L.S. Compliance, Inc.

W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400 Fax: 262-375-4248

COMPLIANCE TESTING OF:

FreeStar Module

Prepared For:

Trane, a Division of American Standard
Attn.: John Van Vleet
3600 Pammel Creek Road
LaCrosse, WI 54601

Test Report Number:

305160-Tx-v2

Test Dates:

June 7TH through July 14TH, 2005

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1. L. S. Compliance In Review

L.S. Compliance - Accreditations and Listing's

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025 : 1999
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 89/336/EEC, Article 10.2.
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 29th day of April 2005.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2007

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. A2LA Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2007 Certificate Number: 1255.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test	Test Method(s)
Emissions	
Conducted	
Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4; EN: 55011, 55022, CISPR: 11, 12, 14-1 (excluding clicks), 22;
Radiated	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4 (3 meter chamber only); EN: 55011, 55022, CISPR: 11, 12, 14-1, 22;
Current Harmonics	IEC 61000-3-2; EN 61000-3-2
Voltage Fluctuations & Flicker	IEC 61000-3-3; EN 61000-3-3
Generic and Specific	EN 61000-6-3, EN 61000-6-4
Immunity	
Generic and Specific	EN 61000-6-1 EN 61000-6-2 CISPR: 14-2, 24
Conducted Immunity	
Fast Transients/Burst	IEC 61000-4-4; EN 61000-4-4
Surge	IEC: 61000-4-5; ENV 50142; EN 61000-4-5
RF Fields	IEC: 61000-4-6; ENV 50141; EN 61000-4-6

(A2LA Cert. No. 1255.01) 04/29/05 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

Test	Test Method(s)
Voltage Dips/Interruptions	IEC 61000-4-11; EN 61000-4-11
Radiated Immunity	
RF Fields	IEC: 61000-4-3; EN: 61000-4-3
RF Fields (50 Hz)	IEC 61000-4-8; EN 61000-4-8
RF Fields (Pulse Mode)	ENV 50204
Electrostatic Discharge (ESD)	IEC: 61000-4-2; EN 60801-2; EN: 61000-4-2

4. Validation Letter – U.S. Competent Body for EMC Directive 89/336/EEC

NIST CENTENNIAL 1901-2001

UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
Gaithersburg, Maryland 20899-

January 16, 2001

Mr. James J. Blaha
L.S. Compliance Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012-2636

Dear Mr. Blaha:

I am pleased to inform you that the European Commission has validated your organization's nomination as a U.S. Conformity Assessment Body (CAB) for the following checked (✓) sectoral annex(es) of the U.S.-EU Mutual Recognition Agreement (MRA).

(✓) Electromagnetic Compatibility-Council Directive 89/336/EEC, Article 10(2)
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex III and IV
Identification Number:
( ) Telecommunication Equipment-Council Directive 98/13/EC, Annex V
Identification Number:

This validation is only for the location noted in the address block, unless otherwise indicated below.

(✓) Only the facility noted in the address block above has been approved.
( ) Additional EMC facilities:
( ) Additional R&TTE facilities:

Please note that an organization's validations for various sectors of the MRA are listed on our web site at http://ts.nist.gov/mra. You may now participate in the conformity assessment activities for the operational period of the MRA as described in the relevant sectoral annex or annexes of the U.S.-EU MRA document.

NIST will continue to work with you throughout the operational period. All CABs validated for the operational phase of the Agreement must sign and return the enclosed CAB declaration form, which states that each CAB is responsible for notifying NIST of any relevant changes such as accreditation status, liability insurance, and key staff involved with projects under the MRA. Please be sure that you fully understand the terms under which you are obligated to operate as a condition of designation as a CAB. As a designating authority, NIST is responsible for monitoring CAB performance to ensure continued competence under the terms of the MRA.

NIST

5. Signature Page

Prepared By: July 21, 2005

Teresa A. White, Document Coordinator Date

Tested By: July 21, 2005

Abtin Spantman, EMC Engineer Date

Approved By: July 21, 2005

Kenneth L. Boston, EMC Lab Manager Date
PE #31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

6. Product and General Information

Manufacturer:	Trane, a Division of American Standard					
Date(s) of Test:	June 7th through July 14th, 2005					
Test Engineer(s):		Tom Smith	√	Abtin Spantman		Ken Boston
Model #:	X13651127					
Serial #:	Various engineering samples.					
Voltage:	3.3 VDC					
Operation Mode:	Normal operation and continuous transmit with modulation					

7. Introduction

Between June 7TH and June 30TH, 2005, a series of Conducted and Radiated RF Emission tests were performed on various samples of the X13651127, here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 (Industry Canada RSS-210) for a low power transmitter. These tests were performed by Abtin Spantman, EMC Engineer at L.S. Compliance, Incorporated.

All Radiated and Conducted RF Emission tests were performed upon the EUT to measure the emissions in the frequency bands described in Title 47 CFR, FCC Part 15, including 15.35, 15.205, 15.247 and Industry Canada RSS-210 to determine whether these emissions are below the limits expressed within the standards. These tests were performed in accordance with the procedures described in the 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 (ANSI C63.4-2003). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2003.

All tests were performed at L.S. Compliance, Inc., in Cedarburg, Wisconsin, unless otherwise noted.

8. Product Description

The X13651127 module is a direct sequence spread spectrum transceiver operating in the 2400 – 2483.5 MHz ISM band. This report covers the tests performed on the transmit portion of the transceiver.

The X13651127 module is based on the MC13192/3 RF transceiver from Freescale, operating within the IEEE 802.15.4 standard, with channels spaced at 5 MHz intervals in the ISM band. The module implements a proprietary communications protocol with the MC13192 and the Zigbee-compliant stack with the MC13193.

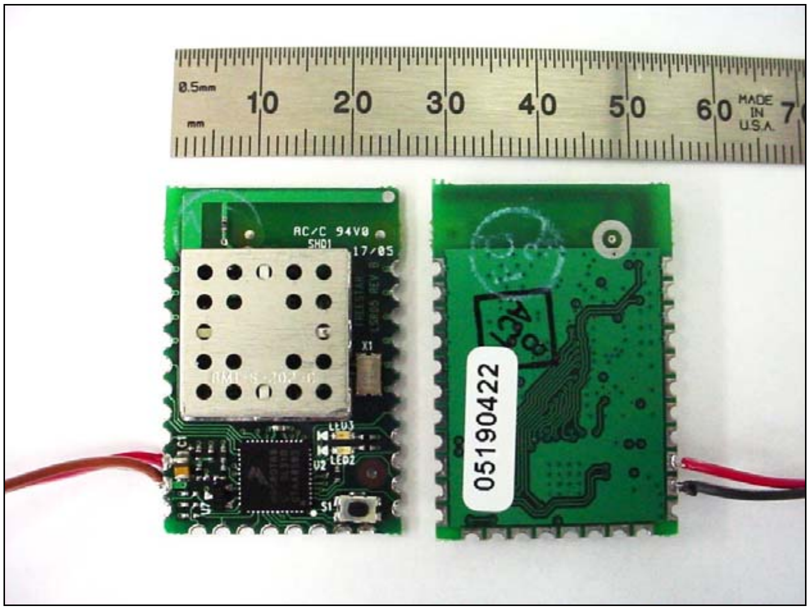
The system operates at a chip rate of 2 Mcps, a symbol rate of 62.5 ksps, and a bit rate of 250kbps. O-QPSK modulation is used with 16-ary orthogonal symbols. It transmits with a maximum power of 100 milliwatts (+20 dBm) into a printed circuit board inverted-F antenna with a measured nominal gain of 4.8 dBi.

The RF power level and channel are selectable within the operating mask provided by the manufacturer. Modulation characteristics are fixed by the transceiver. The samples provided to LS Compliance for testing were set at the maximum power level for the channel tested. The user will have the capability to reduce the power on each channel. They cannot go higher as the software has the ceiling set. The modules are specified to operate on an input of 2.4 to 3.6VDC.

The receiver is a low-IF receiver. The received RF signal is amplified by a low noise amplifier and down-converted to a 1st IF of 65MHz and then down-converted in quadrature (I and Q) to the intermediate frequency (IF) of 1 MHz. The digital back end performs Differential Chip Detection, the correlator de-spreads the Direct Sequence Spread Spectrum O-QPSK signal, determines the symbols and packets, and detects the data.

Each module has a Personal Area Network (PAN) ID used to establish a network of transceivers. Only devices with the same PAN ID can communicate with one another. 16 possible RF channels are available. The X13651127 module runs either a proprietary 'STAR' protocol or an externally provided Zigbee mesh network stack protocol. With the STAR protocol, the maximum transmission time in a 100 millisecond period is 58.3 milliseconds. This allows a duty cycle relaxation of 4.6 dB. This is the worst case duty cycle with either protocol provided.

The relaxation factor due to duty cycle is being requested because in the proprietary protocol, with the large packet size available when transmitted at the fastest rate possible results in the transmitter being on for only 58.3 msec out of 100 msec. All remaining applications will have a shorter transmit time. The timing is a function of the protocol that can run on the module and is fixed by the manufacturer.



9. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the X13651127 module with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.31	15.247a	15.247d
15.205	15.247b	15.247e
15.207	15.247c	

10. Summary of Test Report

DECLARATION OF CONFORMITY

The X13651127 module transmitter was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.247, and Industry Canada RSS-210, Section 6.2.2(o) for a Digital Spread Spectrum (DTS) Transmitter.

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.

11. Radiated Emissions Test

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 modulated mode for this portion of the testing, using 3.3 VDC power as provided by standard bench-type power supply connected with a one meter long cable. The unit has the capability to operate on 16 channels. Multiple samples of the EUT were provided, pre-programmed to the desired channels for testing purposes. A list of the EUT sample serial numbers, along with power and channel settings appears in the appendix.
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 four (4) standard channels:

Frequency	EUT Serial number	Transmit Power
Ch: 01, 2405 MHz	05190422	92.5 mW
Ch: 08, 2440 MHz	05190426	91.2 mW
Ch: 13, 2465 MHz	05190386	89.1 mW
Ch: 16, 2480 MHz	05190384	1.5 mW

The RF power output was reduced, as needed, at channels above 13, to comply with band-edge requirements.

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 25000 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. From 18 GHz to 25 GHz, the EUT was measured at a 0.3 meter separation, using a standard gain Horn Antenna and pre-amplifier.

