

LS Research, LLC

W66 N220 Commerce Court • Cedarburg, WI 53012 • USA

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www.lsr.com

TEST REPORT: 306387 TX-v1

Compliance Testing of:
Eaton HHB Broadband Gateway Extender.

Test Date(s):
August 28th to September 7th 2006

Prepared For:

EATON Corporation
Attn.: Mr. Richard Harwell
170 Industry Drive
Pittsburgh, PA 15275

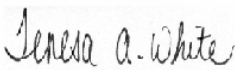
In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Digital Modulation Transmitters (DTS) Operating in the
Frequency Band 2400 MHz – 2483.5 MHz

This Test Report is issued under the Authority of:
Brian E. Petted, VP of Engineering

Signature: 

Date: September 11, 2006

Test Report Prepared by:
Teresa A. White, Document Coordinator

Signature: 
Date: September 11, 2006

Tested by:
Khairul Aidi Zainal, EMC engineer

Signature: 
Date: September 11, 2006

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LSC Revision Control

Date	Revision #	Revised By
August 30, 2006	Version 0	Aidi
Sept. 14, 2006	v1	T. White

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 2400 MHz – 2483.5 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:	<ul style="list-style-type: none"> • Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2005	Code of Federal Regulations - Telecommunications
ANSI C63.4	2004	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	2003	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.
FCC Procedures	2005, 03-23	Measurement of Digital Transmission Systems operating under Section 15.247.

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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.

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EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	Eaton Corporation
Address:	170 Industry Drive Pittsburg PA 15275
Contact Person:	Richard Harwell Eric Chisholm (Technical)

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	HHB Broadband Gateway Extender
Model Number:	70D5050G01
Serial Number:	0000AF060015

2.3 ASSOCIATED ANTENNA DESCRIPTION

The antenna used for this product is a Johanson Technology 2.45 GHz on-board ceramic chip antenna with a peak gain of 0.5 dBi.

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2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	2405 – 2475 MHz
RF Power in Watts	.078 watts
Field Strength (and at what distance)	113.9 dB μ V/m at 1.0 meter
Occupied Bandwidth (99% BW)	2.7 MHz
Type of Modulation	O-QPSK
Emission Designator	G1D2M70
Transmitter Spurious (worst case)	61.4 dB μ V/m at 4950 MHz (1 meter)
Frequency Tolerance %, Hz, ppm	< 100 ppm
Microprocessor Model # (if applicable)	ATMEL MEGA128L
EUT will be operated under FCC Rule Part(s)	15.247, 15.205, 15.207, 15.209 IC: RSS-GEN and RSS-210
Modular Filing	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

RF Technical Information:

Type of Evaluation (check one)	<input type="checkbox"/>	SAR Evaluation: Device Used in the Vicinity of the Human Head
	<input type="checkbox"/>	SAR Evaluation: Body-worn Device
	<input checked="" type="checkbox"/>	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: RSS 210, FCC 15.247
- Measurement Distance: 1.0 m
- RF Value: 0.50 V/m A/m W/m²
 Measured Computed Calculated

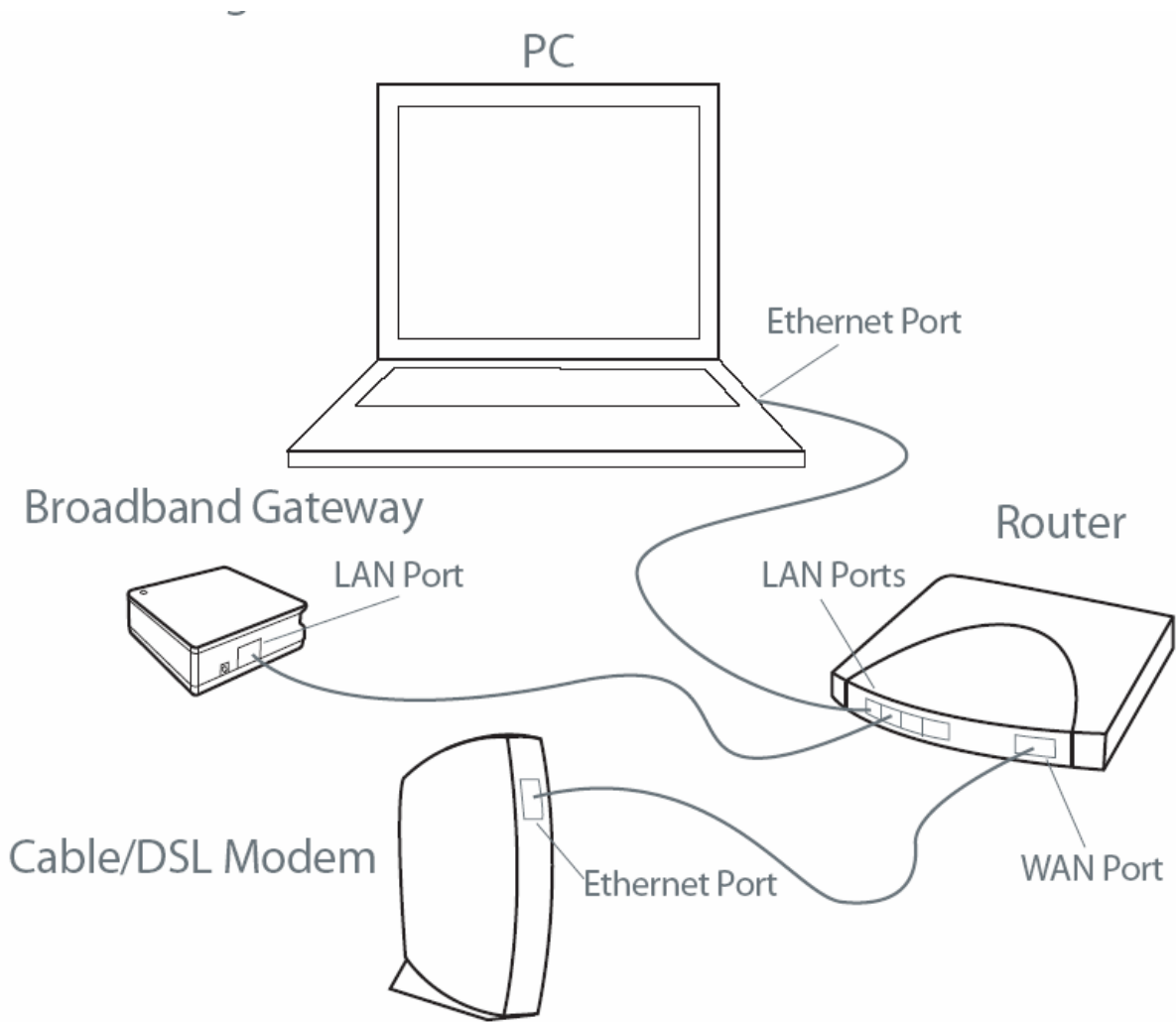
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2.5 PRODUCT DESCRIPTION

The Broadband Gateway Extender is part of the Eaton’s Home Heart Beat (HHB) product line. The unit is installed in a residential setting along with other devices in the HHB product line. It implements an interface between the HHB system control unit (‘Base’) and a wired Ethernet network. When this network is connected to a broadband Internet service, HHB system data can be sent to a central server for processing.

The unit is a mobile DTS system which operates in the 2.4 GHz-2.4835 GHz ISM band with an Offset-QPSK type modulation, with half sine chip shaping at 2 Mcps. An on-board ceramic chip antenna with a peak gain of 0.5 dBi, is the only type of antenna available for this unit.

The unit is powered by an Eaton external AC adapter (model 41-9-500R) that provides +9VDC output. Other than power, the unit has an RJ-45 (shielded) port, with internal filtering, which is connected to a customer-supplied switch, hub or router via a 3 feet CAT 5 cable that is supplied with the unit.



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EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	72° Fahrenheit
Humidity:	54%
Pressure:	746 mmHg

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)(2)	6 dB Bandwidth of a Digital Modulation 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(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d)	Transmitted Power Spectral Density of a Digital Modulation System	Yes
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes

The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices and the associated Radio Receiver 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)

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

None Yes (explain below)

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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 (2005), Section Annex 8 (section 8.2) for a Digital Spread Spectrum (DTS) 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.

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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 120 V 60 Hz AC adapter. The unit has the capability to operate on 15 channels, controllable via a laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 1 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: 0 (2405 MHz), 7 (2440 MHz) and E (2475 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed using a hyper-terminal program on the laptop PC.

5.2 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 EUT was rotated along three orthogonal axis during the investigations to find the highest emission levels.

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5.3 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 Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296
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	Adv. Microwave	WLA612	1145A04094
Horn Antenna – Std. Gain	EMCO	3160-09	9809-1120

5.4 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 (2005), Annex 8 (section 8.2)]. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

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5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in Title 47 CFR 15.247 (b)(3), 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 $\mu\text{V/m}$	3 m Limit (dB $\mu\text{V/m}$)	1 m Limit (dB $\mu\text{V/m}$)
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 $\mu\text{V/m}$ to dB $\mu\text{V/m}$:

$$\begin{aligned} \text{dB}\mu\text{V/m} &= 20 \log_{10} (100) \\ &= 40 \text{ dB}\mu\text{V/m (from 30-88 MHz)} \end{aligned}$$

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

$$\begin{aligned} &960 \text{ MHz to } 10,000 \text{ MHz} \\ &500\mu\text{V/m or } 54.0 \text{ dB}/\mu\text{V/m at } 3 \text{ meters} \\ &54.0 + 9.5 = 63.5 \text{ dB}/\mu\text{V/m at } 1 \text{ meter} \end{aligned}$$

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

$$\begin{aligned} &960 \text{ MHz to } 10,000 \text{ MHz} \\ &500\mu\text{V/m or } 54.0 \text{ dB}/\mu\text{V/m at } 3 \text{ meters} \\ &54.0 + 20 = 74 \text{ dB}/\mu\text{V/m at } 0.3 \text{ meters} \end{aligned}$$

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5.6

RADIATED EMISSIONS TEST 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:	Eaton Corporation.				
Date(s) of Test:	August 28 th – September 7 th 2006				
Test Engineer(s):	Khairul Aidi Zainal				
Voltage:	120 VAC				
Operation Mode:	Continuous transmit				
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %				
EUT Power:	√	Single Phase 120 VAC		3 Phase ___ VAC	
		Battery		Other:	
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 radiated RF emissions found:

Frequency (MHz)	Ant./EUT Polarity	Channel	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dB μ V/m)	15.205 Limit (dB μ V/m)	Margin (dB)
2549.0	V/S	0	1.00	282	53.9	93.9	40.0
2623.0	V/S	E	1.08	288	50.6	91.2	40.6
50.0 <small>NOTE 4</small>	V/S	7	1.00	0	32.6	83.1	50.5
65.8 <small>NOTE 4</small>	V/V	7	1.00	0	24.0	83.1	59.1
70.5 <small>NOTE 4</small>	V/V	7	1.00	0	17.8	83.1	65.3
156.2 <small>NOTE 4</small>	V/S	0	1.00	0	13.0	84.1	71.1
160.0	V/S	0	1.00	169	26.2	84.1	57.9
170.0 <small>NOTE 4</small>	V/V	0	1.00	0	26.1	43.5	17.4
200.0	V/V	0	1.05	161	27.1	84.1	57.0
240.0	V/V	0	1.00	21	28.6	43.5	14.9
660.2	H/S	7	1.29	222	30.2	83.1	52.9
670.3 <small>NOTE 4</small>	H/S	7	1.11	153	30.2	83.1	52.9
710.2 <small>NOTE 4</small>	H/S	7	1.15	20	39.5	83.1	43.6
810.0 <small>NOTE 4</small>	H/V	7	1.00	219	31.3	83.1	51.8
960.3 <small>NOTE 4</small>	V/S	7	1.07	198	35.0	54.0	19.0
900.2	H/V	7	1.00	220	32.5	83.1	50.6

- 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 1 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) Intermittent signal due to digital data transfer on Ethernet port of EUT. These signals are common to all three test channels.

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RADIATED EMISSIONS TEST DATA CHART (continued)

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 0:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2405	V/S	1.08	252	113.9	134.8	20.9
4810	V/V	1.00	183	58.0	63.5	5.5
7215	V/V	1.00	10	54.3	93.9	39.6
9620	H/S	1.00	212	51.5	93.9	42.4
12025	V/H	1.00	318	36.8	63.5	26.7
14430	H/S	1.00	287	40.0	93.9	53.9
16835				NOTE 3		
19240				NOTE 3		
21645				NOTE 3		
24050				NOTE 3		

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 7:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2440	V/S	1.05	289	112.6	134.8	22.2
4880	V/V	1.00	176	59.8	63.5	3.7
7320	V/V	1.00	0	55.6	63.5	7.9
9760	H/S	1.00	212	51.1	92.6	41.5
12200	V/H	1.10	44	42.4	63.5	21.1
14640	H/S	1.00	287	39.8	92.6	52.8
17080				NOTE 3		
19520				NOTE 3		
21960				NOTE 3		
24400				NOTE 3		

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

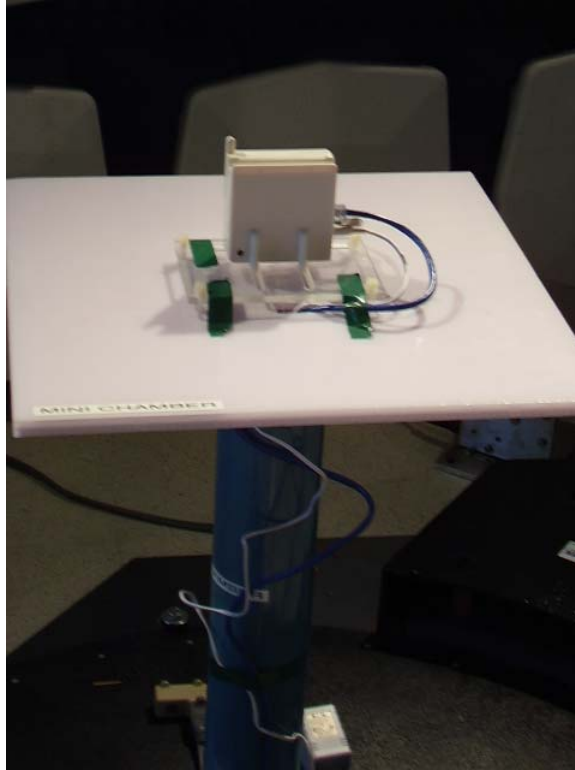
Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)
2475	V/S	1.02	242	111.2	134.8	23.6
4950	V/V	1.12	178	61.4	63.5	2.1
7425	V/V	1.19	9	54.9	63.5	8.6
9900	H/S	1.00	213	51.2	91.2	40
12375	V/H	1.00	43	41.2	63.5	22.3
14850	H/S	1.00	306	38.9	91.2	52.3
17325				NOTE 3		
19800				NOTE 3		
22275				NOTE 3		
24750				NOTE 3		

- 5) 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.
- 6) Measurements above 1 GHz were made at 1 meters of separation from the EUT, and at 0.3 m separation for frequencies between 18 – 25 GHz.
- 7) Measurement at receiver system noise floor.
- 8) Intermittent signal due to data transfer on Ethernet port of EUT. These signals are common to all three test channels.

