



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Bluetooth Vibrator

Model: BVC01

Trade Name: Unik

Issued to

Holly Development CO., LTD
3F., No.68, Jhuangjing 3rd Rd. Jhubei City,
Hsinchu County 30264, Taiwan

Issued by



Compliance Certification Services Inc.
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1. TEST RESULT CERTIFICATION

Applicant: Holly Development CO., LTD
3F., No.68, Jhuangjing 3rd Rd. Jhubei City,
Hsinchu County 30264, Taiwan

Equipment Under Test: Bluetooth Vibrator

Trade Name: Unik

Model: BVC01

Date of Test: October 11 ~ 31, 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:

Reviewed by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Amanda Wu
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	Bluetooth Vibrator
Trade Name	Unik
Model Number	BVC01
Model Discrepancy	N/A
Power Supply	1. Powered from host device 2. HECCELL Lithium Ion Polymer Battery Model: H501721 Rating: 3.7V, 120mAh
Frequency Range	2402 ~ 2480 MHz
Transmit Power	1.26 dBm
Modulation Technique	GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
Transmit Data Rate	1, 2, 3Mbps
Number of Channels	79 Channels
Antenna Specification	Gain: 0 dBi
Antenna Designation	Multilayer 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: **VFJ-UNIK-001** 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: BVC01) had been tested under operating condition.

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

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.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis).

Following channels were selected for the for radiated emission testing only as listed below:

Tested Channel	Modulation Type	Packet Type	Data Rate	Axis
Low, Mid, High	GFSK	DH 5	1	X
Low, Mid, High	8DPSK	DH 5	3	X



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	06/05/2008
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	10/30/2008
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/12/2008
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/01/2008
ISN 9kHz-30MHz	FCC	FCC-TLISN-T4	20167	09/21/2008
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	VCCI R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328, 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 II 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.	PC	HP	PL926AV	SGH528048P	FCC DoC	N/A	Unshielded, 1.8m
2.	Notebook PC	Dell	PP05L	7T390 A03	E2K5HCKT	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
3.	LCD Monitor	ASUS	PW201	64L9447786	FCC DoC	Shielded, 1.8m with 2 cores	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
4.	LCD Monitor	Samsung	173P	D117H4JXB04968Y	FCC DoC	Shielded, 1.8m with 2 cores	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
5.	USB Keyboard	Dell	Sk-8115	N/A	FCC DoC	Shielded, 1.8m	N/A
6.	USB Mouse	Dell	MO56UO	408031121	FCC DoC	Shielded, 1.8m	N/A
7.	USB Mouse	HP	MO19UCA	20440964	FCC DoC	Shielded, 1.8m	N/A
8.	Printer	EPSON	STYLUS C60	DR3K041515	FCC DoC	Shielded, 1.8m	Unshielded, 1.8m
9.	Multimedia Earphone	Labtec	Axis-301	N/A	FCC DoC	Unshielded, 1.8m	N/A
10.	Modem	ACEEX	DM-1414	304012269	IFAXDM1414	Shielded, 1.8m	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

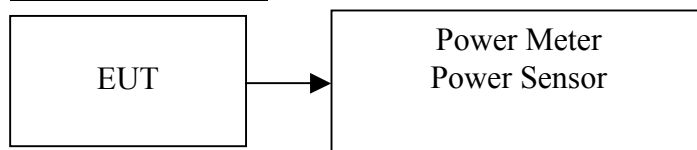
7.1 PEAK POWER

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****For GFSK**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	1.26	0.0013	0.125	PASS
Mid	2441	-0.12	0.0010		PASS
High	2480	-0.54	0.0009		PASS

For 8DPSK

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	0.89	0.0012	0.125	PASS
Mid	2441	-0.43	0.0009		PASS
High	2480	-0.58	0.0009		PASS

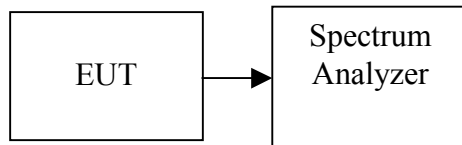


7.2 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

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

TEST RESULTS

No non-compliance noted.

Test Data

For GFSK

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-0.78	0.0008
Mid	2441	-1.19	0.0008
High	2480	-1.66	0.0007

For 8DPSK

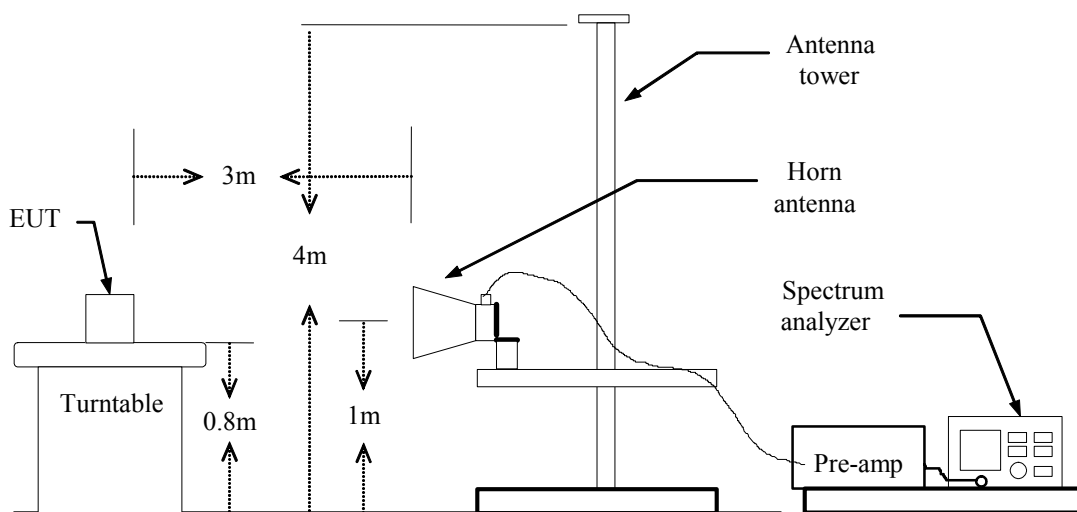
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-0.65	0.0009
Mid	2441	-1.12	0.0008
High	2480	-1.46	0.0007

7.3 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.

**For GFSK****Band Edges (CH Low)****Detector mode: Peak****Polarity: Vertical**

* Agilent 11:40:35 Oct 17, 2007

R T

Mkr1 2.390 00 GHz
45.05 dB μ VRef 99.99 dB μ V

#Atten 0 dB

Peak

Log

10

dB/

Offst

3

dB

DI

74.0

dB μ V

LgAv

M1 S2

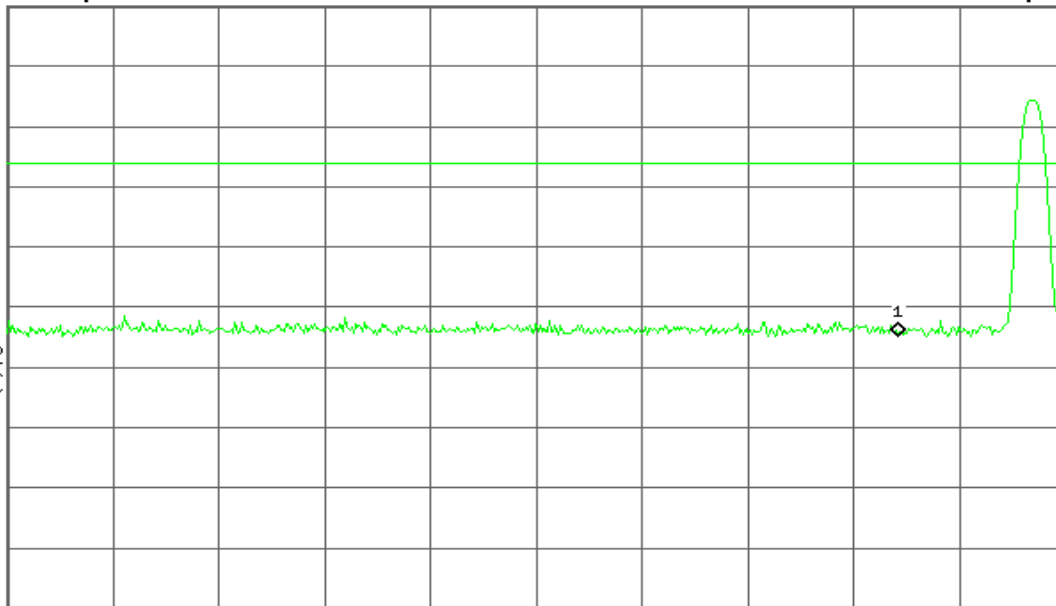
S3 FC

A

 $\mathcal{E}(f)$:

FTun

Swp



Start 2.310 00 GHz

Stop 2.405 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Detector mode: Average**Polarity: Vertical**

* Agilent 11:40:21 Oct 17, 2007

R T

Mkr1 2.390 00 GHz
34.50 dB μ VRef 99.99 dB μ V

#Atten 0 dB

Peak

Log

10

dB/

Offst

3

dB

DI

54.0

dB μ V

LgAv

M1 S2

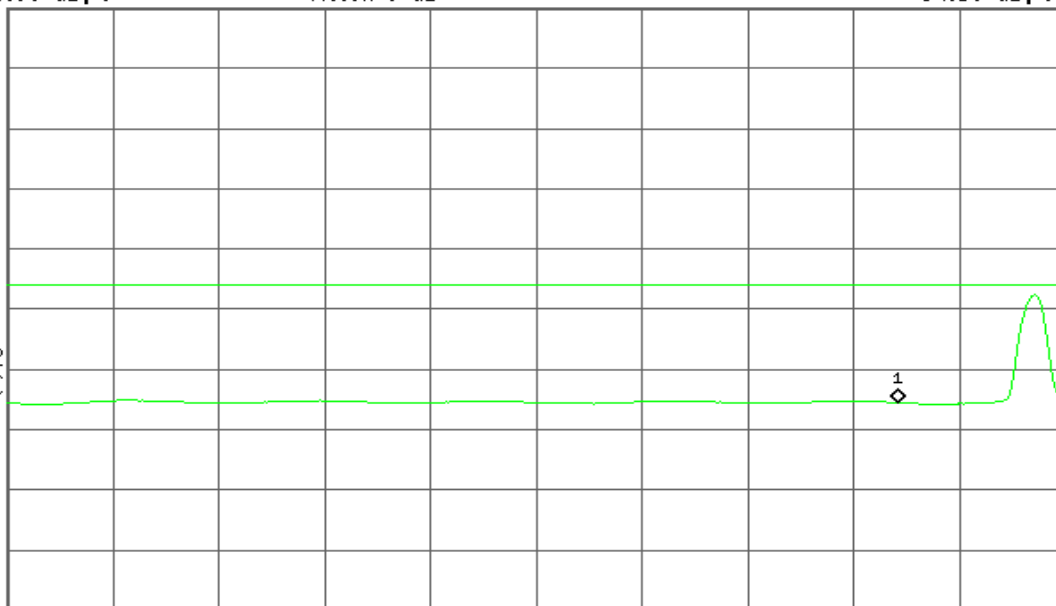
S3 FC

A

 $\mathcal{E}(f)$:

FTun

Swp



Start 2.310 00 GHz

Stop 2.405 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 7.408 s (601 pts)

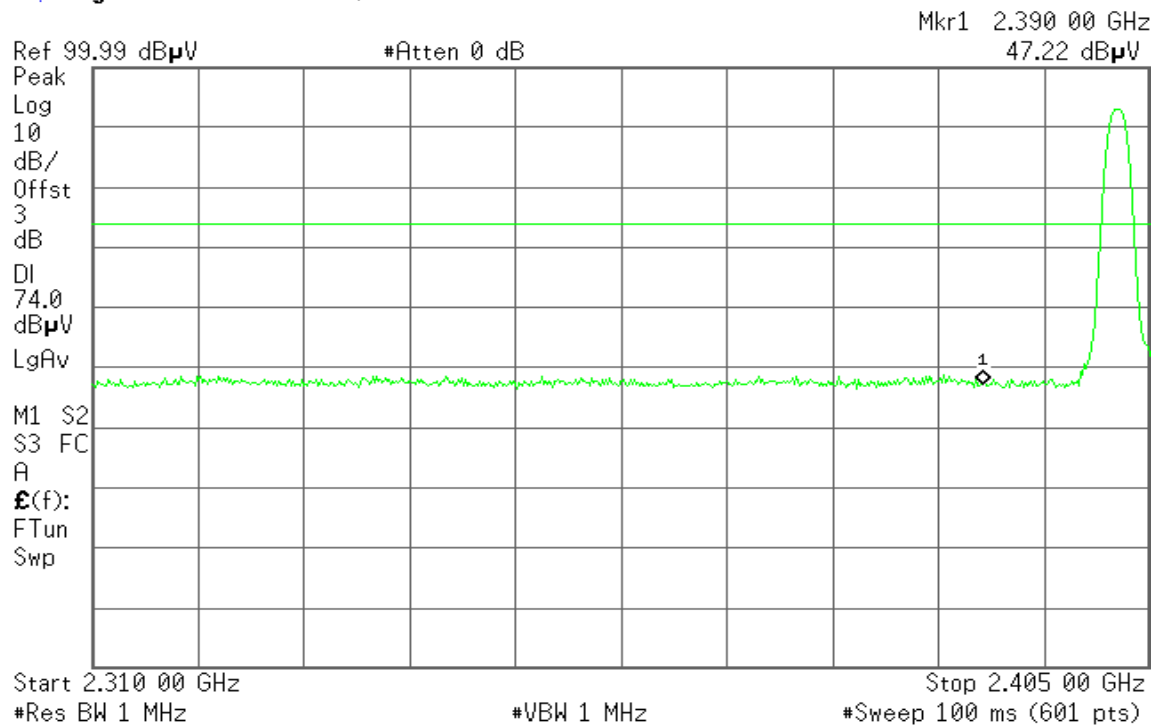


Detector mode: Peak

Polarity: Horizontal

* Agilent 11:44:03 Oct 17, 2007

R L

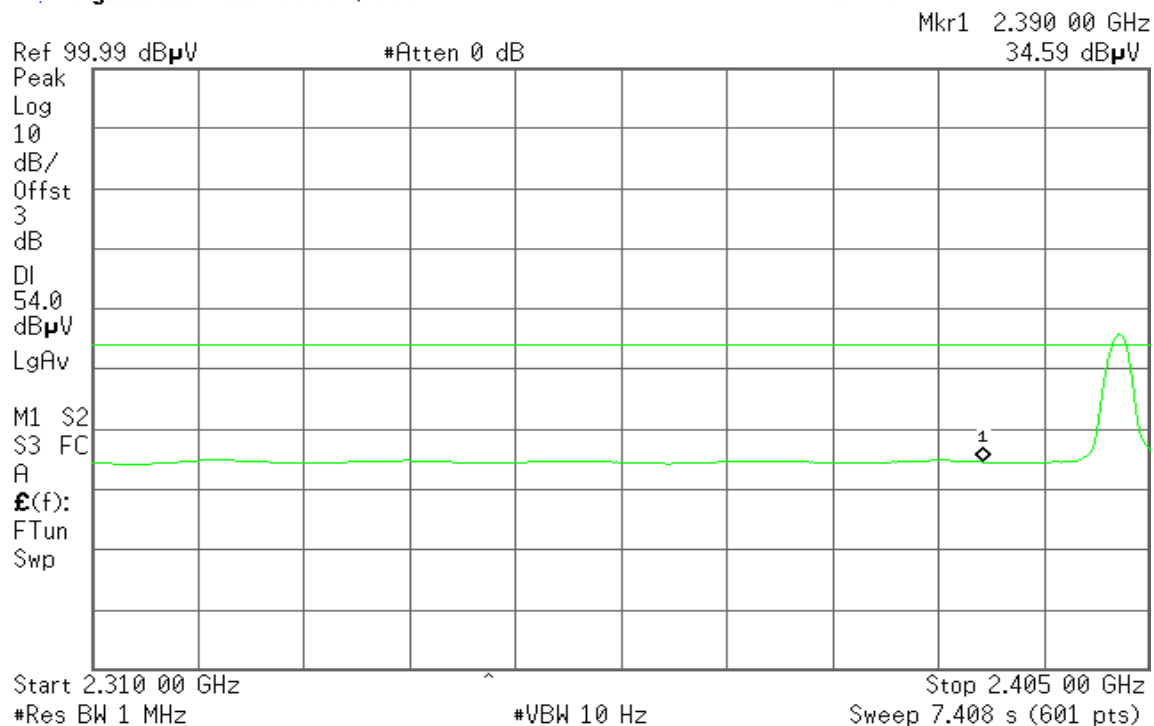


Detector mode: Average

Polarity: Horizontal

* Agilent 11:44:21 Oct 17, 2007

R T





Band Edges (CH High)

