



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

NOTEBOOK PC

Model Number: REVOLUTION PLUS

Trade Name: KONTRON

Issued to

**Kontron Embedded Technology
2FL, No. 2, Lane 50, Nang Kang Rd., Nang Kang Distrtict,
105, Taipei, Taiwan, R.O.C.**

Issued by

**Compliance Certification Services Inc.
No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,
Taoyuan Hsien, (338) Taiwan, R.O.C.
TEL: 886-3-324-0332
FAX: 886-3-324-5235**



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1. TEST RESULT CERTIFICATION

Applicant: Kontron Embedded Technology
2FL, No. 2, Lane 50, Nang Kang Rd., Nang Kang District,
105, Taipei, Taiwan, R.O.C.

Equipment Under Test: NOTEBOOK PC

Trade Name: KONTRON

Model Number: REVOLUTION PLUS

Date of Test: October 27, 2004 ~ February 15, 2005

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.207, 15.209 and 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Reviewed by:

Harris W. Lai
Executive Vice President
Compliance Certification Services Inc.

Gavin Lim
Section Manager
Compliance Certification Services Inc.

**2. EUT DESCRIPTION**

Product	NOTEBOOK PC
Model Number	REVOLUTION PLUS
Trade Name	KONTRON
Model Discrepancy	N/A
Power Supply	E.P.S. INC. / F19603A I/P: AC 100-240V, 1.8A, 50-60Hz O/P: DC 12V, 4.58A
Frequency Range	WLAN: 2412 – 2462 MHz Bluetooth: 2402 MHz – 2480 MHz
Transmit Power	WLAN: IEEE 802.11b: 17.66 dBm IEEE 802.11g: 17.06dBm Bluetooth: 2.32 dBm
Modulation Technique	WLAN: IEEE 802.11b: DSSS (CCK; DQPSK; DBPSK) IEEE 802.11g: OFDM (QPSK, BPSK, 16-QAM, 64-QAM) Bluetooth: Frequency Hopping Spread Spectrum (FHSS) (GFSK)
Number of Channels	WLAN: 11 Channels Bluetooth: 79 Channels
Antenna Specification	WLAN: 1.123 dBi Bluetooth: 1.004 dBi
Antenna Designation	WLAN: PIFA Antenna at left side Bluetooth: PIFA Antenna at right side

Remark: This submittal(s) (test report) is intended for FCC ID: Q7KREVOLUTION-V5 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4. Radiated testing was performed at an antenna to EUT distance 3 meters.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (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

- (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.

3.5 DESCRIPTION OF TEST MODES

The EUT (model: REVOLUTION PLUS) has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis) with Tablet PC mode and Notebook PC mode. The worst emission was found in Notebook PC mode and the worst case was recorded. After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Condition A (WLAN operation): Channel low (2412MHz) 、 mid (2437MHz) and high (2462MHz) with 11Mbps higher data rate were chosen for the final testing.

Condition B (Bluetooth operation): Channel low (2402MHz) 、 mid (2441MHz) and high (2480MHz) were chosen for final testing.

Condition C (Co-located operation): Radiated among the combination of the WLAN low / mid / high channel with Bluetooth mid channel.



4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200600-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: 93105 and 90471).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	EN 55011, EN 55014-1, AS/NZS 1044, CNS 13783-1, EN 55022, CNS 13438, EN 61000-3-2, EN 61000-3-3, ANSI C63.4, FCC OST/MP-5, AS/NZS CISPR 22, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11	 200600-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 93105, 90471
Japan	VCCI	4 3/10 meter Open Area Test Sites to perform conducted/radiated measurements	VCCI R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328-2, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	 ELA 124a ELA 124b ELA 124c
Taiwan	CNLA	EN 300 328-1/2, EN 300 220-1/2/3, EN 300 440-1/2, EN 61000-3-2, EN 61000-3-3, 47 CFR FCC Part 15 Subpart C/D/E, EN 55013, CNS 13439, EN 55014-1, CNS 13783-1, EN 55022, CNS 13438, CISPR 22, AS/NZS 3548, EN 61000-4-2/3/4/5/6/8/11, ENV 50204, IEEE Std 1528, FCC OET Bulletin, 65+Supplement C, EN50360, EN50361, EN50371, RSS102	 0 3 6 3 ILAC MRA
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	 SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	RSS212, Issue 1	 IC 3991-3 IC 3991-4

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



6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Remark:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*



7. FCC PART 15.247 REQUIREMENTS

CONDITION A: WLAN OPERATION

7.1 6dB BANDWIDTH

LIMIT

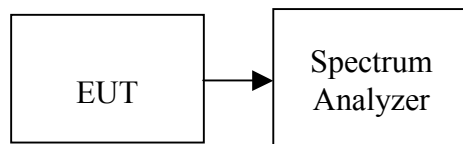
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = RBW, Span = 50MHz, Sweep = auto.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted



Test Data

IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	8500	>500	PASS
Mid	2437	8830		PASS
High	2462	8580		PASS

IEEE 802.11g

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	16080	>500	PASS
Mid	2437	16500		PASS
High	2462	16500		PASS



Test Plot

6dB Bandwidth (IEEE 802.11b / CH Low)

Agilent 11:25:46 Oct 27, 2004

R L

6dB BW, b Mode Low Ch.

Δ Mkr1 8.50 MHz

Ref 20 dBm

Atten 20 dB

-0.94 dB

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-0.6

dBm

LgAv

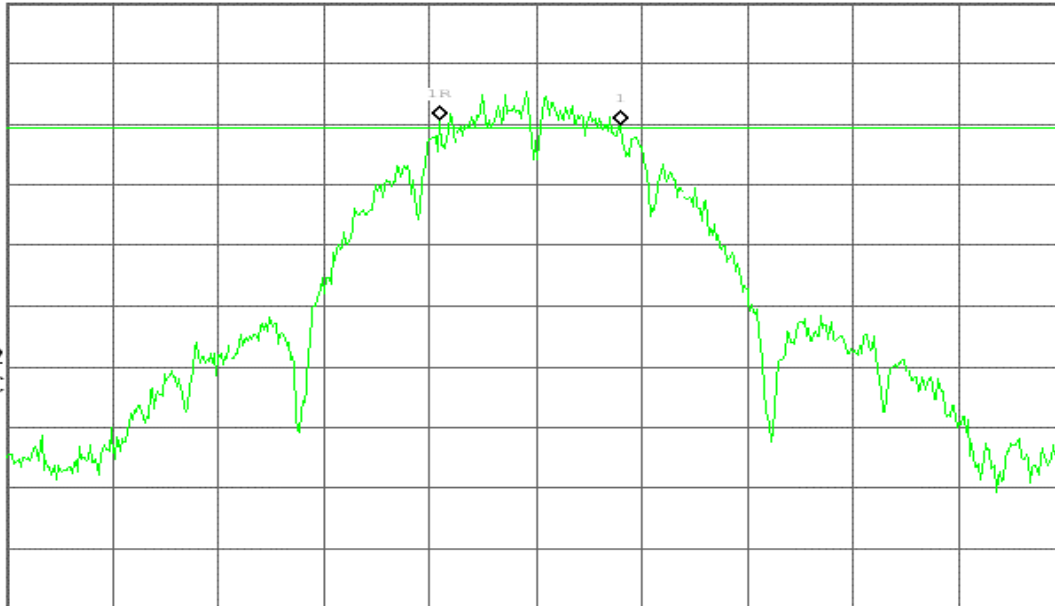
V1 S2

S3 FC

$\alpha(f)$:

FTun

Swp



Center 2.412 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)

6dB Bandwidth (IEEE 802.11b / CH Mid)

Agilent 11:40:03 Oct 27, 2004

R L

6dB BW, b Mode Mid Ch.

Δ Mkr1 8.83 MHz

Ref 20 dBm

Atten 20 dB

0.12 dB

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-3.6

dBm

LgAv

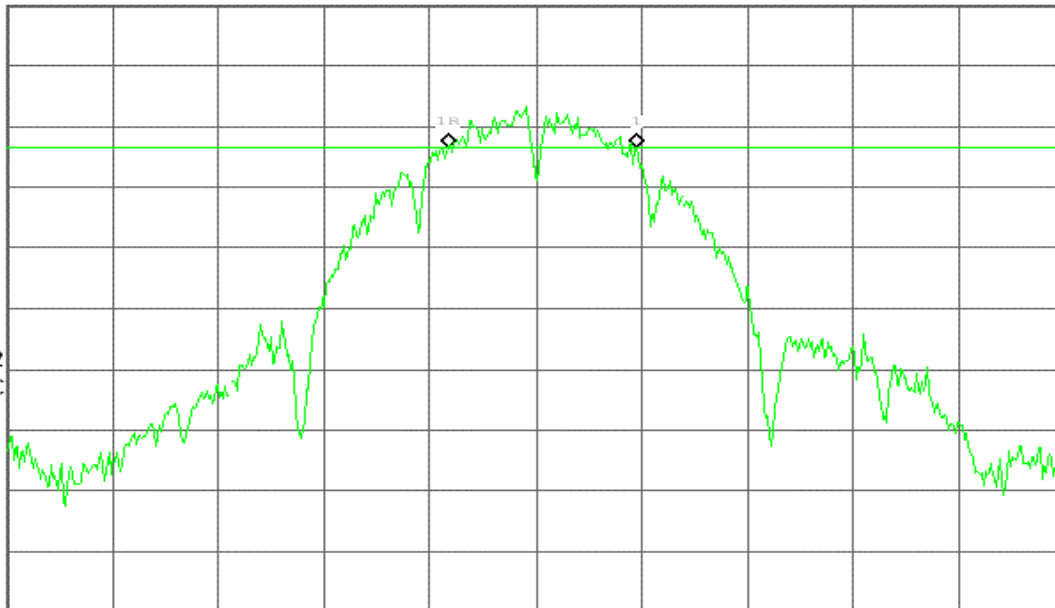
V1 S2

S3 FC

$\alpha(f)$:

FTun

Swp



Center 2.437 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)



6dB Bandwidth (IEEE 802.11b / CH High)

Agilent 11:46:40 Oct 27, 2004

R L

6dB BW, b Mode High Ch.

Δ Mkr1 8.58 MHz

Ref 20 dBm

Atten 20 dB

-0.92 dB

#Peak

Log

10

dB/

Offset

11.7

dB

DI

-2.4

dBm

LgAv

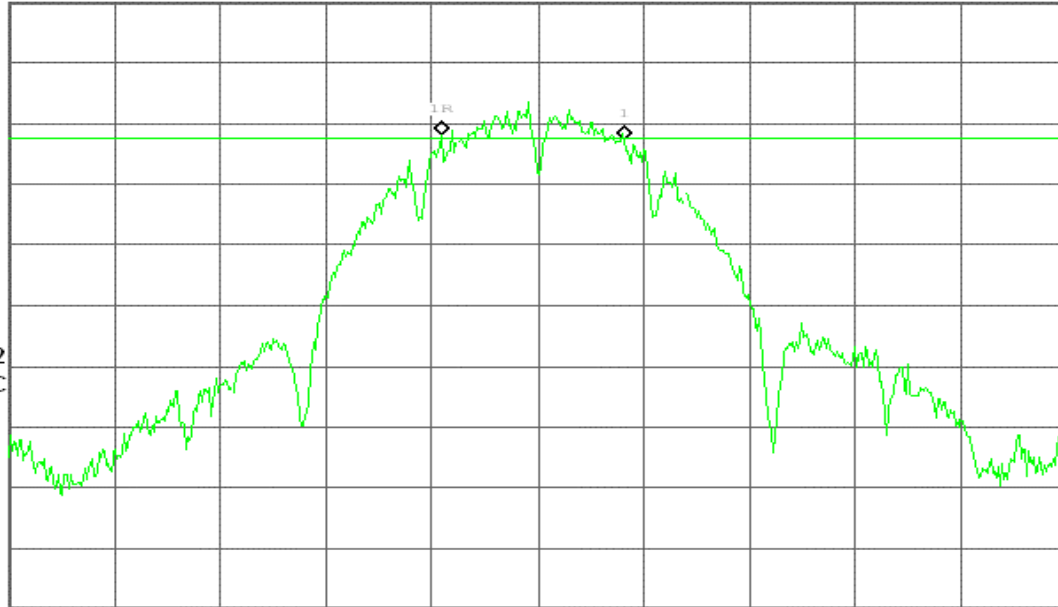
V1 S2

S3 FC

$\square(f)$:

FTun

Swp



Center 2.462 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)



6dB Bandwidth (IEEE 802.11g / CH Low)

Agilent 11:55:02 Oct 27, 2004

R L

6dB BW, g Mode Low Ch.

Δ Mkr1 16.08 MHz

Ref 20 dBm

Atten 20 dB

1.08 dB

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-0.7

dBm

LgAv

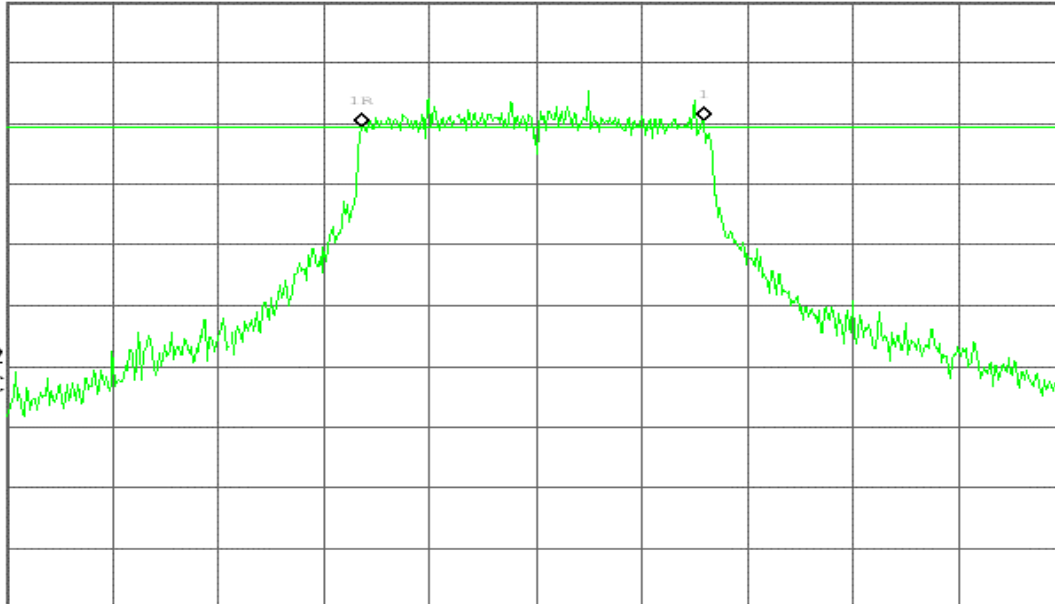
V1 S2

S3 FC

□(f):

FTun

Swp



Center 2.412 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)

6dB Bandwidth (IEEE 802.11g / CH Mid)

Agilent 12:06:06 Oct 27, 2004

R L

6dB BW, g Mode Mid Ch.

Δ Mkr1 16.50 MHz

Ref 20 dBm

Atten 20 dB

-1.66 dB

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-7.5

dBm

LgAv

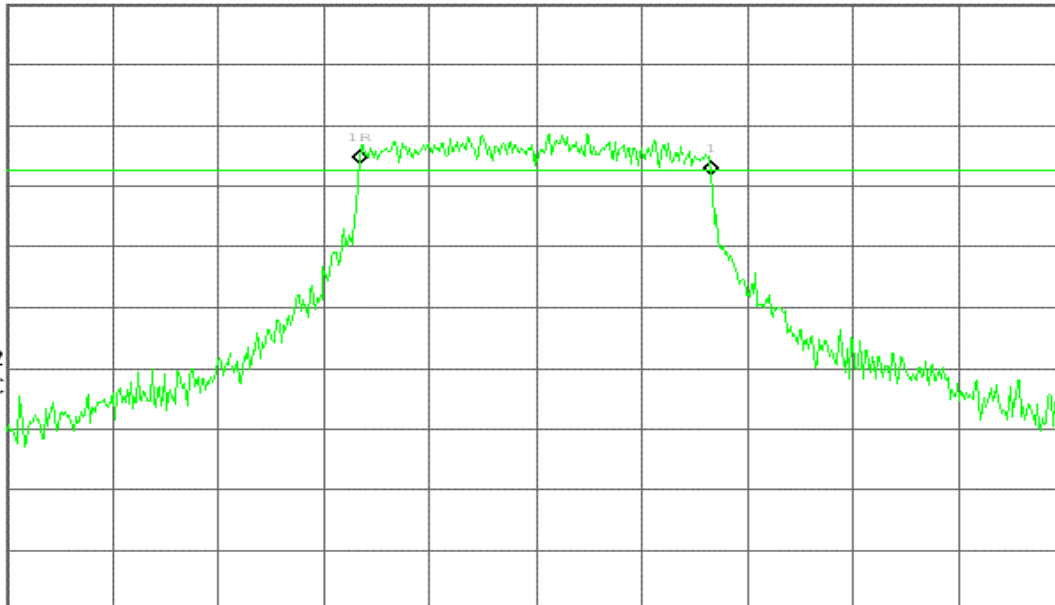
V1 S2

S3 FC

□(f):

FTun

Swp



Center 2.437 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)



6dB Bandwidth (IEEE 802.11g / CH High)

Agilent 12:11:51 Oct 27, 2004

R L

6dB BW, g Mode High Ch.

Δ Mkr1 16.50 MHz

Ref 20 dBm

Atten 20 dB

-0.64 dB

#Peak

Log

10

dB/

Offset

11.7

dB

DI

-6.5

dBm

LgAv

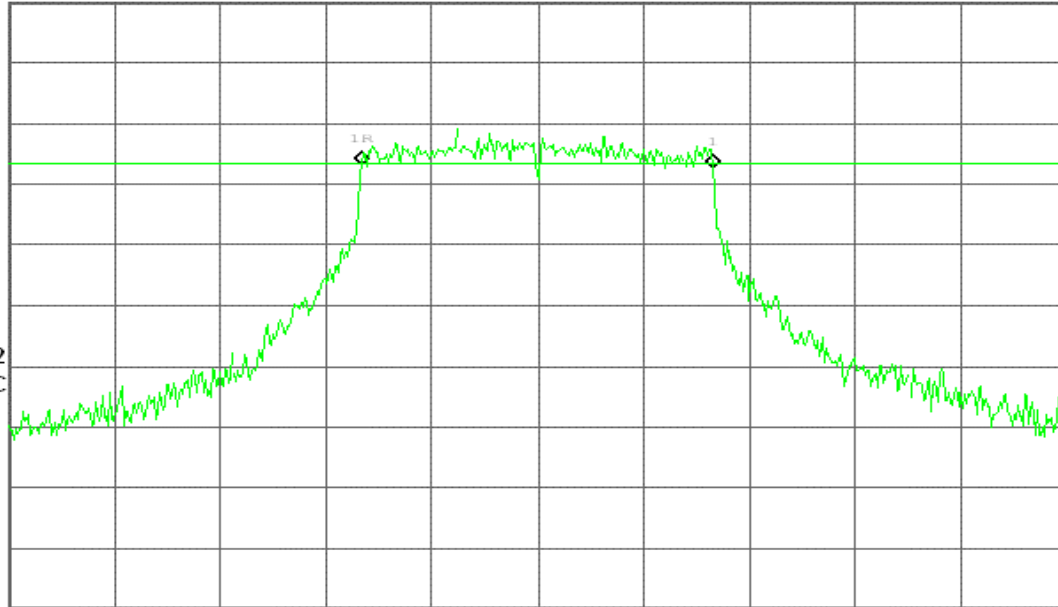
V1 S2

S3 FC

$\square(f)$:

FTun

Swp



Center 2.462 00 GHz

Span 50 MHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 6.04 ms (601 pts)



7.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

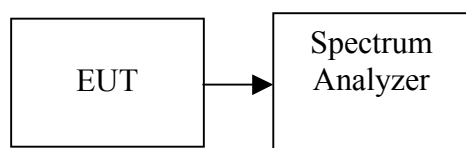
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional 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.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

TEST RESULTS

No non-compliance noted.



Test Data

IEEE 802.11b

Channel	Frequency (MHz)	Output Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	5.96	11.70	17.66	0.05834	1	PASS
Mid	2437	4.49	11.70	16.19	0.04159		PASS
High	2462	3.77	11.70	15.47	0.03524		PASS

IEEE 802.11g

Channel	Frequency (MHz)	Output Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	5.36	11.70	17.06	0.05082	1	PASS
Mid	2437	4.52	11.70	16.22	0.04188		PASS
High	2462	3.91	11.70	15.61	0.03639		PASS



Test Plot

Peak power (IEEE 802.11b / Ch Low)

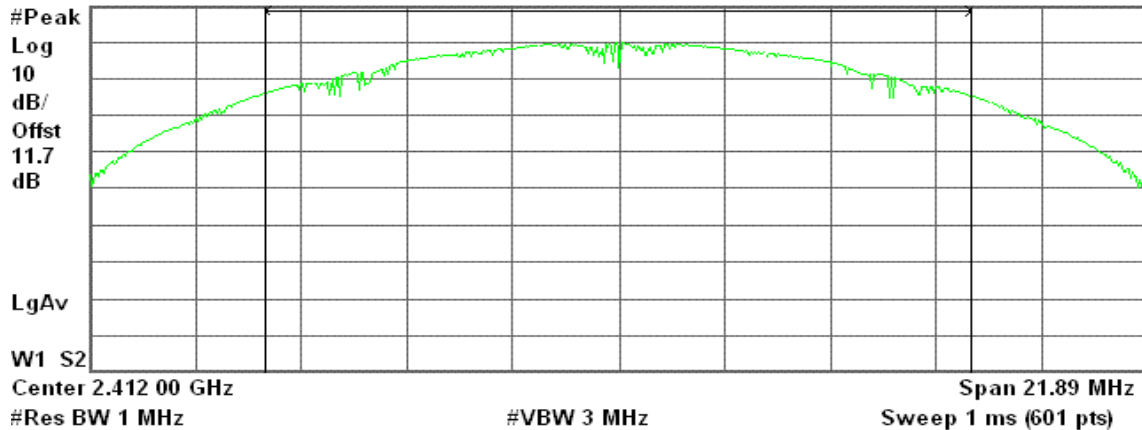
Agilent 11:27:09 Oct 27, 2004

R L

Peak Output Power , b Mode Low Ch.

Ref 20 dBm

Atten 20 dB



Channel Power

Power Spectral Density

17.66 dBm / 14.5960 MHz

-53.98 dBm/Hz

Peak power (IEEE 802.11b / CH Mid)

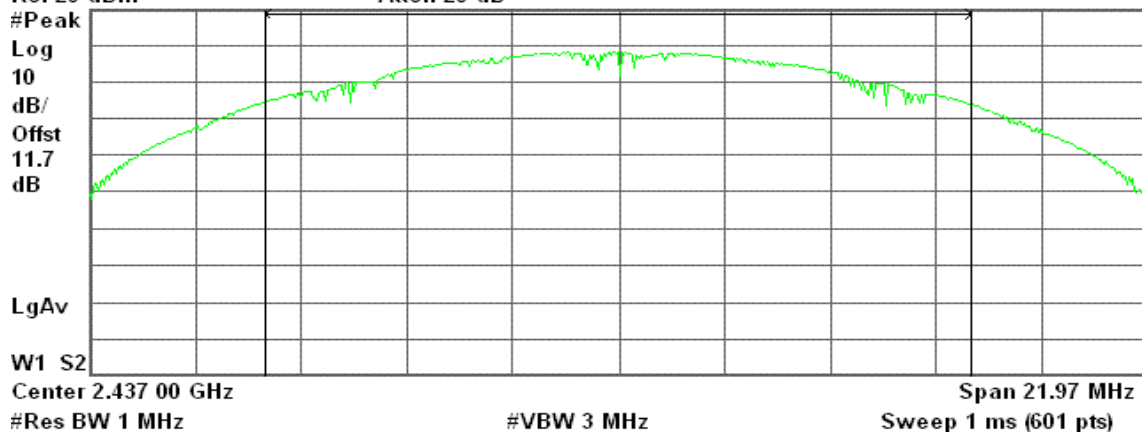
Agilent 11:45:57 Oct 27, 2004

R L

Peak Output Power , b Mode Mid Ch.

Ref 20 dBm

Atten 20 dB



Channel Power

Power Spectral Density

16.19 dBm / 14.6450 MHz

-55.47 dBm/Hz



Peak power (IEEE 802.11b / CH High)

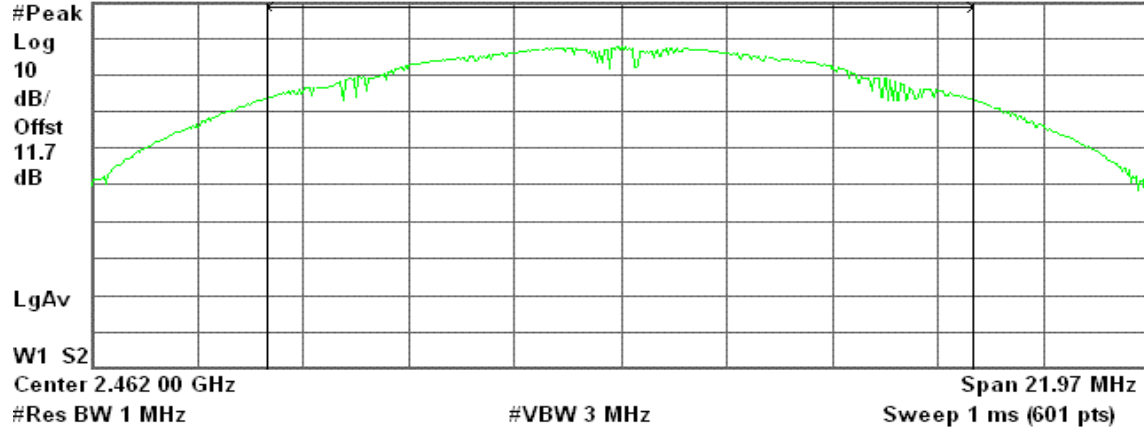
Agilent 11:47:44 Oct 27, 2004

R L

Peak Output Power, b Mode High Ch.

Ref 20 dBm

Atten 20 dB



Channel Power

15.47 dBm / 14.6490 MHz

Power Spectral Density

-56.19 dBm/Hz



Peak power (IEEE 802.11g / Ch Low)

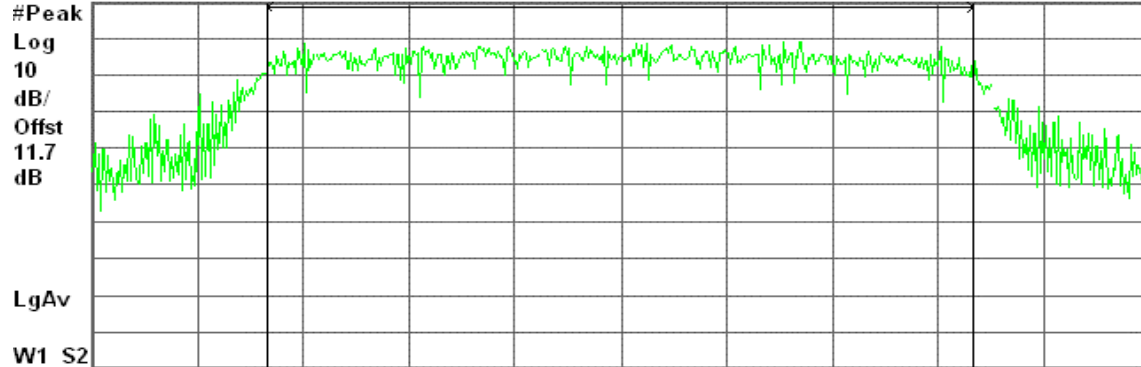
Agilent 11:58:14 Oct 27, 2004

R L

Peak Output Power, g Mode Low Ch.

