



# RADIO TEST REPORT

Report No.: SHATBL2110016W01

Applicant:  
SBOT Technologies LLC

Address:  
230 W 39th St, 8th FL, New York, NY, USA, 10018

Product Name : Smart shopping cart model 2

Brand Name : Caper

Model Name : Caper-V011.0

Series Model : N/A

Test Standard : FCC Part 15.247

FCC ID : 2A3Q4CAPER-V011

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## TEST RESULT CERTIFICATION

Applicant.....: SBOT Technologies LLC

Address.....: 230 W 39th St, 8th FL, New York, NY, USA, 10018

Manufacturer's Name.....: SBOT Technologies LLC

Address.....: 230 W 39th St, 8th FL, New York, NY, USA, 10018

Product Description

Product Name.....: Smart shopping cart model 2

Brand Name .....: Caper

Model Name.....: Caper-V011.0

Series Model.....: N/A

Test Standards.....: FCC Part 15.247

Test Procedure.....: ANSI C63.10-2013

This device described above has been tested by ATBL, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of receipt of test item.....: 01 Nov. 2021

Date (s) of performance of tests.: 01 Nov. 2021 ~ 12 Nov. 2021

Date of Issue.....: 13 Nov. 2021

Test Result.....: Pass

Report Prepared by :

*yongqiang.liu*  
(yongqiang.liu)

Report Approved by :

*Ghost Li.*  
(Ghost.Li)

Authorized Signatory :

*Terry yang*  
(Terry yang)



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**Revision History**

| Rev. | Issue Date   | Report NO.       | Effect Page | Contents      |
|------|--------------|------------------|-------------|---------------|
| 00   | 13 Nov. 2021 | SHATBL2110016W01 | ALL         | Initial Issue |
|      |              |                  |             |               |



## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:  
KDB 558074 D01 15.247 Meas Guidance v05r02.

| FCC Part15.247,Subpart C      |                                         |          |        |
|-------------------------------|-----------------------------------------|----------|--------|
| Standard Section              | Test Item                               | Judgment | Remark |
| 15.207                        | Conducted Emission                      | PASS     | --     |
| 15.247(a)(1)                  | Hopping Channel Separation              | PASS     | --     |
| 15.247(a)(1)&(b)(1)           | Output Power                            | PASS     | --     |
| 15.209                        | Radiated Spurious Emission              | PASS     | --     |
| 15.247(d)                     | Conducted Spurious & Band Edge Emission | PASS     | --     |
| 15.247(a)(1)(iii)             | Number of Hopping Frequency             | PASS     | --     |
| 15.247(a)(1)(iii)             | Dwell Time                              | PASS     | --     |
| 15.247(a)(1)                  | Bandwidth                               | PASS     | --     |
| 15.205                        | Restricted bands of operation           | PASS     | --     |
| Part 15.247(d)/part 15.209(a) | Band Edge Emission                      | PASS     | --     |
| 15.203                        | Antenna Requirement                     | PASS     | --     |

### NOTE:

- (1) 'N/A' denotes test is not applicable in this Test Report.
- (2)All tests are according to ANSI C63.10-2013.

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF THE EUT

|                         |                                          |                                                        |
|-------------------------|------------------------------------------|--------------------------------------------------------|
| Product Name            | Smart shopping cart model 2              |                                                        |
| Trade Name              | Caper                                    |                                                        |
| Model Name              | Caper-V011.0                             |                                                        |
| Series Model            | N/A                                      |                                                        |
| Model Difference        | N/A                                      |                                                        |
| Product Description     | The EUT is a Smart shopping cart model 2 |                                                        |
|                         | Operation Frequency:                     | 2402~2480 MHz                                          |
|                         | Modulation Type:                         | GFSK(1Mbps),<br>$\pi/4$ -DQPSK(2Mbps),<br>8DPSK(3Mbps) |
|                         | Bluetooth Configuration:                 | BR+EDR                                                 |
|                         | Bluetooth Version:                       | 2.0                                                    |
|                         | Number Of Channel:                       | 79                                                     |
|                         | Antenna Designation:                     | Please refer to the Note 3.                            |
|                         | AntennaGain (dBi):                       | 2 dBi                                                  |
| Channel List            | Please refer to the Note 2.              |                                                        |
| Power Rating            | 18V                                      |                                                        |
| Hardware version number | V1.2                                     |                                                        |
| Software versionnumber  | 7.1.2                                    |                                                        |
| Connecting I/O Port(s)  | Please refer to the Note 1.              |                                                        |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.

2.

| Channel List |                 |         |                 |         |                 |
|--------------|-----------------|---------|-----------------|---------|-----------------|
| Channel      | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 00           | 2402            | 27      | 2429            | 54      | 2456            |
| 01           | 2403            | 28      | 2430            | 55      | 2457            |
| 02           | 2404            | 29      | 2431            | 56      | 2458            |
| 03           | 2405            | 30      | 2432            | 57      | 2459            |
| 04           | 2406            | 31      | 2433            | 58      | 2460            |
| 05           | 2407            | 32      | 2434            | 59      | 2461            |
| 06           | 2408            | 33      | 2435            | 60      | 2462            |
| 07           | 2409            | 34      | 2436            | 61      | 2463            |
| 08           | 2410            | 35      | 2437            | 62      | 2464            |
| 09           | 2411            | 36      | 2438            | 63      | 2465            |
| 10           | 2412            | 37      | 2439            | 64      | 2466            |
| 11           | 2413            | 38      | 2440            | 65      | 2467            |
| 12           | 2414            | 39      | 2441            | 66      | 2468            |
| 13           | 2415            | 40      | 2442            | 67      | 2469            |
| 14           | 2416            | 41      | 2443            | 68      | 2470            |
| 15           | 2417            | 42      | 2444            | 69      | 2471            |
| 16           | 2418            | 43      | 2445            | 70      | 2472            |
| 17           | 2419            | 44      | 2446            | 71      | 2473            |
| 18           | 2420            | 45      | 2447            | 72      | 2474            |
| 19           | 2421            | 46      | 2448            | 73      | 2475            |
| 20           | 2422            | 47      | 2449            | 74      | 2476            |
| 21           | 2423            | 48      | 2450            | 75      | 2477            |
| 22           | 2424            | 49      | 2451            | 76      | 2478            |
| 23           | 2425            | 50      | 2452            | 77      | 2479            |
| 24           | 2426            | 51      | 2453            | 78      | 2480            |
| 25           | 2427            | 52      | 2454            |         |                 |
| 26           | 2428            | 53      | 2455            |         |                 |

3. Table for Filed Antenna

| Ant. | Brand | Model Name       | Antenna Type | Connector | Gain (dBi) | NOTE       |
|------|-------|------------------|--------------|-----------|------------|------------|
| 1    | Caper | Caper-V01<br>1.0 | FPC          | N/A       | 2 dBi      | BT Antenna |

## 2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Worst Mode | Description | Data Rate/Modulation   |
|------------|-------------|------------------------|
| Mode 1     | TX CH00     | 1Mbps/GFSK             |
| Mode 2     | TX CH39     | 1Mbps/GFSK             |
| Mode 3     | TX CH78     | 1Mbps/GFSK             |
| Mode 4     | TX CH00     | 2 Mbps/ $\pi/4$ -DQPSK |
| Mode 5     | TX CH39     | 2 Mbps/ $\pi/4$ -DQPSK |
| Mode 6     | TX CH78     | 2 Mbps/ $\pi/4$ -DQPSK |
| Mode7      | TX CH00     | 3 Mbps/8DPSK           |
| Mode 8     | TX CH39     | 3 Mbps/8DPSK           |
| Mode 9     | TX CH78     | 3 Mbps/8DPSK           |
| Mode 10    | Hopping     | GFSK                   |
| Mode 11    | Hopping     | $\pi/4$ -DQPSK         |
| Mode 12    | Hopping     | 8DPSK                  |

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) Wetested for all available U.S. voltage and frequencies (For 120V, 50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report.

For Conducted Emission

| Test Case          |                         |
|--------------------|-------------------------|
| Conducted Emission | Mode 13 : Keeping BT TX |

## 2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple

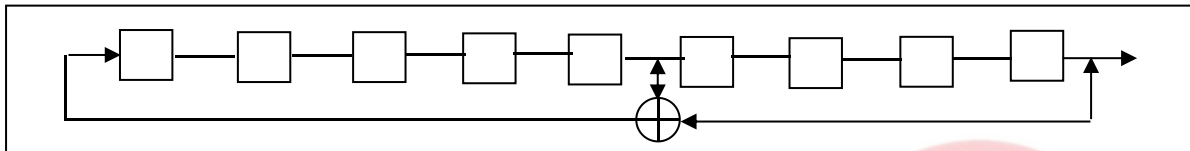
transmitters is not permitted.

(2)The Pseudorandom sequence may be generated in a nine-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized with nine ones.

Numver of shift register stages:9

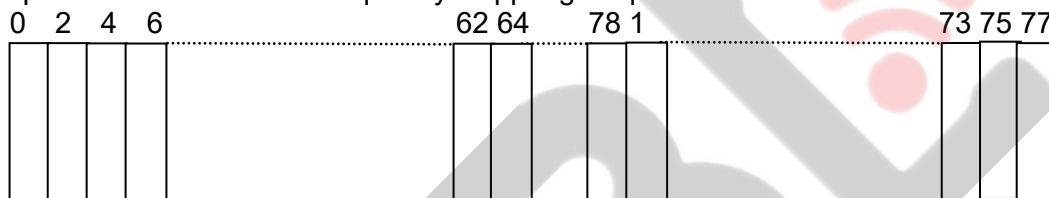
Length of pseudo-random sequence: $2^9-1=511$ bits

Longest sequence of zeros: 8(non-inverted signal)



Liner Feedback Shift Register for Generator of the PRBS sequence

An example of Pseudorandom Frequency Hoppong Sequence as follow:



Each frequency used equally on th average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies ini synchronization with the transmitted signals.

### (3)Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements FCC Part 15.247 rule.

## 2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

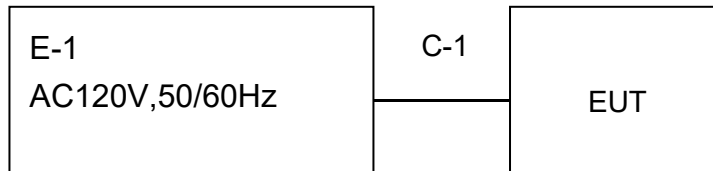
During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

| Test software Version                             | Test program: Bluetooth                                             |                                                                         |                                                                          |
|---------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------|
| (Power control software)<br>Parameters(1/2/3Mbps) | Power class:<br>DH1 rate:4:27<br>2DH1 rate:20:54<br>3DH1 rate:24:83 | Power class:<br>DH3 rate:11:183<br>2DH3 rate:26:367<br>3DH3 rate:27:552 | Power class:<br>DH5 rate:15:339<br>2DH5 rate:30:679<br>3DH5 rate:31:1021 |

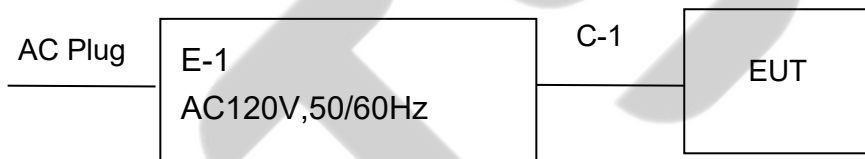
| RF Function | Type   | Mode Or Modulation type | Ant Gain(dBi) | Power Class | Software For Testing |
|-------------|--------|-------------------------|---------------|-------------|----------------------|
| BT          | BR+EDR | GFSK                    | 2             | 10          | RF test tool         |
|             |        | $\pi/4$ -DQPSK          | 2             | 10          |                      |
|             |        | 8DPSK                   | 2             | 10          |                      |

## 2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

### Radiated Spurious Emission Test



### Conduction Emission Test



## 2.6 LABORATORY INFORMATION

|                                    |                                                                                         |
|------------------------------------|-----------------------------------------------------------------------------------------|
| Company Name:                      | Shanghai ATBL Technology Co., Ltd.                                                      |
| Address:                           | Building 8, No. 160 Basheng Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai |
| Telephone:                         | +86(0)21-51298625                                                                       |
| The FCC Registration Number (FRN): | 0031025281                                                                              |
| A2LA Number:                       | 6184.01                                                                                 |
| CNAS Number:                       | CNAS L14531                                                                             |

## 2.7 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately **95 %**.

| No. | Item                               | Uncertainty          |
|-----|------------------------------------|----------------------|
| 1   | RF output power, conducted         | $\pm 0.958\text{dB}$ |
| 2   | Conducted spurious emissions       | $\pm 2.988\text{dB}$ |
| 3   | All emissions, radiated 30MHz-1GHz | $\pm 2.50\text{dB}$  |
| 4   | All emissions, radiated 1GHz-18GHz | $\pm 3.51\text{dB}$  |
| 5   | Occupied bandwidth                 | $\pm 23.20\text{dB}$ |
| 6   | Power spectral density             | $\pm 0.886\text{dB}$ |

## 2.8 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

### Necessary accessories

| Item | Equipment | Mfr/Brand | Model/Type No. | Length | Note |
|------|-----------|-----------|----------------|--------|------|
| N/A  | N/A       | N/A       | N/A            | N/A    | N/A  |
|      |           |           |                |        |      |
|      |           |           |                |        |      |
|      |           |           |                |        |      |

### Support units

| Item | Equipment | Mfr/Brand | Model/Type No.  | Length                  | Note |
|------|-----------|-----------|-----------------|-------------------------|------|
| E-1  | Notebook  | Lenovo    | DESKTOP-USDEO09 | 00326-10000-00000-AA636 | N/A  |
| C-1  | USB Cable | N/A       | 100cm           | N/A                     | N/A  |
|      |           |           |                 |                         |      |
|      |           |           |                 |                         |      |

### Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

## 2.9 EQUIPMENTS LIST

### 2.9.1 Radiation Test equipment

| Kind of Equipment            | Manufacturer | Type No.        | Serial No.       | Management number | Calibrated until |
|------------------------------|--------------|-----------------|------------------|-------------------|------------------|
| Test Receiver                | R&S          | ESCI            | 100469           | SHATBL-E003       | 2022.07.13       |
| Spectrum Analyzer            | Agilent      | N9020A          | MY50200811       | SHATBL-E017       | 2022.07.13       |
| Bilog Antenna                | SCHWARZBECK  | VLUB 9168       | 01174            | SHATBL-E008       | 2023.09.27       |
| Horn Antenna                 | SCHWARZBECK  | BBHA 9120D      | 02014            | SHATBL-E009       | 2023.09.27       |
| Pre-Amplifier (0.1M-3GHz)    | JPT          | JPA-10M1G35     | 21010100035001   | SHATBL-E005       | 2022.10.07       |
| Pre-Amplifier (1G-18GHz)     | JPT          | JPA0118-55-303A | 1910001800055000 | SHATBL-E006       | 2022.07.13       |
| Temperature & Humidity       | DeLi         | DeLi            | N/A              | SHATBL-E016       | 2022.10.07       |
| Antenna/Turntable Controller | Brilliant    | N/A             | N/A              | SHATBL-E007       | N/A              |
| Test SW                      | FALA         | EMC-RI(Ver.4A2) |                  | SHATBL-E046       | N/A              |

### 2.9.2 Conduction Test equipment

| Kind of Equipment      | Manufacturer | Type No.                 | Serial No. | Management number | Calibration date |
|------------------------|--------------|--------------------------|------------|-------------------|------------------|
| Test Receiver          | R&S          | ESPI                     | 101679     | SHATBL-E012       | 2022.07.13       |
| LISN                   | R&S          | ENV216                   | 101300     | SHATBL-E013       | 2022.07.13       |
| LISN                   | R&S          | ENV216                   | 100333     | SHATBL-E041       | 2022.03.08       |
| Temperature & Humidity | DeLi         | DeLi                     | N/A        | SHATBL-E015       | 2022.10.07       |
| Test SW                | FALA         | EZ-EMC(Ver.EMC-CON3A1.1) |            | SHATBL-E044       | N/A              |

### 2.9.3 RF Connected Test

| Kind of Equipment                     | Manufacturer       | Type No.               | Serial No.     | equipment number | Calibrated until |
|---------------------------------------|--------------------|------------------------|----------------|------------------|------------------|
| MIMO Power measurement test Set       | DARE               | RPR3006W               | 16I00054SN016  | SHATBL-W006      | 2022.10.07       |
|                                       |                    |                        | RPR6W-20001005 | SHATBL-W013      | 2022.10.07       |
| Signal Analyzer                       | Agilent            | N9020A                 | MY57300196     | SHATBL-W004      | 2022.10.07       |
| Signal Generator                      | Agilent            | N5182B                 | MY46240556     | SHATBL-W005      | 2022.10.07       |
| Wireless Communications Test Set      | R&S                | CMW500                 | 101331         | SHATBL-W007      | 2022.10.07       |
| Temperature & Humidity                | Deli               | deli                   | N/A            | SHATBL-W011      | 2022.10.07       |
| Attenuator                            | Agilent            | 8494B                  | DC-18G         | SHATBL-W009      | 2022.10.07       |
| Attenuator                            | Agilent            | 8496B                  | DC-18G         | SHATBL-W010      | 2022.10.07       |
| power splitter                        | MNK                | MPD-DC/6-2S            | 62315 G51      | SHATBL-W015      | 2022.10.07       |
|                                       |                    |                        | 62315 G52      | SHATBL-W016      | 2022.10.07       |
| Filter                                | Chengdu kangmaiwei | ZBSF-C2400-2483.5-T3   | N/A            | SHATBL-W021      | N/A              |
| Constant temperature and humidity box | KSON               | THS-B6C-150            | 6159K          | SHATBL-W019      | 2022.01.26       |
| Test SW                               | FALA               | LZ-RF(Ver.LzRF-03A3.1) |                | SHATBL-W020      | N/A              |

