



**FCC 47 CFR PART 15 SUBPART C**

**TEST REPORT**

**For**

**Bluetooth Headphone**

**Model: HD-227, HD-227A, HD-227B, HD-227C, HD-227D, HD-227E**

**Brand: N/A**

**Test Report Number:**

**C130802Z01-RP1**

*Prepared for*

**SHENZHEN QI SHENGLONG INDUSTRIALIST CO.,LTD.**

**5F.,Blk 6A, Jing Nan Industry,Bai Ge long,Buji,Shenzhen,China**

*Prepared by*

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**Issued Date: September 5, 2013**



TESTING CERT #2861.01

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Revision History

Rev.	Issue No.	Revisions	Effect Page	Revised By
00	C130802Z01-RP1	Initial Issue	ALL	Nancy Fu



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## 1. TEST RESULT CERTIFICATION

<b>Product:</b>	Bluetooth Headphone
<b>Model:</b>	HD-227, HD-227A, HD-227B, HD-227C, HD-227D, HD-227E
<b>Brand:</b>	N/A
<b>Tested:</b>	August 2~September 4, 2013
<b>Applicant:</b>	<b>SHENZHEN QI SHENGLONG INDUSTRIALIST CO.,LTD.</b> 5F.,Blk 6A, Jing Nan Industry,Bai Ge long,Buji,Shenzhen,China
<b>Manufacturer:</b>	<b>DONGGUAN FEIHAO INDUSTRIALIST CO.,LTD</b> No.8,Fengyi Road, Dakan Village, Huangjiang, DongGuan, China

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 C63.4:2009 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:**

**Reviewed by:**

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**Tom Gan**  
Supervisor of EMC Dept.  
Compliance Certification Service Inc.

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**Ruby Zhang**  
Supervisor of Report Dept.  
Compliance Certification Service Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	Bluetooth Headphone
<b>Model Number</b>	HD-227, HD-227A, HD-227B, HD-227C, HD-227D, HD-227E
<b>Brand</b>	N/A
<b>Model Discrepancy</b>	The models are identical except different appearance.
<b>Identify Number</b>	C130802Z01-RP1
<b>Power Supply</b>	DC5V supplied by the PC or DC3.7V supplied by the battery
<b>USB In Cable</b>	Unshielded, 0.75m
<b>Received Date</b>	August 2, 2013
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	GFSK : 0.36dBm 8DPSK : -1.05dBm
<b>Modulation Technique</b>	FHSS (GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8DPSK for 3Mbps)
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	Built-in Antenna with 0dBi gain(Max)
<b>Temperature Range</b>	-10°C ~ +45°C

**Note:** This submittal(s) (test report) is intended for FCC ID: Y56QSLHD227X filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



### 3. TEST METHODOLOGY

#### 3.1 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.

The following test mode(s) were scanned during the preliminary test below 1G:

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: Charging	<input type="checkbox"/>
	Mode 2: Charging and bluetooth play music	<input checked="" type="checkbox"/>
Radiated Emission	Mode 1: TX	<input checked="" type="checkbox"/>

Above 1G, Channel Low (2402MHz) 、Mid (2441MHz) and High (2480MHz) were chosen for full testing for GFSK and 8DPSK.



## 4. FACILITIES AND ACCREDITATIONS

### 4.1 FACILITIES

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

- ☒ **No.10-1, Mingkeda Logistics Park, No.18, Huanguan South Rd.,  
Guan Lan Town, Baoan District, Shenzhen, China**

The sites are constructed in conformance with the requirements of ANSI C63.4:2009, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 4.2 ACCREDITATIONS

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

<b>USA</b>	A2LA
<b>China</b>	CNAS

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

<b>USA</b>	FCC
<b>Japan</b>	VCCI(C-3478, R-3135, T-652, G-624)
<b>Canada</b>	INDUSTRY CANADA
<b>Taiwan</b>	BSMI
<b>Norway</b>	Nemko

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

### 4.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

<b>Parameter</b>	<b>Uncertainty</b>
Radiated Emission, 30 to 200 MHz Test Site : 966(2)	+/-3.6880dB
Radiated Emission, 200 to 1000 MHz Test Site : 966(2)	+/-3.6695dB
Radiated Emission, 1 to 8 GHz	+/-5.1782dB
Radiated Emission, 8 to 18 GHz	+/-5.2173dB
Conducted Emissions	+/-3.6836dB
Band Width	178kHz
Peak Output Power MU	+/-1.906dB
Band Edge MU	+/-0.182dB
Channel Separation MU	416.178Hz
Duty Cycle MU	0.054ms
Frequency Stability MU	226Hz

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

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



## 5. SETUP OF EQUIPMENT UNDER TEST

### 5.1 SETUP CONFIGURATION OF EUT

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

### 5.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.	FCC ID	Brand	Data Cable	Power Cord
1	Notebook	5310m	N/A	N/A	HP	N/A	Unshielded 1.80m

**Notes:**

*Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*





## 6. FCC PART 15.247 REQUIREMENTS

### 6.1 20dB BANDWIDTH

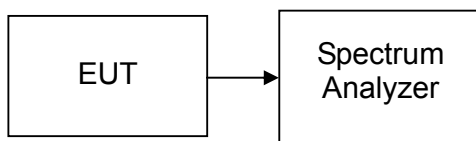
None; for reporting purpose only.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

*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=100kHz, 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