Ref 20 dBm

Atten 20 dB



Center 2.412 00 GHz

Span 24.97 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

17.06 dBm / 16.6460 MHz

-55.15 dBm/Hz

Peak power (IEEE 802.11g / CH Mid)

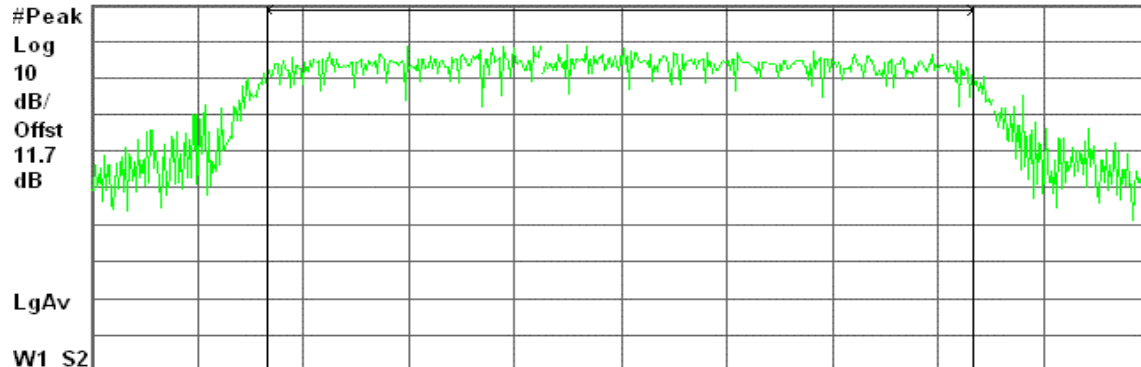
Agilent 12:06:59 Oct 27, 2004

R L

Peak Output Power, g Mode Mid Ch.

Ref 20 dBm

Atten 20 dB



Center 2.437 00 GHz

Span 25.02 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 1 ms (601 pts)

Channel Power

Power Spectral Density

16.22 dBm / 16.6820 MHz

-56.00 dBm/Hz



Peak power (IEEE 802.11g / CH High)

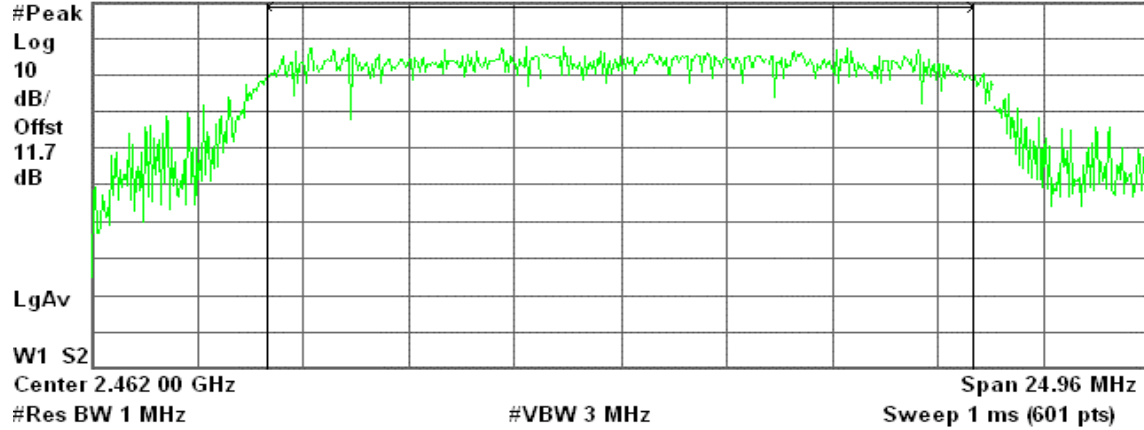
Agilent 12:12:54 Oct 27, 2004

R L

Peak Output Power , g Mode High Ch.

Ref 20 dBm

Atten 20 dB



Channel Power

15.61 dBm / 16.6390 MHz

Power Spectral Density

-56.61 dBm/Hz

7.3 BAND EDGES MEASUREMENT

LIMIT

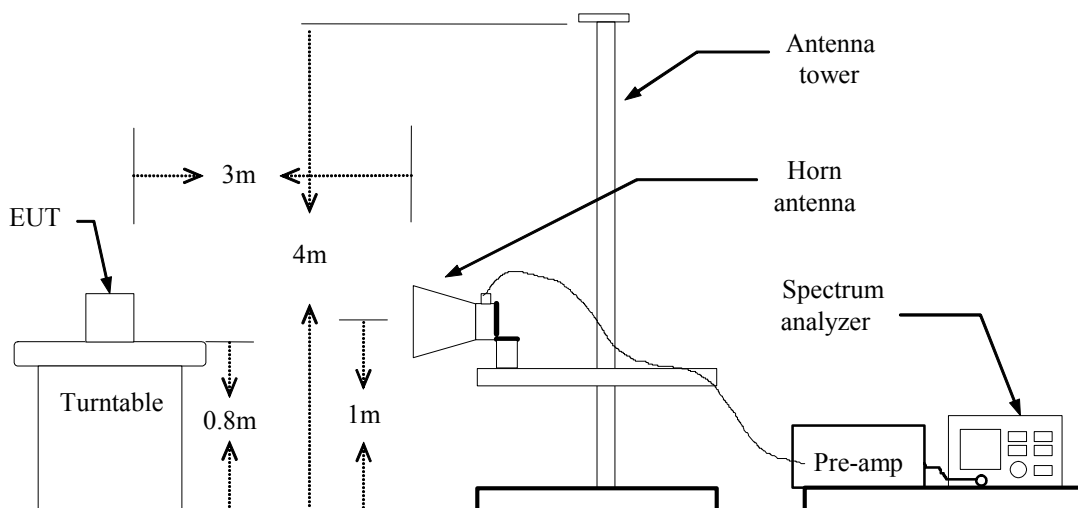
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. 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).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2005

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

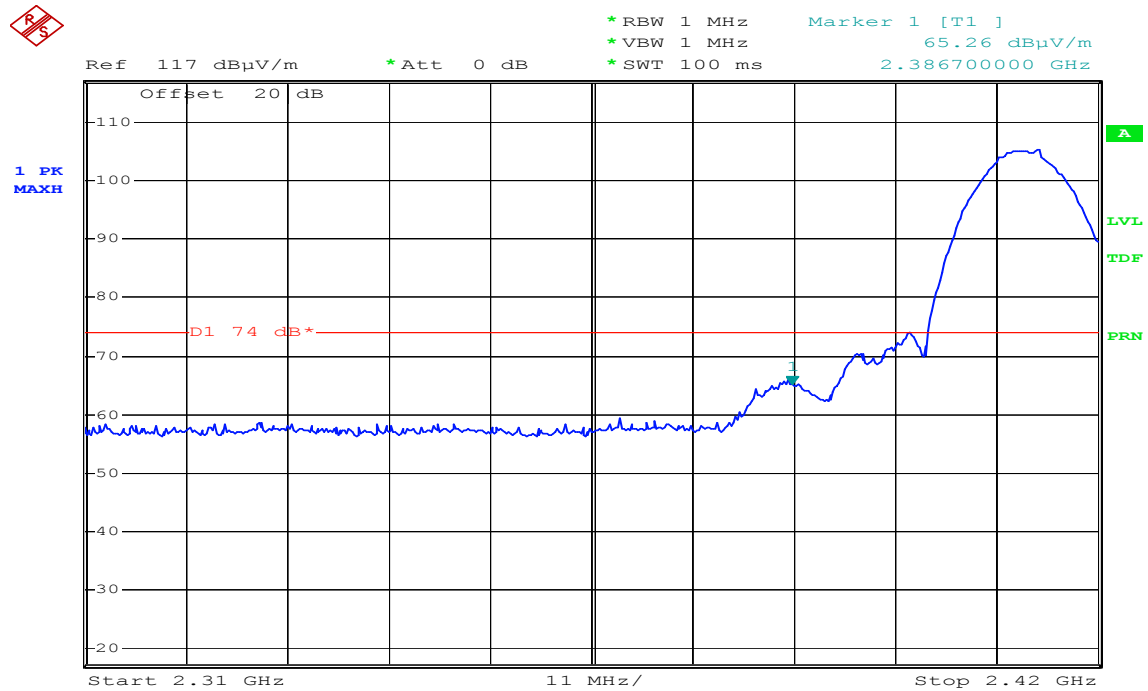
Refer to attach spectrum analyzer data chart.



Band Edges (IEEE 802.11b / CH Low)

Detector mode: Peak

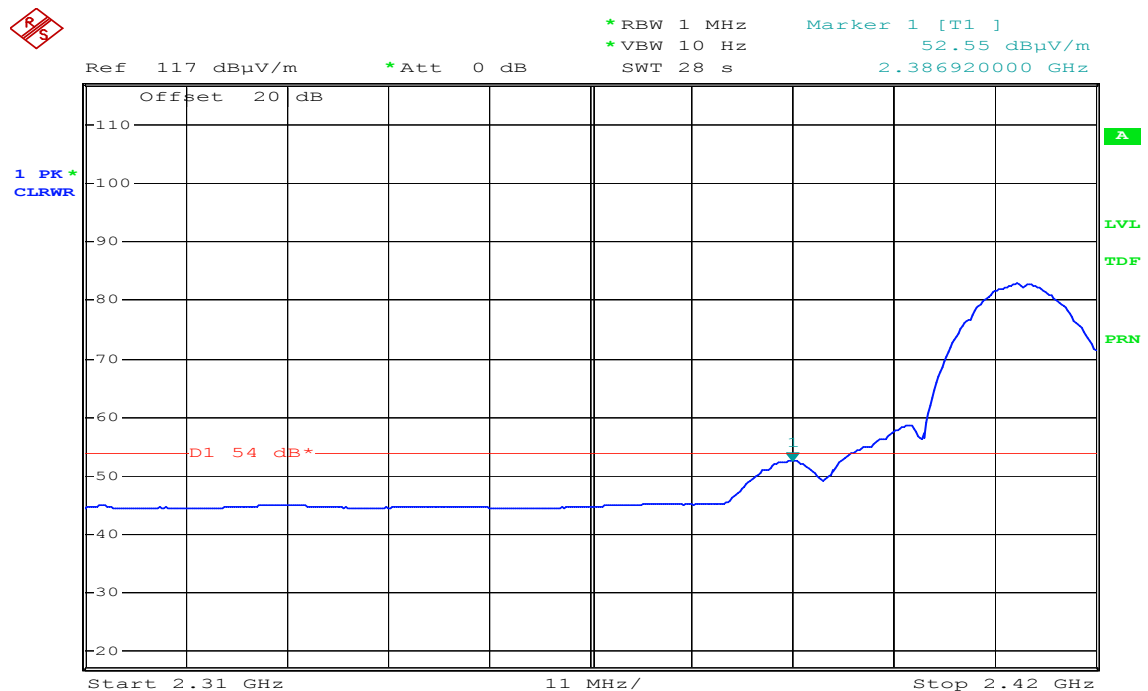
Polarity: Vertical



Date: 5.FEB.2005 08:12:38

Detector mode: Average

Polarity: Vertical

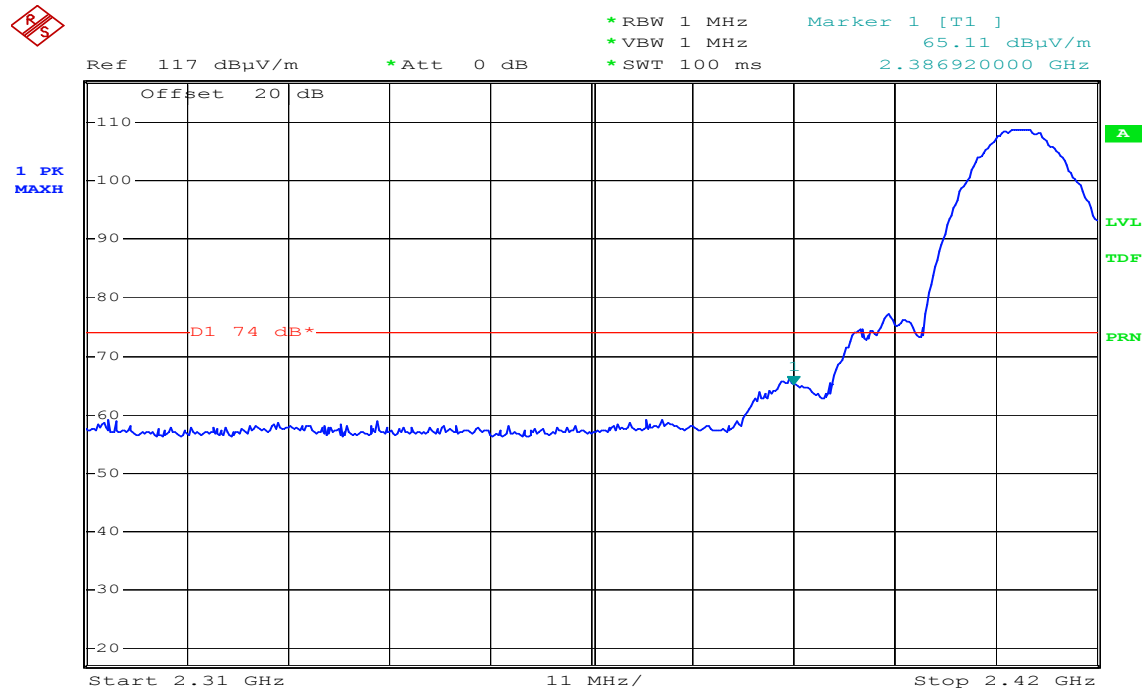


Date: 5.FEB.2005 08:11:26



Detector mode: Peak

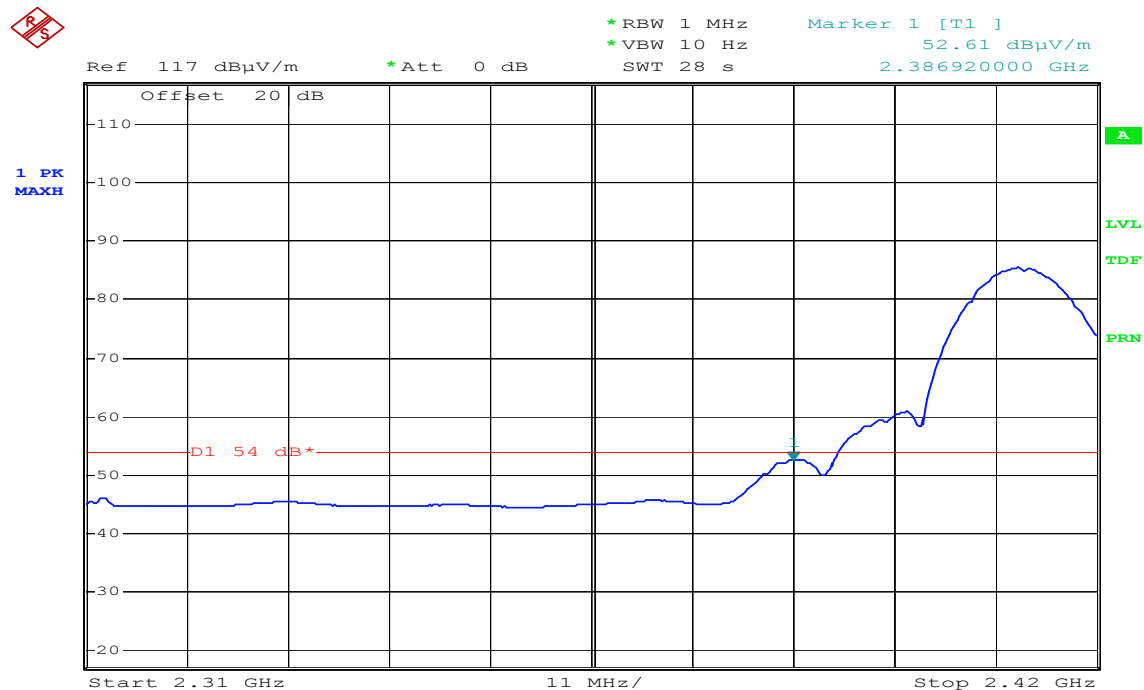
Polarity: Horizontal



Date: 5.FEB.2005 08:19:51

Detector mode: Average

Polarity: Horizontal



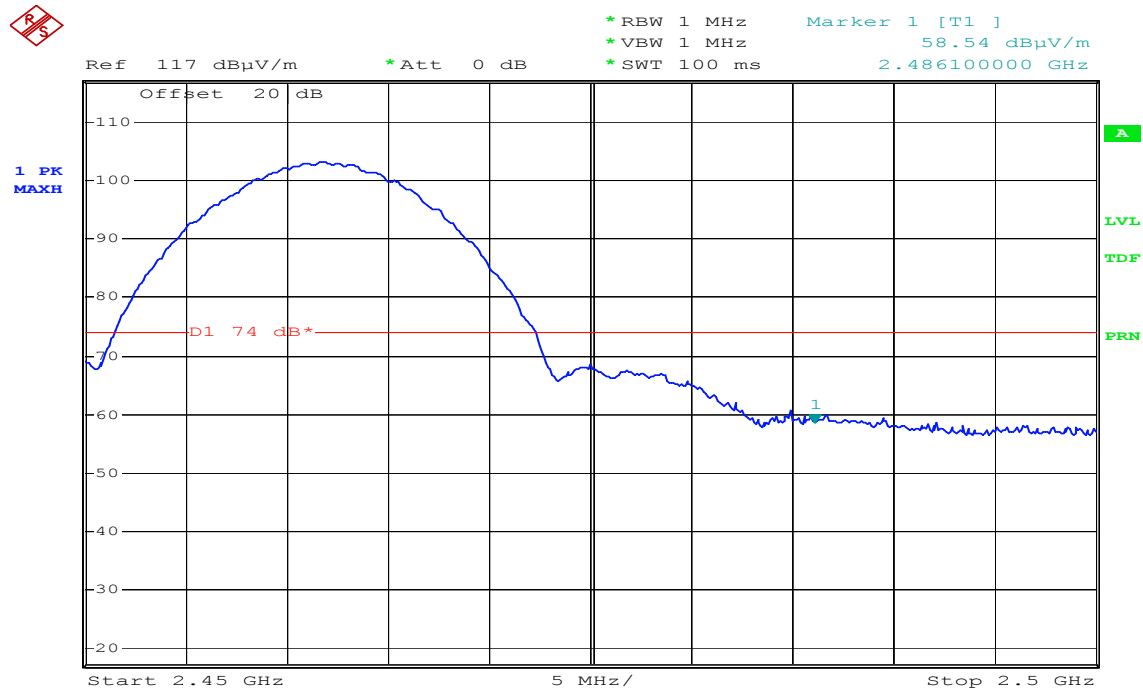
Date: 5.FEB.2005 08:19:01



Band Edges (IEEE 802.11b / CH High)

Detector mode: Peak

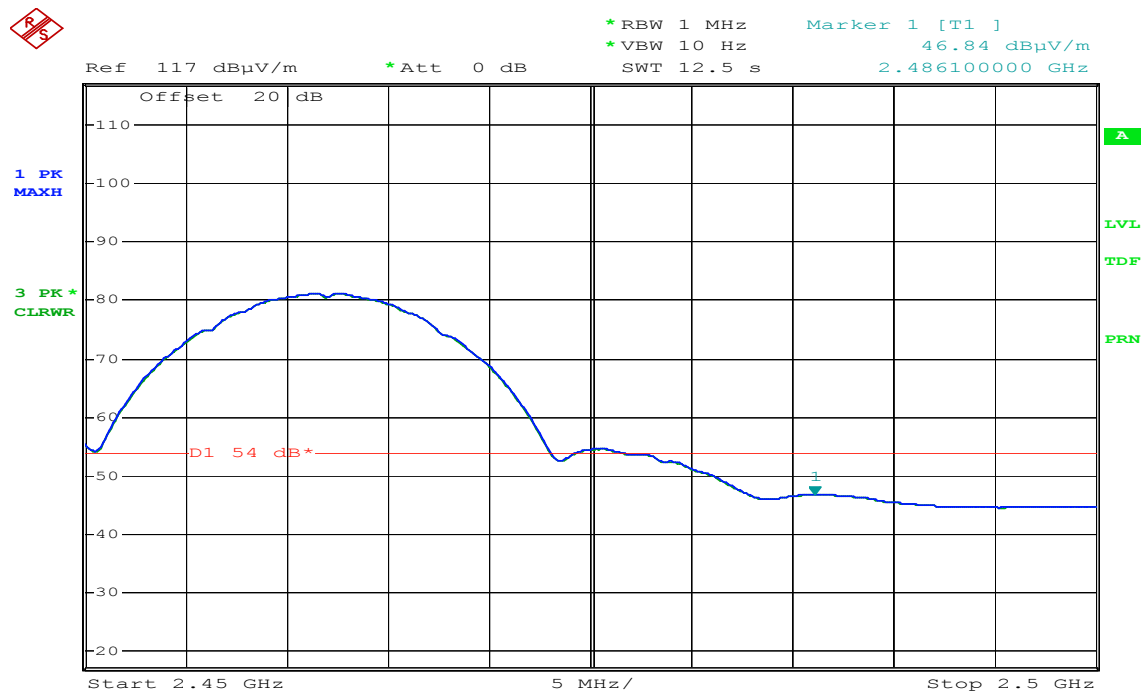
Polarity: Vertical



Date: 5.FEB.2005 08:32:42

Detector mode: Average

Polarity: Vertical

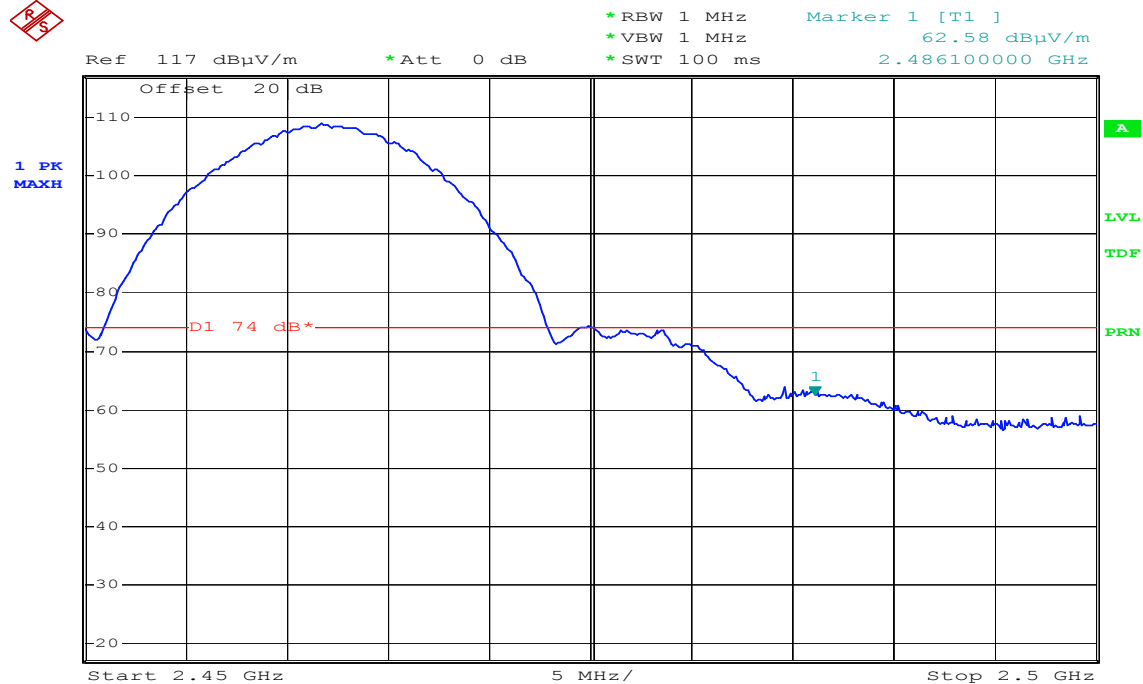


Date: 5.FEB.2005 08:31:11



Detector mode: Peak

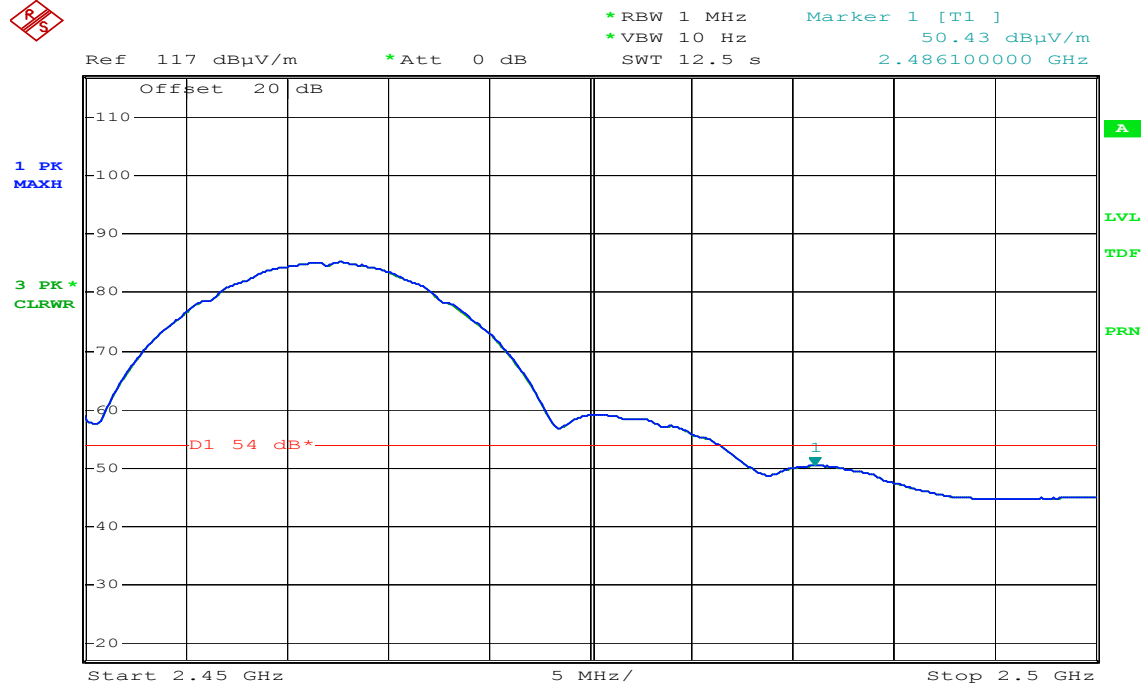
Polarity: Horizontal



Date: 5.FEB.2005 08:25:24

Detector mode: Average

Polarity: Horizontal



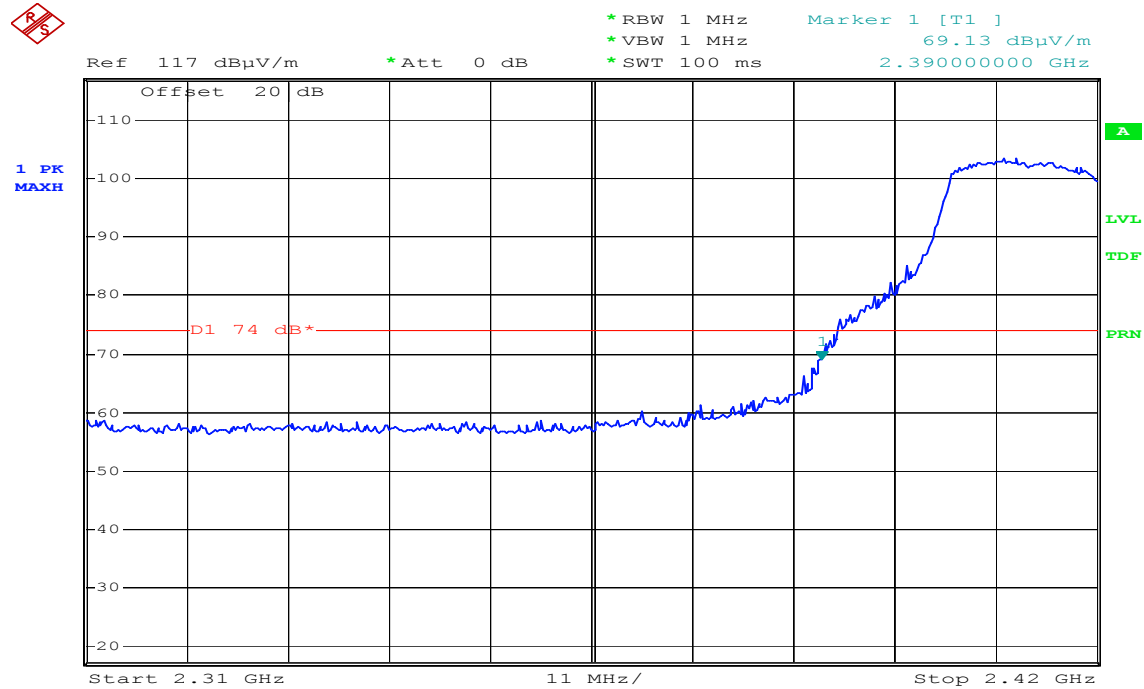
Date: 5.FEB.2005 08:24:20



Band Edges (IEEE 802.11g / CH Low)

