# FCC RF TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

## WIRELESS SPEAKER

ISSUED TO
SHENZHEN G-KINDLY ELECTRONIC CO., LTD

4F, No. 8 Fifth Road, Loucun First Industry Zone, GongMing Town, GuangMing New District, Shenzhen, China


Tested by: Hu Chao
Hu Chao
(Engineer)
Date Nov. 14, 2017

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

| | |
|---|---|
| Report No.: | BL-SZ17A0336-601 |
| EUT Name: | WIRELESS SPEAKER |
| Model Name: | KDL-BT1714, BB724, BB725, BB727 |
| Brand Name: | N/A |
| Test Standard: | 47 CFR Part 15 Subpart C |
| FCC ID: | 2ALR9-KDL-BT1714 |
| Test conclusion: | Pass |
| Test Date: | Oct. 17, 2017 ~ Oct. 21, 2017 |
| Date of Issue: | Nov. 14, 2017 |



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**Revision History**

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

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# 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.<br>The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.<br>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.<br>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℃ |
| 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 | SHENZHEN G-KINDLY ELECTRONIC CO., LTD |
| Address | 4F, No. 8 Fifth Road, Loucun First Industry Zone, GongMing Town, GuangMing New District, Shenzhen, China |

## 2.2 Manufacturer Information

| | |
|---|---|
| Manufacturer | SHENZHEN G-KINDLY ELECTRONIC CO., LTD |
| Address | 4F, No. 8 Fifth Road, Loucun First Industry Zone, GongMing Town, GuangMing New District, Shenzhen, China |

## 2.3 Factory Information

| | |
|---|---|
| Factory | N/A |
| Address | N/A |

## 2.4 General Description for Equipment under Test (EUT)

| | |
|---|---|
| EUT Type | WIRELESS SPEAKER |
| Model Name Under Test | KDL-BT1714 |
| Series Model Name | KDL-BT1714, BB724, BB725, BB727 |
| Description of Model name differentiation | Only the color, model names and brand names are different for different market requirement. The model KDL-BT1714 is the tested sample. |
| Hardware Version | V1.1 |
| Software Version | V1.2 |
| Dimensions (Approx.) | N/A |
| Weight (Approx.) | N/A |
| Network and Wireless connectivity | Bluetooth 3.0 BR+EDR |

## 2.5 Ancillary Equipment

| | | |
|---|---|---|
| Ancillary Equipment 1 | Battery 1 | |
| | Brand Name | N/A |
| | Model No. | N/A |
| | Serial No. | N/A |
| | Capacity | 1800 mAh |
| | Rated Voltage | 3.7 V |

## 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, ∏/4-DQPSK, 8-DPSK |
| Product Type | ☒ Mobile<br>☐ Portable<br>☐ Fix Location |
| Transfer Rate | DH5: 1 Mbps<br>2DH5: 2 Mbps<br>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 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) | Channel number | Freq. (MHz) | Channel number | Freq. (MHz) | 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<br>15.247(d) | Hopping Mode, Low/Middle/High | ANNEX A.8 | Pass | Note [2,4] |
| 10 | Band Edge(Restricted-band band-edge) | 15.209<br>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 Π/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) | +22℃ to +25℃ |
| Working Voltage of the EUT | NV (Normal Voltage) | 3.7 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.

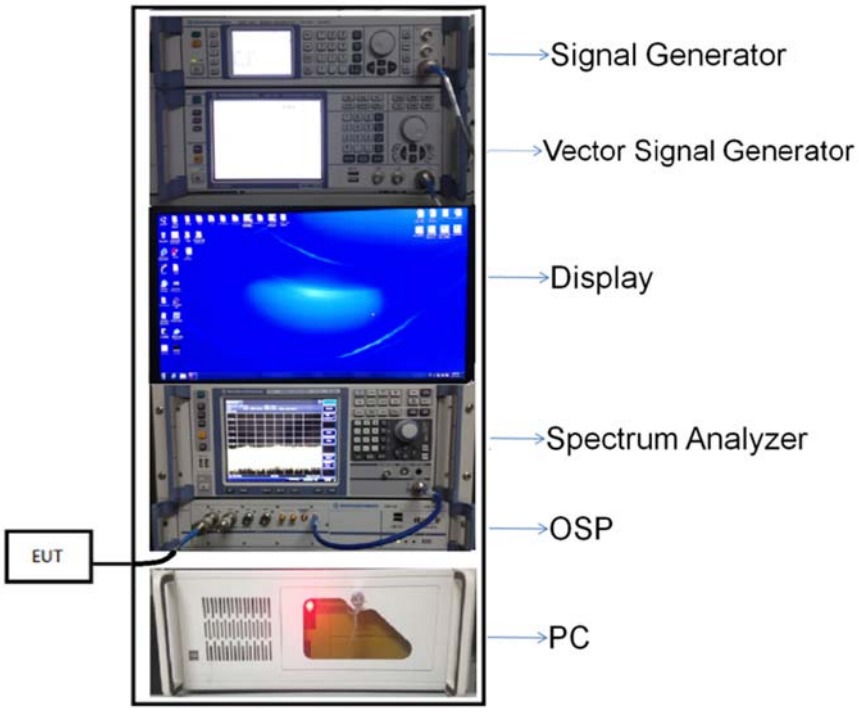
| Measurement | Value |
|---|---|
| Occupied Channel Bandwidth | ±4% |
| RF output power, conducted | ±1.4 dB |
| Power Spectral Density, conducted | ±2.5 dB |
| Unwanted Emissions, conducted | ±2.8 dB |
| All emissions, radiated | ±5.4 dB |
| Temperature | ±1°C |
| Humidity | ±4% |

