FCC REPORT

Report Reference No. ..... :	**TRE1612017202**	R/C…….: 37096
FCC ID ..... :	**SG7201611G303**	
Applicant's name ..... :	**Haier Telecom(Qingdao) CO., Ltd.**	
Address.....:	No1.Haier Road,Hi-tech Zone Qingdao,China	
Manufacturer.....:	Haier Telecom(Qingdao) CO., Ltd.	
Address.....:	No1.Haier Road,Hi-tech Zone Qingdao,China	
Test item description..... :	Smartphone	
Trade Mark.....:	Haier	
Model/Type reference.....:	U21, HM-G303-W	
Standard ..... :	47 CFR Part 15 Subpart C: Radio Frequency Devices ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices	
Date of receipt of test sample……..:	Nov. 14, 2016	
Date of testing……:	Dec. 02, 2016 - Dec. 14, 2016	
Date of issue……...:	Dec. 15, 2016	
Result..... ……..:	**Pass**	

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Table of contents

1. GENERAL INFORMATION 3

1.1. EUT Description 3

1.2. Test Standards and Results 4

1.3. Frequency Hopping System Requirements 5

1.4. Facilities and Accreditations 6

2. 47 CFR PART 15C REQUIREMENTS 7

2.1. Antenna requirement 7

2.2. Number of Hopping Frequency 8

2.3. Peak Output Power 11

2.4. 20dB Bandwidth 13

2.5. Carried Frequency Separation 19

2.6. Dwell time 22

2.7. Conducted Spurious Emissions 29

2.8. Conducted Band Edge 39

2.9. Conducted Emission 46

2.10. Radiated Band Edges and Spurious Emission 50

3. LIST OF MEASURING EQUIPMENT 64

4. UNCERTAINTY OF EVALUATION 65

Change History		
Issue	Date	Reason for change
1.0	2016.12.15	First edition

1. General Information

1.1. EUT Description

EUT Type	Smartphone	
Hardware Version	ZH010-MB-V2.0	
Software Version	U21_H02_S001_Tigo	
EUT supports Radios application	GSM/GPRS/EDGE/WCDMA/HSPA/ LTE WLAN2.4GHz 802.11b/g/n (HT20/HT40) Bluetooth V3.0+EDR / Bluetooth V4.0LE	
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	PIFA Antenna	
Antenna Gain	-2.2dBi	

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.

Note 5: The EUT is a Mobile Phone，it contains 2 models, they are HM-G303-W, U21. They have the same size, appearance and internal structure, and the only difference is the model number.

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 2015	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: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories

(identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection 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 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017.

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	Smartphone	PIFA	-2.2

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

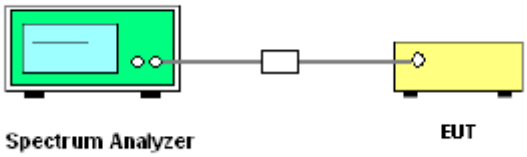
2.2.1. Limit of Number of Hopping Frequency

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

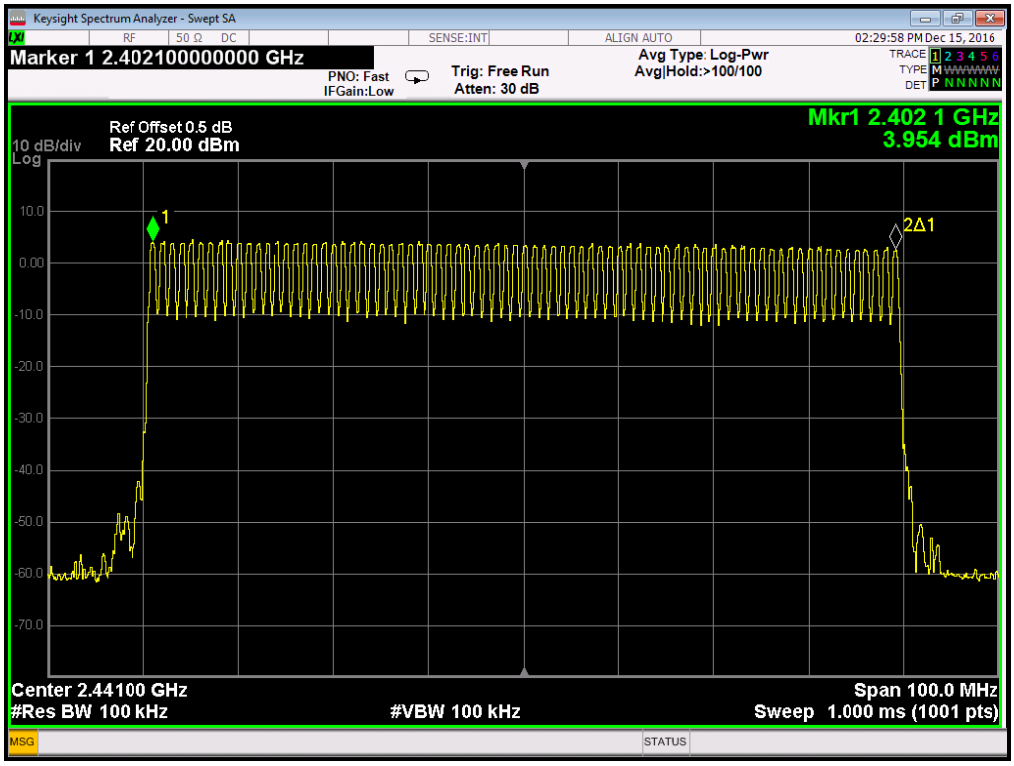
1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.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

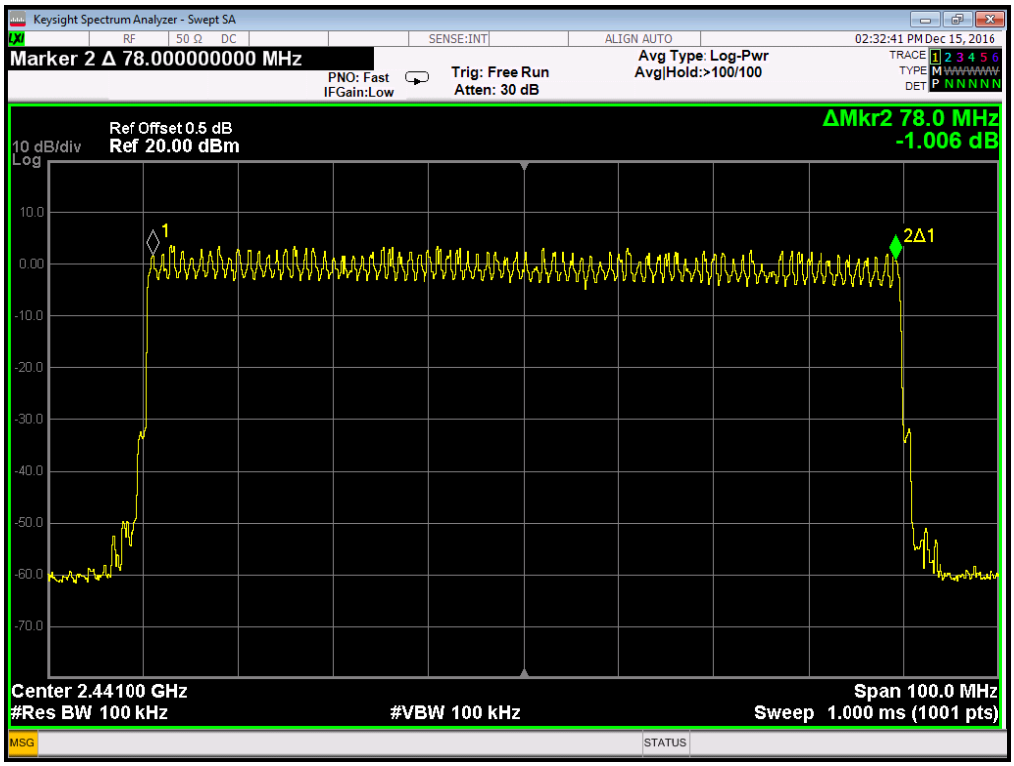
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

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

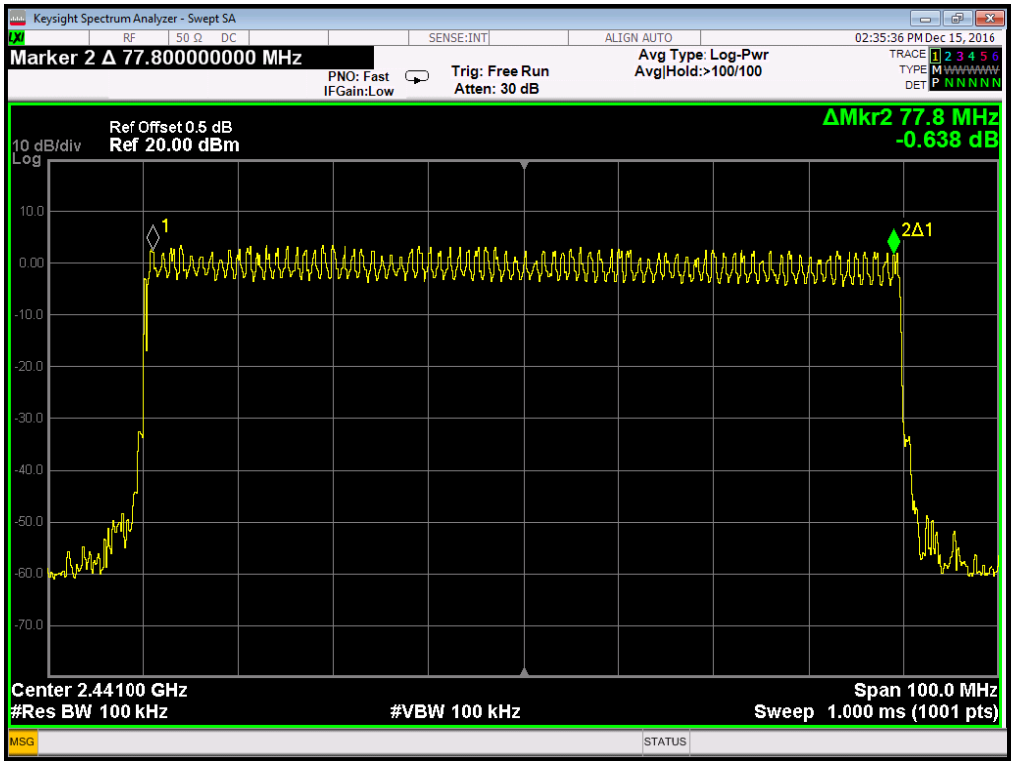
2.2.6. Test Results (plots) of Number of Hopping Frequency



(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

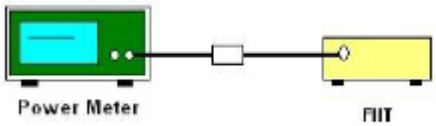
Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz 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	2.33	30	PASS
	39	2441	1.75		PASS
	78	2480	1.34		PASS
π/4-DQPSK	0	2402	2.16		PASS
	39	2441	1.60		PASS
	78	2480	1.13		PASS
8- DPSK	0	2402	2.14		PASS
	39	2441	1.63		PASS
	78	2480	1.23		PASS

2.4. 20dB Bandwidth

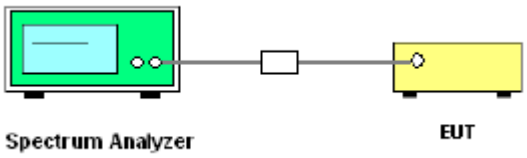
2.4.1. Definition

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;

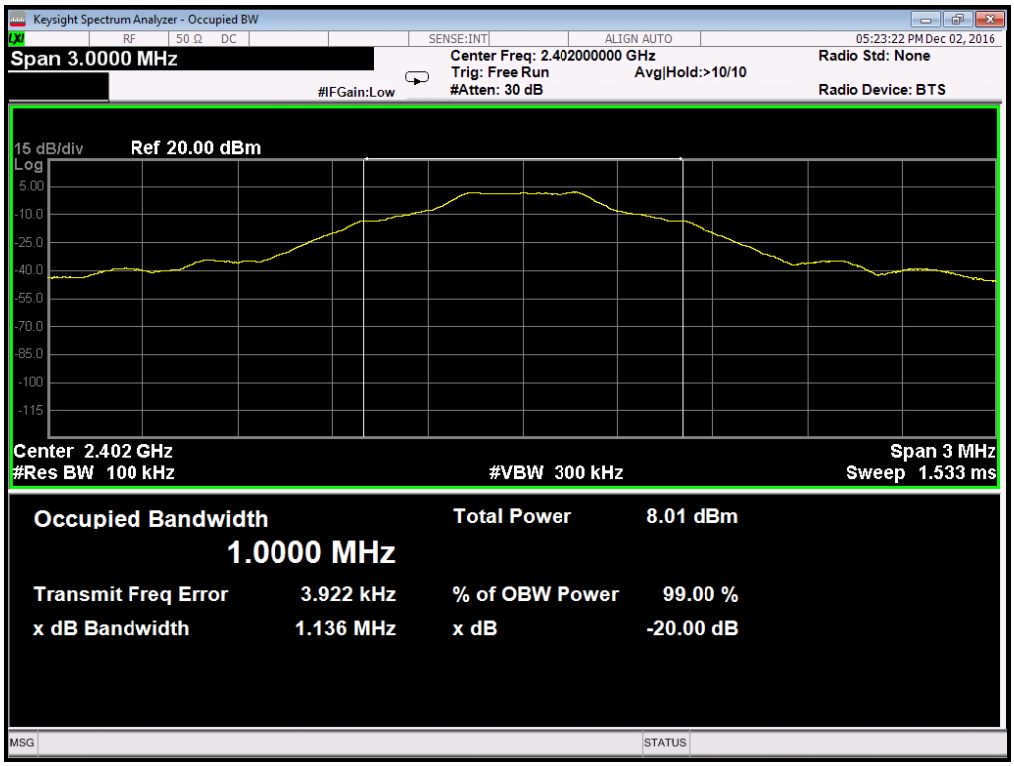
   RBW≥1% of the 20 dB bandwidth; VBW≥RBW; Sweep = auto; Detector function = peak;

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

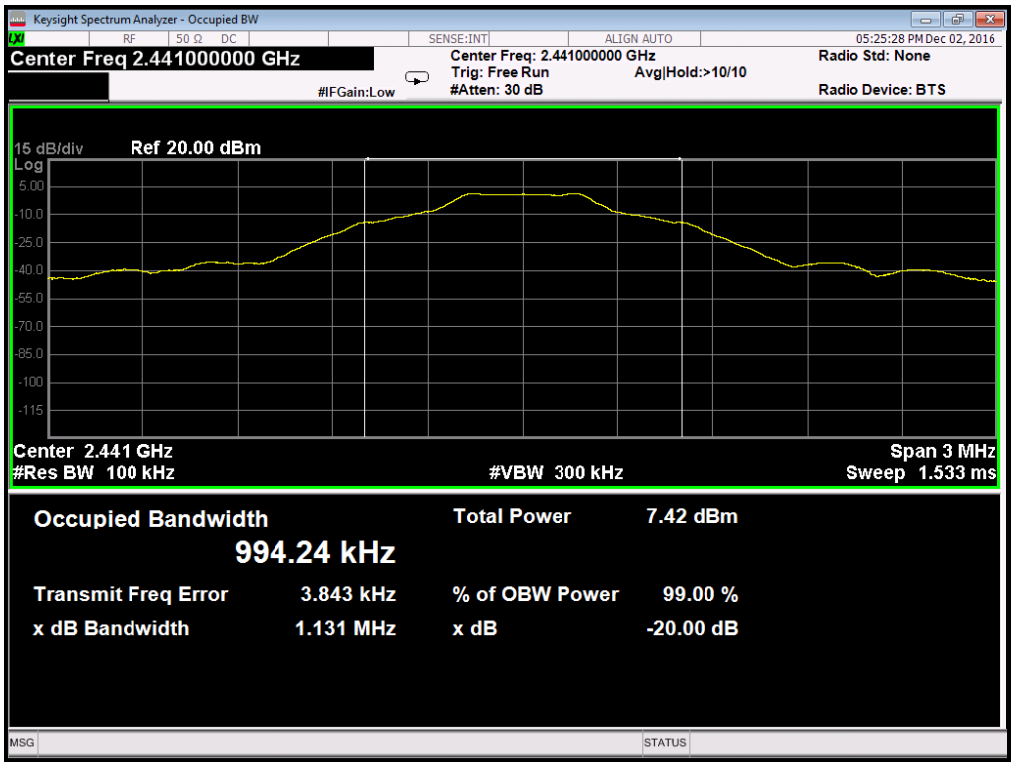
2.4.5. Test Results of 20dB Bandwidth

Mode	Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
GFSK	0	2402	1.136	Plot A
	39	2441	1.131	Plot B
	78	2480	1.126	Plot C
π/4-DQPSK	0	2402	1.365	Plot D
	39	2441	1.362	Plot E
	78	2480	1.357	Plot F
8-DPSK	0	2402	1.362	Plot G
	39	2441	1.367	Plot H
	78	2480	1.366	Plot I

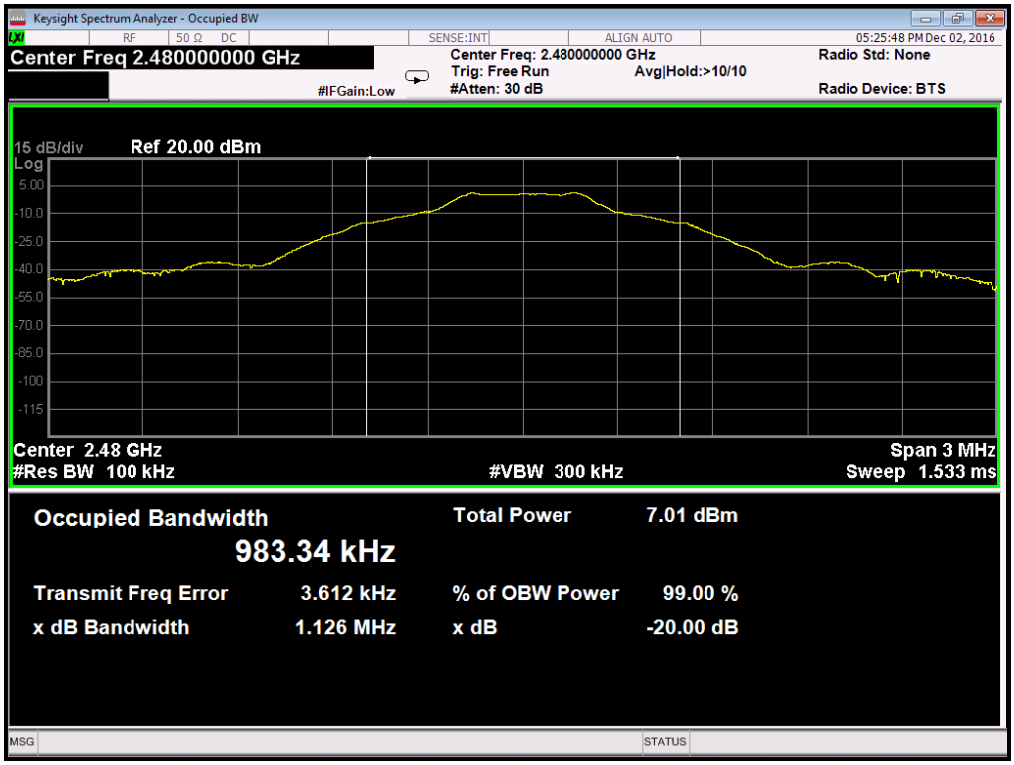
2.4.6. Test Results (plots) of 20dB Bandwidth



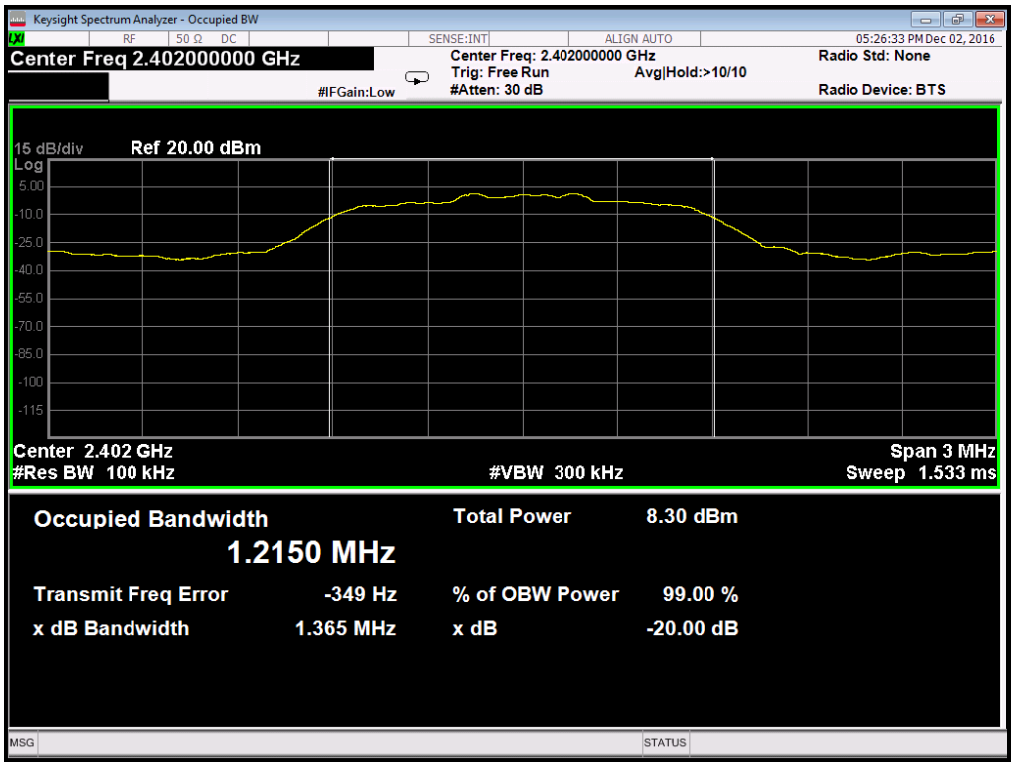
(Plot A: 0 Channel @ GFSK)



