Report No.:SZ13060069W02

FCC PART 15C TEST REPORT

Issued to

East 2 West, LLC

For

The Original Bluetooth Home Ringer

Model Name:	HFD-870 2AAZM- R
Trade Name:	Renny
Brand Name:	Renny
FCC ID:	2AAZMHFD-870
Standard:	47 CFR Part 15 Subpart C
Test date:	2013-8-2 to 2013-8-15
Issue date:	2014-4-28

By

Shenzhen MORLAB Communication Technology Co., Ltd.

Tested by Nie Quan	*Approved by* Zeng Dexin	*Review by* Peng Hua rui
Nie Quan	*Zeng Dexin*	*Peng Huarui*
(Test Engineer)	*(Chief Engineer)*	*(Project Manager)*
Date 2014. 4. 28	*Date* 2014. 4. 28	*Date* 2014. 4. 28

The report refers only to the sample tested and does not apply to the bulk. This report is issued in confidence to the client and it will be strictly treated as such by the Shenzhen MORLAB Communication Technology Co., Ltd. It may not be reproduced rather in its entirety or in part and it may not be used for adverting. The client to whom the report is issued may, however, show or send it . or a certified copy there of prepared by the Shenzhen MORLAB Telecommunication Co., Ltd to his customer. Supplier or others persons directly concerned. Shenzhen MORLAB Telecommunication Co., Ltd will not, without the consent of the client enter into any discussion of correspondence with any third party concerning the contents of the report. In the event of the improper use of the report, Shenzhen MORLAB Telecommunication Co., Ltd reserves the rights to withdraw it and to adopt any other remedies which may be appropriate.

DIRECTORY

1. GENERAL INFORMATION 3

1.1. EUT Description 3

1.2. Test Standards and Results 4

1.3. Facilities and Accreditations 5

2. 47 CFR PART 15C REQUIREMENTS 6

2.1. Antenna requirement 6

2.2. Number of Hopping Frequency 6

2.3. Peak Output Power 11

2.4. 20dB Bandwidth 13

2.5. Carried Frequency Separation 20

2.6. Time of Occupancy (Dwell time) 23

2.7. Conducted Spurious Emissions 35

2.8. Restricted Frequency Bands 48

2.9. Conducted Emission 57

2.10. Radiated Emission 60

2.11. RF exposure evaluation 79

Change History		
Issue	Date	Reason for change
1.0	April 28, 2014	First edition

1. General Information

1.1. EUT Description

EUT Type ..... :	The Original Bluetooth Home Ringer
Serial No..... :	(n.a, marked #1 by test site)
Hardware Version ..... :	V8
Software Version ..... :	V8.1
Applicant ..... :	East 2 West, LLC 1432 S SALTAIR AVE. #209, LOS ANGELES, CA 90025
Manufacturer ..... :	SHENZHEN HI-FID ELECTRONICS TECH CO.,LTD C2,28TH FL,DONGJIANG BLDG., LONGJING RD, 3RD AREA, BAO'AN DISTRICT,SHENZHEN,CHINA 518101
Frequency Range..... :	The frequency range used is 2402MHz - 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Modulation Type ..... :	Bluetooth: FHSS (GFSK(1Mbps), ∏/4-DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Antenna Type..... :	PCB Antenna
Antenna Gain..... :	0dBi for PCB Antenna

Note 1: The EUT is a The Original Bluetooth Home Ringer, 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 a response 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, 3DH1, 3DH3, 3DH5, 5DH1, 5DH3, 5DH5, 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 (10-1-12 Edition)	Radio Frequency 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)	Restricted Frequency Bands	PASS
9	15.207	Conducted Emission	PASS
10	15.209 15.247(d)	Radiated Emission	PASS
11	15.247(i), 1.1307&2.1093	RF exposure evaluation	PASS

NOTE:

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

1.3. Facilities and Accreditations

1.3.1. Facilities

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park,Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

1.3.2. 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):	86-106

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.

2.1.2. **Result:** Compliant

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

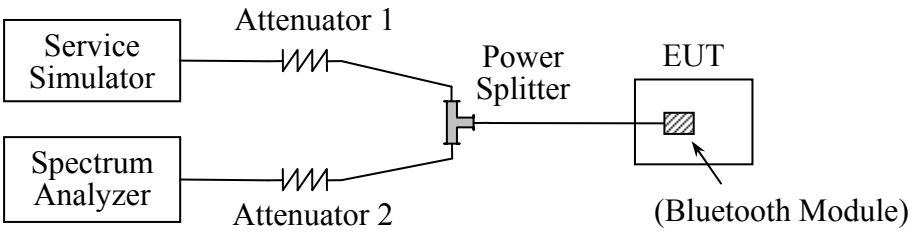
2.2. Number of Hopping Frequency

2.2.1. Requirement

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

2.2.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the SS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.2.3. Test Procedure

The EUT must have its hopping function enabled. 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

Allow the trace to stabilize

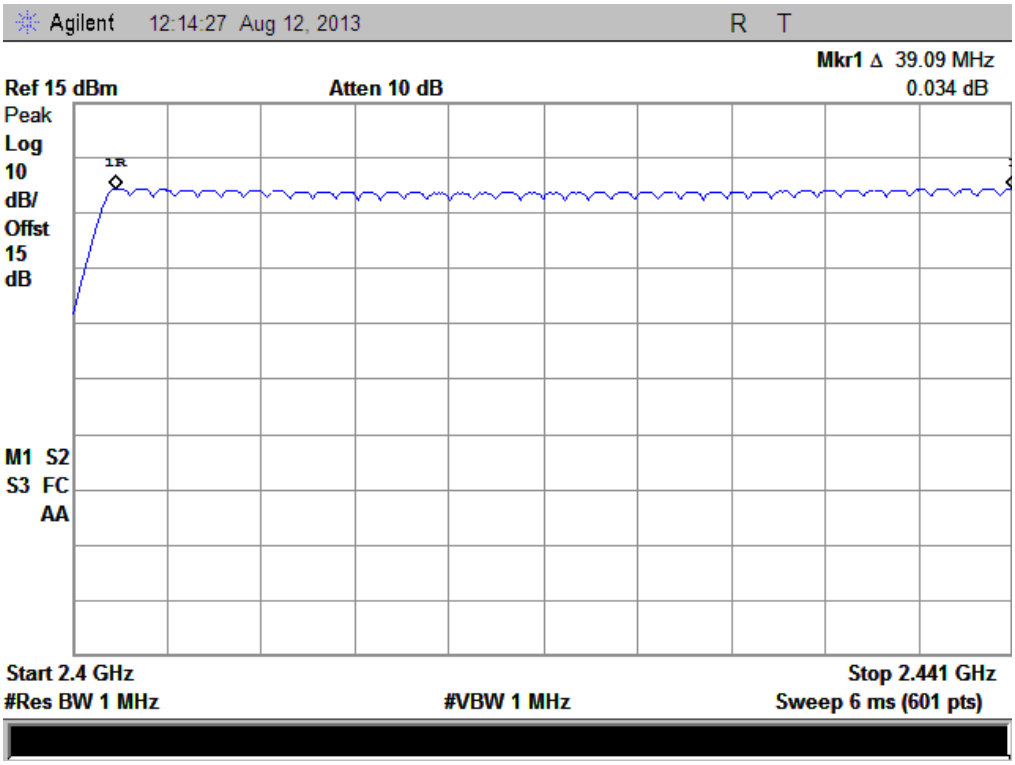
2.2.4. Test Result

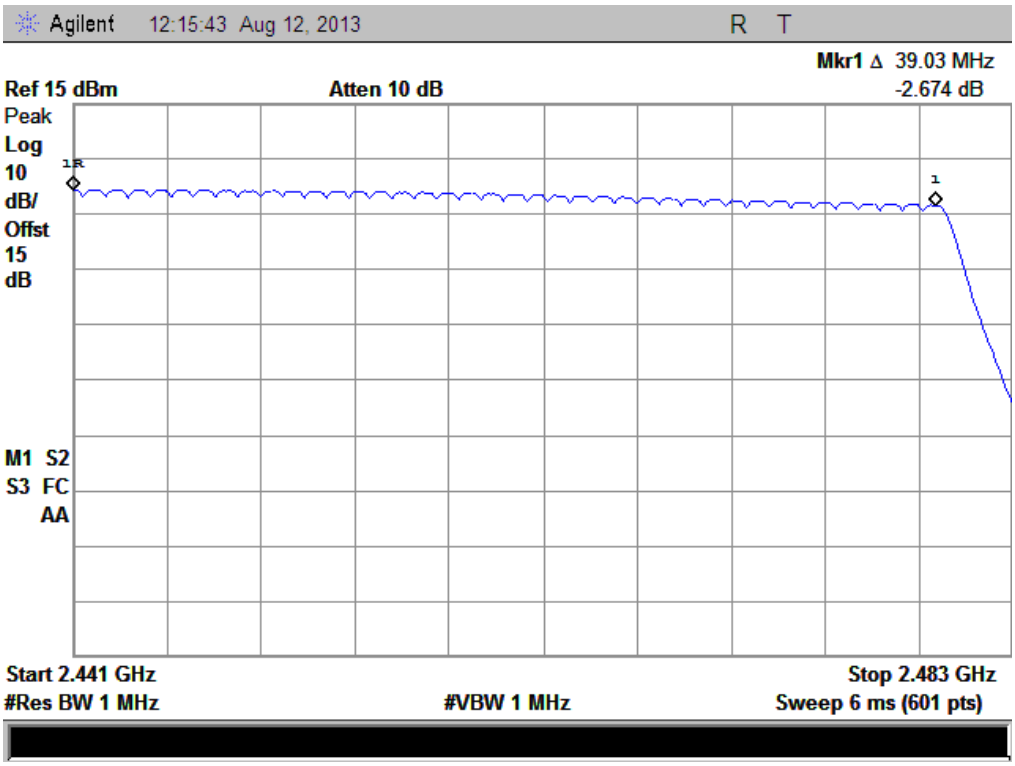
The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

Test Verdict:

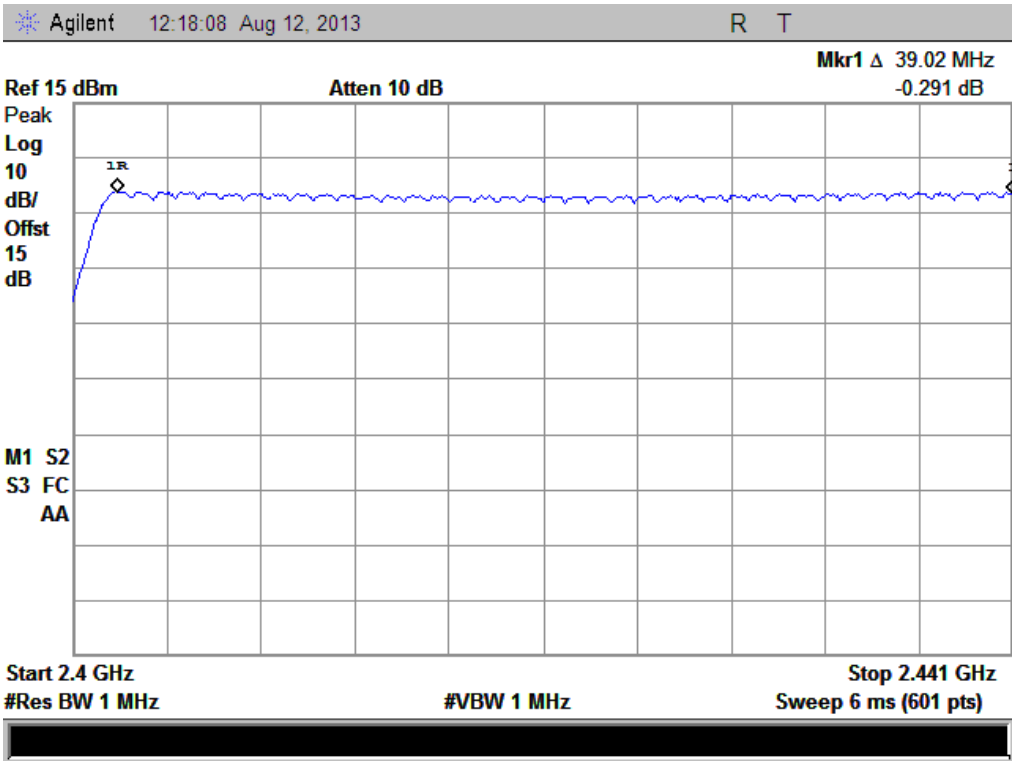
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
Π/4-DQPSK	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

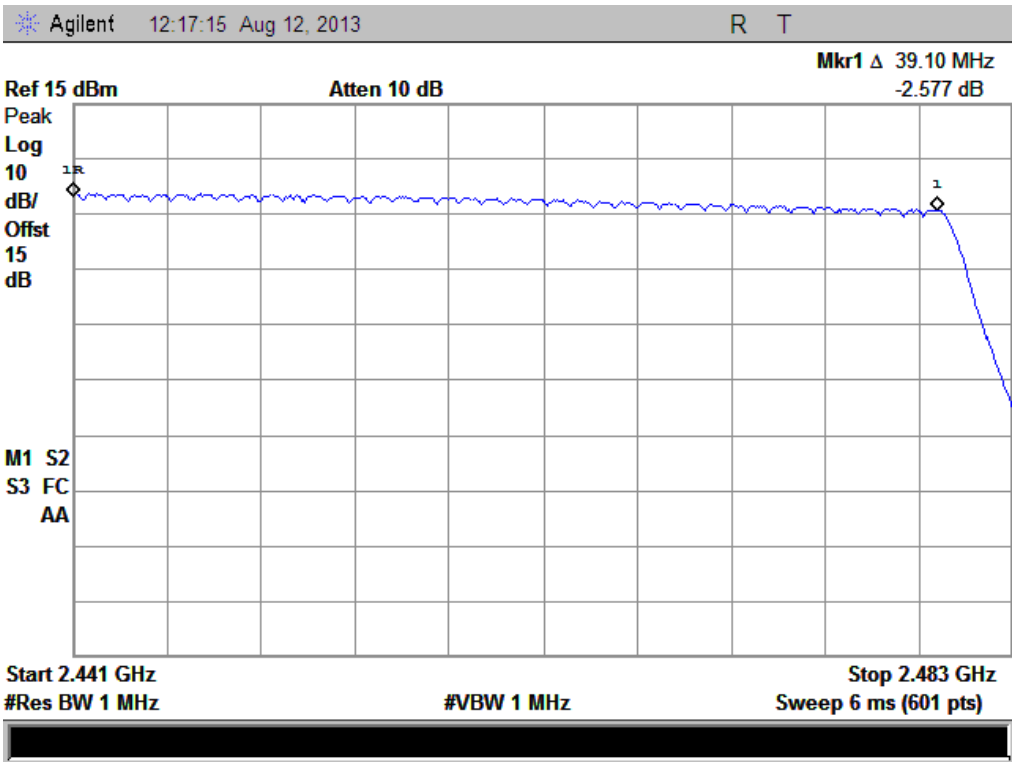
Test Plots:


Agilent 12:14:27 Aug 12, 2013
R T
Mkr1 Δ 39.09 MHz
0.034 dB
Ref 15 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
15
dB
1R
M1 S2
S3 FC
AA
Start 2.4 GHz
Stop 2.441 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 6 ms (601 pts)

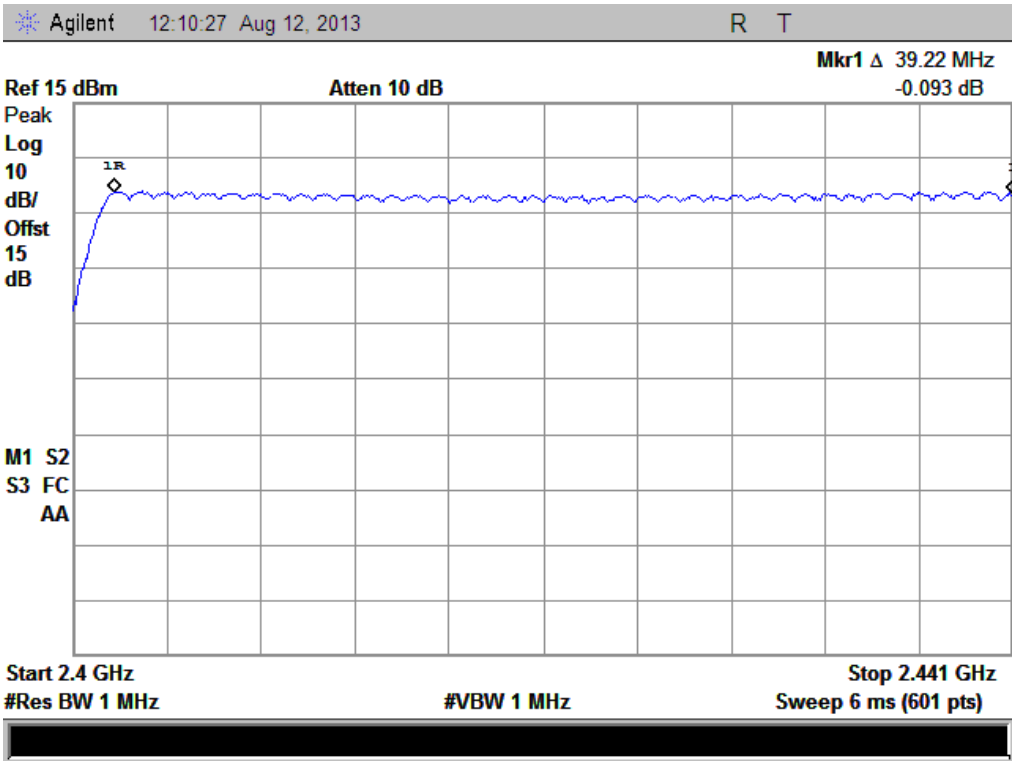

Agilent 12:15:43 Aug 12, 2013
R T
Mkr1 Δ 39.03 MHz
-2.674 dB
Ref 15 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
15
dB
1R
1
M1 S2
S3 FC
AA
Start 2.441 GHz
Stop 2.483 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 6 ms (601 pts)

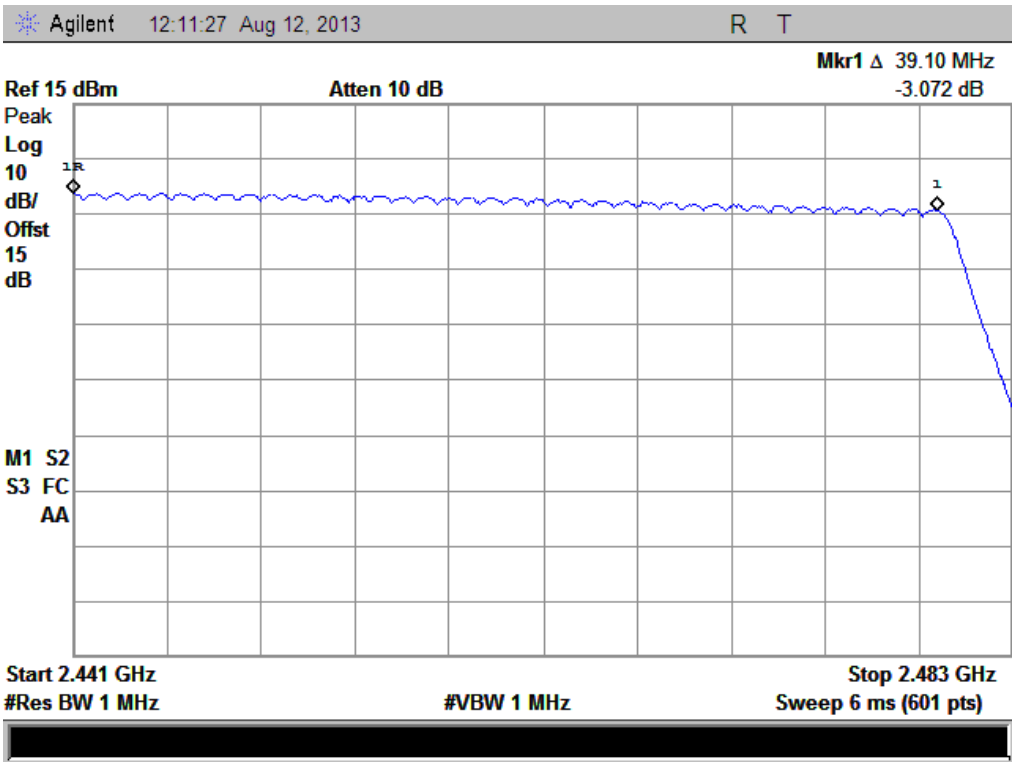
(Plot A: GFSK)





(Plot B: ∏/4-DQPSK)


Agilent 12:10:27 Aug 12, 2013
R T
Mkr1 Δ 39.22 MHz
-0.093 dB
Ref 15 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
15
dB
1R
M1 S2
S3 FC
AA
Start 2.4 GHz
Stop 2.441 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 6 ms (601 pts)


Agilent 12:11:27 Aug 12, 2013
R T
Mkr1 Δ 39.10 MHz
-3.072 dB
Ref 15 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
15
dB
1R
1
M1 S2
S3 FC
AA
Start 2.441 GHz
Stop 2.483 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 6 ms (601 pts)

(Plot C: 8- DPSK)

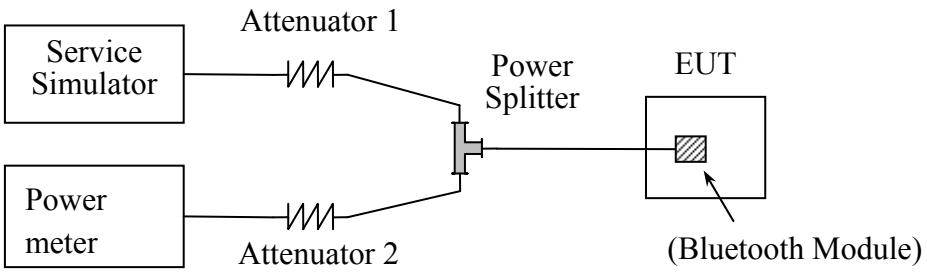
2.3. Peak Output Power

2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.3.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Power meter and the Bluetooth Service Simulator (SS) withAttenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factoris calibrated to correct the reading.During the measurement, the Bluetooth Module of the EUT is activated and controlled by theSS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Power meter	Agilent	E4418B	GB44318055	2013.05.12	2014.05.11
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Power Sensor	Agilent	8482A	MY41091706	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.3.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.The lowest, middle and highest channel were tested by Power meter.

2.3.3.1. GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-0.090	0.000979	20.97	0.125	PASS
39	2441	-0.526	0.000886			PASS
78	2480	-3.234	0.000475			PASS

2.3.3.2. π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-0.772	0.000837	20.97	0.125	PASS
39	2441	-0.955	0.000803			PASS
78	2480	-3.909	0.000407			PASS

2.3.3.3. 8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	-0.600	0.000871	20.97	0.125	PASS
39	2441	-0.890	0.000815			PASS
78	2480	-3.907	0.000407			PASS

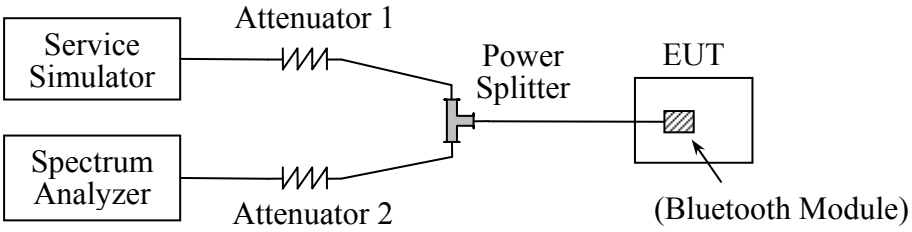
2.4. 20dB Bandwidth

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. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) withAttenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factoris calibrated to correct the reading.During the measurement, the Bluetooth Module of the EUT is activated and controlled by theSS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.4.1. Test Procedure

Use the following spectrum analyzer settings:

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

2.4.2. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

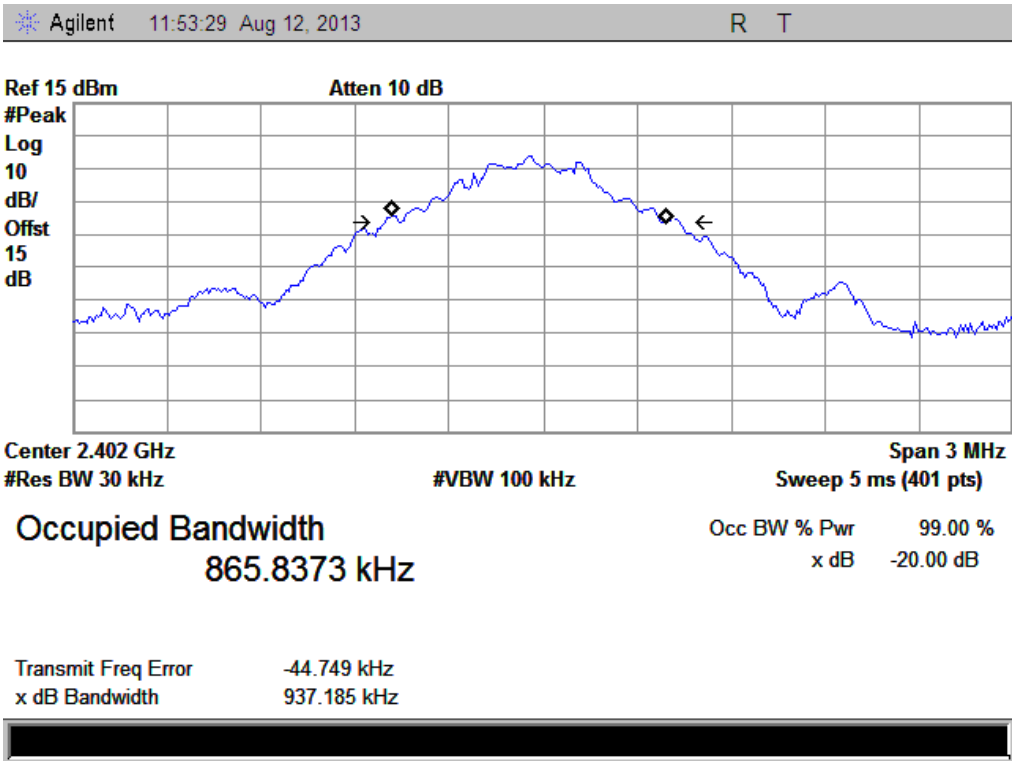
2.4.2.1. GFSK Mode

A. Test Verdict:

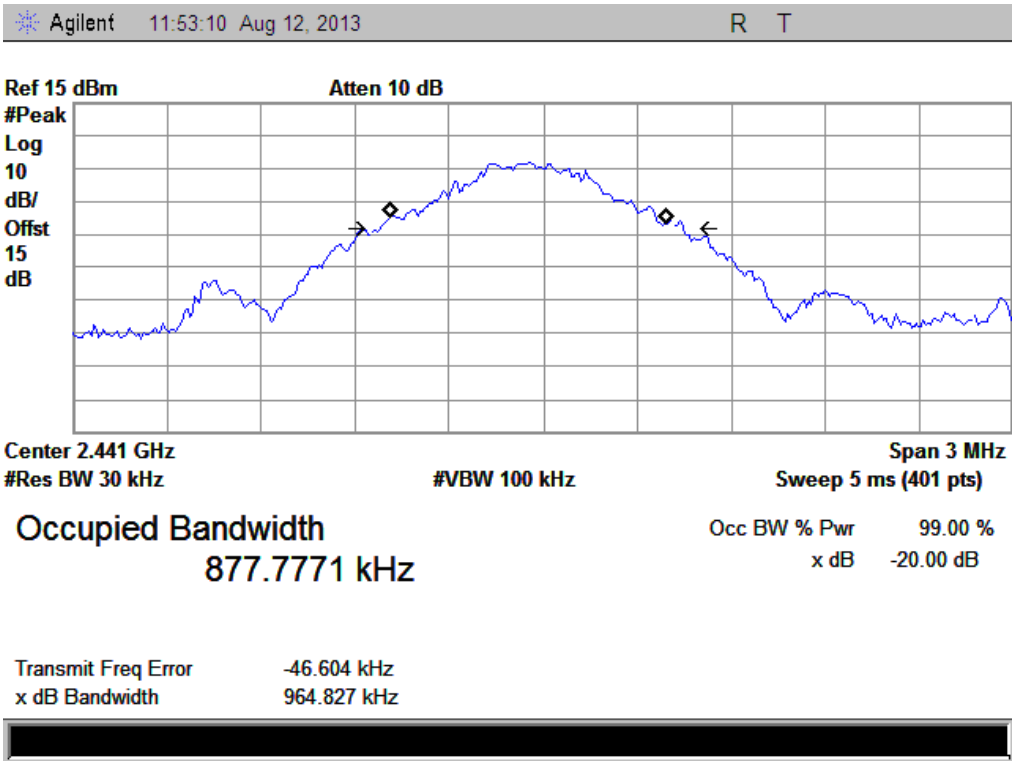
The maximum 20dB bandwidth measured is 0.9648MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	0.9372	Plot A
39	2441	0.9648	Plot B
78	2480	0.9587	Plot C

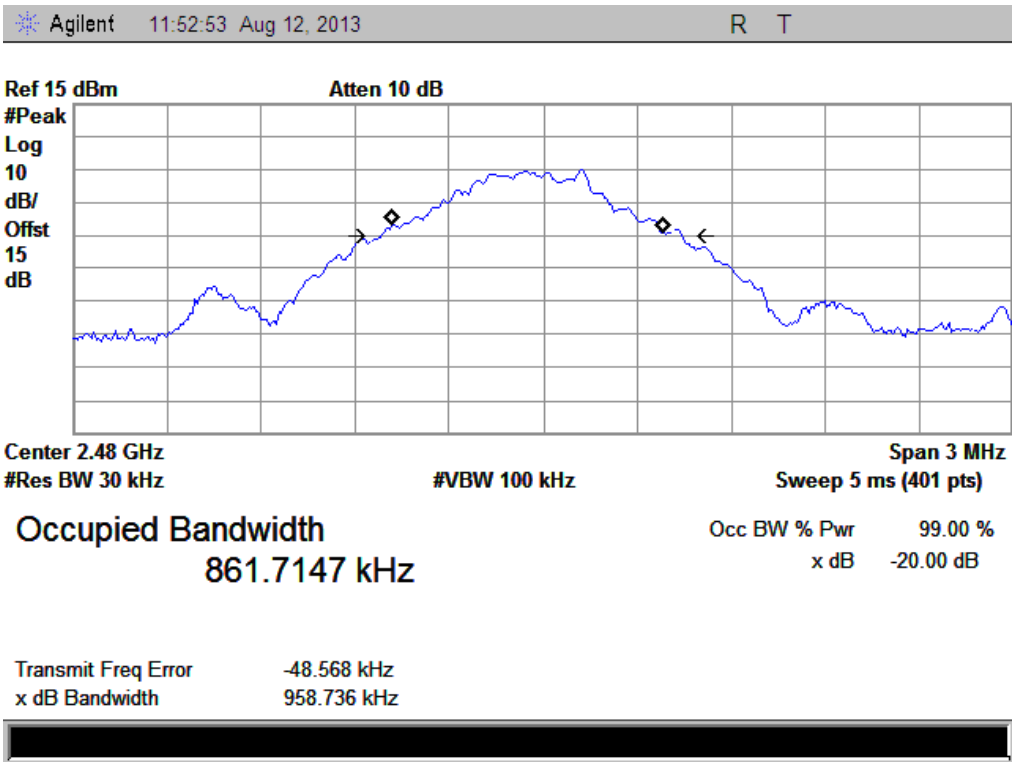
Test Plots:



(Plot A: Channel = 2402 @ GFSK)



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

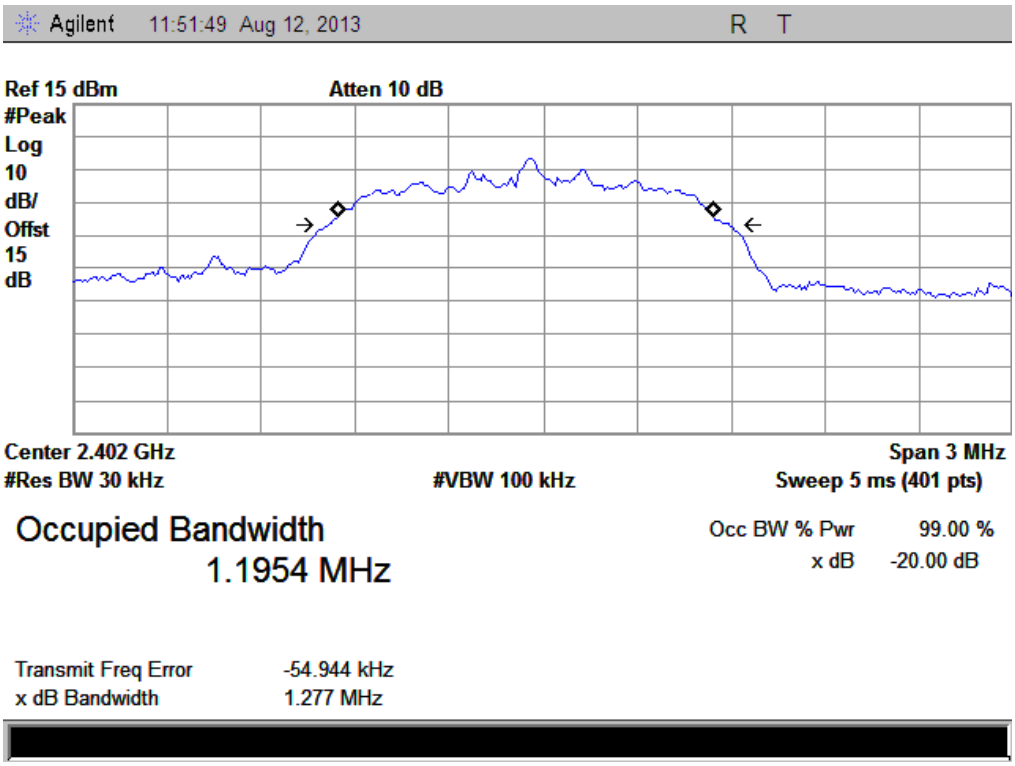
2.4.2.2. Π/4-DQPSK Mode

A. Test Verdict:

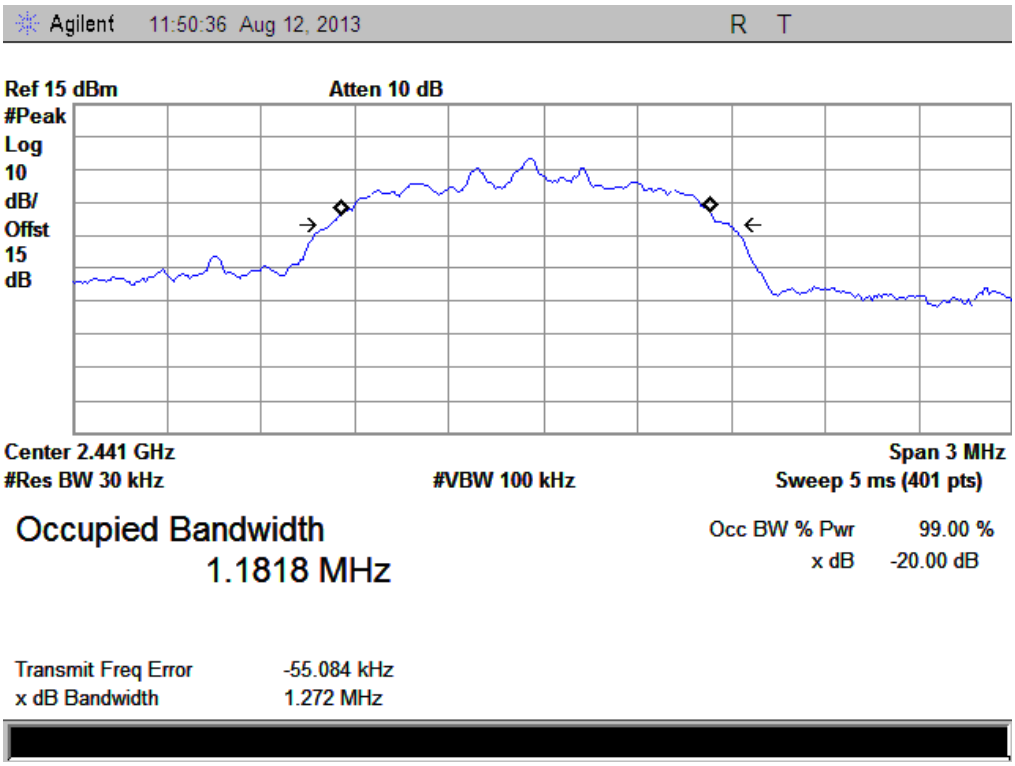
The maximum 20dB bandwidth measured is 1.2770MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.2770	Plot D
39	2441	1.2720	Plot E
78	2480	1.2650	Plot F