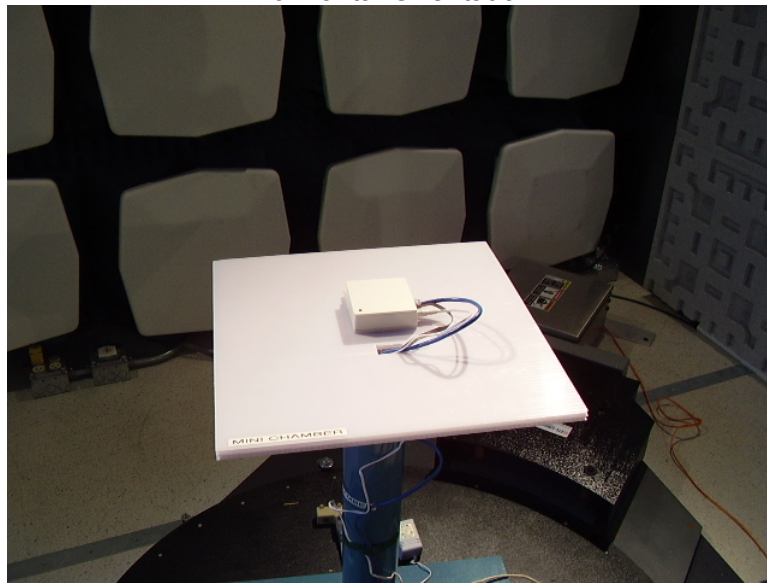
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 15 of 52

5.7 Test Setup Photo(s) – Radiated Emissions Test

Vertical Orientation

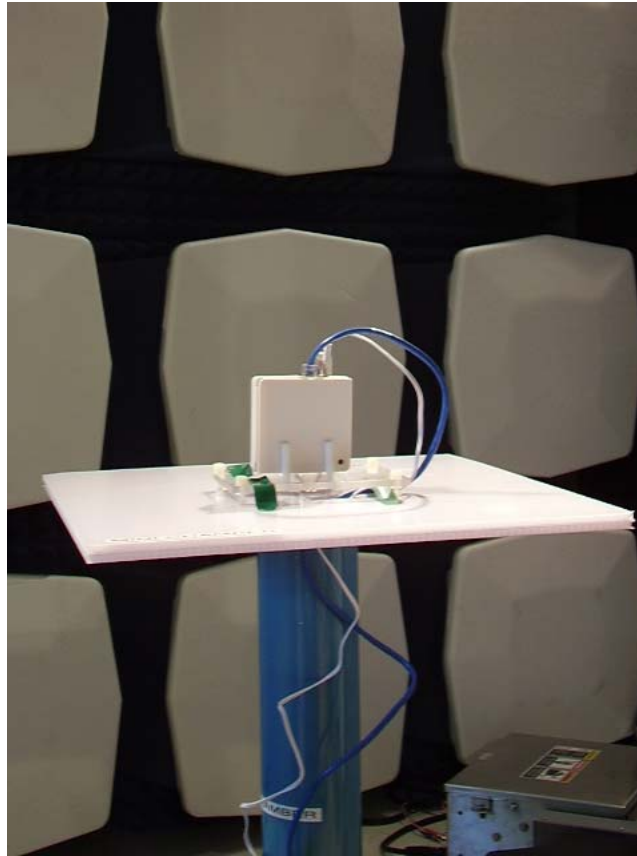


Horizontal Orientation



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 16 of 52

Side Orientation



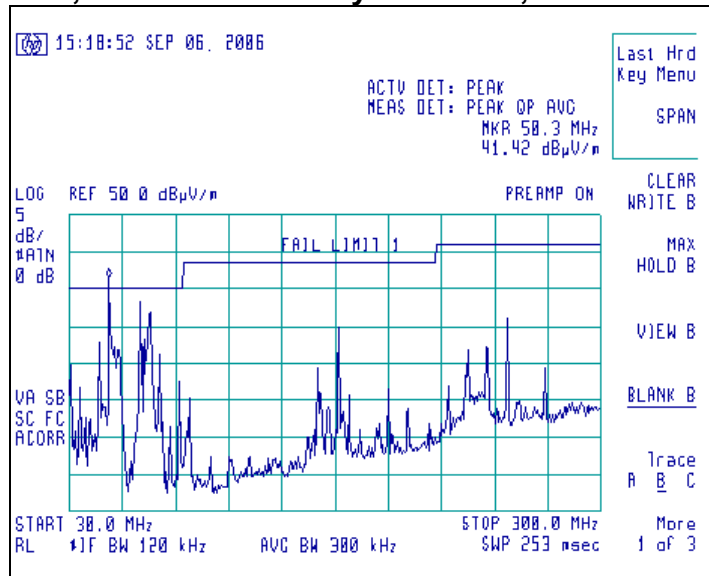
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 17 of 52

5.8 Screen Captures - Radiated Emissions Testing

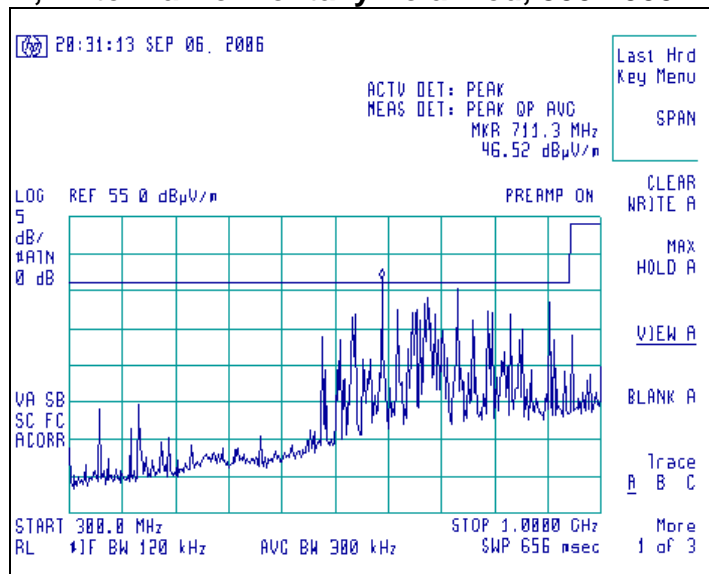
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 0, 7, or E with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Channel 7, Antenna Vertically Polarized, 30-300 MHz, at 3m



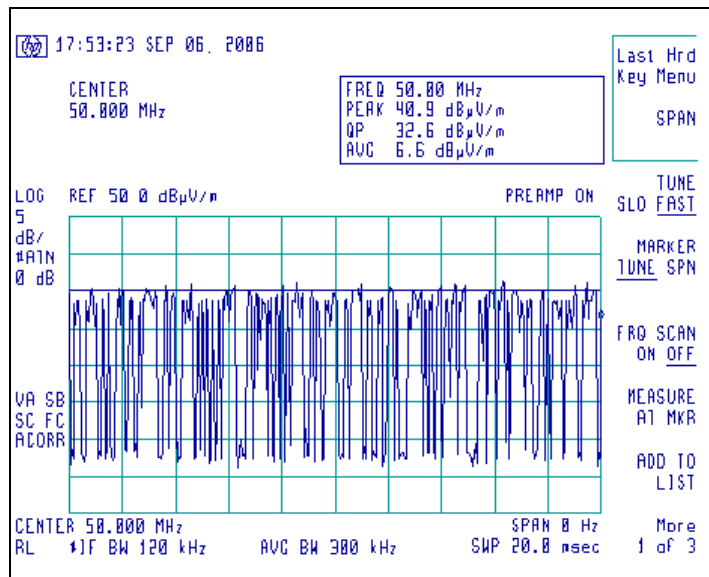
Channel 7, Antenna Horizontally Polarized, 300-1000 MHz, at 3m



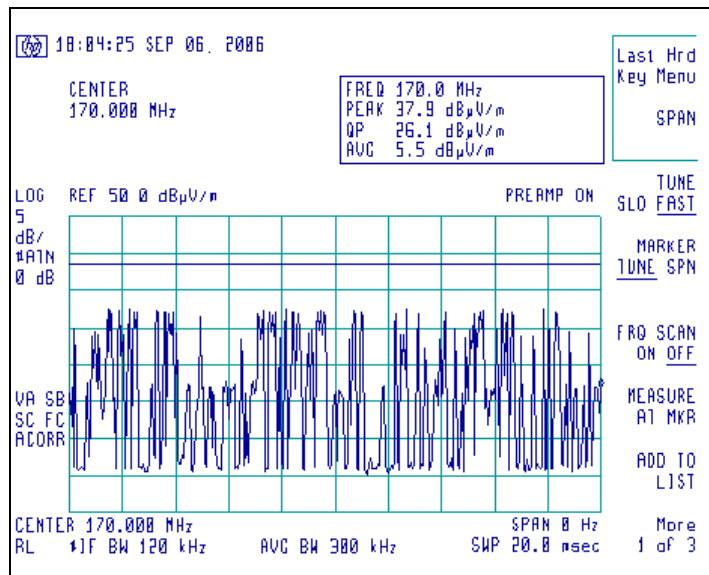
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 18 of 52

Screen captures of select intermittent spurs between 30MHz and 10000 MHz to show compliance

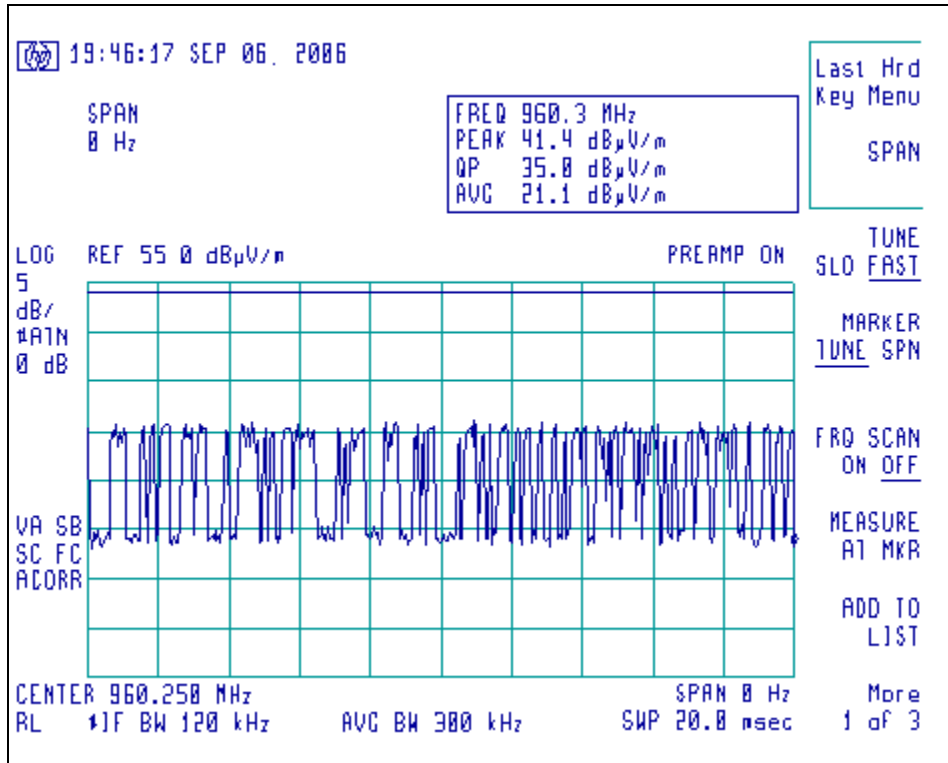
Intermittent spur at 50 MHz, Channel 07 at 3m.



Intermittent spur at 170 MHz (Restricted band), Channel 07 at 3m.



Intermittent spur at 960.3 MHz (Restricted band), Channel 07 at 3m.

