RF TEST REPORT

Report No.: SET2016-11156

Product Name: LTE/WCDMA Dual -Mode Digital Mobile Phone

FCC ID: SRQ-MO-01J

Model No. : MO-01J

Applicant: ZTE Corporation

Address: ZTE Plaza, Keji Road South, Shenzhen, China

Dates of Testing: 06/15/2016 — 06/26/2016

Issued by: CCIC-SET

Lab Location: Electronic Testing Building, Shahe Road, Xili Town, Shenzhen, 518055, China

Tel: 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name ..... : LTE/WCDMA Dual -Mode Digital Mobile Phone

Brand Name..... : ZTE

Trade Name ..... : ZTE

Applicant ..... : ZTE Corporation

Applicant Address ..... : ZTE Plaza, Keji Road South, Shenzhen, China

Manufacturer ..... : ZTE Corporation

Manufacturer Address..... : ZTE Plaza, Keji Road South, Shenzhen, China

Test Standards ..... : 47 CFR Part 15 Subpart C 2013：Radio Frequency Devices
ANSI C63.10:2013：American National Standard for Testing Unlicensed Wireless Devices
DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

Test Result..... : PASS

Tested by ..... :

2016.06.27

Lu Lei， Test Engineer

Reviewed by ..... :

2016.06.27

Zhu Qi, Senior Engineer

Approved by ..... :

2016.06.27

Wu Li'an, Manager

Table of contents

1. GENERAL INFORMATION 4

1.1. EUT Description 4

1.2. Test Standards and Results 5

1.3. Frequency Hopping System Requirements 6

1.4. Facilities and Accreditations 7

2. 47 CFR PART 15C REQUIREMENTS 8

2.1. Antenna requirement 8

2.2. Number of Hopping Frequency 9

2.3. Peak Output Power 12

2.4. 20dB Bandwidth 14

2.5. Carried Frequency Separation 20

2.6. Dwell time 23

2.7. Conducted Spurious Emissions 30

2.8. Conducted Band Edge 40

2.9. Conducted Emission 47

2.10. Radiated Band Edges and Spurious Emission 51

3. LIST OF MEASURING EQUIPMENT 66

4. UNCERTAINTY OF EVALUATION 67

Change History		
Issue	Date	Reason for change
1.0	2016.06.27	First edition

1. General Information

1.1. EUT Description

EUT Type	LTE/WCDMA Dual -Mode Digital Mobile Phone	
Hardware Version	P852D01HW1.0	
Software Version	DCM_JP_MO-01JV1.0.0B02	
EUT supports Radios application	GSM/GPRS/EDGE/WCDMA/HSPA/LTE WLAN2.4GHz 802.11b/g/n (HT20/HT40) Bluetooth V3.0+EDR Bluetooth V4.1 Downward Compatibility BT 4.0LE	
Frequency Range	Bluetooth EDR	2402MHz~2480MHz
Channel Number	Bluetooth EDR	79
Bit Rate of Transmitter	Bluetooth EDR	1/2/3Mbps
Modulation Type	Bluetooth EDR	GFSK, π /4-DQPSK,8DPSK
Antenna Type	Internal Antenna	
Antenna Gain	0.63dBi	

Note 1: The EUT is a Mobile Phone, it contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is F(MHz)=2402+1*n (0<=n<=78). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 3: a. When power on, the EUT will scan the whole frequency until a Connection command from the other BT devices.

b. When receiving the signal from the other BT devices, The EUT transmit are spouse signal.

c. The other devices receive the response signal and recognize it, then send a connection command to establish the connection.

d. After the connection establish successfully, the data transmission is beginning. At the same time, the both devices will shift frequencies in synchronization per a same pseudo randomly ordered list of hopping frequencies, the hopping rate is1600 times per second. This device conforms to the criteria in FCC Public Notice DA 00-705.

e. The bandwidth of the receiver, which is set to a fixed width by the software.

Note 4: Bluetooth signal has 9 packages DH1, DH3, DH5, 2DH1, 2DH3, 2DH5, 3DH1, 3DH3, 3DH5, DH5 package is largest, we are testing DH5 in the document.

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2013	Radio Frequency Devices
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.247(a)	Number of Hopping Frequency	PASS
3	15.247(b)	Peak Output Power	PASS
4	15.247(a)	20dB Bandwidth	PASS
5	15.247(a)	Carrier Frequency Separation	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	Conducted Spurious Emission	PASS
8	15.247(d)	Conducted Band Edge	PASS
9	15.207	Conducted Emission	PASS
10	15.209 15.247(c)	Radiated Band Edges and Spurious Emission	PASS

Note 1: The tests were performed according to the method of measurements prescribed in DA-00-705.

Note 2: The test of Radiated Emission was performed according to the method of measurements prescribed in ANSI C63.10 2013.

1.3. Frequency Hopping System Requirements

1.3.1. Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

1.3.2. Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no

impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for DA 00-705 and FCC Part 15.247 rule.

1.3.3. EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:
Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78,68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48,72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.4. Facilities and Accreditations

1.4.1. Facilities

CNAS-Lab Code: L1659
CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.
FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 406086, valid time is until October 28, 2017.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on July. 15, 2013, valid time is until July. 15, 2016.

1.4.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT	Ant. Type	Gain(dBi)
1	LTE/WCDMA Dual -Mode Digital Mobile Phone	Internal	0.63

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Number of Hopping Frequency

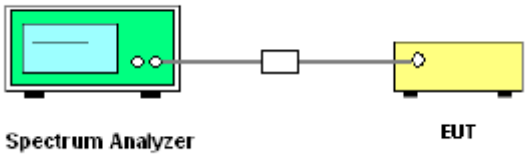
2.2.1. Limit of Number of Hopping Frequency

Frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedure

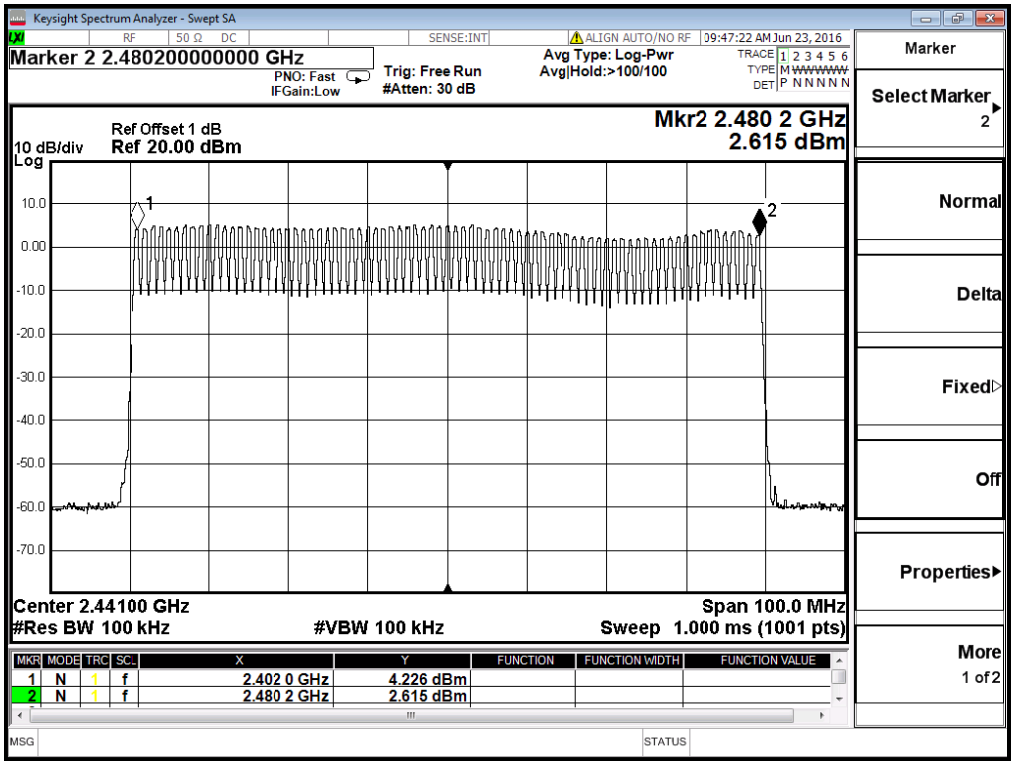
1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW≥1% of the span; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

2.2.5. Test Results of Number of Hopping Frequency

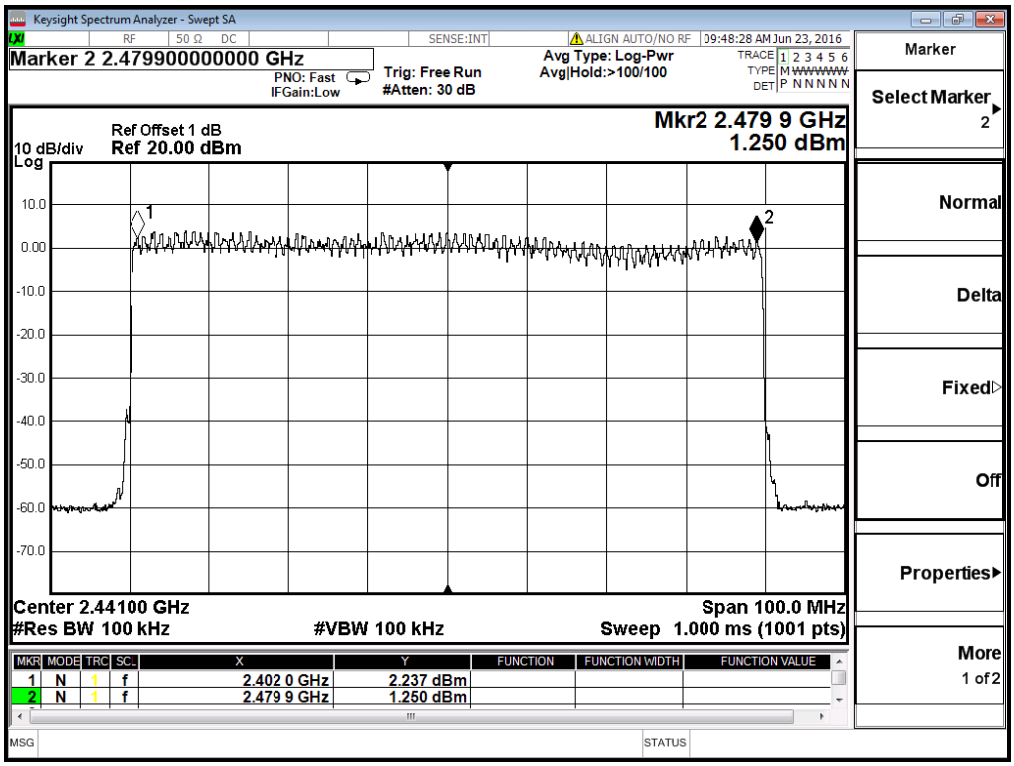
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
π/4-DQPSK	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

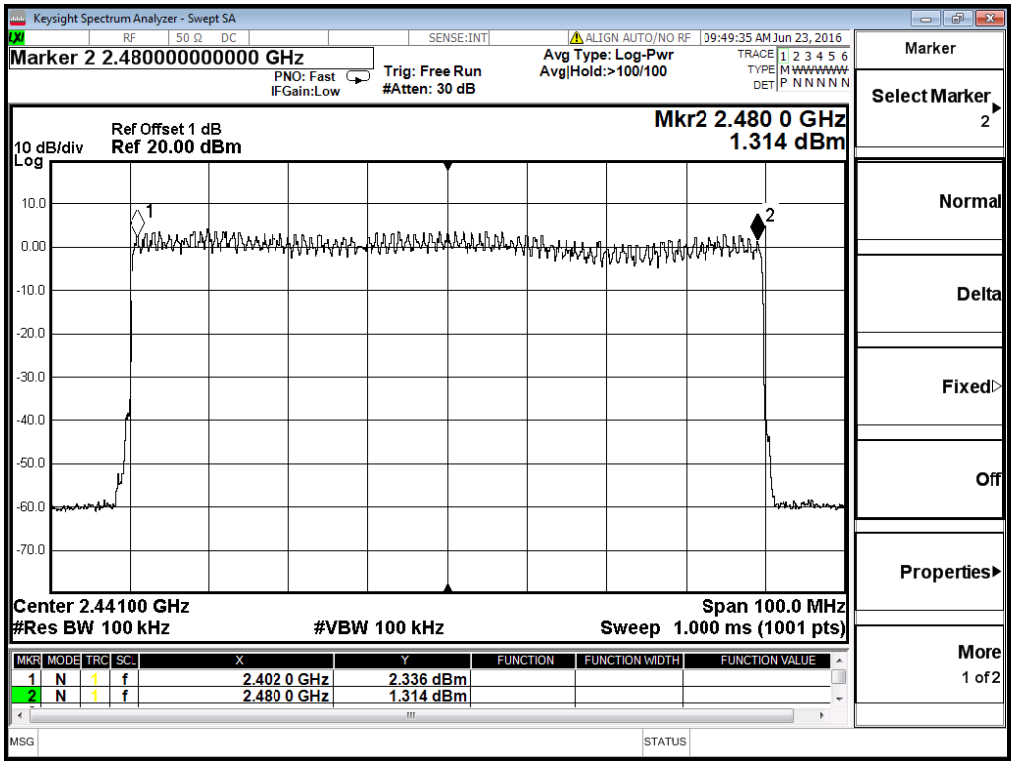
2.2.6. Test Results (plots) of Number of Hopping Frequency



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8- DPSK)

2.3. Peak Output Power

2.3.1. Limit of Peak Output Power

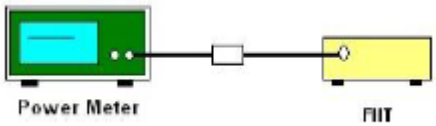
Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

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

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

2.3.5. Test Result

Test Mode	Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limit (dBm)	Verdict
GFSK	0	2402	5.05	30	PASS
	39	2441	5.68		PASS
	78	2480	4.47		PASS
π/4-DQPSK	0	2402	4.51		PASS
	39	2441	5.67		PASS
	78	2480	5.06		PASS
8- DPSK	0	2402	5.59		PASS
	39	2441	6.14		PASS
	78	2480	5.04		PASS

2.4. 20dB Bandwidth

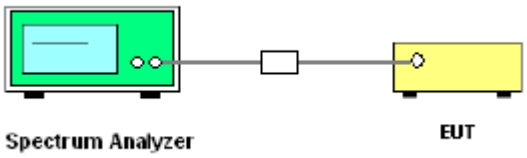
2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.

   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;

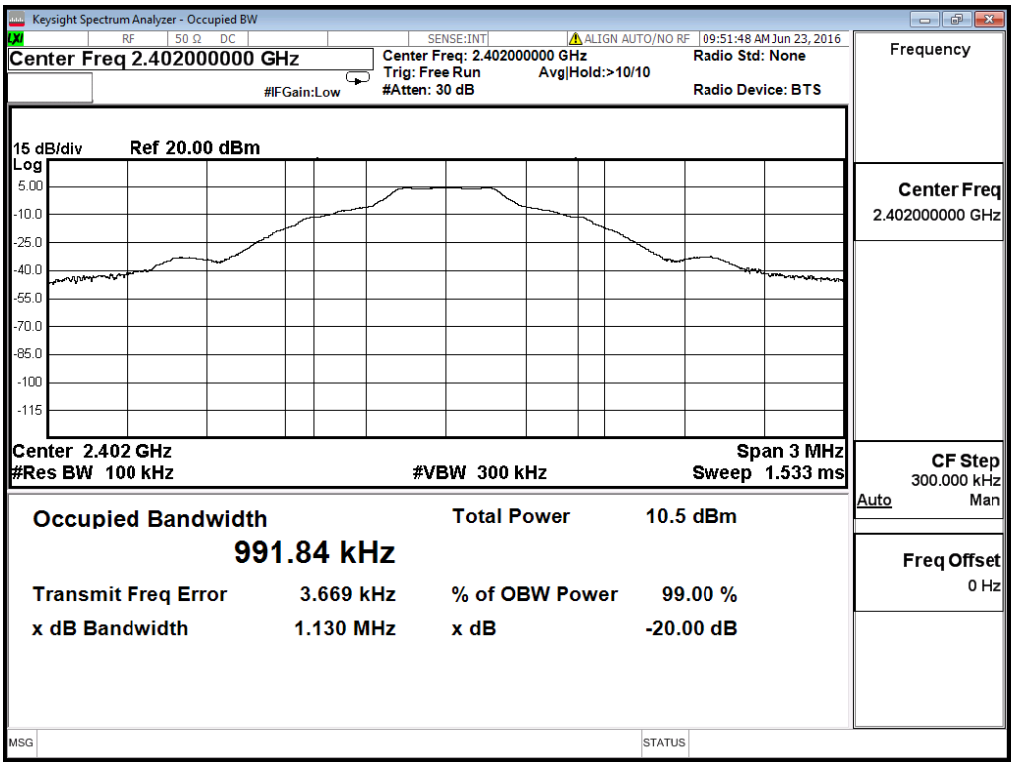
   RBW≥1% of the 20 dB bandwidth; VBW≥RBW; Sweep = auto; Detector function = peak;

   Trace = max hold.
5. Measure and record the results in the test report.

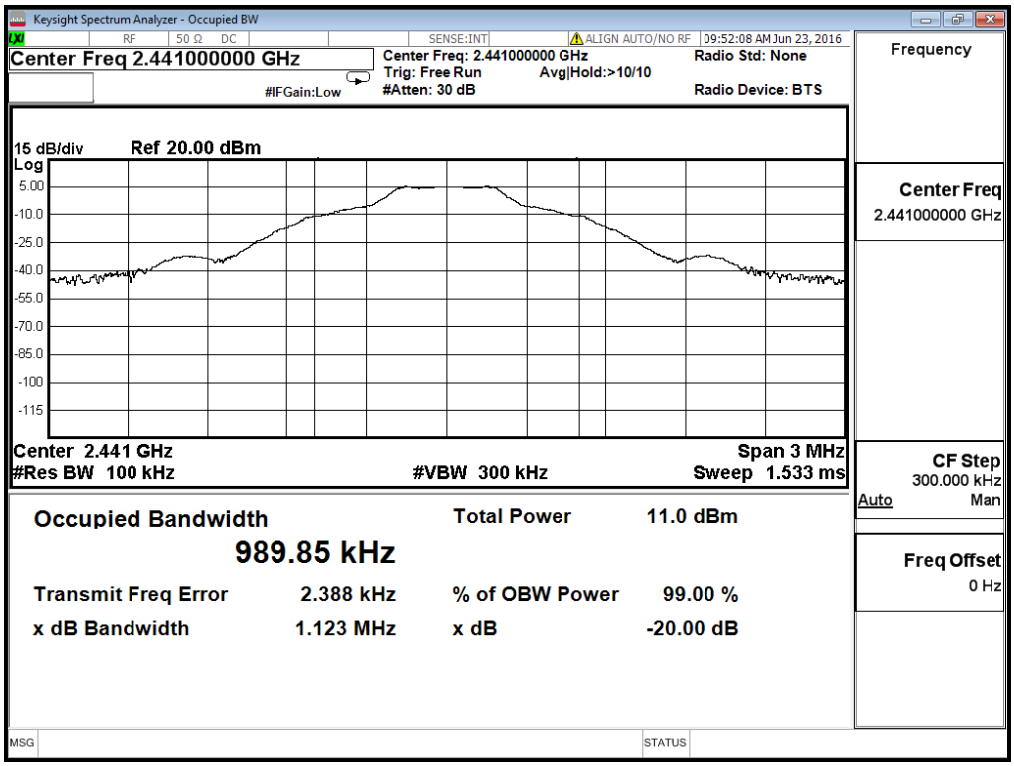
2.4.5. Test Results of 20dB Bandwidth

Mode	Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
GFSK	0	2402	1.130	Plot A
	39	2441	1.123	Plot B
	78	2480	1.133	Plot C
π/4-DQPSK	0	2402	1.376	Plot D
	39	2441	1.380	Plot E
	78	2480	1.376	Plot F
8-DPSK	0	2402	1.378	Plot G
	39	2441	1.376	Plot H
	78	2480	1.378	Plot I

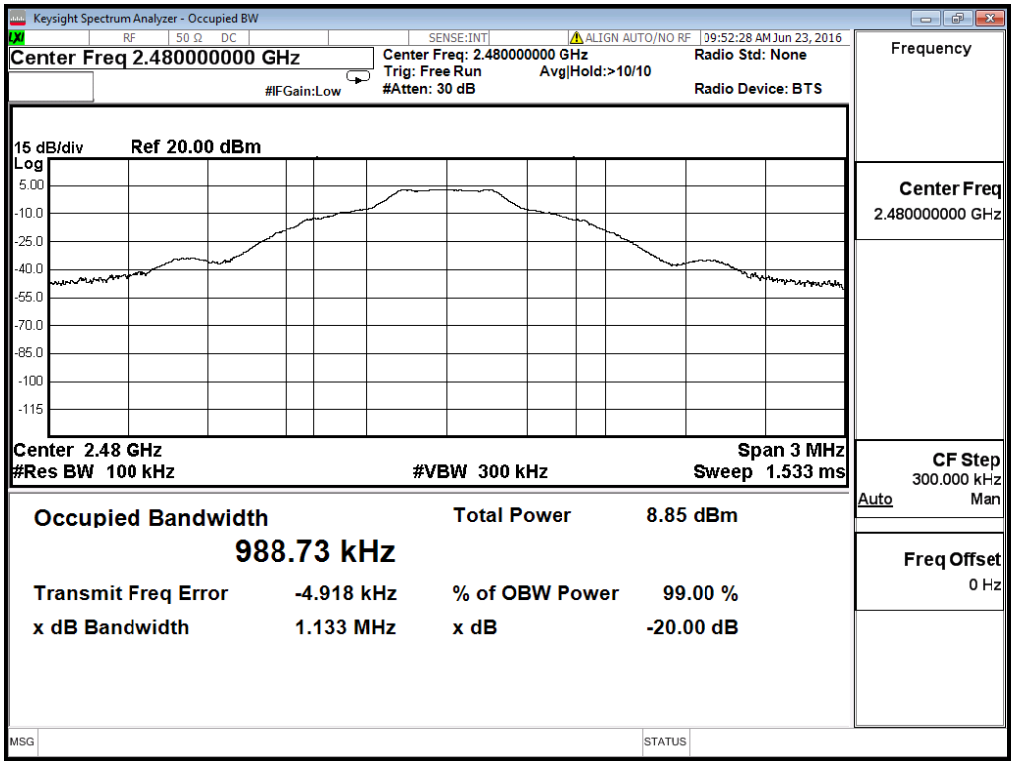
2.4.6. Test Results (plots) of 20dB Bandwidth