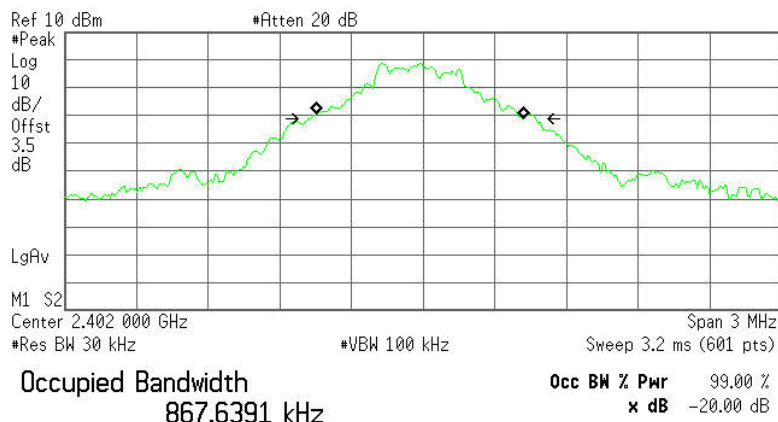
No non-compliance noted

## Test plot GFSK

### 20dB Bandwidth(CH Low)

 Agilent

R T

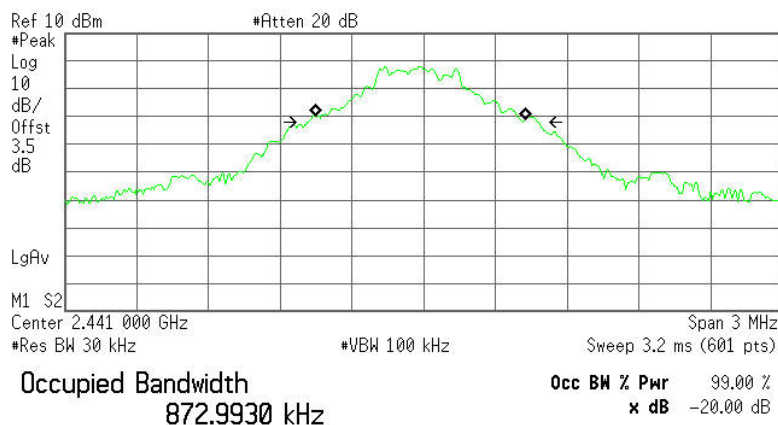


Transmit Freq Error	-13.400 kHz
x dB Bandwidth	940.496 kHz

### 20dB Bandwidth (CH Mid)

 **Agilent**

R T



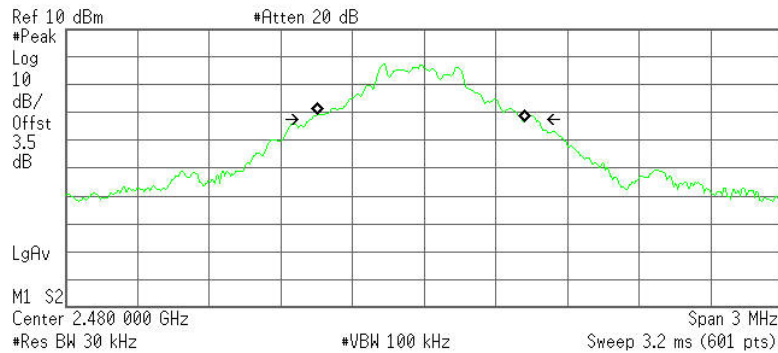
Transmit Freq Error	-13.477 kHz
x dB Bandwidth	954.471 kHz



## 20dB Bandwidth (CH High)

Agilent

R T



Occupied Bandwidth  
864.3729 kHz

Occ BW % Pwr 99.00 %  
x dB -20.00 dB

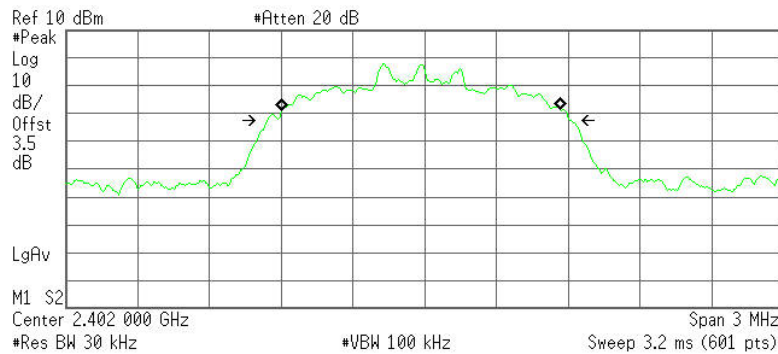
Transmit Freq Error -14.544 kHz  
x dB Bandwidth 942.593 kHz

## 8DPSK

### 20dB Bandwidth (CH Low)

Agilent

R T



Occupied Bandwidth  
1.1588 MHz

Occ BW % Pwr 99.00 %  
x dB -20.00 dB

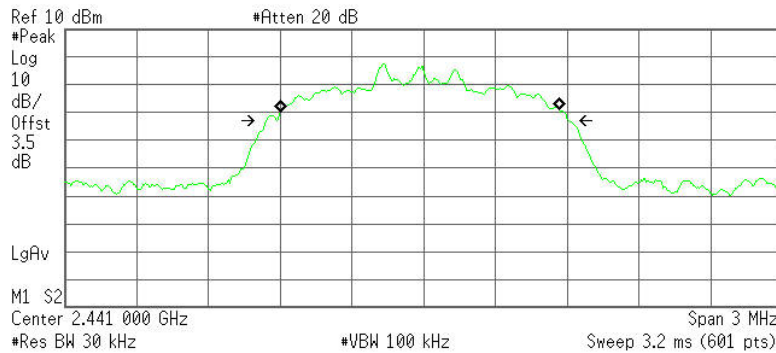
Transmit Freq Error -13.637 kHz  
x dB Bandwidth 1.269 MHz



### 20dB Bandwidth (CH Mid)

Agilent

R T



Occupied Bandwidth  
1.1585 MHz

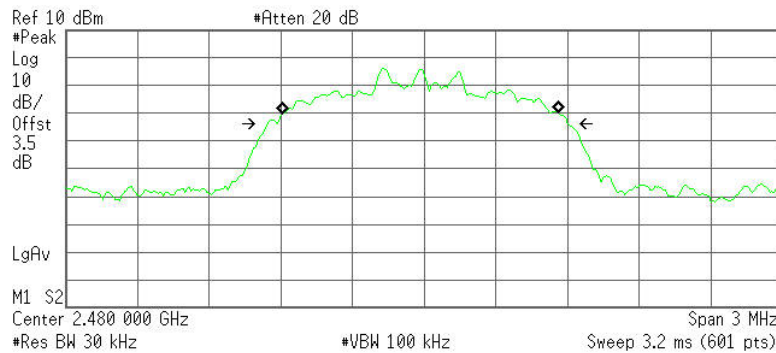
Occ BW % Pwr 99.00 %  
x dB -20.00 dB

Transmit Freq Error -14.435 kHz  
x dB Bandwidth 1.266 MHz

### 20dB Bandwidth (CH High)

Agilent

R T



Occupied Bandwidth  
1.1534 MHz

Occ BW % Pwr 99.00 %  
x dB -20.00 dB

Transmit Freq Error -15.345 kHz  
x dB Bandwidth 1.265 MHz



## 6.2 PEAK POWER

### LIMIT

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

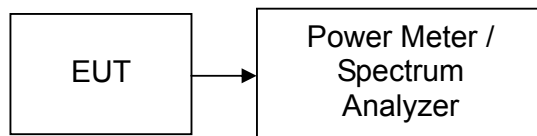
1. For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
2. Except as shown in paragraphs (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.
3. 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.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Power Meter	Anritsu	ML2495A	1204003	03/09/2013	03/08/2014
Power Sensor	Anritsu	MA2411B	1126150	03/09/2013	03/08/2014
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

**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	-3.14	3.50	0.36	0.00109	1	PASS
Mid	2441	-3.64	3.50	-0.14	0.00097		PASS
High	2480	-3.57	3.50	-0.07	0.00098		PASS

**8DPSK**

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-4.55	3.50	-1.05	0.00079	1	PASS
Mid	2441	-4.76	3.50	-1.26	0.00075		PASS
High	2480	-5.95	3.50	-2.45	0.00057		PASS



## 6.3 PEAK POWER SPECTRAL DENSITY

### LIMIT

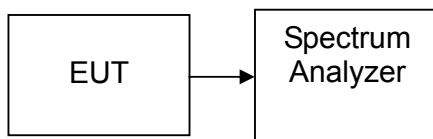
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping 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	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

