



**FCC 47 CFR PART 15 SUBPART C**

**TEST REPORT**

**For**

**Nobo Kapture USB Receiver**

**Model: V10472**

**Trade Name: Nobo Kapture**

*Issued to*

**Acco Brands Europe  
Oxford House, Oxford Road Aylesbury Bucks  
HP218SZ England**

*Issued by*

**Compliance Certification Services Inc.  
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### 1. TEST RESULT CERTIFICATION

**Applicant:** Acco Brands Europe  
 Oxford House, Oxford Road Aylesbury Bucks  
 HP218SZ England

**Equipment Under Test:** Nobo Kapture USB Receiver

**Trade Name:** Nobo Kapture

**Model:** V10472

**Date of Test:** October 17 ~ 29, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

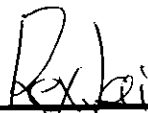
**We hereby certify that:**

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.

  
 \_\_\_\_\_  
 Gina Lo  
 Section Manager  
 Compliance Certification Services Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	Nobo Kapture USB Receiver
<b>Trade Name</b>	Nobo Kapture
<b>Model Number</b>	V10472
<b>Model Discrepancy</b>	N/A
<b>Power Supply</b>	Powered from host device
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	3.69 dBm
<b>Modulation Technique</b>	GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
<b>Transmit Data Rate</b>	1, 2, 3Mbps
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	Gain: -2 dBi
<b>Antenna Designation</b>	PCB 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: **GV3V10472** 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 Part 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
<sup>1</sup> 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	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> 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: V10472) 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.

The worst case data rate is determined as the data rate with highest output power.

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.

During the preliminary test, GFSK,  $\pi/4$ -QPSK & 8DPSK with DH1 were pre-tested and found that 8DPSK emits the highest output power. Then the tests were carried on with DH1 compare to DH3 & DH5 and found that 8DPSK with DH5 emit the highest output power, and therefore had been tested under operating condition.

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

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



## 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	02/23/2010
Power Meter	Agilent	E4416A	GB41291611	04/05/2010
Power Sensor	Agilent	E9327A	US40441097	06/05/2010

3M Semi Anechoic Chamber				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	09/09/2010
Test Receiver	Rohde&Schwarz	ESCI	100064	11/28/2010
Switch Controller	TRC	Switch Controller	SC94050010	05/02/2010
4 Port Switch	TRC	4 Port Switch	SC94050020	05/02/2010
Loop Antenna	EMCO	6502	8905/2356	05/28/2010
Horn-Antenna	TRC	HA-0502	06	06/03/2010
Horn-Antenna	TRC	HA-0801	04	06/18/2010
Horn-Antenna	TRC	HA-1201A	01	08/10/2010
Horn-Antenna	TRC	HA-1301A	01	08/10/2010
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/27/2010
Loop Antenna	EMCO	6502	8905/2356	05/28/2010
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 MRA: TW1039 IC: 2324G-1 / -2	10/16/2010 11/04/2010
Test S/W	LABVIEW (V 6.1)			

Powerline Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	11/25/2009
Two-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/10/2010
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/08/2010
Test S/W	LABVIEW (V 6.1)			





### 4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 2.81
3M Semi Anechoic Chamber / 30MHz ~ 1GHz	+/- 3.70
3M Semi Anechoic Chamber / Above 1GHz	+/- 3.09

*Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .*



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

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

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

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

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	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12.2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method -47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	 Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

\* 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.	Notebook PC	DELL	PP19L	GK102 A00	QDS-BRCM1021	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	LCD Monitor	SAMSUNG	959NF	AQ19H2RT706126P	FCC DoC	Shielded, 1.8m with 2 cores	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
3.	USB 2.0 External HDD	TeraSys	F12-U	A0100214-39t0003	FCC DoC	Shielded, 1.8m	N/A
4.	USB Mouse	Logitech	M-UE58	LZA10752880	FCC DoC	Shielded, 1.8m	N/A

**Remark:**

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



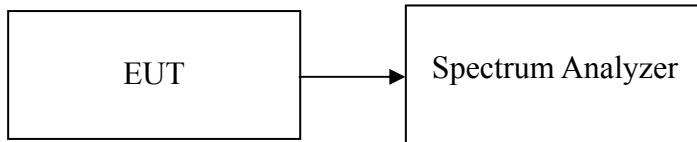
## 7. FCC PART 15.247 REQUIREMENTS

### 7.120 DB BANDWIDTH

#### LIMIT

None; for reporting purposes only.

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10kHz, VBW = 30kHz, Span = 1.5MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

#### TEST RESULTS

*No non-compliance noted.*

#### Test Data

##### **For GFSK / DH5**

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.933
Mid	2441	0.936
High	2480	0.936

##### **For 8DPSK / DH5**

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.268
Mid	2441	1.274
High	2480	1.277



Test Plot

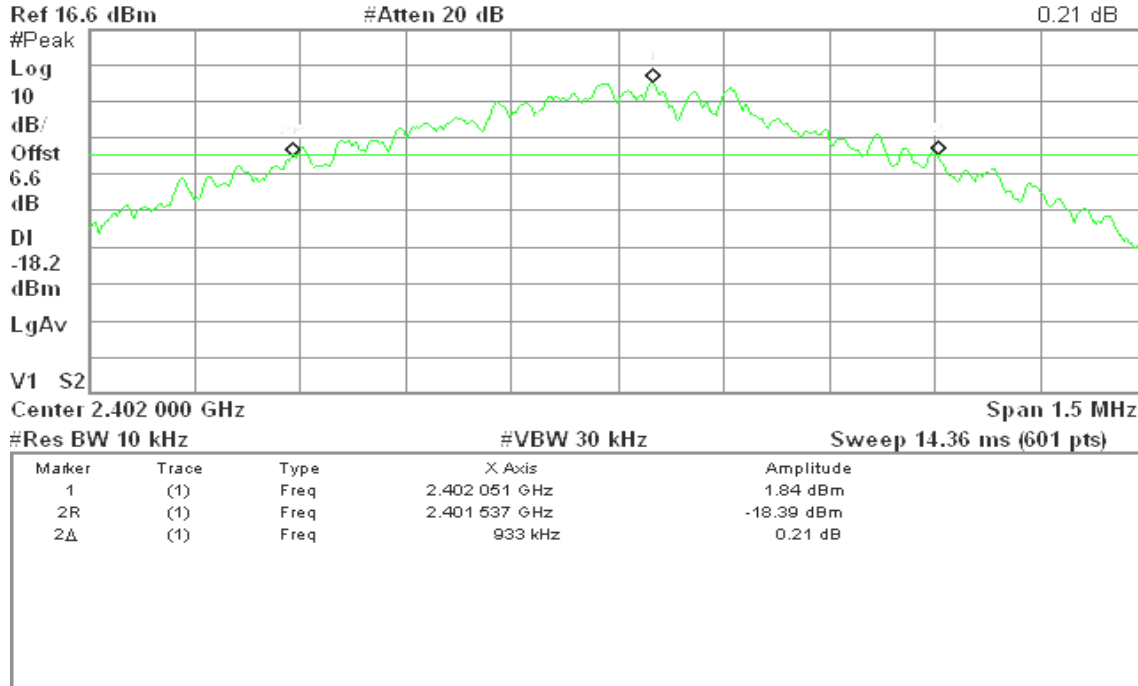
For GFSK / DH5

20dB Bandwidth (CH Low)

Agilent 09:55:55 Oct 20, 2009

R T

Δ Mkr2 933 kHz  
0.21 dB

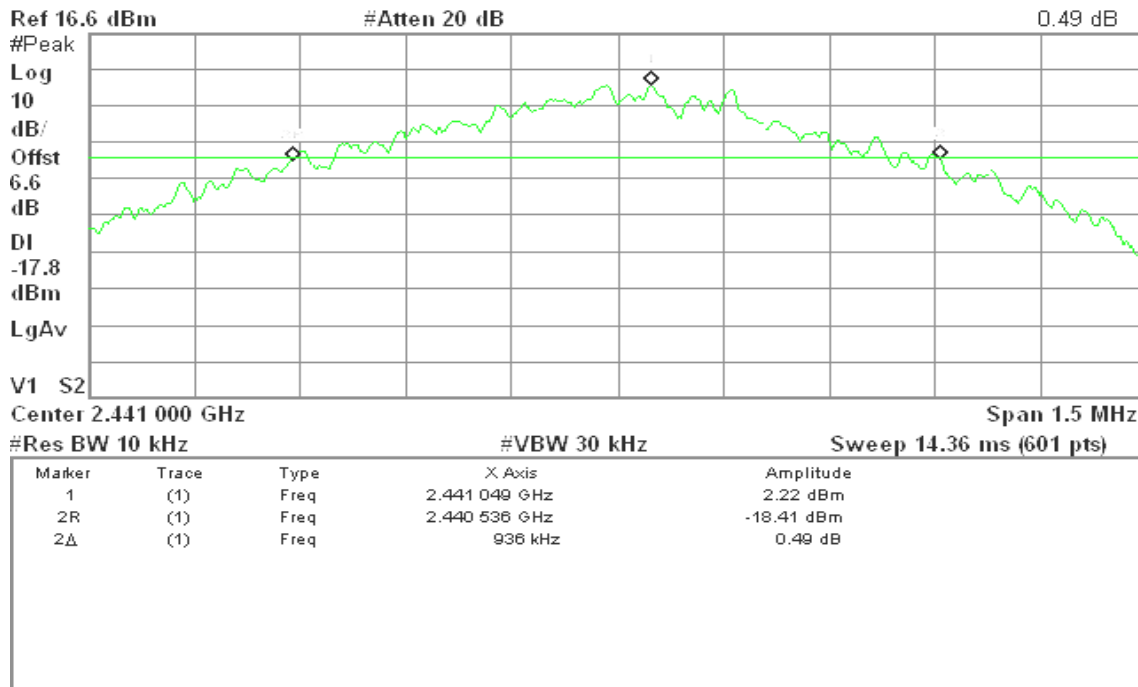


20dB Bandwidth (CH Mid)

Agilent 09:57:15 Oct 20, 2009

R T

Δ Mkr2 936 kHz  
0.49 dB



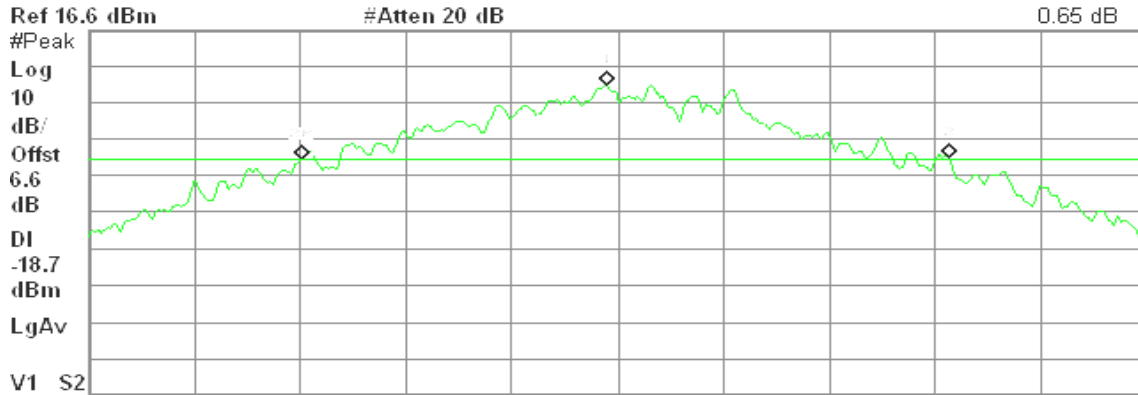


### 20dB Bandwidth (CH High)

Agilent 09:58:06 Oct 20, 2009

R T

Δ Mkr2 936 kHz  
0.65 dB



Ref 16.6 dBm #Atten 20 dB

Center 2.480 000 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	2.479 982 GHz	1.29 dBm
2R	(1)	Freq	2.479 537 GHz	-19.04 dBm
2Δ	(1)	Freq	936 kHz	0.65 dB



For 8DPSK / DH5

20dB Bandwidth (CH Low)

Agilent 10:03:37 Oct 20, 2009

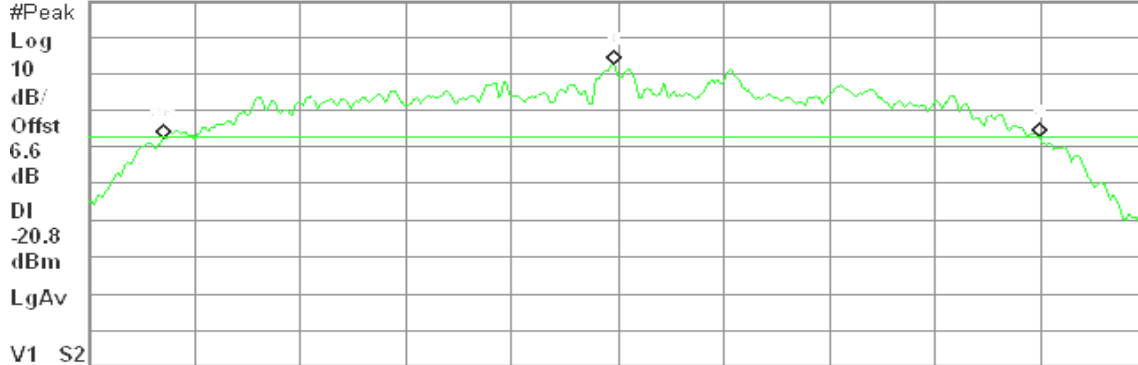
R T

Δ Mkr2 1.268 MHz

0.83 dB

Ref 16.6 dBm

#Atten 20 dB



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	2.401 992 GHz	-0.77 dBm
2R	(1)	Freq	2.401 353 GHz	-21.27 dBm
2Δ	(1)	Freq	1.268 MHz	0.83 dB

20dB Bandwidth (CH Mid)

Agilent 10:02:19 Oct 20, 2009

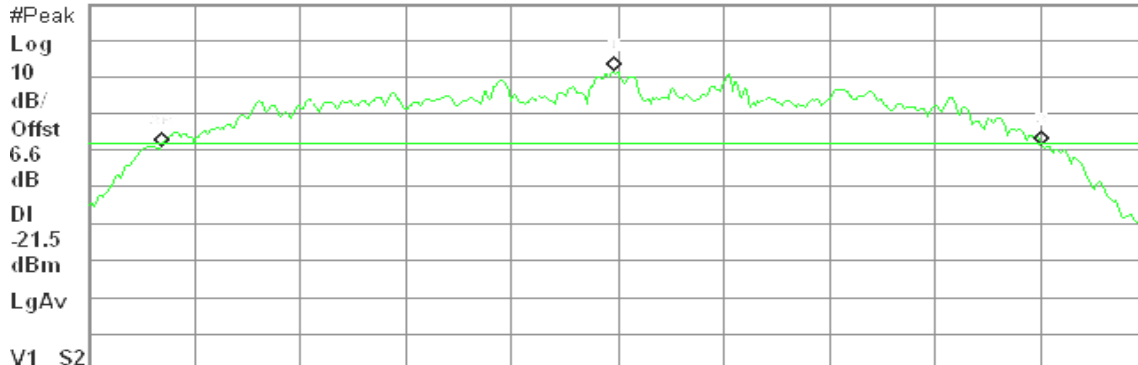
R T

Δ Mkr2 1.274 MHz

0.27 dB

Ref 16.6 dBm

#Atten 20 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	2.440 992 GHz	-1.55 dBm
2R	(1)	Freq	2.440 351 GHz	-22.28 dBm
2Δ	(1)	Freq	1.274 MHz	0.27 dB





### 20dB Bandwidth (CH High)

Agilent 10:01:28 Oct 20, 2009

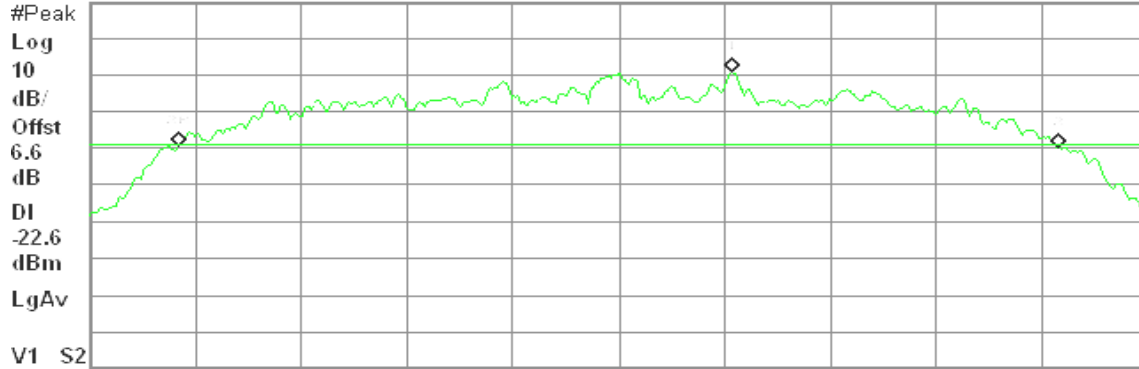
R T

Δ Mkr2 1.277 MHz

-0.39 dB

Ref 16.6 dBm

#Atten 20 dB



Center 2.480 000 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	2.480 163 GHz	-2.56 dBm
2R	(1)	Freq	2.479 351 GHz	-22.70 dBm
2Δ	(1)	Freq	1.277 MHz	-0.39 dB



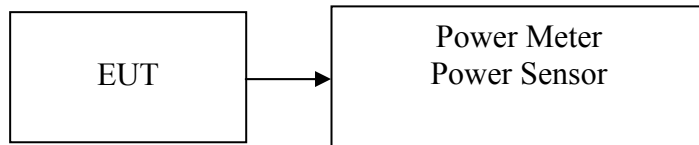
## 7.2 PEAK POWER

### 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 RESULTS

*No non-compliance noted.*



**Test Data**

**For GFSK / DH5**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	3.46	0.0022	0.125	PASS
Mid	2441	3.44	0.0022		PASS
High	2480	3.69	0.0023		PASS

**For 8DPSK / DH5**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	3.32	0.0021	0.125	PASS
Mid	2441	3.48	0.0022		PASS
High	2480	3.48	0.0022		PASS

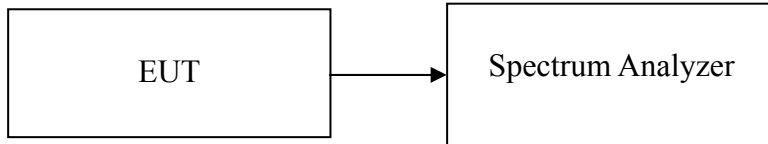


### 7.3 AVERAGE POWER

#### 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 / DH5

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	2.19	0.0017
Mid	2441	2.17	0.0016
High	2480	2.41	0.0017

##### For 8DPSK / DH5

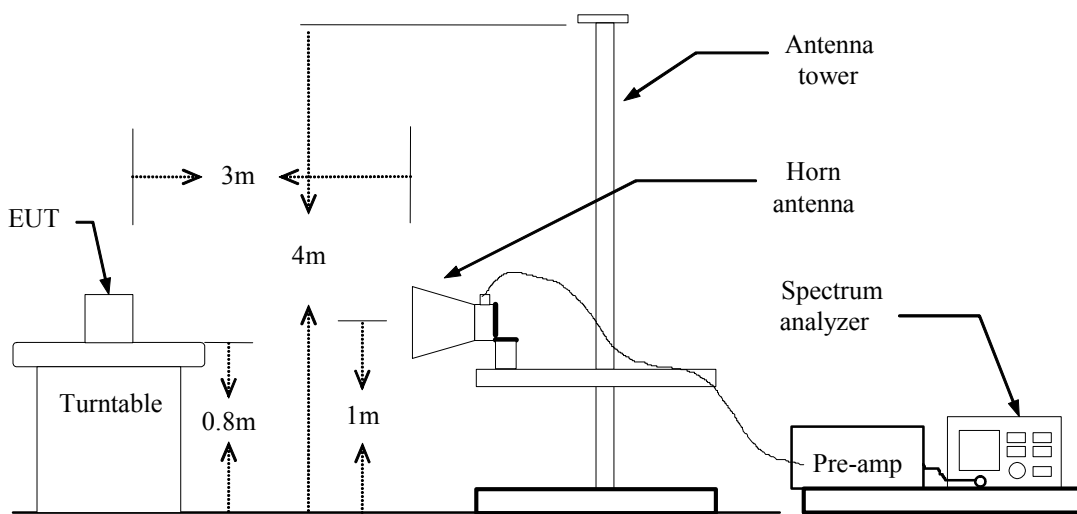
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	0.15	0.0010
Mid	2441	0.24	0.0011
High	2480	0.12	0.0010

## 7.4 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.

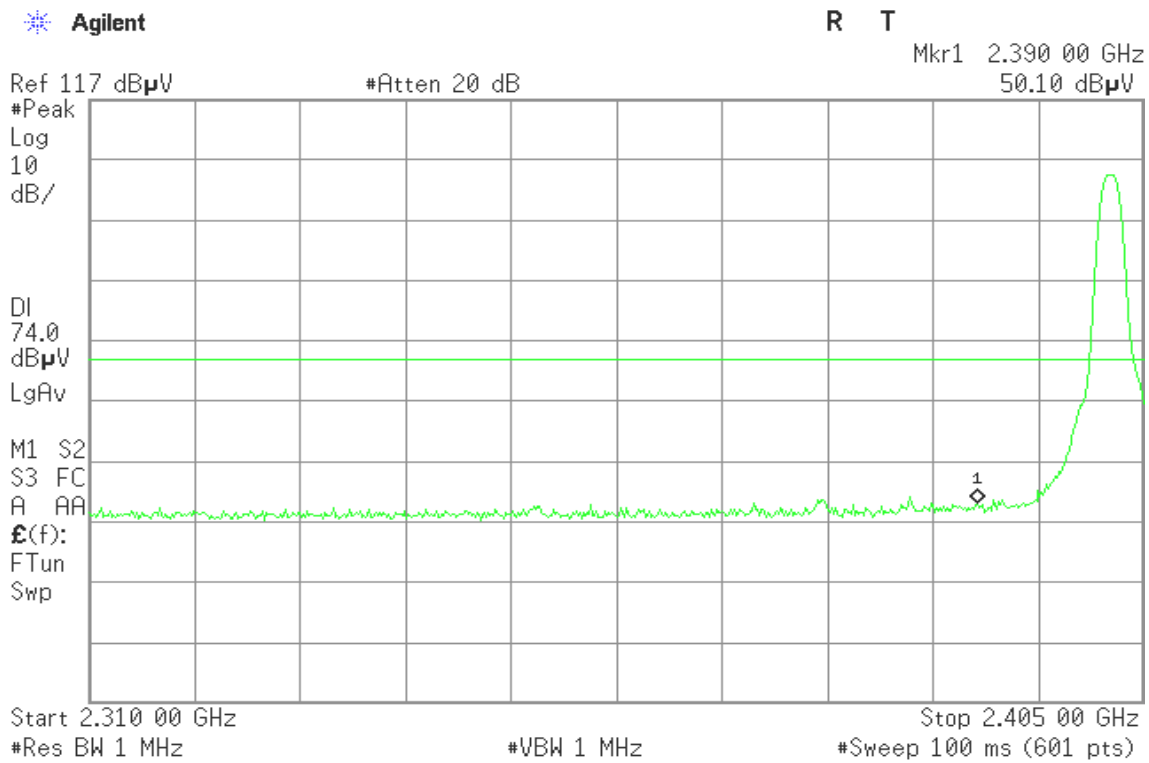


For GFSK / DH5

Band Edges (CH Low)