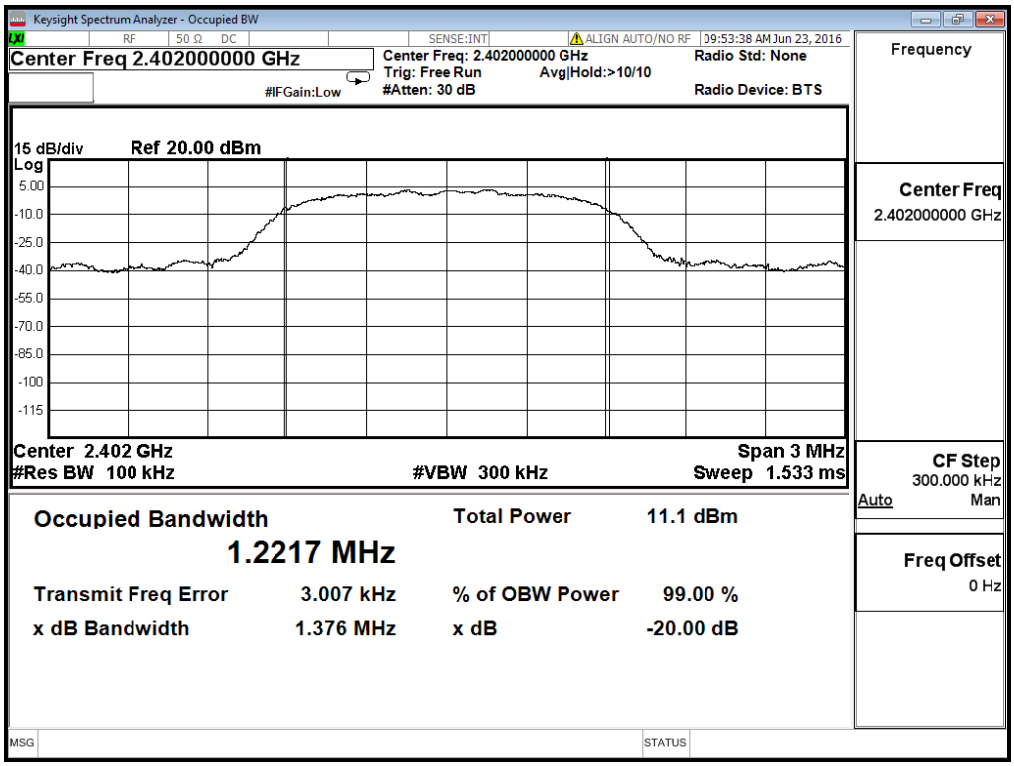
(Plot A: 0 Channel @ GFSK)



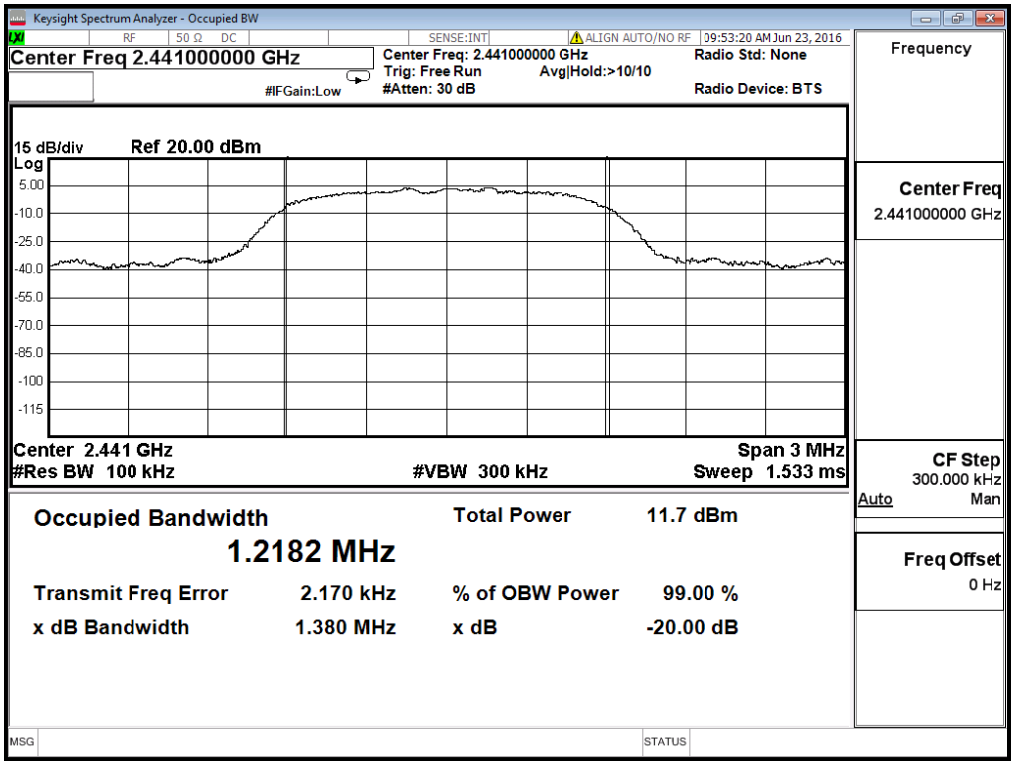
(Plot B: 39 Channel @ GFSK)



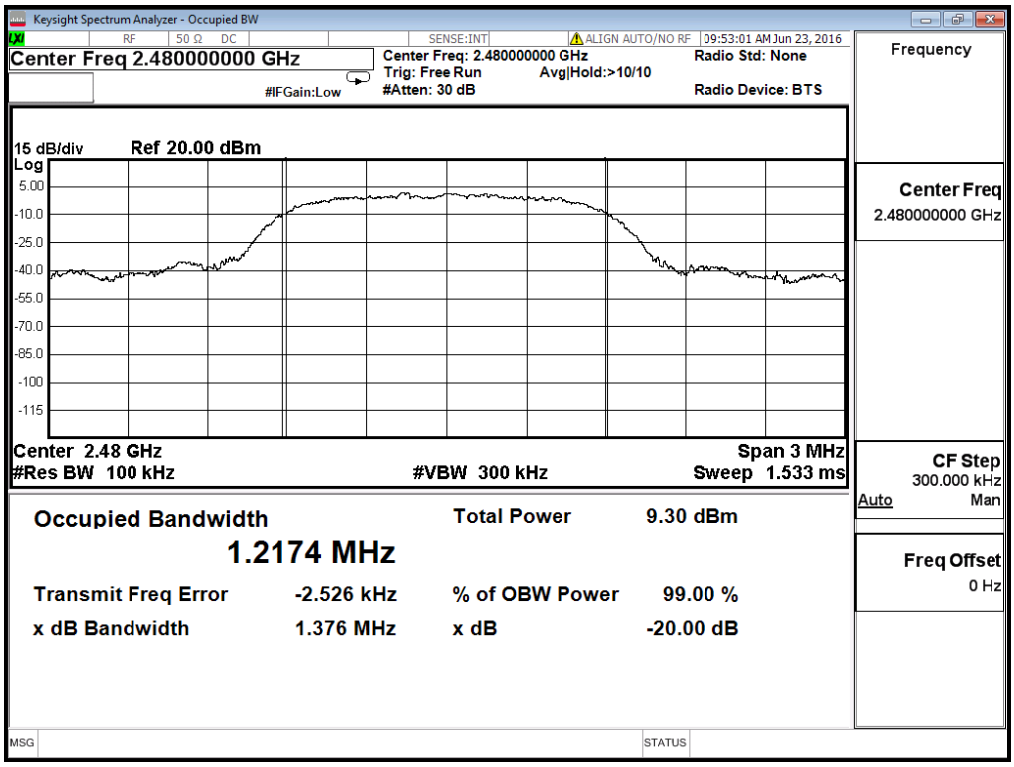
(Plot C: 78 Channel @ GFSK)



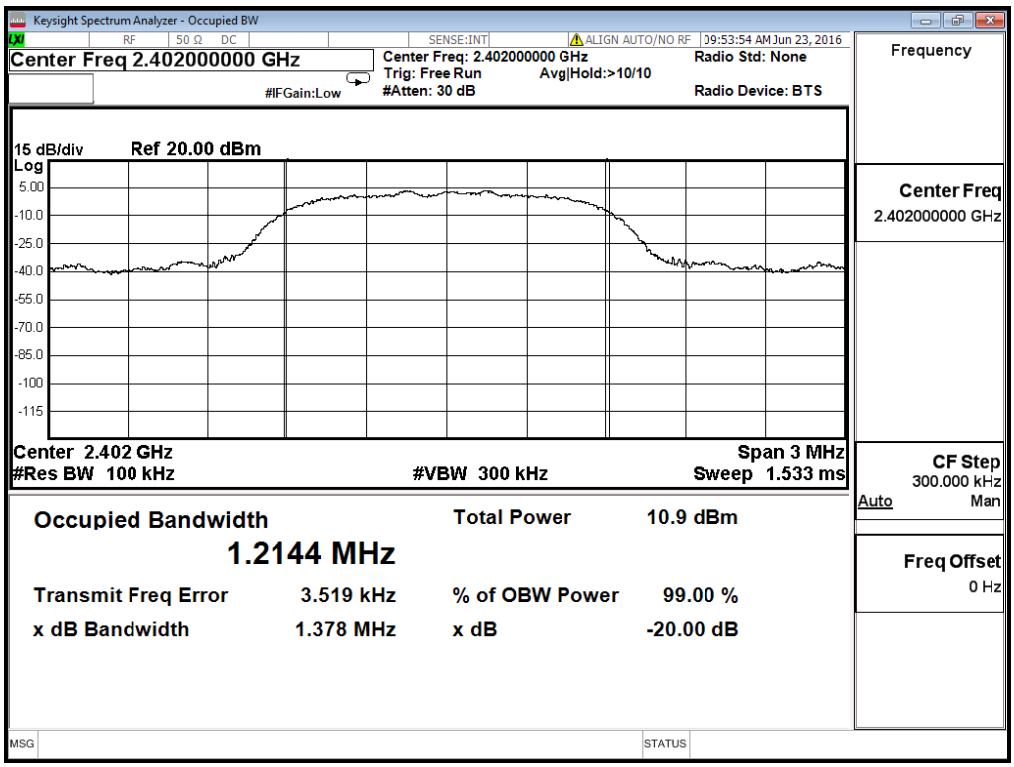
(Plot D: 0 Channel @ π/4-DQPSK)



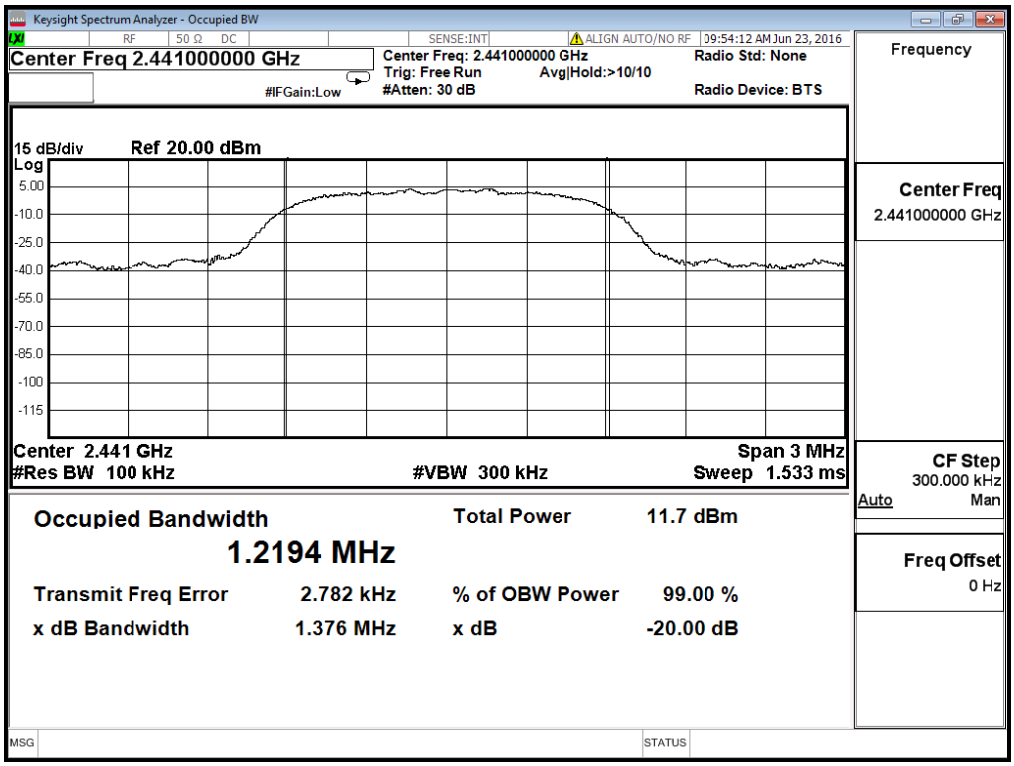
(Plot E: 39 Channel @ π/4-DQPSK)



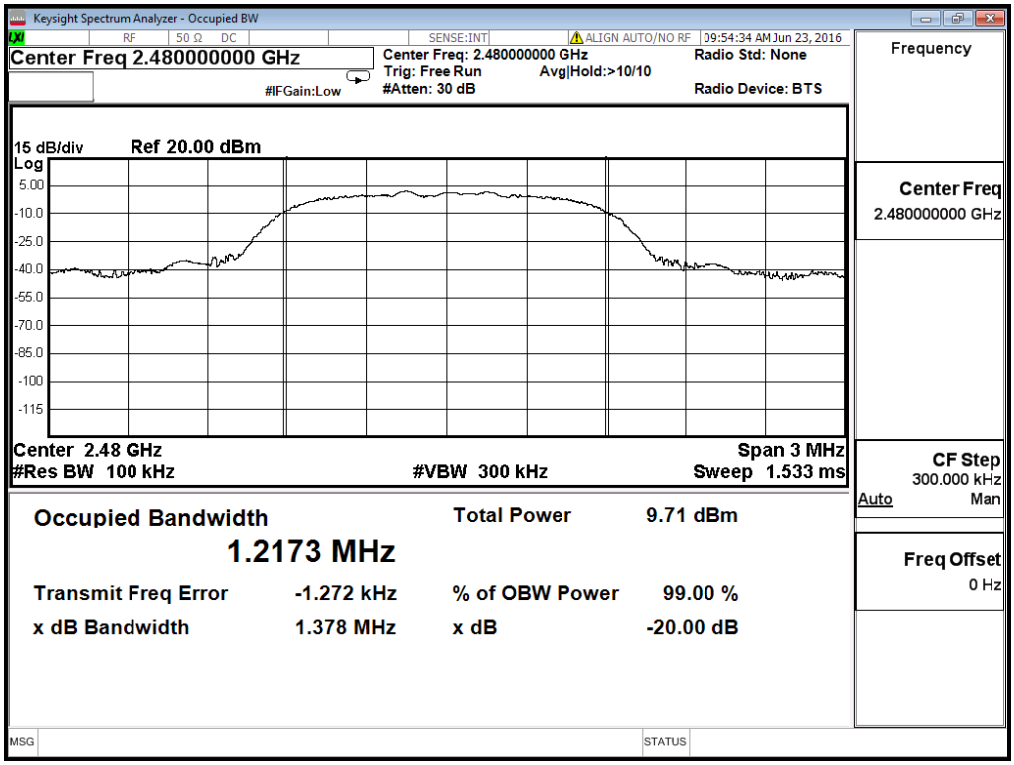
(Plot F: 78 Channel @ π/4-DQPSK)



(Plot G: 0 Channel @ 8-DPSK)



(Plot H: 39 Channel @ 8-DPSK)



(Plot I: 78 Channel @ 8-DPSK)

2.5. Carried Frequency Separation

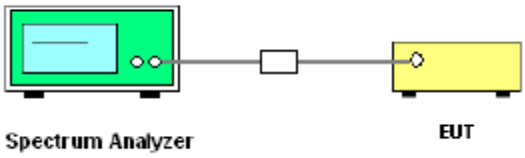
2.5.1. Limit of Carried Frequency Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:

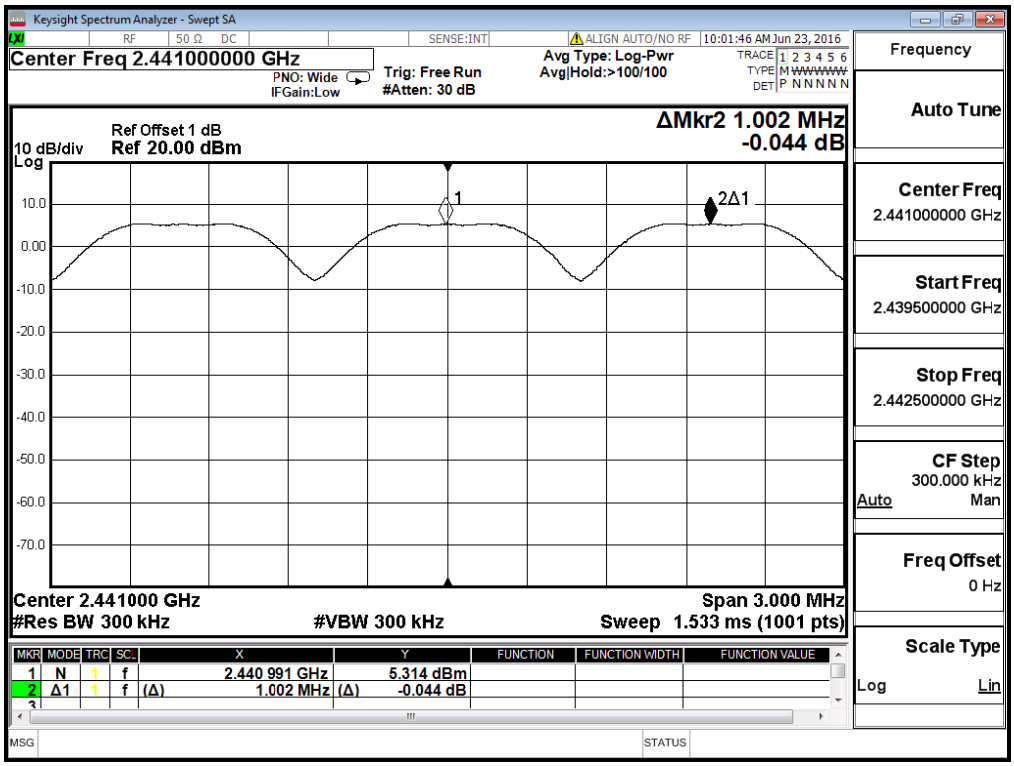
   Span = wide enough to capture the peaks of two adjacent channels; RBW≥1% of the span;

   VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

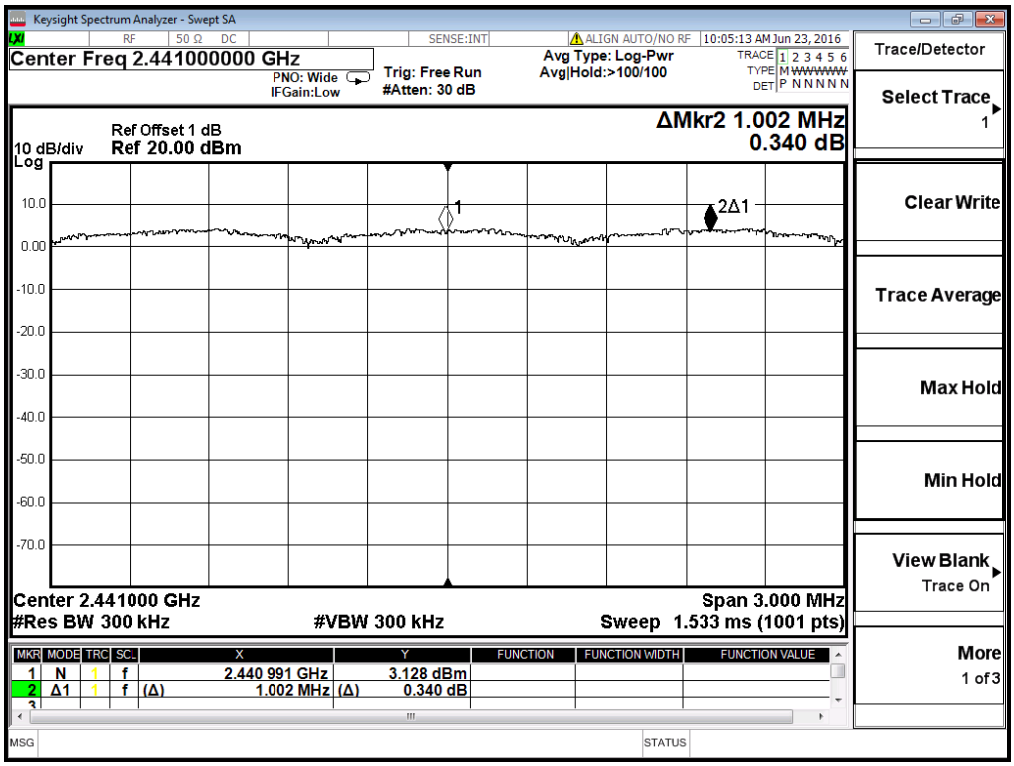
2.5.5. Test Results of Carried Frequency Separation

Test mode	Frequency Separation(MHz)	(2/3 of 20dB BW) Limits (MHz)	Verdict
GFSK	1.002	0.755	PASS
π/4-DQPSK	1.002	0.920	PASS
8-DPSK	1.002	0.919	PASS

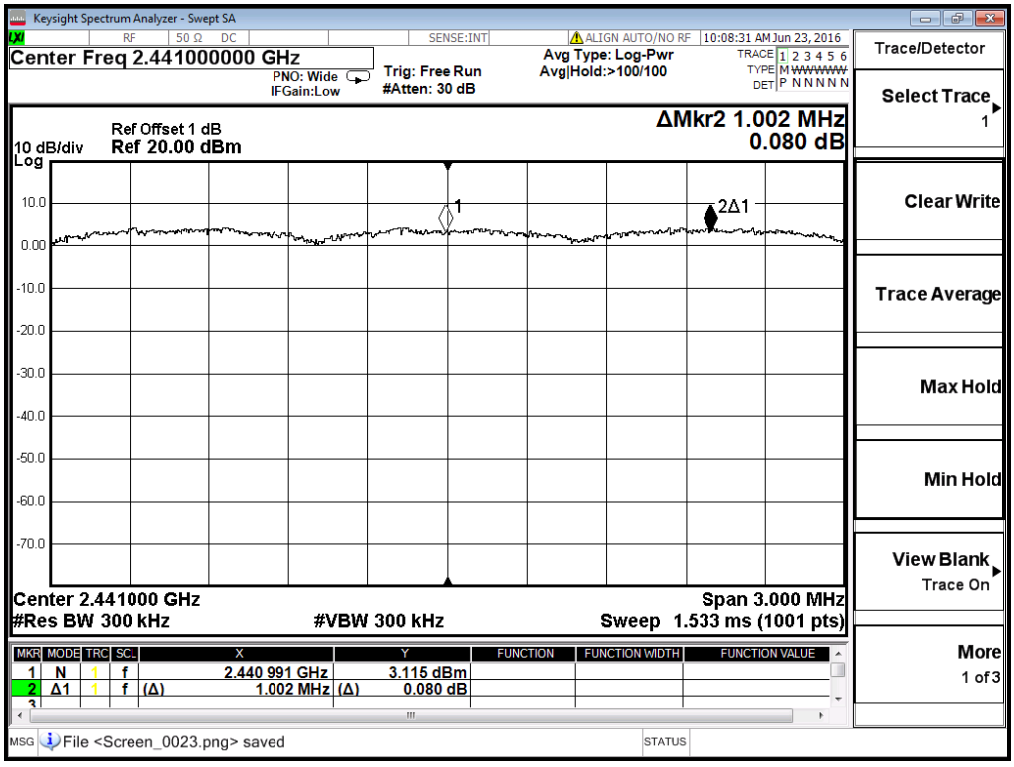
2.5.6. Test Results (plots) of Carried Frequency Separation



GFSK Mode



π/4-DQPSK Mode



8-DPSK Mode

2.6. Dwell time

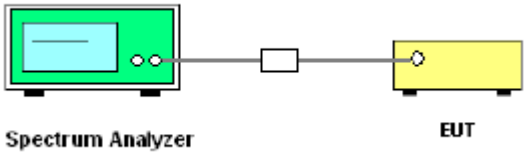
2.6.1. Limit of Dwell Time

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 the number of hopping channels employed.