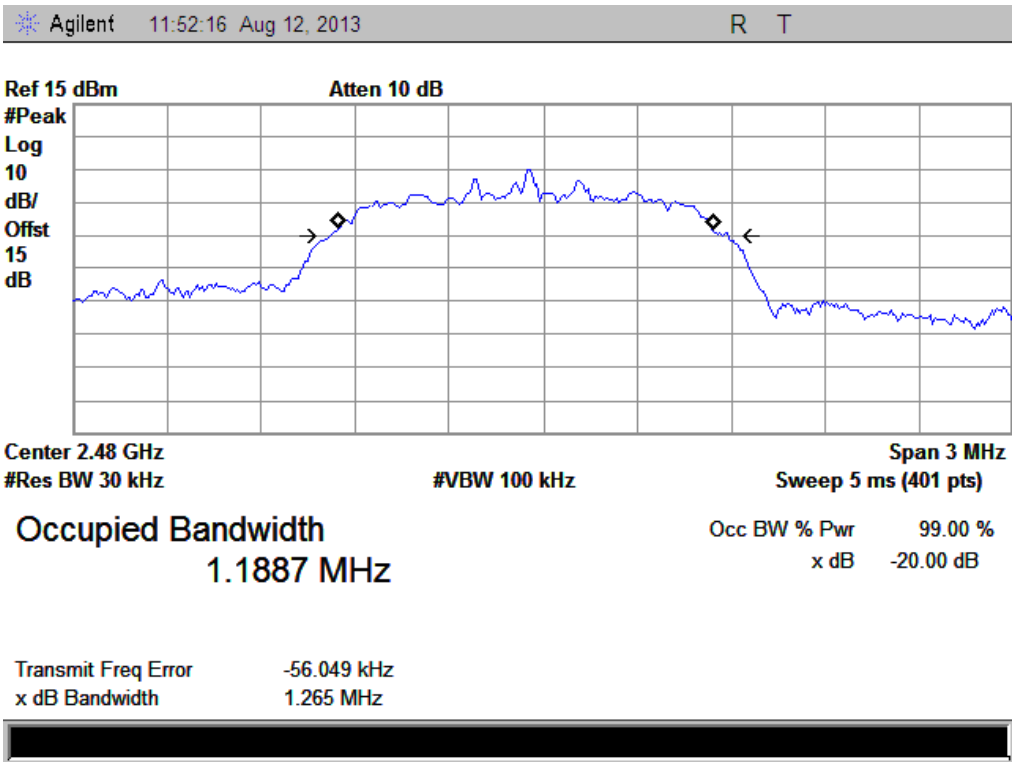
Test Plots:



(Plot D: Channel = 2402 @ Π/4-DQPSK)



(Plot E: Channel = 2441 @ Π/4-DQPSK)



(Plot F: Channel = 2480 @ Π/4-DQPSK)

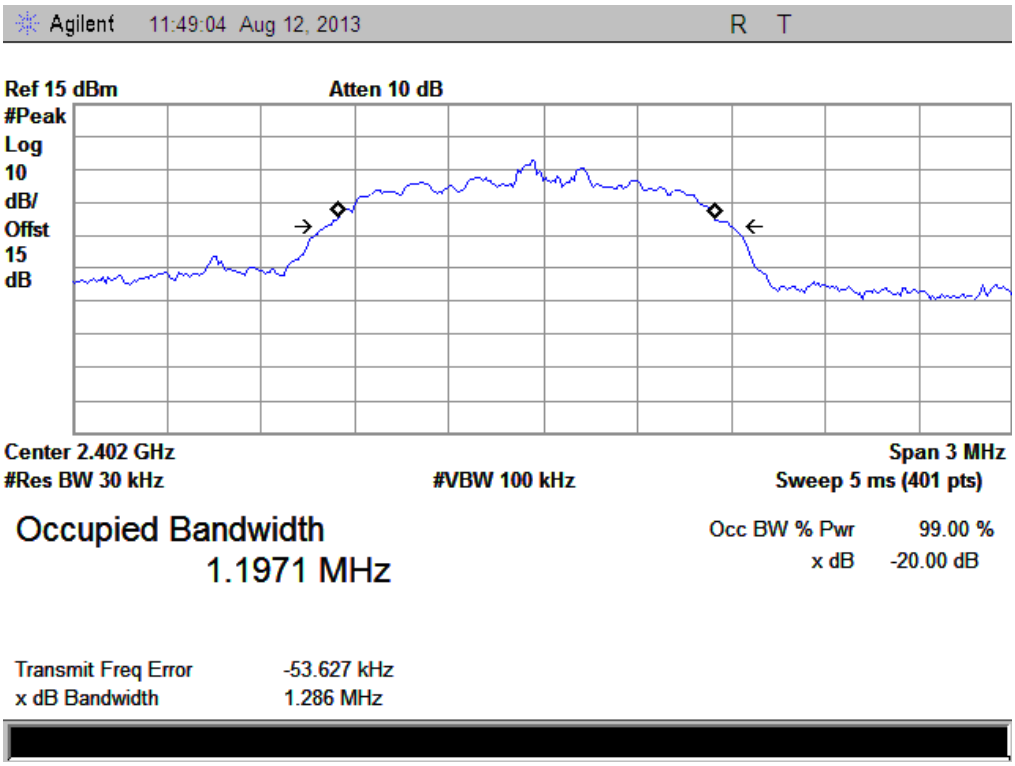
2.4.2.3. 8-DPSK Mode

A. Test Verdict:

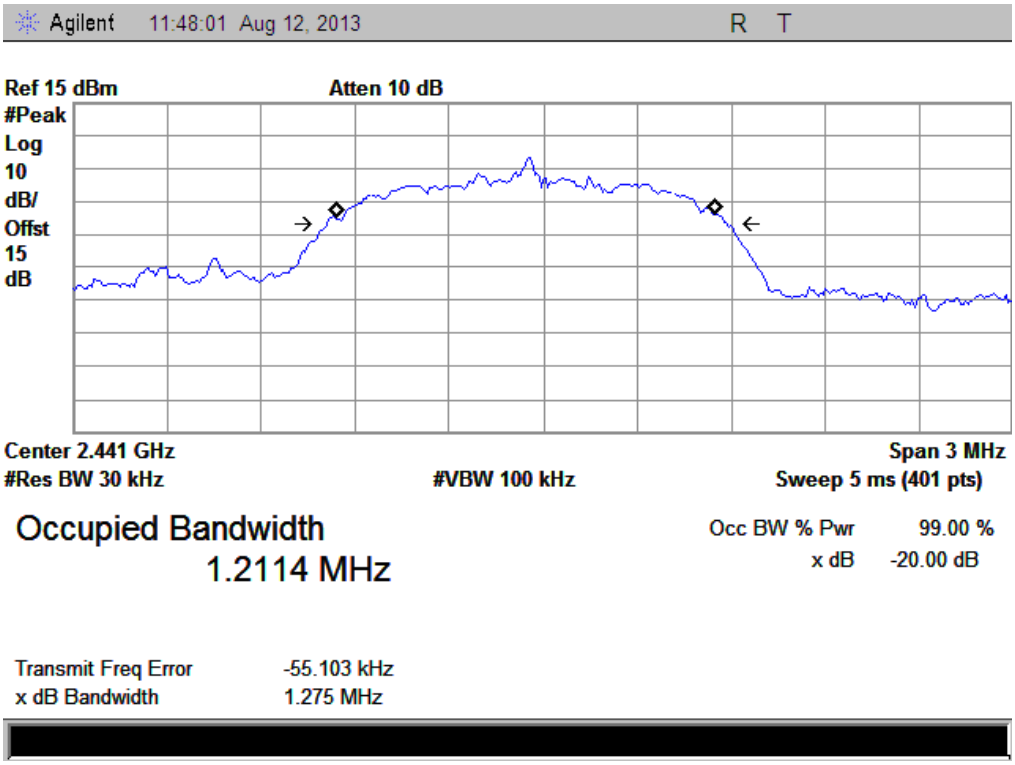
The maximum 20dB bandwidth measured is 1.2860MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.2860	Plot G
39	2441	1.2750	Plot H
78	2480	1.2730	Plot I

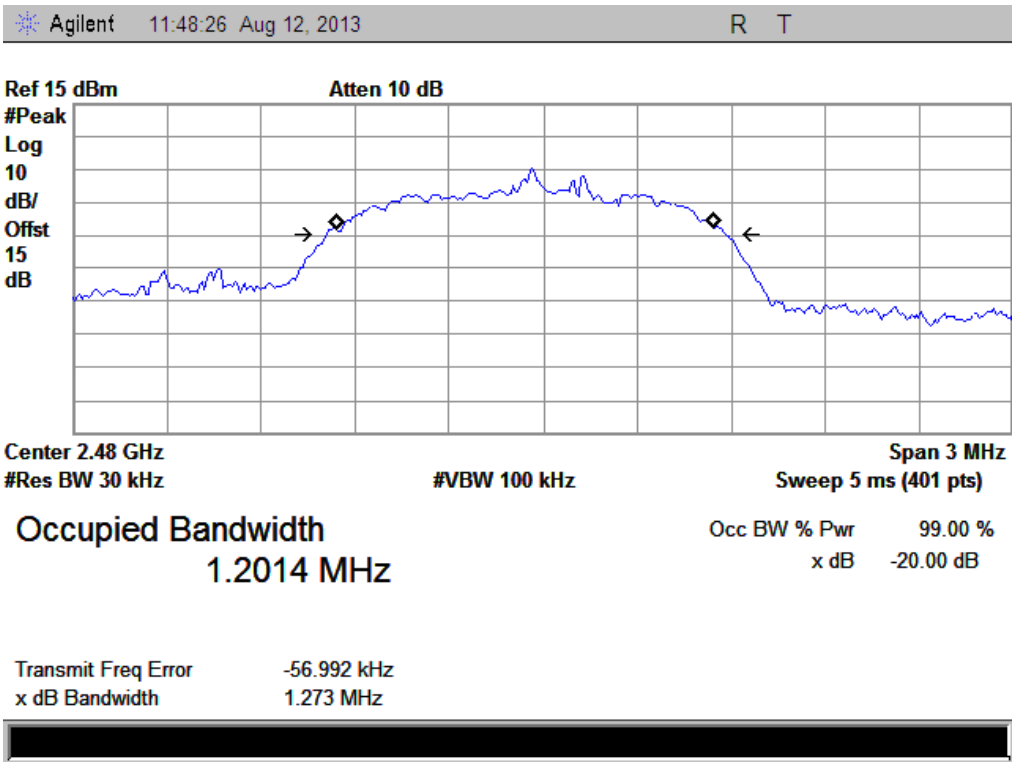
B. Test Plots:



(Plot G: Channel = 2402 @ 8-DPSK)



(Plot H: Channel = 2441 @ 8-DPSK)



(Plot I: Channel = 2480 @ 8-DPSK)

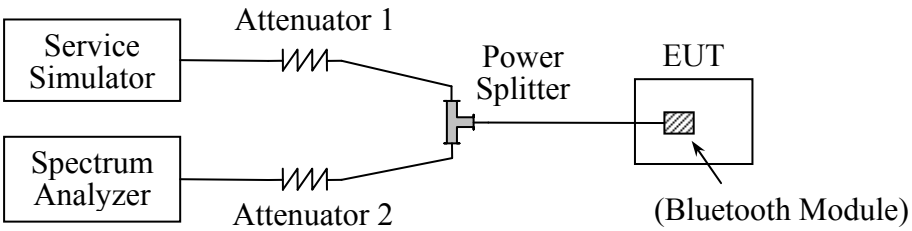
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC §15.247(a)(1), 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. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) withAttenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factoris calibrated to correct the reading.During the measurement, the Bluetooth Module of the EUT is activated and controlled by theSS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.5.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

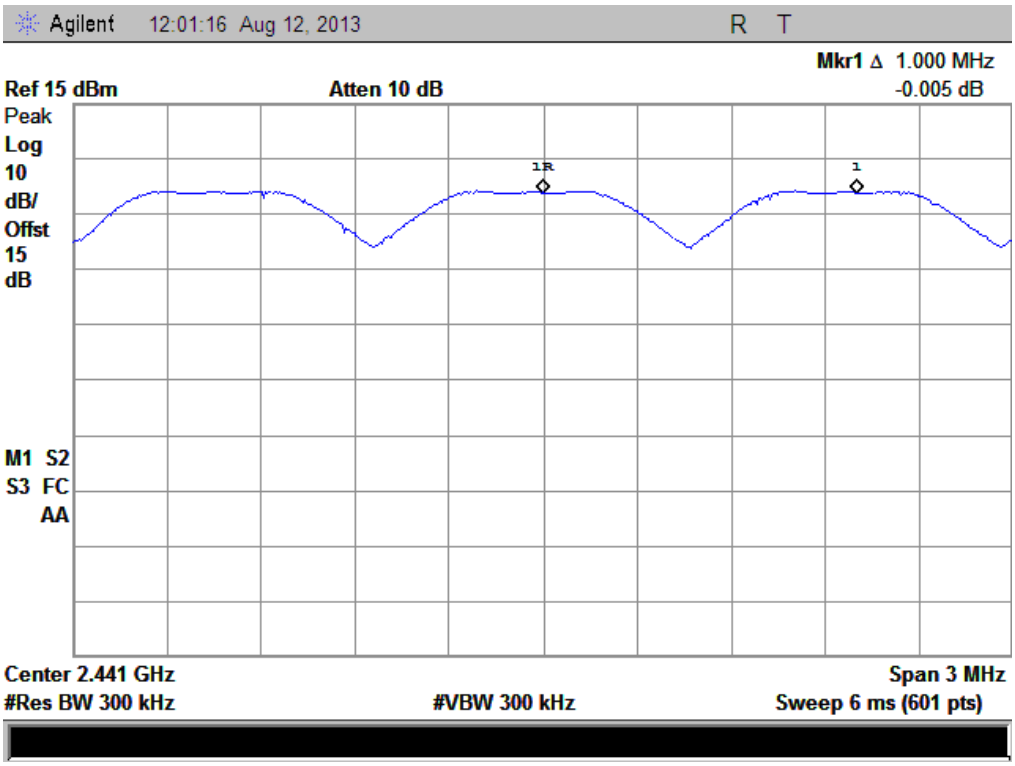
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

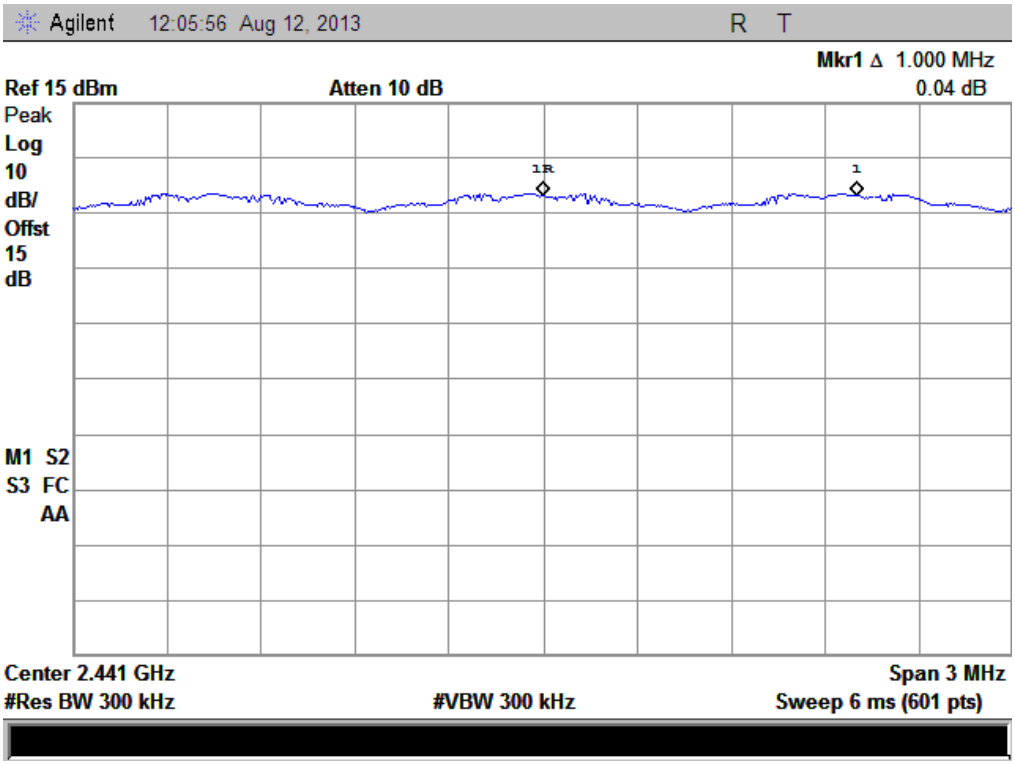
2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

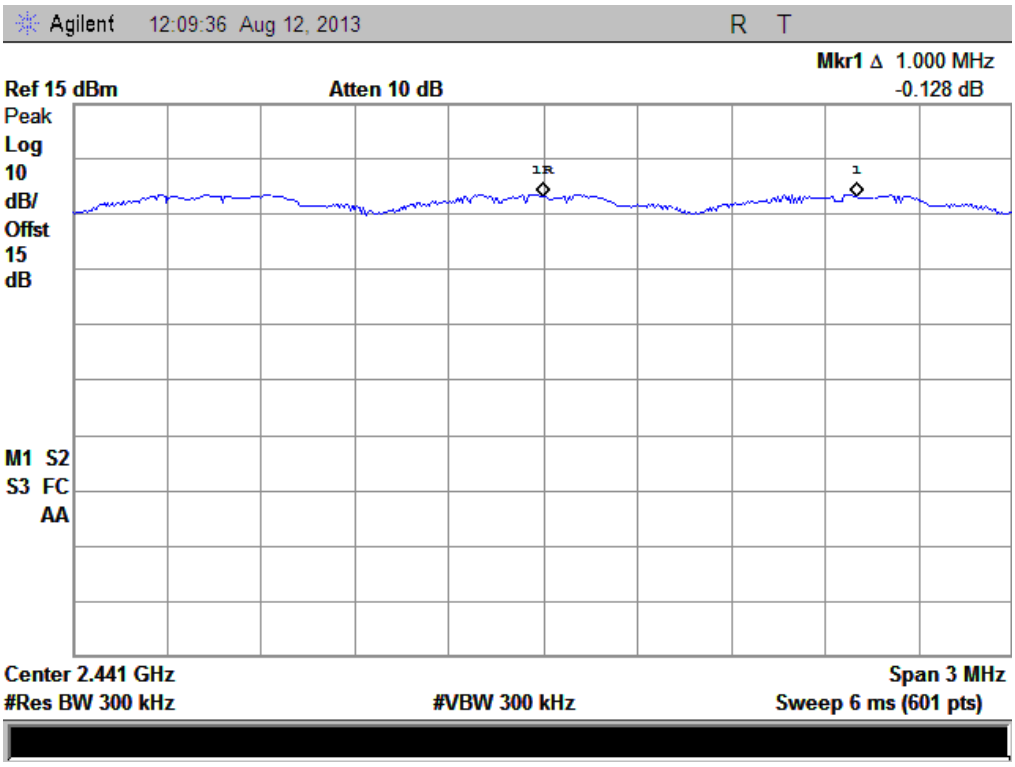
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (0.9648MHz for GFSK mode, 1.2770MHz for ∏/4-DQPSK mode and 1.2860MHz for 8-DPSK mode, refer to section 2.4.1), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



(Plot B: Π/4-DQPSK)



(Plot C: 8-DPSK)

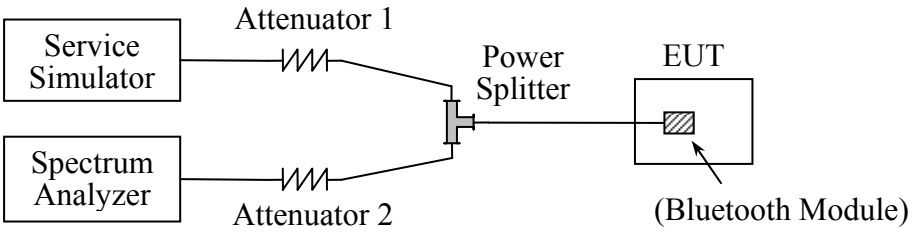
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.6.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) withAttenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factoris calibrated to correct the reading.During the measurement, the Bluetooth Module of the EUT is activated and controlled by theSS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.6.3. Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channel * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

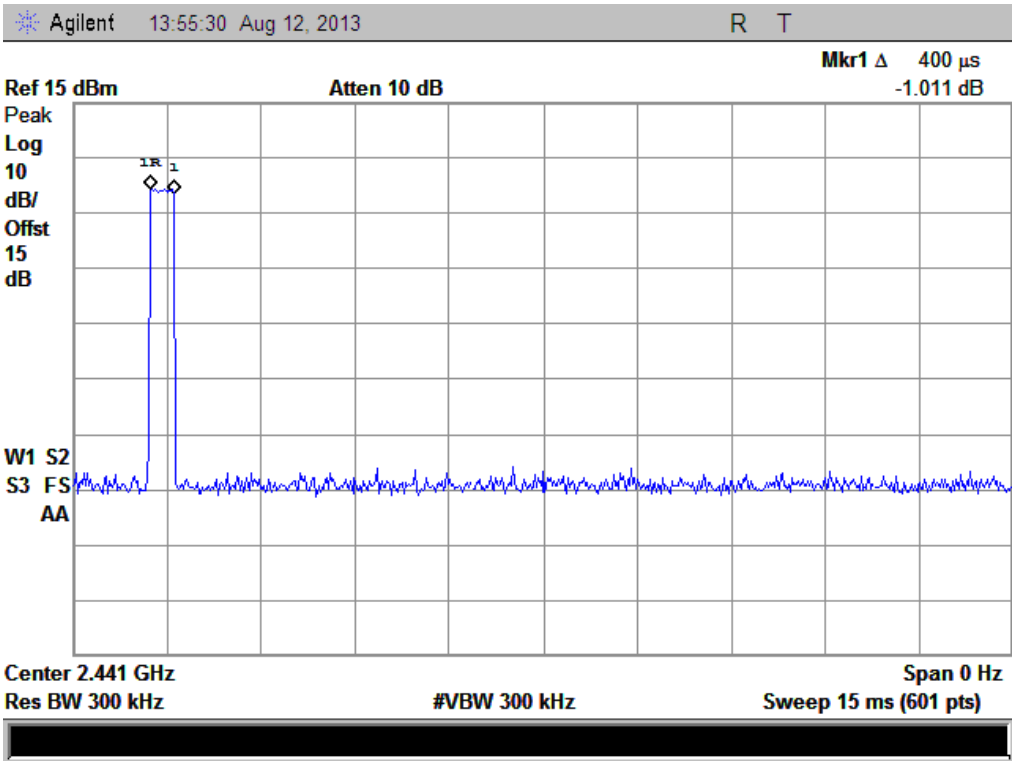
2.6.4. Test Result

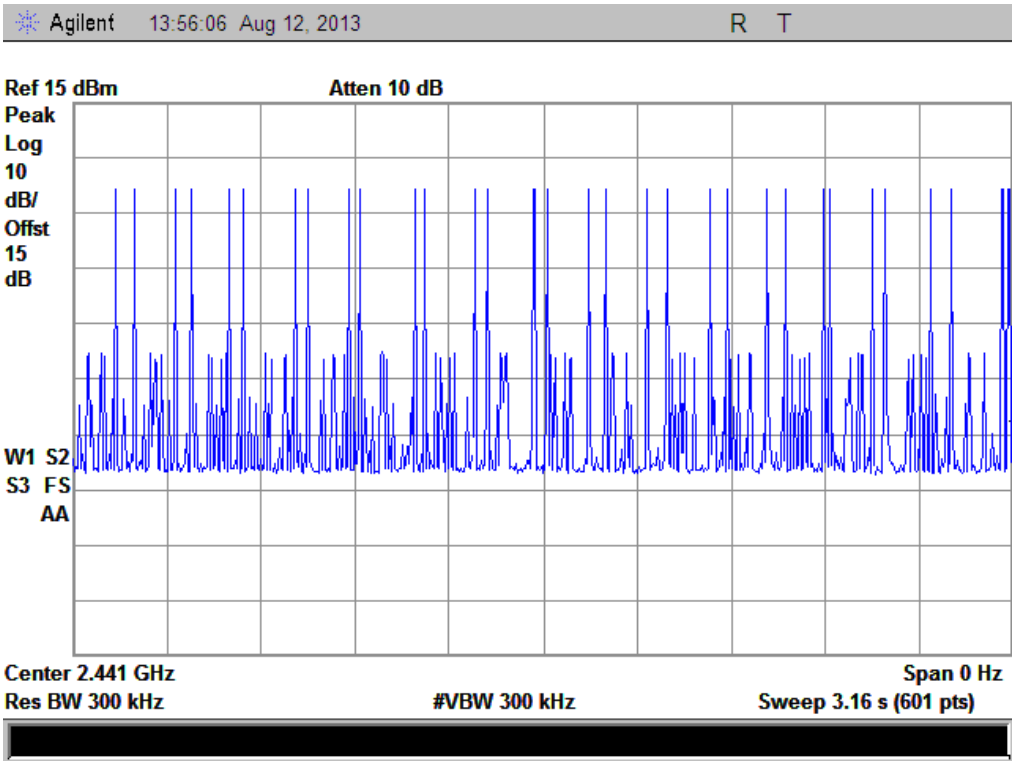
2.6.4.1. GFSK Mode

A. Test Verdict:

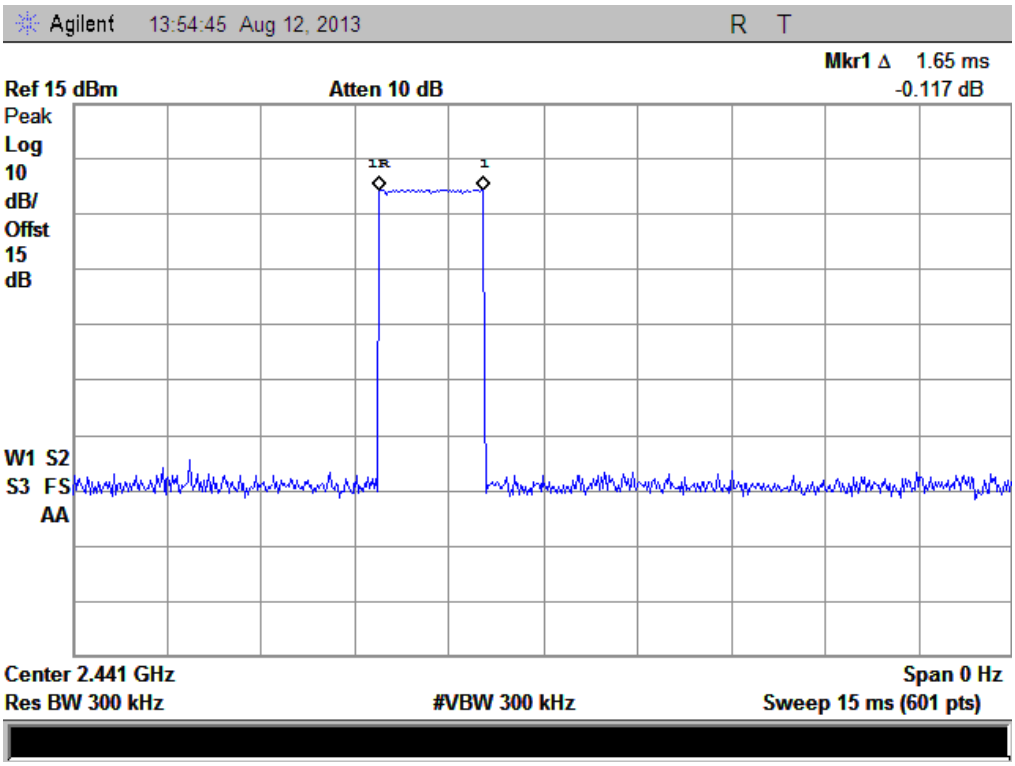
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.400	32	Plot A	0.128	0.4	PASS
DH3	1.650	11	Plot B	0.182		PASS
DH5	2.875	11	Plot C	0.316		PASS

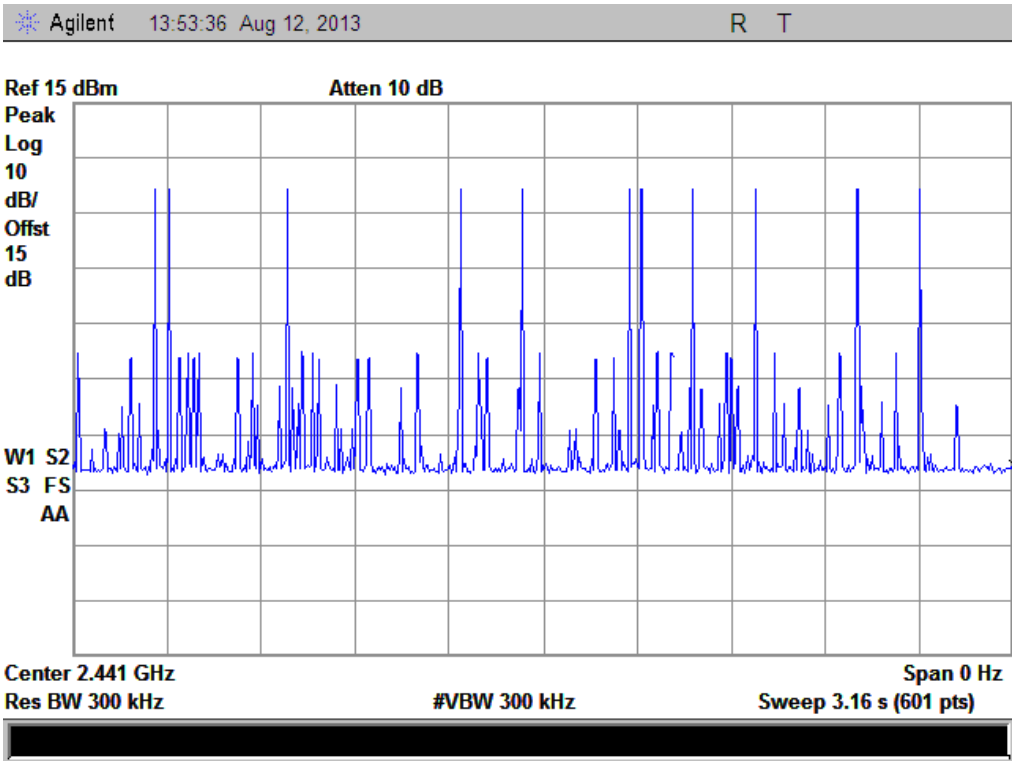
Test Plots:



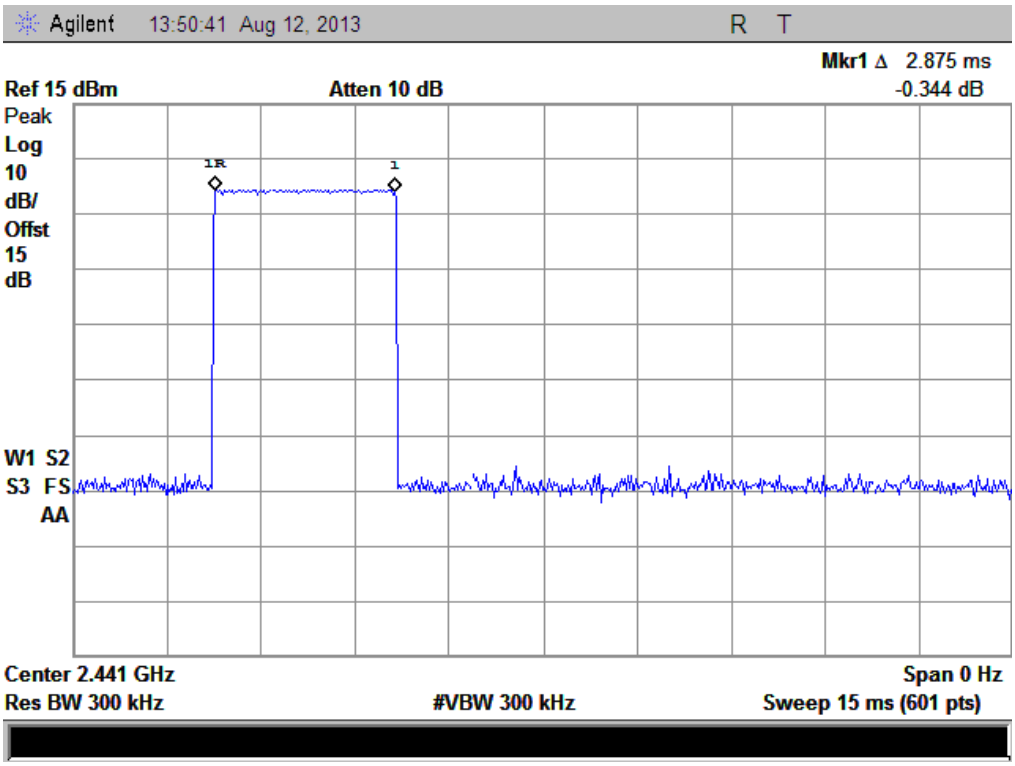


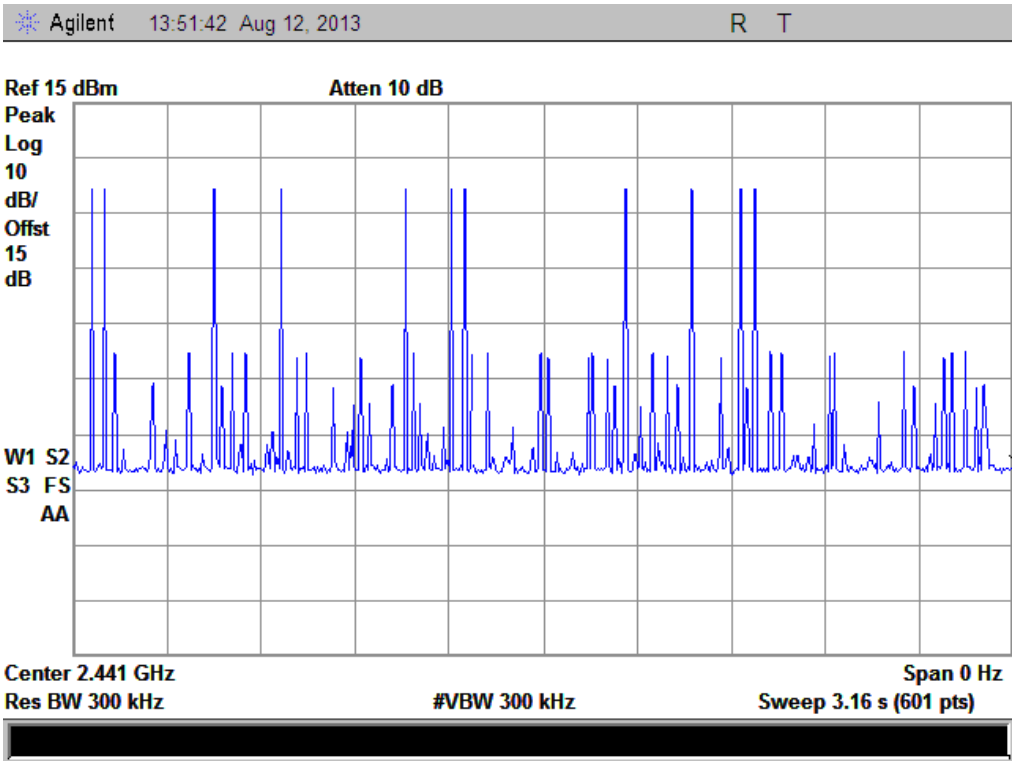
(Plot A: DH1 @ GFSK)