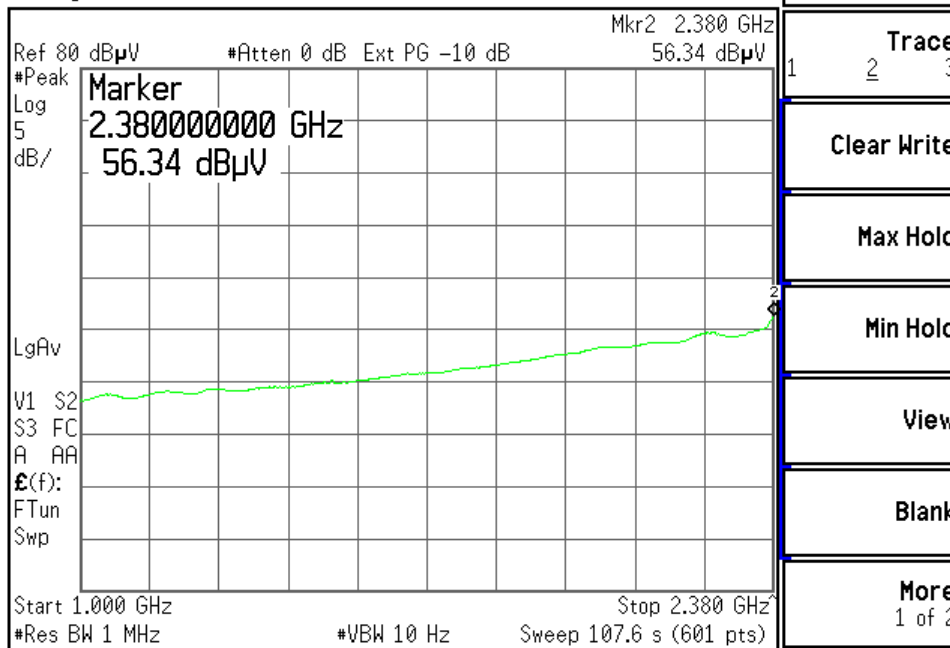


Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 20 of 52

Screen Captures - Radiated Emissions Testing (continued)

Channel 0, Antenna Vertically Polarized, 1000-2380 MHz, at 1m

Agilent 16:14:48 28 Aug 2006

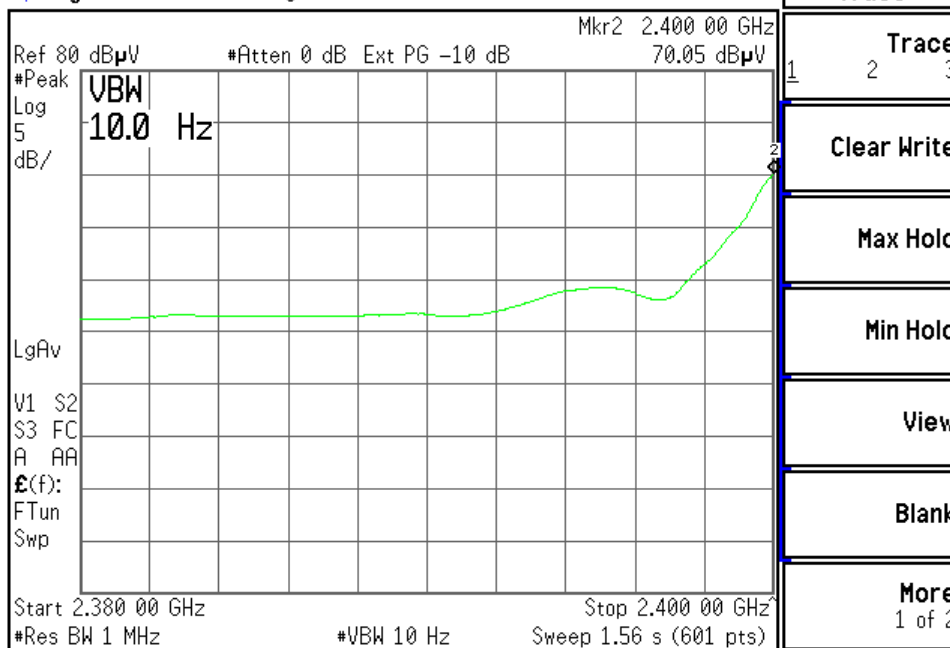


Trace		
1	2	3
Trace		
Clear Write		
Max Hold		
Min Hold		
View		
Blank		
More		
1 of 2		

File Operation Status, C:\COREC489.CBL file loaded

Channel 0, Antenna Vertically Polarized, 2380-2400 MHz, at 1m Lower Band Edge

Agilent 16:15:58 28 Aug 2006



Trace		
1	2	3
Trace		
Clear Write		
Max Hold		
Min Hold		
View		
Blank		
More		
1 of 2		

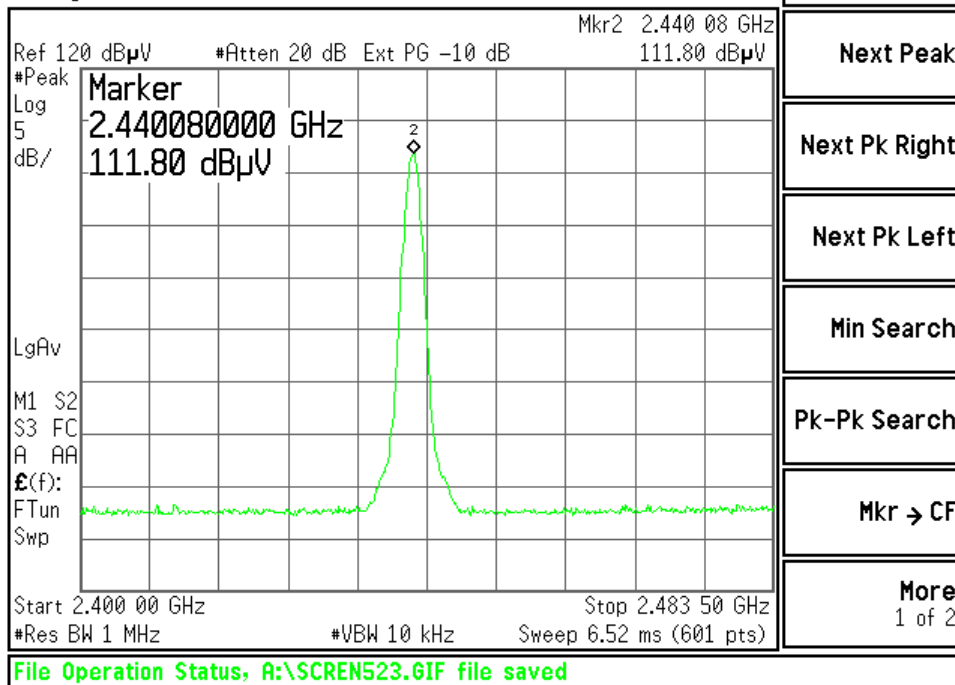
File Operation Status, A:\SCREN522.GIF file saved

Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 21 of 52

Screen Captures - Radiated Emissions Testing (continued)

Channel 7, Antenna Vertically Polarized, 2400-2483.5 MHz, at 1m

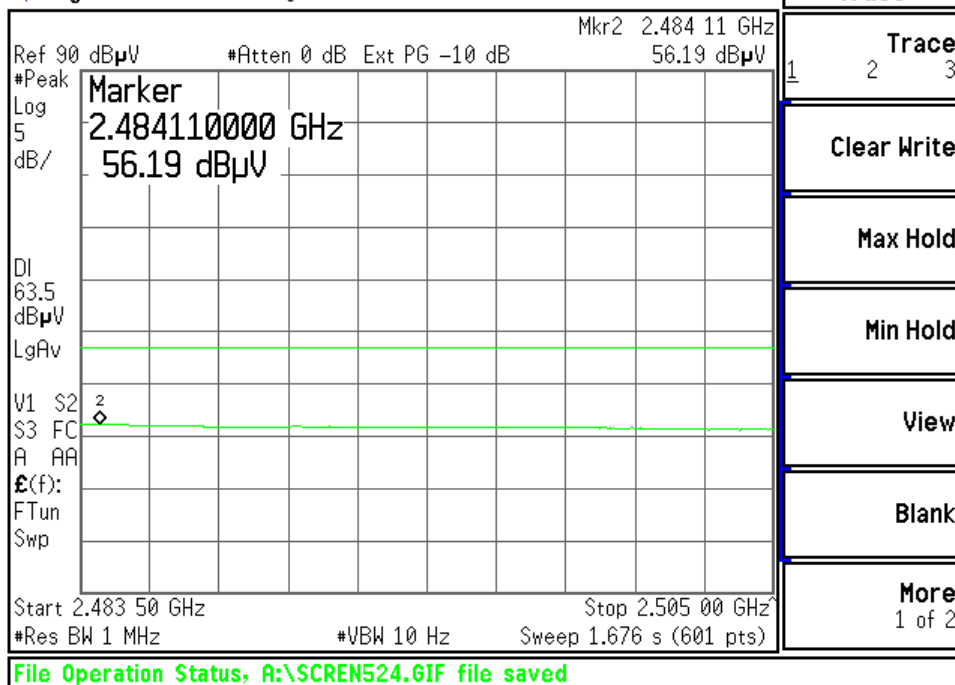
Agilent 16:20:53 28 Aug 2006



- Peak Search
- Next Peak
- Next Pk Right
- Next Pk Left
- Min Search
- Pk-Pk Search
- Mkr \rightarrow CF
- More
1 of 2

Channel E, Antenna Vertically Polarized, 2483.5-2505 MHz, at 1m

Agilent 16:25:18 28 Aug 2006



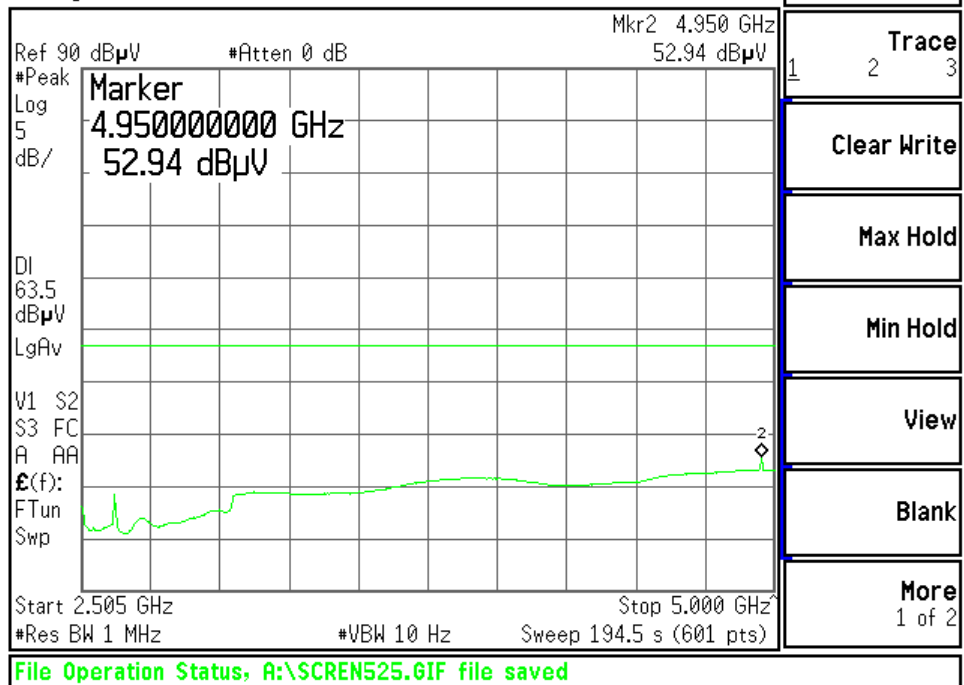
- Trace
- Trace
1 2 3
- Clear Write
- Max Hold
- Min Hold
- View
- Blank
- More
1 of 2

Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 22 of 52

Screen Captures - Radiated Emissions Testing (continued)

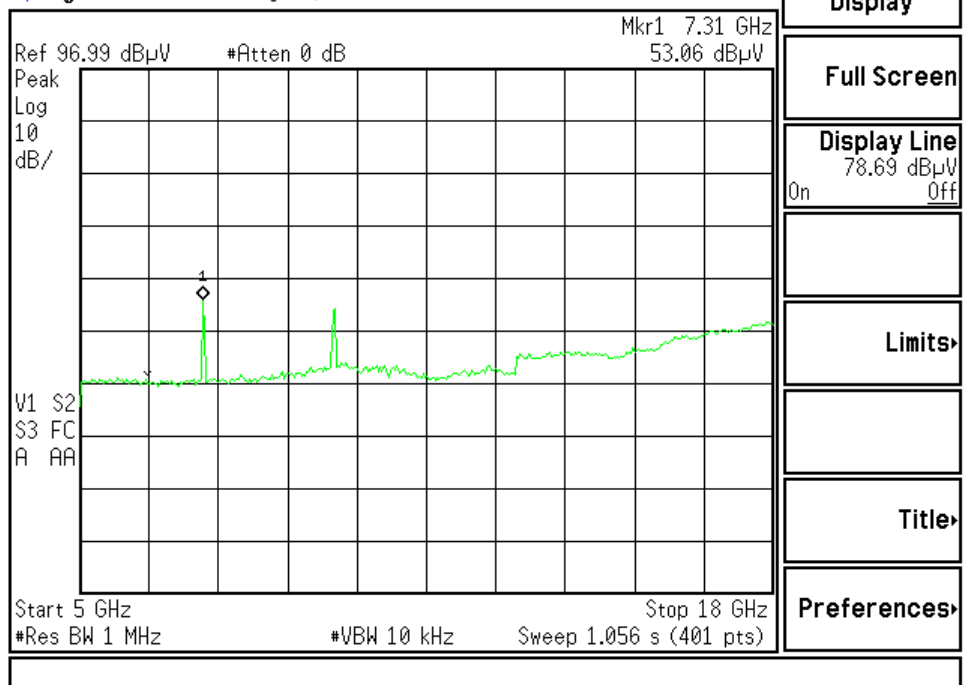
Channel E, Antenna Vertically Polarized, 2505-5000 MHz, at 1m

Agilent 16:37:28 28 Aug 2006



Channel 7, Antenna Vertically Polarized, 5000-18000 MHz, at 1m

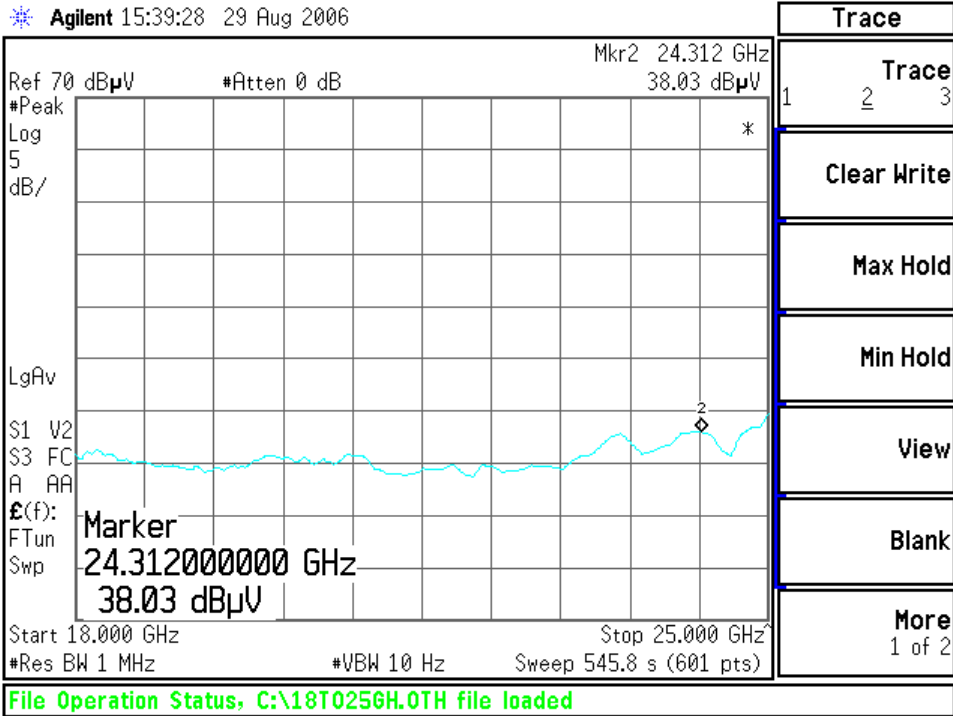
Agilent 14:25:52 Aug 31, 2006



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 23 of 52

Screen Captures - Radiated Emissions Testing (continued)

Channel 7, Antenna Horizontally Polarized, 18000 - 25000 MHz, at 30cm



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 24 of 52

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-210, Issue 6). 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 inside the 3 Meter Semi-Anechoic Chamber 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 L1 (line) or L2 (neutral).

