

# APPLICATION FOR CERTIFICATION

On Behalf of

Zoetronics Technology Co., Ltd.

Bluetooth Heart Rate Monitor

Model No. : TA1102

FCC ID : B5OWT11

Prepared for : Zoetronics Technology Co., Ltd.  
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# TEST REPORT CERTIFICATION

Applicant	:	Zoetronics Technology Co., Ltd.	
Manufacturer	:	Zoetronics Technology Co., Ltd.	
EUT Description	:	Bluetooth Heart Rate Monitor	
<b>FCC ID</b>	<b>:</b>	<b>B5OWT11</b>	
		(A) Model No.	: TA1102
		(B) Serial No.	: N/A
		(C) Power Supply	: DC 3.7V

### Measurement Procedure Used:

FCC RULES AND REGULATIONS PART 15 SUBPART C, Oct. 2011  
AND ANSI C63.4/2003

(FCC CFR 47 Part 15C, §15.207 and §15.209 and §15.247)

The device described above was tested by AUDIX Technology Corporation to determine the maximum emission levels emanating from the device. The maximum emission levels were compared to the FCC Part 15 subpart C limits.

The measurement results are contained in this test report and AUDIX Technology Corporation is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliant with the FCC official limits.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of AUDIX Technology Corporation.

Date of Test : Nov. 19 ~ 20, 2012                      Date of Report : Nov. 20, 2012

Producer : Annie Yu  
(Annie Yu/Assistant Administrator)

Signatory : Ben Cheng  
(Ben Cheng/Manager)

## 1. GENERAL INFORMATION

### 1.1. Description of Device (EUT)

Description	:	Bluetooth Heart Rate Monitor
Model Number	:	TA1102
Serial Number	:	N/A
Applicant	:	Zoetronics Technology Co., Ltd. 7F, No.45, Jilin Road, Taipei City 104, Taiwan
Manufacturer	:	Zoetronics Technology Co., Ltd. 7F, No.45, Jilin Road, Taipei City 104, Taiwan
Fundamental Range	:	2402MHz - 2480MHz
Channel Number	:	79
Radio Technology	:	GFSK, /4DQPSK, 8-DPSK
Antenna Gain	:	2.13dBi
Date of Receipt of Sample	:	Nov. 19, 2012
Date of Test	:	Nov. 19 ~ 20, 2012

### 1.2. Description of Test Facility

Name of Firm	:	<b>AUDIX Technology Corporation</b> EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan, R.O.C.
Test Site (Semi-AC)	:	<b>Semi-Anechoic Chamber</b> No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan, R.O.C. Federal Communication Commission Registration Number: 90993 Date of Renewal: May 14, 2009
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

### 1.3. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Radiation Test (Distance: 3m)	30MHz~300MHz	±2.91dB
	300MHz~1000MHz	±2.94dB
	Above 1GHz	± 5.02dB

Remark : Uncertainty =  $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	± 0.2kHz
Carrier Frequency Separation	± 0.2kHz
Time Of Occupancy	± 0.03sec
Maximum peak Output power	± 0.52dBm
Emission Limitations	± 0.13dB
Band Edges	± 0.13dB

## **2. CONDUCTED EMISSION MEASUREMENT**

【The EUT only employs battery power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】

### 3. RADIATED EMISSION MEASUREMENT

#### 3.1. Test Equipment

The following test equipment was used during the radiated emission measurement:

##### 3.1.1. For Frequency Range 30MHz~1000MHz (at Semi-Anechoic Chamber)

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 07, 12'	Aug. 06, 13'
2.	Test Receiver	R & S	ESCS30	100338	Jul. 04, 12'	Jul. 03, 13'
3.	Amplifier	HP	8447D	2944A06305	Feb. 13, 12'	Feb. 12, 13'
4.	Log Periodic Antenna	Schwarzbeck	UHALP 9108-A	0810	Mar. 03, 12'	Mar. 02, 13'
5.	Biconical Antenna	CHASE	VBA6106A	1264	Mar. 03, 12'	Mar. 02, 13'

##### 3.1.2. For Frequency Above 1GHz (at Semi-Anechoic Chamber)

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 07, 12'	Aug. 06, 13'
2.	Test Receiver	R & S	ESCS30	100338	Jul. 04, 12'	Jul. 03, 13'
3.	Amplifier	HP	8449B	3008A00529	Dec. 09, 11'	Dec. 08, 12'
4.	2.4GHz Notch Filter	EWT	EWT-14-007 0-R1	G2	Feb. 14, 12'	Feb. 13, 13'
5.	3.5G High Pass Filter	HP	84300-80038	005	Jan. 04, 12'	Jan. 03, 13'
6.	Horn Antenna	EMCO	3115	9112-3775	May 09, 12'	May 08, 13'
7.	Horn Antenna	EMCO	3116	2653	Oct. 15, 12'	Oct. 14, 13'

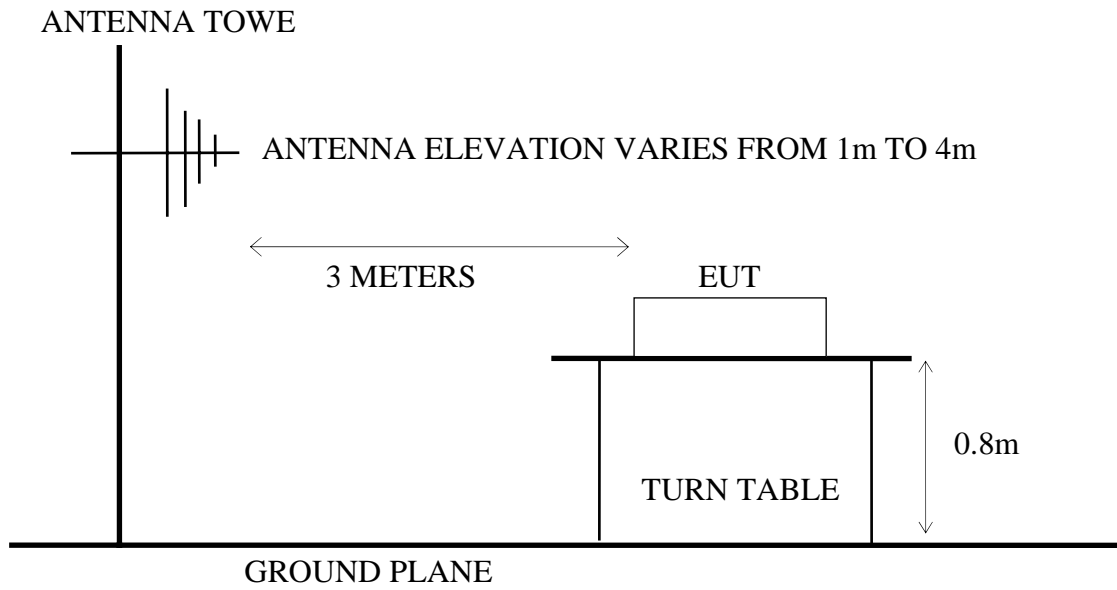
#### 3.2. Block Diagram of Test Setup

##### 3.2.1. Block Diagram of connection between EUT and simulators

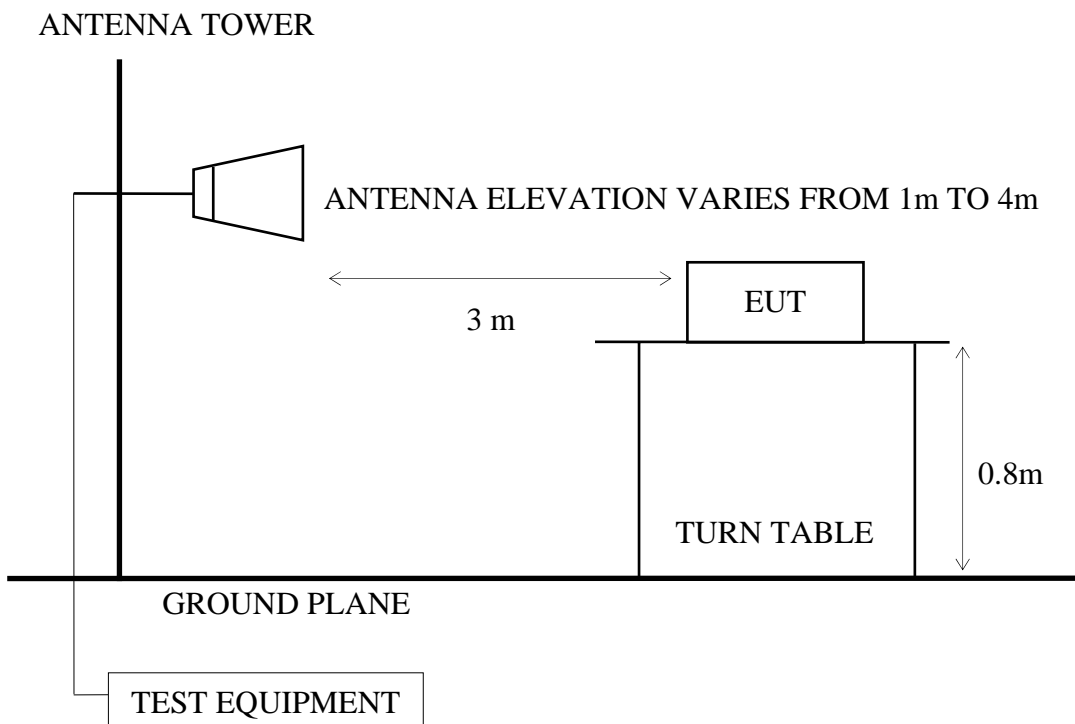
**BLUETOOTH HEART RATE MONITOR (EUT)**



### 3.2.2. Semi-Anechoic Chamber (3m) Setup Diagram for 30-1000MHz



### 3.2.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



### 3.3. Radiated Emission Limits (§15.209)

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMITS	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

- Remark :
- (1) Emission level ( $\text{dB}\mu\text{V/m}$ ) = 20 log Emission level ( $\mu\text{V/m}$ )
  - (2) The tighter limit applies at the edge between two frequency bands.
  - (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
  - (4) The limits in this table are based on CFR 47 Part 15.205(a)(b) and Part 15.209 (a).
  - (5) The over 1GHz limit, FCC limit is used based on CFR 47 Part 15.35(b) and Part 15.205(b) & Part 15.209(e) and Part 15.207(c).

### 3.4. Operating Condition of EUT

- 3.4.1. Set up the EUT (Bluetooth Heart Rate Monitor) as shown on 3.2.
- 3.4.2. To turn on the power of the EUT then press the button to switch the modulation and channel.
- 3.4.3. Transmitting Mode: The EUT was set to continuously transmit signals at 2402MHz, 2441MHz and 2480MHz during the testing.

### 3.5. Test Procedure

The EUT and its simulators were placed on a turn table which was 0.8 meter above the ground. The turn table rotated 360 degrees to determine the position of the maximum emission level. EUT was set to 3 meters away from the receiving antenna which was mounted on an antenna tower. The antenna moved up and down between 1 to 4 meters to find out the maximum emission level. Broadband antenna such as calibrated biconical and log-periodical antenna or horn antenna were used as a receiving antenna. Both horizontal and vertical polarization of the antenna were set on measurement. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4-2003 regulation during radiated measurement.

The bandwidth of the R&S Test Receiver was set at 120kHz. (For 30MHz to 1000MHz)

The resolution bandwidth and video bandwidth of test spectrum analyzer is 1MHz for peak detection (PK) at frequency above 1GHz.

The resolution bandwidth of test spectrum analyzer is 1MHz and the video bandwidth is 10Hz for average detection (AV) at frequency above 1GHz.

The frequency range from 30MHz to 25GHz (Up to 10<sup>th</sup> harmonics from fundamental frequency) was checked. 30MHz to 1000MHz was measured with Quasi-Peak detector. Above 1GHz was measured with peak and average detector. For average reading in frequency from 5.5G to 25GHz, we checked it in 1 meter distance and with a shorter cable 2 meter instead of original's. There is no signal exist.

### 3.6. Radiated Emission Measurement Results

**PASSED.** (All the emissions not reported for there is no signal be found.)

EUT : Bluetooth Heart Rate Monitor M/N : TA1102

Test Date : Nov. 20, 2012 Temperature : 24 Humidity : 59%

The radiation tests on three different axes (stand, lie and side), we assessed the value and we selected the worst radiation position "lie" for our measured results.

**For Frequency Range 30MHz-1000MHz:**

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only the worst case (8-DPSK) was reported in this report.]**

The EUT with the following test modes was tested during the testing and all the test results are listed in section 3.6.1.

No.	Test Mode and Frequency		Reference Test Data No.	
			Horizontal	Vertical
1.	Transmitting	2402MHz (CH0)	# 2	# 1
2.		2441MHz (CH39)	# 1	# 2
3.		2480MHz (CH78)	# 2	# 1

\* Type of modulation: 8-DPSK

\* All above final readings were measured with Peak detector.

\* Pursuant to ANSI C63.4 8.3.1.2, when peak value complies with the average limit, we didn't perform measurement in average detector.

**For Frequency Range above 1GHz:**

The emissions (up to 25GHz) not reported for there is no signal be found.

**For Restricted Bands:**

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK) were reported in this report.]**

The EUT was tested in restricted bands and all the test results are listed in section 3.6.2. (The restricted bands defined in part 15.205(a))

No.	Test Mode and Frequency		Reference Test Data No.	
			Horizontal	Vertical
1.	Transmitting	2402MHz (CH0)	# 3, # 4	# 1, # 2
2.		2480MHz (CH78)	# 5, # 6	# 7, # 8

\* Type of modulation: 8-DPSK.

## 3.6.1. Frequency Range 30MHz-1000MHz Measurement Result

**Transmit, Frequency: 2402MHz**

Site no. : A/C Chamber site                      Data no. : 2  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2402 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	102.750	17.40	2.10	9.72	29.22	43.50	14.28	Peak
2	891.360	25.06	7.30	2.22	34.58	46.00	11.42	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : A/C Chamber site                      Data no. : 1  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2402 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	51.340	15.96	1.50	9.36	26.82	40.00	13.18	Peak
2	63.950	11.90	1.67	13.51	27.08	40.00	12.92	Peak
3	196.840	21.94	3.00	3.57	28.51	43.50	14.99	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

**Transmit, Frequency: 2441MHz**

Site no. : A/C Chamber site                      Data no. : 1  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2441 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	102.750	17.40	2.10	9.34	28.84	43.50	14.66	Peak
2	966.050	26.89	7.70	1.13	35.72	54.00	18.28	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : A/C Chamber site                      Data no. : 2  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2441 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	54.250	14.79	1.50	8.32	24.61	40.00	15.39	Peak
2	107.600	17.87	2.20	8.67	28.75	43.50	14.75	Peak
3	891.360	25.06	7.30	1.73	34.09	46.00	11.91	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

**Transmit, Frequency: 2480MHz**

Site no. : A/C Chamber site                      Data no. : 2  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2480 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	102.750	17.40	2.10	10.04	29.54	43.50	13.96	Peak
2	108.570	18.02	2.20	13.85	34.07	43.50	9.43	Peak
3	974.780	26.52	7.70	1.63	35.85	54.00	18.15	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : A/C Chamber site                      Data no. : 1  
 Dis. / Ant. : 3m    VBA6106A/UHALP9108A      Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 24°C/59%                      Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2480 MHz (8DPSK)

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
1	61.040	12.55	1.60	14.27	28.42	40.00	11.58	Peak
2	84.320	14.58	1.90	14.98	31.46	40.00	8.54	Peak
3	870.020	25.71	7.20	1.47	34.38	46.00	11.62	Peak

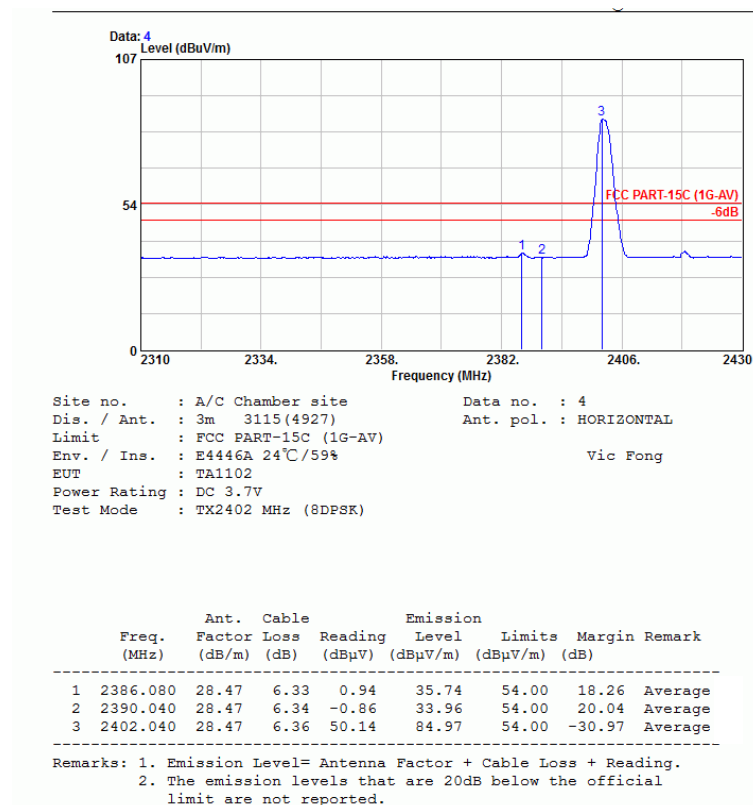
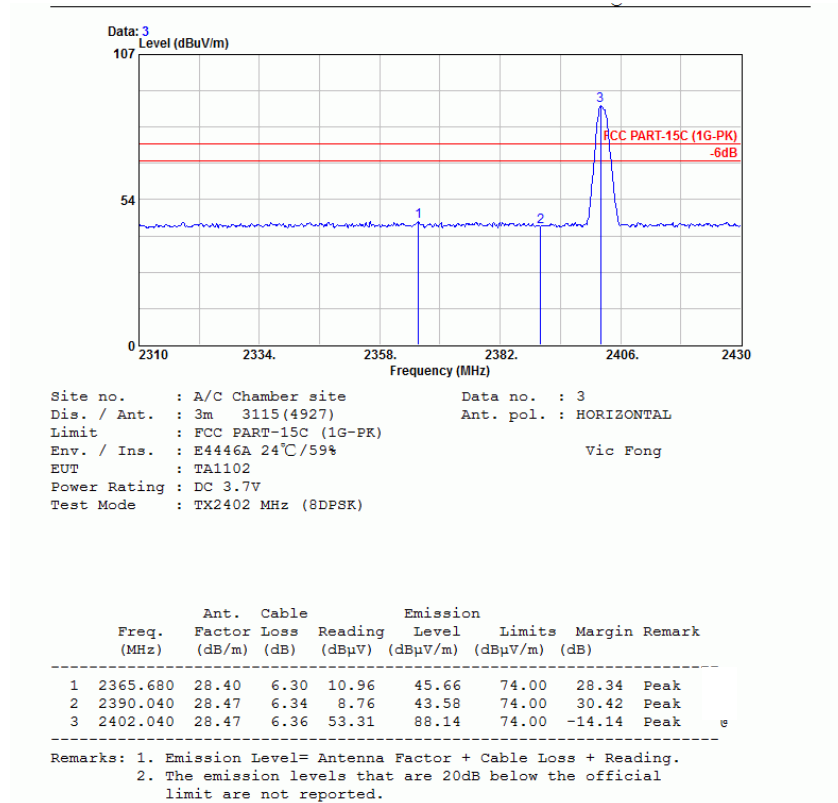
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

## 3.6.2. Restricted Bands Measurement Results

Date of Test : Nov. 19, 2012 Temperature : 24

EUT : Bluetooth Heart Rate Monitor Humidity : 59%

Test Mode : Transmitting Mode, Frequency: 2402MHz (CH0)

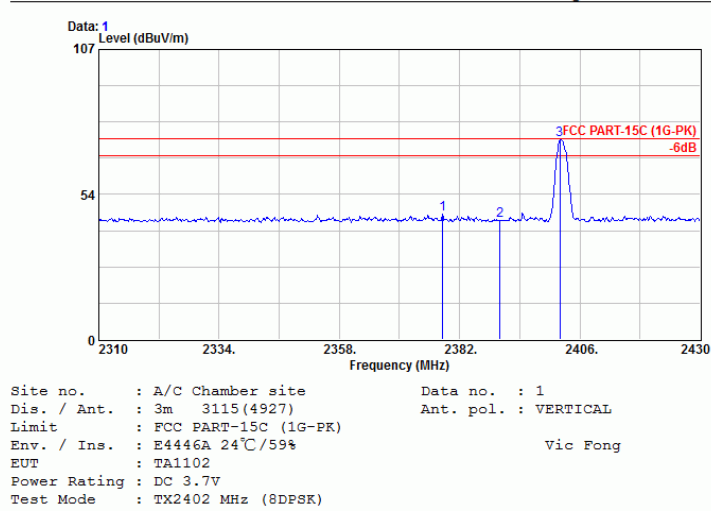




Date of Test : Nov. 19, 2012 Temperature : 24

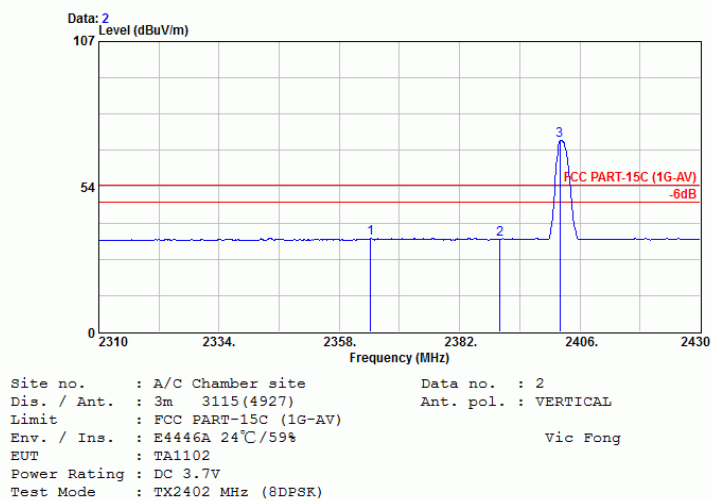
EUT : Bluetooth Heart Rate Monitor Humidity : 59%

Test Mode : Transmitting Mode, Frequency: 2402MHz (CH0)



	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2378.640	28.43	6.32	11.38	46.14	74.00	27.86	Peak
2	2390.040	28.47	6.34	8.93	43.75	74.00	30.25	Peak
3	2402.040	28.47	6.36	38.80	73.63	74.00	0.37	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



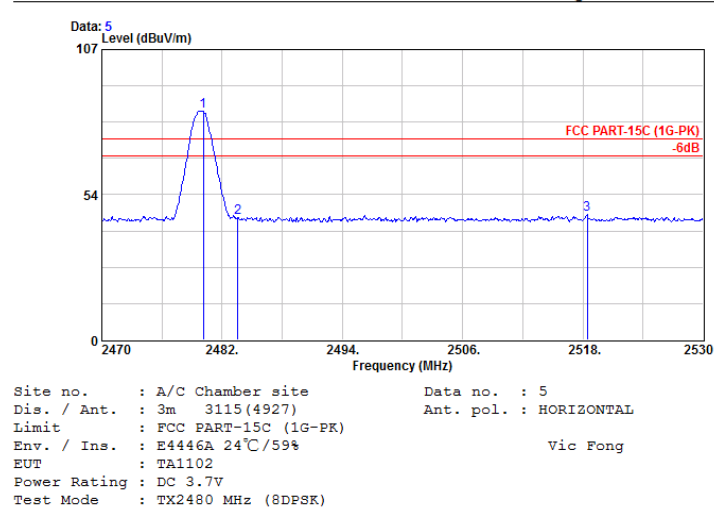
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2364.240	28.40	6.30	-0.22	34.48	54.00	19.52	Average
2	2390.040	28.47	6.34	-0.79	34.03	54.00	19.97	Average
3	2402.040	28.47	6.36	35.79	70.62	54.00	-16.62	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Date of Test : Nov. 19, 2012 Temperature : 24

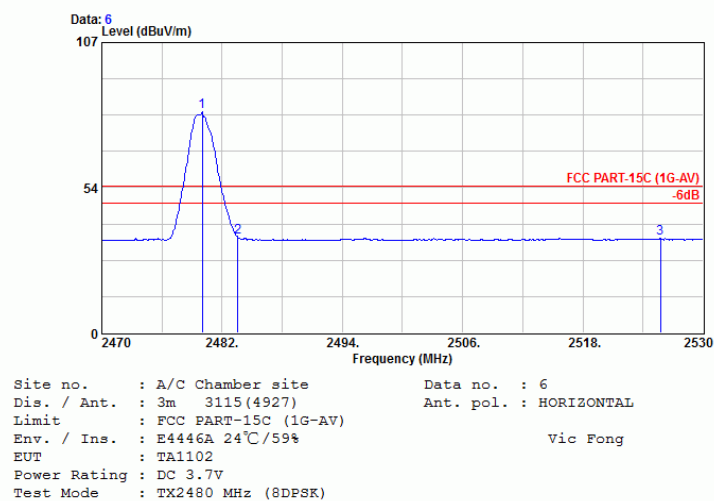
EUT : Bluetooth Heart Rate Monitor Humidity : 59%

Test Mode : Transmitting Mode, Frequency: 2480MHz (CH78)



	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.140	28.66	6.44	49.30	84.41	74.00	-10.41	Peak
2	2483.560	28.66	6.45	9.86	44.98	74.00	29.02	Peak
3	2518.420	28.76	6.49	10.98	46.23	74.00	27.77	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



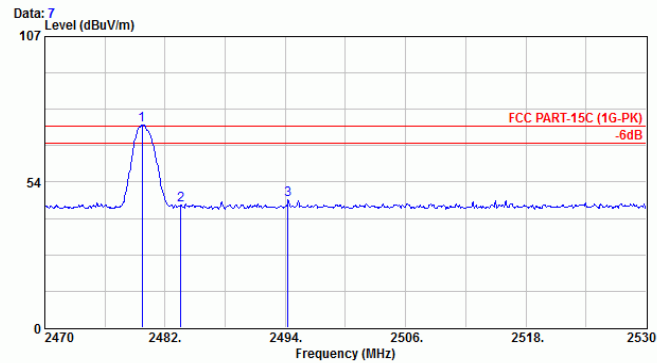
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.020	28.66	6.44	46.34	81.45	54.00	-27.45	Average
2	2483.560	28.66	6.45	0.19	35.30	54.00	18.70	Average
3	2525.740	28.81	6.50	-0.29	35.02	54.00	18.98	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Date of Test : Nov. 19, 2012 Temperature : 24

EUT : Bluetooth Heart Rate Monitor Humidity : 59%

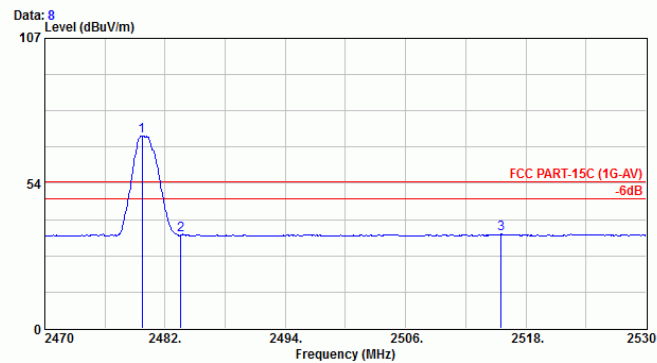
Test Mode : Transmitting Mode, Frequency: 2480MHz (CH78)



Site no. : A/C Chamber site Data no. : 7  
 Dis. / Ant. : 3m 3115(4927) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-PK)  
 Env. / Ins. : E4446A 24°C/59% Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2480 MHz (8DPSK)

	Ant.	Cable		Emission			
Freq.	Factor	Loss	Reading	Level	Limits	Margin	Remark
(MHz)	(dB/m)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)	
1 2479.720	28.66	6.44	39.34	74.44	74.00	-0.44	Peak
2 2483.560	28.66	6.45	9.97	45.09	74.00	28.91	Peak
3 2494.240	28.70	6.46	11.85	47.01	74.00	26.99	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : A/C Chamber site Data no. : 8  
 Dis. / Ant. : 3m 3115(4927) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-AV)  
 Env. / Ins. : E4446A 24°C/59% Vic Fong  
 EUT : TA1102  
 Power Rating : DC 3.7V  
 Test Mode : TX2480 MHz (8DPSK)

	Ant.	Cable		Emission			
Freq.	Factor	Loss	Reading	Level	Limits	Margin	Remark
(MHz)	(dB/m)	(dB)	(dBuV)	(dBuV/m)	(dBuV/m)	(dB)	
1 2479.720	28.66	6.44	35.99	71.09	54.00	-17.09	Average
2 2483.560	28.66	6.45	-0.76	34.35	54.00	19.65	Average
3 2515.540	28.76	6.49	-0.35	34.89	54.00	19.11	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

## 4. 20dB BANDWIDTH MEASUREMENT

### 4.1. Test Equipment

The following test equipment was used during the 20dB bandwidth measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 4.2. Block Diagram of Test Setup

**BLUETOOTH HEART RATE MONITOR (EUT)**

**SPECTRUM ANALYZER**

### 4.3. Specification Limits (§15.247(a)(1))

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 4.4. Operating Condition of EUT

- 4.4.1. Set up the EUT and simulator as shown on 4.2.
- 4.4.2. To turn on the power of all equipment.
- 4.4.3. The EUT (Bluetooth Heart Rate Monitor) was on transmitting frequency function during the testing.

### 4.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 3kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

RBW=1% of the 20dB bandwidth

VBW=RBW

#### 4.6. Test Results

**PASSED.** All the test results are attached in next pages.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

##### 4.6.1.Type of Modulation: 8-DPSK

No.	Channel	Test Frequency	20dB Bandwidth	$\frac{2}{3}$ (20dB Bandwidth)
1.	0	2402MHz	<b>1.116MHz</b>	<b>0.744MHz</b>
2.	39	2441MHz	<b>1.116MHz</b>	<b>0.744MHz</b>
3.	78	2480MHz	<b>1.113MHz</b>	<b>0.742MHz</b>

The maximum two-thirds of the 20dB bandwidth shall be at maximum 0.680MHz.

##### 4.6.2.Type of Modulation: GFSK

No.	Channel	Test Frequency	20dB Bandwidth	$\frac{2}{3}$ (20dB Bandwidth)
1.	0	2402MHz	<b>1.020MHz</b>	<b>0.680MHz</b>
2.	39	2441MHz	<b>1.020MHz</b>	<b>0.680MHz</b>
3.	78	2480MHz	<b>1.020MHz</b>	<b>0.680MHz</b>

The maximum two-thirds of the 20dB bandwidth shall be at maximum 0.744MHz.

