Report No.:SZ12050139W01

MORLAB

ilac-MRA

CNAS TESTING CNAS L3572

FCC/IC RADIO TEST REPORT

Issued to

BST Enterprises, Inc.

For

Bluetooth Stereo Headset

Model Name	:	FreeWheelin; RichardSolo FreeWheelin; SoundRyder
Trade Name	:	N/A
Brand Name	:	N/A
FCC ID	:	ODOSRABTH04X001
IC ID	:	10450A- SRABTH04
Standard	:	47 CFR Part 15 Subpart C RSS-GEN RSS-210
Test date	:	2012-6-5 to 2012-6-29
Issue date	:	2012-7-5

In

Shenzhen MORLAB Communication Technology Co., Ltd.

Products Quality Certification • Services Certification • Q. M. System Certification • MORLAB Certification GLOBAL SERVICE

Tested by Zhang Yan
Zhang Yan
Date 2012.7.5

Approved by Wu Xiuwen
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Date 2012.7.5

Review by Peng Huarui
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Date 2012.7.5

CTIA Authorized Test Lab LAB CODE 20081223-00 IEEE 1725 OTA | OFTA 電訊管理局 | ilac-MRA | TAF Testing Laboratory | GCF Official Observer of Global Certification Forum | Bluetooth BQTF | FCC Reg. No. 741109

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Change History		
Issue	Date	Reason for change
1.0	Jul 5, 2012	First edition

1. General Information

1.1. EUT Description

EUT Type ..... :	Bluetooth Stereo Headset
Serial No..... :	(n.a, marked #1 by test site)
Hardware Version ..... :	BTH-046 V0.3
Software Version ..... :	BTH-046-V102
Applicant ..... :	BST Enterprises, Inc. 17801 S. Susana Road Rancho Dominguez, CA 90221 USA
Manufacturer ..... :	Zhongshan K-mate General Electronics Co.,Ltd Fuwan Industrial Zone，Fuwan South Road，Sunwen East Road，East District，Zhongshan，China
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 ..... :	PCB Antenna, gain: 0dBi

Note 1: The EUT is a Bluetooth Stereo Headset, 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 the purposes of the present report, following the abbreviations are apply:

N.A Not Application

-- Not done this test

EUT Equipment under the test

Note 3: For the radiated emission test, according to the FCC Part 15 Paragraph 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product has a permanent antenna, fulfill the requirement of this section.

Note 4: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 5: 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 aresponse 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.

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C and RSS-210 (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC/IC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-09 Edition)	Radio Frequency Devices
2	RSS-GEN: Issue 3, December 2010	General Requirements and Information for the Certification of Radio Apparatus
3	RSS-210: Issue 8, December 2010	Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

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

No.	Section in CFR 47	Section in RSS-GEN, RSS-210	Description	Result
1	15.247(a)	A8.1 (4)	Number of Hopping Frequency	PASS
2	15.247(b)	A8.4 (2)	Peak Output Power	PASS
3	15.247(a)	A8.1 (1)	20dB Bandwidth	PASS
4	15.247(a)	A8.1 (2)	Carrier Frequency Separation	PASS
5	15.247(a)	A8.1 (4)	Time of Occupancy (Dwell time)	PASS
6	15.247(c)	A8.5	Conducted Spurious Emission	PASS
7	15.247(c)	A8.5	Band Edge	PASS
8	15.207	7.2.2	Conducted Emission	PASS
9	15.209 15.247(c)	A8.5	Radiated Emission	PASS

NOTE:

The tests were performed according to the method of measurements prescribed in DA-00-705 and ANSI C63.4 2009

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 3/F, Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22; the FCC registration number is 741109.

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 and RSS-210 Requirements

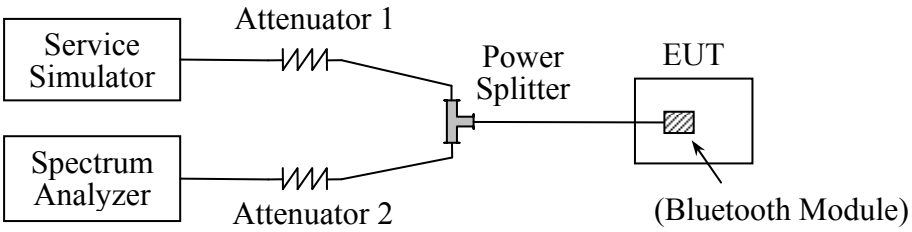
2.1. Number of Hopping Frequency

2.1.1. Requirement

According to FCC §15.247(a)(1)(iii) and RSS-210 A8.1 (4), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 75 hopping frequencies.

2.1.2. 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
System Simulator	R&S	CMU200	100448	2012.05
Spectrum Analyzer	Agilent	E7405A	US44210471	2012.05
Power Splitter	Weinschel	1506A	NW521	(n.a.)
Attenuator 1	Resnet	20dB	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)

C. 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 a low loss cable
3. The modulation types of EUT are irrelevant to number of hopping channels deviation
4. The EUT must have is hopping function enabled. Use the follow spectrum analyzer setting Span = the frequency band of operation; RBW ⩾ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold
5. The number of hopping frequency used is defined as the device has the numbers of total channel

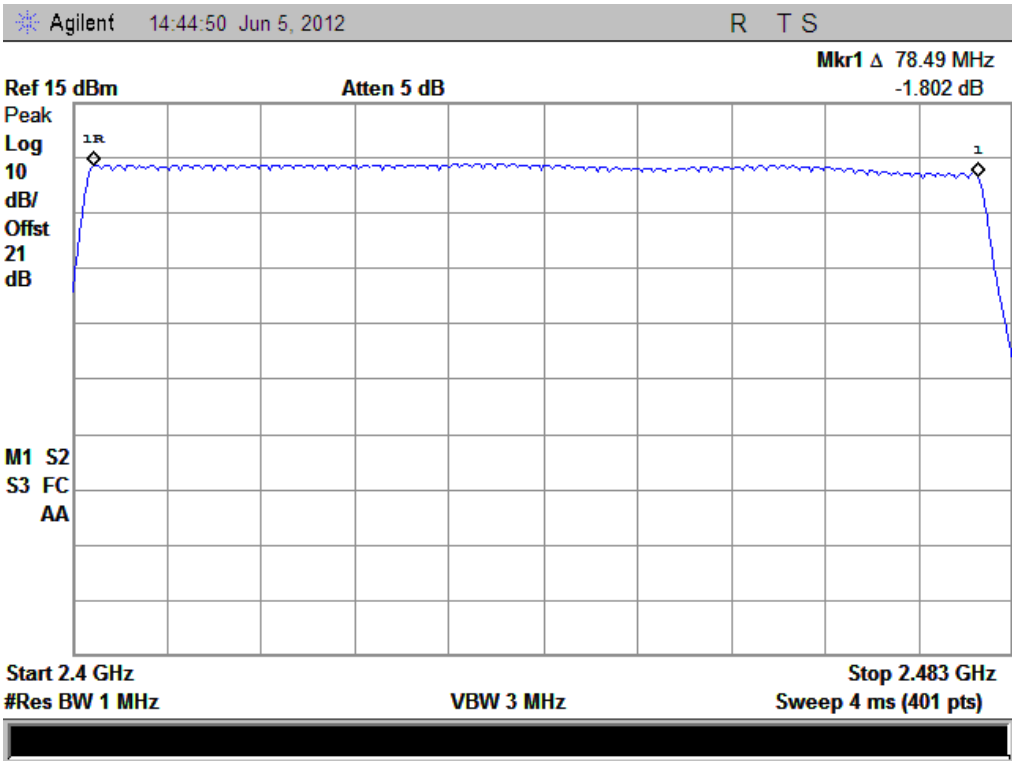
5.1.1. Test Result

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.

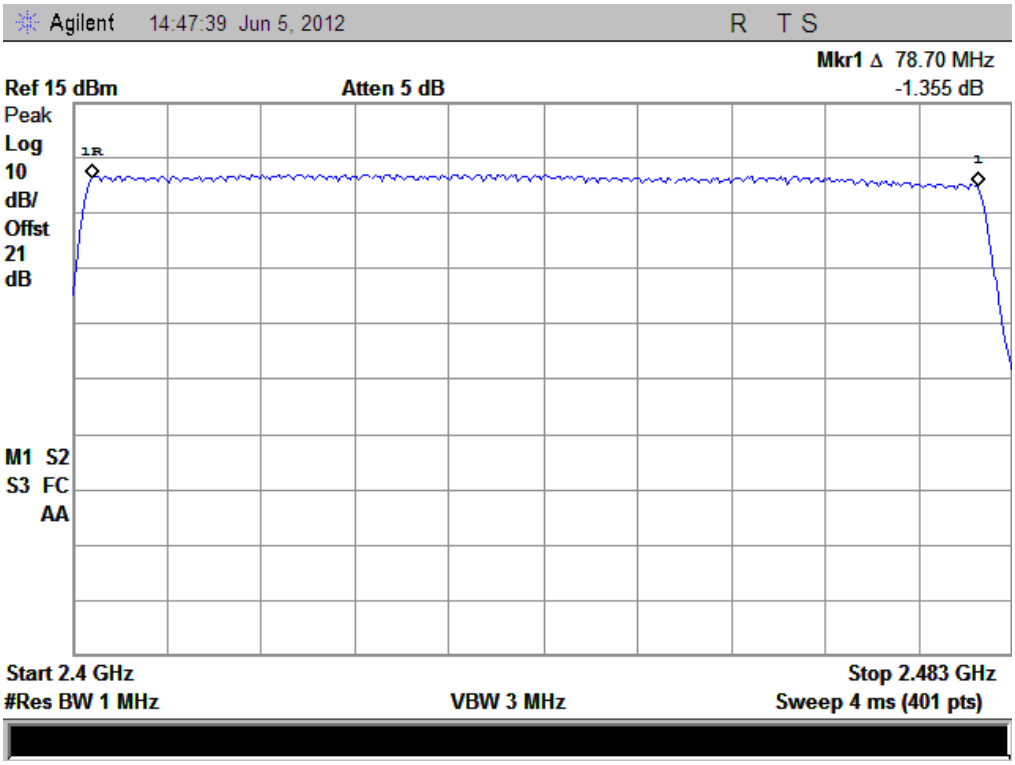
A. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	75	Plot A	PASS
π/4-DQPSK	2400 - 2483.5	79	75	Plot B	PASS
8-DPSK	2400 - 2483.5	79	75	Plot C	PASS

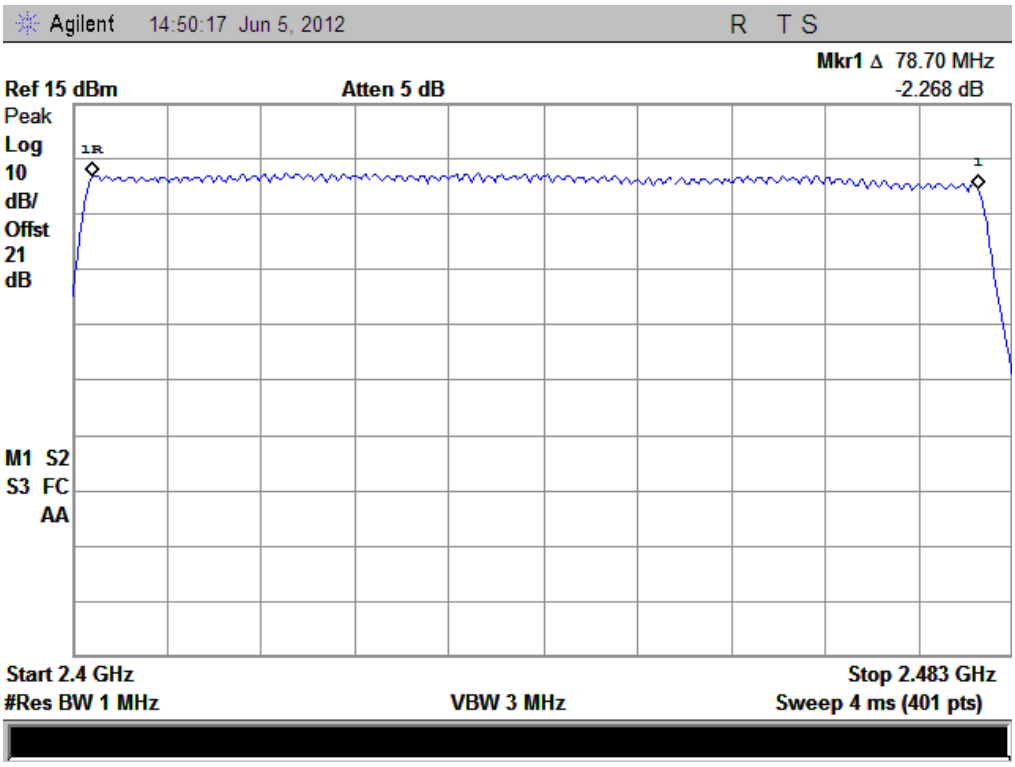
B. Test Plots:



(Plot A: GFSK)



(Plot B: ∏/4-DQPSK)



(Plot C: 8- DPSK)

5.2. Peak Output Power

5.2.1. Requirement

According to FCC §15.247(b)(1) and RSS-210 A8.4 (2), 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.

Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2012.05	1year
Power meter	Agilent	E4418B	GB44318055	2012.05	1year
Power Splitter	Weinschel	1506A	NW521	(n.a.)	(n.a.)
Attenuator 1	Resnet	20dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)

5.2.2. Test Description

See section 2.1.2 of this report.

5.2.3. 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.

5.2.3.1. GFSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power			Limit		Verdict
		dBm	W	Refer to Plot	dBm	W	
0	2402	2.921	0.00196	Plot A	20.96	0.125	PASS
39	2441	3.075	0.00203	Plot B			PASS
78	2480	2.484	0.00177	Plot C			PASS

5.2.3.2. π/4-DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power			Limit		Verdict
		dBm	W	Refer to Plot	dBm	W	
0	2402	2.912	0.00196	Plot D	20.96	0.125	PASS
39	2441	3.077	0.00203	Plot E			PASS
78	2480	2.487	0.00177	Plot F			PASS

5.2.3.3. 8-DPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power			Limit		Verdict
		dBm	W	Refer to Plot	dBm	W	
0	2402	2.157	0.00164	Plot G	20.96	0.125	PASS
39	2441	2.257	0.00168	Plot H			PASS
78	2480	1.609	0.00145	Plot I			PASS

5.3. 20dB Bandwidth

5.3.1. Definition

According to FCC §15.247(a)(1) and RSS-210 A8.1 (1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

5.3.2. Test Description

See section 2.1.2 of this report.

5.3.3. Test Result

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

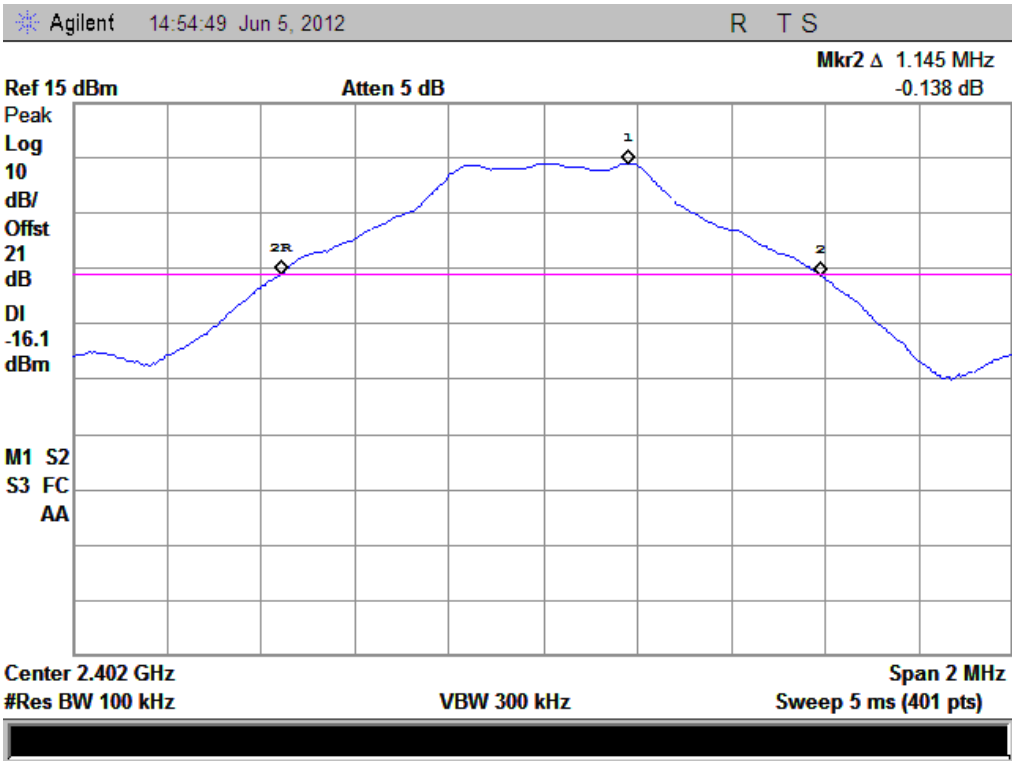
5.3.3.1. GFSK Mode

A. Test Verdict:

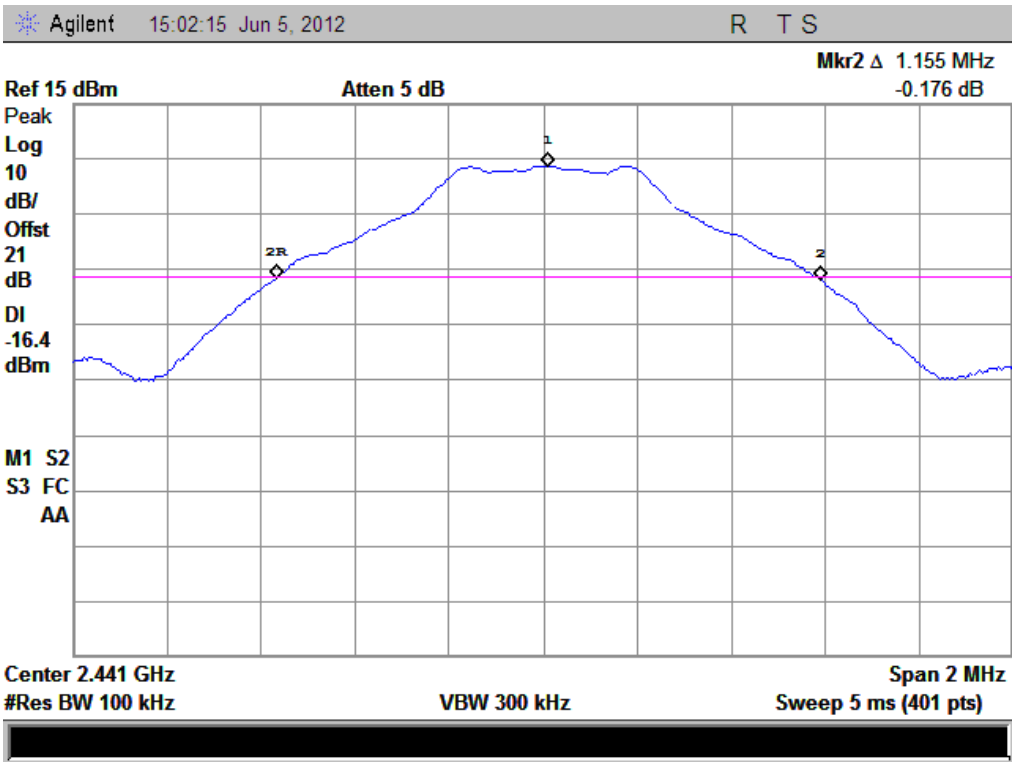
The maximum 20dB bandwidth measured is 1.155MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.145	Plot A
39	2441	1.155	Plot B
78	2480	1.145	Plot C

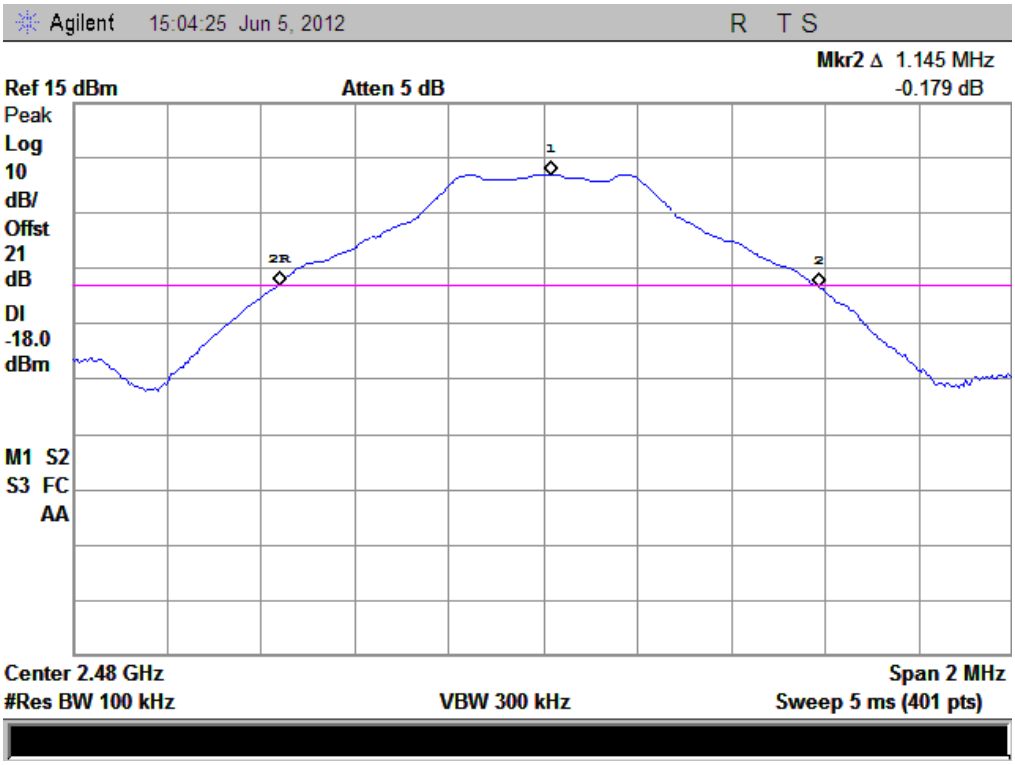
B. Test Plots:



(Plot A: Channel = 2402)



(Plot B: Channel = 2441)



(Plot C: Channel = 2480)

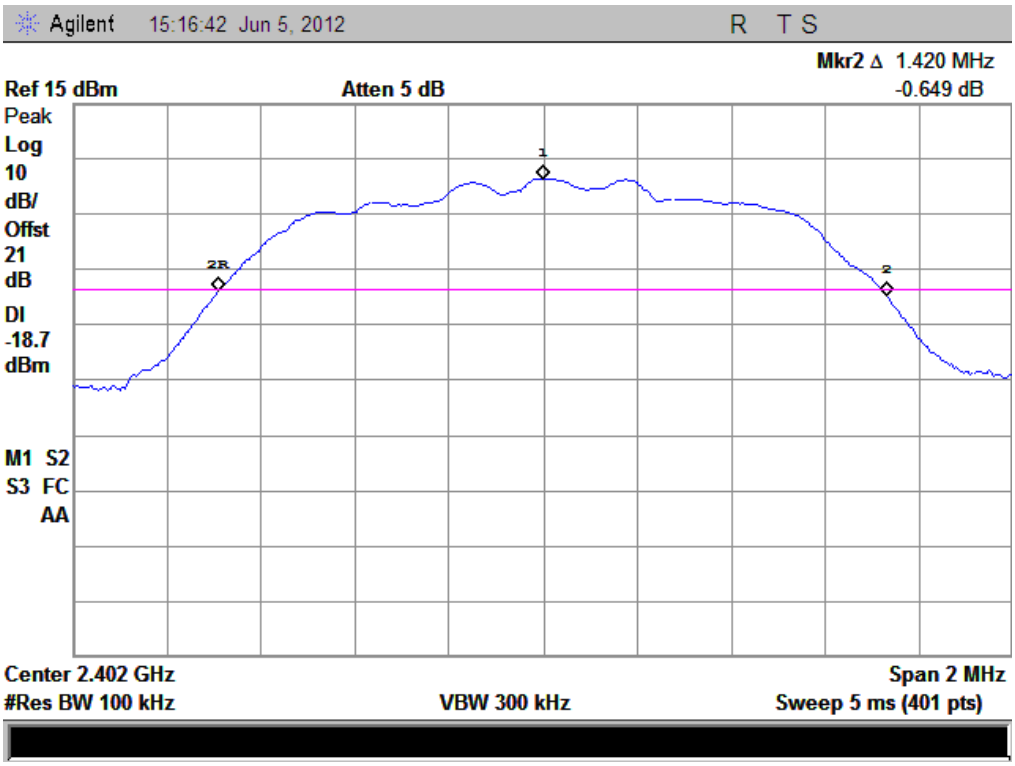
5.3.3.2. π/4-DQPSK Mode

A. Test Verdict:

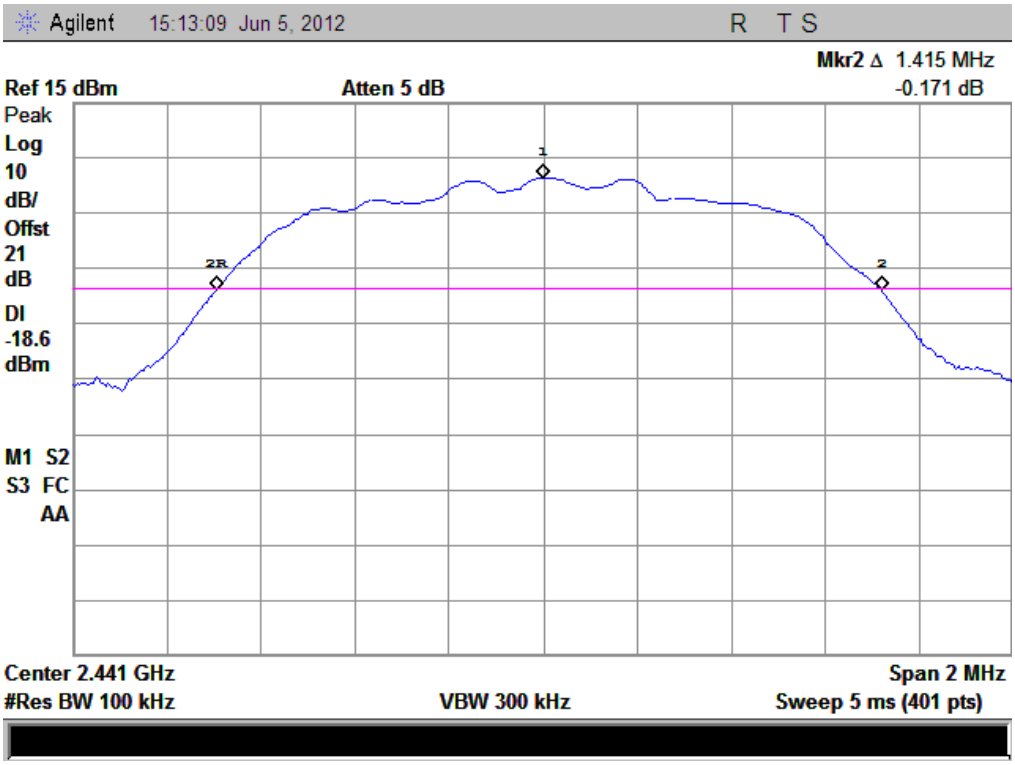
The maximum 20dB bandwidth measured is 1.420MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.420	Plot D
39	2441	1.415	Plot E
78	2480	1.415	Plot F

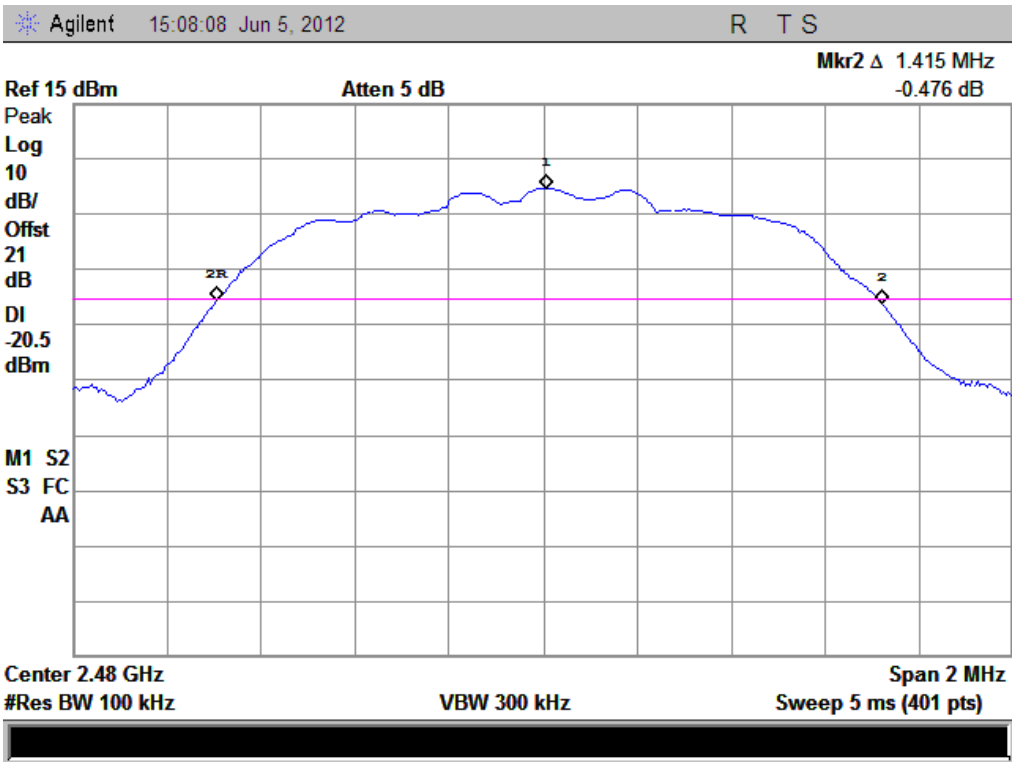
B. Test Plots:



(Plot D: Channel = 2402)



(Plot E: Channel = 2441)



(Plot F: Channel = 2480)