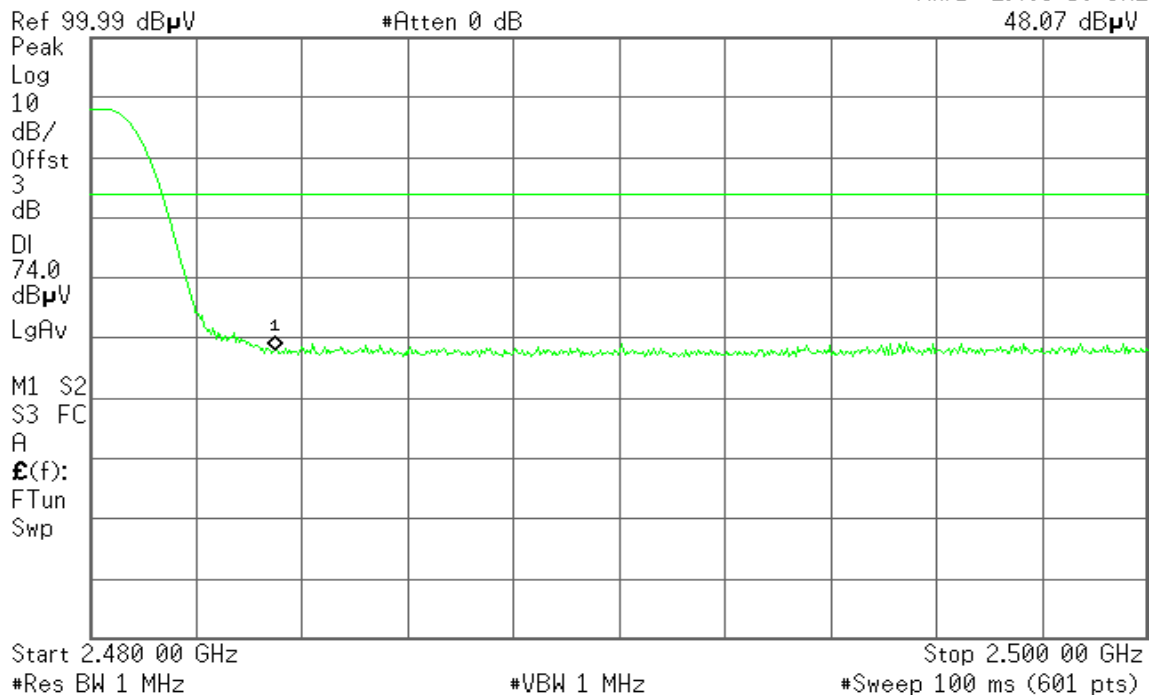
Detector mode: Peak

Polarity: Vertical

Agilent 11:52:04 Oct 17, 2007

R T

Mkr1 2.483 50 GHz
48.07 dB μ V



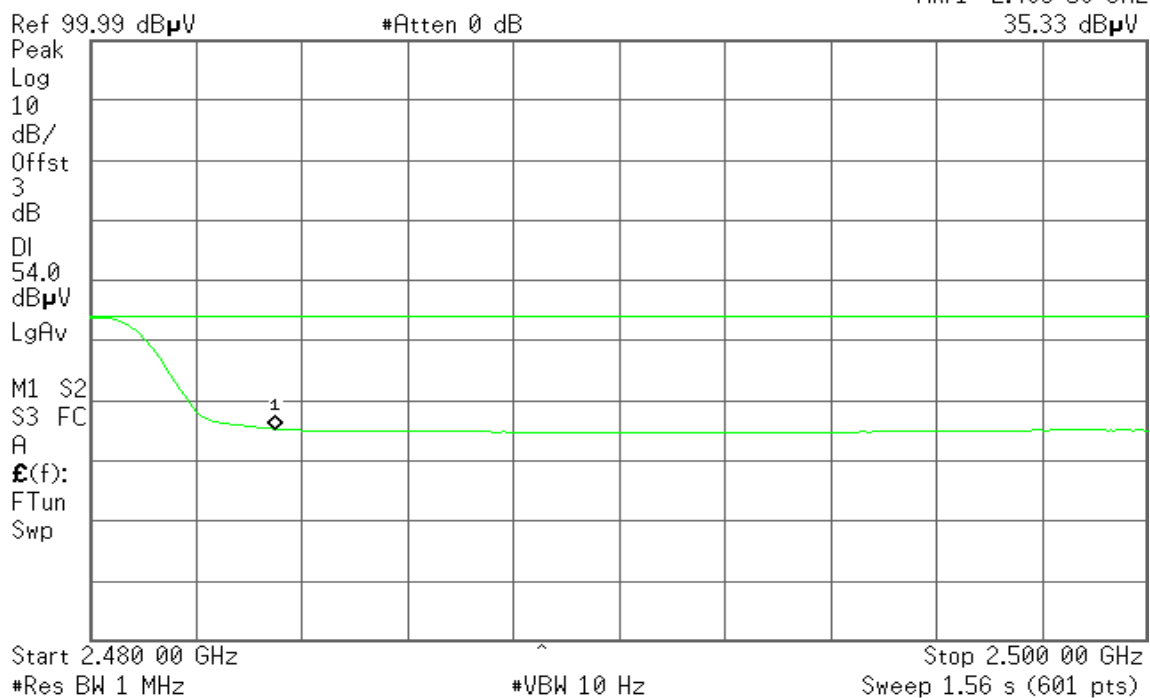
Detector mode: Average

Polarity: Vertical

Agilent 11:52:22 Oct 17, 2007

R T

Mkr1 2.483 50 GHz
35.33 dB μ V





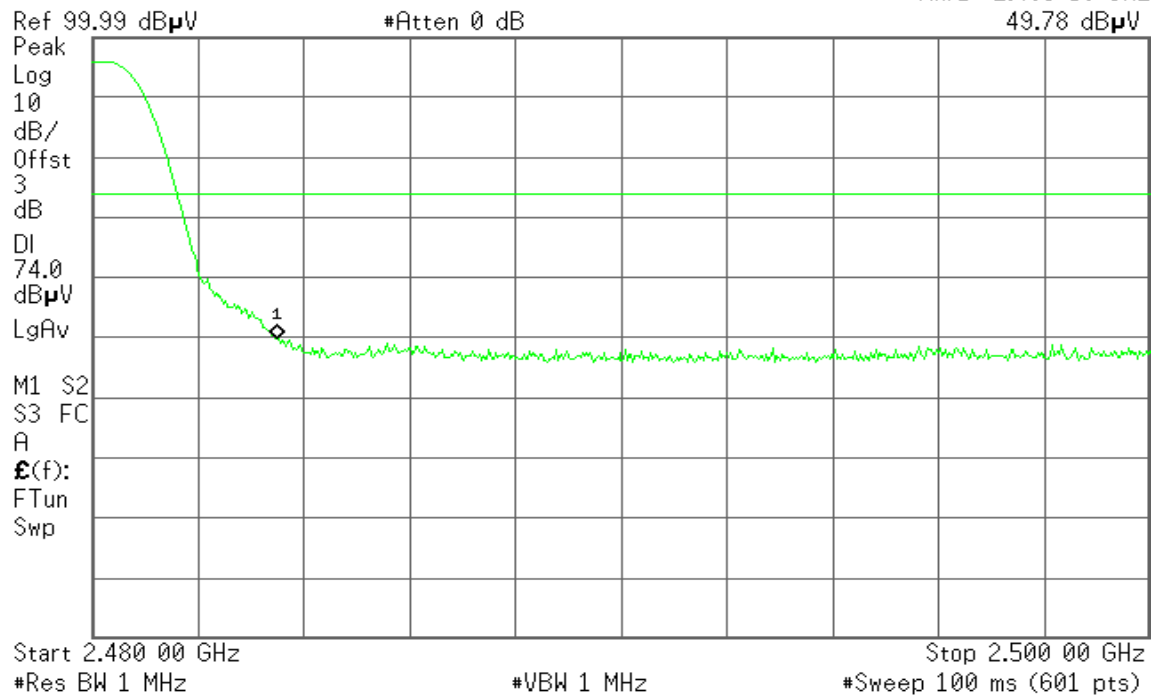
Detector mode: Peak

Polarity: Horizontal

Agilent 11:49:22 Oct 17, 2007

R T

Mkr1 2.483 50 GHz
49.78 dB μ V



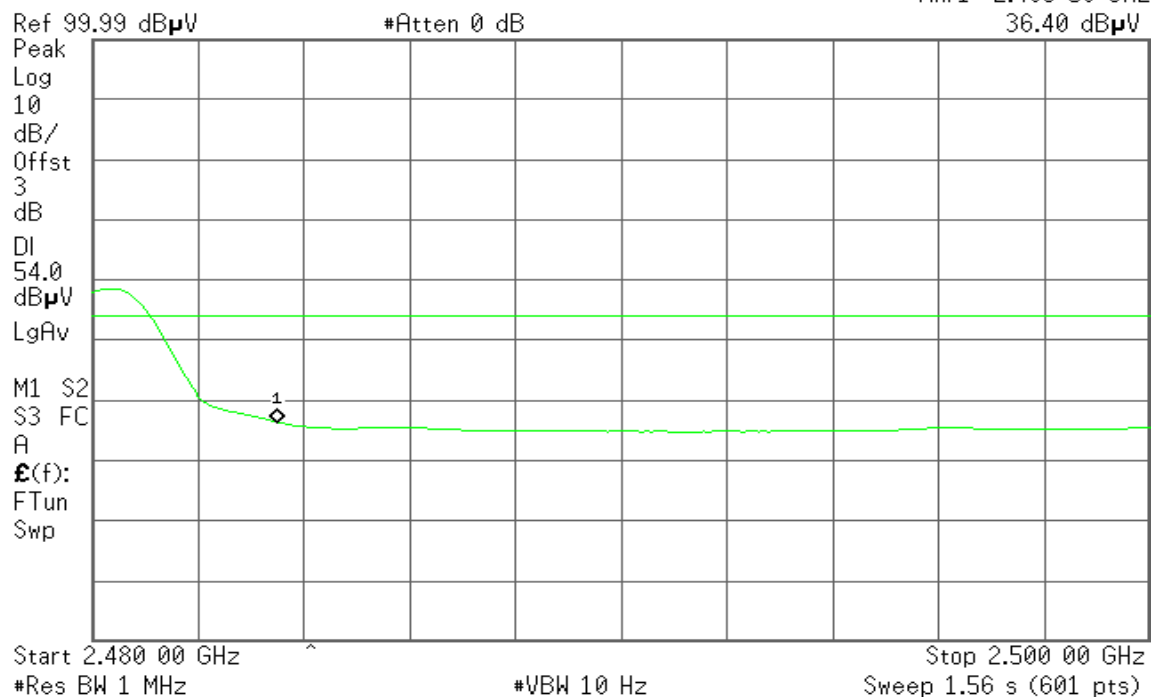
Detector mode: Average

Polarity: Horizontal

Agilent 11:49:05 Oct 17, 2007

R T

Mkr1 2.483 50 GHz
36.40 dB μ V





For 8DPSK

Band Edges (CH Low)

Detector mode: Peak

Polarity: Vertical

Agilent 18:53:52 Oct 30, 2007

R T

Mkr1 2.390 00 GHz
46.61 dB μ V

Ref 99.99 dB μ V

#Atten 0 dB

Peak

Log

10

dB/

Offst

3

dB

DI

74.0

dB μ V

LgAv

M1 S2

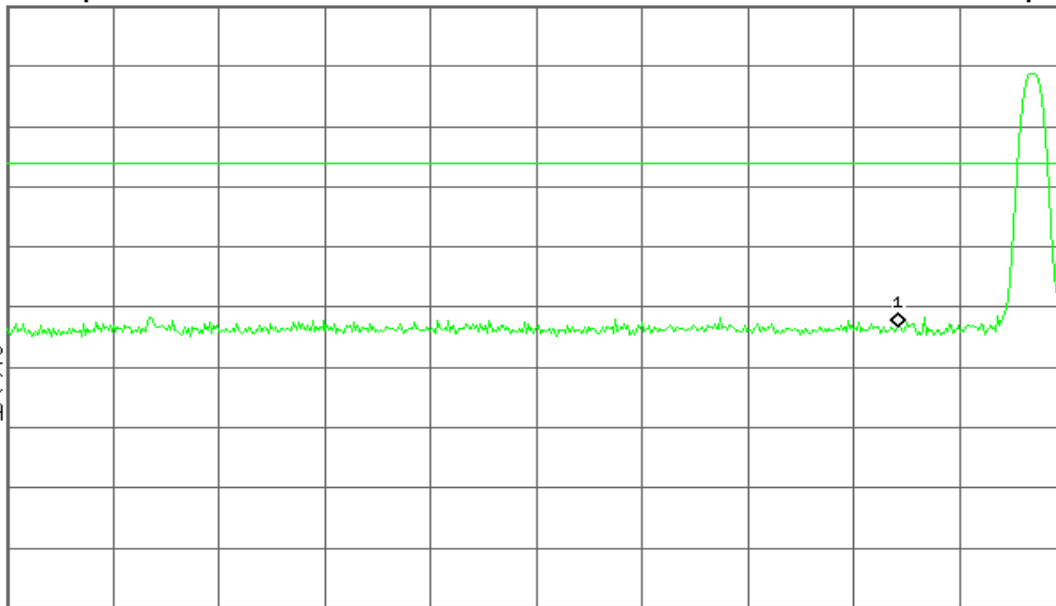
S3 FC

A AA

$\mathcal{E}(f)$:

FTun

Swp



Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.405 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Vertical

Agilent 18:54:10 Oct 30, 2007

R T

Mkr1 2.390 00 GHz
34.61 dB μ V

Ref 99.99 dB μ V

#Atten 0 dB

Peak

Log

10

dB/

Offst

3

dB

DI

54.0

dB μ V

LgAv

M1 S2

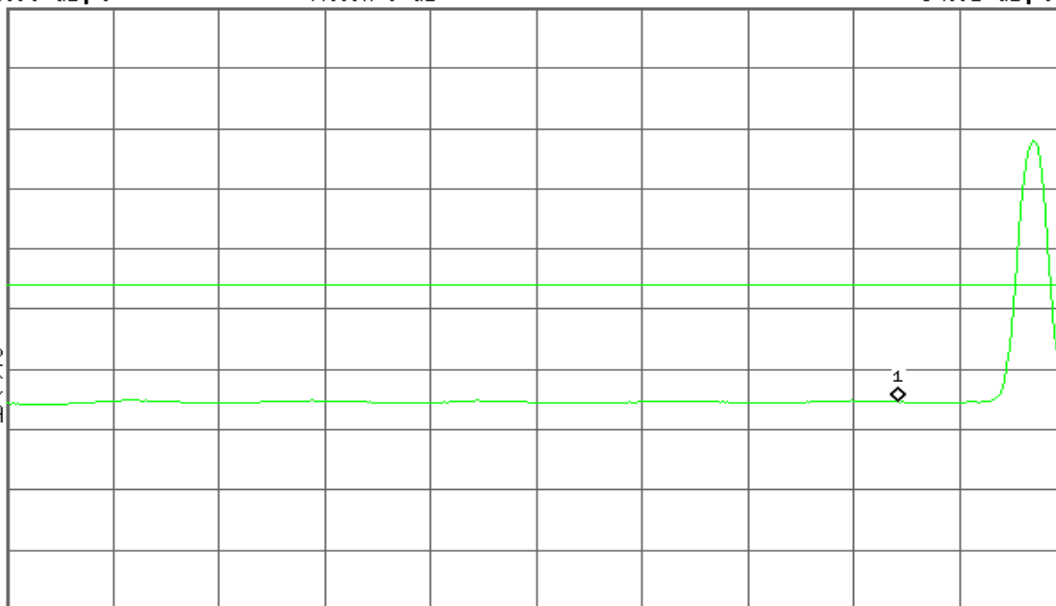
S3 FC

A AA

$\mathcal{E}(f)$:

FTun

Swp



Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.405 00 GHz

Sweep 7.408 s (601 pts)



Detector mode: Peak

Polarity: Horizontal

* Agilent 18:51:59 Oct 30, 2007

R T

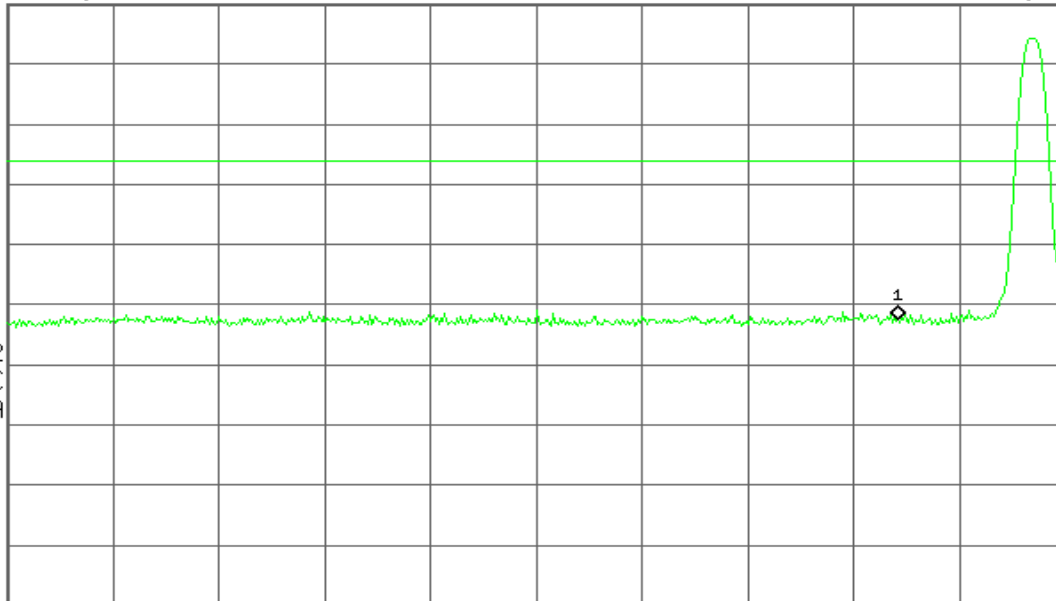
Mkr1 2.390 00 GHz
47.51 dB μ V

Ref 99.99 dB μ V

#Atten 0 dB

Peak
Log
10
dB/
Offst
3
dB
DI
74.0
dB μ V
LgAv

M1 S2
S3 FC
A AA
E(f):
FTun
Swp



Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.405 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

* Agilent 18:52:21 Oct 30, 2007

R T

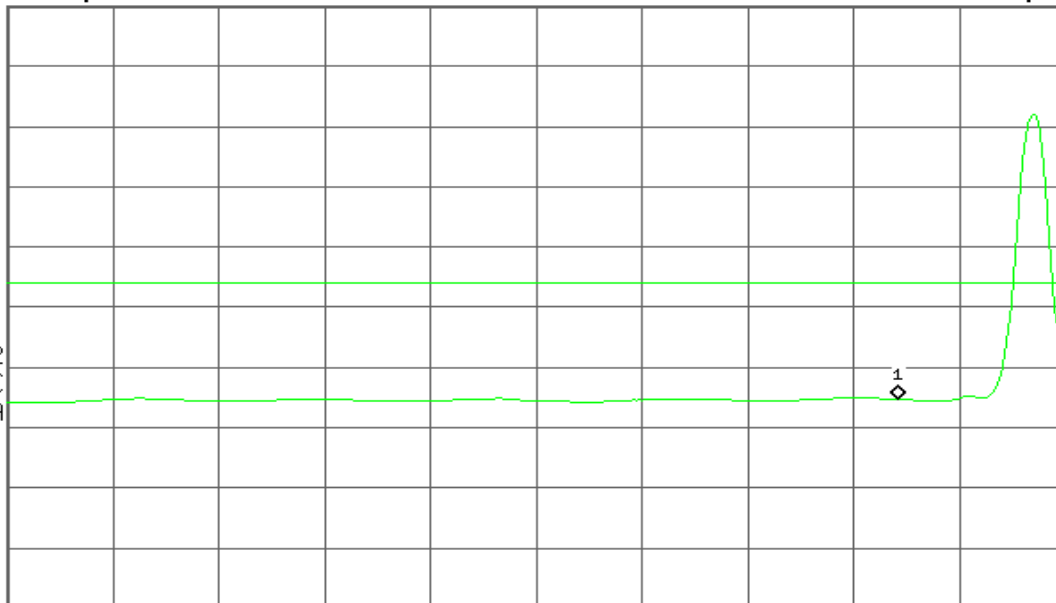
Mkr1 2.390 00 GHz
34.81 dB μ V

Ref 99.99 dB μ V

#Atten 0 dB

Peak
Log
10
dB/
Offst
3
dB
DI
54.0
dB μ V
LgAv

M1 S2
S3 FC
A AA
E(f):
FTun
Swp



Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.405 00 GHz

Sweep 7.408 s (601 pts)



Band Edges (CH High)

