LS Research, LLC

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ENGINEERING TEST REPORT # 308299 TX
LSR Job #:C-346

Compliance Testing of:
Honeywell RFI
Model # THM4000R1000

Test Date(s):
May 12th to 30th 2008

Prepared For:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247 FHSS TX
Frequency Hopping Spread Spectrum Operating in the
Frequency Band 902MHz –928MHz

This Test Report is issued under the Authority of:
Kenneth L. Boston, Sr. EMC Engineer

Signature:  Date: August 14, 2008

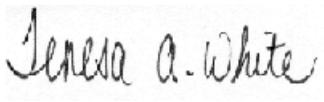
Test Report Reviewed by:	**Tested by:**
Teresa A. White, Quality Manager	Khairul Aidi Zainal, Senior EMC Engineer
Signature: 	Signature: 
Date: August 14, 2008	Date: August 14, 2008

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EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.247
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Digital Modulation Transmitters operating in the Frequency Band of 902 MHz – 928 MHz
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	• Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2007	Code of Federal Regulations - Telecommunications
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-1-1	2006 A2: 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.

1.3 LS RESEARCH, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.lsr.com. Accreditation status can be verified at A2LA's web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**Honeywell**
Address:	**1985 Douglas Drive North Golden Valley, MN 55422**
Contact Person:	**Chris Goh**
Contact Phone:	**N/A**
Contact Email:	**Christopher.Goh@Honeywell.com**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	RFI
Model Number:	THM4000R1000
Serial Number:	365801000400397 (Radiated Measurements) 365801000400398 (Conducted Measurements)

2.3 ASSOCIATED ANTENNA DESCRIPTION

There are two antennas associated with the unit and both are PCB strip antennas.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	903MHz to 926.4MHz
Radiated RF Power (in Watts)	Horizontal EUT antenna: 0.0627 Watts Vertical EUT antenna: 0.0329 Watts
Maximum Conducted RF/Output Power (in dBm)	10.4 dBm (926.4 MHz)
Maximum Conducted RF/Output Power (Watts)	0.011 Watts
Operating Voltage	5.0 VDC
Field Strength (at 3 meters) (in dBuV/m)	Horizontal EUT antenna: 113.2 dBuV/m (926.4 MHz) Vertical EUT antenna: 110.4 dBuV/m (914.6 MHz)
Maximum Occupied Bandwidth (99% BW) (in kHz)	85.5 kHz
Type of Modulation	FSK
Maximum EIRP (in mW)	Horizontal EUT antenna: 62.7 mW Vertical EUT antenna: 32.9 mW
Emission Designator	F1D82K3
Transmitter Spurious (worst case)	Horizontal EUT antenna: 57.7 dBuV/m (9030.0 MHz @ 1m) Vertical EUT antenna: 57.1 dBuV/m (7411.2 MHz @ 1m)
Frequency Tolerance %, Hz, ppm	100 ppm
Microprocessor Model # (if applicable)	MSP430F2370
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	PCB trace
Gain (in dBi) (Note: Measured over conducting Ground Plane.)	Horizontal EUT antenna: 7.6 dBi Vertical EUT antenna: 5.0 dBi
EUT will be operated under FCC and IC Rule Part(s)	47 CFR 15.247 and 15.207 IC: RSS-GEN, 2007 and RSS-210, Issue 7, 2007
Portable/Mobile	☐ Portable ☒ Mobile
Modular Filing	☐ Yes ☒ No

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	√	RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: 100%
- Standard used for evaluation: OET Bulletin 65, IC Safety Code 6
- Measurement Distance: 20 cm
- RF Value: 0.126 ☐ V/m ☐ A/m ☒ W/m^2
  ☐ Measured ☐ Computed ☒ Calculated

2.5 PRODUCT DESCRIPTION

The THM4000R1000 can enable 2 way radio connectivity via 4 wire connection for zoning families HZ432, Hz322 TrueZone™ panels. The THM4000R1000 may be used with THM5320R1000 to enhance communications by remote mounting of the radio. The four wire interface consists of DC power, Ground and RS232 connection.
The circuit card contains a partitioned radio block. The board also contains microcontrollers, power supply circuitry, two LED indictors, and single button interface.
At the core of the radio block is an integrated transceiver, CC1101 manufactured by Texas Instruments. This radio is digitally controlled relative to its mode of operation through the SPI port.
The CC1101 is configured by the RF protocol microcontroller to operate at frequencies as determined by a frequency sequencing algorithm. The bandwidth, transmit power, and modulation rate and type are set identically for the all of the 50 frequencies utilized by this system.
The RF output of the CC1101 is a differential based signal at RF-n, p. A discrete balun network, transforms this signal to a single ended RF signal, while transforming the output impedance to 50ohm. The signal is then presented to a multi element low pass filter shown as block Z3. This filtered signal is routed to either one of two available antennas though an RF switch. Both of the antennas are constructed as PCB strip antenna.

PHOTO (Optional)

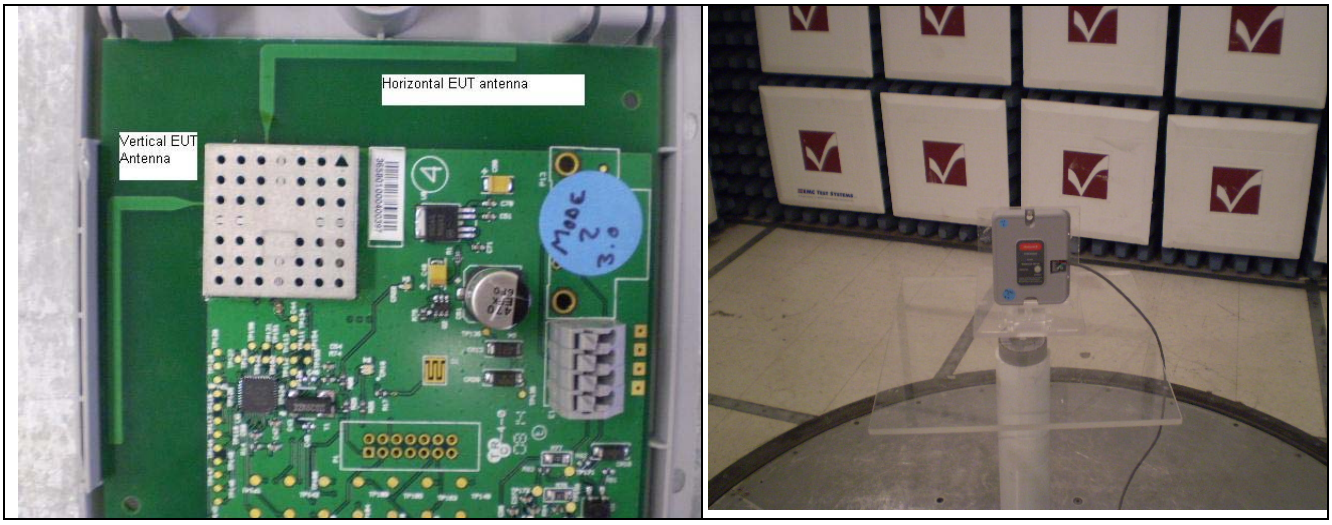


EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTING

3.1 CLIMATE TEST CONDITIONS

Temperature:	72º Fahrenheit
Humidity:	34%
Pressure:	749mmHg

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Paragraph	Test Requirements	Compliance (yes/no)
15.207	Power Line Conducted Emissions Measurements	Yes
15.247(a)(1)	Bandwidth of an FHSS System	Yes
15.247(b) & 1.1310	Maximum Output Power	Yes
15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.247(d)	RF Spurious Emissions	Yes
15.247(b), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
The transmitter circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B and the associated Radio Receiver and Digital Circuitry has also been tested and found to comply with Part 15, Subpart B – Radio Receivers. The Receiver Test Report is available upon request.		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☐ **None** ☒ **Yes (explain below)**

A two piece shield was added to the radio module.

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ **None** ☐ **Yes (explain below)**

3.5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2007	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15-Radio Frequency Device
ANSI C63.4	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 7	2007	Low Power License-Exempt Radio Communication Devices (All Frequency Bands)
IC RSS-212 Issue 1		Test Methods for Radio Equipment
RSS-GEN	2007	General Requirements and Information for the Certification of Radio Communication Equipment

The test procedures used are in accordance with ANSI document C63.4-2003, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 7 (2007), Section Annex 8 (section 8.1) for a Frequency Hopping Spread Spectrum (FHSS)Transmitter.

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15 and ANSI C63.4-2003. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuous transmit mode for final testing using power as provided by the Honeywell EIM. The unit has the capability to operate on 3 channels and two non-detachable EUT antennas. The switching of the antenna and channels of the RFI are done at the Honeywell EIM by:

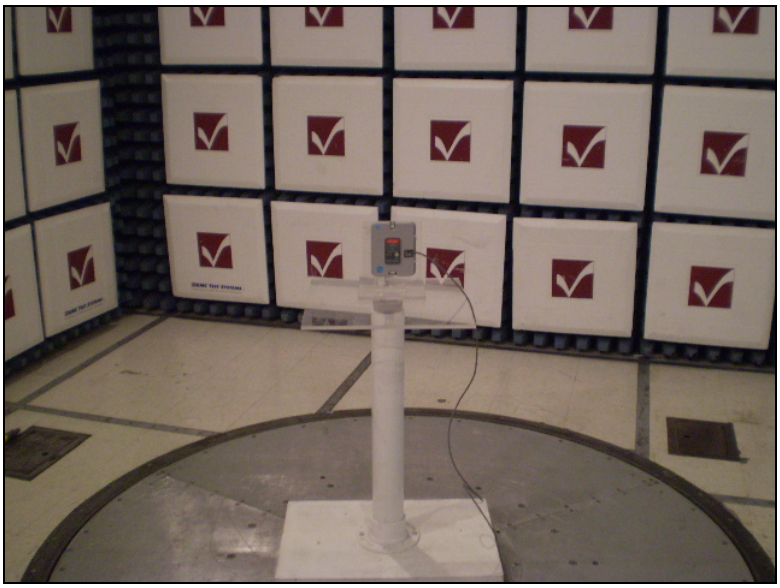
1. Pressing the "Connect" button on the EIM to toggle through the 3 channels.
2. Pressing and holding the EIM "Connect" button down for 5 seconds or longer toggles the RFI between the two antennas.

The RFI defaults to Horizontal EUT antenna and lowest channel when power cycled (Receive mode). To switch to transmit mode, the "Connect" button (on EIM) must be held down as transformer is plugged in.

The applicable limits apply at a 3 meter distance. Measurements above 5 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (903.0MHz), middle (914.6MHz) and high (926.4MHz) to comply with FCC Part 15.35 and both internal non-detachable antennas. The EUT was only tested in one orientation (Vertical) as this is its normal operation orientation.

5.2 Test Setup Photo(s) – Radiated Emissions Test

Vertical Orientation



5.3 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 18 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

5.4 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz From 5 GHz to 10 GHz, an HP E4407B Spectrum Analyzer and an EMCO Horn Antenna were used.

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296
Spectrum Analyzer	HP	E4407B	
Spectrum Analyzer	Agilent	E4446A	US45300564
Log Periodic Antenna	EMCO	93146	9701-4855
Horn Antenna	EMCO	3115	6907
Bicon Antenna	EMCO	93110B	9702-2918
Pre-Amp (5-18 GHz)	Adv. Microwave	WLA612	0123101
Pre-Amp (18-15 GHz)	Adv. Microwave	WLA622-4	0123001
Horn Antenna – Std. Gain	EMCO	3160.09	9809-1120

5.5 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 for an FHSS transmitter [Canada RSS-210, Issue 7 (2007), Annex 8 (section 8.1). The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.6 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 902-928 MHz band, as specified in Title 47 CFR 15.247 (b)(1), is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c).

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion from field strength μV/m to dBμV/m:

$dB\mu V/m = 20 \log_{10} (100)$

= 40 dBμV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

960 MHz to 10,000 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

5.7 DATA CHART – RADIATED EMISSIONS TEST

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(FHSS)
Frequency Range Inspected: 30 MHz to 10000 MHz

Manufacturer:	Honeywell International						
Date(s) of Test:	May 12th to 30th 2008						
Test Engineer(s):	Khairul Aidi Zainal						
Voltage:	5.0 VDC						
Operation Mode:	continuous transmit						
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %						
EUT Power:		Single Phase ___VAC		3 Phase ___VAC			
		Battery	√	Other: Honeywell EIM			
EUT Placement:	√	80cm non-conductive table		10cm Spacers			
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS			
Measurements:		Pre-Compliance		Preliminary	√	Final	
Detectors Used:		Peak	√	Quasi-Peak	√	Average	

The following table depicts the level of significant spurious (not including signal harmonics) radiated RF emissions found:

Frequency (MHz)	Ant./EUT Polarity	EUT Antenna	EUT Channel	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Spurious Limit (dBμV/m)	Margin (dB)
851.0	V/V	Horizontal	Low	1.19	61	38.5	91.7	53.2
952.4	H/V	Vertical	High	1.34	0	43.5`	90.2	46.7
958.1	V/V	Horizontal	High	1.10	54	37.1	93.2	56.1
959.8	H/V	Vertical	High	1.27	11	33.7	90.2	56.5

Note: Spurious Limit is a combination of 15.247 and 15.205 limits.

Radiated Fundamental.

