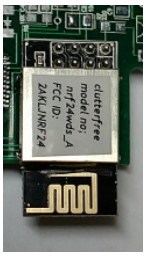
Amber Helm Development L.C.
92723 Michigan Hwy-152
Sister Lakes, MI 49047

EMC Test Report

#MOD-1702123FX
Issued 3/27/2017

Regarding the FCC Part 15, SubPart C testing



2.4 GHz Modular Transceiver
Model: NRF24WDS
FCCID: 2AKLJNRF24
Category: 15.249 Transmit Device

Judgments: FCC Part 15.249 – Compliant

NVLAP LAB CODE 200129-0

Prepared for:

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Test Date(s): 10/31/16-1/20/17

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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/CISPR11: Limits and methods of measurement of electrical disturbance characteristics of Industrial, Scientific, and Medical Radio-Frequency Equipment

IEC/CISPR 22: Limits and methods measurement of radio disturbance characteristics of information technology equipment.

EN 55032 EMC for Multimedia Devices

FCC: Method 47 CFR Part 15 Subpart B: Unintentional Radiators.

FCC: Method 47 CFR Part 15: Subpart C: Intentional Radiators.

FCC: Method 47 CFR Part 18 – Industrial, Scientific, and Medical Equipment

AS/NZS 3548: Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment.

IEC61000-4-2: 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 does not contain data produced under subcontract.

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.

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:

FCC Part 18 ISM Devices:

1. For all industrial, scientific, medical (ISM) devices, the instruction manual or, if no instruction manual is provided, the product packaging, must provide information that addresses the following: (1) interference potential of the device, (2) maintenance of the system and (3) simple measures that can be taken to correct interference. RF lighting devices must add a statement similar to the following: "This product may cause interference to radio equipment and should not be installed near maritime safety communications equipment, ships at sea or other critical navigation or communications equipment operating between 0.45-30 MHz." (Section 18.213)

   In addition, Part 18 devices that are authorized under the DoC procedure shall also include in the instruction manual, on a separate sheet, or on the packaging the following: (1) identification of the product (e.g. name and model number), (2) a statement similar to "This device complies with Part 18 of the FCC Rules" (Section 18.212), and (3) the name and address of the responsible party (Section 2.909).

2. For products certified using the Declaration of Conformity approach, this FCC conformity LOGO is to be placed on the ISM Device.

FCC Part 15 Class A or B Digital Devices or Peripherals:

For products satisfying the FCC Part 15 Class A or 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.

For an FCC Part 15 Class A digital device or peripheral, the user instructions shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against

harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

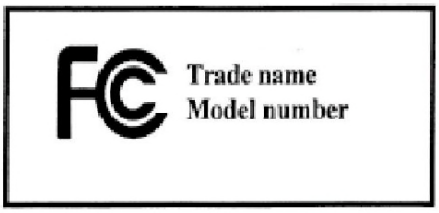
Modifications not expressly approved by the manufacturer could void the user's authority to operated the equipment under FCC rules.

Additionally, for products satisfying the FCC Part 15 Class B requirements the following are to be satisfied:

1. 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:
   - *i. Reorient or relocate the receiving antenna.*
   - *ii. Increase the separation between the equipment and receiver.*
   - *iii. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
   - *iv. Consult the dealer or an experienced radio/TV technician for help.*

2. 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.

Industry Canada Required user statements:

Applies to: [Category II Equipment]

1. For products satisfying the ICES-003, RSS-Gen and RSS-210 Issue 6 requirements the following are to be satisfied:

   User manuals for license-exempt LPDs shall contain the following or equivalent statements in a conspicuous position:

"Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device."

If the antenna is detachable (i.e. selectable by the user), see the user manual requirement in Section 7.1.4. The following instructions in the user manual are also required:

"To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic radiated power (e.i.r.p.) is not more than that permitted for successful communication."

The above statements may be placed on the device instead of the manual.

2. User Manual:

   User manual shall also contain text declaring compliance to the limits found in this Standard in both English and French.

3. Equipment Labels:

   Equipment subject to certification under the applicable RSS's, shall be permanently labeled on each item, or as an inseparable combination. The label must contain the following information for full compliance:

   (a) the certification number, prefixed by the term "IC:";
   (b) the manufacturer's name, trade name or brand name; and
   (c) a model name or number.

   Equipment for which a certificate has been issued is not considered certified if it is not properly labeled.

   The information on the Canadian label can be combined with the manufacturer's other labeling requirements.

   If the device size is too small to put a label, the label can be included in the user's manual, upon agreement with Industry Canada.

Summary of Results

1. The device model number NRF24WDS was tested for compliance with FCC Regulations, Part 15, SubPart C. These tests were performed at AHD EMC Laboratory following the procedures outlined in ANSI C63.4 and ANSI 63.10.
2. The device tested is compliant to the requirements of FCC Part 15 SubPart C 15.249 for low power 2.4 GHz band transmitters.
3. The device meets all 15.212 requirements as a modular transmitter.
4. The equipment under test was received on 10/31/16 and this test series commenced on 10/31/16.
5. In 120VAC 60Hz operation, the conducted emission level nearest the limit occurred at 320 kHz. The signal was measured to be 12.71 dB below the Class B Quasi-Peak limit and 12.71 dB below the Class B Average limit when measuring phase to ground.
6. The spurious radiated emission level nearest the limit occurred at 138 MHz vertically polarized. This signal was measured to be 20.2 dB below the Class B Quasi-peak limit.
7. The worst case transmit fundamental was measured using an average detector to be 18.38 dB within the 15.249 limit.
8. The worst case peak transmit fundamental was measured to be 25.6 dB within the 15.249 limit.
9. The worst case transmit harmonic was measured at 16900 MHz. The signal was measured to be 6.70 dB under the class B spurious emissions limit.
10. The worst case transmit harmonic peak was measured at 16900 MHz. The signal was measured to be 14.20 dB under the class B spurious emissions limit.
11. No signals were detected at the band edges.
12. 20 dB Bandwidth was measured to be 3.31 MHz at 2408 MHz.
13. The radiated receive Local Oscillator was identified 2 MHz offset from the fundamental frequencies. The worst case local oscillator emission occurred 2417 MHz. This signal was measured to be 53.41 dB below the FCC class B average limit.

Changes Made to Achieve Compliance:

1. None

EUT Description

Model: 2.4 GHz Modular Transceiver

Model number: NRF24WDS

Serial/ID No: AHD001

Description: 2.4 GHz Transceiver for use in dental office applications. Device begins transmit at 2405 MHz and then chooses assigned channels within the range 2405-2464 MHz to communicate with other devices using the same module.

Antenna: PCB Antenna, with measured max gain of -7.71 dBi

PCBs:
RF Transceiver: Addicore nRF24L01+ module, which uses a Nordic nRF24L01+ Transceiver IC.

