



REPORT No.: SZ16050024W02

FCC RF TEST REPORT

APPLICANT : Shenzhen Santiago Technology Ltd.

PRODUCT NAME : DUO Bluetooth Communication Accessory

MODEL NAME : DUO-A1

TRADE NAME : DUOSIM

BRAND NAME : DUO

FCC ID : 2AIU7-1508A01

STANDARD(S) : 47 CFR Part 15 Subpart C

ISSUE DATE : 2016-07-11



SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.

MORLAB GROUP

FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,
Block67, BaoAn District, ShenZhen , Guangdong Province, P. R. China

Tel: 86-755-36698555
Http://www.morlab.com

Fax: 86-755-36698525
E-mail: service@morlab.cn



DIRECTORY

TEST REPORT DECLARATION	4
1. TECHNICAL INFORMATION	5
1.1 APPLICANT INFORMATION	5
1.2 EQUIPMENT UNDER TEST (EUT) DESCRIPTION	5
1.2.1 IDENTIFICATION OF ALL USED EUTS	5
1.3 TEST STANDARDS AND RESULTS	6
1.3.1 TEST ENVIRONMENT CONDITIONS	6
2. 47 CFR PART 15C REQUIREMENTS	7
2.1 ANTENNA REQUIREMENT	7
2.1.1 APPLICABLE STANDARD	7
2.1.2 RESULT: COMPLIANT	7
2.2 NUMBER OF HOPPING FREQUENCY	7
2.2.1 REQUIREMENT	7
2.2.2 TEST DESCRIPTION	7
2.2.3 TEST PROCEDURE	8
2.2.4 TEST RESULT	8
2.3 PEAK OUTPUT POWER	12
2.3.1 REQUIREMENT	12
2.3.2 TEST DESCRIPTION	12
2.3.3 TEST RESULT	12
2.4 20DB BANDWIDTH	14
2.4.1 DEFINITION	14
2.4.2 TEST DESCRIPTION	14
2.4.3 TEST PROCEDURE	14
2.4.4 TEST RESULT	14
2.5 CARRIED FREQUENCY SEPARATION	24
2.5.1 DEFINITION	24
2.5.2 TEST DESCRIPTION	24
2.5.3 TEST PROCEDURE	24
2.5.4 TEST RESULT	25
2.6 TIME OF OCCUPANCY (DWELL TIME)	28



2.6.1	REQUIREMENT	28
2.6.2	TEST DESCRIPTION	28
2.6.3	TEST PROCEDURE	28
2.6.4	TEST RESULT	29
2.7	CONDUCTED SPURIOUS EMISSIONS	41
2.7.1	REQUIREMENT	41
2.7.2	TEST DESCRIPTION	41
2.7.3	TEST PROCEDURE	41
2.7.4	TEST RESULT	42
2.8	RESTRICTED FREQUENCY BANDS	54
2.8.1	REQUIREMENT	54
2.8.2	TEST DESCRIPTION	54
2.8.3	TEST PROCEDURE	55
2.8.4	TEST RESULT	55
2.9	CONDUCTED EMISSION	63
2.9.1	REQUIREMENT	63
2.9.2	TEST DESCRIPTION	63
2.9.3	TEST RESULT	64
2.10	RADIATED EMISSION	66
2.10.1	REQUIREMENT	66
2.10.2	TEST DESCRIPTION	67
2.10.3	TEST PROCEDURE	69
2.10.4	TEST RESULT	69
ANNEX A GENERAL INFORMATION		79

Change History		
Issue	Date	Reason for change
1.0	2016-07-11	First edition



REPORT No.: SZ16050024W02

TEST REPORT DECLARATION

Applicant	Shenzhen Santiago Technology Ltd.
Applicant Address	REITH INTERNATIONAL 11A, LUOHU DISTRICT, SHENZHEN
Manufacturer	Shenzhen Santiago Technology Ltd.
Manufacturer Address	REITH INTERNATIONAL 11A, LUOHU DISTRICT, SHENZHEN
Product Name	DUO Bluetooth Communication Accessory
Model Name	DUO-A1
Brand Name	DUO
HW Version	ST-5106
SW Version	DuoPlus_v1.2.018
Test Standards	47 CFR Part 15 Subpart C
Test Date	2016-05-23 to 2016-06-13
Test Result	PASS

Tested by : Yuan Ling
Yuan Ling

Reviewed by : Qiu Xiaojun
Qiu Xiaojun

Approved by : Peng Huarui
Peng Huarui



1. TECHNICAL INFORMATION

Note: Provide by applicant.

1.1 Applicant Information

Company:	Shenzhen Santiago Technology Ltd.
Address:	REITH INTERNATIONAL 11A, LUOHU DISTRICT, SHENZHEN

1.2 Equipment under Test (EUT) Description

Brand Name:	DUO
Trade Name:	DUOSIM
Model Name:	DUO-A1
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), $\pi/4$ -DQPSK(EDR 2Mbps), 8-DPSK(EDR 3Mbps))
Bluetooth Version:	2.1+EDR
Antenna Type:	PCB Antenna
Antenna Gain:	0.3 dBi

NOTE:

The EUT is a DUO Bluetooth Communication Accessory, it contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is $F(\text{MHz})=2402+1*n$ ($0 \leq n \leq 78$). 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).

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

1.2.1 Identification of all used EUTs

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
01	ST-5106	DuoPlus_v1.2.018



1.3 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 (10-1-15 Edition)	Radio Frequency Devices

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

No.	Section in CFR 47	Description	Test Date	Result
1	15.203	Antenna Requirement	N.A	<u>PASS</u>
2	15.247(a)	Number of Hopping Frequency	May 23, 2016	<u>PASS</u>
3	15.247(b)	Peak Output Power	May 23, 2016	<u>PASS</u>
4	15.247(a)	20dB Bandwidth	May 23, 2016	<u>PASS</u>
5	15.247(a)	Carrier Frequency Separation	May 23, 2016	<u>PASS</u>
6	15.247(a)	Time of Occupancy (Dwell time)	May 23, 2016	<u>PASS</u>
7	15.247(d)	Conducted Spurious Emission	May 23, 2016	<u>PASS</u>
8	15.247(d)	Restricted Frequency Bands	Jun 13, 2016	<u>PASS</u>
9	15.209 15.247(d)	Radiated Emission	Jun 13, 2016	<u>PASS</u>
10	15.207	Conducted Emission	Jun 13, 2016	<u>PASS</u>

NOTE: The tests were performed according to the method of measurements prescribed in DA-00-705 and ANSI C63.10-2013.

1.3.1 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 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:

Please reference ANNEX A(1.5).



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 \geq 1% of the span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

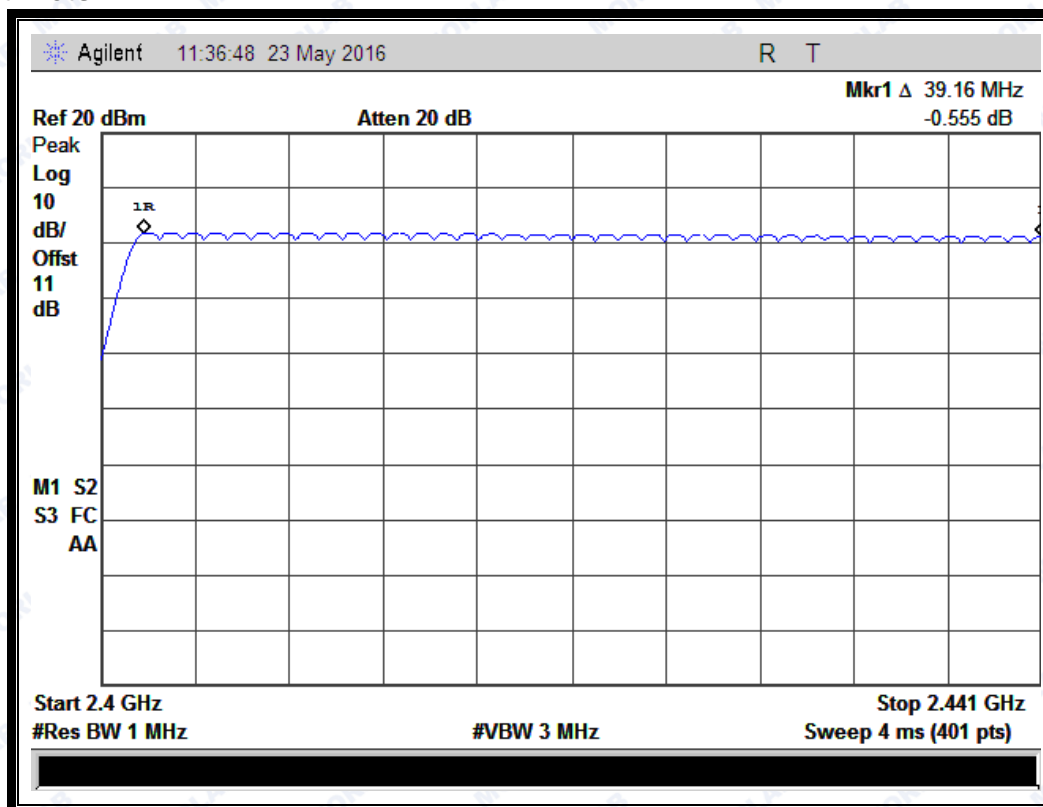
2.2.4 Test Result

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.

A. Test Verdict:

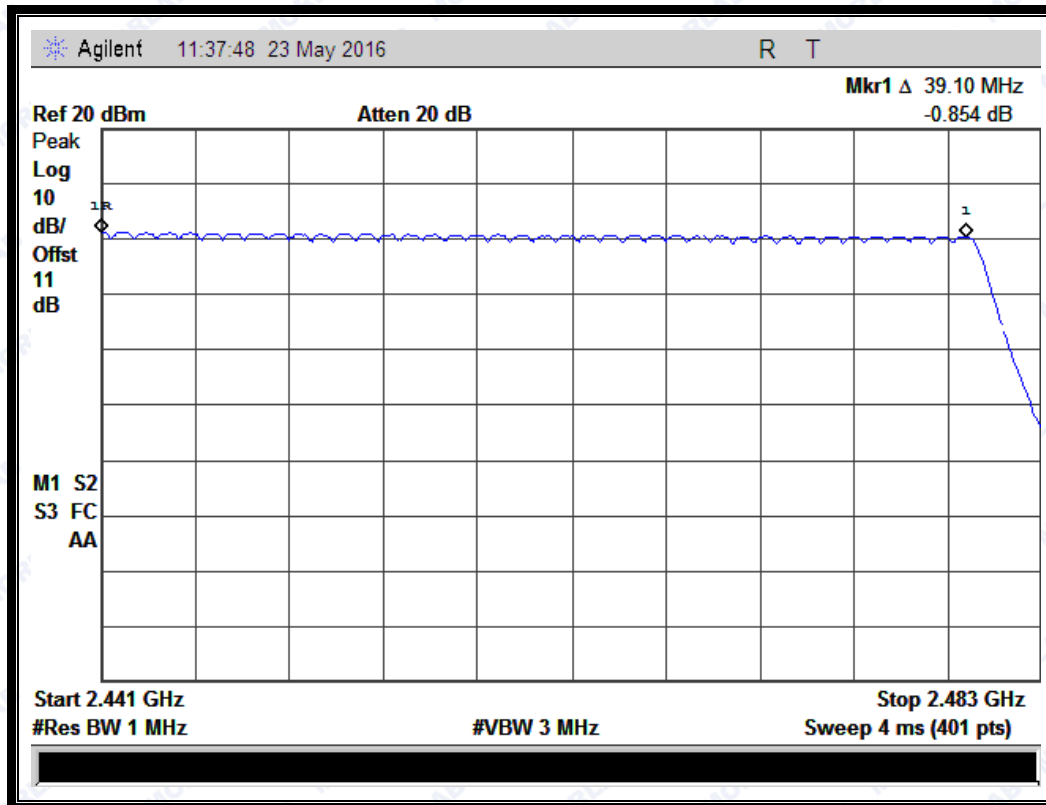
Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A	PASS
$\pi/4$ -DQPSK	2400 - 2483.5	79	15	Plot B	PASS
8-DPSK	2400 - 2483.5	79	15	Plot C	PASS

B. Test Plots:





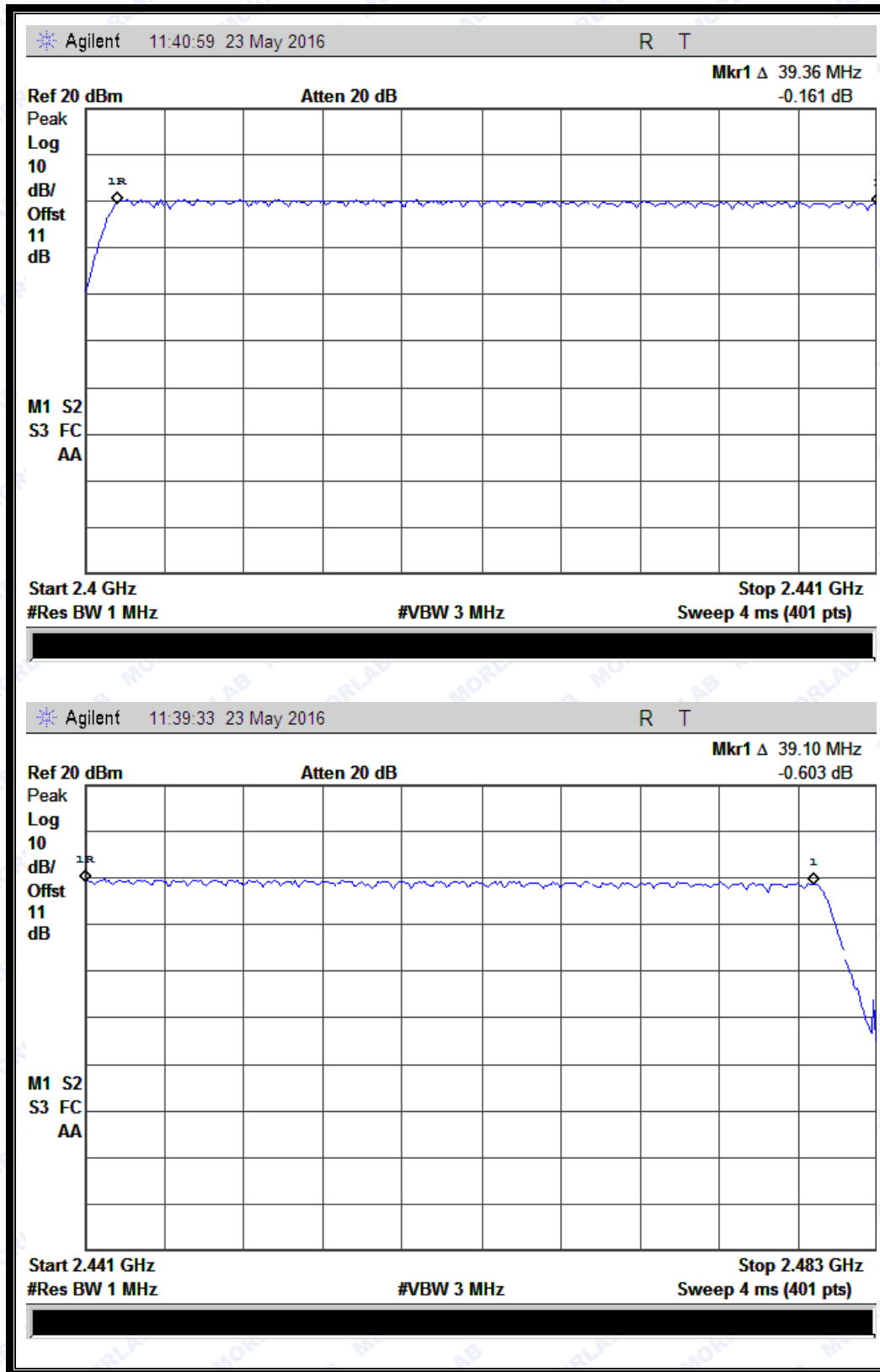
REPORT No.: SZ16050024W02



(Plot A: GFSK)



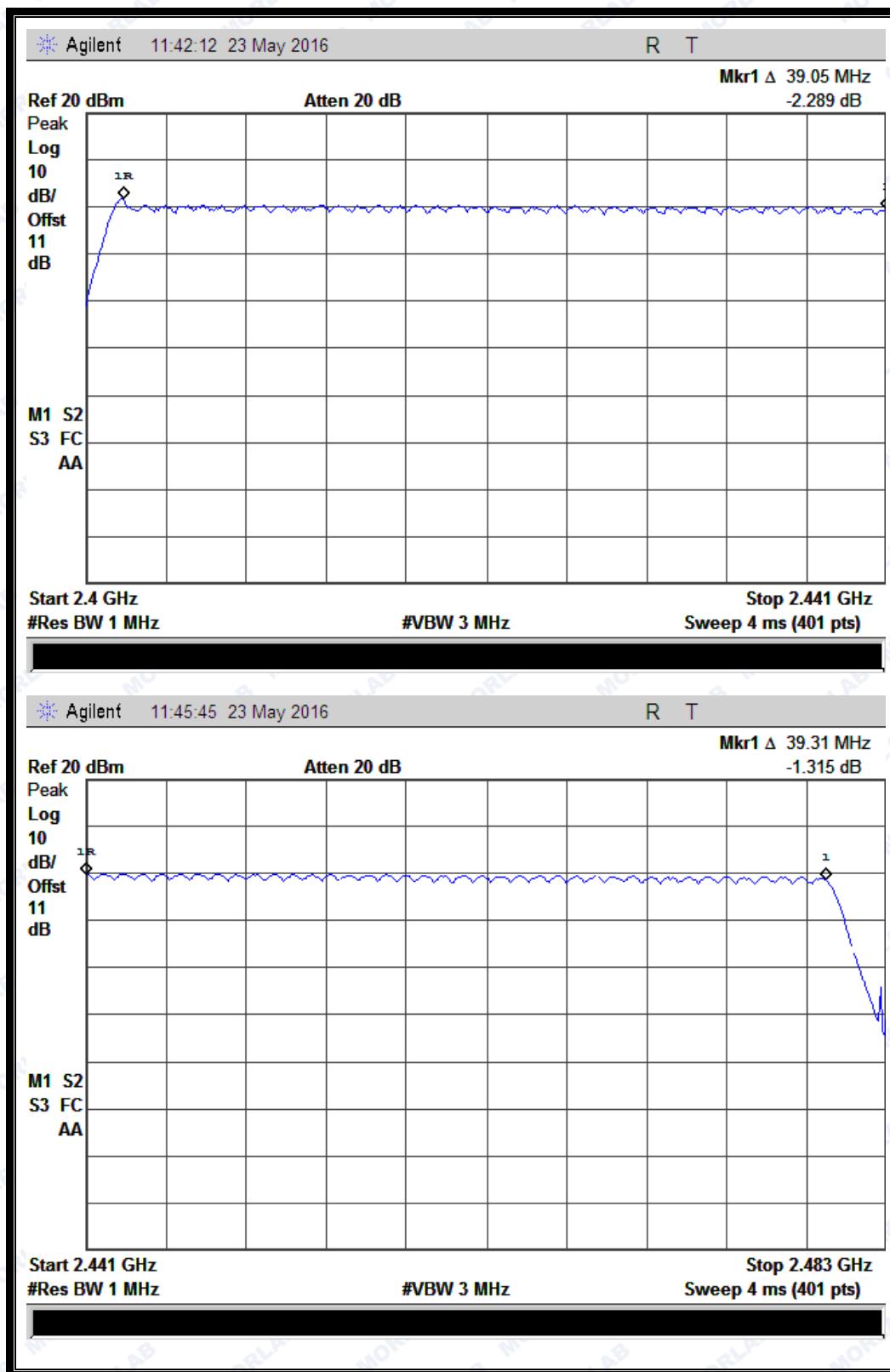
REPORT No.: SZ16050024W02



(Plot B: $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02



(Plot C: 8- DPSK)

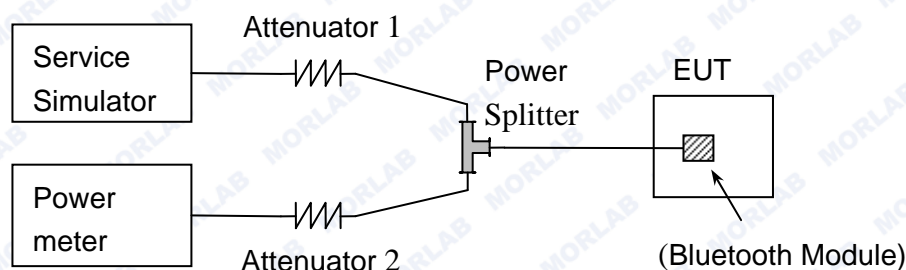
2.3 Peak Output Power

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 is coupled to the Power meter 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:

Please reference ANNEX A(1.5).

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	1.67	0.0015	20.97	0.125	PASS
39	2441	1.03	0.0013			PASS
78	2480	0.26	0.0011			PASS

2.3.3.2 $\pi/4$ -DQPSK Mode**B. Test Verdict:**

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	0.27	0.0011	20.97	0.125	PASS
39	2441	-0.42	0.0009			PASS
78	2480	-1.10	0.0008			PASS

2.3.3.3 8-DPSK Mode**C. Test Verdict:**

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
0	2402	0.34	0.0011	20.97	0.125	PASS
39	2441	-0.19	0.0010			PASS
78	2480	-1.05	0.0008			PASS

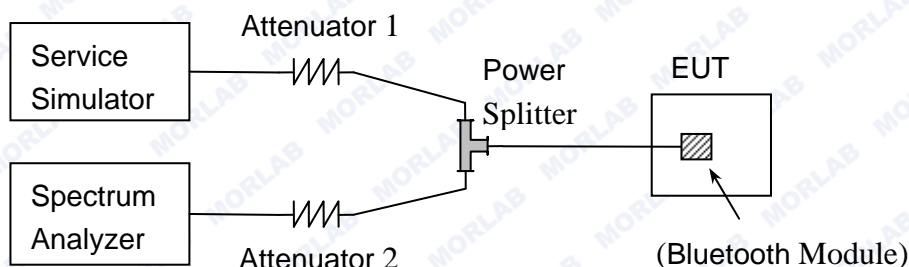
2.4 20dB Bandwidth

2.4.1 Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth ($10 \cdot \log 1\% = 20\text{dB}$) taking the total RF output power.

2.4.2 Test Description

A. Test Setup:



The Bluetooth Module of the EUT 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:

Please reference ANNEX A(1.5).

2.4.3 Test Procedure

Use the following spectrum analyzer settings:

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

RBW \geq 1% of the 20 dB bandwidth

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.4.4 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.