(Plot B: DH3 @ GFSK)





(Plot C: DH5 @ GFSK)

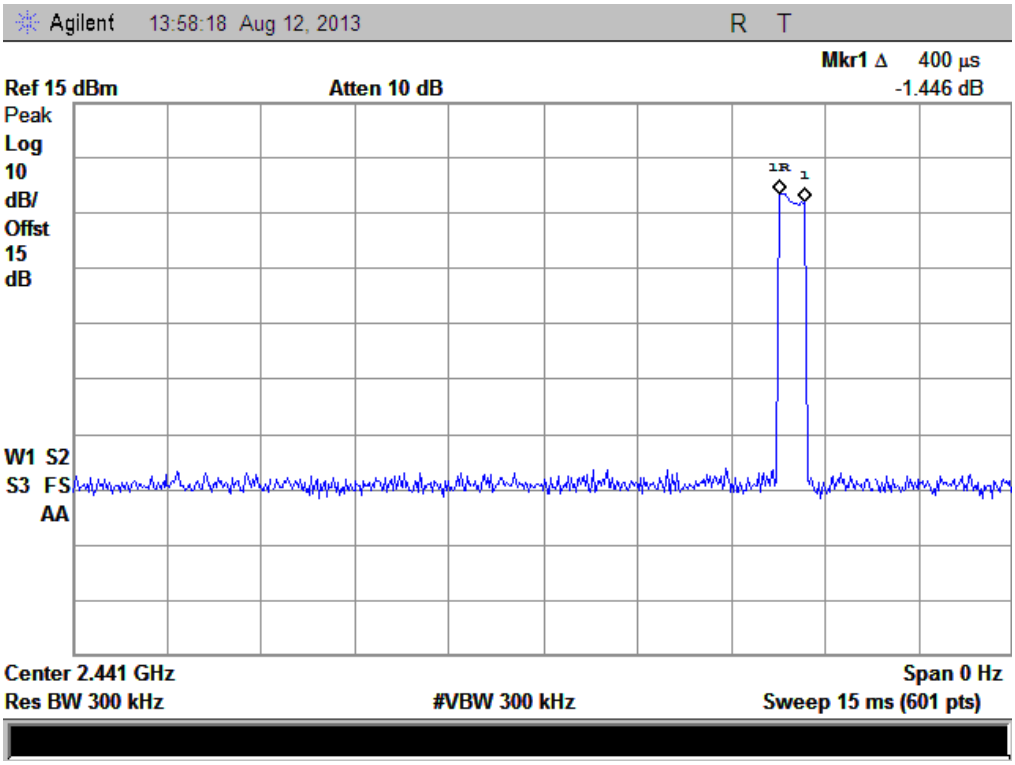
2.6.4.2. ∏/4-DQPSK Mode

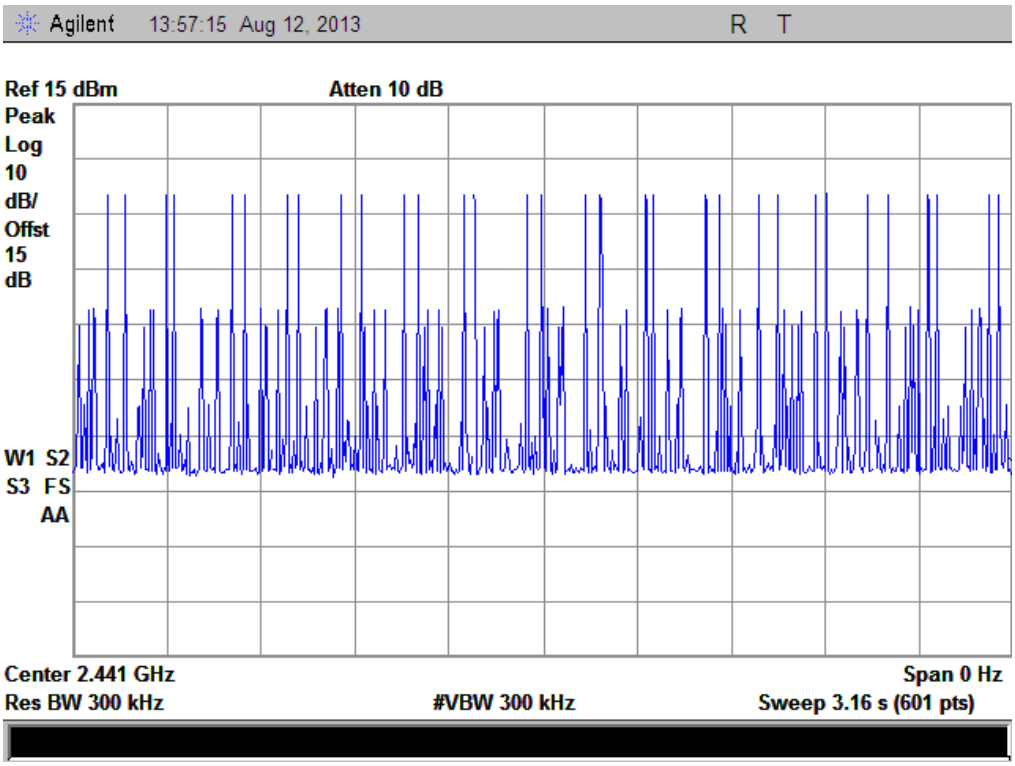
A. Test Verdict:

DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.400	32	Plot A	0.128	0.4	PASS
DH3	1.650	12	Plot B	0.198		PASS
DH5	2.900	10	Plot C	0.290		PASS

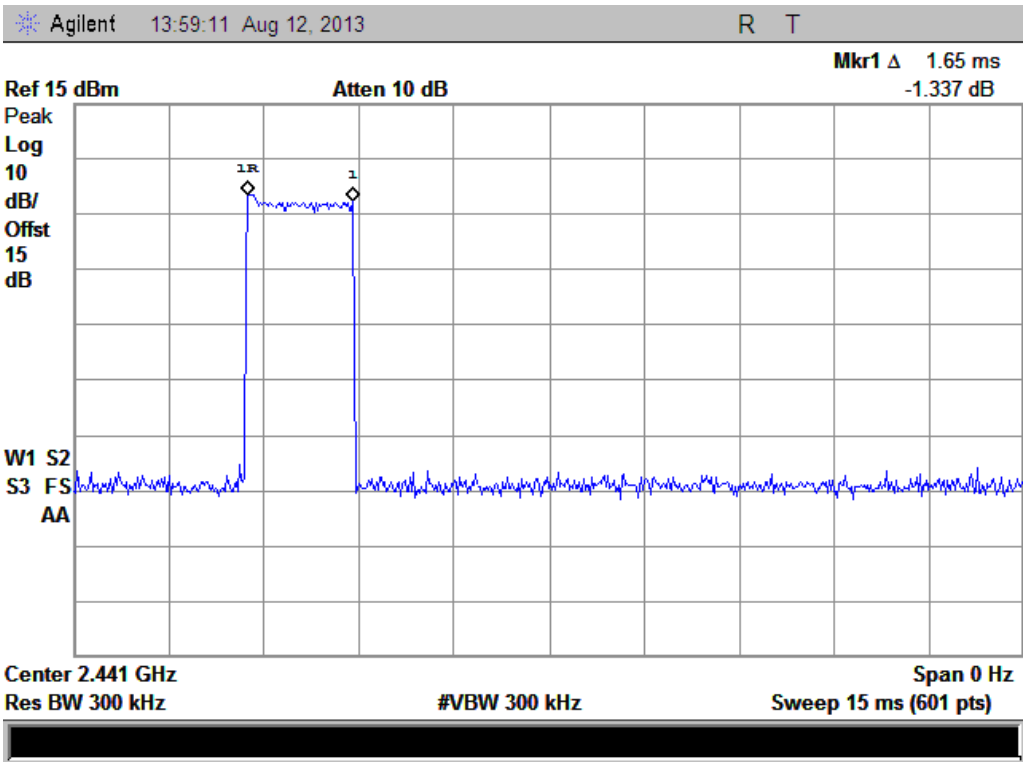
Test Plots:

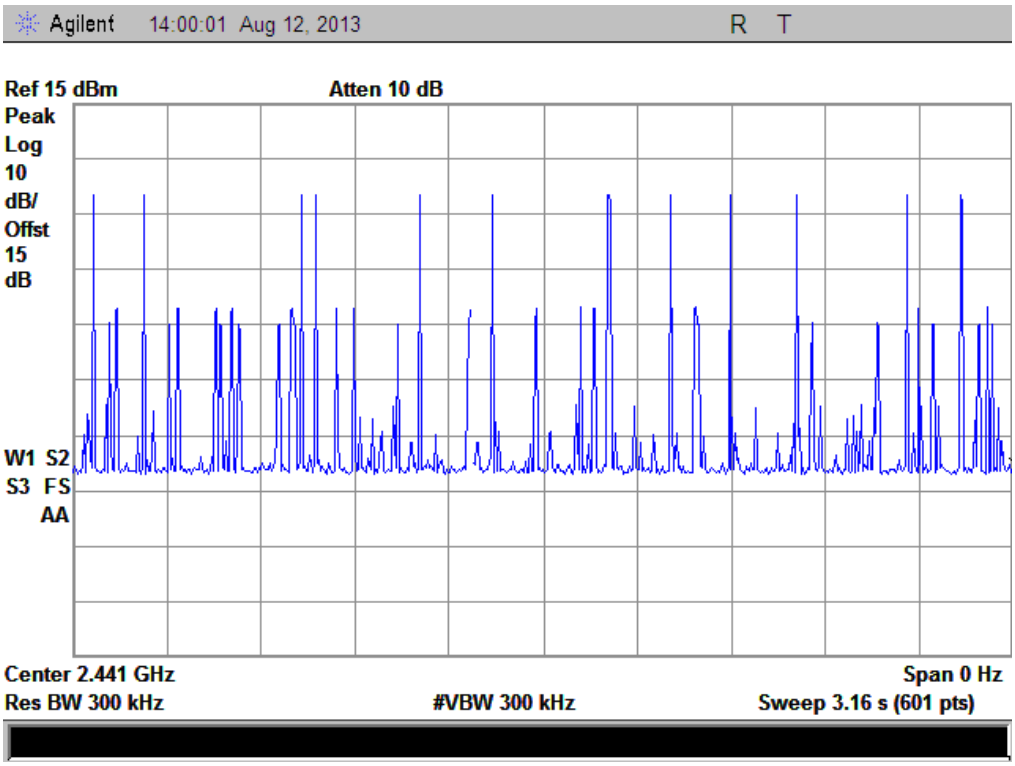
Note: the following plots record the Pulse Time of the Module carrier.



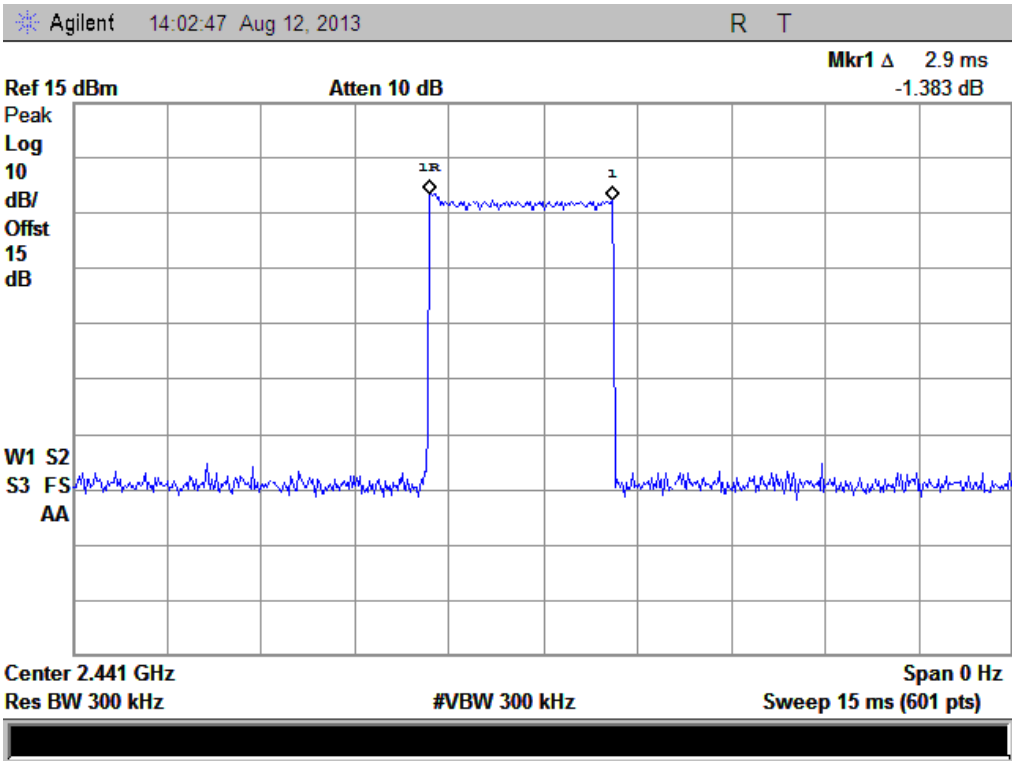


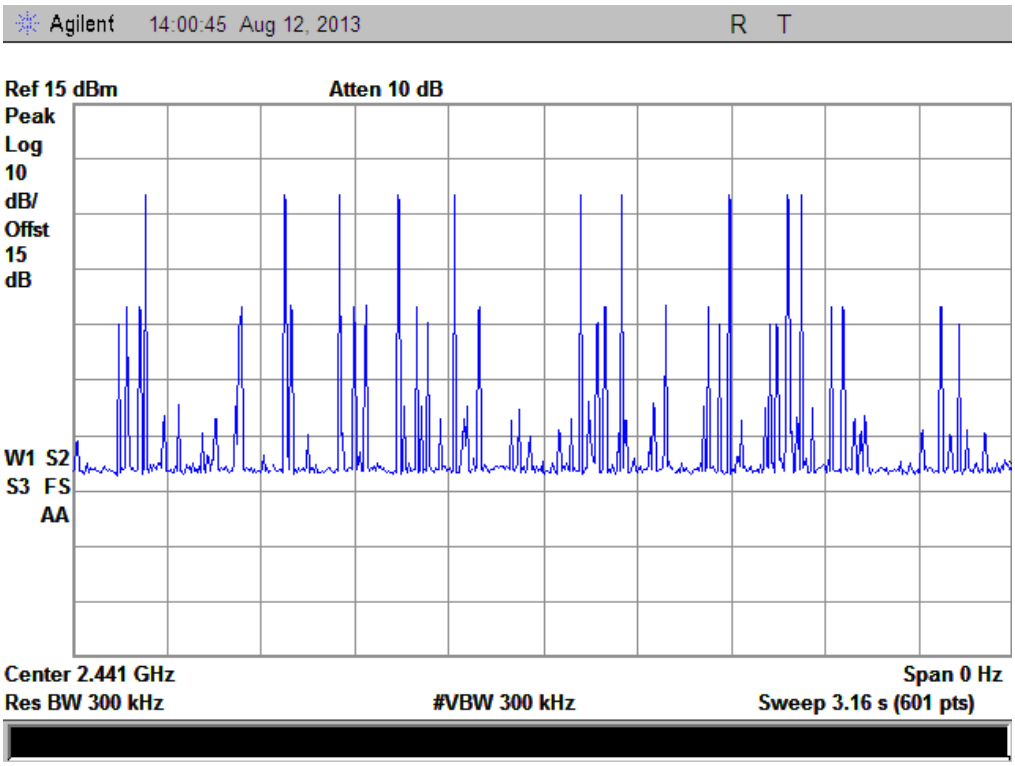
(Plot D: DH1 @ π/4-DQPSK)





(Plot E: DH3 @ π/4-DQPSK)





(Plot F: DH5 @ Π/4-DQPSK)

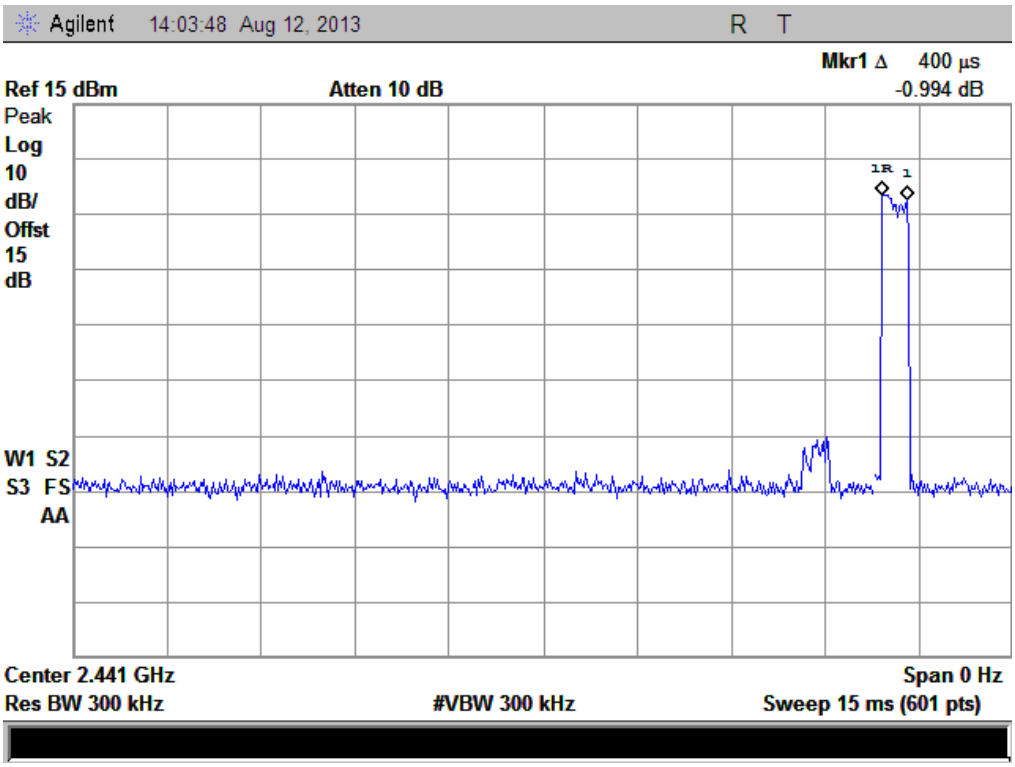
2.6.4.3. 8-DPSK mode

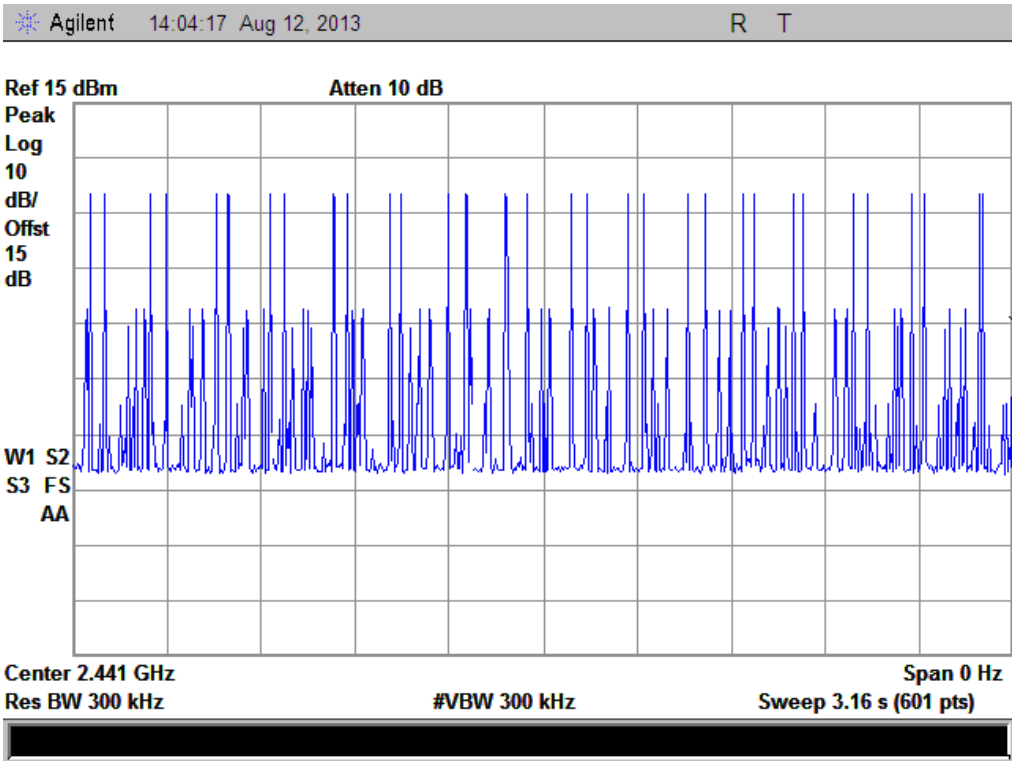
A. Test Verdict:

DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
DH1	0.400	32	Plot A	0.128	0.4	PASS
DH3	0.165	13	Plot B	0.215		PASS
DH5	2.925	10	Plot C	0.293		PASS

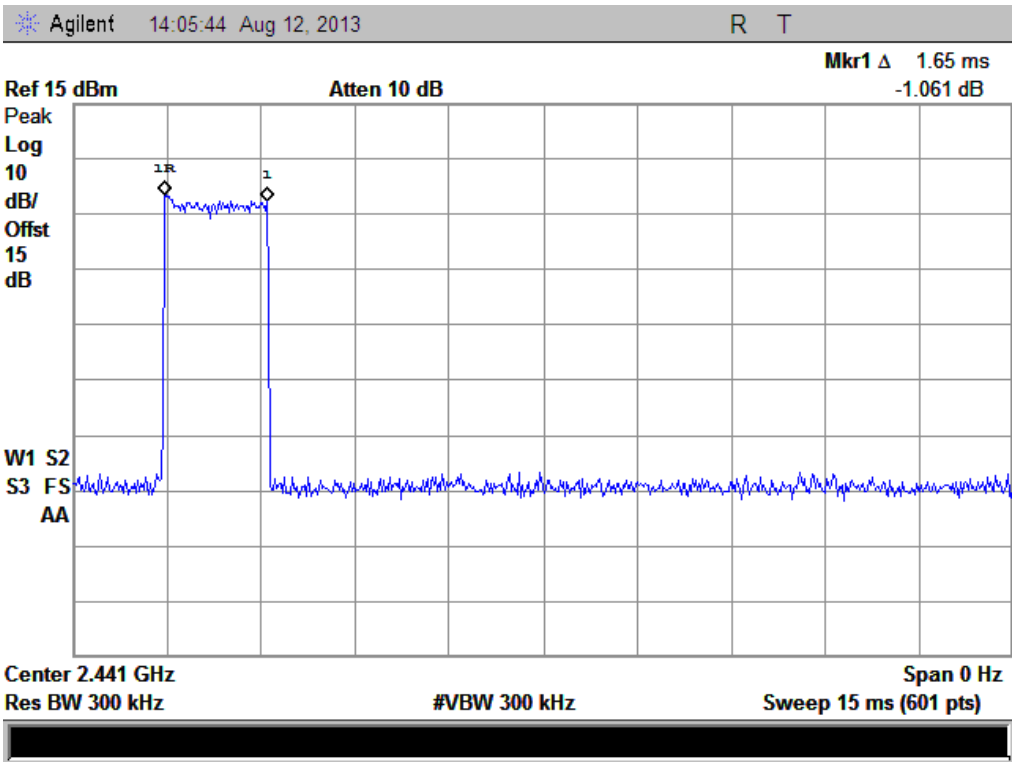
Test Plots:

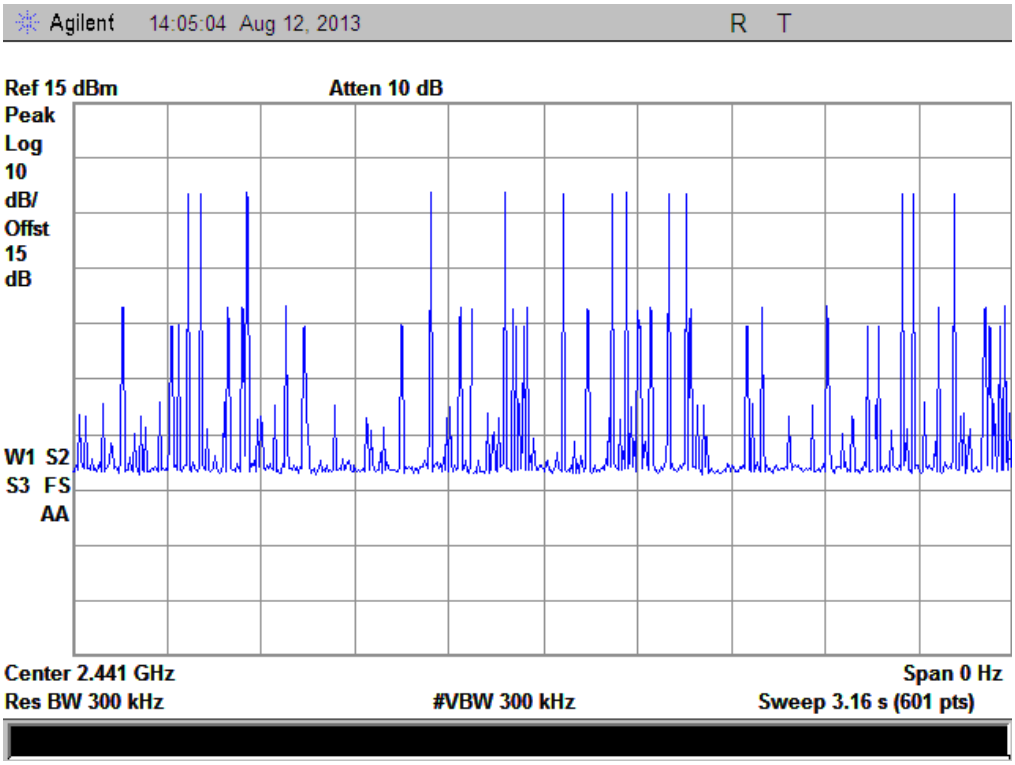
Note: the following plots record the Pulse Time of the Module carrier.



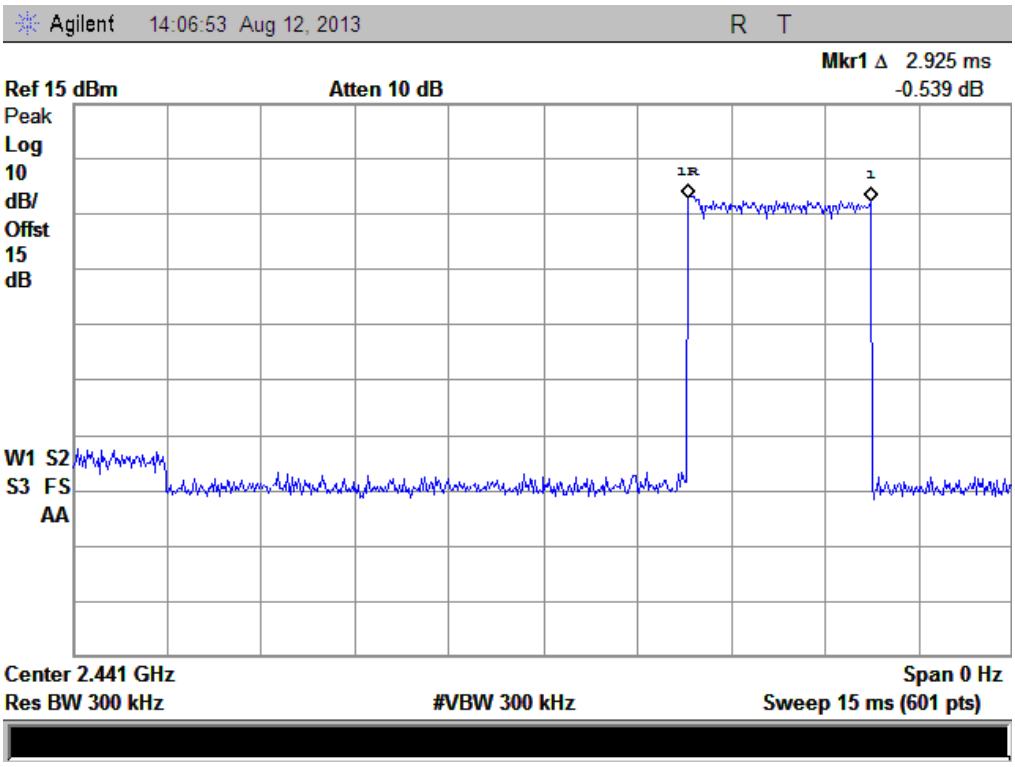


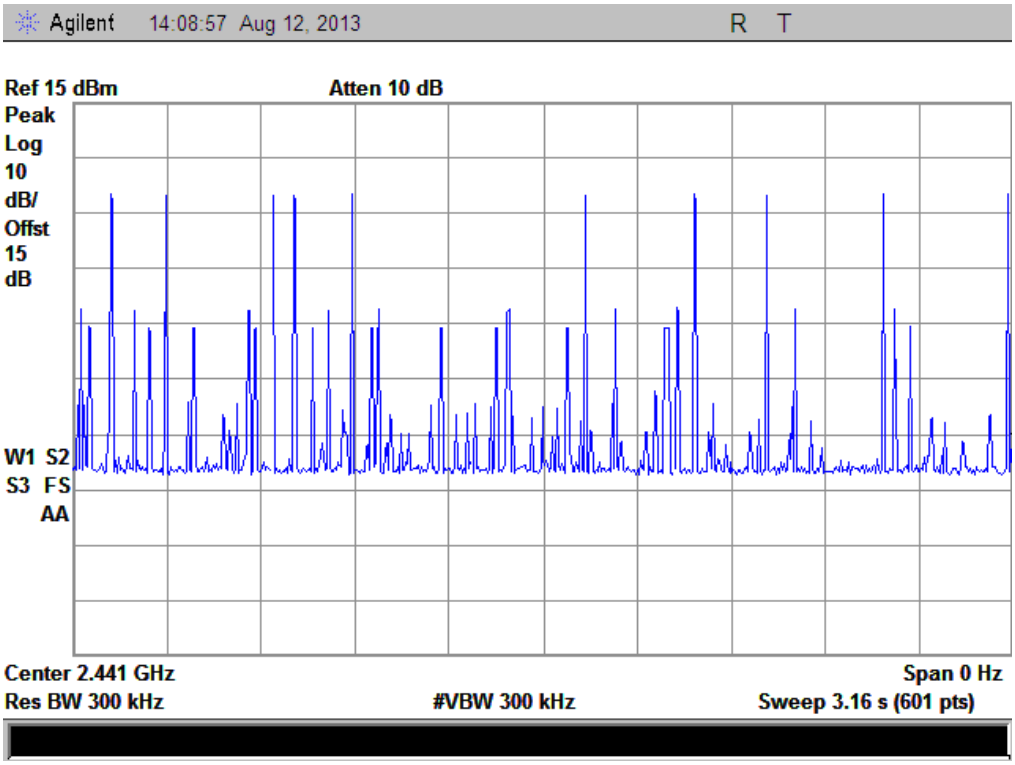
(Plot G: DH1 @ 8-DPSK)





(Plot H: DH3 @ 8-DPSK)





(Plot I: DH5 @ 8-DPSK)

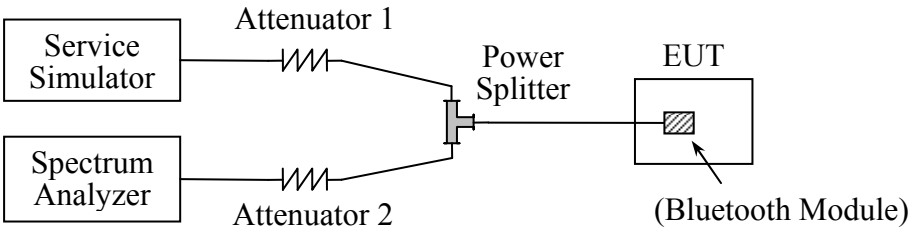
2.7. Conducted Spurious Emissions

2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.7.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the Bluetooth Service Simulator (SS) withAttenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm;the path loss as the factoris calibrated to correct the reading.During the measurement, the Bluetooth Module of the EUT is activated and controlled by theSS, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	Anritsu	MT8852B	6K00006210	2013.05.12	2014.05.11
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Power Splitter	Weinschel	1506A	NW521	2013.05.12	2014.05.11
Attenuator 1	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11
Attenuator 2	Resnet	3dB	(n.a.)	2013.05.12	2014.05.11