## 4.4 Description of Test Setup

### 4.4.1 For Antenna Port Test

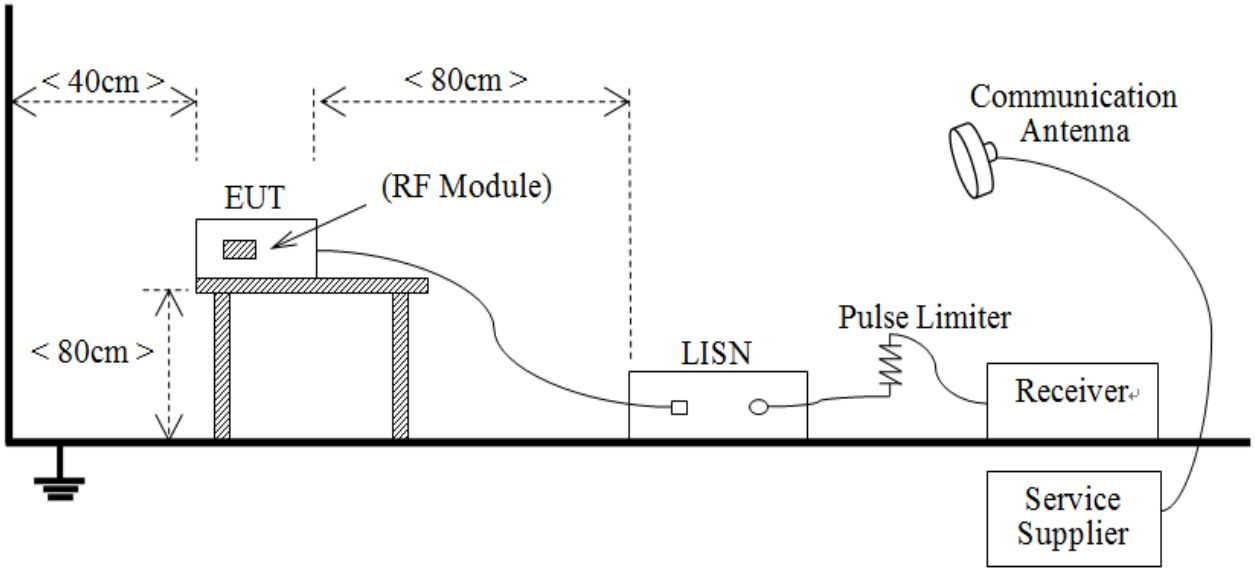
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