Detector mode: Peak

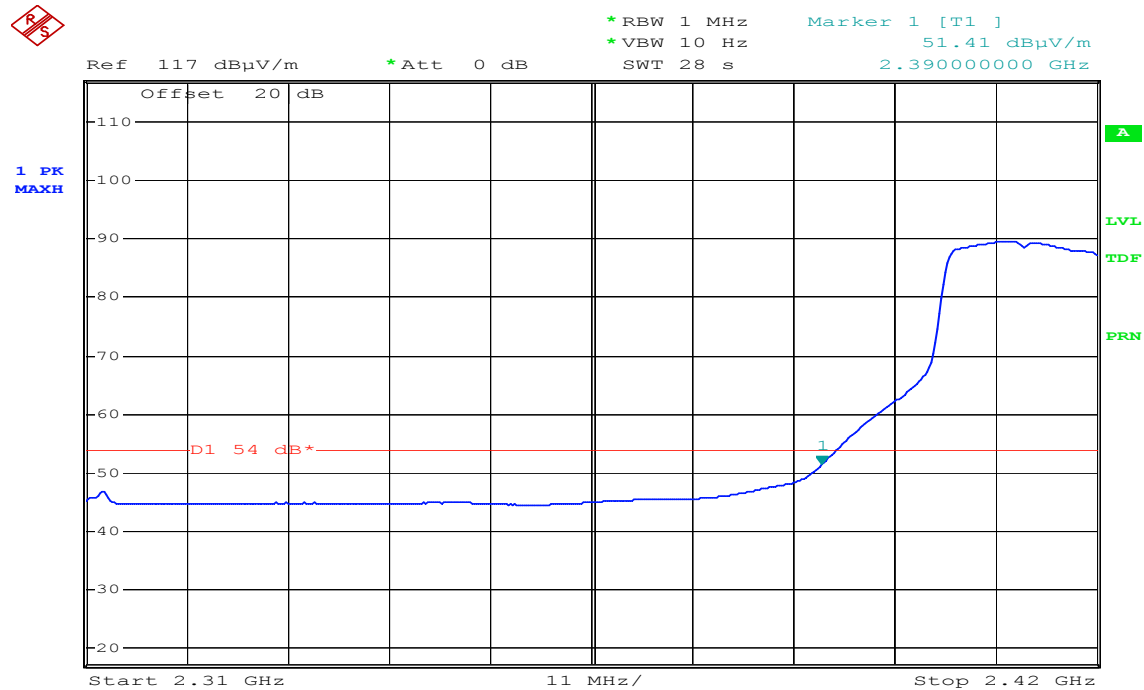
Polarity: Vertical



Date: 5.FEB.2005 08:42:33

Detector mode: Average

Polarity: Vertical

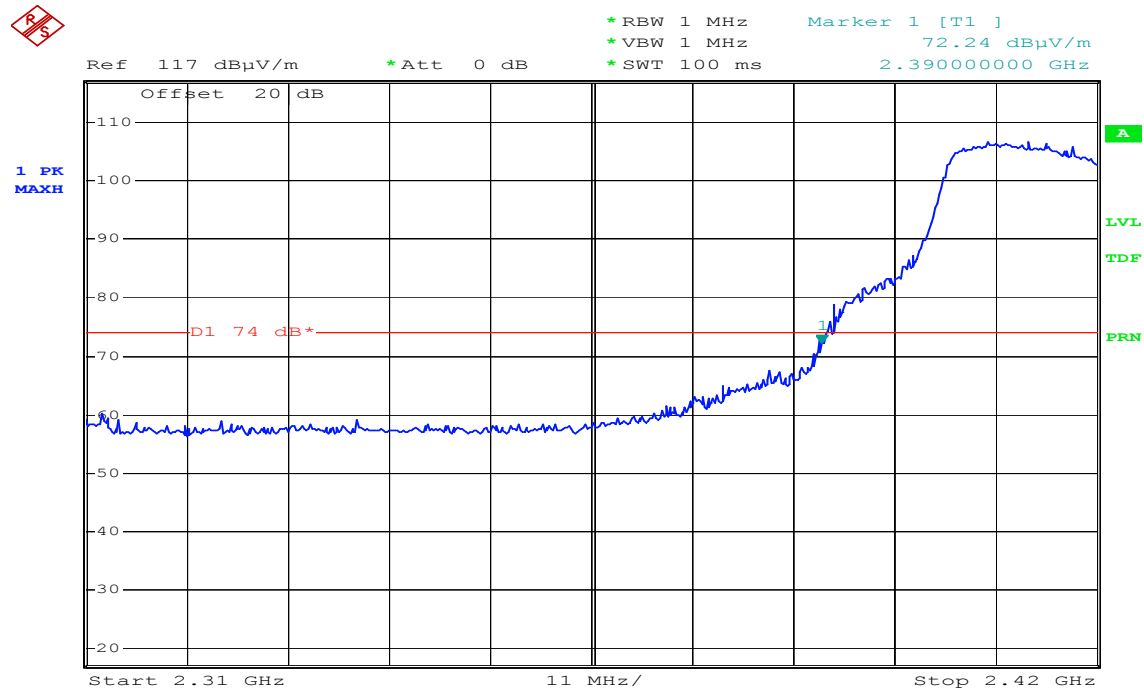


Date: 5.FEB.2005 08:41:13



Detector mode: Peak

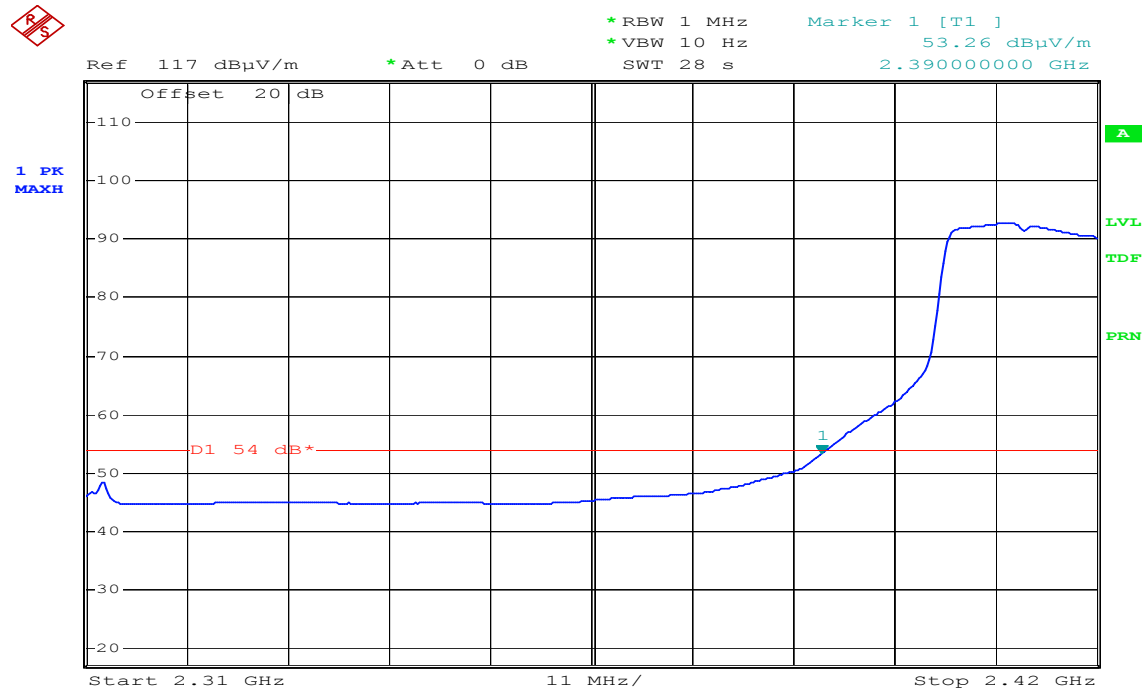
Polarity: Horizontal



Date: 5.FEB.2005 08:49:43

Detector mode: Average

Polarity: Horizontal



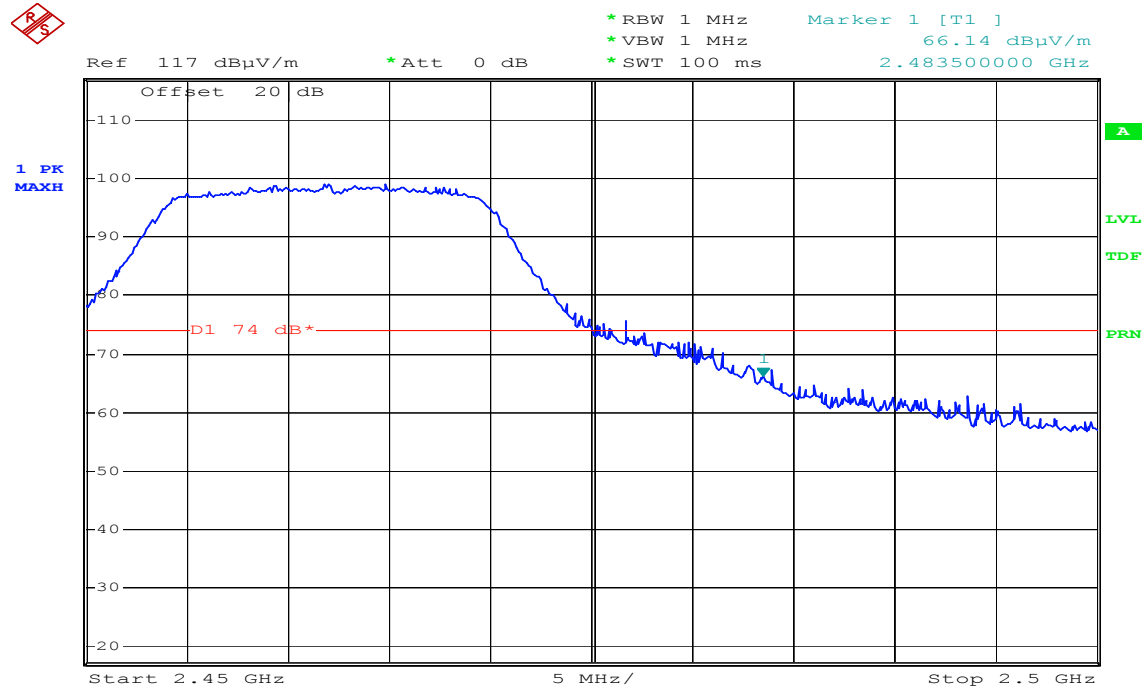
Date: 5.FEB.2005 08:48:33



Band Edges (IEEE 802.11g / CH High)

Detector mode: Peak

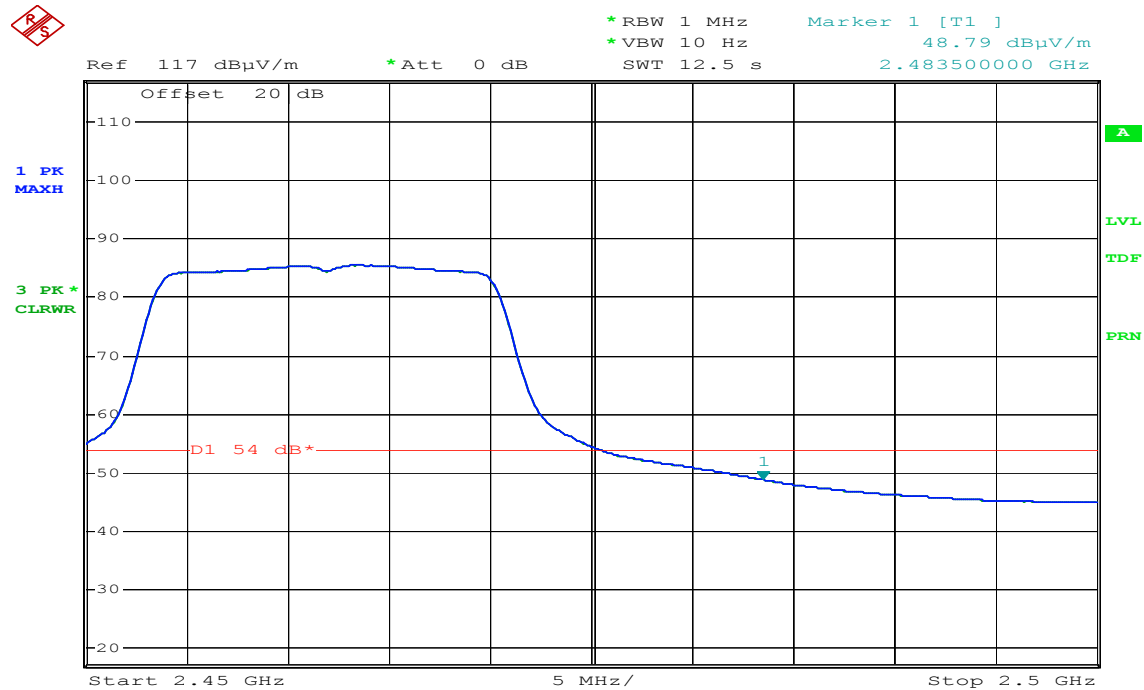
Polarity: Vertical



Date: 5.FEB.2005 09:04:09

Detector mode: Average

Polarity: Vertical

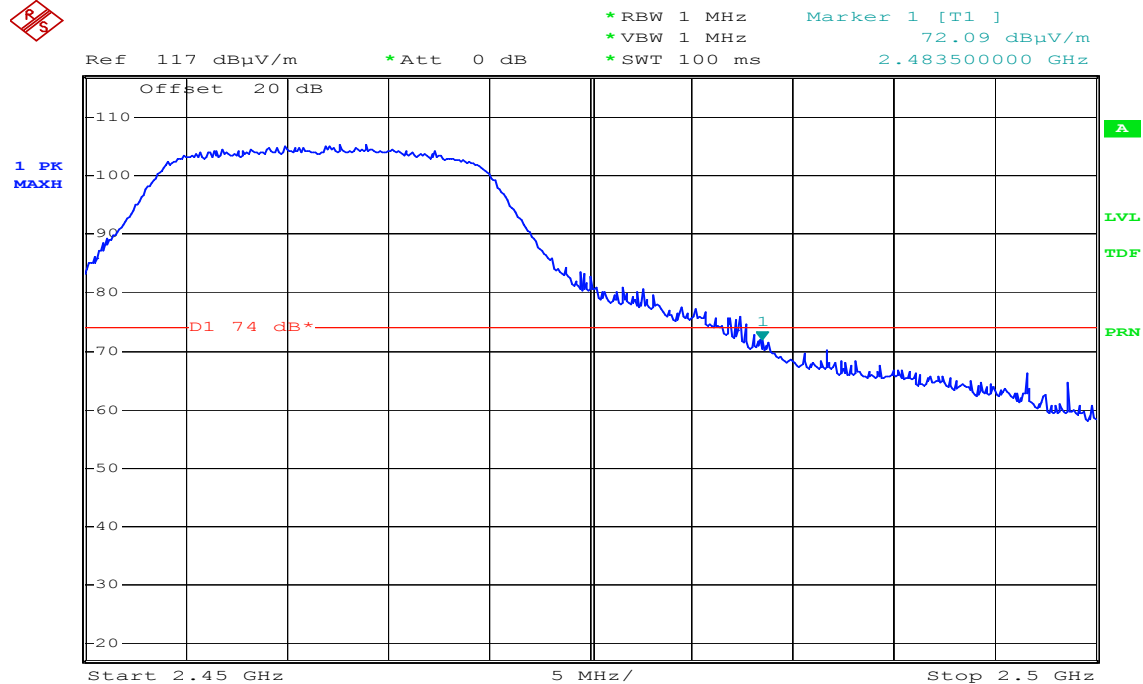


Date: 5.FEB.2005 09:03:11



Detector mode: Peak

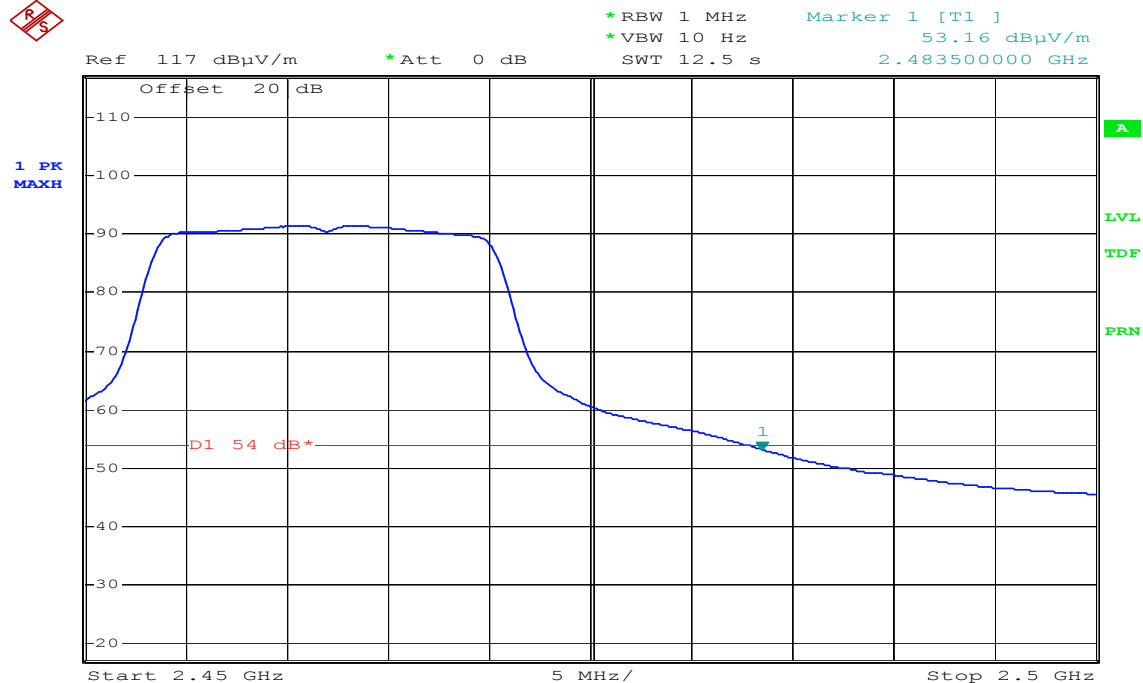
Polarity: Horizontal



Date: 5.FEB.2005 08:59:01

Detector mode: Average

Polarity: Horizontal



Date: 5.FEB.2005 08:57:27



7.4 PEAK POWER SPECTRAL DENSITY

LIMIT

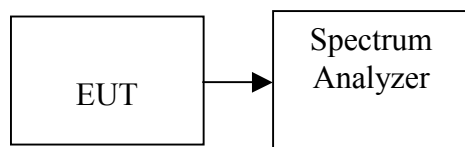
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted.

**Test Data****IEEE 802.11b**

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-19.34	11.70	-7.64	8.00	PASS
Mid	2437	-18.69	11.70	-6.99		PASS
High	2462	-21.31	11.70	-9.61		PASS

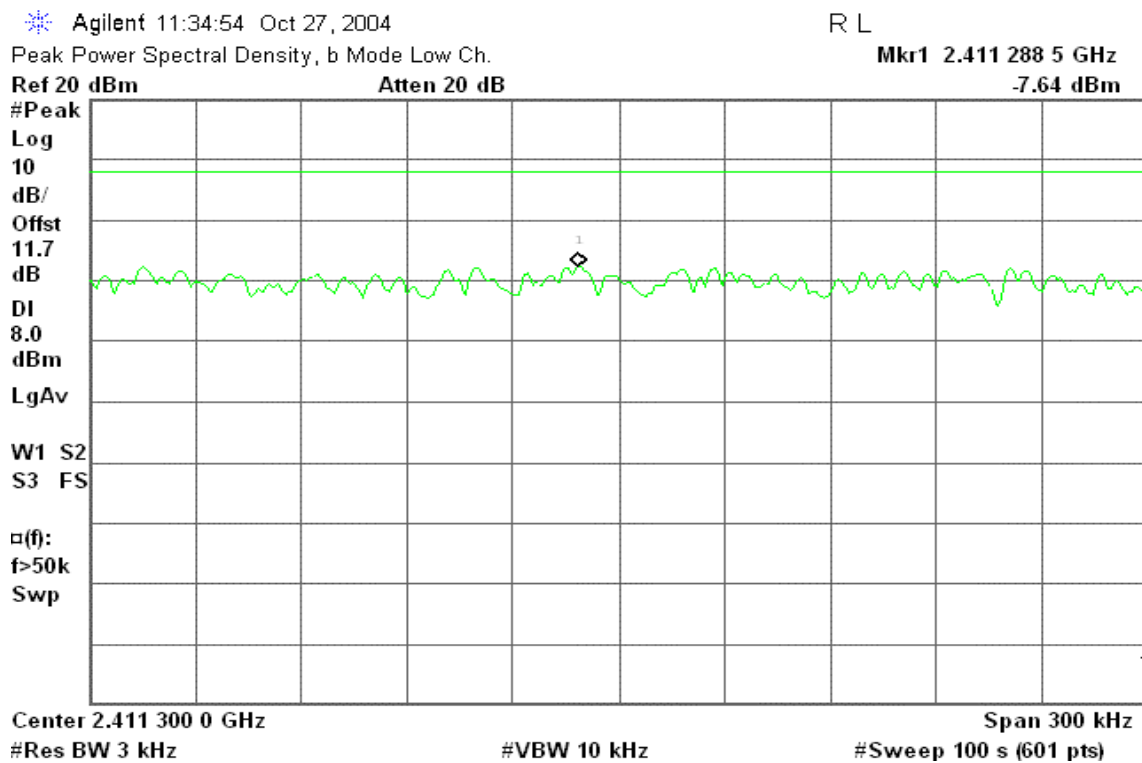
IEEE 802.11g

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-21.59	11.70	-9.89	8.00	PASS
Mid	2437	-23.52	11.70	-11.82		PASS
High	2462	-22.56	11.70	-10.86		PASS

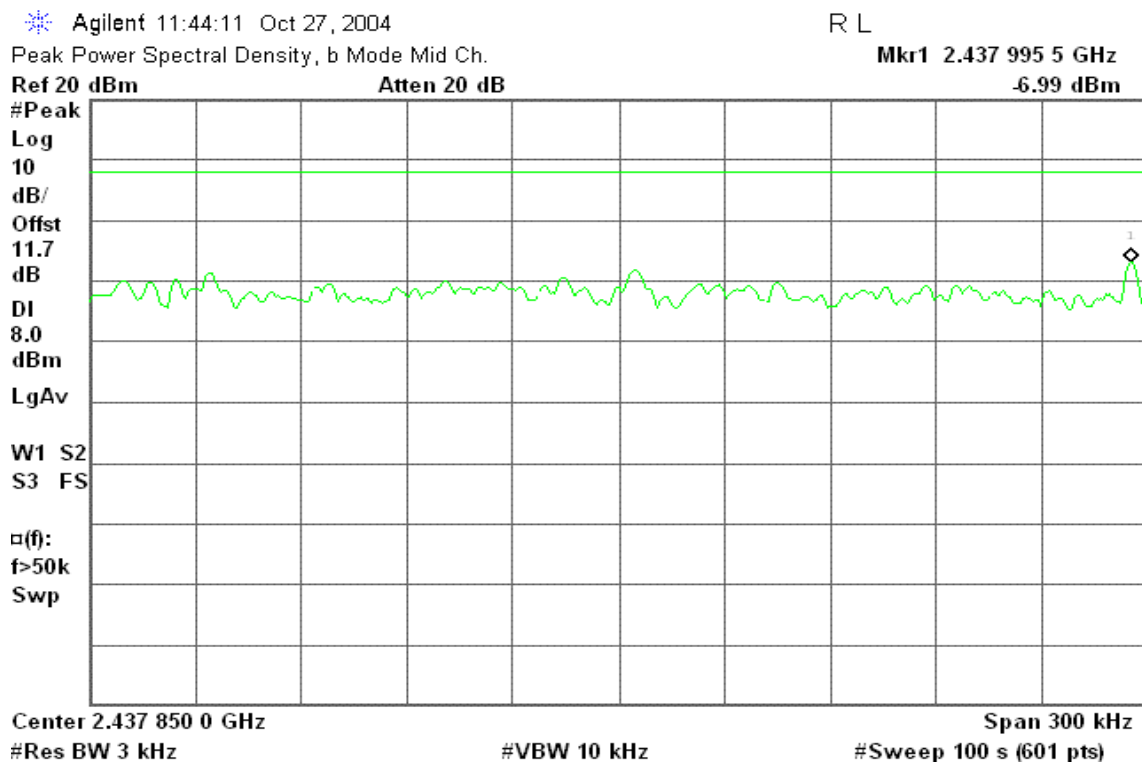


Test Plot

PPSD (IEEE 802.11b / CH Low)



PPSD (IEEE 802.11b / CH Mid)





PPSD (IEEE 802.11b / CH High)

Agilent 11:51:12 Oct 27, 2004

R L

Peak Power Spectral Density, b Mode High Ch.

Mkr1 2.462 697 0 GHz

Ref 20 dBm

Atten 20 dB

-9.61 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

8.0

dBm

LgAv

W1 S2

S3 FS

□(f):

f>50k

Swp

Center 2.462 700 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)



PPSD (IEEE 802.11g / CH Low)

Agilent 12:03:47 Oct 27, 2004

R L

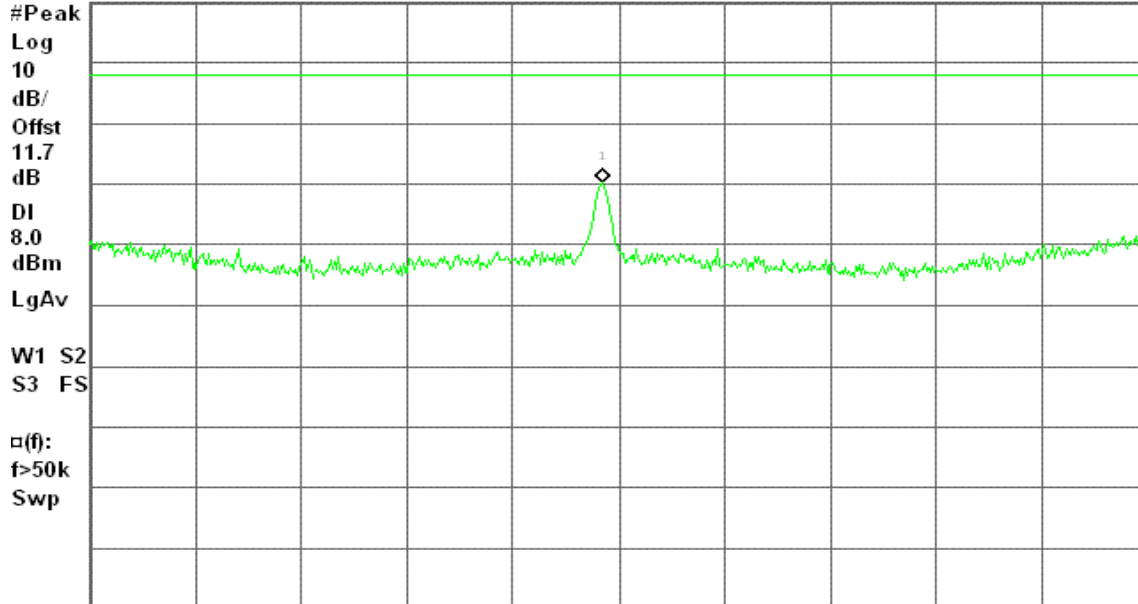
Peak Power Spectral Density, g Mode Low Ch.

