FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

FOR

BROADCOM BLUETOOTH HID MODULE

MODEL NUMBER: BCM92040LMF-M

FCC ID: QDS-BRCM1010

REPORT NUMBER: 03U2374-1

ISSUE DATE: FEBRUARY 06, 2004

Prepared for
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1. TEST RESULT CERTIFICATION

COMPANY NAME: BROADCOM CORP.
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A

EUT DESCRIPTION: BROADCOM BLUETOOTH HID MODULE

MODEL: BCM92040LMF-M

DATE TESTED: NOVEMBER 18, 2003 TO FEBRUARY 06, 2003

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By:

THU CHAN
CHIEF EMC ENGINEER
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2. EUT DESCRIPTION

The EUT is a Bluetooth transceiver module operating in the 2400-2483.5 MHz band.

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2402 - 2480	2.52	1.79

The radio utilizes an Integral PCB antenna with a maximum gain of 1.87 dBi.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2001, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

NVLAP®

LAB CODE:200065-0

No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST AND MEASUREMENT EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/2004
RF Filter Section	HP	85420E	3705A00256	11/21/2004
Bilog Antenna 30MHz~ 2Ghz	Sunol Sciences	JB1 Antenna	A121003	12/22/2004
Spectrum Analyzer 20Hz ~ 44GHz	Agilent	E4446A	MY43360112	1/33/2005
Communication Tester	R & S	CMU 200	838114/032	12/1/2004
EMI Test Receiver 20Hz ~ 40GHz	R & S	ESIB40	100192	11/21/2004
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/7/2004
Peak Power Meter	Agilent	E4416A	GB41291160	11/7/2004
Preamplifier, 1 ~ 26 GHz	Miteq	NSP10023988	646456	4/25/2004
Preamplifier 1-26GHz	MITEQ	NSP2600-SP	924341	4/25/2004
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	2/4/2004
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	2/4/2004
Spectrum Analyzer 3Hz ~ 26.5GHz	Agilent	E4440A	US41421507	5/8/2004
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	2/2/2004
Antenna, Bicon/log, 25-2000 MHz	ARA	LPB-2520/A	1185	3/6/2004
2.4-2.5GHz Reject filter	Micro-Tronics	BRM50702	1	N/A
10dB Attenuator	Weinschel	56-10	k16148	N/A

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
BROADCOM BLUETOOTH HID MODULE	BROADCOM CORP	BCM92040LMF-M	N/A	QDS-BRCM1010
*ADAPTER BOARD / TEST JIG	BROADCOM CORP	N/A	N/A	N/A
*AC ADAPTER	CUI, INC.	CEPA-151DA-05	N/A	N/A

*USED ONLY FOR TESTING PURPOSES

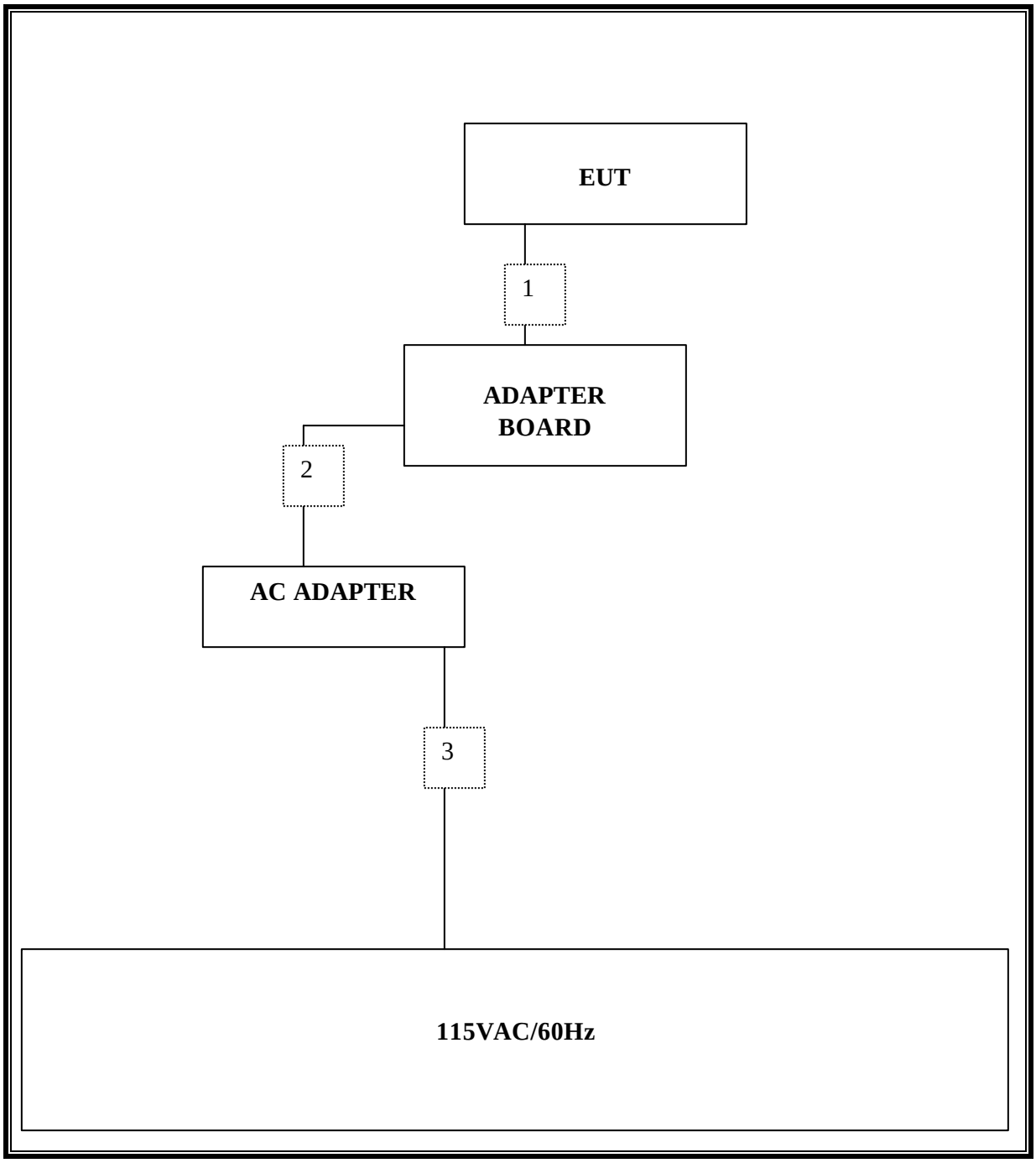
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	CTRL/PWR	1	HARDWIRED	UNSHIELDED	0.2M	USED ONLY FOR TESTING PURPOSES
2	DC POWER	1	DC PWR	UNSHIELDED	1.86M	USED ONLY FOR TESTING PURPOSES
3	AC PWR	1	AC PWR	UNSHIELDED	1.86M	USED ONLY FOR TESTING PURPOSES

TEST SETUP

During the testing process, positions X, Y, and Z were tested “Y” position was found to be worst case because it yielded the highest radiated power. The EUT was set in continues transmit mode and tested in PRBS9 mode for all non-hopping tests.

SETUP DIAGRAM FOR TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

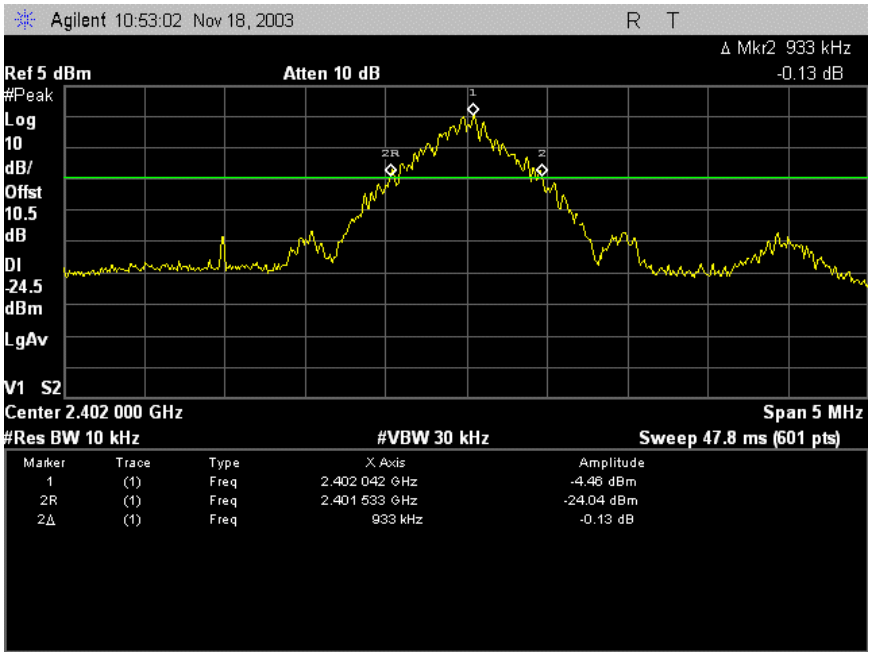
RESULTS

No non-compliance noted:

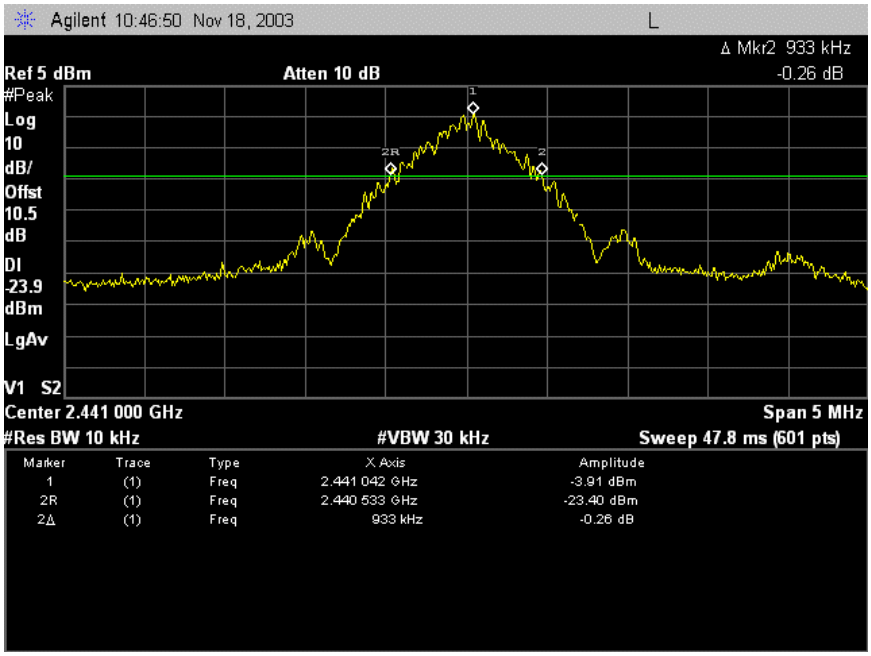
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	933
Middle	2441	933
High	2480	950

