

FCC
RF
TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
Mirror lamp

ISSUED TO
Orient Resource Corporation Limited

#8 of Xingling Road, Xiaolong village, Shiji Town, Panyu disctict,
Guangzhou city, Guangdong Province, China



Tested by: Hu Chao
Date: Nov. 14, 2017
Approved by: Liao Jianming
(Technical Director)
Date: Nov. 14, 2017



Report No.: BL-SZ17A0338-601
EUT Name: Mirror lamp
Model Name: Victor-BTS3920-01-60-20*27*3-B
Brand Name: N/A
Test Standard: 47 CFR Part 15 Subpart C
FCC ID: 2ANQAA
Test conclusion: Pass
Test Date: Oct. 18, 2017 ~ Oct. 23, 2017
Date of Issue: Nov. 14, 2017

NOTE: This test report of test results only related to testing samples, which can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please contact us.

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Nov. 13, 2017	Initial Issue
Rev. 02	Nov. 14, 2017	Added 1/4-DQPSK test data in chapter A.8

TABLE OF CONTENTS

1	ADMINISTRATIVE DATA (GENERAL INFORMATION)	6
1.1	Identification of the Testing Laboratory	6
1.2	Identification of the Responsible Testing Location	6
1.3	Laboratory Condition	6
1.4	Announce	6
2	PRODUCT INFORMATION	7
2.1	Applicant Information	7
2.2	Manufacturer Information	7
2.3	Factory Information	7
2.4	General Description for Equipment under Test (EUT)	7
2.5	Ancillary Equipment	8
2.6	Technical Information	9
3	SUMMARY OF TEST RESULTS	10
3.1	Test Standards	10
3.2	Verdict	11
4	GENERAL TEST CONFIGURATIONS	12
4.1	Test Environments	12
4.2	Test Equipment List	12
4.3	Measurement Uncertainty	13
4.4	Description of Test Setup	13
4.4.1	For Antenna Port Test	13
4.4.2	For AC Power Supply Port Test	14
4.4.3	For Radiated Test (Below 30 MHz)	14
4.4.4	For Radiated Test (30 MHz-1 GHz)	15
4.4.5	For Radiated Test (Above 1 GHz)	15
4.5	Measurement Results Explanation Example	16

4.5.1	For conducted test items:	16
4.5.2	For radiated band edges and spurious emission test:.....	16
5	TEST ITEMS.....	17
5.1	Antenna Requirements.....	17
5.1.1	Relevant Standards.....	17
5.1.2	Antenna Anti-Replacement Construction	17
5.1.3	Antenna Gain	17
5.2	Number of Hopping Frequencies	18
5.2.1	Limit.....	18
5.2.2	Test Setup	18
5.2.3	Test Procedure.....	18
5.2.4	Test Result	18
5.3	Peak Output Power and E.I.R.P.....	19
5.3.1	Test Limit.....	19
5.3.2	Test Setup	19
5.3.3	Test Procedure.....	19
5.3.4	Test Result	19
5.4	Occupied Bandwidth	20
5.4.1	Limit.....	20
5.4.2	Test Setup	20
5.4.3	Test Procedure.....	20
5.4.4	Test Result	20
5.5	Carrier Frequency Separation	21
5.5.1	Limit.....	21
5.5.2	Test Setup	21
5.5.3	Test Procedure.....	21
5.5.4	Test Result	21
5.6	Time of Occupancy (Dwell time)	22
5.6.1	Limit.....	22
5.6.2	Test Setup	22
5.6.3	Test Procedure.....	22

5.6.4	Test Result	22
5.7	Conducted Spurious Emission & Authorized-band band-edge	23
5.7.1	Limit.....	23
5.7.2	Test Setup	23
5.7.3	Test Procedure.....	23
5.7.4	Test Result	24
5.8	Conducted Emission	25
5.8.1	Limit.....	25
5.8.2	Test Setup	25
5.8.3	Test Procedure.....	25
5.8.4	Test Result	25
5.9	Radiated Spurious Emission	26
5.9.1	Limit.....	26
5.9.2	Test Setup	26
5.9.3	Test Procedure.....	26
5.9.4	Test Result	27
5.10	Band Edge (Restricted-band band-edge).....	28
5.10.1	Limit.....	28
5.10.2	Test Setup	28
5.10.3	Test Procedure.....	28
5.10.4	Test Result	28
ANNEX A	TEST RESULT	29
A.1	Number of Hopping Frequency	29
A.2	Peak Output Power and E.I.R.P	29
A.3	20 dB and 99% bandwidth	29
A.4	Hopping Frequency Separation.....	29
A.5	Average Time of Occupancy	29
A.6	Conducted Spurious Emissions & Authorized-band band-edge	30
A.7	Conducted Emissions.....	39
A.8	Radiated Spurious Emission	40
A.9	Band Edge (Restricted-band band-edge).....	43

ANNEX B	TEST SETUP PHOTOS	44
ANNEX C	EUT EXTERNAL PHOTOS	44
ANNEX D	EUT INTERNAL PHOTOS	44

1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory is a testing organization accredited by American Association for Laboratory Accreditation(A2LA) according to ISO/IEC 17025. The accreditation certificate is 4344.01. The 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 L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20 to 25°C
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

1.4 Announce

- (1) The test report reference to the report template version v5.8.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Orient Resource Corporation Limited
Address	#8 of Xingling Road, Xiaolong village, Shiji Town, Panyu disctict, Guangzhou city, Guangdong Province, China

2.2 Manufacturer Information

Manufacturer	Orient Resource Corporation Limite
Address	#8 of Xingling Road, Xiaolong village, Shiji Town, Panyu disctict, Guangzhou city, Guangdong Province, China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Type	Mirror lamp
Model Name Under Test	Victor-BTS3920-01-60-20*27*3-B
Series Model Name	Refer to model list
Description of Model name differentiation	Only the model names and appearance are different for different market requirement. The model Victor-BTS3920-01-60-20*27*3-B is the tested sample.
Hardware Version	V1.3
Software Version	4.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	Bluetooth 3.0 BR+EDR

Model List

Victor-BT(H0520, H0320, Y0120, H0140, J0212, H0230, S0430, S0130, S0330, S3320, S2520, H0240, F0120, S1120, H0330, S0820, S0920, S3920, S3820, S5020, S0520, S3930, S4930, S4430, S1530, S1830, S4230, S4330, S9820, S3230, S4530, S3530, S8020, S9220, S4130, S1220, S0320, J0108, S1230, H0420, S8620, Y0320, Z0120, S7920, S7820, S0230, Z0220, S1820, S0720, S1020, S1130, S0420, S4630, H0130, J1720, S2620, S6620, S0120, S2720, S0220, S8420, S4730 or S4830)-(01 or 02)-(15, 20, 36 or 60) -(X*Y*Z)-(A, B, C or D).

Where the X, Y is the number 10 to 99, the Z is the number 0 to 9

Lily-BT(H0520, H0320, Y0120, H0140, J0212, H0230, S0430, S0130, S0330, S3320, S2520, H0240, F0120, S1120, H0330, S0820, S0920, S3920, S3820, S5020, S0520, S3930, S4930, S4430, S1530, S1830, S4230, S4330, S9820, S3230, S4530, S3530, S8020, S9220, S4130, S1220, S0320, J0108, S1230, H0420, S8620, Y0320, Z0120, S7920, S7820, S0230, Z0220, S1820, S0720, S1020, S1130, S0420, S4630, H0130, J1720, S2620, S6620, S0120, S2720, S0220, S8420, S4730 or S4830)-(01 or 02)-(15, 20, 36 or 60) -(X*Y*Z)-(A, B, C or D)

Where the X, Y is the number 10 to 99, the Z is the number 0 to 9

2.5 Ancillary Equipment

N/A

2.6 Technical Information

The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology	FHSS
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Product Type	<input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location
Transfer Rate	DH5: 1 Mbps 2DH5: 2 Mbps 3DH5: 3 Mbps
Frequency Range	The frequency range used is 2400 MHz to 2483.5 MHz.
Number of channel	79 (at intervals of 1 MHz)
Tested Channel	0 (2402 MHz), 39 (2441 MHz), 78 (2480 MHz)
Antenna Type	PCB Antenna
Antenna Gain	-0.61 dBi (In test items related to antenna gain, the final results reflect this figure.)
Antenna System(MIMO Smart Antenna)	N/A

All channel was listed on the following table:

Channel number	Freq. (MHz)						
0	2402	21	2423	42	2444	63	2465
1	2403	22	2424	43	2445	64	2466
2	2404	23	2425	44	2446	65	2467
3	2405	24	2426	45	2447	66	2468
4	2406	25	2427	46	2448	67	2469
5	2407	26	2428	47	2449	68	2470
6	2408	27	2429	48	2450	69	2471
7	2409	28	2430	49	2451	70	2472
8	2410	29	2431	50	2452	71	2473
9	2411	30	2432	51	2453	72	2474
10	2412	31	2433	52	2454	73	2475
11	2413	32	2434	53	2455	74	2476
12	2414	33	2435	54	2456	75	2477
13	2415	34	2436	55	2457	76	2478
14	2416	35	2437	56	2458	77	2479
15	2417	36	2438	57	2459	78	2480
16	2418	37	2439	58	2460	-	-
17	2419	38	2440	59	2461	-	-
18	2420	39	2441	60	2462	-	-
19	2421	40	2442	61	2463	-	-
20	2422	41	2443	62	2464	-	-

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
2	FCC PUBLIC NOTICE DA 00-705 (Mar. 30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
3	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	Channel	Test Result	Verdict	Remark
1	Antenna Requirement	15.203	N/A	--	Pass	Note ¹
2	Number of Hopping Frequencies	15.247(a)	Hopping Mode	ANNEX A.1	N/A	Note ^{2,4}
3	Peak Output Power and E.I.R.P	15.247(b)	Low/Middle/High	ANNEX A.2	N/A	--
4	Occupied Bandwidth	15.247(a)	Low/Middle/High	ANNEX A.3	N/A	Note ^{2,4}
5	Carrier Frequency Separation	15.247(a)	Hopping Mode	ANNEX A.4	N/A	Note ^{2,4}
6	Time of Occupancy (Dwell time)	15.247(a)	Hopping Mode	ANNEX A.5	N/A	Note ^{2,4}
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	Low/Middle/High	ANNEX A.6	Pass	Note ^{2,4}
8	Conducted Emission	15.207	Low/Middle/High	ANNEX A.7	N/A	Note ^{2,4}
9	Radiated Spurious Emission	15.209 15.247(d)	Hopping Mode, Low/Middle/High	ANNEX A.8	Pass	Note ^{2,4}
10	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	Hopping Mode, Low/Middle/High	ANNEX A.9	N/A	Note ^{2,4}
11	Receiver Spurious Emissions	--	--	--	N/A	Note ³

Note ¹: Please refer to section 5.1

Note ²: Because of the modulation of $\pi/4$ -DQPSK same as 8-DPSK, and the test results are basically the same with them, so we chose 8-DPSK as a typical representative to appear on the report. Another we will show all the modes on the RF output power test item

Note ³: Only radio communication receivers operating in stand-alone mode within the band 30-960 MHz, as well as scanner receivers, are subject to Industry Canada requirements, so this test is not applicable.

Note ⁴: Only the frequency between 18 GHz-40 GHz is reflected in this report, so only the Conducted Spurious Emission and Radiated Spurious Emission is tested in this report.

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

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

Relative Humidity	45% - 55%
Atmospheric Pressure	100 kPa - 102 kPa
Temperature	NT (Normal Temperature)
Working Voltage of the EUT	NV (Normal Voltage)
	120 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Software /Firmware Version	Cal. Date	Cal. Due
Wireless Communications Test Set	R&S	CMW 500	142028	V3.2.73	2017.06.12	2018.06.11
Power Splitter	KMW	DCPD-LDC	1305003215	N/A	N/A	N/A
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	N/A	N/A	N/A
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	N/A	N/A	N/A
Spectrum Analyzer	R&S	FSV-40	101544	2.30.SP4	2017.06.12	2018.06.11
DC Power Supply	R&S	IT6863A	6000140106 87210020	N/A	2017.06.12	2018.06.11
Temperature Chamber	AHK	SP20	1412	N/A	2017.07.12	2018.07.11
Test Antenna-Horn (18-40 GHz)	A-INFO	LB-180400KF	J211060273	N/A	2017.01.06	2018.01.05
Anechoic Chamber	EMC Electronic Co., Ltd	20.10m*11.60m*7.35m	N/A	N/A	2016.08.09	2018.08.08
Shielded Enclosure	ChangNing	CN-130701	130703	N/A	N/A	N/A
Test Software	BALUN	BL410_E	N/A	V16.921	N/A	N/A

4.3 Measurement Uncertainty

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

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

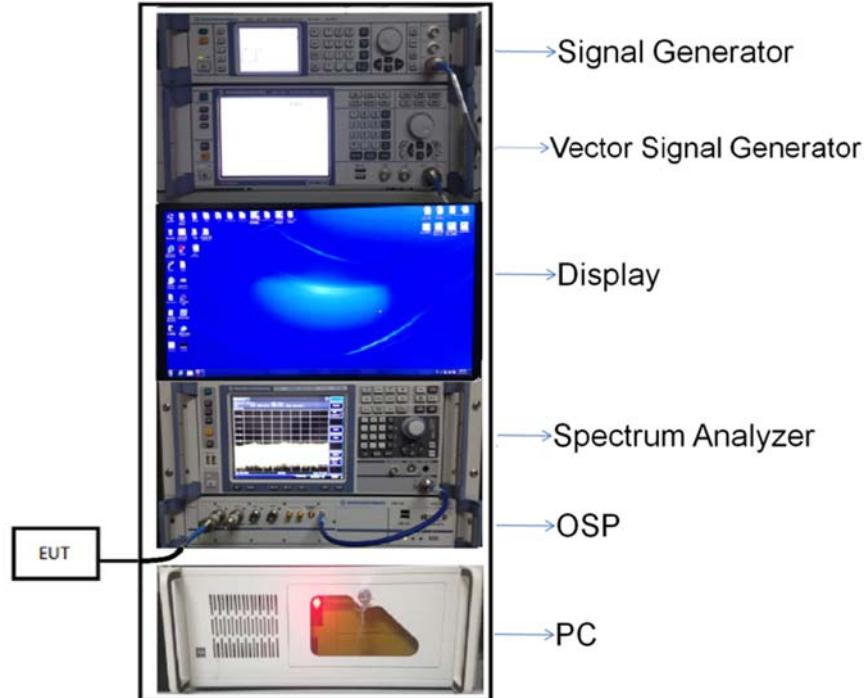
Measurement	Value
Occupied Channel Bandwidth	$\pm 4\%$
RF output power, conducted	± 1.4 dB
Power Spectral Density, conducted	± 2.5 dB
Unwanted Emissions, conducted	± 2.8 dB
All emissions, radiated	± 5.4 dB
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 4\%$

4.4 Description of Test Setup

4.4.1 For Antenna Port Test

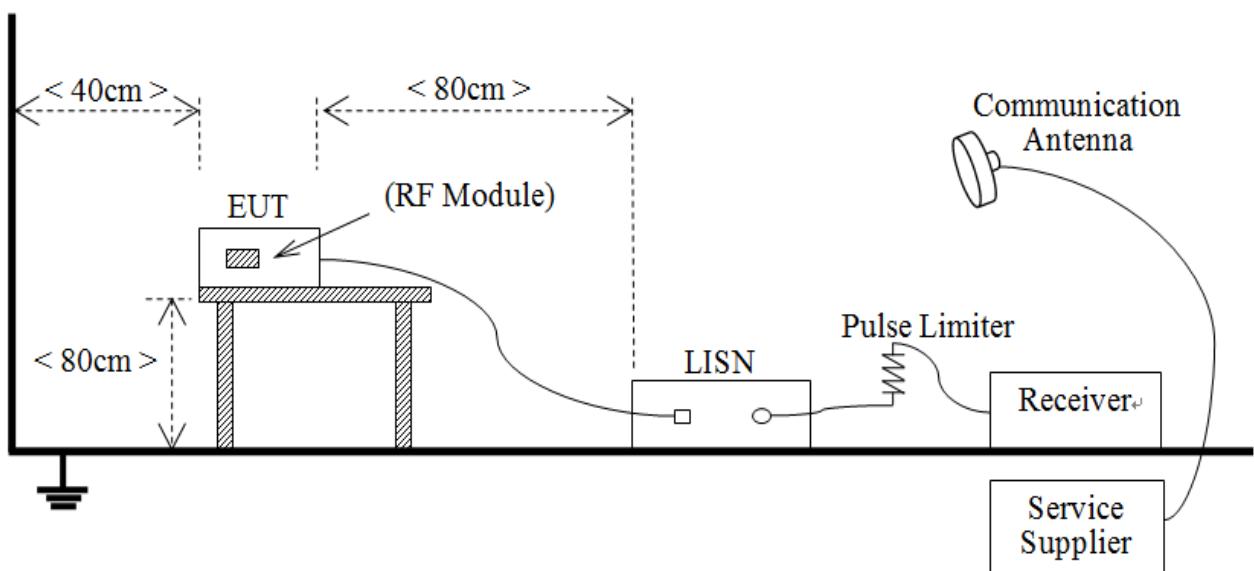
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:
Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



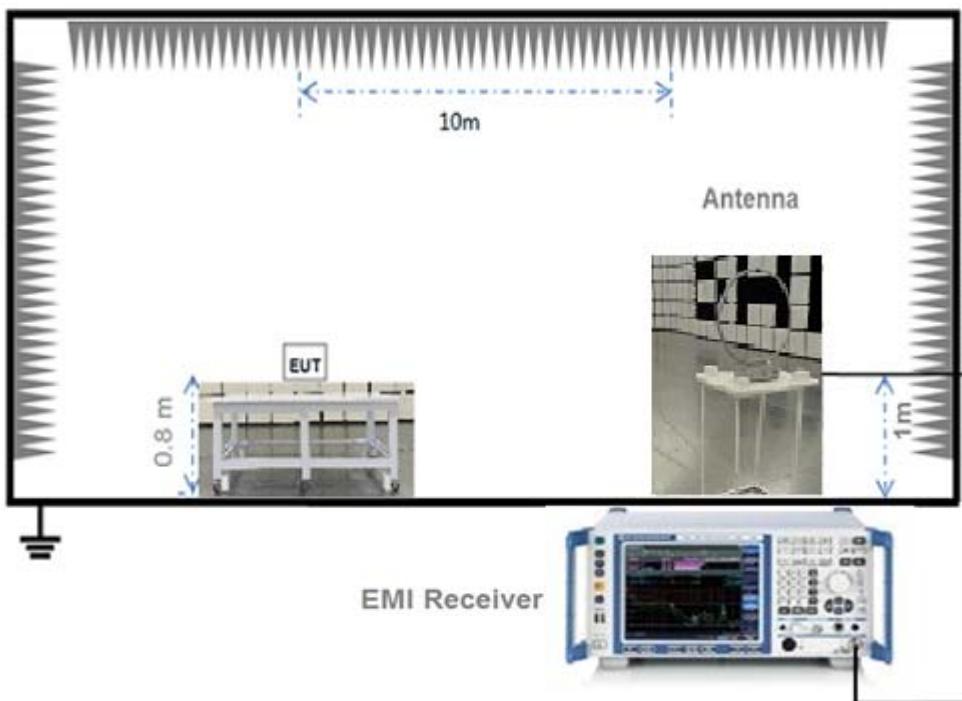
(Diagram 1)

4.4.2 For AC Power Supply Port Test



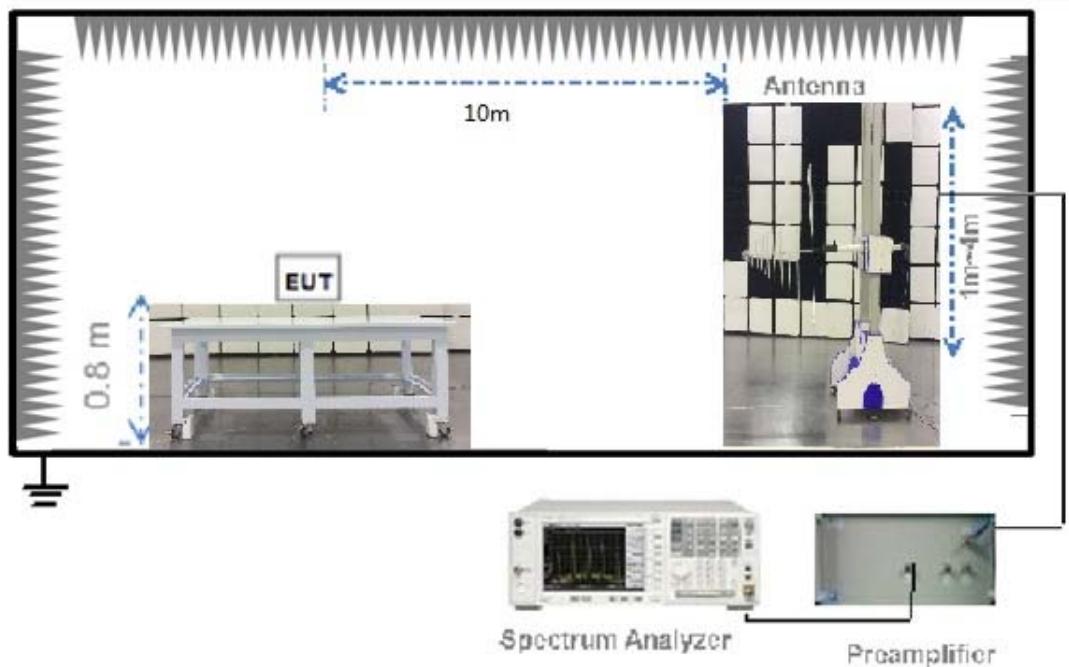
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



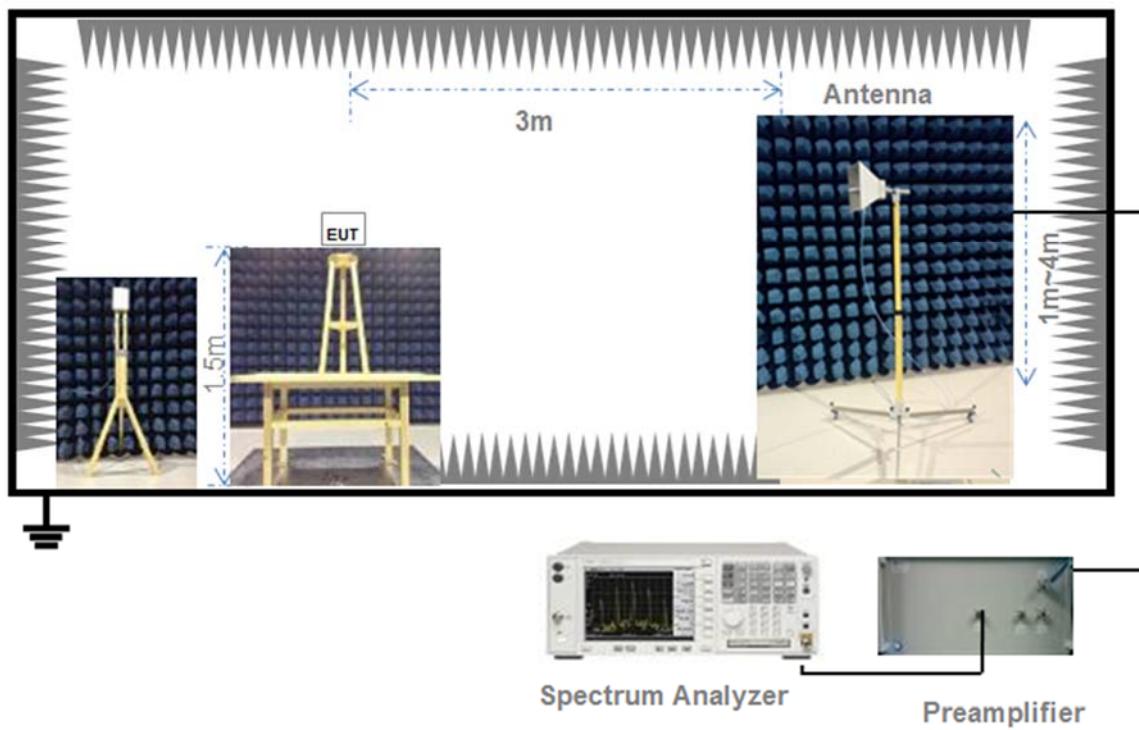
(Diagram 3)

4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.5 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

4.5.2 For radiated band edges and spurious emission test:

Per part 15.35(c), the EUT Bluetooth average emission level could be determined by the peak emission level applying duty cycle correction factor, to represent averaging over the whole pulse train.

The average level is derived from the peak level corrected with "Duty cycle correction factor".

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + Duty cycle correction factor (dB)

Duty cycle correction factor (dB) = $20 * \log (\text{Duty cycle})$.

Duty cycle = on time / 100 milliseconds

On time = dwell time * hopping number in 100 ms

For example: bluetooth with dwell time 2.9 ms and 3 hops in 100 ms, then

Duty cycle correction factor (dB) = $20 * \log ((2.9 * 3) / 100) = -21.21$ dB

Following shows an average computation example with duty cycle correction factor = -21.21 dB, and the peak emission level is 45.61 dBuV/m.

Example:

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + duty cycle correction factor (dB)

= 45.61 + (-21.21) = 24.4 (dBuV/m)

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247, 5.4 (6)

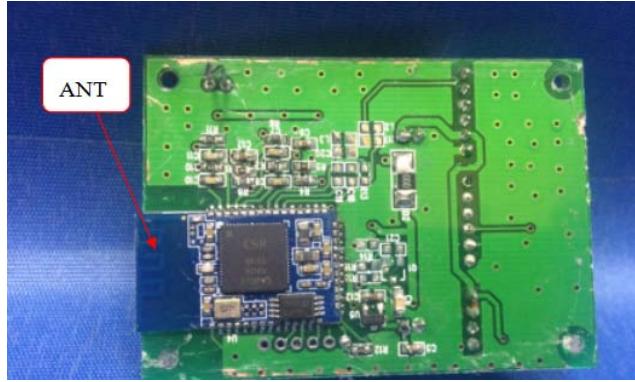
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	The antenna is welded on the mainboard, can't be replaced by the consumer

Reference Documents	Item
Photo	

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Number of Hopping Frequencies

5.2.1 Limit

FCC §15.247(a) (1) (iii); RSS-247, 5.1 (4)

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

5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 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

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Peak Output Power and E.I.R.P

5.3.1 Test Limit

FCC § 15.247(b)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247, 5.4 (2)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels (see Section 5.4(5) for exceptions).

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

The 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.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Occupied Bandwidth

5.4.1 Limit

FCC §15.247(a); RSS-247, 5.1 (1)

Measurement of the 20dB bandwidth of the modulated signal.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

Use the following spectrum analyzer settings:

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

RBW = in the range of 1% to 5% of the OBW

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Carrier Frequency Separation

5.5.1 Limit

FCC §15.247(a); RSS-247, 5.1 (2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 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.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Time of Occupancy (Dwell time)

5.6.1 Limit

FCC §15.247(a); RSS-247, 5.1 (4)

Frequency hopping systems in the 2400 MHz - 2483.5 MHz 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.

5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The average time of occupancy on any channel within the Period can be calculated with formulas:

For DH1 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 2) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

For DH3 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 4) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

For DH5 package type

$$\begin{aligned}\{\text{Total of Dwell}\} &= \{\text{Pulse Time}\} * (1600 / 6) / \{\text{Number of Hopping Frequency}\} * \{\text{Period}\} \\ \{\text{Period}\} &= 0.4 \text{ s} * \{\text{Number of Hopping Frequency}\}\end{aligned}$$

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.

5.6.4 Test Result

Please refer to ANNEX A.5

5.7 Conducted Spurious Emission & Authorized-band band-edge

5.7.1 Limit

FCC §15.247(d); RSS-247, 5.5

In any 100 kHz 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 20 dB below that in the 100 kHz 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 Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency blocks a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

1. The EUT is coupled to the system simulator and spectrum analyzer; the RF load attached to EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.
2. CMW500 was used to establish communication with the EUT, Its parameters were set to force the EUT transmitting at maximum output power.
3. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
4. Spurious emissions were tested with 0.001MHz RBW for frequency less than 150kHz, 0.01MHz RBW for frequency less than 30MHz, 0.1MHz RBW for frequency less than 1GHz, and 1MHz RBW for frequency above 1GHz. And sweep point number were at least 401, referring to following formula.

Sweep point number = Span/RBW

RBW=3RBW

Detector Mode=mean or average power

5. Record the frequencies and levels of spurious emissions.

Note: Reference test setup 4.4.1 (Diagram 1).

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Conducted Emission

5.8.1 Limit

FCC §15.207; RSS-GEN, 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 150 kHz to 30 MHz 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
0.50 - 30	60	50

5.8.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

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.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Radiated Spurious Emission

5.9.1 Limit

FCC §15.209&15.247(d); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

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

Frequency (MHz)	Field Strength (μ V/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. Field Strength ($\text{dB}\mu\text{V/m}$) = $20\log[\text{Field Strength } (\mu\text{V/m})]$.
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, 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.
4. For above 1000 MHz, limit field strength of harmonics: 54dB μ V/m@3m (AV) and 74dB μ V/m@3m (PK).

5.9.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.9.4 Test Result

Please refer to ANNEX A.8.

5.10 Band Edge (Restricted-band band-edge)

5.10.1 Limit

FCC §15.209&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).

5.10.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

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

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.10.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

A.1 Number of Hopping Frequency

Note: Not applicable.

A.2 Peak Output Power and E.I.R.P

Note: Not applicable.

A.3 20 dB and 99% bandwidth

Note: Not applicable.

A.4 Hopping Frequency Separation

Note: Not applicable.

A.5 Average Time of Occupancy

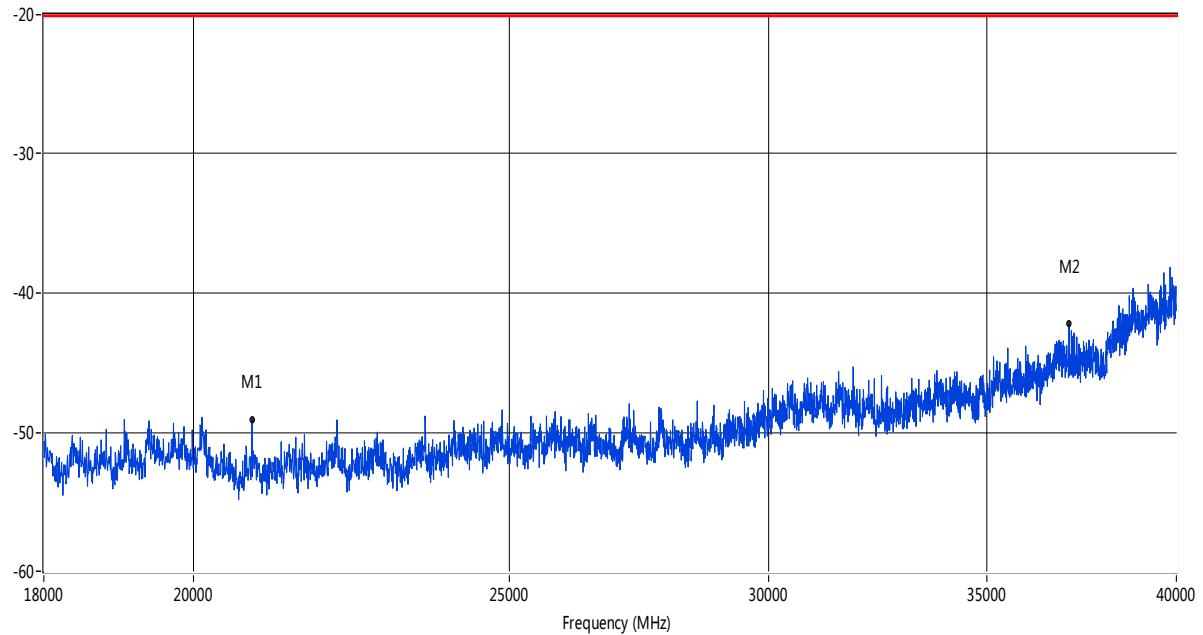
Note: Not applicable.

A.6 Conducted Spurious Emissions & Authorized-band band-edge

Test Data and Plots (18 GHz ~ 40 GHz)

GFSK Low Channel 18 GHz to 40 GHz

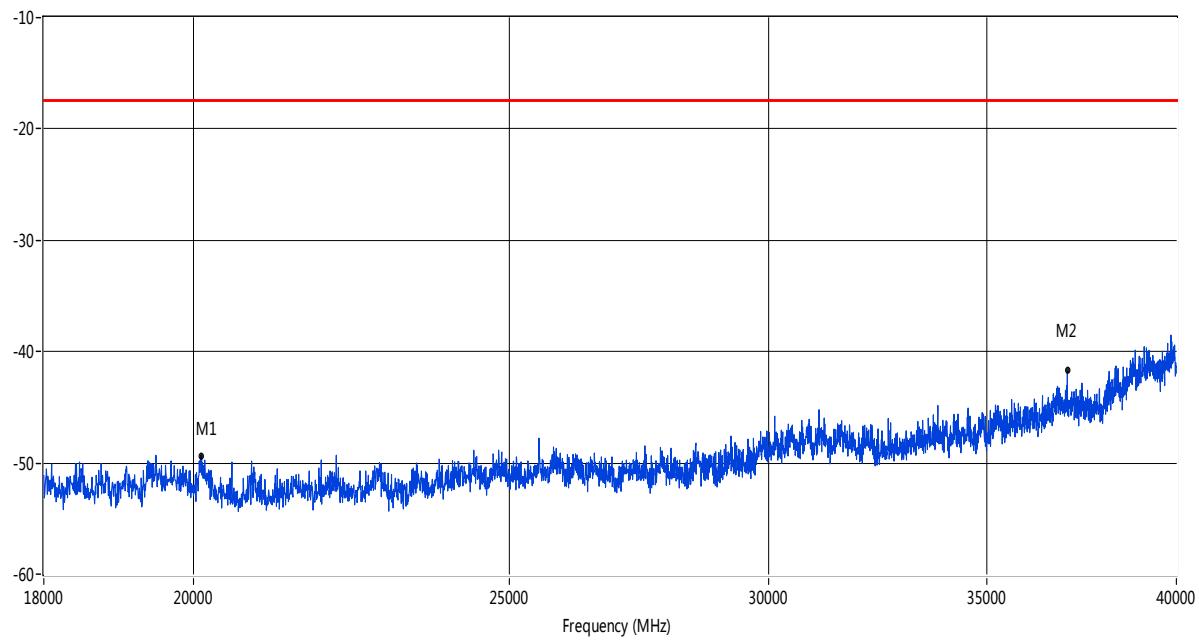
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	20843.500	-49.11	10.53	-20.1	29.01	Peak	Pass
2	37079.499	-42.22	14.32	-20.1	22.12	Peak	Pass

GFSK Middle Channel 18 GHz to 40 GHz

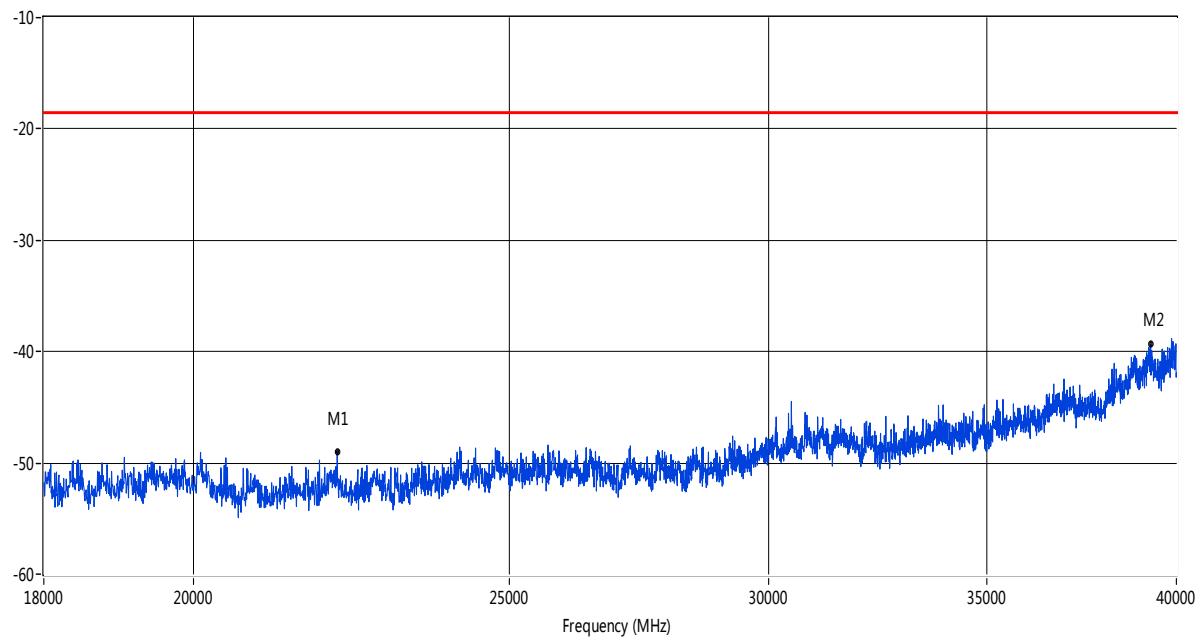
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	20117.500	-49.38	10.36	-17.4	31.98	Peak	Pass
2	37041.000	-41.72	14.31	-17.4	24.32	Peak	Pass

GFSK High Channel 18 GHz to 40 GHz

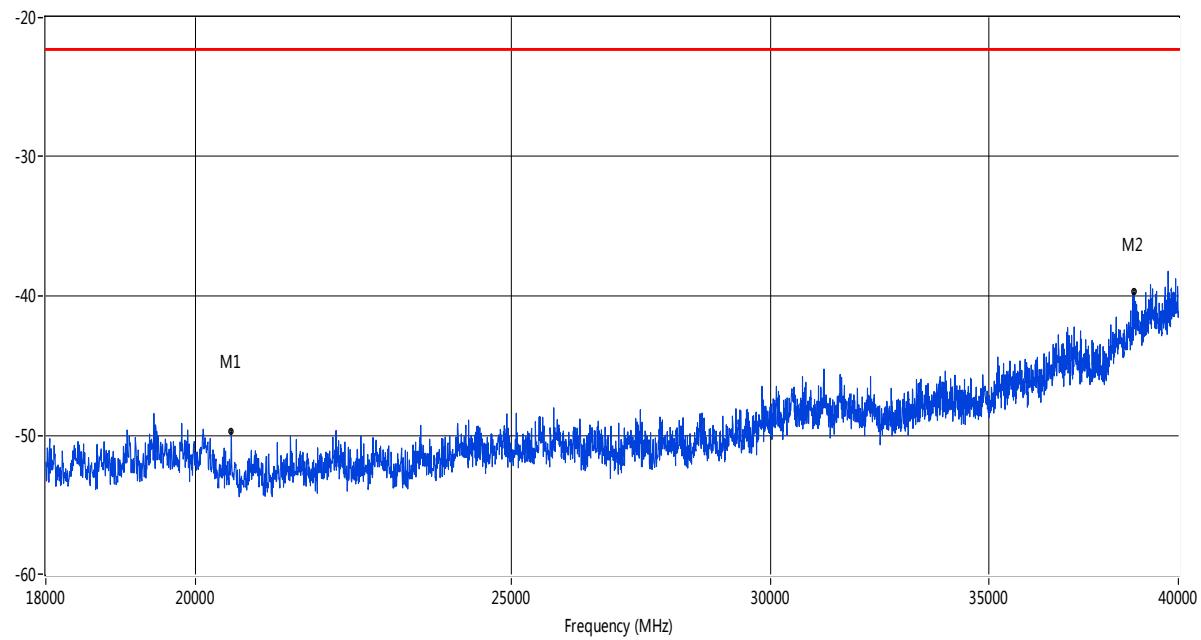
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	22136.001	-48.97	10.83	-18.5	30.47	Peak	Pass
2	39279.501	-39.34	14.83	-18.5	20.84	Peak	Pass

Π/4-DQPSK Low Channel 18 GHz to 40 GHz

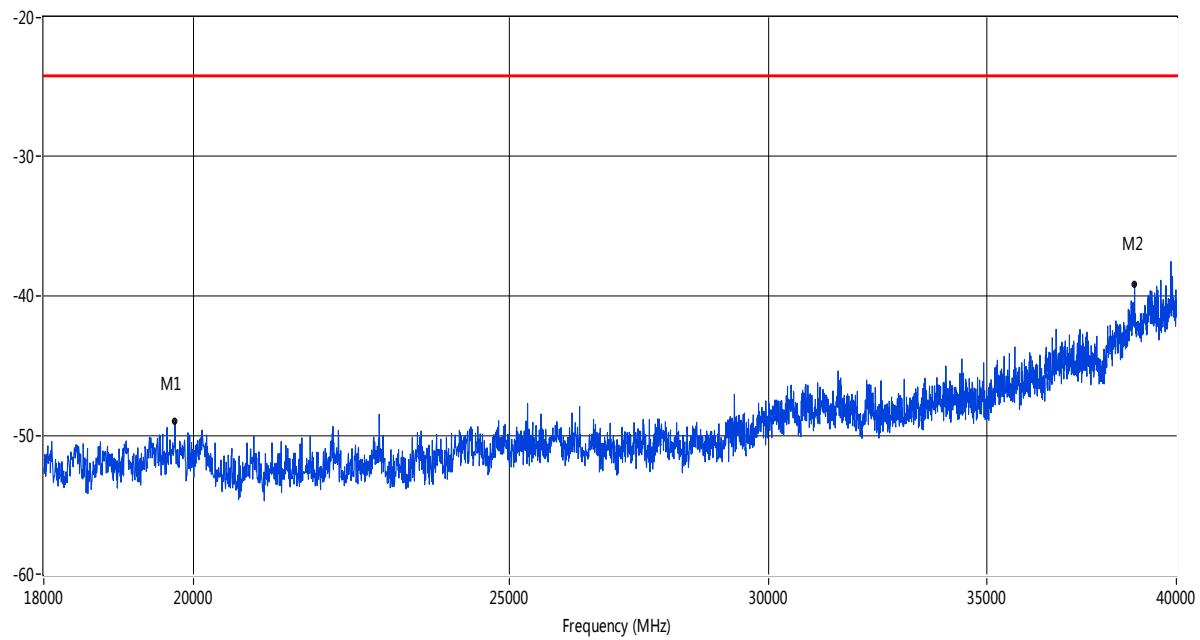
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	20513.499	-49.76	10.45	-22.3	27.46	Pass	Pass
2	38762.500	-39.73	14.71	-22.3	17.43	Pass	Pass

Π/4-DQPSK Middle Channel 18 GHz to 40 GHz

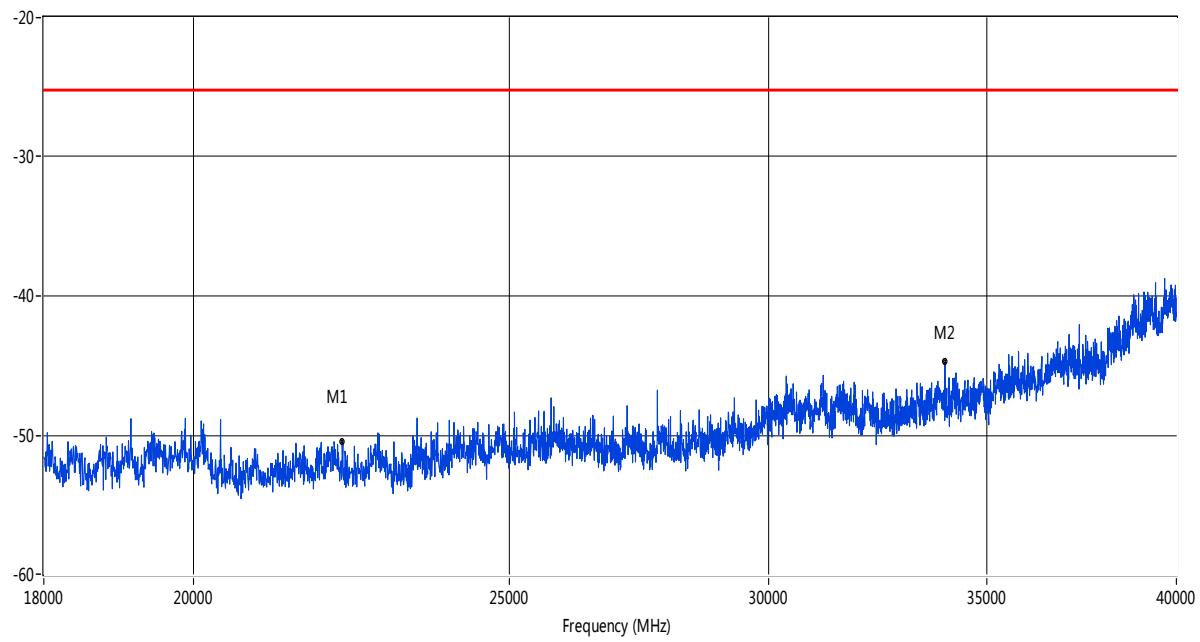
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	19743.500	-49.05	10.27	-24.2	24.85	Peak	Pass
2	38839.501	-39.12	14.73	-24.2	14.92	Peak	Pass

Π/4-DQPSK High Channel 18 GHz to 40 GHz

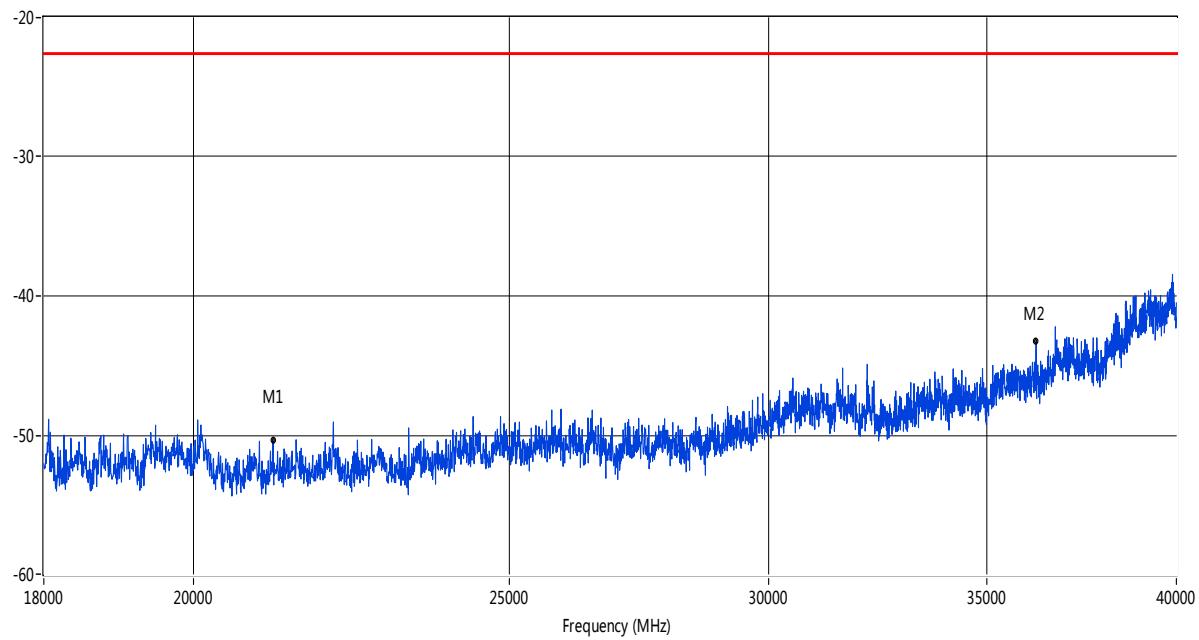
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	22212.999	-50.47	10.85	-25.2	25.27	Peak	Pass
2	33977.500	-44.75	13.59	-25.2	19.55	Peak	Pass

8-DPSK Low Channel 18 GHz to 40 GHz

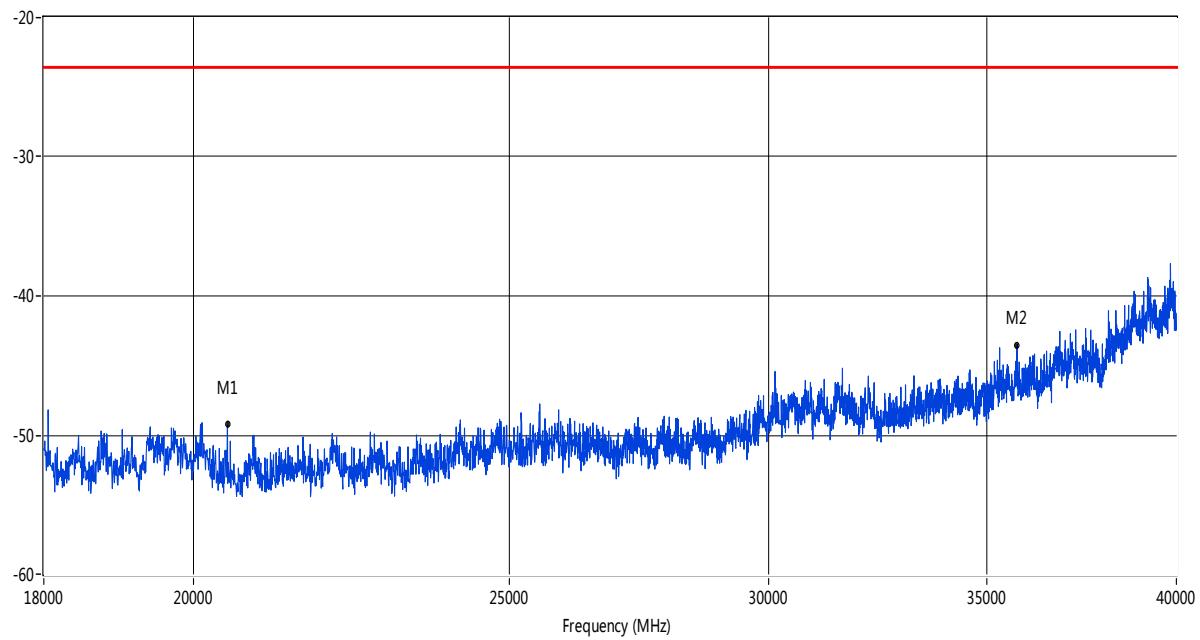
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	21156.999	-50.41	10.60	-22.6	27.81	Peak	Pass
2	36232.499	-43.28	14.12	-22.6	20.68	Peak	Pass

8-DPSK Middle Channel 18 GHz to 40 GHz

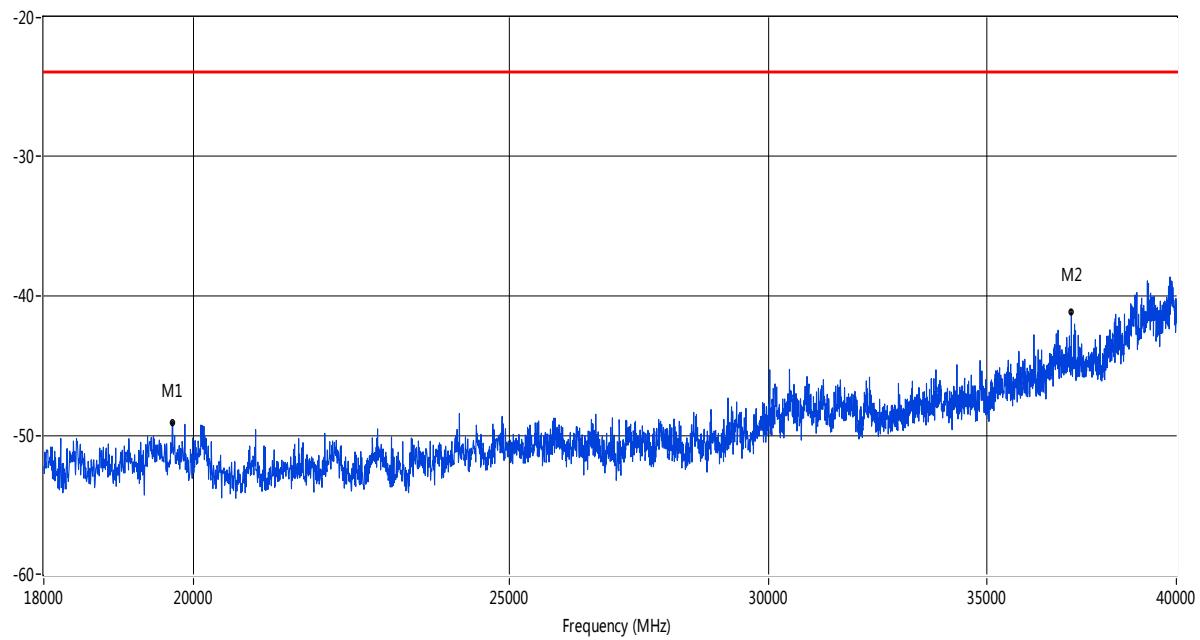
CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	20486.001	-49.23	10.45	-23.6	25.63	Peak	Pass
2	35748.499	-43.54	14.01	-23.6	19.94	Peak	Pass

8-DPSK High Channel 18 GHz to 40 GHz

CSE Test case_FCC CSE 18-40GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Verdict
1	19710.501	-49.10	10.27	-23.9	25.20	Peak	Pass
2	37145.502	-41.18	14.33	-23.9	17.28	Peak	Pass

A.7 Conducted Emissions

Note: Not applicable.

A.8 Radiated Spurious Emission

Test Data and Plots

Note ¹: The symbol of “--” in the table which means not application.

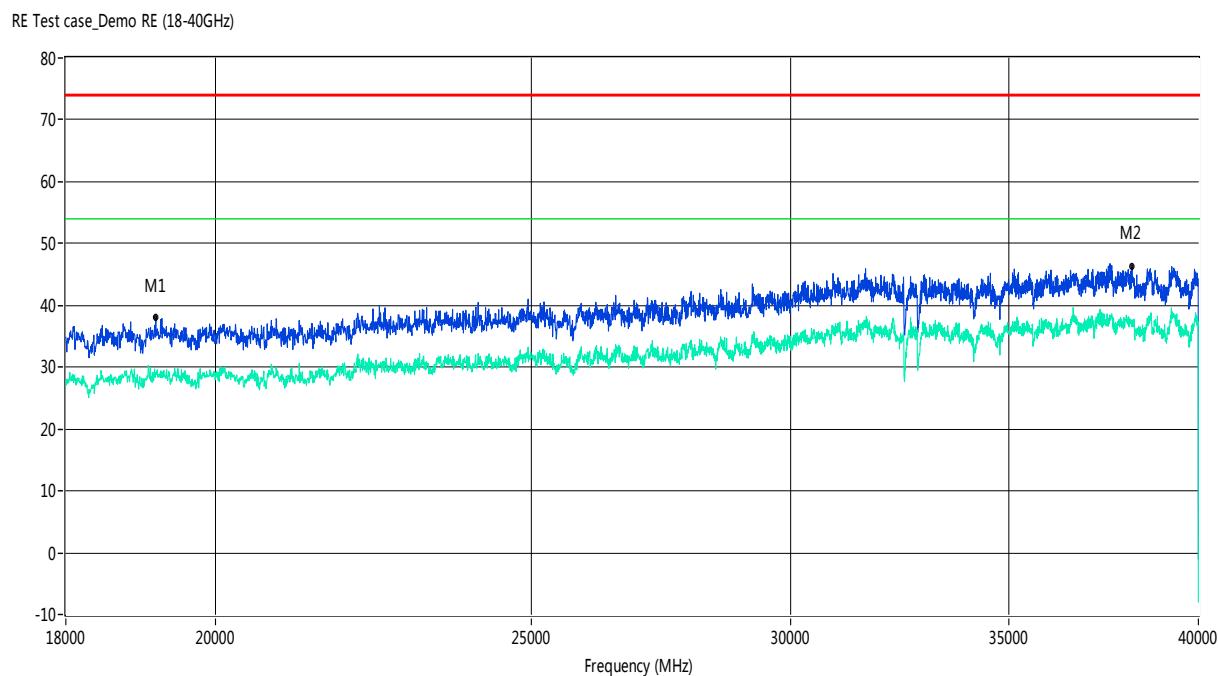
Note ²: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Test Data and Plots (18 GHz ~ 40 GHz)

Note 1: All spurious emissions are tested both vertically and horizontally and only the worst orientation are recorded in this test report.

Note 2: All channel are tested, but only the worst configuration (High) test date are recorded in this test report.

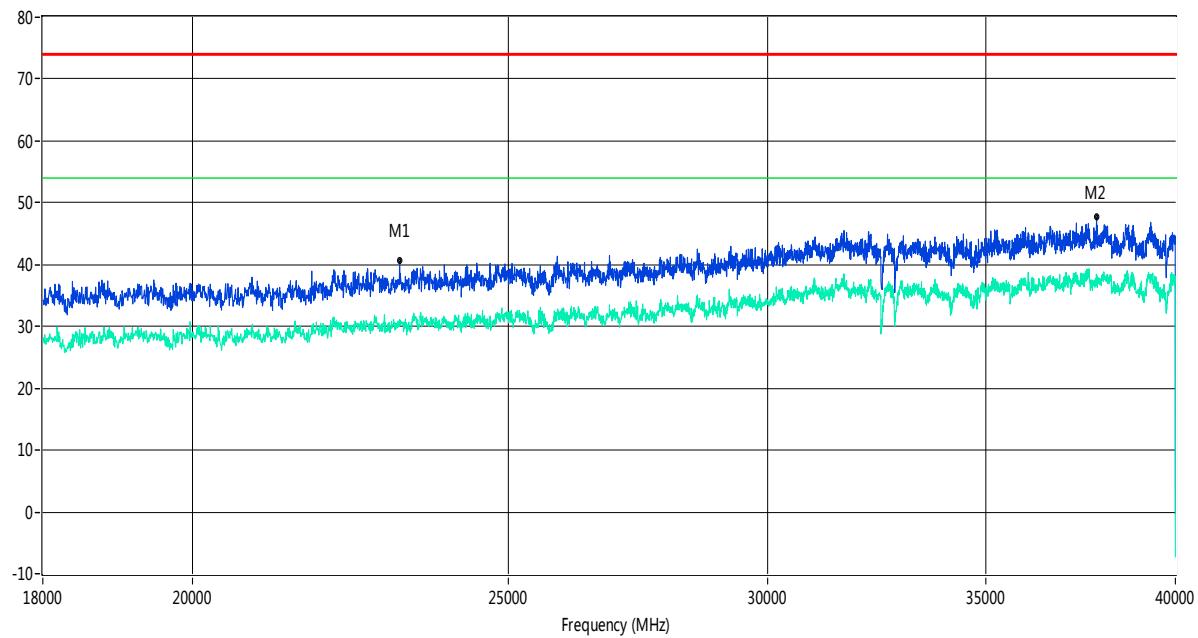
GFSK 18 GHz to 40 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1**	19177.001	29.1	19.44	54.0	24.90	AV	12.00	100	Horizontal	Pass
1	19177.001	38.17	19.44	74.0	35.83	Peak	12.00	100	Horizontal	Pass
2**	38168.498	37.6	24.93	54.0	16.40	AV	15.00	100	Horizontal	Pass
2	38168.498	46.34	24.93	74.0	27.66	Peak	15.00	100	Horizontal	Pass

Π/4-DQPSK 18 GHz to 40 GHz

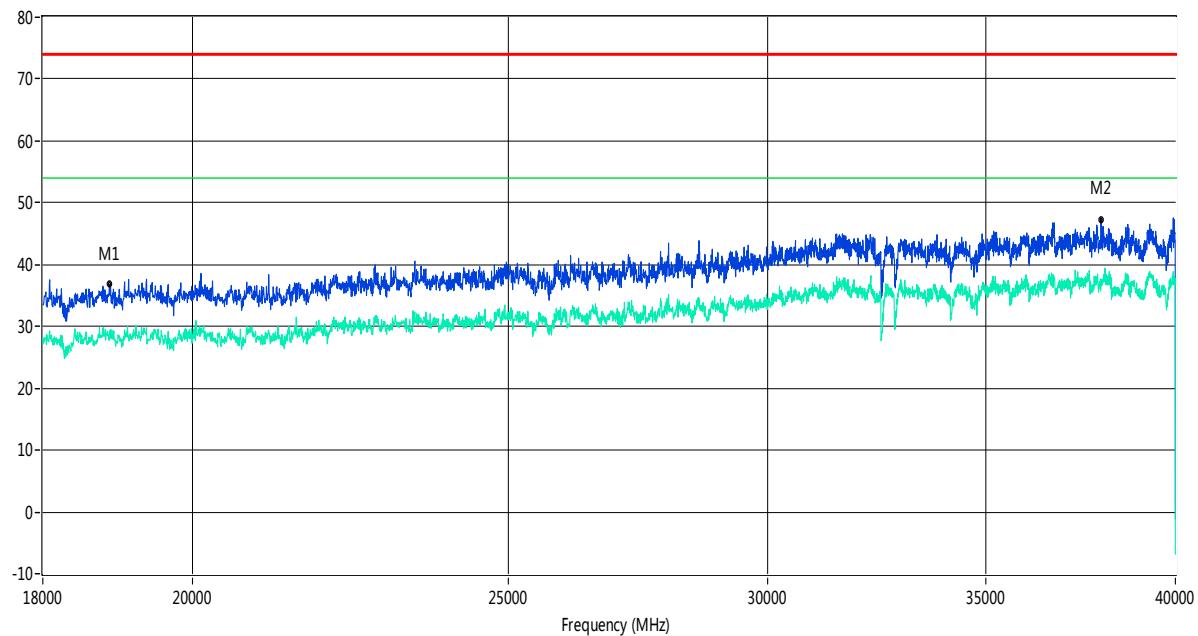
RE Test case_Demo RE (18-40GHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1**	23147.999	31.1	20.19	54.0	22.90	AV	14.00	100	Horizontal	Pass
1	23147.999	40.58	20.19	74.0	33.42	Peak	14.00	100	Horizontal	Pass
2**	37838.500	38.3	24.84	54.0	15.70	AV	2.00	100	Horizontal	Pass
2	37838.500	47.69	24.84	74.0	26.31	Peak	2.00	100	Horizontal	Pass

8-DPSK 18 GHz to 40 GHz

RE Test case_Demo RE (18-40GHz)



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1**	18863.499	29.3	19.23	54.0	24.70	AV	0.00	100	Horizontal	Pass
1	18863.499	36.80	19.23	74.0	37.20	Peak	0.00	100	Horizontal	Pass
2**	37959.500	37.2	24.68	54.0	16.80	AV	0.00	100	Horizontal	Pass
2	37959.500	47.36	24.68	74.0	26.64	Peak	0.00	100	Horizontal	Pass

A.9 Band Edge (Restricted-band band-edge)

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document "BL-SZ17A0338-AR.PDF".

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document "BL- SZ17A0338-AW.PDF".

ANNEX D EUT INTERNAL PHOTOS

Please refer the document "BL- SZ17A0338-AI.PDF".

--END OF REPORT--