# FCC Test Report

| | |
|---|---|
| **Report no.:** | HQ200409EL03-FI |
| **Applicant name:** | ANKANG COMATE TECH CO.,LTD |
| **Applicant address:** | North end of Gaoxin No.7 Road, The High-Tech Industrial Zone, Ankang Shaanxi, China |
| **FCC ID:** | 2ASKIMM444BT |
| **Product name** | 3-PIECE CD SHELF SYSTEM with Digital PLL FM Stereo Radio and Bluetooth® Wireless Technology |
| **Product name:** | MAGNAVOX |
| **Test model:** | MM444BT |
| **Series model:** | CM444BT; CM0300BT; CM-444; |
| **Received date:** | Apr. 18, 2020 |
| **Test date:** | Apr. 19, 2020~May 24, 2020 |
| **Issued date:** | Jun. 12, 2020 |
| **Issued By:** | Hwa-Hsing (Dongguan) Testing Co., Ltd. |
| **Lab Address:** | No.101, Bld N1,Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China |
| **Test Location:** | No.101, Bld N1,Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China |
| **FCC Designation Number:** | CN1255 |
| **Standards:** | 47 CFR FCC Part 15, Subpart C (Section 15.247)<br>ANSI C63.10:2013 |

The above equipmenthas been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** Tank , **Date:** Jun. 12, 2020

Tank Tan//Engineer

**Approved by :** Harry Li , **Date:** Jun. 12, 2020

Harry Li/ Supervisor

## Table of Contents

**Release Control Record**

| Issue No. | Description | Date Issued |
|---|---|---|
| HQ200409EL03-FI | Original Release | Jun. 12, 2020 |

## 1 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C(Section 15.247)<br>ANSI C63.10:2013; | | | |
|---|---|---|---|
| FCCClause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | Pass | Meet the requirement of limit. |
| 15.247(a)(1)(iii) | Number of Hopping Frequency Used | Pass | Meet the requirement of limit. |
| 15.247(a)(1)(iii) | Dwell Time on Each Channel | Pass | Meet the requirement of limit. |
| 15.247(a)(1) | 1. Hopping Channel Separation<br>2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System | Pass | Meet the requirement of limit. |
| 15.247(b) | Maximum Peak Output Power | Pass | Meet the requirement of limit. |
| --- | Occupied Bandwidth Measurement | Pass | Reference only |
| 15.205 & 209 | Radiated Emissions | Pass | Meet the requirement of limit. |
| 15.247(d) | Band Edge Measurement | Pass | Meet the requirement of limit. |
| 15.247(d) | Antenna Port Emission | Pass | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | Pass | No antenna connector is used. |

**Note:**

If The Frequency Hopping System operating in 2400-2483.5MHz band and the outputpower less than 125mW.The hopping channel carrier frequencies separated by a minimumof 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

### 1.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUTas specified in CISPR 16-4-2:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

| Measurement | Frequency | Expended Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 2.66 dB |
| Radiated Emissions up to 1 GHz | 9KHz ~ 30MHz | 2.90dB |
| | 30MHz ~ 1000MHz | 3.47 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 4.84 dB |
| | 18GHz ~ 40GHz | 4.62 dB |

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

### 1.2 Modification Record

There were no modifications required for compliance.

# 2 General Information

## 2.1 General Description of EUT

| | |
|---|---|
| Product Name | 3-PIECE CD SHELF SYSTEM with Digital PLL FM Stereo Radio and Bluetooth® Wireless Technology |
| Brand Name | MAGNAVOX |
| Test Model Name | MM444BT |
| Series Model Name | CM444BT; CM0300BT; CM-444; |
| Model Difference | Only difference of model name for trade purpose |
| Status of EUT | Engineeringprototype |
| Power Supply Rating | AC100-240V~50/60Hz (0.4A Max.), or, DC 1.5V*2(AAA) Battery |
| Modulation Type | GFSK, π/4 DQPSK, 8DPSK |
| Transfer Rate | 1Mbps/2Mbps/3Mbps |
| Operating Frequency | 2402 ~ 2480 MHz |
| Number of Channel | 79 |
| Output Power | 1.45dBm |
| Antenna Type | PCB antenna with-0.58dBi gain |
| Antenna Connector | N/A |
| Raido software | FCC Assist 2.4 |
| Accessory Device | N/A |
| Data Cable Supplied | N/A |

Note:

1. Please refer to the EUT photo document (Reference No.: HQ200409EL03) for detailed product photo.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

## 2.2 Description of Test Modes

79 channels are provided to this EUT:

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

### 2.2.1 Test Mode Applicability and Tested Channel Detail

| EUT Configure Mode | Applicable To | | | | Description |
|---|---|---|---|---|---|
| | **RE≥1G** | **RE<1G** | **PLC** | **APCM** | |
| - | √ | √ | √ | √ | - |

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
**PLC:** Power Line Conducted Emission **APCM:** AntennaPort Conducted Measurement

**Note:**

1.For Radiated emission test, pre-tested GFSK,π/4-DQPSKmodulation type and found GFSK was the worse, therefore chosen for the final test and presented in the test report.

2. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

3. "-"means no effect.

**Radiated Emission Test (Above 1GHz):**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data ratesand antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|---|---|---|---|---|---|
| - | 0 to 78 | 0, 39, 78 | FHSS | GFSK | DH5 |
| - | 0 to 78 | 0, 39, 78 | FHSS | 8DPSK | 3DH5 |

**Radiated Emission Test (Below 1GHz):**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data ratesand antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|---|---|---|---|---|---|
| - | 0 to 78 | 78 | FHSS | GFSK | DH5 |

**Power Line Conducted Emission Test:**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data ratesand antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|---|---|---|---|---|---|
| - | 0 to 78 | 78 | FHSS | GFSK | DH5 |

**Antenna Port Conducted Measurement:**

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|---|---|---|---|---|---|
| - | 0 to 78 | 0, 39, 78 | FHSS | GFSK | DH5 |
| - | 0 to 78 | 0, 39, 78 | FHSS | 8DPSK | 3DH5 |

**Test Condition:**

| Applicable To | Environmental Conditions | Input Power | Tested by |
|---|---|---|---|
| **RE≥1G** | 25deg. C, 65%RH | 120Vac, 60Hz | Tank Tan |
| **RE<1G** | 25deg. C, 65%RH | 120Vac, 60Hz | Tank Tan |
| **PLC** | 25deg. C, 65%RH | 120Vac, 60Hz | Tank Tan |
| **APCM** | 25deg. C, 65%RH | 120Vac, 60Hz | Harry Li |

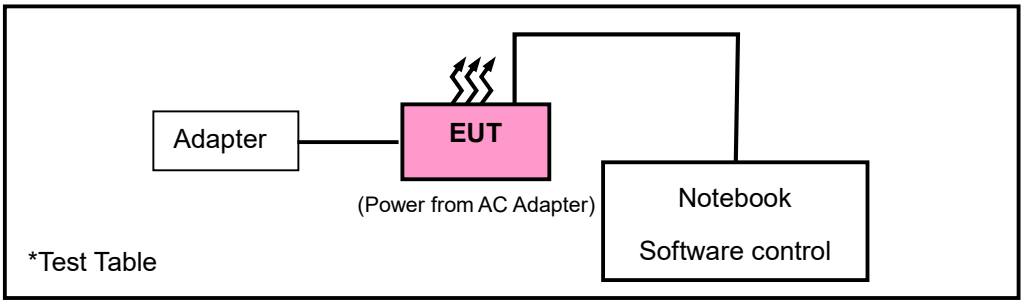
## 2.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

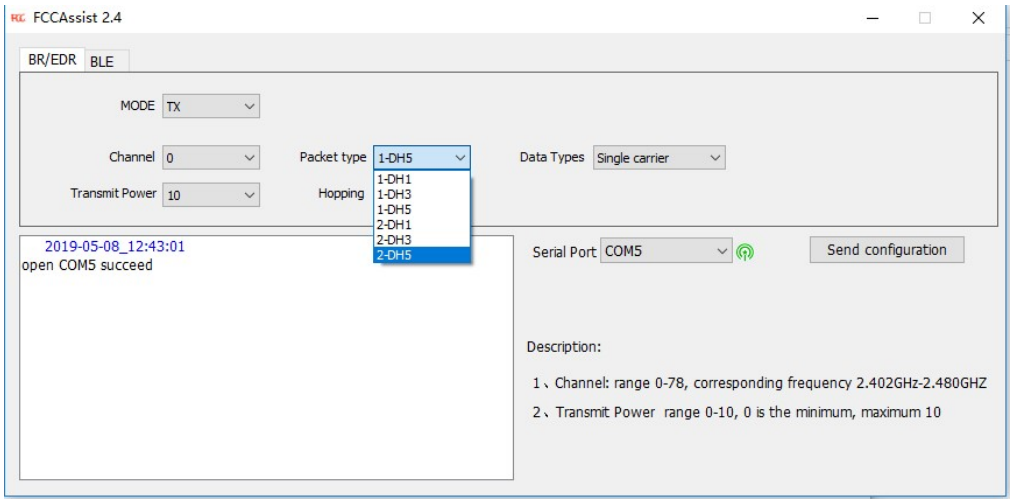
| No. | Product | Brand | Model No. | Serial No. | FCC ID |
|---|---|---|---|---|---|
| 1. | Notebook | Lenovo | E430 | MP-0DN27 | N/A |

| No. | Signal Cable Description Of The Above Support Units |
|---|---|
| 1. | AC Line: Un-shieldin 1.5m |
| 2. | / |
| 3. | / |

### 2.3.1 Configuration of System under Test




Radio Software:



## 2.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.247)**
**ANSI C63.10-2013**
All test items have been performed and recorded as per the above standards.