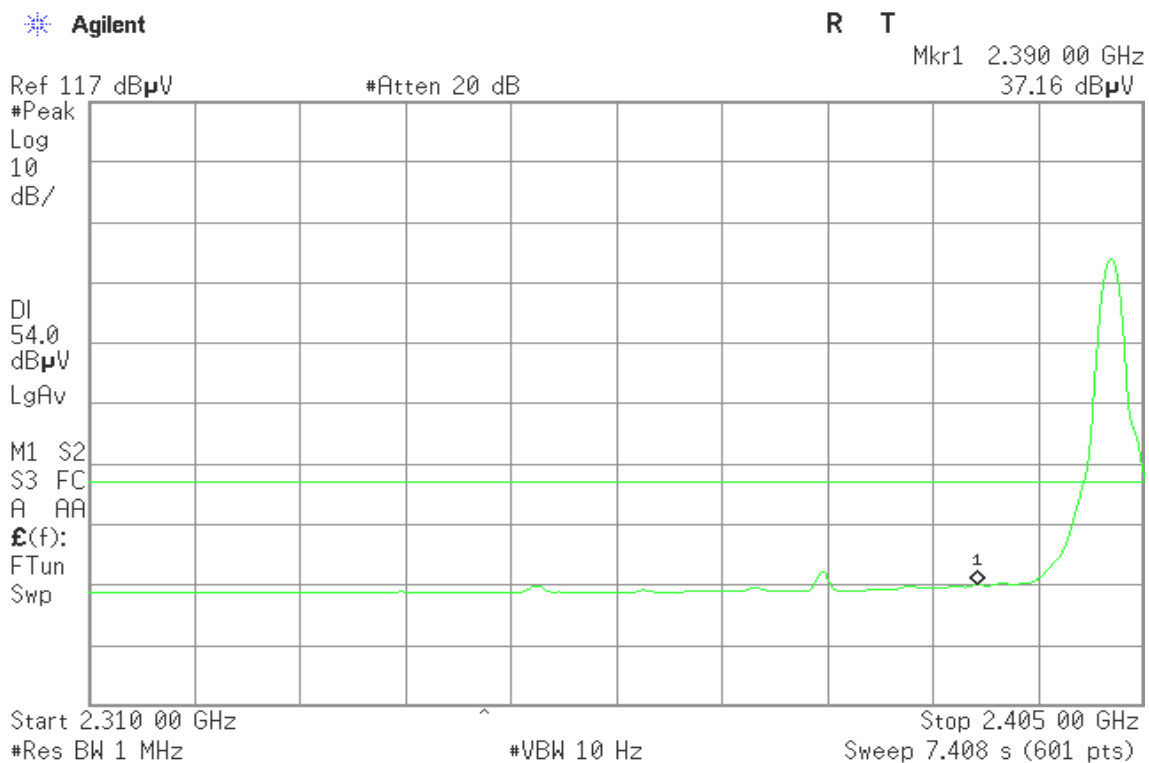
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.390 00 GHz  
48.89 dBµV

Ref 117 dBµV

#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
74.0  
dBµV  
LgAv

M1 S2  
S3 FC  
A AA

£(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: Horizontal

Agilent

R T

Mkr1 2.390 00 GHz  
36.54 dBµV

Ref 117 dBµV

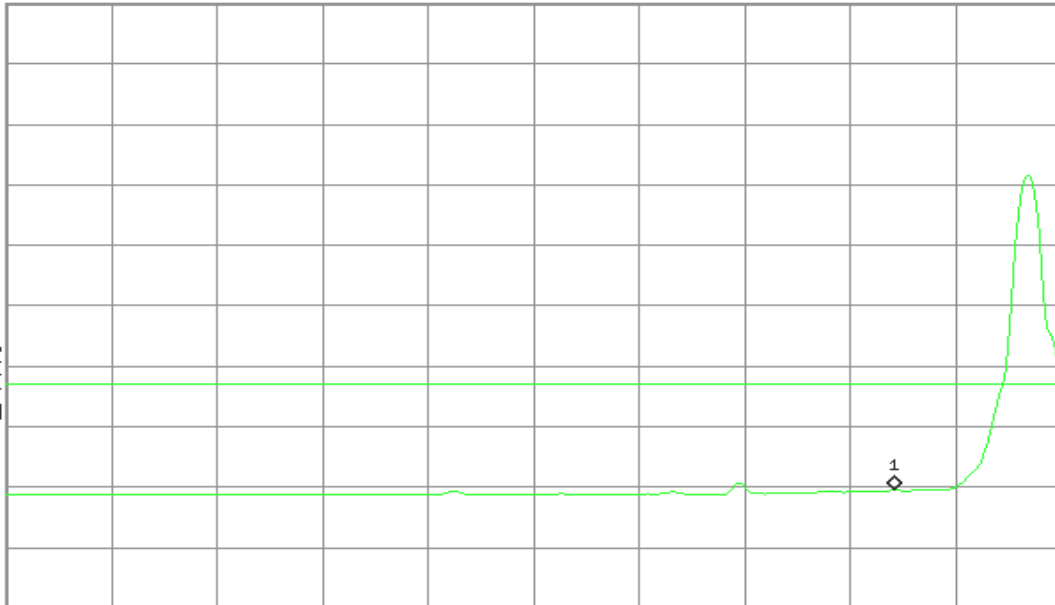
#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
54.0  
dBµV  
LgAv

M1 S2  
S3 FC  
A AA

£(f):  
FTun  
Swp



Start 2.310 00 GHz

Stop 2.405 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

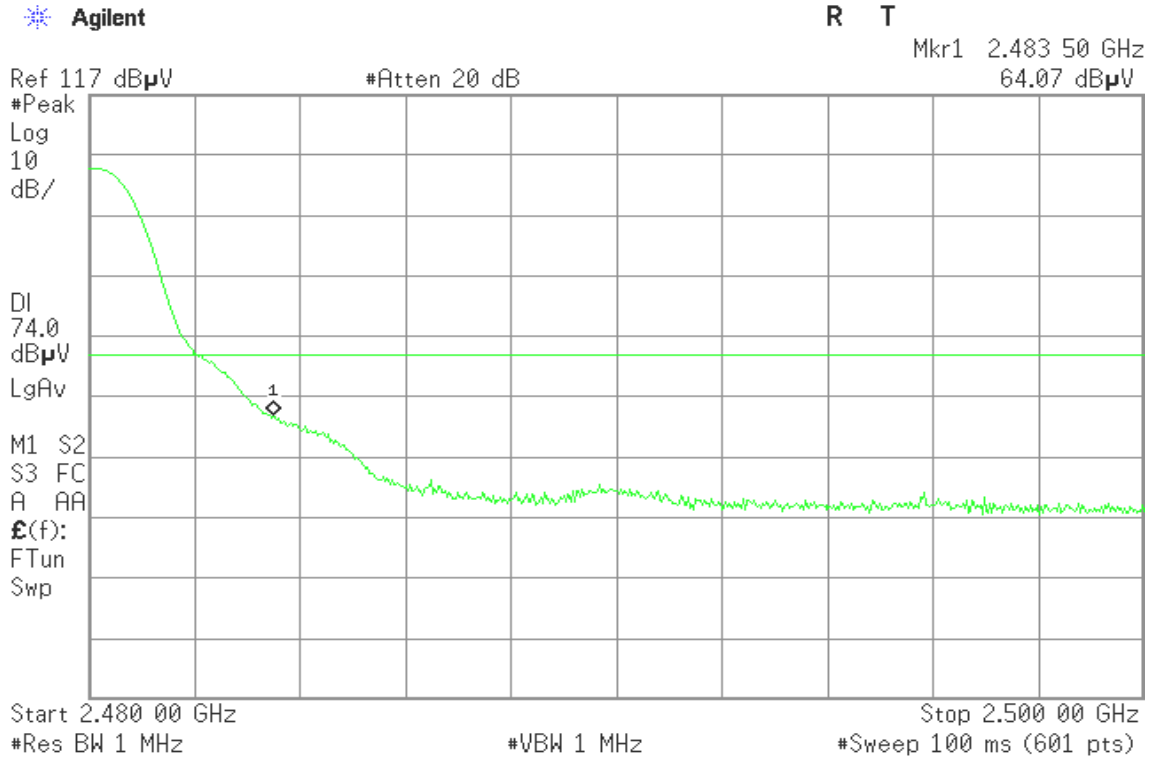
Sweep 7.408 s (601 pts)



### Band Edges (CH High)

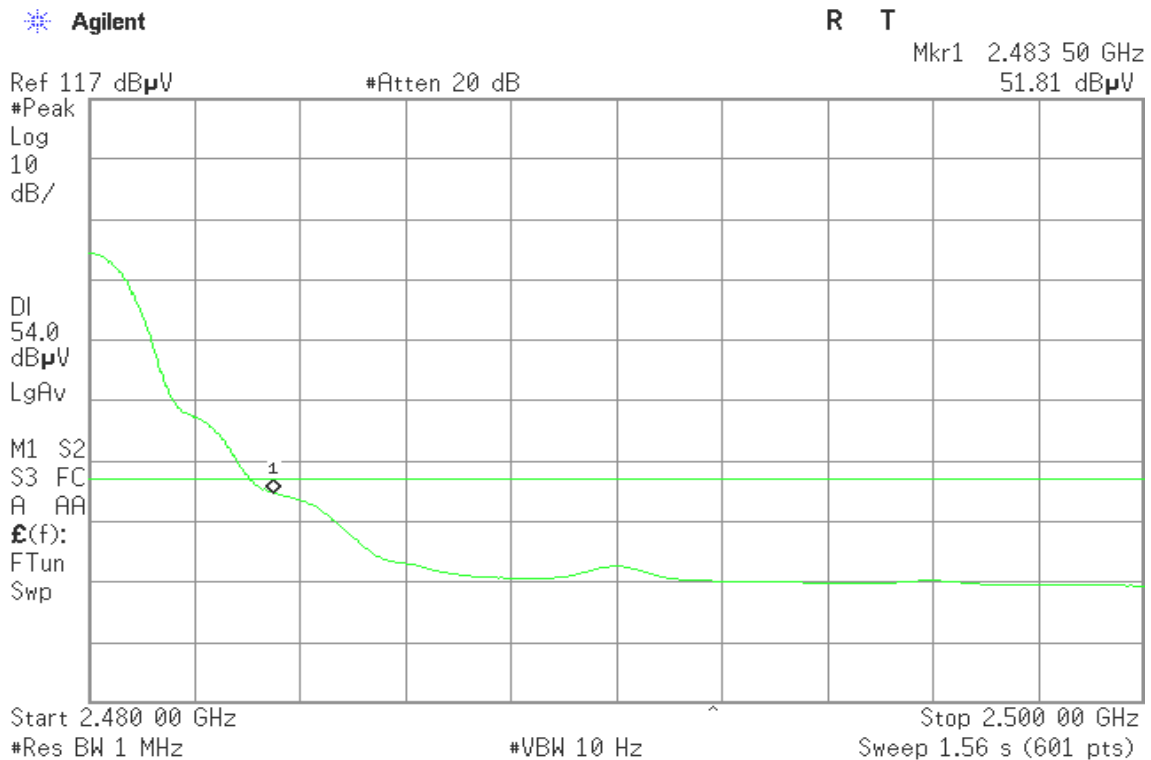
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical







Detector mode: Peak

Polarity: Horizontal

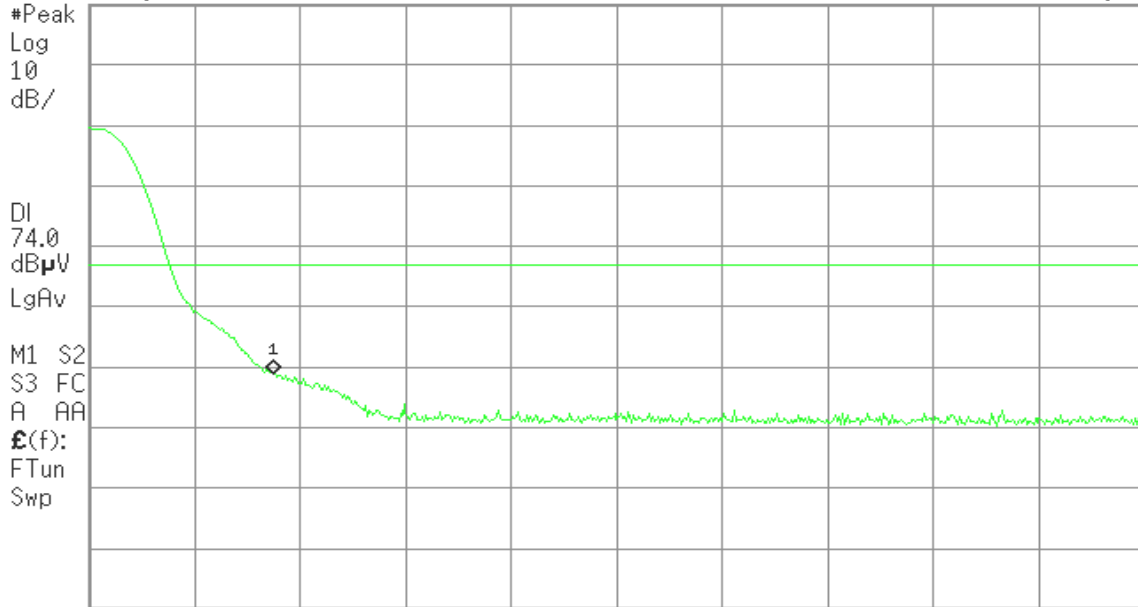
Agilent

R T

Mkr1 2.483 50 GHz  
55.86 dBµV

Ref 117 dBµV

#Atten 20 dB



Start 2.480 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

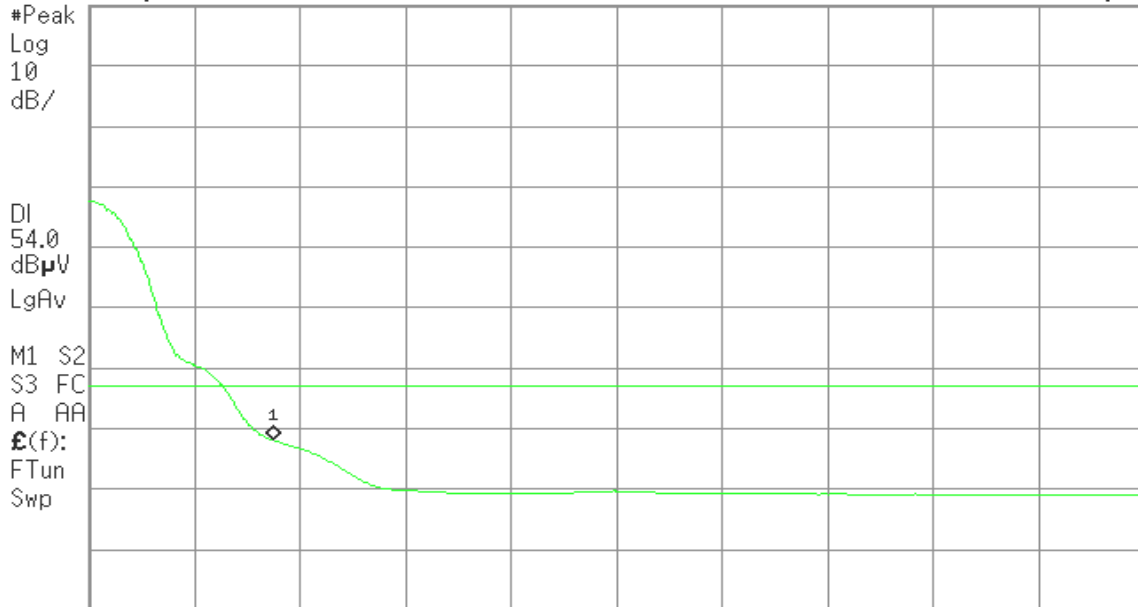
Agilent

R T

Mkr1 2.483 50 GHz  
45.07 dBµV

Ref 117 dBµV

#Atten 20 dB



Start 2.480 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 1.56 s (601 pts)

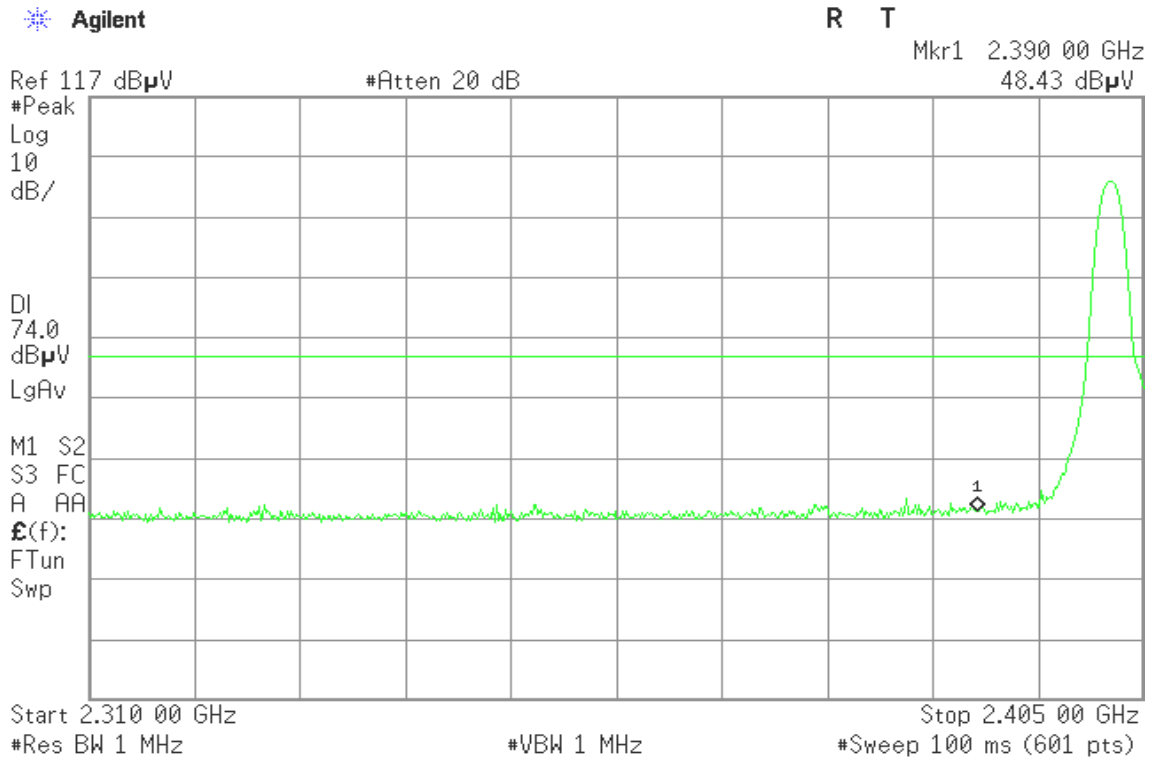


For 8DPSK / DH5

Band Edges (CH Low)

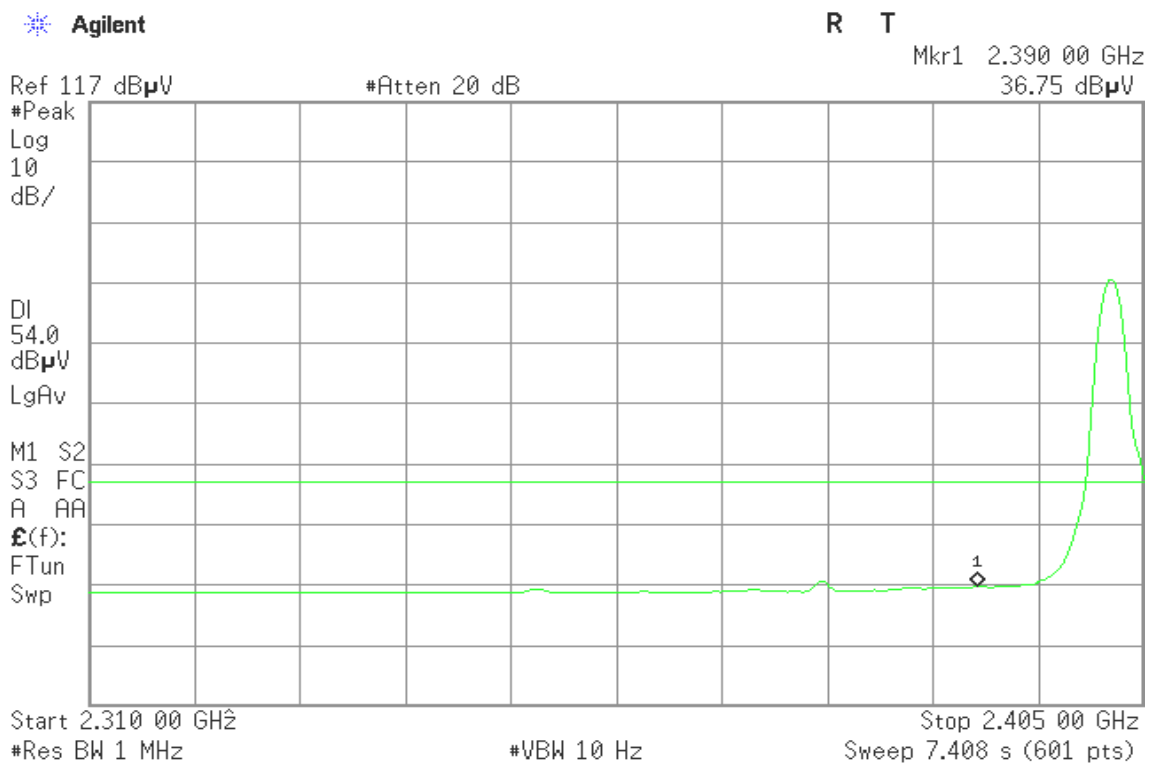
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.390 00 GHz  
47.89 dBµV