2.7.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.7.4. Test Result

The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

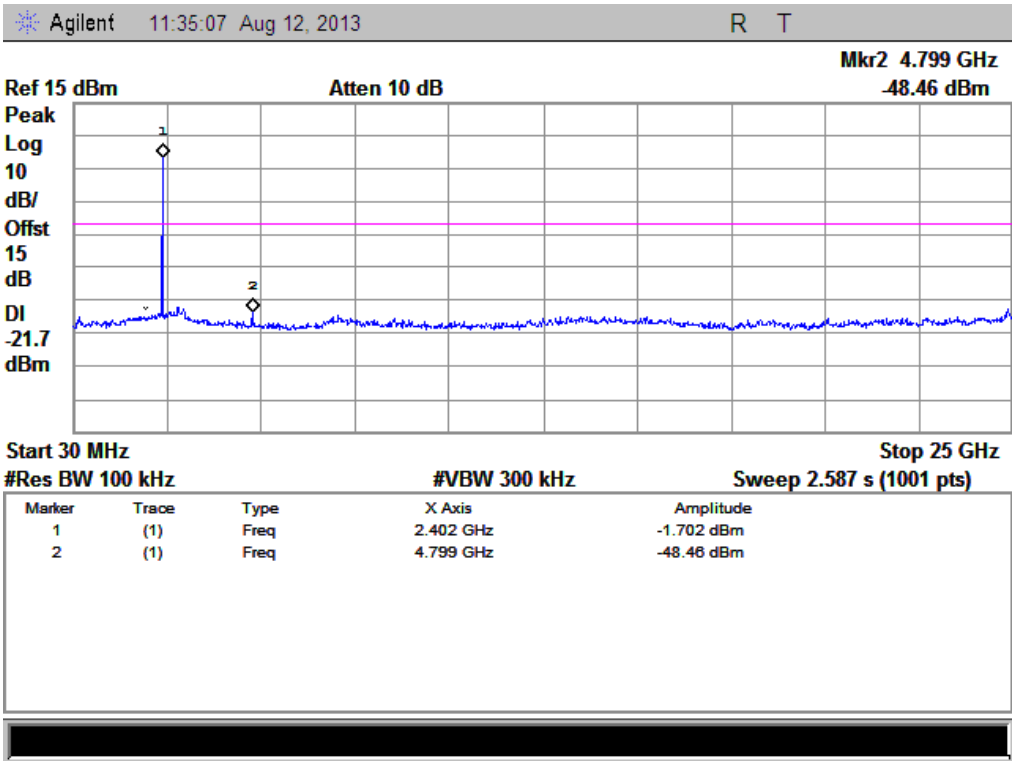
2.7.4.1. GFSK Mode

A. Test Verdict:

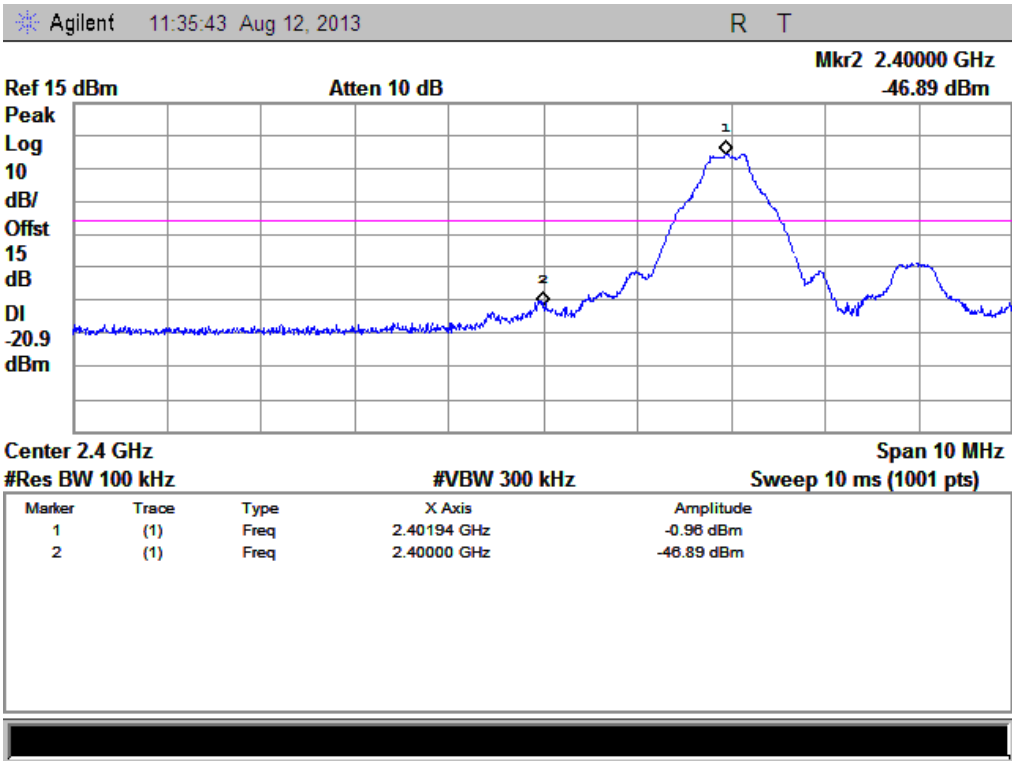
Channel	Frequency (MHz)	Measured Max. Out of Band Emission(dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-48.46	Plot A.1	-1.702	-21.7	PASS
39	2441	-48.52	Plot B.1	-1.702	-21.7	PASS
78	2480	-46.28	Plot C.1	-3.500	-23.5	PASS

B. Test Plots:

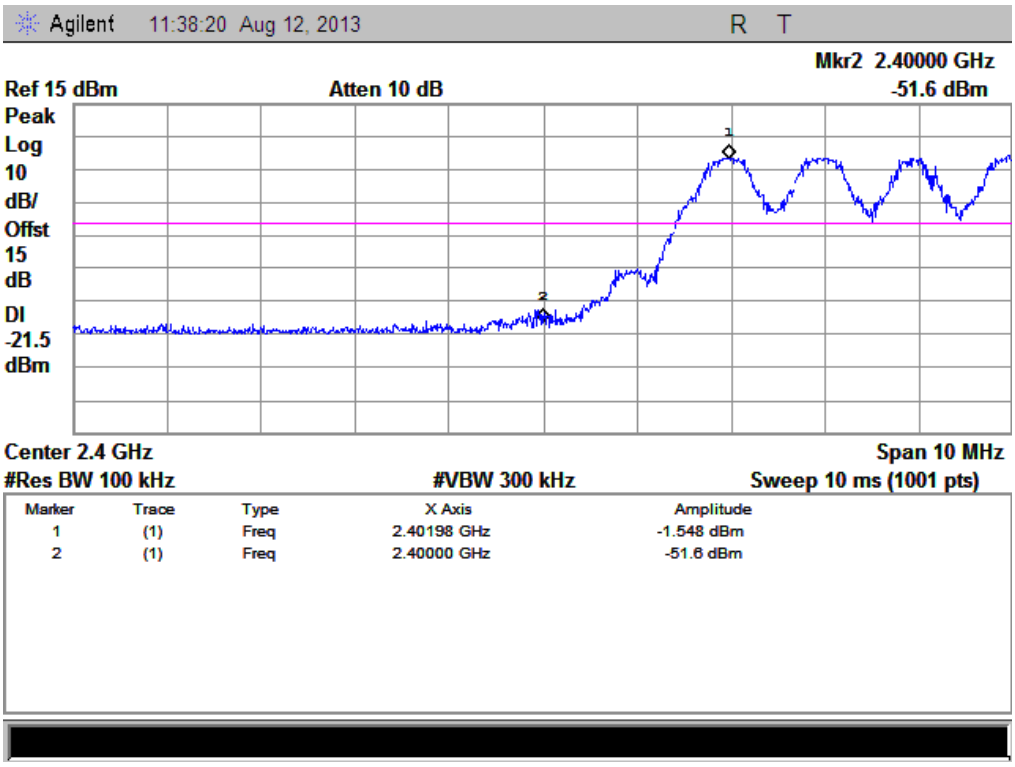
Note: the power of the Module transmitting frequency should be ignored.



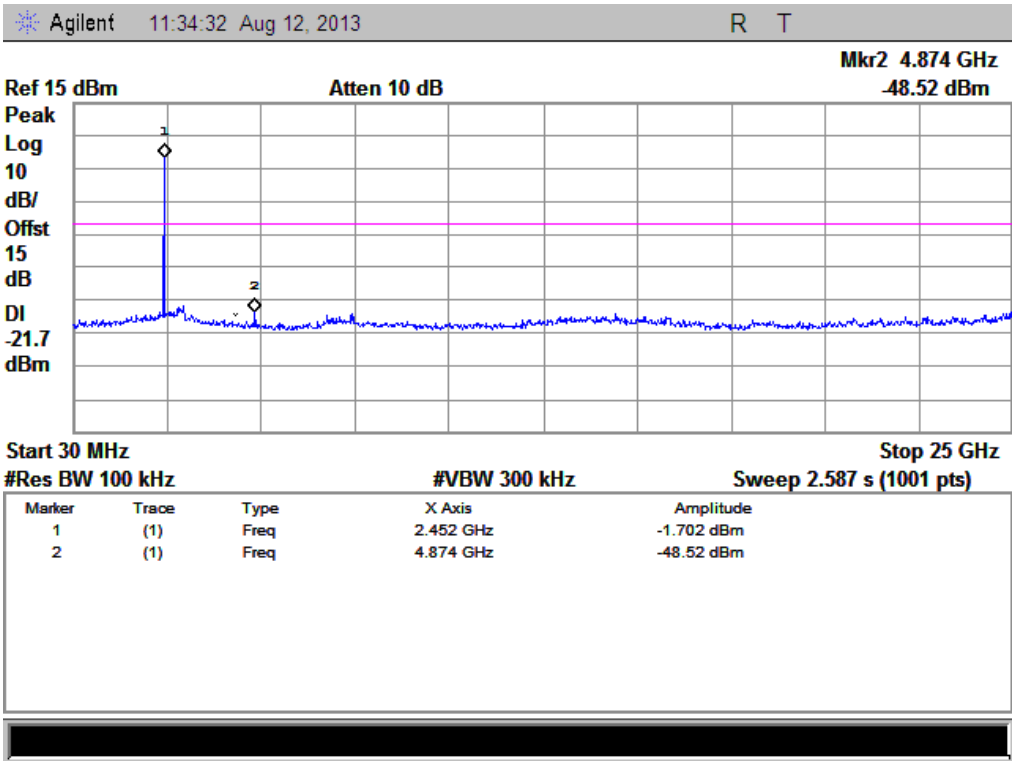
(Plot A.1: Channel = 0, 30MHz to 25GHz @ GFSK Mode)



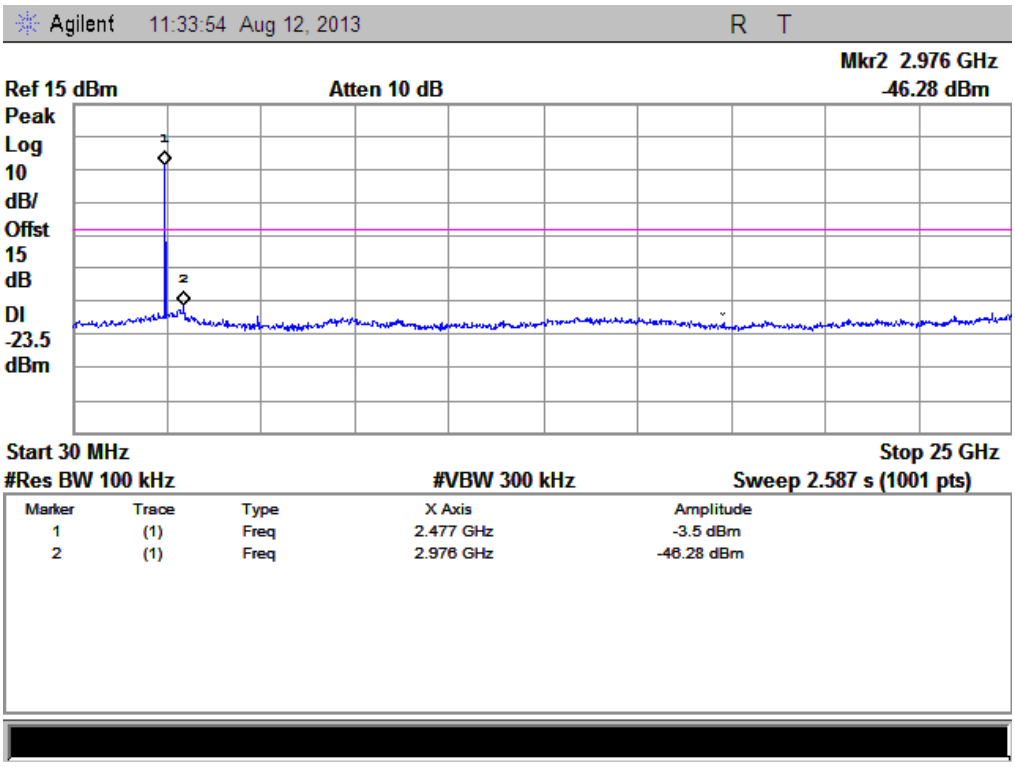
(Channel = 0, Band edge @ GFSK Mode)



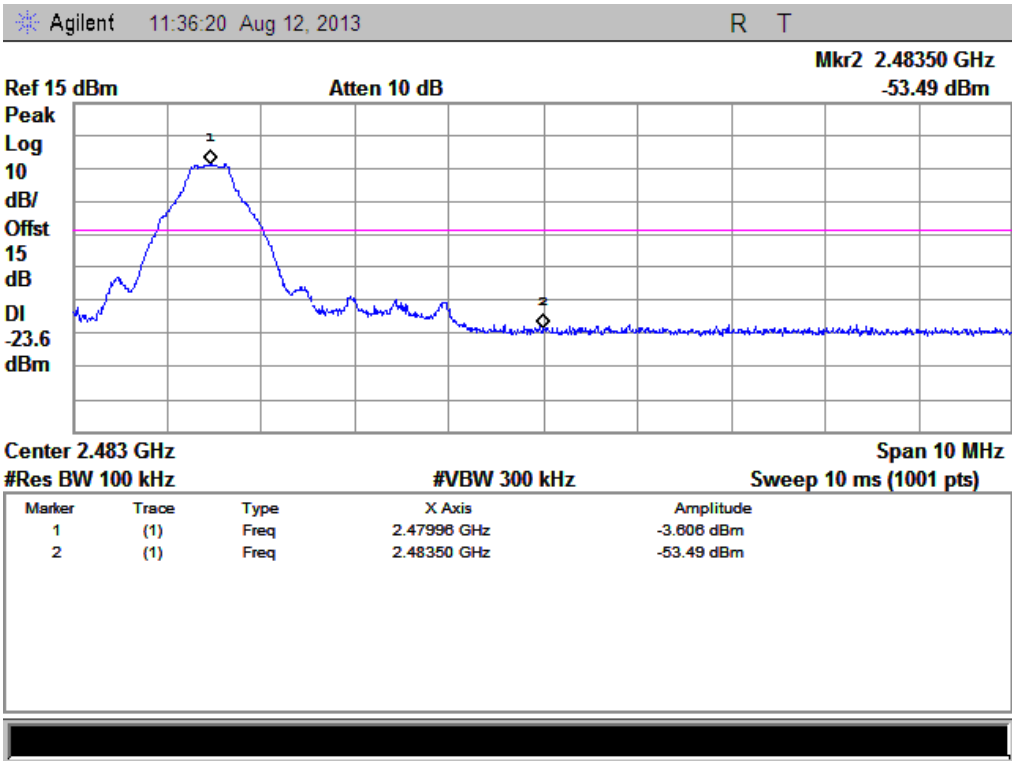
(Channel = 0, Band edge with hopping on @ GFSK Mode)



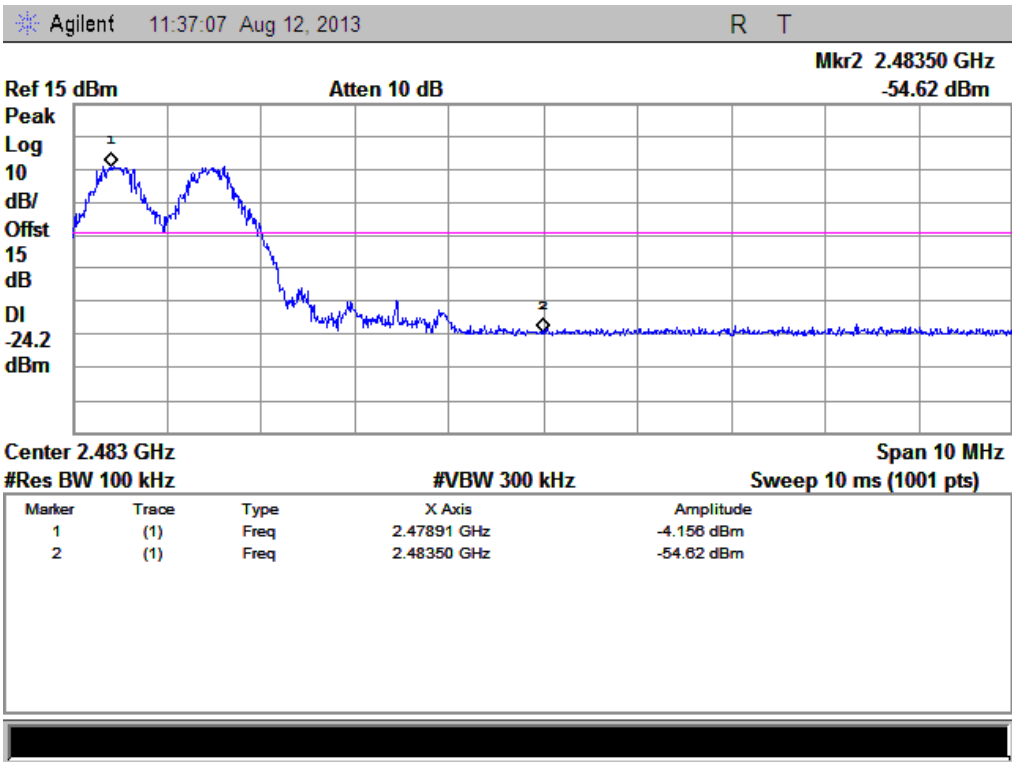
(Plot B.1: Channel = 39, 30MHz to 25GHz @ GFSK Mode)



(Plot C.1: Channel = 78, 30MHz to 25GHz @ GFSK Mode)



(Channel = 78, Band edge @ GFSK Mode)



(Channel = 78, Band edge with hopping on @ GFSK Mode)

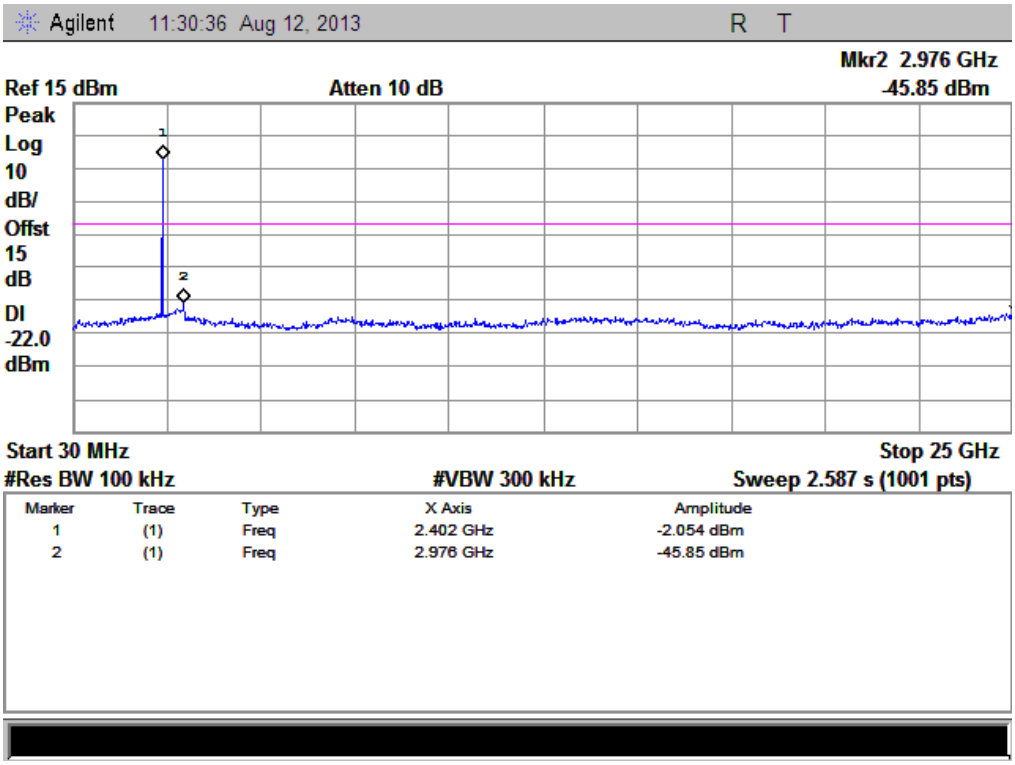
2.7.4.2. ∏/4-DQPSK Mode

A. Test Verdict:

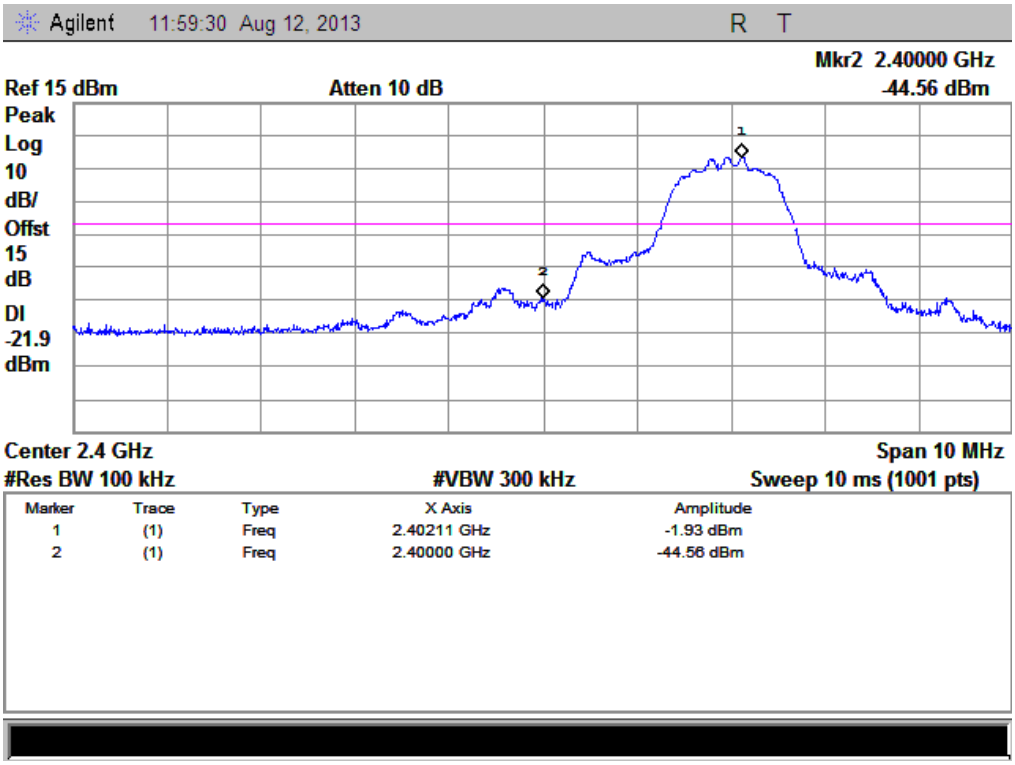
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-45.85	Plot D.1	-2.054	-22.0	PASS
39	2441	-46.86	Plot E.1	-5.628	-25.6	PASS
78	2480	-47.28	Plot F.1	-8.164	-28.2	PASS

B. Test Plots:

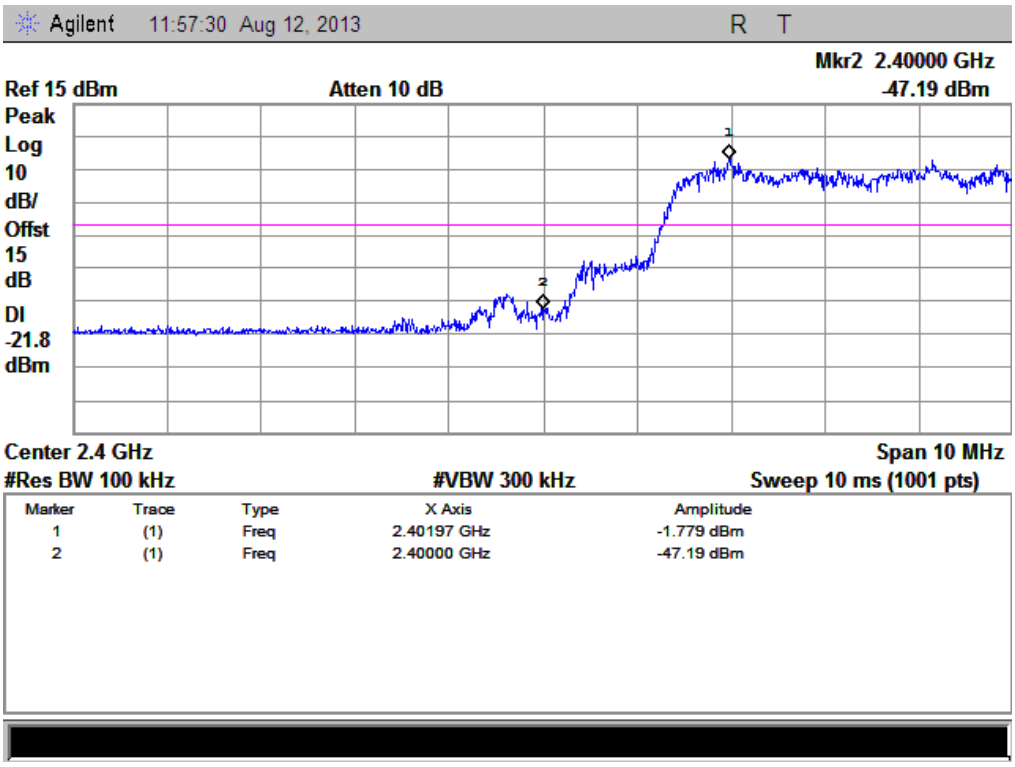
Note: the power of the Module transmitting frequency should be ignored.



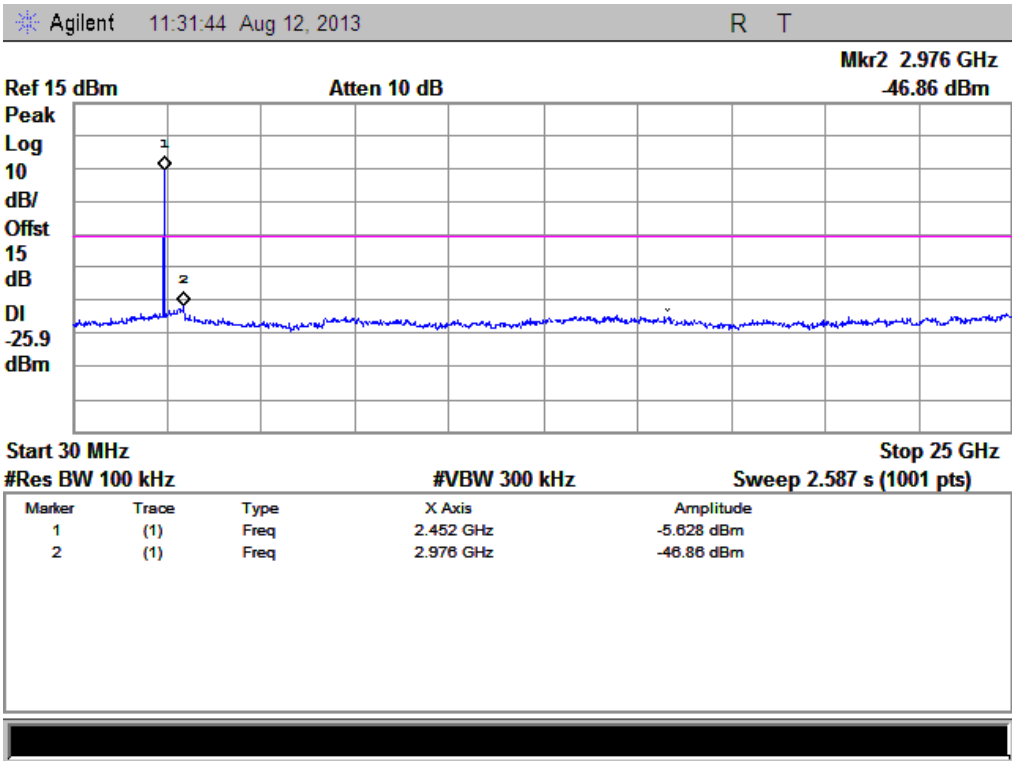
(Plot D.1: Channel = 0, 30MHz to 25GHz @ ∏/4-DQPSK)



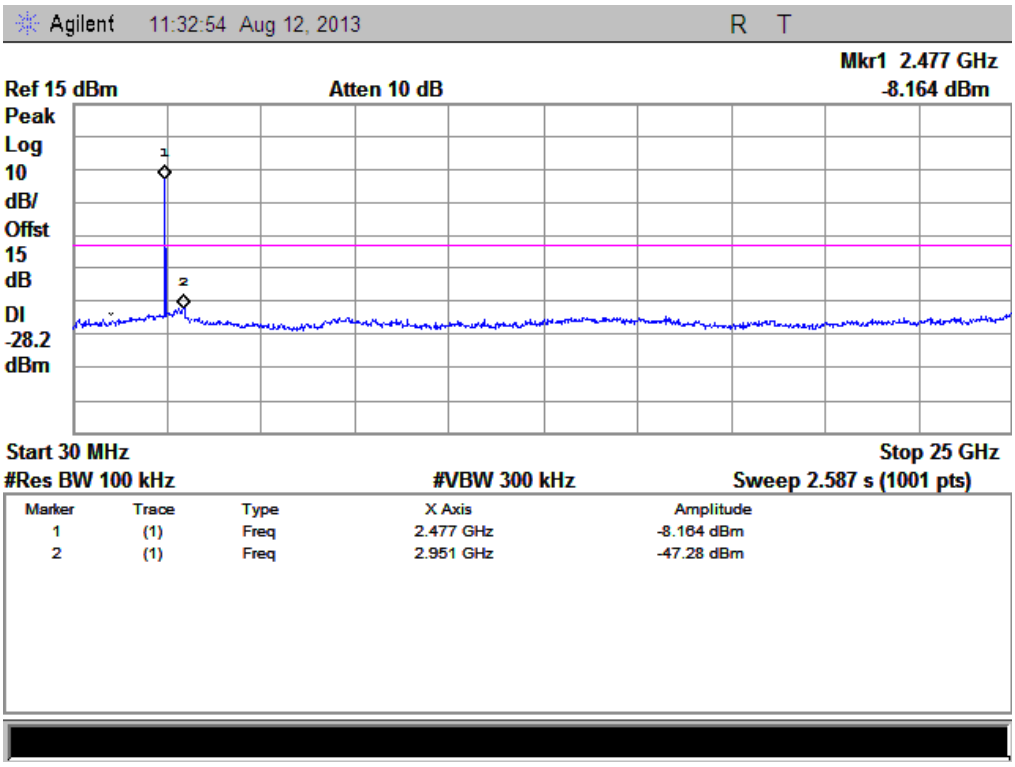
(Channel = 0, Band edge @ ∏/4-DQPSK)



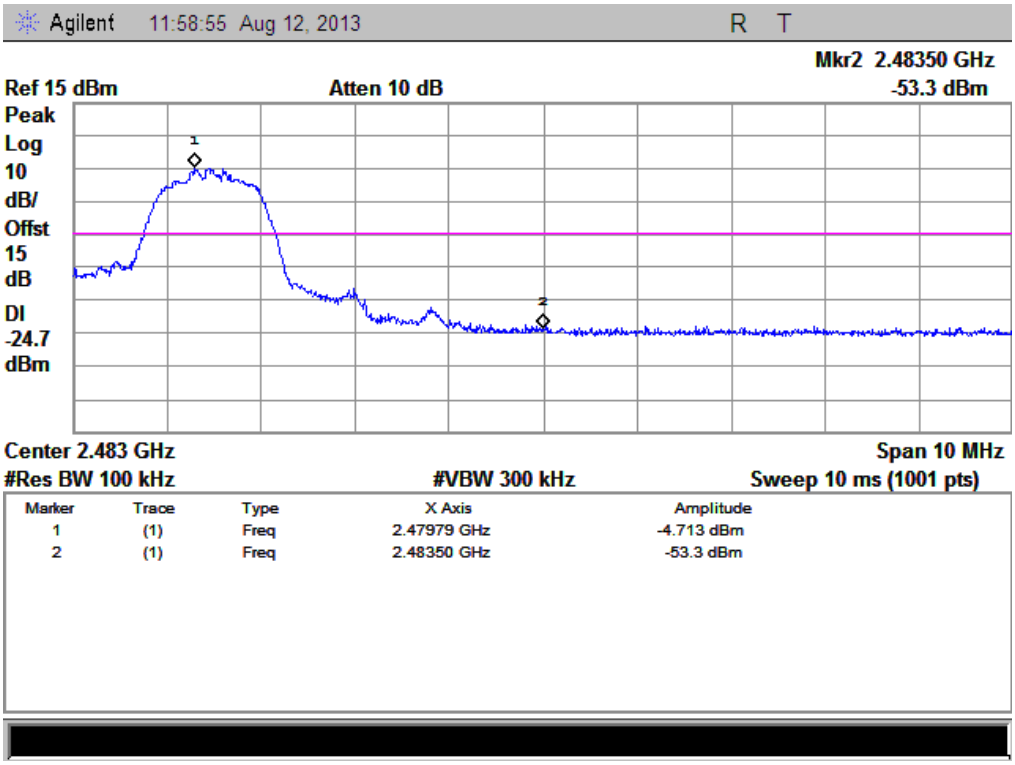
(Channel = 0, Band edge with hopping on @ ∏/4-DQPSK)



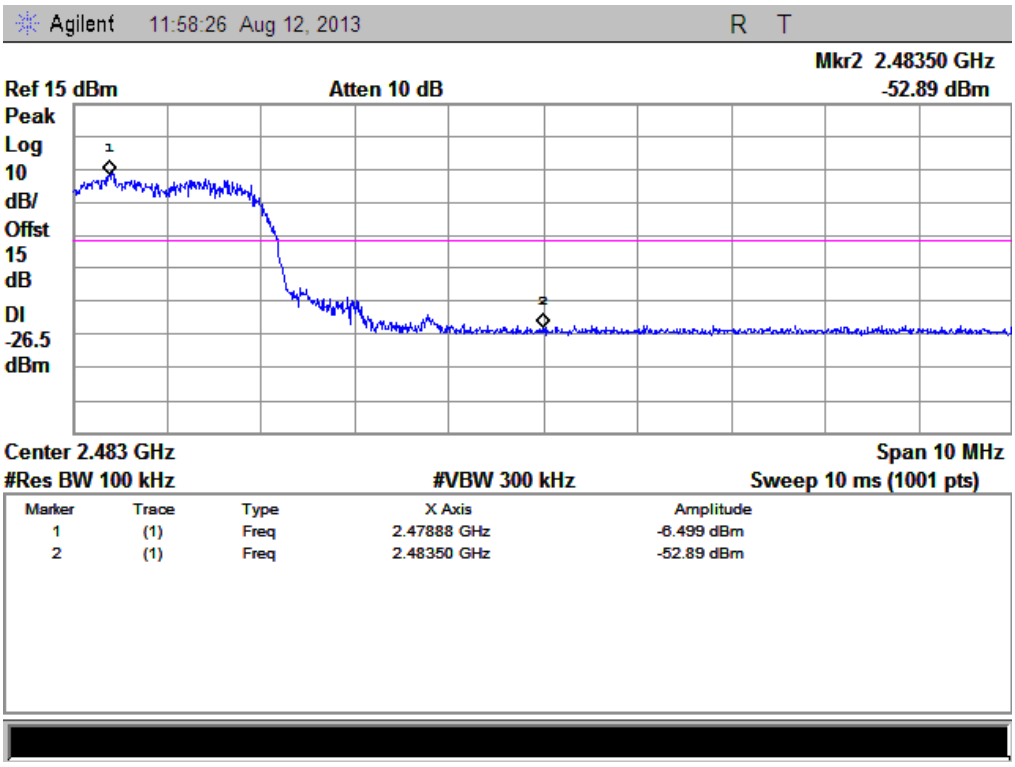
(Plot E.1: Channel = 39, 30MHz to 25GHz @ Π/4-DQPSK)