**Note:** The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (sDoC). The test report has been issued separately.

# 3 Test Types and Results

## 3.1 Radiated Emission and Bandedge Measurement

### 3.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bandsmust comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 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. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

3.1.2 Test Instruments

For radiated emission test (9kHz-1GHz)

| Equipment | Manufacturer | Model No. | **Serial No.** | **Last Cal.** | **Next Cal.** |
|---|---|---|---|---|---|
| EMI Test Receiver (10kHz~7GHz) | Rohde&Schwarz | ESCI 7 | 100962 | 2021/05/14 | 2021/05/13 |
| Loop Antenna 9kHz~30MHz | TESEQ | HLA 6121 | 56735 | 2020/04/15 | 2021/04/15 |
| Broadband antenna (25MHz~2500MHz) | Schwarzbeck | VULB 9168 | 00937 | 2019/10/20 | 2021/10/19 |
| Signal Amplifier (30MHz~1000MHz) | Com-power | PAM-103 | 18020051 | 2019/10/18 | 2020/10/17 |
| 3m Semi-anechoic Chamber | MAORUI | 9m*6m*6m | NSEMC003 | 2020/04/15 | 2021/04/15 |
| Attenuator | R&S | TS2GA-6dB | 18101101 | 2019/10/18 | 2020/10/17 |
| Test software | EZ | EZ_EMC V1.1.4.2 | N/A | N/A | N/A |
| Digital Multimeter | FLUKE | 15B+ | 43512617WS | 2019/10/22 | 2020/10/21 |

For radiated emission test (1GHz-40GHz)

| Equipment | Manufacturer | Model No. | **Serial No.** | **Last Cal.** | **Next Cal.** |
|---|---|---|---|---|---|
| Horn Antenna (1GHz-18GHz) | Schwarzbeck | BBHA 9170 | 01959 | 2019/10/18 | 2020/10/17 |
| Spectrum Analyzer | Rohde&Schwarz | FSV-40N | 101783 | 2019/10/18 | 2020/10/17 |
| Broadband Coaxial Preamplifier (1GHz-18GHz) | Schwarzbeck | BBV 9718 | 00025 | 2019/10/18 | 2020/10/17 |
| Horn Antenna (18GHz-40GHz) | Schwarzbeck | BBHA 9170 | BBHA9170242 | 2019/10/18 | 2020/10/17 |
| Pre-Amplifier (18GHz-40GHz) | EMCI | EMC 184045 | 980102 | 2019/10/18 | 2020/10/17 |
| High pass filter | Micro-Tronics | HPM50107 | G050 | 2019/10/18 | 2020/10/17 |
| High pass filter | Micro-Tronics | HPM50117 | G007 | 2019/10/18 | 2020/10/17 |
| Test software | EZ | EZ_EMC V1.1.4.2 | N/A | N/A | N/A |
| Spectrum （10kHz~26.5GHz） | Keysight | N9020A | MY51240612 | 2019/10/18 | 2020/10/17 |
| EMI Test Receiver (10kHz~7GHz) | Rohde&Schwarz | ESCI 7 | 100962 | 2019/10/18 | 2020/10/17 |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.

2. The test was performed in Chamber 1

3.1.3 Test Procedures

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

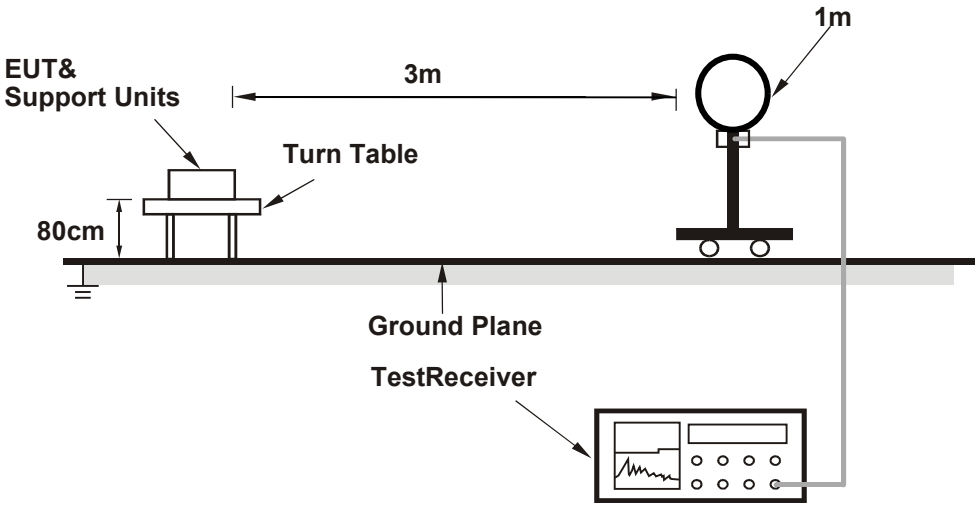
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for Average (Duty cycle < 98 %) detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. Test procedures for measuring FHSS device: The use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period. Subclause 7.5 of ANSI C63.10 provides additional measurement guidance applicable to determination of the DCCF.
6. All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 Deviation from Test Standard

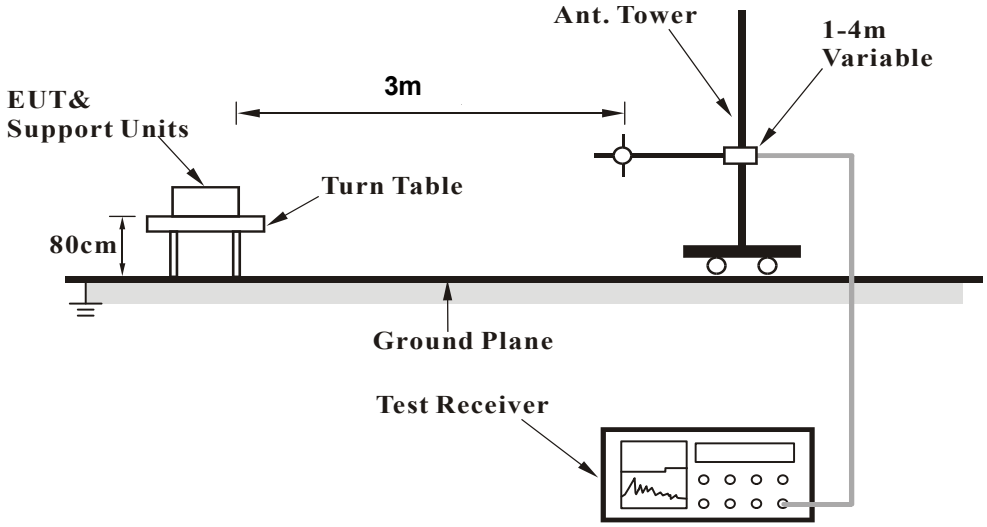
No deviation.

3.1.5 Test Set Up

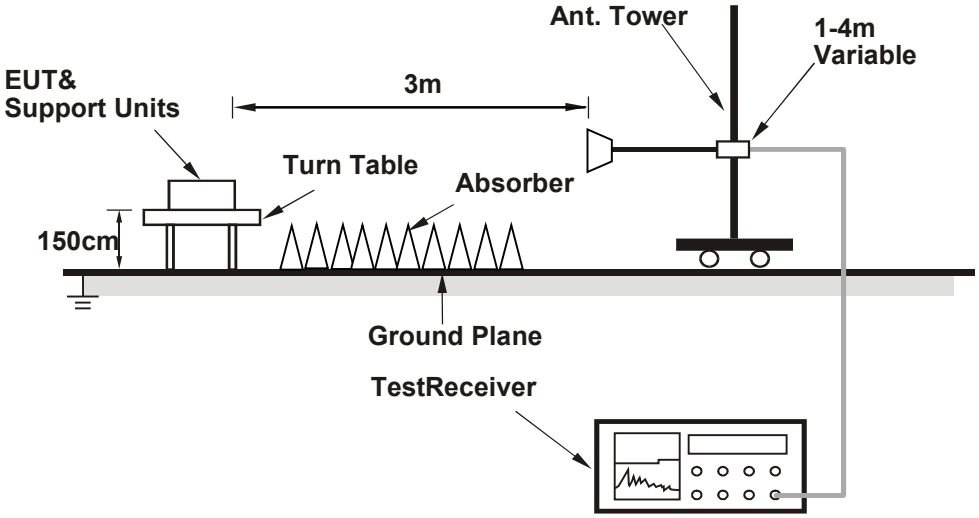
Radiated emission below 30MHz:




Frequency Range below 1GHz:



Frequency Range above 1GHz:




Directional antenna.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 3.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

3.1.7 Test Results

**Above 1GHz Data:**

**GFSK**

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 0 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&Test Distance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2390.000 | 43.23 | -0.77 | 42.46 | 74.00 | -31.54 | peak | 100 | 272 | |
| 2 | 2390.000 | 9.97 | -0.77 | 9.20 | 54.00 | -44.80 | AVG | 100 | 272 | |
| 3 | 2402.000 | 94.42 | -0.75 | 93.67 | | | peak | 100 | 272 | C.F. |
| 4 | 2402.000 | 61.16 | -0.75 | 60.41 | | | AVG | 100 | 272 | C.F. |
| 5 | 4804.000 | 49.19 | 5.36 | 54.55 | 74.00 | -19.45 | peak | 100 | 312 | |
| 6 | 4804.000 | 15.93 | 5.36 | 21.29 | 54.00 | -32.71 | AVG | 100 | 312 | |
| 7 | 7206.000 | 44.12 | 11.75 | 55.87 | 74.00 | -18.13 | peak | 100 | 140 | |
| 8 | 7206.000 | 10.86 | 11.75 | 22.61 | 54.00 | -31.39 | AVG | 100 | 140 | |
| Antenna Polarity&Test Distance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2390.000 | 43.06 | -0.77 | 42.29 | 74.00 | -31.71 | peak | 100 | 229 | |
| 2 | 2390.000 | 9.80 | -0.77 | 9.03 | 54.00 | -44.97 | AVG | 100 | 229 | |
| 3 | 2402.000 | 93.02 | -0.75 | 92.27 | | | peak | 100 | 229 | C.F. |
| 4 | 2402.000 | 59.76 | -0.75 | 59.01 | | | AVG | 100 | 229 | C.F. |
| 5 | 4804.000 | 49.29 | 5.36 | 54.65 | 74.00 | -19.35 | peak | 100 | 360 | |
| 6 | 4804.000 | 16.03 | 5.36 | 21.39 | 54.00 | -32.61 | AVG | 100 | 360 | |
| 7 | 7206.000 | 44.60 | 11.75 | 56.35 | 74.00 | -17.65 | peak | 100 | 82 | |
| 8 | 7206.000 | 11.34 | 11.75 | 23.09 | 54.00 | -30.91 | AVG | 100 | 82 | |

Remarks:

1. Emission Level = Read Level +Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
2. 2402MHz: Fundamental frequency.

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 39 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>CISPR Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&Test Distance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2441.000 | 94.75 | -0.64 | 94.11 | | | peak | 100 | 200 | C.F. |
| 2 | 2441.000 | 61.49 | -0.64 | 60.85 | | | AVG | 100 | 200 | C.F. |
| 3 | 4882.000 | 52.03 | 6.27 | 58.30 | 74.00 | -15.70 | peak | 100 | 360 | |
| 4 | 4882.000 | 18.77 | 6.27 | 25.04 | 54.00 | -28.96 | AVG | 100 | 360 | |
| 5 | 7323.000 | 44.90 | 12.14 | 57.04 | 74.00 | -16.96 | peak | 100 | 290 | |
| 6 | 7323.000 | 11.64 | 12.14 | 23.78 | 54.00 | -30.22 | AVG | 100 | 290 | |
| Antenna Polarity&TestDistance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2441.000 | 94.84 | -0.64 | 94.20 | | | peak | 100 | 218 | C.F. |
| 2 | 2441.000 | 61.58 | -0.64 | 60.94 | | | AVG | 100 | 218 | C.F. |
| 3 | 4882.000 | 47.78 | 6.27 | 54.05 | 74.00 | -19.95 | peak | 100 | 275 | |
| 4 | 4882.000 | 14.52 | 6.27 | 20.79 | 54.00 | -33.21 | AVG | 100 | 275 | |
| 5 | 7323.000 | 45.02 | 12.14 | 57.16 | 74.00 | -16.84 | peak | 100 | 60 | |
| 6 | 7323.000 | 11.76 | 12.14 | 23.90 | 54.00 | -30.10 | AVG | 100 | 60 | |

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
2. 2441MHz: Fundamental frequency.