6.2 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 30MHz. Final readings were then taken and recorded.

6.3 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 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

6.4 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.

Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 25 of 52

6.5 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dB μ V)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW \geq 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.			

6.6

TEST DATA CHART - CONDUCTED EMISSION

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 Class B

Manufacturer:	Eaton Corporation				
Date(s) of Test:	September 7 th 2006				
Test Engineer:	Khairul Aidi Zainal				
Model #:	70D5050G01				
Serial #:	0000AF060015				
Voltage:	120 VAC				
Operation Mode:	continuous transmit				
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %				
Test Location:	√	AC Mains test bench			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

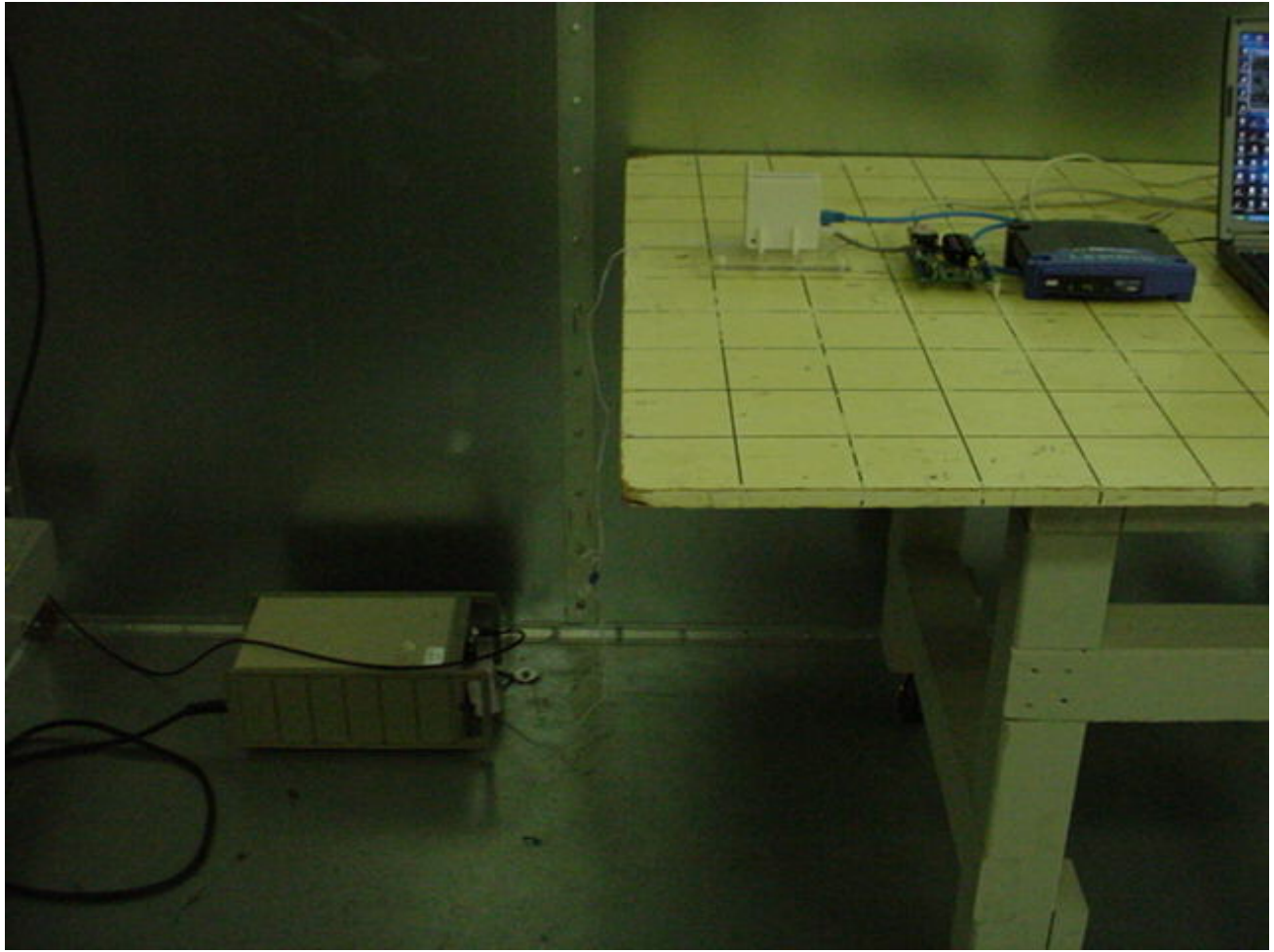
Frequency (MHz)	Line	QUASI-PEAK			AVERAGE		
		Q-Peak Reading (dBμV)	Q-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Reading (dBμV)	Average Limit (dBμV)	Average Margin (dB)
0.176	L1	43.2	64.7	21.5	13.7	54.7	41.0
0.531	L1	36.7	56.0	19.3	10.3	46.0	35.7
2.036	L1	34.0	56.0	22.0	26.7	46.0	19.3
11.670	L1	24.8	60.0	35.2	18.6	50.0	31.4
0.286	L2	42.0	60.6	18.6	12.9	50.6	37.7
0.766	L2	36.5	56.0	19.5	13.7	46.0	32.3
1.950	L2	35.1	56.0	20.9	30.2	46.0	15.8
6.357	L2	27.1	60.0	32.9	19.4	50.0	30.6

Notes:

- 1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.
- 2) The EUT exhibited similar emissions in transmit and receive modes, and across the Low, Middle and High channels tested.

Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 27 of 52

6.7 Test Setup Photo(s) – Conducted Emissions Test



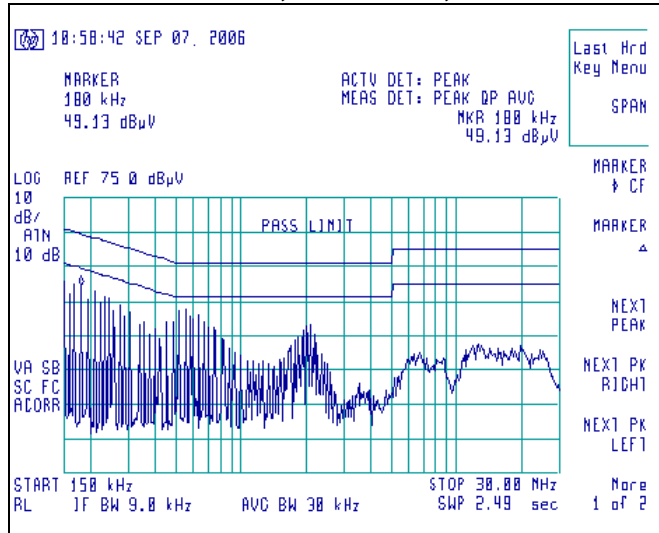
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 28 of 52

6.8 Screen Captures – Conducted Emissions Test

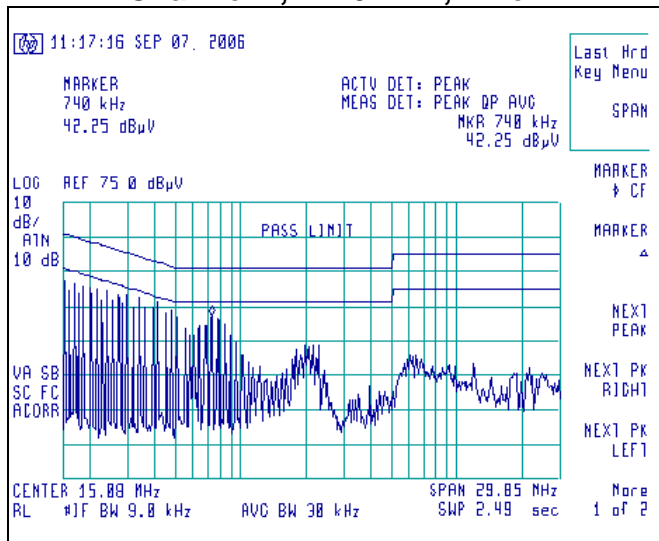
These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207.

The signature scans shown here are from channel 7, chosen as being a good representative of channels.

Channel 7, 2440 MHz, Line 1



Channel 7, 2440 MHz, Line 2



Prepared For: Eaton Corporation	Model #: 70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 29 of 52

EXHIBIT 7. OCCUPIED BANDWIDTH: 15.247(a)(2)

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 and FCC Procedures (March 23, 2005) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=300 kHz.

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. 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, 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.

From this data, the closest measurement when compared to the specified limit, is 1630 kHz, which is above the minimum of 500 kHz.

Test Data

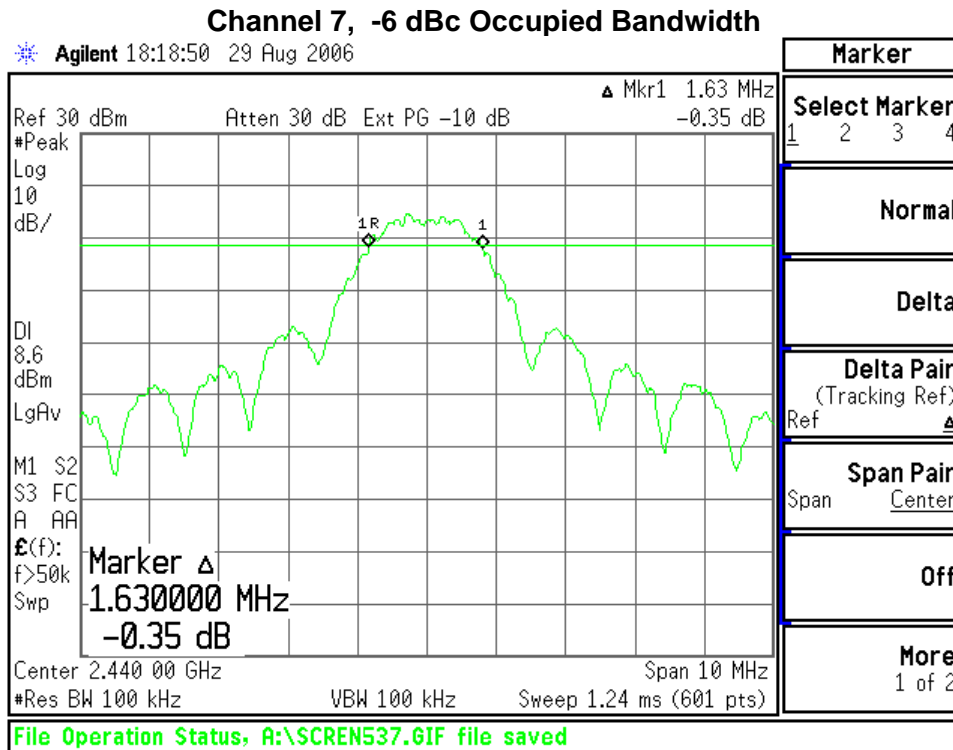
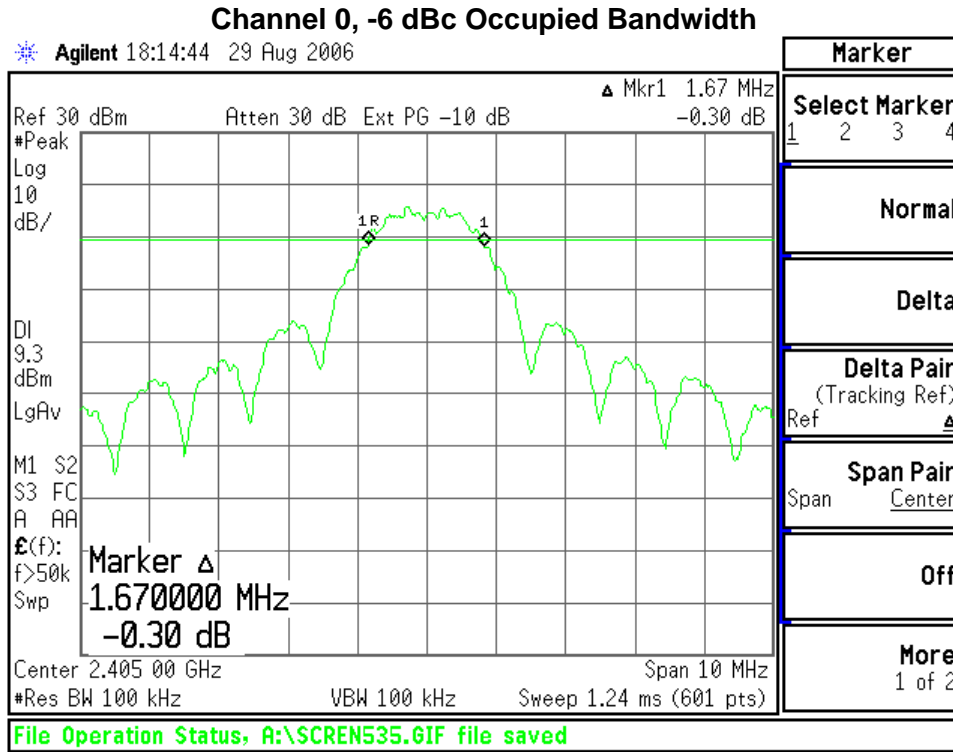
Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured -20 dBc Occ.Bw (kHz)
0	2405	1670	500	2670
7	2440	1630	500	2700
E	2475	1670	500	2670

