



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

WIRELESS CAR CRADLE

Model: WIRELESS CARKIT

Trade Name: ROUTE 66

Issued to

RoyalTek Company Ltd.
9F-1, 1071 Chung Cheng RD., Taoyuan City,
Taoyuan County 330 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	7
4. INSTRUMENT CALIBRATION.....	8
4.1 MEASURING INSTRUMENT CALIBRATION.....	8
4.2 MEASUREMENT EQUIPMENT USED.....	8
5. FACILITIES AND ACCREDITATIONS.....	9
5.1 FACILITIES	9
5.2 EQUIPMENT.....	9
5.3 TABLE OF ACCREDITATIONS AND LISTINGS.....	10
6. SETUP OF EQUIPMENT UNDER TEST.....	11
6.1 SETUP CONFIGURATION OF EUT.....	11
6.2 SUPPORT EQUIPMENT	11
7. FCC PART 15.247 REQUIREMENTS.....	12
7.1 PEAK POWER.....	12
7.2 BAND EDGES MEASUREMENT	13
7.3 PEAK POWER SPECTRAL DENSITY	18
7.4 FREQUENCY SEPARATION.....	21
7.5 NUMBER OF HOPPING FREQUENCY	23
7.6 TIME OF OCCUPANCY (DWELL TIME).....	25
7.7 SPURIOUS EMISSIONS	32
7.8 POWERLINE CONDUCTED EMISSIONS.....	42
APPENDIX I RADIO FREQUENCY EXPOSURE	45
APPENDIX II PHOTOGRAPHS OF TEST SETUP	46



1. TEST RESULT CERTIFICATION

Applicant: RoyalTek Company Ltd.
9F-1, 1071 Chung Cheng RD., Taoyuan City,
Taoyuan County 330 Taiwan, R.O.C.

Equipment Under Test: WIRELESS CAR CRADLE

Trade Name: ROUTE 66

Model: WIRELESS CARKIT

Date of Test: October 4 ~ 16, 2007

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:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Amanda Wu
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	WIRELESS CAR CRADLE
Trade Name	ROUTE 66
Model Number	WIRELESS CARKIT
Model Discrepancy	N/A
Power Supply	Powered from host device via USB cable
Frequency Range	2402 ~ 2480 MHz
Transmit Power	-0.97 dBm
Modulation Technique	FHSS (GFSK)
Transmit Data Rate	1Mbps
Number of Channels	79 Channels
Antenna Specification	Gain: 0.5 dBi
Antenna Designation	Chip Antenna

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **RCCWIRELESSCARKIT** 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: WIRELESS CARKIT) had been tested under operating condition.

Software 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 and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Channel Low (2402MHz), Mid (2441MHz) and High (2480MHz) with 1Mbps data rate was 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	01/30/2008
Power Meter	Agilent	E4416A	GB41291611	03/20/2008
Power Sensor	Agilent	E9327A	US40441097	06/07/2008

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	09/11/2008
Test Receiver	Rohde&Schwarz	ESCI	100064	11/13/2007
Switch Controller	TRC	Switch Controller	SC94050010	05/04/2008
4 Port Switch	TRC	4 Port Switch	SC94050020	05/04/2008
Horn-Antenna	TRC	HA-0502	06	06/04/2008
Horn-Antenna	TRC	HA-0801	04	06/20/2008
Horn-Antenna	TRC	HA-1201A	01	08/12/2008
Horn-Antenna	TRC	HA-1301A	01	08/12/2008
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/29/2008
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	09/25/2008
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	10/31/2007
TWO-LINE V-NETWORK 9kHz-30MHz	SCHAFFNER	NNB41	03/10013	06/12/2008
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/01/2008
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, IEC/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	 ACCREDITED TESTING CERT #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 2324C-3, IC 2324C-5) / 3M Semi Anechoic Chamber (IC 6106)	 IC 2324C-3 IC 2324C-5 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.	Notebook PC	ASUS	M5200AE	5BN0AG019631	PD9WM3B2100	N/A	AC I/P: Unshielded, 1.8m with a core DC O/P: Unshielded, 1.8m
2.	GPS (BT+FMTX+TMC)(4.3")	N/A	MAXI	N/A	N/A	N/A	N/A
3.	GPS (BT+FMTX+TMC)(3.5")	N/A	MINI	N/A	N/A	N/A	N/A
4.	FM Antenna	N/A	N/A	N/A	N/A	N/A	N/A
5.	Notebook PC (remote)	IBM	2672 (X31)	99PBTKB	WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN	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

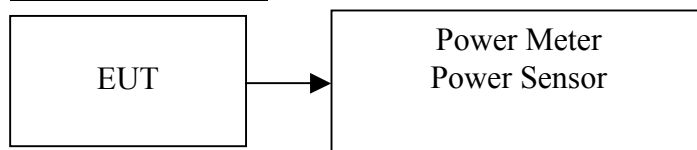
7.1 PEAK POWER

LIMIT

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

1. According to §15.247(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

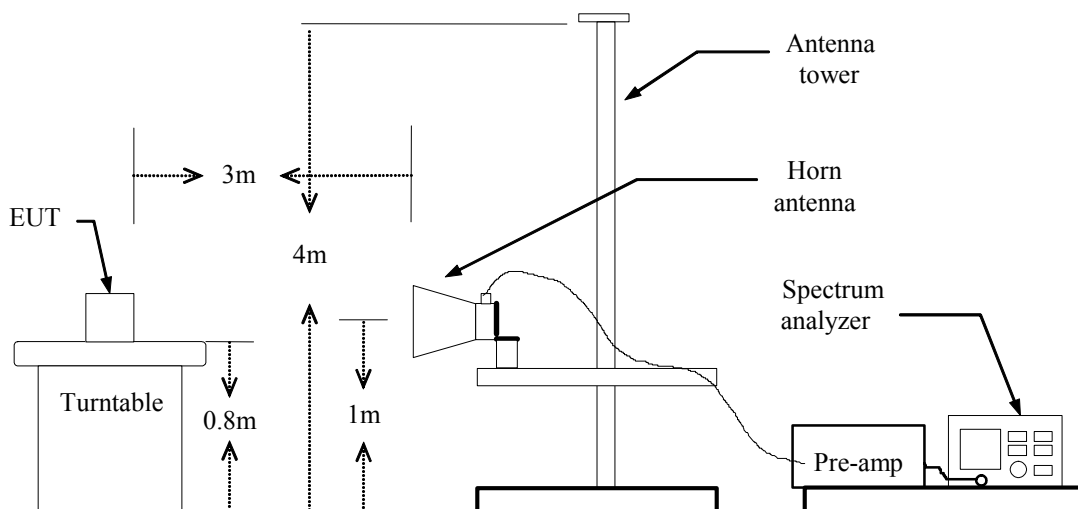
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-1.09	0.00078	0.125	PASS
Mid	2441	-1.14	0.00077		PASS
High	2480	-0.97	0.00080		PASS

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)