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 78 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&TestDistance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2480.000 | 94.36 | -0.52 | 93.84 | | | peak | 154 | 200 | C.F. |
| 2 | 2480.000 | 61.10 | -0.52 | 60.58 | | | AVG | 154 | 200 | C.F. |
| 3 | 2483.500 | 52.68 | -0.51 | 52.17 | 74.00 | -21.83 | peak | 154 | 200 | |
| 4 | 2483.500 | 19.42 | -0.51 | 18.91 | 54.00 | -35.09 | AVG | 154 | 200 | |
| 5 | 4960.000 | 49.84 | 6.09 | 55.93 | 74.00 | -18.07 | peak | 100 | 316 | |
| 6 | 4960.000 | 16.58 | 6.09 | 22.67 | 54.00 | -31.33 | AVG | 100 | 316 | |
| 7 | 7440.000 | 44.48 | 12.53 | 57.01 | 74.00 | -16.99 | peak | 100 | 172 | |
| 8 | 7440.000 | 11.22 | 12.53 | 23.75 | 54.00 | -30.25 | AVG | 100 | 172 | |
| Antenna Polarity&TestDistance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2480.000 | 94.71 | -0.52 | 94.19 | | | peak | 100 | 218 | C.F. |
| 2 | 2480.000 | 61.45 | -0.52 | 60.93 | | | AVG | 100 | 218 | C.F. |
| 3 | 2483.500 | 52.31 | -0.51 | 51.80 | 74.00 | -22.20 | peak | 100 | 218 | |
| 4 | 2483.500 | 19.05 | -0.51 | 18.54 | 54.00 | -35.46 | AVG | 100 | 218 | |
| 5 | 4960.000 | 49.29 | 6.09 | 55.38 | 74.00 | -18.62 | peak | 100 | 240 | |
| 6 | 4960.000 | 16.03 | 6.09 | 22.12 | 54.00 | -31.88 | AVG | 100 | 240 | |
| 7 | 7440.000 | 45.59 | 12.53 | 58.12 | 74.00 | -15.88 | peak | 100 | 308 | |
| 8 | 7440.000 | 12.33 | 12.53 | 24.86 | 54.00 | -29.14 | AVG | 100 | 308 | |

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
2. 2480MHz: Fundamental frequency.

**8DPSK**

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 0 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&TestDistance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2390.000 | 41.07 | -0.77 | 40.30 | 74.00 | -33.70 | peak | 100 | 257 | |
| 2 | 2390.000 | 7.81 | -0.77 | 7.04 | 54.00 | -46.96 | AVG | 100 | 257 | |
| 3 | 2402.000 | 94.87 | -0.75 | 94.12 | | | peak | 100 | 257 | C.F. |
| 4 | 2402.000 | 61.61 | -0.75 | 60.86 | | | AVG | 100 | 257 | C.F. |
| 5 | 4804.000 | 51.57 | 5.36 | 56.93 | 74.00 | -17.07 | peak | 100 | 200 | |
| 6 | 4804.000 | 18.31 | 5.36 | 23.67 | 54.00 | -30.33 | AVG | 100 | 200 | |
| 7 | 7206.000 | 44.89 | 11.75 | 56.64 | 74.00 | -17.36 | peak | 100 | 290 | |
| 8 | 7206.000 | 11.63 | 11.75 | 23.38 | 54.00 | -30.62 | AVG | 100 | 290 | |
| Antenna Polarity&Test Distance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2390.000 | 40.44 | -0.77 | 39.67 | 74.00 | -34.33 | peak | 100 | 170 | |
| 2 | 2390.000 | 7.18 | -0.77 | 6.41 | 54.00 | -47.59 | AVG | 100 | 170 | |
| 3 | 2402.000 | 93.31 | -0.75 | 92.56 | | | peak | 100 | 170 | C.F. |
| 4 | 2402.000 | 60.05 | -0.75 | 59.30 | | | AVG | 100 | 170 | C.F. |
| 5 | 4804.000 | 47.98 | 5.36 | 53.34 | 74.00 | -20.66 | peak | 100 | 331 | |
| 6 | 4804.000 | 14.72 | 5.36 | 20.08 | 54.00 | -33.92 | AVG | 100 | 331 | |
| 7 | 7206.000 | 44.95 | 11.75 | 56.70 | 74.00 | -17.30 | peak | 100 | 204 | |
| 8 | 7206.000 | 11.69 | 11.75 | 23.44 | 54.00 | -30.56 | AVG | 100 | 204 | |

Remarks:

3. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
4. C.F.: Fundamental frequency.

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 39 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&TestDistance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2441.000 | 94.78 | -0.64 | 94.14 | | | peak | 174 | 199 | C.F. |
| 2 | 2441.000 | 61.52 | -0.64 | 60.88 | | | AVG | 174 | 199 | C.F. |
| 3 | 4882.000 | 51.81 | 6.27 | 58.08 | 74.00 | -15.92 | peak | 100 | 195 | |
| 4 | 4882.000 | 18.55 | 6.27 | 24.82 | 54.00 | -29.18 | AVG | 100 | 195 | |
| 5 | 7323.000 | 45.88 | 12.14 | 58.02 | 74.00 | -15.98 | peak | 100 | 300 | |
| 6 | 7323.000 | 12.62 | 12.14 | 24.76 | 54.00 | -29.24 | AVG | 100 | 300 | |
| Antenna Polarity&Test Distance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2441.000 | 94.51 | -0.64 | 93.87 | | | peak | 100 | 216 | C.F. |
| 2 | 2441.000 | 61.25 | -0.64 | 60.61 | | | AVG | 100 | 216 | C.F. |
| 3 | 4882.000 | 47.28 | 6.27 | 53.55 | 74.00 | -20.45 | peak | 100 | 267 | |
| 4 | 4882.000 | 14.02 | 6.27 | 20.29 | 54.00 | -33.71 | AVG | 100 | 267 | |
| 5 | 7323.000 | 44.51 | 12.14 | 56.65 | 74.00 | -17.35 | peak | 100 | 324 | |
| 6 | 7323.000 | 11.25 | 12.14 | 23.39 | 54.00 | -30.61 | AVG | 100 | 324 | |

Remarks:

3. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
4. 2441MHz: Fundamental frequency.

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 78 | Frequency Range | 1GHz ~ 25GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Average (AV) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank Tan |

| Antenna Polarity&Test Distance: Horizontal at 3 m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2480.000 | 93.80 | -0.52 | 93.28 | | | peak | 100 | 218 | C.F. |
| 2 | 2480.000 | 60.54 | -0.52 | 60.02 | | | AVG | 100 | 218 | C.F. |
| 3 | 2483.500 | 51.56 | -0.51 | 51.05 | 74.00 | -22.95 | peak | 100 | 218 | |
| 4 | 2483.500 | 18.30 | -0.51 | 17.79 | 54.00 | -36.21 | AVG | 100 | 218 | |
| 5 | 4960.000 | 51.82 | 6.09 | 57.91 | 74.00 | -16.09 | peak | 100 | 244 | |
| 6 | 4960.000 | 18.56 | 6.09 | 24.65 | 54.00 | -29.35 | AVG | 100 | 244 | |
| 7 | 7440.000 | 44.05 | 12.53 | 56.58 | 74.00 | -17.42 | peak | 100 | 298 | |
| 8 | 7440.000 | 10.79 | 12.53 | 23.32 | 54.00 | -30.68 | AVG | 100 | 298 | |
| Antenna Polarity&Test Distance: Vertical at 3 m | | | | | | | | | | |
| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
| 1 | 2480.000 | 94.94 | -0.52 | 94.42 | | | peak | 100 | 218 | C.F. |
| 2 | 2480.000 | 61.68 | -0.52 | 61.16 | | | AVG | 100 | 218 | C.F. |
| 3 | 2483.500 | 52.86 | -0.51 | 52.35 | 74.00 | -21.65 | peak | 100 | 218 | |
| 4 | 2483.500 | 19.60 | -0.51 | 19.09 | 54.00 | -34.91 | AVG | 100 | 218 | |
| 5 | 4960.000 | 48.27 | 6.09 | 54.36 | 74.00 | -19.64 | peak | 100 | 330 | |
| 6 | 4960.000 | 15.01 | 6.09 | 21.10 | 54.00 | -32.90 | AVG | 100 | 330 | |
| 7 | 7440.000 | 44.75 | 12.53 | 57.28 | 74.00 | -16.72 | peak | 100 | 304 | |
| 8 | 7440.000 | 11.49 | 12.53 | 24.02 | 54.00 | -29.98 | AVG | 100 | 304 | |

Remarks:

3. Emission Level = Read Level +Factor (Antenna Factor + Cable Loss - Preamp Factor)
   Margin value = Emission level – Limit value
4. 2480MHz: Fundamental frequency.

### 9kHz ~ 30MHz Data:

The amplitude of spurious emissions attenuated more than 20dB below the permissible value is not required to be report.