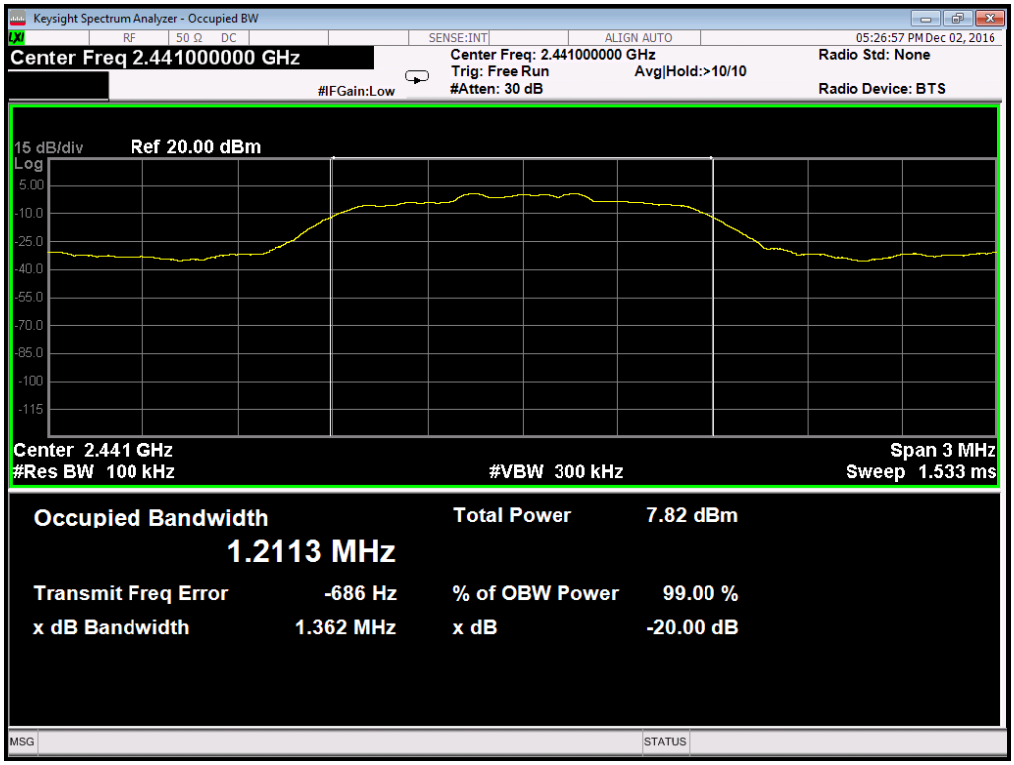
(Plot B: 39 Channel @ GFSK)



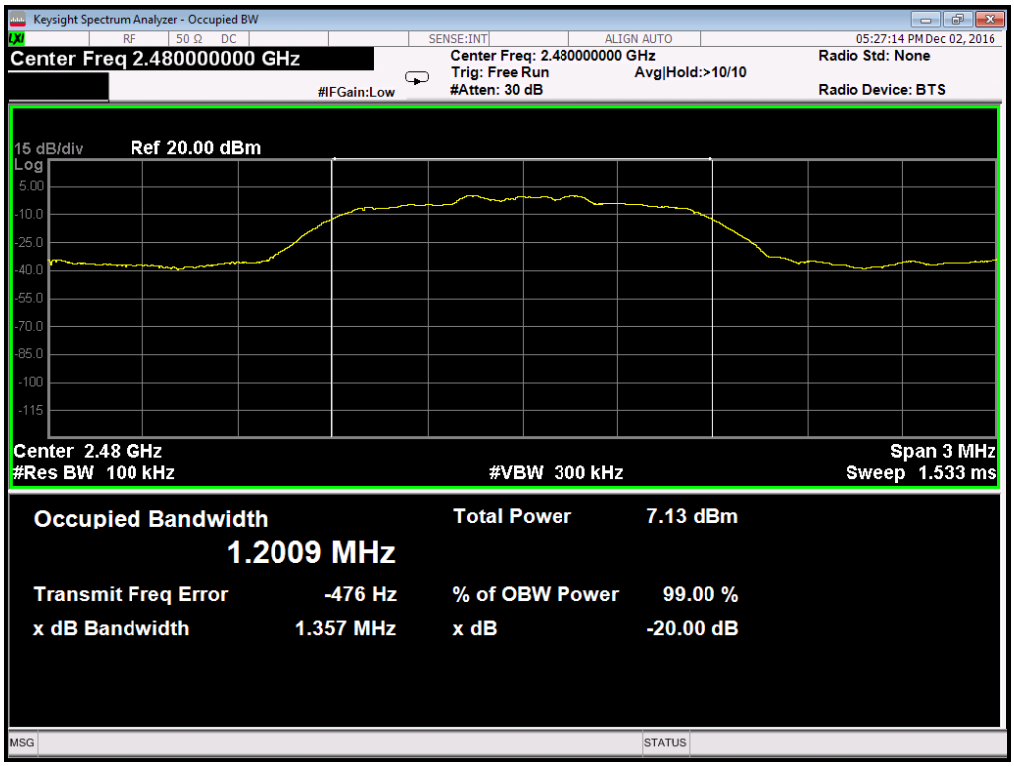
(Plot C: 78 Channel @ GFSK)



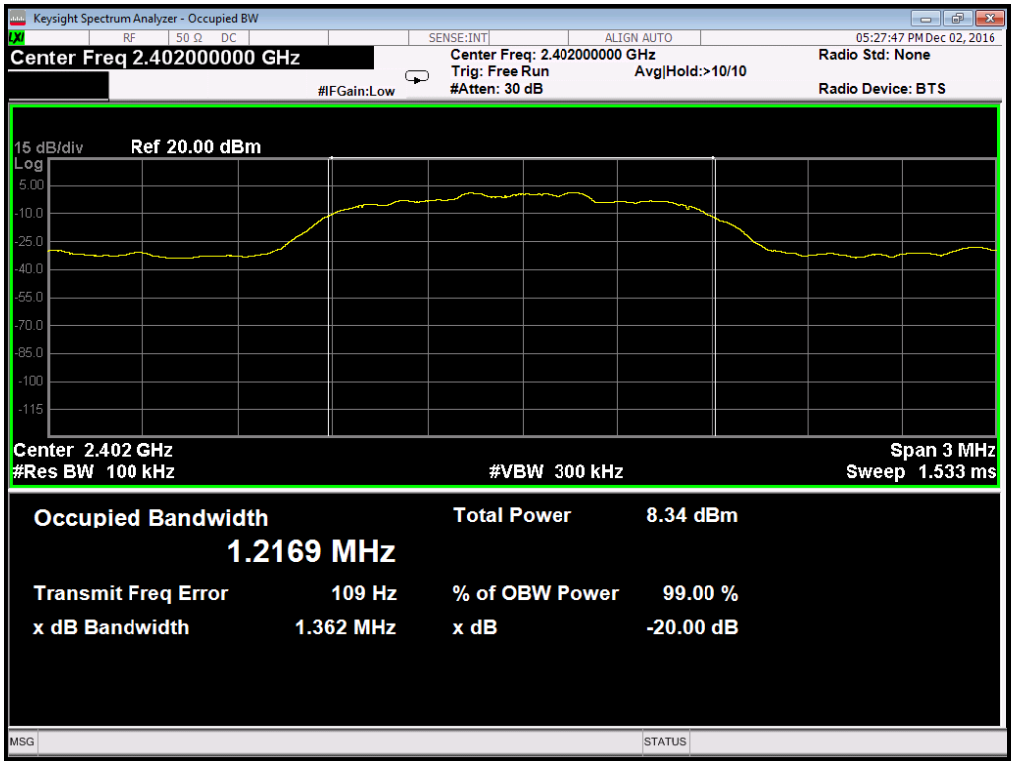
(Plot D: 0 Channel @ π/4-DQPSK)



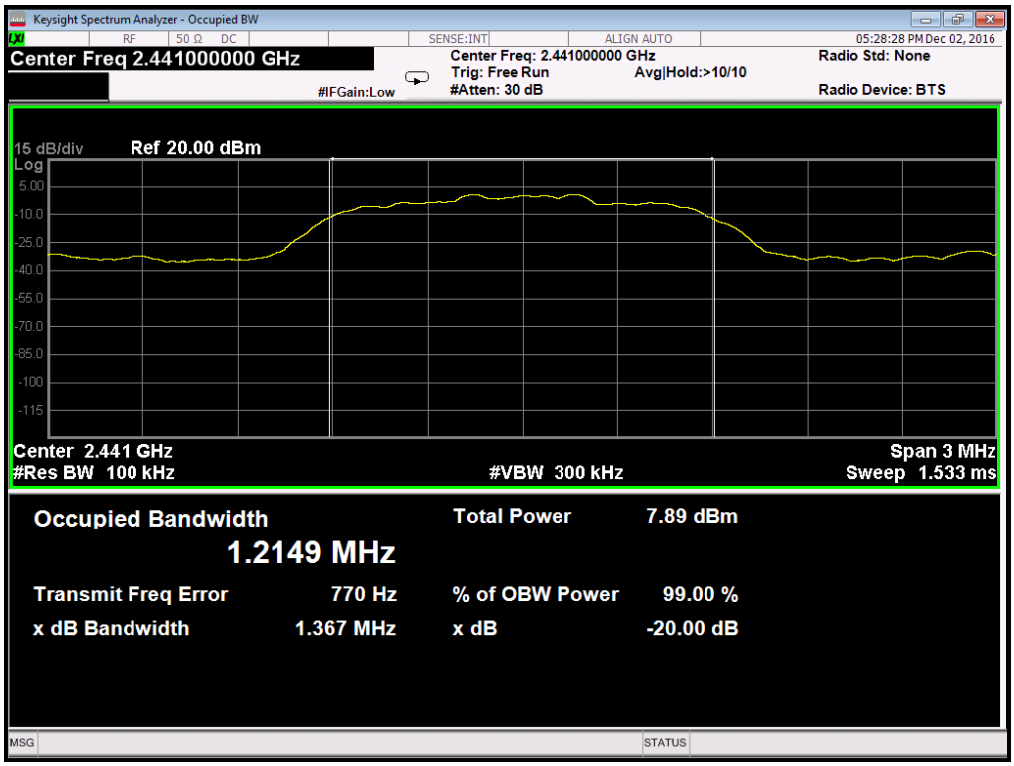
(Plot E: 39 Channel @ π/4-DQPSK)



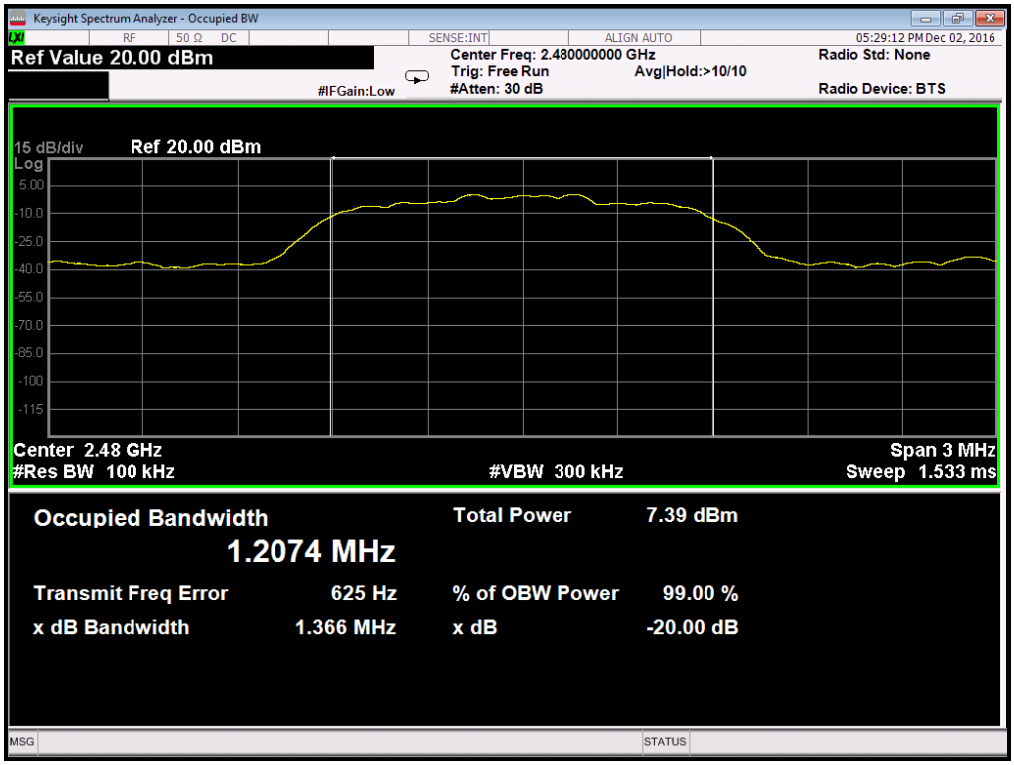
(Plot F: 78 Channel @ π/4-DQPSK)



(Plot G: 0 Channel @ 8-DPSK)



(Plot H: 39 Channel @ 8-DPSK)



(Plot I: 78 Channel @ 8-DPSK)

2.5. Carried Frequency Separation

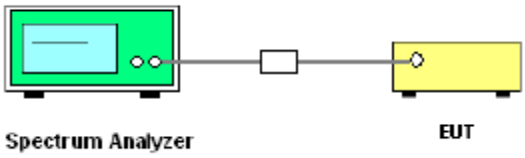
2.5.1. Limit of Carried Frequency Separation

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:

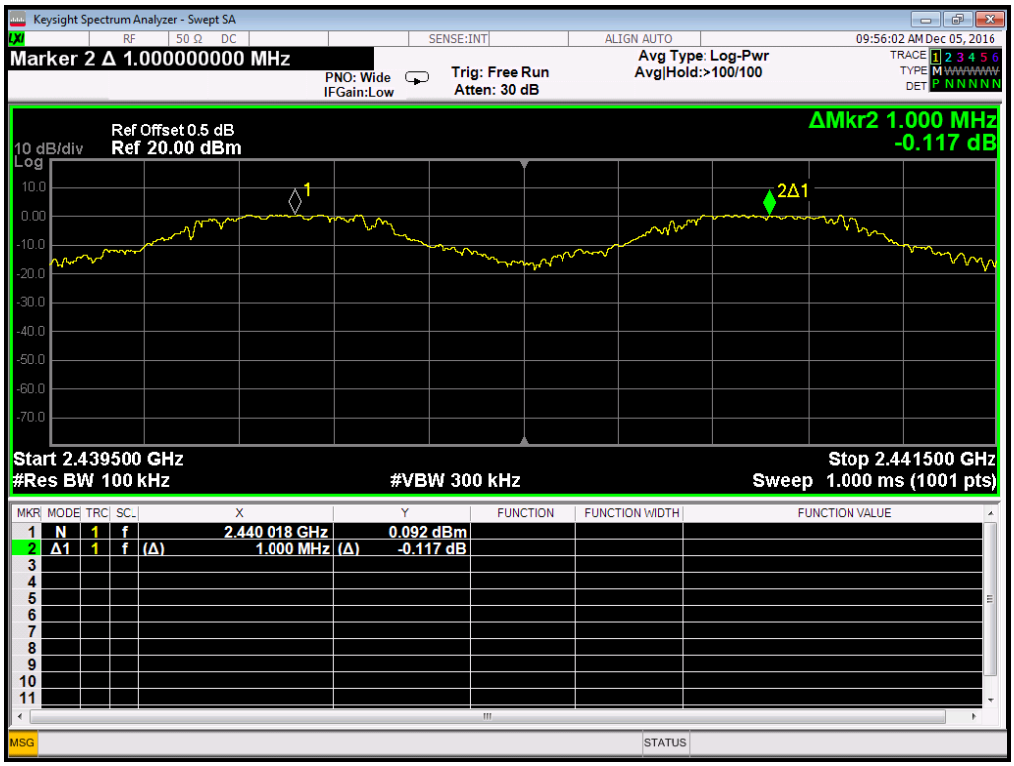
   Span = wide enough to capture the peaks of two adjacent channels; RBW⩾1% of the span;

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

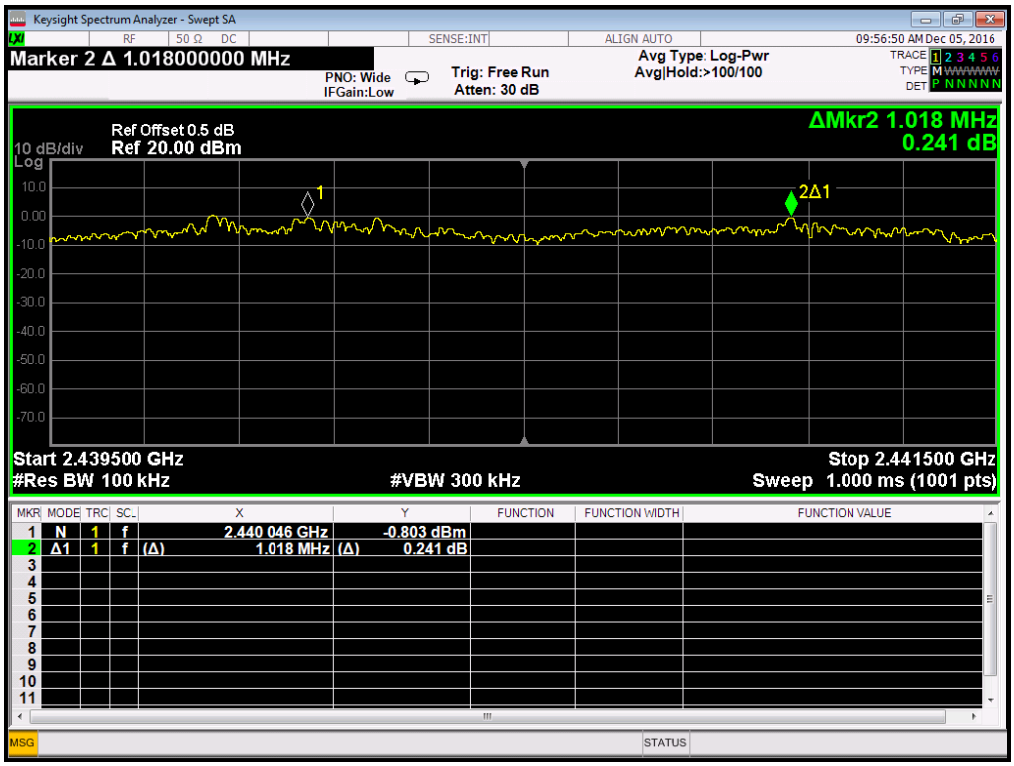
2.5.5. Test Results of Carried Frequency Separation

Test mode	Frequency Separation(MHz)	(2/3 of 20dB BW) Limits (MHz)	Verdict
GFSK	1.000	0.757	PASS
π/4-DQPSK	1.018	0.910	PASS
8-DPSK	1.020	0.911	PASS

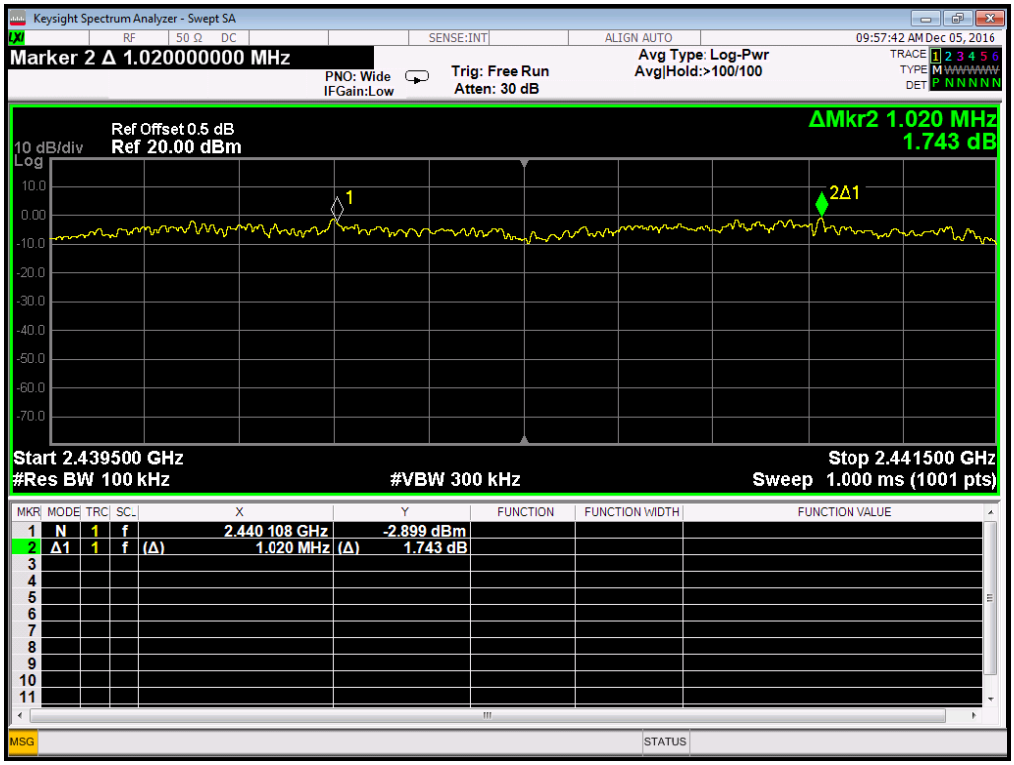
2.5.6. Test Results (plots) of Carried Frequency Separation