Ref 117 dBµV

#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
74.0  
dBµV  
LgAv

M1 S2  
S3 FC  
A AA  
£(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: Horizontal

Agilent

R T

Mkr1 2.390 00 GHz  
36.37 dBµV

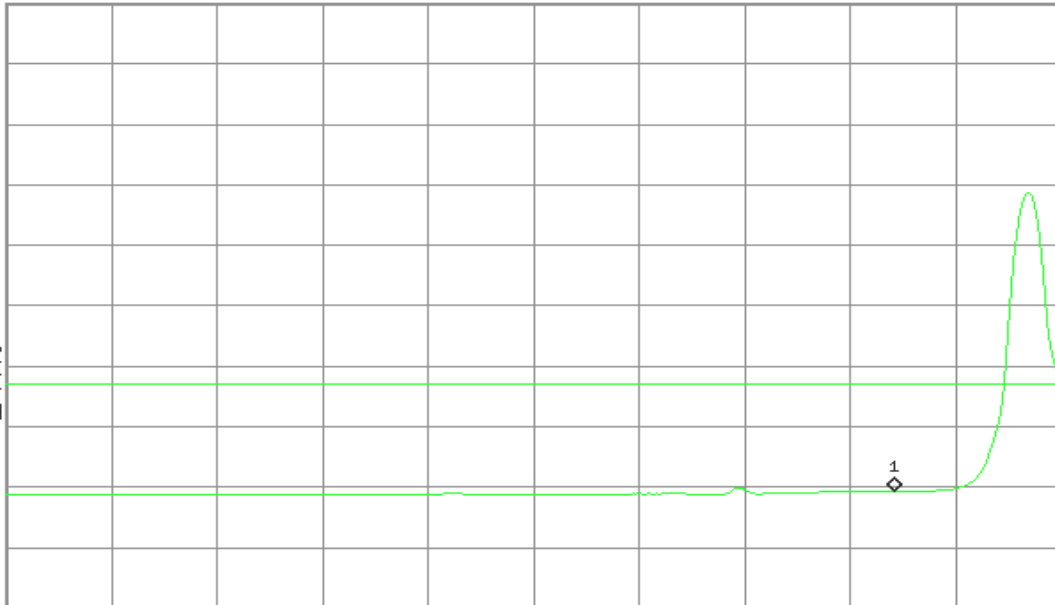
Ref 117 dBµV

#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
54.0  
dBµV  
LgAv

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



Start 2.310 00 GHz

Stop 2.405 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

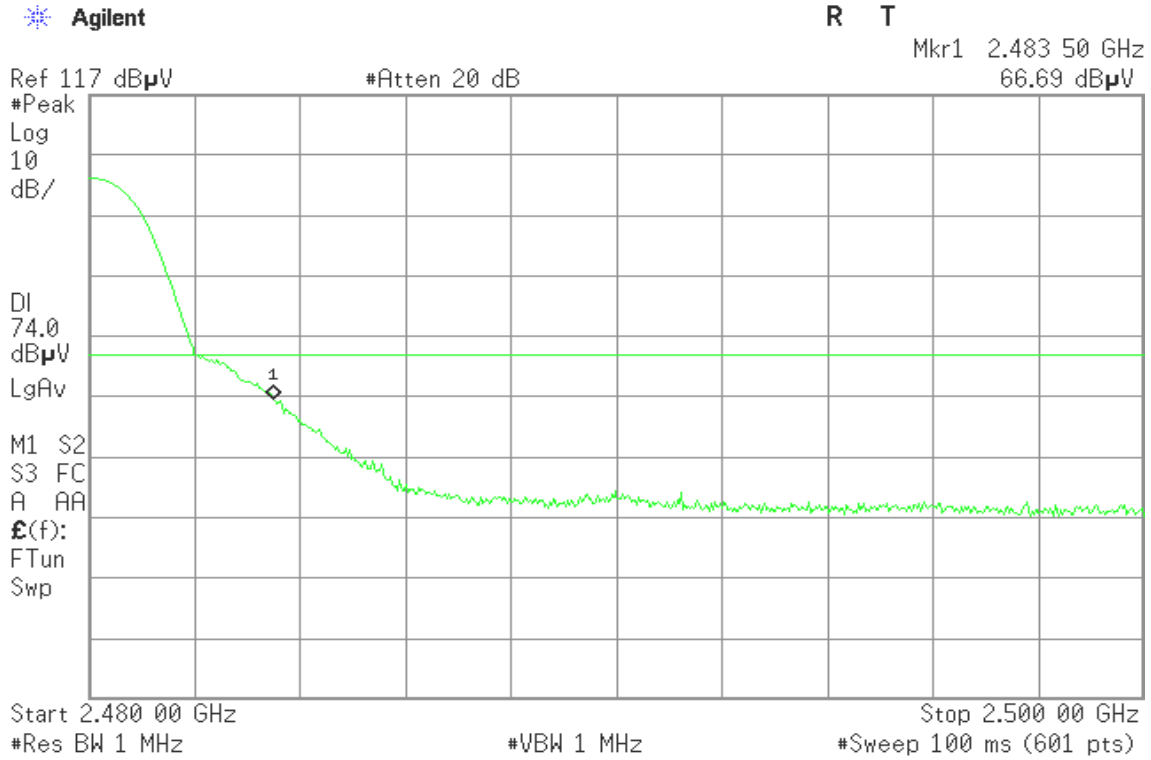
Sweep 7.408 s (601 pts)



### Band Edges (CH High)

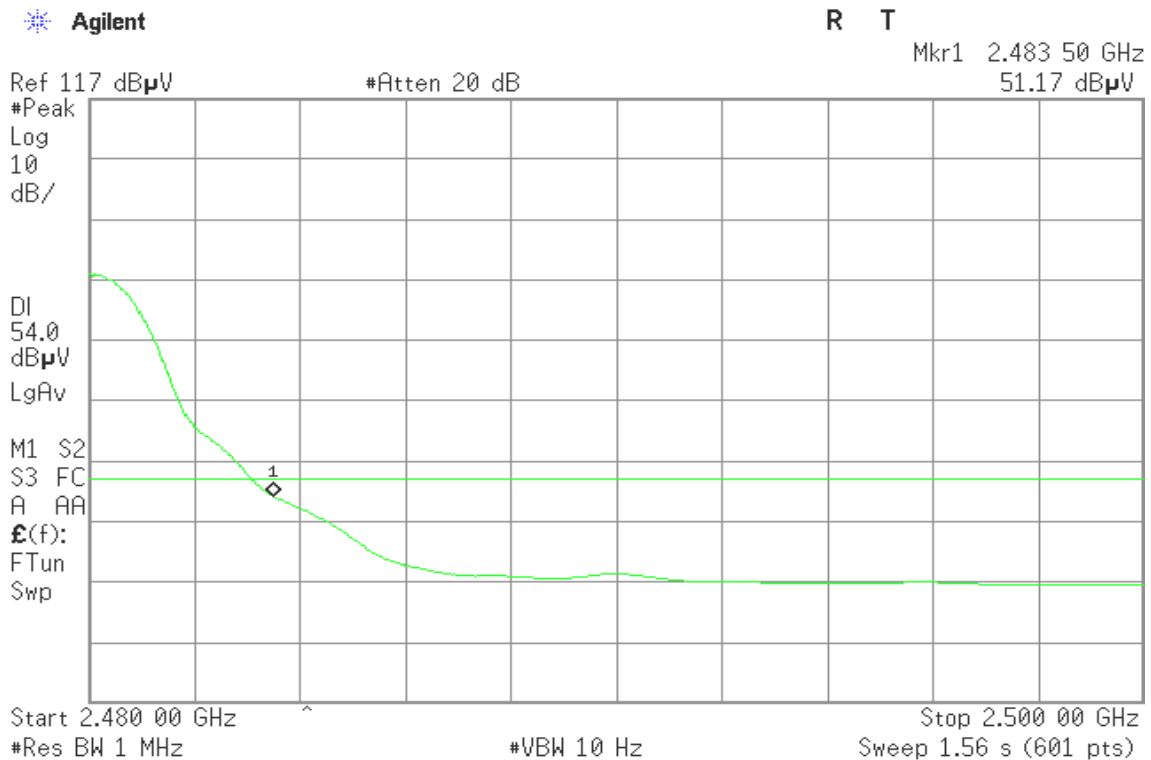
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
58.51 dBμV

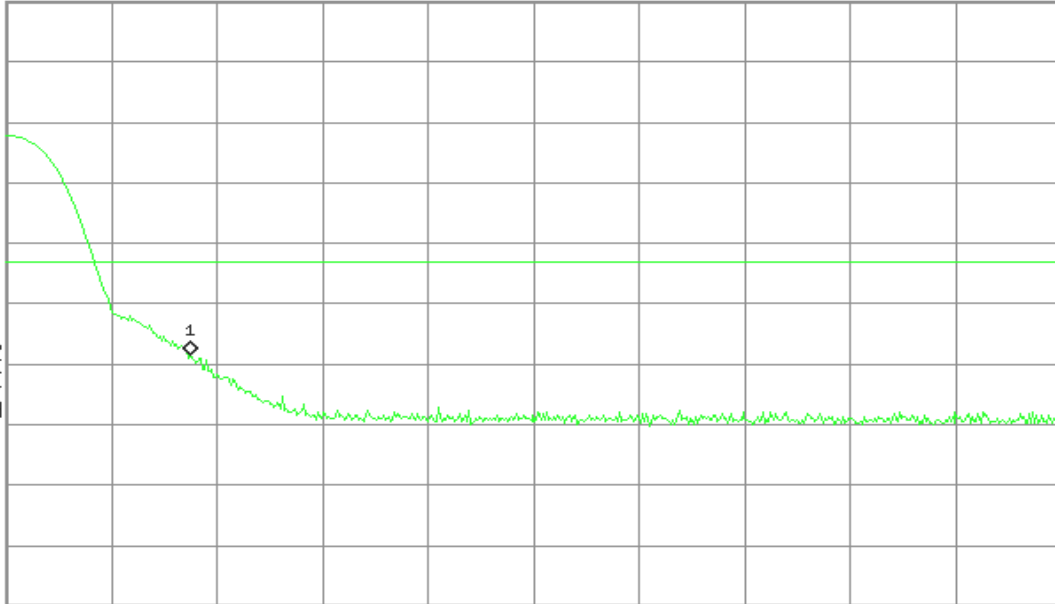
Ref 117 dBμV

#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
74.0  
dBμV  
LgAv

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



Start 2.480 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 50 GHz  
44.491 dBμV

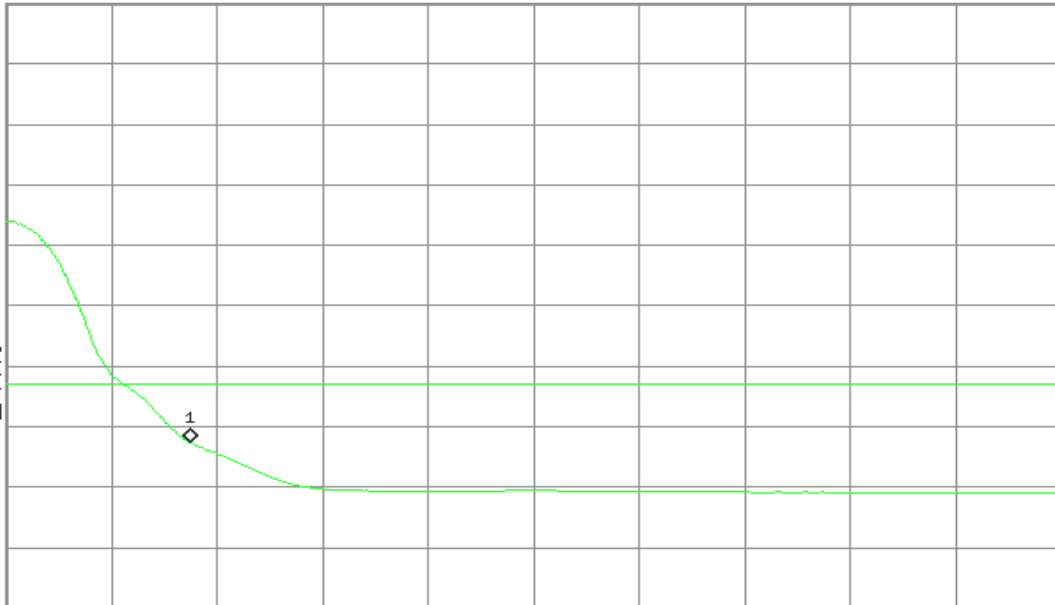
Ref 117 dBμV

#Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
54.0  
dBμV  
LgAv

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



Start 2.480 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Sweep 1.56 s (601 pts)

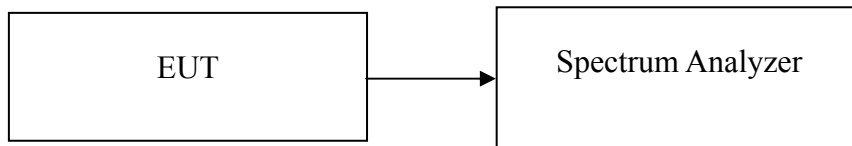


## 7.5 PEAK POWER SPECTRAL DENSITY

### 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 / DH5**

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-7.63	8.00	PASS
Mid	2441	-7.54		PASS
High	2480	-7.00		PASS

**For 8DPSK / DH5**

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-10.30	8.00	PASS
Mid	2441	-9.65		PASS
High	2480	-9.80		PASS



**Test Plot**

**For GFSK / DH5**

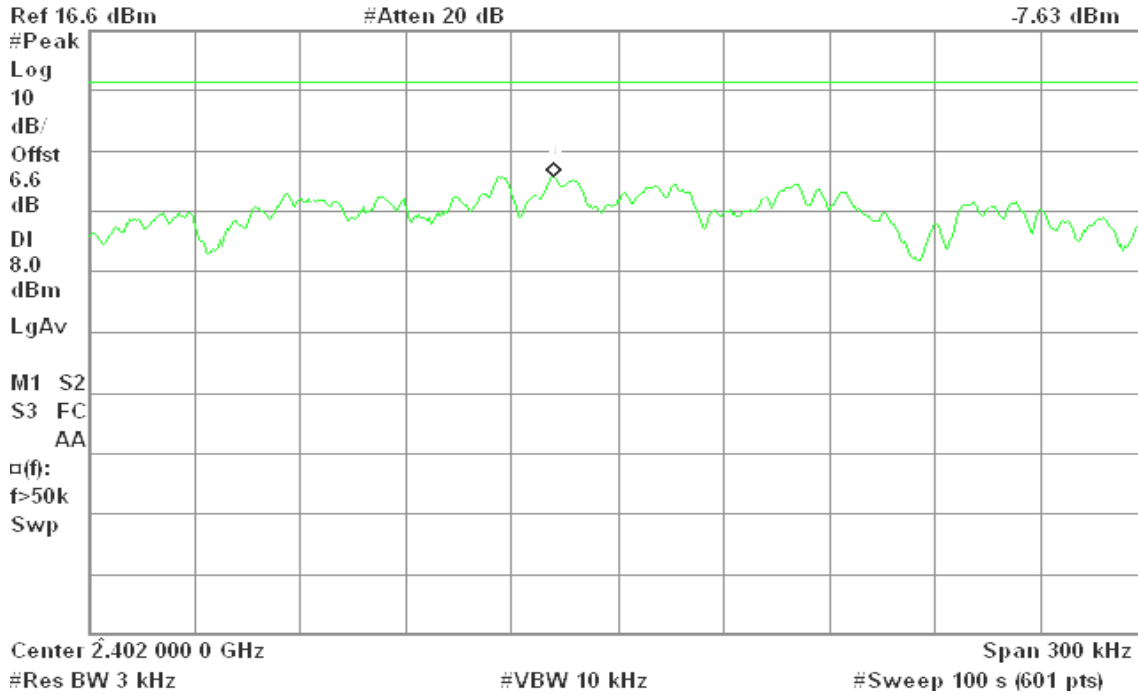
**PPSD (CH Low)**

Agilent 10:58:30 Oct 29, 2009

R T

Mkr1 2.401 981 9 GHz

-7.63 dBm



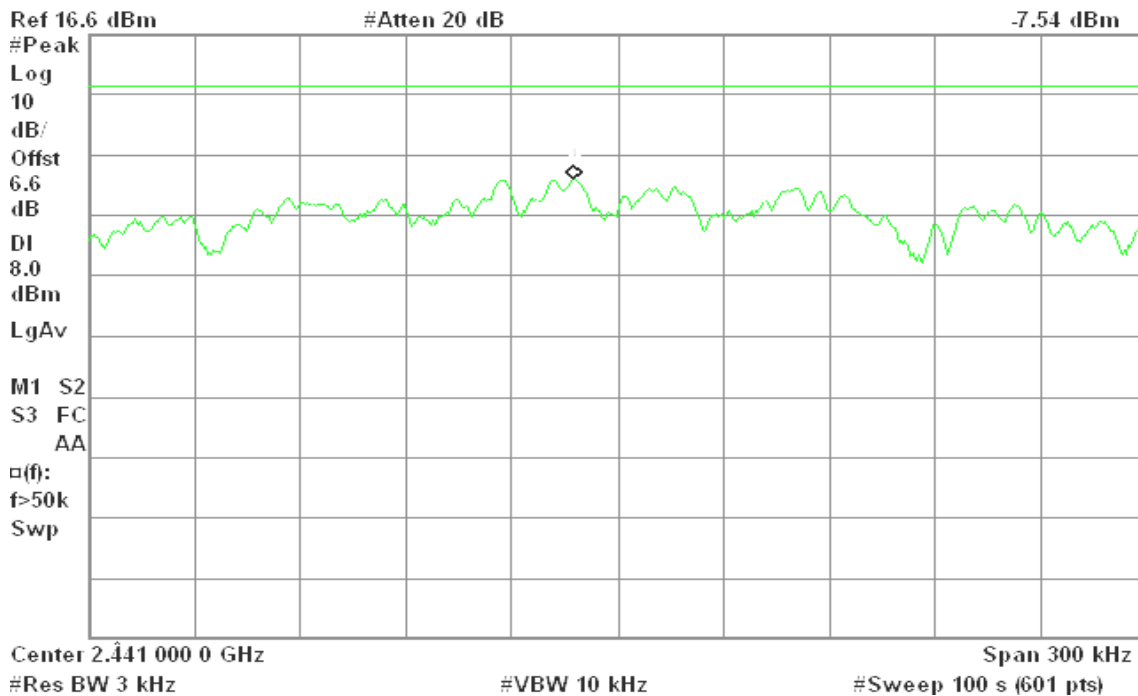
**PPSD (CH Mid)**

Agilent 10:54:38 Oct 29, 2009

R T

Mkr1 2.440 987 5 GHz

-7.54 dBm







### PPSD (CH High)

Agilent 10:56:34 Oct 29, 2009

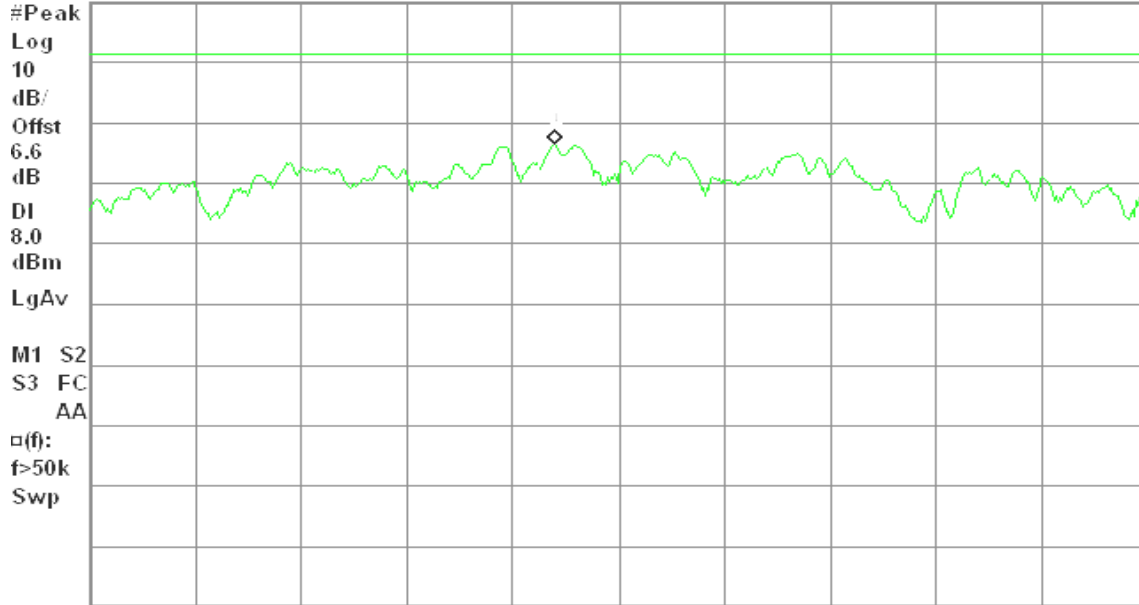
R T

Mkr1 2.479 981 9 GHz

-7.00 dBm

Ref 16.6 dBm

#Atten 20 dB



Center 2.480 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

#Sweep 100 s (601 pts)