## 3. EMC EMISSION TEST

### 3.1 CONDUCTED EMISSION MEASUREMENT

#### 3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

| FREQUENCY (MHz) | Conducted Emissionlimit (dBuV) |           |
|-----------------|--------------------------------|-----------|
|                 | Quasi-peak                     | Average   |
| 0.15 -0.5       | 66 - 56 *                      | 56 - 46 * |
| 0.50 -5.0       | 56.00                          | 46.00     |
| 5.0 -30.0       | 60.00                          | 50.00     |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of “\*” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

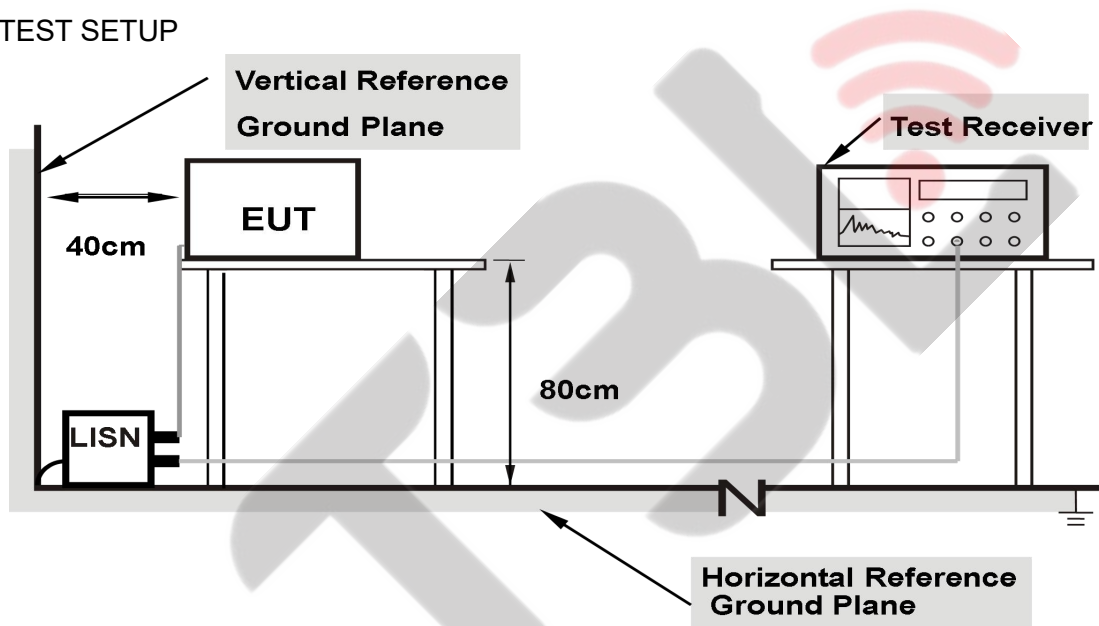
The following table is the setting of the receiver

| Receiver Parameters | Setting  |
|---------------------|----------|
| Attenuation         | 10 dB    |
| Start Frequency     | 0.15 MHz |
| Stop Frequency      | 30 MHz   |
| IF Bandwidth        | 9 kHz    |

### 3.1.2 TEST PROCEDURE

- The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN is at least 80 cm from the nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 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 cm from other units and other metal planes support units.**

### 3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

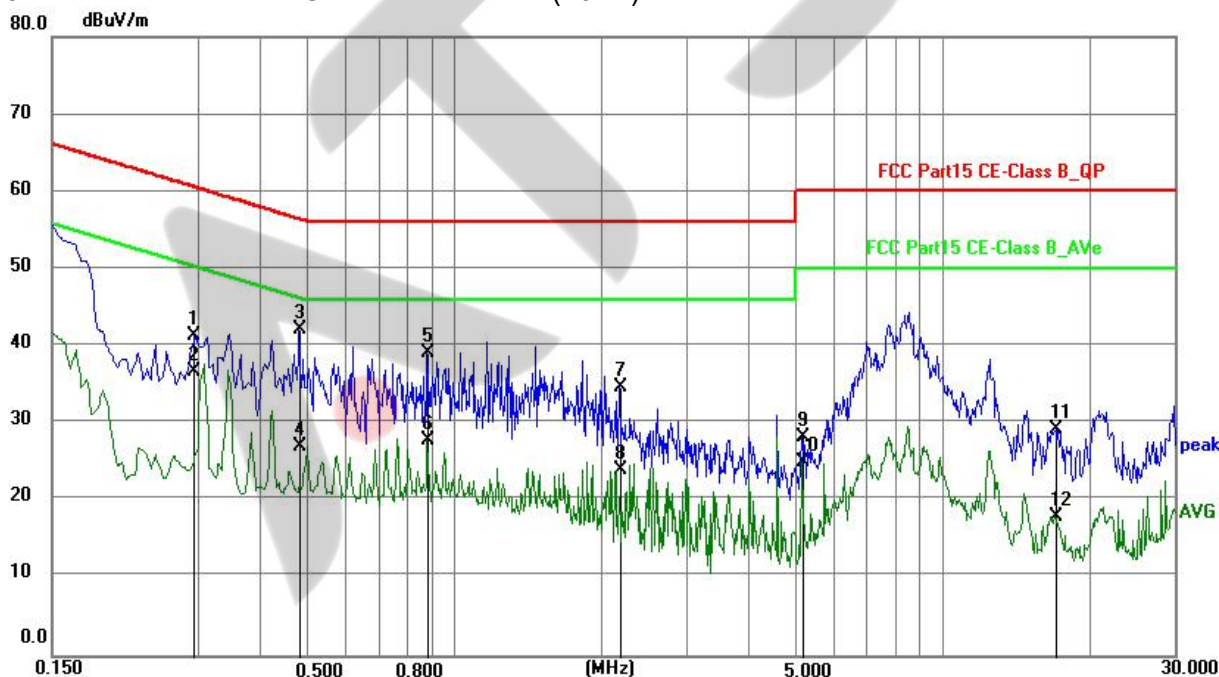
### 3.1.5 TEST RESULT

|               |              |                    |       |
|---------------|--------------|--------------------|-------|
| Temperature:  | 26.2℃        | Relative Humidity: | 53%RH |
| Test Voltage: | AC 120V/60Hz | Phase:             | L     |
| Test Mode:    | Mode 4       |                    |       |

| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------|-----------------|----------------|-------------|--------|
| 1   | 0.2938          | 31.40          | 10.08          | 41.48           | 60.42          | -18.94      | QP     |
| 2   | 0.2938          | 26.63          | 10.08          | 36.71           | 50.42          | -13.71      | AVG    |
| 3   | 0.4828          | 32.13          | 9.99           | 42.12           | 56.29          | -14.17      | QP     |
| 4   | 0.4828          | 17.08          | 9.99           | 27.07           | 46.29          | -19.22      | AVG    |
| 5   | 0.8830          | 29.31          | 9.94           | 39.25           | 56.00          | -16.75      | QP     |
| 6   | 0.8830          | 17.88          | 9.94           | 27.82           | 46.00          | -18.18      | AVG    |
| 7   | 2.1838          | 24.75          | 9.98           | 34.73           | 56.00          | -21.27      | QP     |
| 8   | 2.1838          | 14.01          | 9.98           | 23.99           | 46.00          | -22.01      | AVG    |
| 9   | 5.1900          | 18.14          | 10.09          | 28.23           | 60.00          | -31.77      | QP     |
| 10  | 5.1900          | 14.95          | 10.09          | 25.04           | 50.00          | -24.96      | AVG    |
| 11  | 17.1100         | 18.60          | 10.76          | 29.36           | 60.00          | -30.64      | QP     |
| 12  | 17.1100         | 7.25           | 10.76          | 18.01           | 50.00          | -31.99      | AVG    |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) – Limit.
3. Factor = LISN factor + Cable loss + Limiter (10dB)

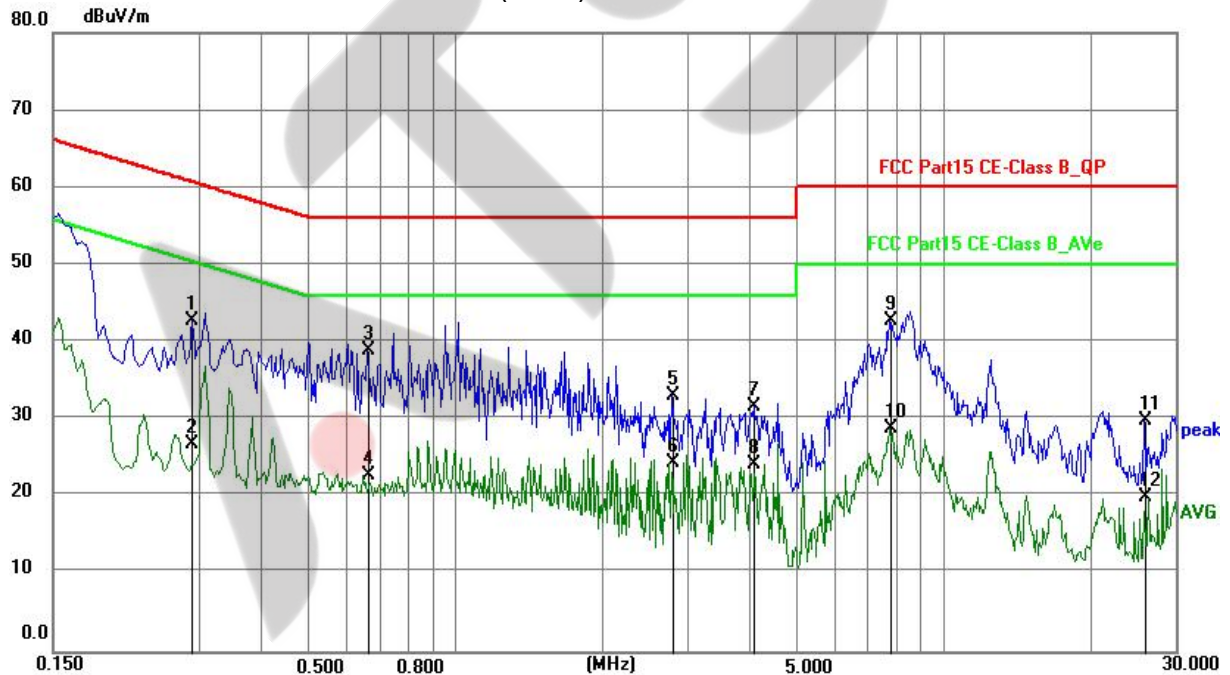


|               |              |                    |       |
|---------------|--------------|--------------------|-------|
| Temperature:  | 26.2℃        | Relative Humidity: | 53%RH |
| Test Voltage: | AC 120V/60Hz | Phase:             | N     |
| Test Mode:    | Mode 4       |                    |       |

| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------|-----------------|----------------|-------------|--------|
| 1   | 0.2893          | 32.53          | 10.33          | 42.86           | 60.54          | -17.68      | QP     |
| 2   | 0.2893          | 16.58          | 10.33          | 26.91           | 50.54          | -23.63      | AVG    |
| 3   | 0.6629          | 28.85          | 10.15          | 39.00           | 56.00          | -17.00      | QP     |
| 4   | 0.6629          | 12.73          | 10.15          | 22.88           | 46.00          | -23.12      | AVG    |
| 5   | 2.7915          | 22.92          | 10.27          | 33.19           | 56.00          | -22.81      | QP     |
| 6   | 2.7915          | 14.30          | 10.27          | 24.57           | 46.00          | -21.43      | AVG    |
| 7   | 4.1055          | 21.47          | 10.22          | 31.69           | 56.00          | -24.31      | QP     |
| 8   | 4.1055          | 14.11          | 10.22          | 24.33           | 46.00          | -21.67      | AVG    |
| 9   | 7.8044          | 32.58          | 10.16          | 42.74           | 60.00          | -17.26      | QP     |
| 10  | 7.8044          | 18.72          | 10.16          | 28.88           | 50.00          | -21.12      | AVG    |
| 11  | 25.9390         | 18.85          | 11.05          | 29.90           | 60.00          | -30.10      | QP     |
| 12  | 25.9390         | 8.90           | 11.05          | 19.95           | 50.00          | -30.05      | AVG    |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor)–Limit.
3. Factor=LISN factor+Cable loss+Limiter (10dB)



## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205 (a)&209(a) limit in the table and according to ANSI C63.10-2013below has to be followed.

#### LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

| Frequencies<br>(MHz) | Field Strength<br>(micorvolts/meter) | Measurement Distance<br>(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                                |

#### LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

| FREQUENCY (MHz) | (dBuV/m) (at 3M) |         |
|-----------------|------------------|---------|
|                 | PEAK             | AVERAGE |
| Above 1000      | 74               | 54      |

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

#### LIMITS OF RESTRICTED FREQUENCY BANDS

| FREQUENCY (MHz)   | FREQUENCY (MHz)     | FREQUENCY (MHz) | FREQUENCY (GHz) |
|-------------------|---------------------|-----------------|-----------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410       | 4.5-5.15        |
| 0.495-0.505       | 16.69475-16.69525   | 608-614         | 5.35-5.46       |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240        | 7.25-7.75       |
| 4.125-4.128       | 25.5-25.67          | 1300-1427       | 8.025-8.5       |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5     | 9.0-9.2         |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5   | 9.3-9.5         |
| 6.215-6.218       | 74.8-75.2           | 1660-1710       | 10.6-12.7       |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2   | 13.25-13.4      |
| 6.31175-6.31225   | 123-138             | 2200-2300       | 14.47-14.5      |
| 8.291-8.294       | 149.9-150.05        | 2310-2390       | 15.35-16.2      |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500     | 17.7-21.4       |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900       | 22.01-23.12     |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267       | 23.6-24.0       |
| 12.29-12.293      | 167.72-173.2        | 3332-3339       | 31.2-31.8       |
| 12.51975-12.52025 | 240-285             | 3345.8-3358     | 36.43-36.5      |
| 12.57675-12.57725 | 322-335.4           | 3600-4400       | Above 38.6      |
| 13.36-13.41       |                     |                 |                 |

## For Radiated Emission

| Spectrum Parameter                    | Setting                                                                                                                         |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Attenuation                           | Auto                                                                                                                            |
| Detector                              | Peak/QP/AV                                                                                                                      |
| Start Frequency                       | 9 KHz/150KHz(Peak/QP/AV)                                                                                                        |
| Stop Frequency                        | 150KHz/30MHz(Peak/QP/AV)                                                                                                        |
| RB / VB (emission in restricted band) | 200Hz (From 9kHz to 0.15MHz)/<br>9KHz (From 0.15MHz to 30MHz);<br>200Hz (From 9kHz to 0.15MHz)/<br>9KHz (From 0.15MHz to 30MHz) |

| Spectrum Parameter                    | Setting            |
|---------------------------------------|--------------------|
| Attenuation                           | Auto               |
| Detector                              | Peak/QP            |
| Start Frequency                       | 30 MHz(Peak/QP)    |
| Stop Frequency                        | 1000 MHz (Peak/QP) |
| RB / VB (emission in restricted band) | 120 KHz / 300 KHz  |

| Spectrum Parameter                    | Setting                                 |
|---------------------------------------|-----------------------------------------|
| Attenuation                           | Auto                                    |
| Detector                              | Peak/AV                                 |
| Start Frequency                       | 1000 MHz(Peak/AV)                       |
| Stop Frequency                        | 10th carrier hamonic(Peak/AV)           |
| RB / VB (emission in restricted band) | 1MHz / 3MHz(Peak)<br>1 MHz/1/T MHz(AVG) |

## For Restricted band

| Spectrum Parameter   | Setting                                                               |
|----------------------|-----------------------------------------------------------------------|
| Detector             | Peak/AV                                                               |
| Start/Stop Frequency | Lower Band Edge: 2310 to 2410 MHz<br>Upper Band Edge: 2475to 2500 MHz |
| RB / VB              | 1 MHz / 3 MHz(Peak)<br>1 MHz/1/T MHz(AVG)                             |

| Receiver Parameter     | Setting                              |
|------------------------|--------------------------------------|
| Attenuation            | Auto                                 |
| Start ~ Stop Frequency | 9kHz~90kHz / RB 200Hz for PK & AV    |
| Start ~ Stop Frequency | 90kHz~110kHz / RB 200Hz for QP       |
| Start ~ Stop Frequency | 110kHz~490kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 490kHz~30MHz / RB 9kHz for QP        |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP     |

### 3.2.2 TEST PROCEDURE

- The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
- The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
- If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

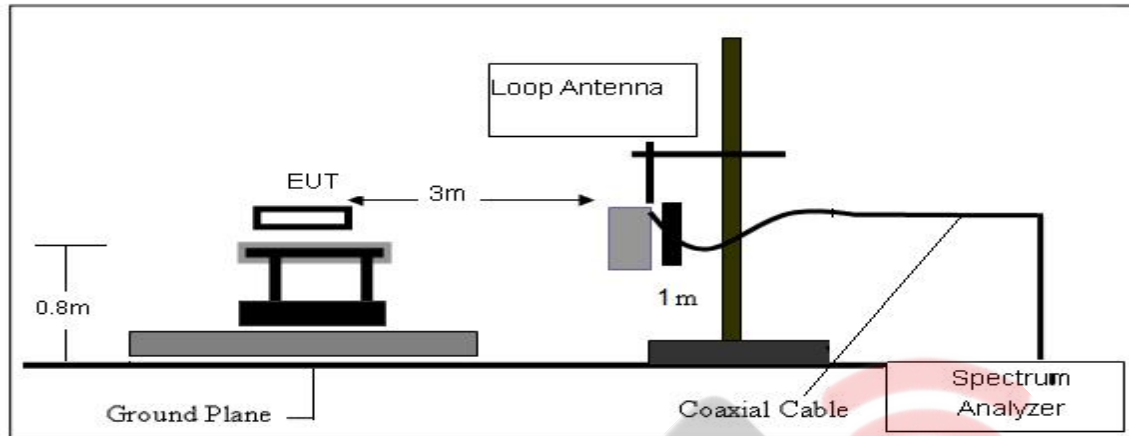
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

### 3.2.3 DEVIATION FROM TEST STANDARD

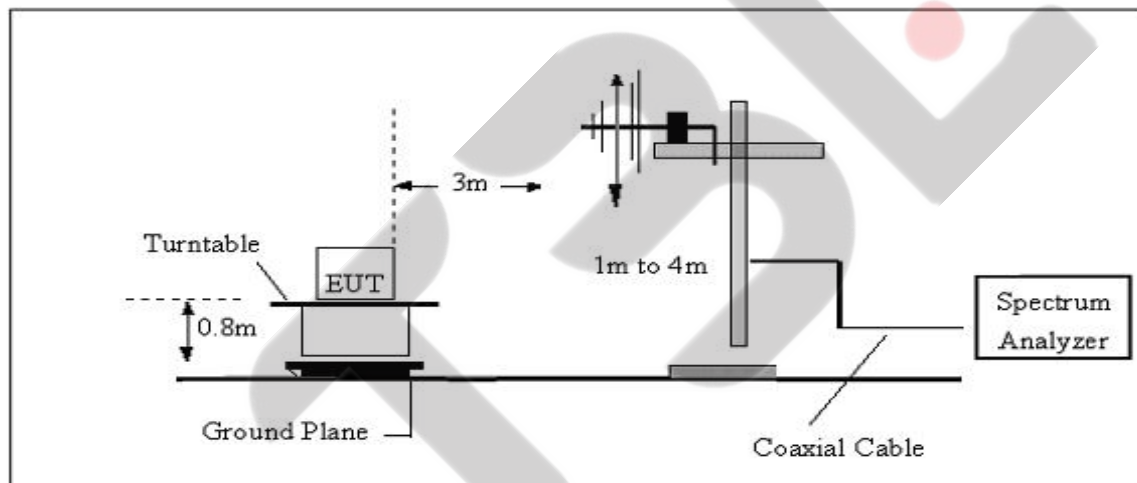
No deviation.

