Amber Helm Development L.C.
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Sister Lakes, MI 49047

EMC Test Report

#1301770FX231-SAHL5
Issued 11/15/13

Regarding the FCC Part 15 testing

Garage Door Opener

Model Number: SAHL5D Family

Category: 15.231 / 15.247 Transmitting Device
FCC ID NZLSAHL5D

Judgments: FCC Part 15.231 – Compliant*
*Within AHD's 95% measurement uncertainty

NVLAP LAB CODE 200129-0

Prepared for:

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Test Date(s): 10/25/13-11/6/13

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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 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.

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:

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:

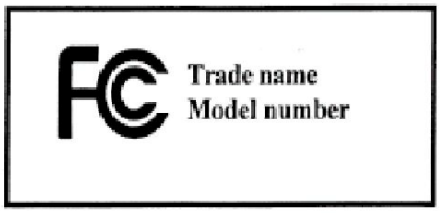
1. The User's Manual shall include this or similar statement:

   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 S550 was tested for compliance with FCC Regulations, Part 15.231 These tests were performed at AHD EMC Laboratory following the procedures outlined in ANSI C63.4.
2. The device FCCID is NZLSAHL5D.
3. The transmitter test results apply to the SAHL5D family of devices, which includes the S550 device.
4. The device tested is compliant to the requirements of FCC Part 15.231 for a digital transmitting device.
5. The device utilizes an integrated PCB antenna with less than 3dBi of gain.
6. This device also transmits as a 15.247 hopping device in the frequency range of 902-928 MHz. Data for hopping mode transmission is available in the 1301770FX247-SAHL5 report.
7. The equipment under test was received on 10/25/13 and this test series commenced on 10/25/13.
8. Device operates on 12VDC battery so no conducted testing was performed.
9. Device is designed to be programmed for operation between 288-450 MHz, with the exception of the regions between 321-336.4 MHz and 398.9-411 MHz. Device operates at 3 possible duty cycle settings: 30%, 50%, and 80%. Transmit power automatically adjusts to higher levels at lower duty cycle settings.
10. 3 representative frequencies were tested to validate device: 288 MHz, 310 MHz, and 433 MHz.
11. Worst case fundamental transmit signal was measured at 310 MHz at 80% modulation in an End orientation Horizontally polarized. The signal was measured to be 362 uV/m below the FCC 15.231 limit of 5833 uV at 310 MHz.
12. Worst case spurious transmit harmonic was measured at 576 MHz operating at a fundamental frequency of 288 MHz. The device was programmed for 30% modulation. The signal was measured to be 335.85 uV/m below the limit of 492 uV/m.
13. Worst case restricted band spurious transmit harmonic was measured at 2891 MHz operating at a fundamental frequency of 288 MHz. The device was programmed for 30% modulation. The signal was measured to be 374.55 uV/m below the limit of 492 uV/m. Note that the 288 MHz transmit limits were used as it was more restrictive than the restricted band limit of 500 uV/m.
14. Worst case transmit restricted signal peak data was measured at 2891 MHz operating at a fundamental frequency of 288 MHz. The signal was measured to be 22.17 dB below the FCC 15.35 limit of 74dB above 1 GHz.
15. In transmit mode, Prescan indicated transmit spurious emissions at 30, 85, 110, 139, 209, and at the second and third harmonic frequencies near 600 MHz and 900 MHz. None of the non-harmonic signals were measurable when tested at the 3 Meters.

16. In "training" receive mode, a transmit burst was observed at 433 MHz. This burst represents an expected 30% duty cycle manufacturing test occurance whenever receive mode is initiated. This burst was measured to be 8213 uV/m below the 15.231 limit of 10958 uV/m at 433 MHz.
17. In "training" receive mode, no spurious radiated signals were found above the ambient noise floor of the receiving instrument with the exception of the manufacturing test burst noted above.
18. The device demonstrated compliance with the 15.231.a.1 5 second transmit deactivation requirement with a margin of 3.901 seconds.
19. The device demonstrated compliance to band edge limits by failing to "train" as a transmitter within 500 kHz of top (470 MHz), bottom (260 MHz), and restricted band edges of 322-335.4 MHz and 399.9-410 MHz.
20. The device demonstrated compliance to restricted band limits by failing to "train" as a transmitter within restricted band edges of 322-335.4 MHz and 399.9-410 MHz.
21. Scope plots are provided demonstrating the device's ability to operate at 30%, 50%, and 80% bandwidths.
22. The worst case 20 dB occupied bandwidth was measured at a fundamental frequency of 310 MHz. The occupied bandwidth was measured to be 122 kHz under the limit of 775 kHz at 310 MHz.

Changes Made to Achieve Compliance:

1. None

EUT Descriptions

Model: Garage Door Opener

Model number: S550

Serial/ID No: AHD-S550

Description: : Programmable Frequency Garage Door Opener Device is designed to be programmed for operation as a hopping device between 902-928 MHz and as a remote control device between 288-450 MHz, with the exception of the regions between 321-336.4 MHz and 398.9-411 MHz. Device operates at 3 possible duty cycle settings: 30%, 50%, and 80%. Transmit power automatically adjusts to higher levels at lower duty cycle settings.

Antenna: Integrated / PCB

PCBs: Transmit / Homelink PCB:

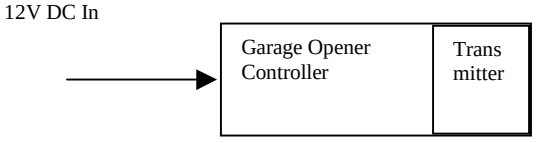
Specifications:

Input Power: 12V DC

Outputs Signals: 288-450 Mhz digitally encoded, with the exception of the regions between 321-336.4 MHz and 398.9-411 MHz. Also operates as a 902-928 MHz hopping device, as detailed in another report.

Input Signals: Receive / training function

EUT Block Diagram:



EUT Pictures

Exterior View Front

Exterior View Rear

Installed Product View

PCB Top View

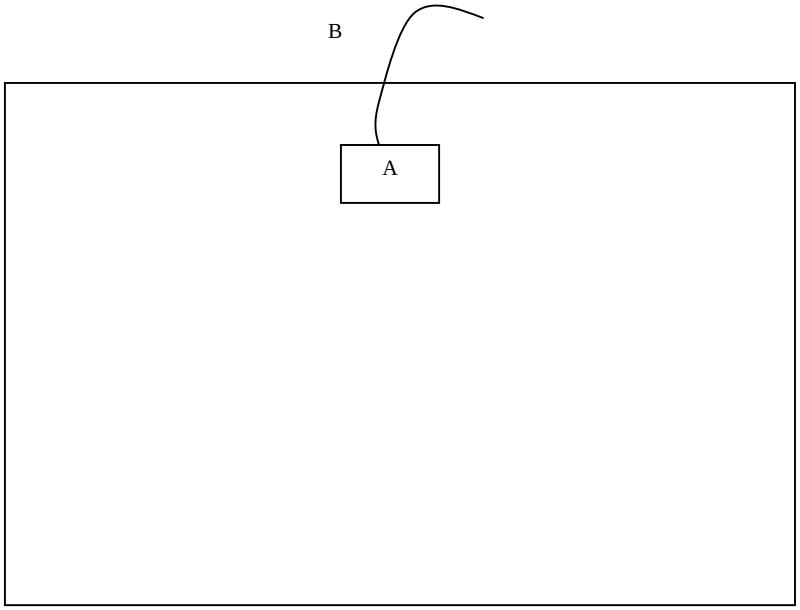
PCB Bottom View

Equipment Test Setup:

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	Garage Door Opener	S550	AHD-S550	15.231 / 15.247 transmitting device
B	12V DC Power Cord	NA	NA	3M unshielded