*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.*



## 6.4 BAND EDGES MEASUREMENT

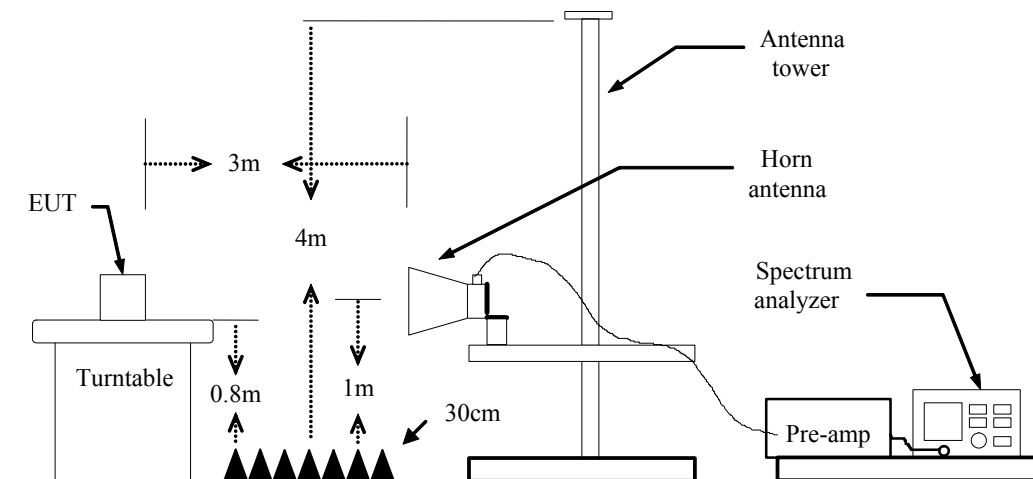
### LIMIT

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

Radiated Emission Test Site 966(2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	03/09/2013	03/08/2014
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2013	03/18/2014
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2013	03/18/2014
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	06/21/2013	06/21/2014
Bilog Antenna	SCHAFFNER	CBL6143	5082	03/02/2013	03/01/2014
Horn Antenna	SCHWARZBECK	BBHA9120	D286	03/02/2013	03/01/2014
Loop Antenna	A. R. A	PLA-1030/B	1029	03/19/2013	03/18/2014
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	03/04/2013	03/03/2014
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

### 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=510Hz / 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

R T

Mkr1 2.402 2 GHz

89.57 dBμV

Ref 107 dBμV

#Atten 10 dB

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.310 0 GHz

Stop 2.410 0 GHz

#Res BW 1 MHz

#VBW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.402 2 GHz	89.57 dBμV
2	(1)	Freq	2.390 0 GHz	47.17 dBμV

**Detector mode: Average**

**Polarity: Vertical**

Agilent

R T

Mkr1 2.401 8 GHz

73.04 dBμV

Ref 107 dBμV

#Atten 10 dB

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.310 0 GHz

Stop 2.410 0 GHz

#Res BW 1 MHz

#VBW 510 Hz

Sweep 152.9 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.401 8 GHz	73.04 dBμV
2	(1)	Freq	2.390 0 GHz	29.05 dBμV

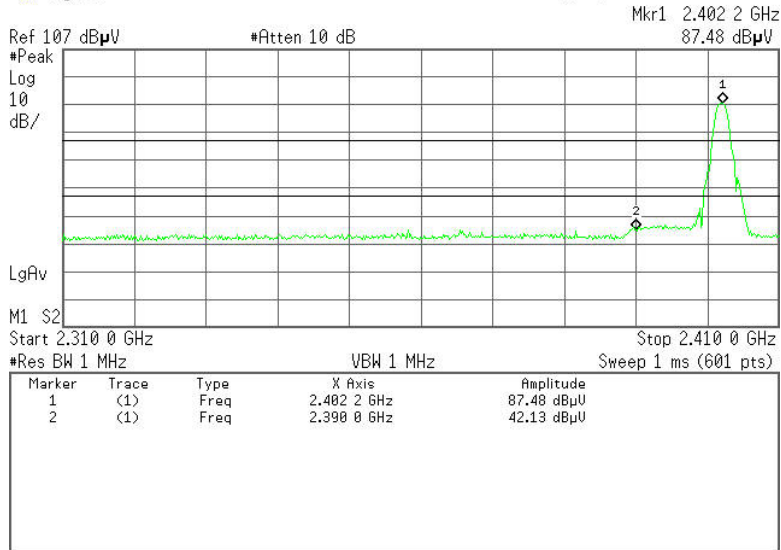


**Detector mode: Peak**

**Polarity: Horizontal**

Agilent

R T

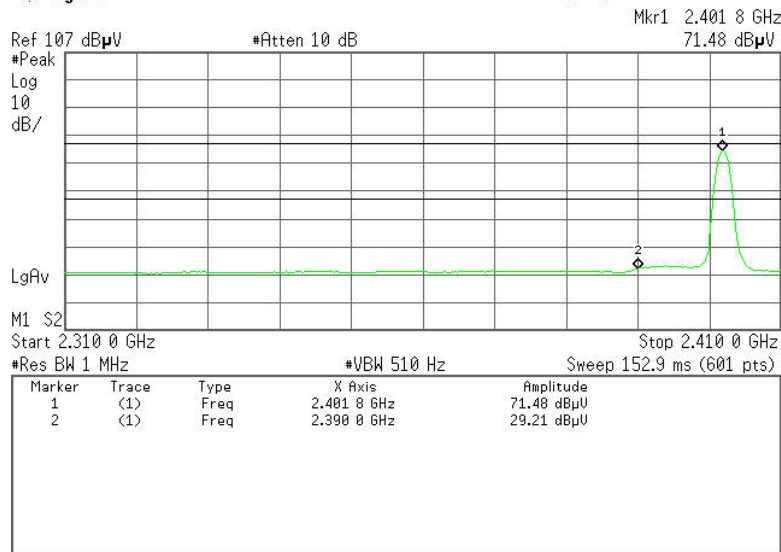


**Detector mode: Average**

**Polarity: Horizontal**

Agilent

R T





## Band Edges (CH-High)

Detector mode: Peak

Polarity: Vertical

Agilent

R T

Mkr1 2.479 83 GHz

Ref 107 dBμV

\*Atten 10 dB

87.96 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

\*Res BW 1 MHz

VBW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 83 GHz	87.96 dBμV
2	(1)	Freq	2.483 50 GHz	42.53 dBμV

Detector mode: Average

Polarity: Vertical

Agilent

R T

Mkr1 2.479 92 GHz

Ref 107 dBμV

\*Atten 10 dB

71.79 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

\*Res BW 1 MHz

\*VBW 510 Hz

Sweep 38.24 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 92 GHz	71.79 dBμV
2	(1)	Freq	2.483 50 GHz	29.18 dBμV



## Detector mode: Peak

## Polarity: Horizontal

Agilent

R T

Mkr1 2.479 83 GHz

Ref 107 dBμV

\*Atten 10 dB

88.83 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

\*Res BW 1 MHz

VBW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 83 GHz	88.83 dBμV
2	(1)	Freq	2.483 50 GHz	44.53 dBμV

## Detector mode: Average

## Polarity: Horizontal

Agilent

R T

Mkr1 2.479 96 GHz

Ref 107 dBμV

\*Atten 10 dB

72.48 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

\*Res BW 1 MHz

\*VBW 510 Hz

Sweep 38.24 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 96 GHz	72.48 dBμV
2	(1)	Freq	2.483 50 GHz	29.31 dBμV