### 3.2.4 TESTSETUP

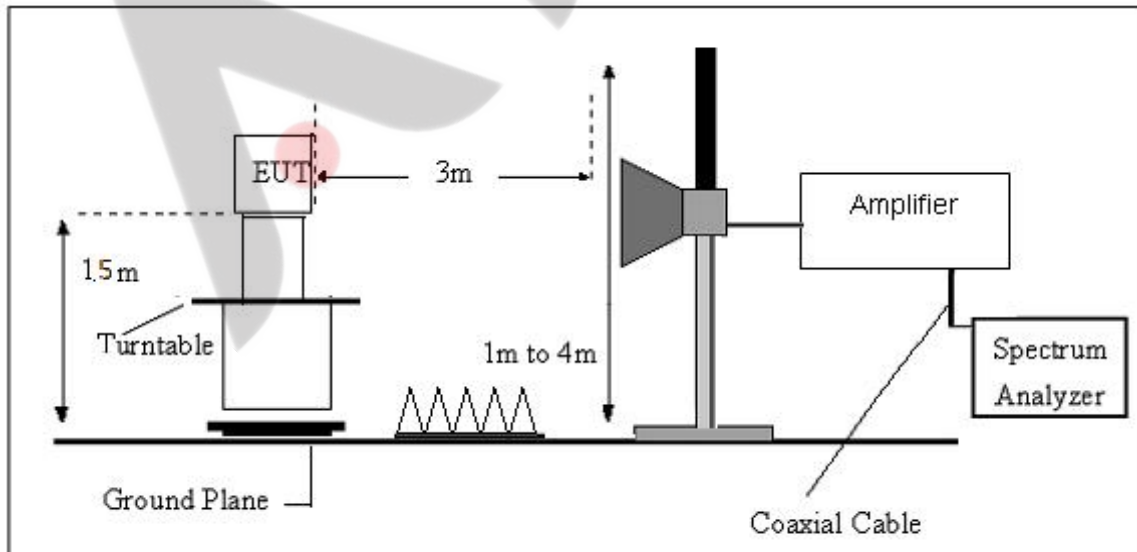
#### (A) Radiated Emission Test-Up Frequency Below 30MHz



#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



#### (C) Radiated Emission Test-Up Frequency Above 1GHz



### 3.2.5 EUT OPERATING CONDITIONS

Please refer to section 3.1.4 of this report.

### 3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

| Frequency | FS       | RA       | AF   | CL   | AG   | Factor |
|-----------|----------|----------|------|------|------|--------|
| (MHz)     | (dBμV/m) | (dBμV/m) | (dB) | (dB) | (dB) | (dB)   |
| 300       | 40       | 58.1     | 12.2 | 1.6  | 31.9 | -18.1  |

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$

### 3.2.7 TEST RESULTS

(9KHz-30MHz)

|               |         |                    |         |
|---------------|---------|--------------------|---------|
| Temperature:  | 23.3(C) | Relative Humidity: | 61%RH   |
| Test Voltage: | AC120V  | Test Mode:         | TX Mode |

| Freq. | Reading  | Limit    | Margin | State | Test Result |
|-------|----------|----------|--------|-------|-------------|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB)   | P/F   |             |
| --    | --       | --       | --     | --    | PASS        |
| --    | --       | --       | --     | --    | PASS        |

**Note:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

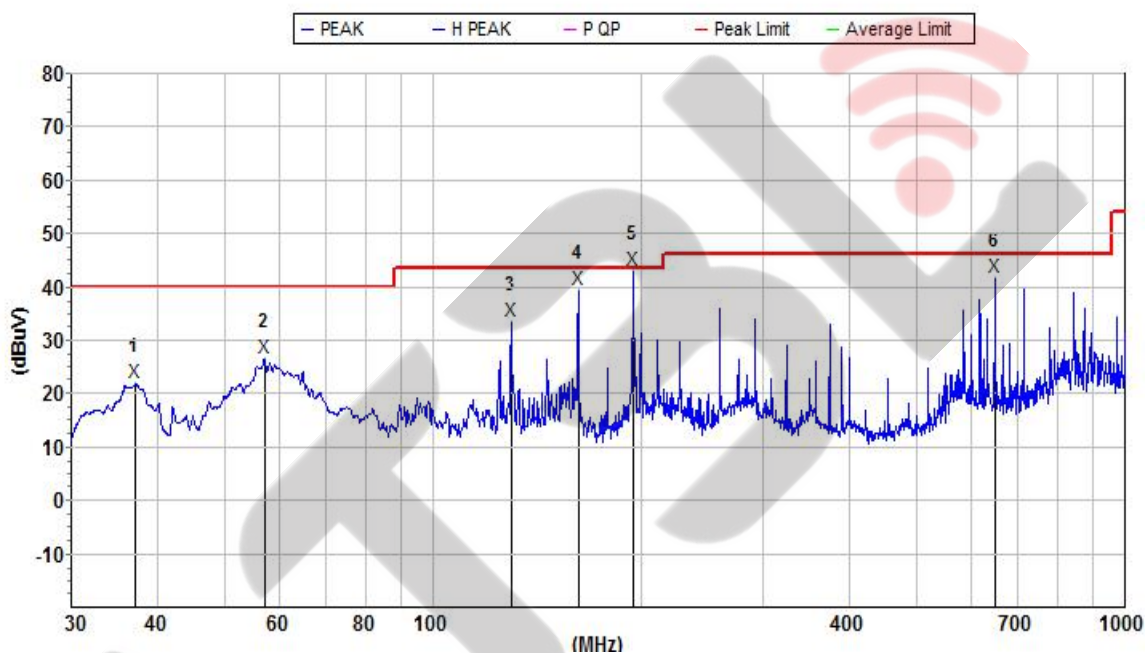
(30MHz-1000MHz)

|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 3  |                    |            |

Remark:

- Margin = Result (Result =Reading + Factor )-Limit
- Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2402 DH5 Horizontal



| Mk. | Freq.(MHz) | Level(d BuV/m) | Limit(dB uV/m) | Margin (dB) | Ant.F/G.( dB/m) | Amp.G.( dB) | Cbl.L .(dB) | Pol. |
|-----|------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| 1   | 37.220165  | 22.1           | 40.0           | 17.9        | 13.7            | 32.3        | 0.8         | H    |
| 2   | 57.091244  | 26.6           | 40.0           | 13.4        | 13.0            | 32.7        | 0.8         | H    |
| 3   | 129.694969 | 33.5           | 43.5           | 10.0        | 12.8            | 32.9        | 1.4         | H    |
| 4   | 162.325732 | 39.6           | 43.5           | 3.9         | 13.9            | 32.9        | 1.6         | H    |
| 5   | 194.794668 | 43.0           | 43.5           | 0.5         | 10.2            | 32.8        | 2.2         | H    |
| 6   | 649.659681 | 41.7           | 46.0           | 4.3         | 16.2            | 32.3        | 3.4         | H    |

(30MHz-1000MHz)

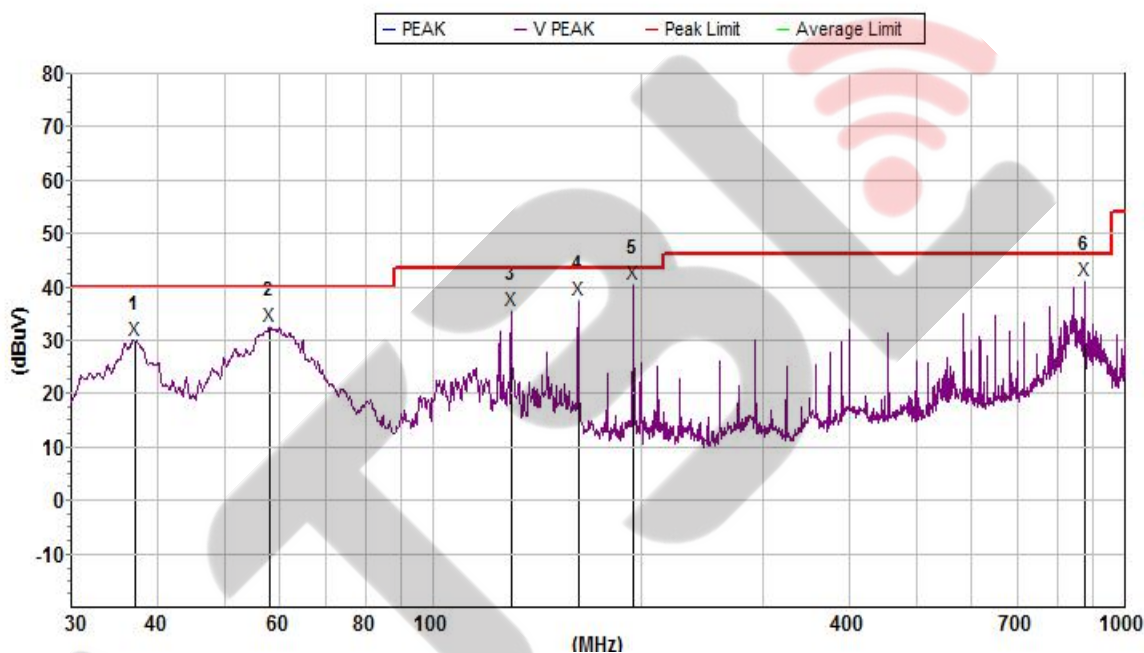
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 1  |                    |          |

Remark:

3. Margin = Result (Result =Reading + Factor )-Limit

4. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2402 DH1 Horizontal



| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|-----|------------|---------------|---------------|-------------|----------------|------------|------------|------|
| 1   | 37.220165  | 30.1          | 40.0          | 9.9         | 13.7           | 32.3       | 0.8        | V    |
| 2   | 58.101039  | 32.5          | 40.0          | 7.5         | 12.9           | 32.7       | 0.8        | V    |
| 3   | 129.694969 | 35.6          | 43.5          | 7.9         | 12.8           | 32.9       | 1.4        | V    |
| 4   | 162.325732 | 37.5          | 43.5          | 6.0         | 13.9           | 32.9       | 1.6        | V    |
| 5   | 194.794668 | 40.4          | 43.5          | 3.1         | 10.2           | 32.8       | 2.2        | V    |
| 6   | 873.713746 | 41.2          | 46.0          | 4.8         | 21.3           | 31.8       | 3.6        | V    |

1000MHz-18000MHz)

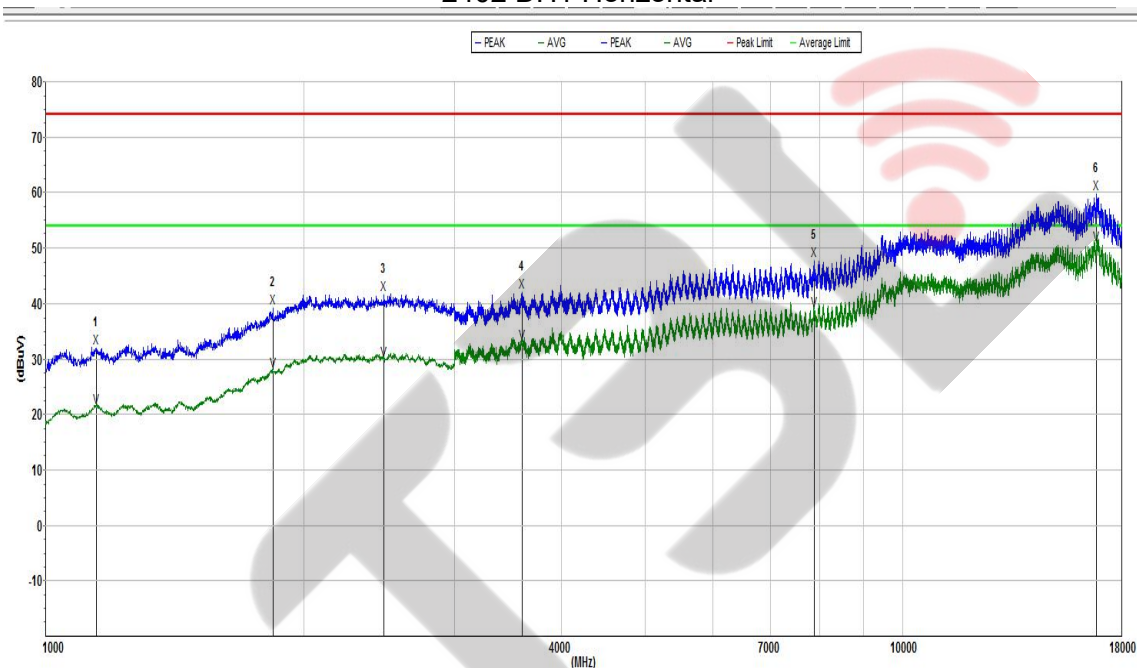
|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 1  |                    |            |

Remark:

5. Margin = Result (Result =Reading + Factor )-Limit

6. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2402 DH1 Horizontal



| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dB uV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|----------------|-------------|----------------|------------|------------|------|
| Peak |              |               |                |             |                |            |            |      |
| 1    | 1147.000000  | 32.1          | 74.0           | 41.9        | 20.8           | 57.3       | 2.2        | H    |
| 2    | 1841.000000  | 39.4          | 74.0           | 34.6        | 21.7           | 52.4       | 2.6        | H    |
| 3    | 2479.000000  | 41.7          | 74.0           | 32.3        | 22.9           | 50.2       | 2.8        | H    |
| 4    | 3597.750000  | 42.1          | 74.0           | 31.9        | 24.2           | 50.4       | 3.2        | H    |
| 5    | 7878.000000  | 47.8          | 74.0           | 26.2        | 26.0           | 48.6       | 4.8        | H    |
| 6    | 16827.000000 | 59.8          | 74.0           | 14.2        | 30.9           | 47.4       | 6.8        | H    |
| Avg  |              |               |                |             |                |            |            |      |
| 1    | 1147.000000  | 21.4          | 54.0           | 32.6        | 20.8           | 57.3       | 2.2        | H    |
| 2    | 1841.000000  | 27.9          | 54.0           | 26.1        | 21.7           | 52.4       | 2.6        | H    |
| 3    | 2479.000000  | 30.0          | 54.0           | 24.0        | 22.9           | 50.2       | 2.8        | H    |
| 4    | 3597.750000  | 33.0          | 54.0           | 21.0        | 24.2           | 50.4       | 3.2        | H    |
| 5    | 7878.000000  | 38.8          | 54.0           | 15.2        | 26.0           | 48.6       | 4.8        | H    |
| 6    | 16827.000000 | 50.7          | 54.0           | 3.3         | 30.9           | 47.4       | 6.8        | H    |

(1000MHz-18000MHz)