Figure 1: 8-DPSK, Channel 0, Frequency: 2402MHz

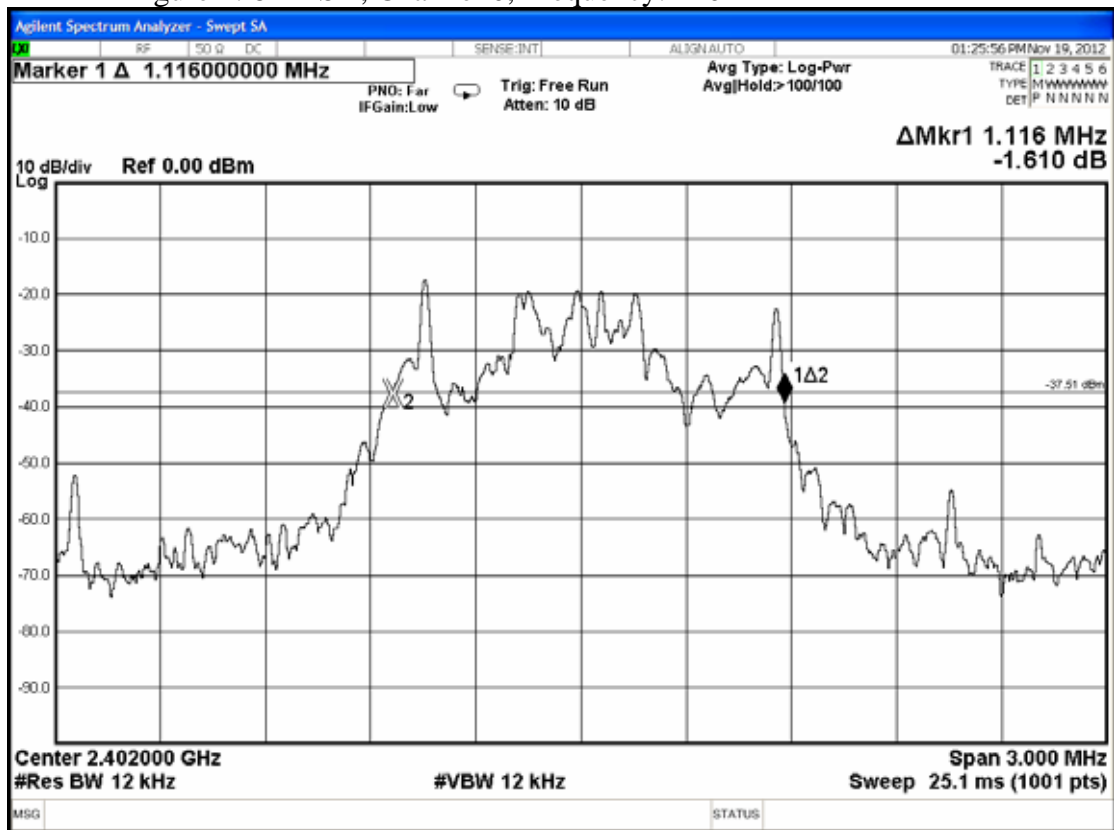


Figure 2: 8-DPSK, Channel 39, Frequency: 2441MHz

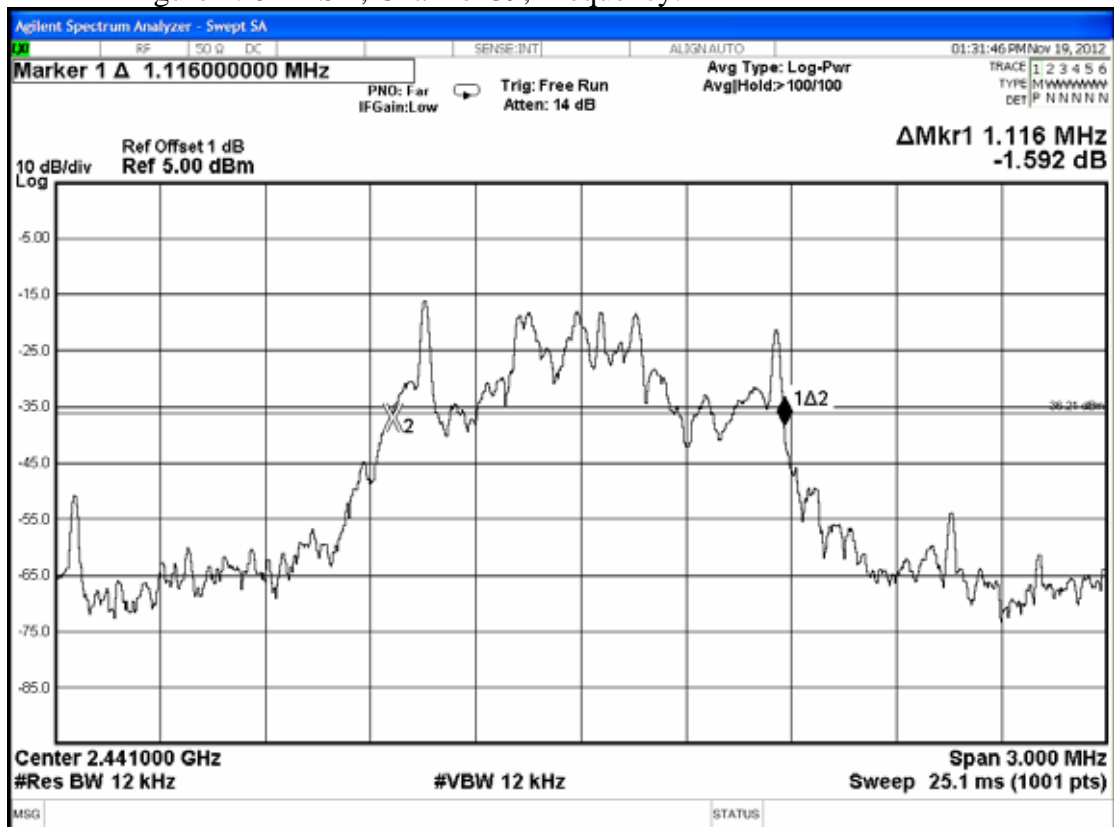


Figure 3: 8-DPSK, Channel 78, Frequency: 2480MHz

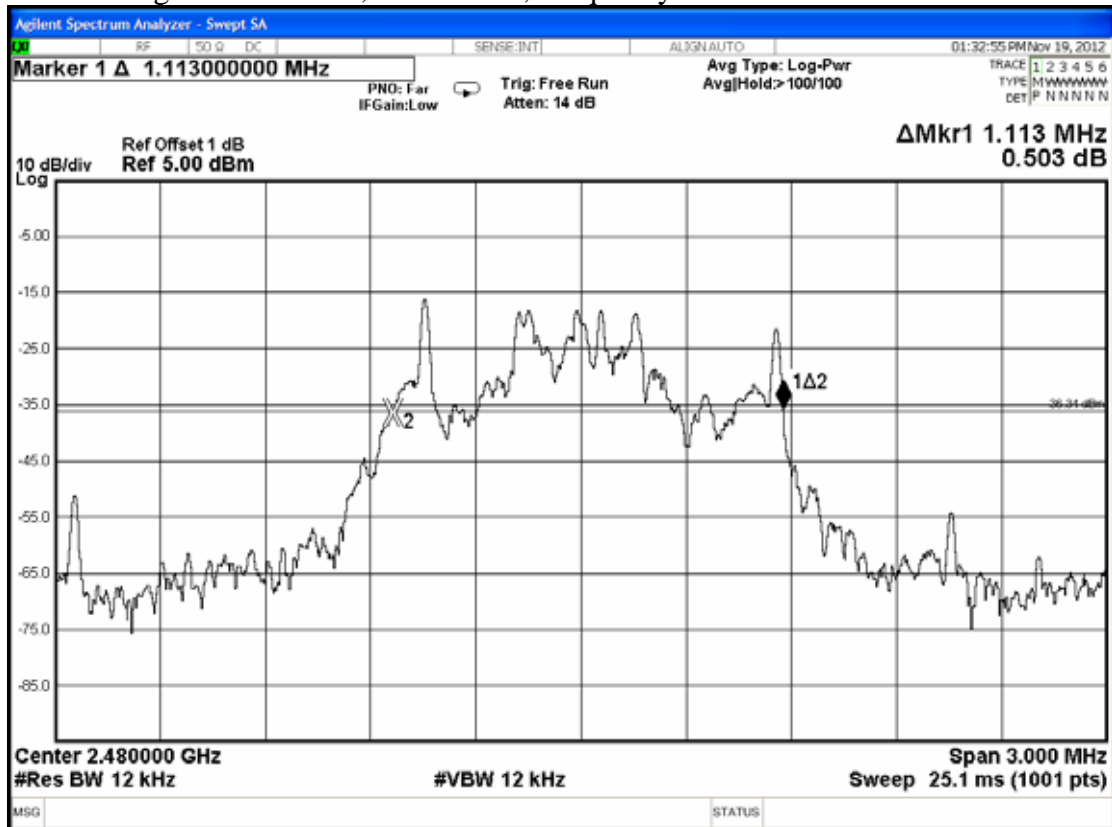


Figure 4: GFSK, Channel 0, Frequency: 2402MHz

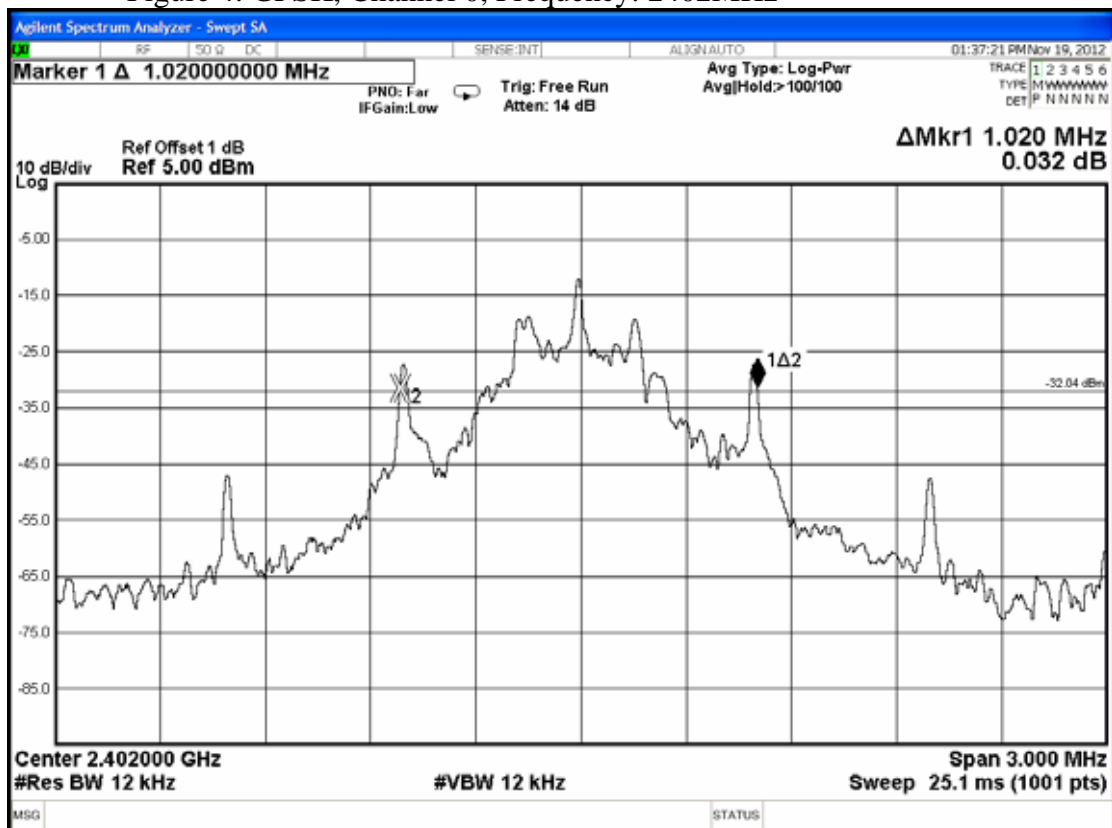


Figure 5: GFSK, Channel 39, Frequency: 2441MHz

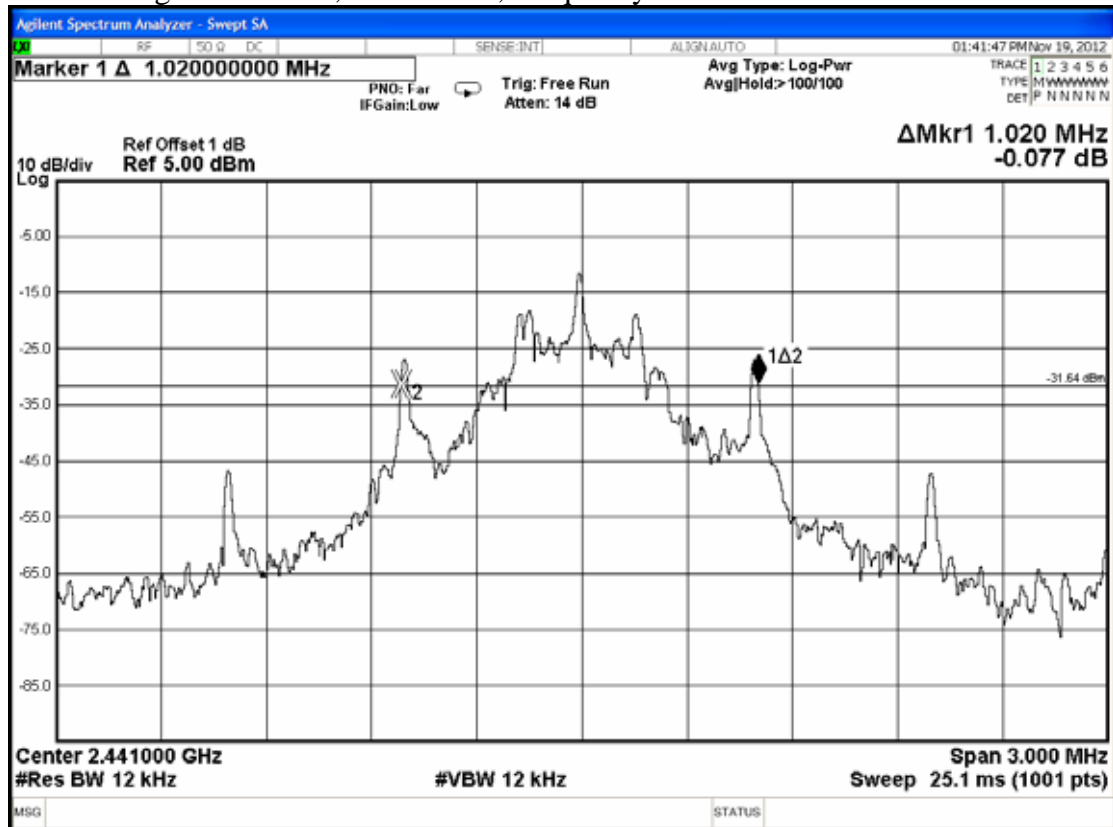
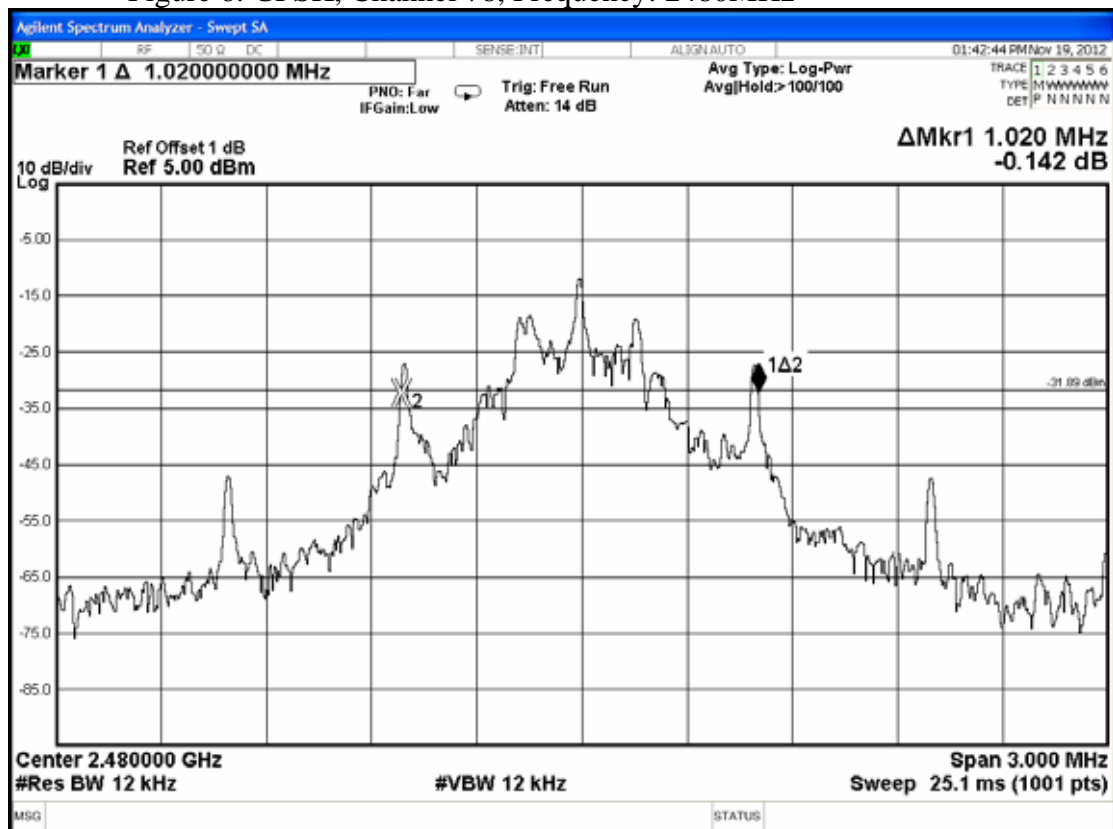


Figure 6: GFSK, Channel 78, Frequency: 2480MHz





## 5. CARRIER FREQUENCY SEPARATION MEASUREMENT

### 5.1. Test Equipment

The following test equipment was used during the carrier frequency separation measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 5.2. Block Diagram of Test Setup

The same as section.4.2.

### 5.3. Specification Limits (§15.247(a)(1))

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output no greater than 125mW.

### 5.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 5.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The channel separation was measure by spectrum analyzer with 39kHz RBW and 39kHz VBW. The video bandwidth not to be smaller than resolution bandwidth, the peak was mark on adjacent bandwidth, the between of peak is carrier frequency separation.

RBW=1% Span

VBW=RBW

## 5.6. Test Results

**PASSED.** All the test results are attached in next pages.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

### 5.6.1.Type of Modulation: 8-DPSK

1. 2402MHz adjacent channel of carrier frequency separation: 1.004MHz<sub>o</sub>.
2. 2441MHz adjacent channel of right carrier frequency separation: 1.004MHz<sub>o</sub>.
3. 2441MHz adjacent channel of left carrier frequency separation: 1.004MHz<sub>o</sub>.
4. 2480MHz adjacent channel of carrier frequency separation: 1.004MHz<sub>o</sub>.

[Above values have met the requirement as specified in section 4.3: 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.]

### 5.6.2.Type of Modulation: GFSK

1. 2402MHz adjacent channel of carrier frequency separation: 1.004MHz<sub>o</sub>.
2. 2441MHz adjacent channel of right carrier frequency separation: 1.004MHz<sub>o</sub>.
3. 2441MHz adjacent channel of left carrier frequency separation: 1.004MHz<sub>o</sub>.
4. 2480MHz adjacent channel of carrier frequency separation: 1.004MHz<sub>o</sub>.

[Above values have met the requirement as specified in section 4.3: 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.]

Figure 1: 8-DPSK, 2402MHz adjacent channel of carrier frequency separation



Figure 2: 8-DPSK, 2441MHz adjacent channel of right carrier frequency separation

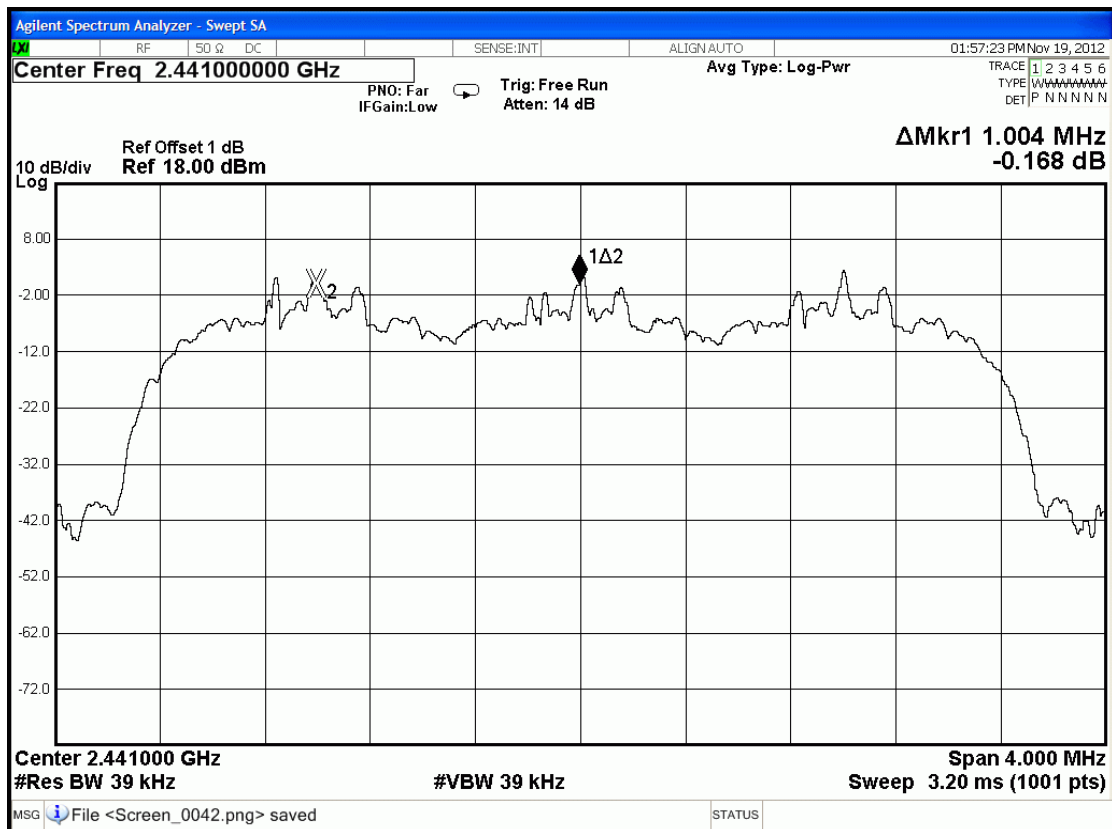


Figure 3: 8-DPSK, 2441MHz adjacent channel of left carrier frequency separation

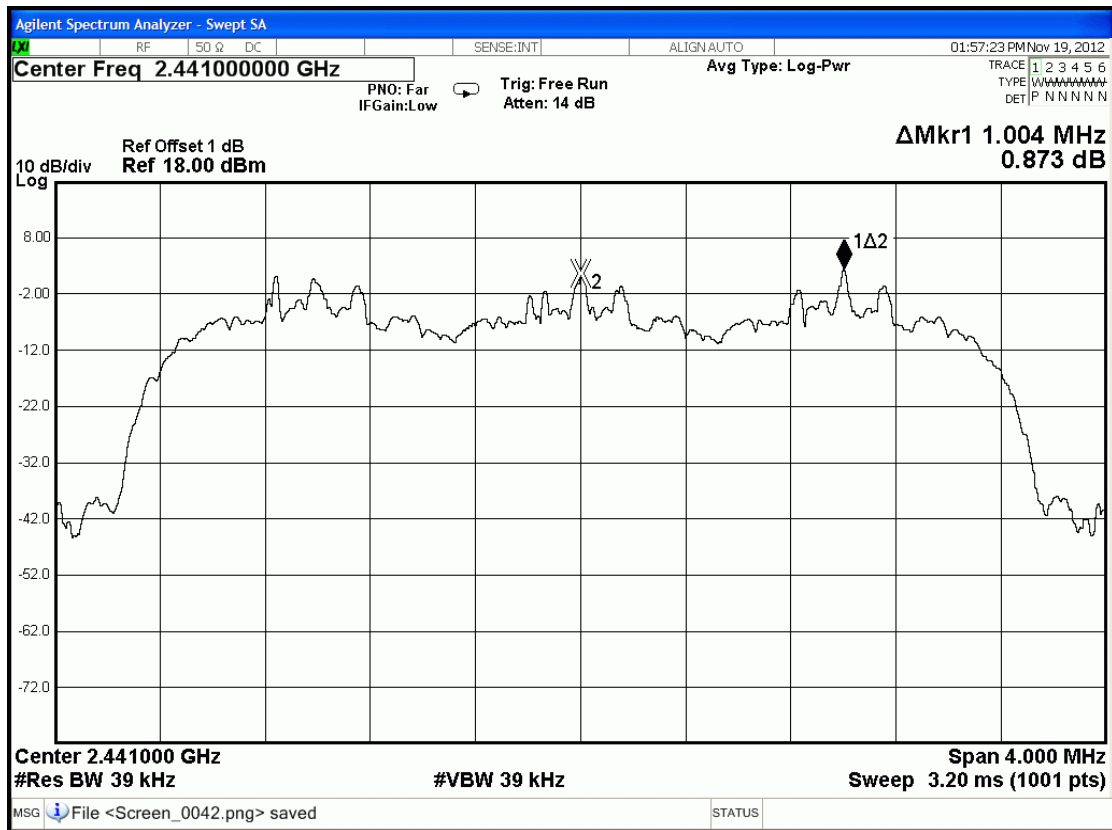


Figure 4: 8-DPSK, 2480MHz adjacent channel of carrier frequency separation



Figure 5: GFSK, 2402MHz adjacent channel of carrier frequency separation



Figure 6: GFSK, 2441MHz adjacent channel of right carrier frequency separation

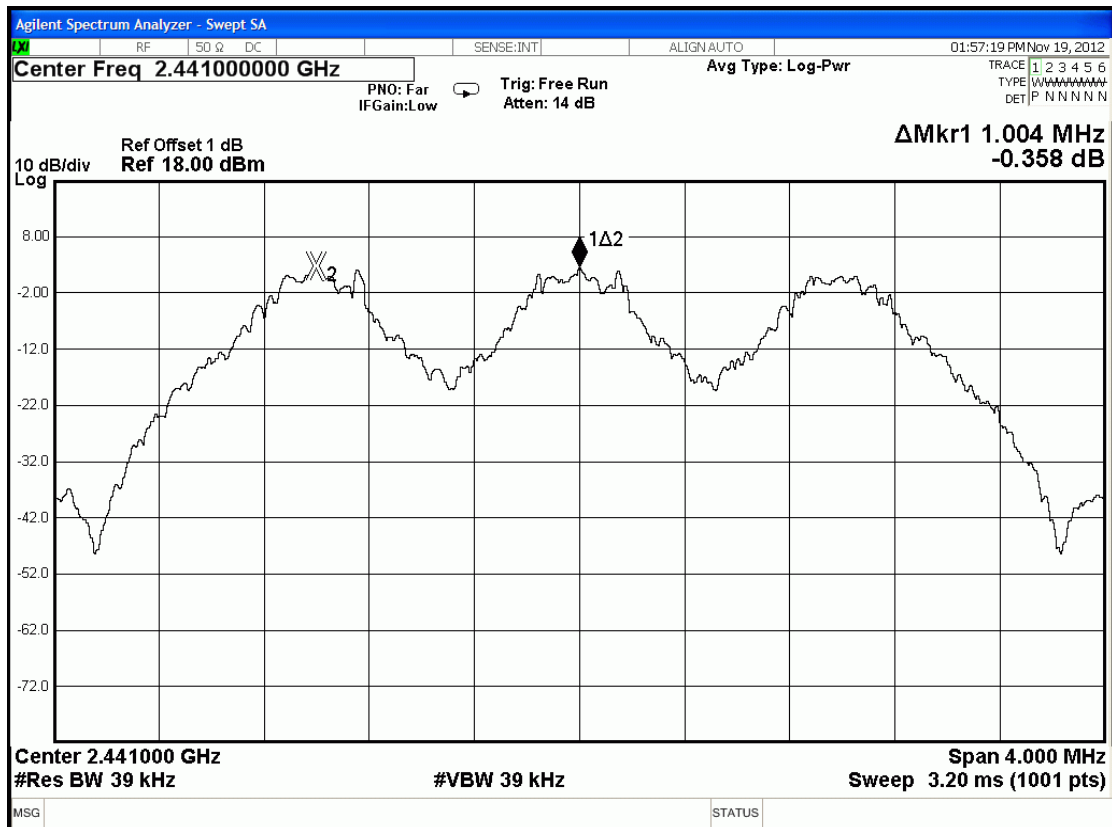


Figure 7: GFSK, 2441MHz adjacent channel of left carrier frequency separation

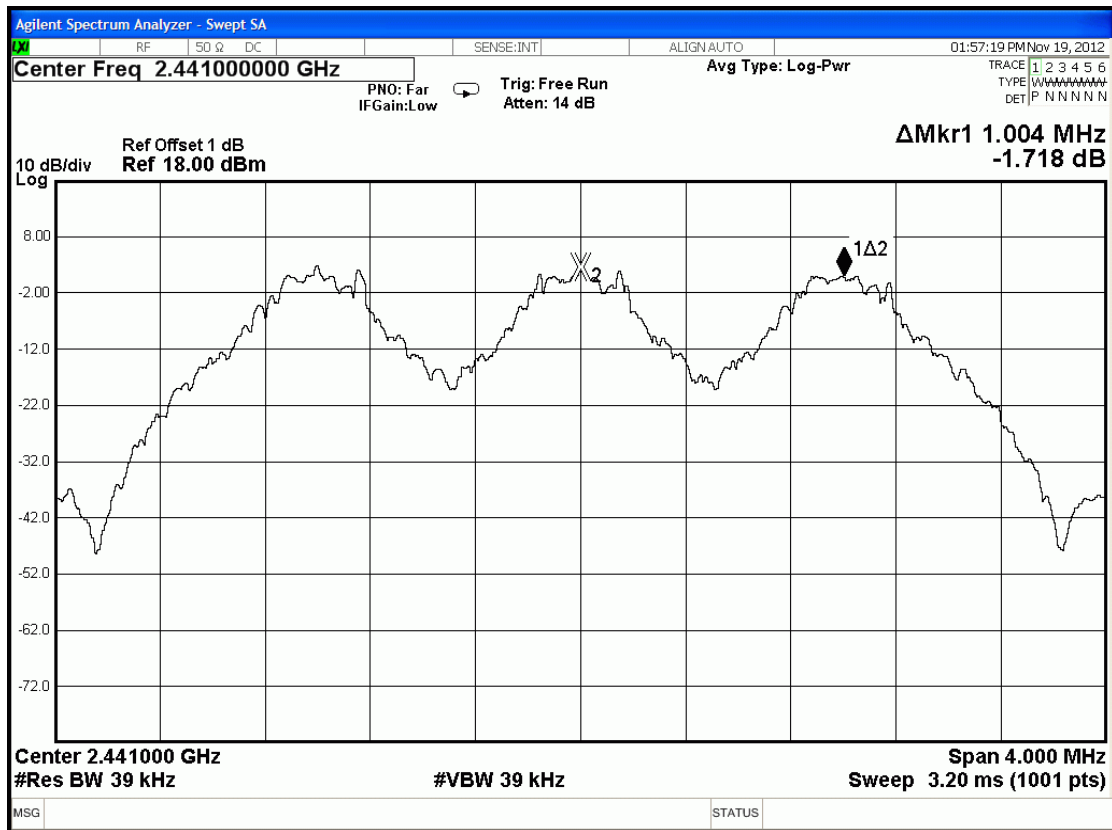


Figure 8: GFSK, 2480MHz adjacent channel of carrier frequency separation



## 6. TIME OF OCCUPANCY MEASUREMENT

### 6.1. Test Equipment

The following test equipment was used during the time of occupancy measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 6.2. Block Diagram of Test Setup

The same as section.4.2.

### 6.3. Specification Limits (§15.247(a)(1)(iii))

Frequency hopping systems in the 2400-2483.5MHz shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by number of hopping channels employed.

### 6.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 6.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 1MHz RBW and 1MHz VBW.  $VBW \geq RBW$  ; Span=zero span.