## 8DPSK

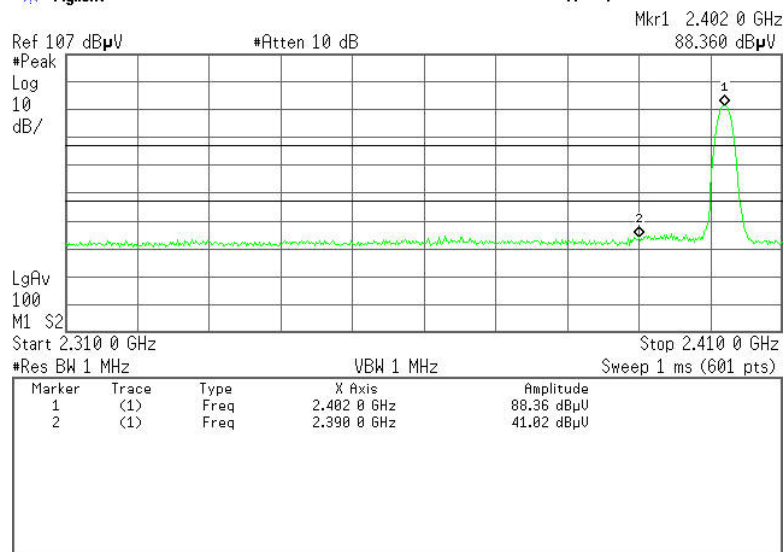
### Band Edges (CH-Low)

Detector mode: Peak

Polarity: Vertical

Agilent

R T

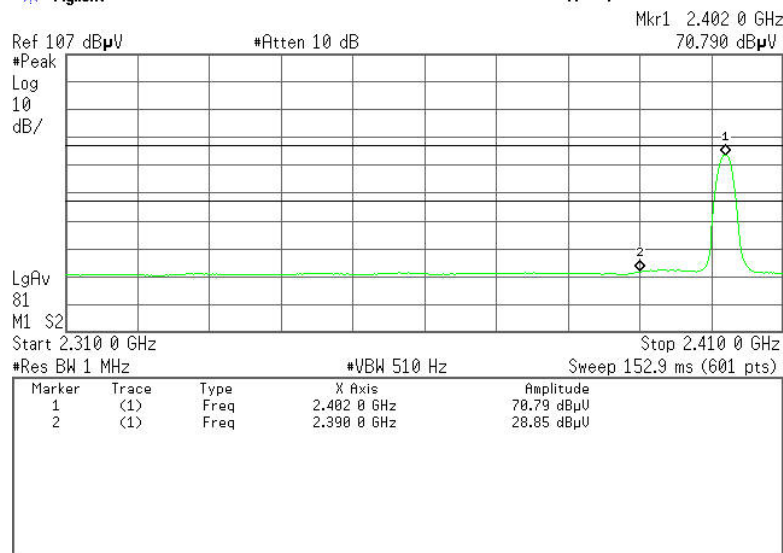


Detector mode: Average

Polarity: Vertical

Agilent

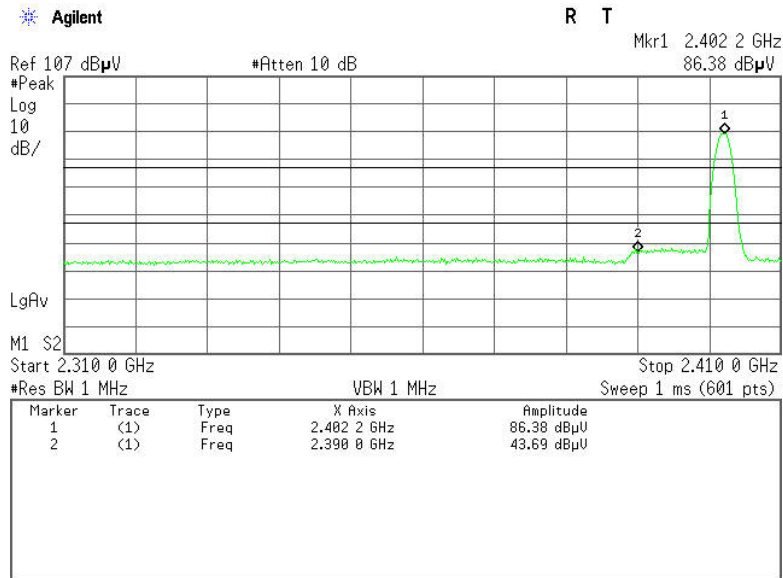
R T





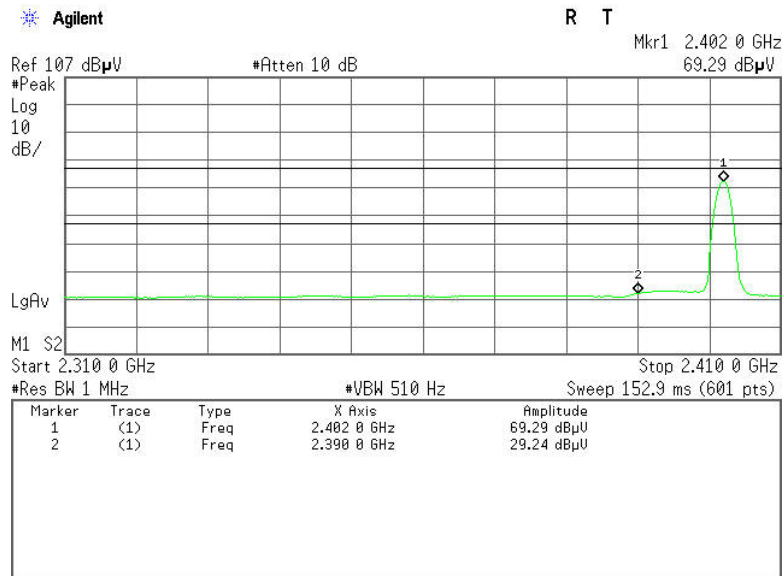
## Detector mode: Peak

## Polarity: Horizontal



## Detector mode: Average

## Polarity: Horizontal





## Band Edges (CH-High)

Detector mode: Peak

Polarity: Vertical

Agilent

R T

Mkr1 2.479 83 GHz

Ref 107 dBμV

#Atten 10 dB

87.41 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

VBW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 83 GHz	87.41 dBμV
2	(1)	Freq	2.483 50 GHz	40.64 dBμV

Detector mode: Average

Polarity: Vertical

Agilent

R T

Mkr1 2.479 96 GHz

Ref 107 dBμV

#Atten 10 dB

69.44 dBμV

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.475 00 GHz

Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 510 Hz

Sweep 38.24 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 96 GHz	69.44 dBμV
2	(1)	Freq	2.483 50 GHz	28.62 dBμV