2.6.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup



2.6.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW⩾RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

2.6.5. Test Results of Dwell Time

For DH1 package type:

{Total of Dwell} = {Pulse Time} * (1600 / 2) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4s * {Number of Hopping Frequency}

For DH3 package type:

{Total of Dwell} = {Pulse Time} * (1600 / 4) / {Number of Hopping Frequency} * {Period}

{Period} = 0.4s * {Number of Hopping Frequency}

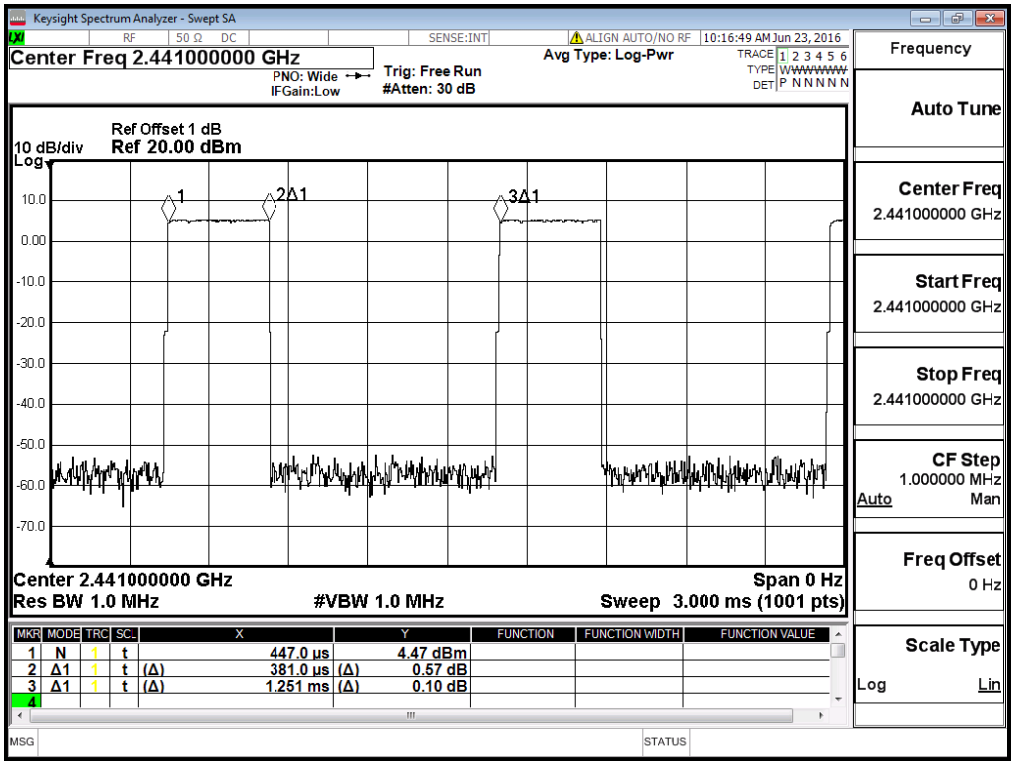
For DH5 package type:

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}

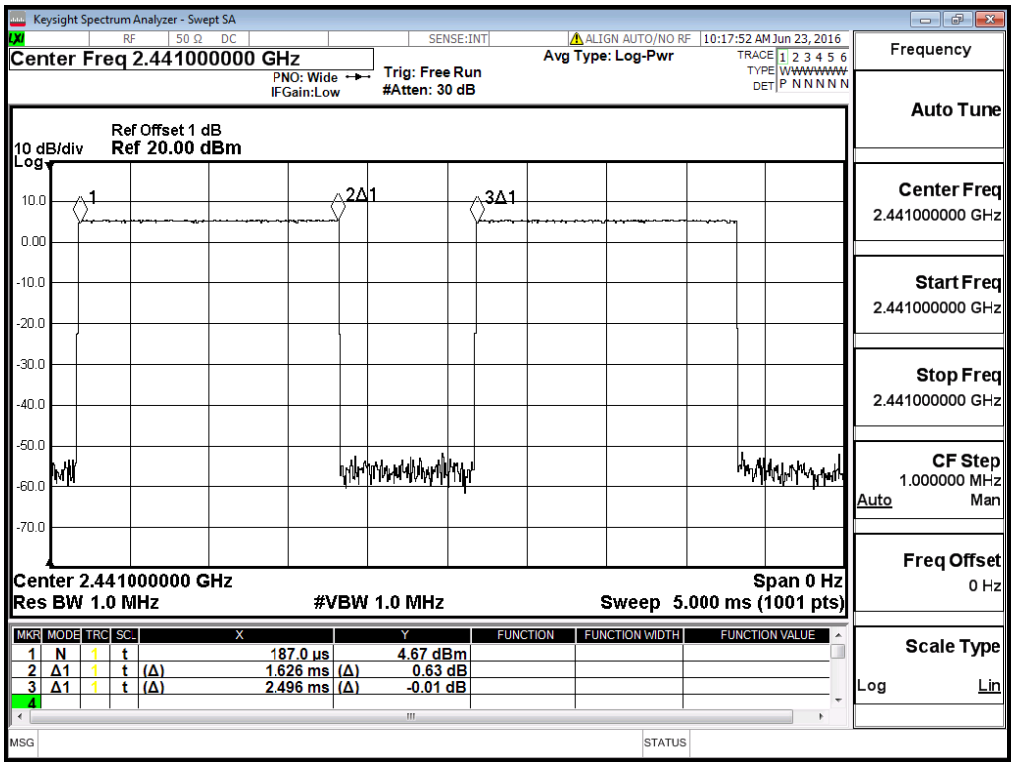
{Period} = 0.4s * {Number of Hopping Frequency}

Modulation	Packet Type	Channel	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	DH1	39	0.381	121.92	400	PASS
	DH3	39	1.626	260.16		PASS
	DH5	39	2.876	306.77		PASS
π/4-DQPSK	DH1	39	0.377	120.64		PASS
	DH3	39	1.637	261.92		PASS
	DH5	39	2.877	306.88		PASS
8-DPSK	DH1	39	0.381	121.92		PASS
	DH3	39	1.629	260.64		PASS
	DH5	39	2.859	304.96		PASS

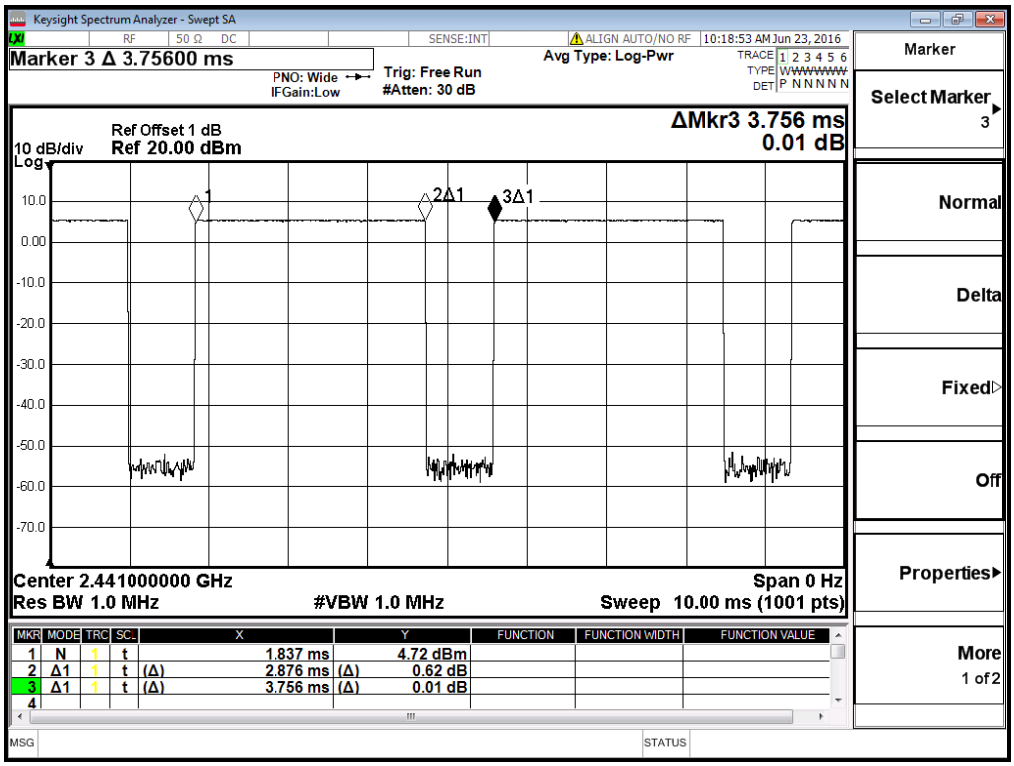
2.6.6. Test Results (plots) of Dwell Time