7.3 Test Equipment List

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

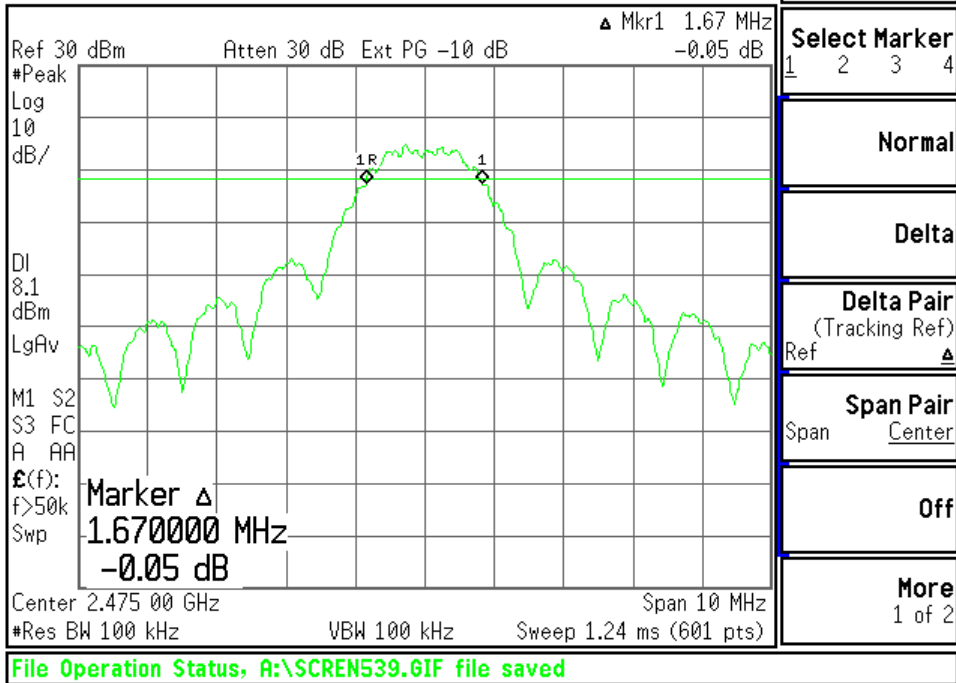
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 30 of 52

7.4 Screen Captures - OCCUPIED BANDWIDTH



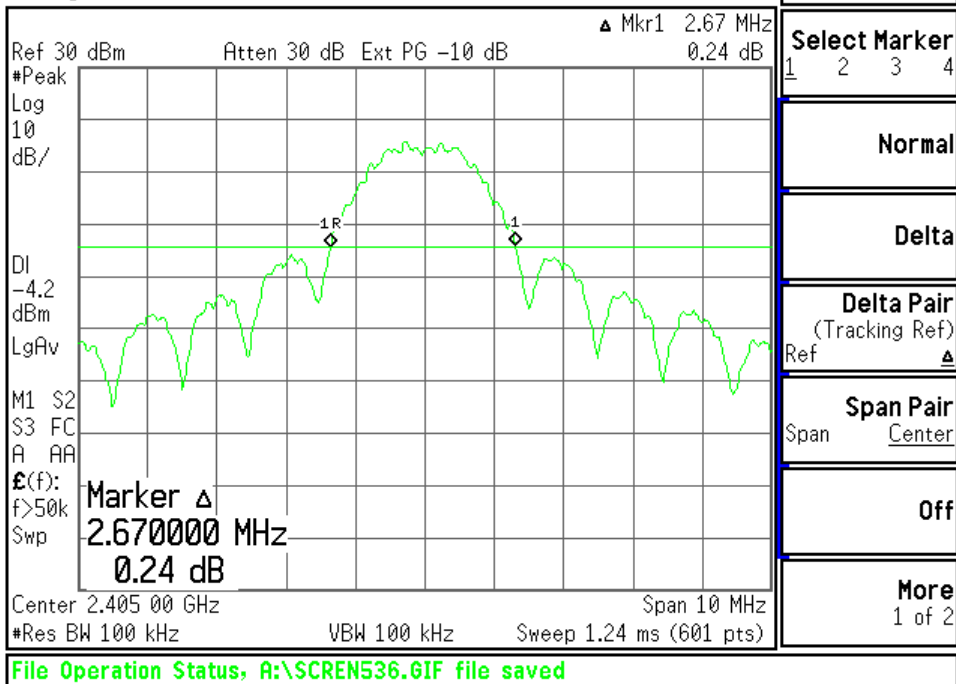
Channel E, -6 dBc Occupied Bandwidth

Agilent 18:21:42 29 Aug 2006



Channel 0, -20 dBc Occupied Bandwidth

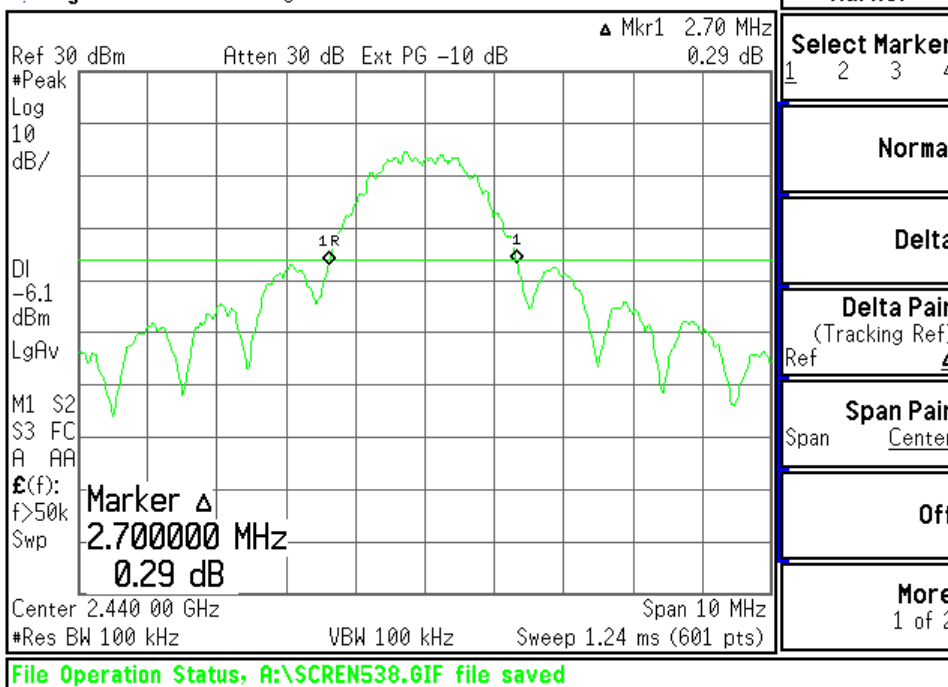
Agilent 18:15:51 29 Aug 2006



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 32 of 52

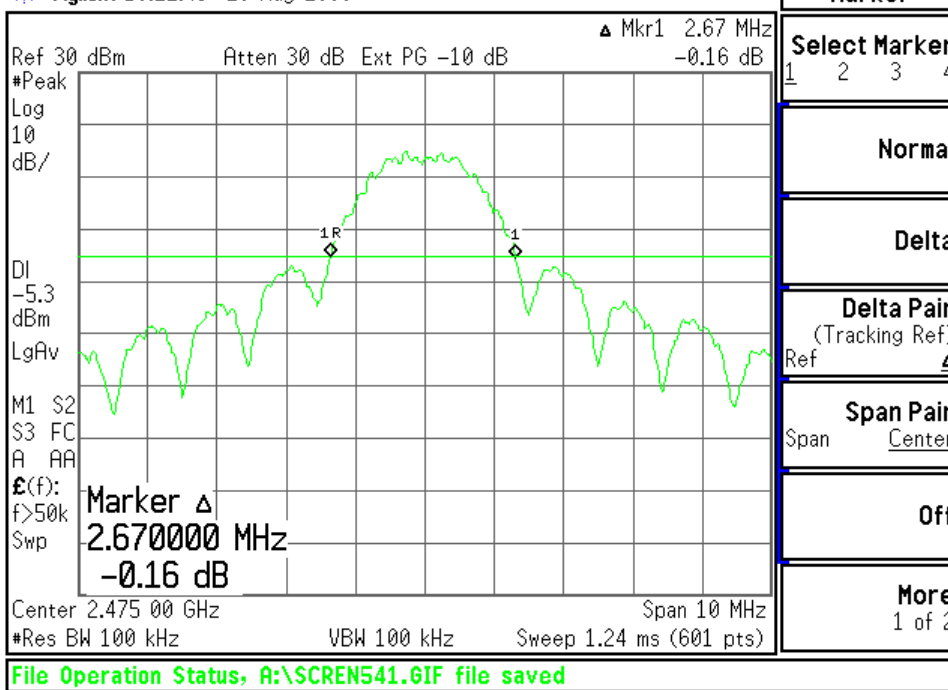
Channel 7, -20 dBc Occupied Bandwidth

Agilent 18:20:02 29 Aug 2006



Channel E, -20 dBc Occupied Bandwidth

Agilent 18:22:43 29 Aug 2006



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 33 of 52

8.1 Method of Measurements

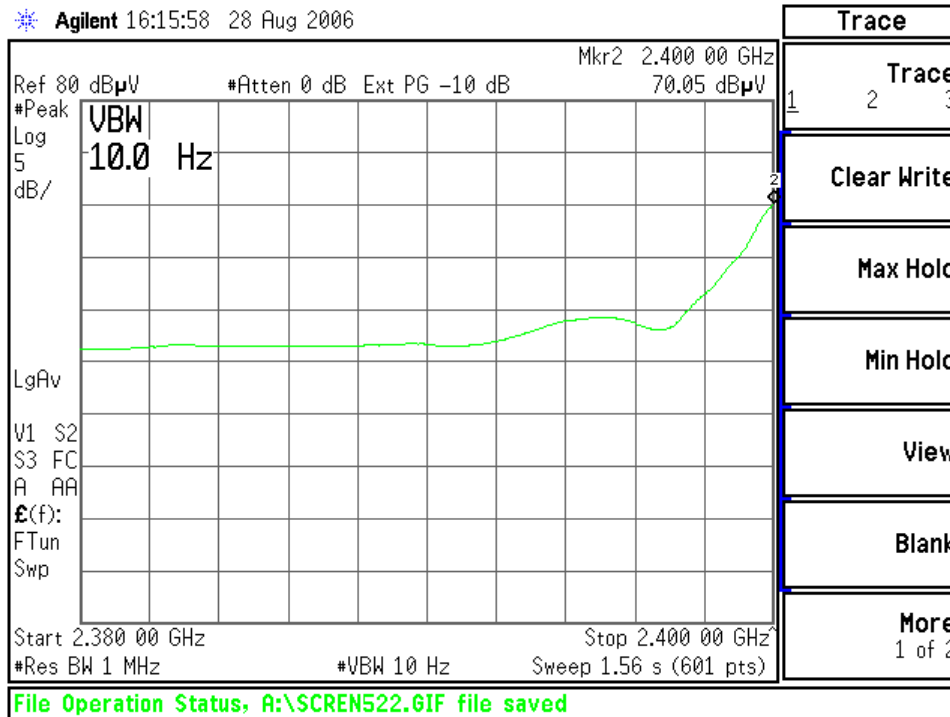
FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 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 the highest channel for the investigation of the higher Band-Edge.

The Lower Band-Edge limit, in this case, would be 93.9 dBμV

The Upper Band-Edge limit, in this case, would be +63.5 dBμV/m at 1m.

8.2 Screen Captures – Band-Edge Measurements

Screen Capture Demonstrating Compliance at the Lower Band-Edge



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 34 of 52

Screen Capture Demonstrating Compliance at the Higher Band-Edge

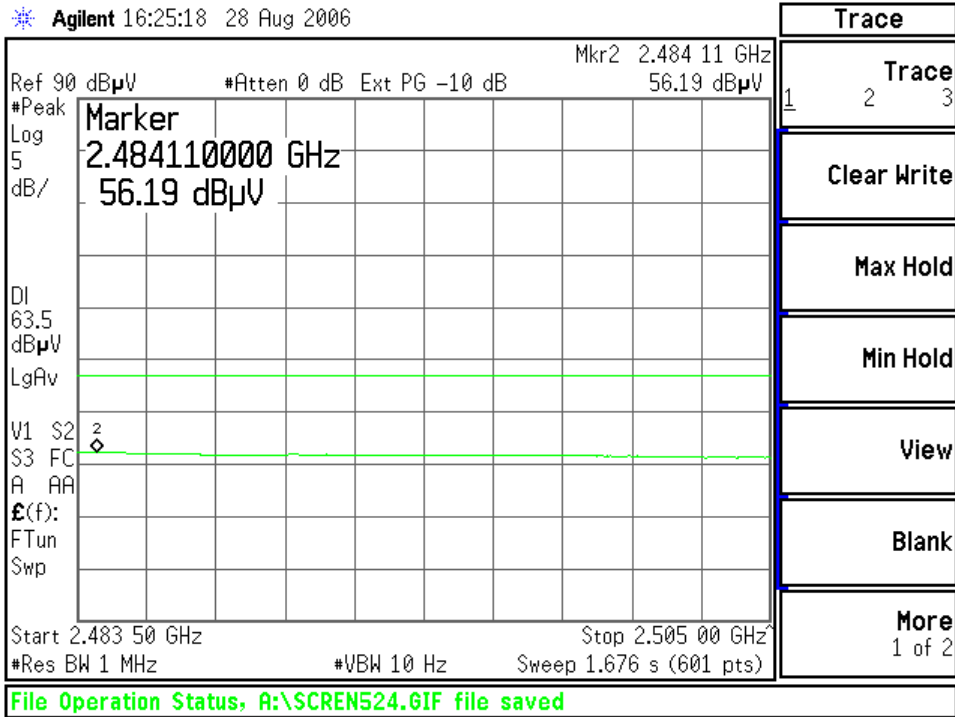


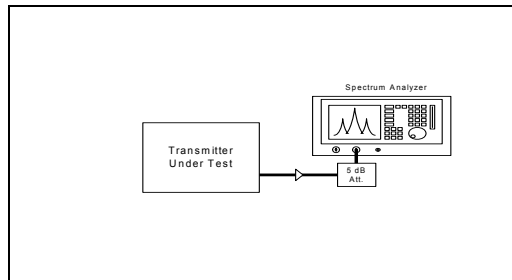
EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the 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 to be 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 15 MHz, 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)
0	2405	+30 dBm	+18.9	11.1
7	2440	+30 dBm	+17.8	12.2
E	2475	+30 dBm	+18.0	12.0