20 dB BANDWIDTH

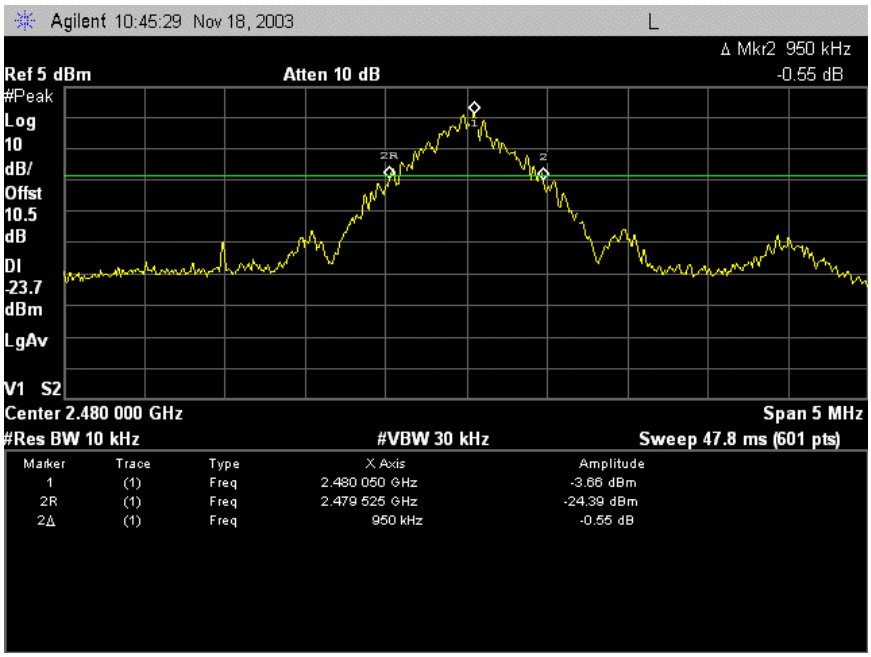
20 dB BANDWIDTH LOW CH



20 dB BANDWIDTH MID CH



20 dB BANDWIDTH HIGH CH



7.2. HOPPING FREQUENCY SEPARATION

LIMIT

§15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

TEST PROCEDURE

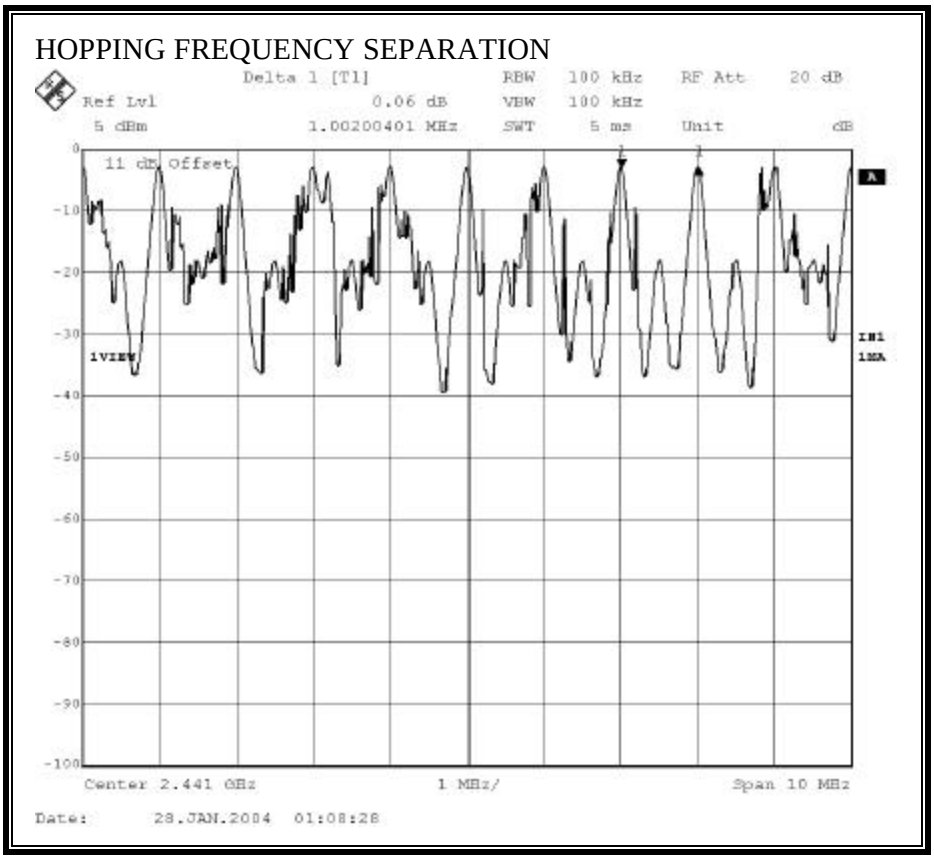
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

Channel Separation (kHz)	20 dB Bandwidth (kHz)	Margin (kHz)
1002	950	52

No non-compliance noted:

HOPPING FREQUENCY SEPARATION



7.3. NUMBER OF HOPPING CHANNELS

LIMIT

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

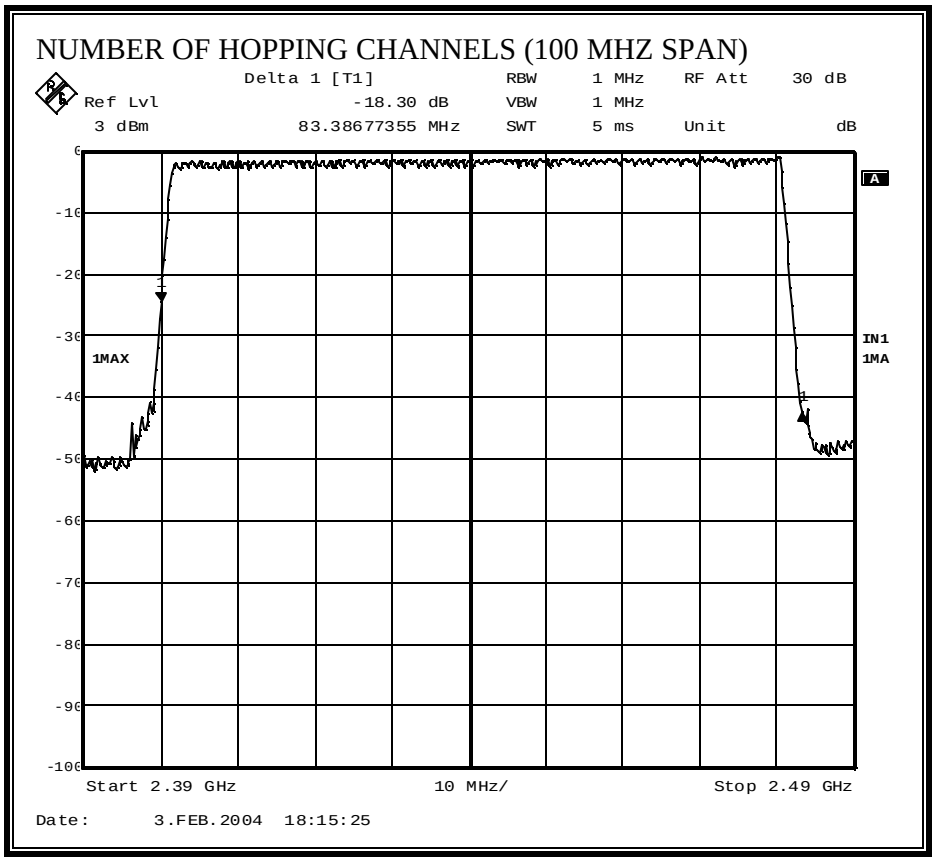
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

RESULTS

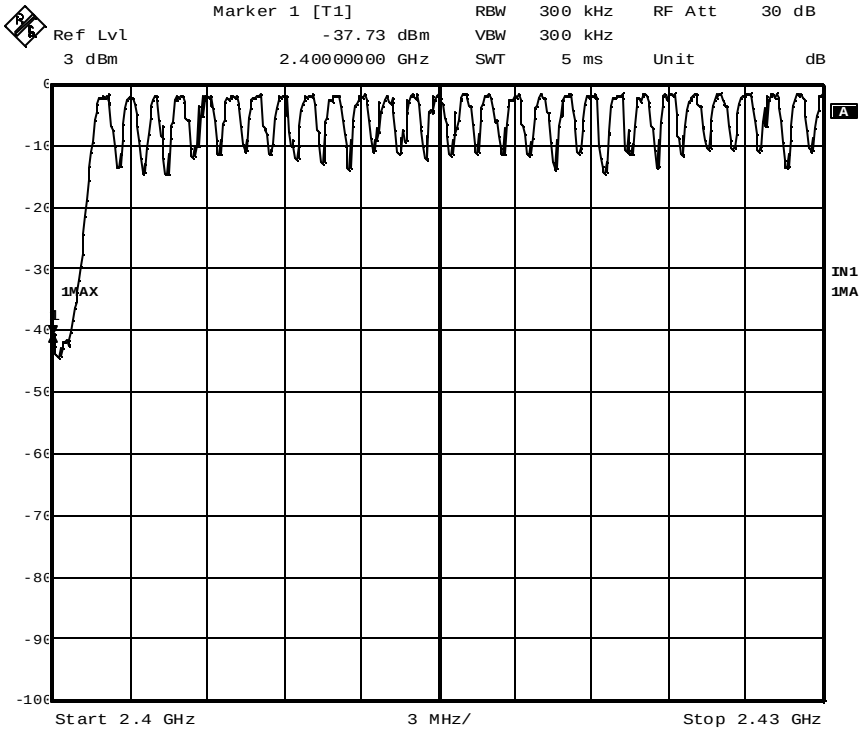
Channels Observed
79

No non-compliance noted:

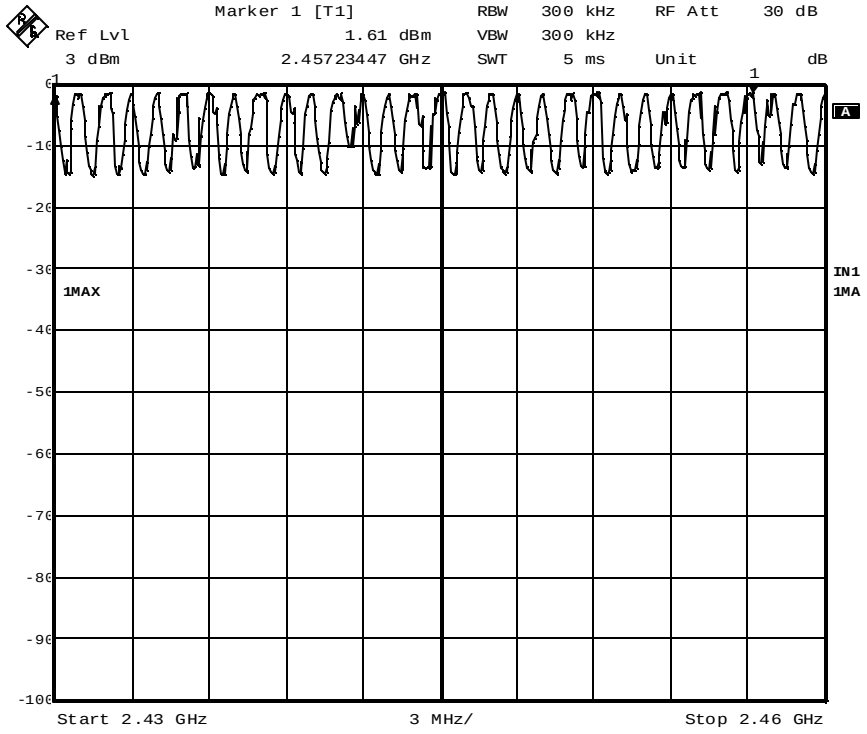
NUMBER OF HOPPING CHANNELS



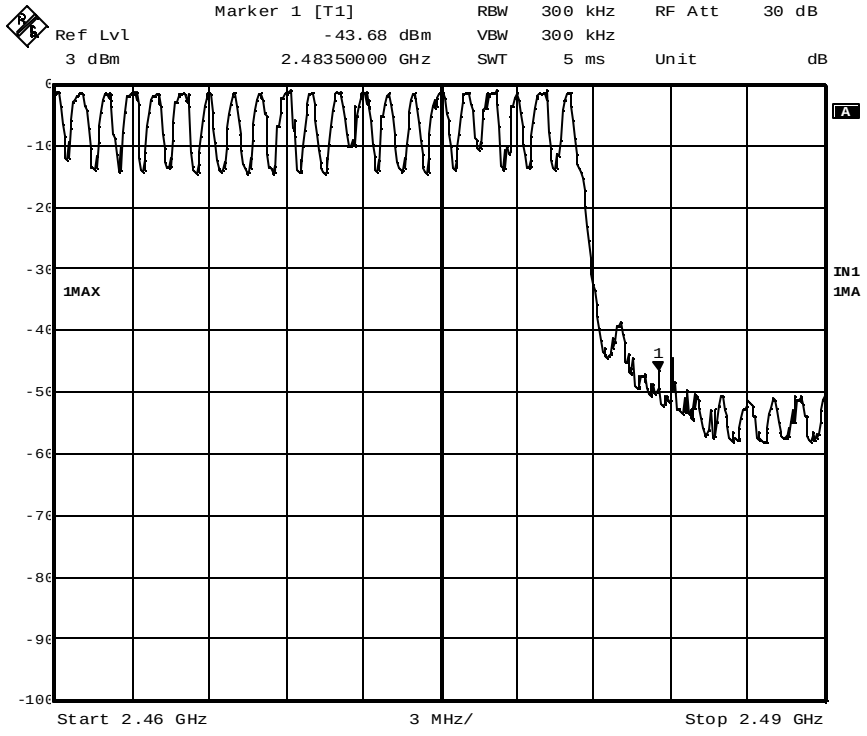
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



7.4. AVERAGE TIME OF OCCUPANCY

LIMIT

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

No non-compliance noted:

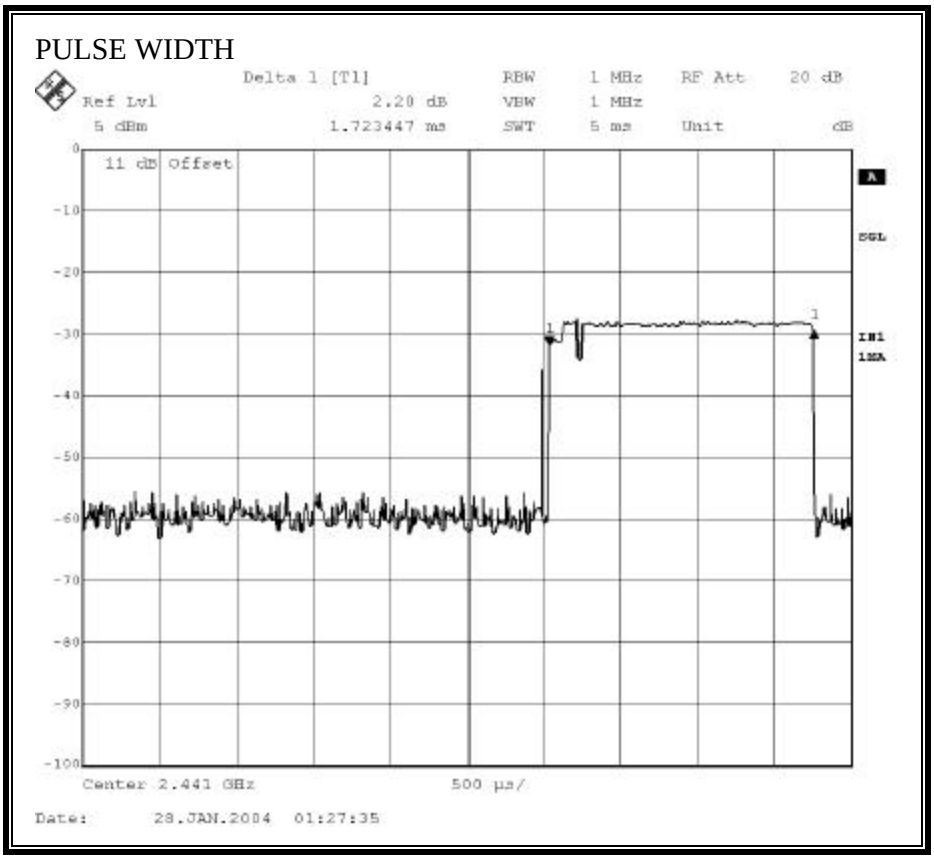
# of Occurrence/Pulses in 3.16 sec
14

14 (occurrence/pulse in 3.16 seconds) x 10 = 140 (pulses in 31.6 seconds)

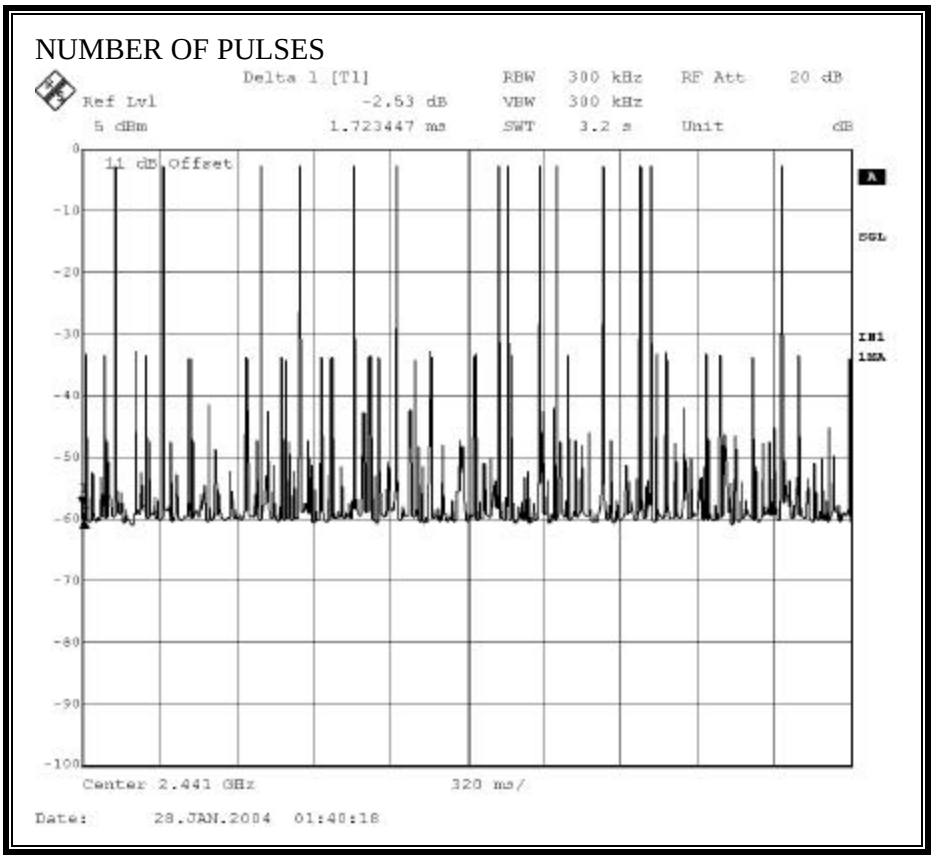
Pulse Width (ms)	# of Occurrence/Pulses in 31.6 sec	Time of Occupancy (sec)	Limit (sec)	Margin (sec)
1.723	140	0.241	0.400	0.159

Note: DH3 packets were found to be worst case and were used for testing purposes. The EUT uses DH1 and DH3 packets only.

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



7.5. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 1.87 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

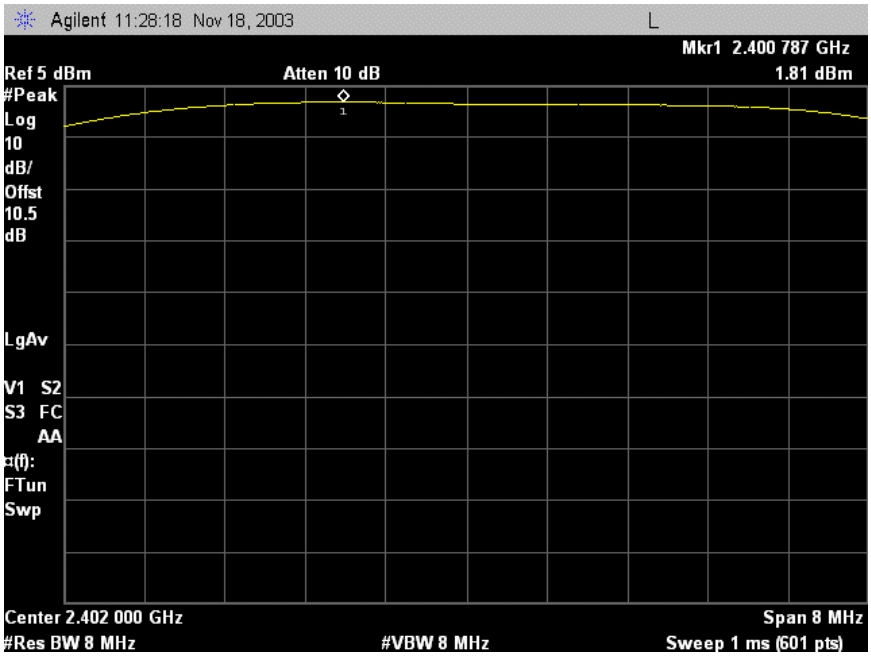
RESULTS

No non-compliance noted:

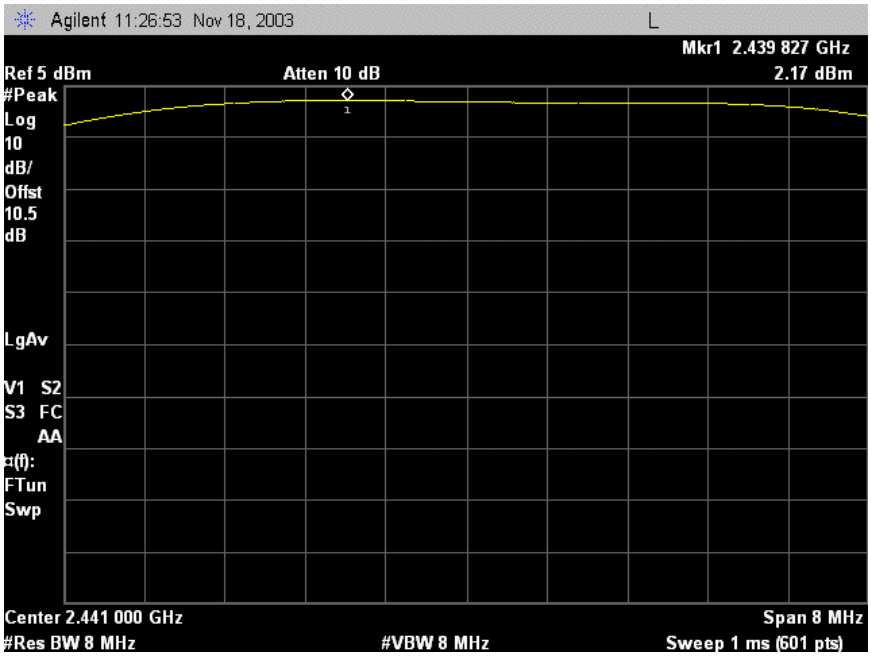
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	1.81	30	-28.19
Middle	2441	2.17	30	-27.83
High	2480	2.52	30	-27.48

OUTPUT POWER

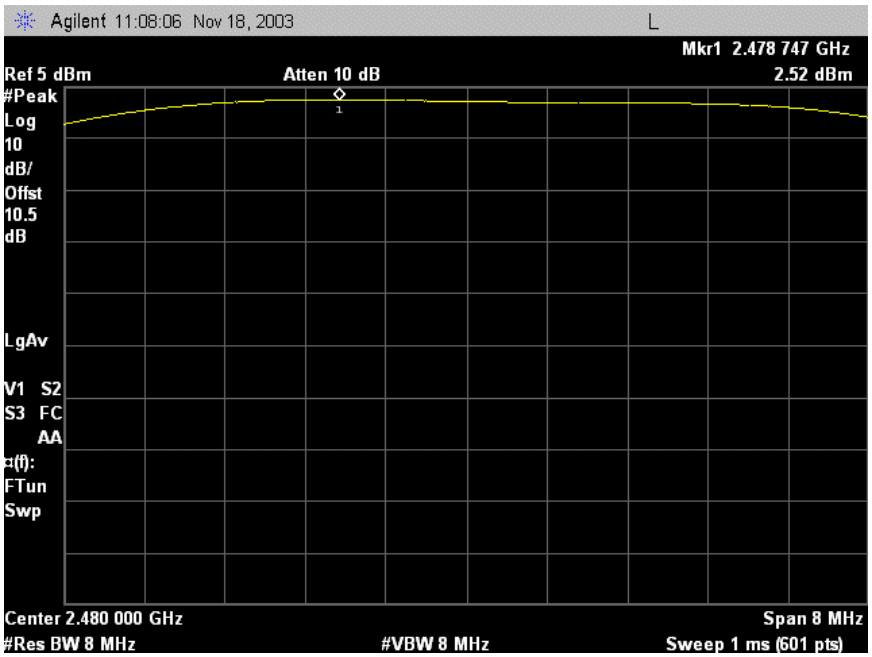
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



7.6. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S}$ Equation (1)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

No non-compliance noted:

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
1.0	2.52	1.87	0.47

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.7. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	1.07
Middle	2441	1.67
High	2480	1.89

7.8. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (d) For direct sequence systems, the peak 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.

§15.247 (f) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

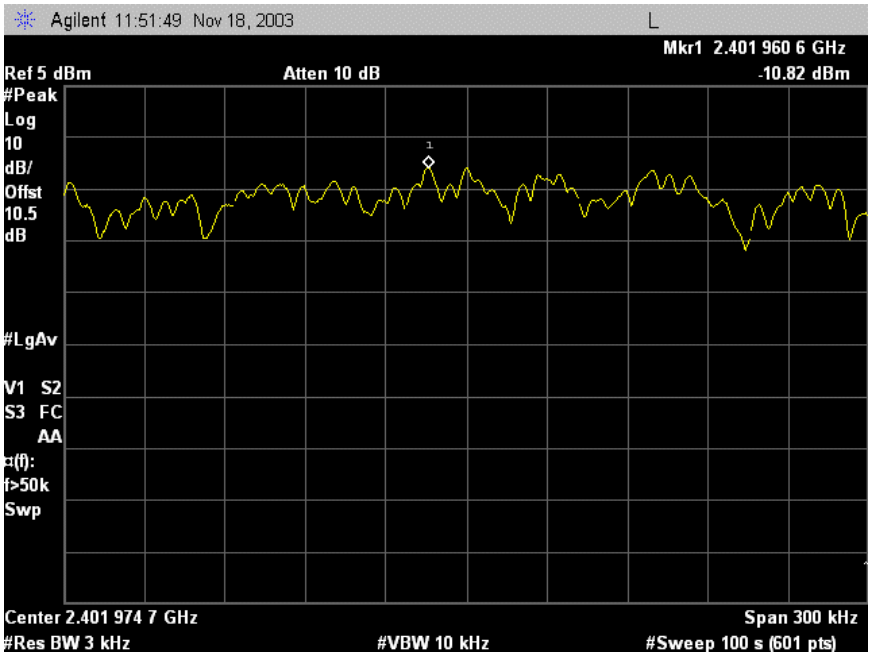
RESULTS

No non-compliance noted:

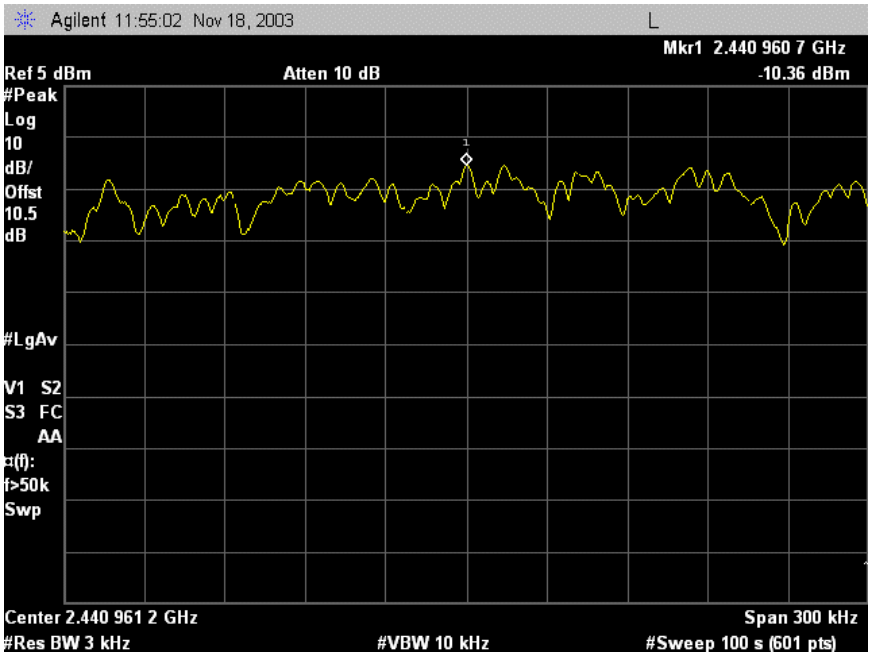
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-10.82	8	-18.82
Middle	2441	-10.36	8	-18.36
High	2480	-10.17	8	-18.17

PEAK POWER SPECTRAL DENSITY

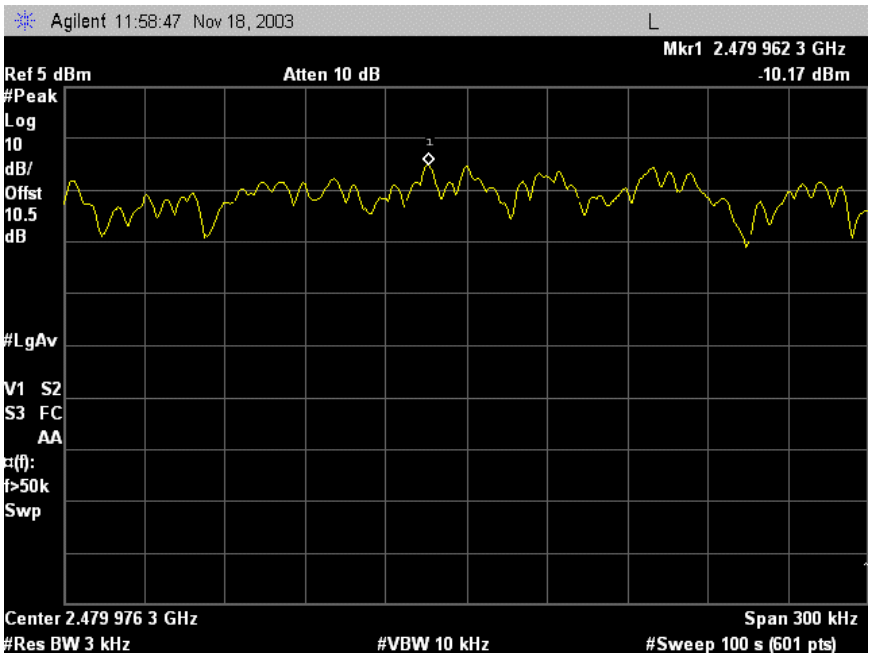
PPSD LOW CH



PPSD MID CH



PPSD HIGH CH



7.9. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

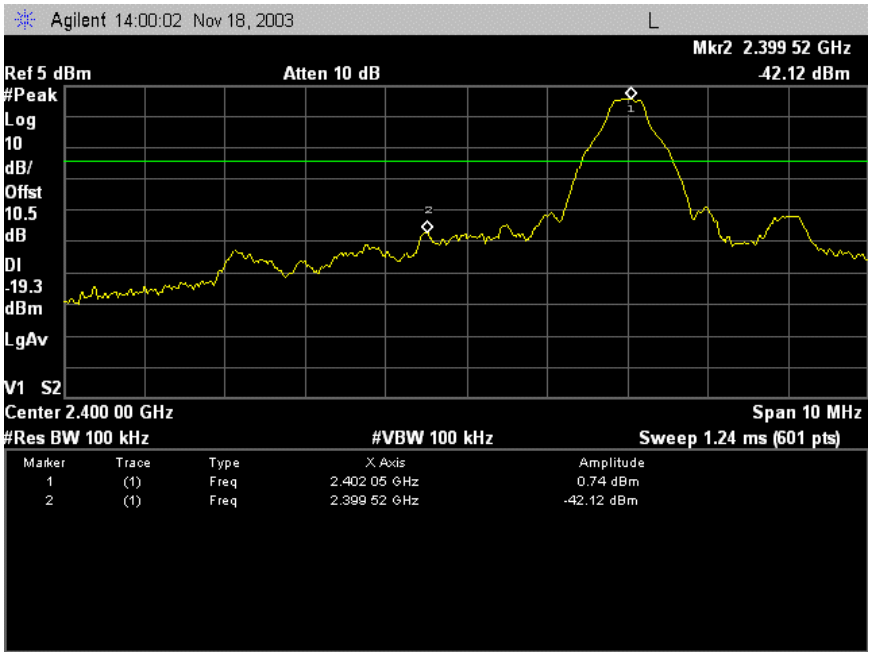
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

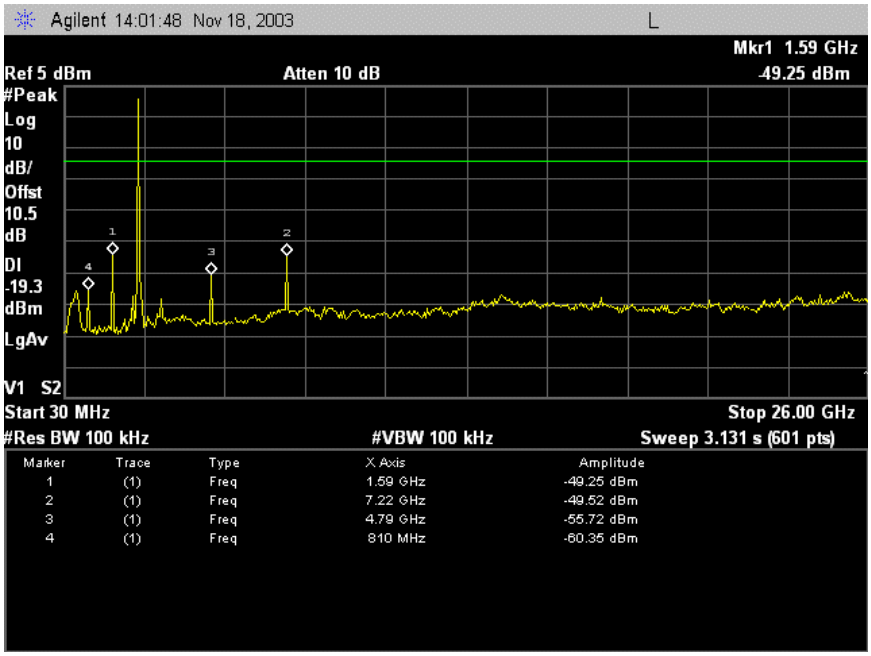
No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