### 30MHz ~ 1GHz Worst-Case Data:

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 78 | Frequency Range | 30MHz ~ 1GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Quasi-peak (QP) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank tan |

Antenna Polarity&Test Distance: Horizontal at 3 m


| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 42.8998 | 38.77 | -14.77 | 24.00 | 40.00 | -16.00 | QP | 200 | 250 | |
| 2 | 84.7019 | 42.51 | -19.06 | 23.45 | 40.00 | -16.55 | QP | 200 | 120 | |
| 3 | 127.2176 | 50.22 | -14.67 | 35.55 | 43.50 | -7.95 | QP | 200 | 134 | |
| 4 | 169.5990 | 47.02 | -13.23 | 33.79 | 43.50 | -9.71 | QP | 200 | 255 | |
| 5 | 212.2695 | 50.59 | -16.73 | 33.86 | 43.50 | -9.64 | QP | 200 | 30 | |
| 6 | 254.7284 | 51.10 | -15.19 | 35.91 | 46.00 | -10.09 | QP | 200 | 270 | |

Remarks:

Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)

Margin value = Emission level – Limit value

| EUT Test Condition | | Measurement Detail | |
|---|---|---|---|
| Channel | Channel 78 | Frequency Range | 30MHz ~ 1GHz |
| Input Power | 120Vac, 60 Hz | Detector Function | Peak (PK)<br>Quasi-peak (QP) |
| Environmental Conditions | 25deg. C, 65%RH | Tested By | Tank tan |

Antenna Polarity&Test Distance: Vertical at 3 m


| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detecter | Antenna Height (cm) | Table Angle (Degree) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30.0000 | 52.84 | -17.12 | 35.72 | 40.00 | -4.28 | QP | 100 | 125 | |
| 2 | 41.7129 | 50.87 | -15.07 | 35.80 | 40.00 | -4.20 | QP | 100 | 187 | |
| 3 | 84.7018 | 43.85 | -19.06 | 24.79 | 40.00 | -15.21 | QP | 100 | 54 | |
| 4 | 136.4598 | 54.40 | -14.40 | 40.00 | 43.50 | -3.50 | QP | 100 | 240 | |
| 5 | 169.5990 | 45.89 | -13.23 | 32.66 | 43.50 | -10.84 | QP | 100 | 130 | |
| 6 | 254.7284 | 49.35 | -15.19 | 34.16 | 46.00 | -11.84 | QP | 100 | 264 | |

Remarks:

Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)

Margin value = Emission level – Limit value

## 3.2 Conducted Emission Measurement

### 3.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to0.50MHz.

### 3.2.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date Of Calibration | Due Date Of Calibration |
|---|---|---|---|---|
| EMI Test Receiver Rohde&Schwarz | ESCI3 | 101418 | 2019/10/18 | 2020/10/17 |
| Artificial Mains Network Rohde&Schwarz | ENV216 | 3560.6550.15 | 2019/10/18 | 2020/10/17 |
| Test software FARAD | EZ_EMC V1.1.4.2 | N/A | N/A | N/A |
| Hygrothermograph Yuhuaze | HTC-1 | NA | 2019/10/20 | 2020/10/19 |
| Digital Multimeter FLUKE | 15B+ | 43512617WS | 2019/10/18 | 2020/10/17 |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Shielded Room 1.

### 3.2.3 Test Procedures

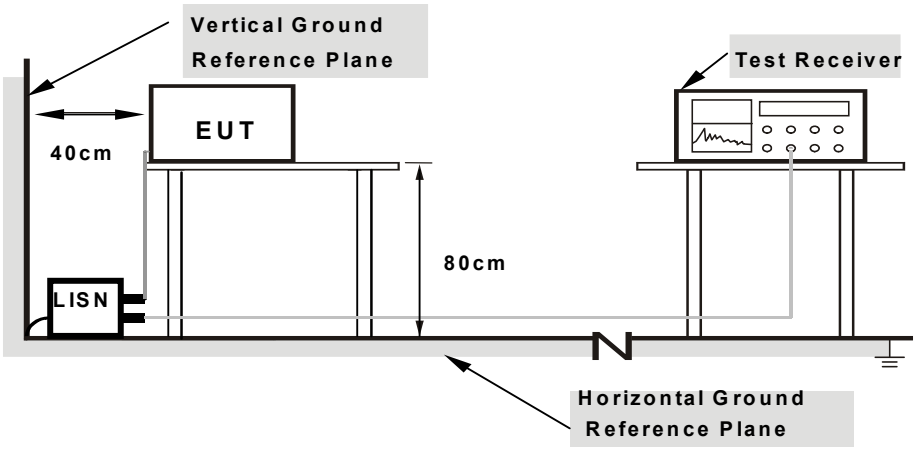
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit – 20dB)was not recorded.

**Note:** All modes of operation were investigated and the worst-case emissions are reported.

### 3.2.4 Deviation from Test Standard

No deviation.

3.2.5 Test Setup




Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.6 EUT Operating Condition

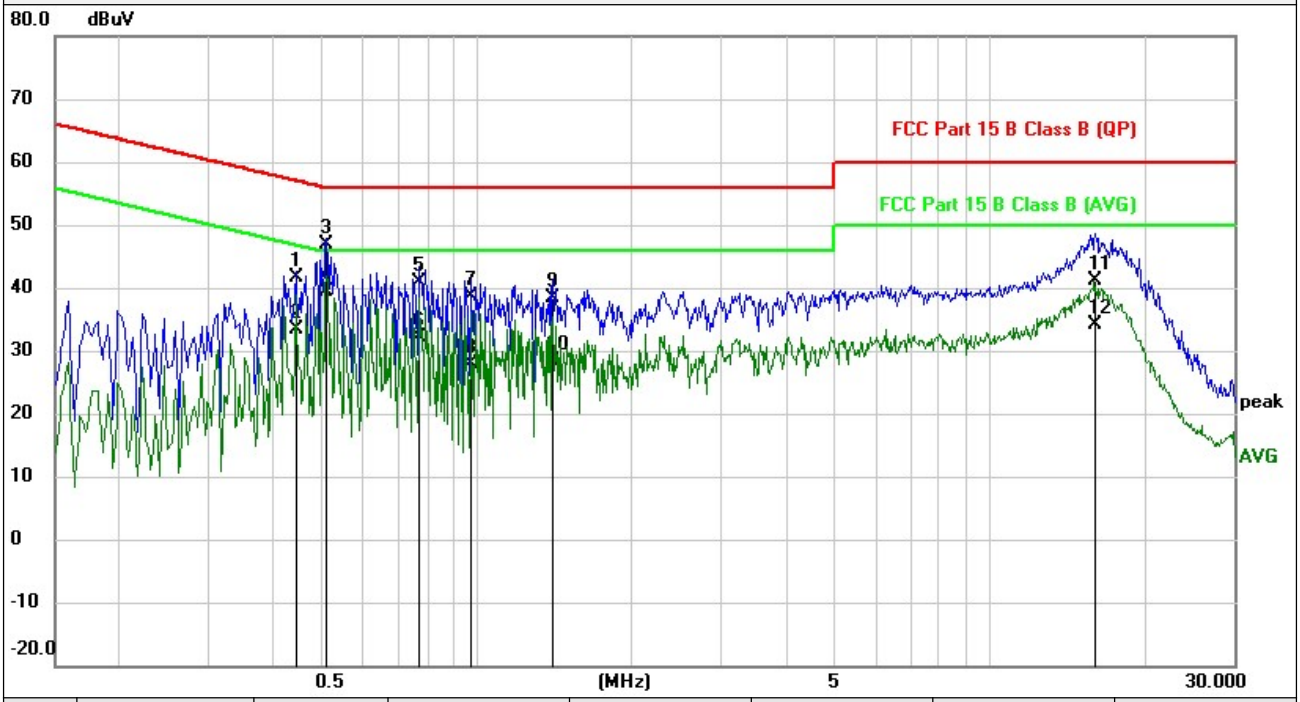
Set the EUT under transmission condition continuously at specific channel frequency.

3.2.7 Test Results

**Conducted worst-case data：GFSK**

| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution andwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 60%RH |
| Tested by | Tank Tan | Test Date | 2020/5/15 |

Phase Of Power: Line (L)



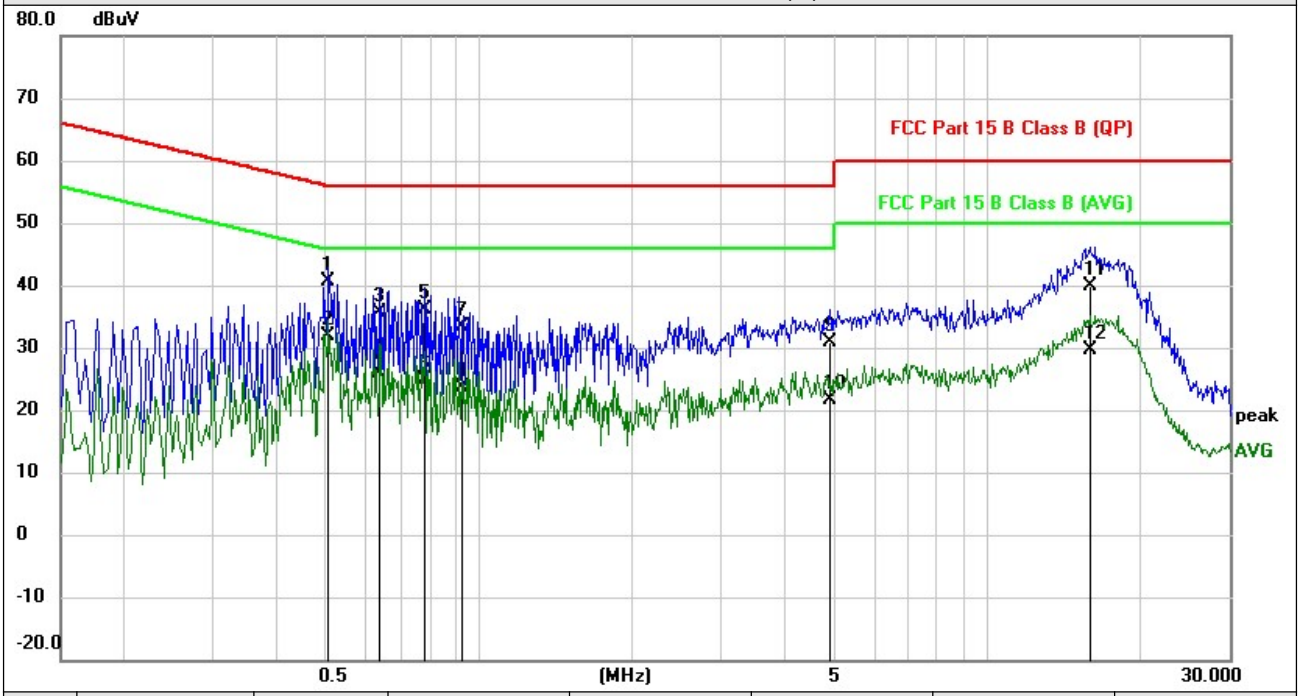

| No | Frequency (MHz) | Reading (dBuV) | Correct Factor dB | Emission Level (dBuV) | Limit (dBuV) | Margin (dB) | Remark Detecter |
|---|---|---|---|---|---|---|---|
| 1 | 0.4425 | 31.83 | 9.76 | 41.59 | 57.01 | -15.42 | QP |
| 2 | 0.4425 | 23.60 | 9.76 | 33.36 | 47.01 | -13.65 | AVG |
| 3 | 0.5100 | 37.21 | 9.78 | 46.99 | 56.00 | -9.01 | QP |
| **4** | **0.5100** | **29.59** | **9.78** | **39.37** | **46.00** | **-6.63** | **AVG** |
| 5 | 0.7710 | 31.15 | 9.73 | 40.88 | 56.00 | -15.12 | QP |
| 6 | 0.7710 | 22.34 | 9.73 | 32.07 | 46.00 | -13.93 | AVG |
| 7 | 0.9690 | 29.08 | 9.65 | 38.73 | 56.00 | -17.27 | QP |
| 8 | 0.9690 | 18.26 | 9.65 | 27.91 | 46.00 | -18.09 | AVG |
| 9 | 1.4100 | 28.86 | 9.63 | 38.49 | 56.00 | -17.51 | QP |
| 10 | 1.4100 | 18.66 | 9.63 | 28.29 | 46.00 | -17.71 | AVG |
| 11 | 16.1205 | 30.87 | 10.34 | 41.21 | 60.00 | -18.79 | QP |
| 12 | 16.1205 | 23.71 | 10.34 | 34.05 | 50.00 | -15.95 | AVG |