The power source voltage was continuously monitored. The EUT was rotated along three orthogonal axis during the investigations to find the highest emission levels.

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 18 GHz, an HP E4407B Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the HP E4407B Spectrum Analyzer with a standard gain horn, and preamp were used.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 for a DTS transmitter [Canada RSS-210, Clause 6.2.2(o)]. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in 47 CFR 15.247 (b)(3), is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100kHz 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 Class B limits for an unintentional radiator. 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	-
960-25,000	500	54.0	63.5

Sample calculations:

Sample conversion from a field strength measurement with units of μV/m to dBμV/m would be:

$$dB\mu V/m = 20Log_{10}\left(\frac{XX\mu V/m}{1\mu V/m}\right)$$

Limit in the frequency range of (30-88 MHz) is calculated to be:

$$40.0dB\mu V/m = 20Log_{10}\left(\frac{100\mu V/m}{1\mu V/m}\right)$$

~ ~

Sample conversion from a field conducted RF power measurement in mW to a radiated field strength measurement in dBμV/m would be:

$$dB\mu V/m @ 3m = 95.23 + 10Log_{10}\left(\frac{XXmW}{1mW}\right)$$

AT the fundamental frequency, the limit for the RF power output of 1W (1000mW) at the antenna port of a transmitter with an antenna gain of 0 dBi would be equivalent to an Equivalent Isotropic Radiated Power (e.i.r.p.) measurement of 125.23 dBμV/m at 3 meters.

$$125.23dB\mu V/m @ 3m = 95.23 + 10Log_{10}\left(\frac{1000mW}{1mW}\right)$$

~ ~

Sample conversion from a measurement distance of 3 meters to a distance of 1meter would be:

$$dB = -20Log_{10}\left(\frac{XXm}{3m}\right)$$

A sample limit, within the frequency range of 960-25,000 MHz for example, when measured at 1 meter instead of 3 meters would change according to the equation:

$$63.5dB\mu V/m = 54.0dB\mu V/m + \left(-20Log_{10}\left(\frac{1m}{3m}\right)\right)$$

Radiated Emissions Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(DTS)
Frequency Range Inspected: 30 MHz to 25000 MHz

Manufacturer:	Trane, a Division of American Standard					
Date(s) of Test:	June 7th through July 14th, 2005					
Test Engineer(s):		Tom Smith	√	Abtin Spantman		Ken Boston
Model #:	X13651127					
Serial #:	Various engineering samples.					
Voltage:	3.3 VDC					
Operation Mode:	Normal operation and continuous transmit with modulation					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery:	√	Other: Bench DC Power Supply		
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

Environmental Conditions in the Lab:
Temperature: 20 – 25°C
Relative Humidity: 30 – 60 %

Test Equipment Used:
EMI Measurement Instrument: HP8546A and Agilent E4407B
Log Periodic Antenna: EMCO #93146
Horn Antenna: EMCO #3115
Biconical Antenna: EMCO 93110
Pre-Amp: Advanced Microwave WHA6224
Standard Gain Horn: EMCO 3160-09

The following table depicts the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Antenna Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
					(Note 1)		

Notes:

1) *There were no significant spurious emissions observed to be within 20 dB of the limits.*

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 01:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2405	H	1.15	160	119.8	125.2	5.4
4810	H	1.10	345	50.3	54.0 (Note 5)	3.7
7215	V	1.10	150	59.6	109.3	49.7
9620	V	1.00	5	49.5	109.3	59.8
12025	H	1.00	65	41.6	63.5 (Note 5)	21.9
14430	H	1.00	0	44.9	109.3	64.4
16835	H	1.00	0	49.1	109.3	60.2
19240				(Note 3)	74.0 (Note 5)	
21645				(Note 3)	119.8	
24050				(Note 3)	119.8	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 08:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2440	H	1.15	170	117.8	125.2	7.4
4880	H	1.15	170	31.1	54.0 (Note 5)	22.9
7320	V	1.00	95	60.7	63.5 (Note 5)	2.8
9760	V	1.00	5	56.2	107.34	51.1
12200	V	1.00	345	53.0	63.5 (Note 5)	10.5
14640	V	1.00	0	49.8	107.34	57.5
17080	V	1.00	0	49.6	107.34	57.7
19520				(Note 3)	74.0 (Note 5)	
21960				(Note 3)	117.8	
24400				(Note 3)	117.8	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 13:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2465	H	1.00	225	118.1	125.2	7.1
4930	H	1.05	145	44.9	54.0 (Note 5)	9.1
7395	V	1.00	95	59.7	63.5 (Note 5)	3.8
9860	V	1.00	10	54.0	107.64	53.6
12325	V	1.00	260	50.2	63.5 (Note 5)	13.3
14790	V	1.00	0	49.2	107.64	58.4
17255	V	1.00	0	49.4	107.64	58.2
19720				(Note 3)	74.0 (Note 5)	
22185				(Note 3)	74.0 (Note 5)	
24650				(Note 3)	118.1	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 14:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2470	H	1.00	320	113.6	125.2	11.6
4940	H	1.00	320	37.4	54.0 (Note 5)	16.6
7410	V	1.15	0	47.1	63.5 (Note 5)	16.4
9880	V	1.00	0	40.6	103.1	62.5
12350	V	1.00	0	50.0	63.5 (Note 5)	13.5
14820	V	1.00	0	49.1	103.1	54.0
17290	V	1.00	0	49.6	103.1	53.5
19760				(Note 3)	74.0 (Note 5)	
22230				(Note 3)	74.0 (Note 5)	
24700				(Note 3)	113.6	

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 15:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2475	H	1.10	330	109.2	125.2	16.0
4950	H	1.10	330	38.1	54.0 (Note 5)	15.9
7425	V	1.00	185	42.2	63.5 (Note 5)	21.3
9900	V	1.00	5	44.0	98.7	54.7
12375	V	1.00	0	49.9	63.5 (Note 5)	13.6
14850	V	1.00	0	49.1	98.7	49.6
17325	V	1.00	0	49.4	98.7	49.3
19800				(Note 3)	74.0 (Note 5)	
22275				(Note 3)	74.0 (Note 5)	
24750				(Note 3)	109.2	

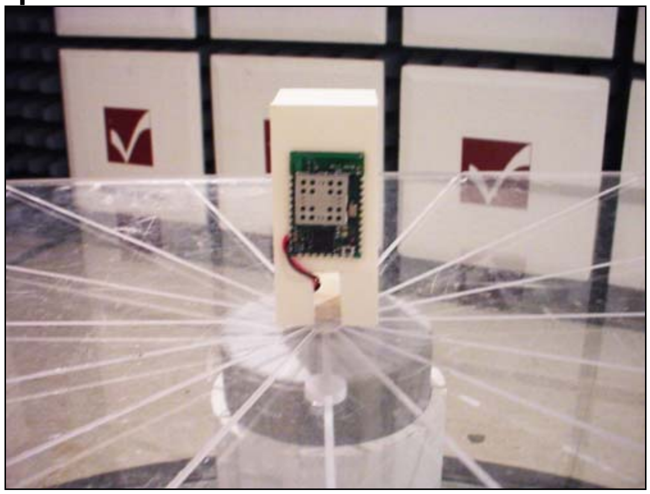
The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 16:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Measured ERP (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2480	H	1.10	325	99.8	125.2	25.4
4960	H	1.05	0	38.3	54.0 (Note 5)	15.7
7440	V	1.00	95	39.2	63.5 (Note 5)	24.3
9920	V	1.00	10	42.0	89.3	47.3
12400	V	1.00	0	51.0	63.5 (Note 5)	12.5
14880	V	1.00	0	49.0	89.3	40.3
17360	V	1.00	0	49.5	89.3	39.8
19840				(Note 3)	74.0 (Note 5)	
22320				(Note 3)	74.0 (Note 5)	
24800				(Note 3)	99.8	

Notes:

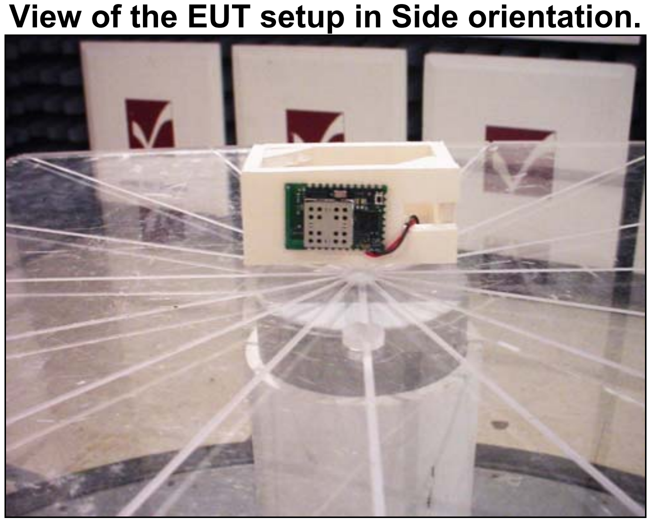
1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Only the results from the Average detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements above 5 GHz were made at 1 meters of separation from the EUT, and at 0.3 m separation for frequencies between 18 – 25 GHz.
3) Measurement at receiver system noise floor.
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=3 MHz.
5) Emission falls within a restricted band of operation as defined in 47CFR 15.205 and is subject to part 15.205 limits.

View of the EUT setup in vertical orientation.