Block Diagram

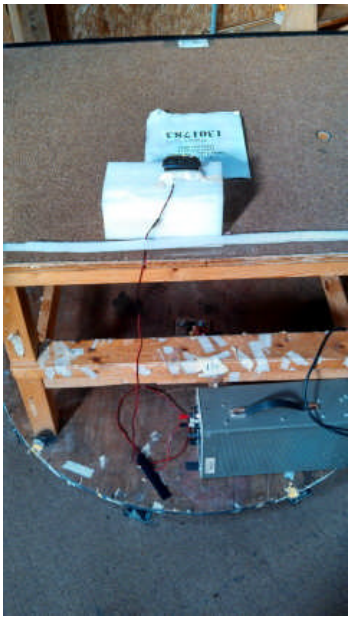


Setup Pictures

Radiated Prescreen Setup

Front Spurious Radiated Test View

Rear Spurious Radiated Test View



Front Orientation Transmit

End Orientation Transmit

Side Orientation Transmit

Measurement Report

Standards Applied to Test

ANSI C63.4 – Radio Noise Emissions 2003.12
CFR47 FCC Part 15.231
AHD/SEI test procedures TP0101LC, TP0102RA
EN55022 ITE Disturbance 2005.11
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

Transmit:

Transmit radiated testing was performed at a 3 meter open field test site, and completed according to the procedures in FCC 15.231 with supporting instructions from ANSI C63.4. Note that for low strength signals distance may be adjusted below 3 meters as noted with the data.

Device was tested at 3 representative frequencies within operational range: 288 MHz, 310 MHz, and 433. MHz.

Device was tested in operational 3 orientations: Front, end, and side. Device was also tested using 2 possible receive antenna orientations: vertical and horizontal. (see pictures.) Extensive testing was performed to determine the worst case device and receive antenna orientation of the device for each representative frequency and modulation. Worst case orientation data is being presented for fundamental signal and signals up to 10 harmonics above fundamental frequencies.

Device was tested at 3 operational duty cycle settings: 30%, 50%, and 80%. At each setting, measurements were made using peak detection (CW equivalent) and compensated based on duty cycle. The following compensation formulas were used: at 30% duty cycle, peak measurement was reduced by 20log(0.3)=-10.46 dB. At 50% duty cycle, 20log(0.5)=-6 dB. At 80% duty cycle, 20log(0.8) = -1.94 dB.

Note that the device transmits its highest power when set to a 30% duty cycle. For that reason, peak measurements made at a 30% duty cycle setting may demonstrate signal strength within FCC limits when compensated to 80% duty cycle.

Transmit was also tested for 20dB bandwidth and for adherence to band edges and exclusion frequencies as well. Band edge adherence to upper, lower, and exclusion limits were demonstrated by attempting to program the device to the band edge frequencies. Refusal to program demonstrates device adherence to band edge and exclusion frequency requirements.

Receive:

Note also that a discrete "programming mode" was tested as well. In programming mode, a series of pulses are received which the device responds to.

Radiated:

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

The EUT was scanned for radiated energy up to 4.33 GHz to meet FCC 15.231 requirements.

The EUT under test was placed per ANSI C63.4

The EUT was exercised as follows:

1. Device was powered via 12VDC
2. The device was activated by depressing transmit button with a rubber band.
3. Evidence of operation was provided by signal measurement

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

Transmit Data

Transmit Fundamental Measurements

Measured Frequency	Azimuth/ Antenna Height	Orientation / Polarization	Duty Cycle	E Field Measurement	Duty Cycle Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	MHz		%	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
288.00	**150 / 1**	**End-H**	**30.00**	**81.10**	**-10.46**	**70.64**	**3405**	**4917**	**1512**
288.00	**150 / 1**	**End-H**	**50.00**	**77.50**	**-6.02**	**71.48**	**3749**	**4917**	**1167**
288.00	**150 / 1**	**End-H**	**80.00**	**72.70**	**-1.94**	**70.76**	**3452**	**4917**	**1465**
310.00	**250 / 1**	**End-H**	**30.00**	**78.70**	**-10.46**	**68.24**	**2583**	**5833**	**3250**
310.00	**250 / 1**	**End-H**	**50.00**	**76.70**	**-6.02**	**70.68**	**3420**	**5833**	**2414**
310.00	**250 / 1**	**End-H**	**80.00**	**76.70**	**-1.94**	**74.76**	**5471**	**5833**	**362***
433.00	**240 / 1**	**Side-H**	**30.00**	**87.30**	**-10.46**	**76.84**	**6952**	**10958**	**4006**
433.00	**240 / 1**	**Side-H**	**50.00**	**84.30**	**-6.02**	**78.28**	**8203**	**10958**	**2755**
433.00	**240 / 1**	**Side-H**	**80.00**	**76.90**	**-1.94**	**74.96**	**5599**	**10958**	**5360**

Note that 362 uV/ M = 0.56dB which is within the AHD 95% uncertainty margin of 1.4dB.

Low Harmonic Measurements

Fundamental Frequency	Measured Frequency	Duty Cycle	E Field Measurement	Duty Cycle Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	MHz	%	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
288.00	**576.00**	**30.00**	**37.70**	**-10.46**	**27.24**	**23**	**492**	**468.65**
288.00	**864.00**	**30.00**	**54.31**	**-10.46**	**43.85**	**156**	**492**	**335.85**
310.00	**620.00**	**30.00**	**32.99**	**-10.46**	**22.53**	**13**	**583**	**569.95**
310.00	**930.00**	**30.00**	**48.70**	**-10.46**	**38.24**	**82**	**583**	**501.65**
433.00	**866.00**	**30.00**	**56.80**	**-10.46**	**46.34**	**208**	**1096**	**888.28**

Note that all low harmonic measurements were made after manipulating the device to a worst case orientation.

288 MHz Transmit Upper Harmonic Measurements

Fundamental Frequency	Measured Frequency	E Field Measurement	Duty Cycle Correction	Distance Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
288.00	**1157a**	**48.85**	**-10.46**	**-9.50**	**28.89**	**28**	**492**	**463.83**
288.00	**1447a**	**51.07**	**-10.46**	**-9.50**	**31.11**	**36**	**492**	**455.72**
288.00	**1728.00**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**NA**	**NA**
288.00	**2021.00**	**51.19**	**-10.46**	**-9.50**	**31.23**	**36**	**492**	**455.22**
288.00	**2311a**	**55.30**	**-10.46**	**-9.50**	**35.34**	**58**	**492**	**433.17**
288.00	**2596.00**	**49.70**	**-10.46**	**-9.50**	**29.74**	**31**	**492**	**460.97**
288.00	**2891a**	**61.33**	**-10.46**	**-9.50**	**41.37**	**117**	**492**	**374.55**

Note that all upper harmonic measurements were made after manipulating the device to a worst case orientation. Also note that because of low signal strength, all measurements were made at a distance of 1 meter, which necessitates the 3 meter distance correction factor.
* Indicates no signal detected at this frequency
a Indicates restricted band signals, however 15.231 limits are more restrictive than 15.205 restricted band limits (500uV/m)

310 MHz Upper Transmit Harmonic Measurements

Fundamental Frequency	Measured Frequency	E Field Measurement	Duty Cycle Correction	Distance Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
310.00	**1242a**	**47.60**	**-10.46**	**-9.50**	**27.64**	**24**	**500**	**475.89**
310.00	**1556a**	**52.00**	**-10.46**	**-9.50**	**32.04**	**40**	**500**	**459.99**
310.00	**1865.00**	**51.24**	**-10.46**	**-9.50**	**31.28**	**37**	**583**	**546.68**
310.00	**2170.00**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**583**	**NA**
310.00	**2487a**	**54.69**	**-10.46**	**-9.50**	**34.73**	**55**	**500**	**445.47**
310.00	**2790a**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**500**	**NA**
310.00	**3100.00**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**583**	**NA**

Note that all upper harmonic measurements were made after manipulating the device to a worst case orientation. Also note that because of low signal strength, all measurements were made at a distance of 1 meter, which necessitates the 3 meter distance correction factor.
* Indicates no signal detected at this frequency
a Indicates restricted band signals, so restricted band limits were used (500uV/m).

