



**FCC 47 CFR PART 15 SUBPART C**

**TEST REPORT**

**For**

**Hands-Free Car Kit for iPhone & BT Phones**

**Model: M01043**

**Brand Name: Kensington**

*Prepared for*

**ACCO Brands, Inc.**

**333 Twin Dolphin 6<sup>th</sup> Floor, Redwood Shores, California, United States**

*Prepared by*

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# 1. TEST RESULT CERTIFICATION

**Applicant:** ACCO Brands, Inc.  
333 Twin Dolphin 6<sup>th</sup> Floor, Redwood Shores, California,  
United States

**Equipment Under Test:** Hands-Free Car Kit for iPhone & BT Phones

**Brand Name:** Kensington

**Model:** M01043

**Date of Test:** November 21-December 11,2008

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 conducted and radiated emission limits of FCC Rules Part 15.207, 15.209 and 15.247.

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

*Approved by:*

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**Clinton Kao**  
Manager  
Compliance Certification Service Inc.

*Reviewed by:*

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**Vincent Yao**  
Assistant manager  
Compliance Certification Service Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	Hands-Free Car Kit for iPhone & BT Phones
<b>Brand Name</b>	Kensington
<b>Model Number</b>	M01043
<b>Model Discrepancy</b>	N/A
<b>Power Supply</b>	DC12V supplied by DC power supply
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	2.51dBm
<b>Modulation Technique</b>	FHSS(GFSK, $\pi/4$ -DQPSK, 8DPSK)
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	IFA Antenna Gain: 2.18 dBi (max)
<b>Temperature Range</b>	0~ +55°C

*Note: This submittal(s) (test report) is intended for FCC ID: GV3M01043 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: 2003. Radiated testing was performed at an antenna to EUT distance 3 meters.

#### **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: 2003. 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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003.



### 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 has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) are chosen for full testing.



#### **4. INSTRUMENT CALIBRATION**

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

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

No. 5, Jinao industrial park, No.35 Jukeng Road, Dashuikeng Village, Guanlan Town, Baoan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4: 2003 and CISPR Publication 22.

### 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 5.3 LABORATORY ACCREDITATIONS AND LISTING

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

**Taiwan** TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

<b>USA</b>	<b>FCC</b>
<b>Japan</b>	<b>VCCI</b>
<b>Canada</b>	<b>INDUSTRY CANADA</b>
<b>Taiwan</b>	<b>BSMI</b>

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsemc.com.tw>





## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### 6.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	Telephone	W8001	N/A	N/A	SONY	N/A	N/A
2	Notebook	2672	N/A	992F2VG	IBM	N/A	Unshielded 1.80m
3	DC power supply	PS-605D	20018978	N/A	DAZHENG	Unshielded 0.50m	Shielded 2.00m
4	Control board	N/A	N/A	N/A	N/A	Shielded 2.00m	Unshielded 1.60m
5	Connector	N/A	N/A	N/A	N/A	N/A	N/A

**Notes:**

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 20DB BANDWIDTH

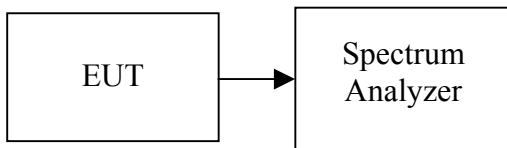
None; for reporting purpose only.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

### TEST CONFIGURATION



### TEST PROCEDURE

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

### TEST RESULTS

No non-compliance noted



**Test plot**

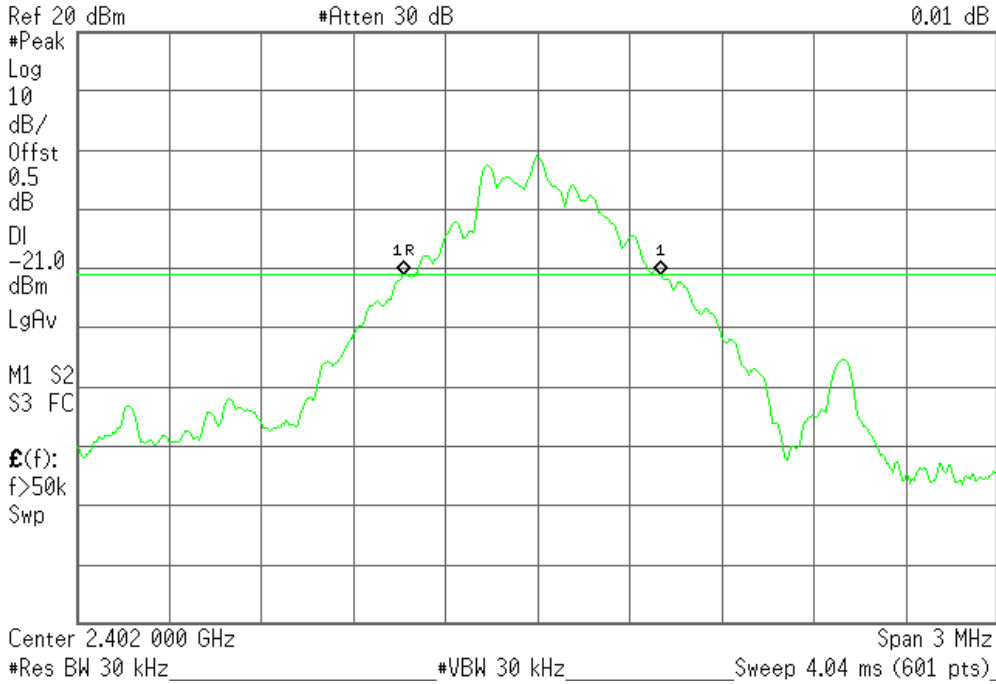
**GFSK**

**20dB Bandwidth (CH Low)**

Agilent 14:31:58 Nov 27, 2008

R T

Mkr1 835 kHz  
0.01 dB

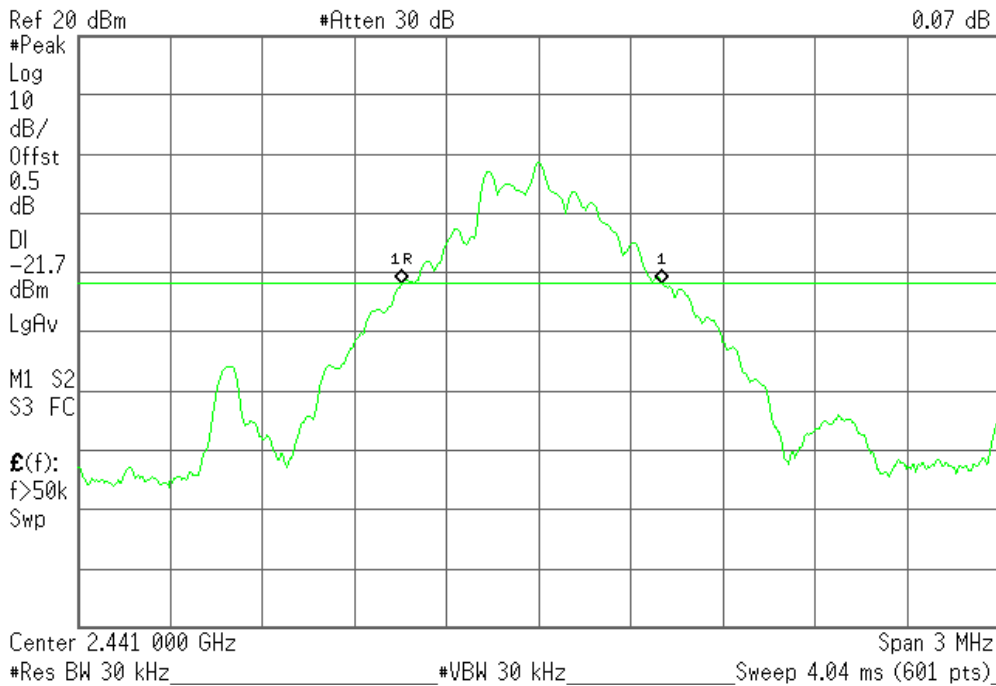


**20dB Bandwidth (CH Mid)**

Agilent 14:33:02 Nov 27, 2008

R T

Mkr1 845 kHz  
0.07 dB



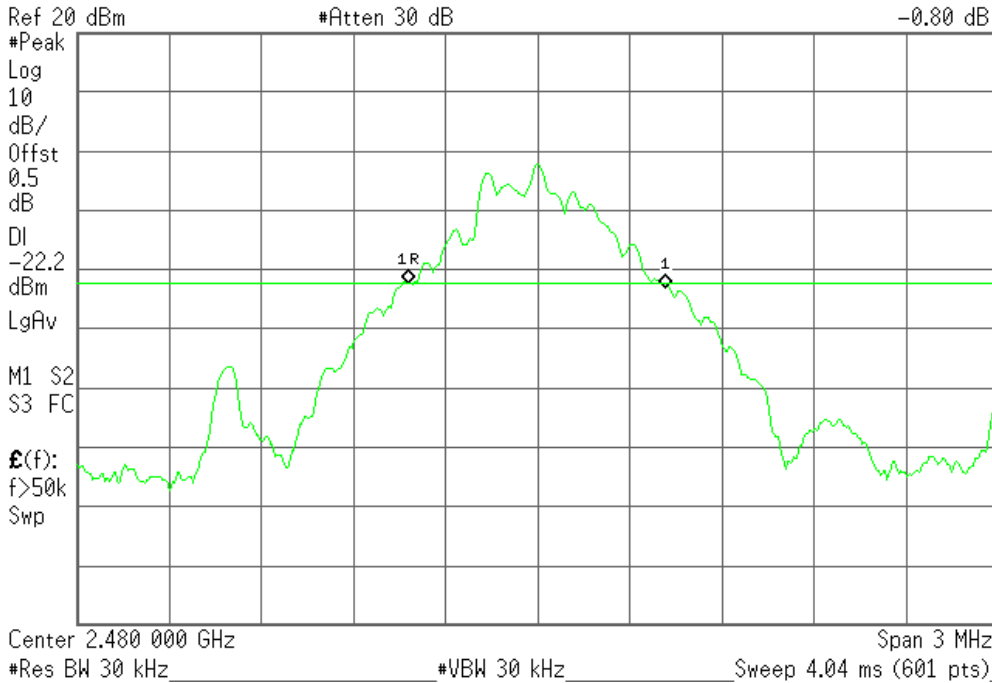


### 20dB Bandwidth (CH High)

Agilent 14:34:05 Nov 27, 2008

R T

Mkr1 835 kHz  
-0.80 dB



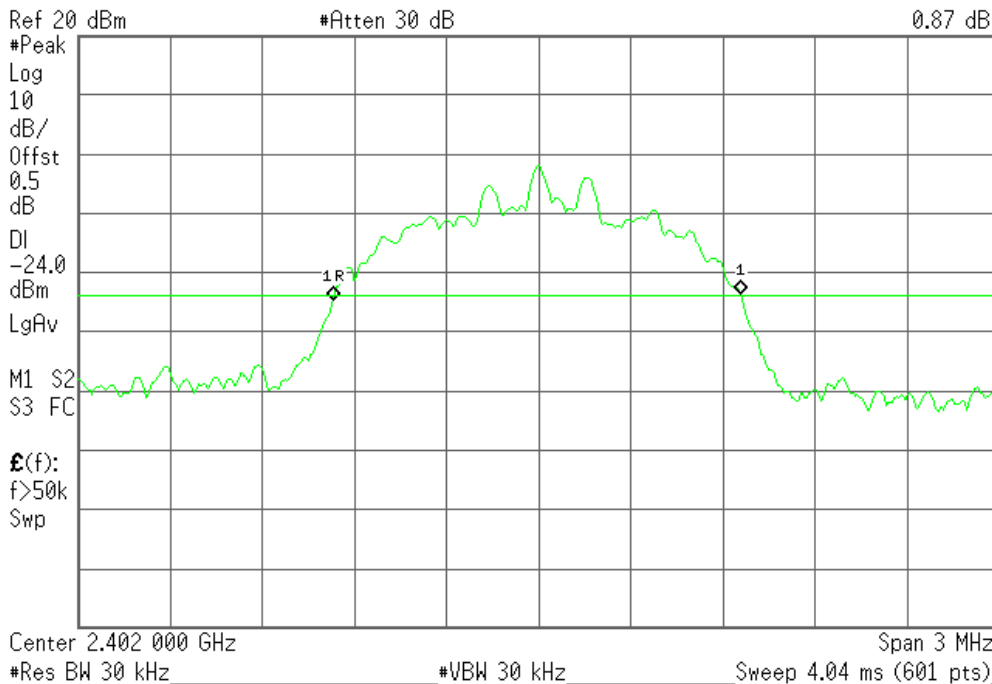
### 8DPSK

### 20dB Bandwidth (CH Low)

Agilent 14:28:51 Nov 27, 2008

R T

Mkr1 1.330 MHz  
0.87 dB



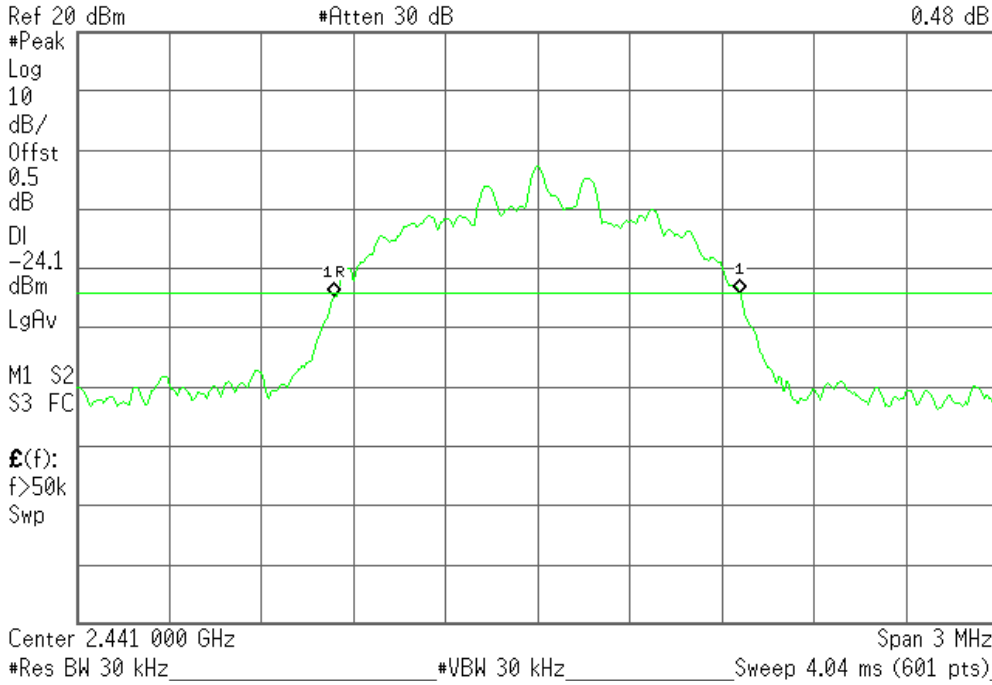


### 20dB Bandwidth (CH Mid)

Agilent 14:27:47 Nov 27, 2008

R T

Mkr1 1.325 MHz  
0.48 dB

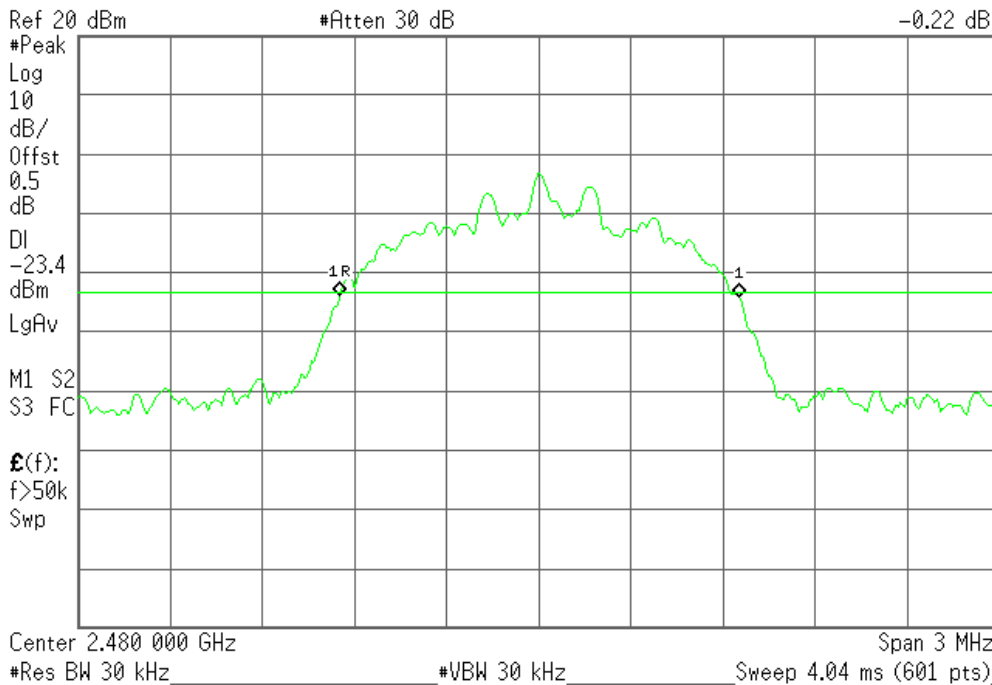


### 20dB Bandwidth (CH High)

Agilent 14:26:12 Nov 27, 2008

R T

Mkr1 1.305 MHz  
-0.22 dB





## 7.2 PEAK POWER

### LIMIT

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

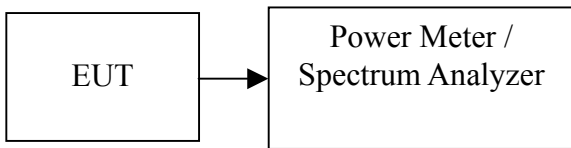
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF Power Meter & Sensor	Anritsu	ML2487A	6K00001491	02/23/2009
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

### Test Configuration



### TEST PROCEDURE

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.



**TEST RESULTS**

*No non-compliance noted*

**Test Data**

**GFSK**

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	1.51	1.0	251	0.00178	1	PASS
Md	2441	1.16	1.0	216	0.00164		PASS
Hgh	2480	1.35	1.0	235	0.00172		PASS

**8DPSK**

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	1.36	1.0	236	0.00172	1	PASS
Md	2441	1.17	1.0	217	0.00165		PASS
Hgh	2480	1.48	1.0	248	0.00177		PASS

### 7.3 PEAK POWER SPECTRAL DENSITY

#### LIMIT

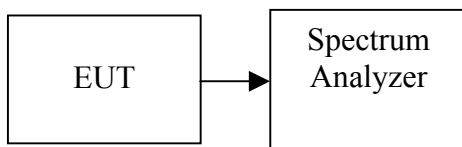
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

#### TEST RESULTS

*Not applicable. Since EUT is the Bluetooth device.*



## 7.4 BAND EDGES MEASUREMENT

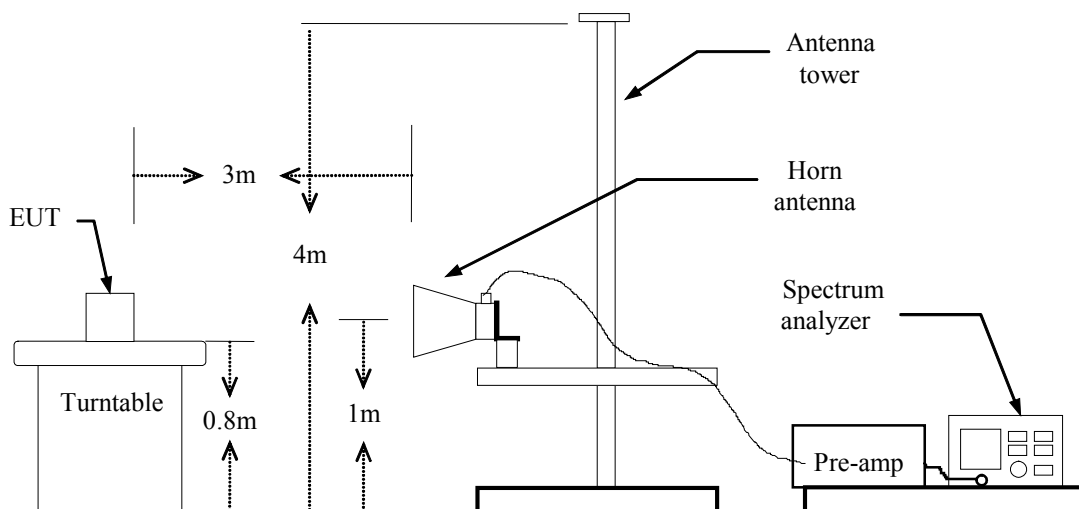
### LIMIT

According to §15.247(c), 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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).