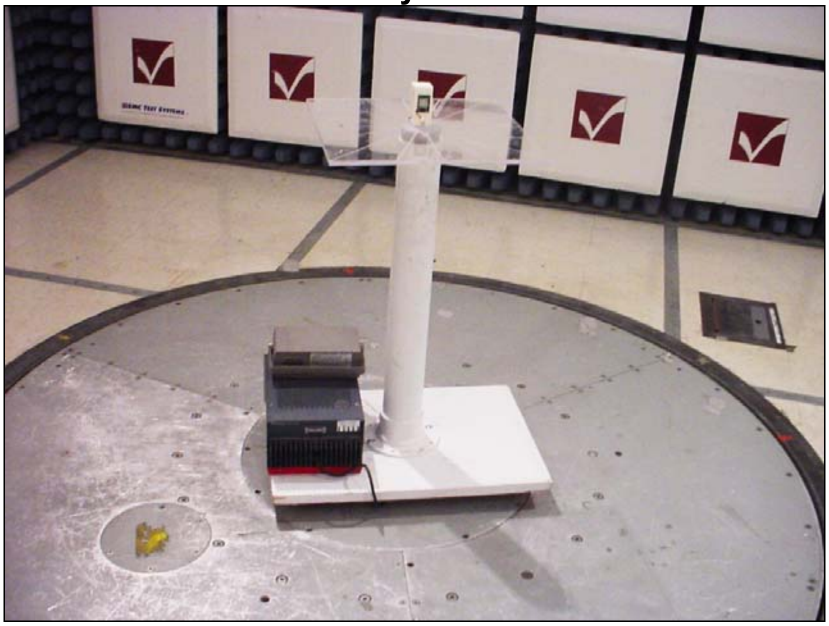


View of the EUT setup in Horizontal orientation.

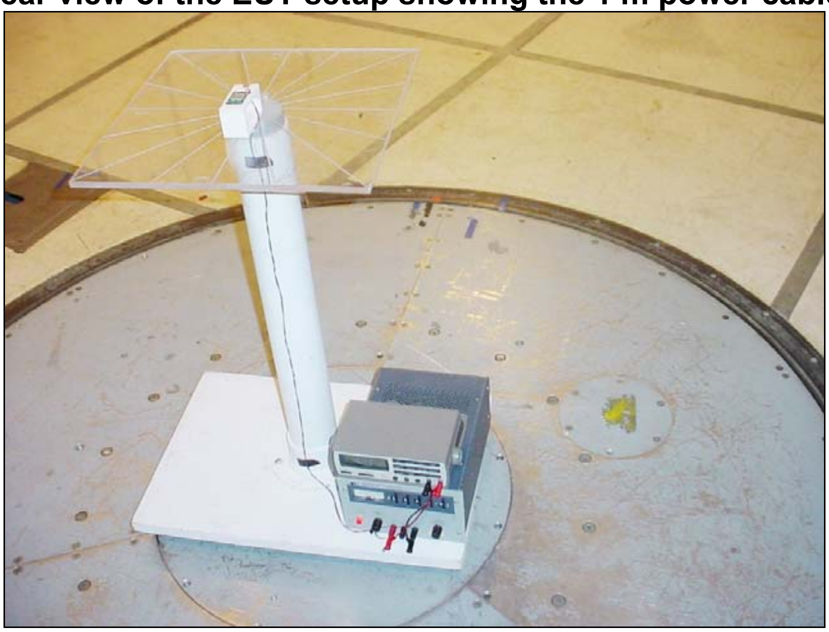
View of the EUT setup in Side orientation.



EUT setup in the test chamber
View as seen by sense antenna.



Rear view of the EUT setup showing the 1 m power cable.

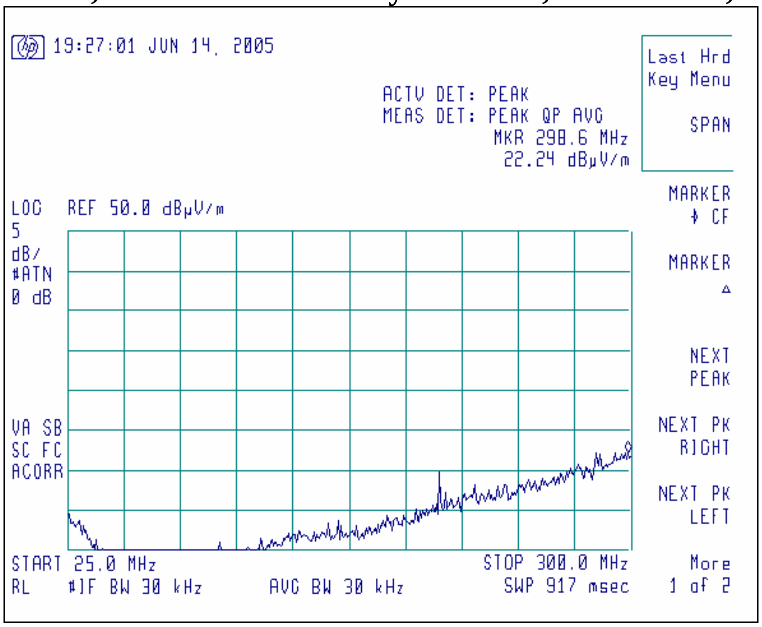


Screen Captures of Radiated RF Emissions:

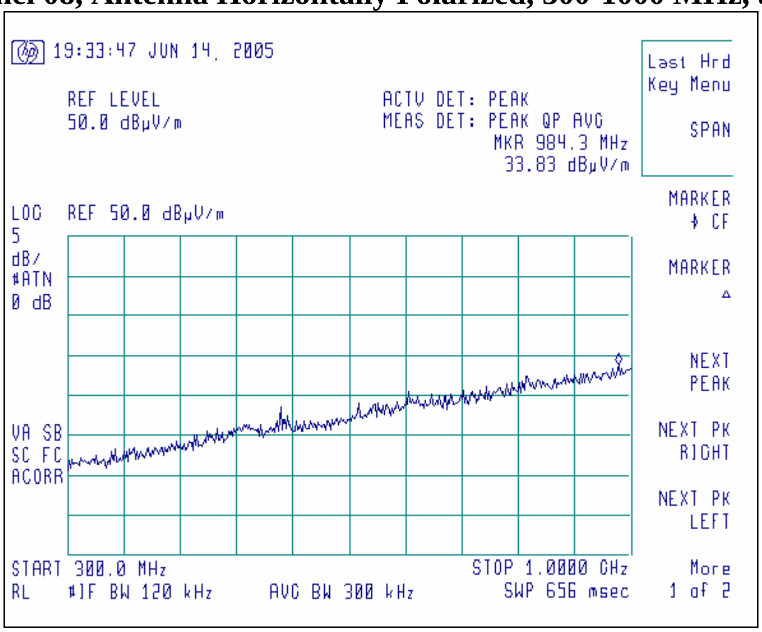
Please note these screen captures represent Peak Emissions. For radiated emission measurements, we utilize a Quasi-Peak detector function when measuring frequencies below 1 GHz, and an Average detector function when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 01, 08, 13 or 16, with the sense and EUT antennas both in vertical polarity for worst case presentations.

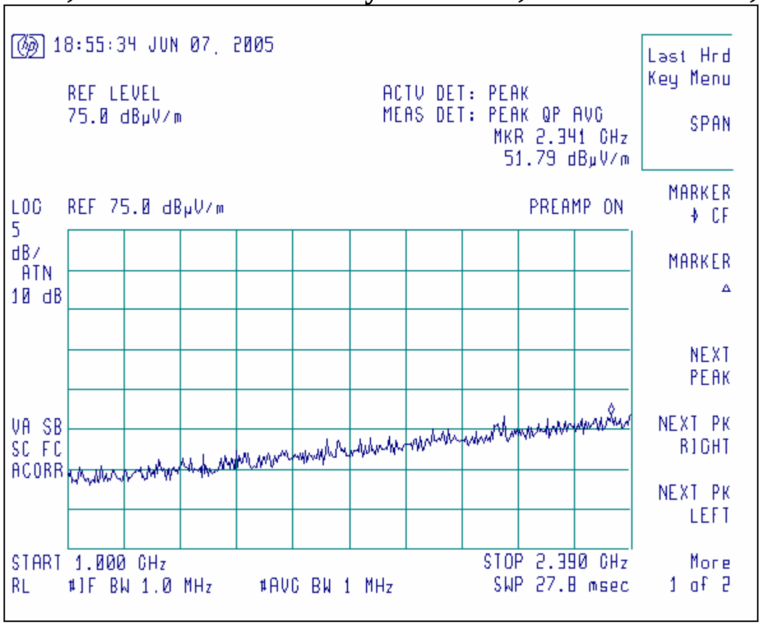
Channel 08, Antenna Horizontally Polarized, 25-300 MHz, at 3m.



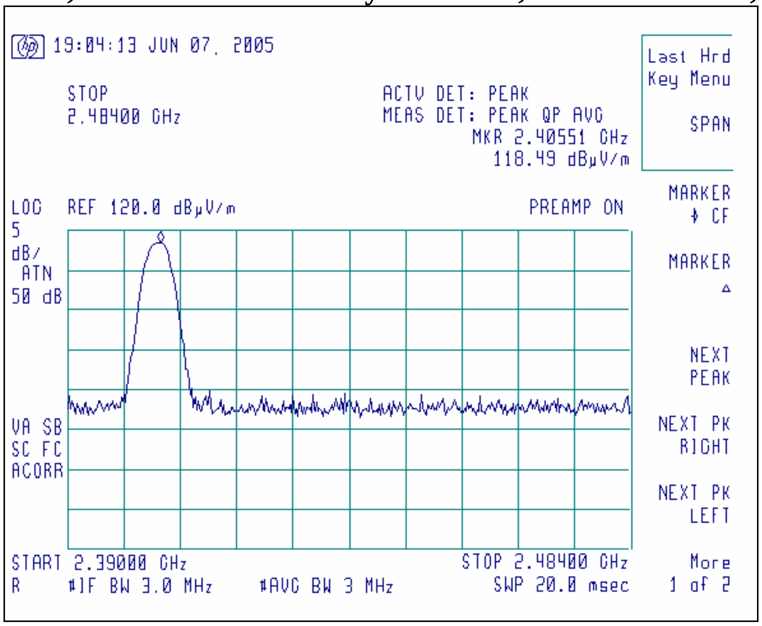
Channel 08, Antenna Horizontally Polarized, 300-1000 MHz, at 3m.