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

| | | | |
|---|---|---|---|
| Frequency Range | 150kHz ~ 30MHz | Detector Function & Resolution andwidth | Quasi-Peak (QP) / Average (AV), 9kHz |
| Input Power | 120Vac, 60Hz | Environmental Conditions | 25℃, 60%RH |
| Tested by | Tank Tan | Test Date | 2020/5/15 |

Phase Of Power: Neutral (N)




| No | Frequency (MHz) | Reading (dBuV) | Correct Factor dB | Emission Level (dBuV) | Limit (dBuV) | Margin (dB) | Remark Detecter |
|---|---|---|---|---|---|---|---|
| 1 | 0.5045 | 30.80 | 9.78 | 40.58 | 56.00 | -15.42 | QP |
| 2 | 0.5045 | 22.10 | 9.78 | 31.88 | 46.00 | -14.12 | AVG |
| 3 | 0.6387 | 25.99 | 9.76 | 35.75 | 56.00 | -20.25 | QP |
| 4 | 0.6387 | 16.04 | 9.76 | 25.80 | 46.00 | -20.20 | AVG |
| 5 | 0.7816 | 26.30 | 9.73 | 36.03 | 56.00 | -19.97 | QP |
| 6 | 0.7816 | 15.13 | 9.73 | 24.86 | 46.00 | -21.14 | AVG |
| 7 | 0.9205 | 23.67 | 9.66 | 33.33 | 56.00 | -22.67 | QP |
| 8 | 0.9205 | 13.99 | 9.66 | 23.65 | 46.00 | -22.35 | AVG |
| 9 | 4.9164 | 21.24 | 9.52 | 30.76 | 56.00 | -25.24 | QP |
| 10 | 4.9164 | 12.17 | 9.52 | 21.69 | 46.00 | -24.31 | AVG |
| 11 | 15.8811 | 29.53 | 10.32 | 39.85 | 60.00 | -20.15 | QP |
| 12 | 15.8811 | 19.37 | 10.32 | 29.69 | 50.00 | -20.31 | AVG |

**REMARKS:**

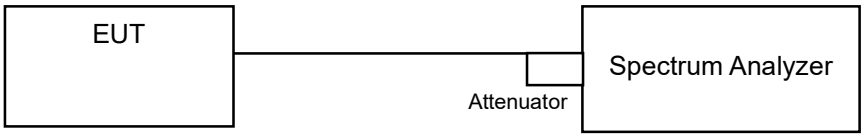
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

## 3.3 Number of Hopping Frequency Used

### 3.3.1 Limits of Hopping Frequency Used Measurement

At least 15 channels frequencies, and should be equally spaced.

### 3.3.2 Test Setup




### 3.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 3.3.4 Test Procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
d. Set the SA on View mode and then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were complete.

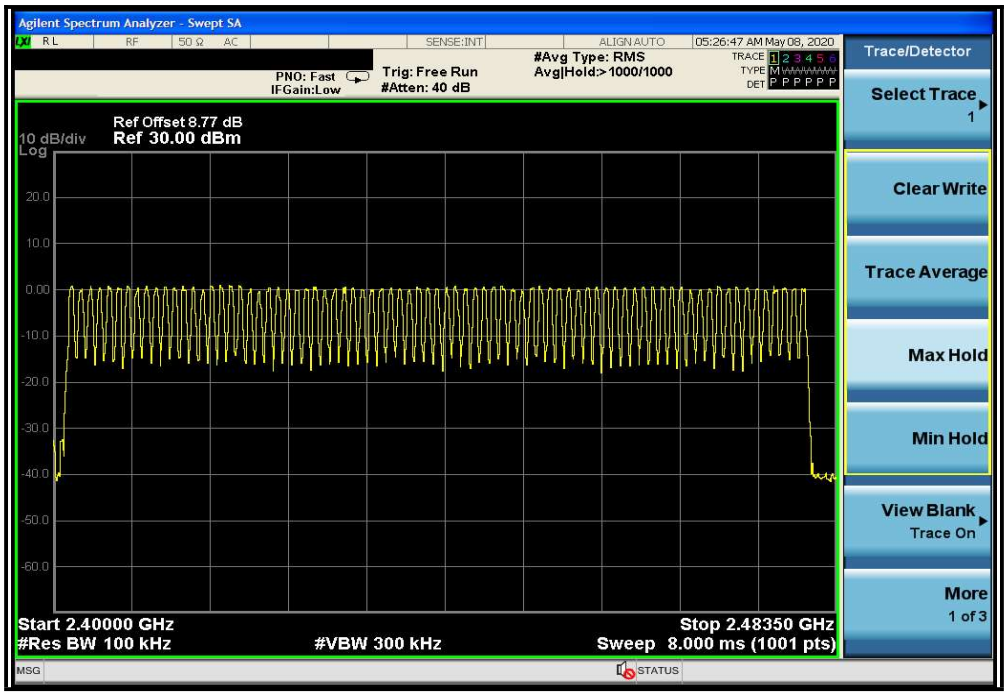
### 3.3.5 Deviation fromTest Standard

No deviation.

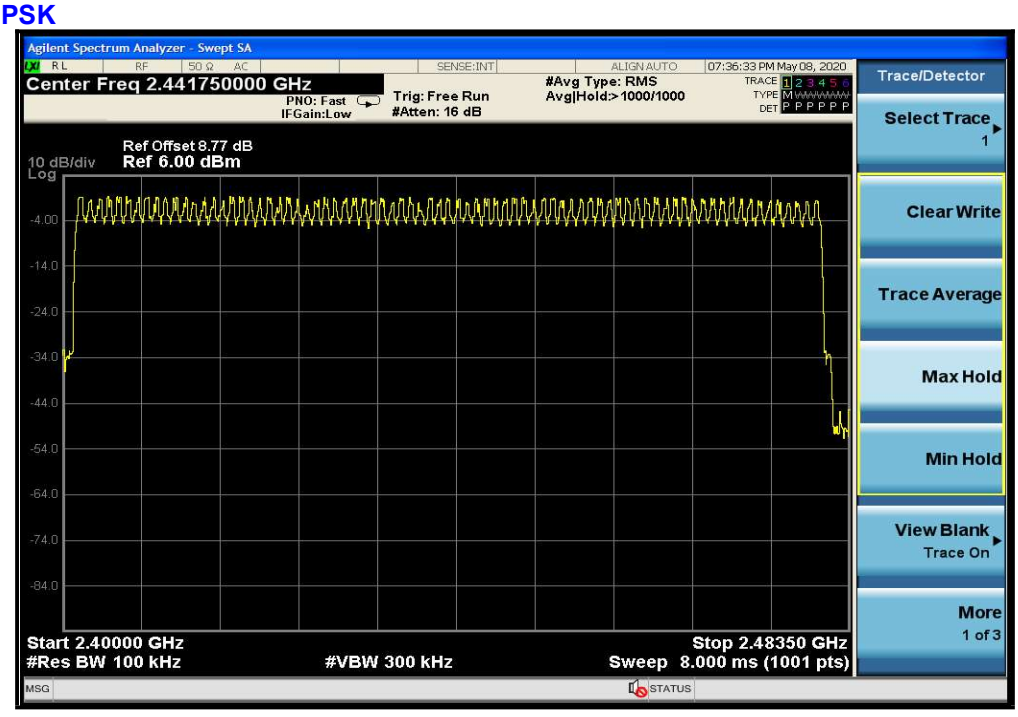
### 3.3.6 Test Results

There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

**GFSK**




**8DPSK**

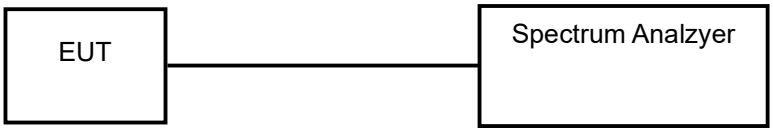


## 3.4 Dwell Time on Each Channel

### 3.4.1 LimitsofDwell Time on Each Channel Measurement

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.

### 3.4.2 Test Setup




### 3.4.3 TestInstruments

Refer to section 4.1.2 to get information of above instrument.

### 3.4.4 Test Procedures

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

.

### 3.4.5 Deviationfrom Test Standard

No deviation.