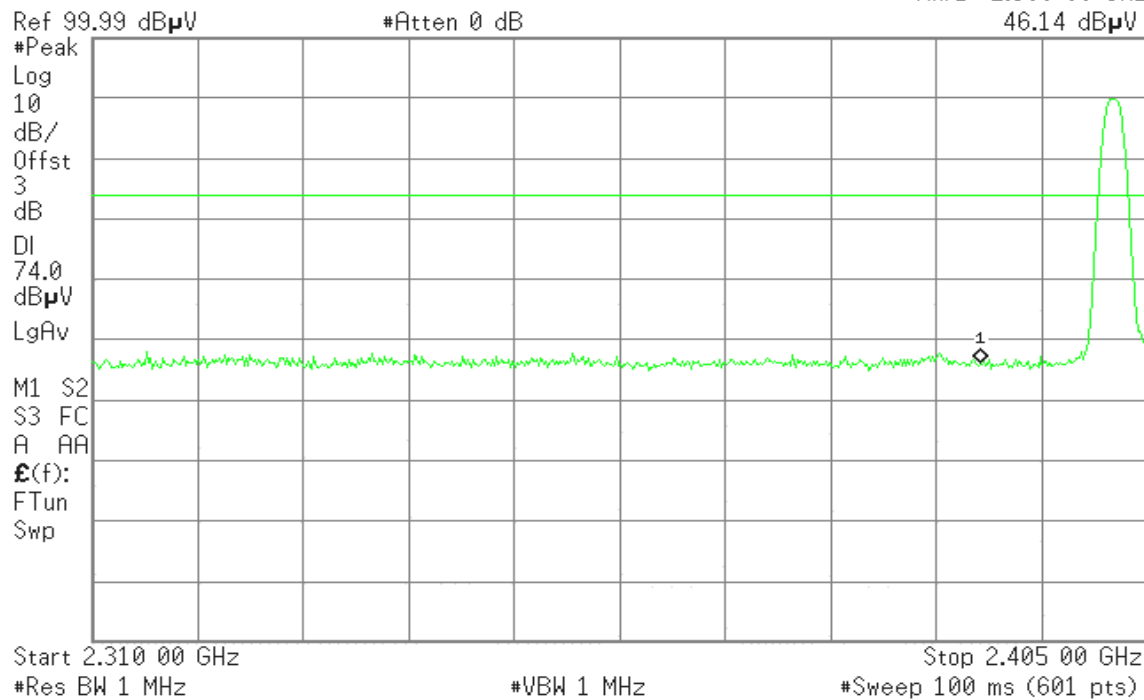
Detector mode: Peak

Polarity: Vertical

Agilent 18:53:41 Oct 11, 2007

R T

Mkr1 2.390 00 GHz
46.14 dB μ V



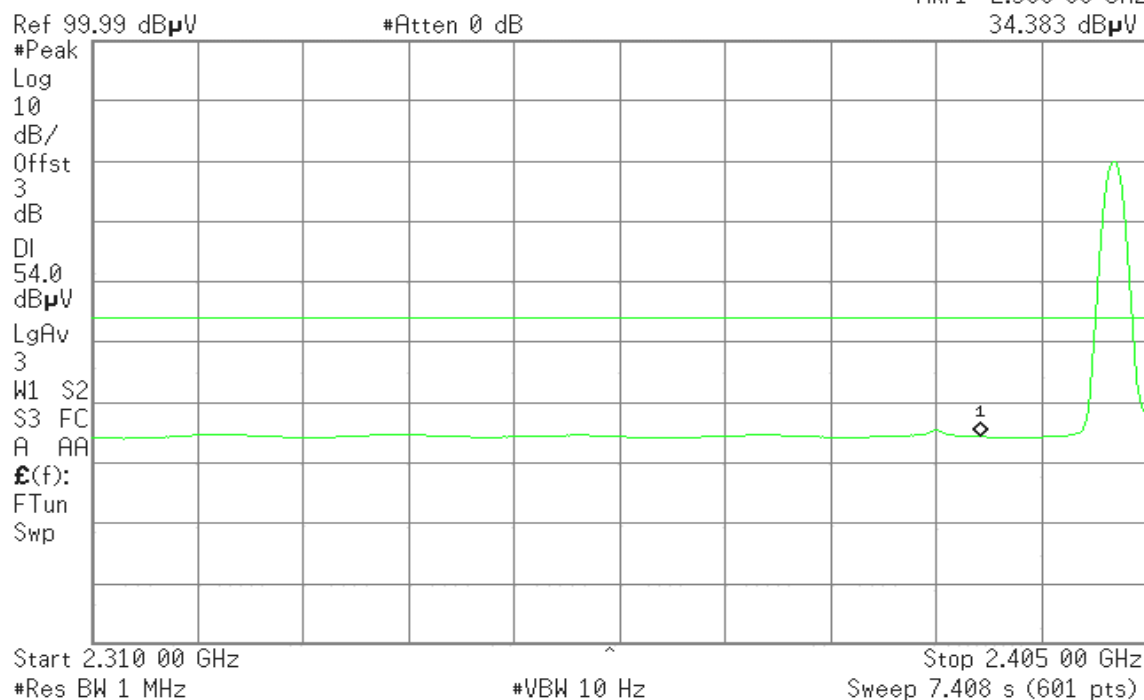
Detector mode: Average

Polarity: Vertical

Agilent 18:54:16 Oct 11, 2007

R T

Mkr1 2.390 00 GHz
34.383 dB μ V





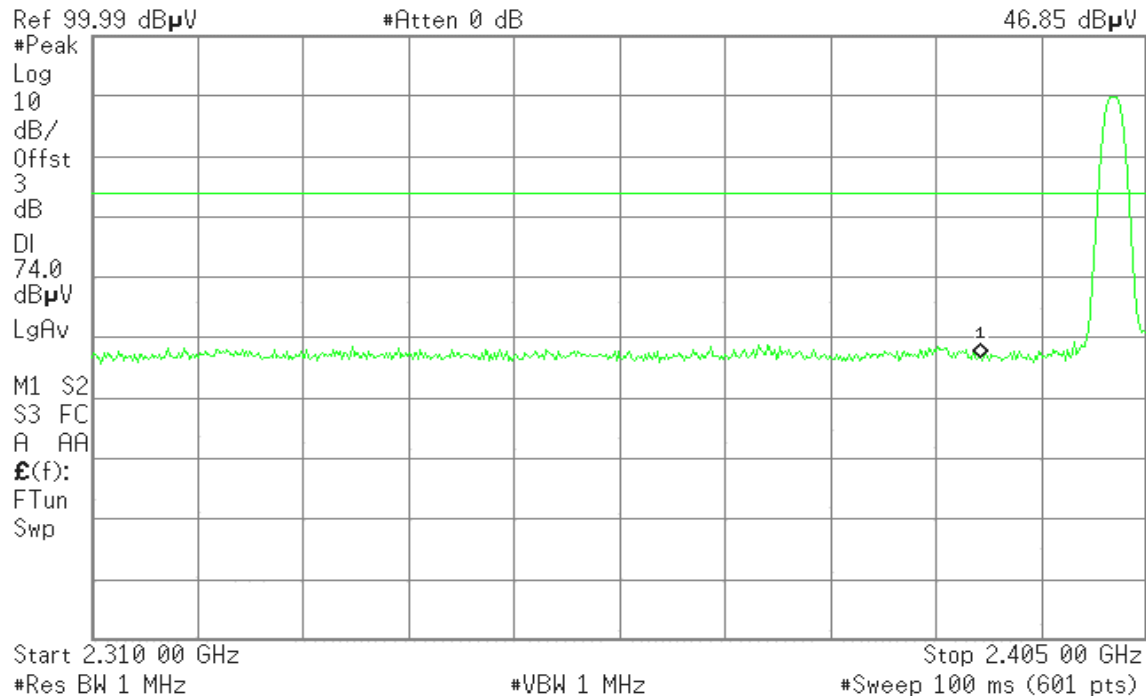
Detector mode: Peak

Polarity: Horizontal

Agilent 19:01:04 Oct 11, 2007

R T

Mkr1 2.390 00 GHz
46.85 dB μ V



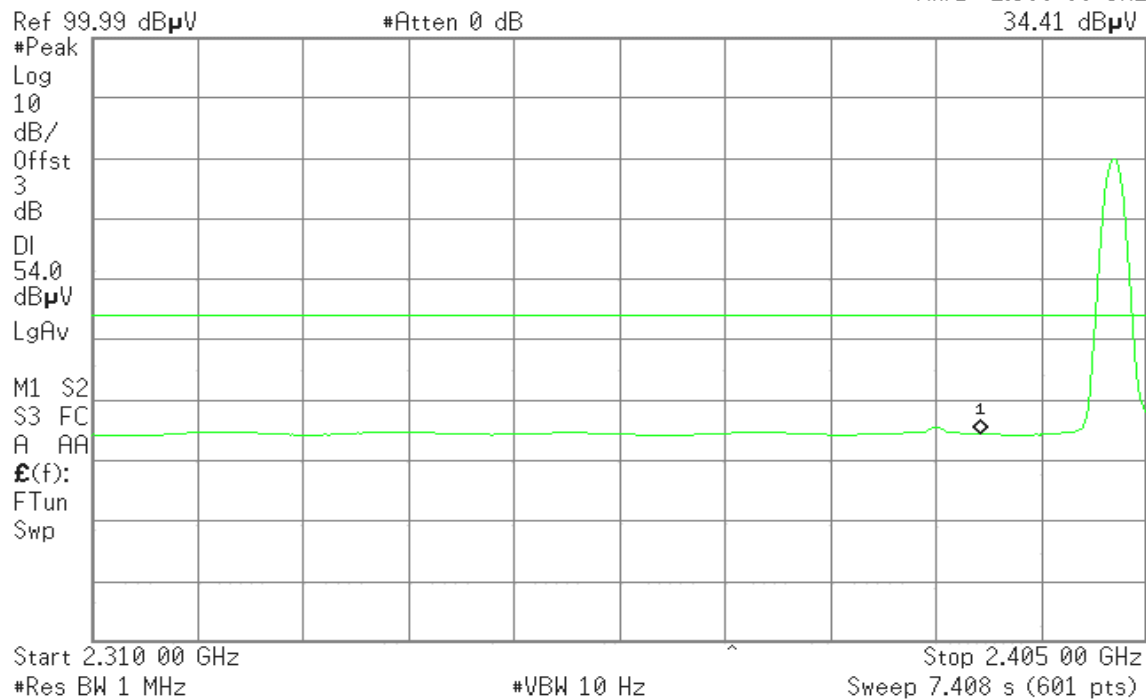
Detector mode: Average

Polarity: Horizontal

Agilent 19:00:33 Oct 11, 2007

R T

Mkr1 2.390 00 GHz
34.41 dB μ V





Band Edges (CH High)