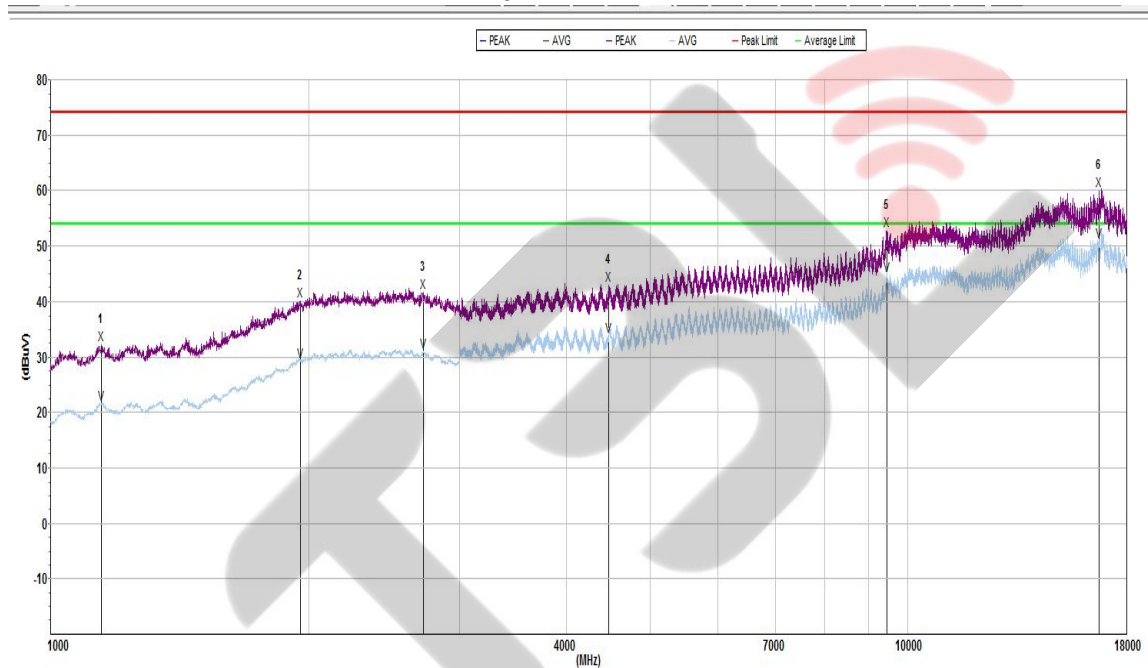
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 1  |                    |          |

Remark:

7. Margin = Result (Result =Reading + Factor )–Limit

8. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2402 DH1 Vertical



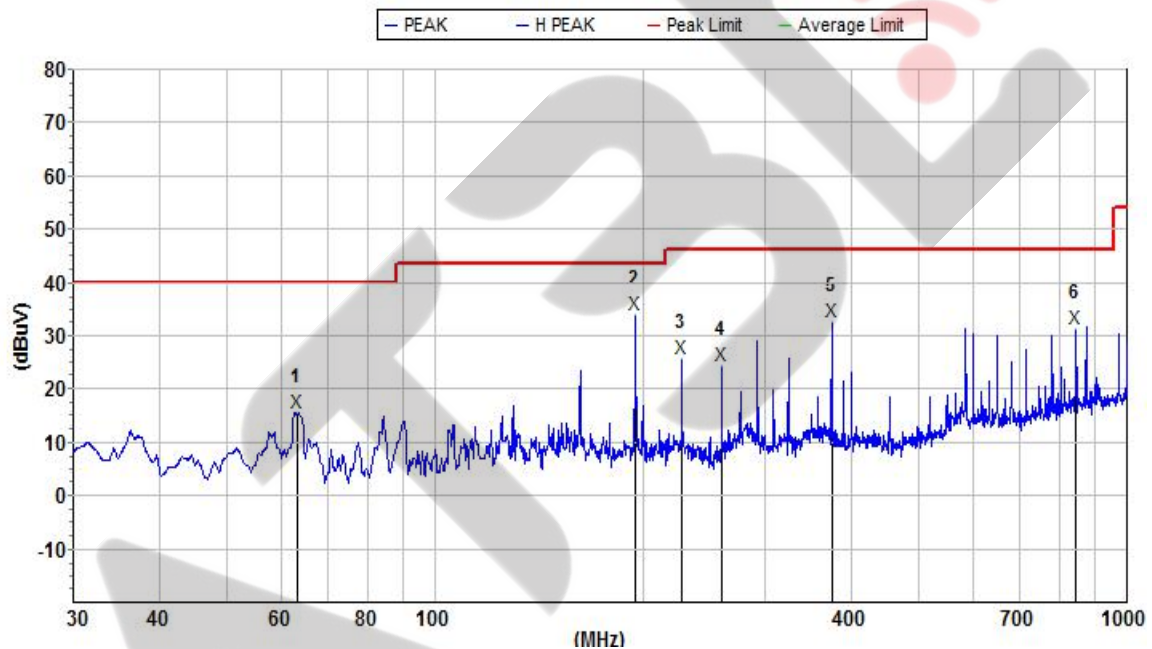
| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|---------------|-------------|----------------|------------|------------|------|
| Peak |              |               |               |             |                |            |            |      |
| 1    | 1147.000000  | 32.2          | 74.0          | 41.8        | 20.7           | 57.3       | 2.2        | V    |
| 2    | 1958.000000  | 40.2          | 74.0          | 33.8        | 22.0           | 50.7       | 2.7        | V    |
| 3    | 2724.000000  | 41.7          | 74.0          | 32.3        | 23.8           | 50.9       | 2.9        | V    |
| 4    | 4479.750000  | 43.1          | 74.0          | 30.9        | 24.8           | 50.1       | 3.5        | V    |
| 5    | 9459.000000  | 52.8          | 74.0          | 21.2        | 27.9           | 48.6       | 5.4        | V    |
| 6    | 16722.000000 | 60.0          | 74.0          | 14.0        | 31.4           | 47.6       | 6.8        | V    |
| Avg  |              |               |               |             |                |            |            |      |
| 1    | 1147.000000  | 21.5          | 54.0          | 32.5        | 20.7           | 57.3       | 2.2        | V    |
| 2    | 1958.000000  | 29.3          | 54.0          | 24.7        | 22.0           | 50.7       | 2.7        | V    |
| 3    | 2724.000000  | 30.9          | 54.0          | 23.1        | 23.8           | 50.9       | 2.9        | V    |
| 4    | 4479.750000  | 33.9          | 54.0          | 20.1        | 24.8           | 50.1       | 3.5        | V    |
| 5    | 9459.000000  | 44.8          | 54.0          | 9.2         | 27.9           | 48.6       | 5.4        | V    |
| 6    | 16722.000000 | 51.0          | 54.0          | 3.0         | 31.4           | 47.6       | 6.8        | V    |

(30MHz-1000MHz)

|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 2  |                    |            |

Remark:

9. Margin = Result (Result =Reading + Factor )-Limit

10. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain  
2440 DH3 Horizontal


| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|-----|------------|---------------|---------------|-------------|----------------|------------|------------|------|
| 1   | 63.424327  | 15.5          | 40.0          | 24.5        | 12.1           | 32.8       | 0.8        | H    |
| 2   | 194.794668 | 33.8          | 43.5          | 9.7         | 10.2           | 32.8       | 2.2        | H    |
| 3   | 227.291780 | 25.6          | 46.0          | 20.4        | 10.9           | 32.8       | 2.5        | H    |
| 4   | 259.688742 | 24.4          | 46.0          | 21.6        | 11.8           | 32.8       | 2.6        | H    |
| 5   | 374.622581 | 32.5          | 46.0          | 13.5        | 13.6           | 32.4       | 2.7        | H    |
| 6   | 843.607400 | 31.4          | 46.0          | 14.6        | 19.3           | 31.9       | 3.6        | H    |

(30MHz-1000MHz)

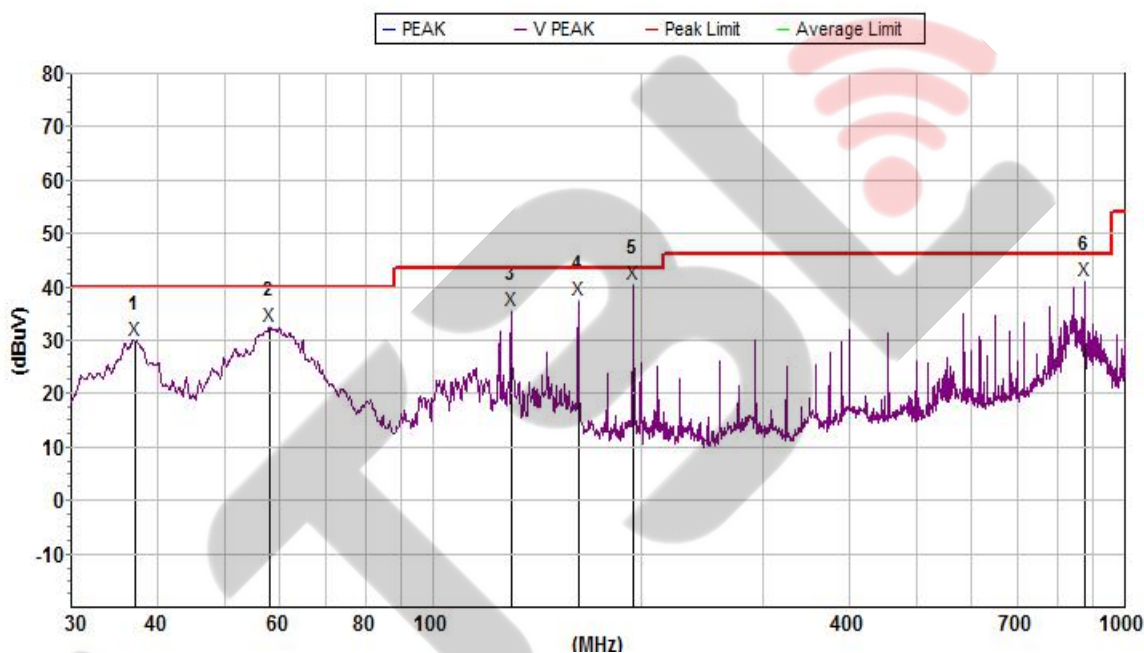
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 2  |                    |          |

Remark:

11. Margin = Result (Result =Reading + Factor )-Limit

12. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2440 DH3 Vertical



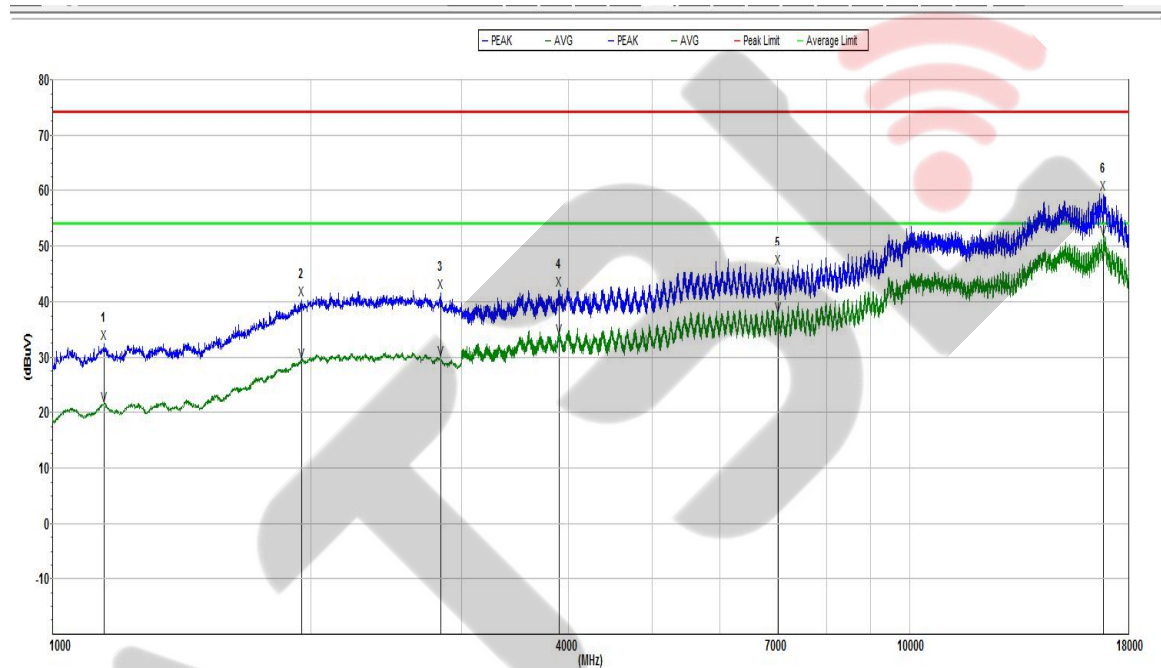
| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|-----|------------|---------------|---------------|-------------|----------------|------------|------------|------|
| 1   | 37.220165  | 30.1          | 40.0          | 9.9         | 13.7           | 32.3       | 0.8        | V    |
| 2   | 58.101039  | 32.5          | 40.0          | 7.5         | 12.9           | 32.7       | 0.8        | V    |
| 3   | 129.694969 | 35.6          | 43.5          | 7.9         | 12.8           | 32.9       | 1.4        | V    |
| 4   | 162.325732 | 37.5          | 43.5          | 6.0         | 13.9           | 32.9       | 1.6        | V    |
| 5   | 194.794668 | 40.4          | 43.5          | 3.1         | 10.2           | 32.8       | 2.2        | V    |
| 6   | 873.713746 | 41.2          | 46.0          | 4.8         | 21.3           | 31.8       | 3.6        | V    |

(1000MHz-18000MHz)

|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 2  |                    |            |

Remark:

13. Margin = Result (Result =Reading + Factor )-Limit

14. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain  
2440 DH3 Horizontal


| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|---------------|-------------|----------------|------------|------------|------|
| Peak |              |               |               |             |                |            |            |      |
| 1    | 1148.000000  | 32.6          | 74.0          | 41.4        | 20.8           | 57.3       | 2.2        | H    |
| 2    | 1951.000000  | 40.3          | 74.0          | 33.7        | 21.8           | 50.8       | 2.7        | H    |
| 3    | 2838.000000  | 41.6          | 74.0          | 32.4        | 23.7           | 51.3       | 2.9        | H    |
| 4    | 3894.750000  | 42.2          | 74.0          | 31.8        | 24.3           | 50.2       | 3.2        | H    |
| 5    | 7018.500000  | 46.0          | 74.0          | 28.0        | 25.6           | 48.9       | 4.4        | H    |
| 6    | 16829.250000 | 59.5          | 74.0          | 14.5        | 30.9           | 47.4       | 6.8        | H    |
| Avg  |              |               |               |             |                |            |            |      |
| 1    | 1148.000000  | 21.4          | 54.0          | 32.6        | 20.8           | 57.3       | 2.2        | H    |
| 2    | 1951.000000  | 29.3          | 54.0          | 24.7        | 21.8           | 50.8       | 2.7        | H    |
| 3    | 2838.000000  | 29.6          | 54.0          | 24.4        | 23.7           | 51.3       | 2.9        | H    |
| 4    | 3894.750000  | 33.7          | 54.0          | 20.3        | 24.3           | 50.2       | 3.2        | H    |
| 5    | 7018.500000  | 37.6          | 54.0          | 16.4        | 25.6           | 48.9       | 4.4        | H    |
| 6    | 16829.250000 | 51.3          | 54.0          | 2.7         | 30.9           | 47.4       | 6.8        | H    |

(1000MHz-18000MHz)

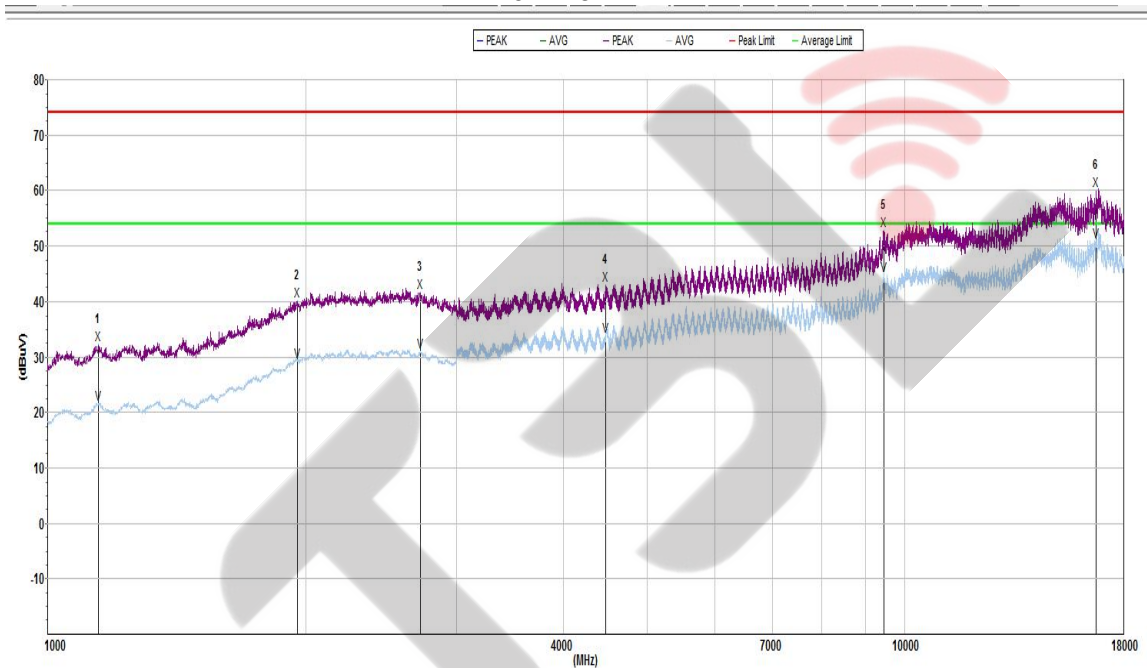
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 2  |                    |          |

Remark:

15. Margin = Result (Result =Reading + Factor )–Limit

16. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2440 DH3 Vertical



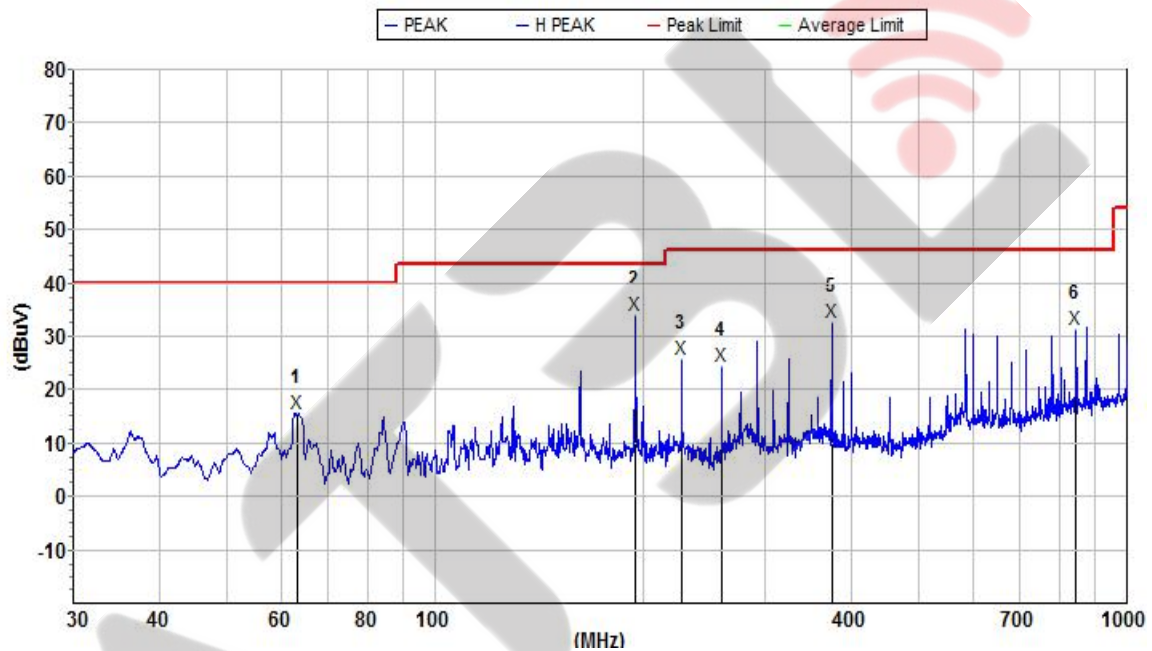
| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|---------------|-------------|----------------|------------|------------|------|
| Peak |              |               |               |             |                |            |            |      |
| 1    | 1100.000000  | 31.3          | 74.0          | 42.7        | 20.4           | 57.3       | 2.2        | V    |
| 2    | 1682.000000  | 35.3          | 74.0          | 38.7        | 21.4           | 54.7       | 2.5        | V    |
| 3    | 2910.000000  | 39.9          | 74.0          | 34.1        | 24.1           | 51.5       | 2.9        | V    |
| 4    | 4383.750000  | 42.5          | 74.0          | 31.5        | 24.8           | 50.1       | 3.5        | V    |
| 5    | 9910.500000  | 53.2          | 74.0          | 20.8        | 28.3           | 48.5       | 5.4        | V    |
| 6    | 16837.500000 | 60.2          | 74.0          | 13.8        | 31.4           | 47.4       | 6.8        | V    |
| Avg  |              |               |               |             |                |            |            |      |
| 1    | 1100.000000  | 19.7          | 54.0          | 34.3        | 20.4           | 57.3       | 2.2        | V    |
| 2    | 1682.000000  | 24.3          | 54.0          | 29.7        | 21.4           | 54.7       | 2.5        | V    |
| 3    | 2910.000000  | 29.0          | 54.0          | 25.0        | 24.1           | 51.5       | 2.9        | V    |
| 4    | 4383.750000  | 34.9          | 54.0          | 19.1        | 24.8           | 50.1       | 3.5        | V    |
| 5    | 9910.500000  | 44.0          | 54.0          | 10.0        | 28.3           | 48.5       | 5.4        | V    |
| 6    | 16837.500000 | 52.5          | 54.0          | 1.5         | 31.4           | 47.4       | 6.8        | V    |

(30MHz-1000MHz)

|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 3  |                    |            |

Remark:

17. Margin = Result (Result =Reading + Factor )–Limit

18. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain  
2480 DH5 Horizontal


| Mk. | Freq.(MHz) | Level(d BuV/m) | Limit(dB uV/m) | Margin (dB) | Ant.F/G.( dB/m) | Amp.G.( dB) | Cbl.L .(dB) | Pol. |
|-----|------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| 1   | 63.424327  | 15.5           | 40.0           | 24.5        | 12.1            | 32.8        | 0.8         | H    |
| 2   | 194.794668 | 33.8           | 43.5           | 9.7         | 10.2            | 32.8        | 2.2         | H    |
| 3   | 227.291780 | 25.6           | 46.0           | 20.4        | 10.9            | 32.8        | 2.5         | H    |
| 4   | 259.688742 | 24.4           | 46.0           | 21.6        | 11.8            | 32.8        | 2.6         | H    |
| 5   | 374.622581 | 32.5           | 46.0           | 13.5        | 13.6            | 32.4        | 2.7         | H    |
| 6   | 843.607400 | 31.4           | 46.0           | 14.6        | 19.3            | 31.9        | 3.6         | H    |

(30MHz-1000MHz)

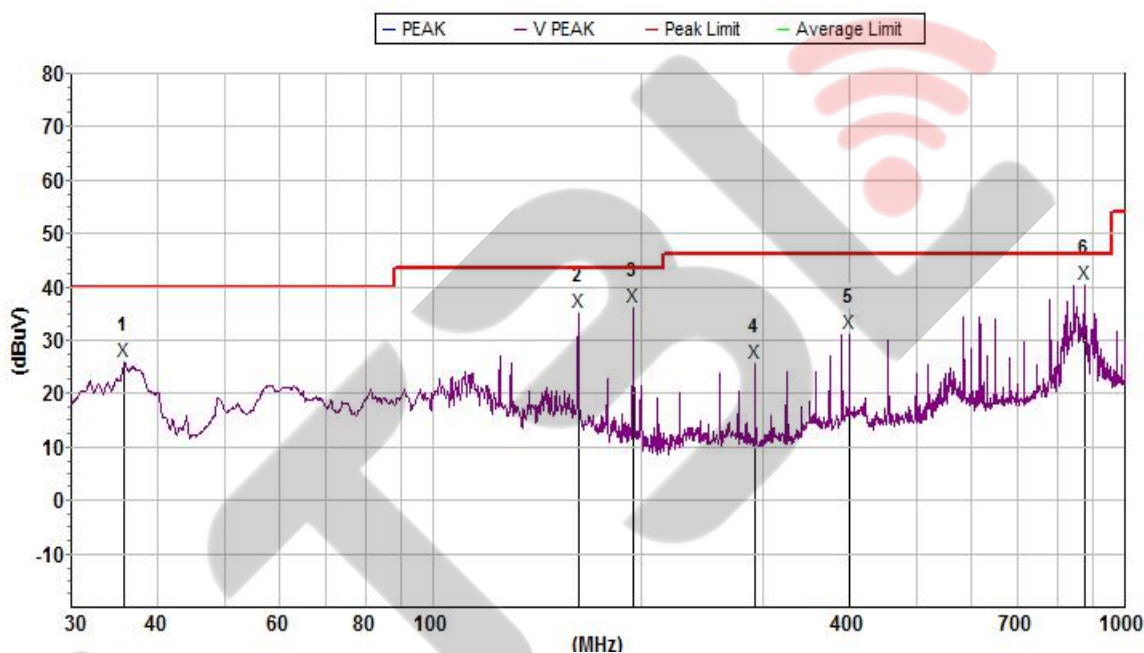
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 3  |                    |          |

Remark:

19. Margin = Result (Result =Reading + Factor )–Limit

20. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2480 DH5 Vertical



| Mk. | Freq.(MHz) | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|-----|------------|---------------|---------------|-------------|----------------|------------|------------|------|
| 1   | 35.811840  | 26.0          | 40.0          | 14.0        | 13.5           | 32.3       | 0.8        | V    |
| 2   | 162.325732 | 35.2          | 43.5          | 8.3         | 13.9           | 32.9       | 1.6        | V    |
| 3   | 194.794668 | 36.2          | 43.5          | 7.3         | 10.2           | 32.8       | 2.2        | V    |
| 4   | 292.058305 | 25.8          | 46.0          | 20.2        | 12.6           | 32.7       | 2.7        | V    |
| 5   | 399.730428 | 31.3          | 46.0          | 14.7        | 14.7           | 32.3       | 2.7        | V    |
| 6   | 873.713746 | 40.5          | 46.0          | 5.5         | 21.3           | 31.8       | 3.6        | V    |

(1000MHz-18000MHz)

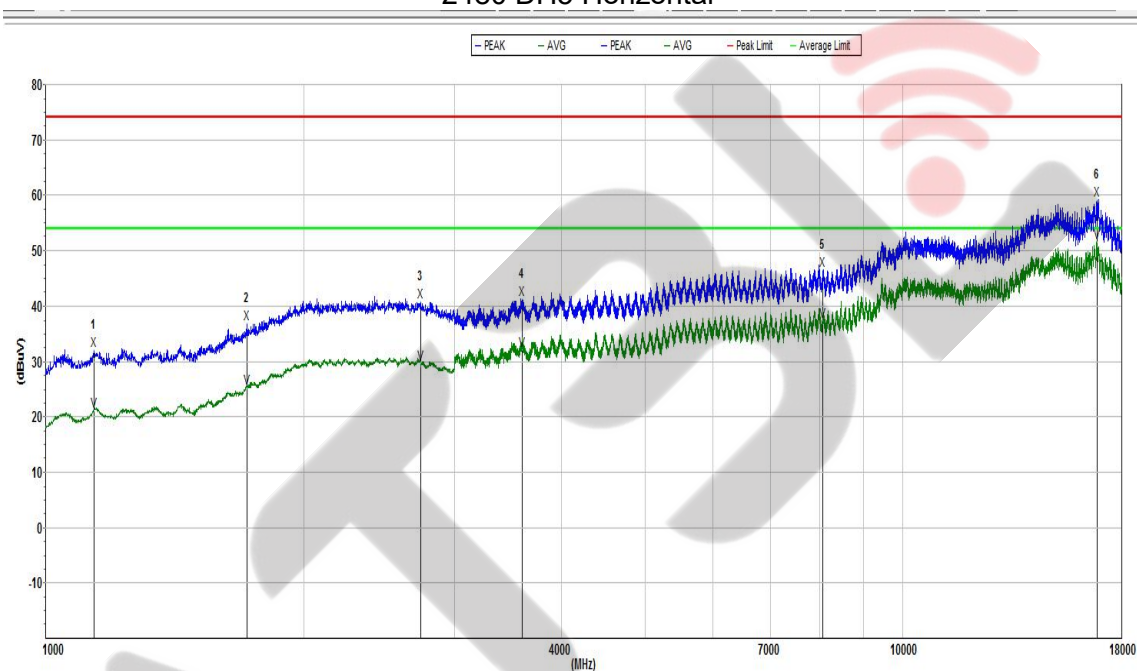
|               |         |                    |            |
|---------------|---------|--------------------|------------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH      |
| Test Voltage: | AC120V  | Phase:             | Horizontal |
| Test Mode:    | Mode 3  |                    |            |

Remark:

21. Margin = Result (Result =Reading + Factor )-Limit

22. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2480 DH5 Horizontal



| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|---------------|-------------|----------------|------------|------------|------|
| Peak |              |               |               |             |                |            |            |      |
| 1    | 1139.000000  | 32.0          | 74.0          | 42.0        | 20.7           | 57.3       | 2.2        | H    |
| 2    | 1719.000000  | 36.8          | 74.0          | 37.2        | 21.5           | 54.1       | 2.6        | H    |
| 3    | 2737.000000  | 40.9          | 74.0          | 33.1        | 23.5           | 51.0       | 2.9        | H    |
| 4    | 3595.500000  | 41.3          | 74.0          | 32.7        | 24.2           | 50.4       | 3.2        | H    |
| 5    | 8068.500000  | 46.6          | 74.0          | 27.4        | 26.2           | 48.6       | 4.9        | H    |
| 6    | 16837.500000 | 59.2          | 74.0          | 14.8        | 30.9           | 47.4       | 6.8        | H    |
| Avg  |              |               |               |             |                |            |            |      |
| 1    | 1139.000000  | 21.2          | 54.0          | 32.8        | 20.7           | 57.3       | 2.2        | H    |
| 2    | 1719.000000  | 25.3          | 54.0          | 28.7        | 21.5           | 54.1       | 2.6        | H    |
| 3    | 2737.000000  | 29.7          | 54.0          | 24.3        | 23.5           | 51.0       | 2.9        | H    |
| 4    | 3595.500000  | 32.1          | 54.0          | 21.9        | 24.2           | 50.4       | 3.2        | H    |
| 5    | 8068.500000  | 37.3          | 54.0          | 16.7        | 26.2           | 48.6       | 4.9        | H    |
| 6    | 16837.500000 | 51.6          | 54.0          | 2.4         | 30.9           | 47.4       | 6.8        | H    |

(1000MHz-18000MHz)

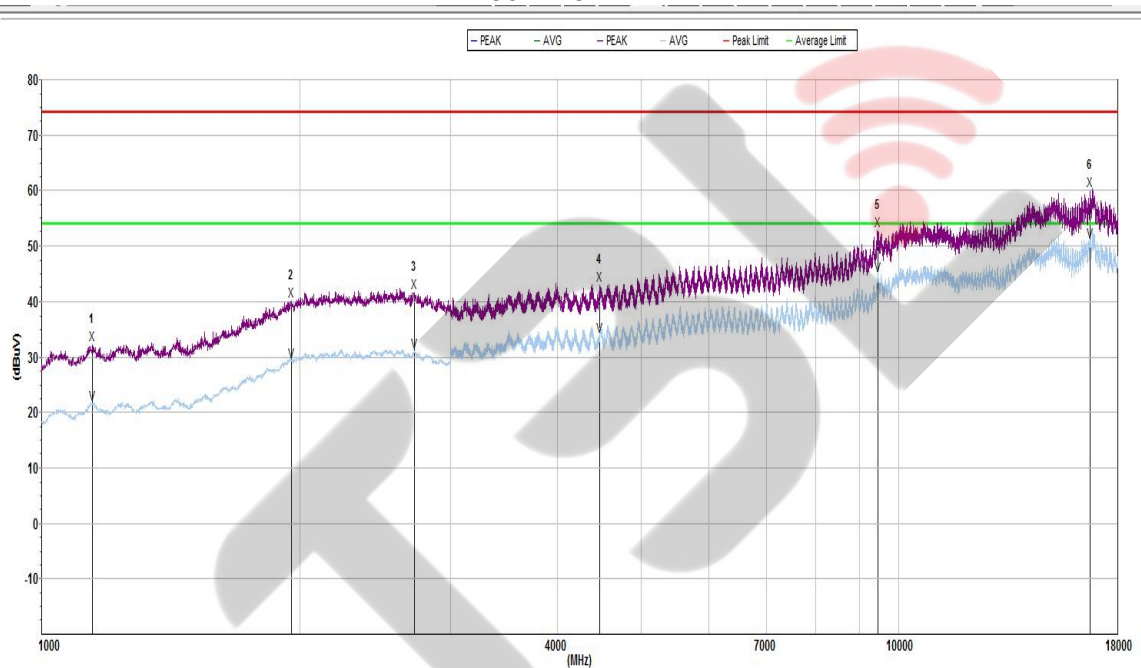
|               |         |                    |          |
|---------------|---------|--------------------|----------|
| Temperature:  | 23.3(C) | Relative Humidity: | 60%RH    |
| Test Voltage: | AC120V  | Phase:             | Vertical |
| Test Mode:    | Mode 3  |                    |          |

Remark:

23. Margin = Result (Result =Reading + Factor )–Limit

24. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

2480 DH5 Vertical



| Mk.  | Freq.(MHz)   | Level(dBuV/m) | Limit(dBuV/m) | Margin (dB) | Ant.F/G.(dB/m) | Amp.G.(dB) | Cbl.L.(dB) | Pol. |
|------|--------------|---------------|---------------|-------------|----------------|------------|------------|------|
| Peak |              |               |               |             |                |            |            |      |
| 1    | 1133.000000  | 31.0          | 74.0          | 43.0        | 20.6           | 57.3       | 2.2        | V    |
| 2    | 1835.000000  | 38.3          | 74.0          | 35.7        | 21.7           | 52.5       | 2.6        | V    |
| 3    | 2637.000000  | 42.2          | 74.0          | 31.8        | 23.7           | 50.6       | 2.9        | V    |
| 4    | 3984.750000  | 43.1          | 74.0          | 30.9        | 24.8           | 50.1       | 3.3        | V    |
| 5    | 10712.250000 | 54.7          | 74.0          | 19.3        | 29.1           | 48.6       | 5.6        | V    |
| 6    | 16914.000000 | 59.9          | 74.0          | 14.1        | 31.5           | 47.3       | 6.8        | V    |
| Avg  |              |               |               |             |                |            |            |      |
| 1    | 1133.000000  | 20.5          | 54.0          | 33.5        | 20.6           | 57.3       | 2.2        | V    |
| 2    | 1835.000000  | 27.6          | 54.0          | 26.4        | 21.7           | 52.5       | 2.6        | V    |
| 3    | 2637.000000  | 31.1          | 54.0          | 22.9        | 23.7           | 50.6       | 2.9        | V    |
| 4    | 3984.750000  | 33.3          | 54.0          | 20.7        | 24.8           | 50.1       | 3.3        | V    |
| 5    | 10712.250000 | 46.5          | 54.0          | 7.5         | 29.1           | 48.6       | 5.6        | V    |
| 6    | 16914.000000 | 51.4          | 54.0          | 2.6         | 31.5           | 47.3       | 6.8        | V    |

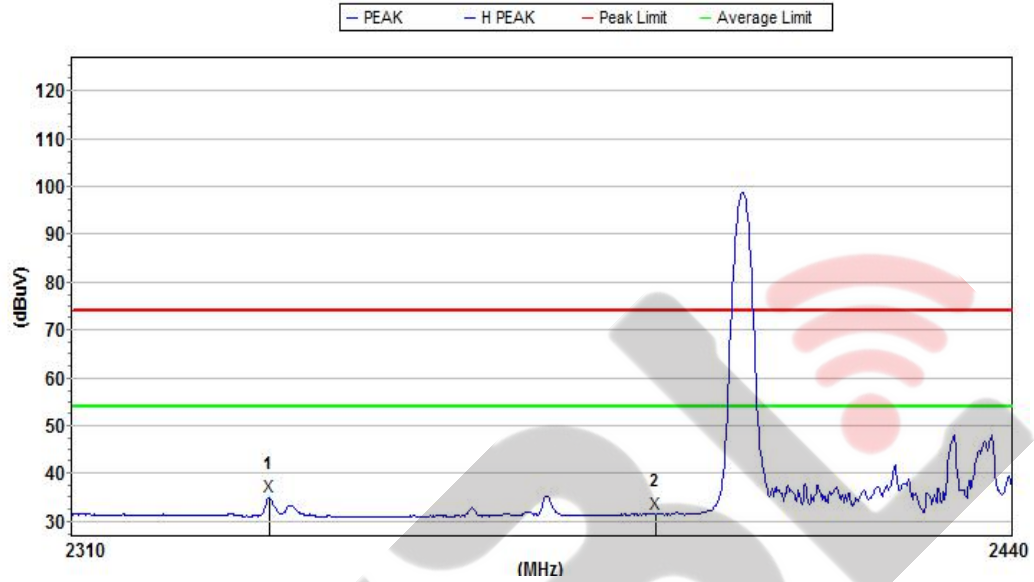
Note: 1.All TX Mode, the worst case is mode1,2&amp;3, only show the worst case.

