FCC CFR47 PART 15 SUBPART C
CERTIFICATION
TEST REPORT

FOR

RF MODULE

MODEL NUMBER: XBOX 360 RF MODULE

FCC ID: C3K-WKS268

REPORT NUMBER: 05U3586-1B

ISSUE DATE: AUGUST 25, 2005

Prepared for
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Revision History

Rev.	Issue Date	Revisions	Revised By
A		Initial Issue	DG
A.1	8-11-05	Added manufacturers Avg time of occupancy statement, deleted occupancy plots in lieu of statement.	DG
B	8-24-05	Added i/o cable table for config. 2, corrected AVG power frequency table.	DG
	8-25-05	Updated the Peak Power Limit description and the limit in the table under Section 7.1.5 on page 23	D.Z.
		Added host system information on page 6	D.Z.
		Update section 7.1.4 to declare that there is only minimum of 15 channels and update the timing to describe the average time of occupancy requirement	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052-6399

EUT DESCRIPTION: RF MODULE

MODEL: XBOX 360 RF MODULE

SERIAL NUMBER: X802779003

DATE TESTED: JULY 8 - JULY 23, 2005

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 most of the requirements set forth in the above standards. Testing the average time of occupancy is not feasible, therefore the demonstration of compliance with this requirement is based on the theory of operation as documented in this report. The test results show that the equipment tested is capable of demonstrating compliance with the remaining requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

DAVID GARCIA
EMC SUPERVISOR
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Tested By:

DEVIN CHANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

3. 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.

4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. 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. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a frequency hopping transceiver module. This RF module will always be installed in Xbox 360 or Xbox 360 XDK console by the manufacturer. RF module is not an optional accessory to be installed by the end user. RF module utilizes a propitiatory communication protocol to interact with Xbox 360 game pads.

The two host system models: Xbox 360 and Xbox 360 XDK belong to the same product type and series, and are identical in regard to technical specification and RF performance.

During the final tests, a special design test accessory (RTX Unity) was used to control the frequency channel and enable continuous transmission.

Propitiatory communication protocol is detailed in the theory of operation.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:
2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2402 - 2482	1.54	1.43

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a directional patch antenna, with a maximum peak gain of 6.38 dBi @2.45 GHz.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Argon FW 107.

The EUT driver software installed in the host support equipment (Laptop computer) during testing was Argon-Xbox360 Wireless module.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2402 MHz.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Monitor	Sony	KV13M30	4000452	N/A
Xbox Game Controller	KRYPTON	EVT 2B	KEVT2B-087	N/A
AC/DC Adapter 230V	DELTA Elect.	DPSN-186CB-1A	1.10001E+11	N/A
AC/DC Adapter 120V	DELTA Elect.	DPSN-186CBA	9.90002E+12	N/A
HeadPhone	KRYPTON	N/A	N/A	N/A
DC Power Supply	H-P	E3601A	KR24104150	N/A
RTX Unity	Microsoft	N/A	76	N/A
Level Converter	Microsoft	N/A	N/A	N/A
Laptop PC	Toshiba	Tecra 8200	81212625PU	DoC
Laptop AC Adapter	Toshiba	PA3083U-1ACA	1555164G	N/A
Game Controller	Microsoft	XBox360 Wireless Controller	83518	C3K-WKS368
Game Controller	Microsoft	XBox360 Wireless Controller	236525	C3K-WKS368
Game Controller	Microsoft	XBox360 Wireless Controller	906525	C3K-WKS368
Game Controller	Microsoft	XBox360 Wireless Controller	356525	C3K-WKS368

I/O CABLES (CONFIGURATION 1)

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	DC	1	DC	Unshielded	1.2m	
2	AC	1	AC	Unshielded	1.2m	
3	USB	1	USB	Unshielded	1m	Wire
4	RTX interface	1	8 pin	Unshielded	.5m	Wire
5	DC	1	DC	Unshielded	.5m	Wire
6	AC	1	AC	Unshielded	1.2m	

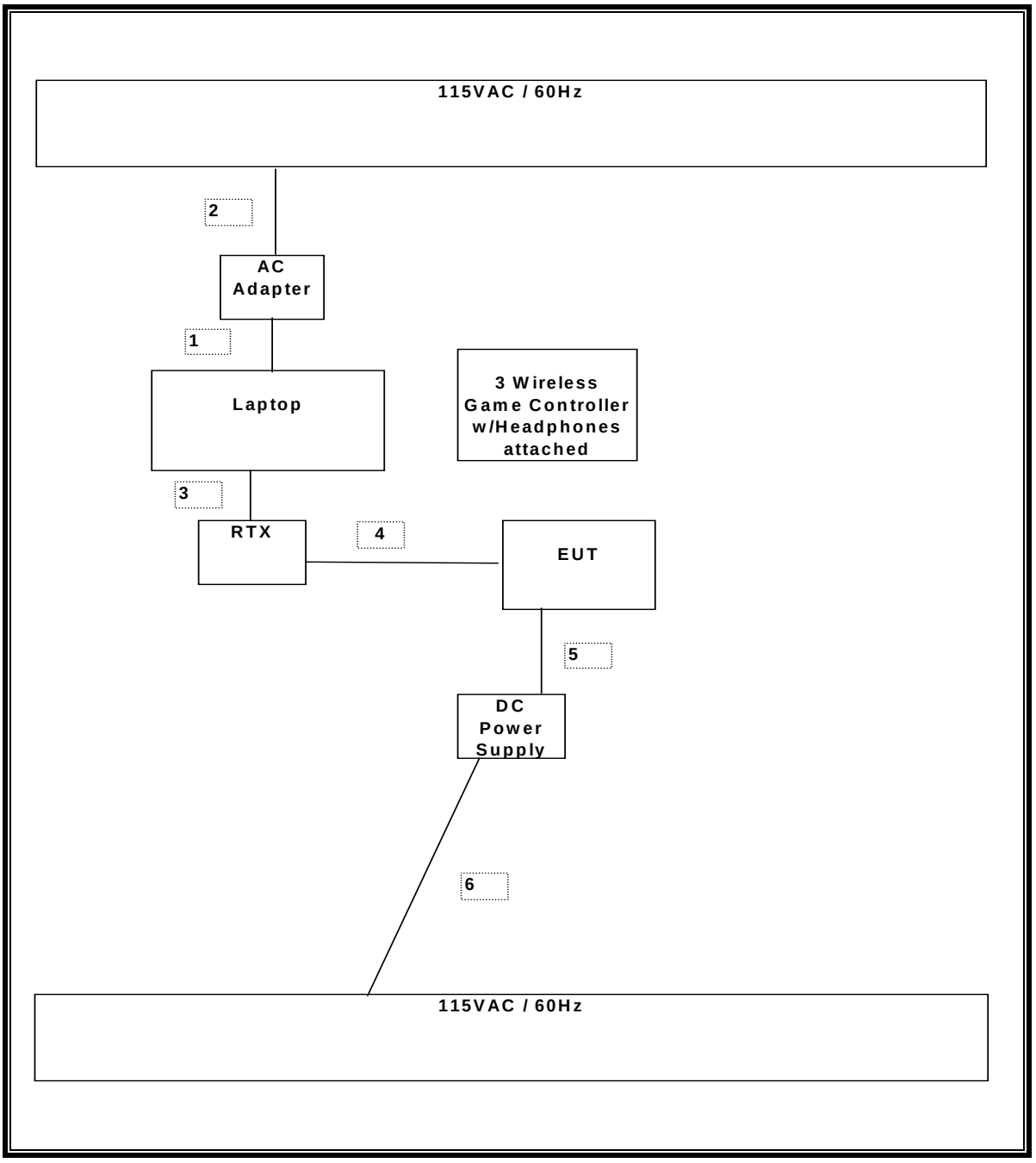
I/O CABLES (CONFIGURATION 2)

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	AC	Unshielded	1.2m	
2	DC	1	6 pin DC	Unshielded	1.0m	
3	Audio	1	Audio	Unshielded	1.2m	
4	USB	1	USB to 8 pin	Unshielded	2.9m	Game Controller
5	Video	1	30 pin to RCA	Unshielded	2.0m	

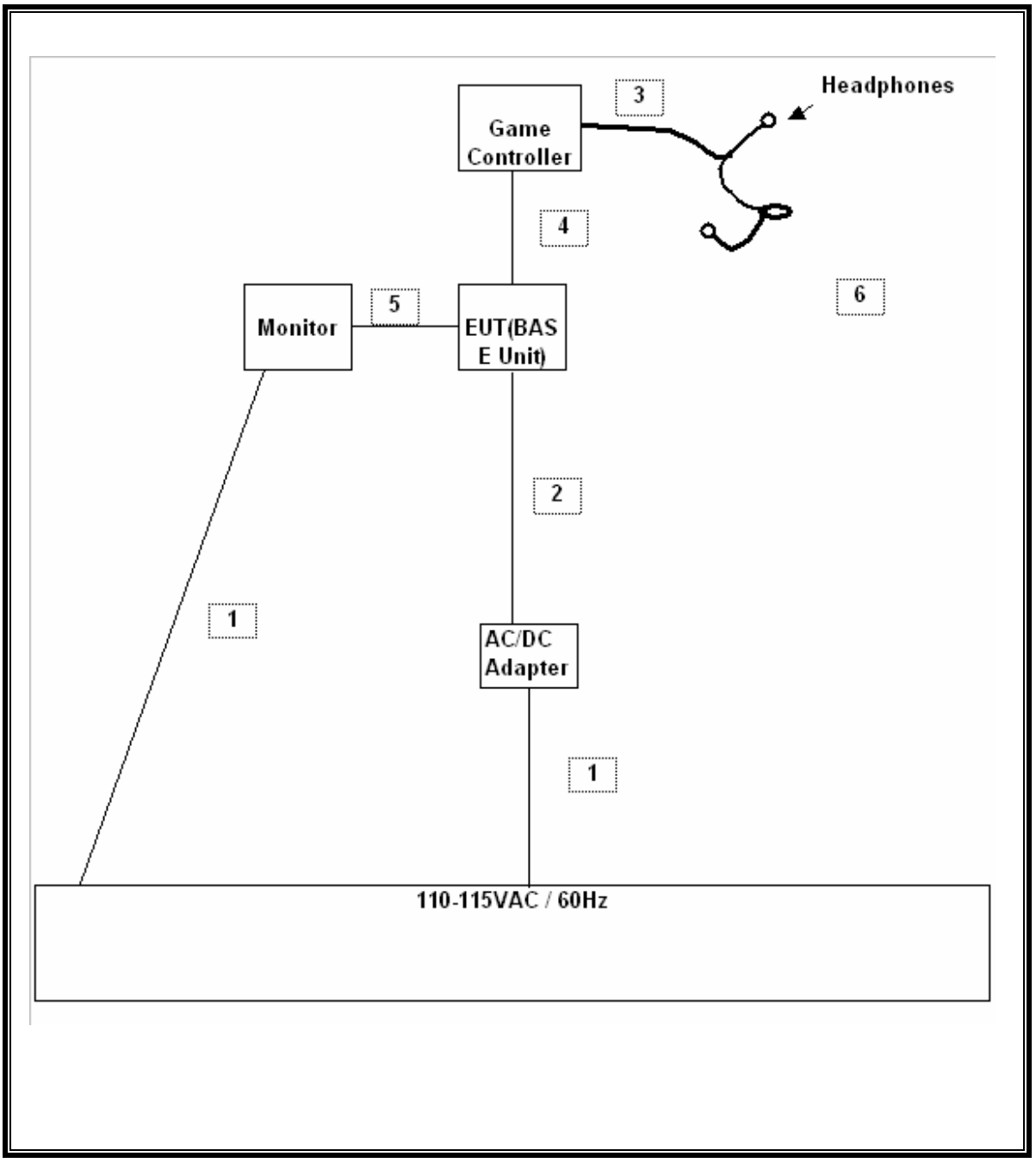
TEST SETUP

The EUT is initially connected to the RTX unit which is the interface to the laptop. The EUT was tested in a standalone configuration once it was setup for testing with the laptop.