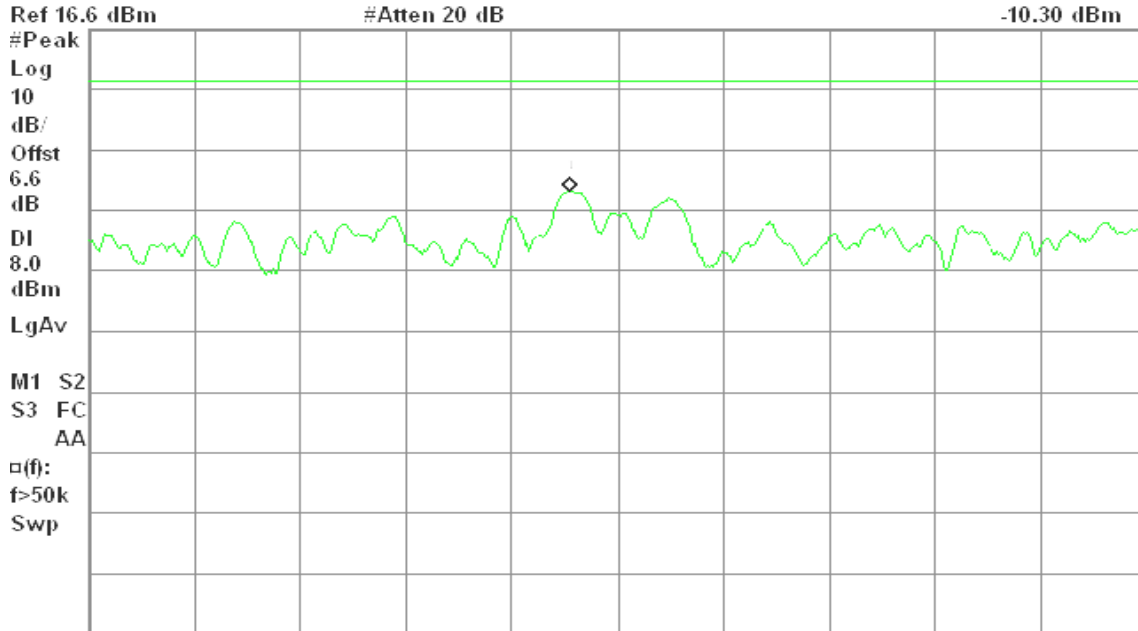
### For 8DPSK / DH5

### PPSD (CH Low)

Agilent 10:50:00 Oct 29, 2009

R T

Mkr1 2.401 986 5 GHz  
-10.30 dBm



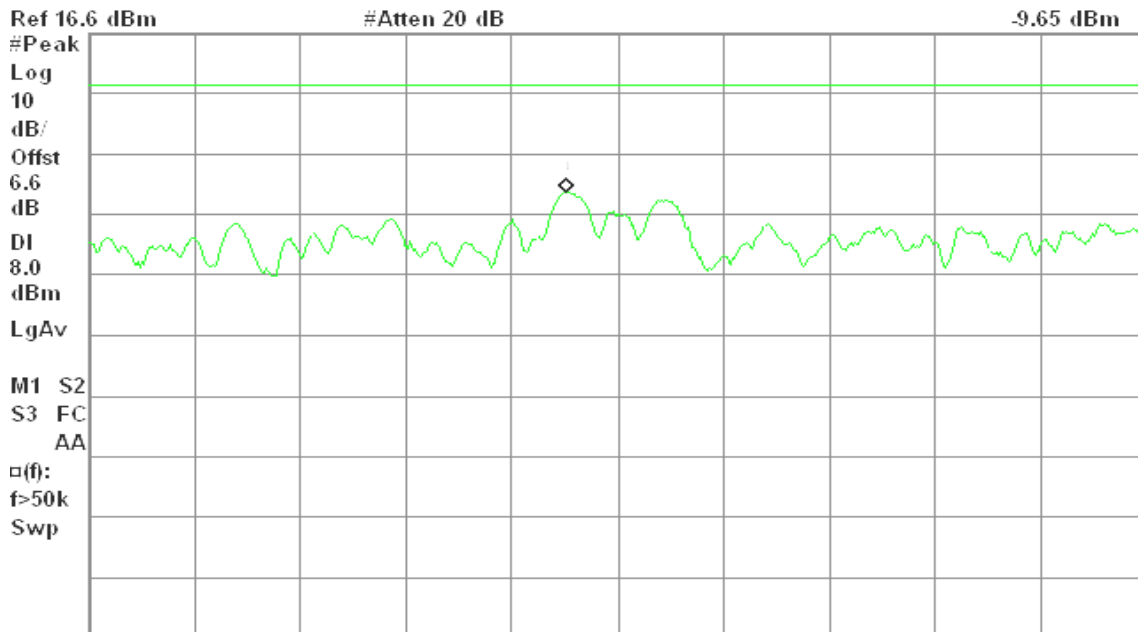
Center 2.402 000 0 GHz Span 300 kHz  
#Res BW 3 kHz #VBW 10 kHz #Sweep 100 s (601 pts)

### PPSD (CH Mid)

Agilent 10:51:58 Oct 29, 2009

R T

Mkr1 2.440 985 4 GHz  
-9.65 dBm



Center 2.441 000 0 GHz Span 300 kHz  
#Res BW 3 kHz #VBW 10 kHz #Sweep 100 s (601 pts)



### PPSD (CH High)

Agilent 10:47:27 Oct 29, 2009

R T

Mkr1 2.479 986 9 GHz

-9.80 dBm

Ref 16.6 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

6.6

dB

Dl

8.0

dBm

LgAv

M1 S2

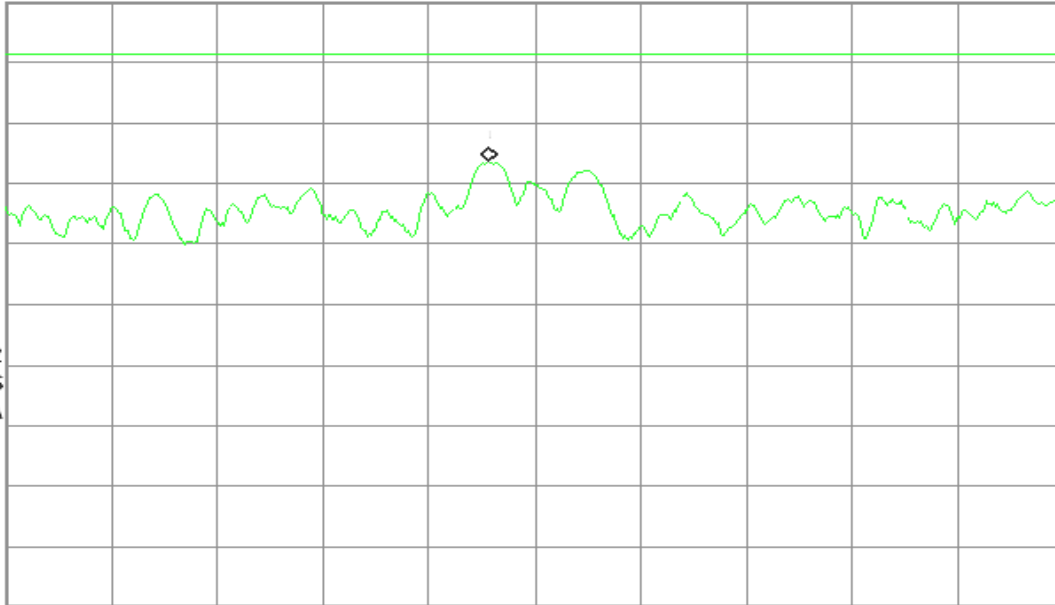
S3 FS

AA

□(f):

f>50k

Swp



Center 2.480 000 0 GHz

Span 300 kHz

#Res BW 3 kHz

#VBW 10 kHz

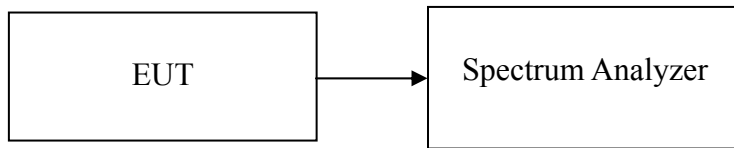
#Sweep 100 s (601 pts)

## 7.6 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 / DH5**

<b>Channel Separation (MHz)</b>	<b>two-thirds of the 20 dB bandwidth</b>	<b>Channel Separation Limit</b>	<b>Result</b>
1.00	624	>two-thirds of the 20 dB bandwidth	Pass

**For 8DPSK / DH5**

<b>Channel Separation (MHz)</b>	<b>two-thirds of the 20 dB bandwidth</b>	<b>Channel Separation Limit</b>	<b>Result</b>
1.00	851.3	>two-thirds of the 20 dB bandwidth	Pass



**Test Plot**

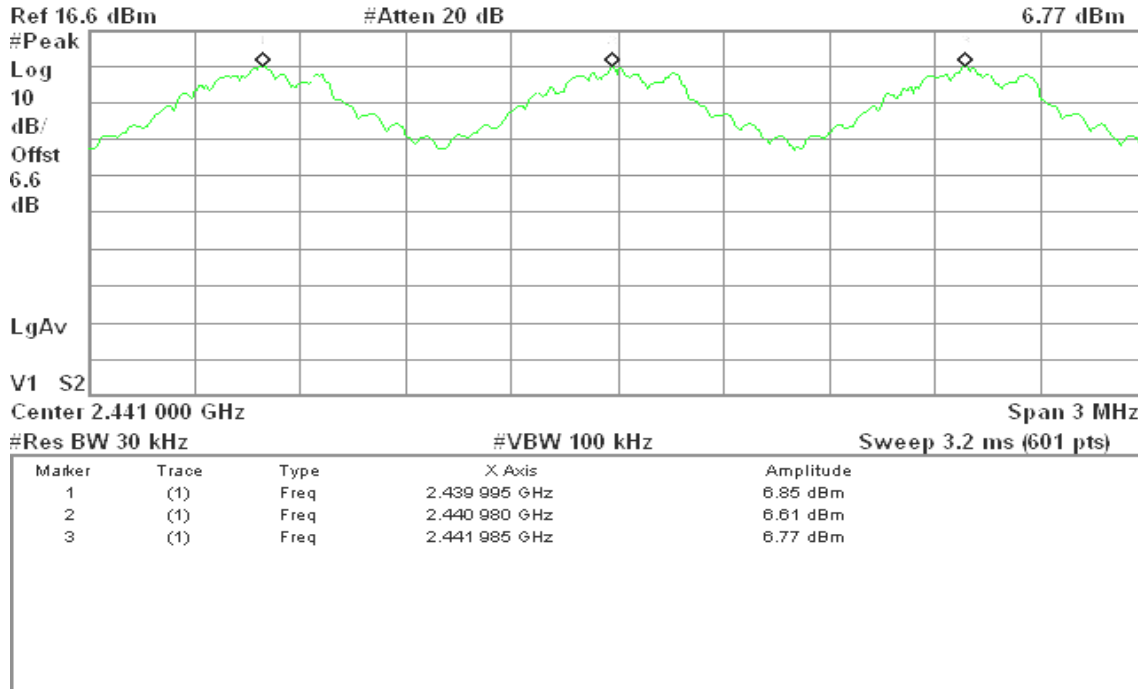
**For GFSK / DH5**

**Measurement of Channel Separation**

Agilent 11:01:17 Oct 20, 2009

R T

Mkr3 2.441 985 GHz  
6.77 dBm

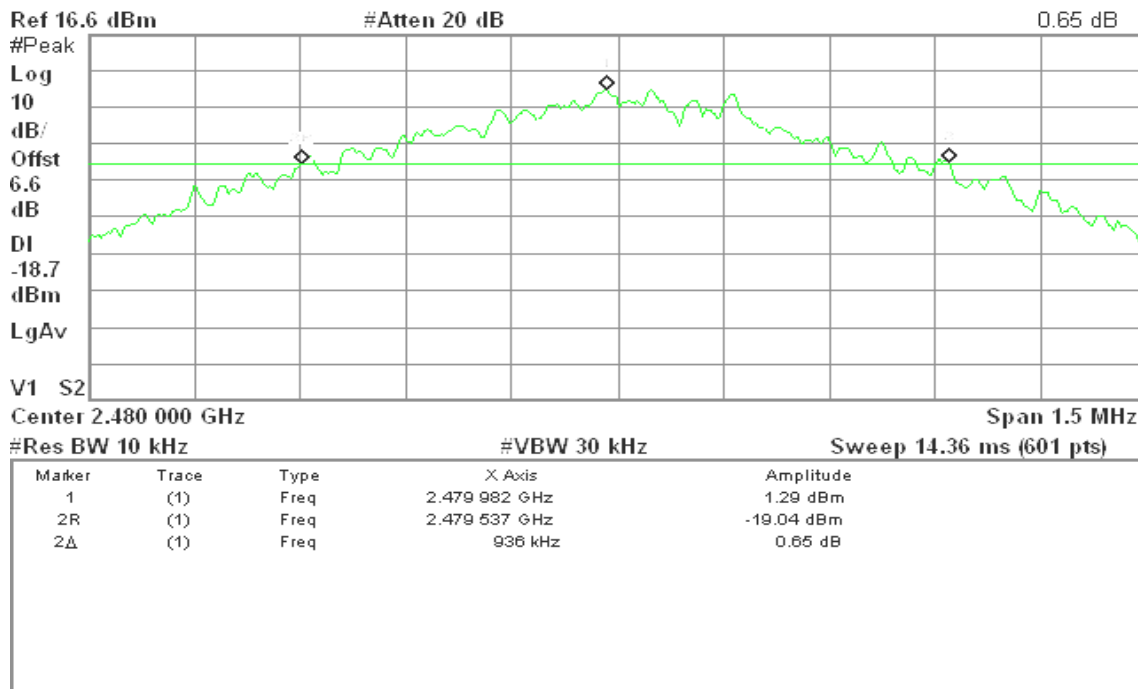


**Measurement of 20dB Bandwidth**

Agilent 09:58:06 Oct 20, 2009

R T

Δ Mkr2 936 kHz  
0.65 dB





### For 8DPSK / DH5

### Measurement of Channel Separation

Agilent 11:02:47 Oct 20, 2009

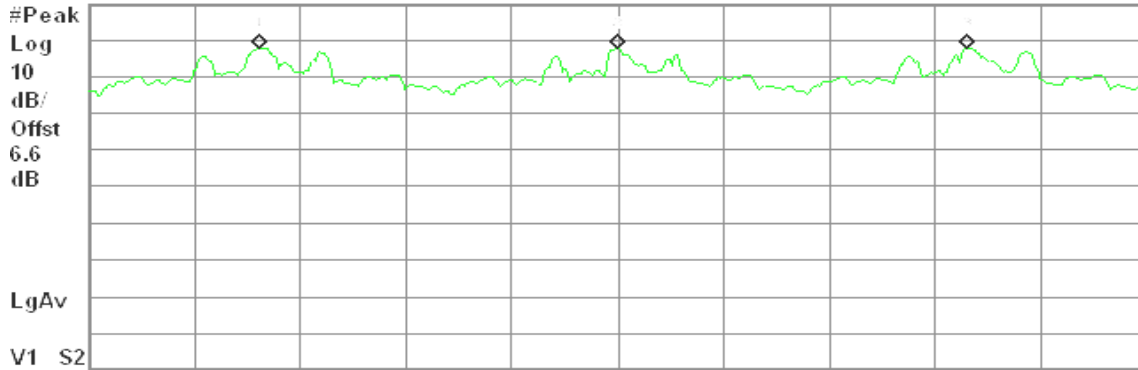
R T

Mkr3 2.441 990 GHz

4.59 dBm

Ref 16.6 dBm

#Atten 20 dB



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	2.439 985 GHz	4.61 dBm
2	(1)	Freq	2.441 000 GHz	4.62 dBm
3	(1)	Freq	2.441 990 GHz	4.59 dBm

### Measurement of 20dB Bandwidth

Agilent 10:01:28 Oct 20, 2009

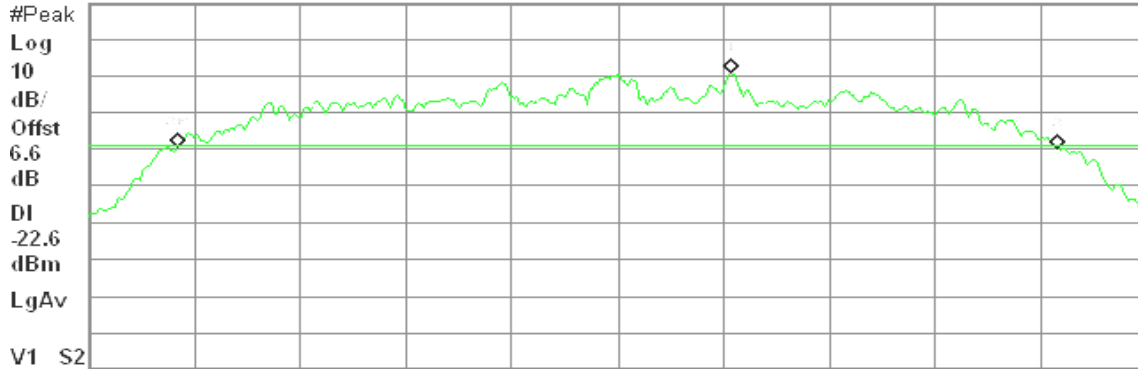
R T

Δ Mkr2 1.277 MHz

-0.39 dB

Ref 16.6 dBm

#Atten 20 dB



Center 2.480 000 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	2.480 163 GHz	-2.56 dBm
2R	(1)	Freq	2.479 351 GHz	-22.70 dBm
2Δ	(1)	Freq	1.277 MHz	-0.39 dB