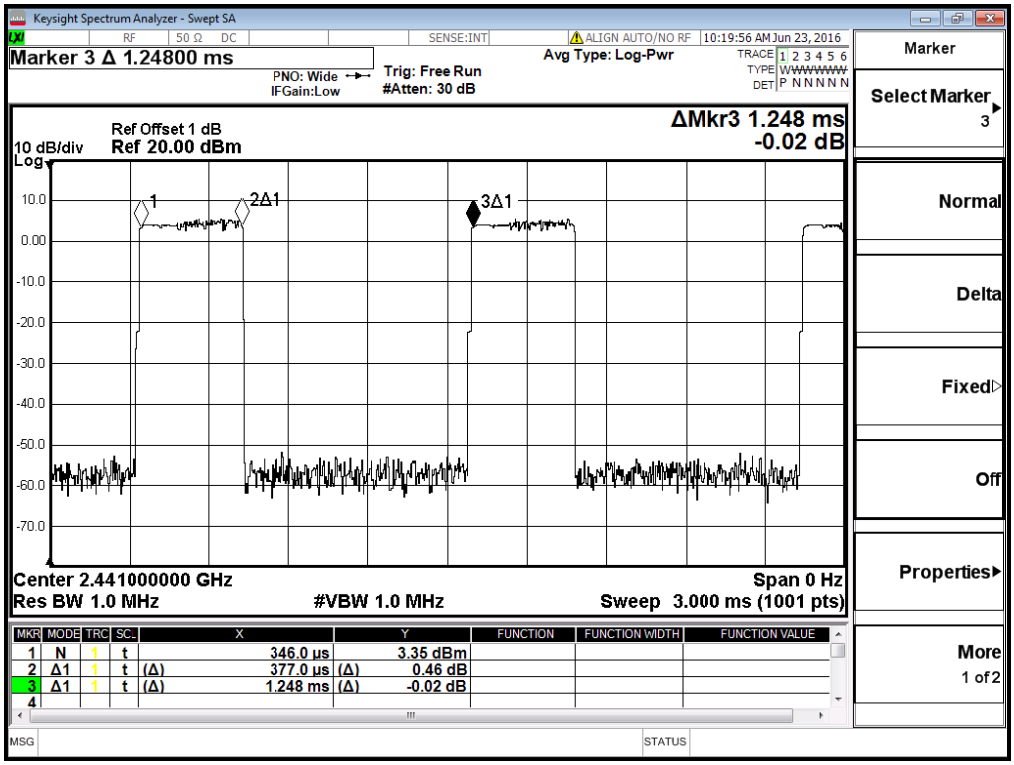
39 Channel @ DH1



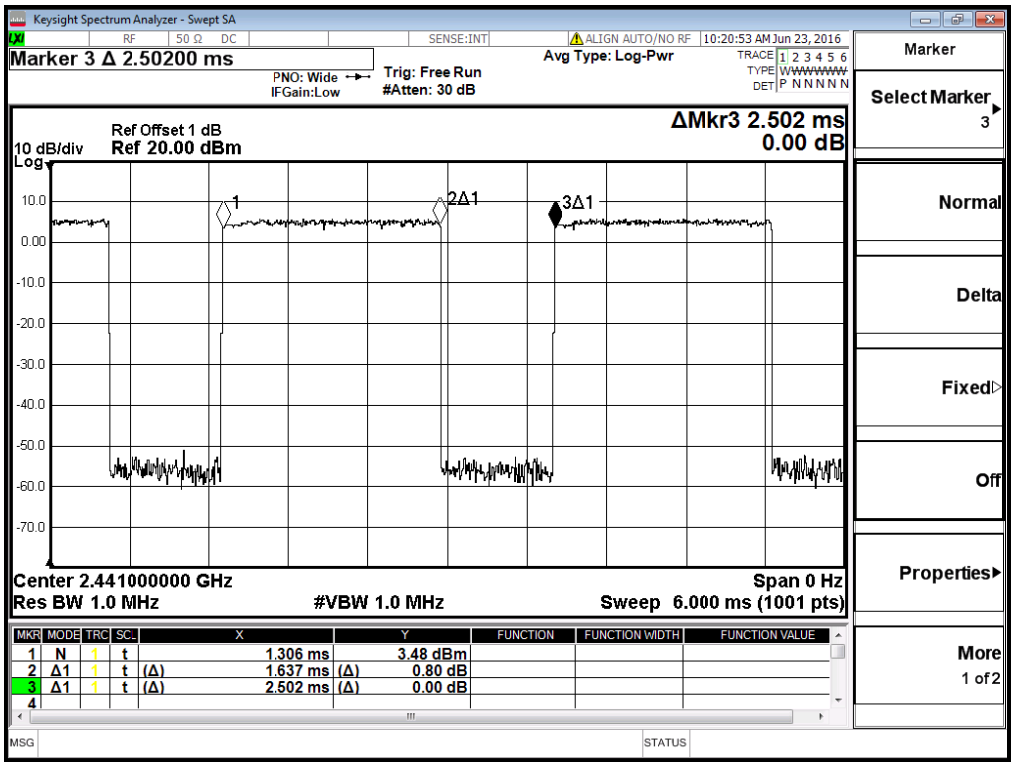
39 Channel @ DH3



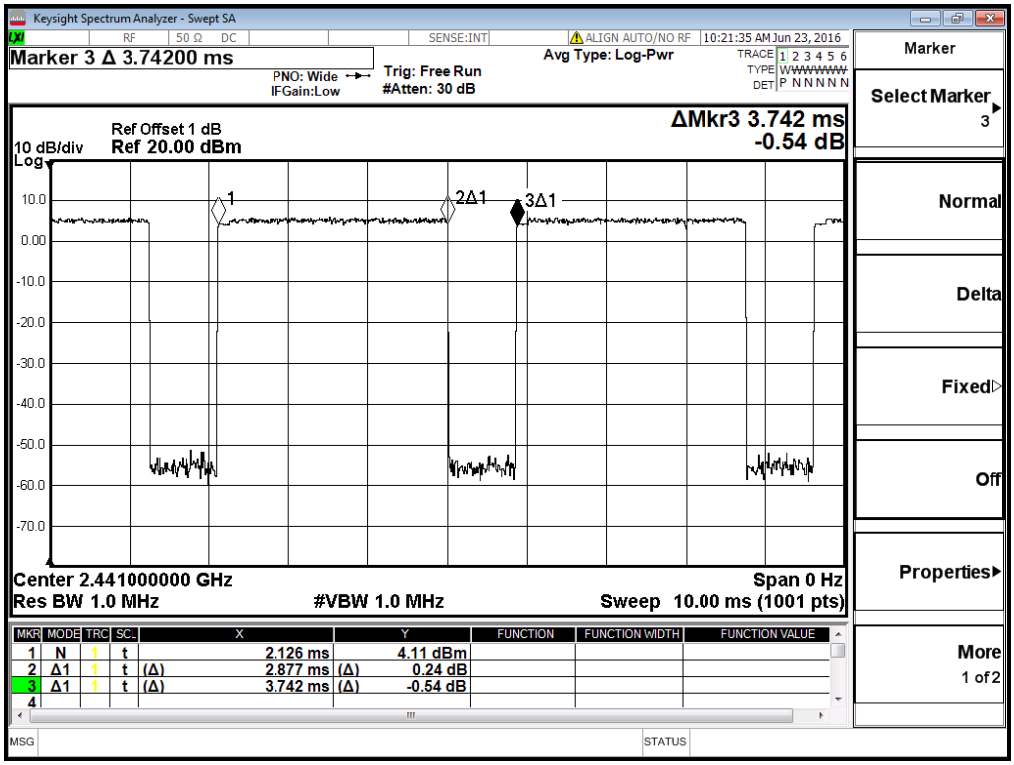
39 Channel @ DH5



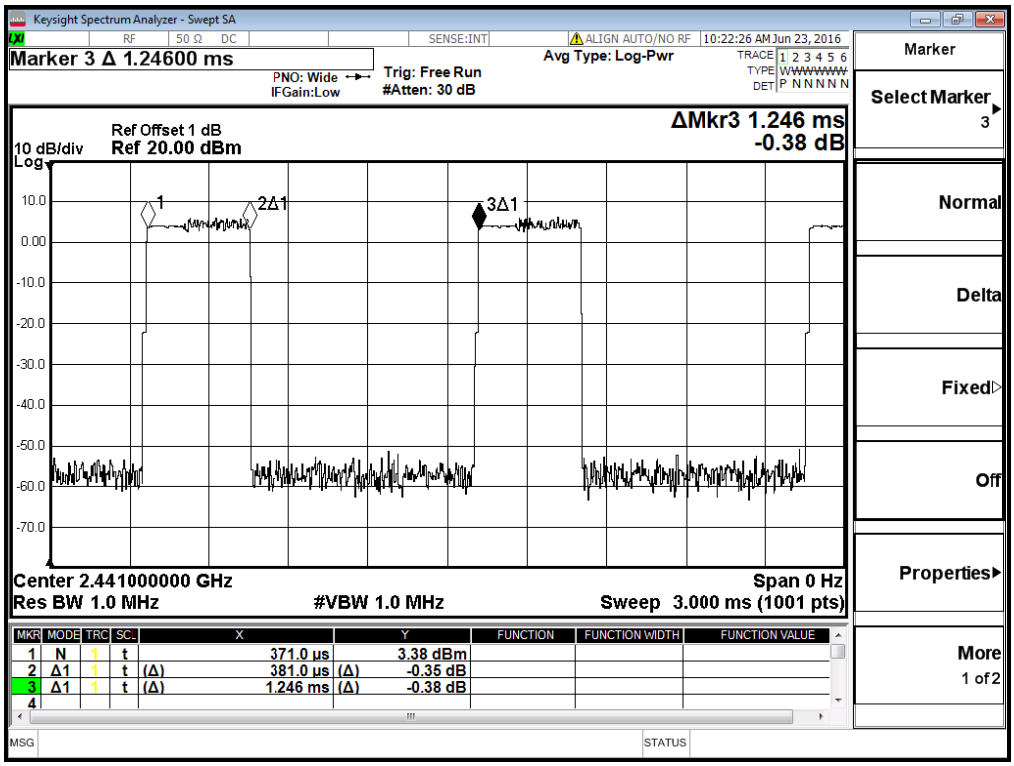
39 Channel @ 2DH1



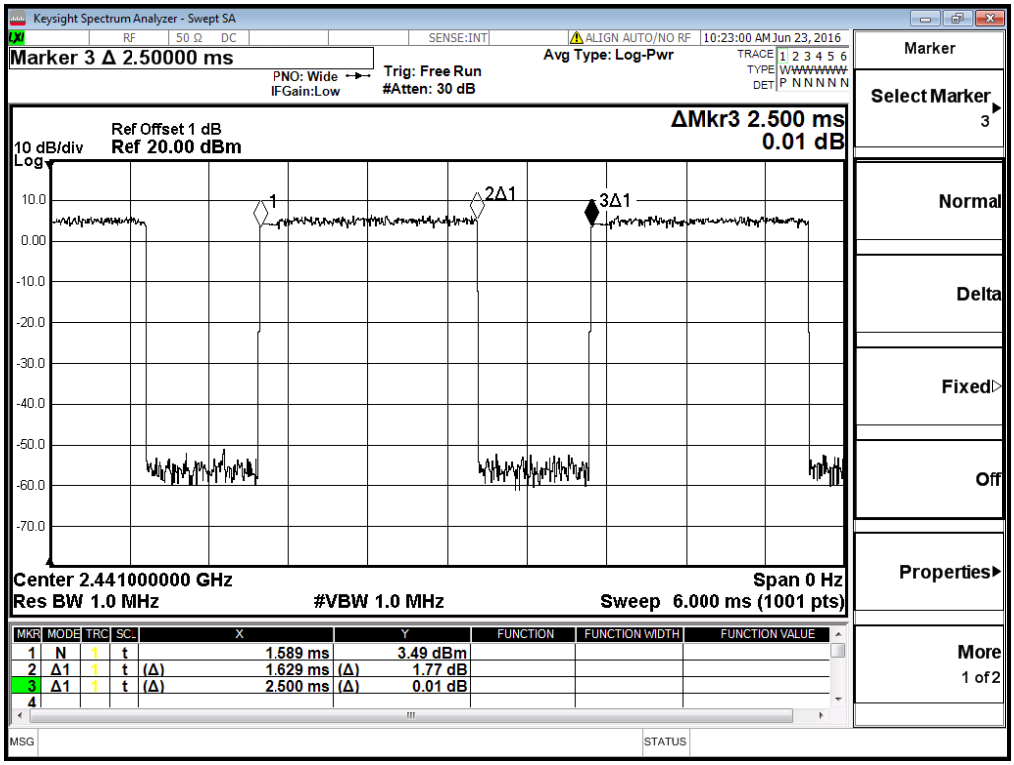
39 Channel @ 2DH3



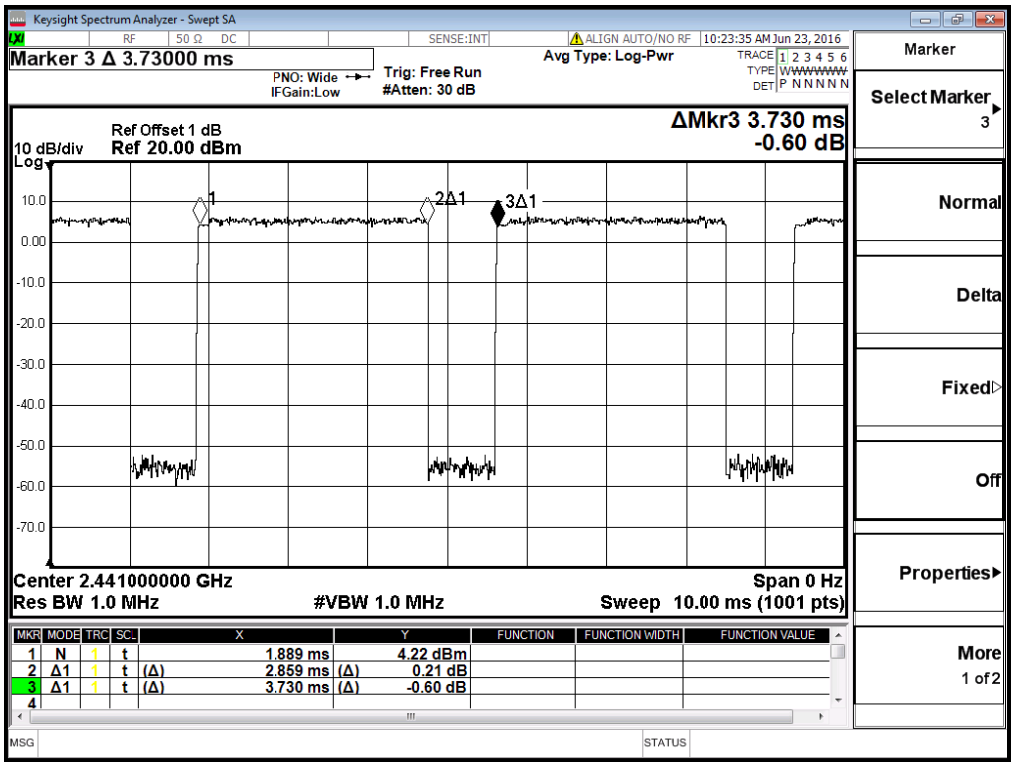
39 Channel @ 2DH5



39 Channel @ 3DH1



39 Channel @ 3DH3



39 Channel @ 3DH5

2.7. Conducted Spurious Emissions

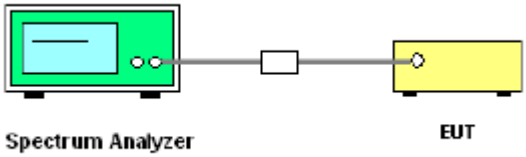
2.7.1. Limit of Spurious Emission

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

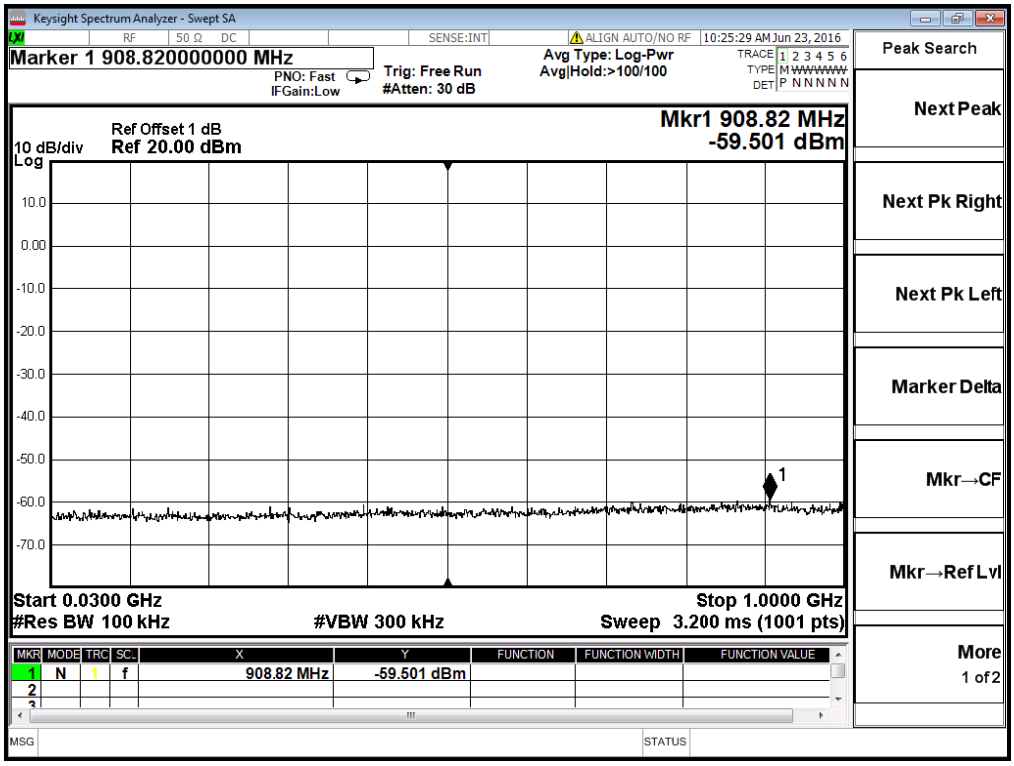
2.7.3. Test Setup



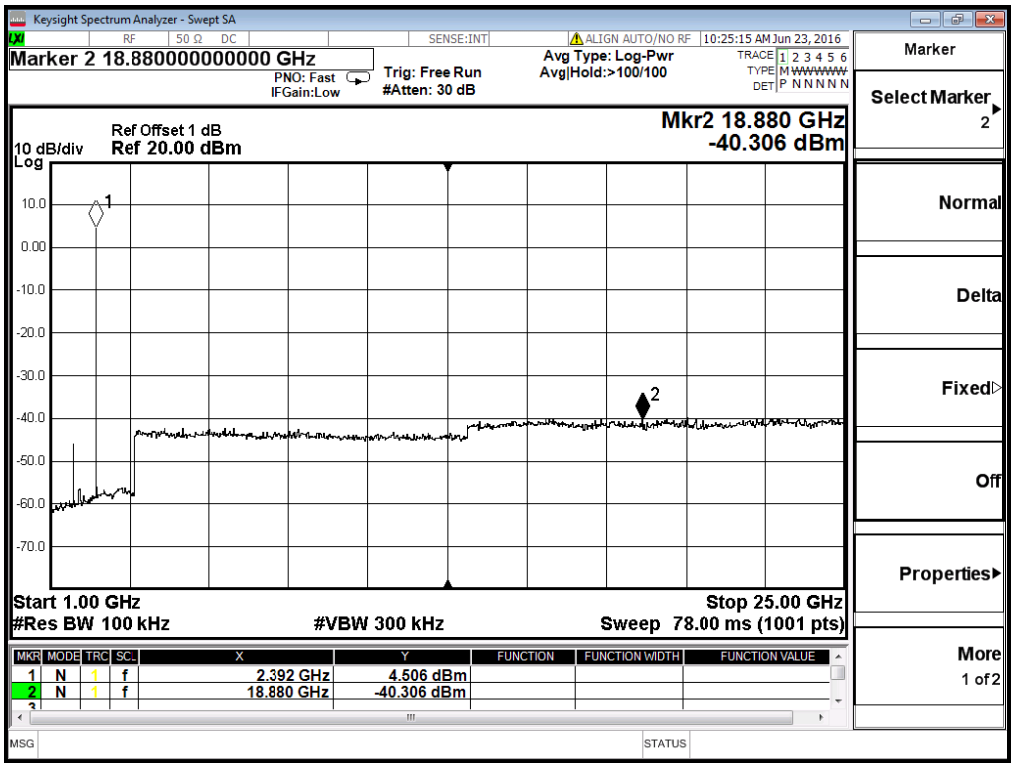
2.7.4. Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

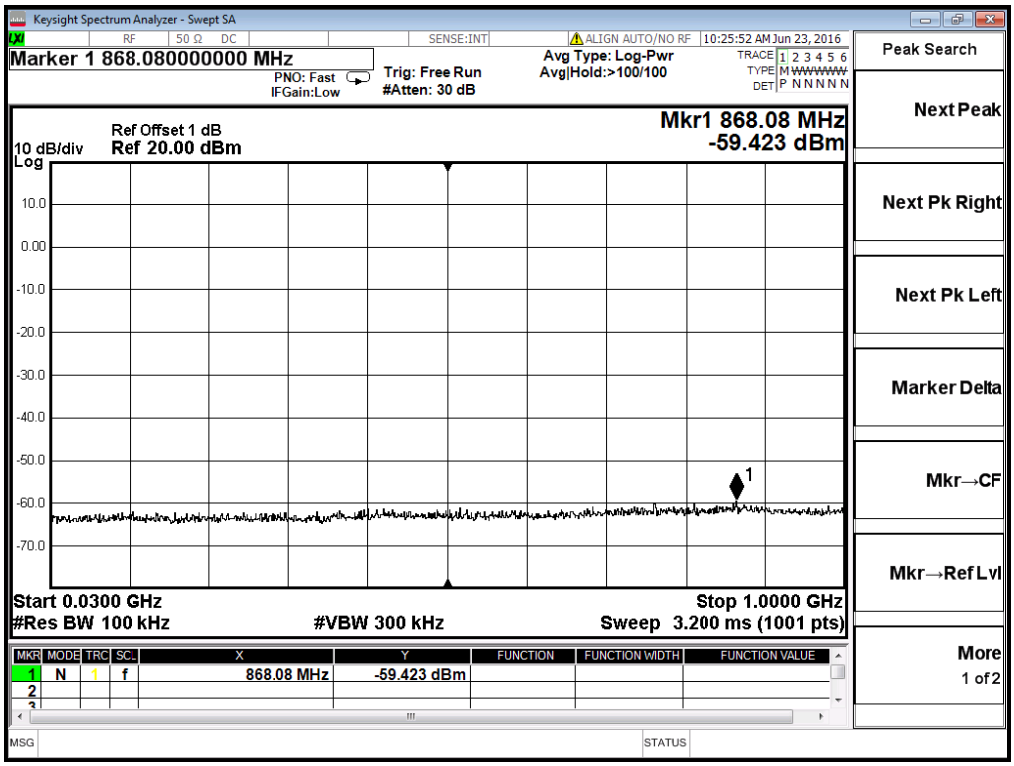
2.7.5. Test Results of Conducted Spurious Emissions