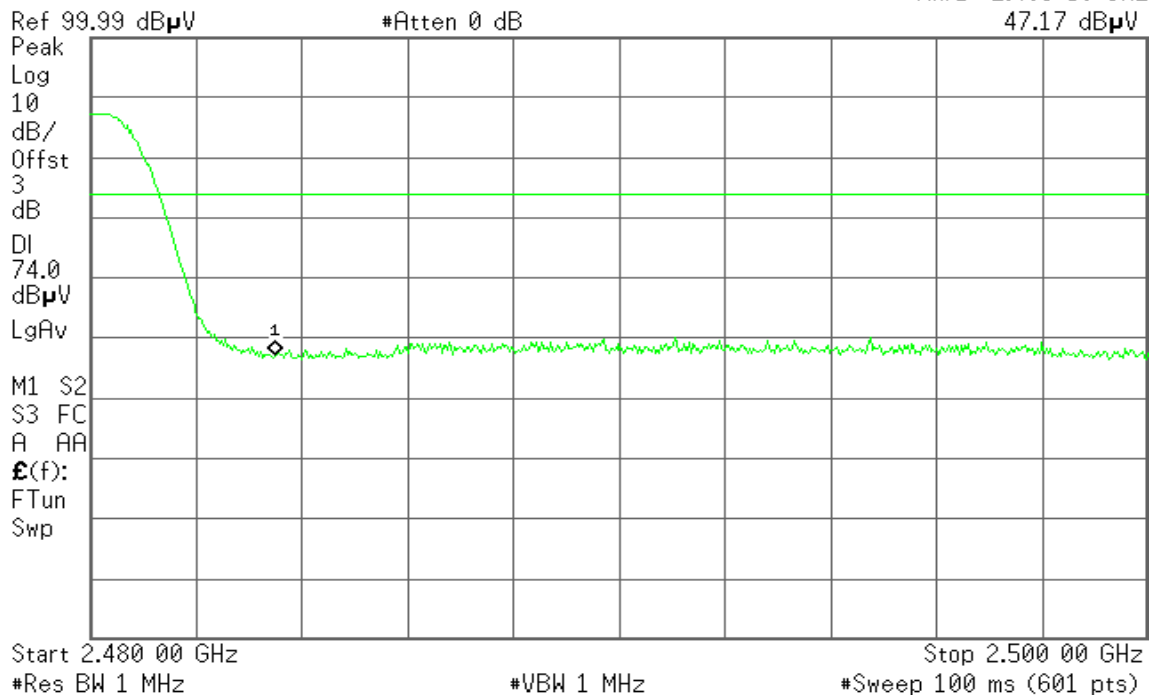
Detector mode: Peak

Polarity: Vertical

Agilent 18:58:02 Oct 30, 2007

R T

Mkr1 2.483 50 GHz
47.17 dB μ V



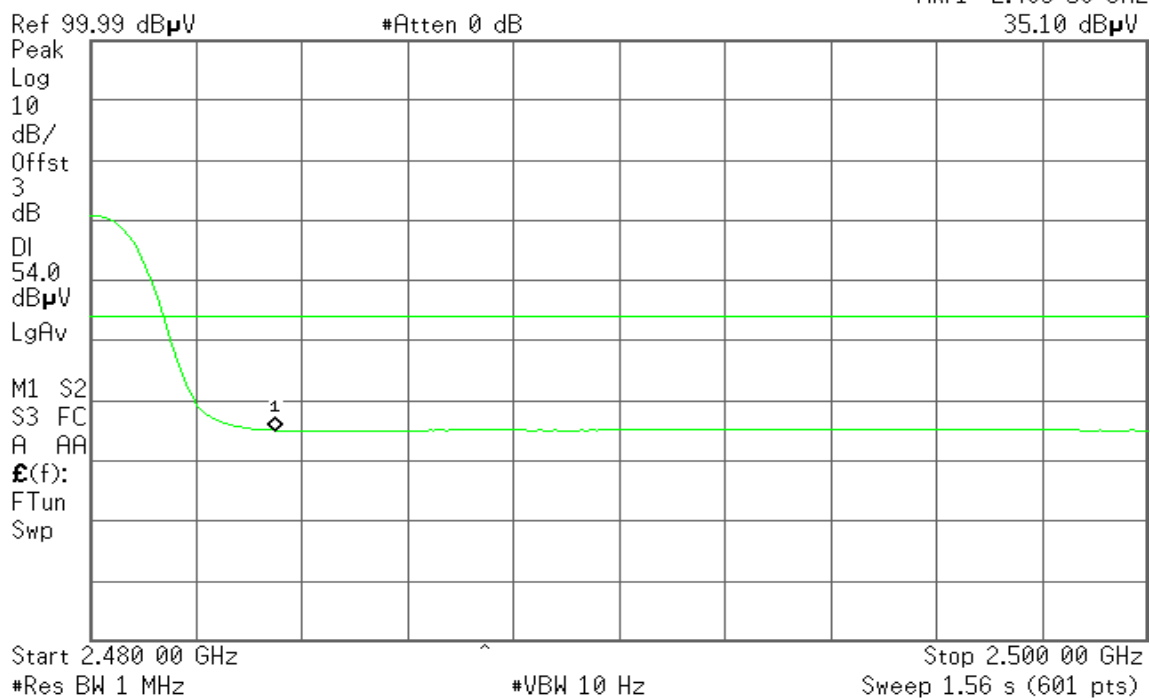
Detector mode: Average

Polarity: Vertical

Agilent 18:57:32 Oct 30, 2007

R T

Mkr1 2.483 50 GHz
35.10 dB μ V





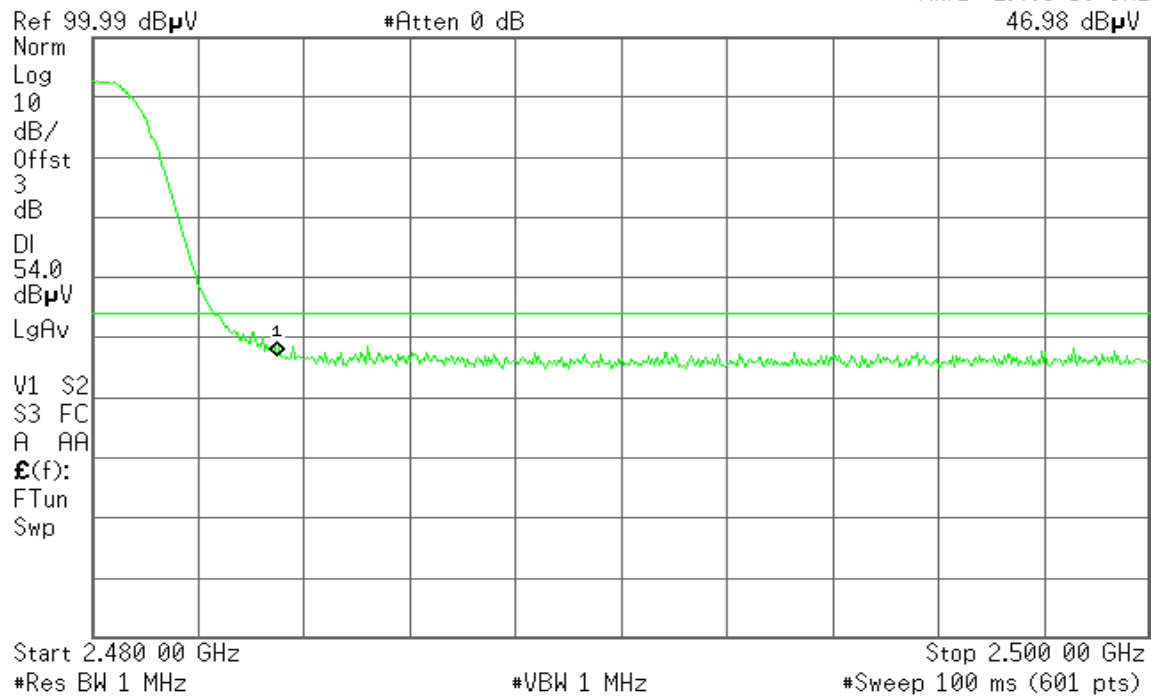
Detector mode: Peak

Polarity: Horizontal

Agilent 19:00:40 Oct 30, 2007

R T

Mkr1 2.483 50 GHz
46.98 dBμV



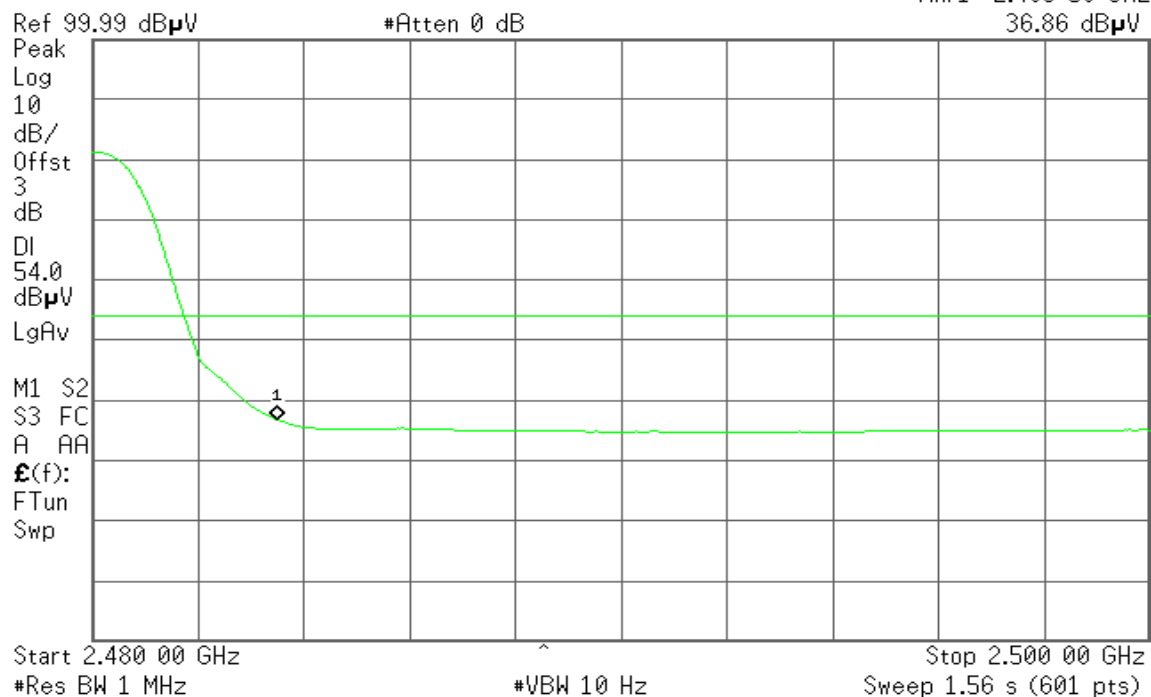
Detector mode: Average

Polarity: Horizontal

Agilent 19:00:24 Oct 30, 2007

R T

Mkr1 2.483 50 GHz
36.86 dBμV



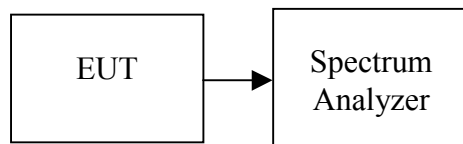


7.4 PEAK POWER SPECTRAL DENSITY

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****For GFSK**

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-7.92	8.00	PASS
Mid	2441	-8.12		PASS
High	2480	-8.24		PASS

For 8DPSK

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	1.08	8.00	PASS
Mid	2441	0.92		PASS
High	2480	0.35		PASS



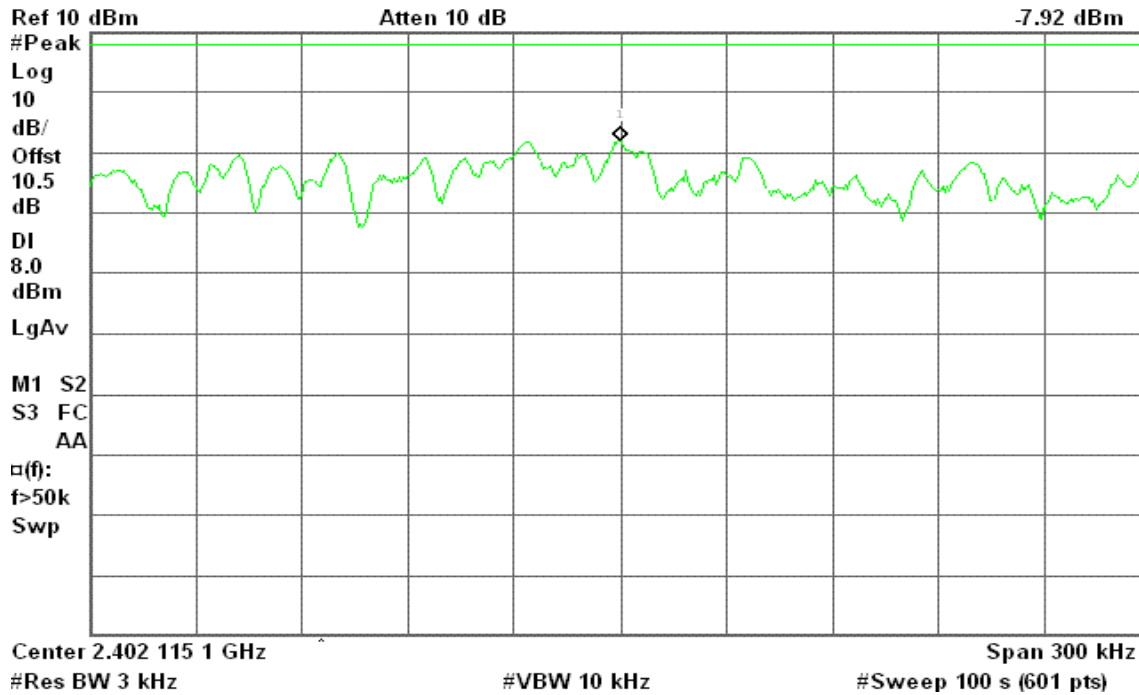
Test Plot

For GFSK

PPSD (CH Low)

Agilent 03:49:39 Oct 11, 2007

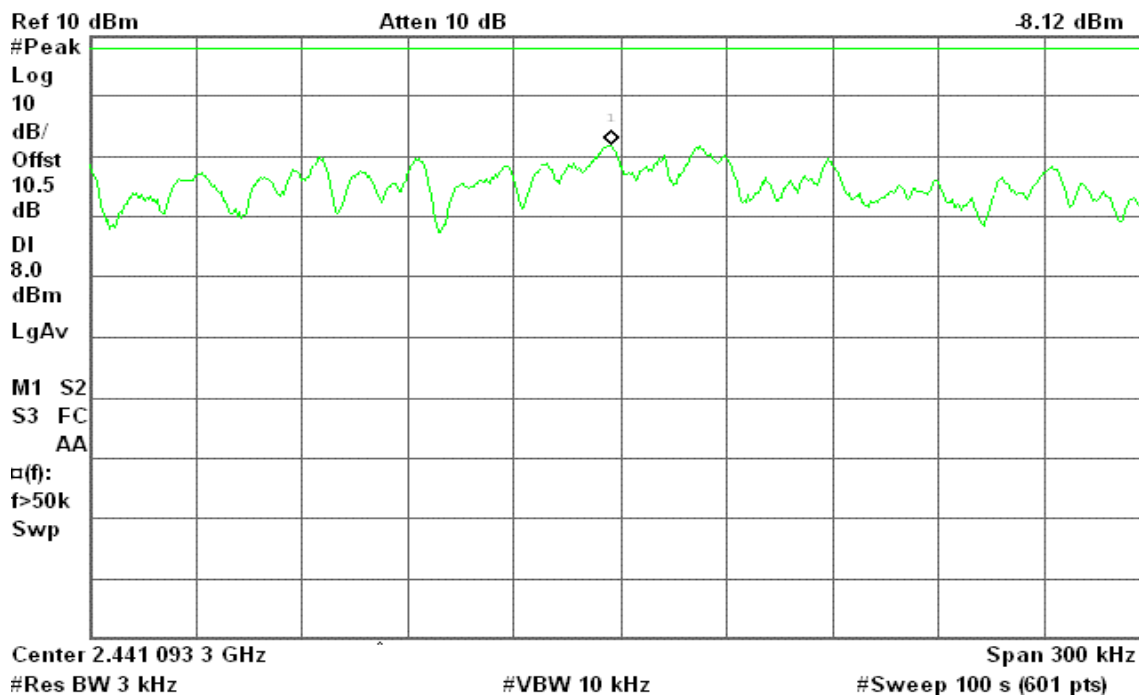
R T
Mkr1 2.402 114 6 GHz
-7.92 dBm



PPSD (CH Mid)

Agilent 03:52:30 Oct 11, 2007

R T
Mkr1 2.441 090 3 GHz
-8.12 dBm





PPSD (CH High)

Agilent 03:55:30 Oct 11, 2007

R T

Mkr1 2.480 091 0 GHz

-8.24 dBm

Ref 10 dBm

Atten 10 dB

#Peak

Log

10

dB/

Offst

10.5

dB

DI

8.0

dBm

LgAv

M1 S2

S3 FC

AA

□(f):

f>50k

Swp

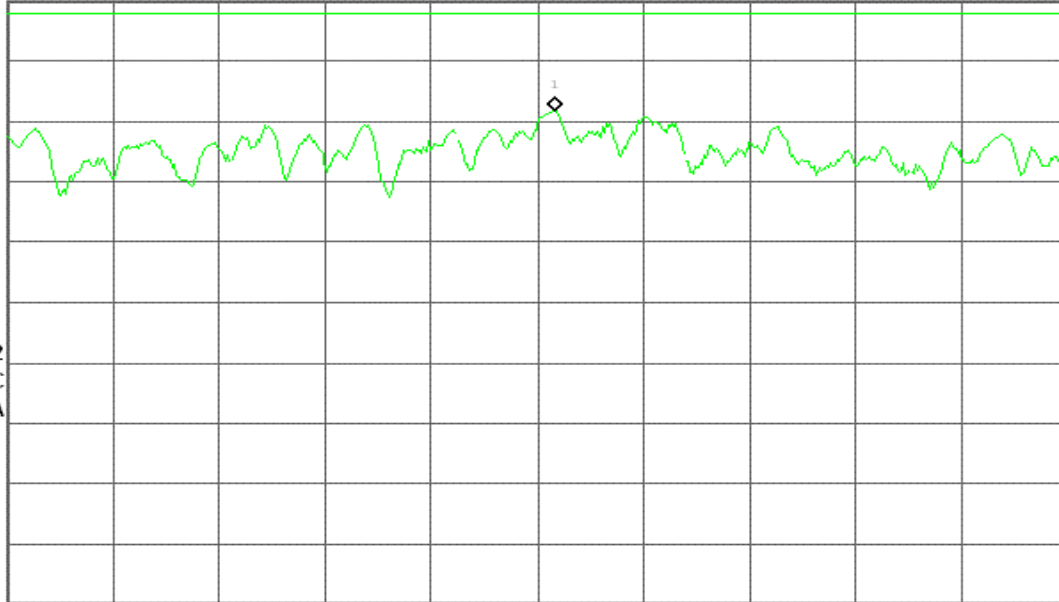
Center 2.480 086 0 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 300 kHz

#Sweep 100 s (601 pts)





For 8DPSK

PPSD (CH Low)

Agilent 16:22:17 Oct 31, 2007

R T

Mkr1 2.402 095 6 GHz

1.08 dBm

Ref 10.5 dBm

Atten 10 dB

#Peak

Log

10

dB/

Offst

10.5

dB

DI

8.0

dBm

LgAv

M1 S2

S3 FC

AA

□(f):

f>50k

Swp

Center 2.402 000 0 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 300 kHz

#Sweep 100 s (601 pts)

PPSD (CH Mid)

Agilent 16:19:25 Oct 31, 2007

R T

Mkr1 2.441 097 1 GHz

0.92 dBm

Ref 10.5 dBm

Atten 10 dB

#Peak

Log

10

dB/

Offst

10.5

dB

DI

8.0

dBm

LgAv

M1 S2

S3 FC

AA

□(f):

f>50k

Swp

Center 2.441 000 0 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 300 kHz

#Sweep 100 s (601 pts)

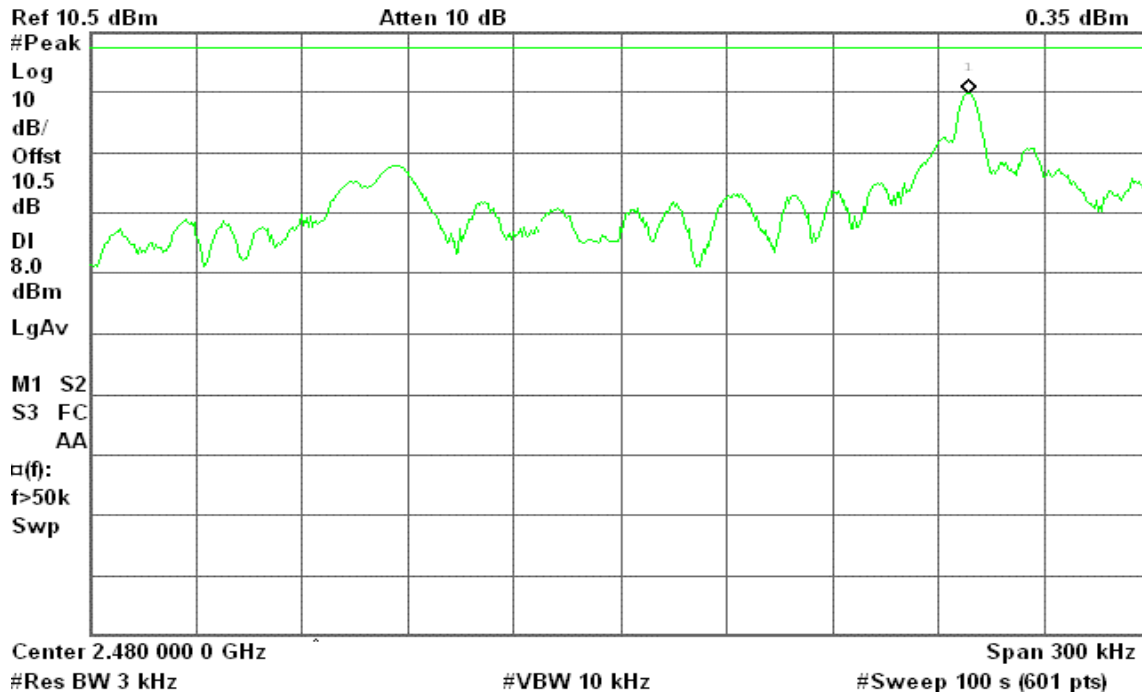


PPSD (CH High)

Agilent 16:16:17 Oct 31, 2007

R T

Mkr1 2.480 098 6 GHz



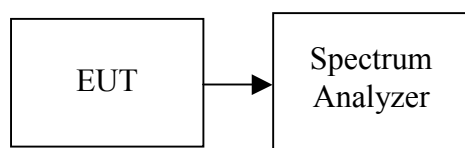


7.5 FREQUENCY SEPARATION

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

For GFSK

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (kHz)	Channel Separation Limit	Result
1.00	631	> two-thirds of the 20 dB bandwidth	Pass

For 8DPSK

Channel Separation (MHz)	two-thirds of the 20 dB bandwidth (kHz)	Channel Separation Limit	Result
1.00	682	> two-thirds of the 20 dB bandwidth	Pass