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due				
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009				
EMI Test Receiver	R&S	ESCI	1166.5950 03	01/13/2009				
Low Noise Amplifier	MITEQ	AM-1604-3000	1123808	02/14/2009				
Bilog Antenna	SCHWAZBECK	CBL6143	5082	06/09/2009				
Turn Table	EMCO	2081-1.21	N/A	N.C.R				
Antenna Tower	CT	N/A	N/A	N.C.R				
Controller	CT	N/A	N/A	N.C.R				
High Noise Amplifier	Agilent	89842	N/A	06/09/2009				
Site NSA	C&C	N/A	N/A	06/09/2009				
Horn Antenna	TRC	N/A	N/A </tr <tr> <td>Signal Generator</td> <td>Anritsu</td> <td>MG3694A</td> <td>#050125</td> <td>02/24/2009</td> </tr>	Signal Generator	Anritsu	MG3694A	#050125	02/24/2009
Signal Generator	Anritsu	MG3694A	#050125	02/24/2009				

### 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.



Test Data

GFSK

Band Edges (CH-Low)

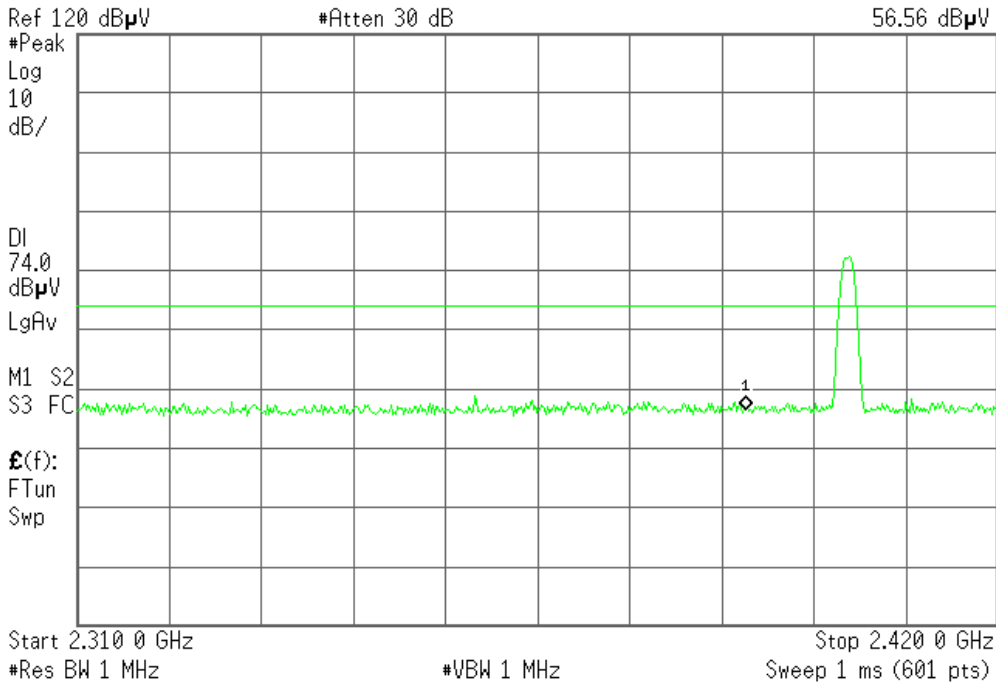
Detector mode: Peak

Polarity: Vertical

Agilent 14:36:23 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
56.56 dBµV



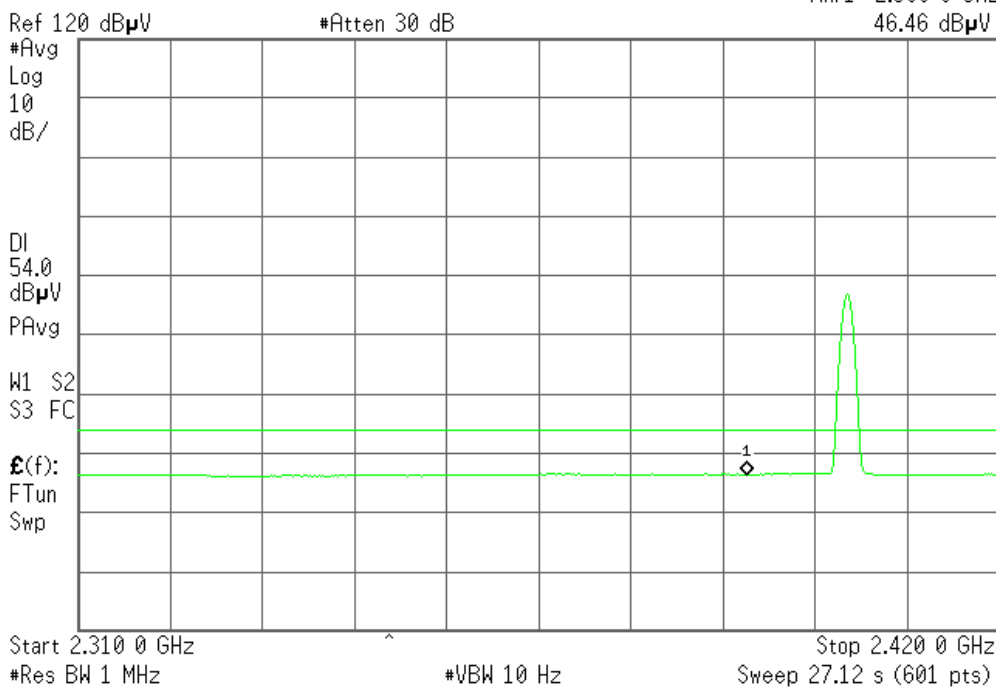
Detector mode: Average

Polarity: Vertical

Agilent 14:37:32 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
46.46 dBµV





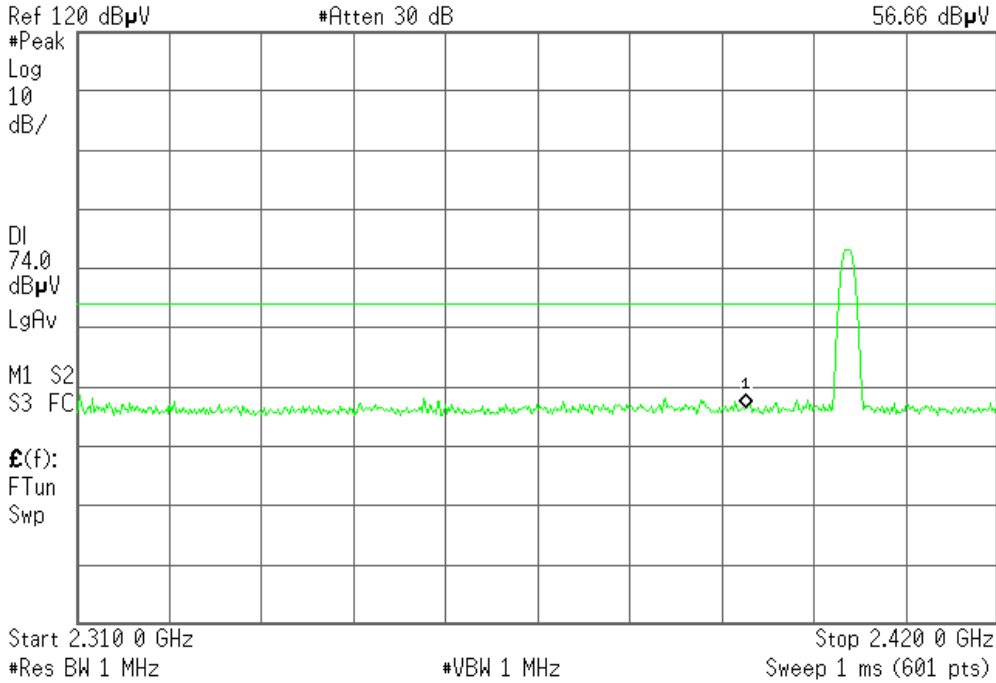
Detector mode: Peak

Polarity: Horizontal

Agilent 14:33:19 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
56.66 dBμV



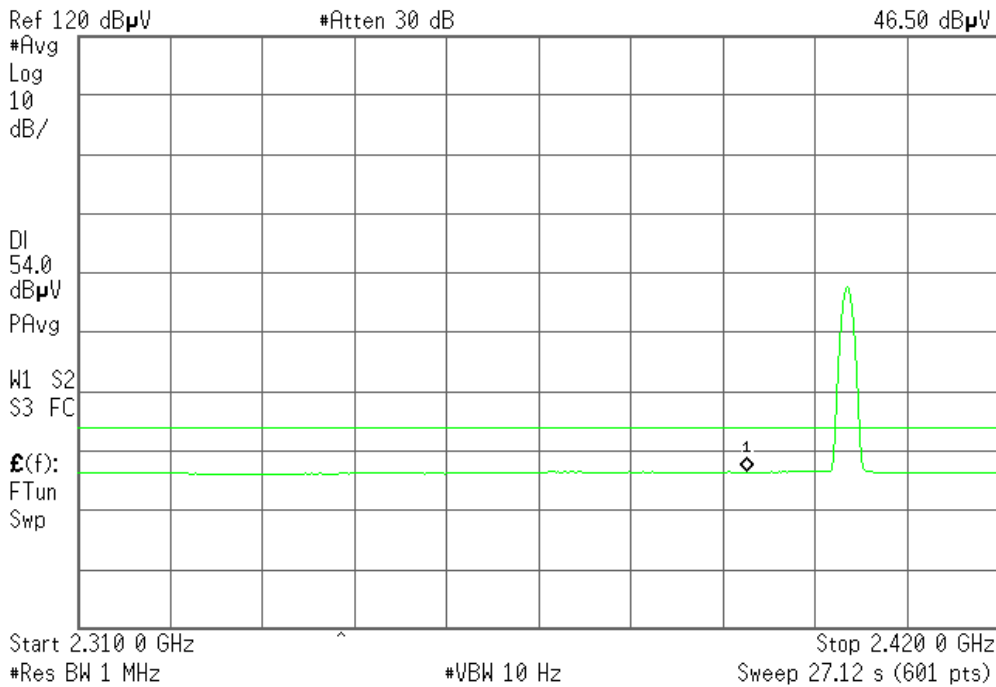
Detector mode: Average

Polarity: Horizontal

Agilent 14:34:07 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
46.50 dBμV





### Band Edges (CH-High)

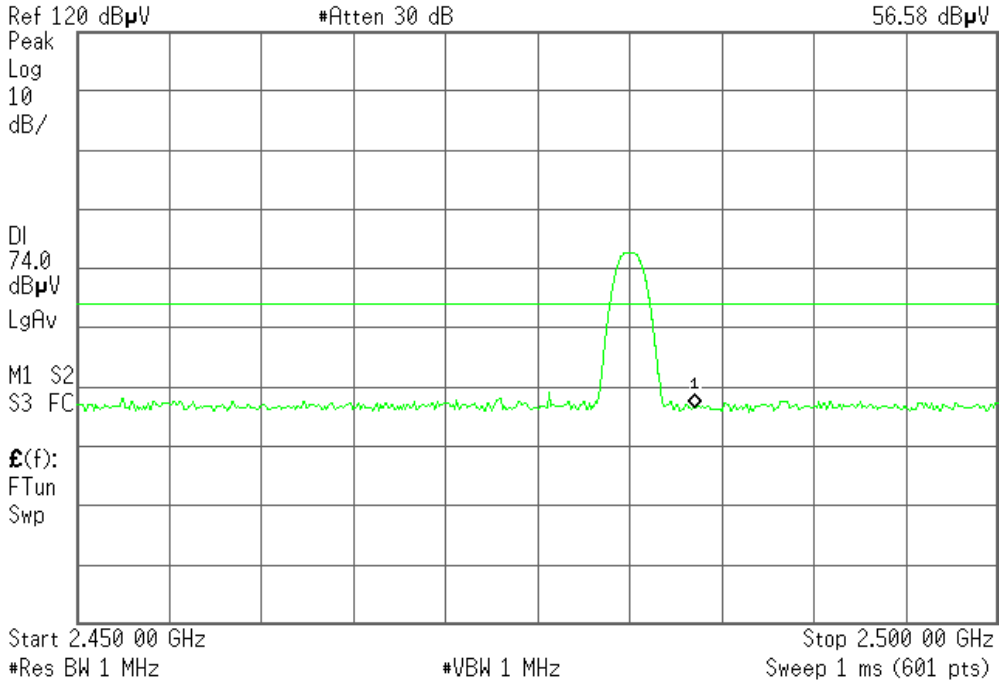
Detector mode: Peak

Polarity: Vertical

Agilent 14:26:03 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
56.58 dBμV



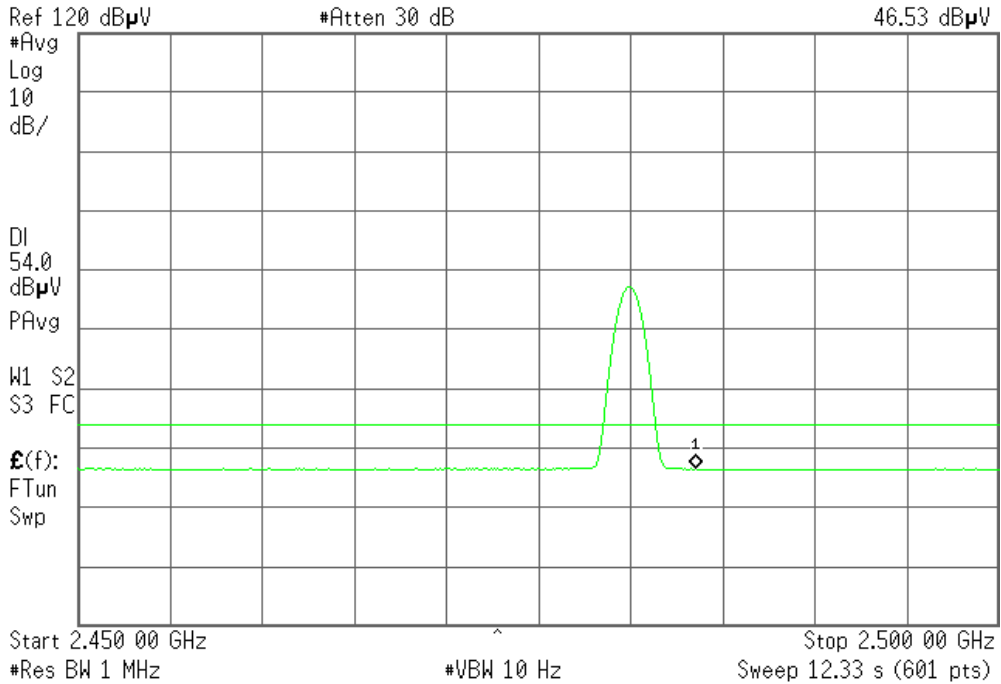
Detector mode: Average

Polarity: Vertical

Agilent 14:26:49 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
46.53 dBμV





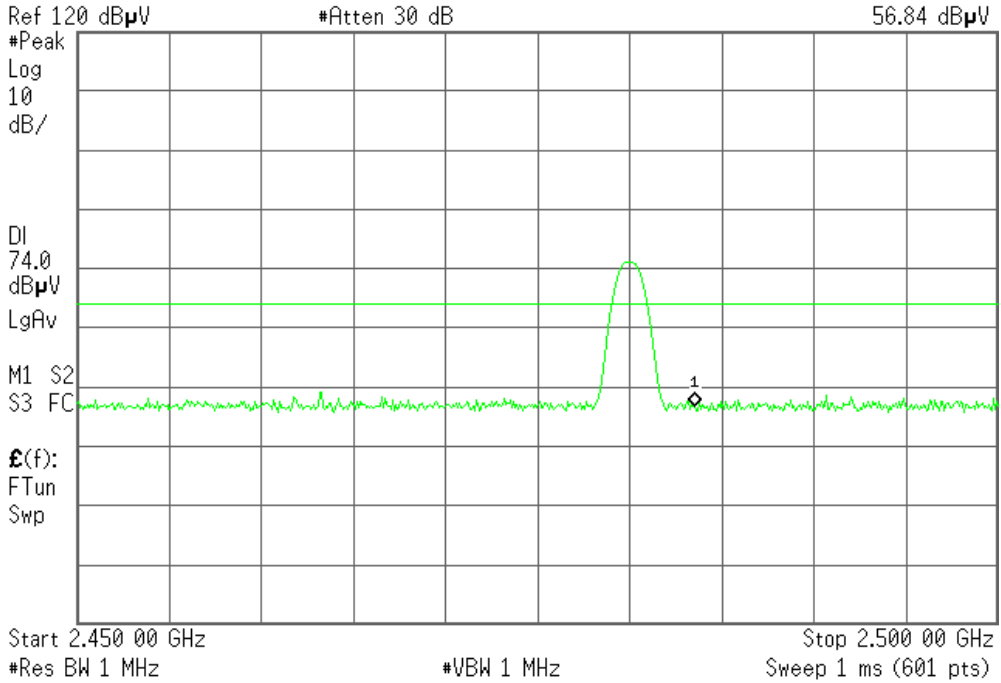
Detector mode: Peak

Polarity: Horizontal

Agilent 14:30:03 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
56.84 dBµV



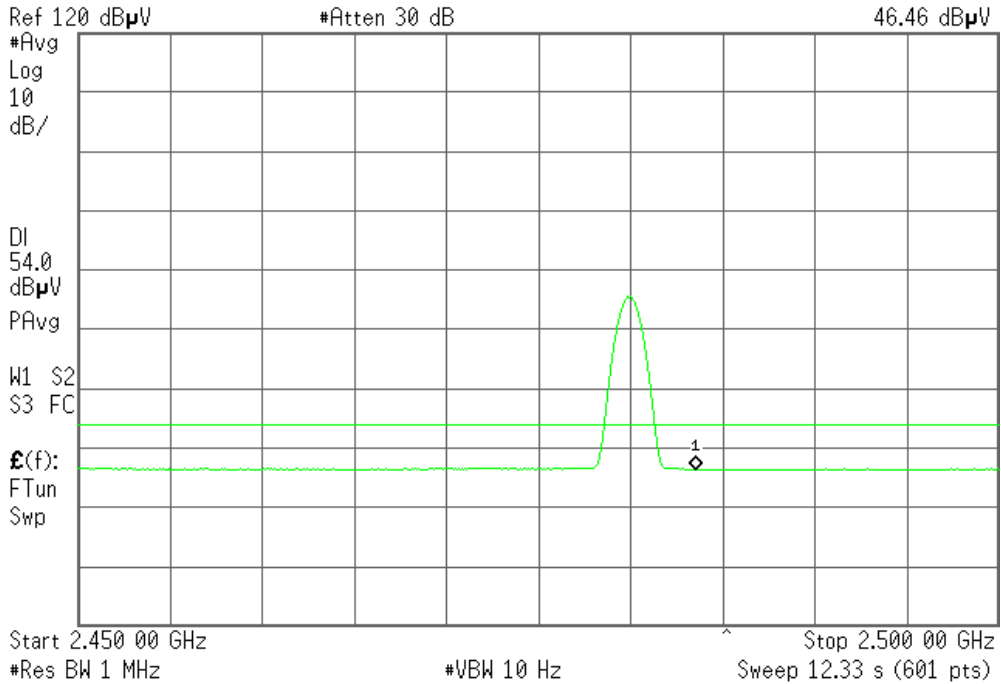
Detector mode: Average

Polarity: Horizontal

Agilent 14:30:39 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
46.46 dBµV





### 8DPSK

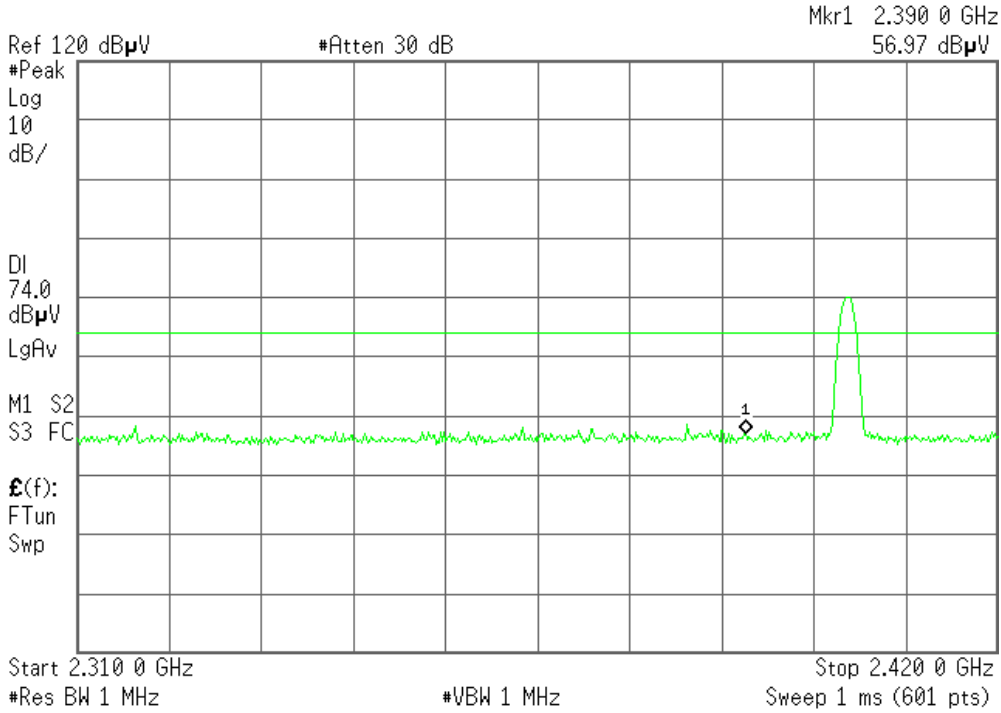
#### Band Edges (CH-Low)