Measured radiated RF power output (in watts): 0.008 watts

Measured RF Power Output (in Watts): 0.078 Watts

Declared RF Power Output (in Watts): 0.1 Watts

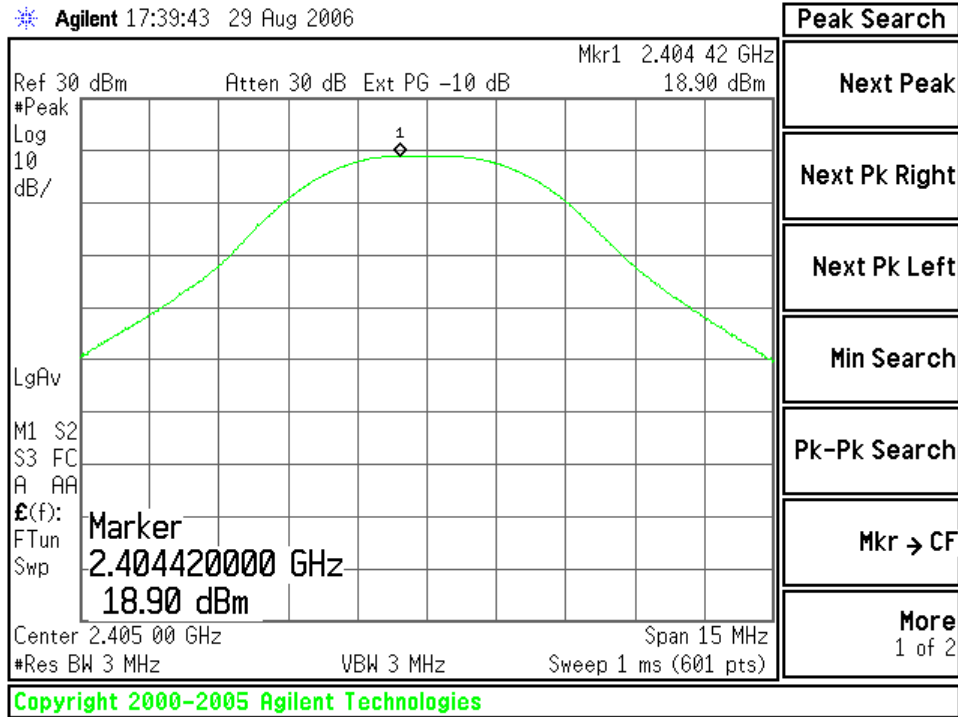
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 36 of 52

9.3 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	3Hz to 44 GHz

9.4 Screen Captures – Power Output (Conducted)

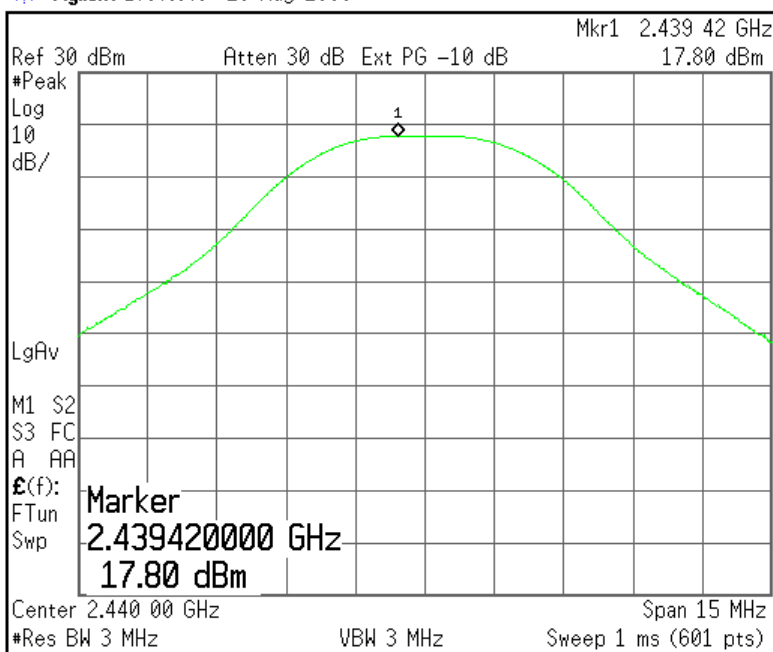
Channel 0



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 37 of 52

Channel 7

Agilent 17:40:49 29 Aug 2006

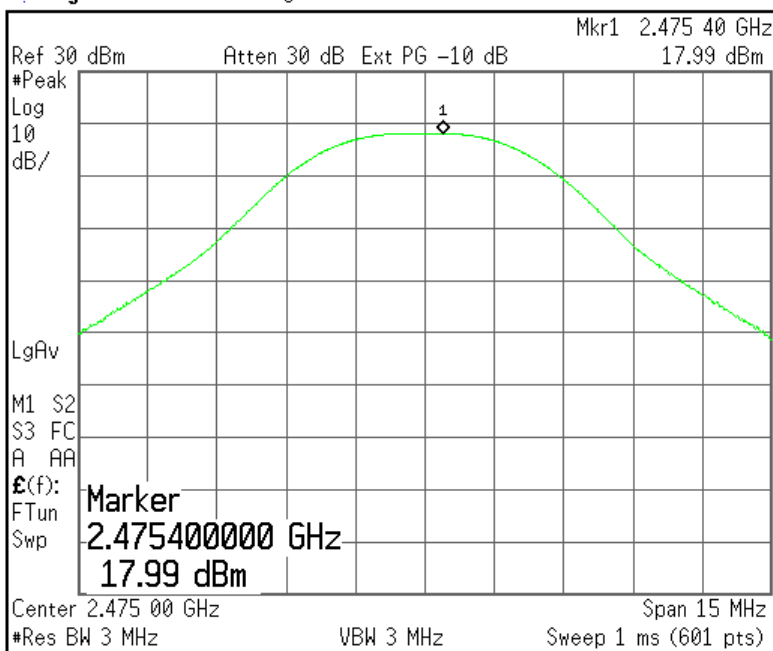


Peak Search
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More 1 of 2

File Operation Status, A:\SCREN533.GIF file saved

Channel E

Agilent 17:45:49 29 Aug 2006



Peak Search
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More 1 of 2

File Operation Status, A:\SCREN534.GIF file saved

Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 38 of 52

EXHIBIT 10. POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 +3.7 dBm, which is under the allowable limit by 4.3 dB.

10.2 Test Equipment List

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

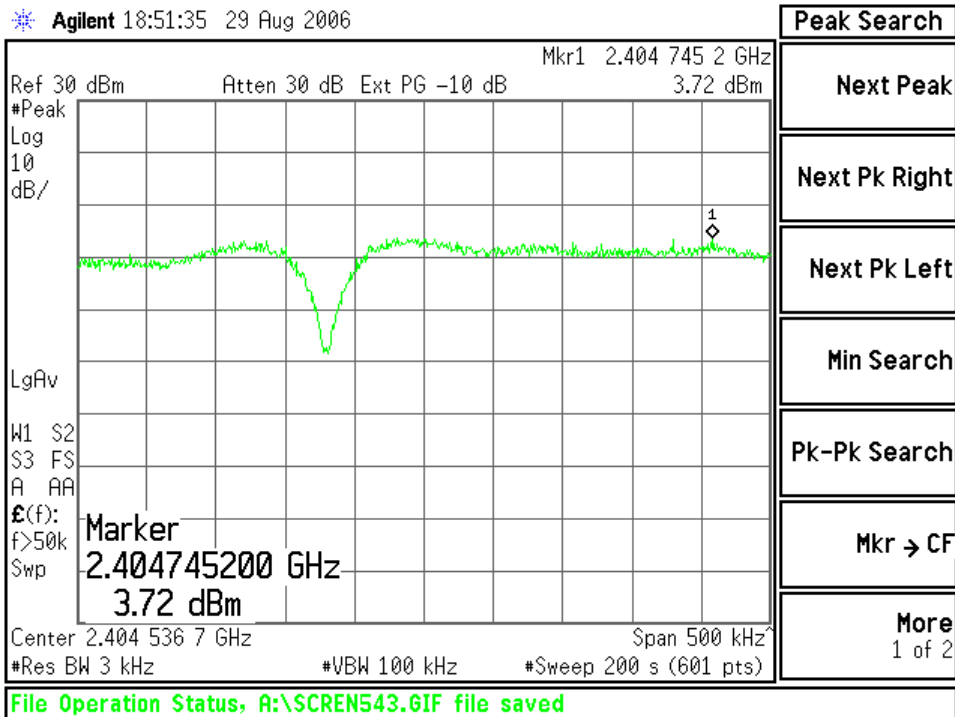
10.3 Test Data

Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
Lowest	2405	+3.7	+8.0	4.3	PASS
Middle	2445	+2.8	+8.0	5.2	PASS
Highest	2480	+3.2	+8.0	4.8	PASS

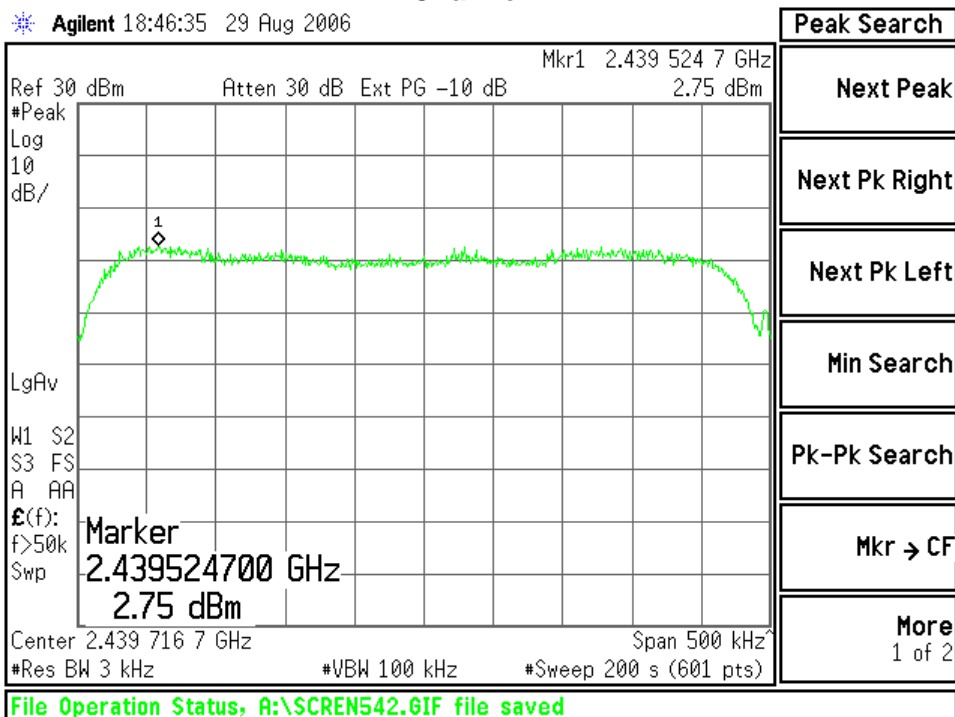
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
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10.4 Screen Captures – Power Spectral Density

Channel 0



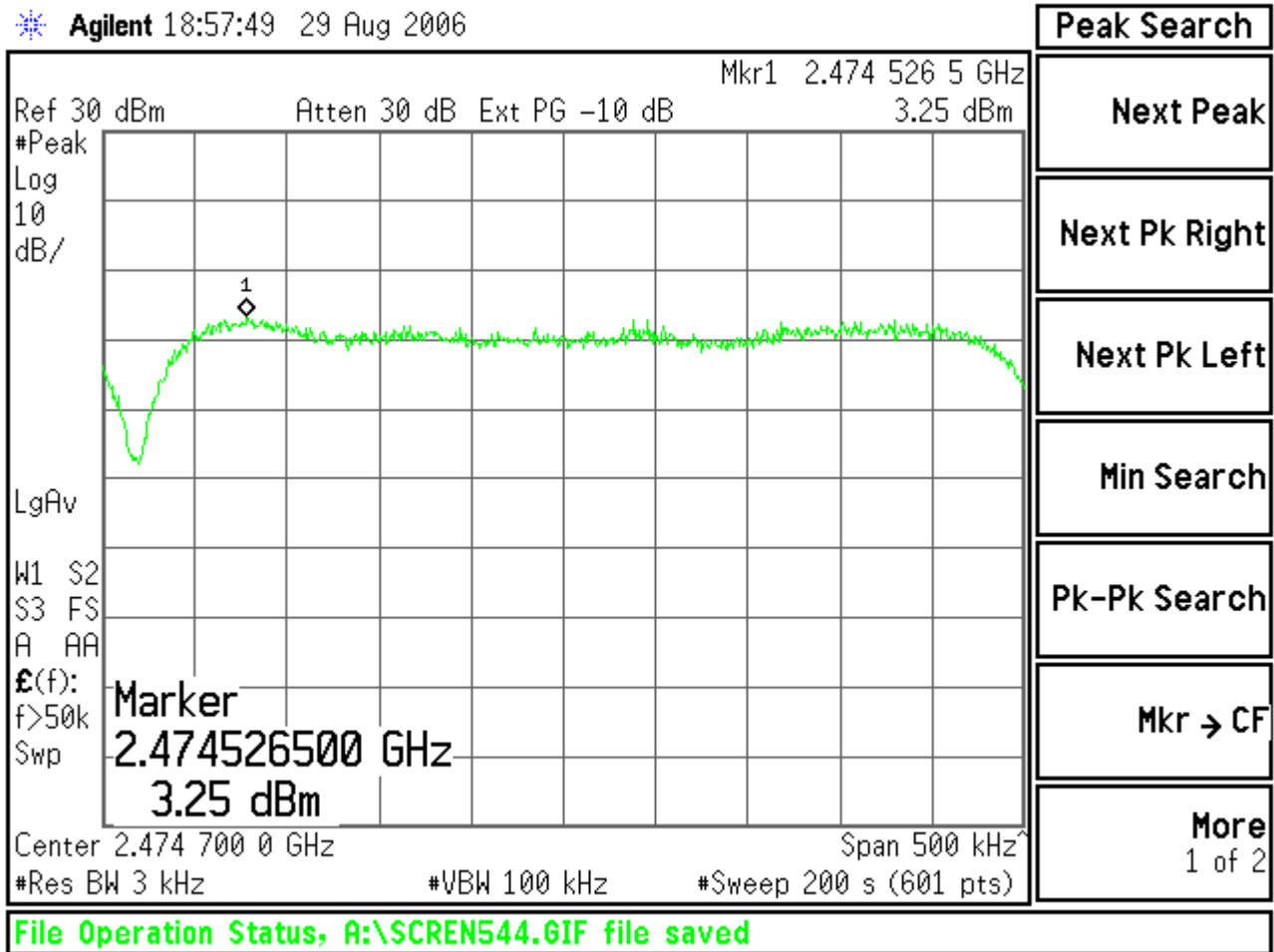
Channel 7



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Channel E

Agilent 18:57:49 29 Aug 2006



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EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
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EXHIBIT 11. SPURIOUS RADIATED 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 least 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 ($\mu\text{V}/\text{m}$)	3 m Limit ($\text{dB}\mu\text{V}/\text{m}$)	1 m Limit ($\text{dB}\mu\text{V}/\text{m}$)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-25,000	500	54.0	63.5

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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 measurements to be 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 -50 dBc of the fundamental level for this product.