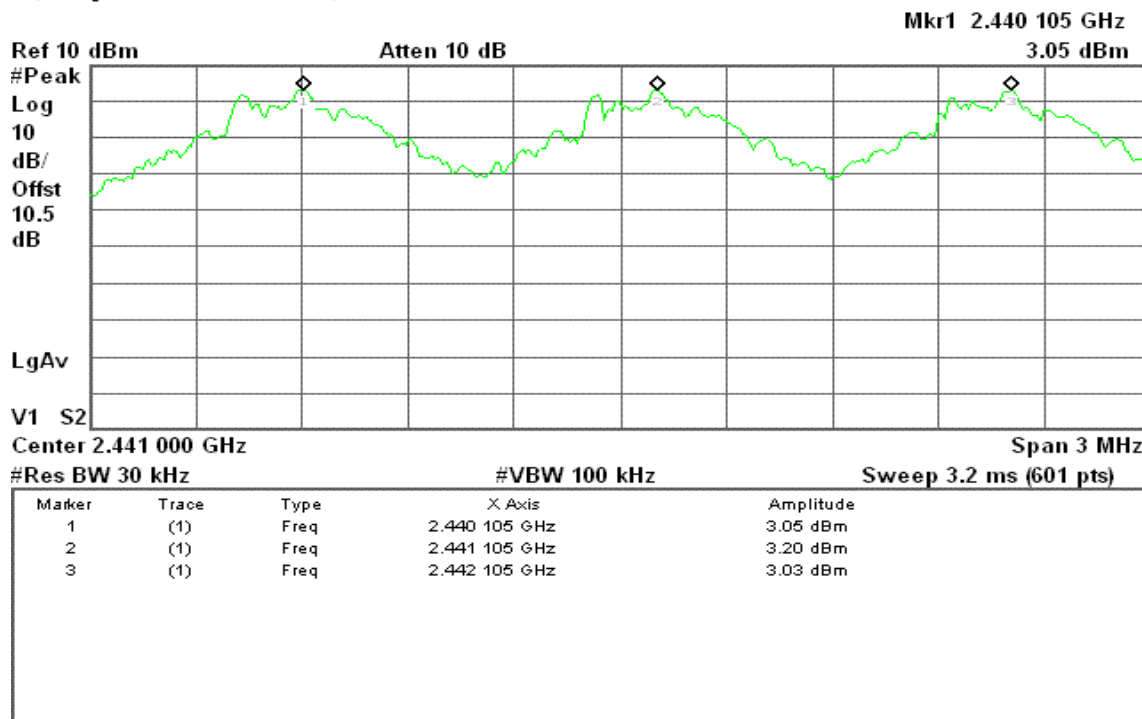
Test Plot

For GFSK

Measurement of Channel Separation

* Agilent 04:01:58 Oct 11, 2007

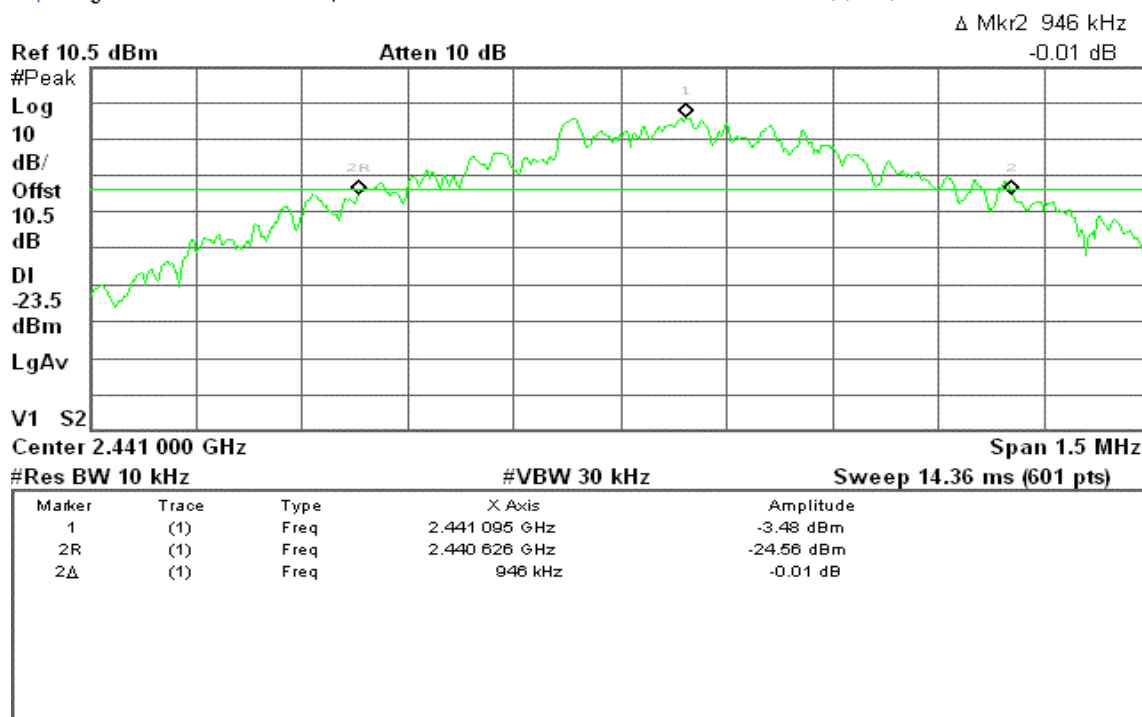
R T



Measurement of 20dB Bandwidth

* Agilent 03:15:06 Oct 11, 2007

R T



**For 8DPSK****Measurement of Channel Separation**

* Agilent 16:25:54 Oct 31, 2007

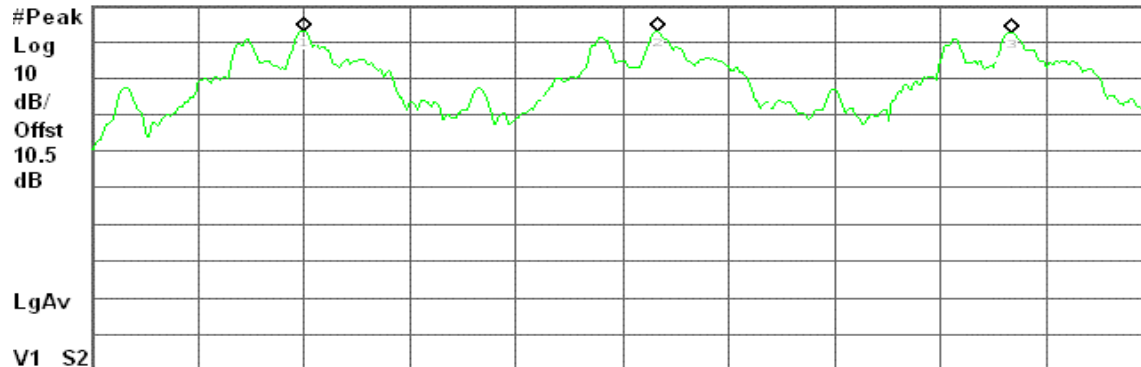
R T

Mkr1 2.440 100 GHz

Ref 10.5 dBm

Atten 10 dB

3.54 dBm



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	2.440 100 GHz	3.54 dBm
2	(1)	Freq	2.441 100 GHz	3.43 dBm
3	(1)	Freq	2.442 100 GHz	3.35 dBm

Measurement of 20dB Bandwidth

* Agilent 15:59:44 Oct 31, 2007

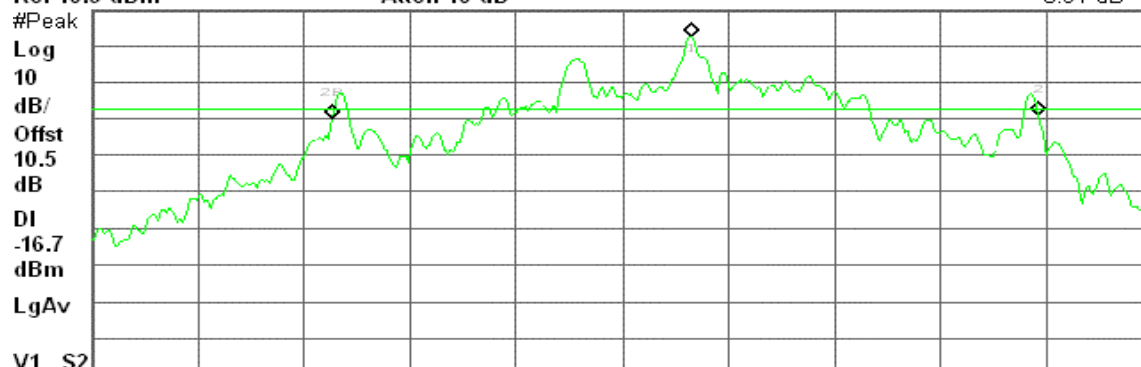
R T

Δ Mkr2 1.023 MHz

0.91 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.441 000 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	2.441 100 GHz	3.29 dBm
2R	(1)	Freq	2.440 586 GHz	-19.40 dBm
2Δ	(1)	Freq	1.023 MHz	0.91 dB

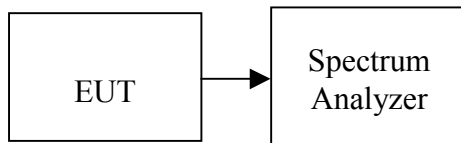


7.6 NUMBER OF HOPPING FREQUENCY

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

For GFSK / 8DPSK

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS



Test Plot

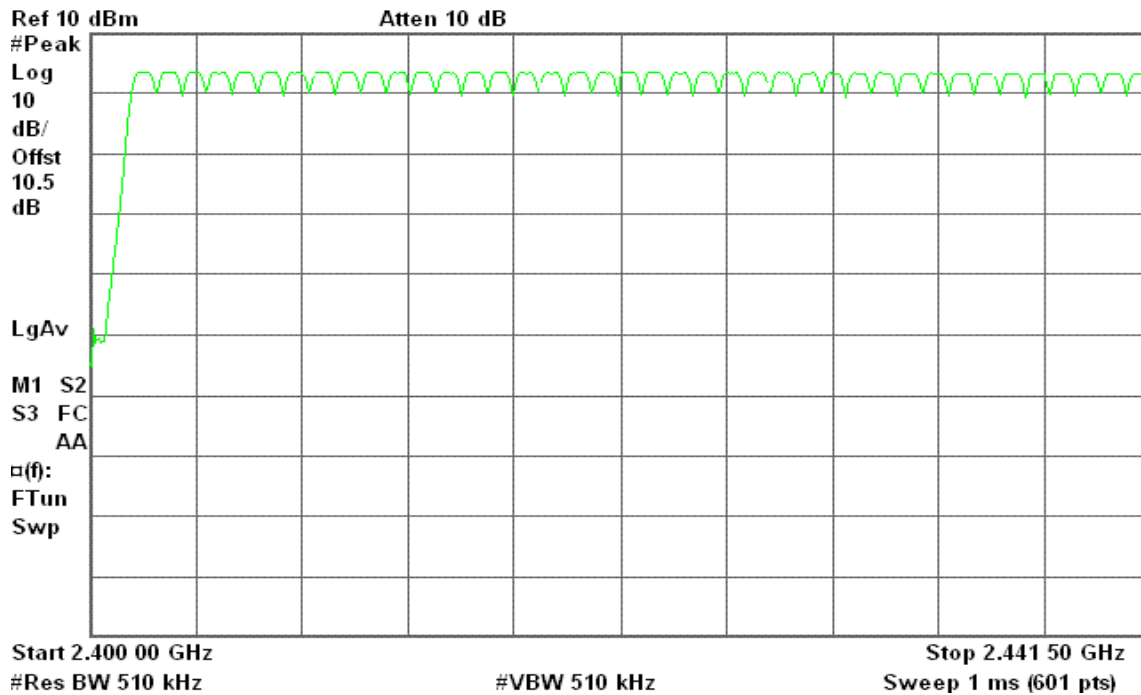
For GFSK

Channel Number

2.4 GHz – 2.4415 GHz

* Agilent 03:44:10 Oct 11, 2007

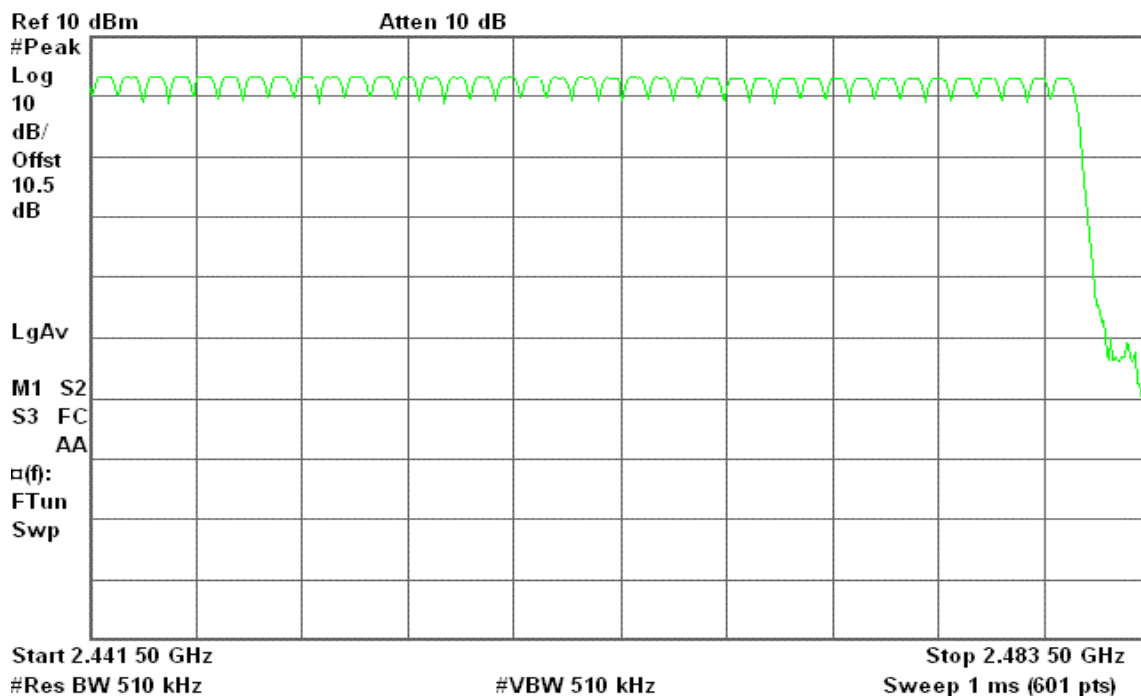
R T



2.4415 GHz – 2.4835 GHz

* Agilent 03:46:13 Oct 11, 2007

R T





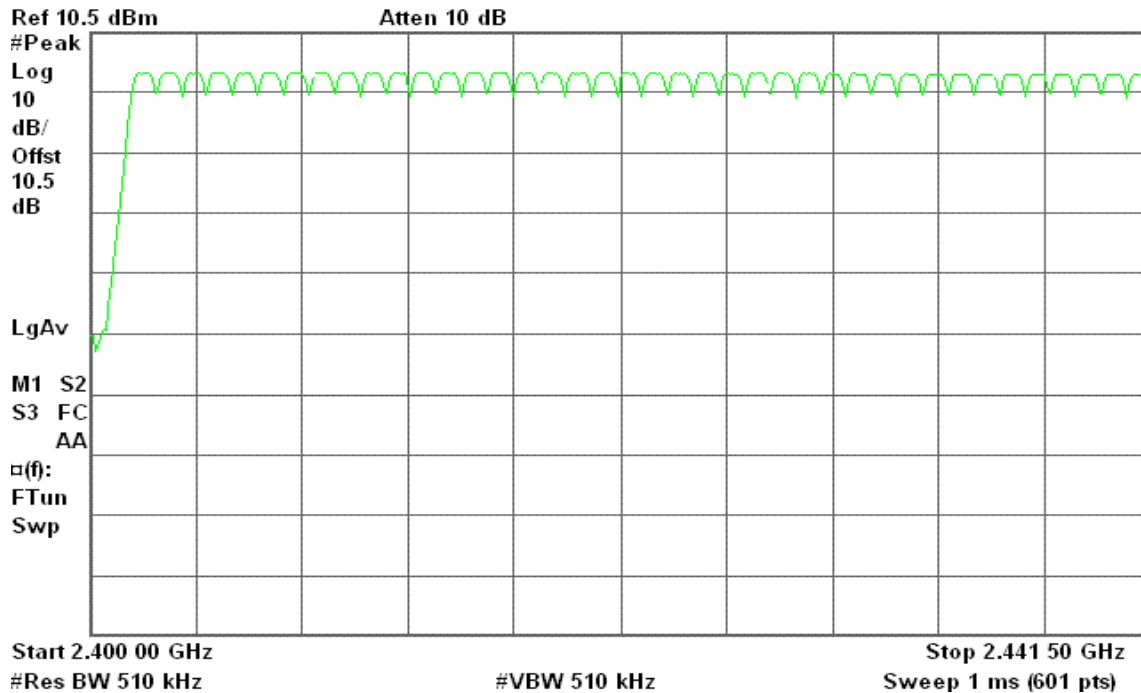
For 8DPSK

Channel Number

2.4 GHz – 2.4415 GHz

* Agilent 16:12:41 Oct 31, 2007

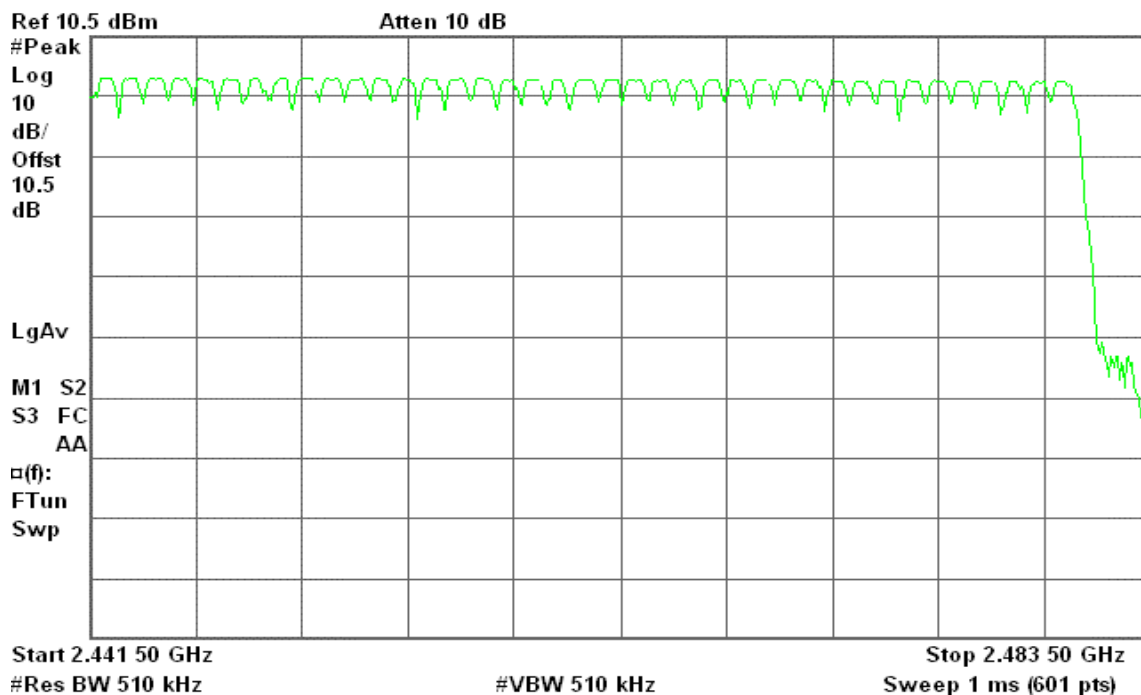
R T



2.4415 GHz – 2.4835 GHz

* Agilent 16:13:19 Oct 31, 2007

R T



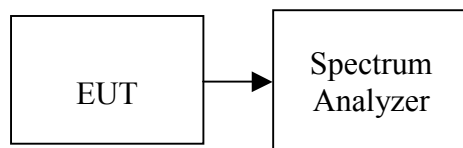


7.7 TIME OF OCCUPANCY (DWELL TIME)

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

For GFSK

DH 1

CH Low: $0.39 * (1600/2)/79 * 31.6 = 125.92$ (ms)

CH Mid: $0.39 * (1600/2)/79 * 31.6 = 125.92$ (ms)

CH High: $0.38 * (1600/2)/79 * 31.6 = 121.06$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.39	125.92	31.60	400.00	PASS
Mid	0.39	125.92	31.60		PASS
High	0.38	121.06	31.60		PASS

DH 3

CH Low: $1.65 * (1600/4)/79 * 31.6 = 2664.00$ (ms)

CH Mid: $1.65 * (1600/4)/79 * 31.6 = 2664.00$ (ms)

CH High: $1.65 * (1600/4)/79 * 31.6 = 2664.00$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.65	264.00	31.60	400.00	PASS
Mid	1.65	264.00	31.60		PASS
High	1.65	264.00	31.60		PASS

DH 5

CH Low: $2.91 * (1600/6)/79 * 31.6 = 309.97$ (ms)

CH Mid: $2.88 * (1600/6)/79 * 31.6 = 306.67$ (ms)

CH High: $2.91 * (1600/6)/79 * 31.6 = 309.97$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.91	309.97	31.60	400.00	PASS
Mid	2.88	306.67	31.60		PASS
High	2.91	309.97	31.60		PASS

**For 8DPSK****DH 1**CH Low: $0.39 * (1600/2)/79 * 31.60 = 126.30$ (ms)CH Mid: $0.38 * (1600/2)/79 * 31.60 = 122.24$ (ms)CH High: $0.39 * (1600/2)/79 * 31.60 = 126.30$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.39	126.30	31.60	400.00	PASS
Mid	0.38	122.24	31.60		PASS
High	0.39	126.30	31.60		PASS

