



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

BLUETOOTH USB DONGLE

Model: BT-20S, BT-20B, BT-20C

Trade Name: BT-LINKS

Issued to

BT-LINKS COMPANY LIMITED
RM 802, 8/F, NAN FUNG CTR, 264-298 CASTLE PEAK RD.,
TSUEN WAN, HK

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



Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.



TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION.....	3
2. EUT DESCRIPTION	4
3. TEST METHODOLOGY	5
3.1 EUT CONFIGURATION	5
3.2 EUT EXERCISE.....	5
3.3 GENERAL TEST PROCEDURES.....	5
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS.....	6
3.5 DESCRIPTION OF TEST MODES	6
4. INSTRUMENT CALIBRATION.....	7
5. FACILITIES AND ACCREDITATIONS	8
5.1 FACILITIES	8
5.2 EQUIPMENT.....	8
5.3 LABORATORY ACCREDITATIONS AND LISTING.....	8
5.4 TABLE OF ACCREDITATIONS AND LISTINGS.....	9
6. SETUP OF EQUIPMENT UNDER TEST	10
6.1 SETUP CONFIGURATION OF EUT.....	10
6.2 SUPPORT EQUIPMENT	10
7. FCC PART 15.247 REQUIREMENTS.....	11
7.1 PEAK POWER.....	11
7.2 BAND EDGES MEASUREMENT	12
7.3 PEAK POWER SPECTRAL DENSITY	17
7.4 FREQUENCY SEPARATION.....	20
7.5 NUMBER OF HOPPING FREQUENCY	22
7.6 TIME OF OCCUPANCY (DWELL TIME).....	24
7.7 RADIO FREQUENCY EXPOSURE	31
7.8 SPURIOUS EMISSIONS	32
7.9 POWERLINE CONDUCTED EMISSIONS.....	42
APPENDIX 1 PHOTOGRAPHS OF TEST SETUP	45



1. TEST RESULT CERTIFICATION

Applicant: BT-LINKS COMPANY LIMITED
RM 802, 8/F, NAN FUNG CTR, 264-298 CASTLE PEAK RD.,
TSUEN WAN, HK

Equipment Under Test: BLUETOOTH USB DONGLE

Trade Name: BT-LINKS

Model: BT-20S, BT-20B, BT-20C

Date of Test: August 02 ~ 16, 2005

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR 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: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

Approved by:

Gavin Lim
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Amanda Wu
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	BLUETOOTH USB DONGLE
Trade Name	BT-LINKS
Model Number	BT-20S, BT-20B, BT-20C
Model Discrepancy	All the above models are identical except that they come with three different models with four different colors and external appearance for sale. Please refer to the external photos for further details.
Power Supply	Powered from host device.
Frequency Range	2402 ~ 2480 MHz
Transmit Power	3.20 dBm
Modulation Technique	FHSS (GFSK)
Transmit Data Rate	1Mbps
Number of Channels	79 Channels
Antenna Specification	PIFA Antenna / Gain: 1.0 dBi

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: TMY-BT-20 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 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

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 maximum emissions, exploratory radiated emission measurements were made 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

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: BT-20S) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

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.

Channel Low (2402MHz) · Mid (2441MHz) and High (2480MHz) were chosen for full testing.



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	 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.

* Australia: MRA of NVLAP AS/NZS 4771 & AS/NZS 4268.



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
1.	Notebook PC	IBM	2672(X31)	99PBTKB	FCC DoC	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

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

7.1 PEAK POWER

LIMIT

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

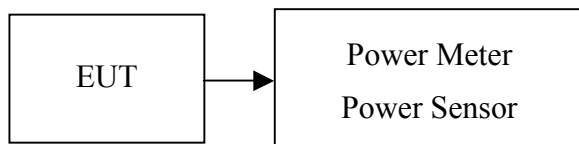
1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) 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
Power Meter	Agilent	E4416A	GB41291611	06/02/2006
Power Sensor	Agilent	E9327A	US40441097	06/02/2006

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)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-8.80	12.00	3.20	0.00209	0.125	PASS
Mid	2441	-8.91	12.00	3.09	0.00204		PASS
High	2480	-9.03	12.00	2.97	0.00198		PASS

7.2 BAND EDGES MEASUREMENT

LIMIT

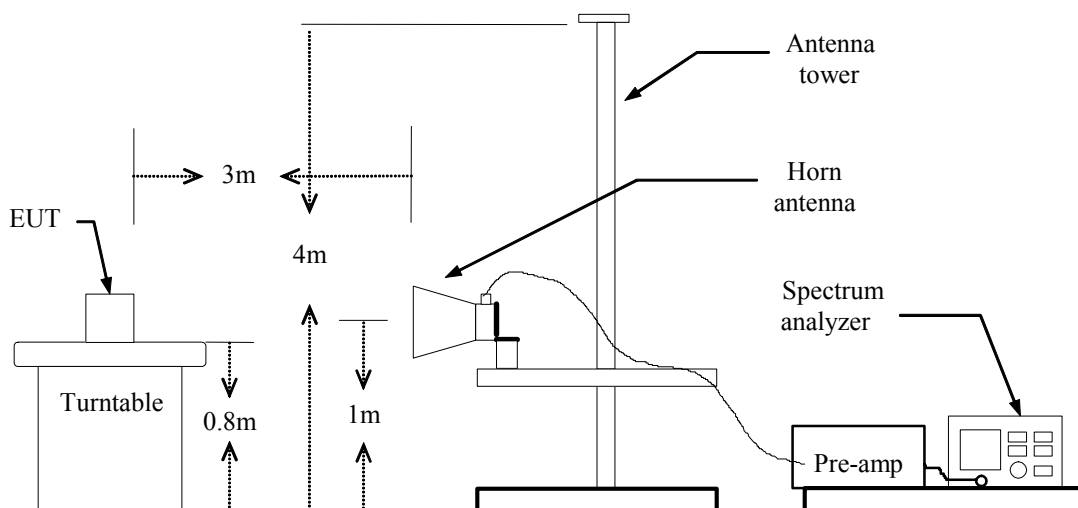
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 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

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.



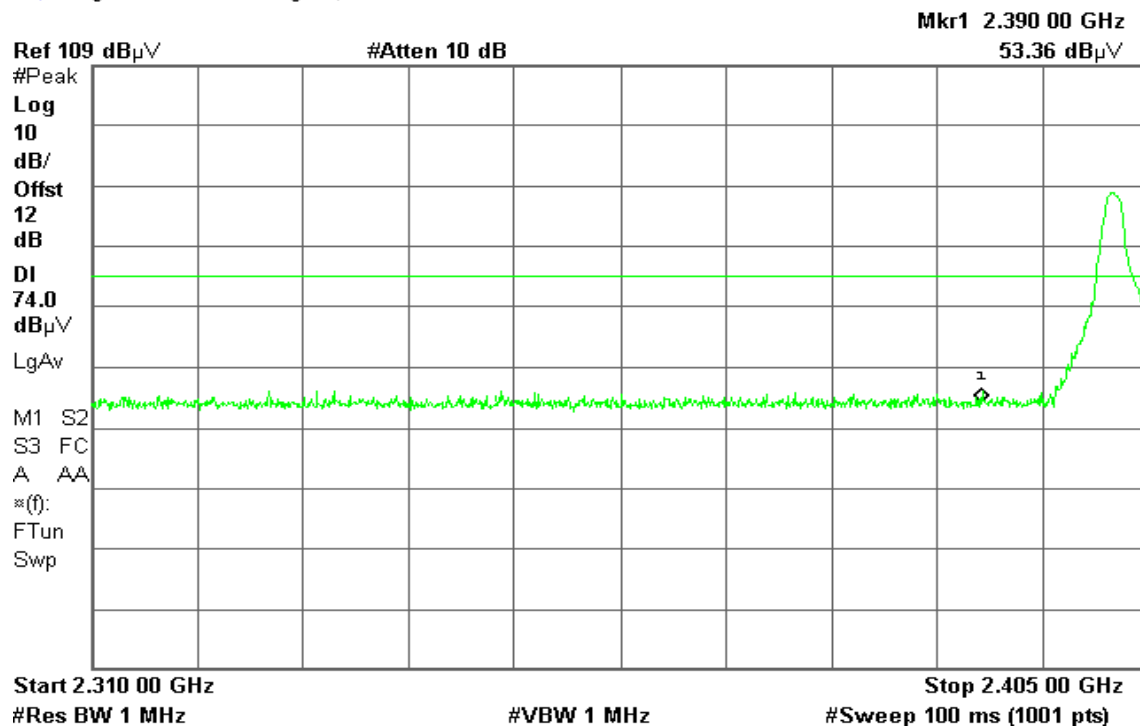
Band Edges (CH Low)

Detector mode: Peak

Polarity: Vertical

✱ Agilent 13:15:18 Aug 16, 2005

T

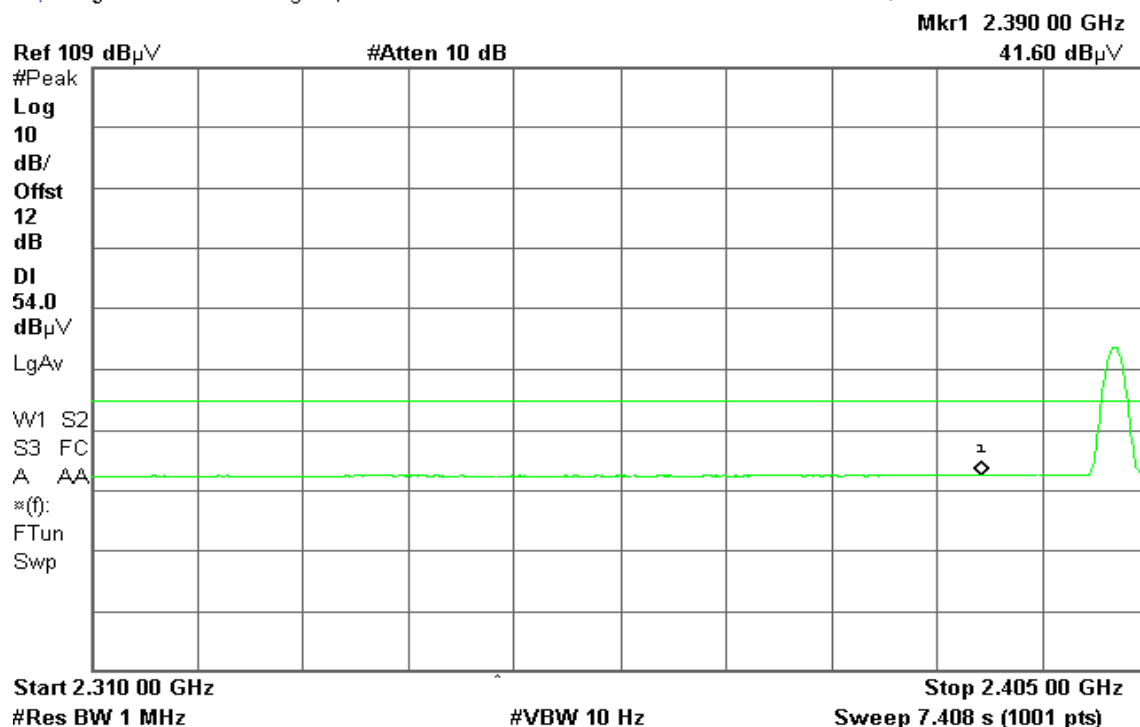


Detector mode: Average

Polarity: Vertical

✱ Agilent 13:14:58 Aug 16, 2005

T





Detector mode: Peak

Polarity: Horizontal

Agilent 13:09:25 Aug 16, 2005

T

Mkr1 2.386 01 GHz

Ref 109 dB μ V

#Atten 10 dB

55.04 dB μ V

#Peak

Log

10

dB/

Offst

12

dB

DI

74.0

dB μ V

LgAv

M1 S2

S3 FC

A AA

*(f):