Detector mode: Peak

Polarity: Vertical

Agilent 14:40:37 Dec 2, 2008

R T

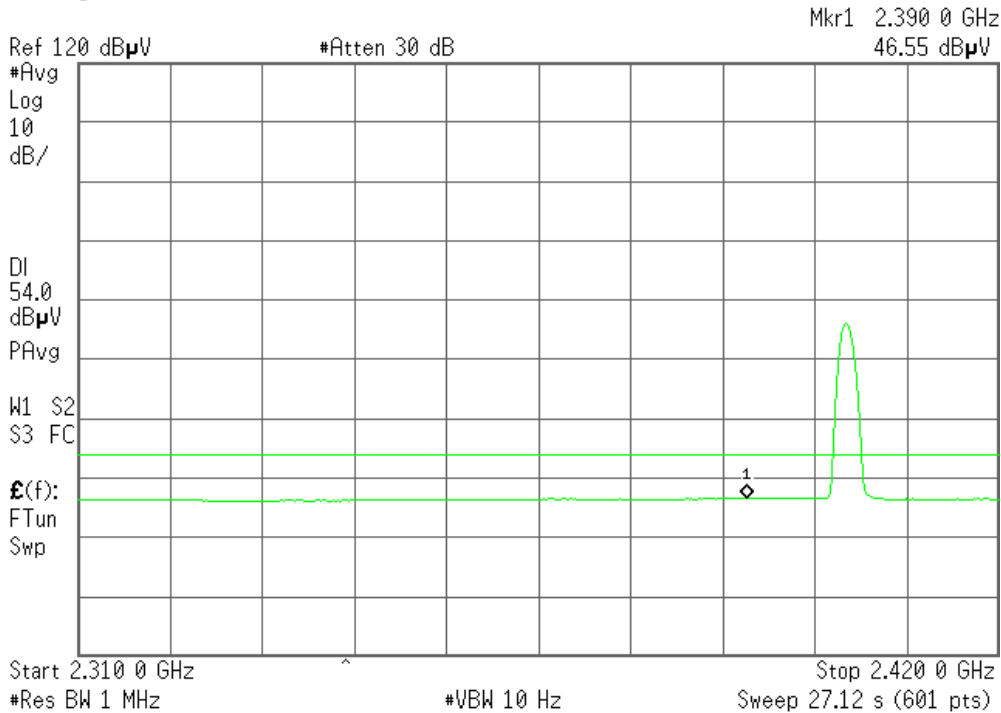


Detector mode: Average

Polarity: Vertical

Agilent 14:41:27 Dec 2, 2008

R T





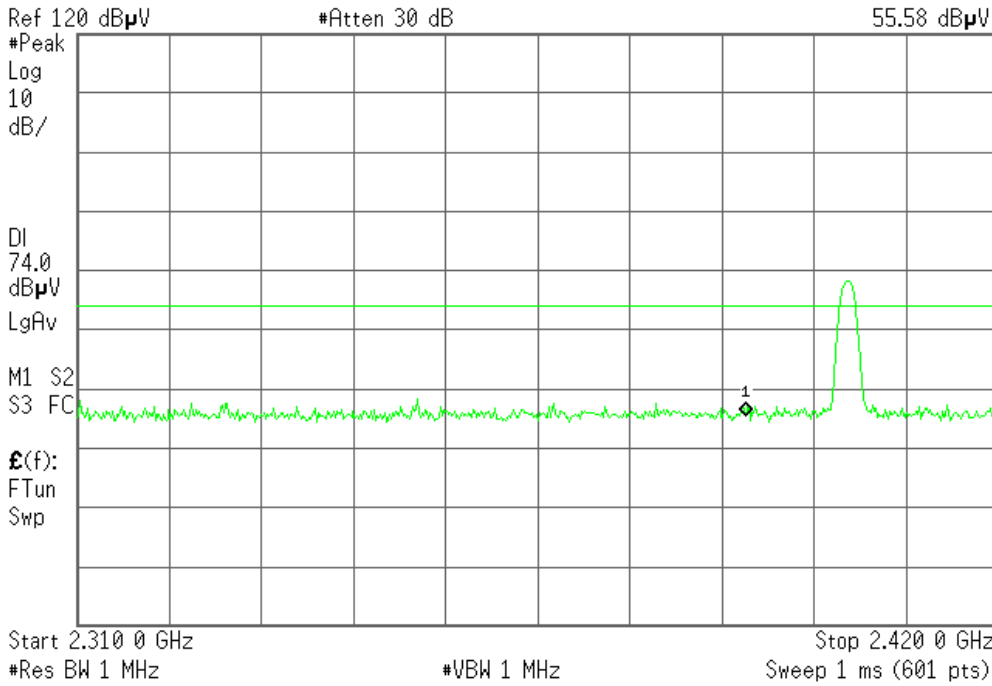
Detector mode: Peak

Polarity: Horizontal

Agilent 14:44:23 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
55.58 dBµV



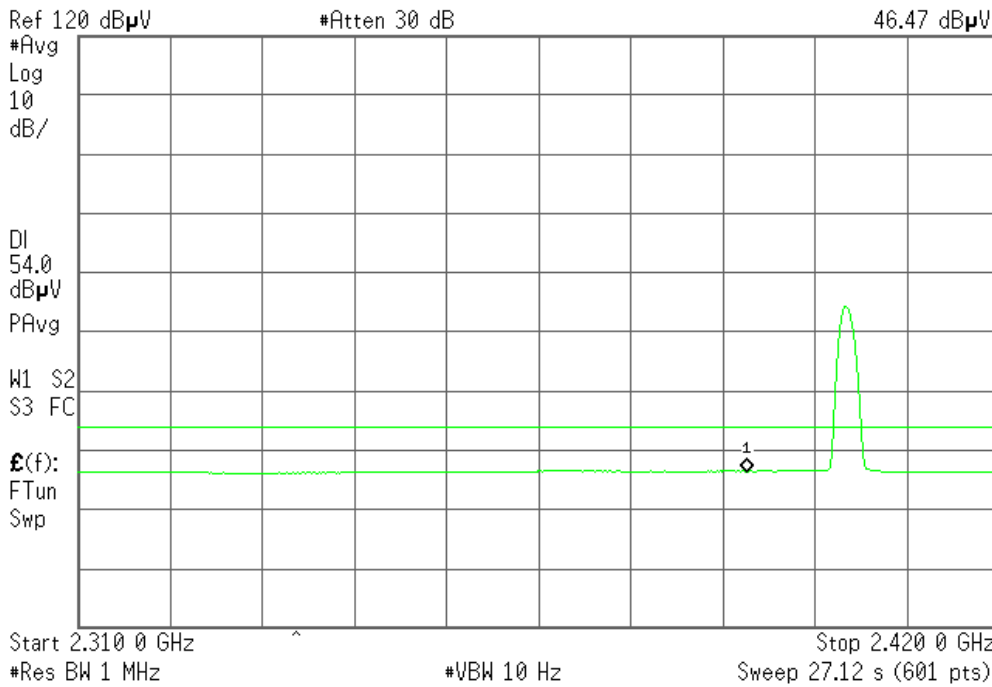
Detector mode: Average

Polarity: Horizontal

Agilent 14:45:10 Dec 2, 2008

R T

Mkr1 2.390 0 GHz  
46.47 dBµV







### Band Edges (CH-High)

Detector mode: Peak

Polarity: Vertical

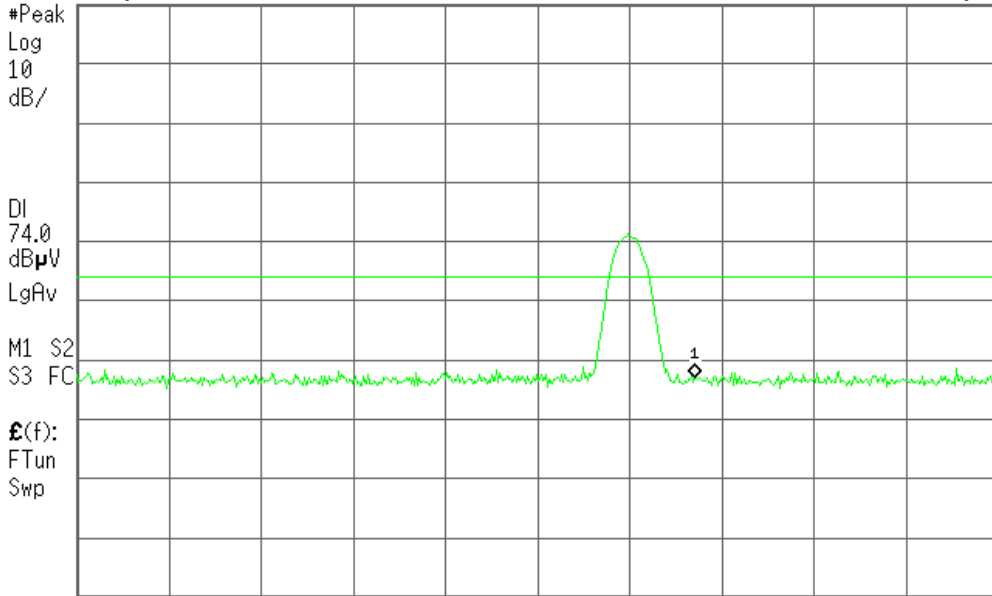
Agilent 14:50:29 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
57.01 dBµV

Ref 120 dBµV

#Atten 30 dB



Start 2.450 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.500 00 GHz

Sweep 1 ms (601 pts)

Detector mode: Average

Polarity: Vertical

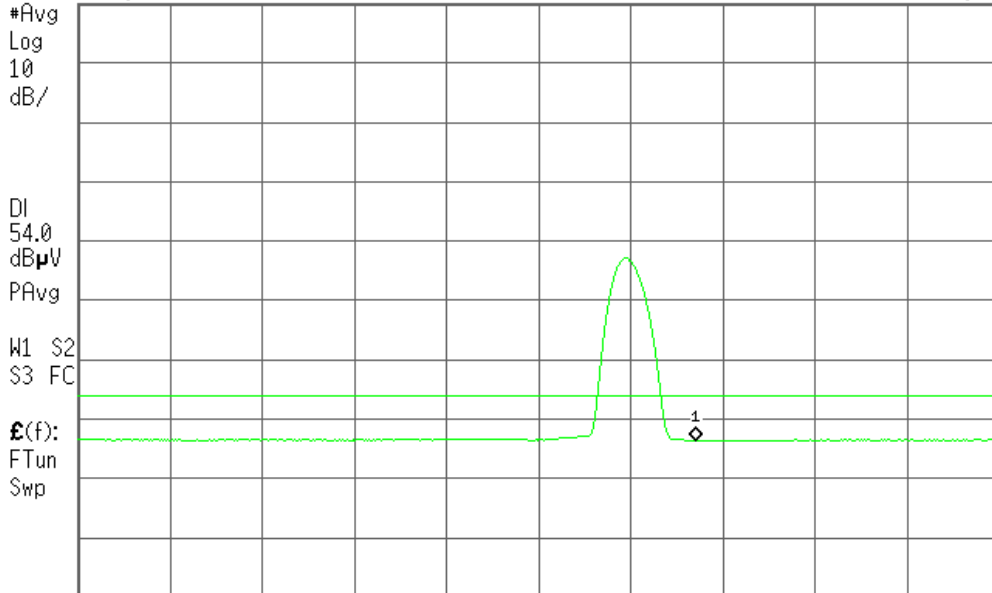
Agilent 14:51:07 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
46.41 dBµV

Ref 120 dBµV

#Atten 30 dB



Start 2.450 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.500 00 GHz

Sweep 12.33 s (601 pts)



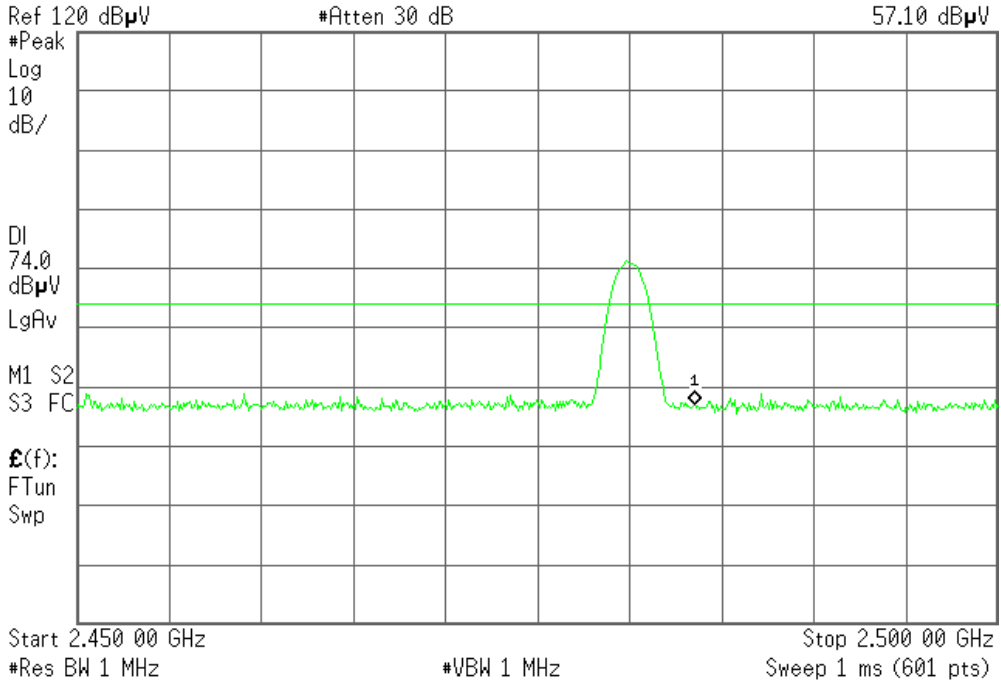
Detector mode: Peak

Polarity: Horizontal

Agilent 14:47:48 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
57.10 dBµV



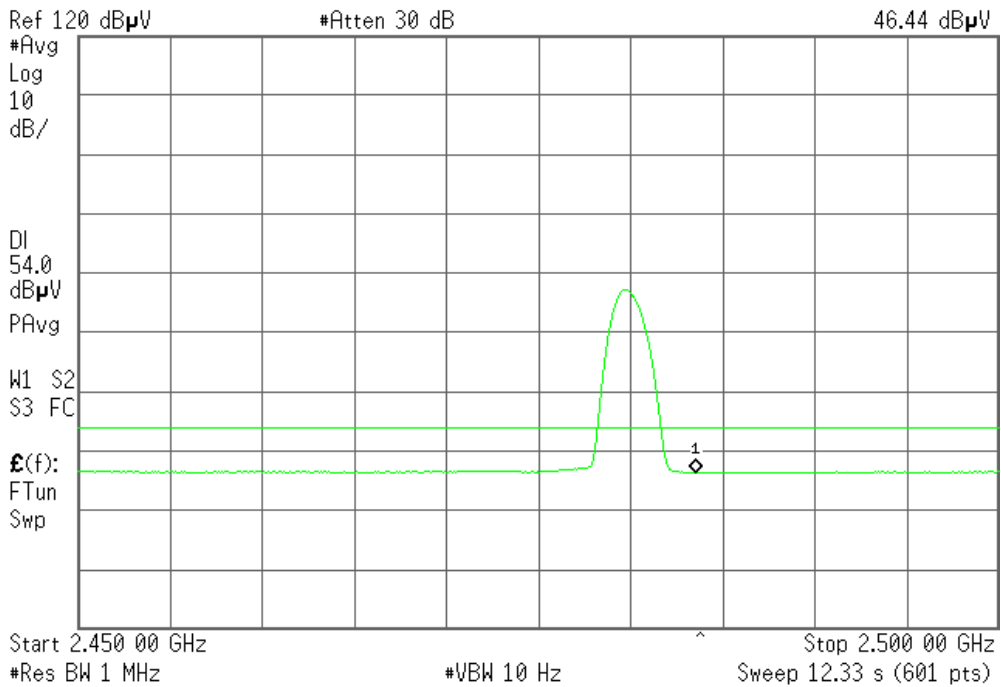
Detector mode: Average

Polarity: Horizontal

Agilent 14:48:21 Dec 2, 2008

R T

Mkr1 2.483 50 GHz  
46.44 dBµV



## 7.5 FREQUENCY SEPARATION

### LIMIT

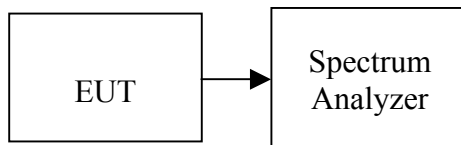
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel 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.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2009

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

### TEST CONFIGURATION



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW, VBW=30kHz, Adjust Span to 3 MHz, 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

##### GFSK

Channel Separation (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Result
1.0	845 (Max.)	563	Pass

##### 8DPSK

Channel Separation (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Result
1.0	1330 (Max.)	887	Pass