SETUP DIAGRAM FOR TESTS, CONFIGURATION 1



SETUP DIAGRAM FOR TESTS, CONFIGURATION 2



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/05
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/21/05
Site A Line Stabilizer/Conditioner	Tripplite	LC-1800a	A005181	CNR
EMI Test Receiver	R & S	ESHS 20	827129/006	6/3/06
AC Power Source, 10 kVA	ACS	AFC-10K-AFC-2	J1568	CNR
Antenna, Horn 1 ~ 18 GHz	ETS	3117	29301	4/22/06
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent	E4446A	US42510266	8/25/05
Preamplifier, 1 ~ 26 GHz	Miteq	NSP2600-44	646456	8/17/05
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	3/29/06
RF Filter Section	HP	85420E	3705A00256	3/29/06
Antenna, Bilog 30MHz ~ 2Ghz	Sunol Sciences	JB1	A121003	3/3/06
Peak / Average Power Sensor	Agilent	E9327A	US40440755	2/10/06
Peak Power Meter	Agilent	E4416A	GB41291160	2/9/06
4.0 High Pass Filter	Microtronics	HPM13351	4	CNR

7. LIMITS AND RESULTS

7.1. ANTENNA PORT CHANNEL TESTS

7.1.1. 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

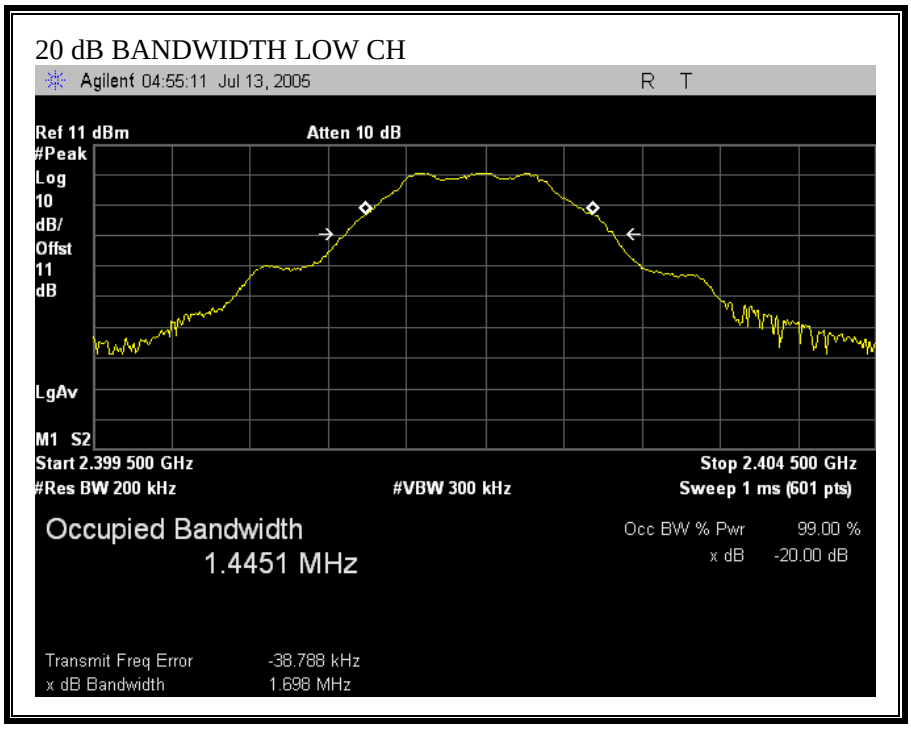
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

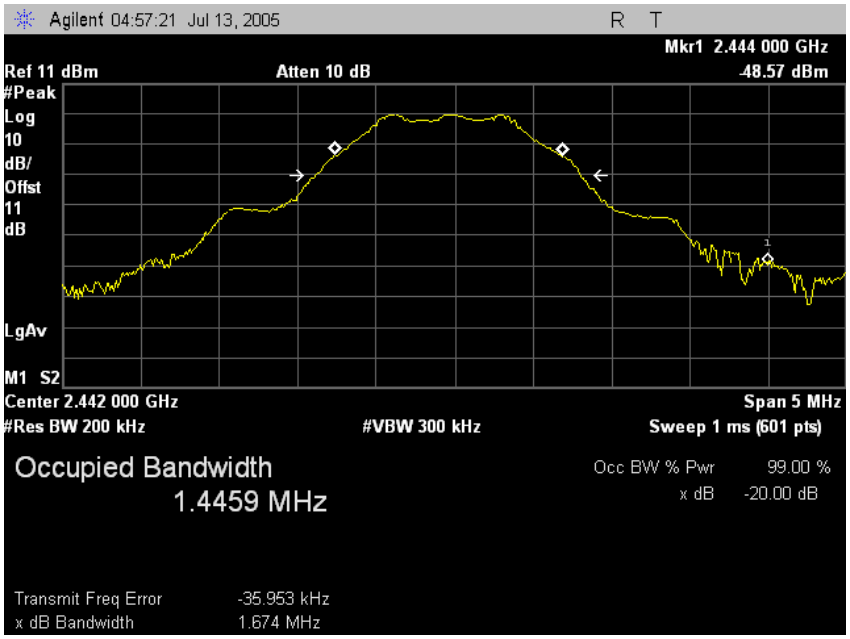
No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	1698
Middle	2442	1674
High	2482	1690

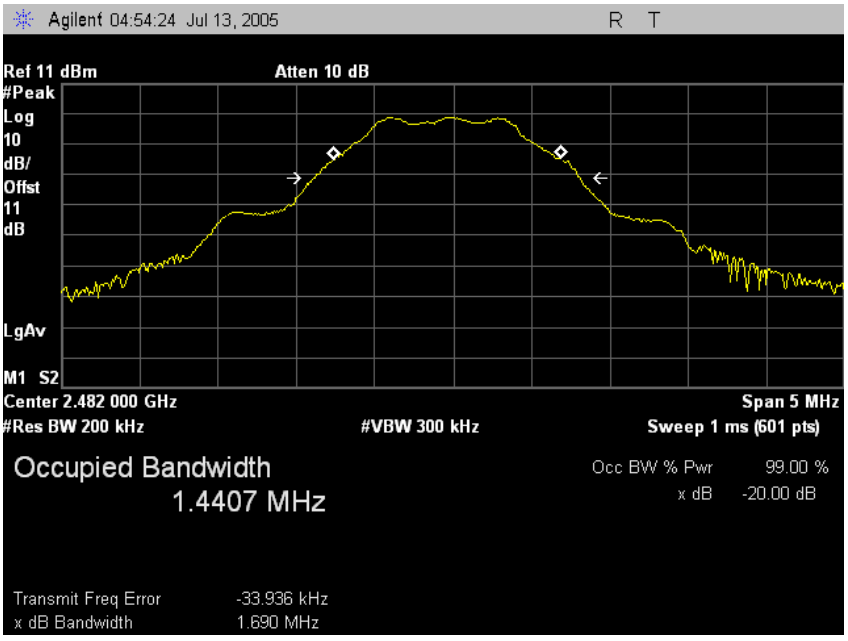
20 dB BANDWIDTH



20 dB BANDWIDTH MID CH



20 dB BANDWIDTH HIGH CH



7.1.2. 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

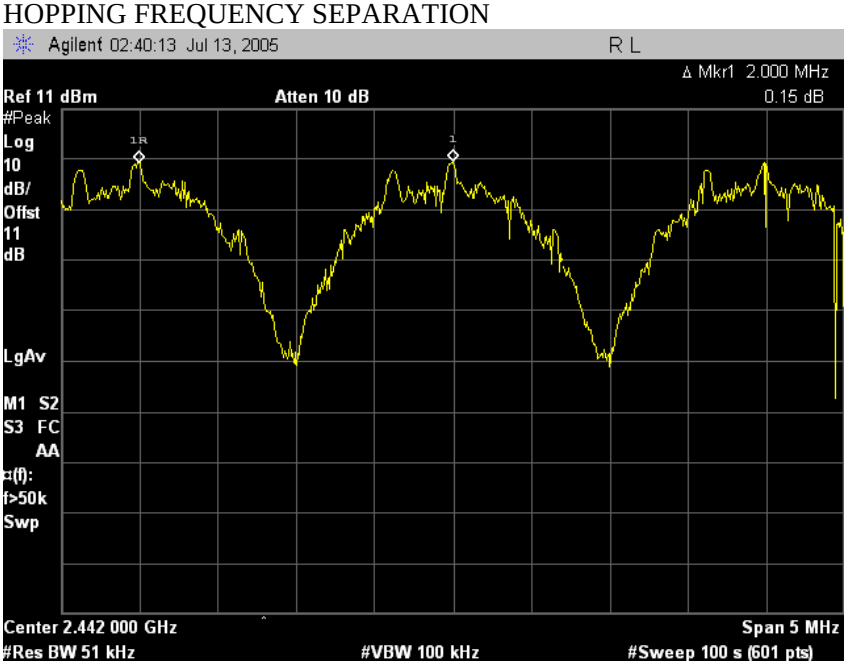
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted:

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



Channel Separation	20 dB Bandwidth	Margin
2 MHz	1.698 MHz	302 kHz

7.1.3. 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.