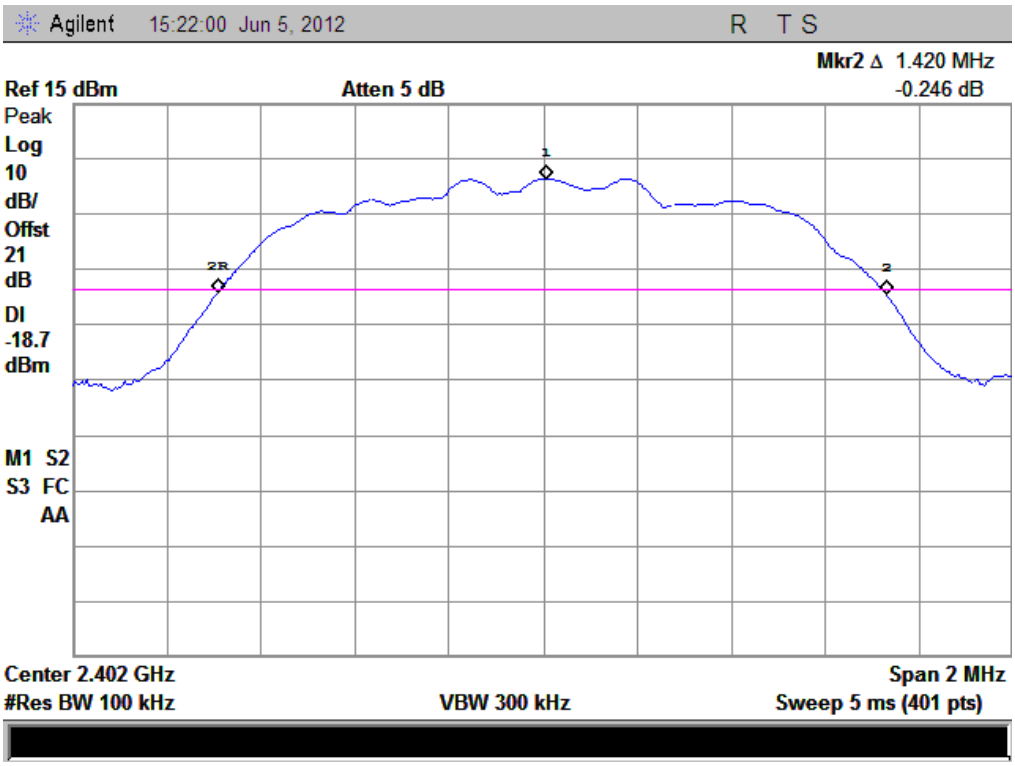
5.3.3.3. 8-DPSK Mode

A. Test Verdict:

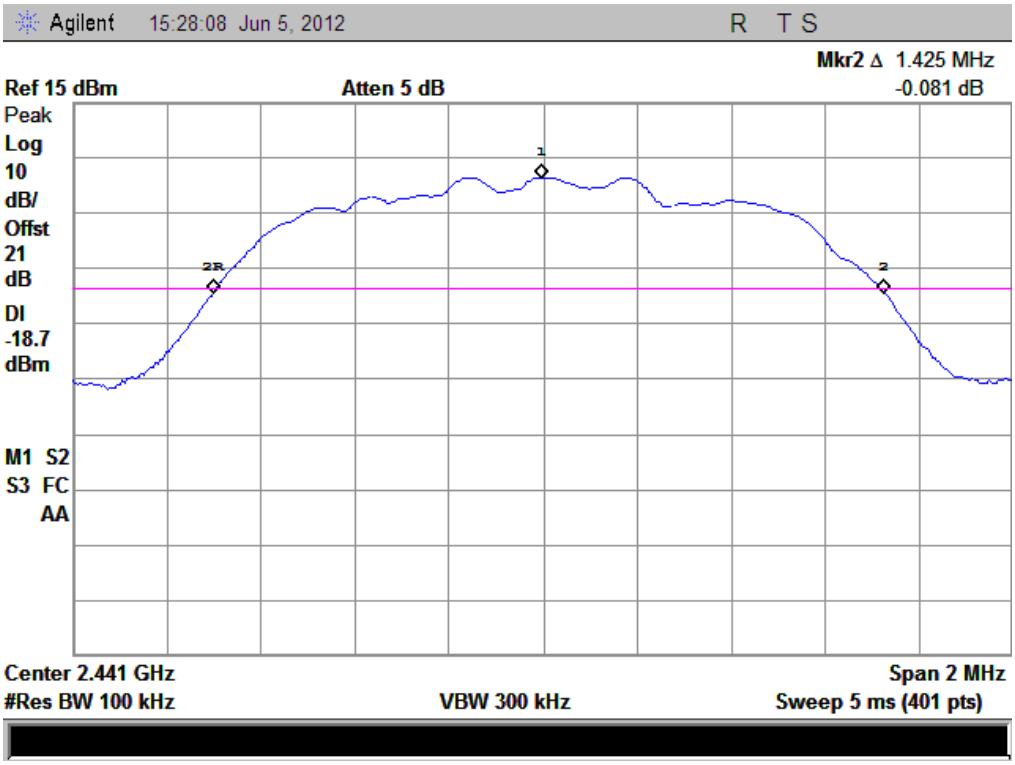
The maximum 20dB bandwidth measured is 1.430MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.420	Plot G
39	2441	1.425	Plot H
78	2480	1.430	Plot I

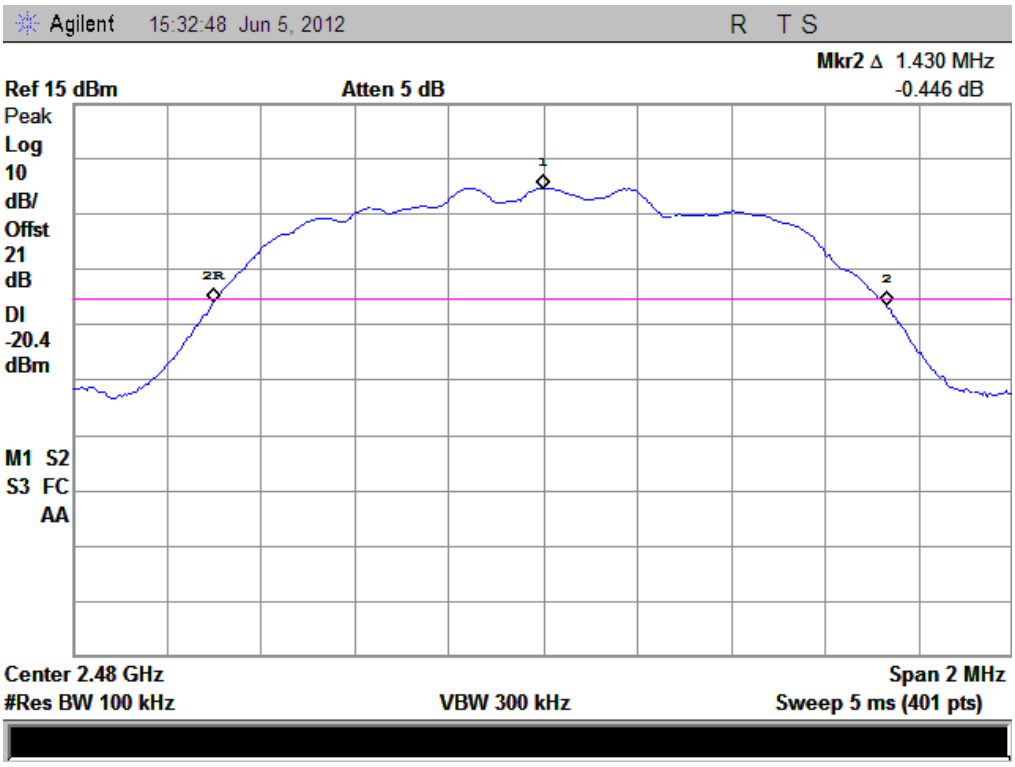
B. Test Plots:



(Plot G: Channel = 2402)



(Plot H: Channel = 2441)



(Plot I: Channel = 2480)

5.4. Carried Frequency Separation

5.4.1. Definition

According to FCC §15.247(a)(1) RSS-210 A8.1 (2), 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.

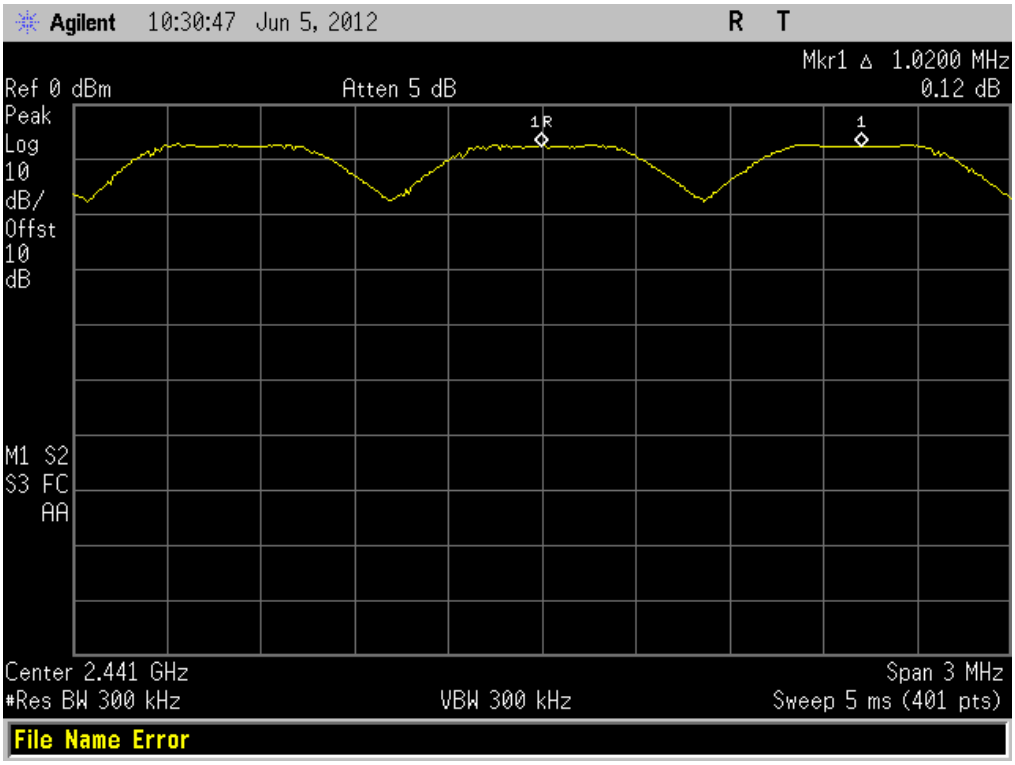
5.4.2. Test Description

See section 2.1.2 of this report.

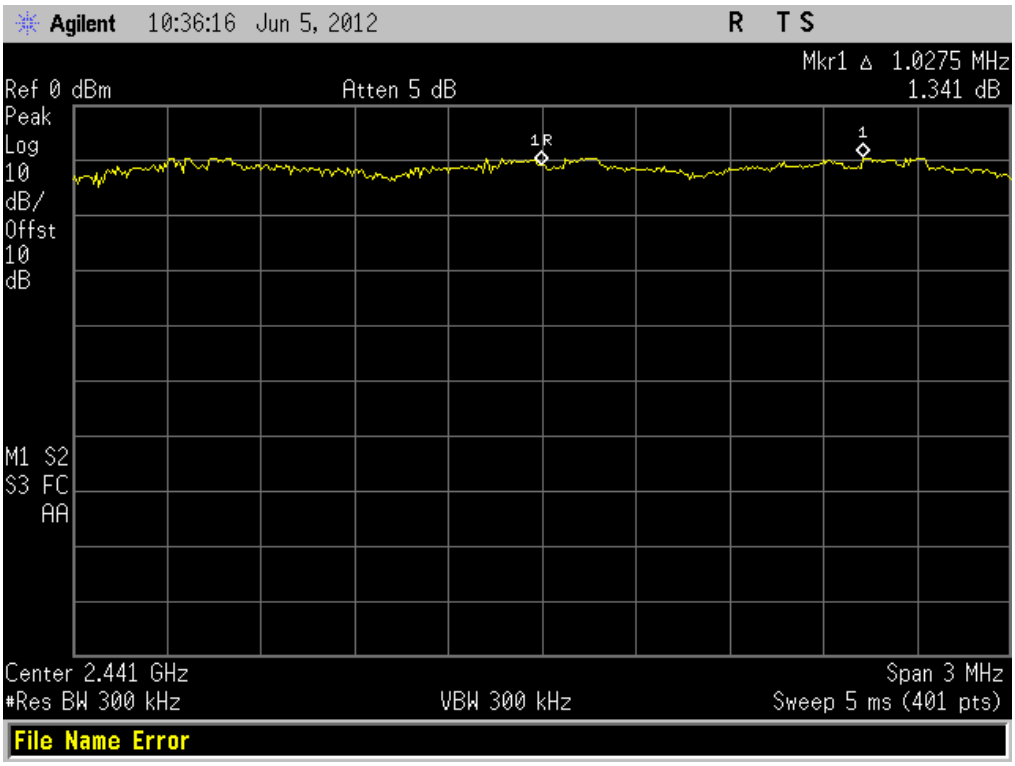
5.4.3. Test Result

The Bluetooth Module operates at hopping-on test mode.

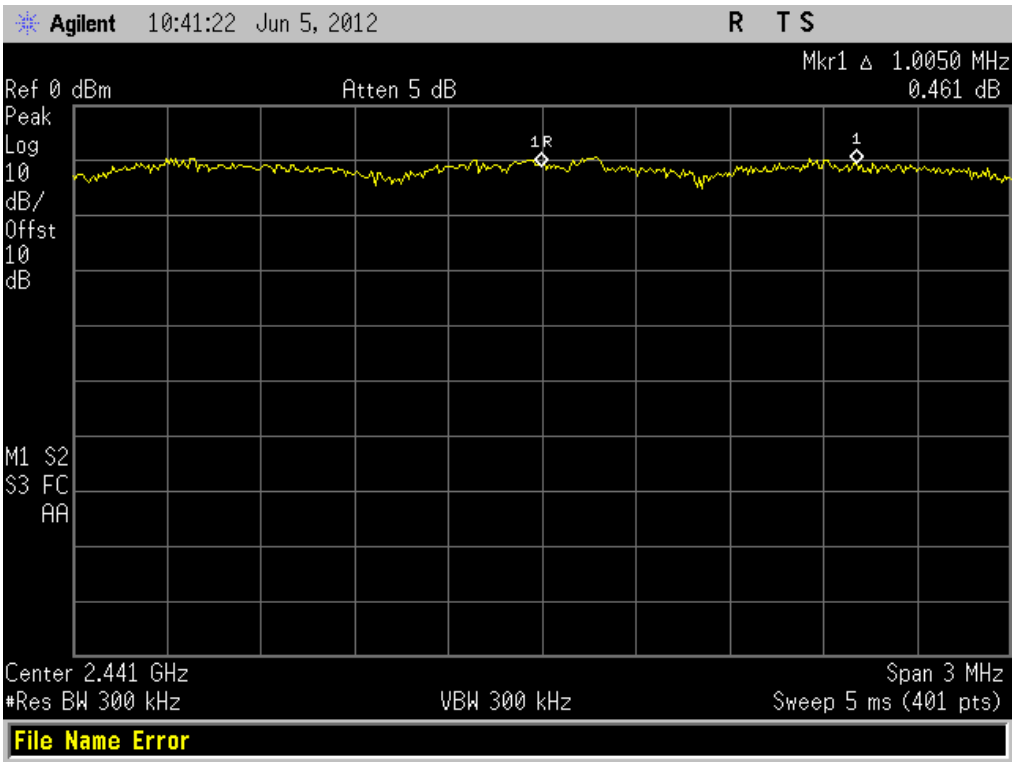
For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.155MHz for GFSK mode, 1.420MHz for π/4-DQPSK mode and 1.430MHz for 8-DPSK mode, refer to section 5.3.3), whichever is greater. So, the verdict is PASS.



(Plot A: GFSK)



(Plot B: π/4-DQPSK)



(Plot C: 8-DPSK)

5.5. Time of Occupancy (Dwell time)

5.5.1. Requirement

According to FCC §15.247(a)(1)(iii) and RSS-210 A8.1 (4), 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.

5.5.2. Test Description

See section 2.1.2 of this report.

5.5.3. Test Result

The average time of occupancy on any channel within the Period can be calculated with formulas (for DH5 package type):

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4s * {Number of Hopping Frequency}

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

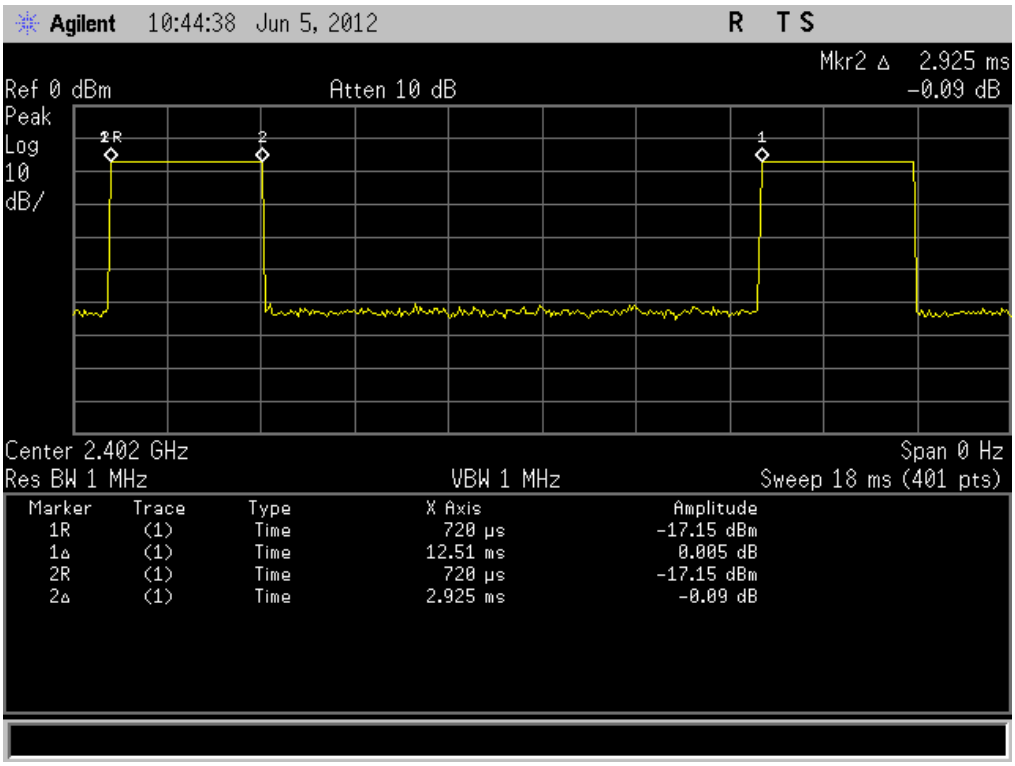
5.5.3.1. GFSK Mode

A. Test Verdict:

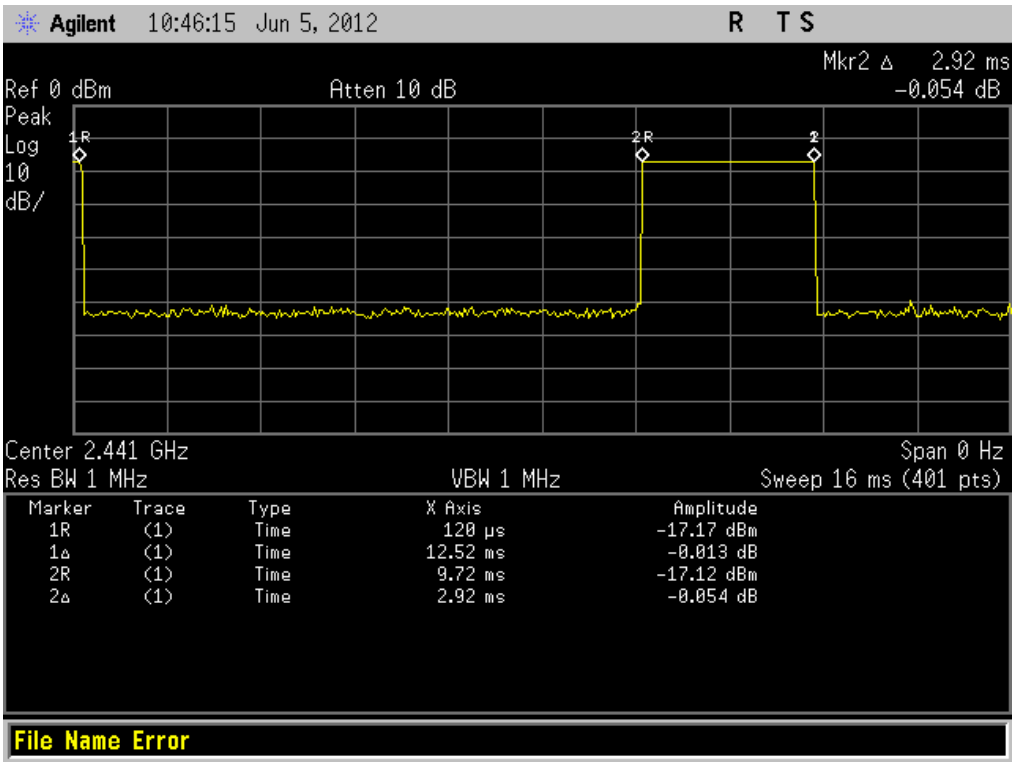
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.925	Plot A	312.000	400	PASS
39	2441	2.920	Plot B	311.467		PASS
78	2480	2.925	Plot C	312.000		PASS

B. Test Plots:

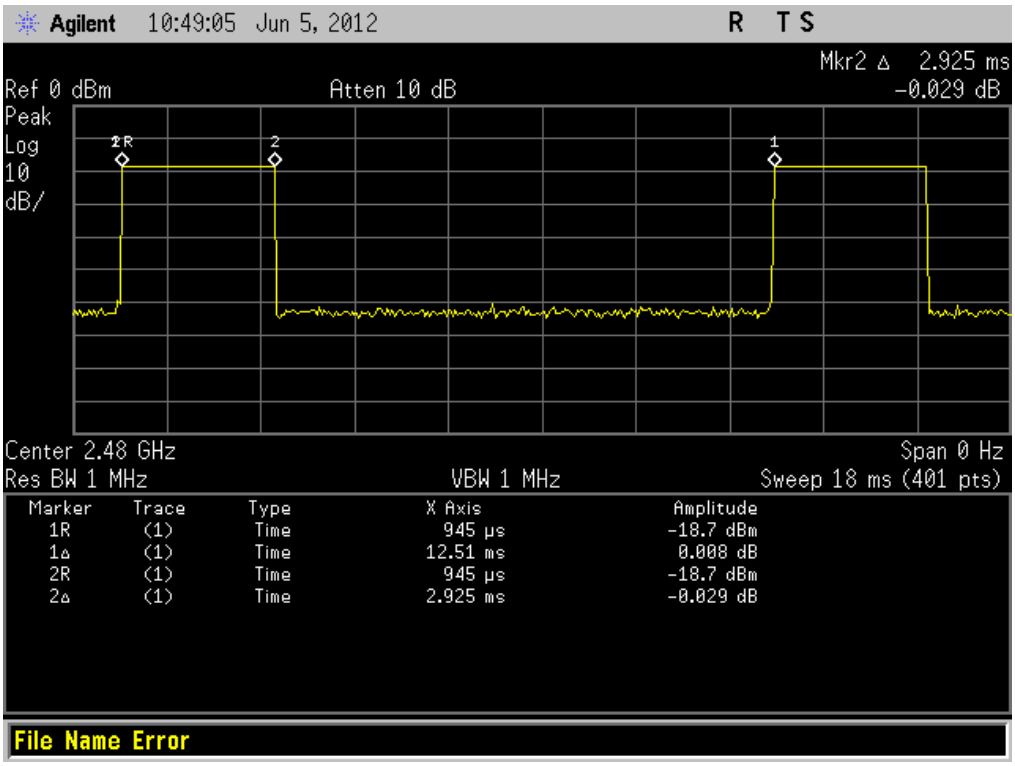
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402)



(Plot B: Channel = 2441)



(Plot C: Channel = 2480)

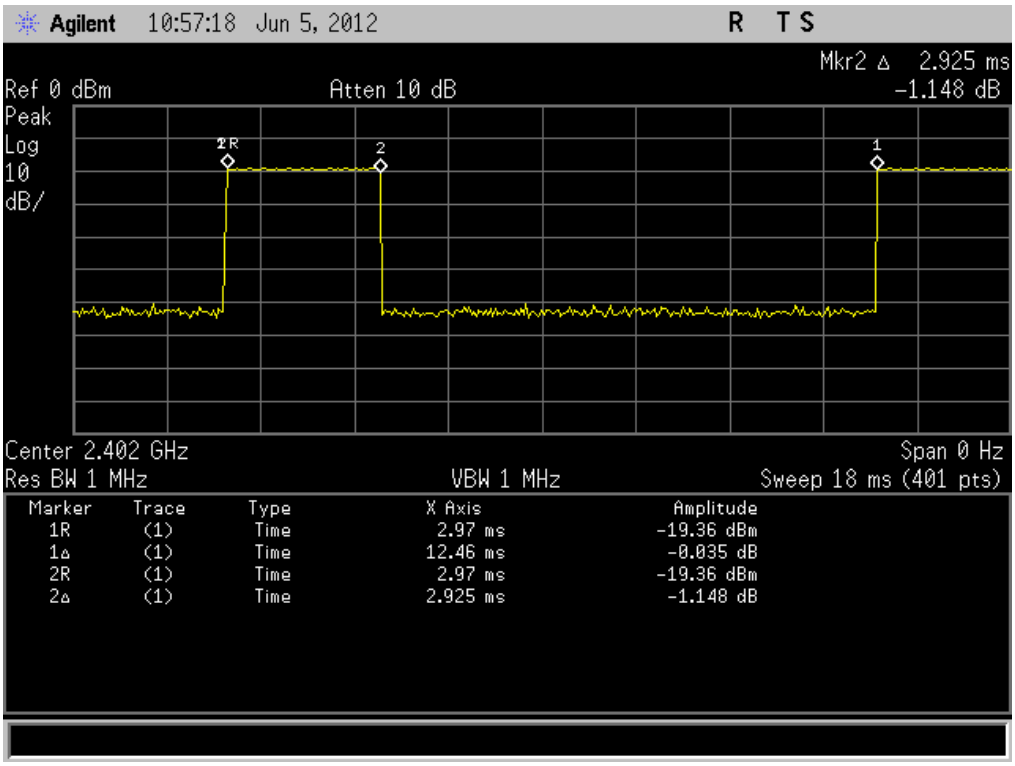
5.5.3.2. π/4-DQPSK Mode

A. Test Verdict:

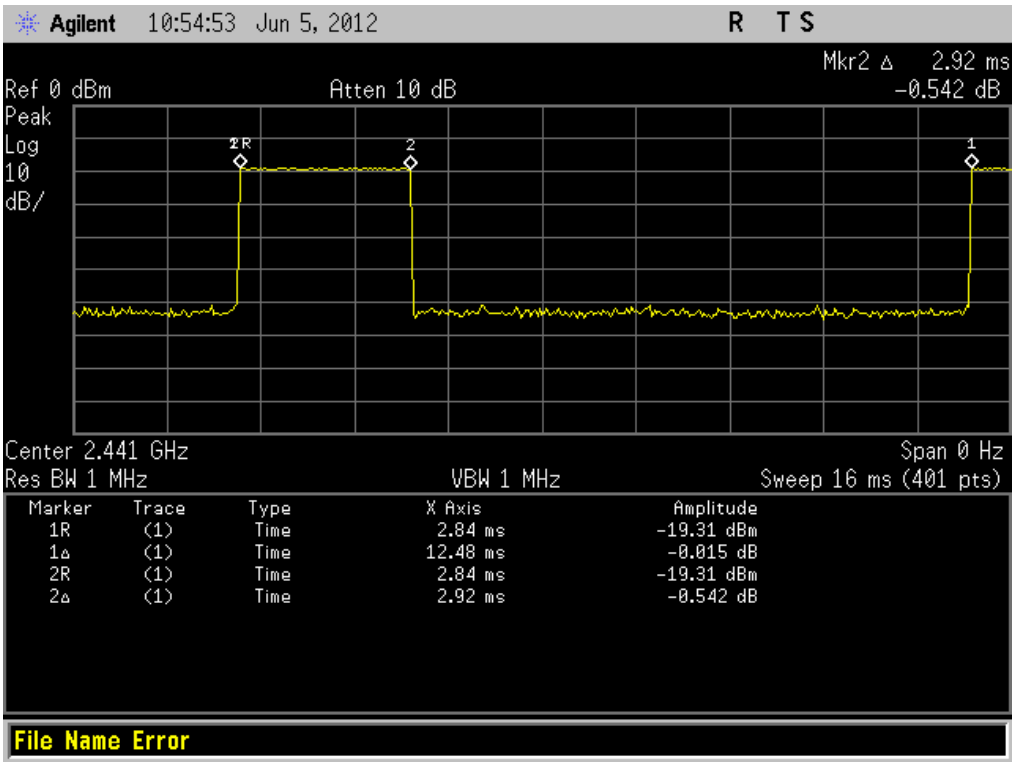
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.925	Plot D	312.000	400	PASS
39	2441	9.920	Plot E	311.467		PASS
78	2480	2.920	Plot F	311.467		PASS

B. Test Plots:

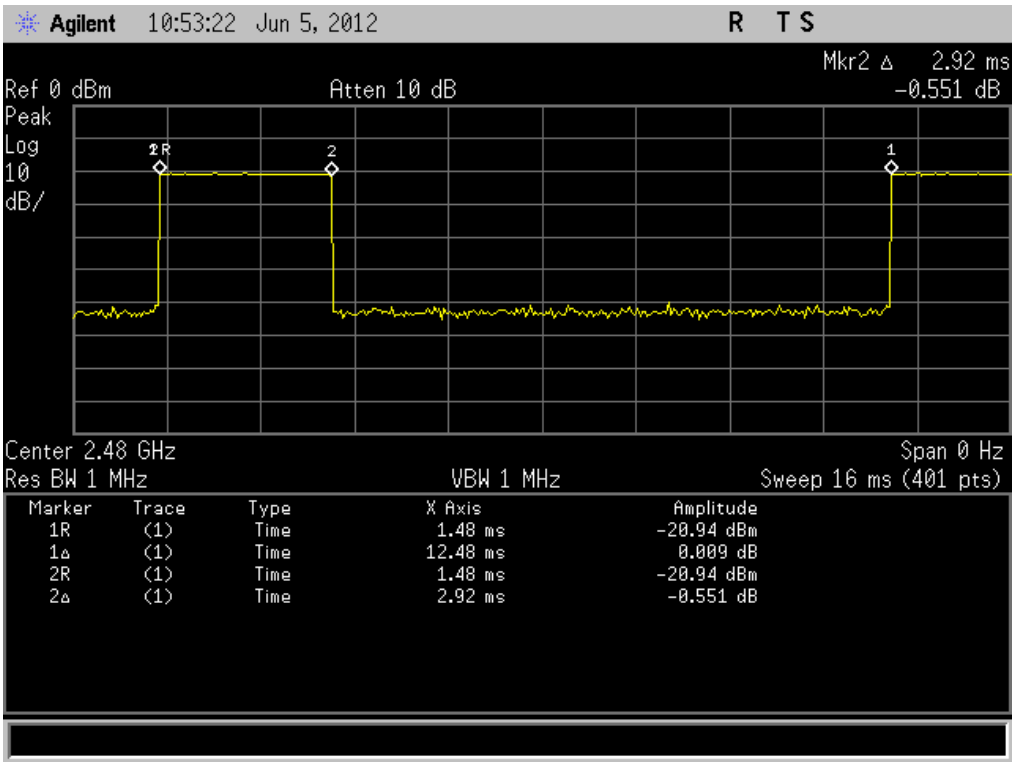
Note: the following plots record the Pulse Time of the Module carrier.