**GFSK**

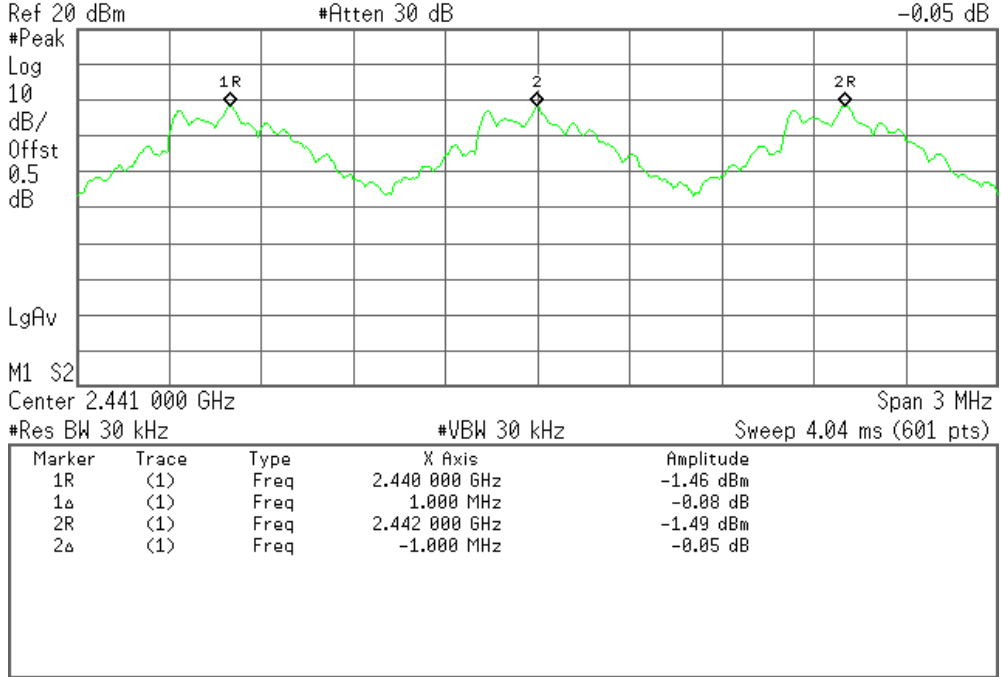
**Test Plot**

**Measurement of Channel Separation**

Agilent 14:36:20 Nov 27, 2008

R T

Mkr2 -1.000 MHz  
-0.05 dB

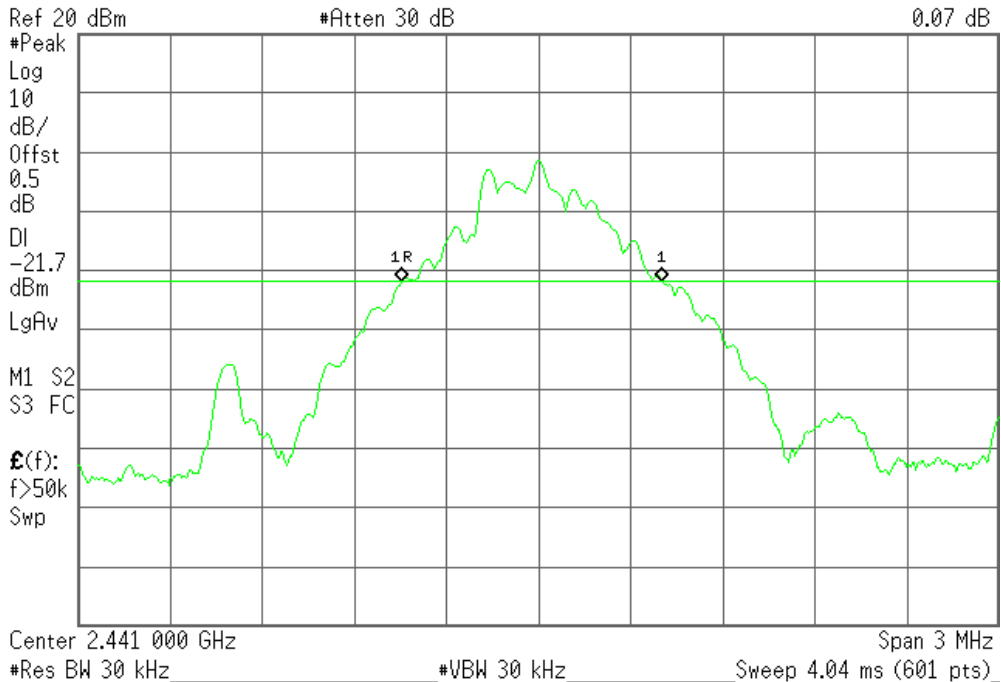


**20 dB bandwidth(CH Mid)**

Agilent 14:33:02 Nov 27, 2008

R T

Mkr1 845 kHz  
0.07 dB





### 8DPSK

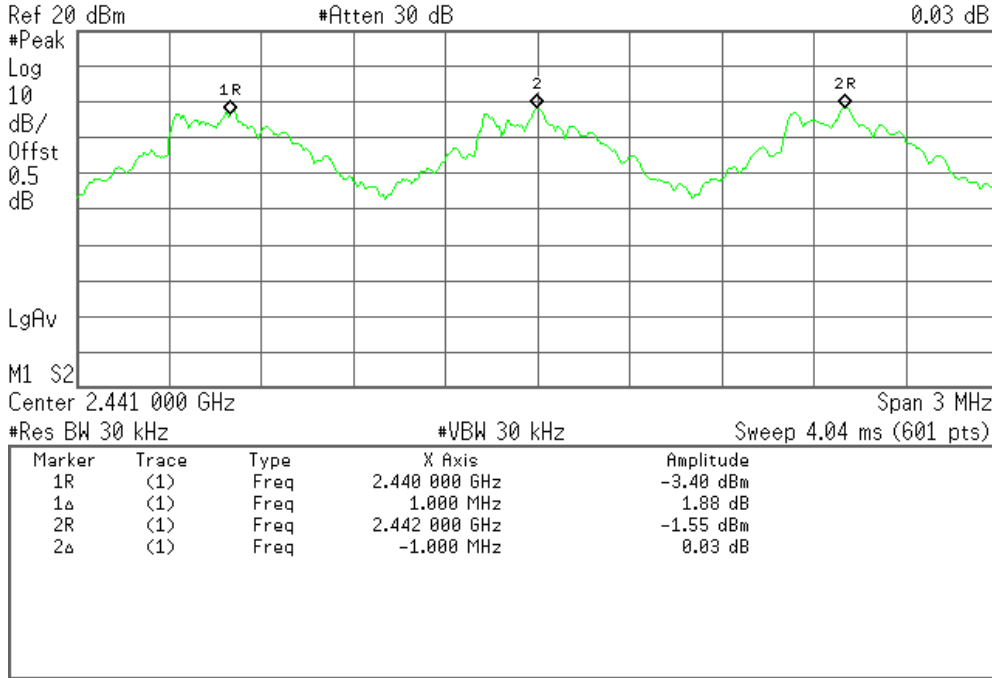
#### Test Plot

#### Measurement of Channel Separation

Agilent 14:41:50 Nov 27, 2008

R T

Mkr2 -1.000 MHz  
0.03 dB

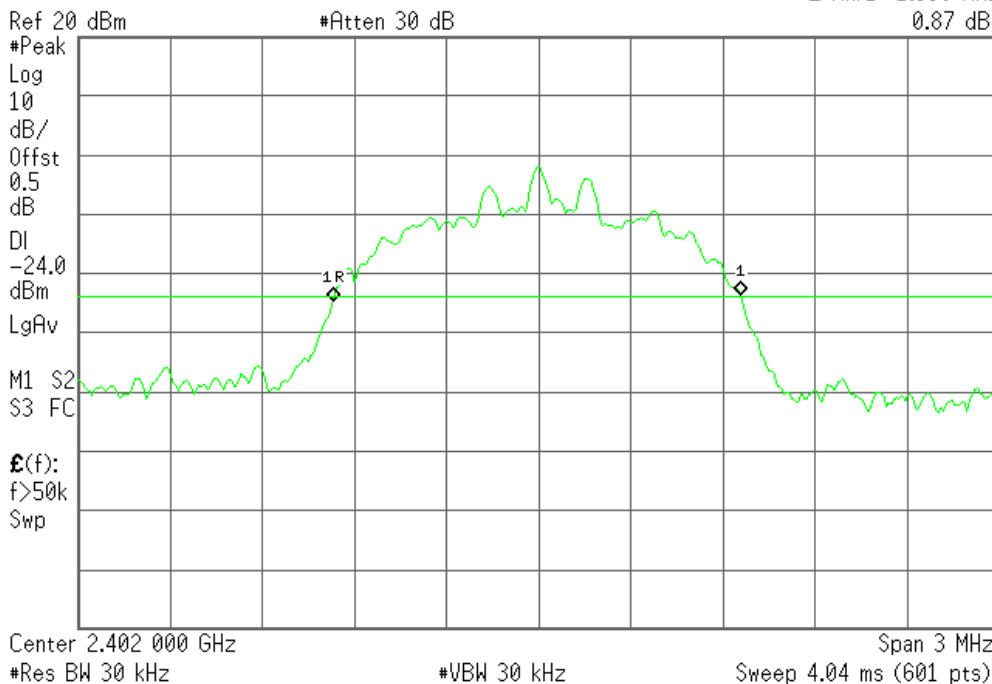


#### 20 dB bandwidth(CH Low)

Agilent 14:28:51 Nov 27, 2008

R T

Mkr1 1.330 MHz  
0.87 dB



## 7.6 NUMBER OF HOPPING FREQUENCY

### LIMIT

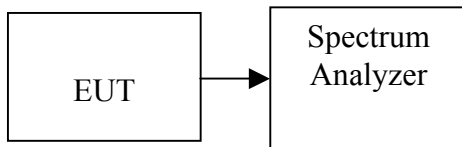
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = 1ms and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = 1ms.
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

#### GFSK / 8DPSK

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



**Test Plot**

**Channel Number**

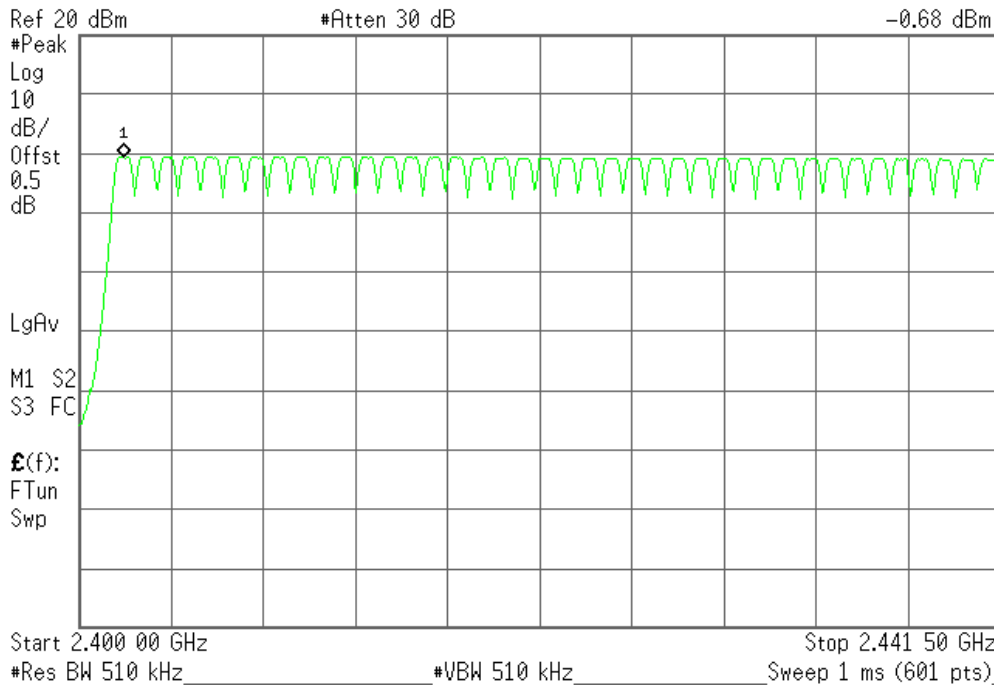
**GFSK**

**2.4 GHz – 2.441 GHz**

Agilent 14:49:57 Nov 27, 2008

R T

Mkr1 2.402 00 GHz  
-0.68 dBm

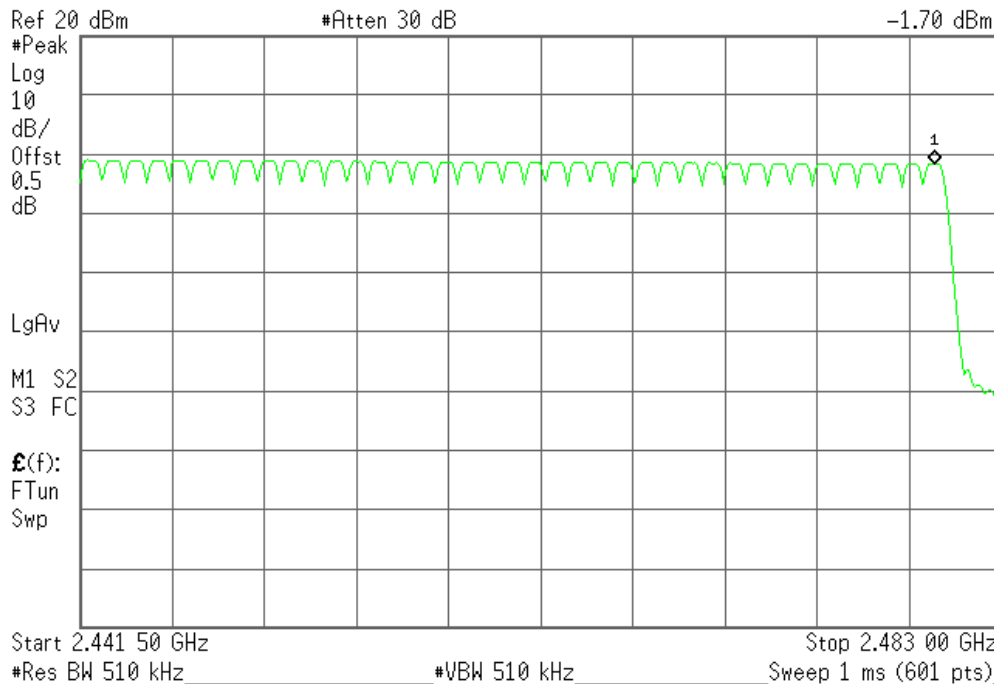


**2.441 GHz – 2.4835 GHz**

Agilent 15:11:58 Nov 27, 2008

R T

Mkr1 2.480 00 GHz  
-1.70 dBm





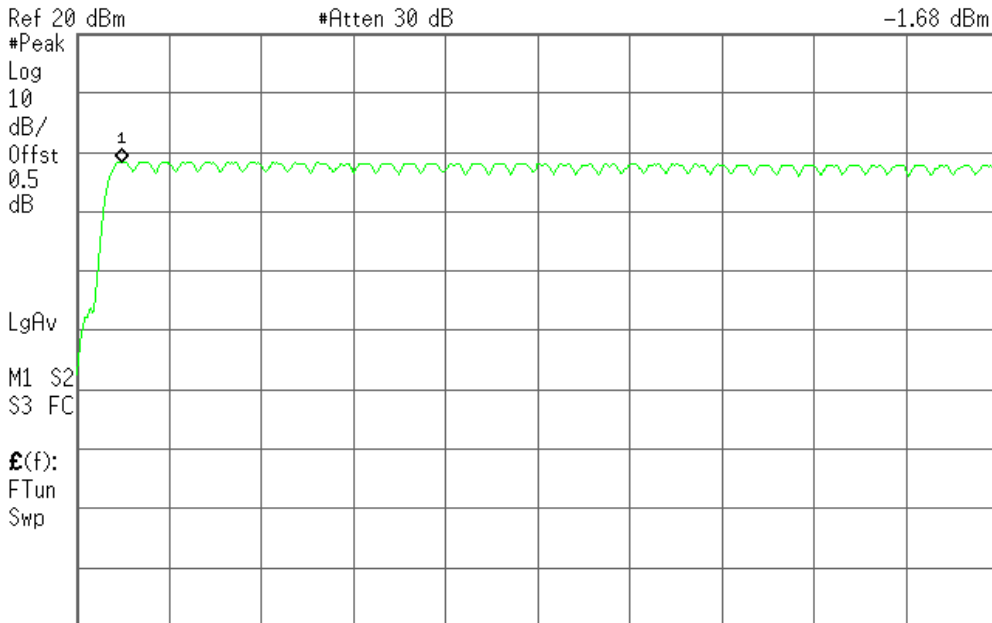
### 8DPSK

#### 2.4 GHz – 2.441 GHz

Agilent 15:16:44 Nov 27, 2008

R L

Mkr1 2.402 00 GHz  
-1.68 dBm



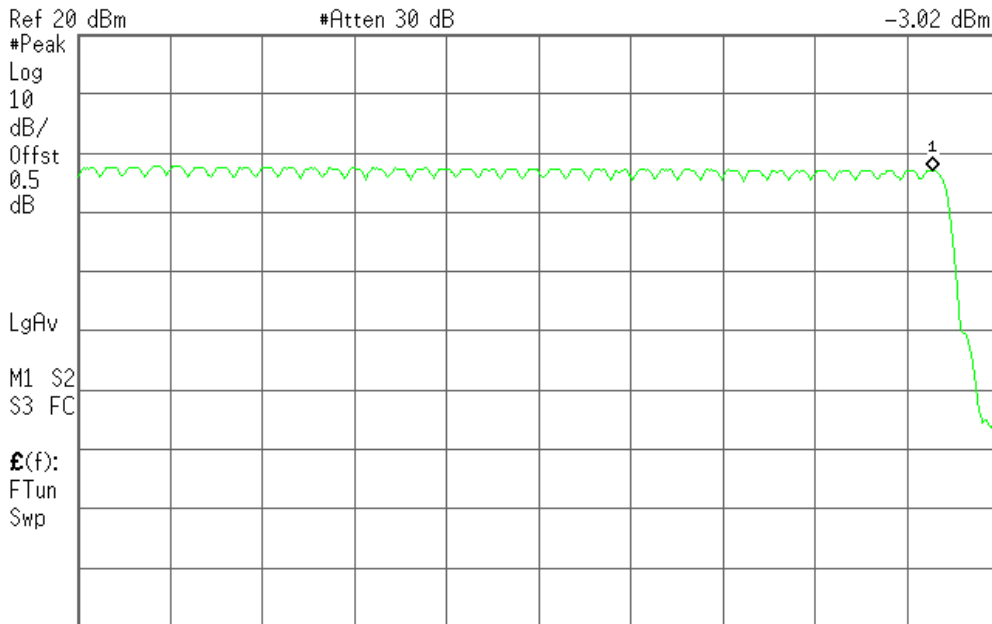
Start 2.400 00 GHz Stop 2.441 50 GHz  
#Res BW 510 kHz #VBW 510 kHz Sweep 1 ms (601 pts)

#### 2.441 GHz – 2.4835 GHz

Agilent 15:03:51 Nov 27, 2008

R T

Mkr1 2.480 00 GHz  
-3.02 dBm



Start 2.441 50 GHz Stop 2.483 00 GHz  
#Res BW 510 kHz #VBW 510 kHz Sweep 1 ms (601 pts)



## 7.7 TIME OF OCCUPANCY (DWELL TIME)

### LIMIT

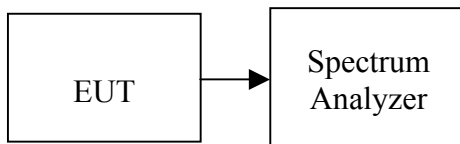
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.



**TEST RESULTS**

*No non-compliance noted*

**Test Data**

**GFSK**

**DH 1**

CH Low:  $0.40 * (1600/2)/79 * 31.6 = 128.0(\text{ms})$

CH Mid:  $0.40 * (1600/2)/79 * 31.6 = 128.0(\text{ms})$

CH High:  $0.39 * (1600/2)/79 * 31.6 = 124.8(\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.40	128.0	31.60	400.00	PASS
Mid	0.40	128.0	31.60		PASS
High	0.39	124.8	31.60		PASS

**DH 3**

CH Low:  $1.63 * (1600/4)/79 * 31.6 = 260.8 (\text{ms})$

CH Mid:  $1.66 * (1600/4)/79 * 31.6 = 265.6(\text{ms})$

CH High:  $1.64 * (1600/4)/79 * 31.6 = 262.4 (\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.63	260.8	31.60	400.00	PASS
Mid	1.66	265.6	31.60		PASS
High	1.64	262.4	31.60		PASS

**DH 5**

CH Low:  $2.90 * (1600/6)/79 * 31.6 = 309.3 (\text{ms})$

CH Mid:  $2.90 * (1600/6)/79 * 31.6 = 309.3 (\text{ms})$

CH High:  $2.90 * (1600/6)/79 * 31.6 = 309.3(\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.90	309.3	31.60	400.00	PASS
Mid	2.90	309.3	31.60		PASS
High	2.90	309.3	31.60		PASS



**8DPSK**

**DH 1**

CH Low:  $0.40 * (1600/2)/79 * 31.6 = 128.0(\text{ms})$

CH Mid:  $0.40 * (1600/2)/79 * 31.6 = 128.0(\text{ms})$

CH High:  $0.40 * (1600/2)/79 * 31.6 = 128.0(\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.40	128.0	31.60	400.00	PASS
Mid	0.40	128.0	31.60		PASS
High	0.40	128.0	31.60		PASS

**DH 3**

CH Low:  $1.66 * (1600/4)/79 * 31.6 = 265.6(\text{ms})$

CH Mid:  $1.66 * (1600/4)/79 * 31.6 = 265.6(\text{ms})$

CH High:  $1.66 * (1600/4)/79 * 31.6 = 265.6(\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.66	264.0	31.60	400.00	PASS
Mid	1.66	264.0	31.60		PASS
High	1.66	264.0	31.60		PASS

**DH 5**

CH Low:  $2.89 * (1600/6)/79 * 31.6 = 309.3 (\text{ms})$

CH Mid:  $2.89 * (1600/6)/79 * 31.6 = 309.3 (\text{ms})$

CH High:  $2.91 * (1600/6)/79 * 31.6 = 310.4 (\text{ms})$

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.90	309.3	31.60	400.00	PASS
Mid	2.90	309.3	31.60		PASS
High	2.91	310.4	31.60		PASS