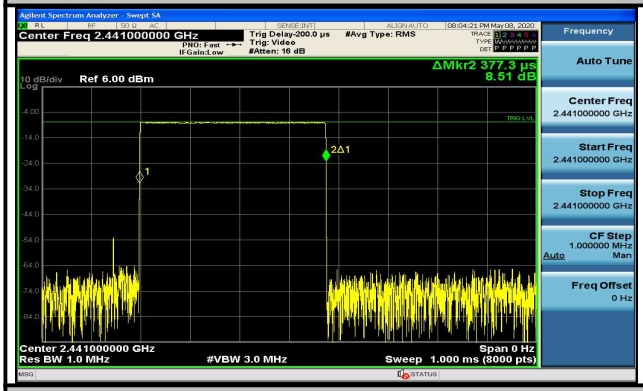
### 3.4.6 Test Results

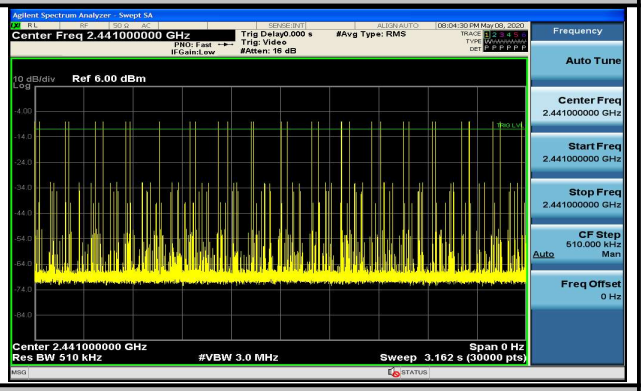
**GFSK**

| Mode | Number of Hopping Channel | Number of transmission in a period(channel number*0.4 sec) | | | | Length of transmission time (msec) | Result (msec) | Limit (msec) | pass / fail |
|---|---|---|---|---|---|---|---|---|---|
| | | period (sec) | sweep time (sec) | times in a sweep | times in a period | | | | |
| DH1 | 79 | 31.6 | 3.16 | 32 | 320 | 0.377 | 120.640 | 400 | pass |
| DH3 | 79 | 31.6 | 3.16 | 10 | 100 | 1.633 | 163.30 | 400 | pass |
| DH5 | 79 | 31.6 | 3.16 | 8 | 80 | 2.880 | 230.40 | 400 | pass |

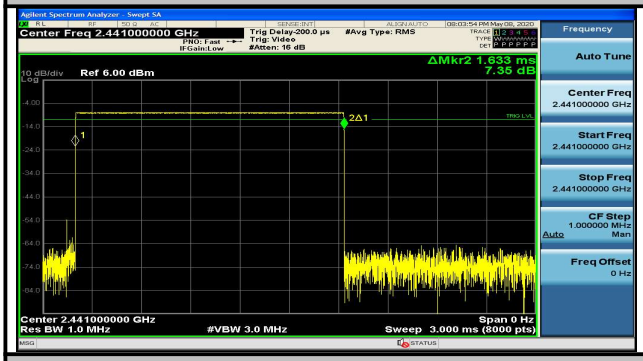
**Note:** Test plots of the transmitting time slot are shown as below.

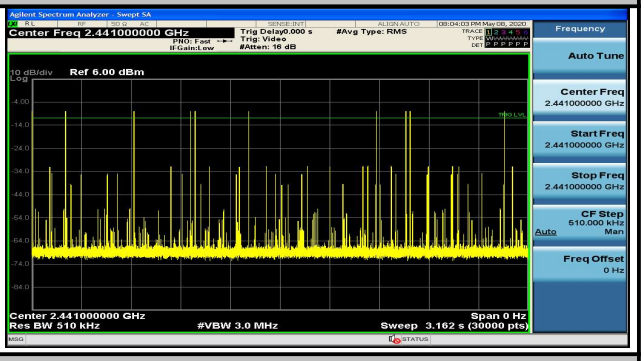
DH1



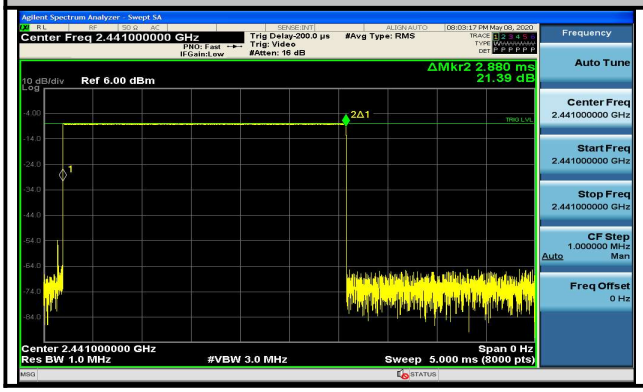



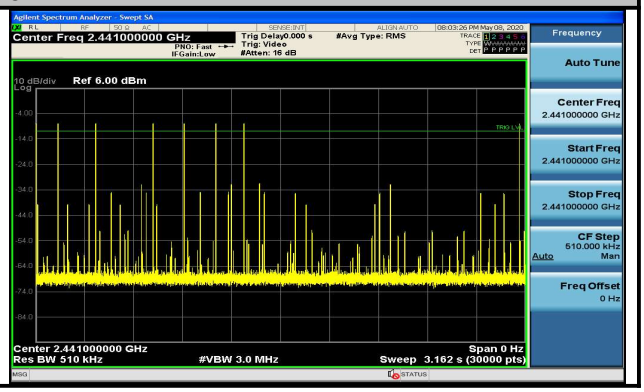

DH3




DH5



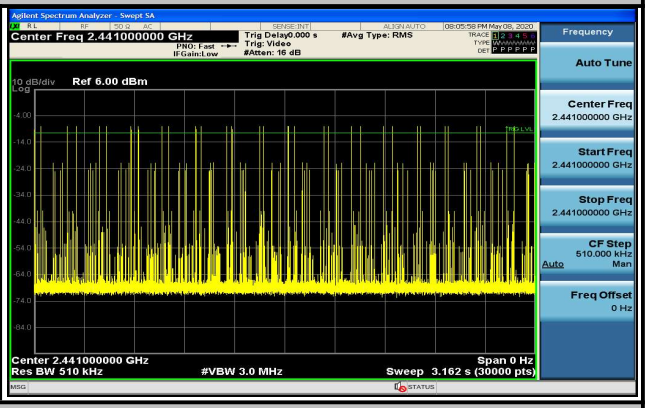




**8DPSK**

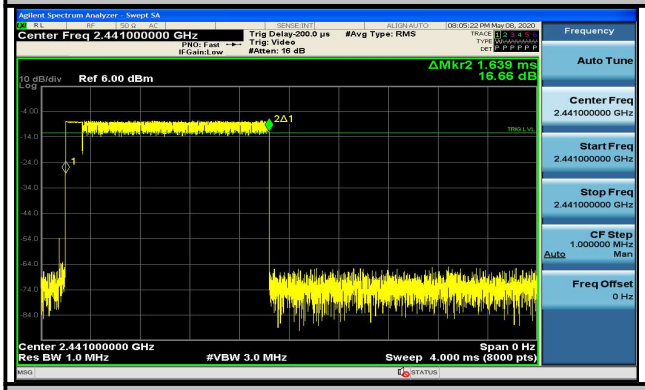
| Mode | Number of Hopping Channel | Number of transmission in a period(channel number*0.4 sec) | | | | Length of transmission time (msec) | Result (msec) | Limit (msec) | pass / fail |
|---|---|---|---|---|---|---|---|---|---|
| | | period (sec) | sweep time (sec) | times in a sweep | times in a period | | | | |
| DH1 | 79 | 31.6 | 3.16 | 32 | 320 | 0.387 | 123.840 | 400 | pass |
| DH3 | 79 | 31.6 | 3.16 | 13 | 130 | 1.639 | 213.07 | 400 | pass |
| DH5 | 79 | 31.6 | 3.16 | 9 | 90 | 2.887 | 259.83 | 400 | pass |

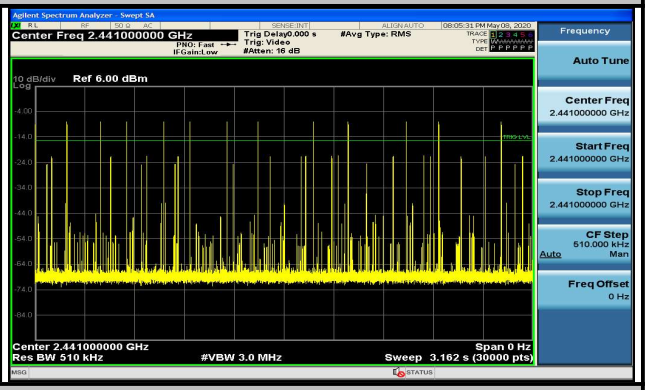
**Note:** Test plots of the transmitting time slot are shown as below.

**3DH1**

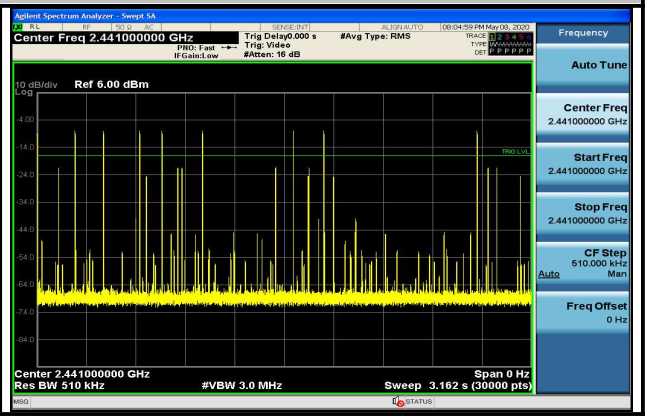




**3DH3**




**3DH5**

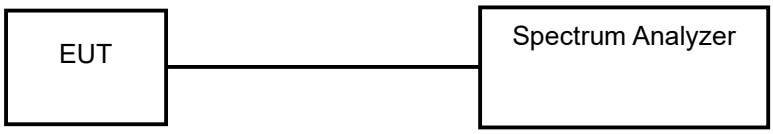



## 3.5 Channel Bandwidth

### 3.5.1 Limits of Channel Bandwidth Measurement

For frequency hopping system operating in the 2400-2483.5MHz, if the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

### 3.5.2 Test Setup




### 3.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 3.5.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

### 3.5.5 Deviation from Test Standard

No deviation.

### 3.5.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

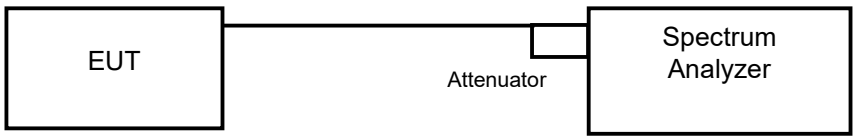
### 3.5.7 Test Results

| Channel | Frequency (MHz) | 20dB Bandwidth(MHz) | |
|---|---|---|---|
| | | GFSK | 8 DPSK |
| 0 | 2402 | 1.074 | 1.341 |
| 39 | 2441 | 1.095 | 1.362 |
| 78 | 2480 | 1.098 | 1.362 |

| Spectrum Plot of Worst Value | |
|---|---|
| GFSK | **8DPSK** |
|  |  |

## 3.6 Occupied Bandwidth Measurement

### 3.6.1 Test Setup




### 3.6.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument

### 3.6.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5%of the total mean power of a given emission.

### 3.6.4 Deviation from Test Standard

No deviation.