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



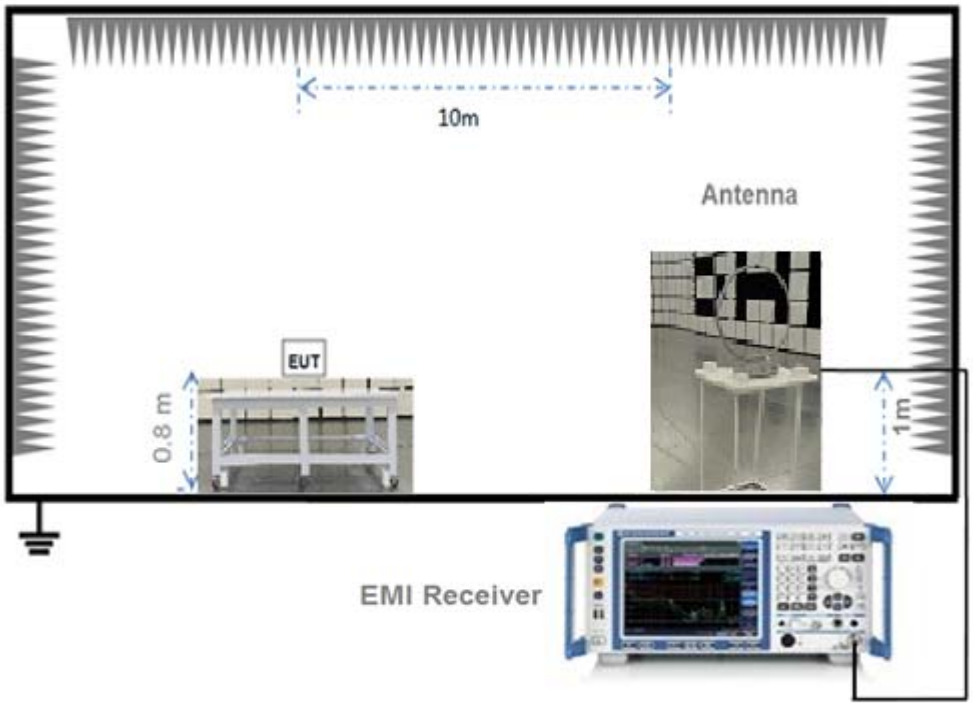

**(Diagram 1)**

4.4.2 For AC Power Supply Port Test



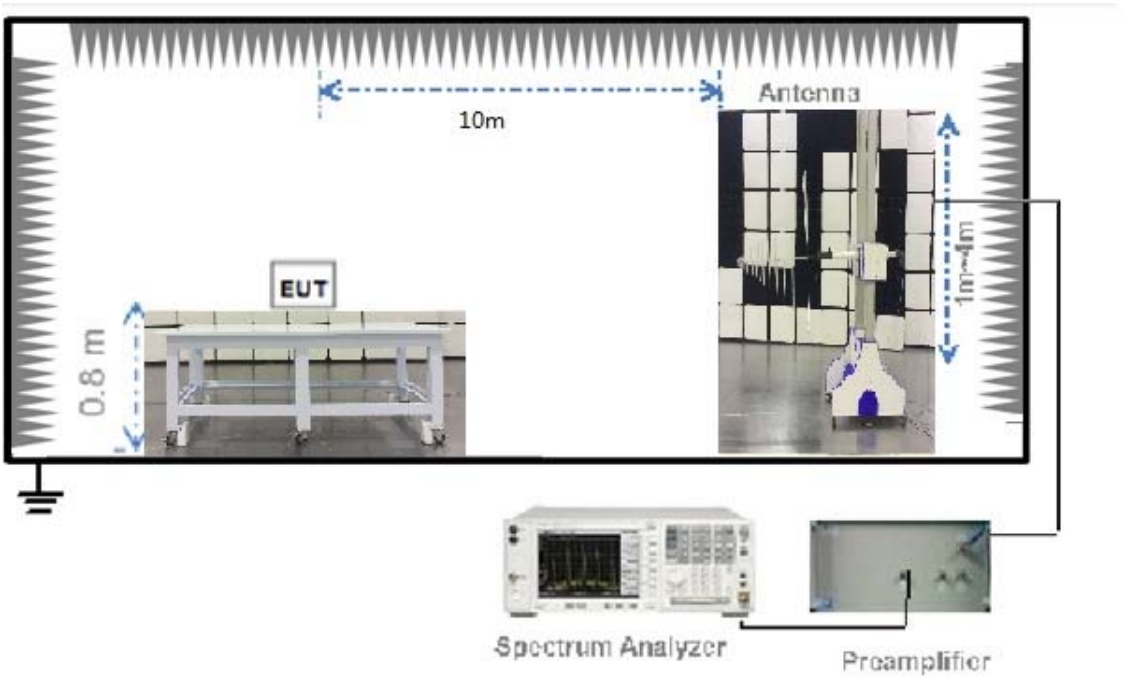

**(Diagram 2)**

4.4.3 For Radiated Test (Below 30 MHz)



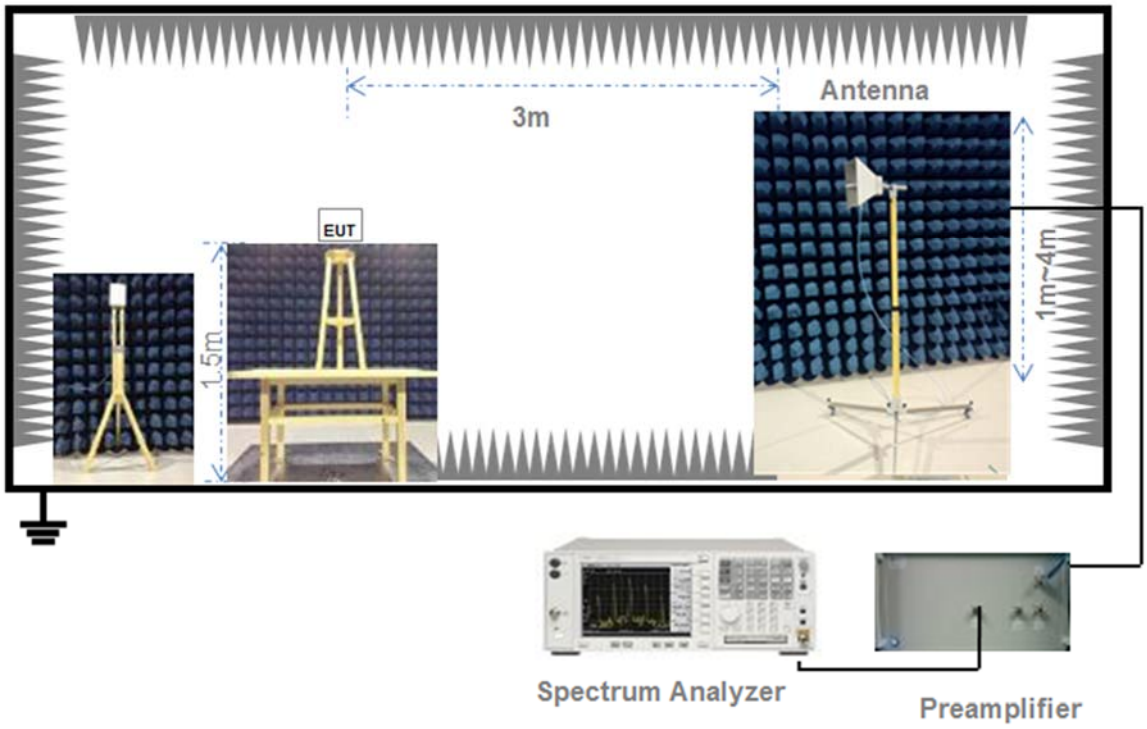

**(Diagram 3)**

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 (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)

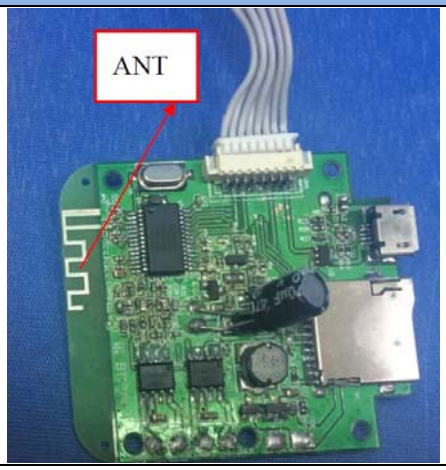
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply 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 ≥ 1% of the span

VBW ≥ 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 ≥ 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 ≥ 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) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

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

### 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

{Total of Dwell} = {Pulse Time} * (1600 / 2) / {Number of Hopping Frequency} * {Period}

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

For DH3 package type

{Total of Dwell} = {Pulse Time} * (1600 / 4) / {Number of Hopping Frequency} * {Period}

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

For DH5 package type

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

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

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

### 5.6.4 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

VBW=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 50μH/50Ω line impedance stabilization network (LISN).

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

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

Note:

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/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: 54dBuV/m@3m (AV) and 74dBuV/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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ 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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ 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.

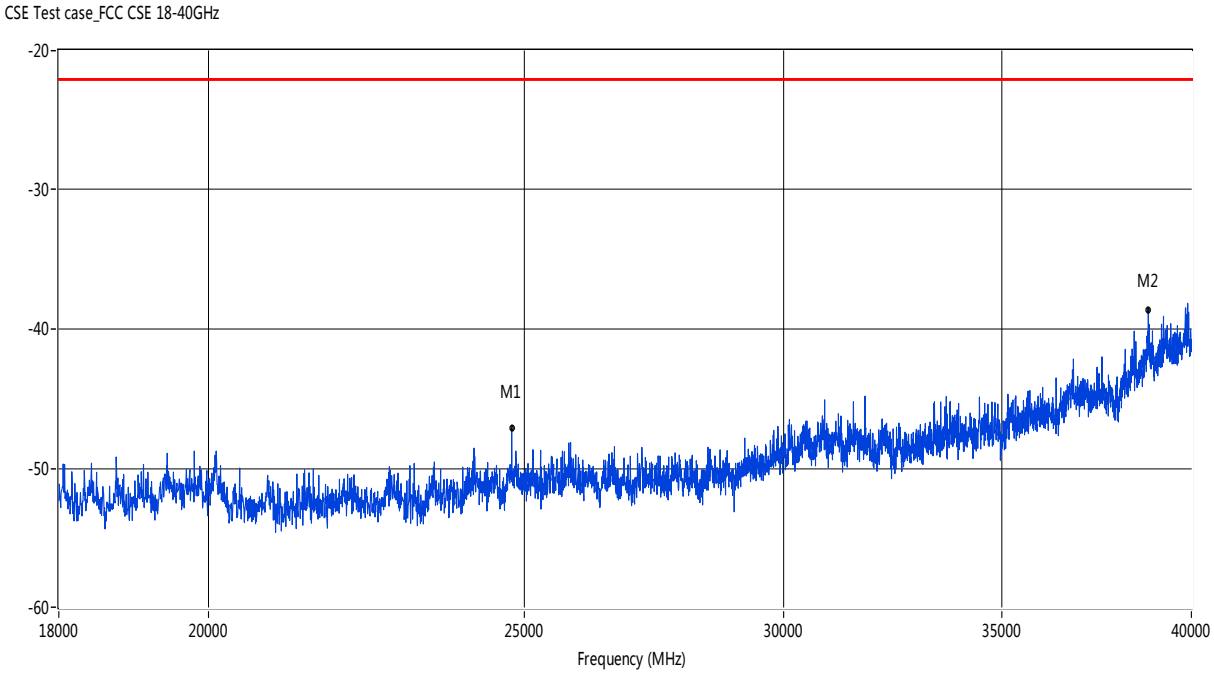
## A.5 Average Time of Occupancy

Note: Not applicable.