11.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Agilent	E4446A	US45300564	To 44 GHz

11.3 Test Data

	Channel 0	Channel 7	Channel E
Fundamental	+ 15.6 (dBm)	+ 14.7 (dBm)	+ 15.0 (dBm)
2 nd Harmonic	- 58.0 (dBm)	- 58.5 (dBm)	- 60.7 (dBm)
3 rd Harmonic	- 66.6 (dBm)	- 69.1 (dBm)	- 68.1 (dBm)
4 th Harmonic	Note (1)	Note (1)	Note (1)
5 th Harmonic	- 63.7 (dBm)	- 62.7 (dBm)	- 67.7 (dBm)
6 th Harmonic	- 69.4 (dBm)	- 70.6 (dBm)	- 71.8 (dBm)
7 th Harmonic	Note (1)	Note (1)	Note (1)
8 th Harmonic	Note (1)	Note (1)	Note (1)
9 th Harmonic	Note (1)	Note (1)	Note (1)
10 th Harmonic	Note (1)	Note (1)	Note (1)

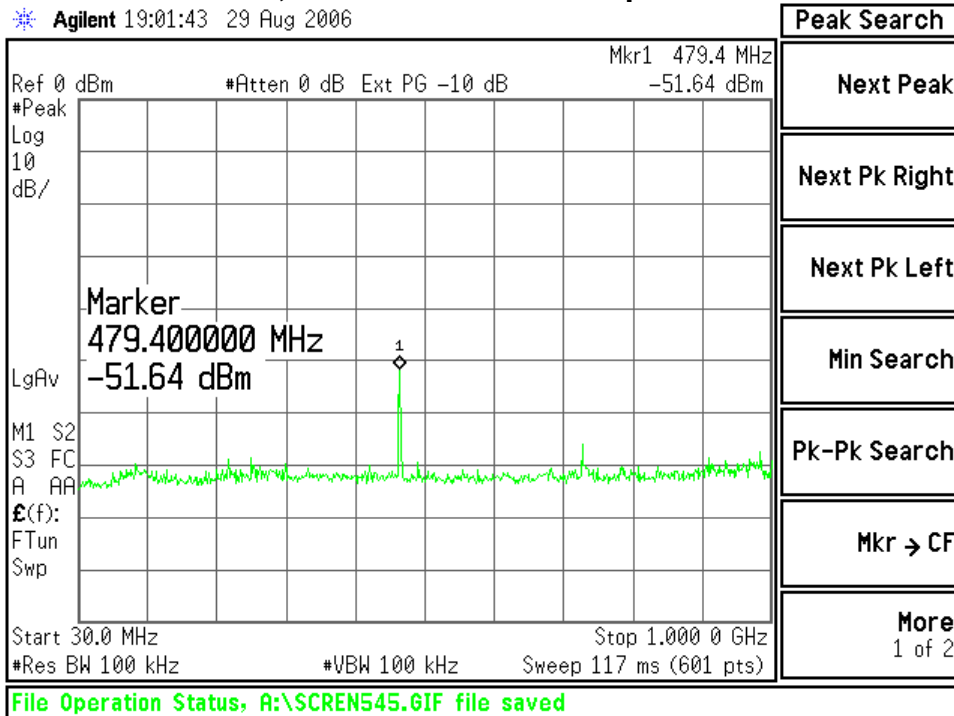
Notes:

(1) Measurement at system noise floor.

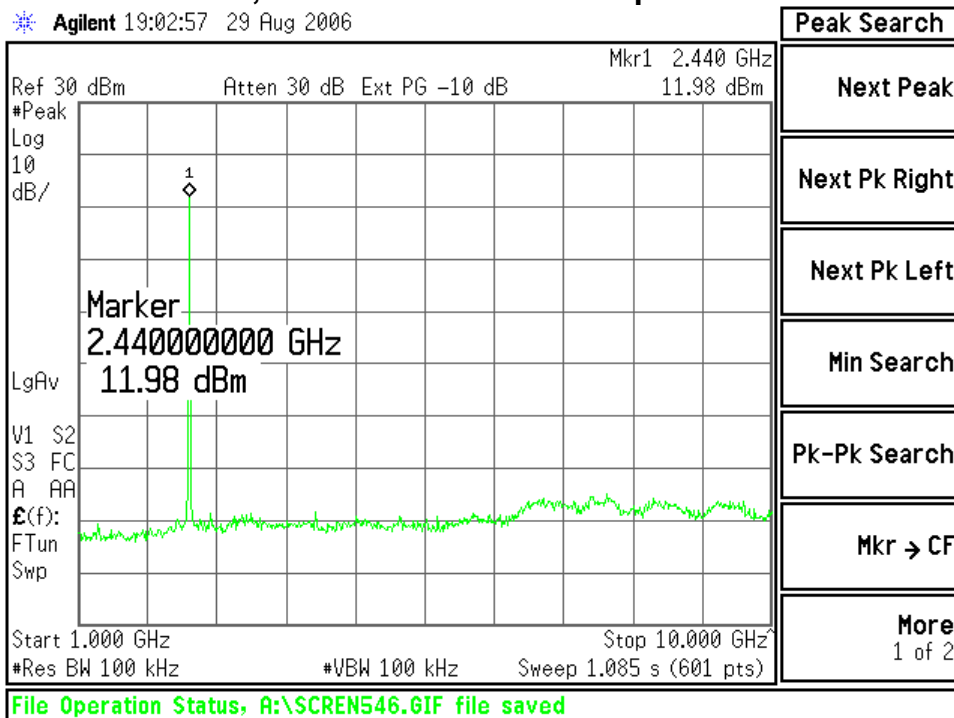
Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
Report #: 306387 TX-v1	Customer FCC ID #: TSV-HHB1BBGW	Page 43 of 52

11.4 Screen Captures – Spurious Radiated Emissions

Channel 0, shown from 30 MHz up to 1000 MHz



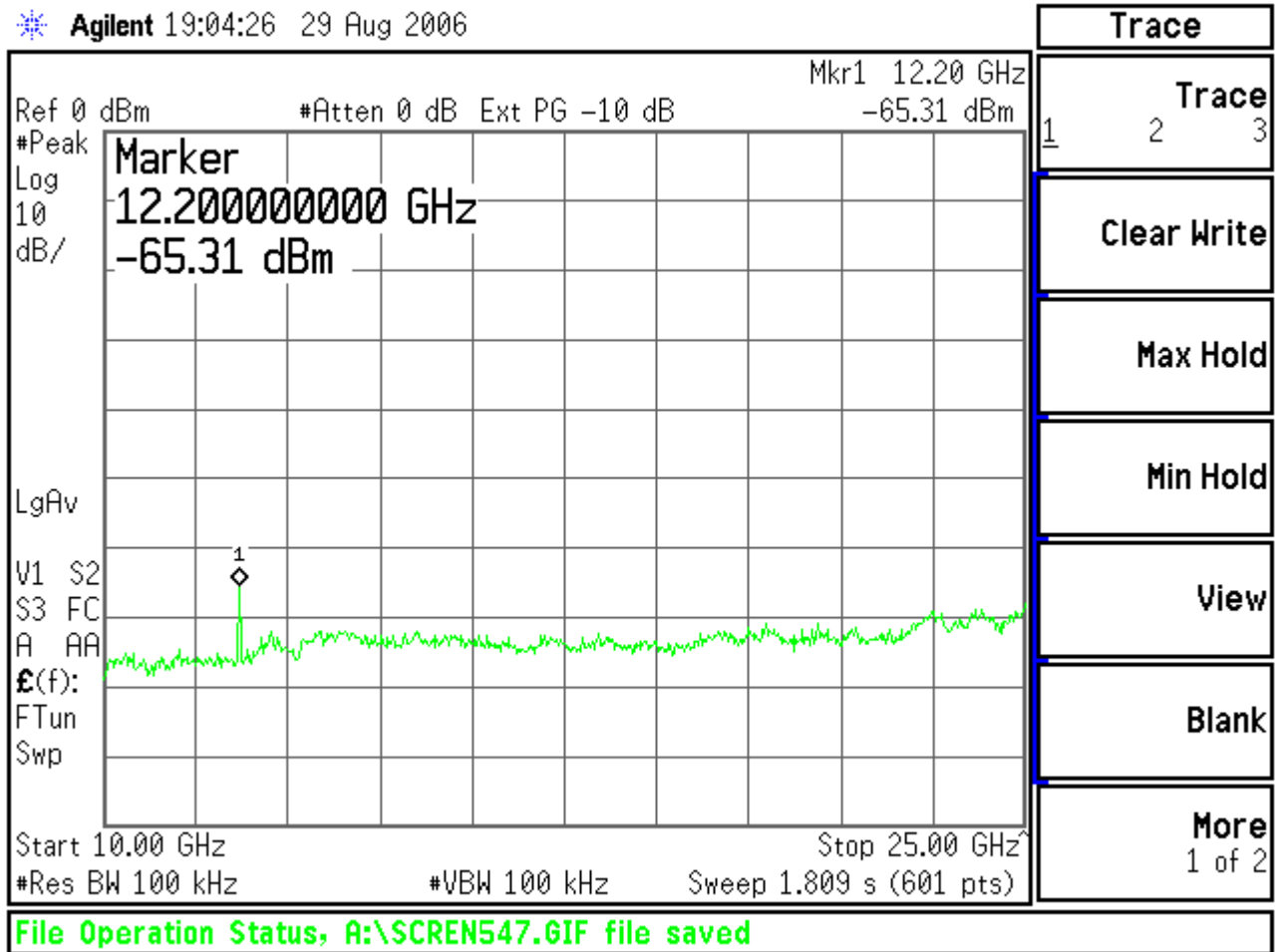
Channel 7, shown from 1000 MHz up to 10000 MHz



Prepared For: Eaton Corporation	Model #:70D5050G01	LS Research, LLC
EUT: Gateway	Serial #: 0000AF060015	Template: 15.247 DTS TX (V1 6-09-06)
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Channel E, shown from 10000 MHz up to 25000 MHz

Agilent 19:04:26 29 Aug 2006



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EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the transmitter portion of the EUT placed in CW modulated continuous transmit mode. Power was supplied by an external bench-type AC variable power supply, and the frequency of operation was monitored using the spectrum analyzer. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied.

	AC Voltage Source		
	102 VAC	120 VAC	138 VAC
Channel 0	2404.70 (MHz)	2404.70 (MHz)	2404.70 (MHz)
Channel 7	2439.75 (MHz)	2439.72 (MHz)	2439.72 (MHz)
Channel E	2474.70 (MHz)	2474.72 (MHz)	2474.72 (MHz)

The RF Power Output of the EUT was also monitored in a separate test, also using a Spectrum Analyzer with RBW=VBW=3 MHz setting while the voltage was varied.

	DC/AC Voltage Source		
	102 VAC	120 VAC	138 VAC
Channel 0	18.9 (dBm)	18.9 (dBm)	18.9 (dBm)
Channel 7	17.7 (dBm)	17.8 (dBm)	17.7 (dBm)
Channel E	18.0 (dBm)	18.0 (dBm)	18.0 (dBm)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characterizes were well behaved, and the system returned to the same state of operation as before the power cycle.

No anomalies were noted, in the measured transmit power, varying less than 1 dB, during the voltage variation tests.

EXHIBIT 13. CHANNEL PLAN AND SEPARATION

THIS TEST IS NOT REQUIRED FOR DTS SYSTEMS

EXHIBIT 14. MPE CALCULATIONS

The following MPE calculations are based on a Johanson Technology 2.45 GHz ceramic chip antenna, with a measured ERP of 113.9 dBµV/m at 1 meter, and conducted RF power of +18.9 dBm as presented to the antenna. The gain of the antenna is +0.5 dB

<u>Prediction of MPE limit at a given distance</u>	
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:	18.90 (dBm)
Maximum peak output power at antenna input terminal:	77.625 (mW)
Antenna gain(typical):	0.5 (dBi)
Maximum antenna gain:	1.122 (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:	0.017327 (mW/cm ²)
Maximum allowable antenna gain:	18.1 (dBi)
Margin of Compliance at 20 cm =	17.6 dB

APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/27/05	9/27/06
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	7/26/06	7/26/07
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	7/20/06	7/20/07
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/07/05	12/07/06
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/29/05	12/29/06
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/29/05	9/29/06
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/29/05	9/29/06
EE960073	Agilent	E4446A	US45300564	Spectrum Analyzer	2/01/06	2/01/07
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.

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

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Appendix B

Antenna Specification(s)

"High Frequency Ceramic Solutions"

2.45 GHz Antenna

P/N 2450AT18A100

Detail Specification: 09/03/03

Page 1 of 3

General Specifications

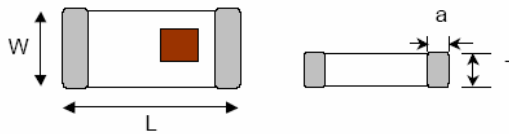
Part Number	2450AT18A100
Frequency Range	2400 - 2500 Mhz
Peak Gain	0.5 dBi typ. (XZ-V)
Average Gain	-0.5 dBi typ. (XZ-V)
Return Loss	9.5 dB min.