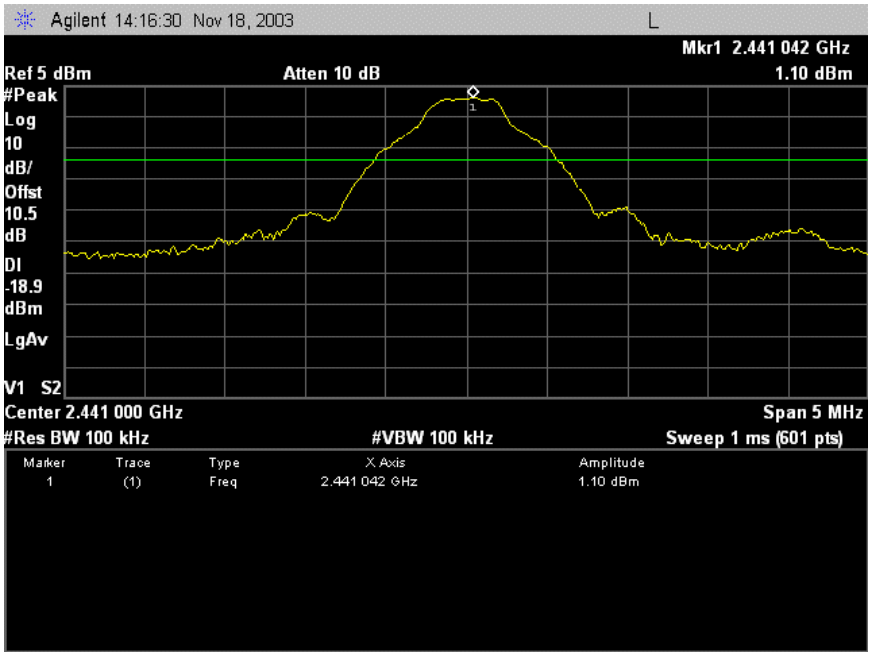


LOW CHANNEL SPURIOUS

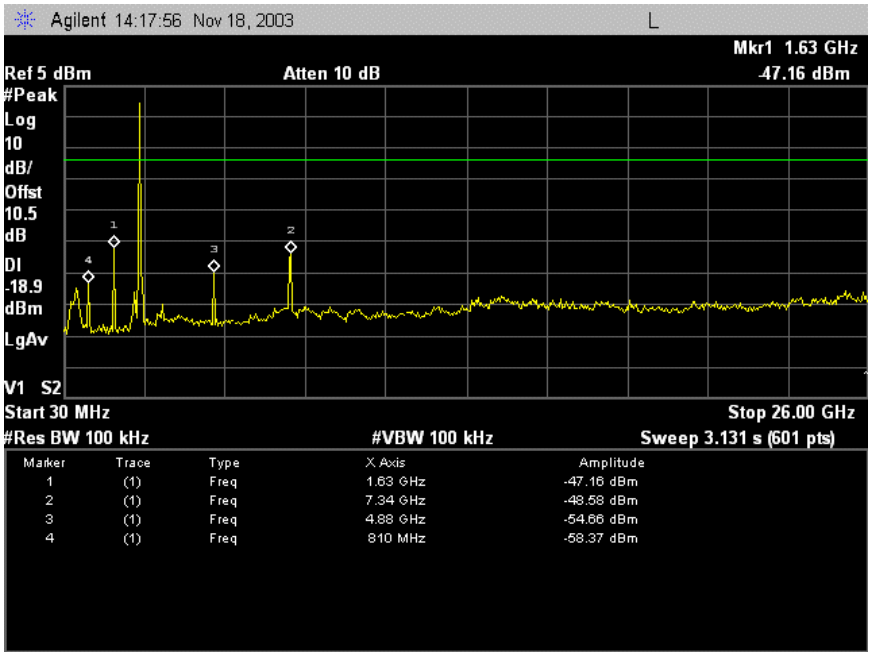


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE

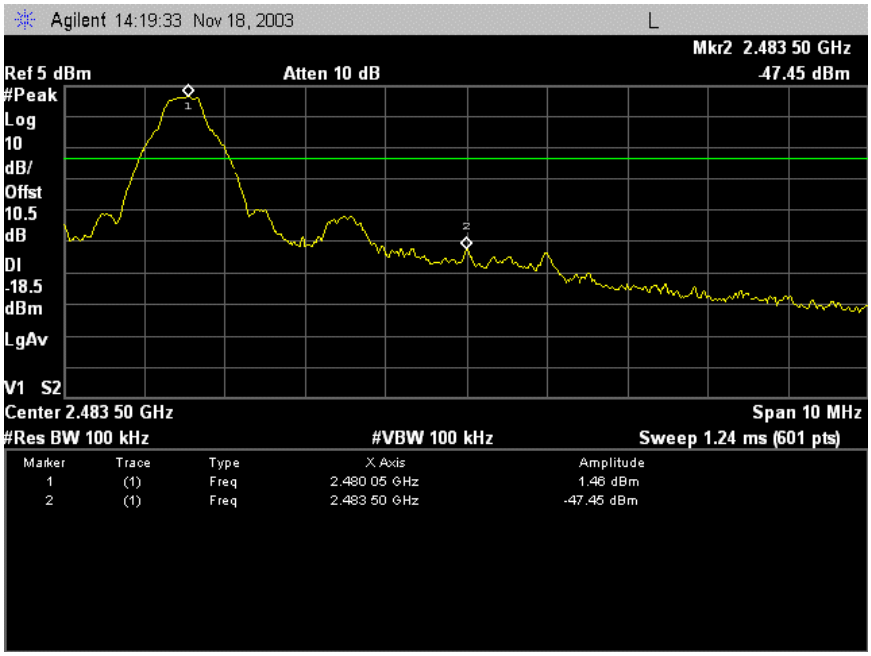


MID CHANNEL SPURIOUS

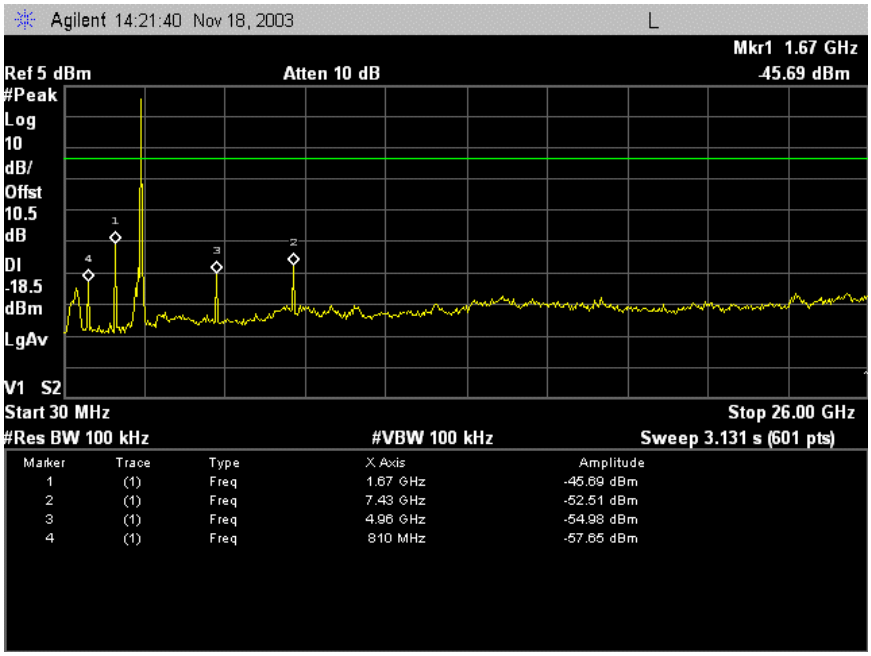


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

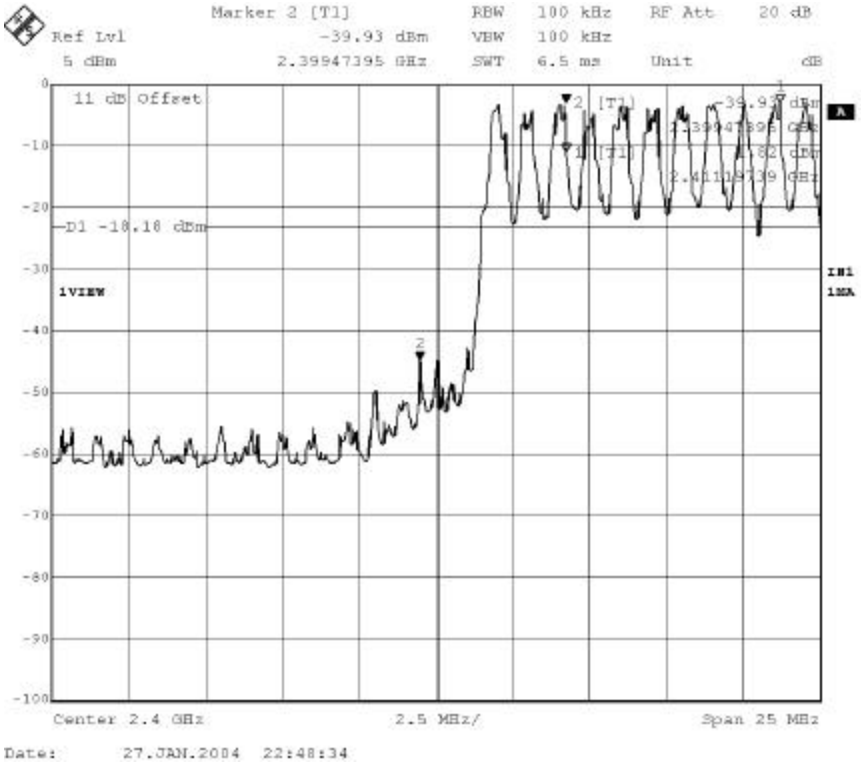


HIGH CHANNEL SPURIOUS

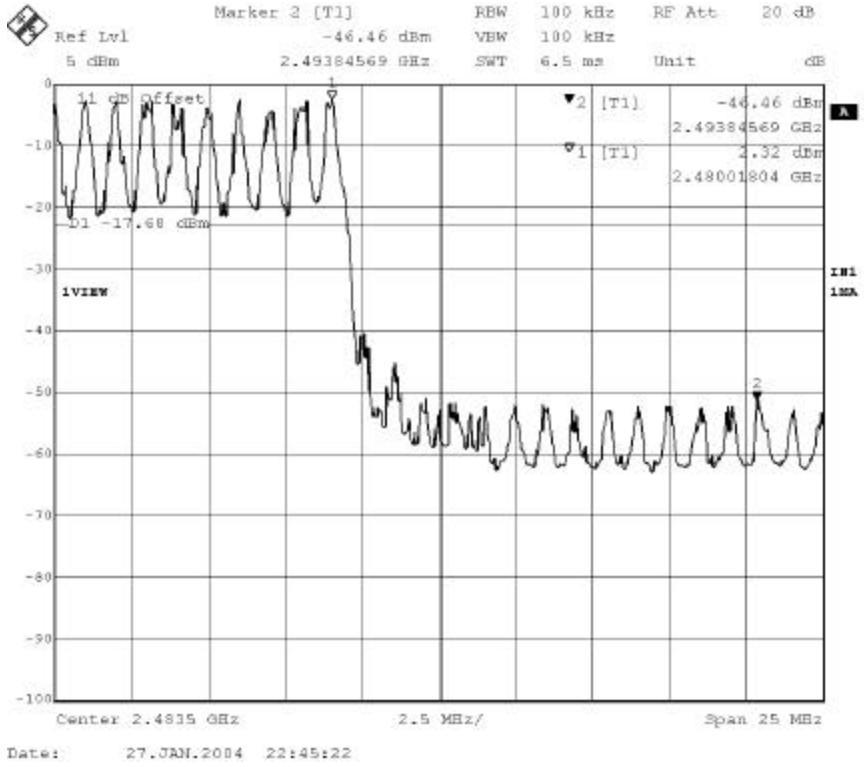


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



7.10. RADIATED EMISSIONS

7.10.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

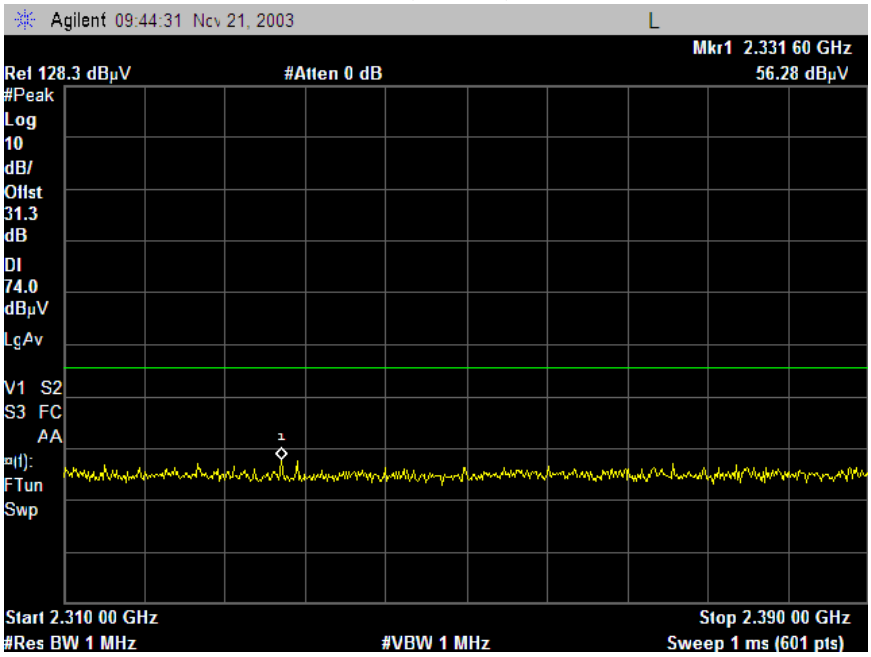
RESULTS

No non-compliance noted:

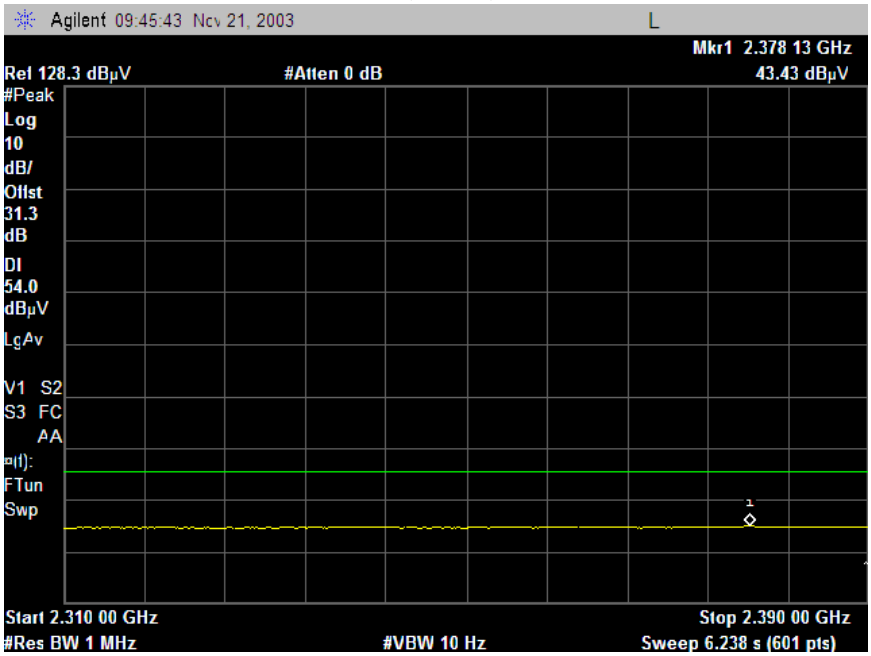
7.10.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