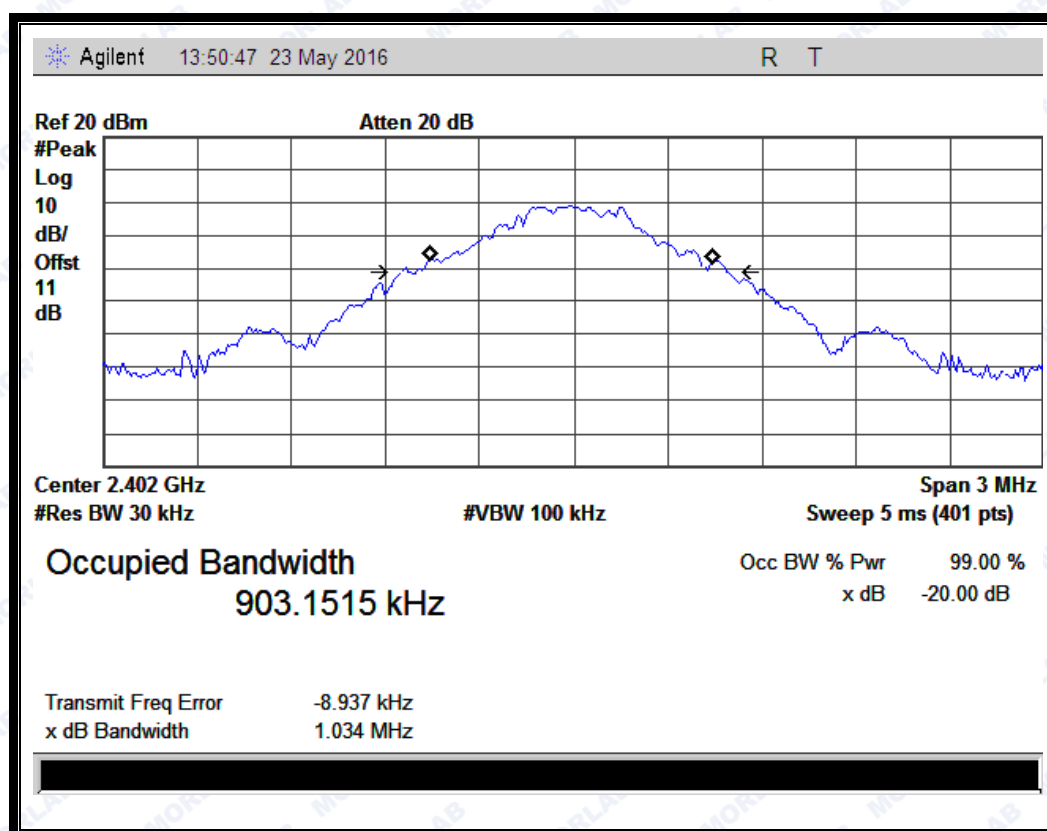
2.4.4.1 GFSK Mode

A. Test Verdict:

The maximum 20dB bandwidth measured is 1.053MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.034	Plot A
39	2441	1.034	Plot B
78	2480	1.053	Plot C

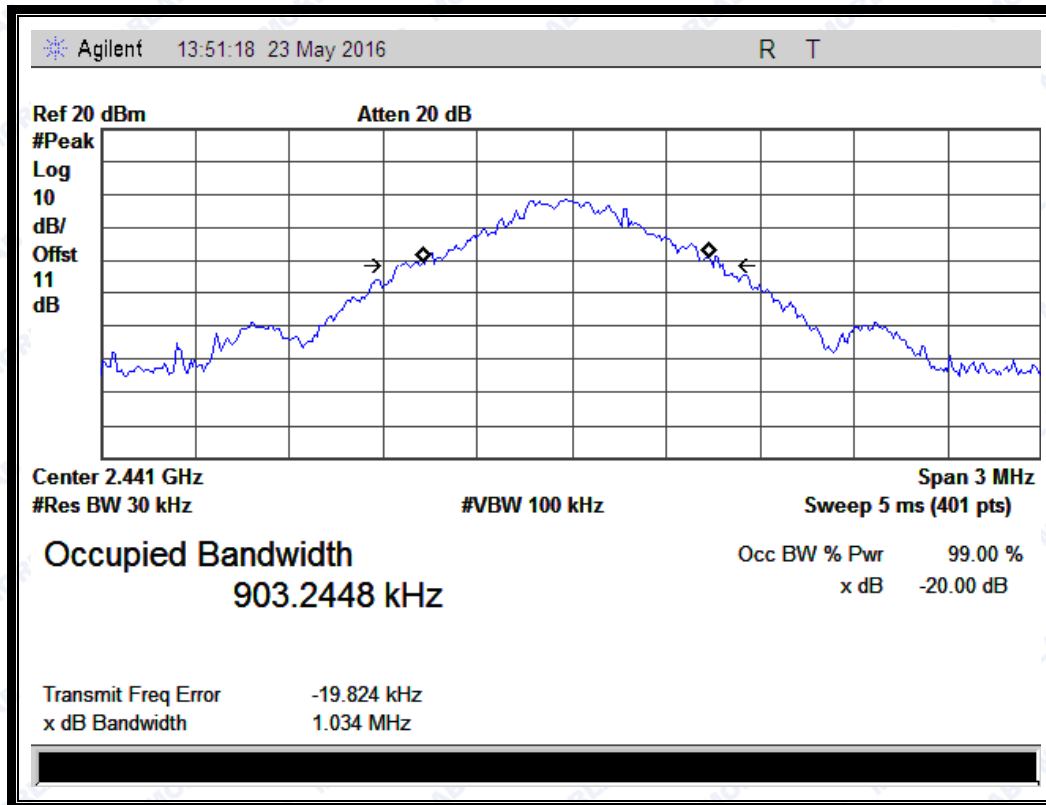
B. Test Plots:



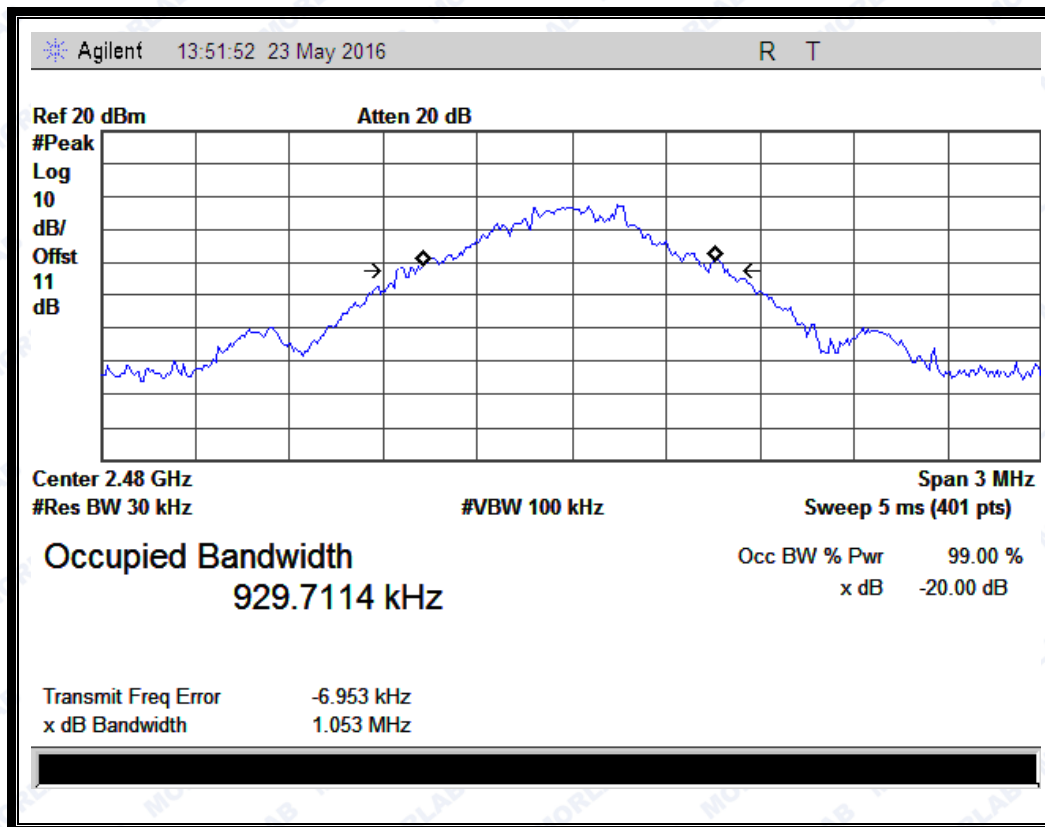
(Plot A: Channel = 2402 @ GFSK)



REPORT No.: SZ16050024W02



(Plot B: Channel = 2441 @ GFSK)



(Plot C: Channel = 2480 @ GFSK)

2.4.4.2 $\pi/4$ -DQPSK Mode

A. Test Verdict:

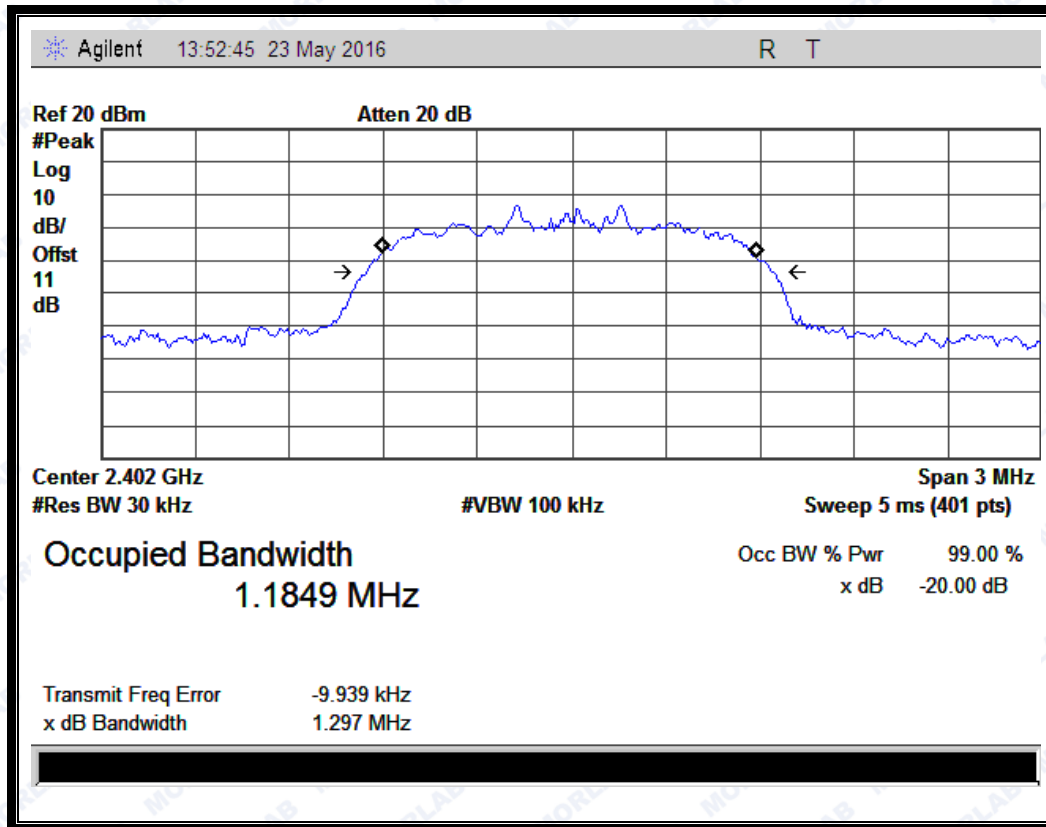
The maximum 20dB bandwidth measured is 1.298MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.297	Plot D
39	2441	1.298	Plot E
78	2480	1.277	Plot F

B. Test Plots:



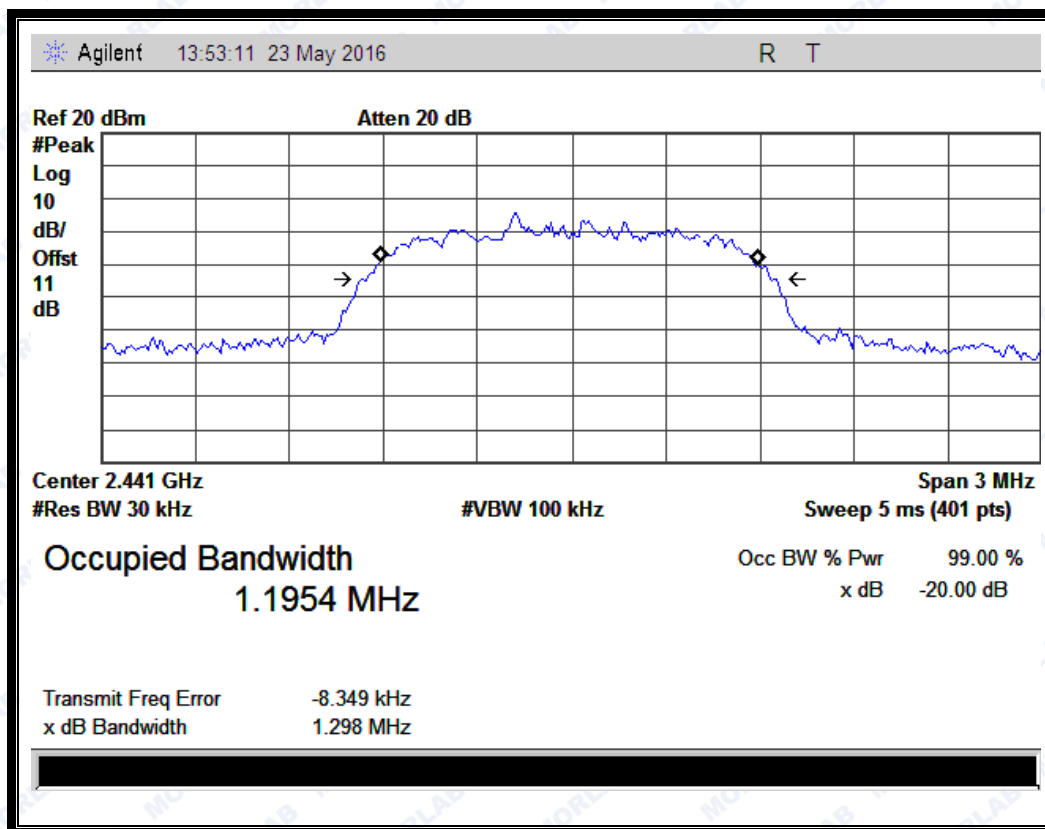
REPORT No.: SZ16050024W02



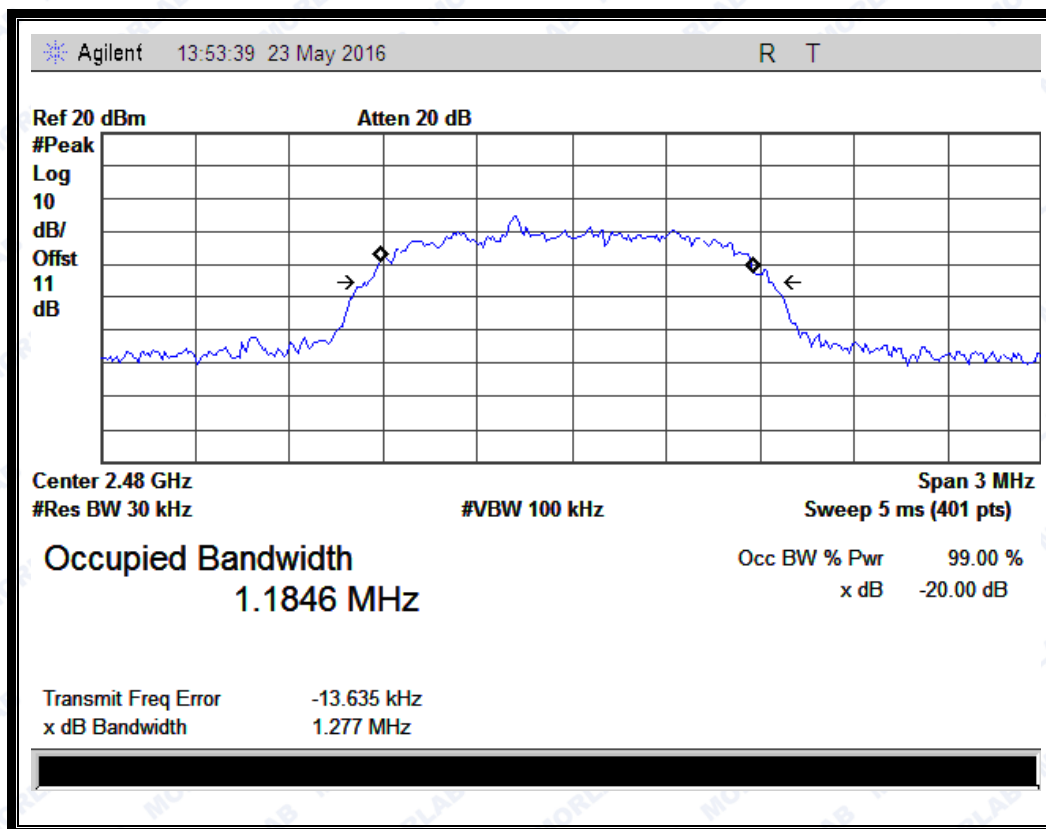
(Plot D: Channel = 2402 @ $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02



(Plot E: Channel = 2441 @ $\pi/4$ -DQPSK)

(Plot F: Channel = 2480 @ $\pi/4$ -DQPSK)

2.4.4.3 8-DPSK Mode

A. Test Verdict:

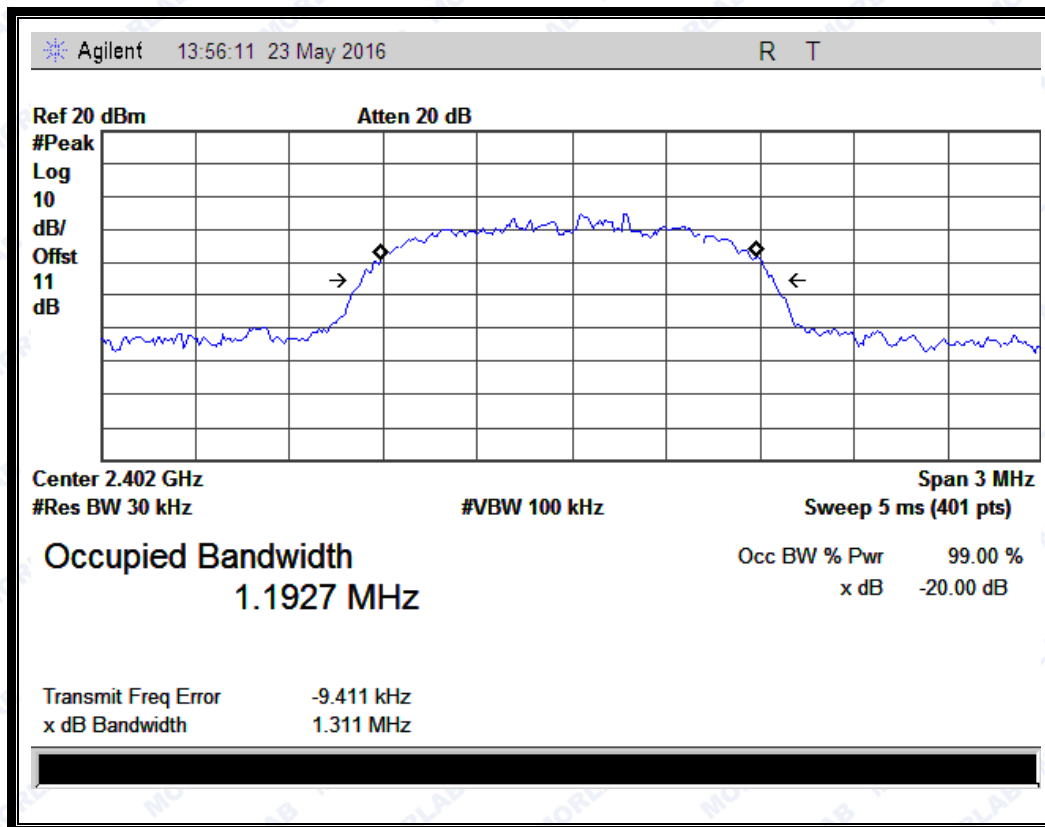
The maximum 20dB bandwidth measured is 1.312MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.311	Plot G
39	2441	1.312	Plot H
78	2480	1.304	Plot I

B. Test Plots:



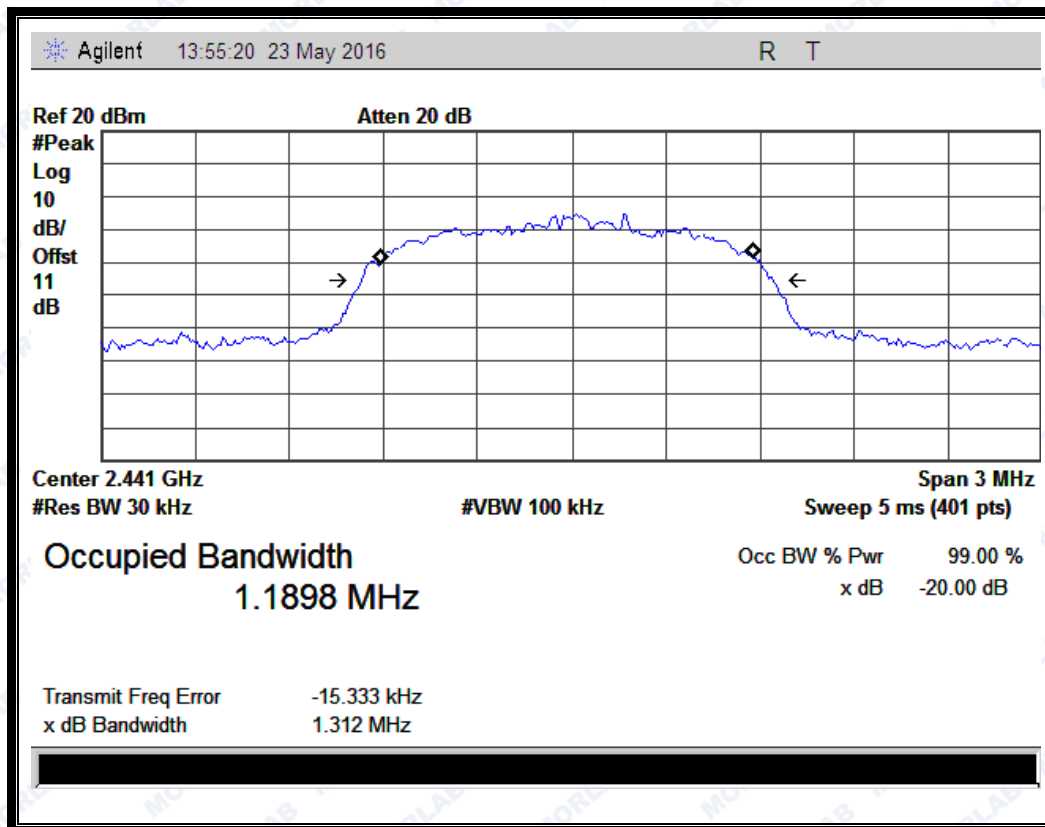
REPORT No.: SZ16050024W02



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



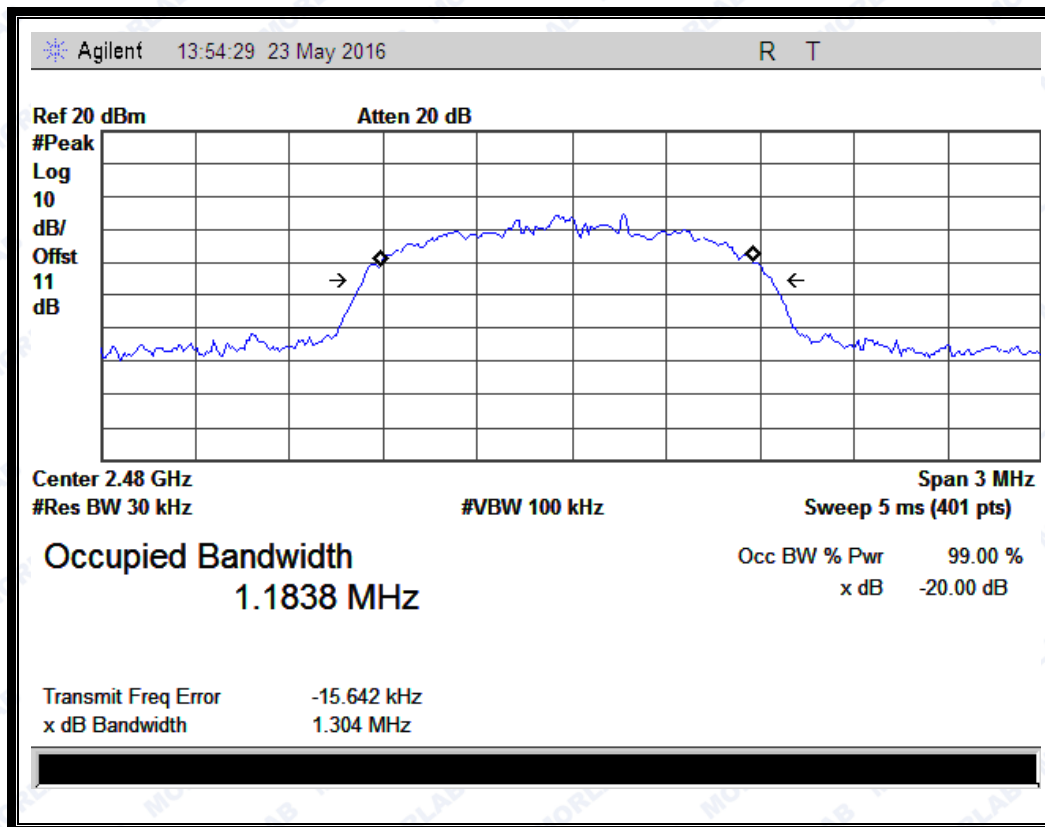
REPORT No.: SZ16050024W02



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



REPORT No.: SZ16050024W02



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

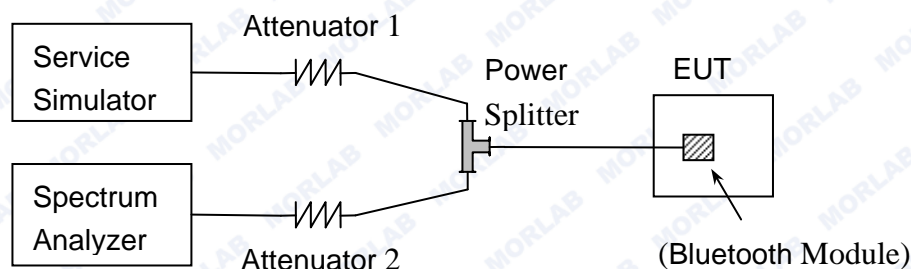
2.5 Carried Frequency Separation

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 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:

Please reference ANNEX A(1.5).