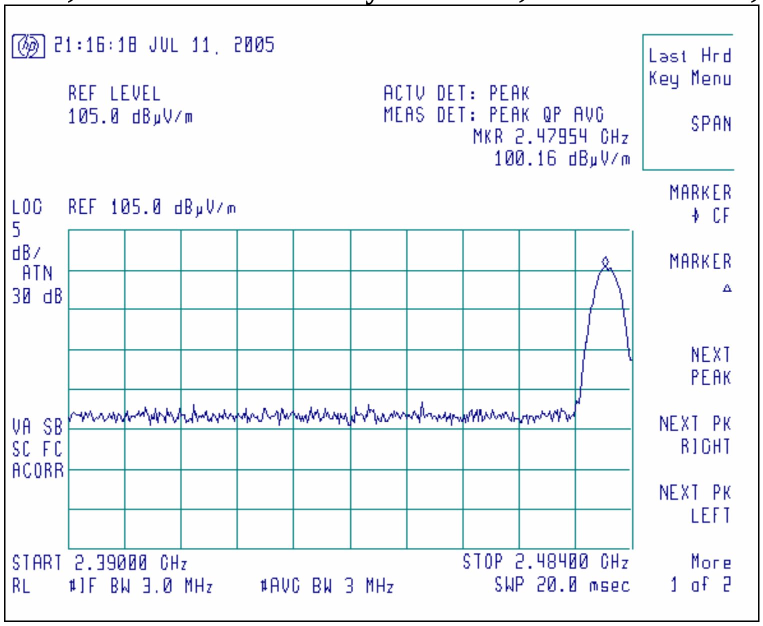
Channel 01, Antenna Horizontally Polarized, 1000-2390 MHz, at 3m.



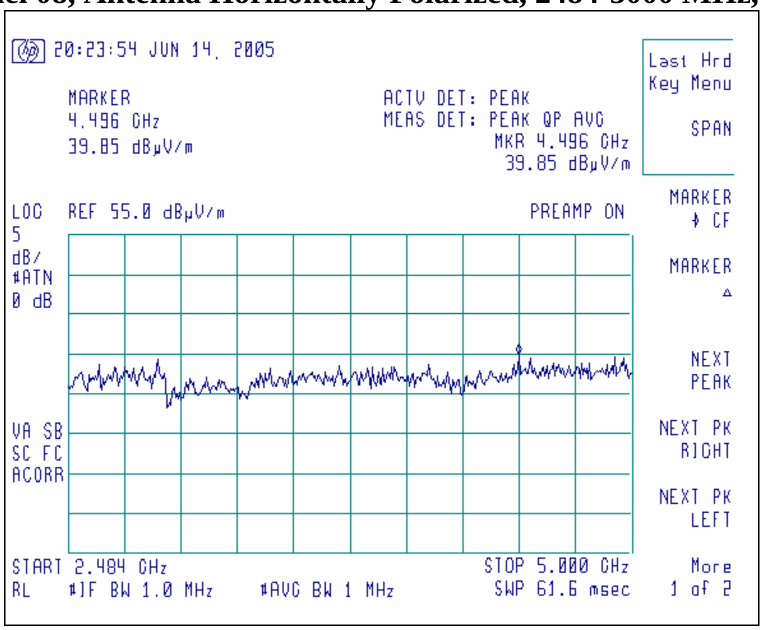
Channel 01, Antenna Horizontally Polarized, 2390-2484 MHz, at 3m.



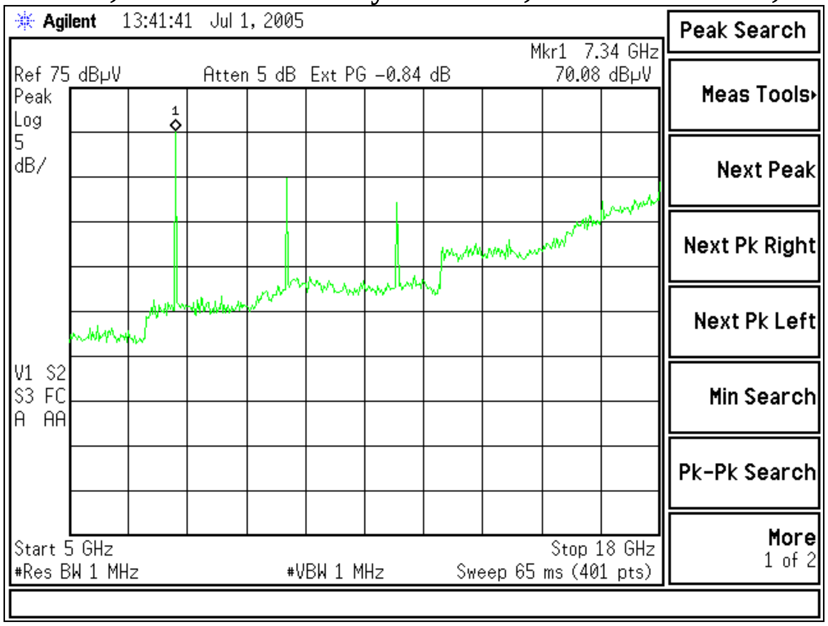
Channel 16, Antenna Horizontally Polarized, 2390-2484 MHz, at 3m.



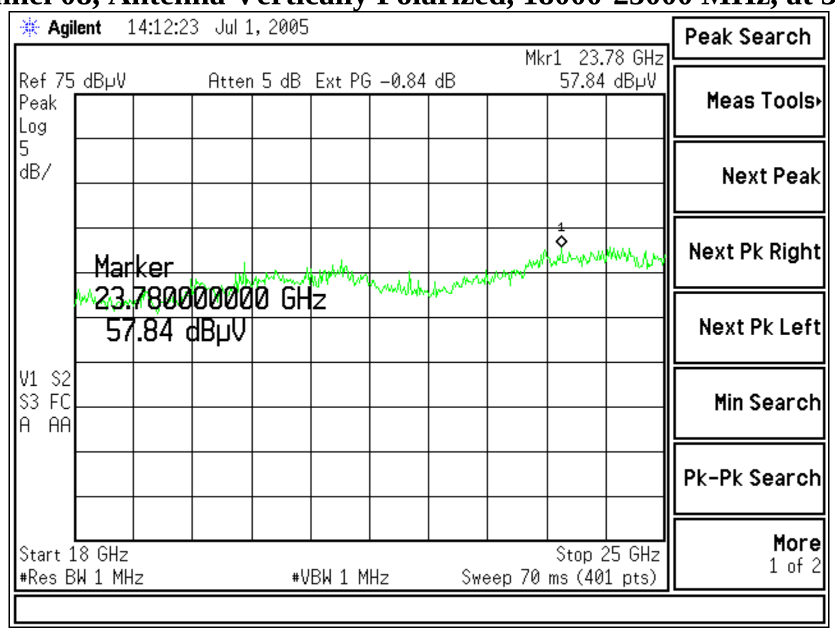
Channel 08, Antenna Horizontally Polarized, 2484-5000 MHz, at 3m.



Channel 08, Antenna Vertically Polarized, 5000-18000 MHz, at 1m.



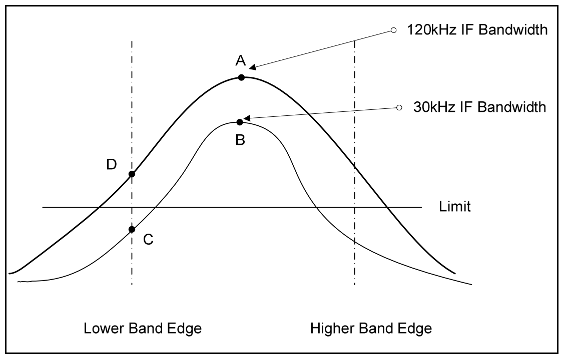
Channel 08, Antenna Vertically Polarized, 18000-25000 MHz, at 30cm.



12. Band-Edge Measurements

FCC 15.209(b) and 15.247(d) require 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 2400-2483.5 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 channels 13, 14, 15 and 16 for the investigation of the higher band-edge.

The emission amplitude of the modulated signal, at the lower band-edge, is measured using a marker delta method, to ensure that the modulated signal does not exceed the emission limits outside of the operational band. The EUT was placed in continuous transmit mode with internal typical data as the source of modulation. The emission was then measured at the lower operational band edge to ensure compliance. The following diagram and formula illustrates how the band edge measurements were taken.



Measurement A is taken using a 3 MHz IF Bandwidth at the Center Frequency.
Measurement B is taken using a 30kHz IF Bandwidth at the Center Frequency.
Measurement C is taken using a 30kHz IF Bandwidth at the lower Band Edge Frequency

To Calculate the Value for lower Band Edge Frequency at Point D:

$$A - B = \Delta$$

$$\Delta + C = D$$

The Lower Band-Edge limit, in this case, would be D = -20dBc.
The Upper Band-Edge limit, in this case, would be D = 54 dBµV/m at 3mteres.
The measurement and calculations at the lower band-edge is as follows:

At the Lower Band-edge (Channel 01):

$A - B = \Delta$; $119.9 dB\mu V/m - 111.9 dB\mu V/m = 8.0 dB$

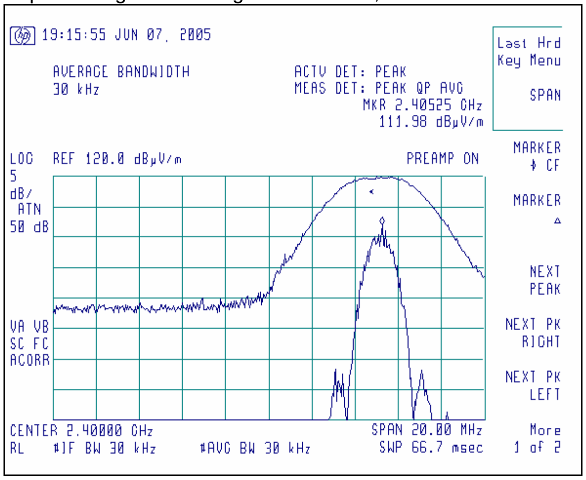
$\Delta + C = D$; $8.0 dB + 68.2 dB\mu V/m = 76.2 dB\mu V/m$ Showing compliance at Lower Band-Edge

At the upper band-edge, a simple measurement was made with RBW=VBW=1MHz, to ensure that the measured emission is below 54.0 dBµV/m at 3mteres. A relaxation factor of 4.6 dB is invoked for the band-edge tests per the declared operation in the 'Product Description' section of this report.