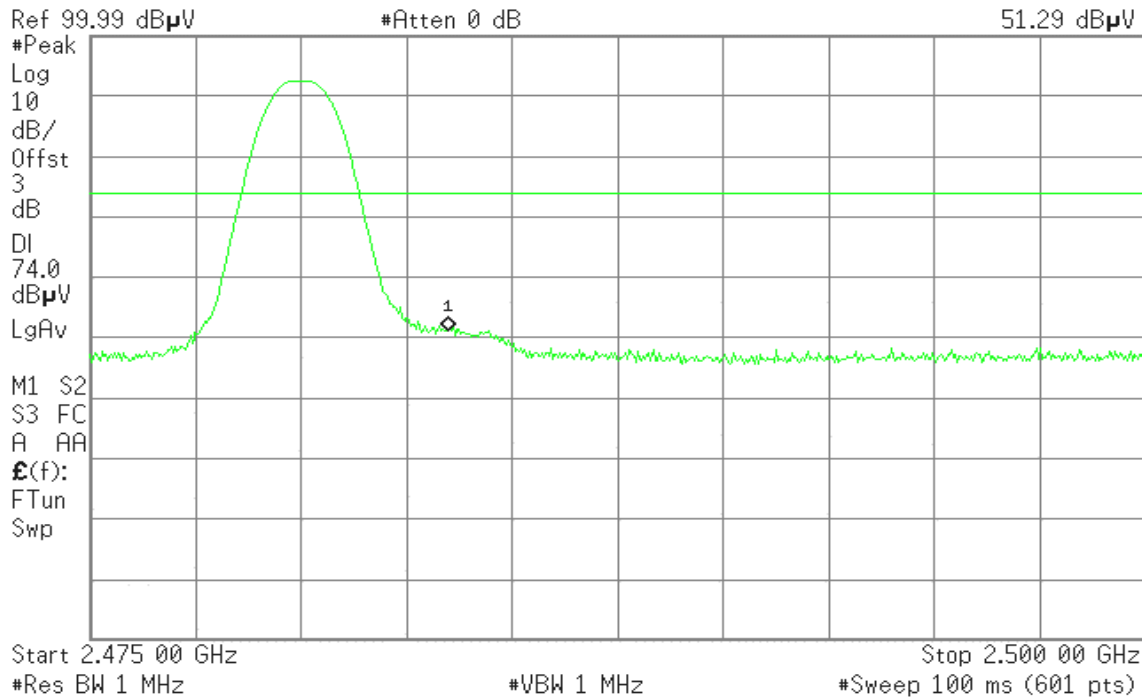
Detector mode: Peak

Polarity: Vertical

Agilent 19:11:14 Oct 11, 2007

R T

Mkr1 2.483 50 GHz
51.29 dB μ V



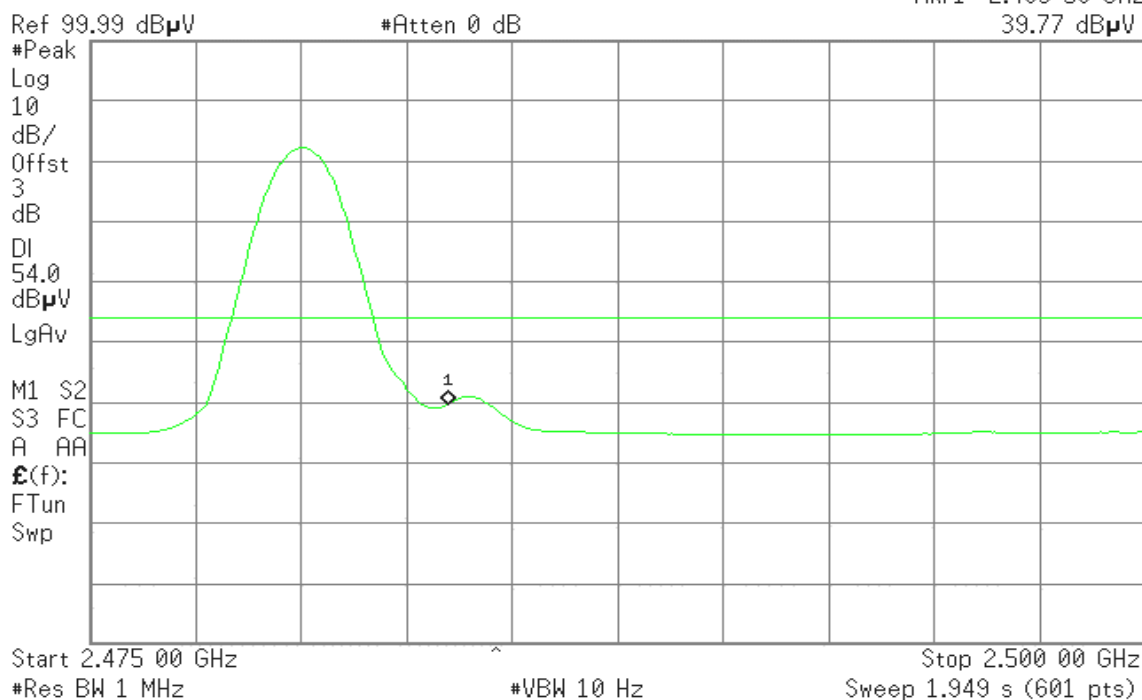
Detector mode: Average

Polarity: Vertical

Agilent 19:11:29 Oct 11, 2007

R T

Mkr1 2.483 50 GHz
39.77 dB μ V





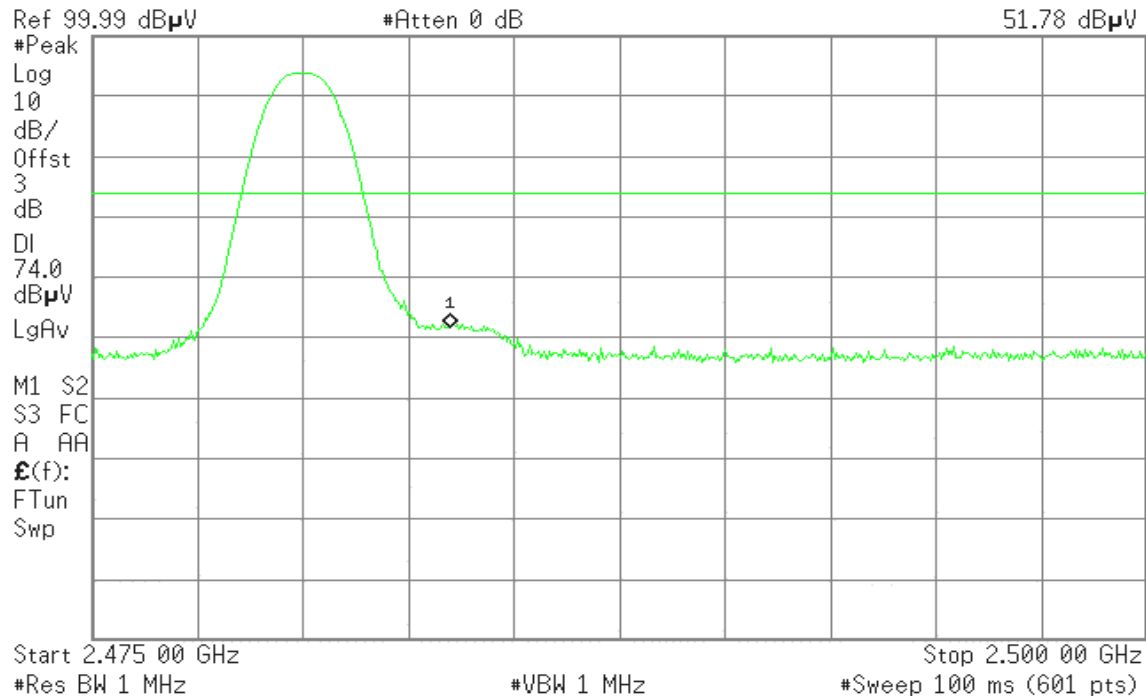
Detector mode: Peak

Polarity: Horizontal

Agilent 19:07:21 Oct 11, 2007

R T

Mkr1 2.483 50 GHz
51.78 dB μ V



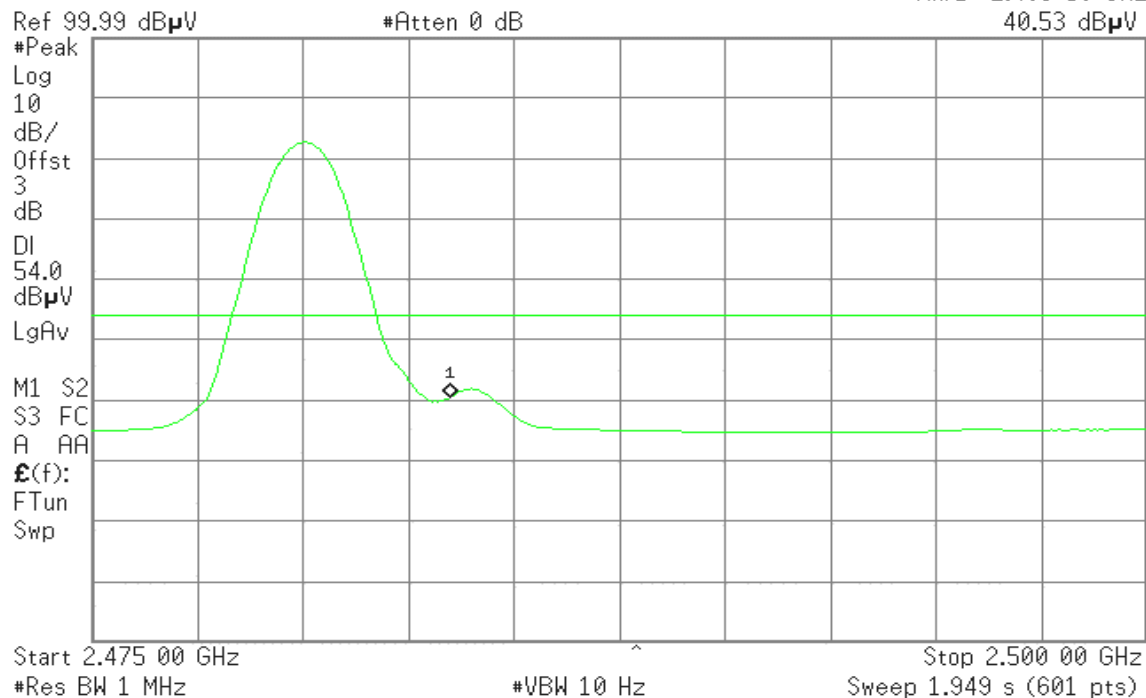
Detector mode: Average

Polarity: Horizontal

Agilent 19:07:44 Oct 11, 2007

R T

Mkr1 2.483 50 GHz
40.53 dB μ V



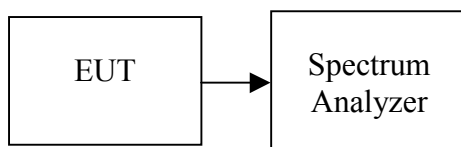


7.3 PEAK POWER SPECTRAL DENSITY

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.

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	-0.26	8.00	PASS
Mid	2441	-0.42		PASS
High	2480	-0.28		PASS



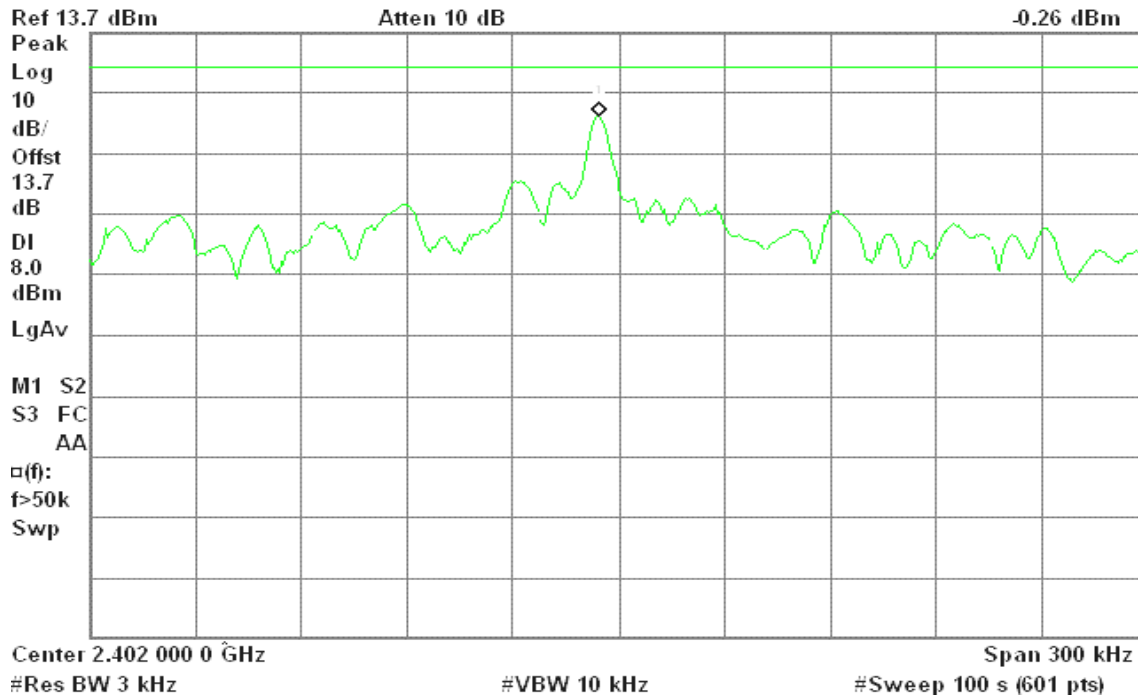
Test Plot

PPSD (CH Low)

Agilent 17:02:10 Oct 4, 2007

R T

Mkr1 2.401 994 0 GHz
-0.26 dBm

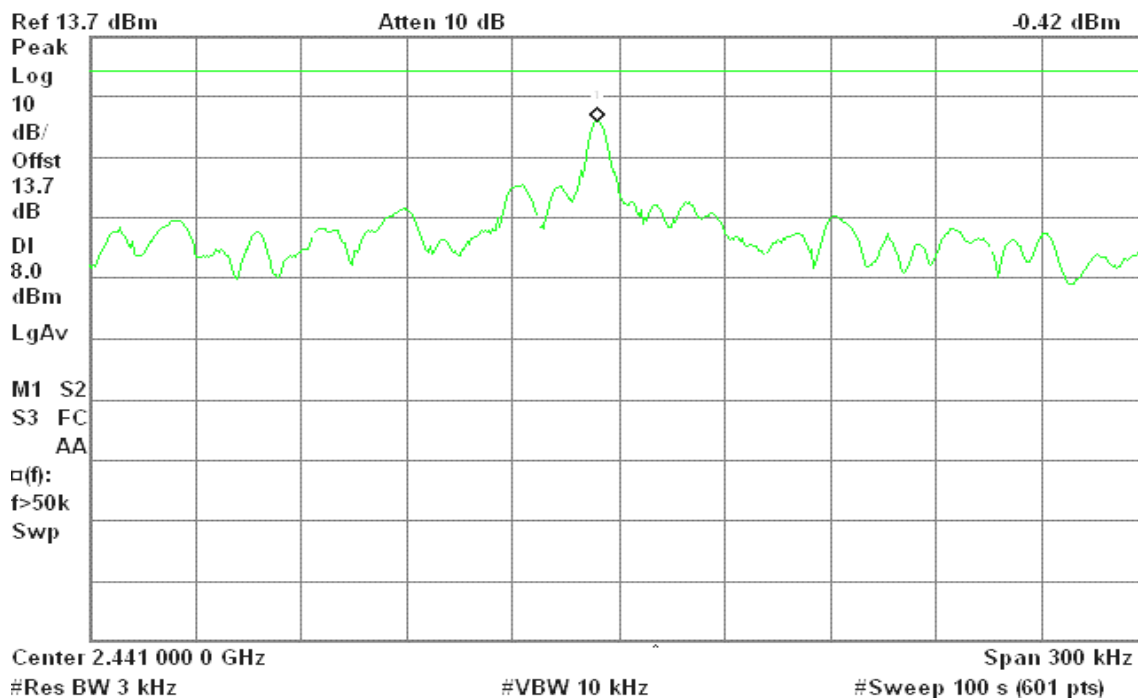


PPSD (CH Mid)

Agilent 17:05:10 Oct 4, 2007

R T

Mkr1 2.440 993 5 GHz
-0.42 dBm





PPSD (CH High)