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) $\geq 1\%$ of the span

Video (or Average) Bandwidth (VBW) \geq RBW

Sweep = auto

Detector function = peak

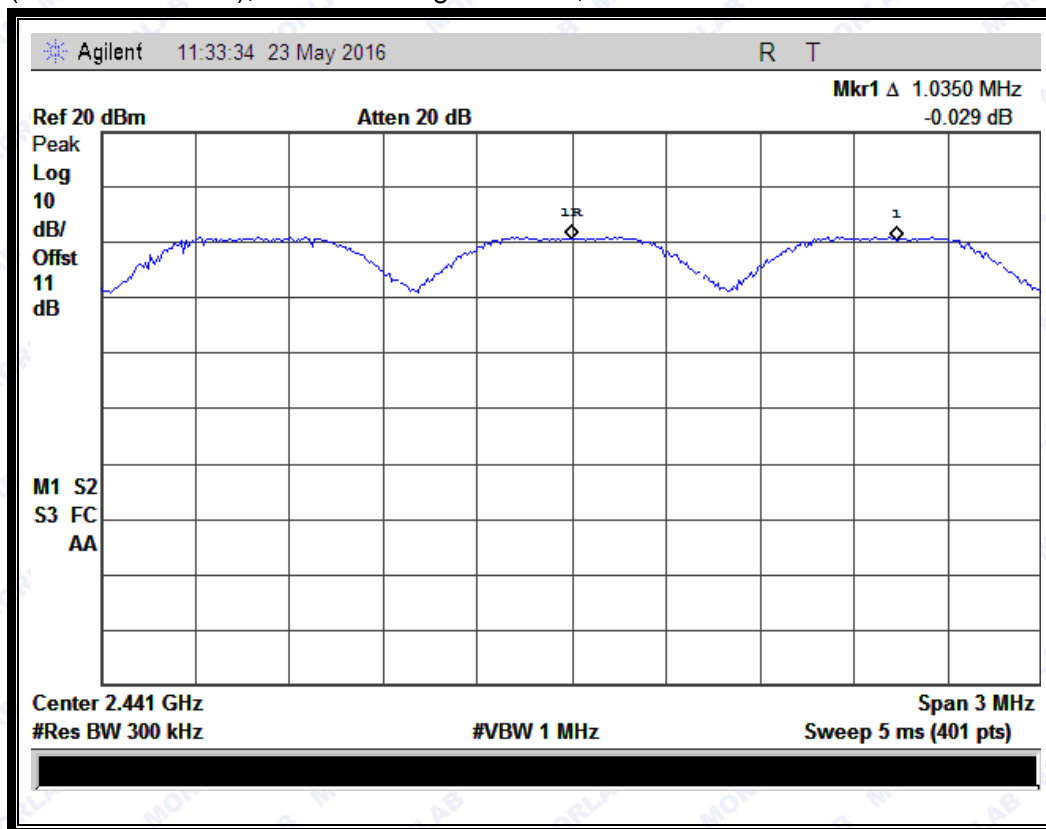
Trace = max hold

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

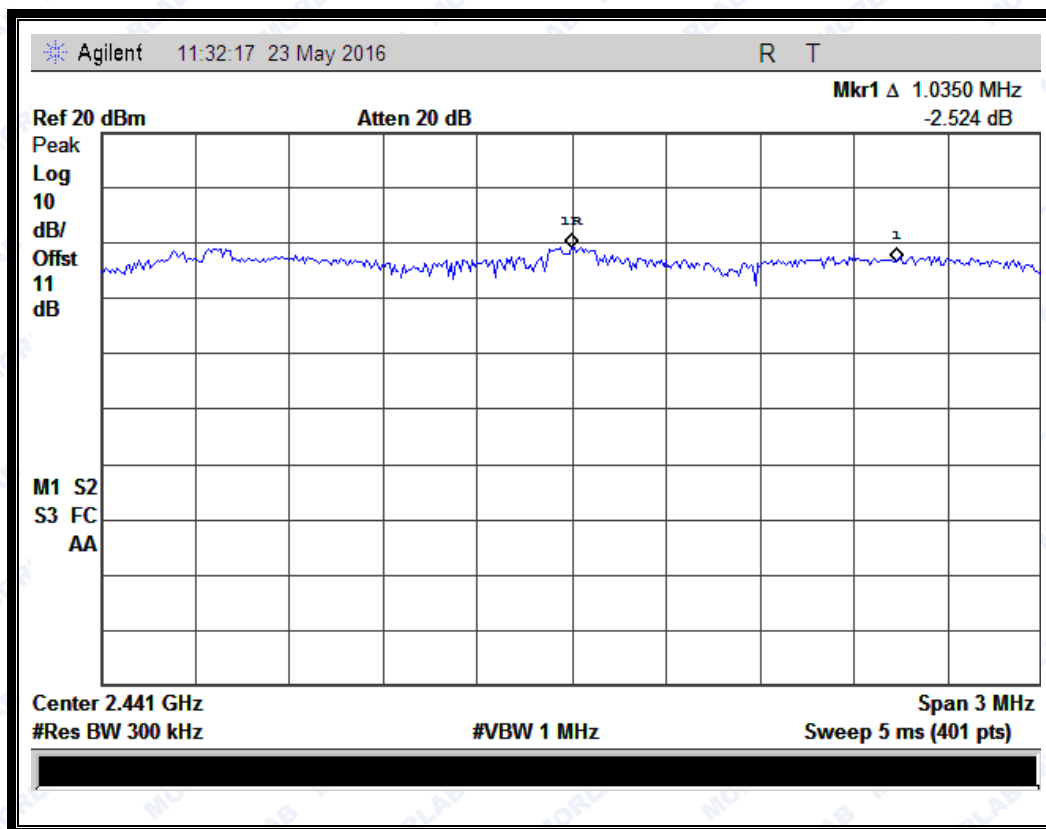
The Bluetooth Module operates at hopping-on test mode. For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 0), whichever is greater. So, the verdict is PASSING



(Plot A: GFSK)



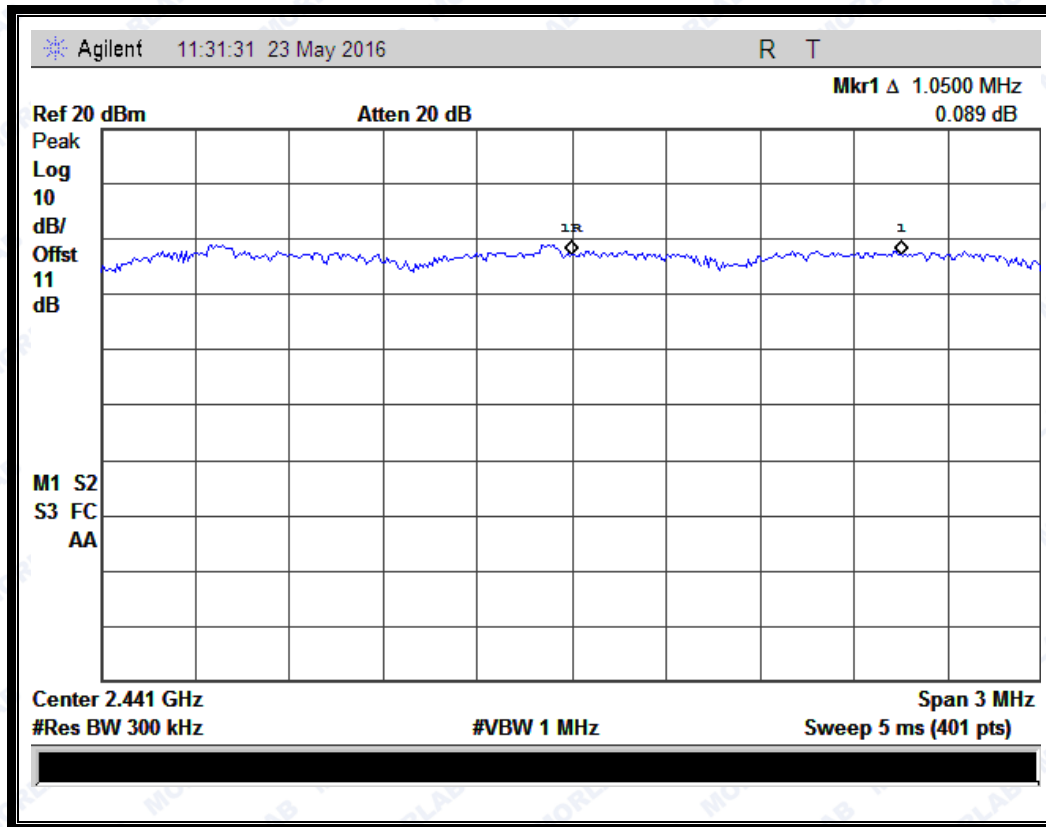
REPORT No.: SZ16050024W02



(Plot B: $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02



(Plot C: 8-DPSK)

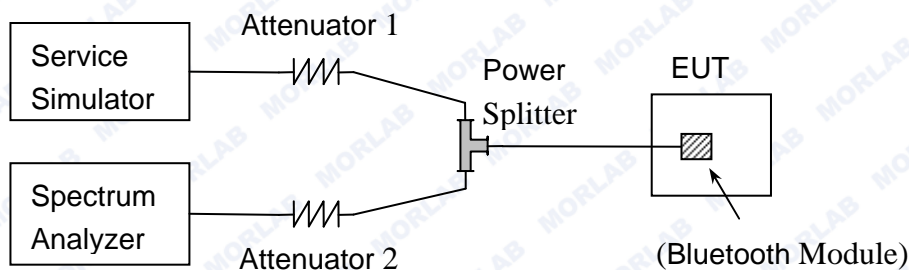
2.6 Time of Occupancy (Dwell time)

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 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:

Please reference ANNEX A(1.5).

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 $10 * (\# \text{ of pulses in 3.16 s}) * \text{pulse width}$.



REPORT No.: SZ16050024W02

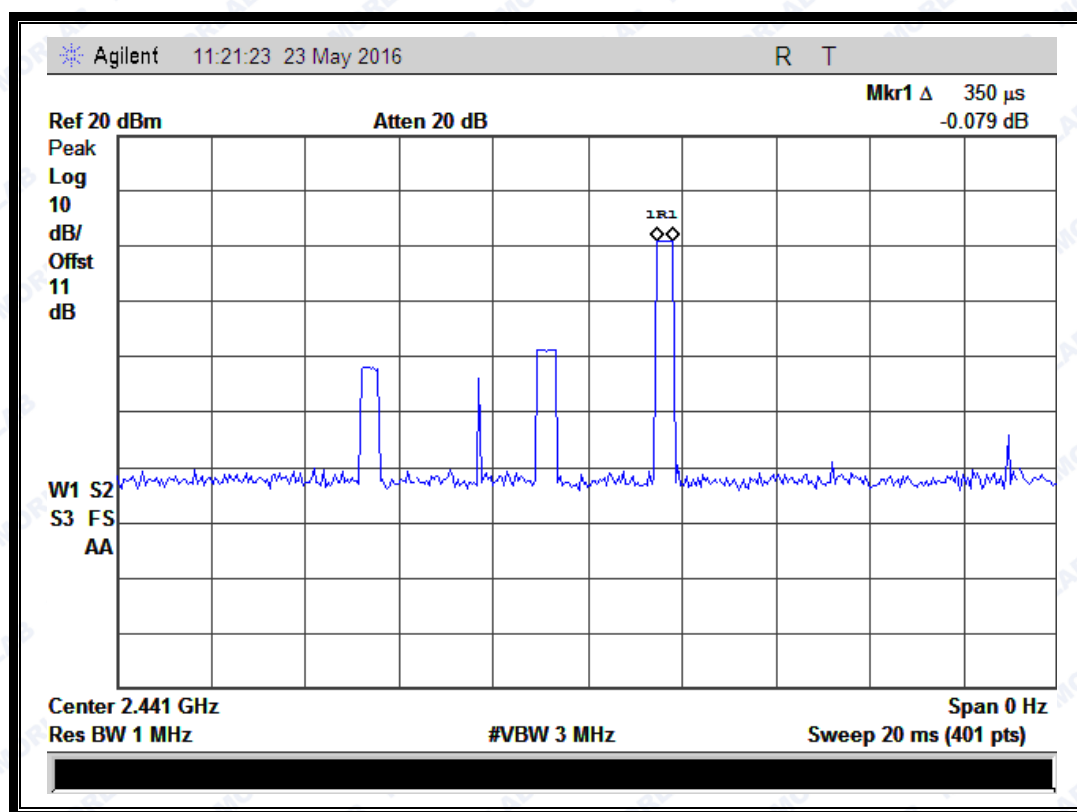
2.6.4 Test Result

2.6.4.1 GFSK Mode

A. Test Verdict:

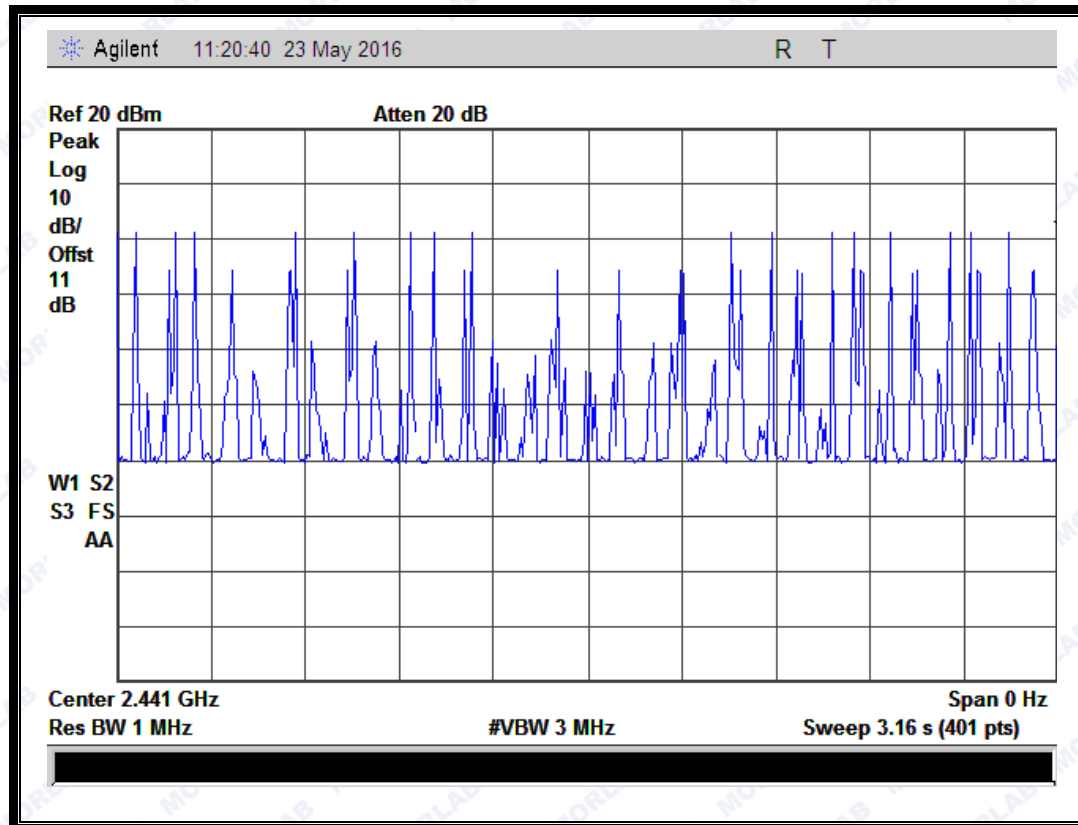
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.35	16	0.0056	0.056	0.4	PASS
DH3	1.6	11	0.0176	0.176		PASS
DH5	2.9	6	0.0174	0.175		PASS

B. Test Plots:





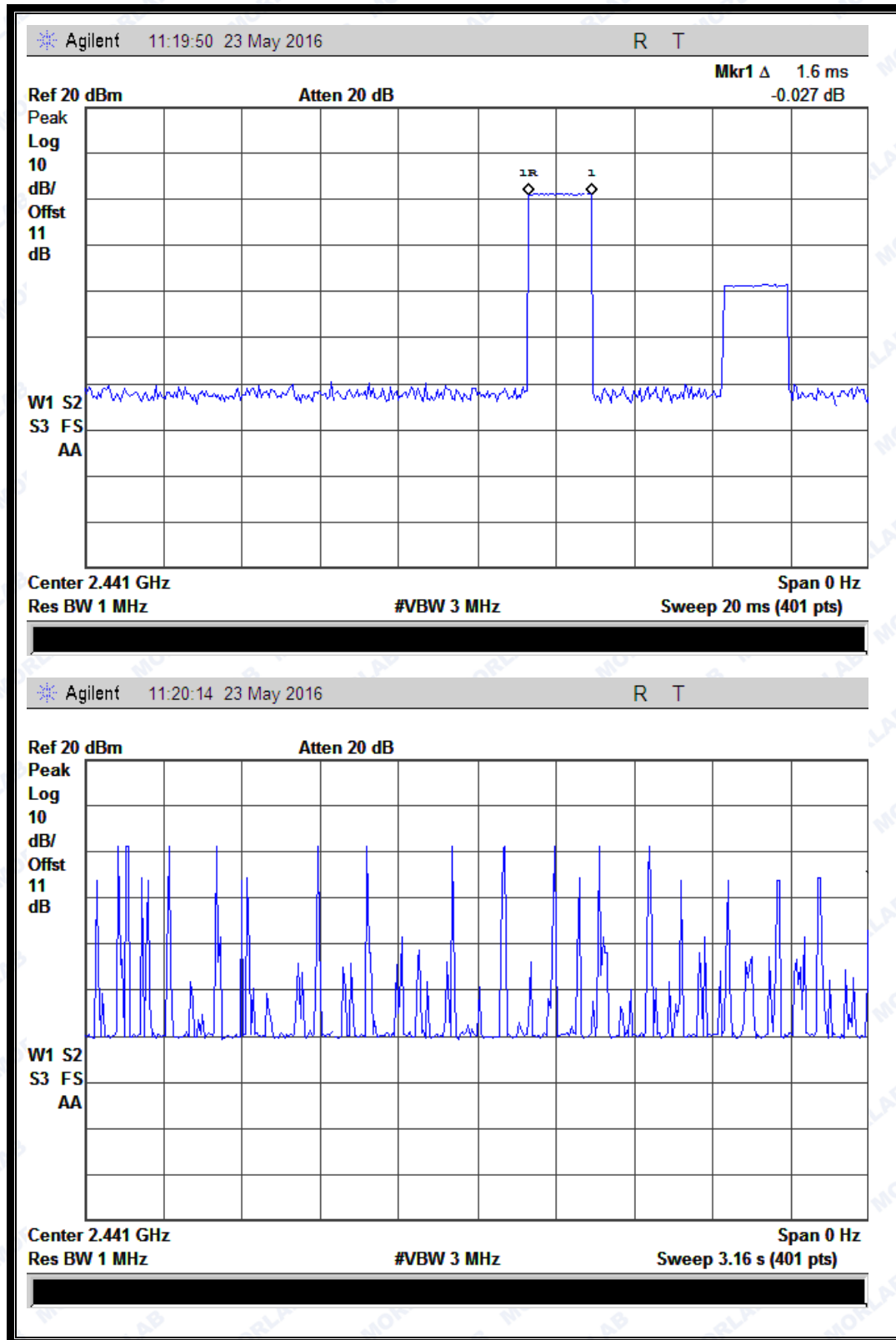
REPORT No.: SZ16050024W02



(Plot A: DH1 @ GFSK)



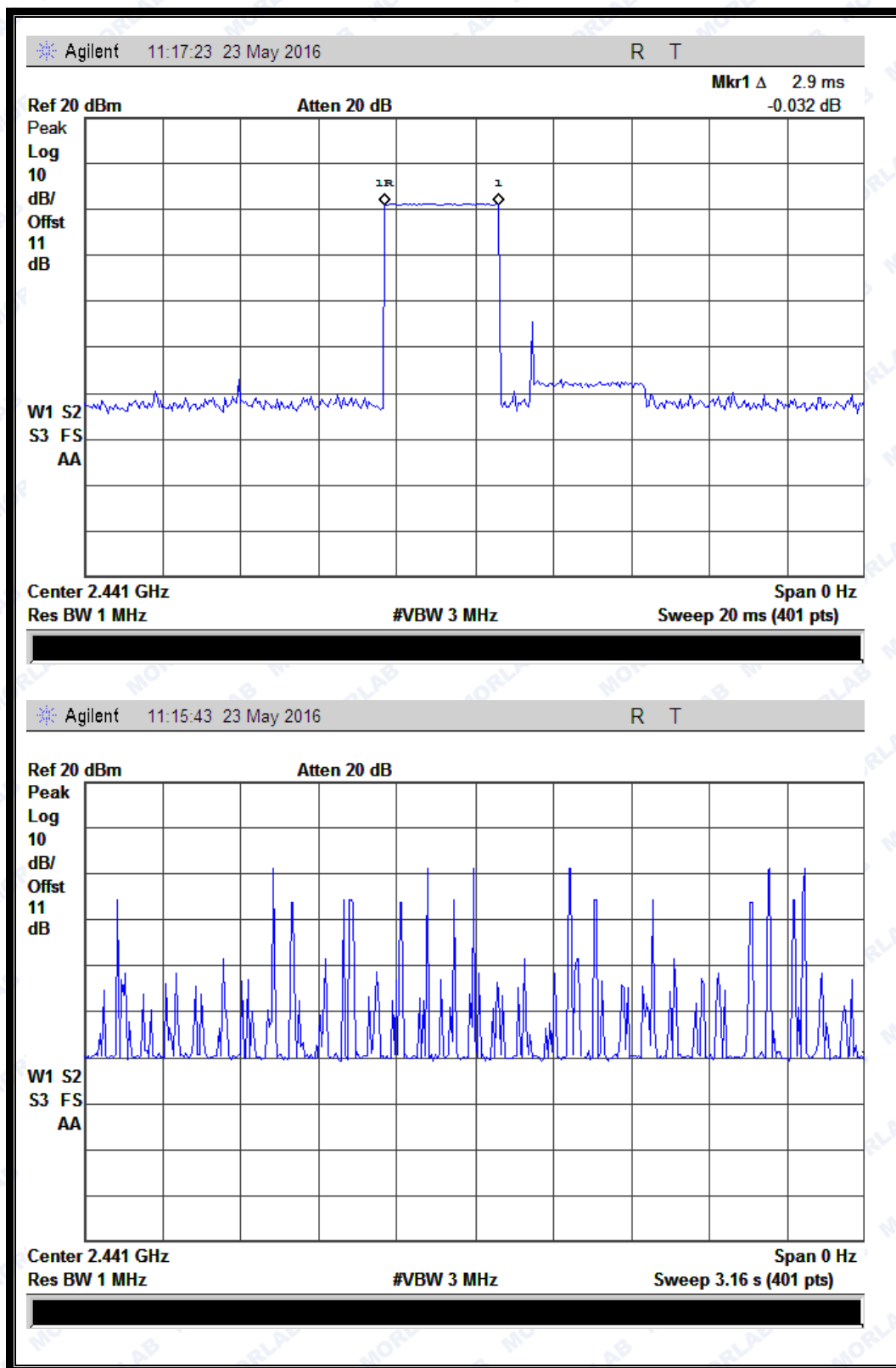
REPORT No.: SZ16050024W02



(Plot B: DH3 @ GFSK)



REPORT No.: SZ16050024W02



(Plot C: DH5 @ GFSK)



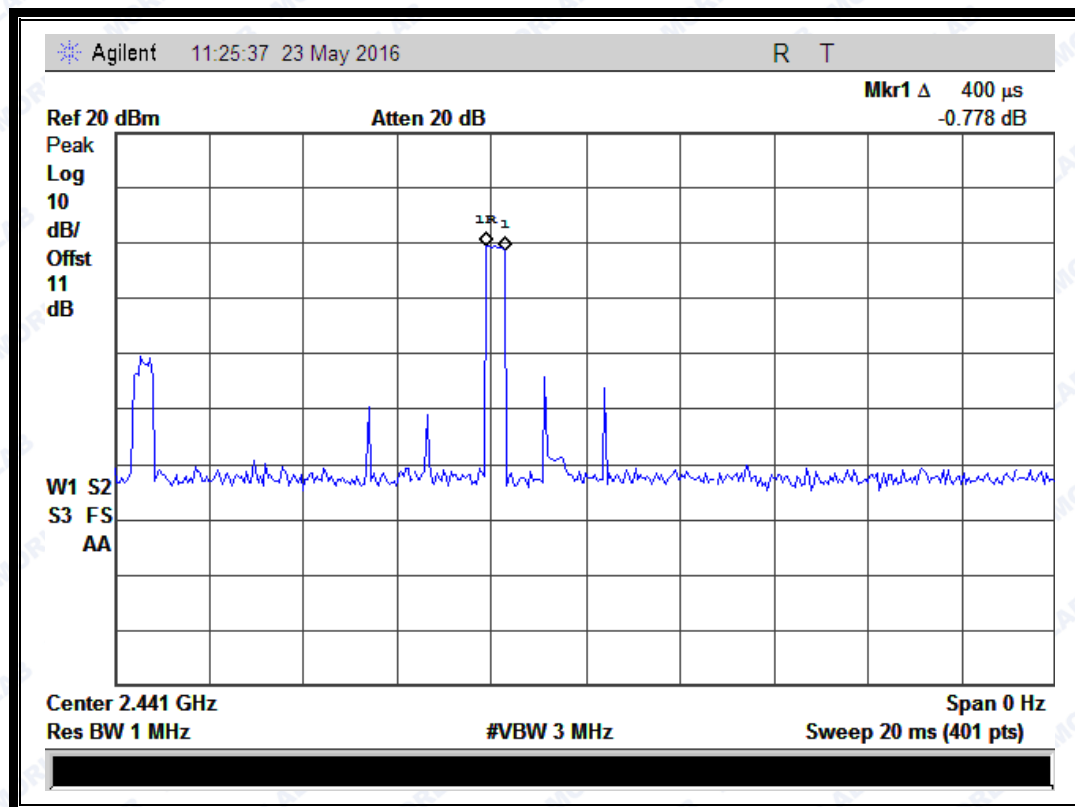
REPORT No.: SZ16050024W02

2.6.4.2 $\pi/4$ -DQPSK Mode

A. Test Verdict:

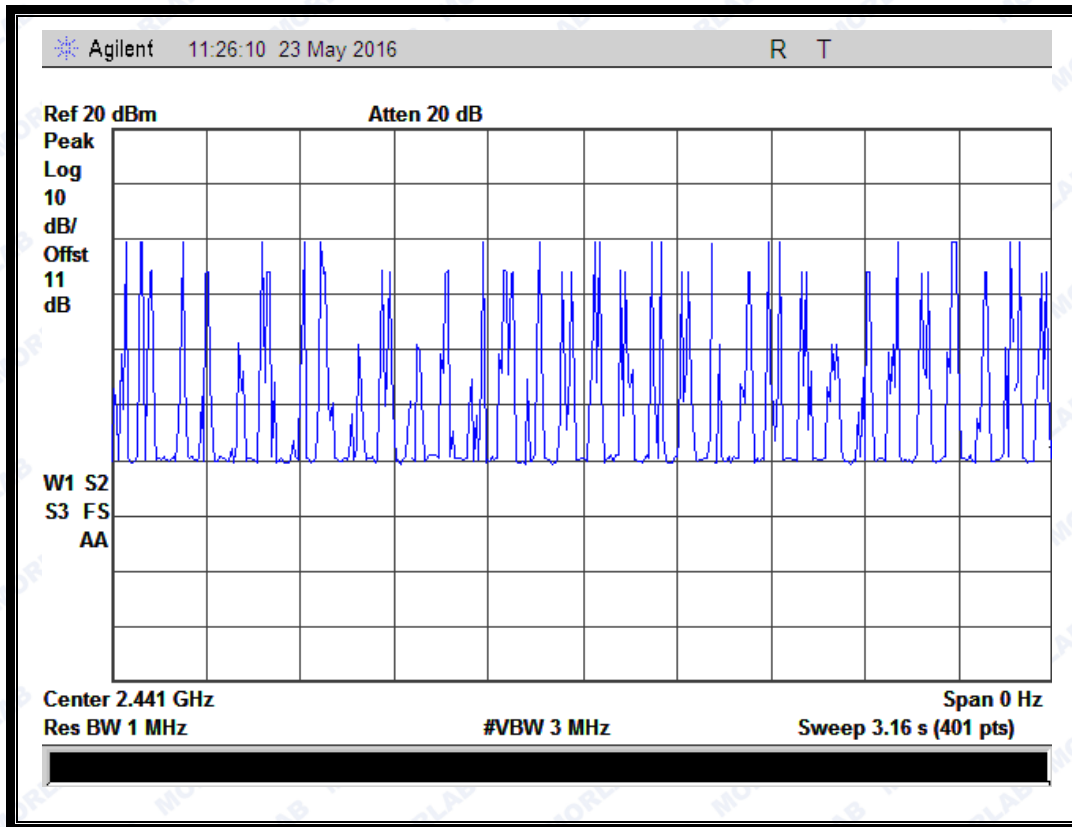
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.4	19	0.0076	0.076	0.4	PASS
DH3	1.5	9	0.0135	0.135		PASS
DH5	2.75	3	0.0083	0.083		PASS