433 MHz Transmit Upper Harmonic Measurements

Fundamental Frequency	Measured Frequency	E Field Measurement	Duty Cycle Correction	Distance Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
433.00	**1299.00**	**46.30**	**-10.46**	**-9.50**	**26.34**	**21**	**1096**	**1075.08**
433.00	**1736.00**	**59.80**	**-10.46**	**-9.50**	**39.84**	**98**	**1096**	**997.63**
433.00	**2169.00**	**57.80**	**-10.46**	**-9.50**	**37.84**	**78**	**1096**	**1017.83**
433.00	**2606.00**	**66.82**	**-10.46**	**-9.50**	**46.86**	**220**	**1096**	**875.48**
433.00	**3031.00**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**1096**	**NA**
433.00	**3464.00**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**1096**	**NA**
433.00	**3897a**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**500**	**NA**
433.00	**4330a**	*****	**-10.46**	**-9.50**	**NA**	**NA**	**500**	**NA**

Note that all upper harmonic measurements were made after manipulating the device to a worst case orientation. Also note that because of low signal strength, all measurements were made at a distance of 1 meter, which necessitates the 3 meter distance correction factor.
* Indicates no signal detected at this frequency
a Indicates restricted band signals, so restricted band limits were used (500uV/m).

Restricted Band Harmonic Peak Compliance

Restricted Band Peak Data

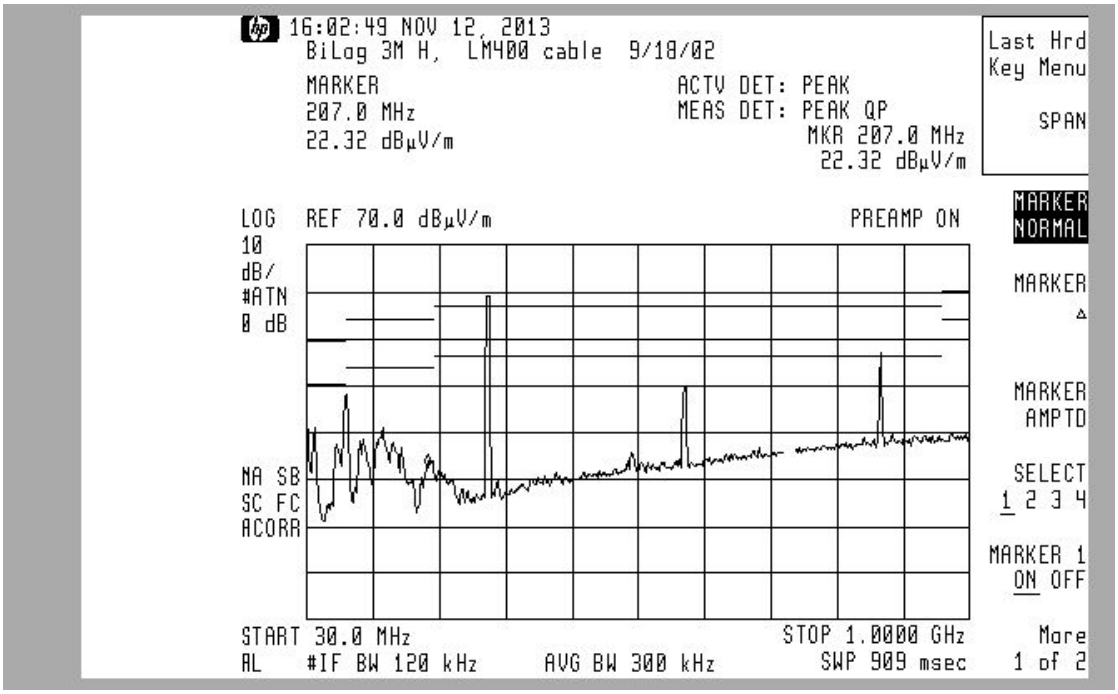
Fundamental Frequency	Measured Frequency	E Field Measurement	Duty Cycle Correction	Distance Correction	Corrected Data	FCC Limit	Margin
MHz	MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m
288.00	**1157a**	**48.85**	**0.00**	**-9.50**	**39.35**	**74**	**34.65**
288.00	**1447a**	**51.07**	**0.00**	**-9.50**	**41.57**	**74**	**32.43**
288.00	**2311a**	**55.30**	**0.00**	**-9.50**	**45.80**	**74**	**28.20**
288.00	**2891a**	**61.33**	**0.00**	**-9.50**	**51.83**	**74**	**22.17**
310.00	**1242a**	**47.60**	**0.00**	**-9.50**	**38.10**	**74**	**35.90**
310.00	**1556a**	**52.00**	**0.00**	**-9.50**	**42.50**	**74**	**31.50**
310.00	**2487a**	**54.69**	**0.00**	**-9.50**	**45.19**	**74**	**28.81**
310.00	**2790a**	*****	**0.00**	**-9.50**	**NA**	**74**	**NA**
433.00	**3897a**	*****	**-10.46**	**-9.50**	**NA**	**74**	**NA**
433.00	**4330a**	*****	**-10.46**	**-9.50**	**NA**	**74**	**NA**

Note that all upper harmonic measurements were made after manipulating the device to a worst case orientation. Also note that because of low signal strength, all measurements were made at a distance of 1 meter, which necessitates the 3 meter distance correction factor.
* Indicates no signal detected at this frequency

Spurious Data

Prescan indicated transmit spurious emissions at 30, 85, 110, 139, 209, and at the second and third harmonic frequencies near 600 MHz and 900 MHz. None of the non-harmonic signals were measurable when tested at the 3 Meters. Harmonic signal strengths are detailed in the harmonic transmit section of this report.

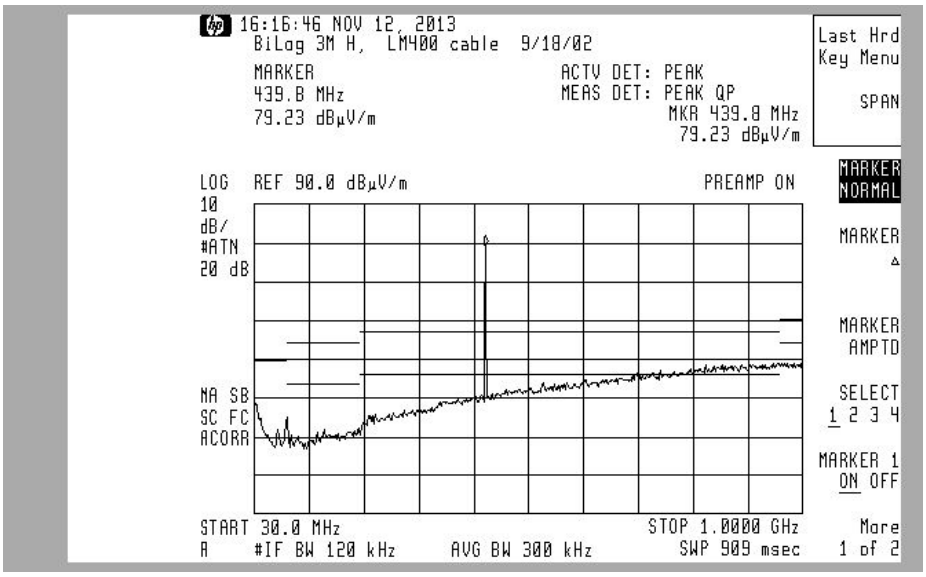
Tx Spurious Prescreen Plot



Receive Mode Manufacturing Test Burst

Measured Frequency	Duty Cycle	Training Pulse E Field Measurement	Duty Cycle Correction	Corrected Data	Corrected Data	FCC Limit	Margin
MHz	%	dBuV/m	dBuV/m	dBuV/m	uV/m	uV/m	uV/m
433.00	**30.00**	**79.23**	**-10.46**	**68.77**	**2745**	**10958**	**8213**