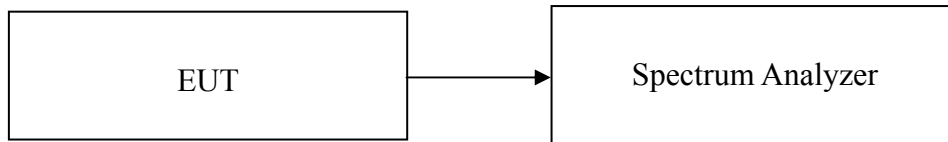


## 7.7 NUMBER OF HOPPING FREQUENCY

### 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**

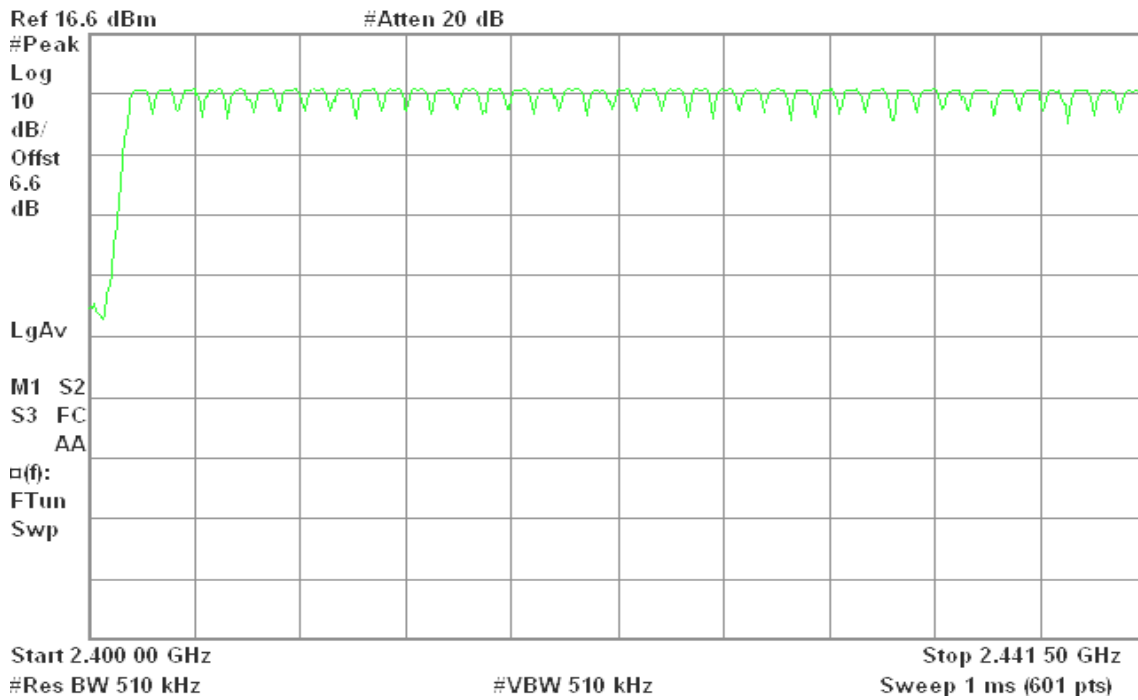
**For GFSK**

**Channel Number**

**2.4 GHz – 2.4415 GHz**

Agilent 10:41:59 Oct 20, 2009

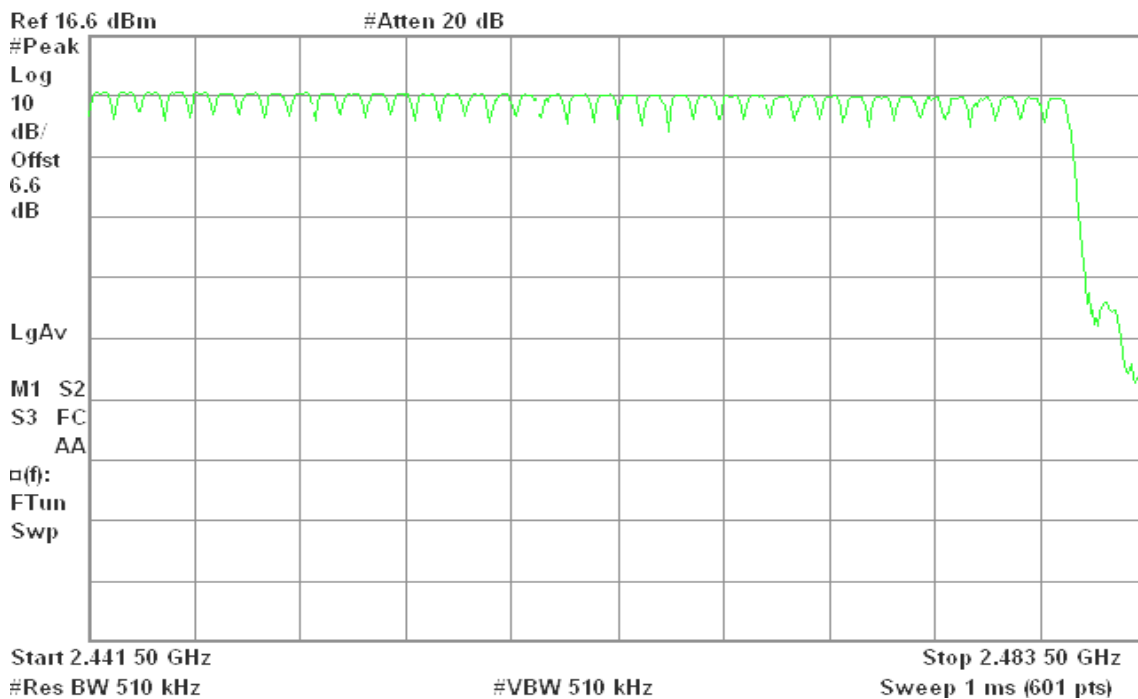
R T



**2.4415 GHz – 2.4835 GHz**

Agilent 10:41:39 Oct 20, 2009

R T





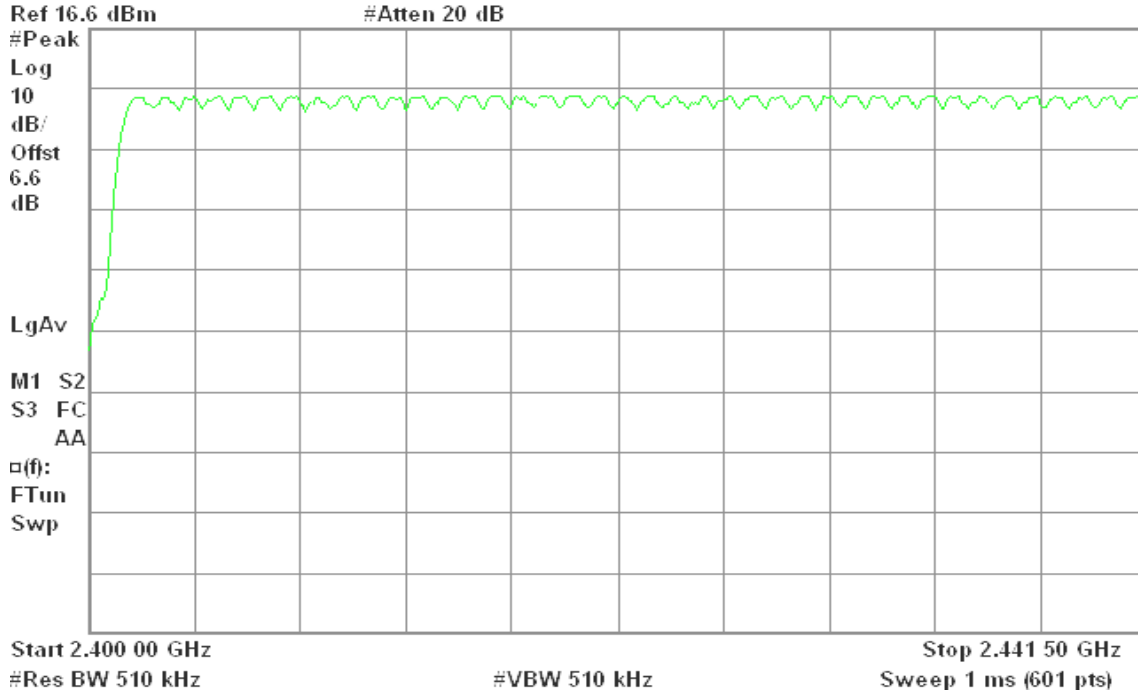
**For 8DPSK**

**Channel Number**

**2.4 GHz – 2.4415 GHz**

\* Agilent 10:38:20 Oct 20, 2009

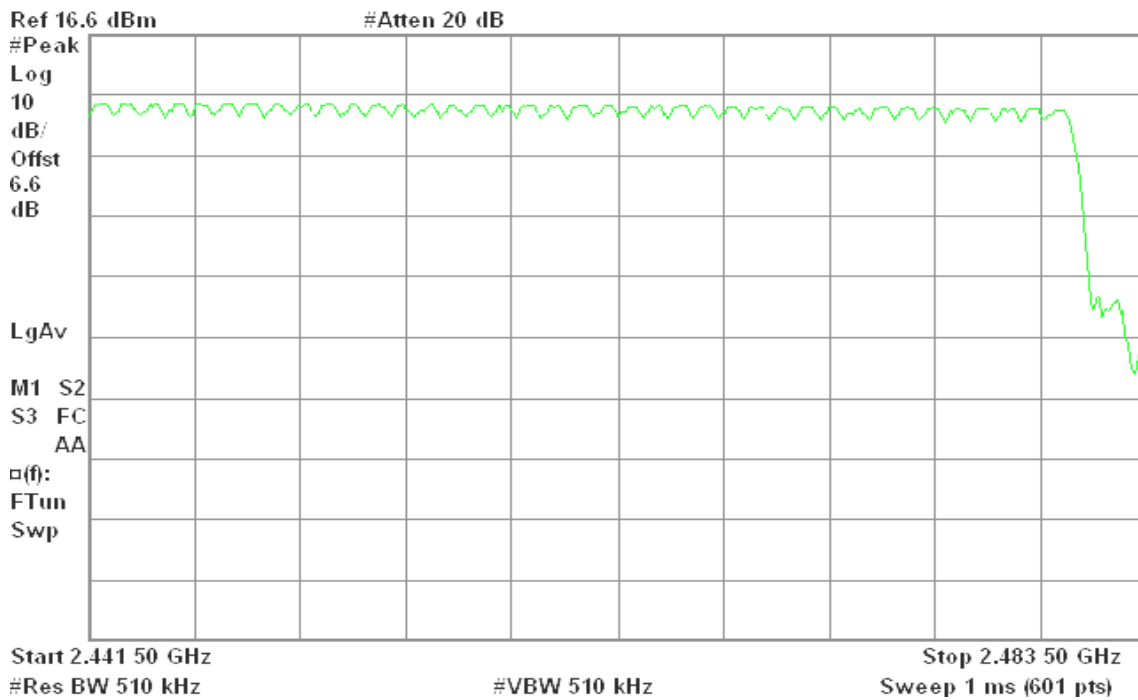
R T



**2.4415 GHz – 2.4835 GHz**

\* Agilent 10:40:17 Oct 20, 2009

R T



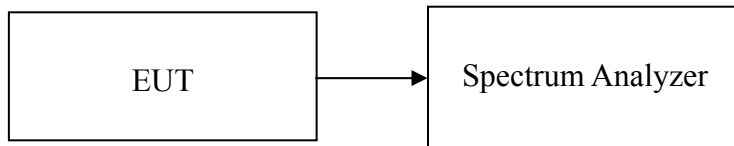


## **7.8 TIME OF OCCUPANCY (DWELL TIME)**

### **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:  $0.400 * (1600/2)/79 * 31.6 = 128.00$  (ms)

CH Mid:  $0.400 * (1600/2)/79 * 31.6 = 128.00$  (ms)

CH High:  $0.400 * (1600/2)/79 * 31.6 = 128.00$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.400	128.00	31.60	400.00	PASS
Mid	0.400	128.00	31.60		PASS
High	0.400	128.00	31.60		PASS

**DH 3**

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

CH Mid:  $1.650 * (1600/4)/79 * 31.6 = 264.00$  (ms)

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

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.667	266.72	31.60	400.00	PASS
Mid	1.650	264.00	31.60		PASS
High	1.667	266.72	31.60		PASS

**DH 5**

CH Low:  $2.900 * (1600/6)/79 * 31.6 = 309.33$  (ms)

CH Mid:  $2.900 * (1600/6)/79 * 31.6 = 309.33$  (ms)

CH High:  $2.900 * (1600/6)/79 * 31.6 = 309.33$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.900	309.33	31.60	400.00	PASS
Mid	2.900	309.33	31.60		PASS
High	2.900	309.33	31.60		PASS