B. Test Plots:





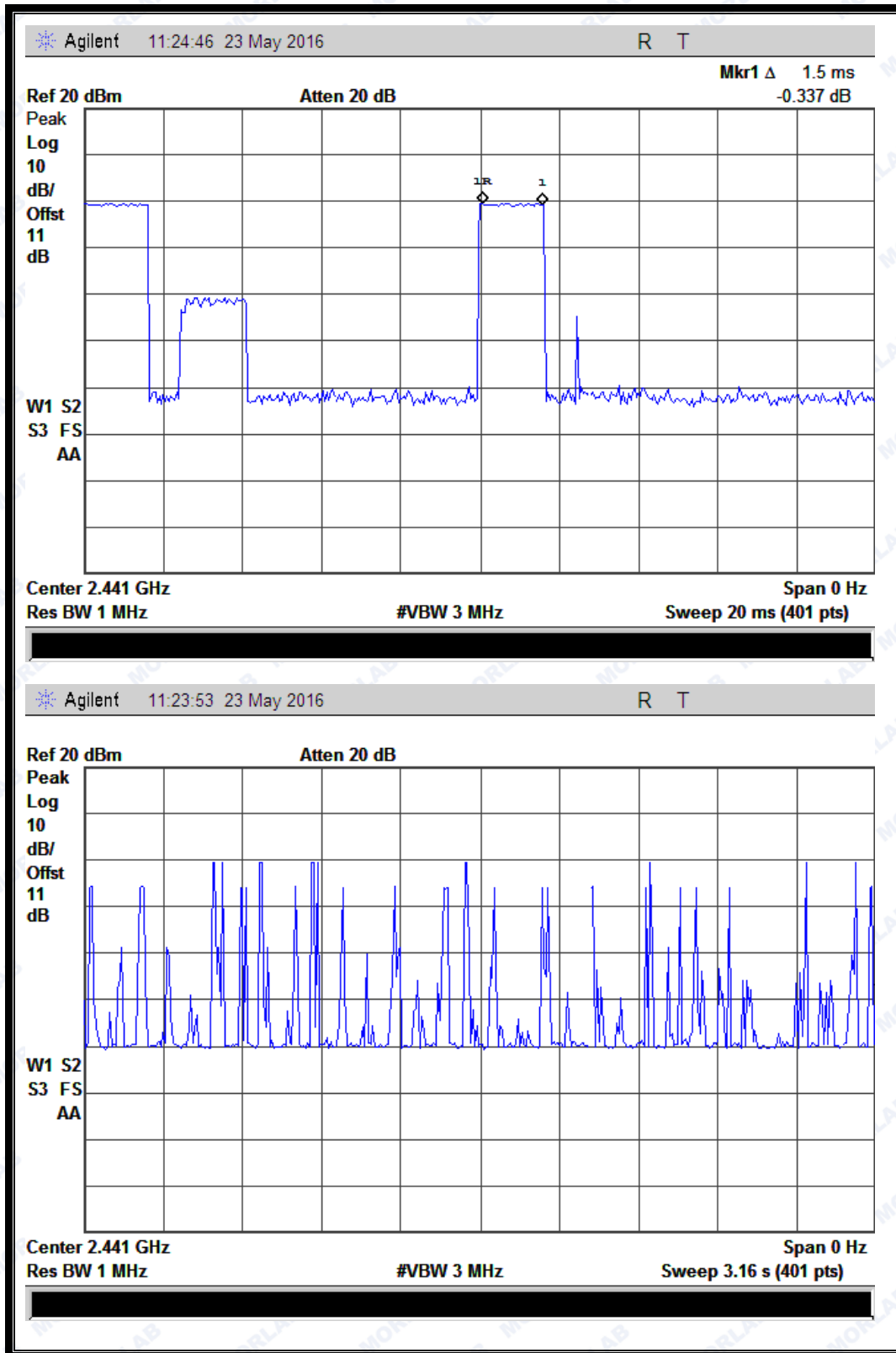
REPORT No.: SZ16050024W02



(Plot D: DH1 @ $\pi/4$ -DQPSK)



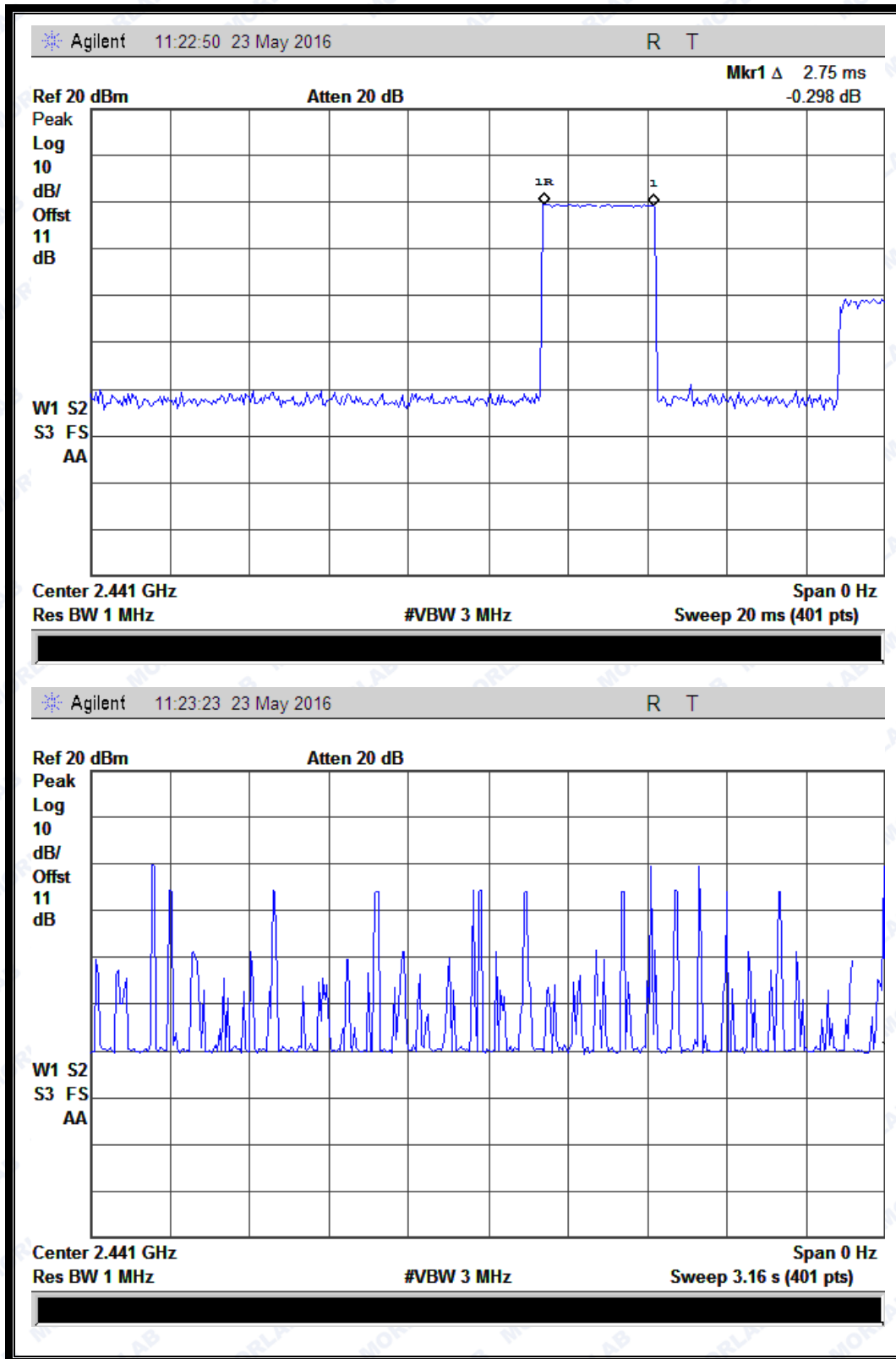
REPORT No.: SZ16050024W02



(Plot E: DH3 @ $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02



(Plot F: DH5 @ $\pi/4$ -DQPSK)

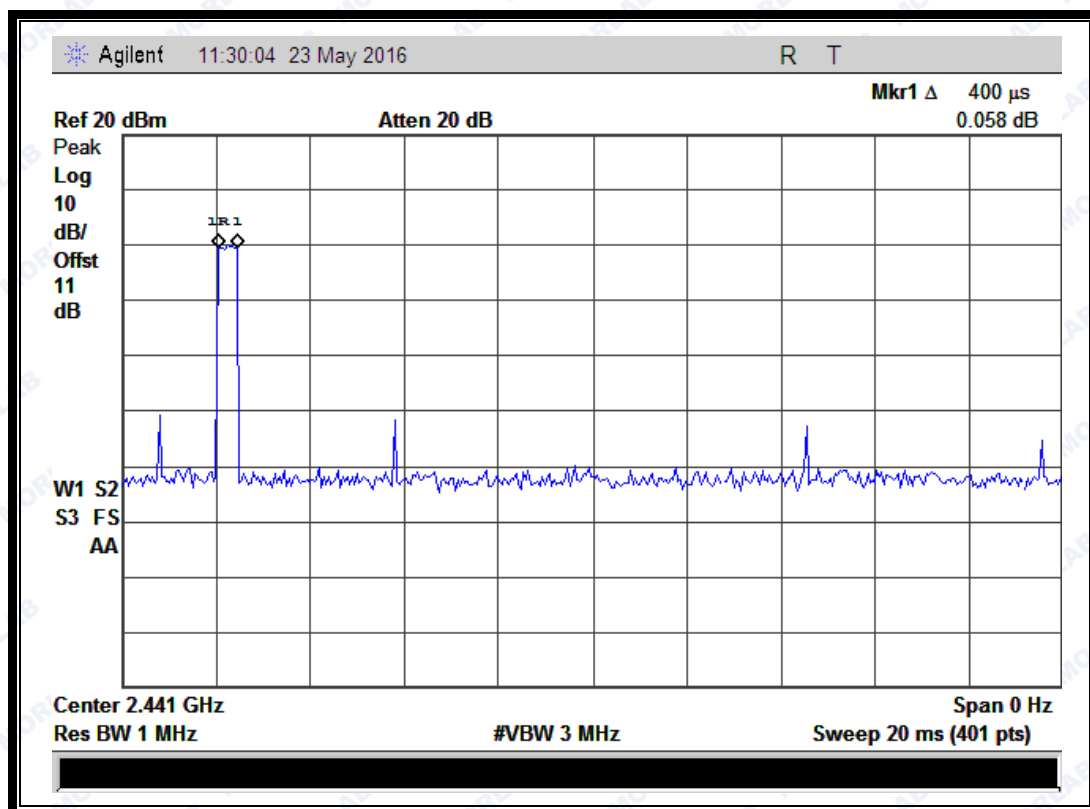


2.6.4.3 8-DPSK mode

A. Test Verdict:

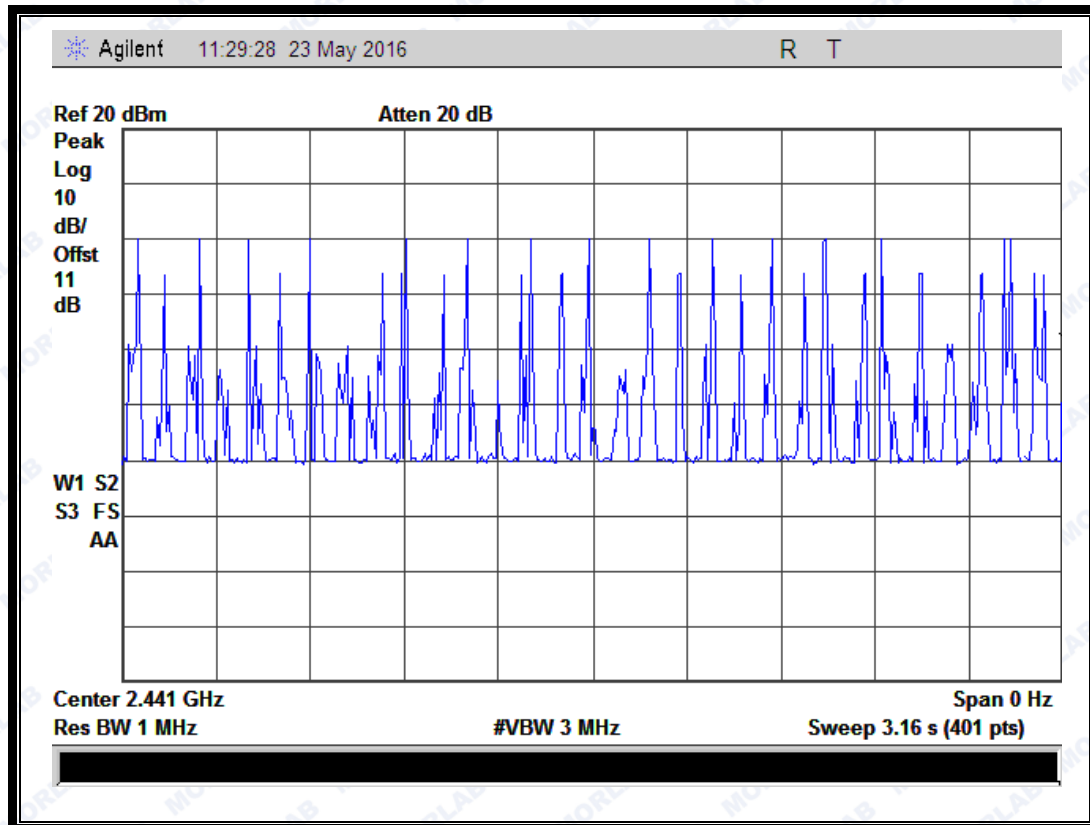
DH Packet	Pulse Width (msec)	Number of pulse in 3.16 seconds	Average Time of Occupancy in 3.16 seconds (sec)	Average Time of Occupancy in 31.6 seconds (sec)	Limit (sec)	Verdict
DH1	0.4	15	0.0060	0.060	0.4	PASS
DH3	1.65	6	0.0099	0.099		PASS
DH5	2.9	8	0.0232	0.232		PASS

B. Test Plots:





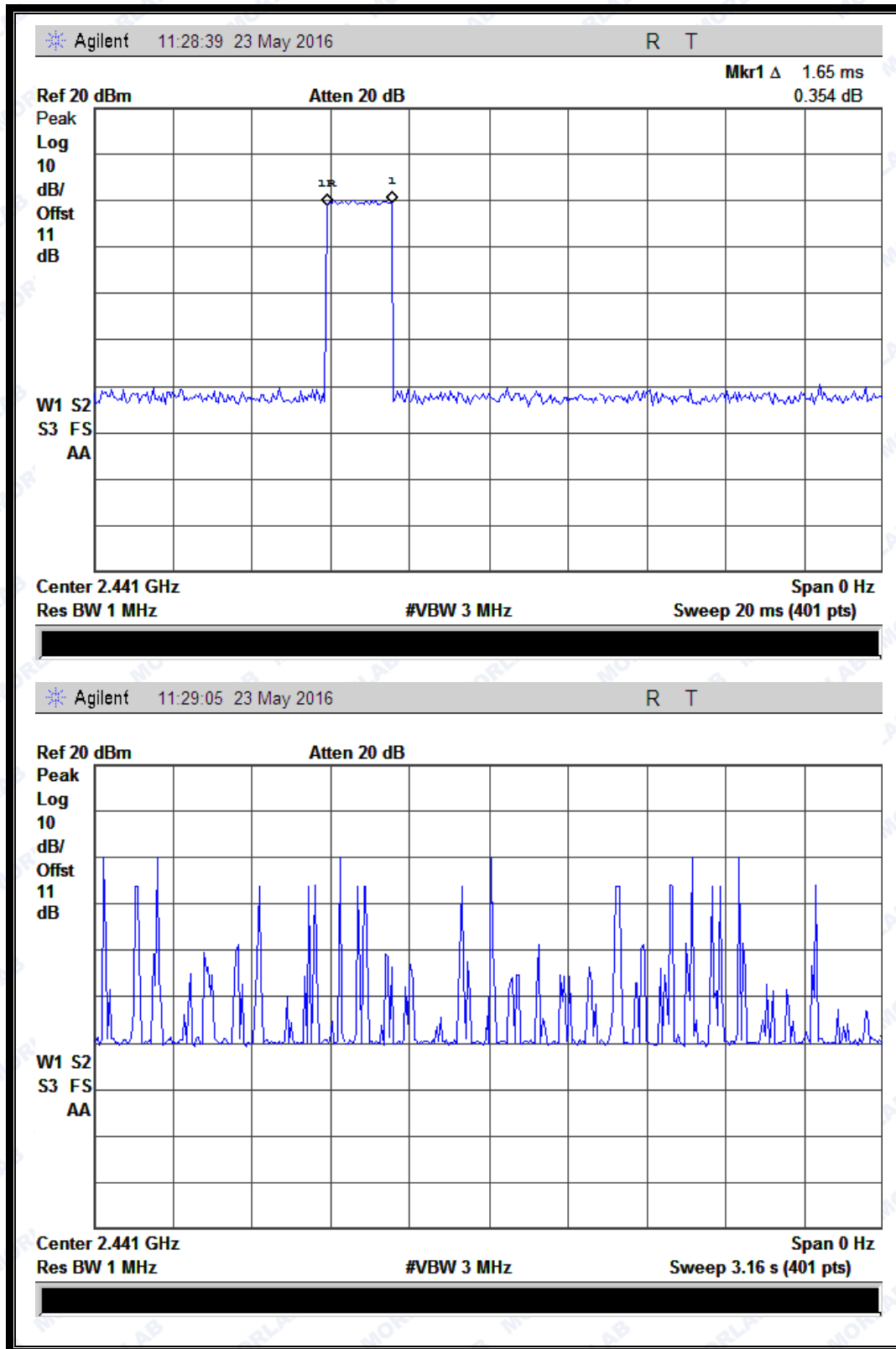
REPORT No.: SZ16050024W02



(Plot G: DH1 @ 8-DPSK)



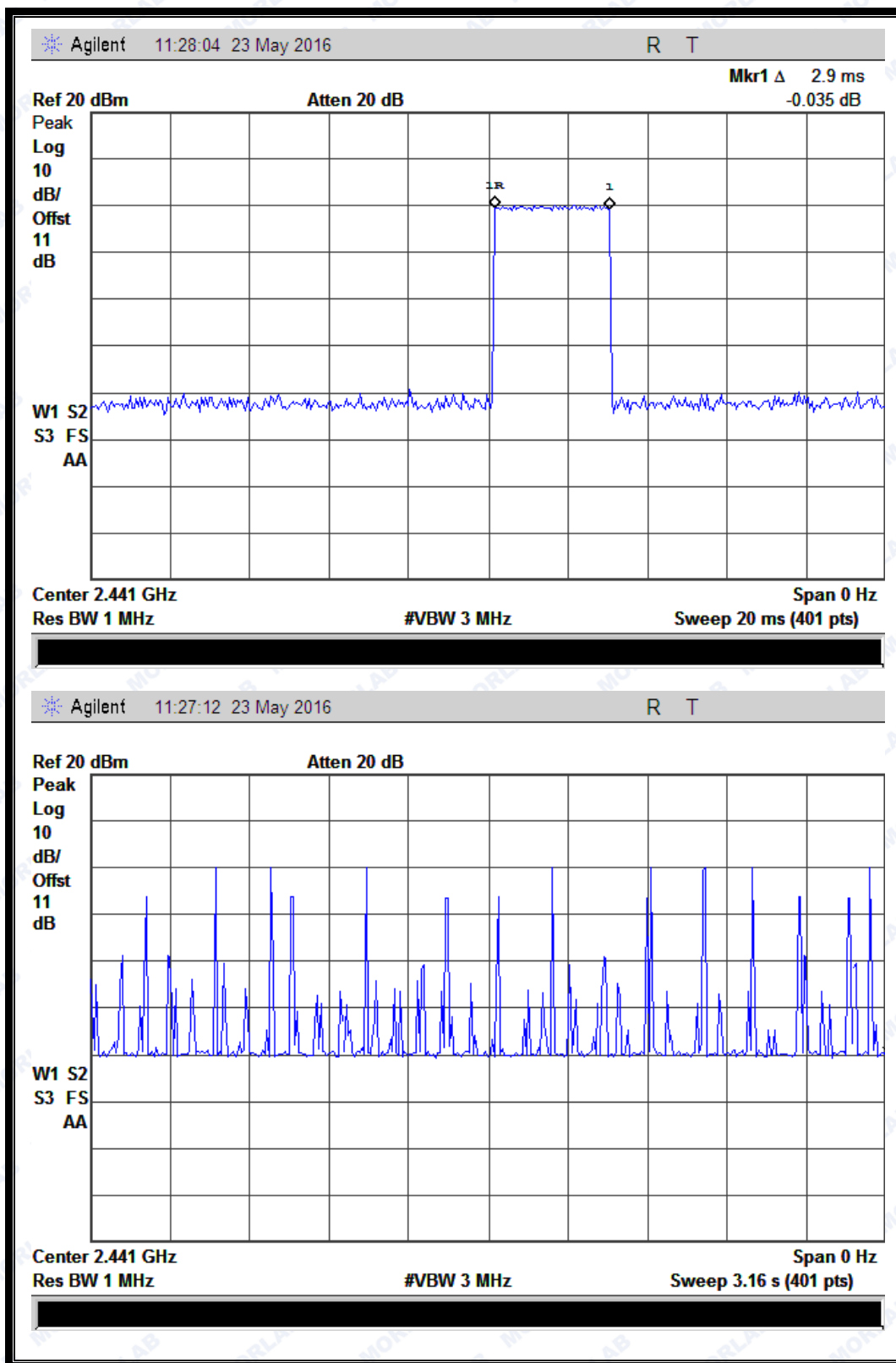
REPORT No.: SZ16050024W02



(Plot H: DH3 @ 8-DPSK)



REPORT No.: SZ16050024W02



(Plot I: DH5 @ 8-DPSK)

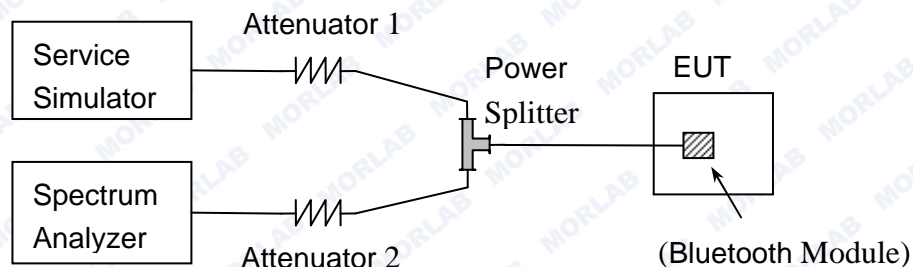
2.7 Conducted Spurious Emissions

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 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:

Please reference ANNEX A(1.5).

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 \geq 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.

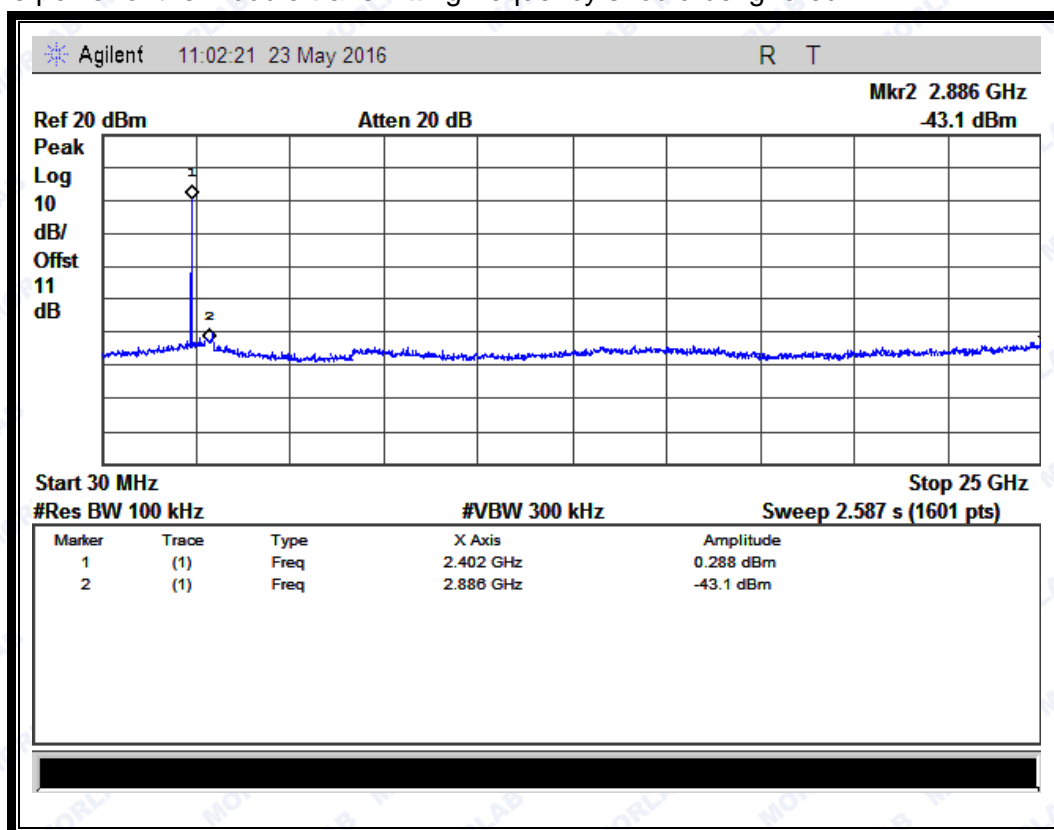
2.7.4.1 GFSK Mode

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	-43.10	Plot A.1	0.29	-19.71	PASS
39	2441	-42.09	Plot B.1	-0.21	-20.21	PASS
78	2480	-41.73	Plot C.1	-0.79	-20.79	PASS

B. Test Plots:

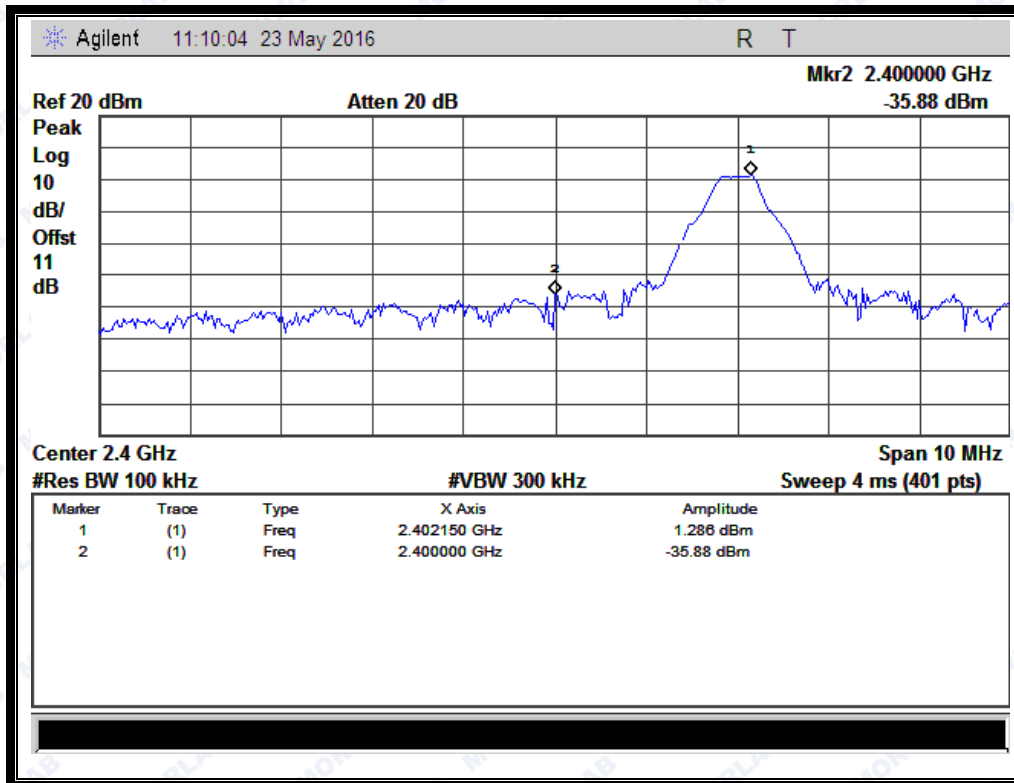
Note: the power of the Module transmitting frequency should be ignored.