A. Horizontal EUT antenna

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
903.0	V/V	1.03	63	111.7	125.2	13.5
914.6	V/V	1.00	63	112.3	125.2	12.9
926.4	V/V	1.00	54	113.2	125.2	12.0

B. Vertical EUT antenna

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
903.0	H/V	1.37	0	109.1	125.2	16.1
914.6	H/V	1.34	0	110.4	125.2	14.8
926.4	H/V	1.35	0	110.2	125.2	15.0

DATA CHART-RADIATED EMISSIONS TEST *(continued)*

A. Horizontal EUT antenna

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Low Channel :

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBμV/m)	Average (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
1806	V/V	1.19	14	45.1	43.9	91.7	47.8
2709			Note3				
3612	H/V	1.10	69	49.3	43.6	54.0	10.4
4515	V/V	1.16	0	44.9	41.0	54.0	13.0
5418	V/V	1.13	167	57.7	54.2	63.5	9.3
6321	V/V	1.09	328	49.9	43.2	101.2	58.0
7224	V/V	1.27	64	53.4	48.3	101.2	52.9
8127			Note3				
9030	V/V	1.16	305	61.7	57.7	63.5	5.8

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Middle Channel :

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBμV/m)	Average (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
1829.2	V/V	1.16	44	46.6	46.3	92.3	46.0
2743.8			Note3				
3658.4			Note3				
4573.0	V/V	1.00	0	44.4	41.4	54.0	12.6
5487.6	V/V	1.12	13	54.3	51.5	101.8	50.3
6402.2	V/V	1.05	327	49.9	43.6	101.8	58.2
7316.8	V/V	1.12	342	57.3	53.6	63.5	9.9
8231.4			Note3				
9146.0	V/V	1.22	303	60.6	57.7	63.5	5.8

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on High Channel:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBμV/m)	Average (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
1852.8	V/V	1.14	21	46.8	45.8	93.2	47.4
2779.2			Note3				
3705.6	H/V	1.06	56	46.9	44.7	54.0	9.3
4632.0	V/V	1.00	0	45.8	42.2	54.0	11.8
5558.4	V/V	1.10	4	56.2	53.5	102.7	49.2
6484.8	V/V	1.00	331	51.2	45.4	102.7	57.3
7411.2	V/V	1.15	340	58.4	56.3	63.5	7.2
8337.6			Note3				
9264.0	V/V	1.20	299	59.7	57.1	102.7	45.6

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Only the results from the Average detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 5 GHz were made at 1 meters of separation from the EUT
3) Measurement at receiver system noise floor.

DATA CHART-RADIATED EMISSIONS TEST *(continued)*

B. Vertical EUT antenna

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Low Channel :

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBµV/m)	Average (dBµV/m)	15.247 Limit (dBµV/m)	Margin (dB)
1806	V/V	1.57	0	42.5	41.0	89.1	48.1
2709			Note3				
3612	H/V	1.11	66	46.2	43.8	54.0	10.2
4515	V/V	1.14	0	44.8	40.9	54.0	13.1
5418	V/V	1.13	171	56.3	54.1	63.5	9.4
6321	V/V	1.09	331	51.0	45.5	98.6	53.1
7224	V/V	1.15	64	53.4	49.1	98.6	49.5
8127			Note3				
9030	V/V	1.37	249	59.2	56.5	63.5	7.0

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Middle Channel :

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBµV/m)	Average (dBµV/m)	15.247 Limit (dBµV/m)	Margin (dB)
1829.2	V/V	1.14	8	45.1	44.1	90.4	46.3
2743.8			Note3				
3658.4	H/V	1.07	50	46.6	44.2	54.0	9.8
4573.0	V/V	1.11	3	44.8	41.6	54.0	12.4
5487.6	V/V	1.11	356	54.8	51.9	99.9	48.0
6402.2	V/V	1.04	329	50.1	45.4	99.9	54.5
7316.8	V/V	1.12	341	56.6	53.9	63.5	9.6
8231.4			Note3				
9146.0	V/V	1.46	302	59.8	56.9	63.5	6.6

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on High Channel:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Peak (dBµV/m)	Average (dBµV/m)	15.247 Limit (dBµV/m)	Margin (dB)
1852.8	V/V	1.14	0	45.6	44.5	90.2	45.7
2779.2			Note3				
3705.6	H/V	1.06	56	46.7	44.4	54.0	9.6
4632.0	V/V	1.00	0	46.0	42.5	54.0	11.5
5558.4	V/V	1.10	3	56.4	54.2	99.7	45.5
6484.8	V/V	1.00	329	51.0	46.8	99.7	52.9
7411.2	V/V	1.16	348	59.2	57.1	63.5	6.4
8337.6			Note3				
9264.0	V/V	1.42	301	59.8	56.8	99.7	42.9

Notes:

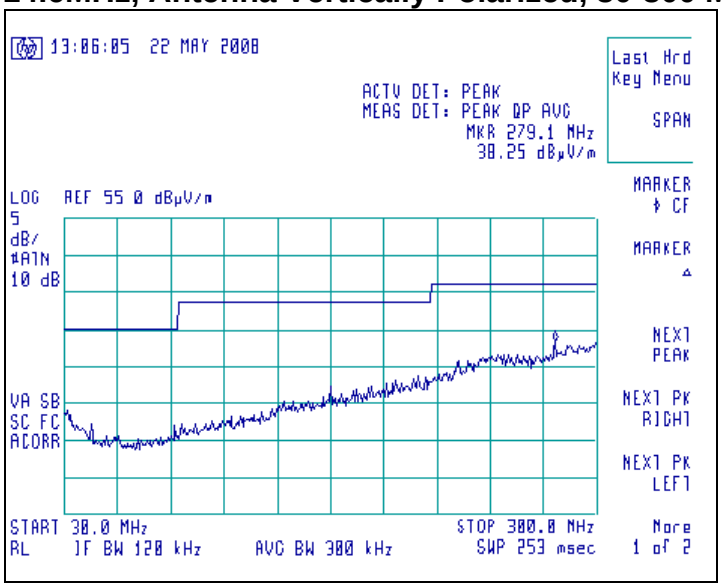
1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Only the results from the Average detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 5 GHz were made at 1 meters of separation from the EUT
3) Measurement at receiver system noise floor.

5.8 Screen Captures - Radiated Emissions Testing

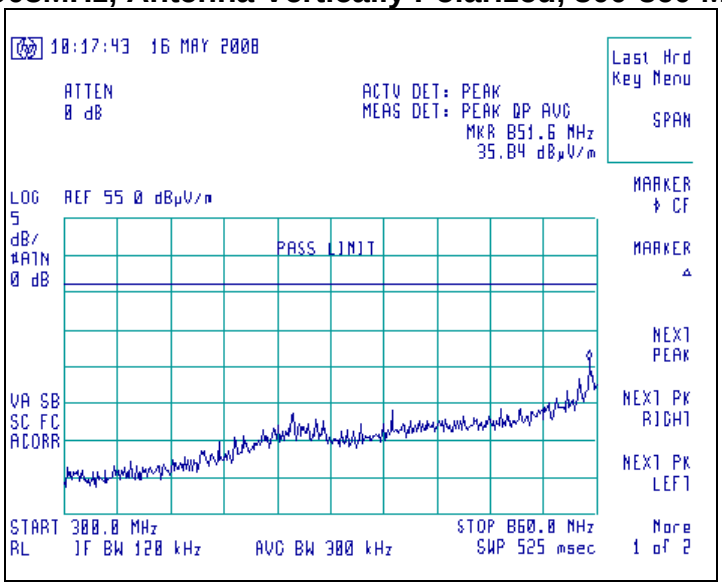
These screen captures represent Peak emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 903MHz, 914.6MHz, or 926.4MHz and the two types of EUT antenna (Horizontal or Vertical), with the sense antenna both in vertical and horizontal polarity.