Test Plot For GFSK

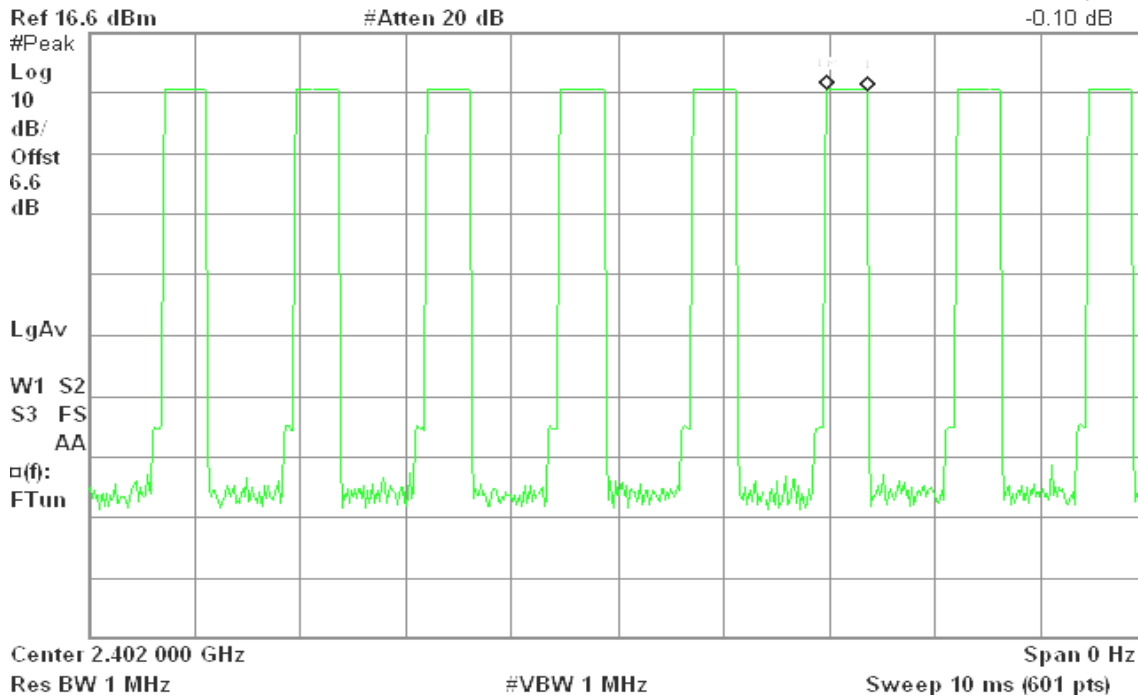
DH 1

CH Low

Agilent 10:28:24 Oct 20, 2009

R T

Δ Mkr1 400 μs -0.10 dB

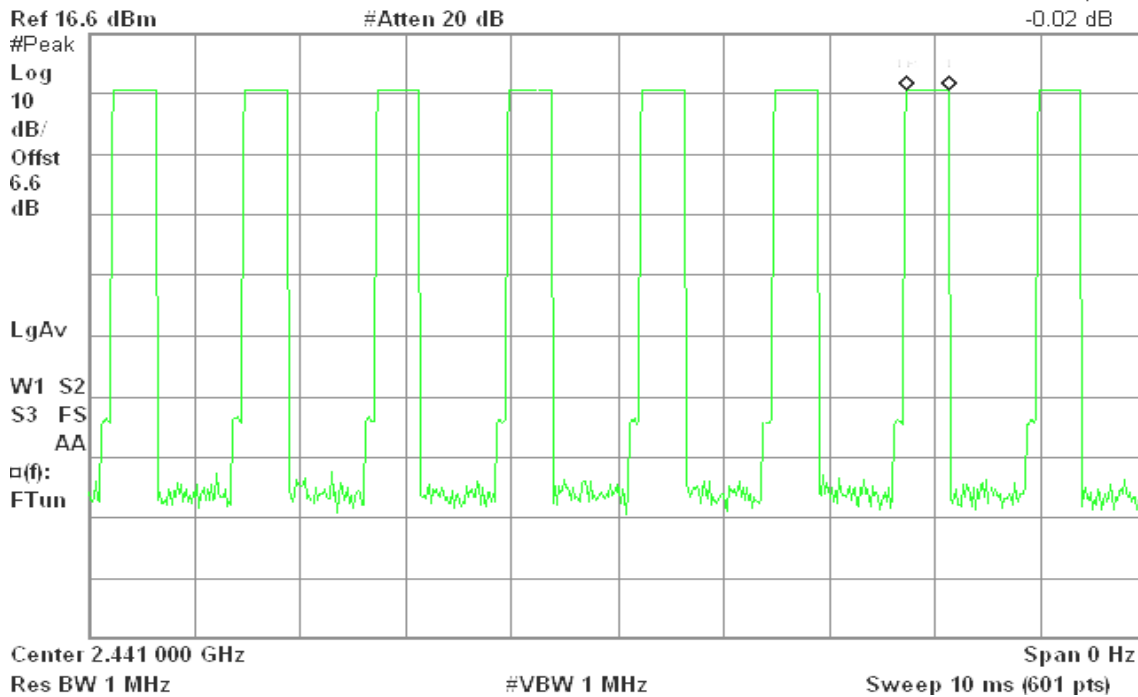


CH Mid

Agilent 10:25:43 Oct 20, 2009

R T

Δ Mkr1 400 μs -0.02 dB



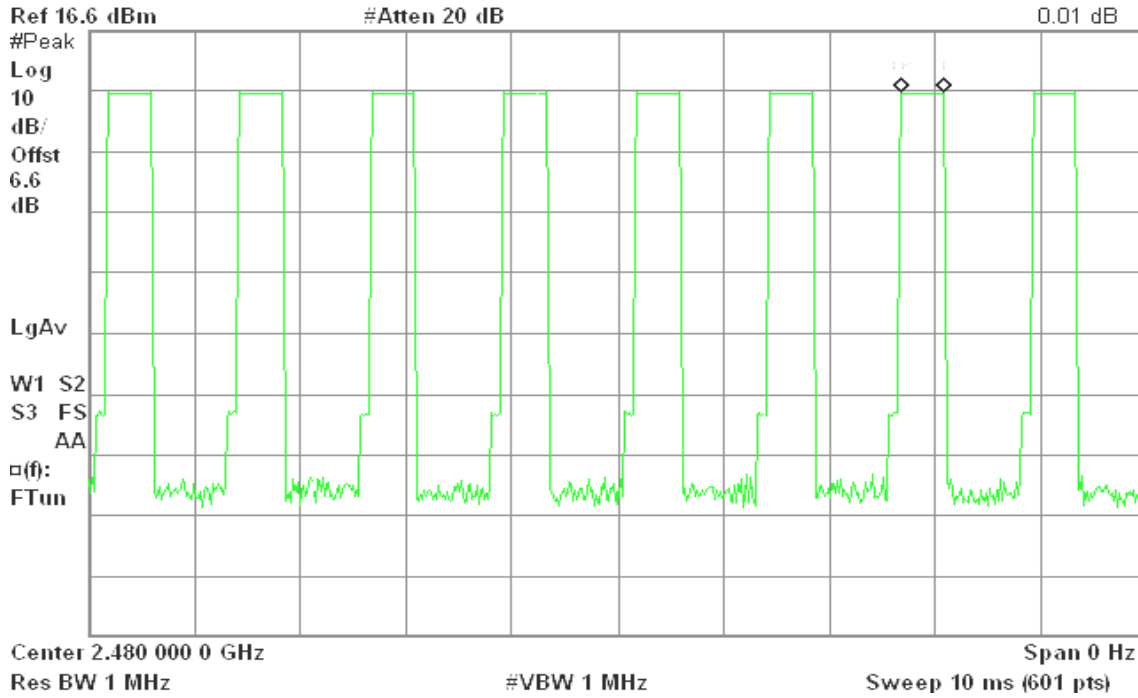


### CH High

Agilent 10:25:03 Oct 20, 2009

R T

Δ Mkr1 400 μs  
0.01 dB



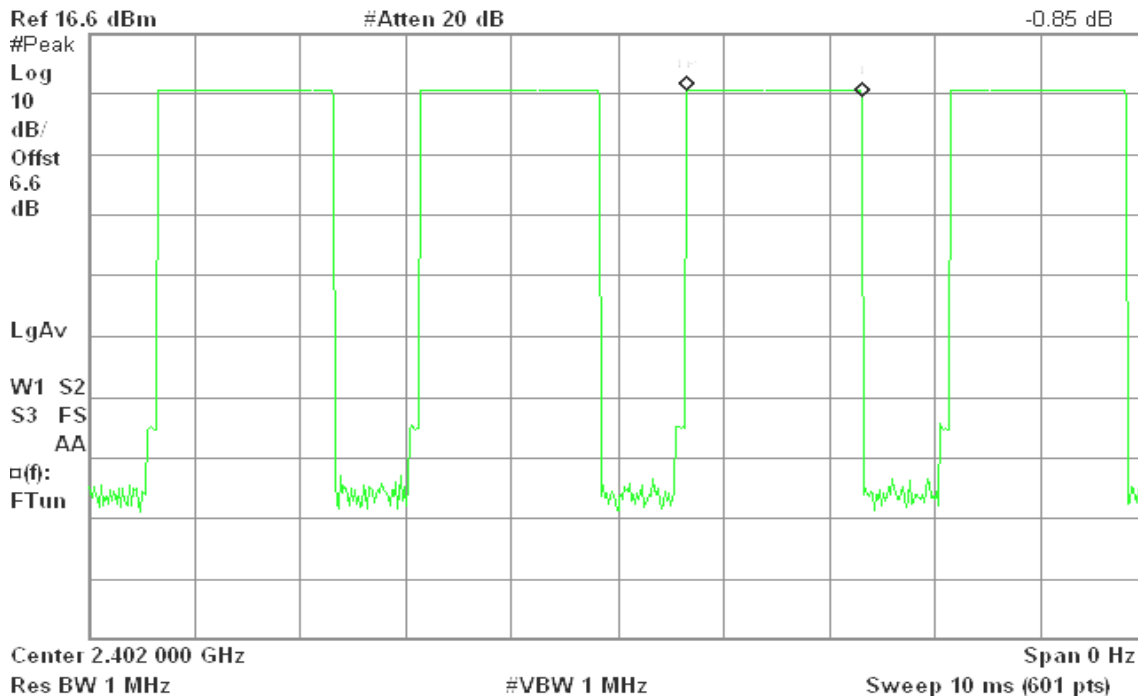
### DH 3

### CH Low

Agilent 10:28:01 Oct 20, 2009

R T

Δ Mkr1 1.667 ms  
-0.85 dB



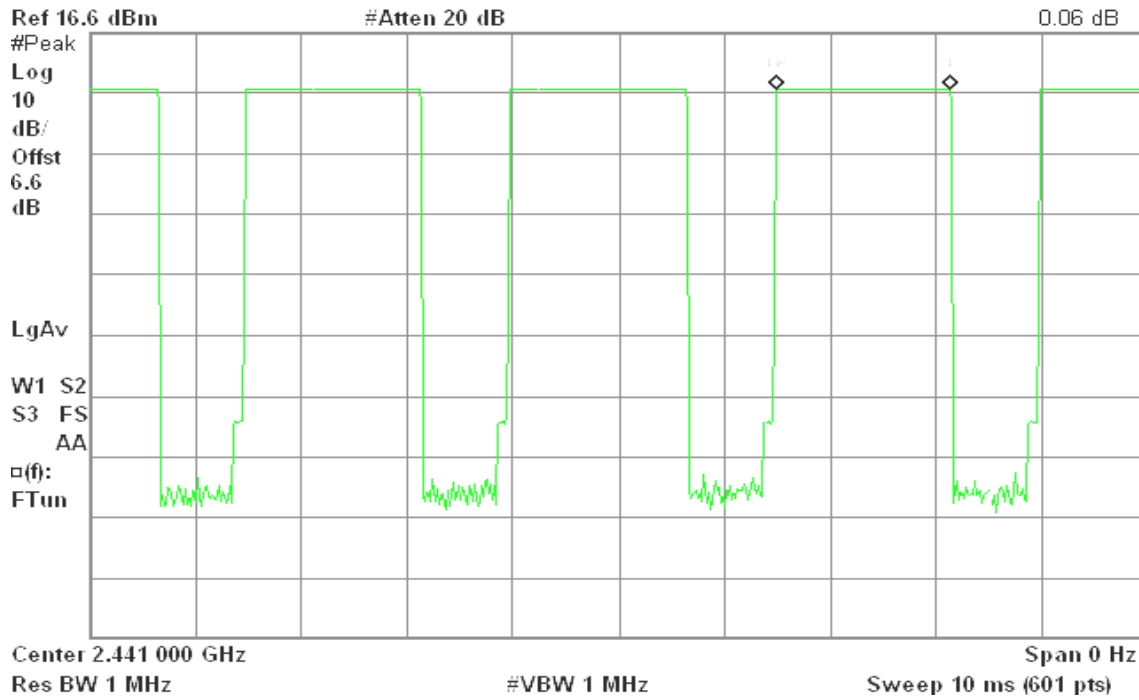


### CH Mid

Agilent 10:26:33 Oct 20, 2009

R T

Δ Mkr1 1.65 ms  
0.06 dB

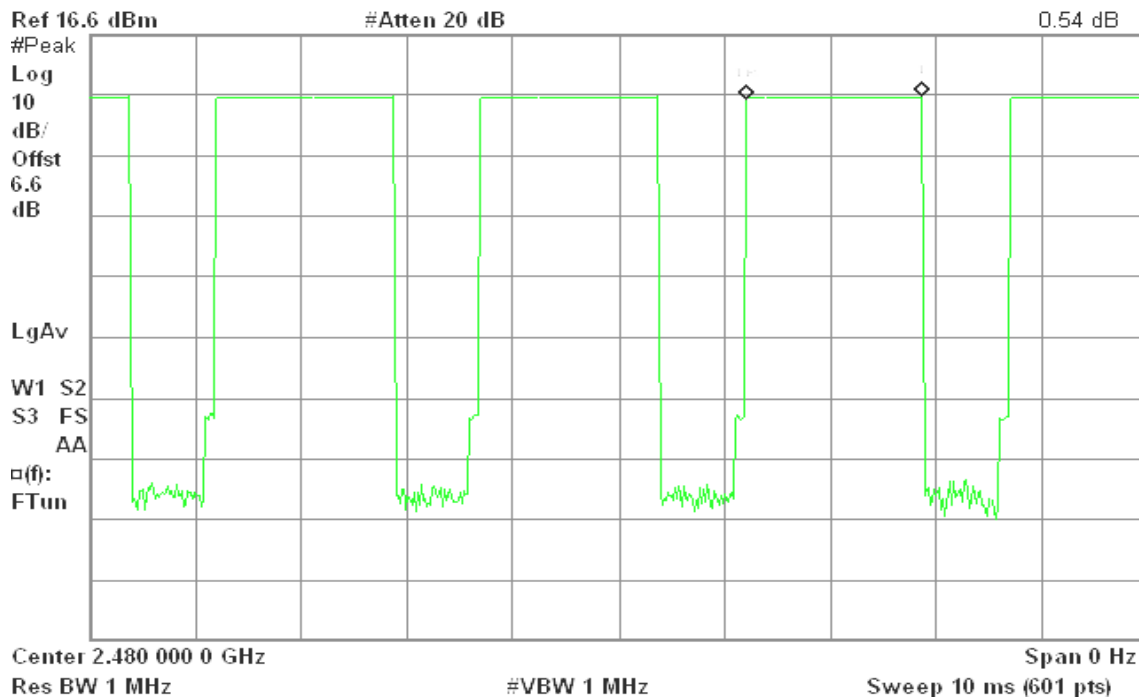


### CH High

Agilent 10:24:36 Oct 20, 2009

R T

Δ Mkr1 1.667 ms  
0.54 dB





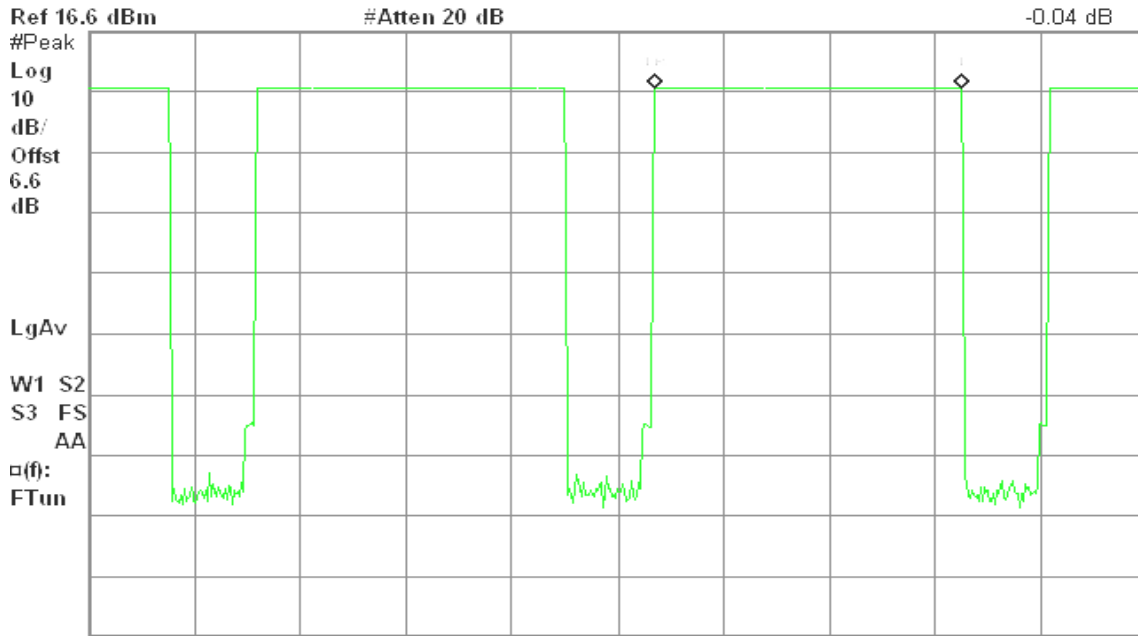
### DH 5

### CH Low

Agilent 10:27:36 Oct 20, 2009

R T

Δ Mkr1 2.9 ms  
-0.04 dB



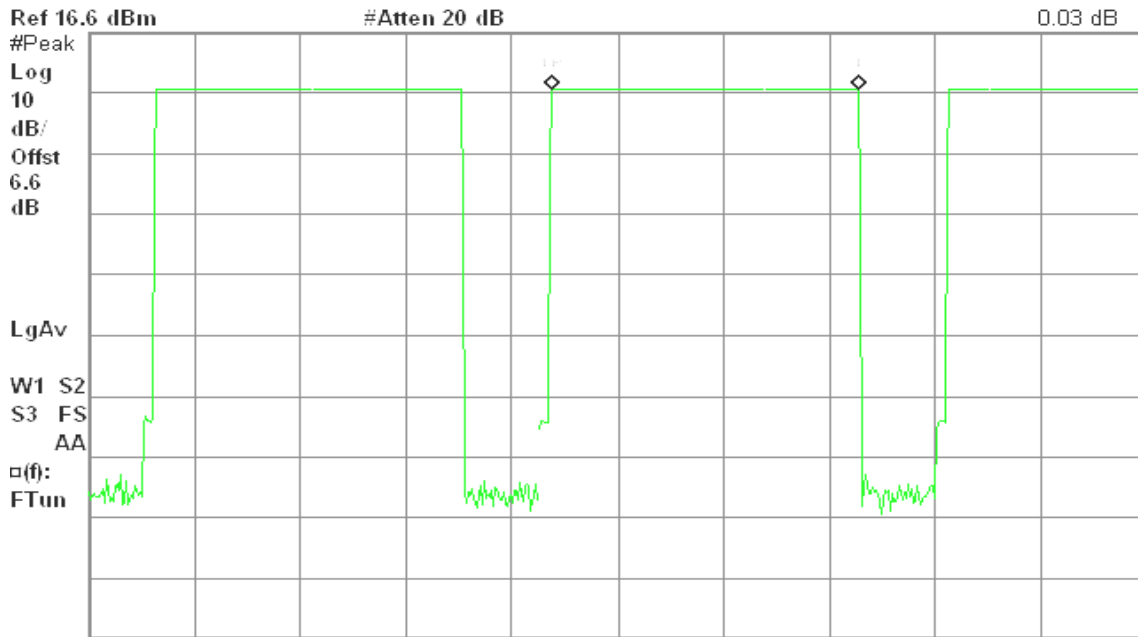
Center 2.402 000 GHz Span 0 Hz  
Res BW 1 MHz #VBW 1 MHz Sweep 10 ms (601 pts)

### CH Mid

Agilent 10:26:56 Oct 20, 2009

R T

Δ Mkr1 2.9 ms  
0.03 dB



Center 2.441 000 GHz Span 0 Hz  
Res BW 1 MHz #VBW 1 MHz Sweep 10 ms (601 pts)



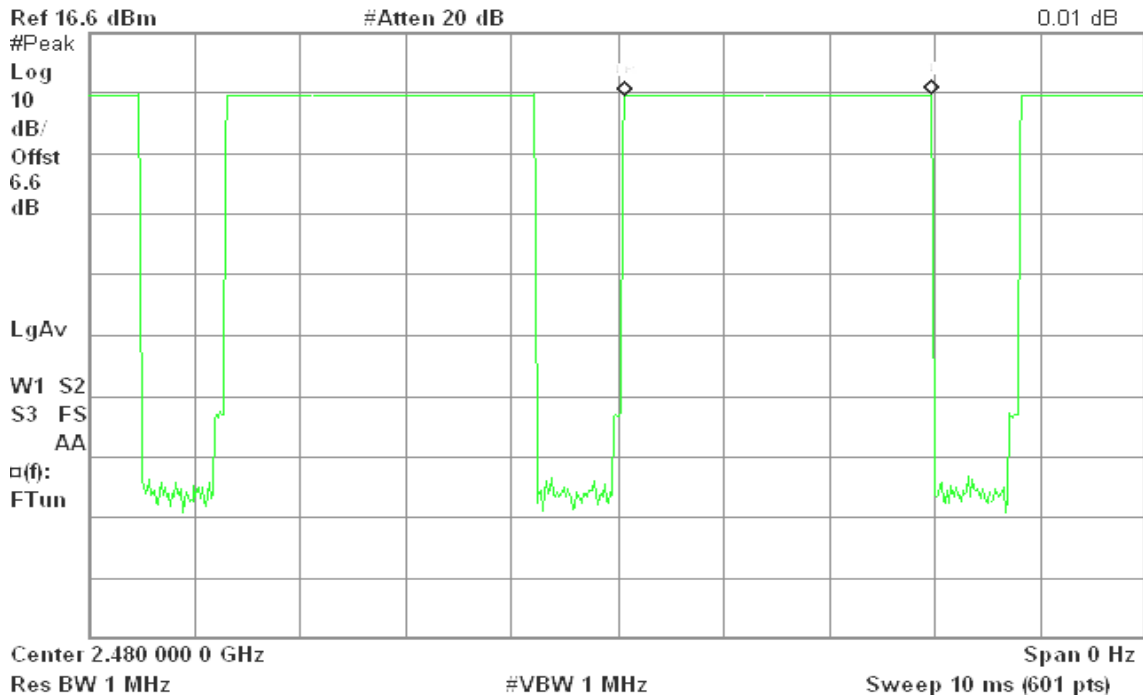


### CH High

Agilent 10:23:37 Oct 20, 2009

R T

Δ Mkr1 2.9 ms  
0.01 dB





**Test Data**

**For 8DPSK**

**DH 1**

CH Low:  $0.416 * (1600/2)/79 * 31.6 = 133.12$  (ms)

CH Mid:  $0.416 * (1600/2)/79 * 31.6 = 133.12$  (ms)

CH High:  $0.416 * (1600/2)/79 * 31.6 = 133.12$  (ms)

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

**DH 3**

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

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

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

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

**DH 5**

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

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

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

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



### For 8DPSK

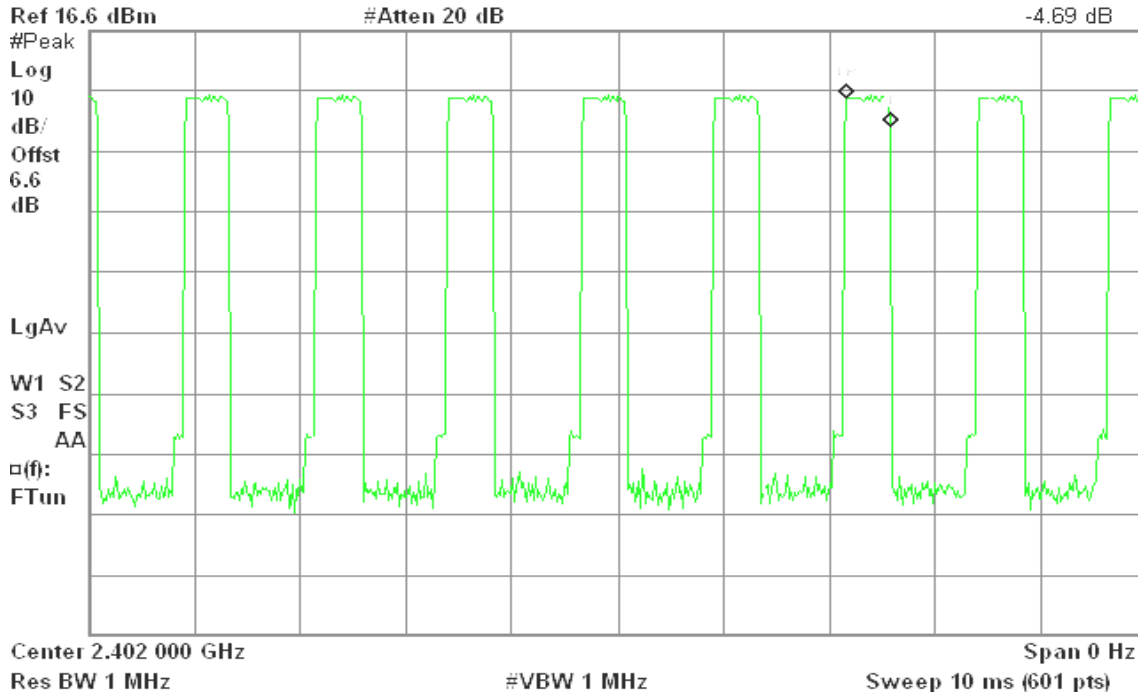
### DH 1

### CH Low

Agilent 10:29:25 Oct 20, 2009

R T

Δ Mkr1 416.7 μs  
-4.69 dB

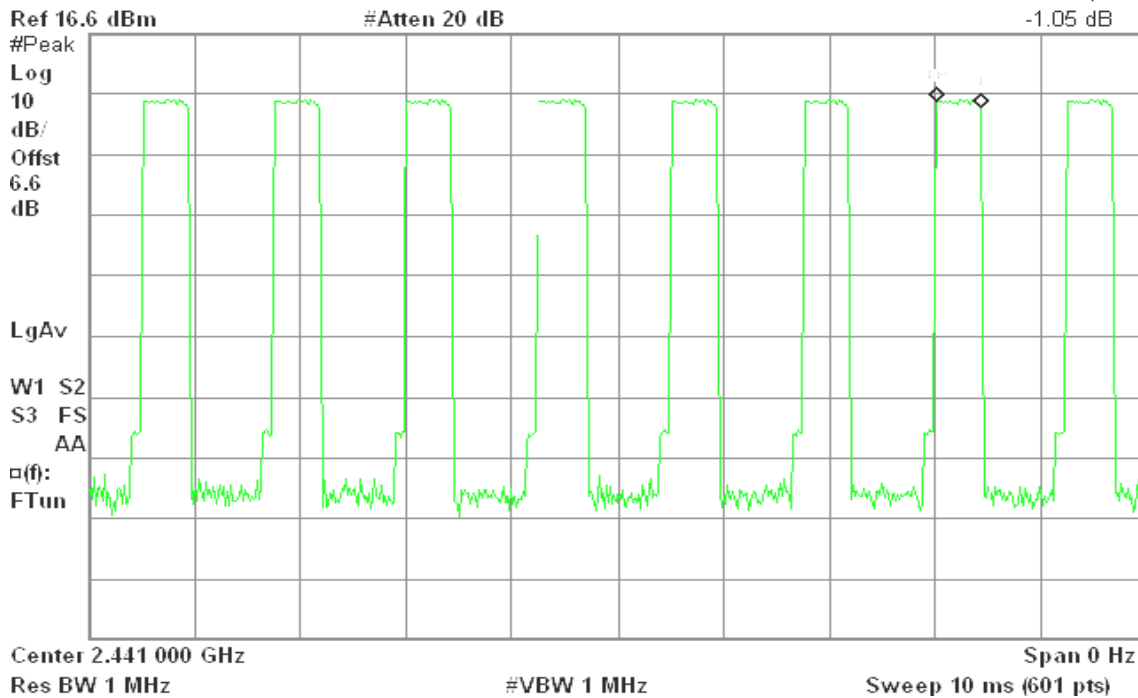


### CH Mid

Agilent 10:33:55 Oct 20, 2009

R T

Δ Mkr1 416.7 μs  
-1.05 dB



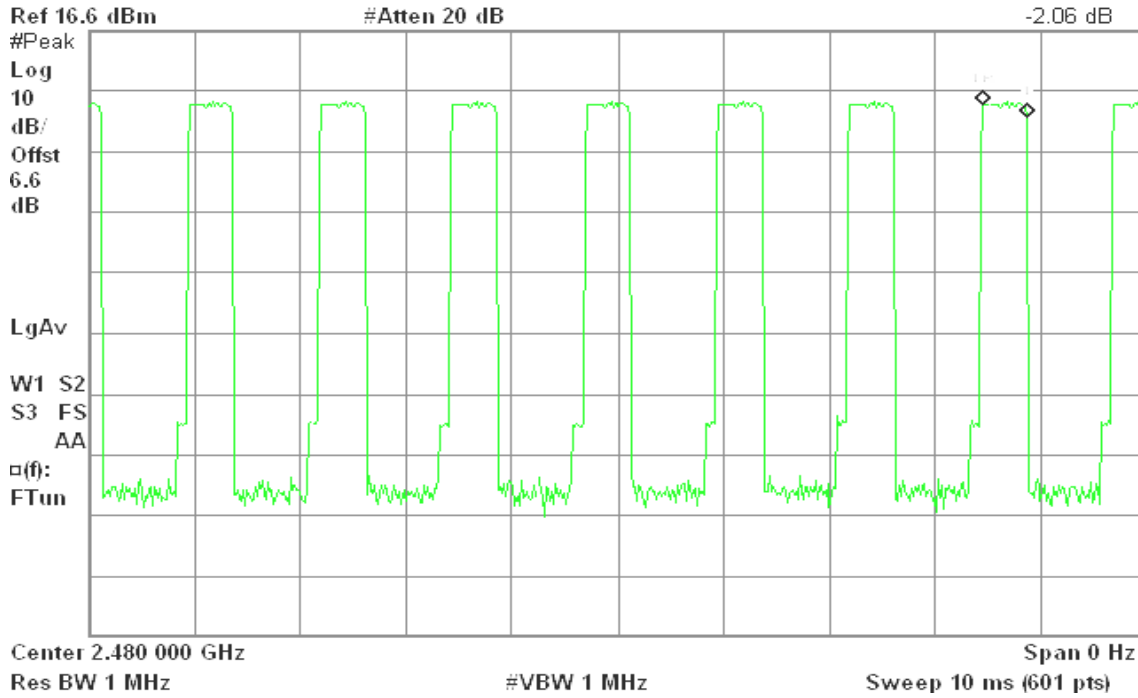


### CH High

Agilent 10:34:25 Oct 20, 2009

R T

Δ Mkr1 416.7 μs  
-2.06 dB



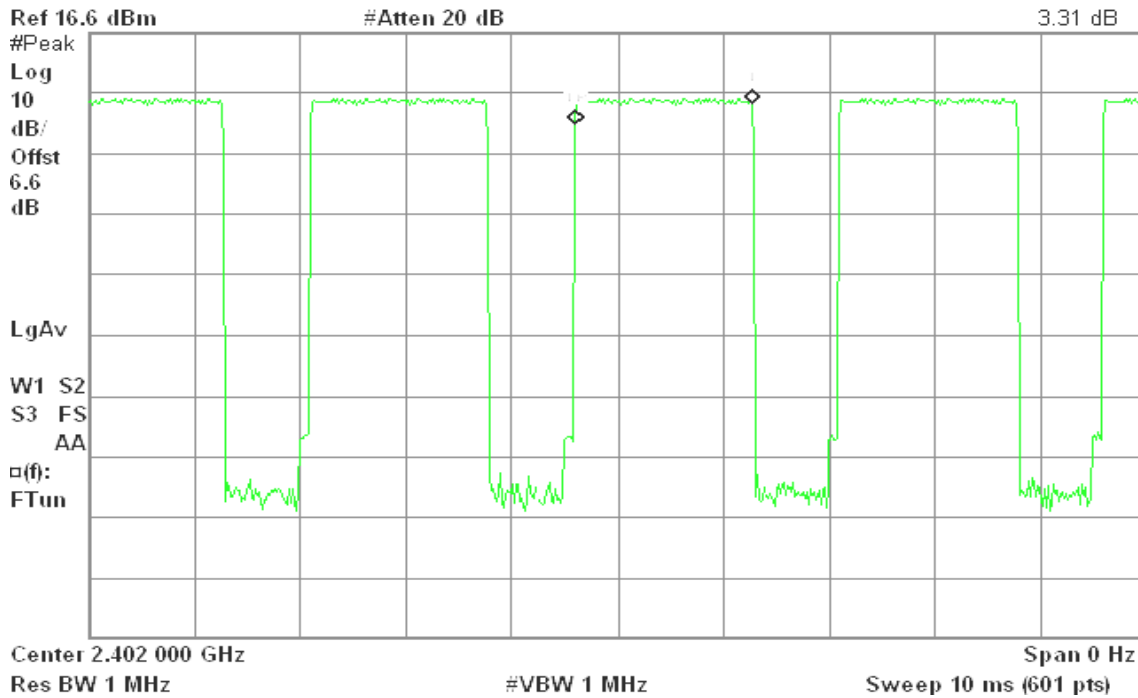
### DH 3

### CH Low

Agilent 10:30:42 Oct 20, 2009

R T

Δ Mkr1 1.667 ms  
3.31 dB



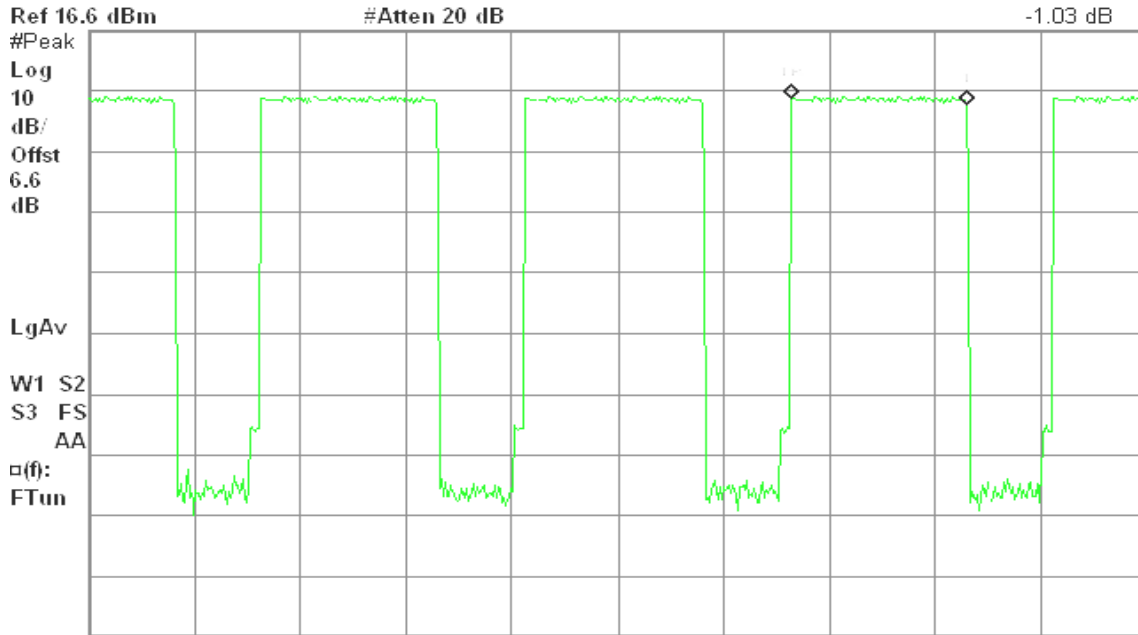


### CH Mid

Agilent 10:33:35 Oct 20, 2009

R T

Δ Mkr1 1.667 ms  
-1.03 dB



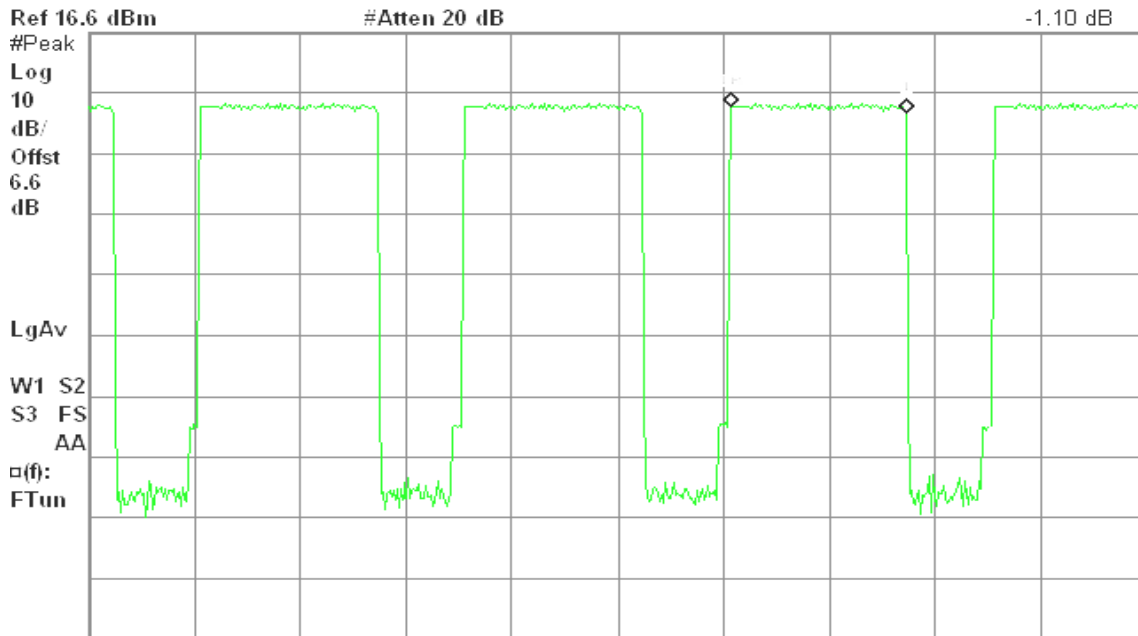
Center 2.441 000 GHz Span 0 Hz  
Res BW 1 MHz #VBW 1 MHz Sweep 10 ms (601 pts)