Receive Mode Spurious with Manufacturing Test Burst Plot



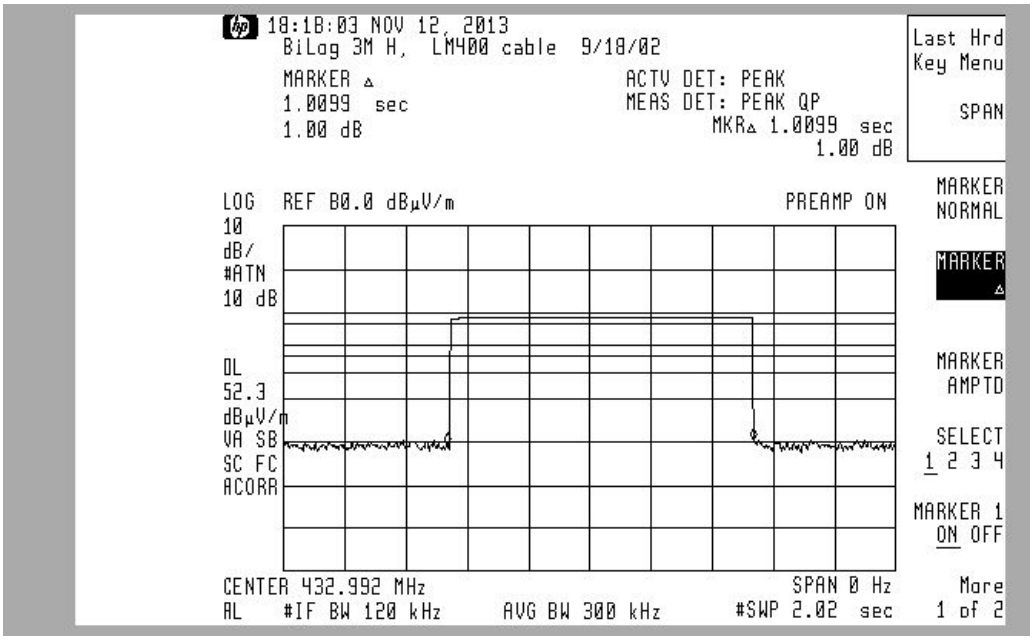
Note that marker frequency is innacurate due to broad span of scan.

Receive Spurious Measurements

- Screen room prescan indicated receive only the manufacturing test burst signal at 433 MHz, which is reported above. No other spurious emissions were detected.

Device Deactivation

Automatic Device Deactivation Plot



*Note – deactivation margin is 5 seconds – 1.009 seconds = 3.901 seconds.

Band Edge and Restricted Band Testing

Band Edge Testing Results Table

Frequency (MHz)	Part 15 Status	Result	Pass/Fail	Frequency (MHz)	Part 15 Status	Result	Pass/Fail
285.0	banned	would not train	Pass	398.0	allowed	trained	Pass
285.5	guard band	would not train	Pass	399.0	guard band	would not train	Pass
286.0	guard band	would not train	Pass	399.5	guard band	would not train	Pass
287.0	allowed	trained	Pass	400.0	banned	would not train	Pass
319.0	allowed	trained	Pass	401.0	banned	would not train	Pass
319.5	guard band	would not train	Pass	402.0	banned	would not train	Pass
320.5	guard band	would not train	Pass	403.0	banned	would not train	Pass
321.0	guard band	would not train	Pass	404.0	banned	would not train	Pass
321.5	guard band	would not train	Pass	405.0	banned	would not train	Pass
322.0	banned	would not train	Pass	406.0	banned	would not train	Pass
323.0	banned	would not train	Pass	407.0	banned	would not train	Pass
324.0	banned	would not train	Pass	408.0	banned	would not train	Pass
325.0	banned	would not train	Pass	409.0	banned	Adapted to 411 MHz	Pass
326.0	banned	would not train	Pass	410.0	banned	Adapted to 411 MHz	Pass
327.0	banned	would not train	Pass	410.5	guard band	Adapted to 411 MHz	Pass
328.0	banned	would not train	Pass	411.0	guard band	would not train	Pass
329.0	banned	would not train	Pass	411.5	allowed	trained	Pass
330.0	banned	would not train	Pass	412.0	allowed	trained	Pass
331.0	banned	would not train	Pass	447.0	allowed	trained	Pass
332.0	banned	would not train	Pass	448.0	allowed	would not train	Pass
333.0	banned	would not train	Pass	449.0	allowed	would not train	Pass
334.0	banned	would not train	Pass	450.0	device bandedge	would not train	Pass
335.0	banned	would not train	Pass	450.5	device bandedge	would not train	Pass
336.0	guard band	would not train	Pass	451.0	device bandedge	would not train	Pass
337.0	guard band	trained	Pass	452.0	device bandedge	would not train	Pass

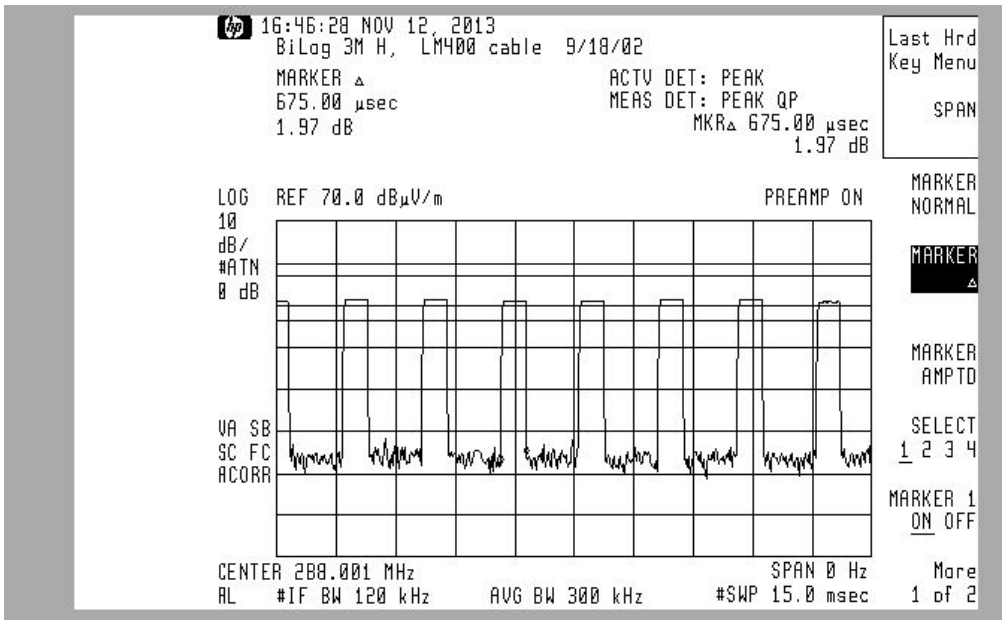
Duty Cycle

The following illustrates the 30%, 50%, and 80% duty cycle settings used for testing the device.