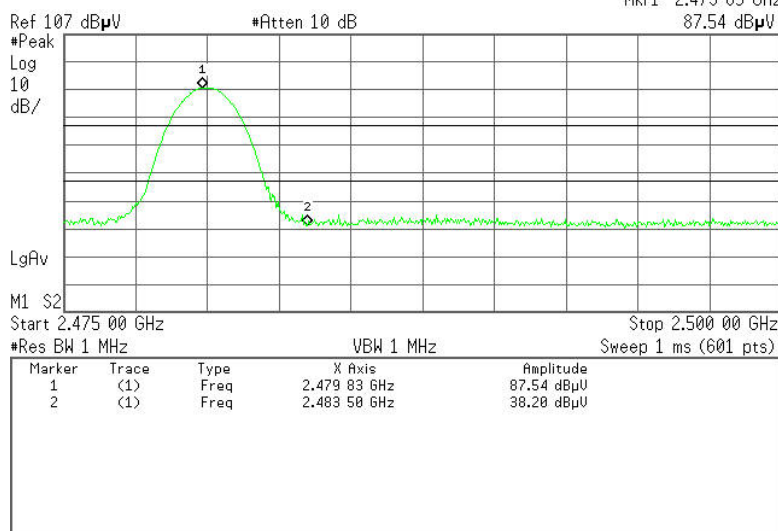
## Detector mode: Peak

## Polarity: Horizontal

Agilent

R T

Mkr1 2.479 83 GHz  
87.54 dBμV



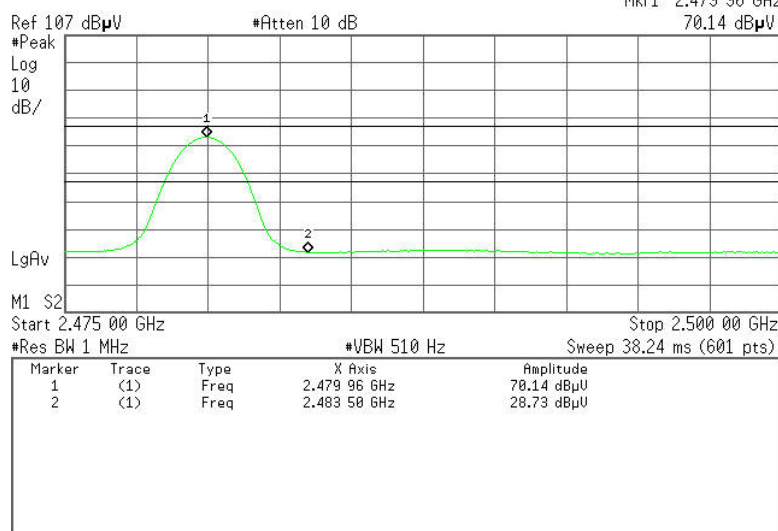
## Detector mode: Average

## Polarity: Horizontal

Agilent

R T

Mkr1 2.479 96 GHz  
70.14 dBμV





## 6.5 FREQUENCY SEPARATION

### LIMIT

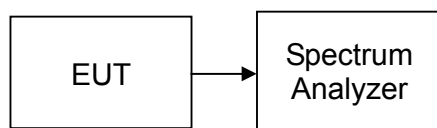
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel 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	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

**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=30kHz, VBW=30kHz, Adjust Span to 4 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)	Two-thirds of the 20 dB Bandwidth (kHz)	Channel Separation Limit	Result
1.000	636.314	> Two-thirds of the 20 dB Bandwidth	Pass

##### 8DPSK

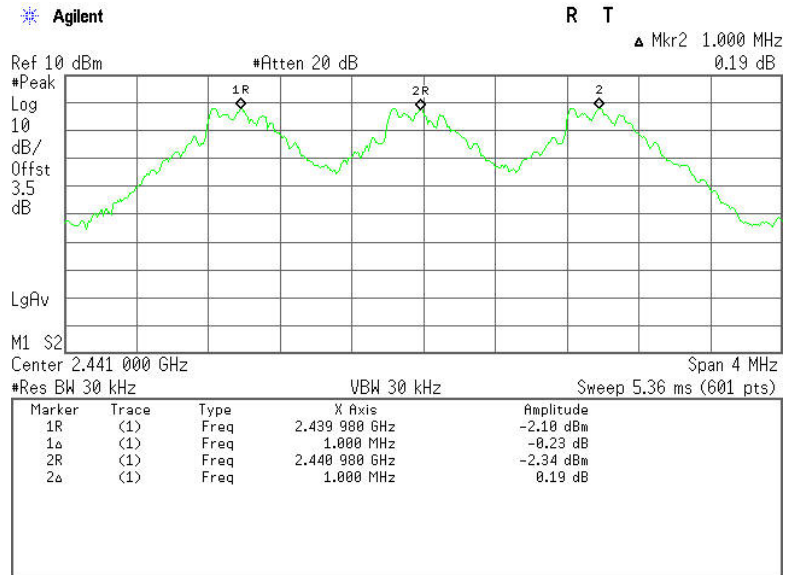
Channel Separation (MHz)	Two-thirds of the 20 dB Bandwidth (kHz)	Channel Separation Limit	Result
1.000	846.000	> Two-thirds of the 20 dB Bandwidth	Pass