### 3.6.5 EUT Operating Conditions

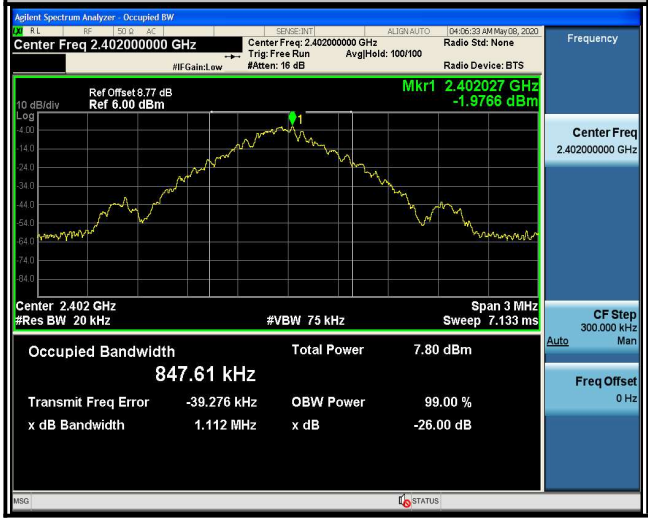
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

### 3.6.6 Test Results

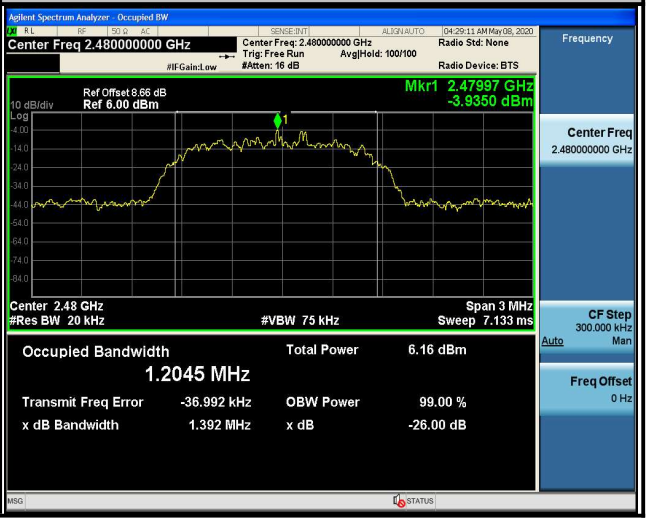
| Channel | Frequency (MHz) | OccupiedBandwidth(MHz) | |
|---|---|---|---|
| | | GFSK | 8 DPSK |
| 0 | 2402 | 0.84761 | 1.1937 |
| 39 | 2441 | 0.84395 | 1.1985 |
| 78 | 2480 | 0.83107 | 1.2045 |

**Spectrum Plot of Worst Value**

**GFSK**




**8DPSK**

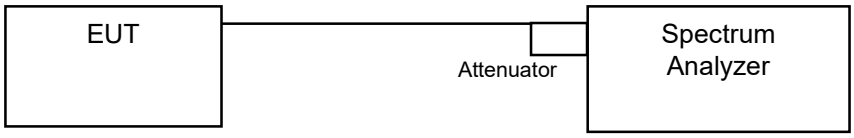


## 3.7 Hopping Channel Separation

### 3.7.1 Limitsof Hopping Channel Separation Measurement

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

### 3.7.2 Test Setup




### 3.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 3.7.4 Test Procedure

Measurement Procedure REF

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
c. By using the MaxHold function record the separation of two adjacent channels.
d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were complete.

### 3.7.5 Deviationfrom Test Standard

No deviation.

### 3.7.6 Test Results

| Channel No. | Frequency (MHz) | Adjacent Channel Separation (MHz) | | 20dB channel bandwidth (MHz) | | Minimum Limit (MHz) | | Pass / Fail |
|---|---|---|---|---|---|---|---|---|
| | | GFSK | 8DPSK | GFSK | 8DPSK | GFSK | 8DPSK | |
| 0 | 2402 | 1.002 | 1.002 | 1.074 | 1.341 | 0.72 | 0.90 | Pass |
| 39 | 2441 | 1.000 | 0.996 | 1.095 | 1.362 | 0.74 | 0.91 | Pass |
| 78 | 2480 | 0.996 | 0.993 | 1.098 | 1.362 | 0.74 | 0.91 | Pass |

**Note:**

1. The minimum limit is two-third 20 dB bandwidth.

**Spectrum Plot of Worst Value**

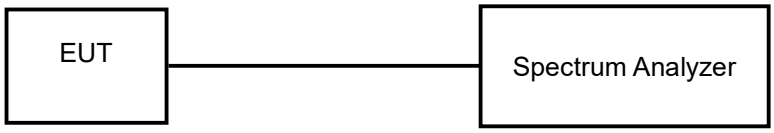
| GFSK | 8DPSK |
|---|---|
|  |  |
|  |  |
|  |  |

## 3.8 Maximum Output Power

### 3.8.1 Limitsof Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

### 3.8.2 Test Setup




### 3.8.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 3.8.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any oneconvenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
d. Measure the captured power within the band and recording the plot.
e. Repeat above procedures until all frequencies required were complete.

### 3.8.5 Deviation fromTest Standard

No deviation.

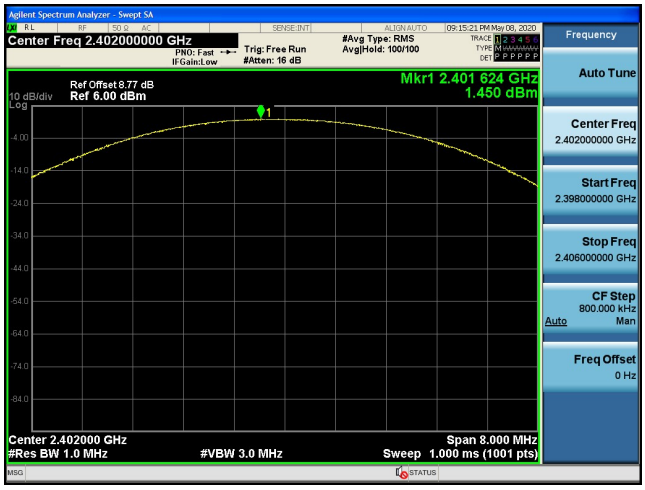
### 3.8.6 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

3.8.7 Test Results

Average Power:

| Channel No. | Freq. (MHz) | Output Power (mW) | | Output Power (dBm) | | Power Limit (mW) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | GFSK | 8DPSK | GFSK | 8DPSK | | |
| 0 | 2402 | 1.159 | 1.396 | 0.64 | **1.45** | 125 | Pass |
| 39 | 2441 | 1.089 | 1.265 | 0.37 | 1.02 | 125 | Pass |
| 78 | 2480 | 1.069 | 1.199 | 0.29 | 0.79 | 125 | Pass |




Peak Power:

| Channel No. | Freq. (MHz) | Output Power (mW) | | Output Power (dBm) | | Power Limit (mW) | Pass / Fail |
|---|---|---|---|---|---|---|---|
| | | GFSK | 8DPSK | GFSK | 8DPSK | | |
| 0 | 2402 | 1.268 | 1.521 | 1.03 | 1.82 | 125 | Pass |
| 39 | 2441 | 1.186 | 1.384 | 0.74 | 1.41 | 125 | Pass |
| 78 | 2480 | 1.161 | 1.343 | 0.65 | 1.28 | 125 | Pass |

## 3.9 Conducted Out of Band Emission Measurement

### 3.9.1 Limits Of Conducted Out Of Band Emission Measurement

For average power：
Below –30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
For peak power:
Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth)

### 3.9.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 3.9.3 Test Procedure

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 3.9.4 Deviation from Test Standard

No deviation.

### 3.9.5 EUT Operating Condition

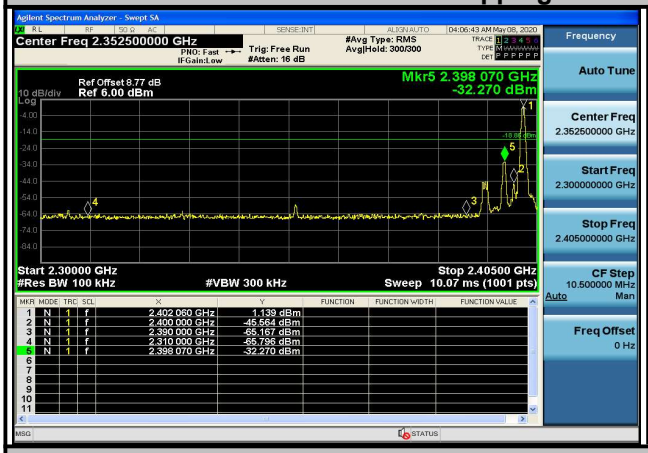
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

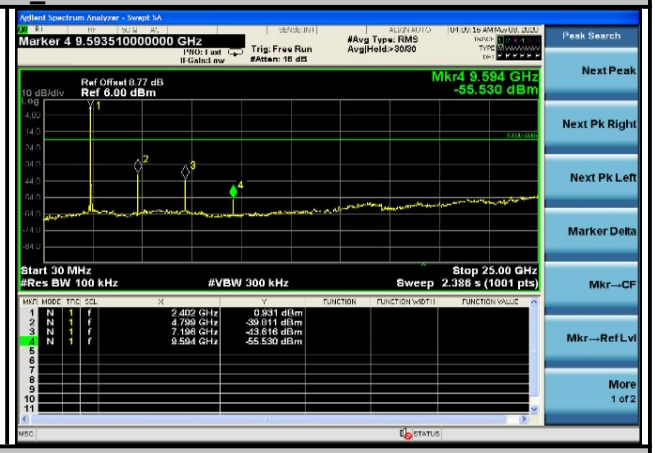
### 3.9.6 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