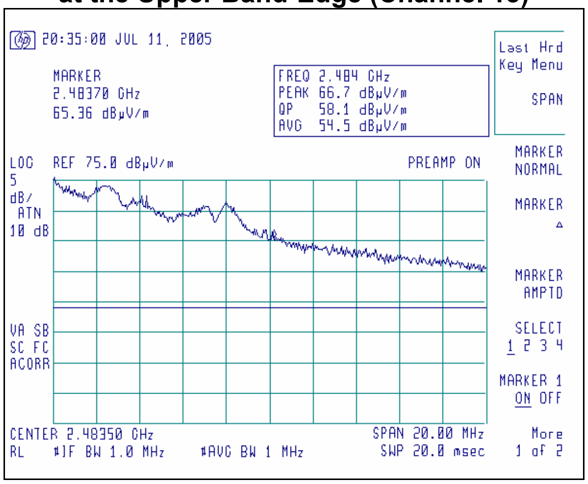
Channel	Measured emission level dBµV/m at 3mteres	Relaxation dB	Adjusted emission level dBµV/m at 3mteres
13	54.5	4.6	49.9
14	56.7	4.6	52.1
15	54.8	4.6	50.2
16	56.1	4.6	51.5

Screen Capture demonstrating compliance at the Lower Band-Edge (Channel 01)

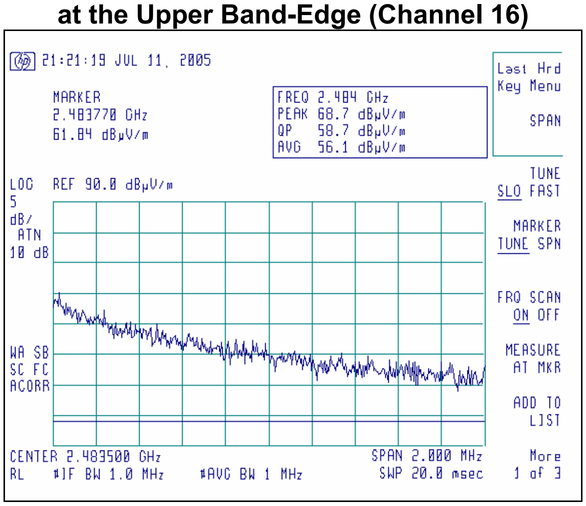
(Top trace shows spectral signature using RBW=3 MHz, while lower trace uses RBW=30 kHz)



Screen Capture demonstrating compliance, with the relaxation factor, at the Upper Band-Edge (Channel 13)



Screen Capture demonstrating compliance, with the relaxation factor, at the Upper Band-Edge (Channel 16)



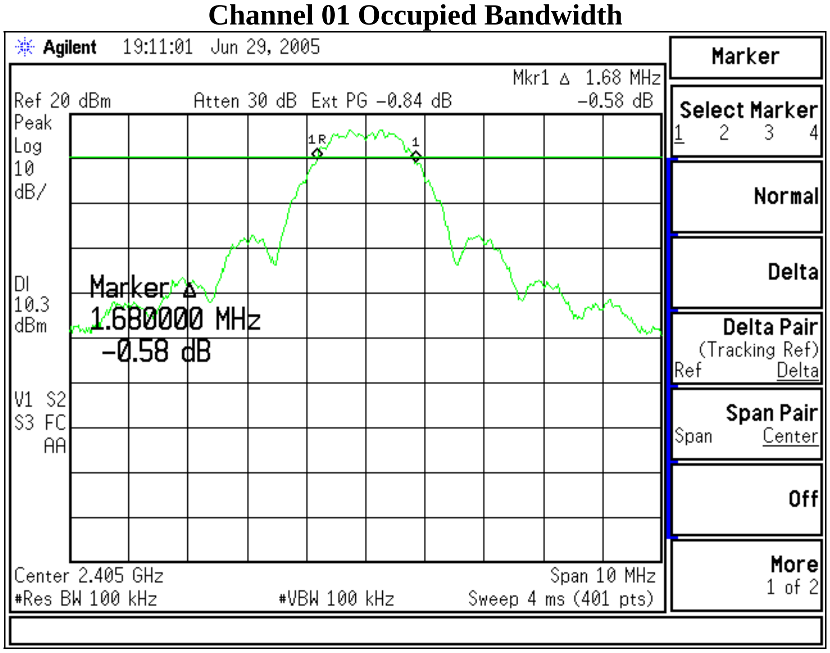
13. Occupied Bandwidth

The bandwidth requirement found in FCC Part 15.247(a)(2) requires a minimum -6dBc occupied bandwidth of 500 kHz. 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 E4407B spectrum analyzer. The loss from the cable was 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 E4407B spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

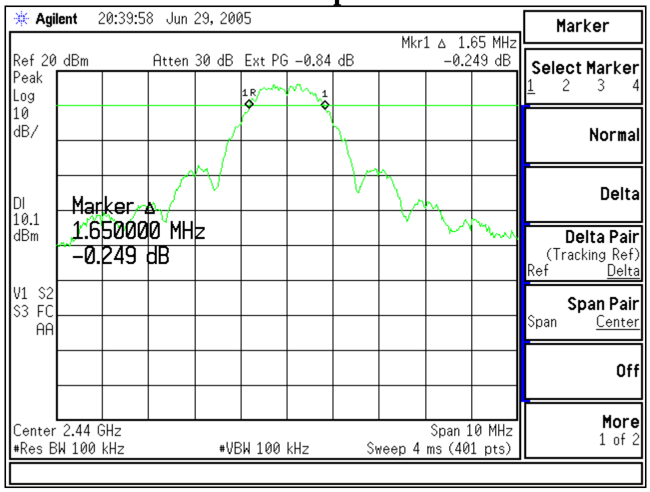
Channel	Center Frequency (MHz)	Measured 6 dB BW (kHz)	Minimum Limit (kHz)
01	2405	1680	500
08	2440	1650	500
13	2465	1650	500
16	2480	1650	500

Plots of Occupied Bandwidth

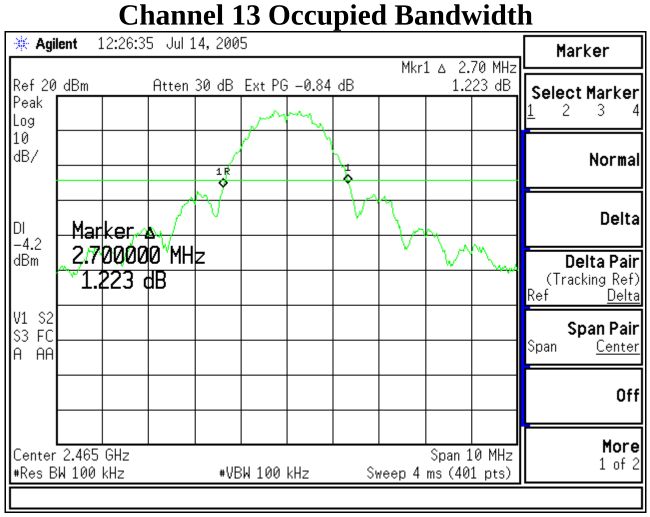
Channel 01 Occupied Bandwidth



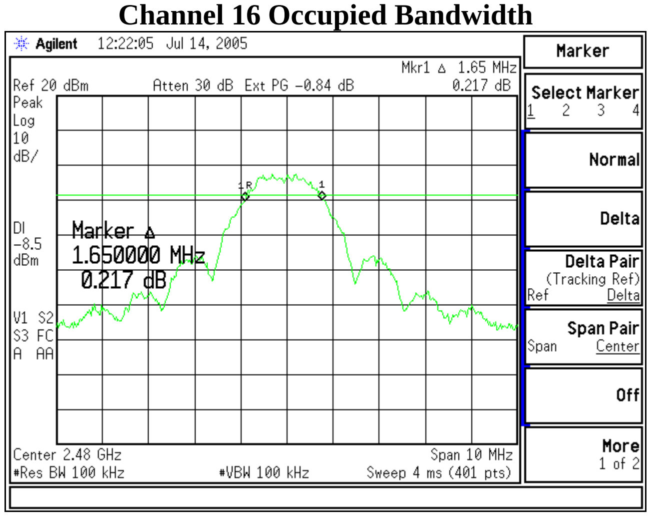
Channel 08 Occupied Bandwidth



Channel 13 Occupied Bandwidth



Channel 16 Occupied Bandwidth



14. Conducted RF Emissions Test on AC Power Line

Test Setup

The Conducted Emissions test was performed at L.S. Compliance, Inc. in Cedarburg, Wisconsin. The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15 (Industry Canada RSS-210). 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 was derived from a bench-type DC power supply, and the power supply was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120VAC, 60 Hz, was provided inside the Shielded Room via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. 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 phase.

Test Procedure

The EUT was investigated in continuous transmit mode, with modulation from typical data pattern, 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 30MHz. Final readings were then taken and recorded.

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 taken.

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.

Calculation of Conducted Emissions Limits

The following table describes the Class B limits for an intentional radiator. These limits are obtained from Title 47 CFR, Part 15.107 (a) for Conducted Emissions.

Frequency (MHz)	Quasi-Peak Limit (dBμV)	Average Limit (dBμV)
0.15 – 0.5	66 – 56 *	56 - 46
0.5 – 5.0	56	46
5.0 – 30.0	60	50

* Decreases with the logarithm of the frequency.

