

AHD

92723 Mich. Hwy-152
Sister Lakes, MI 49047

EMC Test Report

#0700789

Issued 3/26/07

Regarding the FCC 15.231 Testing OF



IN WALL DIMMER

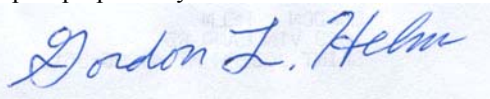
908.42MHZ TRANSCEIVER MODEL RZ106

Judgment: FCC Part 2.1031, Part 15 Subpart C (15.249) – Compliant

Prepared for: LEVITON MANUFACTURING, Inc.
59-25 Little Neck Pkwy
Little Neck, NY 11362

Test Date(s): February 20-23, 2007

Report prepared by:



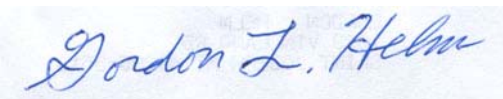
Gordon Helm, NCE

Report reviewed by:



Warren Guthrie, RF Engineer

Data recorded by:



Gordon Helm, NCE

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Statements Concerning this Report

NVLAP Accreditation: NVLAP Lab Code 200129-0

The scope of AHD accreditation is the conducted emissions, radiated emissions test methods of:

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

FCC Method – 47 CFT Part 15:

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 covered by the NVLAP accreditation.

Subcontracted Testing:

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

Test Traceability:

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

Limitations on results:

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

Limitations on copying:

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

Limitations of the report:

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

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

Retention of Records:

- 1) For equipment verified to comply with FCC regulations, the manufacturer is obliged to retain this report with the product records for two years following the manufacture of the equipment that was tested.

Manufacturer/Applicant [2.1033(b1)]

The manufacturer and applicant:

LEVITON MANUFACTURING, Inc.
59-25 Little Neck Pkwy
Little Neck, NY 11362

Measurement/Test Site Facility & Equipment**Test Site1 [2.948, 2.1033(b6)]****SITE 1.**

The AHD test facility is centered on 9 acres of rural property near Sister Lakes, Michigan. The mailing address is 92723 MI Hwy-152, Sister Lakes, Michigan 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 [2.947(d), 15.31(b)]**SITE 1.**

Measurement Equipment Used

Equipment Calibration	Model	S/N	Last Cal Date	Interval
HP EMI Receiver system	HP 8546A			
RF Filter Section	HP-85460A	3448A00283	12-June-06	12 months
RF Receiver Section	HP-85462A	3625A00342	12-June-06	12 months
EMCO BiconiLog Antenna	3142	1077	01-Sept-06	12 months
Solar LISN	8012-50-R-24-BNC	962137	01-Sept-06	12 months
Solar LISN	8012-50-R-24-BNC	962138	01-Sept-06	12 months
(LCI) Double shielded 50ohm Coax	RG58/U	920809	23-Feb-07	12 months
(3-m) LMR-400 Ultra Flex	LMR400	9812-11	07-Nov-06	6 months
(3-m) CS-3227 RG8	CS-3227	C060914	07-Nov-06	6 months
(10-m) Amelco 50ohm Coax	RG213U	9903-10ab	07-Nov-06	6 months

Test Site2 [2.948, 2.1033(b6)]**Site 2:**

The University of Michigan test facility is located at 8501 Beck Road, Belleville, Michigan 48111. This test facility has been fully described and accepted by the FCC and Industry Canada. This facility was utilized to measure emissions occurring at frequencies greater than 2.9 GHz.

Measurement Equipment Used [2.947(d), 15.31(b)]

Equipment Calibration	Model	S/N	Last Cal	
			Date	Interval
C-Band Std. Gain Horn	UM NRL design		calibration by design & physical inspection.	
XN-Band Std. Gain Horn	UM NRL design		calibration by design & physical inspection.	
X-Band Std. Gain Horn	SA 12-8.2	730	calibration by design & physical inspection.	
K-band horn (18-26.5 GHz) FXR, Inc.	K638KF		calibration by design & physical inspection.	
Avantek RF amplifier	AFT-12665		Jul-06	12 months
3ft Low Loss coax	RG142	-	with Avantek amp	
Spectrum Analyzer 26GHz	HP 8593E	3412A01131	Jul-06	12 months

Measurement Equipment Used [2.947(d), 15.31(b)]

Measurement Environment

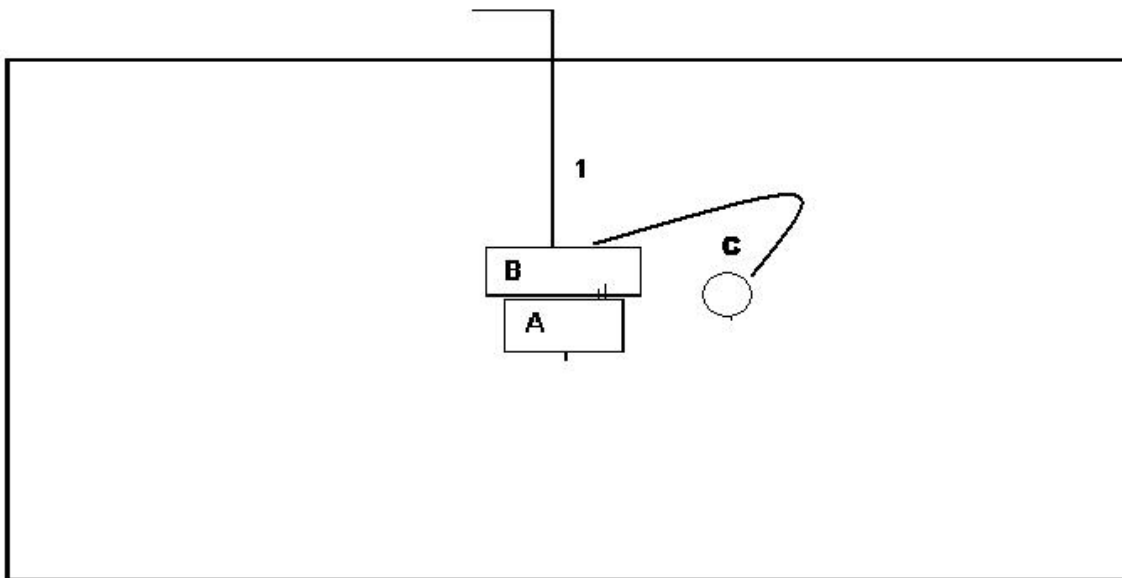
The tests were performed with the equipment under test, and measurement equipment inside the all-weather enclosure. Ambient temperature was 22deg.C., the relative humidity 30%.