Mkr1 2.411 995 0 GHz

Ref 20 dBm

Atten 20 dB

-9.89 dBm



Center 2.412 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)

PPSD (IEEE 802.11g / CH Mid)

Agilent 12:09:59 Oct 27, 2004

R L

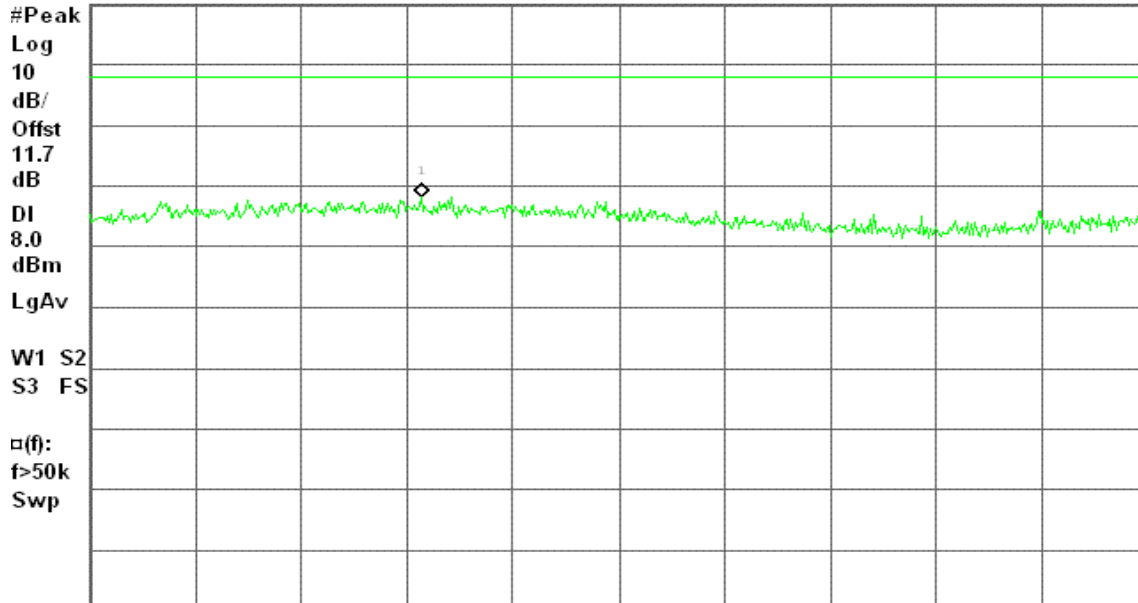
Peak Power Spectral Density, g Mode Mid Ch.

Mkr1 2.434 194 2 GHz

Ref 20 dBm

Atten 20 dB

-11.82 dBm



Center 2.434 250 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)



PPSD (IEEE 802.11g / CH High)

Agilent 12:16:10 Oct 27, 2004

R L

Peak Power Spectral Density, g Mode High Ch.

Mkr1 2.462 869 6 GHz

Ref 20 dBm

Atten 20 dB

-10.86 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

8.0

dBm

LgAv

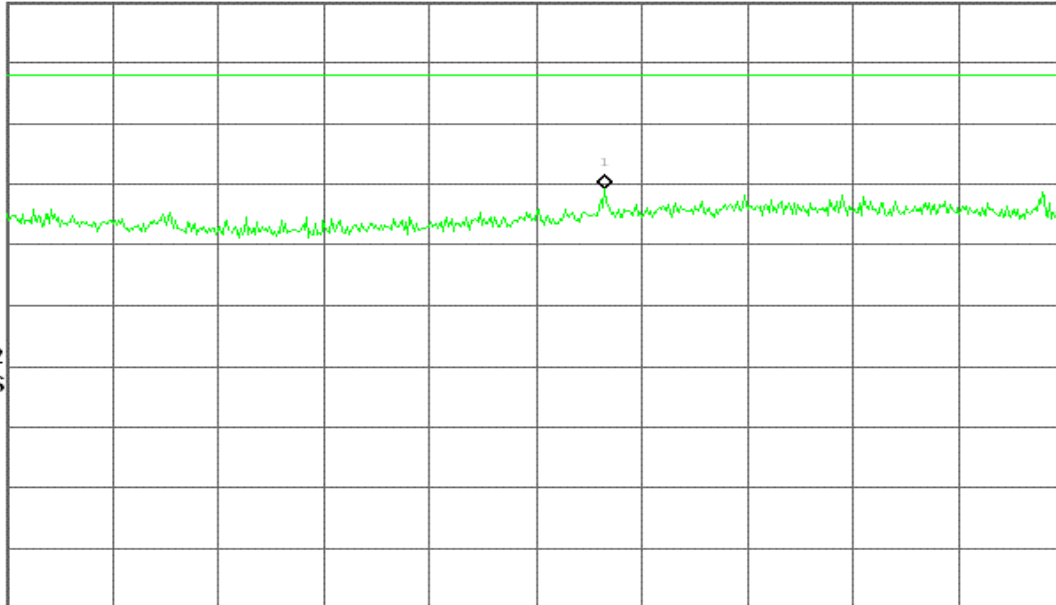
W1 S2

S3 FS

□(f):

f>50k

Swp



Center 2.462 850 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)



7.5 RADIO FREQUENCY EXPOSURE

LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	NOTEBOOK PC
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☐ Others _____
Device category	☒ Portable (<20cm separation) ☐ Mobile (>20cm separation) ☐ Others _____
Exposure classification	☐ Occupational/Controlled exposure ($S = 5mW/cm^2$) ☒ General Population/Uncontrolled exposure ($S=1mW/cm^2$)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ TX diversity ☐ RX diversity ☒ TX/RX diversity
Max. output power	17.66 dBm (58.34mW)
Antenna gain (Max)	1.123 dBi (Numeric gain: 1.295)
Evaluation applied	☐ MPE Evaluation ☒ SAR Evaluation* ☐ N/A

Remark:

1. The maximum output power is 17.66dBm (58.34mW) at 2412MHz (with 1.295 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

TEST RESULTS

No non-compliance noted.

Remark: Please refer to the separated SAR report.



CONDITION B: BLUETOOTH OPERATION

7.6 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

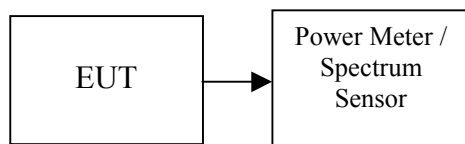
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional 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.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF Power Meter	BOONTON	4531	130601	01/09/2006
RF Power Sensor	BOONTON	56218	2240	01/09/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted.

Test Data

Channel	Frequency (MHz)	Output Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-1.13	2.40	1.27	0.00134	1	PASS
Mid	2441	-0.34	2.40	2.06	0.00161		PASS
High	2480	-0.08	2.40	2.32	0.00171		PASS

7.7 BAND EDGES MEASUREMENT

LIMIT

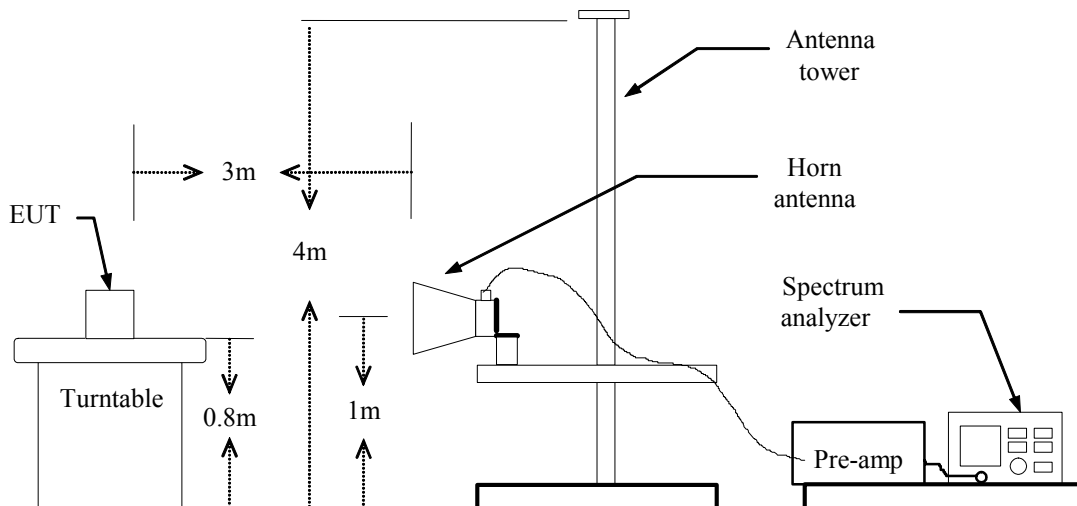
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. 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).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2005

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

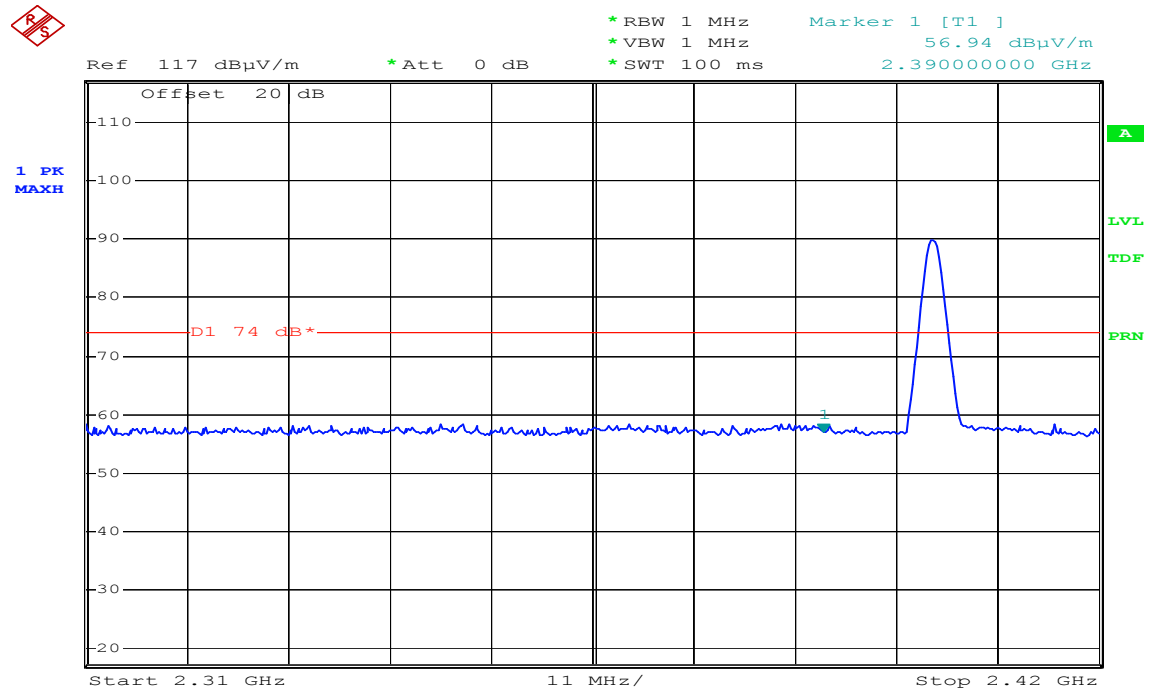
Refer to attach spectrum analyzer data chart.



Band Edges (Bluetooth mode / CH-Low)

Detector mode: Peak

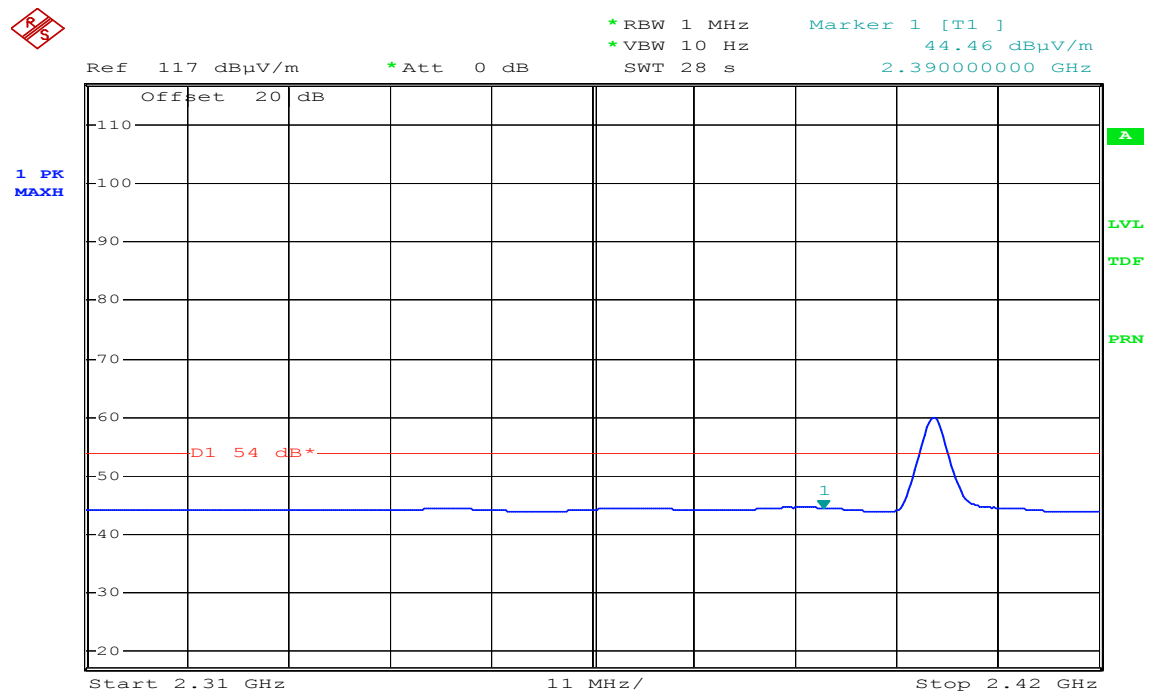
Polarity: Vertical



Date: 6.FEB.2005 06:59:10

Detector mode: Average

Polarity: Vertical

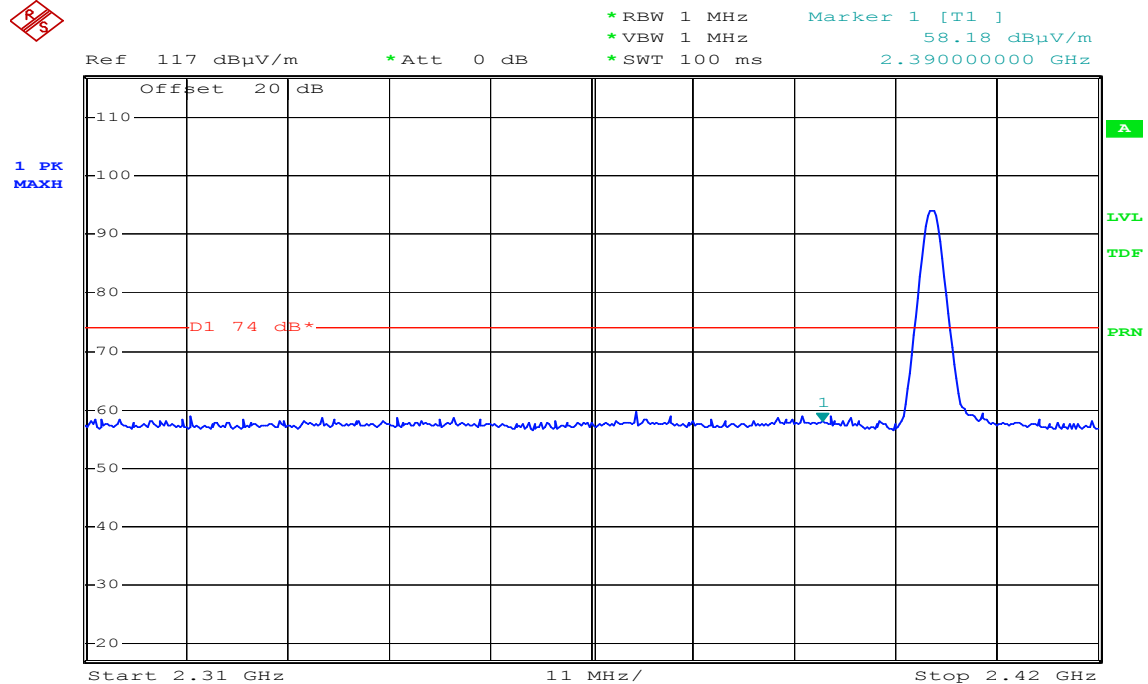


Date: 6.FEB.2005 07:14:45



Detector mode: Peak

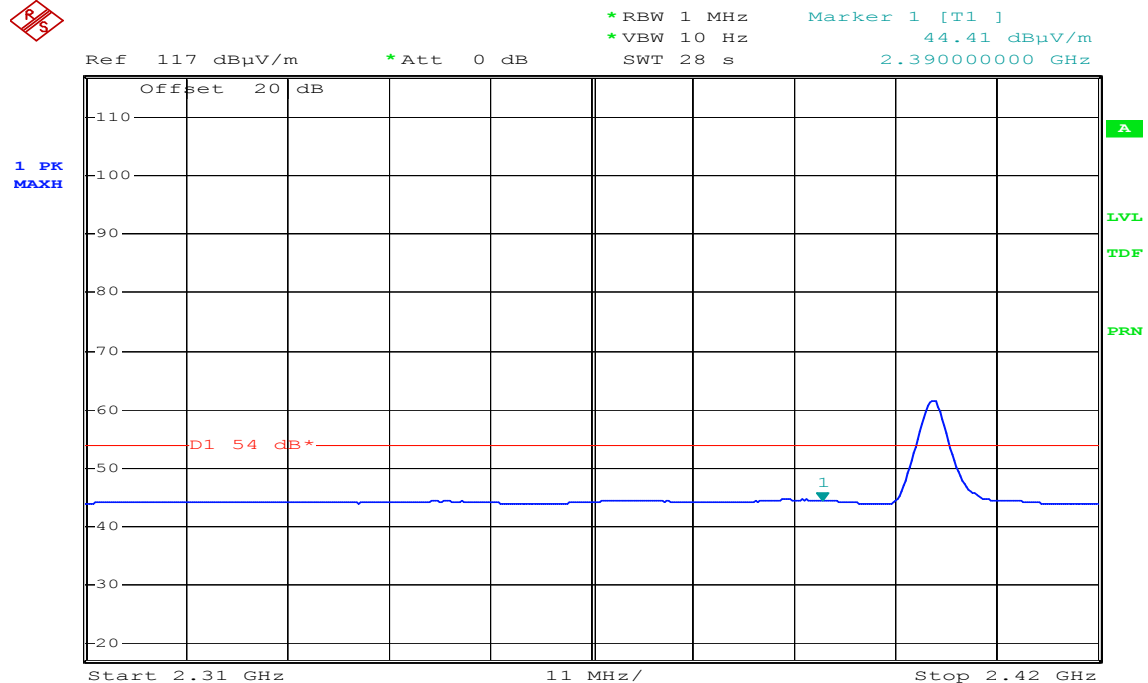
Polarity: Horizontal



Date: 6.FEB.2005 06:48:54

Detector mode: Average

Polarity: Horizontal



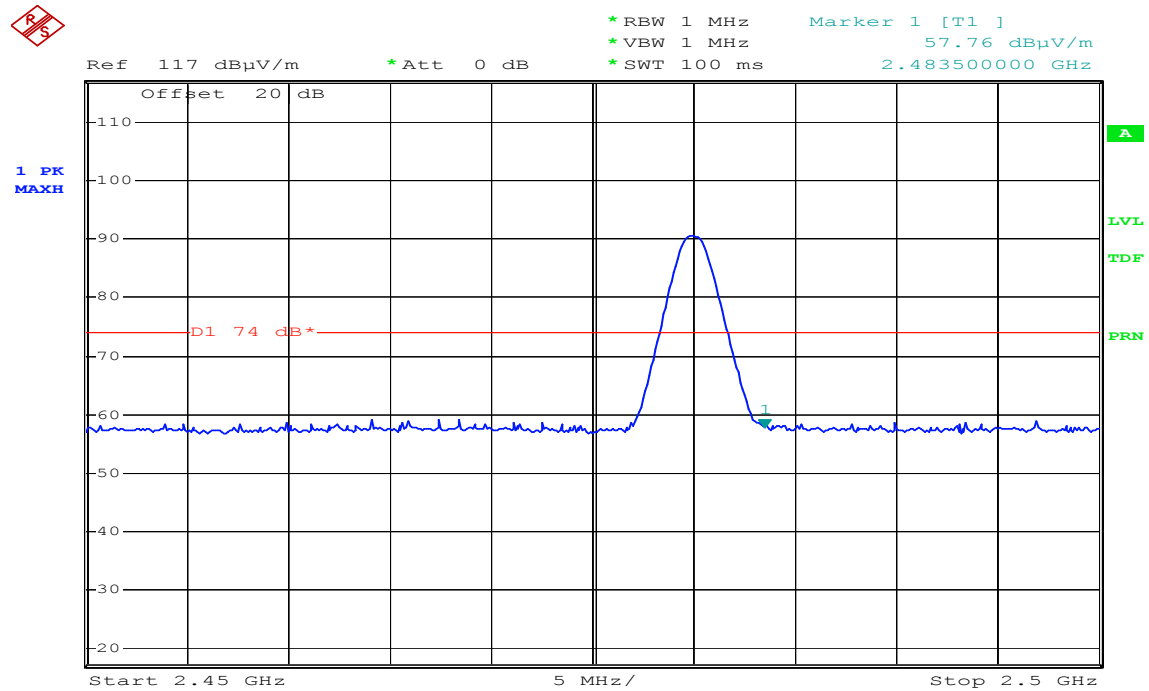
Date: 6.FEB.2005 06:51:47



Band Edges (Bluetooth mode / CH-High)

Detector mode: Peak

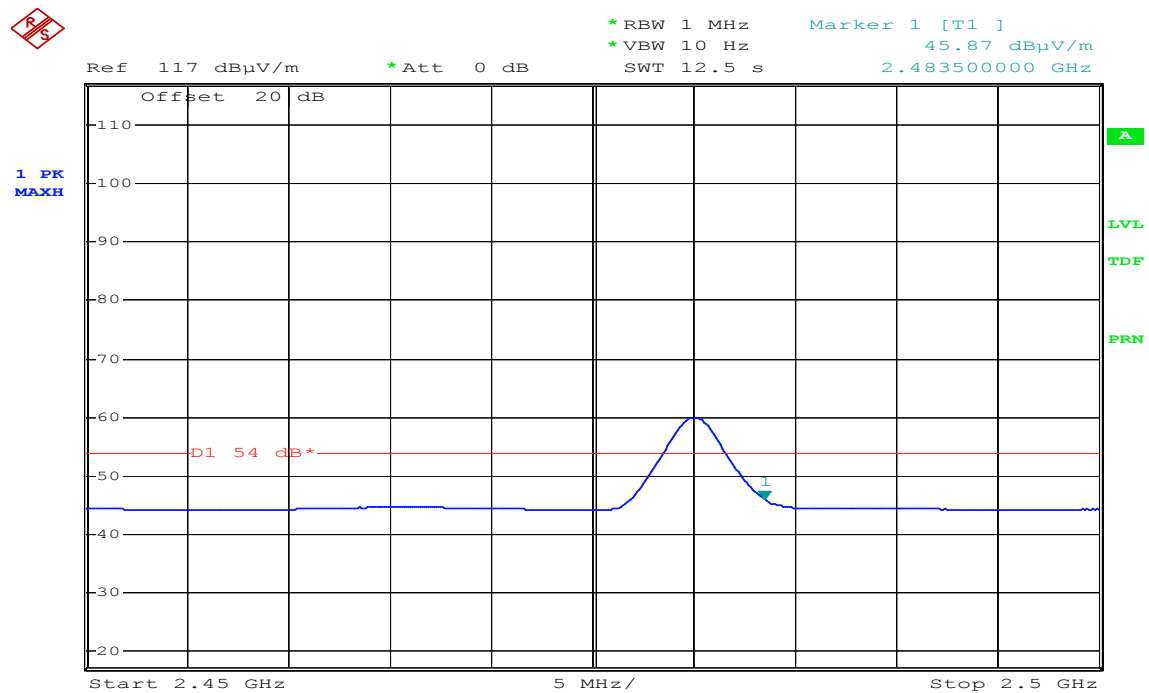
Polarity: Vertical



Date: 6.FEB.2005 07:20:21

Detector mode: Average

Polarity: Vertical

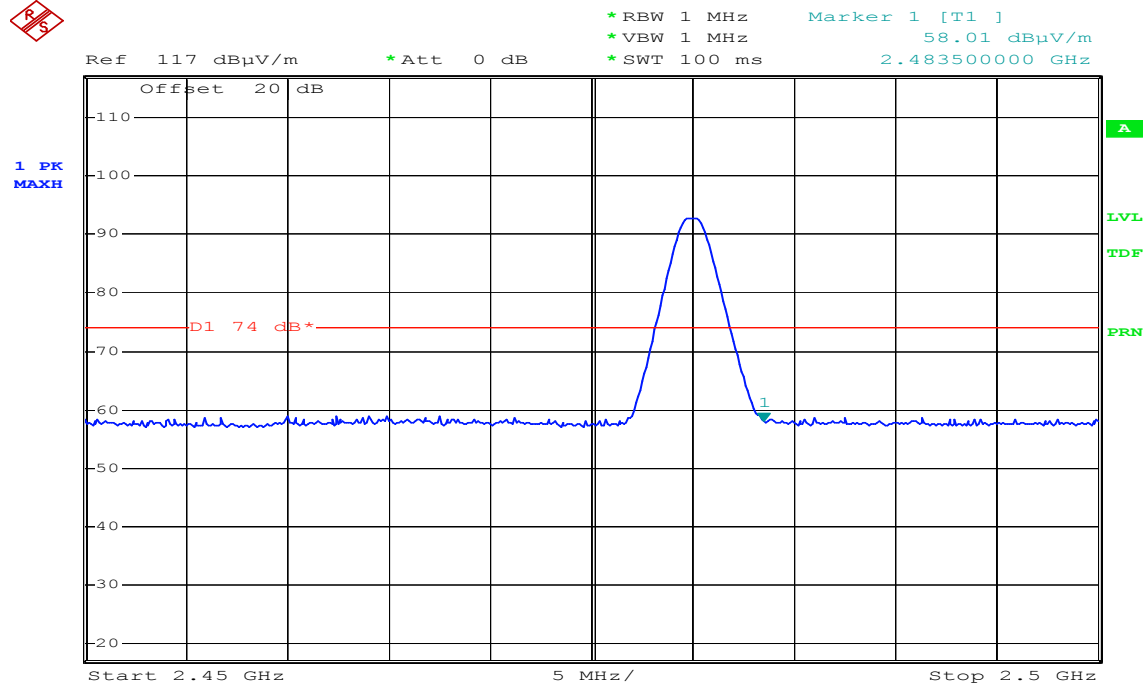


Date: 6.FEB.2005 07:22:27



Detector mode: Peak

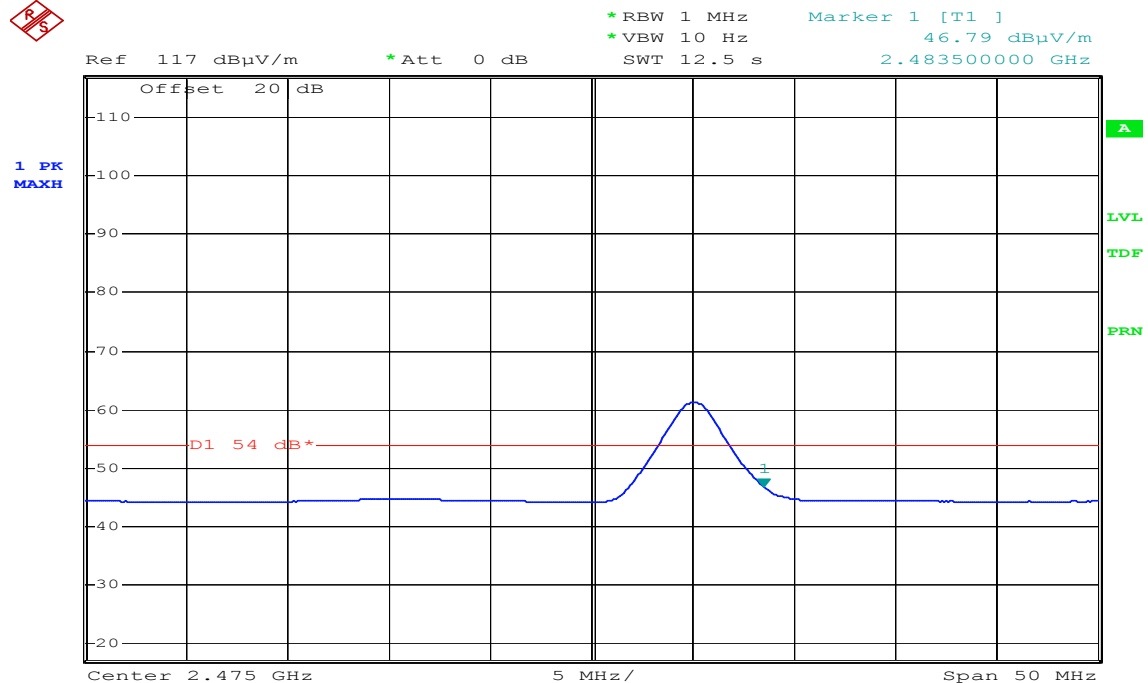
Polarity: Horizontal



Date: 6.FEB.2005 07:34:45

Detector mode: Average

Polarity: Horizontal



Date: 6.FEB.2005 07:41:24



7.8 PEAK POWER SPECTRAL DENSITY

LIMIT

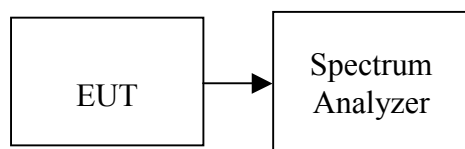
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-10.43	2.40	-8.03	8.00	PASS
Mid	2441	-9.66	2.40	-7.26		PASS
High	2480	-9.51	2.40	-7.11		PASS