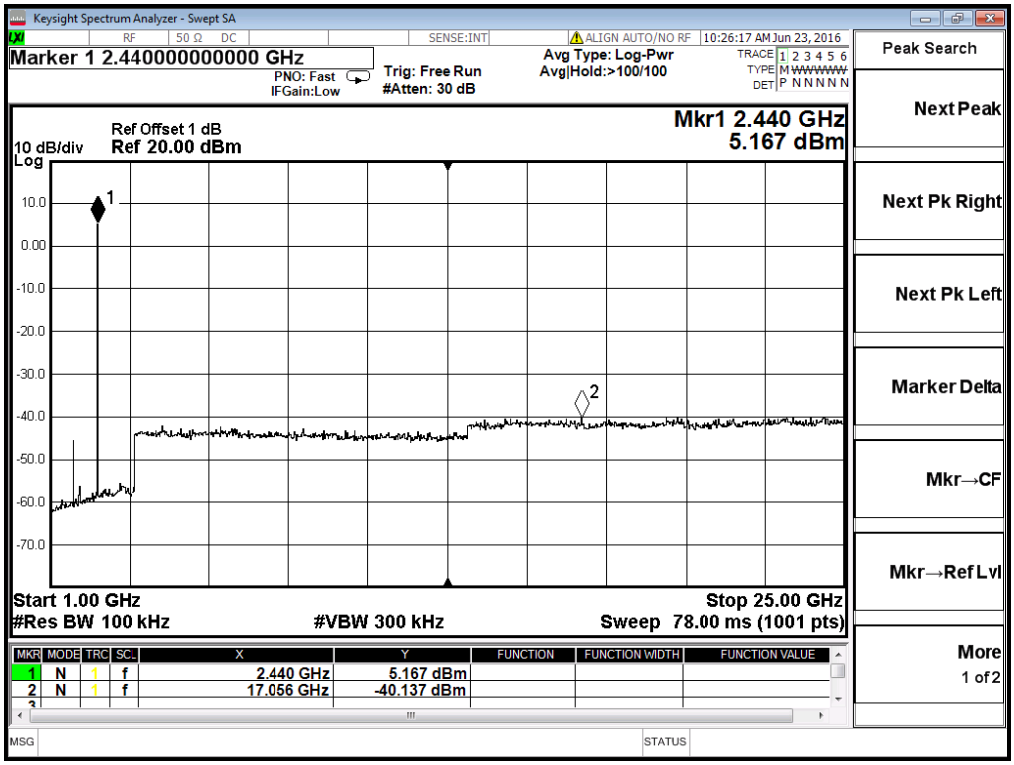
Low Channel 30MHz to 1GHz @ GFSK Mode



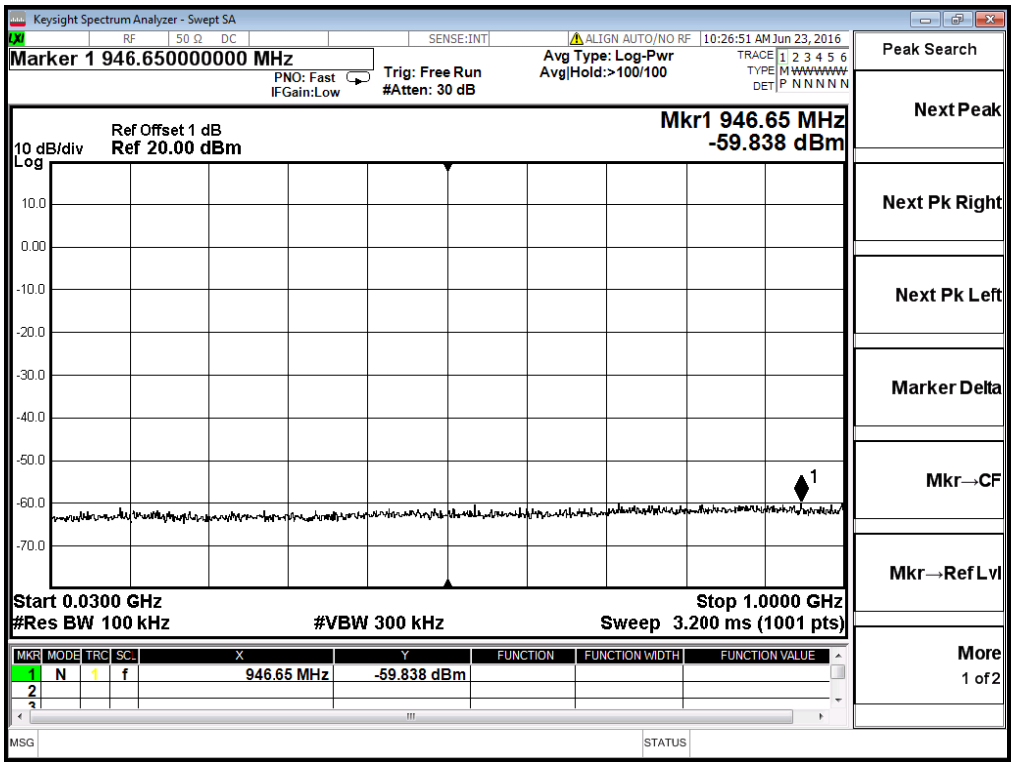
Low Channel 1GHz to 25GHz @ GFSK Mode



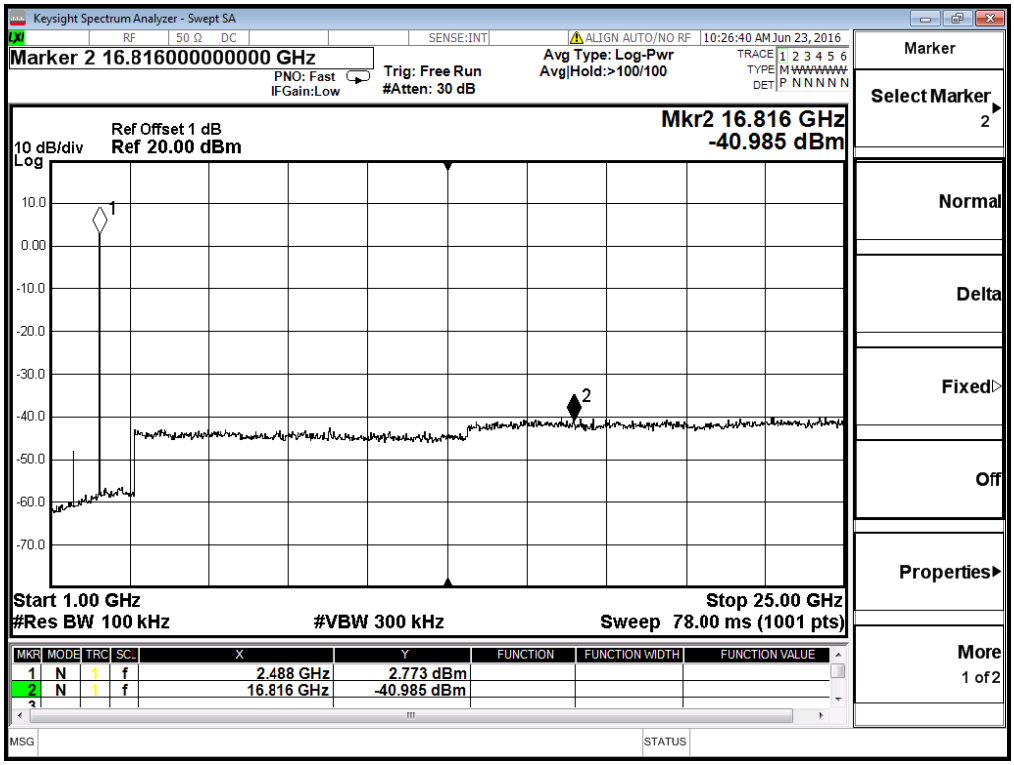
Mid Channel 30MHz to 1GHz @ GFSK Mode



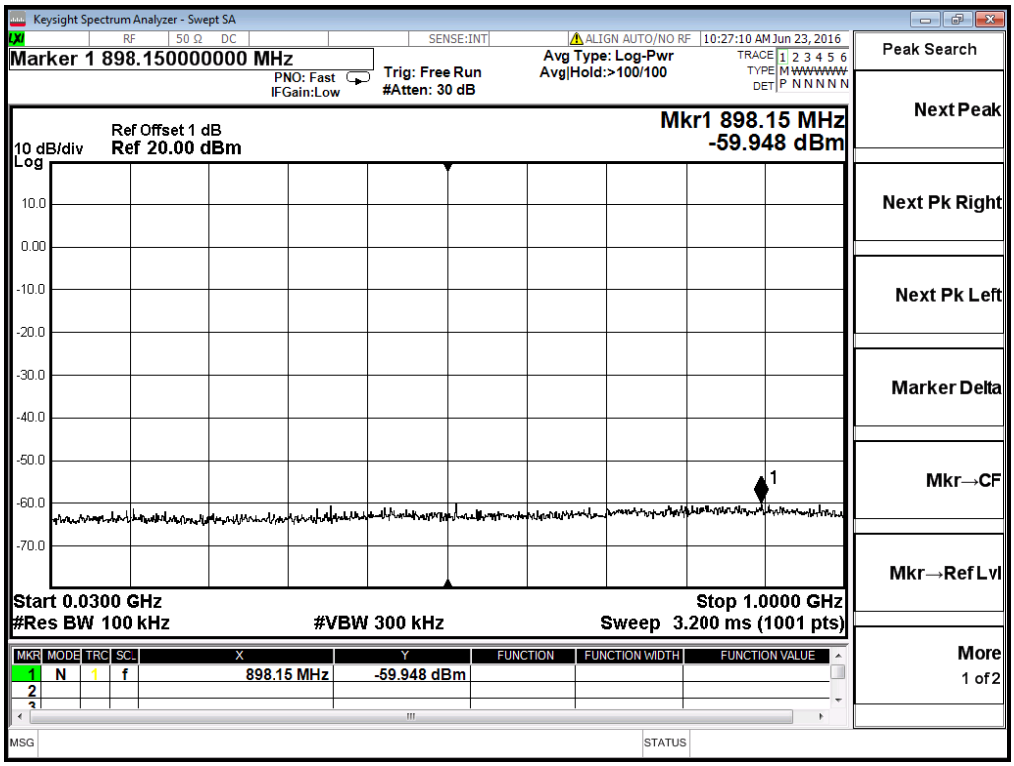
Mid Channel 1GHz to 25GHz @ GFSK Mode



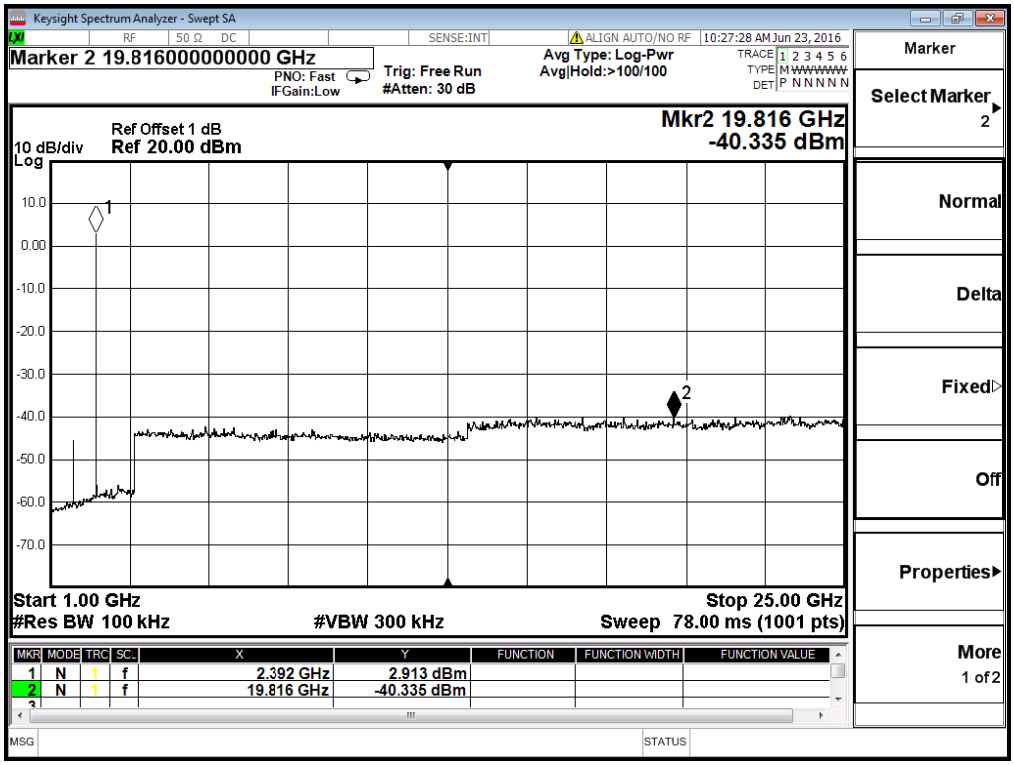
High Channel 30MHz to 1GHz @ GFSK Mode



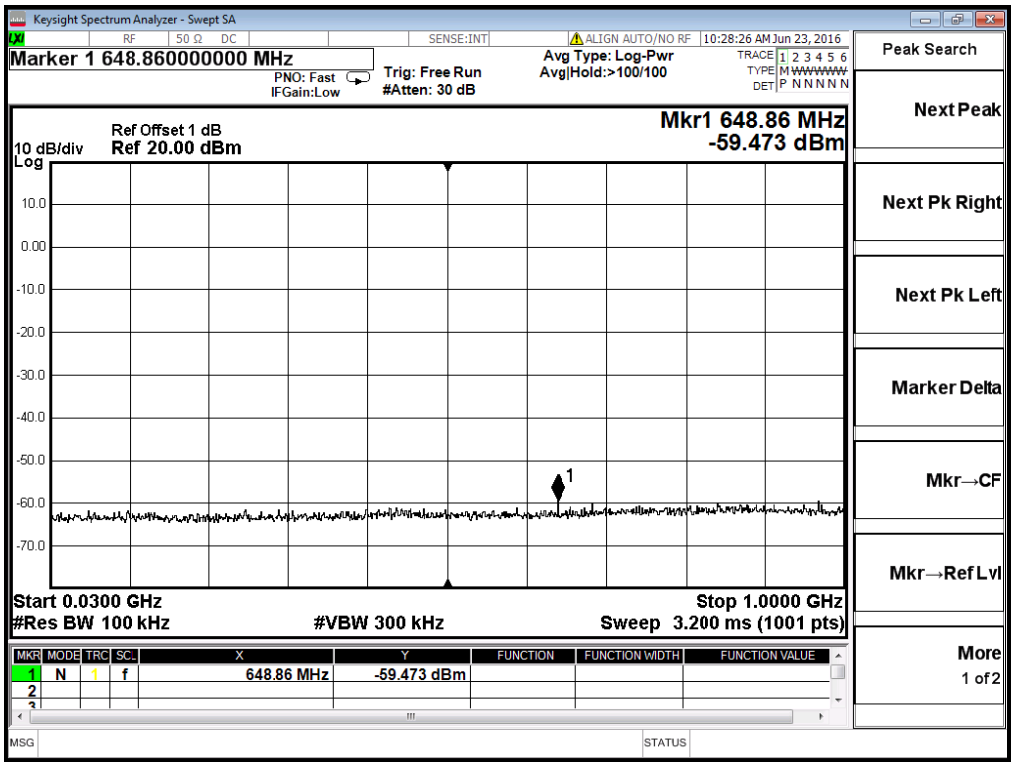
High Channel 1GHz to 25GHz @ GFSK Mode



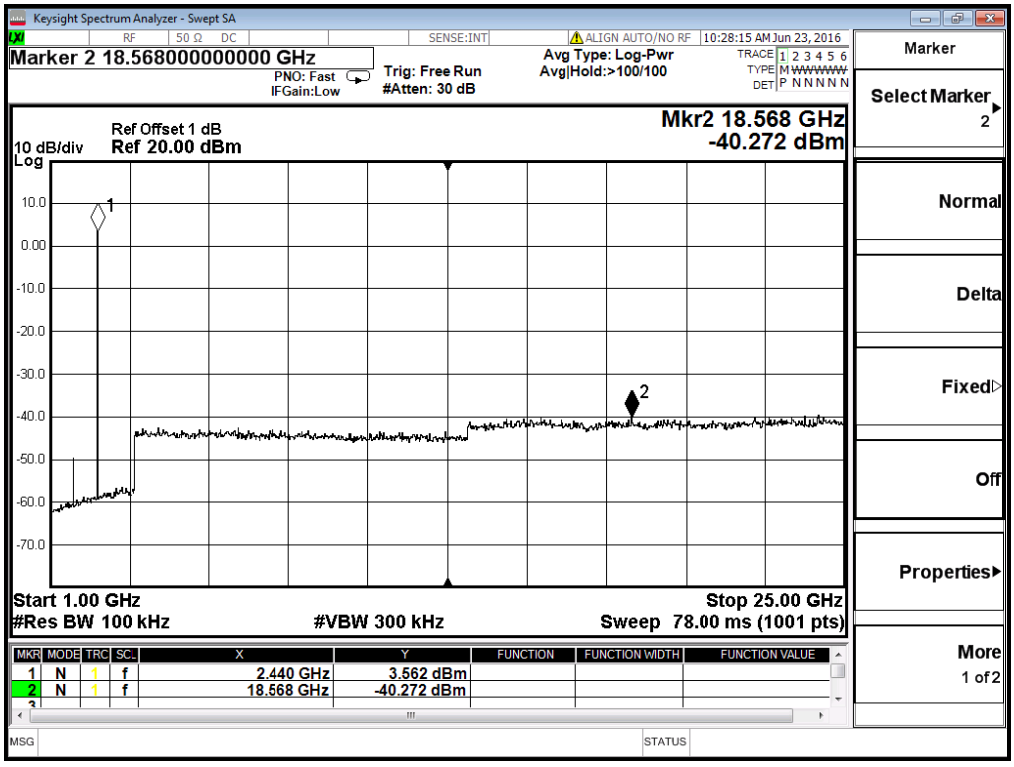
Low Channel 30MHz to 1GHz @π/4-DQPSK



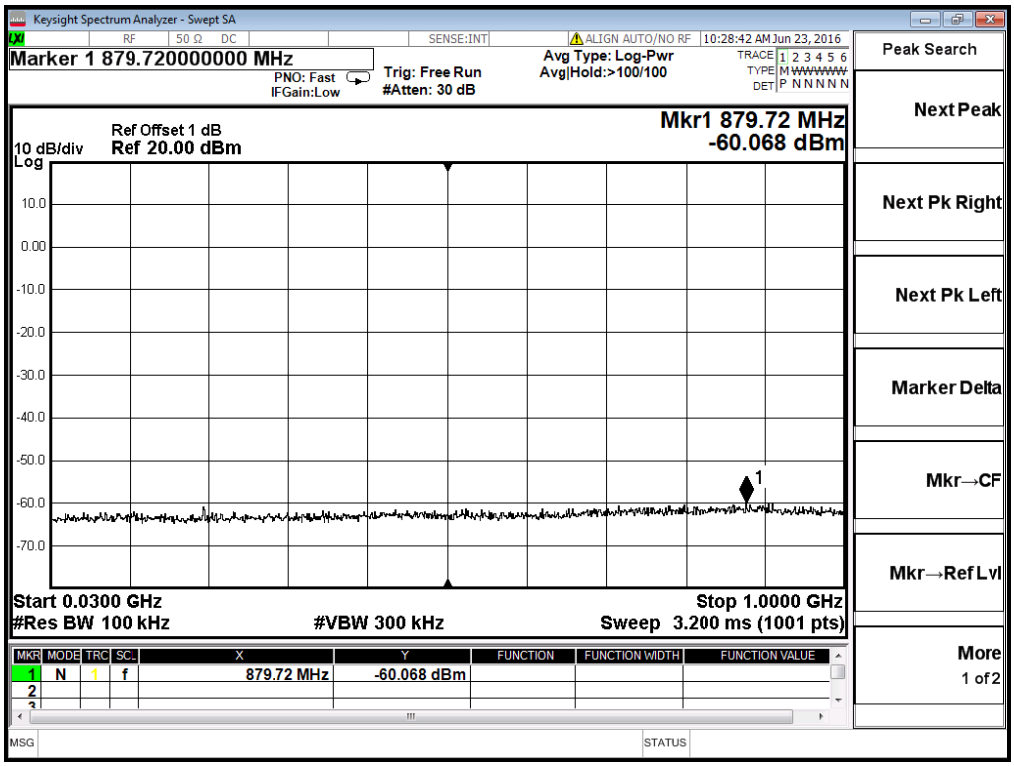
Low Channel 1GHz to 25GHz @π/4-DQPSK



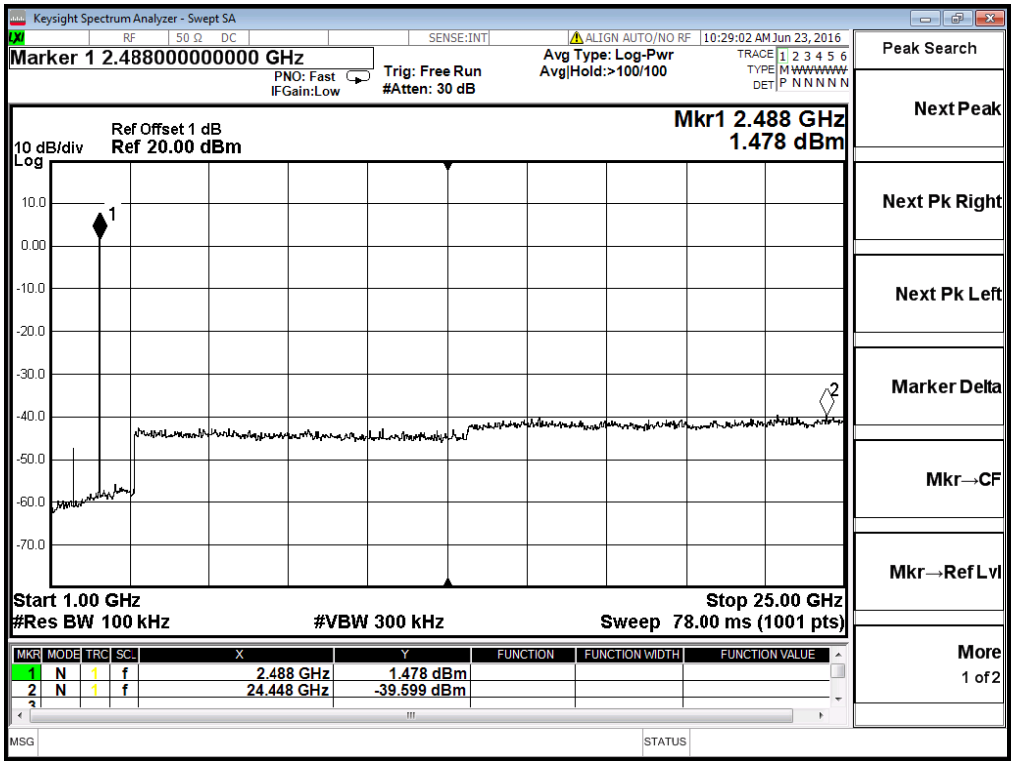
Mid Channel 30MHz to 1GHz @π/4-DQPSK



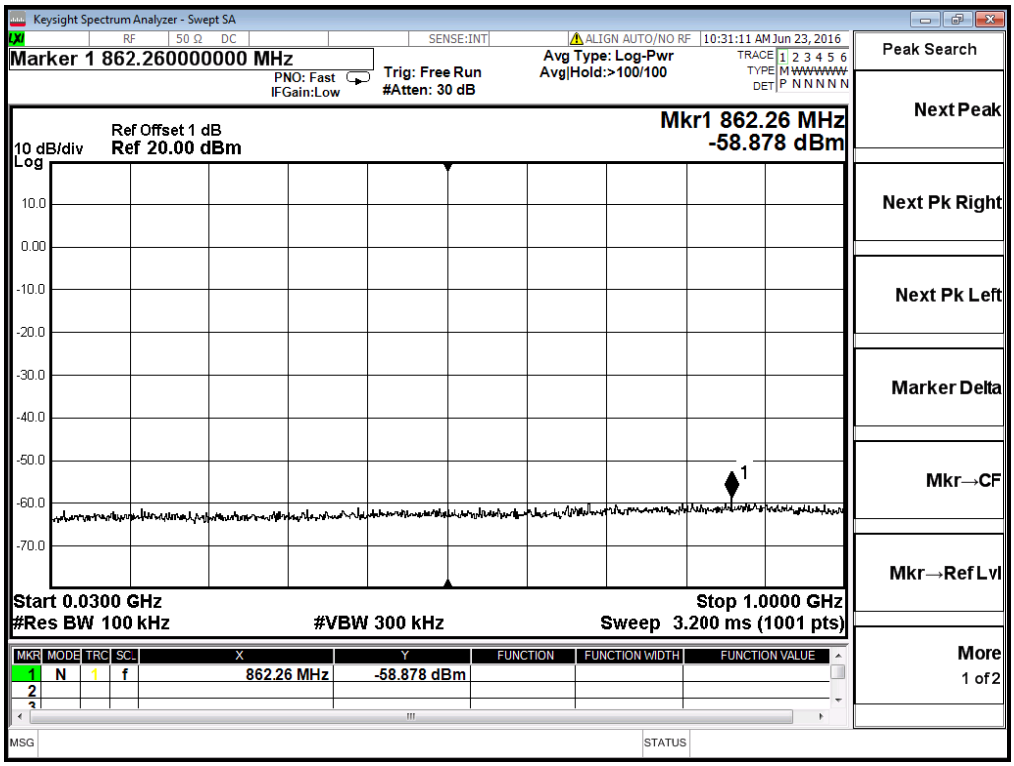
Mid Channel 1GHz to 25GHz @π/4-DQPSK



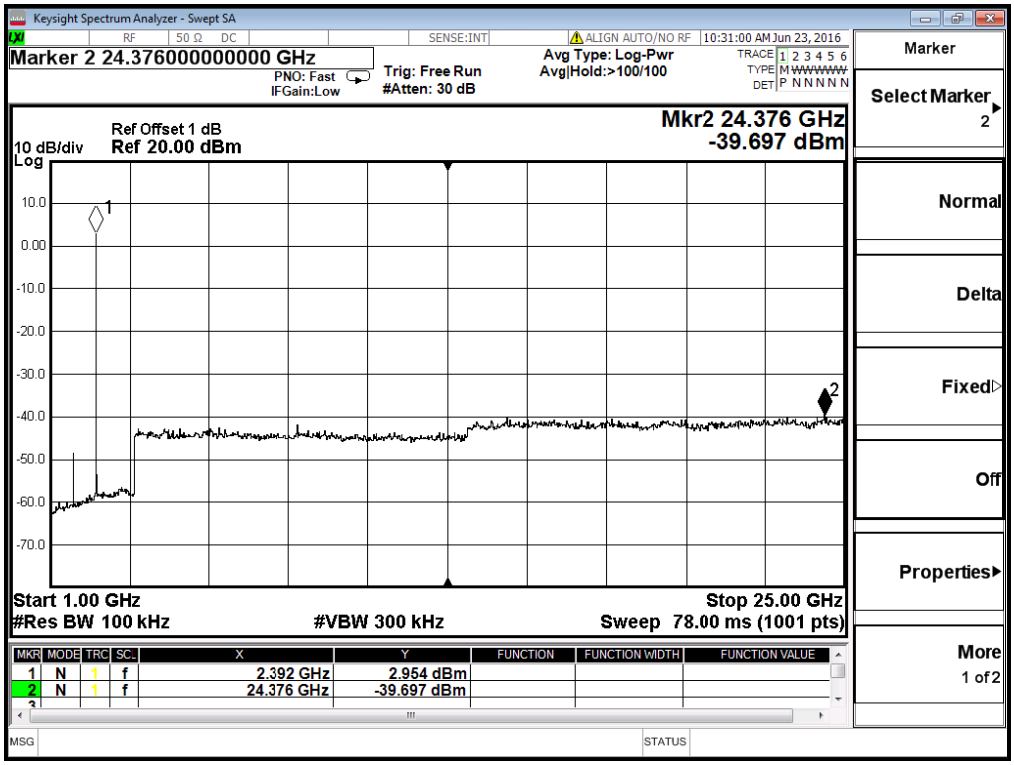
High Channel 30MHz to 1GHz @π/4-DQPSK



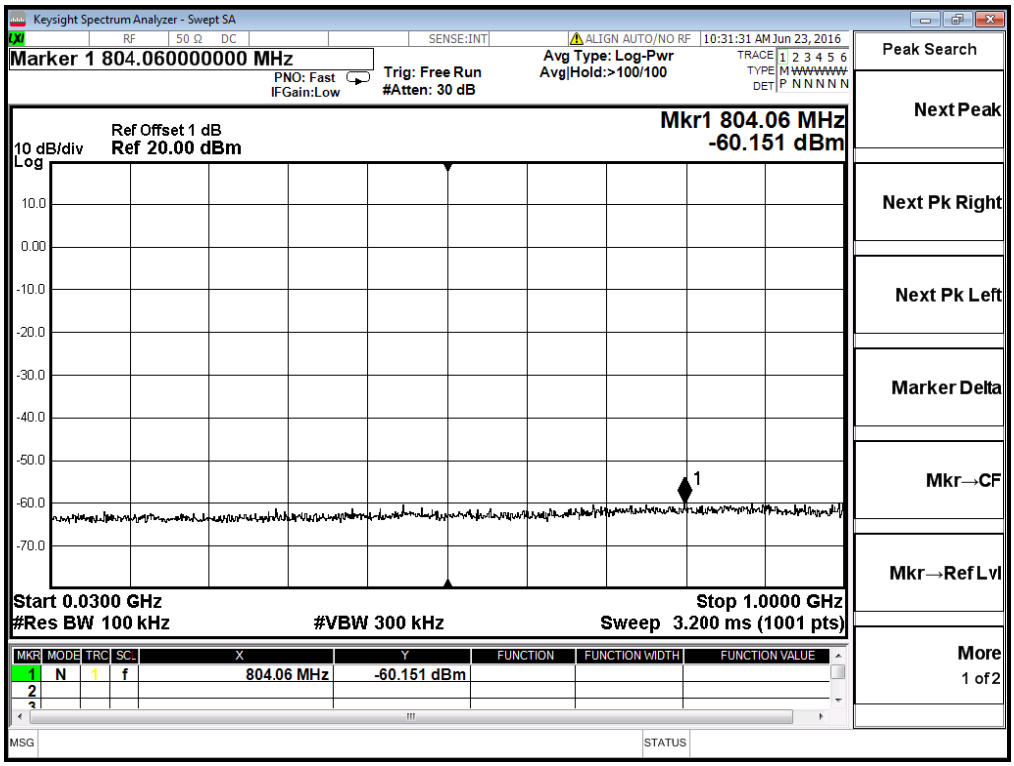
High Channel 1GHz to 25GHz @π/4-DQPSK



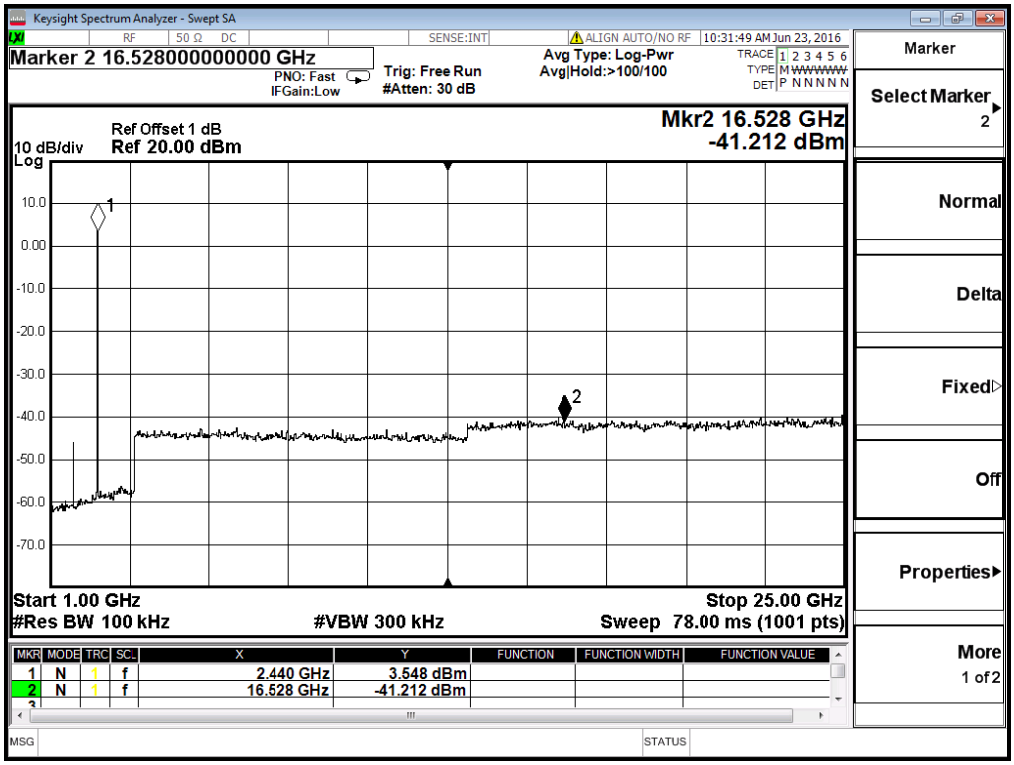
Low Channel 30MHz to 1GHz @ 8-DPSK



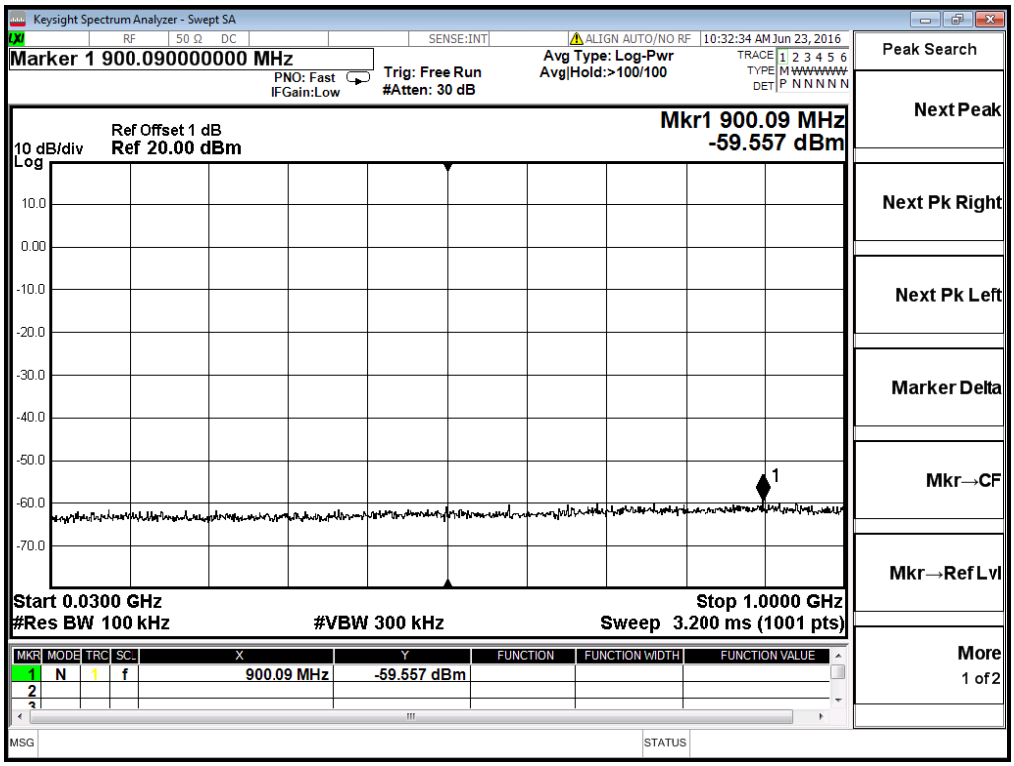
Low Channel 1GHz to 25GHz @ 8-DPSK



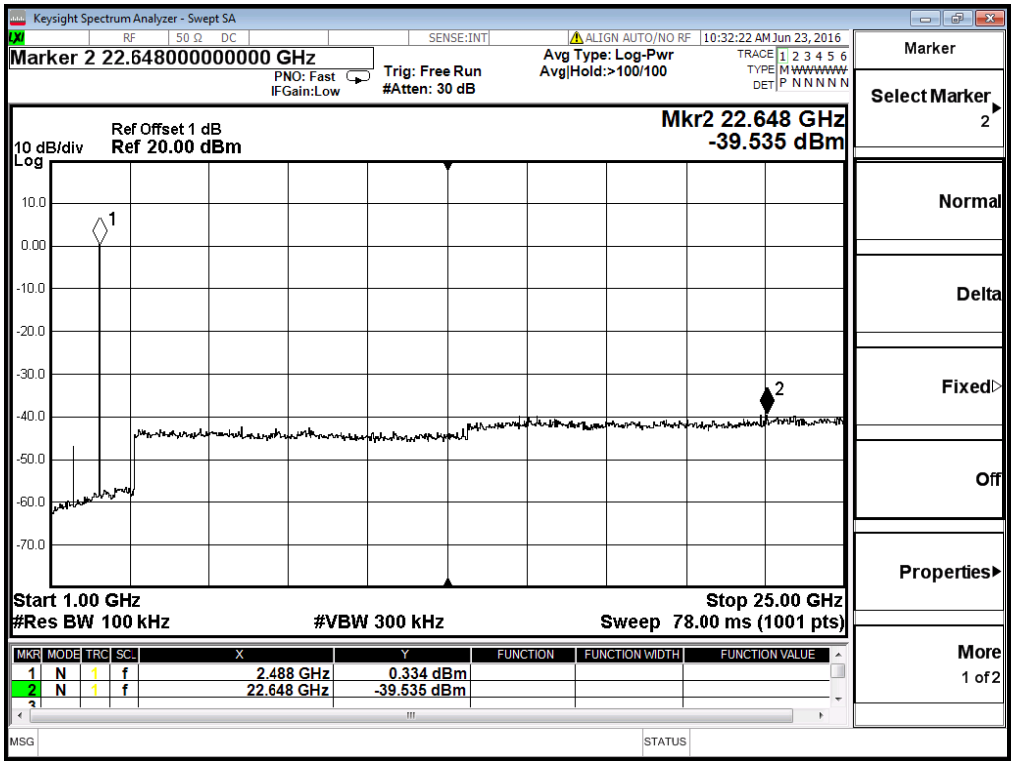
Mid Channel 30MHz to 1GHz @ 8-DPSK



Mid Channel 1GHz to 25GHz @ 8-DPSK



High Channel 30MHz to 1GHz @ 8-DPSK



High Channel 1GHz to 25GHz @ 8-DPSK

2.8. Conducted Band Edge

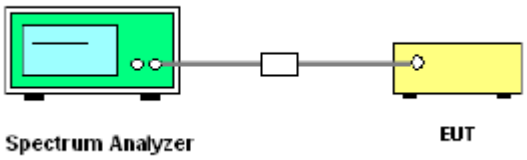
2.8.1. Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.8.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.8.3. Test Setup