Centred on a hopping channel sweep=as necessary to capture the entire dwell time per hopping channel ; Detector function=peak ; Trace=Max hold

## 6.6. Test Results

**PASSED.** All the test results are attached in next pages.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24 Humidity : 60%

### 6.6.1. Type of Modulation : 8-DPSK, Test Frequency : 2441MHz

Duty cycle: 79channels\*0.4 seconds = 31.6 seconds

3DH1 : For each 5 seconds of 50 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$50 \text{ channels} * 31.6 \text{ seconds} / 5 * 0.43\text{ms} = 135.88\text{ms} (<400\text{ms})$$

3DH3 : For each 5 seconds of 25 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$25 \text{ channels} * 31.6 \text{ seconds} / 5 * 1.69\text{ms} = 267.020\text{ms} (<400\text{ms})$$

3DH5 : For each 5 seconds of 17 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$17 \text{ channels} * 31.6 \text{ seconds} / 5 * 2.93\text{ms} = 314.799\text{ms} (<400\text{ms})$$



Figure 1: 8-DPSK, 2441MHz, 3DH1

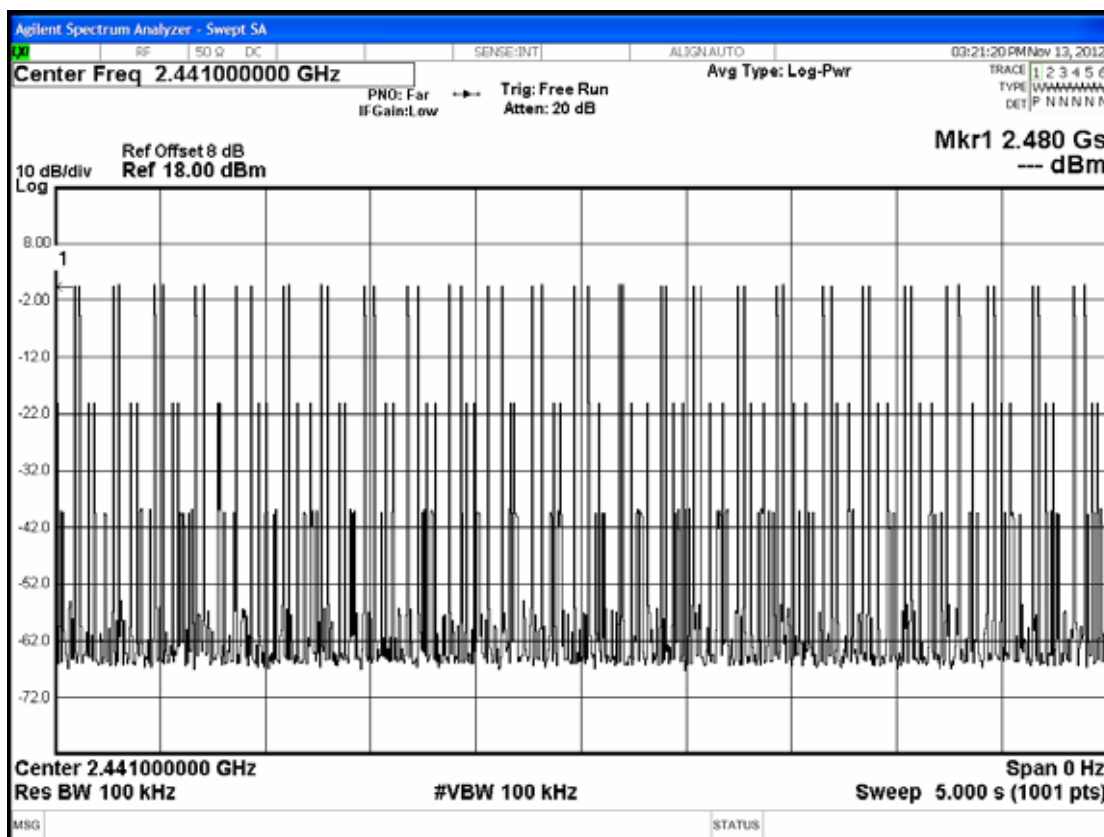
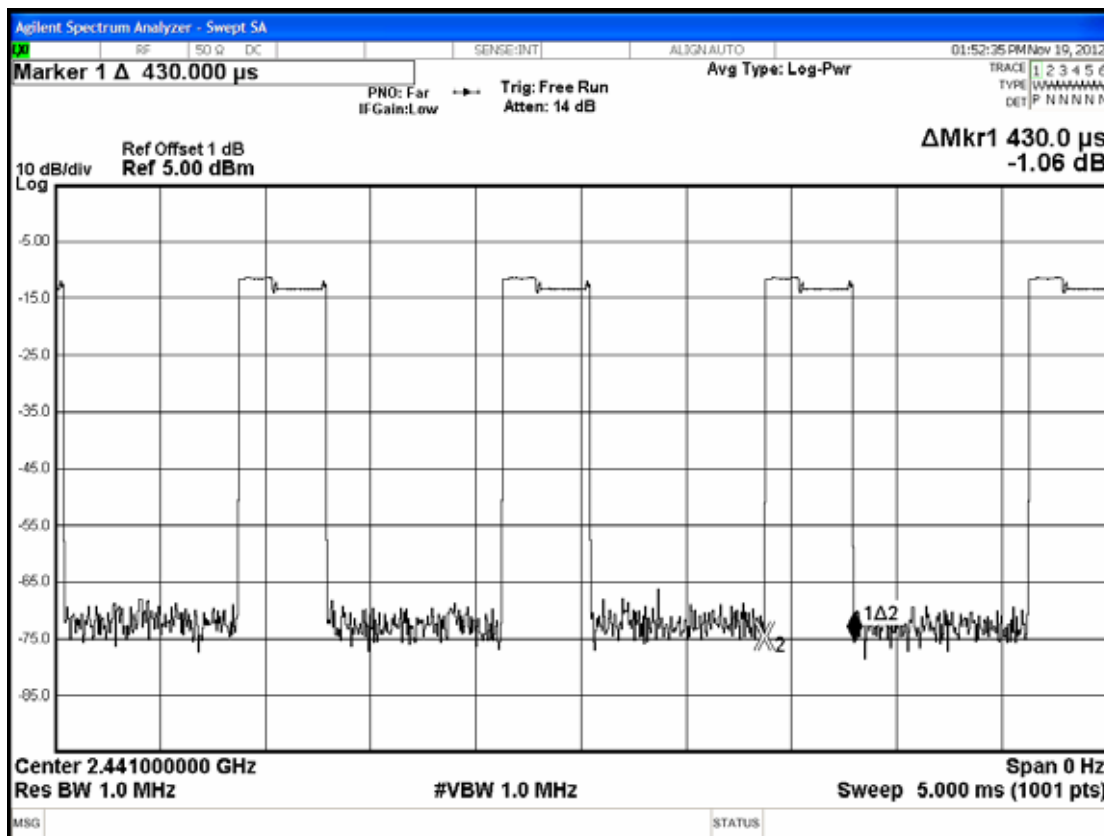


Figure 2: 8-DPSK, 2441MHz, 3DH3

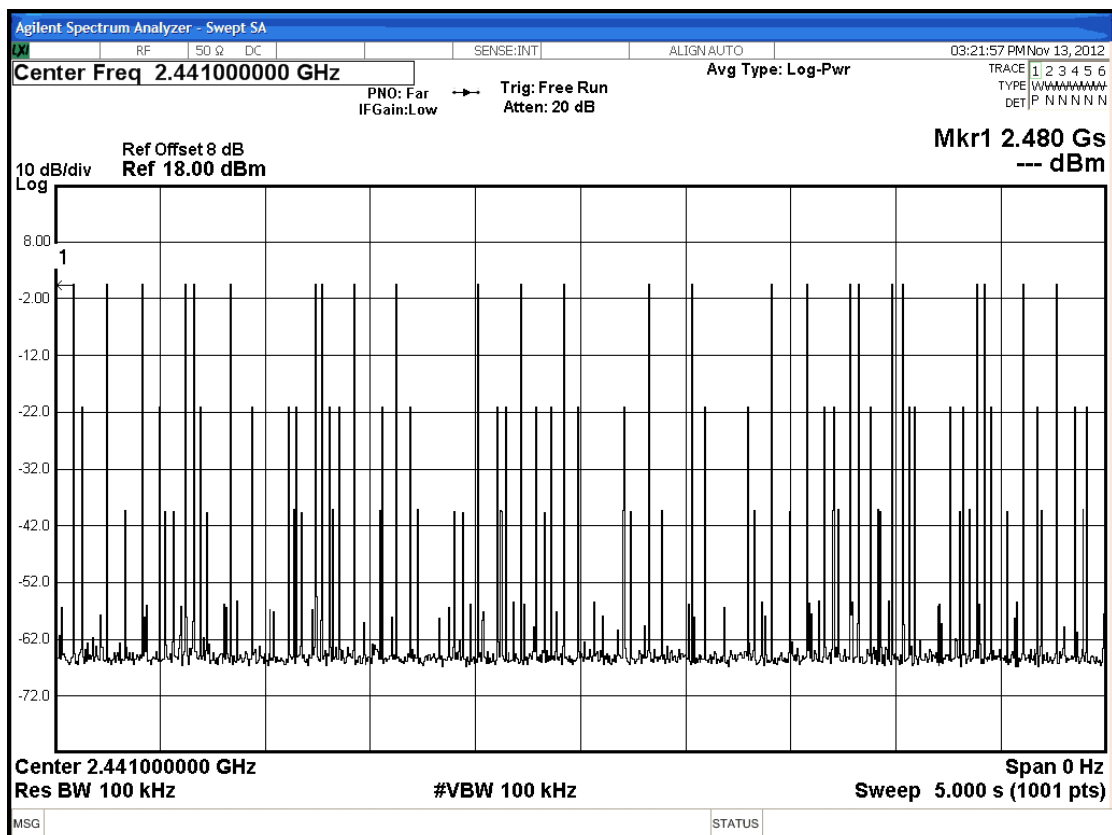
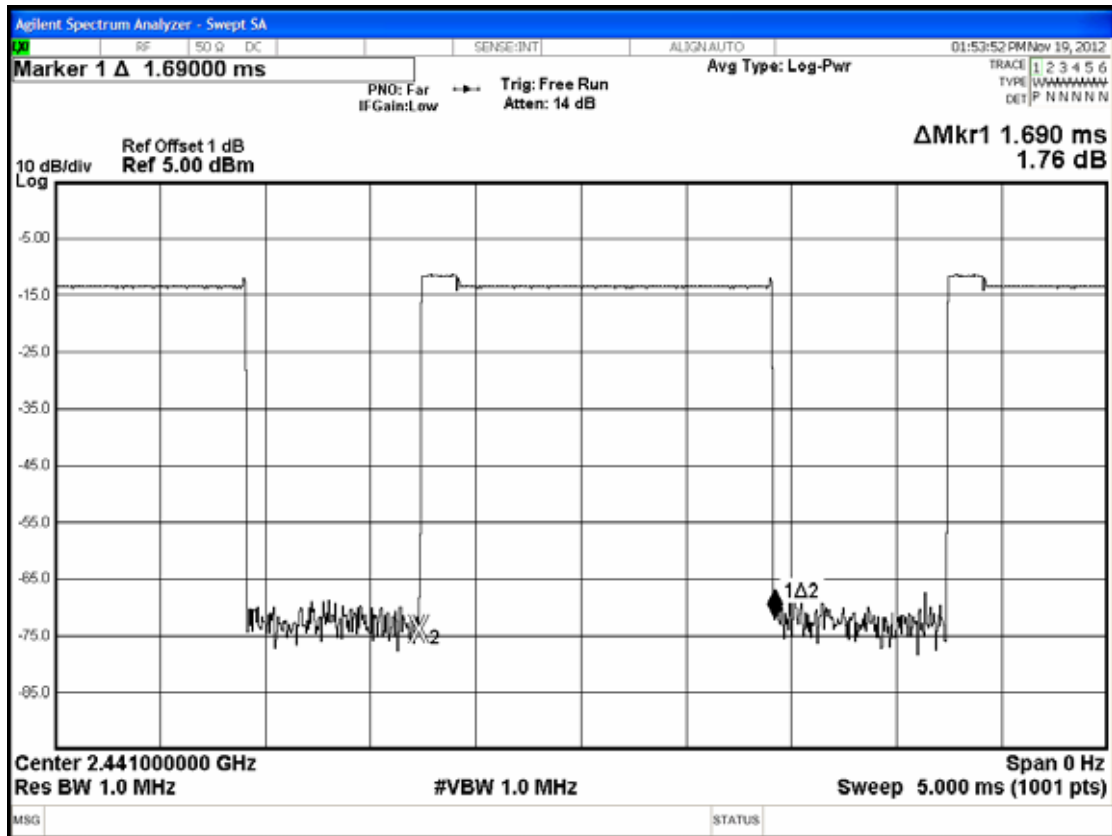
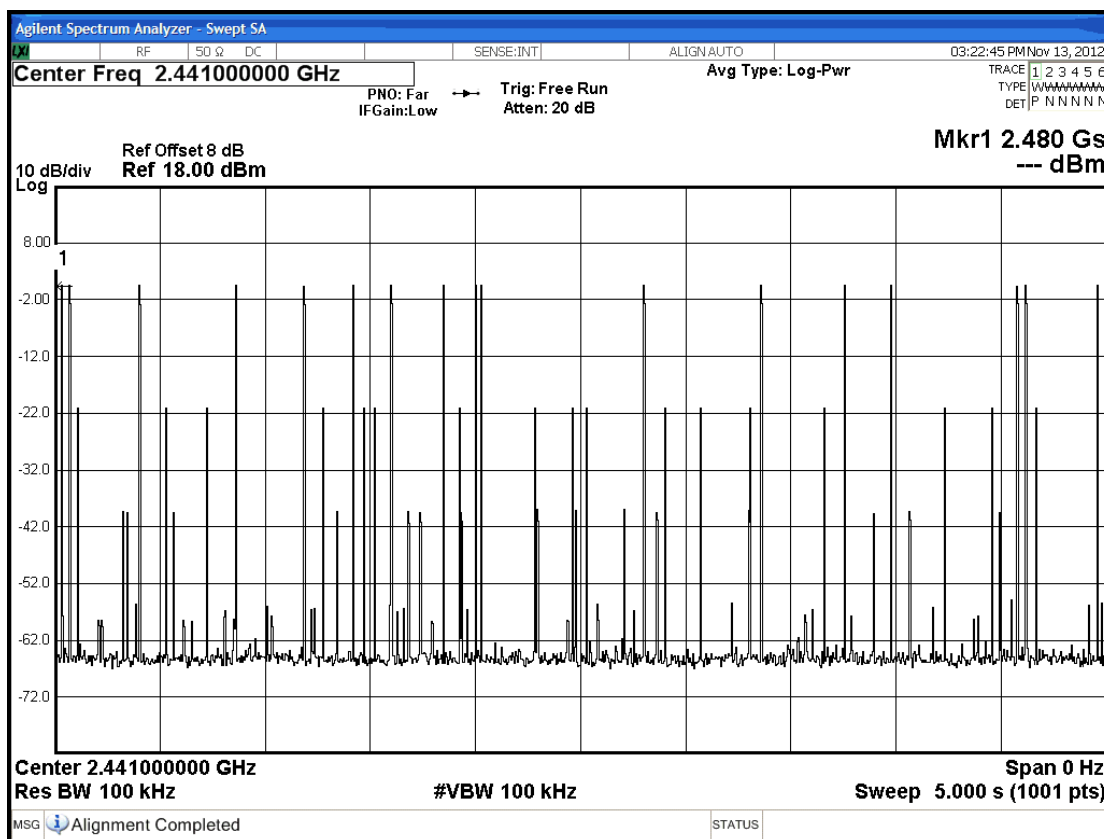
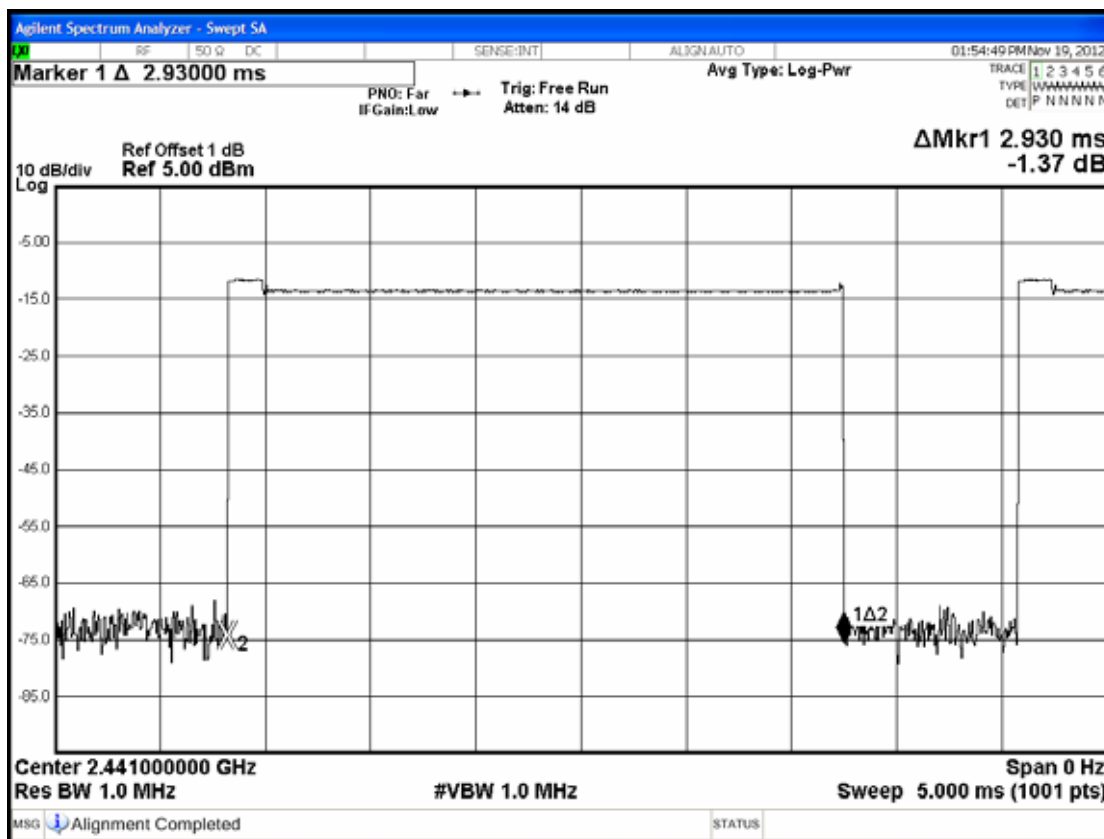


Figure 3: 8-DPSK, 2402MHz, 3DH5



### 6.6.2. Type of Modulation : GFSK, Test Frequency : 2441MHz

Duty cycle: 79channels\*0.4 seconds = 31.6 seconds

DH1 : For each 5 seconds of 51 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$51 \text{ channels} * 31.6 \text{ seconds} / 5 * 0.42\text{ms} = 135.374\text{ms} (<400\text{ms})$$

DH3 : For each 5 seconds of 27 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$27 \text{ channels} * 31.6 \text{ seconds} / 5 * 1.675\text{ms} = 285.822\text{ms} (<400\text{ms})$$

DH5 : For each 5 seconds of 18 channels appearance, the longest time of occupancy for each of 31.6 seconds is:

$$18 \text{ channels} * 31.6 \text{ seconds} / 5 * 2.95\text{ms} = 335.592\text{ms} (<400\text{ms})$$

Figure 4: GFSK, 2441MHz, DH1

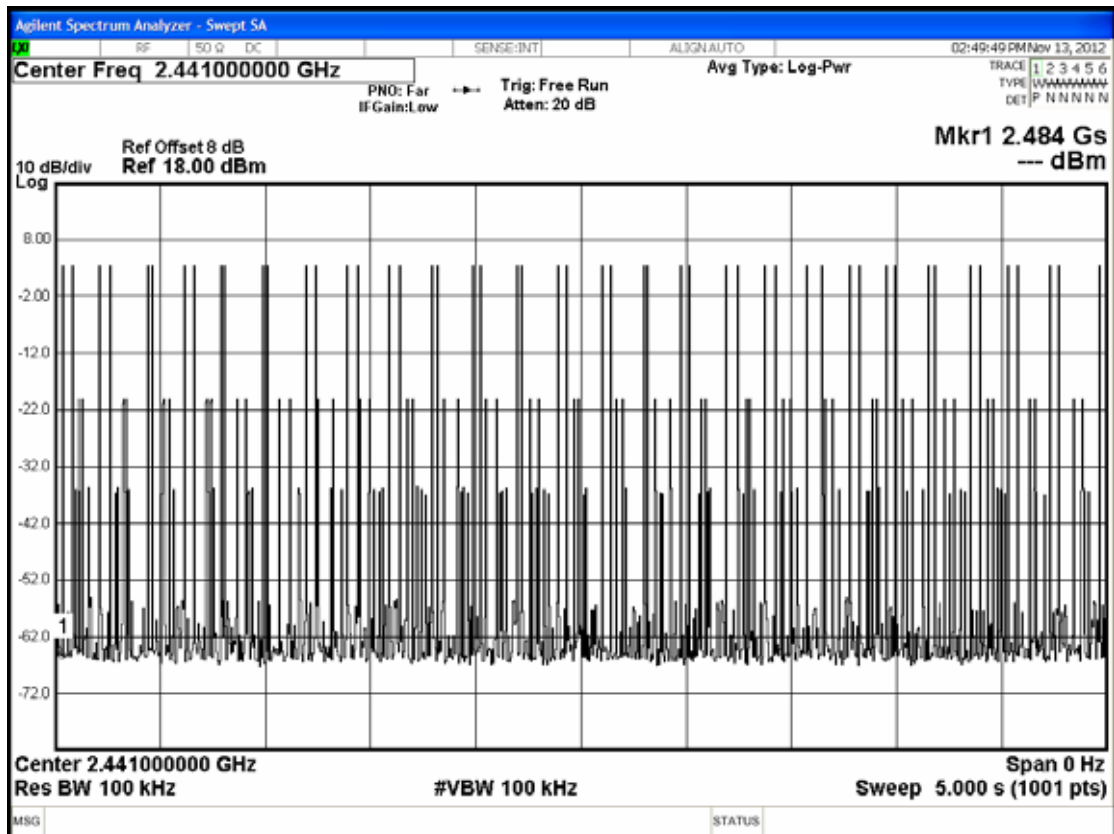
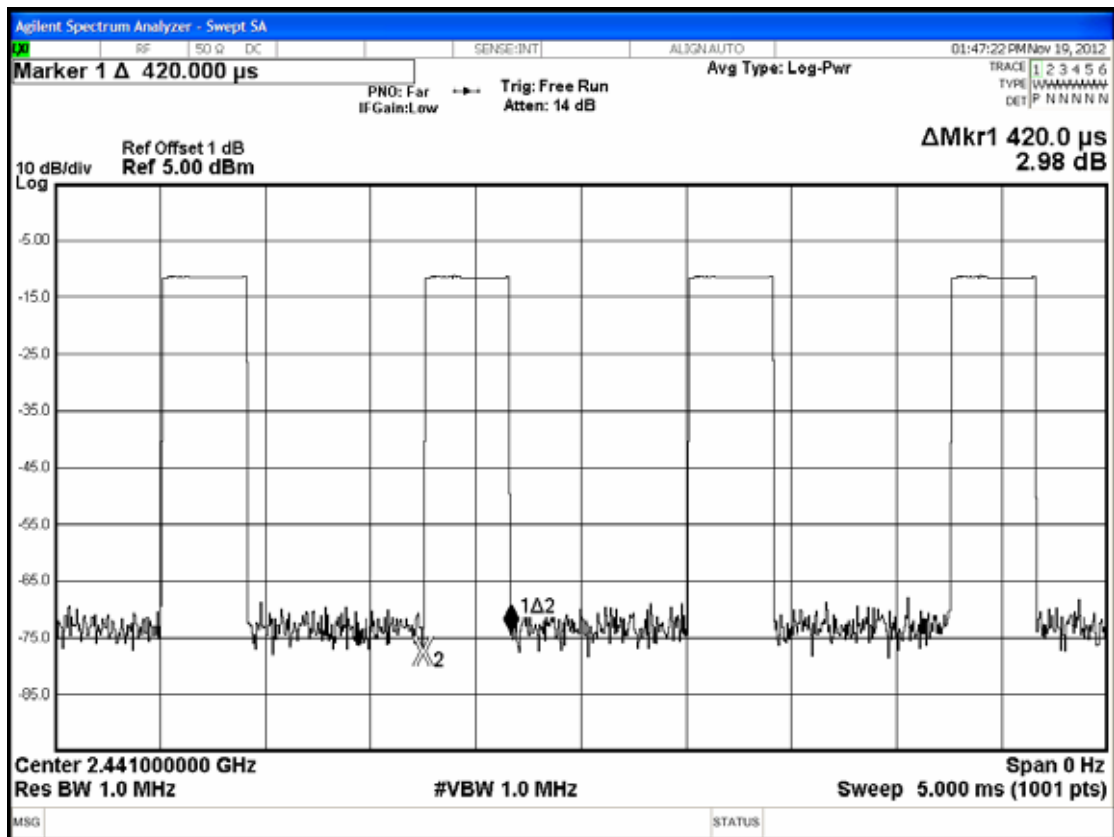


Figure 5: GFSK, 2441MHz, DH3

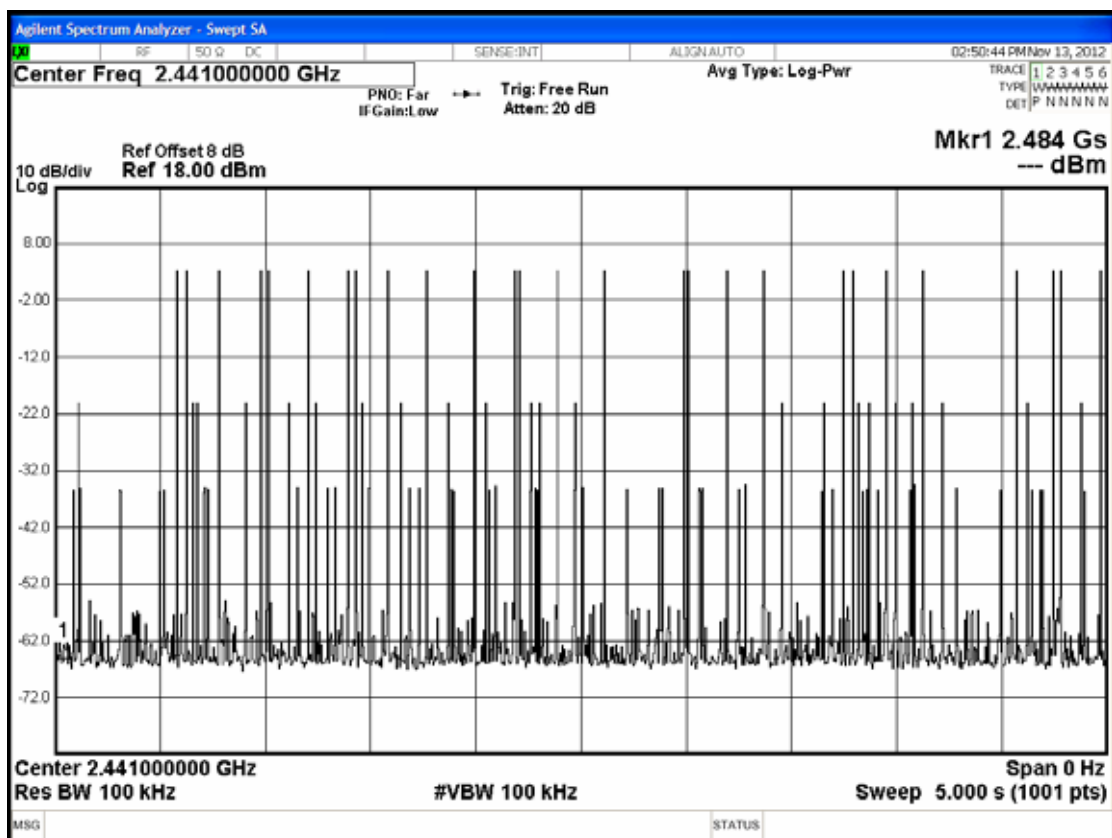
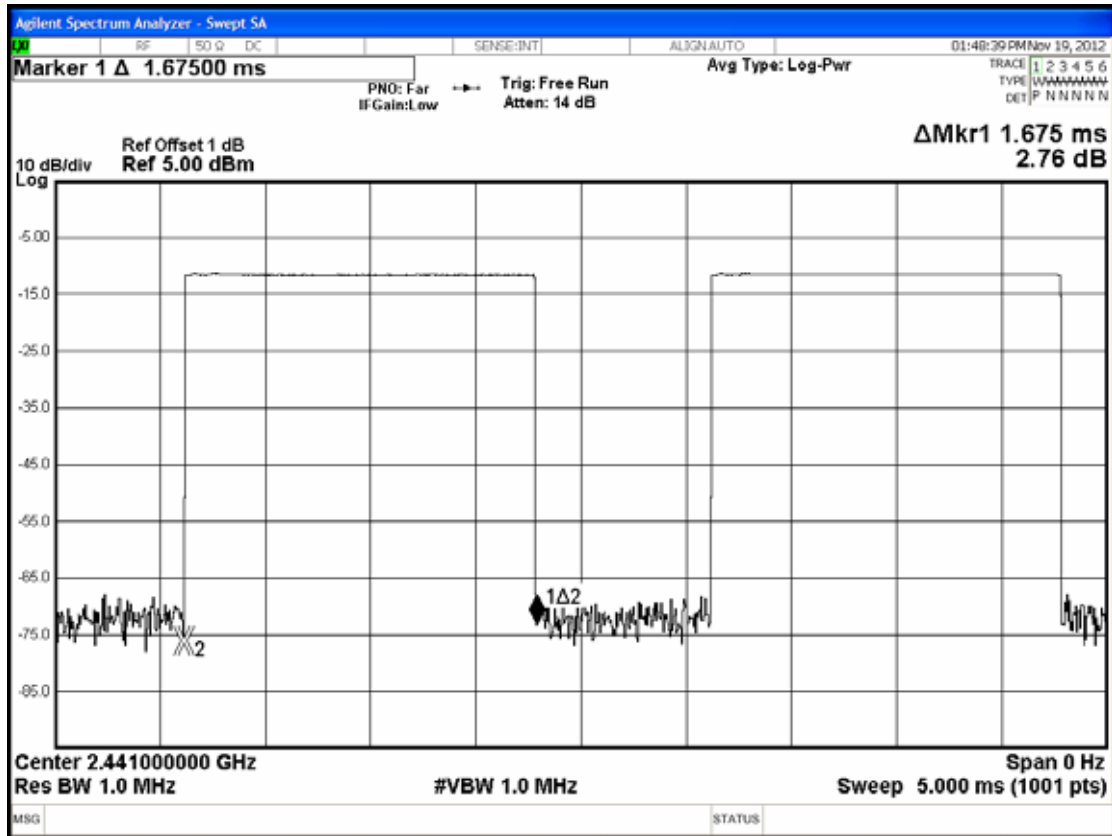
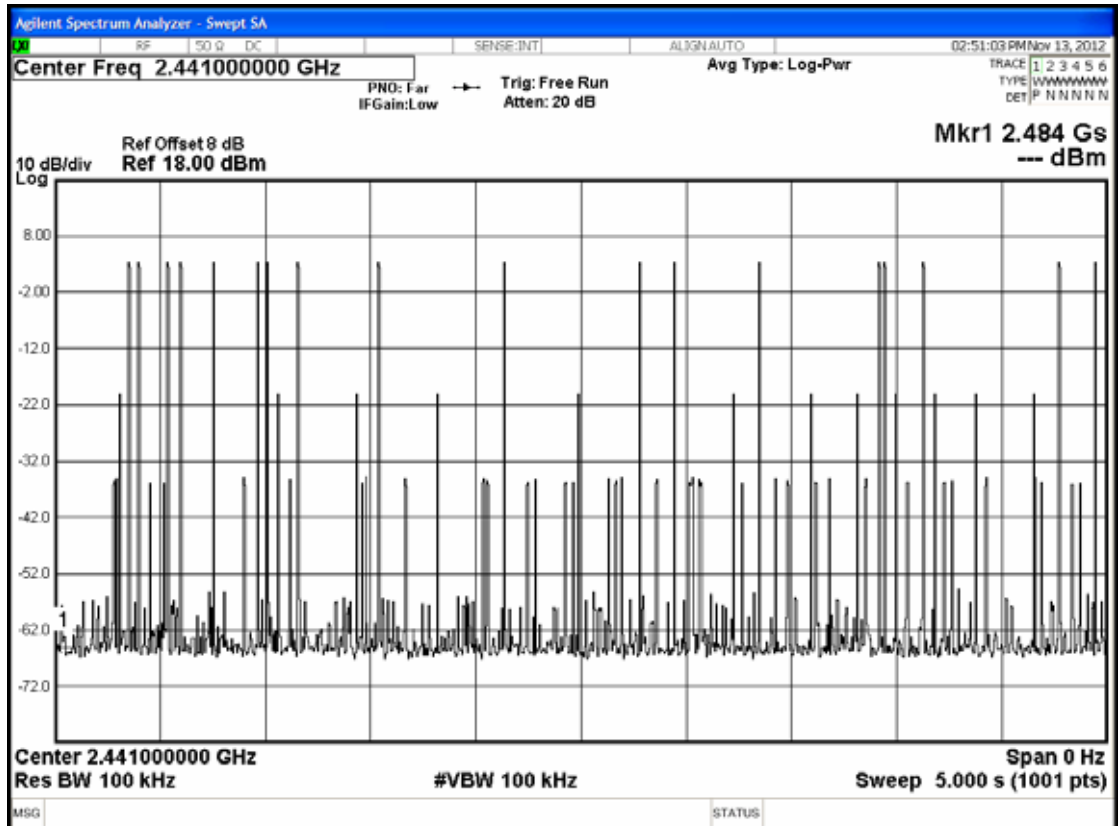
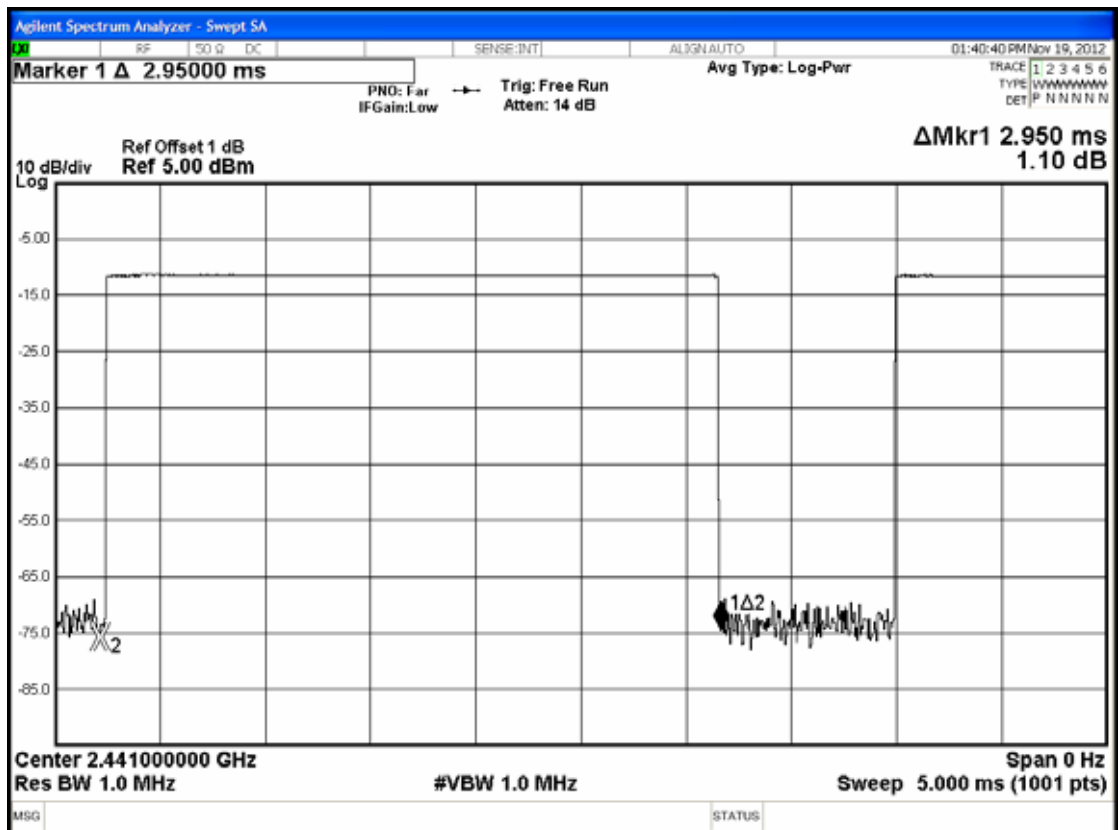