FTun

Swp

Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.405 00 GHz

#Sweep 100 ms (1001 pts)

Detector mode: Average

Polarity: Horizontal

Agilent 13:08:19 Aug 16, 2005

T

Mkr1 2.386 01 GHz

Ref 109 dB μ V

#Atten 10 dB

42.52 dB μ V

#Peak

Log

10

dB/

Offst

12

dB

DI

54.0

dB μ V

LgAv

W1 S2

S3 FC

A AA

*(f):

FTun

Swp

Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.405 00 GHz

Sweep 7.408 s (1001 pts)



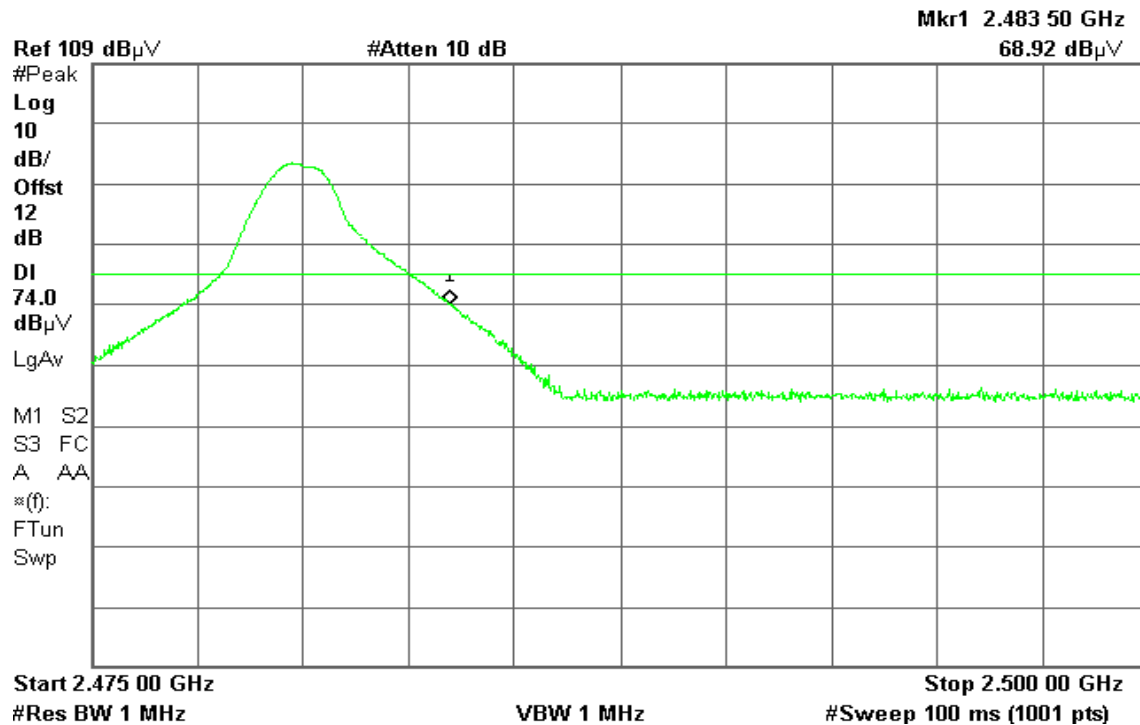
Band Edges (CH High)