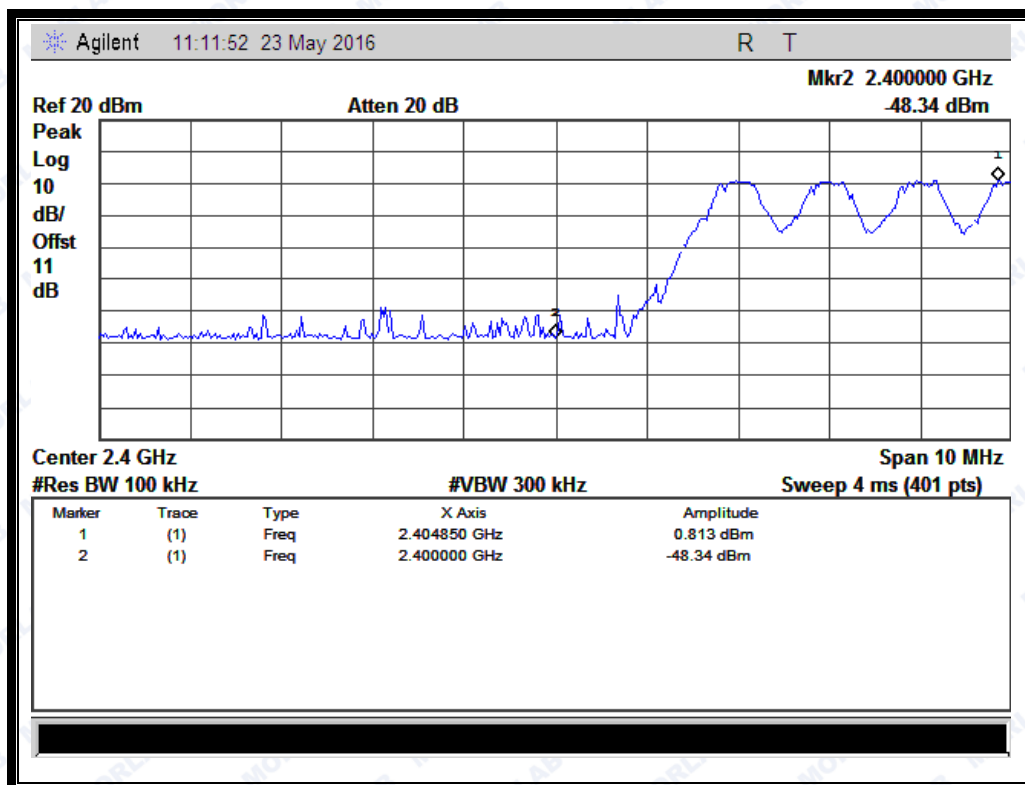
(Plot A.1: Channel = 0, 30MHz to 25GHz @ GFSK Mode)



REPORT No.: SZ16050024W02



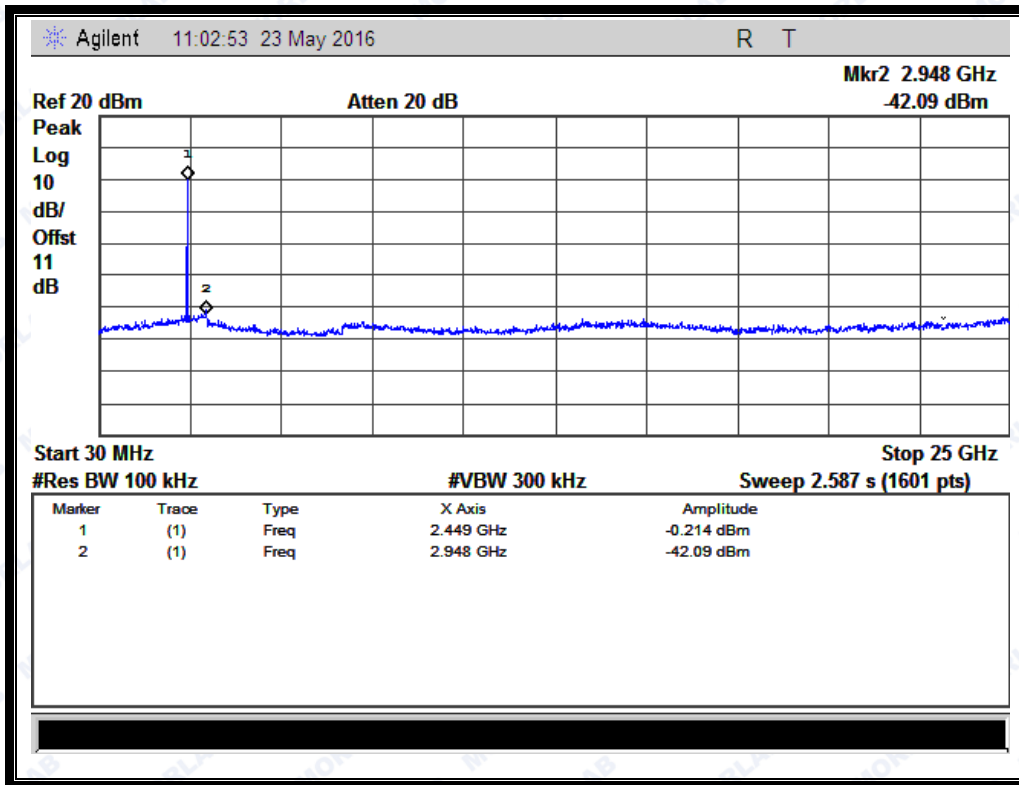
(Channel = 0, Band edge @ GFSK Mode)



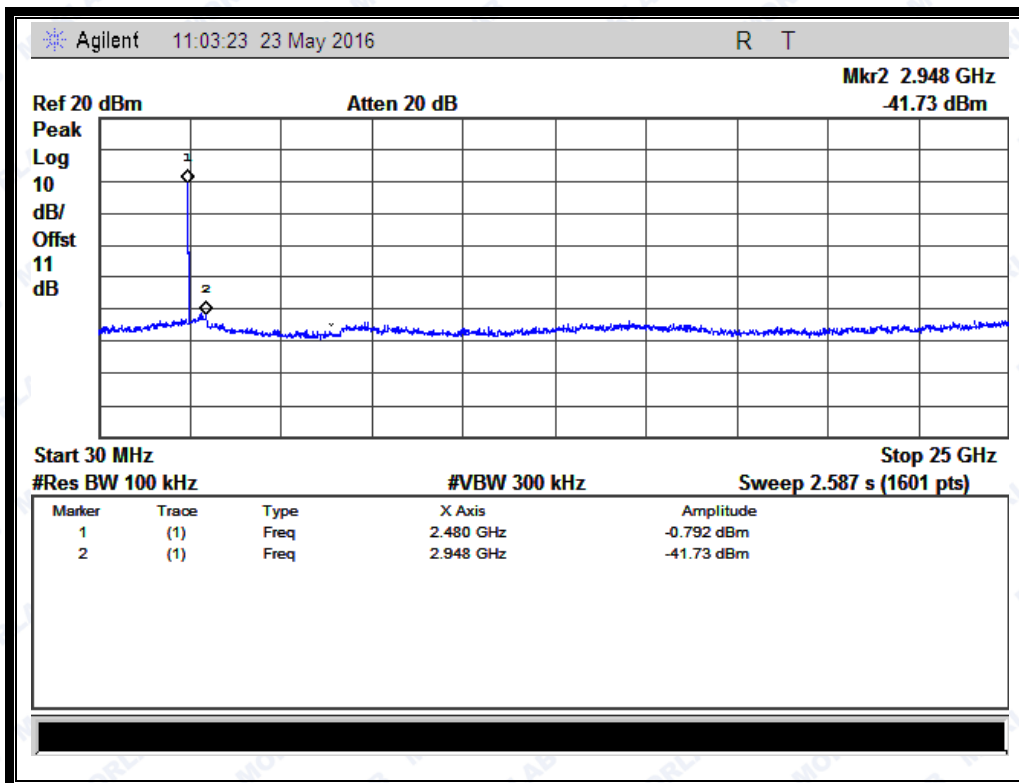
(Channel = 0, Band edge with hopping on @ GFSK Mode)



REPORT No.: SZ16050024W02



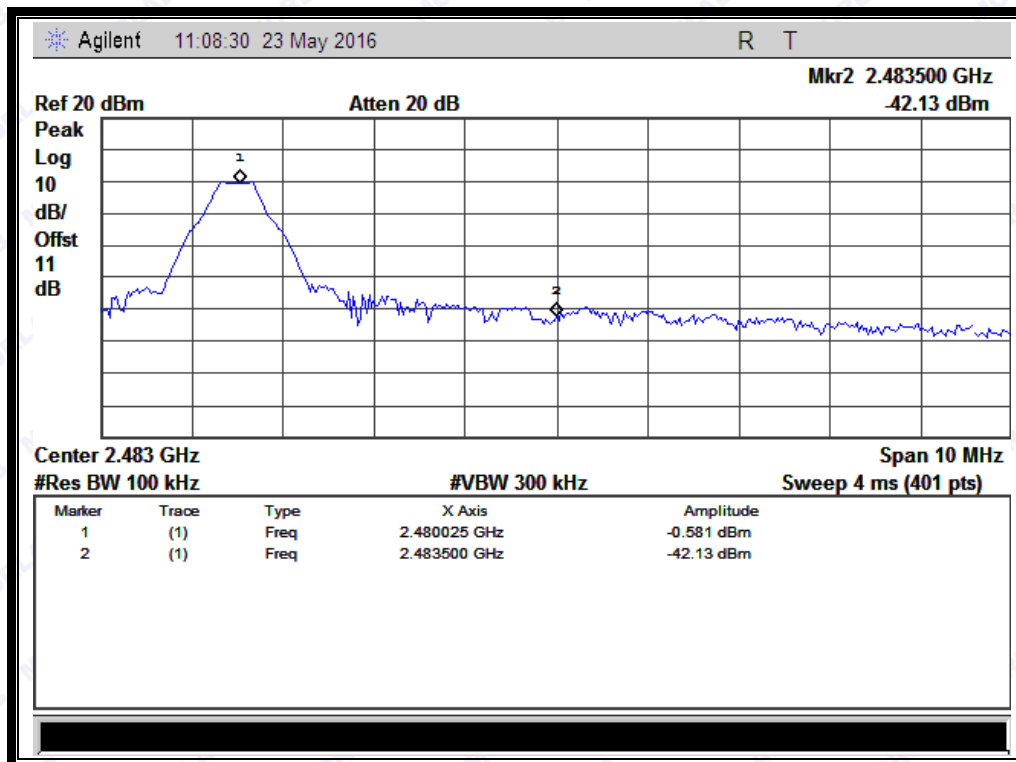
(Plot B.1: Channel = 39, 30MHz to 25GHz @ GFSK Mode)



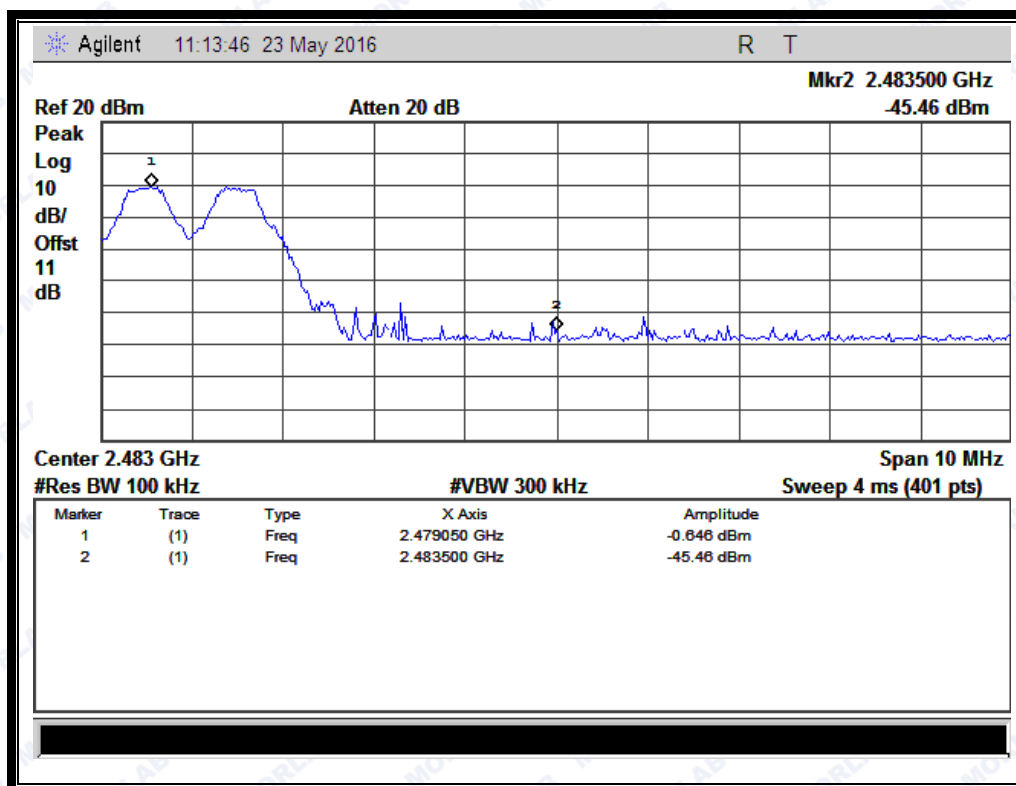
(Plot C.1: Channel = 78, 30MHz to 25GHz @ GFSK Mode)



REPORT No.: SZ16050024W02



(Channel = 78, Band edge @ GFSK Mode)



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



A. Test Verdict:

B. Test Plots:

The screenshot shows a spectrum analyzer interface with the following settings and data:

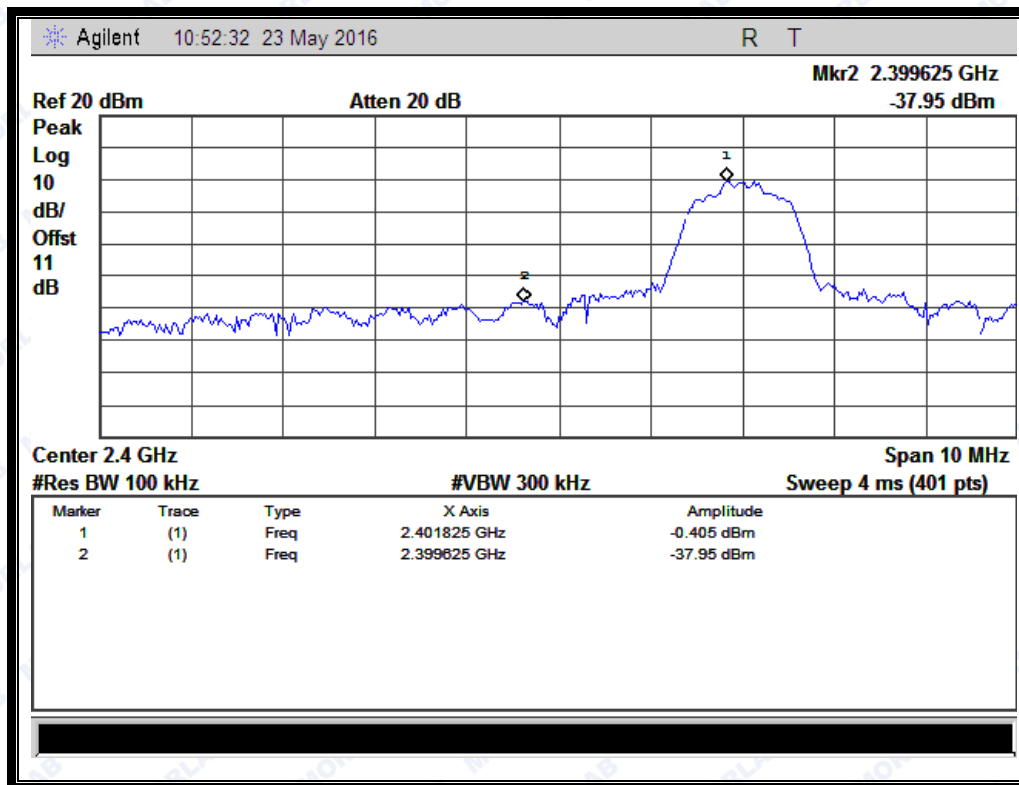
- Reference Level:** Ref 20 dBm
- Attenuation:** Atten 20 dB
- Marker 2:** 2.886 GHz, -41.89 dBm
- Scale:** Peak, Log, 10 dB/Offst, 11 dB
- Start Frequency:** Start 30 MHz
- Stop Frequency:** Stop 25 GHz
- Resolution Bandwidth:** #Res BW 100 kHz
- Video Bandwidth:** #VBW 300 kHz
- Sweep Time:** Sweep 2.587 s (1601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.402 GHz	-5.453 dBm
2	(1)	Freq	2.886 GHz	-41.89 dBm

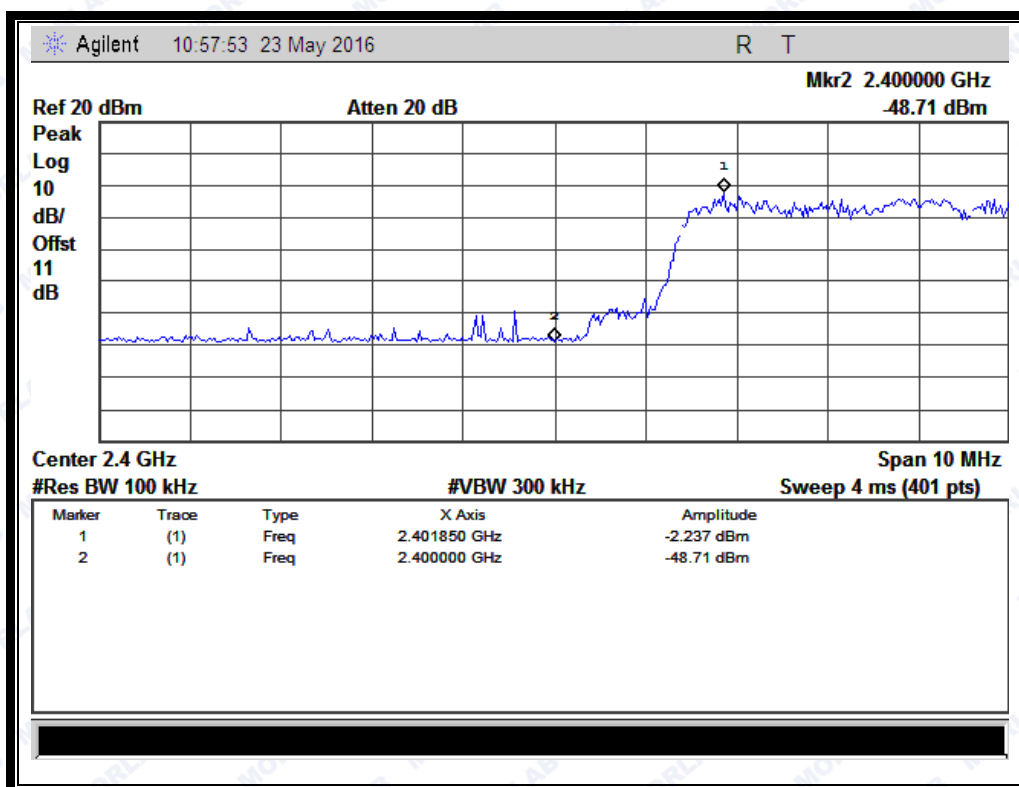
(Plot D.1: Channel = 0, 30MHz to 25GHz @ $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02



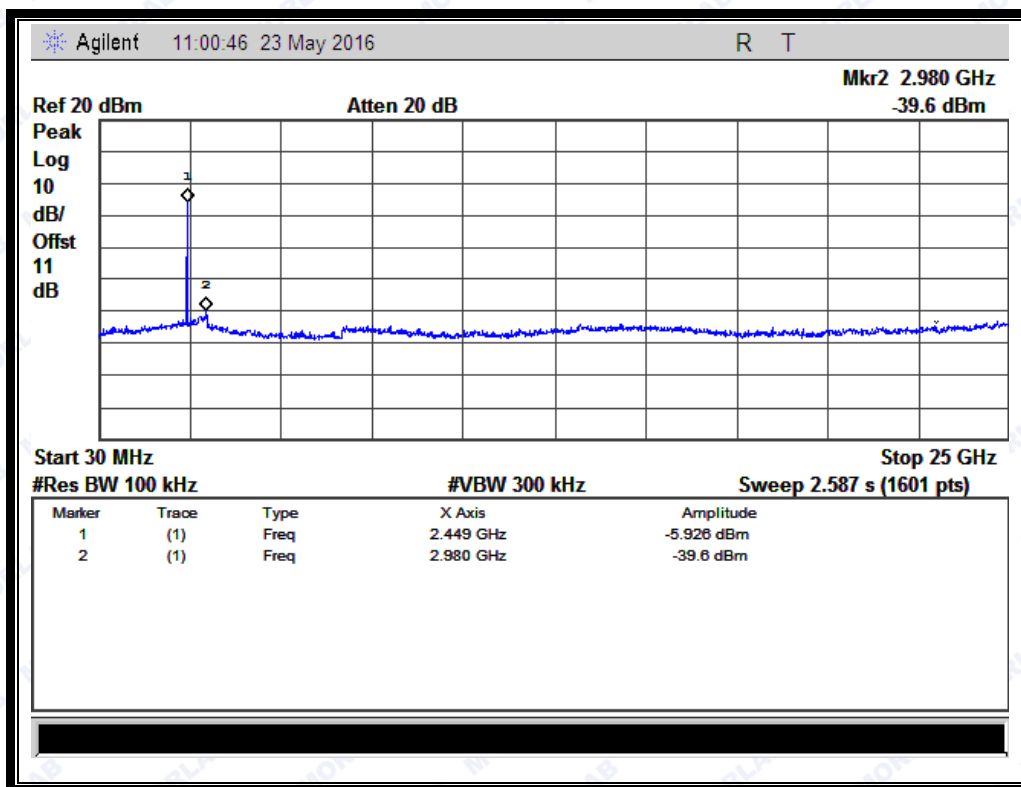
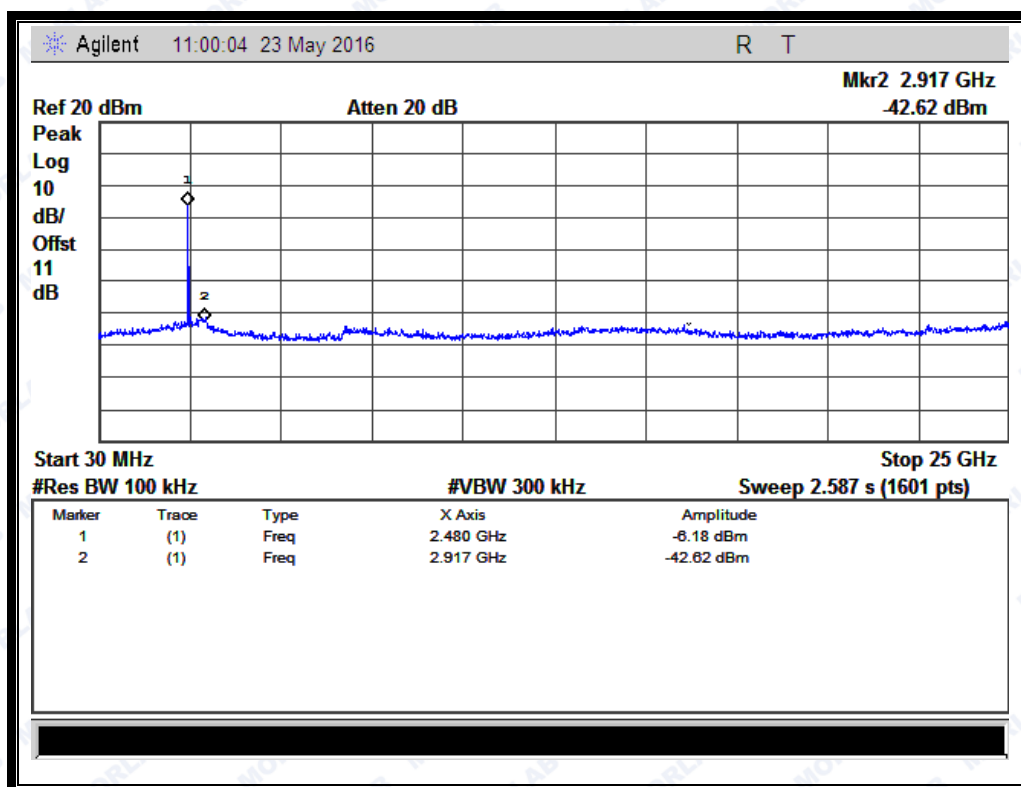
(Channel = 0, Band edge @ $\pi/4$ -DQPSK)