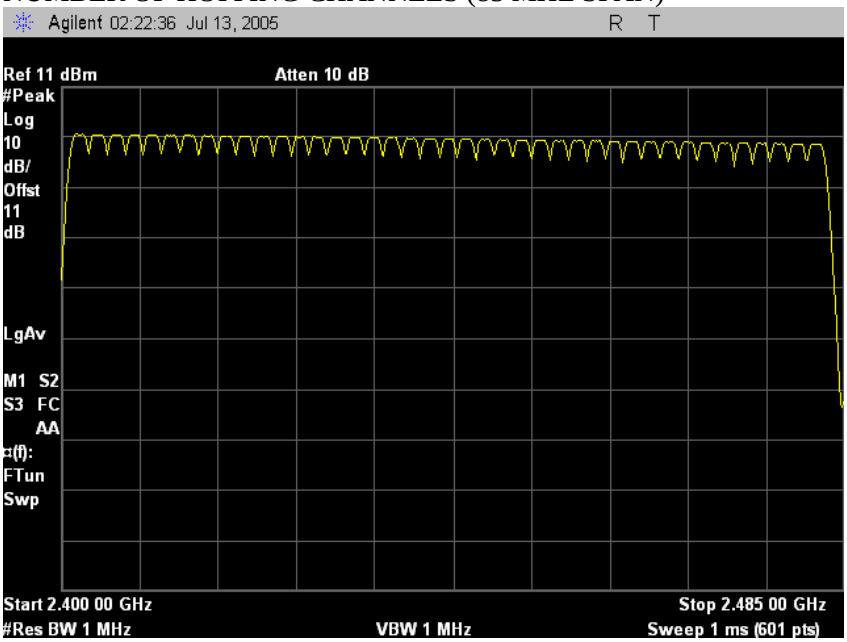
RESULTS

No non-compliance noted:

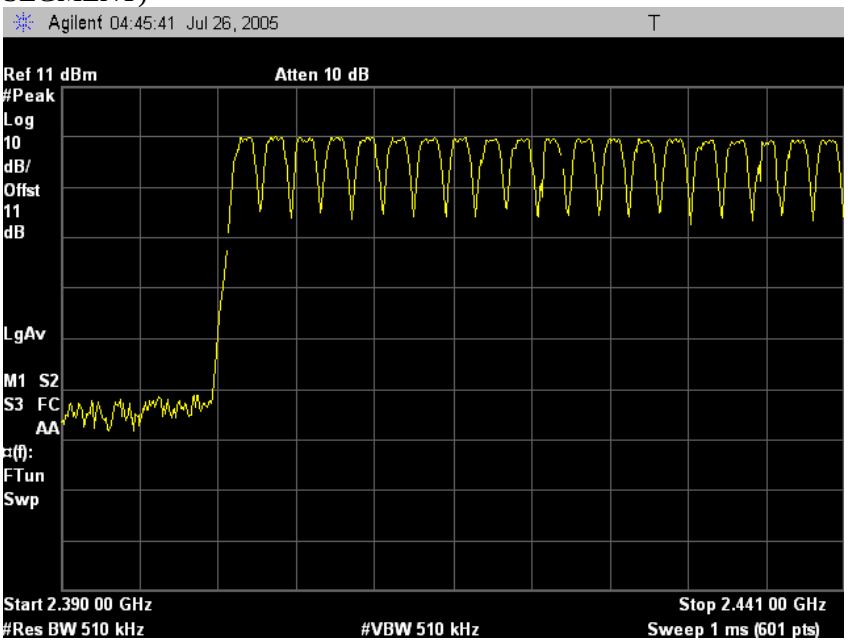
41 Channels observed.

NUMBER OF HOPPING CHANNELS

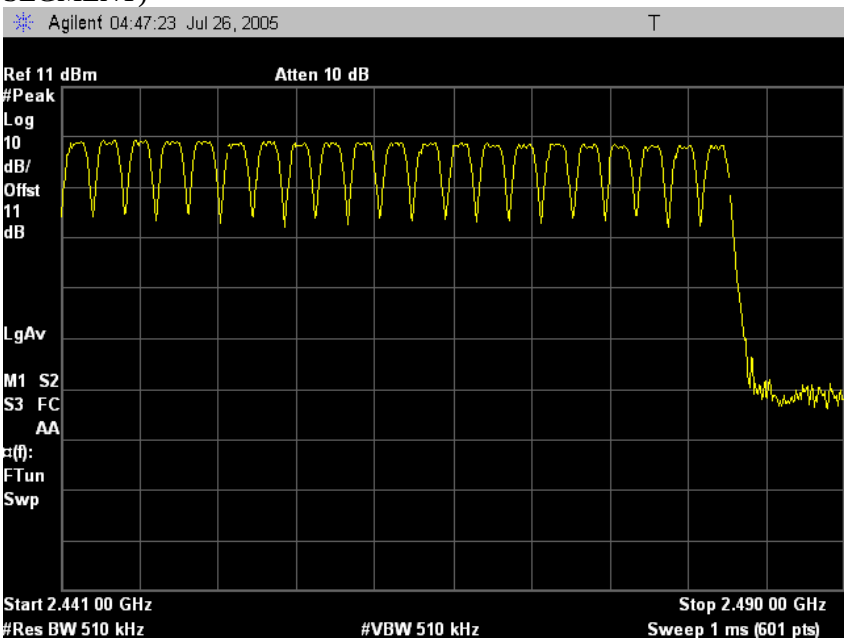
NUMBER OF HOPPING CHANNELS (85 MHZ SPAN)



NUMBER OF HOPPING CHANNELS (51 MHZ SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (49 MHZ SPAN, SECOND SEGMENT)



7.1.4. 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.

The window period is 0.4 seconds times 41 channels = 16.4 seconds

TEST PROCEDURE

The hopping sequence is 524,287 frequencies long before it repeats therefore testing for this parameter is not feasible. Compliance is demonstrated by the manufacturers declaration of the theory of operation as stated below.

RESULTS

MANUFACTURERS DECLARATION

Adaptive frequency hopping is used by the host firmware in the baseband chip to continuously assess channel performance and mark channels as bad if performance is not acceptable. When marked as bad, channels will be deleted from the hopping table for a minimum of 5 seconds. No less than 15 channels will be used no matter how bad the interference, to comply with FCC 15.247 rules. There are 4 frequencies used in every 8 mS frame of the protocol, for an average hopping rate of about 500 hops/sec.

The worst-case, longest dwell time per channel is 3147 us in every 8ms when you have 2 or more wireless game pads and wireless voice devices. This includes both receiving and transmitting. The worst-case, longest transmitting dwell time per channel for the Xbox RF module is 568 us in every 8 ms under these same conditions.

For host, the longest dwell time is (981+758)*750ns = 1304.24 us in 8 ms this is only for TX from devices to host. The longest dwell time for channel for RX is 1229*2*750ns = 1843us.

The worst-case, longest dwell time per channel for the game controller is 1657 us in every 8 ms. This includes both receiving and transmitting. The worst-case, longest transmitting dwell time per channel for Xbox RF module is 922 us in every 8 ms.

Per controller, the longest TX dwell time is 1229*750ns = 921.75us in 8ms. The longest RX dwell time is 981*750ns = 735us in 8 ms.

If AFH is used, the longest dwell time is 208 ms in every 328 ms period. This means we have only 15 channels left and the 26 removed channels are consecutive in the hopping sequence.

27,594 unique frequency hopping polynomials are used by the console. The hopping sequence is 524,287 frequencies long before it repeats.

The polynomials are selected such that on average no hopping frequency channel is occupied for more than 0.4 seconds within any 16.4 second window.

7.1.5. 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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

§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 6.38 dBi, therefore the limit is 20.59 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.

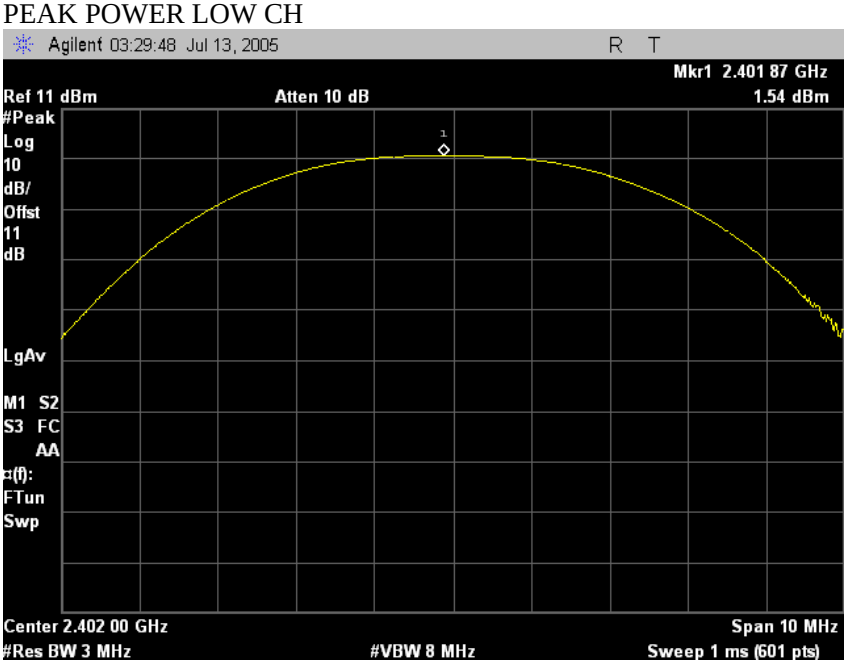
RESULTS

No non-compliance noted:

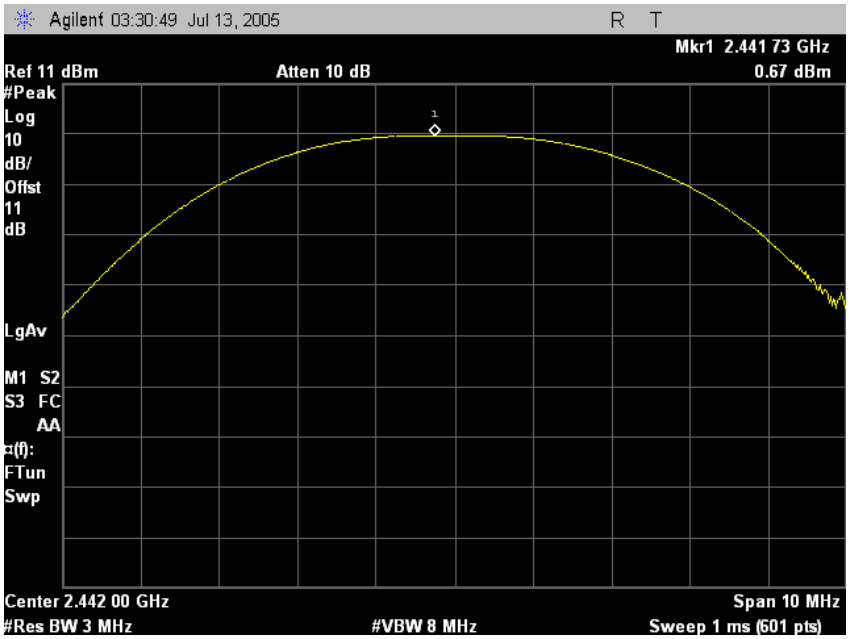
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	1.54	20.59	-19.05
Middle	2442	0.67	20.59	-19.92
High	2482	-0.35	20.59	-20.94

OUTPUT POWER

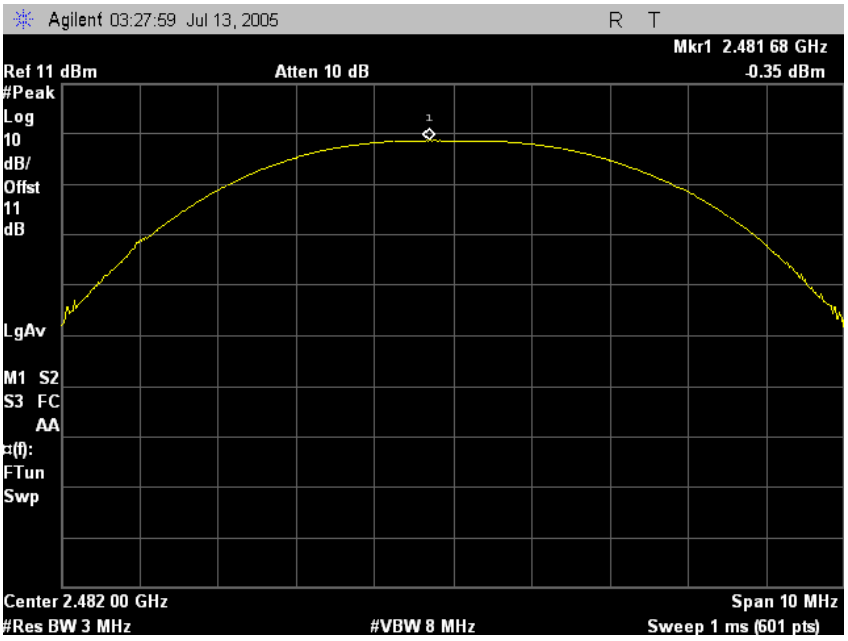
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



7.1.6. 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

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

where

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

Rearranging terms to calculate the power density at a specific distance yields

$S = .0795 * 10 \wedge ((P + G) / 10) / (d^2)$ Equation (1)

LIMITS

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

RESULTS

No non-compliance noted:

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
FHSS	20.0	1.54	6.38	0.001

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.