Figure 6: GFSK, 2441MHz, DH5



## 7. NUMBER OF HOPPING CHANNELS MEASUREMENT

### 7.1. Test Equipment

The following test equipment was used during the number of hopping channels measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 7.2. Block Diagram of Test Setup

The same as section.4.2.

### 7.3. Specification Limits (§15.247(a)(1)(iii))

Frequency hopping systems which use fewer than 20 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels.

### 7.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 7.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 100kHz RBW and 100kHz VBW. Sweep=Auto ; Detector function=peak ; Trace=Max hold

### 7.6. Test Results

**PASSED.** All the test results are attached in next page.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

#### 7.6.1.Type of Modulation: 8-DPSK

The number hopping channel is 79.

#### 7.6.2.Type of Modulation: GFSK

The number hopping channel is 79.



Figure 1: 8-DPSK

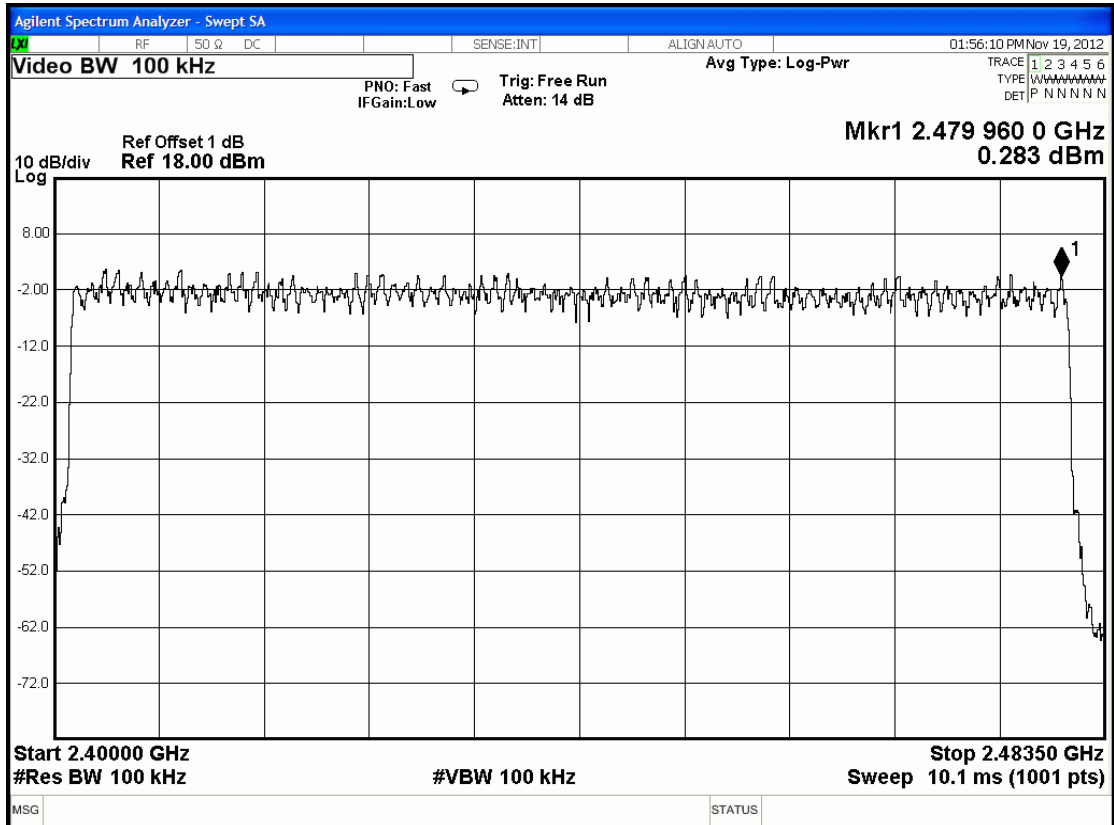
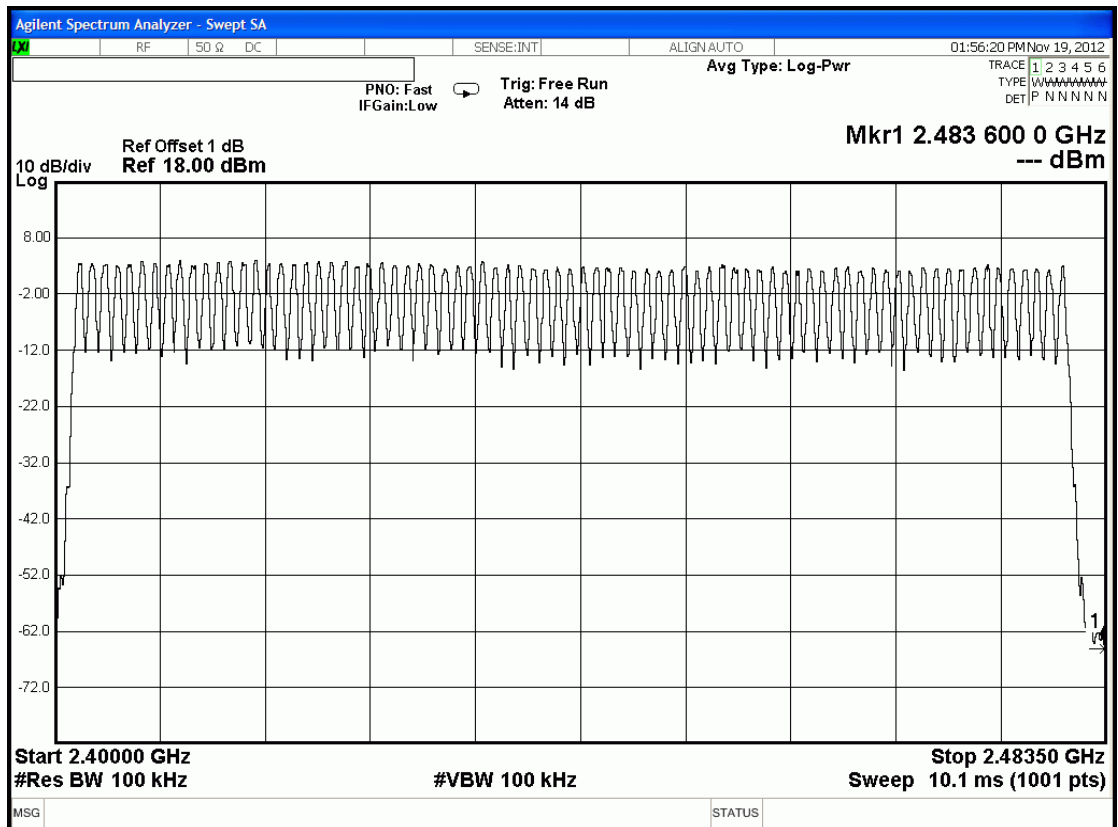


Figure 2: GFSK



## 8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

### 8.1. Test Equipment

The following test equipment was used during the maximum peak output power measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 8.2. Block Diagram of Test Setup

The same as section.4.2.

### 8.3. Specification Limits (§15.247(b)-(1))

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

### 8.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in 4.4 except the test set up replaced by section 8.2.

### 8.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 2MHz RBW and 6MHz VBW. Sweep=Auto ; Detector function=peak ; Trace=Max hold

## 8.6. Test Results

**PASSED.** All the test results are listed below.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

### 8.6.1.Type of Modulation: 8-DPSK

No.	Channel	Test Frequency	Peak Output Power	Limit
1.	0	2402MHz	<b>-11.416dBm</b>	21dBm
2.	39	2441MHz	<b>-11.044dBm</b>	21dBm
3.	78	2480MHz	<b>-11.183dBm</b>	21dBm

### 8.6.2.Type of Modulation: GFSK

No.	Channel	Test Frequency	Peak Output Power	Limit
1.	0	2402MHz	<b>-11.483dBm</b>	21dBm
2.	39	2441MHz	<b>-11.044dBm</b>	21dBm
3.	78	2480MHz	<b>-11.250dBm</b>	21dBm

Figure 1: 8-DPSK, Channel 0, Frequency: 2402MHz

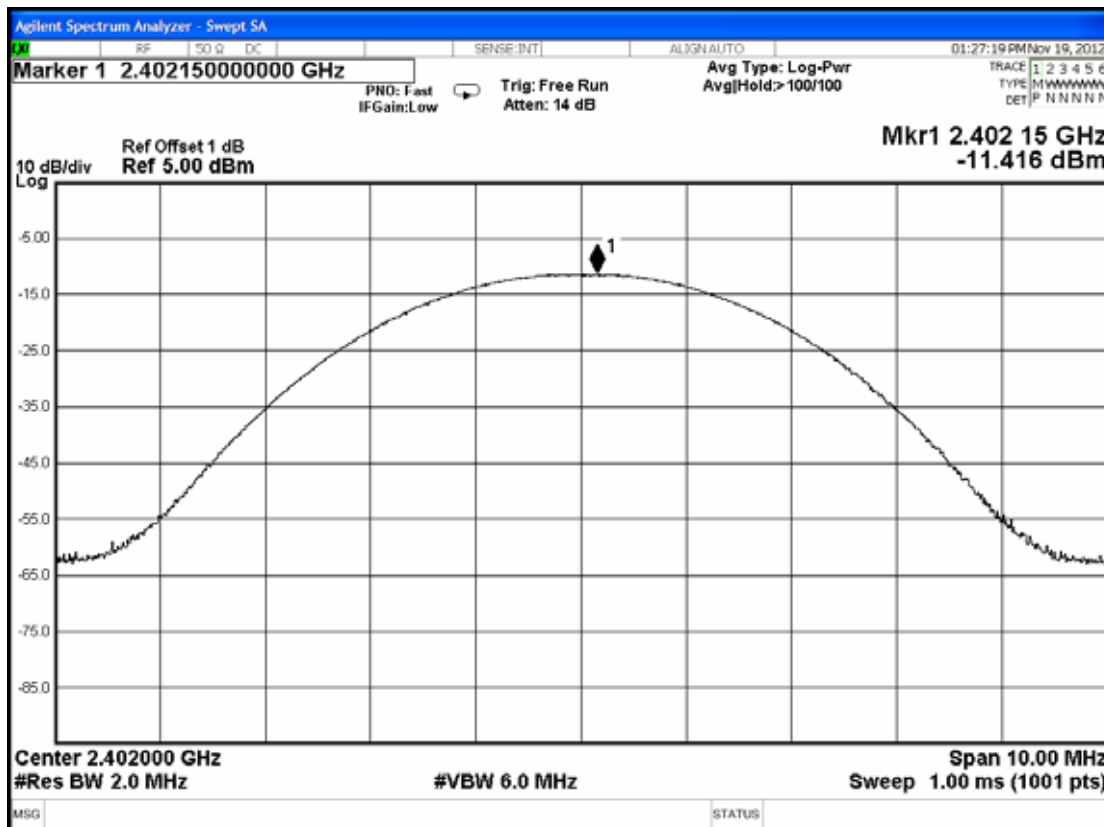


Figure 2: 8-DPSK, Channel 39, Frequency: 2441MHz

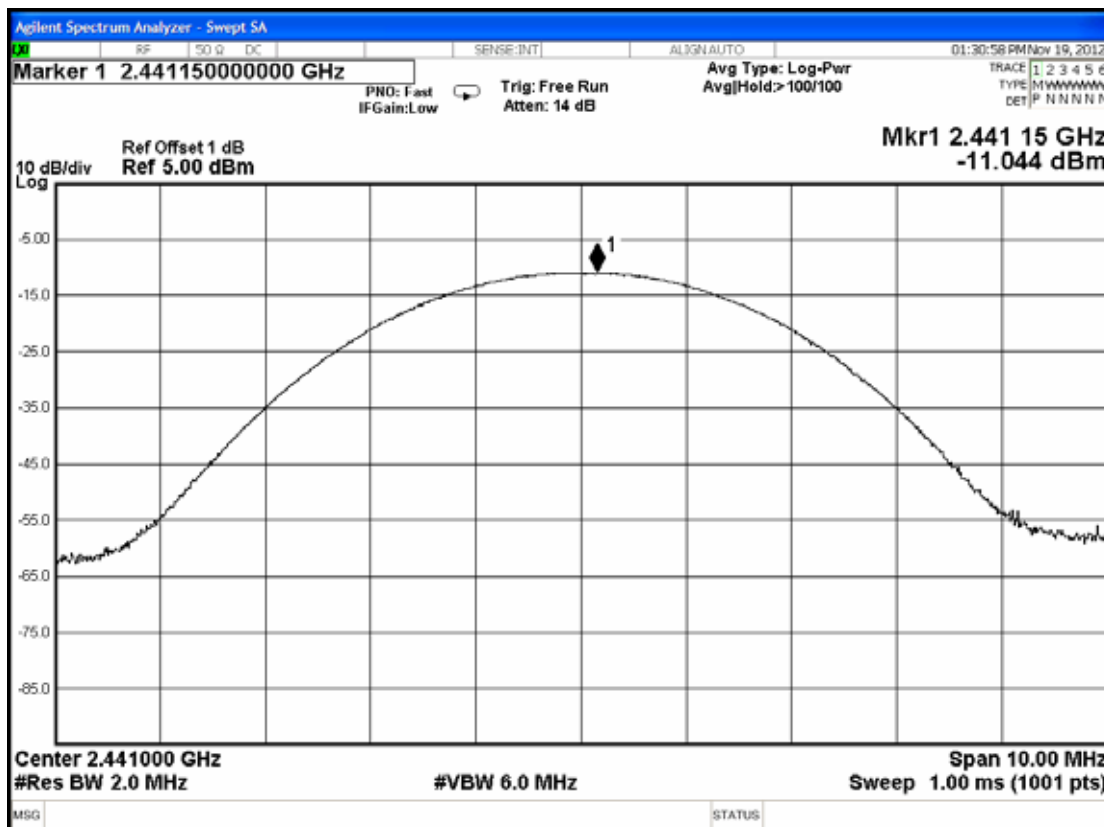


Figure 3: 8-DPSK, Channel 78, Frequency: 2480MHz

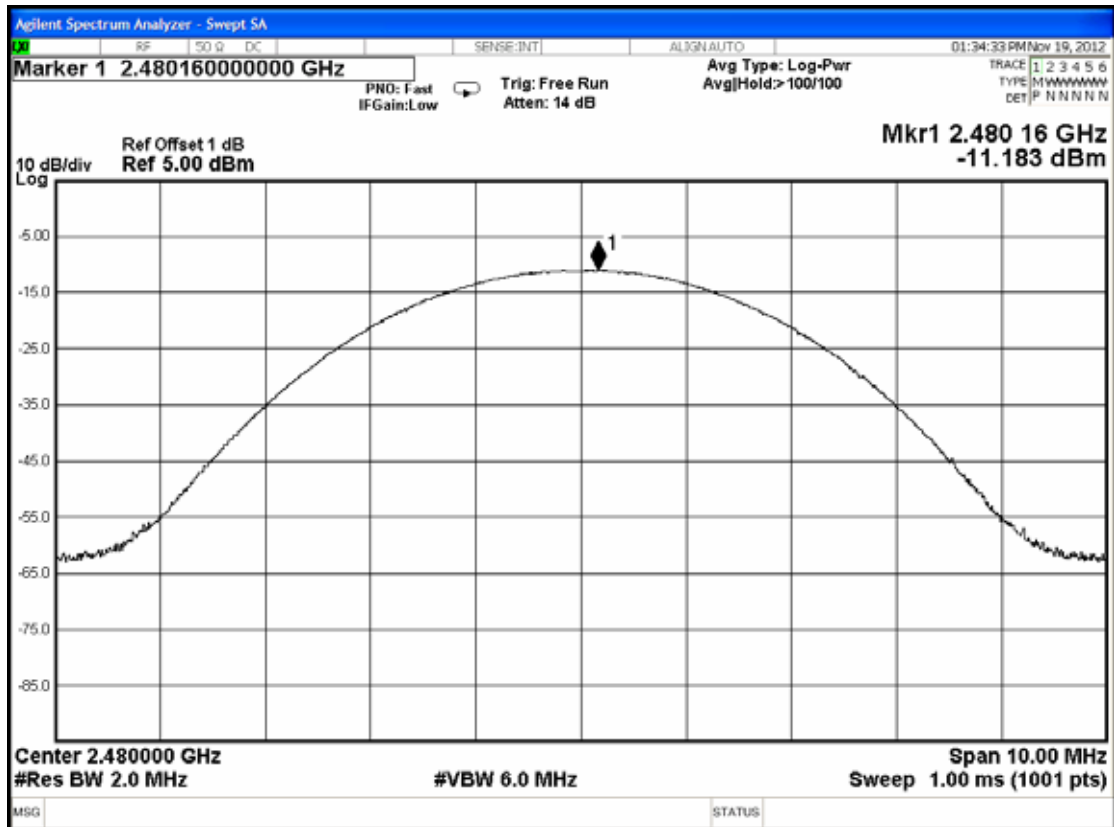


Figure 4: GFSK, Channel 0, Frequency: 2402MHz

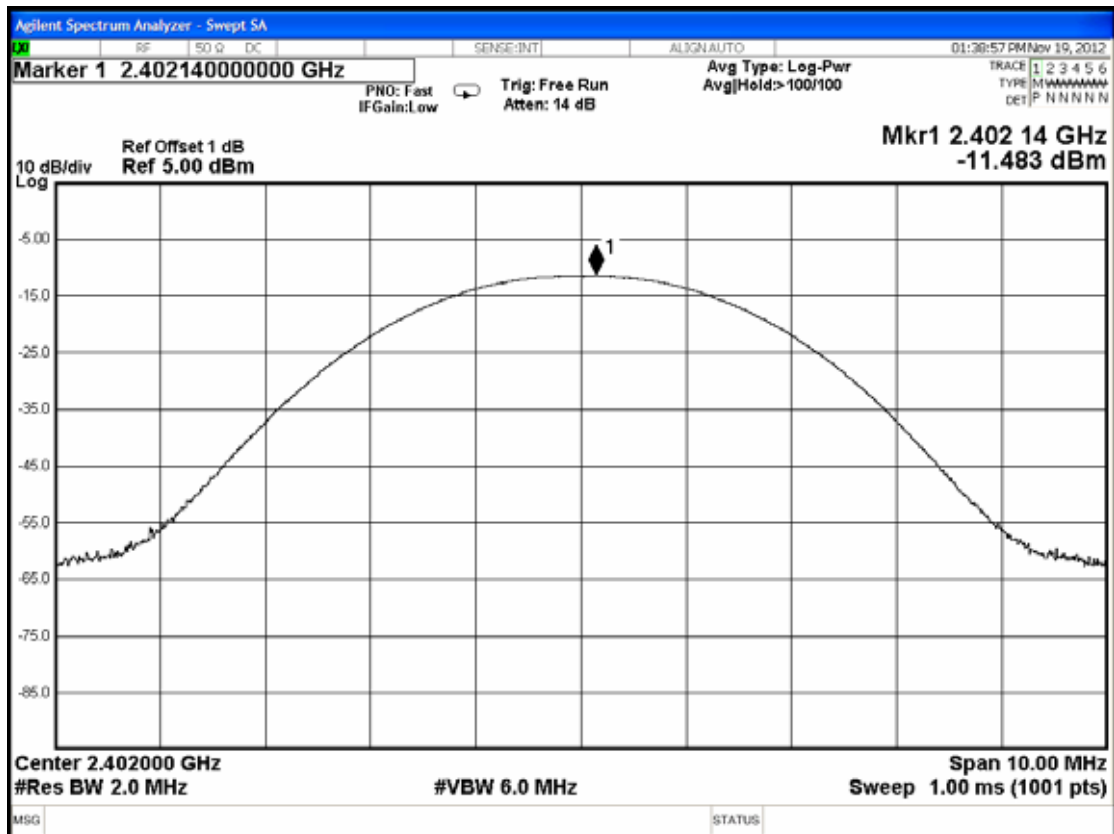


Figure 5: GFSK, Channel 39, Frequency: 2441MHz

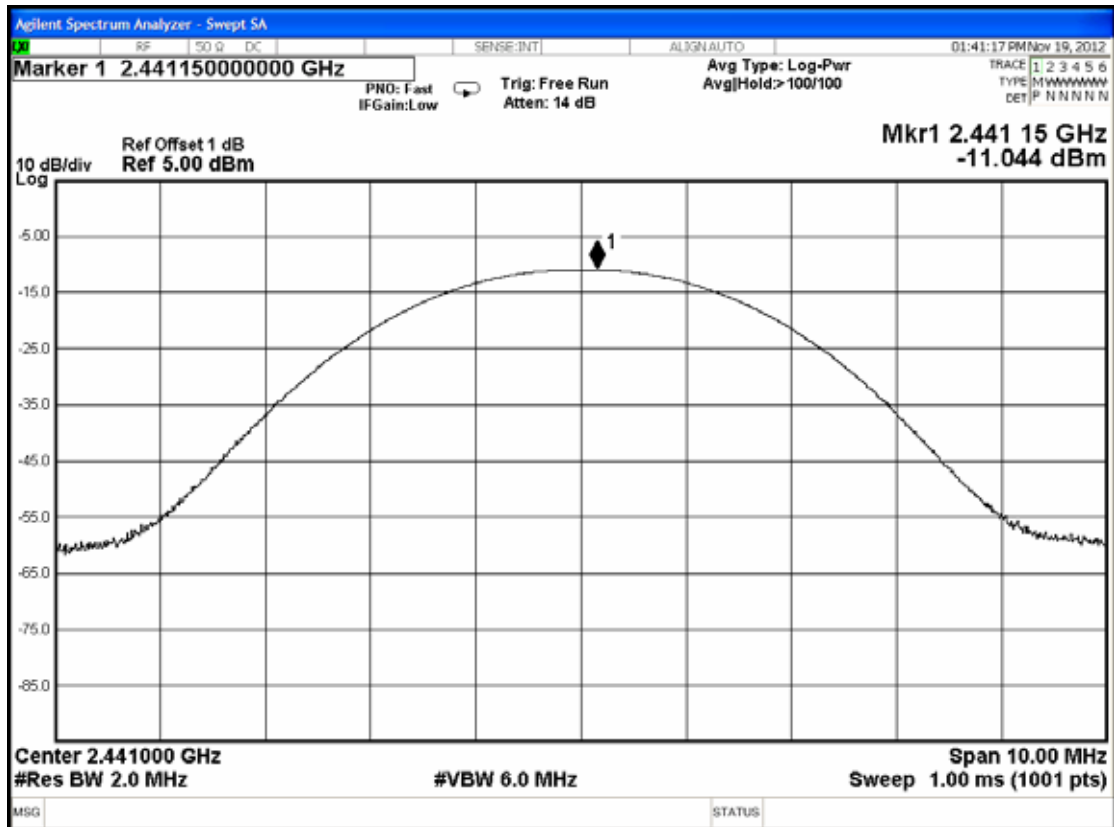
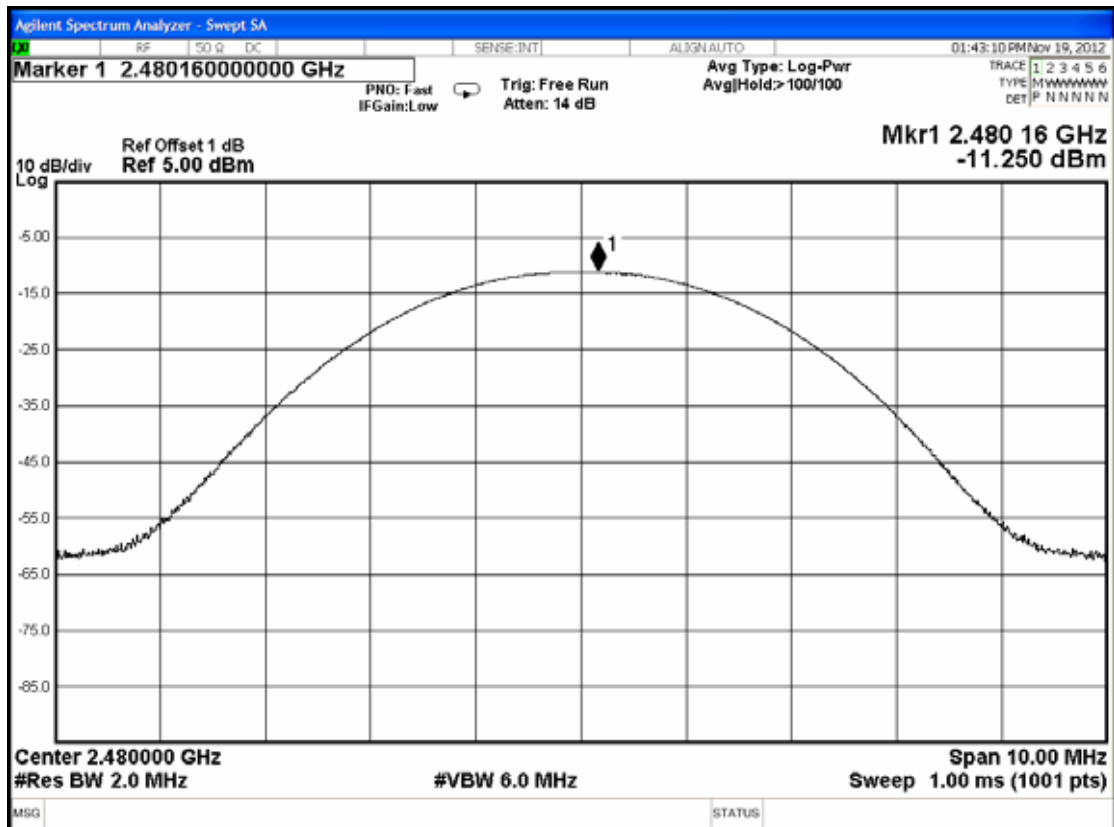


Figure 6: GFSK, Channel 78, Frequency: 2480MHz



## 9. EMISSION LIMITATIONS MEASUREMENT

### 9.1. Test Equipment

The following test equipment was used during the emission limitations measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 9.2. Block Diagram of Test Setup

The same as section.4.2.

### 9.3. Specification Limits (§15.247(c))

In any 100kHz 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 20dB below that in the 100kHz 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 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)).(This test result attaching to §3.6.3)

### 9.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 9.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. Set both RBW and VBW of spectrum analyzer to 100kHz with frequency range from 30MHz to 25GHz.