(Plot D: Channel = 2402)



(Plot E: Channel = 2441)



(Plot F: Channel = 2480)

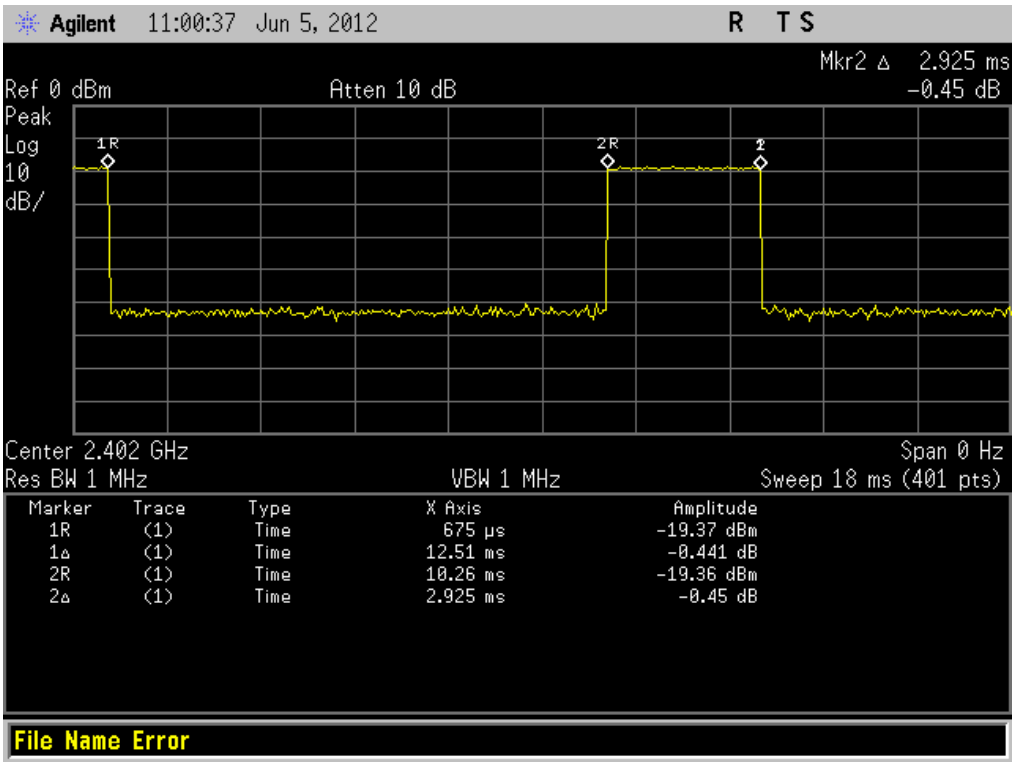
5.5.3.3. 8-DPSK Mode

A. Test Verdict:

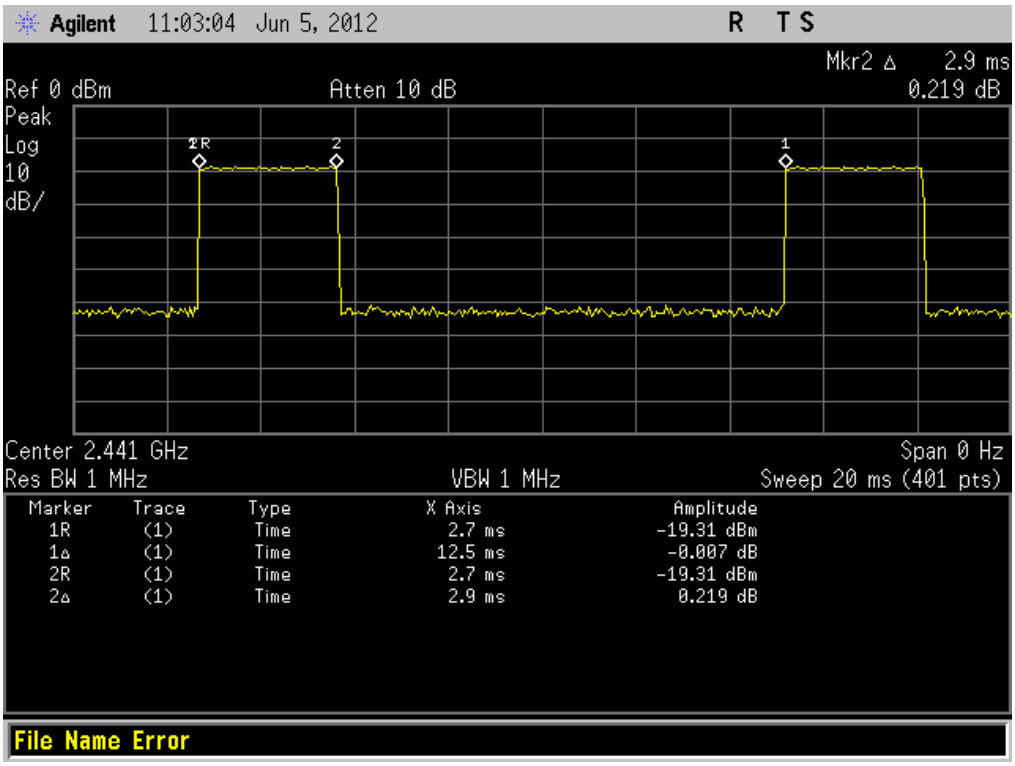
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.925	Plot G	312.000	400	PASS
39	2441	2.900	Plot H	308.333		PASS
78	2480	2.925	Plot I	312.000		PASS

B. Test Plots:

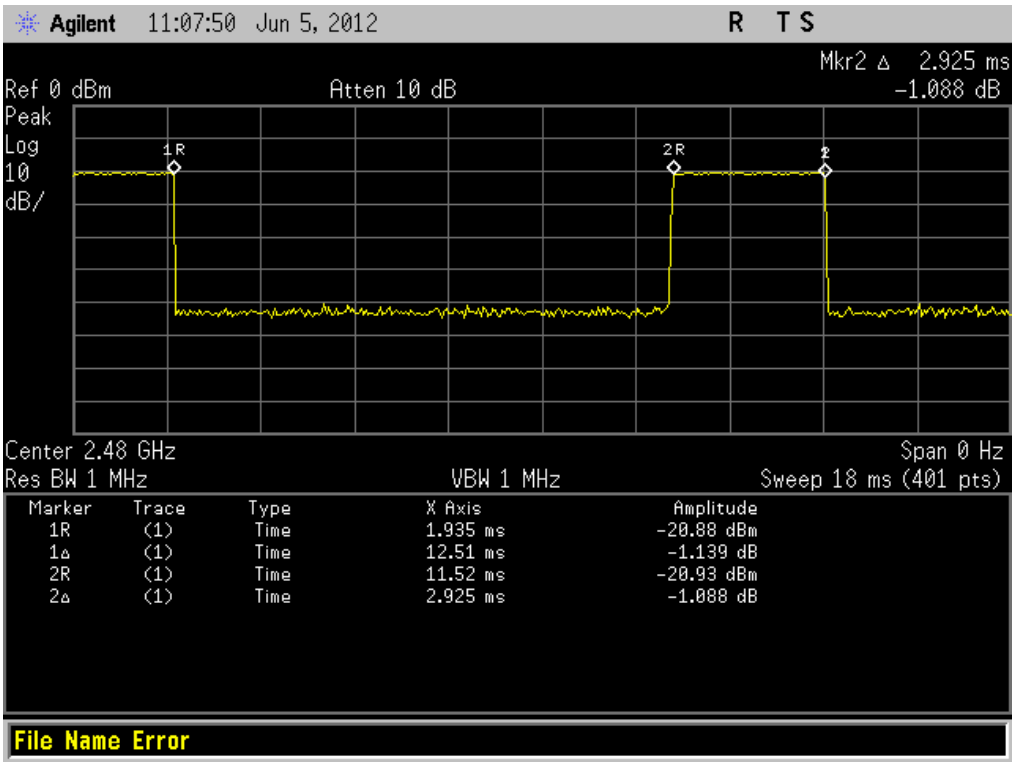
Note: the following plots record the Pulse Time of the Module carrier.



(Plot G: Channel = 2402)



(Plot H: Channel = 2441)



(Plot I: Channel = 2480)

5.6. Conducted Spurious Emissions

5.6.1. Requirement

According to FCC §15.247(c) and RSS-A8.5, 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.

5.6.2. Test Description

See section 2.1.2 of this report.

5.6.3. 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.

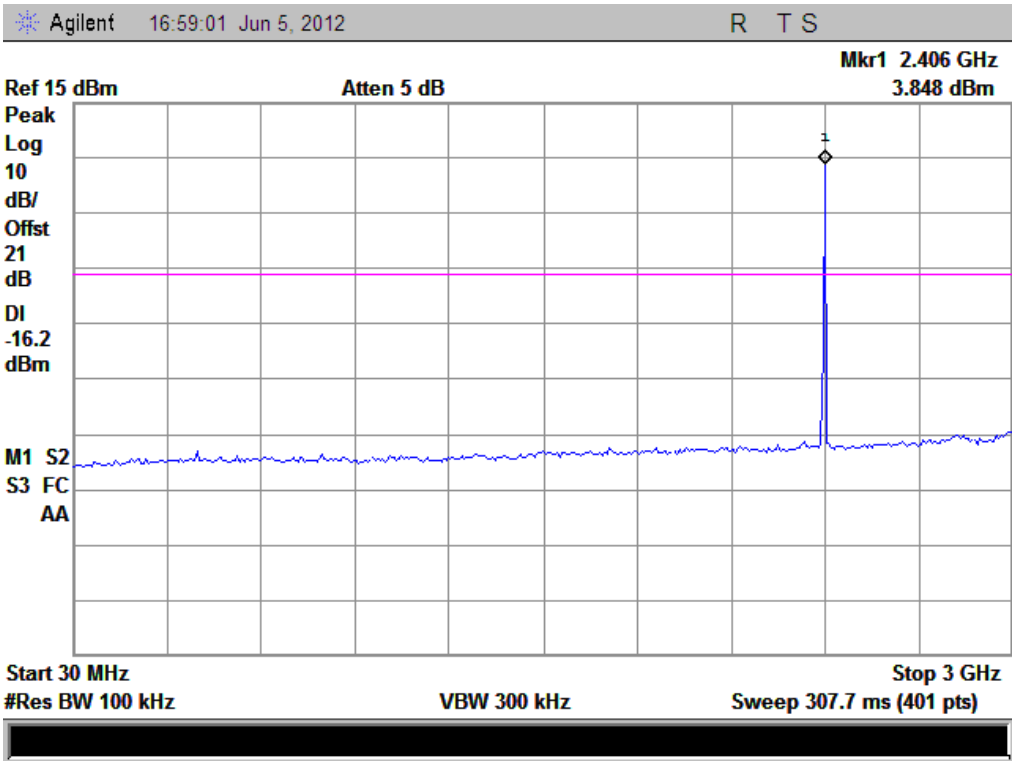
5.6.3.1. GFSK Mode

A. Test Verdict:

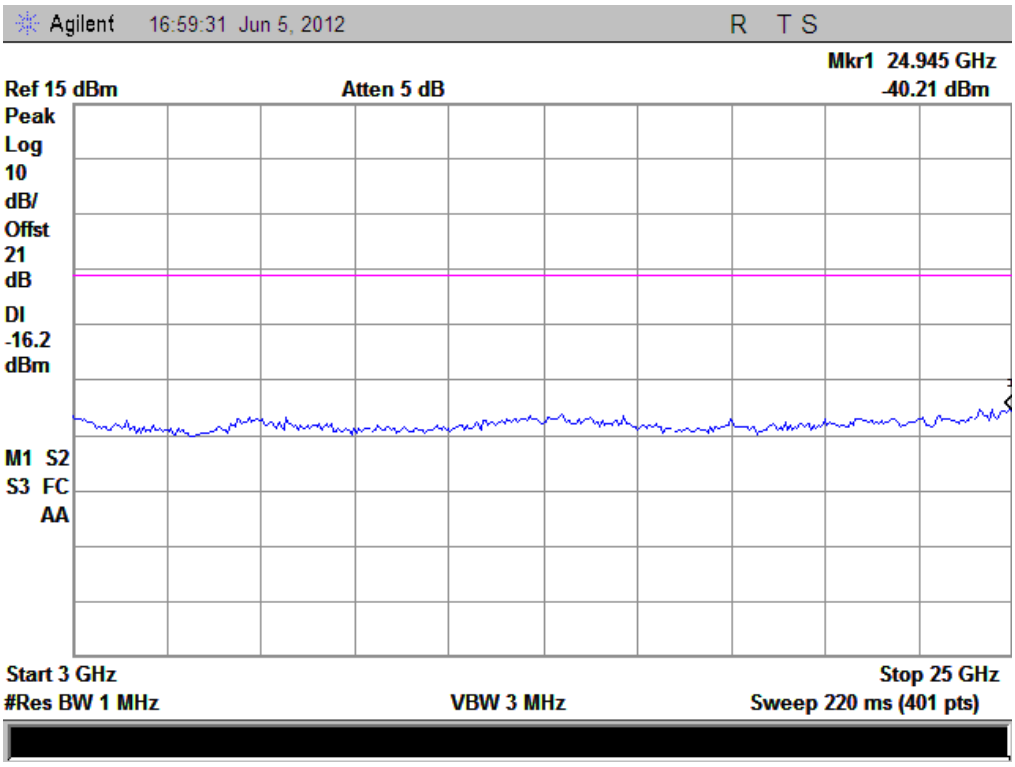
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	<-25	Plot A.1/A.2	3.848	-16.2	PASS
39	2441	<-25	Plot B.1/B.2	3.447	-16.6	PASS
78	2480	<-25	Plot C.1/C.2	1.232	-18.8	PASS

B. Test Plots:

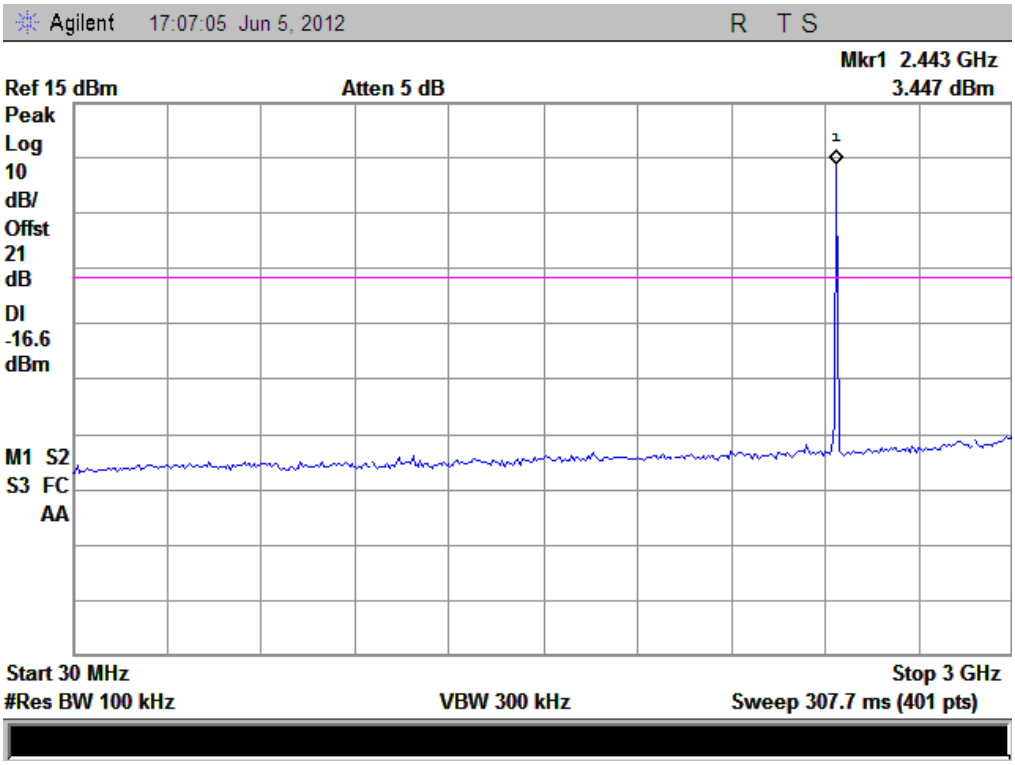
Note: the power of the Module transmitting frequency should be ignored.



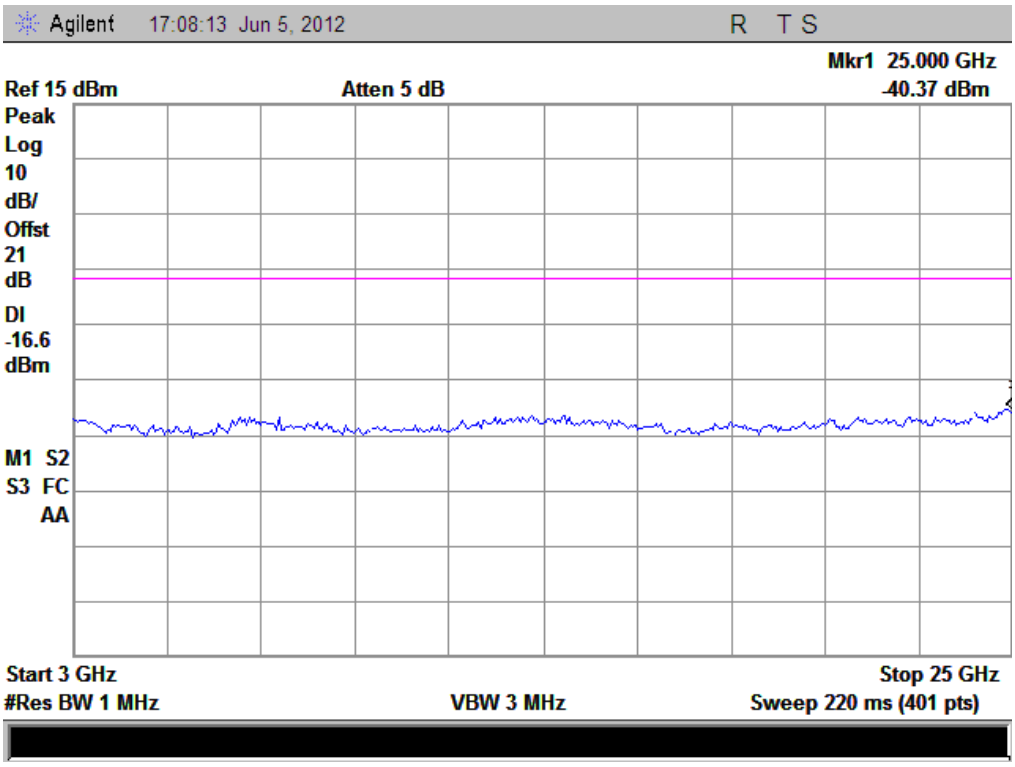
(Plot A.1: Channel = 0, 30MHz to 3GHz)



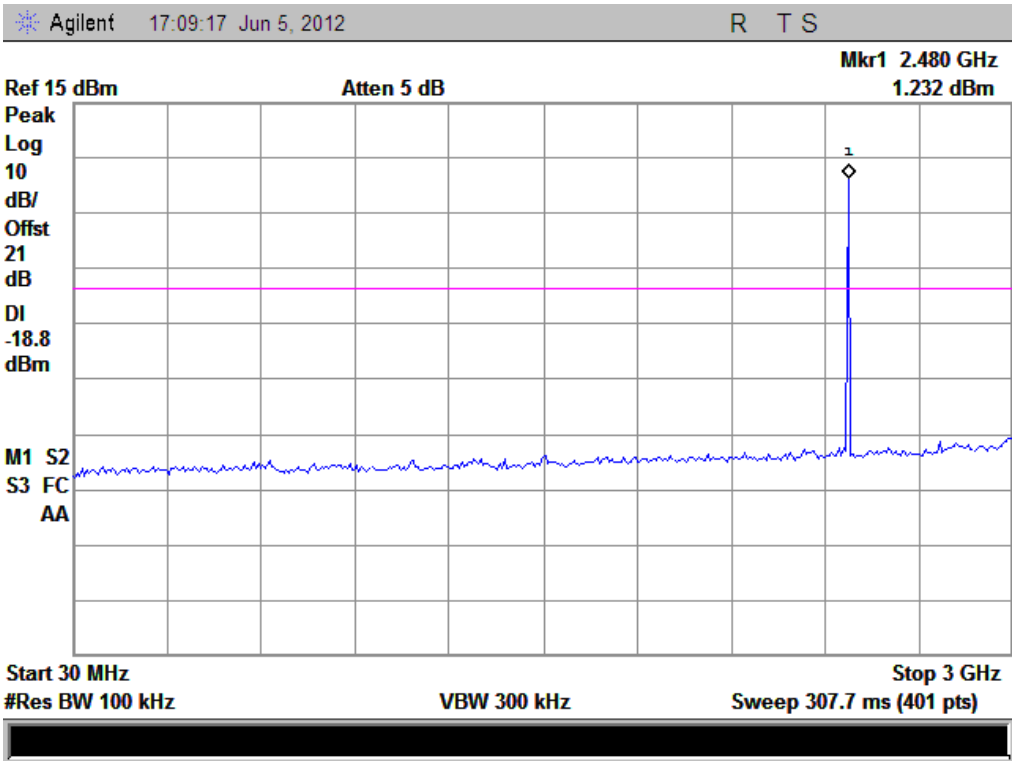
(Plot A.2: Channel = 0, 3GHz to 25GHz)



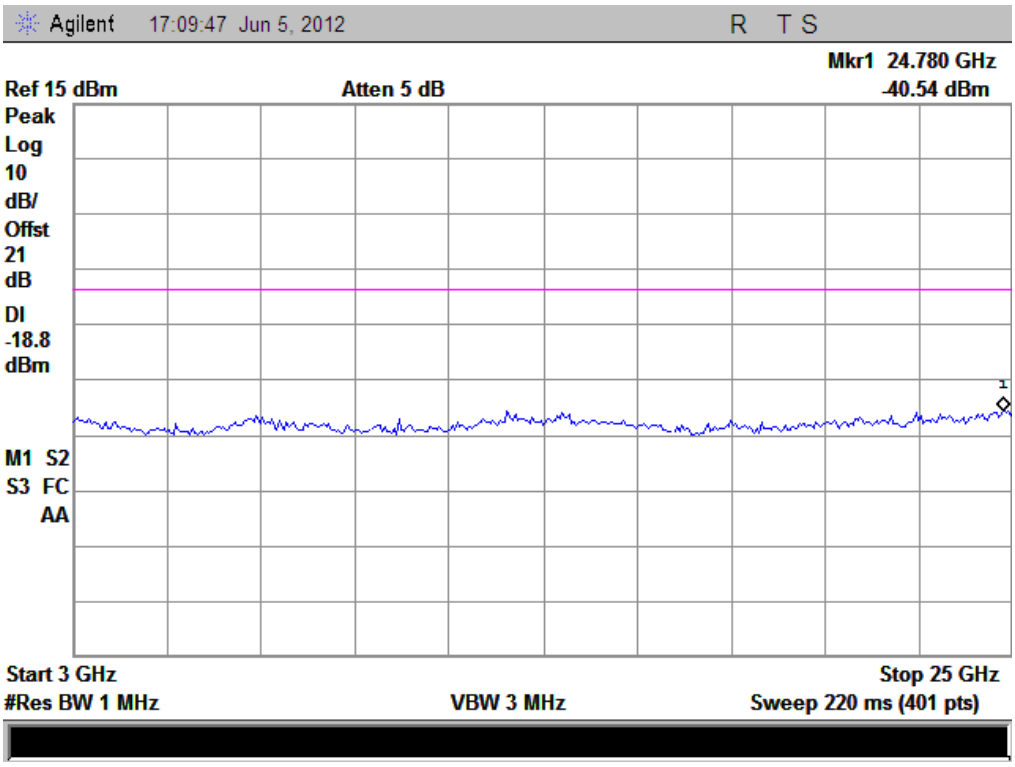
(Plot B.1: Channel = 39, 30MHz to 3GHz)



(Plot B.2: Channel = 39, 3GHz to 25GHz)



(Plot C.1: Channel = 78, 30MHz to 3GHz)



(Plot C.2: Channel = 78, 3GHz to 25GHz)

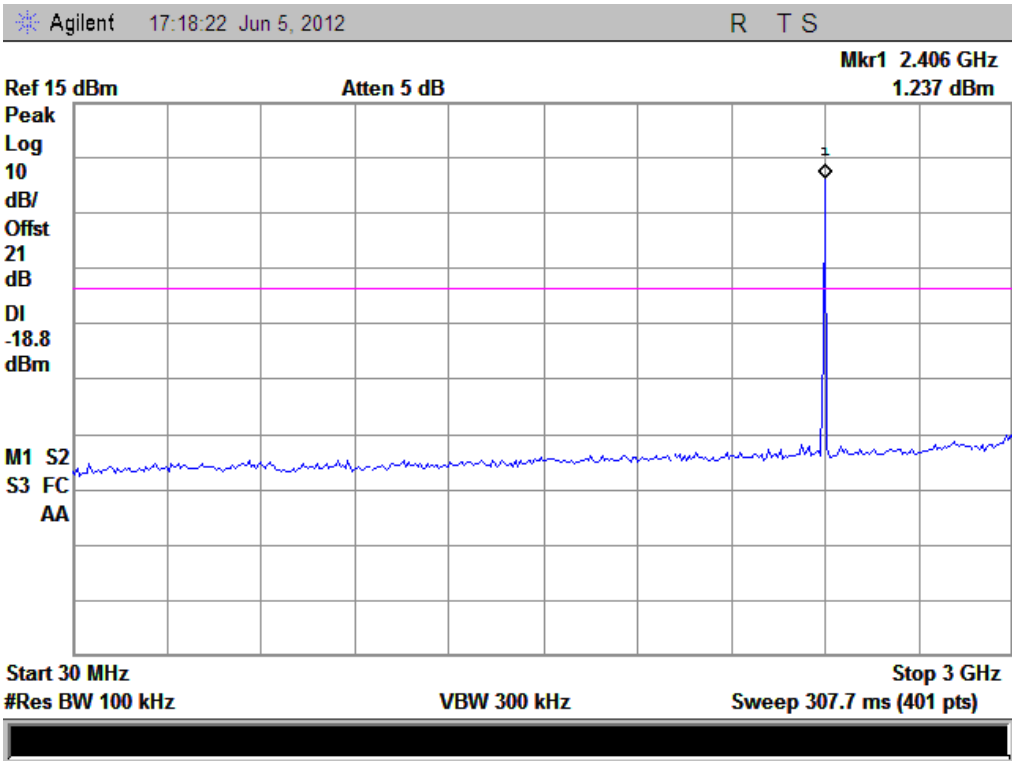
5.6.3.2. π/4-DQPSK Mode

A. Test Verdict:

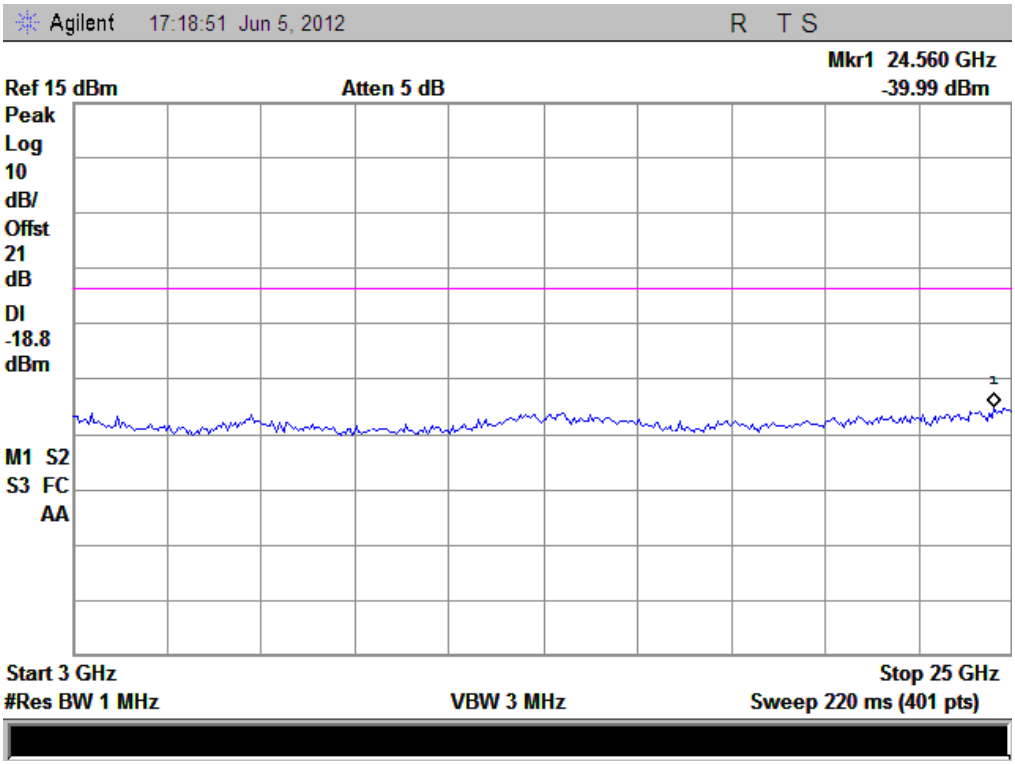
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	<-25	Plot D.1/D.2	1.237	-18.8	PASS
39	2441	<-25	Plot E.1/E.2	1.313	-18.7	PASS
78	2480	<-25	Plot F.1/F.2	-2.468	-22.5	PASS

B. Test Plots:

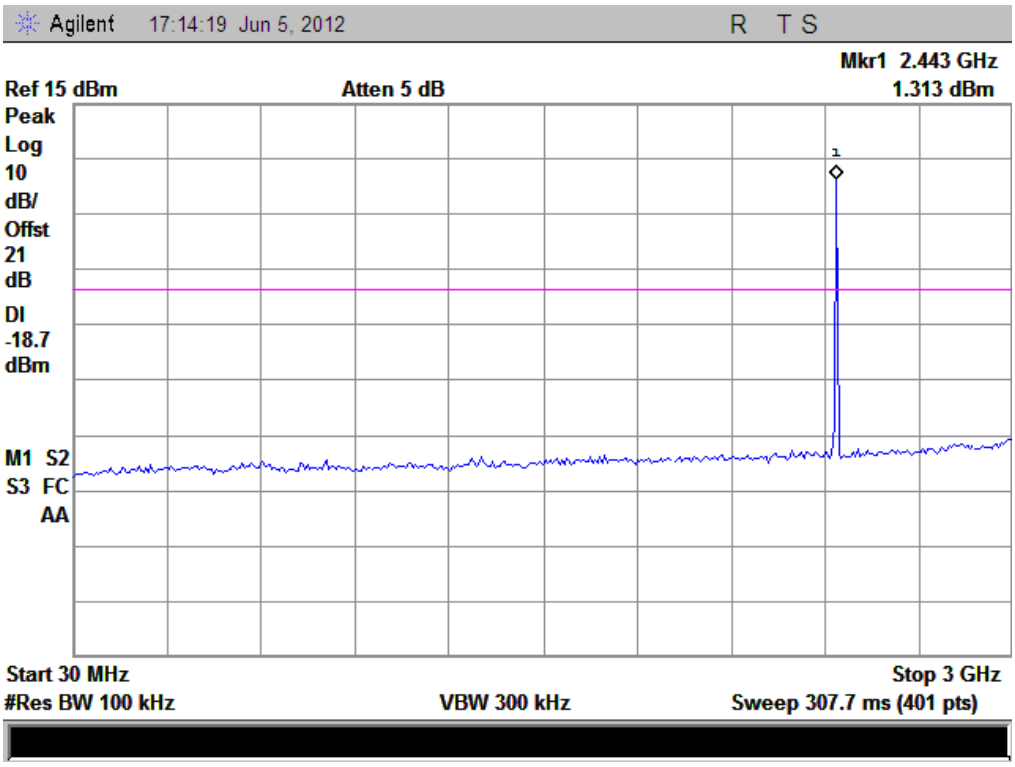
Note: the power of the Module transmitting frequency should be ignored.