2.Other 18G-25G Emission detected are more than 20dB below the limit.

### 3.2.6 TEST RESULTS (BAND EDGE REQUIREMENTS)

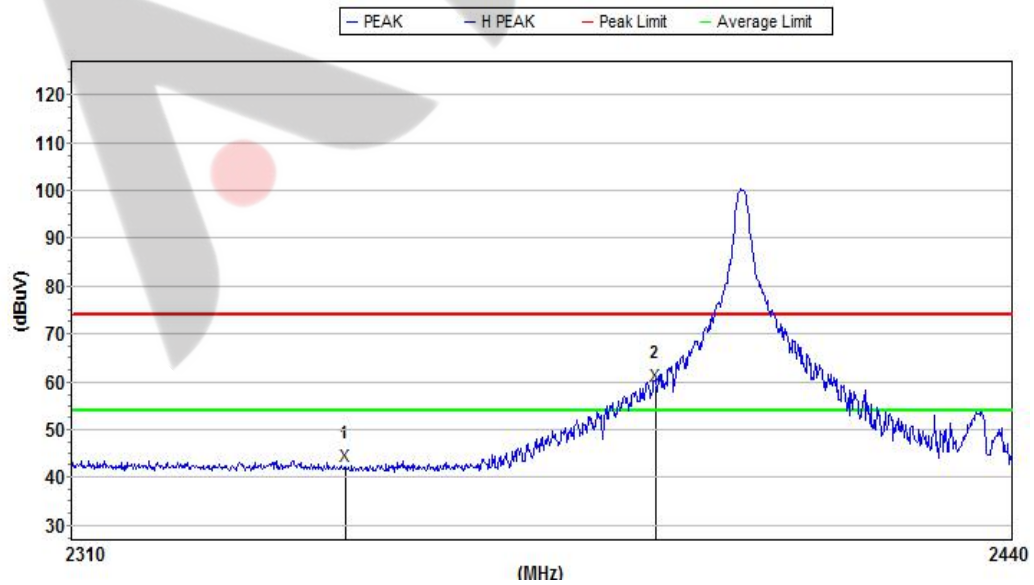
#### DH5-Low

Horizontal



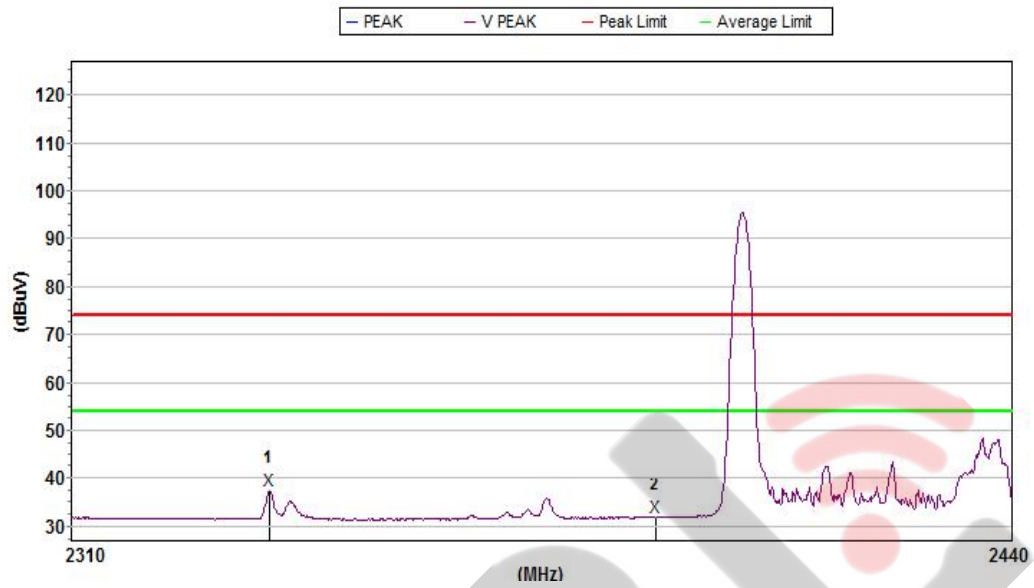
| Mk. | Frequency (MHz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.F/G. (dB/m) | Amp.G. (dB) | Cbl.L. (dB) | Pol. |
|-----|-----------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| AVG |                 |                |                |             |                 |             |             |      |
| 1   | 2336.712747     | 35.1           | 54.0           | 18.9        | 22.7            | 50.2        | 2.8         | H    |
| 2   | 2390.000000     | 31.5           | 54.0           | 22.5        | 22.8            | 50.2        | 2.8         | H    |

Horizontal



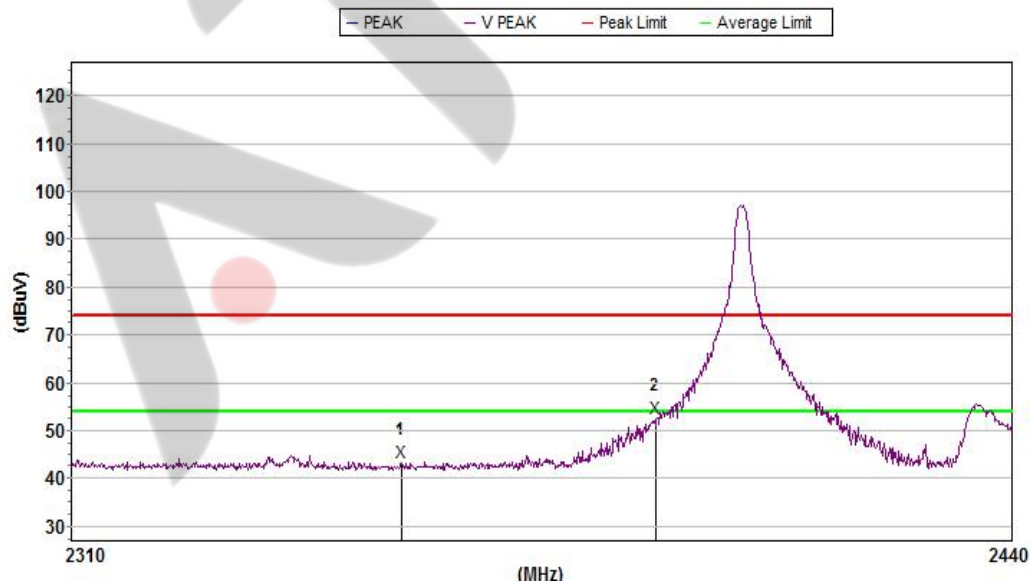
| Mk.  | Frequency (MHz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.F/G. (dB/m) | Amp.G. (dB) | Cbl.L. (dB) | Pol. |
|------|-----------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| Peak |                 |                |                |             |                 |             |             |      |
| 1    | 2347.227102     | 42.6           | 74.0           | 31.4        | 22.7            | 50.2        | 2.8         | H    |
| 2    | 2390.000000     | 59.3           | 74.0           | 14.7        | 22.8            | 50.2        | 2.8         | H    |

## Vertical



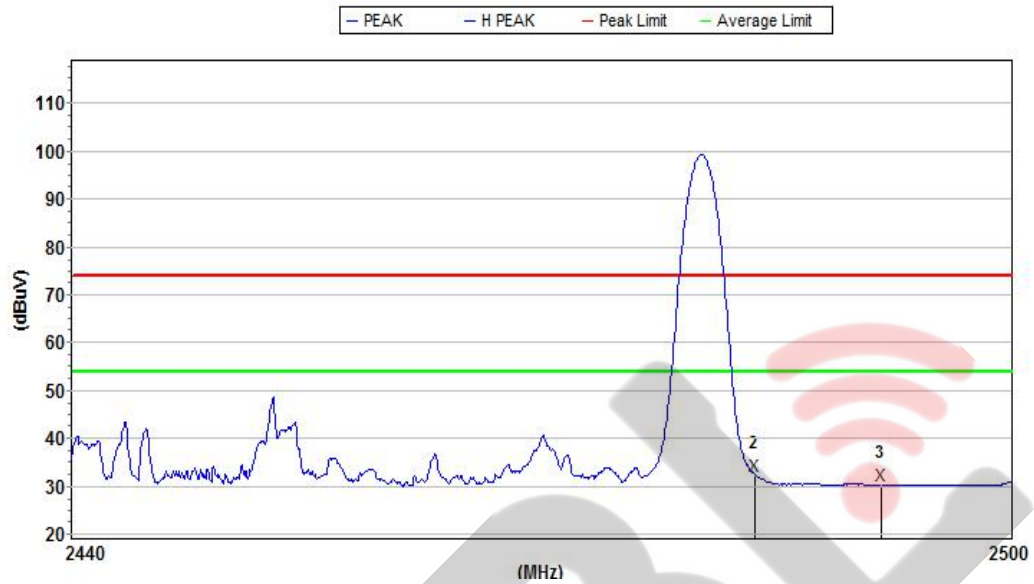
| Mk. | Frequency (MHz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.F/G. (dB/m) | Amp.G. (dB) | Cbl.L. (dB) | Pol. |
|-----|-----------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| AVG |                 |                |                |             |                 |             |             |      |
| 1   | 2336.840687     | 37.5           | 54.0           | 16.5        | 23.0            | 50.2        | 2.8         | V    |
| 2   | 2390.000000     | 32.0           | 54.0           | 22.0        | 23.1            | 50.2        | 2.8         | V    |

## Vertical



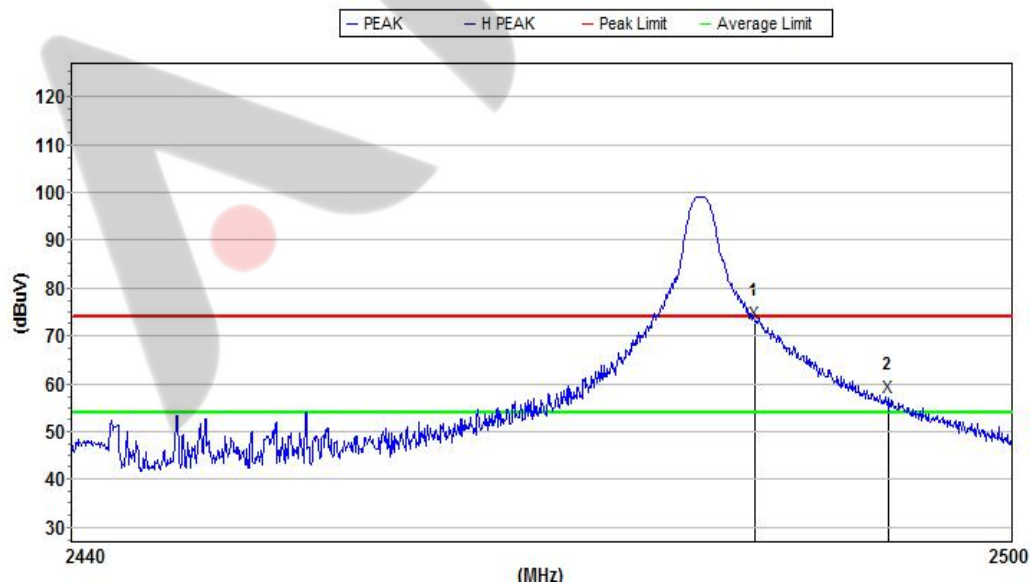
| Mk.  | Frequency (MHz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Ant.F/G. (dB/m) | Amp.G. (dB) | Cbl.L. (dB) | Pol. |
|------|-----------------|----------------|----------------|-------------|-----------------|-------------|-------------|------|
| Peak |                 |                |                |             |                 |             |             |      |
| 1    | 2354.821563     | 43.3           | 74.0           | 30.7        | 23.0            | 50.2        | 2.8         | V    |
| 2    | 2390.000000     | 52.5           | 74.0           | 21.5        | 23.1            | 50.2        | 2.8         | V    |

### DH5-High Horizontal

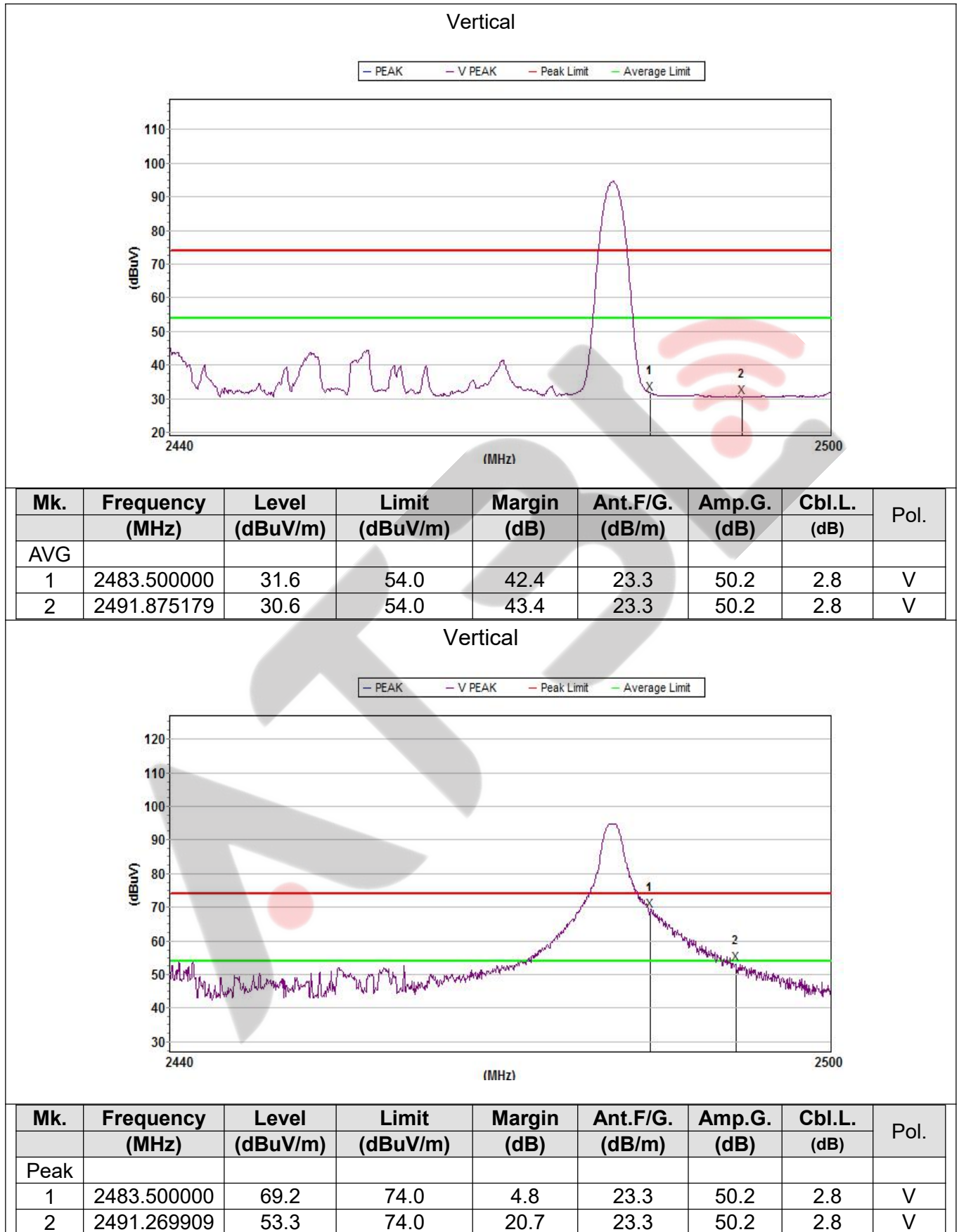


| Mk. | Frequency<br>(MHz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Ant.F/G.<br>(dB/m) | Amp.G.<br>(dB) | Cbl.L.<br>(dB) | Pol. |
|-----|--------------------|-------------------|-------------------|----------------|--------------------|----------------|----------------|------|
| AVG |                    |                   |                   |                |                    |                |                |      |
| 1   | 2483.500000        | 32.3              | 54.0              | 11.7           | 22.9               | 50.2           | 2.8            | H    |
| 2   | 2491.572526        | 30.3              | 54.0              | 23.7           | 22.9               | 50.2           | 2.8            | H    |

### Horizontal



| Mk.  | Frequency<br>(MHz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Ant.F/G.<br>(dB/m) | Amp.G.<br>(dB) | Cbl.L.<br>(dB) | Pol. |
|------|--------------------|-------------------|-------------------|----------------|--------------------|----------------|----------------|------|
| Peak |                    |                   |                   |                |                    |                |                |      |
| 1    | 2483.500000        | 72.8              | 74.0              | 1.2            | 22.9               | 50.2           | 2.8            | H    |
| 2    | 2491.996251        | 57.1              | 74.0              | 16.9           | 22.9               | 50.2           | 2.8            | H    |



Note: 1.All mode all have been tested, the worst case is DH5, only show the worst case.