Agilent 17:07:21 Oct 4, 2007

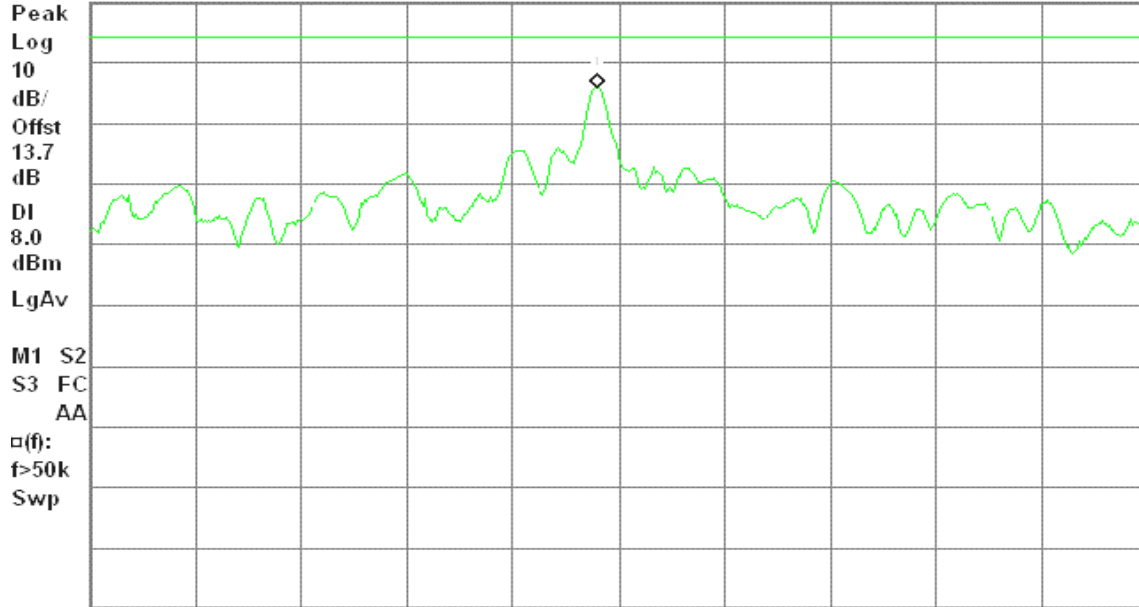
R T

Mkr1 2.479 993 5 GHz

Ref 13.7 dBm

Atten 10 dB

-0.28 dBm



Center 2.480 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)

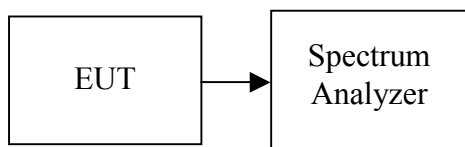


7.4 FREQUENCY SEPARATION

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 = 10kHz, VBW = 30kHz, Span = 1.5MHz, 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)	Channel Separation Limit	Result
1.00	1021	two-thirds of the 20 dB bandwidth	Pass



Test Plot

Measurement of Channel Separation

Agilent 17:12:40 Oct 4, 2007

R T

Mkr3 2.441 995 GHz

Ref 13.7 dBm

Atten 10 dB

1.85 dBm

#Peak

Log

10

dB/

Offst

13.7

dB

LgAv

V1 S2

Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 100 kHz

Sweep 3.2 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.439 995 GHz	1.67 dBm
2	(1)	Freq	2.440 995 GHz	1.72 dBm
3	(1)	Freq	2.441 995 GHz	1.85 dBm

Measurement of 20dB Bandwidth

Agilent 16:34:55 Oct 4, 2007

R T

Δ Mkr2 1.021 MHz

0.20 dB

Ref 13.7 dBm

Atten 10 dB

Norm

Log

10

dB/

Offst

13.7

dB

DI

-18.1

dBm

LgAv

V1 S2

Center 2.402 000 GHz

Span 1.5 MHz

#Res BW 10 kHz

#VBW 30 kHz

Sweep 14.36 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.401 995 GHz	1.85 dBm
2R	(1)	Freq	2.401 484 GHz	-20.17 dBm
2Δ	(1)	Freq	1.021 MHz	0.20 dB

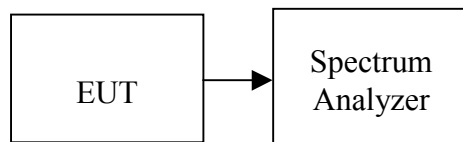


7.5 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 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	>15	PASS



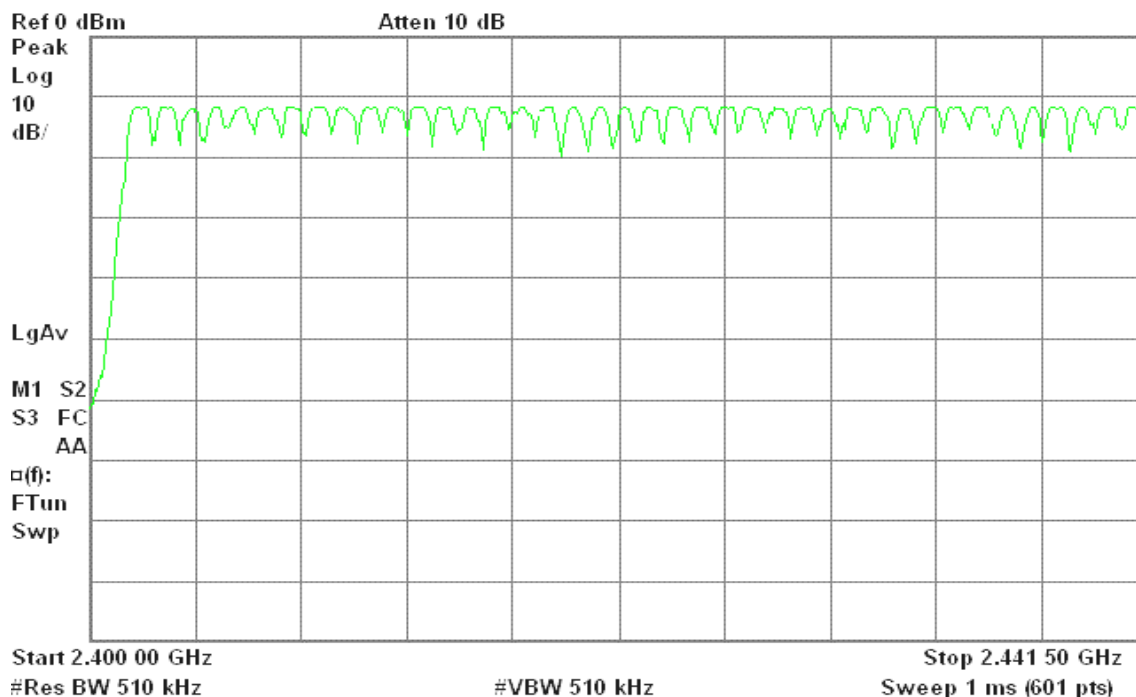
Test Plot

Channel Number

2.4 GHz – 2.4415 GHz

✱ Agilent 16:50:49 Oct 4, 2007

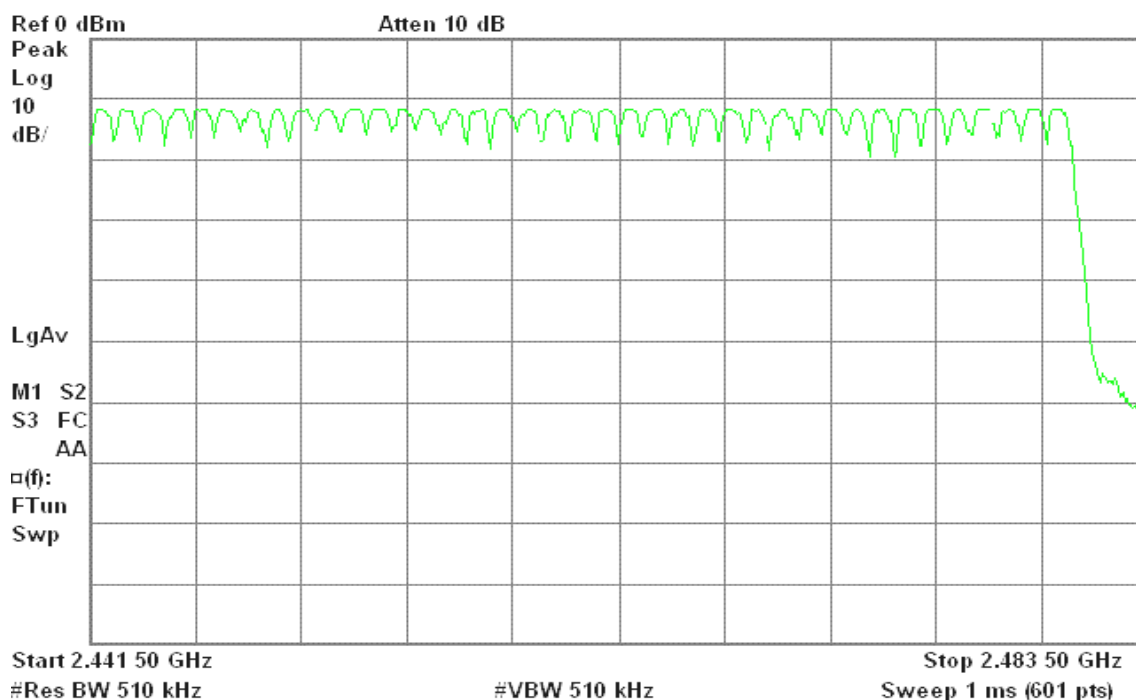
R T



2.4415 GHz – 2.4835 GHz

✱ Agilent 16:51:28 Oct 4, 2007

R T



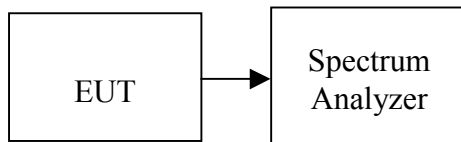


7.6 TIME OF OCCUPANCY (DWELL TIME)

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 Data

DH 1

CH Low: $0.4193 * (1600/2)/79 * 31.6 = 134.176$ (ms)

CH Mid: $0.4193 * (1600/2)/79 * 31.6 = 134.176$ (ms)

CH High: $0.4193 * (1600/2)/79 * 31.6 = 134.176$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.4193	134.176	31.60	400.00	PASS
Mid	0.4193	134.176	31.60		PASS
High	0.4193	134.176	31.60		PASS

DH 3

CH Low: $1.666 * (1600/4)/79 * 31.6 = 266.56$ (ms)

CH Mid: $1.666 * (1600/4)/79 * 31.6 = 266.56$ (ms)

CH High: $1.677 * (1600/4)/79 * 31.6 = 268.32$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.666	266.56	31.60	400.00	PASS
Mid	1.666	266.56	31.60		PASS
High	1.677	268.3	31.60		PASS

DH 5

CH Low: $2.913 * (1600/6)/79 * 31.6 = 310.72$ (ms)

CH Mid: $2.924 * (1600/6)/79 * 31.6 = 311.89$ (ms)

CH High: $2.924 * (1600/6)/79 * 31.6 = 315.73$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.913	310.72	31.60	400.00	PASS
Mid	2.924	311.89	31.60		PASS
High	2.924	311.89	31.60		PASS