### 9.6. Test Results

**PASSED.** All the test results are attached in next pages.

**[Note: Three types of modulation (8-DPSK,  $\pi$ /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

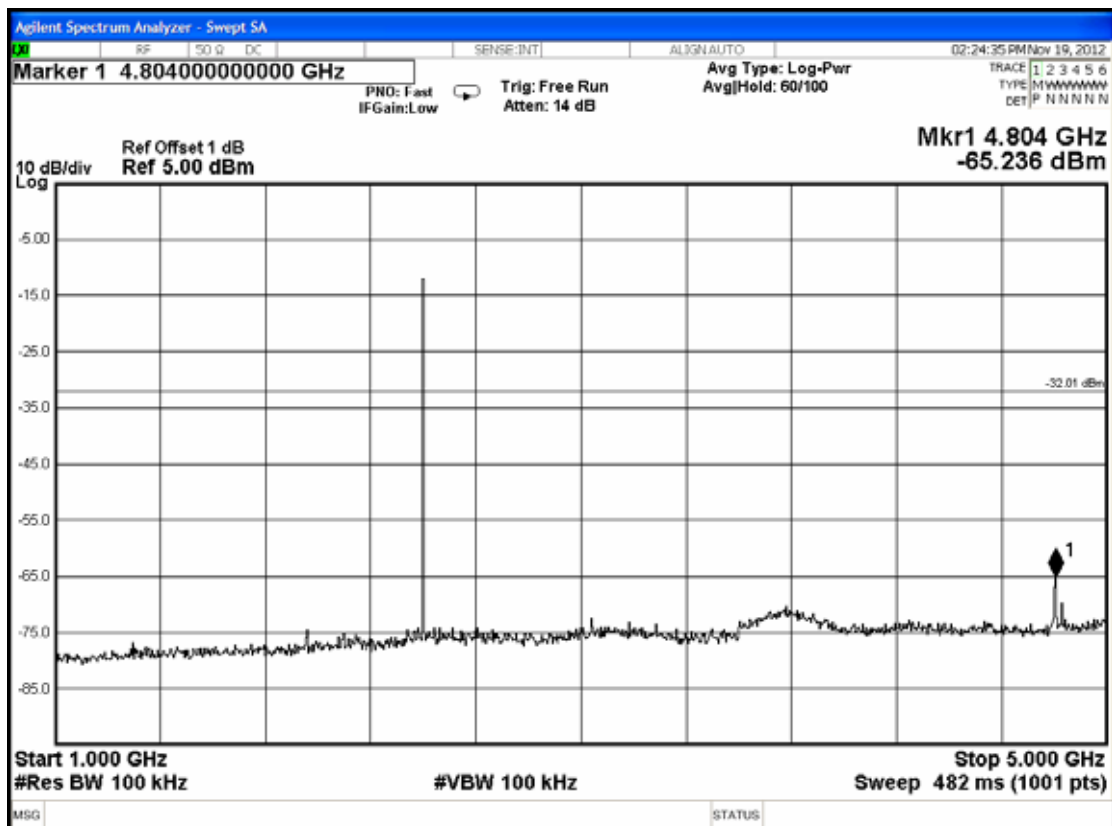
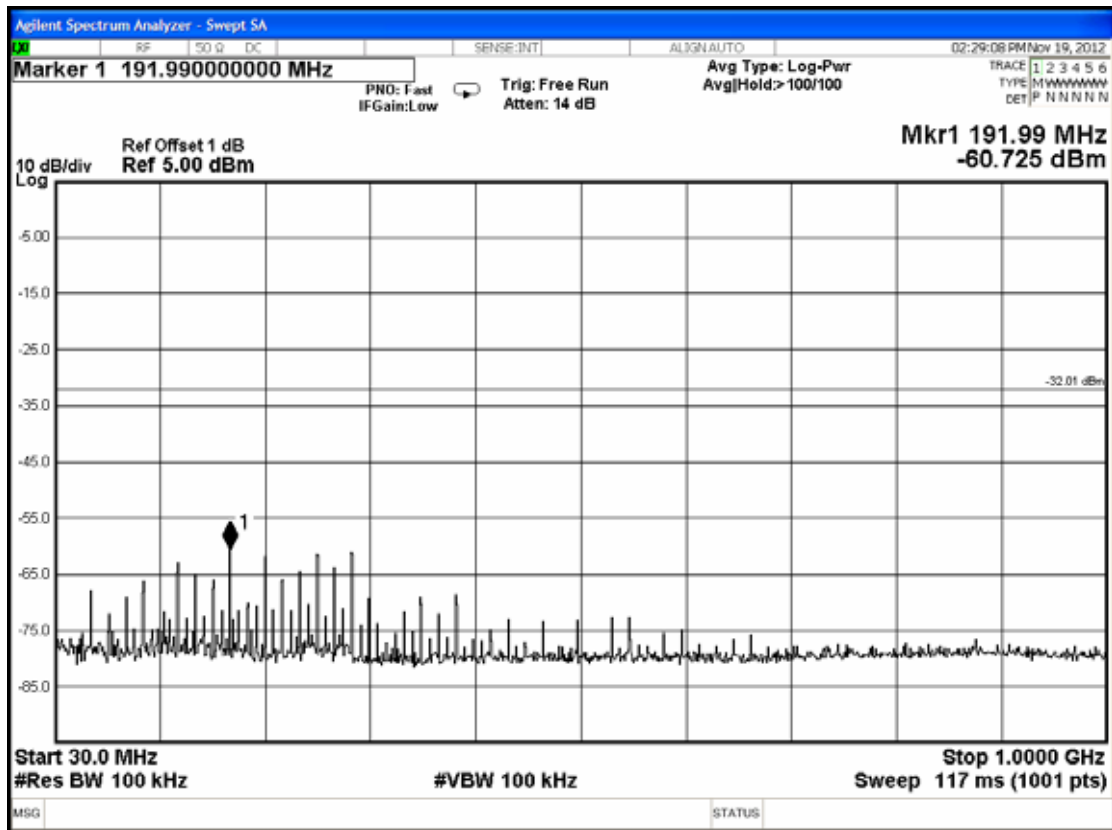
EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

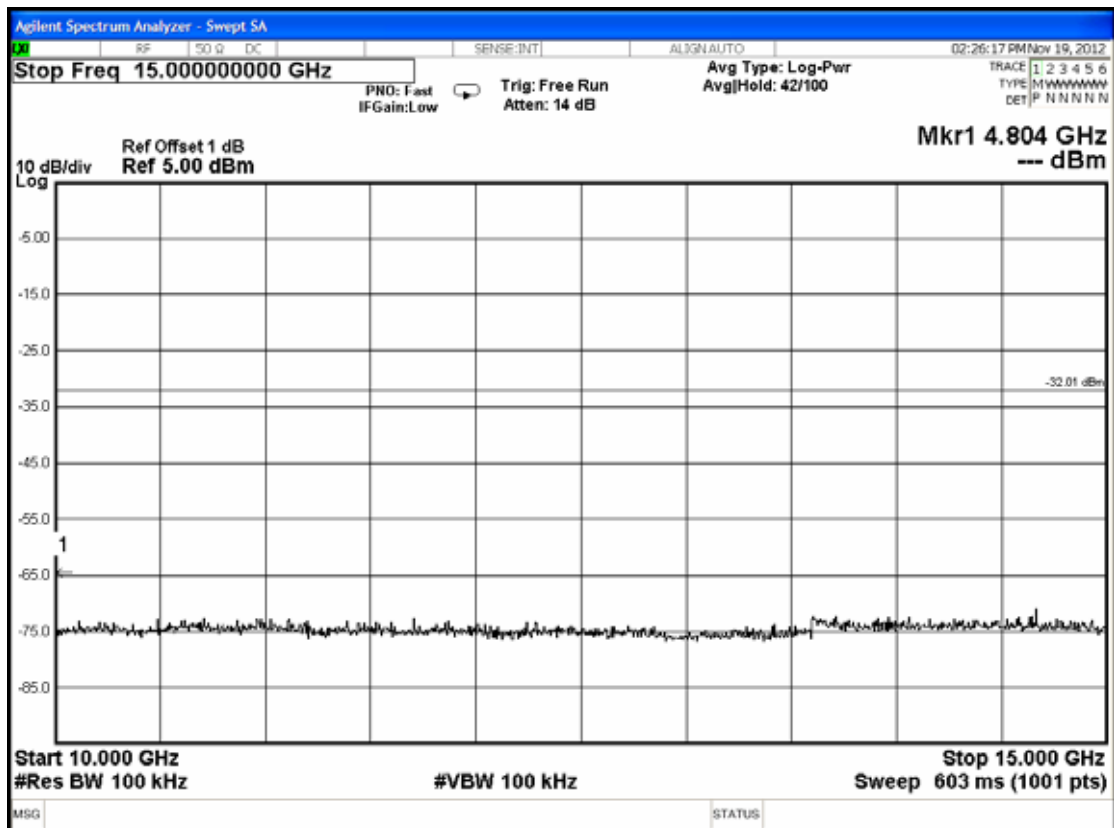
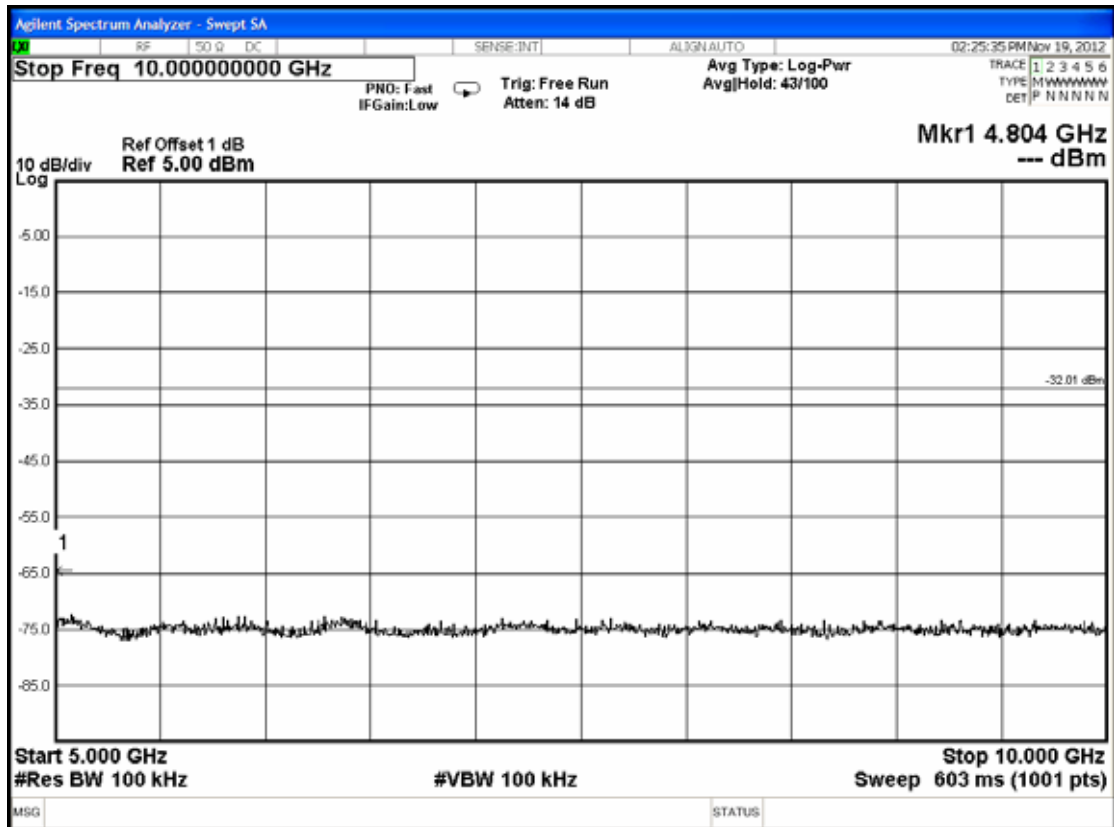
Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

Figure 1: 8-DPSK, Channel 0, Frequency: 2402MHz







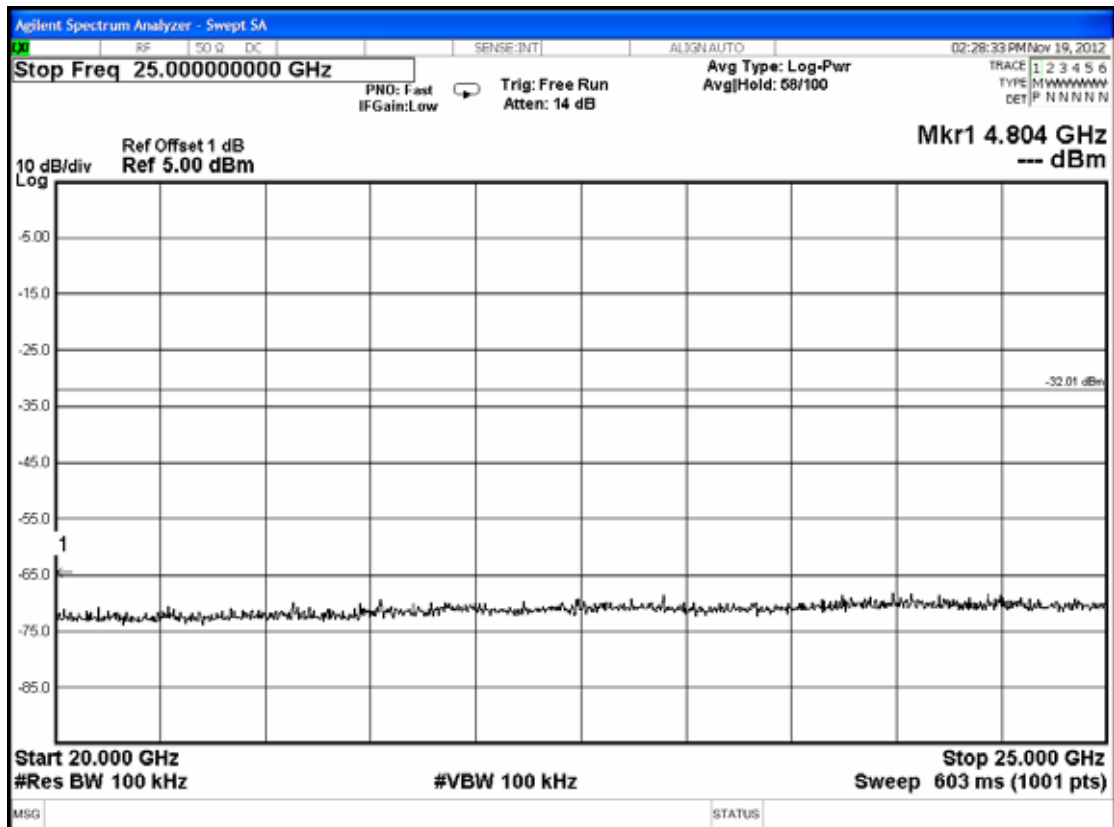
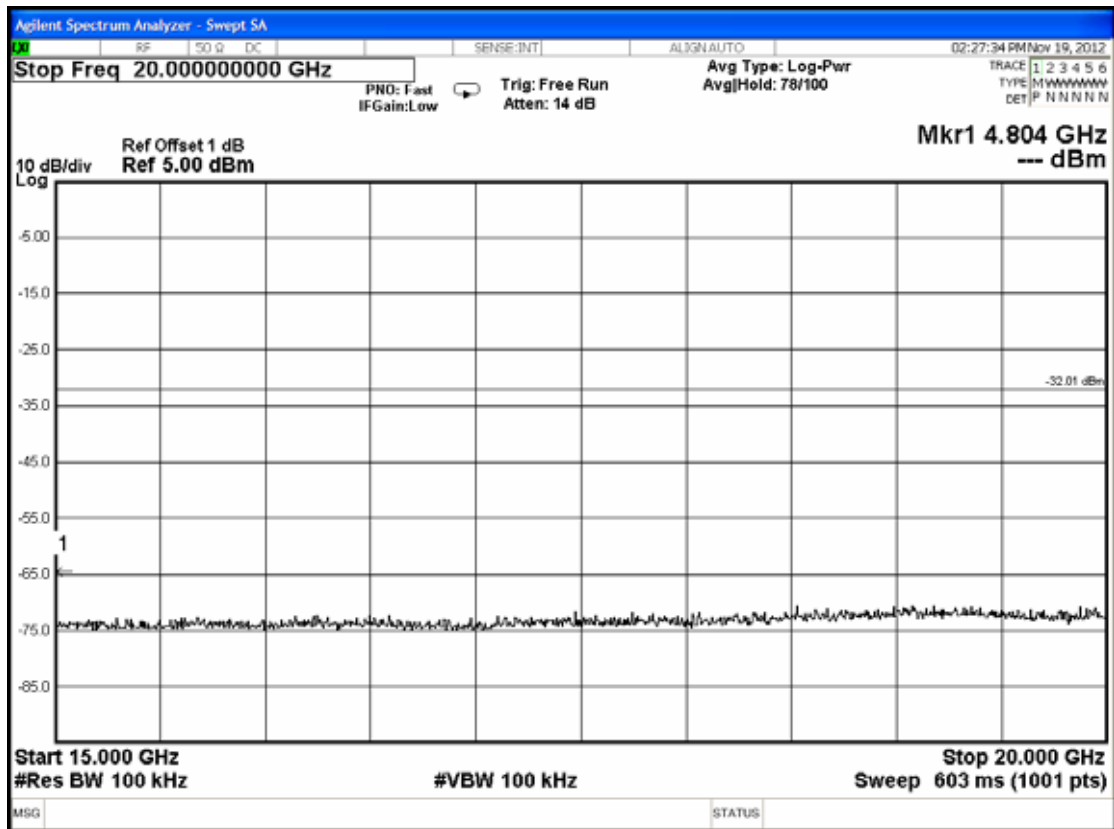
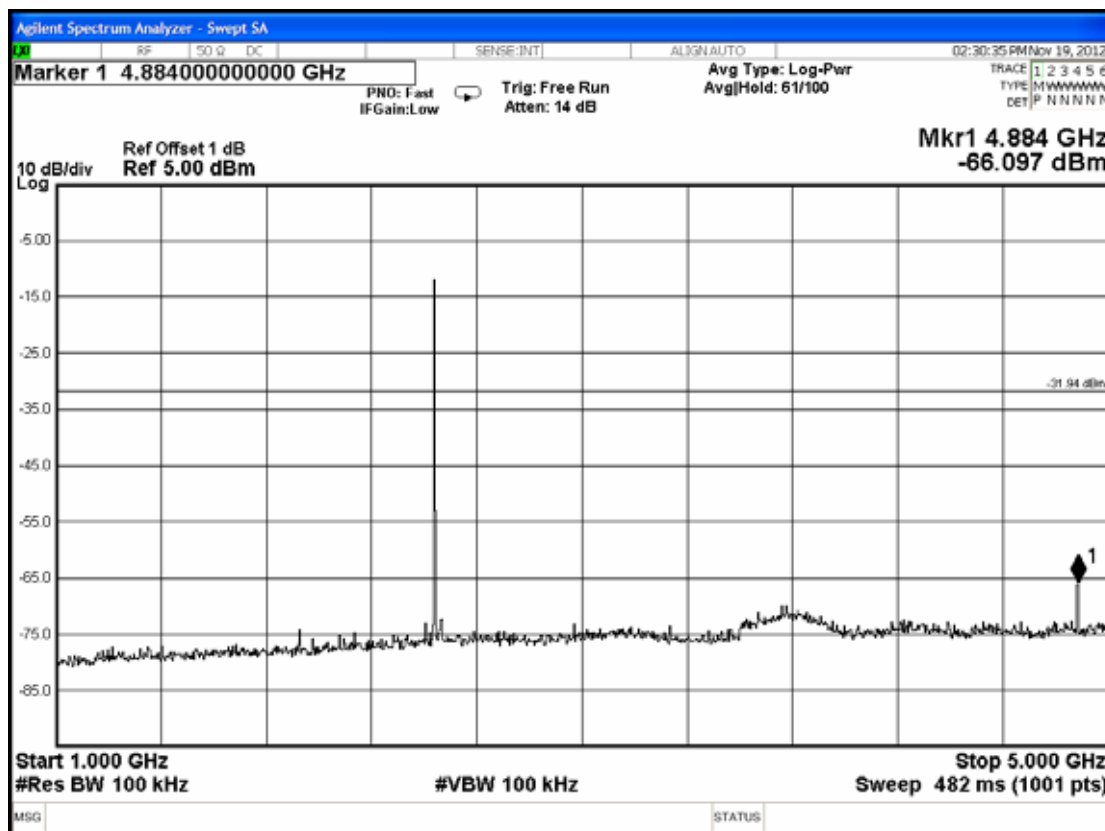
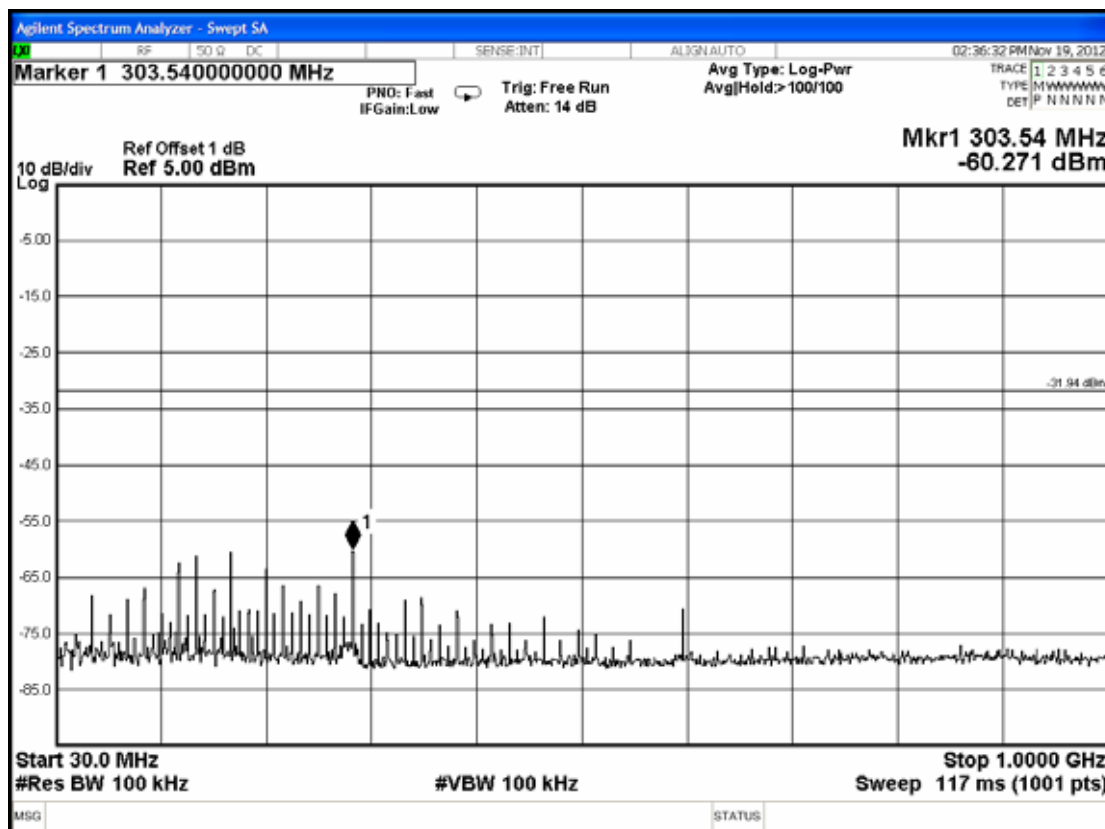
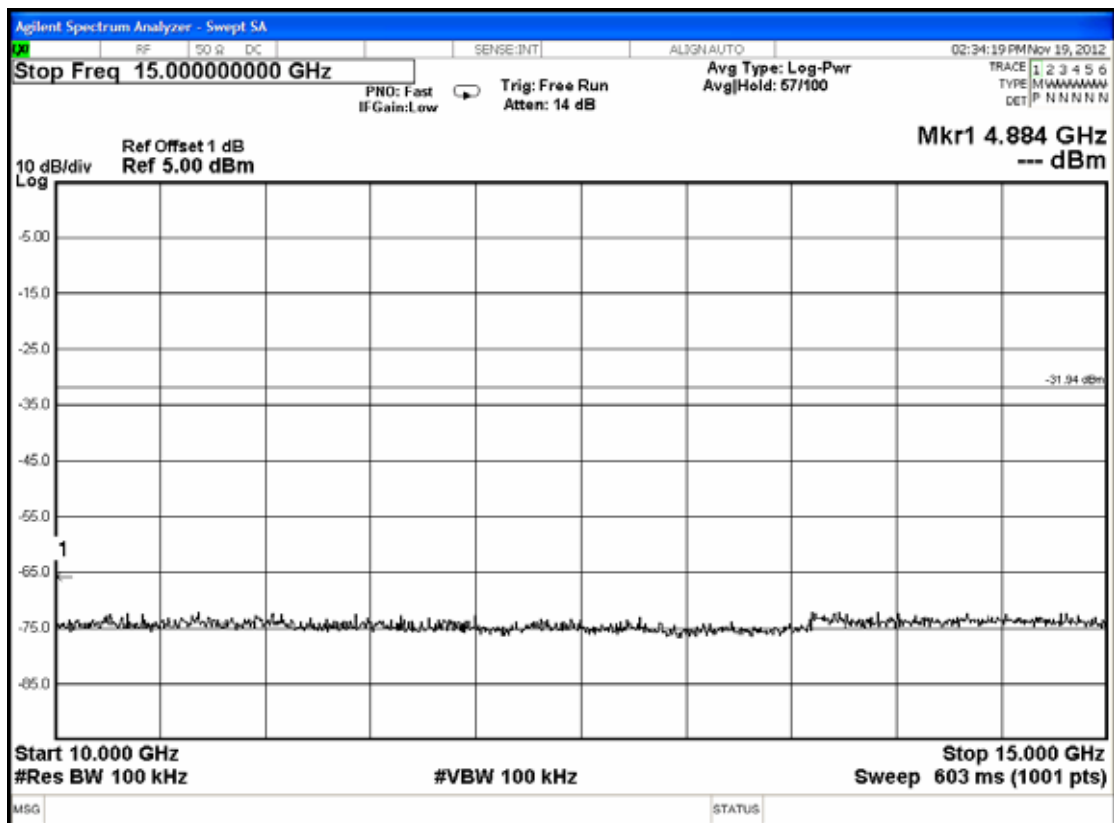
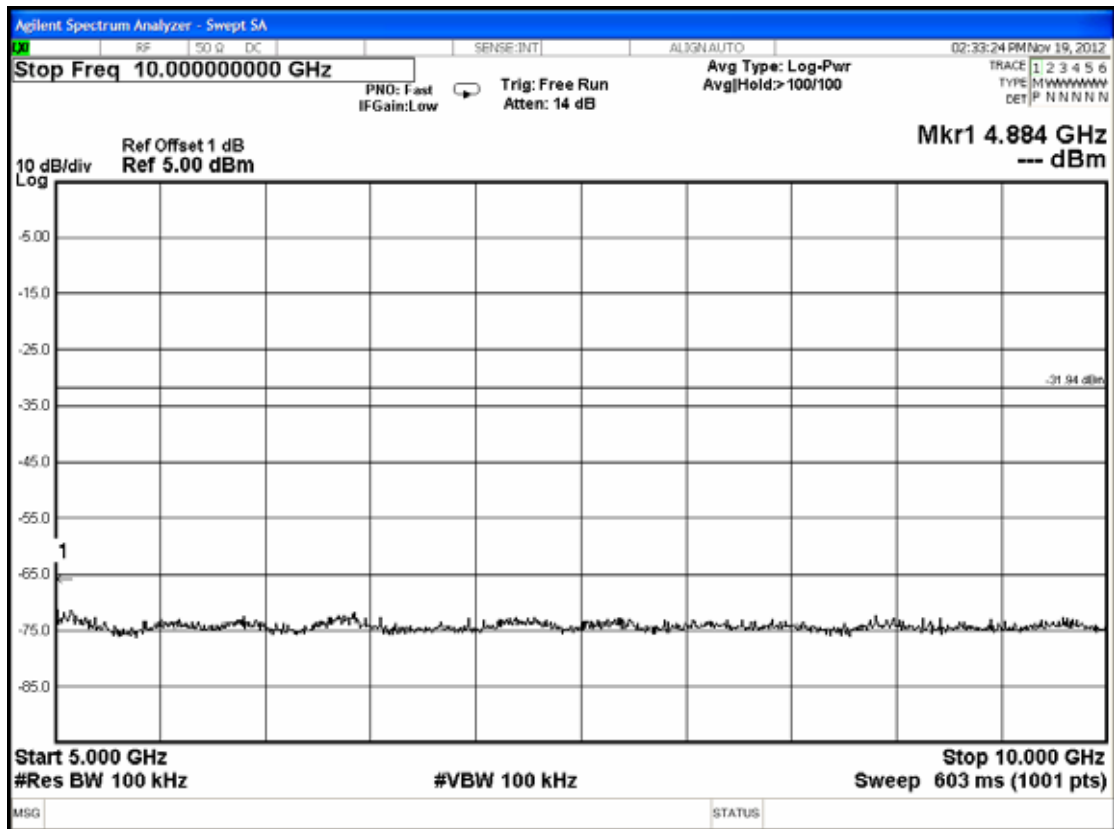