**Test Plot**

**GFSK**

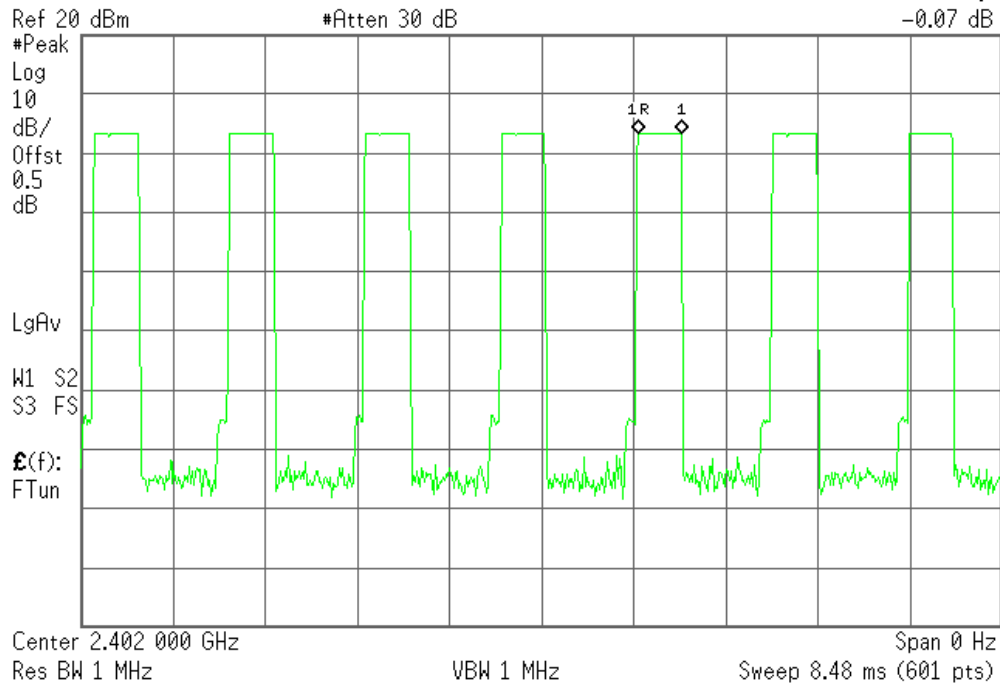
**DH 1**

**(CH Low)**

Agilent 16:58:22 Dec 3, 2008

R T

Mkr1 395.7  $\mu$ s  
-0.07 dB

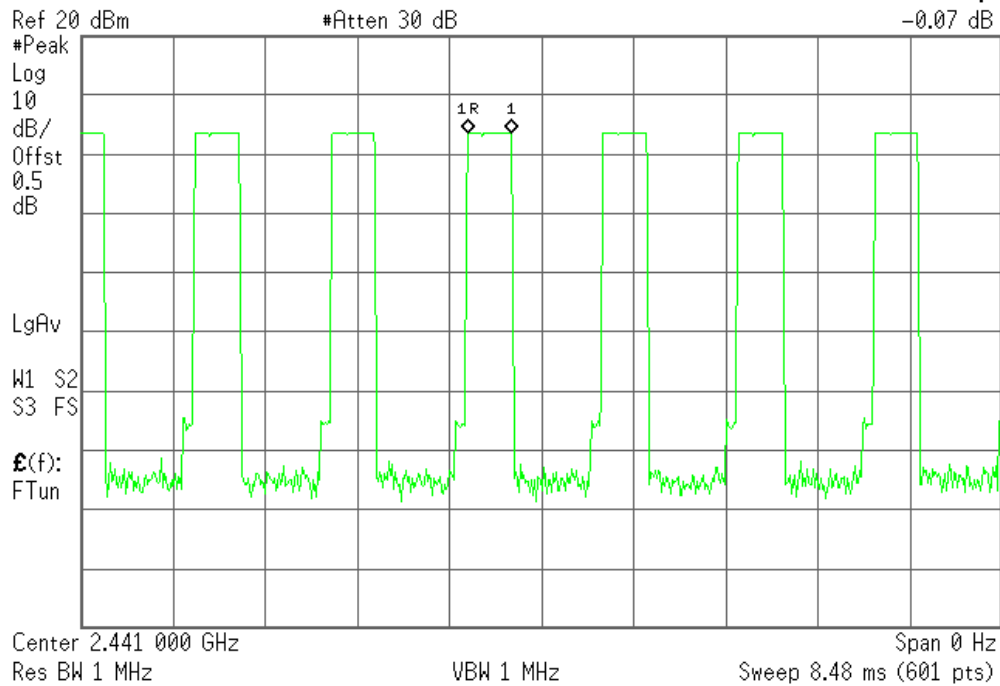


**(CH Mid)**

Agilent 16:57:21 Dec 3, 2008

R T

Mkr1 395.7  $\mu$ s  
-0.07 dB



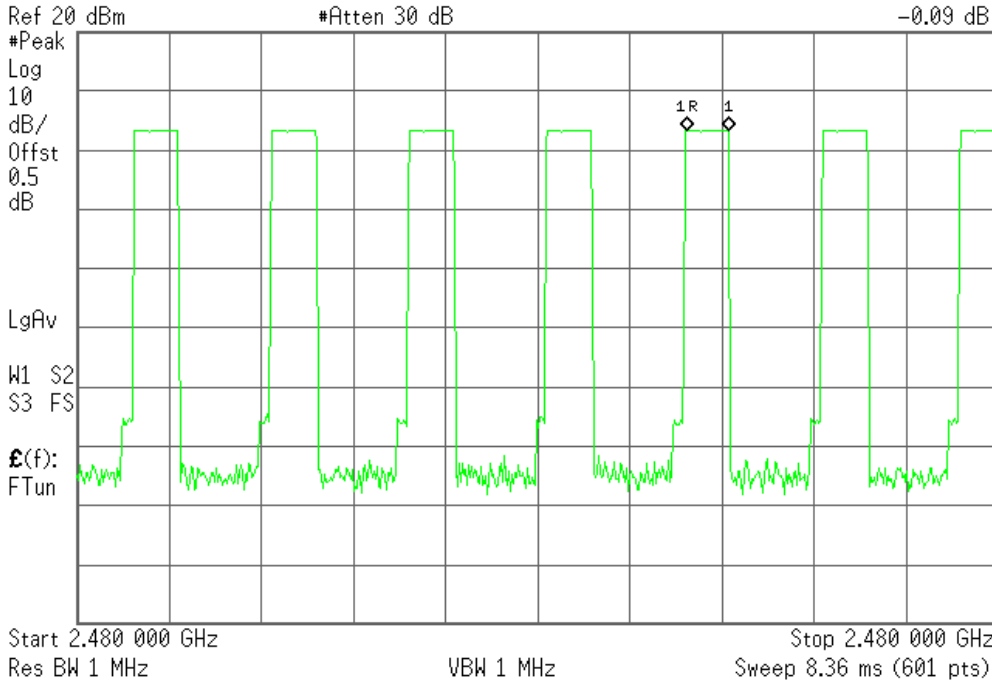


**(CH High)**

Agilent 16:54:08 Dec 3, 2008

R L

Mkr1 390.1  $\mu$ s  
-0.09 dB



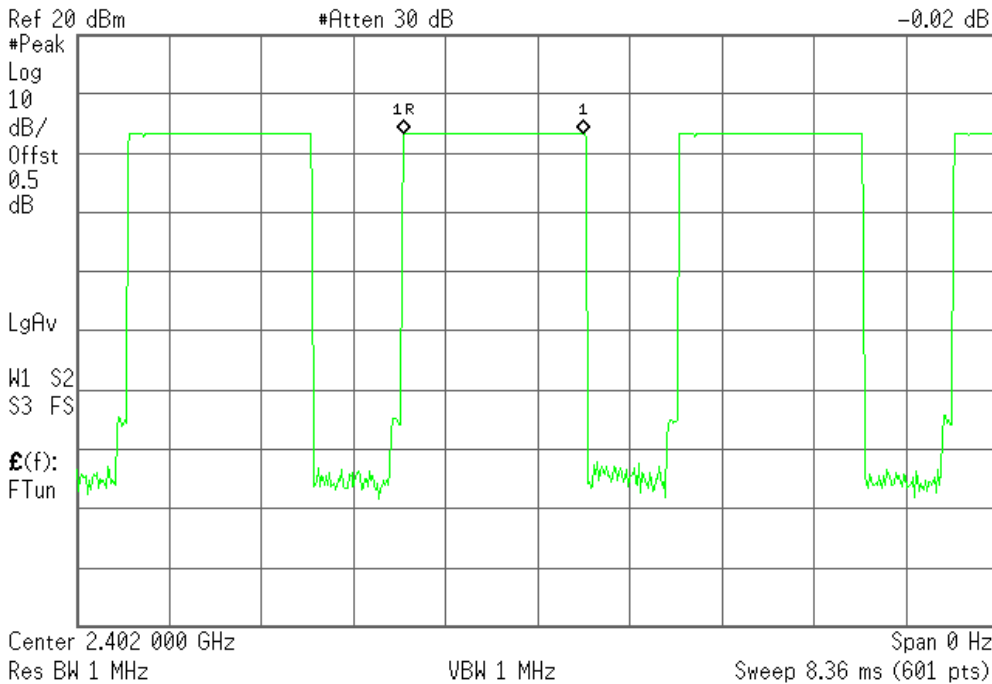
**DH 3**

**(CH Low)**

Agilent 16:51:12 Dec 3, 2008

R T

Mkr1 1.63 ms  
-0.02 dB



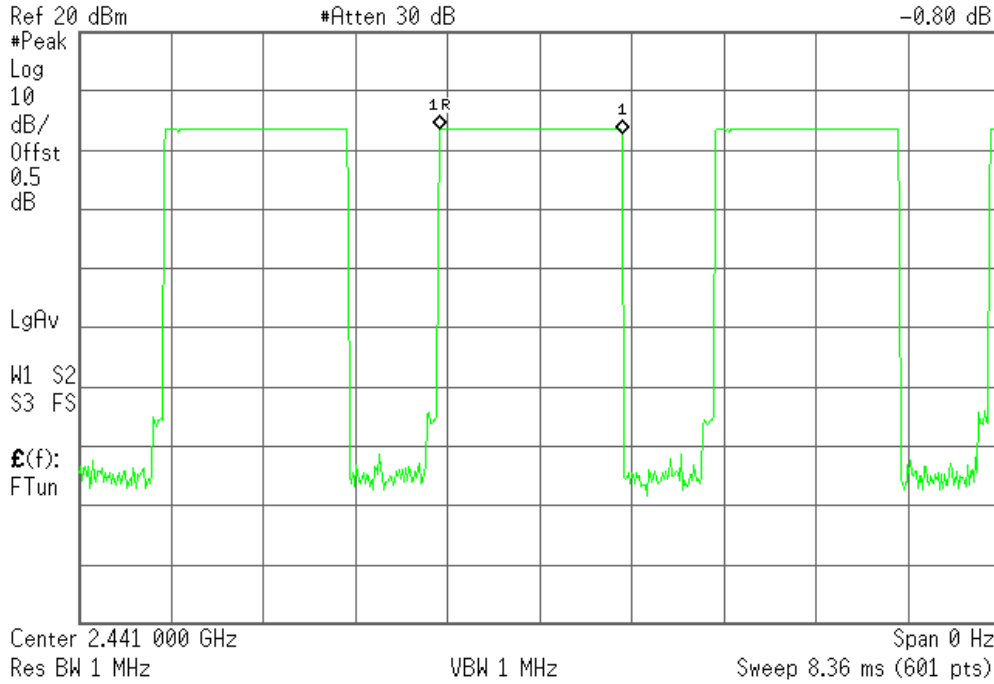


**(CH Mid)**

Agilent 16:52:04 Dec 3, 2008

R T

Δ Mkr1 1.658 ms  
-0.80 dB

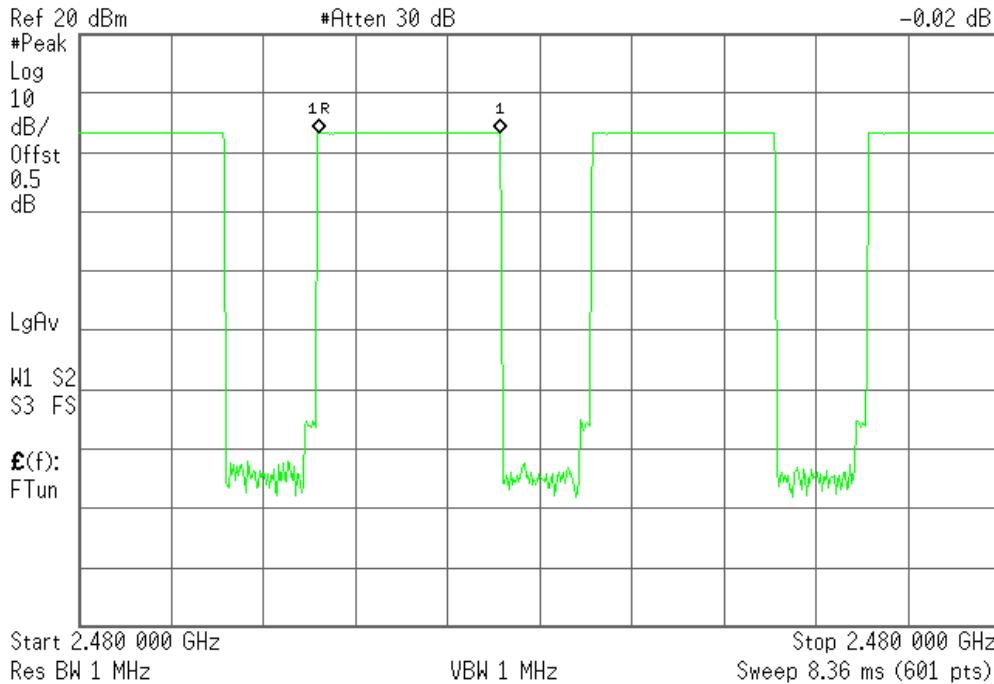


**(CH High)**

Agilent 16:53:00 Dec 3, 2008

R T

Δ Mkr1 1.644 ms  
-0.02 dB





**DH5**

**(CH Low)**

Agilent 16:49:58 Dec 3, 2008

R T

Mkr1 2.898 ms  
-0.03 dB

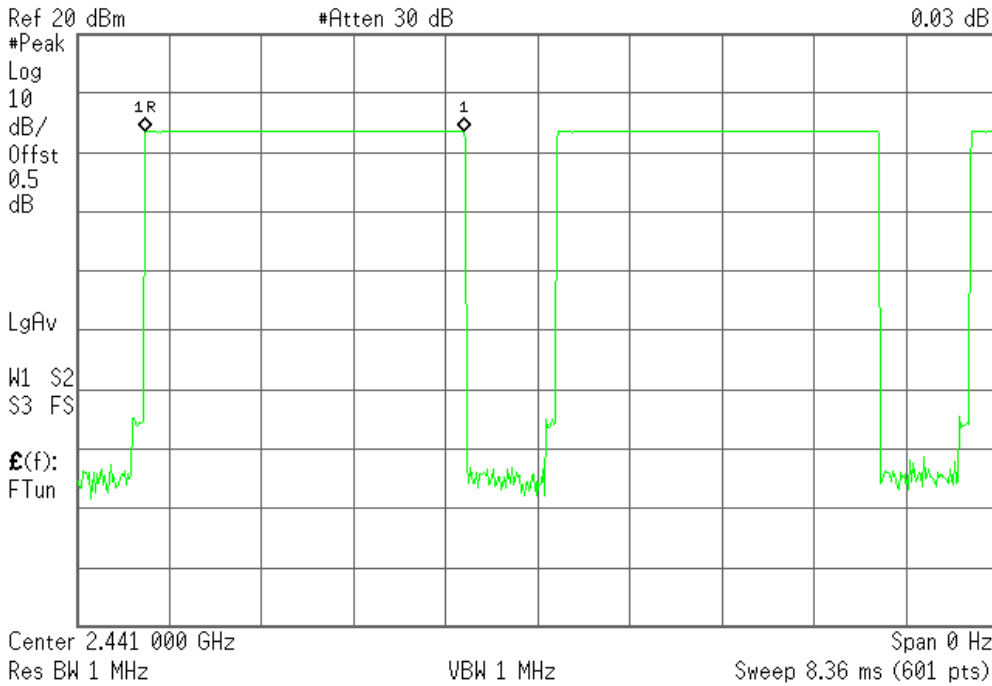


**(CH Mid)**

Agilent 16:48:43 Dec 3, 2008

R T

Mkr1 2.898 ms  
0.03 dB



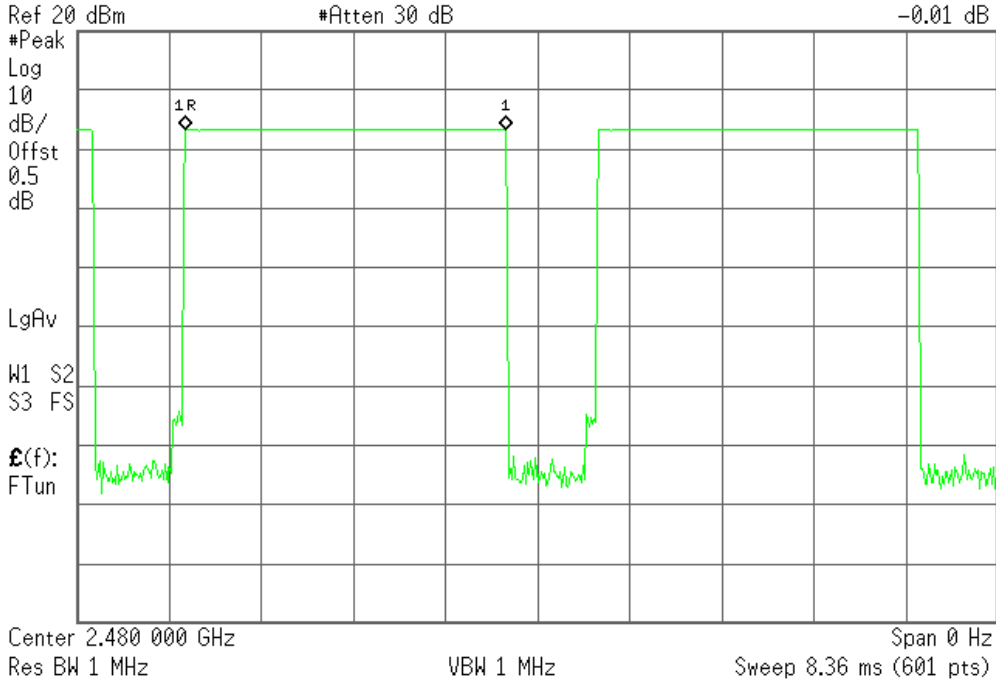


**(CH High)**

Agilent 16:47:33 Dec 3, 2008

R T

▲ Mkr1 2.898 ms  
-0.01 dB







### 8DPSK

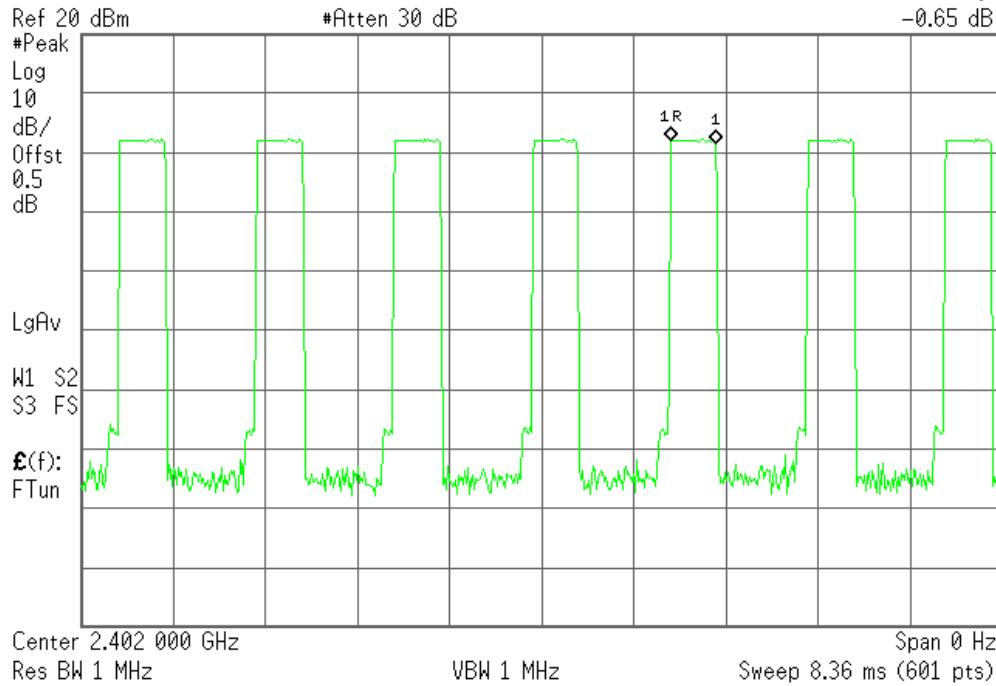
#### DH 1

##### (CH Low)

Agilent 16:43:17 Dec 3, 2008