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

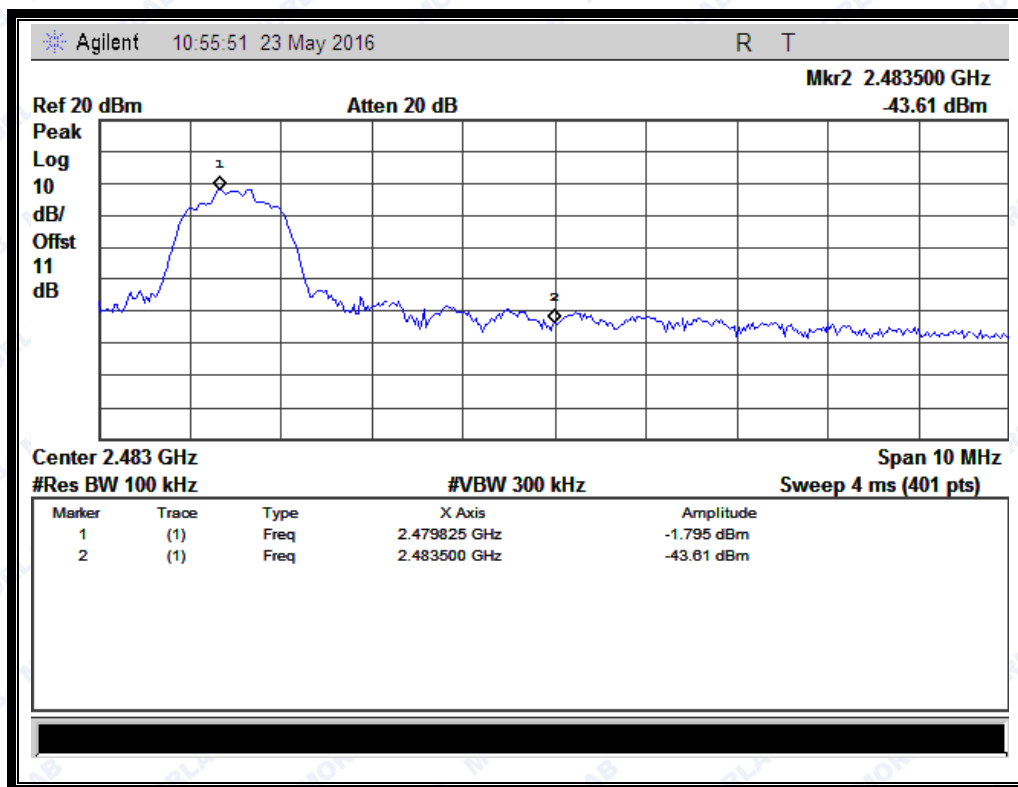
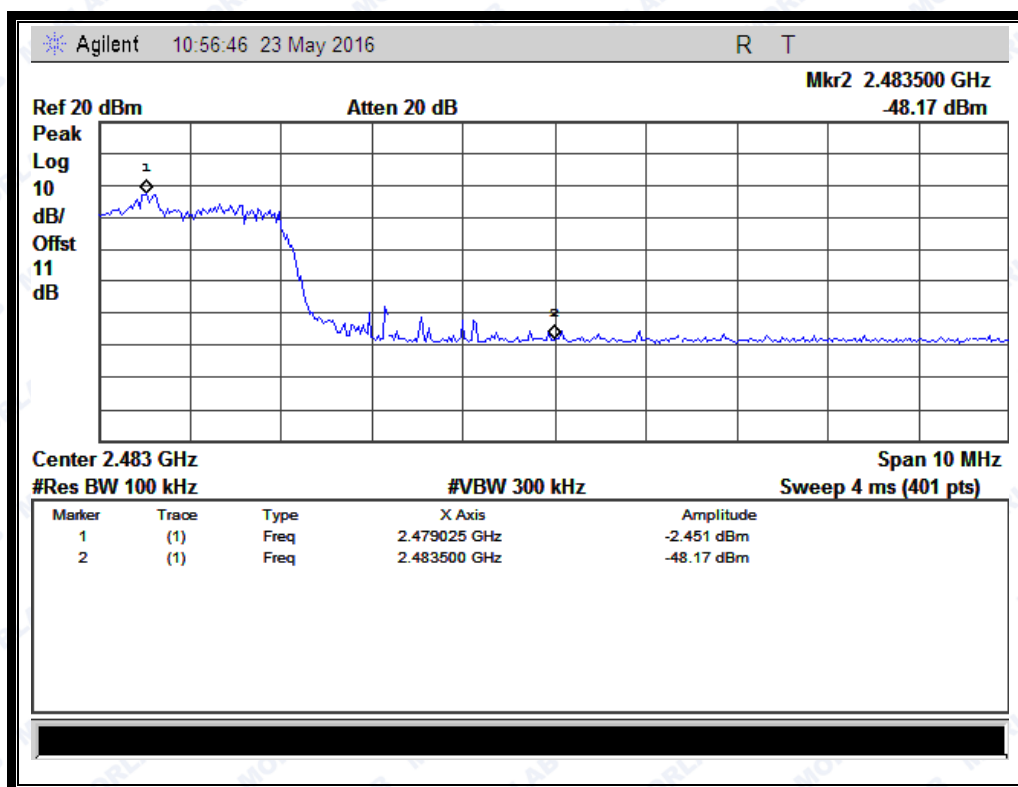


REPORT No.: SZ16050024W02

(Plot E.1: Channel = 39, 30MHz to 25GHz @ $\pi/4$ -DQPSK)(Plot F.1: Channel = 78, 30MHz to 25GHz @ $\pi/4$ -DQPSK)



REPORT No.: SZ16050024W02

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



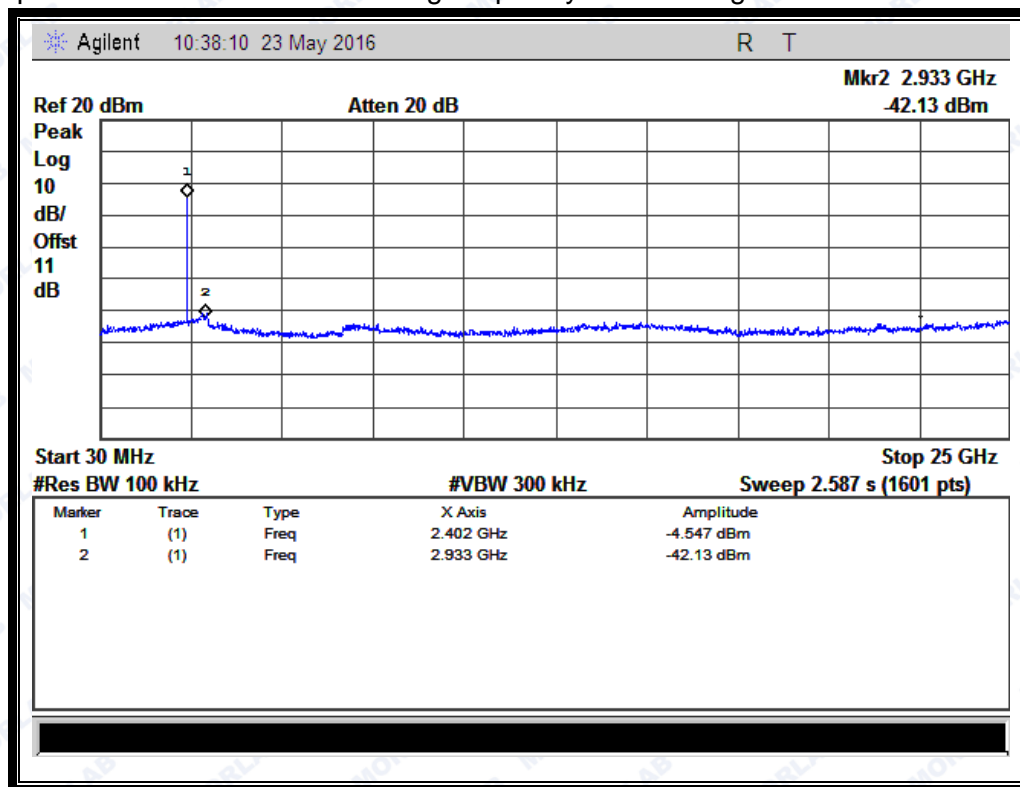
2.7.4.3 8-DPSK Mode

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	-42.13	Plot G.1	-4.55	-24.55	PASS
39	2441	-41.42	Plot H.1	-4.12	-24.12	PASS
78	2480	-47.22	Plot I.1	-1.85	-21.85	PASS

B. Test Plots:

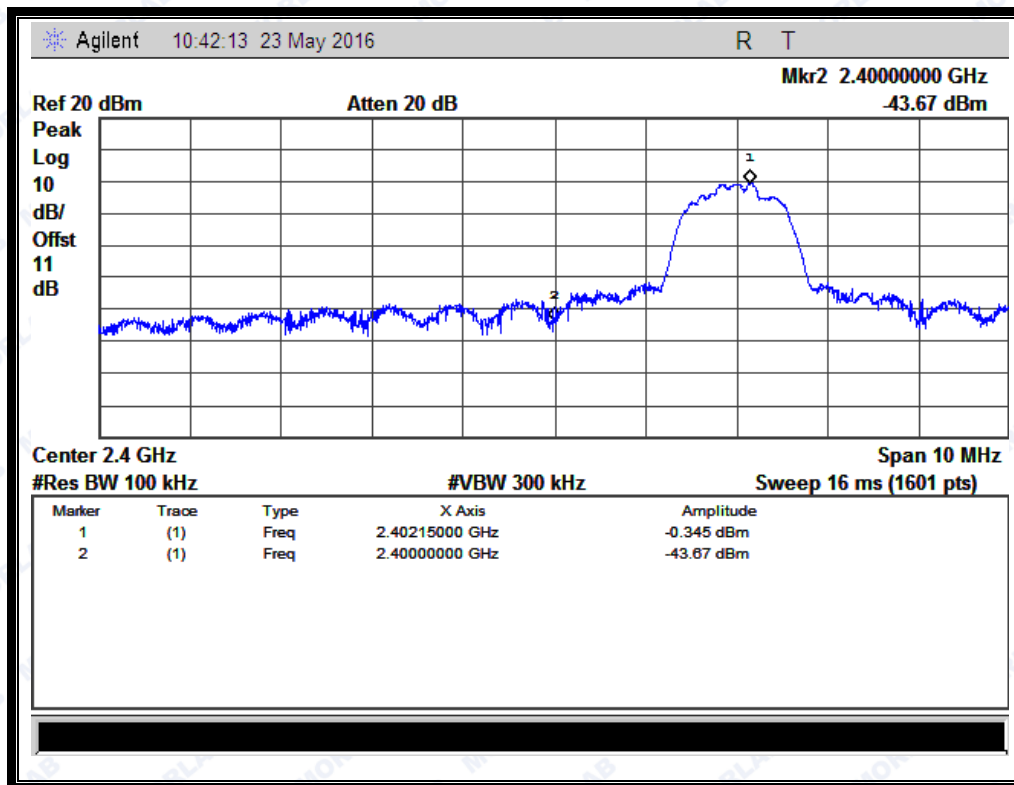
Note: the power of the Module transmitting frequency should be ignored.



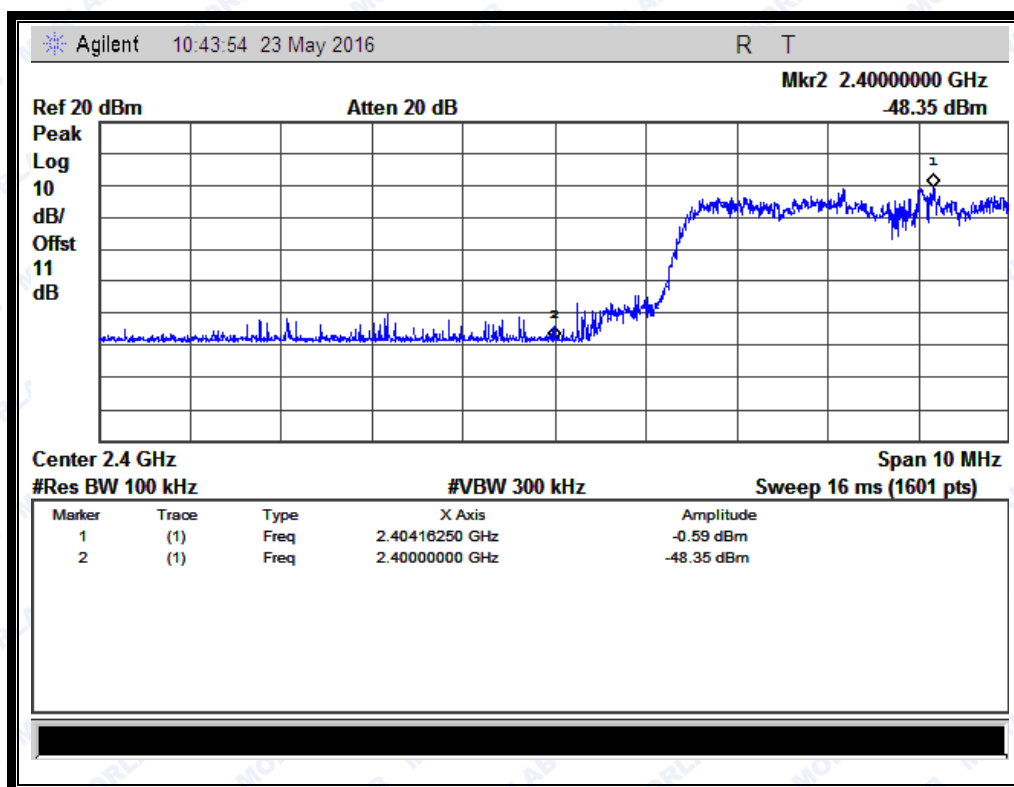
(Plot G.1: Channel = 0, 30MHz to 25GHz @ 8-DPSK)



REPORT No.: SZ16050024W02



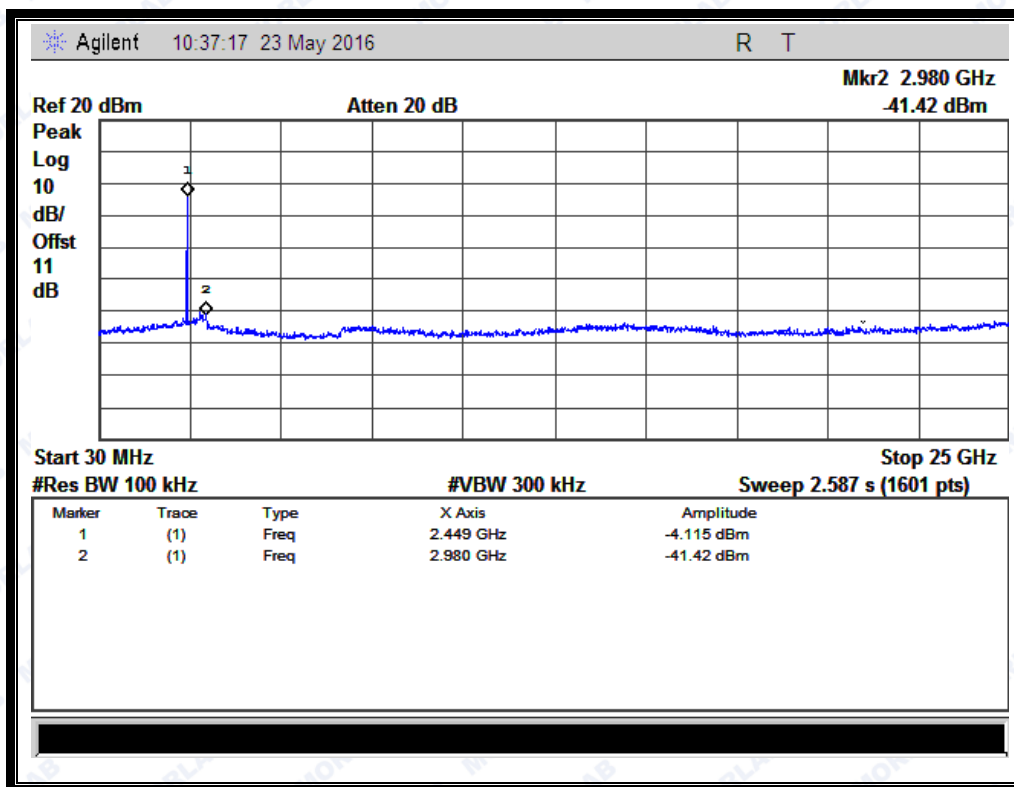
(Channel = 0, Band edge @ 8-DPSK)



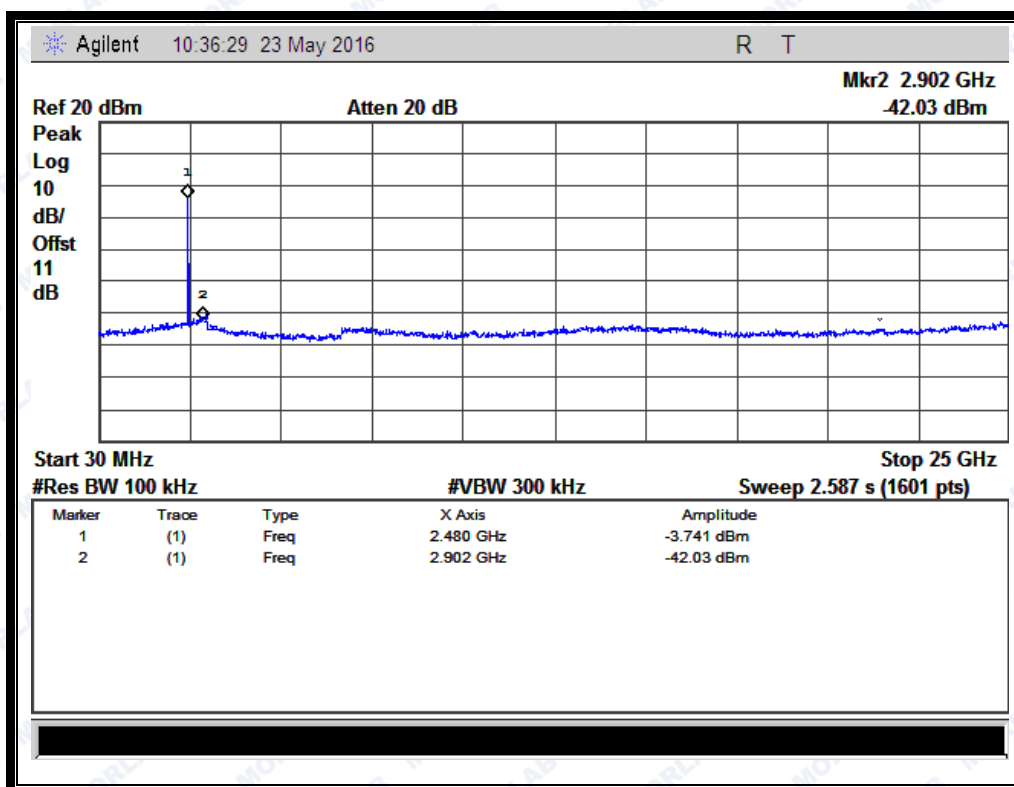
(Channel = 0, Band edge with hopping on @ 8-DPSK)



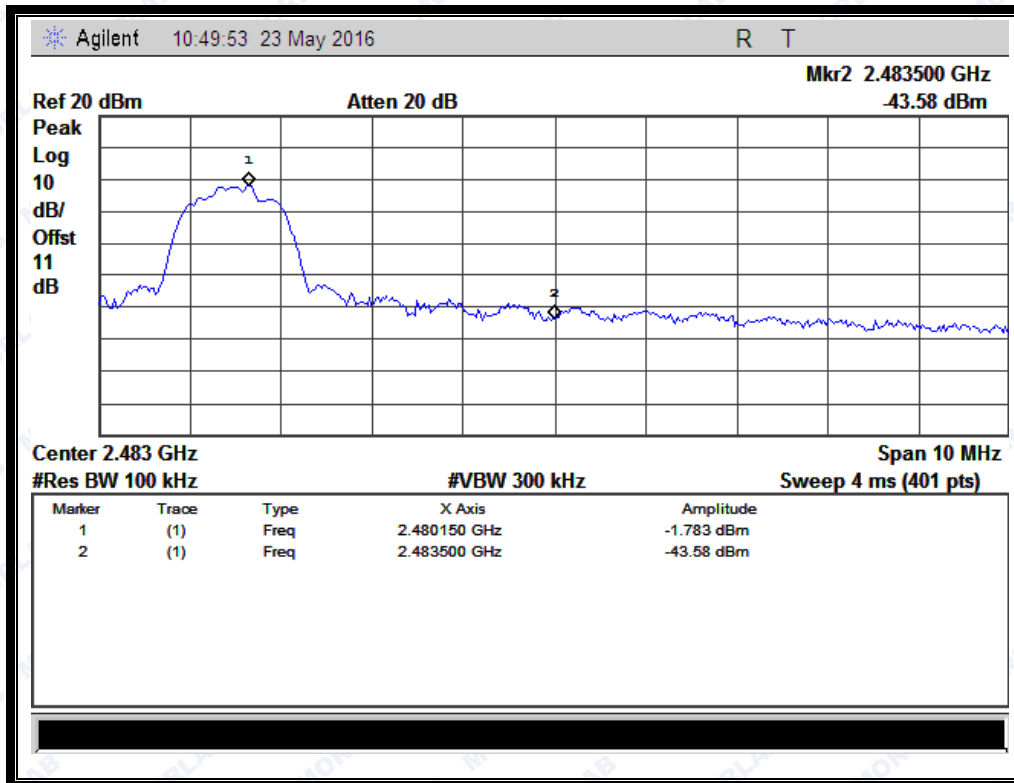
REPORT No.: SZ16050024W02



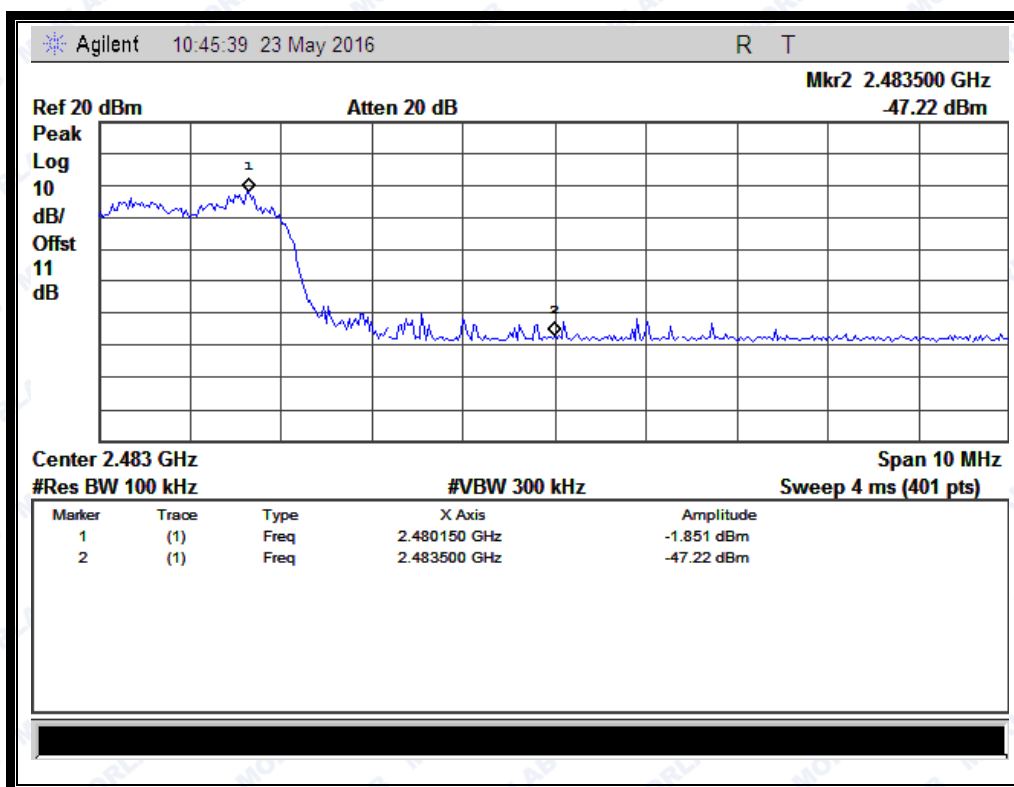
(Plot H.1: Channel = 39, 30MHz to 25GHz @ 8-DPSK)



(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)

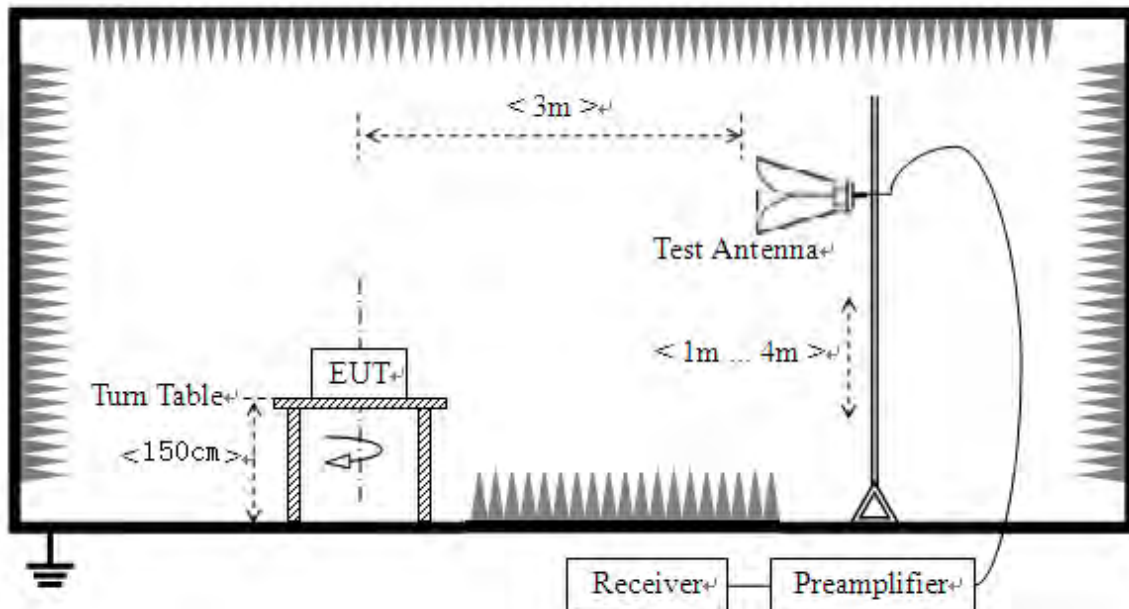
2.8 Restricted Frequency Bands

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:**

Please reference ANNEX A(1.5).