(Plot F.1: Channel = 78, 30MHz to 25GHz @ Π/4-DQPSK)



(Channel = 78, Band edge @ Π/4-DQPSK)



(Channel = 78, Band edge with hopping on @ Π/4-DQPSK)

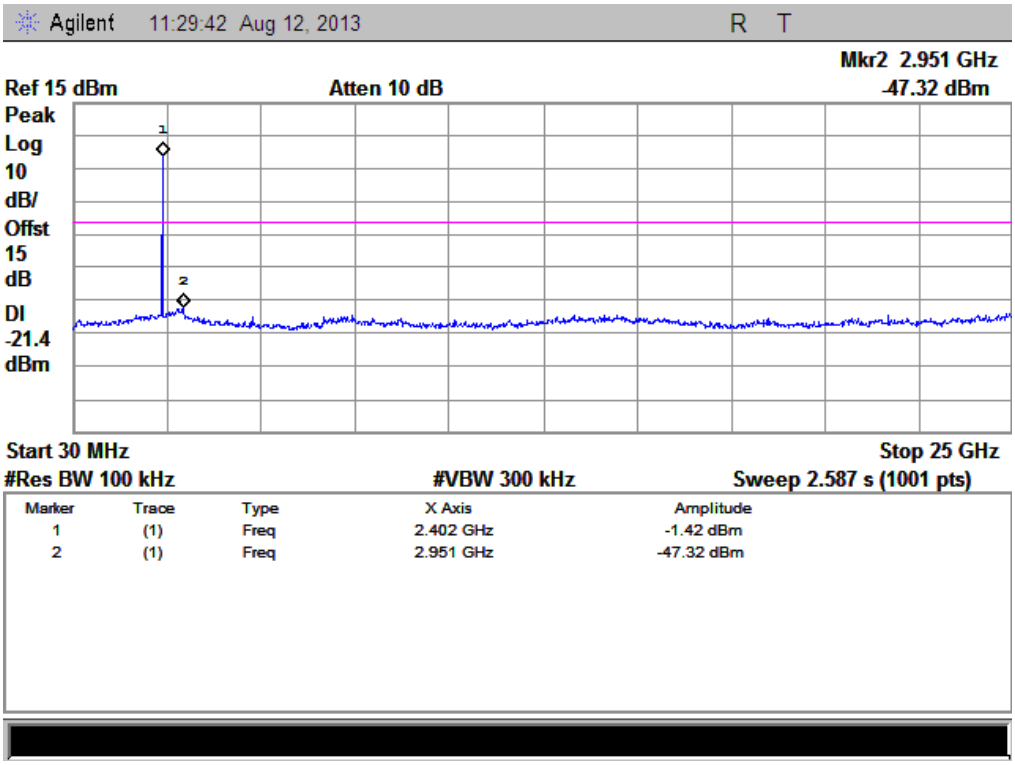
2.7.4.3. 8-DPSK Mode

A. Test Verdict:

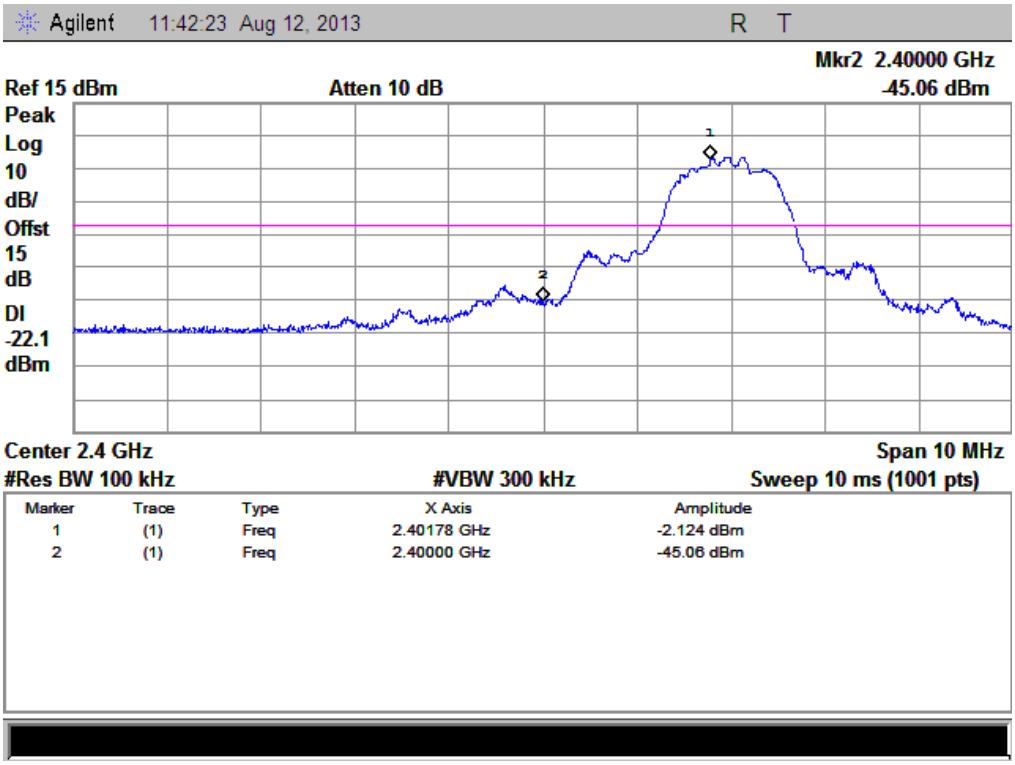
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-47.32	Plot G.1	-1.420	-21.4	PASS
39	2441	-47.01	Plot H.1	-4.815	-24.8	PASS
78	2480	-46.76	Plot I.1	-6.968	-27.0	PASS

B. Test Plots:

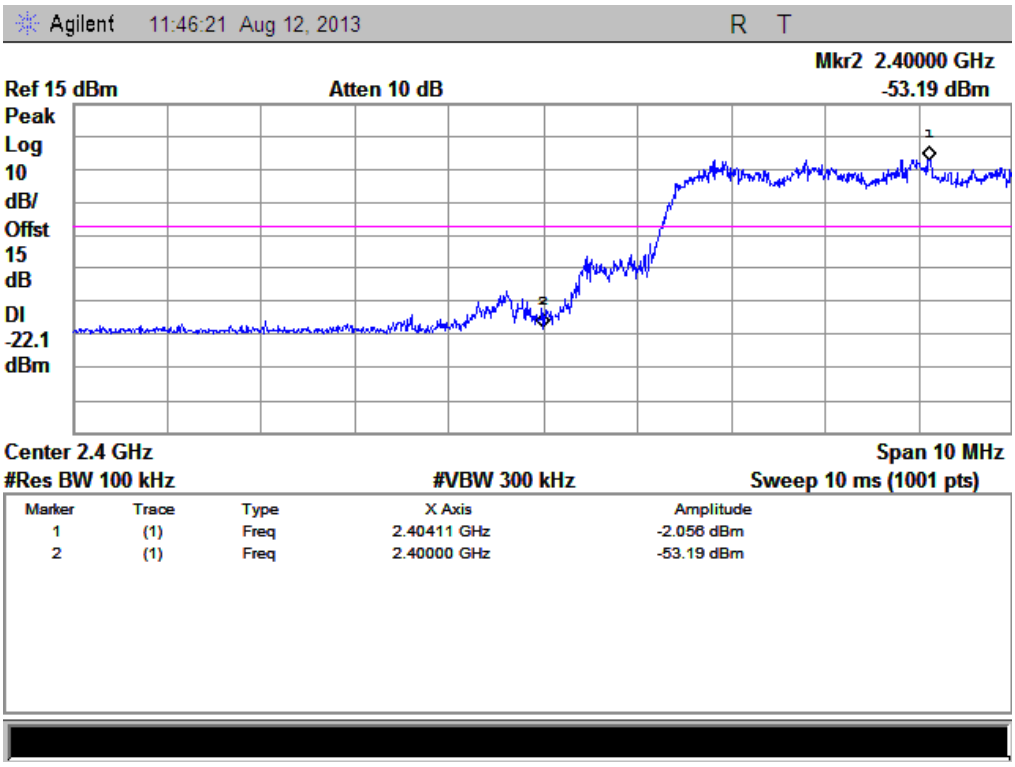
Note: the power of the Module transmitting frequency should be ignored.



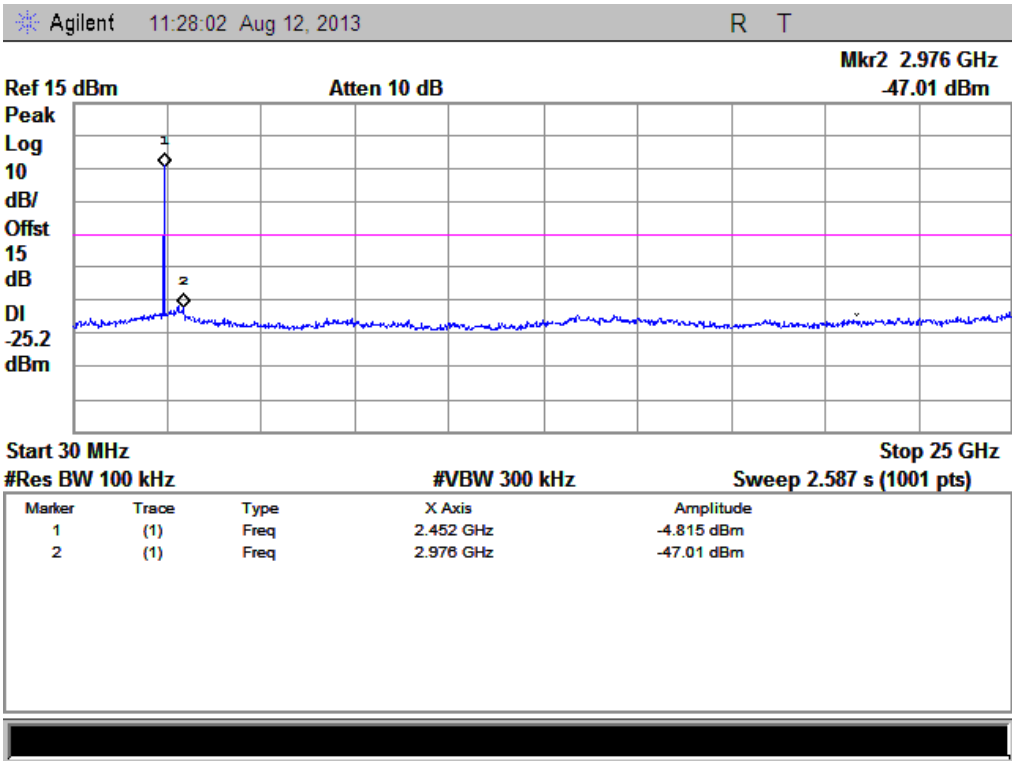
(Plot G.1: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



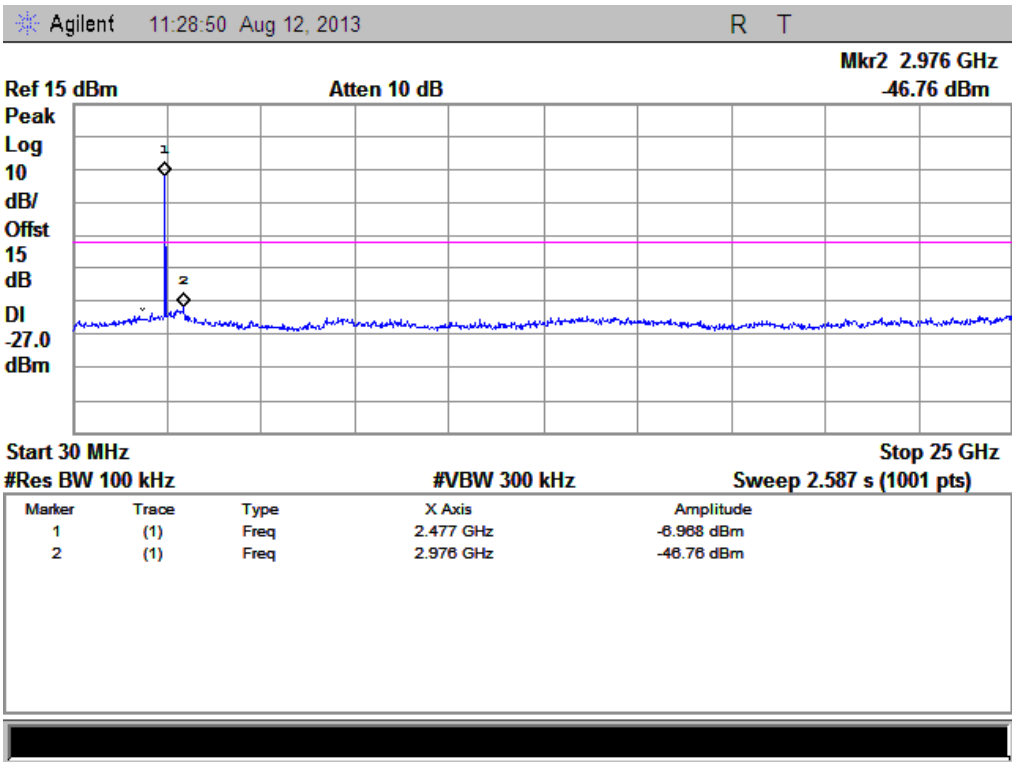
(Channel = 0, Band edge @ 8-DPSK)



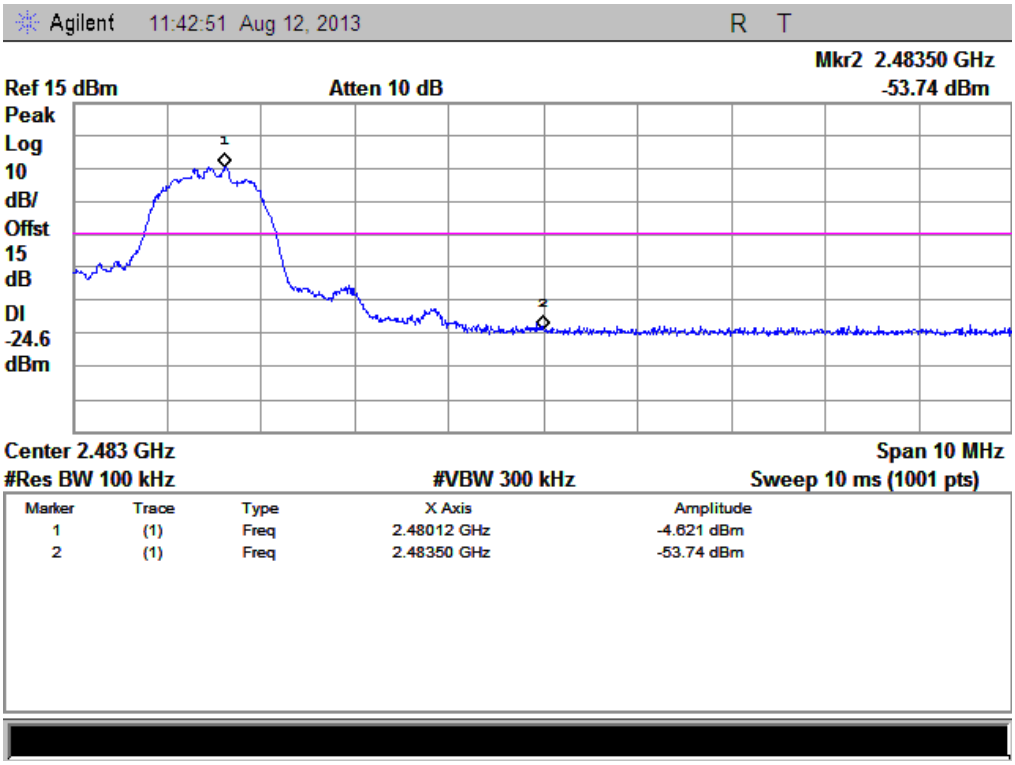
(Channel = 0, Band edge with hopping on @ 8-DPSK)



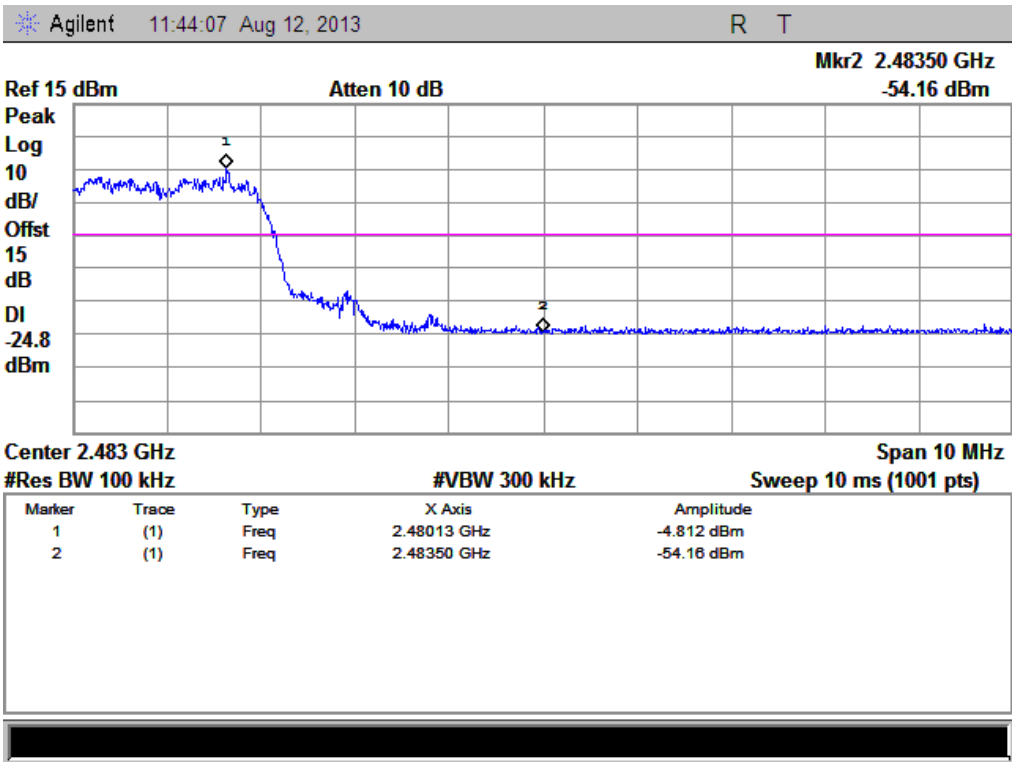
(Plot H.1: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(Plot I.1: Channel = 78, 30MHz to 25GHz @ 8-DPSK)



(Plot I.1: Channel = 78, Band edge @ 8-DPSK)



(Plot I.1: Channel = 78, Band edge with hopping on @ 8-DPSK)

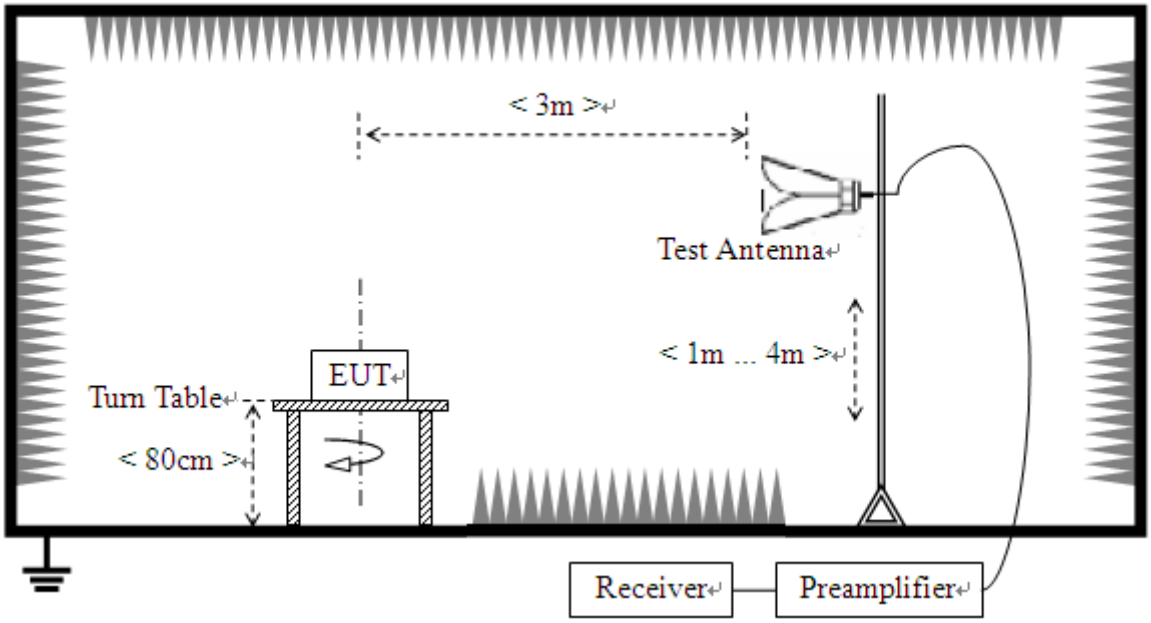
2.8. Restricted Frequency Bands

2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

2.8.2. Test Description

A. Test Setup:



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2013.05.12	2014.05.11

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2013.05.12	2014.05.11
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120D-963	2013.05.12	2014.05.11

2.8.3. Test Procedure

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1GHz, 100 KHz for f < 1GHz

VBW = 3 MHz for peak and 10Hz for average

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.8.4. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.

The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

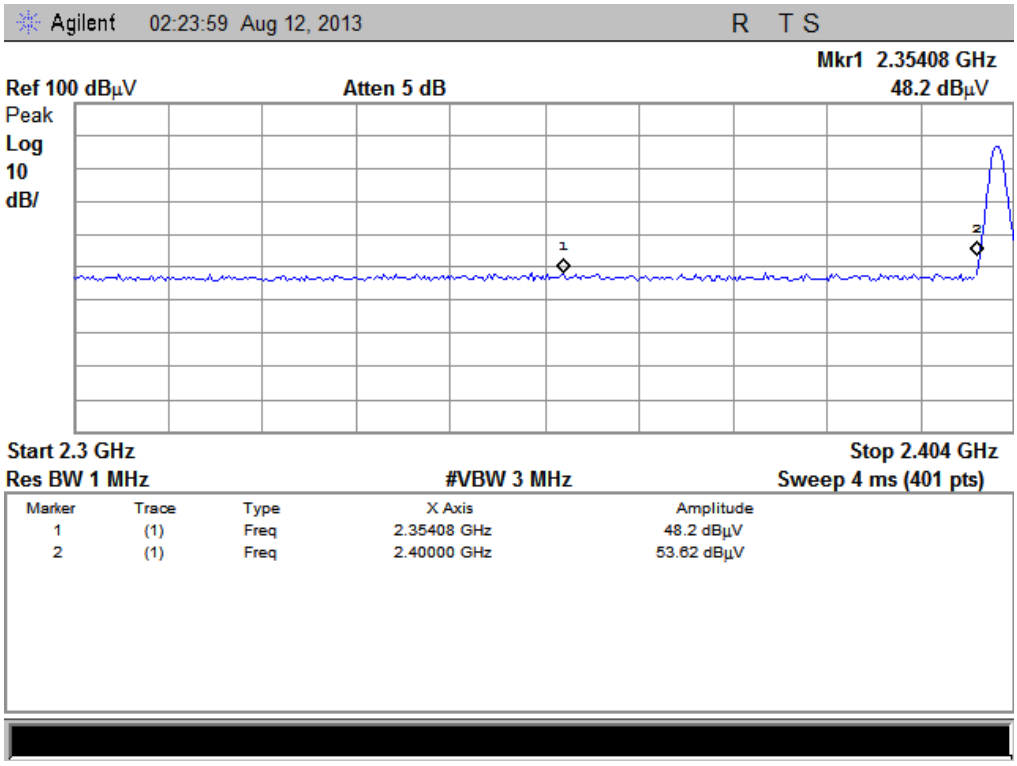
2.8.4.1. GFSK Mode

A. Test Verdict:

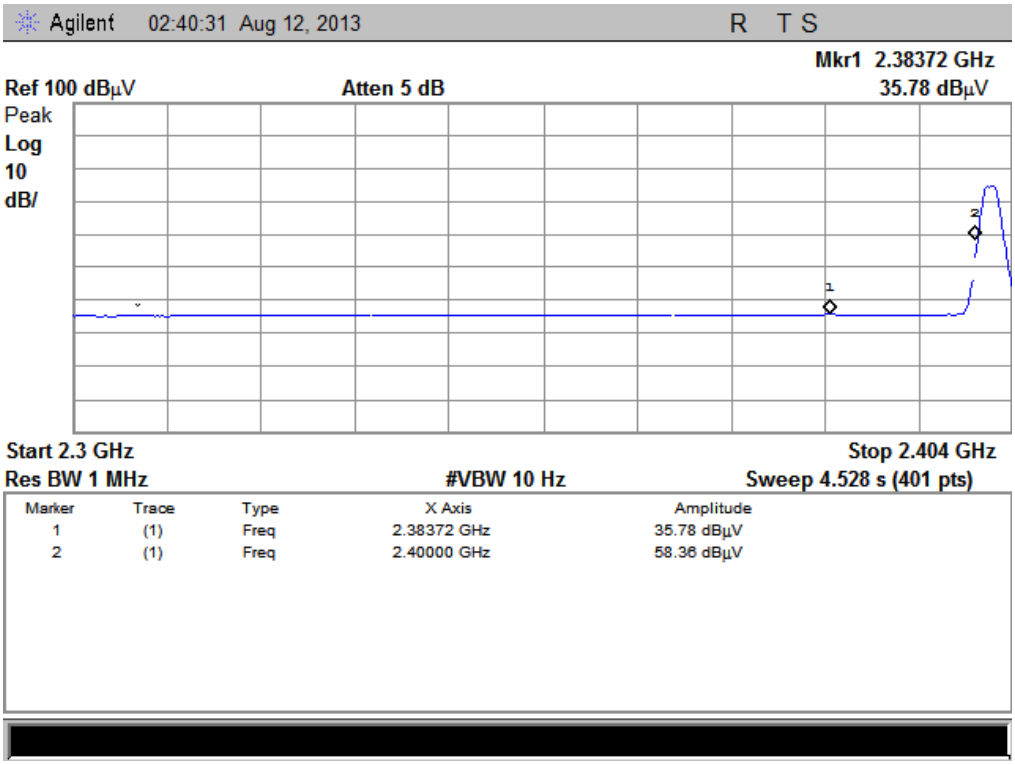
Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2354.08	PK	48.20	-30.93	32.56	49.83	74	Pass
0	2383.72	AV	35.78	-30.93	32.56	37.41	54	Pass
78	2492.63	PK	47.72	-29.05	32.50	51.17	74	Pass

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
78	2483.50	AV	38.12	-29.05	32.50	41.57	54	Pass

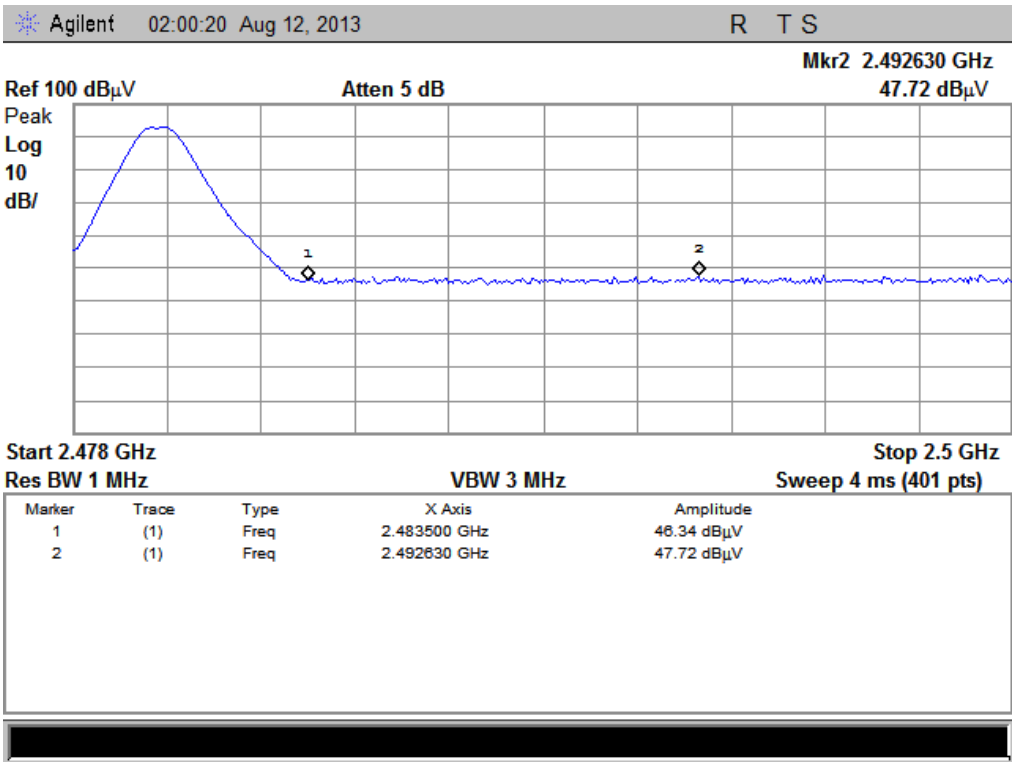
B. Test Plots:



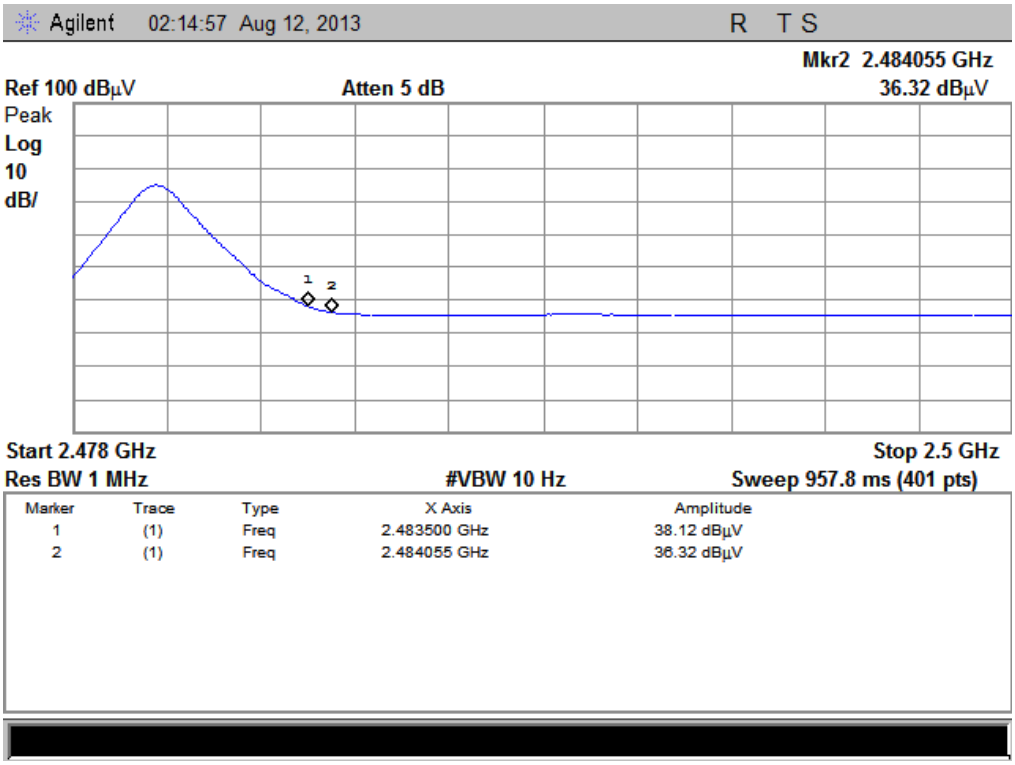
(Plot A1: Channel = 0 PEAK @ GFSK)



(Plot A2: Channel = 0 AVERAGE @ GFSK)



(Plot B1: Channel = 78 PEAK @ GFSK)



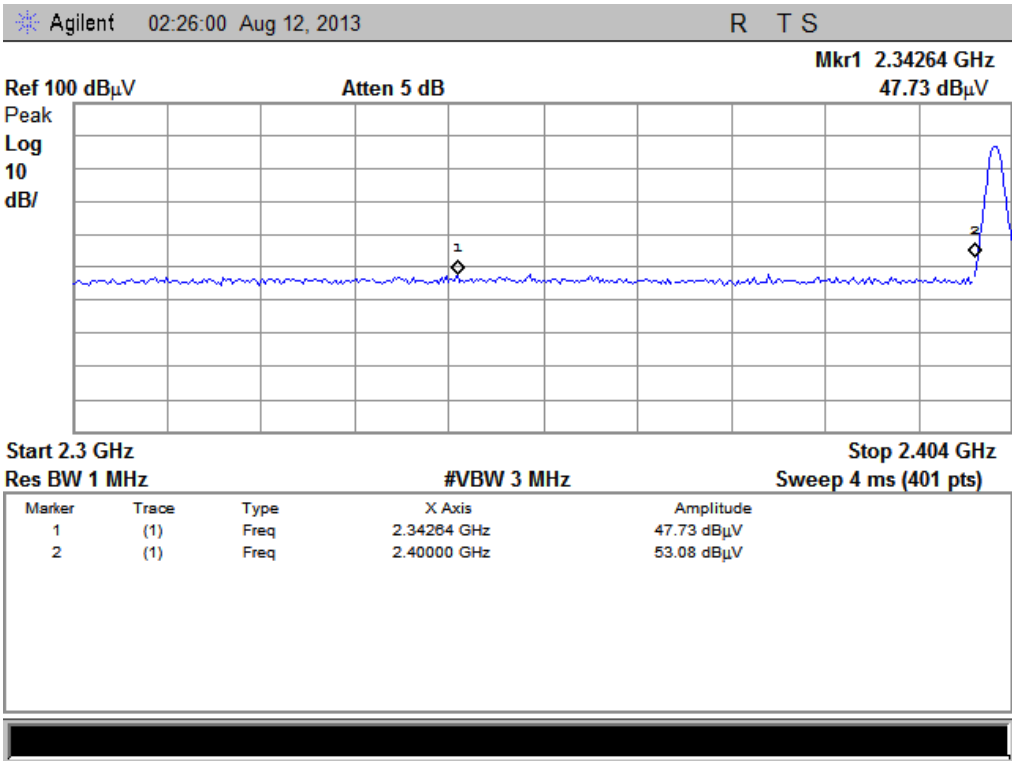
(Plot B2: Channel = 78 AVERAGE @ GFSK)