R T

Mkr1 404.1  $\mu$ s  
-0.65 dB

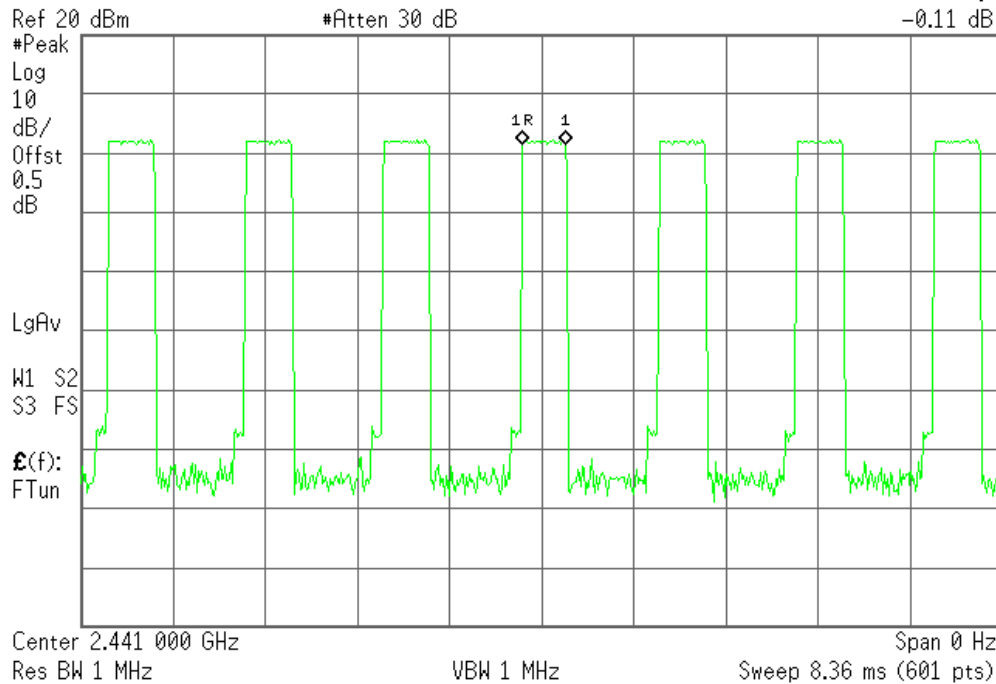


##### (CH Mid)

Agilent 16:44:35 Dec 3, 2008

R T

Mkr1 404.1  $\mu$ s  
-0.11 dB



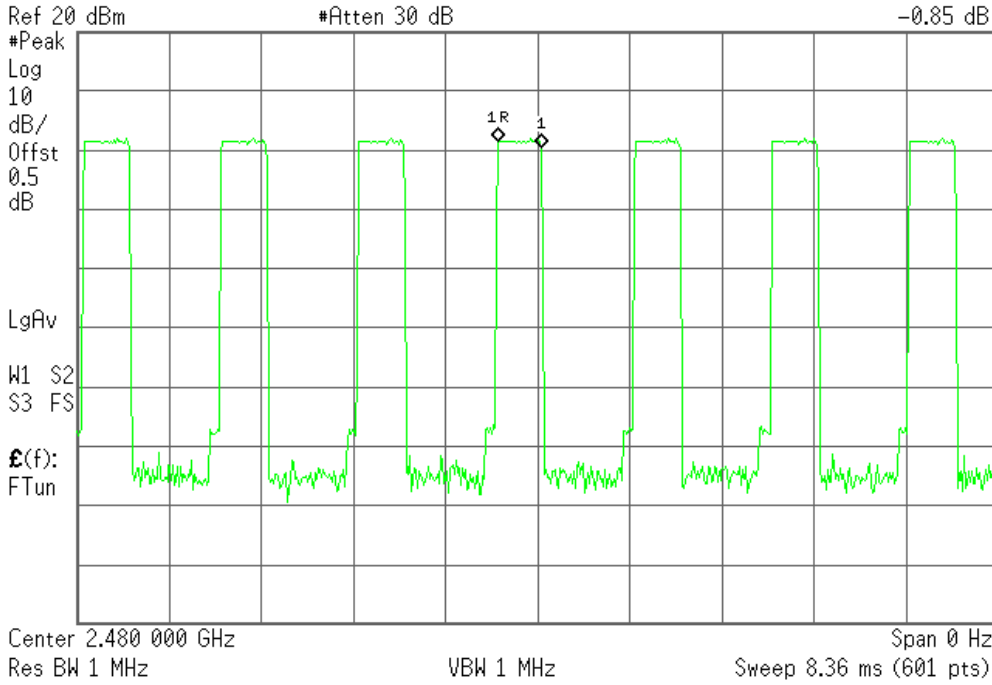


**(CH High)**

Agilent 16:45:44 Dec 3, 2008

R L

Mkr1 404.1  $\mu$ s  
-0.85 dB



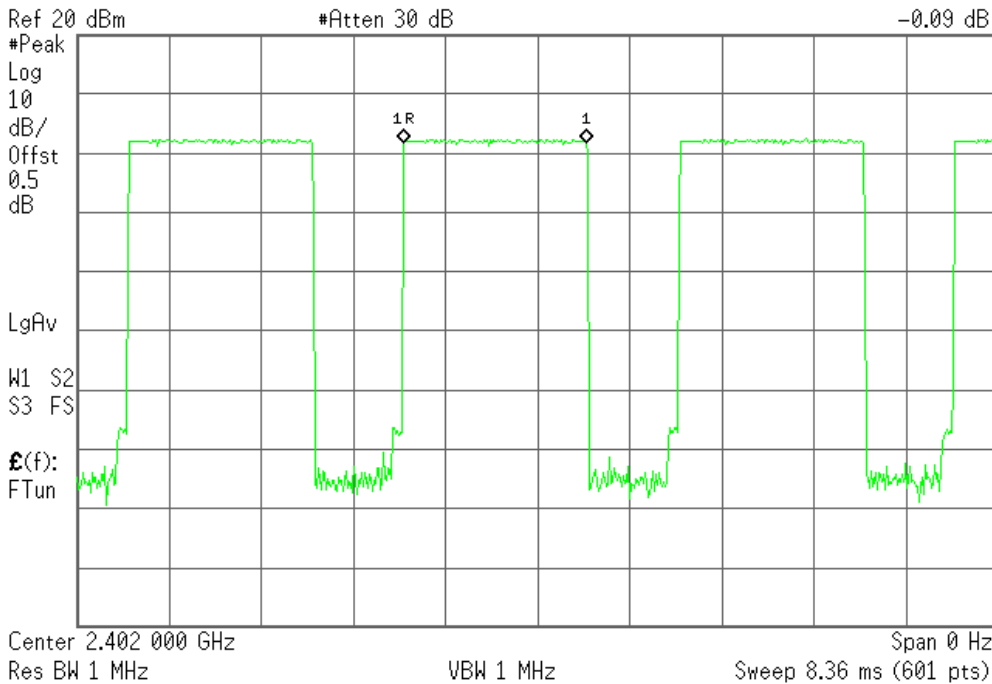
**DH 3**

**(CH Low)**

Agilent 16:42:10 Dec 3, 2008

R T

Mkr1 1.658 ms  
-0.09 dB



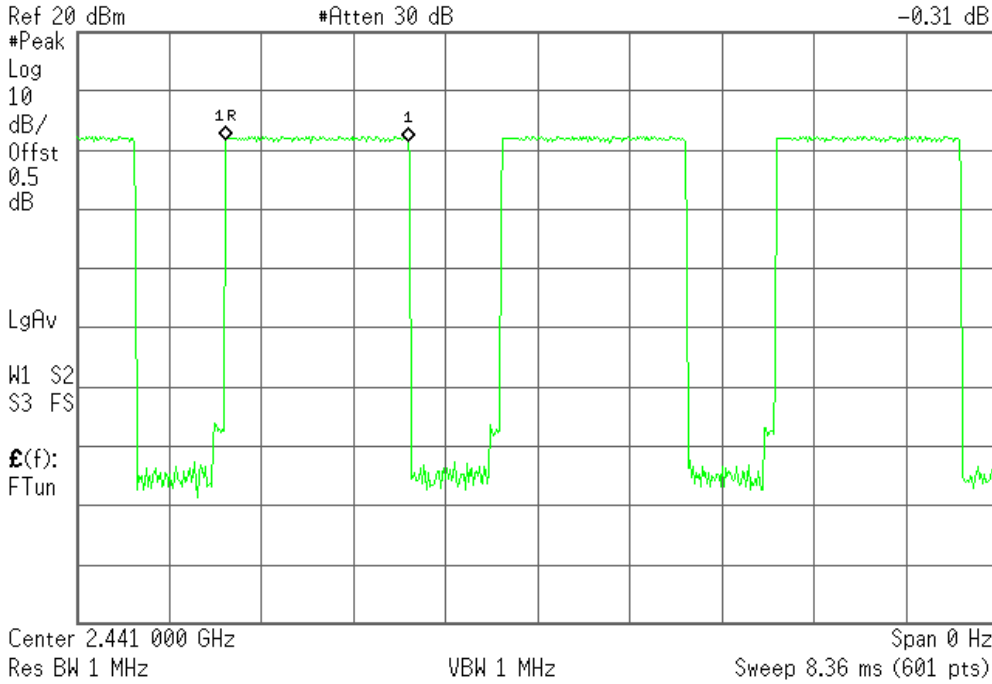


**(CH Mid)**

Agilent 16:39:20 Dec 3, 2008

R T

Δ Mkr1 1.658 ms  
-0.31 dB

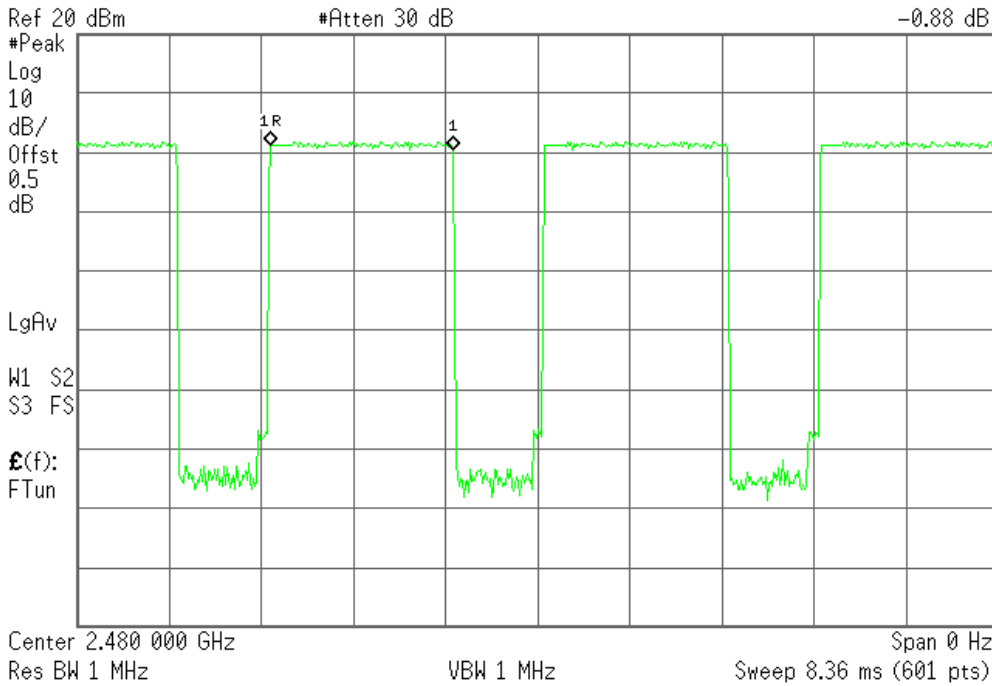


**(CH High)**

Agilent 16:37:42 Dec 3, 2008

R T

Δ Mkr1 1.658 ms  
-0.88 dB





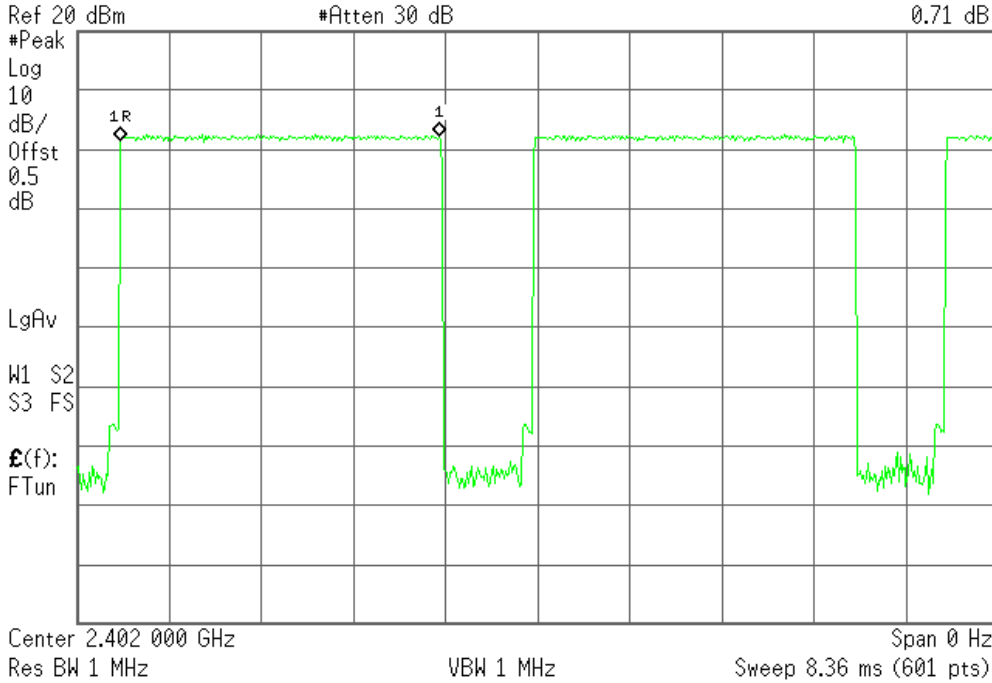
**DH5**

**(CH Low)**

Agilent 16:29:29 Dec 3, 2008

R T

Mkr1 2.898 ms  
0.71 dB

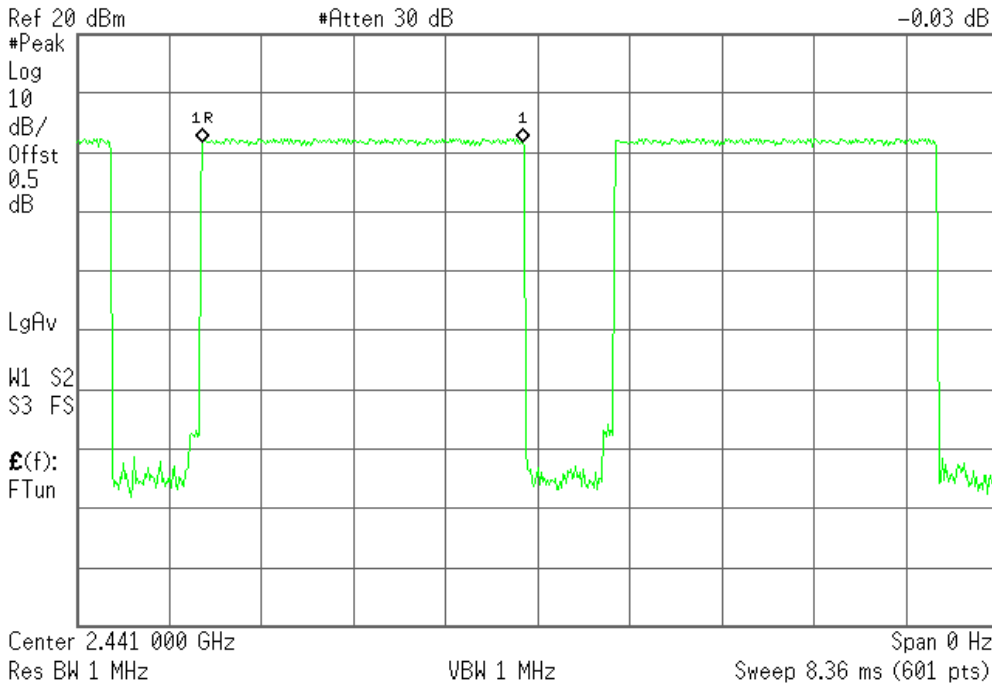


**(CH Mid)**

Agilent 16:31:08 Dec 3, 2008

R T

Mkr1 2.898 ms  
-0.03 dB



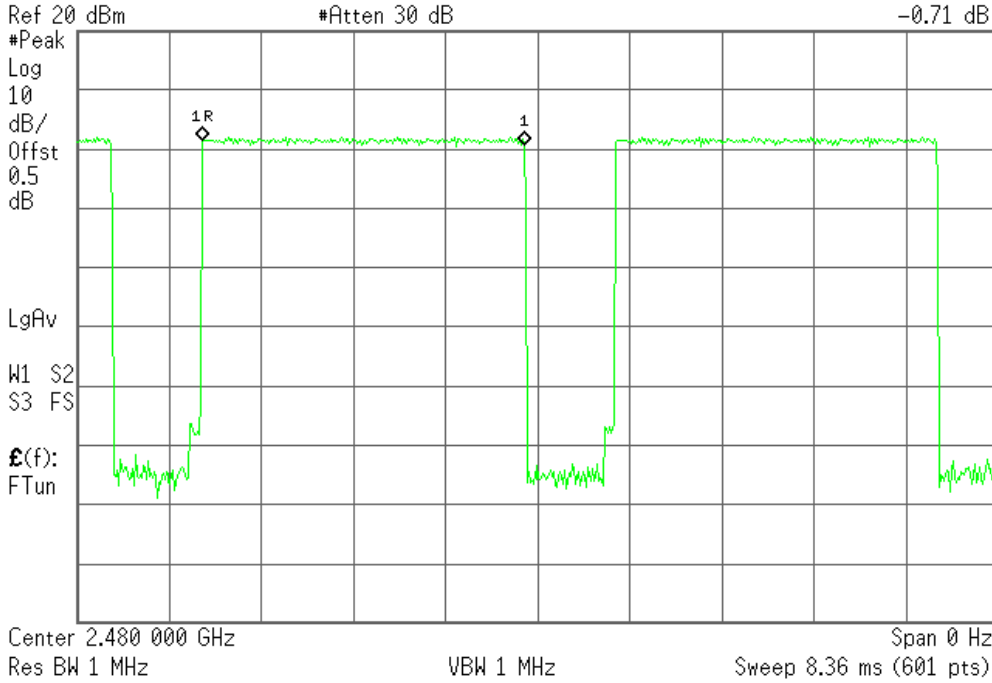


**(CH High)**

Agilent 16:32:46 Dec 3, 2008

R T

▲ Mkr1 2.912 ms  
-0.71 dB





## 7.8 SPURIOUS EMISSIONS

### 7.8.1 Conducted Measurement

#### LIMIT

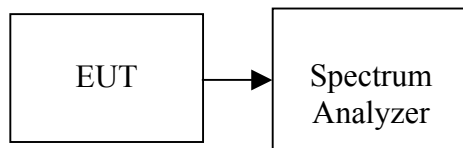
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009