Carrier PCB: Modified FPM module PCB

Specifications:

Input Power: 120VAC to 5VDC 550 mA model PSM03A-050
Input / Outputs Signals:

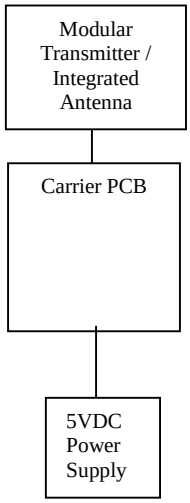
2.4 GHz signal,
Buffered IO signals

Statement of Modular Compliance:

Per FCC 15.12 regulations:

1. Radio elements are shielded
2. Nordic IC features Buffered modulation / data inputs
3. Nordic IC features on chip Power Regulation
4. Tested in a stand alone configuration – testing performed with minimized component carrier PCB to demonstrate stand alone operation.
5. AC line conducted compliant.
6. Permanently affixed label with FCCID on shield.
7. External product labels will say “Contains Transmitter Module FCCID:2AKLJNRF24”
8. Explicit Modular transmitter instructions submitted with application
9. Permanent integrated PCB antenna

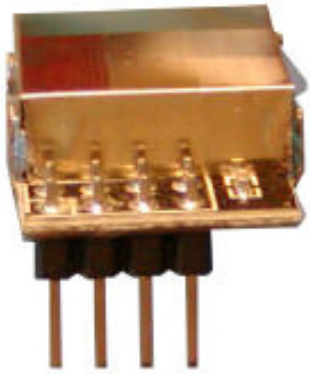
EUT Block Diagram:



EUT Pictures

Exterior View Module With Shield

RF Module NRF24WDS rev A
Bottom Side (ground plane side)

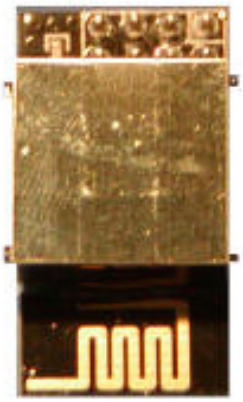


RF Module NRF24WDS Rev A
Rear Side

RF Module NRF24WDS Rev A
left Side Voew

RF Module NRF24WDS Rev A
Right Side View

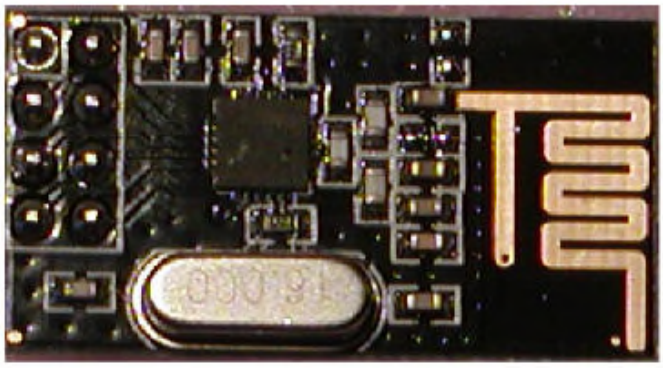
RF Module NRF24WDS Rev A
Front View



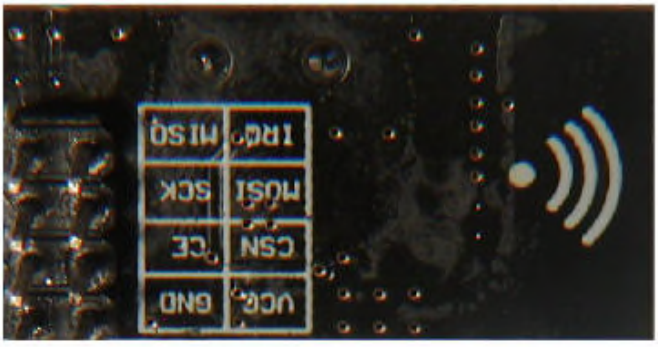
RF Module NRF24WDS rev A
Top Side with RF shield