DH 3CH Low: $1.64 * (1600/4)/79 * 31.60 = 262.88$ (ms)CH Mid: $1.64 * (1600/4)/79 * 31.60 = 262.88$ (ms)CH High: $1.63 * (1600/4)/79 * 31.60 = 260.80$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.64	262.88	31.60	400.00	PASS
Mid	1.64	262.88	31.60		PASS
High	1.63	260.80	31.60		PASS

DH 5CH Low: $2.88 * (1600/6)/79 * 31.60 = 306.99$ (ms)CH Mid: $2.90 * (1600/6)/79 * 31.60 = 309.65$ (ms)CH High: $2.90 * (1600/6)/79 * 31.60 = 309.65$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.88	306.99	31.60	400.00	PASS
Mid	2.90	309.65	31.60		PASS
High	2.90	309.65	31.60		PASS



Test Plot

For GFSK

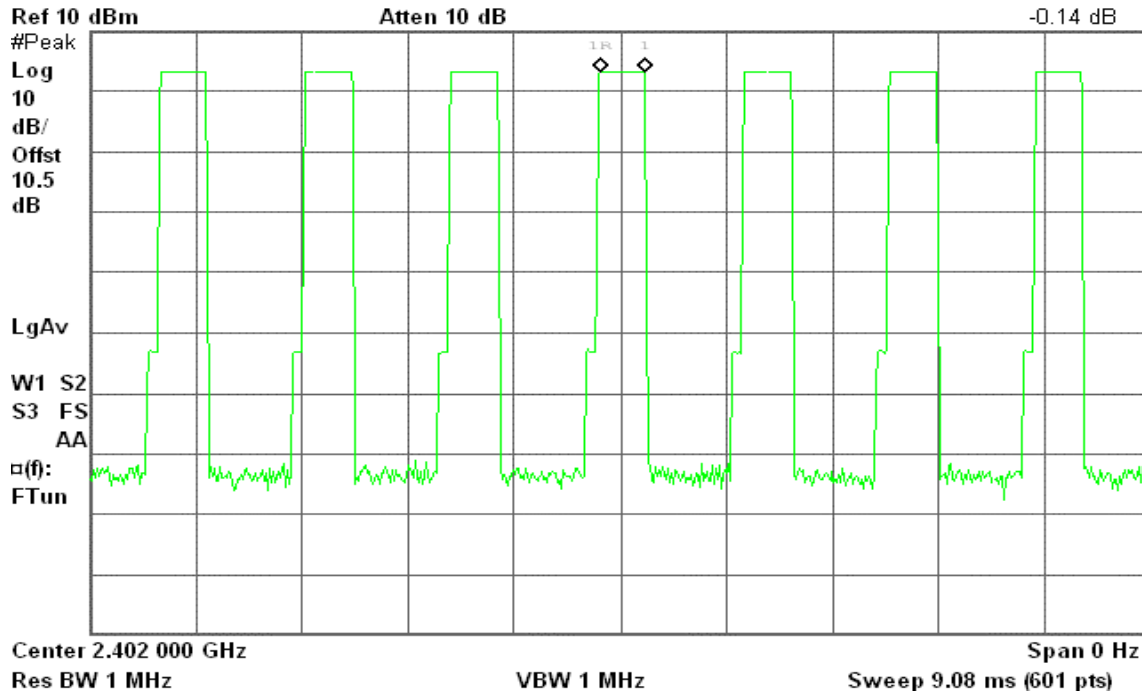
DH 1

(CH Low)

Agilent 03:37:29 Oct 11, 2007

R T

Δ Mkr1 393.5 μs
-0.14 dB

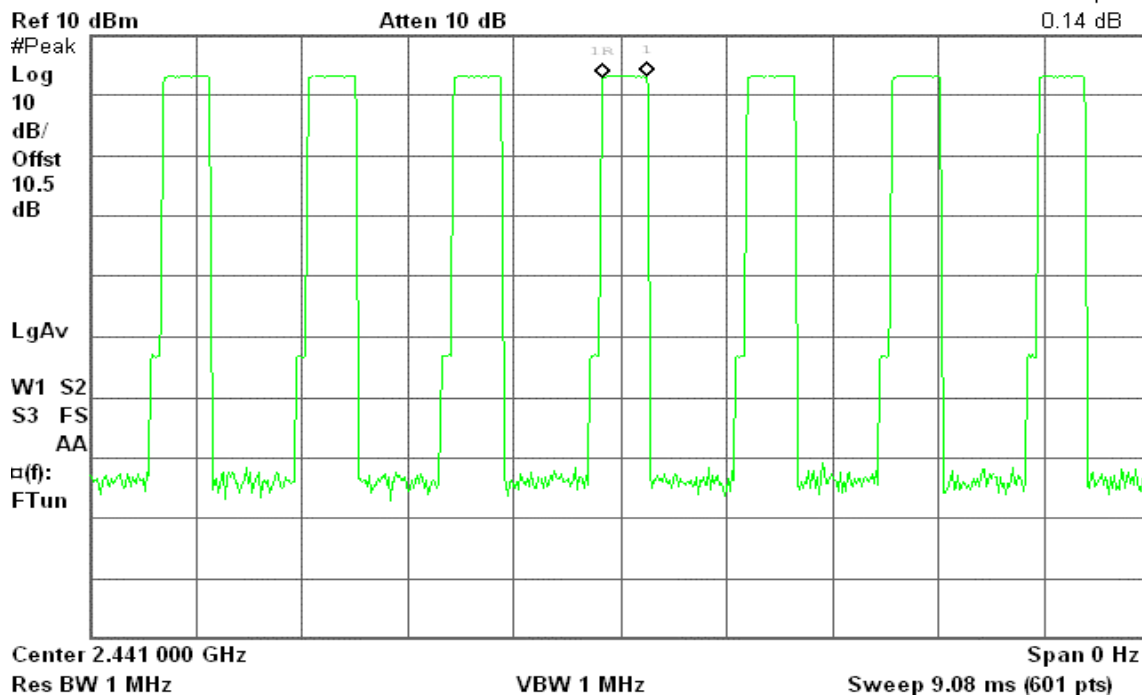


(CH Mid)

Agilent 03:37:50 Oct 11, 2007

R T

Δ Mkr1 393.5 μs
0.14 dB



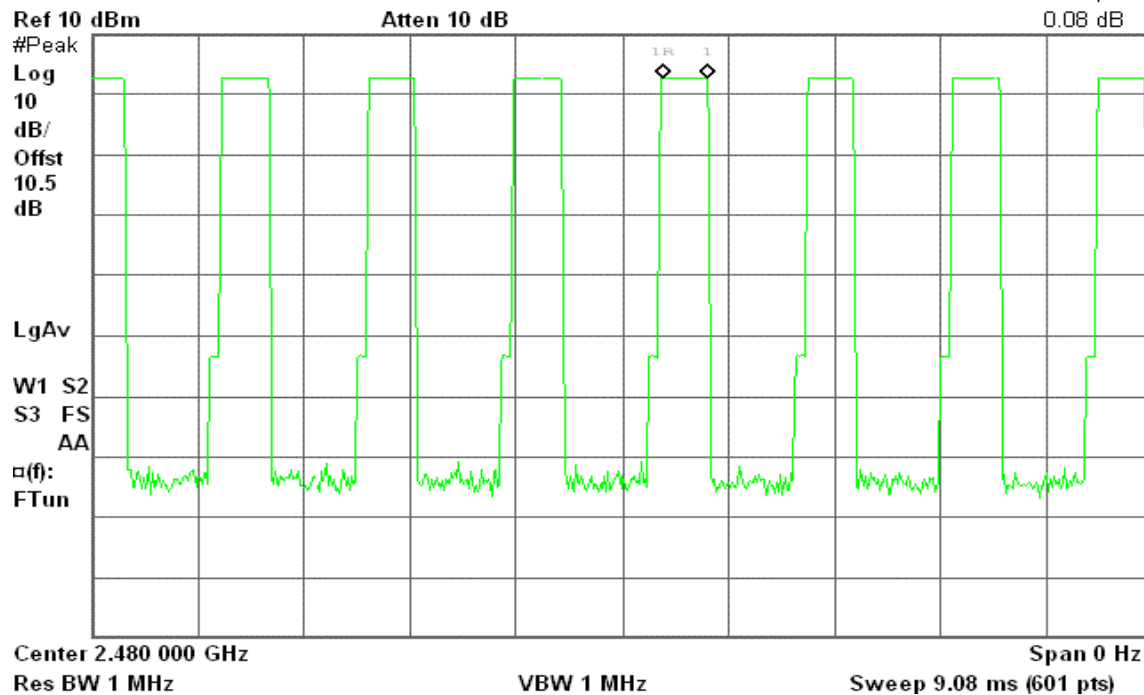


(CH High)

Agilent 03:38:18 Oct 11, 2007

R T

Δ Mkr1 378.3 μ s
0.08 dB



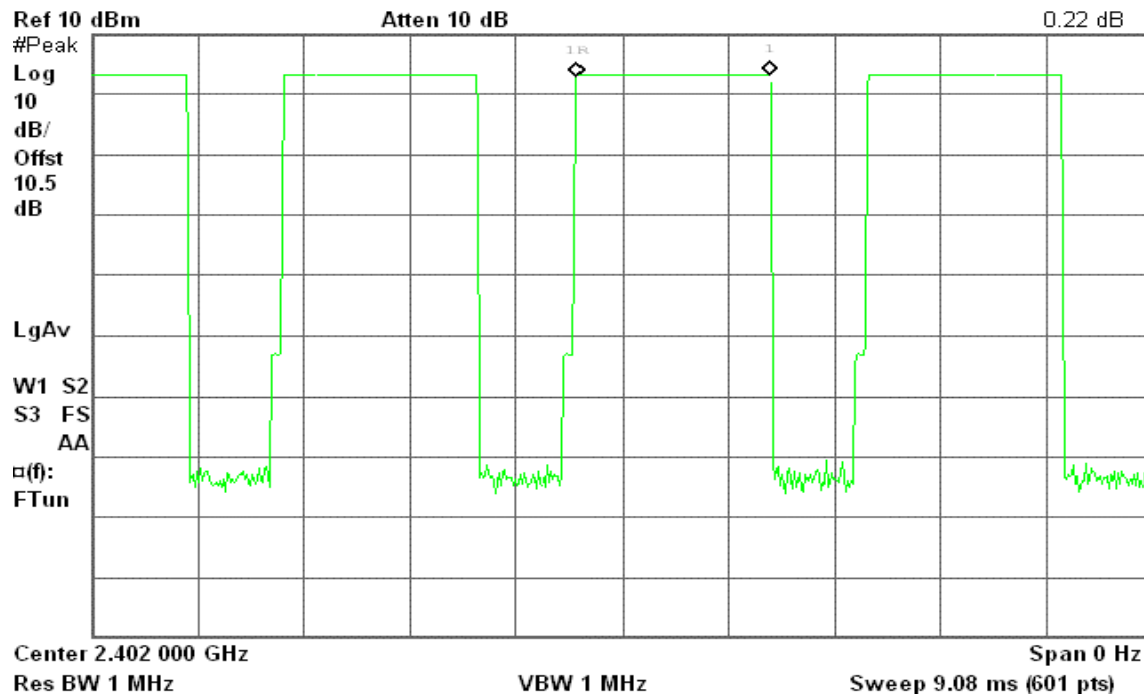
DH 3

(CH Low)

Agilent 03:36:54 Oct 11, 2007

R T

Δ Mkr1 1.65 ms
0.22 dB



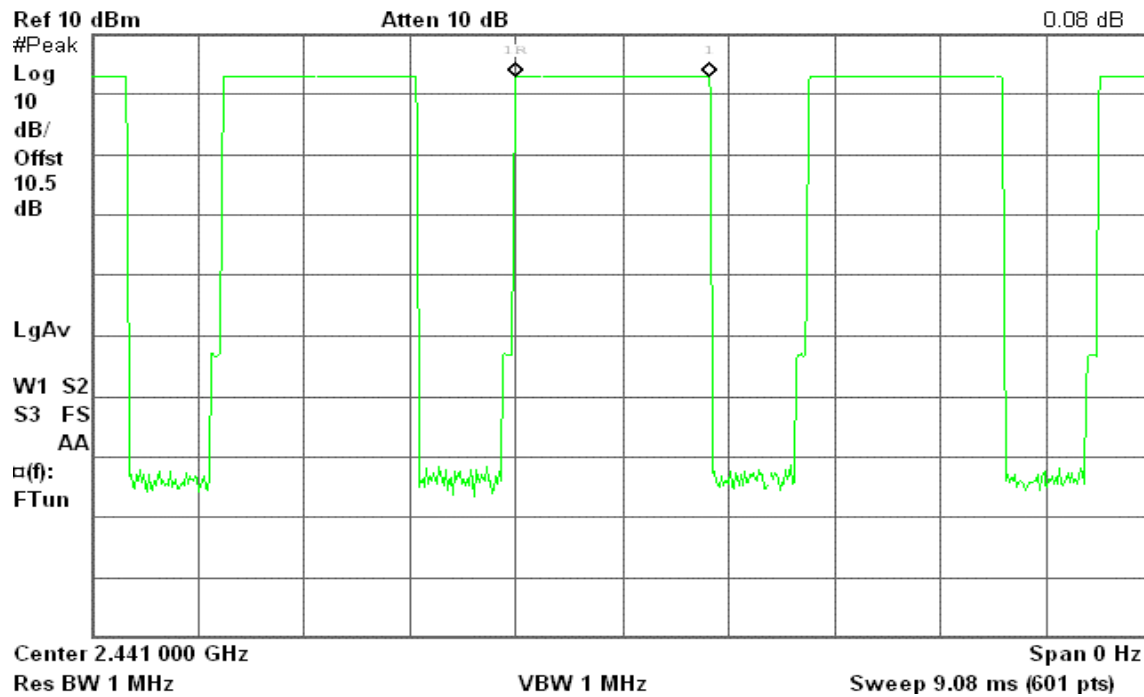


(CH Mid)

Agilent 03:36:24 Oct 11, 2007

R T

Δ Mkr1 1.65 ms
0.08 dB

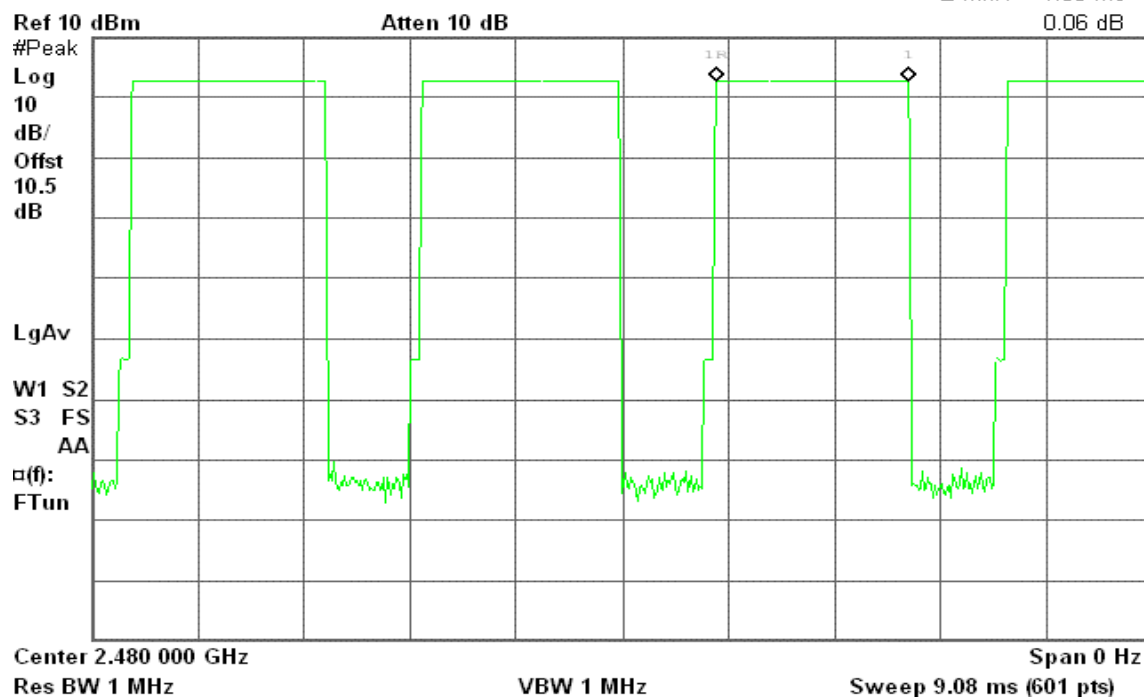


(CH High)

Agilent 03:35:55 Oct 11, 2007

R T

Δ Mkr1 1.65 ms
0.06 dB





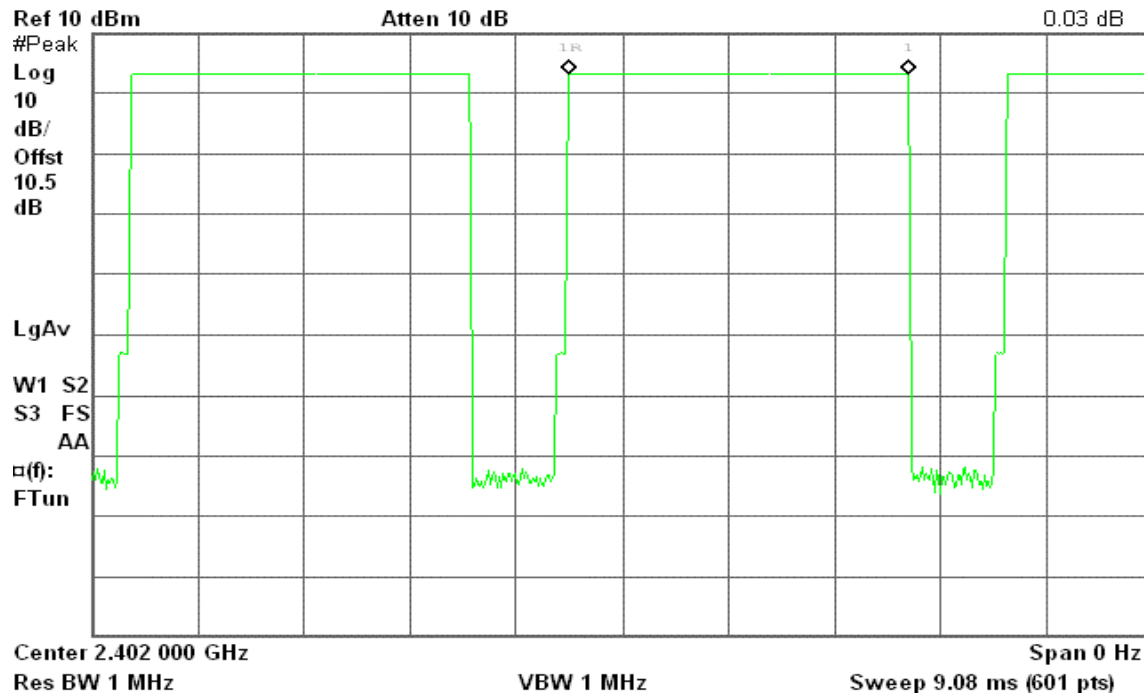
DH 5

(CH Low)

Agilent 03:39:56 Oct 11, 2007

R T

Δ Mkr1 2.906 ms
0.03 dB

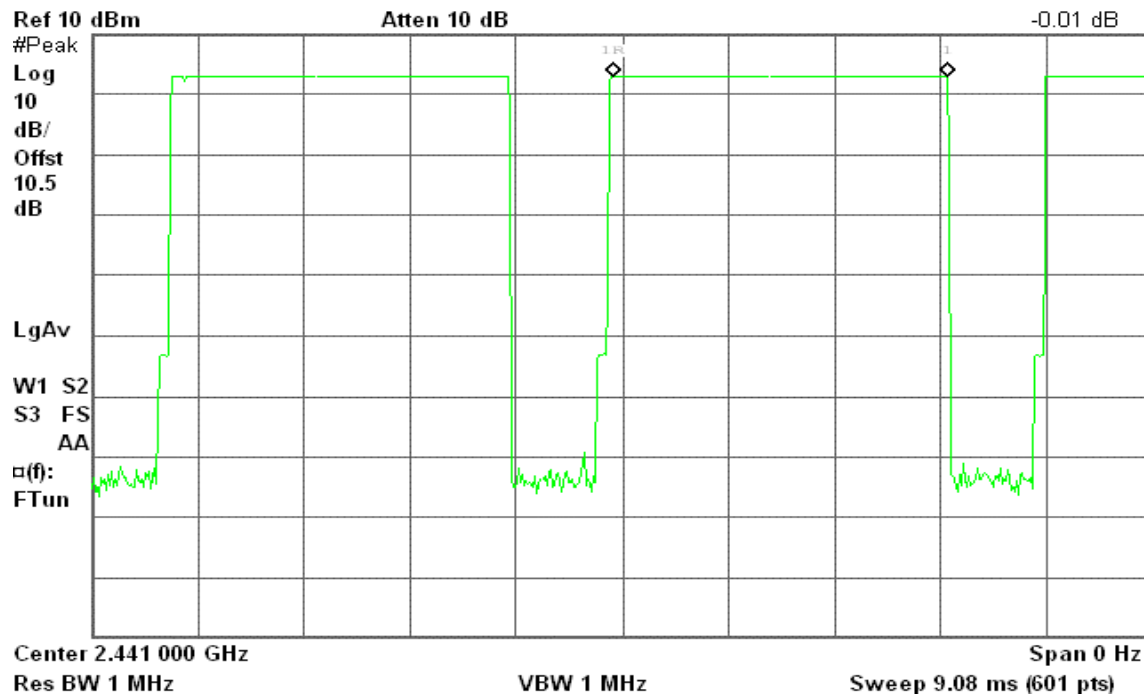


(CH Mid)