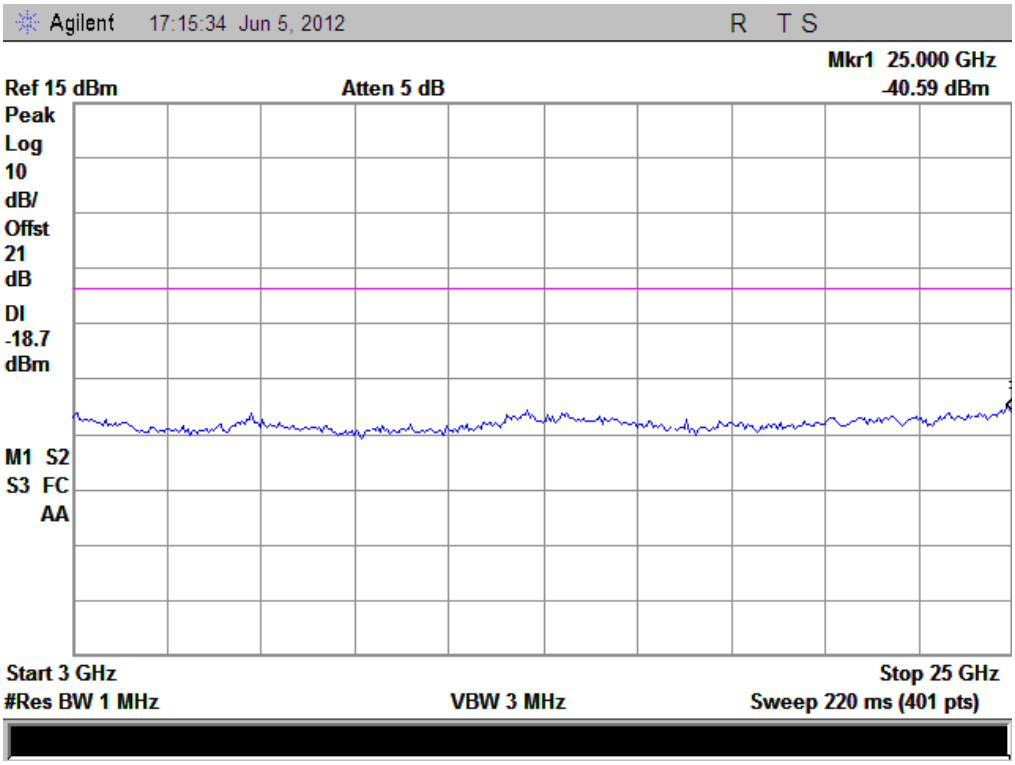
(Plot D.1: Channel = 0, 30MHz to 3GHz)



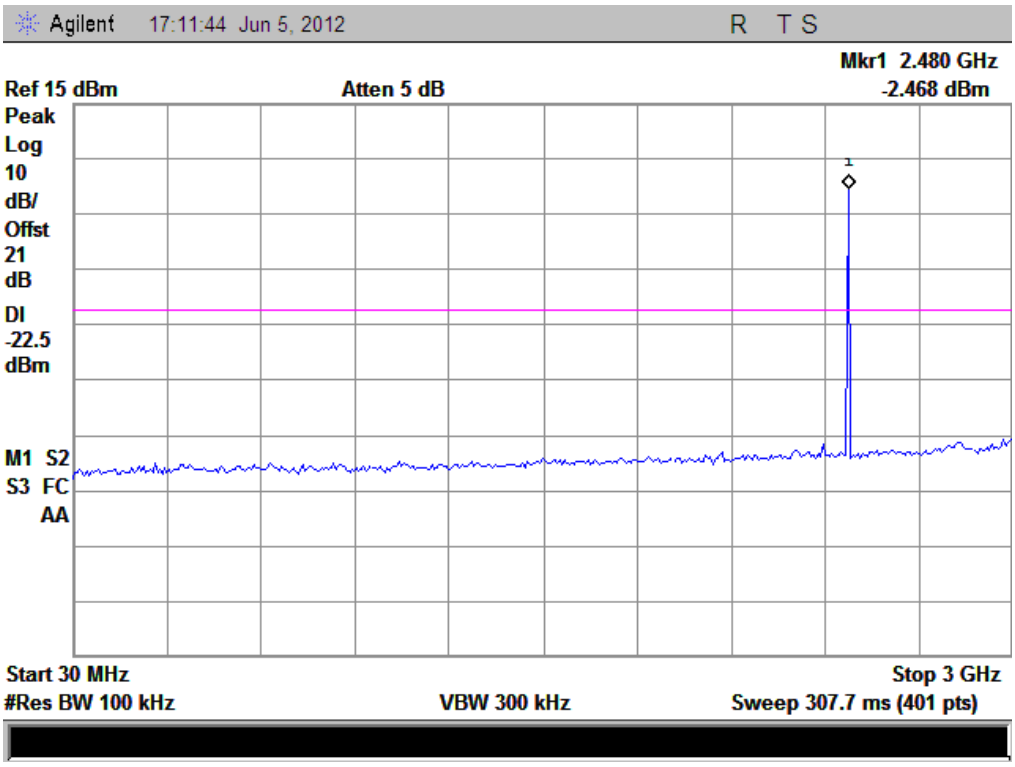
(Plot D.2: Channel = 0, 3GHz to 25GHz)



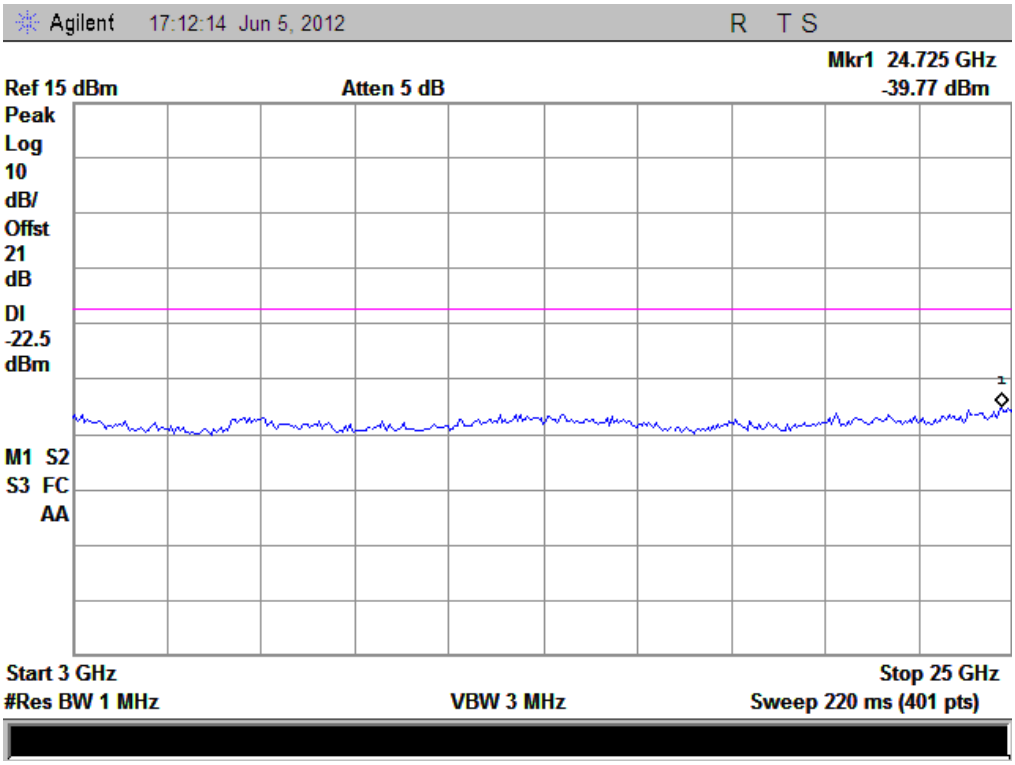
(Plot E.1: Channel = 39, 30MHz to 3GHz)



(Plot E.2: Channel = 39, 3GHz to 25GHz)



(Plot F.1: Channel = 78, 30MHz to 3GHz)



(Plot F.2: Channel = 78, 3GHz to 25GHz)

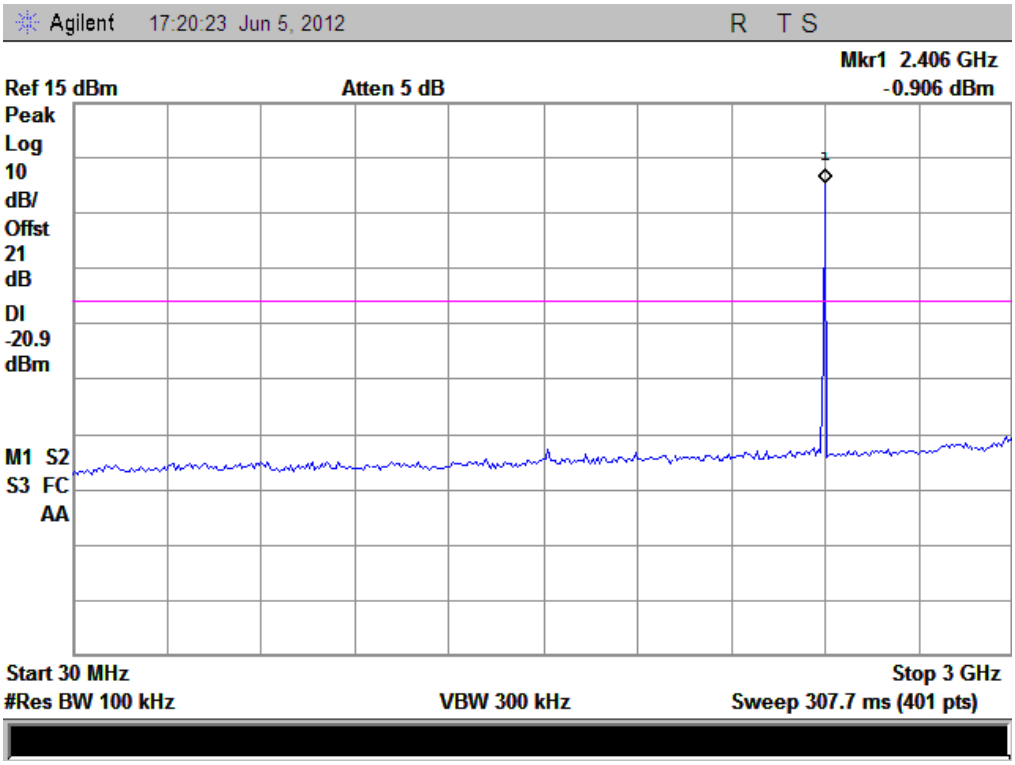
5.6.3.3. 8-DPSK Mode

A. Test Verdict:

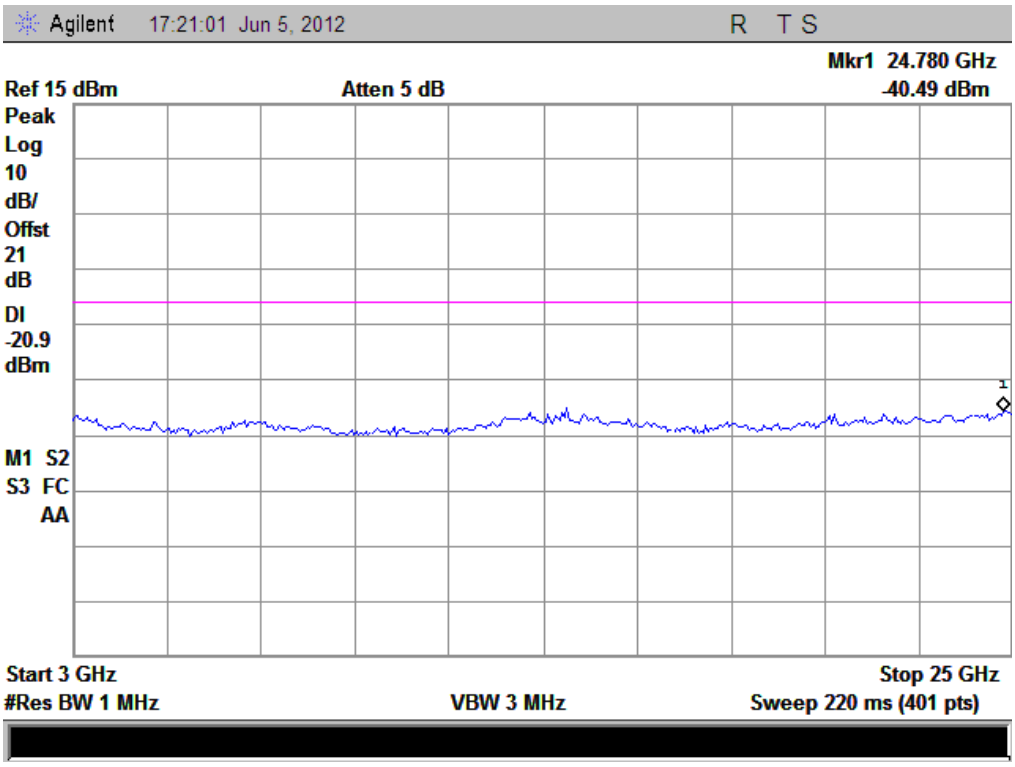
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	<-25	Plot G.1/G.2	-0.906	-20.9	PASS
39	2441	<-25	Plot H.1/H.2	0.99	-19.0	PASS
78	2480	<-25	Plot I.1/I.2	-0.523	-20.5	PASS

B. Test Plots:

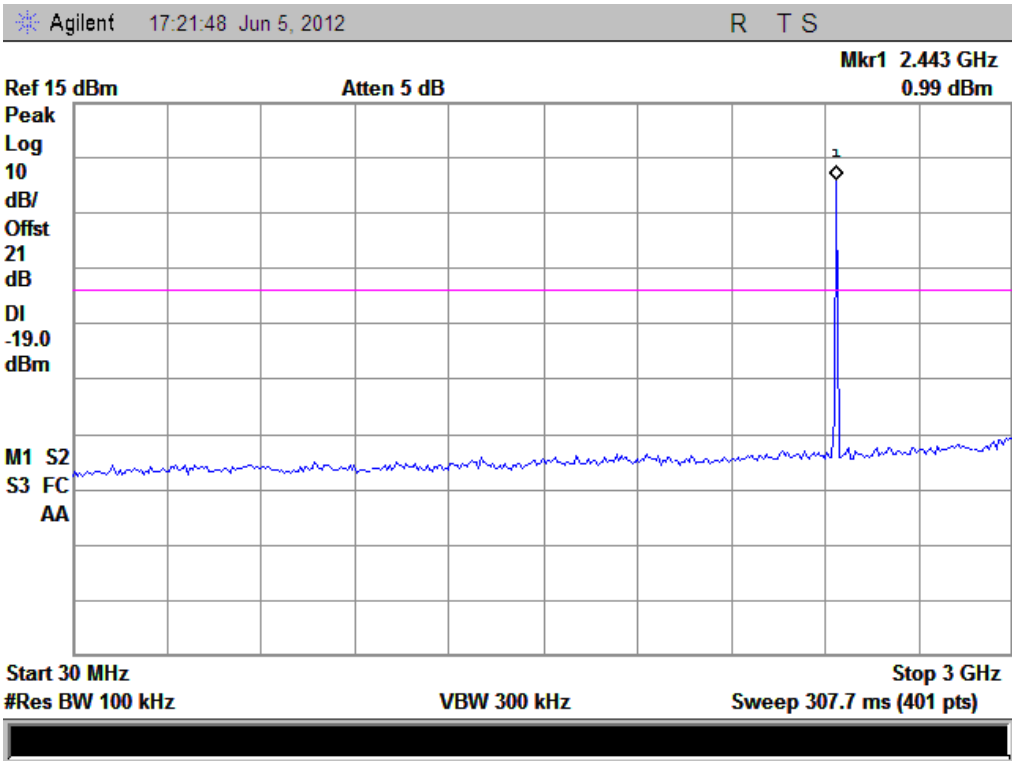
Note: the power of the Module transmitting frequency should be ignored.



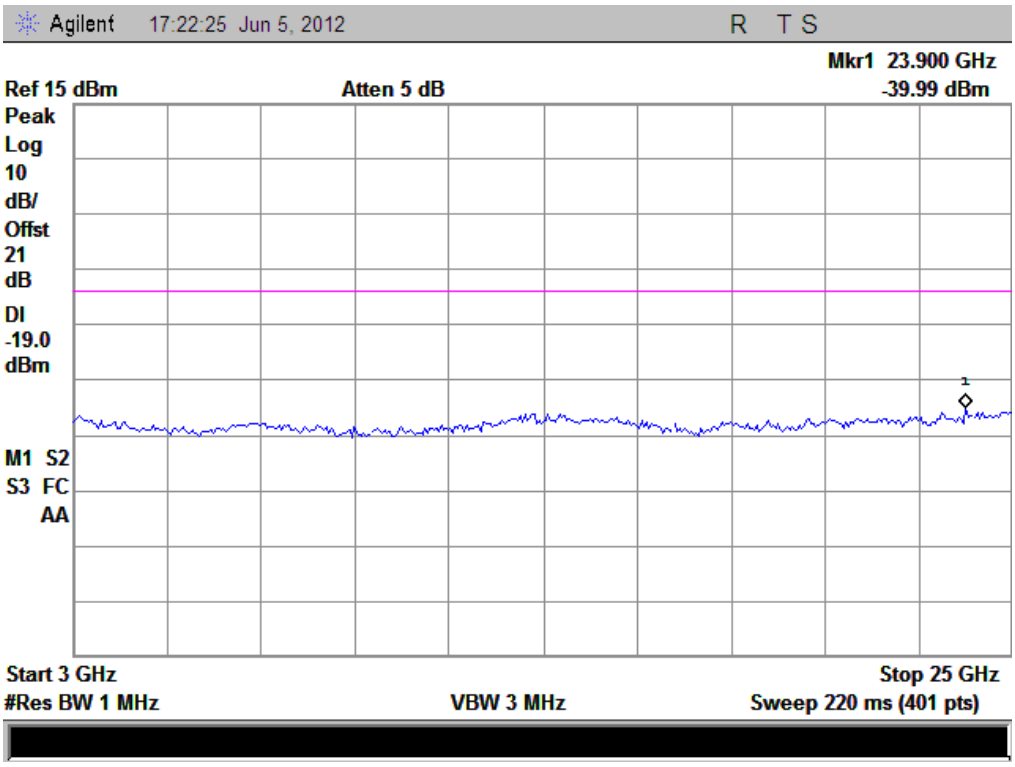
(Plot G.1: Channel = 0, 30MHz to 3GHz)



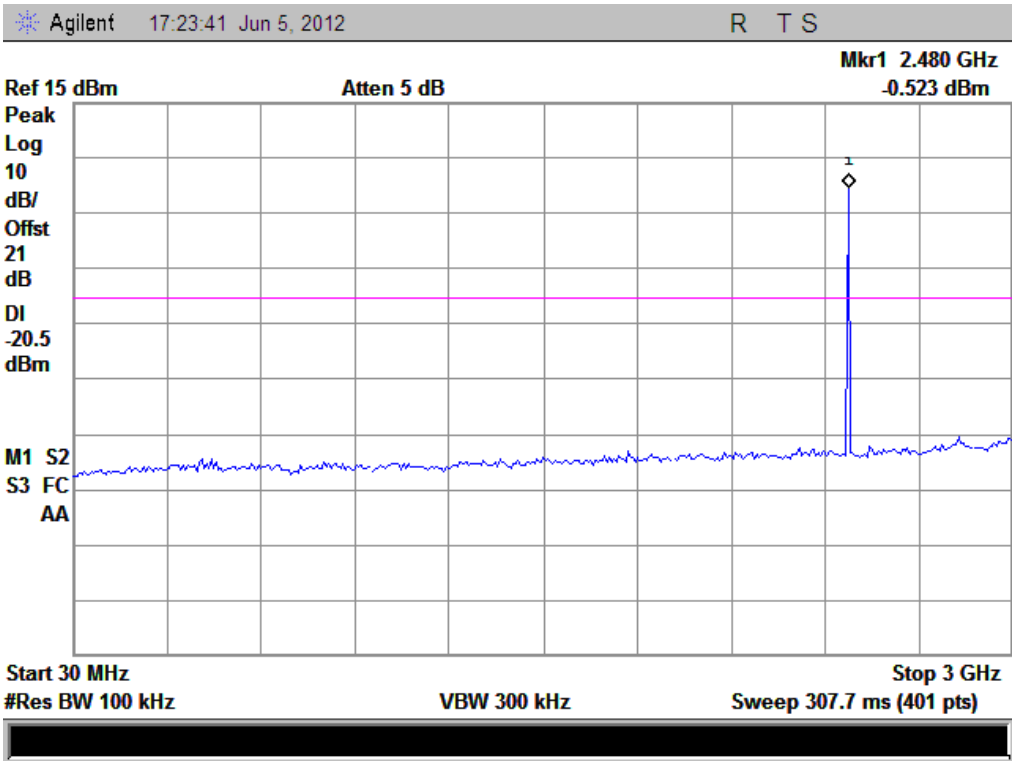
(Plot G.2: Channel = 0, 3GHz to 25GHz)



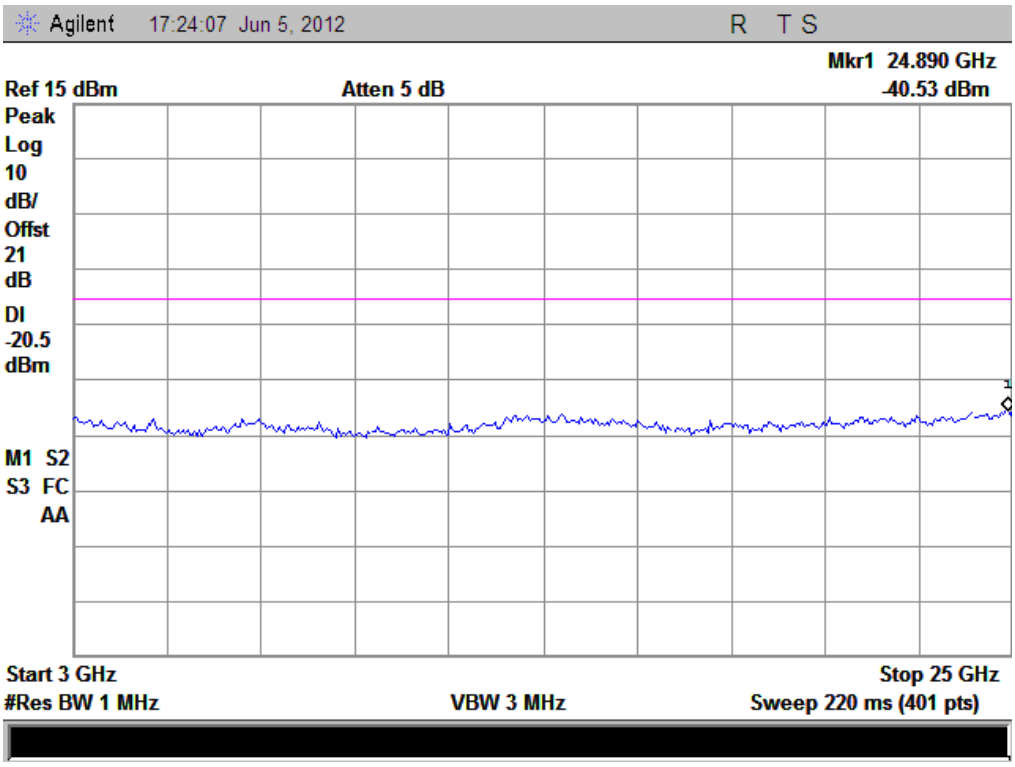
(Plot H.1: Channel = 39, 30MHz to 3GHz)



(Plot H.2: Channel = 39, 3GHz to 25GHz)



(Plot I.1: Channel = 78, 30MHz to 3GHz)



(Plot I.2: Channel = 78, 3GHz to 25GHz)

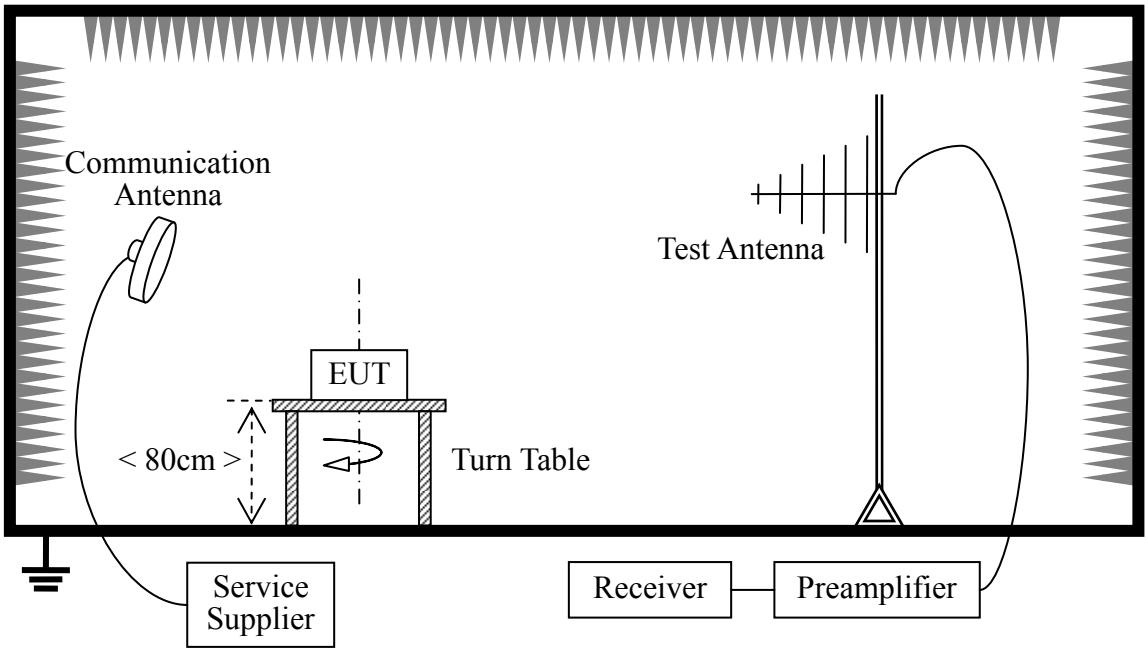
5.7. Band Edge

5.7.1. Requirement

According to FCC section 15.247(c) and RSS- A8.5, 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.

5.7.2. Test Description

A. Test Setup:



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:

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
System Simulator	R&S	CMU200	100448	2012.05
Receiver	Agilent	E7405A	US44210471	2012.05
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2012.05

Description	Manufacturer	Model	Serial No.	Cal. Date
Test Antenna - Horn	Schwarzbeck	BBHA 9120C	9120C-384	2012.05

5.7.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest and highest channels are tested to verify the band edge emissions.

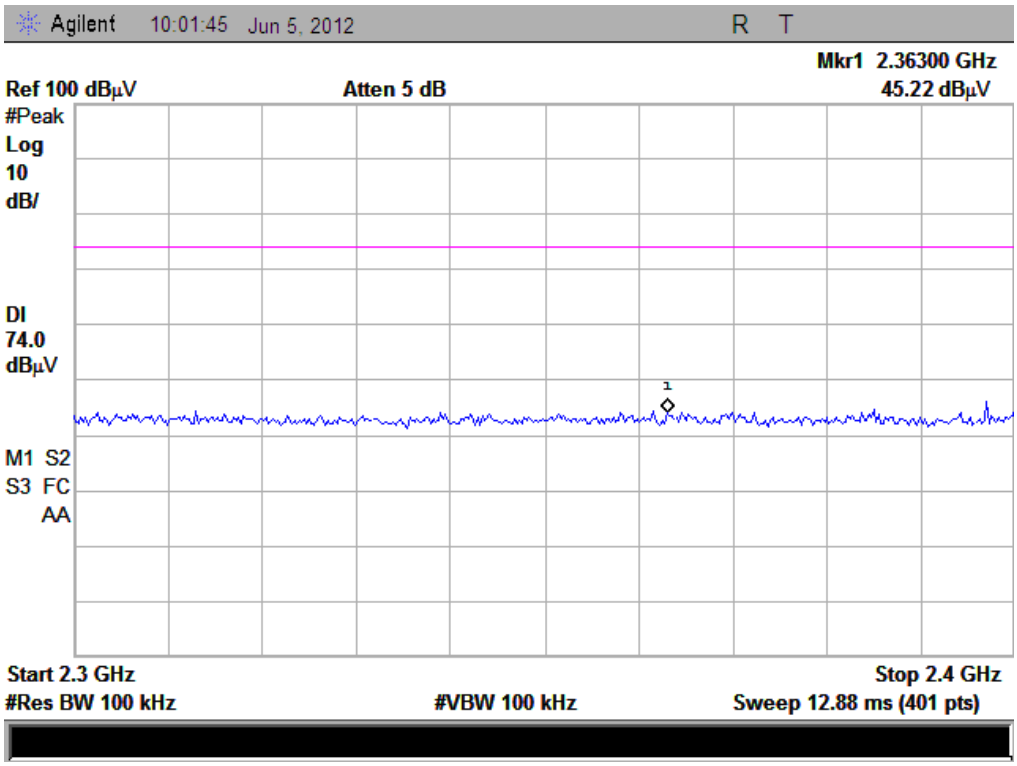
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

5.7.3.1. GFSK Mode

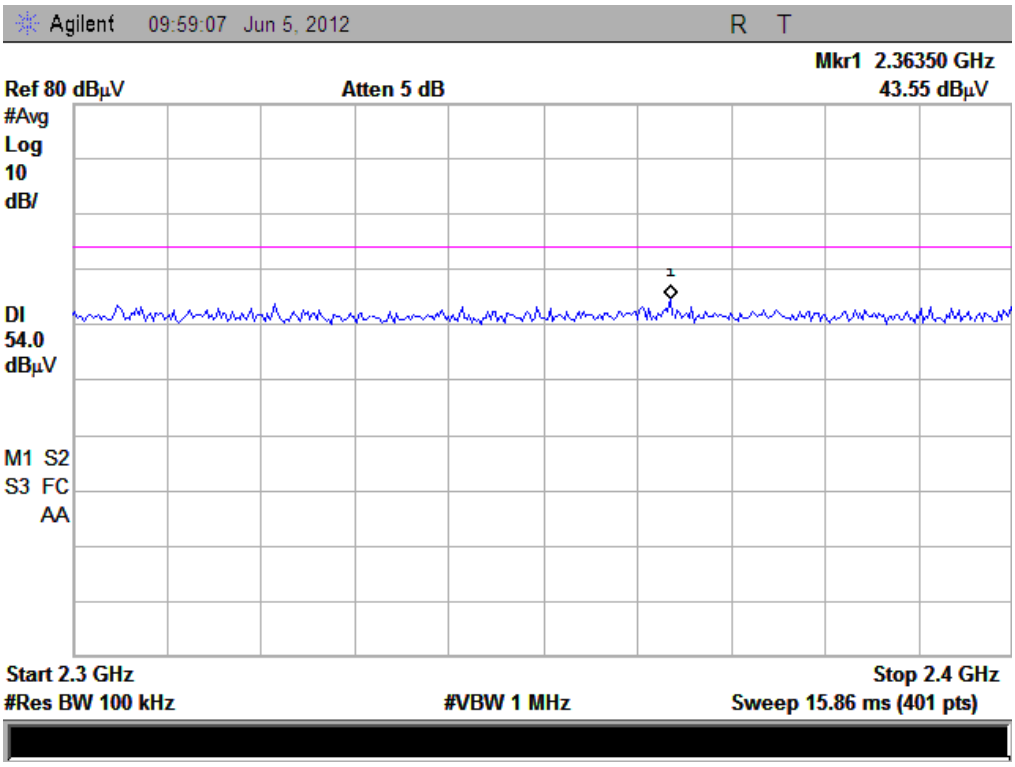
A. Test Verdict:

Channel	Frequency (MHz)	Receiver Reading U_R (dBuV)		A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)		Limit (dBμV/m)		Verdict
		PK	AV			PK	AV	PK	AV	
0	2402	45.22	43.55	-30.93	32.56	46.85	45.18	74	54	PASS
78	2480	43.84	42.13	-29.05	32.5	47.29	45.57	74	54	PASS

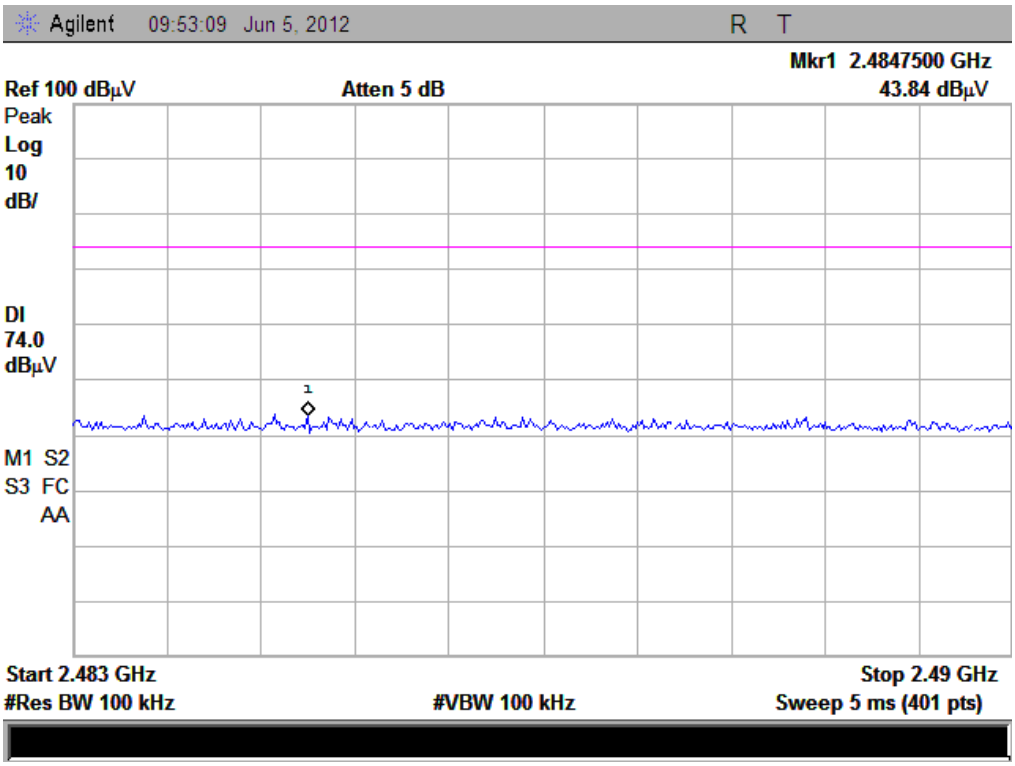
B. Test Plots:



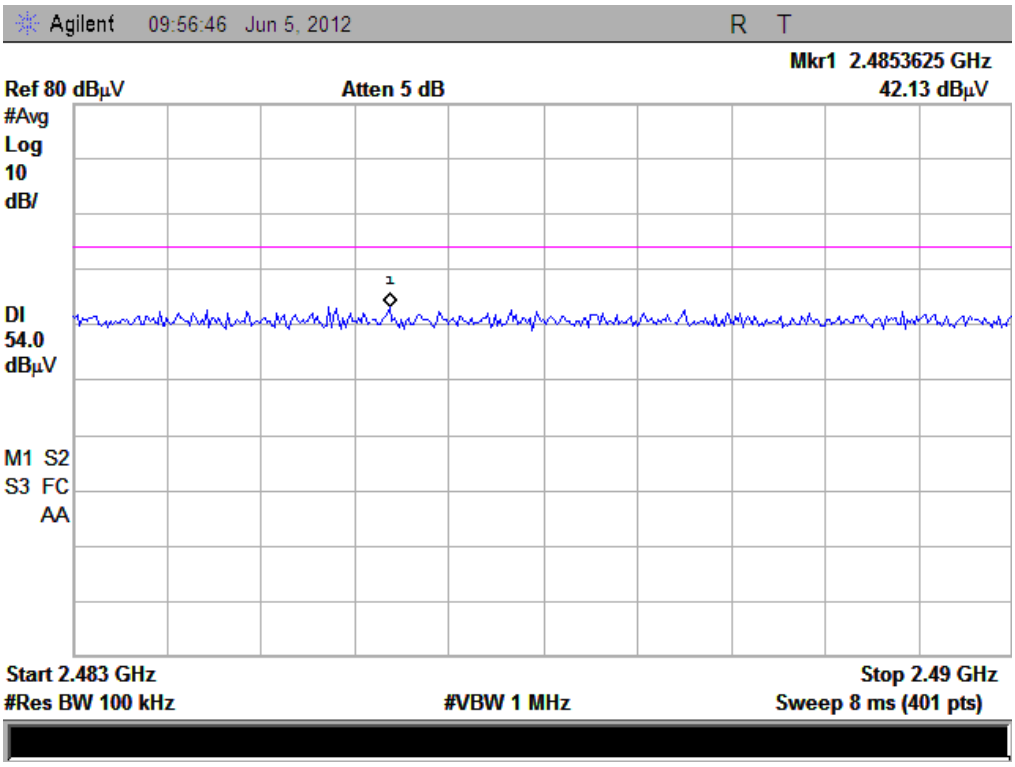
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVERAGE)



(Plot B1: Channel = 78 PEAK)



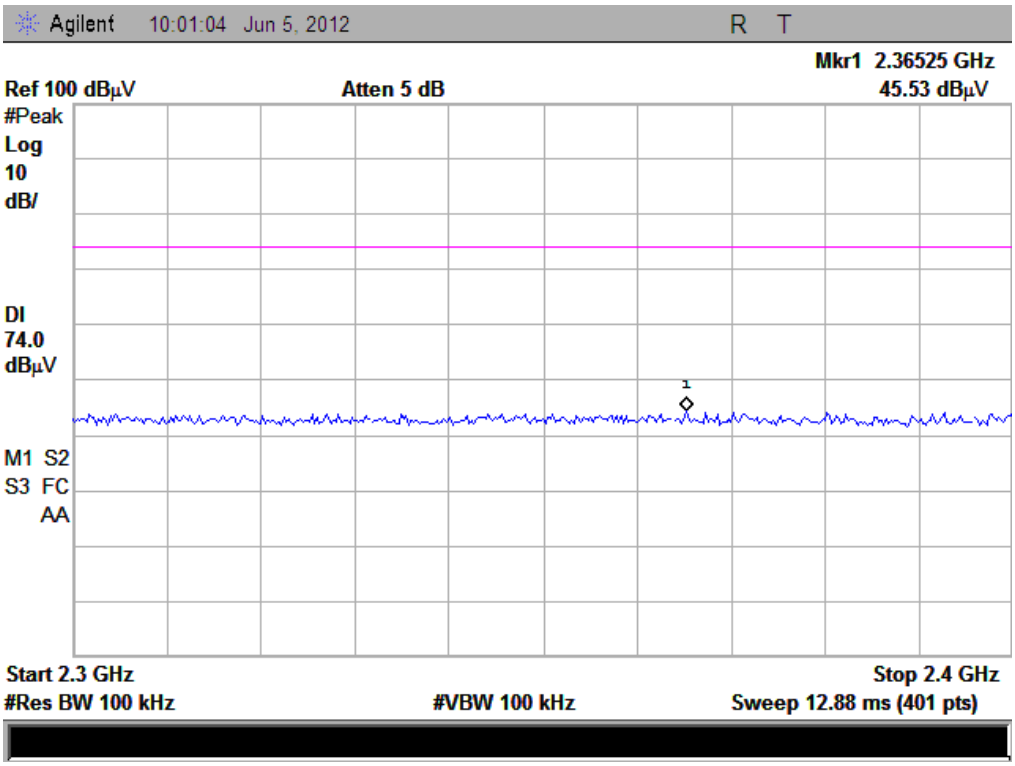
(Plot B2: Channel = 78 AVERAGE)

5.7.3.2. π/4-DQPSK Mode

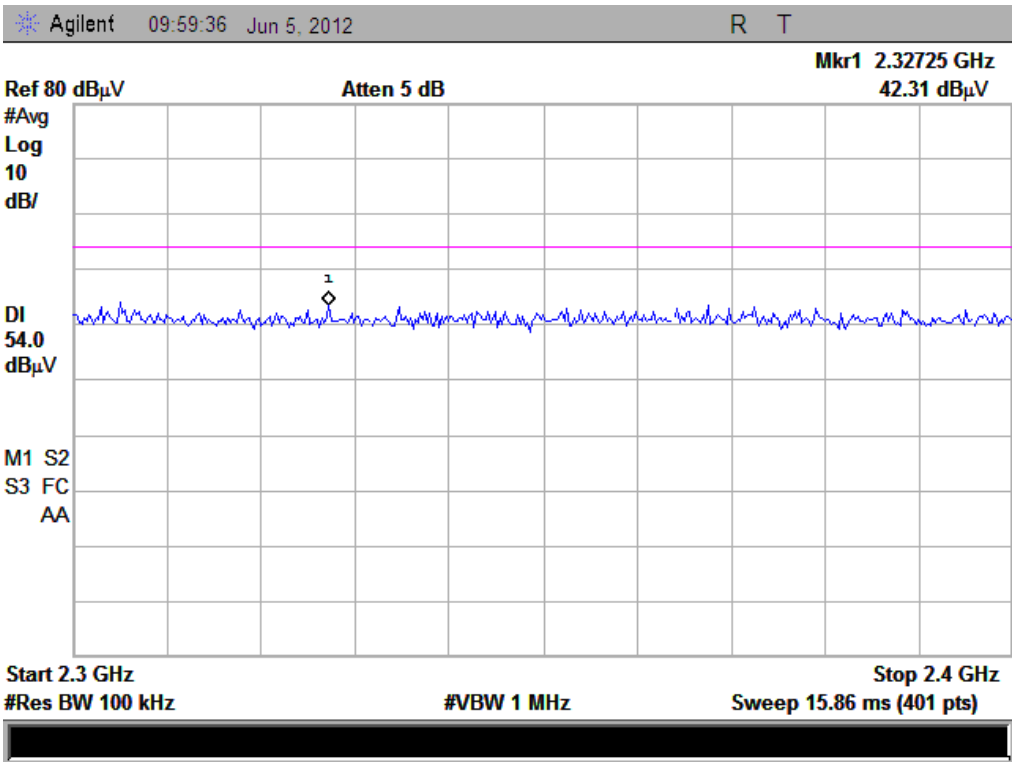
A. Test Verdict:

Channel	Frequency (MHz)	Receiver Reading U_R (dBuV)		A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)		Limit (dBμV/m)		Verdict
		PK	AV			PK	AV	PK	AV	
0	2402	45.53	42.31	-30.93	32.56	47.16	43.88	74	54	PASS
78	2480	45.27	42.75	-29.05	32.5	48.72	46.2	74	54	PASS

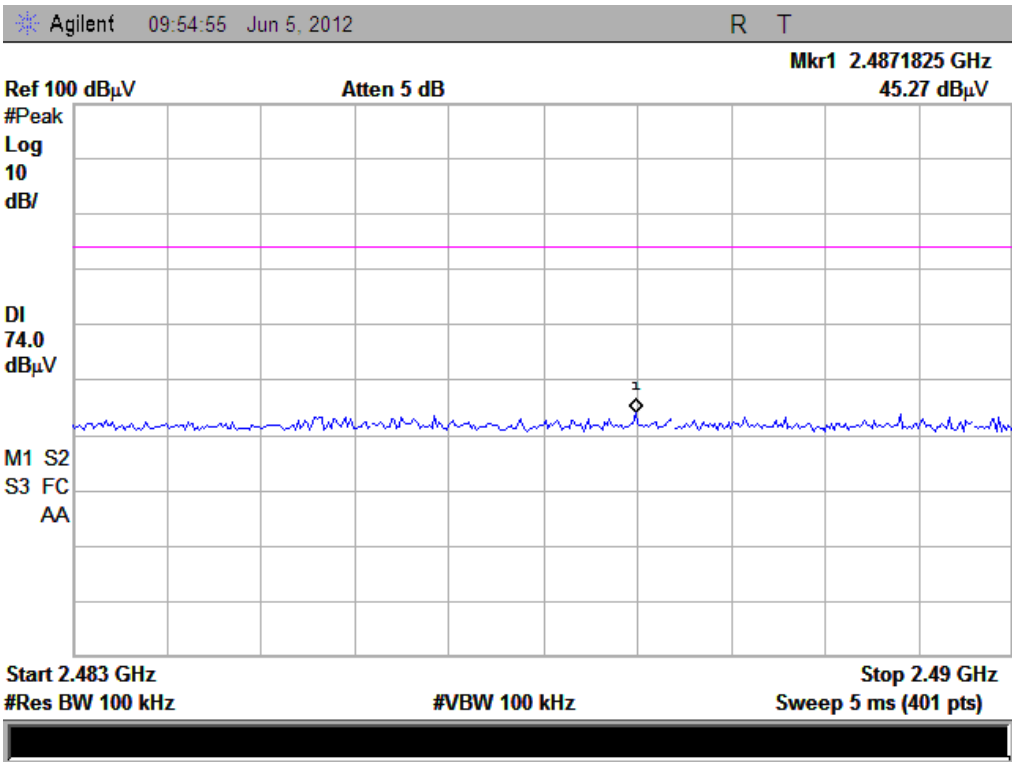
B. Test Plots:



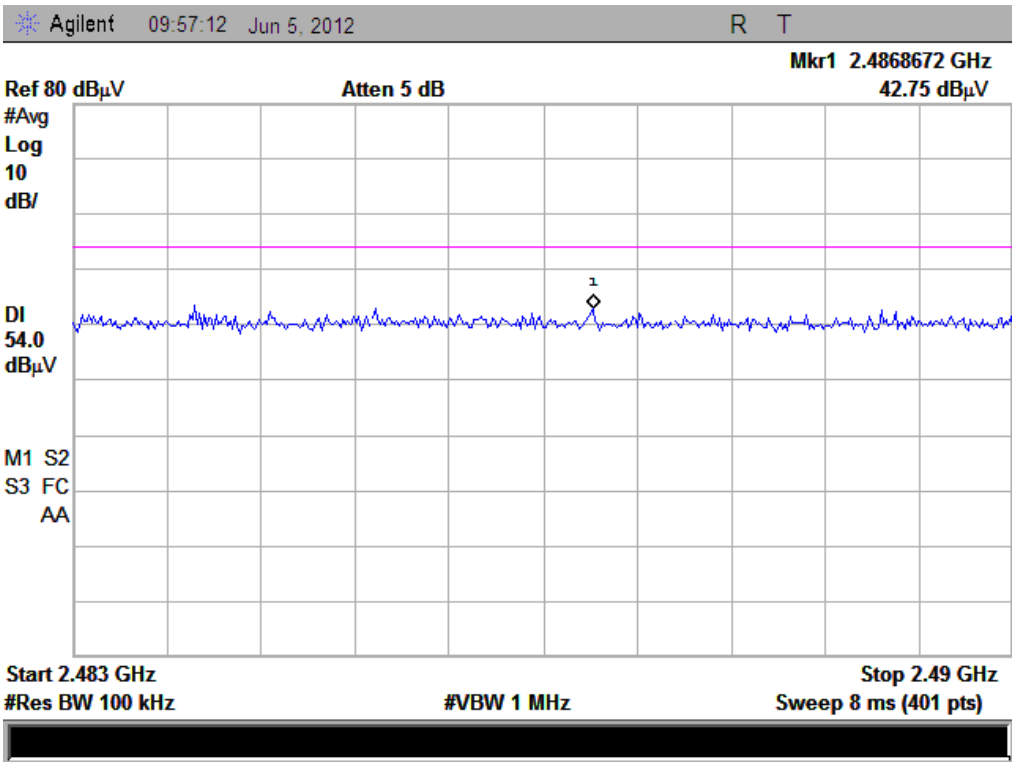
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVERAGE)



(Plot B1: Channel = 78 PEAK)



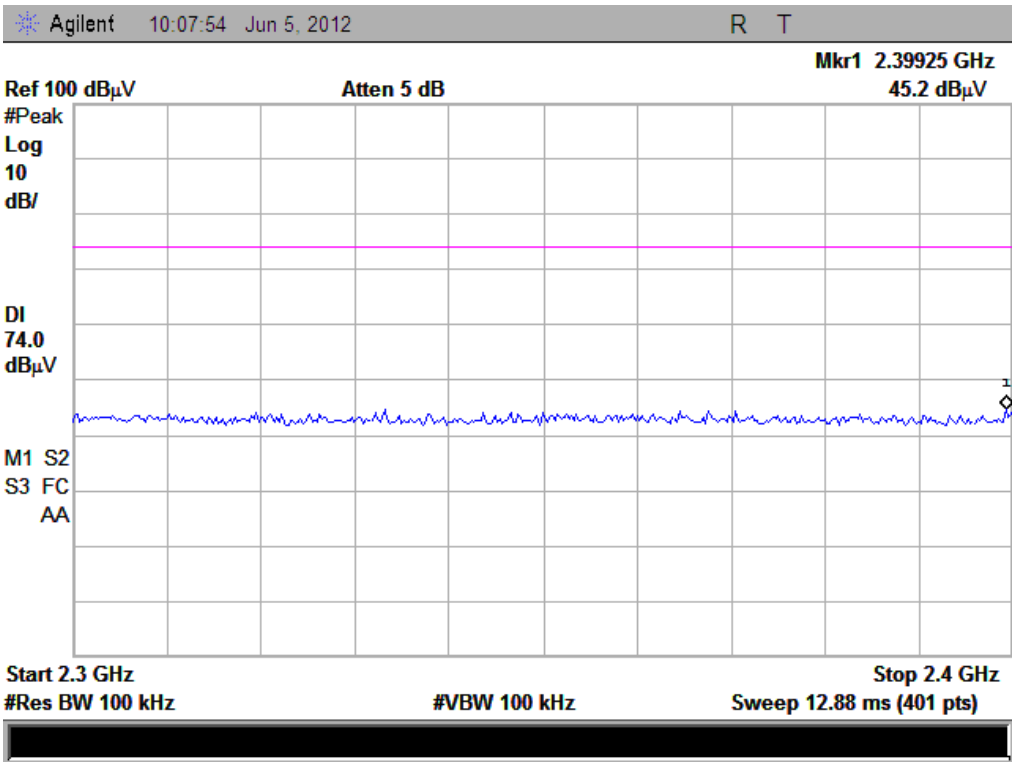
(Plot B2: Channel = 78 AVERAGE)

5.7.3.3. 8-DPSK Mode

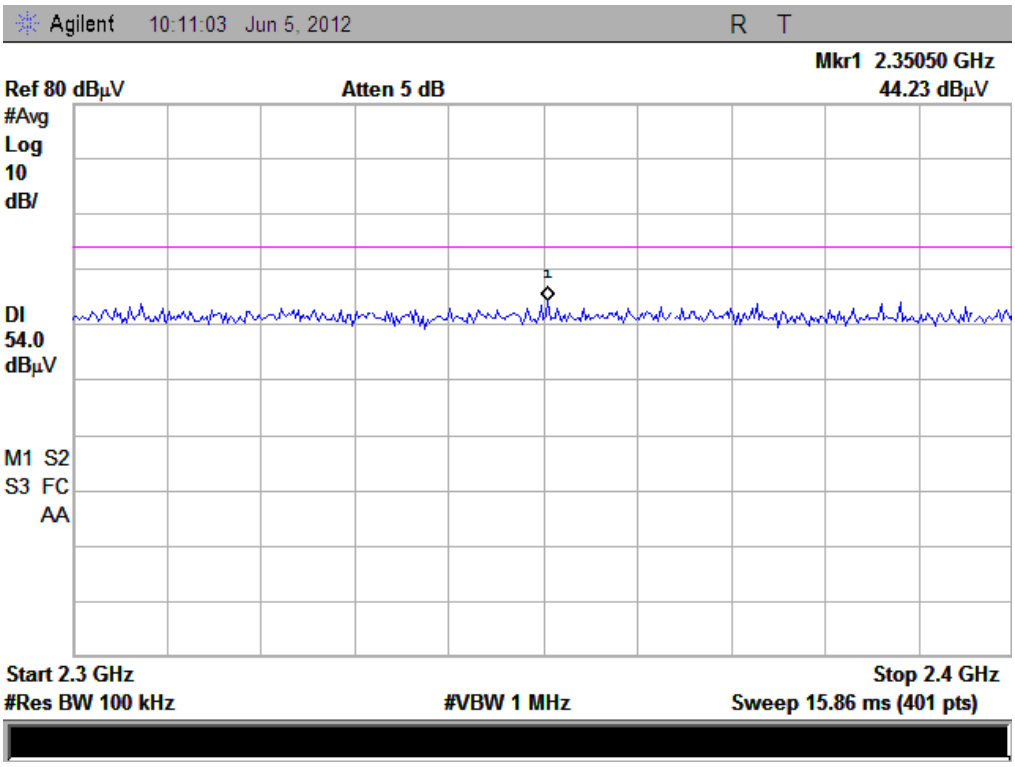
A. Test Verdict:

Channel	Frequency (MHz)	Receiver Reading U_R (dBuV)		A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBµV/m)		Limit (dBµV/m)		Verdict
		PK	AV			PK	AV	PK	AV	
0	2402	45.20	42.33	-30.93	32.56	46.83	43.96	74	54	PASS
78	2480	45.42	42.48	-29.05	32.5	48.87	45.93	74	54	PASS

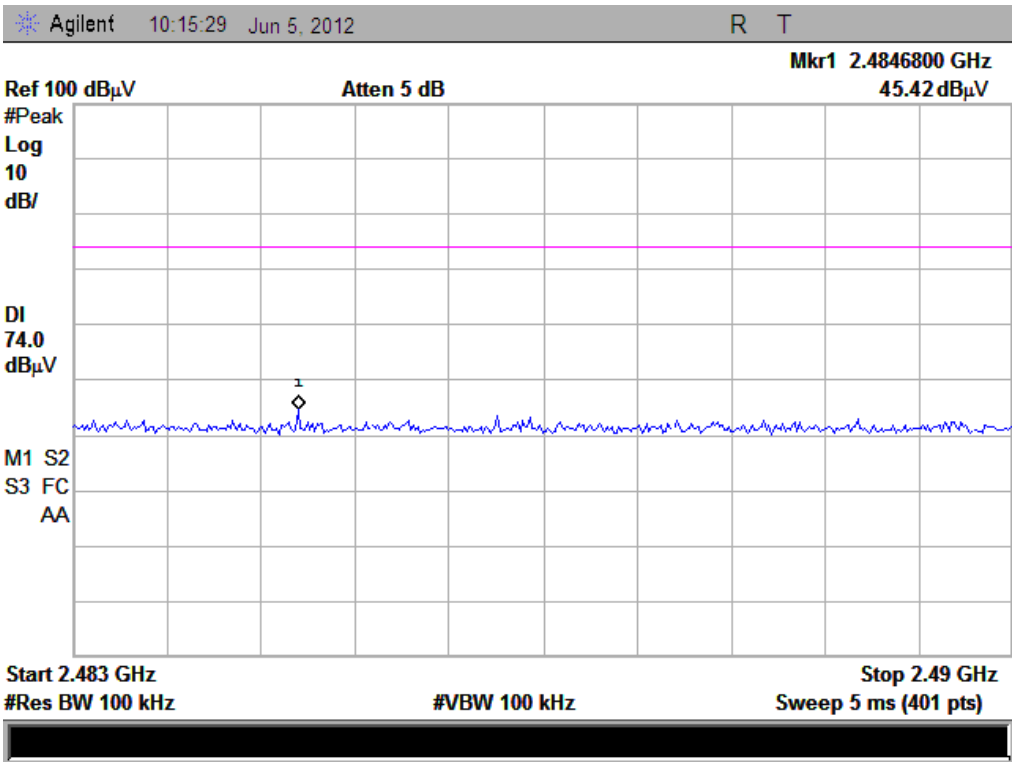
B. Test Plots:



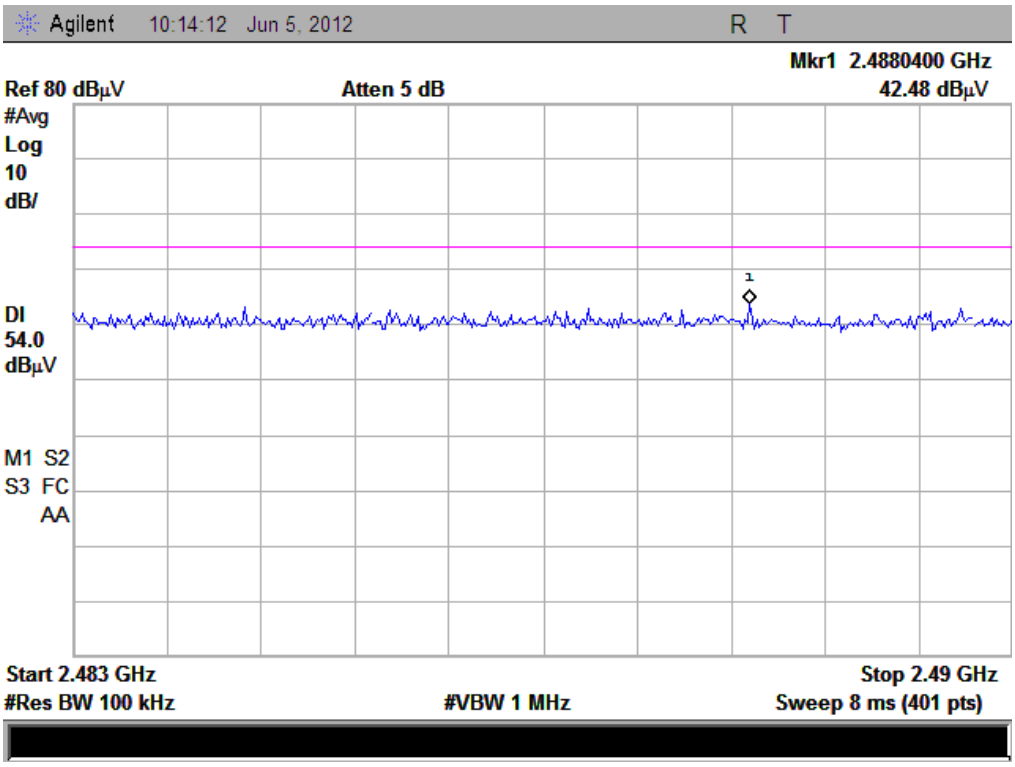
(Plot A1: Channel = 0 PEAK)



(Plot A2: Channel = 0 AVERAGE)



(Plot B1: Channel = 78 PEAK)



(Plot B2: Channel = 78 AVERAGE)

5.8. Conducted Emission

5.8.1. 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
0.50 - 30	60	50

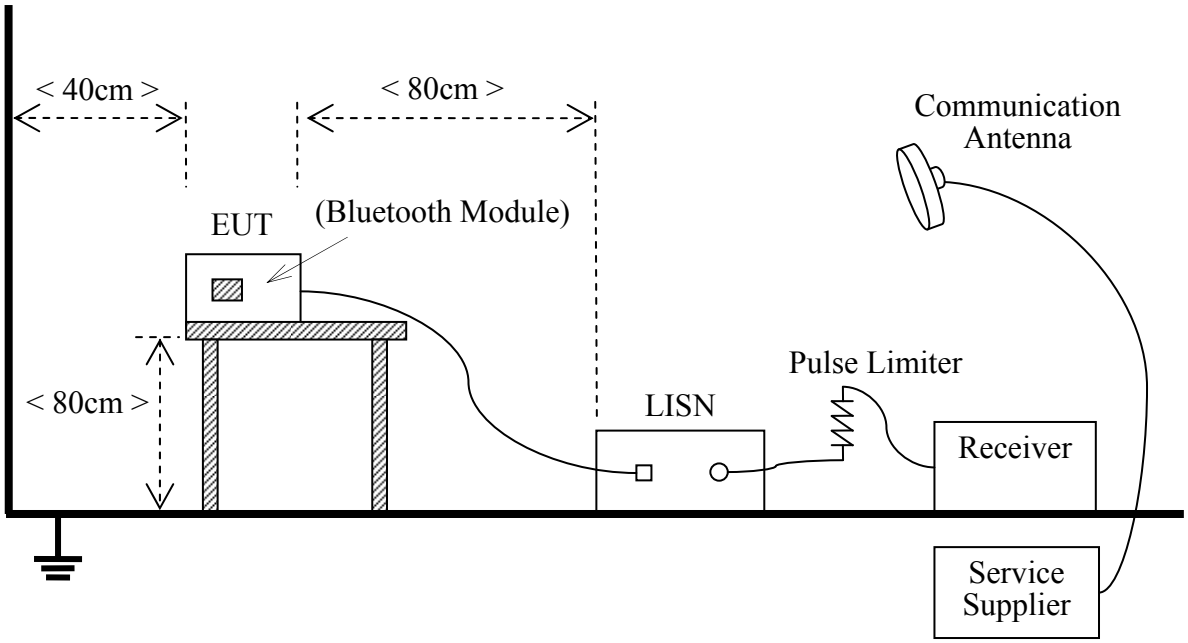
NOTE:

(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.

5.8.2. 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

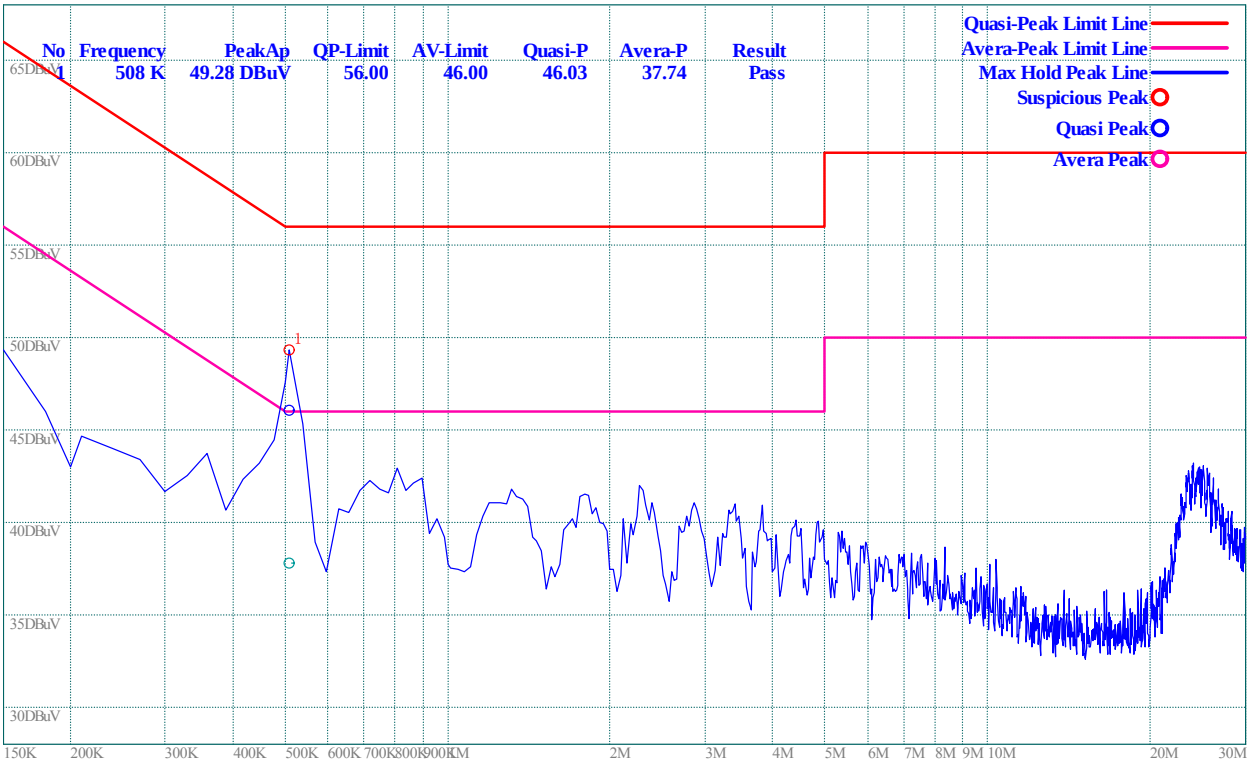
339 bytes DH5 packages at maximum power.