Interior Views Module without Shield

RF Module, Part Number: NRF240L01

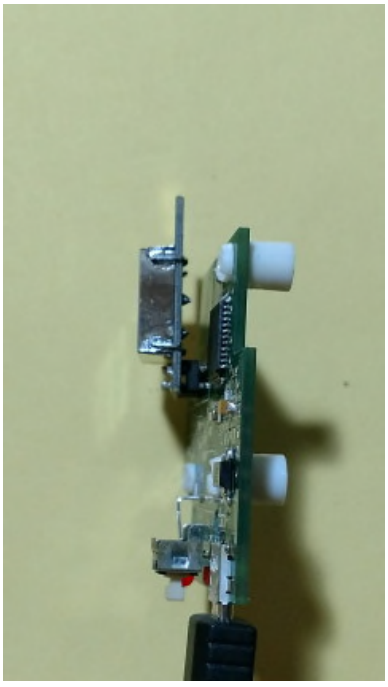


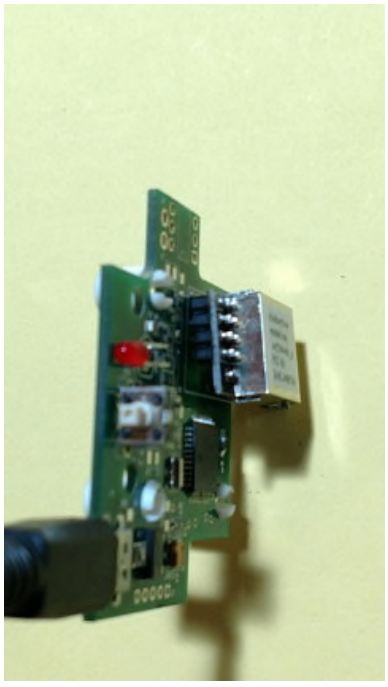
TOP VIEW

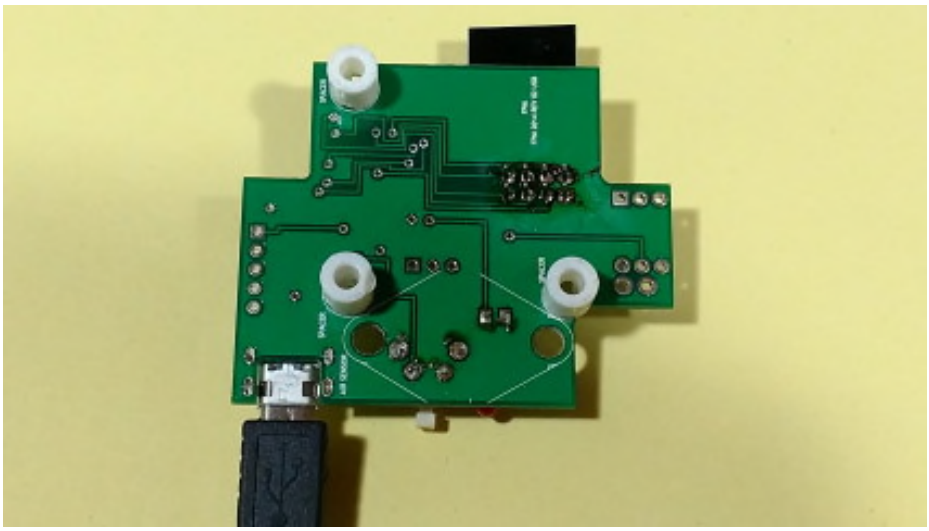


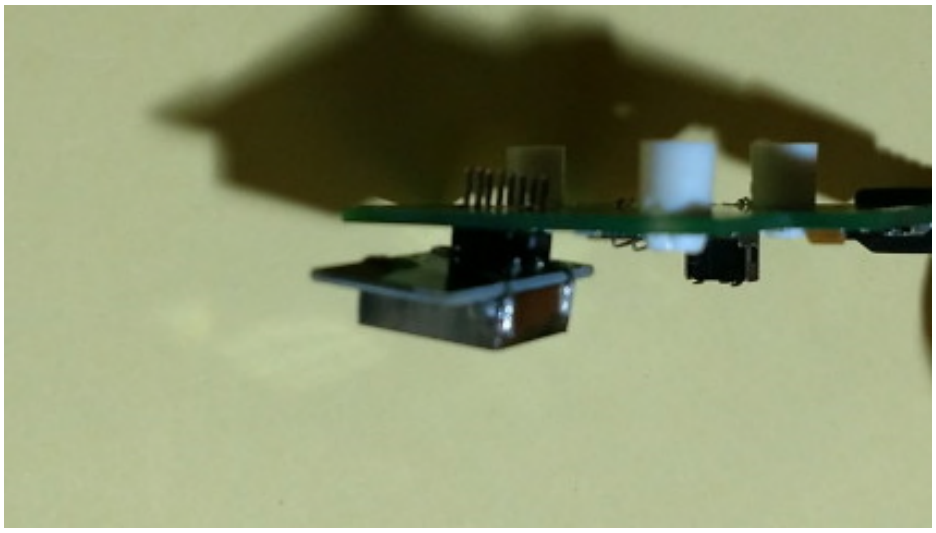
Bottom View

Exterior Views Module on Carrier







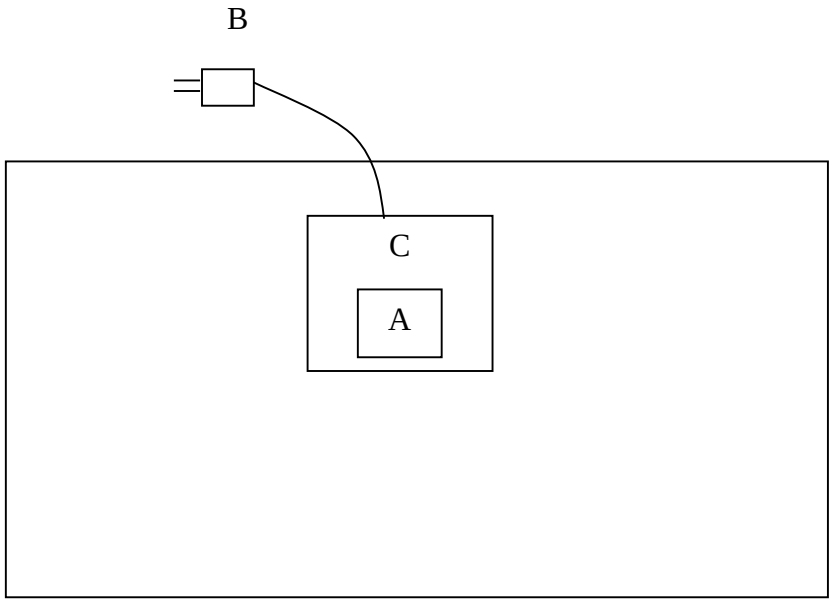


Equipment Test Setup:

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	2.4 GHz Gateway Transceiver	NRF24WDS	1A	2.4 GHz Modular Transceiver
B	5V 550 mA Power Supply		PSM03A-050	DC Power Supply, 1M Cable
C	Carrier PCB		Carrier PCB	Fixture for testing Module

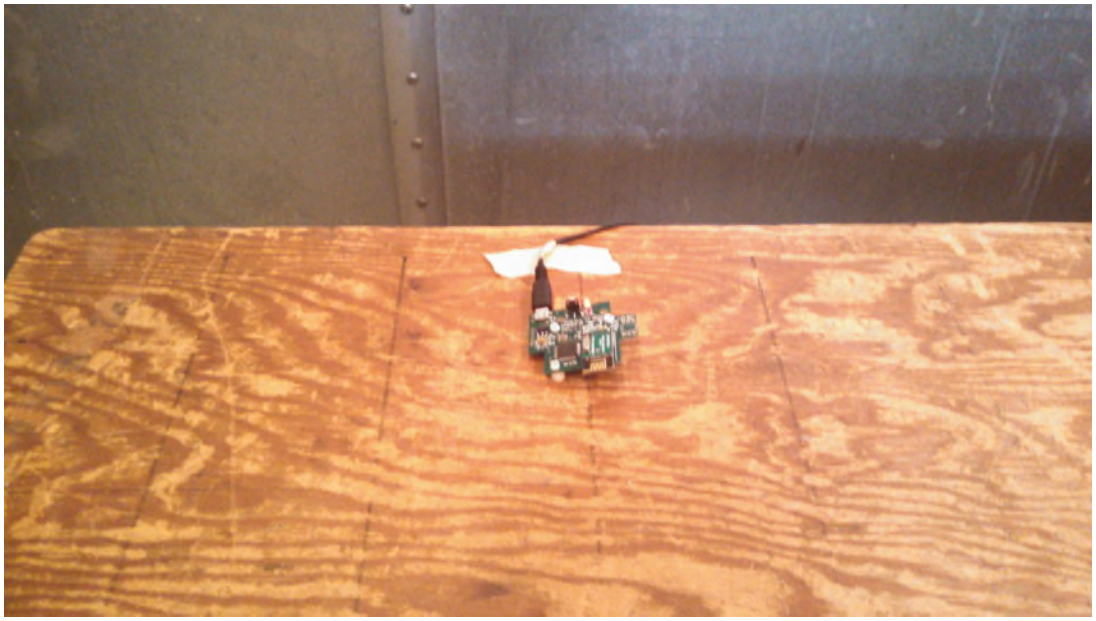
Block Diagram



Setup Pictures

Radiated Prescreen Setup

Conducted Setup Front View



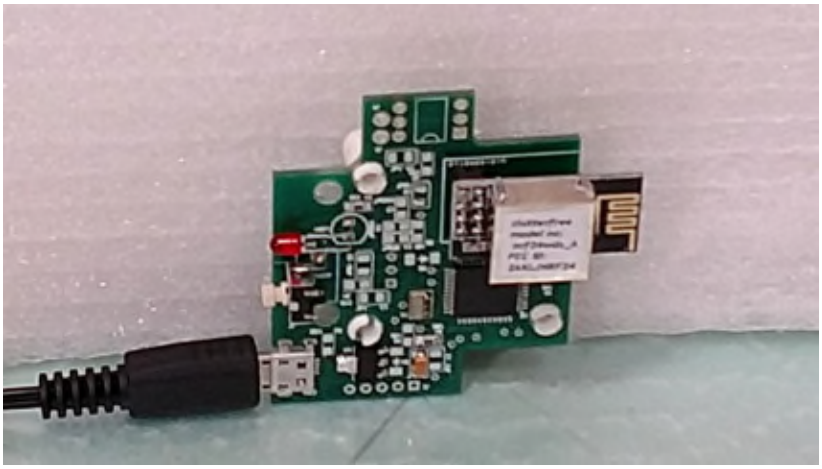
Conducted Setup Rear View

Spurious Front View

Spurious Rear View

Transmit Setup – Flat Orientation

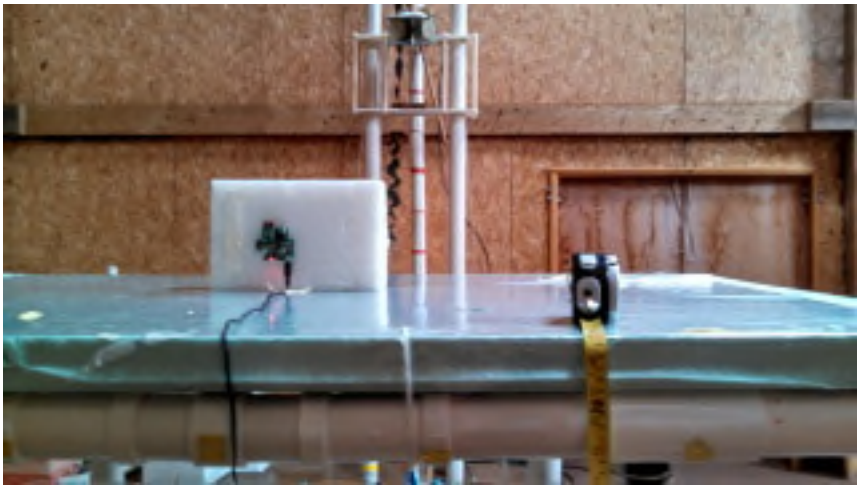
Transmit Setup – Side Orientation



Transmit Setup – End Orientation

Transmit Setup - Floor Absorber View

Transmit Setup – Table View



Measurement Report

Standards Applied to Test

ANSI C63.4 – Radio Noise Emissions 2014
ANSI C63.10 – Intentional Radiators 2013
CFR47 FCC Part 15, SubPart B/C
AHD/SEI test procedures TP0101LC, TP0102RA
EN55032:2012 EMC for Multimedia Devices
EN61000-6-3 Generic 2007.2

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:

Line Conducted test procedures are described in Appendix A.