Channel 914.6MHz, Antenna Vertically Polarized, 30-300 MHz, at 3m

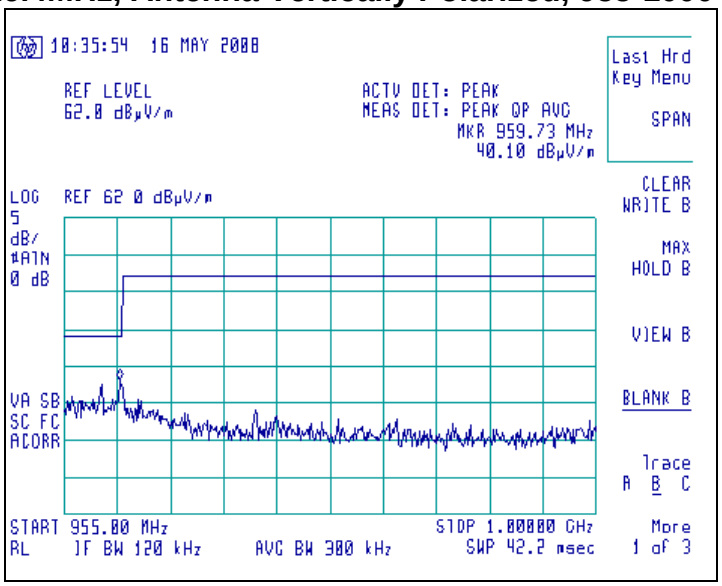


Channel 903MHz, Antenna Vertically Polarized, 300-860 MHz, at 3m

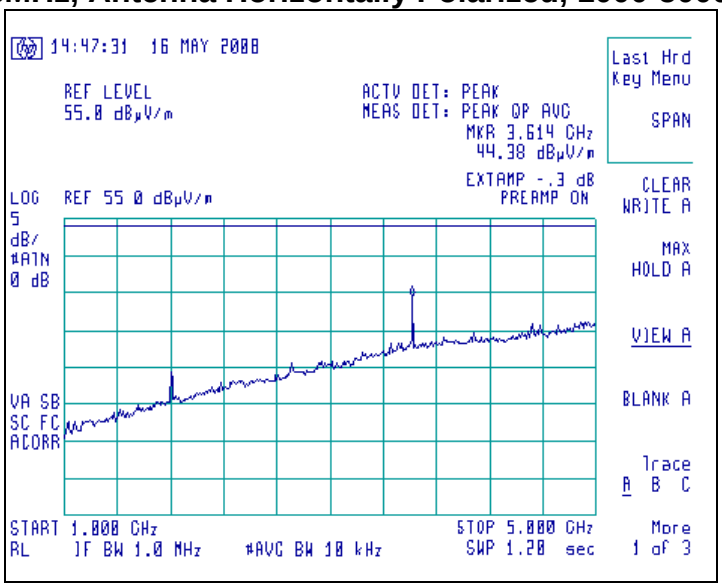


Screen Captures - Radiated Emissions Testing *(continued)*

Channel 926.4MHz, Antenna Vertically Polarized, 955-1000 MHz, at 3m



Channel 903MHz, Antenna Horizontally Polarized, 1000-5000 MHz, at 3m



Screen Captures - Radiated Emissions Testing *(continued)*

Channel 903MHz, Antenna Horizontally Polarized, 5000-10000 MHz, at 1m

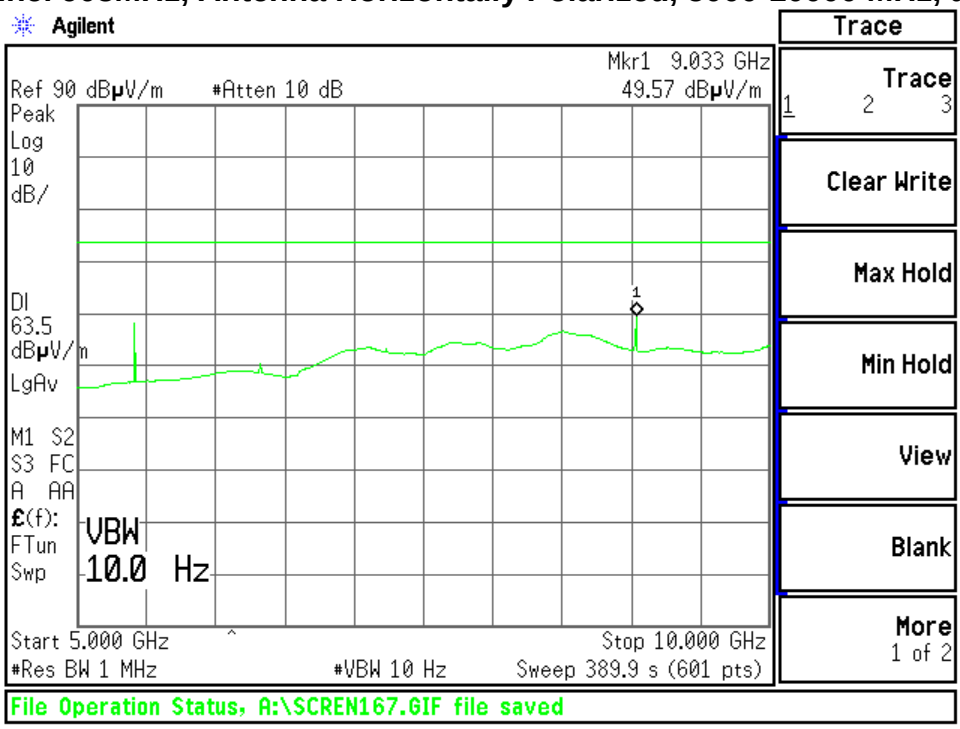


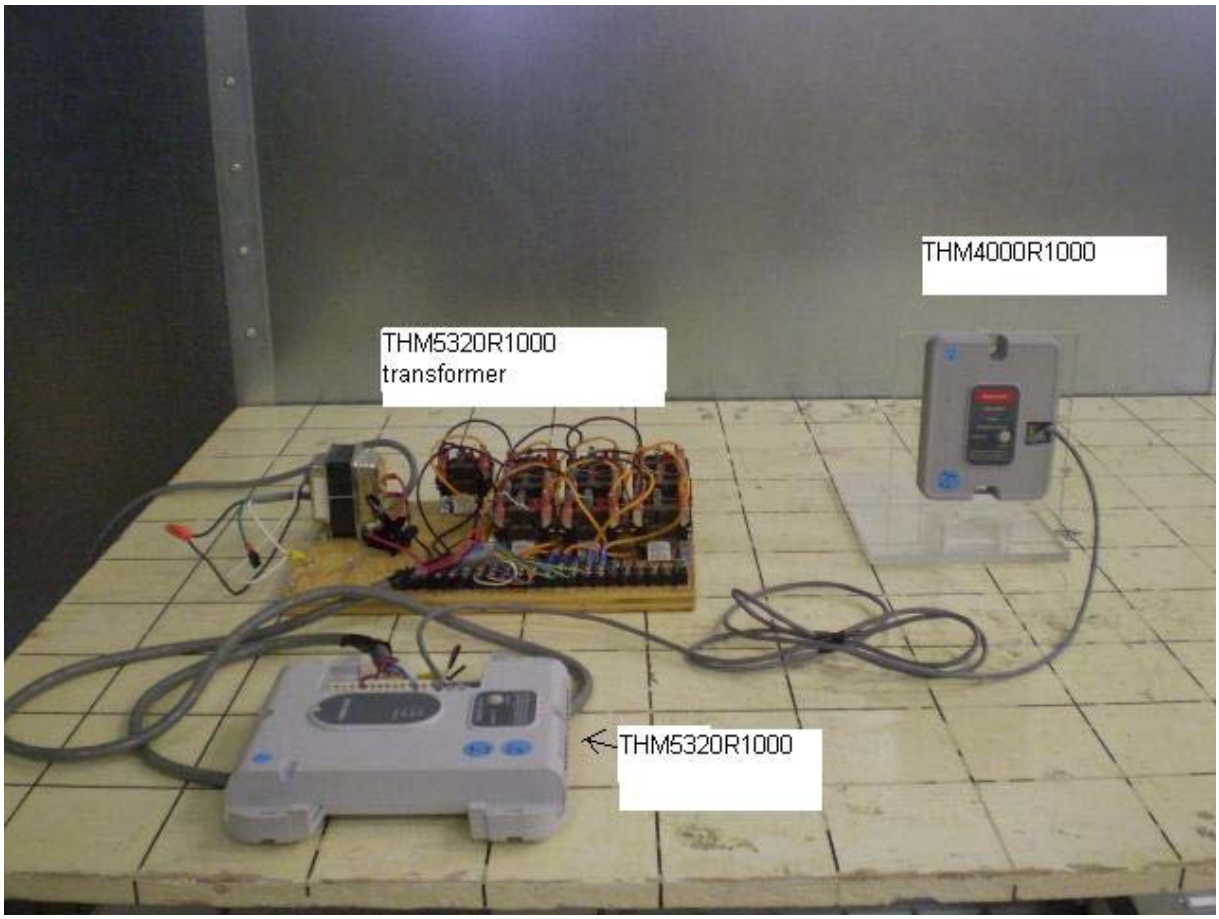
EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE: 15.207

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15 (Industry Canada RSS-GEN, 2007 (section 7.2.2). The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the HP 8546A EMI Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

Supply voltage to the RFI was provided by the EIM which was being supplied by its own power supply. The power supply converts 120VAC into 27VAC to be supplied to the EIM which then supplies the RFI with 5VDC.

6.2 Test Setup Photo(s) – Conducted Emissions Test



6.3 Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1 (2003), Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz.

6.4 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be used as measurements.

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
Spectrum Analyzer	Agilent	E4446A	US45300564
LISN	EMCO	3816/2NM	9701-1057
Transient Limiter	HP	119474A	3107A01708

6.5 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

6.6 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

6.7 DATA CHART-CONDUCTED RF EMISSIONS TEST

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 Class B

Manufacturer:	Honeywell International					
Date(s) of Test:	May 22nd 2008					
Test Engineer:	Khairul Aidi Zainal					
Voltage:	115 VAC (EIM power supply)					
Operation Mode:	continuous transmit					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:	√	Conducted RF Emissions Area				Chamber
EUT Placed On:	√	40cm from Vertical Ground Plane				10cm Spacers
	√	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:		Peak	√	Quasi-Peak	√	Average

A. Horizontal EUT antenna.

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Measured (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Measured (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.155	1	13.8	**65.7**	51.9	4.4	55.7	51.3
0.172	2	11	**64.8**	53.8	2.3	54.8	52.5

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.
2) All other emissions were better than 20 dB below the limits.
3) The EUT exhibited similar emissions across the Low, Middle and High channels tested.

B. Vertical EUT antenna.

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Measured (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Measured (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.1575	1	15	65.6	50.6	3.3	55.6	52.3
0.163	2	12.3	65.3	53	2.8	55.3	52.5

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.
2) All other emissions were better than 20 dB below the limits.
3) The EUT exhibited similar emissions across the Low, Middle and High channels tested.

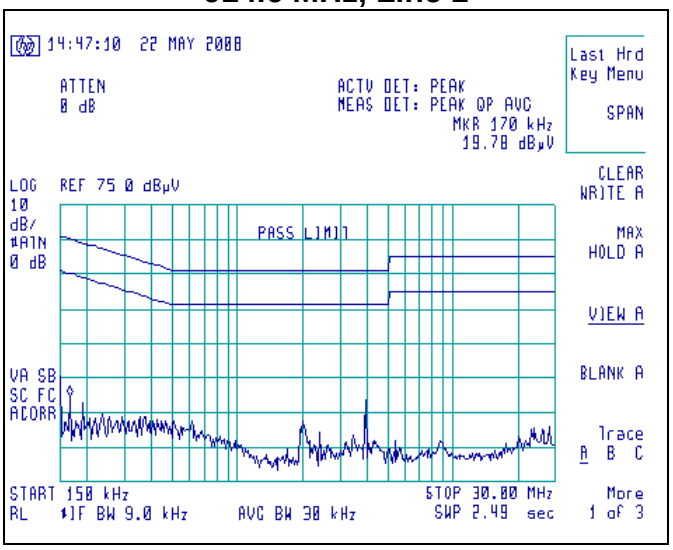
6.8 Screen Captures – Conducted Emissions Test

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207.

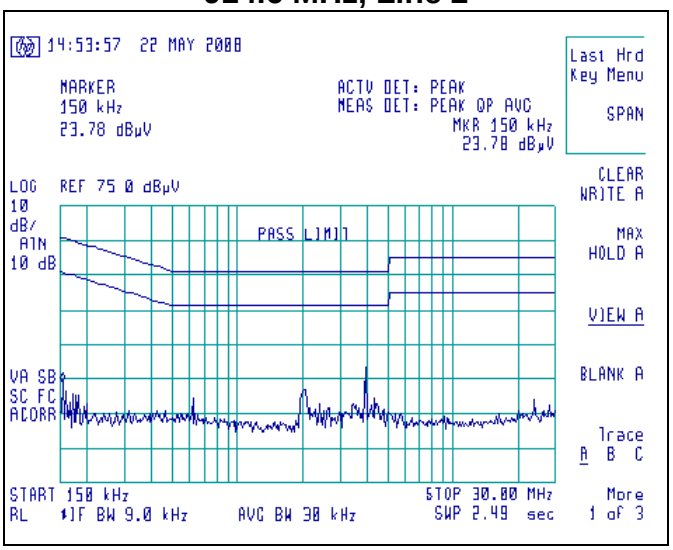
The signature scans shown here are from the middle channel, chosen as being a good representative of channels.

A. Horizontal EUT antenna

914.6 MHz, Line 1

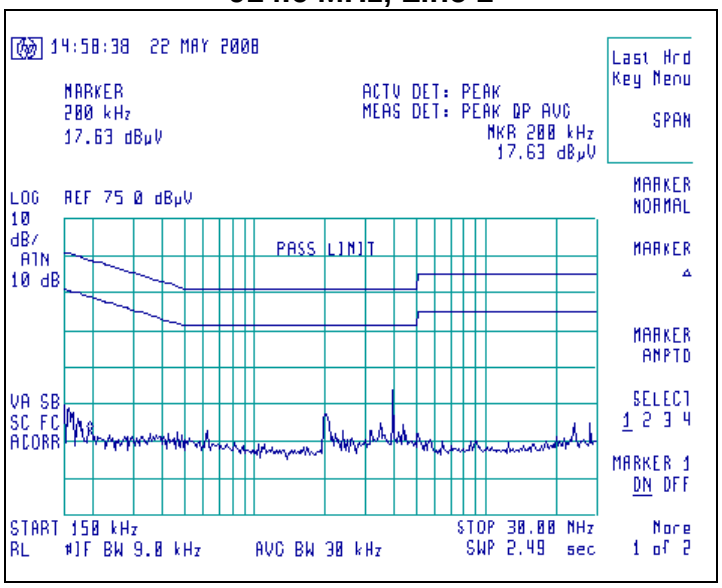


914.6 MHz, Line 2



B. Vertical EUT antenna

914.6 MHz, Line 1



914.6 MHz, Line 2

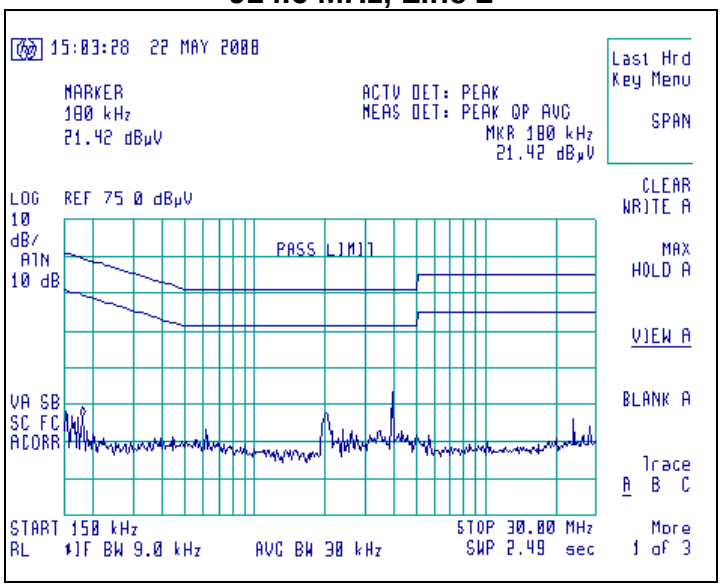


EXHIBIT 7. OCCUPIED BANDWIDTH: 15.247(a)(1)

7.1 Limits

For a Frequency Hopping Spread Spectrum, the -20 dB bandwidth shall be less than 250 kHz. The maximum allowed 20dB bandwidth is 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 (2003) and FCC Procedures (2007) for FHSS Systems operating under 15.247.

The bandwidth requirement found in FCC Part 15.247(a)(1) requires a -20dB occupied bandwidth of less than 250 kHz since the EUT has 50 channels. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the HP E4446A spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The spectrum analyzer used had the resolution bandwidth set to 10 kHz for this portion of the tests to satisfy the requirement that the measuring equipment RBW be at greater than or equal to 5% of the occupied bandwidth. The EUT was configured to run in a continuous transmit mode. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement when compared to the specified limit is 85.5 kHz, which is below the maximum of 250 kHz.

7.3 Test Equipment List

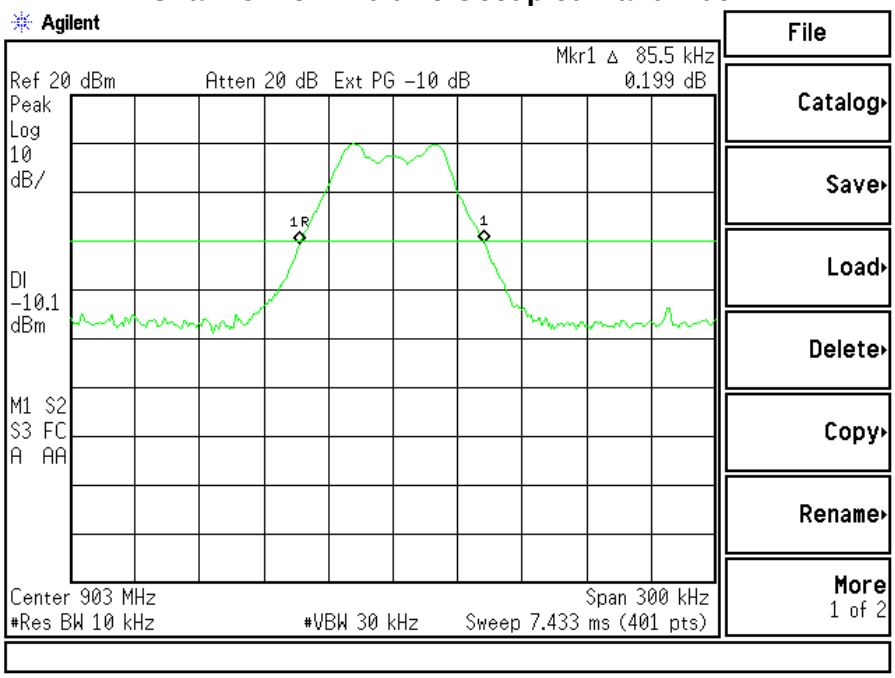
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

