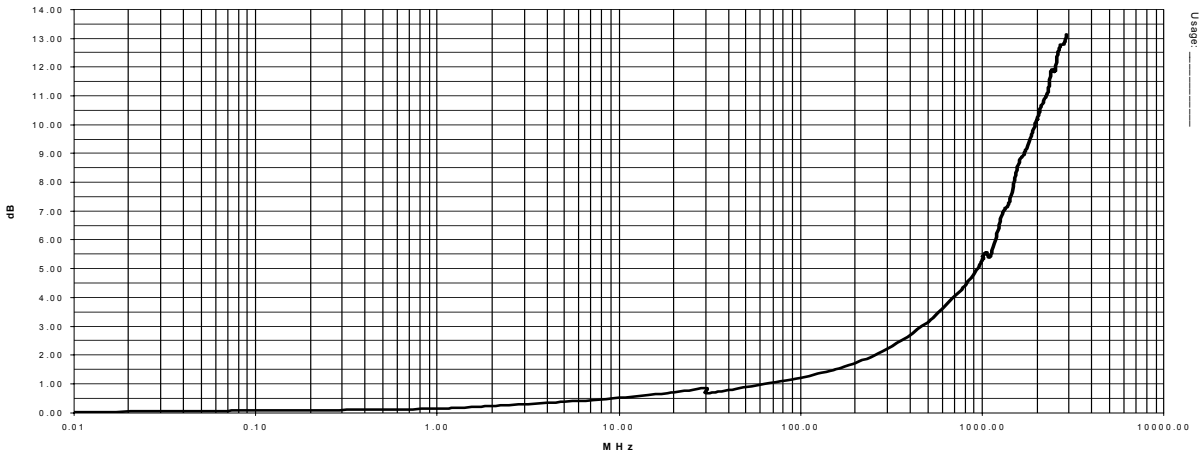
The resultant Field Strength (FS) is a summation in decibels (dB) of the Indicated Receiver Level (RF), the Antenna Correction Factor (AF), and the Cable Loss Factor (CF). If a PreAmplifier (PA) is used, its gain (dB) is subtracted from the above sum.

Formula 1: FS(dBuV/m) = RF(dBuV) + AF(dB/m) +CF(dB) - PA(dB)
To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

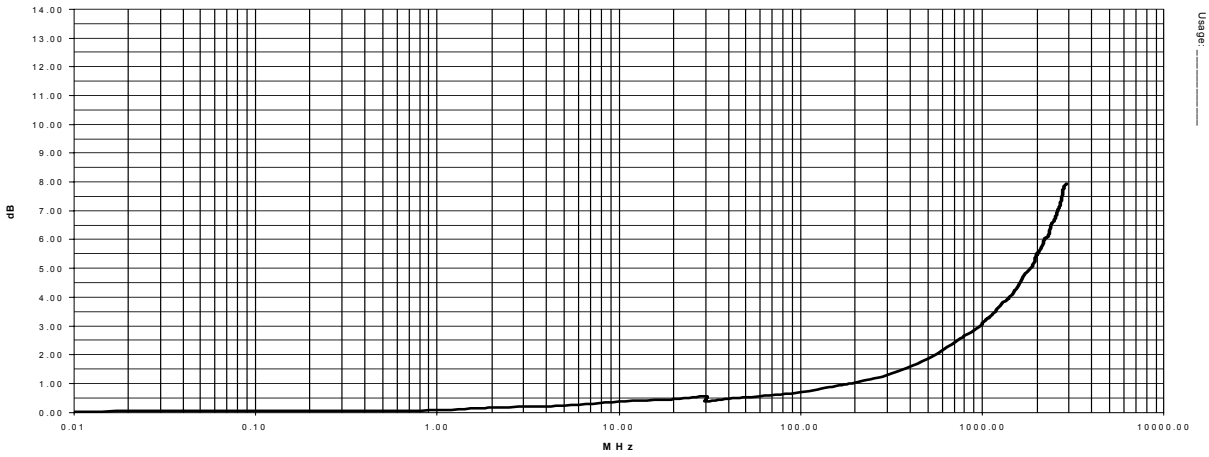
Formula 2: FS(uV/m) = AntiLog[(FS(dBuV/m))/20]

Cable Loss

Line Conducted 150KHz through 30MHz, Coax #920809
Last Calibration date: March 11, 2009