Figure 2: 8-DPSK, Channel 39, Frequency: 2441MHz





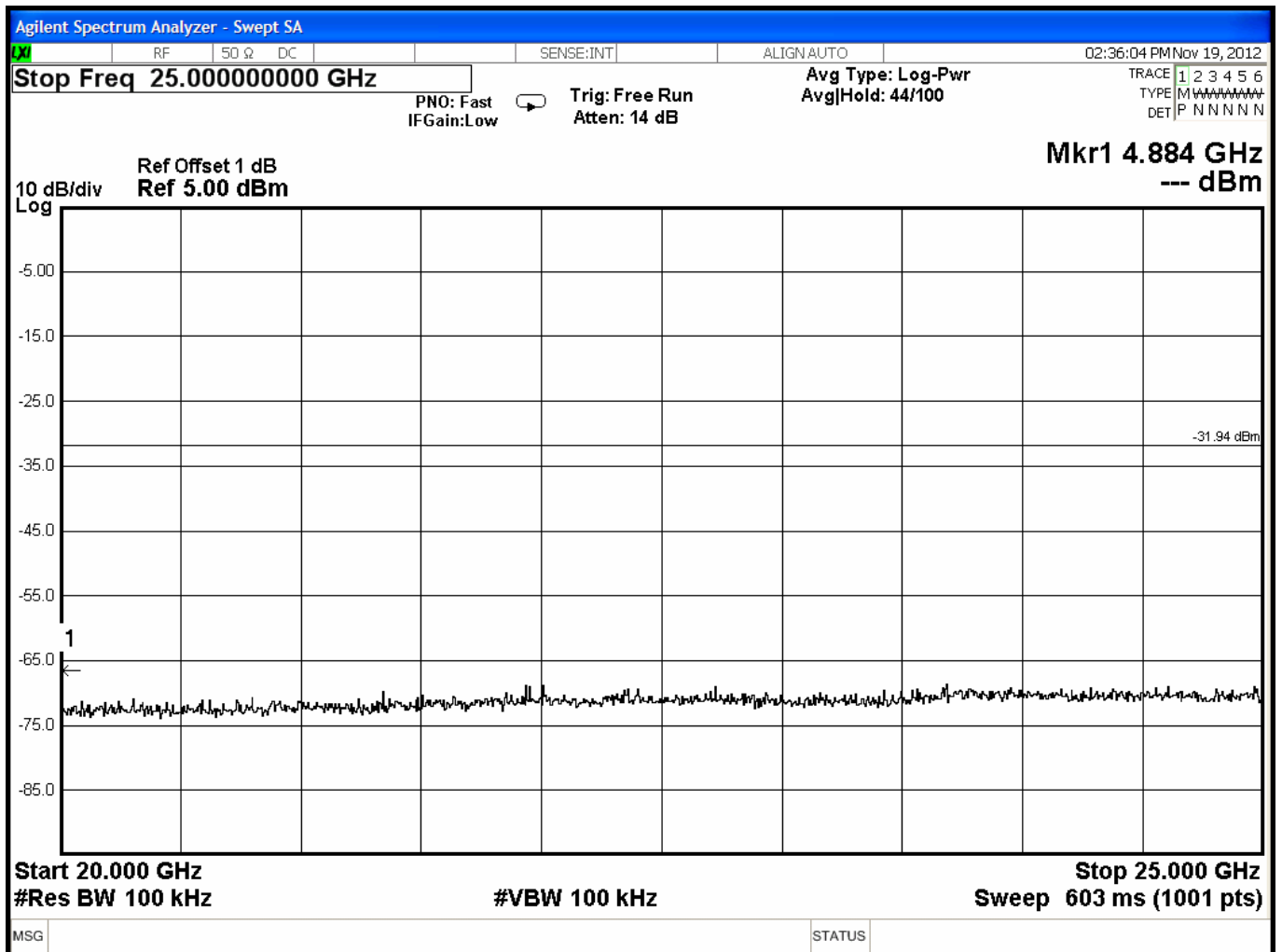
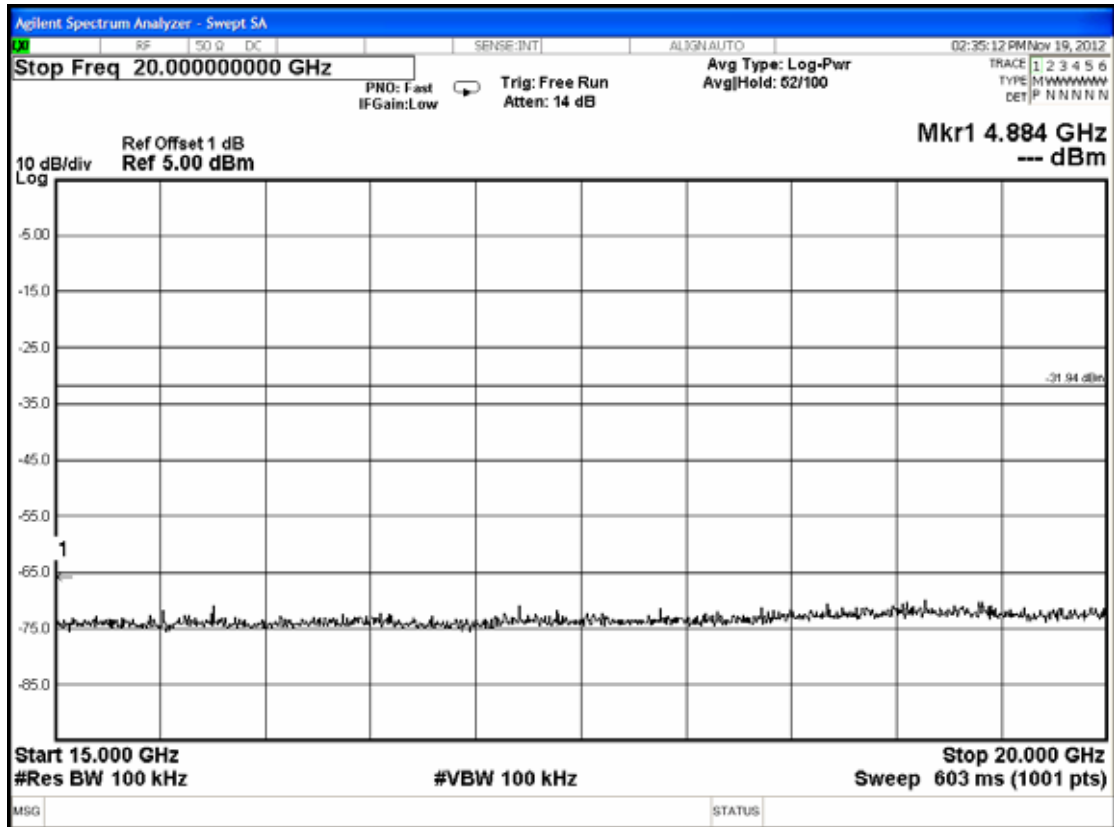
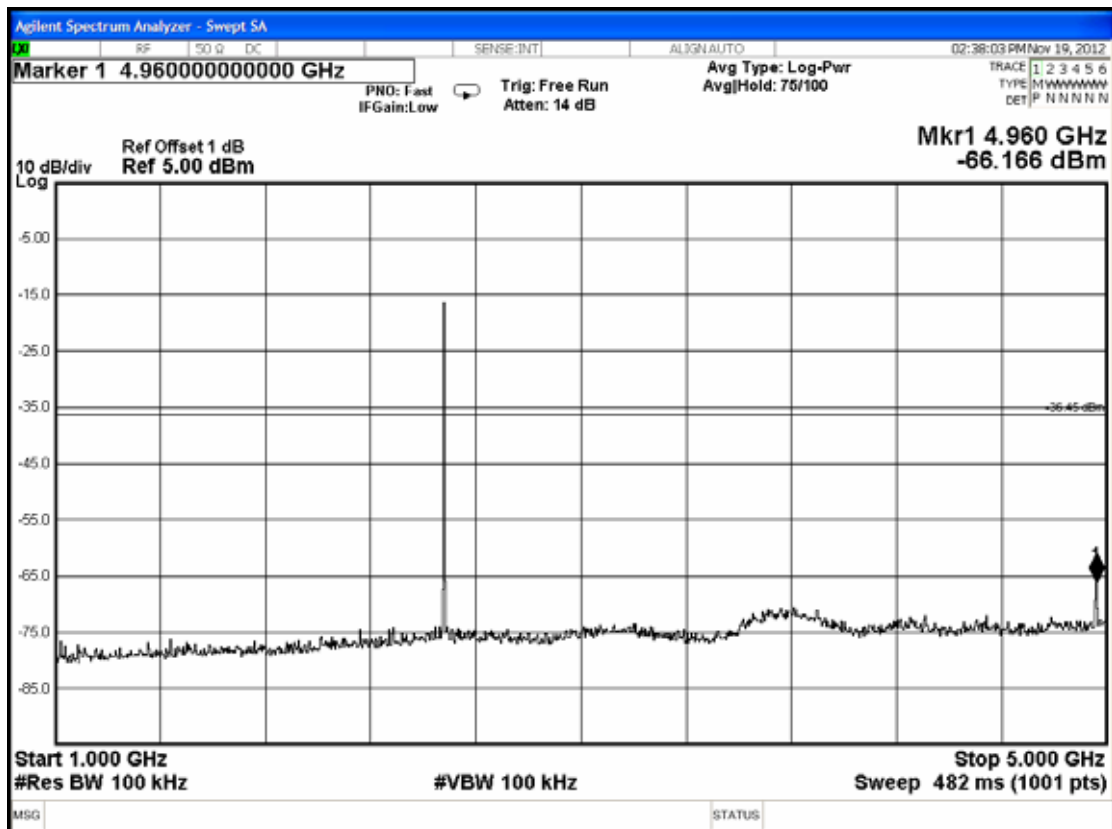
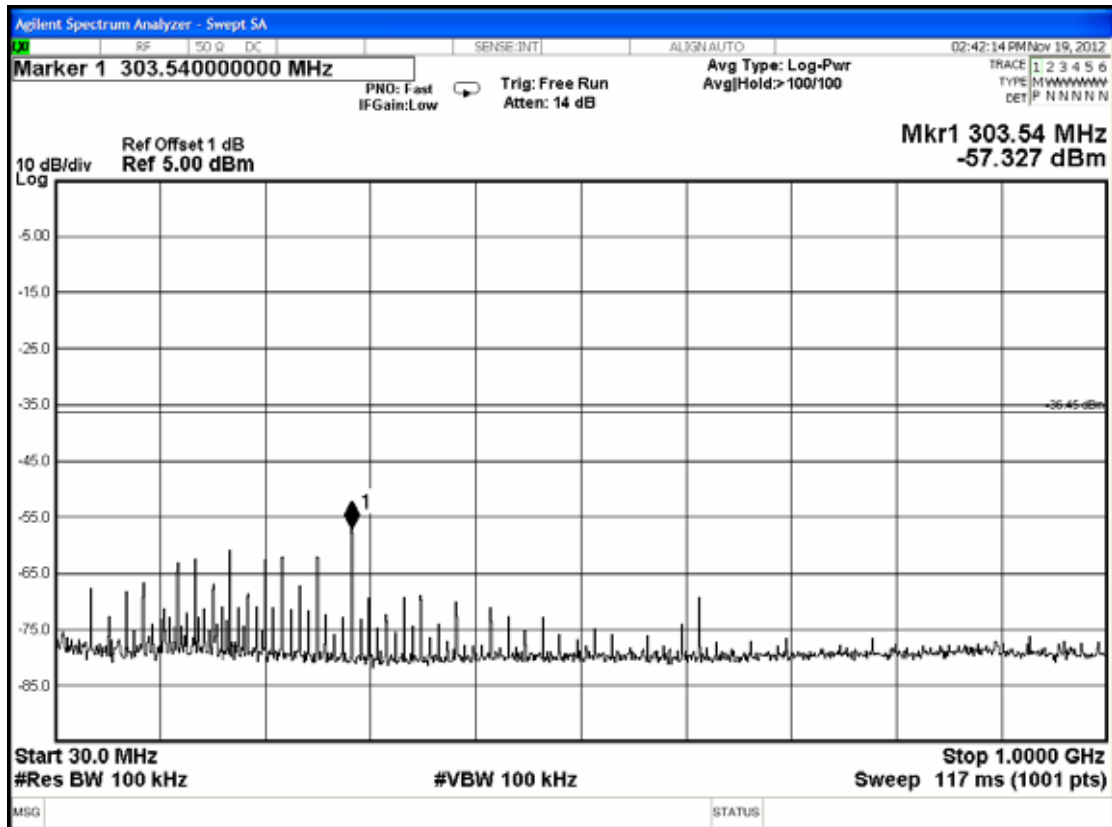
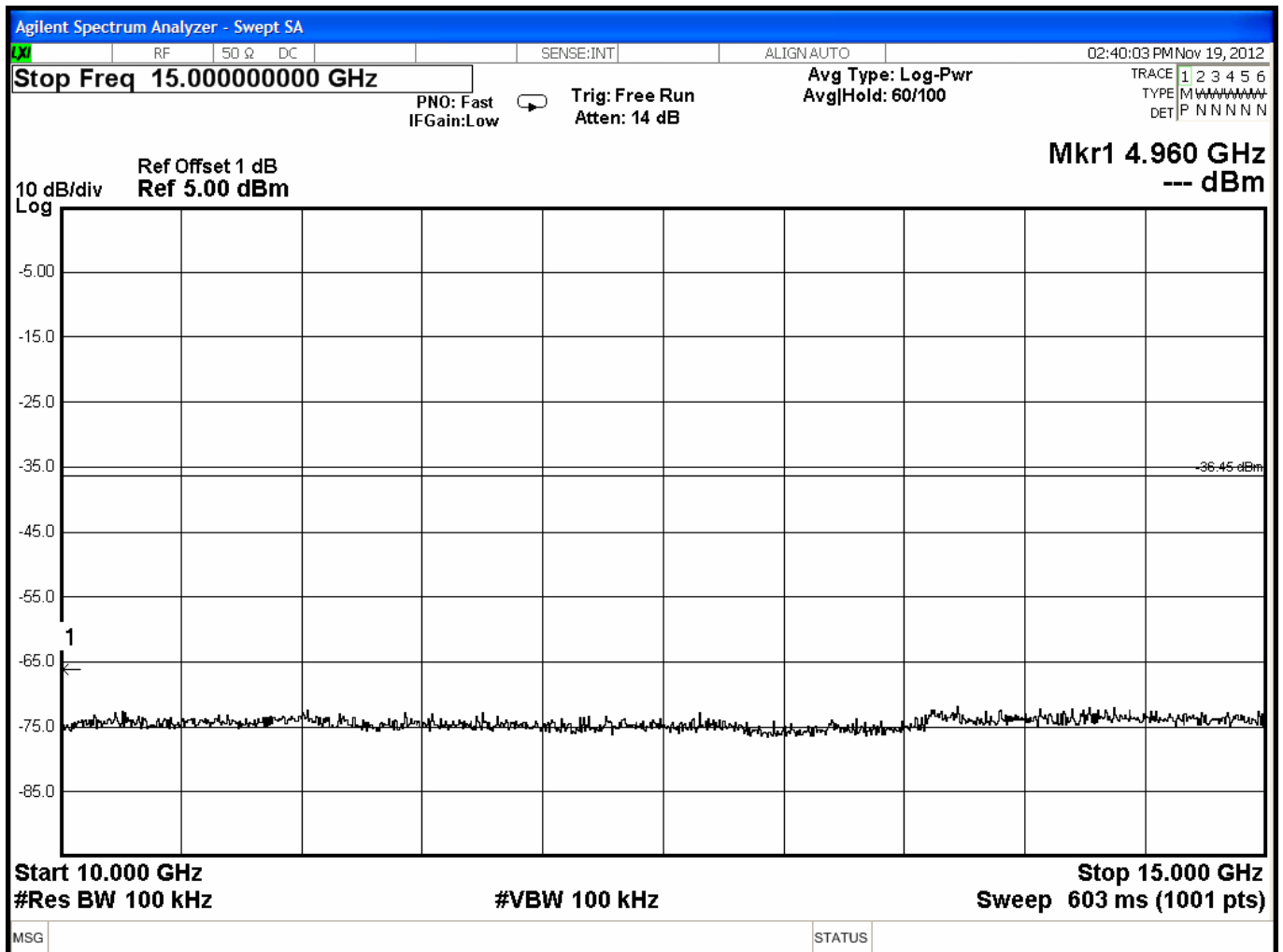
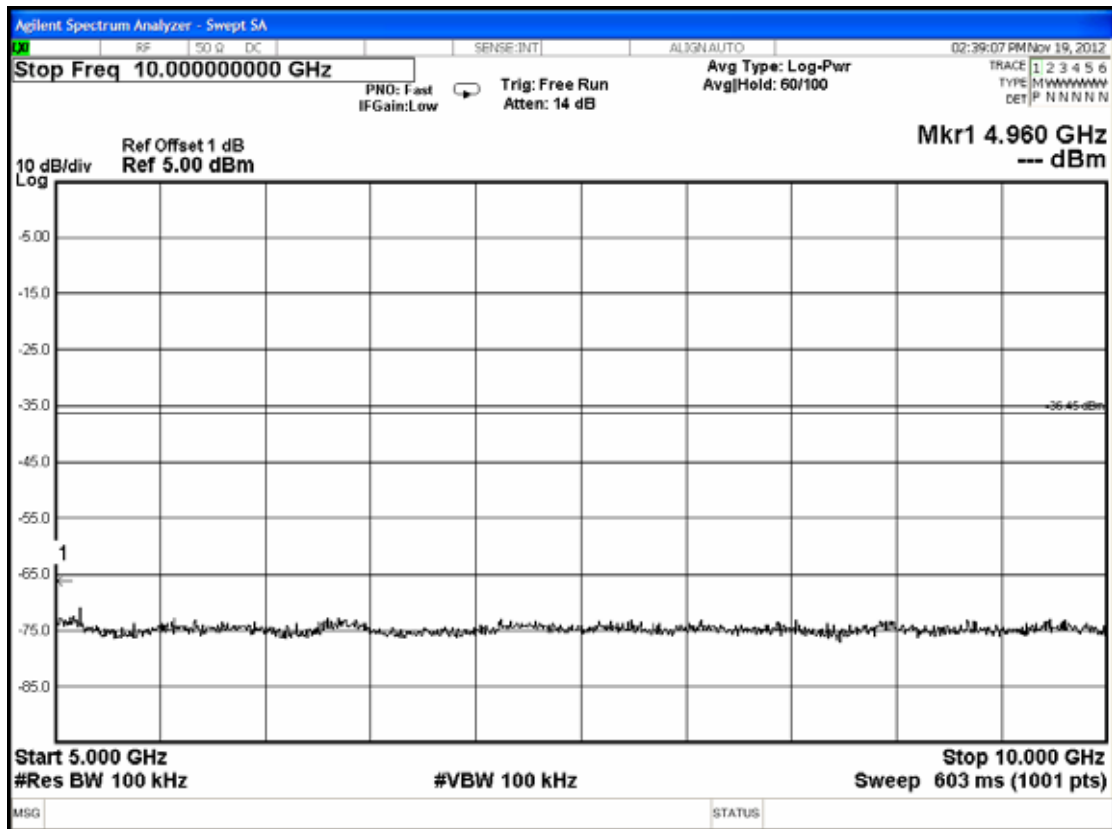


Figure 3: 8-DPSK, Channel 78, Frequency: 2480MHz





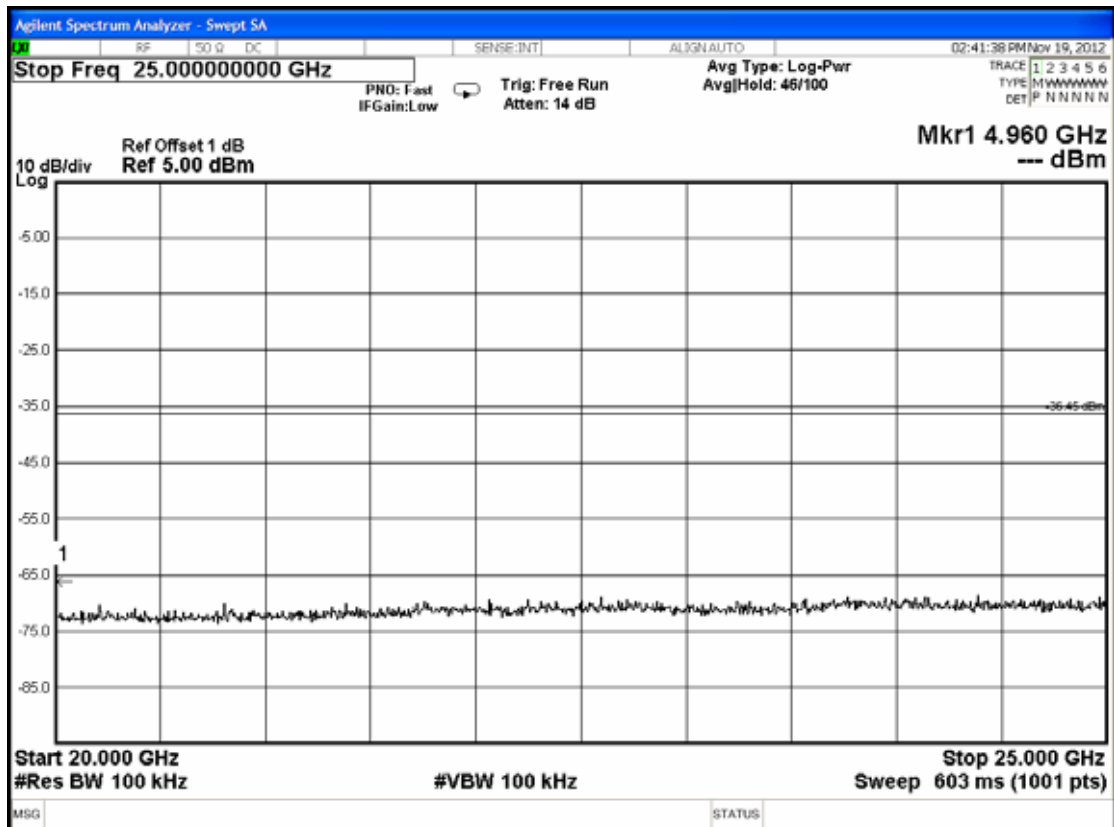
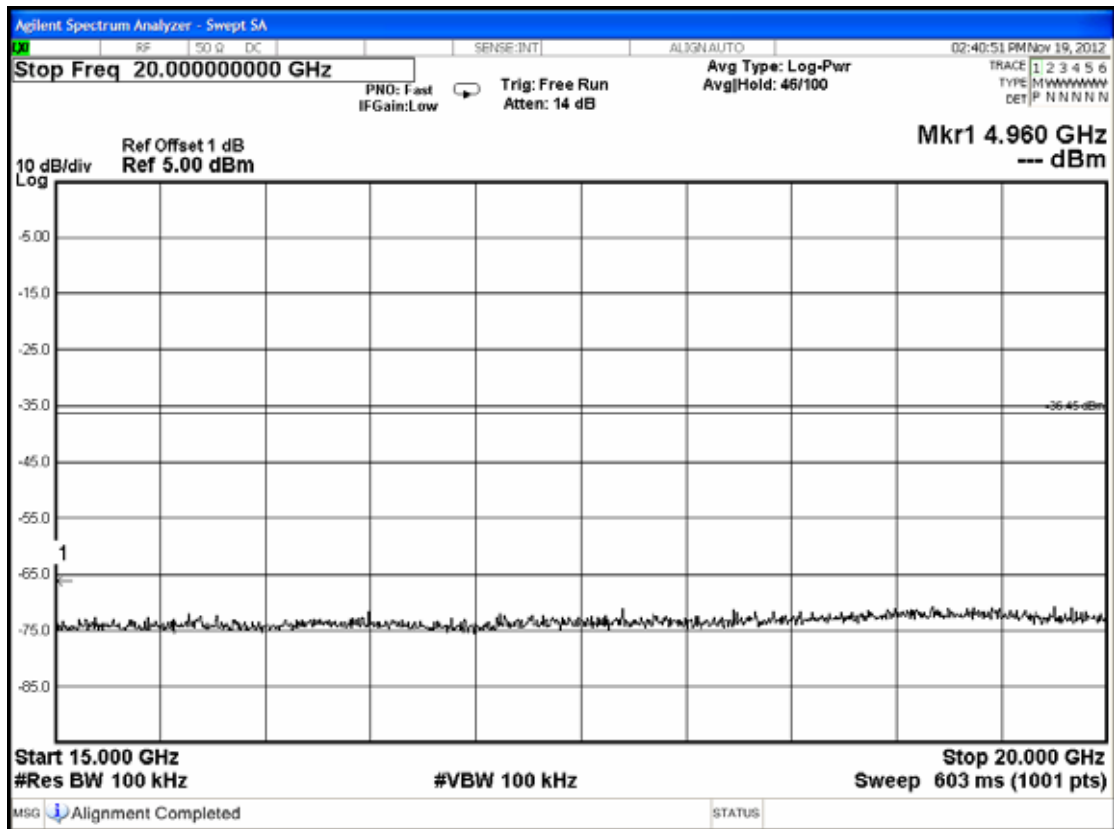
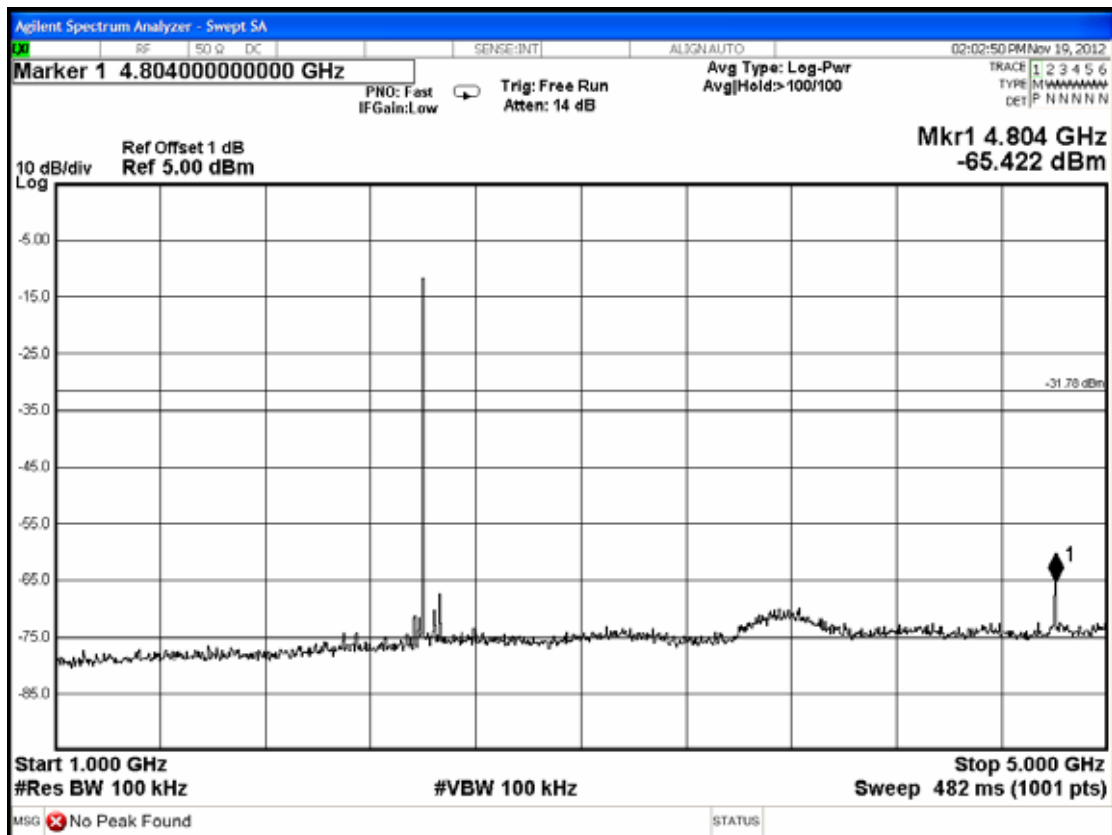
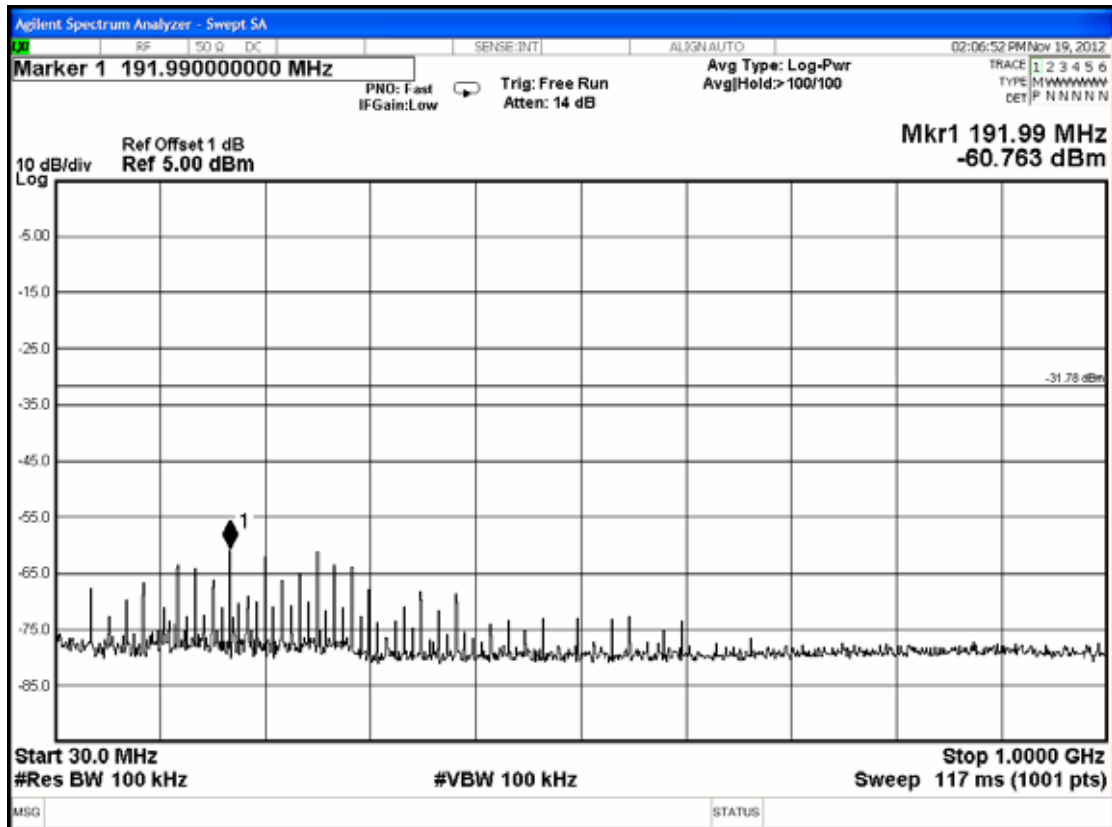
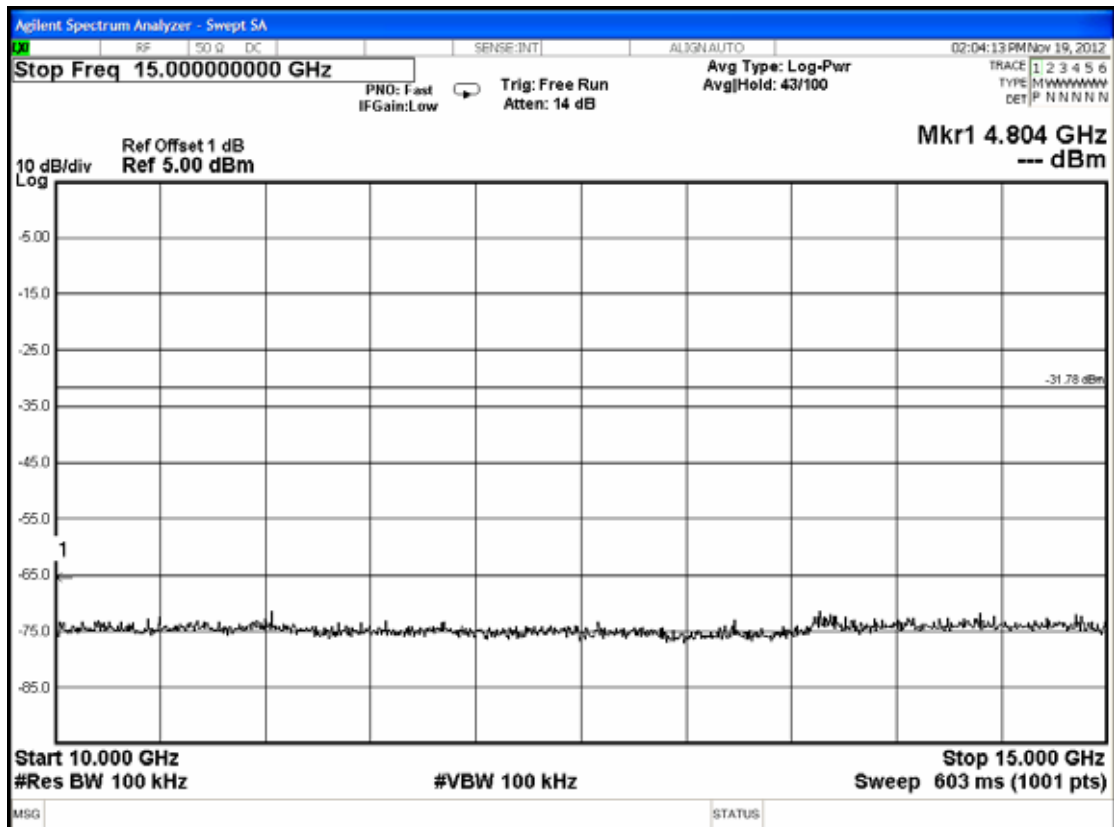
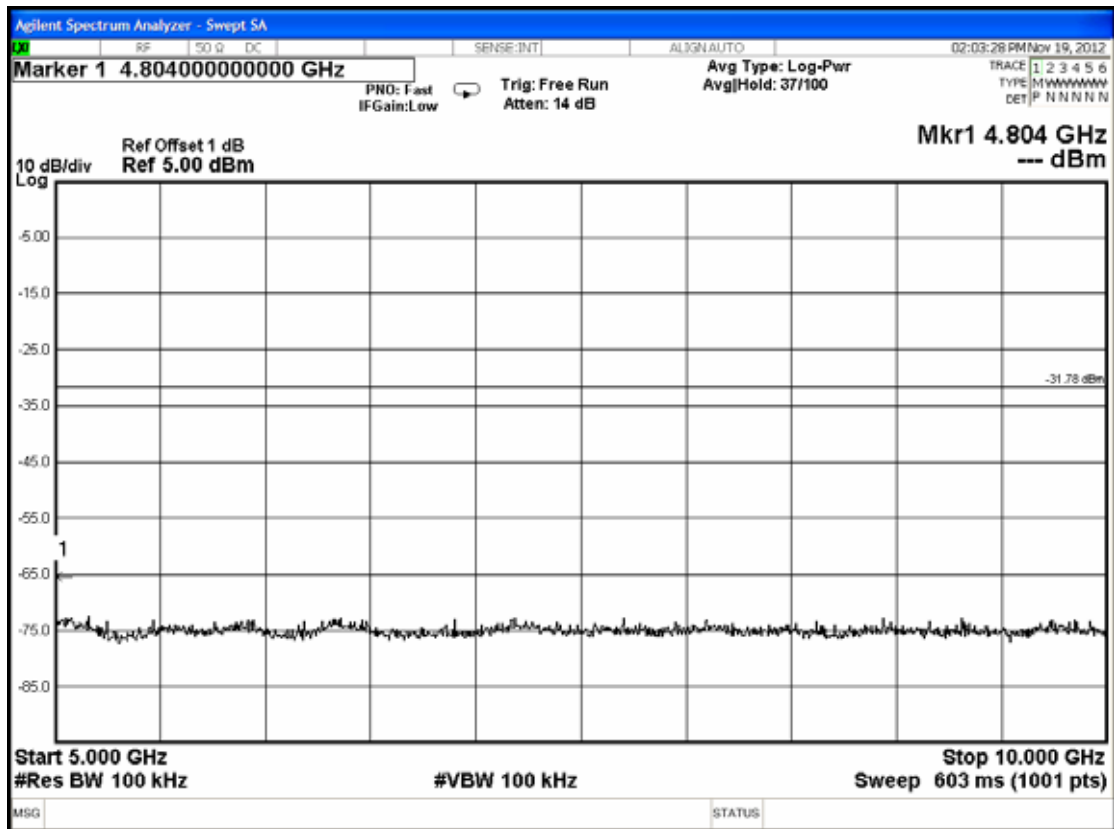