7.1.7. 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 11 dB (including 10 dB pad and 1 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	-8.53
Middle	2442	-9.49
High	2482	-10.17

7.1.8. 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.

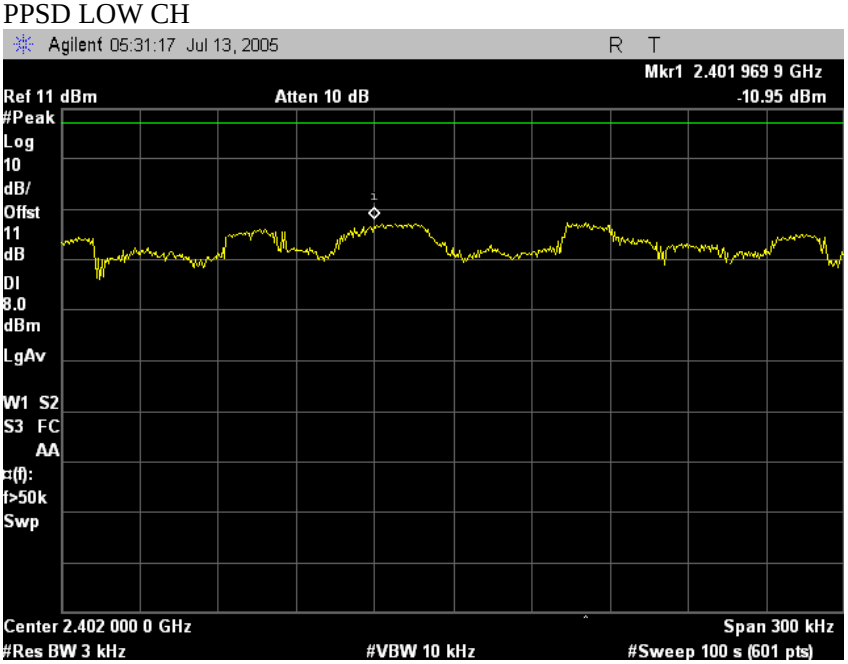
RESULTS

No non-compliance noted:

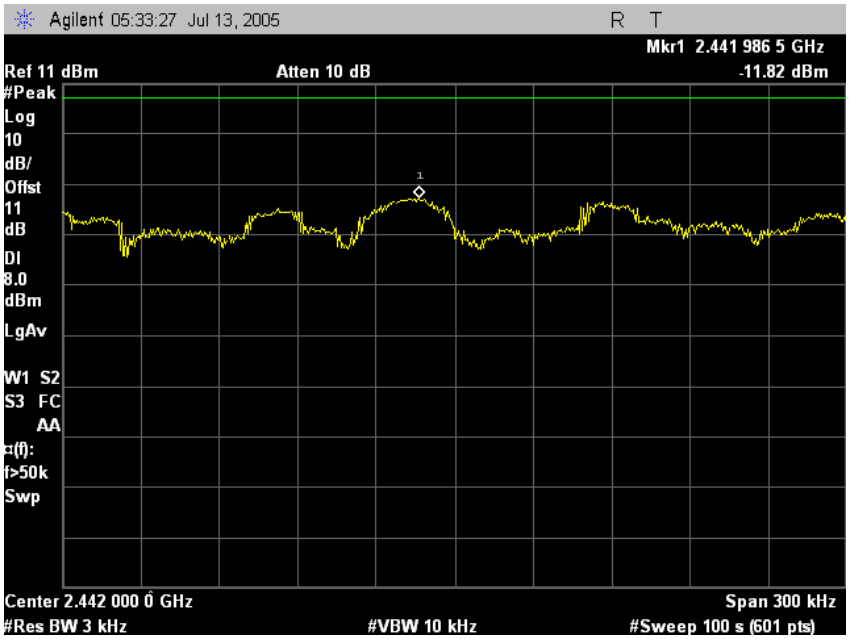
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-10.95	8	-18.95
Middle	2442	-11.82	8	-19.82
High	2482	-12.86	8	-20.86

PEAK POWER SPECTRAL DENSITY

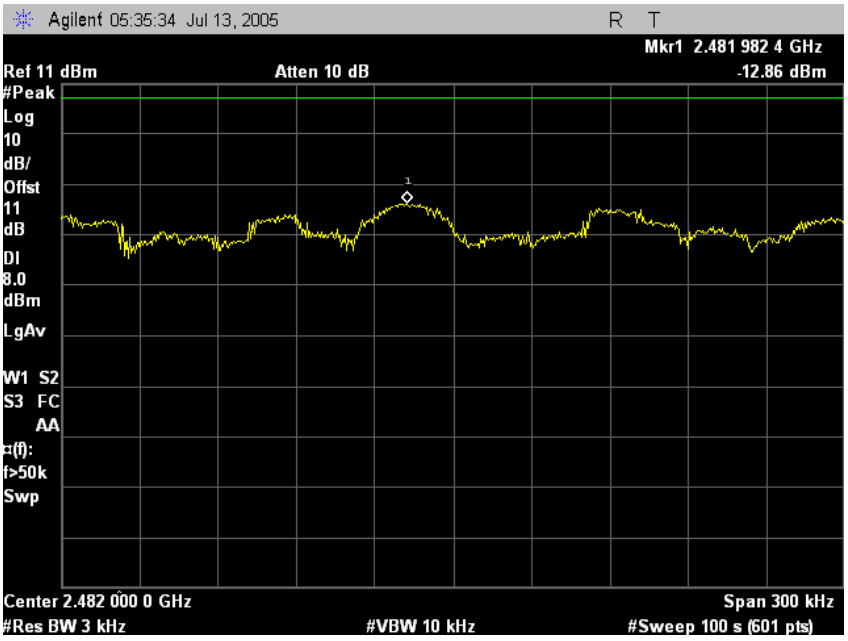
PPSD LOW CH



PPSD MID CH



PPSD HIGH CH



7.1.9. 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 300 kHz.

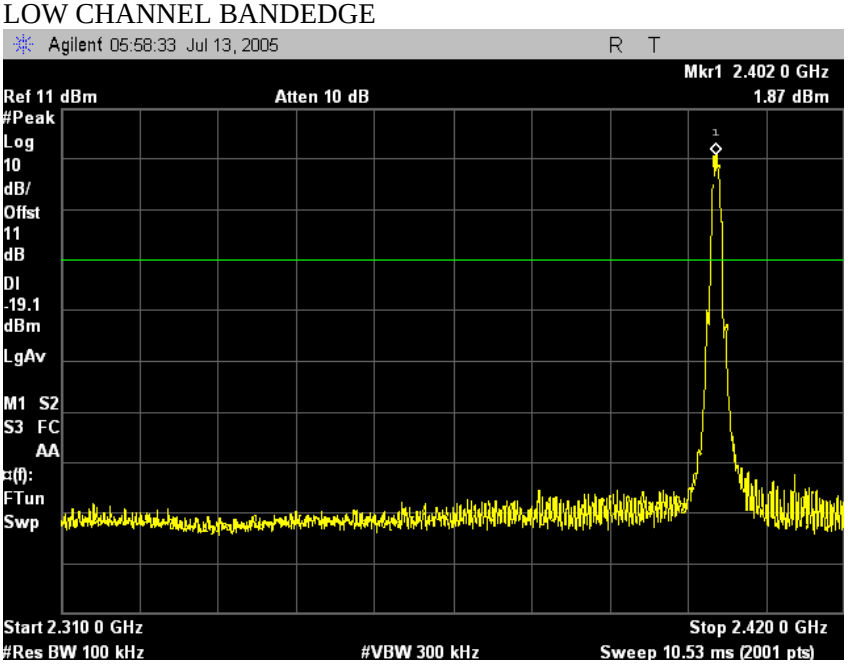
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

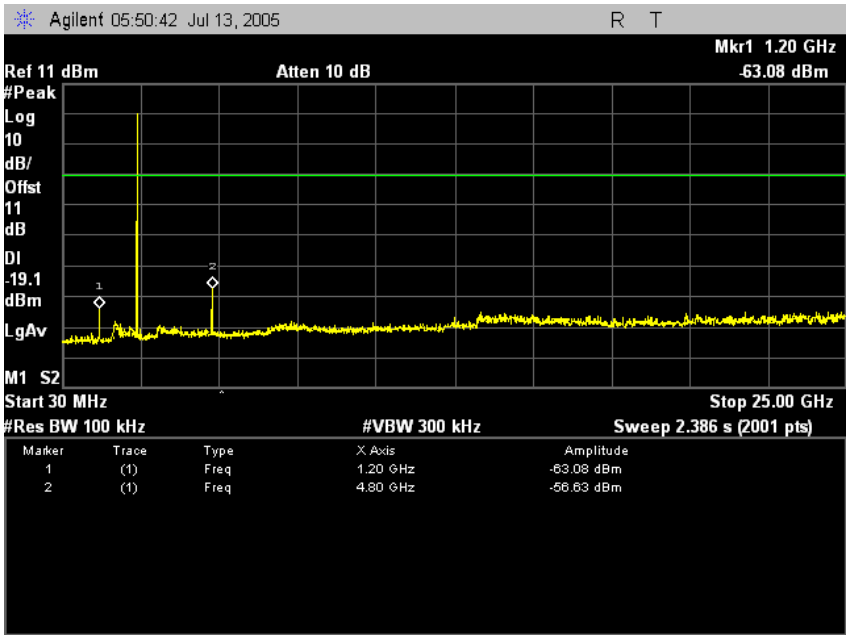
No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