Radiated:

Radiated emission 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.

Note that distances less than 3 meters (i.e. 1 and 0.1 meter) may be used if signals are not detectable at specified distances, and distances compensated for within the tabulated measurements.

For spurious radiated emissions testing, 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).

For intentional radiated emissions testing, the system was placed upon a 1 x 1.5 meter non-metallic table 150cm from the open field site ground plane in the prescribed setup per ANSI C63.10-2013.

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 signals recorded in the shielded room prescan were then measured at the 3-meter open area test site.

The EUT was scanned for radiated energy up to 24 GHz to meet FCC 15.33 requirements.

The EUT was tested using software that transmit continuously on each channel. Measurements were recorded on low, middle, and high frequency channels, in three orientations, with horizontal and vertical antennal polarities.

The EUT under test was placed per ANSI C63.4 and ANSI C63.10.

The EUT was exercised as follows:

1. Device was powered and activated with external power supply.
2. Evidence of operation was signal presence operation.

The cables were manipulated to produce the highest signal level relative to the limit.

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

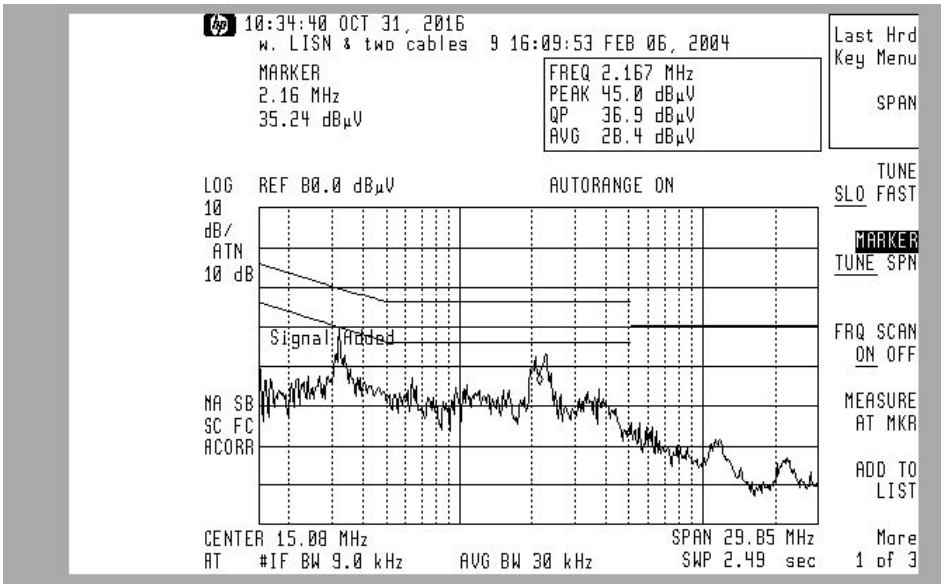
Variance from Test Procedure:

None

Test Data

Line Conducted:

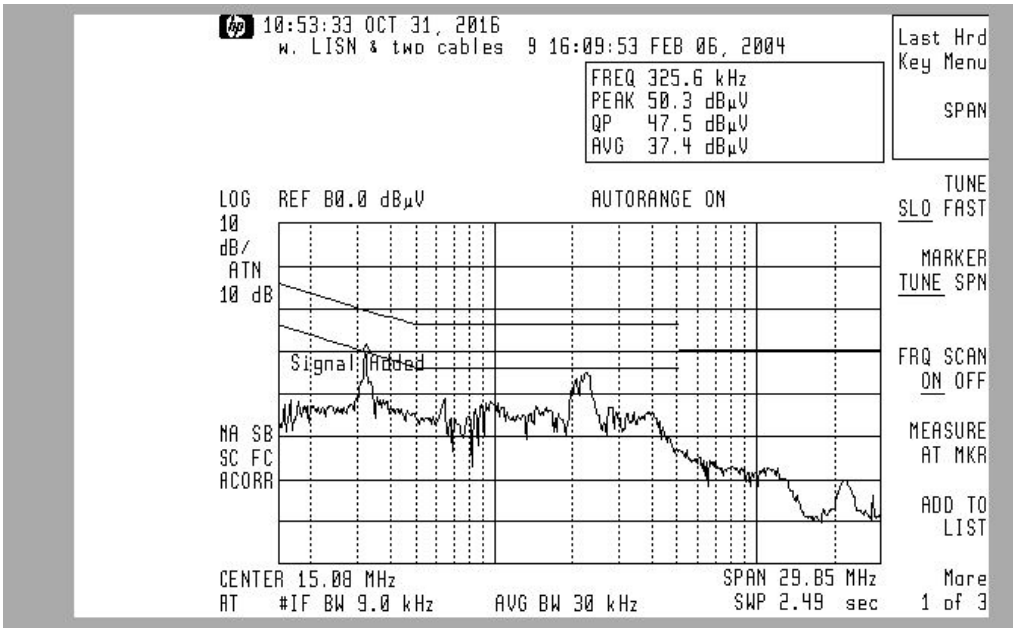
NEUTRAL to Ground Measurement.
Class B Plot of Peak Values



NEUTRAL to Ground Conducted
Class B Tabulated Measurements

Frequency	dBuV Reading		FCC / EN55032 dBuV Class B Limit		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
0.32	**44.00**	**37.00**	59.71	49.71	15.71	12.71
0.63	**30.00**	**21.00**	56.00	46.00	26.00	25.00
2.10	**36.00**	**28.00**	56.00	46.00	20.00	18.00
2.30	**36.00**	**26.00**	56.00	46.00	20.00	20.00
4.00	**29.00**	**21.00**	56.00	46.00	27.00	25.00
10.70	**15.00**	**3.00**	60.00	50.00	45.00	47.00

PHASE to Ground Measurement.
Class B Plot of Peak Values



PHASE to Ground Conducted
Class B Tabulated Measurements

Frequency	dBuV Reading		FCC / EN55032 dBuV Class B Limit		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
0.32	**47.00**	**37.00**	59.71	49.71	12.71	12.71
0.64	**35.00**	**22.00**	56.00	46.00	21.00	24.00
1.90	**38.00**	**28.00**	56.00	46.00	18.00	18.00
2.30	**39.00**	**27.00**	56.00	46.00	17.00	19.00
3.80	**31.00**	**22.00**	56.00	46.00	25.00	24.00
11.00	**16.00**	**5.90**	60.00	50.00	44.00	44.10

Radiated Spurious Emissions

Vertically Polarized
Class B Tabulated Spurious Quasi-Peak Measurements at 3 Meters

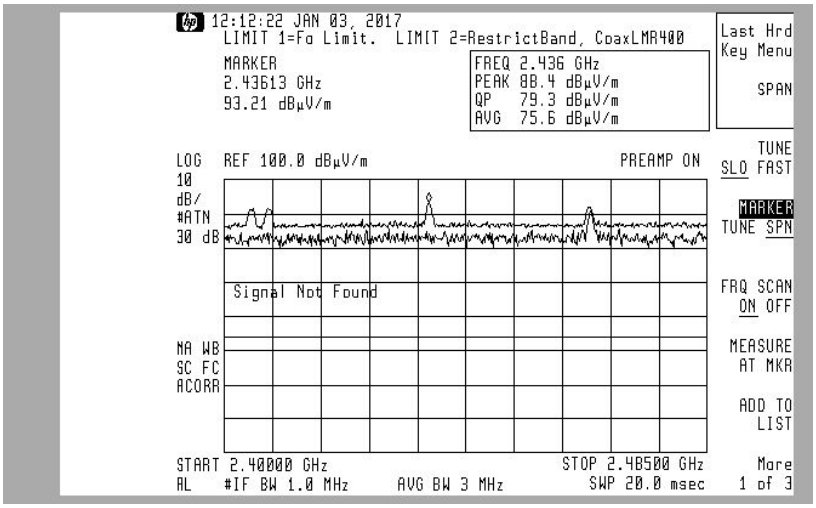
Frequency	Corrected Quasipeak Measurement	Turntable Azimuth	Antenna Height	FCC Class B Limit	Margin Class B
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
70.00	**20.40**	**0**	**1.0**	**40.00**	**20.40**
111.50	**18.70**	**240**	**1.0**	**43.50**	**24.80**
138.00	**23.30**	**300**	**1.0**	**43.50**	**20.20**
232.00	**19.20**	**110**	**1.0**	**46.00**	**26.80**
236.00	**15.70**	**200**	**1.1**	**46.00**	**30.30**