Tested Configuration /Setup: [2.1033(b8)]

Support Equipment & Cabling

Setup Diagram Legend	Description	Model	Serial No. / Part No.	EMC Consideration
A	[EUT] In Wall Dimmer	[Leviton] RZ106	preproduction	FCC ID: QGH-RZD06
B	Electrical Box/Socket			
A	Wire Antenna			L shaped; 34mm
I	AC Mains cable	-		1 meter Unshielded
C	Load-Light Bulb	40 Watts		Load

Setup Diagram

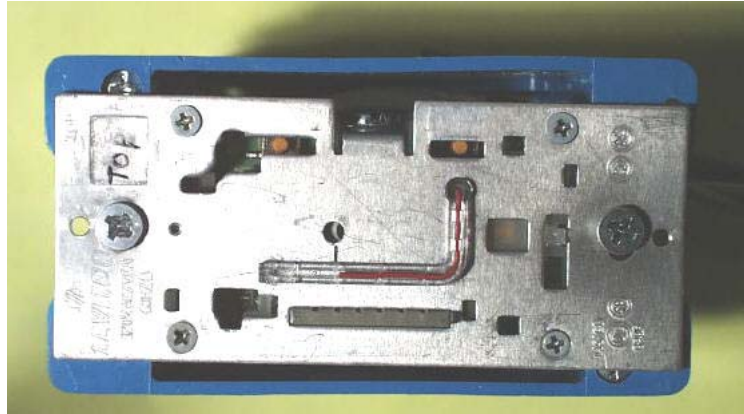


BASIC EUT SETUP
 (Legend designation is above)

Setup Photographs [ANSI C63.4.2.1033(B8)]**EUT Pictures**

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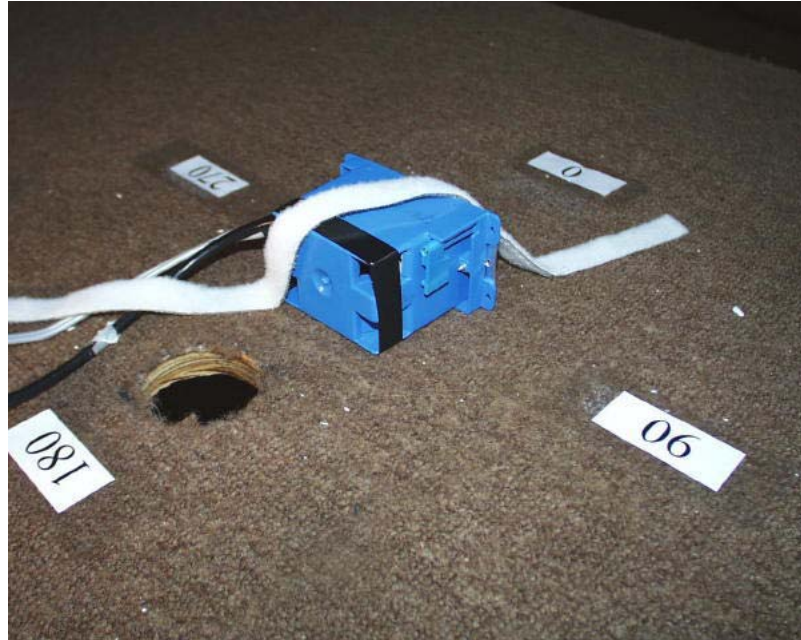
EUT EXT TOP