Detector mode: Peak

Polarity: Vertical

Agilent 13:22:50 Aug 16, 2005

T

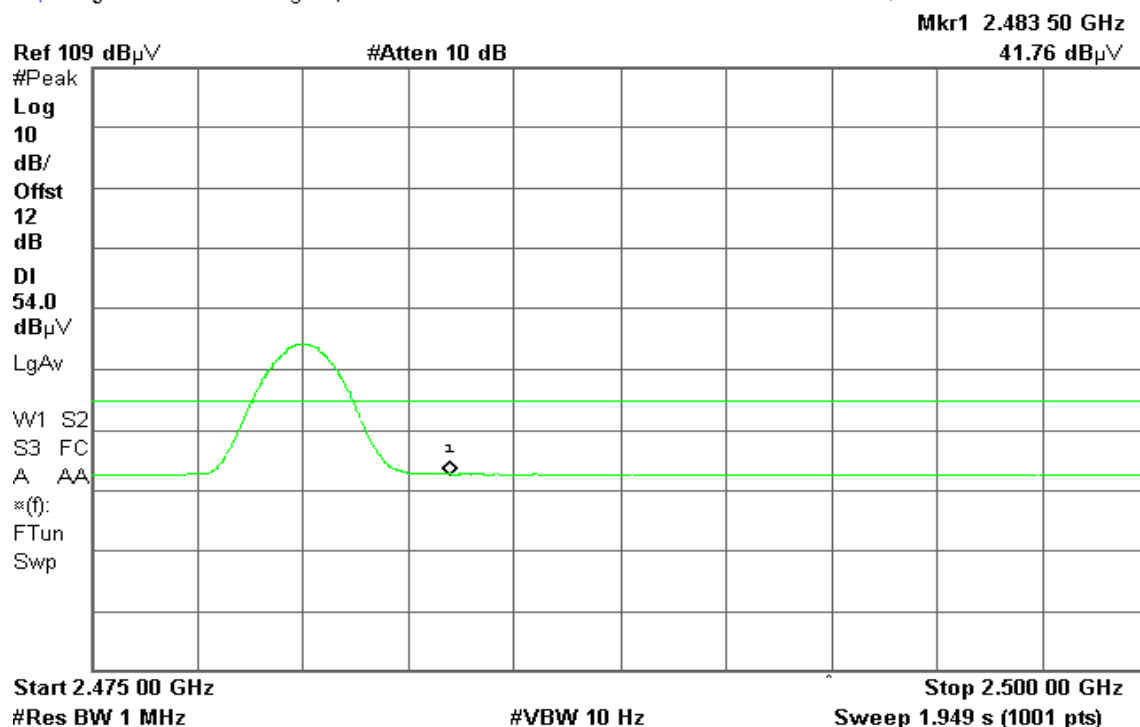


Detector mode: Average

Polarity: Vertical

Agilent 13:21:45 Aug 16, 2005

T



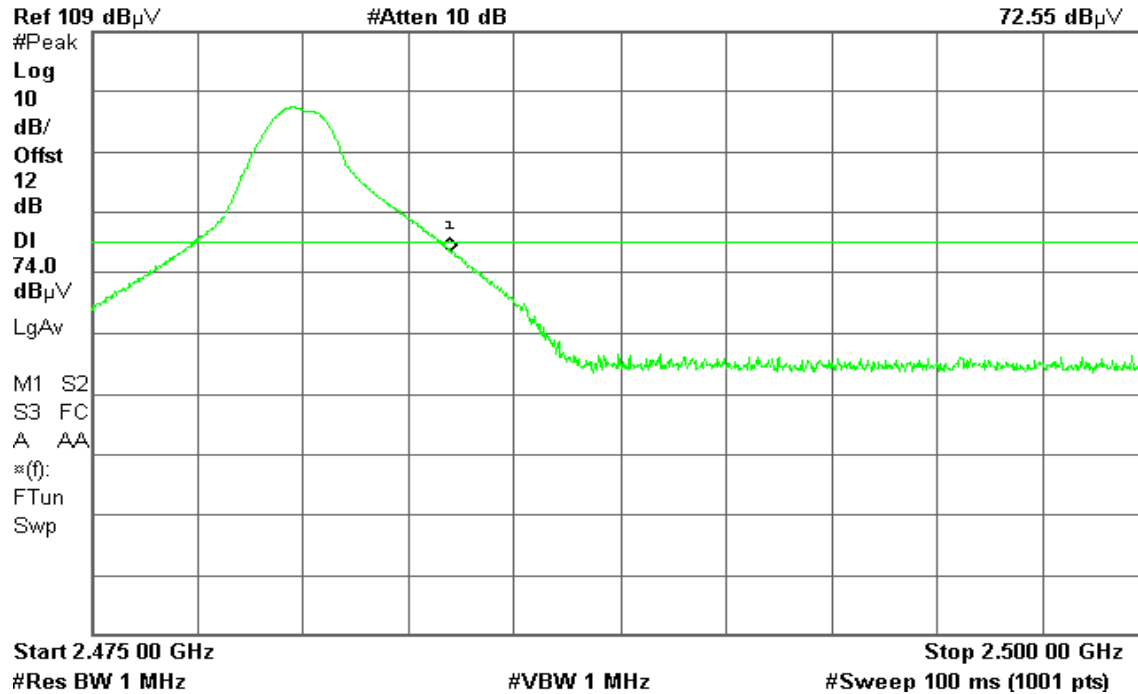


Detector mode: Peak

Polarity: Horizontal

* Agilent 13:29:49 Aug 16, 2005

T

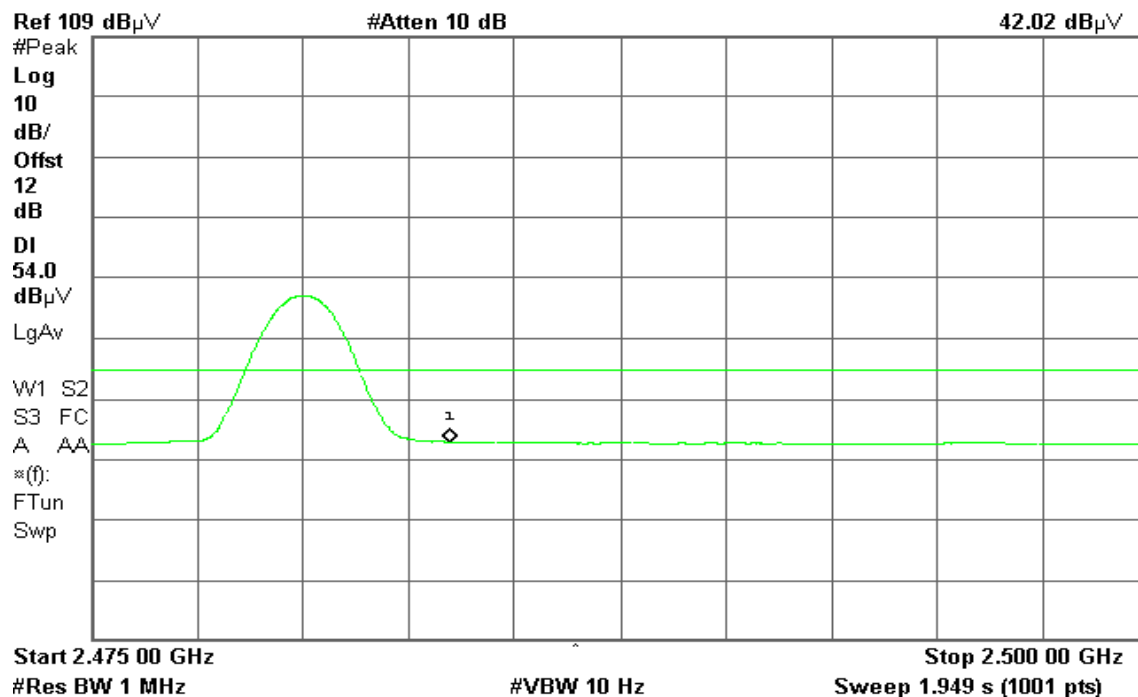
Mkr1 2.483 50 GHz
72.55 dB μ V

Detector mode: Average

Polarity: Horizontal

* Agilent 13:28:20 Aug 16, 2005

T

Mkr1 2.483 50 GHz
42.02 dB μ V



7.3 PEAK POWER SPECTRAL DENSITY

LIMIT

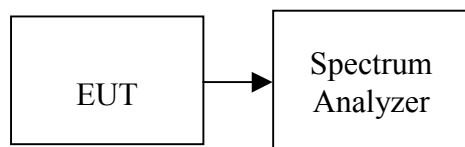
1. According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

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 (MHz)	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-25.36	6.00	-19.36	8.00	PASS
Mid	2441	-25.59	6.00	-19.59		PASS
High	2480	-25.12	6.00	-19.12		PASS

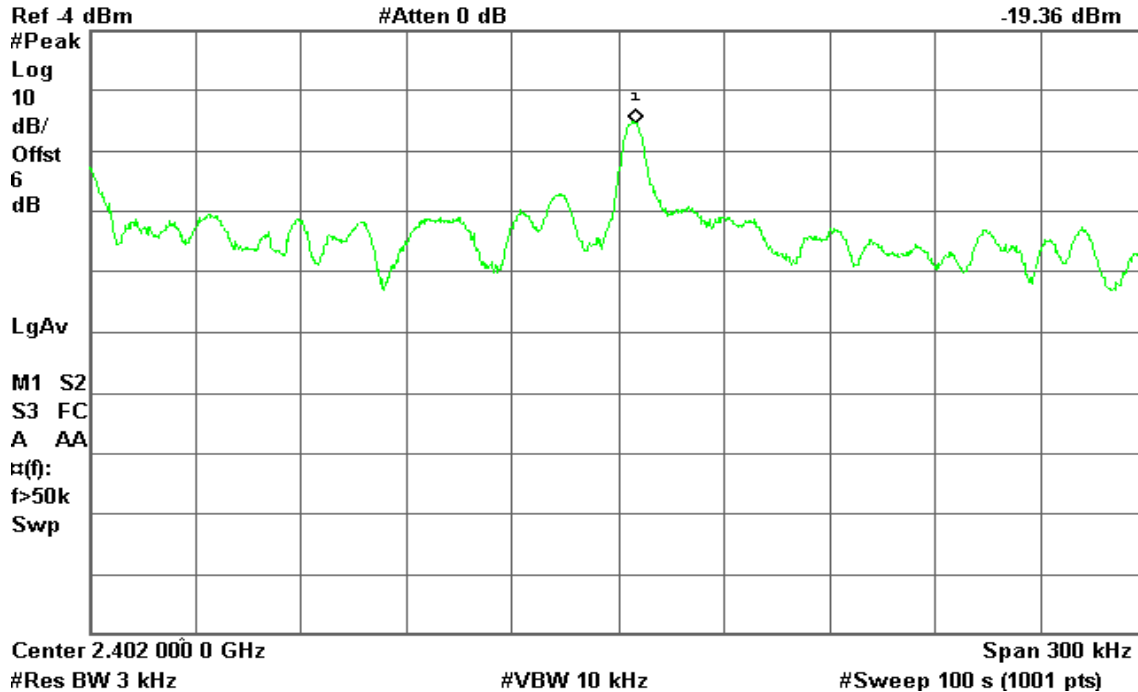


Test Plot

PPSD (CH Low)

Agilent 15:14:26 Aug 15, 2005

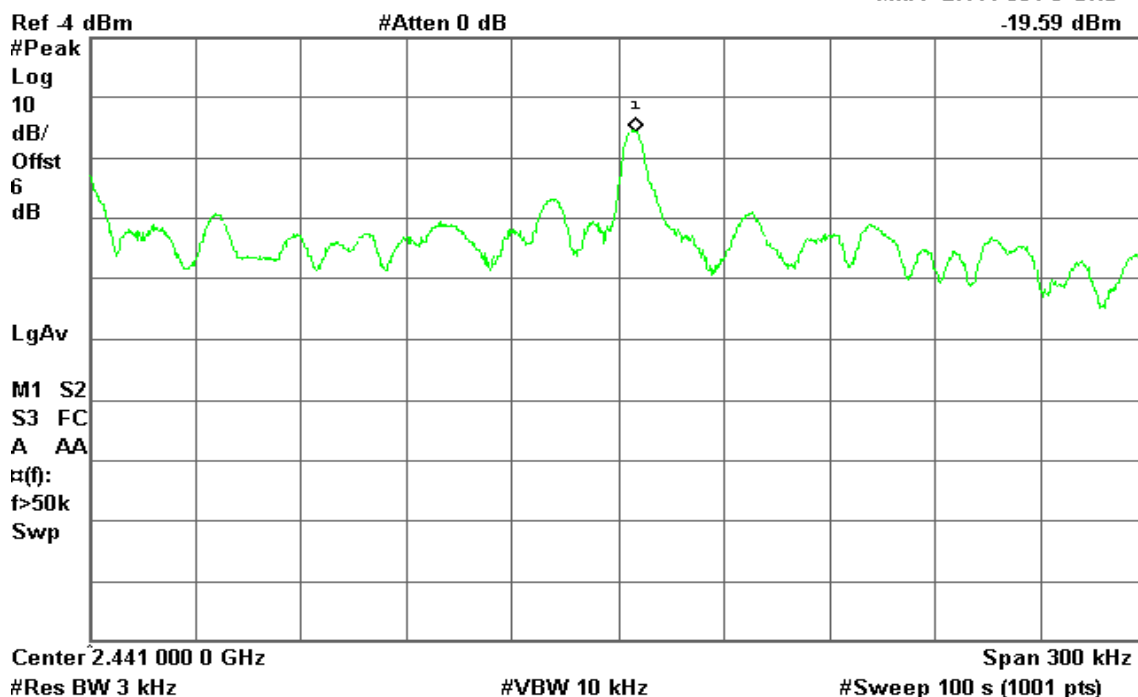
T
Mkr1 2.402 004 8 GHz
-19.36 dBm



PPSD (CH Mid)

Agilent 15:17:59 Aug 15, 2005

T
Mkr1 2.441 004 8 GHz
-19.59 dBm



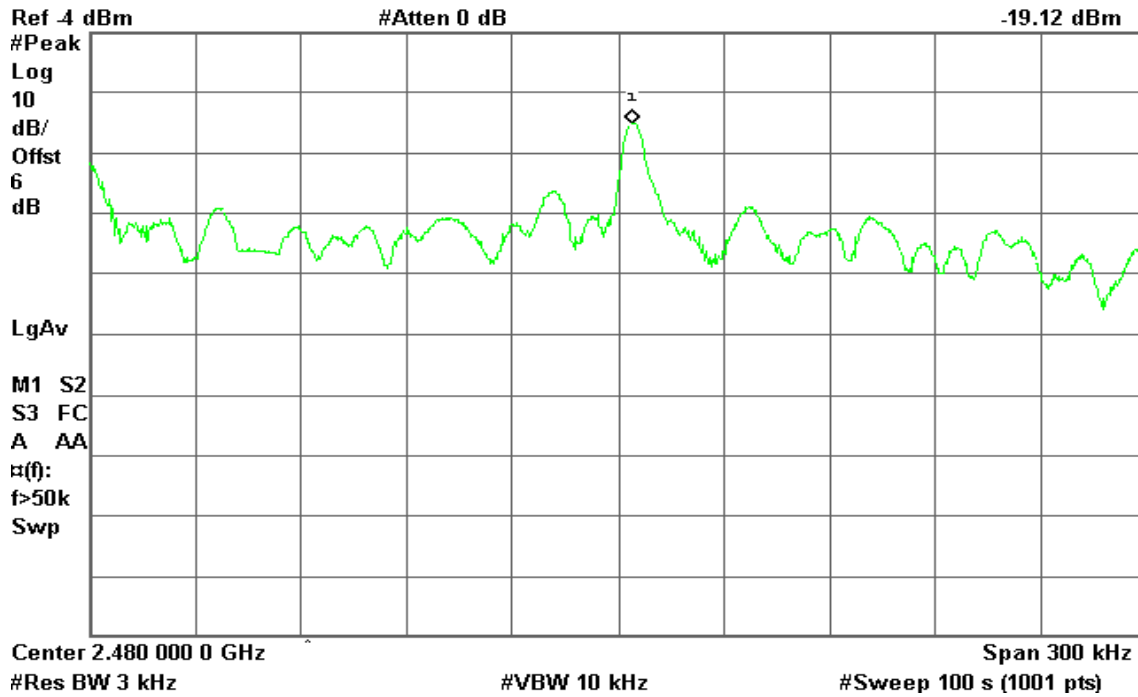


PPSD (CH High)

Agilent 15:20:32 Aug 15, 2005

R L

Mkr1 2.480 003 9 GHz
-19.12 dBm





7.4 FREQUENCY SEPARATION

LIMIT

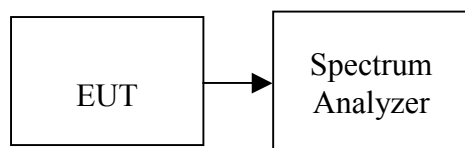
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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	1014	>676	Pass