2.8.3 Test Procedure

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1\text{GHz}$, 100 KHz for $f < 1\text{GHz}$

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:

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

AT: Total correction Factor except Antenna

UR: Receiver Reading

Gpreamp: Preamplifier Gain

AFactor: Antenna Factor at 3m

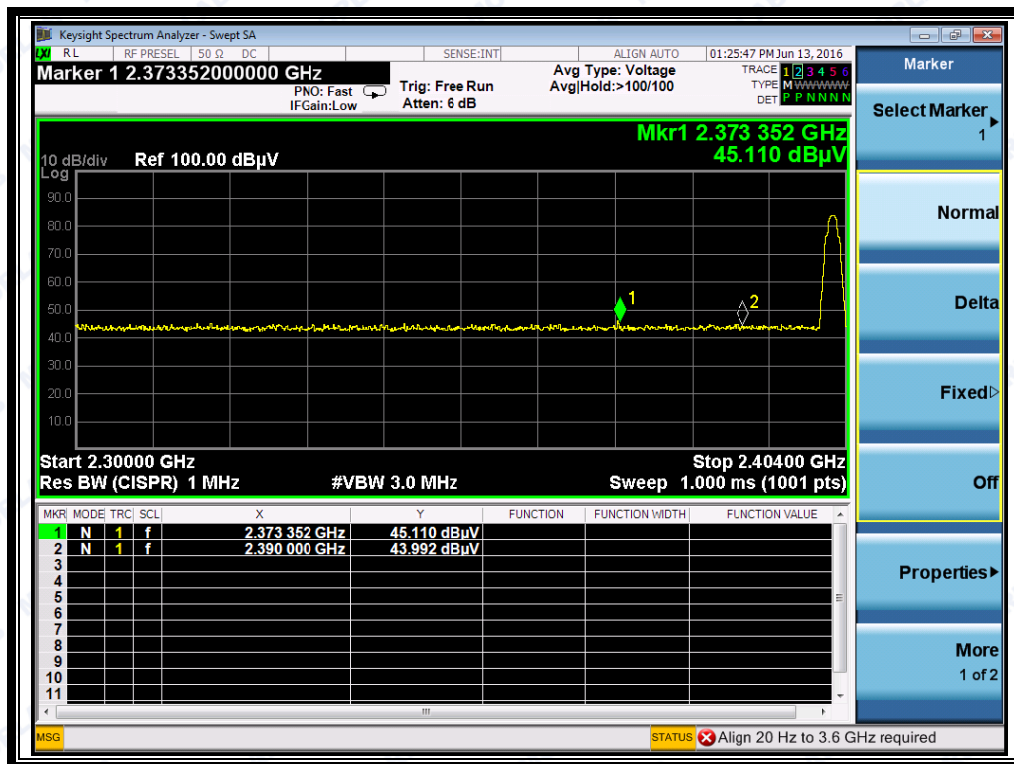
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

2.8.4.1 GFSK Mode**A. Test Verdict:**

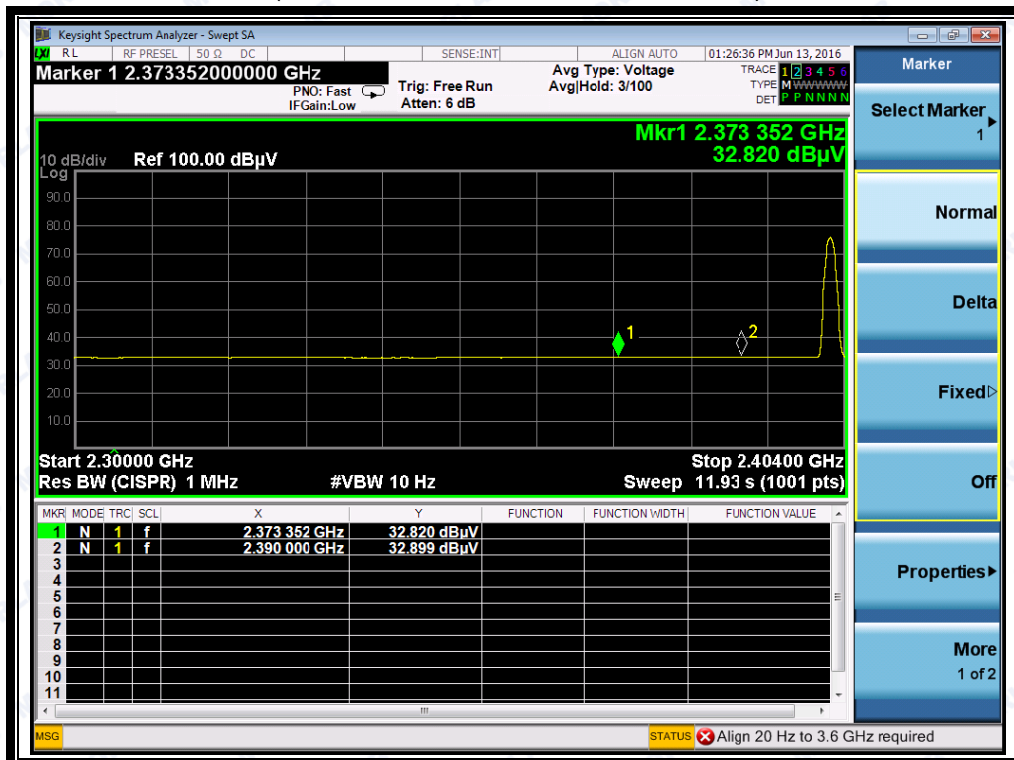
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBuV/m)	Limit (dBuV/m)	Verdict
		PK/ AV						
0	2373.35	PK	45.11	-33.63	32.56	44.04	74	Pass
0	2373.35	AV	32.82	-33.63	32.56	31.75	54	Pass
78	2493.90	PK	44.92	-33.18	32.50	44.24	74	Pass
78	2492.14	AV	32.84	-33.18	32.50	32.16	54	Pass



B. Test Plots:



(Plot A1:Channel = 0 PEAK @ GFSK)



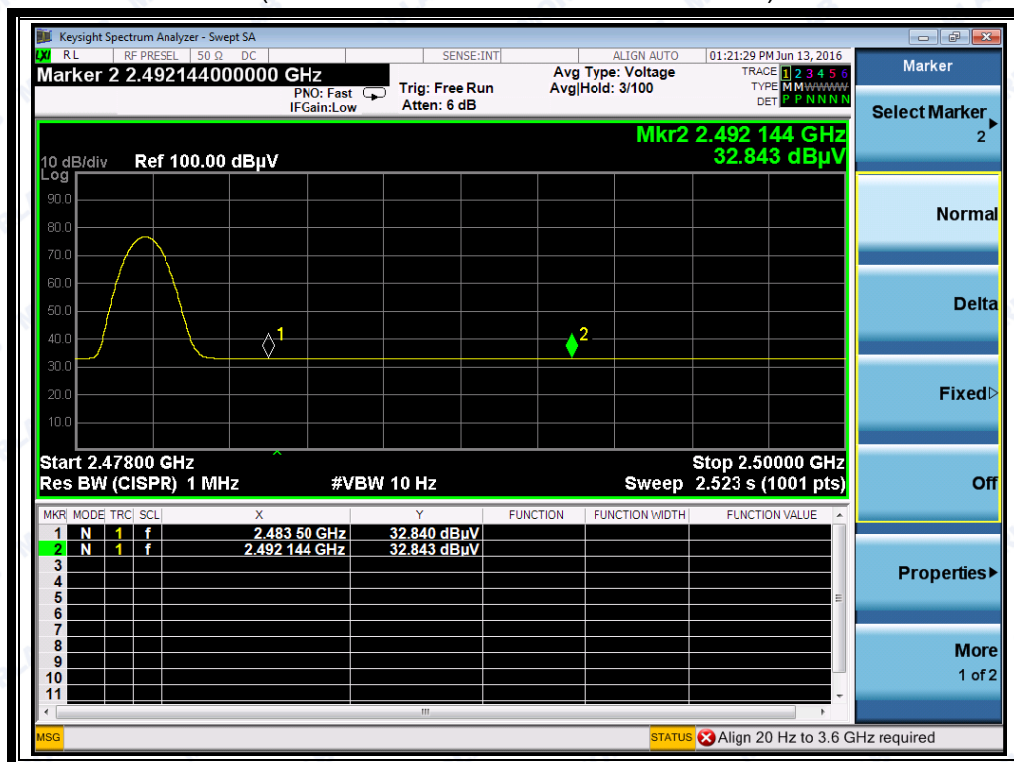
(Plot A2:Channel = 0 AVERAGE @ GFSK)



REPORT No.: SZ16050024W02



(Plot B1: Channel = 78 PEAK @ GFSK)



(Plot B2: Channel = 78 AVERAGE @ GFSK)

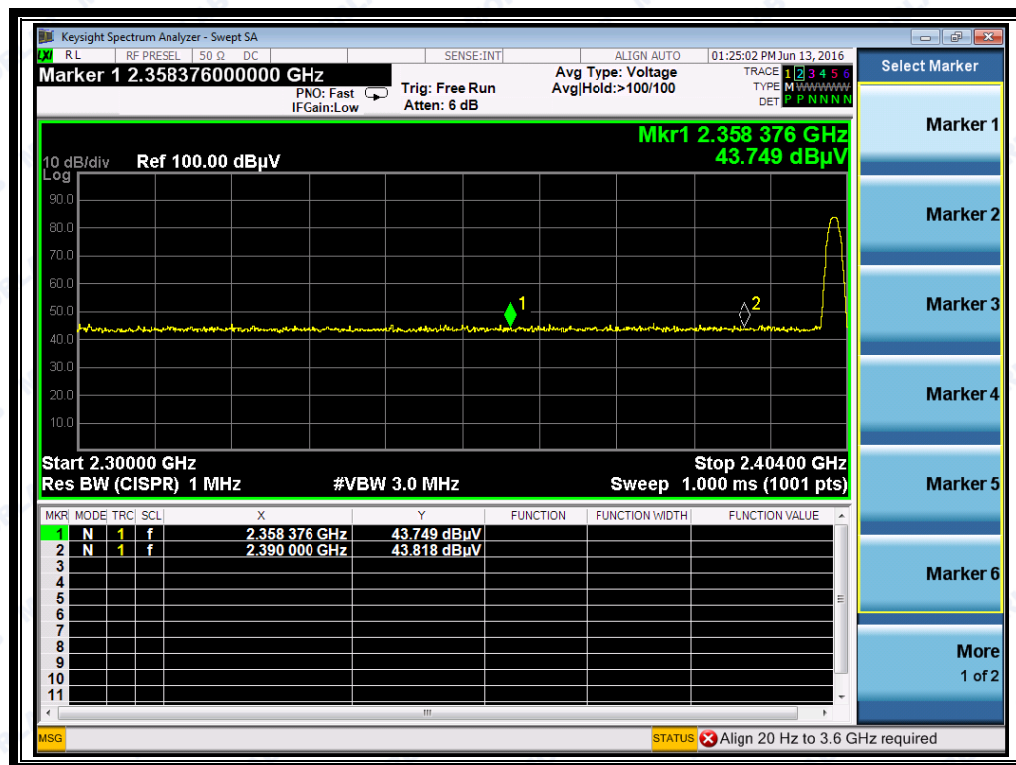


2.8.4.2 $\pi/4$ -DQPSK Mode

A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBuV/m)	Limit (dBuV/m)	Verdict
		PK/ AV						
0	2358.38	PK	43.75	-33.63	32.56	42.68	74	Pass
0	2383.13	AV	32.83	-33.63	32.56	31.76	54	Pass
78	2491.31	PK	44.88	-33.18	32.5	44.2	74	Pass
78	2488.12	AV	32.83	-33.18	32.5	32.15	54	Pass

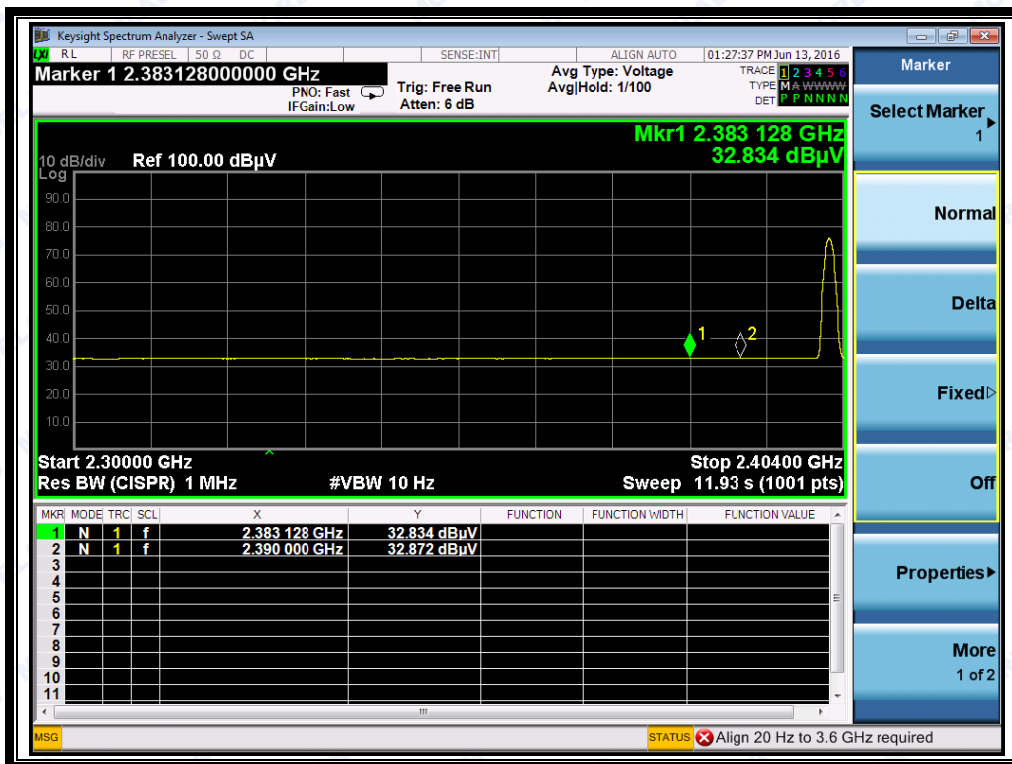
B. Test Plots:



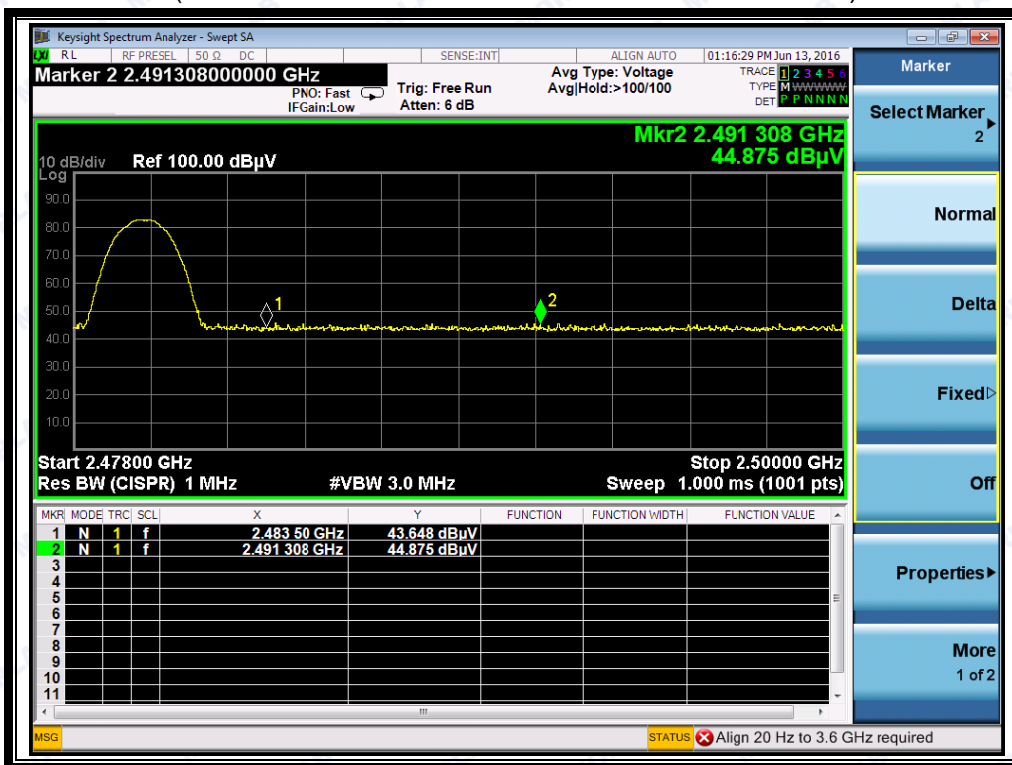
(Plot C1: Channel = 0 PEAK @ $\pi/4$ -DQPSK)



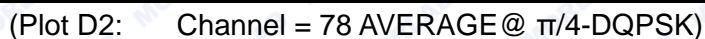
REPORT No.: SZ16050024W02



(Plot C2: Channel = 0 AVERAGE @ $\pi/4$ -DQPSK)

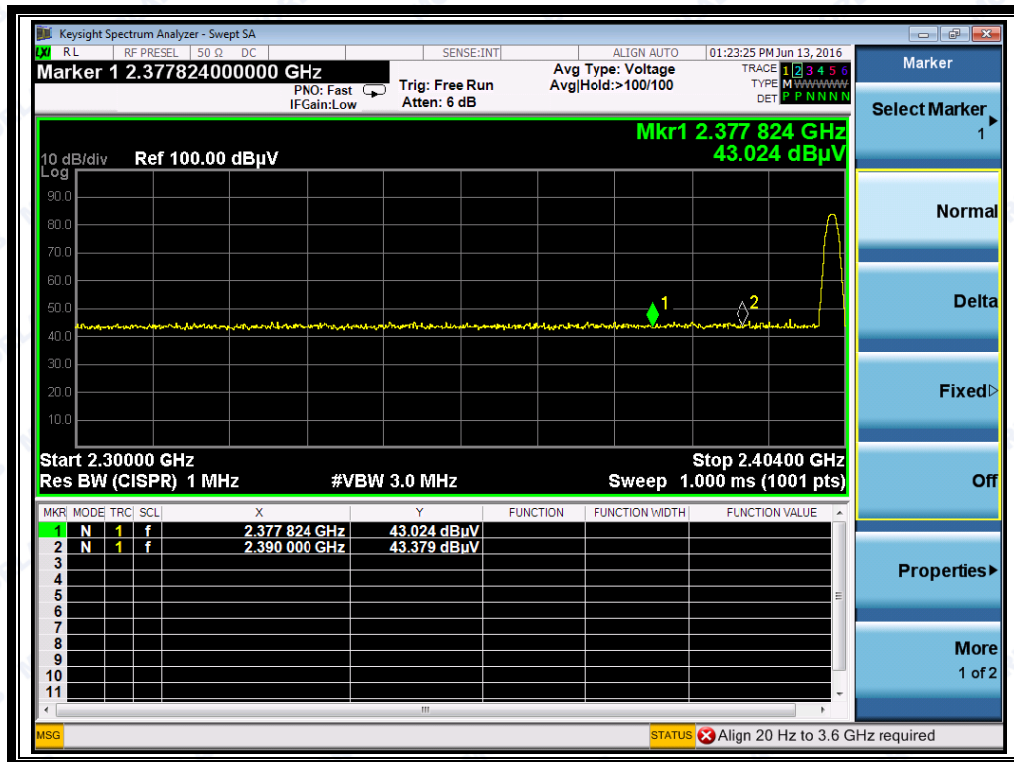


(Plot D1: Channel = 78 PEAK @ $\pi/4$ -DQPSK)

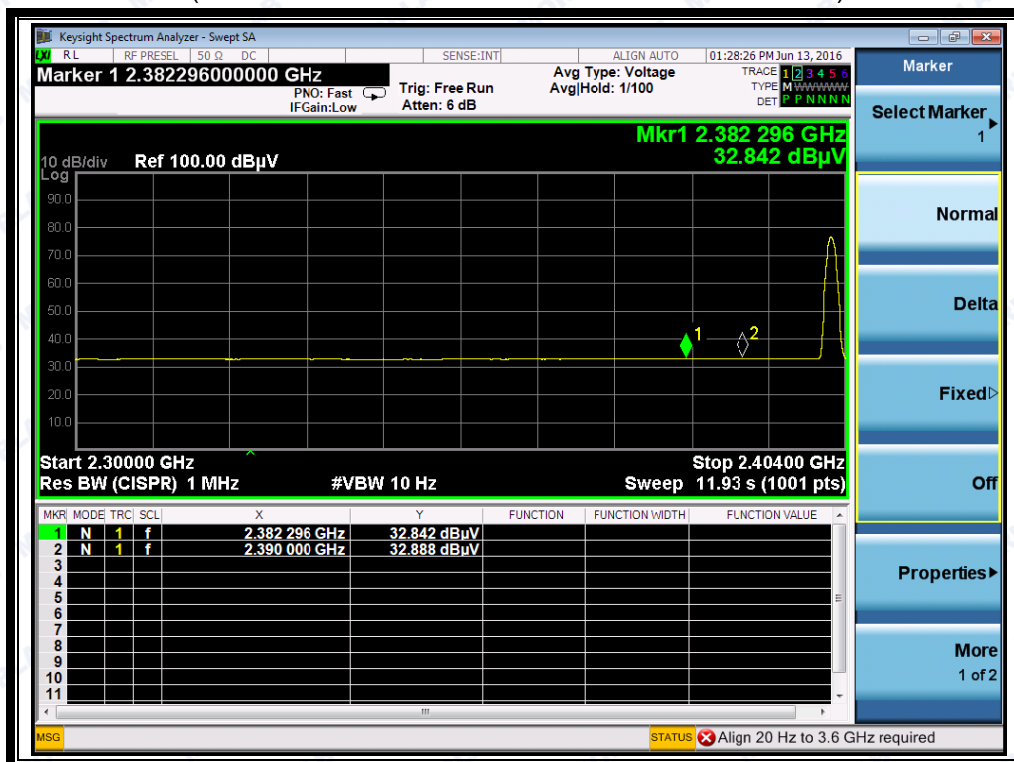


A. Test Verdict:

B. Test Plots:



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



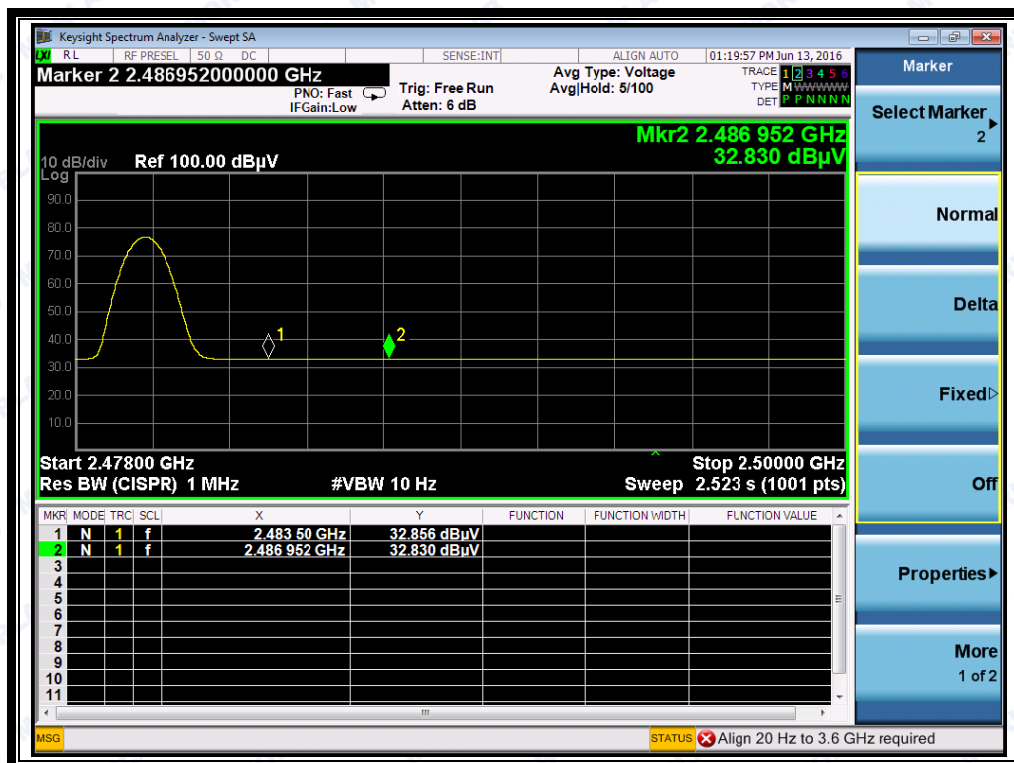
(Plot E2: Channel = 0 AVERAGE @ 8-DPSK Mode)



REPORT No.: SZ16050024W02



(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 RSS-GEN section 8.8, 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 50 μ H/50 Ω line impedance stabilization network (LISN).