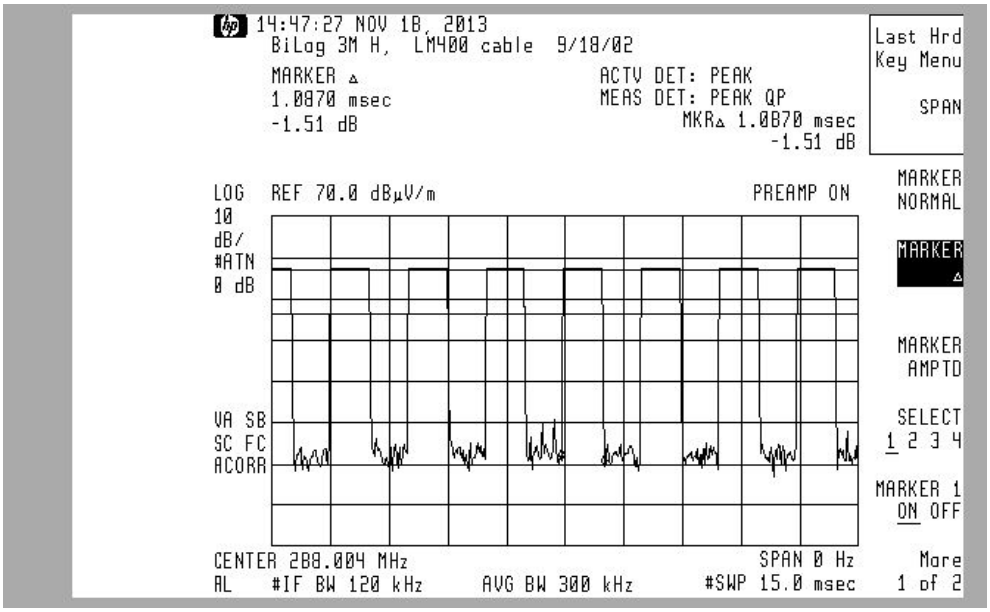
Duty Cycle Testing Results

Modulation Setting	Pulse Off Width	Pulse Width	Measured Duty Cycle
%	uSec	uSec	%
30	1275	675	34.62%
50	862	1087	55.77%
80	337	1650	83.04%

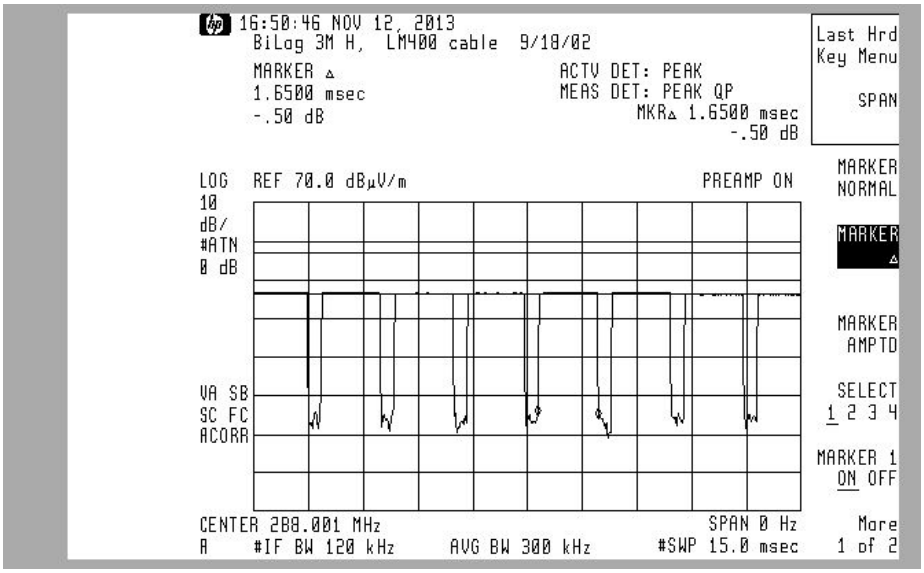
30% Duty Cycle Pulse Width



50% Duty Cycle Pulse Width



80% Duty Cycle

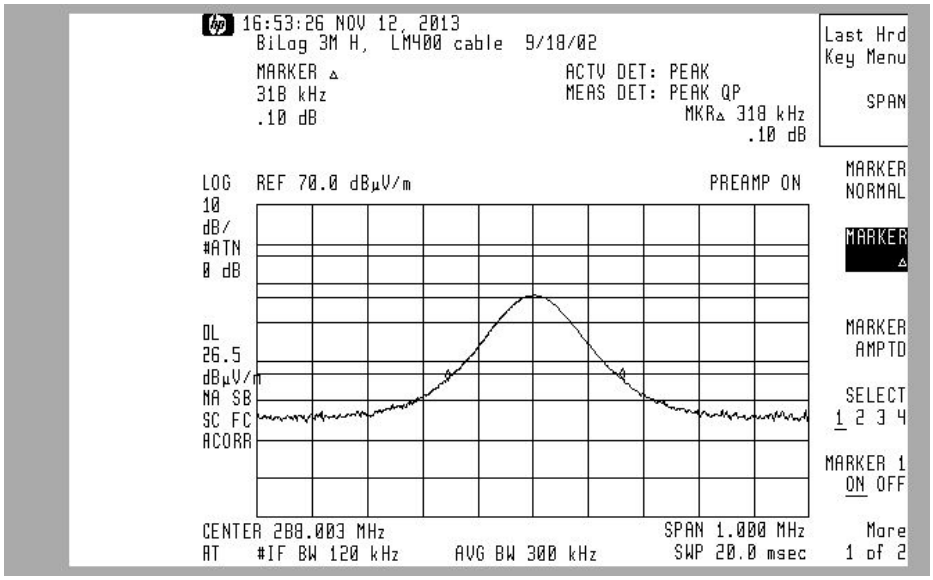


20 dB Bandwidth Measurement:

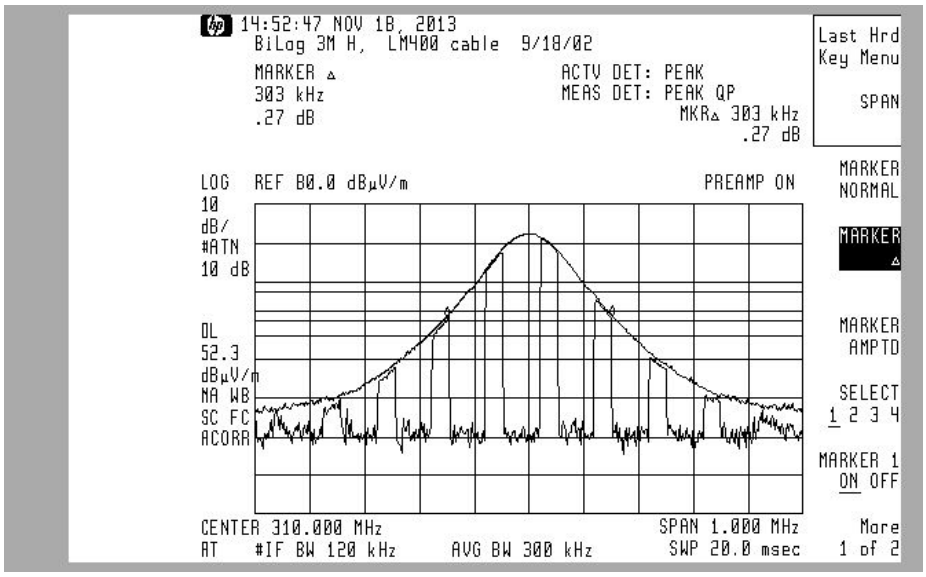
Tabulated Summary of 20dB Bandwidth Measurements

Frequency	Resolution Bandwidth	Occupied Bandwidth	Limit	Margin
MHz	KHz	KHz	KHz	KHz
288	120	318	720	402
310	120	303	775	472
433	120	303	1082.5	779.5