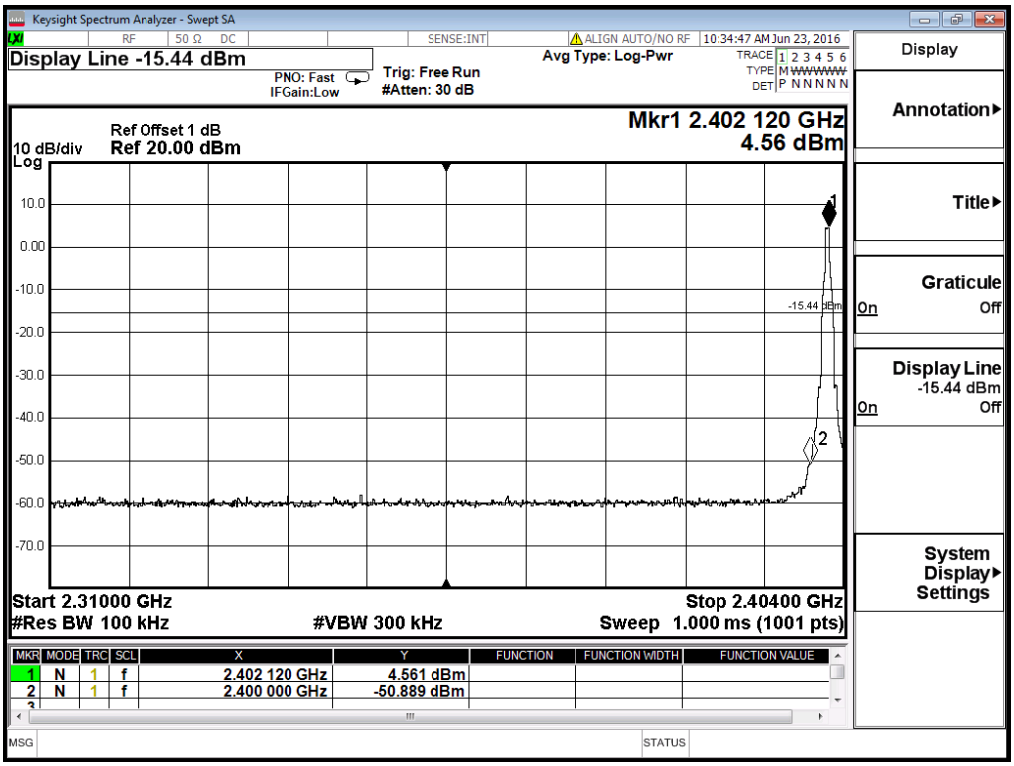


2.8.1. Test Procedure

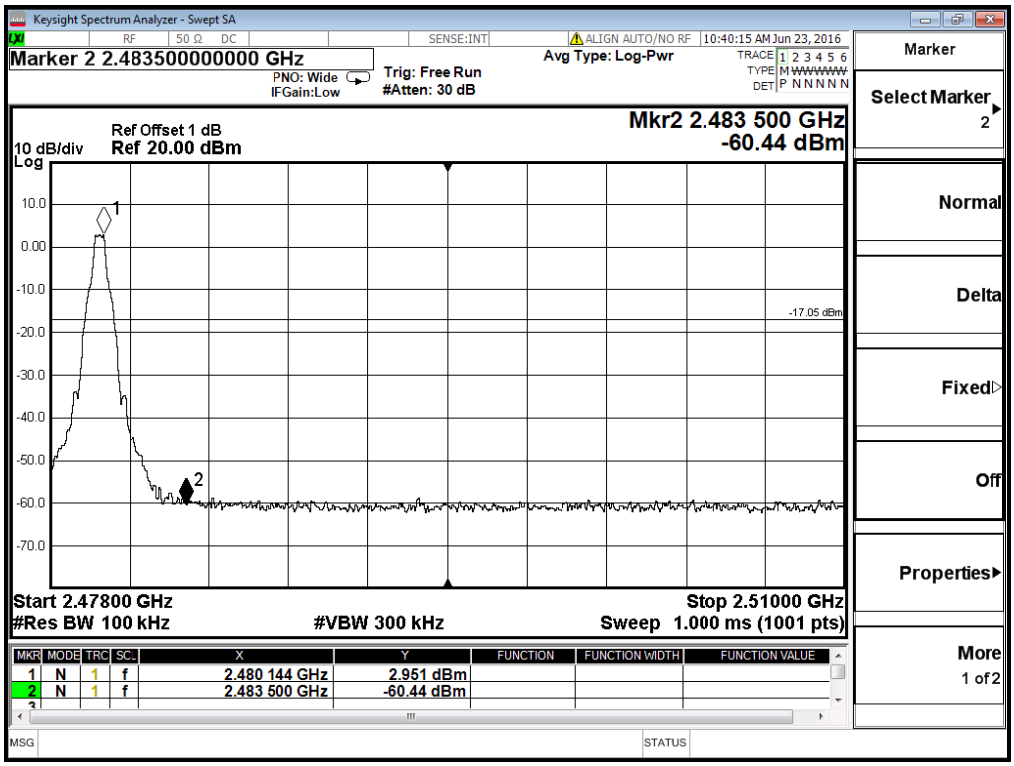
1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz (≥1% span=10MHz), VBW = 300kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

2.8.2. Test Results of Conducted Band Edge

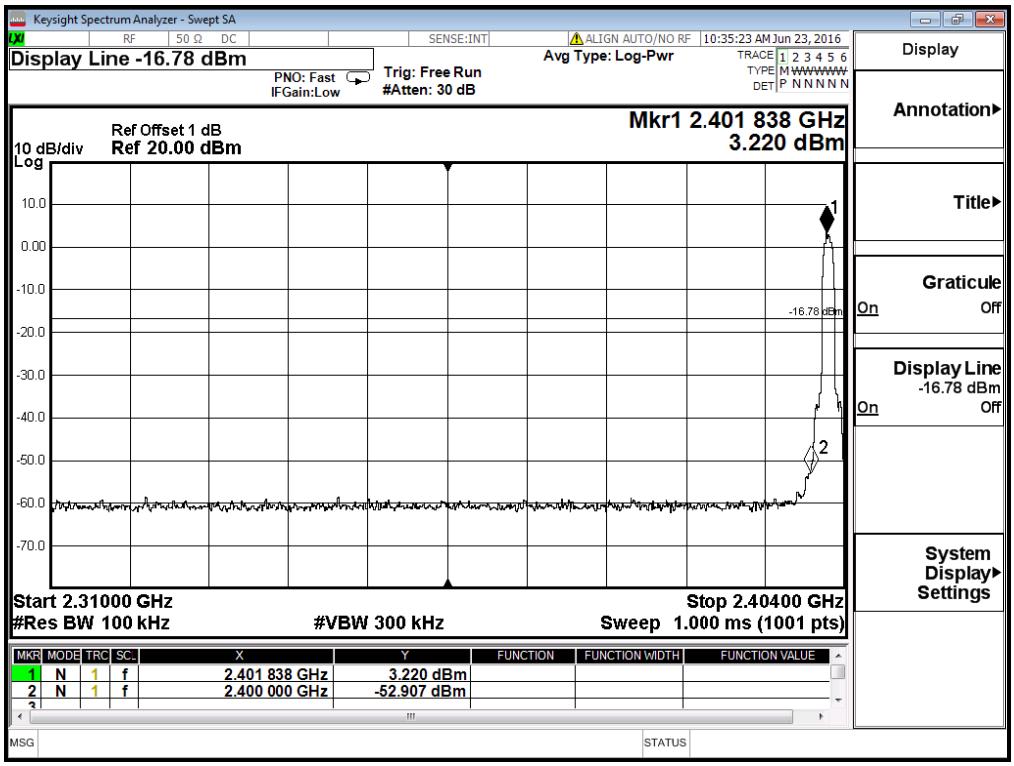
Band edge – Conducted (Un-hopping)



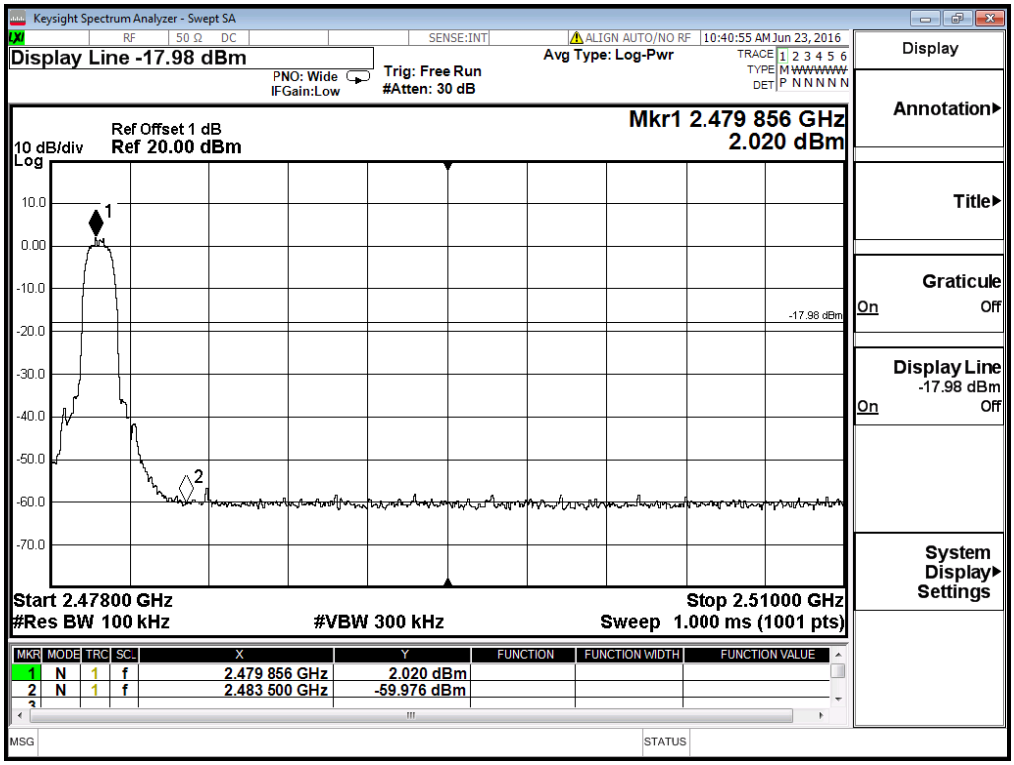
Low Band Edge Plot on channel 0 @ GFSK



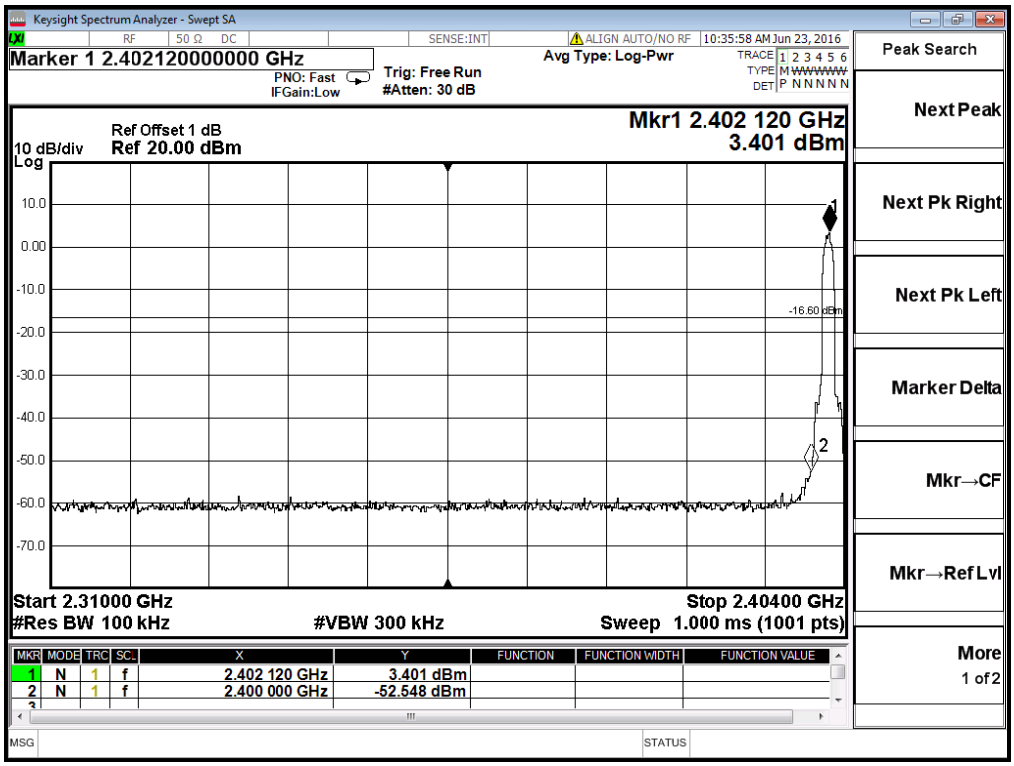
High Band Edge Plot on channel 78 @ GFSK



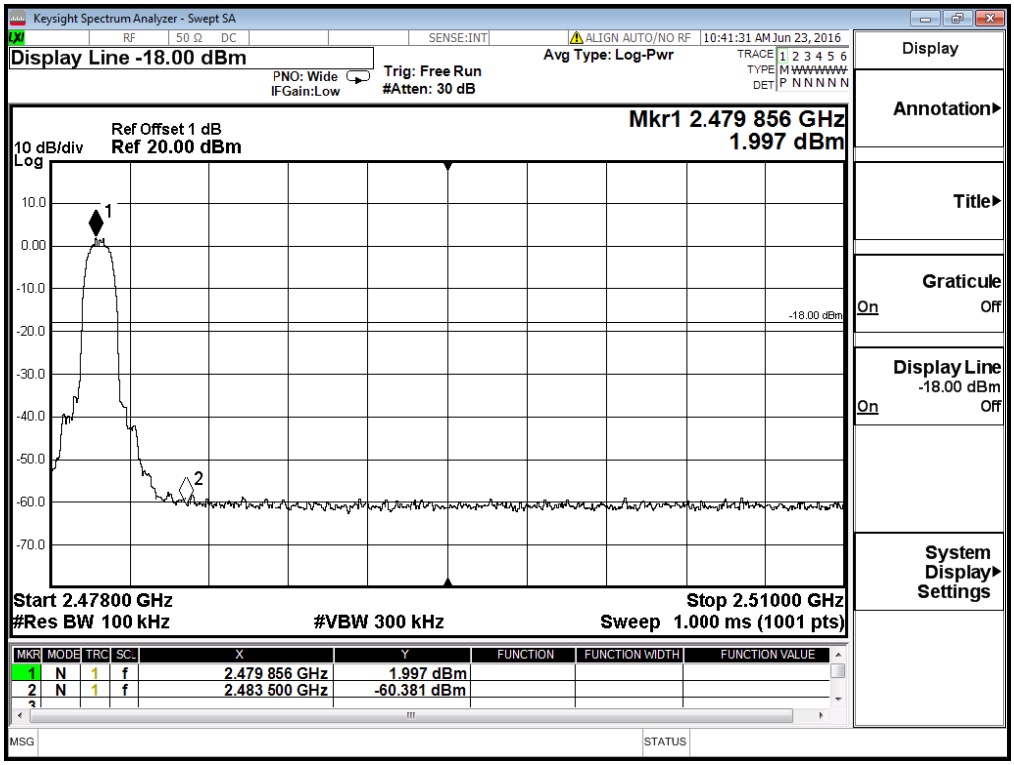
Low Band Edge Plot on channel 0 @π/4-DQPSK



High Band Edge Plot on channel 78 @π/4-DQPSK

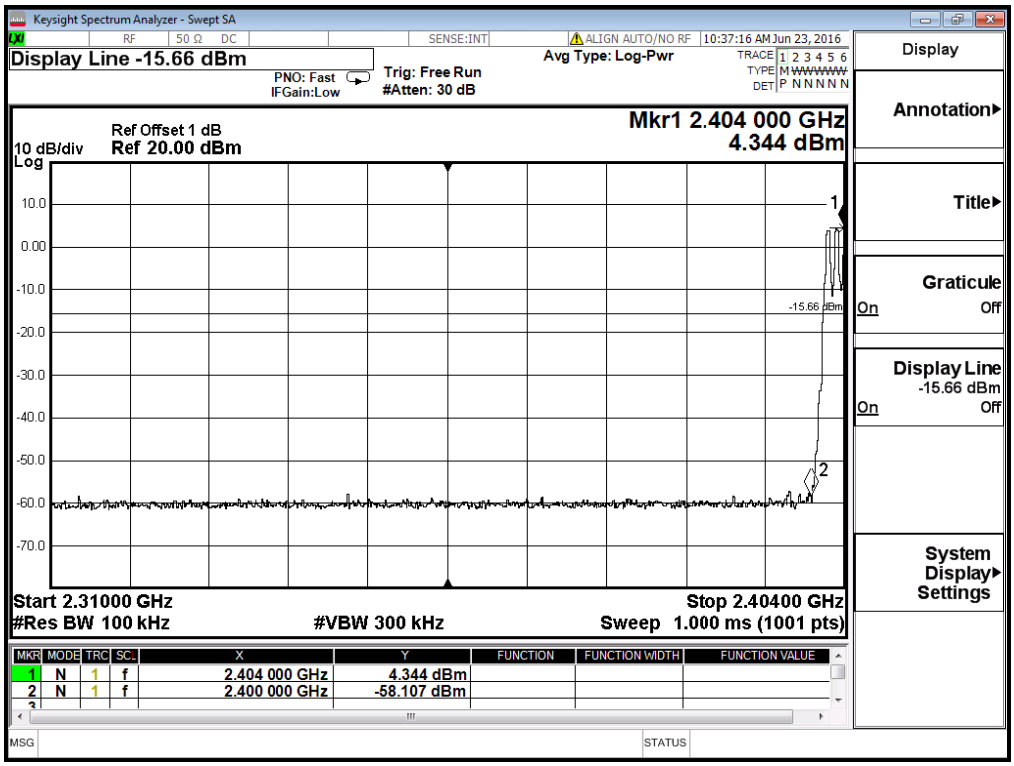


Low Band Edge Plot on channel 0 @8-DPSK

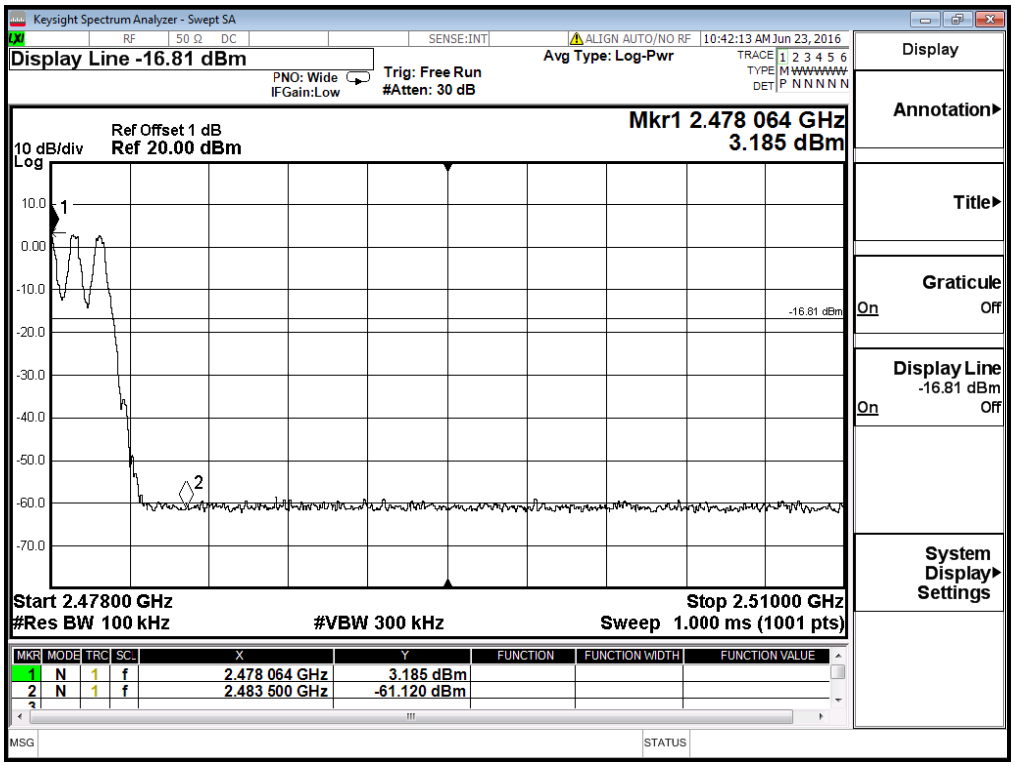


High Band Edge Plot on channel 78 @8-DPSK

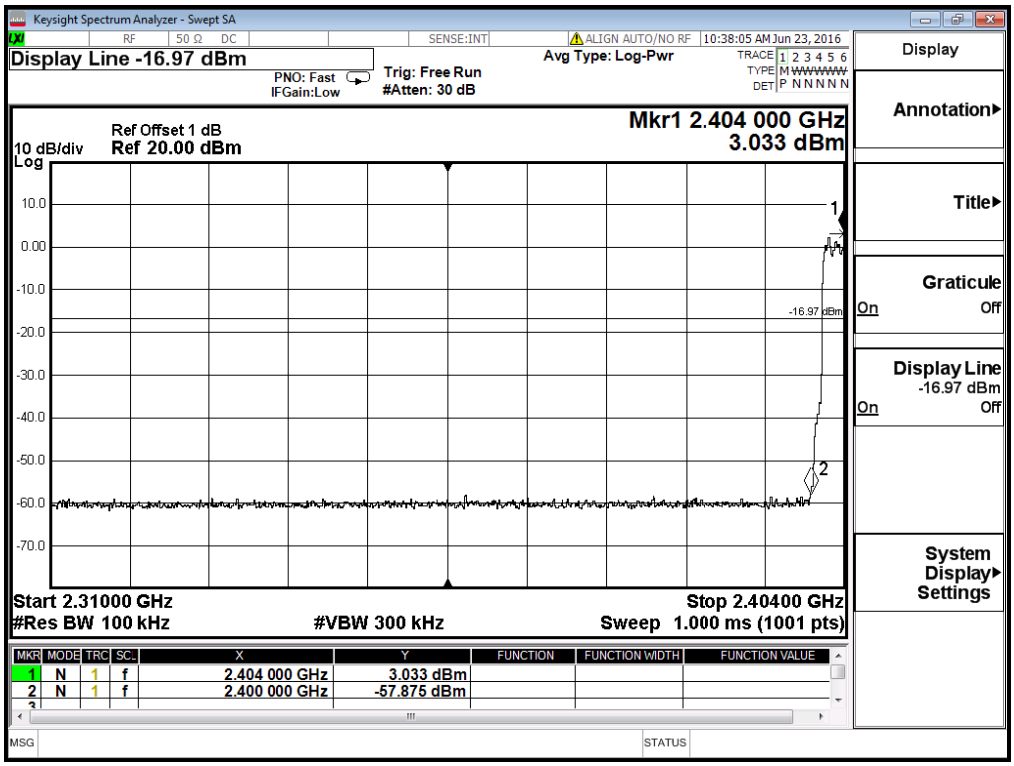
Band edge - Conducted (hopping)