Test Plot

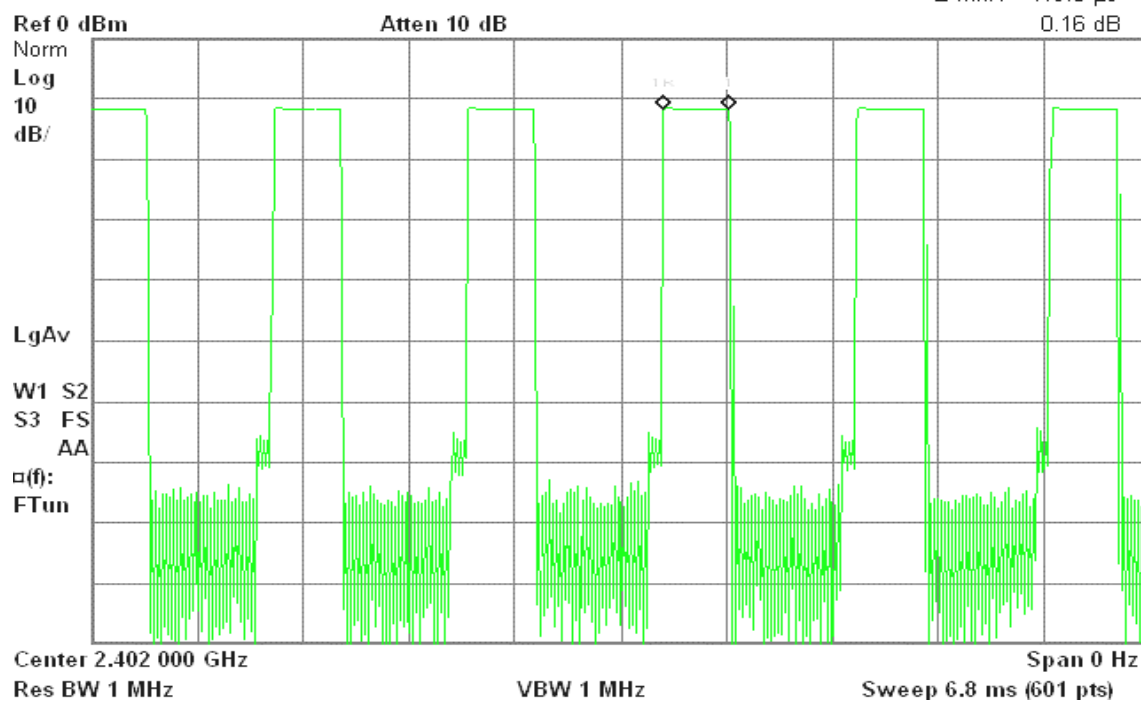
DH 1

(CH Low)

Agilent 16:40:54 Oct 4, 2007

R T

Δ Mkr1 419.3 μ s
0.16 dB

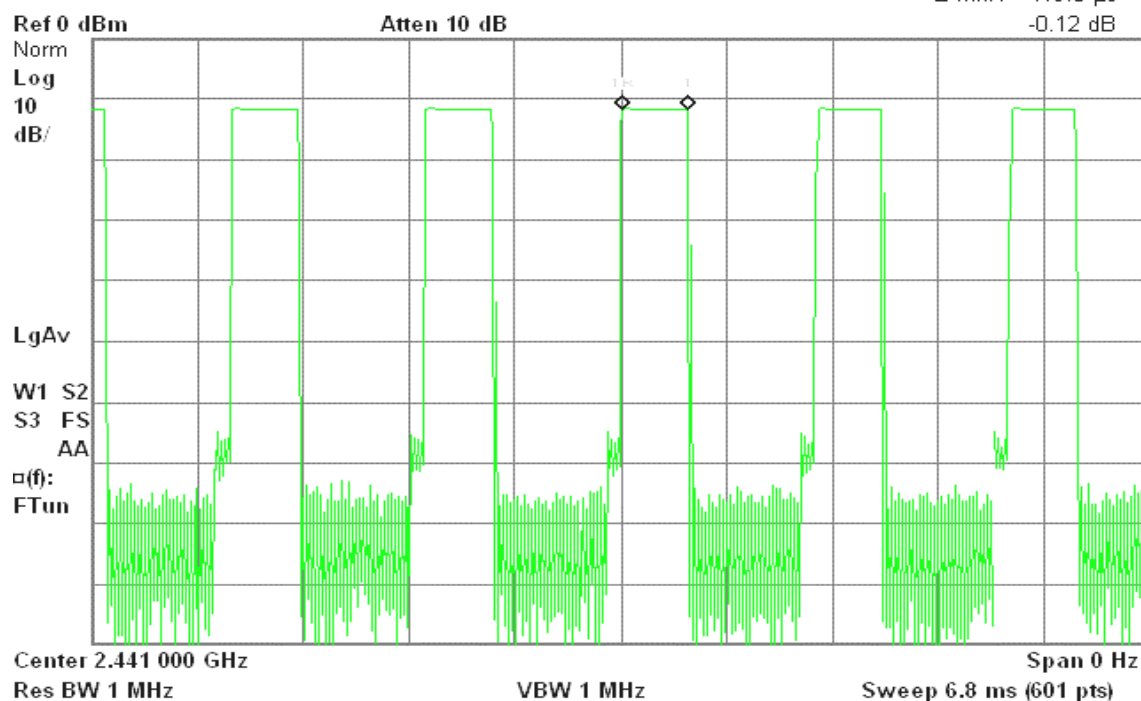


(CH Mid)

Agilent 16:41:26 Oct 4, 2007

R T

Δ Mkr1 419.3 μ s
-0.12 dB



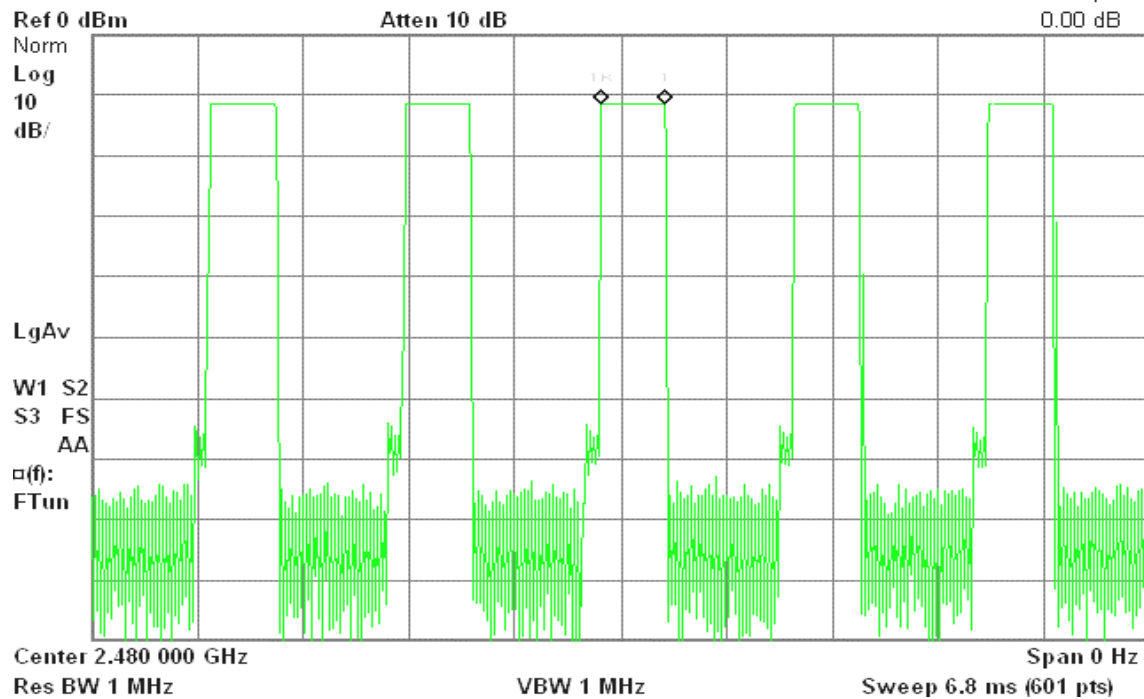


(CH High)

Agilent 16:41:55 Oct 4, 2007

R T

Δ Mkr1 419.3 μ s
0.00 dB



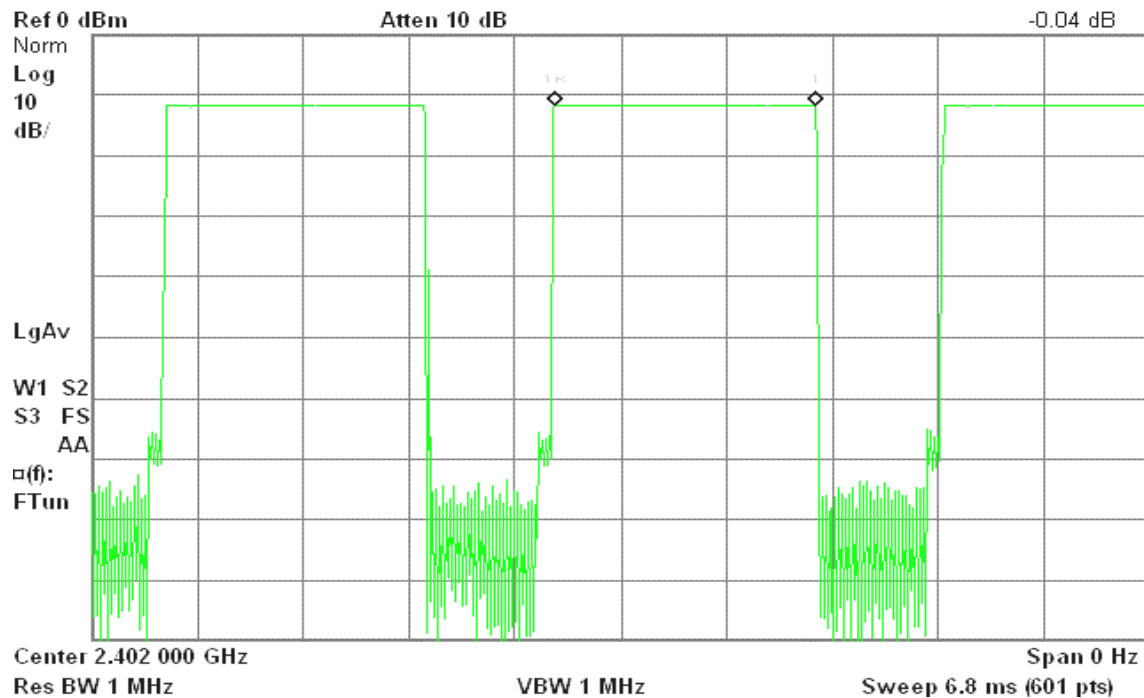
DH 3

(CH Low)

Agilent 16:43:42 Oct 4, 2007

R T

Δ Mkr1 1.666 ms
-0.04 dB



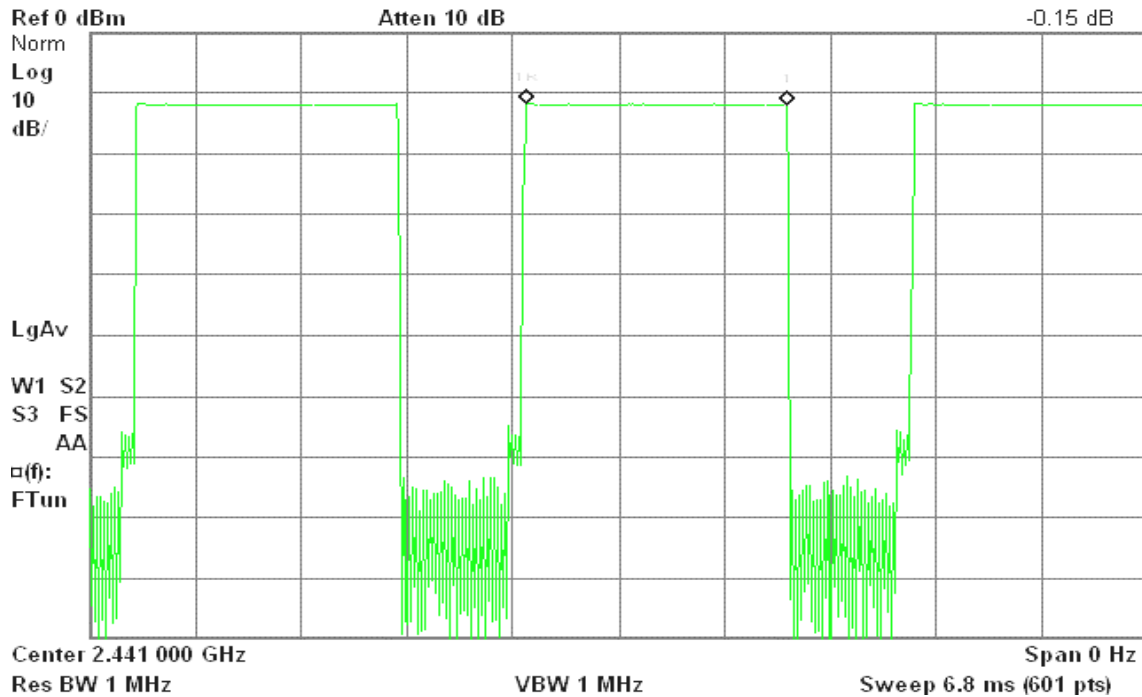


(CH Mid)

