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92723 Michigan Hwy-152
Sister Lakes, MI 49047

EMC Test Report

#1301666FX-JLRHL4

Issued 01/28/13

Regarding the FCC Part 15 testing



Rear View Mirror

Model Number: JLRHL4 Family

Category: 15.231 Transmitting Device

Judgments: FCC Part 15.231 – Compliant



NVLAP LAB CODE 200129-0

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12/15/12-1/28/13

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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 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:

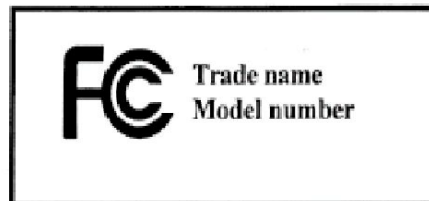
1. The User's Manual shall include this or similar statement:

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 905-3461 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 transmitter test results apply to the JLRHL4 family of devices, which include the 905-4020, 905-3461, 905-3740, and 905-4077 devices.
3. The device tested is compliant to the requirements of FCC Part 15.231 for a periodic digital transmitting device.
4. Non-transmit related spurious radiation measurements associated with this JLRHL4 family of devices are provided in the 1301683FB-4020, 1301683FB -3461, 1301683FB -3740, and 1301683FB-4077 specific reports.
5. The equipment under test was received on 12/15/12 and this test series commenced on 12/15/12.
6. Device operates on 12VDC battery so no conducted testing was performed.
7. 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.
8. 3 representative frequencies were tested to validate device: 288 MHz, 310 MHz, and 433 MHz.
9. Worst case fundamental transmit signal was measured at 310 MHz at 50% modulation in a Flat orientation vertically polarized. The signal was measured to be 1816 uV below the FCC 15.231 limit of 5833 uV at 310 MHz.
10. Worst case "training mode" transmit signal was measured at 288 MHz at 30% modulation. The signal was measured to be 2839 uV/m below the FCC 15.231 limit of 4917 uV/m at 288 MHz.
11. Worst case transmit harmonic was measured at 1550 MHz operating at a fundamental frequency of 310 MHz. The device was programmed for 80% modulation. The signal was measured to be 376.09 uV below the FCC 15.209 restricted band limit of 500 uV above 1 GHz.
12. Worst case transmit harmonic restricted signal peak data was measured at 1550 MHz operating at a fundamental frequency of 310 MHz. The device was programmed for 80% modulation. The signal was measured to be 25 dB below the FCC 15.35 limit of 74dB above 1 GHz.
13. In transmit mode, the spurious radiated emission levels were undetectable at a 3 Meter distance between EUT and receive antennas.
14. In "training" receive mode, the spurious radiated emission levels were undetectable at a 3 Meter distance between EUT and receive antennas.
15. The device demonstrated compliance with the 15.231.a.1 5 second transmit deactivation requirement with a margin of 4.48 seconds.

16. 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.
17. 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.
18. Scope plots are provided demonstrating the device’s ability to operate at 30%, 50%, and 80% bandwidths.
19. The worst case 20 dB occupied bandwidth was measured at a fundamental frequency of 288 MHz. The occupied bandwidth was measured to be 495 KHz under the limit of 720 KHz at 288 MHz.
20. The fundamental signal was found to be 132.713 mW below the FCC KDB 447948-D01 recommended limit for evaluating SAR performance. SAR measurement is not required for FCC certification.

Changes Made to Achieve Compliance:

1. None

EUT Descriptions

Model: Rear View Mirror

Model number: 905-3461 representing the JLRHL4 family of devices.

Serial/ID No: AHD-3461

Description: : Programmable Frequency Garage Door Opener / Digital Device Controller with 1 set of front facing optics that provide a Smart Beam oncoming high beam detect function and rear facing optics that provide auto-dimming function. 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.

Antenna: Integrated / PCB

PCBs: Transmit / Homelink PCB: 700-0342 VAAA
Mirror / Controller PCB: 700-0073 VBAE

Family Device Features and PCB's:

Model	Description	System PCB Number	System PCB Description	Transmit PCB	Spurious Report
905-4020	Driver Assist + SmartBeam + Auto Dimming (CAN Bus enabled)	700-0341 V004	Long	700-0342-VAAA	1301683FB-4020
905-3461	SmartBeam + Auto Dimming (CAN Bus enabled)	700-0073 VBAE	3/4 length	700-0342-VAAA	1301683FB-3461
905-3740	Base - Auto Dimming (Leaded)	700-0410 V002	Trapezoidal	700-0342-VAAA	1301683FB-3740
905-4077	Base - Auto Dimming (Lead Free)	280-0569 VAAB	Half Length	700-0342-V002*	1301683FB-4077

*note: V002 version of 700-0342 transmit board differs from VAAA transmit board only in certain component pad sizes to accommodate lead free manufacturing)

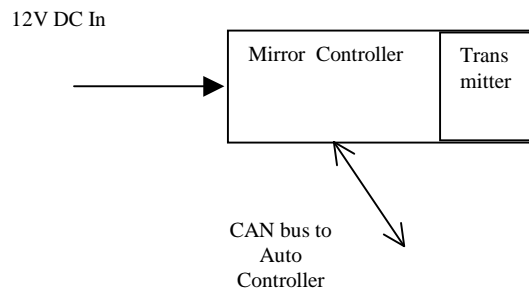
Specifications:

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.

Input Signals: Receive / training function and inputs from 2 forward facing and 1 rear facing optics.

EUT Block Diagram:



EUT Pictures

- Exterior View Front Page 11
- Exterior View Mirror Assy Page 11
- Exterior View Rear Page 12
- Mirror PCB Top View Page 12
- Mirror PCB Bottom View Page 13
- Homelink PCB Top View Page 13
- Homelink PCB Bottom View Page 14
- Homelink PCB Bottom Shield Page 14

Exterior View Front



Exterior View Mirror Assy Front



Exterior View Rear



Mirror PCB Top View



Mirror PCB Bottom View



Homelink PCB Top View



Homelink PCB Bottom View



Homelink PCB Bottom Cover

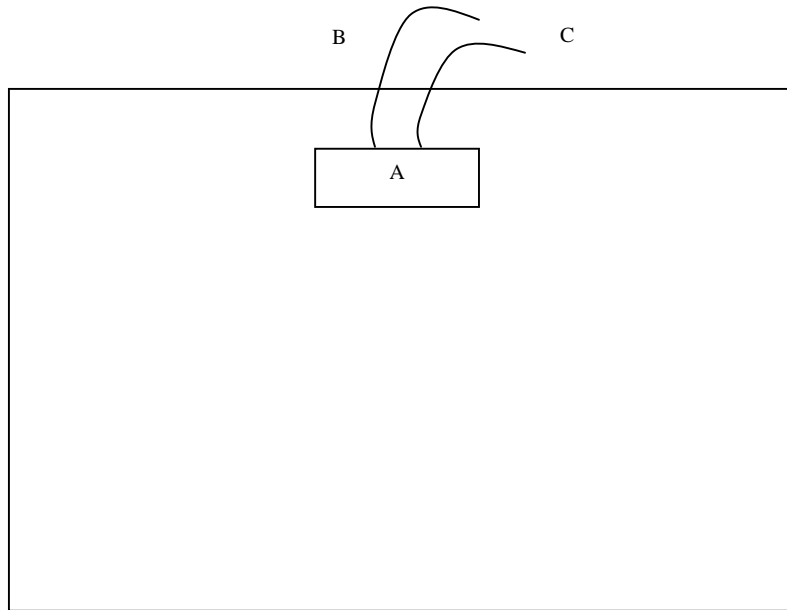


Equipment Test Setup:

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	Rear View Mirror	905-3461 of JLRHL4 family of devices	AHD-02	15.231 transmitting device
B	12V DC Power Cord	NA	NA	3M unshielded
C	CAN Cable	NA	NA	3M Single twisted pair

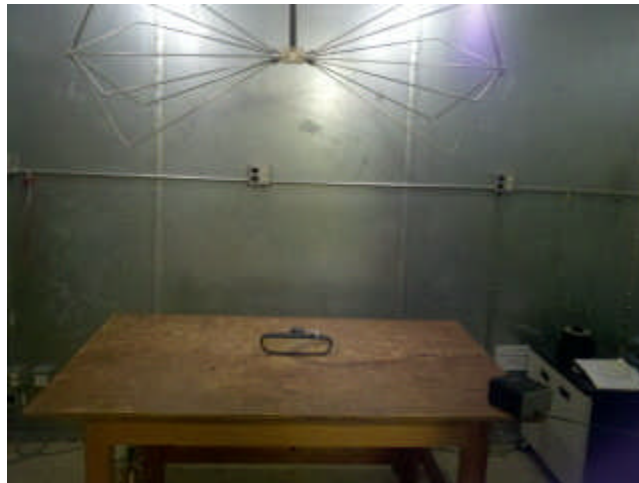
Block Diagram



Setup Pictures

- Radiated Prescreen Setup Page 16
- Front Orientation Transmit View Page 16
- End Orientation Transmit View Page 17
- Side Orientation Transmit View Page 17

Radiated Prescreen Setup



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.

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 $20\log(0.3)=-10.46$ dB. At 50% duty cycle, $20\log(0.5)=-6$ dB. At 80% duty cycle, $20\log(0.8) = -1.94$ 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 and by CAN bus interface operation on PC outside the test area.

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 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	0 / 1.7	End-V	30.00	75.30	-10.46	64.84	1746	4917	3170
288.00	0 / 1.7	End-V	50.00	70.90	-6.02	64.88	1754	4917	3163
288.00	0 / 1.7	End-V	80.00	66.70	-1.94	64.76	1730	4917	3186
310.00	10 / 1.5	Flat-V	30.00	81.10	-10.46	70.64	3405	5833	2428
310.00	10 / 1.5	Flat-V	50.00	78.10	-6.02	72.08	4018	5833	1816
310.00	10 / 1.5	Flat-V	80.00	73.90	-1.94	71.96	3964	5833	1870
433.00	0 / 1.1	End-V	30.00	89.70	-10.46	79.24	9165	10958	1794
433.00	350 / 1.1	End-V	50.00	82.60	-6.02	76.58	6745	10958	4214
433.00	350 / 1.1	End-V	80.00	75.30	-1.94	73.36	4657	10958	6302

288 MHz Transmit Harmonic Measurements

Fundamental Frequency	Measured Frequency	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	576.00	Flat-V	30.00	43.60	-10.46	33.14	45	492	446.26
288.00	576.00	Flat-V	50.00	37.50	-6.02	31.48	37	492	454.17
288.00	576.00	Flat-V	80.00	32.70	-1.94	30.76	35	492	457.15
288.00	864.00	Flat-V	30.00	*	-10.46	*	*	492	*
288.00	864.00	Flat-V	50.00	*	-6.02	*	*	492	*
288.00	864.00	Flat-V	80.00	*	-1.94	*	*	492	*
288.00	1152.00	Side-H	30.00	37.00	-10.46	26.54	21	492	470.43
288.00	1152.00	Side-H	50.00	37.00	-6.02	30.98	35	492	456.27
288.00	1152.00	Side-H	80.00	37.00	-1.94	35.06	57	492	435.03
288.00	1440.00	Side-H	30.00	43.00	-10.46	32.54	42	492	449.29
288.00	1440.00	Side-H	50.00	41.00	-6.02	34.98	56	492	435.57
288.00	1440.00	Side-H	80.00	40.06	-1.94	38.12	81	492	411.11
288.00	1728.00	Side-H	30.00	*	-10.46	*	*	492	*
288.00	1728.00	Side-H	50.00	*	-6.02	*	*	492	*
288.00	1728.00	Side-H	80.00	*	-1.94	*	*	492	*
288.00	2016.00	Side-H	30.00	*	-10.46	*	*	492	*
288.00	2016.00	Side-H	50.00	*	-6.02	*	*	492	*
288.00	2016.00	Side-H	80.00	*	-1.94	*	*	492	*
288.00	2304.00	Side-H	30.00	*	-10.46	*	*	492	*
288.00	2304.00	Side-H	50.00	*	-6.02	*	*	492	*
288.00	2304.00	Side-H	80.00	*	-1.94	*	*	492	*
288.00	2592.00	Side-H	30.00	*	-10.46	*	*	492	*
288.00	2592.00	Side-H	50.00	*	-6.02	*	*	492	*
288.00	2592.00	Side-H	80.00	*	-1.94	*	*	492	*
288.00	2880.00	Side-H	30.00	*	-10.46	*	*	492	*
288.00	2880.00	Side-H	50.00	*	-6.02	*	*	492	*
288.00	2880.00	Side-H	80.00	*	-1.94	*	*	492	*