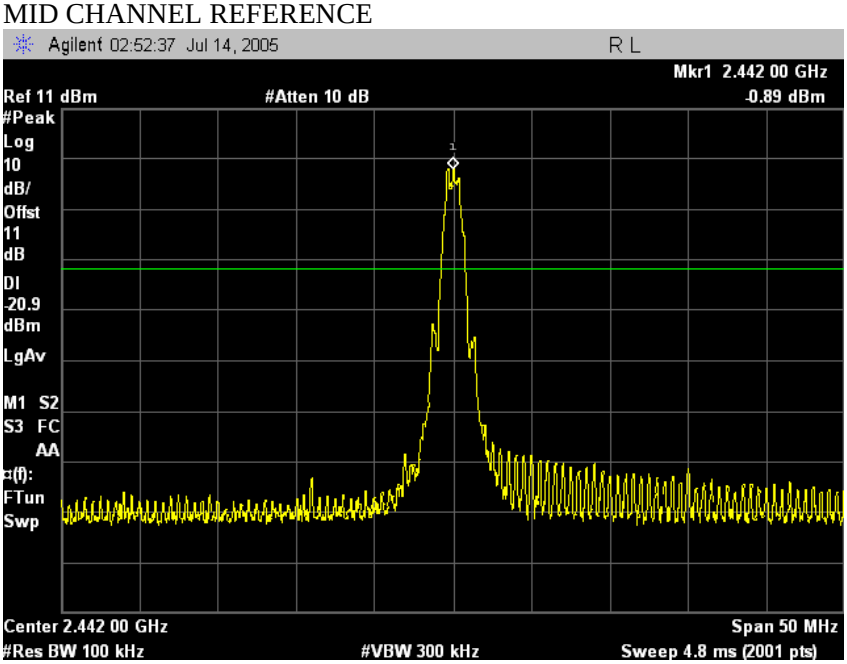


LOW CHANNEL SPURIOUS

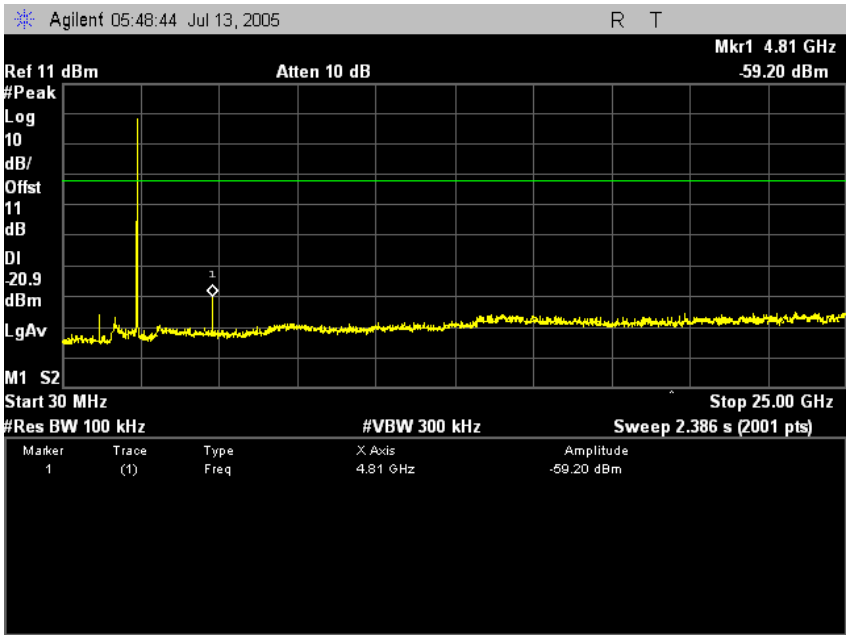


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE

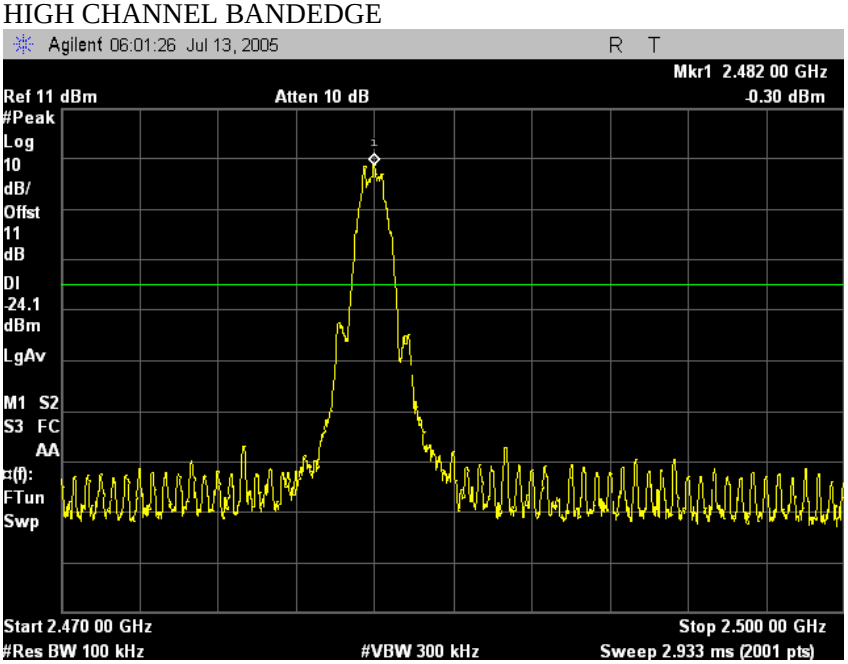


MID CHANNEL SPURIOUS

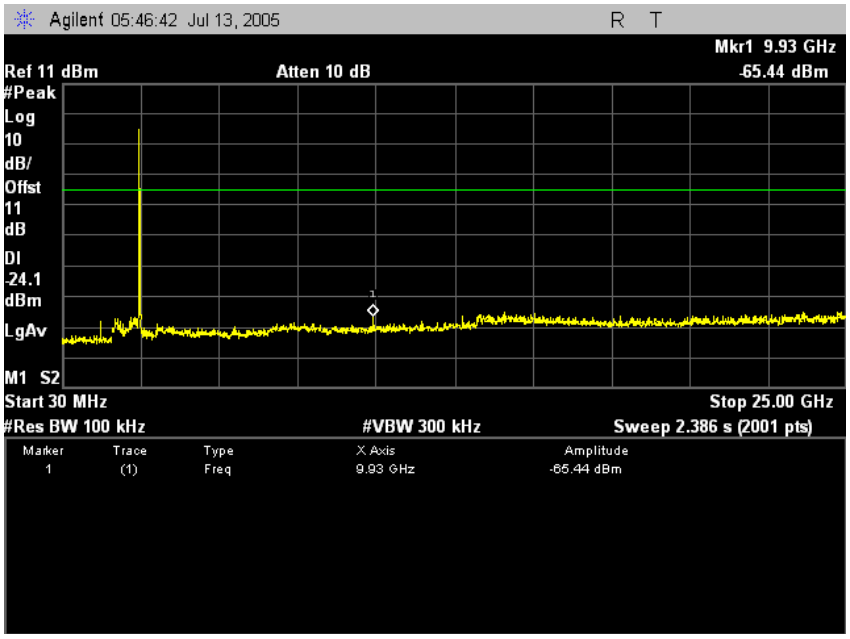


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

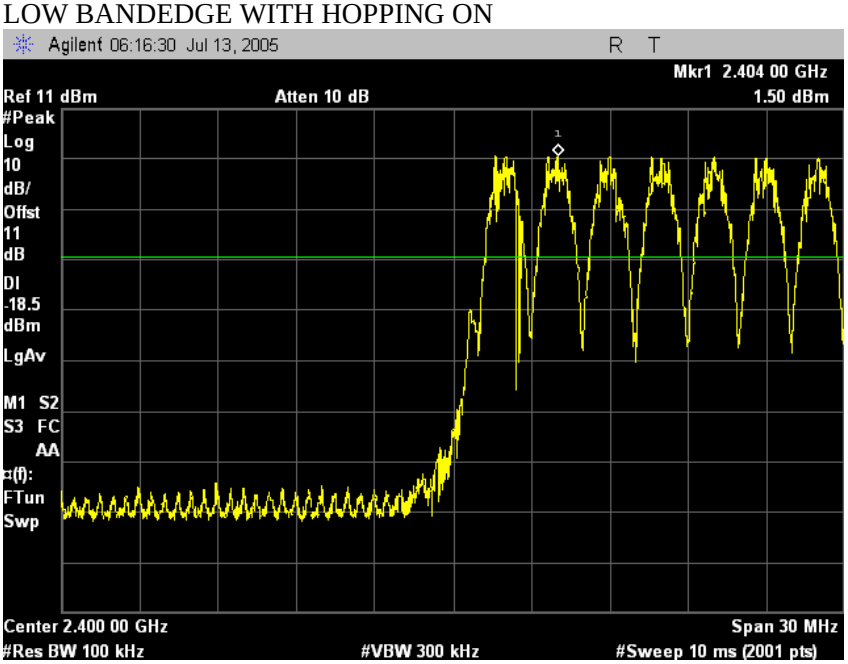


HIGH CHANNEL SPURIOUS

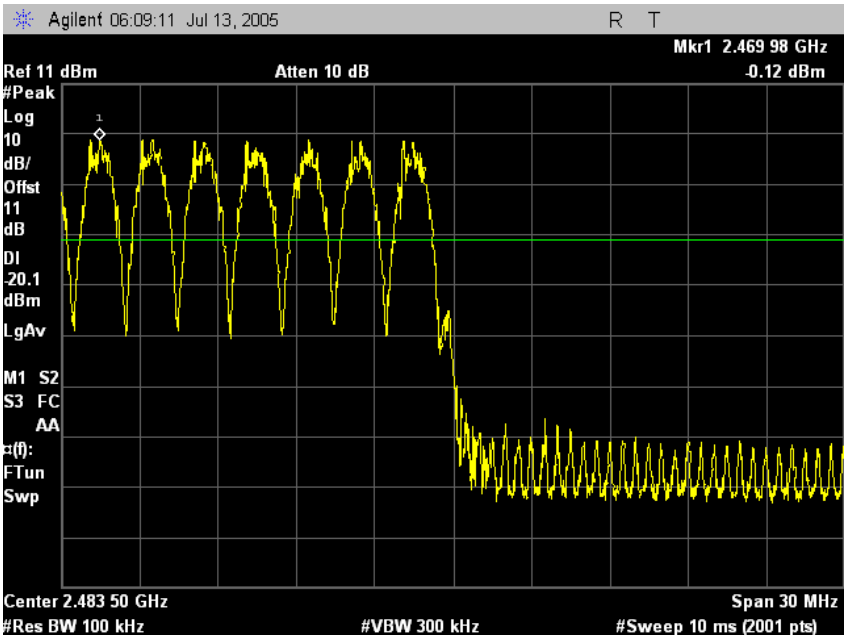


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



7.2. RADIATED EMISSIONS

7.2.1. 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 in the 2.4 GHz band.