Horizontally Polarized
Class B Tabulated Quasi-Peak Measurements at 3 Meters

Frequency	Corrected Quasipeak Measurement	Turntable Azimuth	Antenna Height	FCC Class B Limit	Margin
MHz	dBuV/m	deg	Mtr	dBuV/m	dBuV/m
72.00	**12.90**	**0**	**2.0**	**40.00**	**27.10**
108.00	**15.50**	**170**	**2.0**	**43.50**	**28.00**
232.00	**17.70**	**170**	**2.0**	**46.00**	**28.30**
236.00	**11.30**	**170**	**2.0**	**46.00**	**34.70**

Transmit Measurement:

Worst Case Transmit Fundamental Signal Plot



Tabulated Transmit Fundamental Measurement Data

Orientation	Maximized Frequency	Average Measurement at 3M	Average Measurement	15.249 Limit	Margin	Margin
MHz	dBuV	dBuV/M	uV/M	uV/M	uV	dB
H-Flat	**2464.00**	**55.50**	**595.66**	**50000.00**	**49404.34**	**38.48**
H-Side	**2436.00**	**65.50**	**1883.65**	**50000.00**	**48116.35**	**28.48**
H-End	**2436.00**	**65.50**	**1883.65**	**50000.00**	**48116.35**	**28.48**
V-Flat	**2436.00**	**75.60**	**6025.60**	**50000.00**	**43974.40**	**18.38**
V-Side	**2405.00**	**65.30**	**1840.77**	**50000.00**	**48159.23**	**28.68**
V-End	**2408.00**	**61.90**	**1244.51**	**50000.00**	**48755.49**	**32.08**

Note: Measurements taken with transmitter in “continuous transmit mode.”

Tabulated Transmit Fundamental Peak Data

Orientation	Maximized Frequency	Peak Measurement at 3M	15.249 Limit	Margin
MHz	dBuV	dBuV/M	dB	dB
H-Flat	**2464.00**	**68.00**	**114.00**	**46.00**
H-Side	**2436.00**	**78.60**	**114.00**	**35.40**
H-End	**2436.00**	**78.30**	**114.00**	**35.70**
V-Flat	**2436.00**	**88.40**	**114.00**	**25.60**
V-Side	**2405.00**	**78.30**	**114.00**	**35.70**
V-End	**2408.00**	**78.30**	**114.00**	**35.70**

Tabulated Average Transmit Harmonic and Spurious Signals

Frequency	Average Measurement	Antenna Correction Factor	Preamp Adjustment (if applicable)	Adjusted Measurement	Distance of Measurement	Adjusted for Distance to 3M	Limit	Margin
GHz	dBuV /M	dB	dB	dB	M	M	dBuV/M	dB
#4.81	**44.10**	**0.00**	**0.00**	**44.10**	**3.00**	**44.10**	**54.00**	**9.90**
#4.87	**45.05**	**0.00**	**0.00**	**45.05**	**3.00**	**45.05**	**54.00**	**8.95**
#4.92	**42.90**	**0.00**	**0.00**	**42.90**	**3.00**	**42.90**	**54.00**	**11.10**
#5.14	**20.83**	**33.90**	**0.00**	**54.73**	**0.33**	**35.56**	**54.00**	**18.44**
5.24	**20.83**	**33.95**	**0.00**	**54.78**	**0.33**	**35.61**	**54.00**	**18.39**
6.85	**22.00**	**36.45**	**0.00**	**58.45**	**0.33**	**39.28**	**54.00**	**14.72**
7.22	**36.83**	**36.00**	**-20.00**	**52.83**	**0.50**	**37.27**	**54.00**	**16.73**
#7.38	**39.83**	**37.01**	**-20.00**	**56.84**	**0.50**	**41.28**	**54.00**	**12.72**
8.67	**22.50**	**37.64**	**0.00**	**60.14**	**0.33**	**40.97**	**54.00**	**13.03**
8.78	**21.17**	**37.79**	**0.00**	**58.96**	**0.33**	**39.79**	**54.00**	**14.21**
9.97	**21.67**	**38.27**	**0.00**	**59.94**	**0.33**	**40.77**	**54.00**	**13.23**
10.16	**22.17**	**38.41**	**0.00**	**60.58**	**0.33**	**41.41**	**54.00**	**12.59**
10.51	**21.33**	**38.70**	**0.00**	**60.03**	**0.33**	**40.86**	**54.00**	**13.14**
#11.72	**21.83**	**39.22**	**0.00**	**61.05**	**0.33**	**41.88**	**54.00**	**12.12**
#12.07	**21.74**	**39.91**	**0.00**	**61.65**	**0.33**	**42.48**	**54.00**	**11.52**
14.27	**23.83**	**41.21**	**0.00**	**65.04**	**0.33**	**45.87**	**54.00**	**8.13**
#15.71	**23.50**	**38.34**	**0.00**	**61.84**	**0.33**	**42.67**	**54.00**	**11.33**
#16.18	**23.33**	**38.72**	**0.00**	**62.05**	**0.33**	**42.88**	**54.00**	**11.12**
16.90	**25.17**	**41.30**	**0.00**	**66.47**	**0.33**	**47.30**	**54.00**	**6.70**

Restricted Band Signal (same limits apply)
Note: No signals detected above 16.9 GHz

Tabulated Peak Transmit Harmonic and Spurious Signals

Frequency	Peak Measurement	Antenna Correction Factor	Preamp Adjustment (if applicable)	Adjusted Measurement	Distance of Measurement	Adjusted for Distance to 3M	Limit	Margin
GHz	dBuV /M	dB	dB	dB	M	M	dBuV/M	dB
#4.81	**56.60**	**0.00**	**0.00**	**56.60**	**3.00**	**56.60**	**74.00**	**17.40**
#4.87	**57.55**	**0.00**	**0.00**	**57.55**	**3.00**	**57.55**	**74.00**	**16.45**
#4.92	**55.40**	**0.00**	**0.00**	**55.40**	**3.00**	**55.40**	**74.00**	**18.60**
#5.14	**33.33**	**33.90**	**0.00**	**67.23**	**0.33**	**48.06**	**74.00**	**25.94**
5.24	**33.33**	**33.95**	**0.00**	**67.28**	**0.33**	**48.11**	**74.00**	**25.89**
6.85	**34.50**	**36.45**	**0.00**	**70.95**	**0.33**	**51.78**	**74.00**	**22.22**
7.22	**49.33**	**36.00**	**-20.00**	**65.33**	**0.50**	**49.77**	**74.00**	**24.23**
#7.38	**52.33**	**37.01**	**-20.00**	**69.34**	**0.50**	**53.78**	**74.00**	**20.22**
8.67	**35.00**	**37.64**	**0.00**	**72.64**	**0.33**	**53.47**	**74.00**	**20.53**
8.78	**33.67**	**37.79**	**0.00**	**71.46**	**0.33**	**52.29**	**74.00**	**21.71**
9.97	**34.17**	**38.27**	**0.00**	**72.44**	**0.33**	**53.27**	**74.00**	**20.73**
10.16	**34.67**	**38.41**	**0.00**	**73.08**	**0.33**	**53.91**	**74.00**	**20.09**
10.51	**33.83**	**38.70**	**0.00**	**72.53**	**0.33**	**53.36**	**74.00**	**20.64**
#11.72	**34.33**	**39.22**	**0.00**	**73.55**	**0.33**	**54.38**	**74.00**	**19.62**
#12.07	**34.24**	**39.91**	**0.00**	**74.15**	**0.33**	**54.98**	**74.00**	**19.02**
14.27	**36.33**	**41.21**	**0.00**	**77.54**	**0.33**	**58.37**	**74.00**	**15.63**
#15.71	**36.00**	**38.34**	**0.00**	**74.34**	**0.33**	**55.17**	**74.00**	**18.83**
#16.18	**35.83**	**38.72**	**0.00**	**74.55**	**0.33**	**55.38**	**74.00**	**18.62**
16.90	**37.67**	**41.30**	**0.00**	**78.97**	**0.33**	**59.80**	**74.00**	**14.20**