GFSK Mode



π/4-DQPSK Mode



8-DPSK Mode

2.6. Dwell time

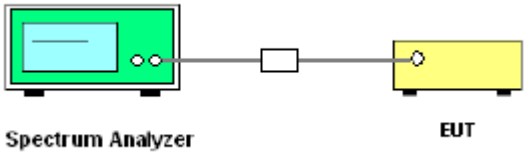
2.6.1. Limit of Dwell Time

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}

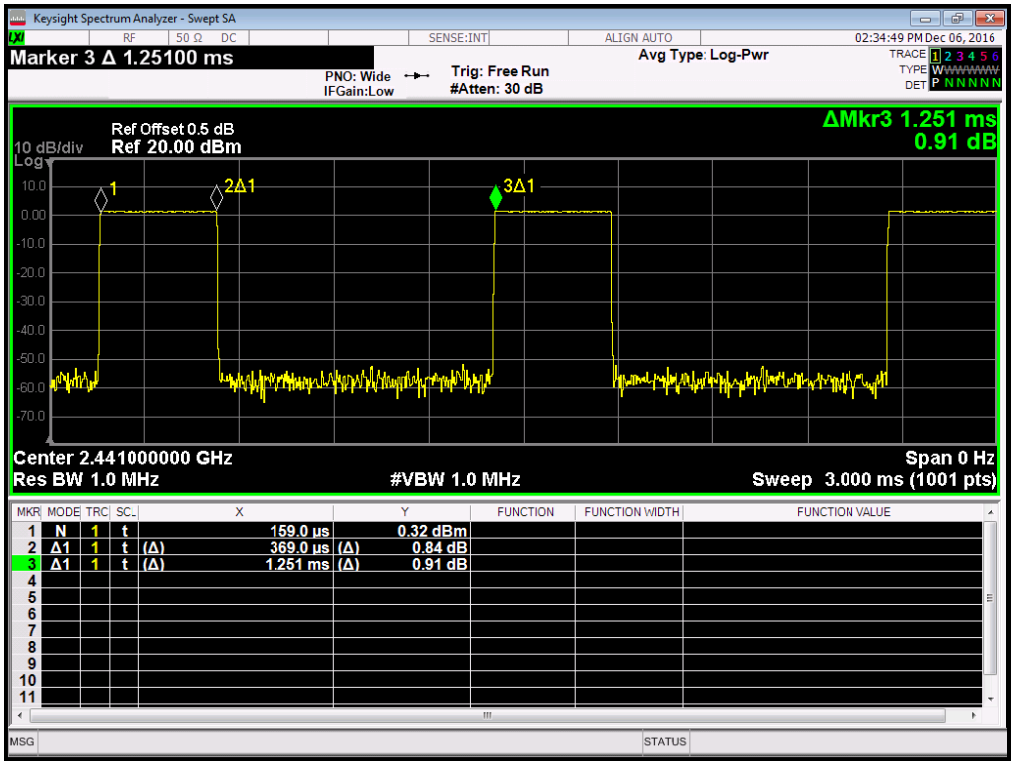
For DH5 package type:

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

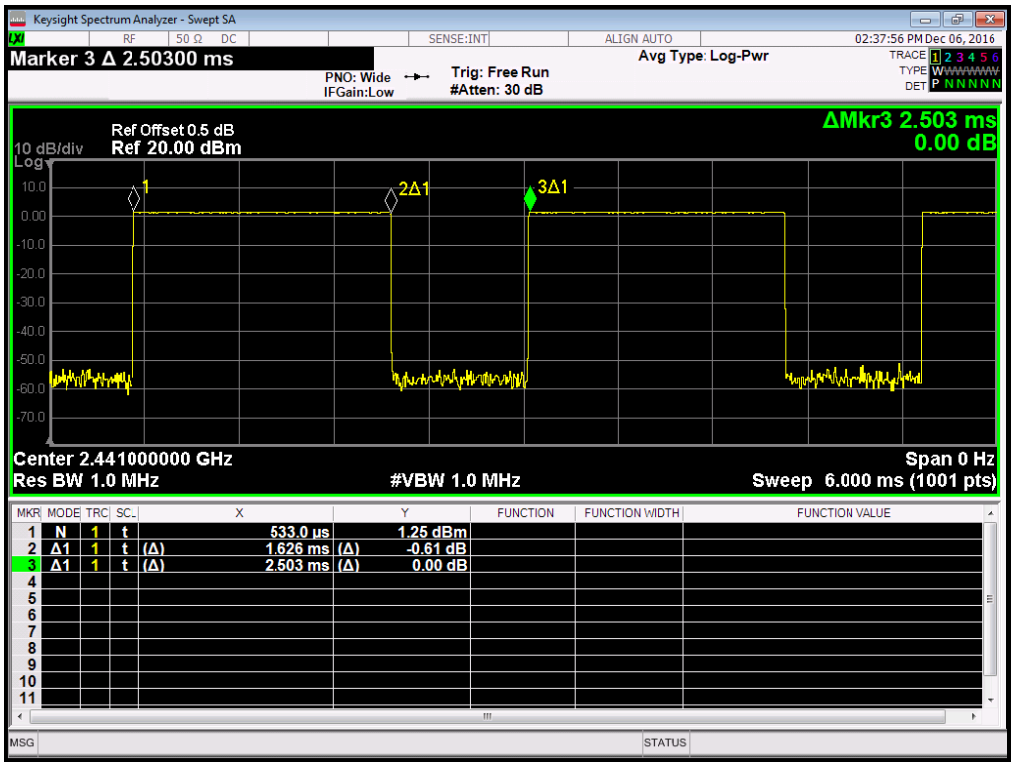
{Period} = 0.4s * {Number of Hopping Frequency}

Modulation	Packet Type	Channel	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	DH1	39	0.369	118.08	400	PASS
	DH3	39	1.626	258.88		PASS
	DH5	39	2.870	306.13		PASS
π/4-DQPSK	DH1	39	0.378	120.96		PASS
	DH3	39	1.626	258.88		PASS
	DH5	39	2.870	306.13		PASS
8-DPSK	DH1	39	0.378	120.96		PASS
	DH3	39	1.620	259.20		PASS
	DH5	39	2.880	307.20		PASS

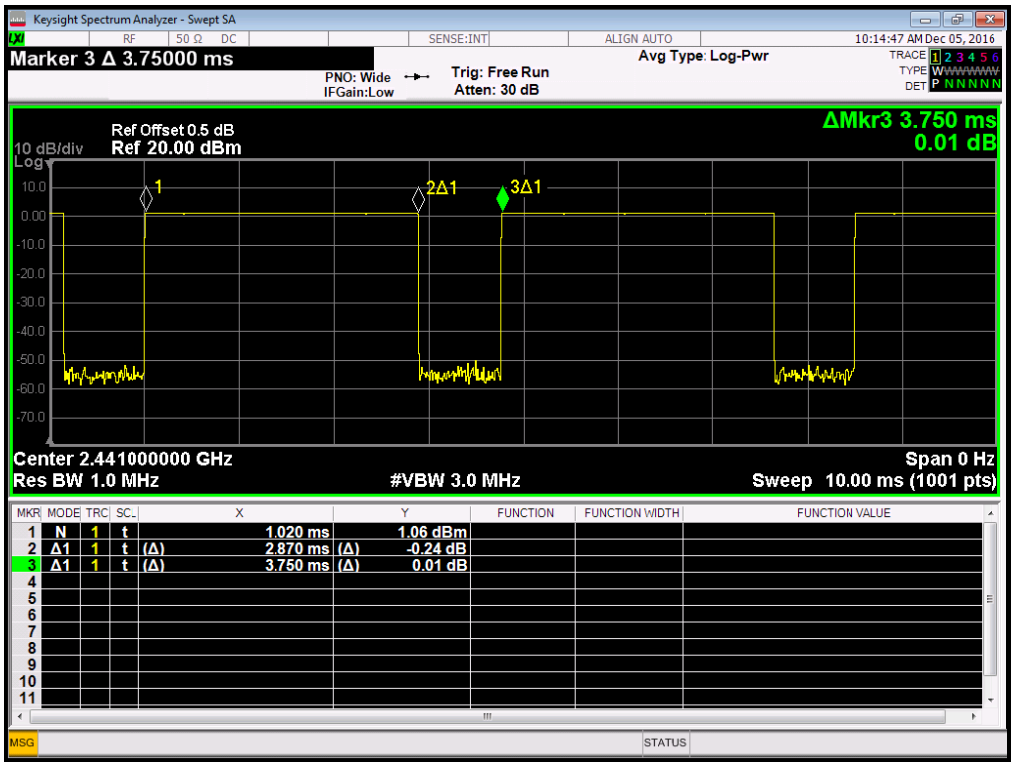
2.6.6. Test Results (plots) of Dwell Time



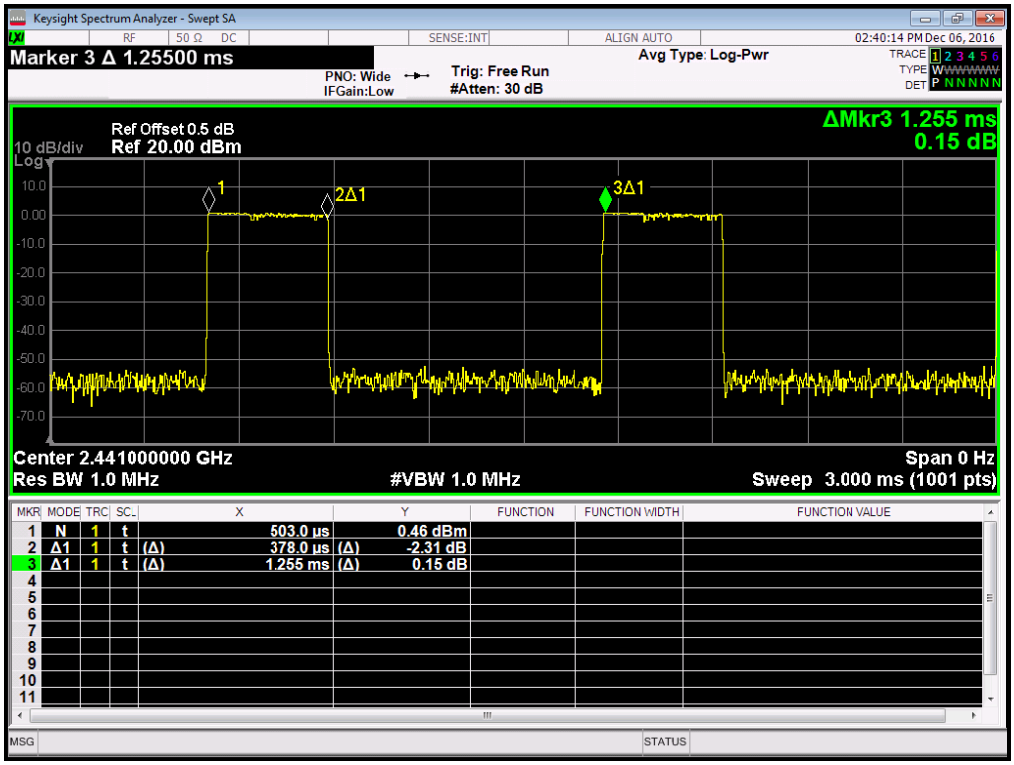
39 Channel @ DH1



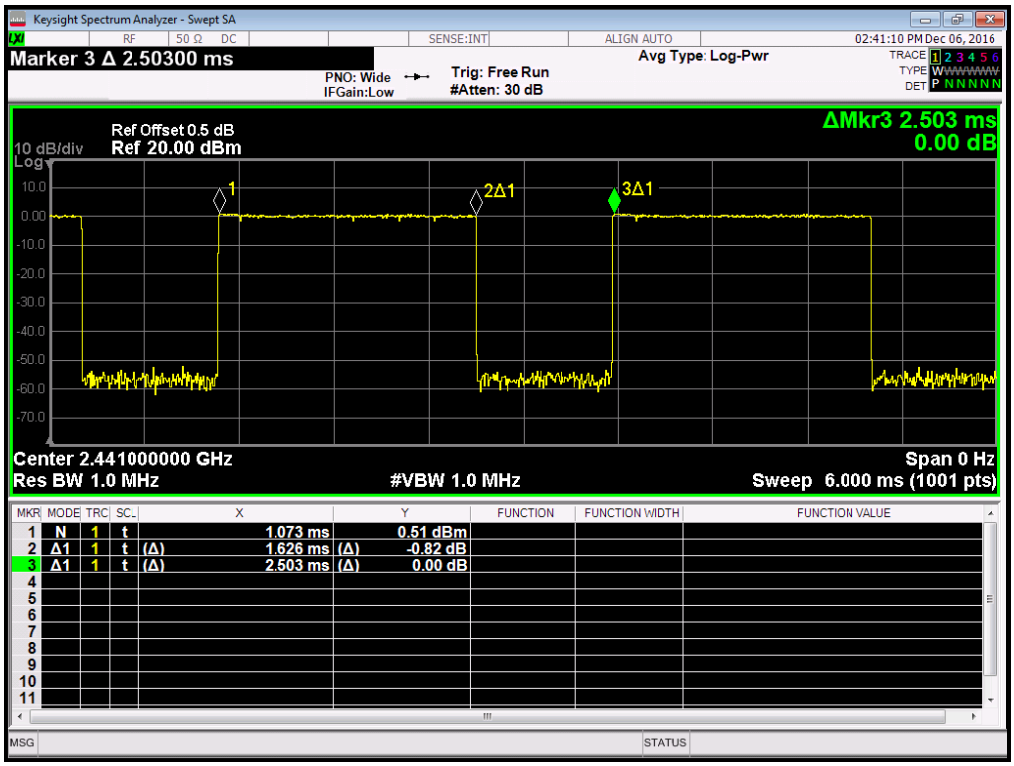
39 Channel @ DH3



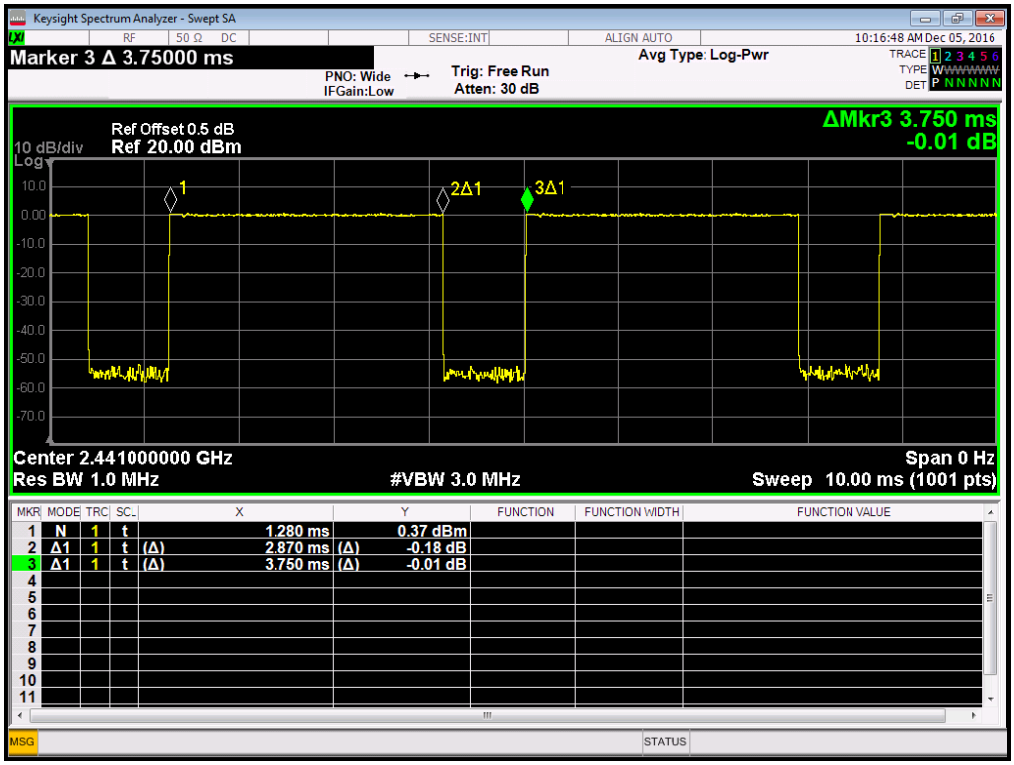
39 Channel @ DH5



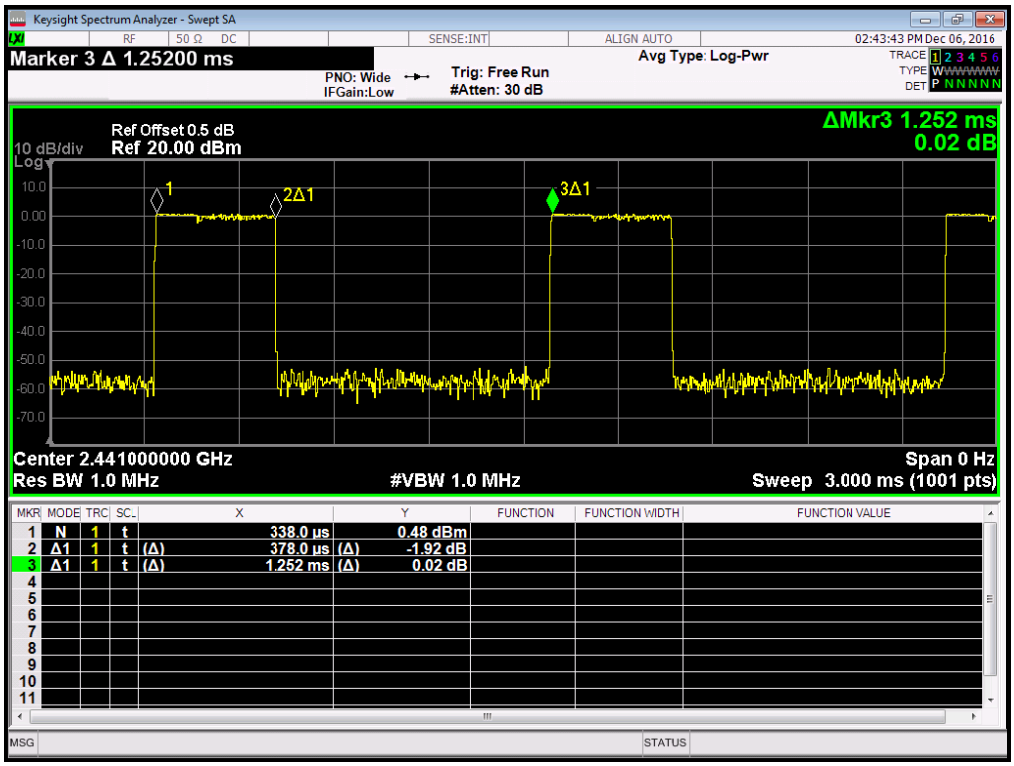
39 Channel @ 2DH1



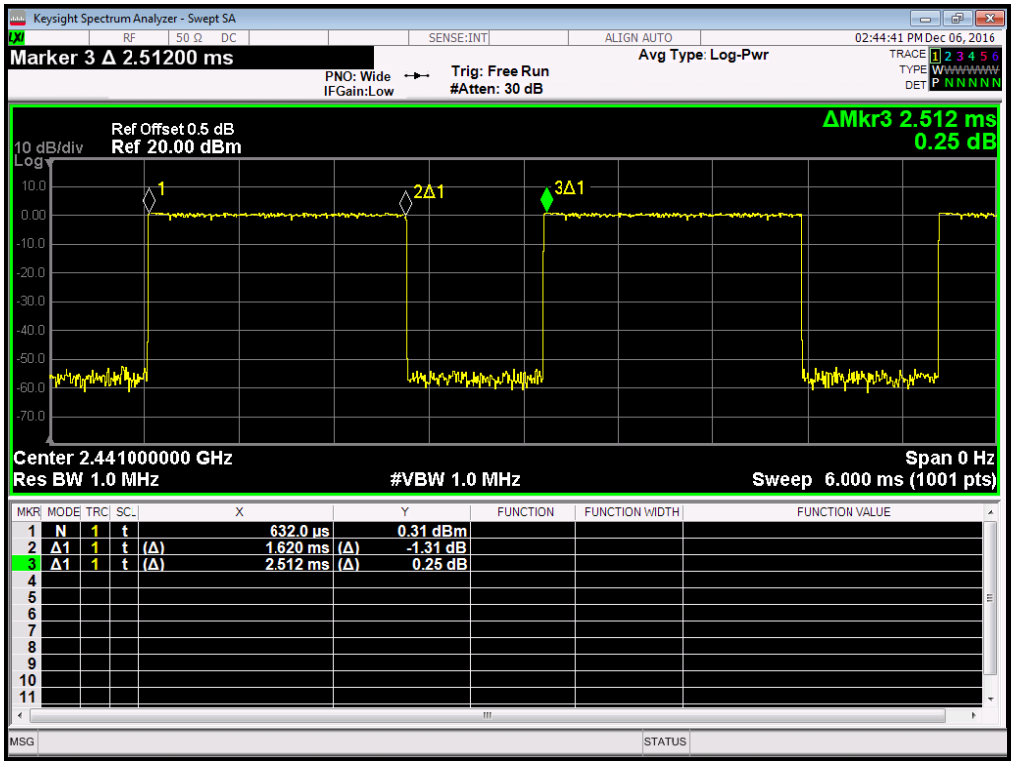
39 Channel @ 2DH3



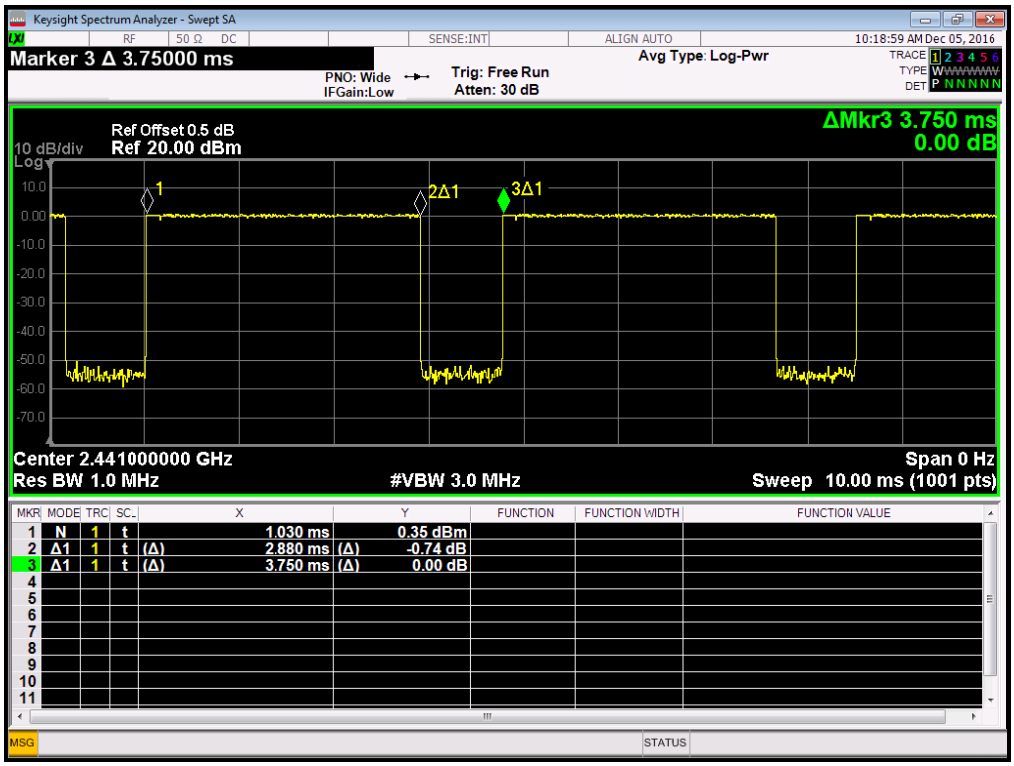
39 Channel @ 2DH5



39 Channel @ 3DH1



39 Channel @ 3DH3



39 Channel @ 3DH5

2.7. Conducted Spurious Emissions

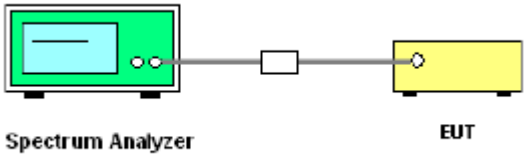
2.7.1. Limit of Spurious Emission

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.