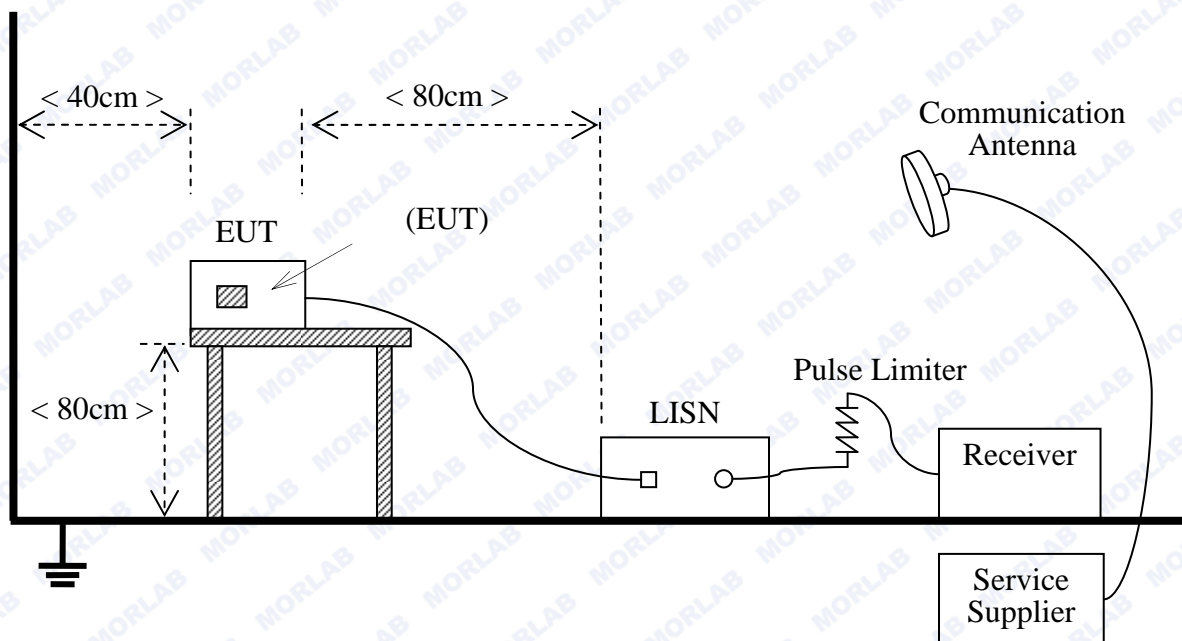
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

NOTE:

- The lower limit shall apply at the band edges.
- 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 C63.10 2013.

The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth EUT 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:

Please reference ANNEX A(1.5).

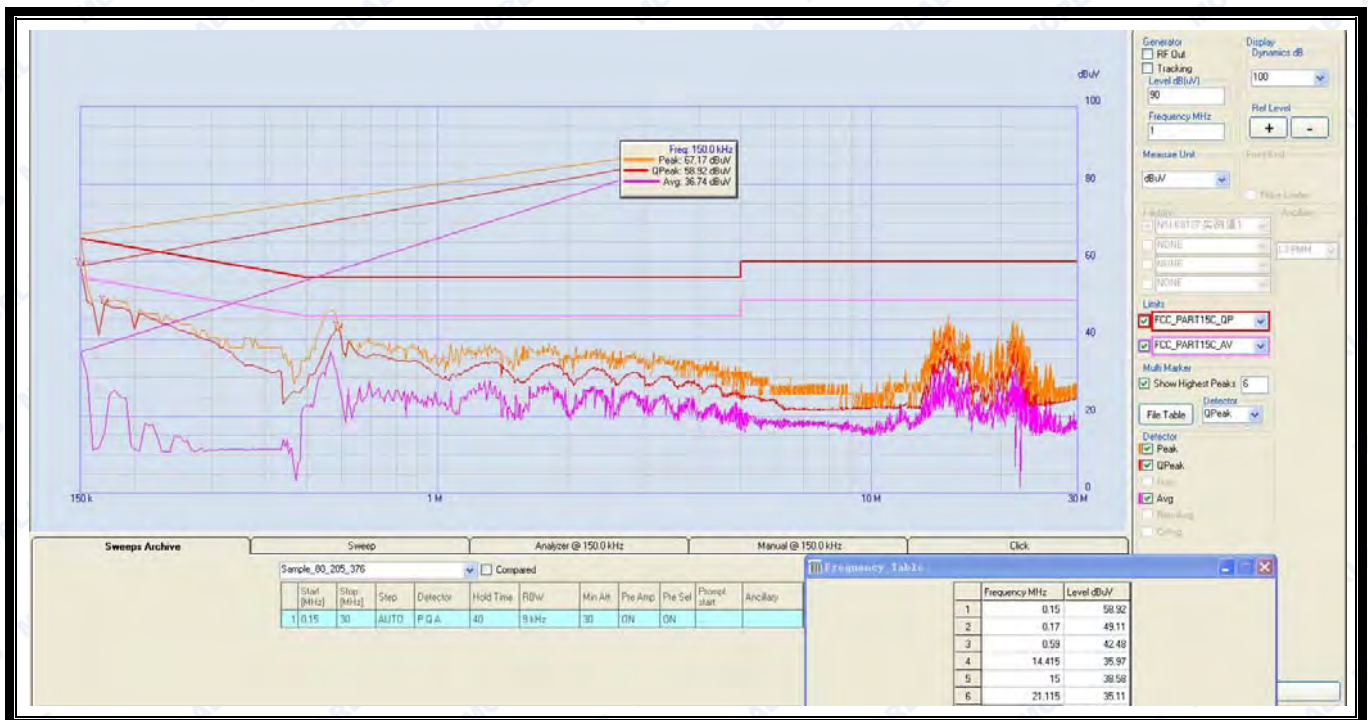
2.9.3 Test Result

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.

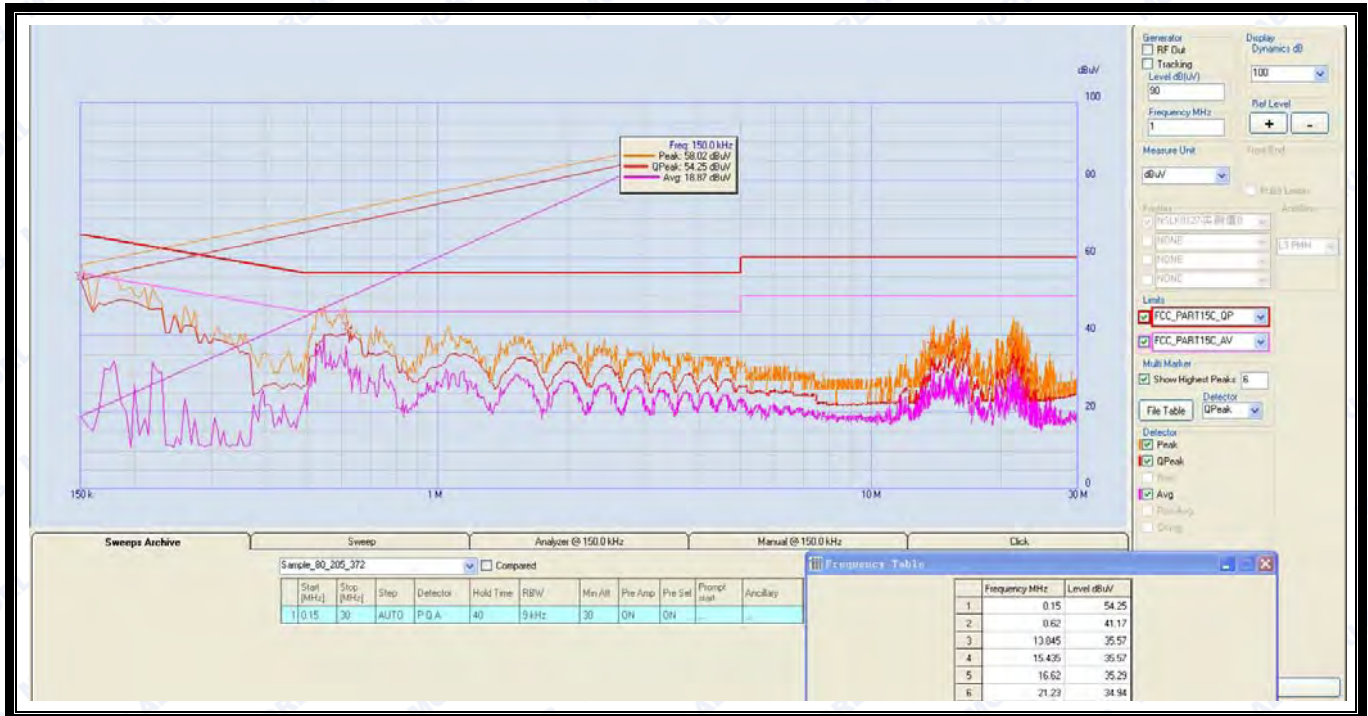
B. Test Plots:



(Plot A: L Phase)



REPORT No.: SZ16050024W02



(Plot B: N Phase)



2.10 Radiated Emission

2.10.1 Requirement

According to FCC section 15.247(d), 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 ($\mu\text{V}/\text{m}$)	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:

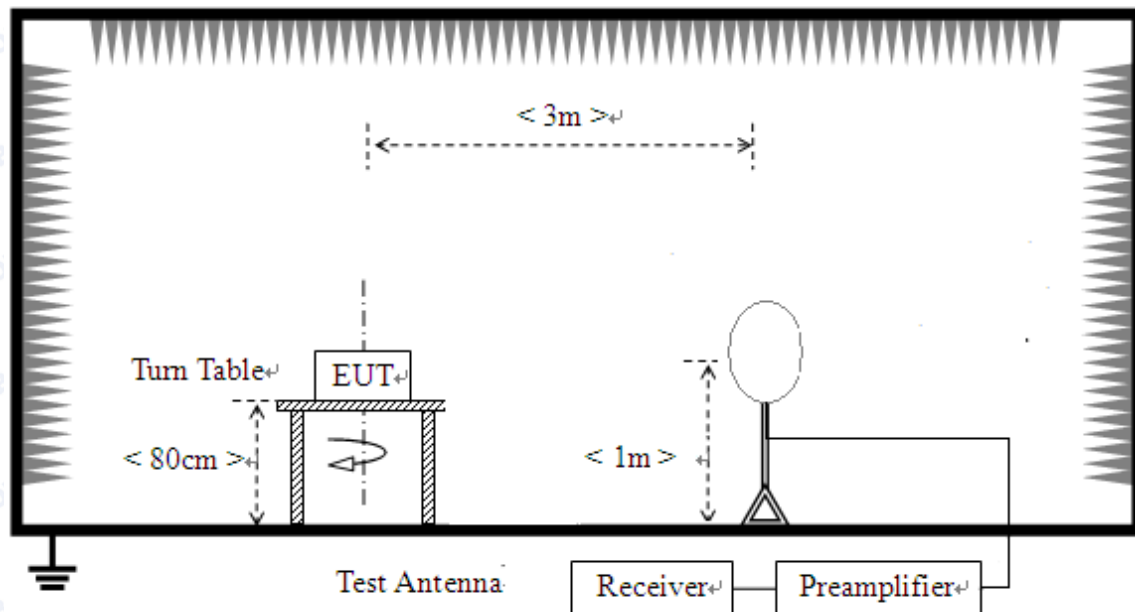
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength 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)

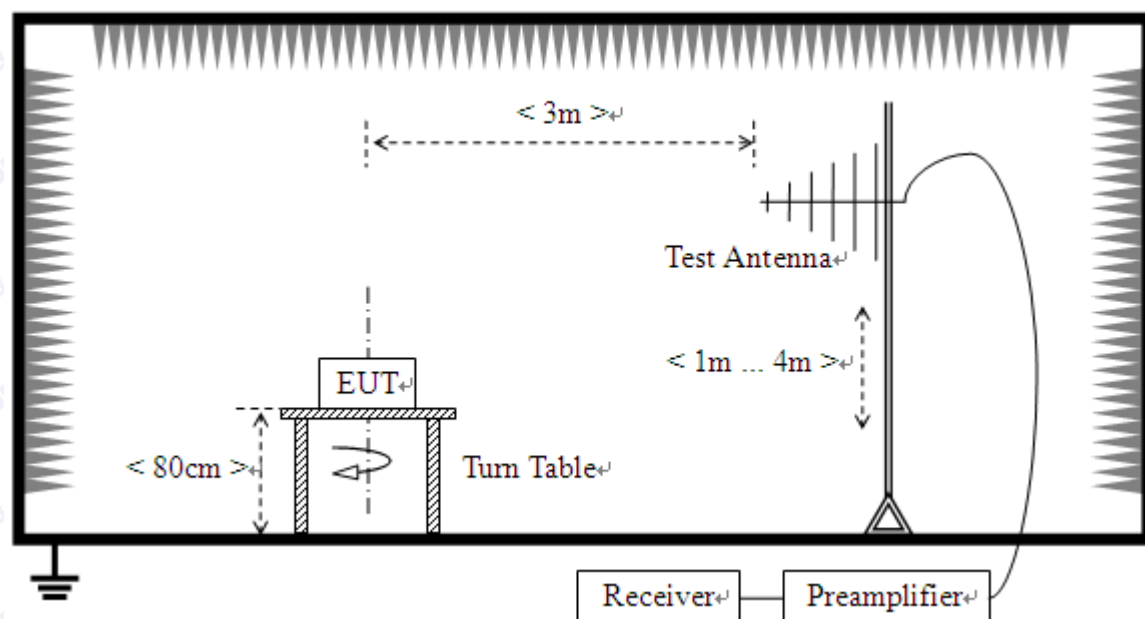
2.10.2 Test Description

A. Test Setup:

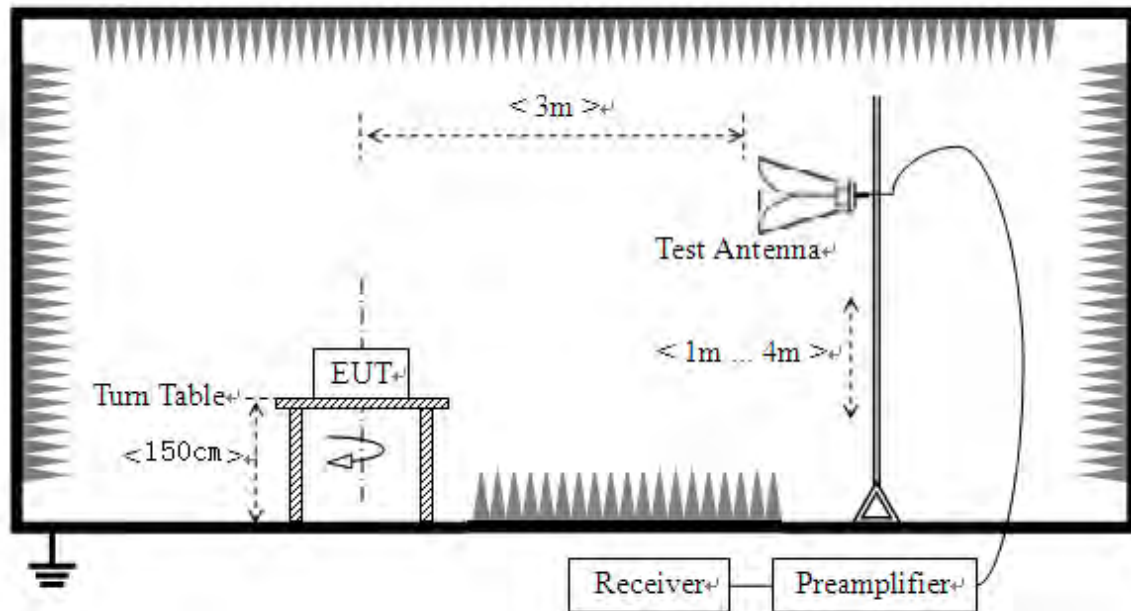
- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



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 C63.10 (2013). For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT 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.

For the Test Antenna:

- 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.
- 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:**

Please reference ANNEX A(1.5).

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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.10.4 Test Result

According to ANSI C63.10, 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:

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

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 A_T 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.

The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

**2.10.4.1 GFSK Mode:****A. Test Plots for the Whole Measurement Frequency Range:**Plots for Channel = 0

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
118.623	23.31	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	36.03	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
299.512	30.00	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
407.559	25.63	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2583.994	43.24	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
8999.418	46.64	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 0)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	13.63	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
90.701	15.82	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
233.955	20.05	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
407.559	24.03	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2373.990	43.91	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
5655.101	45.98	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 0)



Plot for Channel = 39



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
119.837	25.45	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
180.538	28.28	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	30.61	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
408.773	26.98	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
1594.798	42.93	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
8001.418	46.42	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 39)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	14.77	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
91.915	14.69	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
240.025	24.78	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
395.419	27.79	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2824.041	44.58	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
18498.745	50.21	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 39)



Plot for Channel = 78



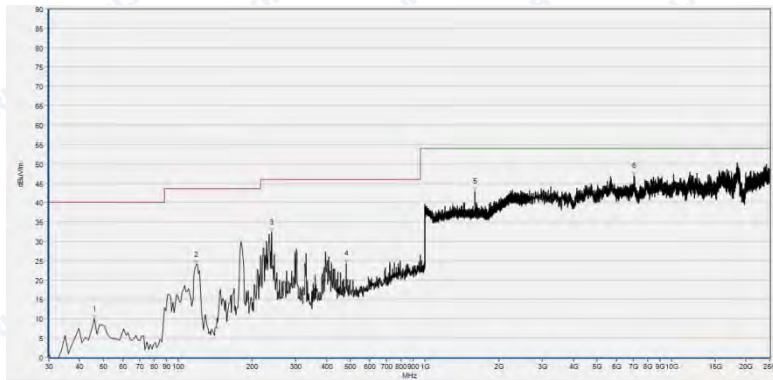
Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
121.051	23.25	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	35.30	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
395.419	32.88	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
1596.078	40.04	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
5699.909	46.40	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
16266.485	49.49	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ GFSK, channel 78)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
90.701	16.89	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
240.025	24.21	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
396.633	28.44	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2234.414	44.01	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
7944.390	47.38	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
18384.688	49.04	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ GFSK, channel 78)

**2.10.4.2 $\pi/4$ -DQPSK Mode:****B. Test Plots for the Whole Measurement Frequency Range:**Plots for Channel = 0

Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
45.782	9.81	N.A	N.A	N.A	40.00	N.A	Horizontal	PASS
118.623	24.04	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
240.025	32.38	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
480.401	24.27	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
1597.359	42.83	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
7040.080	46.86	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ $\pi/4$ -DQPSK, channel 0)

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
45.782	9.91	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
90.701	14.58	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
233.955	27.22	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
407.559	21.93	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
4477.869	45.43	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
15610.656	48.11	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ $\pi/4$ -DQPSK, channel 0)



Plot for Channel = 39



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
49.424	9.74	N.A	N.A	N.A	40.00	N.A	Horizontal	PASS
119.837	21.28	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	34.53	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
396.633	26.82	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2726.278	43.67	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
8779.451	46.97	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ $\pi/4$ -DQPSK, channel 39)

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	11.41	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
90.701	14.87	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
240.025	27.35	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2311.885	43.27	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
5773.231	46.41	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
18563.921	50.04	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ $\pi/4$ -DQPSK, channel 39)

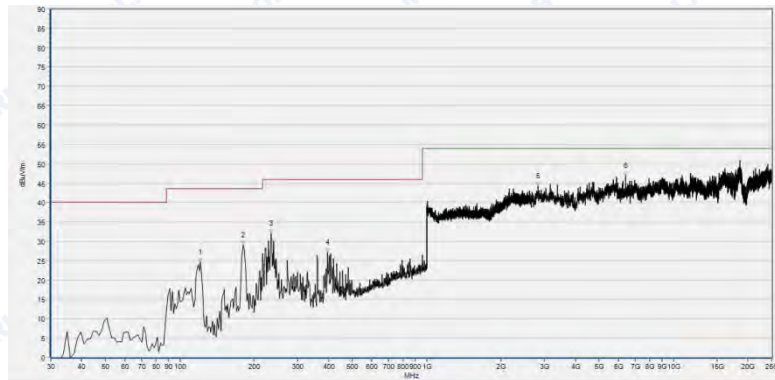
Plot for Channel = 78

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
48.210	8.54	N.A	N.A	N.A	40.00	N.A	Horizontal	PASS
119.837	20.06	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
227.885	34.70	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
396.633	27.36	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
3007.347	44.26	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
5842.480	46.94	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @ $\pi/4$ -DQPSK, channel 78)

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
90.701	14.23	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
233.955	28.06	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
480.401	23.03	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
2954.392	44.24	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
4730.424	44.65	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
16087.252	49.96	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @ $\pi/4$ -DQPSK, channel 78)

**2.10.4.3 8-DPSK Mode:****C. Test Plots for the Whole Measurement Frequency Range:**Plots for Channel = 0

Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
121.051	24.61	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
180.538	29.03	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	31.94	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
396.633	27.16	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
2824.041	44.24	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
6388.325	46.92	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 0)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	13.56	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
89.487	16.97	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
233.955	23.66	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
480.401	23.93	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
1386.715	40.12	N.A	N.A	74.0	N.A	54.00	Vertical	PASS
4701.909	44.67	N.A	N.A	74.0	N.A	54.00	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 0)



REPORT No.: SZ16050024W02

Plot for Channel = 39



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
119.837	25.75	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
179.324	27.42	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	28.86	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
402.703	25.49	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
3088.816	43.69	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
8930.169	47.95	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 39)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	17.09	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
90.701	17.02	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
240.025	23.21	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
407.559	24.03	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
3406.547	43.62	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
10237.752	47.73	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 39)



Plot for Channel = 78



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
121.051	24.34	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
179.324	26.83	N.A	N.A	N.A	43.50	N.A	Horizontal	PASS
233.955	30.24	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
396.633	26.48	N.A	N.A	N.A	46.00	N.A	Horizontal	PASS
1593.517	41.20	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS
11744.935	48.50	N.A	N.A	74.0	N.A	54.00	Horizontal	PASS

(30MHz to 25GHz, Antenna Horizontal @8-DPSK, channel 78)



Fre.(MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
44.568	17.44	N.A	N.A	N.A	40.00	N.A	Vertical	PASS
90.701	16.85	N.A	N.A	N.A	43.50	N.A	Vertical	PASS
233.955	20.91	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
407.559	24.56	N.A	N.A	N.A	46.00	N.A	Vertical	PASS
1596.719	41.54	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7997.345	46.54	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(30MHz to 25GHz, Antenna Vertical @8-DPSK, channel 78)



ANNEX A GENERAL INFORMATION

1.1 Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

1.2 Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

1.3 Facilities and Accreditations

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 2013 and CISPR Publication 22; the FCC registration number is 695796.

1.4 Maximum measurement uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Measurements	Frequency	Uncertainty
Conducted emissions	9KHz~30MHz	2.44dB
Radiated emissions	30MHz~200MHz	2.93
	200MHz~1000MHz	2.95
	1GHz~18GHz	2.26
	18GHz~40GHz	1.94

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



REPORT No.: SZ16050024W02

1.5 Test Equipments Utilized**1.5.1 Conducted Test Equipments**

Conducted Test Equipment						
No.	Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
1	Spectrum Analyzer	MY45101810	E4407B	Agilent	2016.03.02	2017.03.01
2	USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2016.03.02	2017.03.01
3	EXA Signal Analyzer	MY53470838	N9010A	Agilent	2015.08.26	2016.08.25
4	RF cable	CB01	RF01	Morlab	N/A	N/A
5	Attenuator	(n.a.)	10dB	Resnet	N/A	N/A
6	SMA connector <small>Note</small>	CN01	RF03	HUBER-SUHNER	N/A	N/A

Note: The SMA antenna connector is soldered on the PCB board in order to perform conducted tests and this SMA antenna connector is listed in the equipment list.

1.5.2 Radiated Test Equipments

Radiated Test Equipments						
No	Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal.Due Date
1	System Simulator	GB45360846	8960-E5515C	Agilent	2016.03.02	2017.03.01
2	Receiver	MY54130016	N9038A	Agilent	2016.03.02	2017.03.01
3	Test Antenna - Bi-Log	N/A	VULB9163	Schwarzbeck	2016.03.02	2017.03.01
4	Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2016.03.02	2017.03.01
5	Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2016.03.02	2017.03.01
6	Test Antenna - Horn	71688	BBHA 9120D	Schwarzbeck	2016.03.02	2017.03.01
7	Coaxial cable(N male)	CB02	EMC02	Morlab	N/A	N/A
8	Coaxial cable(N male)	CB03	EMC03	Morlab	N/A	N/A
9	1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde&Schwarz	2016.03.02	2017.03.01
10	18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde&Schwarz	2016.03.02	2017.03.01

1.5.3 Climate Chamber

Climate Chamber



REPORT No.: SZ16050024W02

No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Climate Chamber	2004012	HL4003T	Yinhe	2016.03.02	2017.03.01

1.5.4 Vibration Table

Vibration Table						
No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Vibration Table	N/A	ACT2000-S015L	CMI-COM	2016.03.02	2017.03.01

1.5.5 Anechoic Chamber

Anechoic Chamber						
No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Anechoic Chamber	N/A	9m*6m*6m	Changning	2016.03.02	2017.03.01

1.5.6 Auxiliary Test Equipment

Auxiliary Test Equipment						
No.	Equipment Name	Serial No.	Type	Manufacturer	Cal.Date	Cal.Due Date
1	Computer	N.A	PU500C	Asus	N.A	N.A

***** END OF REPORT *****