Agilent 03:39:31 Oct 11, 2007

R T

Δ Mkr1 2.875 ms
-0.01 dB

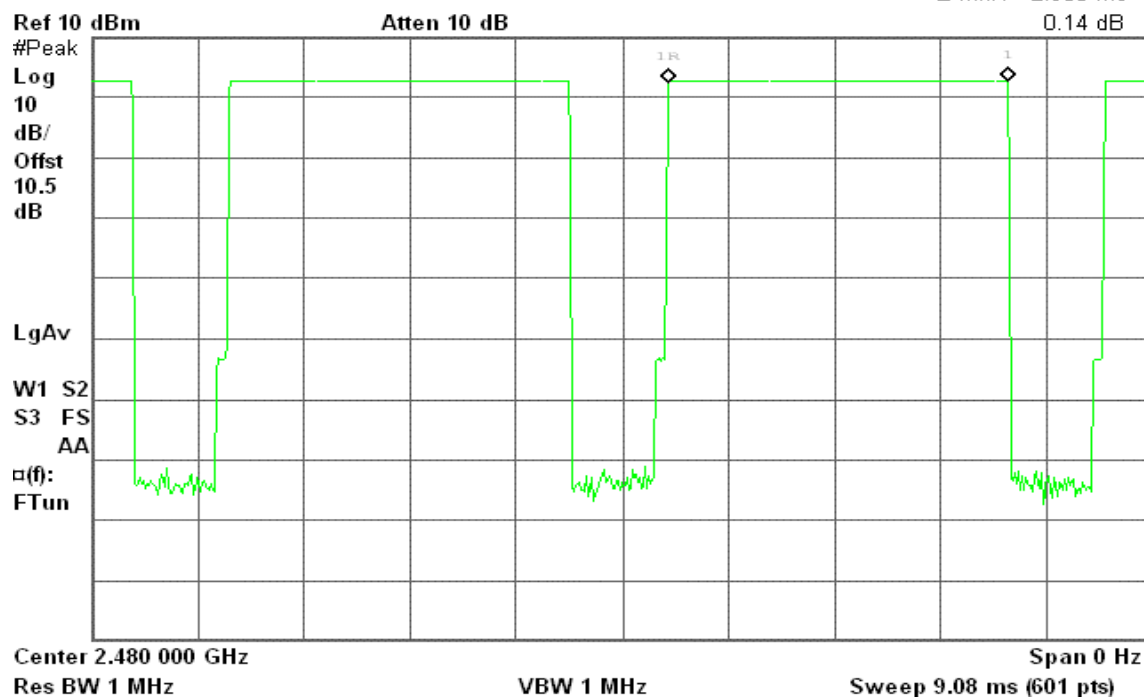


(CH High)

Agilent 03:39:06 Oct 11, 2007

R T

Δ Mkr1 2.906 ms
0.14 dB





For 8DPSK

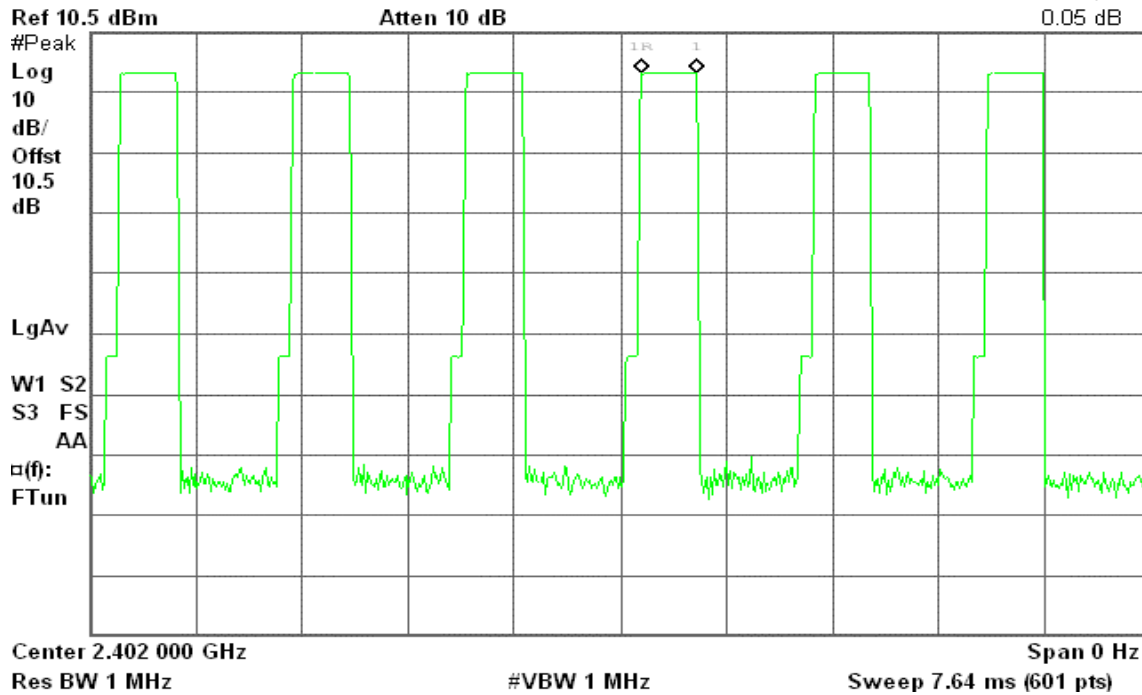
DH 1

(CH Low)

Agilent 16:03:41 Oct 31, 2007

R T

Δ Mkr1 394.7 μs
0.05 dB

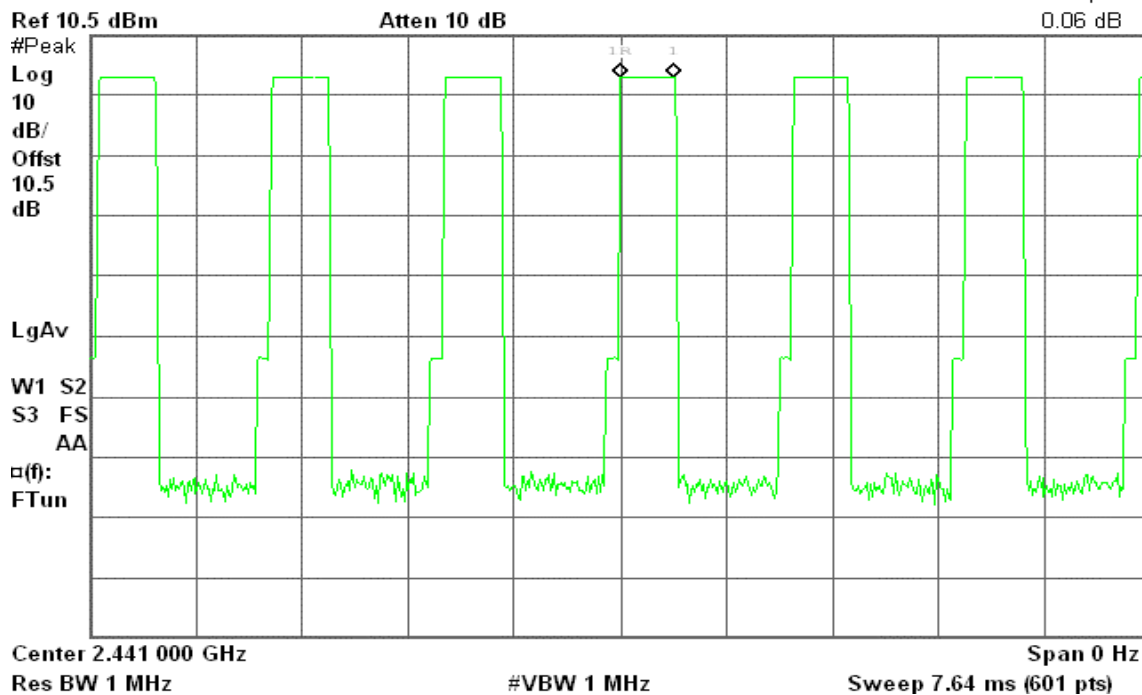


(CH Mid)

Agilent 16:04:08 Oct 31, 2007

R T

Δ Mkr1 382 μs
0.06 dB



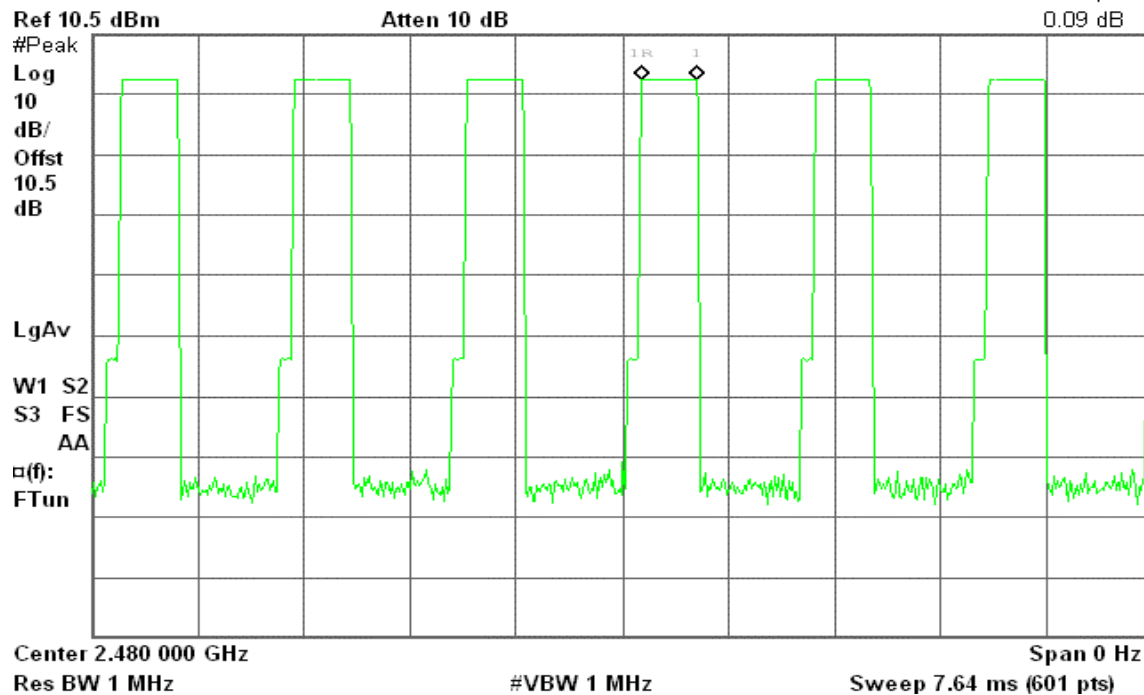


(CH High)

Agilent 16:04:37 Oct 31, 2007

R T

Δ Mkr1 394.7 μs
0.09 dB



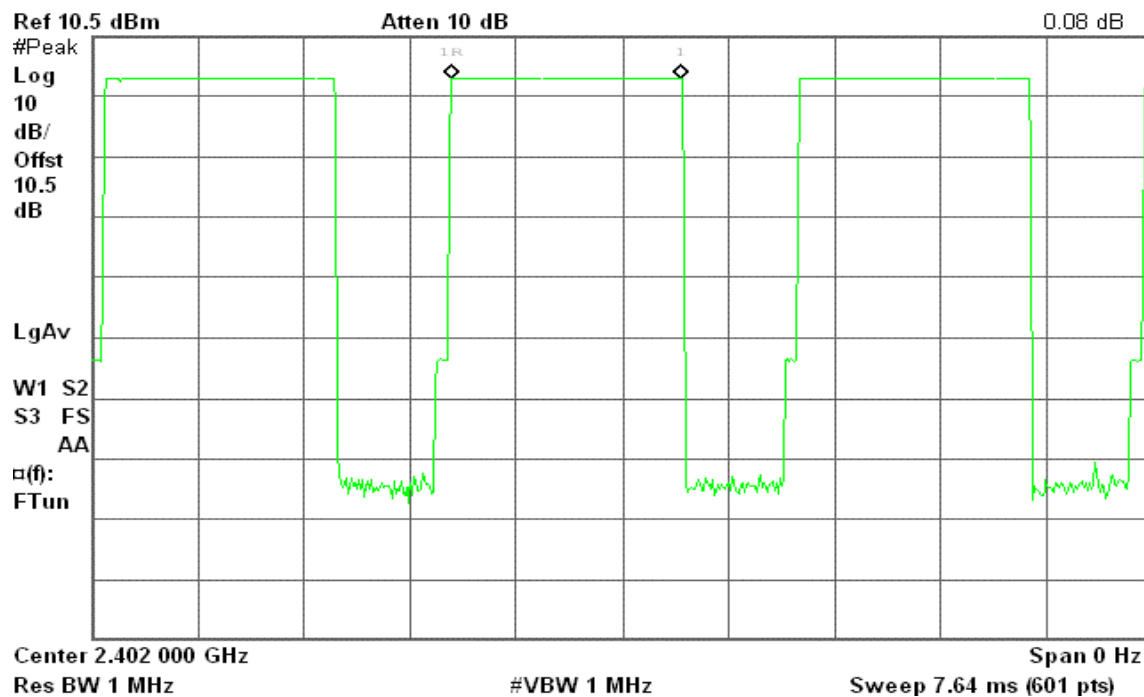
DH 3

(CH Low)

Agilent 16:06:30 Oct 31, 2007

R T

Δ Mkr1 1.643 ms
0.08 dB





(CH Mid)

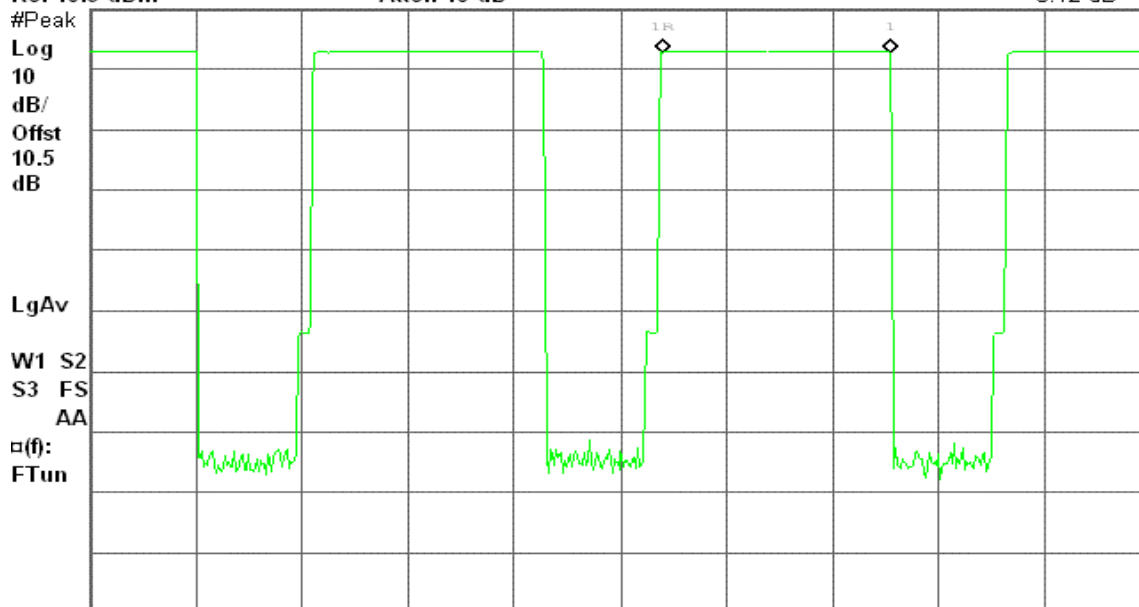
Agilent 16:06:01 Oct 31, 2007

R T

Δ Mkr1 1.643 ms
-0.12 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.441 000 GHz

Res BW 1 MHz

#VBW 1 MHz

Span 0 Hz
Sweep 7.64 ms (601 pts)

(CH High)

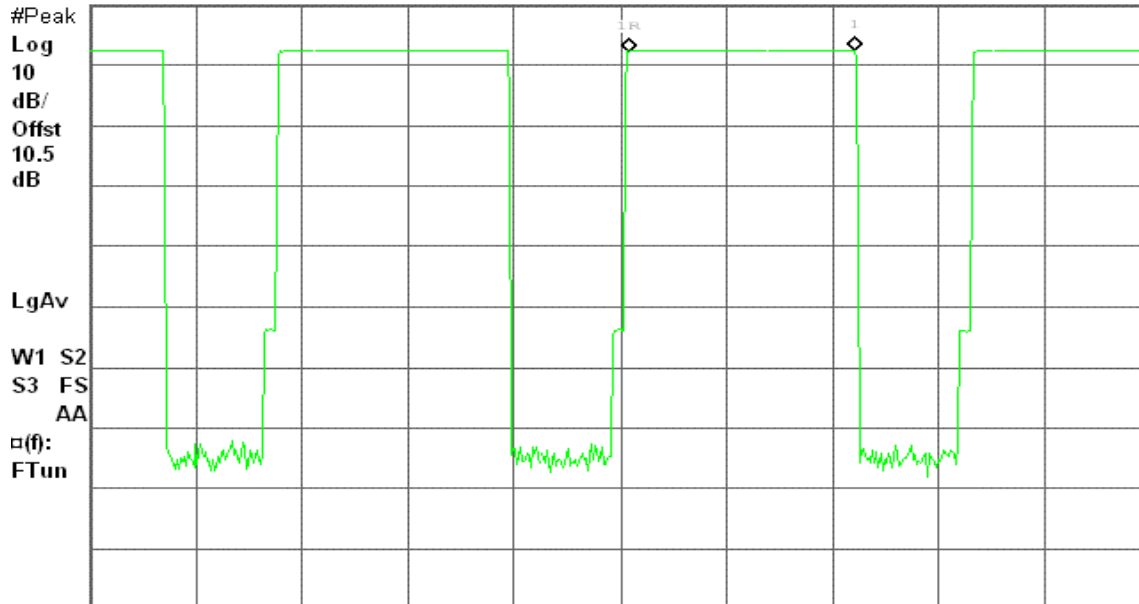
Agilent 16:05:38 Oct 31, 2007

R T

Δ Mkr1 1.63 ms
0.06 dB

Ref 10.5 dBm

Atten 10 dB



Center 2.480 000 GHz

Res BW 1 MHz

#VBW 1 MHz

Span 0 Hz
Sweep 7.64 ms (601 pts)



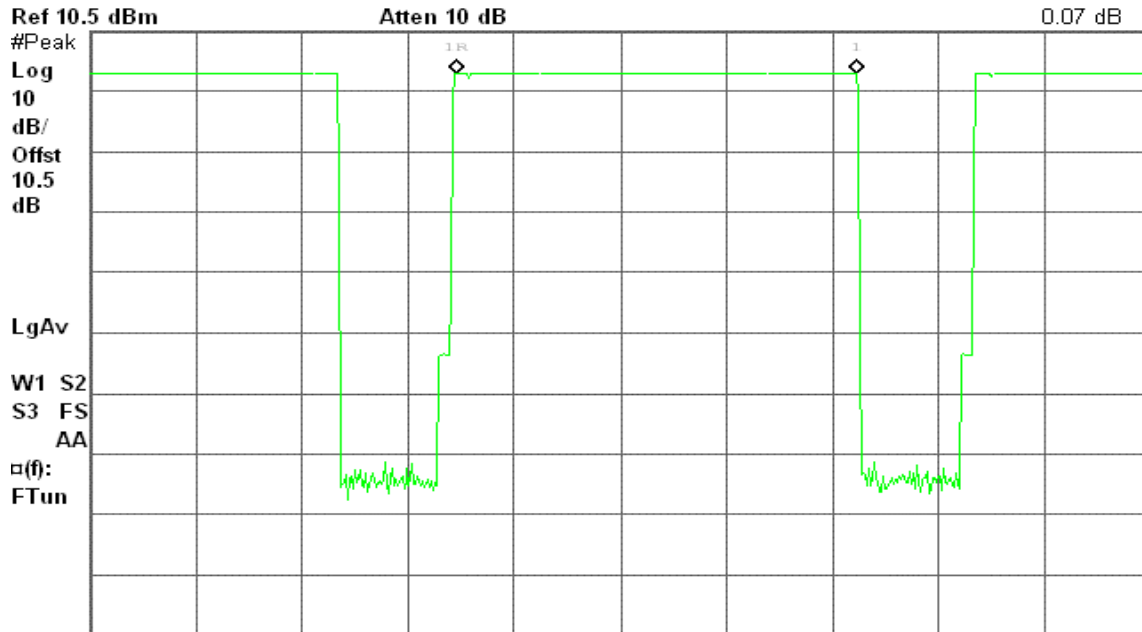
DH 5

(CH Low)