7.4 Test Data

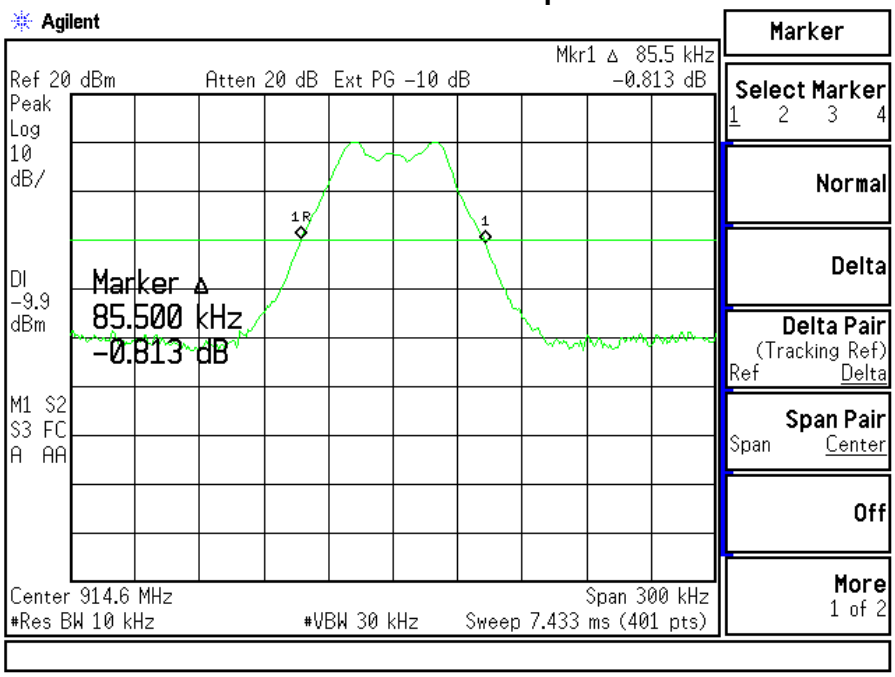
Channel	Center Frequency (MHz)	Measured -20 dBc Occ. BW (kHz)	Maximum -20 dBc Occ. BW Limit (kHz)
Low	903.0	85.5	250
Middle	914.6	85.5	250
High	926.4	85.5	250

7.5 Screen Captures - OCCUPIED BANDWIDTH

Channel Low -20 dBc Occupied Bandwidth



Channel Middle -20 dBc Occupied Bandwidth



Channel High -20 dBc Occupied Bandwidth

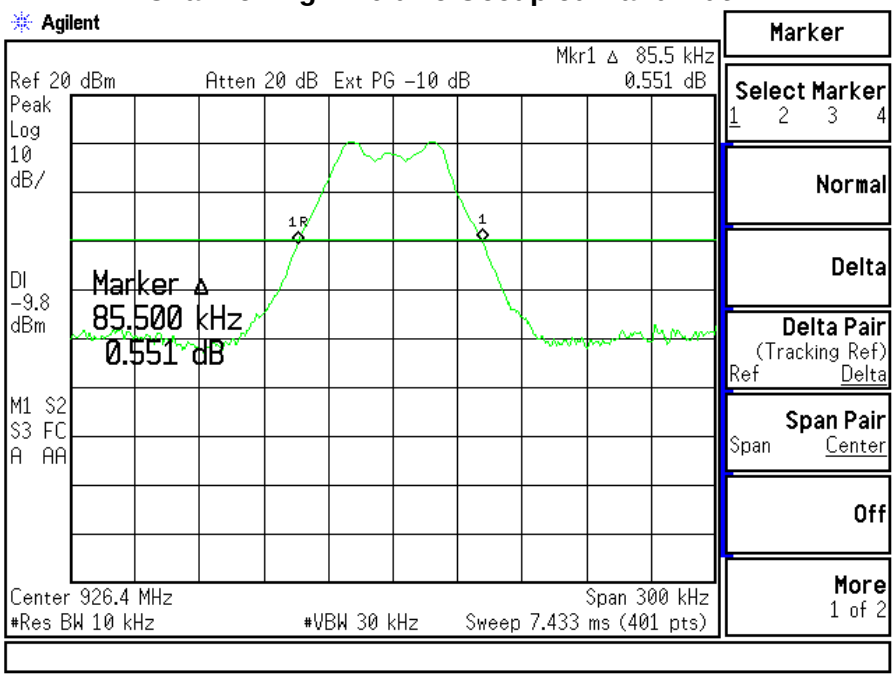


EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

FCC 15.247(d) requires a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 902-928 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

The Lower Band-Edge limit, Horizontal EUT antenna, would be 91.7dBuV/m.

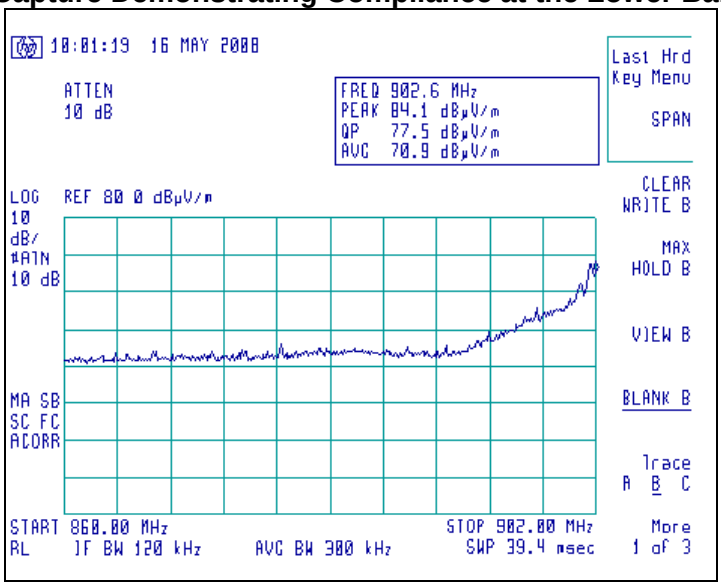
The Lower Band-Edge limit, Vertical EUT antenna, would be 89.1dBuV/m.

The Upper Band-Edge limit, Horizontal EUT antenna, would be 93.2dBuV/m.

The Upper Band-Edge limit, Vertical EUT antenna, would be 90.2dBuV/m.

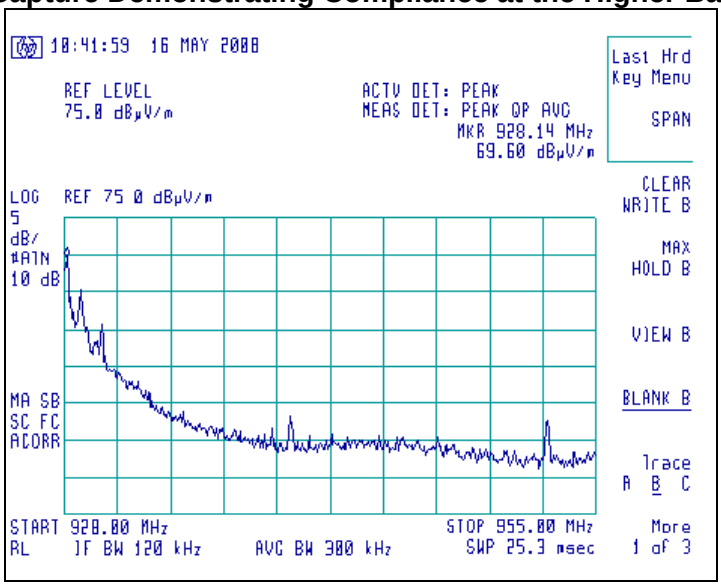
A. Horizontal EUT Antenna

Screen Capture Demonstrating Compliance at the Lower Band-Edge



The Lower Band-Edge limit, Horizontal EUT antenna, would be 91.7dBuV/m.

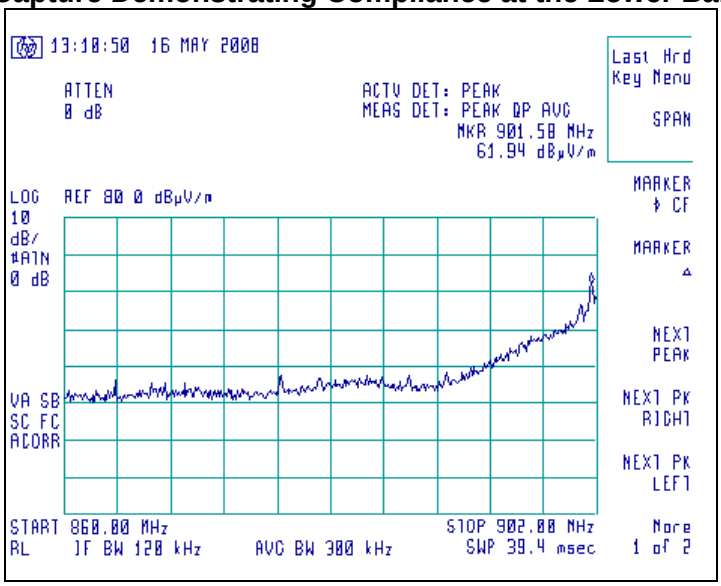
Screen Capture Demonstrating Compliance at the Higher Band-Edge



The Upper Band-Edge limit, Horizontal EUT antenna, would be 93.2dBuV/m.

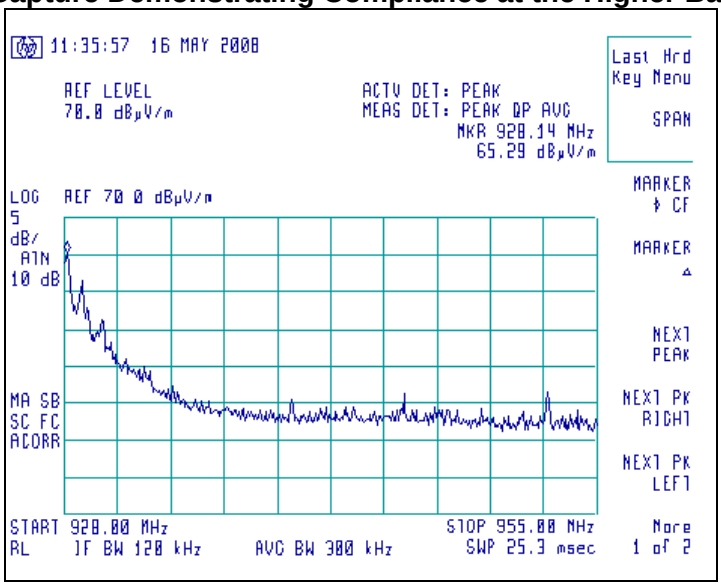
B. Vertical EUT Antenna

Screen Capture Demonstrating Compliance at the Lower Band-Edge



The Lower Band-Edge limit, Vertical EUT antenna, would be 89.1dBuV/m.

Screen Capture Demonstrating Compliance at the Higher Band-Edge



The Upper Band-Edge limit, Vertical EUT antenna, would be 90.2dBuV/m.

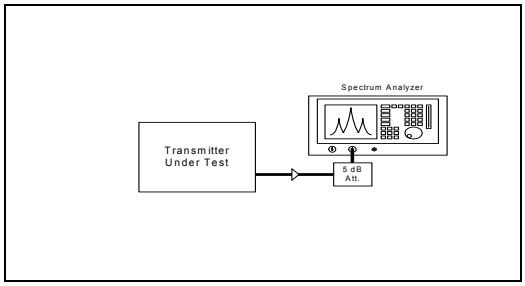
EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

Signals to the antennas on the THM4000R1000 are routed through an RF switch. The conducted RF output power of the EUT was measured at the input of this RF switch, which switches between the trace antennas, using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct measurements, without the need for any further corrections. The unit was configured to run in a continuous transmit mode. The spectrum analyzer was used with resolution and video bandwidths set to 100kHz, and a span of 500kHz, with measurements from a peak detector presented in the chart below.

9.2 Test Data

CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
Low	903.0	+30.0	9.9	20.1
Middle	914.6	+30.0	10.2	19.8
High	926.4	+30.0	10.4	19.6



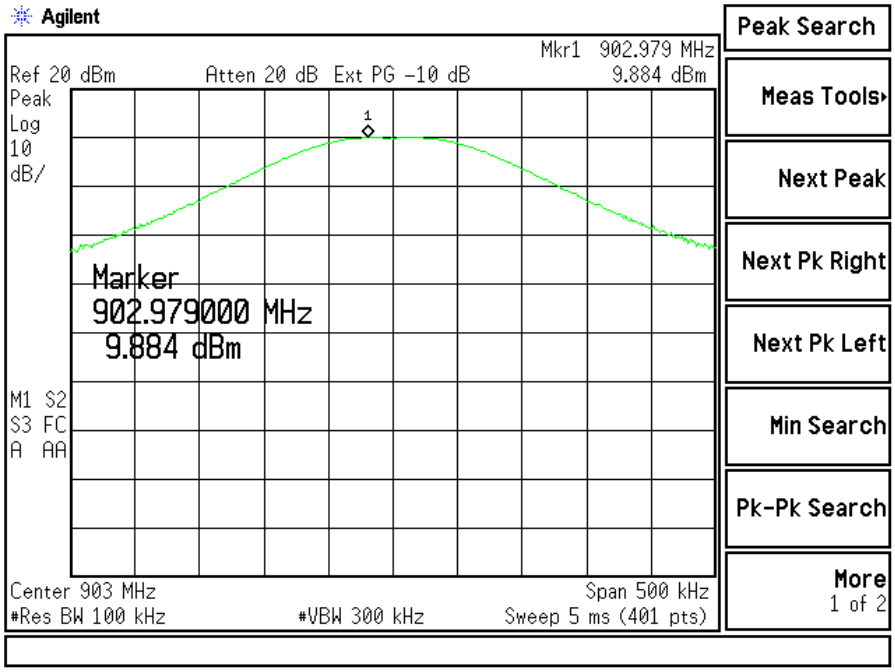
Measured Conducted RF Power Output (in Watts): 0.011 Watts