Restricted Band Signal (same limits apply)
Note: No signals detected above 16.9 GHz

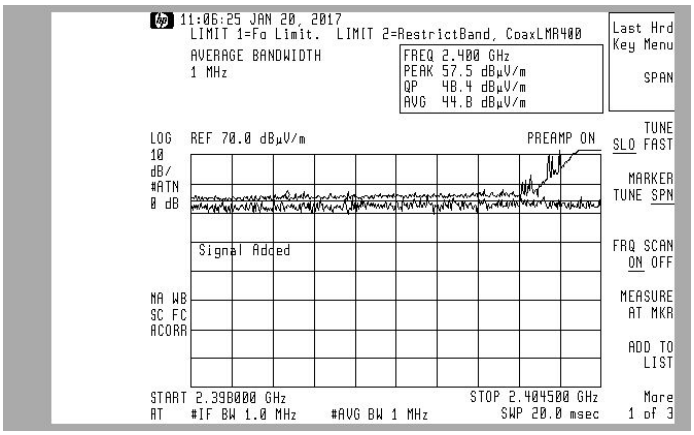
Band Edge Tabulated Data

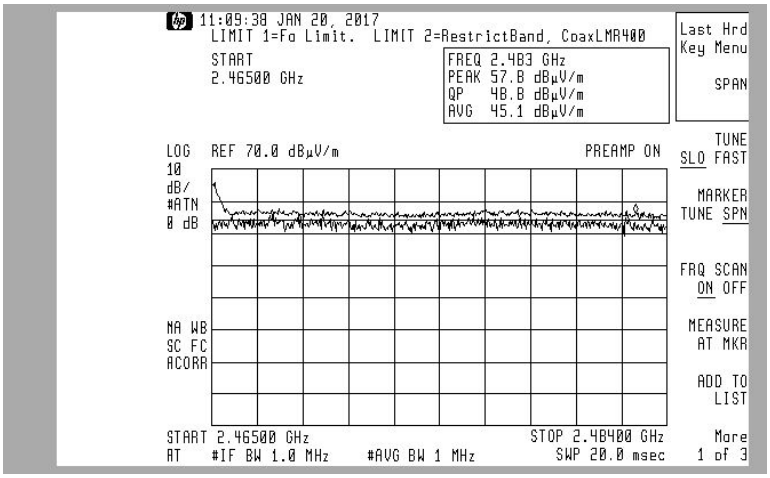
Frequency	Average Measurement at 3M	Limit	Margin
MHz	dBuV/M	dBuV/M	dB
2400.00	**44.80**	**54.00**	**9.20**
2483.50	**45.10**	**54.00**	**8.90**

- **Note: These are noise floor measurements**

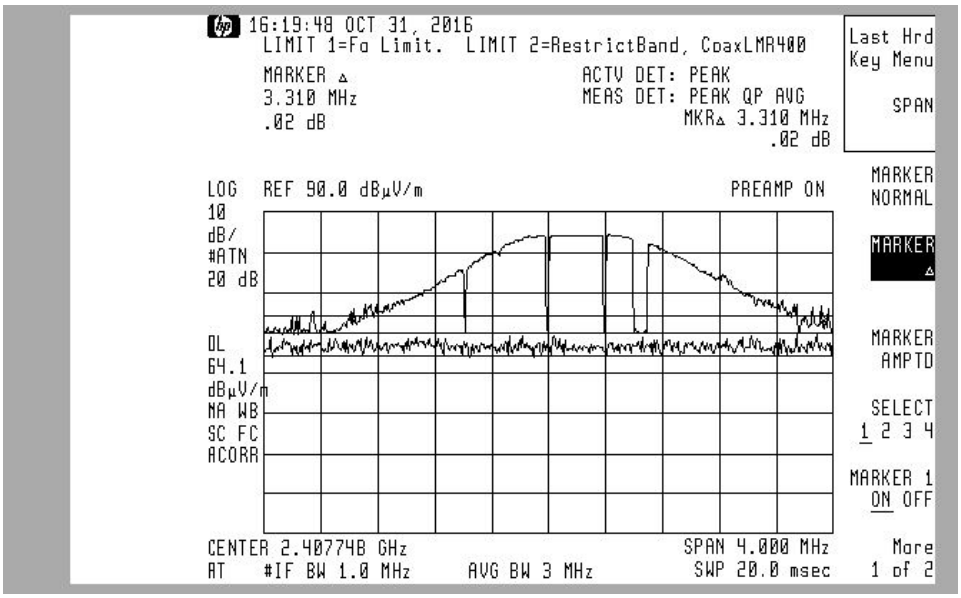
Frequency	Peak Measurement at 3M	Limit	Margin
MHz	dBuV/M	dBuV/M	dB
2400.00	**57.50**	**74.00**	**16.50**
2483.50	**57.80**	**74.00**	**16.20**

Band Edge Plots





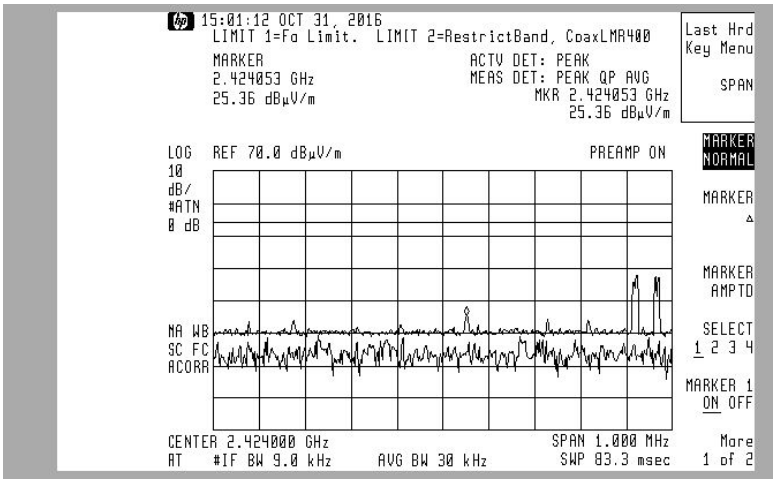
Plot of 20 dB BW



Tabulated 20 dB BW Measurement

Frequency	Measurement
MHz	MHz
2408.00	**3.31**

Local Oscillator Plot



Tabulated Local Oscillator Fundamentals

Frequency	10cM Peak Measurement	Adjusted Peak Measurement -29.5 dB to 3M	Limit	Margin
MHz	dBuV	dBuV	dBuV/M	dB
2424.00	**29.30**	**-0.20**	**54.00**	**54.20**
2410.00	**28.10**	**-1.40**	**54.00**	**55.40**
2417.00	**30.09**	**0.59**	**54.00**	**53.41**
2434.00	**29.15**	**-0.35**	**54.00**	**54.35**

Environment

The test was performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 67 deg F, the relative humidity 42%.