2.8.4.2. ∏/4-DQPSK Mode

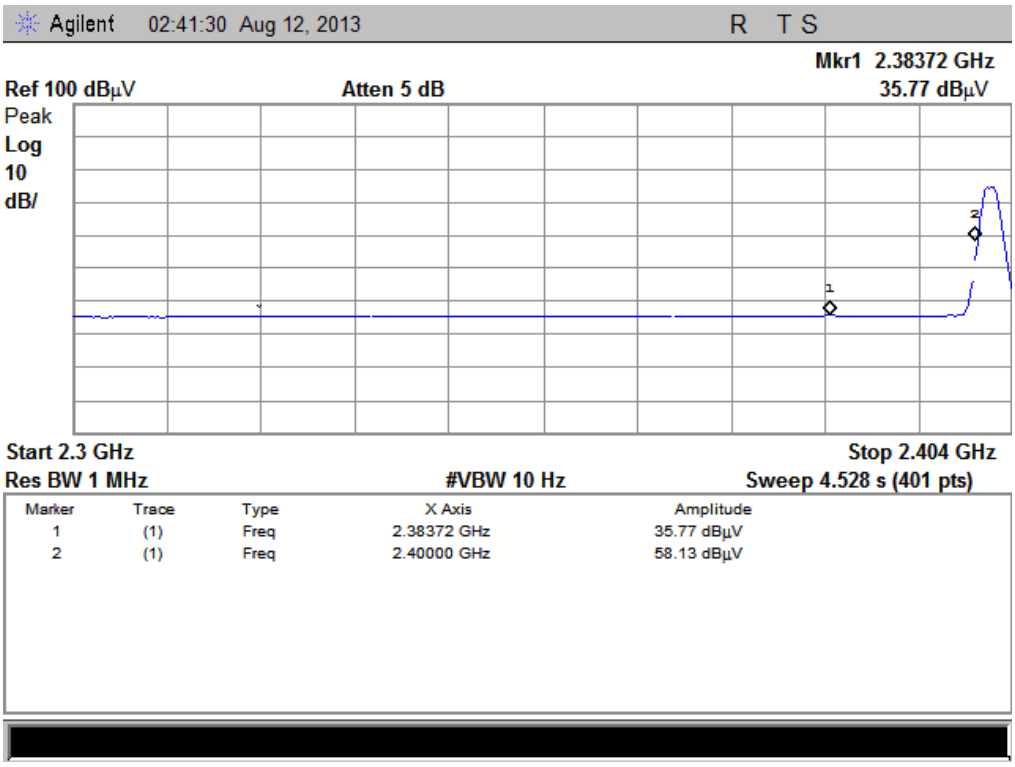
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
0	2342.64	PK	47.73	-30.93	32.56	49.36	74	Pass
0	2383.72	AV	35.77	-30.93	32.56	37.40	54	Pass
78	2485.70	PK	47.75	-29.05	32.50	51.20	74	Pass
78	2483.50	AV	38.12	-29.05	32.50	41.57	54	Pass

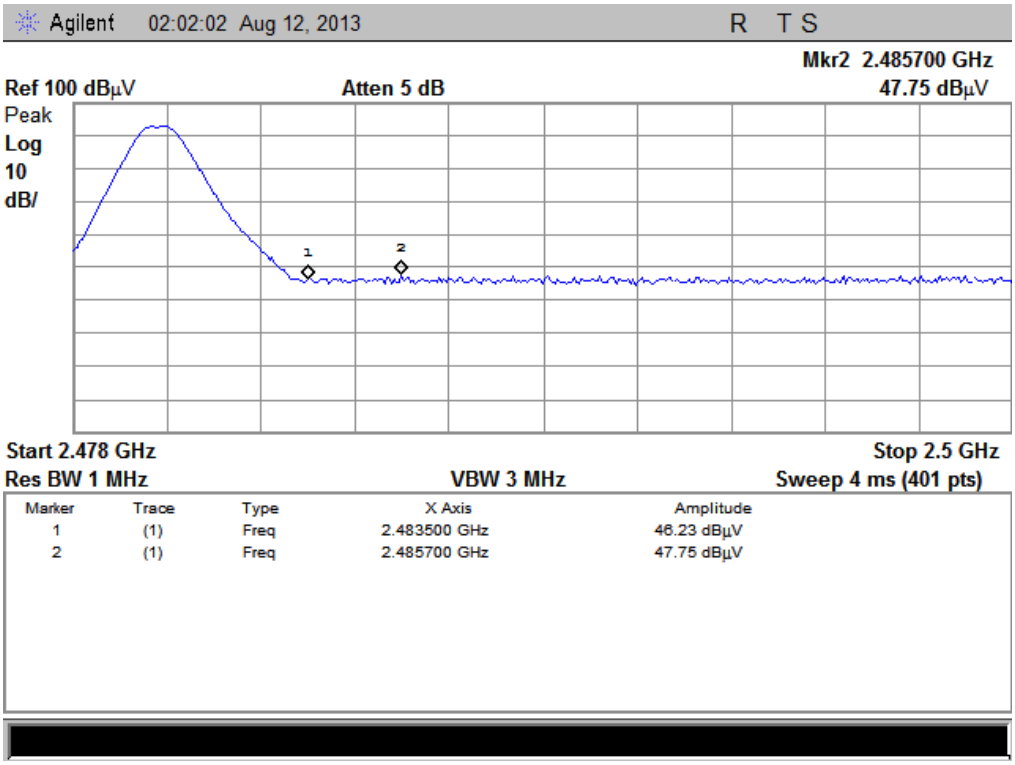
B. Test Plots:



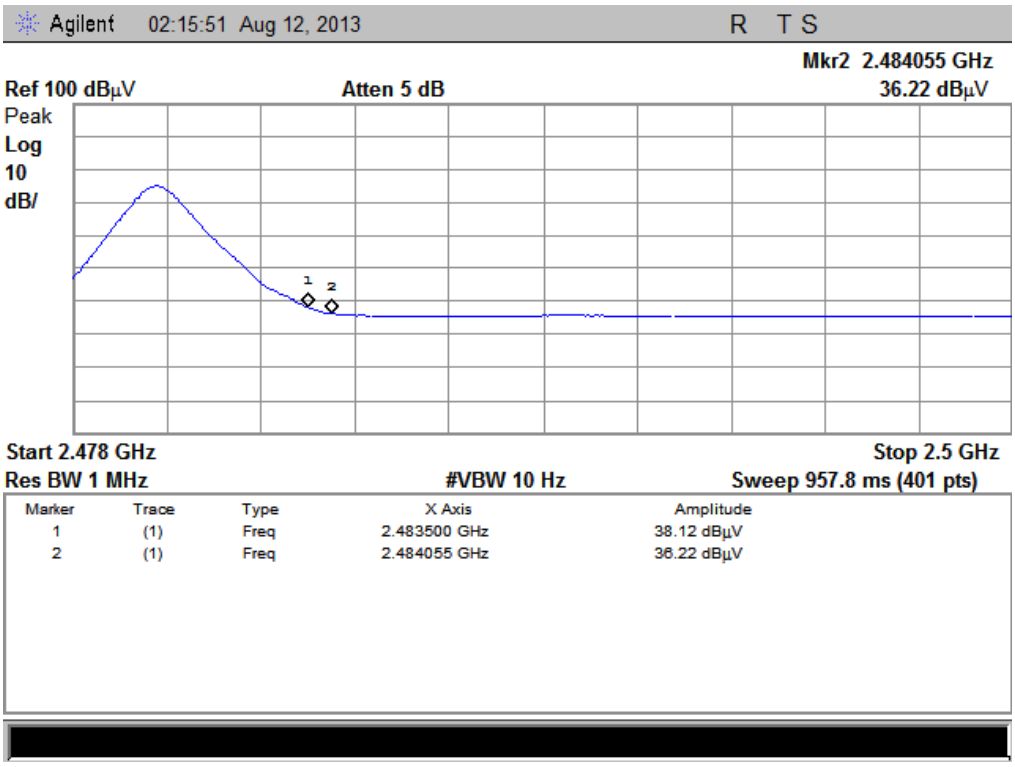
(Plot C1: Channel = 0 PEAK @ Π/4-DQPSK)



(Plot C2: Channel = 0 AVERAGE @ Π/4-DQPSK)



(Plot D1: Channel = 78 PEAK @ Π/4-DQPSK)



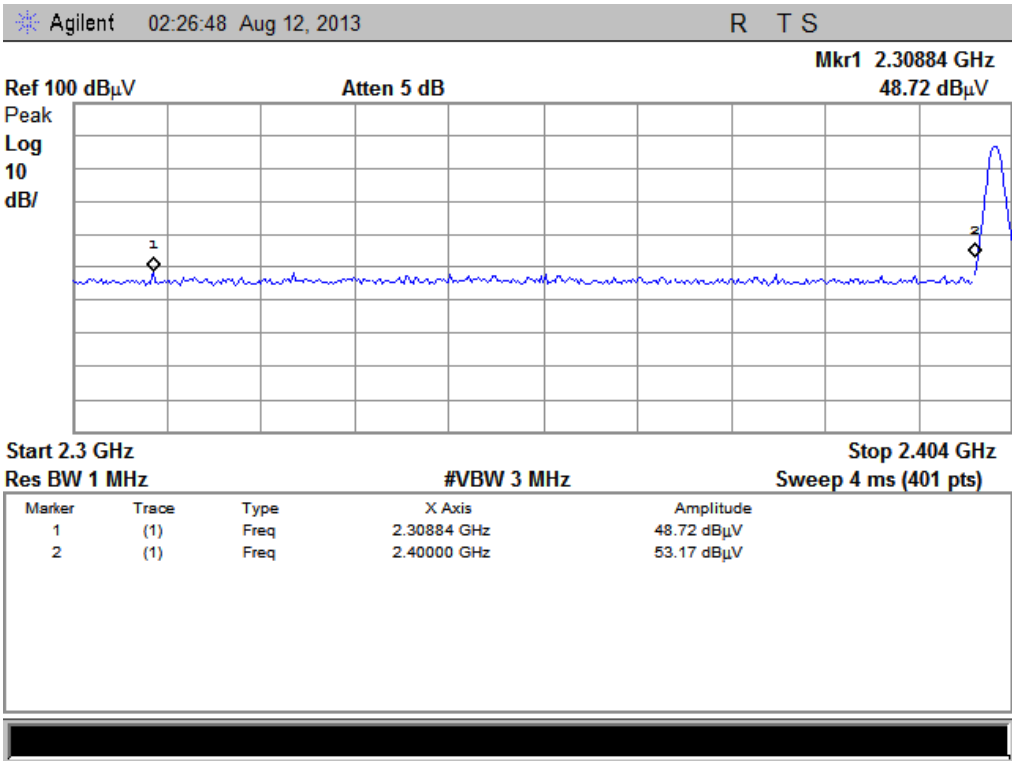
(Plot D2: Channel = 78 AVERAGE@ Π/4-DQPSK)

2.8.4.3. 8-DPSK Mode

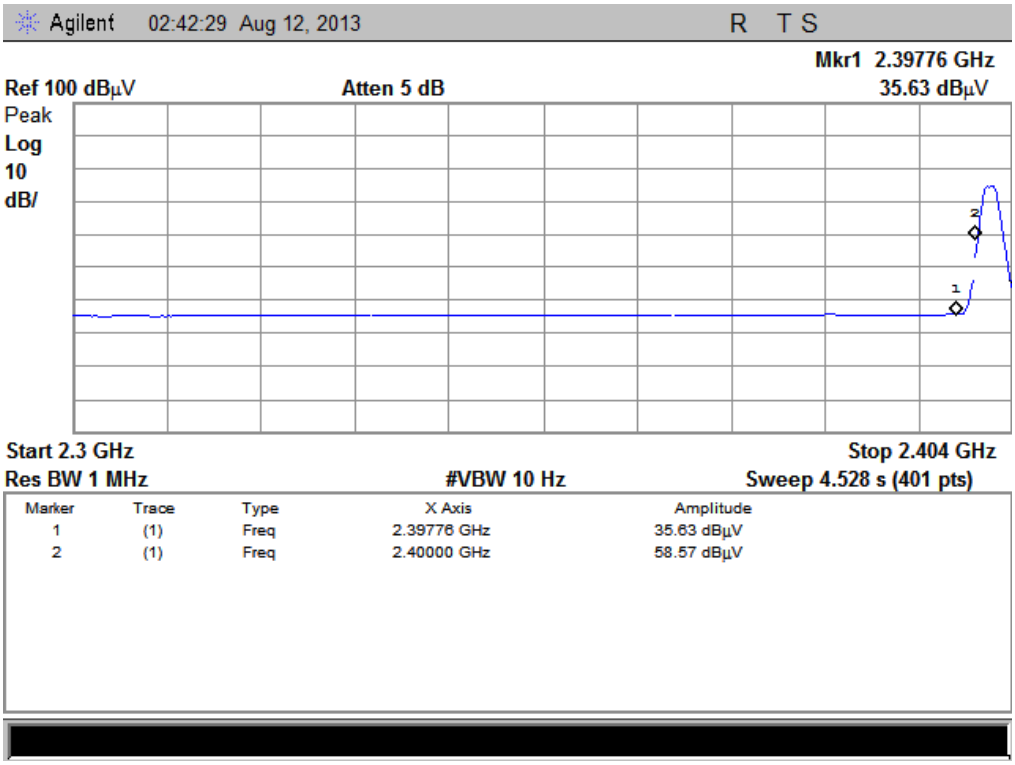
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2308.84	PK	48.72	-30.93	32.56	50.35	74	Pass
0	2397.76	AV	35.63	-30.93	32.56	37.26	54	Pass
78	2486.03	PK	47.41	-29.05	32.50	50.86	74	Pass
78	2483.50	AV	38.17	-29.05	32.50	41.62	54	Pass

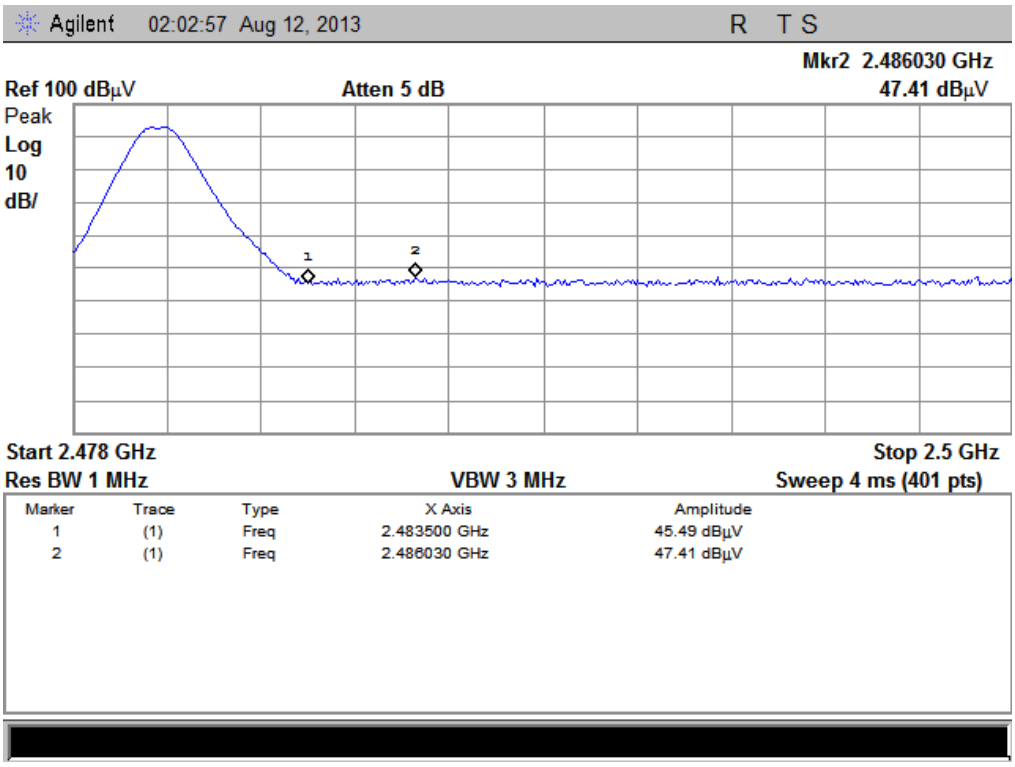
B. Test Plots:



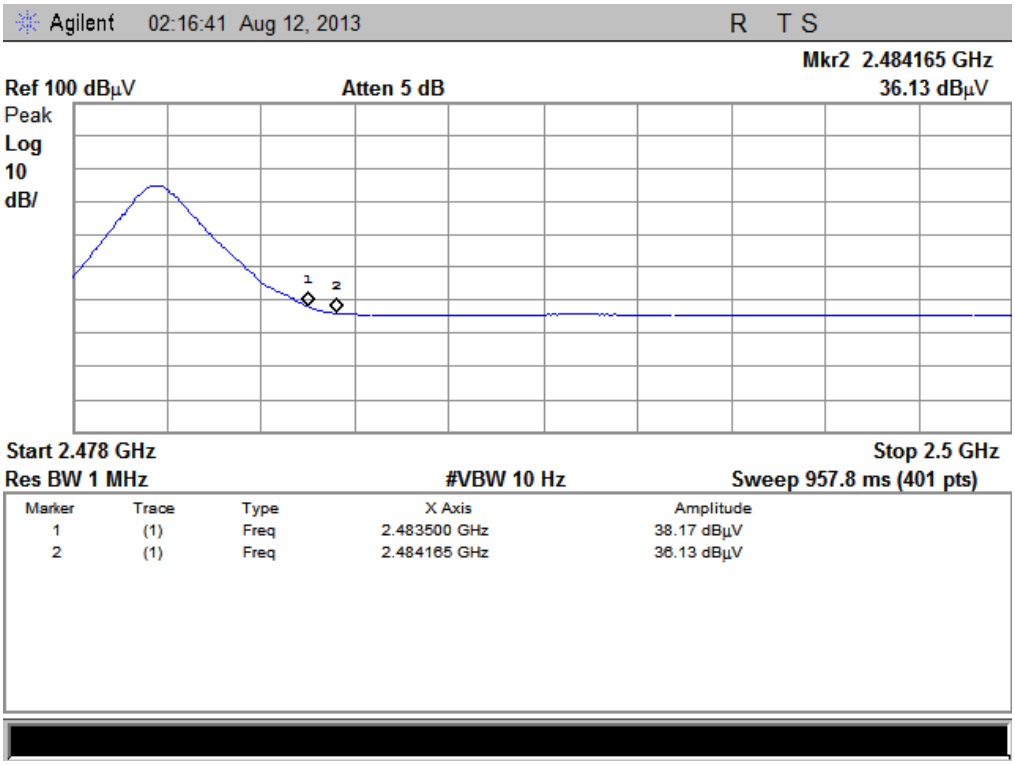
(Plot E1: Channel = 0 PEAK @ 8-DPSK Mode)



(Plot E2: Channel = 0 AVERAGE @ 8-DPSK Mode)



(Plot F1: Channel = 78 PEAK @ 8-DPSK Mode)



(Plot F2: Channel = 78 AVERAGE @ 8-DPSK Mode)

2.9. Conducted Emission

2.9.1. Requirement

According to FCC section 15.207, for an intentional radiator 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 within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50µH/50Ω line impedance stabilization network (LISN).

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

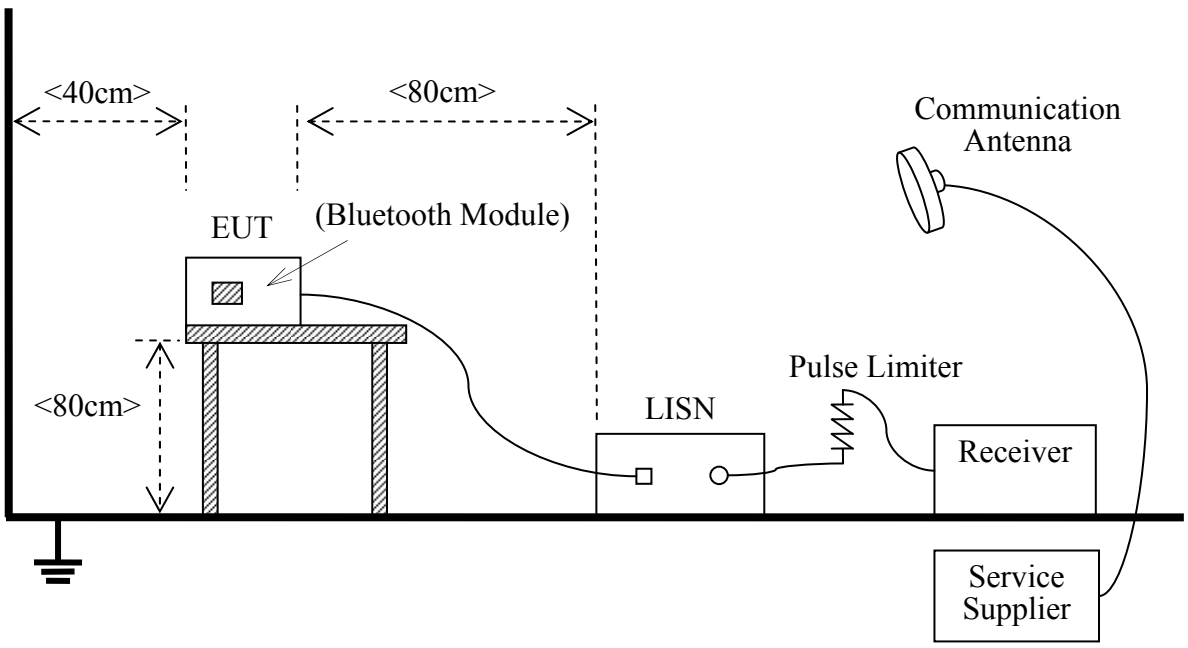
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.9.2. Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

The Bluetooth Module of the EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
LISN	Schwarzbeck	NSLK 8127	812744	2013.05.12	2014.05.11
Service Supplier	R&S	CMU200	100448	2013.05.12	2014.05.11
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	2013.05.12	2014.05.11

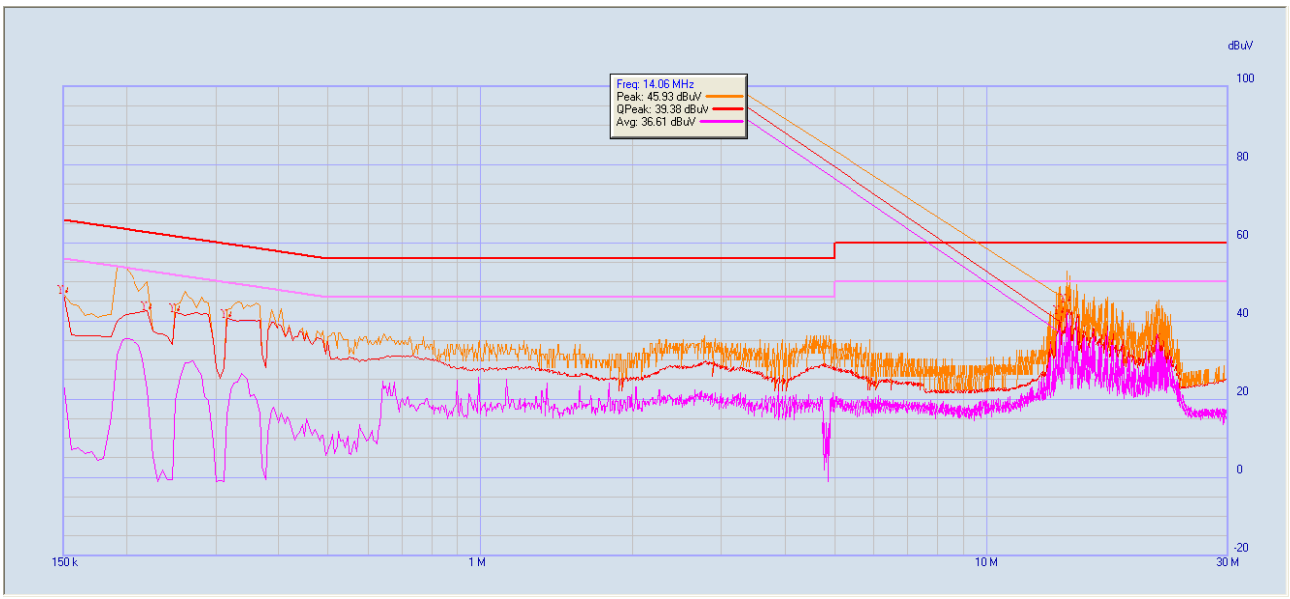
2.9.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

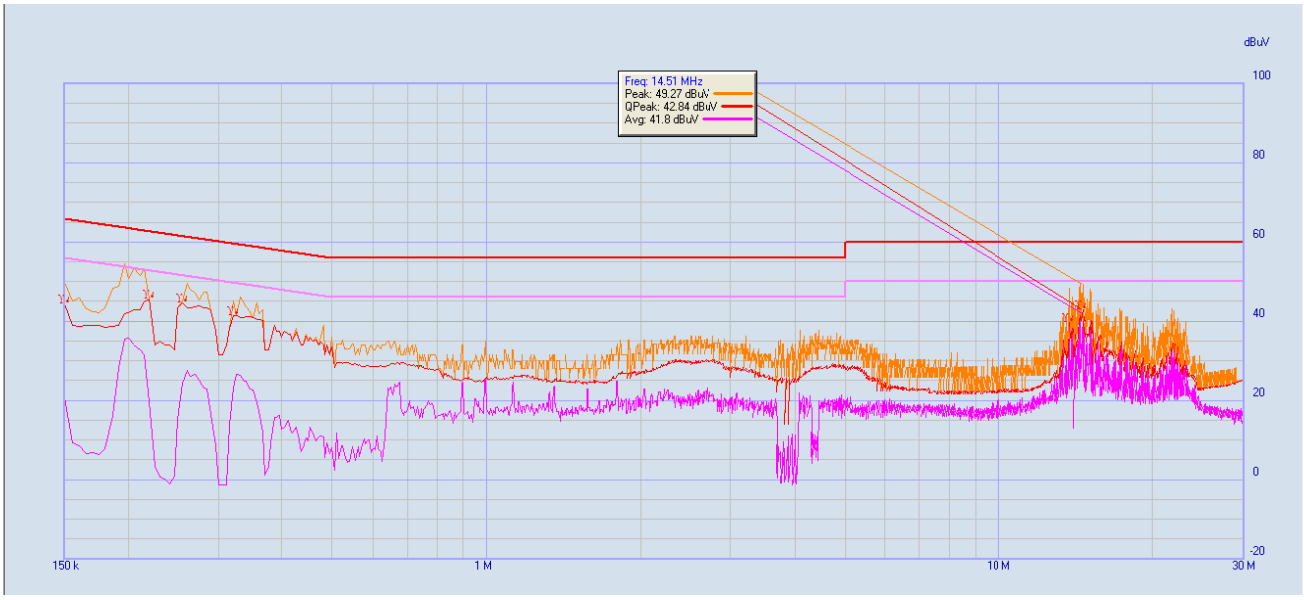
A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

B. Test Plots:



(Plot A: L Phase)



(Plot B: N Phase)

2.10. Radiated Emission

2.10.1. Requirement

According to FCC section 15.247(d) and RSS-A8.5, radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (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

Note:

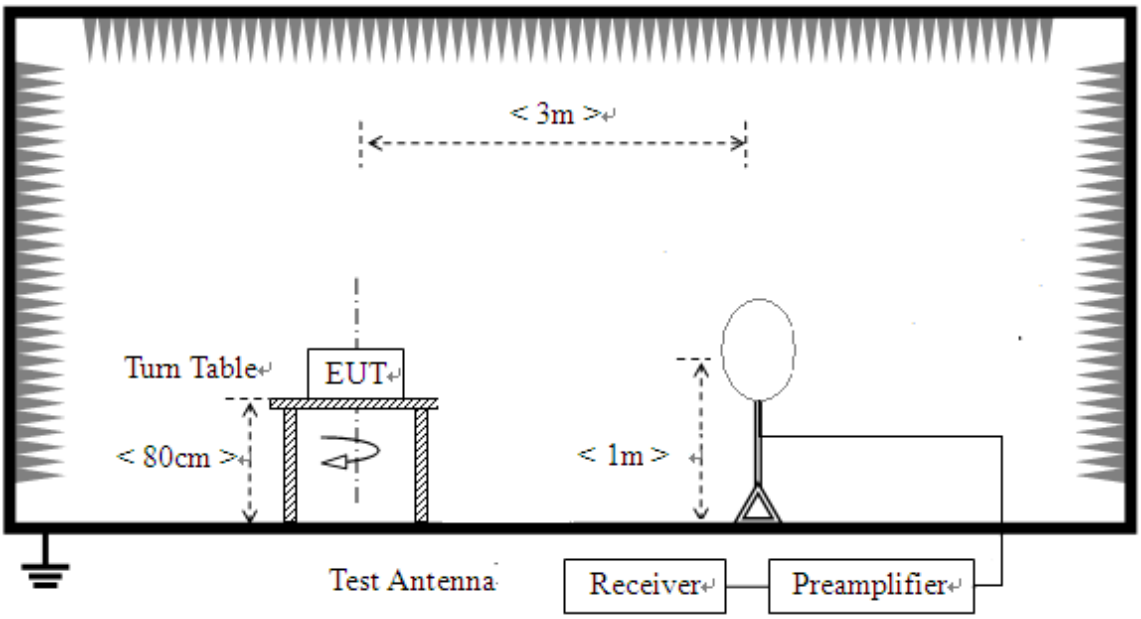
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

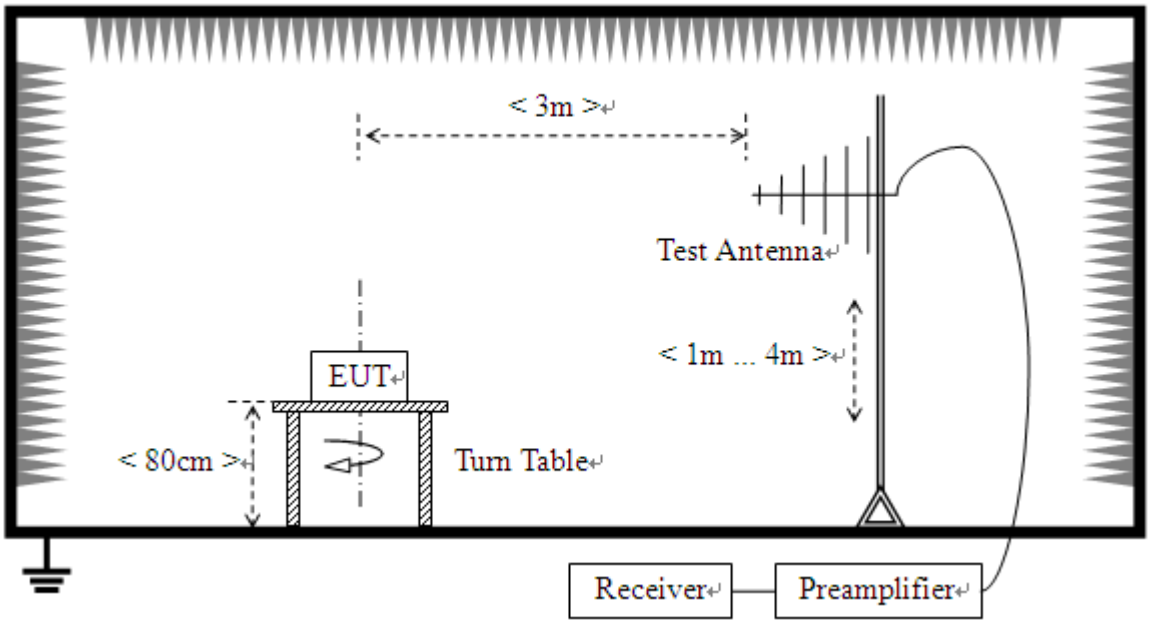
2.10.2. Test Description

A. Test Setup:

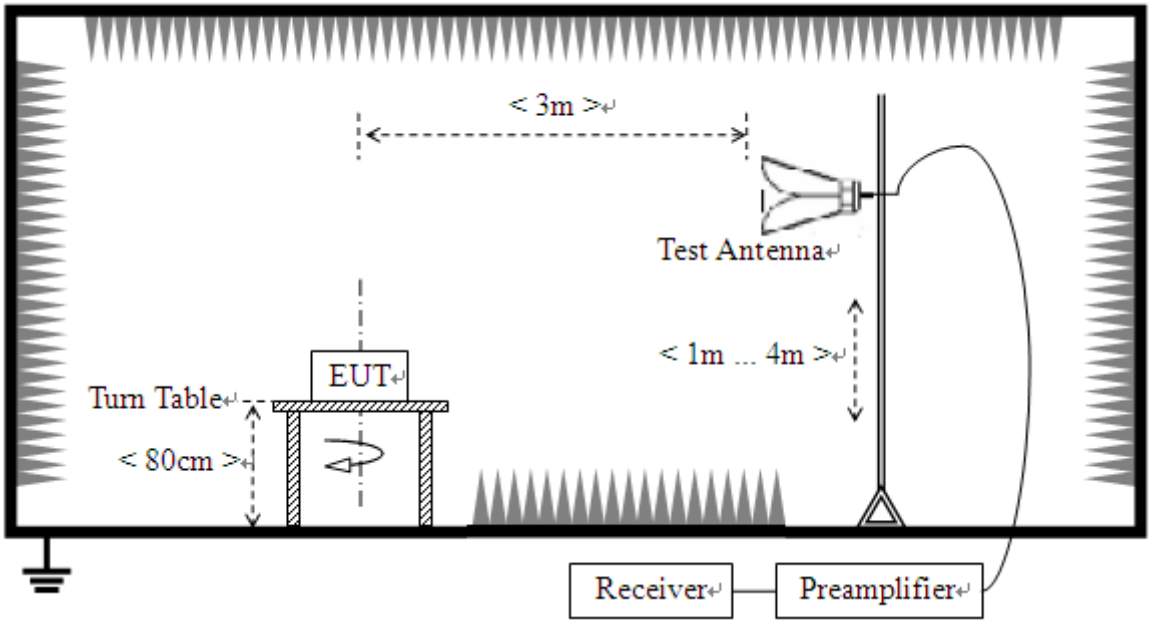
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2013.05.12	2014.05.11
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2013.05.12	2014.05.11
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2013.05.12	2014.05.11
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120D-963	2013.05.12	2014.05.11

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Test Antenna - Horn	R&S	HL050S7	71688	2013.05.12	2014.05.11
Test Antenna - Loop	Schwarzbeck	FMZB 1519	1519-022	2013.05.12	2014.05.11

2.10.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.10.4. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

E [dBμV/m] $= U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor AT and A_{Factor} were built in test software.