B. Equipments List:

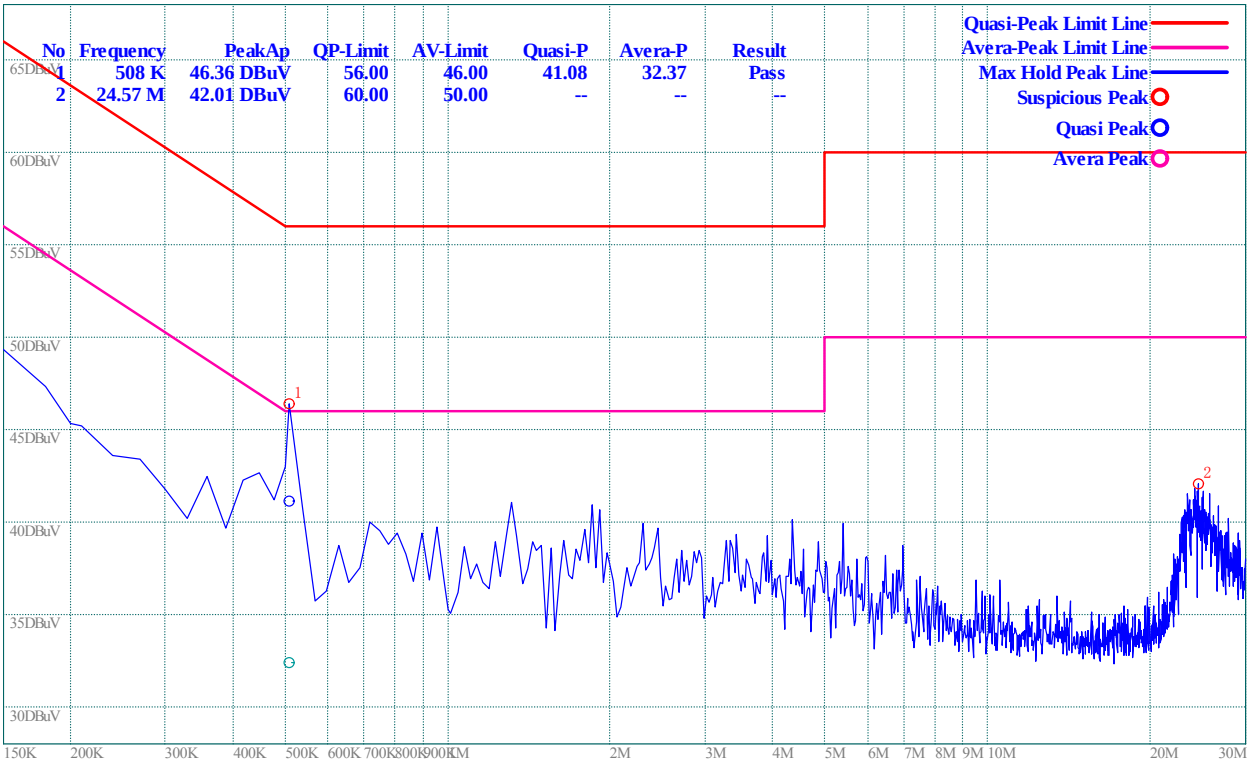
Description	Manufacturer	Model	Serial No.	Cal. Date
Receiver	Agilent	E7405A	US44210471	2012.05
LISN	Schwarzbeck	NSLK 8127	812744	2012.05
Service Supplier	R&S	CMU200	100448	2012.05
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	(n.a.)

5.8.3. 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.



(Plot A: L Phase)



(Plot B: N Phase)

5.9. Radiated Emission

5.9.1. Requirement

According to FCC section 15.247(c) 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 RSS- Gen section 7.2.3. Those emissions generated in a receiver and radiated from the receiver either via the antenna path or via the control, power, and audio cables that may be used with the receiver. All spurious emissions shall comply with the limits of next table:

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)	Detector
0.009 - 0.490	2400/F(kHz)	300	QP
0.490 - 1.705	24000/F(kHz)	30	QP
1.705 - 30.0	30	30	QP
30 - 88	100	3	QP
88 - 216	150	3	QP
216 - 960	200	3	QP
960 - 1000	500	3	QP
Above 1000	500	3	AV

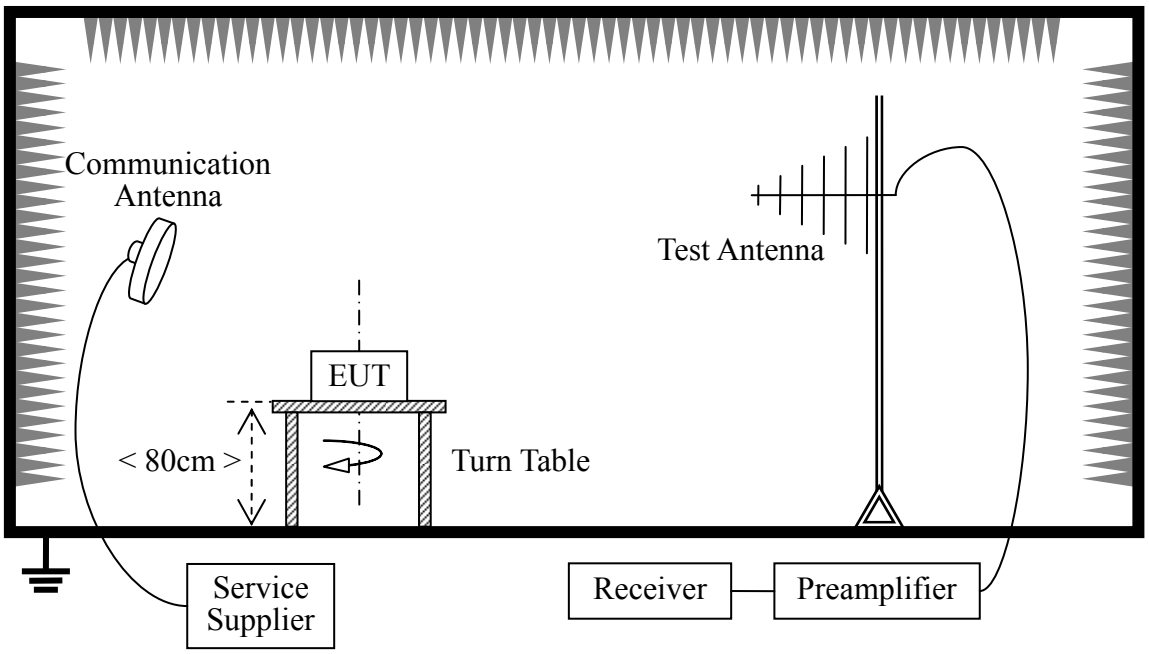
Note:

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)

5.9.2. Test Description

A. Test Setup:



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-off 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 1GHz) and Horn Test Antenna (above 1GHz) 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
System Simulator	R&S	CMU200	100448	2011.05
Receiver	Agilent	E7405A	US44210471	2011.05
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2011.05
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2011.05
Test Antenna - Horn	Schwarzbeck	BBHA 9120C	9120C-384	2011.05
Test Antenna - circular	R&S	AC004R1	0749.3000.03	2011.05

5.9.3. 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.

5.9.3.1. GFSK Mode:

A. Test Verdict for Harmonics:

<u>The Fundamental Emissions</u>

The field strength of {Fundamental Emission} listed below is recorded, and used in the next table.

Channel	Frequency (MHz)	Fundamental Emission (dBμV/m)		Antenna Polarization	Refer to Plot
		PK	AV		
0	2402	69.98	64.04	Horizontal	Plot A.1
		74.54	70.25	Vertical	Plot A.2
39	2441	71.45	68.06	Horizontal	Plot B.1
		75.78	70.79	Vertical	Plot B.2
78	2480	71.77	66.23	Horizontal	Plot C.1
		75.41	70.37	Vertical	Plot C.2

<u>Test result of channel 0 (2402MHz) :</u>

Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
598.4	33.94	--	N.A	46	N.A	>6	100	113	PASS	Horizontel
912.7	33.4	--	N.A	46	N.A	>6	100	340	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
3.085	43.21	--	74	54	>6	>6	100	103	PASS	Horizontel
14.065	43.49	--	74	54	>6	>6	100	4	PASS	Vertical
14.132	44.31	--	74	54	>6	>6	100	114	PASS	Horizontel

<u>Test result of channel 39 (2441MHz):</u>

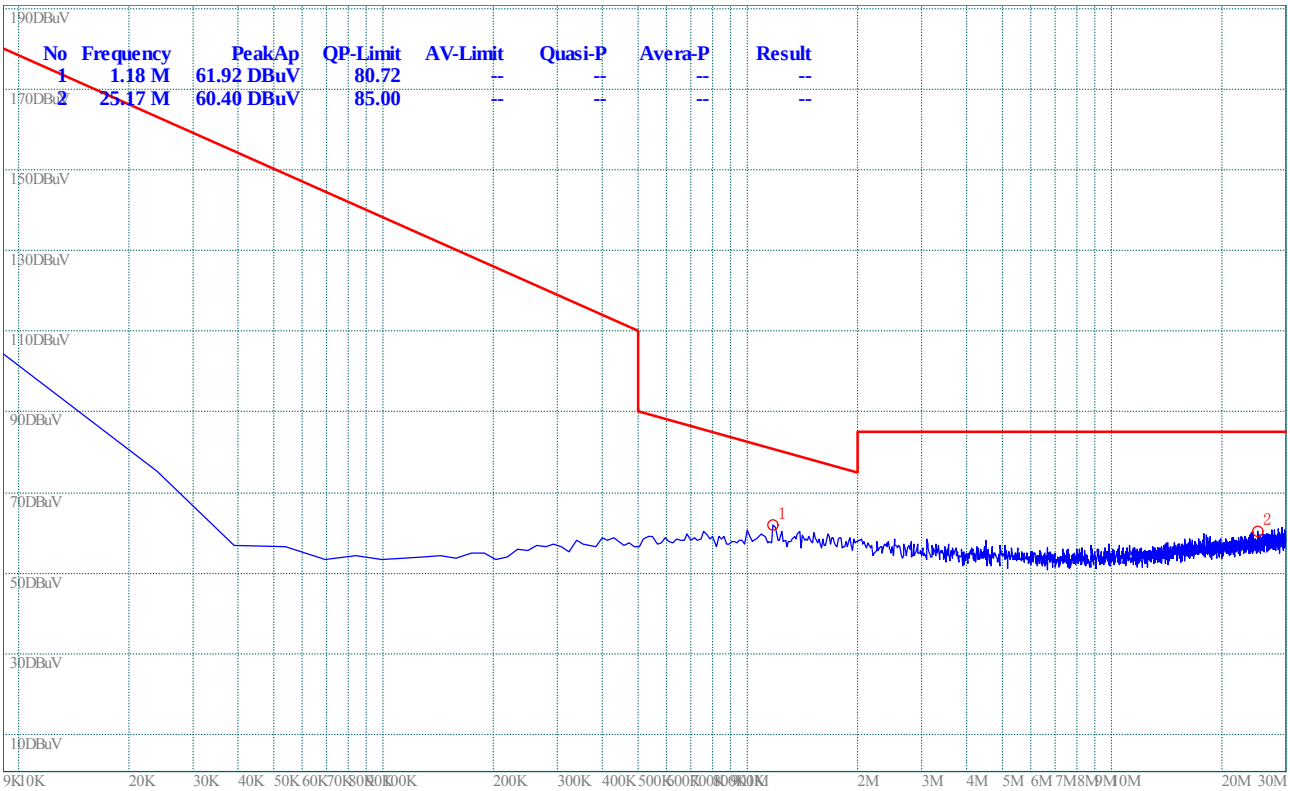
Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
111.5	27.51	--	N.A	43.5	N.A	>6	100	28	PASS	Vertical
266.7	26.39	--	N.A	46	N.A	>6	100	107	PASS	Vertical
598.4	34.75	--	N.A	46	N.A	>6	100	125	PASS	Horizontel
912.7	34.32	--	N.A	46	N.A	>6	100	93	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
7.922	44.61	--	74	54	>6	>6	100	117	PASS	Horizontel
14.02	43.58	--	74	54	>6	>6	100	20	PASS	Horizontel

Test result of channel 78 (2480MHz):

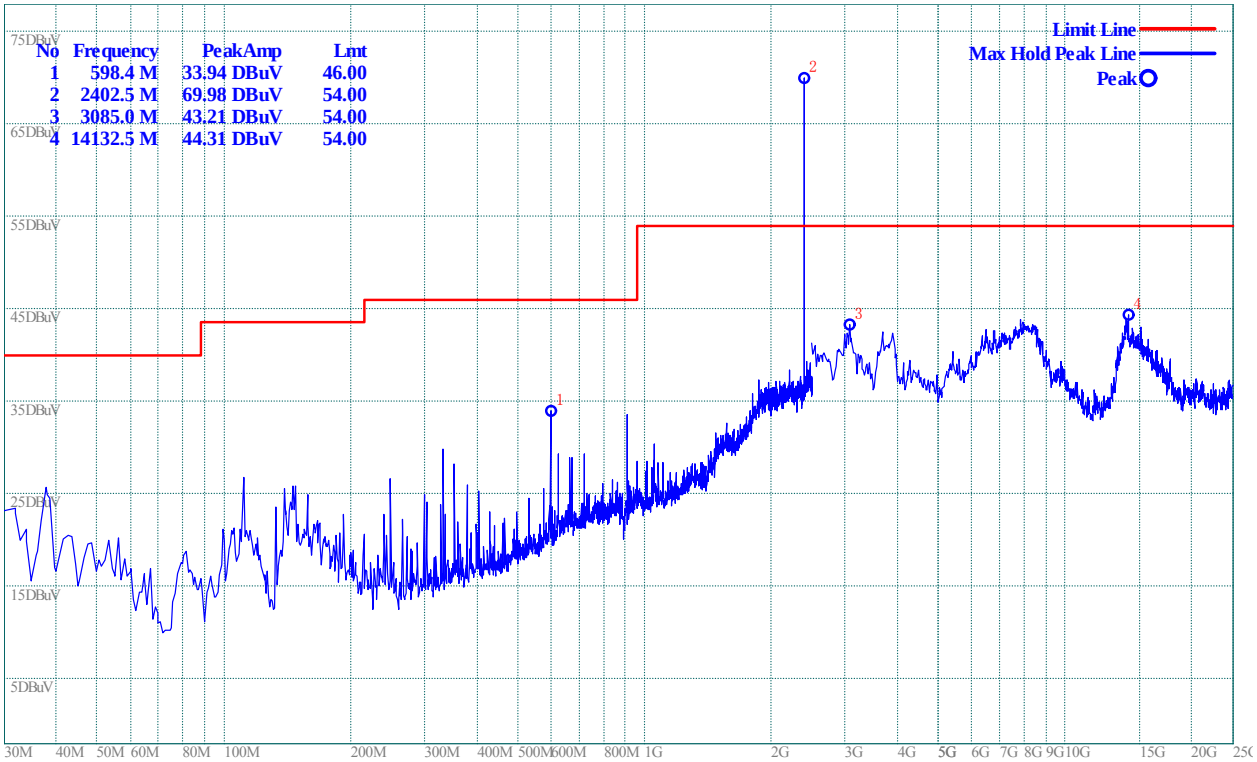
Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
111.5	28.46	--	N.A	43.5	N.A	>6	100	114	PASS	Vertical
111.5	27.43		N.A	43.5	N.A	>6	100	60	PASS	Horizontel
912.7	34.3	--	N.A	46	N.A	>6	100	20	PASS	Vertical
912.7	33.61	--	N.A	46	N.A	>6	100	46	PASS	Horizontel
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
8.508	44.07	--	74	54	>6	>6	100	92	PASS	Vertical
14.335	43.63	--	74	54	>6	>6	100	97	PASS	Horizontel

B. Test Plots for the Whole Measurement Frequency Range:

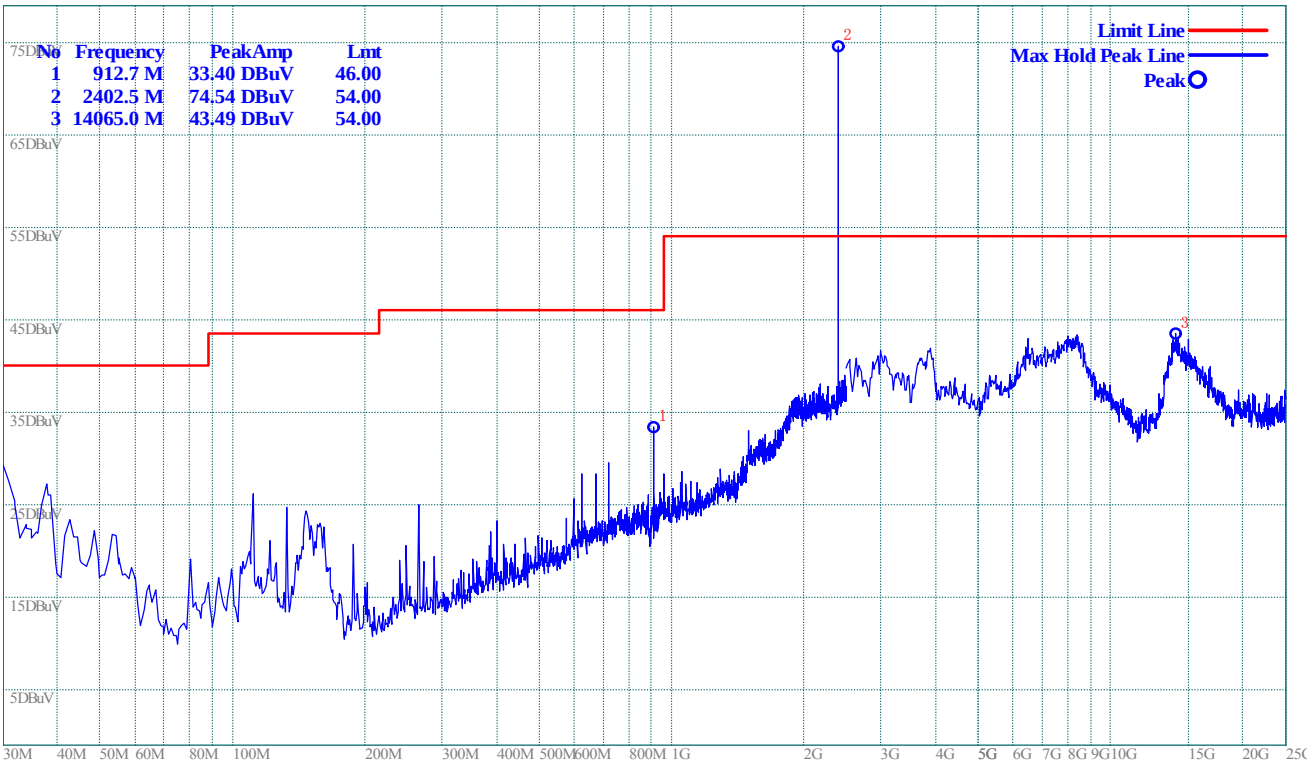
Plots for Channel = 0



(Plot A.0: 9kHz to 30MHz)

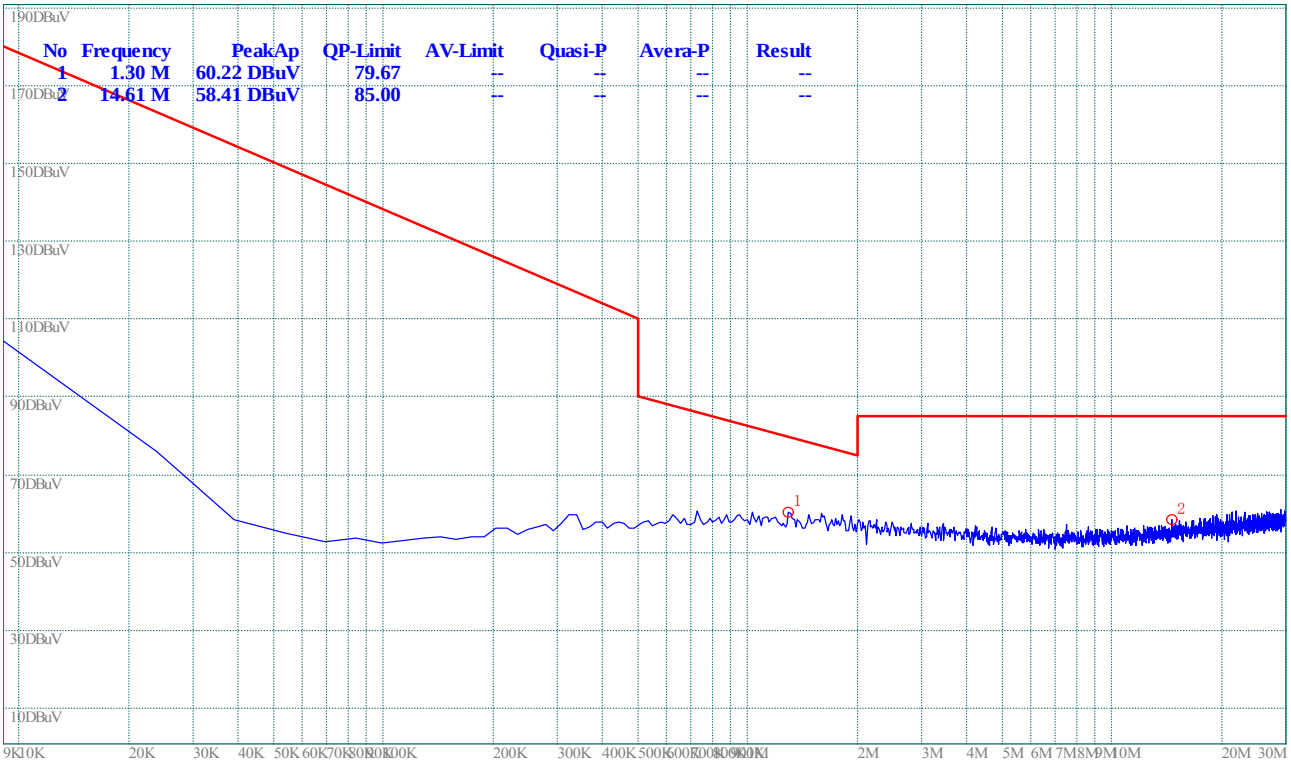


(Plot A.1: Antenna Horizontal)

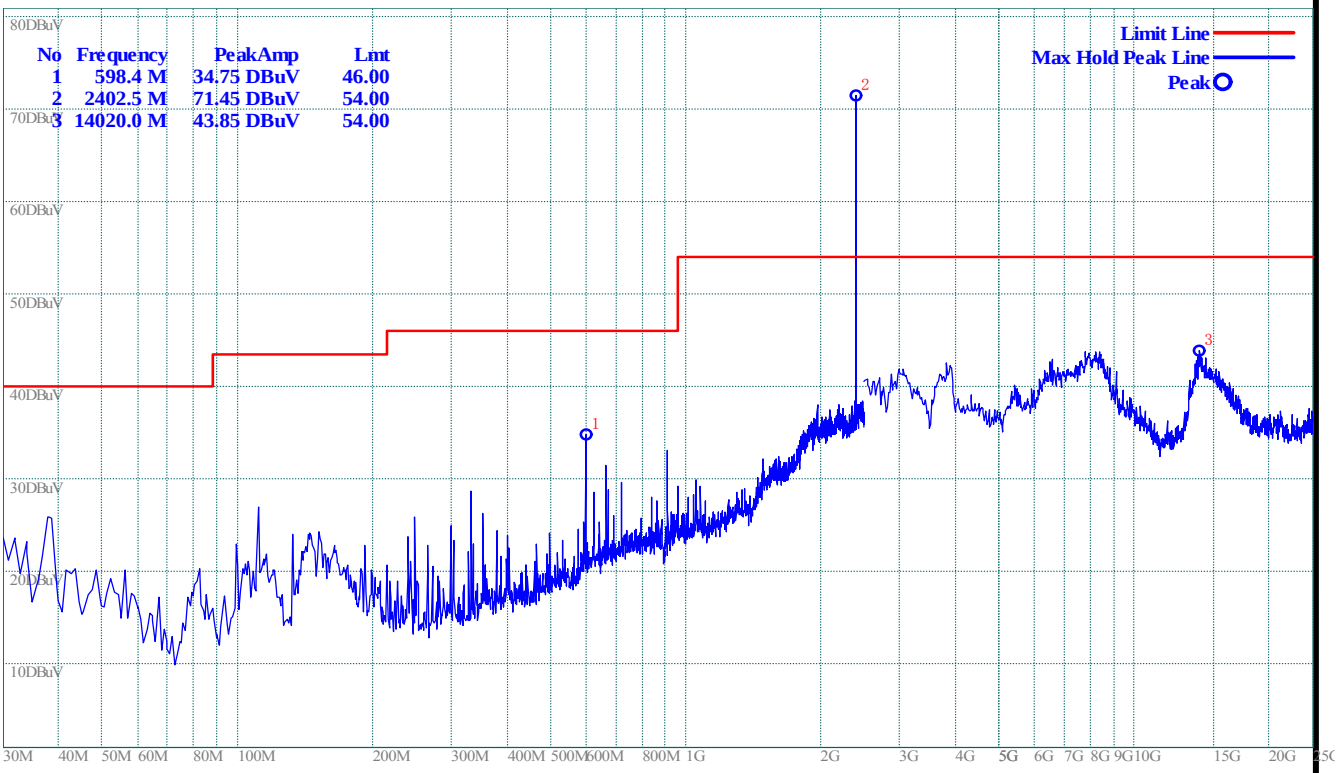


(Plot A.2: Antenna Vertical)

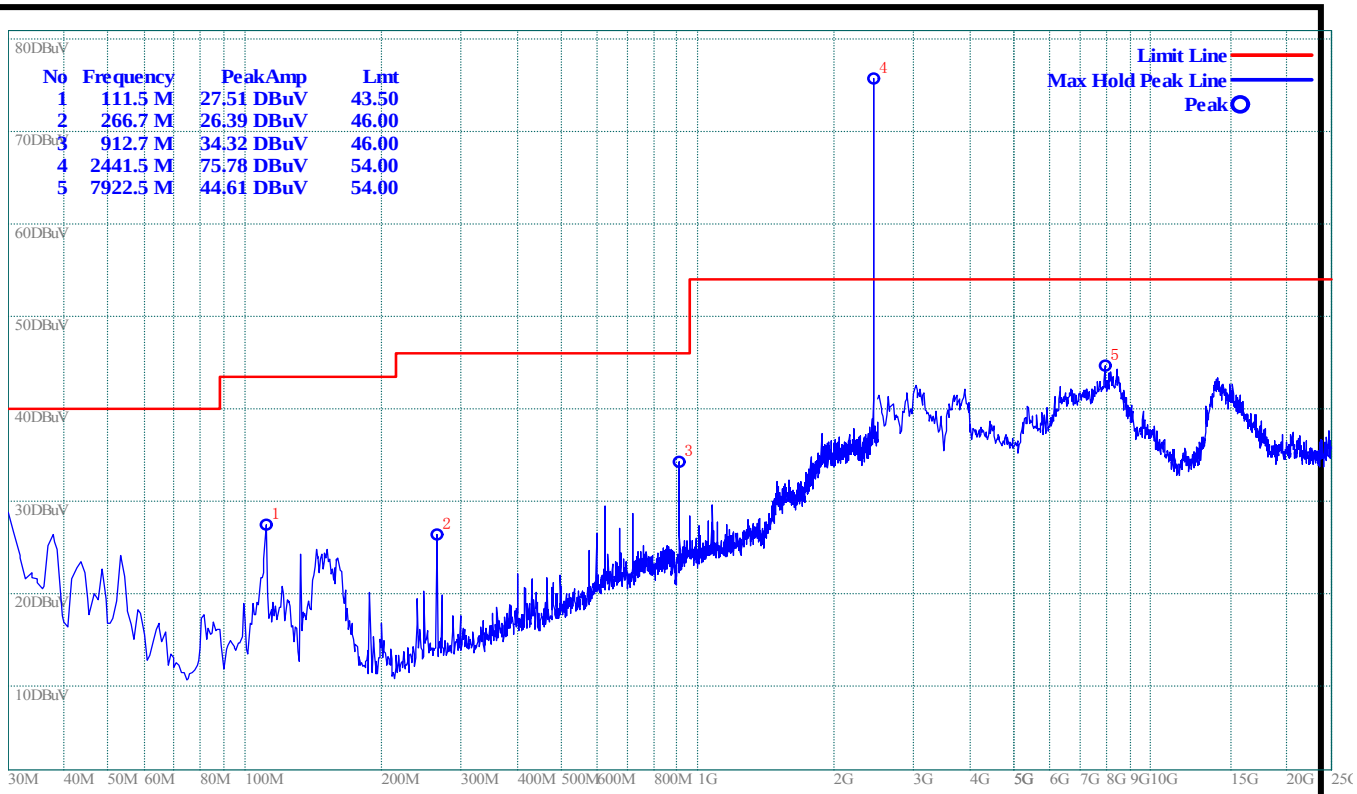
<u>Plot for Channel = 39</u>



(Plot B.0: 9kHz to 30MHz)



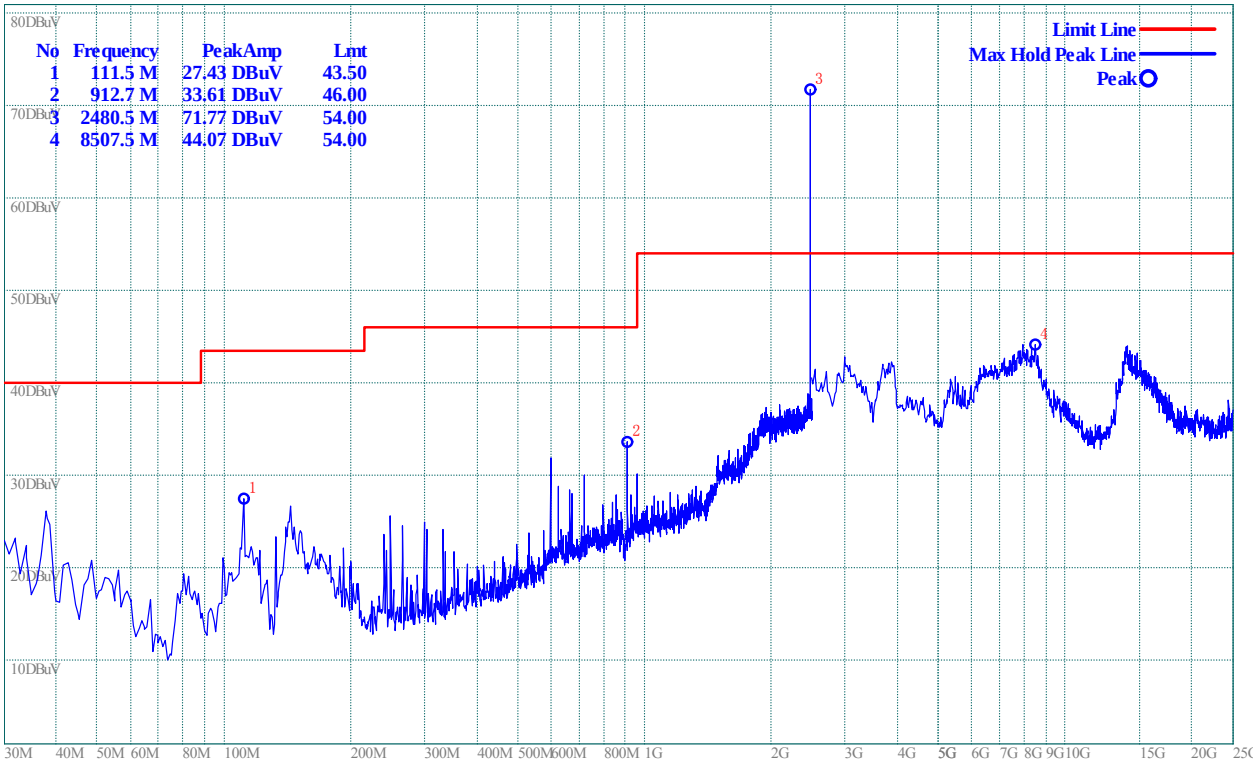
(Plot B.1: Antenna Horizontal)



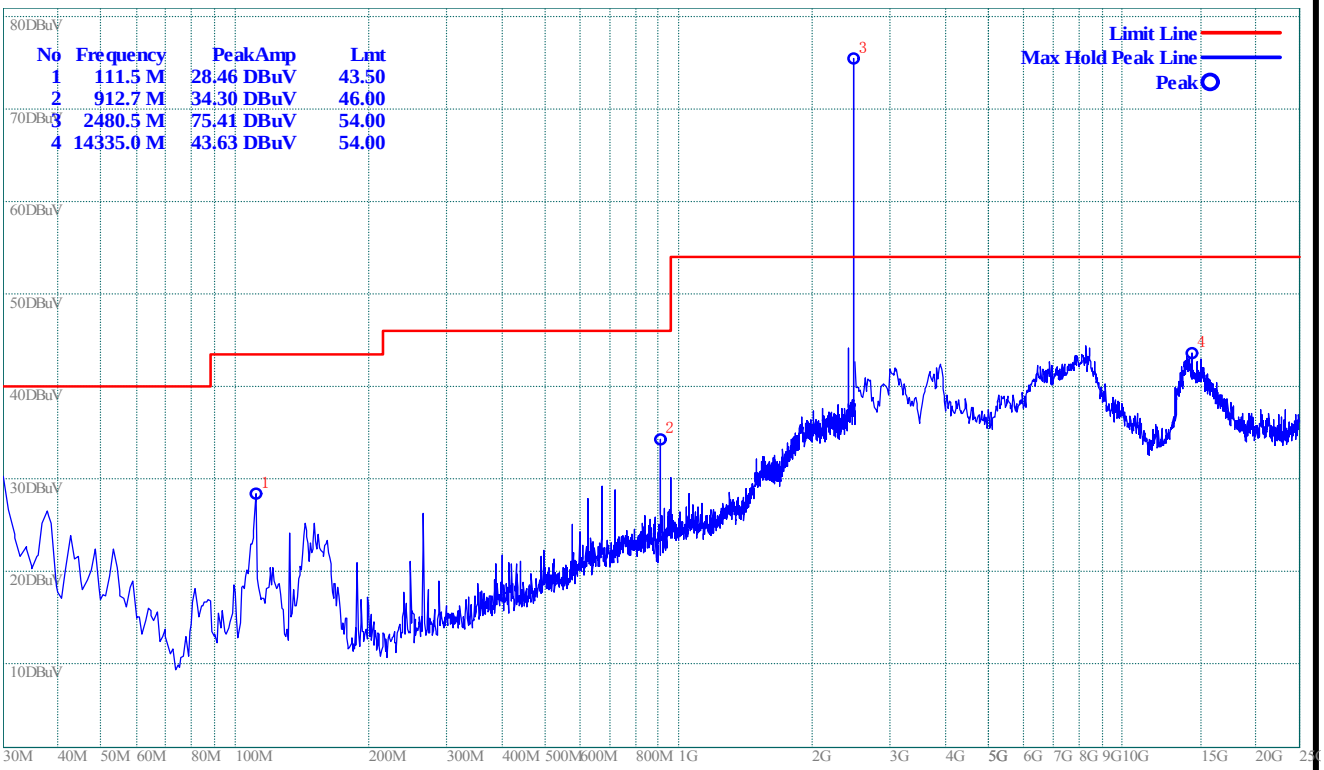
(Plot B.2: Antenna Vertical)

Plot for Channel = 78

(Plot C.0: 9kHz to 30MHz)



(Plot C.1: Antenna Horizontal)



(Plot C.2: Antenna Vertical)

5.9.3.2. π/4-DQPSK Mode:

A. Test Verdict for Harmonics:

The Fundamental Emissions

The field strength of {Fundamental Emission} listed below is recorded, and used in the next table.