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

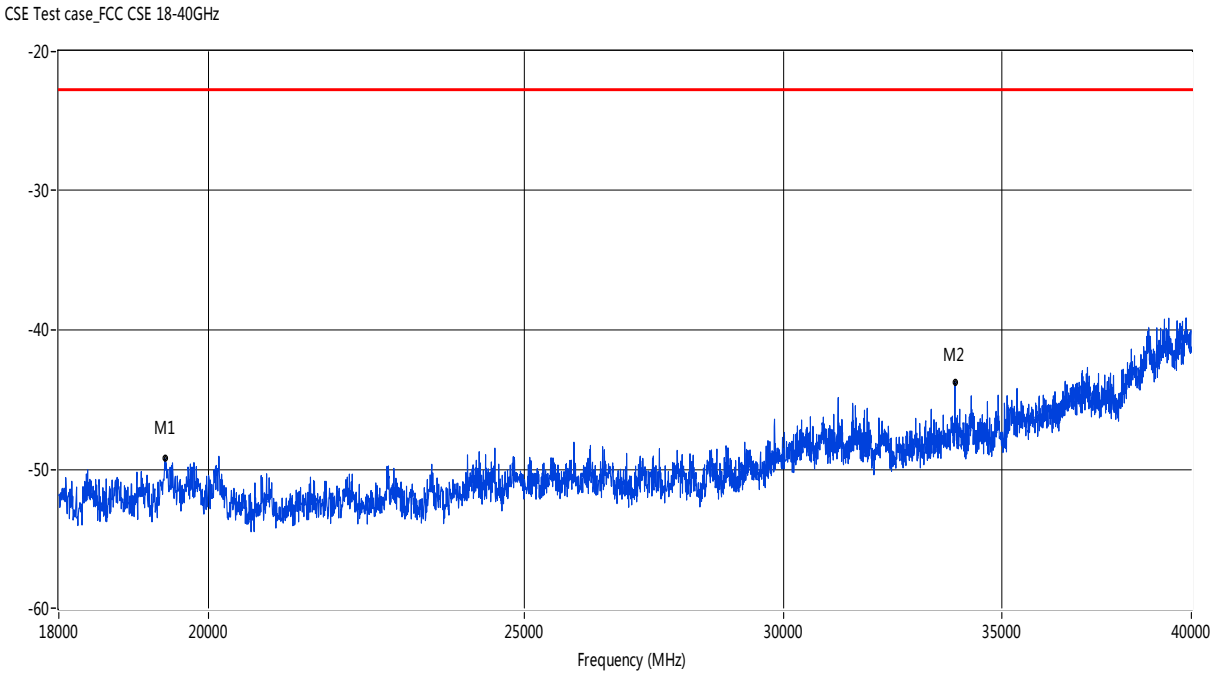
Test Data and Plots (18 GHz ~ 40 GHz)

GFSK Low Channel 18 GHz to 40 GHz



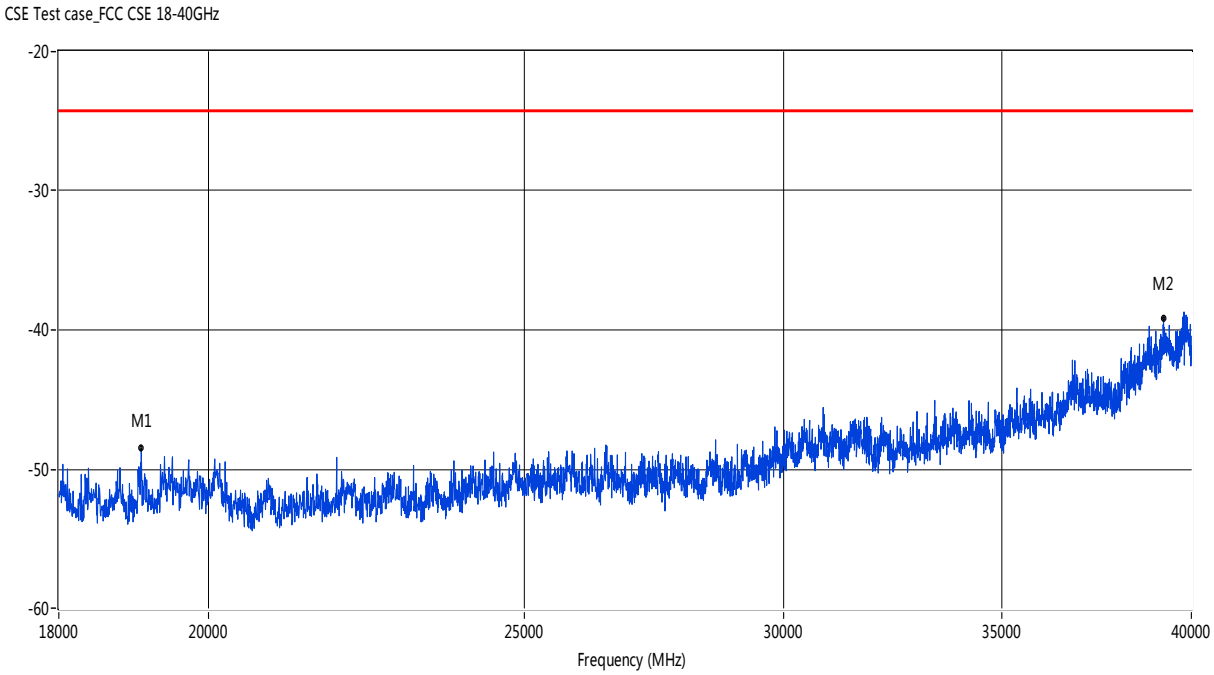

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 24770.501 | -47.14 | 11.45 | -22.1 | 25.04 | Peak | Pass |
| 2 | 38806.499 | -38.60 | 14.72 | -22.1 | 16.50 | Peak | Pass |

## GFSK Middle Channel 18 GHz to 40 GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 19396.999 | -49.25 | 10.19 | -22.7 | 26.55 | Peak | Pass |
| 2 | 33856.500 | -43.73 | 13.57 | -22.7 | 21.03 | Peak | Pass |