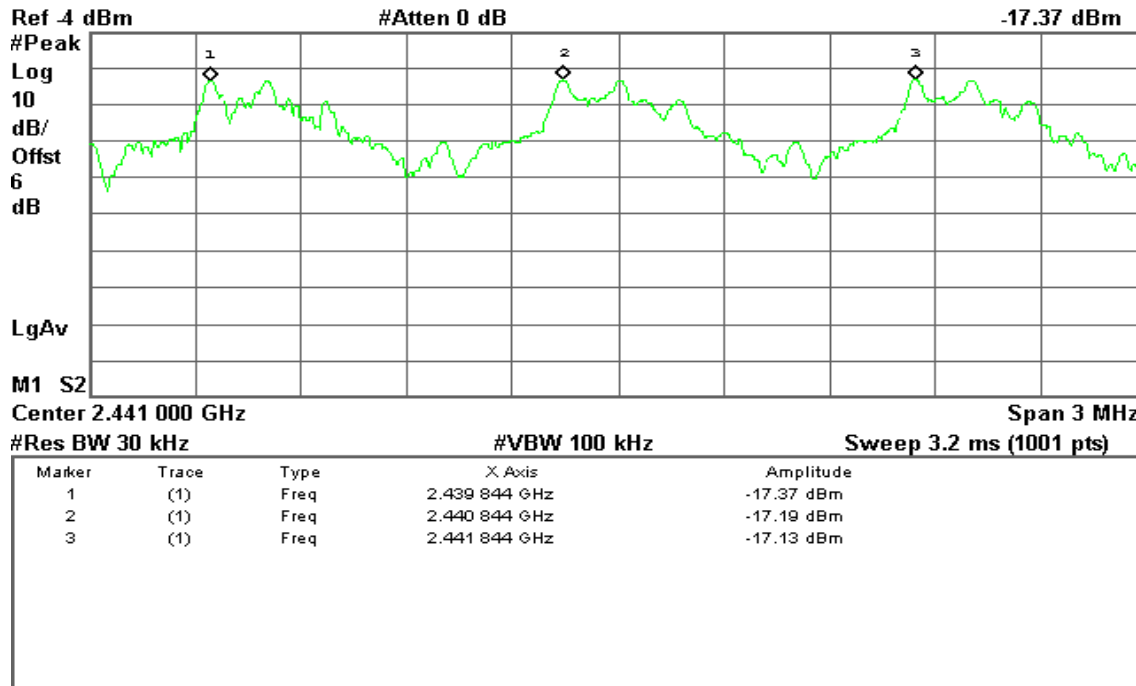
Test Plot

Measurement of Channel Separation

* Agilent 15:35:53 Aug 15, 2005

T

Mkr1 2.439 844 GHz

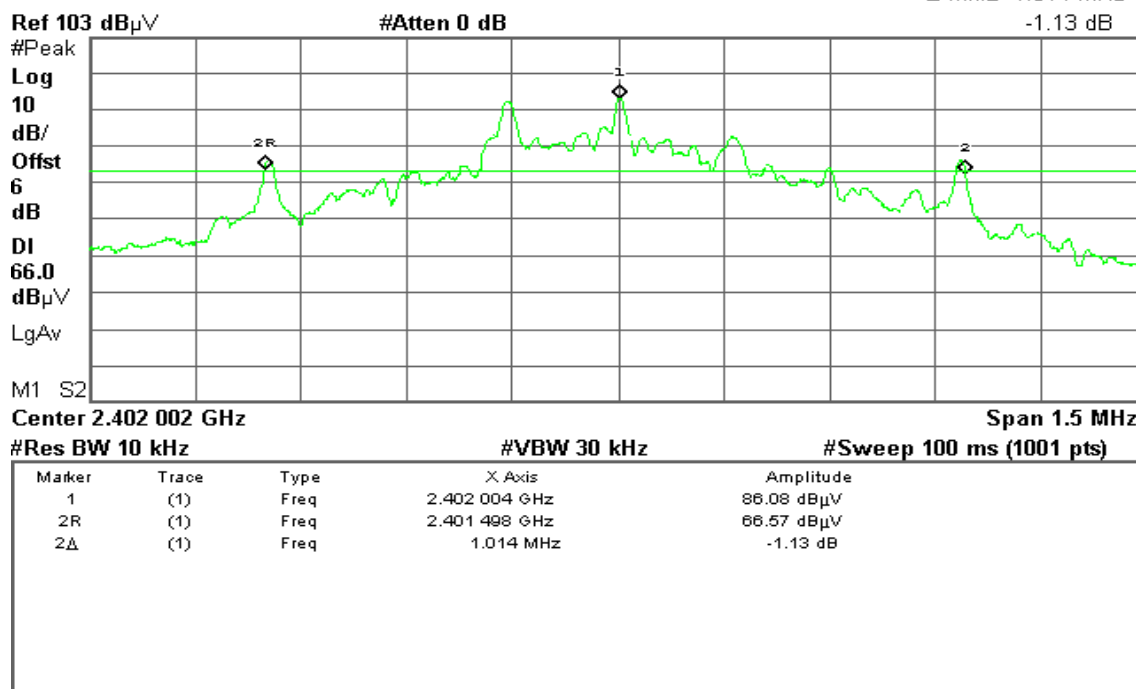


Measurement of 20dB Bandwidth

* Agilent 14:53:48 Aug 15, 2005

R T

Δ Mkr2 1.014 MHz





7.5 NUMBER OF HOPPING FREQUENCY

LIMIT

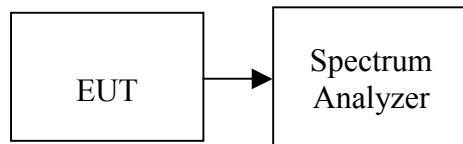
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

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=1MHz.
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



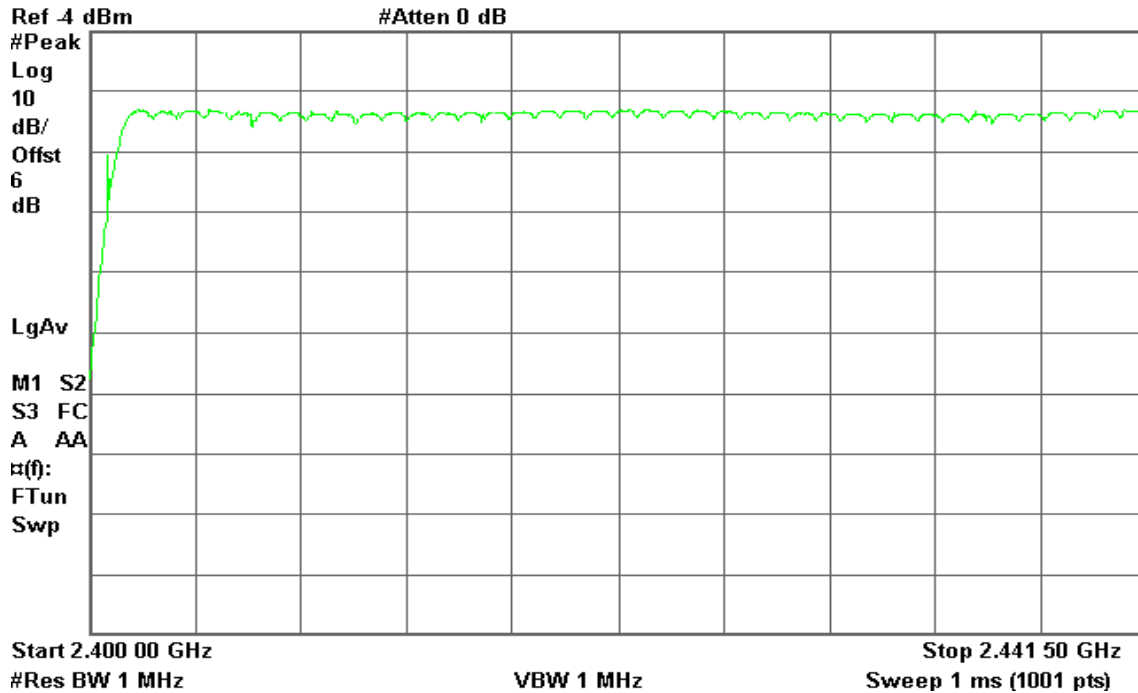
Test Plot

Channel Number

2.4 GHz – 2.4415 GHz

Agilent 15:38:04 Aug 15, 2005

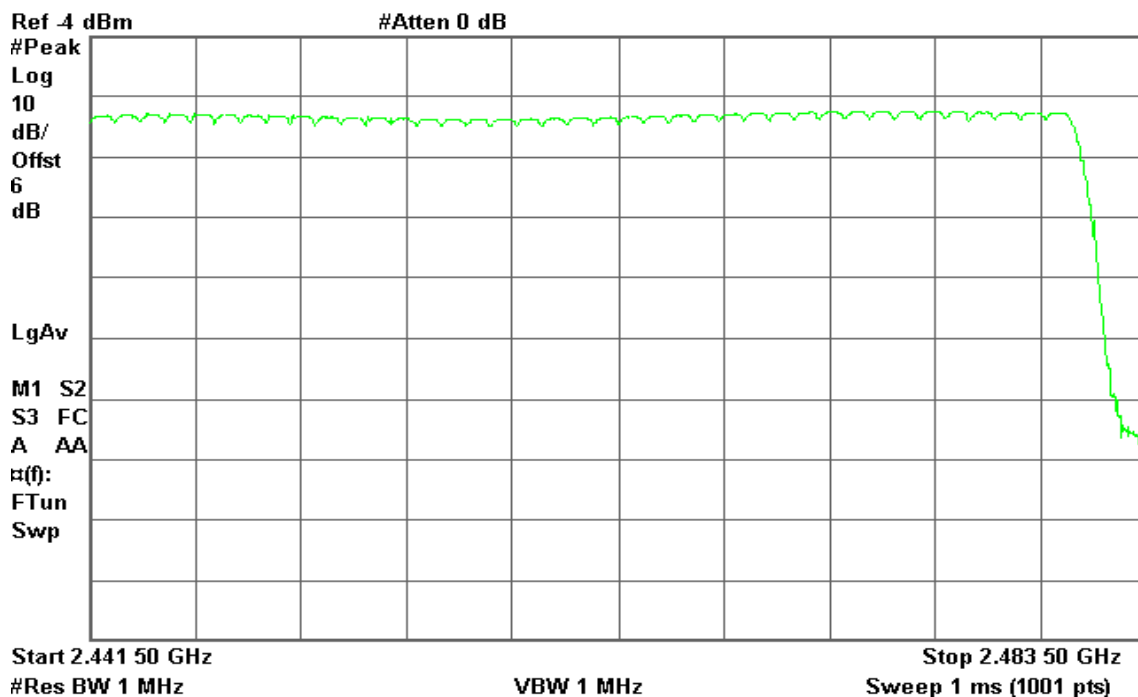
R T



2.4415 GHz – 2.4835 GHz

Agilent 15:39:14 Aug 15, 2005

T





7.6 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

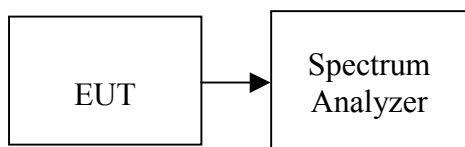
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