Test Plot

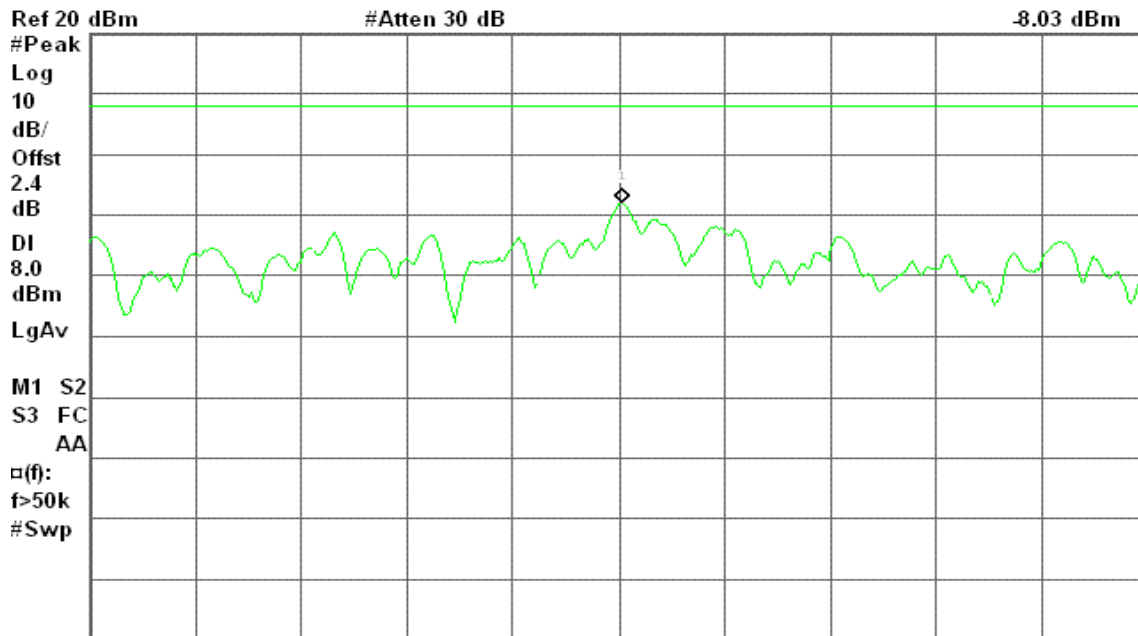
PPSD (CH Low)

Agilent 15:56:01 Feb 14, 2005

R T

Mkr1 2.401 981 5 GHz

-8.03 dBm



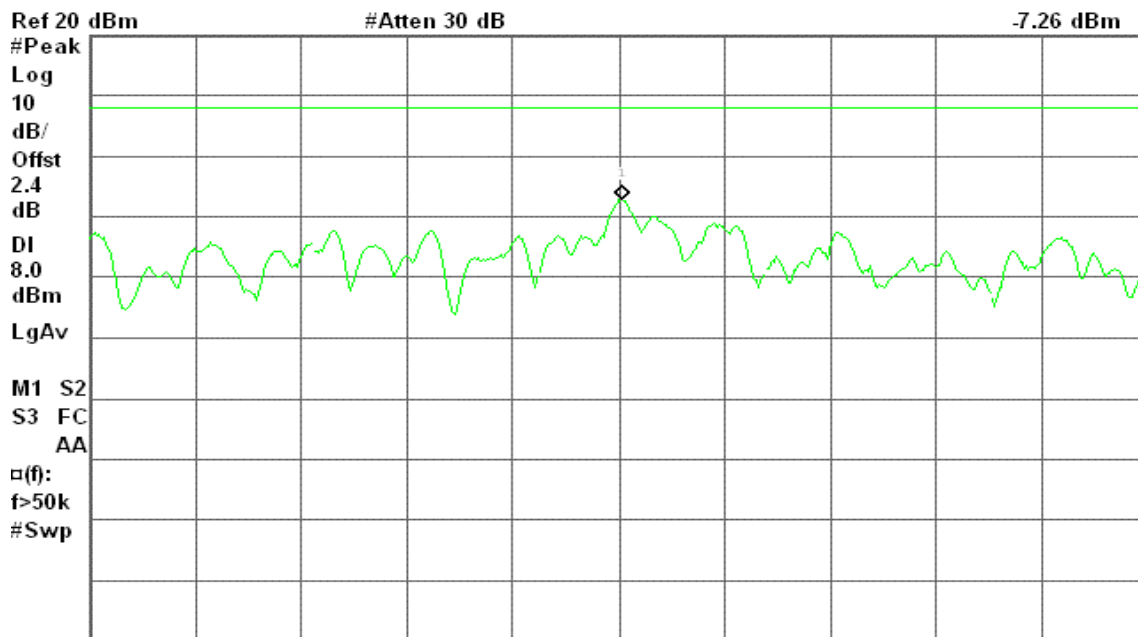
PPSD (CH Mid)

Agilent 15:59:43 Feb 14, 2005

R T

Mkr1 2.440 981 4 GHz

-7.26 dBm





PPSD (CH High)

Agilent 16:03:01 Feb 14, 2005

R T

Mkr1 2.479 981 4 GHz

-7.11 dBm

Ref 20 dBm

#Atten 30 dB

#Peak

Log

10

dB/

Offst

2.4

dB

DI

8.0

dBm

LgAv

M1 S2

S3 FC

AA

□(f):

f>50k

#Swp

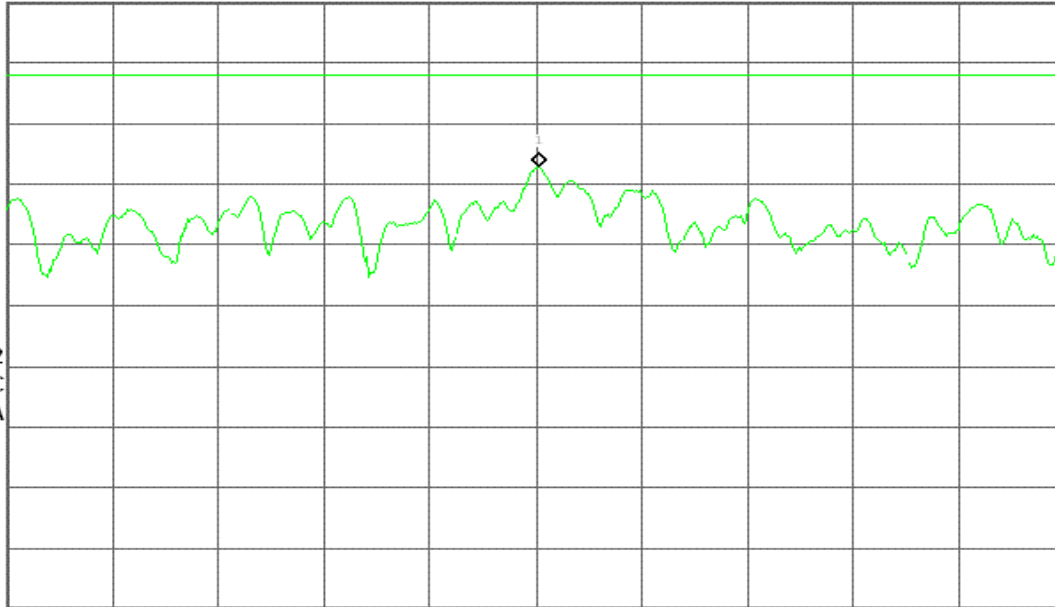
Center 2.479 980 4 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 300 kHz

#Sweep 100 s (601 pts)





7.9 FREQUENCY SEPARATION

LIMIT

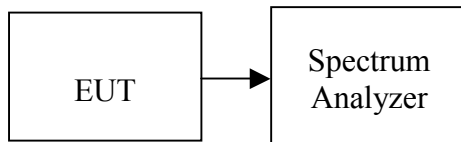
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

Channel Separation (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
1.00	830.00	>25	Pass



Test Plot

Measurement of Channel Separation

Agilent 16:18:40 Feb 14, 2005

R T

Mkr3 2.441 990 GHz

2.20 dBm

Ref 20 dBm

#Atten 30 dB

#Peak

Log

10

dB/

Offst

2.4

dB

LgAv

M1 S2

Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.439 990 GHz	2.30 dBm
2	(1)	Freq	2.440 990 GHz	2.16 dBm
3	(1)	Freq	2.441 990 GHz	2.20 dBm

Measurement of 20dB Bandwidth

Agilent 15:44:22 Feb 14, 2005

R T

Δ Mkr2 830 kHz

-0.20 dB

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

2.4

dB

DI

-20.8

dBm

LgAv

V1 S2

Center 2.441 000 GHz

Span 2 MHz

#Res BW 10 kHz

#VBW 30 kHz

Sweep 19.12 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.440 987 GHz	-0.81 dBm
2R	(1)	Freq	2.440 590 GHz	-22.43 dBm
2Δ	(1)	Freq	830 kHz	-0.20 dB



7.10 NUMBER OF HOPPING FREQUENCY

LIMIT

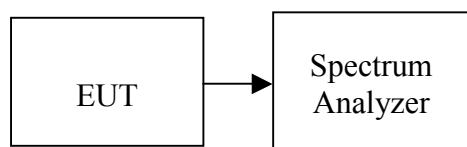
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = auto and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=510kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted.

Test Data

Result (No. of CH)	Limit (No. of CH)	Result
79	>75	PASS



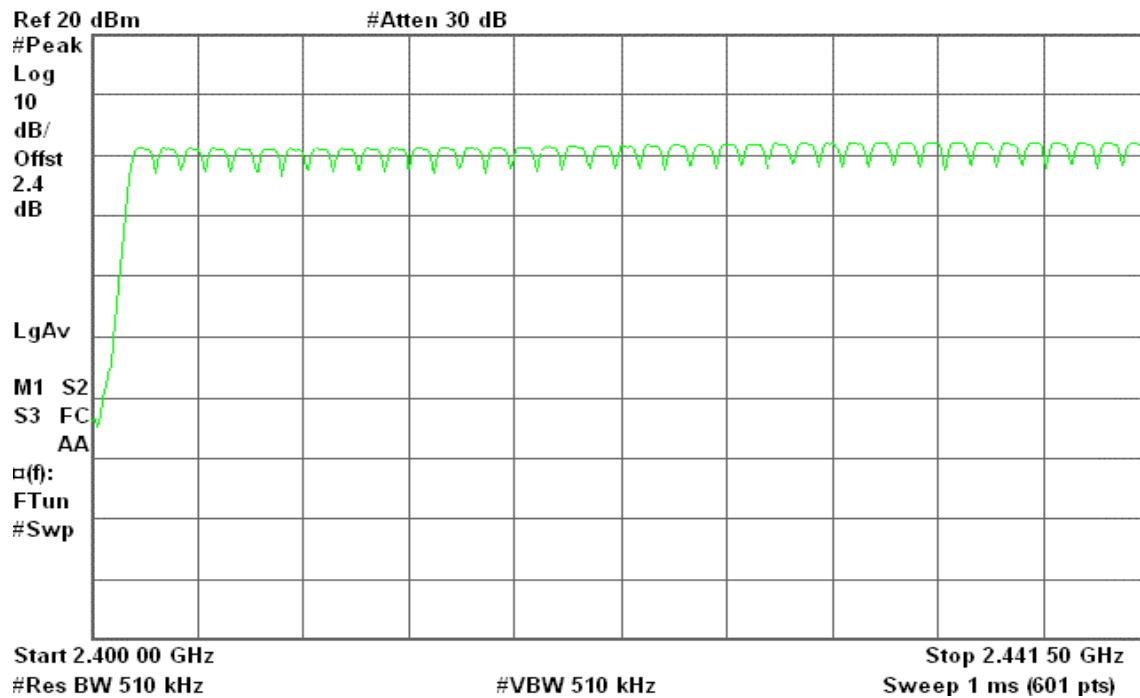
Test Plot

Channel Number

2.4 GHz – 2.441 GHz

Agilent 16:14:05 Feb 14, 2005

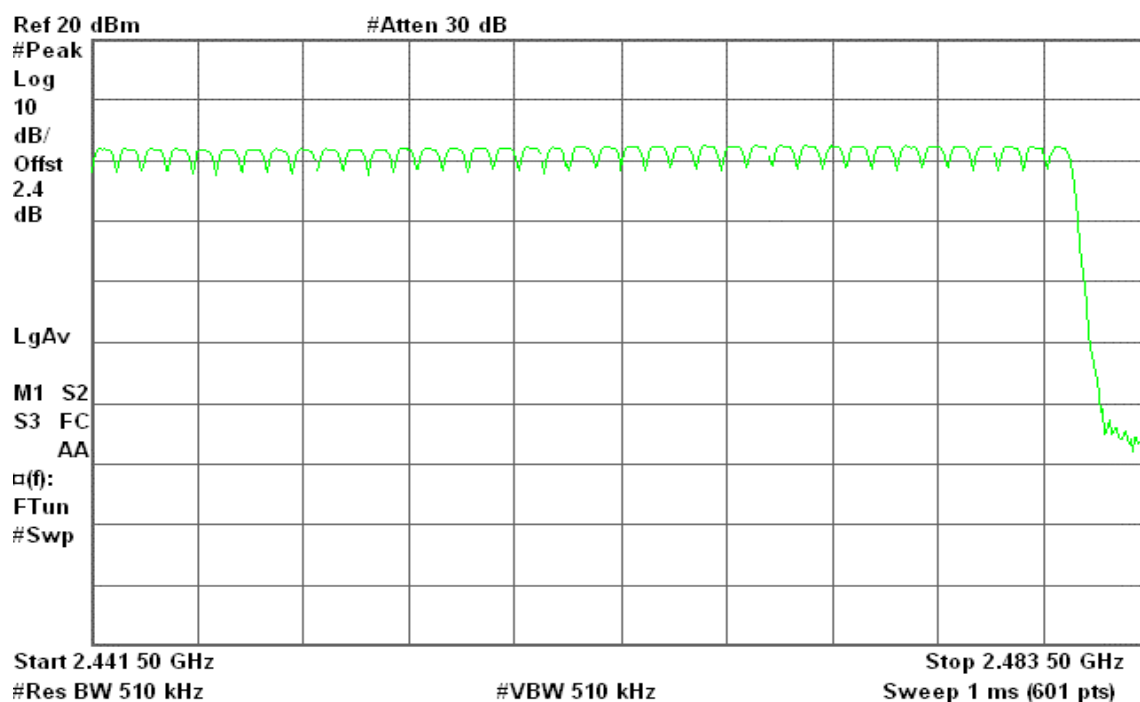
R T



2.441 GHz – 2.4835 GHz

Agilent 16:15:31 Feb 14, 2005

R T





7.11 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

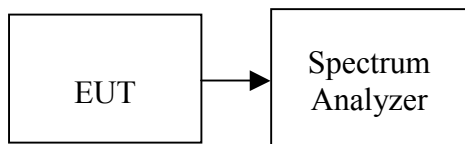
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.



TEST RESULTS

No non-compliance noted.

Test Data

DH 1

CH Low: $0.416 * (1600/2)/79 * 31.60 = 133.12$ (ms)

CH Mid: $0.416 * (1600/2)/79 * 31.60 = 133.12$ (ms)

CH High: $0.416 * (1600/2)/79 * 31.60 = 133.12$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.416	133.12	31.60	400.00	PASS
Mid	0.416	133.12	31.60		PASS
High	0.416	133.12	31.60		PASS

DH 3

CH Low: $1.683 * (1600/4)/79 * 31.60 = 269.28$ (ms)

CH Mid: $1.683 * (1600/4)/79 * 31.60 = 269.28$ (ms)

CH High: $1.683 * (1600/4)/79 * 31.60 = 269.28$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.683	269.28	31.60	400.00	PASS
Mid	1.683	269.28	31.60		PASS
High	1.683	269.28	31.60		PASS

DH 5

CH Low: $2.933 * (1600/6)/79 * 31.60 = 312.85$ (ms)

CH Mid: $2.933 * (1600/6)/79 * 31.60 = 312.85$ (ms)

CH High: $2.933 * (1600/6)/79 * 31.60 = 312.85$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.933	312.85	31.60	400.00	PASS
Mid	2.933	312.85	31.60		PASS
High	2.933	312.85	31.60		PASS



Test Plot

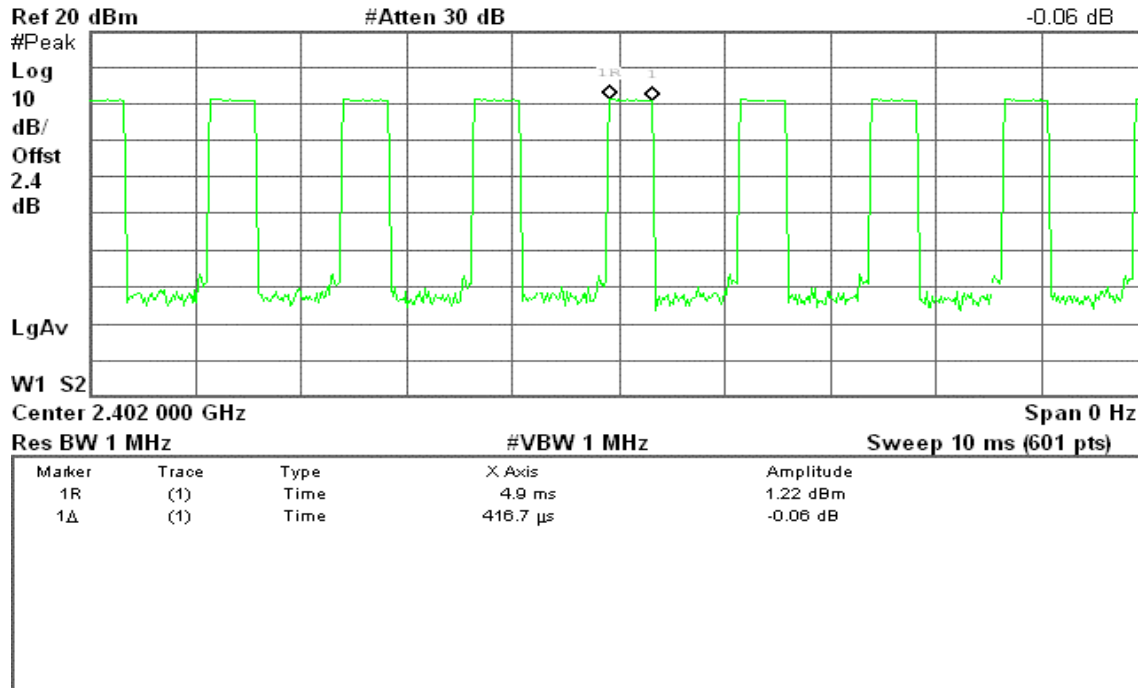
DH 1

(CH Low)

Agilent 16:20:37 Feb 14, 2005

R T

Δ Mkr1 416.7 μs
-0.06 dB



(CH Mid)

Agilent 16:21:39 Feb 14, 2005

R T

Δ Mkr1 416.7 μs
-0.05 dB



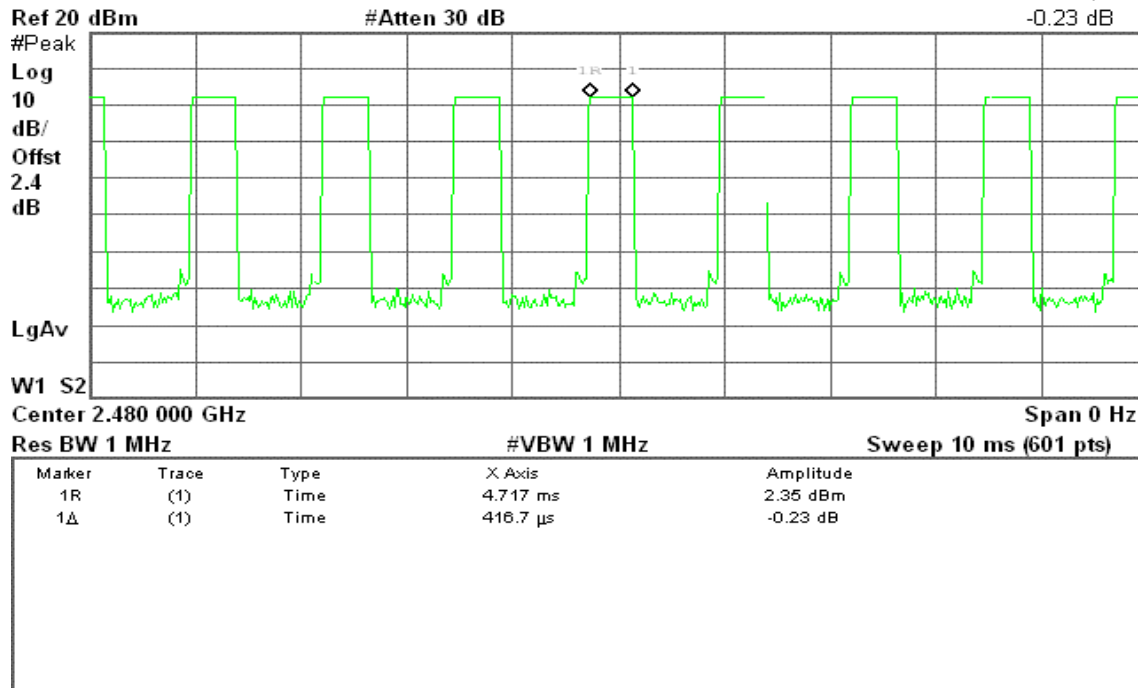


(CH High)

Agilent 16:24:01 Feb 14, 2005

R T

Δ Mkr1 416.7 μs
-0.23 dB



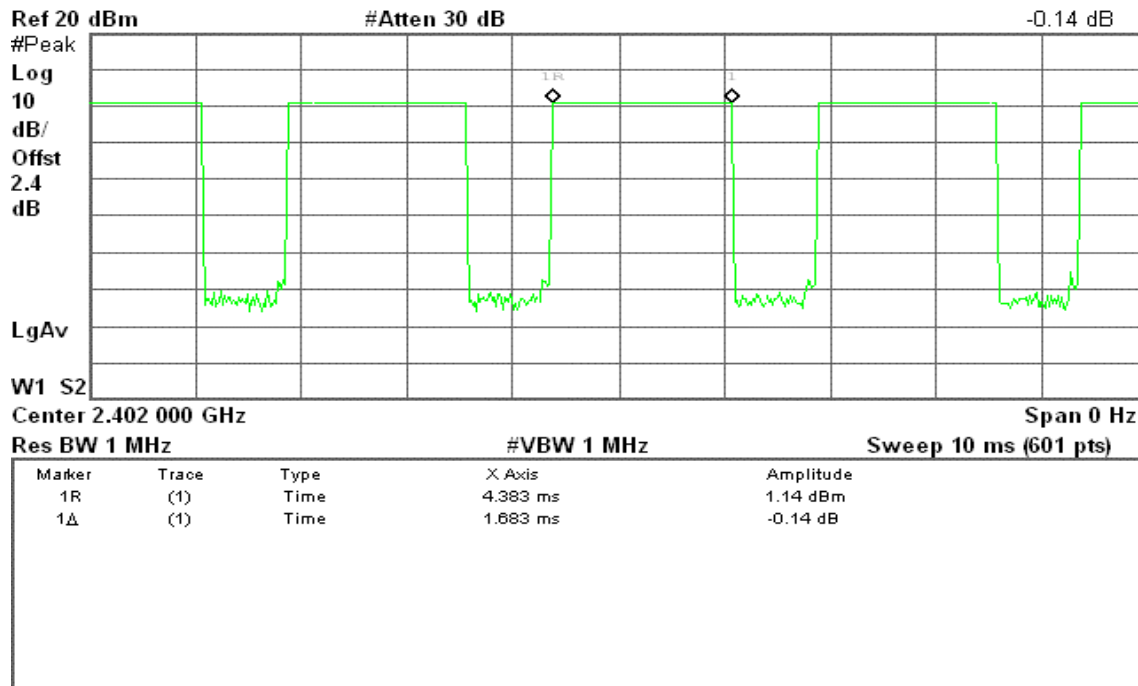
DH 3

(CH Low)