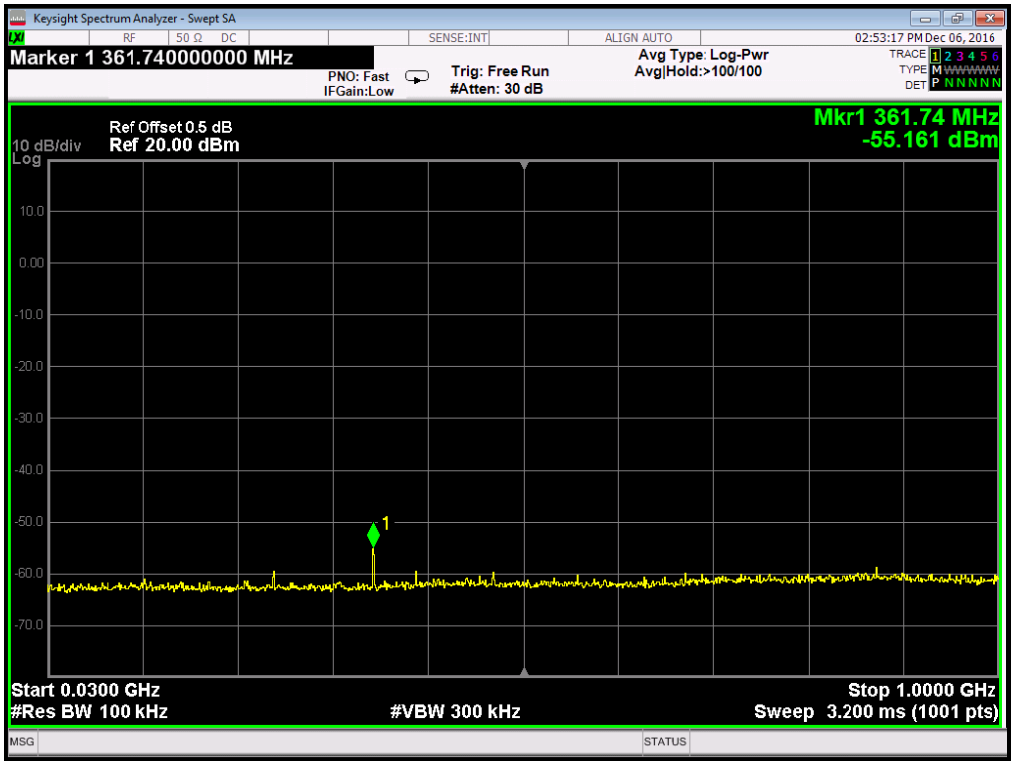
2.7.3. Test Setup



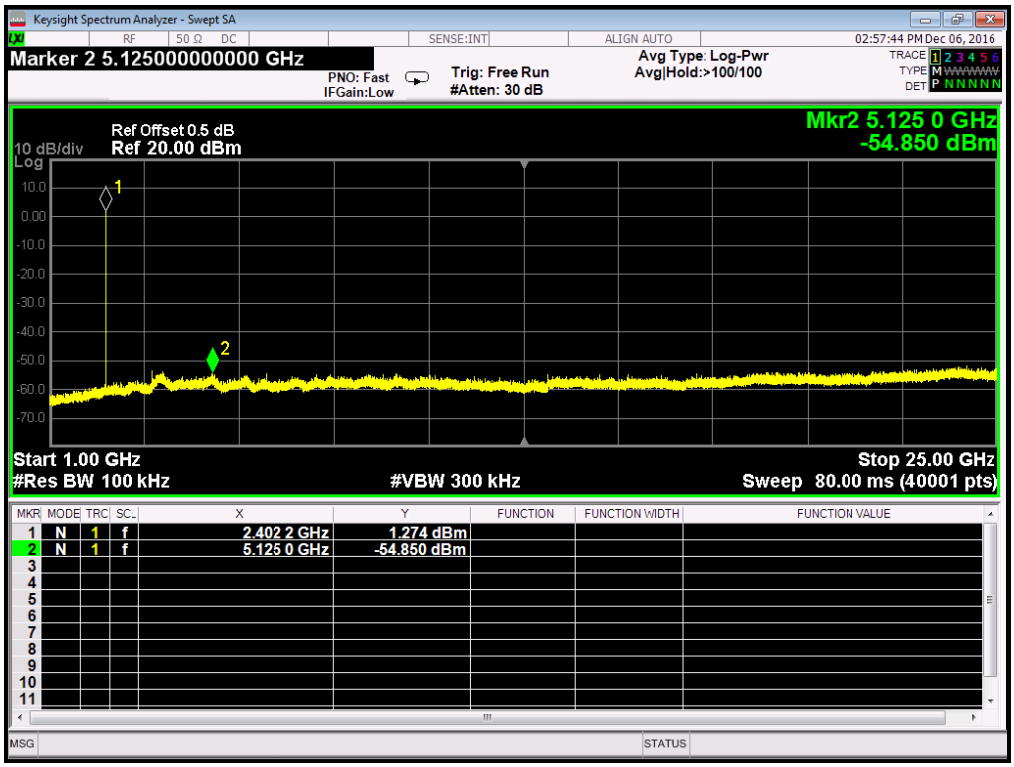
2.7.4. Test Procedure

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.

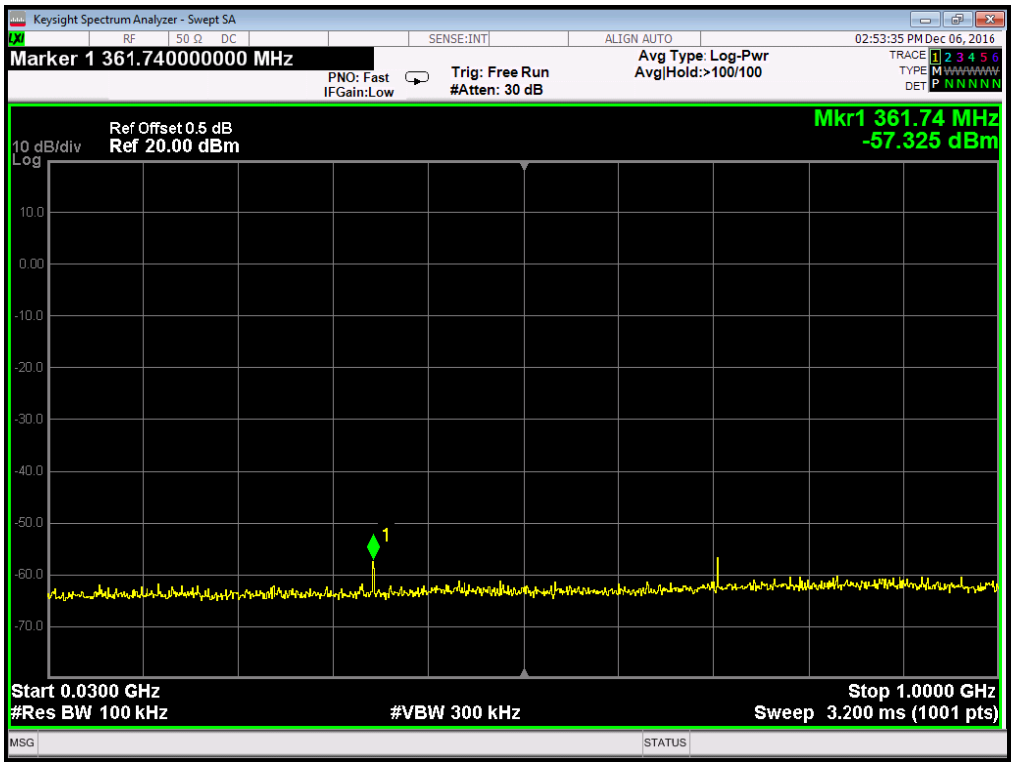
2.7.5. Test Results of Conducted Spurious Emissions