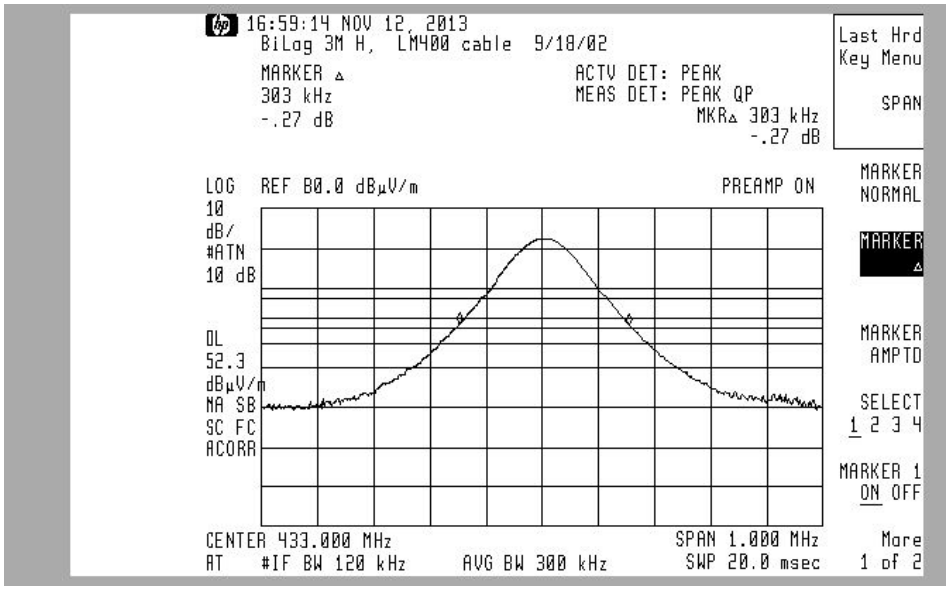
288 MHz 20dB Bandwidth Plot



310 MHz 20dB Bandwidth Plot

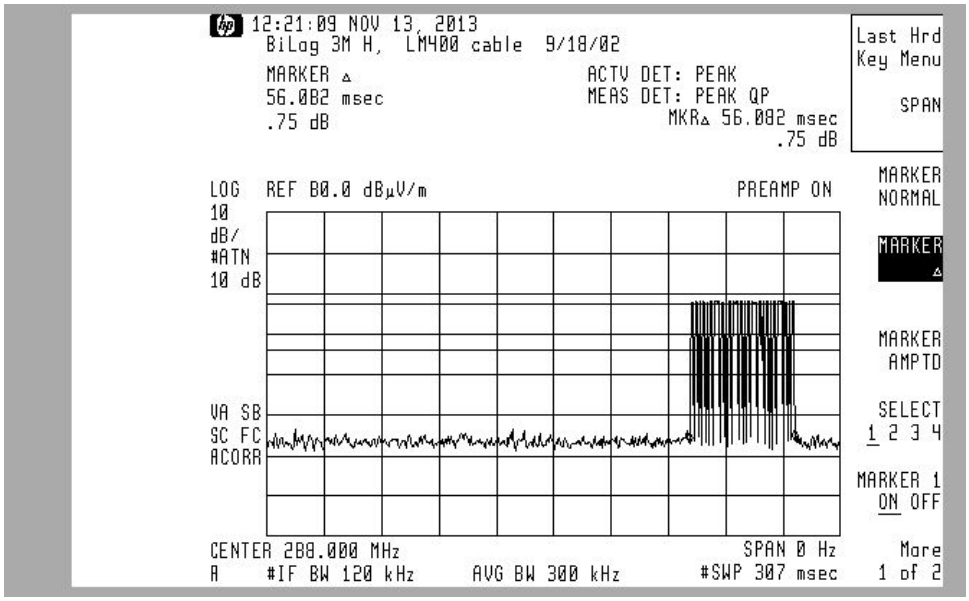


433 MHz 20dB Bandwidth Plot

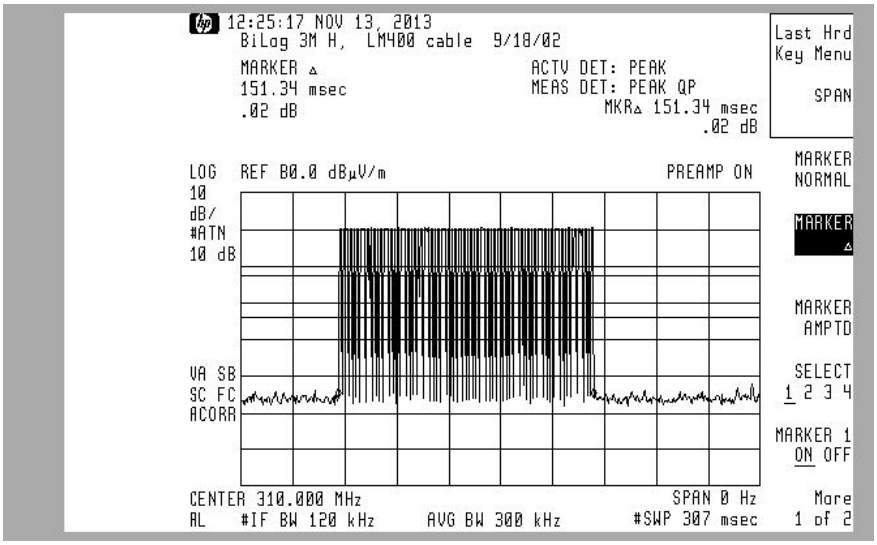


Training Pulse Measurement

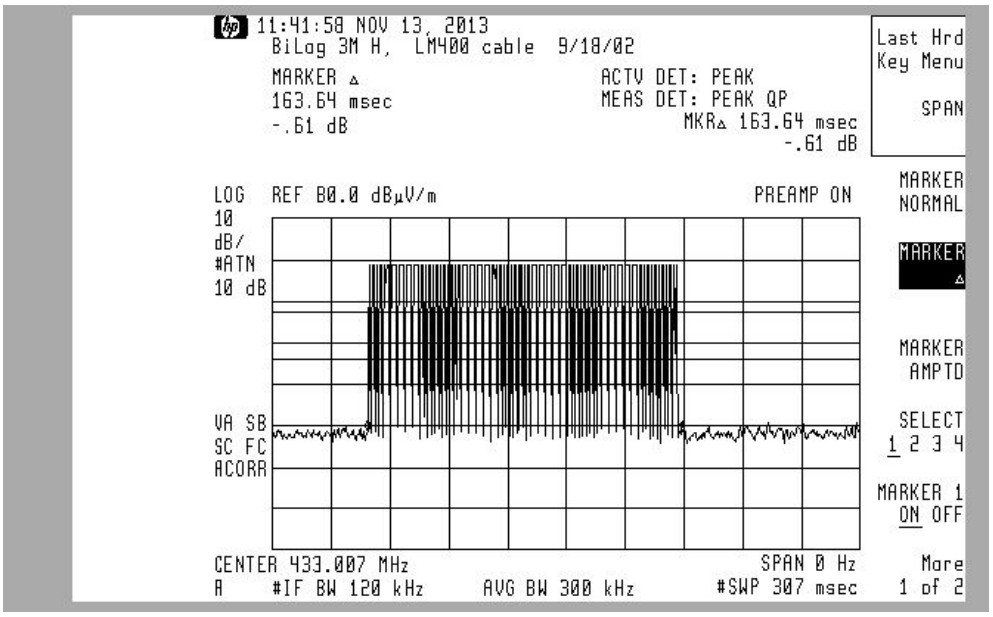
288 MHz Training Pulse Plot



310 MHz Training Pulse Plot



433 MHz Training Pulse Plot



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 43%.