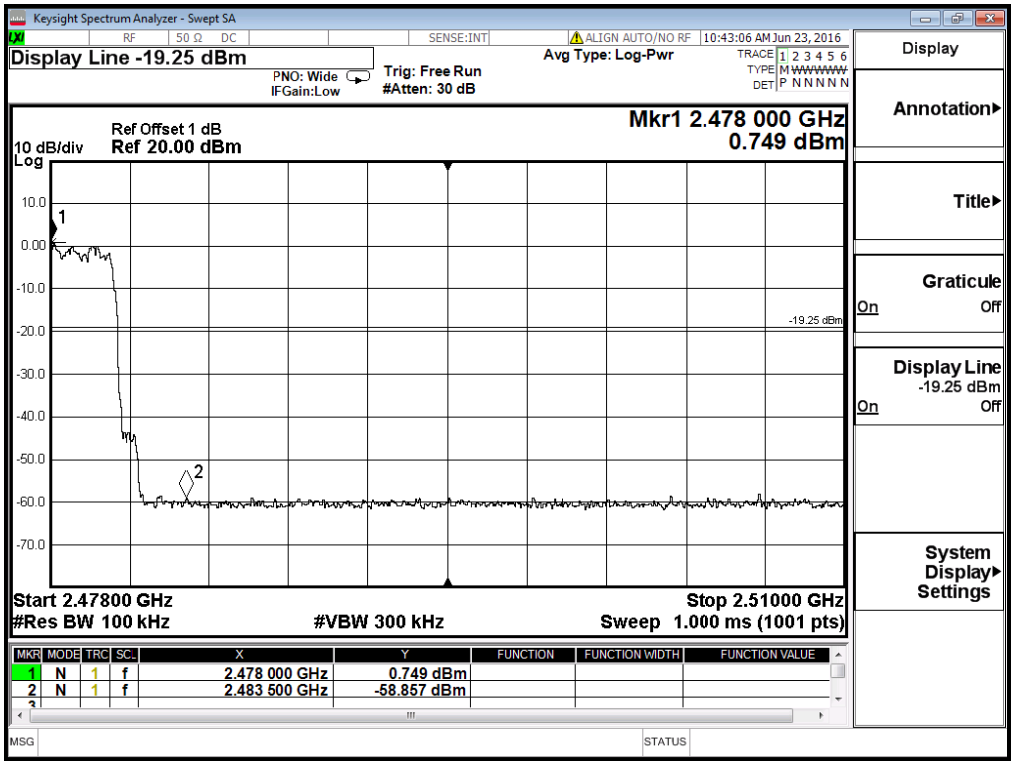
Low Band Edge Plot on channel 0 @ GFSK



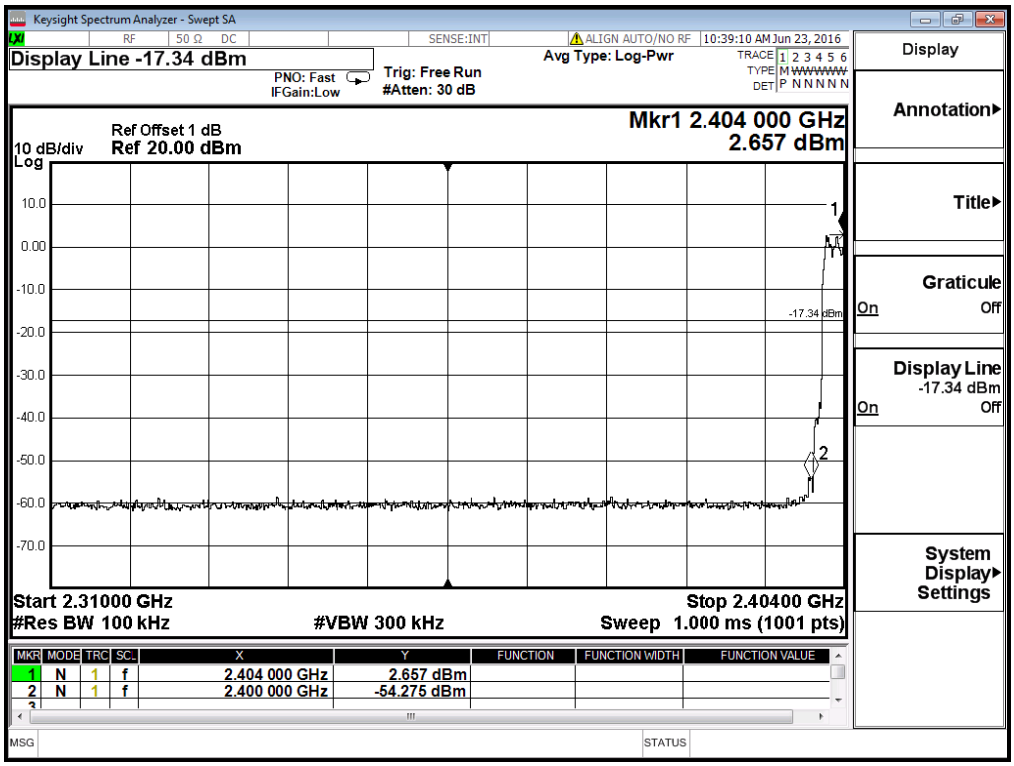
High Band Edge Plot on channel 78 @ GFSK



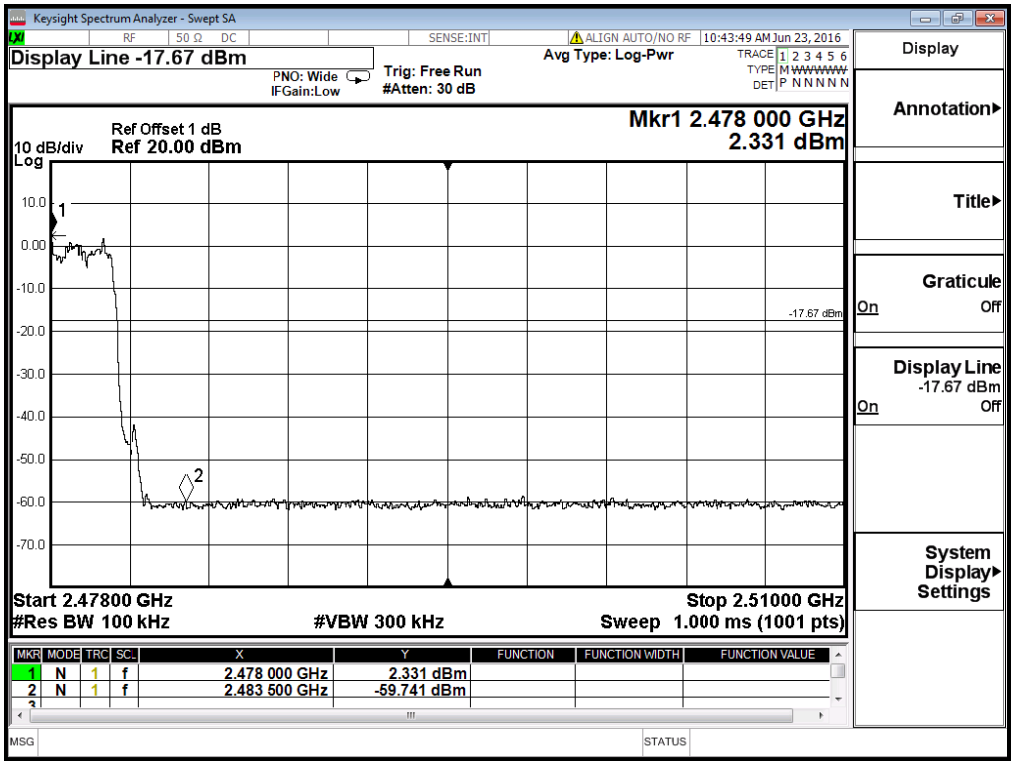
Low Band Edge Plot on channel 0 @π/4-DQPSK



High Band Edge Plot on channel 0 @π/4-DQPSK



Low Band Edge Plot on channel 0 @8-DPSK



High Band Edge Plot on channel 0 @8-DPSK

2.9. Conducted Emission

2.9.1. Limit of Conducted Emission

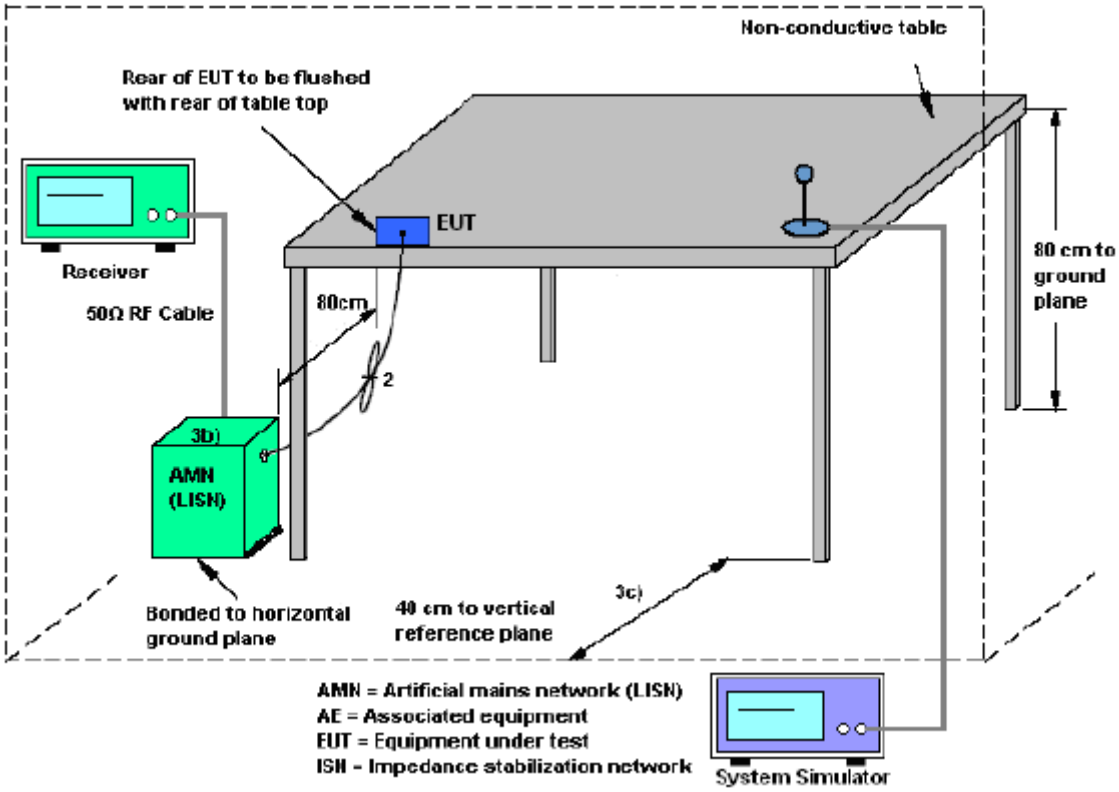
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

2.9.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.9.3. Test Setup

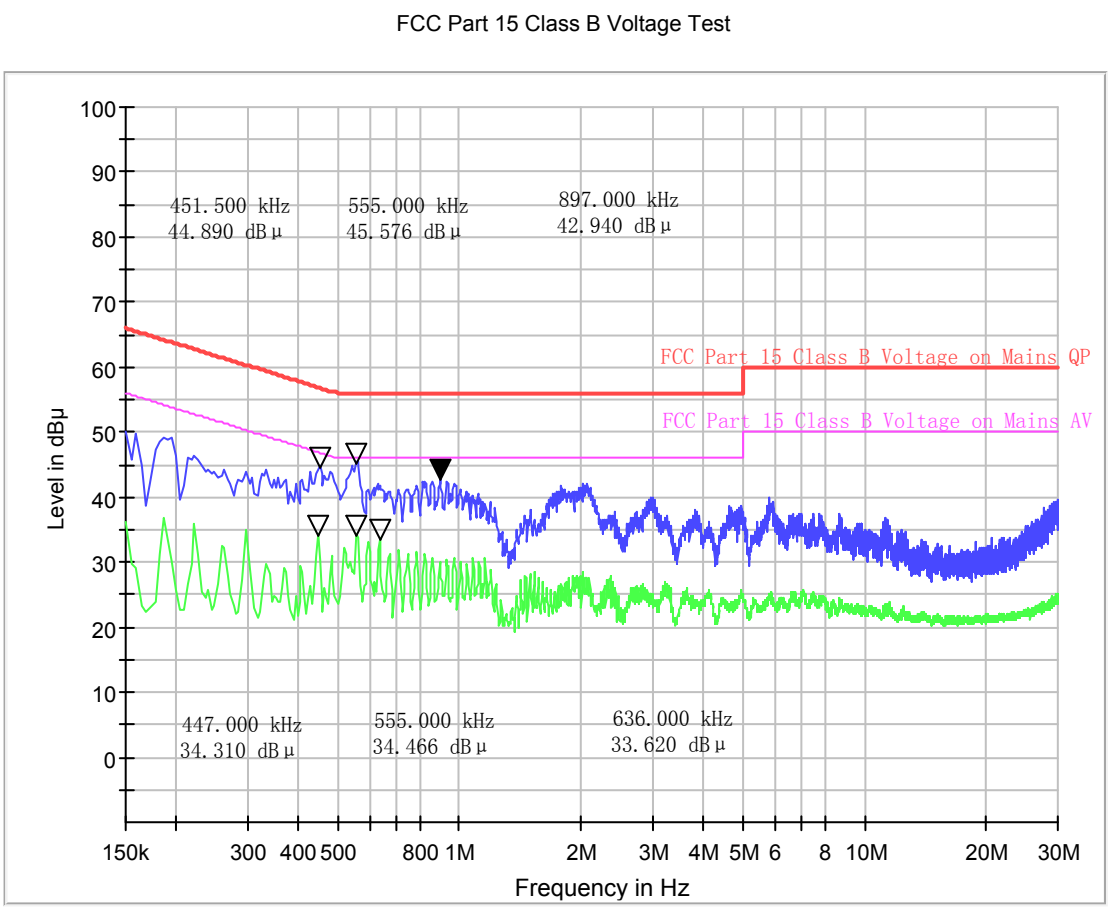


2.9.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

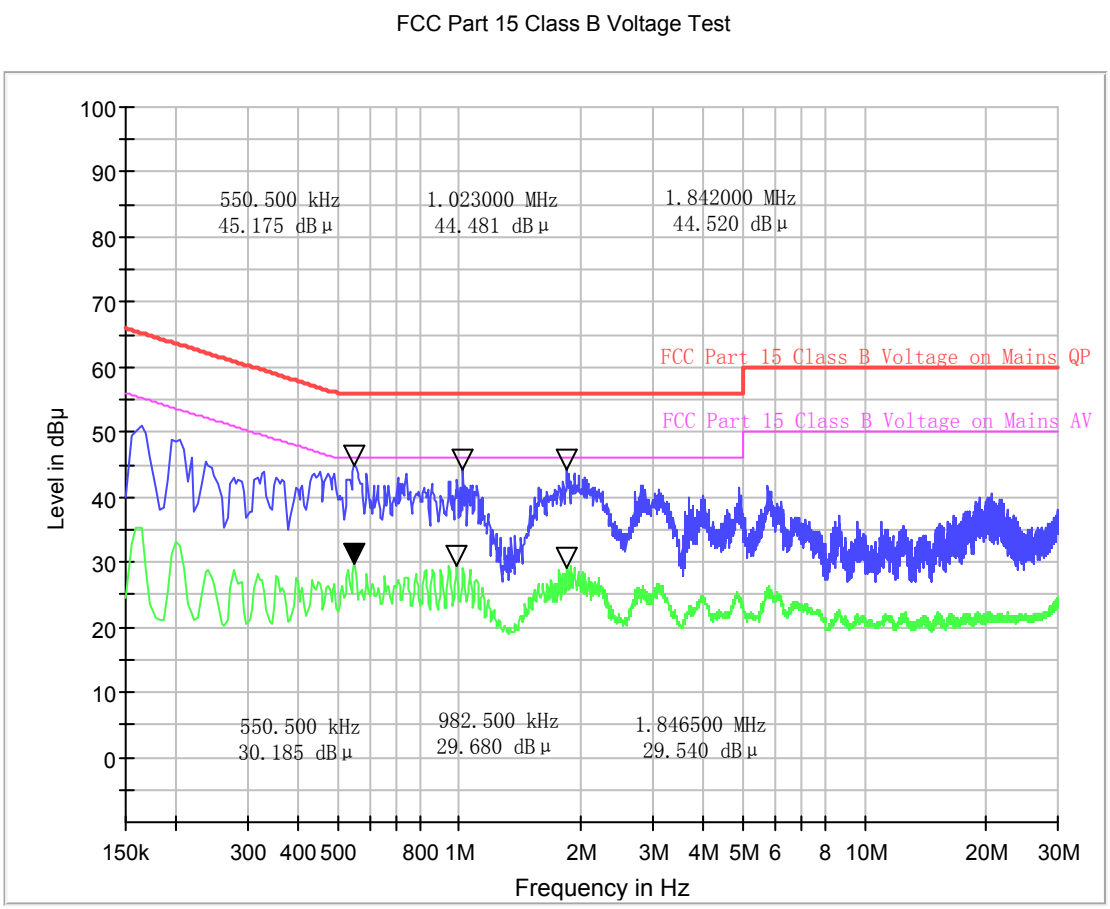
2.9.3. Test Results of Conducted Emission

1. The EUT configuration of the emission tests is Bluetooth Link + USB Cable (Charging from Adapter) + Earphone.
2. The power adapter support (100~240V AC, 50/60Hz), the EUT was tested at the both available voltages (120, 240V AC), and 60Hz. Only the worst-case mode (120V/60Hz) was record in this report.