EUT PRETEST FOR EMISSION SPECTRUM



EUT IN "SIDE" POSITION



EUT IN "END" POSITION



EUT LINE CONDUCTED SETUP FRONT



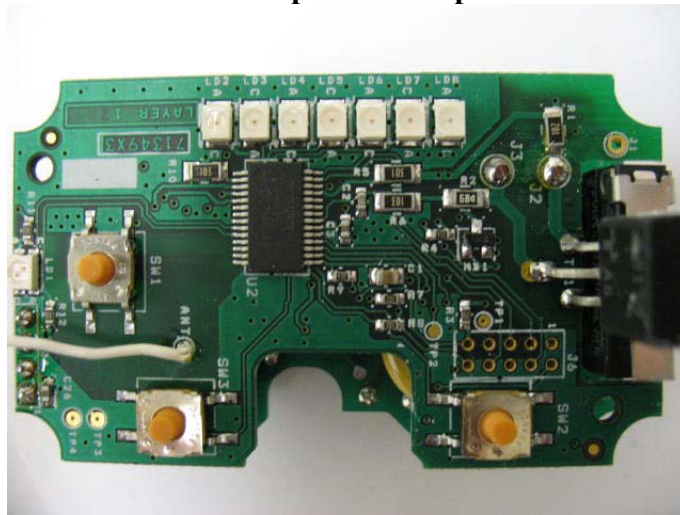
EUT LINE CONDUCTED SETUP REAR



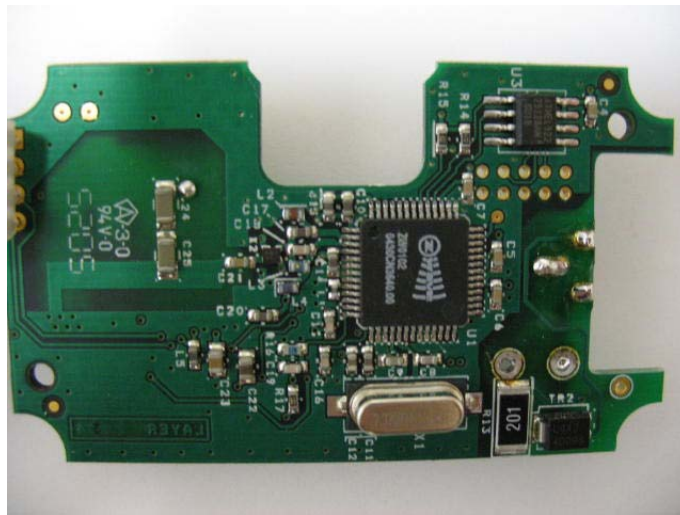
U of M SETUP



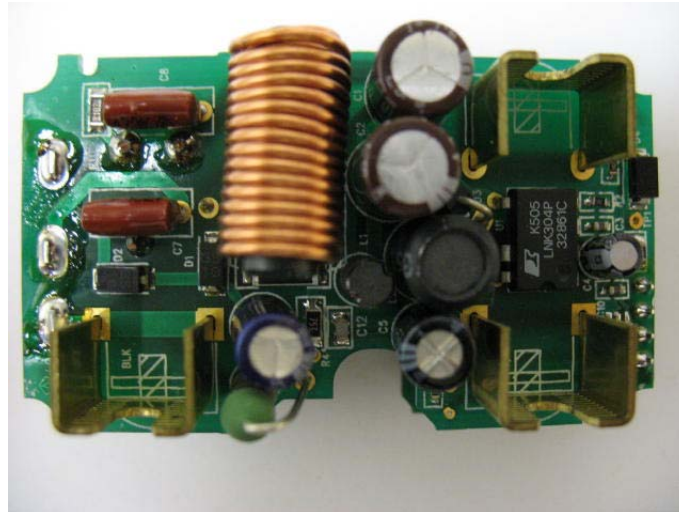
EUT RZ106 Top PCB Component Side



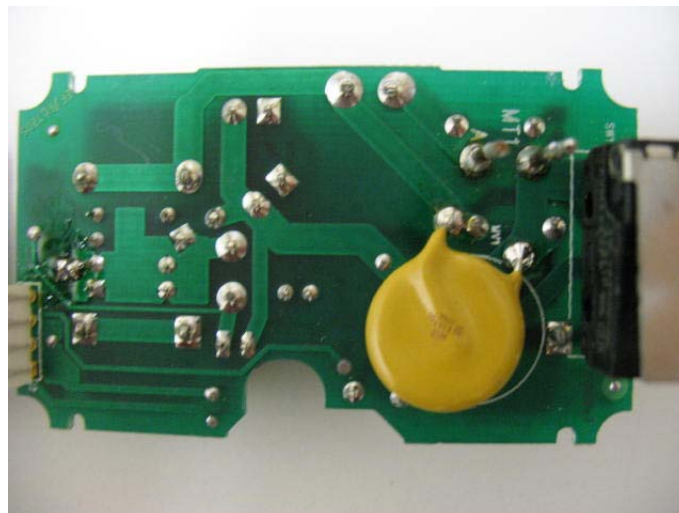
EUT RZ106 Top PCB Foil Side



EUT RZ106 Bottom PCB Component Side



EUT RZ106 Bottom PCB Foil Side



Summary of Results:

1. This test series evaluated the Equipment Under Test to FCC Part 15, SubPart C.
2. The system tested is compliant to the requirement of CFR 47, FCC Part 15, SubPart C for operation in the 902-928MHz frequency band, (Part 15.249).
3. The equipment under test was received on January 20, 2007 and this test series commenced on January 20, 2007.
4. The unit operates only at the frequency 908.42MHz.
5. The Occupied Band width of the fundamental, using the 99% method with a 100KHz RBW, measured 345KHz.
6. The field strength level of the fundamental was measured with a Quasi-Peak detection and observed to be **1.4dB** below the quasi-peak limit of 94dBuV/m (50,000uV/m). The EUT was positioned on the 'end' and the receive antenna oriented in the vertical polarization.

This measurement falls within the uncertainty of the site

7. The evaluation of the field strength levels of the transmitter harmonics showed the emission nearest the limit occurred at 2725MHz. This signal was measured to be **0.5dB** below the average limit of 54dBuV/m (500uV/m). The EUT was configured in the 'end' position, and the receive antenna oriented in the horizontal polarization.

This measurement falls within the uncertainty of the site

8. The field strength level of the Local Oscillator was measured to be 3.8dB below the quasi-peak limit of 46dBuV/m (200uV/m). The EUT was positioned on the 'end' and the receive antenna oriented in the horizontal polarization.
9. The evaluation of the field strength levels of the Local Oscillator harmonics showed the measurable emission nearest the limit occurred at 4542MHz. This emission was measured to be 9.9dB below the average limit of 54dBuV/m (500uV/m). The EUT was configured in the 'end' position, and the receive antenna oriented in the horizontal polarization.
10. Spurious emissions, not harmonics of transmitter or local oscillator, were initially determined in a shielded enclosure. At the open area test site the spurious emission level nearest the limit occurred at 30.253MHz. This emission was measured to be 28.3dBuV/m Quasi-Peak which is 11.6dB below the limit of 40dBuV/m. The EUT was in the vertical polarization.
11. The line conducted emission level nearest the limit occurred at 0.497MHz. This emission was measured to be 4.4dB below the Average limit of 46.05dBuV when measuring phase to ground.

Changes made to achieve compliance

1. Added new clear Antenna Spacer.

Standards Applied to Test: [2.1033(b6)]

ANSI C63.4 - 2001

CFR47 FCC Part 2;, Part 15, SubPart C, 15.249 Intentional Radiator; SubPart B, Digital Device
AHD test procedures TP0101-01, TP0102-01

Test Methodology: [2.1033(b6)]

The setup pictures in this report indicate the configuration of testing for this product.

The product was evaluated for emissions in both transmit and receive modes. The transmitted power output is set in firmware and the user does not have access to this location. The receiver uses a local oscillator 200KHz below the received signal.

In transmit mode, the EUT was setup up to transmit continuously with an FSK modulation. The measurements of the fundamental and its harmonics were recorded with Peak detection. The measurements of the fundamental frequencies were compared to the appropriate Quasi-Peak and average limits of section 15.249.