Channel	Frequency (MHz)	Fundamental Emission (dBμV/m)		Antenna Polarization	Refer to Plot
		PK	AV		
0	2402	71.45	67.05	Horizontal	Plot A.1
		74.16	70.26	Vertical	Plot A.2
39	2441	75.05	70.33	Horizontal	Plot B.1
		76.57	72.15	Vertical	Plot B.2
78	2480	71.87	67.65	Horizontal	Plot C.1
		75.47	71.43	Vertical	Plot C.2

Test result of channel 0 (2402MHz):

Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
598.4	34.38	--	N.A	46	N.A	>6	100	56	PASS	Horizontel
912.7	33.78	--	N.A	46	N.A	>6	100	37	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
3.018	42.55	--	74	54	>6	>6	100	113	PASS	Horizontel
8.08	45.24	--	74	54	>6	>6	100	65	PASS	Vertical
8.418	44.48	--	74	54	>6	>6	100	117	PASS	Horizontel
14.448	43.98	--	74	54	>6	>6	100	104	PASS	Horizontel

Test result of channel 39 (2441MHz):

Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
111.5	28.18	--	N.A	43.5	N.A	>6	100	20	PASS	Vertical
598.4	35.02	--	N.A	46	N.A	>6	100	97	PASS	Horizontel
912.7	33.88	--	N.A	46	N.A	>6	100	118	PASS	Vertical
912.7	33.7	--	N.A	46	N.A	>6	100	65	PASS	Horizontel
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
8.125	44.14	--	74	54	>6	>6	100	38	PASS	Vertical
14.065	43.6	--	74	54	>6	>6	100	103	PASS	Horizontel

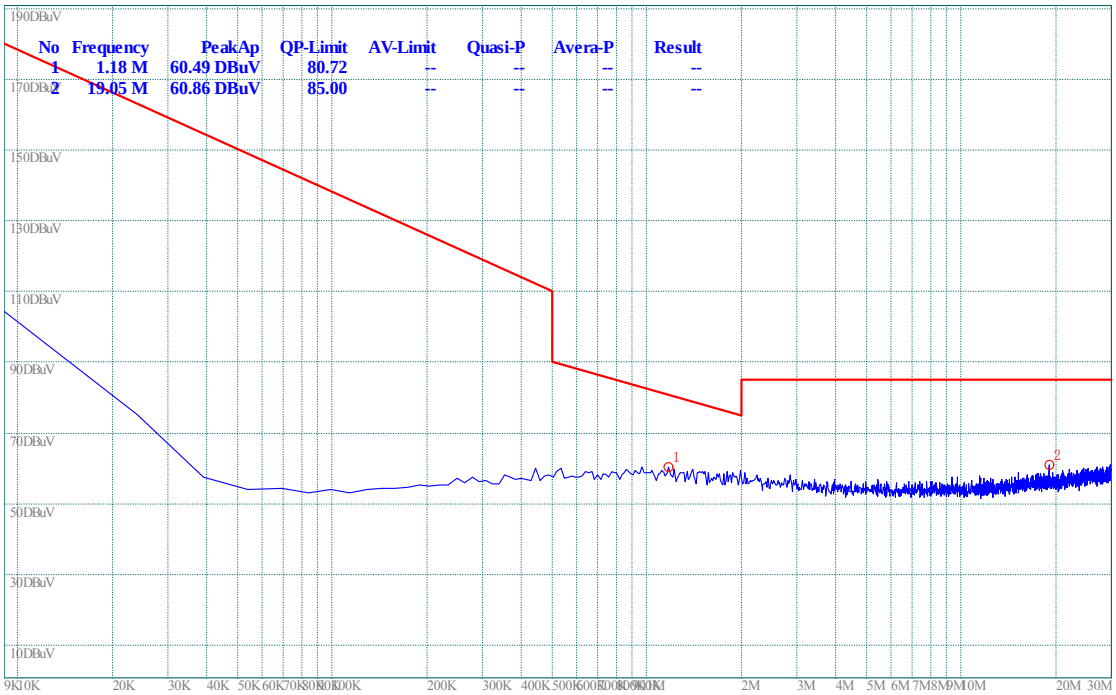
Test result of channel 78 (2480MHz):

Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
111.5	28.46	--	N.A	43.5	N.A	>6	100	78	PASS	Horizontel
912.7	33.47	--	N.A	46	N.A	>6	100	94	PASS	Vertical
912.7	33.62	--	N.A	46	N.A	>6	100	78	PASS	Horizontel

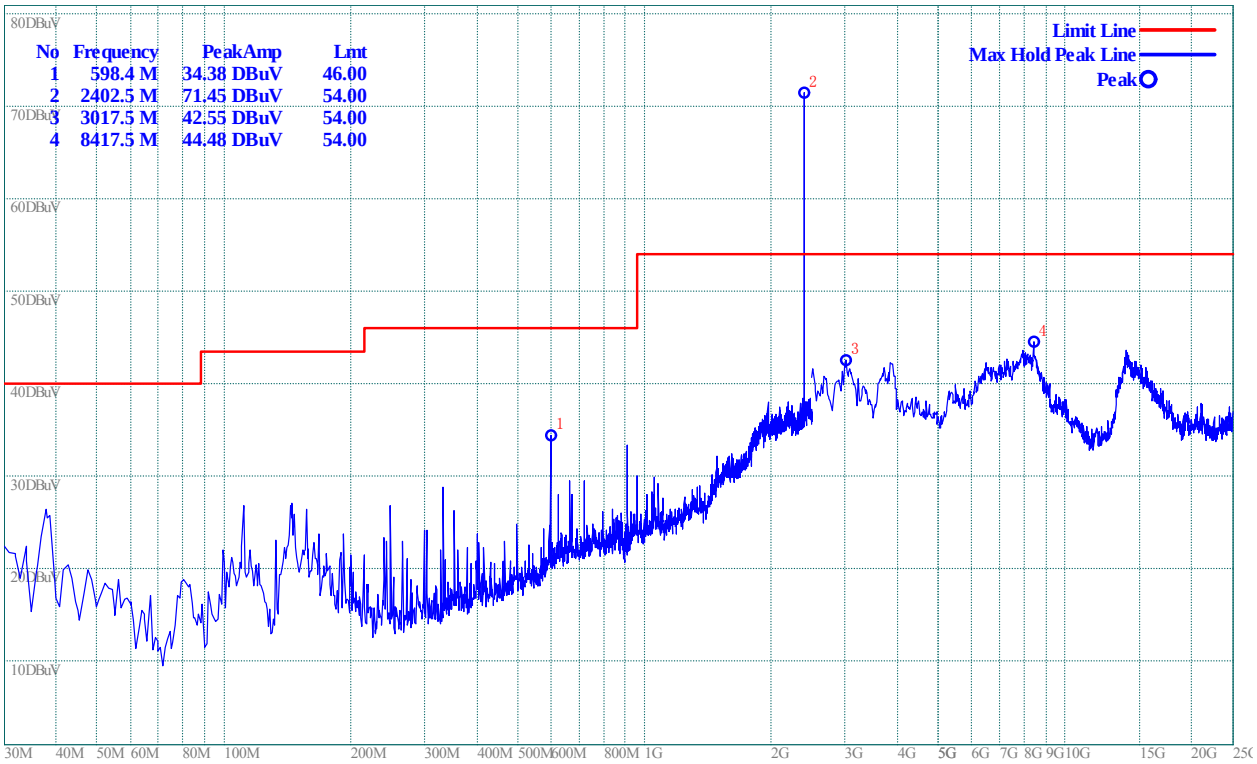
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
14.245	44.04	--	74	54	>6	>6	100	102	PASS	Horizontel
14.065	43.89	--	74	54	>6	>6	100	107	PASS	Vertical

B. Test Plots for the Whole Measurement Frequency Range:

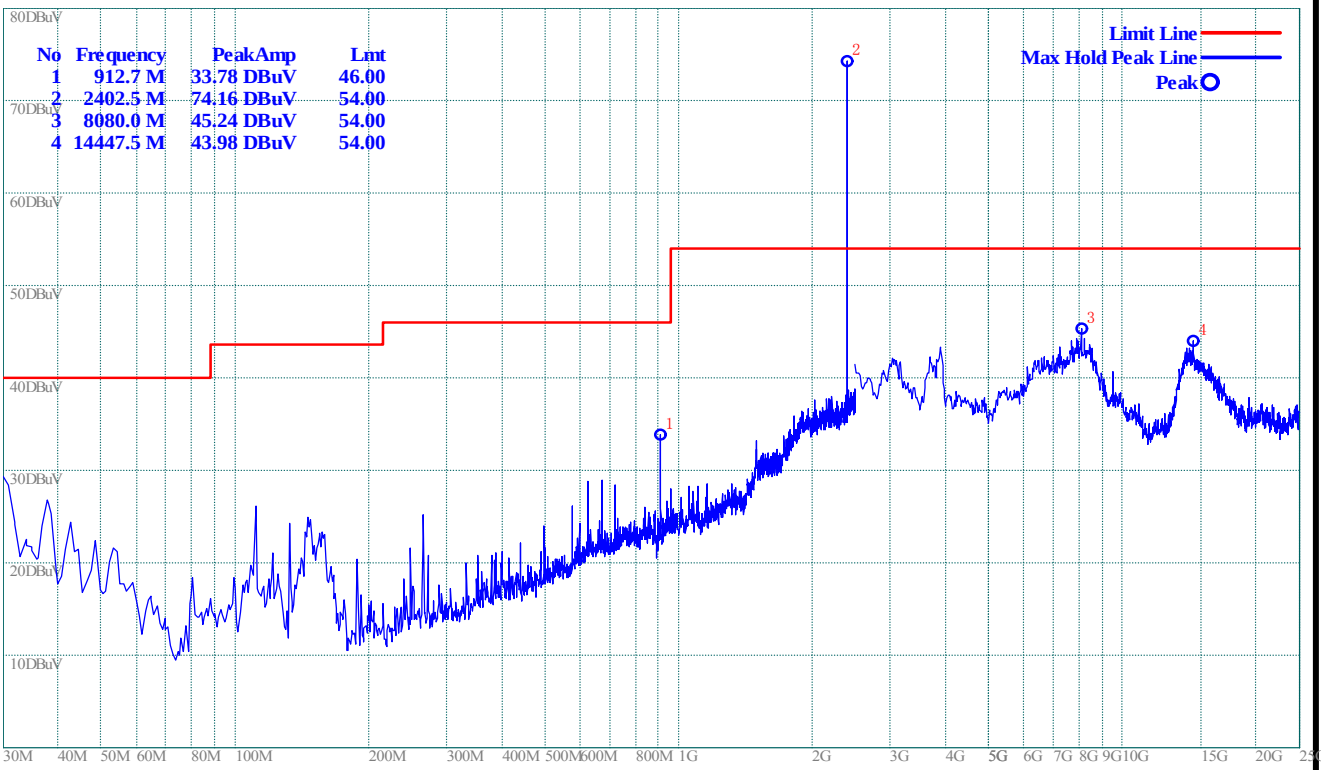
Plots for Channel = 0



(Plot A.0: 9kHz to 30MHz)

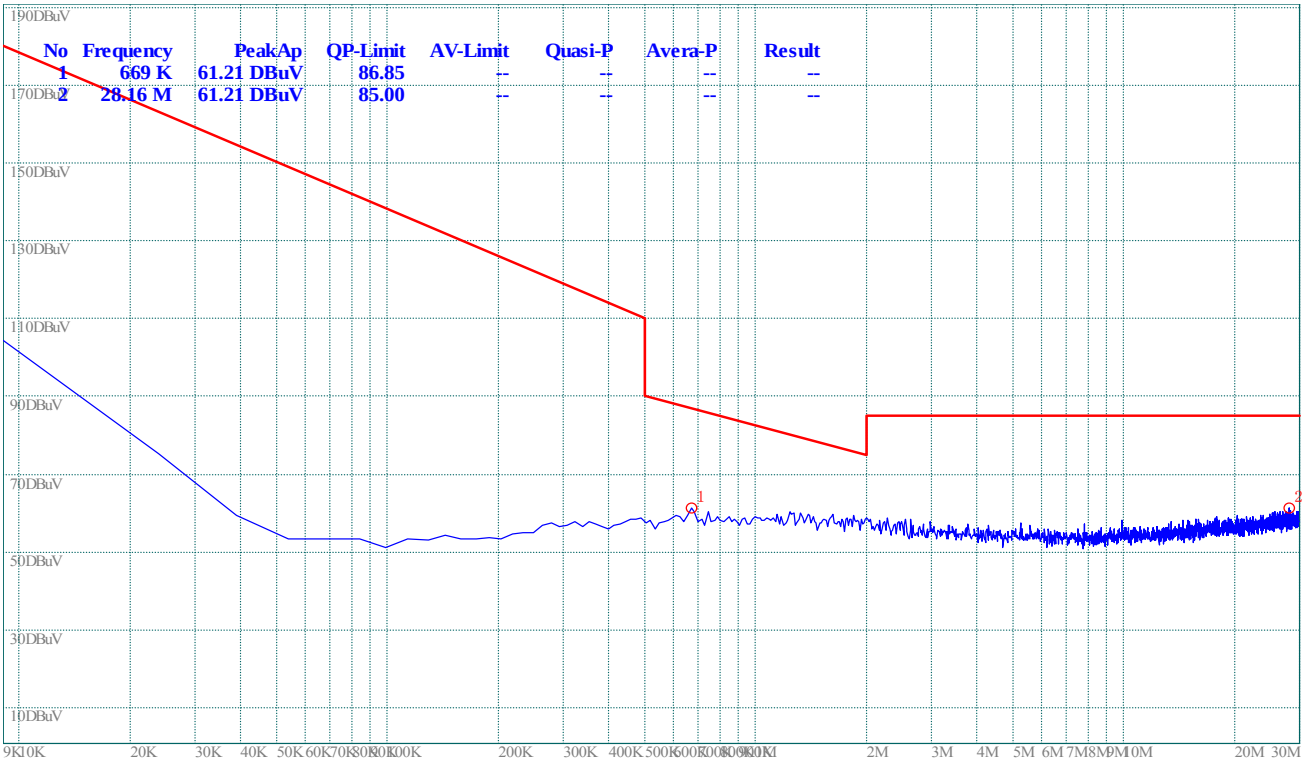


(Plot A.1: Antenna Horizontal)

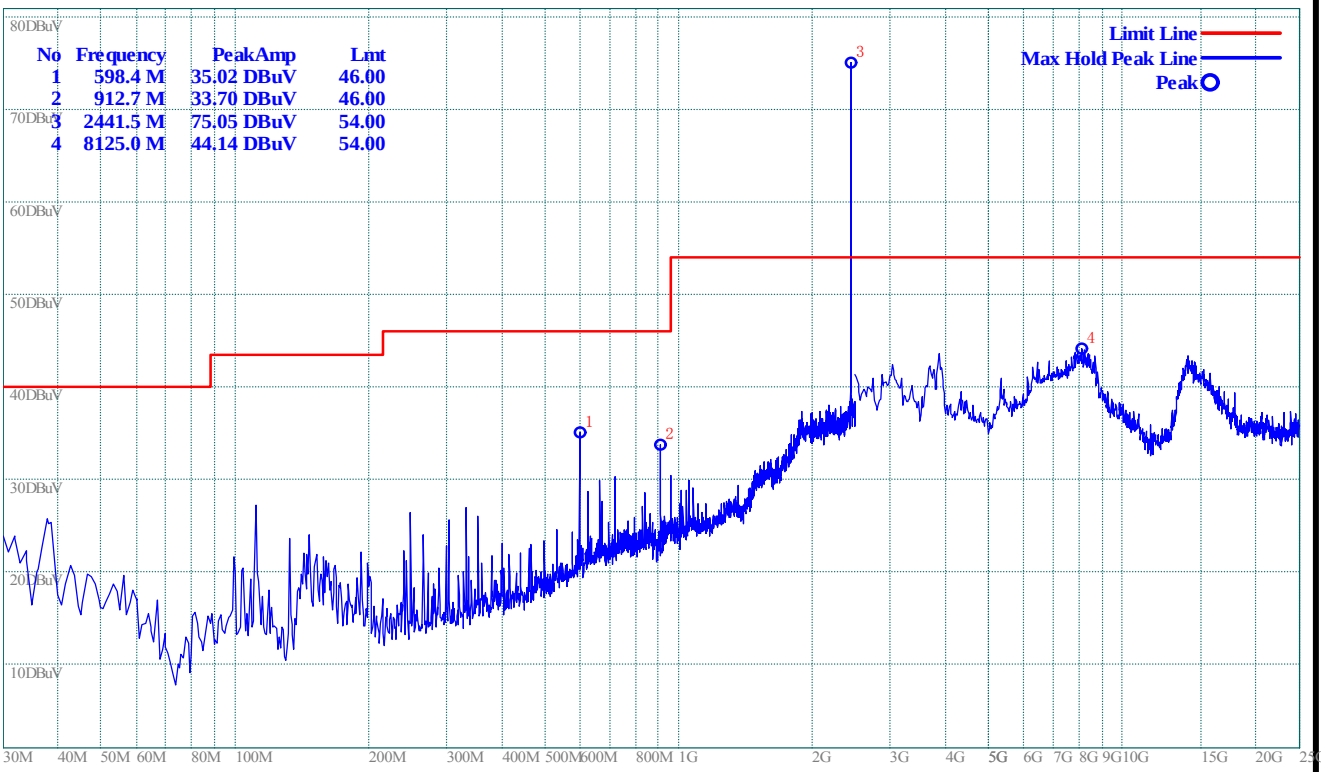


(Plot A.2: Antenna Vertical)

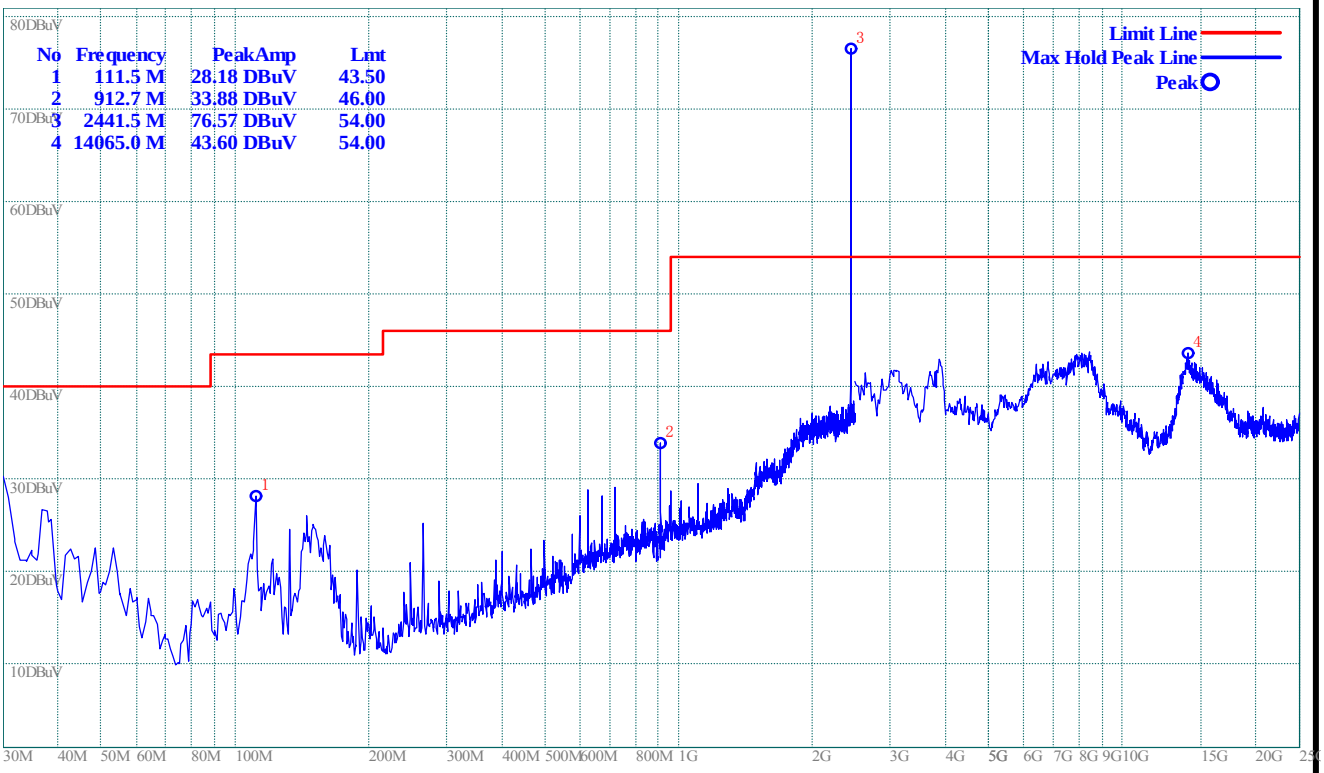
Plot for Channel = 39



(Plot B.0: 9kHz to 30MHz)

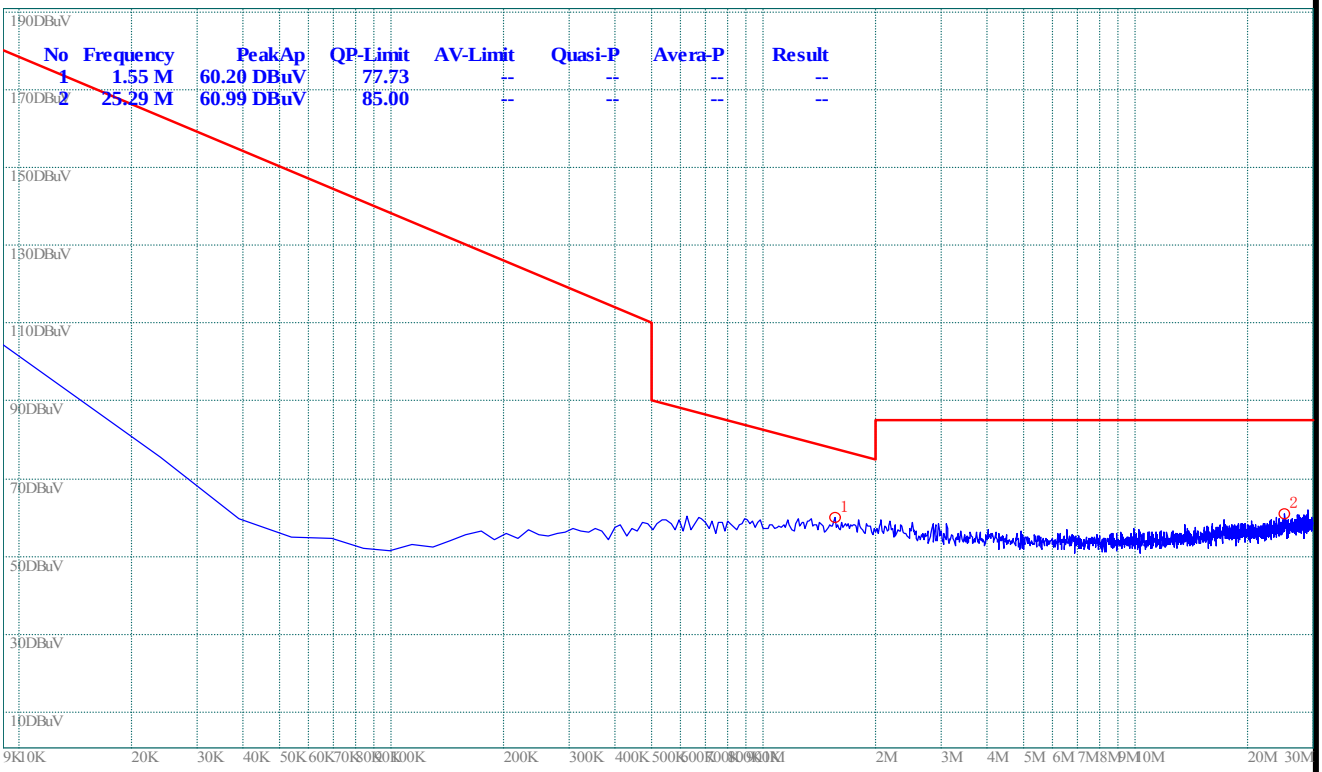


(Plot B.1: Antenna Horizontal)

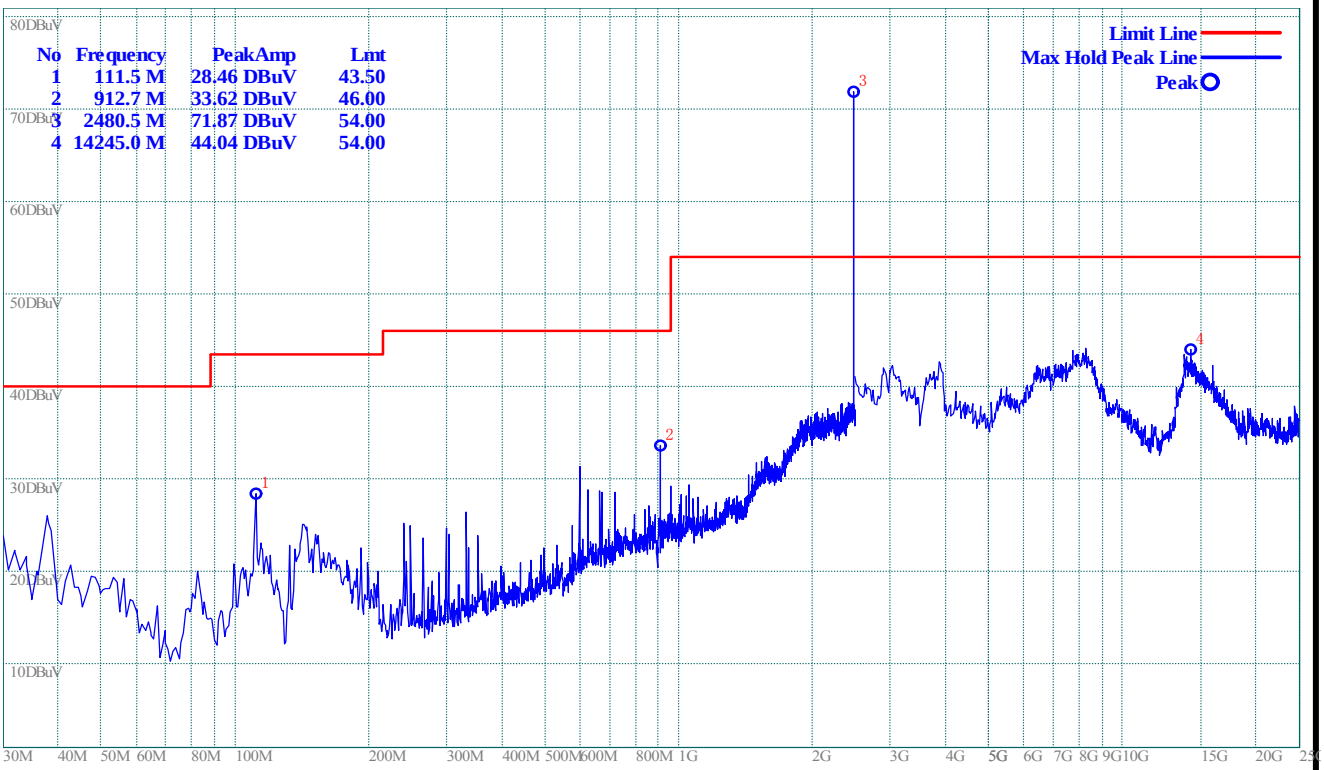


(Plot B.2: Antenna Vertical)

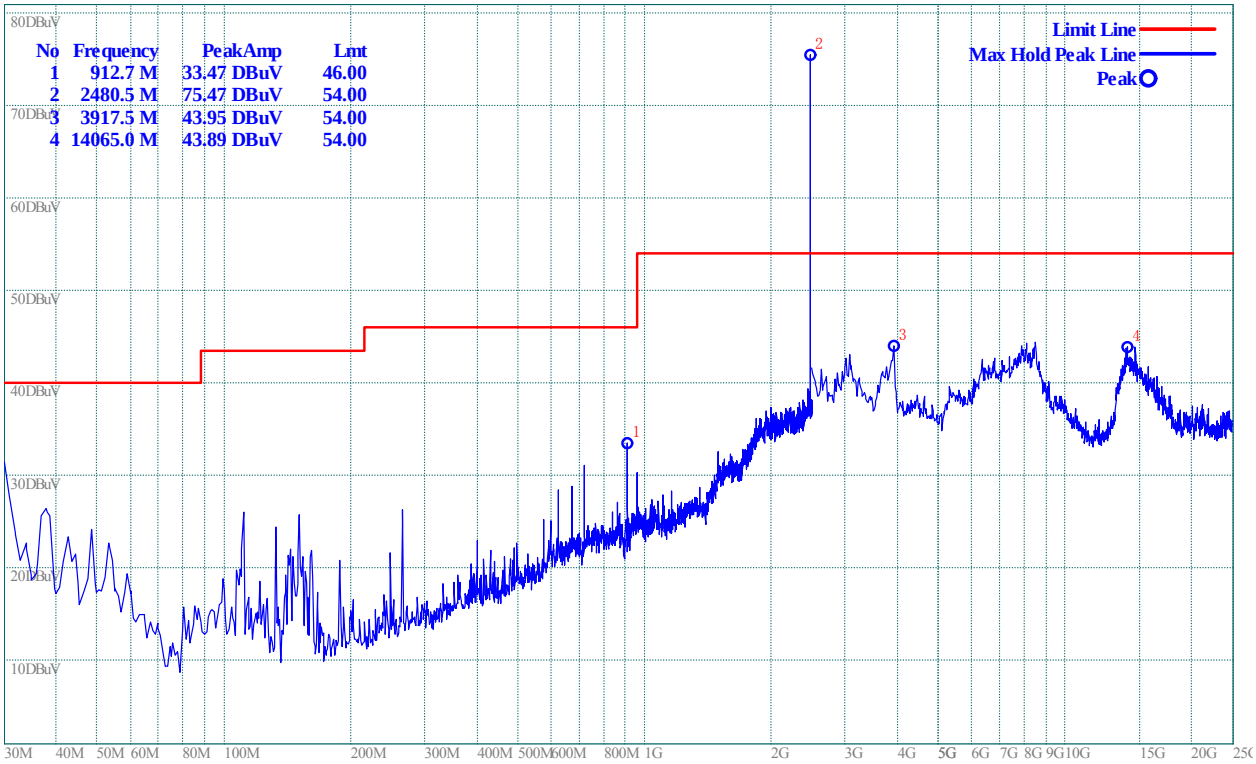
<u>Plot for Channel = 78:</u>



(Plot C.0: 9kHz to 30MHz)



(Plot C.1: Antenna Horizontal)



(Plot C.2: Antenna Vertical)

5.9.3.3. 8-DPSK Mode:

A. Test Verdict for Harmonics:

<u>The Fundamental Emissions</u>

The field strength of {Fundamental Emission} listed below is recorded, and used in the next table.