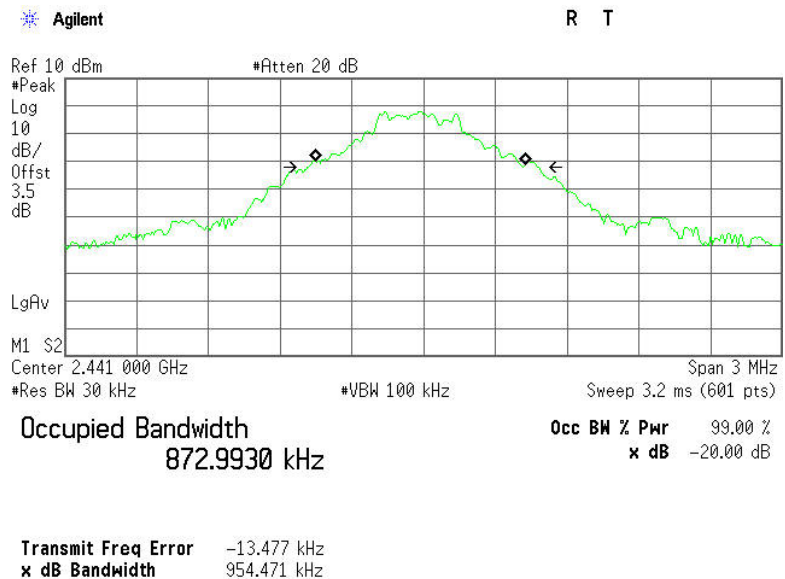
## GFSK

### Test Plot

#### Measurement of Channel Separation



#### 20 dB bandwidth(CH Mid)

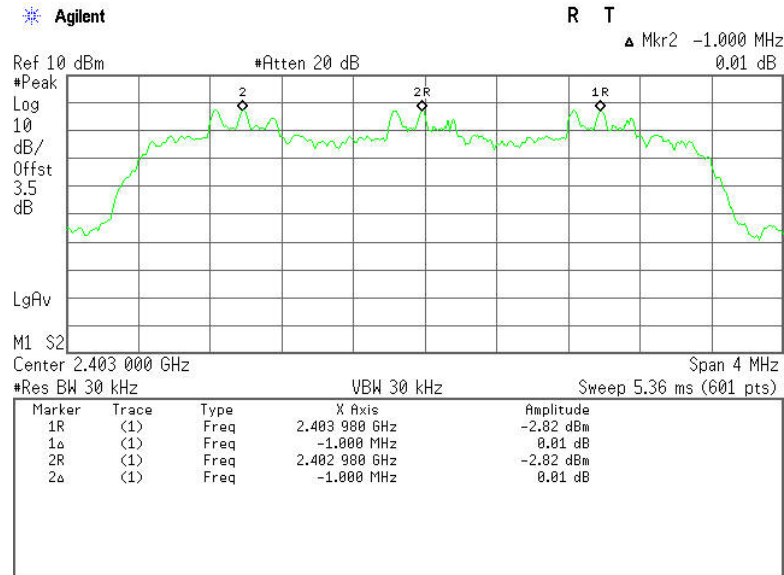




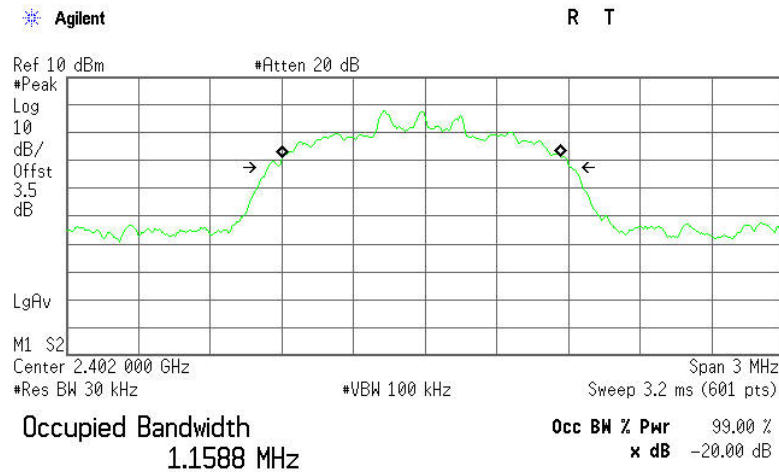
## 8DPSK

### Test Plot

#### Measurement of Channel Separation



#### 20 dB bandwidth(CH Low)



Transmit Freq Error -13.637 kHz

x dB Bandwidth 1.269 MHz



## 6.6 NUMBER OF HOPPING FREQUENCY

### LIMIT

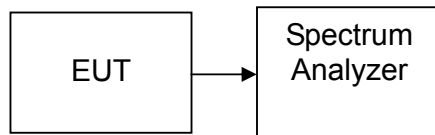
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

*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=300kHz,
5. Max hold, view and count how many channel in the band.

### TEST RESULTS

*No non-compliance noted*

### Test Data

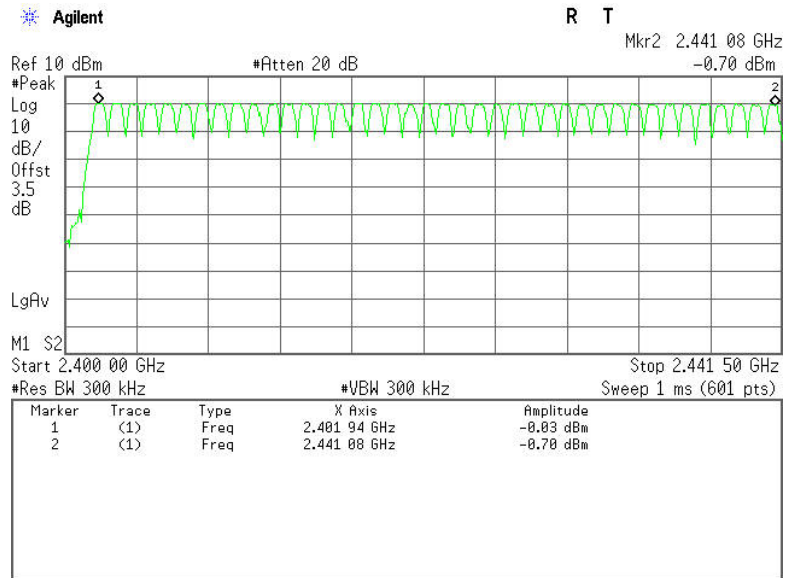
Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS



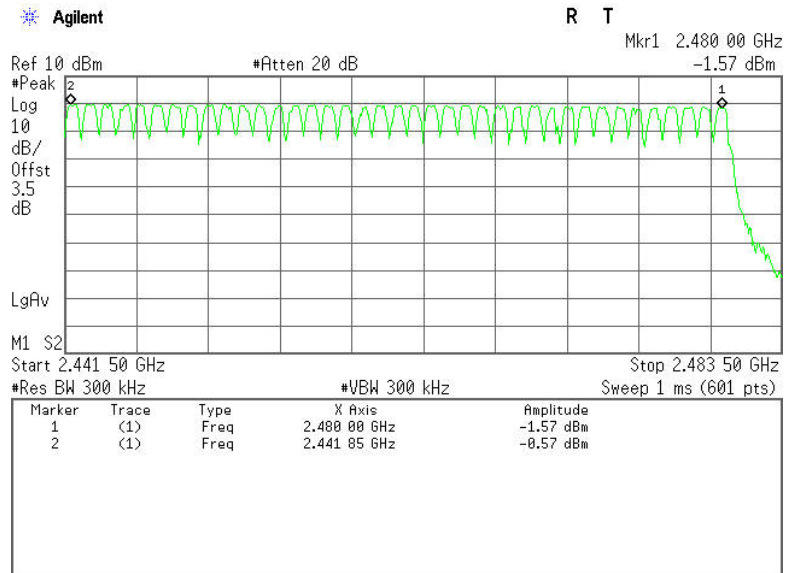
## Test Plot ( GFSK )