The system was placed at the center of the table 80cm above the ground plane pursuant to ANSI C63.4 for stand-alone equipment.

Variance From Test Procedure:

1. Unit was set to continuously transmit a manufacturer's provided representative waveform to facilitate efficient capture of the waveform. The normal mode of communication of a user's remote control functions were not evaluated.

Radiated

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm above the open field site ground plane in the prescribed setup per ANSI C63.4.

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 principle settings of the EMI Receiver for radiated testing include:

- IF Bandwidth: 120KHz for frequencies less than 1GHz.
 1 MHz for frequencies greater than 1GHz.
- Detector Function: Peak Mode for transmitter fundamental and harmonics.
 Quasi-Peak for other emissions less than 1GHz.
 Average for other emissions greater than 1GHz.

At frequencies up to 1000MHz a BiconiLog broadband antenna was used for measurements.

At frequencies above 1000MHz a double-ridge Horn broadband antenna was used for measurements.

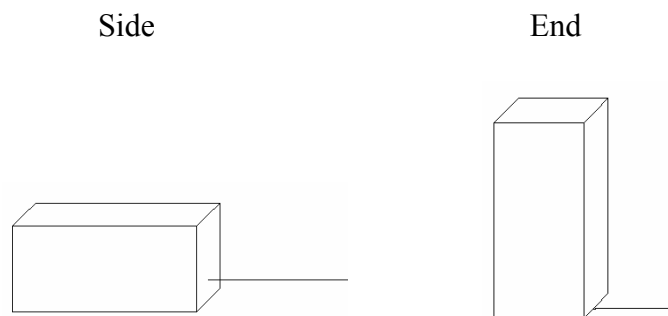
During the transmitter evaluation the EUT was transmitting continuously.

The turntable was rotated 360 degrees and the receiving antenna height varied from 1 to 4 meters to search out the highest emissions.

The final measurements were made with the EUT placed in one of two positions (designated as side, and end). Measurements were recorded in each of these two positions and with the measuring antenna in vertical and horizontal positions.

The unit was evaluated up to the tenth harmonic of the transmit fundamental, and up to 5000MHz for other spurious signals.

The test positions of EUT are:



FORMULAS AND SAMPLE CALCULATIONS:

THE HP8546A EMI Receiver has stored in memory the antenna and coax correction factors used in this test. The resultant Field Strength (FS) in dBuV/m presented by the HP8546A is the summation in decibels (dB) of the Received Level (RF), the Antenna Correction Factor (AF), and the Cable Loss Factor (CF).

Formula 1:
$$FS(\text{dBuV/m}) = RF(\text{dBuV}) + AF(\text{dB/m}) + CF(\text{dB})$$

With the EUT in transmitting mode only the resultant Field Strength measurement is recorded using the peak hold detector of the HP8546A.

Where it was necessary to move the EUT to 1 meter distance to take measurements a 'dB' factor which adjusts for this distance variance is used before comparing the emission level to the FCC limits. This factor is determined by the following formula.

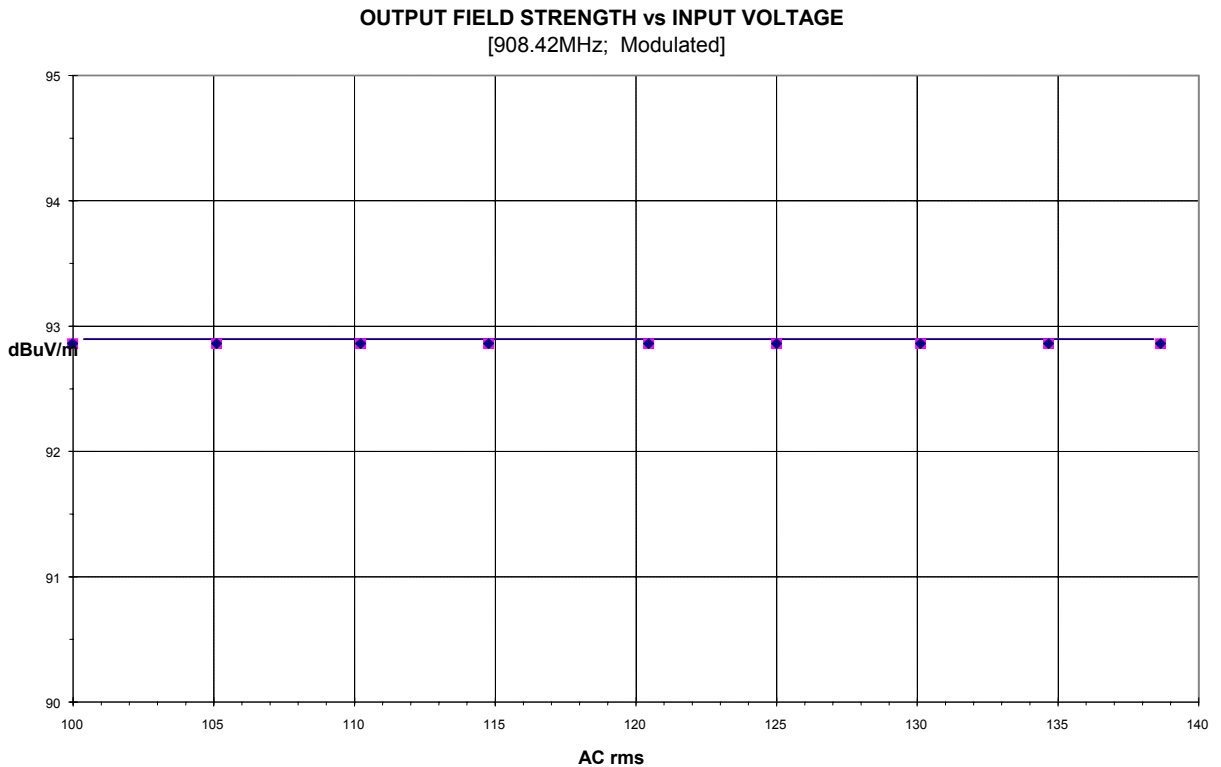
Formula 3:
$$\text{Distance factor}(\text{dB}) = 20 * \text{Log}(3\text{meter}/1\text{meter}) = 20 * \text{Log}(3) = 9.54\text{dB}.$$

Test Data [2.1033(b6)]

Relative Emission Level vs. Supply Voltage [15.31(e)]

The relative emission level as the supply voltage varied is presented in the charts below. The ac mains level, input to the EUT, was adjusted from 100vac to 138vac.