9.3 Test Equipment List

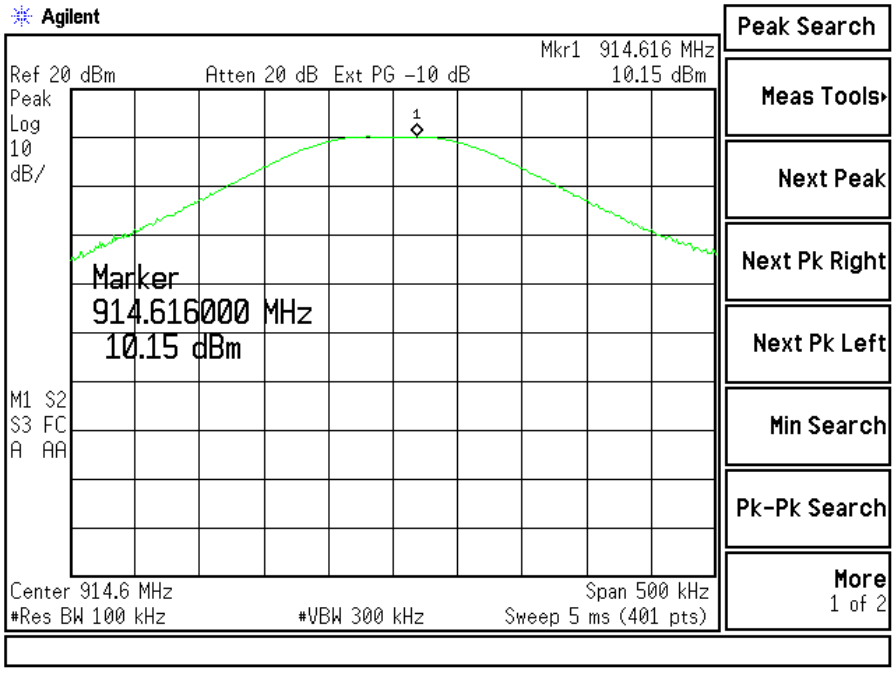
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

9.4 Screen Captures – Power Output (Conducted)

Channel Low



Channel Middle



Channel High

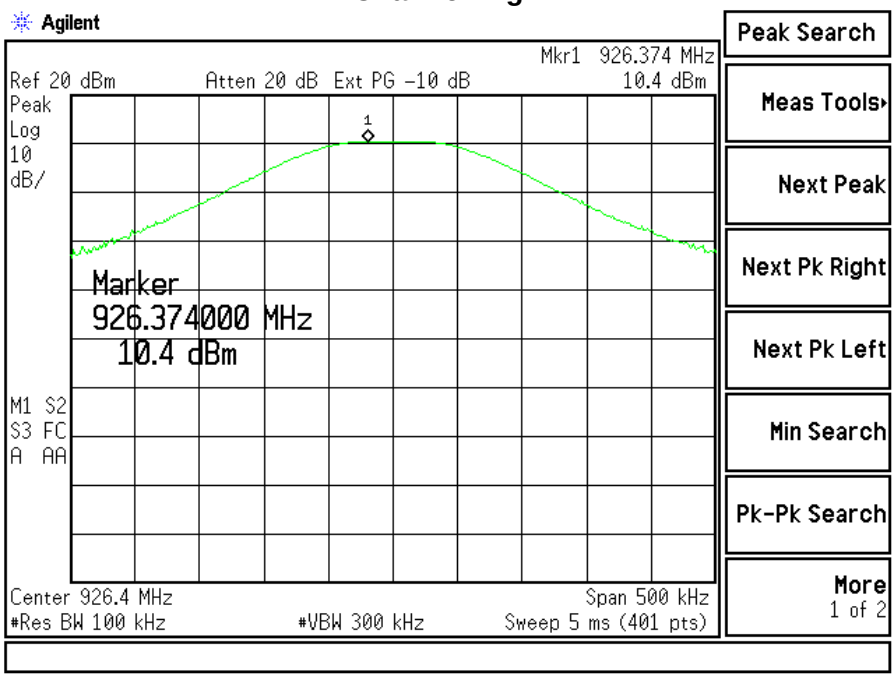


EXHIBIT 10. CHANNEL OCCUPANCY

10.1 Test Setup & Procedure

Part 15.247(a)(1)(i) requires a measurement of channel occupancy, for this device, of no more than 400 milliseconds in a 10 second period if utilizing between 25 and 50 channels, or in a 20 second period if utilizing 50 or more channels. The channel occupancy for this EUT was measured using an HP E4446A spectrum analyzer, set to zero-span at the frequency of interest. With the analyzer in peak-hold mode, the transmission lengths can be measured by adjusting the sweep rate of the analyzer. A suitable sweep rate was used to measure the channel occupancy at the low, mid and high channels. Measurement was performed radiated.

The longest time any transmission will occur on a single channel is 219.0 milliseconds. In the worst case scenario, transition time to the next hop channel is 15 seconds (typical 1 minute) which leads to a same channel repeat time of 750 seconds for the THM4000R1000. Therefore, in a 20 second period, average channel occupancy would be no greater than 219.0 milliseconds.

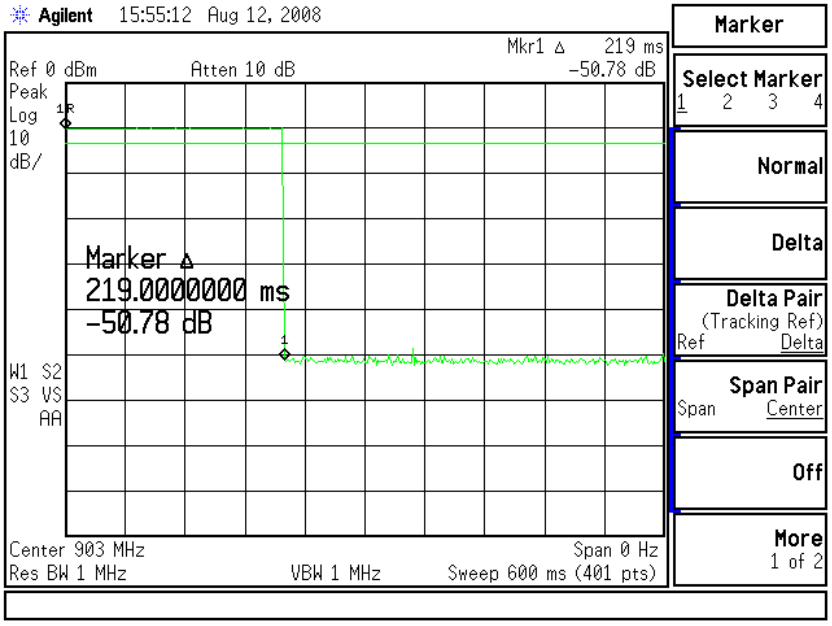
Note: For the sole purpose of expediting testing, the manufacturer re-programmed the hopping duration. Instead of a channel repeat time of 750 seconds, during testing it was reduced to 36 seconds.

10.2 Test Data

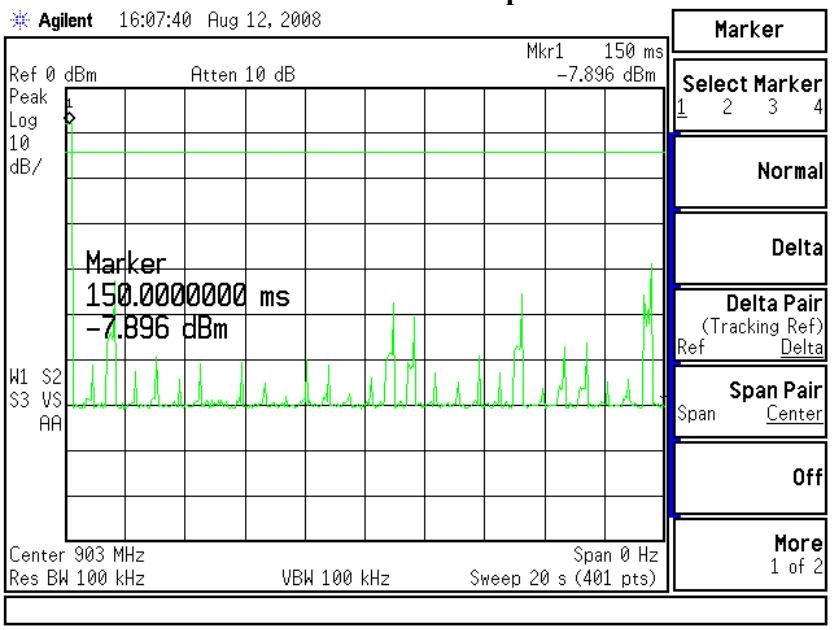
Channel	Frequency (MHz)	Occupancy Per transmission (ms)	Occupancy in 20 second window (ms)
Low	903.0	219.0	219.0
Middle	914.6	219.0	219.0
High	926.4	219.0	219.0

10.3 Plots of Channel Occupancy

Occupancy on 903MHz
600 milliseconds sweep

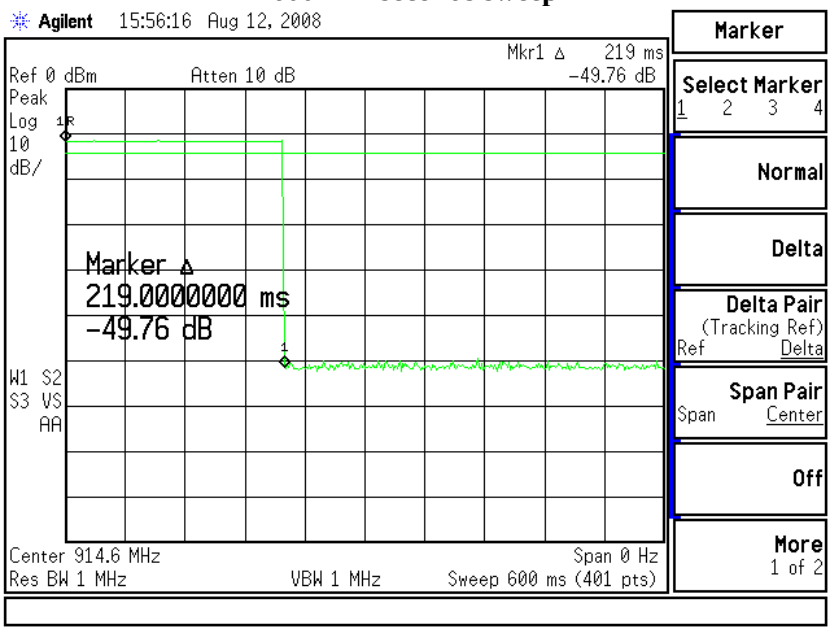


20 seconds sweep

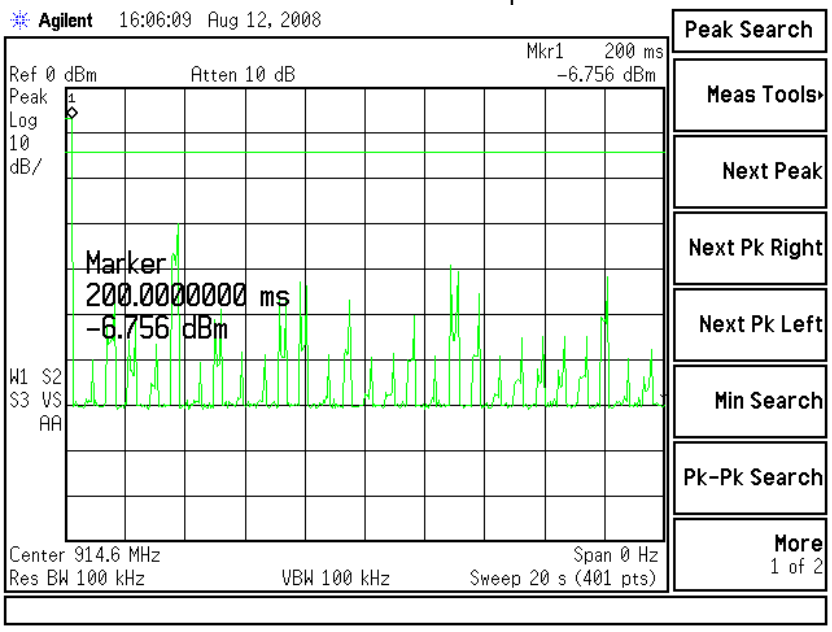


Plots of Channel Occupancy *(continued)*

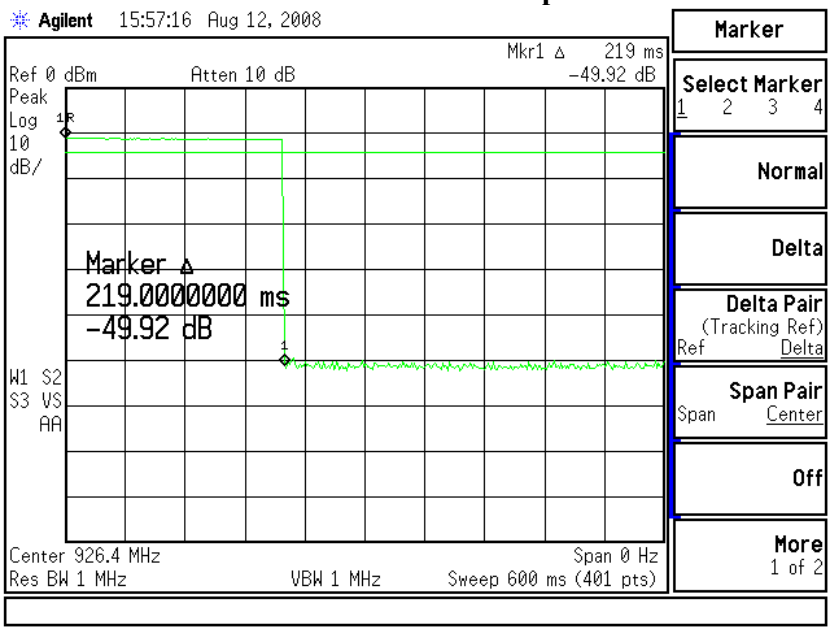
Occupancy in 914.6MHz
600 milliseconds sweep