Channel	Frequency (MHz)	Fundamental Emission (dBμV/m)		Antenna Polarization	Refer to Plot
		PK	AV		
0	2402	71.45	67.56	Horizontal	Plot A.1
		74.24	70.06	Vertical	Plot A.2
39	2441	74.49	70.52	Horizontal	Plot B.1
		76.26	72.09	Vertical	Plot B.2
78	2480	72.14	68.68	Horizontal	Plot C.1
		75.02	71.24	Vertical	Plot C.2

<u>Test result of channel 0 (2402MHz):</u>

Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
598.4	28.46	--	N.A	46	N.A	>6	100	98	PASS	Horizontel
912.7	33.74	--	N.A	46	N.A	>6	100	49	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				

3.873	43.18	--	74	54	>6	>6	100	102	PASS	Vertical
14.133	44.52	--	74	54	>6	>6	100	112	PASS	Vertical
14.38	44.52	--	74	54	>6	>6	100	56	PASS	Horizontel

Test result of channel 39 (2441MHz):

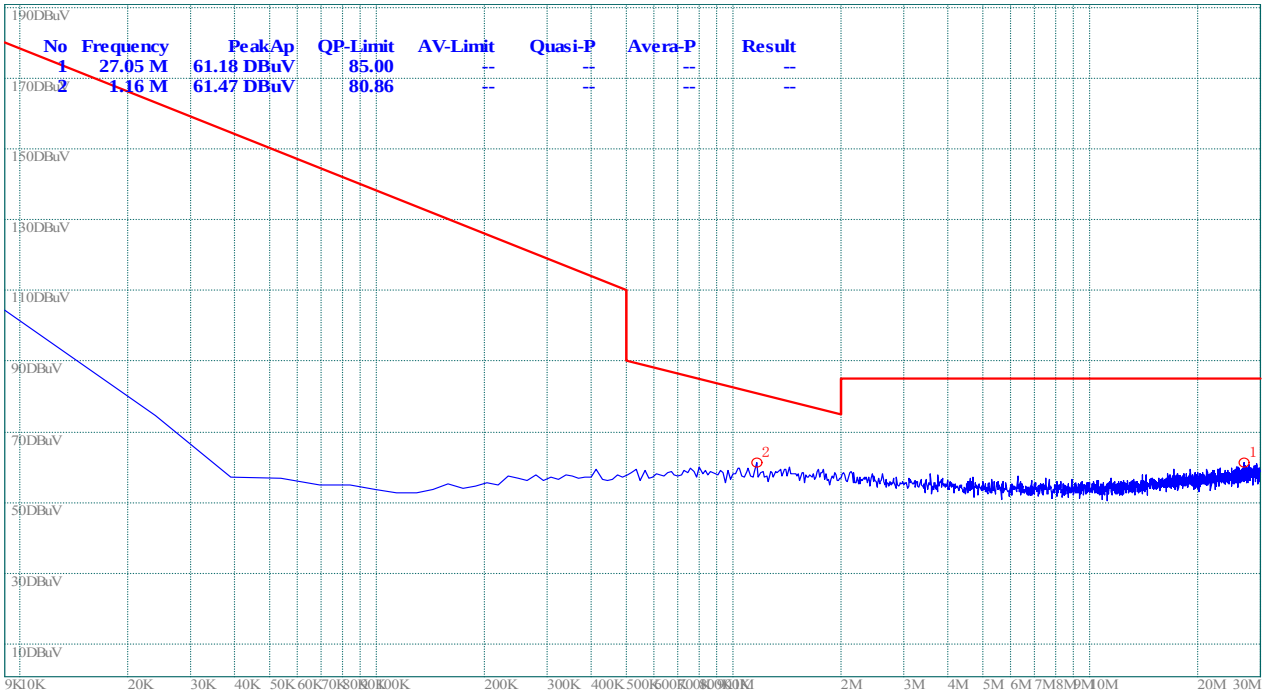
Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
111.5	26.88	--	N.A	43.5	N.A	>6	100	23	PASS	Vertical
598.4	33.35	--	N.A	46	N.A	>6	100	79	PASS	Horizontel
912.7	33.45	--	N.A	46	N.A	>6	100	106	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
3.85	42.96	--	74	54	>6	>6	100	79	PASS	Horizontel
8.305	43.87	--	74	54	>6	>6	100	87	PASS	Horizontel
14.115	44.52	--	74	54	>6	>6	100	114	PASS	Vertical

Test result of channel 78 (2480MHz):

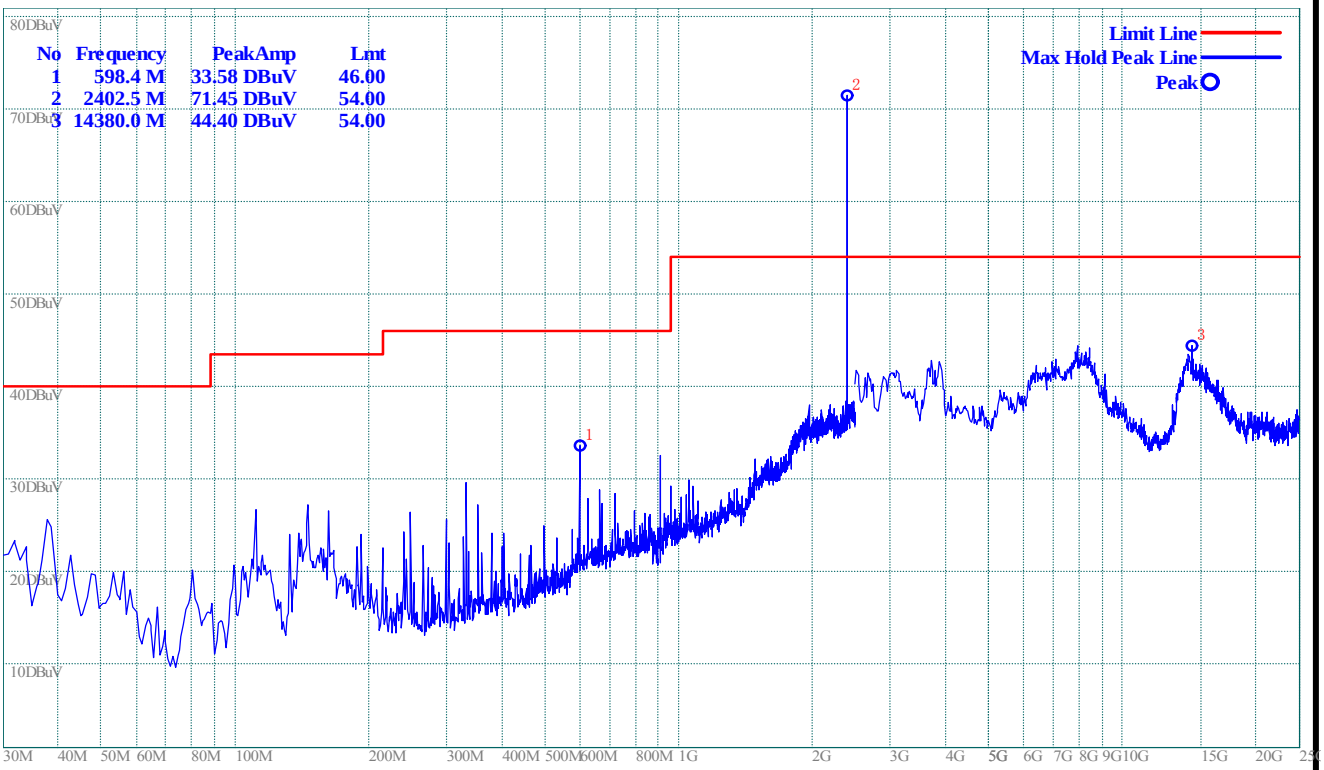
Frequency (MHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	QP	PK	QP	PK	QP				
598.4	33.58	--	N.A	46	N.A	>6	100	78	PASS	Horizontel
912.7	33.74	--	N.A	46	N.A	>6	100	43	PASS	Vertical
Frequency (GHz)	Measurement		Limit		Margin (dB)		Height (cm)	Azimuth (deg)	Verdict	Antenna Polarization
	PK	AV	PK	QP	PK	AV				
3.873	43.18	--	74	54	>6	>6	100	112	PASS	Vertical
14.133	44.52	--	74	54	>6	>6	100	112	PASS	Vertical
14.38	44.4	--	74	54	>6	>6	100	59	PASS	Horizontel

B. Test Plots for the Whole Measurement Frequency Range:

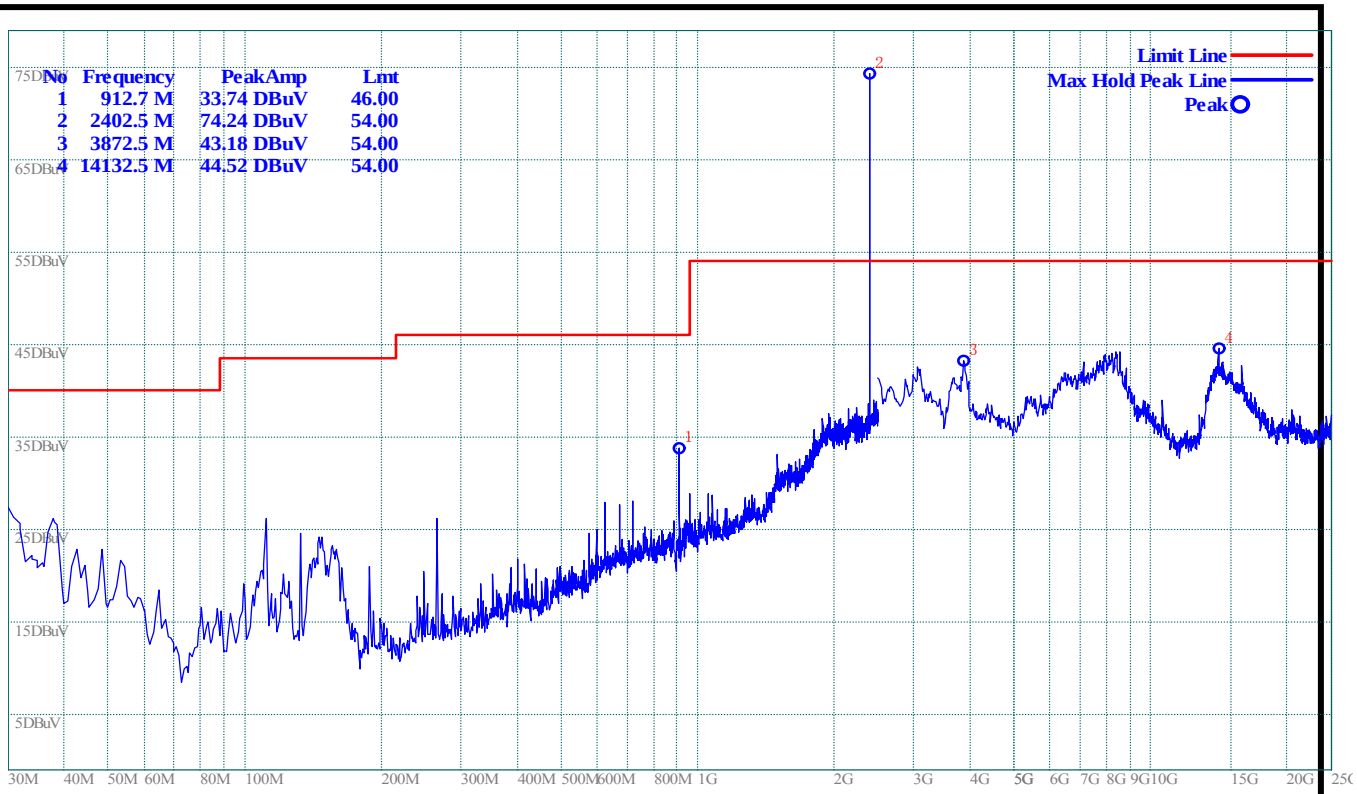
Plots for Channel = 0



(Plot A.0: 9kHz to 30MHz)

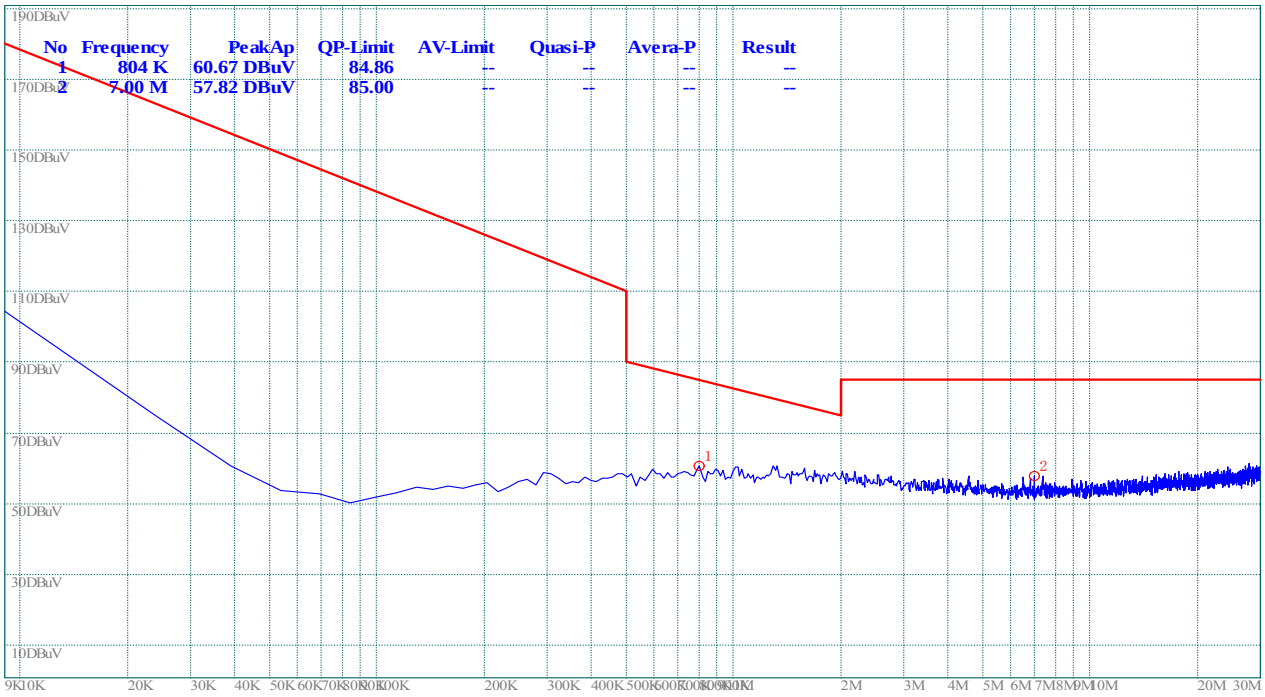


(Plot A.1: Antenna Horizontal)

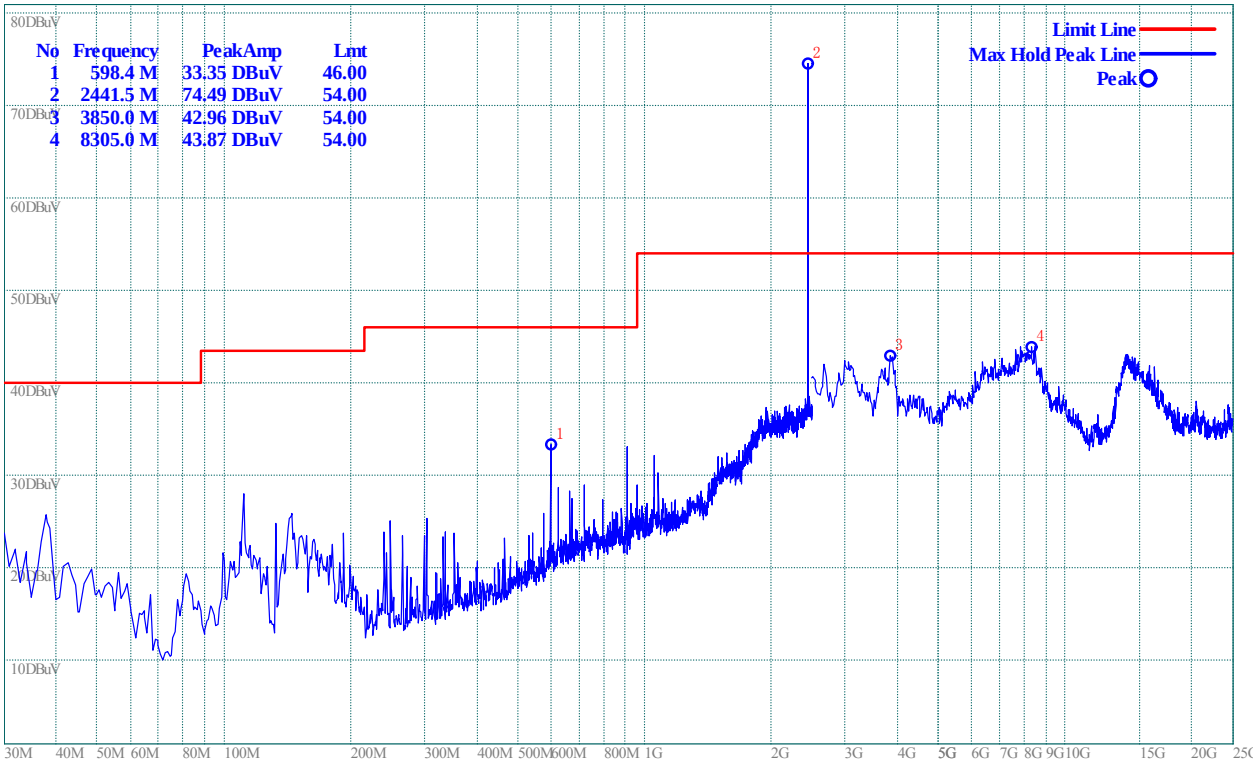


(Plot A.2: Antenna Vertical)

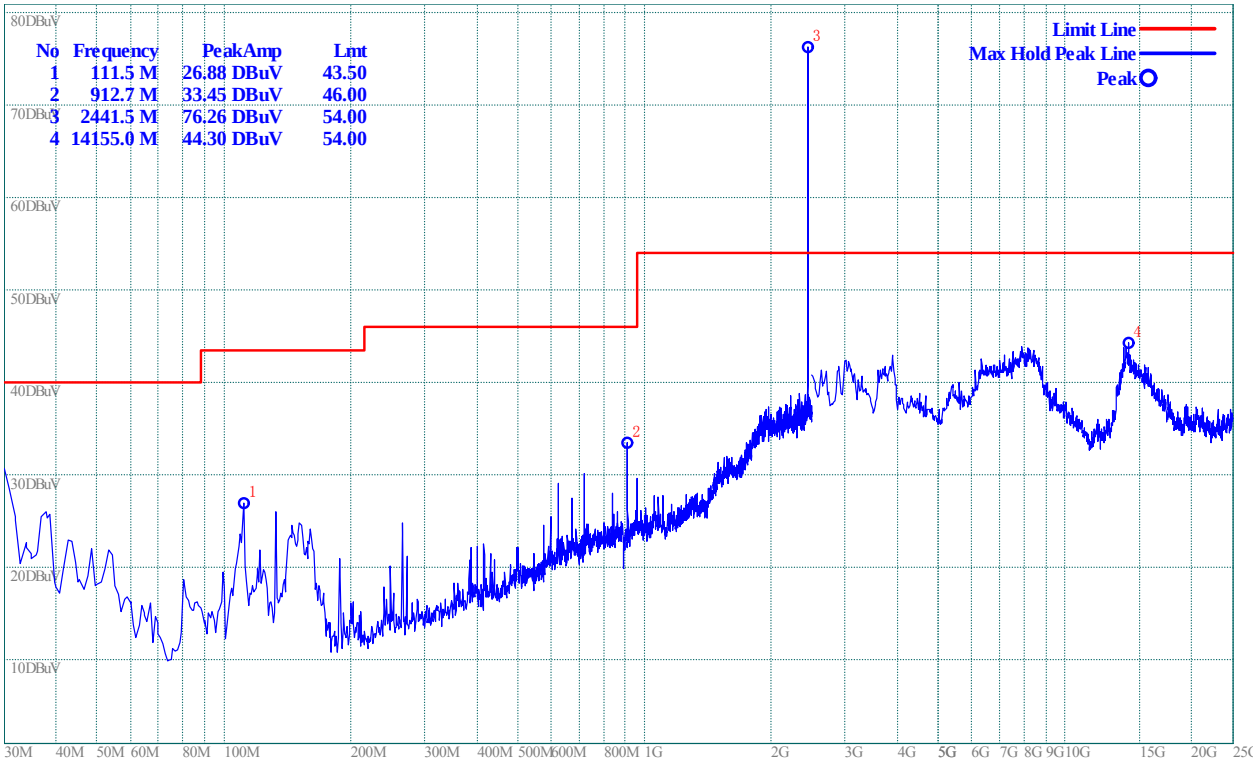
Plot for Channel = 39



(Plot B.0: 9kHz to 30MHz)

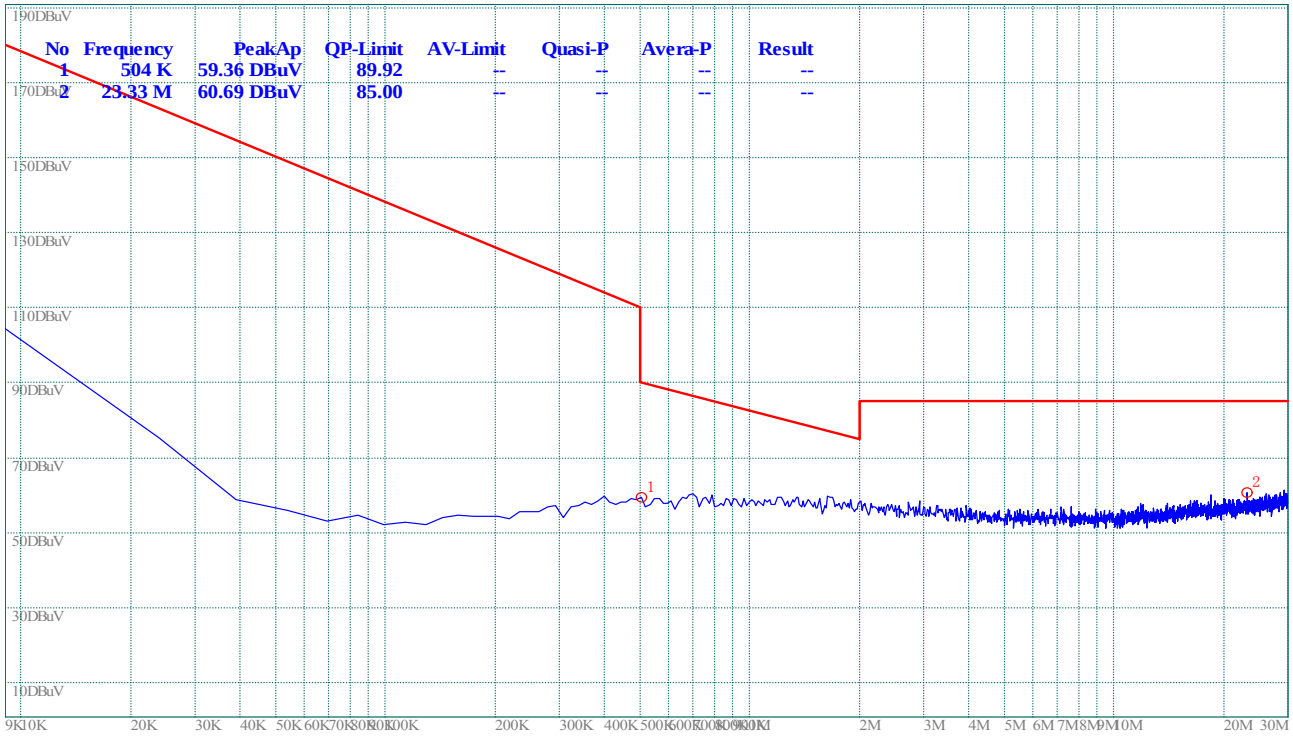


(Plot B.1: Antenna Horizontal)

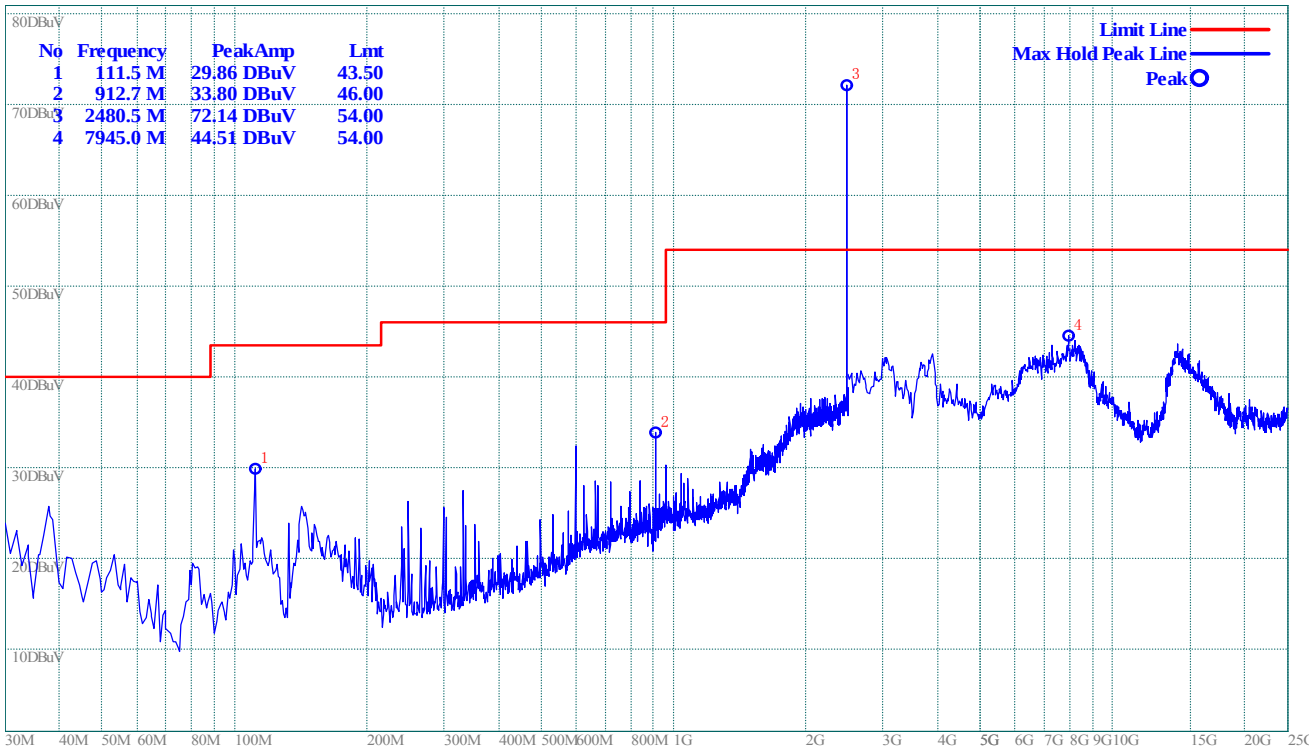


(Plot B.2: Antenna Vertical)

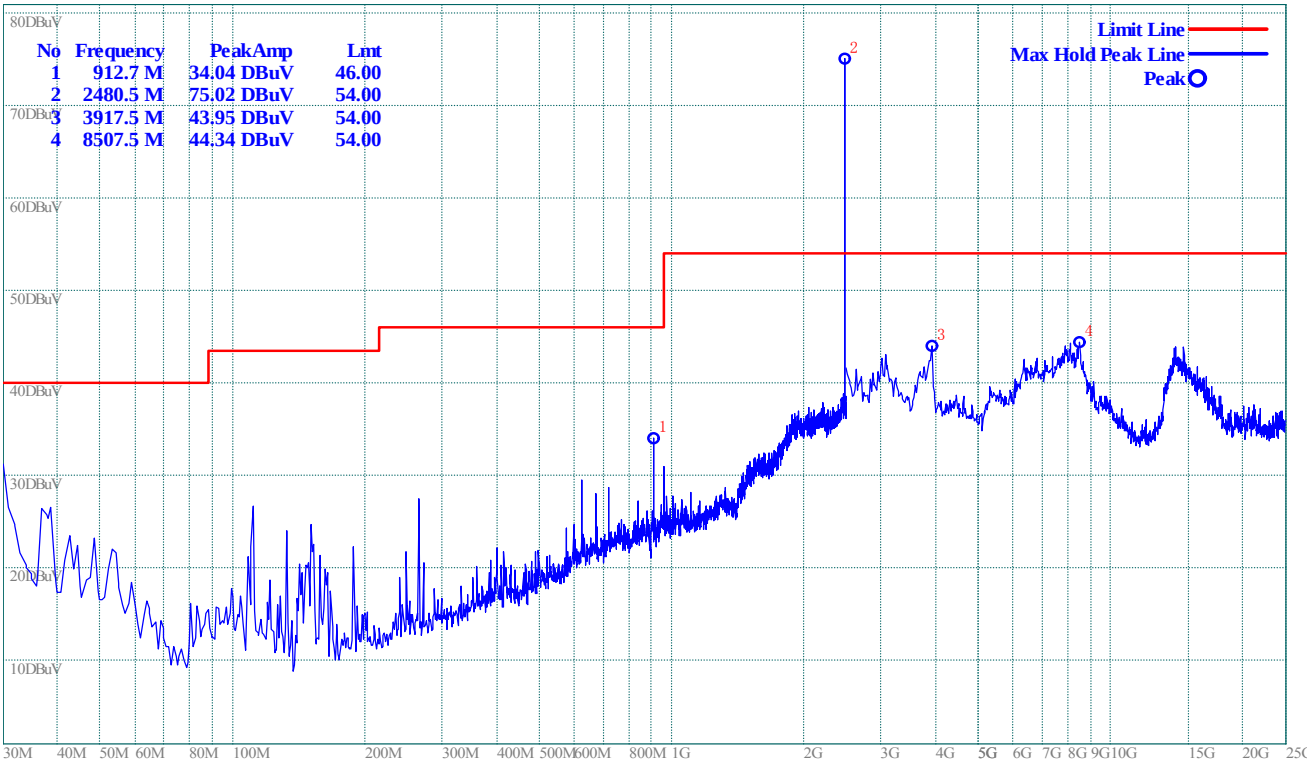
<u>Plot for Channel = 78</u>



(Plot C.0: 9kHz to 30MHz)



(Plot C.1: Antenna Horizontal)



(Plot C.2: Antenna Vertical)

** END OF REPORT **