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: $0.57 * (1600/2)/79 * 31.6 = 182.4$ (ms)

CH Mid: $0.60 * (1600/2)/79 * 31.6 = 192.0$ (ms)

CH High: $0.56 * (1600/2)/79 * 31.6 = 179.2$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.57	182.4	31.6	400.0	PASS
Mid	0.60	192.0	31.6		PASS
High	0.56	179.2	31.6		PASS

DH 3

CH Low: $1.84 * (1600/4)/79 * 31.6 = 294.4$ (ms)

CH Mid: $1.85 * (1600/4)/79 * 31.6 = 296.0$ (ms)

CH High: $1.88 * (1600/4)/79 * 31.6 = 300.8$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.84	294.4	31.6	400.0	PASS
Mid	1.85	296.0	31.6		PASS
High	1.88	300.8	31.6		PASS

DH 5

CH Low: $3.09 * (1600/6)/79 * 31.6 = 329.6$ (ms)

CH Mid: $3.06 * (1600/6)/79 * 31.6 = 326.4$ (ms)

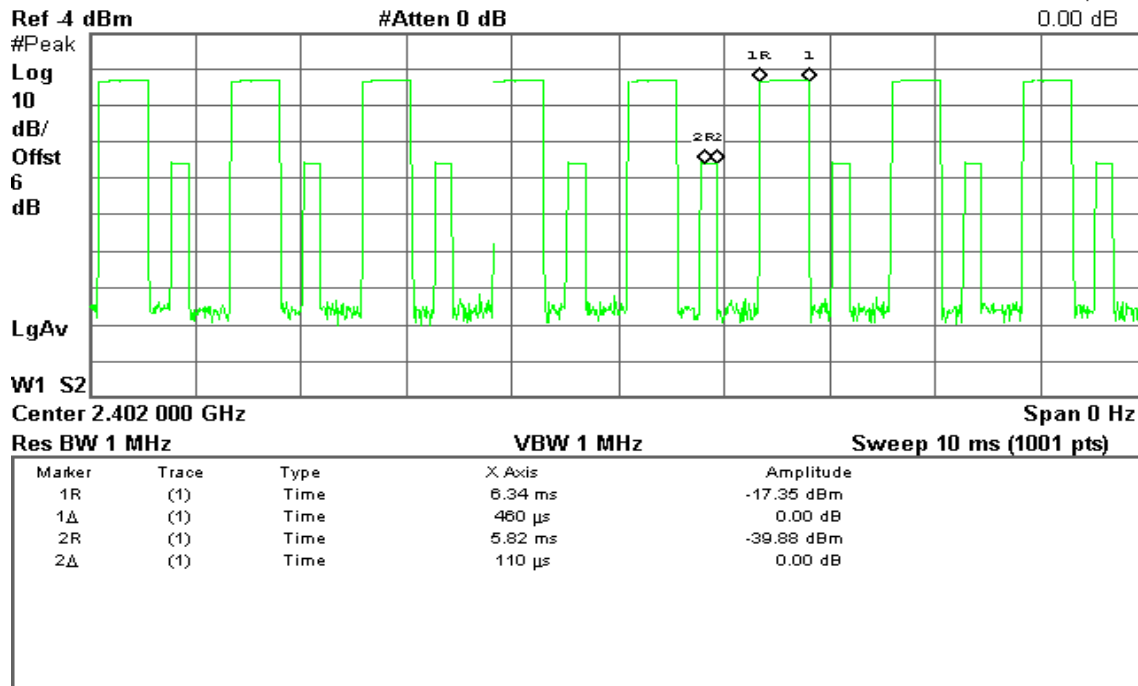
CH High: $3.12 * (1600/6)/79 * 31.6 = 332.8$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	3.09	329.6	31.6	400.0	PASS
Mid	3.06	326.4	31.6		PASS
High	3.12	332.8	31.6		PASS

**Test Plot****DH 1****(CH Low)**

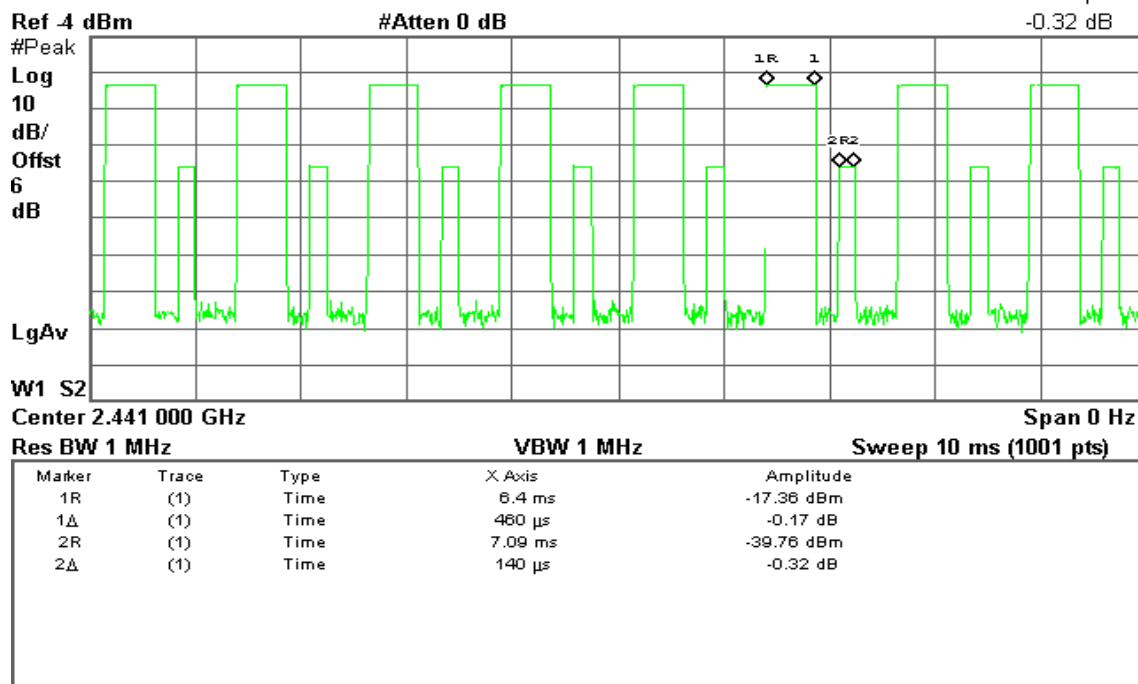
* Agilent 15:29:56 Aug 15, 2005

T

 Δ Mkr2 110 μ s
0.00 dB**(CH Mid)**

* Agilent 15:28:43 Aug 15, 2005

T

 Δ Mkr2 140 μ s
-0.32 dB

**(CH High)**

* Agilent 15:22:25 Aug 15, 2005

R T

 Δ Mkr2 120 μ s
0.02 dB

Ref -4 dBm

#Atten 0 dB

#Peak

Log

10

dB/

Offst

6

dB

LgAv

W1 S2

Center 2.480 004 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.82 ms	-17.20 dBm
1 Δ	(1)	Time	440 μ s	0.39 dB
2R	(1)	Time	5.53 ms	-39.33 dBm
2 Δ	(1)	Time	120 μ s	0.02 dB

DH 3**(CH Low)**

* Agilent 15:30:57 Aug 15, 2005

T

 Δ Mkr2 150 μ s
-0.35 dB

Ref -4 dBm

#Atten 0 dB

#Peak

Log

10

dB/

Offst

6

dB

LgAv

W1 S2

Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (1001 pts)

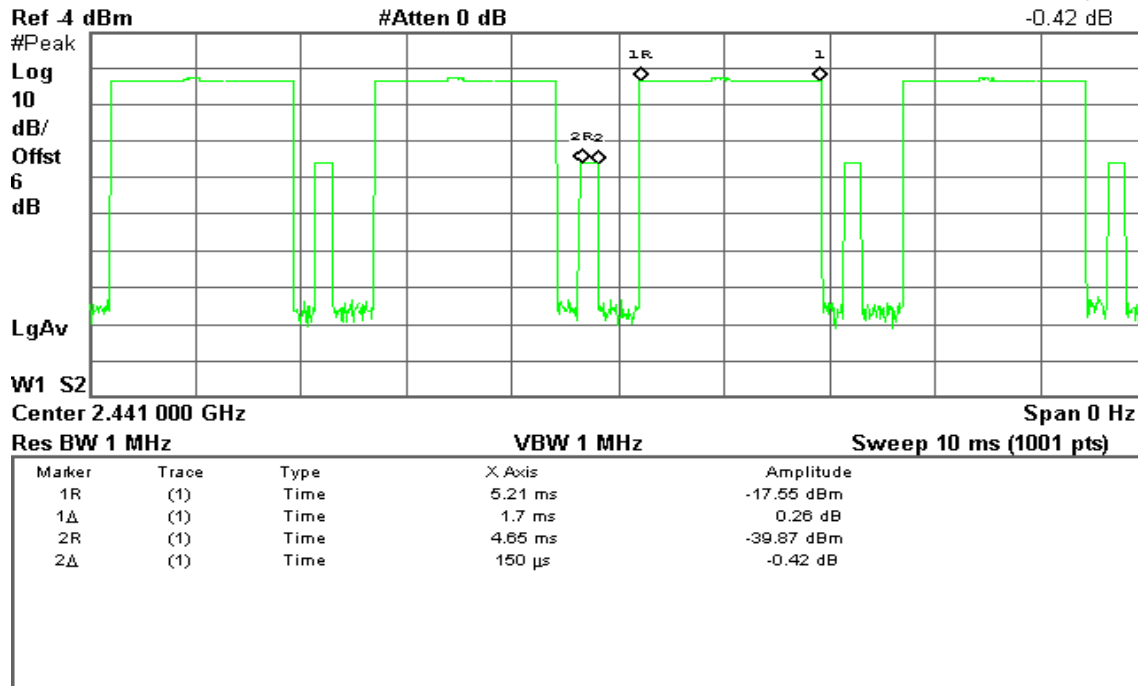
Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	6.07 ms	-17.49 dBm
1 Δ	(1)	Time	1.69 ms	0.28 dB
2R	(1)	Time	5.5 ms	-39.55 dBm
2 Δ	(1)	Time	150 μ s	-0.35 dB



(CH Mid)