Agilent 16:27:09 Feb 14, 2005

R T

Δ Mkr1 1.683 ms
-0.14 dB



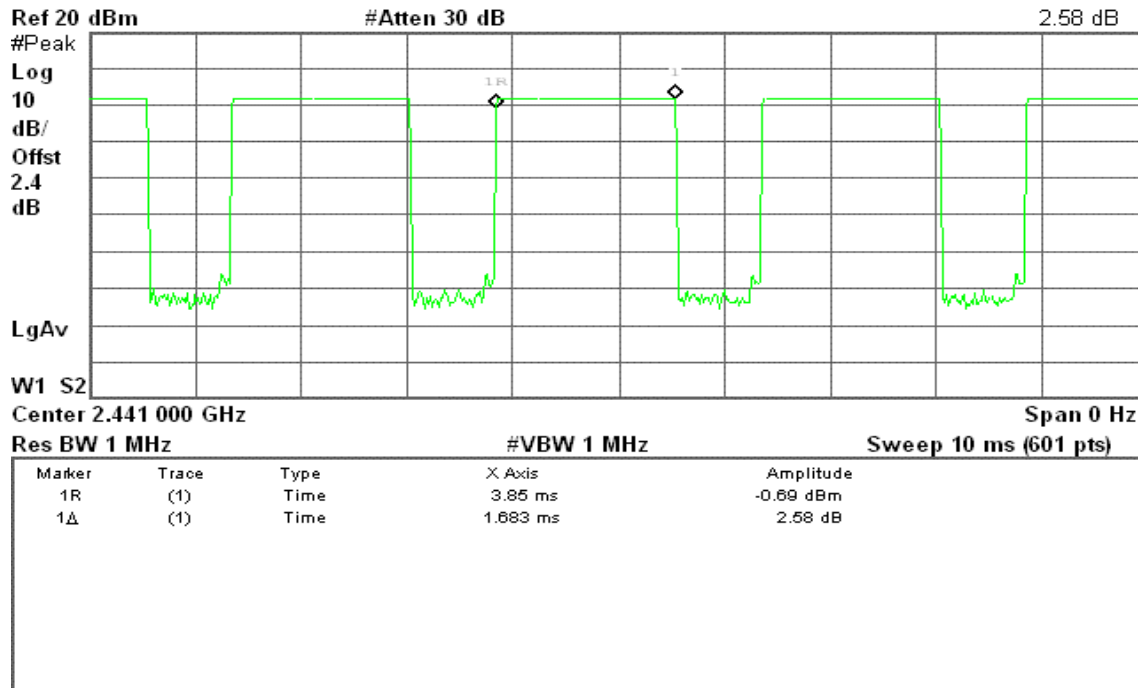


(CH Mid)

Agilent 16:26:07 Feb 14, 2005

R T

Δ Mkr1 1.683 ms
2.58 dB

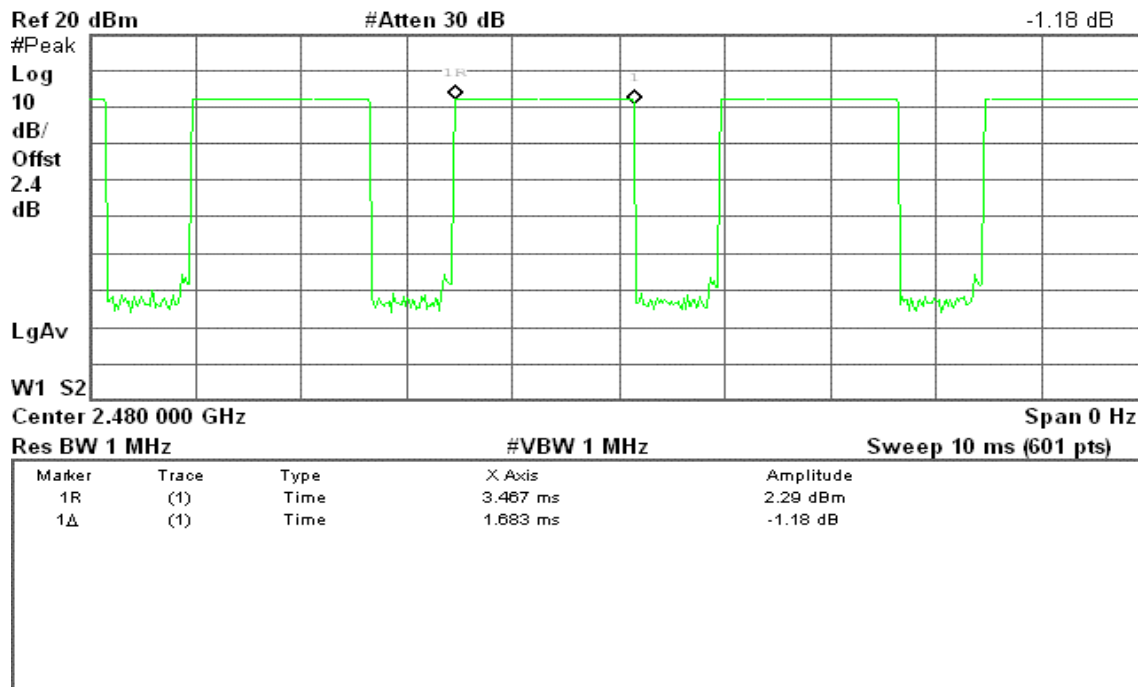


(CH High)

Agilent 16:24:56 Feb 14, 2005

R T

Δ Mkr1 1.683 ms
-1.18 dB





DH 5

(CH Low)

Agilent 16:28:27 Feb 14, 2005

R T

Δ Mkr1 2.933 ms

0.19 dB

Ref 20 dBm

#Atten 30 dB

#Peak

Log

10

dB/

Offst

2.4

dB

LgAv

W1 S2

Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.583 ms	0.81 dBm
1Δ	(1)	Time	2.933 ms	0.19 dB

(CH Mid)

Agilent 16:29:56 Feb 14, 2005

R T

Δ Mkr1 2.933 ms

0.23 dB

Ref 20 dBm

#Atten 30 dB

#Peak

Log

10

dB/

Offst

2.4

dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.567 ms	1.56 dBm
1Δ	(1)	Time	2.933 ms	0.23 dB



(CH High)

Agilent 16:31:35 Feb 14, 2005

R T

Δ Mkr1 2.933 ms

3.00 dB

Ref 20 dBm

#Atten 30 dB

#Peak

Log

10

dB/

Offst

2.4

dB

LgAv

W1 S2

Center 2.480 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.433 ms	-0.92 dBm
1Δ	(1)	Time	2.933 ms	3.00 dB



7.12 RADIO FREQUENCY EXPOSURE

LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	NOTEBOOK PC
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☒ Bluetooth: 2.402GHz ~ 2.480GHz
Device category	☒ Portable (<20cm separation) ☐ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure ($S = 5mW/cm^2$) ☒ General Population/Uncontrolled exposure ($S=1mW/cm^2$)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	2.32 dBm (1.706mW)
Antenna gain (Max)	1.0045 dBi (Numeric gain: 1.26)
Evaluation applied	☐ MPE Evaluation ☐ SAR Evaluation ☒ N/A*

Remark:

1. The maximum output power is 2.32dBm (1.7069mW) at 2480MHz (with 1.26 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20 cm, even if the calculations indicate that the MPE distance would be lesser.

TEST RESULTS

No non-compliance noted.

(SAR evaluation is not required for the PORTABLE device while its maximum output power is lower than the general population low threshold: $60/f_{(GHz)}=60/2.441=24.58mW$)

MPE evaluation

Not applicable.



7.13 SPURIOUS EMISSIONS

7.13.1 CONDUCTED MEASUREMENT

LIMIT

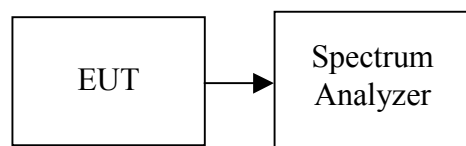
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz for WLAN mode, 100 kHz for Bluetooth mode.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

No non-compliance noted



Test Plot

IEEE 802.11b mdofe / CH Low

30MHz – 26GHz

Agilent 11:36:13 Oct 27, 2004

L

Spurious, b Mode Low Ch.

Ref 20 dBm

Atten 20 dB

Mkr2 9.64 GHz

-42.86 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-16.8

dBm

LgAv

V1 S2

Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.42 GHz	3.19 dBm
2	(1)	Freq	9.64 GHz	-42.86 dBm

IEEE 802.11b mdofe / CH Mid

30MHz – 26GHz

Agilent 11:45:11 Oct 27, 2004

L

Spurious, b Mode Mid Ch.

Ref 20 dBm

Atten 20 dB

Mkr2 9.74 GHz

-43.92 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-17.1

dBm

LgAv

V1 S2

Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.45 GHz	2.93 dBm
2	(1)	Freq	9.74 GHz	-43.92 dBm



IEEE 802.11b mdoe / CH High

30MHz – 26GHz

Agilent 11:52:11 Oct 27, 2004

L

Spurious, b Mode High Ch.

Mkr2 9.85 GHz

Ref 20 dBm

Atten 20 dB

-43.42 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-16.3

dBm

LgAv

V1 S2

Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.47 GHz	3.73 dBm
2	(1)	Freq	9.85 GHz	-43.42 dBm



IEEE 802.11g mdoe / CH Low

30MHz – 26GHz

Agilent 12:05:14 Oct 27, 2004

L

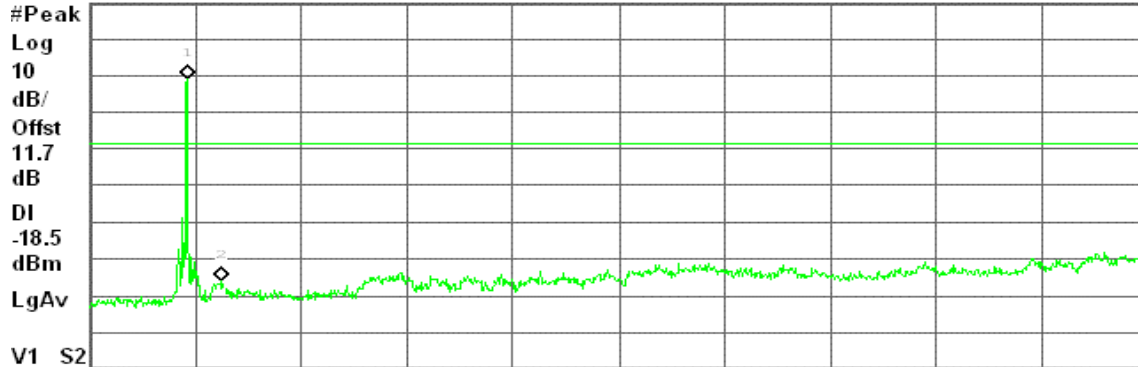
Spurious, g Mode Low Ch.

Mkr2 3.28 GHz

Ref 20 dBm

Atten 20 dB

-56.01 dBm



Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.42 GHz	-0.86 dBm
2	(1)	Freq	3.28 GHz	-56.01 dBm

IEEE 802.11g mdoe / CH Mid

30MHz – 26GHz

Agilent 12:11:02 Oct 27, 2004

L

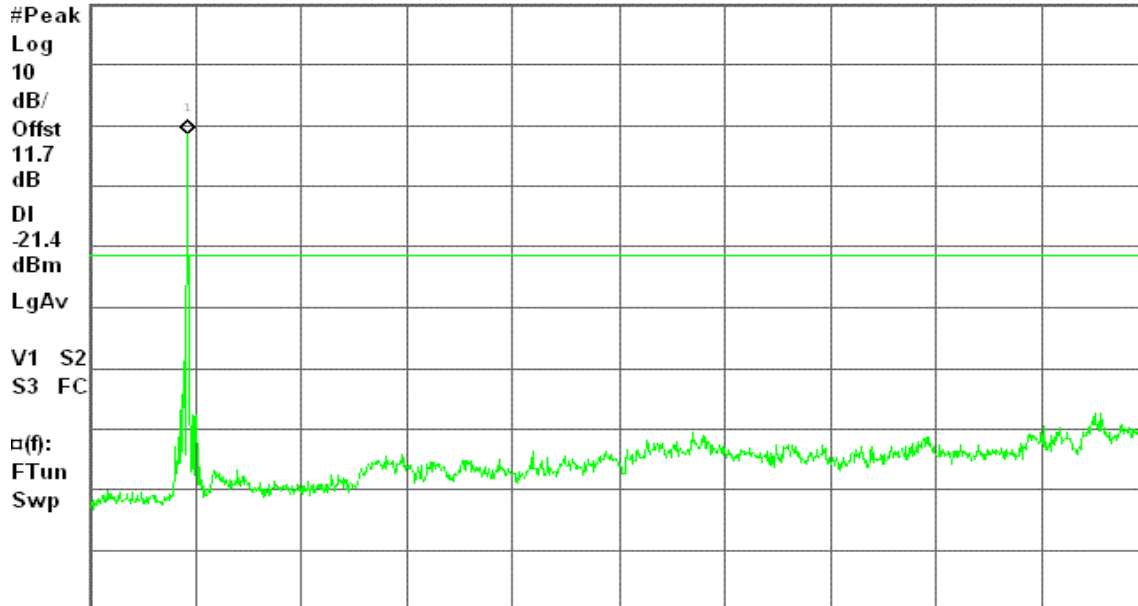
Spurious, g Mode Mid Ch.

Mkr1 2.45 GHz

Ref 20 dBm

Atten 20 dB

-1.42 dBm



Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)



IEEE 802.11g mdoe / CH High

30MHz – 26GHz

Agilent 12:17:07 Oct 27, 2004

L

Spurious, g Mode High Ch.

Mkr1 2.47 GHz

Ref 20 dBm

Atten 20 dB

-1.96 dBm

#Peak

Log

10

dB/

Offst

11.7

dB

DI

-22.0

dBm

LgAv

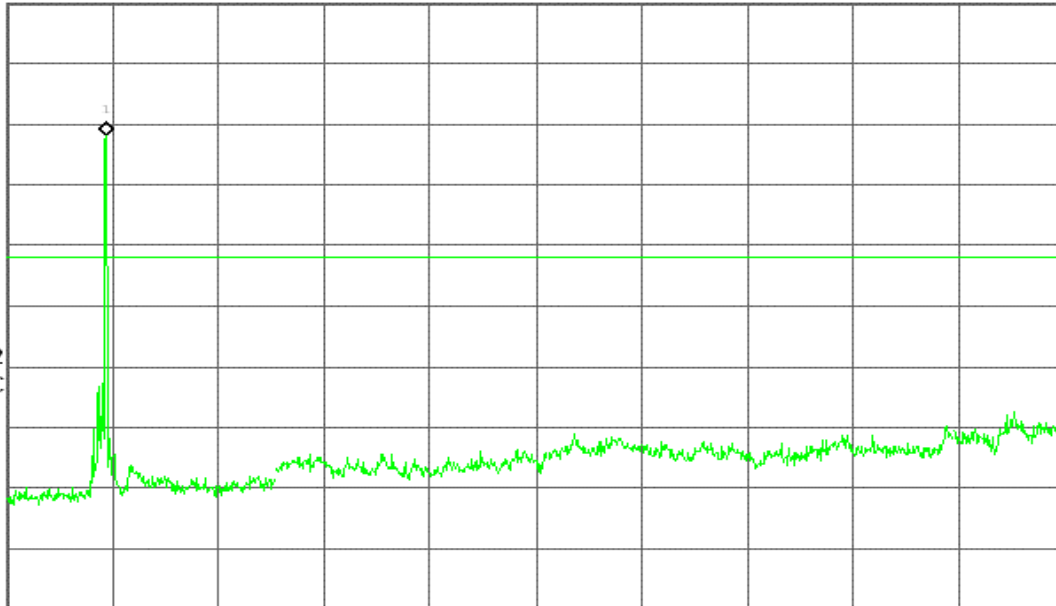
V1 S2

S3 FC

□(f):

FTun

Swp



Start 30 MHz

Stop 26.00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.482 s (1001 pts)

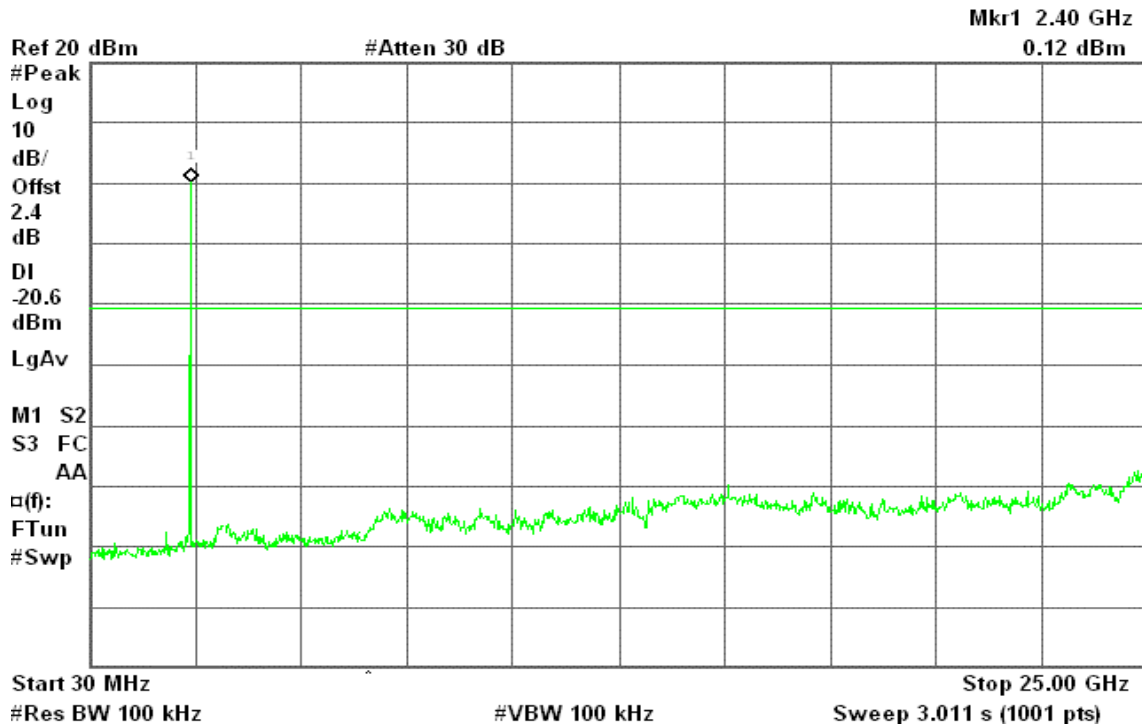


Blueooth mode / CH Low

30MHz ~ 25GHz

Agilent 16:06:36 Feb 14, 2005

R T

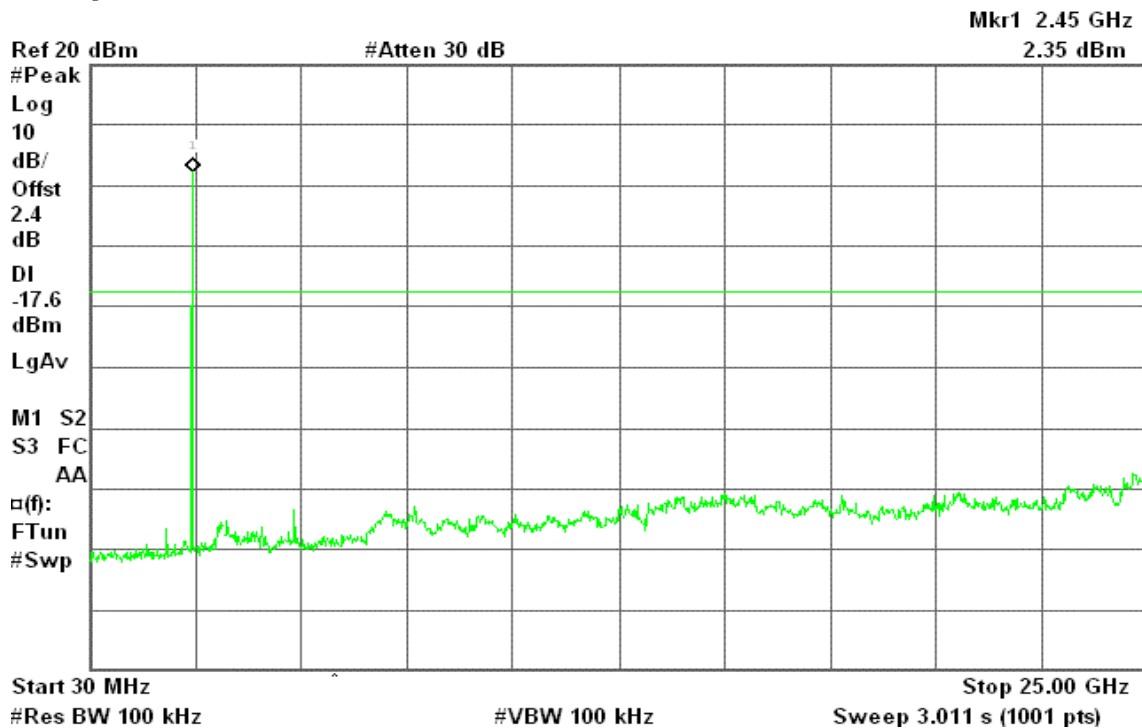


Blueooth mode / CH Mid

30MHz ~ 25GHz

Agilent 16:05:43 Feb 14, 2005

R T



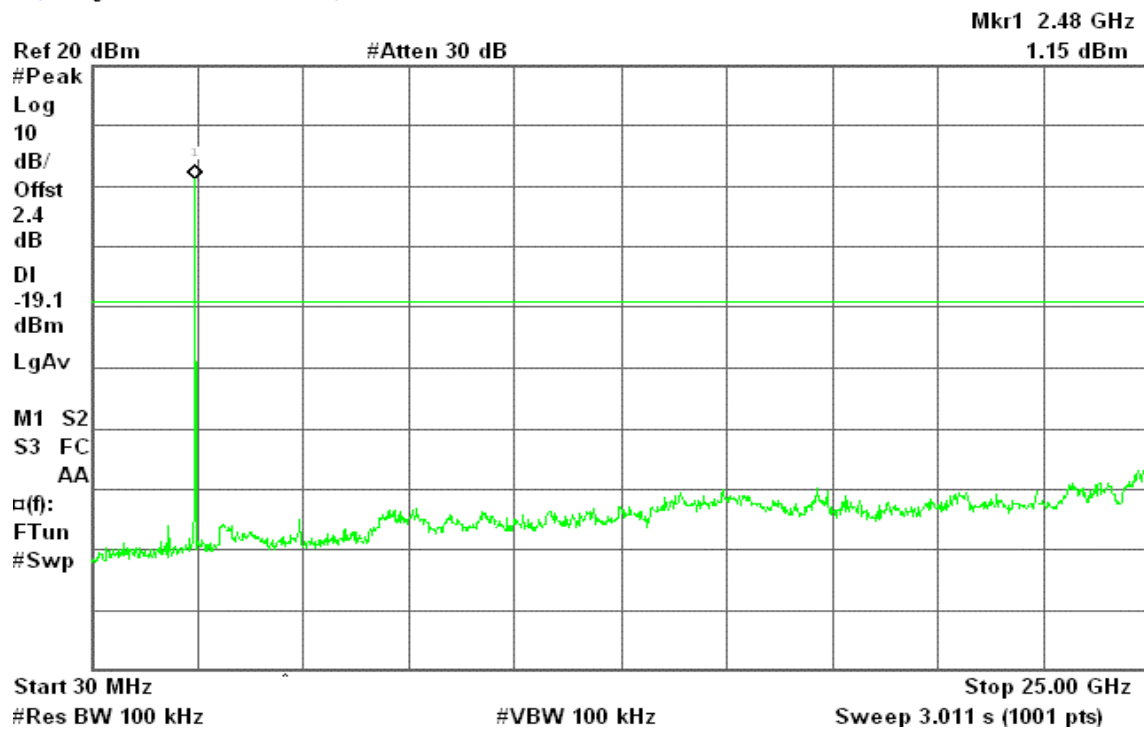


Blueooth mode / CH High

30MHz ~ 25GHz

Agilent 16:04:46 Feb 14, 2005

R T





7.13.2 RADIATED EMISSIONS

LIMIT

1. 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 (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: 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.

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

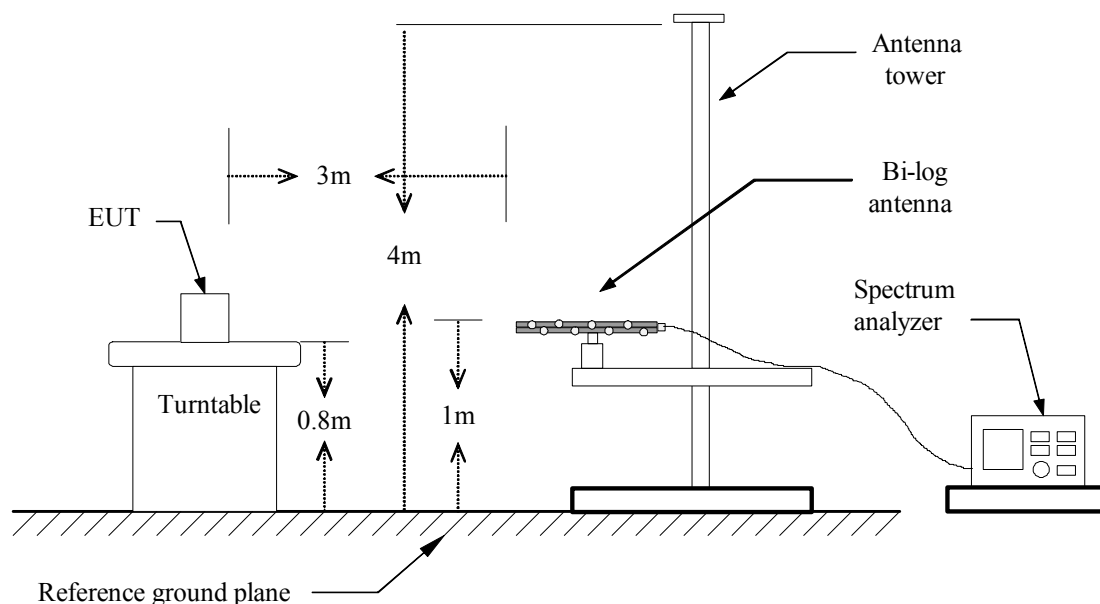
MEASUREMENT EQUIPMENT USED

Open Area Test Site # 3				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESVS20	838804/004	01/08/2006
Spectrum Analyzer	R&S	FSP30	100112	09/23/2005
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2006
Pre-Amplifier	MITEC	AFS42-00102650	924206	N.C.R.
Pre-Amplifier	MITEC	AMF-6F-260400	945377	N.C.R.
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2005
Horn Antenna	EMCO	3115	00022250	03/15/2005
Horn Antenna	EMCO	3116	2487	12/08/2005
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R
Controller	EMCO	2090	9709-1256	N.C.R
RF Switch	ANRITSU	MP59B	M53867	N.C.R
Site NSA	C&C	N/A	N/A	09/06/2005

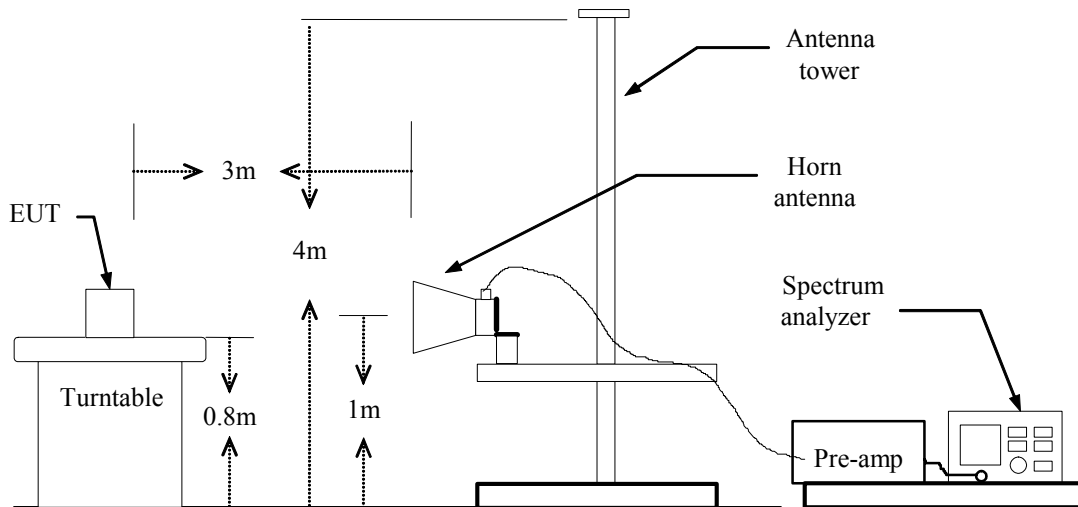
Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Below 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(c) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(d) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