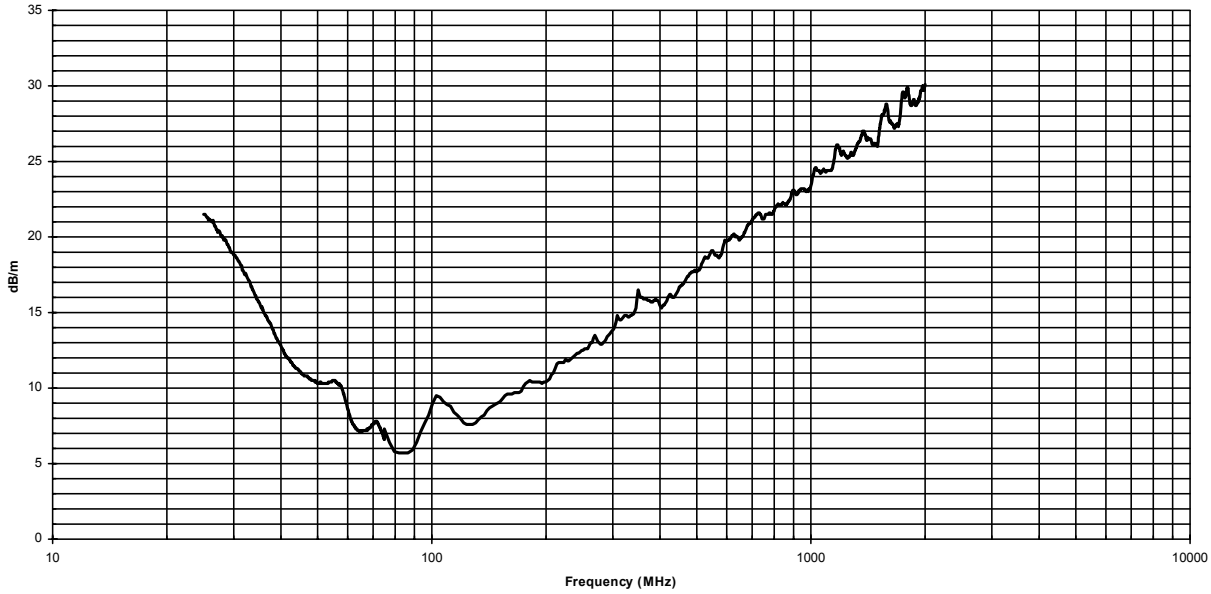


Radiated at 3 meters; 30MHz through 3000MHz, Coax #9812_11
Last Calibration date: Nov 19, 2008

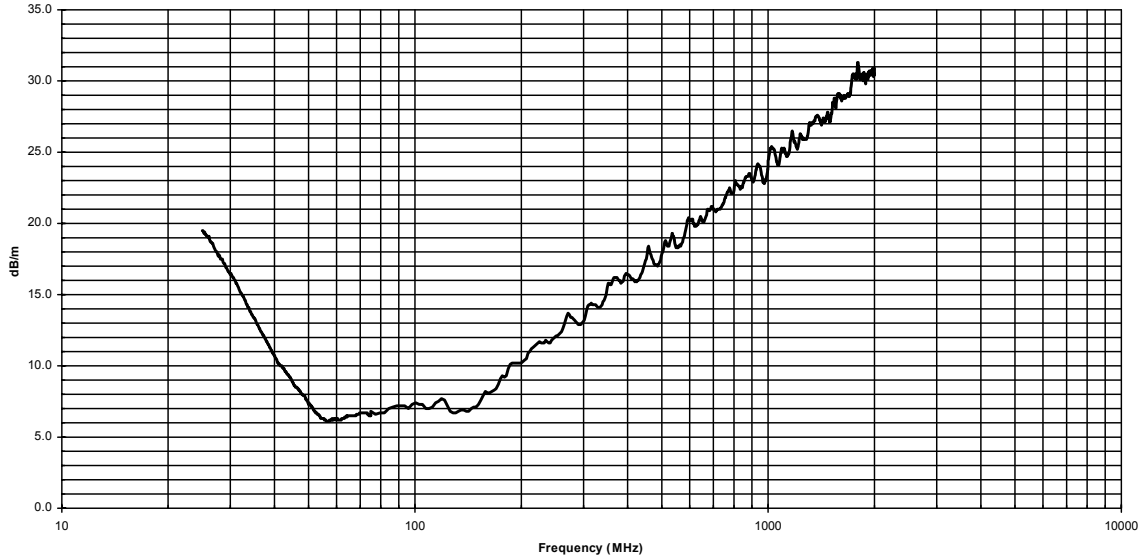


Antenna Factors

EMCO Model 3142 Antenna #1069
Last Calibration Date; 27-July-09
3 Meter Distance Factors



10 Meter Distance Factors



AHD Accreditation

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200129-0

AHD (Amber Helm Development, L.C.)
Dowagiac, MI

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 18 June 2005).

2008-07-01 through 2009-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

April 16, 2008

Registration Number: 90413

AHD EMC Laboratory
92723 M-152,
Dowagiac, MI 49047

Attention: Gordon Helm

Re: Measurement facility located at Sister Lakes
3 & 10 meter site
Date of Renewal: April 16, 2008

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing- OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Phyllis Parrish
Industry Analyst

NARTE Seal