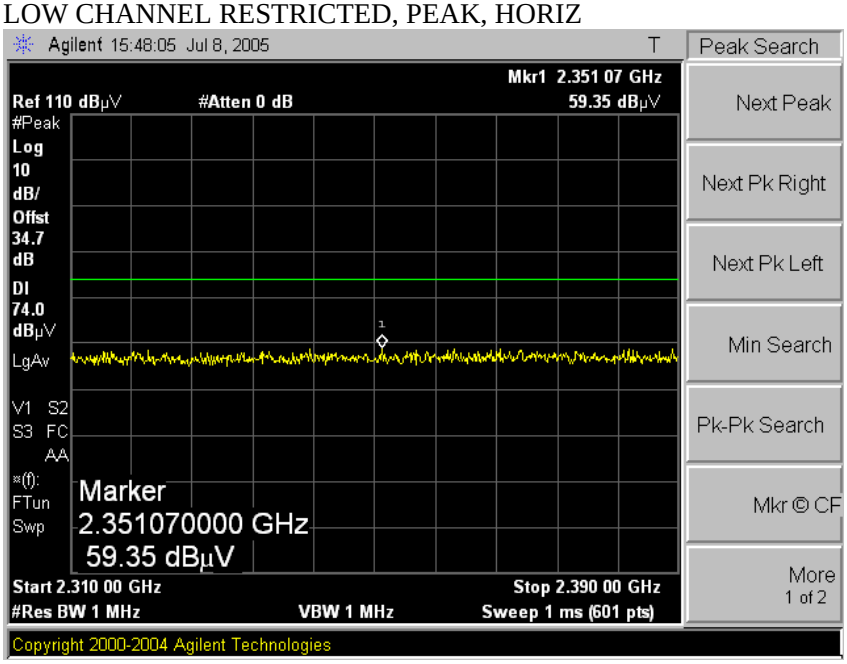
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

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.

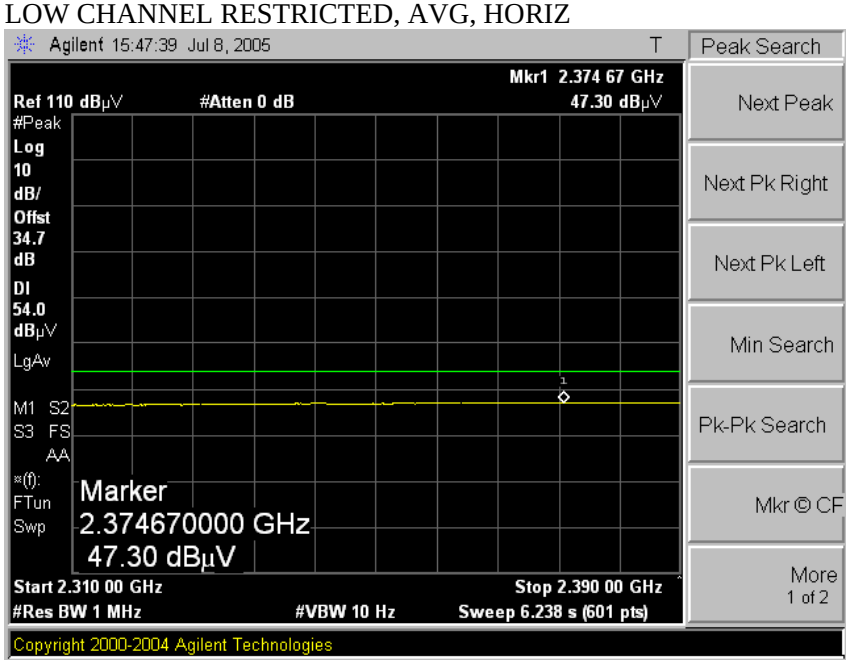
7.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