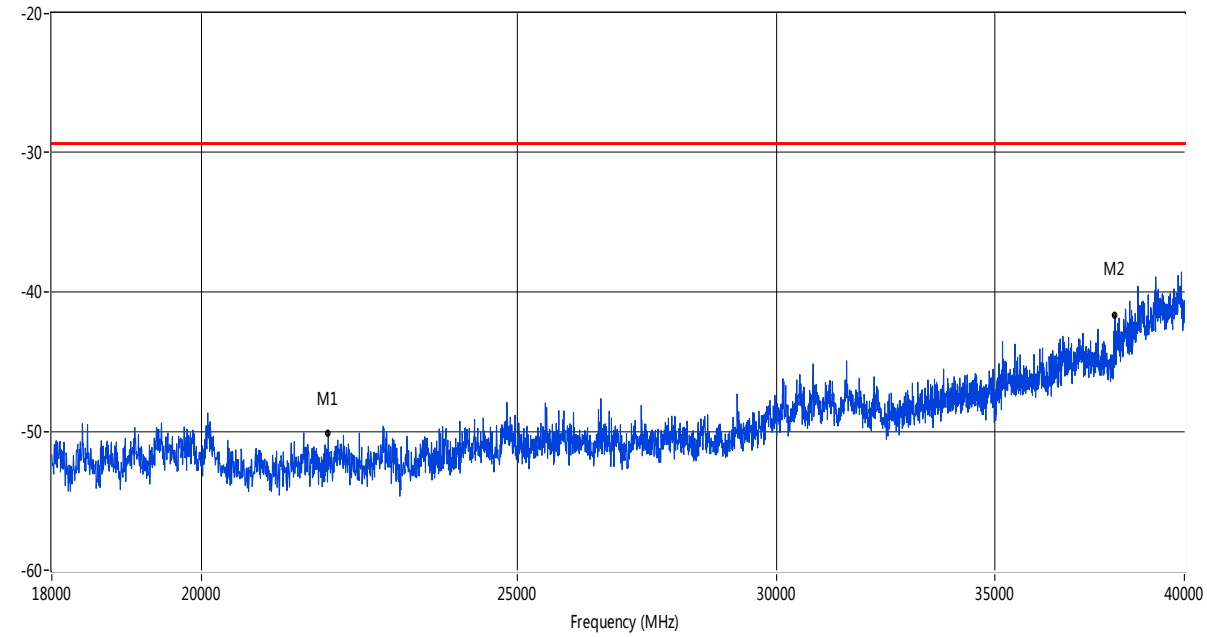
GFSK High Channel 18 GHz to 40 GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 19078.001 | -48.51 | 10.12 | -24.2 | 24.31 | Peak | Pass |
| 2 | 39224.500 | -39.13 | 14.82 | -24.2 | 14.93 | Peak | Pass |

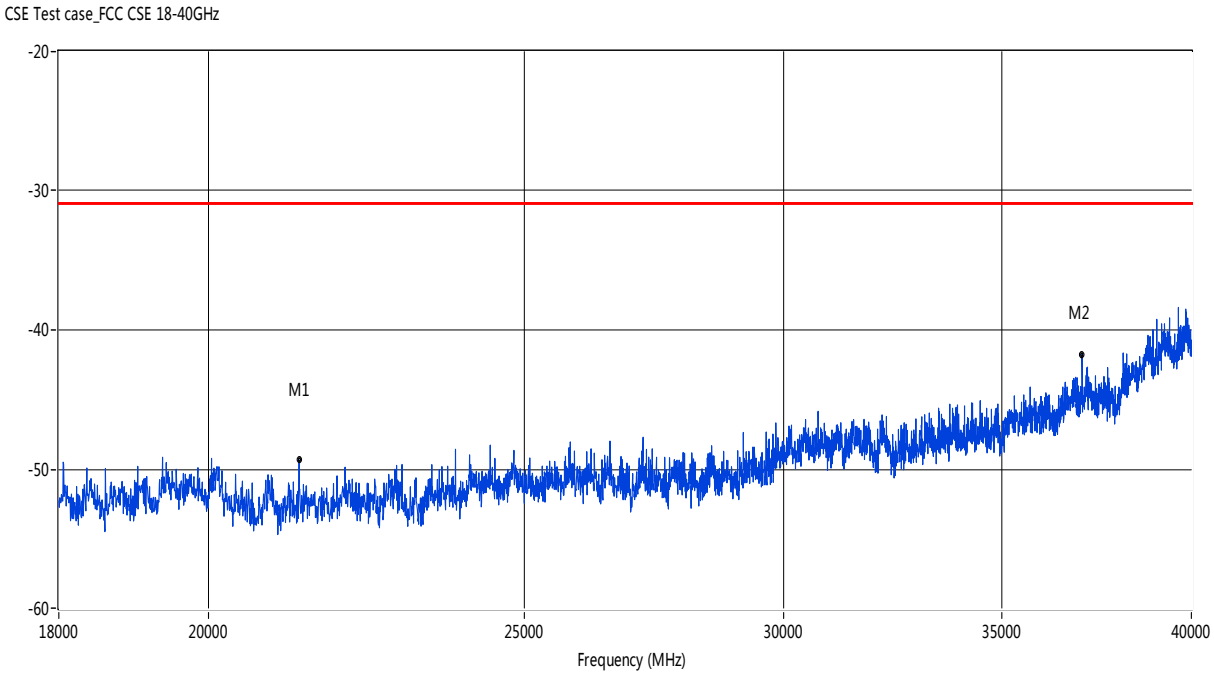
## Π/4-DQPSK Low Channel 18 GHz to 40 GHz

CSE Test case_FCC CSE 18-40GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 21872.001 | -50.13 | 10.77 | -29.3 | 20.83 | Peak | Pass |
| 2 | 38091.502 | -41.68 | 14.55 | -29.3 | 12.38 | Peak | Pass |

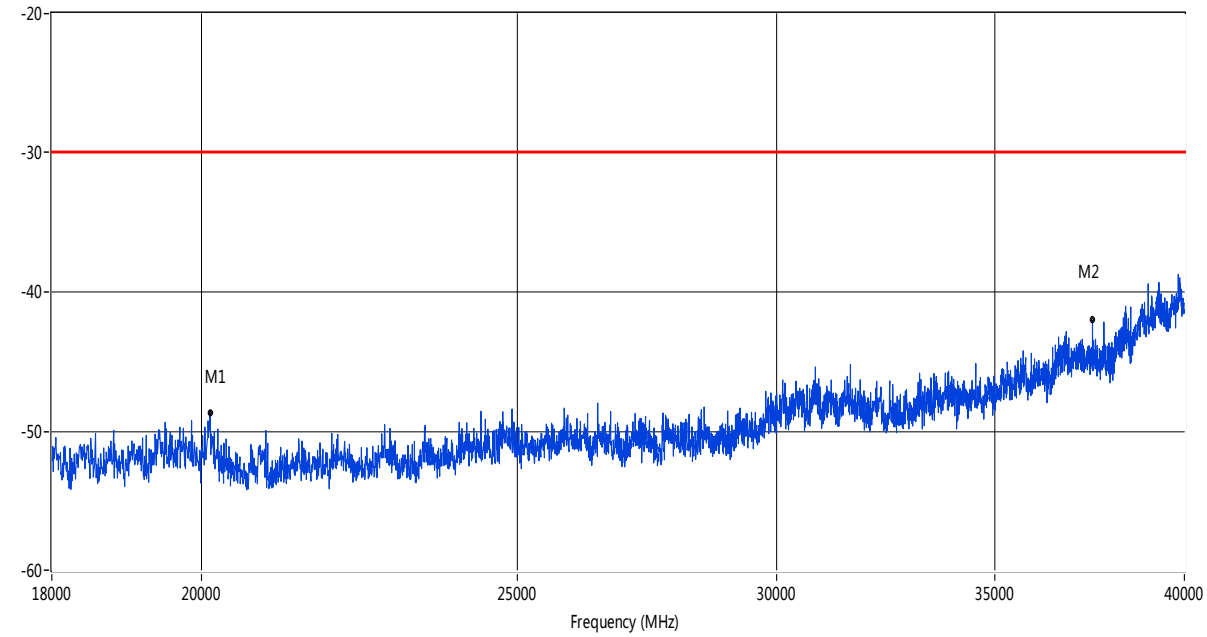
## Π/4-DQPSK Middle Channel 18 GHz to 40 GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 21322.000 | -49.34 | 10.64 | -30.9 | 18.44 | Peak | Pass |
| 2 | 37035.500 | -41.73 | 14.31 | -30.9 | 10.83 | Peak | Pass |

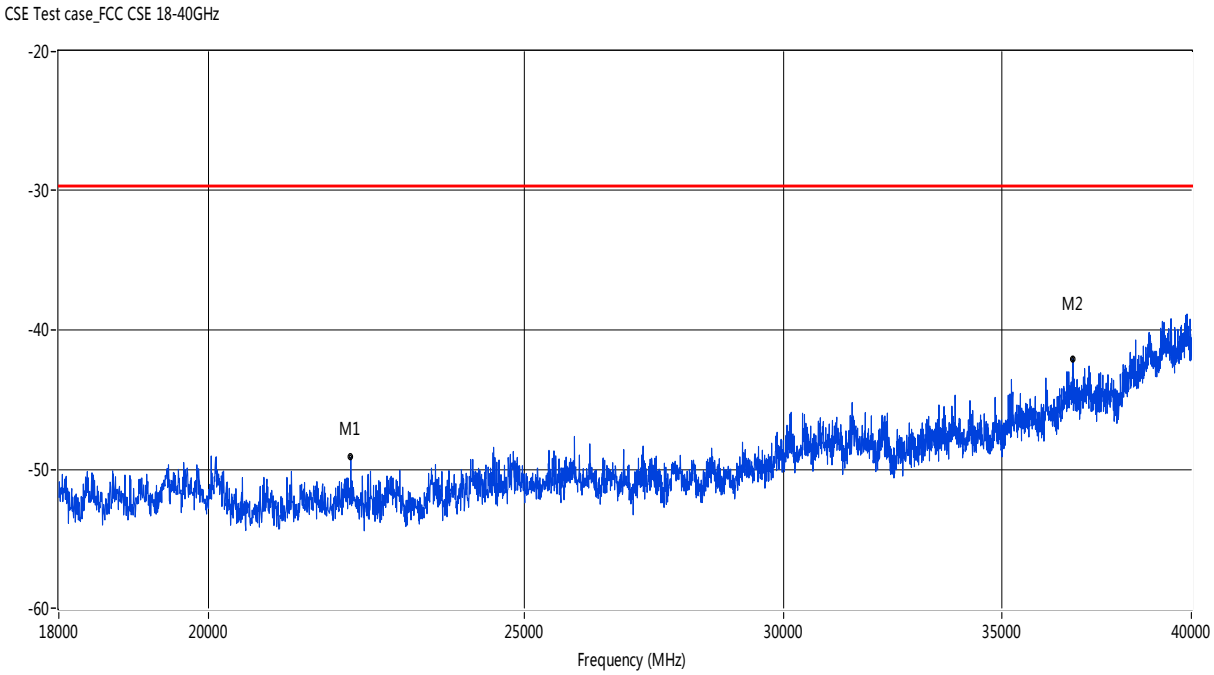
## Π/4-DQPSK High Channel 18 GHz to 40 GHz

CSE Test case_FCC CSE 18-40GHz



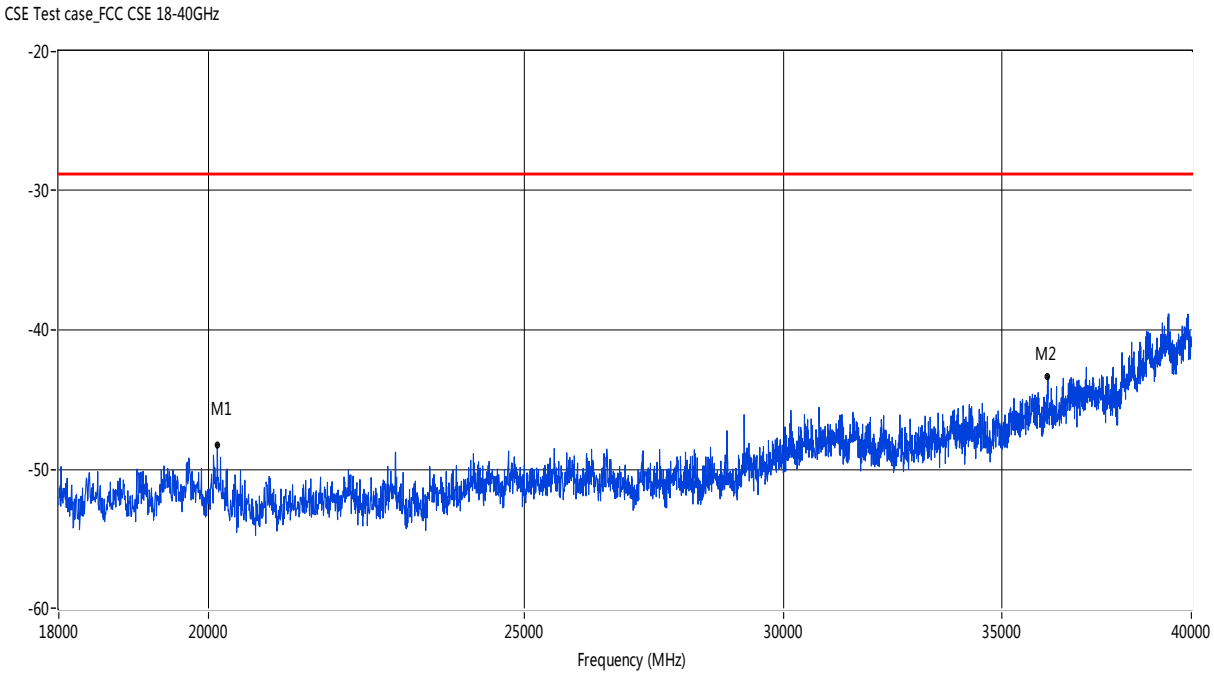

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 20123.001 | -48.68 | 10.36 | -29.9 | 18.78 | Peak | Pass |
| 2 | 37491.999 | -42.04 | 14.41 | -29.9 | 12.14 | Peak | Pass |

## 8-DPSK Low Channel 18 GHz to 40 GHz



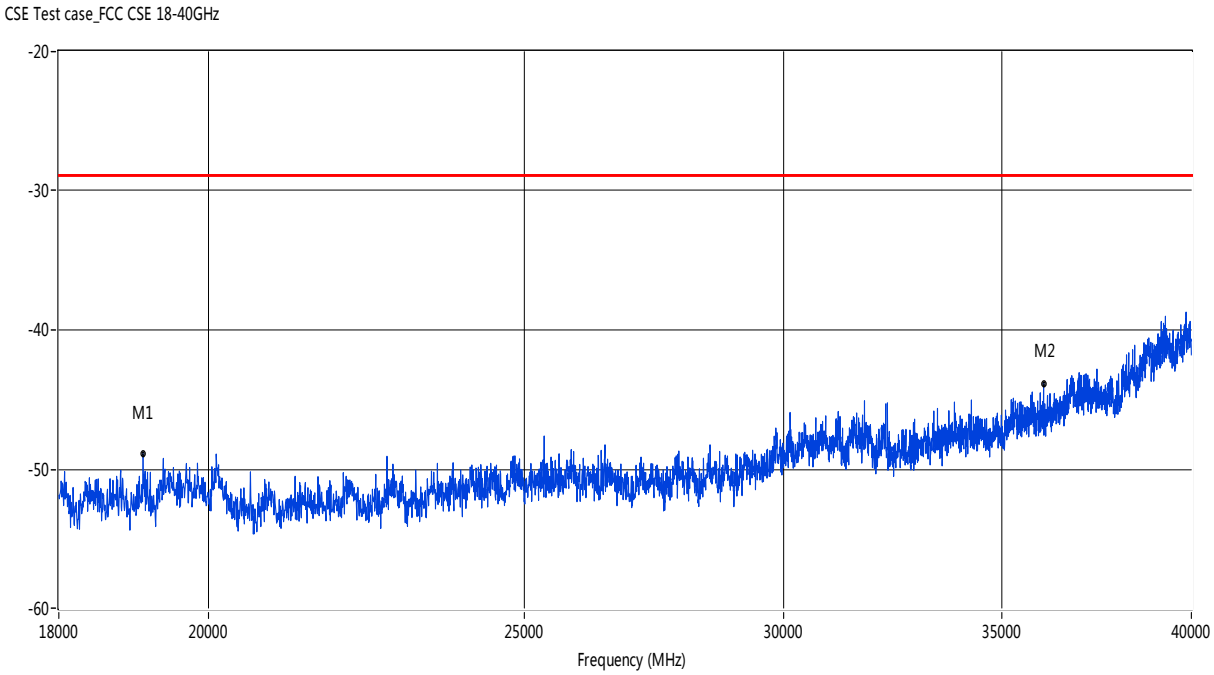

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 22114.001 | -49.16 | 10.83 | -29.7 | 19.46 | Peak | Pass |
| 2 | 36793.500 | -42.07 | 14.25 | -29.7 | 12.37 | Peak | Pass |

8-DPSK Middle Channel 18 GHz to 40 GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 20128.500 | -48.25 | 10.36 | -28.8 | 19.45 | Peak | Pass |
| 2 | 36150.002 | -43.32 | 14.10 | -28.8 | 14.52 | Peak | Pass |

## 8-DPSK High Channel 18 GHz to 40 GHz




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Verdict |
|---|---|---|---|---|---|---|---|
| 1 | 19100.000 | -48.87 | 10.12 | -28.9 | 19.97 | Peak | Pass |
| 2 | 36039.999 | -43.86 | 14.08 | -28.9 | 14.96 | 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.

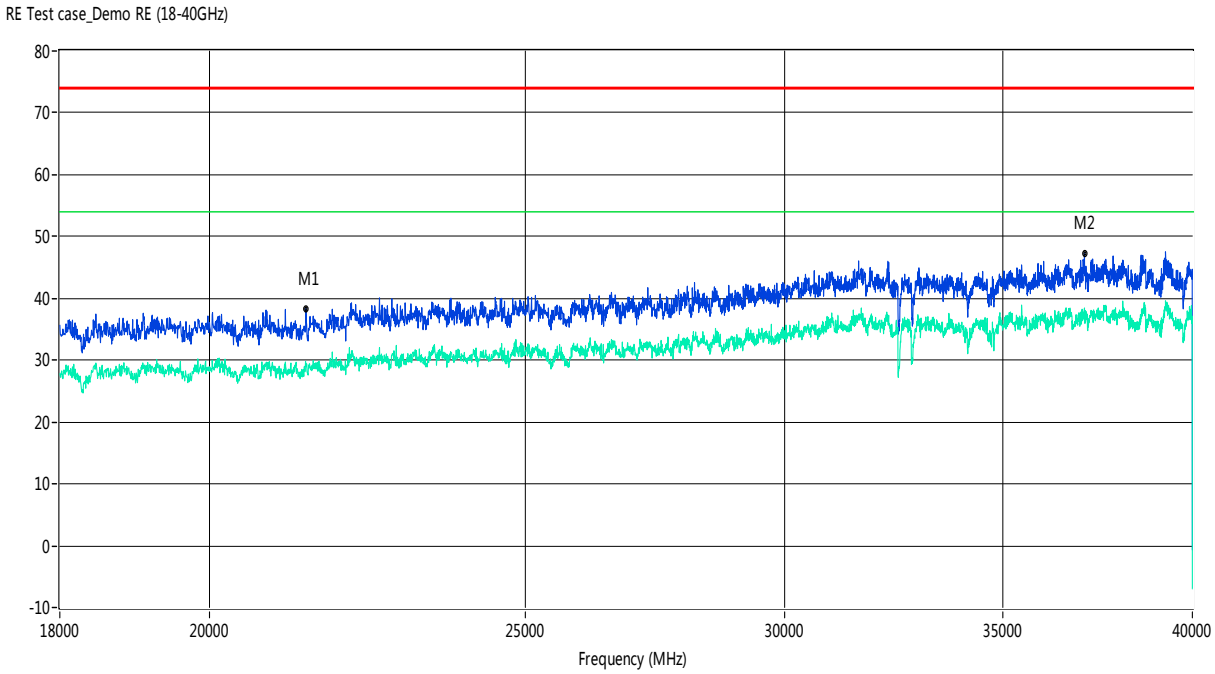
Note [2]: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

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.