2.Other 18G-25G Emission detected are more than 20dB below the limit.

## 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

### 4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 4.2 TEST PROCEDURE

| Spectrum Parameter                    | Setting                         |
|---------------------------------------|---------------------------------|
| Detector                              | Peak                            |
| Start/Stop Frequency                  | 30 MHz to 10th carrier harmonic |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                 |
| Trace-Mode:                           | Max hold                        |

For Band edge

| Spectrum Parameter                    | Setting                                                              |
|---------------------------------------|----------------------------------------------------------------------|
| Detector                              | Peak                                                                 |
| Start/Stop Frequency                  | Lower Band Edge: 2300 – 2407 MHz<br>Upper Band Edge: 2475 – 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                                                      |
| Trace-Mode:                           | Max hold                                                             |

For Hopping Band edge

| Spectrum Parameter                    | Setting                                                             |
|---------------------------------------|---------------------------------------------------------------------|
| Detector                              | Peak                                                                |
| Start/Stop Frequency                  | Lower Band Edge: 2300– 2403 MHz<br>Upper Band Edge: 2479 – 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                                                     |
| Trace-Mode:                           | Max hold                                                            |

#### 4.3 TEST SETUP



The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Tune the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, the span is set to be greater than RBW.

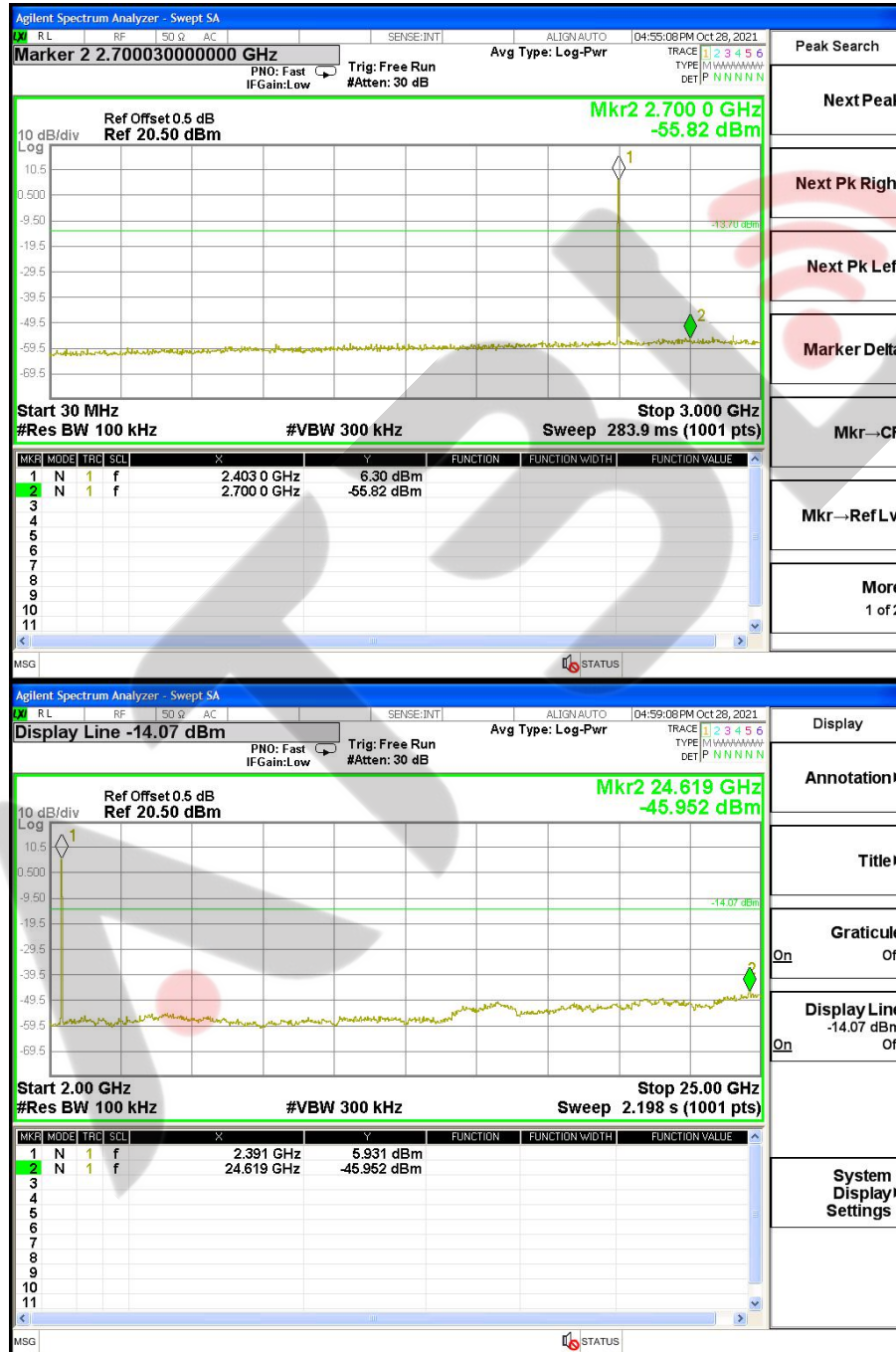
#### 4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

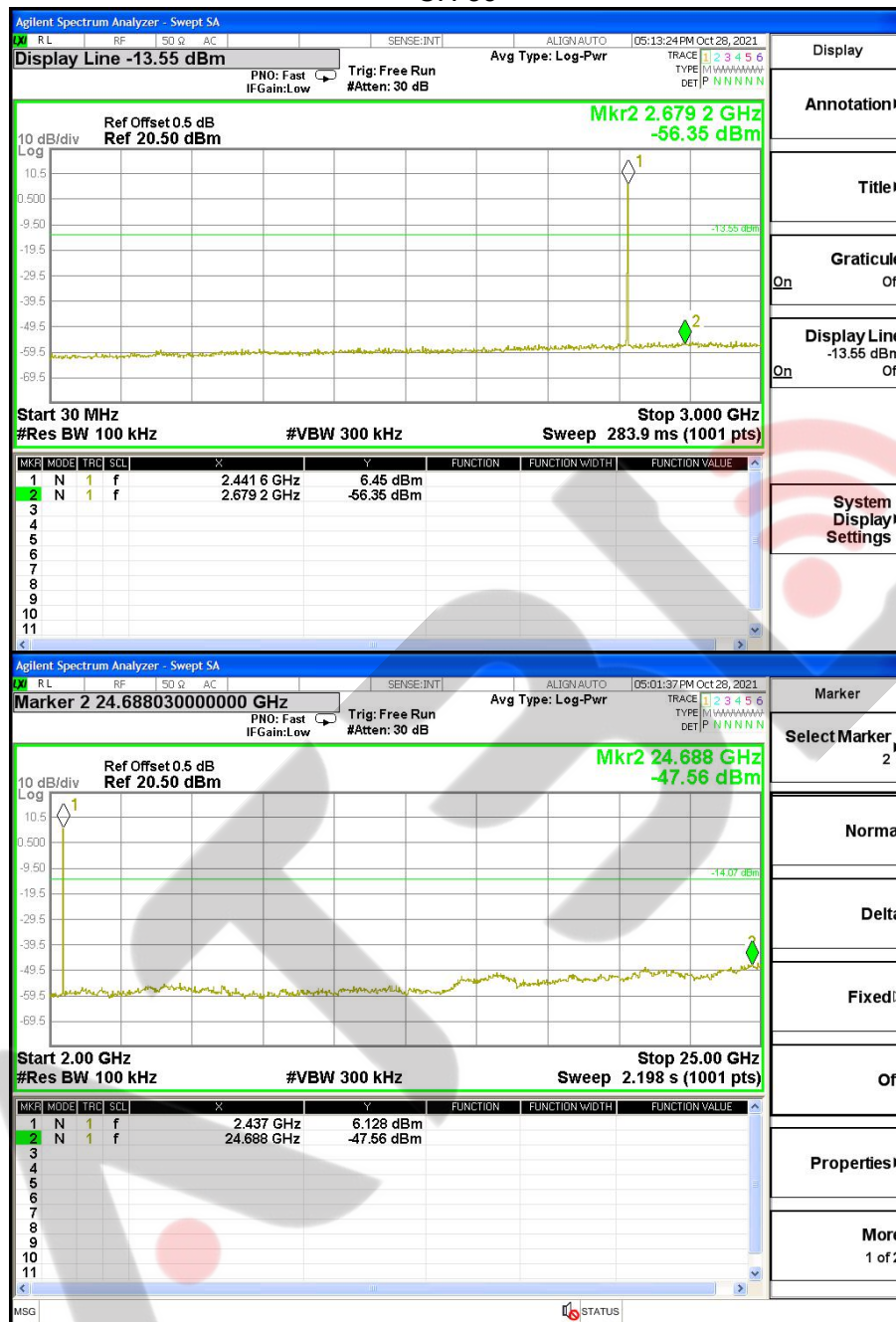
#### 4.5 TEST RESULTS

|              |                         |                    |         |
|--------------|-------------------------|--------------------|---------|
| Temperature: | 25°C                    | Relative Humidity: | 50%     |
| Test Mode:   | GFSK(1Mbps)-00/39/78 CH | Test Voltage:      | AC 120V |

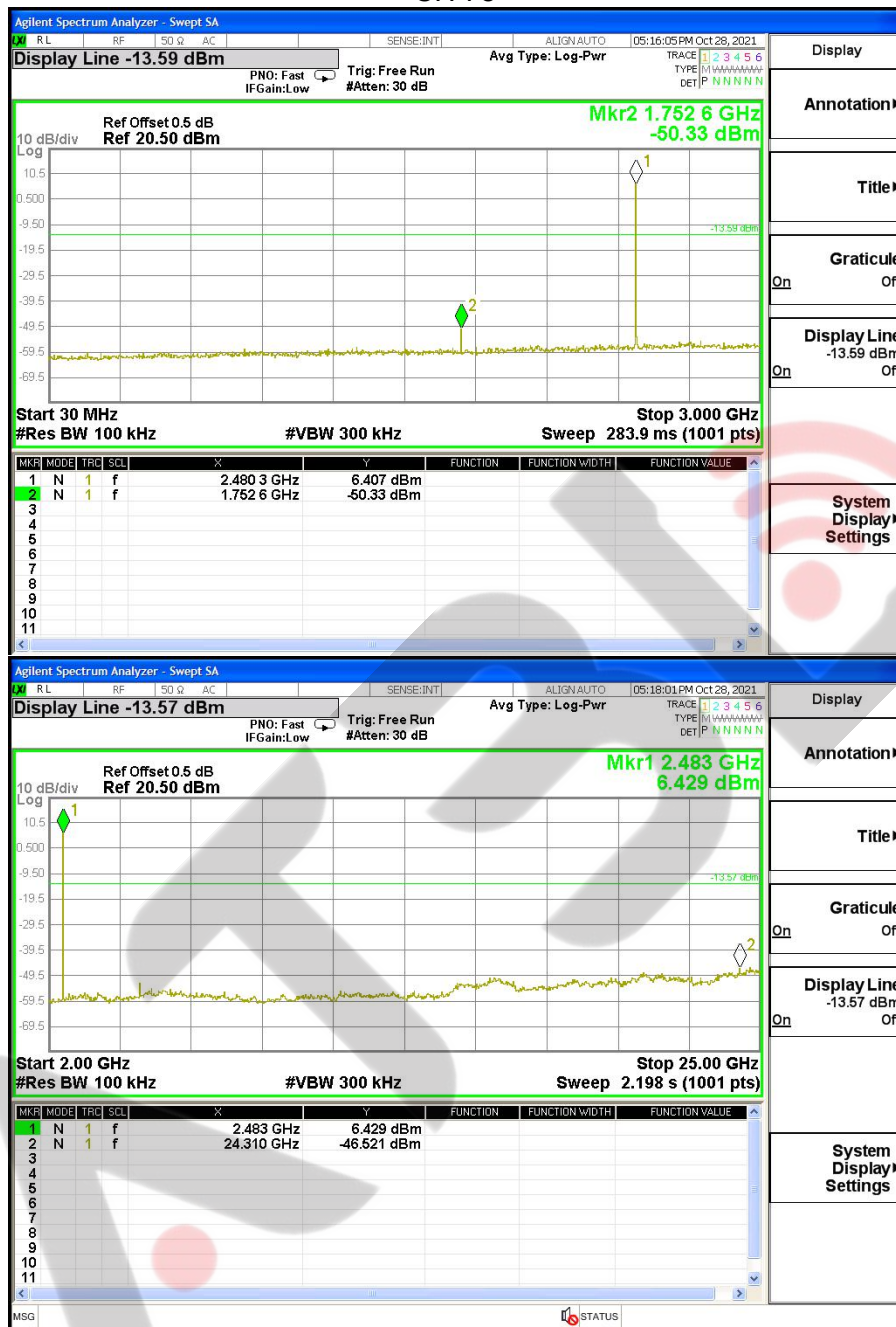
#### CH 00



## CH 39

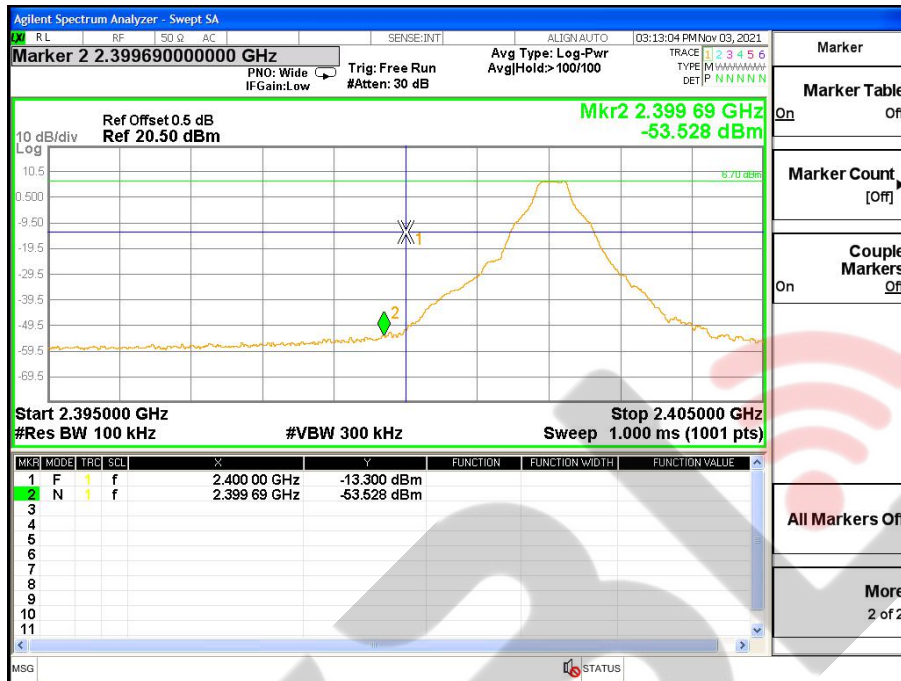


## CH 78

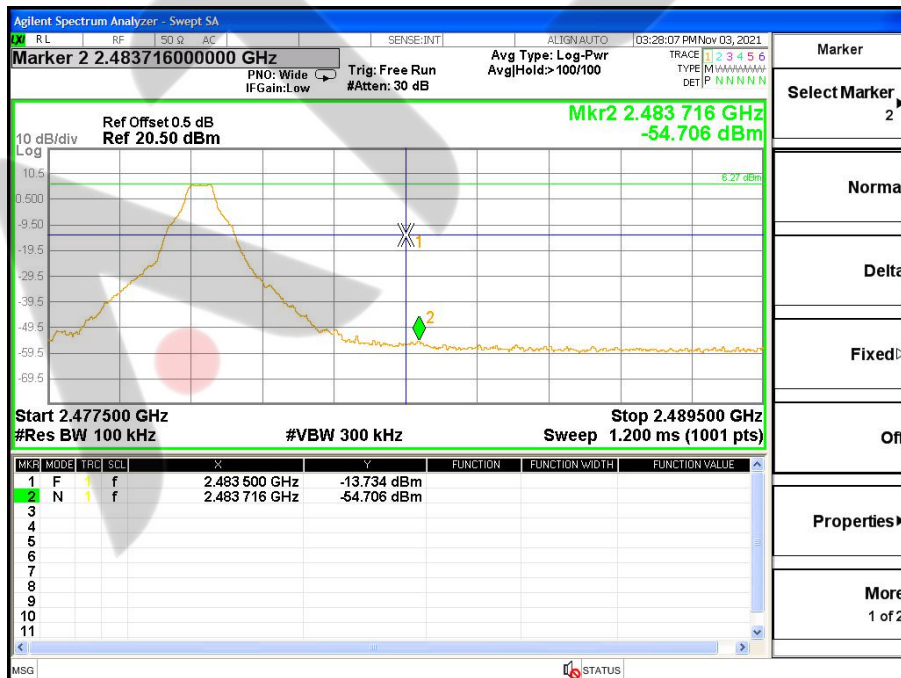


For Band edge(it's also the reference level for conducted spurious emission)