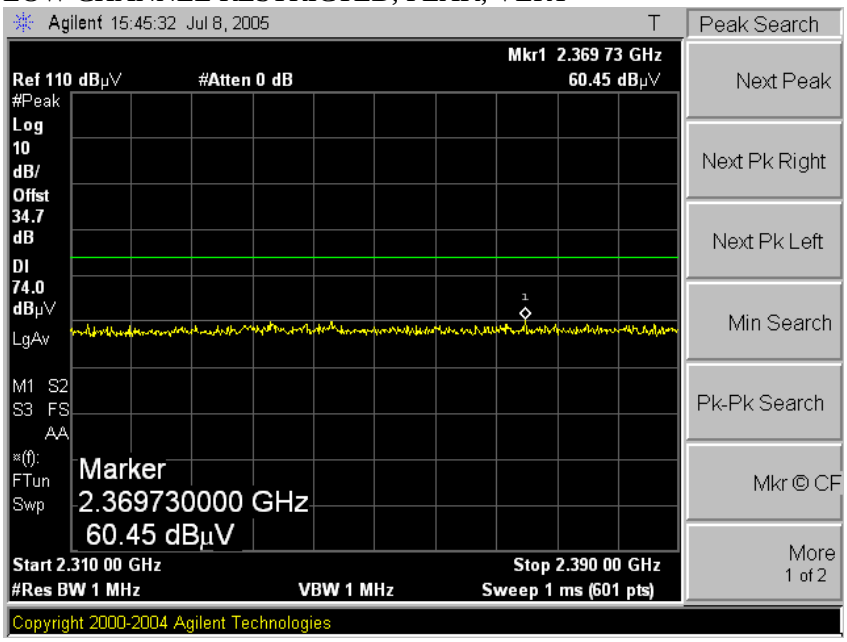


LOW CHANNEL RESTRICTED, AVG, HORIZ

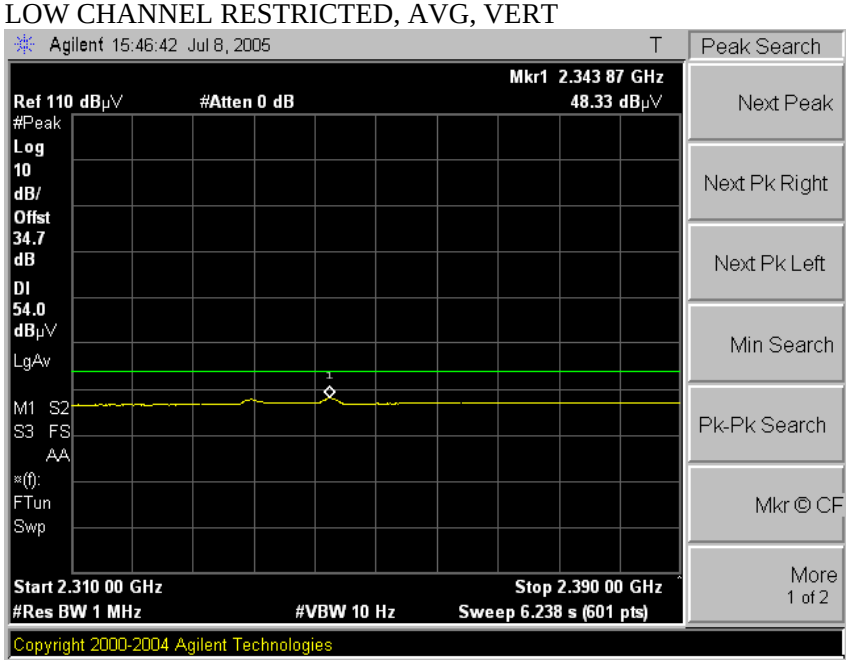


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

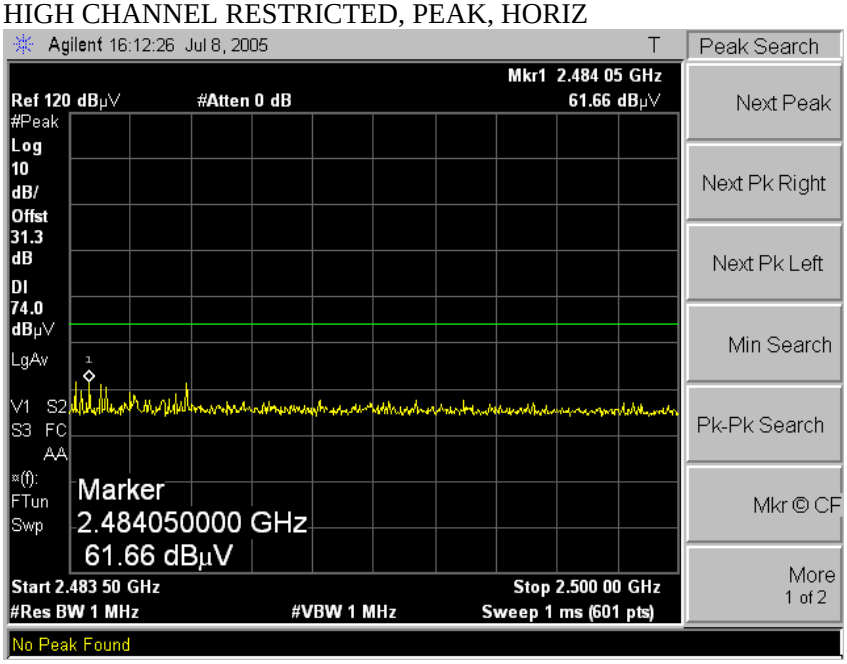


LOW CHANNEL RESTRICTED, AVG, VERT

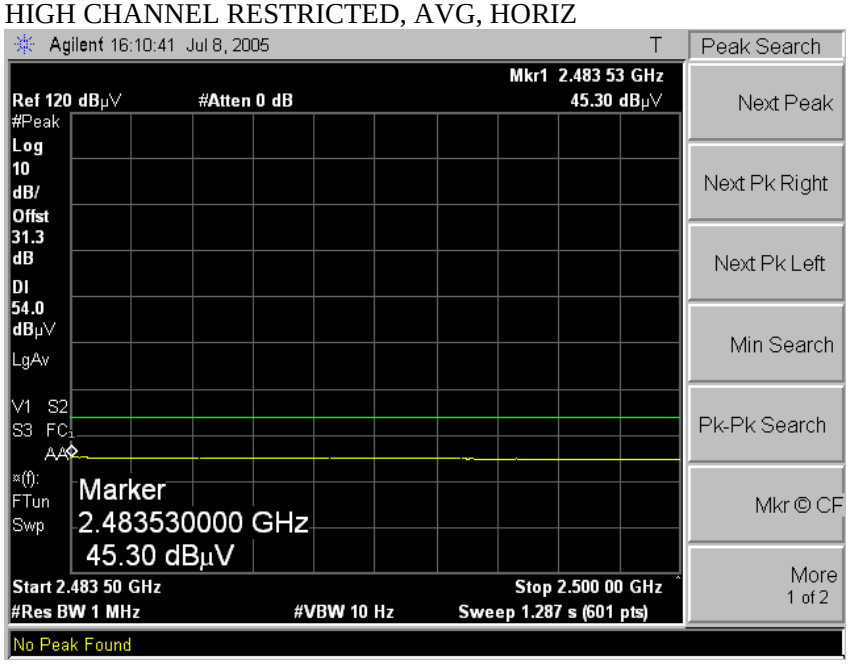


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

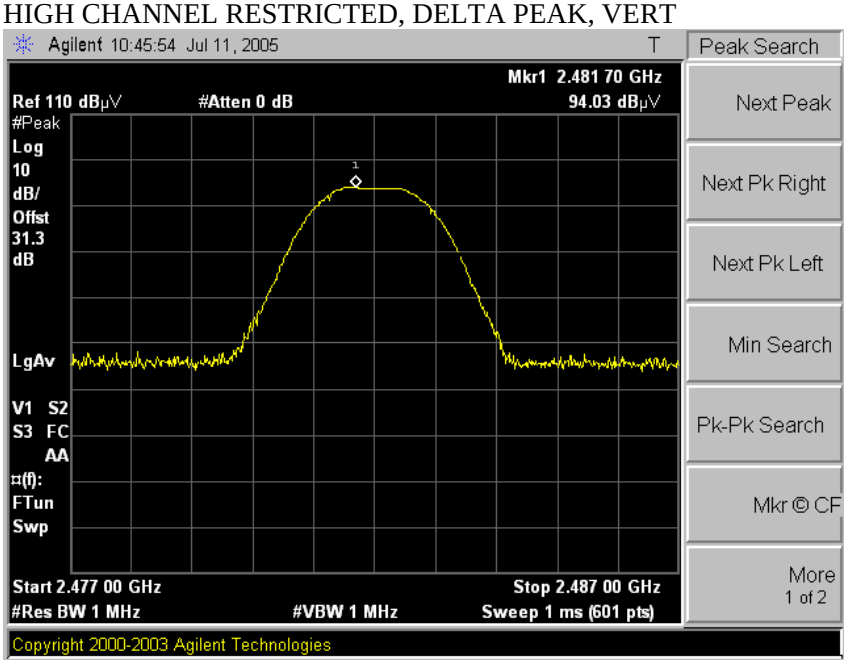


HIGH CHANNEL RESTRICTED, AVG, HORIZ

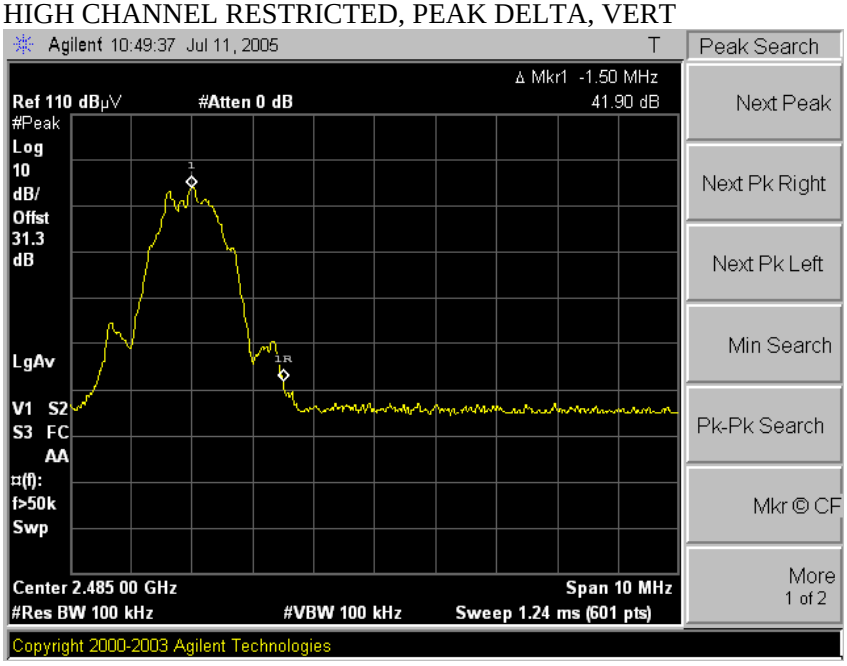


RESTRICTED BANDEDGE (HIGH CHANNEL, DELTA METHOD, VERTICAL)

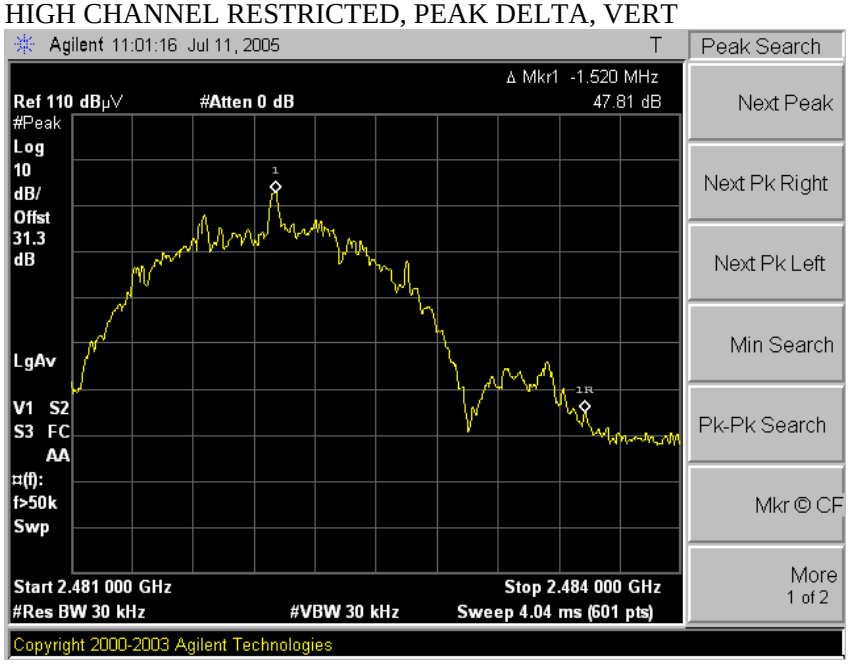
HIGH CHANNEL RESTRICTED, DELTA PEAK, VERT



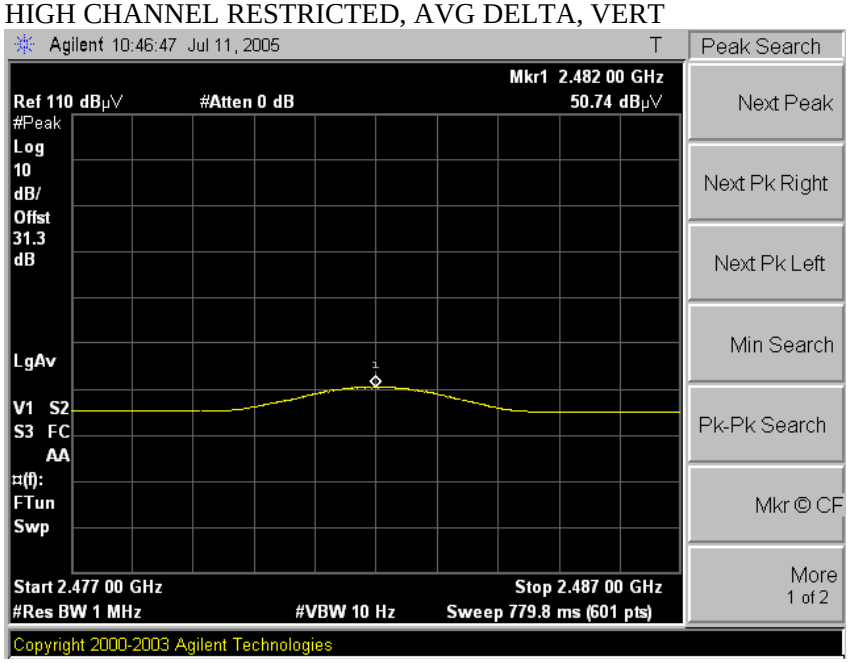
HIGH CHANNEL RESTRICTED, PEAK DELTA, VERT



HIGH CHANNEL RESTRICTED, PEAK DELTA, VERT



HIGH CHANNEL RESTRICTED, AVG DELTA, VERT



HARMONICS AND SPURIOUS EMISSIONS

07/11/05 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 05Uxxxx
Company: Microsoft
EUT Descrip.: 802.11 hopping Xbox controller and main lan
EUT M/N: Argon (Main), Radon (Game Controller0
Test Target: FCC
Mode Oper: Transmitting
Average Power Meter: Low = xx dBm, Mid = xx dBm, High = xx dBm

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T63 Miteq 646456			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	4 foot cable	12 foot cable	HPF	Reject Filter
2_David		4_David	12_Yan		R_001

Peak Measurements
RBW=VBW=1MHz

Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
2402 Channel															
4.804	3.0	47.6	35.8	33.6	5.5	-37.9	0.0	0.0	48.7	36.9	74	54	-25.3	-17.1	V
4.804	3.0	46.6	35.4	33.6	5.5	-37.9	0.0	0.0	47.7	36.5	74	54	-26.3	-17.5	H
2442 Channel															
4.884	3.0	47.7	35.9	33.7	5.5	-37.9	0.0	0.0	49.0	37.2	74	54	-25.0	-16.8	V
4.884	3.0	47.4	35.2	33.7	5.5	-37.9	0.0	0.0	48.7	36.5	74	54	-25.3	-17.5	H
2482 Channel															
4.964	3.0	47.9	36.0	33.8	5.6	-37.9	0.0	0.0	49.4	37.5	74	54	-24.6	-16.5	V
4.964	3.0	46.9	35.1	33.8	5.6	-37.9	0.0	0.0	48.4	36.6	74	54	-25.6	-17.4	H

No Further emissions were detected above the noise floor of the test receiver.

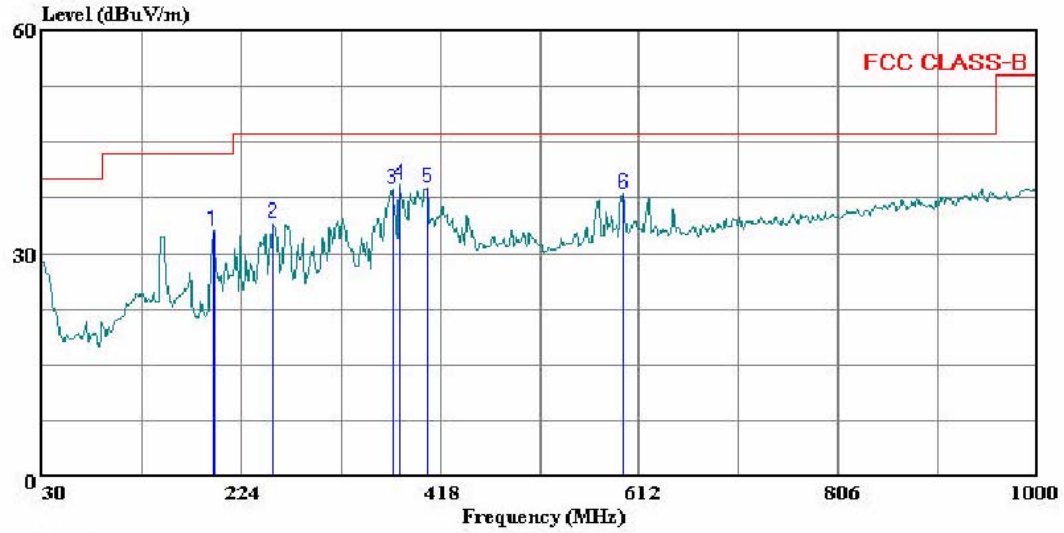
7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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

HORIZONTAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 2 File#: Radonargon.EMI Date: 07-11-2005 Time: 18:47:43



(Audix ATC)

Trace: 1 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : David Garcia
Project #: : 05U3586 & 05U3587
Company: : Microsoft
EUT: : Wireless game controller and base unit
Model No. : Radon and Argon
Configuration : EUT Stand Alone/ Argon to laptop
Target of Test : FCC ClassB
Mode of Operation: Tx