* Agilent 15:27:47 Aug 15, 2005

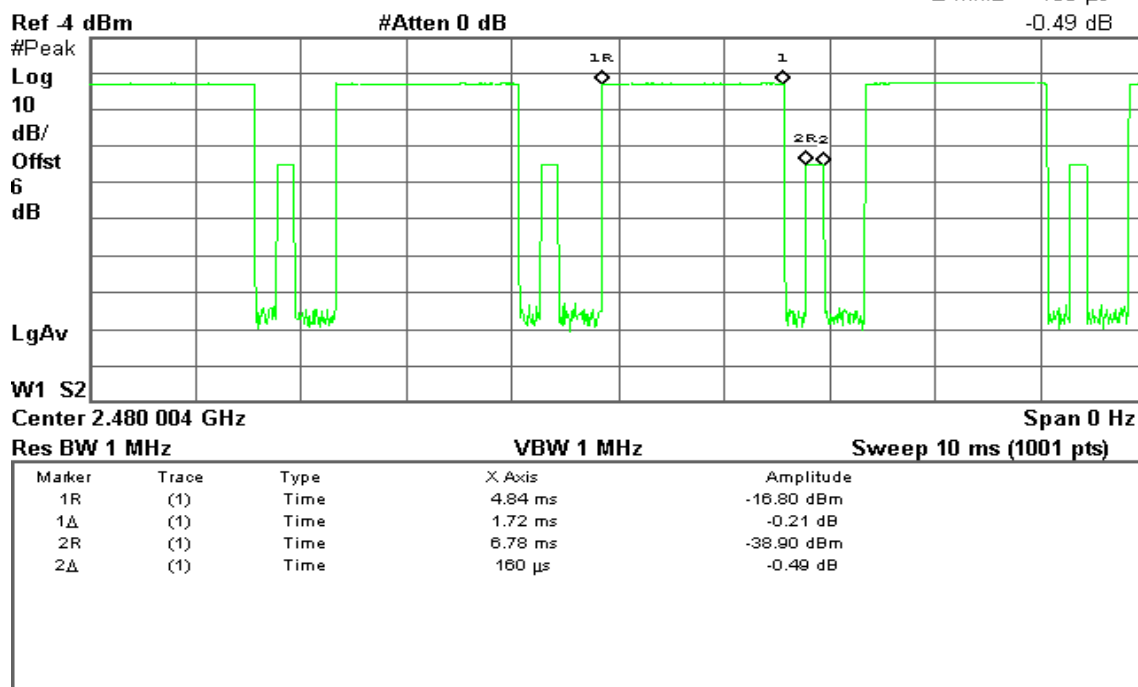
T

 Δ Mkr2 150 μ s
-0.42 dB

(CH High)

* Agilent 15:24:11 Aug 15, 2005

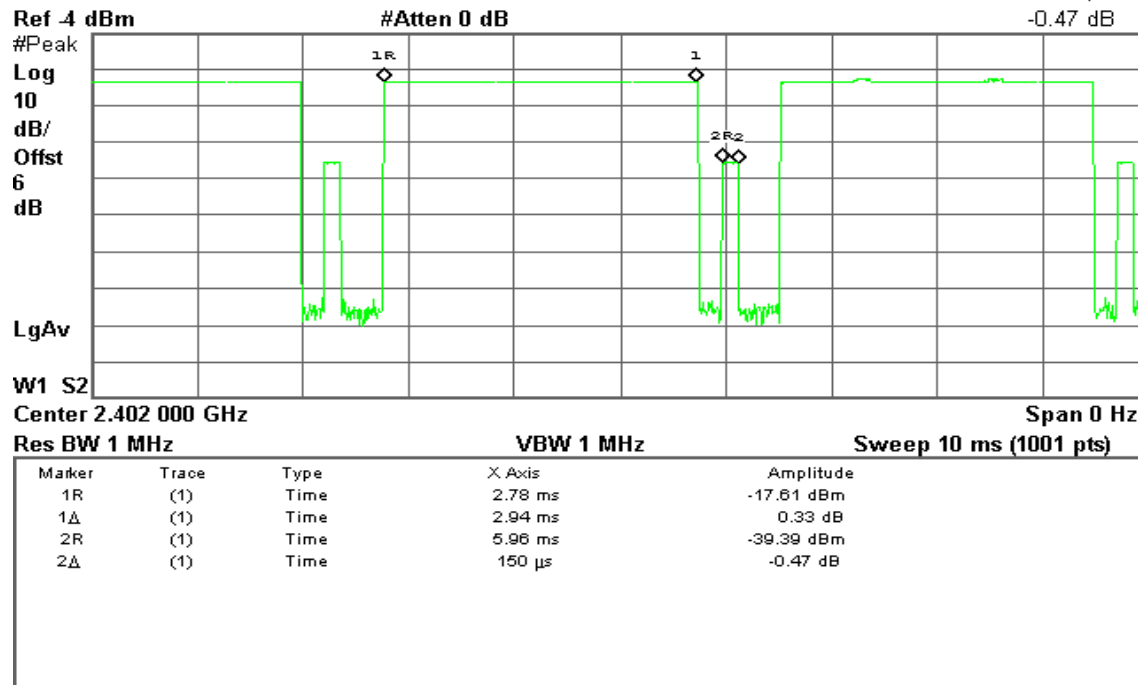
T

 Δ Mkr2 160 μ s
-0.49 dB

**DH 5****(CH Low)**

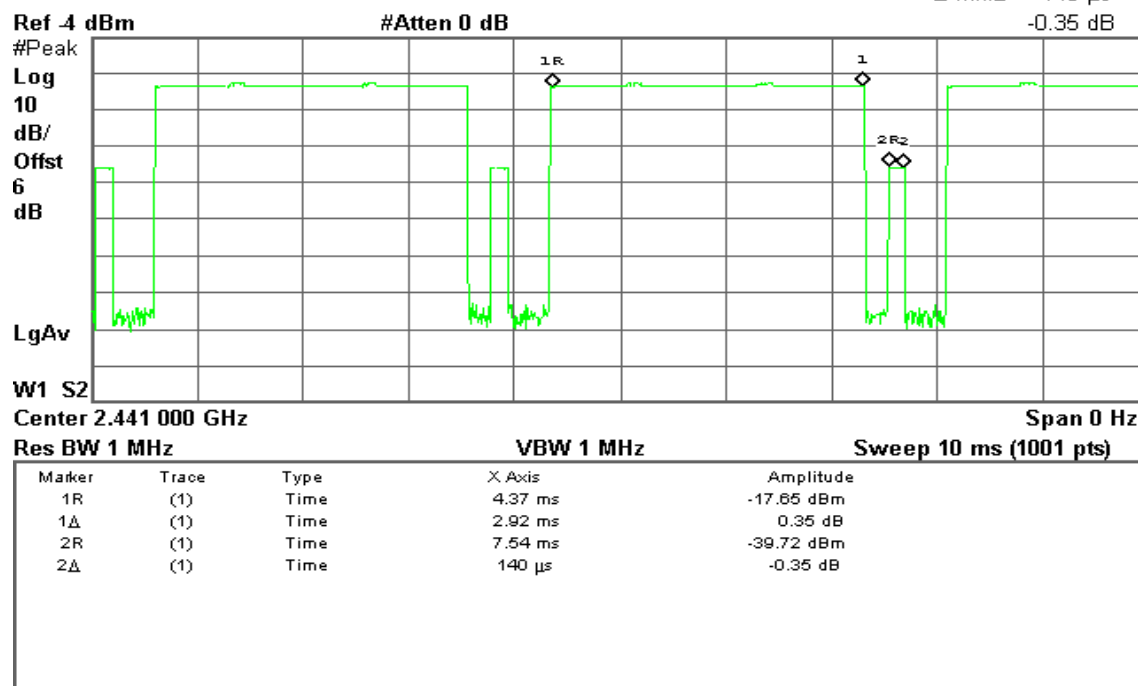
* Agilent 15:32:19 Aug 15, 2005

T

 Δ Mkr2 150 μ s
-0.47 dB**(CH Mid)**

* Agilent 15:26:40 Aug 15, 2005

T

 Δ Mkr2 140 μ s
-0.35 dB



(CH High)

* Agilent 15:25:14 Aug 15, 2005

T

 Δ Mkr2 160 μ s
-0.50 dB

Ref -4 dBm

#Atten 0 dB

#Peak

Log

10

dB/

Offst

6

dB

LgAv

W1 S2

Center 2.480 004 GHz

Span 0 Hz

Res BW 1 MHz

VBW 1 MHz

Sweep 10 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.53 ms	-16.73 dBm
1 Δ	(1)	Time	2.96 ms	0.00 dB
2R	(1)	Time	6.72 ms	-38.91 dBm
2 Δ	(1)	Time	160 μ s	-0.50 dB



7.7 RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.247(i), 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 § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	BLUETOOTH USB DONGLE
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☒ Others: 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	3.20 dBm (2.09mW)
Antenna gain (Max)	0.5 dBi (Numeric gain: 1.12)
Evaluation applied	☐ MPE Evaluation ☐ SAR Evaluation ☒ N/A
Remark: 1. The maximum output power is <u>3.20dBm (2.09mW) at 2402MHz (with 1.12 numeric antenna gain.)</u> 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 maximum power density is $1.0 mW/cm^2$ even if the calculation indicates that the power density would be larger.	

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.



7.8 SPURIOUS EMISSIONS

7.8.1 Conducted Measurement

LIMIT

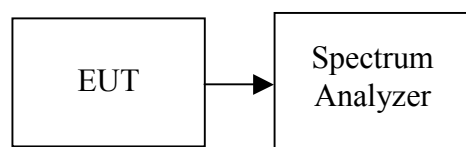
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 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 100 kHz.

Measurements are made over the 30MHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels.