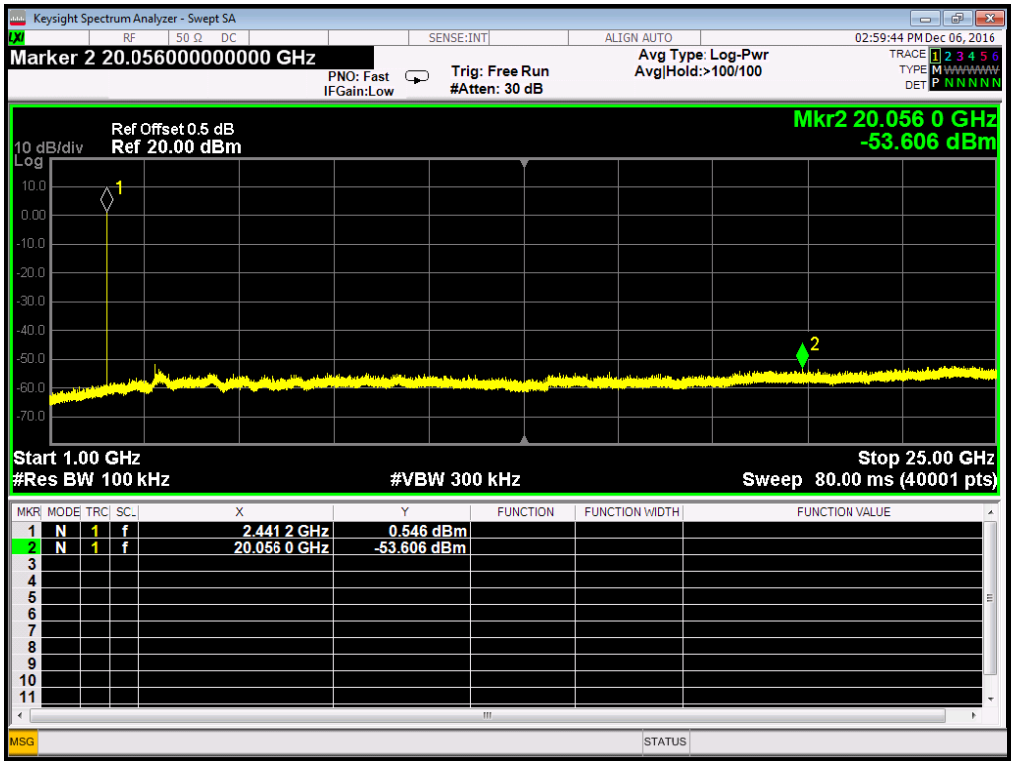
Low Channel 30MHz to 1GHz @ GFSK Mode



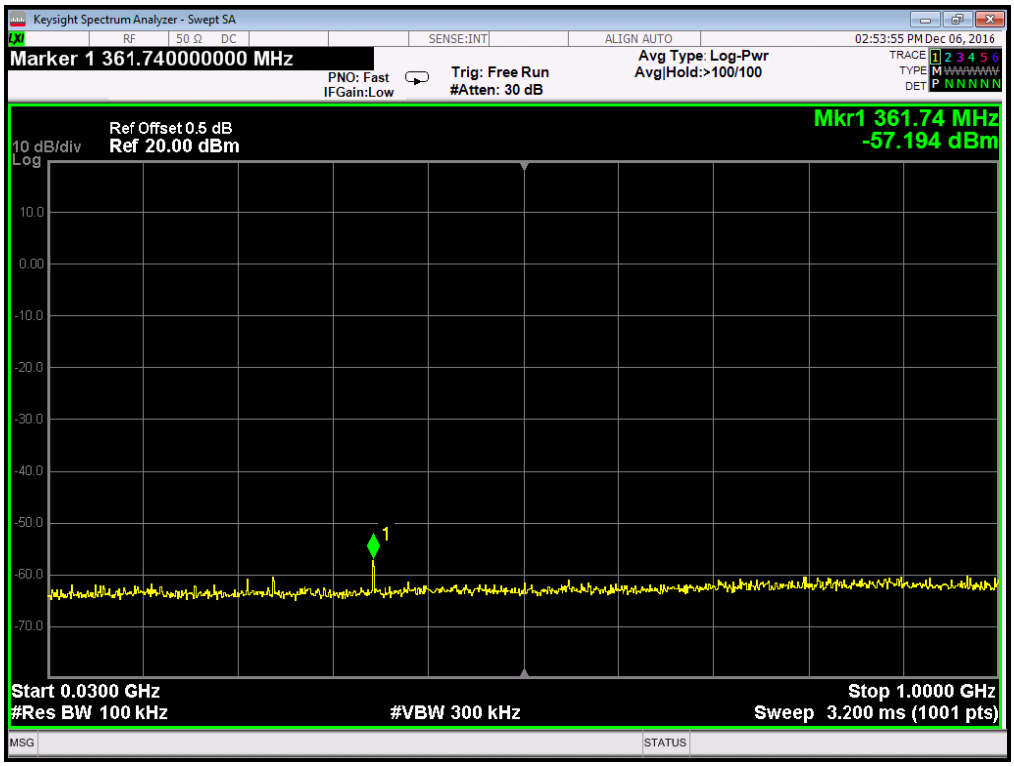
Low Channel 1GHz to 25GHz @ GFSK Mode



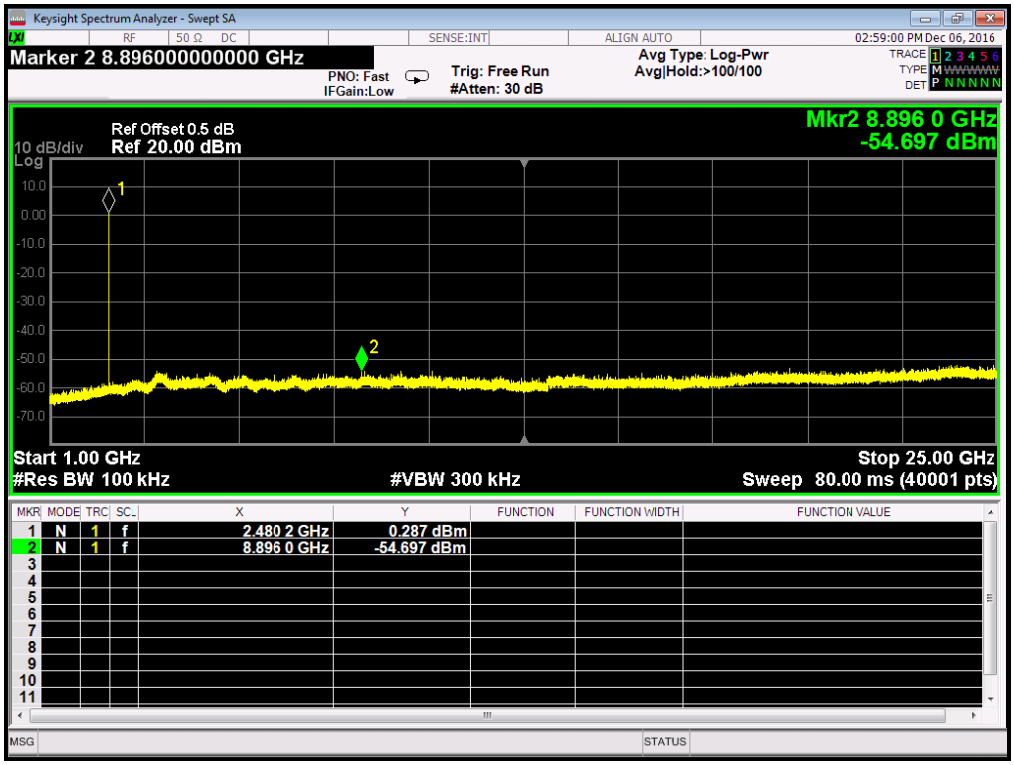
Mid Channel 30MHz to 1GHz @ GFSK Mode



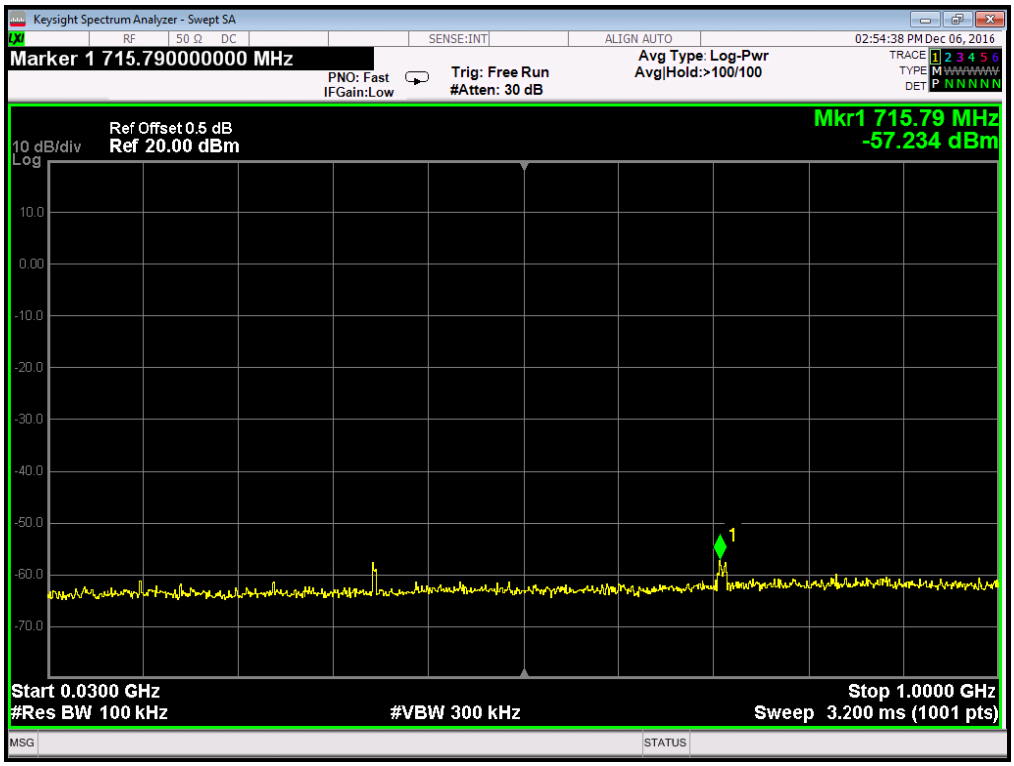
Mid Channel 1GHz to 25GHz @ GFSK Mode



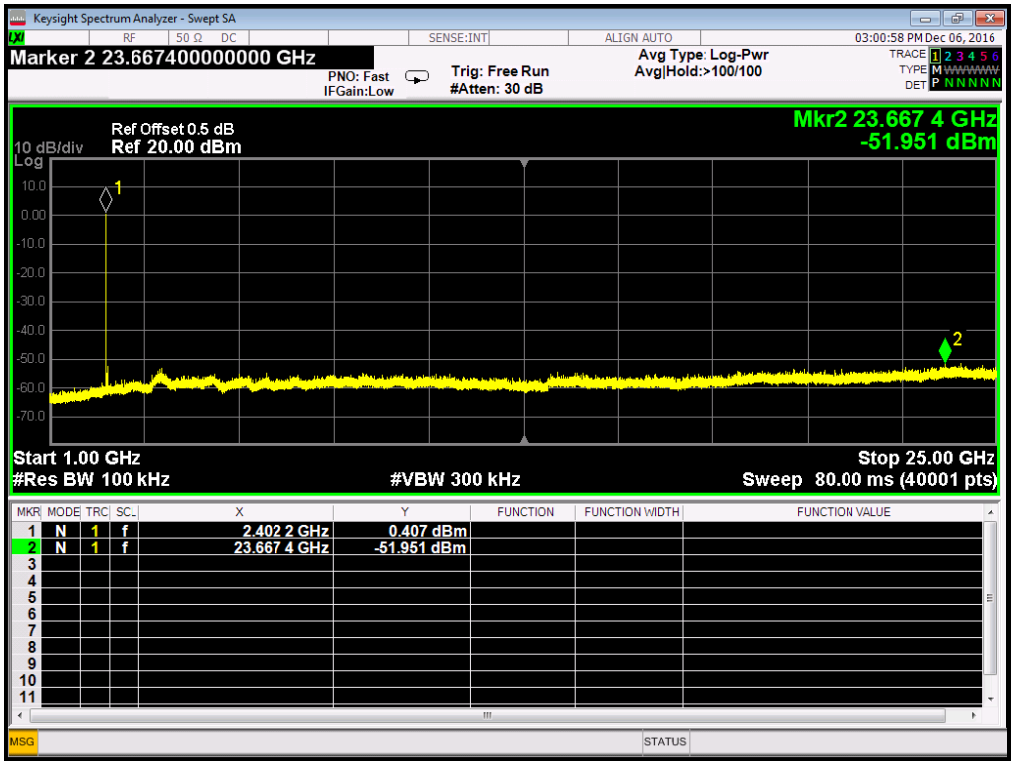
High Channel 30MHz to 1GHz @ GFSK Mode



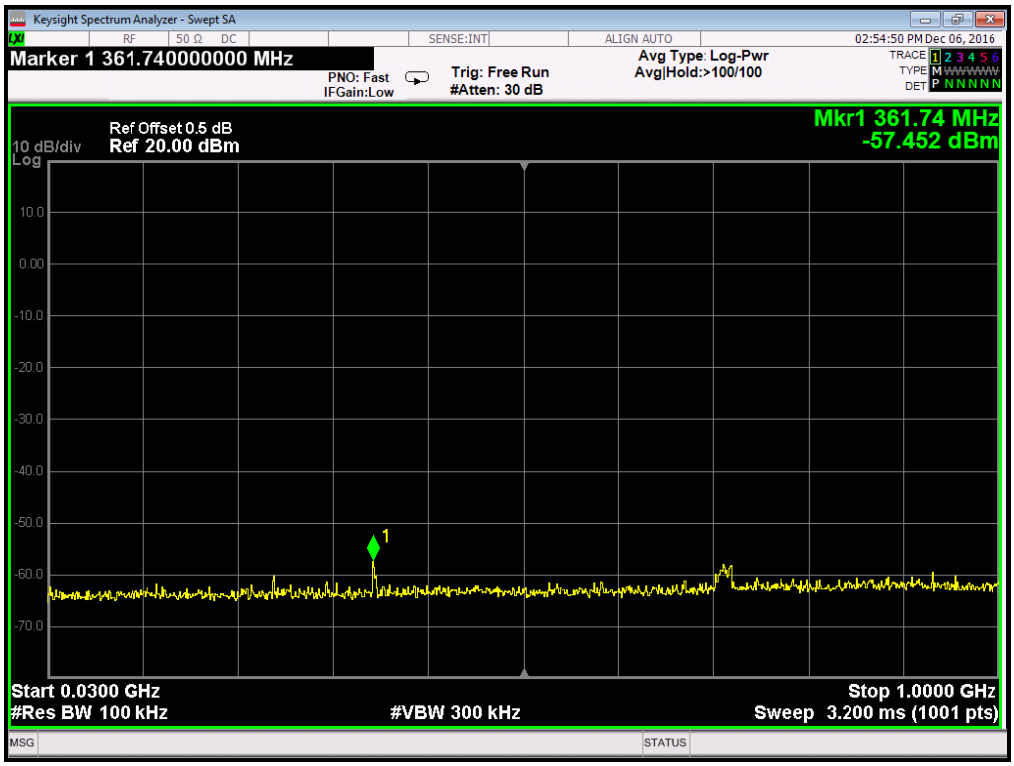
High Channel 1GHz to 25GHz @ GFSK Mode



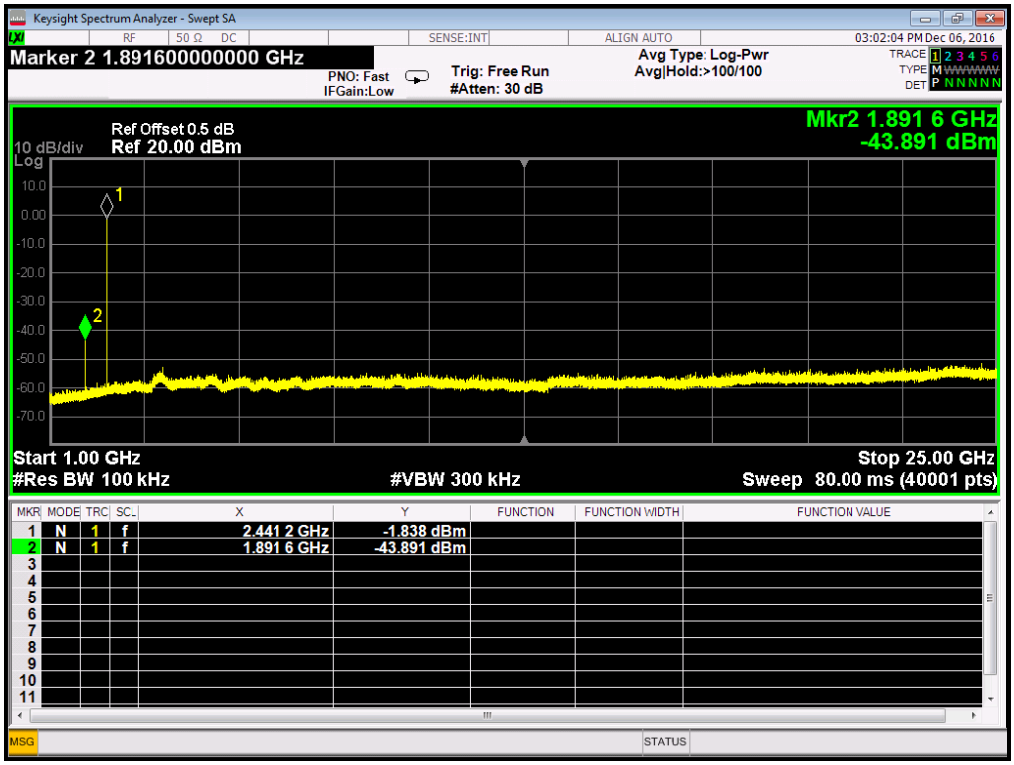
Low Channel 30MHz to 1GHz @π/4-DQPSK



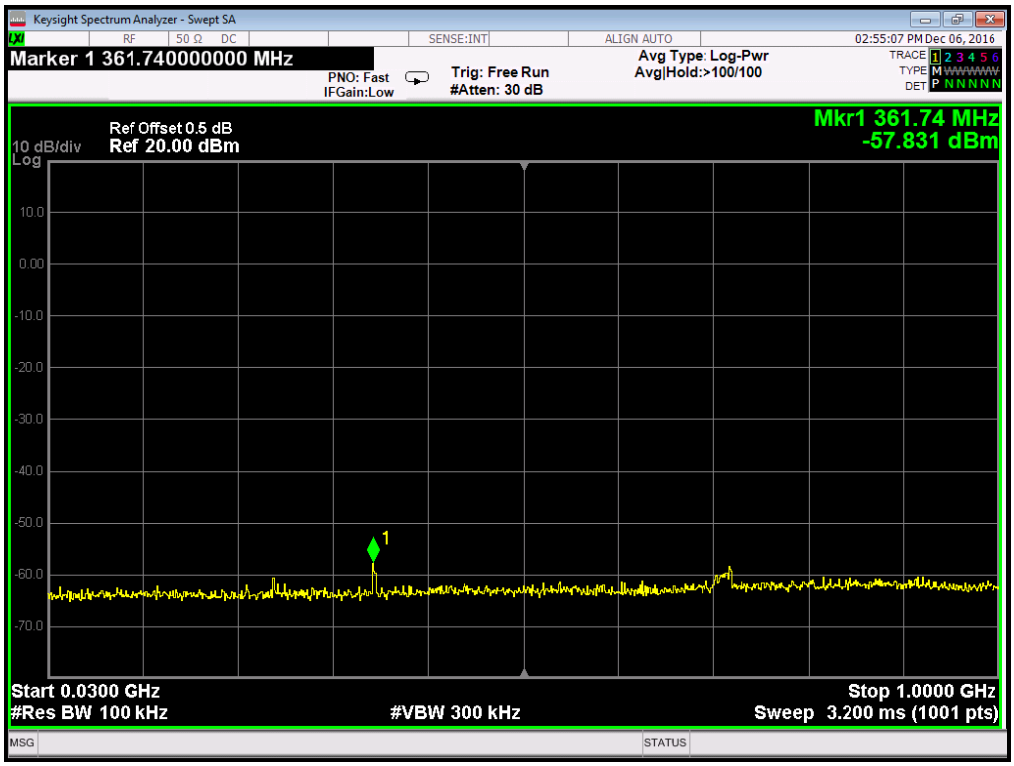
Low Channel 1GHz to 25GHz @π/4-DQPSK



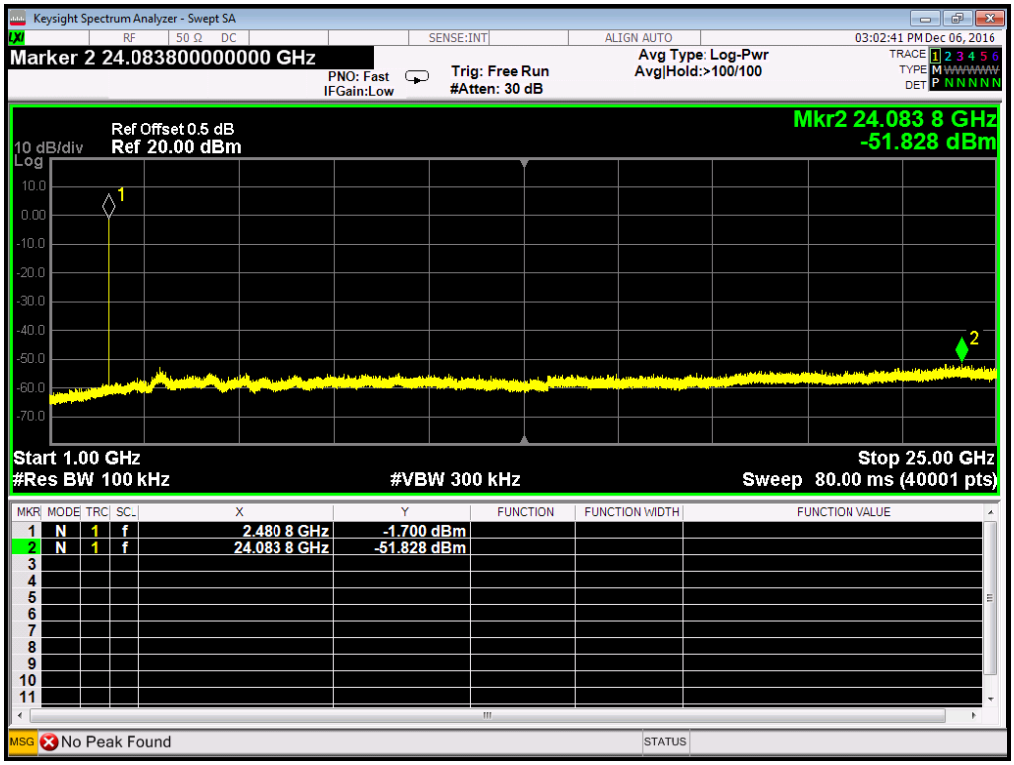
Mid Channel 30MHz to 1GHz @π/4-DQPSK



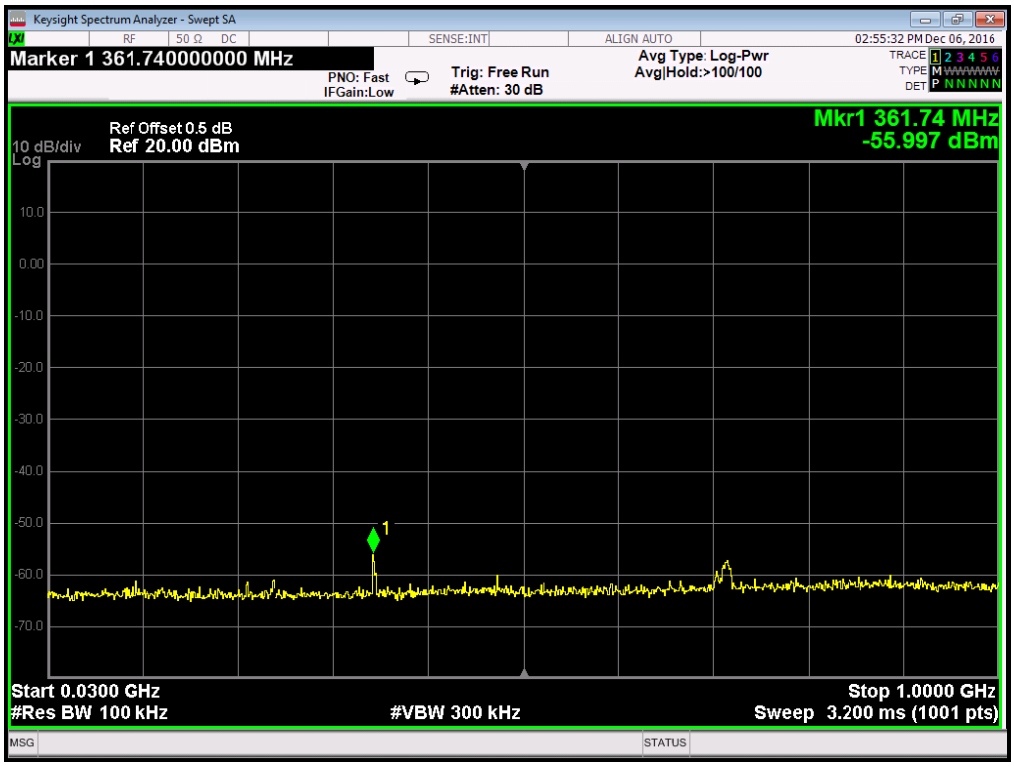
Mid Channel 1GHz to 25GHz @π/4-DQPSK



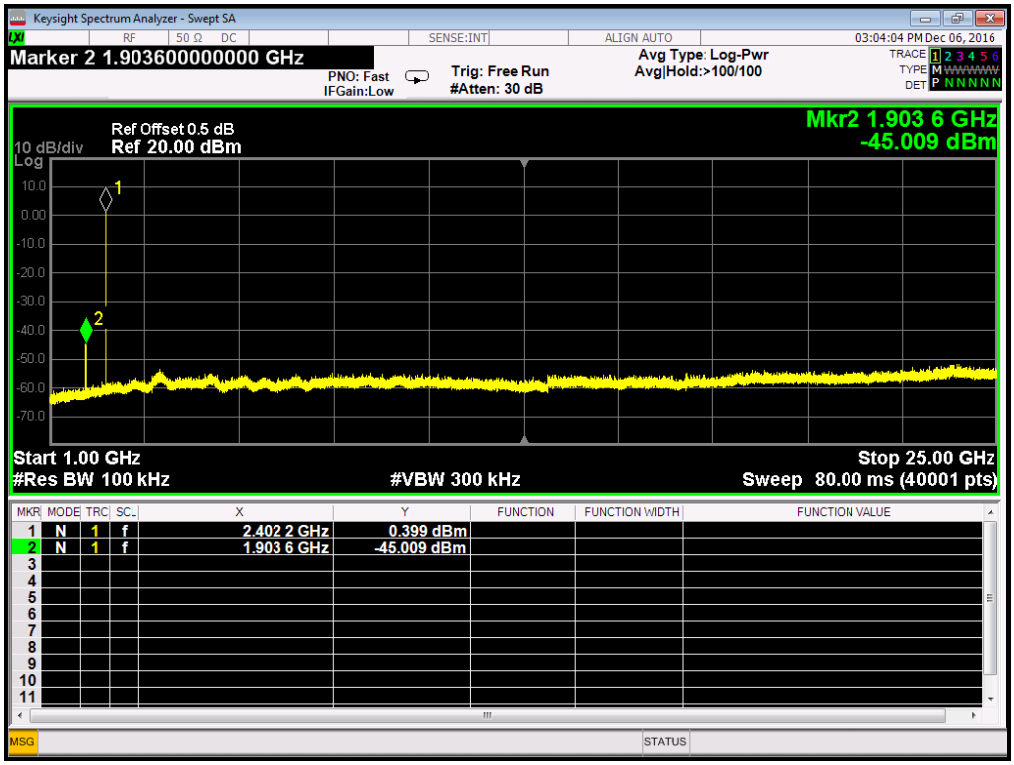
High Channel 30MHz to 1GHz @π/4-DQPSK



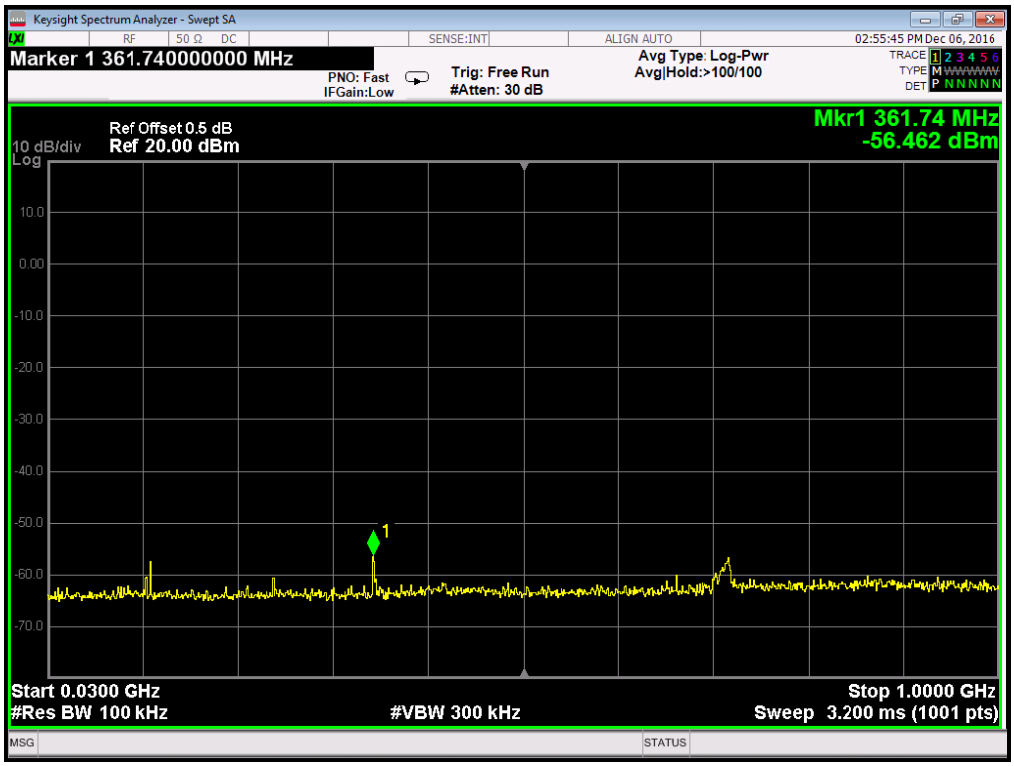
High Channel 1GHz to 25GHz @π/4-DQPSK



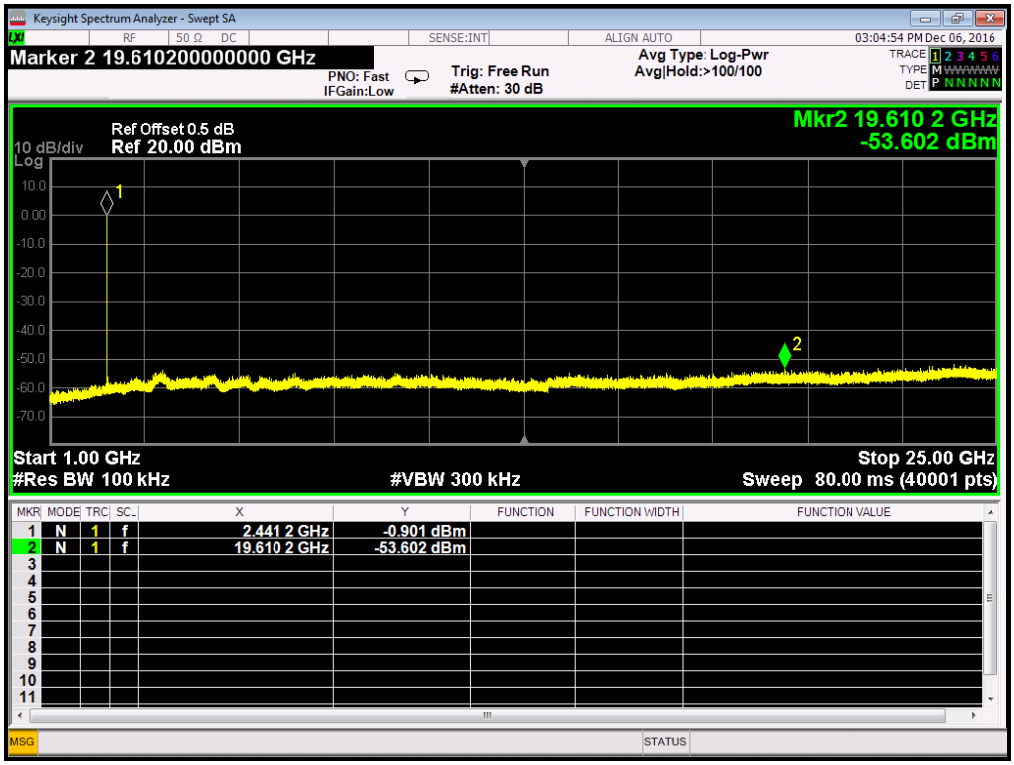