HORIZONTAL DATA

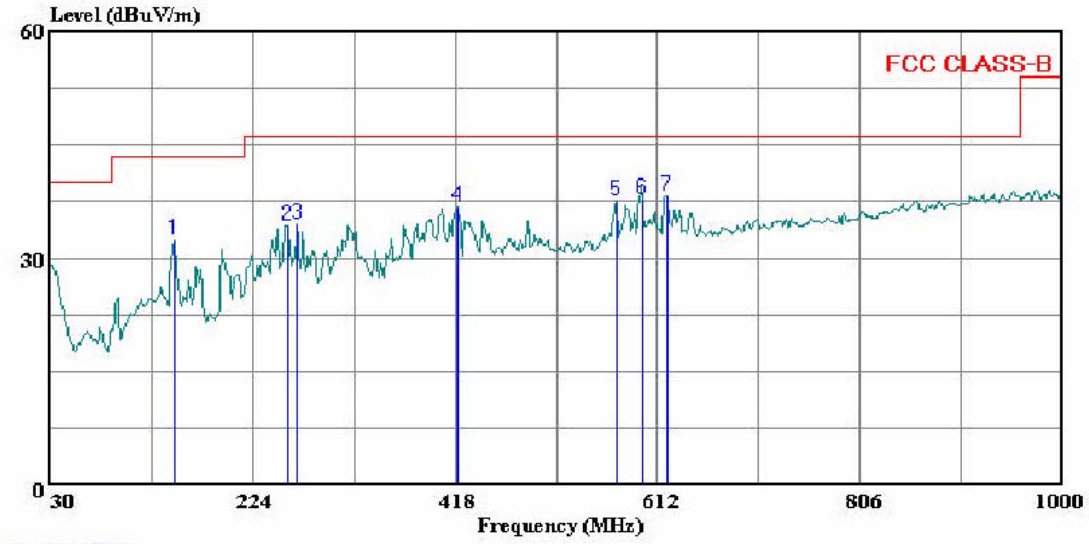
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	196.840	19.02	14.00	33.02	43.50	-10.48	Peak
2	255.040	19.87	14.09	33.96	46.00	-12.04	Peak
3	371.440	21.18	17.44	38.62	46.00	-7.38	Peak
4	378.230	21.62	17.55	39.17	46.00	-6.83	Peak
5	405.390	20.65	18.18	38.83	46.00	-7.17	Peak
6	596.480	16.50	21.48	37.98	46.00	-8.02	Peak

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

VERTICAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 4 File#: Radonargon.EMI Date: 07-11-2005 Time: 18:53:22



(Audix ATC)

Trace: 3 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : David Garcia
Project #: : 05U3586 & 05U3587
Company: : Microsoft
EUT: : Wireless game controller and base unit
Model No. : Radon and Argon
Configuration : EUT Stand Alone/ Argon to laptop
Target of Test : FCC ClassB
Mode of Operation: Tx

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	148.340	18.09	14.33	32.41	43.50	-11.09	Peak
2	256.980	20.13	14.21	34.34	46.00	-11.66	Peak
3	266.680	19.99	14.45	34.44	46.00	-11.56	Peak
4	419.940	18.19	18.51	36.70	46.00	-9.30	Peak
5	572.230	16.43	21.14	37.57	46.00	-8.43	Peak
6	597.450	16.23	21.48	37.71	46.00	-8.29	Peak
7	620.730	16.36	21.88	38.24	46.00	-7.76	Peak

7.3. 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.

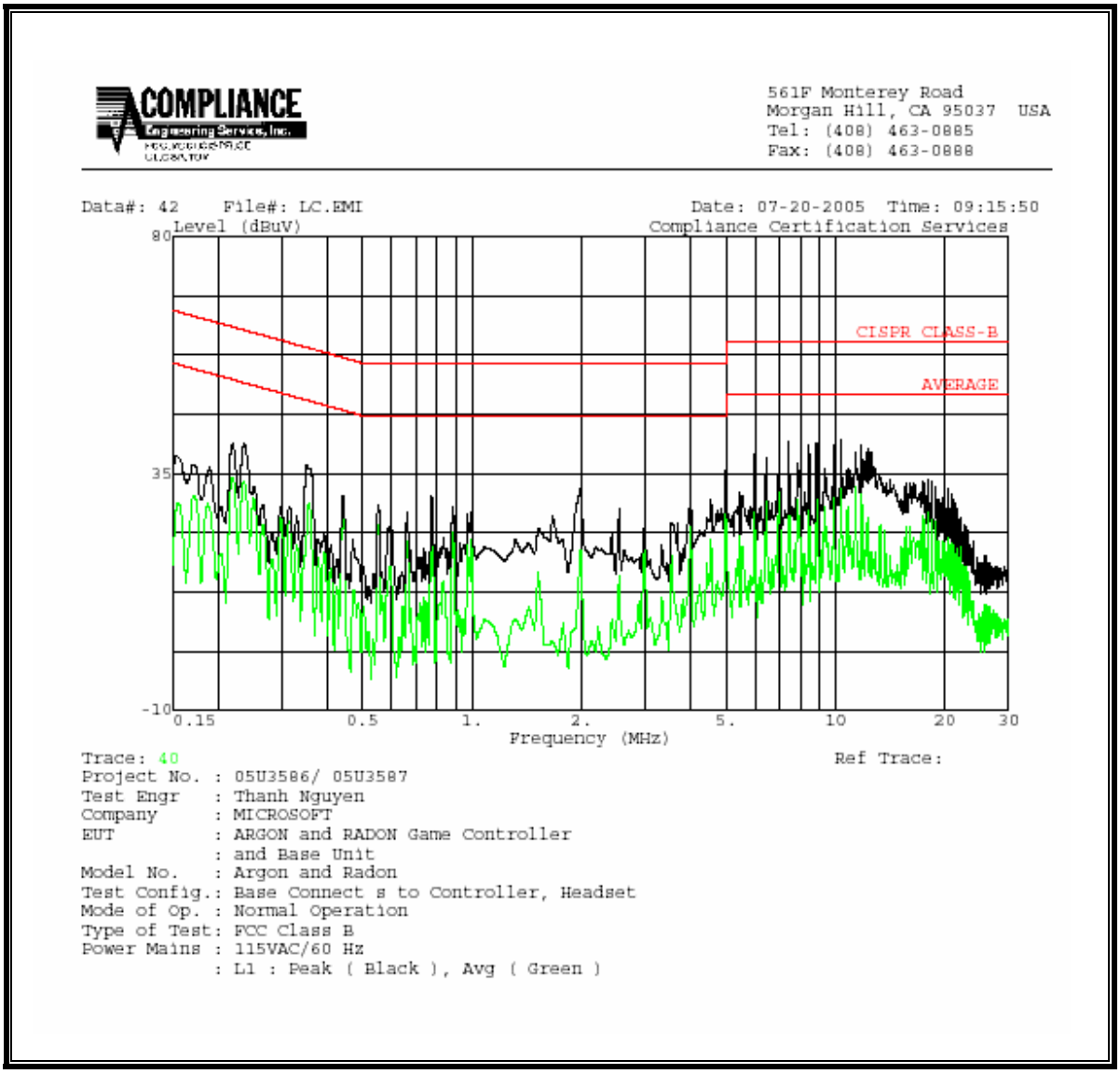
RESULTS

No non-compliance noted:

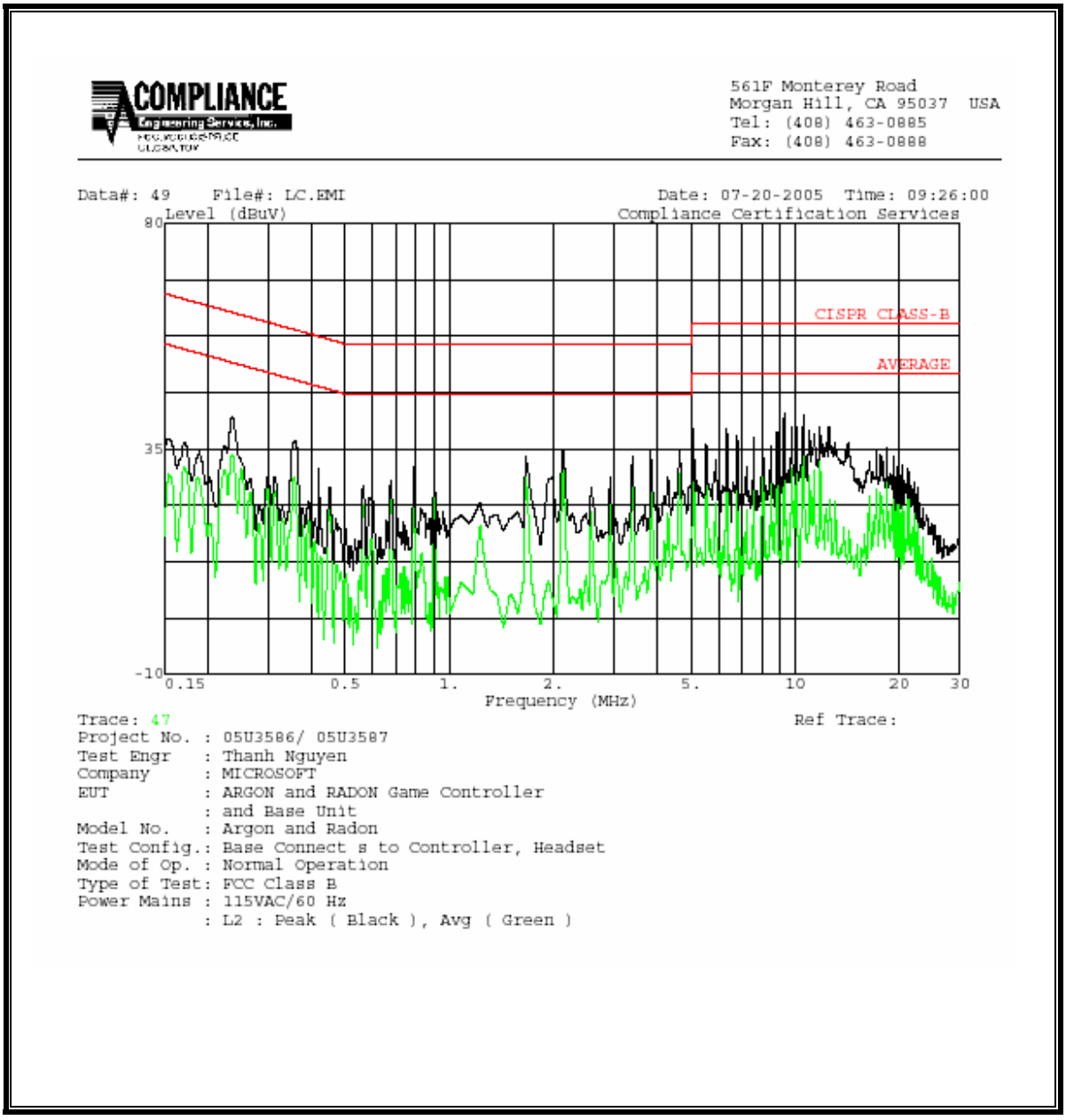
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.24	40.70	--	--	0.00	62.20	52.20	-21.50	-11.50	L1
4.98	35.64	--	--	0.00	56.00	46.00	-20.36	-10.36	L1
10.34	41.42	--	--	0.00	60.00	50.00	-18.58	-8.58	L1
0.24	41.28	--	--	0.00	62.20	52.20	-20.92	-10.92	L2
5.08	38.96	--	--	0.00	60.00	50.00	-21.04	-11.04	L2
9.30	42.12	--	--	0.00	60.00	50.00	-17.88	-7.88	L2
6 Worst Data									

LINE 1 RESULTS



LINE 2 RESULTS



8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO