



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

NOTEBOOK PC

Model: X51IAx (x=0~9 or a~z or blank)

Trade Name: UNIWILL

Issued to

UNIWILL COMPUTER CORP.
5F, No. 9, Wu Chiuan Rd., Wu Cu Ind. Park,
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.
<http://www.ccsemc.com.tw>
service@tw.ccsemc.com



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
4.1 MEASURING INSTRUMENT CALIBRATION.....	7
4.2 MEASUREMENT EQUIPMENT USED.....	7
5. FACILITIES AND ACCREDITATIONS.....	8
5.1 FACILITIES	8
5.2 EQUIPMENT.....	8
5.3 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 SPURIOUS EMISSIONS	31
7.8 POWERLINE CONDUCTED EMISSIONS.....	41
APPENDIX I RADIO FREQUENCY EXPOSURE	44
APPENDIX II PHOTOGRAPHS OF TEST SETUP	45



1. TEST RESULT CERTIFICATION

Applicant: UNIWILL COMPUTER CORP.
5F, No. 9, Wu Chiuan Rd., Wu Cu Ind. Park,
Taipei, Taiwan, R.O.C.

Equipment Under Test: NOTEBOOK PC

Trade Name: UNIWILL

Model: X51IAx (x=0~9 or a~z or blank)

Date of Test: March 14 ~ 31, 2006

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	NOTEBOOK PC
Trade Name	UNIWILL
Model Number	X51IAx (x=0~9 or a~z or blank)
Model Discrepancy	The suffix of “x” (x= 0~9 or blank) on model number is just for marketing purpose only.
Power Supply	Power Adapter: LI SHIN INTERNATIONAL ENTERPRISE CORP. Model: 0227A20120 I/P: AC 100-240V, 50-60Hz, 2.0A O/P: DC 20V, 6.0A Battery: Sony / X51-4S4800-G1S3 14.8Vdc, 4800mAh
Frequency Range	2402 ~ 2480 MHz
Transmit Power	4.21 dBm (0.00264W)
Modulation Technique	FHSS (GFSK)
Transmit Data Rate	1Mbps
Number of Channels	79 Channels
Antenna Specification	PIFA antenna / Gain: 2.42 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: **SAZ-GUBTCRQ2426** 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: X51IAx (x=0~9 or a~z or blank)) 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

4.1 MEASURING 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.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/10/2007
Power Meter	Agilent	E4416A	GB41291611	06/02/2006
Power Sensor	Agilent	E9327A	US40441097	06/02/2006

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	07/25/2006
Test Receiver	Rohde&Schwarz	ESCI	100064	06/28/2006
Switch Controller	TRC	Switch Controller	SC94050010	05/05/2006
4 Port Switch	TRC	4 Port Switch	SC94050020	05/05/2006
Horn-Antenna	TRC	HA-0502	06	06/02/2006
Horn-Antenna	TRC	HA-0801	04	05/05/2006
Horn-Antenna	TRC	HA-1201A	01	07/04/2006
Horn-Antenna	TRC	HA-1301A	01	07/04/2006
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/09/2007
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC: 965860 IC: IC 6106	09/26/2008
Test S/W	LABVIEW (V 6.1)			

Remark: The measurement uncertainty is less than $\pm 2.0065\text{dB}$ (30MHz ~ 1GHz), $\pm 3.0958\text{dB}$ (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI TEST RECEIVER 9kHz-30MHz	ROHDE & SCHWARZ	ESHS30	828144/003	09/24/2006
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/11/2006
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	02/17/2007
Test S/W	LABVIEW (V 6.1)			

Remark: The measurement uncertainty is less than $\pm 2.81\text{dB}$, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

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

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan

Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan

Tel: 886-3-324-0332 / Fax: 886-3-324-5235

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 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2, EN 55022, EN 55015, CISPR 22, CISPR 15, AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18, CNS 13783-1, CNS 13439, CNS 13438, CNS 13803, CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4, IEC/EN 61000-3-2, EIC/EN 61000-3-3, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/ EN 61000-6-3, EN 50081-2/EN 61000-6-4, EN 50081-2/EN 61000-6-1: 2001	 0824-01
USA	FCC	3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements	 93105, 90471 965860
Japan	VCCI	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, 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	TAF	EN 300 328, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3	 Testing Laboratory 0363
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	3/10 meter Open Area Test Sites (IC 3991-3, IC 3991-4) / 3M Semi Anechoic Chamber (IC 6106) to perform RSS 212 Issue 1	 IC 3991-3 IC 3991-4 IC 6106

* No part of this report may be used to claim or imply product endorsement by A2LA 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
1.	Universal Radio Communication Tester	R&S	CMU200	1100.000.8.02	N/A	N/A	Unshielded, 1.8m

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

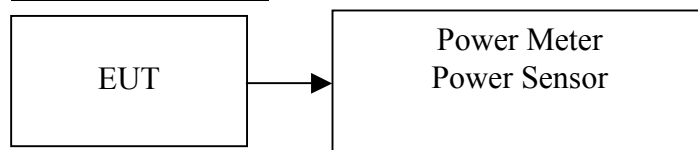
7.1 PEAK POWER

LIMIT

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

1. According to §15.247(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.
2. 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.
3. 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.

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

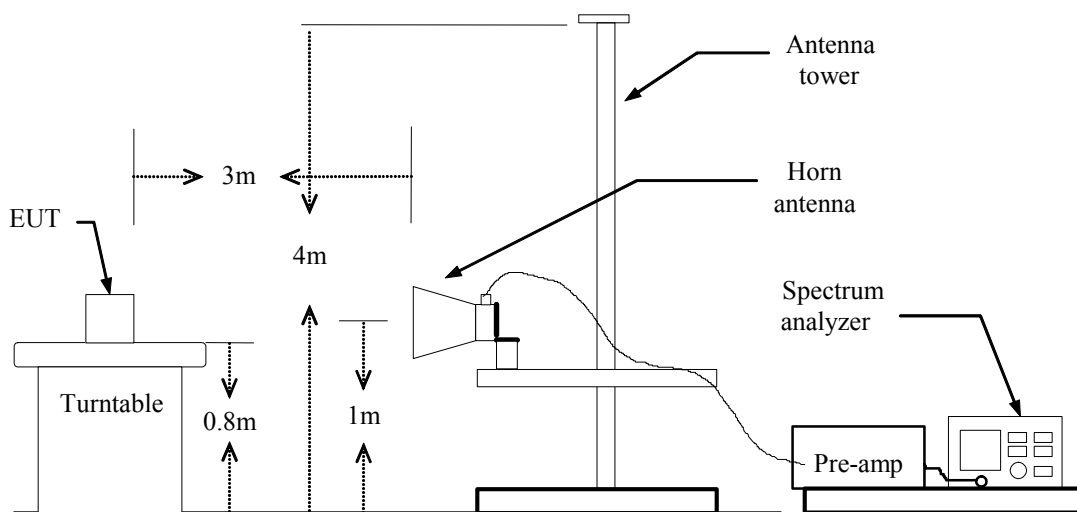
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	0.85	0.00122	1	PASS
Mid	2441	3.15	0.00207		PASS
High	2480	4.21	0.00264		PASS

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)).

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.



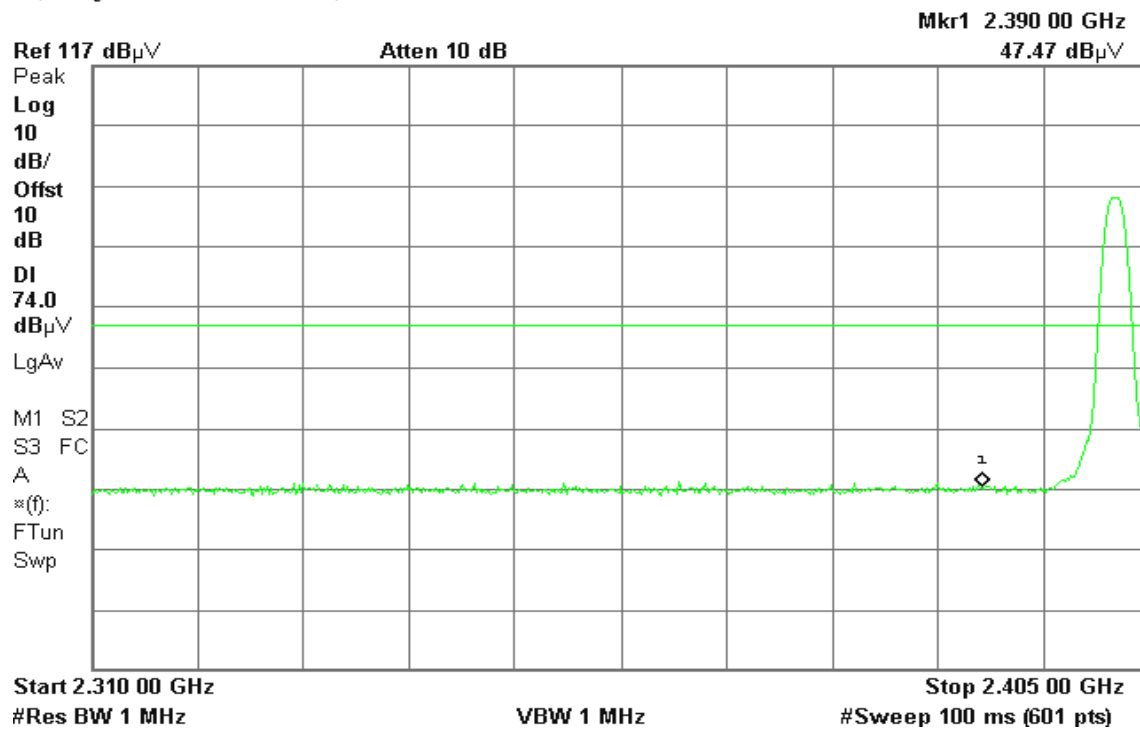
Band Edges (CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent 14:28:11 Mar 28, 2006

T

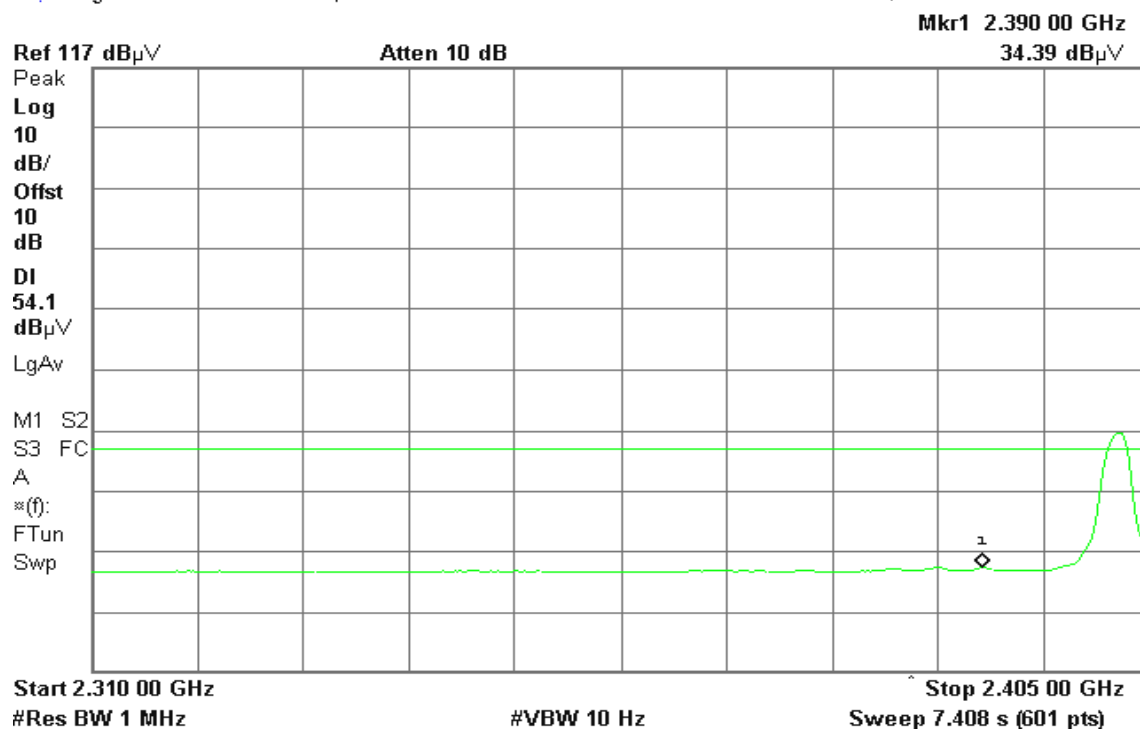


Detector mode: Average

Polarity: Vertical

Agilent 14:28:38 Mar 28, 2006

T



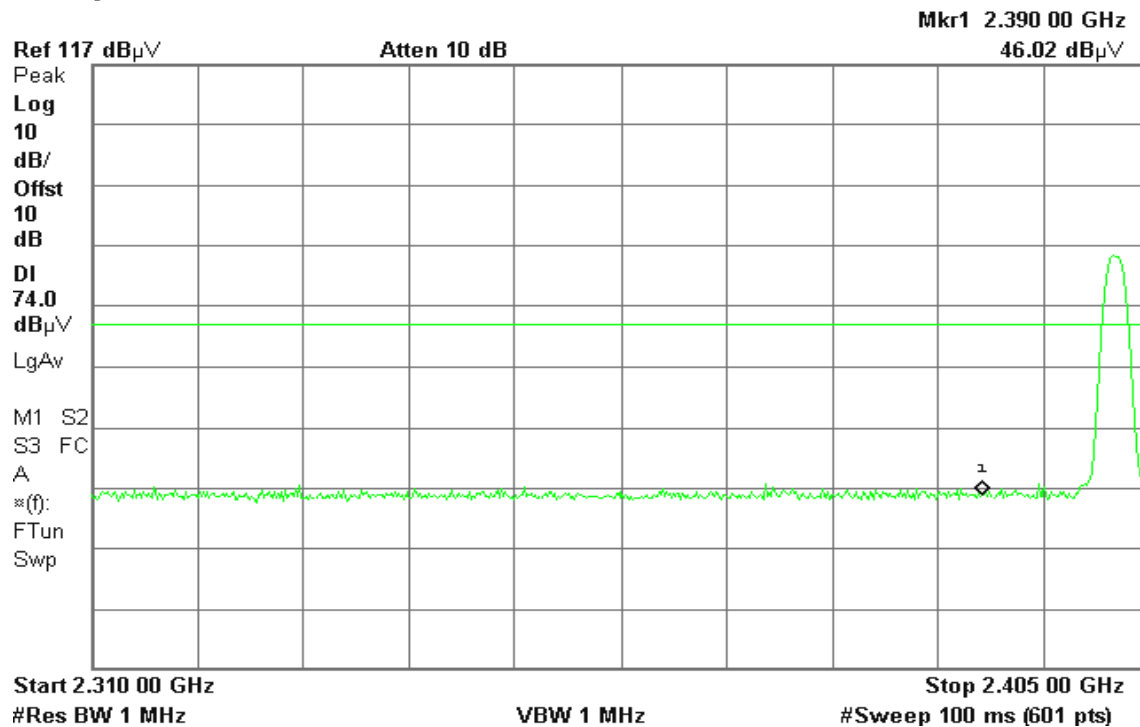


Detector mode: Peak

Polarity: Horizontal

Agilent 14:20:06 Mar 28, 2006

T

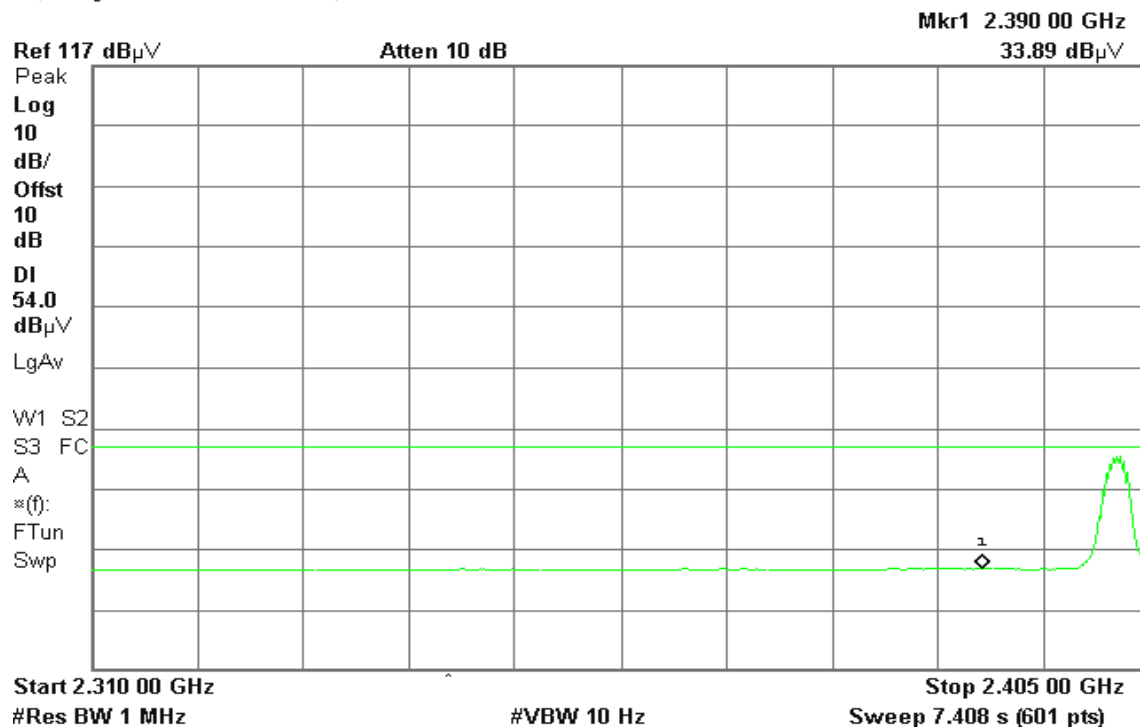


Detector mode: Average

Polarity: Horizontal

Agilent 14:19:29 Mar 28, 2006

R T





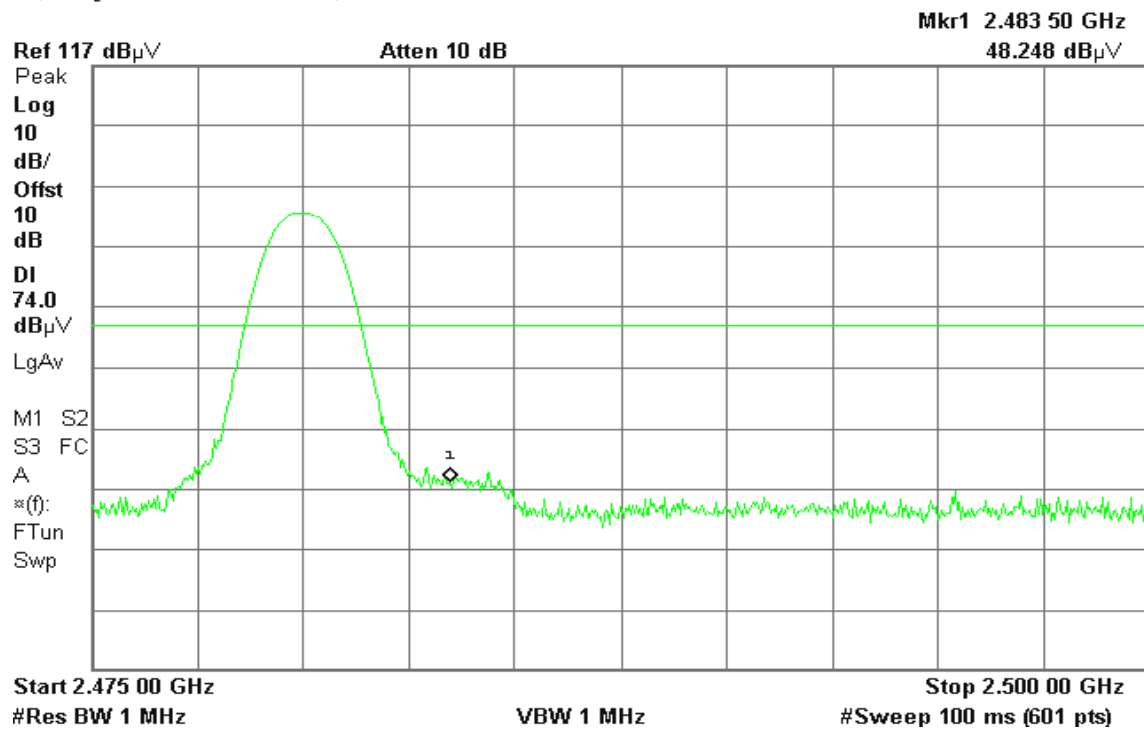
Band Edges (CH High)

Detector mode: Peak

Polarity: Vertical

Agilent 14:35:03 Mar 28, 2006

T

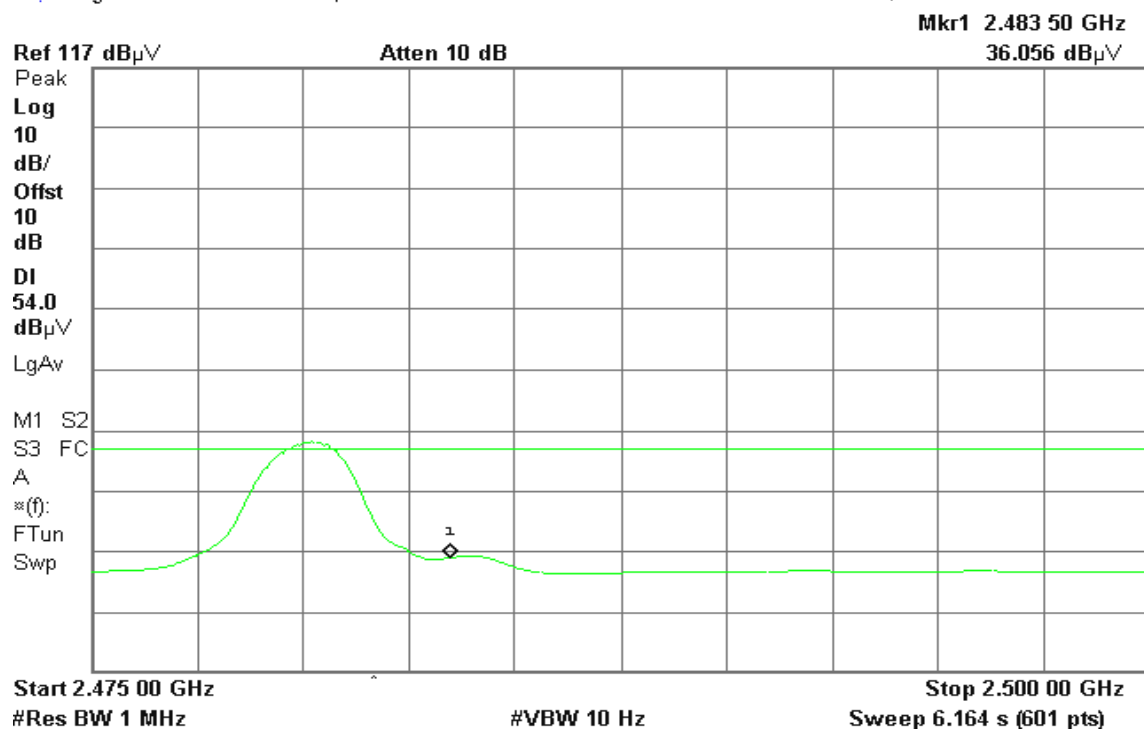


Detector mode: Average

Polarity: Vertical

Agilent 14:34:40 Mar 28, 2006

T



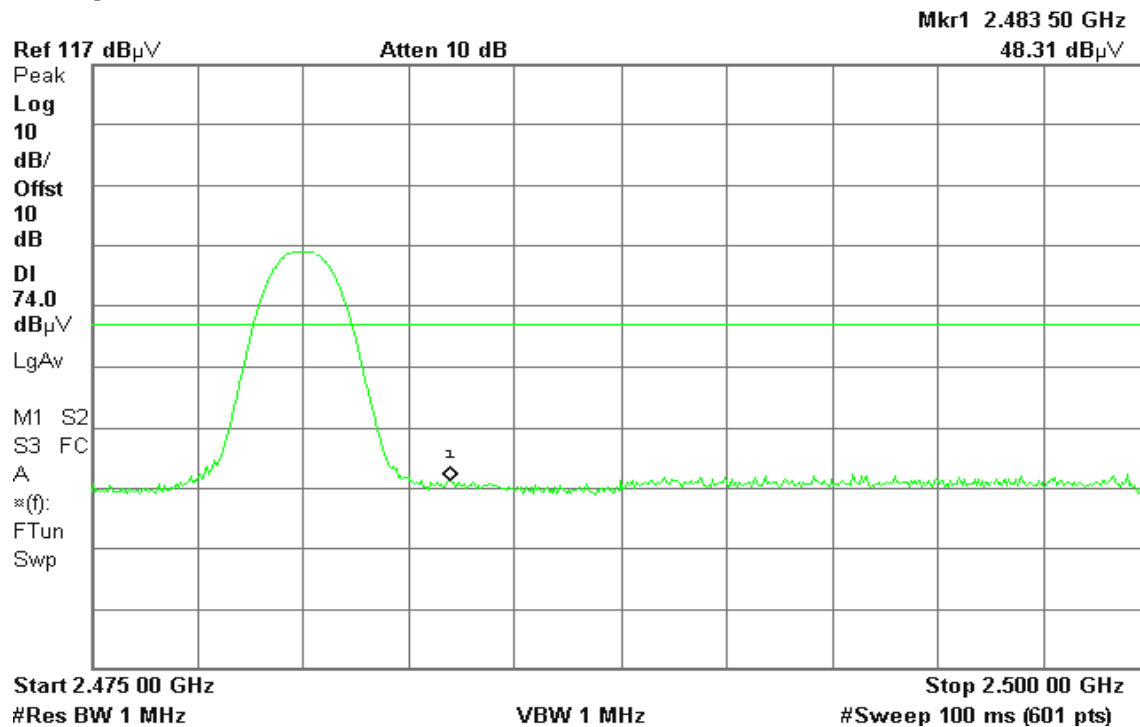


Detector mode: Peak

Polarity: Horizontal

Agilent 14:37:57 Mar 28, 2006

T

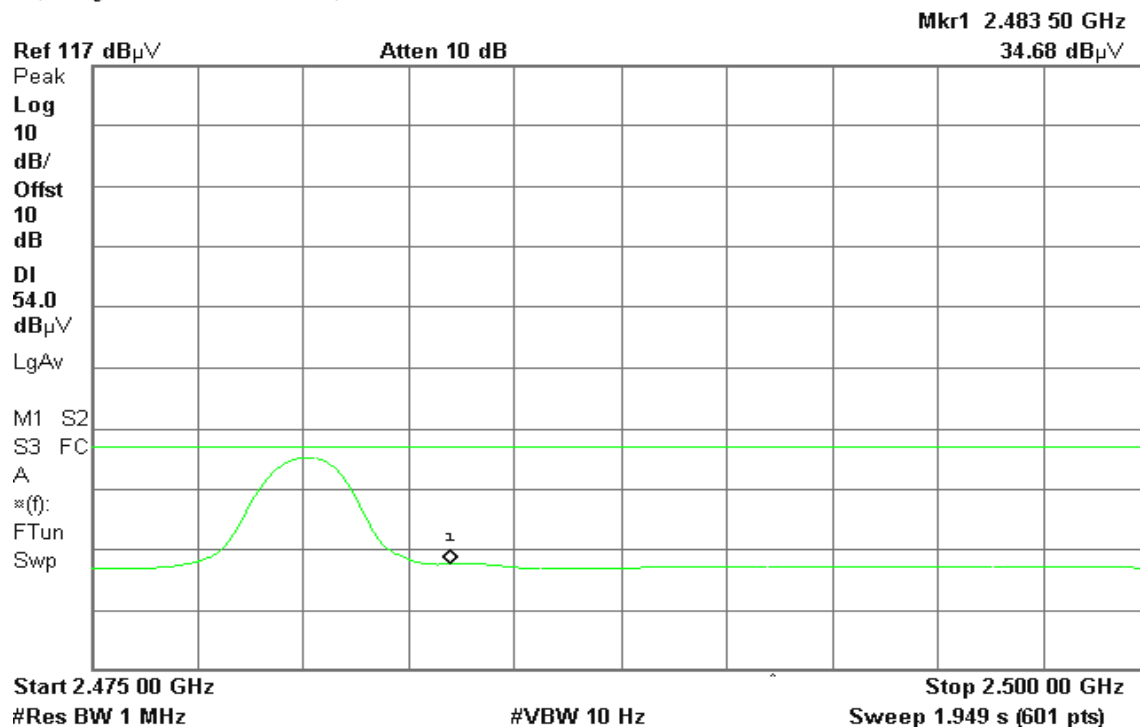


Detector mode: Average

Polarity: Horizontal

Agilent 14:38:29 Mar 28, 2006

T



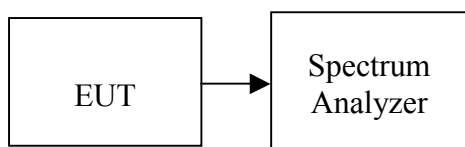


7.3 PEAK POWER SPECTRAL DENSITY

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.

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)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-10.61	8.00	PASS
Mid	2441	-8.26		PASS
High	2480	-7.23		PASS

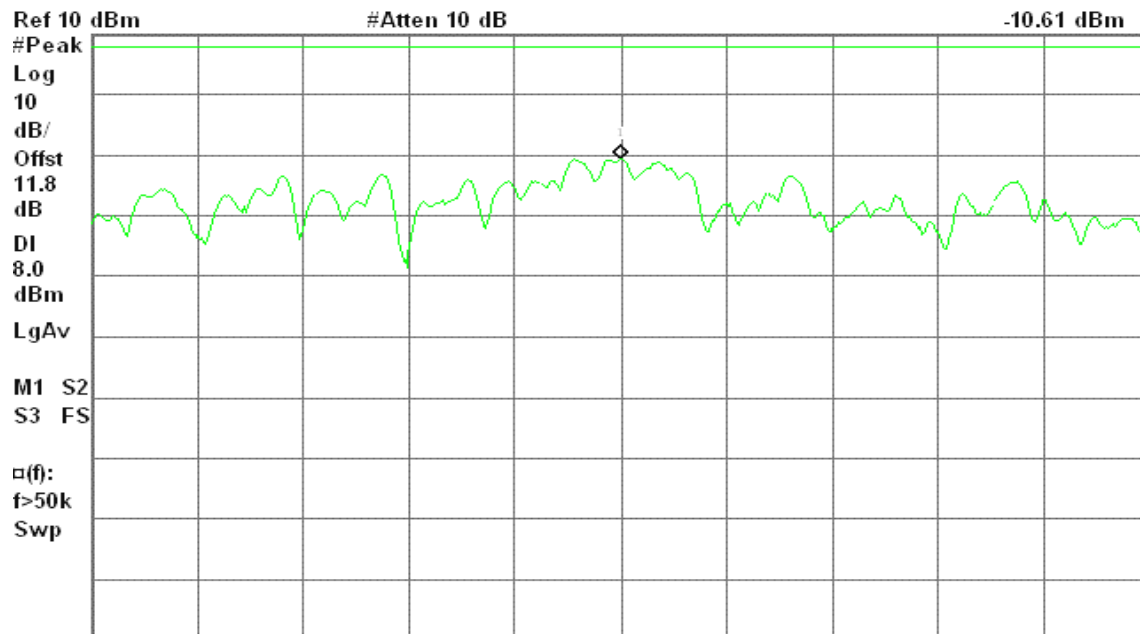


Test Plot

PPSD (CH Low)

Agilent 20:46:23 Mar 14, 2006

T
Mkr1 2.402 025 0 GHz
-10.61 dBm



Center 2.402 025 0 GHz

#Res BW 3 kHz

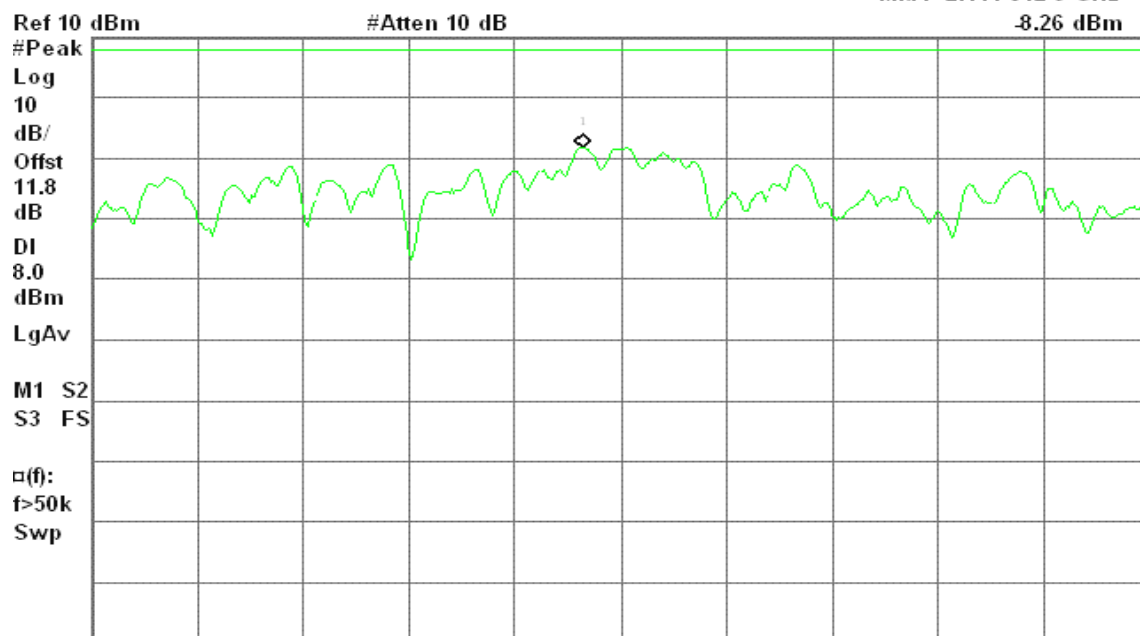
#VBW 10 kHz

Span 300 kHz
#Sweep 100 s (601 pts)

PPSD (CH Mid)

Agilent 20:43:49 Mar 14, 2006

T
Mkr1 2.441 012 3 GHz
-8.26 dBm



Center 2.441 023 3 GHz

#Res BW 3 kHz

#VBW 10 kHz

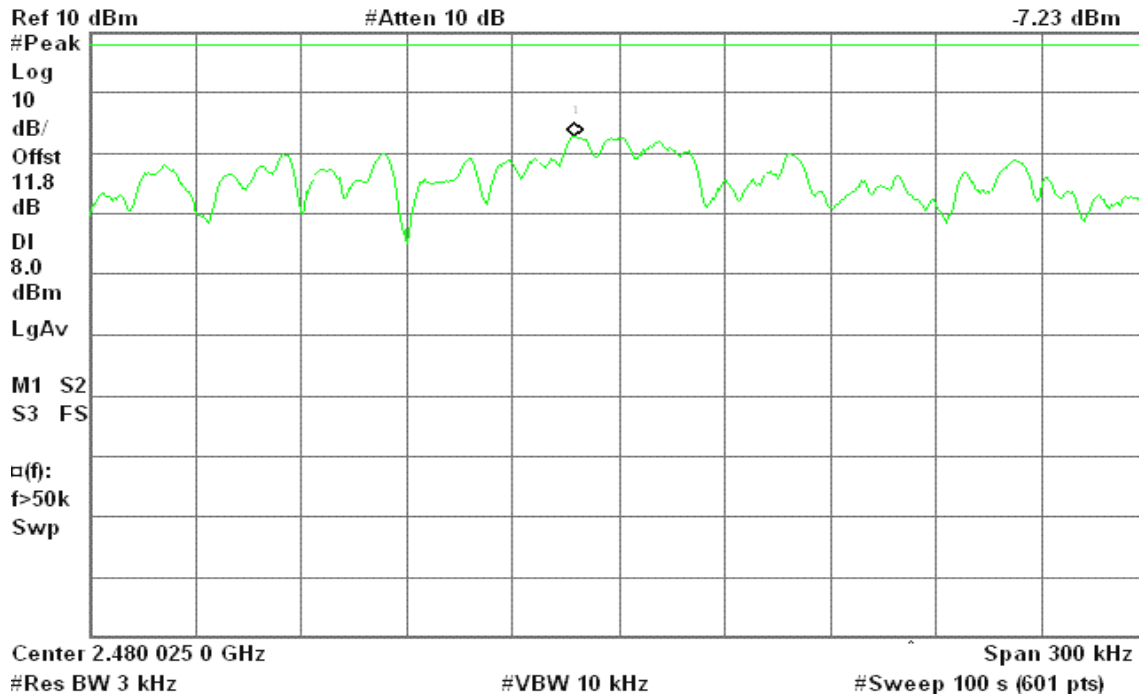
Span 300 kHz
#Sweep 100 s (601 pts)



PPSD (CH High)

* Agilent 20:41:13 Mar 14, 2006

T
Mkr1 2.480 012 4 GHz



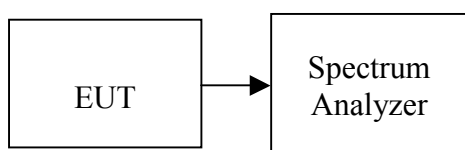


7.4 FREQUENCY SEPARATION

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.

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	815	>25	Pass

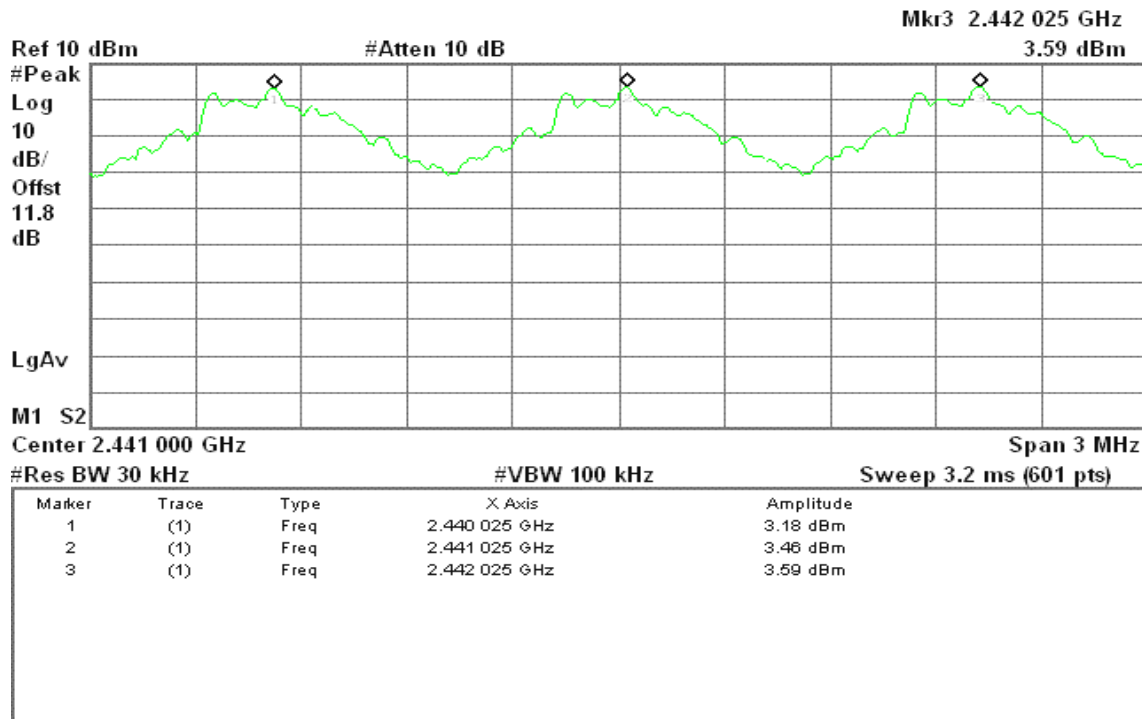


Test Plot

Measurement of Channel Separation

* Agilent 21:09:35 Mar 14, 2006

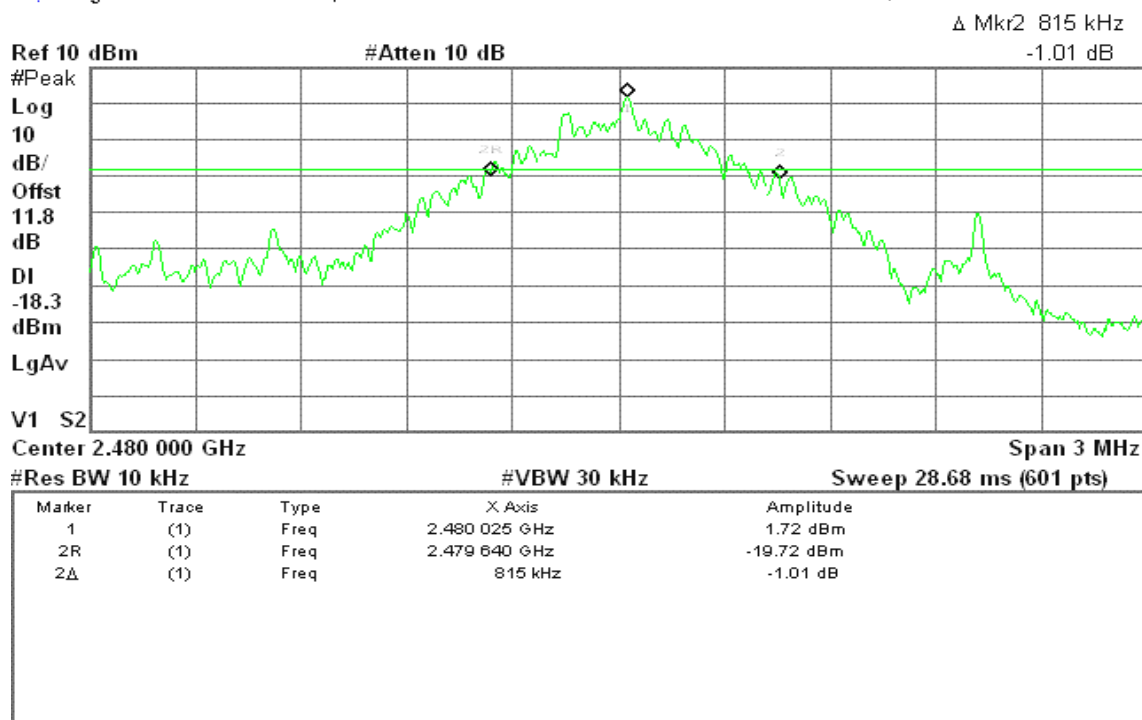
T



Measurement of 20dB Bandwidth

* Agilent 20:32:22 Mar 14, 2006

T



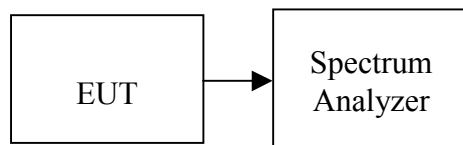


7.5 NUMBER OF HOPPING FREQUENCY

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.

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



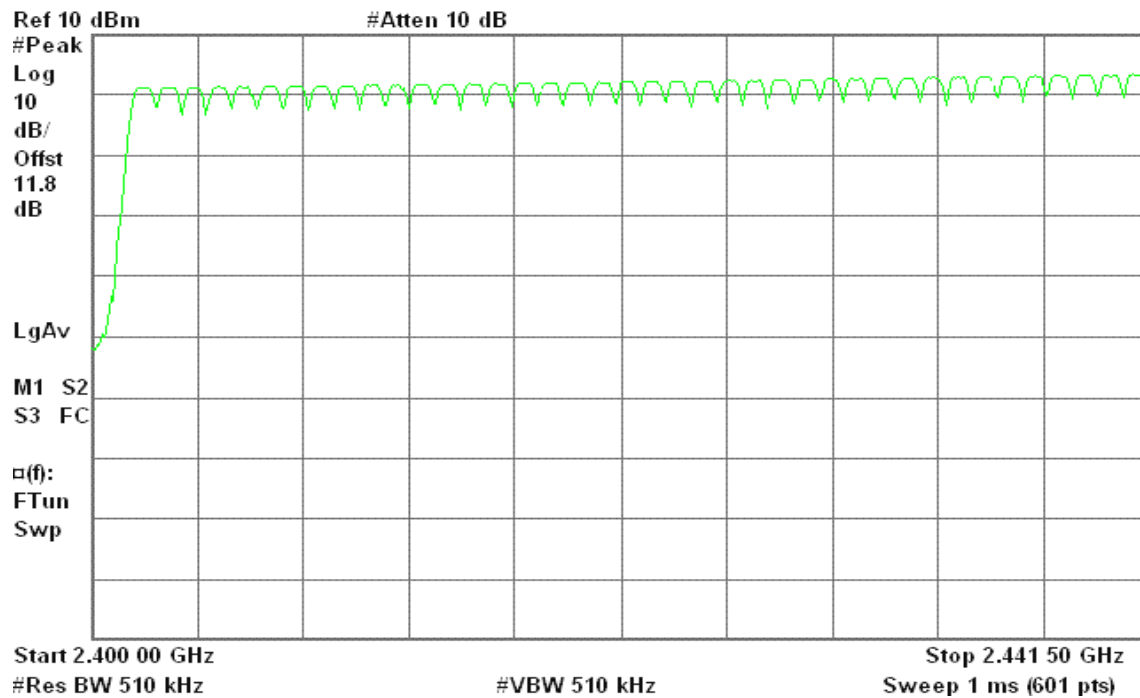
Test Plot

Channel Number

2.4 GHz – 2.4415 GHz

Agilent 20:52:27 Mar 14, 2006

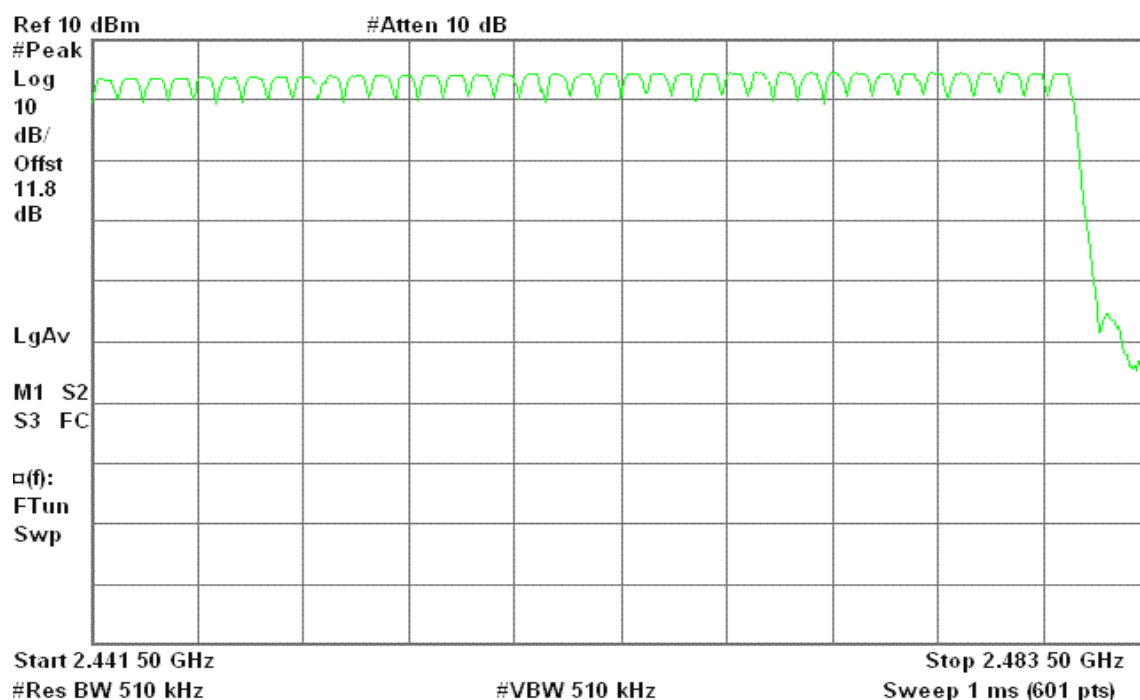
T



2.4415 GHz – 2.4835 GHz

Agilent 20:53:20 Mar 14, 2006

T



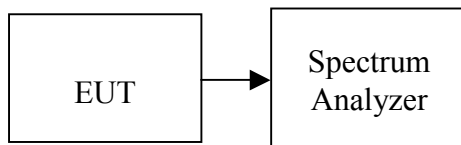


7.6 TIME OF OCCUPANCY (DWELL TIME)

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.

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 RESULTS

No non-compliance noted

Test Data

DH 1

CH Low: $0.417 * (1600/2)/79 * 31.6 = 117.13$ (ms)

CH Mid: $0.417 * (1600/2)/79 * 31.6 = 117.13$ (ms)

CH High: $0.417 * (1600/2)/79 * 31.6 = 117.13$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.417	117.13	31.60	400.00	PASS
Mid	0.417	117.13	31.60		PASS
High	0.417	117.13	31.60		PASS

DH 3

CH Low: $1.667 * (1600/4)/79 * 31.6 = 266.72$ (ms)

CH Mid: $1.667 * (1600/4)/79 * 31.6 = 266.72$ (ms)

CH High: $1.683 * (1600/4)/79 * 31.6 = 269.28$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.667	266.72	31.60	400.00	PASS
Mid	1.667	266.72	31.60		PASS
High	1.683	269.28	31.60		PASS

DH 5

CH Low: $2.917 * (1600/6)/79 * 31.6 = 311.15$ (ms)

CH Mid: $2.917 * (1600/6)/79 * 31.6 = 311.15$ (ms)

CH High: $2.933 * (1600/6)/79 * 31.6 = 312.85$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.917	311.15	31.60	400.00	PASS
Mid	2.917	311.15	31.60		PASS
High	2.933	312.85	31.60		PASS



Test Plot

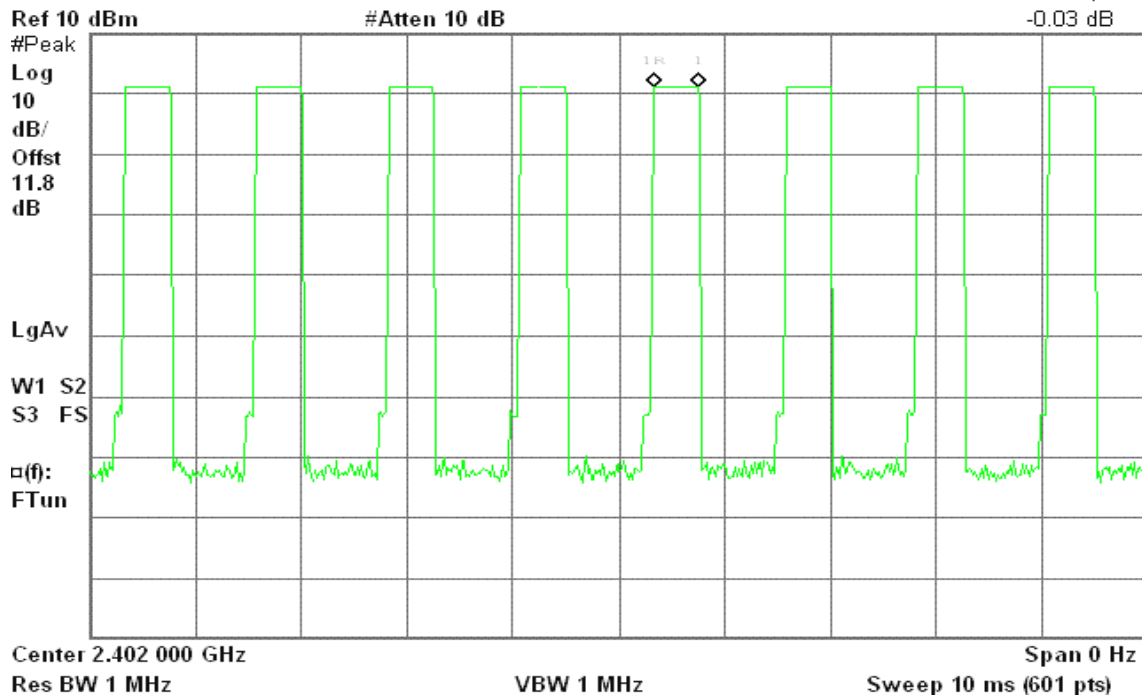
DH 1

(CH Low)

Agilent 20:58:14 Mar 14, 2006

T

Δ Mkr1 416.7 μ s
-0.03 dB

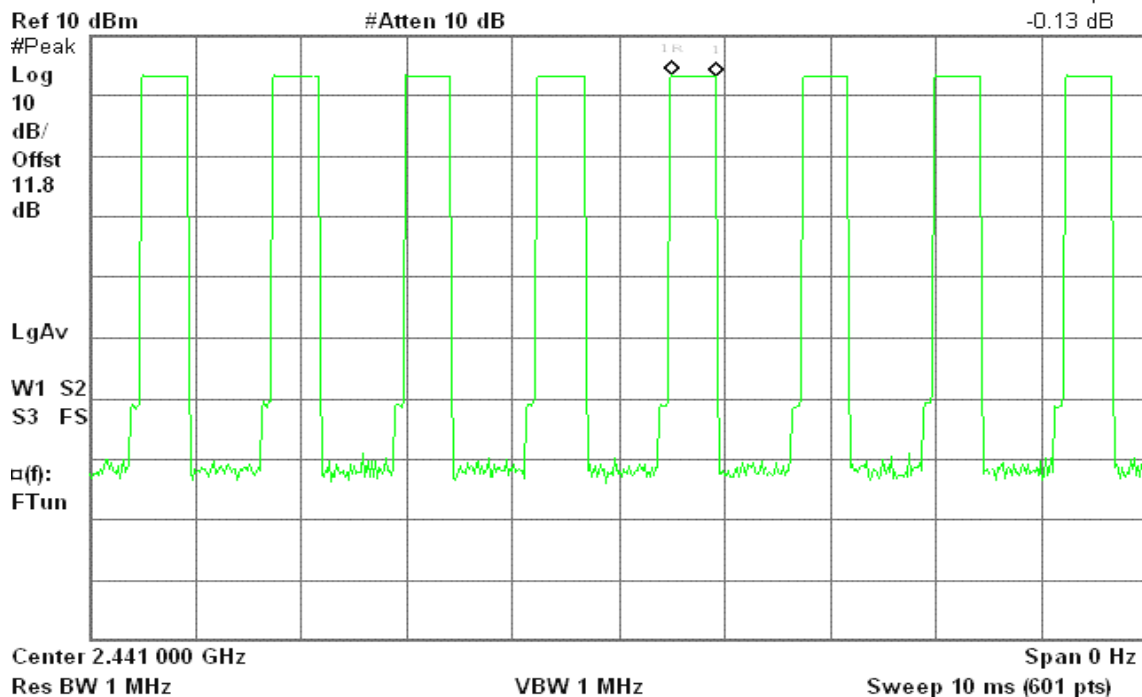


(CH Mid)

Agilent 20:58:46 Mar 14, 2006

T

Δ Mkr1 416.7 μ s
-0.13 dB



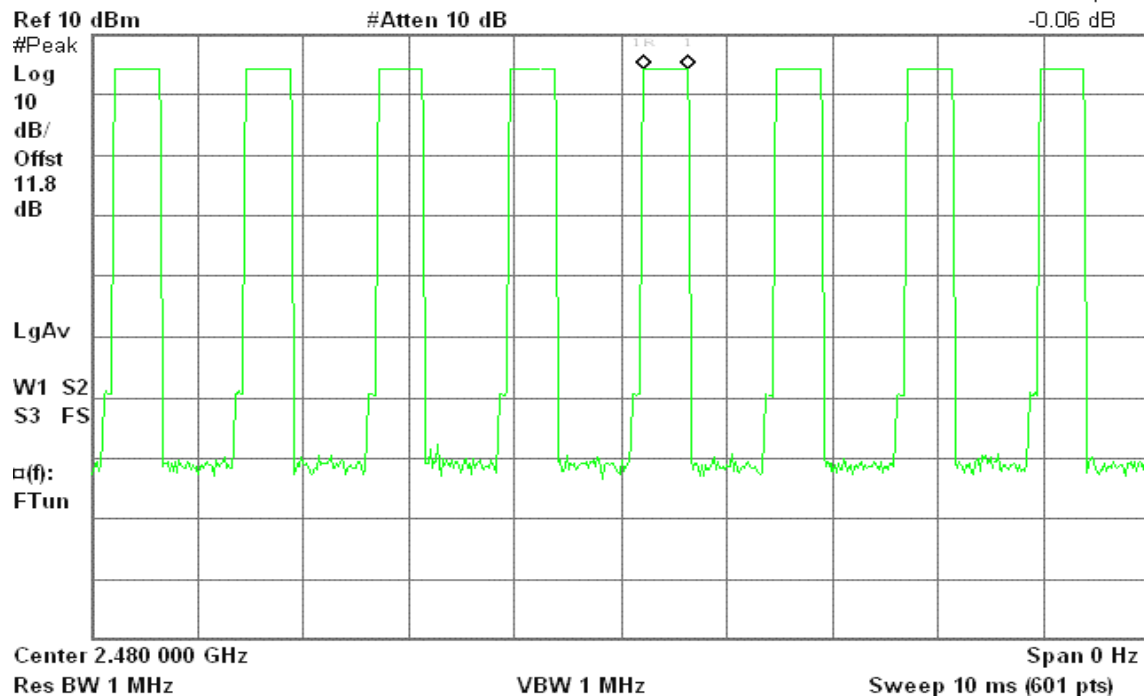


(CH High)

Agilent 20:59:35 Mar 14, 2006

T

Δ Mkr1 416.7 μ s
-0.06 dB



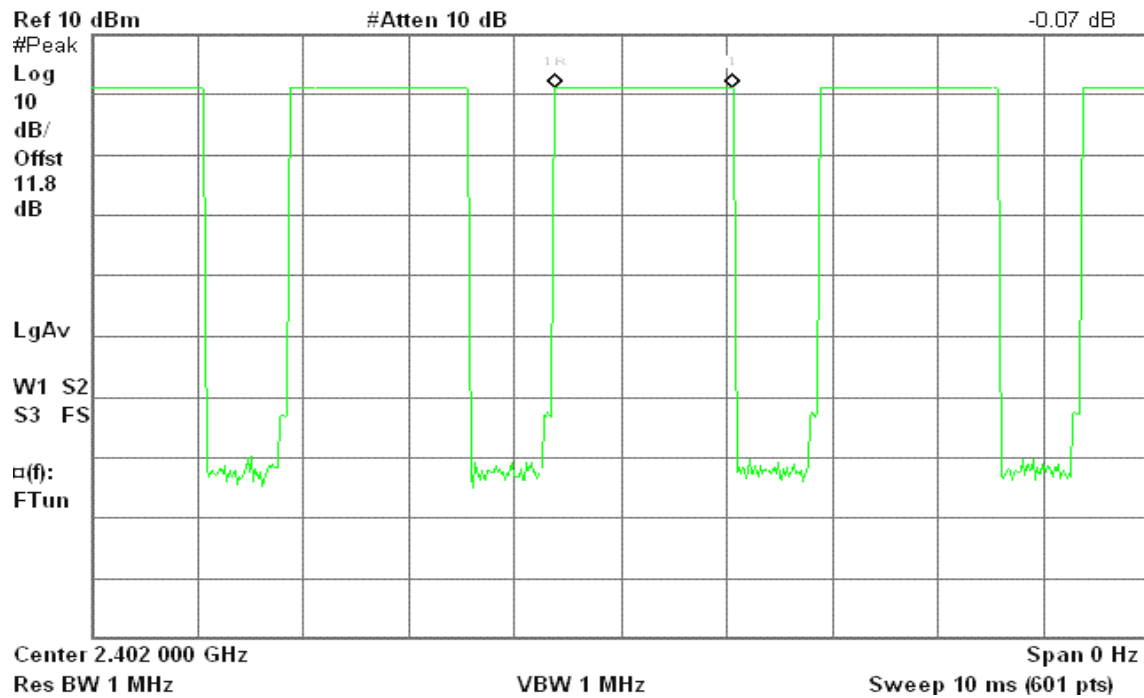
DH 3

(CH Low)

Agilent 21:02:54 Mar 14, 2006

T

Δ Mkr1 1.667 ms
-0.07 dB



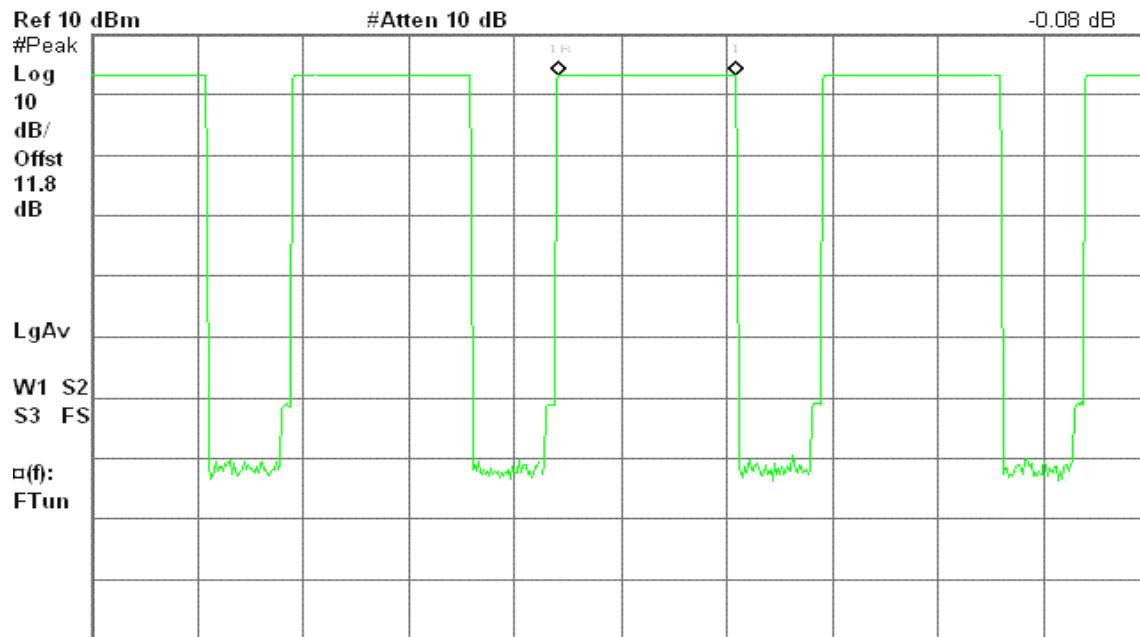


(CH Mid)

Agilent 21:01:16 Mar 14, 2006

T

Δ Mkr1 1.667 ms
-0.08 dB



Center 2.441 000 GHz

Res BW 1 MHz

VBW 1 MHz

Span 0 Hz

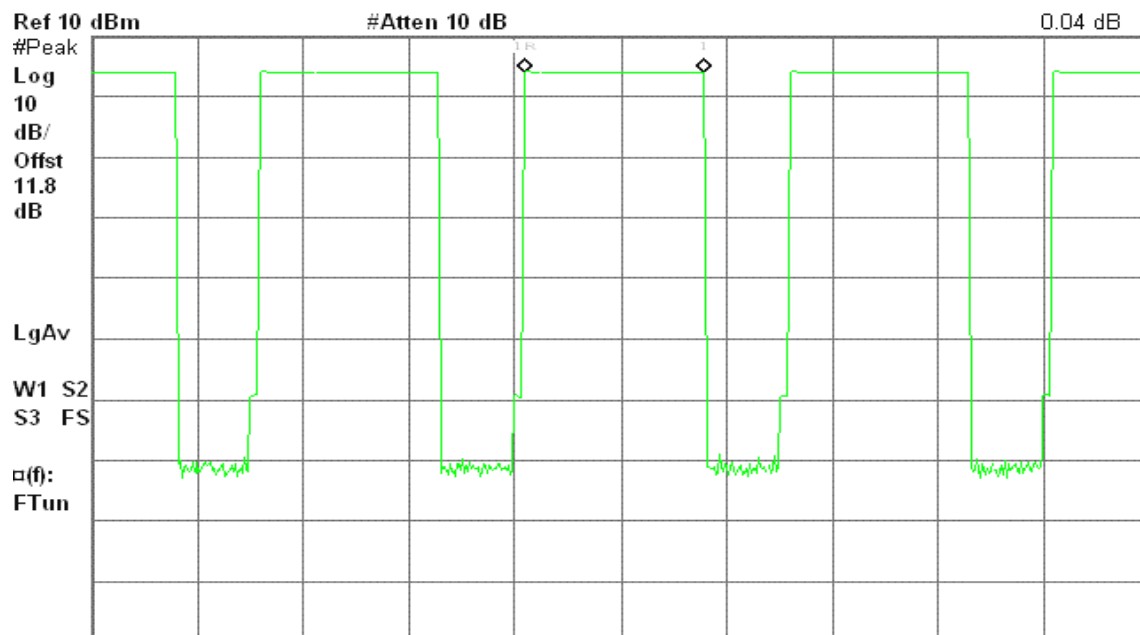
Sweep 10 ms (601 pts)

(CH High)

Agilent 21:06:38 Mar 14, 2006

T

Δ Mkr1 1.683 ms
0.04 dB



Center 2.480 000 GHz

Res BW 1 MHz

VBW 1 MHz

Span 0 Hz

Sweep 10 ms (601 pts)



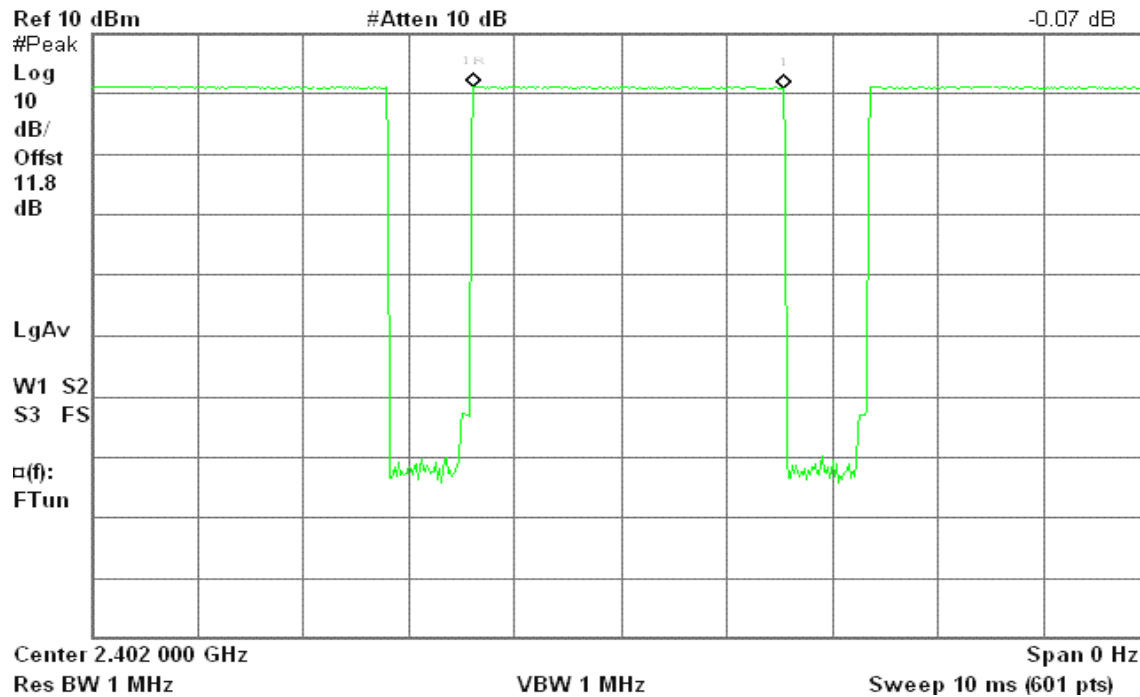
DH 5

(CH Low)

Agilent 21:03:45 Mar 14, 2006

T

Δ Mkr1 2.917 ms
-0.07 dB

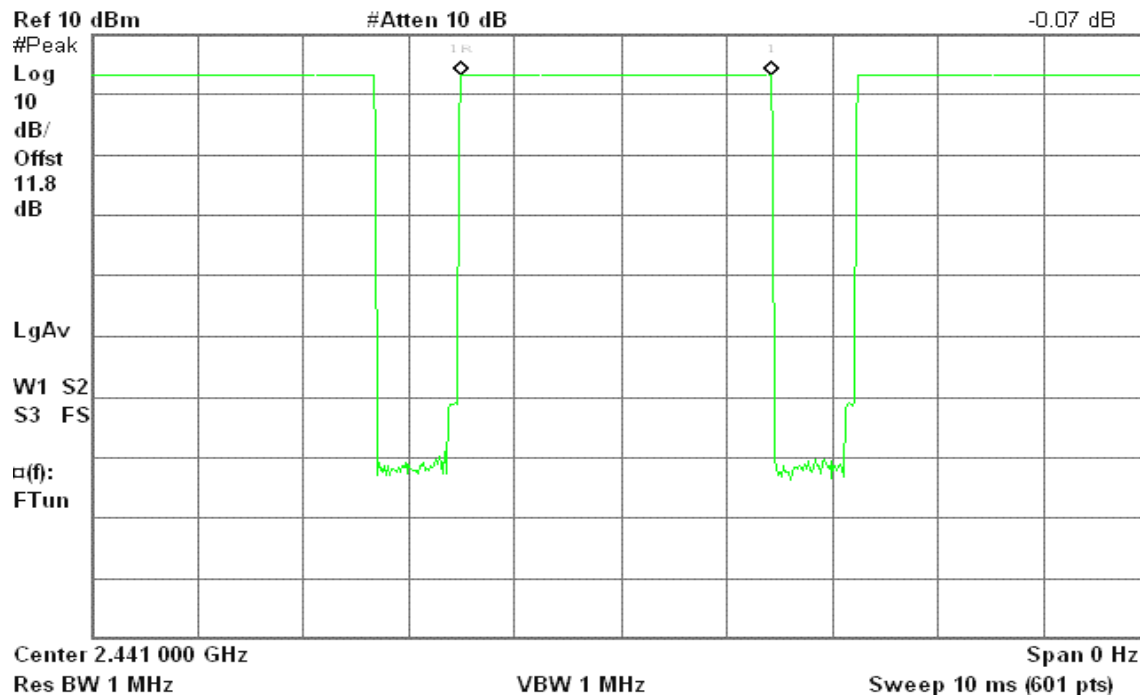


(CH Mid)

Agilent 21:04:47 Mar 14, 2006

T

Δ Mkr1 2.917 ms
-0.07 dB





(CH High)

Agilent 21:05:40 Mar 14, 2006

T

Δ Mkr1 2.933 ms
-0.06 dB

Ref 10 dBm

#Atten 10 dB

#Peak

Log

10

dB/

Offst

11.8

dB

LgAv

W1 S2

S3 FS

□(f):

FTun

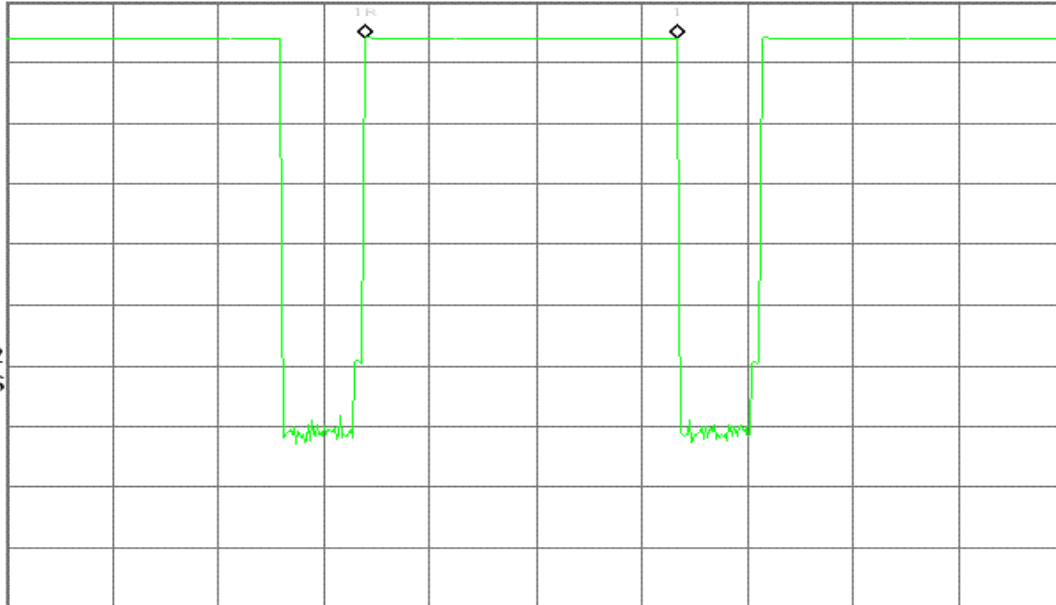
Center 2.480 000 GHz

Res BW 1 MHz

VBW 1 MHz

Span 0 Hz

Sweep 10 ms (601 pts)





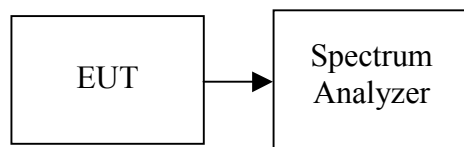
7.7 SPURIOUS EMISSIONS

7.7.1 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)).

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 25GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

No non-compliance noted

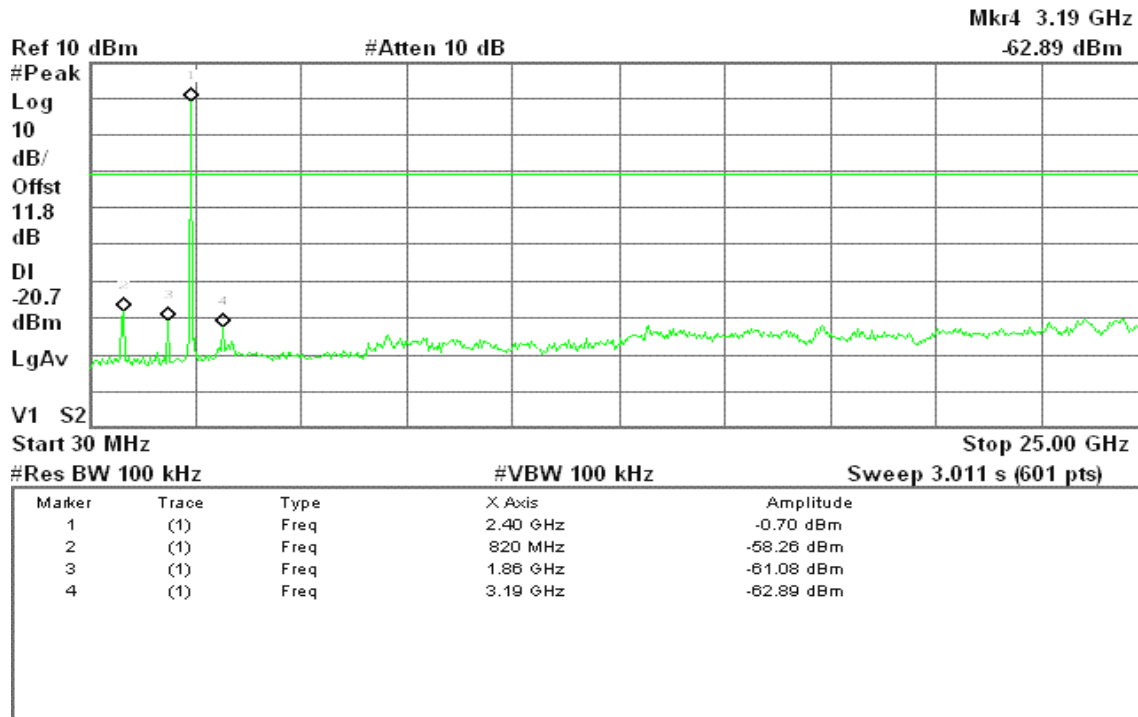


Test Plot

CH Low

* Agilent 20:48:13 Mar 14, 2006

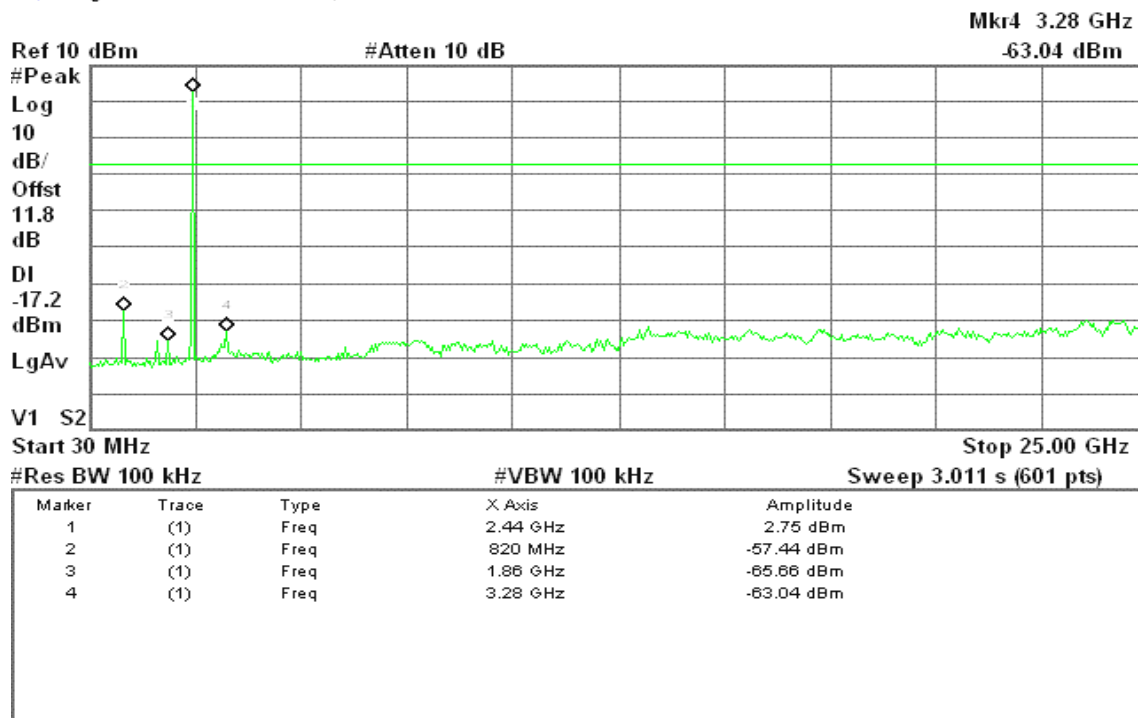
T



CH Mid

* Agilent 20:49:51 Mar 14, 2006

T





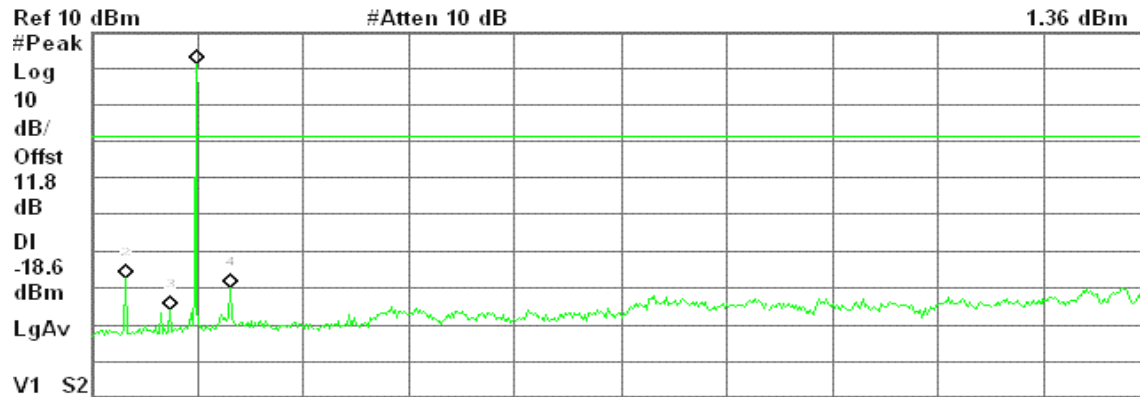
CH High

Agilent 20:50:44 Mar 14, 2006

T

Mkr1 2.49 GHz

1.36 dBm



Start 30 MHz

Stop 25.00 GHz

#Res BW 100 kHz

#VBW 100 kHz

Sweep 3.011 s (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.49 GHz	1.36 dBm
2	(1)	Freq	820 MHz	-57.63 dBm
3	(1)	Freq	1.86 GHz	-66.25 dBm
4	(1)	Freq	3.32 GHz	-60.04 dBm



7.7.2 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

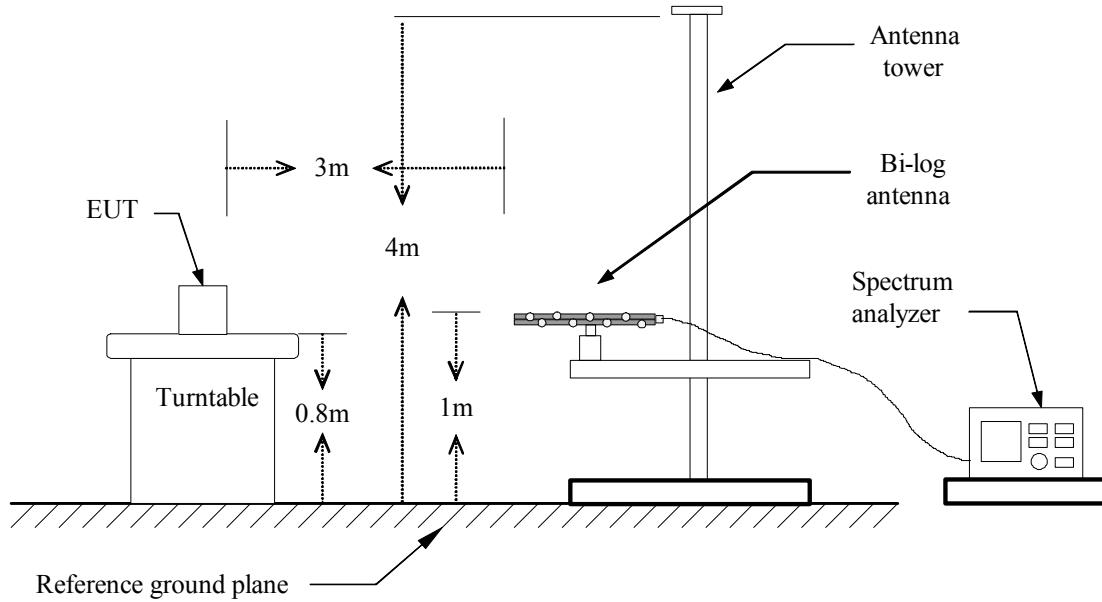
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

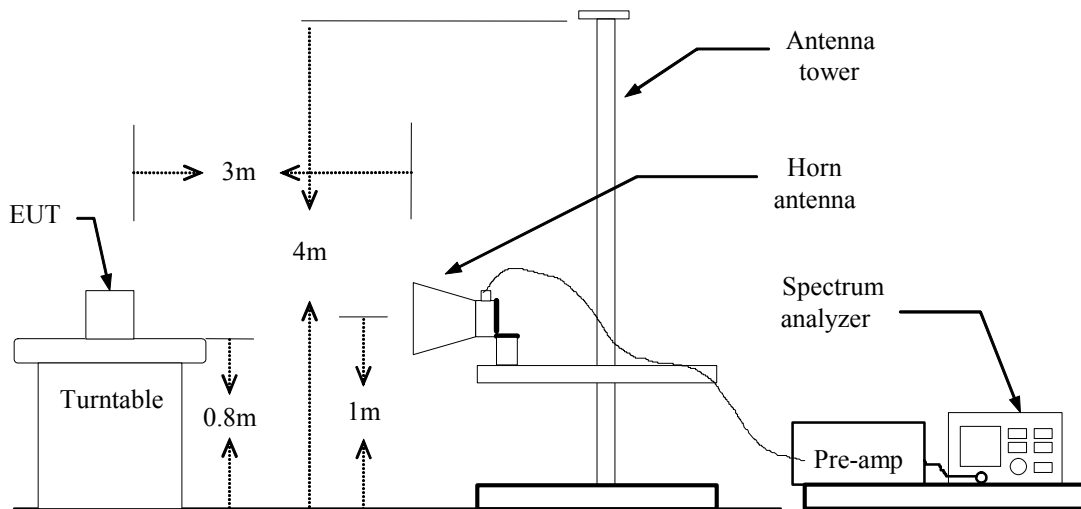
Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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:** March 31, 2006**Temperature:** 21°C**Tested by:** James Yu**Humidity:** 42 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
143.17	V	49.06	-20.14	28.92	43.50	-14.58	Peak
241.78	V	51.36	-20.44	30.93	46.00	-15.07	Peak
301.60	V	51.79	-18.46	33.33	46.00	-12.67	Peak
432.55	V	53.42	-15.14	38.28	46.00	-7.72	Peak
487.52	V	50.67	-13.56	37.10	46.00	-8.90	Peak
864.20	V	44.06	-8.59	35.47	46.00	-10.53	Peak
185.20	H	50.52	-21.64	28.87	43.50	-14.63	Peak
301.60	H	54.60	-18.46	36.14	46.00	-9.86	Peak
432.55	H	52.23	-15.14	37.09	46.00	-8.91	Peak
720.32	H	43.25	-10.42	32.83	46.00	-13.17	Peak
768.82	H	44.58	-9.82	34.75	46.00	-11.25	Peak
815.70	H	46.99	-9.04	37.95	46.00	-8.05	Peak

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. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. 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.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

**Above 1 GHz****Operation Mode:** TX / CH Low**Test Date:** March 28, 2006**Temperature:** 22°C**Tested by:** Rex Lai**Humidity:** 57 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1723.33	V	56.28	---	-12.58	43.70	---	74.00	54.00	-10.30	Peak
2000.00	V	55.64	---	-10.91	44.73	---	74.00	54.00	-9.27	Peak
2490.00	V	55.81	---	-10.28	45.53	---	74.00	54.00	-8.47	Peak
4975.00	V	49.50	---	-7.77	41.74	---	74.00	54.00	-12.26	Peak
N/A										
S	H	55.15	---	-13.92	41.23	---	74.00	54.00	-12.77	Peak
1996.67	H	54.65	---	-10.93	43.72	---	74.00	54.00	-10.28	Peak
5000.00	H	44.68	---	-7.76	36.92	---	74.00	54.00	-17.08	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. 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.
5. 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.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** TX / CH Mid**Test Date:** March 28, 2006**Temperature:** 22°C**Tested by:** Rex Lai**Humidity:** 57 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
2496.67	V	59.90	---	-10.27	49.62	---	74.00	54.00	-4.38	Peak
4983.33	V	48.73	---	-7.76	40.97	---	74.00	54.00	-13.03	Peak
9716.67	V	44.22	---	-0.74	43.48	---	74.00	54.00	-10.52	Peak
N/A										
1993.33	H	58.69	---	-10.95	47.74	---	74.00	54.00	-6.26	Peak
5000.00	H	54.29	---	-7.76	37.53	---	74.00	54.00	-16.47	Peak
9716.67	H	41.94	---	-0.74	41.20	---	74.00	54.00	-12.80	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. 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.
5. 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.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**Operation Mode:** TX / CH High**Test Date:** March 28, 2006**Temperature:** 22°C**Tested by:** Rex Lai**Humidity:** 57 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1663.33	V	59.62	---	-12.94	46.68	---	74.00	54.00	-7.32	Peak
5000.00	V	49.87	---	-7.76	42.11	---	74.00	54.00	-11.89	Peak
9733.33	V	44.02	---	-0.71	43.32	---	74.00	54.00	-10.68	Peak
N/A										
1240.00	H	58.85	---	-14.43	44.41	---	74.00	54.00	-9.59	Peak
1993.33	H	59.56	---	-10.95	48.61	---	74.00	54.00	-5.39	Peak
5000.00	H	46.13	---	-7.76	38.37	---	74.00	54.00	-15.63	Peak
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. 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.
5. 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.
6. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.



7.8 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.

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:** March 31, 2006**Temperature:** 25°C**Tested by:** Tom Jen**Humidity:** 55% RH

Frequency (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Correction factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.154	41.510	31.270	0.192	41.702	31.462	65.781	55.781	-24.079	-24.319	L1
0.352	26.010	23.670	0.100	26.110	23.770	58.915	48.915	-32.805	-25.145	L1
1.488	23.530	18.800	0.100	23.630	18.900	56.000	46.000	-32.370	-27.100	L1
3.098	26.540	21.200	0.100	26.640	21.300	56.000	46.000	-29.360	-24.700	L1
4.614	21.710	19.070	0.161	21.871	19.231	56.000	46.000	-34.129	-26.769	L1
16.912	16.830	14.690	0.953	17.783	15.643	60.000	50.000	-42.217	-34.357	L1
0.150	41.620	32.210	0.200	41.820	32.410	66.000	56.000	-24.180	-23.590	L2
0.266	19.250	16.750	0.100	19.350	16.850	61.242	51.242	-41.892	-34.392	L2
3.001	28.030	24.520	0.100	28.130	24.620	56.000	46.000	-27.870	-21.380	L2
4.578	22.820	19.880	0.158	22.978	20.038	56.000	46.000	-33.022	-25.962	L2
17.047	22.710	20.290	0.964	23.674	21.254	60.000	50.000	-36.326	-28.746	L2
24.013	19.900	17.270	1.200	21.100	18.470	60.000	50.000	-38.900	-31.530	L2

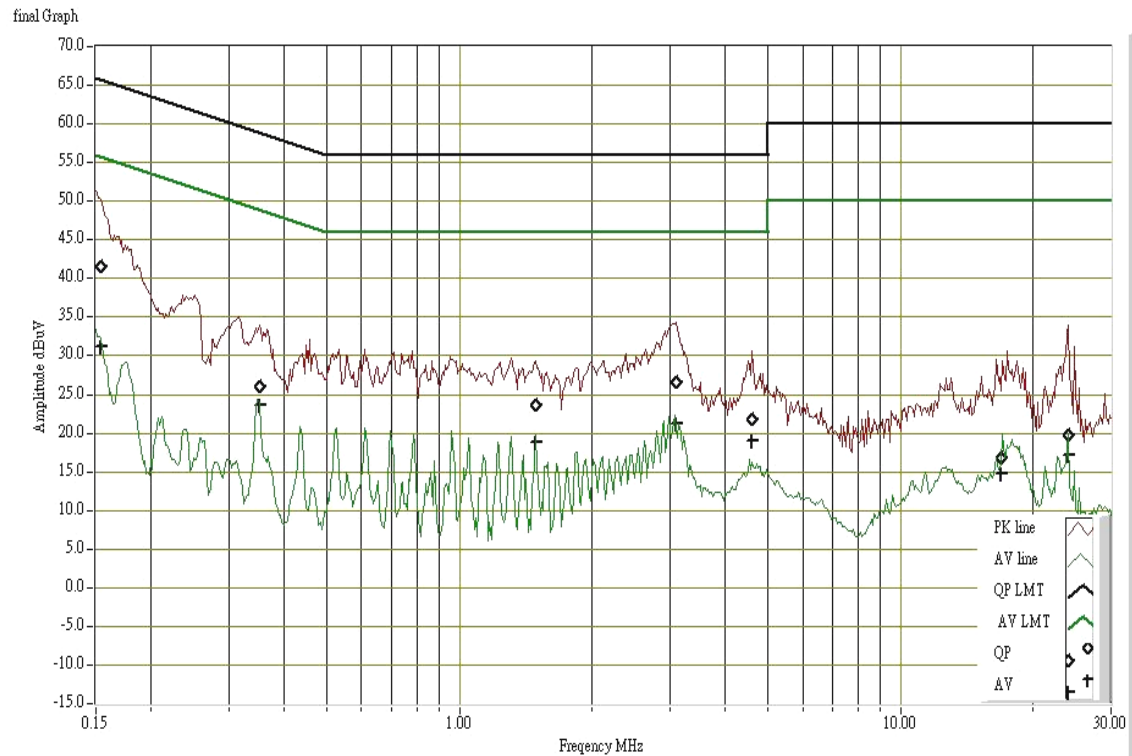
Remark:

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)

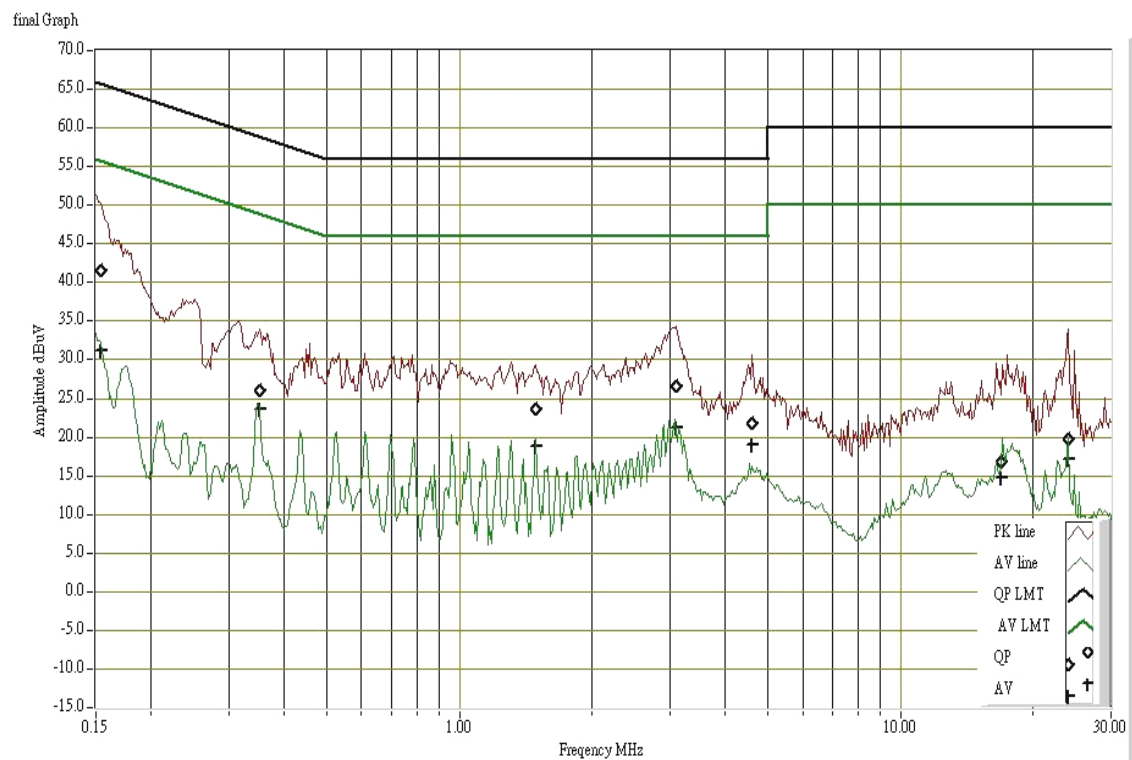


Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)





APPENDIX I

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	NOTEBOOK PC
Frequency band (Operating)	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others: <u>Bluetooth: 2.402GHz ~ 2.480GHz</u>
Device category	<input checked="" type="checkbox"/> Portable (<20cm separation) <input type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure ($S = 5mW/cm^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S = 1mW/cm^2$)
Antenna diversity	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
Max. output power	4.21dBm (0.00264W)
Antenna gain (Max)	2.42 dBi (Numeric gain: 1.75)
Evaluation applied	<input type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation <input checked="" type="checkbox"/> N/A*

Remark:

1. The maximum output power is 4.21dBm (0.0264W) at 2480MHz (with 1.75 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 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: $60/f_{(GHz)} = 60/2.441 = 24.58mW$)