Agilent 16:07:14 Oct 31, 2007

R T

Δ Mkr1 2.878 ms
0.07 dB



Center 2.402 000 GHz

Res BW 1 MHz

#VBW 1 MHz

Sweep 7.64 ms (601 pts)

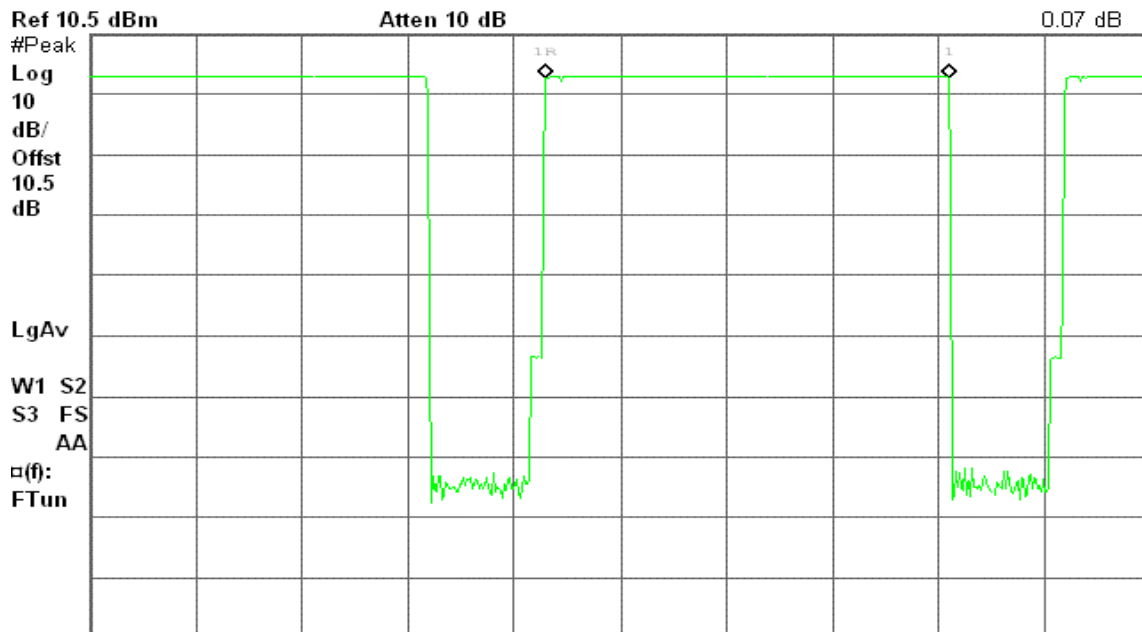
Span 0 Hz

(CH Mid)

Agilent 16:07:57 Oct 31, 2007

R T

Δ Mkr1 2.903 ms
0.07 dB



Center 2.441 000 GHz

Res BW 1 MHz

#VBW 1 MHz

Sweep 7.64 ms (601 pts)

Span 0 Hz



(CH High)

Agilent 16:08:30 Oct 31, 2007

R T

Δ Mkr1 2.903 ms
0.90 dB

Ref 10.5 dBm

Atten 10 dB

#Peak

Log

10

dB/

Offst

10.5

dB

LgAv

W1 S2

S3 FS

AA

$\alpha(f)$:

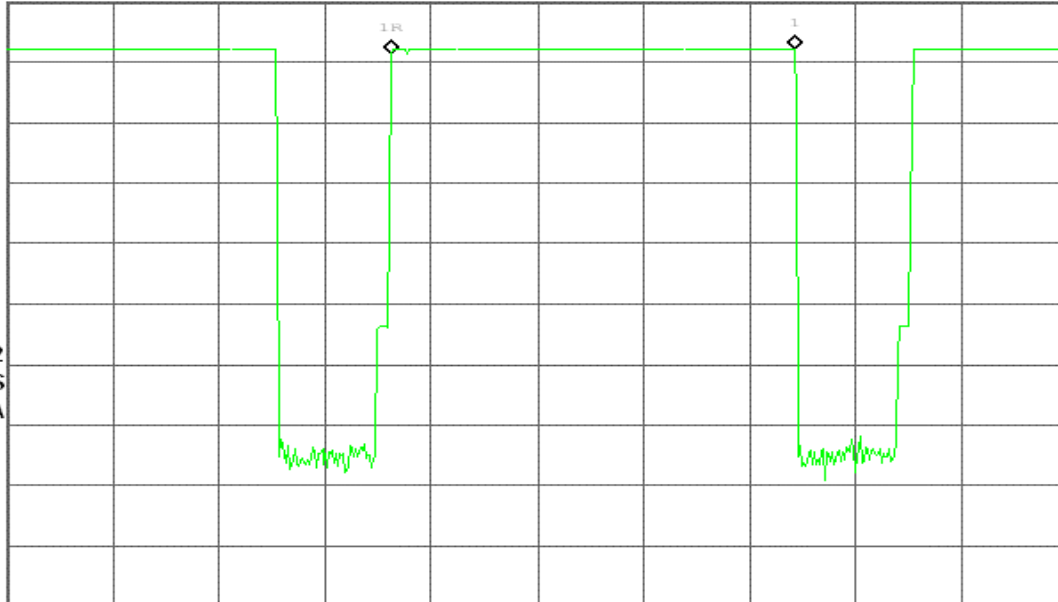
FTun

Center 2.480 000 GHz

Res BW 1 MHz

#VBW 1 MHz

Span 0 Hz
Sweep 7.64 ms (601 pts)





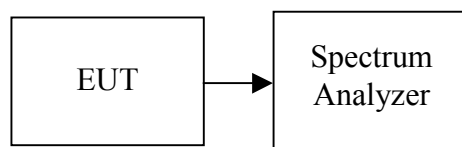
7.8 SPURIOUS EMISSIONS

7.8.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

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.