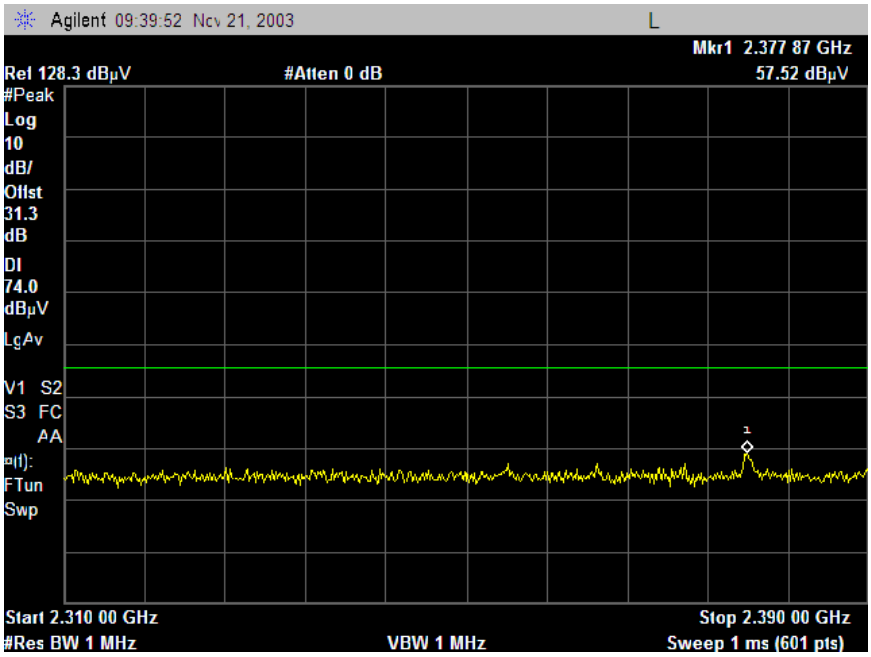


LOW CHANNEL RESTRICTED, AVG, HORIZ

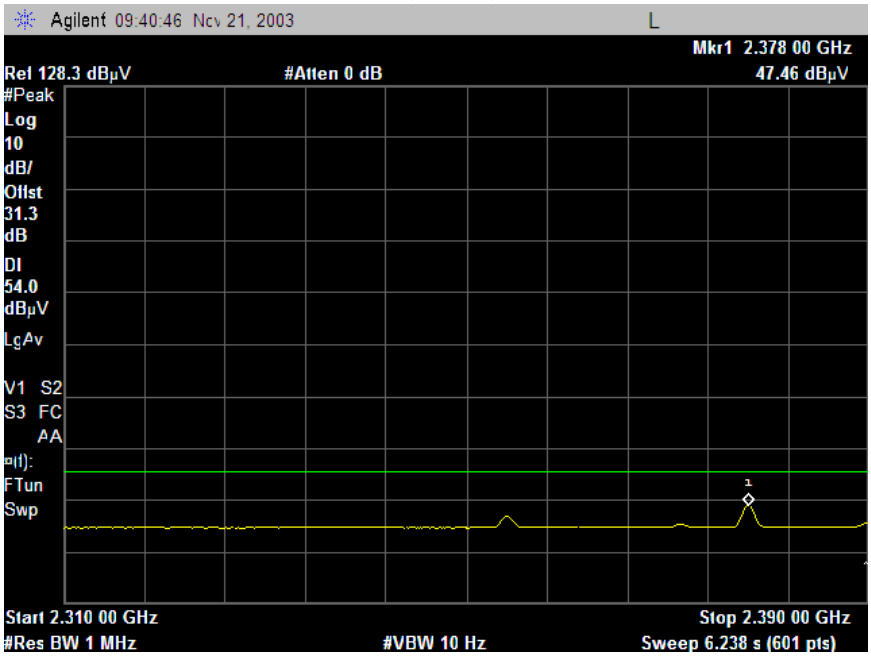


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

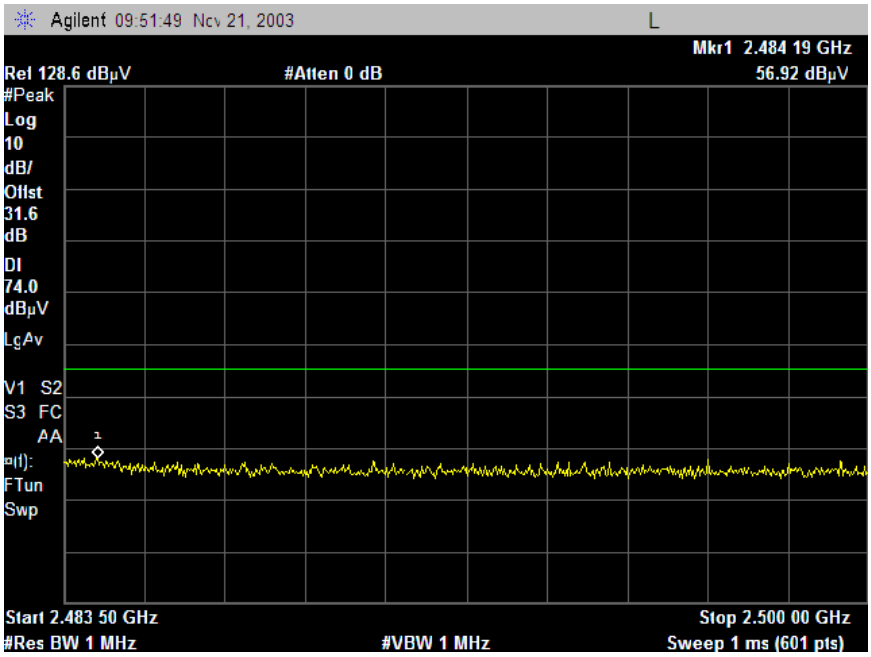


LOW CHANNEL RESTRICTED, AVG, VERT

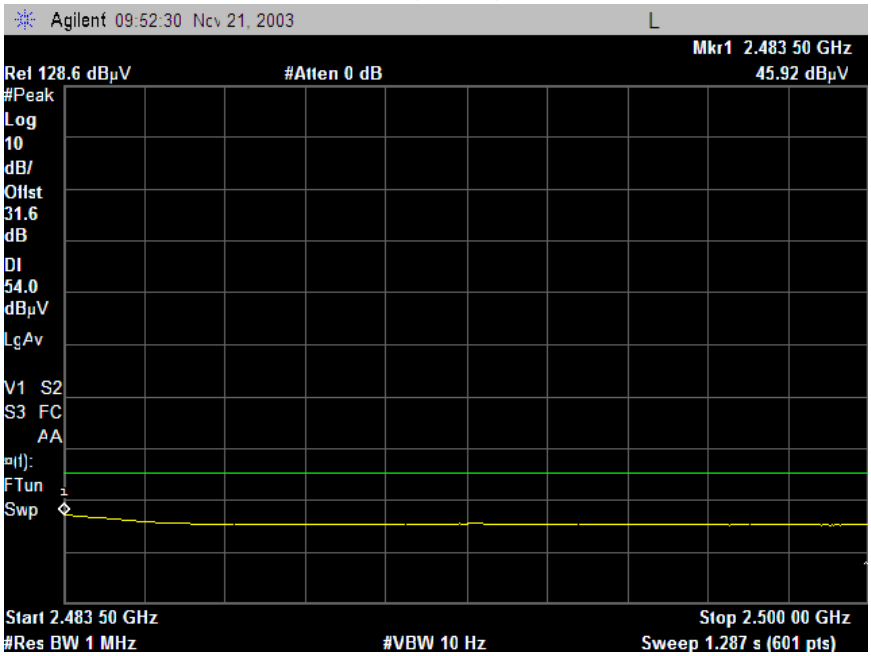


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

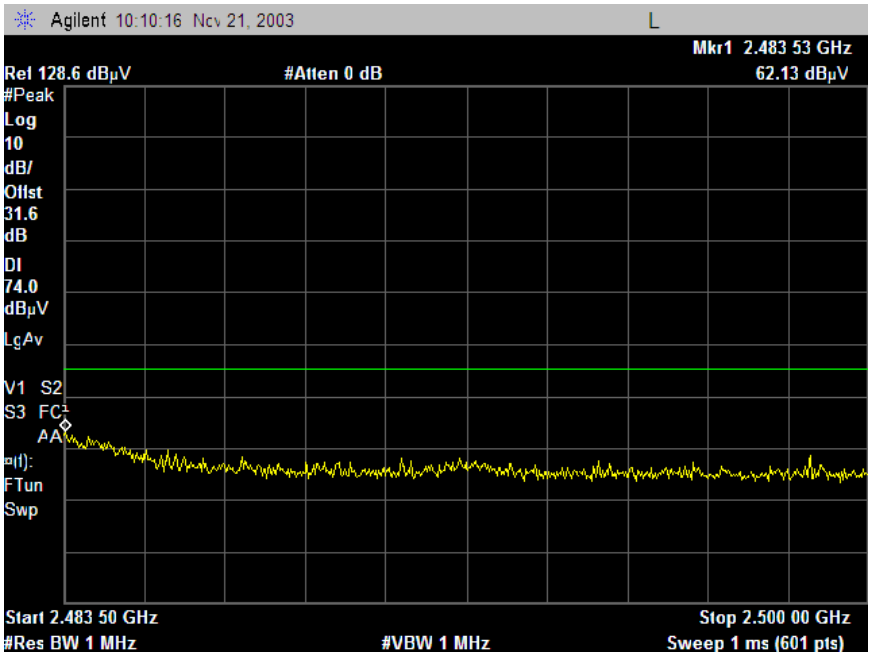


HIGH CHANNEL RESTRICTED, AVG, HORIZ

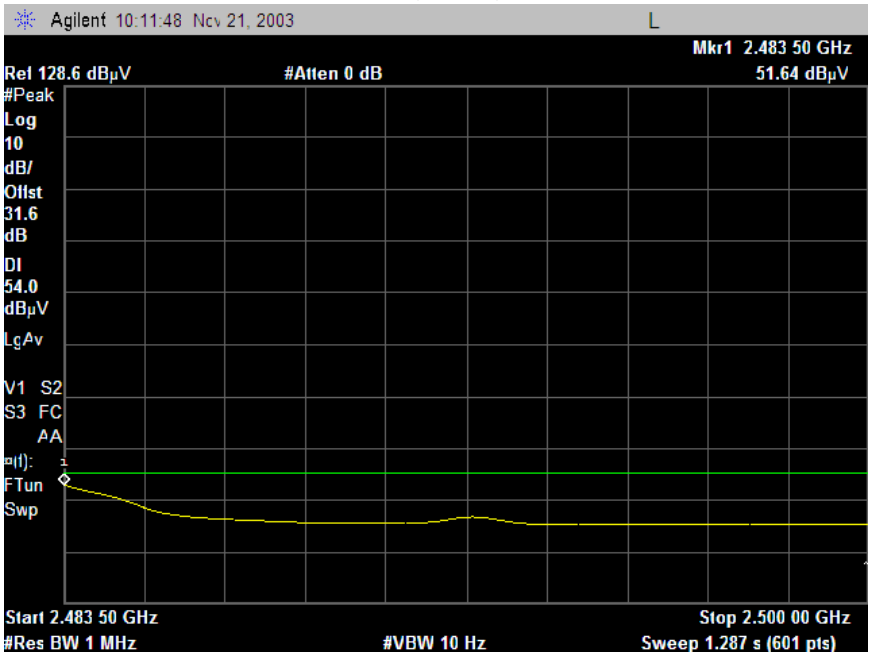


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

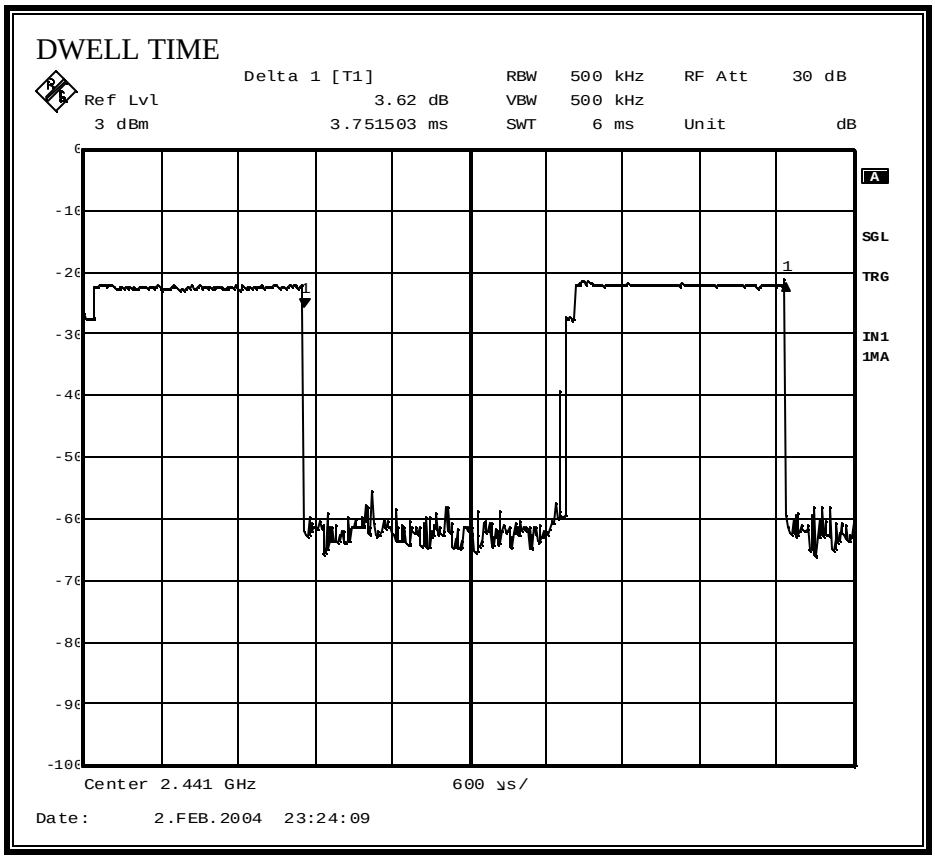
HIGH CHANNEL RESTRICTED, PEAK, VERT



HIGH CHANNEL RESTRICTED, AVG, VERT



DUTY CYCLE CORRECTION FACTOR



*IN ACCORDANCE WITH FCC PUBLIC NOTICE DA-00-705, THE “DUTY CYCLE CORRECTION FACTOR” FOR SPURIOUS RADIATED EMISSIONS IS; 20 log * (3.752 ms / 100 ms) = -28.5 dB, WHICH WAS USED TO CORRECT THE AVERAGE SPURIOUS READING.