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

For spurious radiated emissions testing, 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).

For intentional radiated emissions testing, the system was placed upon a 1 x 1.5 meter non-metallic table 150cm from the open field site ground plane in the prescribed setup per ANSI C63.10-2013.

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.

Note that distances less than 3 meters (i.e. 1 and 0.1 meter) may be used if signals are not detectable at specified distances, and distances compensated for within the tabulated measurements.

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 signal testing between 30 MHz and 1 GHz 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 principal settings of the EMI Receiver for radiated testing above 1 GHz include:

Bandwidth:	1 MHz
Detector Function:	scanning and signal search = Peak Mode
	Duty Cycle Compensated Measurements = Peak Mode
	Direct Signal Measurements = Average Mode.
Search Range:	Above 1000MHz as required

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]

Measurement Facilities & Equipment

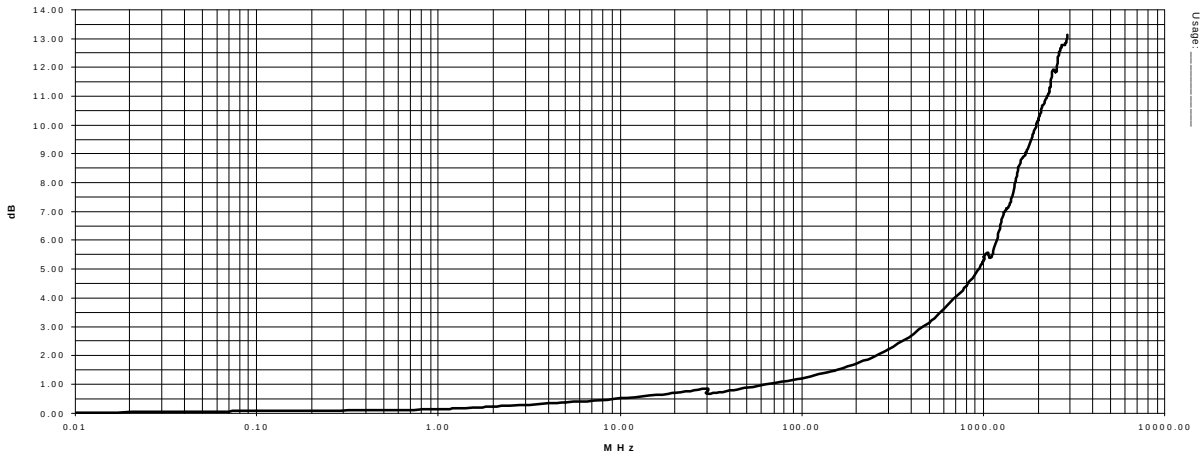
Test Site:

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).

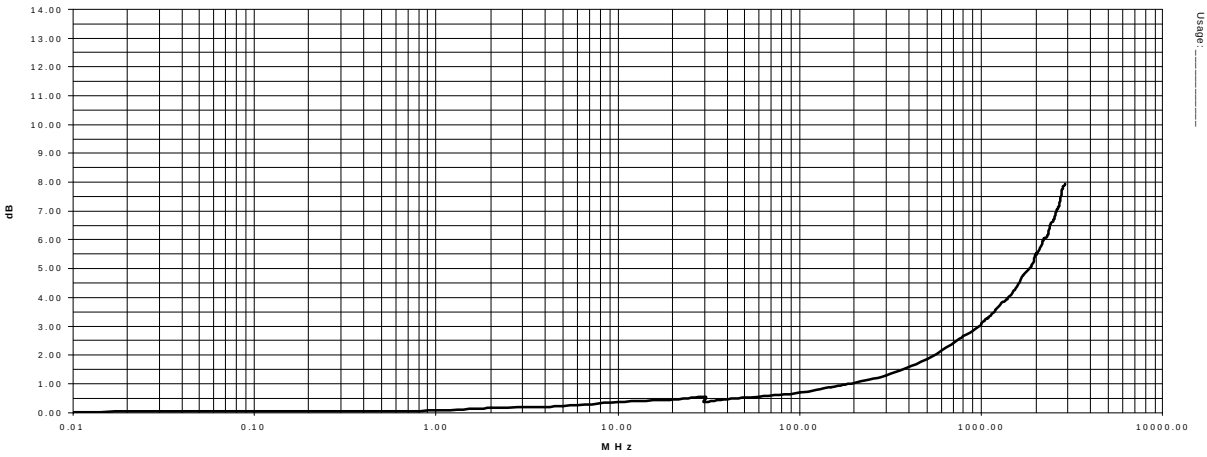
Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8546A			
RF Filter Section	HP-85460A	3448A00267	22 Jan-15	24 months
RF Receiver Section	HP-85462A	3807A00437	22 Jan-15	24 months
EMCO Double Ridged Horn	3115	2788	28-Jul-16	12 months
EMCO BiconiLog Antenna	3142	1169	25- Apr-16	12 months
Solar LISN	8012-50-R-24-BNC	962138	9 Mar-16	18 months
(3-m) LMR-400 Ultra Flex	LMR400	C090804	3-Mar-17	6 months
(3-m) CS-3227 RG8	CS-3227	C060914	3-Mar-17	6 months
(10-m) Amelco 50ohm Coax	RG213U	9903-10ab	3-Mar-17	6 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	1-Jul-16	12 months
Keytek Surge	711B	8511854	1-Jul-16	12 months
Schaffner ESD	NSG432	01027	1-Jul-16	12 months
Schaffner EFT	NSG600/641	0113	1-Jul-16	12 months
Compliance Design Biconical Antenna	B100	016460	6-August-15	36 months
Compliance Design Biconical Antenna	B200	A10102	14-August-15	36 months
Compliance Design Biconical Antenna	B300	A10103	6-August-15	36 months

Cable Loss

Line Conducted 150KHz through 30MHz, Coax #920809
Last Calibration date: 3-Mar-17

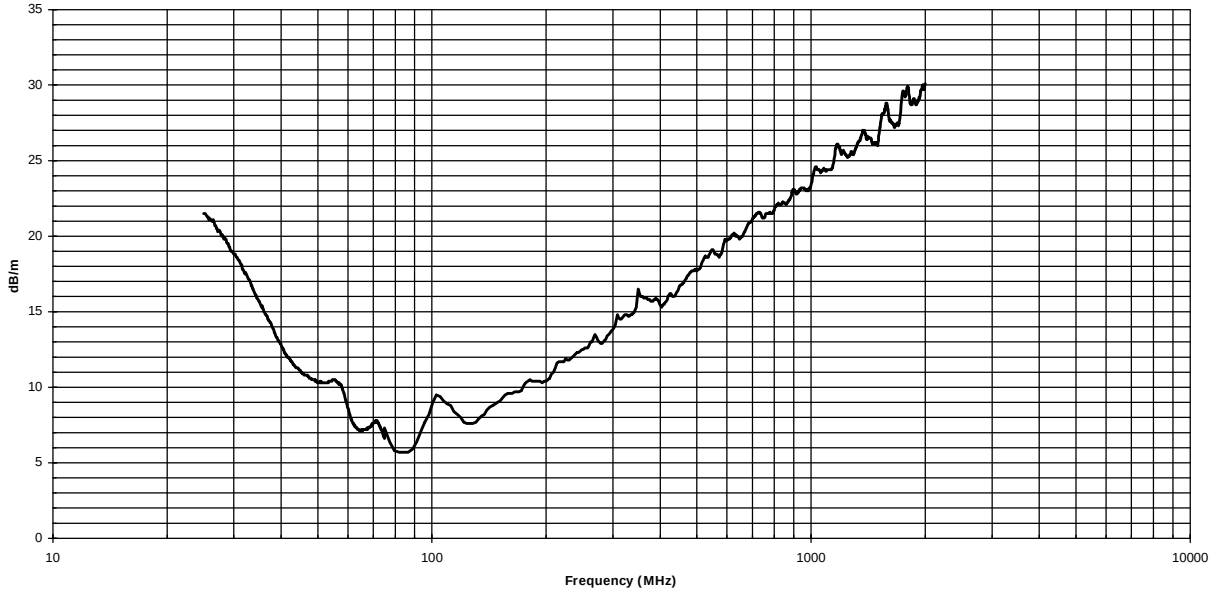


Radiated at 3 meters; 30MHz through 3000MHz, Coax #C090804
Last Calibration date: 3-Mar-17