* Indicates no signal detected at this frequency

310 MHz Transmit Harmonic Measurements

Fundamental Frequency	Measured Frequency	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
310.00	620.00	Side-H	30.00	46.70	-10.46	36.24	65	583	518.45
310.00	620.00	Side-H	50.00	40.60	-6.02	34.58	54	583	529.76
310.00	620.00	Side-H	80.00	35.20	-1.94	33.26	46	583	537.30
310.00	930.00	Side-H	30.00	39.90	-10.46	29.44	30	583	553.68
310.00	930.00	Side-H	50.00	32.80	-6.02	26.78	22	583	561.51
310.00	930.00	Side-H	80.00	30.00	-1.94	28.06	25	583	558.04
310.00	1240.00(a)	Side-H	30.00	38.50	-10.46	28.04	25	500	474.76
310.00	1240.00(a)	Side-H	50.00	35.30	-6.02	29.28	29	500	470.89
310.00	1240.00(a)	Side-H	80.00	*	-1.94	*	*	500	*
310.00	1550.00(a)	End-H	30.00	49.30	-10.46	38.84	88	500	412.48
310.00	1550.00(a)	Side-H	50.00	45.79	-6.02	39.77	97	500	402.62
310.00	1550.00(a)	Side-H	80.00	43.80	-1.94	41.86	124	500	376.09
310.00	1860.00	Side-H	30.00	*	-10.46	*	*	583	*
310.00	1860.00	Side-H	50.00	*	-6.02	*	*	583	*
310.00	1860.00	Side-H	80.00	*	-1.94	*	*	583	*
310.00	2170.00	Side-H	30.00	*	-10.46	*	*	583	*
310.00	2170.00	Side-H	50.00	*	-6.02	*	*	583	*
310.00	2170.00	Side-H	80.00	*	-1.94	*	*	583	*
310.00	2480.00	Side-H	30.00	*	-10.46	*	*	583	*
310.00	2480.00	Side-H	50.00	*	-6.02	*	*	583	*
310.00	2480.00	Side-H	80.00	*	-1.94	*	*	583	*
310.00	2790.00(a)	Side-H	30.00	*	-10.46	*	*	500	*
310.00	2790.00(a)	Side-H	50.00	*	-6.02	*	*	500	*
310.00	2790.00(a)	Side-H	80.00	*	-1.94	*	*	500	*
310.00	3100.00	Side-H	30.00	*	-10.46	*	*	583	*
310.00	3100.00	Side-H	50.00	*	-6.02	*	*	583	*
310.00	3100.00	Side-H	80.00	*	-1.94	*	*	583	*

* Indicates no signal detected at this frequency

(a) Signals fall within restricted bands so limits revert to spurious limits

433 MHz Transmit Harmonic Measurements

Fundamental Frequency	Measured Frequency	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
433.00	866.00	Flat-H	30.00	52.60	-10.46	42.14	128	1096	967.86
433.00	866.00	Flat-H	50.00	48.20	-6.02	42.18	129	1096	967.31
433.00	866.00	Flat-H	80.00	46.20	-1.94	44.26	163	1096	932.49
433.00	1299.00	Side-H	30.00	47.07	-10.46	36.61	68	1096	1028.13
433.00	1299.00	Side-H	50.00	38.25	-6.02	32.23	41	1096	1054.96
433.00	1299.00	Side-H	80.00	34.00	-1.94	32.06	40	1096	1055.74
433.00	1732.00	Side-H	30.00	*	-10.46	*	*	1096	*
433.00	1732.00	Side-H	50.00	*	-6.02	*	*	1096	*
433.00	1732.00	Side-H	80.00	*	-1.94	*	*	1096	*
433.00	2165.00	End-H	30.00	*	-10.46	*	*	1096	*
433.00	2165.00	Side-H	50.00	*	-6.02	*	*	1096	*
433.00	2165.00	Side-H	80.00	*	-1.94	*	*	1096	*
433.00	2598.00	Side-H	30.00	*	-10.46	*	*	1096	*
433.00	2598.00	Side-H	50.00	*	-6.02	*	*	1096	*
433.00	2598.00	Side-H	80.00	*	-1.94	*	*	1096	*
433.00	3031.00	Side-H	30.00	*	-10.46	*	*	1096	*
433.00	3031.00	Side-H	50.00	*	-6.02	*	*	1096	*
433.00	3031.00	Side-H	80.00	*	-1.94	*	*	1096	*
433.00	3464.00	Side-H	30.00	*	-10.46	*	*	1096	*
433.00	3464.00	Side-H	50.00	*	-6.02	*	*	1096	*
433.00	3464.00	Side-H	80.00	*	-1.94	*	*	1096	*
433.00	3897.00(a)	Side-H	30.00	*	-10.46	*	*	500	*
433.00	3897.00(a)	Side-H	50.00	*	-6.02	*	*	500	*
433.00	3897.00(a)	Side-H	80.00	*	-1.94	*	*	500	*
433.00	4330.00(a)	Side-H	30.00	*	-10.46	*	*	500	*
433.00	4330.00(a)	Side-H	50.00	*	-6.02	*	*	500	*
433.00	4330.00(a)	Side-H	80.00	*	-1.94	*	*	500	*

* Indicates no signal detected at this frequency

(a) Signals fall within restricted bands so limits revert to spurious limits

Restricted Band Harmonic Peak Compliance

Restricted Band Harmonic Peak Data

Fundamental Frequency	Measured Frequency	Orientation / Polarization	Duty Cycle	Peak E Field Measurement	Average FCC Limit	Peak FCC Limit	Margin
MHz	MHz		%	dBuV/m	dBuV/m	dBuV/m	dBuV/m
310.00	1240.00	Side-H	30.00	38.50	54.00	74.00	36
310.00	1240.00	Side-H	50.00	35.30	54.00	74.00	39
310.00	1240.00	Side-H	80.00	*	54.00	74.00	*
310.00	1550.00	End-H	30.00	49.30	54.00	74.00	25
310.00	1550.00	Side-H	50.00	45.79	54.00	74.00	28
310.00	1550.00	Side-H	80.00	43.80	54.00	74.00	30

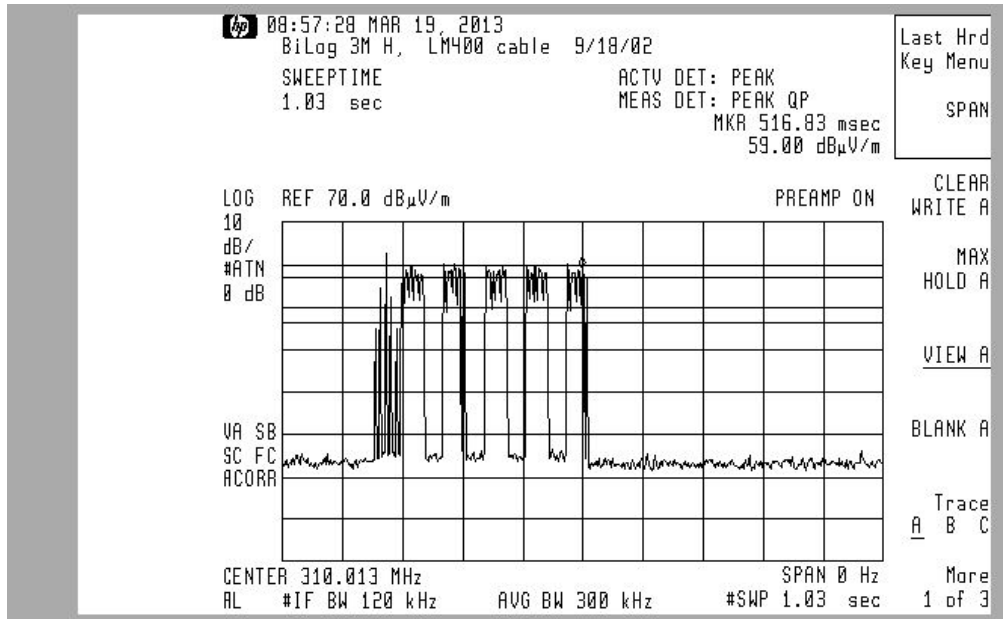
* Indicates no signal detected at this frequency

Receive Spurious Measurements

- No Spurious Signals Detected while in learn mode / receive.

Device Deactivation

Automatic Device Deactivation Plot



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	338.0	allowed	trained	Pass
285.5	guard band	would not train	Pass	398.0	allowed	trained	Pass
286.0	guard band	trained	Pass	399.0	guard band	trained	Pass
287.0	allowed	trained	Pass	399.5	guard band	would not train	Pass
319.0	allowed	trained	Pass	400.0	banned	would not train	Pass
320.0	allowed	trained	Pass	401.0	banned	would not train	Pass
320.5	allowed	trained	Pass	402.0	banned	would not train	Pass
321.0	guard band	trained	Pass	403.0	banned	would not train	Pass
321.5	guard band	would not train	Pass	404.0	banned	would not train	Pass
322.0	banned	would not train	Pass	405.0	banned	would not train	Pass
323.0	banned	would not train	Pass	406.0	banned	would not train	Pass
324.0	banned	would not train	Pass	407.0	banned	would not train	Pass
325.0	banned	would not train	Pass	408.0	banned	would not train	Pass
326.0	banned	would not train	Pass	409.0	banned	would not train	Pass
327.0	banned	would not train	Pass	410.0	banned	would not train	Pass
328.0	banned	would not train	Pass	410.5	guard band	would not train	Pass
329.0	banned	would not train	Pass	411.0	guard band	trained	Pass
330.0	banned	would not train	Pass	411.5	allowed	trained	Pass
331.0	banned	would not train	Pass	412.0	allowed	trained	Pass
332.0	banned	would not train	Pass	449.0	allowed	trained	Pass
333.0	banned	would not train	Pass	450.0	allowed	trained	Pass
334.0	banned	would not train	Pass	450.5	allowed	would not train	Pass
335.0	banned	would not train	Pass	451.0	allowed	would not train	Pass
336.0	guard band	would not train	Pass	452.0	allowed	would not train	Pass
337.0	guard band	trained	Pass				

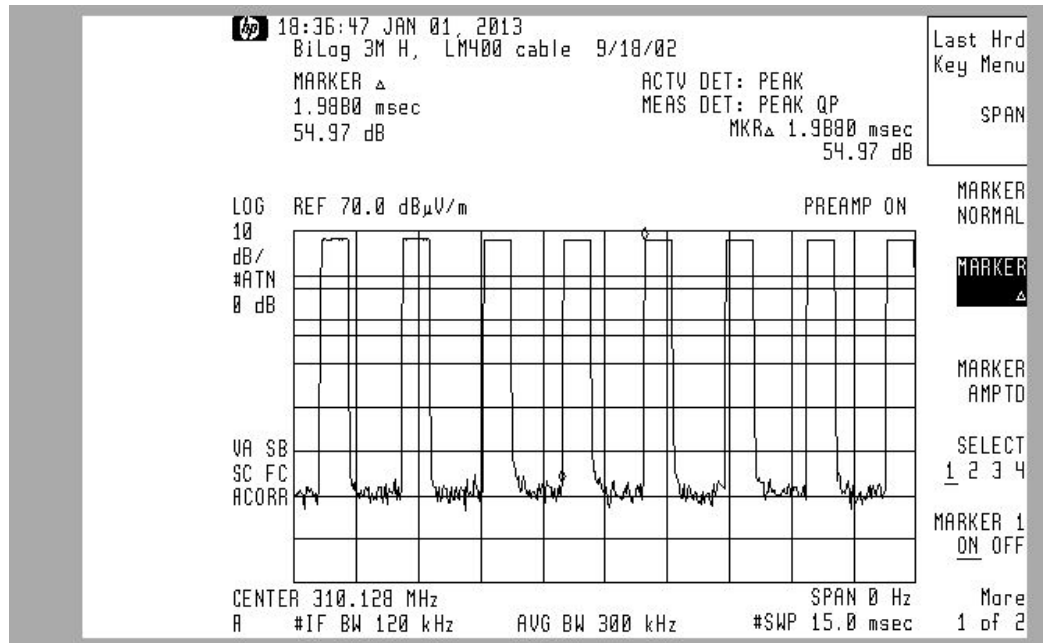
Duty Cycle

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

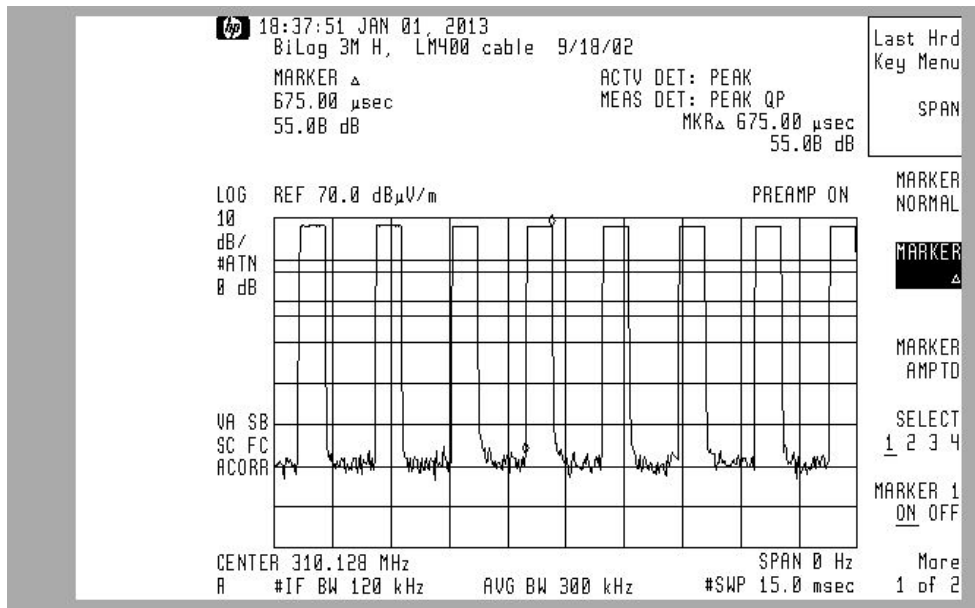
Duty Cycle Testing Results

Baseline Period	Modulation Setting	Pulse Width	Measured Duty Cycle
uSec	%	uSec	%
1988	30	675	33.95
1988	50	1000	50.30
1988	80	1600	80.48

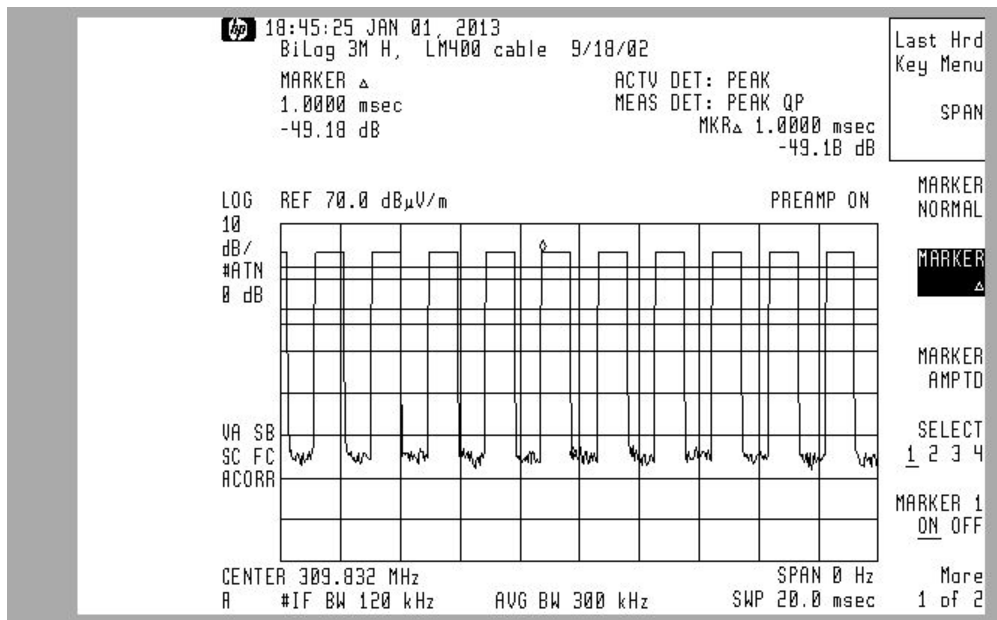
Duty Cycle Baseline Period



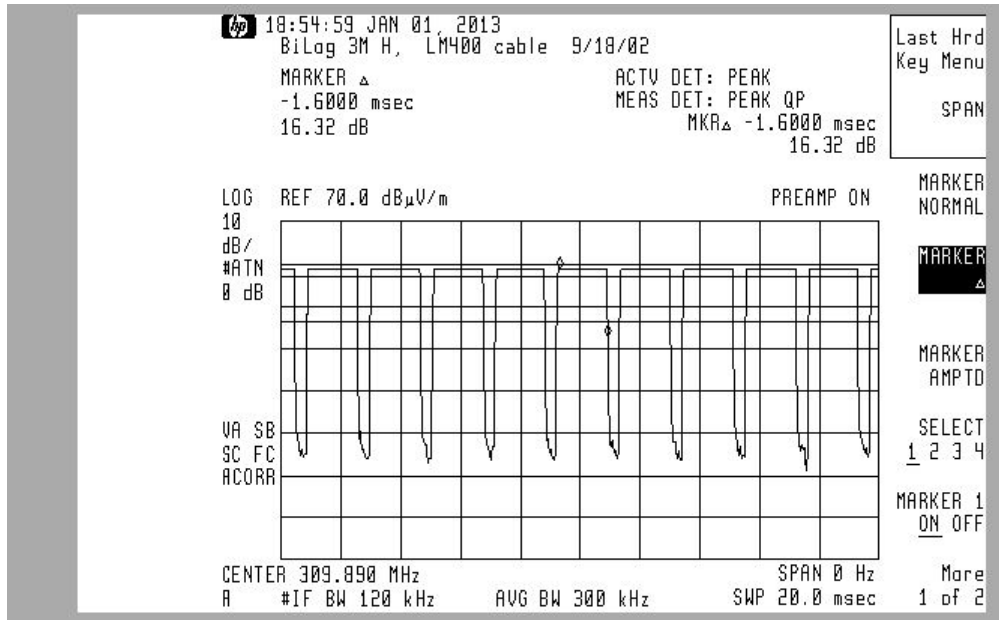
30% Duty Cycle Pulse Width



50% Duty Cycle Pulse Width



80% Duty Cycle

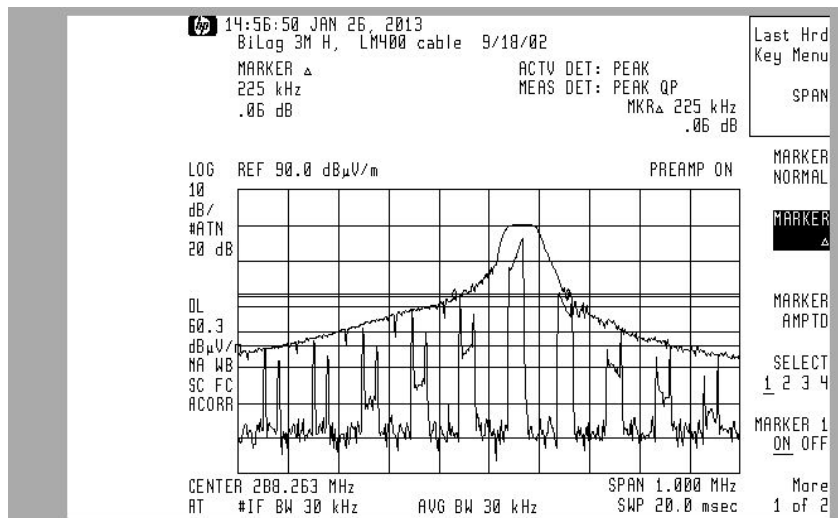


20 dB Bandwidth Measurement:

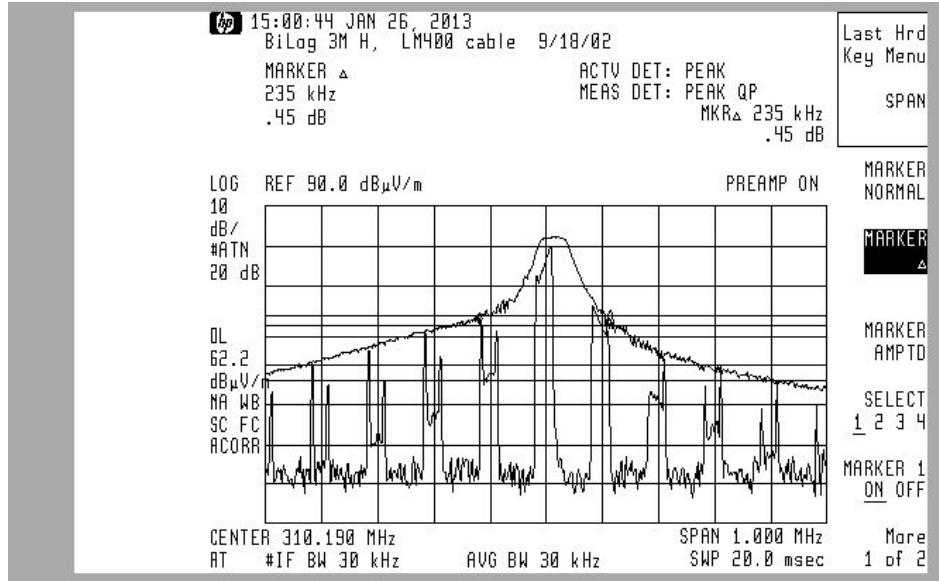
Tabulated Summary of 20dB Bandwidth Measurements

Frequency	Resolution Bandwidth	Occupied Bandwidth	Limit	Margin
MHz	KHz	KHz	KHz	KHz
288	30	225	720	495
310	30	235	775	540
433	30	183	1082.5	899.5

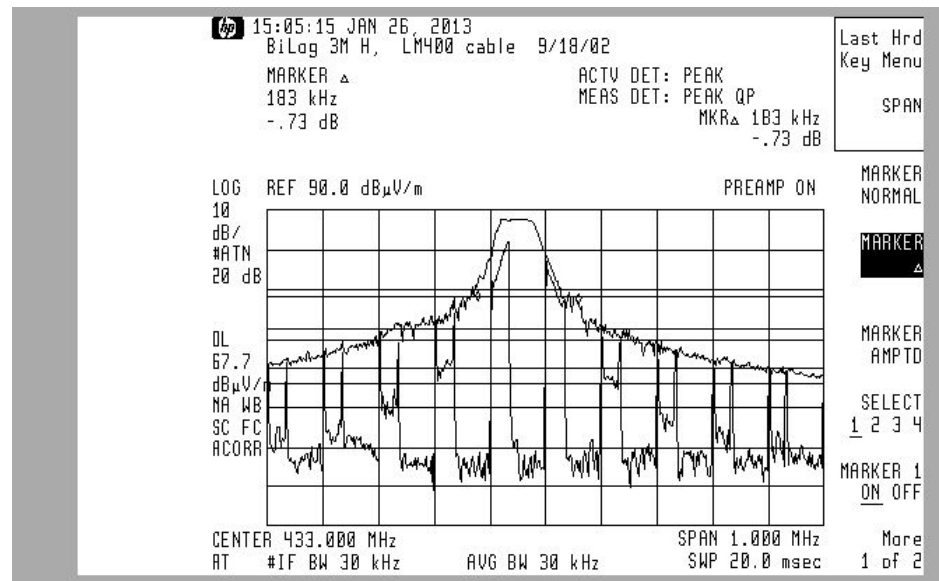
Plot of 288 MHz 20dB Bandwidth Plot



Plot of 310 MHz 20dB Bandwidth Plot



Plot of 433 MHz 20dB Bandwidth Plot

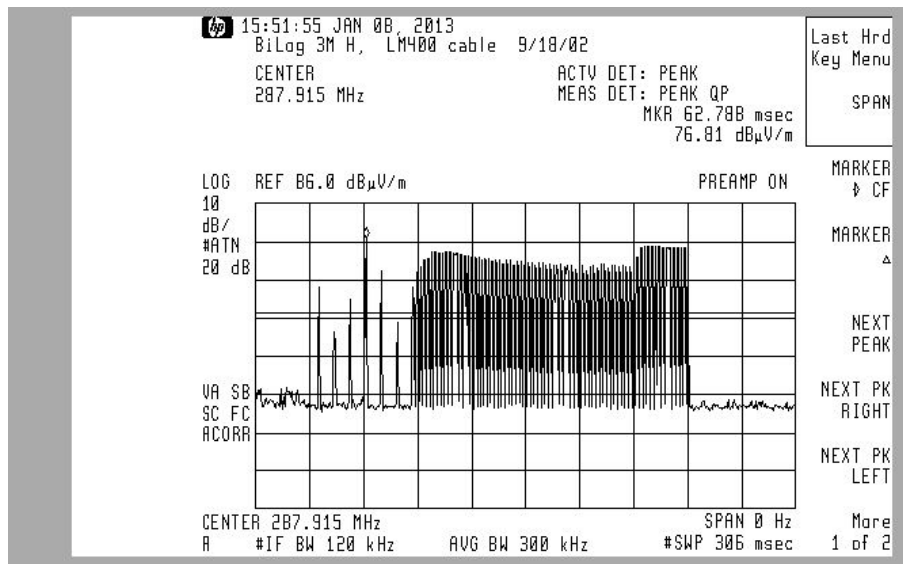


Training Pulse Measurement

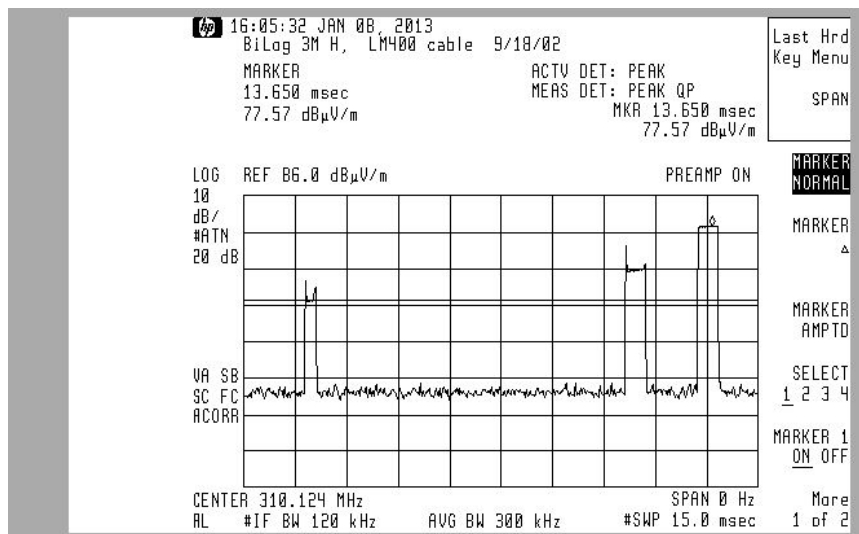
Tabulated Summary of Training Pulse Measurements

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
288.00	30.00	76.81	-10.46	66.35	2078	4917	2839
310.00	30.00	77.57	-10.46	67.11	2268	5833	3565
433.00	30.00	82.69	-10.46	72.23	4089	10958	6869

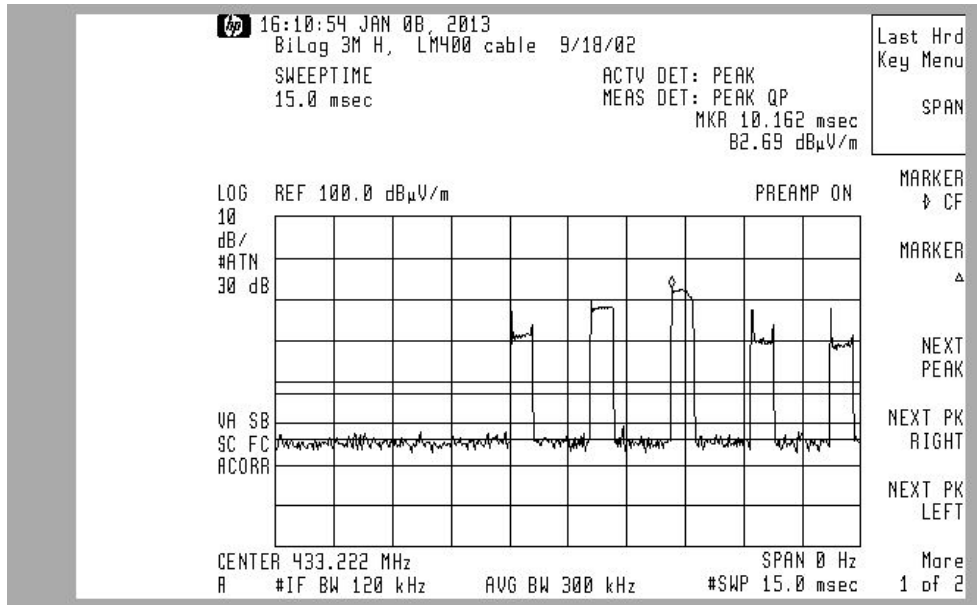
288 MHz Training Pulse Plot



310 MHz Training Pulse Plot



433 MHz Training Pulse Plot



FCC SAR Calculations

FCC Spec Reference	Spec Data	Units	Spec	Data	Margin
KDB 447948 D01	min SAR Evaluation Limit = 60/Freq (GHz)	mW	132.743	0.030	132.713
15.203	Fixed Antenna	NA	Antenna unchangeable by end user	Integrated PCB Antenna	
1.1310	Max Occupational Exposure (assuming distance of 2.5cm) using formula $EIRP/(4*(\pi)*(d^2))$	mW/cm ²	5.000	0.000	5.000
1.1310	General Population Exposure (assuming distance of 2.5cm) using formula $EIRP/(4*(\pi)*(d^2))$	mW/cm ²	1.000	0.000	1.000

Environment

The test was performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 62 deg F, the relative humidity 35%.

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: $FS(\text{dBuV/m}) = RF(\text{dBuV}) + AF(\text{dB/m}) + CF(\text{dB}) - PA(\text{dB})$

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: $FS(\text{uV/m}) = \text{AntiLog}[(FS(\text{dBuV/m}))/20]$

Measurement Facilities & Equipment

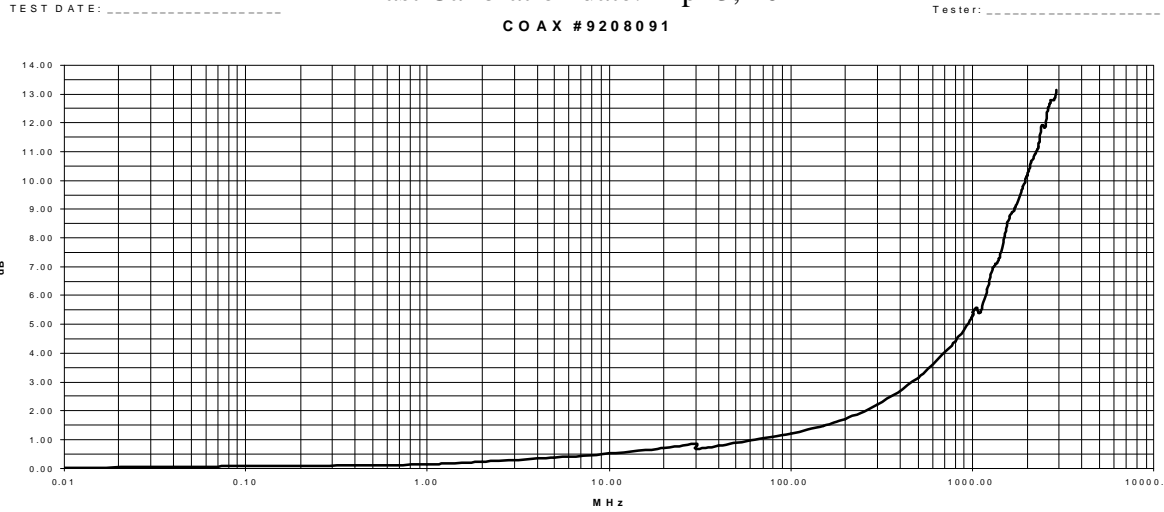
Test Site

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).

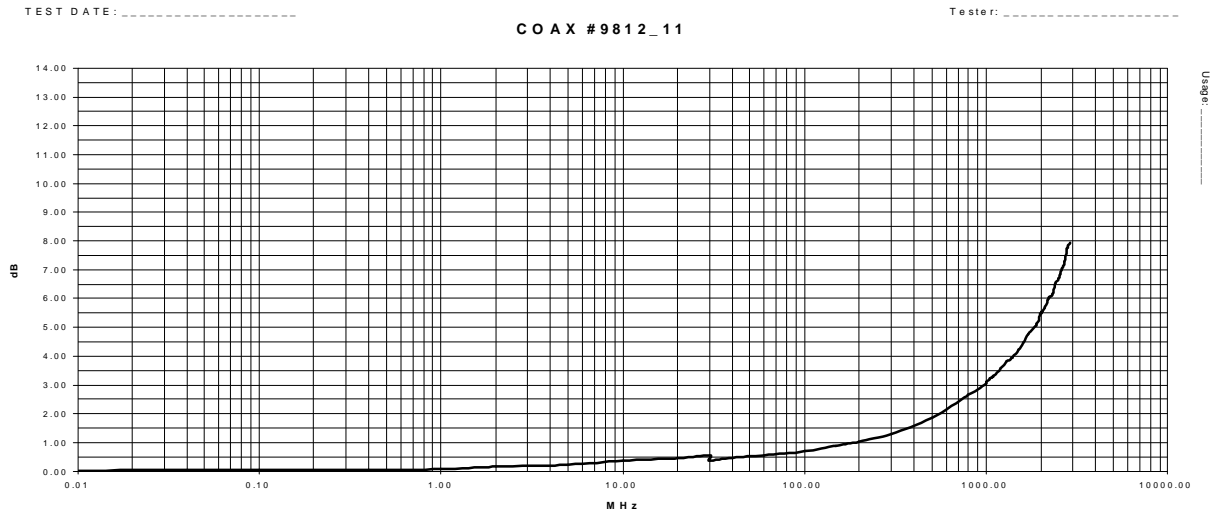
Measurement Equipment Used Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8542E			
RF Filter Section	HP-85420E	3448A00144	4 Sept-12	12 months
RF Receiver Section	HP-85422E	3625A00174	4 Sept-12	12 months
EMCO BiconiLog Antenna	3142	1069	18- Sept-12	12 months
EMCO Double Ridged Horn	3115	7770	22-Sept-12	12 months
Solar LISN	8012-50-R-24-BNC	962137	14 Sept-12	12 months
Solar LISN	8012-50-R-24-BNC	962138	28-Aug-12	12 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	3 April-12	12 months
(3-m) LMR-400 Ultra Flex	LMR400	C090804	6-Dec-12	6 months
(3-m) CS-3227 RG8	CS-3227	C060914	6-Dec-12	6 months
(10-m) Amelco 50ohm Coax	RG213U	9903-10ab	6-Dec-12	6 months
Schaffner EFT	NSG600/641	0113	12-Jan-12	12 months
Keytek Surge	711B	8511854	16-Jan-12	12 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

Cable Loss

Line Conducted 150KHz through 30MHz, Coax #920809
Last Calibration date: Apr 3, 2012



Radiated at 3 meters; 30MHz through 3000MHz, Coax #C090804
Last Calibration date: 6-Dec-12

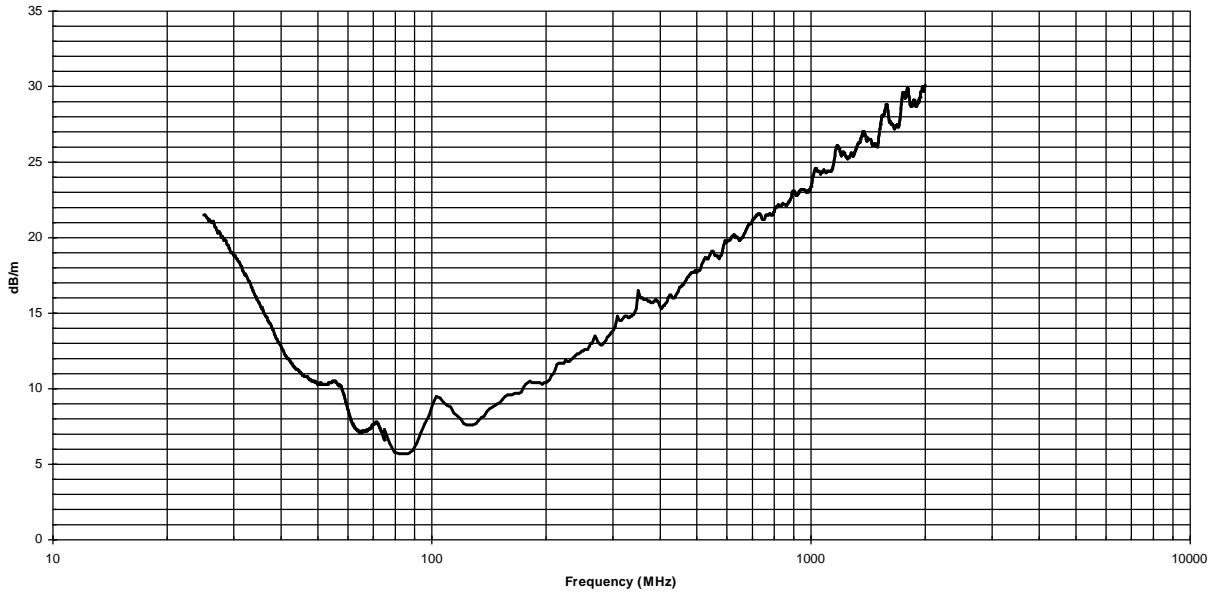


Antenna Factors

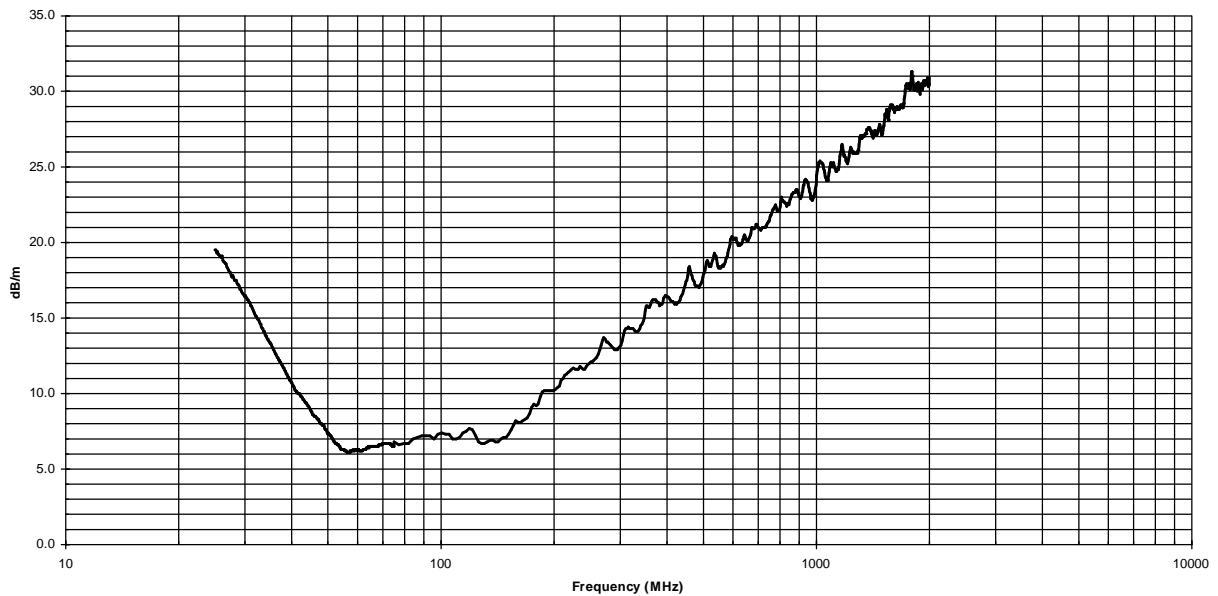
EMCO Model 3142 Antenna #1069

Last Calibration Date; 18- Sept-12

3 Meter Distance Factors

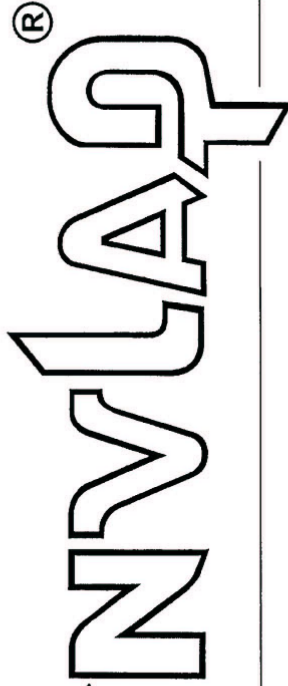


10 Meter Distance Factors



AHD Accreditation

United States Department of Commerce
National Institute of Standards and Technology



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 Communiqué dated January 2009).



2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Ouldard Mills Road
Columbia, MD 21046

November 30, 2011

Registration Number: 90413

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

Attention: Gordon Helm, President

Re: Measurement facility located at Sister Lakes
3 & 10 meter site
Date of Renewal: November 30, 2011

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