TX OUTPUT vs Voltage LEVEL 908.42MHz	
Volt In AC rms	TX OutPut Pk dBuV/m
100	92.6
105	92.6
110	92.6
115	92.6
120	92.6
125	92.6
130	92.6
135	92.6
138	92.6



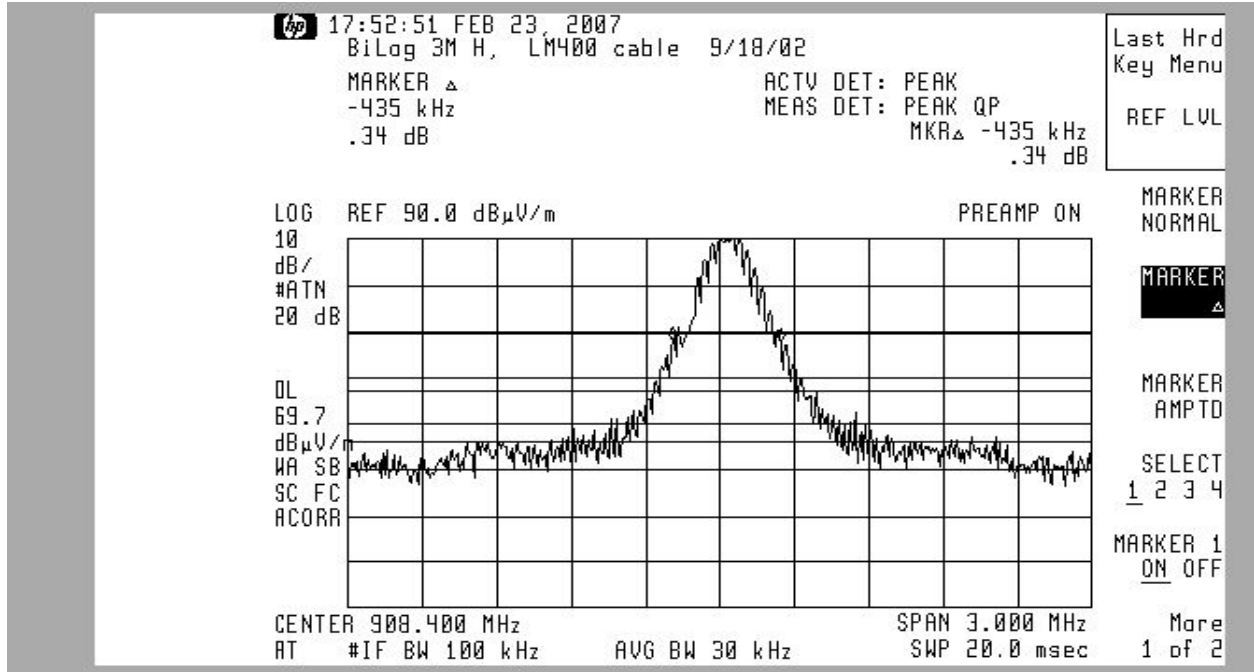
Modulation Characteristics

The transmitter is FSK modulated using ± 22 KHz frequency shifting.

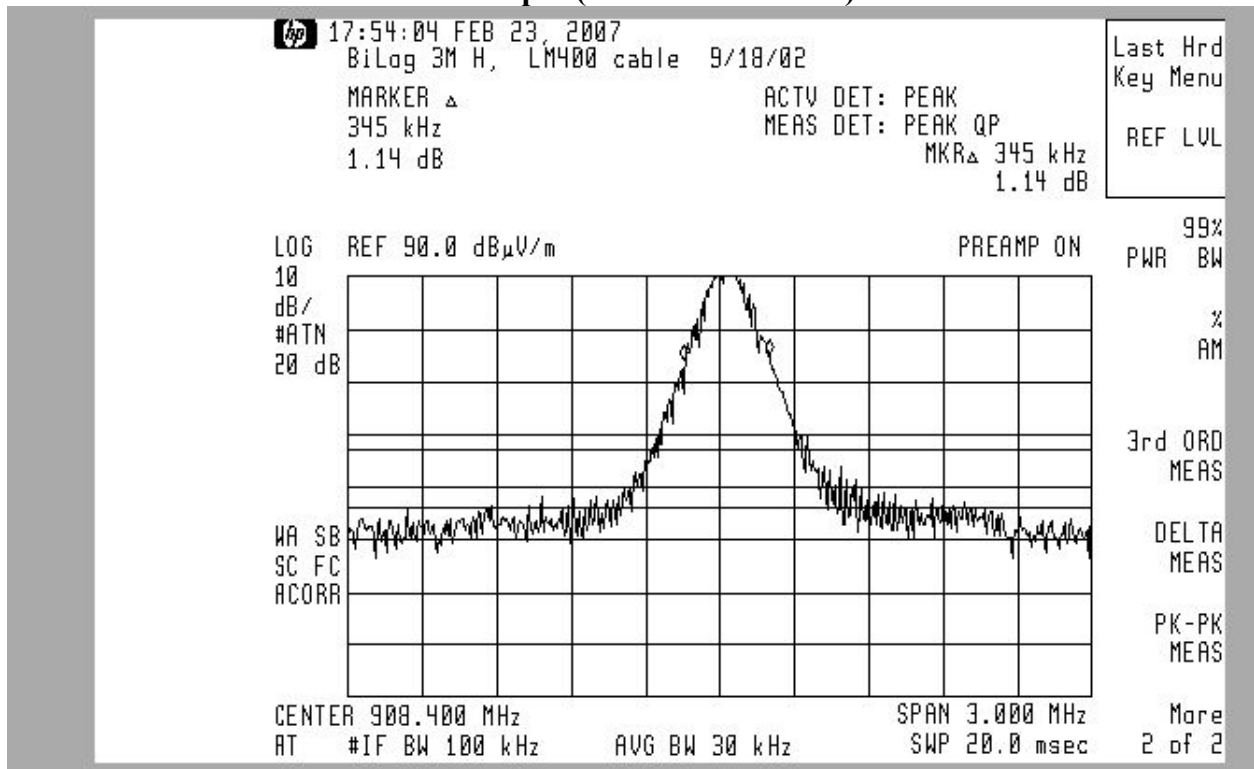
Occupied Bandwidth (15.249 and RSS210)

An RBW of 100KHz is selected.