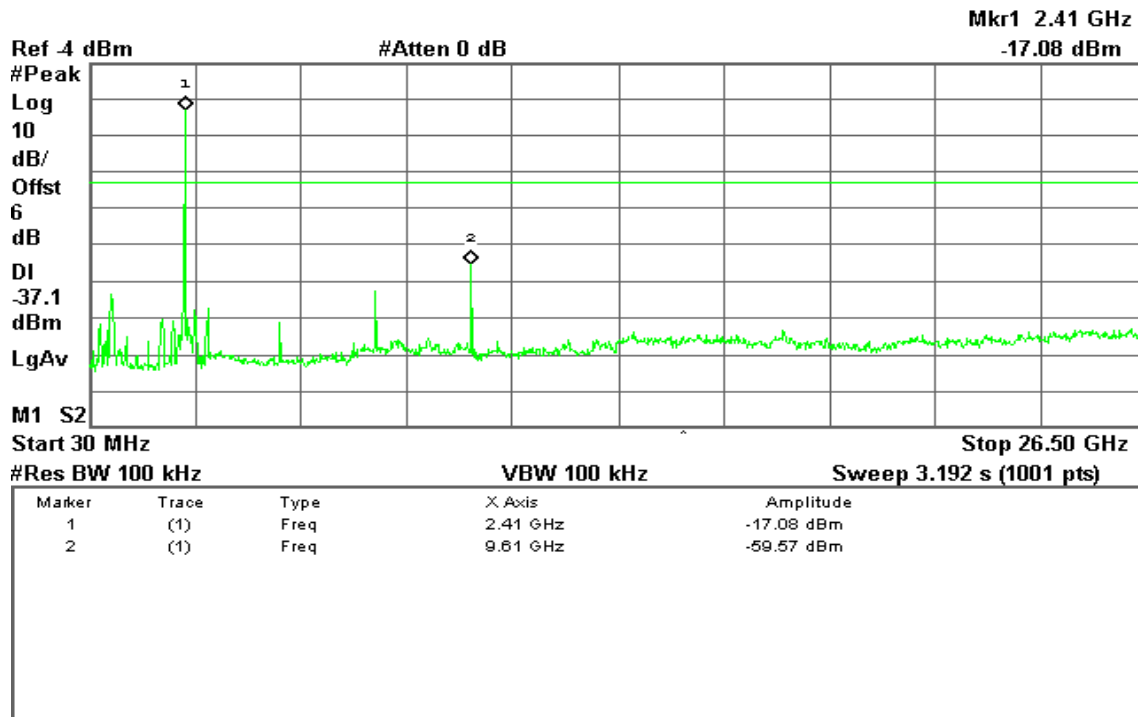
TEST RESULTS

No non-compliance noted

**Test Plot****CH Low****30MHz ~26.5GHz**

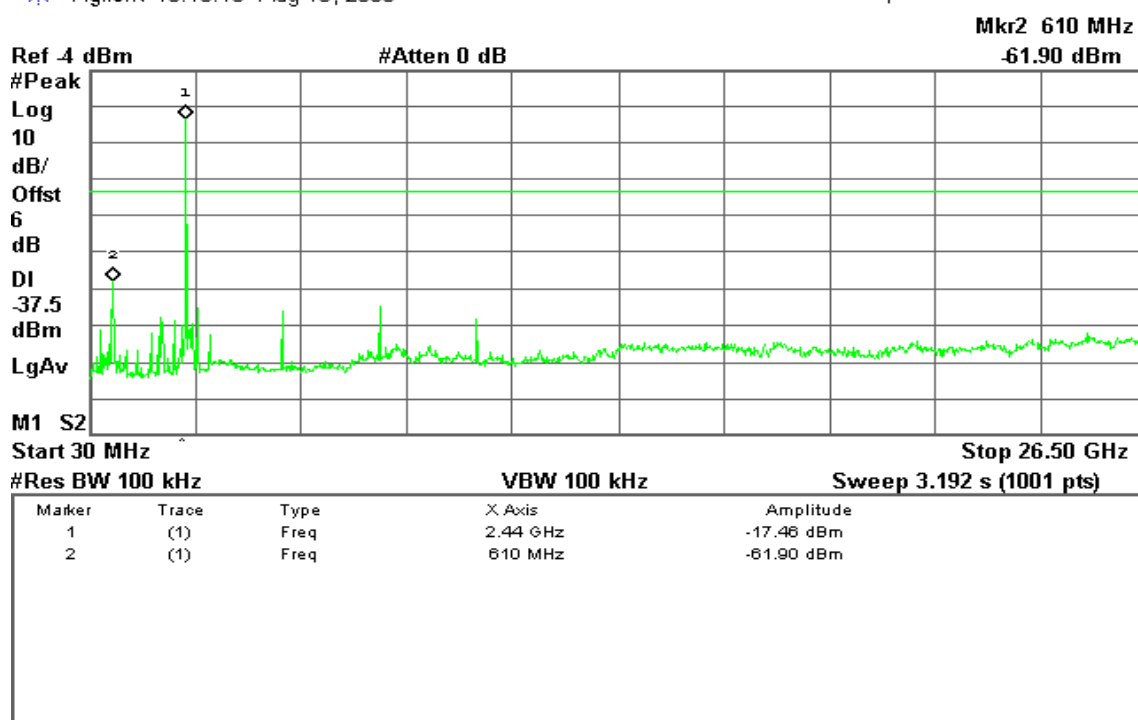
* Agilent 15:11:45 Aug 15, 2005

T

**CH Mid****30MHz ~ 26.5GHz**

* Agilent 15:10:13 Aug 15, 2005

T



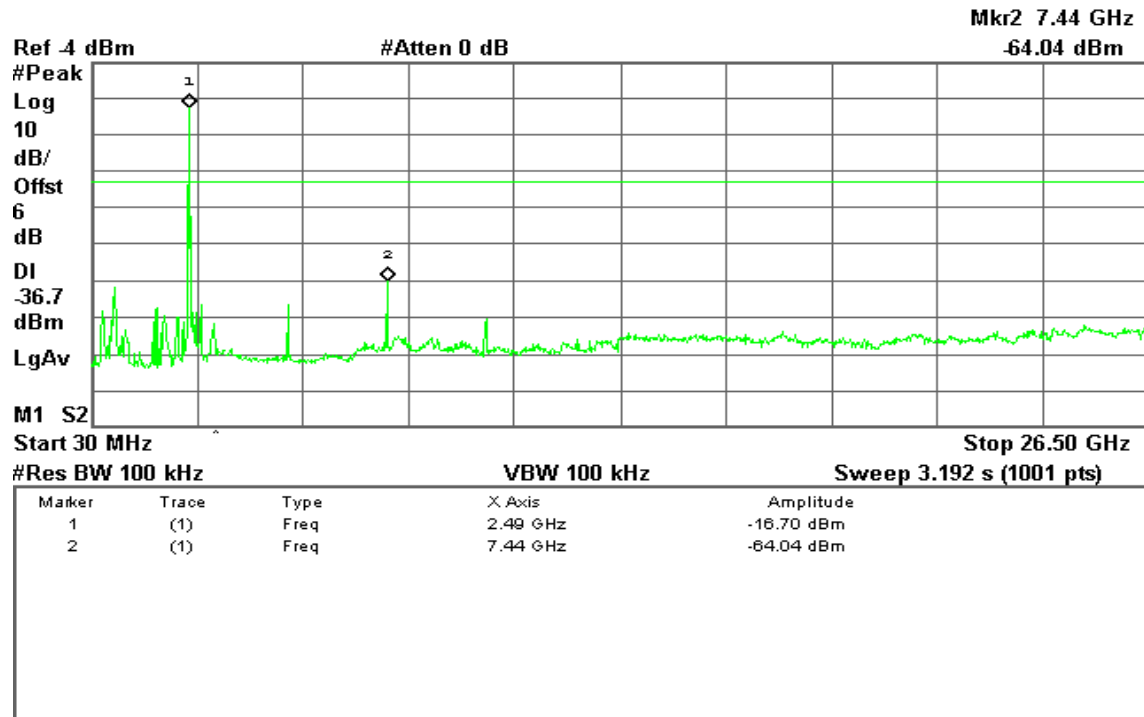


CH High

30MHz ~ 26.5GHz

Agilent 15:09:20 Aug 15, 2005

T





7.8.2 Radiated Emissions

LIMIT

1. According to §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 ($\mu\text{V/m}$)	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 emission table above, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

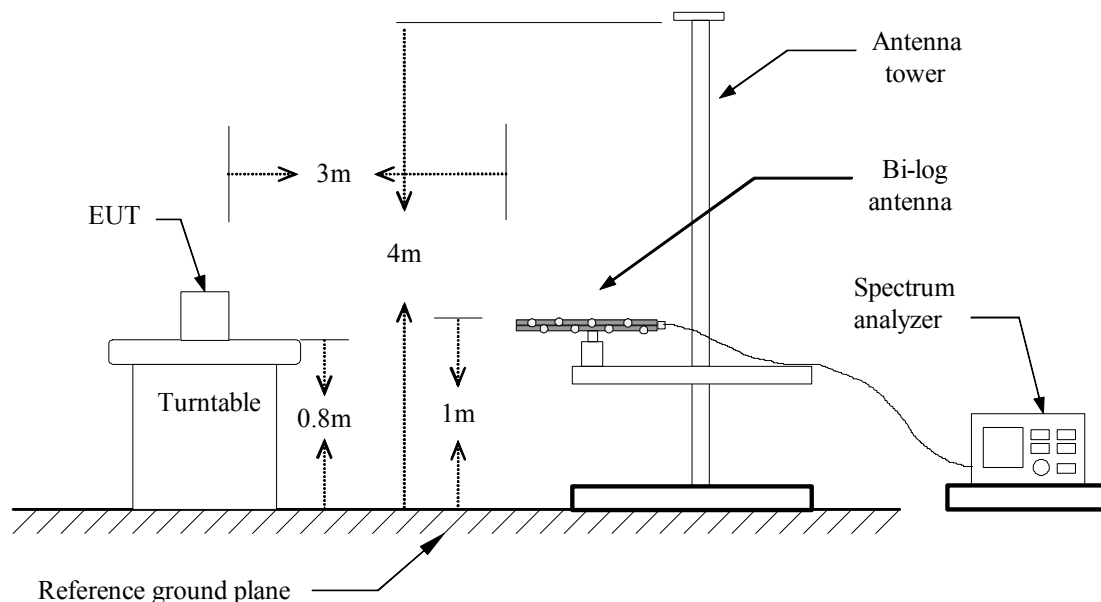
MEASUREMENT EQUIPMENT USED

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	07/05/2006
Horn Antenna	EMCO	3115	00022250	04/18/2006
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

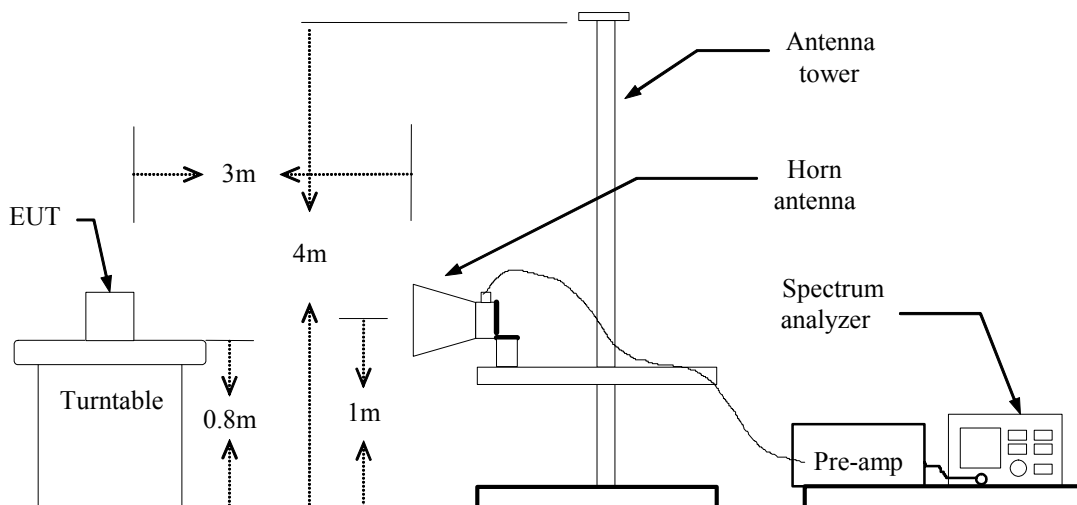
Remark: Each piece of equipment is scheduled for calibration once a year.