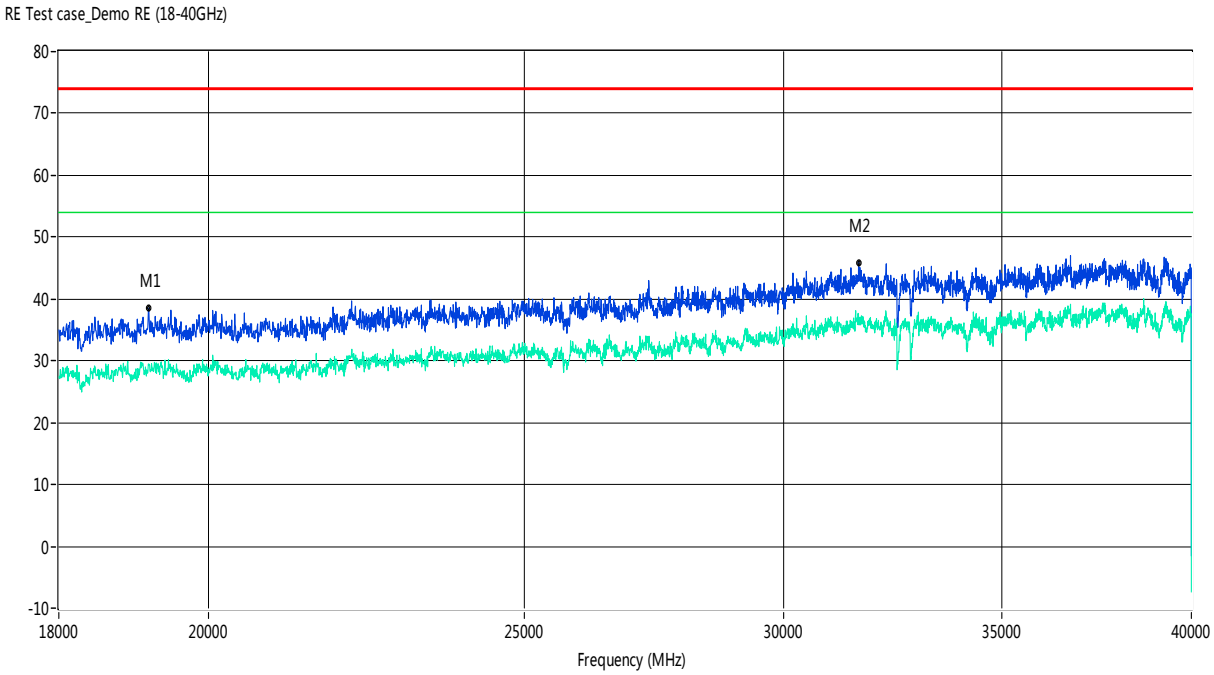
Note 2: All channel are tested, but only the worst configuration (High) test date are recorded in this test report.

GFSK 18 GHz to 40 GHz



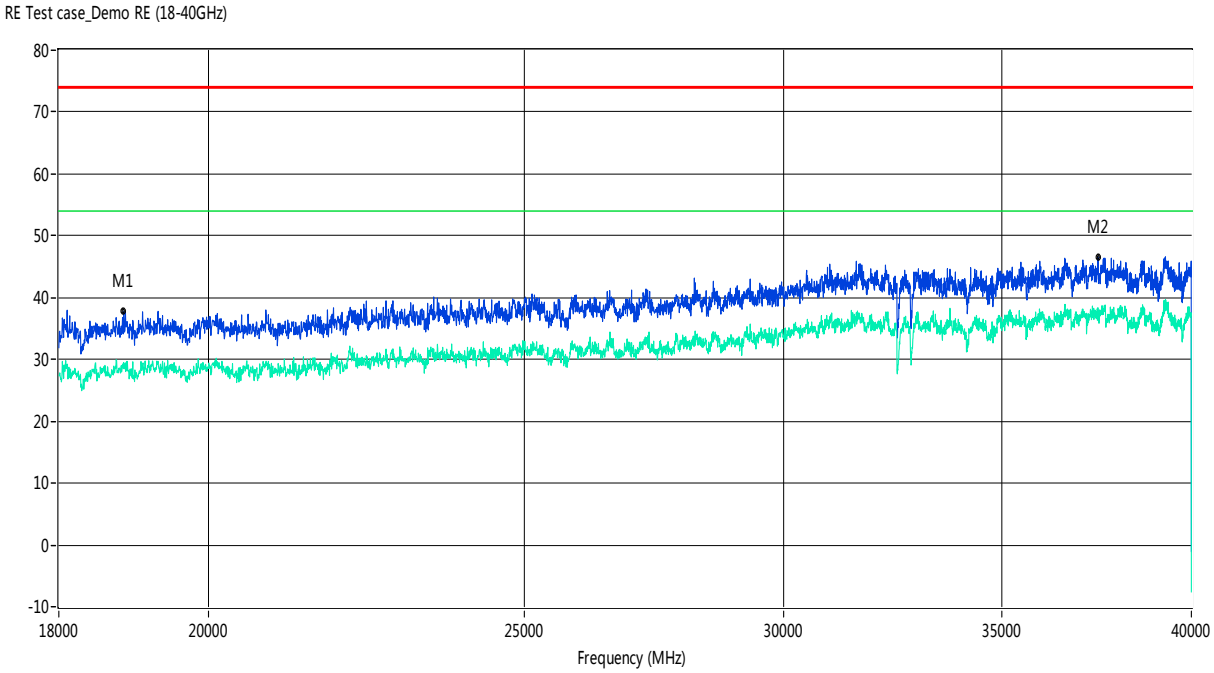

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1** | 21410.001 | 29.3 | 19.28 | 54.0 | 24.70 | AV | 2.00 | 100 | Horizontal | Pass |
| 1 | 21410.001 | 38.38 | 19.28 | 74.0 | 35.62 | Peak | 2.00 | 100 | Horizontal | Pass |
| 2** | 37068.501 | 38.4 | 24.28 | 54.0 | 15.60 | AV | 15.00 | 100 | Horizontal | Pass |
| 2 | 37068.501 | 47.23 | 24.28 | 74.0 | 26.77 | Peak | 15.00 | 100 | Horizontal | Pass |

## Π/4-DQPSK 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 | 29.3 | 19.44 | 54.0 | 24.70 | AV | 13.00 | 100 | Horizontal | Pass |
| 1 | 19177.001 | 38.51 | 19.44 | 74.0 | 35.49 | Peak | 13.00 | 100 | Horizontal | Pass |
| 2** | 31634.500 | 36.6 | 22.47 | 54.0 | 17.40 | AV | 5.00 | 100 | Horizontal | Pass |
| 2 | 31634.500 | 45.86 | 22.47 | 74.0 | 28.14 | Peak | 5.00 | 100 | Horizontal | Pass |

## 8-DPSK 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** | 18841.500 | 29.5 | 19.20 | 54.0 | 24.50 | AV | 14.00 | 100 | Horizontal | Pass |
| 1 | 18841.500 | 37.72 | 19.20 | 74.0 | 36.28 | Peak | 14.00 | 100 | Horizontal | Pass |
| 2** | 37453.500 | 37.9 | 24.34 | 54.0 | 16.10 | AV | 5.00 | 100 | Horizontal | Pass |
| 2 | 37453.500 | 46.51 | 24.34 | 74.0 | 27.49 | Peak | 5.00 | 100 | Horizontal | Pass |

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

Note: Not applicable.

# ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ17A0336-AR.PDF”.

# ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL- SZ17A0336-AW.PDF”.

# ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL- SZ17A0336-AI.PDF”.

--END OF REPORT--