Agilent 16:43:17 Oct 4, 2007

R T

Δ Mkr1 1.666 ms
-0.15 dB

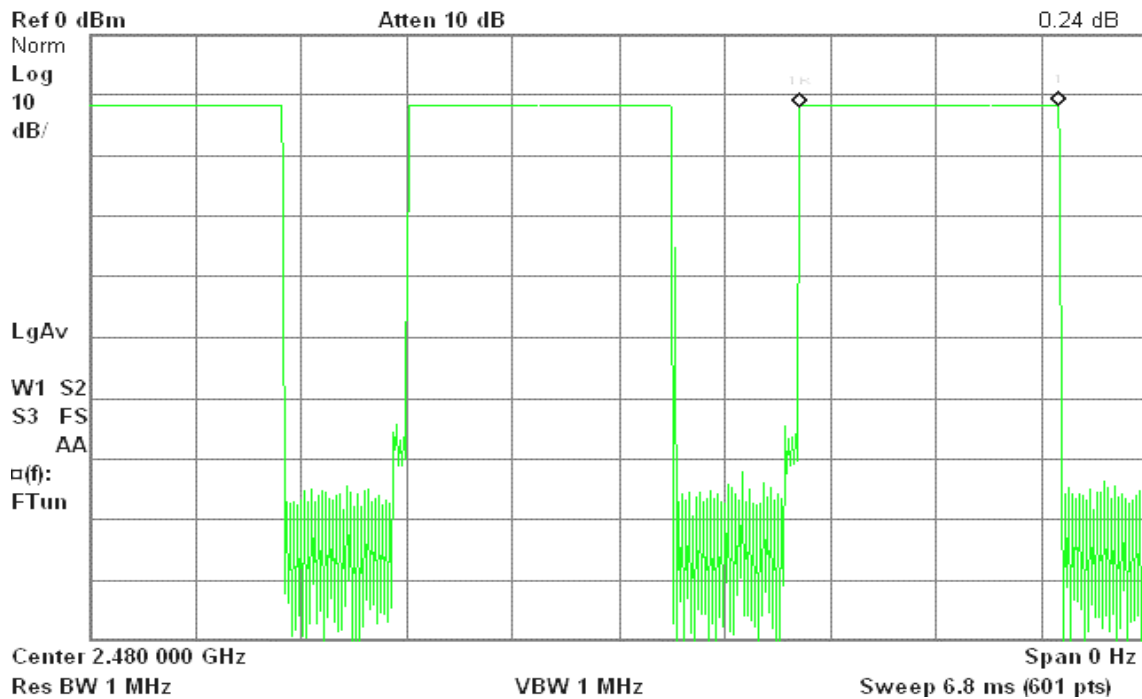


(CH High)

Agilent 16:42:49 Oct 4, 2007

R T

Δ Mkr1 1.677 ms
0.24 dB





DH 5

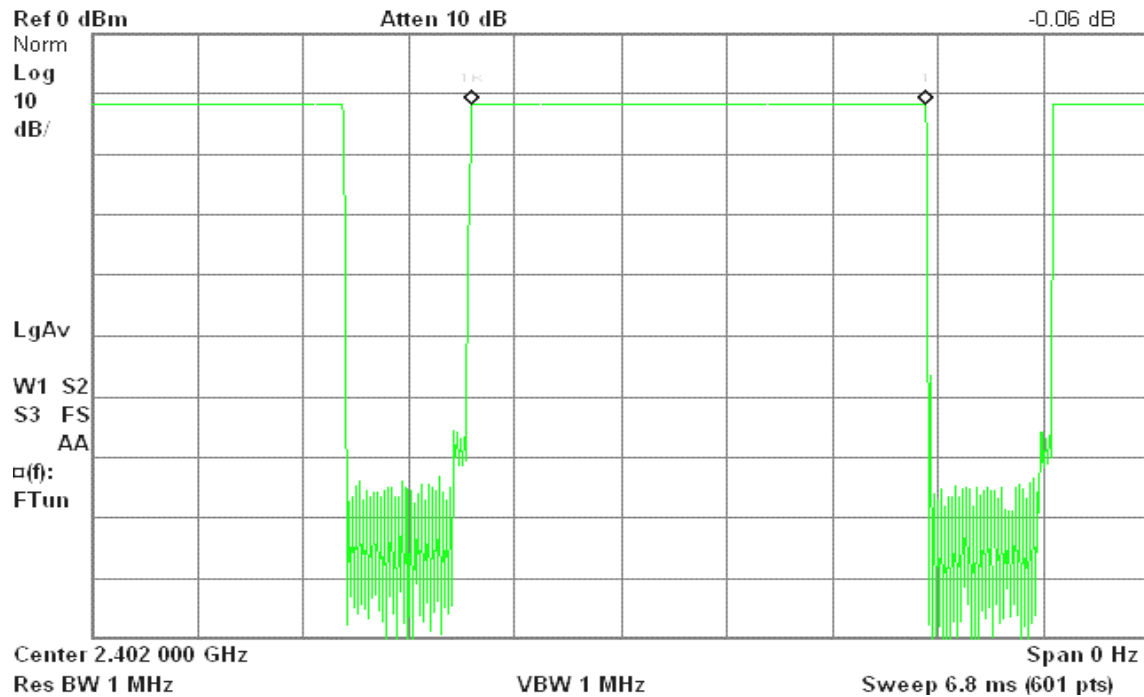
(CH Low)

Agilent 16:44:10 Oct 4, 2007

R T

Δ Mkr1 2.913 ms

-0.06 dB



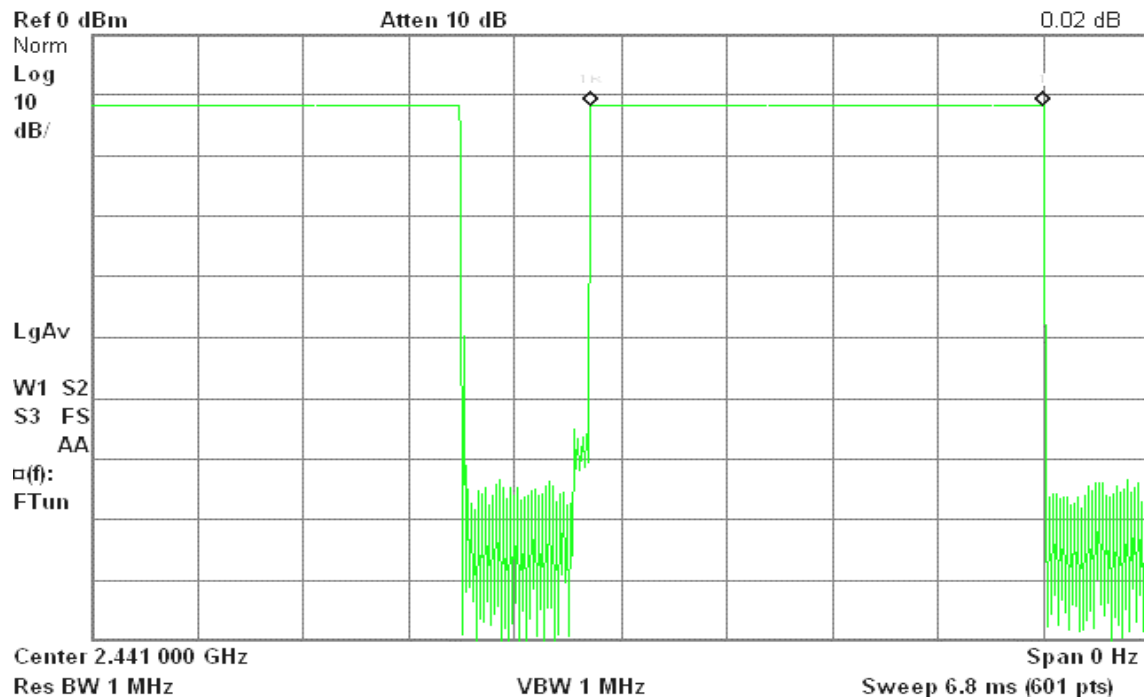
(CH Mid)

Agilent 16:44:38 Oct 4, 2007

R T

Δ Mkr1 2.924 ms

0.02 dB



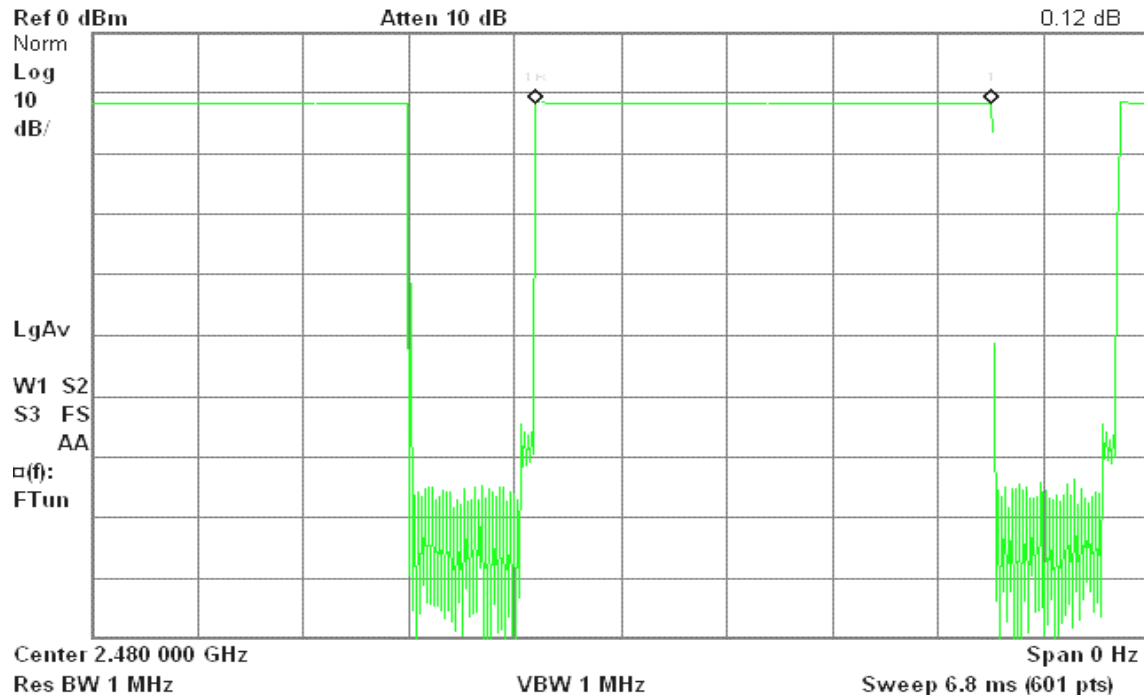


(CH High)