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:

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

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

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



TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link**Test Date:** August 04, 2005**Temperature:** 26°C**Tested by:** Rex Lai**Humidity:** 52 % 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)
122.25	V	Peak	23.80	10.10	33.90	43.50	-9.60
199.20	V	Peak	21.90	11.70	33.60	43.50	-9.90
232.95	V	Peak	18.20	14.20	32.40	46.00	-13.60
288.30	V	Peak	16.50	15.30	31.80	46.00	-14.20
564.83	V	Peak	13.20	22.30	35.50	46.00	-10.50
863.50	V	Peak	10.20	24.00	34.20	46.00	-11.80
183.90	H	Peak	19.20	11.10	30.30	43.50	-13.20
247.35	H	Peak	16.70	14.80	31.50	46.00	-14.50
288.30	H	Peak	18.50	15.30	33.80	46.00	-12.20
399.17	H	Peak	15.90	16.90	32.80	46.00	-13.20
632.50	H	Peak	12.60	24.10	36.70	46.00	-9.30
798.17	H	Peak	11.50	24.60	36.10	46.00	-9.90

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/Quasi-peak detector mode.*
- 3. Measurements above show only up to 6 maximum emissions noted, or would be lesser; with " N/A " remark, 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.*
- 4. The IF bandwidth of SPA between 30MHz and 1GHz was 100kHz.*

**Above 1 GHz****Operation Mode:** TX / CH Low**Test Date:** August 04, 2005**Temperature:** 26°C**Tested by:** Rex Lai**Humidity:** 52 % 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	55.10	42.34	0.33	55.43	42.67	74.00	54.00	-11.33	AVG
7204.00	V	56.39	37.39	3.27	59.66	40.66	74.00	54.00	-13.34	AVG
N/A										
4804.00	H	51.56	---	0.33	51.89	---	74.00	54.00	-2.11	Peak
7204.00	H	63.27	39.64	3.27	66.54	42.91	74.00	54.00	-11.09	AVG
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, with " N/A " remark, 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. 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. 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.
5. 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:** August 04, 2005**Temperature:** 26°C**Tested by:** Rex Lai**Humidity:** 52 % 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)				
4876.00	V	52.06	36.22	0.39	52.45	36.61	74.00	54.00	-17.39	AVG
7324.00	V	59.37	38.13	3.49	62.86	41.62	74.00	54.00	-12.38	AVG
N/A										
4876.00	H	52.10	35.17	0.39	52.49	35.56	74.00	54.00	-18.44	AVG
7322.00	H	58.56	37.84	3.49	62.05	41.33	74.00	54.00	-12.67	AVG
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, with " N/A " remark, 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. 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. 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.
5. 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:** August 04, 2005**Temperature:** 26°C**Tested by:** Rex Lai**Humidity:** 52 % 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	51.11	---	0.48	51.59	---	74.00	54.00	-2.41	Peak
N/A										
7438.00	H	62.11	38.75	3.68	65.79	42.43	74.00	54.00	-11.57	AVG
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, with " N/A " remark, 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. 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. 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.
5. 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.



7.9 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §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 μ H/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 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

* Decreases with the logarithm of the frequency.

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	06/11/2006
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2006

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.

Test Data

Operation Mode: Normal Link **Test Date:** August 02, 2005
Temperature: 25°C **Tested by:** Steven Young
Humidity: 55% RH

Freq. (MHz)	QP Reading	AV Reading	Corr. factor	QP Result	AV Result	QP Limit	AV Limit	QP Margin	AV Margin	Note
0.469	35.330	34.090	0.100	35.430	34.190	56.532	46.532	-21.102	-12.342	L1
1.802	33.510	33.250	0.100	33.610	33.350	56.000	46.000	-22.390	-12.650	L1
2.771	34.510	33.870	0.100	34.610	33.970	56.000	46.000	-21.390	-12.030	L1
4.160	27.710	26.500	0.116	27.826	26.616	56.000	46.000	-28.174	-19.384	L1
9.529	27.910	26.380	0.653	28.563	27.033	60.000	50.000	-31.437	-22.967	L1
21.308	25.090	22.710	1.200	26.290	23.910	60.000	50.000	-33.710	-26.090	L1
0.378	25.970	23.370	0.100	26.070	23.470	58.323	48.323	-32.253	-24.853	L2
0.624	33.470	33.060	0.100	33.570	33.160	56.000	46.000	-22.430	-12.840	L2
2.771	32.490	30.200	0.100	32.590	30.300	56.000	46.000	-23.410	-15.700	L2
6.818	26.260	24.180	0.382	26.642	24.562	60.000	50.000	-33.358	-25.438	L2
15.492	27.970	25.530	0.839	28.809	26.369	60.000	50.000	-31.191	-23.631	L2
21.308	28.000	25.980	1.200	29.200	27.180	60.000	50.000	-30.800	-22.820	L2

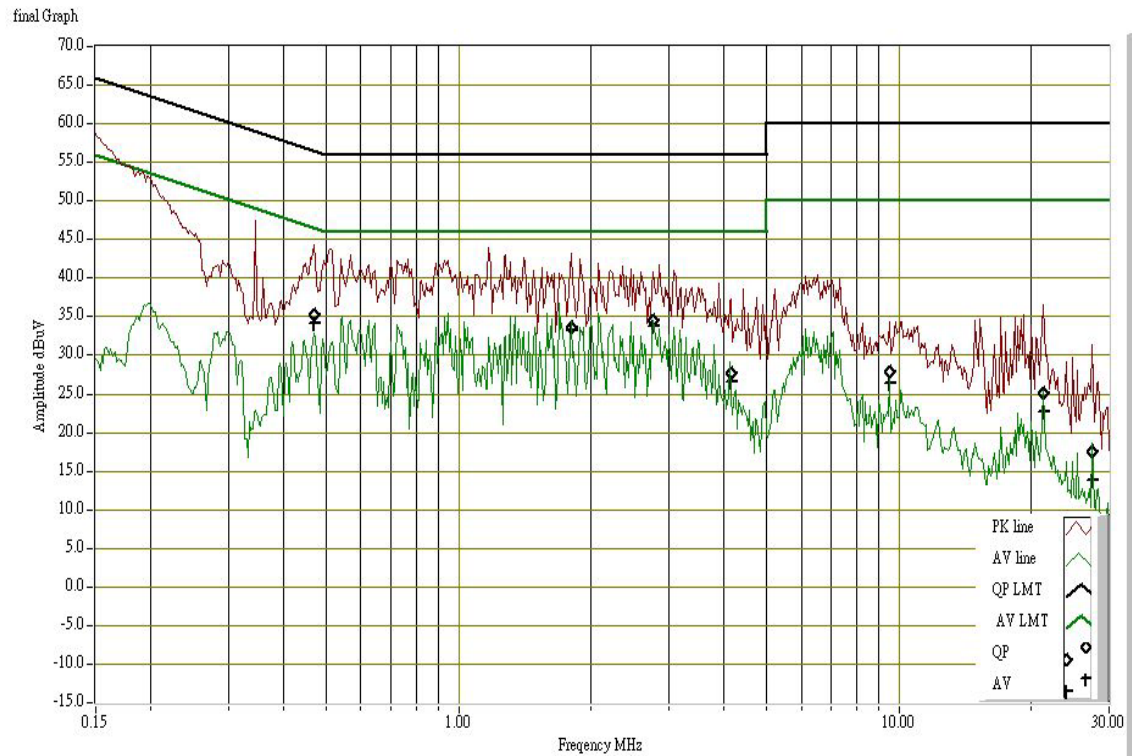
Remark:

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. 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;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

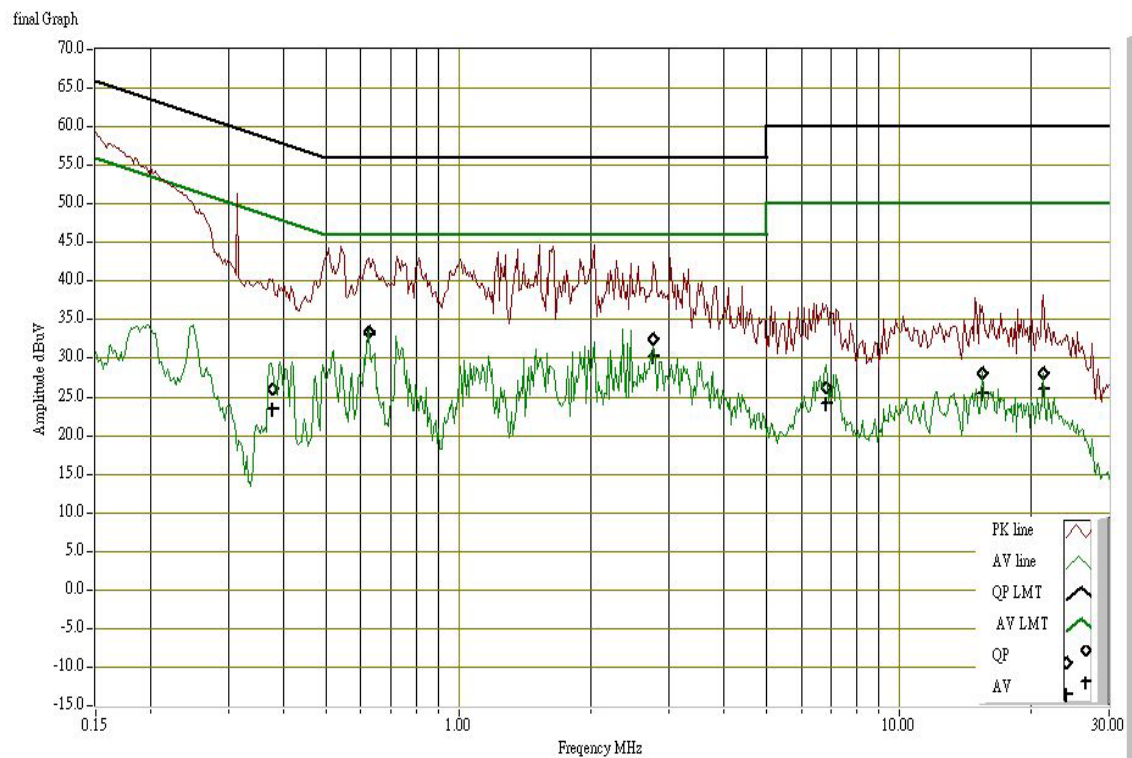


Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)



APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Conducted Emission Set Up Photo