Low Channel 30MHz to 1GHz @ 8-DPSK



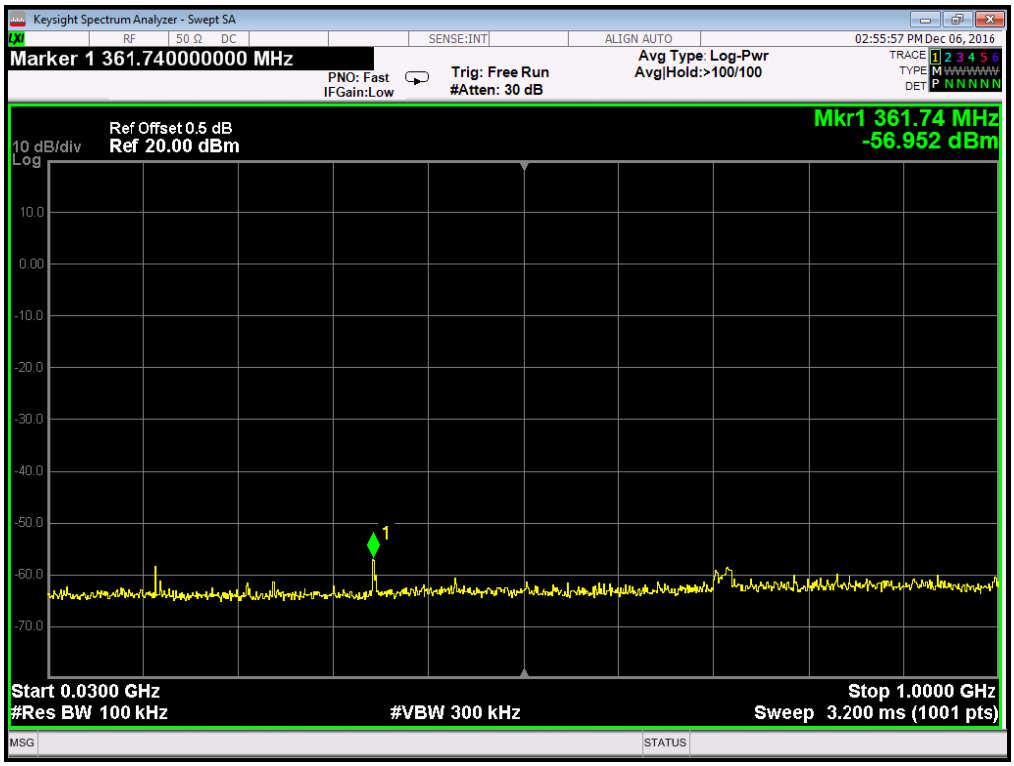
Low Channel 1GHz to 25GHz @ 8-DPSK



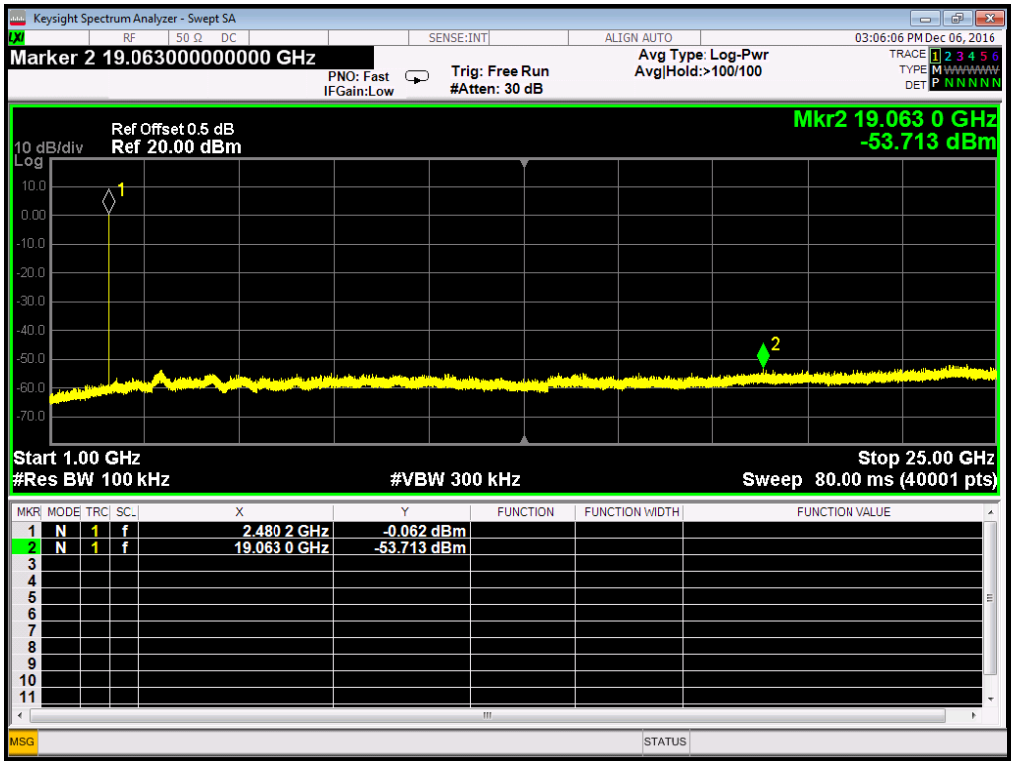
Mid Channel 30MHz to 1GHz @ 8-DPSK



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

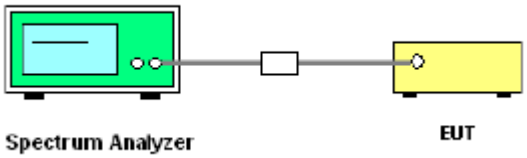
2.8.1. Limit of Band Edges

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

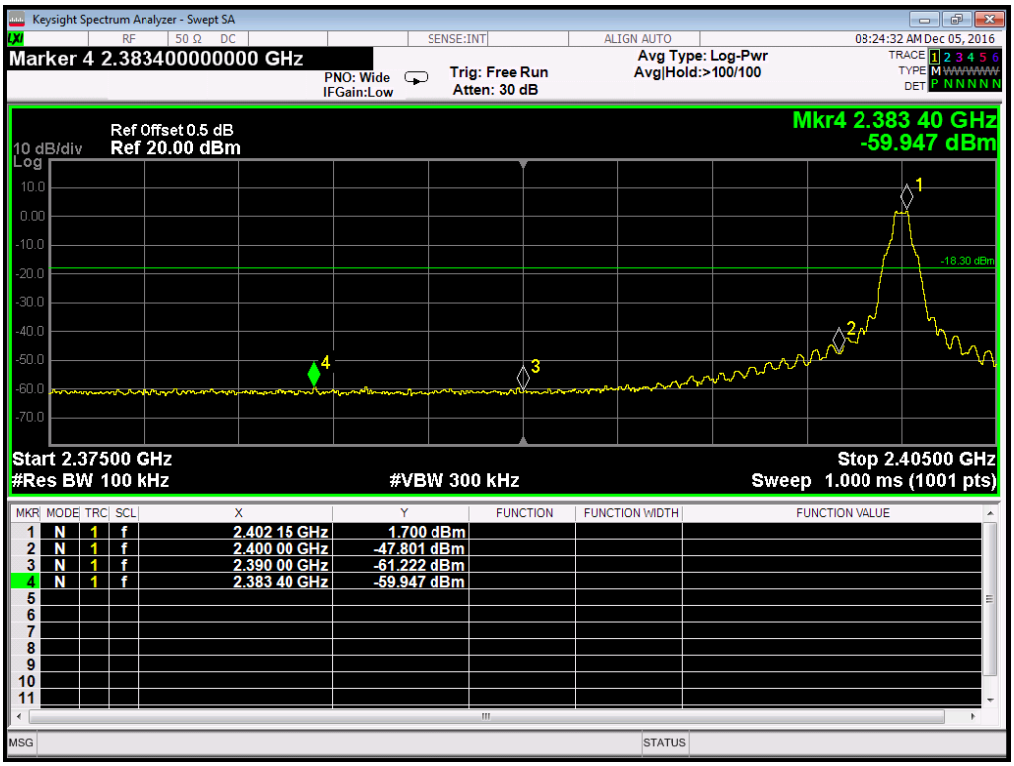


2.8.1. Test Procedure

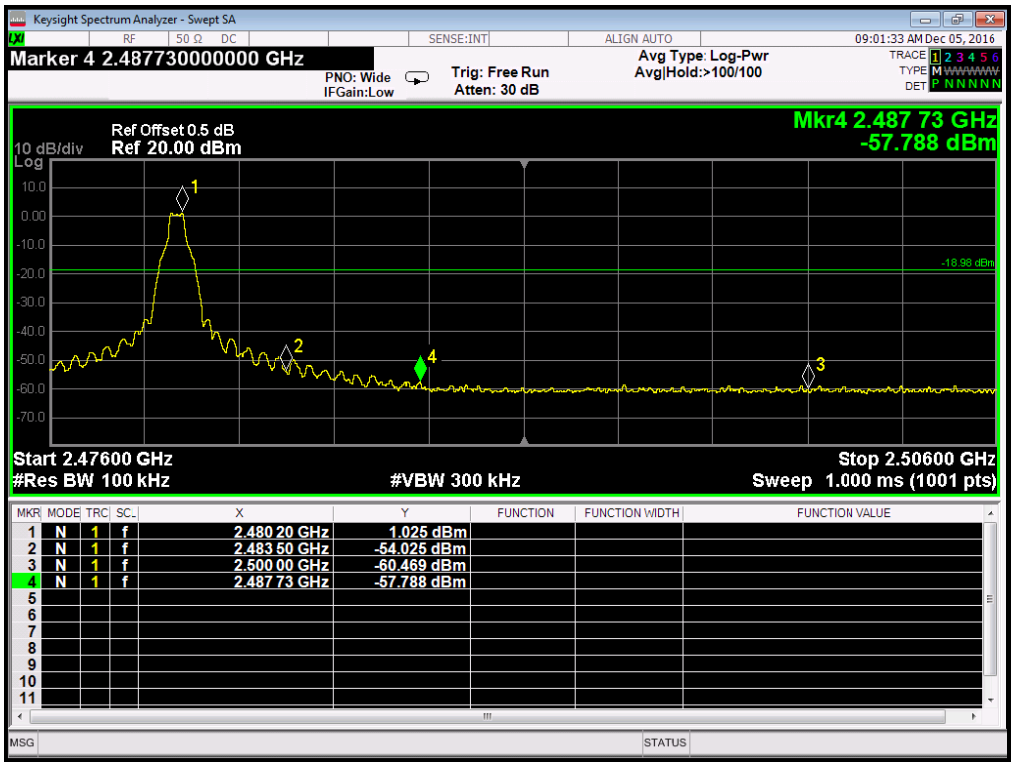
1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz (≥1% span=10MHz), VBW = 300kHz (≥RBW). Band edge emissions must 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

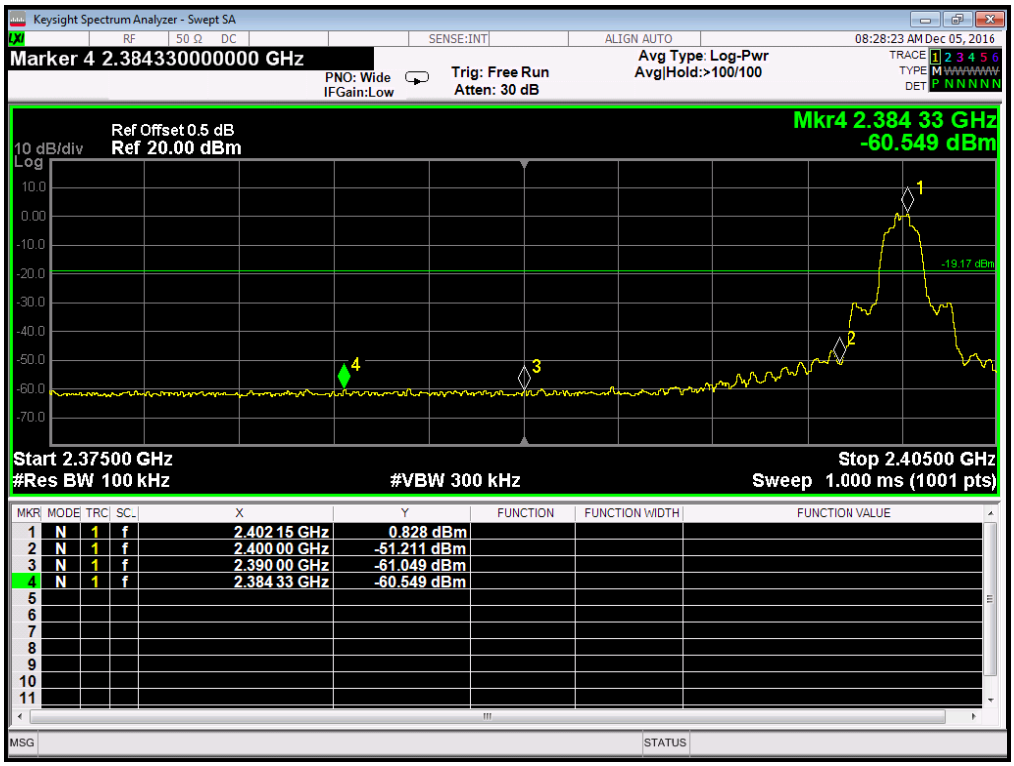
Band edge – Conducted (Un-hopping)



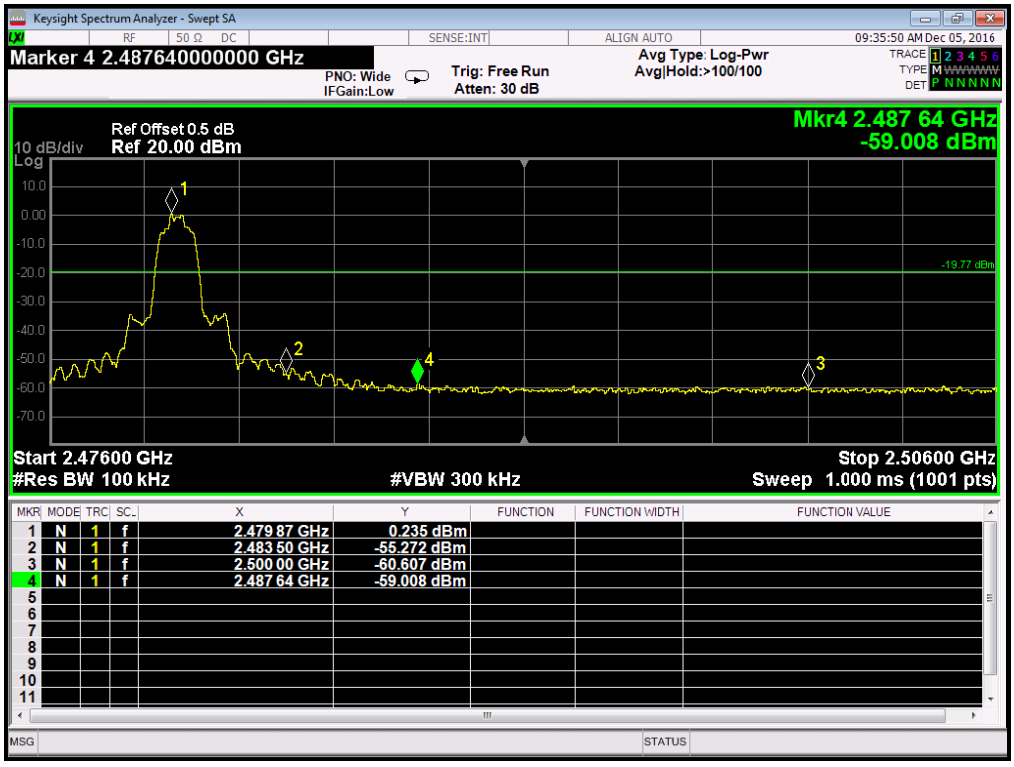
Low Band Edge Plot on channel 0 @ GFSK



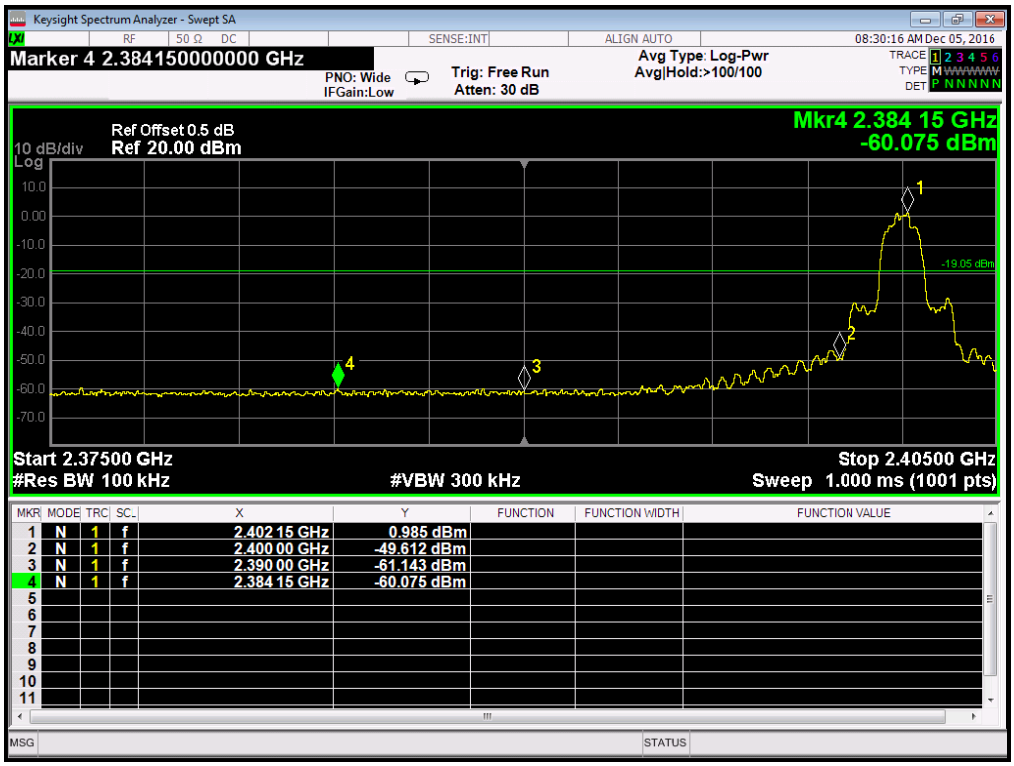
High Band Edge Plot on channel 78 @ GFSK



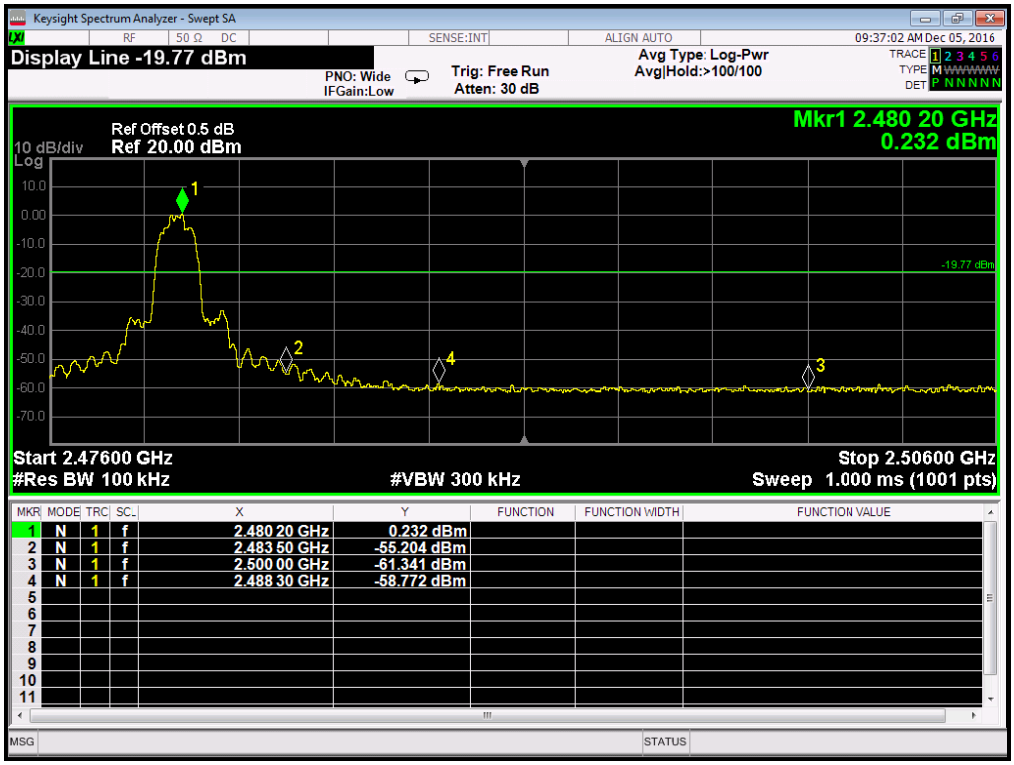
Low Band Edge Plot on channel 0 @π/4-DQPSK