HARMONICS AND SPURIOUS EMISSIONS

11/21/03 High Frequency Measurement

Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: NEELESH RAJ
Project #: 03U2374
Company: BROADCOM CORP.
EUT Descrip.: BLUETOOTH HID MODULE
EUT M/N: BCM92040LMF-M
Test Target: FCC
Mode Oper: TX

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifier 1-26GHz	Spectrum Analyzer	Horn > 18GHz	Limit
T73; S/N: 6717 @1m	T87 Miteq 926342			FCC 15.205

Hi Frequency Cables: ☐ (2 ft) ☑ (2 – 3 ft) ☐ (4 – 6 ft) ☑ (12 ft)

Peak Measurements: 1 MHz Resolution Bandwidth, 1MHz Video Bandwidth
Average Measurements: 1 MHz Resolution Bandwidth, 10Hz Video Bandwidth

f GHz	Dist feet	Raw Pk dBuV	Raw Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
						LOW CHANNEL HARMONICS									
4.804	9.8	65.0	63.7	33.9	2.9	-44.7	0.0	1.0	58.2	28.4	74.0	54.0	-15.8	-25.6	V
4.804	9.8	60.1	56.3	33.9	2.9	-44.7	0.0	1.0	53.2	21.0	74.0	54.0	-20.8	-33.0	H
12.101	9.8	47.0	38.9	39.5	5.1	-42.3	0.0	1.0	50.3	13.7	74.0	54.0	-23.7	-40.3	V
12.101	9.8	46.8	38.0	39.5	5.1	-42.3	0.0	1.0	50.1	12.8	74.0	54.0	-23.9	-41.2	H
						LOW CHANNEL SPURIOUS									
1.602	9.8	60.7	57.9	26.8	1.4	-43.3	0.0	1.0	46.4	15.2	74.0	54.0	-27.6	-38.8	V
1.602	9.8	56.0	53.4	26.8	1.4	-43.3	0.0	1.0	41.8	10.7	74.0	54.0	-32.2	-43.3	H
						MIDDLE CHANNEL HARMONICS									
4.882	9.8	64.9	62.1	34.0	3.0	-44.7	0.0	1.0	58.0	26.7	74.0	54.0	-16.0	-27.3	V
4.882	9.8	58.6	55.0	34.0	3.0	-44.7	0.0	1.0	51.7	19.7	74.0	54.0	-22.3	-34.3	H
7.323	9.8	64.1	59.1	36.8	3.8	-44.5	0.0	1.0	61.2	27.7	74.0	54.0	-12.8	-26.3	V
7.323	9.8	58.5	53.1	36.8	3.8	-44.5	0.0	1.0	55.6	21.6	74.0	54.0	-18.4	-32.4	H
12.205	9.8	48.4	39.2	39.6	5.2	-42.4	0.0	1.0	51.7	14.0	74.0	54.0	-22.3	-40.0	V
12.205	9.8	48.3	39.1	39.6	5.2	-42.4	0.0	1.0	51.6	13.9	74.0	54.0	-22.4	-40.1	H
						HIGH CHANNEL HARMONICS									
4.960	9.8	64.8	62.6	34.0	3.0	-44.8	0.0	1.0	58.0	27.2	74.0	54.0	-16.0	-26.8	V
4.960	9.8	59.1	57.0	34.0	3.0	-44.8	0.0	1.0	52.3	21.7	74.0	54.0	-21.7	-32.3	H
7.440	9.8	52.6	42.3	37.0	3.8	-44.4	0.0	1.0	50.0	11.2	74.0	54.0	-24.0	-42.8	V
7.440	9.8	51.3	41.6	37.0	3.8	-44.4	0.0	1.0	48.7	10.5	74.0	54.0	-25.3	-43.5	H
12.399	9.8	51.4	39.2	39.8	5.2	-42.6	0.0	1.0	54.7	14.0	74.0	54.0	-19.3	-40.0	V
12.399	9.8	51.5	38.2	39.8	5.2	-42.6	0.0	1.0	54.8	13.0	74.0	54.0	-19.2	-41.0	H

NO OTHER HARMONICS OR SPURIOUS EMISSIONS DETECTED IN THE REST. BAND ABOVE THE SYSTEM FLOOR NOISE ABOVE -20 dB TO THE LIMIT

NOTE: AVERAGE FIELD STRENGTH INCLUDES DUTY CYCLE CORRECTION FACTOR OF -28.5 dB

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

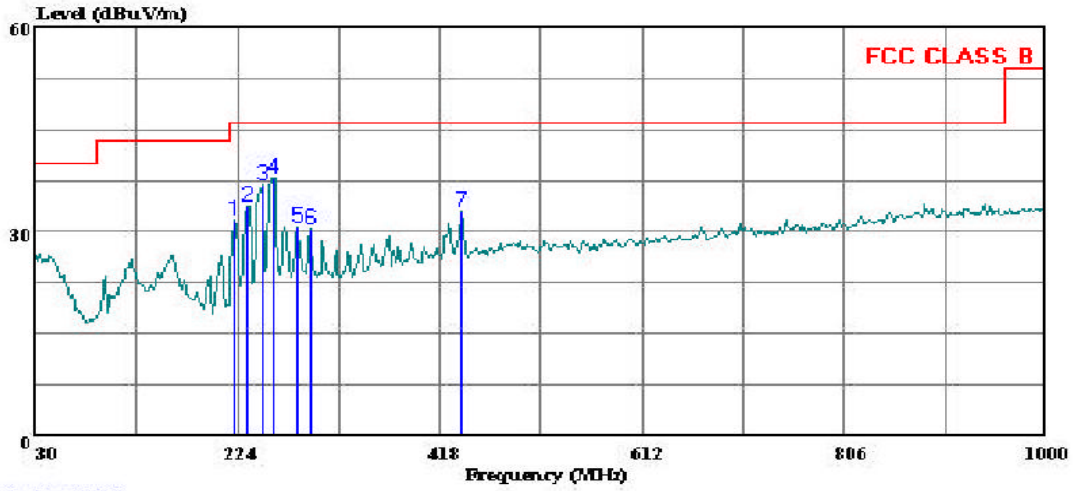
7.10.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT

COMPLIANCE Engineering Services, Inc.
561F Monterey Road
San Jose, CA 95131
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 2 File#: Blue.EMI Date: 01-29-2004 Time: 18:12:35



(Audix ATC)
Trace: 1 Ref Trace:

Condition: FCC CLASS B CHAMBER 030306 1185 HORIZONTAL
Test Eng: : Thanh Nguyen
Project #: : 03U2374
Company: : BROADCOM
EUT: : BLUETOOTH (Module)
Model No: : BCM92040LMF-M
Configuration: : EUT
Target of Test: : FCC-B
Mode of Operation: Tx (WORST CASE)

Page: 1

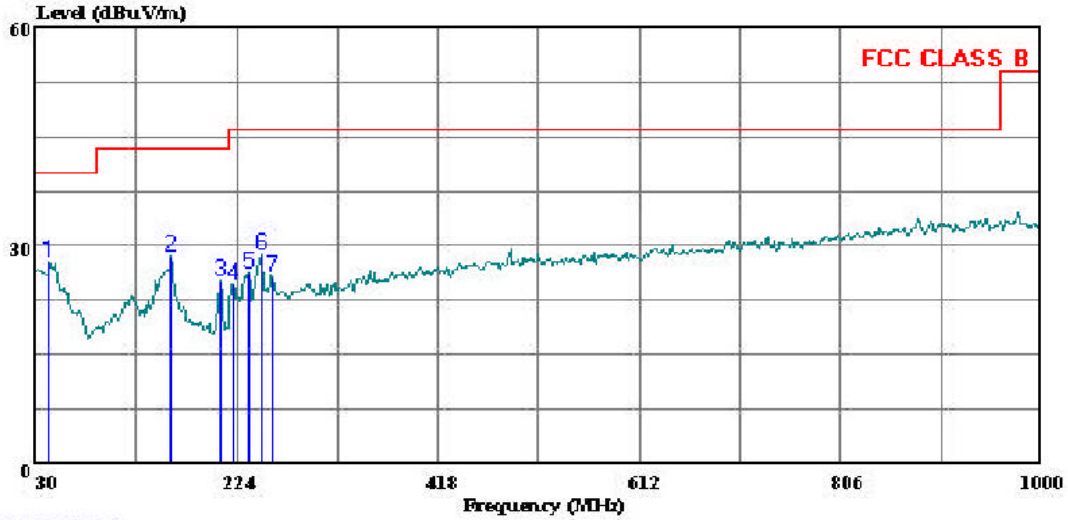
	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	221.090	Peak	21.46	10.25	31.71	46.00	-14.29
2	232.730	Peak	22.87	10.85	33.72	46.00	-12.28
3	247.280	Peak	25.26	11.54	36.80	46.00	-9.20
4	258.920	Peak	26.07	11.82	37.89	46.00	-8.11
5	281.230	Peak	18.79	11.95	30.74	46.00	-15.26
6	293.840	Peak	18.28	12.03	30.31	46.00	-15.69
7	439.340	Peak	17.64	15.32	32.96	46.00	-13.04

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT

COMPLIANCE Engineering Services, Inc.
561F Monterey Road
San Jose, CA 95131
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 4 File#: Blue.EMI Date: 01-29-2004 Time: 18:29:08



(Audix ATC)
Trace: 3 Ref Trace:

Condition: FCC CLASS B CHAMBER 030306 1185 VERTICAL
Test Eng: : Thanh Nguyen
Project #: : 03U2374
Company: : BROADCOM
EUT: : BLUETOOTH (Module)
Model No: : BCM92040LMF-M
Configuration: : EUT
Target of Test: : FCC-B
Mode of Operation: Tx (WORST CASE)

Page: 1

	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	43.580	Peak	11.63	16.14	27.77	40.00	-12.23
2	159.980	Peak	19.87	8.60	28.47	43.50	-15.03
3	208.480	Peak	15.56	9.51	25.07	43.50	-18.43
4	221.090	Peak	14.56	10.25	24.81	46.00	-21.19
5	235.640	Peak	15.32	11.02	26.34	46.00	-19.66
6	247.280	Peak	17.28	11.54	28.82	46.00	-17.18
7	257.950	Peak	13.90	11.81	25.71	46.00	-20.29

7.11. POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

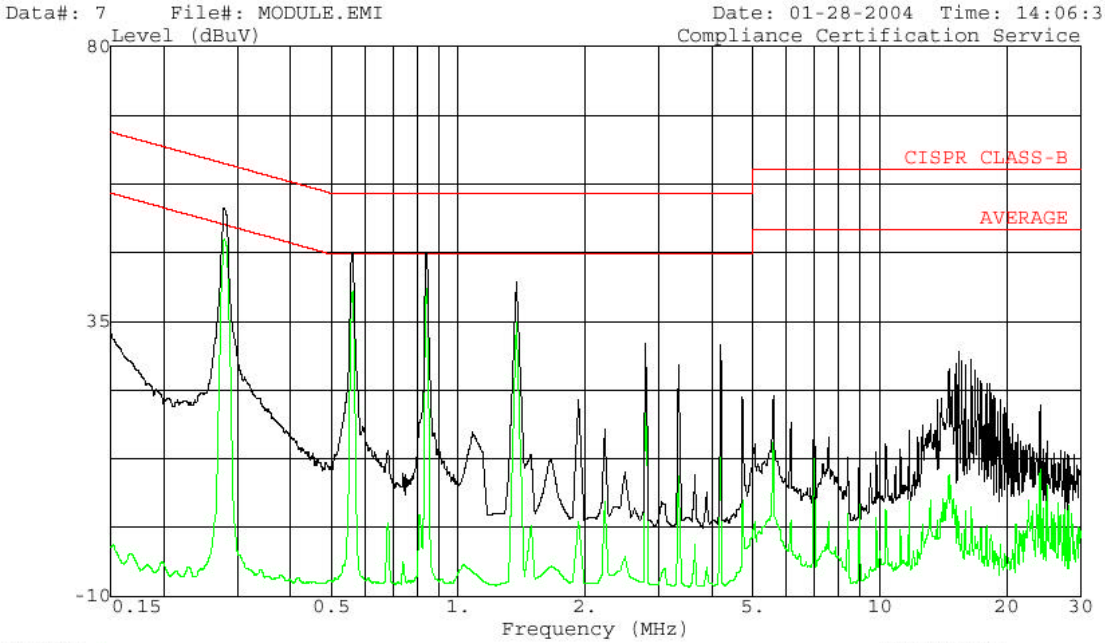
No non-compliance noted:

6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.28	53.54	--	48.45	0.00	62.29	52.29	-8.75	-3.84	L1
0.56	46.02	--	39.83	0.00	56.00	46.00	-9.98	-6.17	L1
0.84	46.36	--	40.43	0.00	56.00	46.00	-9.64	-5.57	L1
2.77	50.48	--	40.80	0.00	56.00	46.00	-5.52	-5.20	L2
0.84	44.76	--	33.63	0.00	56.00	46.00	-11.24	-12.37	L2
0.56	43.74	--	33.40	0.00	56.00	46.00	-12.26	-12.60	L2
6 Worst Data									

LINE 1 RESULTS

COMPLIANCE Engineering Service, Inc.
561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