Sample calculation for the limits in the 0.15 to 0.5 MHz:

$$\text{Limit} = -19.12\ (\text{Log}_{10}\ (\text{F[MHz]} / 0.15\ \text{[MHz]})) + 66.0\ \text{dB}\mu\text{V}$$

For a frequency of 200 kHz for example:

$$\text{Quasi-Peak Limit (F = 200kHz)} = -19.12\ (\text{Log}_{10}\ (0.2\text{[MHz]} / 0.15\ \text{[MHz]})) + 66.0\ \text{dB}\mu\text{V}$$

Quasi-Peak Limit (F = 200kHz) = 63.6 dBμV

$$\text{Average Limit (F=200kHz)} = -19.12\ (\text{Log}_{10}(0.2\text{[MHz]}/0.15\text{[MHz]})) + 56.0\ \text{dB}\mu\text{V}$$

Average Limit (F = 200 kHz) = 53.6 dBμV

Measurement of Electromagnetic Conducted Emission

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 (a)

Manufacturer:	Trane, a Division of American Standard					
Date(s) of Test:	June 7th through July 14th, 2005					
Test Engineer:		Tom Smith	√	Abtin Spantman		Ken Boston
Model #:	X13651127					
Serial #:	Various engineering samples.					
Voltage:	3.3 VDC					
Operation Mode:	Normal operation and continuous transmit with modulation					
Test Location:	√	Shielded Room				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

Environmental Conditions in the Lab:
Temperature: 20 – 25° C
Atmospheric Pressure: 86 kPa – 106 kPa
Relative Humidity: 30 – 60%

Test Equipment Utilized:
EMI Receiver: HP 8546A
LISN: EMCO 3816/2NM
Transient Limiter: HP 119474A

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Reading (dBµV/m)	Q-Peak Limit (dBµ V/m)	Quasi-Peak Margin (dB)	Average Reading (dBµV/m)	Average Limit (dBµ V/m)	Average Margin (dB)
0.155	L1	49.4	65.7	16.3	22.0	55.7	33.7
0.320	L1	44.6	59.7	15.1	17.0	49.7	32.7
0.428	L1	40.0	57.3	17.3	12.9	47.3	34.4
0.460	L1	38.8	56.7	17.9	11.6	46.7	35.1
0.570	L1	35.8	56.0	20.2	7.1	46.0	38.9
0.155	L2	48.5	65.7	17.2	24.6	55.7	31.1
0.320	L2	44.5	59.7	15.2	15.8	49.7	33.9
0.428	L2	41.3	57.3	16.0	10.1	47.3	37.2
0.460	L2	38.2	56.7	18.5	10.8	46.7	35.9
0.570	L2	33.8	56.0	22.2	8.2	46.0	37.8

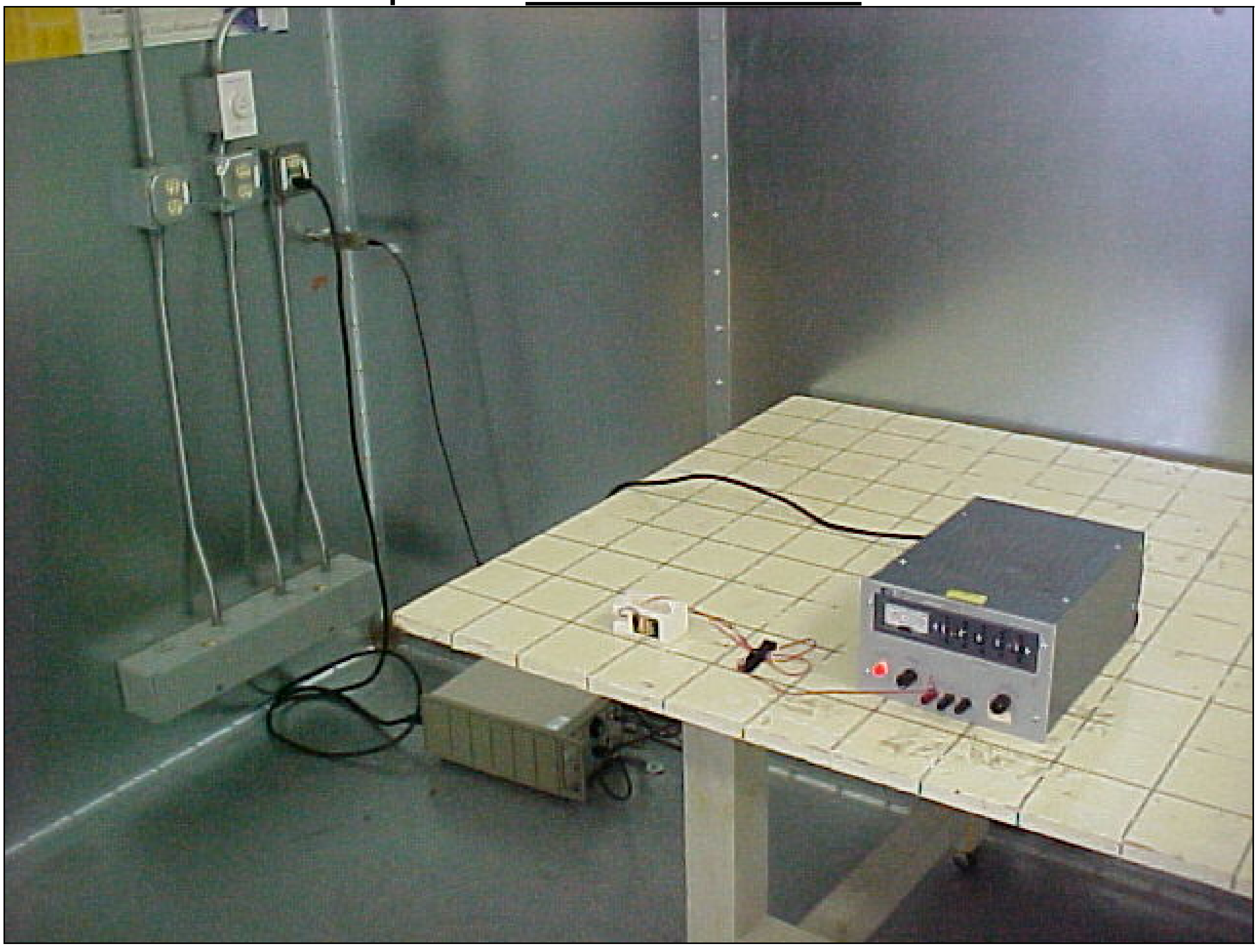
Notes:

1) The emissions listed are characteristic of the bench DC power supply used, and were not affected by the EUT.

2) All other emissions were better than 20 dB below the limits.

3) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

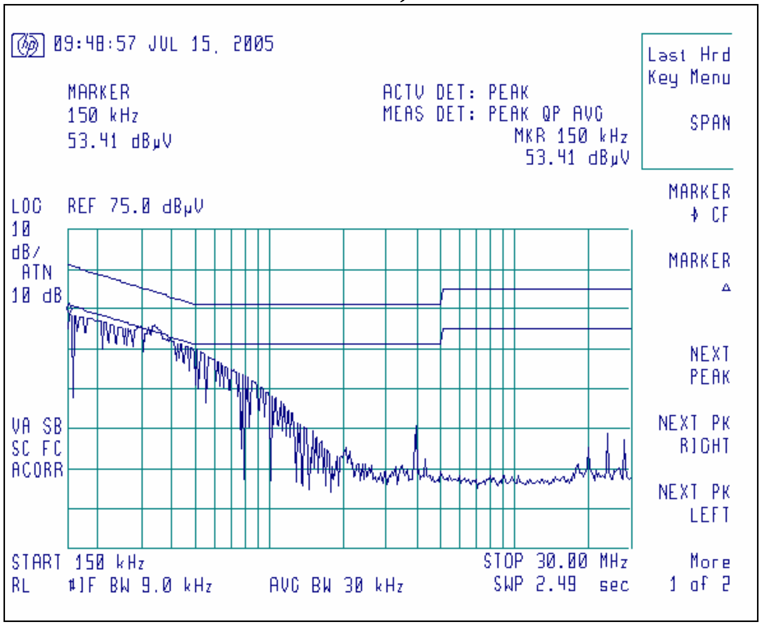
Setup for the Conducted Emissions Test



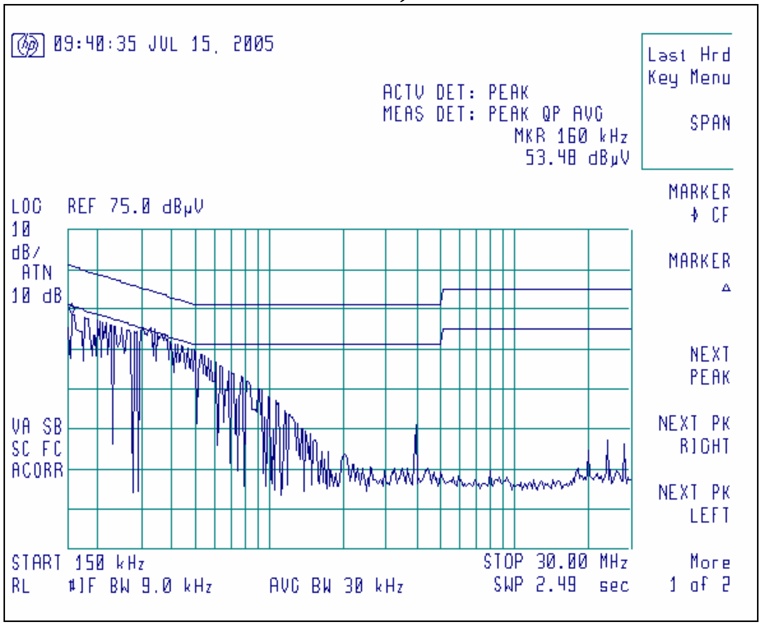
Screen Captures of Conducted AC Mains Emissions:

Please note these screen captures represent Peak Emissions. For conducted emission measurements, we utilize both a Quasi-Peak detector function as well as the Average detector function for measurements. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.209.
The signature scans shown here are from channel 08, chosen as being a good representative of channels.

Channel 08, Line 1



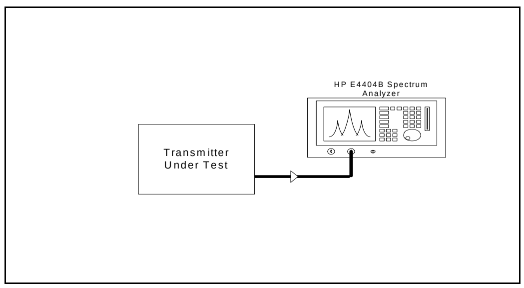
Channel 08, Line 2



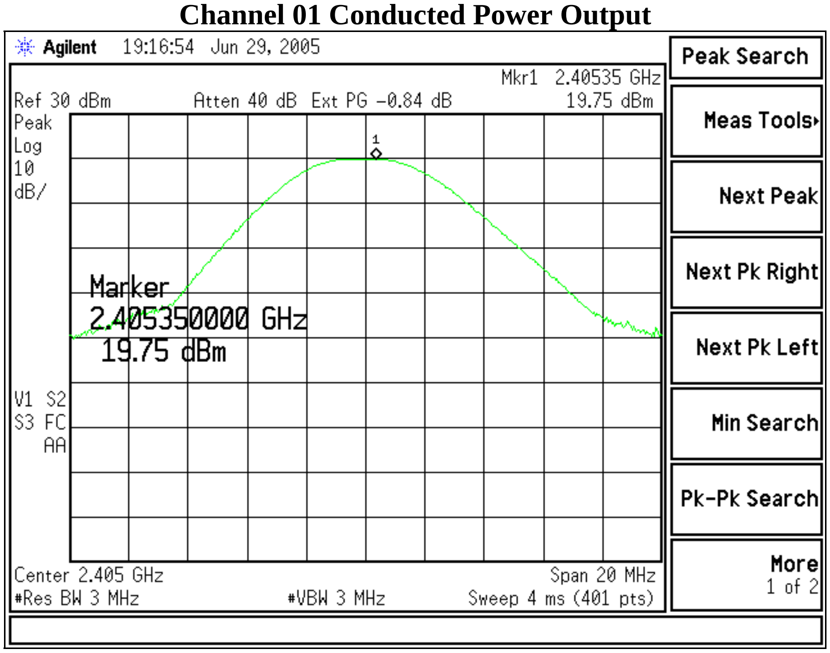
15. Power Output 15.247(b)

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable for the spectrum analyzer. The loss from the cable was added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 20 MHz, with measurements from a peak detector presented in the chart below. RF Power Output was also monitored while varying the DC voltage as sourced by a DC bench type power supply. No discernable variation in output power was seen while setting the DC voltage to 2.80 VDC (-15%) or to 3.80 VDC (+15%).