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 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

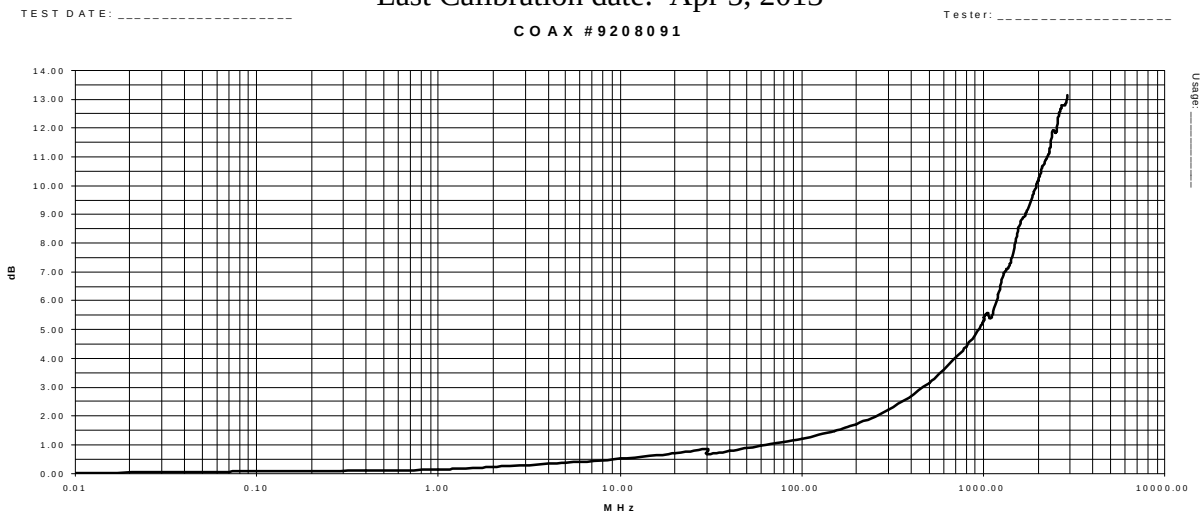
The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 Michigan Hwy152, Sister Lakes, 49047. This test facility is NVLAP accredited (LabCode 200129-0). It has been fully described in a report filed with the FCC (No.90413) and Industry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

Measurement Equipment Used

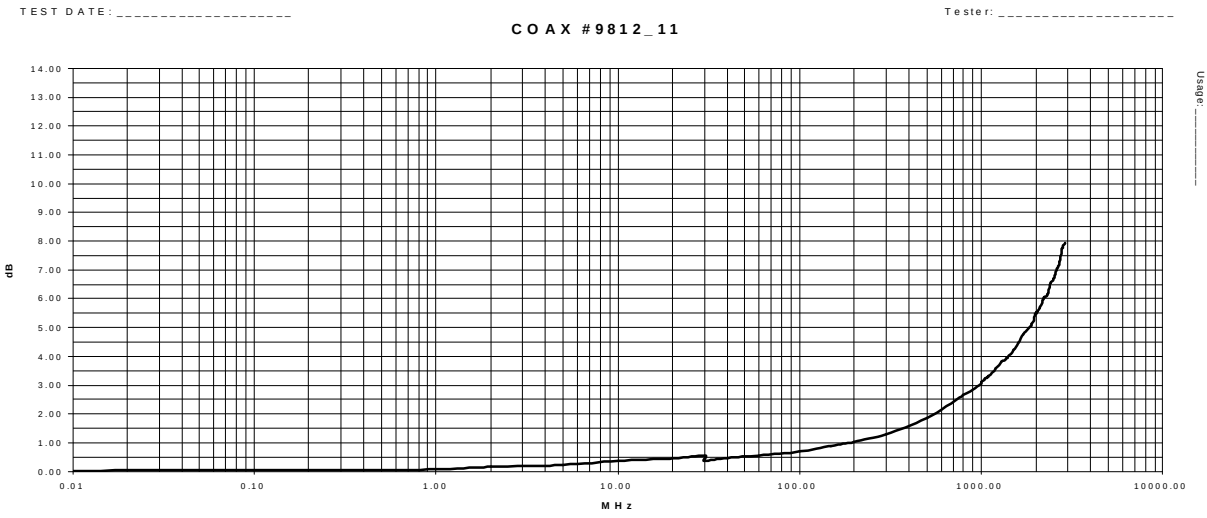
Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8542E			
RF Filter Section	HP-85420E	3448A00144	4 Sept-12	14 months
RF Receiver Section	HP-85422E	3625A00174	4 Sept-12	14 months
EMCO BiconiLog Antenna	3142	1069	18- Sept-12	14 months
EMCO Double Ridged Horn	3115	7770	22-Sept-12	14 months
Solar LISN	8012-50-R-24-BNC	962137	14 Sept-12	14 months
Solar LISN	8012-50-R-24-BNC	962138	28-Aug-12	14 months
(3-m) LMR-400 Ultra Flex	LMR400	C090804	02-May-13	6 months
(3-m) CS-3227 RG8	CS-3227	C060914	02-May-13	6 months
(10-m) Amelco 50ohm Coax	RG213U	9903-10ab	02-May-13	6 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	05-Apr-13	14 months
HP Oscilloscope	54100D	2510A00511	08-Apr-13	14 months
Keytek Surge	711B	8511854	10-Apr-13	14 months
Schaffner ESD	NSG432	01027	09-Apr-13	14 months
Schaffner EFT	NSG600/641	0113	11-Apr-13	14 months
Compliance Design Biconical Antenna	B100	016460	29-June-11	36 months
Compliance Design Biconical Antenna	B200	A10102	29-June-11	36 months
Compliance Design Biconical Antenna	B300	A10103	29-June-11	36 months
EMCO Loop	6205	2164	22-Sept-12	36 months

Cable Loss

Line Conducted 150KHz through 30MHz, Coax #920809
Last Calibration date: Apr 5, 2013

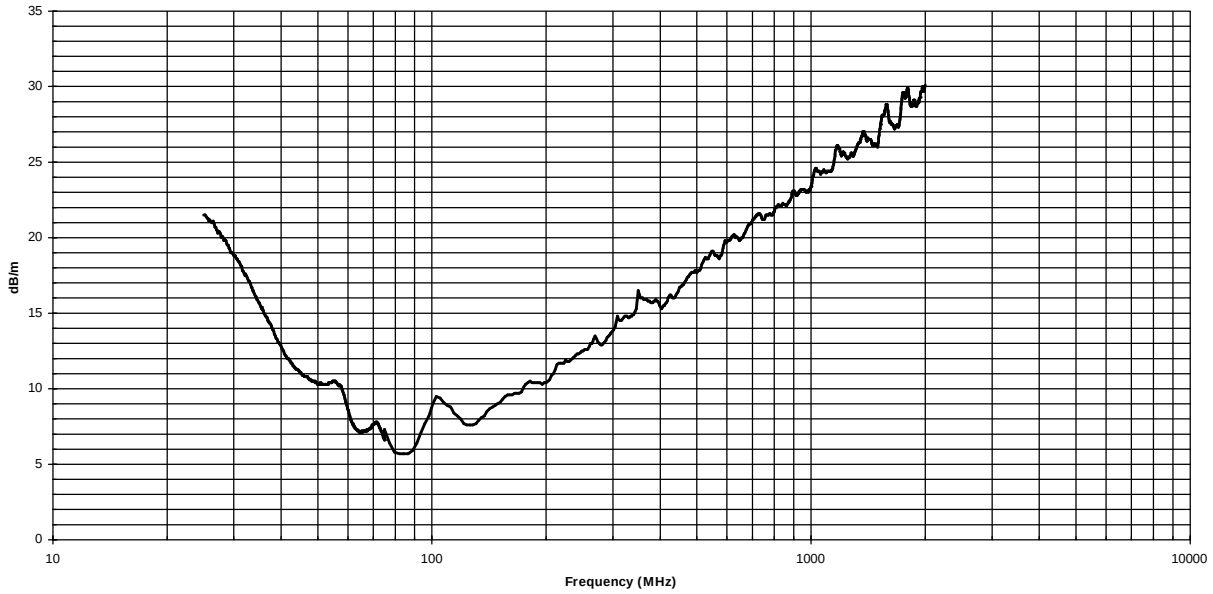


Radiated at 3 meters; 30MHz through 3000MHz, Coax #C090804
Last Calibration date: 02-May-13