**TEST RESULTS****WLAN OPERATION****Below 1 GHz****Operation Mode:** Normal Link**Test Date:** February 4, 2005**Temperature:** 16°C**Tested by:** Max Yao**Humidity:** 57 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
37.20	V	Peak	12.92	13.79	26.70	40.00	-13.30
165.90	V	Peak	21.27	12.72	33.99	43.50	-9.51
232.05	V	Peak	10.58	16.38	26.96	46.00	-19.04
260.85	V	Peak	21.41	16.49	37.90	46.00	-8.10
293.70	V	Peak	19.14	17.13	36.27	46.00	-9.73
300.00	V	Peak	20.44	17.48	37.92	46.00	-8.08
36.70	H	Peak	11.87	13.55	25.42	40.00	-14.58
160.05	H	Peak	16.94	12.70	29.64	43.50	-13.86
260.85	H	Peak	16.41	16.49	32.90	46.00	-13.10
298.00	H	Peak	17.28	17.38	34.66	46.00	-11.34
325.66	H	Peak	13.22	18.45	31.66	46.00	-14.34
366.50	H	Peak	7.85	19.60	27.45	46.00	-18.55

Remark:

- 1. Measuring frequencies from 30 MHz to the 1GHz.*
- 2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.*
- 3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
- 4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Above 1 GHz****Operation Mode:** IEEE 802.11b / TX / CH Low**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4824.00	V	46.46	34.50	2.53	48.99	37.03	74.00	54.00	-5.01	Peak
N/A										
4824.00	H	46.35	33.95	2.53	48.88	36.48	74.00	54.00	-5.12	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** IEEE 802.11b / TX / CH Mid**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4874.00	V	46.19	34.08	2.68	48.87	36.76	74.00	54.00	-5.13	Peak
N/A										
4874.00	H	46.83	34.33	2.68	49.51	37.01	74.00	54.00	-4.49	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** IEEE 802.11b / TX / CH High**Test Date:** February 4, 2004**Temperature:** 30°C**Tested by:** Max Yao**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4924.00	V	46.77	34.30	2.83	49.60	37.13	74.00	54.00	-4.40	Peak
N/A										
4924.00	H	46.23	34.17	2.83	49.06	---	74.00	54.00	-4.94	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** IEEE 802.11g / TX / CH Low**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4824.00	V	46.19	34.03	2.53	48.72	36.56	74.00	54.00	-5.28	Peak
N/A										
4824.00	H	45.91	33.75	2.53	48.44	36.28	74.00	54.00	-5.56	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** IEEE 802.11g / TX / CH Mid**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4874.00	V	46.55	34.58	2.68	49.23	37.26	74.00	54.00	-4.77	Peak
N/A										
4874.00	H	46.83	34.09	2.68	49.51	36.77	74.00	54.00	-4.49	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** IEEE 802.11g / TX / CH High**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4924.00	V	46.94	34.60	2.83	49.77	37.43	74.00	54.00	-4.23	Peak
N/A										
4924.00	H	46.50	34.17	2.83	49.33	---	74.00	54.00	-4.67	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**BLUETOOTH OPERATION****Below 1 GHz****Operation Mode:** Normal Link**Test Date:** February 4, 2005**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
37.20	V	Peak	12.92	13.79	26.70	40.00	-13.30
165.90	V	Peak	21.27	12.72	33.99	43.50	-9.51
232.05	V	Peak	10.58	16.38	26.96	46.00	-19.04
260.85	V	Peak	21.41	16.49	37.90	46.00	-8.10
293.70	V	Peak	19.14	17.13	36.27	46.00	-9.73
300.00	V	Peak	20.44	17.48	37.92	46.00	-8.08
36.70	H	Peak	11.87	13.55	25.42	40.00	-14.58
160.05	H	Peak	16.94	12.70	29.64	43.50	-13.86
260.85	H	Peak	16.41	16.49	32.90	46.00	-13.10
298.00	H	Peak	17.28	17.38	34.66	46.00	-11.34
325.66	H	Peak	13.22	18.45	31.66	46.00	-14.34
366.50	H	Peak	7.85	19.60	27.45	46.00	-18.55

Remark:

- 1. Measuring frequencies from 30 MHz to the 1GHz.*
- 2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.*
- 3. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
- 4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Above 1 GHz****Operation Mode:** TX / CH Low**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4804.00	V	46.42	---	2.47	48.89	---	74.00	54.00	-5.11	Peak
N/A										
4804.00	H	46.77	---	2.47	49.24	---	74.00	54.00	-4.76	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / CH Mid**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4882.00	V	46.71	---	2.71	49.42	---	74.00	54.00	-4.58	Peak
N/A										
4882.00	H	46.26	---	2.71	48.97	---	74.00	54.00	-5.03	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**Operation Mode:** TX / CH High**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4960.00	V	46.20	---	2.95	49.15	---	74.00	54.00	-4.85	Peak
N/A										
4960.00	H	45.95	----	2.95	48.90	---	74.00	54.00	-5.10	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

**CONDITION C: CO-LACATED OPERATION
WLAN & BLUETOOTH OPERATED SIMULTANEOUSLY)****Below 1 GHz****Operation Mode:** Normal Link**Test Date:** February 4, 2005**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
37.20	V	Peak	12.92	13.79	26.70	40.00	-13.30
165.90	V	Peak	21.27	12.72	33.99	43.50	-9.51
232.05	V	Peak	10.58	16.38	26.96	46.00	-19.04
260.85	V	Peak	21.41	16.49	37.90	46.00	-8.10
293.70	V	Peak	19.14	17.13	36.27	46.00	-9.73
300.00	V	Peak	20.44	17.48	37.92	46.00	-8.08
36.70	H	Peak	11.87	13.55	25.42	40.00	-14.58
160.05	H	Peak	16.94	12.70	29.64	43.50	-13.86
260.85	H	Peak	16.41	16.49	32.90	46.00	-13.10
298.00	H	Peak	17.28	17.38	34.66	46.00	-11.34
325.66	H	Peak	13.22	18.45	31.66	46.00	-14.34
366.50	H	Peak	7.85	19.60	27.45	46.00	-18.55

Remark:

- 1. Measuring frequencies from 30 MHz to the 1GHz.*
- 2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.*
- 3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
- 4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*

**Above 1 GHz****Operation Mode:** WLAN IEEE 802.11b / TX Mode / Ch Low +
BT TX Mode / Ch Mid**Test Date:** February 4, 2004**Temperature:** 21°C**Tested by:** Max Yao**Humidity:** 55 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4824.00	V	46.83	---	2.53	49.36	---	74.00	54.00	-4.64	Peak
N/A										
4824.00	H	46.53	---	2.53	49.06	---	74.00	54.00	-4.94	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



Operation Mode: WLAN IEEE 802.11b / TX Mode / Ch Mid +
BT TX Mode / Ch Mid

Test Date: February 4, 2004

Temperature: 21°C

Tested by: Max Yao

Humidity: 55 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4874.00	V	46.64	---	2.68	49.32	---	74.00	54.00	-4.68	Peak
N/A										
4874.00	H	46.16	---	2.68	48.84	---	74.00	54.00	-5.16	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.



Operation Mode: WLAN IEEE 802.11b / TX Mode / Ch High +
BT TX Mode / Ch Mid

Test Date: February 4, 2004

Temperature: 21°C

Tested by: Max Yao

Humidity: 55 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
4924.00	V	46.38	---	2.83	49.21	---	74.00	54.00	-4.79	Peak
N/A										
4924.00	H	47.37	---	2.83	50.20	---	74.00	54.00	-3.80	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
 - a. Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.
 - b. AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.

7.14 BAND EDGES MEASUREMENT

LIMIT

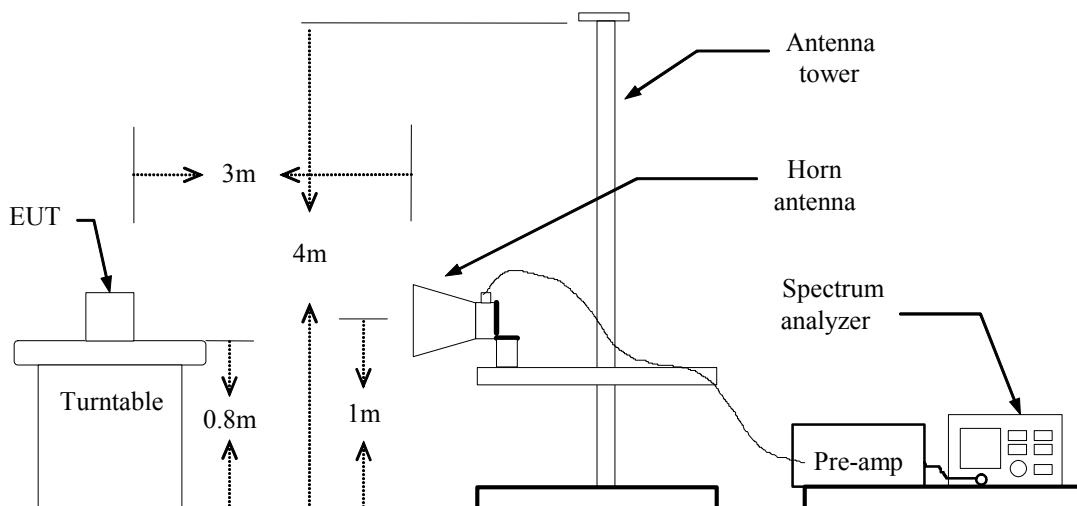
According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. 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).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2005

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - a. PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - b. AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

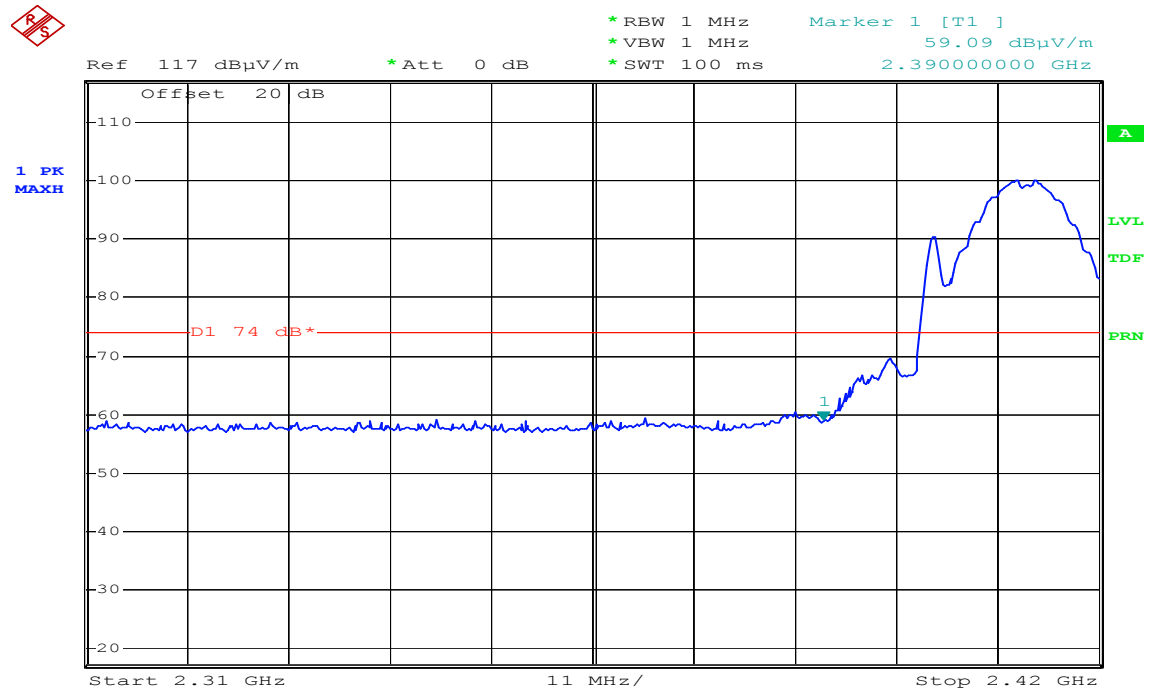
Refer to attach spectrum analyzer data chart.



Band Edges (IEEE 802.11b / CH Low + Bluetooth / CH Low)

Detector mode: Peak

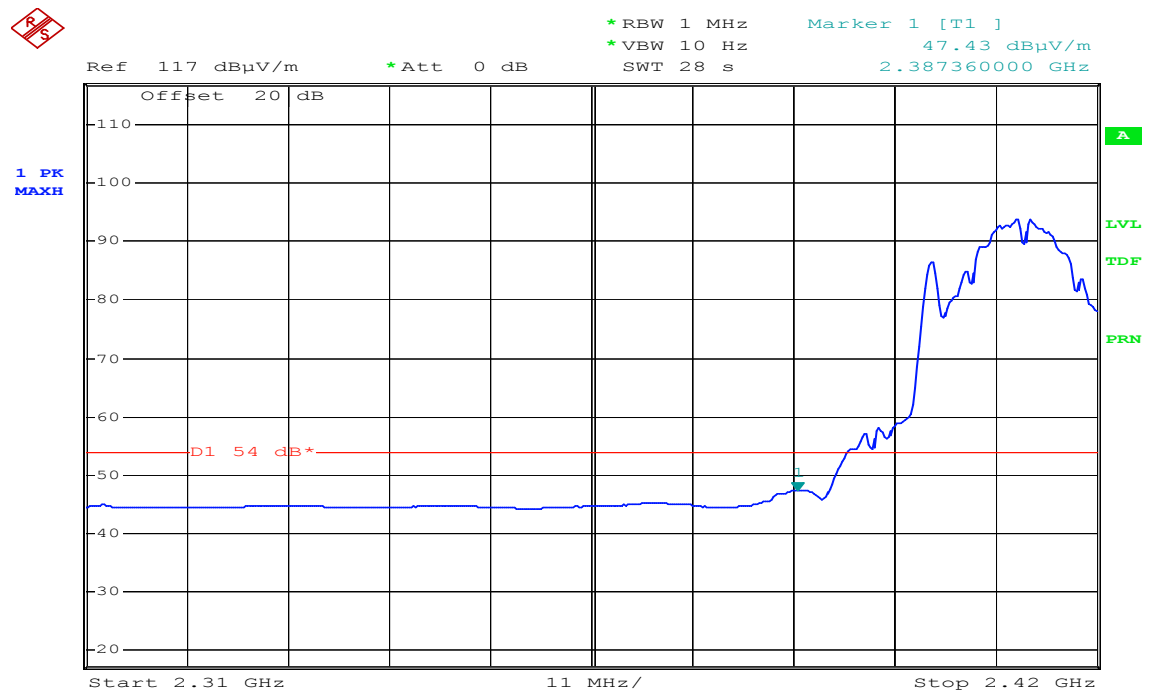
Polarity: Vertical



Date: 5.FEB.2005 09:52:53

Detector mode: Average

Polarity: Vertical

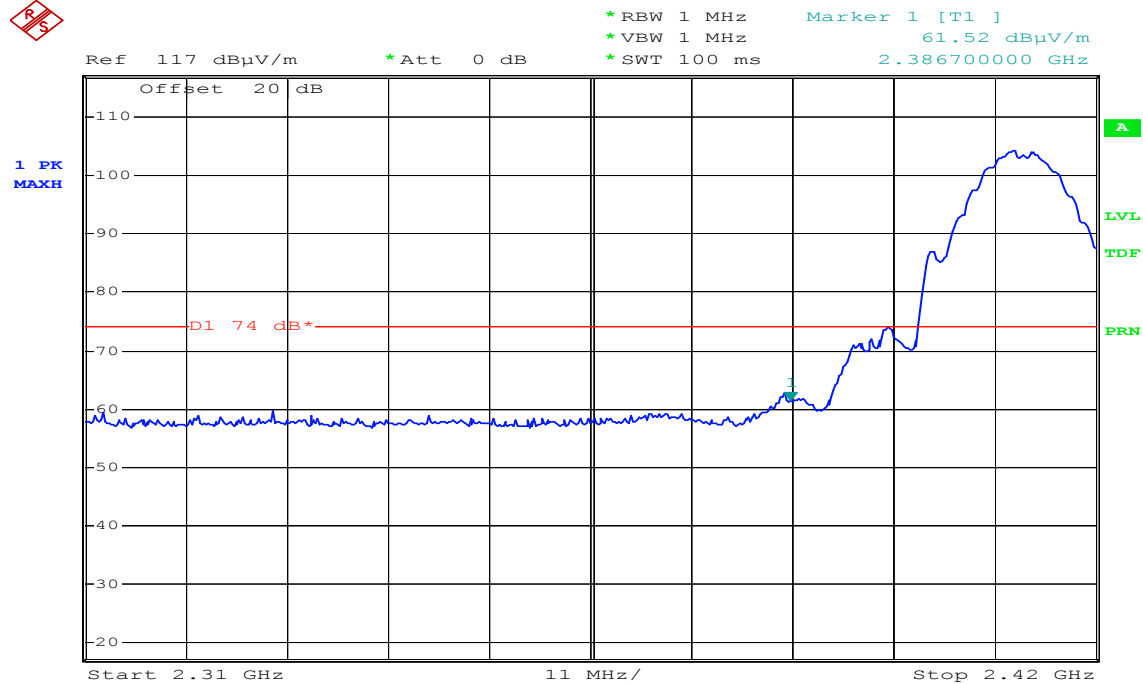


Date: 5.FEB.2005 09:56:23



Detector mode: Peak

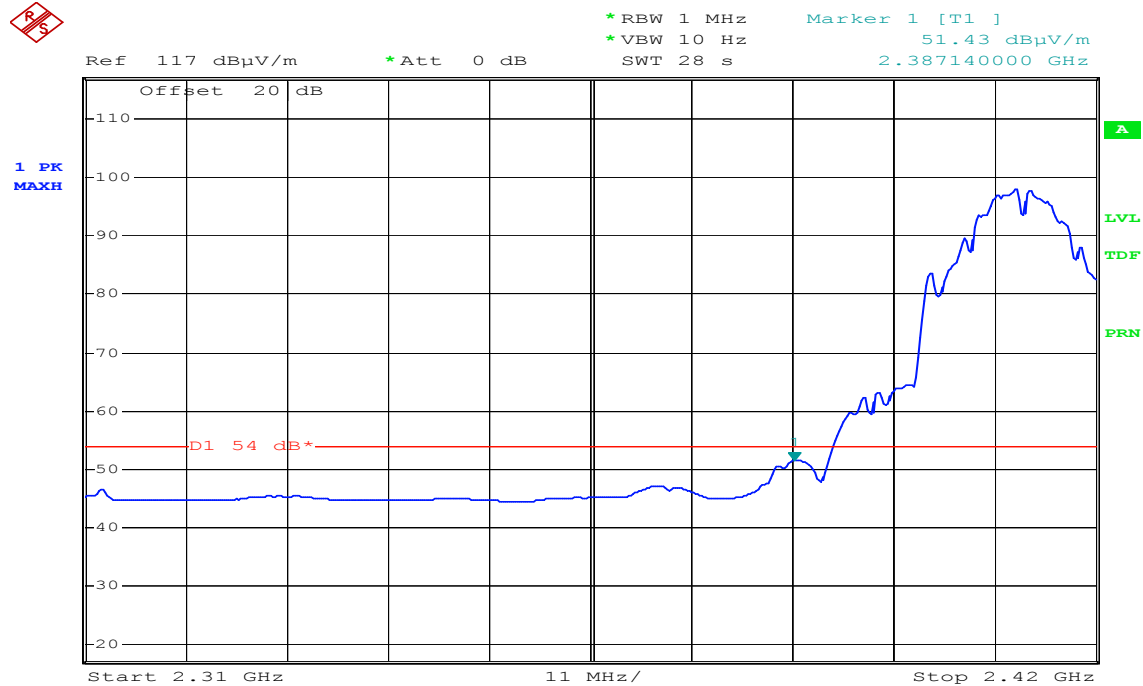
Polarity: Horizontal



Date: 5.FEB.2005 10:00:33

Detector mode: Average

Polarity: Horizontal



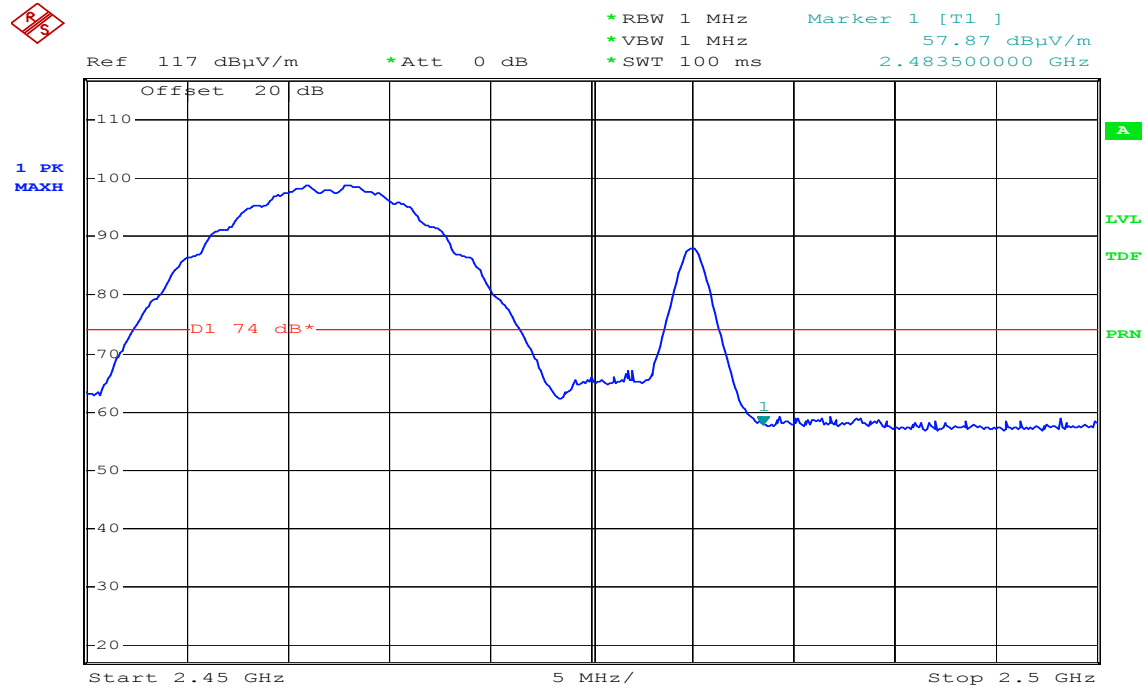
Date: 5.FEB.2005 10:02:16



Band Edges (IEEE 802.11b / CH High + Bluetooth / CH High)