FCC 15.249



IC 99% per (IC RSS-210 issue 6)



Fundamental (MHz)	RBW (kHz)	Measured 20dB Bandwidth	
908.42	100	435kHz	FCC 20dB
	100	345kHz	IC 99%

Radiated Field Strength Measurements: [15.209, 15.249(a,d)]**Field Strength Measurements of Fundamental & LO: [15.249(a,d), 15.209]**

MEASUREMENT PROCEDURE:

1. The EUT was setup to one of the two positions.
2. The receive antenna is positioned vertical or horizontal polarity.
3. Steps 1-2 were repeated to cover all positions.

The FCC field strength limit of the fundamental is 50milliVolt/m at a measurement distance of 3 meters. This number is equivalent to 94dBuV/m.

Calculation: $50\text{mV/m} = 50,000\text{uV/m}$. $20*\text{Log}(50,000\text{uV/m})=94\text{dBuV/m}$

The FCC field strength limit of the harmonics is 500microVolt/m at a measurement distance of 3 meters. This number is equivalent to 54dBuV/m.

Calculation: $20*\text{Log}(500\text{uV/m})=54\text{dBuV/m}$

Transmit Mode. Fundamental

Frequency	Corrected Quasi Peak Measurement	Included Cable+Antenna Factors	Turntable Azimuth	Antenna Height	FCC Limit	Margin	EUT posi on	Ant. Pol.
MHz	dBuV/m	dB+dB/m	deg	Mtr	dBuV/ m	dB		
908.4	92.6	26.93	170	1.1	94	1.4	End	V

Transmit Mode. Harmonics

Frequency MHz	Corrected AVERAGE Measurement dBuV/m	Included Cable+Antenna Factors dB+dB/m	Turntable Azimuth deg	Antenna Height Mtr	FCC Limit dBuV/m	Margin dB	EUT position	Ant. Pol
1817	52.4	29.31	160	1.0	54.00	1.6	Flat	V
2725	53.5	31.45	220	1.0	54.00	0.5	end	H
3634	42.7	32.9	220	1.2	54.00	11.3	Flat	H
4542	48.9	33.51	110	1.7	54.00	5.1	end	H
5451*	46.2	36.92	*	1.0	54.00	7.8	end	H

*These levels are at the noise floor of the measurement systems.

The following transmitter harmonic measurements were taken at the UM Radiation Lab facility. The distance between the EUT and Horn antenna is 3 meter. Spectrum analyzer settings for peak measurements are 1MHz RBW, 3MHz VBW.

The term in the column “calculated average level” is determined by
 SA Peak Measurement + Ant Factor – Amp Factor

The Avg level emissions are compared to the FCC average limits. Compliance is demonstrated.

Freq MHz	S.A. Avg Measurement dBm	Antenna Correction Factor dB/m	RF Amp Factor dB	Calculated Avg Level dBuV/m	FCC Avg Limit dBuV/m	Margin dB
6358	-62.6	24.4	38.0	30.8	54	23.2
7266	-68.0	25.2	36.8	27.4	54	26.6
8174	-69.7	27.0	36.8	27.5	54	26.5
9083	-69.7	27.5	36.8	28.0	54	26

*These levels are at the noise floor of the measurement systems.

Receive Mode. Local Oscillator & harmonics

Frequency MHz	Corrected Quasi-peak Measurement dBuV/m	Included Cable+Antenna Factors dB+dB/m	Turntable Azimuth deg	Antenna Height Mtr	FCC Limit dBuV/m	Margin dB	EUT postion	Ant. Pol.
908.27	42.2	26.93	0	1.0	46.00	3.8	Flat	H
Frequency MHz	Corrected AVERAGE Measurement dBuV/m	Included Cable+Antenna Factors dB+dB/m	Turntable Azimuth deg	Antenna Height Mtr	FCC Class B Limit dBuV/m	Margin dB	EUT postion	Ant. Pol.
1816.5	33.0	29.31	150	1.1	54.00	21	Flat	V
2724.9	33.6	31.54	*	1.0	54.00	20.3	end	H
3633.9	40.2	32.91	*	1.0	54.00	13.8	end	H
4542	44.1	33.47	*	1.0	54.00	9.9	end	H

*These levels are at the noise floor of the measurement systems.

Out of Band Emissions [15.249(d)]

The emissions outside the 902-928MHz band are to be either 50dB below the level of the fundamental or the limits of section 15.209.