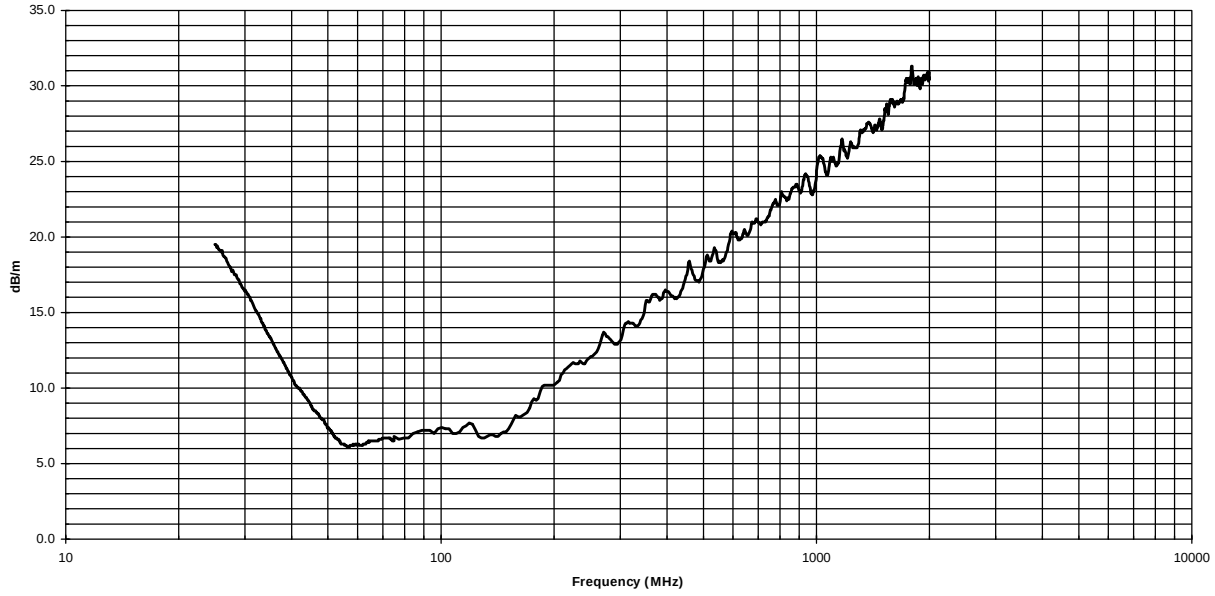


Antenna Factors

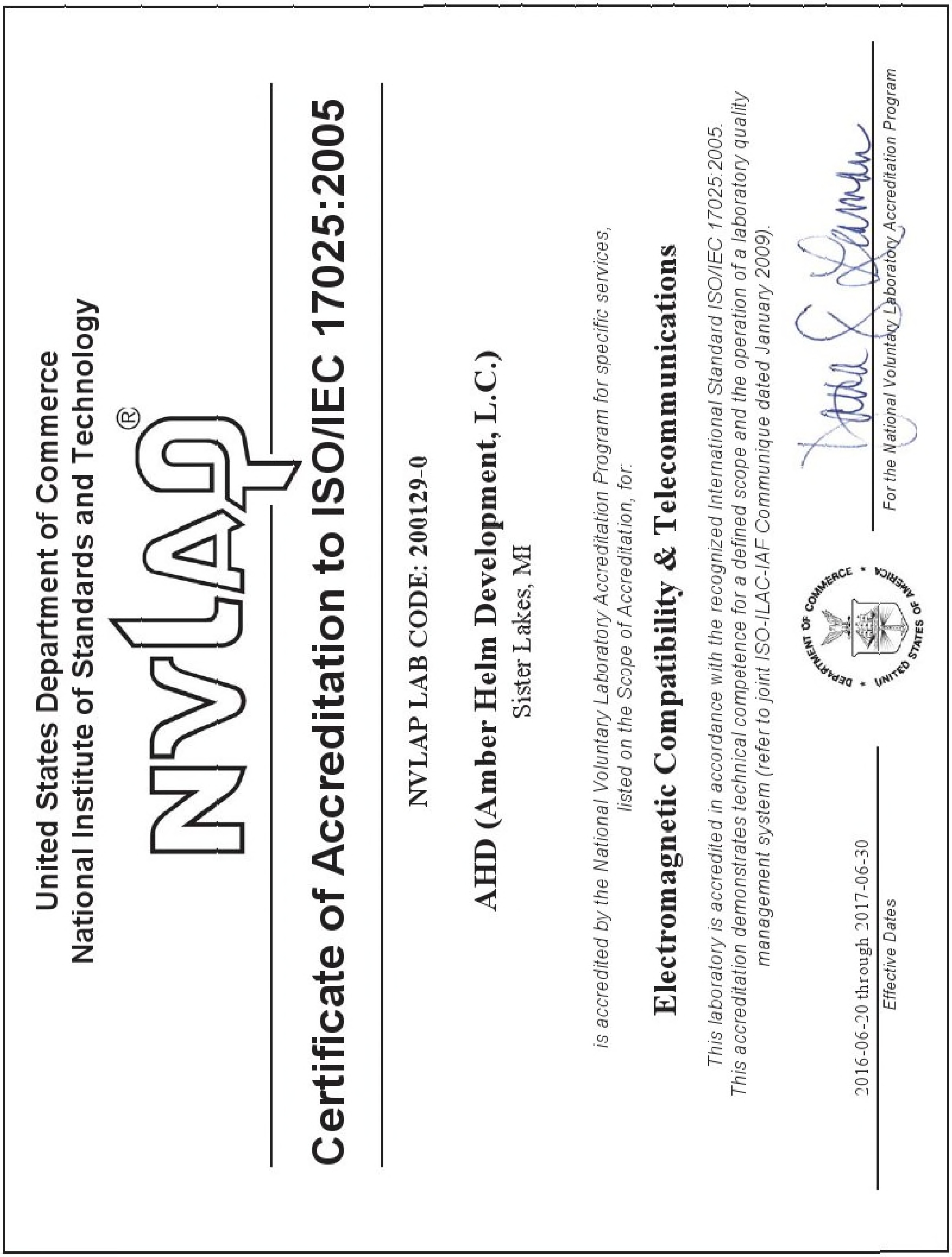
EMCO Model 3142 Antenna
Last Calibration Date; 25- Apr-16
3 Meter Distance Factors



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.)
Sister Lakes, MI

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

Electromagnetic Compatibility & 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 January 2009).

2016-06-20 through 2017-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

December 06, 2016

AHD (Amber Helm Development, L.C.)
92723 Michigan Highway 152,
Sister Lakes, MI 49047

Attention: Gordon Helm

Re: Accreditation of AHD (Amber Helm Development, L.C.)
Designation Number: US5348
Test Firm Registration #: 639064

Dear Sir or Madam:

We have been notified by National Voluntary Laboratory Accreditation Program that AHD (Amber Helm Development, L.C.) has been accredited as a Conformity Assessment Body (CAB).

At this time AHD (Amber Helm Development, L.C.) is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,
Dave Galosky
Dave Galosky
Electronics Engineer

NARTE Seal