Detector mode: Peak

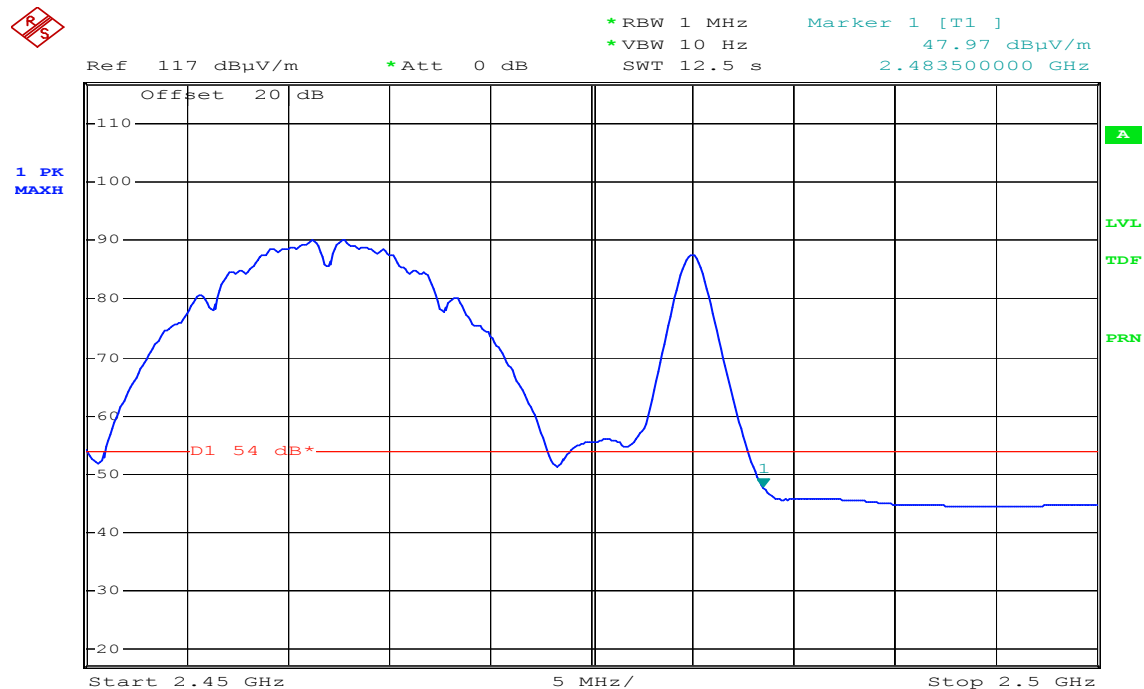
Polarity: Vertical



Date: 5.FEB.2005 10:17:45

Detector mode: Average

Polarity: Vertical

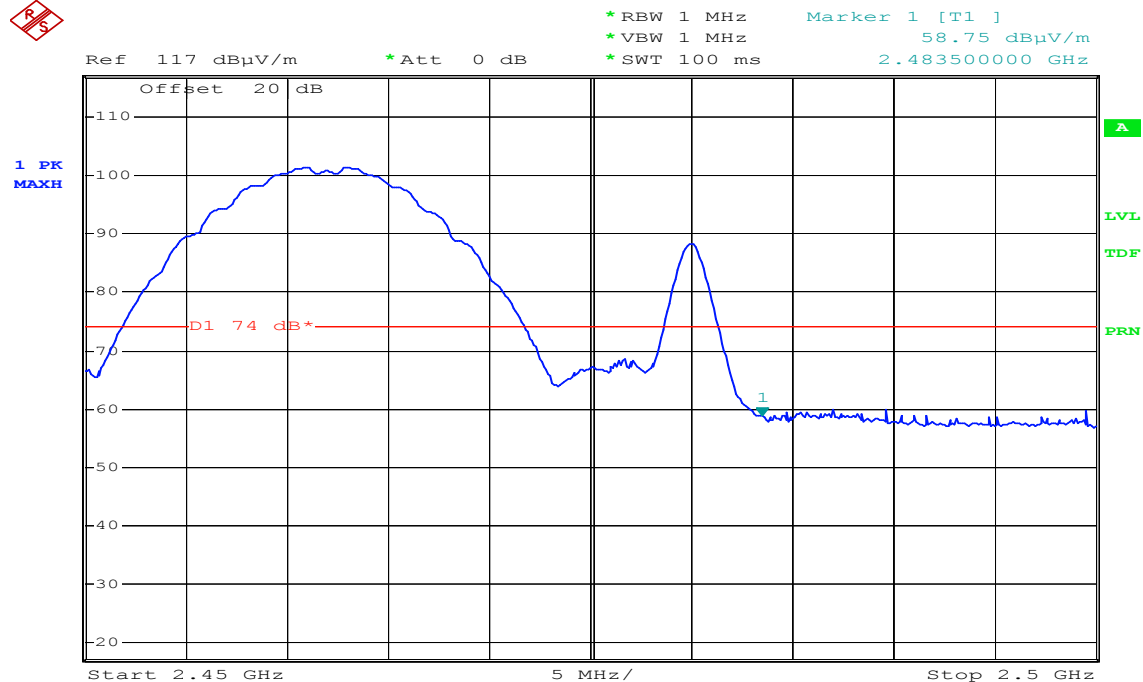


Date: 5.FEB.2005 10:19:59



Detector mode: Peak

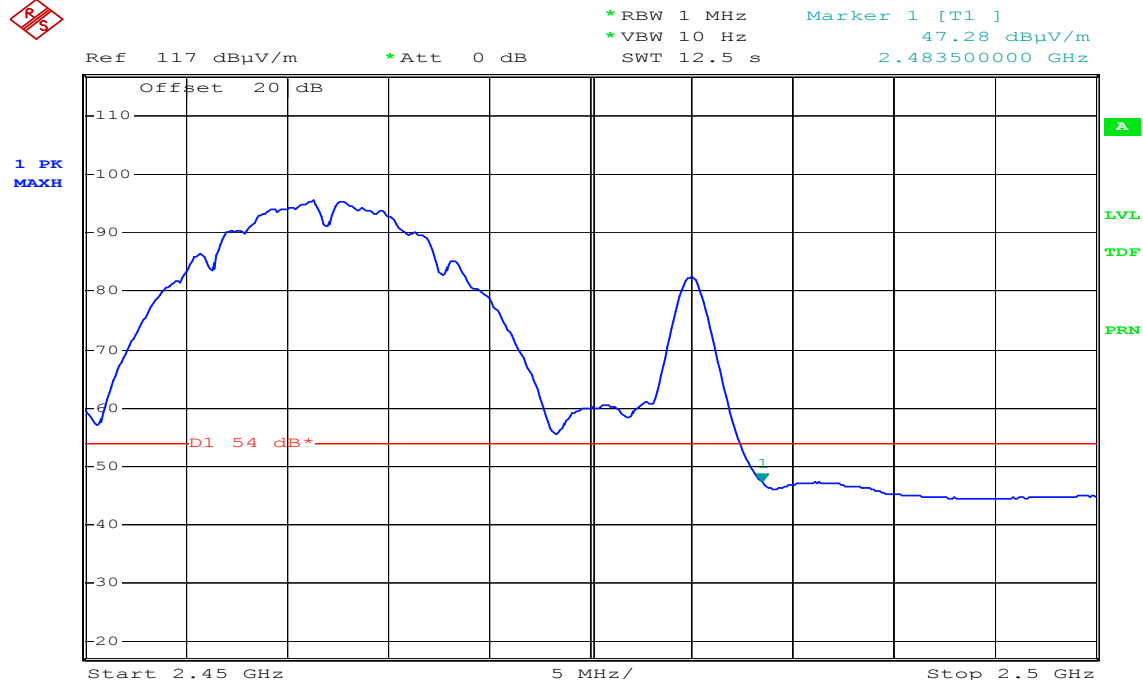
Polarity: Horizontal



Date: 5.FEB.2005 10:06:14

Detector mode: Average

Polarity: Horizontal



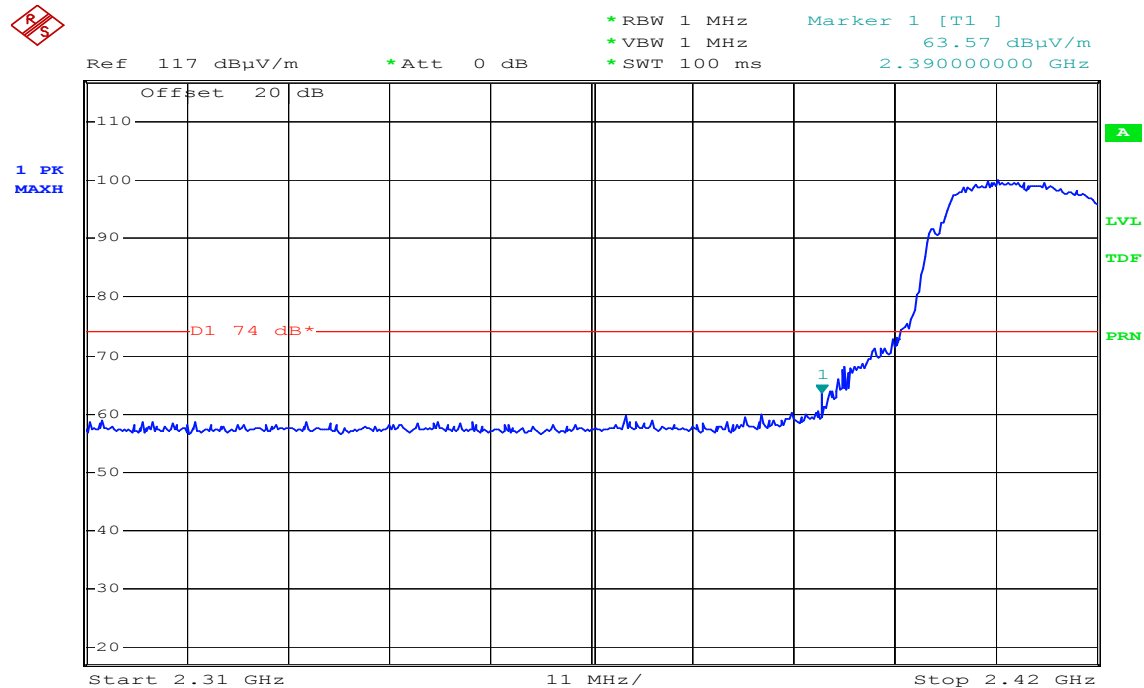
Date: 5.FEB.2005 10:07:29



Band Edges (IEEE 802.11g / CH Low + Bluetooth / CH Low)

Detector mode: Peak

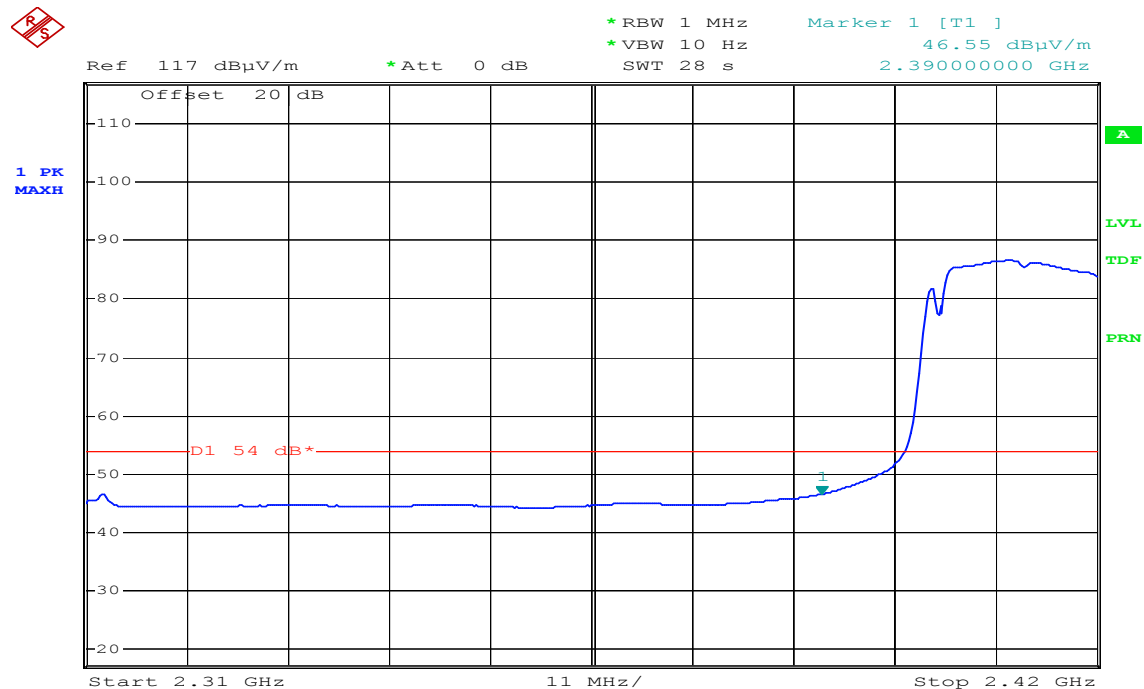
Polarity: Vertical



Date: 5.FEB.2005 10:37:02

Detector mode: Average

Polarity: Vertical

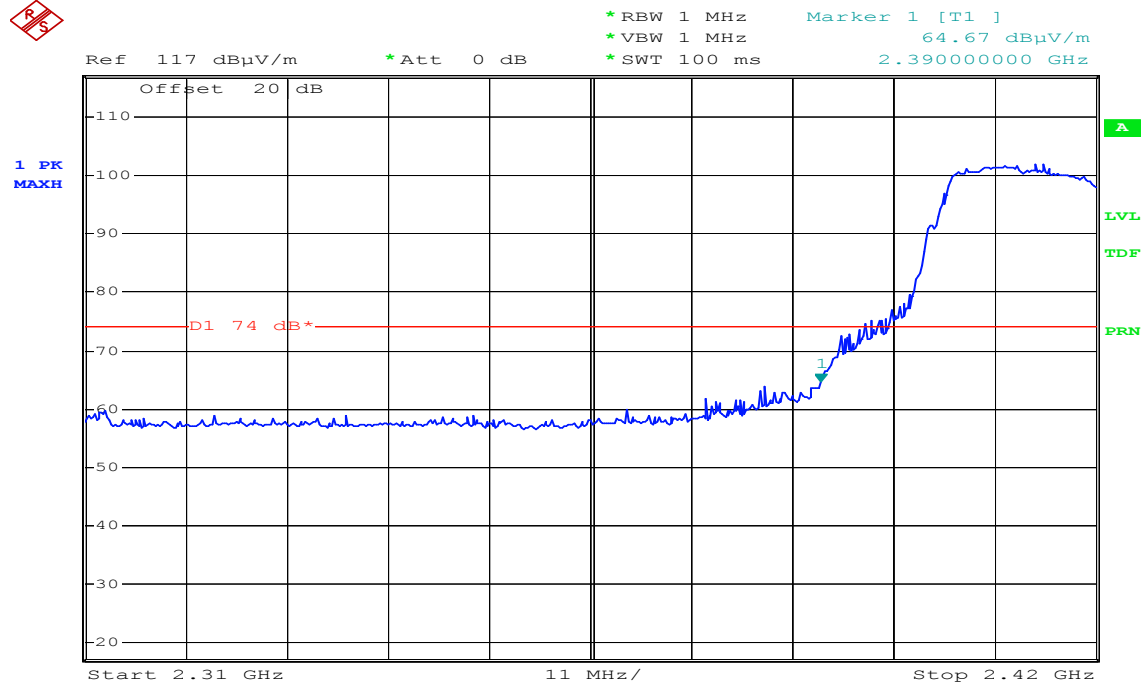


Date: 5.FEB.2005 10:38:54



Detector mode: Peak

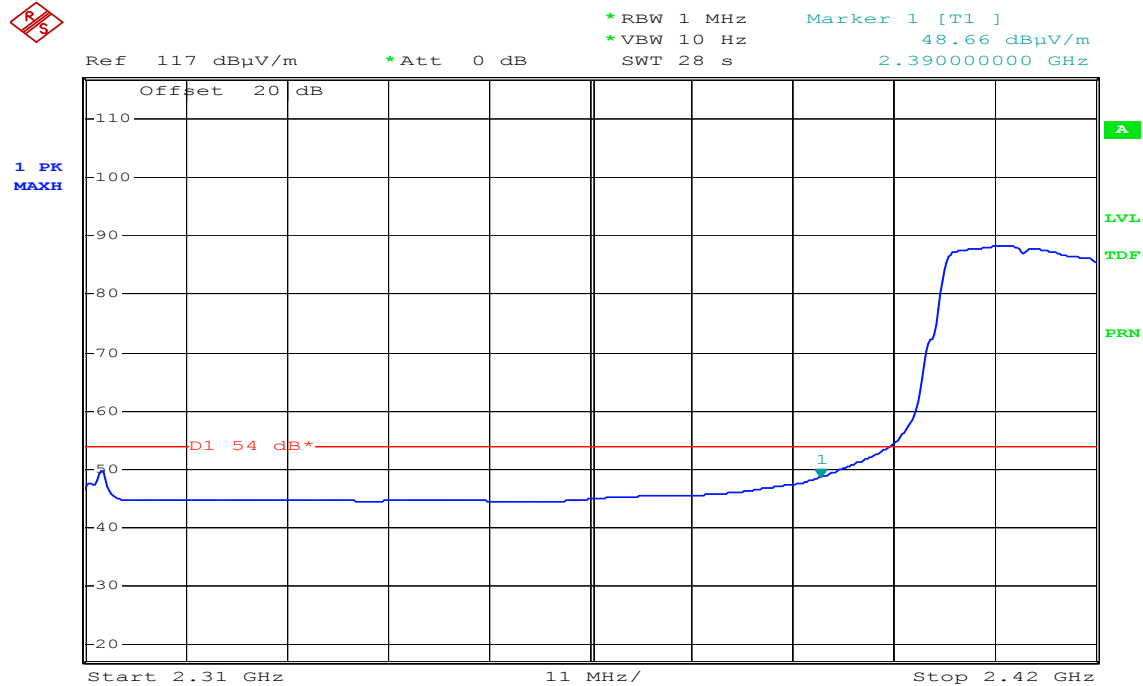
Polarity: Horizontal



Date: 5.FEB.2005 10:32:38

Detector mode: Average

Polarity: Horizontal



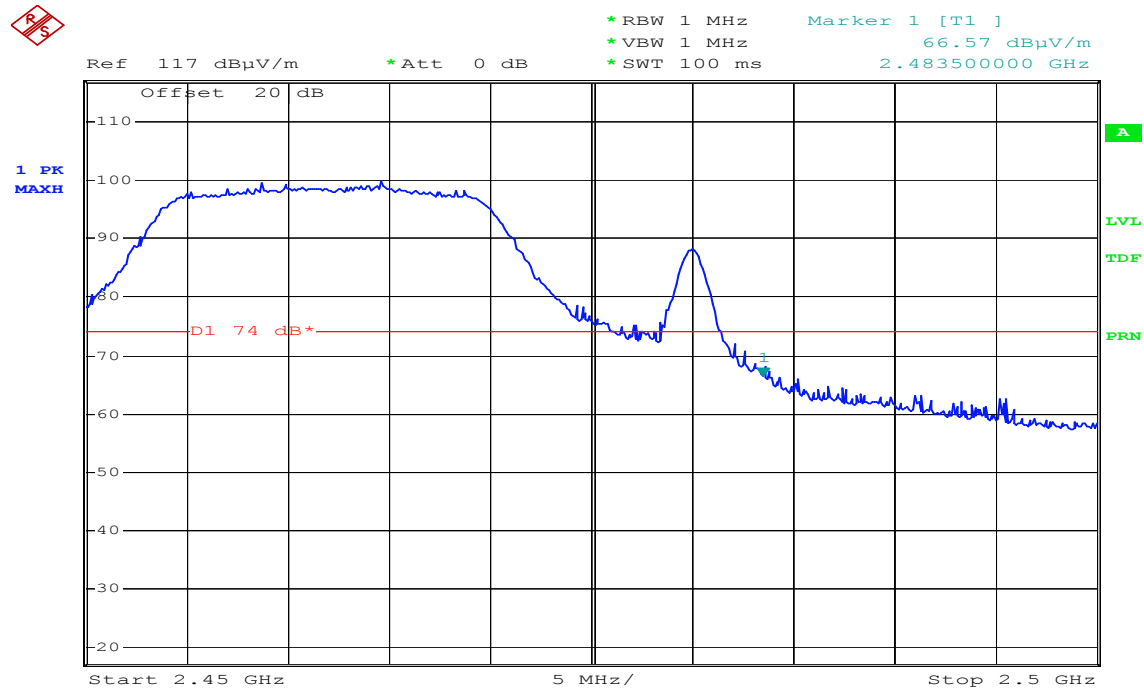
Date: 5.FEB.2005 10:34:21



Band Edges (IEEE 802.11g / CH High + Bluetooth / CH High)

Detector mode: Peak

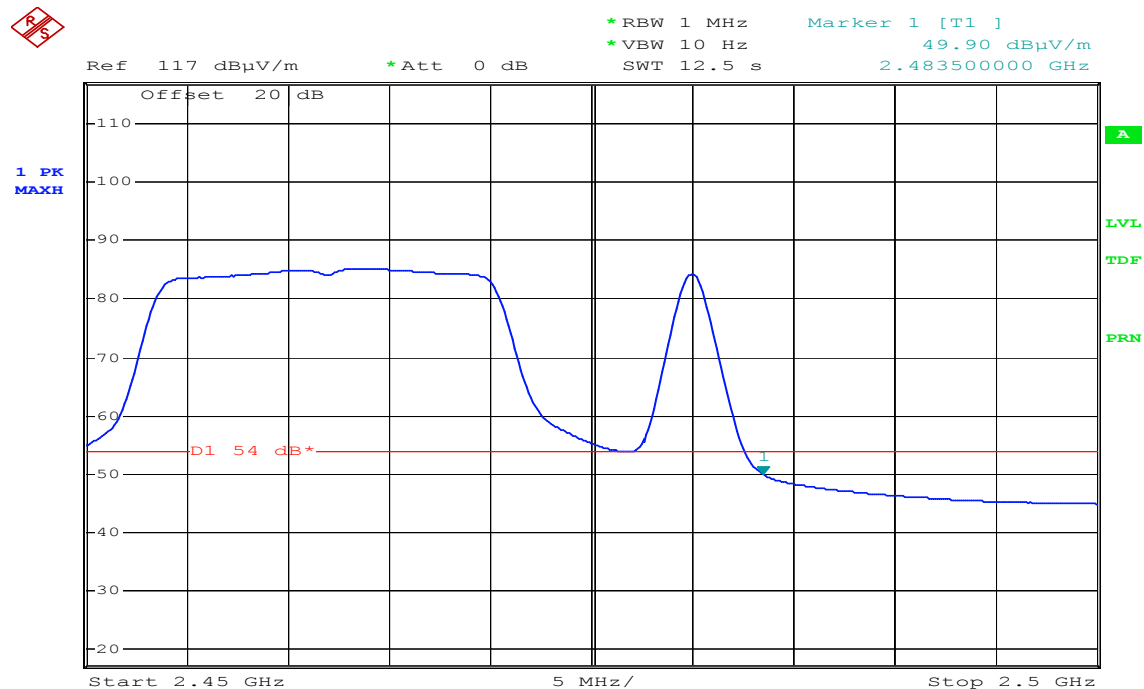
Polarity: Vertical



Date: 5.FEB.2005 10:23:24

Detector mode: Average

Polarity: Vertical

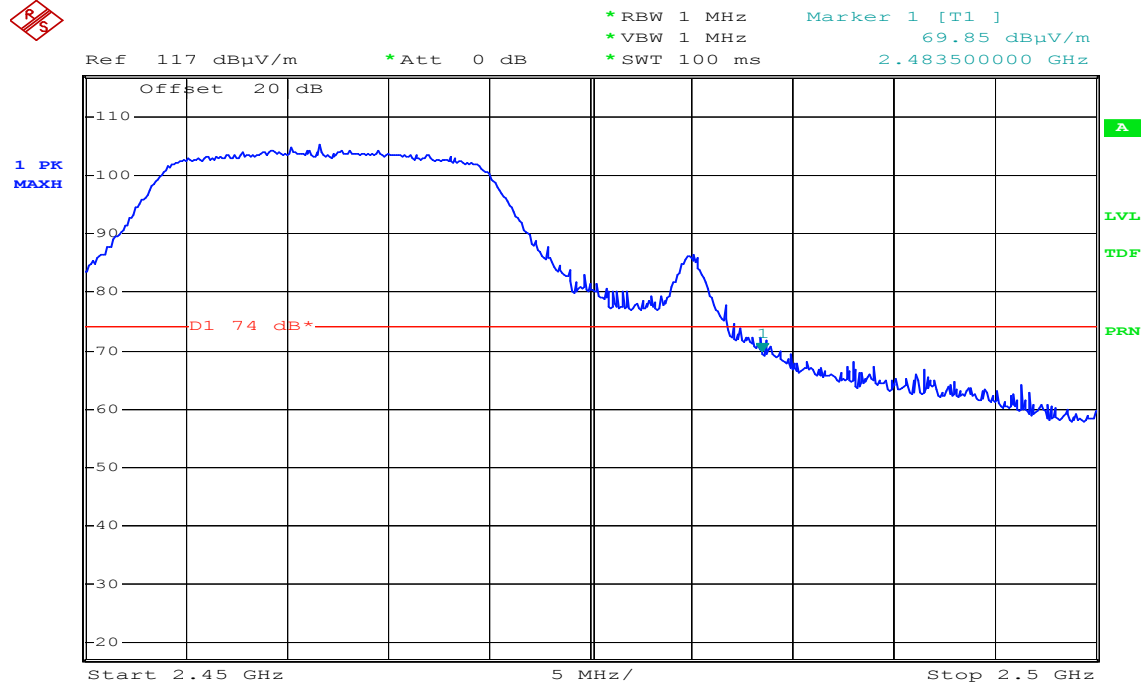


Date: 5.FEB.2005 10:24:29



Detector mode: Peak

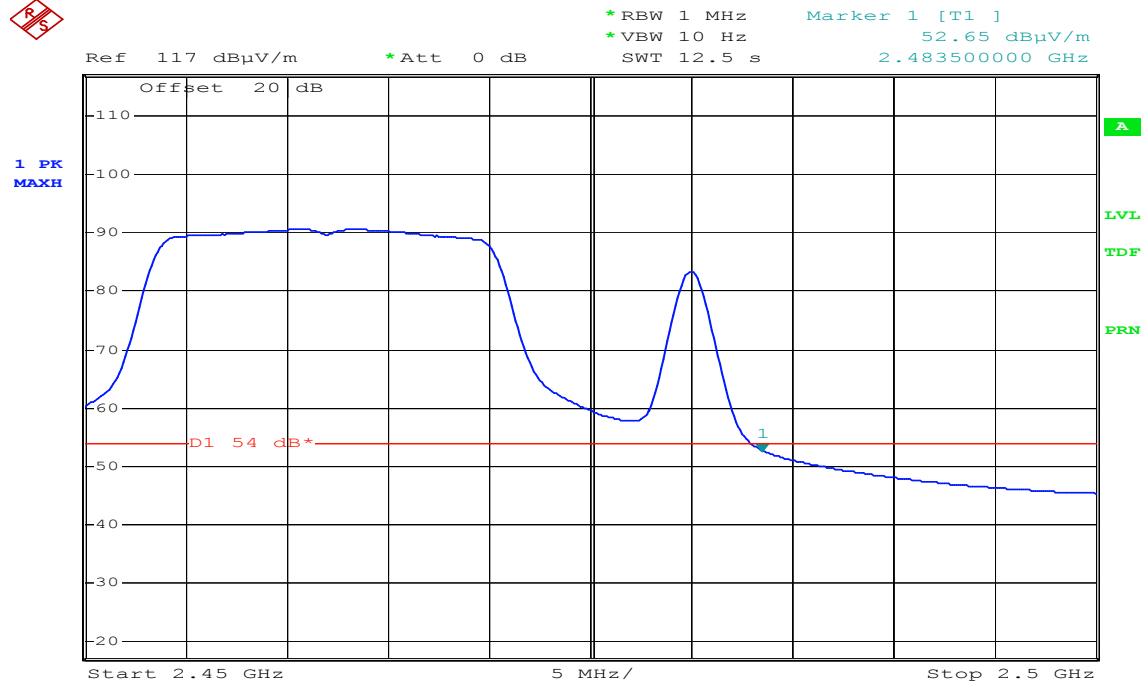
Polarity: Horizontal



Date: 5.FEB.2005 10:27:24

Detector mode: Average

Polarity: Horizontal



Date: 5.FEB.2005 10:28:22



7.15 POWER LINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2005
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2005
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/05/2006

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

**TEST RESULTS**

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Operation Mode: TX + RX mode **Test Date:** February 15, 2005
Temperature: 25°C **Tested by:** Joan Liu
Humidity: 55% RH

Freq. (MHz)	QP Reading	AV Reading	Corr. factor	QP Result	AV Result	QP Limit	AV Limit	QP Margin	AV Margin	Note
0.179	37.730	38.250	0.067	37.797	38.317	64.532	54.532	-26.735	-16.215	L1
0.222	36.230	36.410	0.082	36.312	36.492	62.744	52.744	-26.432	-16.252	L1
0.333	33.980	32.970	0.090	34.070	33.060	59.376	49.376	-25.306	-16.316	L1
0.443	32.000	31.760	0.099	32.099	31.859	57.005	47.005	-24.907	-15.147	L1
0.999	30.030	30.080	0.110	30.140	30.190	56.000	46.000	-25.860	-15.810	L1
2.727	19.990	17.600	0.191	20.181	17.791	56.000	46.000	-35.819	-28.209	L1
0.168	43.100	40.080	0.057	43.157	40.137	65.059	55.059	-21.902	-14.922	L2
0.222	34.760	33.930	0.074	34.834	34.004	62.744	52.744	-27.909	-18.739	L2
0.279	37.420	37.600	0.086	37.506	37.686	60.846	50.846	-23.340	-13.160	L2
0.335	33.320	33.290	0.090	33.410	33.380	59.326	49.326	-25.916	-15.946	L2
0.387	35.500	35.860	0.090	35.590	35.950	58.128	48.128	-22.538	-12.178	L2
0.500	34.260	34.540	0.130	34.390	34.670	56.000	46.000	-21.610	-11.330	L2

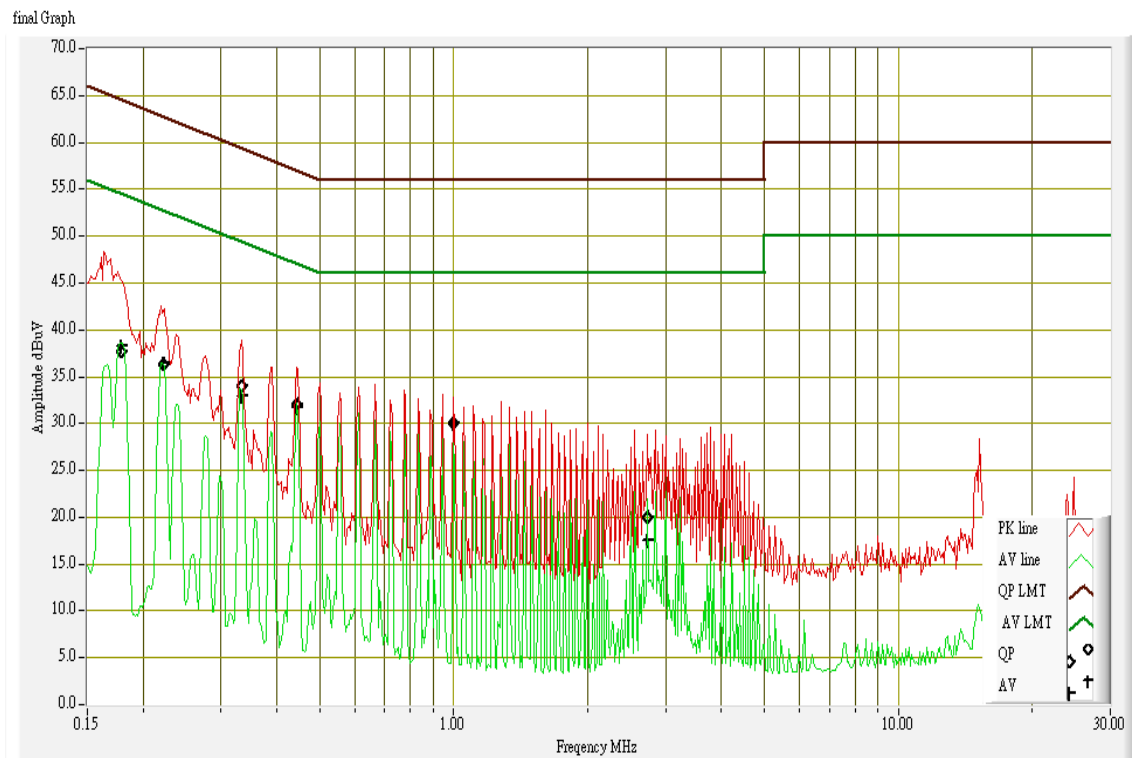
Remark:

1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. “---” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
4. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9KHz.
5. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



Test Data Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)

