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

EMC Test Report

#1301770FX247-SAHL5
Issued 1/20/2014

Regarding the FCC Part 15 testing

Garage Door Opener

Model Number: SAHL5D Family

Category: 15.247 / 15.231 Transmitting Device
FCC ID NZLSAHL5D
Judgments: FCC Part 15.247 – Compliant

NVLAP LAB CODE 200129-0

Prepared for:

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Test Date(s): 10/25/13-1/19/2014

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Table of Contents

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.

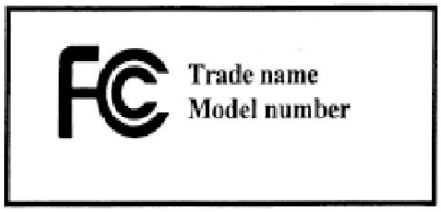
Additionally, for products satisfying the FCC Part 15 Class B requirements the following are to be satisfied:

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 15.247 These tests were performed at AHD EMC Laboratory following the procedures outlined in FCC part 15.247.d and ANSI C63.4 as applicable.
2. The device FCCID is NZLSAHL5D.
3. The transmitter test results apply to the SAHL5D family of devices, which includes the S550 device.
4. This device is compliant as a 15.247 hopping device in the frequency range of 902-928 MHz.
5. The integrated PCB monopole antenna gain was measured to provide –5.48 dBi of gain at 900 MHz. The measurement was completed by subtracting the observed EIRP power from the observed conducted power without the antenna attached.
6. The device also operates as an FCC Part 15.231 digital transmitting device that operates between 288-450 MHz. Data for 15.231 mode transmission is available in the 1301770FX231-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. 3 representative frequencies were tested to validate device: 902.25 MHz, 914.7 MHz, and 926.5 MHz.
10. Worst case fundamental transmit signal was measured using conducted peak detection at 902.2, 914.7 and 926.5 MHz. The signal was measured to be 975 mW under the 15.247 limit.
11. The worst case non-restricted band spurious transmit harmonic was measured using conducted peak detection at 1853 MHz. The signal was a harmonic to the 926.5 MHz fundamental. The signal was measured 32.05 dB below the conducted limit (20 dB under the conducted peak.)
12. The worst case restricted band spurious transmit harmonic was measured at 3707 MHz. The signal was a harmonic to the 926.5 MHz fundamental. The average (duty cycle compensated peak) signal was measured 3.14 dB below the limit of 54 dBuV/m.
13. The worst case peak restricted band spurious transmit harmonic was measured at 3707 MHz. The signal was a harmonic to the 926.5 MHz fundamental. The compensated signal was measured 3.14 dB below the limit of 74 dBuV/m.
14. Transmit mode spurious emissions were measured at 30, 85, 110, 139, 209, and 929 MHz at all three fundamental transmit frequencies. None of these signals were detectable when measured for compliance at 3 Meters distance.
15. The receive local oscillator was measured using conducted peak detection. The signal was measured 17.37 dB below the equivalent 3 Meter EIRP spurious quasipeak limit.
16. This hopping mode device utilizes 50 channels, which complies with the specified minimum with a margin of 25 channels.
17. This device demonstrated a worst case 20 dB bandwidth that complies with the 500 kHz maximum specification with 252 kHz margin.

18. This device demonstrated a worst case carrier separation that complies with the minimum specification (20 dB band width) with 252 kHz of margin.
19. This device utilizes a fixed pseudorandom sequence by design that evenly distributes hopping among all channels during each cycle.
20. The device demonstrated an 177 mSec occupied channel time in 10 seconds, which provides 223 msec of margin compared to the 15.247.a.1.i 400 mSec specification.
21. This device demonstrated 100 KHz Bandwidth low band edge conducted signal strength that was 8.88 dBm within the specified margin of 20 dB below the peak measurement.
22. This device demonstrated 100 KHz Bandwidth high band edge conducted signal strength that was 36.8 dBm within the specified margin of 20 dB below the peak measurement.
23. The measured distance from the PCB to the top / button outer case is 5 mm. The measured distance from the PCB to the bottom outer case is 2mm. The device manual specifies that the device is to be incorporated in an automobile overhead console or sun visor with the buttons exposed and the bottom of the device not directly accessible. The device is activated by hand (extremity.) A picture is included of the intended manufactured configuration.
24. Based on the KDB447498 D01 V5r01 specification, this device does not require SAR testing. The device transmits 20.078 mW less power than the required limit given the 5 mm separation between transmitter and user and the intended extremity use of this device.

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 with less than 3dB of gain.

PCBs: Transmit / Homelink PCB:

Specifications:

Input Power: 12V DC

Outputs Signals: 902-928 MHz 15.247 hopping device. Also operates as a 288-450 Mhz digitally encoded, with the exception of the regions between 321-336.4 MHz and 398.9-411 MHz as described in another 15.231 report.

Input Signals: Receive / training function

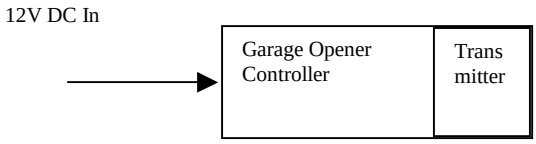
Antenna: Integrated PCB monopole antenna provides –5dBi of gain at 900 MHz.

Hopping Specifications:

The device utilizes 50 hopping channels. The channels are accessed in a fixed pseudo-random sequence. Frequencies and channel sequence are provided the table below:

#	Channel #	Freq (MHz)	#	Channel #	Freq (MHz)	#	Channel #	Freq (MHz)	#	Channel #	Freq (MHz)	#	Channel #	Freq (MHz)
1	3	903.75	11	23	913.75	21	19	911.75	31	22	913.25	41	20	912.25
2	39	921.75	12	31	917.75	22	30	917.25	32	11	907.75	42	48	926.25
3	45	924.75	13	37	920.75	23	41	922.75	33	26	915.25	43	8	906.25
4	35	919.75	14	14	909.25	24	33	918.75	34	18	911.25	44	32	918.25
5	10	907.25	15	49	926.75	25	25	914.75	35	27	915.75	45	42	923.25
6	24	914.25	16	0	902.25	26	46	925.25	36	7	905.75	46	34	919.25
7	15	909.75	17	1	902.75	27	13	908.75	37	17	910.75	47	2	903.25
8	12	908.25	18	43	923.75	28	16	910.25	38	5	904.75	48	6	905.25
9	9	906.75	19	44	924.25	29	38	921.25	39	4	904.25	49	29	916.75
10	28	916.25	20	21	912.75	30	36	920.25	40	47	925.75	50	40	922.25

EUT Block Diagram:



EUT Pictures

Exterior View Front

Exterior View Rear

Installed Product View

PCB Top View

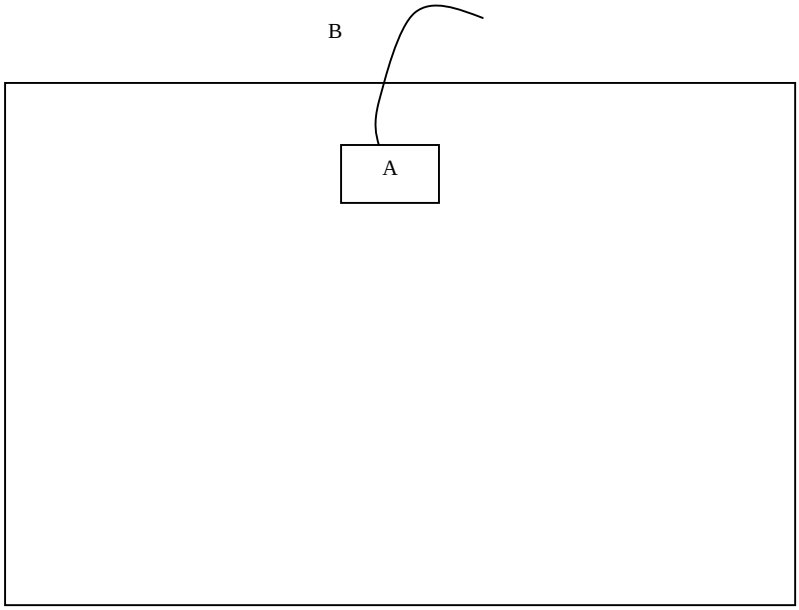
PCB Bottom View

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

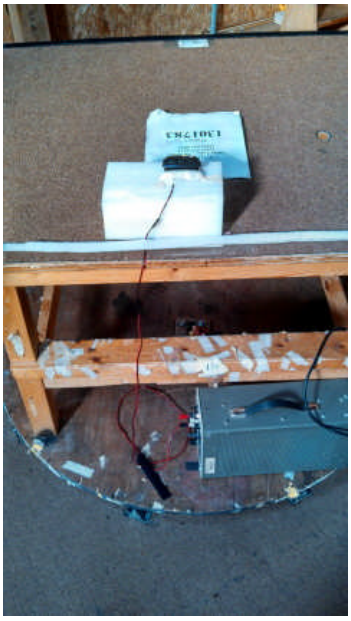


Setup Pictures

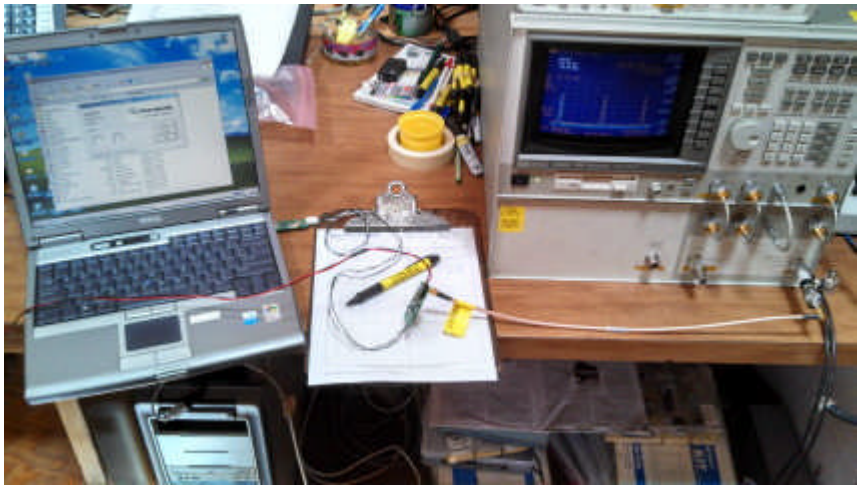
Radiated Prescreen Setup

Front Spurious Radiated Setup

Rear Radiate Spurious Setup



Conducted Transmit Test



Measurement Report

Standards Applied to Test

ANSI C63.4 – Radio Noise Emissions 2003.12
CFR47 FCC Part 15.247
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 15.247 with supporting instructions from ANSI C63.4.

Device was tested at 3 representative frequencies within operational range: 902.25, 914.7, and 926.5 MHz.

Device was tested for conducted power by connecting directly to the output of the transmitter.

Device was tested for restricted band harmonics using radiated emissions measurements. This testing was performed by manipulating the device orientation until a maximum signal strength measurement was recorded.

The following 15.247 test parameter setups apply to transmit test:

15.247 Reference	Spec Data	Units	Span Spec	RBW Spec	VBW Spec
a.1	Min # of channels		Channel Width	>1% of Span	>RBW
a.1	max channel 20 dB BW	kHz	2 to 3*OBW	>1% of OBW	>RBW
a.1	Min Carrier separation	kHz	Capture 2 peaks	>1% of span	>RBW
a.1.iii	max time occupied per channel in 10 seconds	msec	0 Hz	1 MHz	>RBW
b.1	max power (eirp)	mw	5*20 dB BW	> 20 dB BW	>RBW
d	measured low, high band edge 100KHz BW signal - 20 dB below peak	dBm	Enough to capture band edge plus noise - note measure in hopping and non-hopping modes	>1% of Span	>RBW

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 9.265 GHz to meet FCC 15.33.a.1 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:

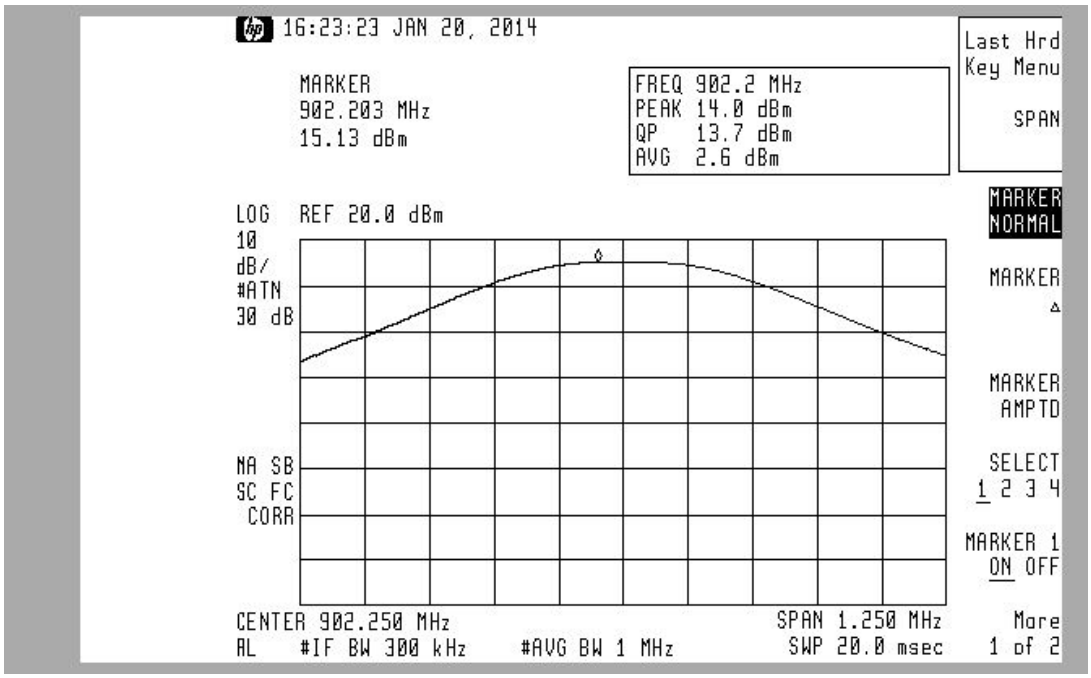
None

Test Data

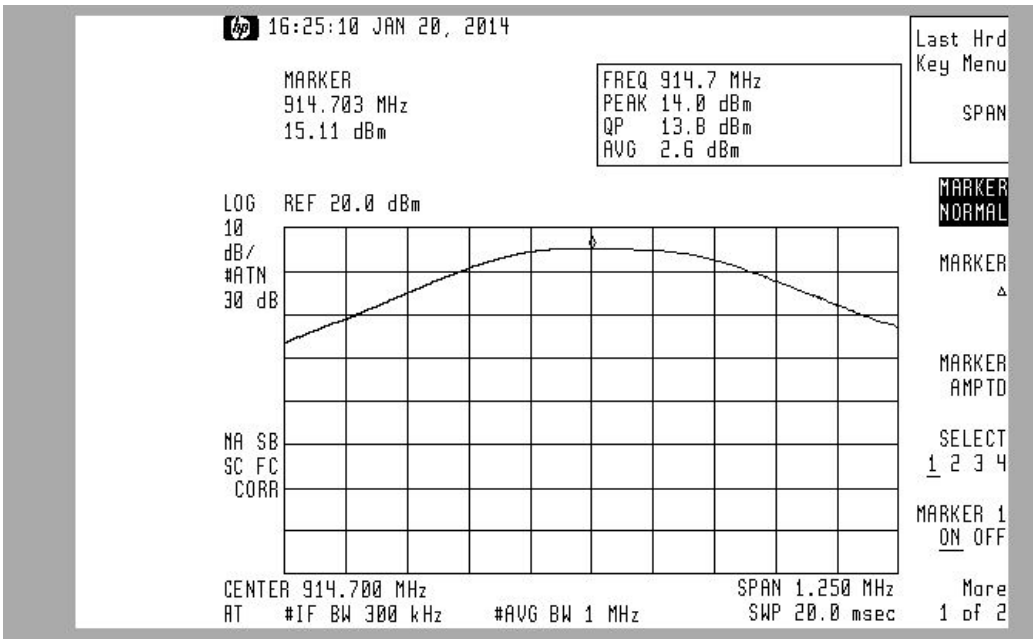
Transmit Fundamental Measurements

Measured Frequency	Conducted Power Measurement	Corrected Data	FCC Limit	Margin
MHz	dBm	mW	mW	mW
902.20	**14.00**	**25.12**	**1000**	**975**
914.70	**14.00**	**25.12**	**1000**	**975**
926.50	**14.00**	**25.12**	**1000**	**975**

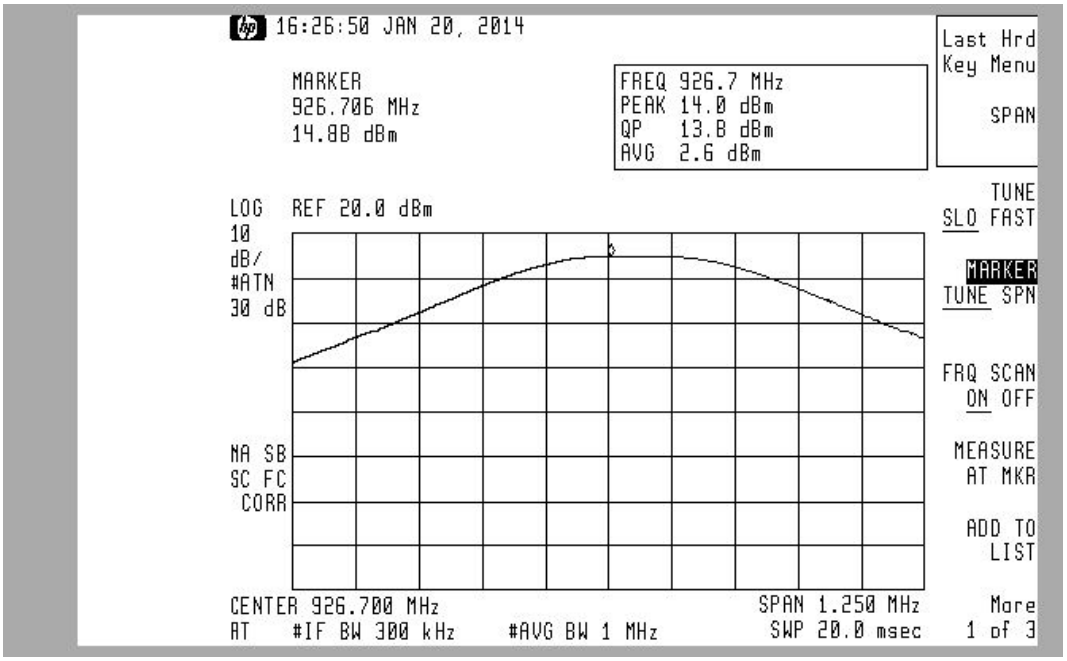
Transmit Fundamental Plot – 902.20 MHz



Transmit Fundamental Plot – 914.7 MHz



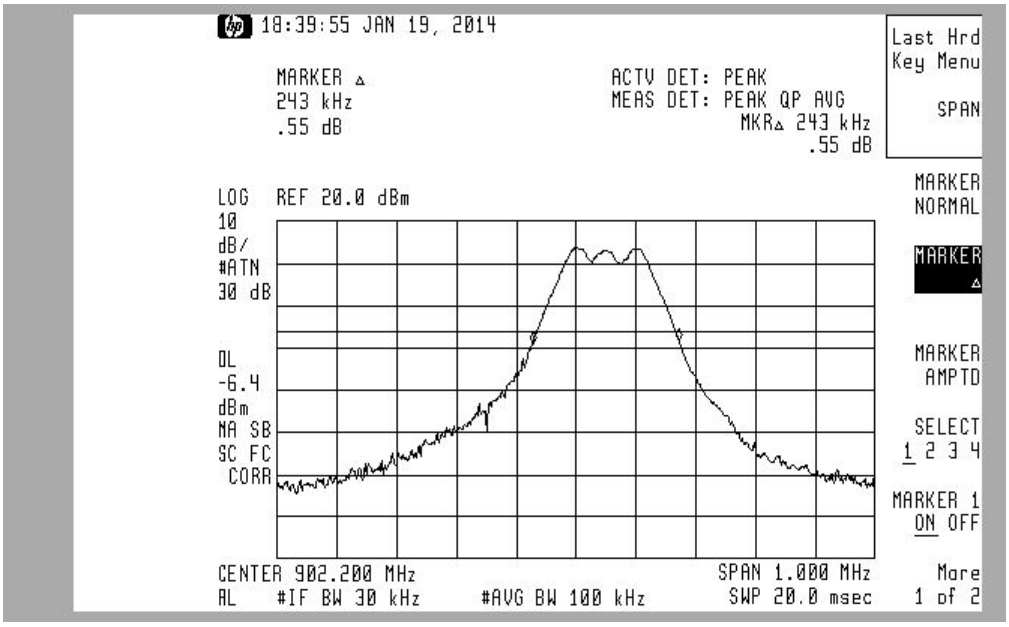
Transmit Fundamental Plot – 962.7 MHz



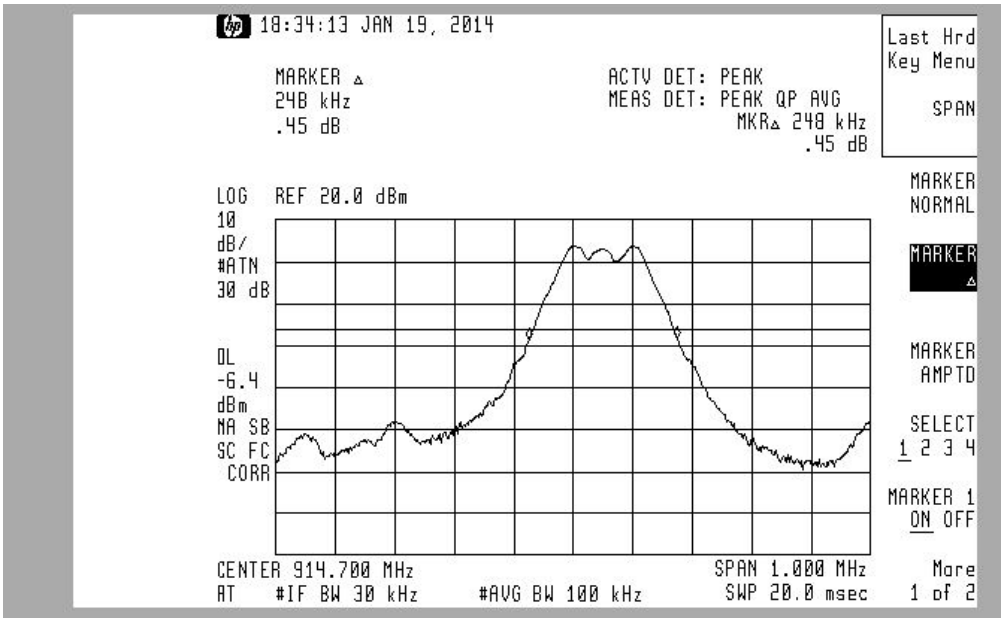
Transmit 20dB BW Measurements

Measured Frequency	20 dBc Bandwidth Measurement	FCC Limit	Margin
MHz	kHz	kHz	kHz
902.20	**243.00**	**500**	**257**
914.70	**248.00**	**500**	**252**
926.80	**245.00**	**500**	**255**

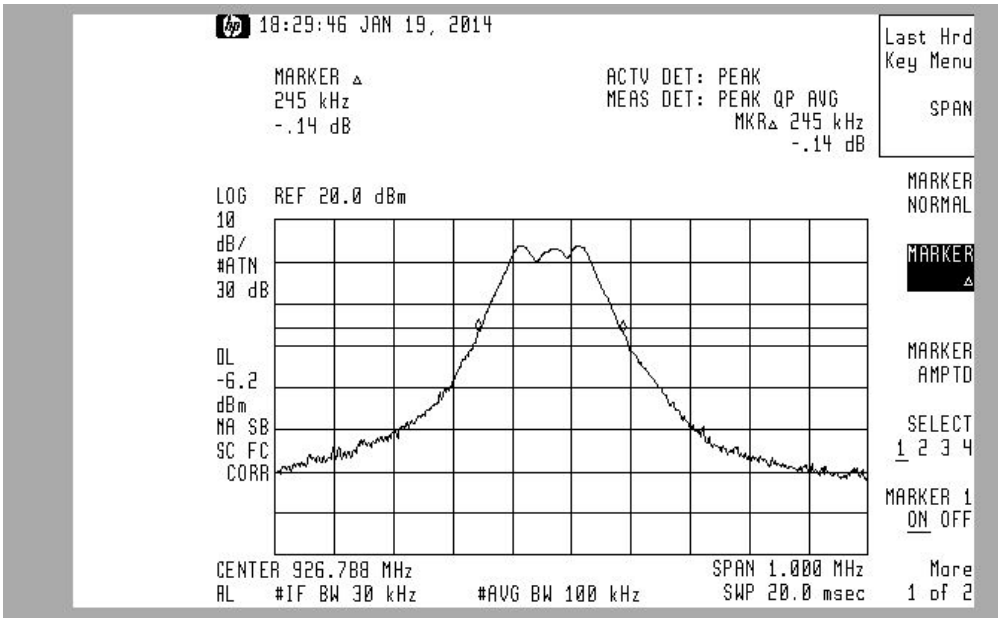
20 dB Bandwidth Plot – 902.25 MHz



20 dB Bandwidth Plot – 914.76 MHz



20 dB Bandwidth Plot – 926.7 MHz



Transmit Harmonics of 902.25 MHz

Fundamental Frequency	Measured Frequency	Conducted Peak Measurement	Limit (20 dB under fundamental)	Margin
MHz	MHz	dBm	dBm	dBm
902.25	**1804.00**	**-70.90**	**-7.13**	**63.77**
902.25	**2706.00**	**R**	**NA**	**NA**
902.25	**3608.00**	**R**	**NA**	**NA**
902.25	**4510.00**	**-64.00**	**-7.13**	**56.87**
902.25	**5415.00**	**R**	**NA**	**NA**
902.25	**6316.00**	**-51.00**	**-7.13**	**43.87**
902.25	**7216.00**	**-48.60**	**-7.13**	**41.47**
902.25	**8122.00**	**R**	**NA**	**NA**
902.25	**9024.25**	**R**	**NA**	**NA**

*R Indicates restricted band signals, addressed in another table

Transmit Harmonics for 914.7 MHz

Fundamental Frequency	Measured Frequency	Conducted Peak Measurement	Limit	Margin
MHz	MHz	dBm	dBm	dBm
914.70	**1829.00**	**-58.00**	**-7.11**	**50.89**
914.70	**2744.00**	**R**	**NA**	**NA**
914.70	**3659.00**	**R**	**NA**	**NA**
914.70	**4575.00**	**-63.00**	**-7.11**	**55.89**
914.70	**5490.00**	**-58.80**	**-7.11**	**51.69**
914.70	**6400.00**	**-49.60**	**-7.11**	**42.49**
914.70	**7324.00**	**R**	**NA**	**NA**
914.70	**8238.70**	**R**	**NA**	**NA**
914.70	**9148.00**	**R**	**NA**	**NA**

*R Indicates restricted band signals, addressed in another table

Transmit Harmonics for 926.5 MHz

Fundamental Frequency	Measured Frequency	Conducted Peak Measurement	Limit	Margin
MHz	MHz	dBm	dBm	dBm
926.50	**1853.00**	**-39.20**	**-7.15**	**32.05**
926.50	**2780.00**	**R**	**NA**	**NA**
926.50	**3707.00**	**R**	**NA**	**NA**
926.50	**4622.00**	**-63.50**	**-7.15**	**56.35**
926.50	**5560.00**	**-58.30**	**-7.15**	**51.15**
926.50	**6484.00**	**-50.30**	**-7.15**	**43.15**
926.50	**7408.00**	**R**	**NA**	**NA**
926.50	**8332.00**	**R**	**NA**	**NA**
926.50	**9265.00**	*****	**-7.15**	**NA**

* Indicates no signal detected at this frequency
R Indicates restricted band signals, addressed in another table

Restricted Band Harmonic Peak Compliance

Restricted Band Average Data

Fundamental Frequency	Measured Frequency	Radiated Peak Measurement at 1 Meter	Distance Compensation	Antenna + Cable Correction factors	Duty Cycle Factor	Adjusted 3M Equivalent	Limit	Margin
MHz	MHz	dBuV/m	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m
902.25	**2706.00**	**46.17**	**-9.54**	**31.86**	**-20.00**	**48.49**	**54.00**	**5.51**
902.25	**3608.00**	**39.50**	**-9.54**	**35.18**	**-20.00**	**45.14**	**54.00**	**8.86**
902.25	**5415.00**	*****					**54.00**	**NA**
902.25	**8122.00**	*****					**54.00**	**NA**
902.25	**9024.00**	*****					**54.00**	**NA**
914.70	**2744.00**	**47.50**	**-9.54**	**31.79**	**-20.00**	**49.75**	**54.00**	**4.25**
914.70	**3659.00**	**41.20**	**-9.54**	**35.43**	**-20.00**	**47.09**	**54.00**	**6.91**
914.70	**7324.00**	*****					**54.00**	**NA**
914.70	**8238.00**	*****					**54.00**	**NA**
914.70	**9148.00**	*****					**54.00**	**NA**
926.50	**2780.00**	**45.00**	**-9.54**	**31.85**	**-20.00**	**47.31**	**54.00**	**6.69**
926.50	**3707.00**	**44.50**	**-9.54**	**35.90**	**-20.00**	**50.86**	**54.00**	**3.14**
926.50	**7408.00**	*****					**54.00**	**NA**
926.50	**8332.00**	*****					**54.00**	**NA**

Note: Peak data was measured and a duty cycle correction of 20 dB was applied. The 100 msec duty cycle for this device was measured to be 4.43% or 27 dB.

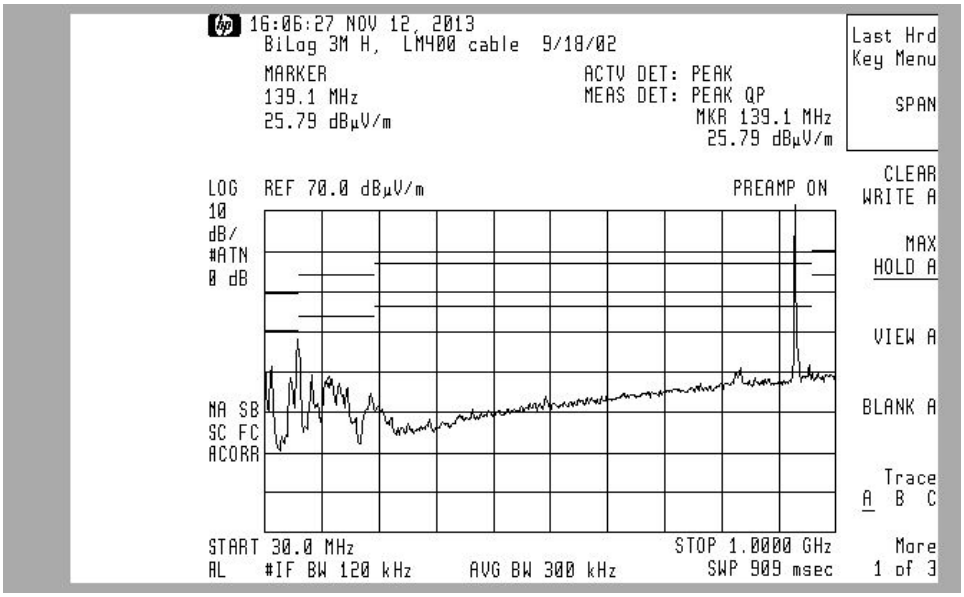
Restricted Band Peak Data

Fundamental Frequency	Measured Frequency	Radiated Peak Measurement at 1 Meter	Distance Compensation	Antenna + Cable Correction factors	Adjusted 3M Equivalent	Limit	Margin
MHz	MHz	dBuV/m	dB	dB	dBuV/m	dBuV/m	dBuV/m
902.25	**2706.00**	**46.17**	**-9.54**	**31.86**	**68.49**	**74.00**	**5.51**
902.25	**3608.00**	**39.50**	**-9.54**	**35.18**	**65.14**	**74.00**	**8.86**
902.25	**5415.00**	*****				**74.00**	
902.25	**8122.00**	*****				**74.00**	
902.25	**9024.00**	*****				**74.00**	
914.70	**2744.00**	**47.50**	**-9.54**	**31.79**	**69.75**	**74.00**	**4.25**
914.70	**3659.00**	**41.20**	**-9.54**	**35.43**	**67.09**	**74.00**	**6.91**
914.70	**7324.00**	*****				**74.00**	
914.70	**8238.00**	*****				**74.00**	
914.70	**9148.00**	*****				**74.00**	
926.50	**2780.00**	**45.00**	**-9.54**	**31.85**	**67.31**	**74.00**	**6.69**
926.50	**3707.00**	**44.50**	**-9.54**	**35.90**	**70.86**	**74.00**	**3.14**
926.50	**7408.00**	*****				**74.00**	
926.50	**8332.00**	*****				**74.00**	

Transmit Mode Non-Harmonic Spurious Emissions

Prescan indicated transmit spurious emissions at 30, 85, 110, 139, 209, and 929 MHz. None of these signals were measurable when tested at the 3 Meters.

Tx Spurious Prescan Plot

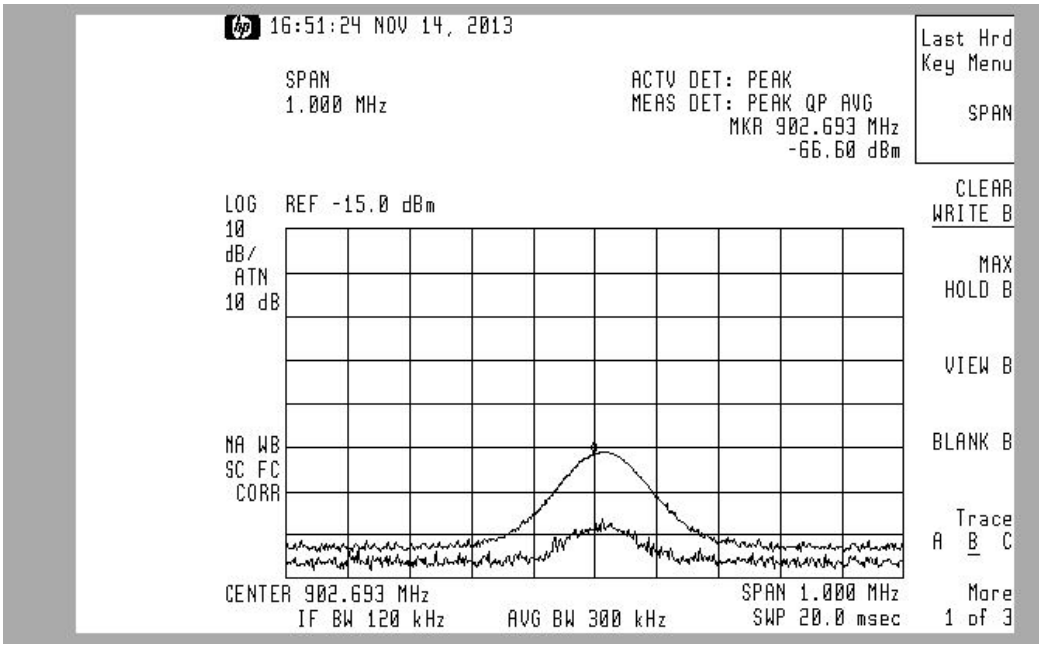


Radiated Receive Local Oscillator Emissions

Conducted Receive Mode Local Oscillator Data

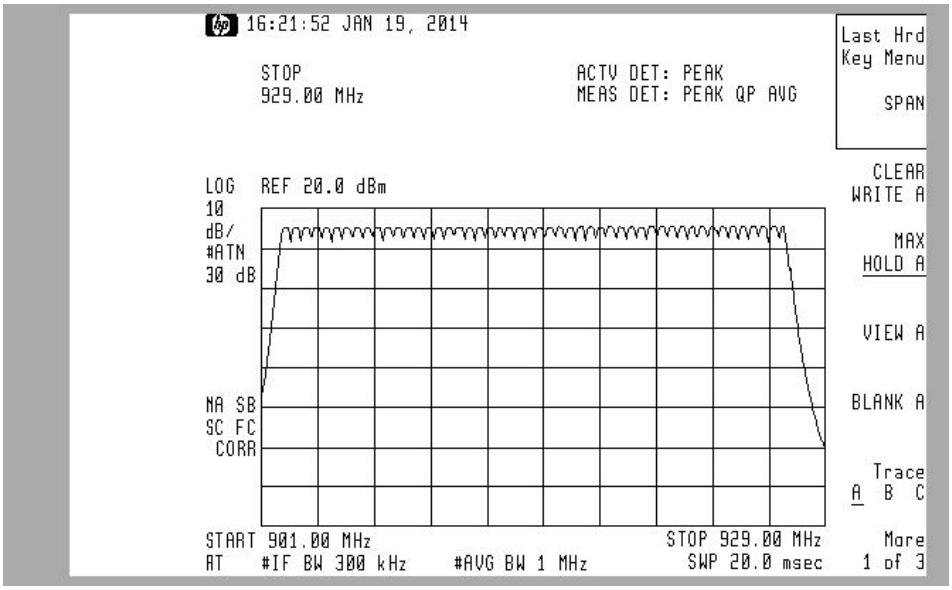
Measured Frequency	Conducted Peak Measurement	3M EIRP Equivalent	Limit	Margin
MHz	dBm	dBuV/m	dBuV/m	dBuV/m
902.69	**-66.60**	**28.63**	**46.00**	**17.37**

Conducted Receive Mode Local Oscillator Plot

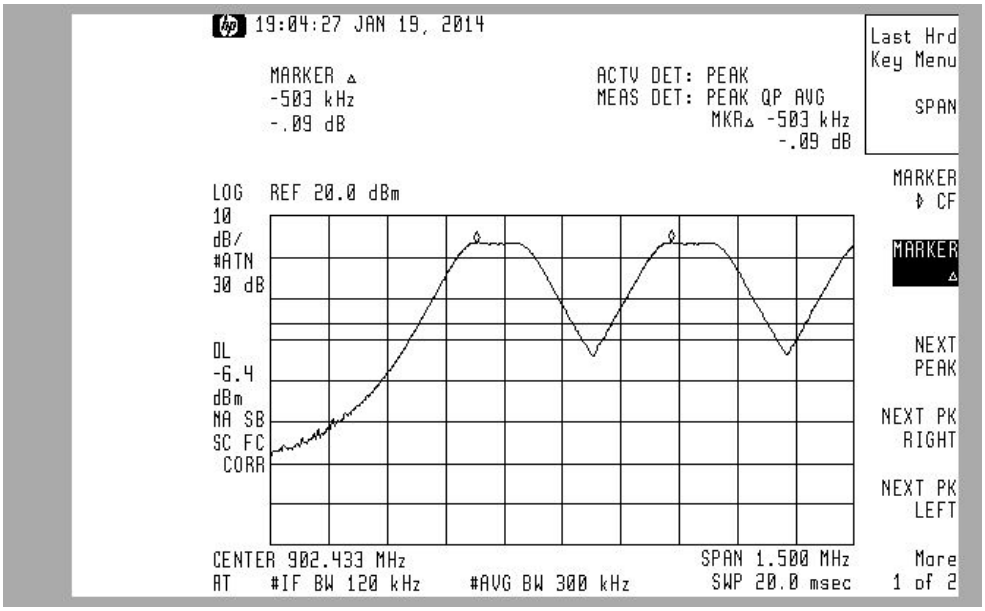


15.247 Specific Transmit Emissions

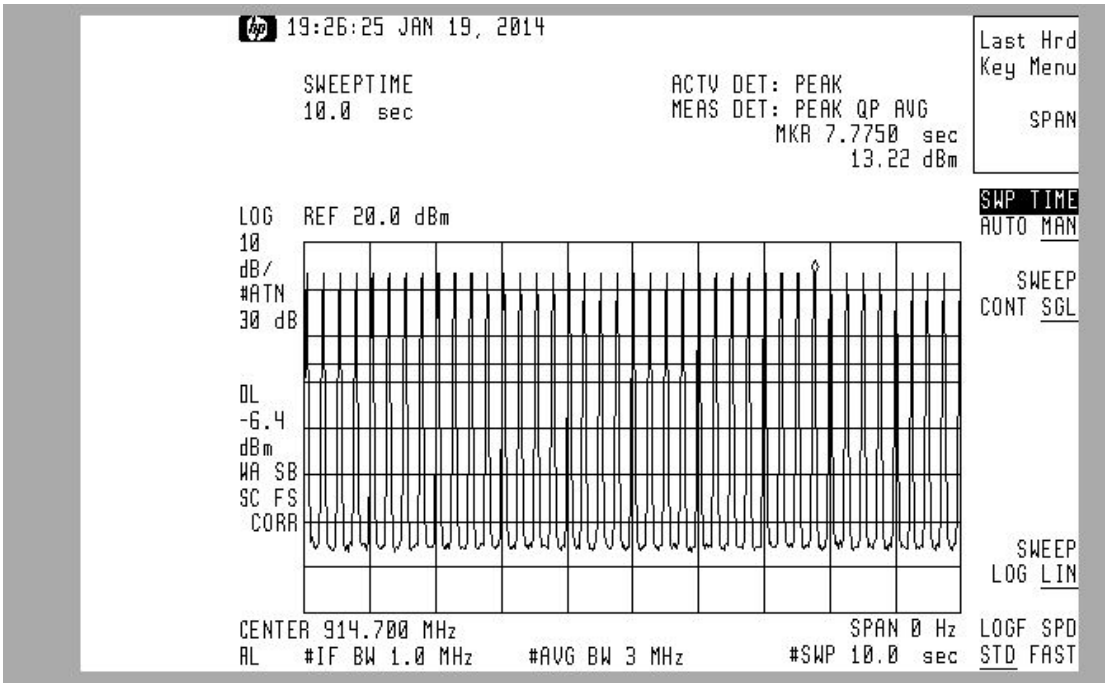
50 Channel Plot



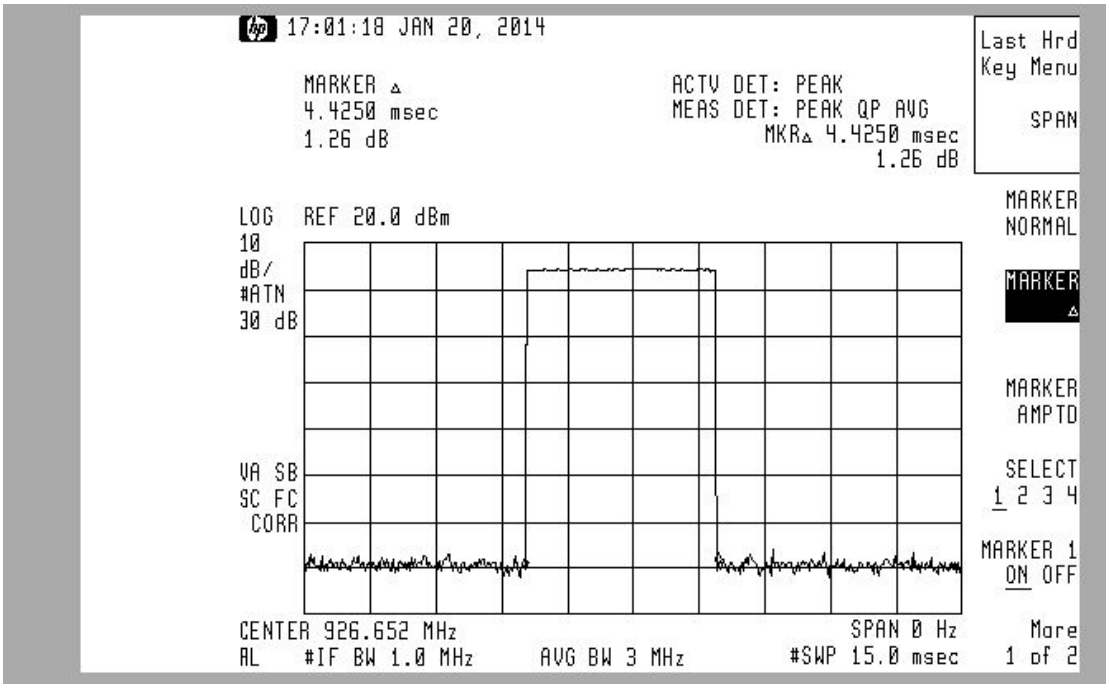
Carrier Separation Plot



Plot Demonstrating 40 cycles in 10 seconds

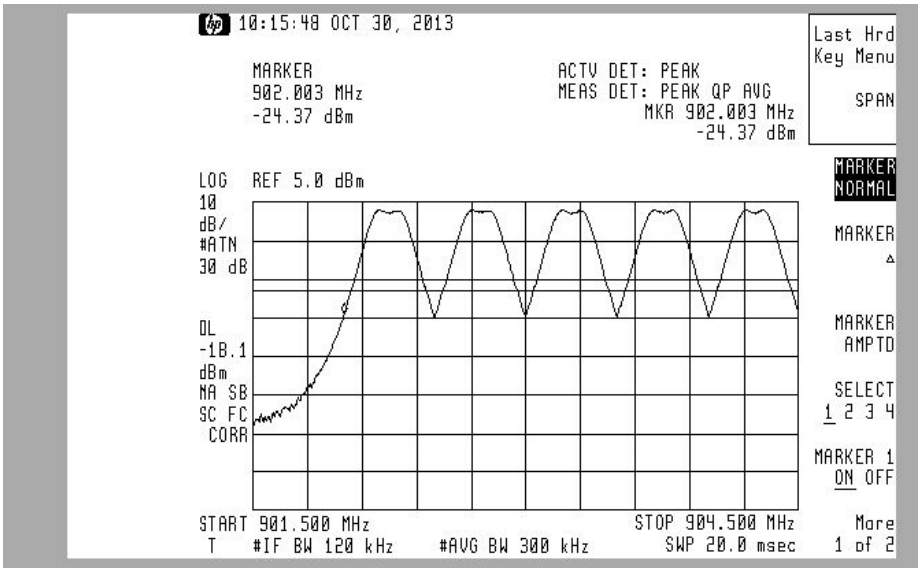


Plot Demonstrating Channel "On" Time



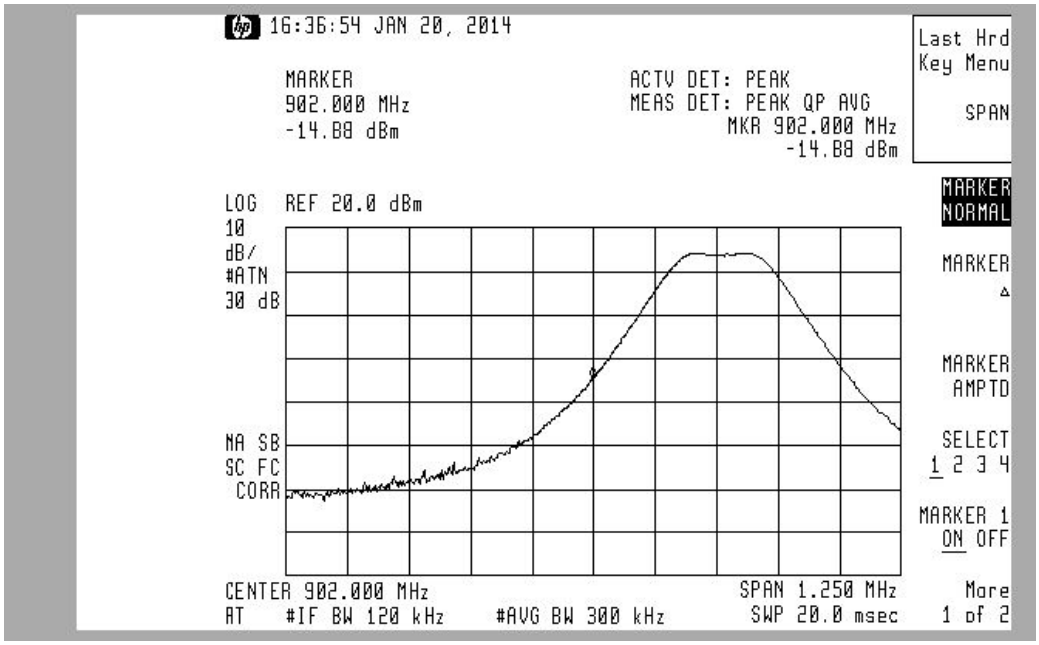
Note: 40 cycles/10 seconds * 4.43msec on / cycle = 17.68 msec on / second or 177 msec in 10 seconds. Also note that since cycle length = 250 msec, duty cycle in any 100msec period = 4.43%.

100 kHz Low Band Edge Plot – Hopping Mode



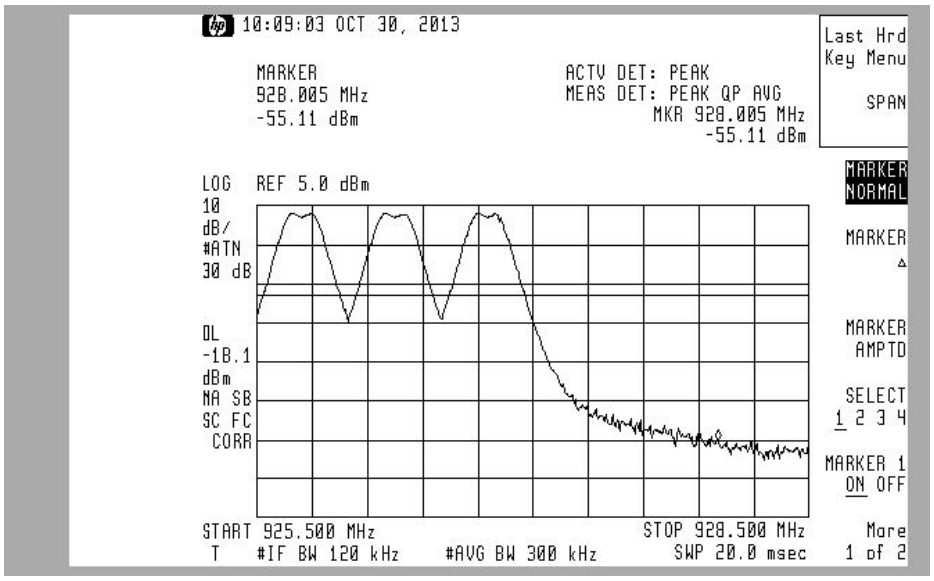
Note: (14.0 dBm- 20dBm) – (-24.37) dBm = 18.37 dBm margin

100 kHz Low Band Edge Plot – non-Hopping Mode



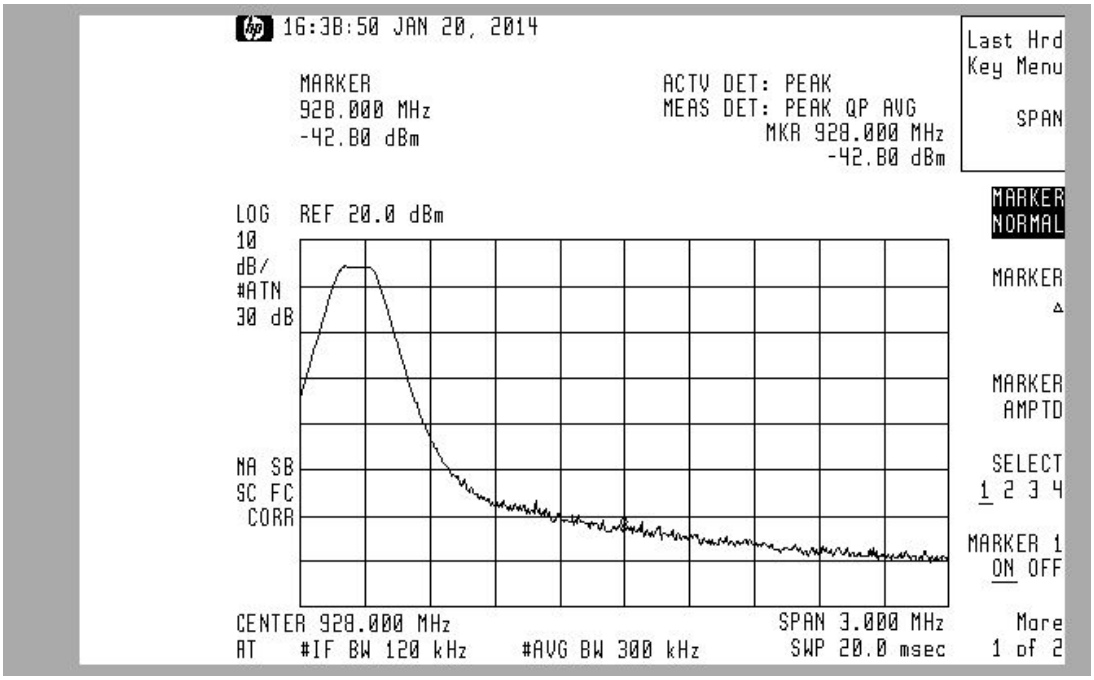
Note: (14.0 dBm- 20dBm) – (-14.88) dBm = 8.88 dBm margin

100 KHz High Band Edge
Plot – Hopping Mode



Note: (14.0 dBm- 20dBm) – (-55.11) dBm = 49.11 dBm margin

100 KHz High Band Edge
Plot – non-Hopping Mode



Note: (14.0 dBm- 20dBm) – (-42.8) dBm = 36.8 dBm margin

Antenna Gain Measurement

Measured Frequency	Conducted Power Measurement	Equivalent EIRP @ 3M	Measured Peak EIRP @ 3M	Antenna Gain
MHz	dBm	dBuV/M	dBuV/M	mW
926.50	**12.85**	**108.08**	**102.60**	**-5.48**

Tabulated 15.247 Data

15.247 Reference	Spec Data	Units	Spec	Data	Margin
	Operating Mode		Frequency Hopper / Digital Modulation	Frequency Hopper	NA
a.1	Min # of channels		25	50	25
a.1	Channel Carrier Frequencies	MHz	902-928	902.25-926.7	NA
a.1	max channel 20 dB BW	kHz	500	248	252
a.1	Min Carrier separation	kHz	248	503	255
a.1	hopping algorithm		Pseudo Random, equal distribution	Compliant	NA
a.1.iii	max time occupied per channel in 10 seconds	msec	400	177	223
b.1	max power (eirp)	mw	1000	25.12	974.88
b.4	max antenna gain		6	-5.48	11.48
d	measured in band 100 KHz BW signal	dBm	None	14	NA
d	measured low band edge 100KHz BW signal - 20 dB below peak	dBm	-6	-14.88	8.88
d	measured high band edge 100KHz BW signal - 20 dB below peak	dBm	-6	-42.8	36.8

RF SAR Calculation:

Tabulated RF Exposure Calculation

FCC Spec Reference	Spec Data	Distance (mm)	Frequency (GHz)	Extremity / Body Contact Factor	Spec (mW)	Data (mW)	Margin (mW)
KDB 447498 D01V5r01	min SAR Evaluation Limit = (mW/distance)*f^.5 < 3 for body contact, < 7.5 for extremity contact	5.00	0.900	7.500	39.528	19.450	20.078

Note: The measured distance from the PCB to the top / button outer case is 5 mm. The measured distance from the PCB to the bottom outer case is 2mm. The device manual specifies that the device is to be incorporated in an automobile overhead console or sun visor with the buttons exposed and the bottom of the device not directly accessible. The device is activated by hand (extremity.)

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

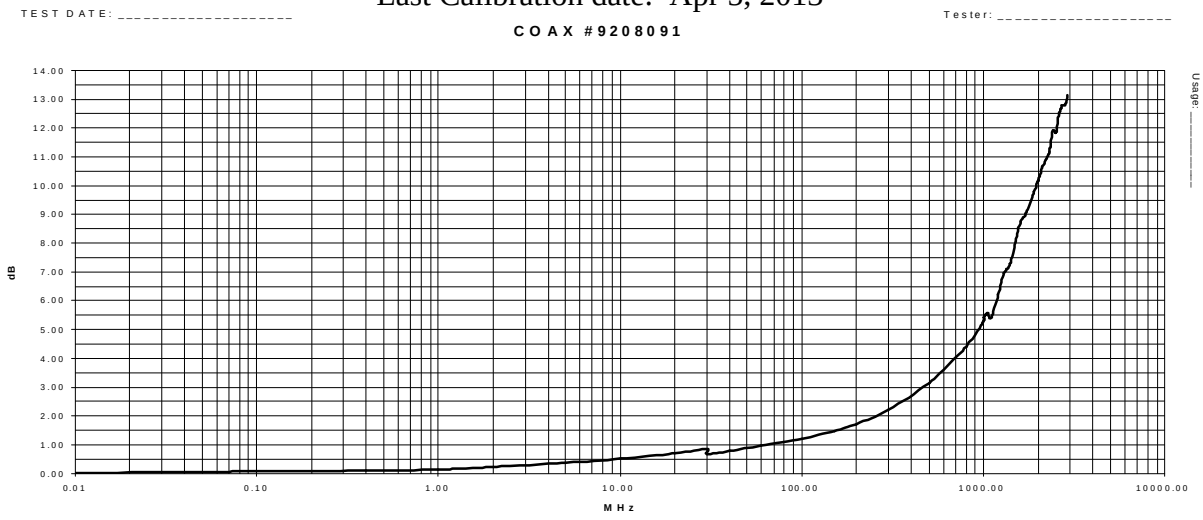
The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 Michigan Hwy152, Sister Lakes, 49047. This test facility is NVLAP accredited (LabCode 200129-0). It has been fully described in a report filed with the FCC (No.90413) and Industry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

Measurement Equipment Used

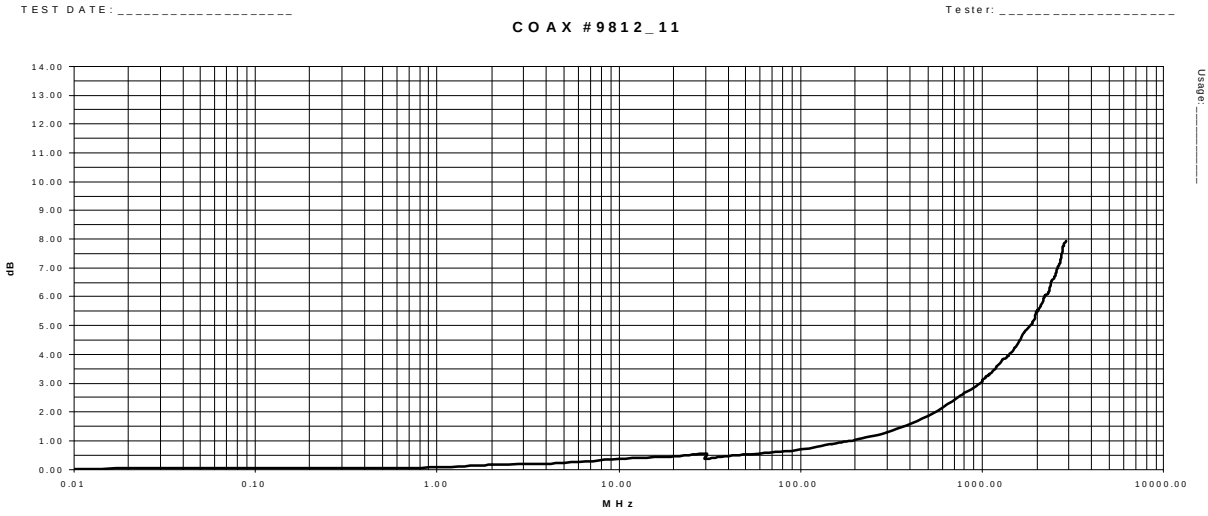
Equipment	Model	S/N	Last Cal Date	Calibration Interval
HP EMI Receiver system	HP 8542E			
RF Filter Section	HP-85420E	3448A00144	4 Sept-12	14 months
RF Receiver Section	HP-85422E	3625A00174	4 Sept-12	14 months
EMCO BiconiLog Antenna	3142	1069	18- Sept-12	14 months
EMCO Double Ridged Horn	3115	7770	22-Sept-12	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

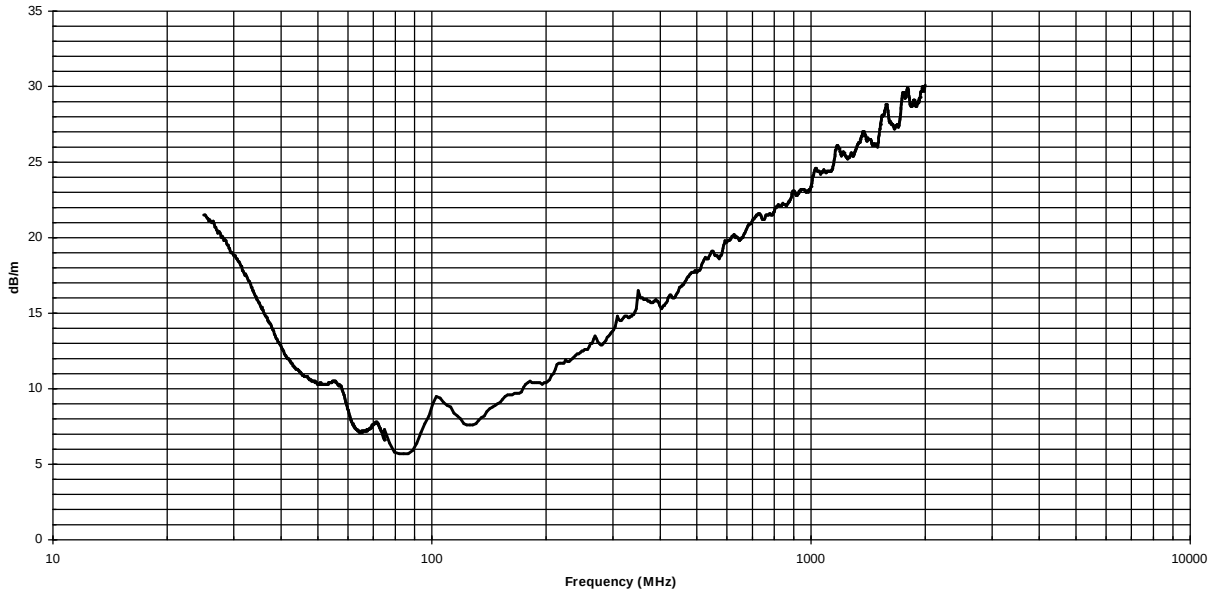


Radiated at 3 meters; 30MHz through 3000MHz, Coax #C090804
Last Calibration date: 02-May-13

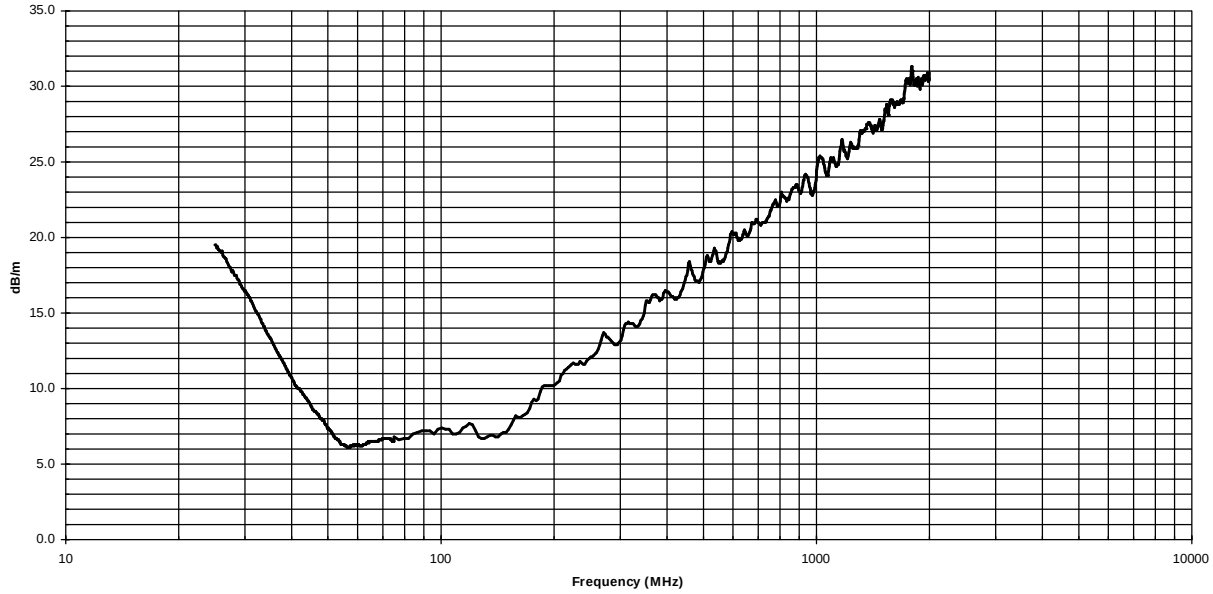


Antenna Factors

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).

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA

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

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