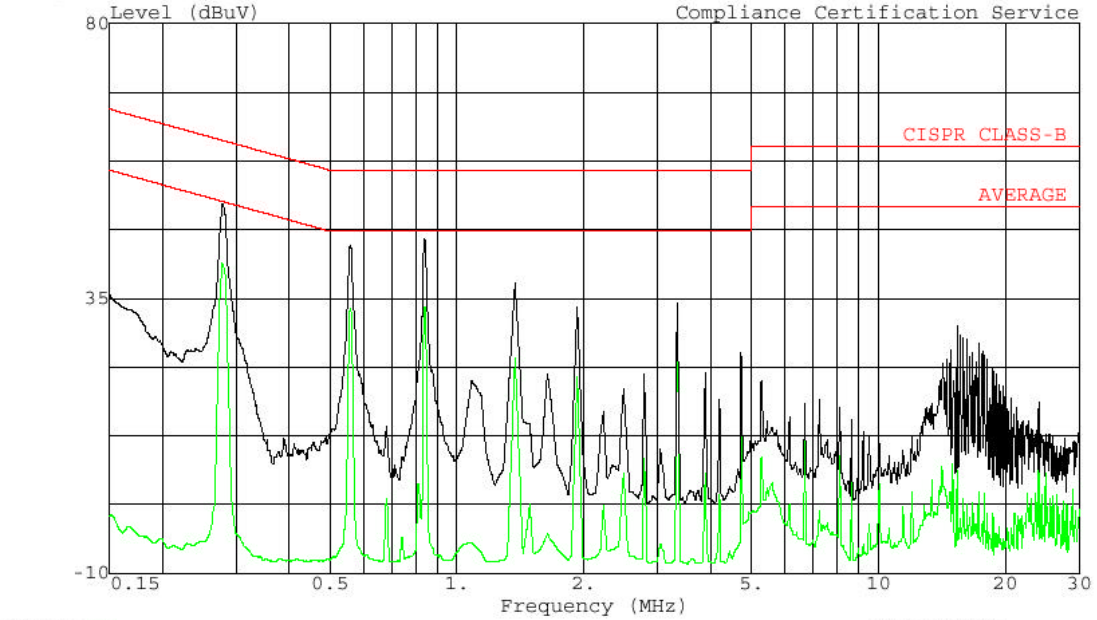


Trace: 5 Ref Trace:

Project #	: 03u2374
Test Operator	: NEELESH RAJ
Company	: BROADCOM CORP.
EUT	: BLUETOOTH MODULE
Model	: BCM92040LMF-M
Configuration	: EUT/TEST JIG
Mode of Operation	: TX (WORST CASE)
Target of Test	: CISPR-B
Voltage	: 115VAC, 60Hz
	: L1(PEAK;BLACK AVG;GREEN)

LINE 2 RESULTS

COMPLIANCE Engineering Services, Inc.
561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888



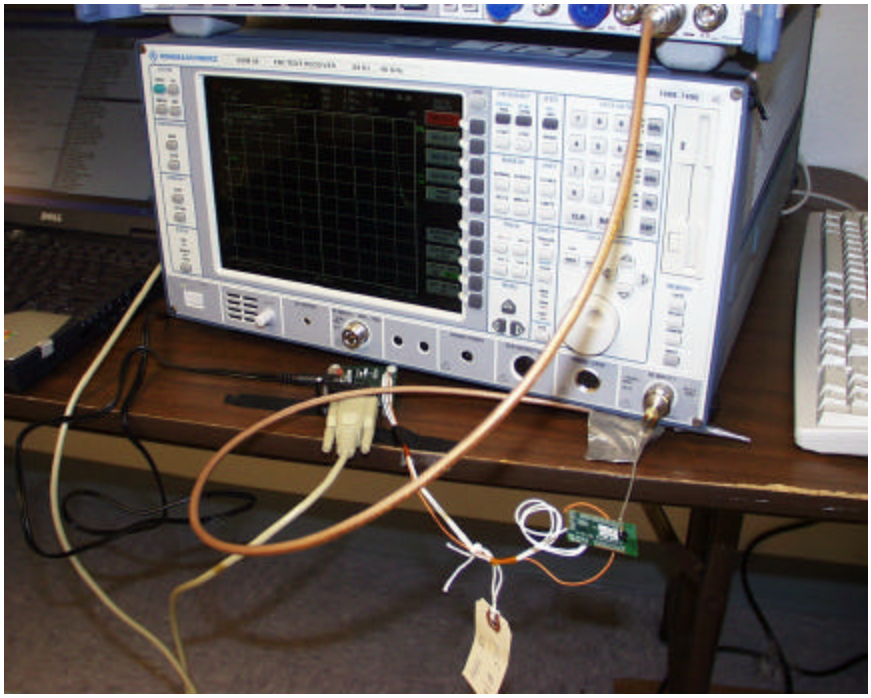
Trace: 12 Ref Trace:

Project #	: 03u2374
Test Operator	: NEELESH RAJ
Company	: BROADCOM CORP.
EUT	: BLUETOOTH MODULE
Model	: BCM92040LMF-M
Configuration	: EUT/TEST JIG
Mode of Operation	: TX (WORST CASE)
Target of Test	: CISPR-B
Voltage	: 115VAC, 60Hz
	: L2(PEAK;BLACK AVG;GREEN)

8. SETUP PHOTOS

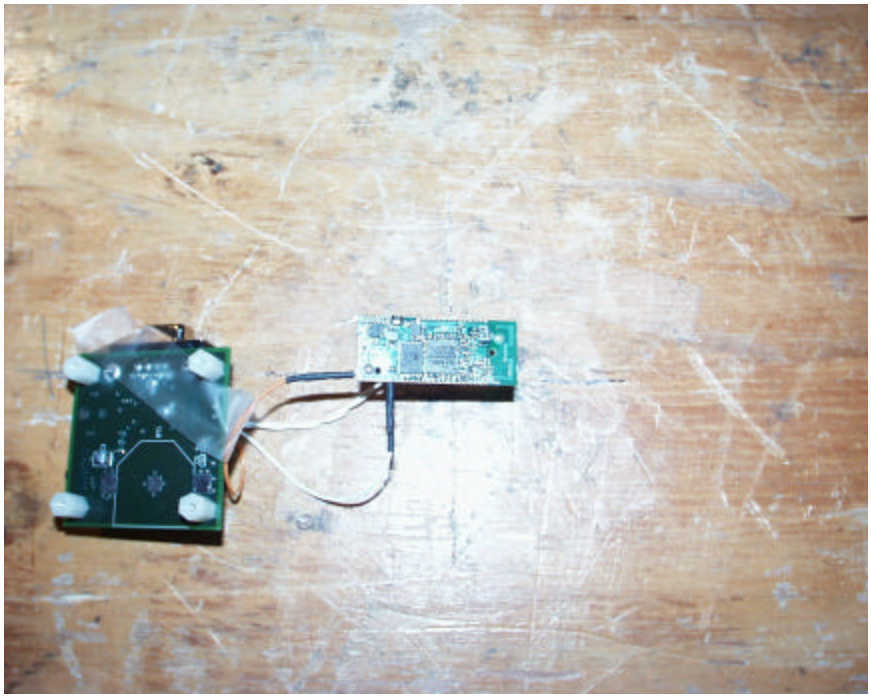
ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO

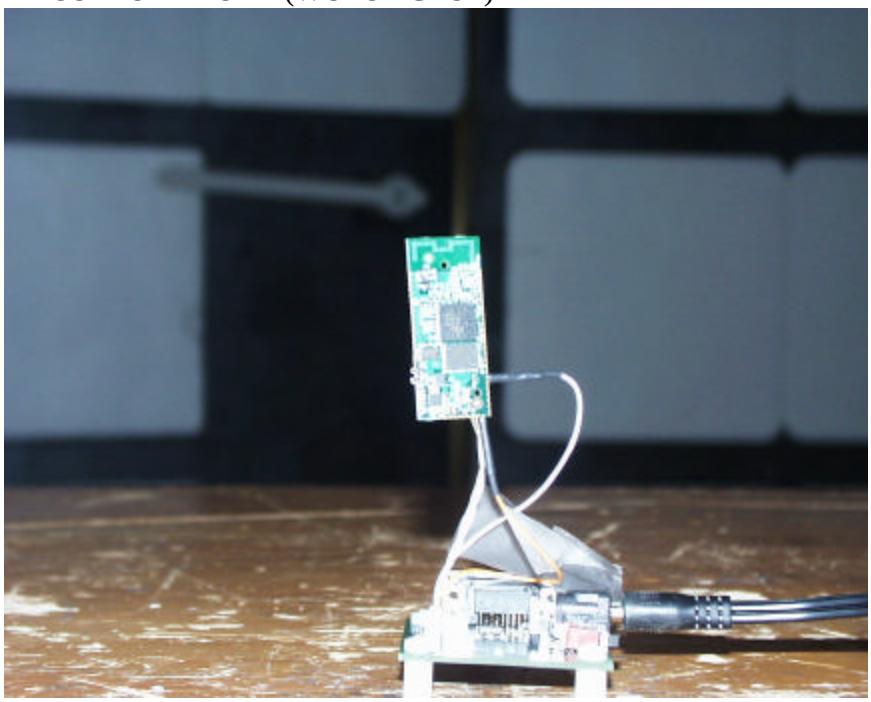


RADIATED RF MEASUREMENT SETUP

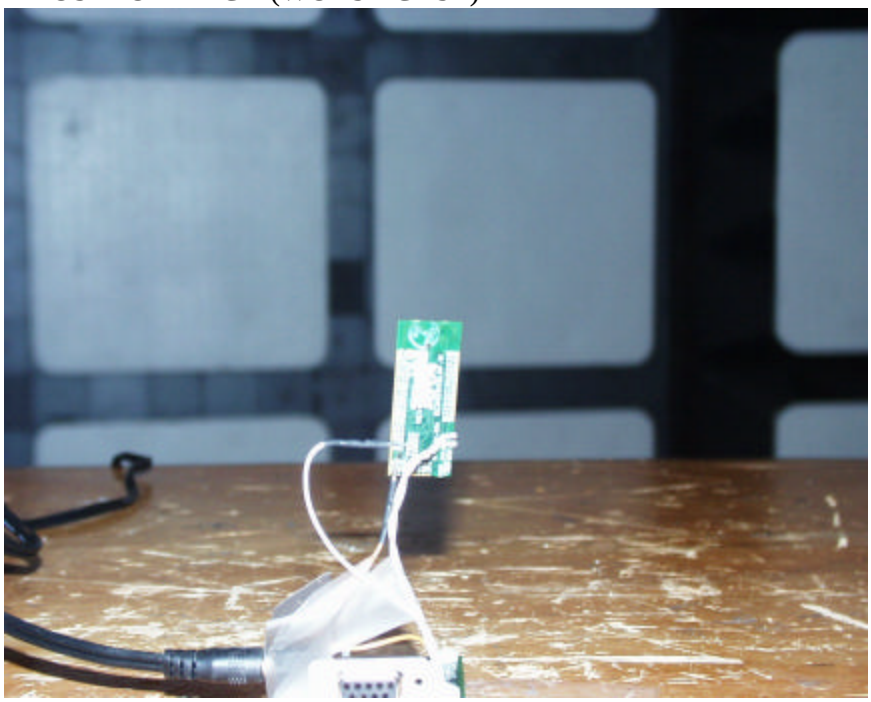
X POSITION



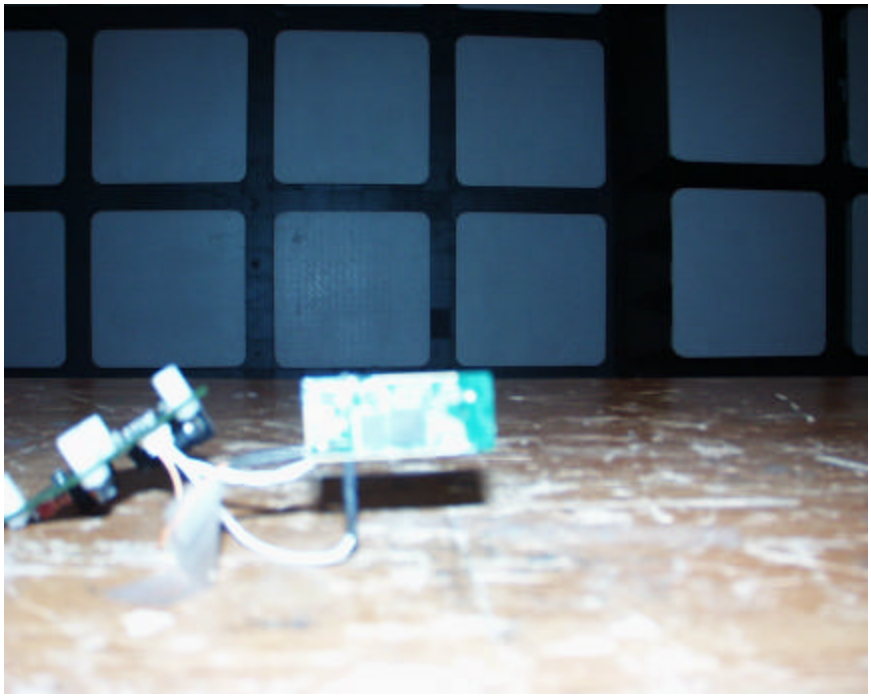
Y POSITION FRONT (WORST CASE)



Y POSITION BACK (WORST CASE)



Z POSITION



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO

END OF REPORT