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

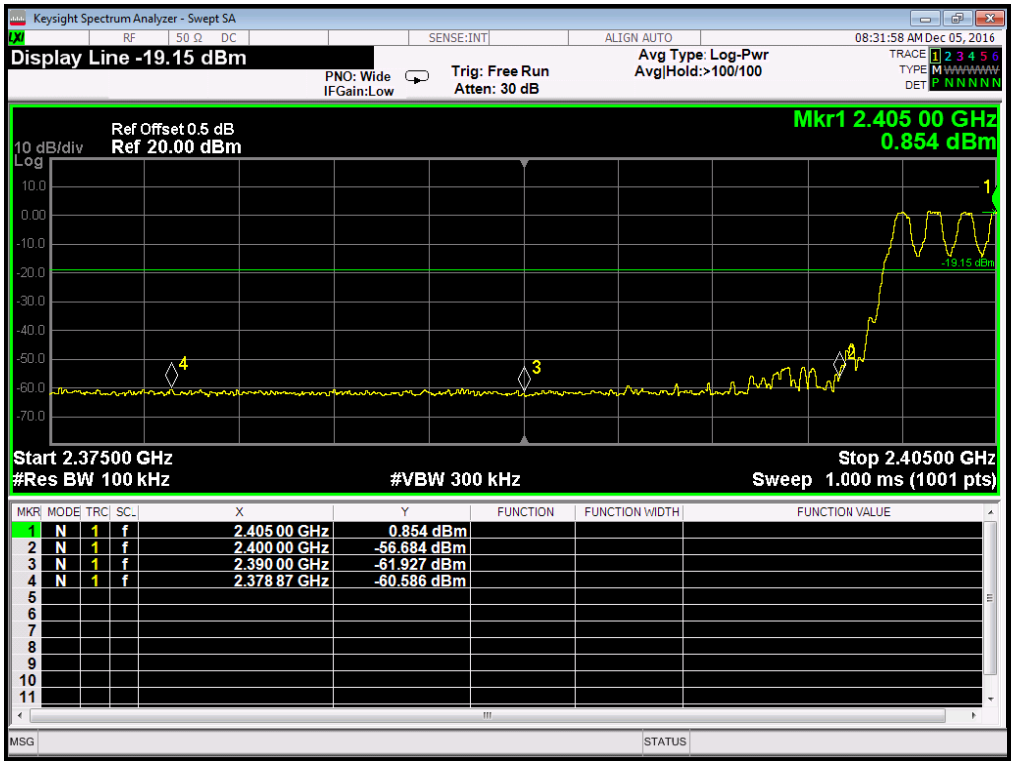


Low Band Edge Plot on channel 0 @8-DPSK

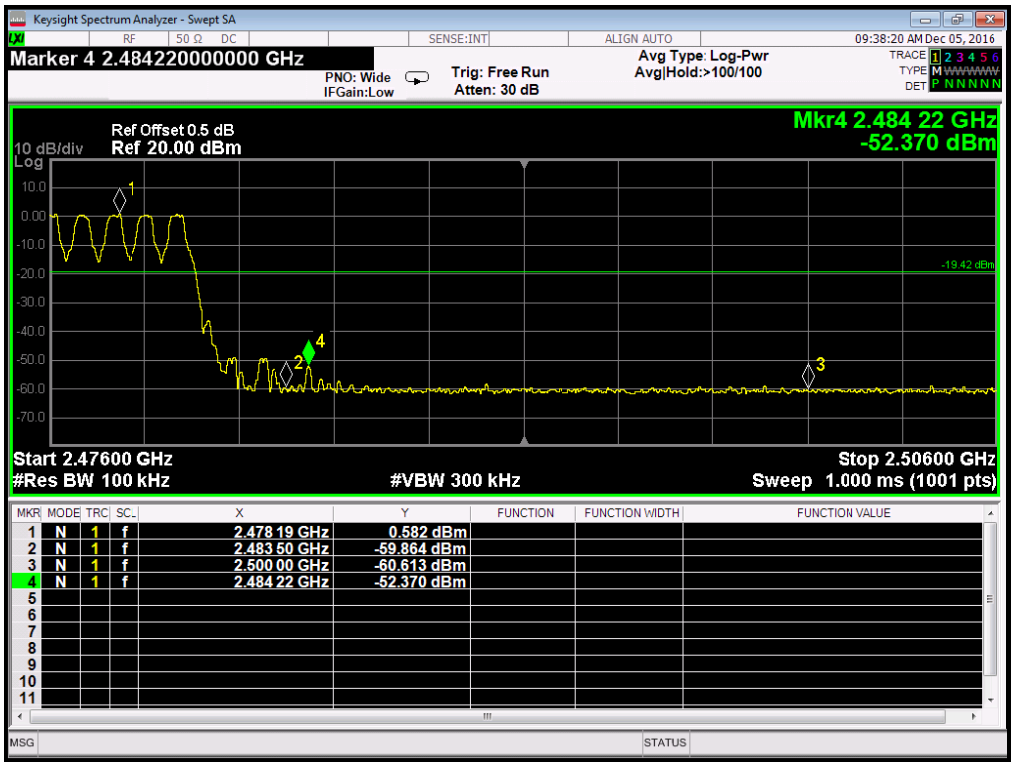


High Band Edge Plot on channel 78 @8-DPSK

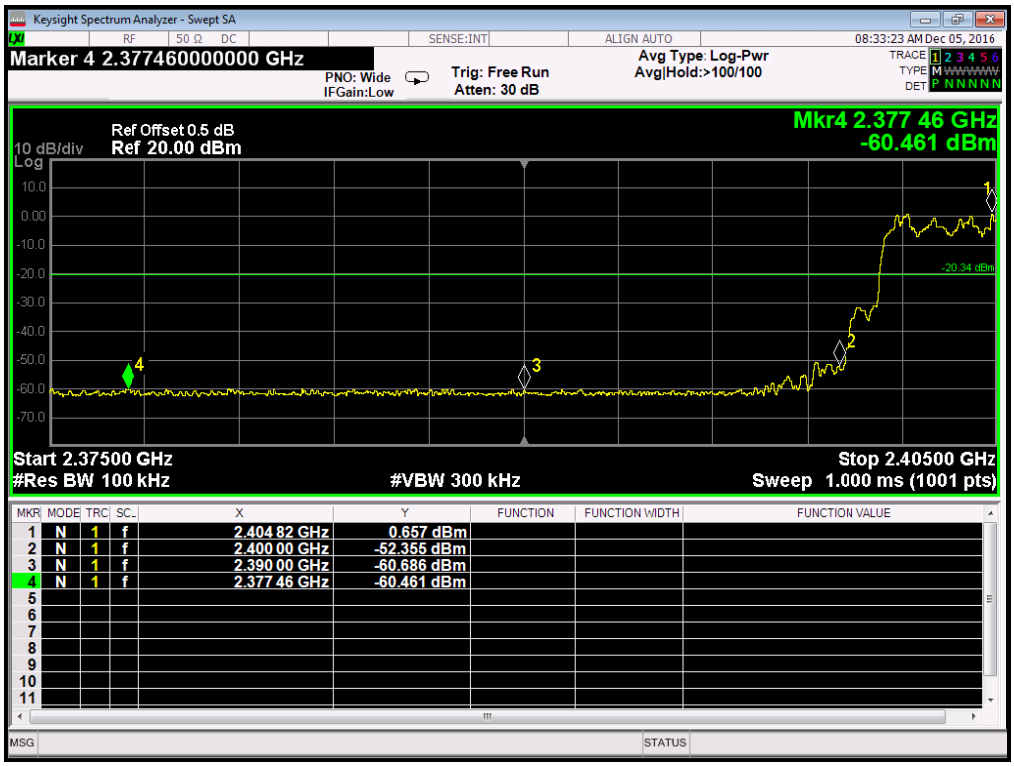
Band edge - Conducted (hopping)



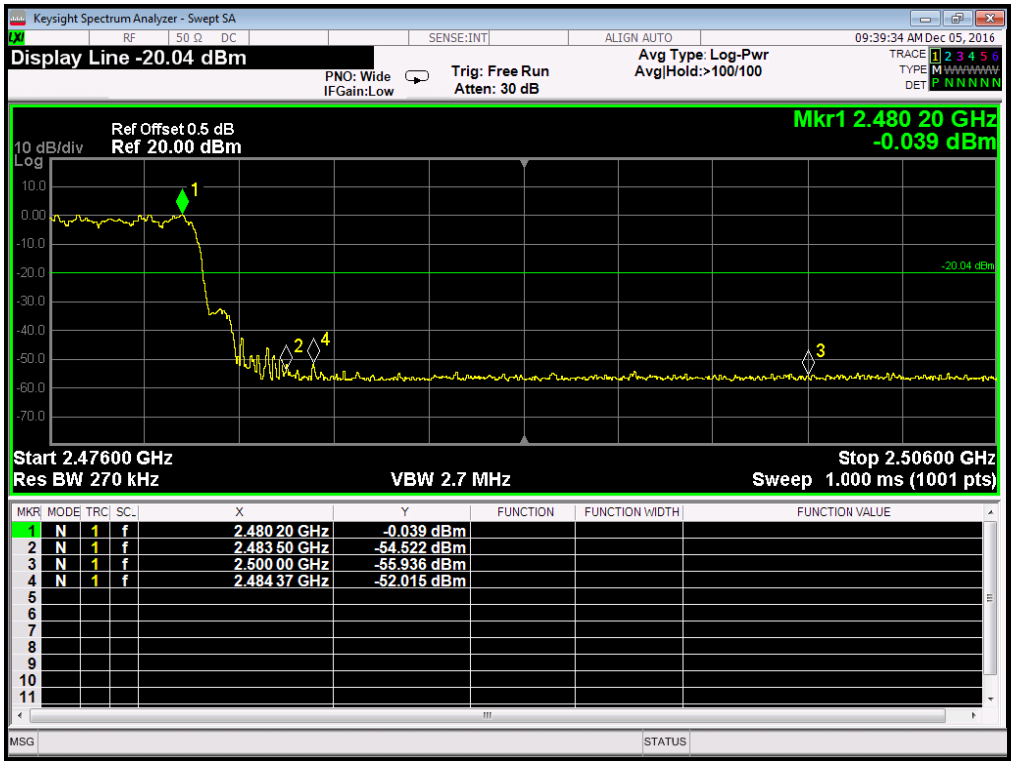
Low Band Edge Plot on channel 0 @ GFSK



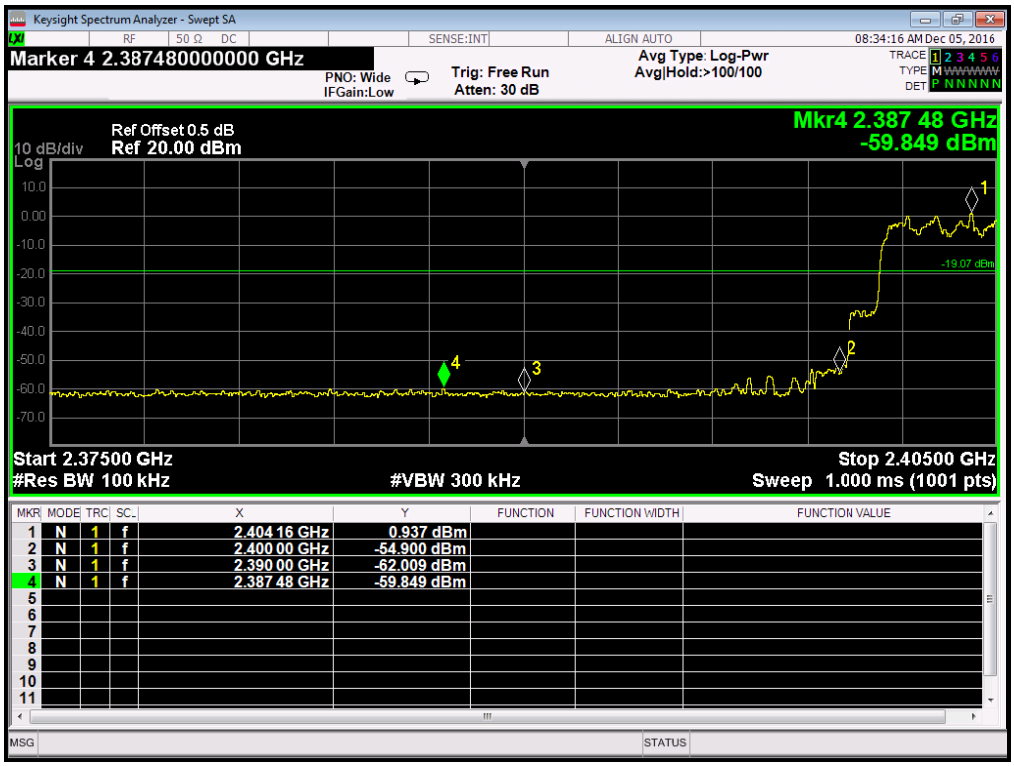
High Band Edge Plot on channel 78 @ GFSK



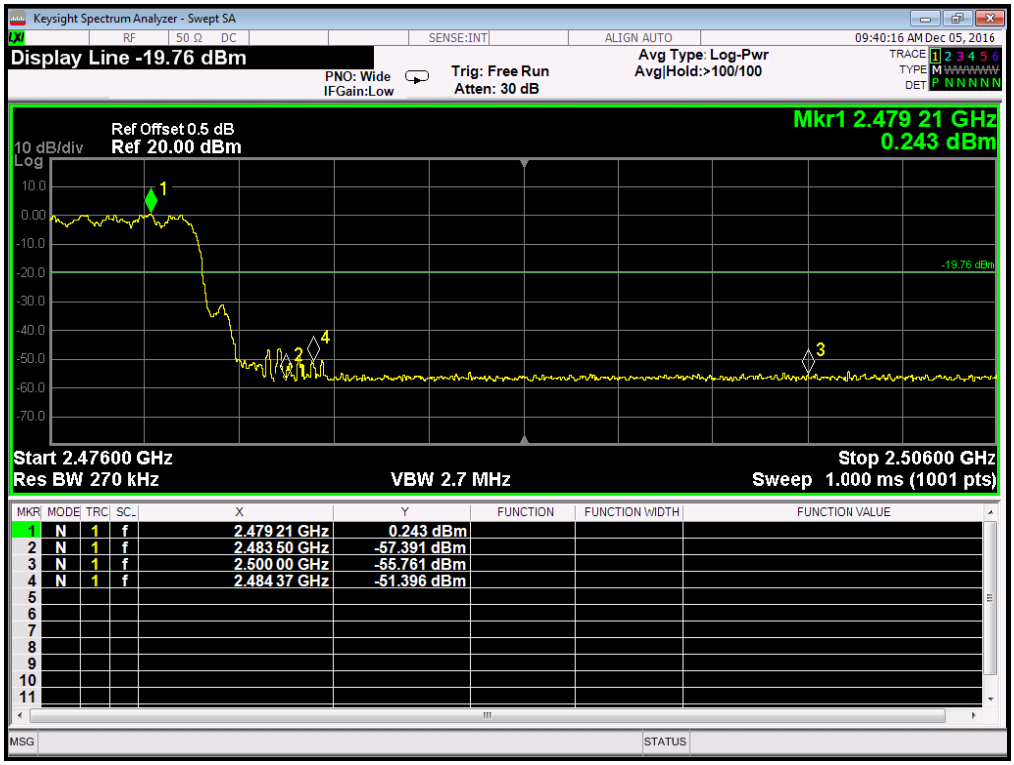
Low Band Edge Plot on channel 0 @π/4-DQPSK



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

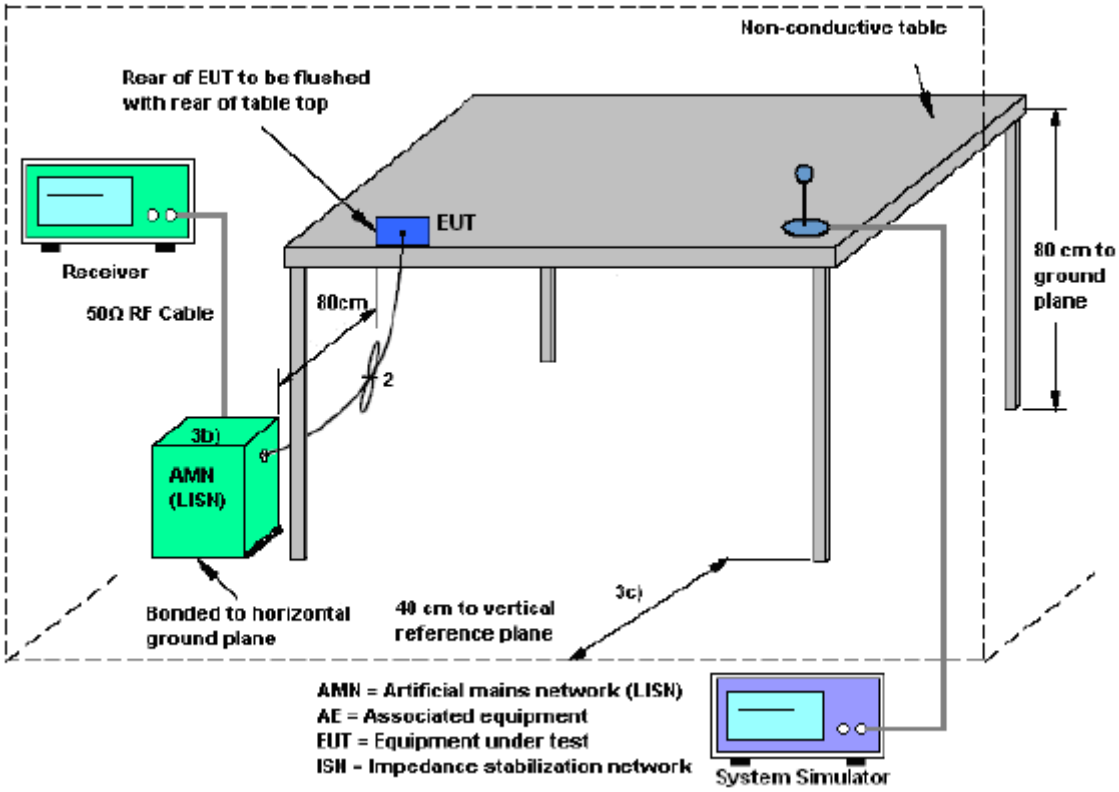
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

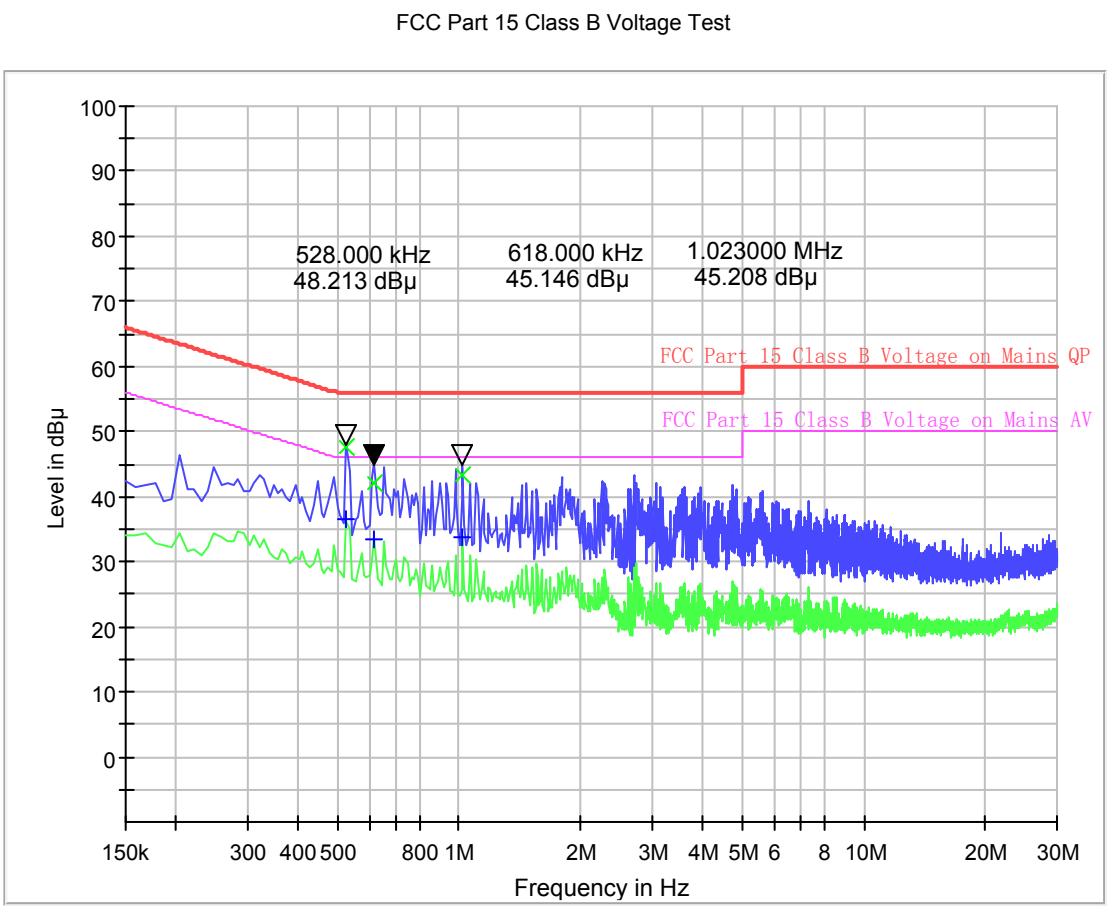


2.9.4. Test Procedures

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.

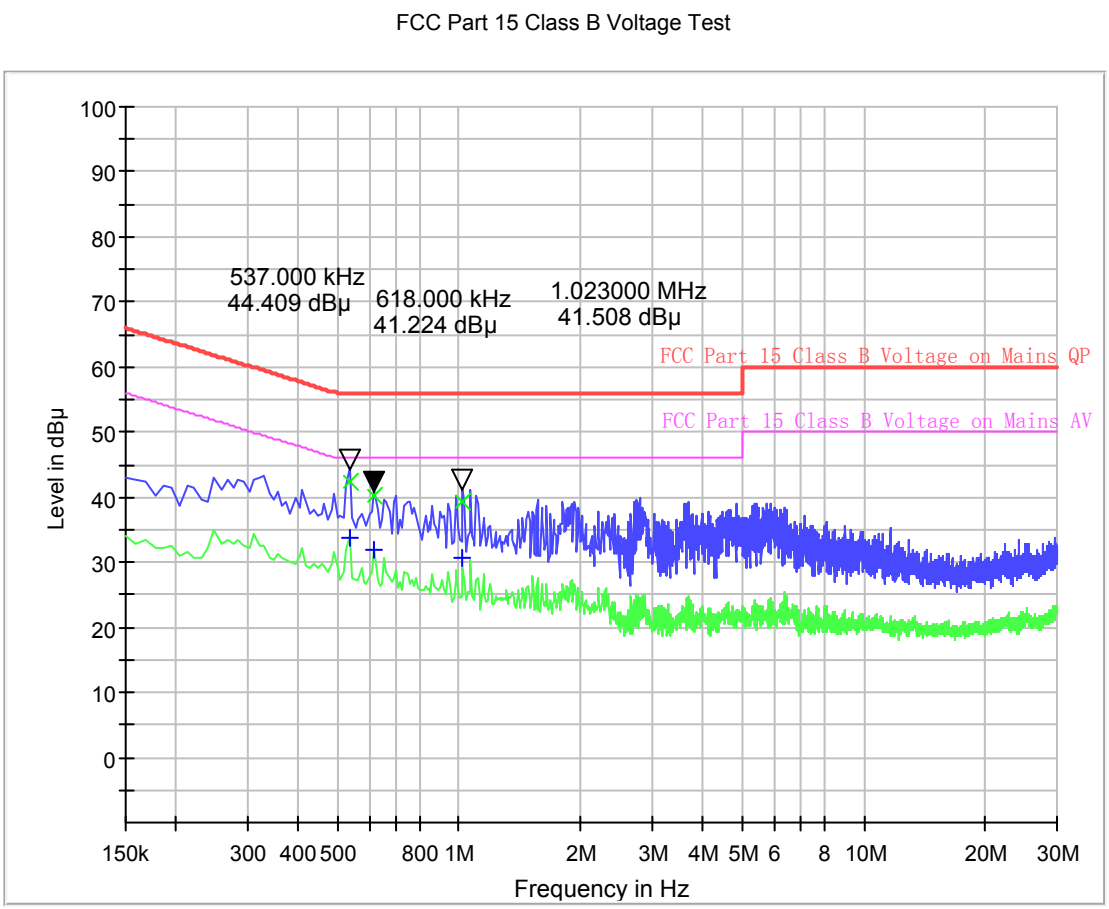
2.9.3. Test Results of Conducted Emission

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)
0.528000	56.0	47.75	0.528000	46.0	36.60
0.618000	56.0	42.21	0.618000	46.0	33.39
1.023000	56.0	43.43	1.023000	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)
0.537000	56.0	42.45	0.537000	46.0	33.65
0.618000	56.0	40.24	0.618000	46.0	31.83
1.023000	56.0	39.39	1.023000	46.0	30.66

Test Result: PASS

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.