Input Power	500mW max.
Impedance	50 Ω
Operating Temperature	-40 to +85°C
Reel Quantity	3,000

No.	Function	Terminal Configuration
1	Feeding Point	
2	NC	

Mechanical Dimensions

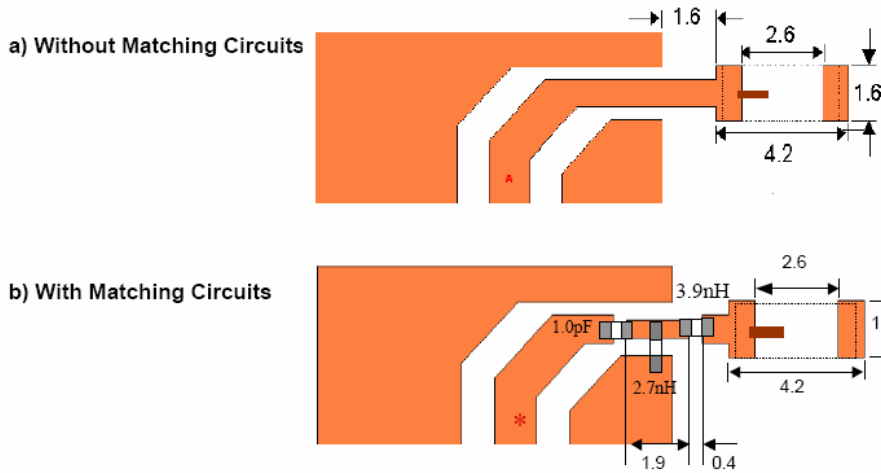
	In	mm
L	0.126 ± 0.008	3.20 ± 0.20
W	0.063 ± 0.008	1.60 ± 0.20
T	0.051 +.004/-0.008	1.30 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Mounting Considerations

Mount these devices with brown mark facing up. Units: mm

Line width should be designed to provide 50Ω impedance matching characteristics.



"High Frequency Ceramic Solutions"

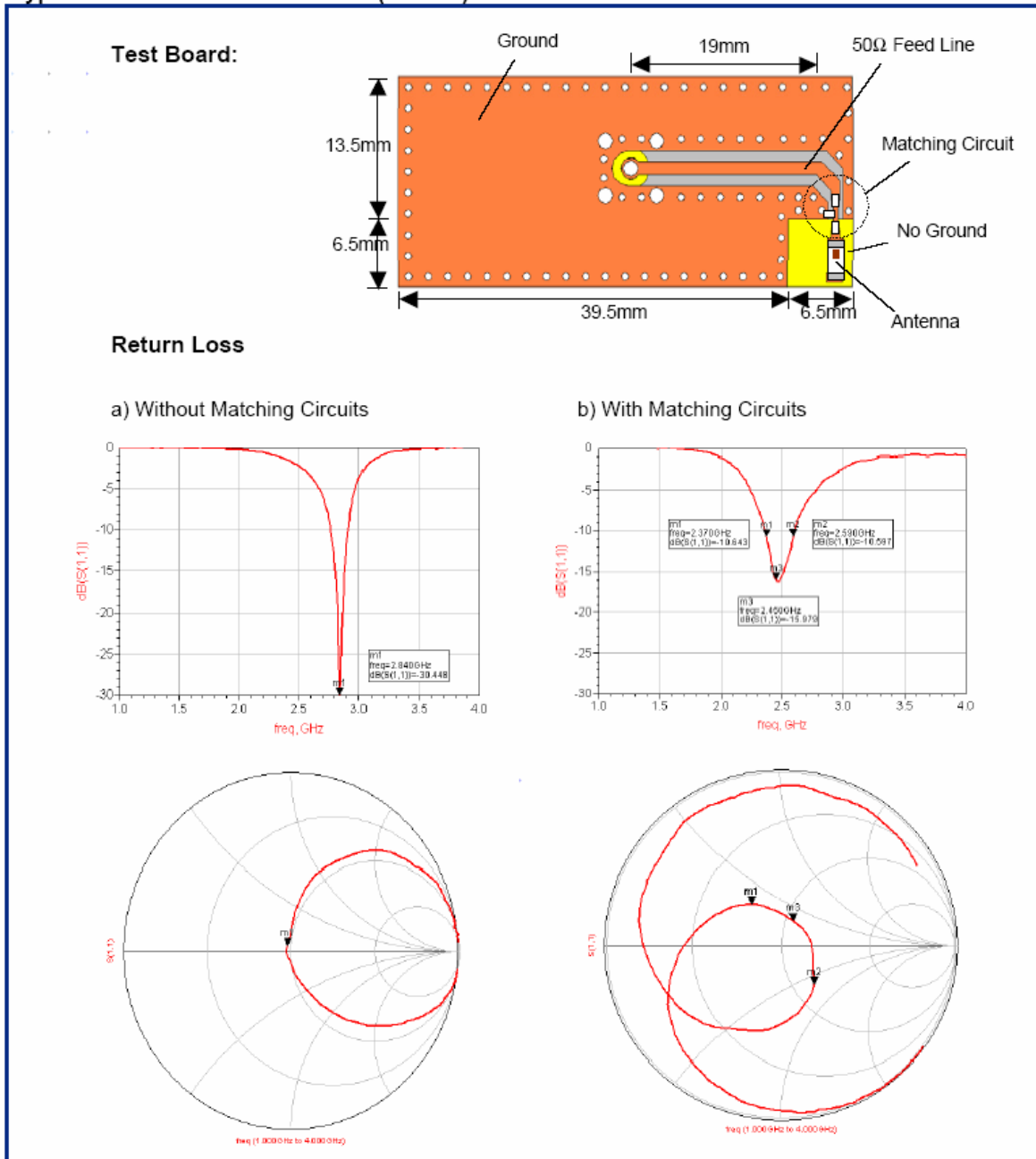
2.45 GHz Antenna

P/N 2450AT18A100

Detail Specification: 09/03/03

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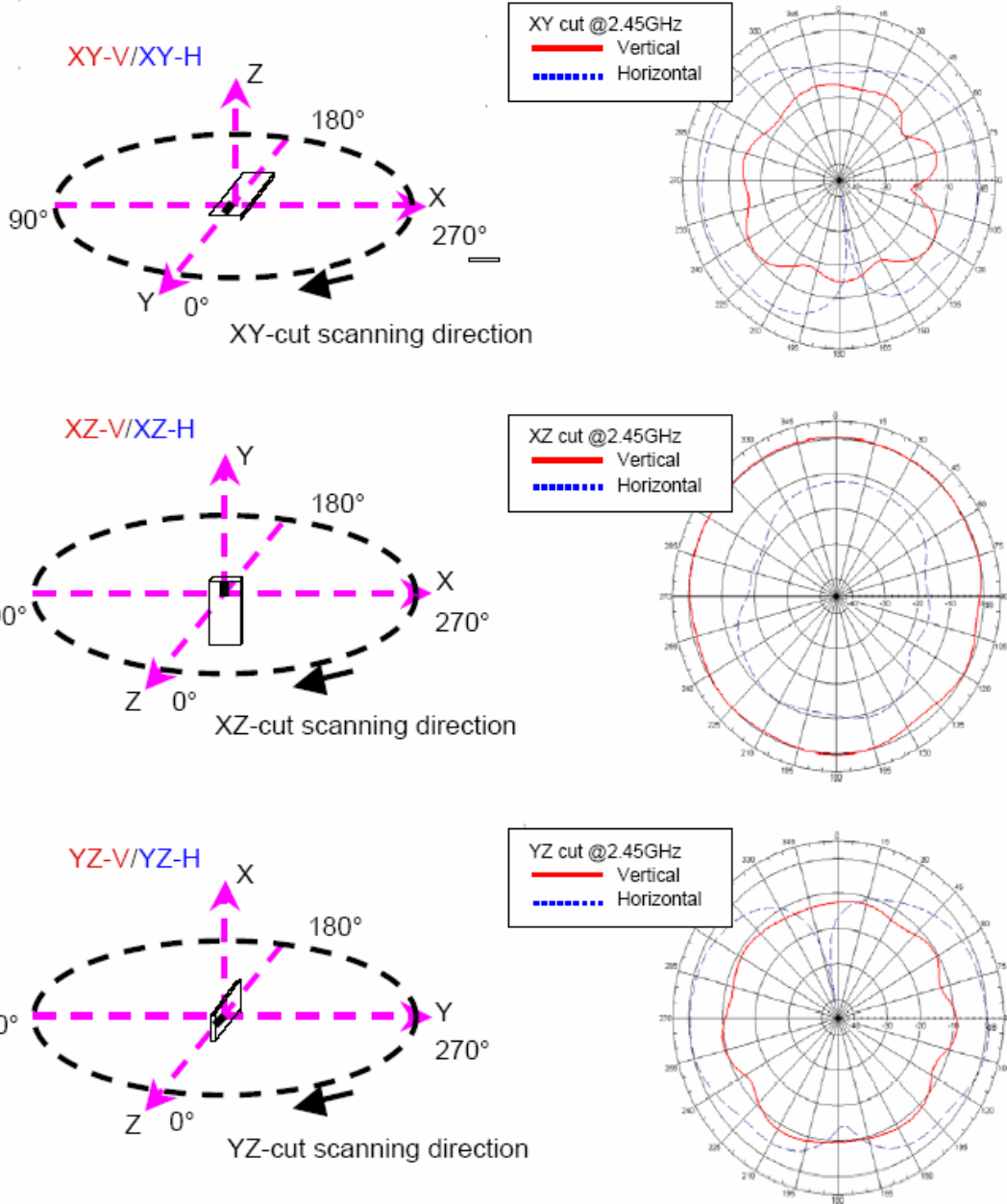
Typical Electrical Characteristics (T=25°C)



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Typical Radiation Patterns

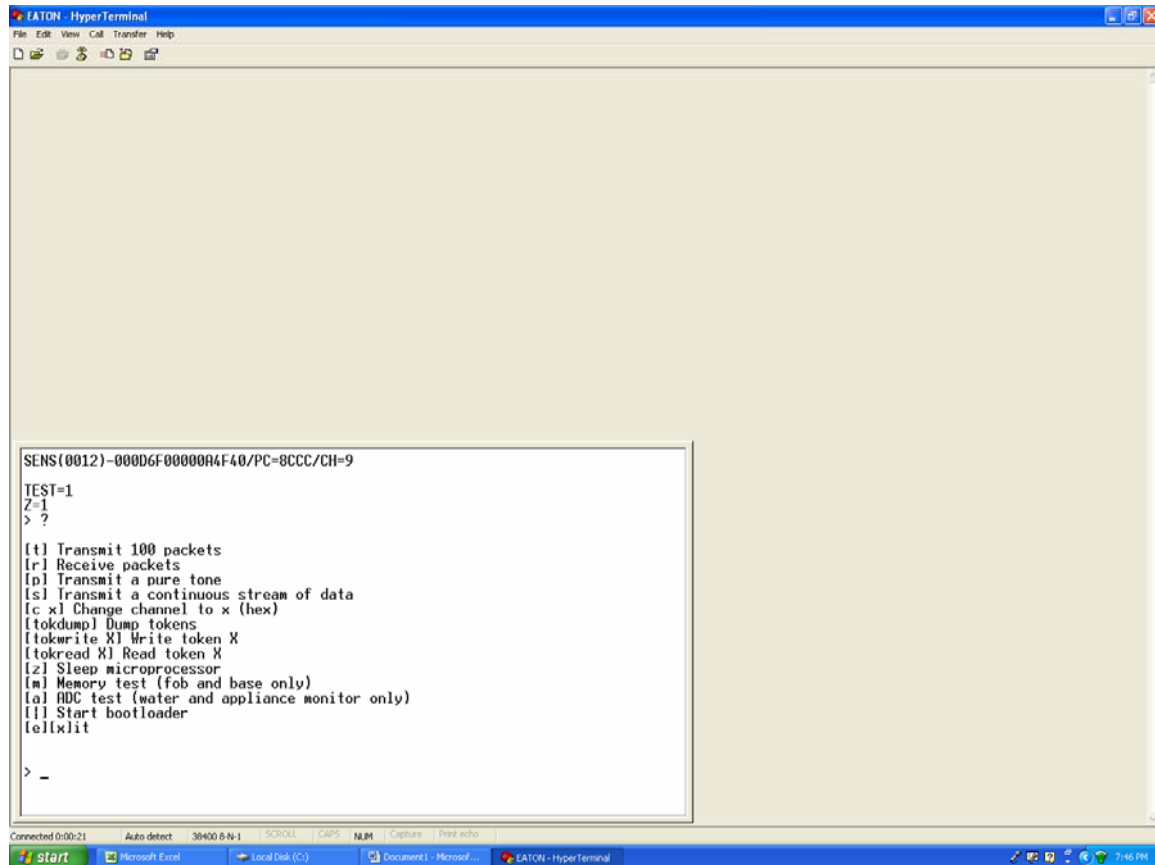


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Appendix C

Firmware and Setup Instructions



```
EATON - HyperTerminal
File Edit View Call Transfer Help
[Icons]

SENS(0012)-000D6F00000A4F40/PC-8CCC/CH=9
TEST=1
Z=1
> ?

[t] Transmit 100 packets
[r] Receive packets
[p] Transmit a pure tone
[s] Transmit a continuous stream of data
[c x] Change channel to x (hex)
[tokdump] Dump tokens
[tokwrite X] Write token X
[tokread X] Read token X
[z] Sleep microprocessor
[m] Memory test (fob and base only)
[a] ADC test (water and appliance monitor only)
[l] Start bootloader
[e] Exit

> _
```

1. Connect the LSR Freestar Interface Board to J4 on the PCB.
2. Start Hyperterminal on PC.
3. Set serial port parameters to 38400 Bauds, 8 data bits, 1 stop, no parity and no flow control.
4. Press 'T' key and the prompt '>' will appear.
5. To set channel type 'c x' and enter (x=0 to F)
6. To transmit a continuous stream of data, type 's' and enter. As long as there is no power interruption, the cable connected to J4 can be removed without affecting this setting.
7. Please refer to figure above for the test menu which was generated by typing '?' at the prompt and pressing enter.

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