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

#### Test Configuration



#### TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

#### TEST RESULTS

*No non-compliance noted*



**Test Plot**

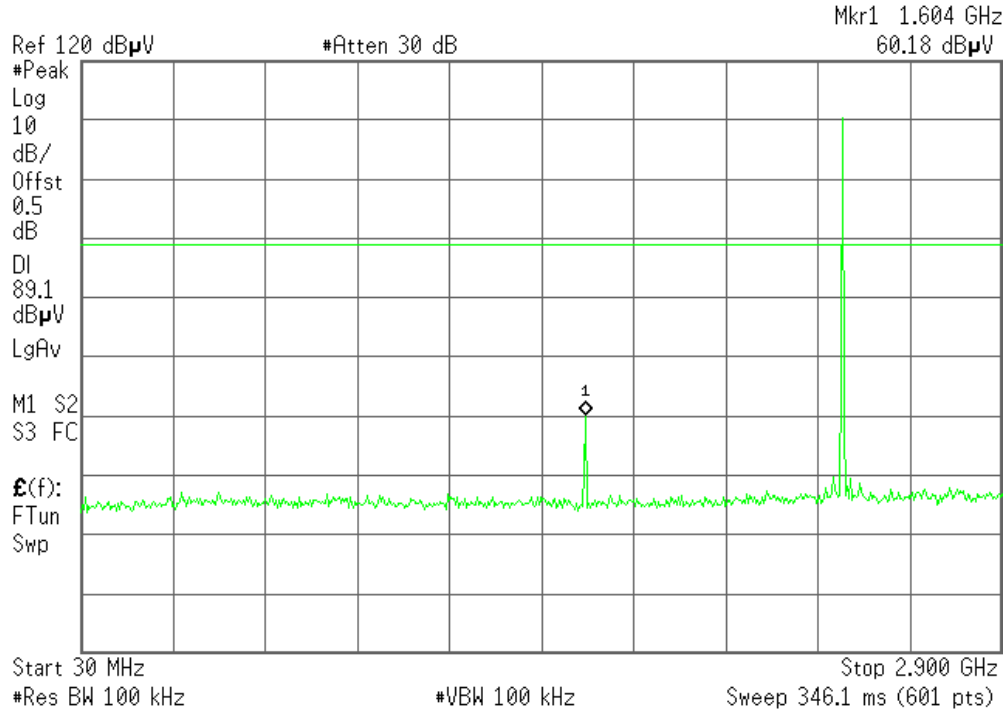
**GFSK**

**CH Low**

**30MHz – 2.9GHz**

Agilent 16:19:23 Dec 3, 2008

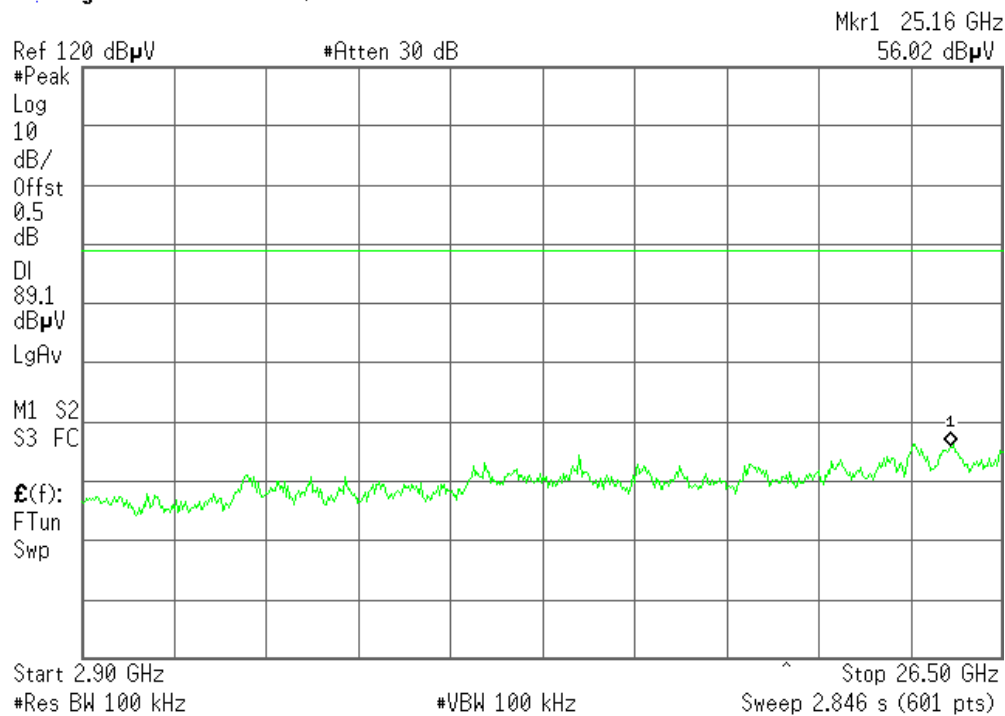
R T



**2.9GHz – 26.5GHz**

Agilent 16:19:55 Dec 3, 2008

R T



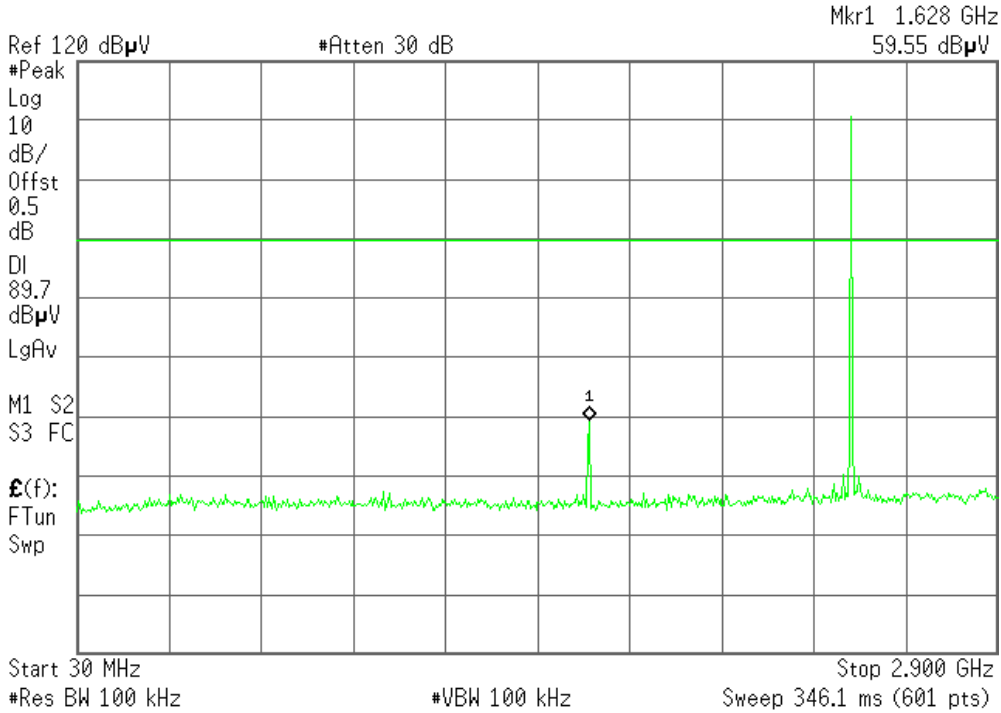


### CH Mid

#### 30MHz – 2.9GHz

Agilent 16:21:08 Dec 3, 2008

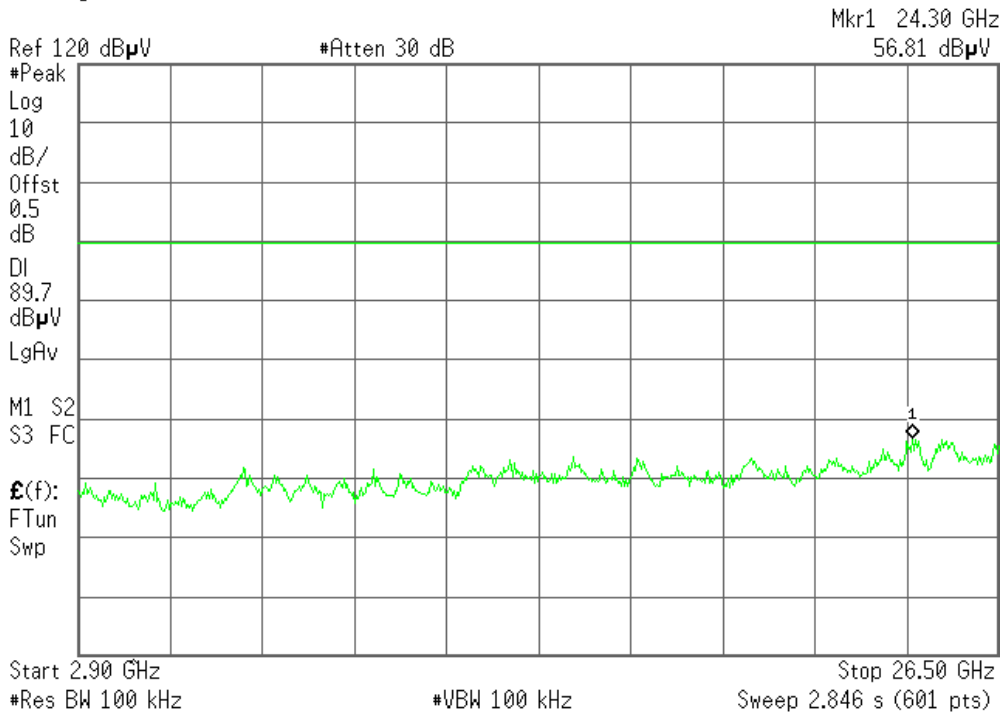
R T



#### 2.9GHz – 26.5GHz

Agilent 16:21:38 Dec 3, 2008

R T





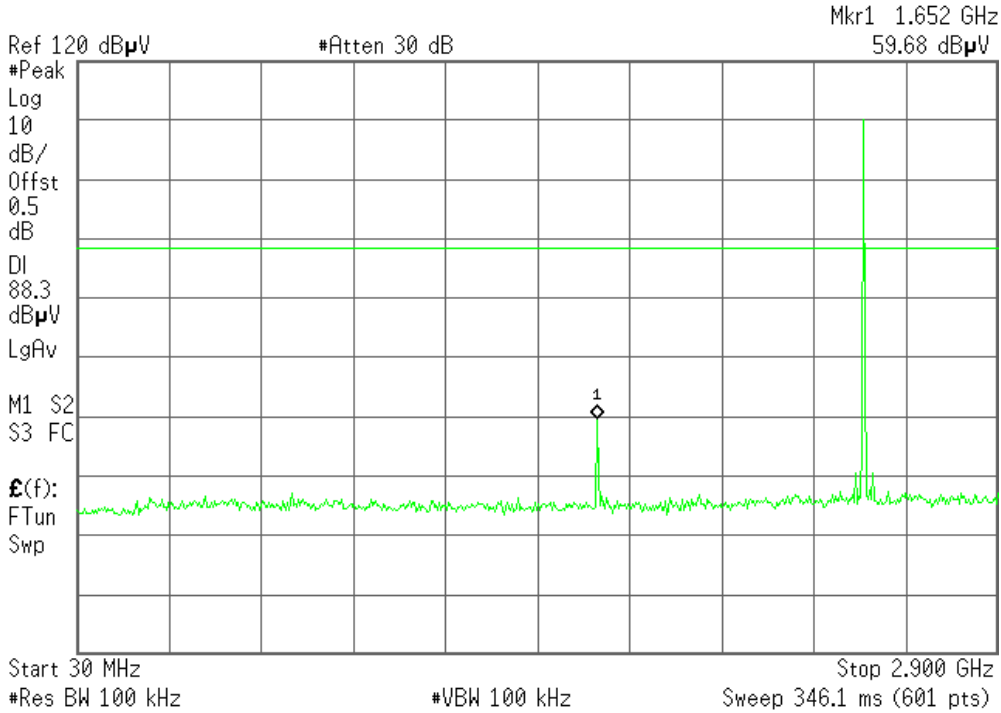


### CH High

#### 30MHz – 2.9GHz

Agilent 16:22:22 Dec 3, 2008

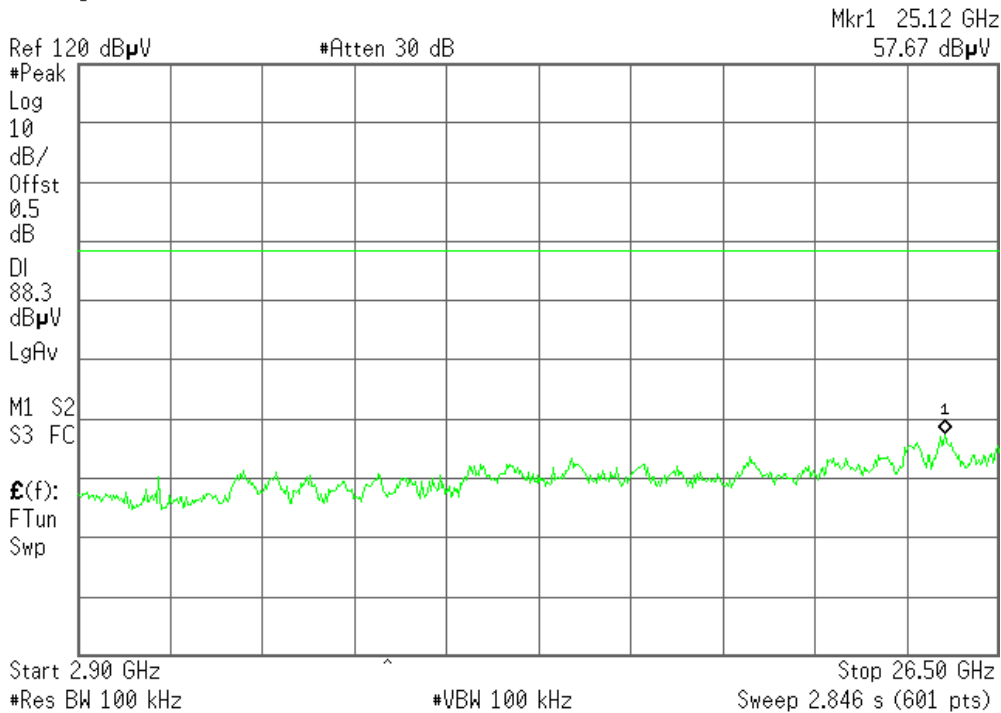
R T



#### 2.9GHz – 26.5GHz

Agilent 16:22:53 Dec 3, 2008

R L





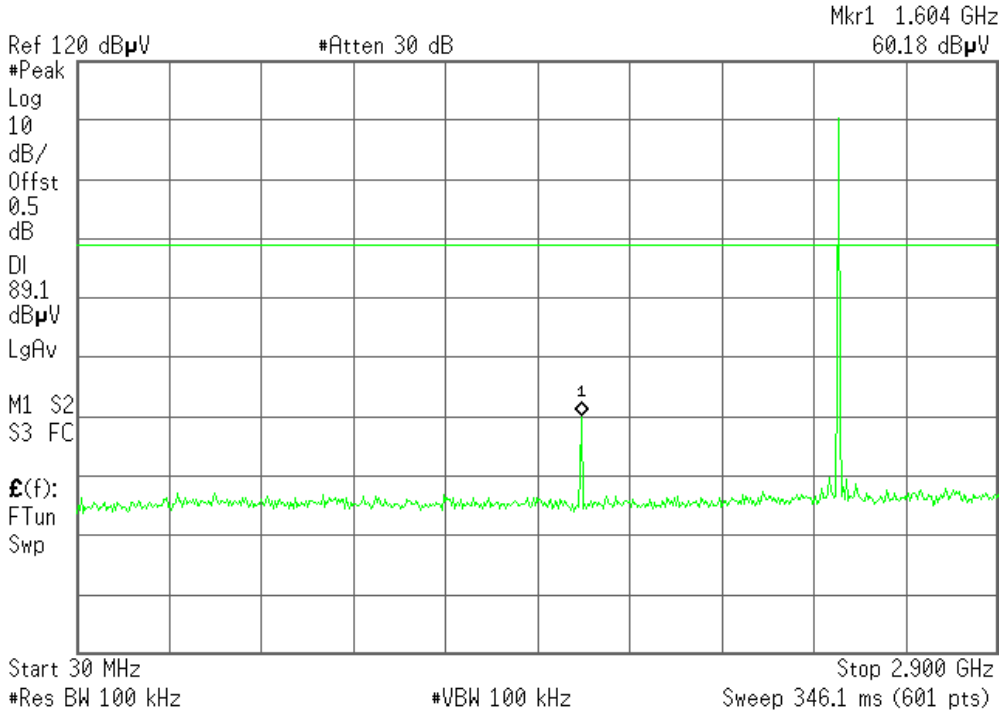
**8DPSK**

**CH Low**

**30MHz – 2.9GHz**

Agilent 16:19:23 Dec 3, 2008

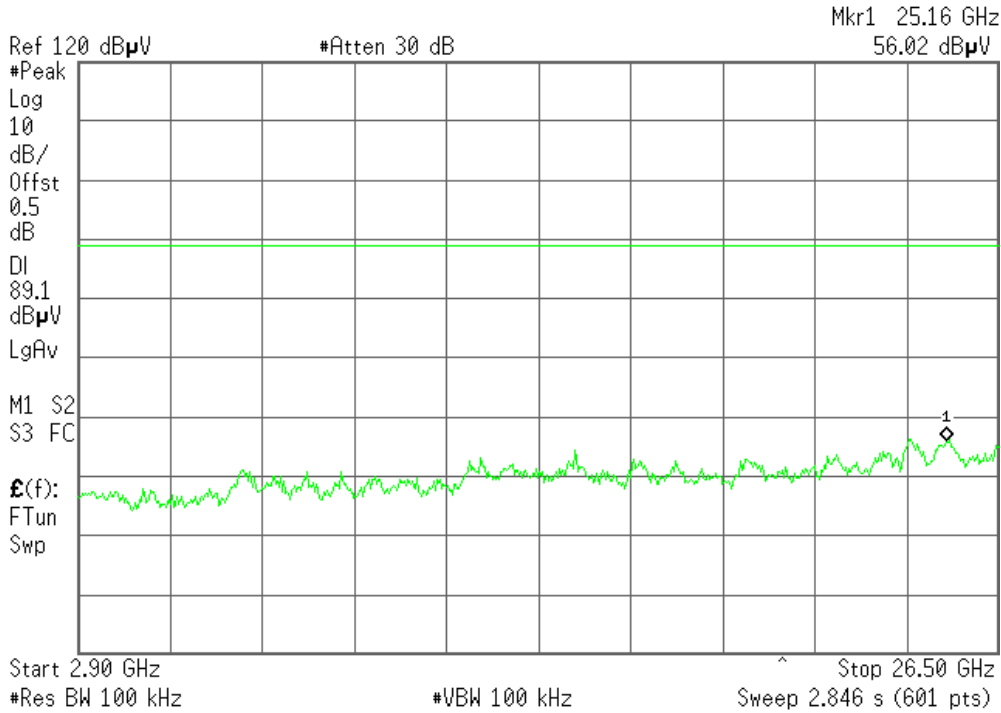
R T



**2.9GHz – 26.5GHz**

Agilent 16:19:55 Dec 3, 2008

R T



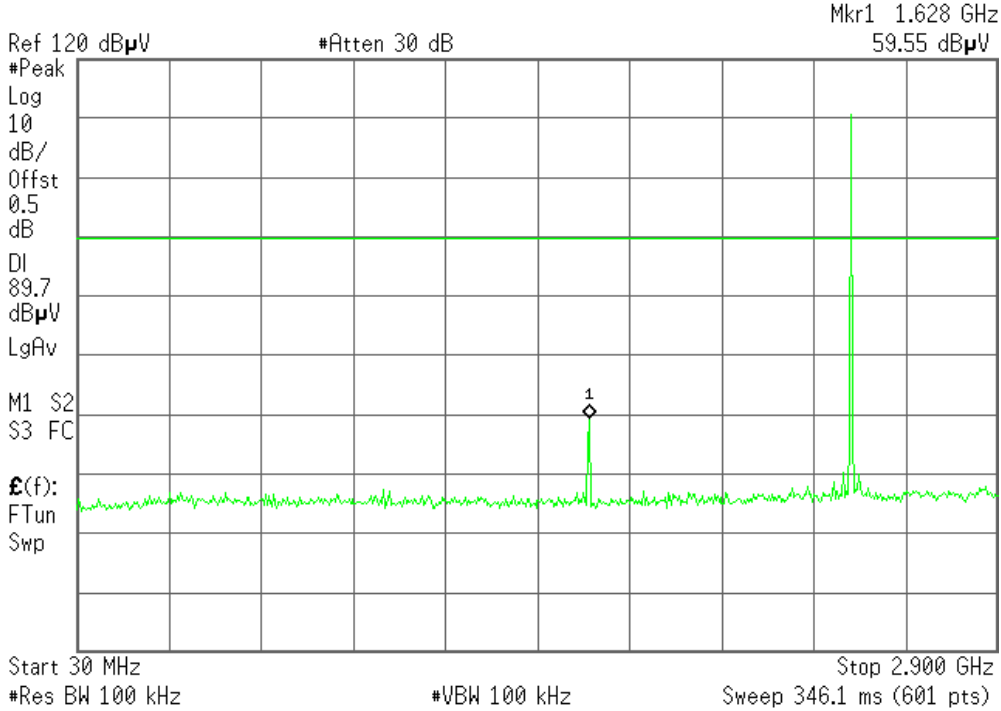


### CH Mid

### 30MHz – 2.9GHz

Agilent 16:21:08 Dec 3, 2008

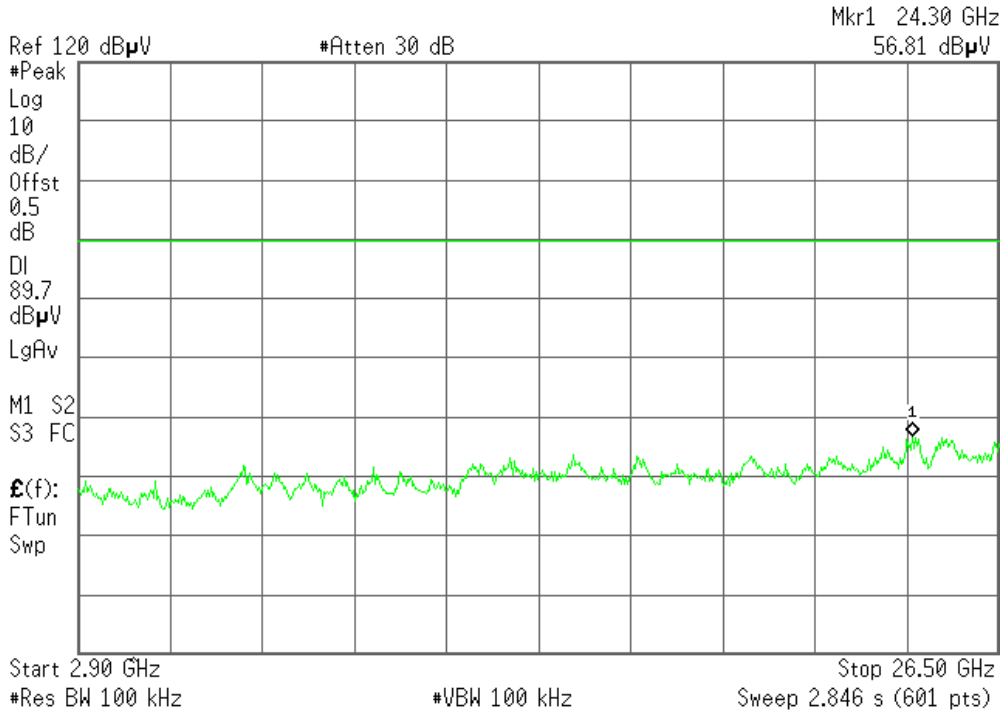
R T



### 2.9GHz – 26.5GHz

Agilent 16:21:38 Dec 3, 2008

R T



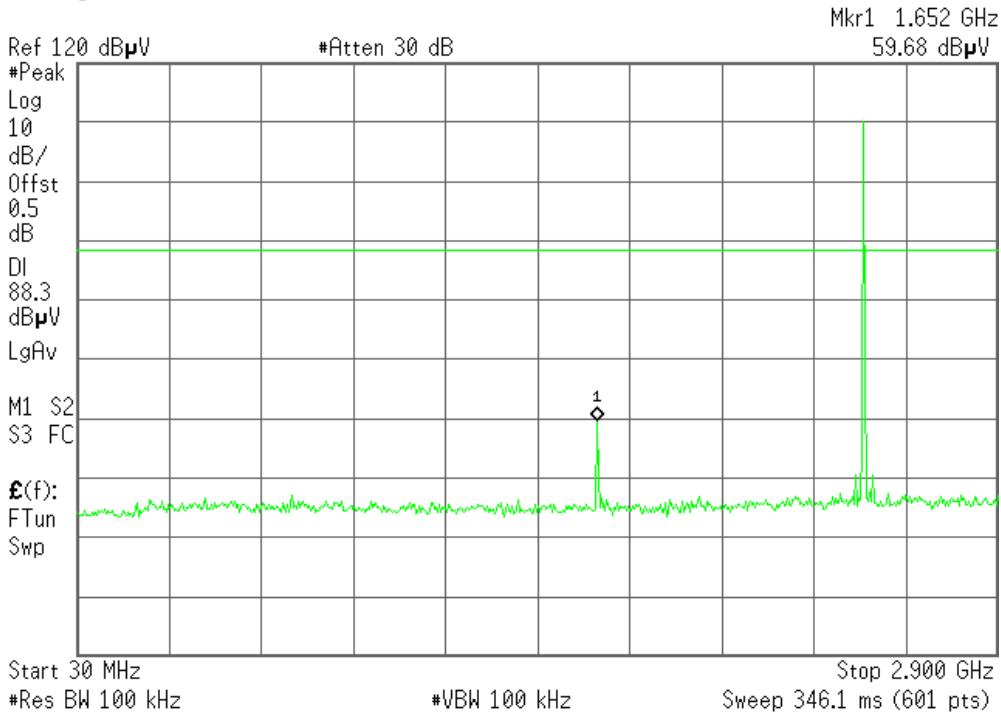


### CH High

#### 30MHz – 2.9GHz

Agilent 16:22:22 Dec 3, 2008

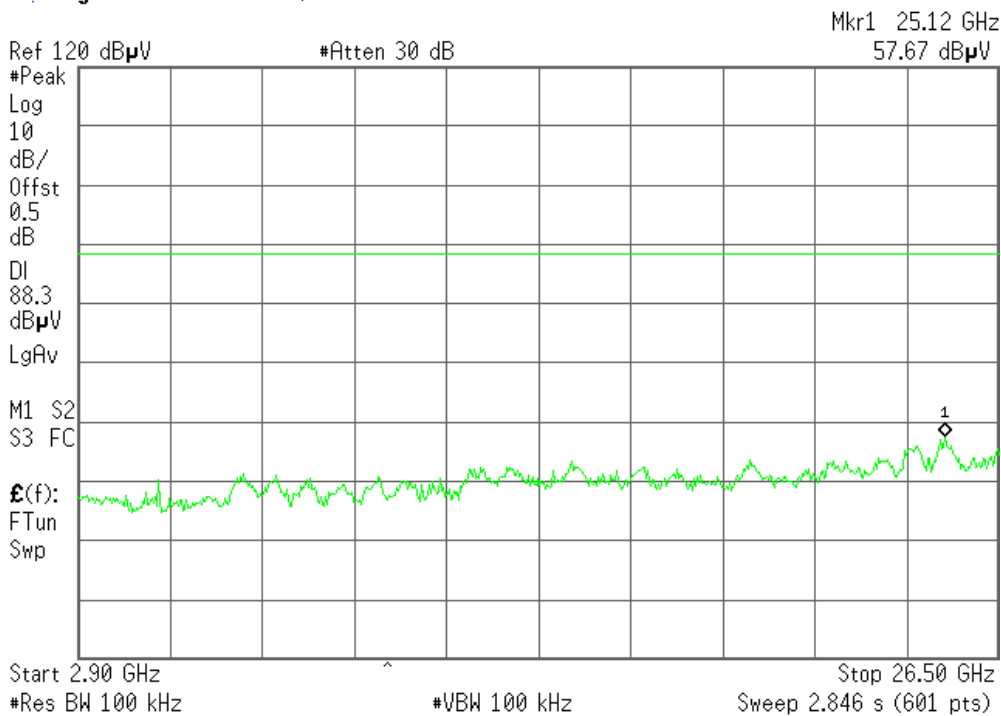
R T



#### 2.9GHz – 26.5GHz

Agilent 16:22:53 Dec 3, 2008

R L





### 7.8.2 Radiated Emissions

#### LIMIT

1. 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 (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

*Note: 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 above emission table, the tighter limit applies at the band edges.