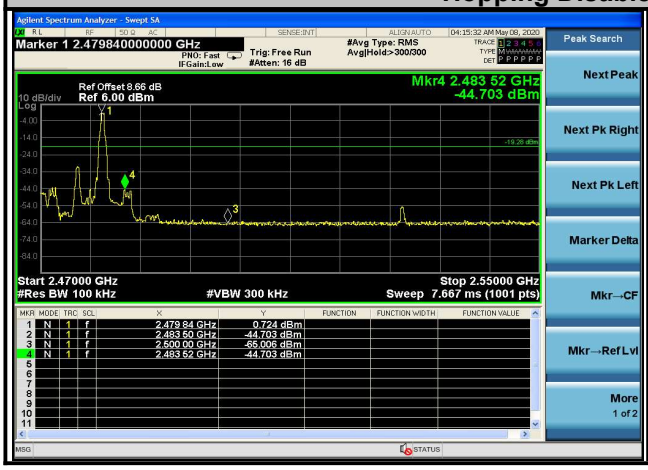
GFSK

**Hopping Disabled_Low Channel**

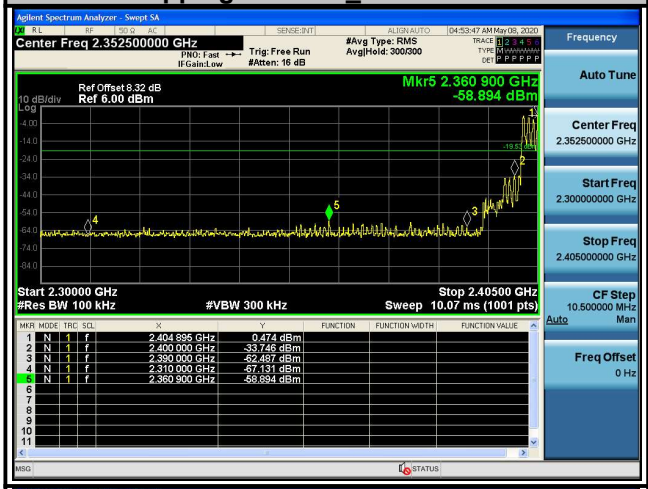
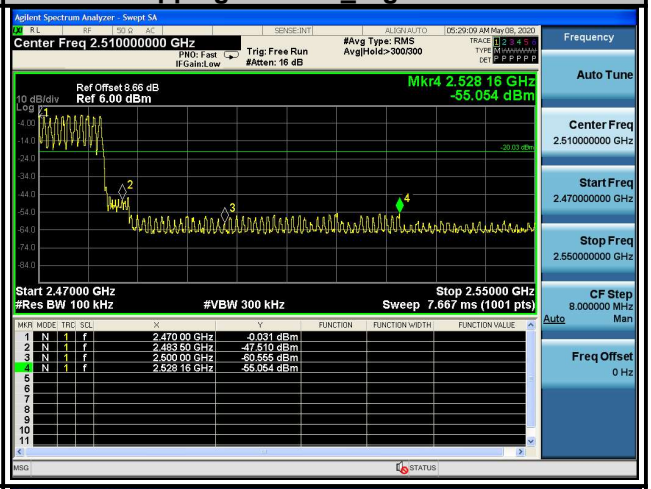
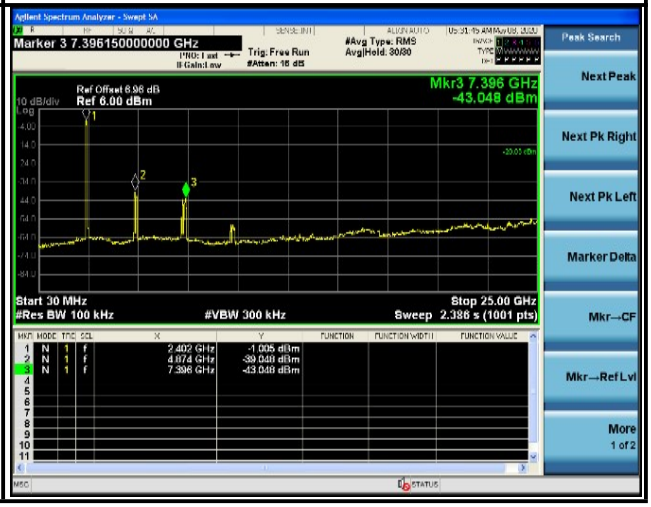



**Hopping Disabled_High Channel**

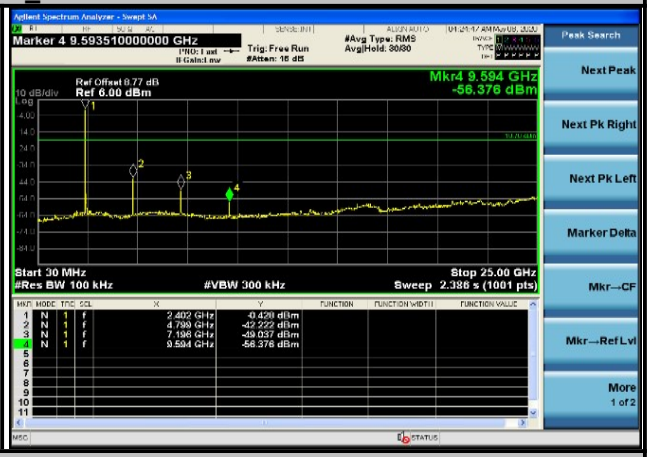



GFSK

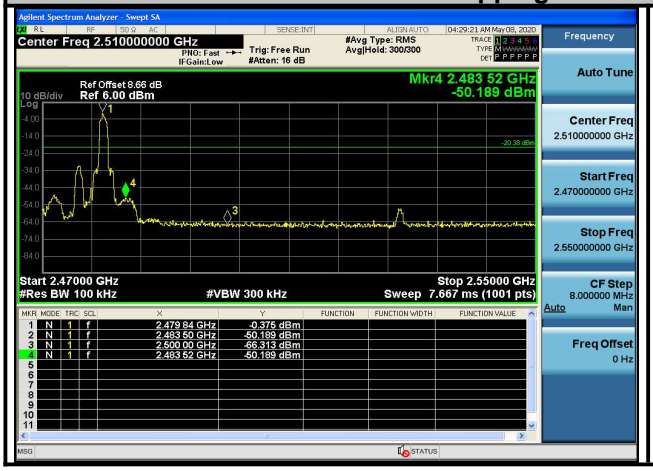
| Hopping Enabled_Low Channel | Hopping Enabled_High Channel |
| --- | --- |
|  |  |
|  |  |

## 8-DPSK

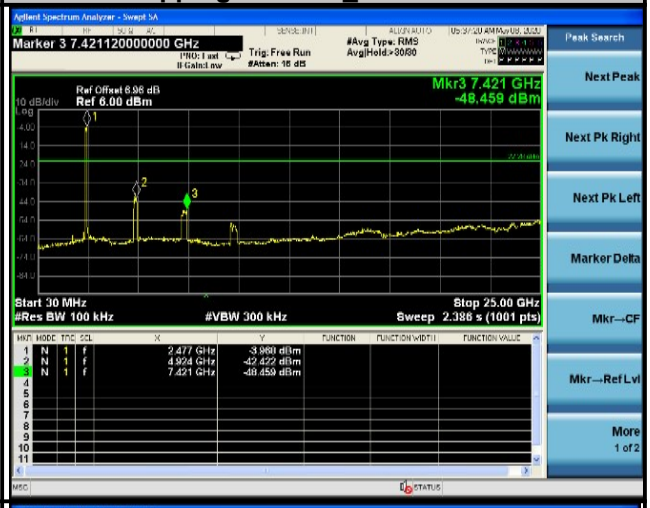
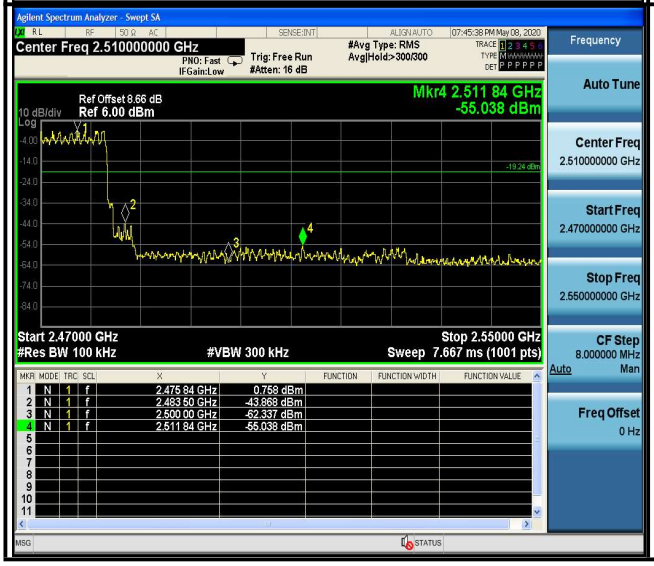
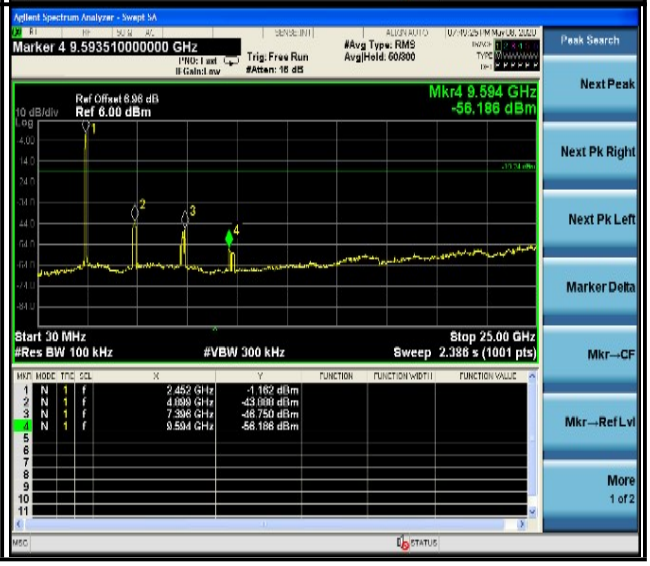
### Hopping Disabled_Low Channel


### Hopping Disabled_High Channel




## 8-DPSK

| Hopping Enabled_Low Channel | Hopping Enabled_Low Channel |
| --- | --- |
|  |  |
|  |  |

## 4 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

### 4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date of Calibration |
|---|---|---|---|---|
| Spectrum Keysight | N9020A | MY51240612 | 2019/10/18 | 2020/10/17 |
| Spectrum Analyzer Rohde&Schwarz | FSV-40N | 101783 | 2019/10/18 | 2020/10/17 |
| Power Meter10Hz~18GHz Tonscend | JS0806-2 | 188060126 | 2019/10/18 | 2020/10/17 |
| Signal generator Keysight | N5182A | GB40051020 | 2019/10/18 | 2020/10/17 |
| Signal generator Keysight | N5182A | MY47420944 | 2019/10/18 | 2020/10/17 |
| Test Software Tonscend | JS0806-2 | NA | NA | NA |
| Hygrothermograph Yuhuaze | HTC-1 | NA | 2019/10/18 | 2020/10/17 |

Note: 3. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.

4. The test was performed in Chamber 1.

**Appendix – Information on the Testing Laboratories**

We,Hwa-Hsing (Dongguan) Co., Ltd.,A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Lab Address:** No.101, Bld N1,Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China
**Contact Tel:** 0769-83078199
**Email:**customerservice.dg@hwa-hsing.com
**Web Site:**www.hwa-hsing.com

The address and road map of all our labs can be found in our web site also.

**--- END ---**