Figure 4: GFSK, Channel 0, Frequency: 2402MHz





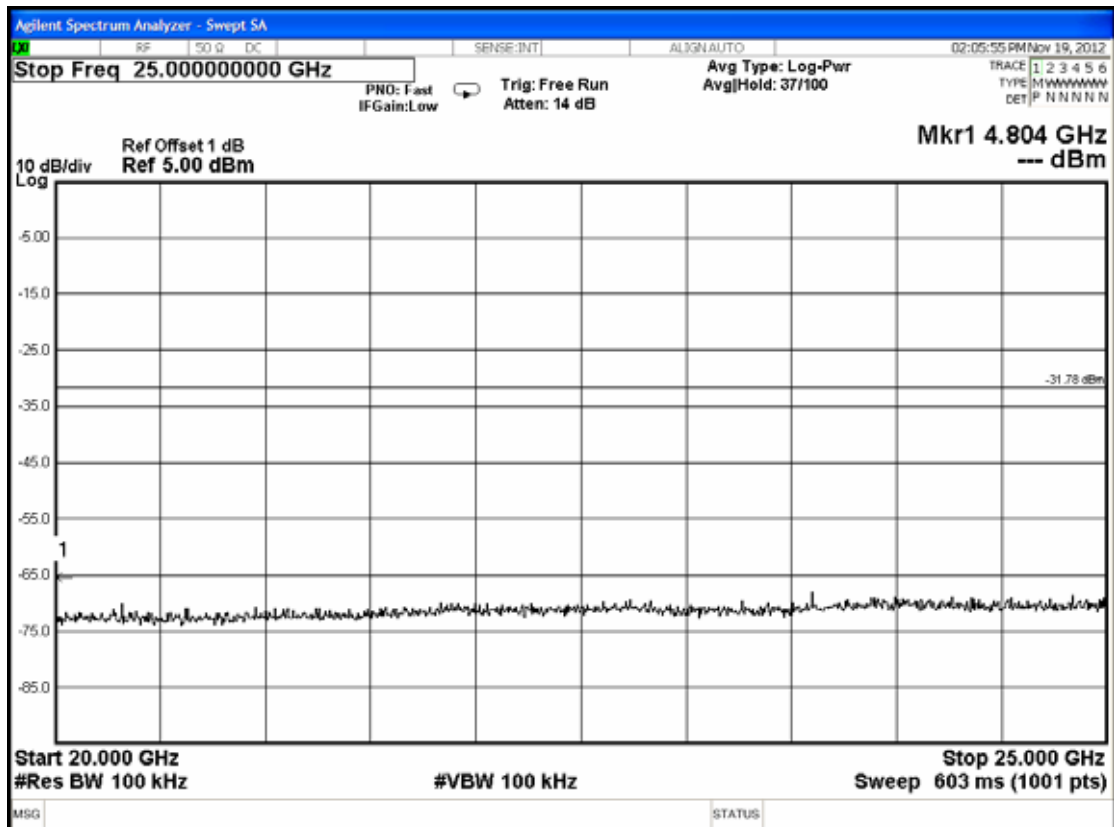
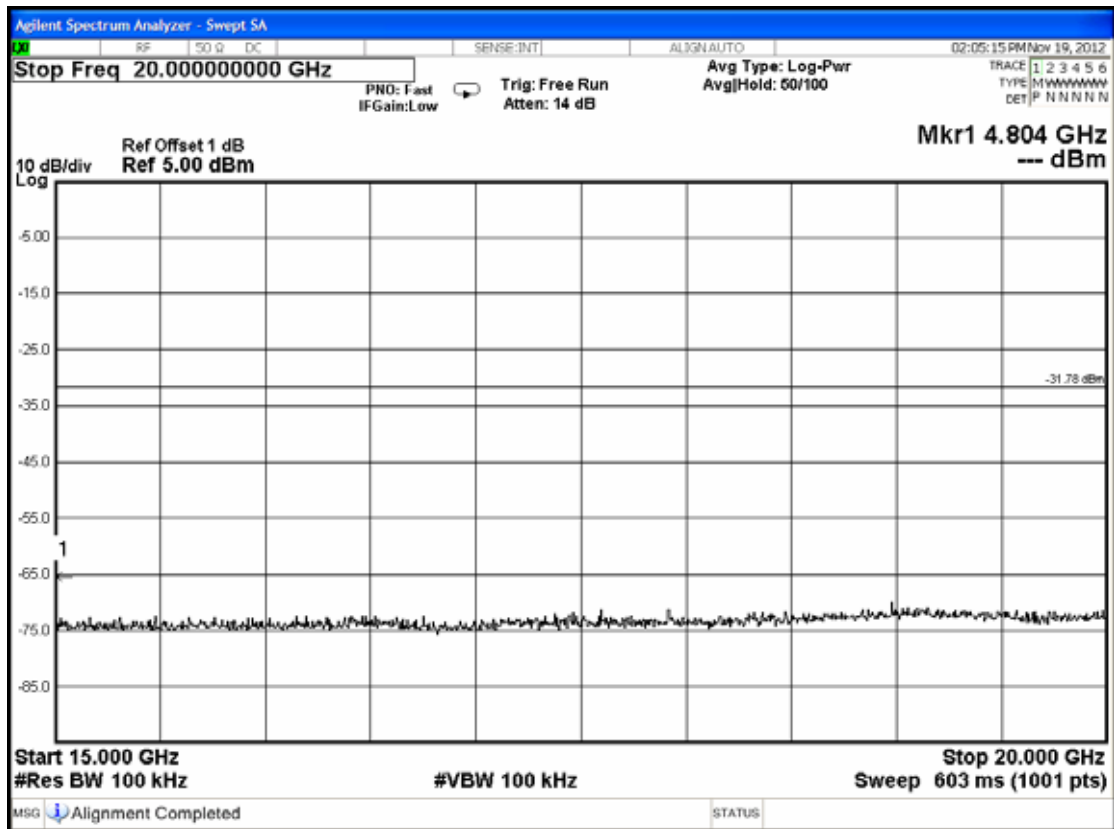
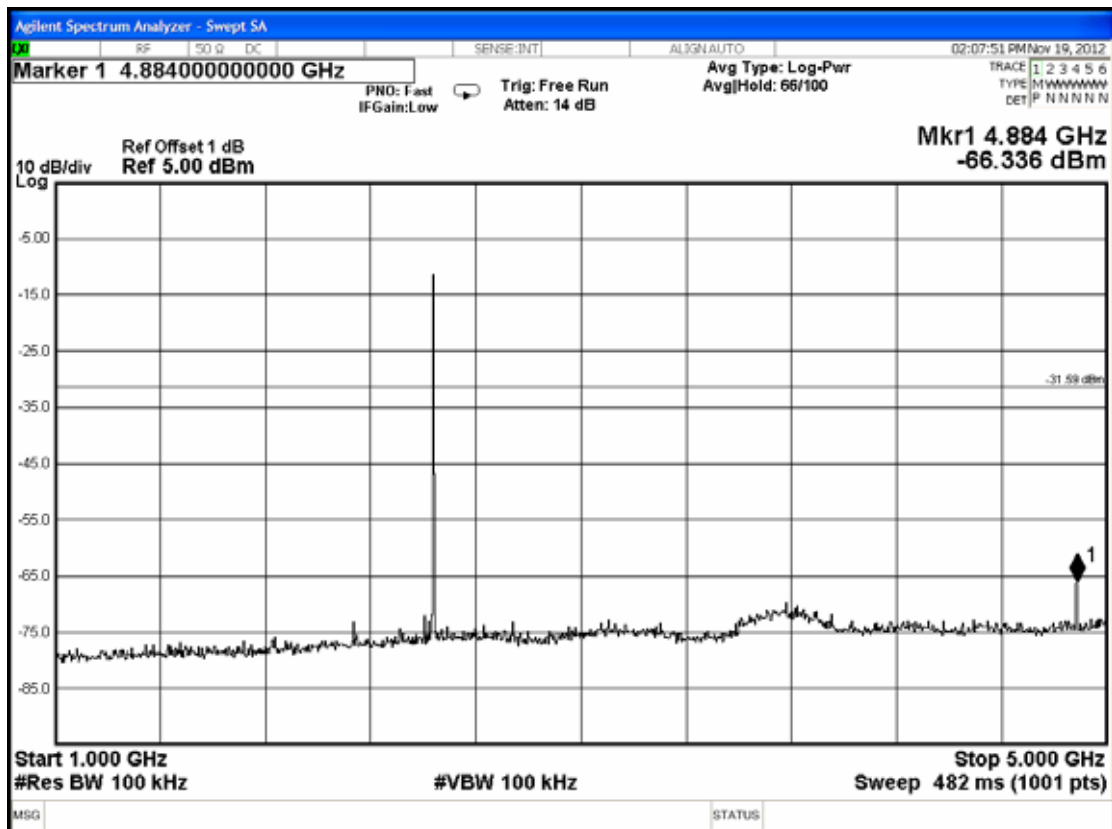
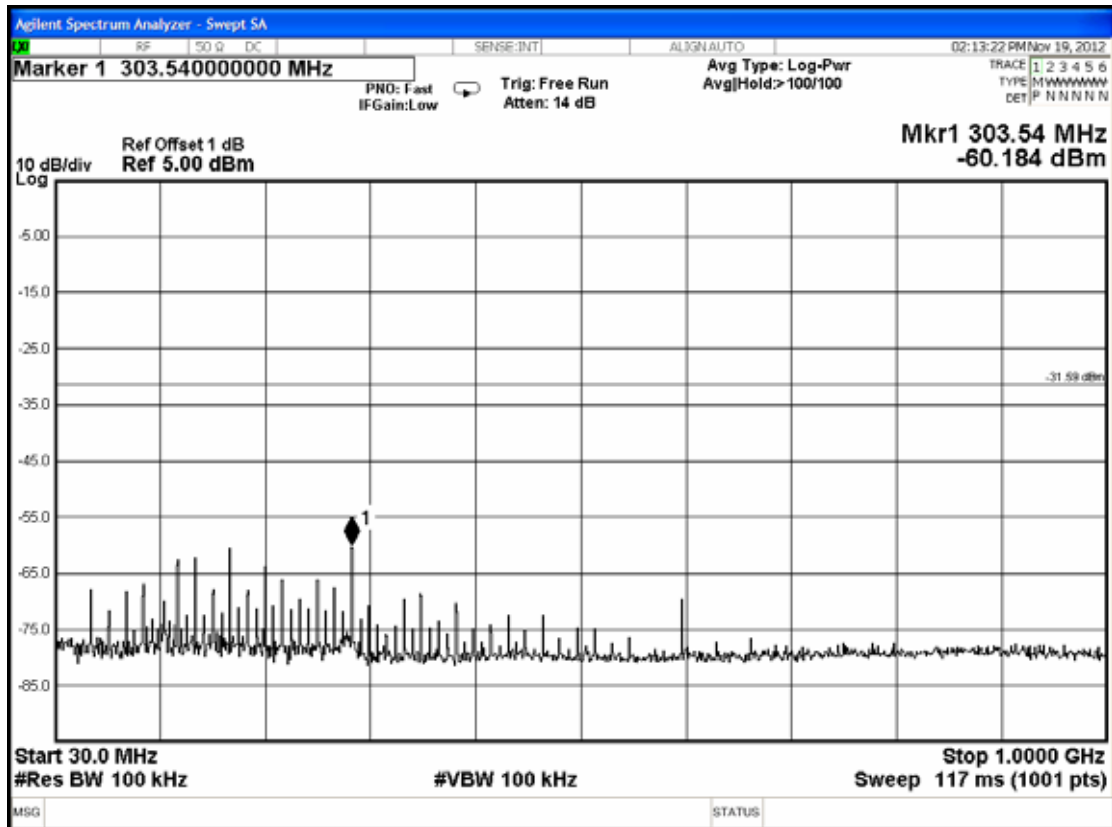
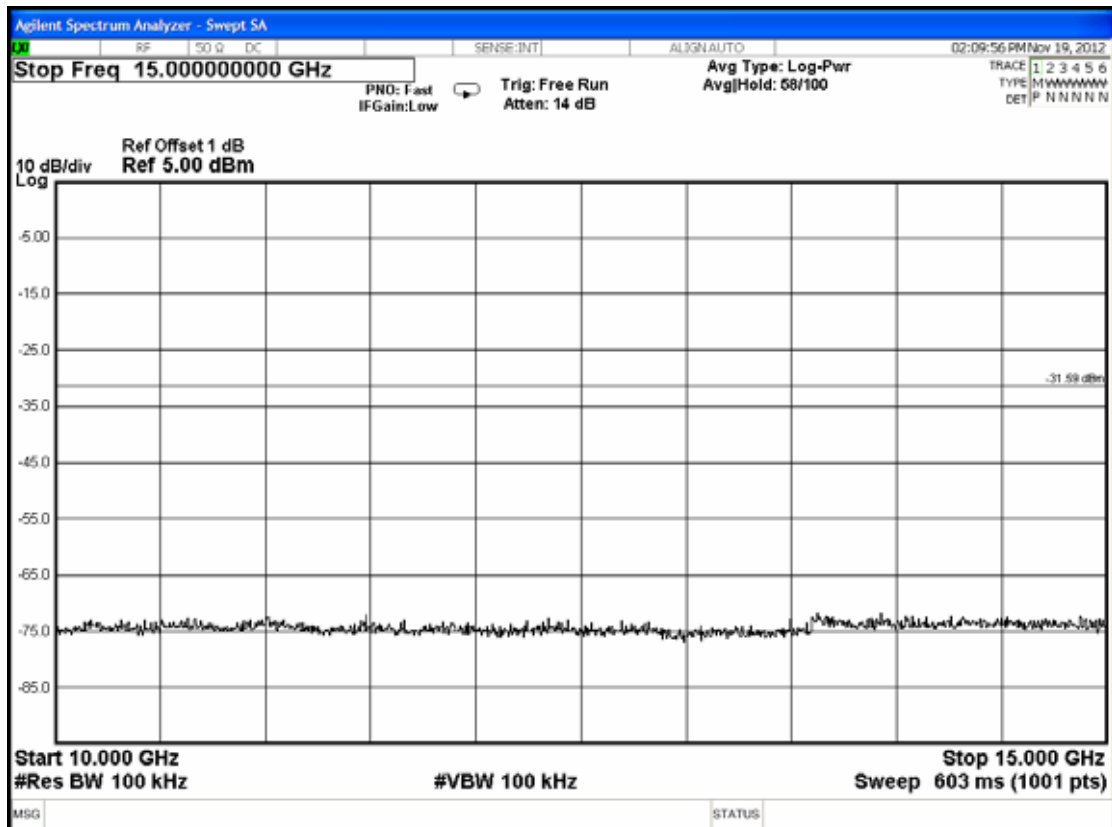
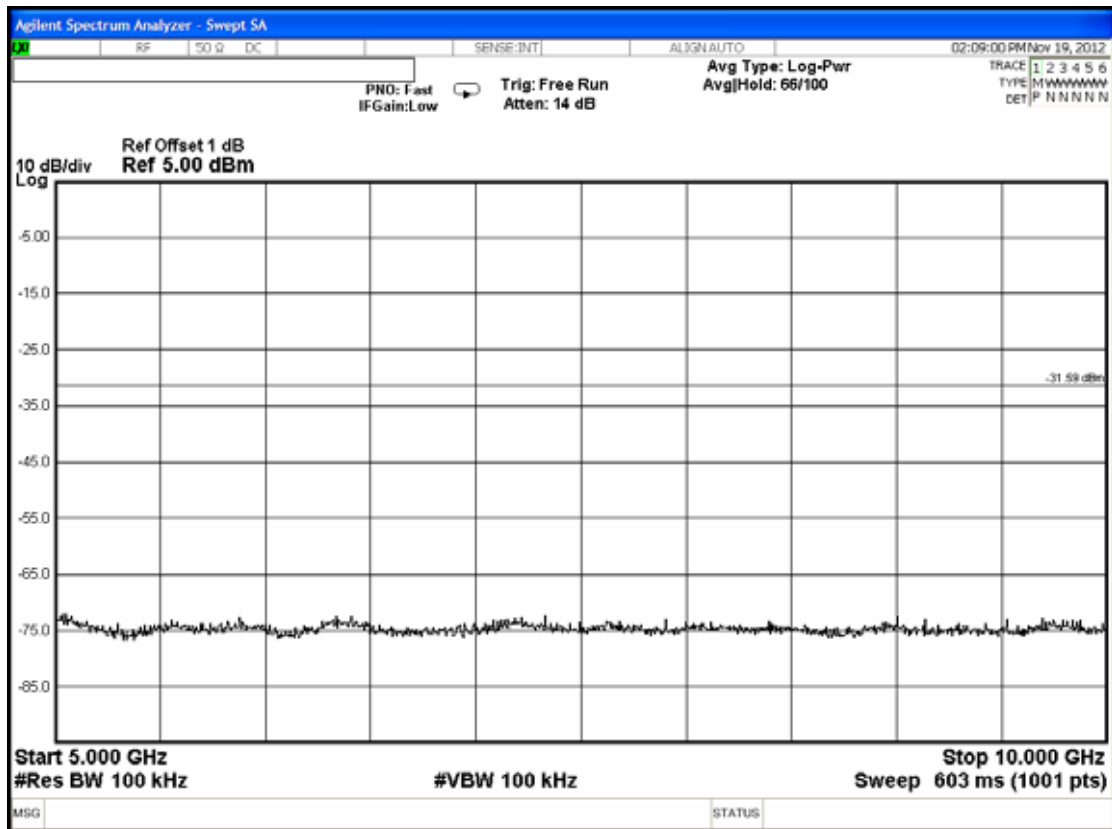


Figure 5: GFSK, Channel 39, Frequency: 2441MHz





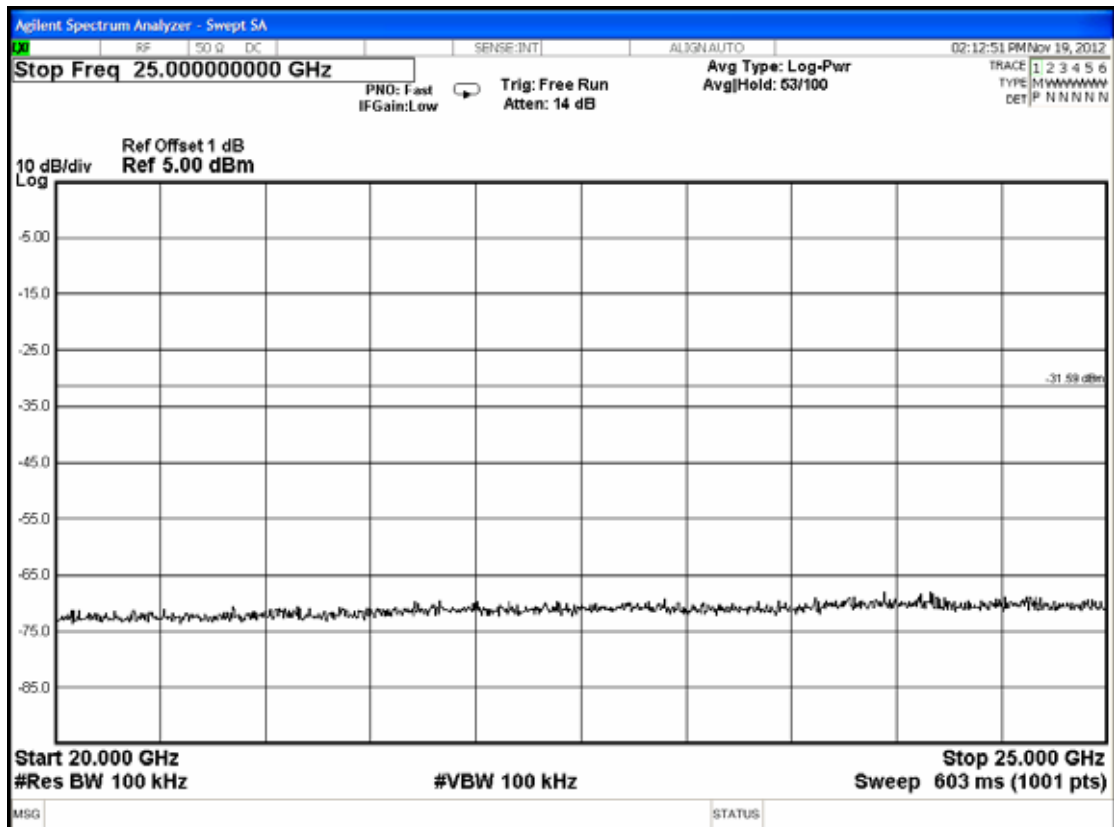
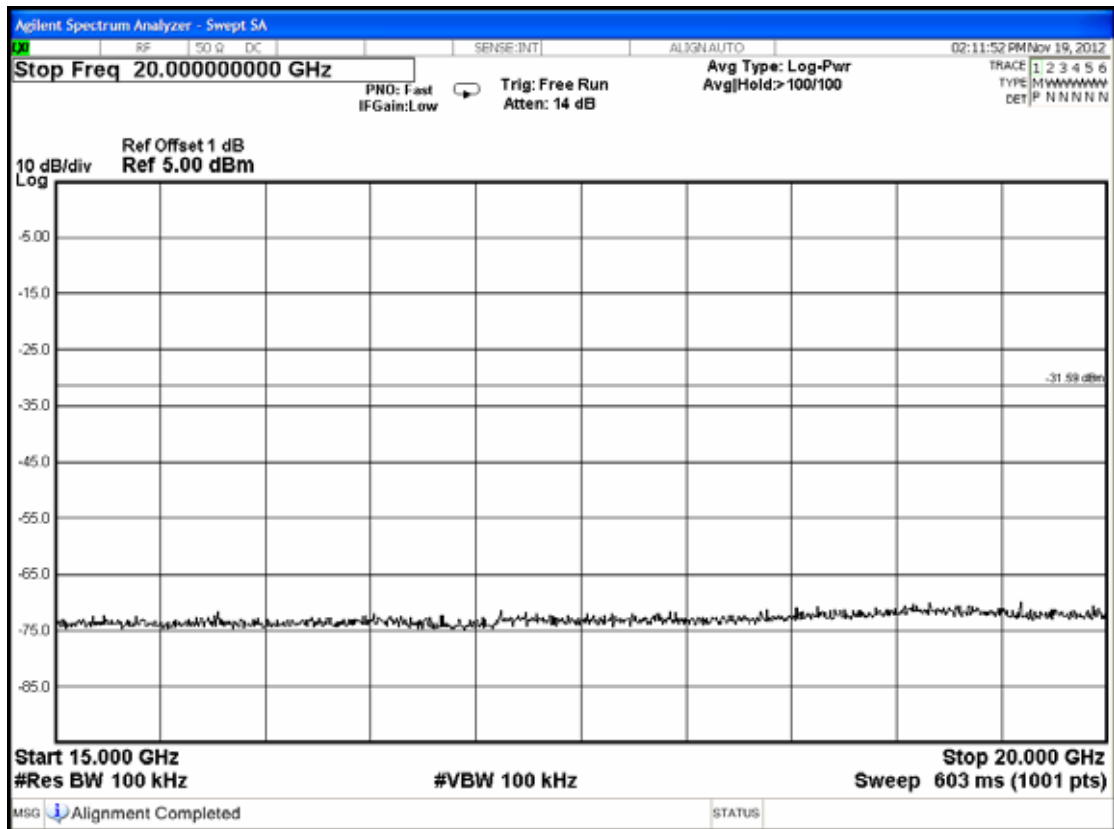
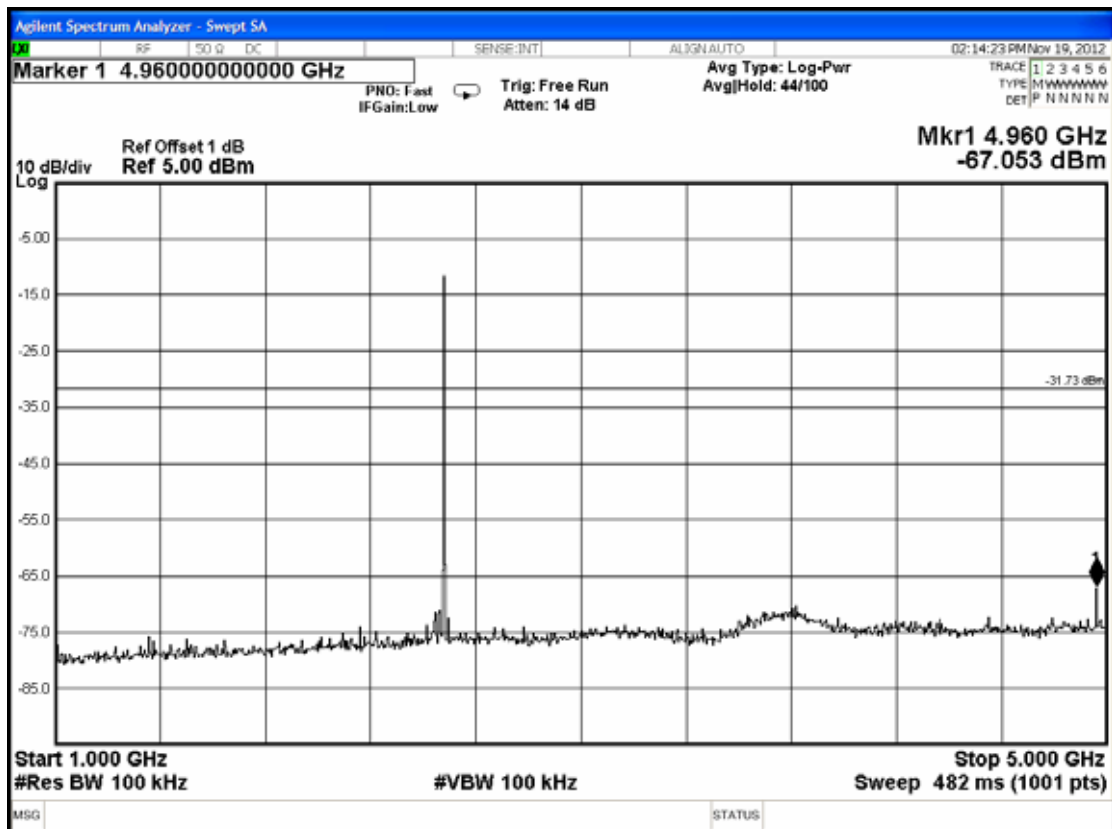
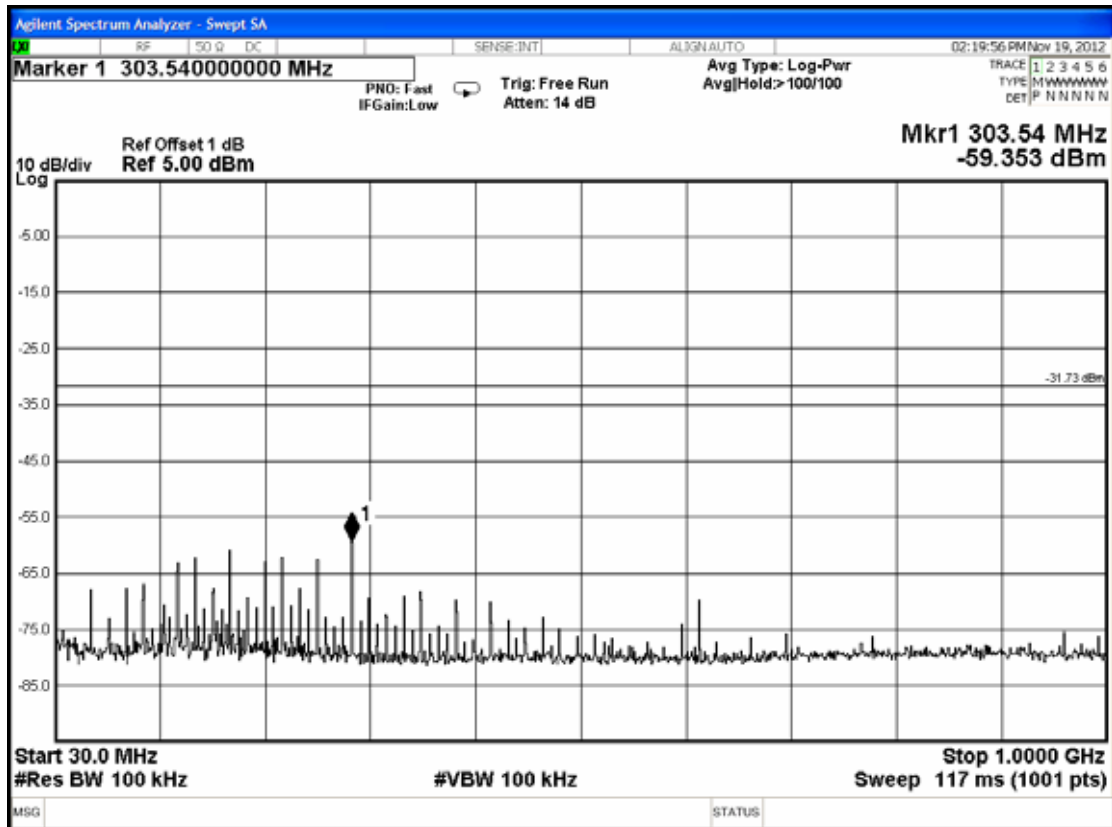
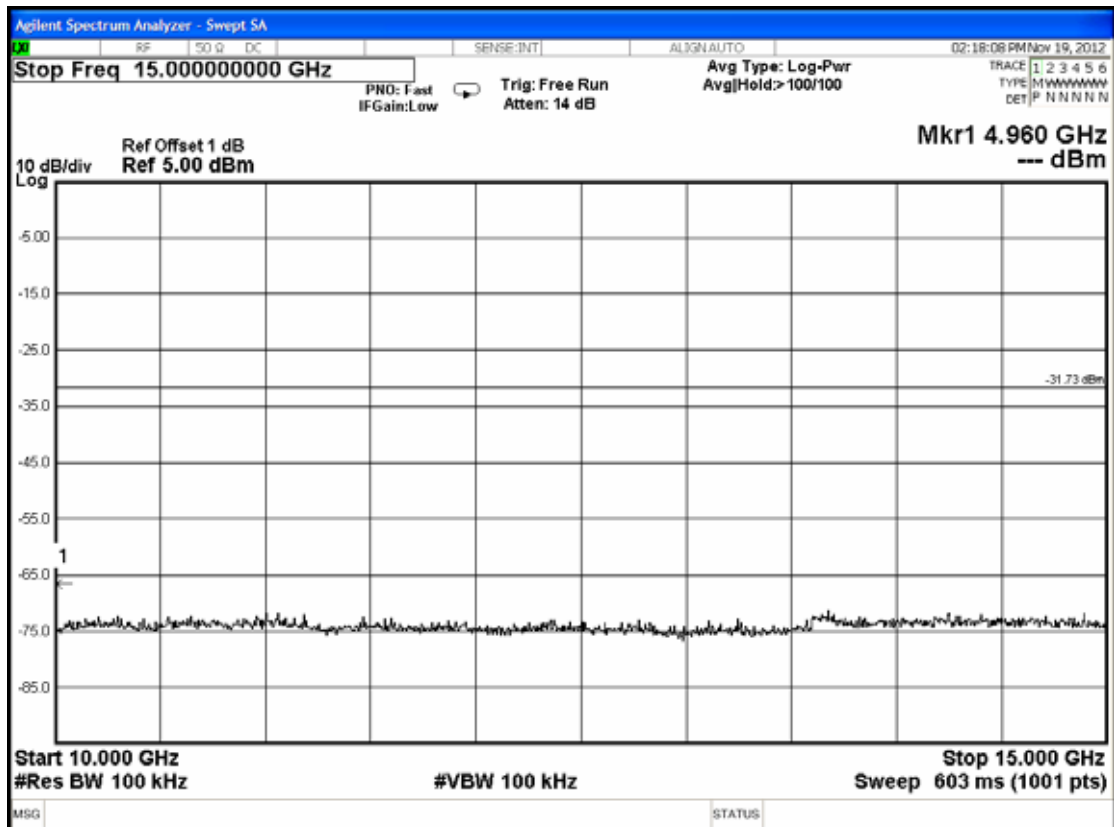
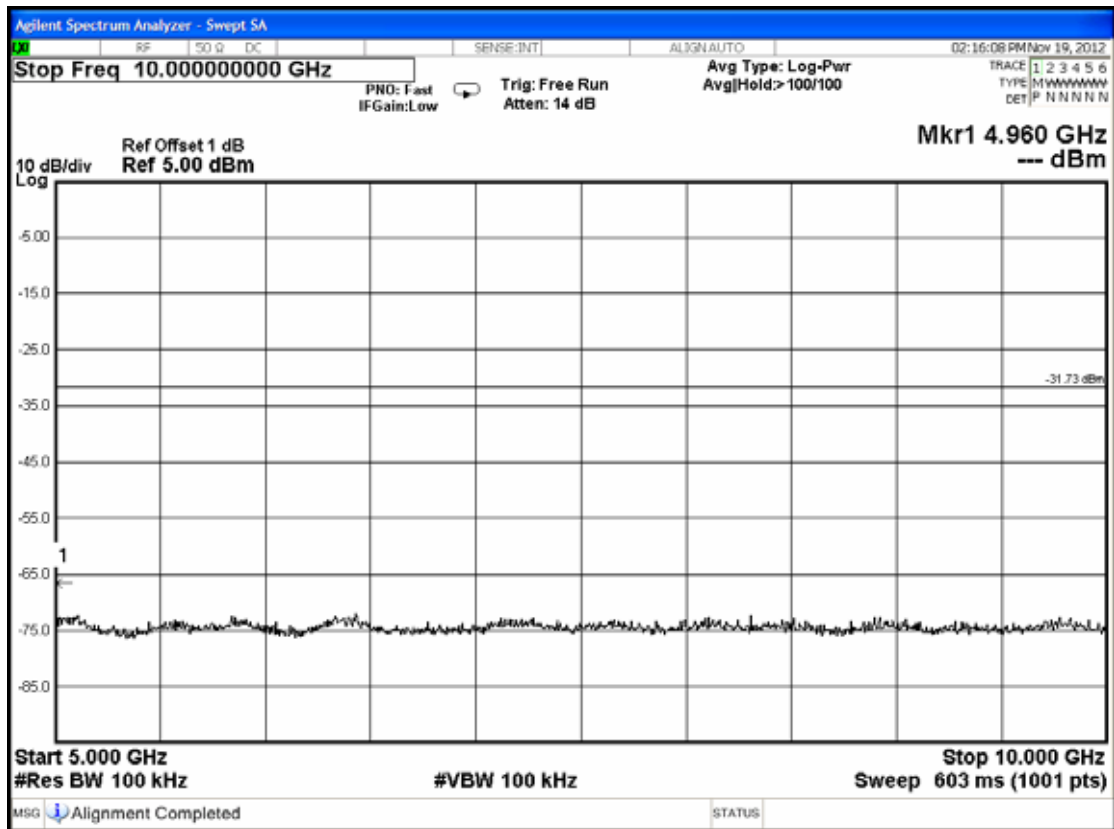
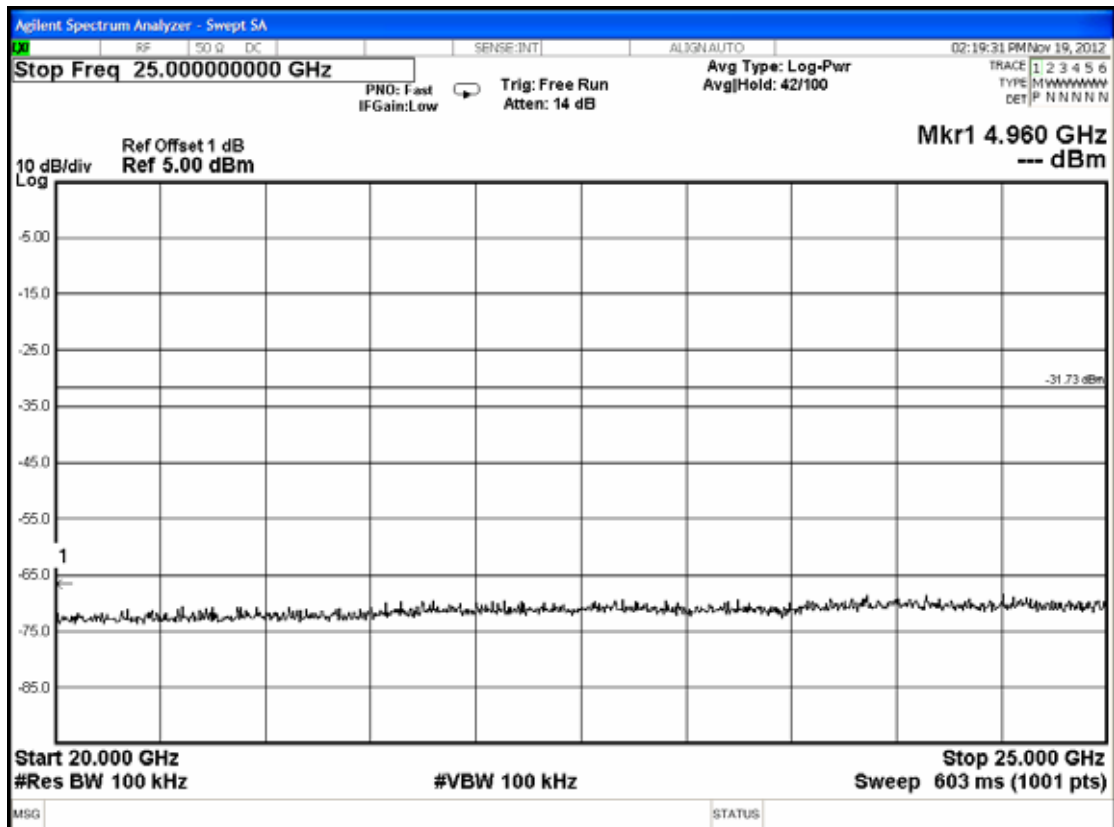
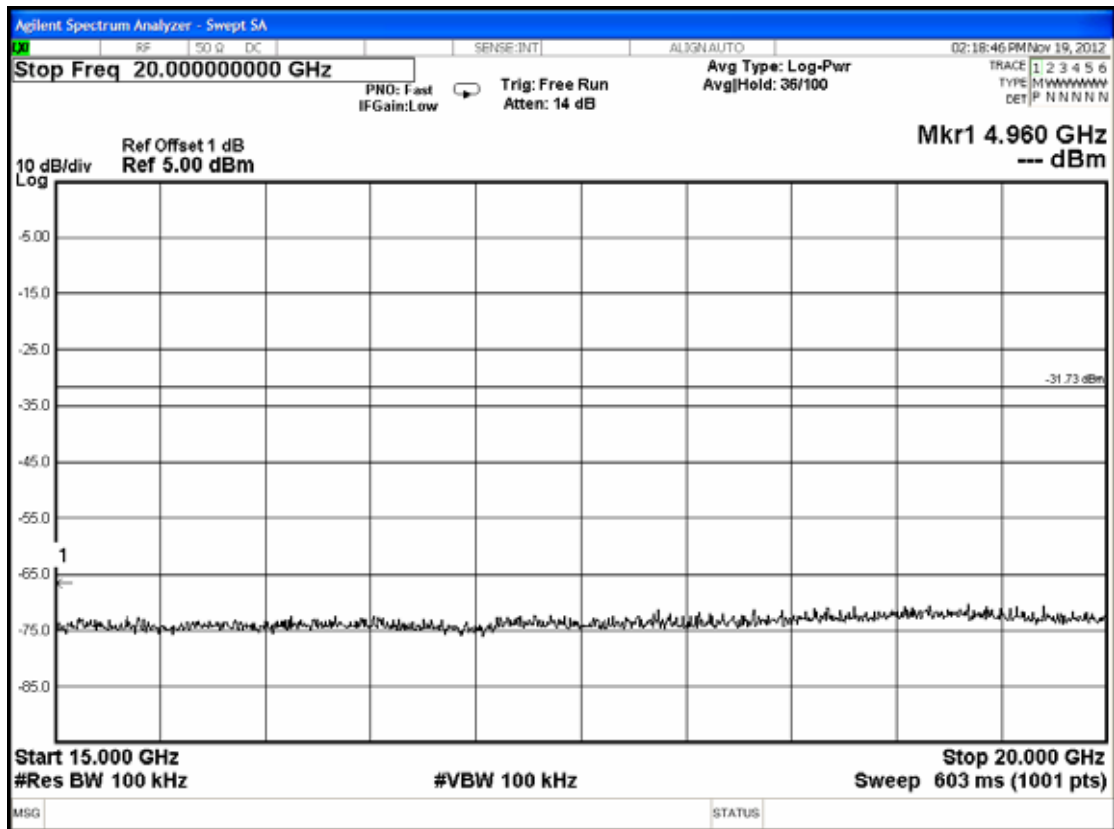