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

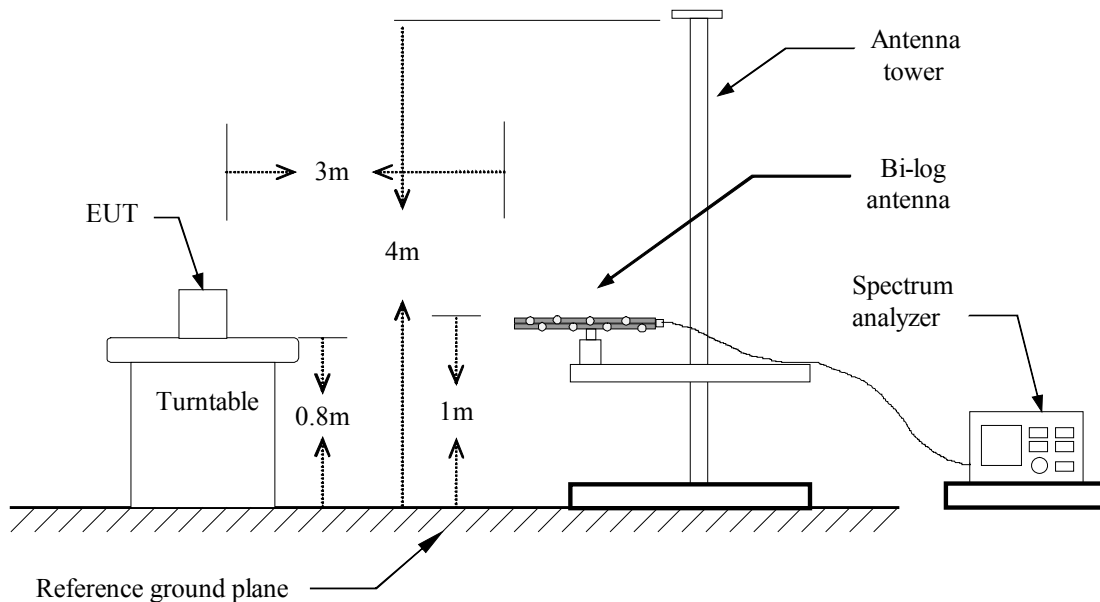
**MEASUREMENT EQUIPMENT USED**

966 RF CHAMBER 2				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009
EMI Test Receiver	R&S	ESCI	1166.5950 03	01/13/2009
Low Noise Amplifier	MITEQ	AM-1604-3000	1123808	02/14/2009
Bi-log Antenna	SCHWAZBECK	CBL6143	5082	06/09/2009
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CT	N/A	N/A	N.C.R
High Noise Amplifier	Agilent	89842	N/A	06/09/2009
Site NSA	C&C	N/A	N/A	06/09/2009
Horn Antenna	TRC	N/A	N/A	03/04/2009
Signal Generator	Anritsu	MG3694A	#050125	02/24/2009

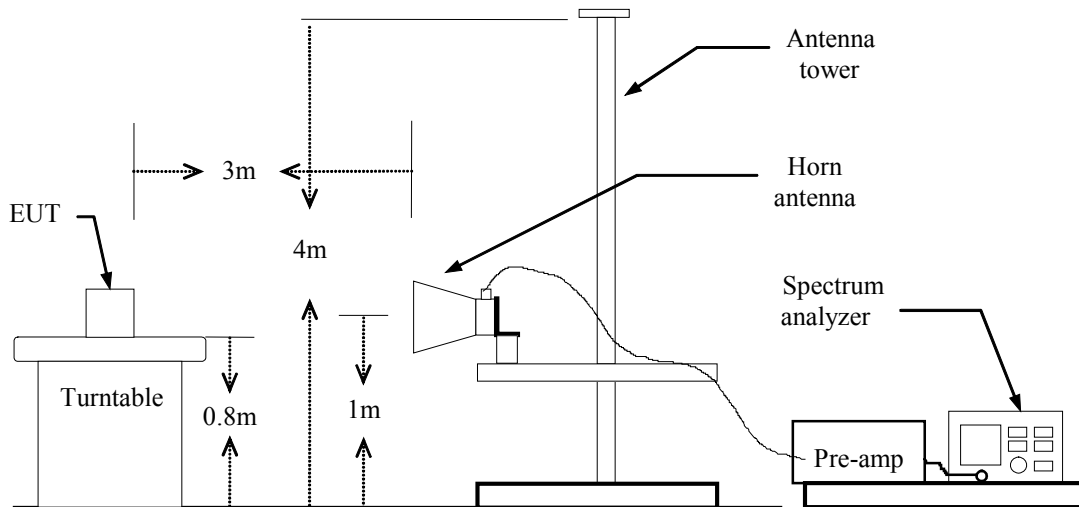
*Remark: Each piece of equipment is scheduled for calibration once a year.*

**Test Configuration**

**Below 1 GHz**



## Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.



**TEST RESULTS**

**Below 1 GHz**

**Operation Mode:** Normal

**Test Date:** : December 01,2008

**Temperature:** 27°C

**Tested by:** Simple Guan

**Humidity:** 56 % RH

**Polarity:** Ver. / Hor.

***GFSK***

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/Q.P)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Safe Margin (dBuV/m)
52.725	V	Peak	41.87	-19.39	22.48	40.00	-17.52
82.485	V	Peak	48.50	-19.98	28.52	40.00	-11.48
120.901	V	Peak	47.78	-19.56	28.22	43.50	-15.28
343.487	V	Peak	43.30	-13.46	29.84	46.00	-16.16
444.489	V	Peak	39.59	-10.37	29.22	46.00	-16.78
587.575	V	Peak	38.76	-6.59	32.17	46.00	-13.83
75.450	V	Peak	41.00	-20.16	20.84	40.00	-19.16
114.408	V	Peak	42.63	-19.79	22.84	43.50	-20.66
149.579	V	Peak	49.09	-19.14	29.95	43.50	-13.55
433.266	V	Peak	45.89	-10.67	35.22	46.00	-10.78
521.643	V	Peak	40.44	-8.97	31.47	46.00	-14.53
704.008	V	Peak	33.82	-4.88	28.94	46.00	-17.06





8DPSK

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/Q.P)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Safe Margin (dBuV/m)
53.266	V	Peak	41.89	-19.38	22.51	40.00	-17.49
85.190	V	Peak	43.96	-20.10	23.86	40.00	-16.14
162.565	V	Peak	43.88	-18.92	24.96	43.50	-18.54
360.320	V	Peak	36.92	-12.97	23.95	46.00	-22.05
502.004	V	Peak	41.15	-9.22	31.93	46.00	-14.07
704.008	V	Peak	38.38	-4.88	33.50	46.00	-12.50
40.280	H	Peak	29.56	-18.92	10.64	40.00	-29.36
68.957	H	Peak	36.29	-19.99	16.30	40.00	-23.70
96.012	H	Peak	34.01	-20.31	13.70	43.50	-29.80
558.116	H	Peak	33.25	-8.16	25.09	46.00	-20.91
597.394	H	Peak	30.48	-6.06	24.42	46.00	-21.58
628.256	H	Peak	30.34	-5.54	24.80	46.00	-21.20

**\*\*Remark:** No emission found between lowest internal used/generated frequency to 30 MHz.

**Notes:**

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 detector mode.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.



**Above 1 GHz**

**GFSK**

**Operation Mode:** TX(CH Low)

**Test Date:** December 01,2008

**Temperature:** 27°C

**Tested by:** Simple Guan

**Humidity:** 56 % RH

**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1333.330	V	56.28	---	-10.34	45.94	---	74.00	54.00	-8.06	Peak
1496.666	V	55.57	---	-9.44	46.13	---	74.00	54.00	-7.87	Peak
3425.000	V	47.68	---	-1.14	46.54	---	74.00	54.00	-7.46	Peak
3833.333	V	46.56	---	0.78	47.34	---	74.00	54.00	-6.66	Peak
N/A										
1126.666	H	57.30	---	-11.47	45.83	---	74.00	54.00	-8.17	Peak
1373.333	H	56.25	---	-10.12	46.13	---	74.00	54.00	-7.87	Peak
1550.000	H	55.82	---	-9.02	46.80	---	74.00	54.00	-7.20	Peak
3800.000	H	46.22	---	-0.19	46.03	---	74.00	54.00	-7.97	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



Operation Mode: TX(CH Mid)

Test Date: December 01,2008

Temperature: 27°C

Tested by: Simple Guan

Humidity: 56 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1306.67	V	55.84	---	-10.48	45.36	---	74.00	54.00	-8.64	Peak
1493.33	V	55.34	---	-9.46	45.88	---	74.00	54.00	-8.12	Peak
4175.00	V	46.05	---	1.82	47.87	---	74.00	54.00	-6.13	Peak
5541.67	V	45.69	---	4.79	50.48	---	74.00	54.00	-3.52	Peak
N/A										
1250.00	H	55.91	---	-10.79	45.12	---	74.00	54.00	-8.88	Peak
1516.67	H	55.63	---	-9.29	46.34	---	74.00	54.00	-7.66	Peak
4250.00	H	45.99	---	1.89	47.88	---	74.00	54.00	-6.12	Peak
5050.00	H	45.77	---	3.16	48.93	---	74.00	54.00	-5.07	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



Operation Mode: TX(CH High)

Test Date: December 01,2008

Temperature: 27°C

Tested by: Simple Guan

Humidity: 56 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1153.33	V	57.49	---	-11.33	46.16	---	74.00	54.00	-7.84	Peak
1346.67	V	56.65	---	-10.26	46.39	---	74.00	54.00	-7.61	Peak
1540.00	V	56.40	---	-9.10	47.30	---	74.00	54.00	-6.70	Peak
5075.00	V	45.28	---	3.24	48.52	---	74.00	54.00	-5.48	Peak
N/A										
1200.00	H	56.49	---	-11.07	45.42	---	74.00	54.00	-8.58	Peak
1330.00	H	56.30	---	-10.36	45.94	---	74.00	54.00	-8.06	Peak
1543.33	H	55.37	---	-9.08	46.29	---	74.00	54.00	-7.71	Peak
3291.67	H	47.99	---	-2.60	45.39	---	74.00	54.00	-8.61	Peak
N/A										

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



**8DPSK**

**Operation Mode:** TX(CH Low)

**Test Date:** December 01,2008

**Temperature:** 27°C

**Tested by:** Simple Guan

**Humidity:** 56 % RH

**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1226.666	V	56.73	---	-10.92	45.81	---	74.00	54.00	-8.19	Peak
1403.333	V	56.23	---	-9.95	46.28	---	74.00	54.00	-7.72	Peak
3825.000	V	45.73	---	0.74	46.47	---	74.00	54.00	-7.53	Peak
5133.333	V	44.28	---	3.45	47.73	---	74.00	54.00	-6.27	Peak
N/A										
1660.000	H	55.73	---	-8.15	47.58	---	74.00	54.00	-6.42	Peak
1916.666	H	55.59	---	-6.12	49.47	---	74.00	54.00	-4.53	Peak
4541.666	H	44.87	---	2.19	47.06	---	74.00	54.00	-6.94	Peak
4625.000	H	45.01	---	2.33	47.34	---	74.00	54.00	-6.66	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



Operation Mode: TX(CH Mid)

Test Date: December 01,2008

Temperature: 27°C

Tested by: Simple Guan

Humidity: 56 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1173.33	V	57.34	---	-11.22	46.12	---	74.00	54.00	-7.88	Peak
1466.67	V	55.21	---	-9.60	45.61	---	74.00	54.00	-8.39	Peak
4391.67	V	45.12	---	2.02	47.14	---	74.00	54.00	-6.86	Peak
5083.33	V	44.95	---	3.27	48.22	---	74.00	54.00	-5.78	Peak
N/A										
1270.00	H	56.36	---	-10.69	45.67	---	74.00	54.00	-8.33	Peak
1426.67	H	55.46	---	-9.82	45.64	---	74.00	54.00	-8.36	Peak
4233.33	H	44.64	---	1.87	46.51	---	74.00	54.00	-7.49	Peak
4458.33	H	44.14	---	2.08	46.22	---	74.00	54.00	-7.78	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



Operation Mode: TX(CH High)

Test Date: December 01,2008

Temperature: 27°C

Tested by: Simple Guan

Humidity: 56 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1150.00	V	56.89	---	-11.35	45.54	---	74.00	54.00	-8.46	Peak
1406.67	V	56.49	---	-9.93	46.56	---	74.00	54.00	-7.44	Peak
3075.00	V	47.45	---	-1.92	45.53	---	74.00	54.00	-8.47	Peak
3525.00	V	46.89	---	-0.84	46.05	---	74.00	54.00	-7.95	Peak
N/A										
1306.67	H	56.62	---	-10.48	46.14	---	74.00	54.00	-7.86	Peak
1450.00	H	56.40	---	-9.70	46.70	---	74.00	54.00	-7.30	Peak
4708.33	H	44.92	---	2.48	47.40	---	74.00	54.00	-6.60	Peak
4875.00	H	44.71	---	2.77	47.48	---	74.00	54.00	-6.52	Peak
N/A										

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



## 7.9 POWERLINE CONDUCTED EMISSIONS

### LIMIT

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

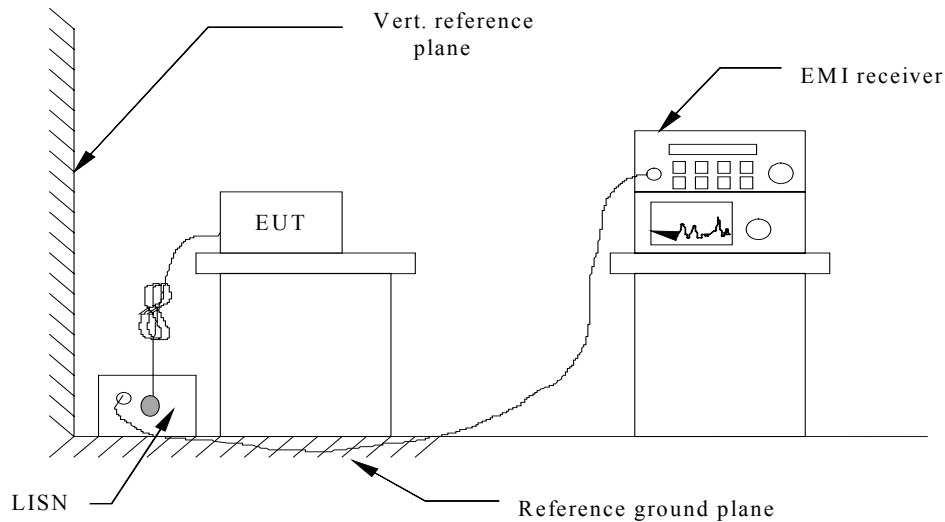
### MEASUREMENT EQUIPMENT USED

Conducted Emission Test Site G				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESCI EMI TEST RECEIV.ESCI	ROHDE&SCHWARZ	1166.5950 03	100088	02/24/2009
LISN	EMCO	3825/2	1371	02/24/2009
LISN	EMCO	3825/2	8901-1459	02/24/2009

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



## Test Configuration



See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

## TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.



**Test Data**

<b>Test Mode:</b> Normal Link	<b>Location:</b> Site G
<b>Model Name:</b> M01043	<b>Test Date:</b> December 01,2008
<b>Tested by:</b> Simple Guan	<b>Test Results:</b> Passed

(The chart below shows the highest readings taken from the final data.)

FREQ MHz	PEAK RAW dBuV	Q.P. RAW dBuV	AVG RAW dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
4.637	23.01	---	---	56.00	46.00	---	-22.99	L1
8.340	27.12	---	---	60.00	50.00	---	-22.88	L1
9.206	25.50	---	---	60.00	50.00	---	-24.50	L1
14.689	27.39	---	---	60.00	50.00	---	-22.61	L1
16.661	25.96	---	---	60.00	50.00	---	-24.04	L1
24.212	34.57	---	---	60.00	50.00	---	-15.43	L1
2.761	19.28	---	---	56.00	46.00	---	-26.72	L2
3.683	23.41	---	---	56.00	46.00	---	-22.59	L2
4.637	27.61	---	---	56.00	46.00	---	-18.39	L2
8.340	22.91	---	---	60.00	50.00	---	-27.09	L2
19.210	28.59	---	---	60.00	50.00	---	-21.41	L2
24.212	34.96	---	---	60.00	50.00	---	-15.04	L2

**Remark:**

1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. “---” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
4. 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.
5. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

**Note:**

Freq. = Emission frequency in KHz

Factor (dB) = cable loss + Insertion loss of LISN+ Insertion loss of TRANSIENT LIMITER (The TRANSIENT LIMITER included 10 dB ATTENUATION)

Amptd dBuV = Uncorrected Analyzer/Receiver reading + cable loss + Insertion loss of LISN+ Insertion loss of TRANSIENT LIMITER,

if it > 0.5 dB

Limit dBuV = Limit stated in standard ; Margin dB= Reading in reference to limit

**Calculation Formula**

Margin (dB) = Amptd (dBuV) – Limit (dBuV)



## **8. ANNEX DECLARATION FOR BLUETOOTH DEVICE ACC TO PART 15.247**

### **1 Output power and channel separation of a Bluetooth device in the different operating modes:**

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device has no influence on the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters. Only a different hopping sequence will be used. For this reason the check of these

RF parameters in one op-mode is sufficient.

### **2 Frequency range of a Bluetooth device:**

Hereby we declare that the maximum frequency of this device is: 2402 – 2480 MHz. This is according to the Bluetooth Core Specification (+ critical errata) for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04E). Other frequency ranges ( e.g. for Spain, France, Japan) which are allowed according the Core Specification are not supported by this device.

### **3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:**

Bluetooth units which want to communicate with other units must be organised in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from its BD address which is unique for each Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

### **4 Example of a hopping sequence in data mode:**

Example of a 79 hopping sequence in data mode: 40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

## **5 Equally average use of frequencies in data mode and behaviour for short transmissions:**

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD\_ADDRESS. The BD\_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD\_ADDRESS.

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronisation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5  $\mu$ s. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behaviour: The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5  $\mu$ s). The hopping sequence will always differ from the first one.

## **6 Receiver input bandwidth and behaviour for repeated single or multiple packets:**

The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multislot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.



## 7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length \* hop rate / number of hopping channels \*30s

Example for a DH1 packet (with a maximum length of one time slot) Dwell time =  $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 30\text{s} = 0.3797\text{s}$  (in a 30s period)

For multislot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots) Dwell time =  $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/s / 79 * 30\text{s} = 0.3797\text{s}$  (in a 30s period).

This is according to the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore all Bluetooth devices **comply** with the FCC dwell time requirement in data mode. This was checked during the Bluetooth Qualification tests. The Dwell time in hybrid mode is measured and stated in the test report.

## 8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode. The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is  $f_{\text{center}} = 75 \text{ kHz}$ . This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07E) for three frequencies (2402, 2441, 2480 MHz). Additionally an example for the channel separation is given in the test report

## 9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see chapter 5), but this time with different input vectors:

- For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
- For the page hop sequence, the device address of the paged unit is used as input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.

So it is ensured that also in hybrid mode the frequency use is equally averaged.

Example of a hopping sequence in inquiry mode: 48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23



Example of a hopping sequence in paging mode:08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

#### **10 Receiver input bandwidth and synchronisation in hybrid mode:**

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code, the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD\_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced considerably.

#### **11 Spread rate / data rate of the direct sequence signal**

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate/ Data rate will be 68/1.

#### **12 Spurious emission in hybrid mode**

The dwell time in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.

#### **13 Peak power spectral density measurement**

Since the transmitter is only active for some milliseconds on one channel you would get a result with many interruptions if using a sweep time of e.g. 1s as stated in the FCC rules. Therefore a fast sweep in maxhold function is used instead and the EUT is activated several times until the measurement curve has stabilized.