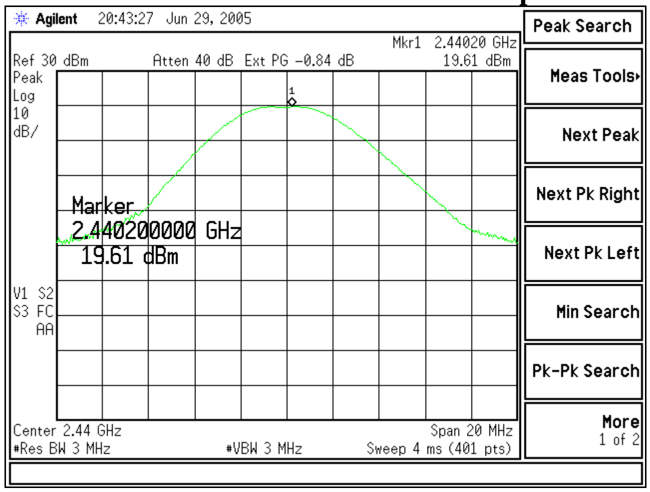
CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
01	2405	+ 30 dBm	+ 19.8	10.2
08	2440	+ 30 dBm	+ 19.6	10.4
13	2465	+ 30 dBm	+ 19.5	10.5
16	2480	+ 30 dBm	+ 1.6	28.4



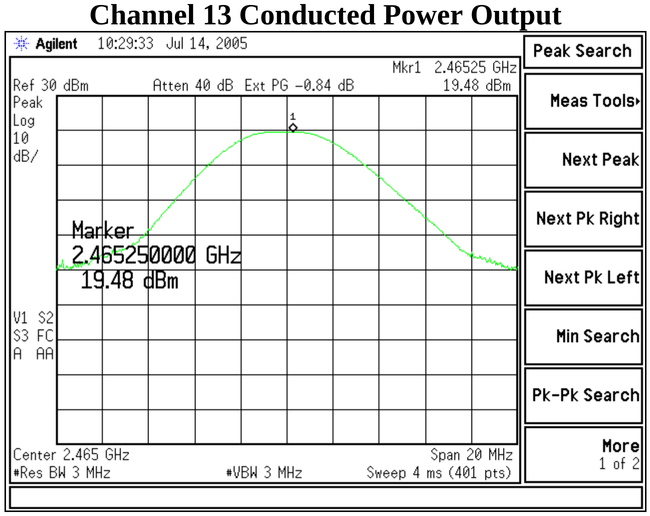
Channel 01 Conducted Power Output



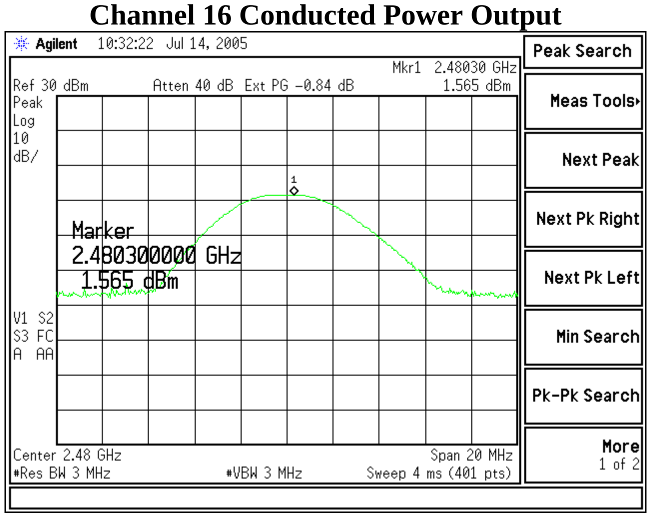
Channel 08 Conducted Power Output



Channel 13 Conducted Power Output



Channel 16 Conducted Power Output



16. Spurious Emissions 15.247(d)

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. The loss from the cable was 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 E4407B 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, while being supplied with typical data as a modulation source. 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.

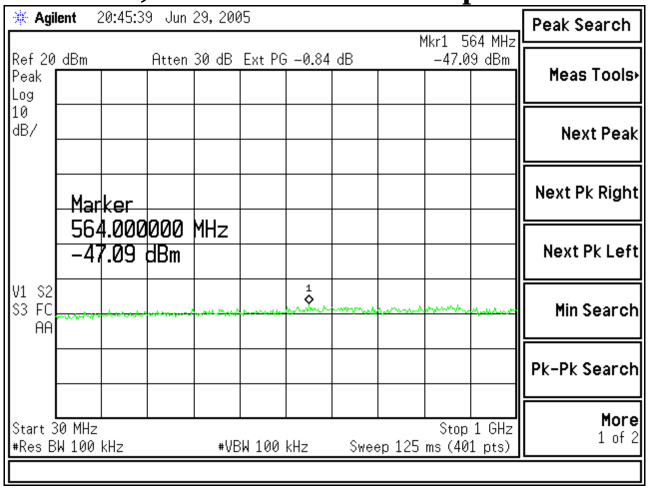
No significant emissions could be noted within -60 dBc of the fundamental level for this product.

	Channel 01	Channel 08	Channel 13	Channel 16
Fundamental	+ 15.6 (dBm)	+ 15.8 (dBm)	+ 15.2 (dBm)	- 3.0 (dBm)
2^{nd} Harmonic	- 49.4 (dBm)	- 55.2 (dBm)	-49.0 (dBm)	- 75.9 (dBm)
3^{rd} Harmonic	- 67.7 (dBm)	- 67.8 (dBm)	-61.4 (dBm)	- 78.9 (dBm)
4^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
5^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
6^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
7^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
8^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
9^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)
10^{th} Harmonic	Note (1)	Note (1)	Note (1)	Note (1)

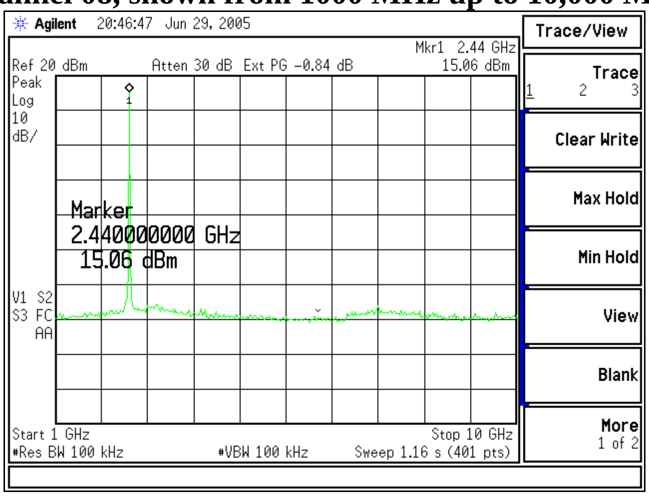
Notes:
(1) Measurement at system noise floor.

Representative plots for the middle channel are presented here, for the conducted RF spurious measurements.

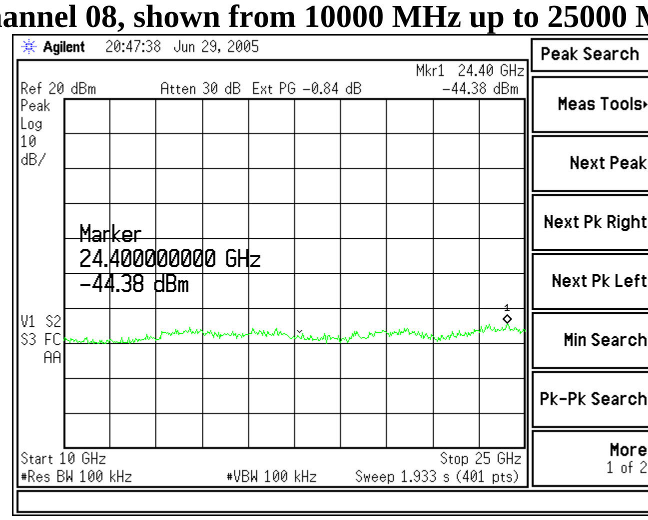
Channel 08, shown from 30 MHz up to 1000 MHz