Figure 6: GFSK, Channel 78, Frequency: 2480MHz









## 10.BAND EDGES MEASUREMENT

### 10.1.Test Equipment

The following test equipment was used during the band edges measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9030A-544	US51350140	Oct. 17, 12'	Oct. 16, 13'

### 10.2.Block Diagram of Test Setup

The same as section.4.2.

### 10.3.Specification Limits (§15.247(c))

In any 100kHz 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 20dB below that in the 100kHz 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 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)). ( This test result attaching to §3.6.3)

### 10.4.Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 10.5.Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.

## 10.6. Test Results

**PASSED.** The testing data was attached in the next pages.

**[Note: Three types of modulation (8-DPSK,  $\pi$  /4DQPSK, GFSK) were evaluated but only two types of modulation (8-DPSK and GFSK) were reported in this report.]**

EUT : Bluetooth Heart Rate Monitor

M/N : TA1102

Test Date: Nov. 19, 2012 Temperature : 24

Humidity : 60%

### 10.6.1. Type of Modulation: 8-DPSK

1. Below Band edge : The highest emission level is -64.471dBm on 2.39990GHz.
2. Upper Band edge: The highest emission level is -75.869dBm on 2.48360GHz.

### 10.6.2. Type of Modulation: GFSK

1. Below Band edge : The highest emission level is -65.521dBm on 2.39990GHz.
2. Upper Band edge: The highest emission level is -74.059dBm on 2.48360GHz.

Figure 1: 8-DPSK, Below Band edge

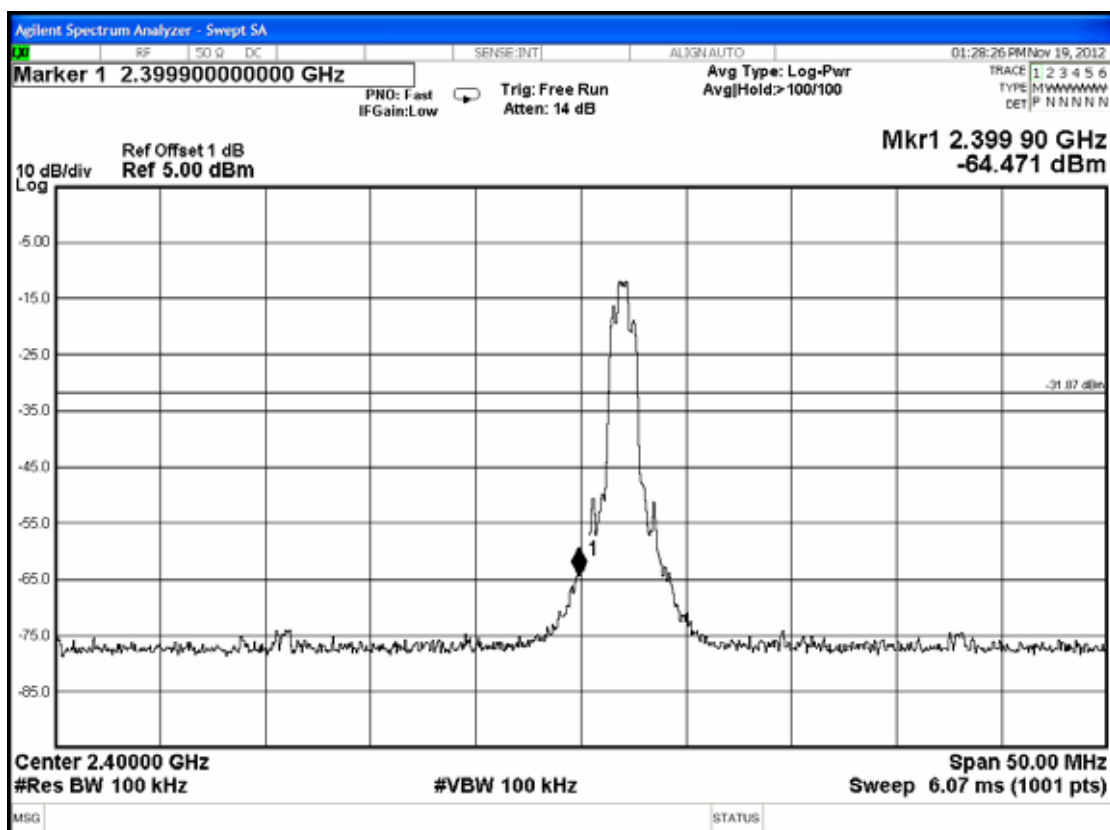


Figure 2: 8-DPSK, Upper Band edge

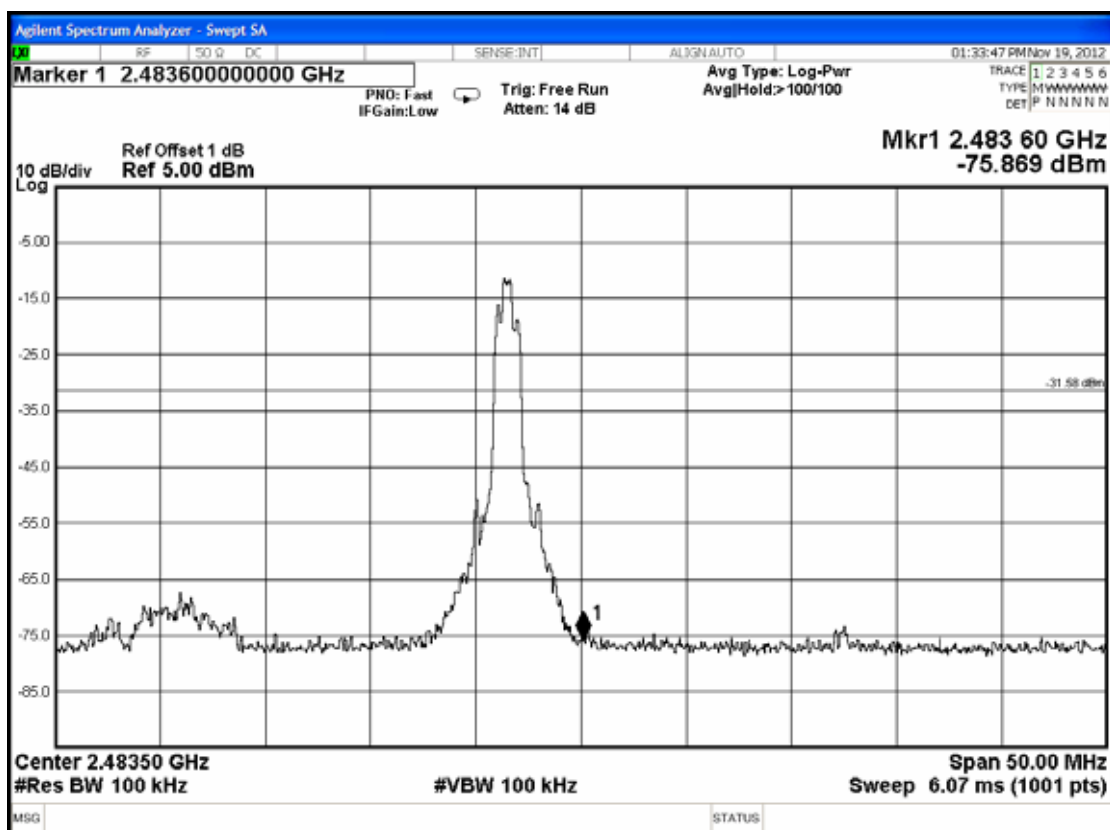


Figure 5: GFSK, Below Band edge

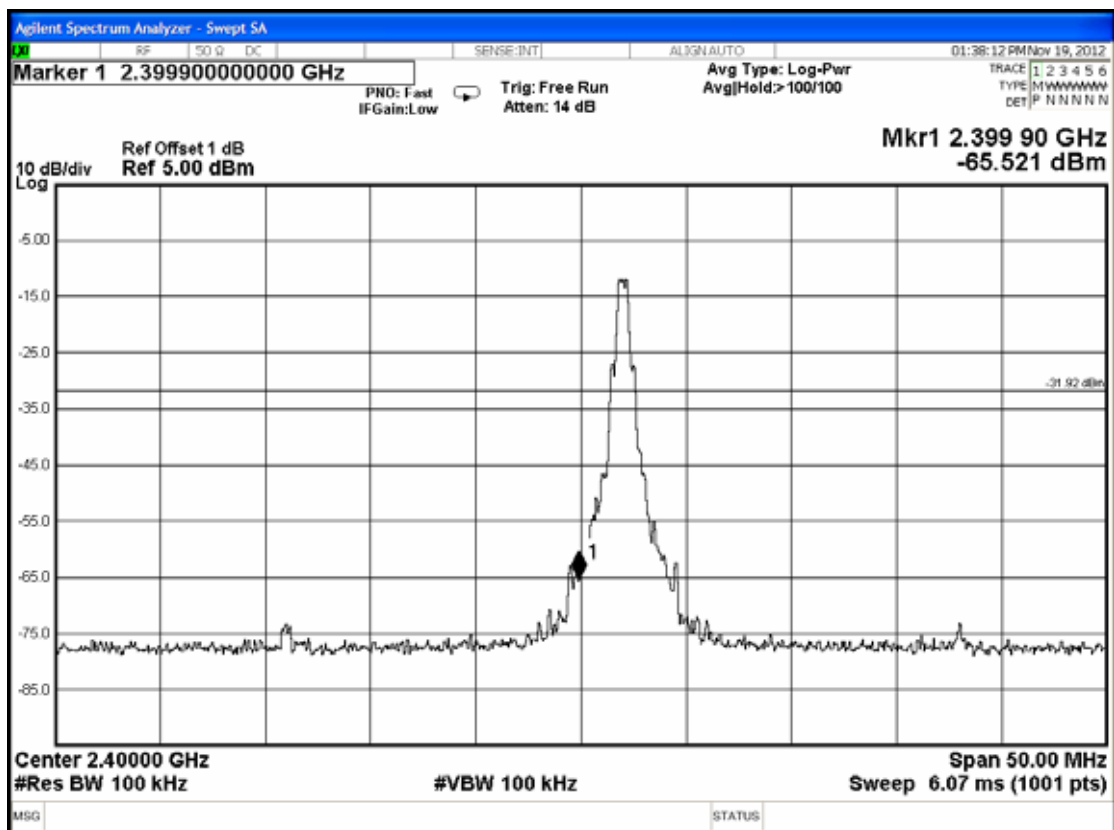
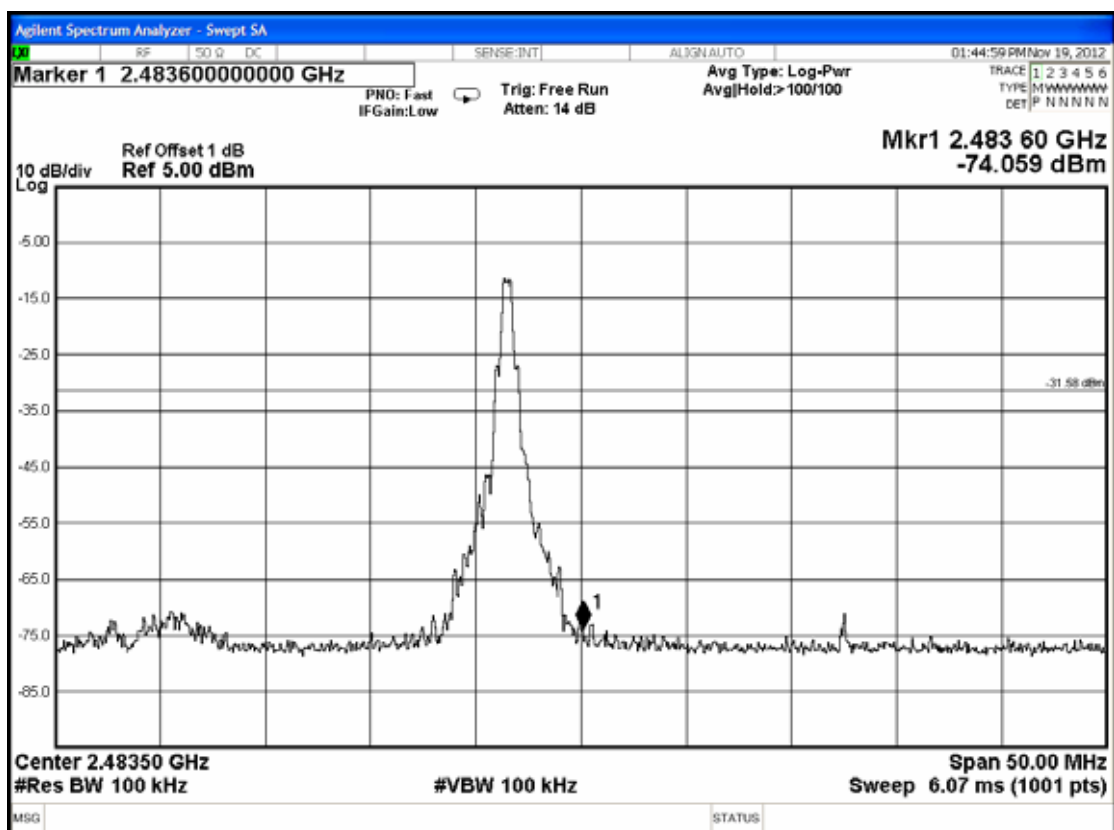


Figure 6: GFSK, Upper Band edge



## **11.DEVIATION TO TEST SPECIFICATIONS**

**【NONE】**

## 12. PHOTOGRAPHS

### 12.1. Photos of Radiated Emission Measurement at Semi-Anechoic Chamber

#### 12.1.1. Frequency Range 30MHz-1GHz

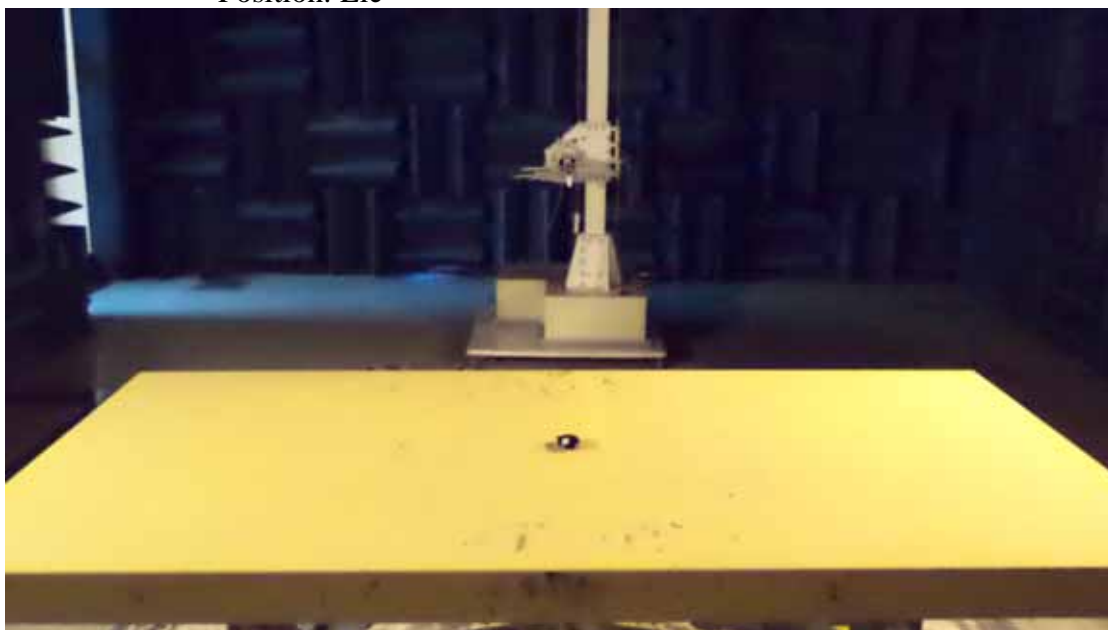
Position: Stand



Position: Side



Position: Lie

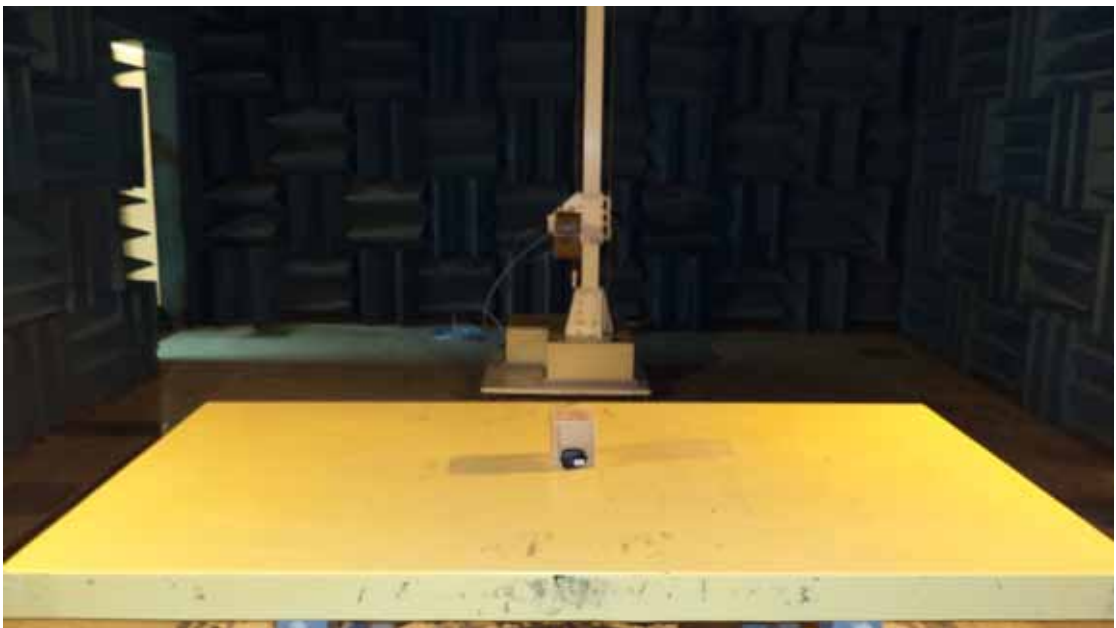




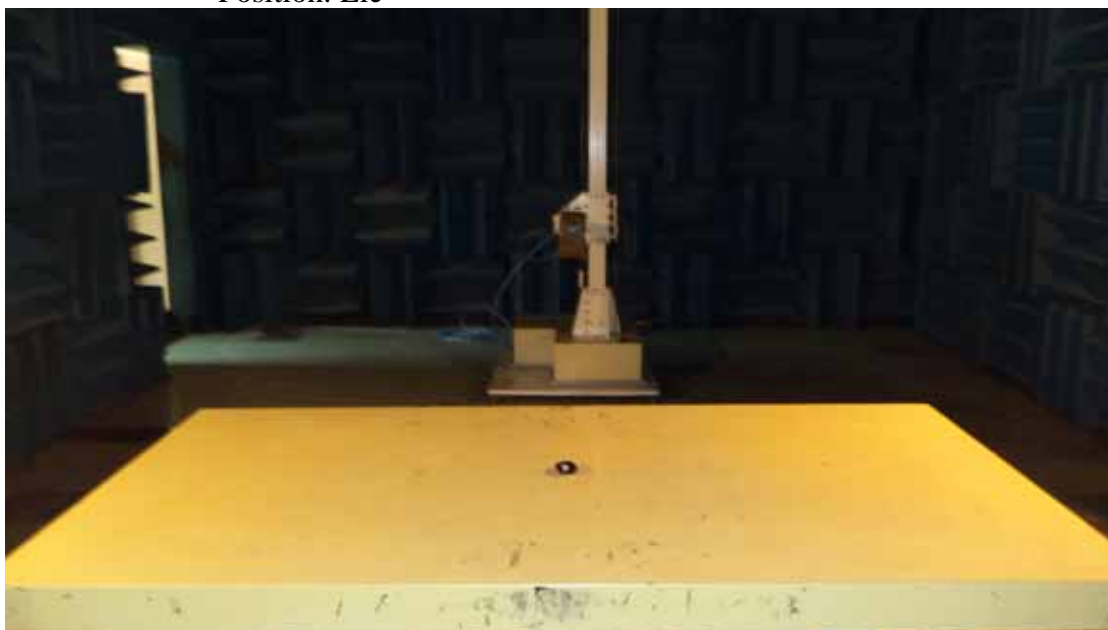
12.1.2. Frequency Range Above 1GHz  
Position: Stand



Position: Side



Position: Lie



## 12.2.Photo of Section RF Conducted Measurement