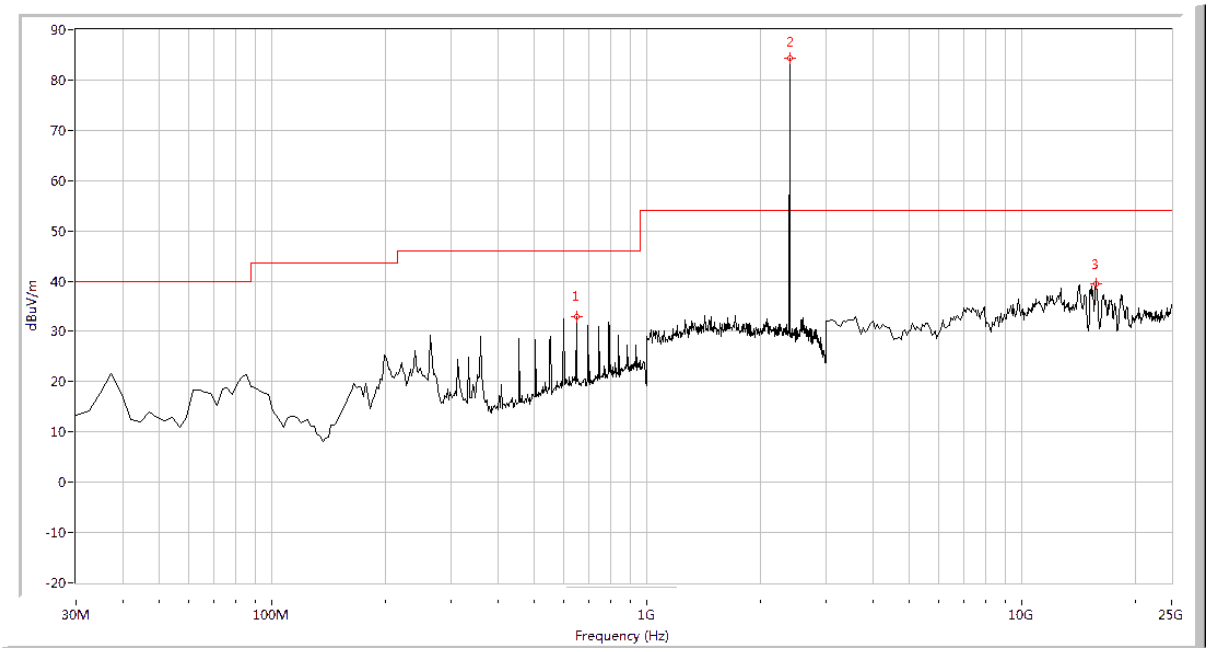
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.10.4.1. GFSK Mode:

A. Test Plots for the Whole Measurement Frequency Range:

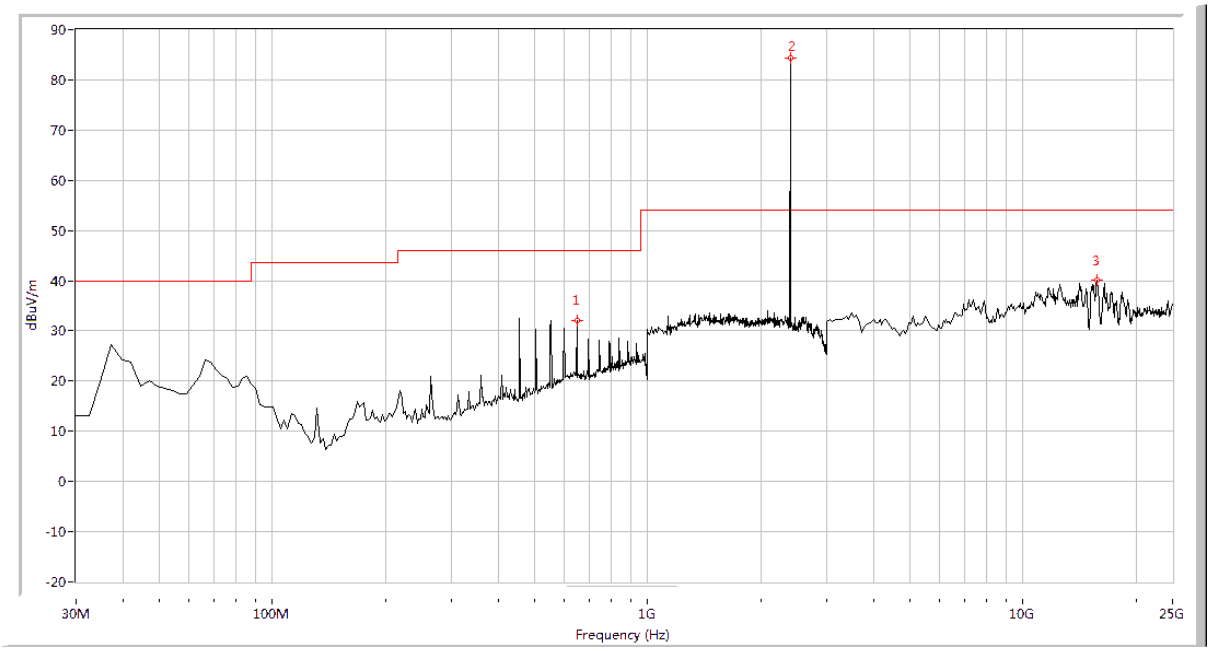
<u>Plots for Channel = 0</u>

(Plot A.0: 9kHz to 30MHz @ GFSK, channel 0)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.00	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2402.000	84.29	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.48	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

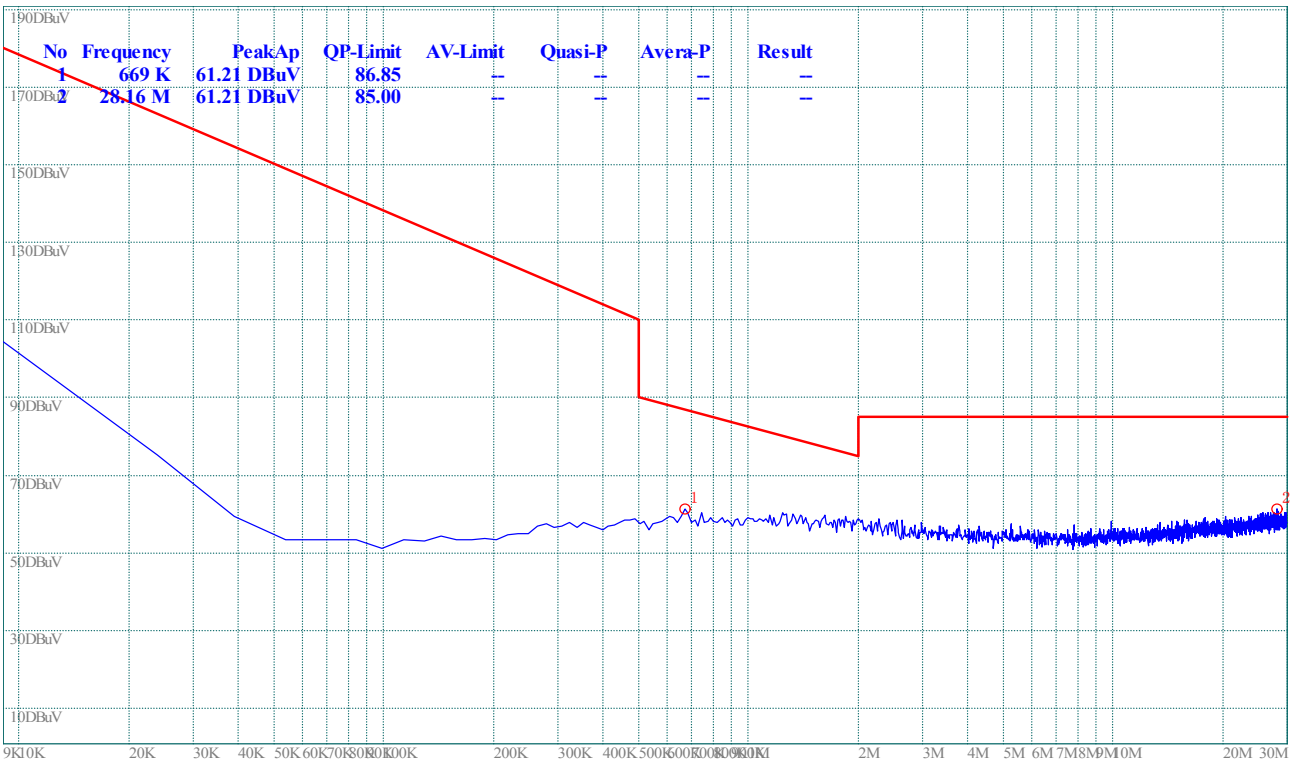
(Plot A.1: 30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 0)



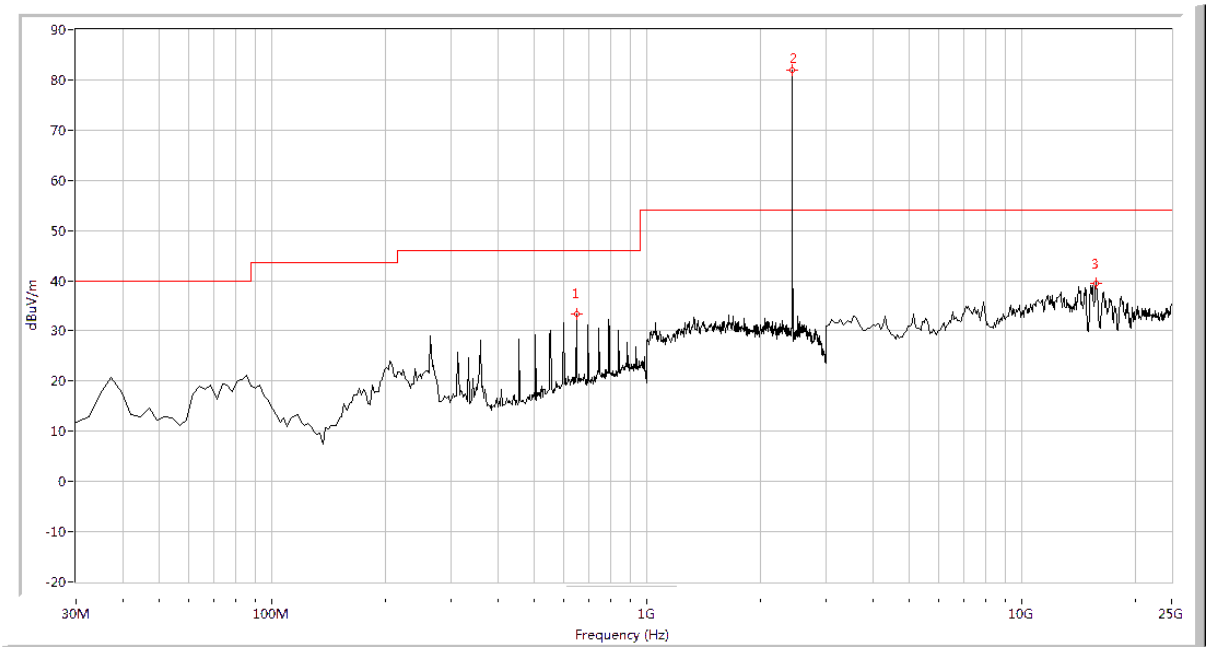
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	32.14	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2402.000	84.39	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.04	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot A.2: 30MHz to 25GHz, Antenna Vertical @ GFSK, channel 0)

Plot for Channel = 39

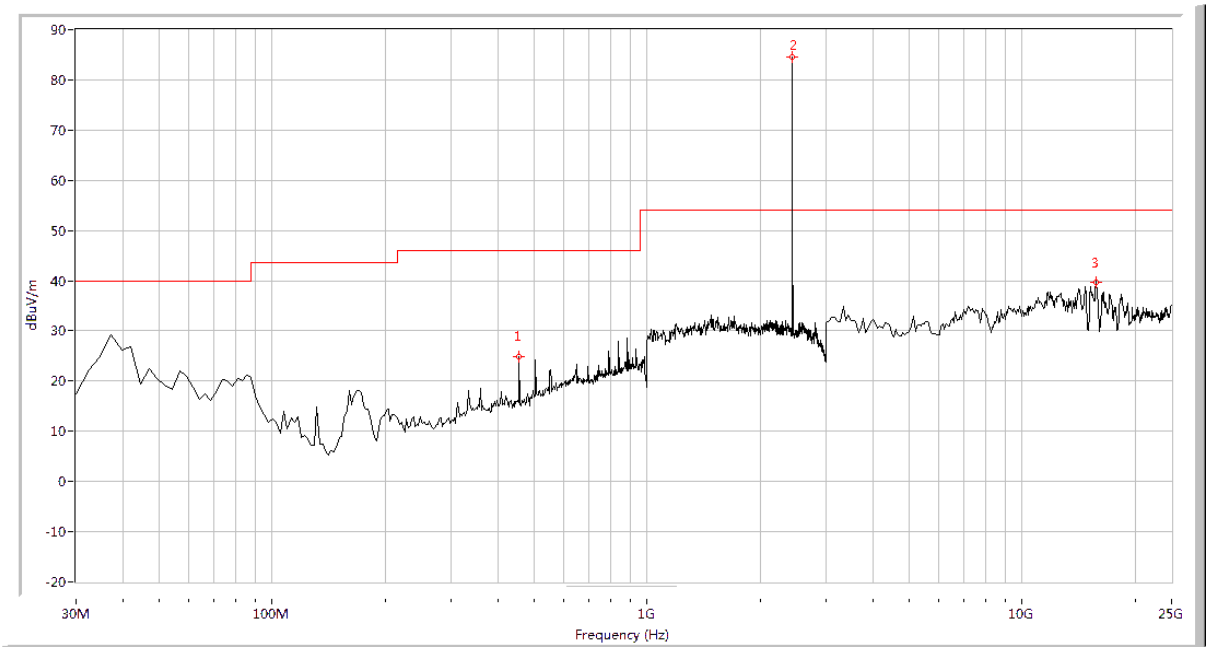


(Plot B.0: 9kHz to 30MHz @ GFSK, channel 39)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.38	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2441.000	81.83	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.51	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

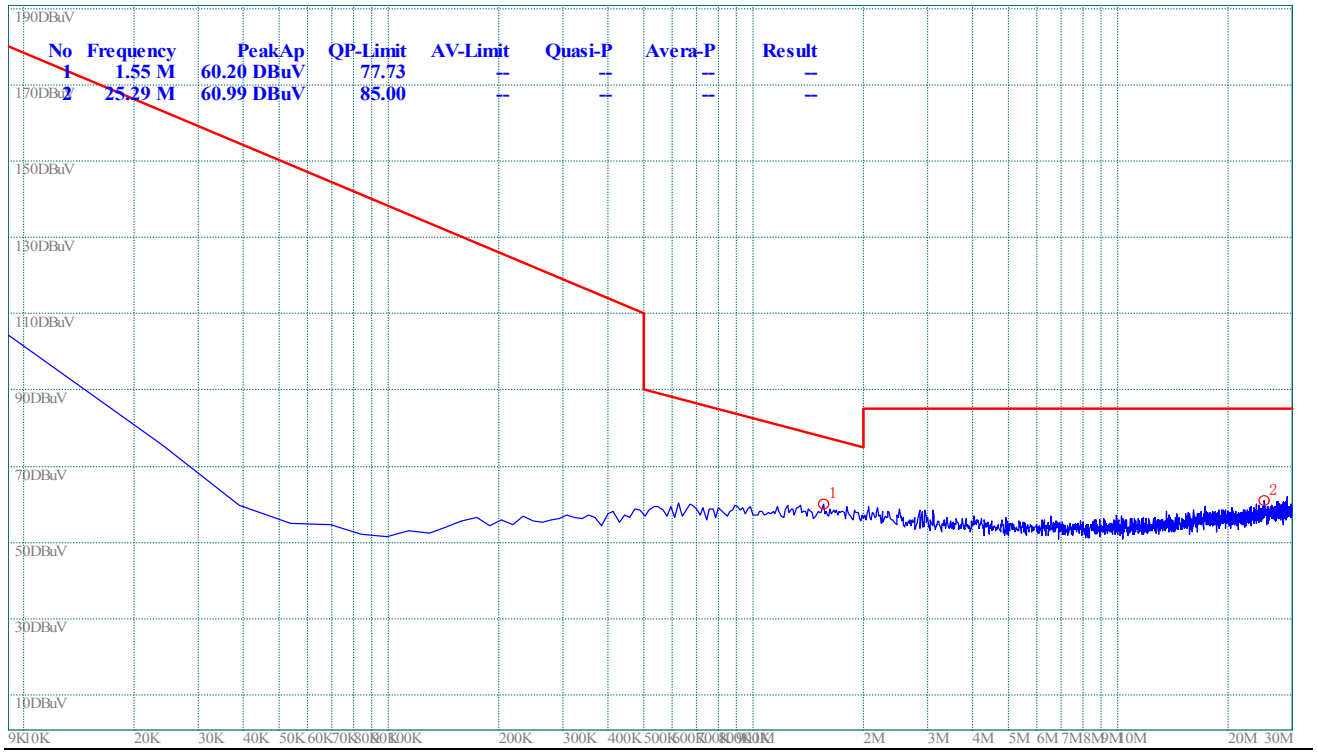
(Plot B.1: 30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 39)



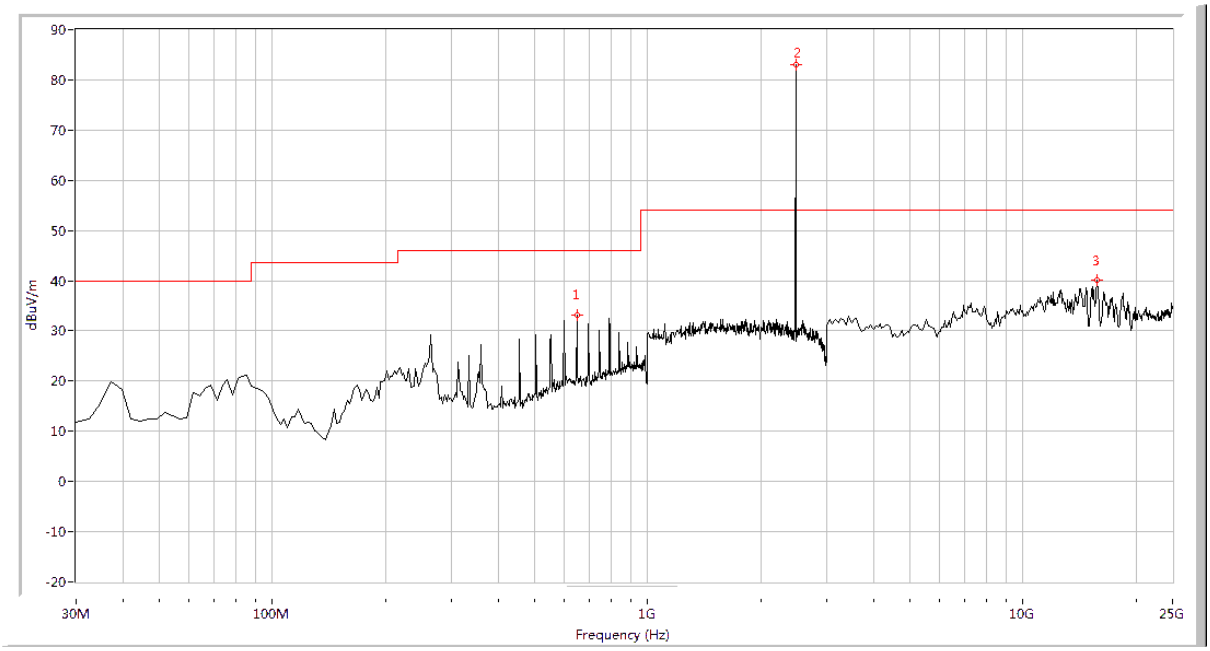
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	24.88	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2441.000	84.63	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	39.77	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot B.2: 30MHz to 25GHz, Antenna Vertical @ GFSK, channel 39)

Plot for Channel = 78

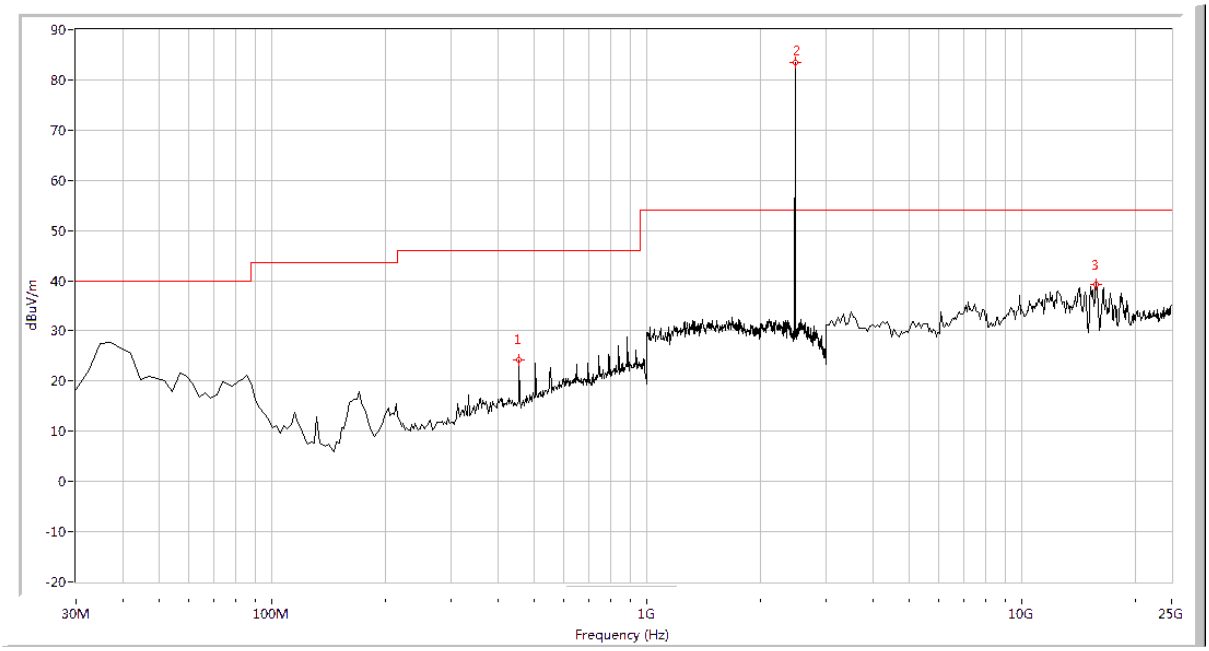


(Plot C.0: 9kHz to 30MHz @ GFSK, channel 78)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.17	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2480.000	83.07	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	40.07	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 78)



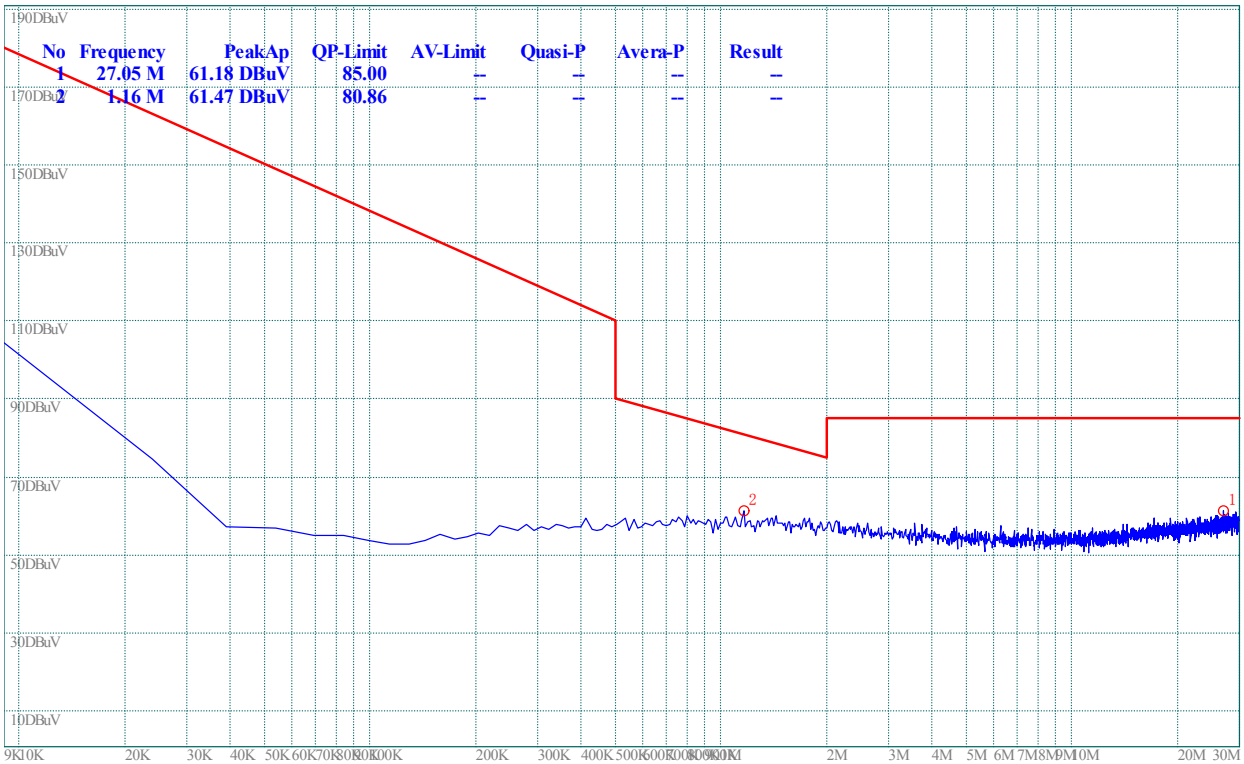
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	24.20	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2480.000	83.57	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	39.18	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 25GHz, Antenna Vertical @ GFSK, channel 78)

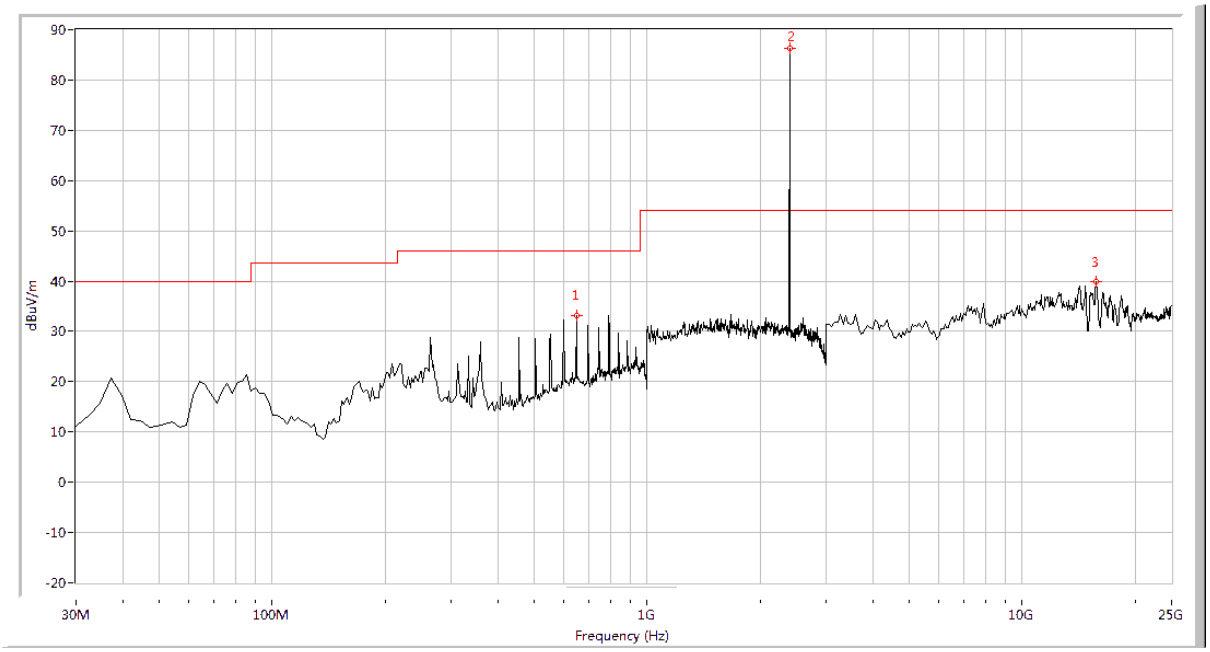
2.10.4.2. π/4-DQPSK Mode:

A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0

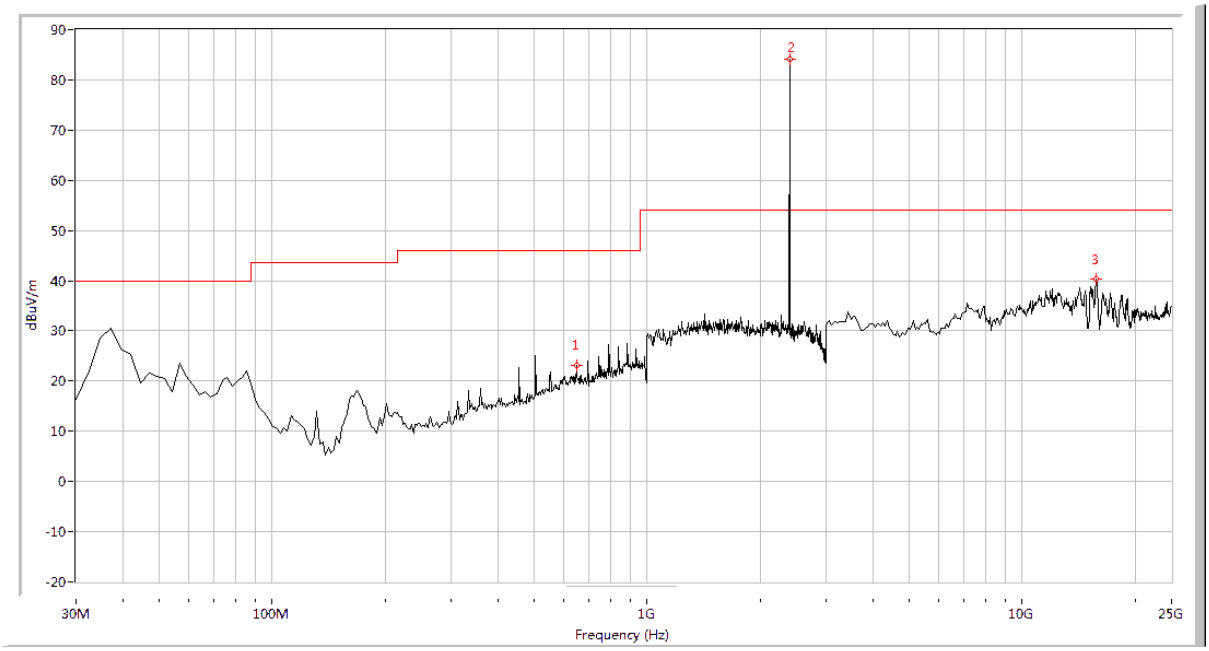


(Plot A.0: 9kHz to 30MHz @ Π/4-DQPSK, channel 0)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.24	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2402.000	86.40	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.90	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

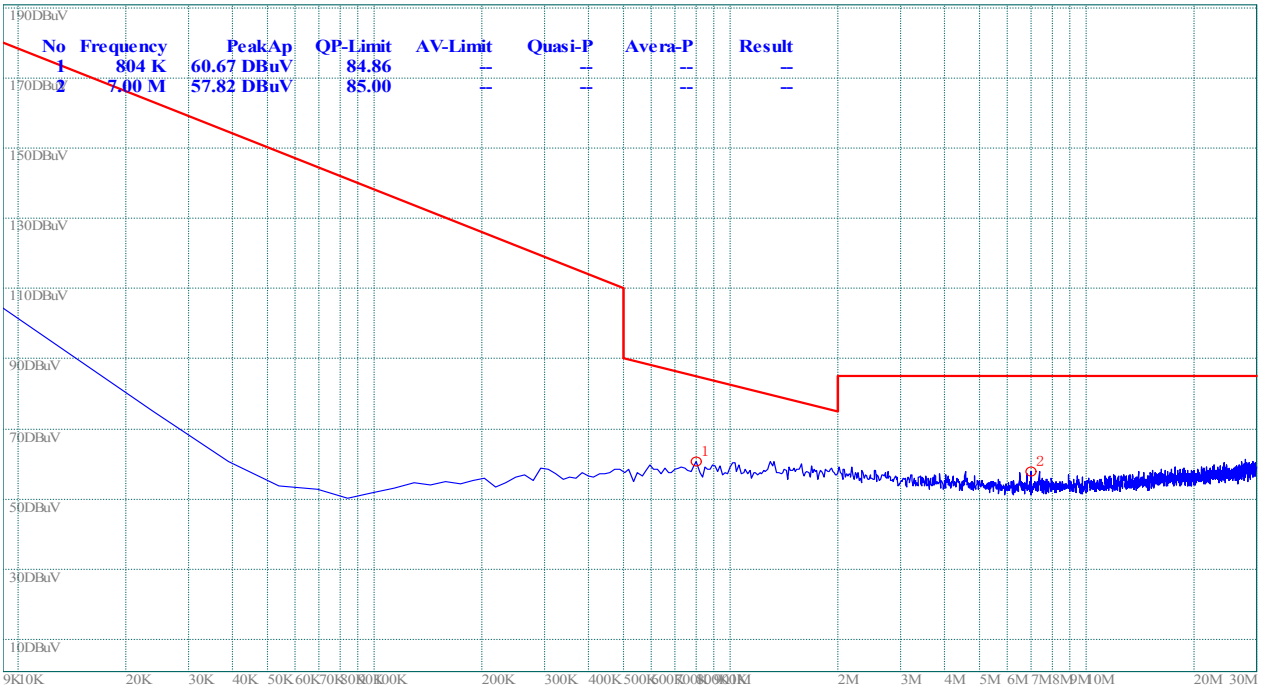
(Plot A.1: 30MHz to 25GHz, Antenna Horizontal @ Π/4-DQPSK, channel 0)



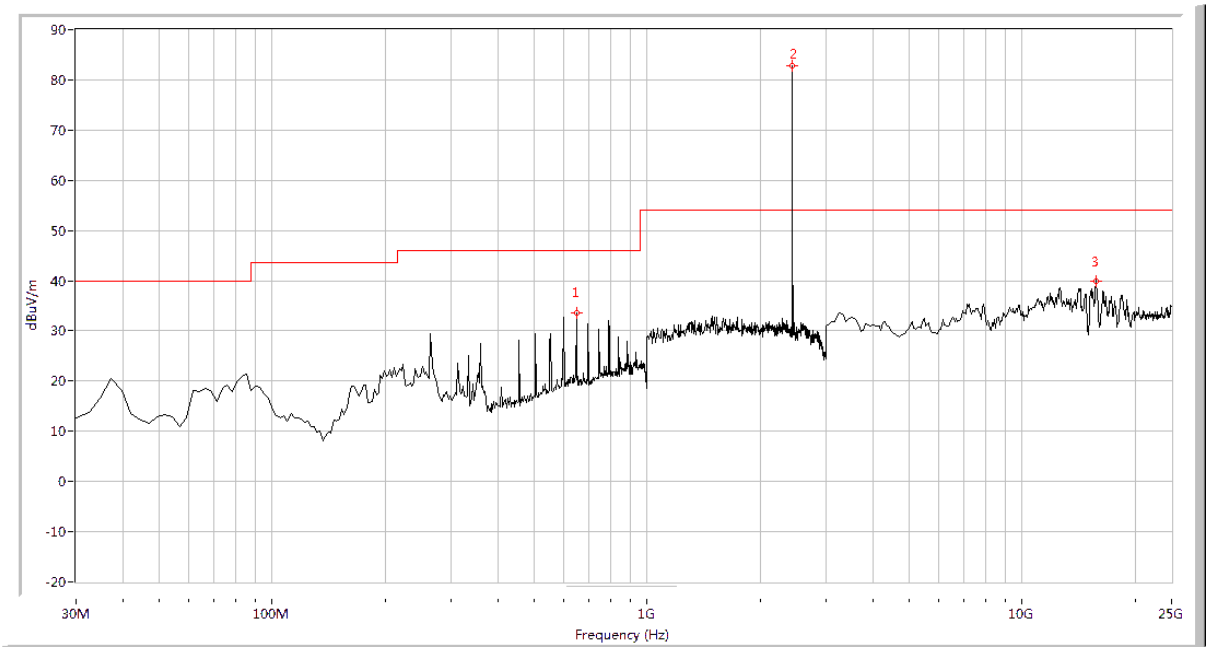
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	23.11	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2402.000	84.02	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.35	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot A.2: 30MHz to 25GHz, Antenna Vertical @ Π/4-DQPSK, channel 0)