### CH High

Agilent 10:34:49 Oct 20, 2009

R T

Δ Mkr1 1.667 ms  
-1.10 dB



Center 2.480 000 GHz Span 0 Hz  
Res BW 1 MHz #VBW 1 MHz Sweep 10 ms (601 pts)



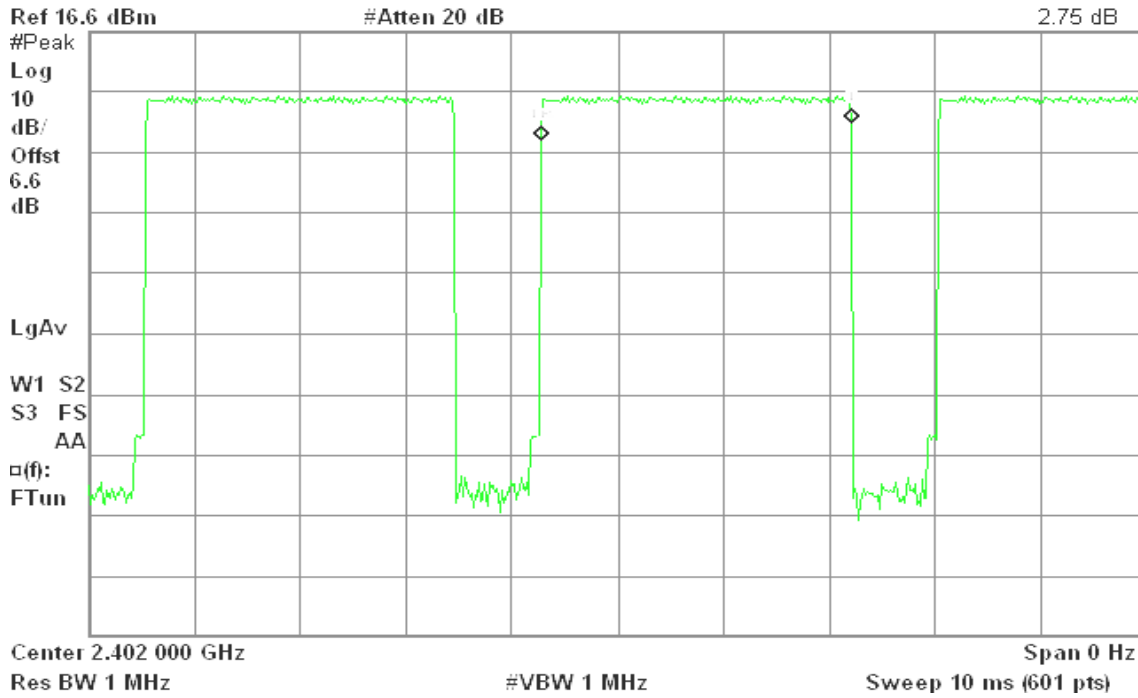
### DH 5

### CH Low

Agilent 10:31:12 Oct 20, 2009

R T

Δ Mkr1 2.933 ms  
2.75 dB

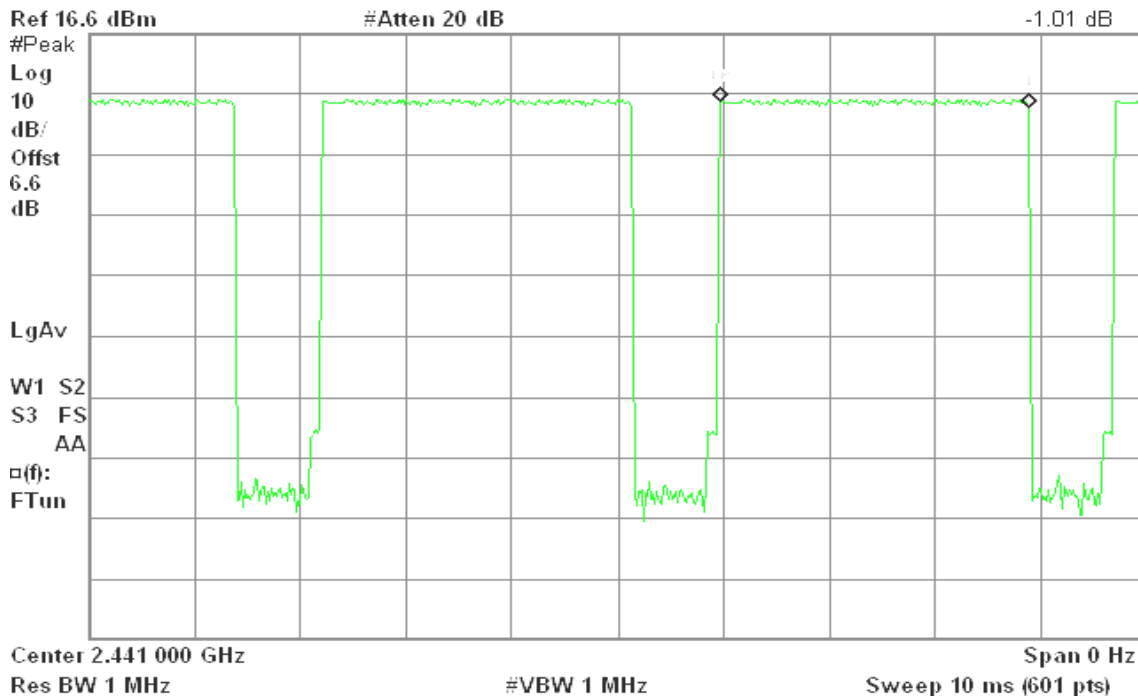


### CH Mid

Agilent 10:33:09 Oct 20, 2009

R T

Δ Mkr1 2.917 ms  
-1.01 dB



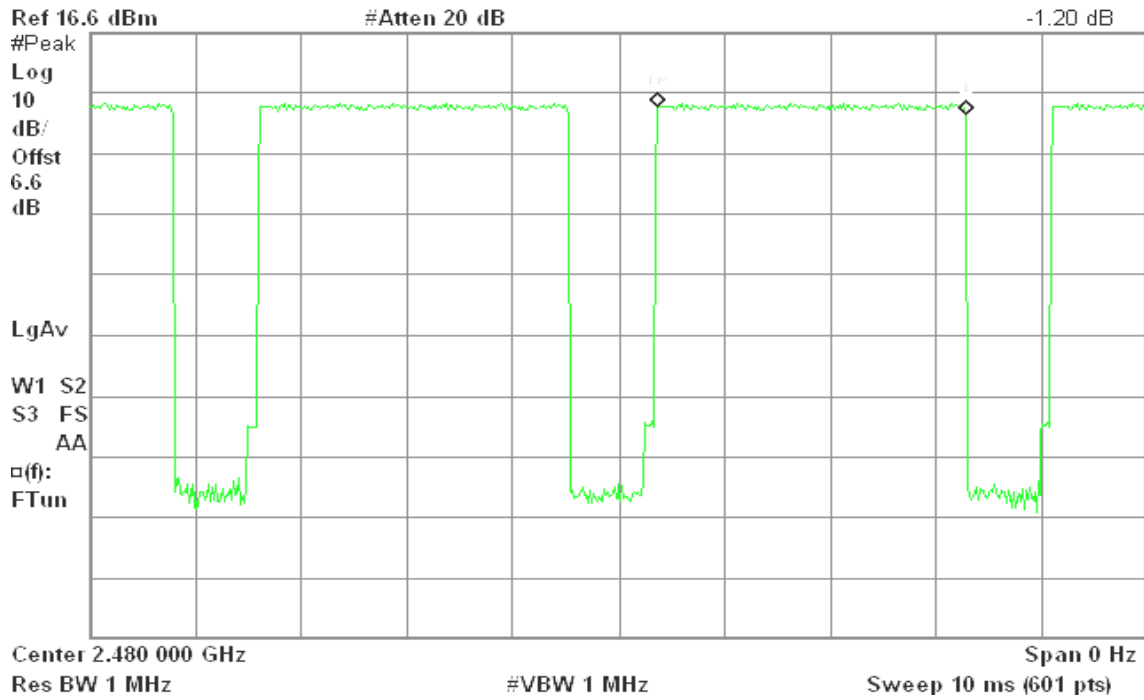


### CH High

Agilent 10:35:18 Oct 20, 2009

R T

Δ Mkr1 2.917 ms  
-1.20 dB





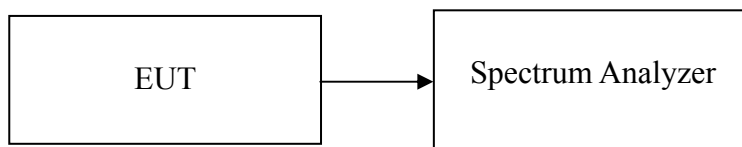
## 7.9 SPURIOUS EMISSIONS

### 7.9.1 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*





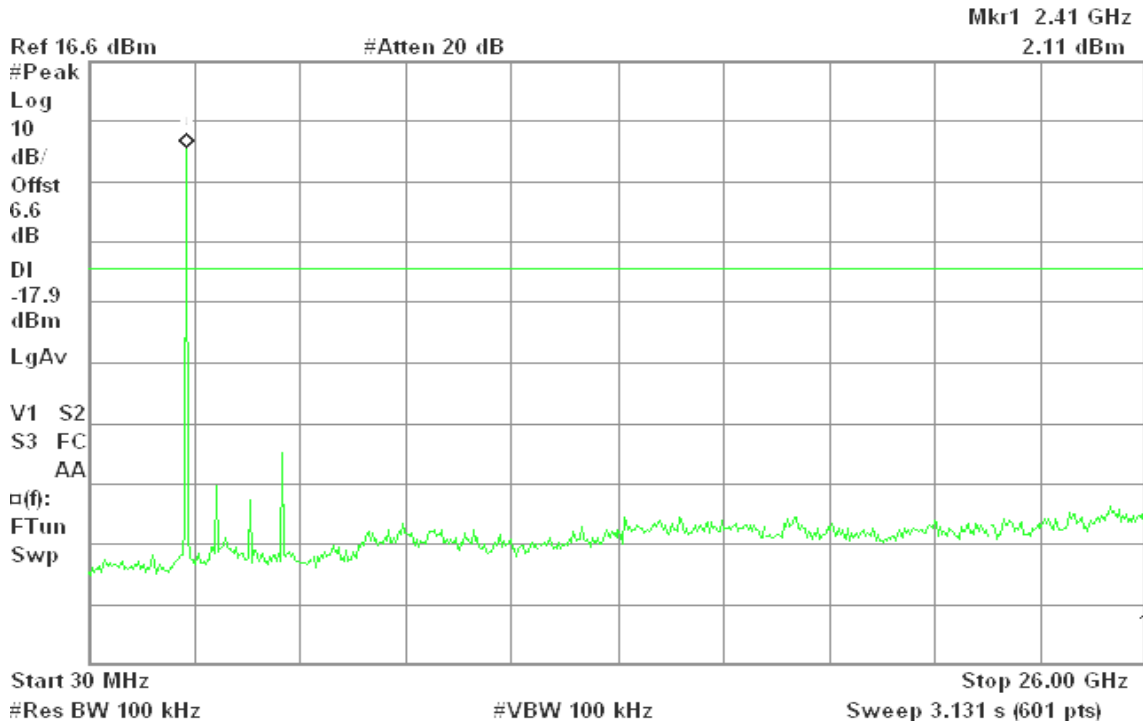
**Test Plot**

**For GFSK / DH5**

**CH Low**

Agilent 12:05:43 Oct 29, 2009

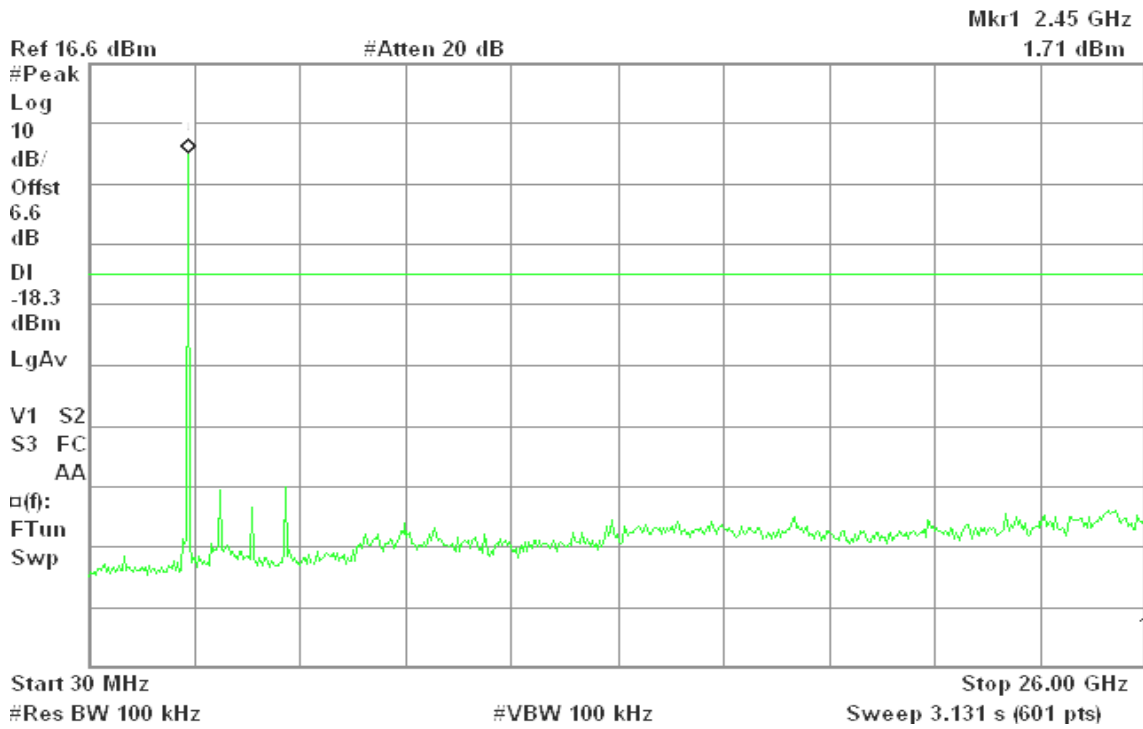
R T



**CH Mid**

Agilent 12:06:29 Oct 29, 2009

R T





### CH High

Agilent 12:07:08 Oct 29, 2009

R T

Mkr1 2.50 GHz  
2.23 dBm



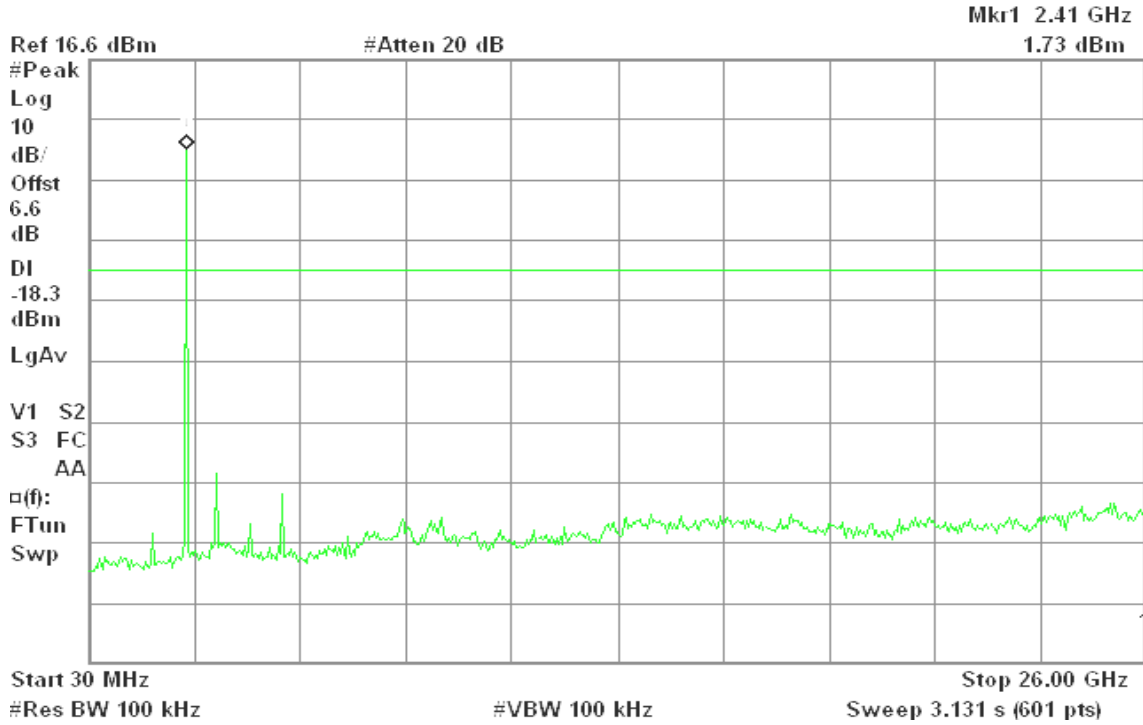


### For 8DPSK / DH5

#### CH Low

Agilent 12:09:46 Oct 29, 2009

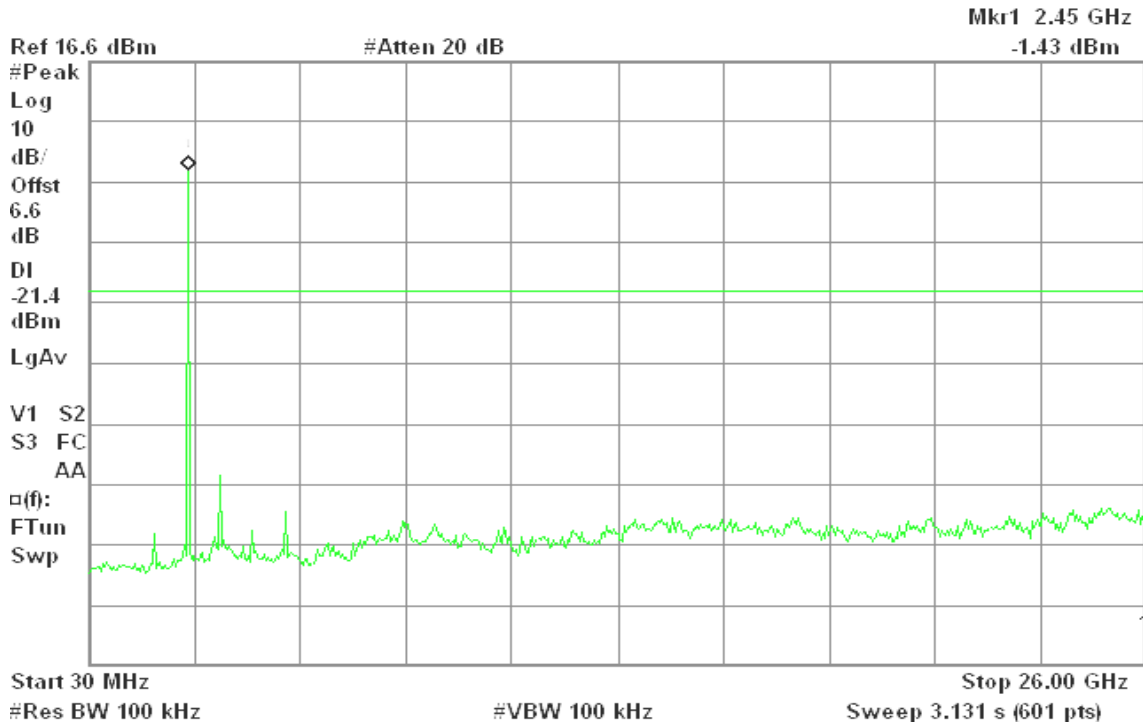
R T



#### CH Mid

Agilent 12:09:03 Oct 29, 2009

R T



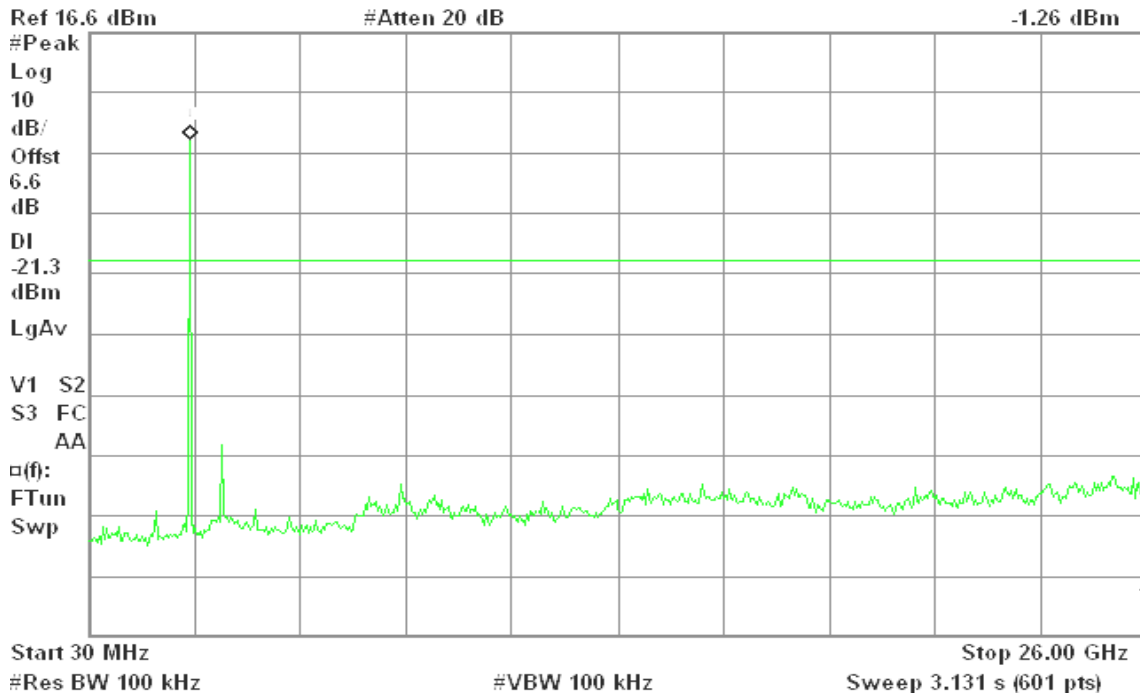


### CH High

Agilent 12:08:21 Oct 29, 2009

R T

Mkr1 2.50 GHz  
-1.26 dBm





### 7.9.2 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

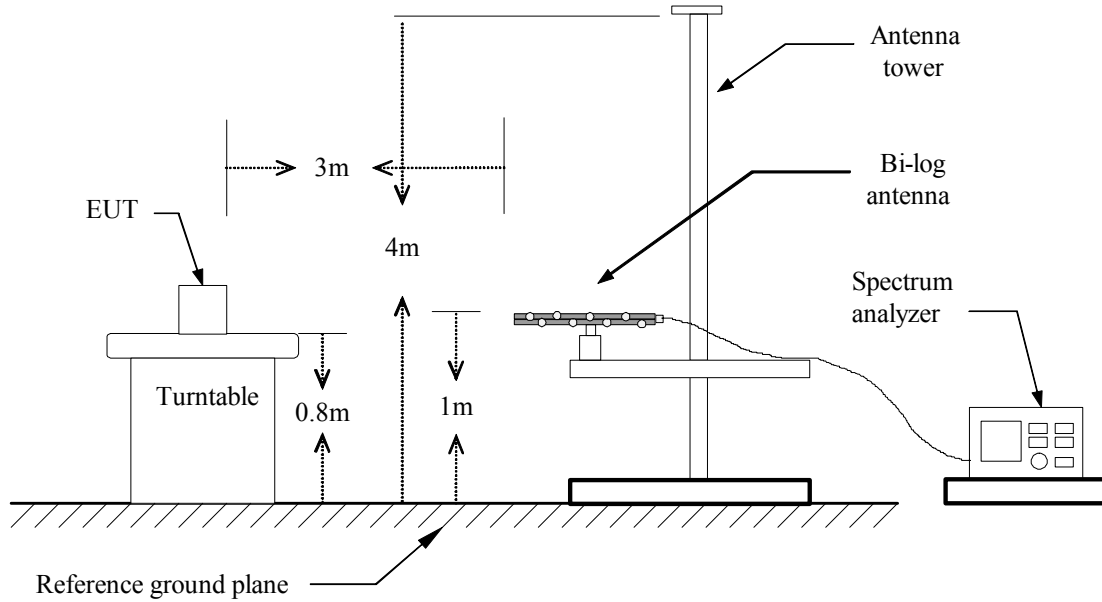
*Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

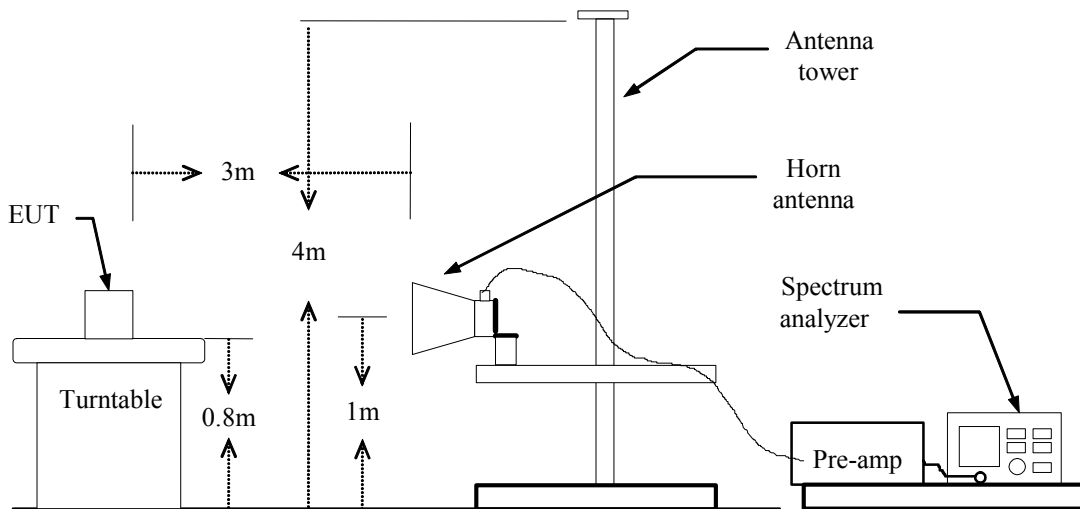
Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

### 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.



**Below 1 GHz**

**Operation Mode:** Normal Link

**Test Date:** October 17, 2009

**Temperature:** 25°C

**Tested by:** Nan Tsai

**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
36.47	V	38.65	-6.46	32.19	40.00	-7.81	Peak
68.80	V	45.21	-14.63	30.59	40.00	-9.41	Peak
296.75	V	36.68	-8.74	27.94	46.00	-18.06	Peak
432.55	V	35.23	-5.50	29.73	46.00	-16.27	Peak
663.73	V	37.96	-1.60	36.36	46.00	-9.64	Peak
799.53	V	32.12	0.04	32.15	46.00	-13.85	Peak
272.50	H	41.02	-9.08	31.94	46.00	-14.06	Peak
335.55	H	39.51	-7.79	31.72	46.00	-14.28	Peak
432.55	H	38.67	-5.50	33.17	46.00	-12.83	Peak
666.97	H	31.33	-1.57	29.75	46.00	-16.25	Peak
799.53	H	32.30	0.04	32.34	46.00	-13.66	Peak
969.28	H	37.85	2.18	40.03	54.00	-13.97	Peak

**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).





**Above 1 GHz**

**Operation Mode:** TX / GFSK / DH5 / CH Low

**Test Date:** October 17, 2009

**Temperature:** 25°C

**Tested by:** Nan Tsai

**Humidity:** 50 % 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
1033.33	V	61.14	42.48	-7.90	53.24	34.58	74.00	54.00	-19.42	AVG
1326.67	V	58.99	---	-7.35	51.64	---	74.00	54.00	-2.36	Peak
1990.00	V	52.01	---	-2.35	49.67	---	74.00	54.00	-4.33	Peak
2663.33	V	53.39	38.19	-1.10	52.29	37.09	74.00	54.00	-16.91	AVG
4800.00	V	59.47	51.54	1.04	60.51	52.58	74.00	54.00	-1.42	AVG
N/A										
1016.67	H	61.86	44.06	-7.93	53.93	36.13	74.00	54.00	-17.87	AVG
1603.33	H	55.90	---	-6.04	49.85	---	74.00	54.00	-4.15	Peak
4800.00	H	57.94	51.84	1.04	58.98	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 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 / GFSK / DH5 / CH Mid

Test Date: October 17, 2009

Temperature: 25°C

Tested by: Nan Tsai

Humidity: 50 % 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
1030.00	V	60.94	42.49	-7.90	53.03	34.59	74.00	54.00	-19.41	AVG
1330.00	V	57.32	---	-7.35	49.98	---	74.00	54.00	-4.02	Peak
1626.67	V	53.02	---	-5.82	47.20	---	74.00	54.00	-6.80	Peak
1993.33	V	52.56	---	-2.31	50.25	---	74.00	54.00	-3.75	Peak
2656.67	V	52.50	---	-1.11	51.39	---	74.00	54.00	-2.61	Peak
3258.33	V	49.87	---	-0.14	49.73	---	74.00	54.00	-4.27	Peak
4883.33	V	56.11	50.96	1.02	57.13	51.98	74.00	54.00	-2.02	AVG
1026.67	H	61.90	44.07	-7.91	53.99	36.16	74.00	54.00	-17.84	AVG
1626.67	H	55.73	---	-5.82	49.91	---	74.00	54.00	-4.09	Peak
3258.33	H	51.36	---	-0.14	51.22	---	74.00	54.00	-2.78	Peak
4883.33	H	54.60	48.66	1.02	55.62	49.68	74.00	54.00	-4.32	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 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 / GFSK / DH5 / CH High**Test Date:** October 17, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % 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
1096.67	V	55.66	---	-7.78	47.88	---	74.00	54.00	-6.12	Peak
1333.33	V	54.34	---	-7.34	47.00	---	74.00	54.00	-7.00	Peak
1653.33	V	53.64	---	-5.56	48.08	---	74.00	54.00	-5.92	Peak
2666.67	V	53.79	38.08	-1.09	52.70	36.99	74.00	54.00	-17.01	AVG
4958.33	V	55.57	50.19	1.00	56.57	51.19	74.00	54.00	-2.81	AVG
N/A										
1026.67	H	59.00	---	-7.91	51.09	---	74.00	54.00	-2.91	Peak
1653.33	H	55.93	---	-5.56	50.37	---	74.00	54.00	-3.63	Peak
3308.33	H	52.26	46.31	-0.08	52.18	46.23	74.00	54.00	-7.77	AVG
4958.33	H	54.01	48.65	1.00	55.01	49.65	74.00	54.00	-4.35	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 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 / 8DPSK / DH5 / CH Low