### Channel Number

#### 2.400 GHz – 2.4415 GHz



#### 2.4415 GHz – 2.4835 GHz

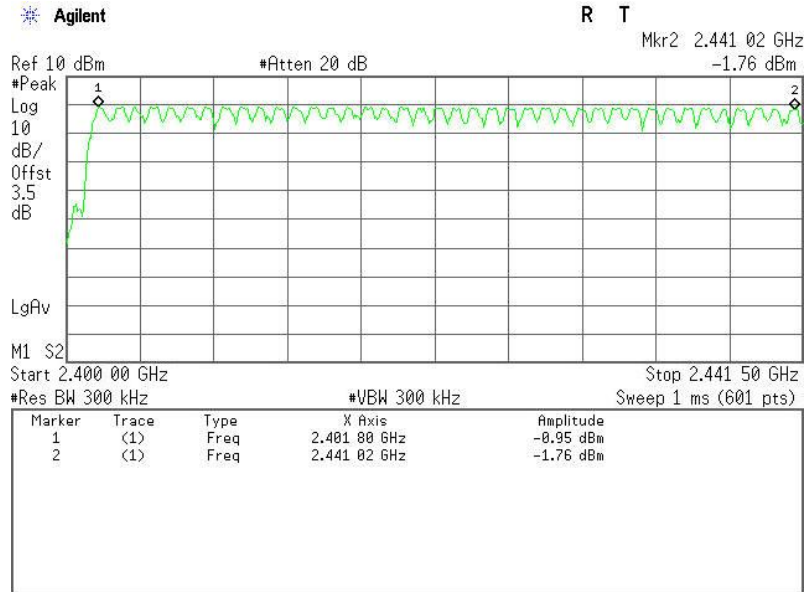




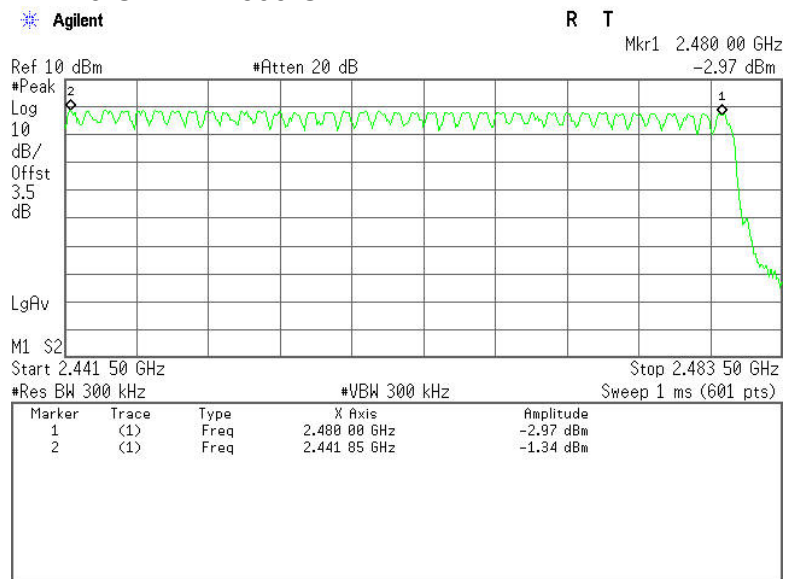
## Test Plot (8DPSK )

### Channel Number

#### 2.400 GHz – 2.4415 GHz



#### 2.4415 GHz – 2.4835 GHz





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

### **LIMIT**

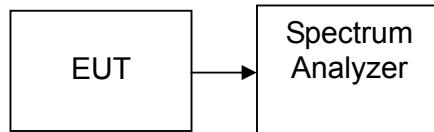
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### **MEASUREMENT EQUIPMENT USED**

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

*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 Mid:  $0.398 * (1600/2)/79 * 31.6 = 127.360(\text{ms})$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	0.398	127.360	31.60	400.00	PASS

**DH 3**CH Mid:  $1.655 * (1600/4)/79 * 31.6 = 264.800 (\text{ms})$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	1.655	264.800	31.60	400.00	PASS

**DH 5**CH Mid:  $2.900 * (1600/6)/79 * 31.6 = 309.333(\text{ms})$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	2.900	309.333	31.60	400.00	PASS

**Test Data****8DPSK****DH 1**CH Mid:  $0.408 * (1600/2)/79 * 31.6 = 130.560 \text{ (ms)}$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	0.408	130.560	31.60	400.00	PASS

**DH 3**CH Mid:  $1.660 * (1600/4)/79 * 31.6 = 265.600 \text{ (ms)}$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	1.660	265.600	31.60	400.00	PASS

**DH 5**CH Mid:  $2.908 * (1600/6)/79 * 31.6 = 310.187 \text{ (ms)}$ 

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	2.908	310.187	31.60	400.00	PASS