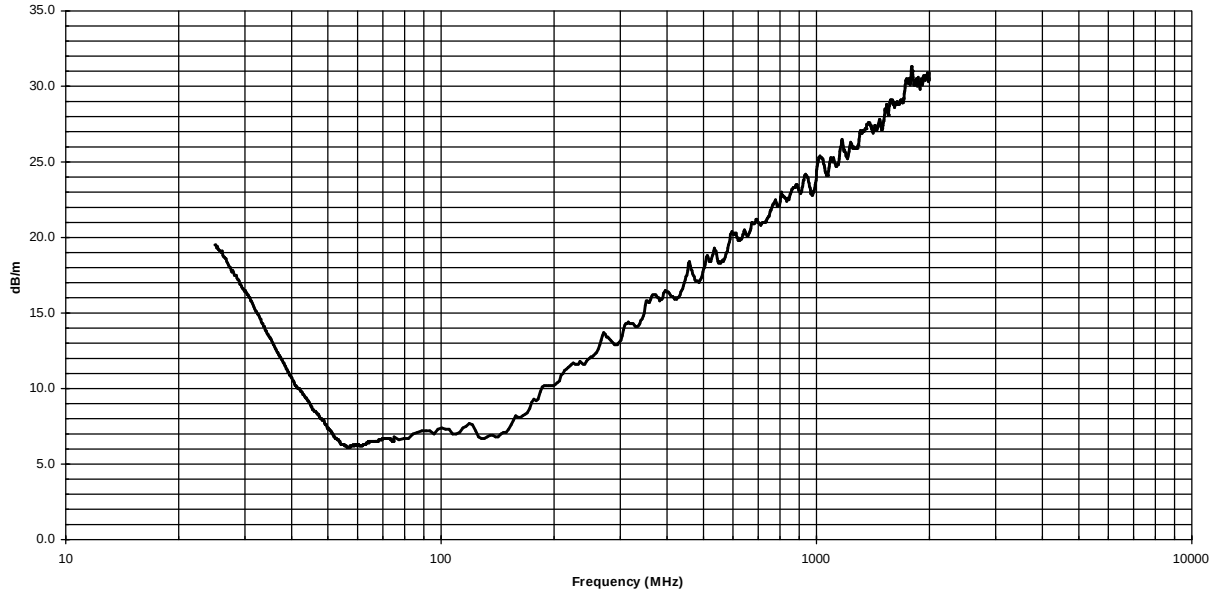


Antenna Factors

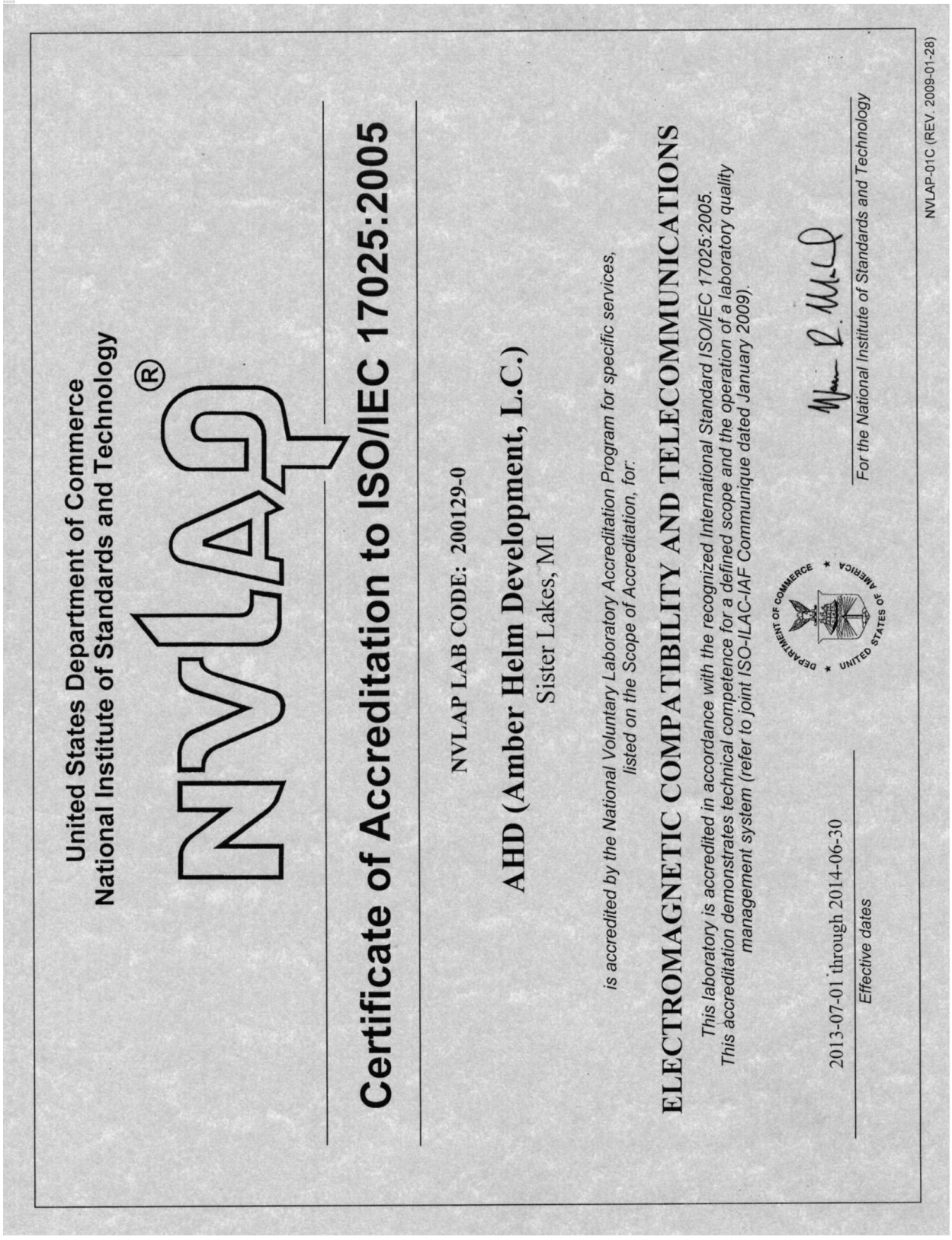
EMCO Model 3142 Antenna #1069
Last Calibration Date; 18- Sept-12
3 Meter Distance Factors



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 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 January 2009).

2013-07-01 through 2014-06-30
Effective dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

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

June 07, 2013

AHD (Amber Helm Development, Inc.
92723 Michigan Highway 152,
Sister Lakes, MI 49047

Attention: Gordon Helm

Re: Accreditation of AHD (Amber Helm Development, Inc.
Designation Number: US5317
Test Firm Registration #: 955409

Dear Sir or Madam:

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

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

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

Sincerely,

George Tannahill

George Tannahill
Electronics Engineer

NARTE SEAL