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
0.452	56.8	44.89	0.447	46.9	34.31
0.555	56.0	45.58	0.555	46.0	34.47
0.897	56.0	42.94	0.636	46.0	33.62



(Plot B: N Phase)

Conducted Disturbance at Mains Terminals					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
0.551	56.0	45.18	0.551	46.0	30.19
1.023	56.0	44.48	0.983	46.0	29.68
1.842	56.0	44.52	1.847	46.0	29.54

2.10. Radiated Band Edges and Spurious Emission

2.10.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

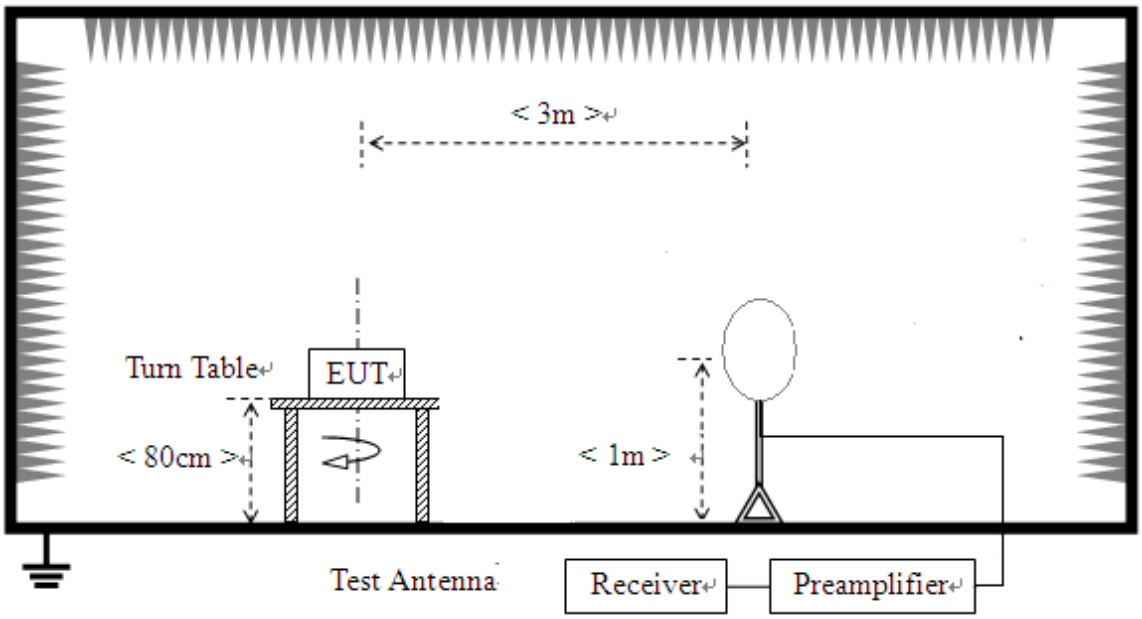
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.10.2. Measuring Instruments

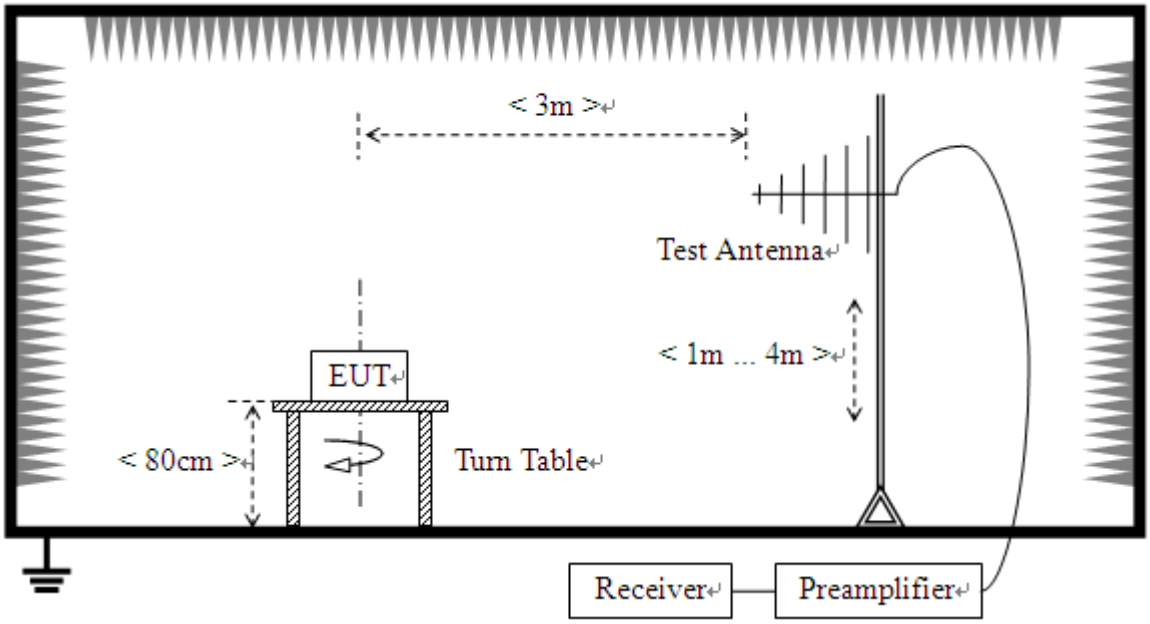
The measuring equipment is listed in the section 3 of this test report.

2.10.3. Test Setup

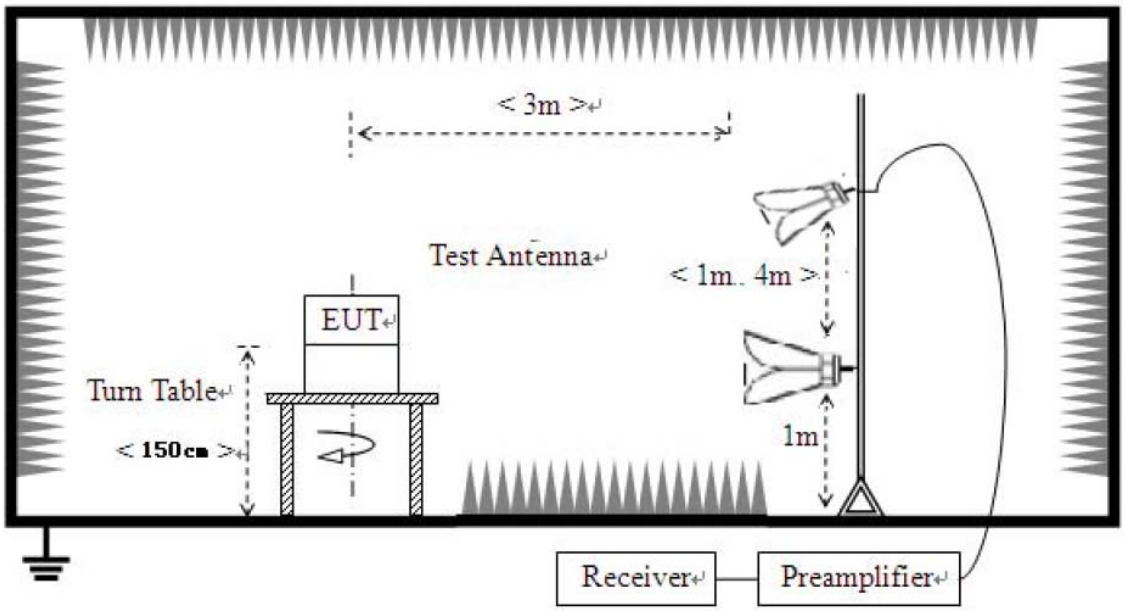
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



2.10.4. Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings:

(1) Span shall wide enough to fully capture the emission being measured;

(2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW⩾RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak

(3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds

On time = N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln

Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20*log(Duty cycle)

7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
8. For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground

plane.

NOTE:

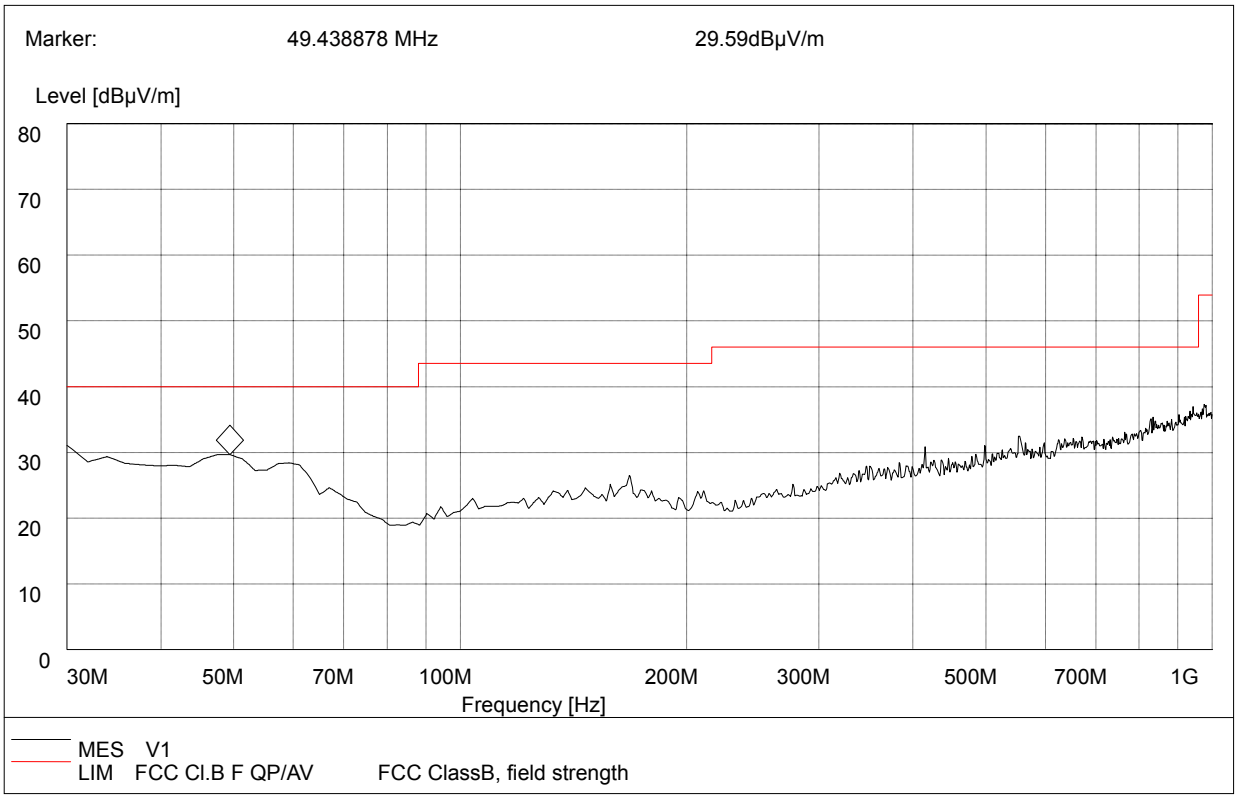
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is≥ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.10.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 KHz to 30MHz

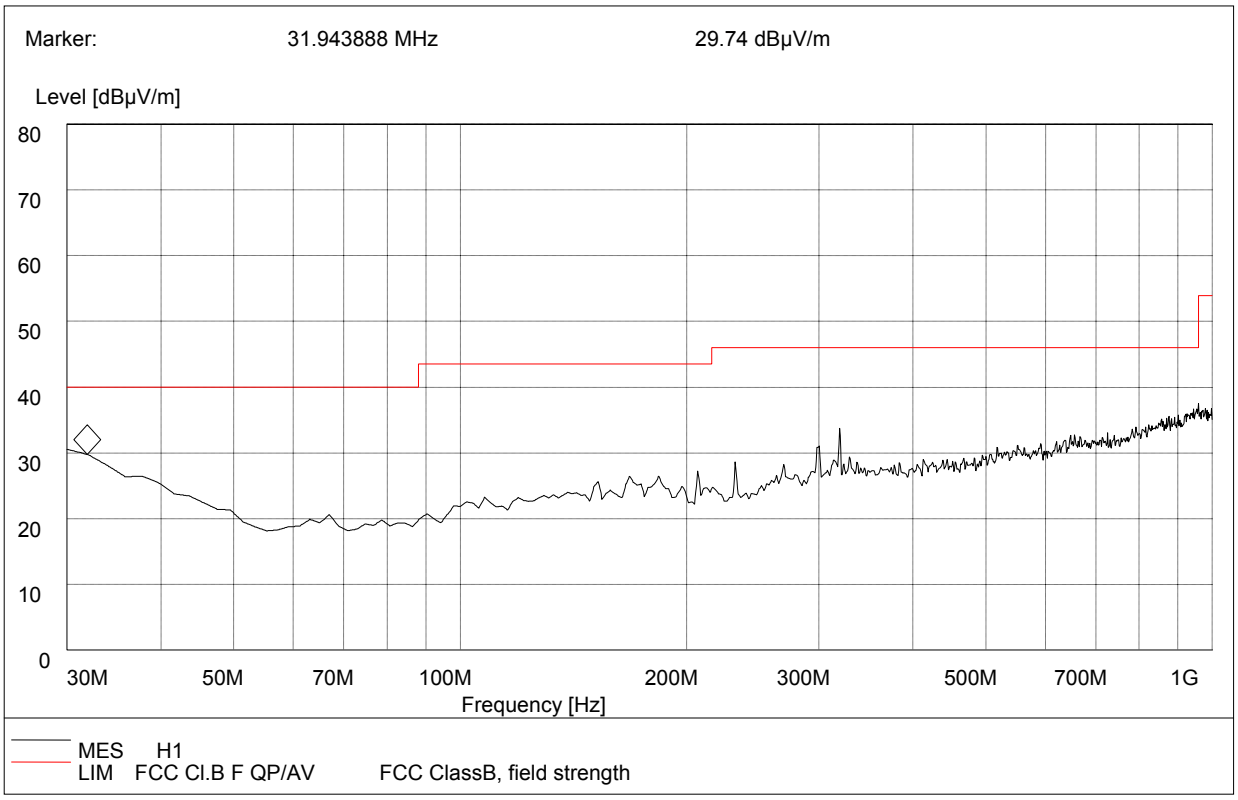
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB µ V/m)	Antenna	Verdict
49.44	29.59	120.000	100.0	40.0	Vertical	Pass

(Plot A: 30MHz to 1GHz, Antenna Vertical)



Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB µ V/m)	Antenna	Verdict
31.94	29.74	120.000	100.0	40.0	Horizontal	Pass

(Plot B: 30MHz to 1GHz, Antenna Horizontal)

For 1GHz to 25GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK-2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	2390.00	56.70	PK	74.0	-17.30	1.01 H	228	24.50	32.20
2	2390.00	43.50	AV	54.0	-10.50	1.01 H	228	11.30	32.20
3	*2402.00	106.60	PK	/	/	1.03 H	112	74.40	32.20
4	*2402.00	105.80	AV	/	/	1.03 H	112	73.60	32.20
5	4804.00	50.50	PK	74.00	-23.50	1.00 H	254	45.20	5.30
6	4804.00	42.80	AV	54.00	-11.20	1.00 H	254	37.50	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK-2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	2390.00	56.90	PK	74.0	-17.10	1.11 V	228	24.70	32.20
2	2390.00	44.30	AV	54.0	-9.70	1.11 V	228	12.10	32.20
3	*2402.00	107.10	PK	/	/	1.09 V	112	74.90	32.20
4	*2402.00	107.60	AV	/	/	1.03 V	112	75.40	32.20
5	4804.00	51.40	PK	74.00	-22.60	1.21 V	254	46.10	5.30
6	4804.00	43.70	AV	54.00	-10.30	1.21 V	254	38.40	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	107.80	PK	/	/	1.01 H	210	75.60	32.20
2	*2441.00	106.70	AV	/	/	1.01 H	210	74.50	32.20
3	4882.00	54.50	PK	74.00	-19.50	1.03 H	272	49.20	5.30
4	4882.00	43.6	AV	54.00	-10.40	1.03 H	272	38.30	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	108.40	PK	/	/	1.09 V	112	76.20	32.20
2	*2441.00	106.10	AV	/	/	1.09 V	112	73.90	32.20
3	4884.00	55.50	PK	74.00	-18.50	1.21 V	254	50.20	5.30
4	4884.00	42.80	AV	54.00	-11.20	1.21 V	254	37.50	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	108.00	PK	/	/	1.05 H	215	75.70	32.30
2	*2480.00	106.50	AV	/	/	1.05 H	215	74.20	32.30
3	2483.50	56.80	PK	74.0	-17.20	1.05 H	211	24.40	32.40
4	2483.50	45.20	AV	54.0	-8.80	1.05 H	211	12.80	32.40
5	4960.00	52.20	PK	74.0	-21.80	1.45 H	320	46.70	5.50
6	4960.00	45.10	AV	54.0	-8.90	1.45 H	320	39.60	5.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	109.10	PK	/	/	1.05 V	174	76.80	32.30
2	*2480.00	107.80	AV	/	/	1.05 V	174	75.50	32.30
3	2483.50	56.30	PK	74.0	-17.70	1.05 V	177	23.90	32.40
4	2483.50	45.90	AV	54.0	-8.10	1.05 V	177	13.50	32.40
5	4960.00	53.70	PK	74.0	-20.30	1.45 V	201	48.20	5.50
6	4960.00	42.60	AV	54.0	-11.40	1.45 V	201	37.10	5.50

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π/4-DQPSK -2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	2390.00	57.30	PK	74.0	-16.70	1.01 H	228	25.10	32.20
2	2390.00	43.70	AV	54.0	-10.30	1.01 H	228	11.40	32.20
3	*2402.00	107.70	PK	/	/	1.03 H	112	75.50	32.20
4	*2402.00	106.50	AV	/	/	1.03 H	112	74.30	32.20
5	4804.00	52.80	PK	74.00	-21.2	1.00 H	254	47.50	5.30
6	4804.00	44.30	AV	54.00	-9.70	1.00 H	254	39.00	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π/4-DQPSK -2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	2390.00	56.70	PK	74.0	-17.30	1.11 V	228	24.50	32.20
2	2390.00	43.30	AV	54.0	-10.70	1.11 V	228	12.10	32.20
3	*2402.00	108.4	PK	/	/	1.09 V	112	76.20	32.20
4	*2402.00	107.3	AV	/	/	1.03 V	112	75.10	32.20
5	4804.00	54.10	PK	74.00	-19.90	1.21 V	254	48.80	5.30
6	4804.00	43.40	AV	54.00	-10.60	1.21 V	254	38.10	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π/4-DQPSK _2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	108.60	PK	/	/	1.01 H	210	76.40	32.20
2	*2441.00	107.90	AV	/	/	1.01 H	210	75.70	32.20
3	4882.00	53.20	PK	74.00	-19.80	1.03 H	272	47.90	5.30
4	4882.00	40.80	AV	54.00	-13.20	1.03 H	272	35.50	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π/4-DQPSK _2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	109.40	PK	/	/	1.09 V	112	77.20	32.20
2	*2441.00	107.30	AV	/	/	1.09 V	112	75.10	32.20
3	4884.00	53.60	PK	74.00	-20.40	1.21 V	254	48.30	5.30
4	4884.00	41.80	AV	54.00	-12.20	1.21 V	254	36.50	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（π/4-DQPSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	108.40	PK	/	/	1.05 H	215	76.10	32.30
2	*2480.00	107.60	AV	/	/	1.05 H	215	75.30	32.30
3	2483.50	57.10	PK	74.0	-16.90	1.05 H	211	24.70	32.40
4	2483.50	43.20	AV	54.0	-10.80	1.05 H	211	10.80	32.40
5	4960.00	52.00	PK	74.0	-22.00	1.45 H	320	46.50	5.50
6	4960.00	44.30	AV	54.0	-9.70	1.45 H	320	38.80	5.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（π/4-DQPSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	109.80	PK	/	/	1.05 V	174	77.50	32.30
2	*2480.00	106.40	AV	/	/	1.05 V	174	74.10	32.30
3	2483.50	55.80	PK	74.0	-18.20	1.05 V	177	23.40	32.40
4	2483.50	43.90	AV	54.0	-10.10	1.05 V	177	11.50	32.40
5	4960.00	53.80	PK	74.0	-20.20	1.45 V	201	48.30	5.50
6	4960.00	44.60	AV	54.0	-9.40	1.45 V	201	39.10	5.50

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK -2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	55.30	PK	74.0	-18.70	1.01 H	228	23.10	32.20
2	2390.00	44.60	AV	54.0	-9.40	1.01 H	228	12.40	32.20
3	*2402.00	109.70	PK	/	/	1.03 H	112	77.50	32.20
4	*2402.00	108.30	AV	/	/	1.03 H	112	76.10	32.20
5	4804.00	52.50	PK	74.00	-21.50	1.00 H	254	47.20	5.30
6	4804.00	45.40	AV	54.00	-8.60	1.00 H	254	40.10	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DPSK -2402MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	2390.00	56.40	PK	74.0	-17.60	1.11 V	228	24.20	32.20
2	2390.00	44.00	AV	54.0	-10.00	1.11 V	228	11.80	32.20
3	*2402.00	109.10	PK	/	/	1.09 V	112	76.90	32.20
4	*2402.00	109.60	AV	/	/	1.03 V	112	77.40	32.20
5	4804.00	53.40	PK	74.00	-20.60	1.21 V	254	48.10	5.30
6	4804.00	44.70	AV	54.00	-9.30	1.21 V	254	39.40	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK _2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	107.60	PK	/	/	1.01 H	210	75.40	32.20
2	*2441.00	106.70	AV	/	/	1.01 H	210	74.50	32.20
3	4882.00	53.40	PK	74.00	-20.60	1.03 H	272	48.10	5.30
4	4882.00	45.10	AV	54.00	-8.90	1.03 H	272	39.80	5.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DQPSK _2441MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2441.00	108.30	PK	/	/	1.09 V	112	76.10	32.20
2	*2441.00	106.10	AV	/	/	1.09 V	112	73.90	32.20
3	4884.00	54.80	PK	74.00	-17.2	1.21 V	254	49.50	5.30
4	4884.00	43.90	AV	54.00	-10.5	1.21 V	254	38.60	5.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8-DPSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	110.20	PK	/	/	1.05 H	215	77.90	32.30
2	*2480.00	107.80	AV	/	/	1.05 H	215	75.50	32.30
3	2483.50	57.60	PK	74.0	-16.40	1.05 H	211	25.20	32.40
4	2483.50	44.70	AV	54.0	-9.30	1.05 H	211	12.30	32.40
5	4960.00	54.60	PK	74.0	-19.40	1.45 H	320	49.10	5.50
6	4960.00	41.70	AV	54.0	-12.30	1.45 H	320	36.20	5.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8-DPSK _2480MHz）									
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	*2480.00	109.10	PK	/	/	1.05 V	174	76.80	32.30
2	*2480.00	109.70	AV	/	/	1.05 V	174	77.40	32.30
3	2483.50	57.20	PK	74.0	-16.80	1.05 V	177	24.80	32.40
4	2483.50	43.90	AV	54.0	-10.10	1.05 V	177	11.50	32.40
5	4960.00	54.90	PK	74.0	-19.10	1.45 V	201	49.40	5.50
6	4960.00	42.80	AV	54.0	-11.20	1.45 V	201	37.30	5.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

3. List of measuring equipment

Description	Manufacturer	Model	Serial No.	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESIB26	A0304218	2016.06.02	2017.06.01	Radiation
Full-Anechoic Chamber	Albatross	12.8m*6.8m* 6.4m	A0412372	2016.06.02	2017.06.01	Radiation
Loop Antenna	Schwarz beck	HFH2-Z2	100047	2016.06.02	2017.06.01	Radiation
Ultra-wideband antenna (30MHz~1GHz)	R&S	HL562	100089	2016.06.02	2017.06.01	Radiation
Double ridge horn antenna (1G~18GHz)	R&S	HF906	100150	2016.06.02	2017.06.01	Radiation
Test Antenna – Horn (18G-26.5GHz)	ETS	3160-09	A0902607	2016.06.02	2017.06.01	Radiation
Amplifier 20M~3GHz	R&S	PAP-0203H	22018	2016.06.02	2017.06.01	Radiation
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101 800	25-S-42	2016.06.02	2017.06.01	Radiation
Ampilier 18G~40GHz	R&S	JS42-180026 00-28-5A	12111.0980.00	2016.06.02	2017.06.01	Radiation
Spectrum Analyzer	KEYSIGHT	N9030A	MY55410524	2016.05.05	2017.05.04	Conducted
Power Meter	R&S	NRP2	1020.1809.02	2016.06.02	2017.06.01	Conducted
Power Sensor	R&S	NRP-Z81	823.3618.03	2016.06.02	2017.06.01	Conducted
LISN	ROHDE&SC HWARZ	ESH2-Z5	A0304221	2016.06.02	2017.06.01	Conducted
Test Receiver	R&S	ESCS30	A0304260	2016.06.02	2017.06.01	Conducted
Cable	SUNHNER	SUCOFLEX 100	/	2016.06.02	2017.06.01	Radiation
Cable	SUNHNER	SUCOFLEX 104	/	2016.06.02	2017.06.01	Radiation

4. Uncertainty of Evaluation

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

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	2.35dB
Radiated emissions	30MHz~1000MHz	2.45dB
	1G~18GHz	2.21dB
	18G~40GHz	1.96dB

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

** END OF REPORT **