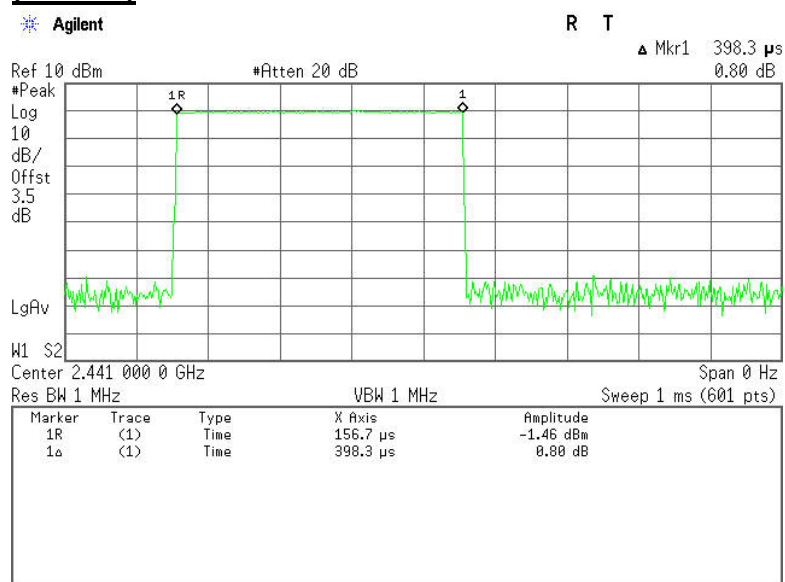


## Test Plot

### GFSK

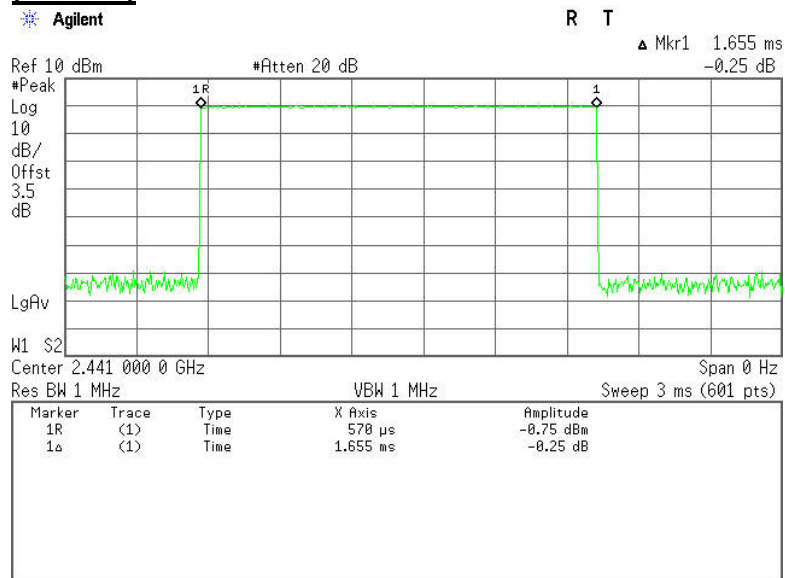
#### DH 1

#### (CH Mid)



#### DH 3

#### (CH Mid)





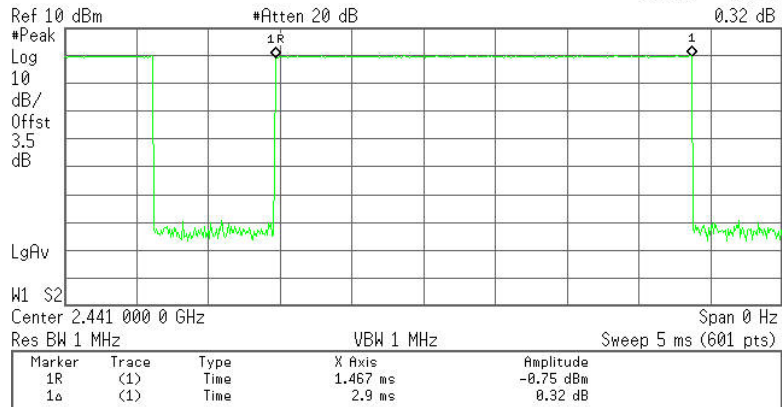
**DH 5**

**(CH Mid)**

Agilent

R T

▲ Mkr1 2.9 ms  
0.32 dB

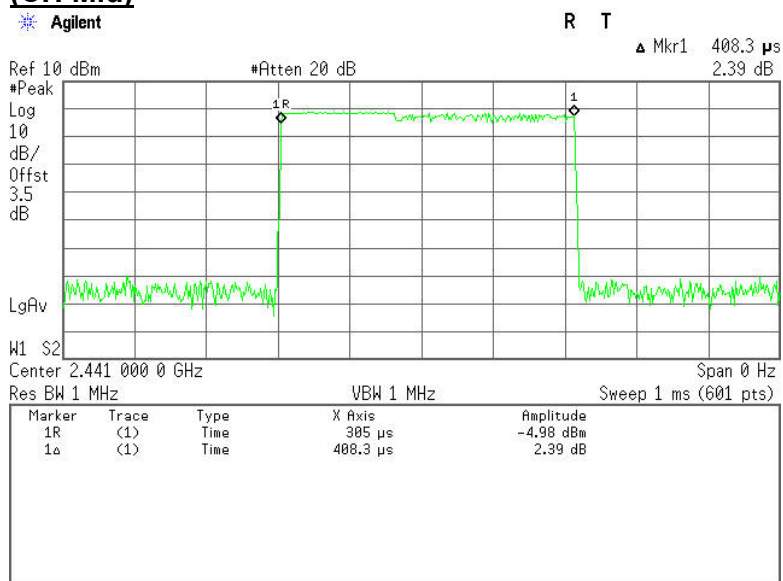




**Test Plot**  
**8DPSK**

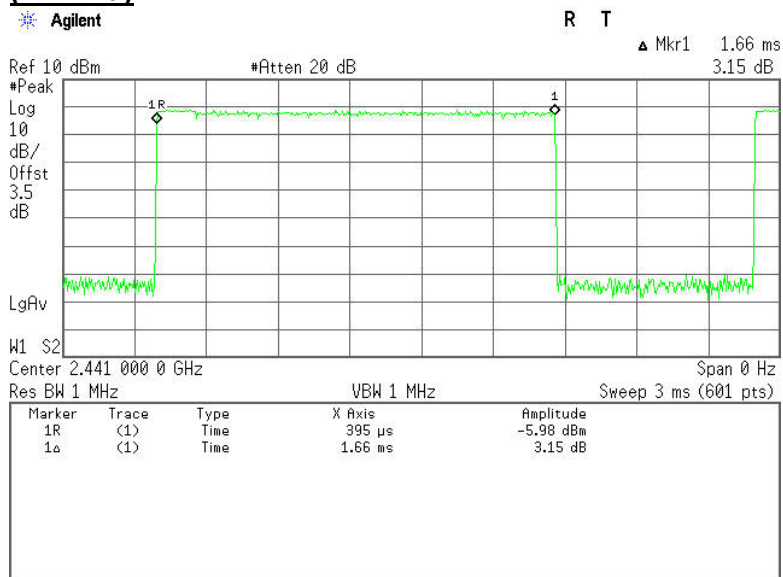
**DH 1**

**(CH Mid)**



**DH 3**

**(CH Mid)**





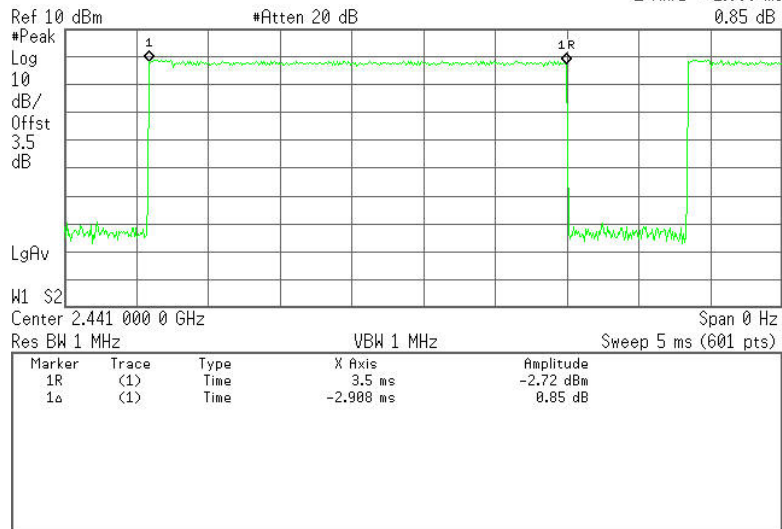
**DH 5**

**(CH Mid)**

Agilent

R T

▲ Mkr1 -2.908 ms  
0.85 dB





## 6.8 SPURIOUS EMISSIONS

### 6.8.1. CONDUCTED MEASUREMENT

#### LIMIT

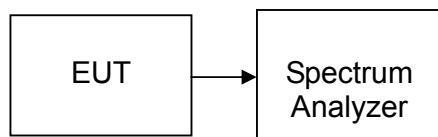
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

*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.

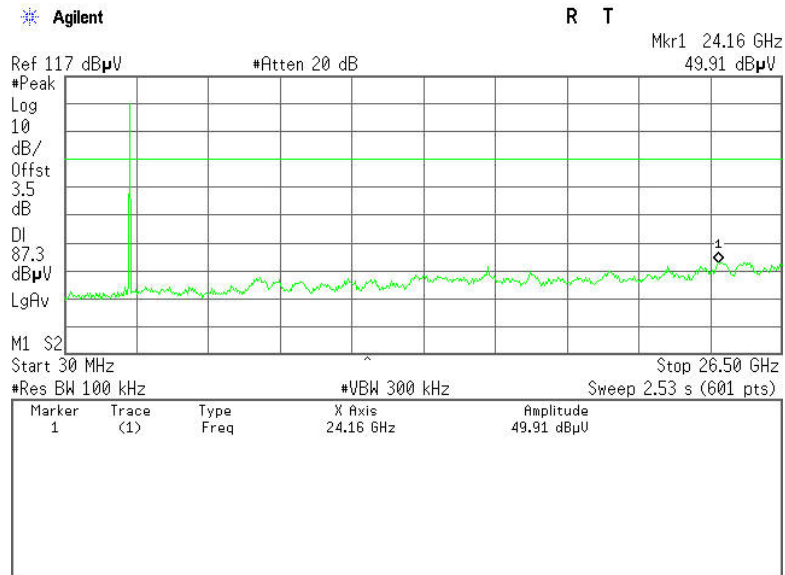
#### TEST RESULTS

*No non-compliance noted*



## Test Plot ( GFSK )

### CH Low (30MHz ~26.5GHz )



### CH Low (2.31GHz ~2.41GHz )