Agilent 16:45:07 Oct 4, 2007

R T

Δ Mkr1 2.924 ms
0.12 dB





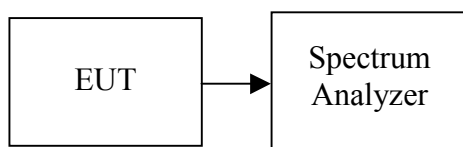
7.7 SPURIOUS EMISSIONS

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 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

No non-compliance noted

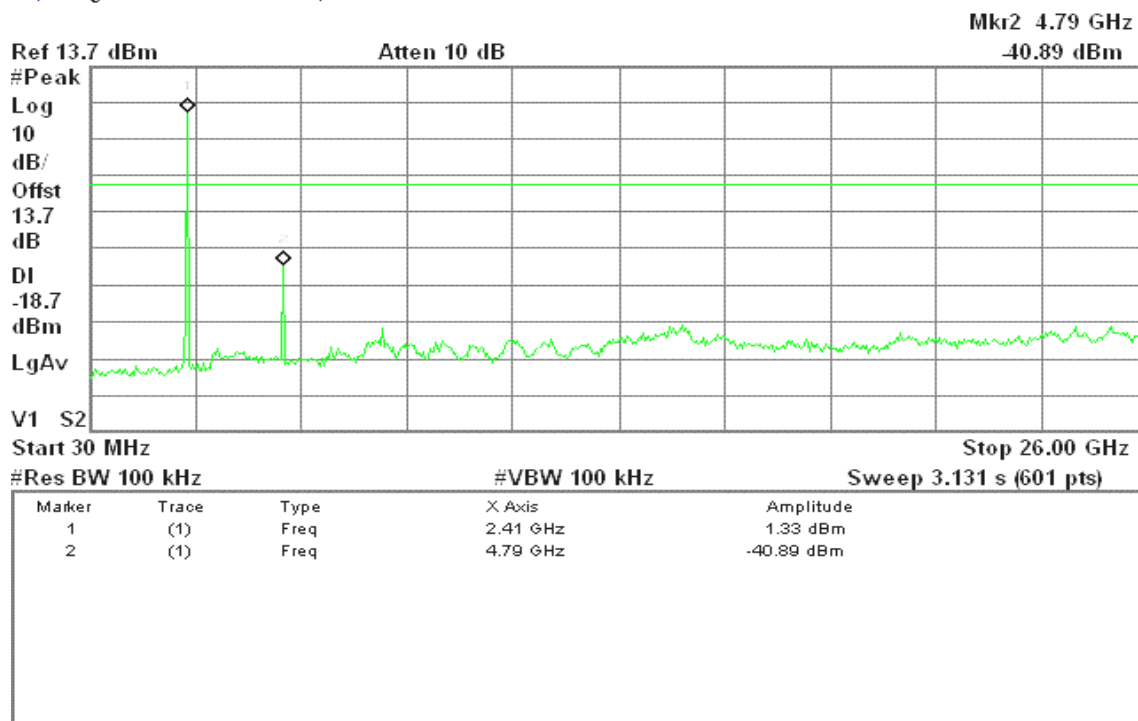


Test Plot

CH Low

Agilent 17:11:22 Oct 4, 2007

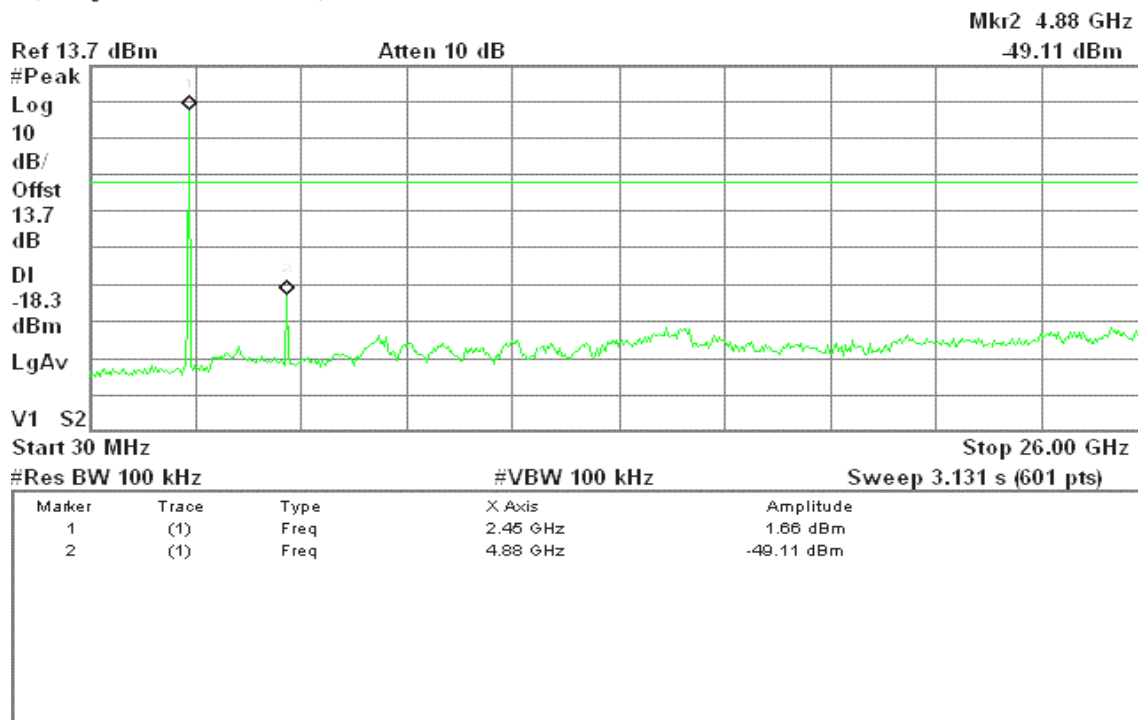
R T



CH Mid

Agilent 17:10:13 Oct 4, 2007

R T

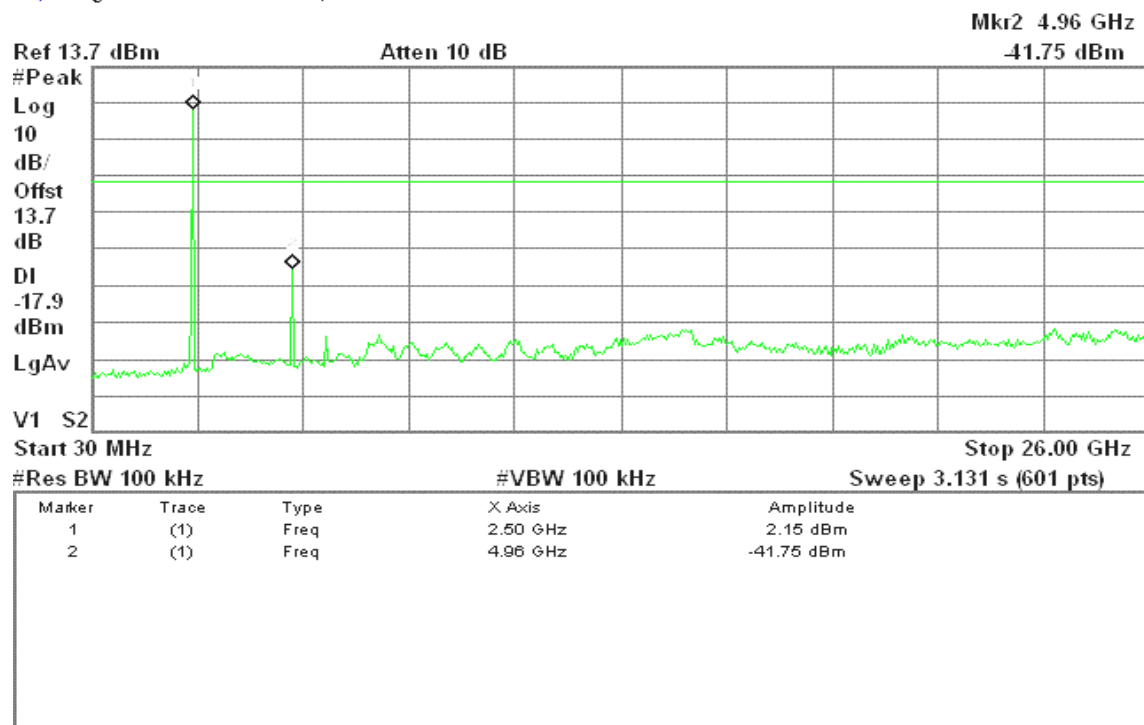




CH High

Agilent 17:09:10 Oct 4, 2007

R T





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

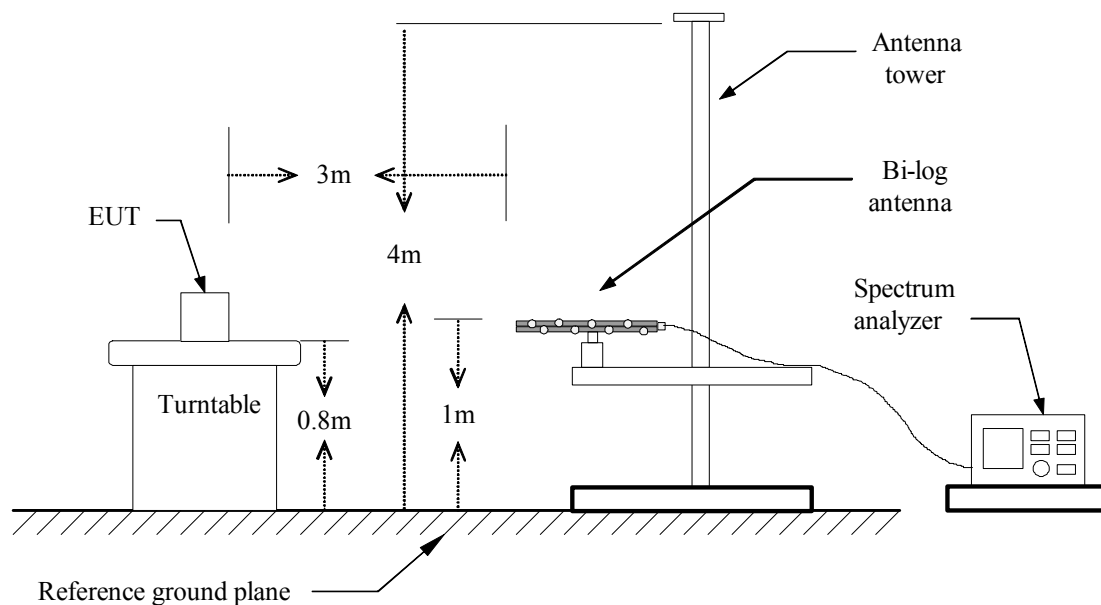
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