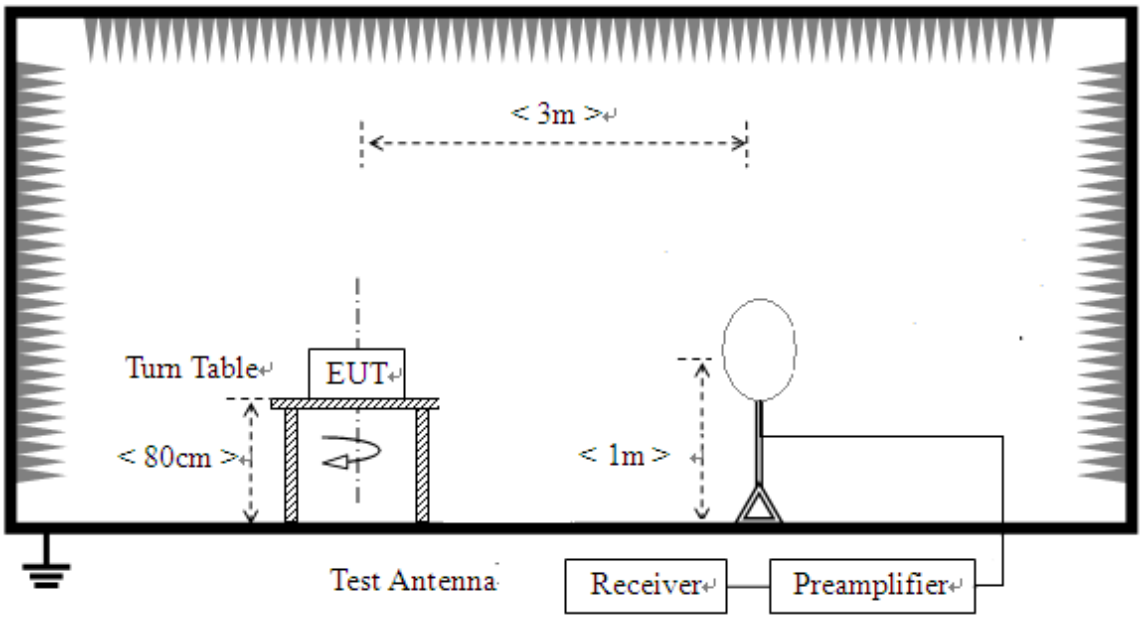
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.10.2. Measuring Instruments

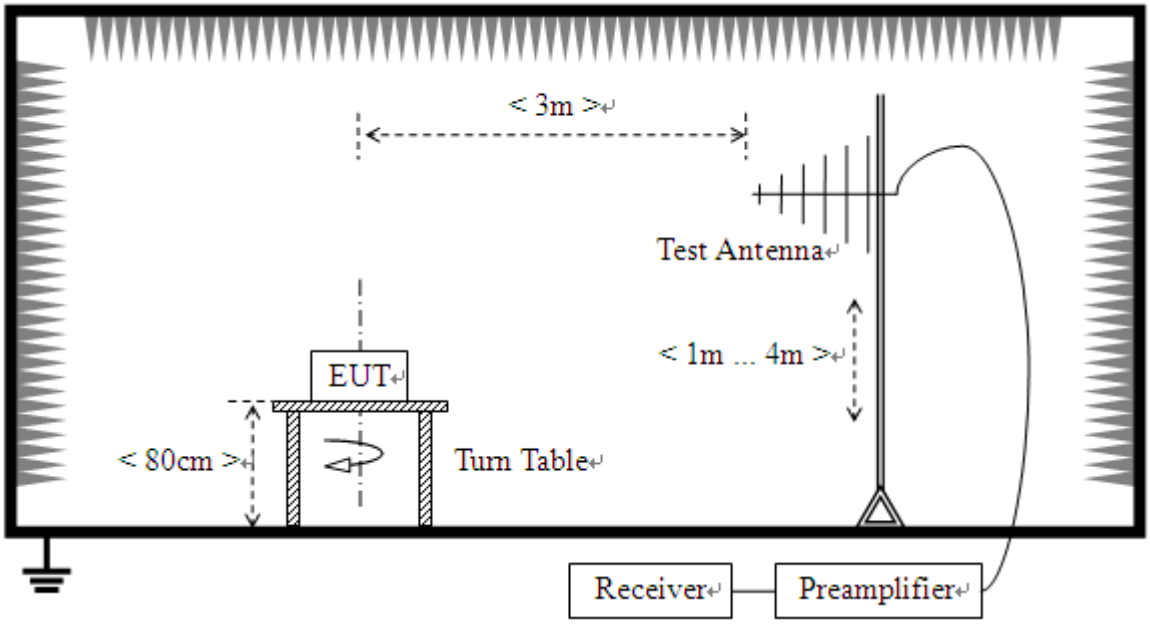
The measuring equipment is listed in the section 3 of this test report.

2.10.3. Test Setup

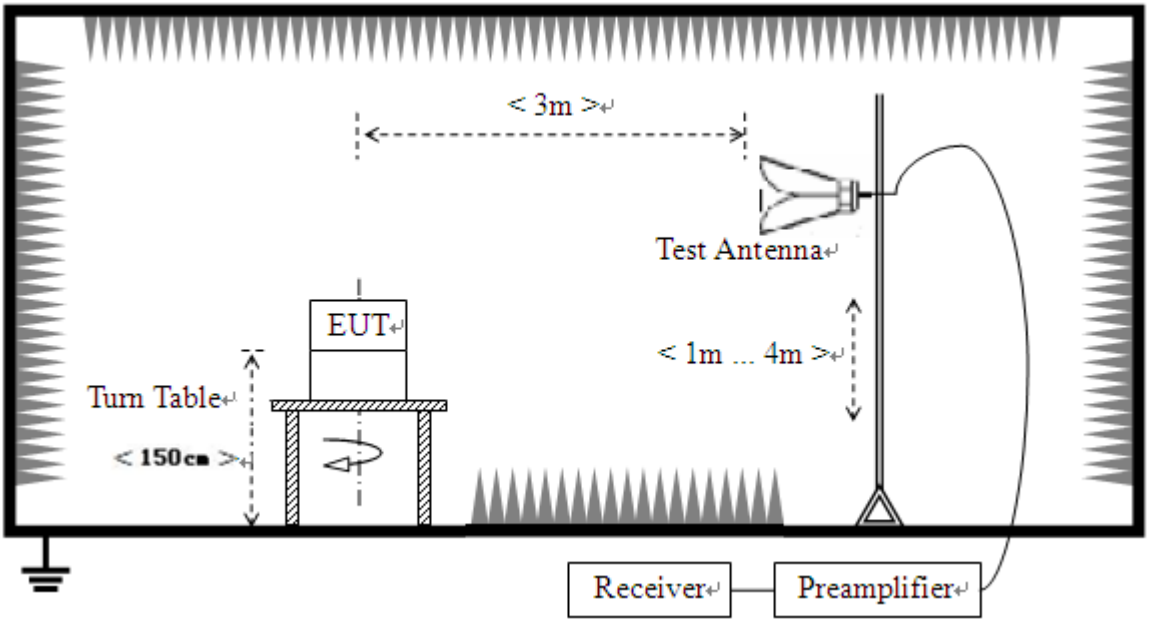
1) For radiated emissions from 9kHz to 30MHz



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 /1.5 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 = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+Nn*Ln$

Where N_1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

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

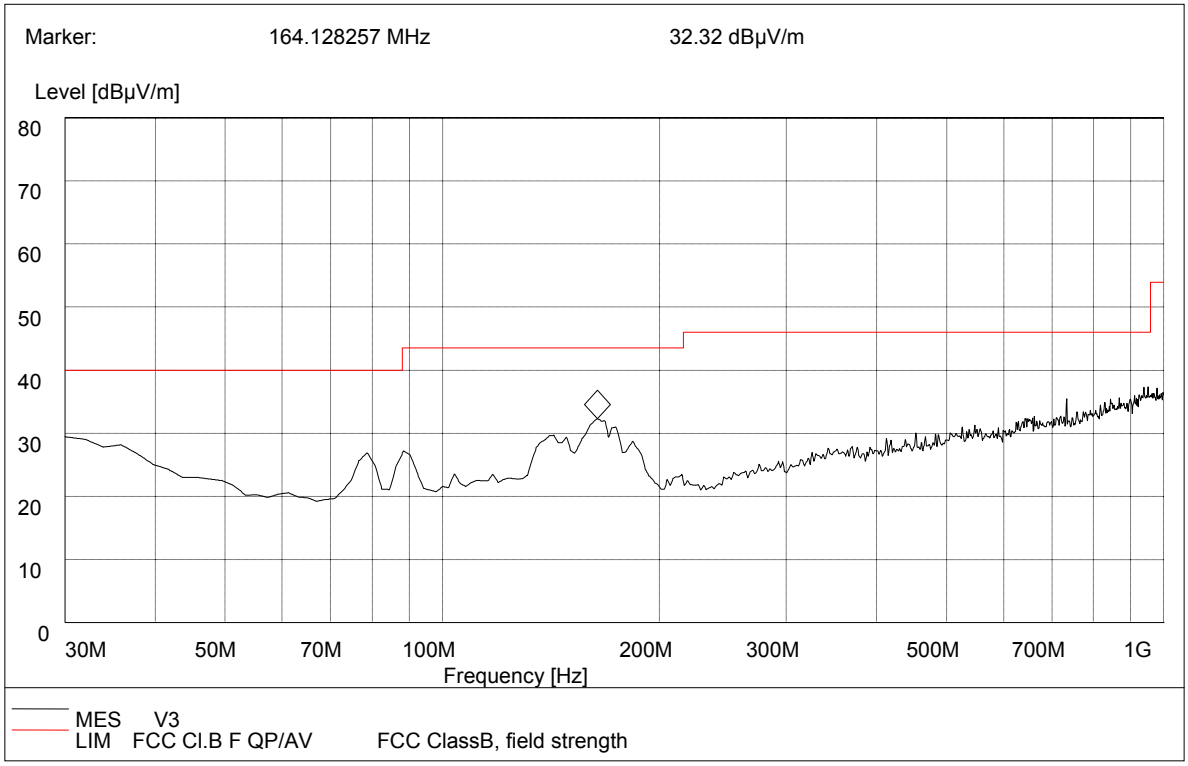
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
8. All modes (three orthogonal orientations) of operation were investigated and the worst-case emissions are reported.

2.10.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 KHz to 30MHz

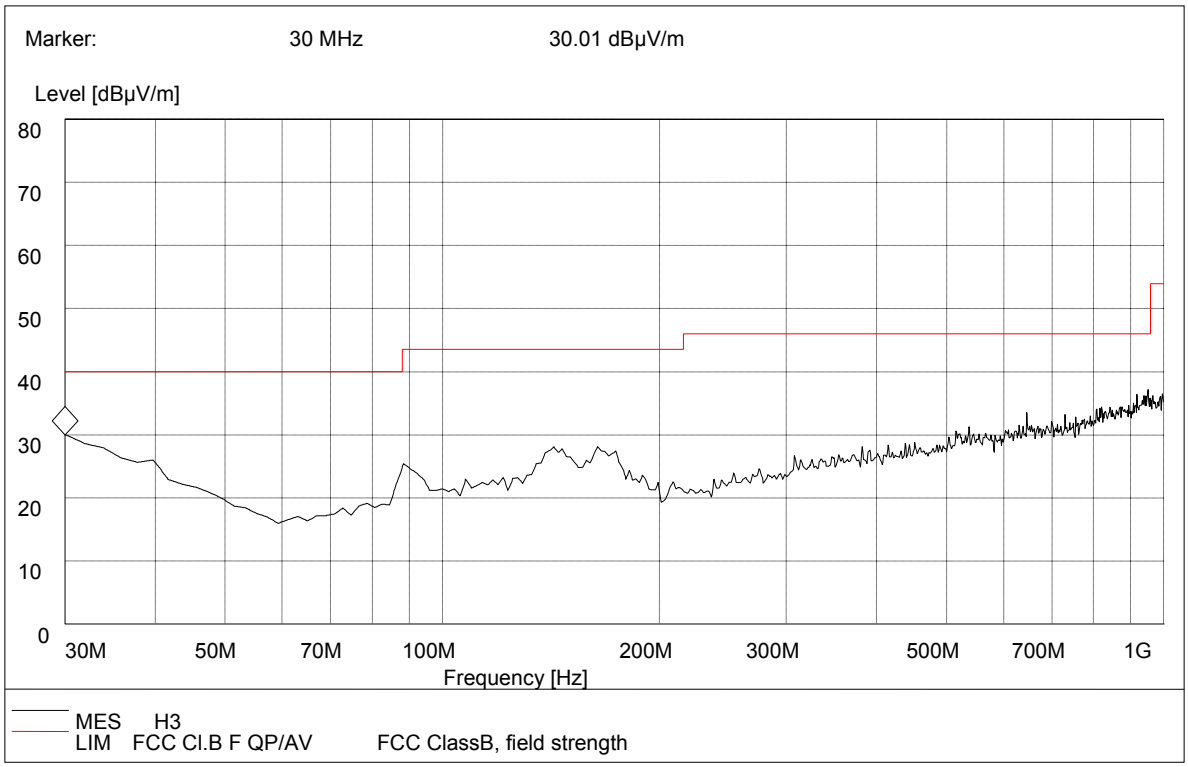
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB µ V/m)	Antenna	Verdict
30.000000	28.76	120.000	100.0	40.0	Vertical	Pass
78.250000	26.85	120.000	100.0	40.0	Vertical	Pass
89.900000	26.64	120.000	100.0	40.0	Vertical	Pass
152.35000	28.75	120.000	100.0	43.5	Vertical	Pass
165.260000	30.26	120.000	100.0	43.5	Vertical	Pass
723.250000	34.74	120.000	100.0	46.0	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
30.000000	28.22	120.000	100.0	40.00	Horizontal	Pass
85.620000	24.58	120.000	100.0	43.50	Horizontal	Pass
128.450000	27.01	120.000	100.0	43.50	Horizontal	Pass
178.590000	26.77	120.000	100.0	40.00	Horizontal	Pass
432.240000	26.85	120.000	100.0	43.50	Horizontal	Pass
641.250000	31.49	120.000	100.0	43.50	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	50.12	PK	74.0	-23.88	1.51 H	30	48.82	1.3
2	2390.00	37.53	AV	54.0	-16.47	1.51 H	30	36.23	1.3
3	*2402.00	91.08	PK	/	/	1.50 H	42	89.48	1.6
4	*2402.00	70.19	AV	/	/	1.50 H	42	68.59	1.6
5	4804.00	49.19	PK	74.00	-24.81	1.51 H	25	42.79	6.4
6	4804.00	37.76	AV	54.00	-16.24	1.51 H	25	31.36	6.4
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	51.51	PK	74.0	-22.49	1.51 V	32	50.21	1.3
2	2390.00	37.53	AV	54.0	-16.47	1.51 V	32	36.23	1.3
3	*2402.00	81.39	PK	/	/	1.50 V	25	79.79	1.6
4	*2402.00	60.39	AV	/	/	1.50 V	25	58.79	1.6
5	4804.00	48.60	PK	74.00	-25.4	1.50 V	20	42.2	6.4
6	4804.00	37.76	AV	54.00	-16.24	1.50 V	20	31.36	6.4

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	91.35	PK	/	/	1.50 H	20	89.25	2.1
2	*2441.00	69.75	AV	/	/	1.50 H	20	67.65	2.1
3	4882.00	48.65	PK	74.00	-25.35	1.50 H	30	42.15	6.5
4	4882.00	37.01	AV	54.00	-16.99	1.50 H	30	30.51	6.5
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	78.24	PK	/	/	1.50 V	20	76.14	2.1
2	*2441.00	57.13	AV	/	/	1.50 V	20	55.03	2.1
3	4884.00	49.62	PK	74.00	-24.38	1.50 V	45	43.12	6.5
4	4884.00	37.39	AV	54.00	-16.61	1.50 V	45	30.89	6.5

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	86.87	PK	/	/	1.50 H	40	84.27	2.6
2	*2480.00	65.81	AV	/	/	1.50 H	40	63.21	2.6
3	2483.50	54.23	PK	74.0	-19.77	1.51 H	45	51.63	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.51 H	45	35.71	2.6
5	4960.00	48.70	PK	74.0	-25.30	1.50 H	30	42.00	6.7
6	4960.00	37.55	AV	54.0	-16.45	1.50 H	30	30.85	6.7
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	78.50	PK	/	/	1.50 V	30	75.90	2.6
2	*2480.00	57.59	AV	/	/	1.50 V	30	54.99	2.6
3	2483.50	50.13	PK	74.0	-23.87	1.50 V	40	47.53	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.50 V	40	35.71	2.6
5	4960.00	49.01	PK	74.0	-24.99	1.51 V	35	42.31	6.7
6	4960.00	37.45	AV	54.0	-16.55	1.51 V	35	30.75	6.7

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	50.12	PK	74.0	-23.88	1.50 H	30	48.82	1.3
2	2390.00	37.53	AV	54.0	-16.47	1.50 H	30	36.23	1.3
3	*2402.00	90.69	PK	/	/	1.51 H	25	89.09	1.6
4	*2402.00	68.14	AV	/	/	1.51 H	25	66.54	1.6
5	4804.00	48.70	PK	74.00	-25.3	1.50 H	40	42.3	6.4
6	4804.00	36.76	AV	54.00	-17.24	1.50 H	40	30.36	6.4
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	49.90	PK	74.0	-24.1	1.50 V	35	48.60	1.3
2	2390.00	37.52	AV	54.0	-16.48	1.50 V	35	36.22	1.3
3	*2402.00	79.54	PK	/	/	1.50 V	25	77.94	1.6
4	*2402.00	56.71	AV	/	/	1.50 V	25	55.11	1.6
5	4804.00	48.40	PK	74.00	-25.6	1.50 V	50	42.00	6.4
6	4804.00	36.76	AV	54.00	-17.24	1.50 V	50	30.36	6.4

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	89.07	PK	/	/	1.50 H	30	86.97	2.1
2	*2441.00	67.77	AV	/	/	1.50 H	30	65.67	2.1
3	4882.00	49.15	PK	74.00	-24.85	1.50 H	35	42.65	6.5
4	4882.00	37.40	AV	54.00	-16.60	1.50 H	35	30.90	6.5
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	74.01	PK	/	/	1.51 V	25	71.91	2.1
2	*2441.00	53.96	AV	/	/	1.51 V	25	51.86	2.1
3	4884.00	49.15	PK	74.00	-24.85	1.51 V	50	42.65	6.5
4	4884.00	37.40	AV	54.00	-16.60	1.51 V	50	30.90	6.5

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	84.91	PK	/	/	1.50 H	25	82.31	2.6
2	*2480.00	62.77	AV	/	/	1.50 H	25	60.17	2.6
3	2483.50	52.55	PK	74.0	-21.45	1.51 H	30	49.95	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.51 H	30	35.71	2.6
5	4960.00	50.04	PK	74.0	-23.96	1.50 H	32	43.34	6.7
6	4960.00	37.45	AV	54.0	-16.55	1.50 H	32	30.75	6.7
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	75.76	PK	/	/	1.51 V	25	73.16	2.6
2	*2480.00	55.08	AV	/	/	1.51 V	25	52.48	2.6
3	2483.50	50.02	PK	74.0	-23.98	1.50 V	30	47.42	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.50 V	30	35.71	2.6
5	4960.00	50.30	PK	74.0	-23.70	1.50 V	50	43.60	6.7
6	4960.00	37.45	AV	54.0	-16.55	1.50 V	50	30.75	6.7

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	49.45	PK	74.0	-24.55	1.51 H	30	48.15	1.3
2	2390.00	37.52	AV	54.0	-16.48	1.51 H	30	36.22	1.3
3	*2402.00	90.63	PK	/	/	1.50 H	44	89.03	1.6
4	*2402.00	59.82	AV	/	/	1.50 H	44	58.22	1.6
5	4804.00	49.37	PK	74.00	-24.63	1.50 H	50	42.97	6.4
6	4804.00	37.76	AV	54.00	-16.24	1.50 H	50	31.36	6.4
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	48.98	PK	74.0	-25.02	1.51 V	35	47.68	1.3
2	2390.00	37.53	AV	54.0	-16.47	1.51 V	35	36.23	1.3
3	*2402.00	79.64	PK	/	/	1.50 V	30	78.04	1.6
4	*2402.00	58.13	AV	/	/	1.50 V	30	56.53	1.6
5	4804.00	48.29	PK	74.00	-25.71	1.50 V	55	41.89	6.4
6	4804.00	36.76	AV	54.00	-17.24	1.50 V	55	30.36	6.4

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	88.98	PK	/	/	1.51 H	35	86.88	2.1
2	*2441.00	62.73	AV	/	/	1.51 H	35	60.63	2.1
3	4882.00	48.85	PK	74.00	-25.15	1.50 H	50	42.35	6.5
4	4882.00	37.76	AV	54.00	-16.24	1.50 H	50	31.26	6.5
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	79.09	PK	/	/	1.50 V	30	76.99	2.1
2	*2441.00	55.54	AV	/	/	1.50 V	30	53.44	2.1
3	4884.00	49.98	PK	74.00	-24.02	1.51 V	45	43.48	6.5
4	4884.00	37.39	AV	54.00	-16.61	1.51 V	45	30.89	6.5

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	86.39	PK	/	/	1.50 H	30	83.79	2.6
2	*2480.00	67.10	AV	/	/	1.50 H	30	64.50	2.6
3	2483.50	52.96	PK	74.0	-21.04	1.50 H	40	50.36	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.50 H	40	35.71	2.6
5	4960.00	48.81	PK	74.0	-25.19	1.50 H	35	42.11	6.7
6	4960.00	38.16	AV	54.0	-15.84	1.50 H	35	31.46	6.7
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	77.08	PK	/	/	1.50 V	25	74.48	2.6
2	*2480.00	56.15	AV	/	/	1.50 V	25	53.55	2.6
3	2483.50	50.57	PK	74.0	-23.43	1.50 V	35	47.97	2.6
4	2483.50	38.31	AV	54.0	-15.69	1.50 V	35	35.71	2.6
5	4960.00	49.68	PK	74.0	-24.32	1.50 V	40	42.98	6.7
6	4960.00	37.46	AV	54.0	-16.54	1.50 V	40	30.76	6.7

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

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal
1	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	11/13/2016
2	EMI TEST RECEIVER	Rohde&Schwarz	ESI 26	100009	11/13/2016
3	EMI TEST Software	Audix	E3	N/A	N/A
4	TURNTABLE	ETS	2088	2149	N/A
5	ANTENNA MAST	ETS	2075	2346	N/A
6	EMI TEST Software	Rohde&Schwarz	ESK1	N/A	N/A
7	HORNANTENNA	ShwarzBeck	9120D	1011	11/13/2016
8	Amplifer	Sonoma	310N	E009-13	11/13/2016
9	JS amplifer	Rohde&Schwarz	JS4-00101800-28-5A	F201504	11/13/2016
10	High pass filter	Compliance Direction systems	BSU-6	34202	11/13/2016
11	HORNANTENNA	ShwarzBeck	9120D	1012	11/13/2016
12	Amplifer	Compliance Direction systems	PAP1-4060	120	11/13/2016
13	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	11/13/2016
14	TURNTABLE	MATURO	TT2.0	----	N/A
15	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
16	Horn Antenna	SCHWARZBECK	BBHA9170	25841	11/13/2016
17	ULTRA-BROADBAND ANTENNA	Rohde&Schwarz	HL562	100015	11/13/2016

Maximum Peak Output Power / Power Spectral Density / 6dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal
1	Spectrum Analyzer	Rohde&Schwarz	FSP	1164.4391.40	11/13/2016
2	Spectrum Analyzer	Keysight	N9030A	ATO-67098	07/19/2016
3	Power Meter	Anritsu	ML2480B	100798	11/13/2016
4	Power Sensor	Anritsu	MA2411B	100258	11/13/2016

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	9kHz~30MHz	2.20dB
	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 **