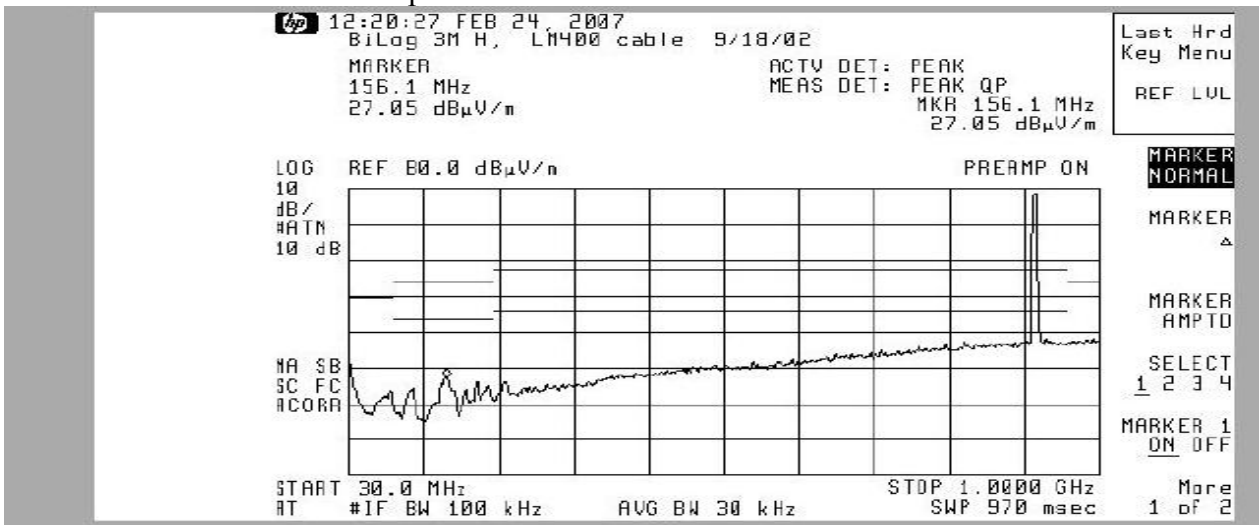
LIMIT @ 3meter: [15.209(a)]

30-88MHz	100uV/m	40dBuV/m
88-216MHz	150uV/m	43.5dBuV/m
216-960MHz	200uV/m	46dBuV/m
above 960MHz	500uV/m	54dBuV/m

A scan of the EUT was made in a shielded room to study the emission profile. These scans indicate there are low level spurious emissions from the unit other than the fundamental and its associated harmonics. These suspect signals were measured at the 3-meter open area test site.

Spurious Emissions: [15.249d]

Graph of scan made in shielded enclosure



Tabulated Quasi-Peak Measurements

Frequency	Corrected Quasi Peak Measurement	Included Cable+Antenna Factors	Turntable Azimuth	Antenna Height	Polarity	FCC Class B Limit	Margin
MHz	dBuV/m	dB+dB/m	deg	Mtr		dBuV/m	dB
30.253	28.33	19.01	*	1	V	40.00	11.6
84.849	21.13	7.61	*	1	V	40.00	18.8
111.618	22.42	8.93	*	1	V	43.50	21.0
155.753	18.78	9.41	*	1	V	43.50	24.7
203.226	30.45	11.44	270	1	V	43.50	13.0
202.524	24.39	11.41	270	1	H	43.50	19.1
227.429	19.15	12.61	*	1	H	43.50	24.3
226.601	18.58	12.56	*	2	H	43.50	24.9
201.988	21.92	11.38	90	1.7	H	43.50	21.5
152.383	19.52	9.21	240	1.9	H	43.50	23.9
111.583	19.5	8.93	*	2	H	43.50	24.0
85.255	15.88	7.64	*	4	H	40.00	24.1
30.052	26.01	19.13	*	1	H	40.00	13.9

* Not Azimuth dependant

The frequencies for measurements were determined by the suspect list generated from the shielded room prescan of 30MHz through 1GHz.

All other spurious emission are greater than 30dB below limits.

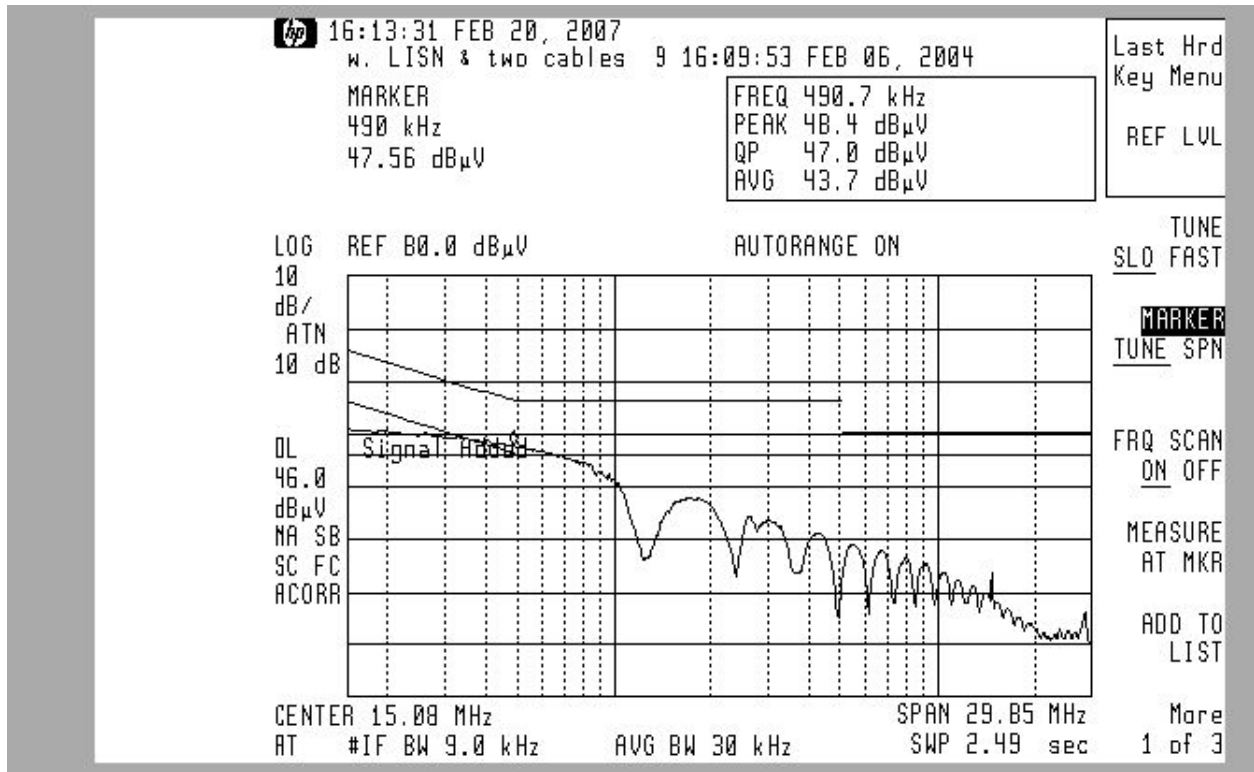
Line Conducted Measurements: [15.207(a)]

Line Conducted

NEUTRAL to Ground Measurement.