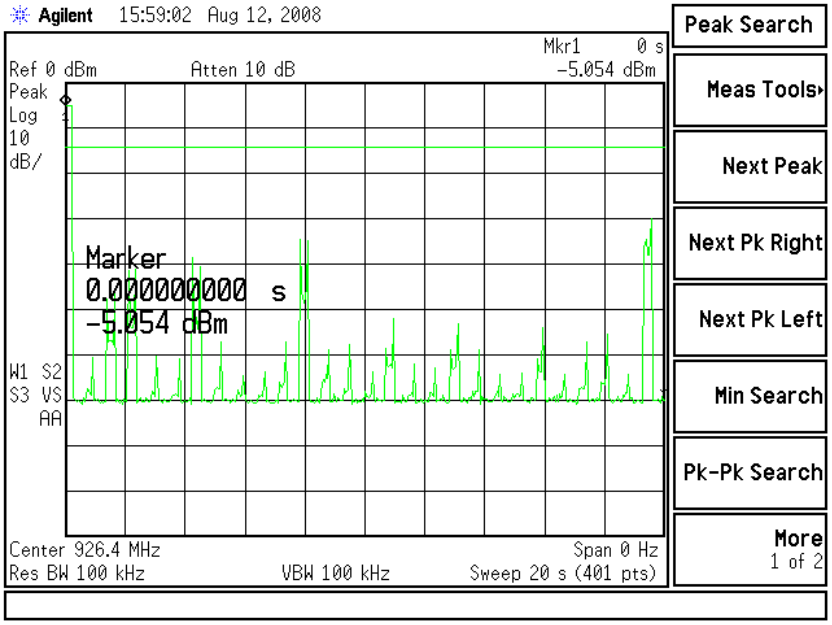
20 seconds sweep



Occupancy on 926.4MHz
600 milliseconds sweep



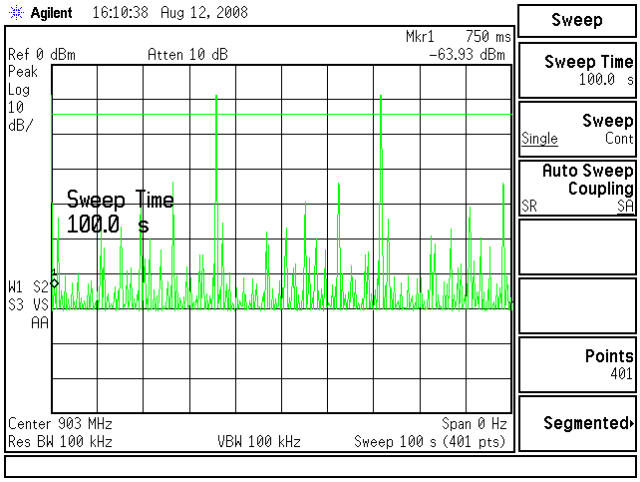
20 seconds sweep



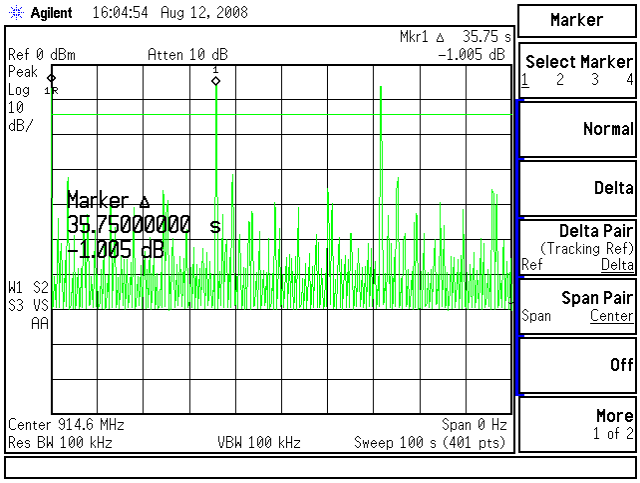
Duration Between consecutive hops.

Note: Plots show modified hop duration. Actual hop duration is longer than 36 seconds.

903MHz



914.6MHz



926.4MHz

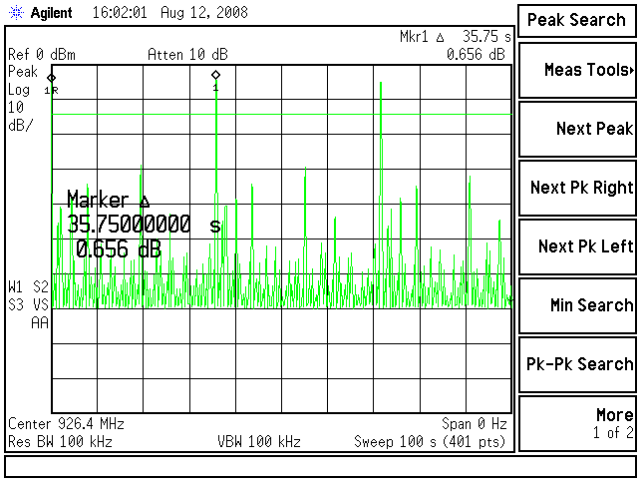


EXHIBIT 11. SPURIOUS EMISSIONS: 15.247(d)

11.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at lease 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

In addition, radiated emissions, which fall in the restricted band, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(e)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

FCC 47 CFR 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 – 0.110	162.0125 – 167.17	2310 – 2390	9.3 – 9.5
0.49 – 0.51	167.72 – 173.2	2483.5 – 2500	10.6 – 12.7
2.1735 – 2.1905	240 – 285	2655 – 2900	13.25 – 13.4
8.362 – 8.366	322 – 335.4	3260 – 3267	14.47 – 14.5
13.36 – 13.41	399.9 – 410	3332 – 3339	14.35 – 16.2
25.5 – 25.67	608 – 614	3345.8 – 3358	17.7 – 21.4
37.5 – 38.25	960 – 1240	3600 – 4400	22.01 – 23.12
73 – 75.4	1300 – 1427	4500 – 5250	23.6 – 24.0
108 – 121.94	1435 – 1626.5	5350 – 5460	31.2 – 31.8
123 – 138	1660 – 1710	7250 – 7750	36.43 – 36.5
149.9 – 150.05	1718.8 – 1722.2	8025 – 8500	Above 38.6
156.7 – 156.9	2200 – 2300	9000 – 9200	

FCC 47 CFR 15.209(a) Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength Limits (microvolts/m)	Distance (Meters)
0.009 – 0.490	2,400 / F (kHz)	300
0.490 – 1.705	24,000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

Calculation of Radiated Emission Measurements

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-25,000	500	54.0	63.5

FCC Part 15.247(d) requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. A Hewlett Packard model E4446A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

No significant emissions other than the harmonics could be noted within -50 dBc of the fundamental level for this product.

11.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564
Spectrum Analyzer	HP	E4407B	US39160256

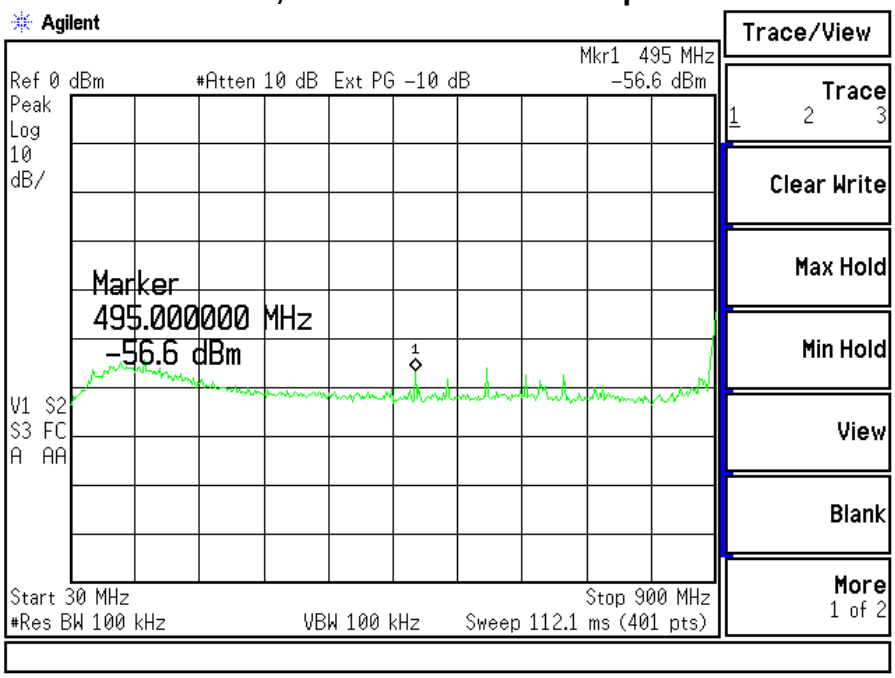
11.3 Test Data

	Channel Low	Channel Middle	Channel High
Fundamental	9.9 (dBm)	10.1 (dBm)	10.6 (dBm)
2nd Harmonic	-50.6 (dBm)	-48.1 (dBm)	-45.1 (dBm)
3rd Harmonic	-59.9 (dBm)	-55.7 (dBm)	-56.0 (dBm)
4th Harmonic	Note1	Note1	Note1
5th Harmonic	-76.3 (dBm)	Note1	Note1
6th Harmonic	-68.8 (dBm)	-65.8 (dBm)	-67.9 (dBm)
7th Harmonic	-76.3 (dBm)	-71.4 (dBm)	-68.5 (dBm)
8th Harmonic	-62.0 (dBm)	-61.6 (dBm)	-61.7 (dBm)
9th Harmonic	-75.1 (dBm)	-71.3 (dBm)	-71.4 (dBm)
10th Harmonic	-57.5 (dBm)	-61.4 (dBm)	-63.2 (dBm)

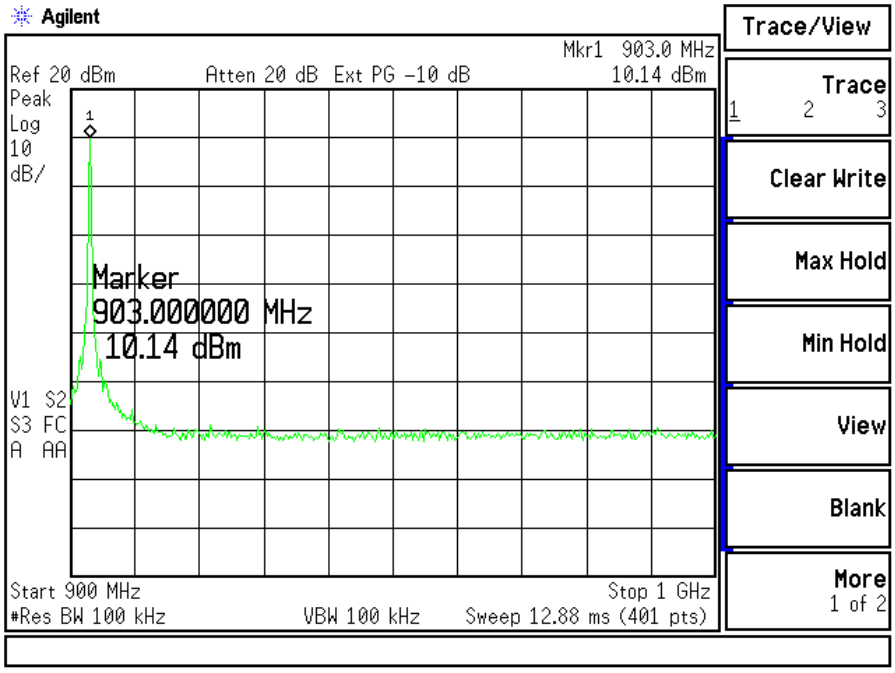
Notes:
(1) Measurement at system noise floor.

11.4 Screen Captures – Spurious Emissions

Channel Low, shown from 30 MHz up to 900 MHz



Channel Low, shown from 900 MHz up to 1000 MHz



Channel High, shown from 1000 MHz up to 10000 MHz

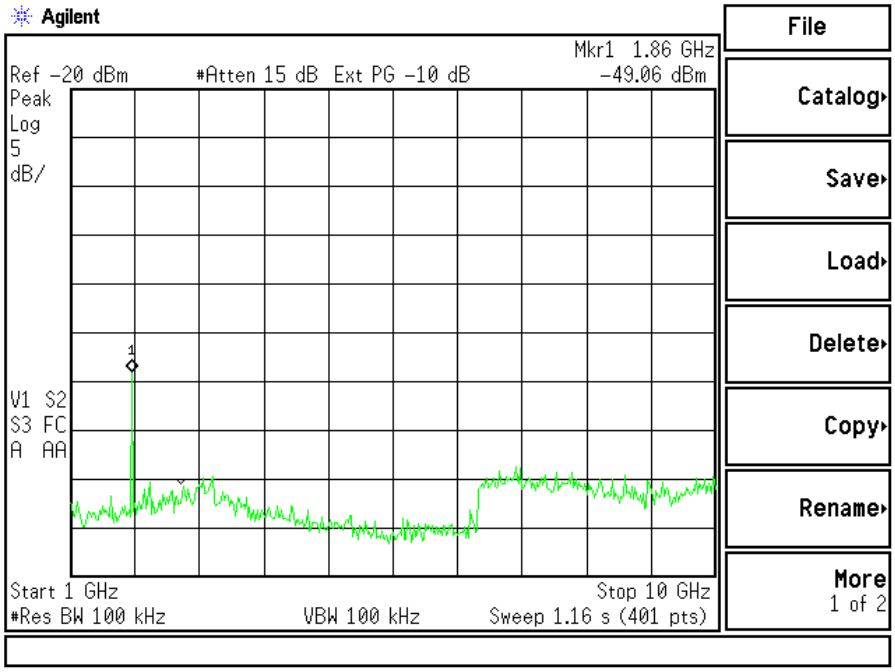


EXHIBIT 12. CHANNEL PLAN AND SEPARATION

An HP E4407B spectrum analyzer was used with a resolution bandwidth of 30 kHz to measure the channel separation of the EUT.