Channel 08, shown from 1000 MHz up to 10,000 MHz



Channel 08, shown from 10000 MHz up to 25000 MHz

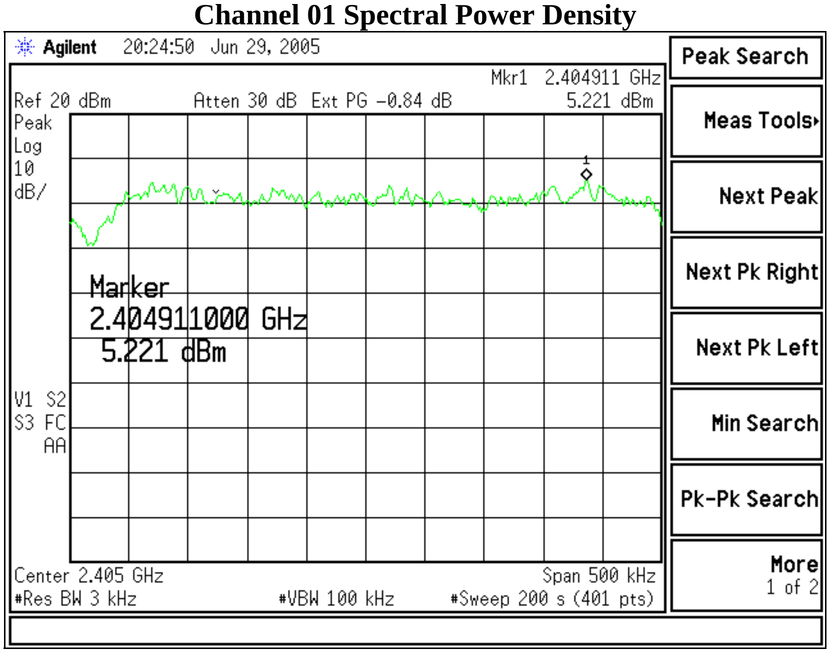


17. Spectral Density

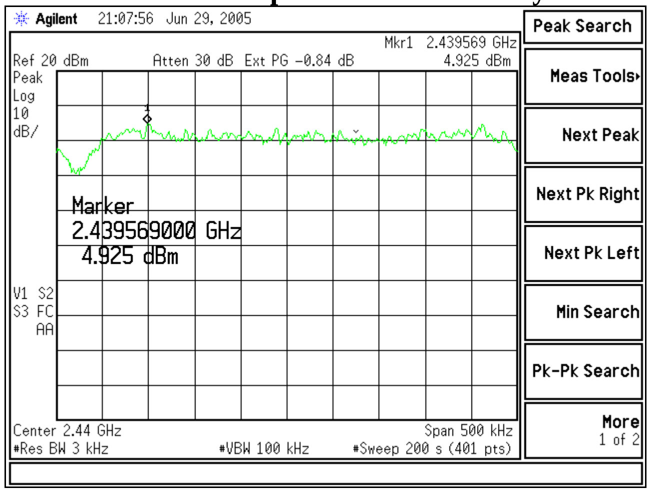
In accordance with FCC Part 15.247(e), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed. The highest density was found to be no greater than approximately +5.2 dBm, which is under the allowable limit by 2.8 dB.

Channel	Center Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Margin (dB)
01	2405	+ 5.22 dBm	+8 dBm	2.78
08	2440	+ 5.13 dBm	+8 dBm	2.87
13	2465	+ 4.21	+8 dBm	3.79
16	2480	- 13.30	+8 dBm	21.30

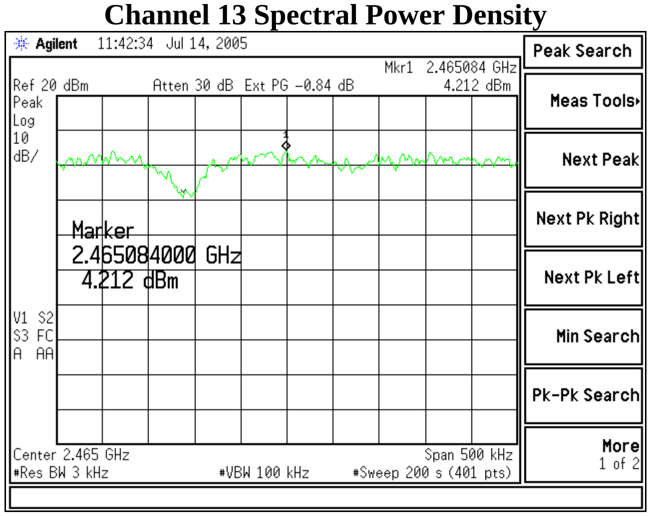
Channel 01 Spectral Power Density



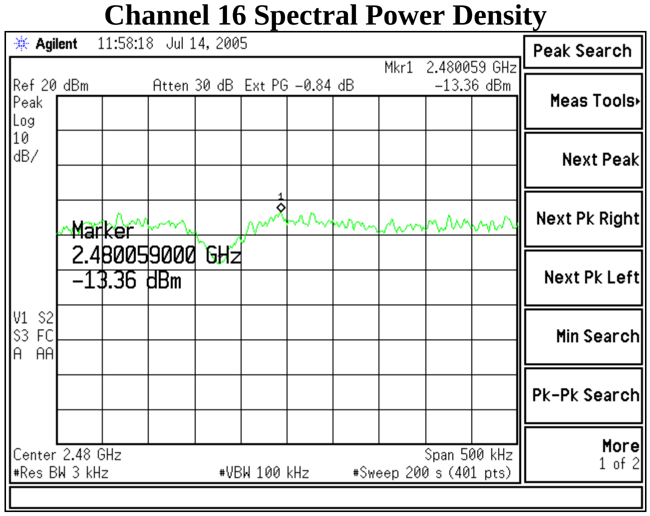
Channel 08 Spectral Power Density



Channel 13 Spectral Power Density



Channel 16 Spectral Power Density



18. Frequency and Power Stability over Voltage and Temperature Variations

For measurements of the frequency and voltage stability, the transmitter was placed inside a temperature controlled environmental chamber (Thermotron S-8C). A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was place inside a temperature chamber, with the transmitter portion of the EUT placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer. The power supply and spectrum analyzer were located outside the temperature chamber. The frequency was measured with a receiver resolution bandwidth of 10 Hz, and video bandwidth of 10 Hz.

Quote #	305160
Model	FreeStar
Serial	05190422
Sample #	01

Center Freq	2405.00	MHz

Temperature °C	DC Voltage Source 2.40	3.30	3.80
+85	2404.9948	2404.9963	2404.8000
+55	2404.9785	2404.9775	2404.9773
+40	2404.9875	2404.9865	2404.9850
+25	2404.9990	2404.9958	2404.9948
+10	2405.0105	2405.0095	2405.0085
0	2405.0135	2405.0128	2405.0123
-10	2405.0133	2405.0135	2405.0135
-20	2405.0095	2405.0113	2405.0113
-40	2404.9730	2404.9775	2404.9805

Max Freq	2405.0135	MHz
Min Freq	2404.8000	MHz
Total Freq Excurs	0.2135	MHz
Limit (100ppm Cri	0.2405	MHz
	Pass	

Quote #	305160
Model	FreeStar
Serial	05190386
Sample #	13

Center Freq	2465.00	MHz

Temperature °C	DC Voltage Source 2.40	3.30	3.80
+85	2464.9800	2464.9820	2464.9880
+55	2464.9670	2464.9665	2464.9653
+40	2464.9770	2464.9743	2464.9723
+25	2464.9915	2464.9898	2464.9858
+10	2465.0050	2465.0030	2464.9995
0	2465.0108	2465.0098	2465.0080
-10	2465.0123	2465.0123	2465.0115
-20	2465.0080	2465.0088	2465.0108
-40	2464.9785	2464.9830	2464.9893

Max Freq	2465.0123	MHz
Min Freq	2464.9653	MHz
Total Freq Excurs	0.0470	MHz
Limit (100ppm Cri	0.2465	MHz
	Pass	

Quote #	305160
Model	FreeStar
Serial	05190384
Sample #	16

Center Freq	2480.00	MHz

Temperature °C	DC Voltage Source 2.40	3.30	3.80
+85	2480.0038	2480.0050	2480.0155
+55	2479.9843	2479.9840	2479.9840
+40	2479.9920	2479.9910	2479.9878
+25	2480.0008	2479.9990	2479.9965
+10	2480.0140	2480.0133	2480.0098
0	2480.0173	2480.0163	2480.0145
-10	2480.0173	2480.0168	2480.0165
-20	2480.0120	2480.0125	2480.0150
-40	No Signal	2479.9818	2479.9913

Max Freq	2480.0173	MHz
Min Freq	2479.9818	MHz
Total Freq Excurs	0.0355	MHz
Limit (100ppm Cri	0.2480	MHz
	Pass	

	DC Voltage Source 2.40 V	3.30 V	3.80 V
Channel 01	+ 0.1 (dBm)	+ 18.6 (dBm)	+ 19.5 (dBm)
Channel 08	+ 3.3 (dBm)	+ 18.2 (dBm)	+ 18.9 (dBm)
Channel 16	No Transmssions	- 0.1 (dBm)	- 0.8 (dBm)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the proper power-up state. At the extreme temperature settings, a wide frequency sweep was also investigated, with minimum and maximum input voltages, to ensure that no unexpected anomalies have occurred. No unexpected anomalies were noted, in the measured transmit power. The transmit power varied less than 1 dB, during the increase of voltage, and slowly dropped in power, without a loss of frequency-lock as the voltage was reduced.

19. MPE Calculations

The following MPE calculations are based on a 1.8 centimeter inverted-F printed circuit board trace antenna, with a measured ERP of 119.8 dBµV/m, at 3 meters, and conducted RF power of +19.8 dBm as presented to the antenna. The calculated gain of this antenna, based on the ERP measurements is 4.8 dB.

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:	19.80	(dBm)
Maximum peak output power at antenna input terminal:	95.499	(mW)
Antenna gain(typical):	4.8	(dBi)
Maximum antenna gain:	3.020	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.057376	(mW/cm^2)
Maximum allowable antenna gain:	17.2	(dBi)
Margin of Compliance at 20 cm =	12.4	dB

Appendix A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/15/04	9/15/05
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/16/04	9/16/05
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/16/04	9/16/05
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/06/04	12/06/05
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/06/04	12/06/05
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/16/04	9/16/05
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/16/04	9/16/05
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0038	1 Meter RG 214 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.

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

Antenna Specification

The EUT uses a 1.8 cm printed circuit board trace antenna, and does not have any other facilities for external or commercial antenna connections.

Appendix C

Firmware and Setup Instructions

The EUTs were presented for testing with special firmware test modes.

Multiple EUT samples were presented for testing, by the manufacturer, each pre-programmed for a particular channel and mode of operation. There were no adjustments or modifications made at the test facility.

The EUT samples tested are tabulated below:

Channel	Frequency (MHz)	EUT Serial Number	RF Power Ouput (dBm)
01	2405	05190422	+ 19.8
08	2440	05190426	+ 19.6
13	2465	05190386	+ 19.5
14	2470	05190393	+ 16.3
15	2475	05190388	+ 10.2
16	2480	05190384	+ 1.6