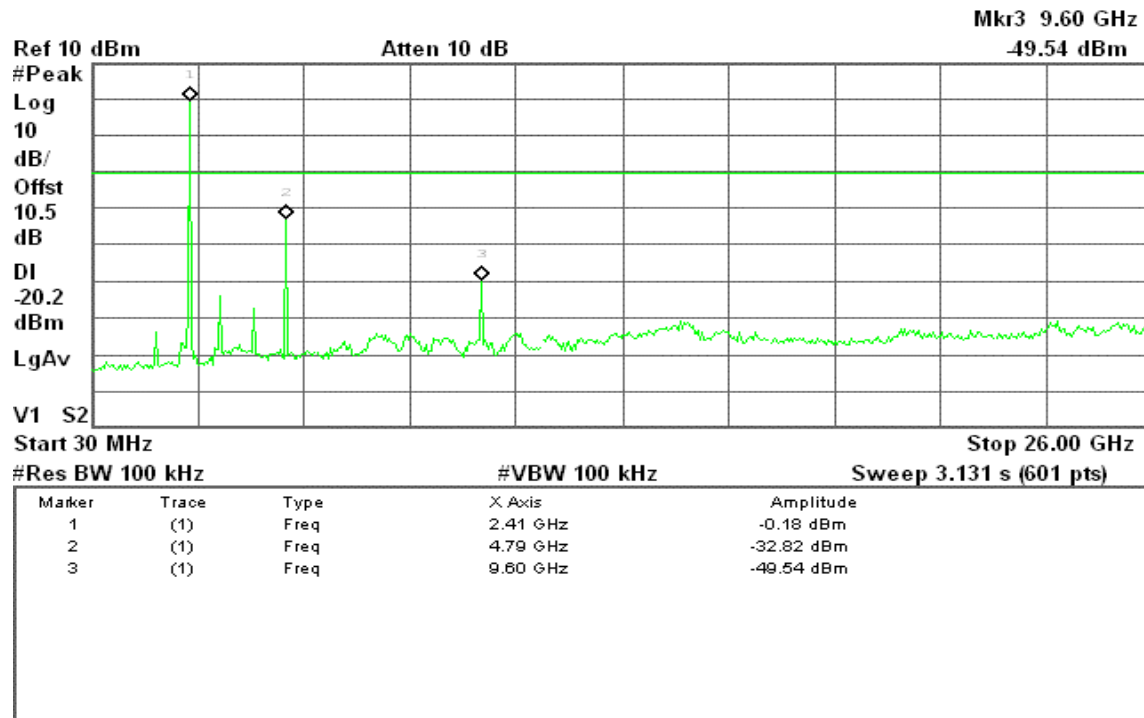
TEST RESULTS

No non-compliance noted

**Test Plot****For GFSK****CH Low**

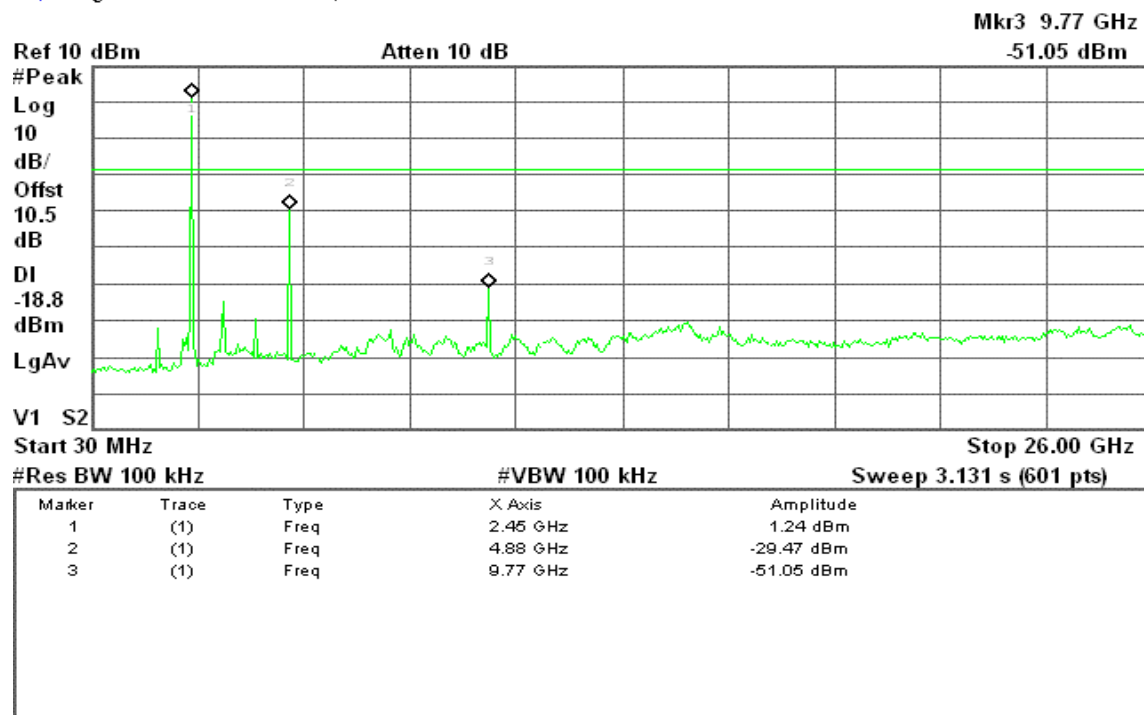
* Agilent 04:00:13 Oct 11, 2007

R T

**CH Mid**

* Agilent 03:59:15 Oct 11, 2007

R T

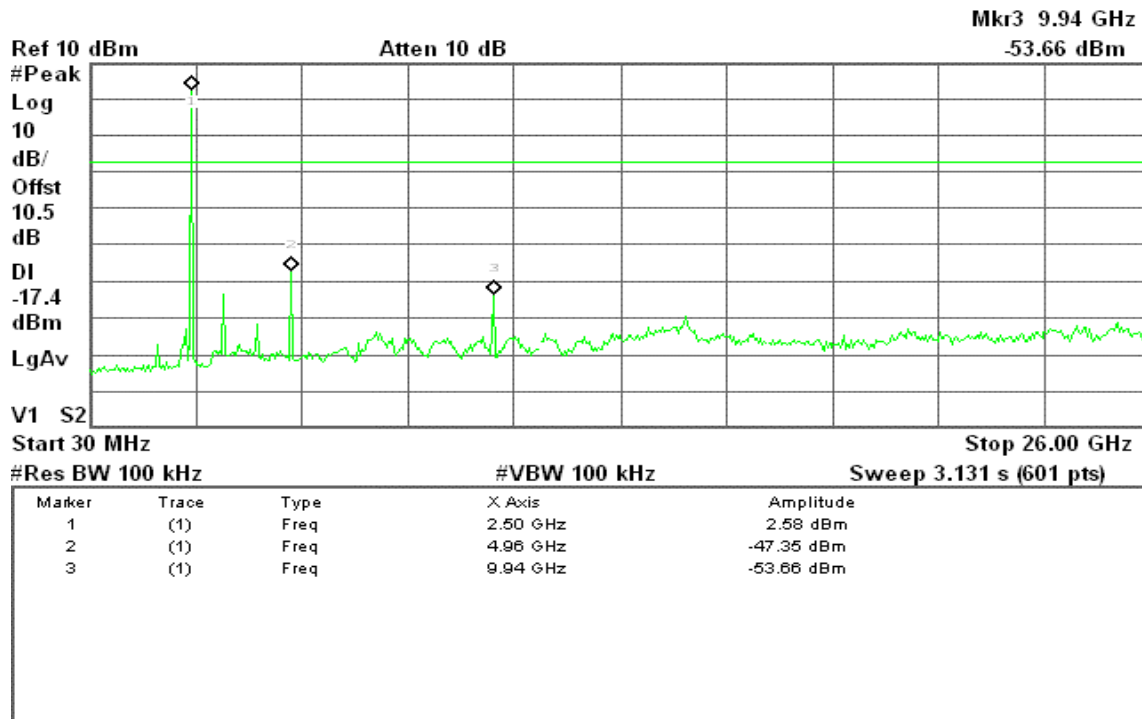




CH High

Agilent 03:58:09 Oct 11, 2007

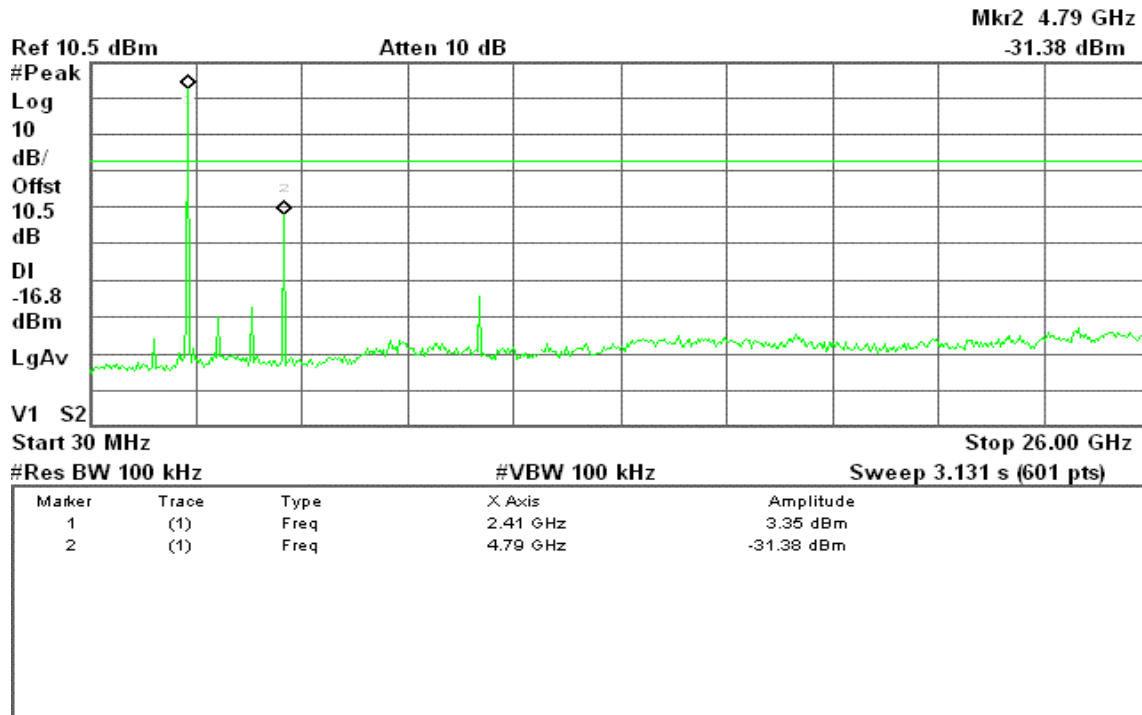
R T



**For 8DPSK****CH Low**

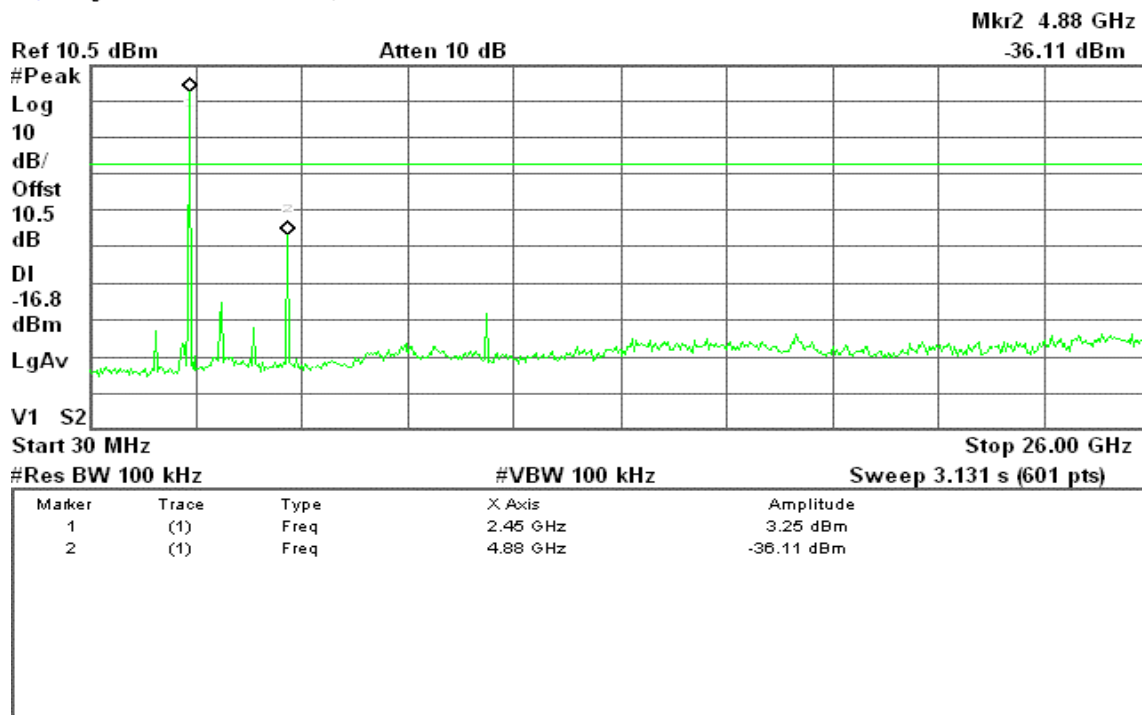
* Agilent 16:23:31 Oct 31, 2007

R T

**CH Mid**

* Agilent 16:24:01 Oct 31, 2007

R T

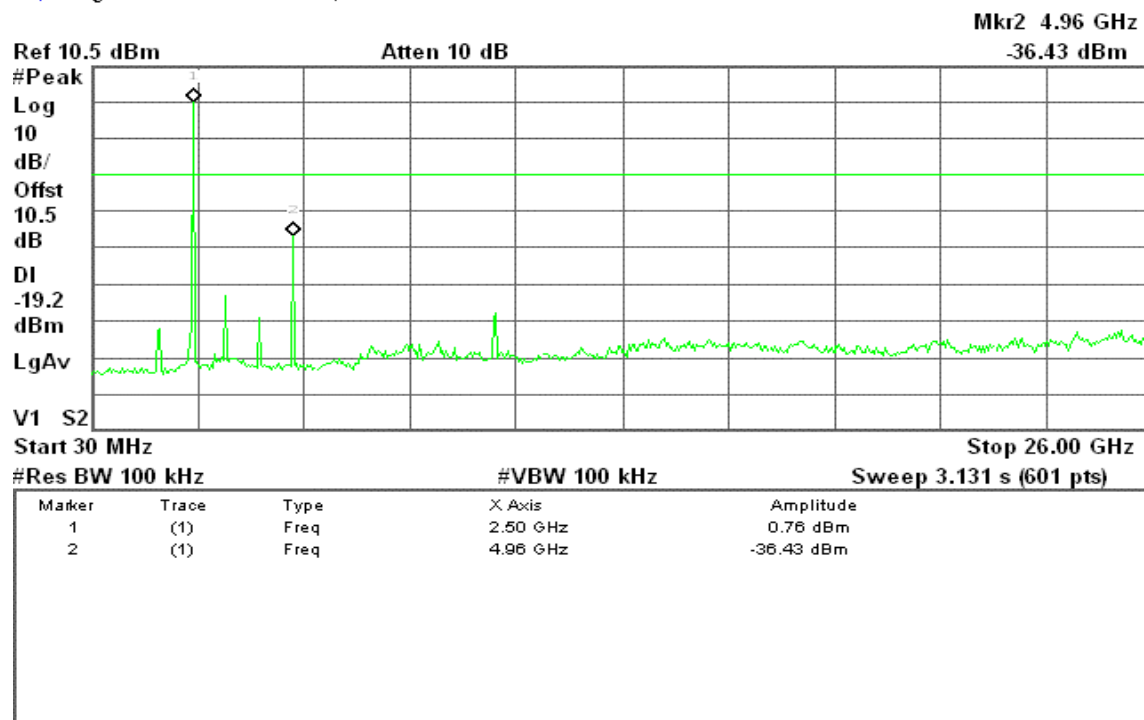




CH High

Agilent 16:24:39 Oct 31, 2007

R T





7.8.2 Radiated Emissions

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

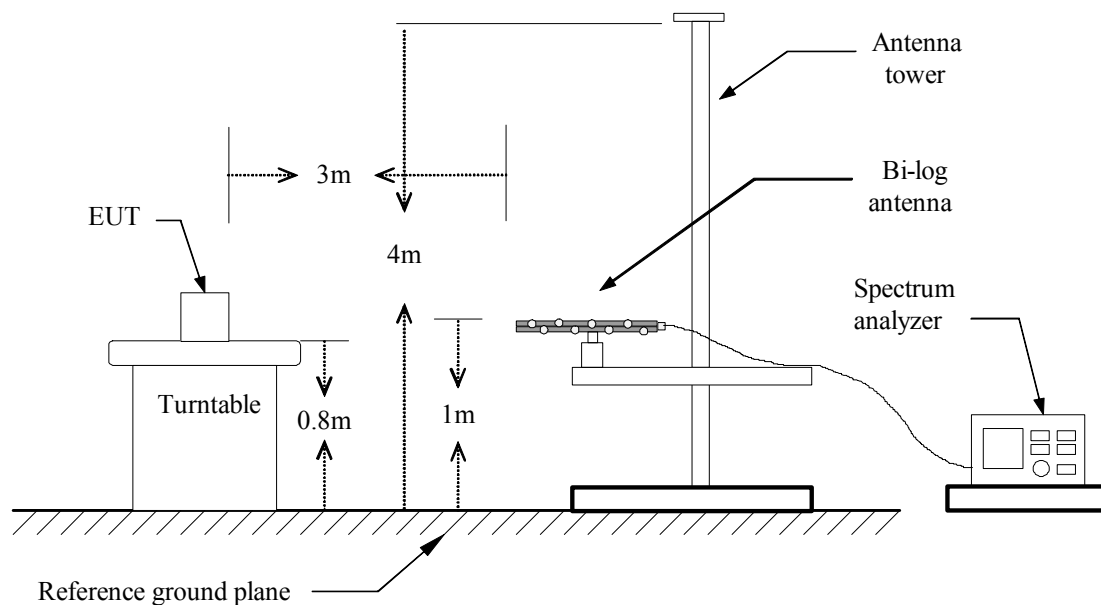
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

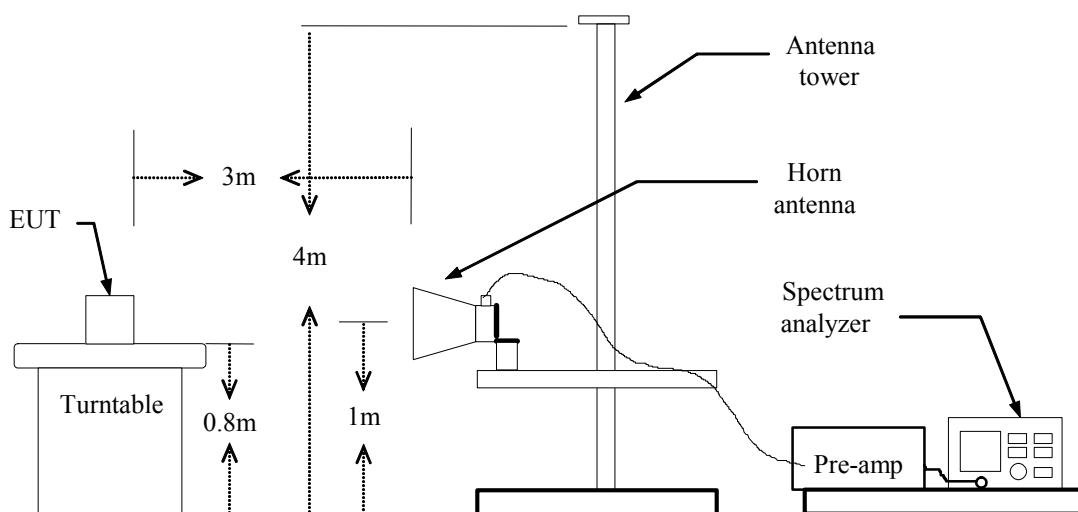
Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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 26, 2007

Temperature: 25°C

Tested by: Eric Cheng

Humidity: 55 % 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
31.62	V	42.02	-6.21	35.81	40.00	-4.19	Peak
47.78	V	49.90	-17.34	32.56	40.00	-7.44	Peak
139.93	V	46.81	-13.66	33.15	43.50	-10.35	Peak
167.42	V	48.28	-14.59	33.69	43.50	-9.81	Peak
662.12	V	37.19	-4.99	32.20	46.00	-13.80	Peak
932.10	V	34.58	-1.40	33.18	46.00	-12.82	Peak
30.00	H	38.59	-4.65	33.94	40.00	-6.06	Peak
144.78	H	48.92	-13.88	35.04	43.50	-8.46	Peak
191.67	H	46.39	-14.69	31.70	43.50	-11.80	Peak
253.10	H	48.32	-14.38	33.94	46.00	-12.06	Peak
299.98	H	45.03	-12.43	32.60	46.00	-13.40	Peak
996.77	H	35.15	-0.64	34.51	54.00	-19.49	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****For GFSK****Operation Mode:** TX / CH Low**Test Date:** October 15, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1170.00	V	53.02	---	-10.51	42.51	---	74.00	54.00	-11.49	Peak
1293.33	V	52.31	---	-10.31	42.00	---	74.00	54.00	-12.00	Peak
1603.33	V	56.54	---	-8.95	47.59	---	74.00	54.00	-6.41	Peak
4500.00	V	47.75	---	0.24	47.99	---	74.00	54.00	-6.01	Peak
4808.33	V	62.20	51.95	0.54	62.74	52.49	74.00	54.00	-1.51	AVG
N/A										
1166.67	H	60.03	---	-10.52	49.51	---	74.00	54.00	-4.49	Peak
1333.33	H	56.17	---	-10.25	45.92	---	74.00	54.00	-8.08	Peak
1600.00	H	59.99	---	-8.98	51.01	---	74.00	54.00	-2.99	Peak
1993.33	H	51.79	---	-5.07	46.72	---	74.00	54.00	-7.28	Peak
4500.00	H	50.22	---	0.24	50.45	---	74.00	54.00	-3.55	Peak
4808.33	H	66.73	53.14	0.54	67.27	53.68	74.00	54.00	-0.32	AVG

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:** October 15, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1270.00	V	53.56	---	-10.35	43.21	---	74.00	54.00	-10.79	Peak
1626.67	V	57.13	---	-8.72	48.42	---	74.00	54.00	-5.58	Peak
4500.00	V	47.44	---	0.24	47.68	---	74.00	54.00	-6.32	Peak
4883.33	V	58.20	48.17	0.61	58.81	48.78	74.00	54.00	-5.22	AVG
6000.00	V	46.63	---	2.09	48.72	---	74.00	54.00	-5.28	Peak
N/A										
1166.67	H	60.32	---	-10.52	49.80	---	74.00	54.00	-4.20	Peak
1333.33	H	56.79	---	-10.25	46.55	---	74.00	54.00	-7.45	Peak
1396.67	H	54.04	---	-10.14	43.90	---	74.00	54.00	-10.10	Peak
1490.00	H	56.47	---	-9.99	46.48	---	74.00	54.00	-7.52	Peak
1626.67	H	59.01	---	-8.72	50.30	---	74.00	54.00	-3.70	Peak
4500.00	H	49.90	---	0.24	50.14	---	74.00	54.00	-3.86	Peak
4883.33	H	62.66	52.77	0.61	63.27	53.38	74.00	54.00	-0.62	AVG

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 High**Test Date:** October 15, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1653.33	V	58.51	---	-8.45	50.06	---	74.00	54.00	-3.94	Peak
4500.00	V	47.81	---	0.24	48.05	---	74.00	54.00	-5.95	Peak
4958.33	V	56.42	46.51	0.68	57.10	47.19	74.00	54.00	-6.81	AVG
6000.00	V	47.94	---	2.09	50.03	---	74.00	54.00	-3.97	Peak
N/A										
1166.67	H	59.36	---	-10.52	48.84	---	74.00	54.00	-5.16	Peak
1393.33	H	56.11	---	-10.15	45.96	---	74.00	54.00	-8.04	Peak
1486.67	H	55.98	---	-10.00	45.99	---	74.00	54.00	-8.01	Peak
1653.33	H	58.25	---	-8.45	49.80	---	74.00	54.00	-4.20	Peak
4500.00	H	50.04	---	0.24	50.28	---	74.00	54.00	-3.72	Peak
4958.33	H	53.16	---	0.68	53.85	---	74.00	54.00	-0.15	Peak

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. $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$.

**For 8DPSK****Operation Mode:** TX / CH Low**Test Date:** October 30, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1496.67	V	70.14	52.24	-9.98	60.16	42.26	74.00	54.00	-11.74	AVG
1600.00	V	56.65	---	-8.98	47.67	---	74.00	54.00	-6.33	Peak
4808.33	V	64.10	52.31	0.54	64.64	52.85	74.00	54.00	-1.15	AVG
N/A										
1500.00	H	64.18	46.28	-9.97	54.21	36.31	74.00	54.00	-17.69	Peak
1600.00	H	58.27	---	-8.98	49.29	---	74.00	54.00	-4.71	Peak
4808.33	H	64.81	52.34	0.54	65.35	52.88	74.00	54.00	-1.12	AVG
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 30, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1133.33	V	64.84	42.62	-10.57	54.27	32.05	74.00	54.00	-21.95	AVG
1493.33	V	74.07	58.79	-9.98	64.08	48.81	74.00	54.00	-5.19	AVG
1626.67	V	58.75	---	-8.72	50.04	---	74.00	54.00	-3.96	Peak
1996.67	V	56.59	---	-5.04	51.55	---	74.00	54.00	-2.45	Peak
4883.33	V	57.68	47.17	0.61	58.29	47.78	74.00	54.00	-6.22	AVG
N/A										
1143.33	H	57.55	---	-10.56	46.99	---	74.00	54.00	-7.01	Peak
1493.33	H	65.71	48.57	-9.98	55.73	38.59	74.00	54.00	-15.41	AVG
1626.67	H	59.02	---	-8.72	50.30	---	74.00	54.00	-3.70	Peak
4883.33	H	61.48	51.87	0.61	62.09	52.48	74.00	54.00	-1.52	AVG
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 30, 2007**Temperature:** 25°C**Tested by:** Steven Young**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
1133.33	V	61.98	---	-10.57	51.41	---	74.00	54.00	-2.59	Peak
1496.67	V	72.38	58.54	-9.98	62.40	48.56	74.00	54.00	-5.44	AVG
1653.33	V	59.48	---	-8.45	51.03	---	74.00	54.00	-2.97	Peak
1993.33	V	56.46	---	-5.07	51.39	---	74.00	54.00	-2.61	Peak
4958.33	V	57.54	46.87	0.68	58.22	47.55	74.00	54.00	-6.45	AVG
N/A										
1133.33	H	58.25	---	-10.57	47.68	---	74.00	54.00	-6.32	Peak
1493.33	H	64.19	47.11	-9.98	54.21	37.13	74.00	54.00	-16.87	AVG
1653.33	H	58.85	---	-8.45	50.40	---	74.00	54.00	-3.60	Peak
4958.33	H	62.43	50.23	0.68	63.11	50.91	74.00	54.00	-3.09	AVG
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).



7.9 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

* Decreases with the logarithm of the frequency.

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 23, 2007**Temperature:** 25°C**Tested by:** Eric Cheng**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
0.177	49.060	44.450	0.131	49.191	44.581	64.625	54.625	-15.435	-10.045	L1
0.234	42.580	38.340	0.098	42.678	38.438	62.307	52.307	-19.629	-13.869	L1
0.293	37.220	34.340	0.076	37.296	34.416	60.439	50.439	-23.143	-16.023	L1
1.952	38.830	38.400	0.010	38.840	38.410	56.000	46.000	-17.160	-7.590	L1
2.015	34.790	34.430	0.010	34.800	34.440	56.000	46.000	-21.200	-11.560	L1
4.030	23.560	16.370	0.071	23.631	16.441	56.000	46.000	-32.369	-29.559	L1
0.176	48.210	43.440	0.132	48.342	43.572	64.672	54.672	-16.331	-11.101	L2
0.234	41.330	38.510	0.098	41.428	38.608	62.307	52.307	-20.879	-13.699	L2
0.295	39.660	36.840	0.075	39.735	36.915	60.382	50.382	-20.647	-13.467	L2
1.890	35.020	32.820	0.009	35.029	32.829	56.000	46.000	-20.971	-13.171	L2
3.721	37.620	30.360	0.062	37.682	30.422	56.000	46.000	-18.318	-15.578	L2
3.842	29.500	23.460	0.065	29.565	23.525	56.000	46.000	-26.435	-22.475	L2

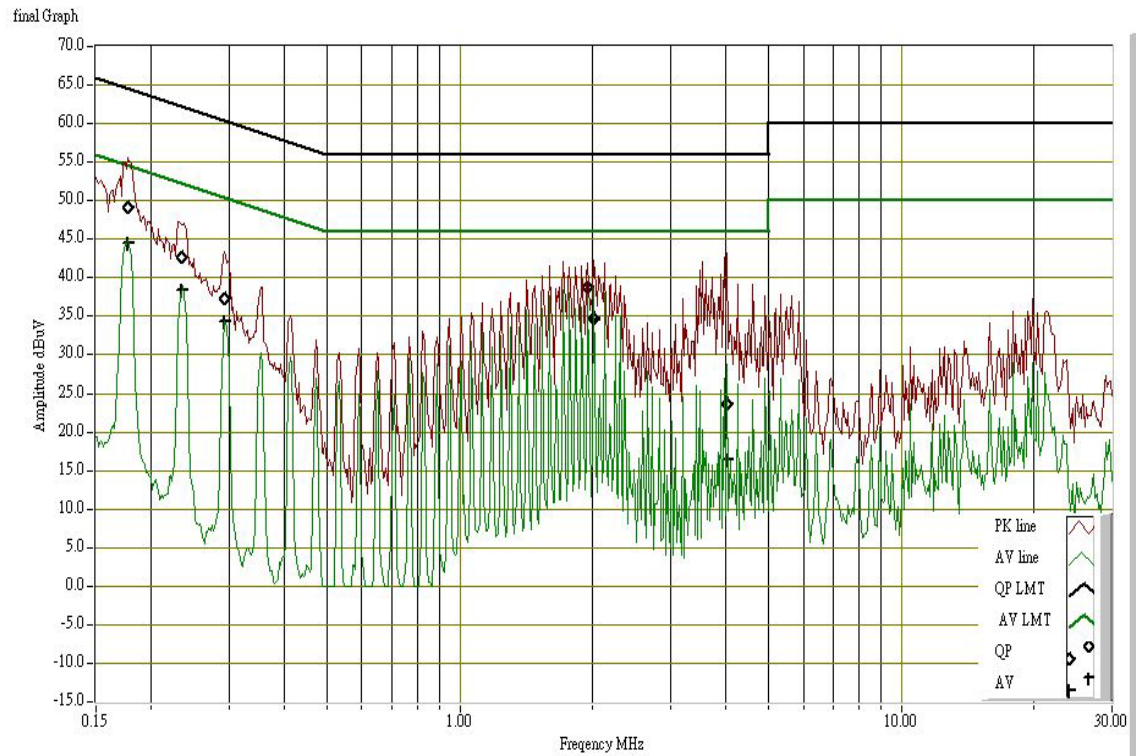
Remark:

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)

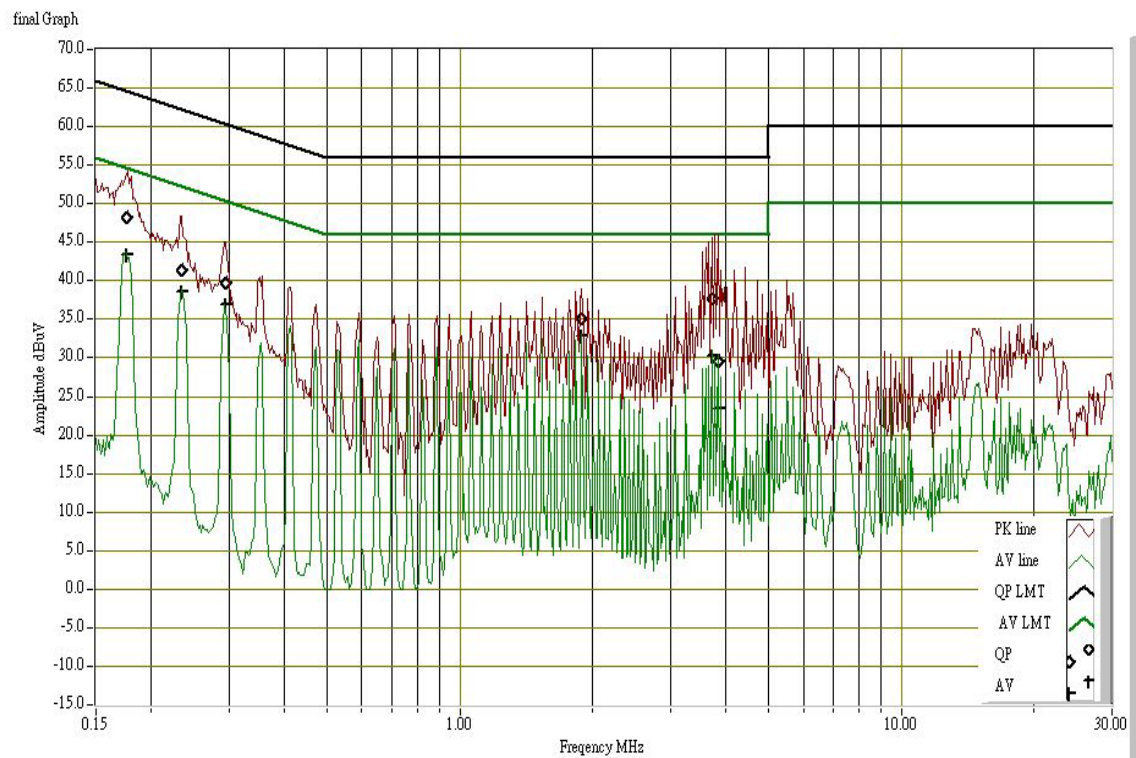


Test Plots

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	Bluetooth Vibrator
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	1.26dBm (1.34mW)
Antenna gain (Max)	0 dBi (Numeric gain: 1)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A

Remark:

1. The maximum output power is 1.26dBm (1.34mW) at 2402MHz (with 1 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.

**Calculation**

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

Maximum Permissible Exposure

EUT output power = 1.34mW

Numeric Antenna gain = 1

Substituting the MPE safe distance using $d = 20$ cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

$$\rightarrow \text{Power density} = 0.00027 \text{ mW / cm}^2$$

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)