The minimum and maximum channel-separations measured for this device are 359 kHz and 419 kHz respectively. The maximum occupied bandwidth of the device, as reported in the previous section is 85.5 kHz. The following plots describe this spacing, and also establish the channel separation and plan.

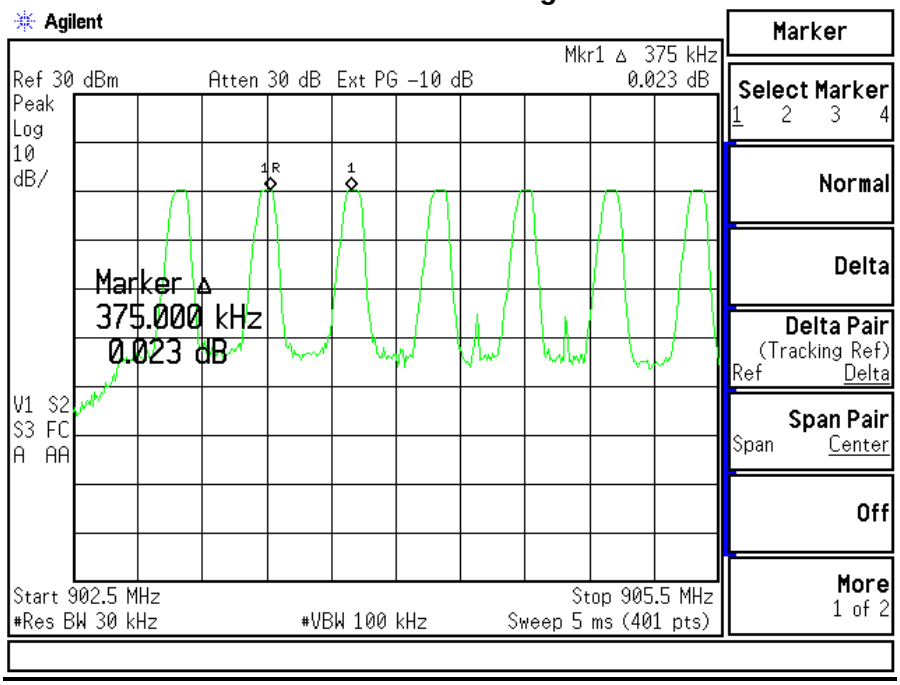
12.1 Test Data

Frequency Span (MHz)	Number of Channels	Minimum Separation (kHz)
902.5 to 905.5	7	375
905.5 to 908.5	7	359
908.5 to 911.5	4	360
911.5 to 914.5	7	375
914.5 to 917.5	6	419
917.5 to 920.5	8	375
920.5 to 923.5	4	375
923.5 to 926.5	7	382
926.5 to 928.5	0	NA
	Total channels=50	

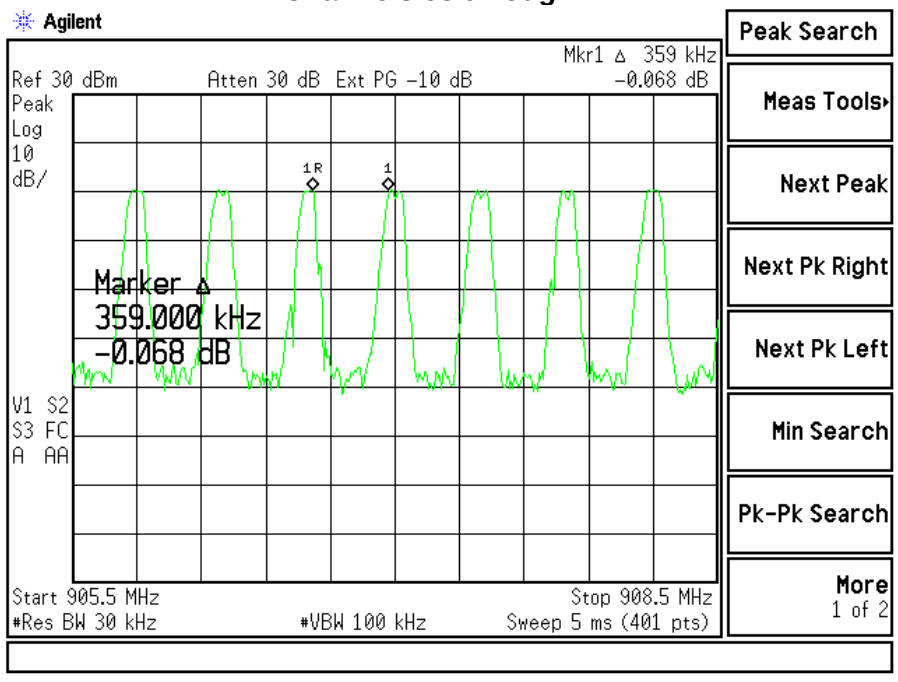
The system **MEETS** the minimum requirement of utilizing **50** channels, as well as maintaining a minimum channel separation of **359kHz**, which is greater than the -20 dBc OCCBW of **85.5kHz**.