Class B

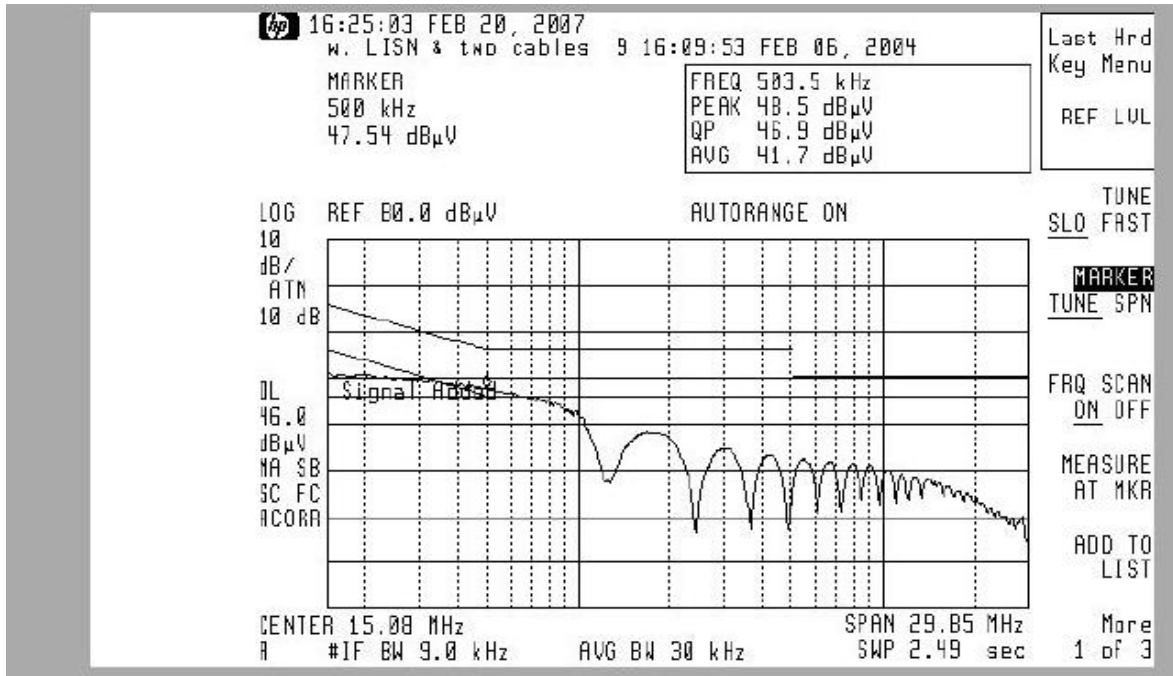
Plot of Peak Values



Tabulated Quasi-Peak/Average Measurements.

Frequency MHz	dBuV Reading		FCC / EN55022 dBuV Class B Limit		dB Margin	
	QP	Avg	QP	Avg	QP	Avg
1.791	36.41	31.21	56.00	46.00	19.59	14.79
3.054	32.4	27.11	56.00	46.00	23.60	18.89
4.255	30	24.75	56.00	46.00	26.00	21.25
5.515	27.93	22.86	60.00	50.00	32.07	27.14
28.314	9.13	3.48	60.00	50.00	50.87	46.52

PHASE to Ground Measurement.
 Class B
 Plot of Peak Values



Tabulated Quasi-Peak/Average Measurements

Frequency MHz	dBuV Reading		FCC / EN55022 dBuV Class B Limit		dB Margin	
	QP	Avg	QP	Avg	QP	Avg
0.497	46.92	41.57	56.05	46.05	9.13	4.48
1.716	36.95	31.76	56.00	46.00	19.05	14.24
3.054	33.9	28.74	56.00	46.00	22.10	17.26
4.192	32.19	27.02	56.00	46.00	23.81	18.98
5.515	31.38	26.11	60.00	50.00	28.62	23.89
28.314	14.27	8.83	60.00	50.00	45.73	41.17

AHD Accreditation

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:1999

NVLAP LAB CODE: 200129-0

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

is recognized by the National Voluntary Laboratory Accreditation Program for conformance with criteria set forth in
NIST Handbook 150:2001 and all requirements of ISO/IEC 17025:1999.
Accreditation is granted for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

2006-07-01 through 2007-06-30

Effective dates



Sally S. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2005-05-19)



**National Voluntary
Laboratory Accreditation Program**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

AHD (Amber Helm Development, L.C.)

92723 Michigan Highway 152
Dowagiac, MI 49047-8824

Mr. Gordon Helm

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E-Mail: ghelm@ahde.com

URL: http://www.ahde.com

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 200129-0

NVLAP Code Designation / Description

Emissions Test Methods:

12/CIS22	IEC/CISPR 22 (1997) & EN 55022 (1998) + A1(2000): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22 (1993) and EN 55022 (1994): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996)
12/FCC15b	ANSI C63.4 (2003) with FCC Method 47 CFR Part 15, Subpart B: Unintentional Radiators (Limited to 1 GHZ)
12/T51	AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment

Immunity Test Methods:

12/I01	IEC 61000-4-2, Ed. 1.2 (2001) + A1, A2; EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I04	IEC 61000-4-5, Ed. 1.1 (2001-04); EN 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test

2006-07-01 through 2007-06-30

Effective dates

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Sally S. Bruce
For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

May 17, 2005

Registration Number: 90413

AHD EMC Laboratory
92723 M-152
Dowagiac, MI 49047

Attention: Gordon Helm

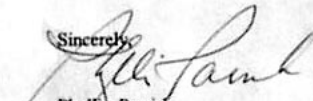
Re: Measurement facility located at Sister Lakes
3 & 10 meter site
Date of Renewal: May 17, 2005

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
Information Technician

NARTE Seal