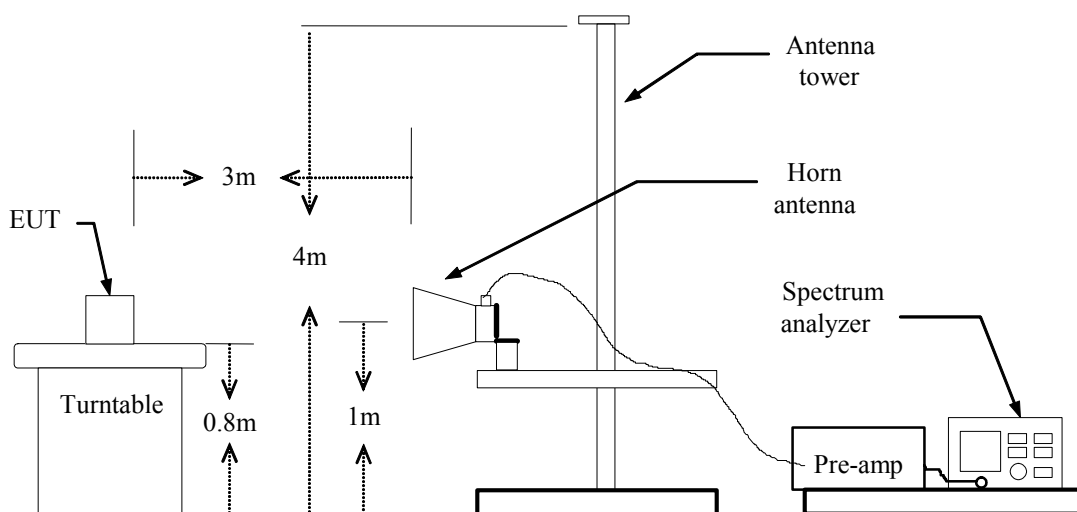
Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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***No non-compliance noted***Below 1 GHz****Operation Mode:** Normal Link**Test Date:** October 16, 2007**Temperature:** 25°C**Tested by:** Ryan Chen**Humidity:** 50 % 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
30.00	V	40.43	-4.65	35.78	40.00	-4.22	Peak
80.12	V	44.67	-19.00	25.67	40.00	-14.33	Peak
175.50	V	50.17	-14.80	35.37	43.50	-8.13	Peak
261.18	V	48.13	-13.84	34.28	46.00	-11.72	Peak
327.47	V	45.60	-11.35	34.25	46.00	-11.75	Peak
422.85	V	37.21	-9.16	28.05	46.00	-17.95	Peak
30.00	H	39.07	-4.65	34.42	40.00	-5.58	Peak
175.50	H	56.46	-14.80	41.66	43.50	-1.84	QP
261.18	H	57.33	-13.84	43.49	46.00	-2.51	QP
270.88	H	51.68	-12.80	38.88	46.00	-7.12	QP
337.17	H	54.23	-11.17	43.06	46.00	-2.94	Peak
413.15	H	45.48	-9.53	35.95	46.00	-10.05	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.*
- 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:** October 11, 2007**Temperature:** 35°C**Tested by:** Ryan Chen**Humidity:** 55 % 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
1606.67	V	51.56	---	-8.91	42.64	---	74.00	54.00	-11.36	Peak
1828.33	V	50.59	---	-6.71	43.88	---	74.00	54.00	-10.12	Peak
N/A										
1606.67	H	52.44	---	-8.91	43.52	---	74.00	54.00	-10.48	Peak
4803.33	H	51.92	---	0.53	52.45	---	74.00	54.00	-1.55	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.
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:** October 11, 2007**Temperature:** 25°C**Tested by:** Ryan Chen**Humidity:** 55 % 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
1758.33	V	52.32	---	-7.41	44.91	---	74.00	54.00	-9.09	Peak
4885.00	V	50.95	---	0.61	51.57	---	74.00	54.00	-2.43	Peak
N/A										
1630.00	H	52.85	---	-8.68	44.17	---	74.00	54.00	-9.83	Peak
4885.00	H	50.83	---	0.61	51.44	---	74.00	54.00	-2.56	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.
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 High**Test Date:** October 11, 2007**Temperature:** 25°C**Tested by:** Ryan Chen**Humidity:** 55 % 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
1676.67	V	52.88	---	-8.22	44.67	---	74.00	54.00	-9.33	Peak
N/A										
1653.33	H	52.75	---	-8.45	44.30	---	74.00	54.00	-9.70	Peak
4955.00	H	50.37	---	0.68	51.05	---	74.00	54.00	-2.95	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.
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).



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 II 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: October 11, 2007

Temperature: 25°C

Tested by: Ryan Chen

Humidity: 55% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.175	50.490	44.290	0.133	50.623	44.423	64.720	54.720	-14.097	-10.297	L1
0.232	43.910	37.500	0.098	44.008	37.598	62.378	52.378	-18.370	-14.780	L1
0.645	26.420	25.470	0.000	26.420	25.470	56.000	46.000	-29.580	-20.530	L1
1.408	28.250	25.800	0.004	28.254	25.804	56.000	46.000	-27.746	-20.196	L1
2.113	21.550	17.770	0.013	21.563	17.783	56.000	46.000	-34.437	-28.217	L1
3.811	29.030	21.370	0.064	29.094	21.434	56.000	46.000	-26.906	-24.566	L1
0.173	50.000	44.560	0.134	50.134	44.694	64.815	54.815	-14.681	-10.121	L2
0.232	42.850	36.640	0.098	42.948	36.738	62.378	52.378	-19.430	-15.640	L2
0.409	31.490	28.480	0.033	31.523	28.513	57.669	47.669	-26.145	-19.155	L2
1.574	30.870	29.580	0.006	30.876	29.586	56.000	46.000	-25.124	-16.414	L2
3.328	25.220	19.780	0.050	25.270	19.830	56.000	46.000	-30.730	-26.170	L2
3.966	33.050	25.920	0.069	33.119	25.989	56.000	46.000	-22.881	-20.011	L2

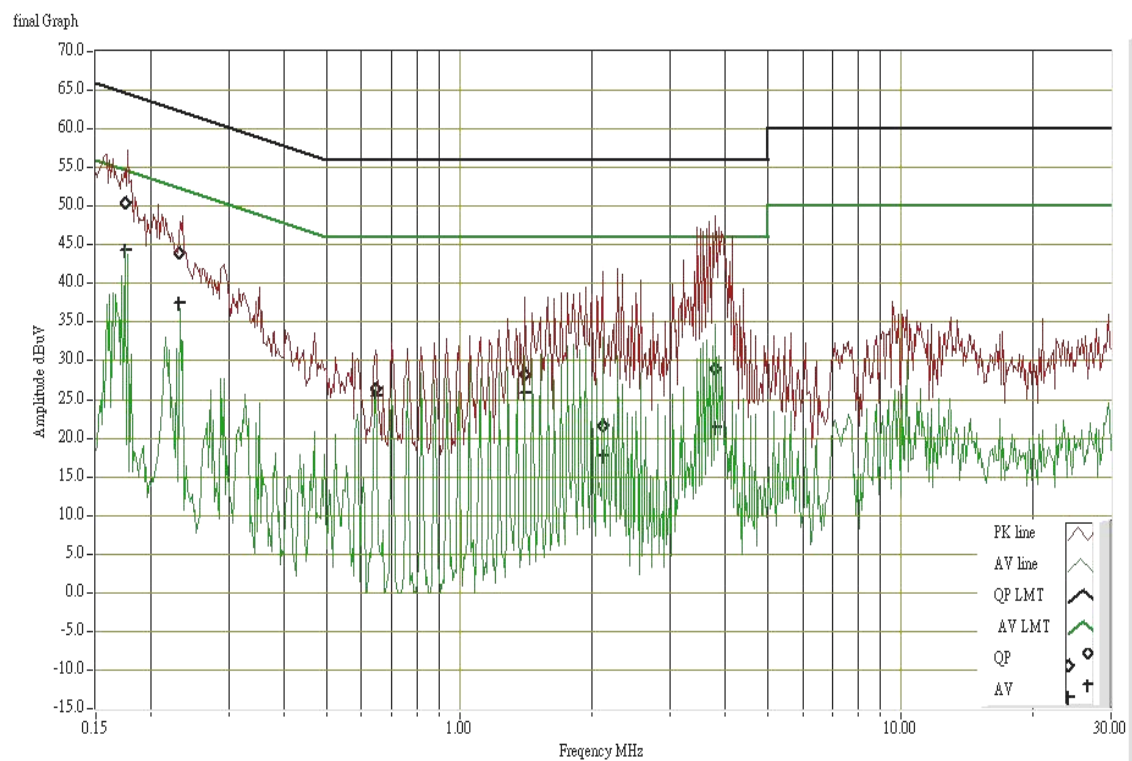
Remark:

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)

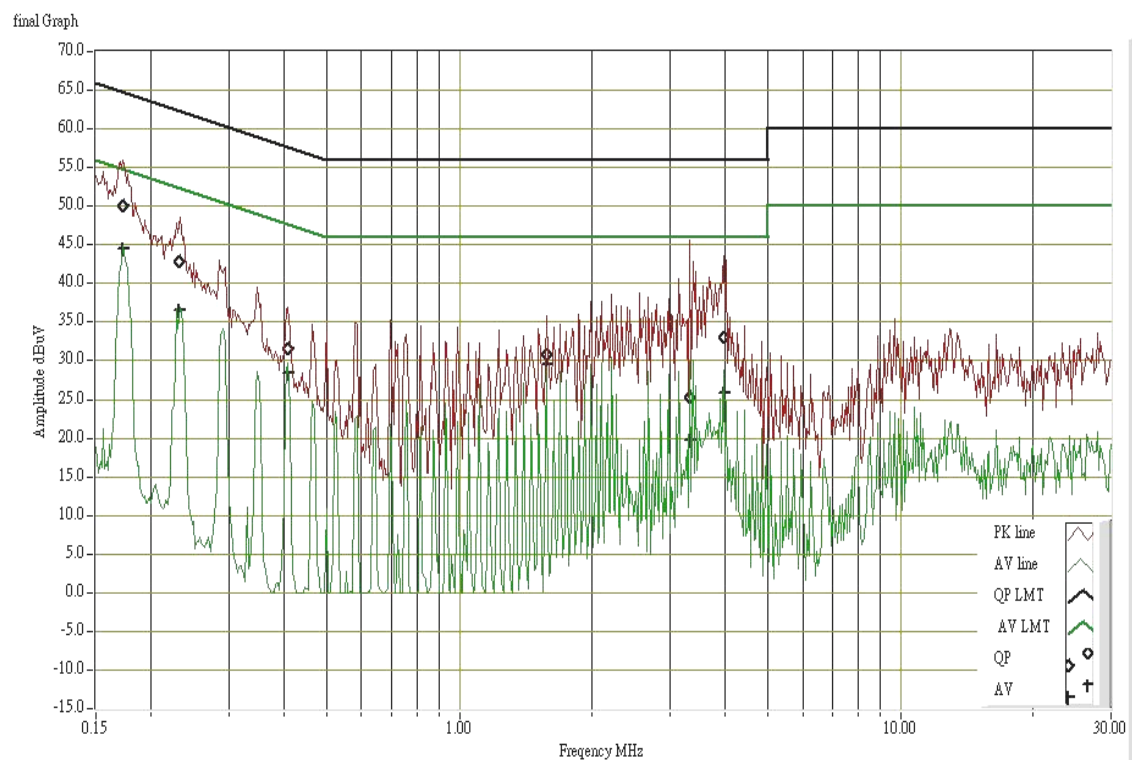


Test Plots

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	WIRELESS CAR CRADLE
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 type="checkbox"/> Portable (<20cm separation) <input checked="" 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	-0.97dBm (0.780mW)
Antenna gain (Max)	0.5 dBi (Numeric gain: 1.12)
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 -0.97dBm (0.780mW) at 2480MHz (with 1.12 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: $60/f_{(GHz)} = 60/2.441 = 24.58mW$)