12.2 Screen Captures – Channel Separation

Channels 01 through 07

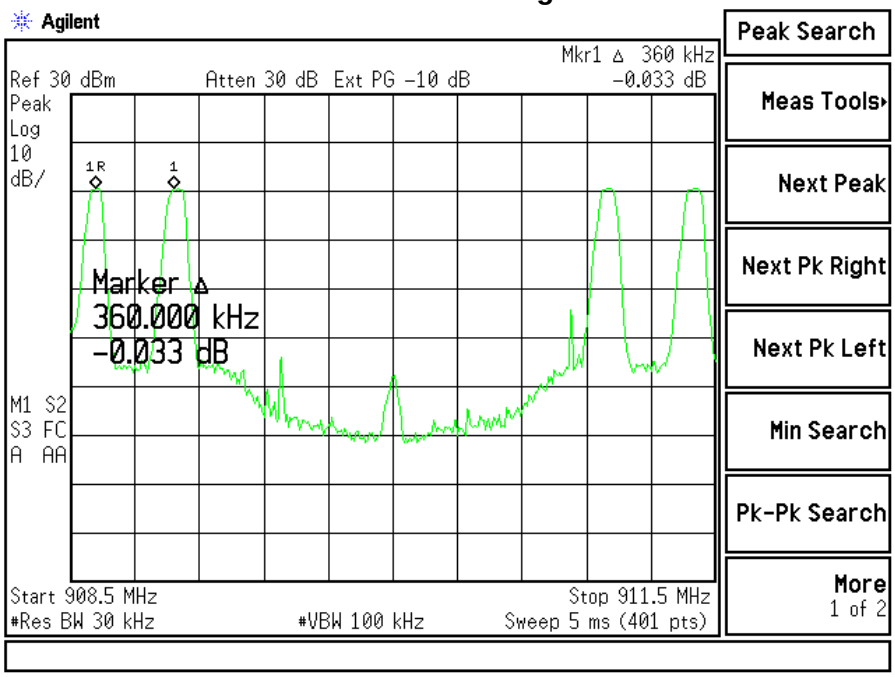


Channels 08 through 14

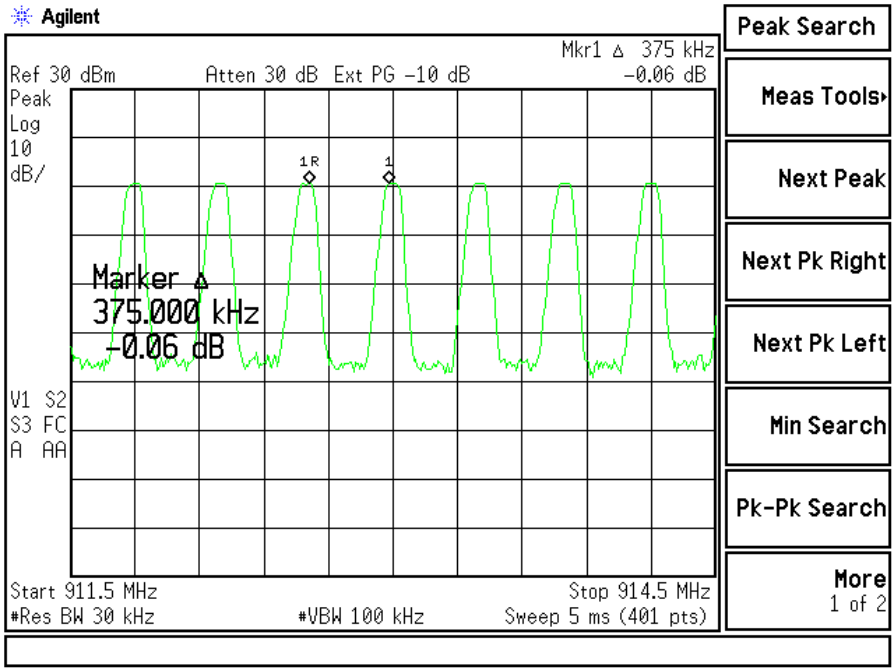


Screen Captures – Channel Separation *(continued)*

Channels 15 through 18

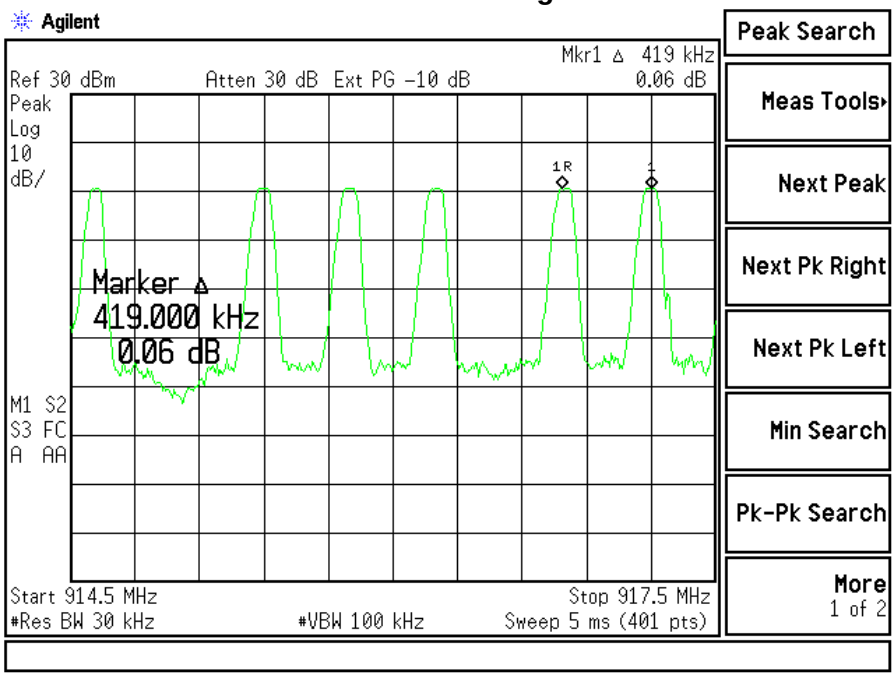


Channels 19 through 25

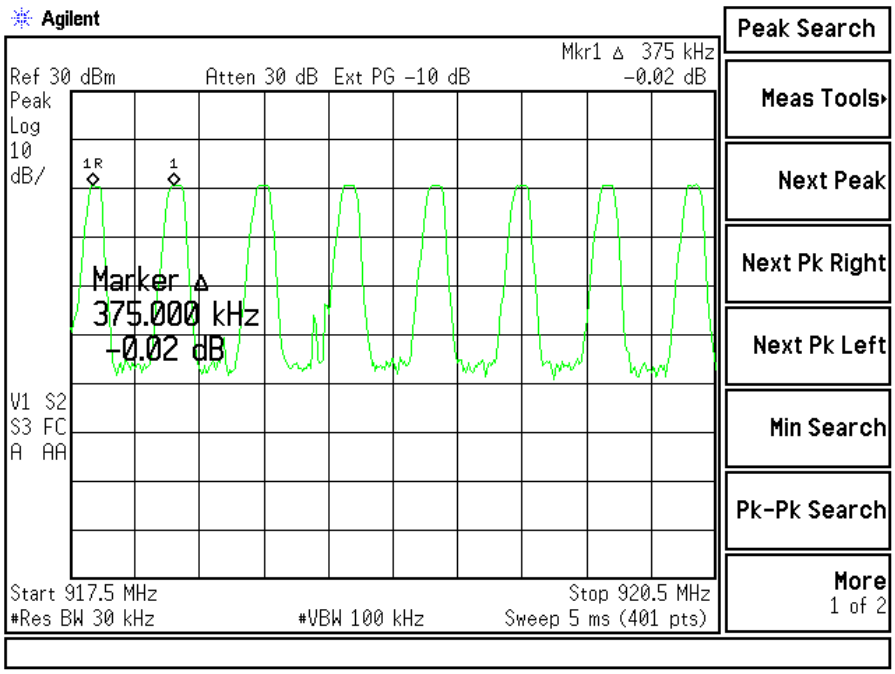


Screen Captures – Channel Separation *(continued)*

Channels 26 through 31

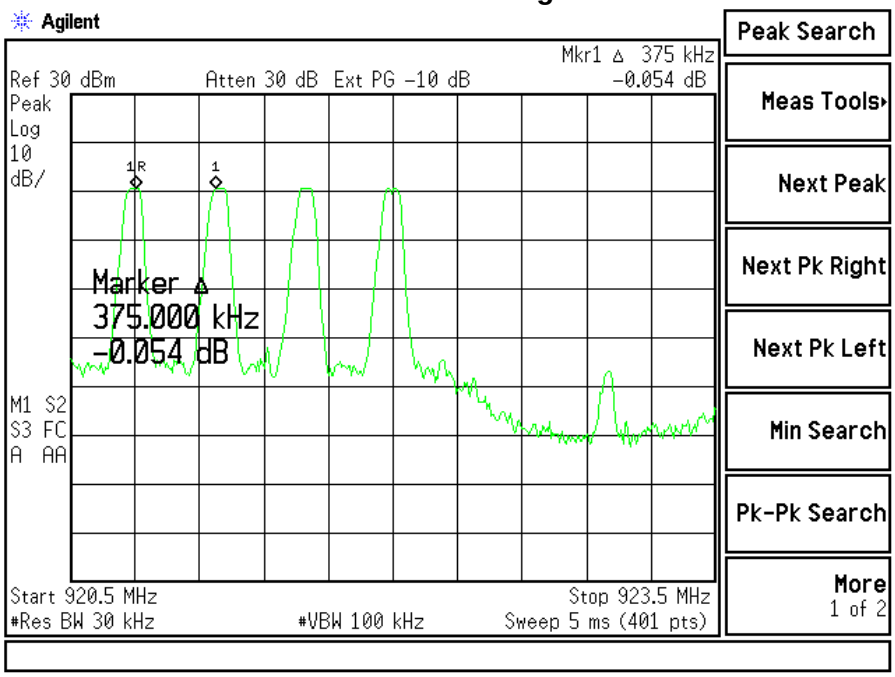


Channels 32 through 39

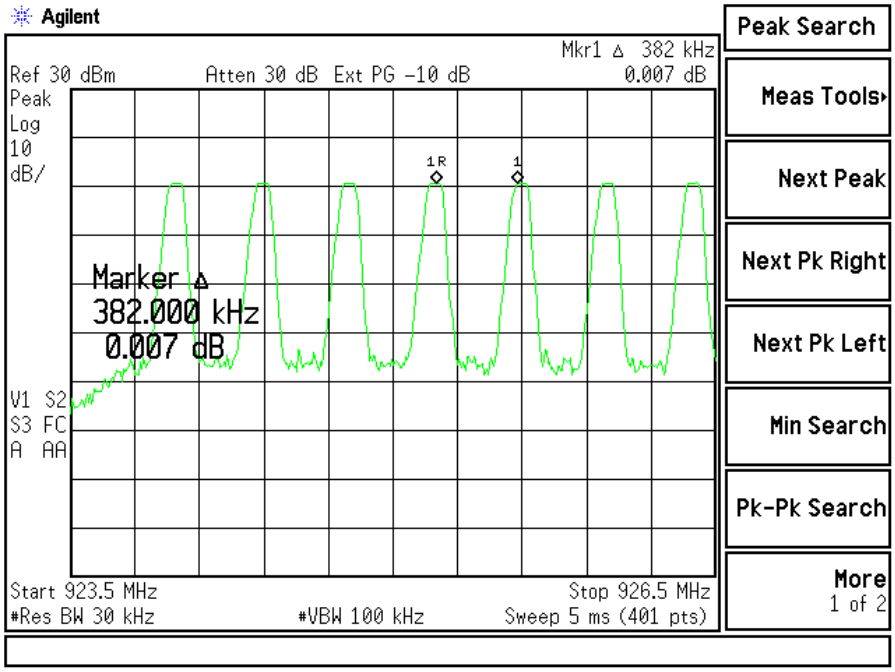


Screen Captures – Channel Separation *(continued)*

Channels 40 through 43



Channels 44 through 50



Screen Captures – Channel Separation *(continued)*

Scan of 926.5MHz to 928.5MHz

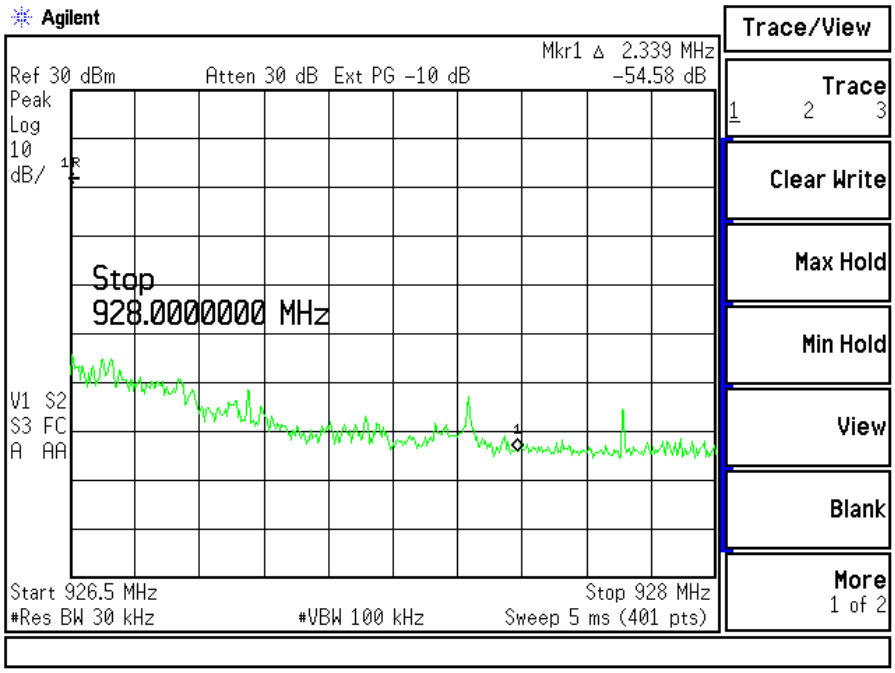


EXHIBIT 13. EQUAL CHANNEL USAGE

Due to the nature of the transmission, testing to the standard was not possible. Below is an excerpt from the manufacturer's declaration which is in Appendix C

Table 2 (typical hop sequence)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Transmission #
6	31	33	8	48	23	26	1	17	42	38	13	19	44	35	10	Channel used
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Transmission #
9	34	37	12	0	25	3	28	16	41	24	49	18	43	45	20	Channel used
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	Transmission #
21	46	30	5	7	32	47	22	29	4	40	15	14	39	27	2	Channel used
48	49	50														Transmission #
11	36	repeat														Channel used

This sample hop sequence shows equal usage of all channels

EXHIBIT 14. PSEUDORANDOM HOPPING PATTERN

Below is an excerpt from the manufacturer's declaration which is in Appendix C

Table 2 (typical hop sequence)																
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Transmission #
6	31	33	8	48	23	26	1	17	42	38	13	19	44	35	10	Channel used
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Transmission #
9	34	37	12	0	25	3	28	16	41	24	49	18	43	45	20	Channel used
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	Transmission #
21	46	30	5	7	32	47	22	29	4	40	15	14	39	27	2	Channel used
48	49	50														Transmission #
11	36	repeat														Channel used

This sample hop sequence shows usage of all channels and randomness of channel selections.

EXHIBIT 15. MPE CALCULATIONS

A. Horizontal EUT antenna.

The following MPE calculations are based on an inverted-L printed circuit board trace antenna, with a measured ERP of 113.2 dBµV/m, at 3 meters, and conducted RF power of +10.4 dBm as presented to the antenna. The calculated gain (measured over conducting ground plane) of this antenna, based on the ERP measurements is 7.6 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S \angle \frac{PG}{4\angle R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	10.40	(dBm)
Maximum peak output power at antenna input terminal:	10.965	(mW)
Antenna gain(typical):	7.6	(dBi)
Maximum antenna gain:	5.754	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	900	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.6	(mW/cm^2)

Power density at prediction frequency:	0.012552	(mW/cm^2)
Maximum allowable antenna gain:	24.4	(dBi)
Margin of Compliance at 20 cm =	16.8	dB

B. Vertical EUT antenna.

The following MPE calculations are based on an inverted-L printed circuit board trace antenna, with a measured ERP of 110.4 dBµV/m, at 3 meters, and conducted RF power of +10.2 dBm as presented to the antenna. The calculated gain of this antenna, based on the ERP measurements is 5.0 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	10.20	(dBm)
Maximum peak output power at antenna input terminal:	10.471	(mW)
Antenna gain(typical):	5	(dBi)
Maximum antenna gain:	3.162	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	900	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.6	(mW/cm^2)
Power density at prediction frequency:	0.006588	(mW/cm^2)
Maximum allowable antenna gain:	24.6	(dBi)
Margin of Compliance at 20 cm =	19.6	dB

APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	12/6/07	12/6/08
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/19/07	9/19/08
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/19/07	9/19/08
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/04/07	12/04/08
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	1/11/07	1/11/08
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/20/07	9/20/08
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/20/07	9/20/08
EE960073	Agilent	E4446A	US45300564	Spectrum Analyzer	8/17/07	8/17/08
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	Note 1	Note 1
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	Note 1	Note 1

Note 1 - Equipment calibrated within a traceable system.

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Uncertainty Statement

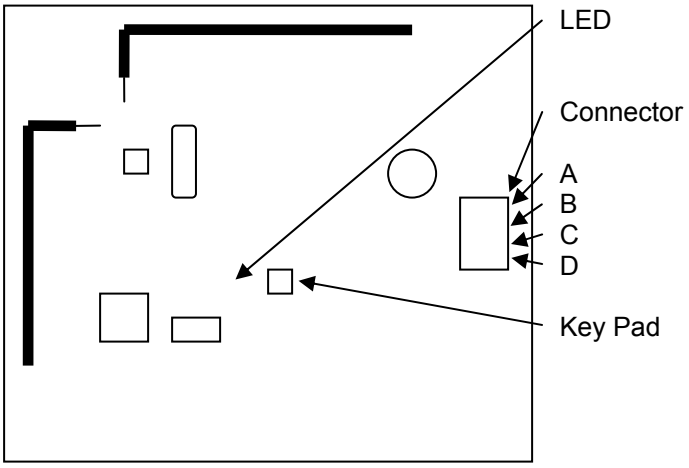
This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

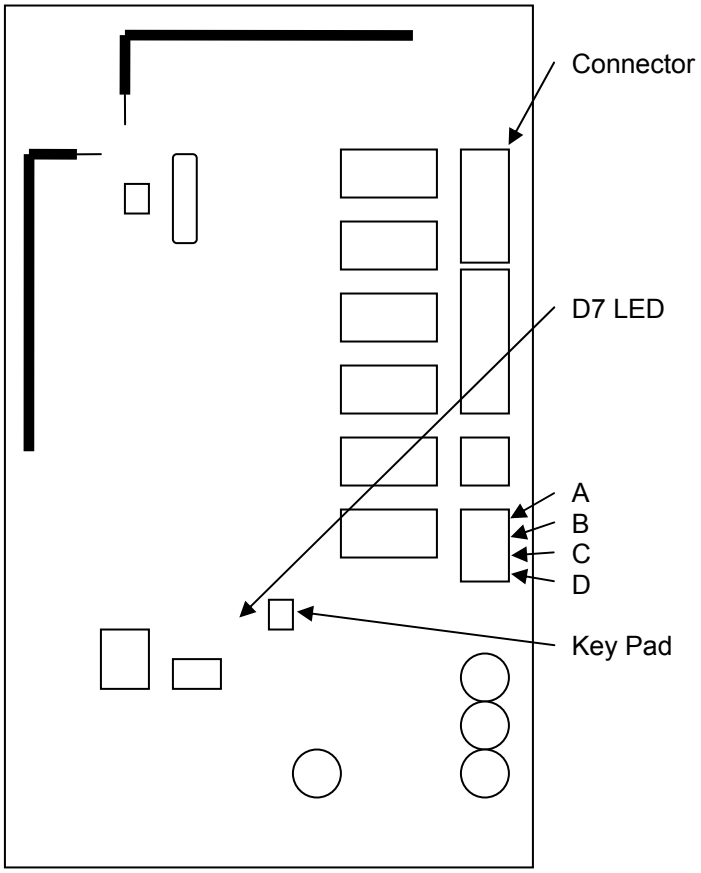
Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V

Appendix B

Firmware and Setup Instructions



THM4000R1000



THM5320R1000

Note: For RF operation with an RFI module, the RFI and EIM must be connected A to A, B to B, C to C and D to D. Key pad on the RFI board is non-functional.

Functional Description:
Initially, at power-up, the EIM is in the receive mode at a frequency of 902.999726 MHz. Pressing the EIM key pad once will cycle through each of the frequencies shown in Table 1.

LED D1	LED D2	Frequency
OFF	ON	902.999726
ON	OFF	914.596894
ON	ON	926.394013

Table 1

Transmit:
Press and hold EIM key pad during at power-up. Initially the EIM is at a frequency of 902.999726 MHz. Pressing the EIM key pad once will cycle through each of the frequencies shown in Table 1.