Plot for Channel = 39

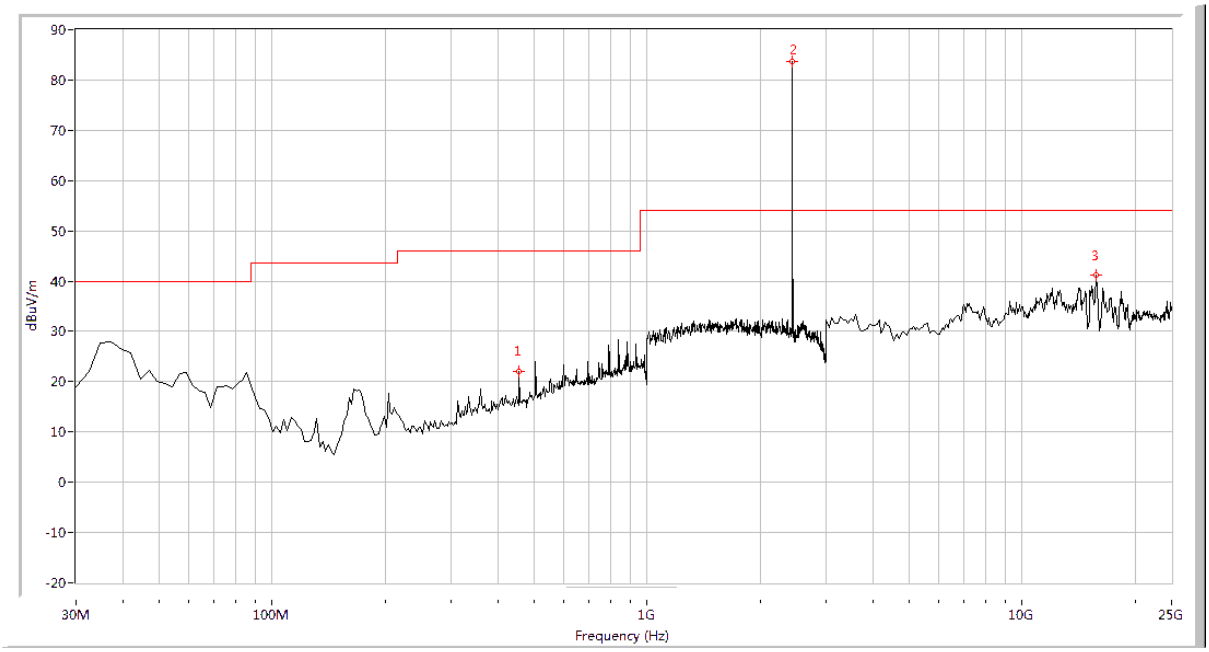


(Plot B.0: 9kHz to 30MHz @ Π/4-DQPSK, channel 39)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.49	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2441.000	82.78	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.95	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

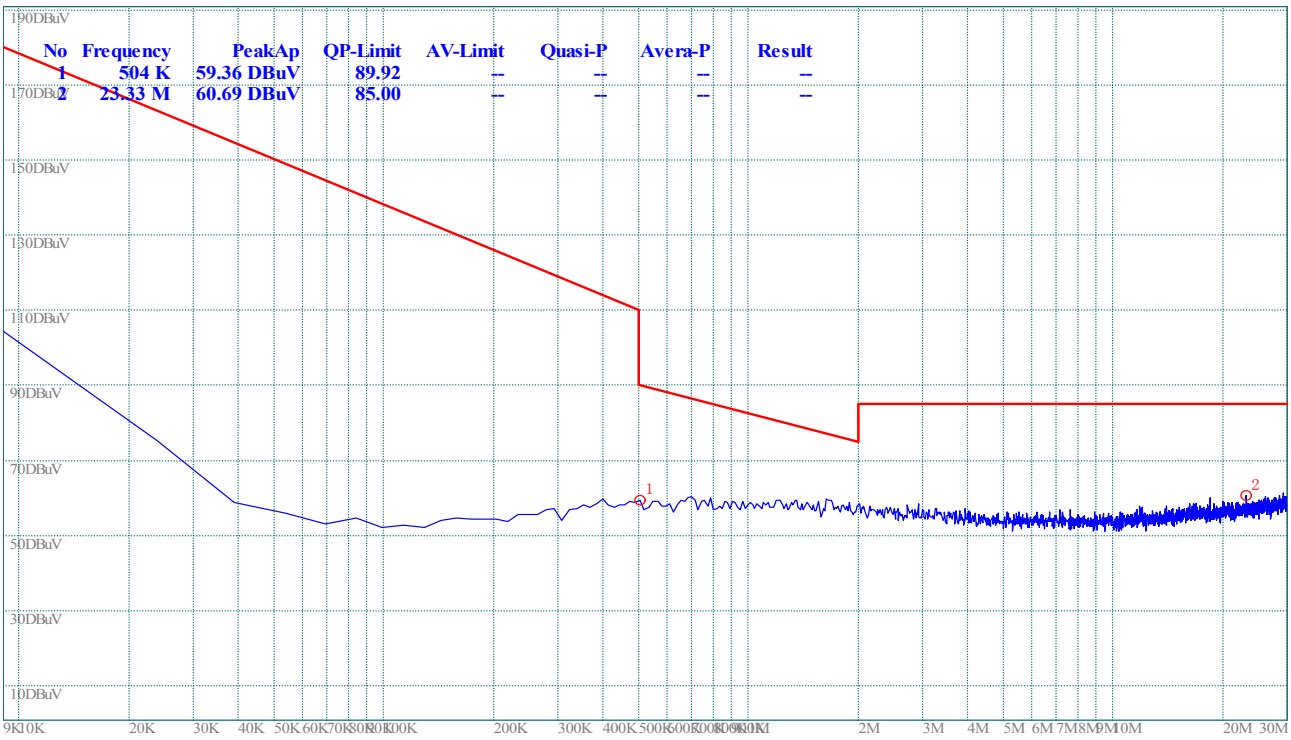
(Plot B.1: 30MHz to 25GHz, Antenna Horizontal @ Π/4-DQPSK, channel 39)



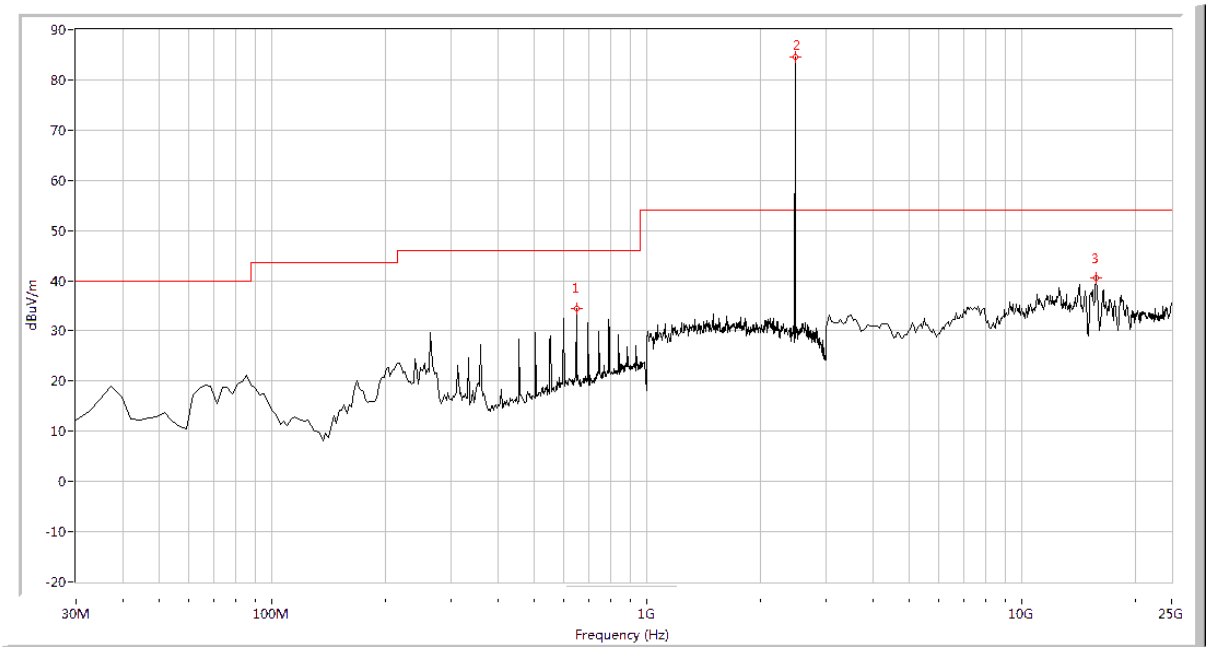
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	22.13	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2441.000	83.62	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	41.17	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot B.2: 30MHz to 25GHz, Antenna Vertical @ Π/4-DQPSK, channel 39)

Plot for Channel = 78

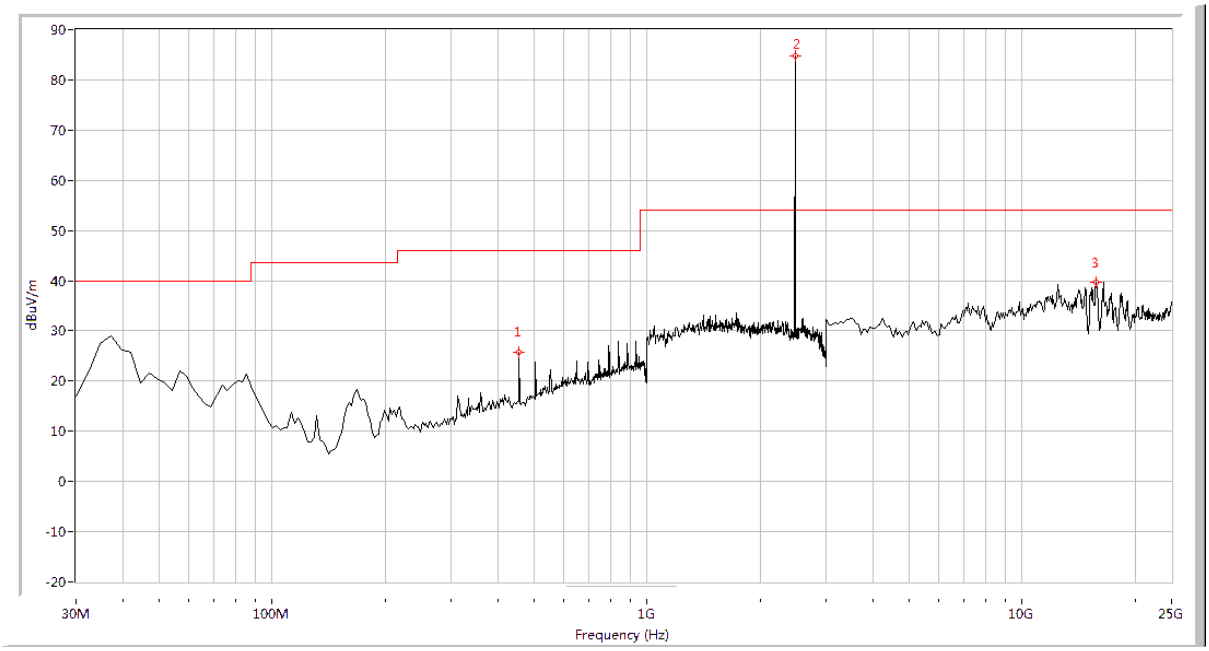


(Plot C.0: 9kHz to 30MHz @ Π/4-DQPSK, channel 78)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	34.40	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2476.309	84.61	N.A	N.A	54.0	N.A	54.0	Horizontal	FAIL
15783.042	40.56	N.A	N.A	54.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 25GHz, Antenna Horizontal @ Π/4-DQPSK, channel 78)



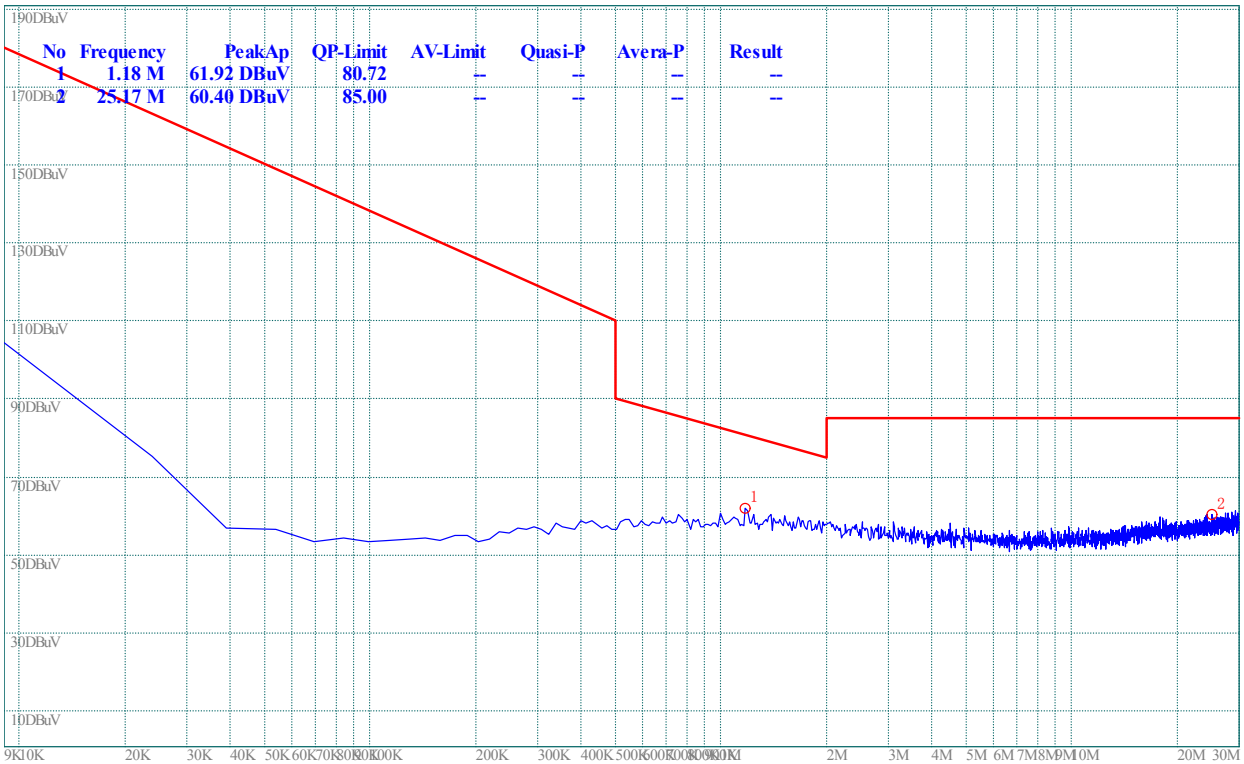
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	25.81	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2480.000	84.81	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	39.77	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 25GHz, Antenna Vertical @ Π/4-DQPSK, channel 78)

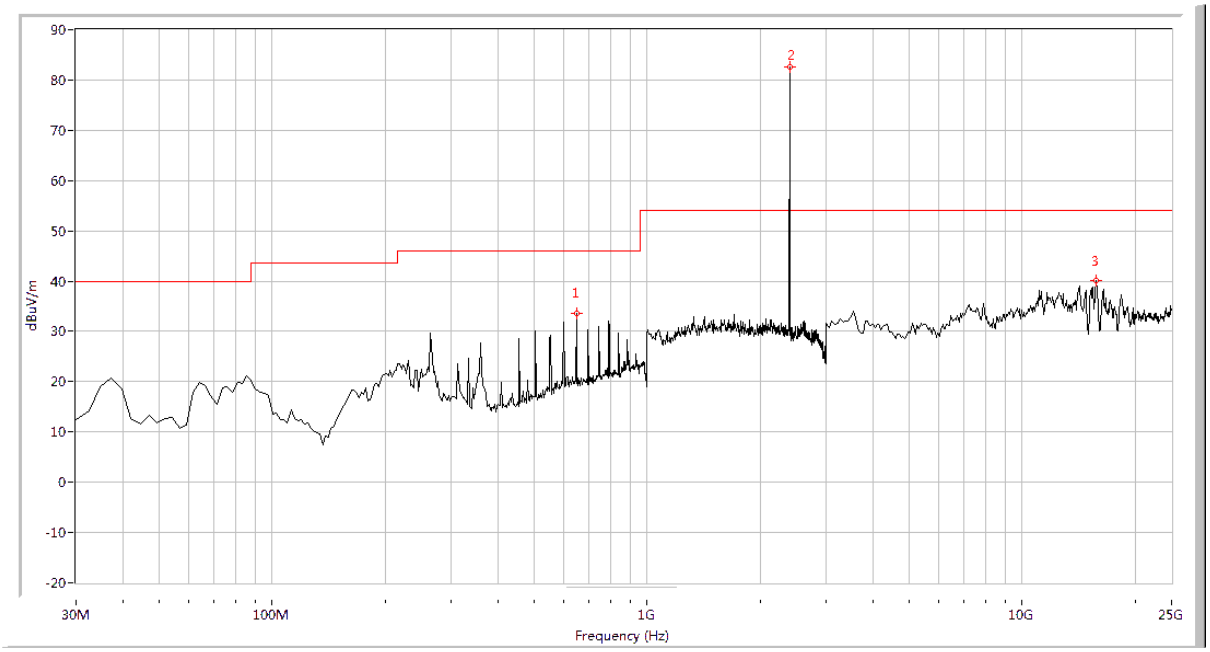
2.10.4.3. 8-DPSK Mode:

A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 0

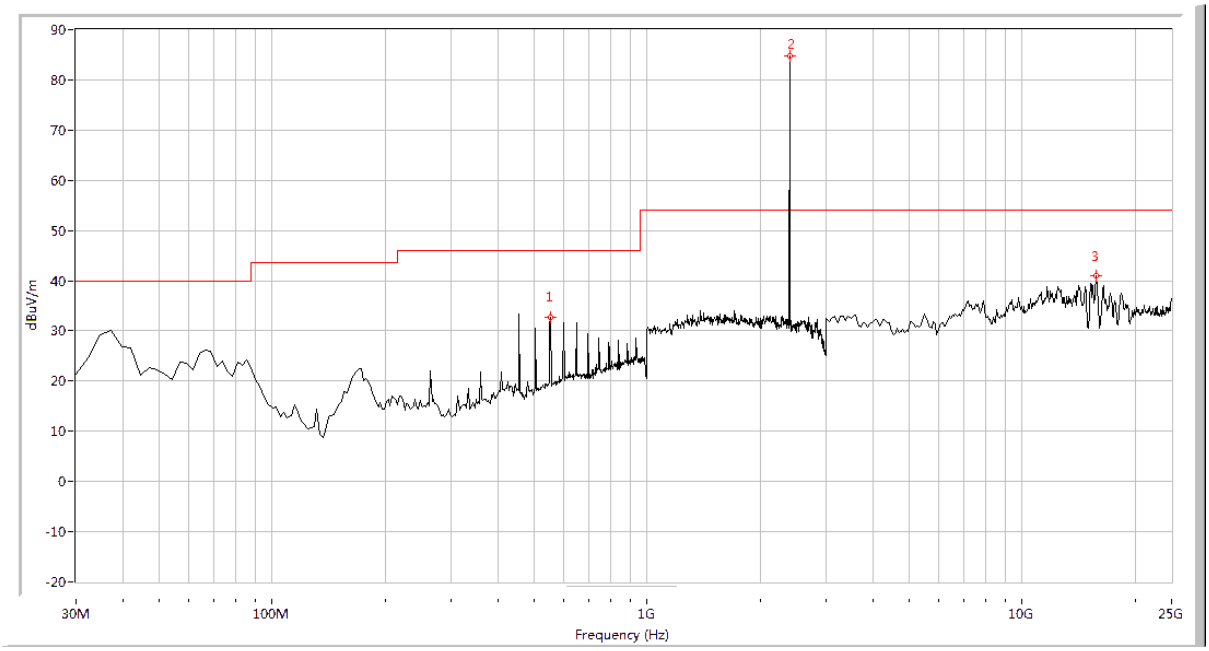


(Plot A.0: 9kHz to 30MHz @8-DPSK, channel 0)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.69	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2402.000	82.58	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	40.16	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

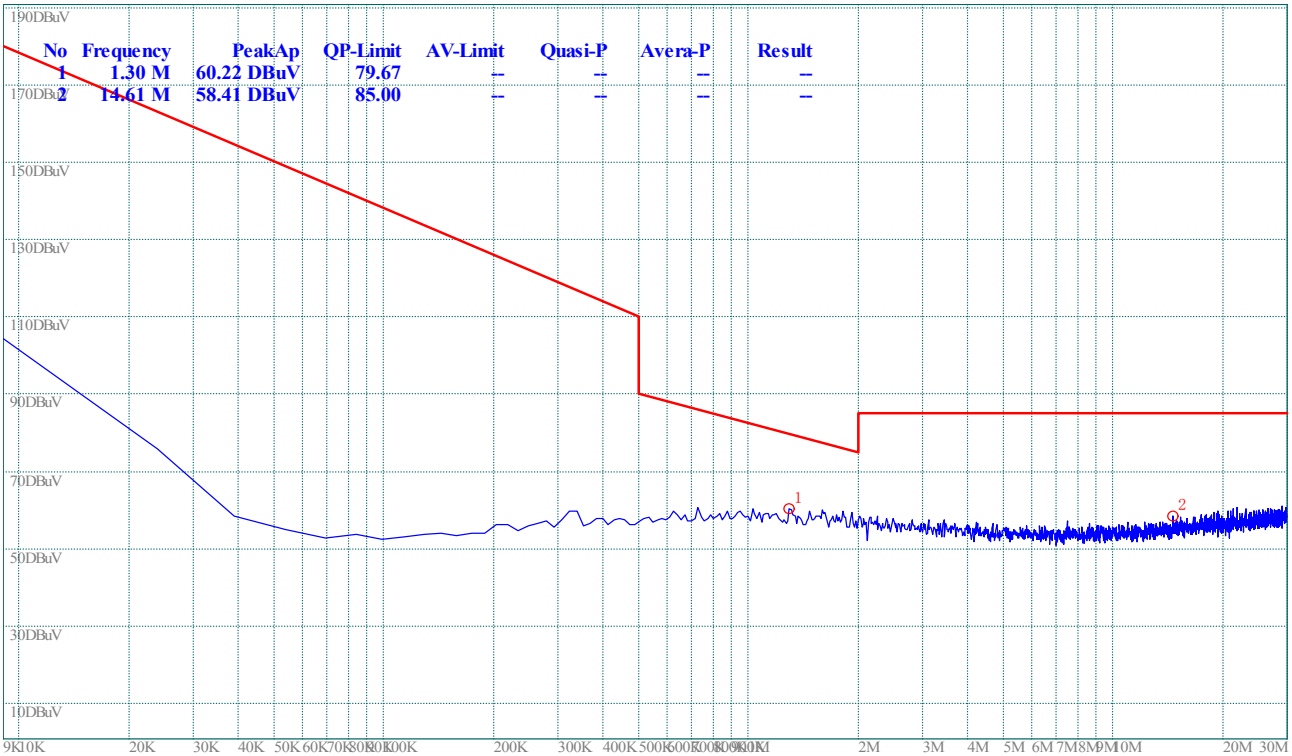
(Plot A.1: 30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



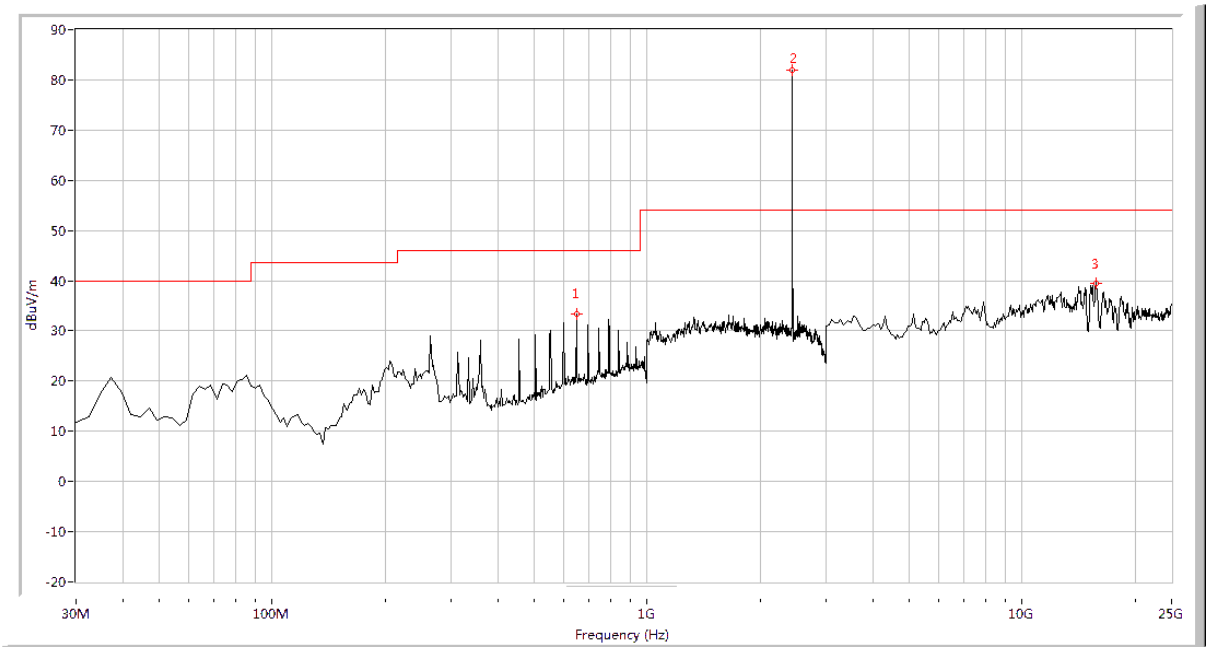
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
552.494	32.63	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2402.000	84.67	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.95	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot A.2: 30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)

Plot for Channel = 39

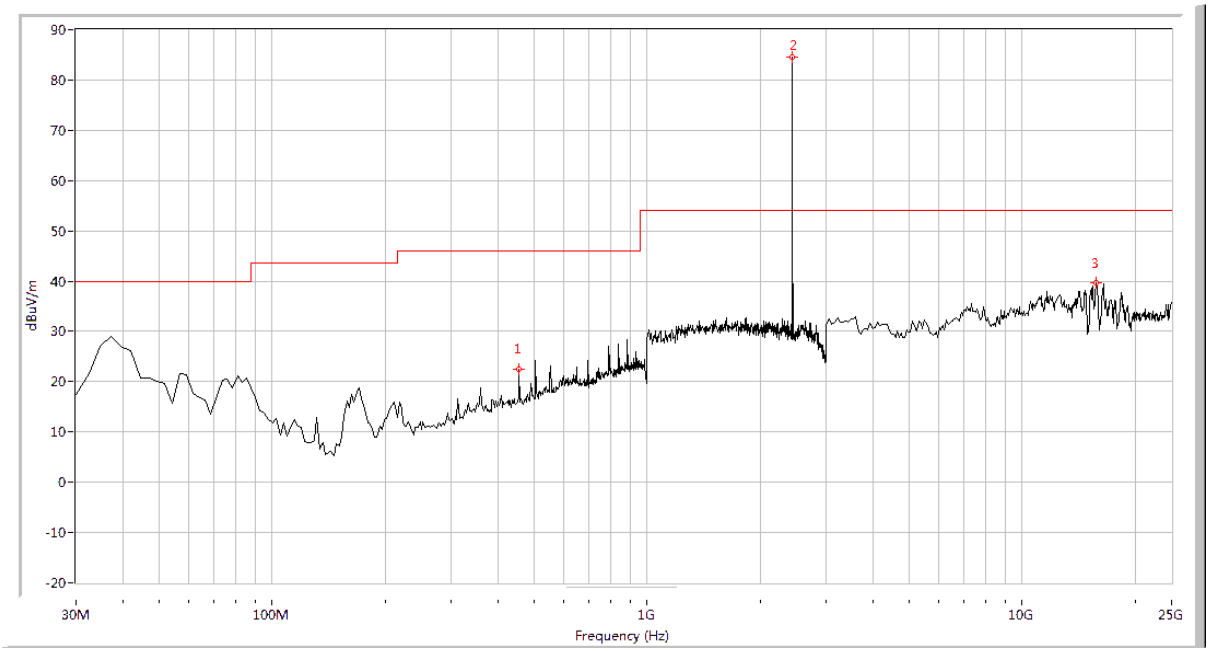


(Plot B.0: 9kHz to 30MHz @8-DPSK, channel 39)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.38	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2441.000	81.83	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.51	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot B.1: 30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)

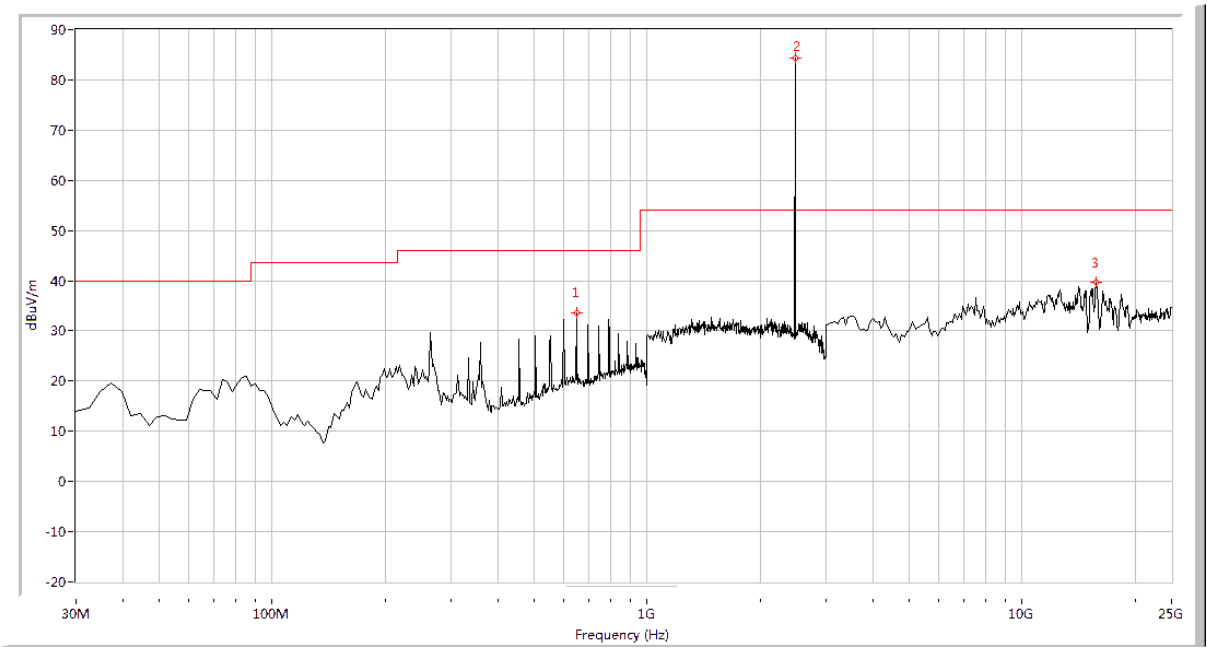


Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	22.46	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2441.000	84.53	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	39.76	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot B.2: 30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)

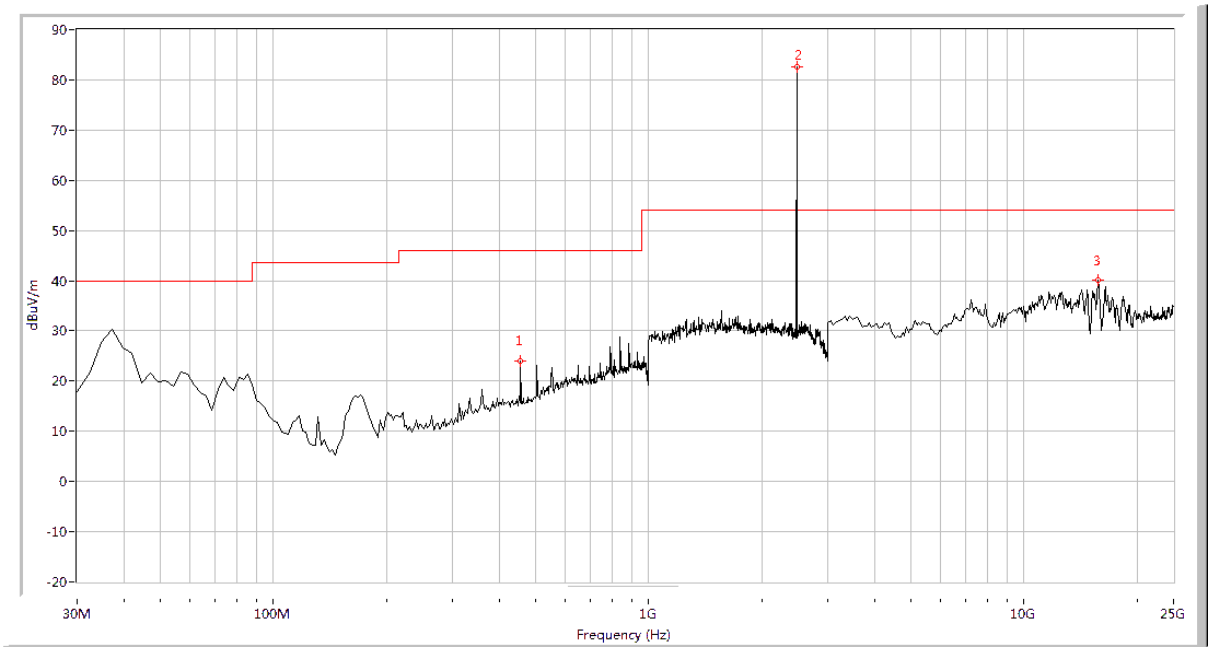
Plot for Channel = 78

(Plot C.0: 9kHz to 30MHz @8-DPSK, channel 78)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
646.833	33.69	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2480.000	84.26	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15783.042	39.77	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 78)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
455.736	23.94	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
2480.000	82.68	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.12	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 78)

2.11. RF exposure evaluation

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy lever in excess of Commission's guideline.

According to 447498 D01 General RF Exposure Guidance v05, exclusion threshold values at selected frequencies and distances table as following.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Routine SAR evaluation refers to the specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evolution is not required, the portable transmitters with output power greater than the applicable low threshold SAR evolution to qualify for TCB approval.

Result:

This is portable device and the Max conducted peak output power is -0.090dBm, the maximum gain of antenna is 5dBi, the maximum output power is 4.91dBm (3.097mW). which is lower than the exclusion threshold 10mW, at frequency 2450MHz, and distance is 5mm.

The SAR measurement is not required.

** END OF REPORT **