Test Date: October 17, 2009

Temperature: 25°C

Tested by: Nan Tsai

Humidity: 50 % 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
1036.67	V	56.00	---	-7.89	48.11	---	74.00	54.00	-5.89	Peak
1333.33	V	55.06	---	-7.34	47.72	---	74.00	54.00	-6.28	Peak
2660.00	V	52.59	---	-1.10	51.49	---	74.00	54.00	-2.51	Peak
3200.00	V	51.00	---	-0.21	50.80	---	74.00	54.00	-3.20	Peak
4808.33	V	51.67	44.14	1.04	52.71	45.18	74.00	54.00	-8.82	AVG
N/A										
1033.33	H	61.66	44.08	-7.90	53.76	36.18	74.00	54.00	-17.82	AVG
1333.33	H	52.85	---	-7.34	45.51	---	74.00	54.00	-8.49	Peak
1603.33	H	56.14	---	-6.04	50.09	---	74.00	54.00	-3.91	Peak
3200.00	H	52.12	---	-0.21	51.91	---	74.00	54.00	-2.09	Peak
4800.00	H	52.70	44.20	1.04	53.74	45.24	74.00	54.00	-8.76	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 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 / 8DPSK / DH5 / CH Mid**Test Date:** October 17, 2009**Temperature:** 25°C**Tested by:** Nan Tsai**Humidity:** 50 % 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
1326.67	V	55.41	---	-7.35	48.06	---	74.00	54.00	-5.94	Peak
1626.67	V	53.02	---	-5.82	47.20	---	74.00	54.00	-6.80	Peak
2666.67	V	53.58	38.06	-1.09	52.49	36.97	74.00	54.00	-17.03	AVG
3258.33	V	53.52	47.21	-0.14	53.38	47.07	74.00	54.00	-6.93	AVG
4883.33	V	51.97	41.56	1.02	52.99	42.58	74.00	54.00	-11.42	AVG
N/A										
1020.00	H	59.03	---	-7.92	51.11	---	74.00	54.00	-2.89	Peak
1626.67	H	55.42	---	-5.82	49.60	---	74.00	54.00	-4.40	Peak
2440.00	H	98.88	---	-1.52	97.36	---	74.00	54.00	43.36	Peak
2660.00	H	51.17	---	-1.10	50.07	---	74.00	54.00	-3.93	Peak
3258.33	H	54.34	48.79	-0.14	54.20	48.65	74.00	54.00	-5.35	AVG
4883.33	H	49.74	---	1.02	50.76	---	74.00	54.00	-3.24	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. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



Operation Mode: TX / 8DPSK / DH5 / CH High

Test Date: October 17, 2009

Temperature: 25°C

Tested by: Nan Tsai

Humidity: 50 % 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
1036.67	V	57.37	---	-7.89	49.48	---	74.00	54.00	-4.52	Peak
1330.00	V	57.96	---	-7.35	50.62	---	74.00	54.00	-3.38	Peak
1996.67	V	53.16	---	-2.28	50.88	---	74.00	54.00	-3.12	Peak
2666.67	V	53.36	38.09	-1.09	52.27	37.00	74.00	54.00	-17.00	AVG
3308.33	V	52.32	47.17	-0.08	52.23	47.09	74.00	54.00	-16.91	AVG
4958.33	V	49.08	---	1.00	50.08	---	74.00	54.00	-3.92	Peak
1010.00	H	60.87	44.05	-7.94	52.93	36.11	74.00	54.00	-17.89	AVG
1653.33	H	56.60	---	-5.56	51.04	---	74.00	54.00	-2.96	Peak
3308.33	H	55.52	46.30	-0.08	55.44	46.22	74.00	54.00	-7.78	AVG
4950.00	H	49.82	---	1.00	50.82	---	74.00	54.00	-3.18	Peak
N/A										

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser; with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



## 7.10 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  $\mu$ 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 $\mu$ 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 21, 2009

**Temperature:** 22°C

**Tested by:** Nan Tsai

**Humidity:** 45% 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
0.1700	48.09	41.29	0.11	48.20	41.40	64.96	54.96	-16.76	-13.56	L1
1.5100	37.84	32.04	0.06	37.90	32.10	56.00	46.00	-18.10	-13.90	L1
2.0300	44.84	38.34	0.06	44.90	38.40	56.00	46.00	-11.10	-7.60	L1
3.1900	39.04	28.34	0.06	39.10	28.40	56.00	46.00	-16.90	-17.60	L1
3.7100	49.34	36.44	0.06	49.40	36.50	56.00	46.00	-6.60	-9.50	L1
3.9400	50.24	37.34	0.06	50.30	37.40	56.00	46.00	-5.70	-8.60	L1
0.2300	42.50	34.00	0.10	42.60	34.10	62.45	52.45	-19.85	-18.35	L2
0.2900	39.41	33.01	0.09	39.50	33.10	60.52	50.52	-21.02	-17.42	L2
1.3900	41.02	37.12	0.08	41.10	37.20	56.00	46.00	-14.90	-8.80	L2
1.8500	44.42	40.32	0.08	44.50	40.40	56.00	46.00	-11.50	-5.60	L2
2.2000	44.82	39.52	0.08	44.90	39.60	56.00	46.00	-11.10	-6.40	L2
3.8200	50.21	37.51	0.09	50.30	37.60	56.00	46.00	-5.70	-8.40	L2

### **Remark:**

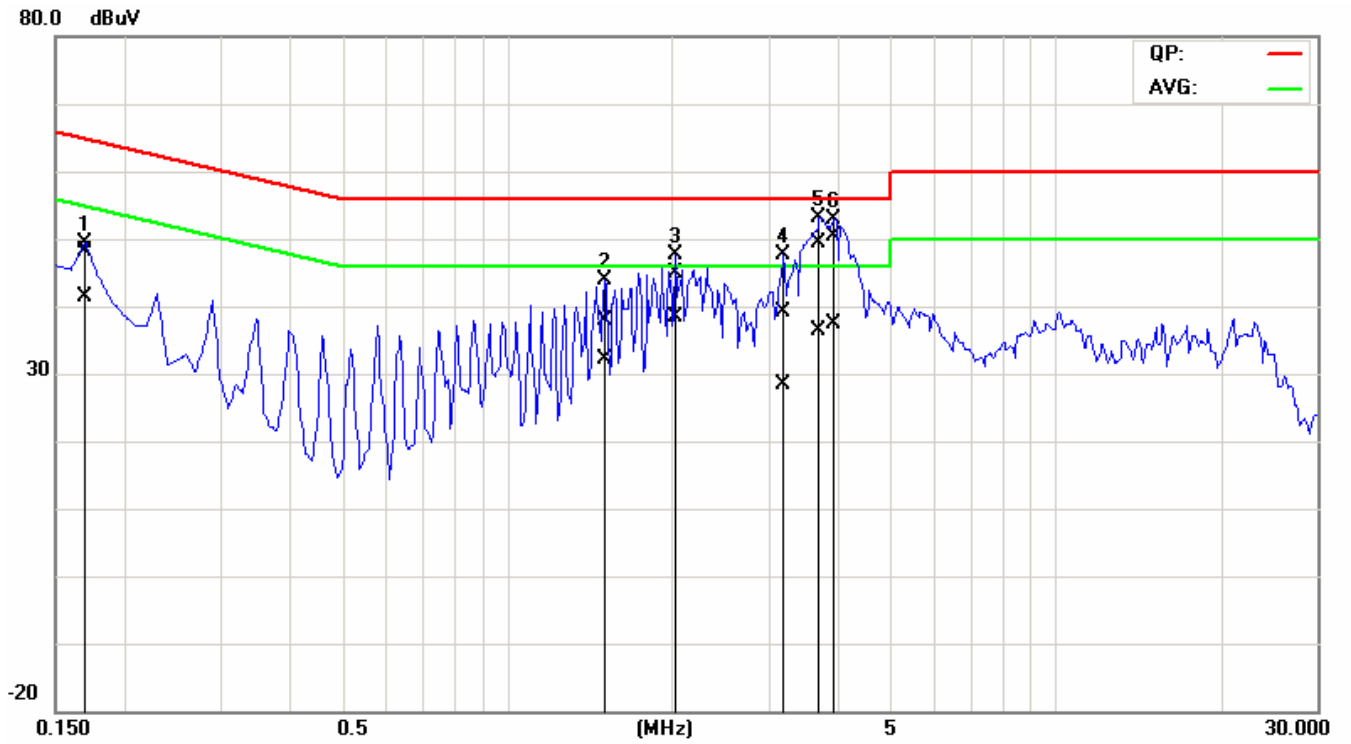
1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



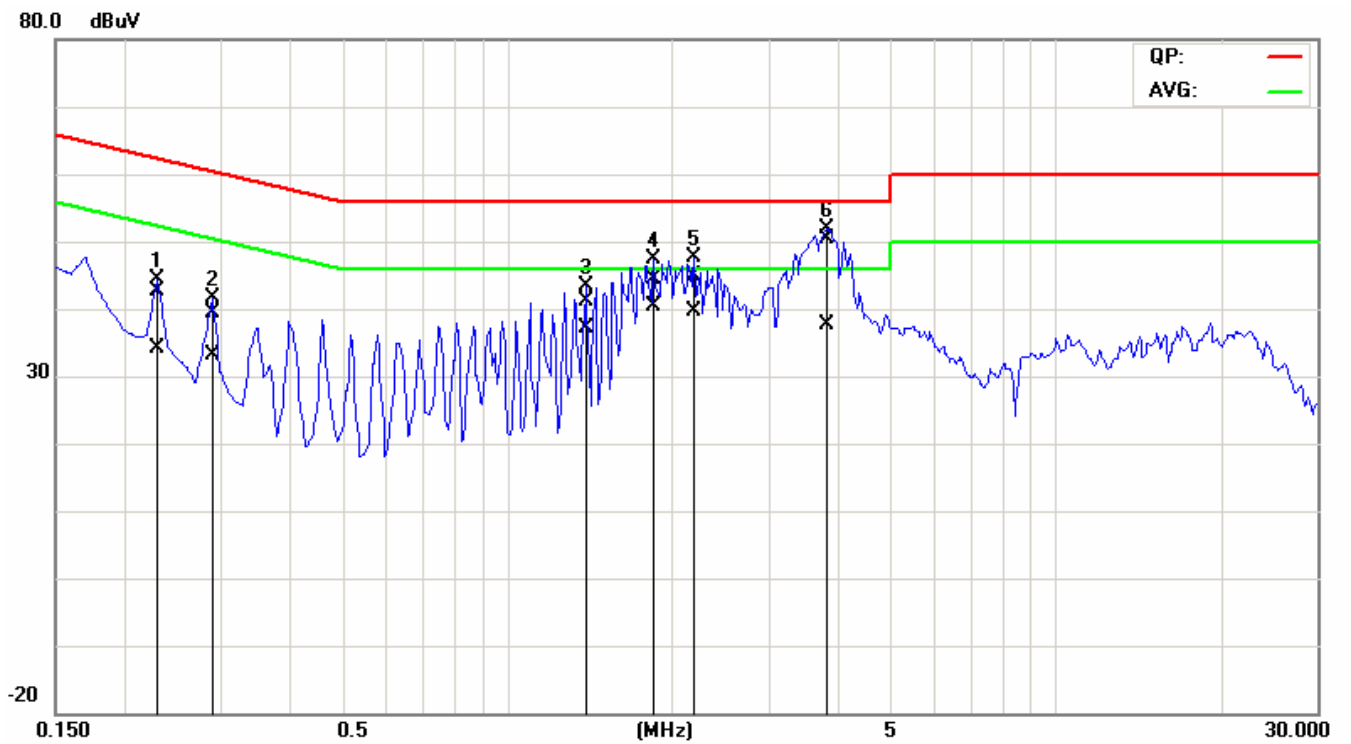


**Test Plots**

**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

<b>EUT</b>	Nobo Kapture USB Receiver
<b>Frequency band (Operating)</b>	<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>
<b>Device category</b>	<input checked="" type="checkbox"/> Portable (<20cm separation) <input type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure ( $S = 5mW/cm^2$ ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S = 1mW/cm^2$ )
<b>Antenna diversity</b>	<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
<b>Max. output power</b>	3.69dBm (0.0023mW)
<b>Antenna gain (Max)</b>	-2 dBi (Numeric gain: 0.631)
<b>Evaluation applied</b>	<input type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation <input checked="" type="checkbox"/> N/A*

### Remark:

1. The maximum output power is 3.69dBm (0.0023mW) at 2402MHz (with 0.631 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:  $60/f_{(GHz)} = 60/2.441 = 24.58mW$ )