CH 00

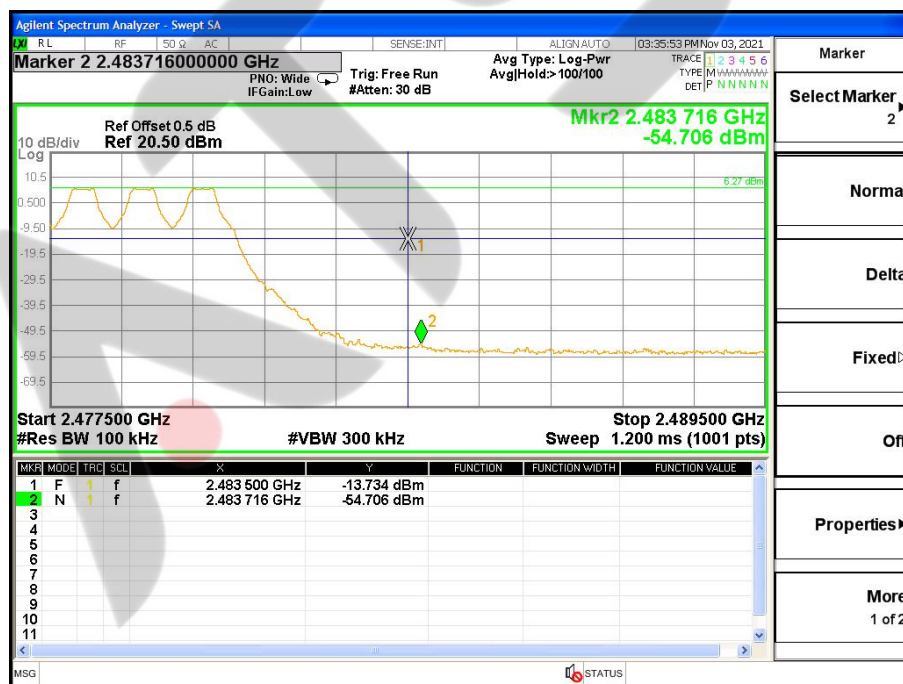
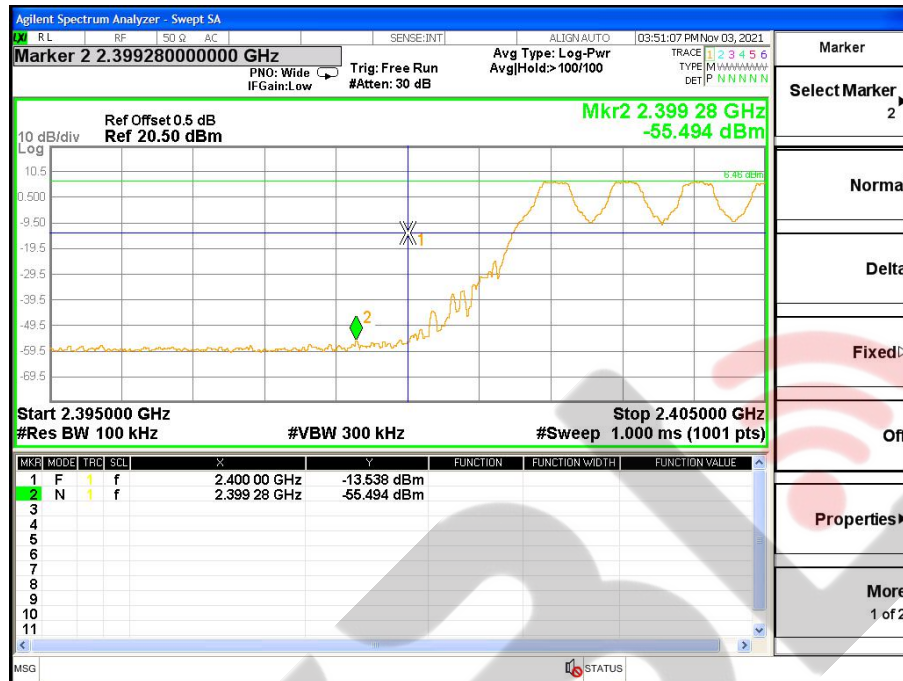


CH 78



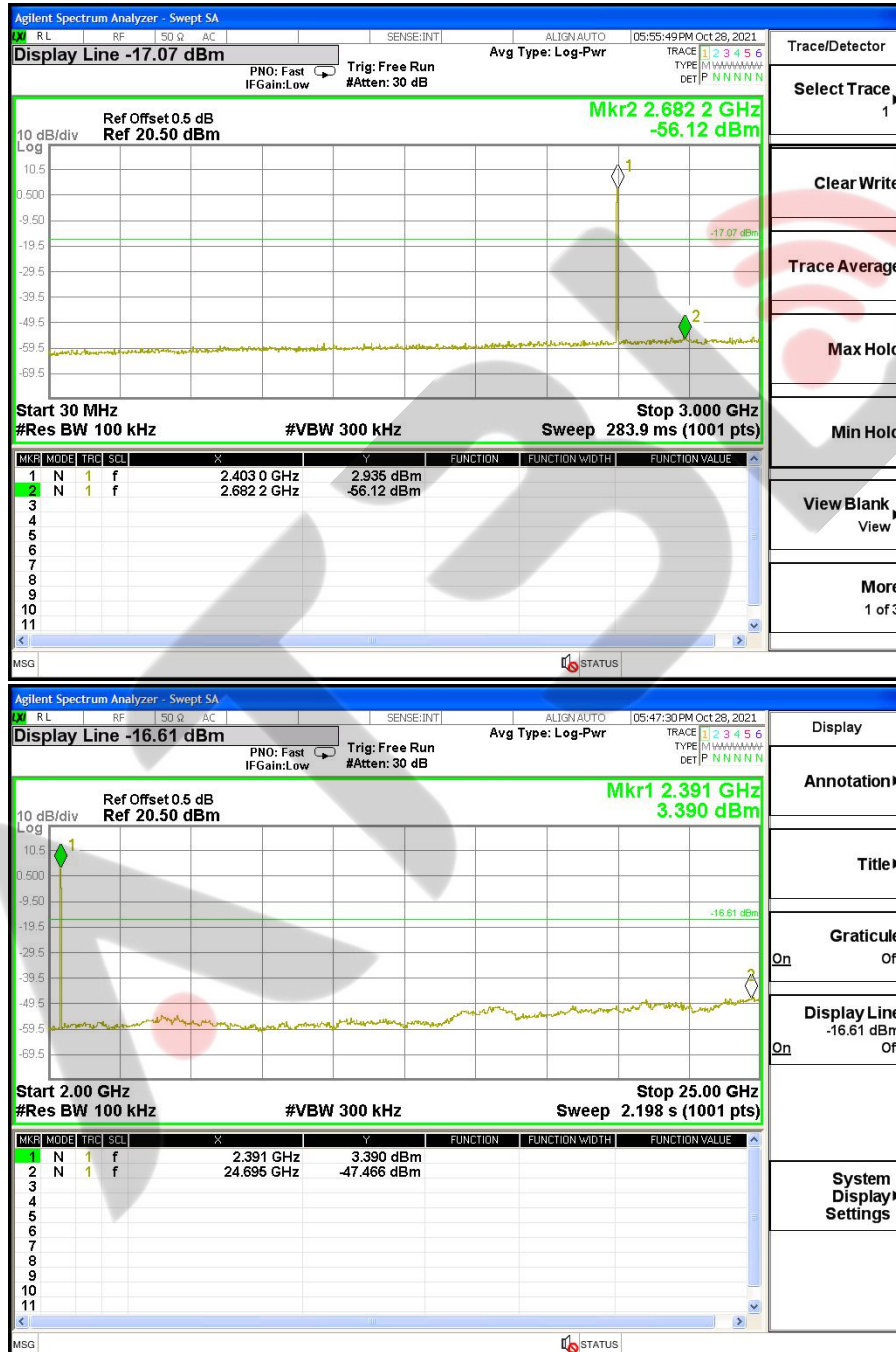
For Hopping Band edge

GFSK

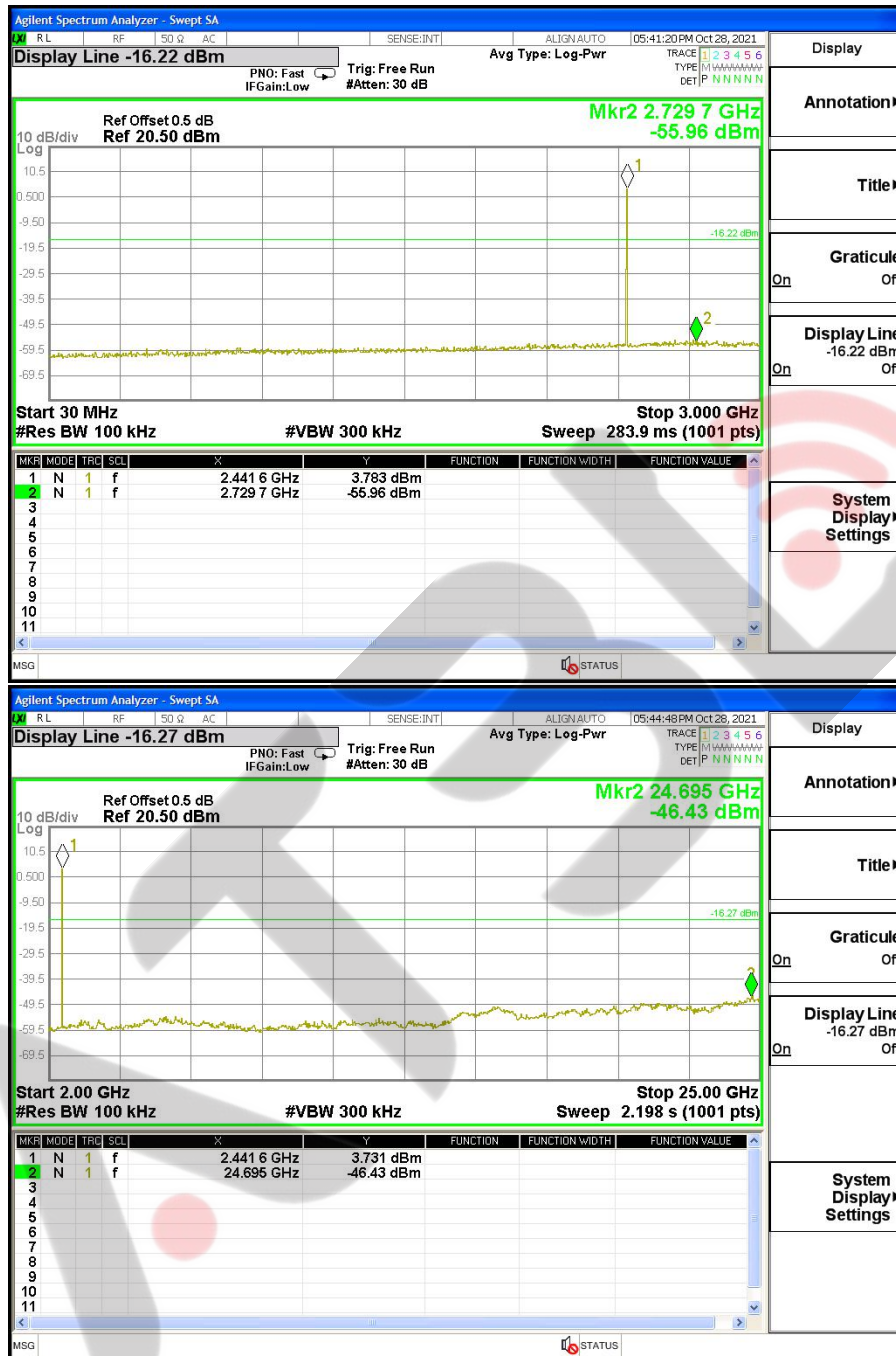


|              |                                       |                    |         |
|--------------|---------------------------------------|--------------------|---------|
| Temperature: | 25°C                                  | Relative Humidity: | 50%     |
| Test Mode:   | $\pi/4$ -DQPSK(2Mbps)–<br>00/39/78 CH | Test Voltage:      | AC 120V |

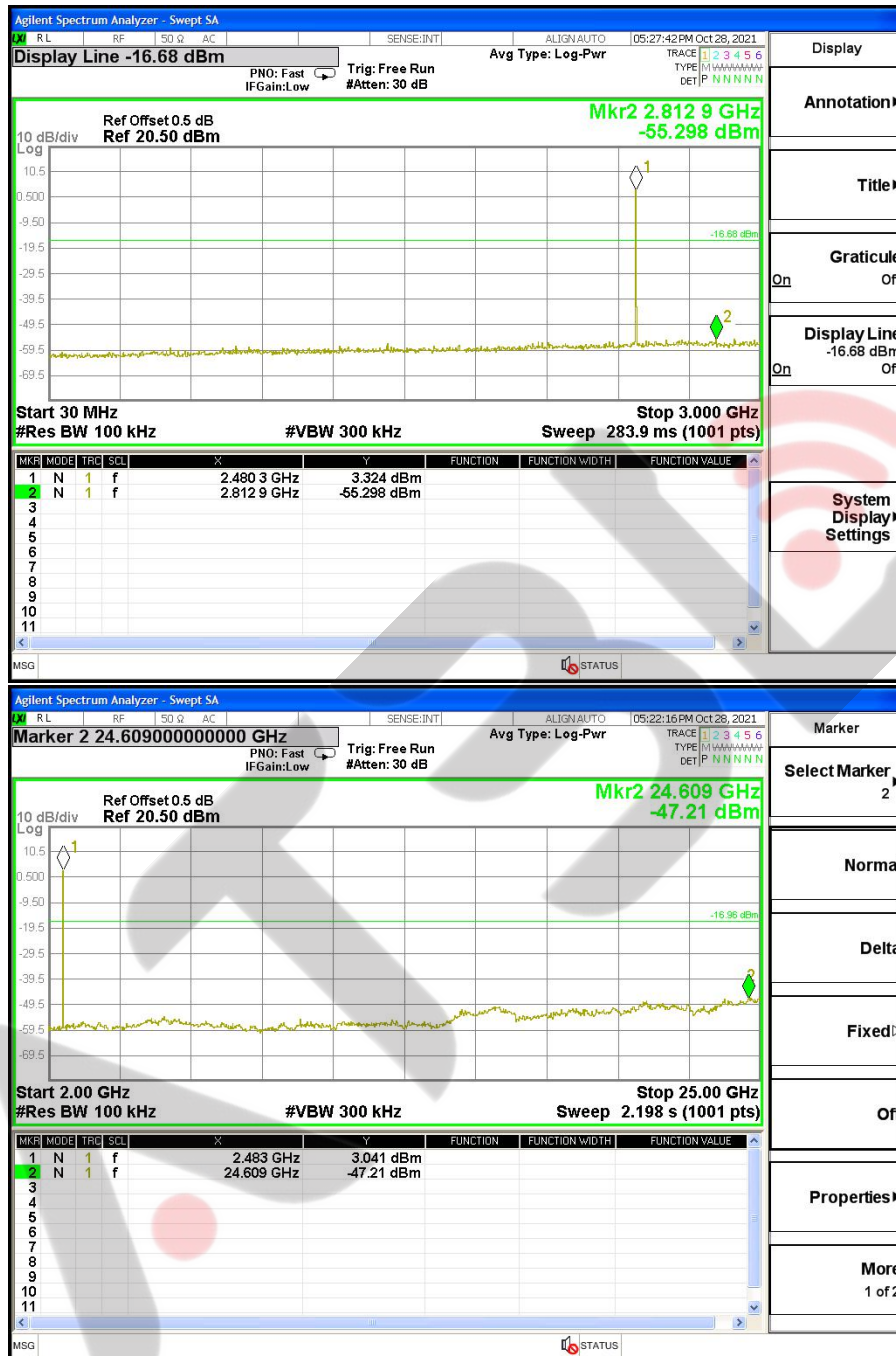
00 CH



39 CH

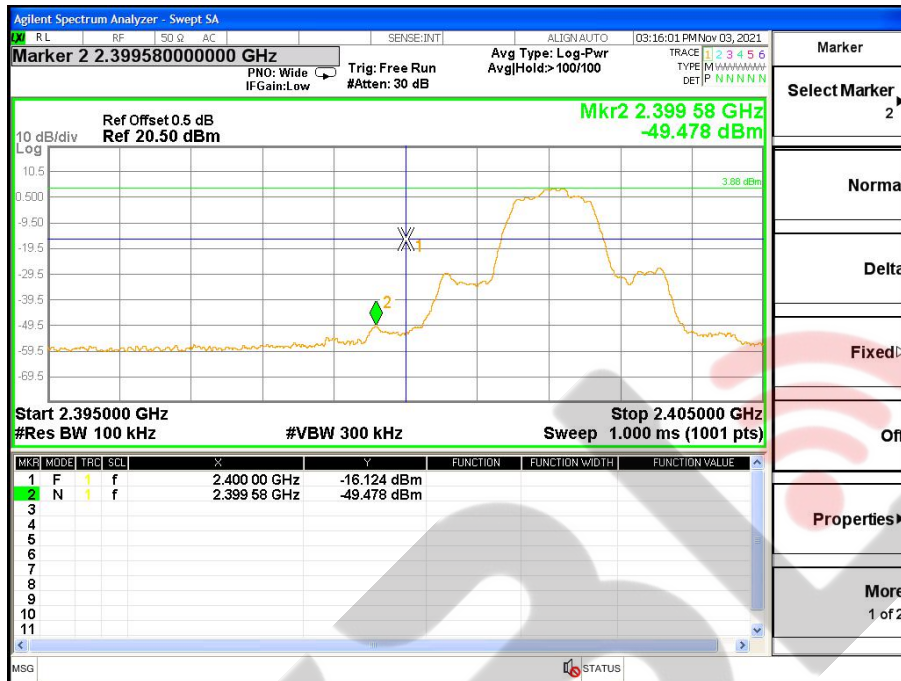


## 78 CH

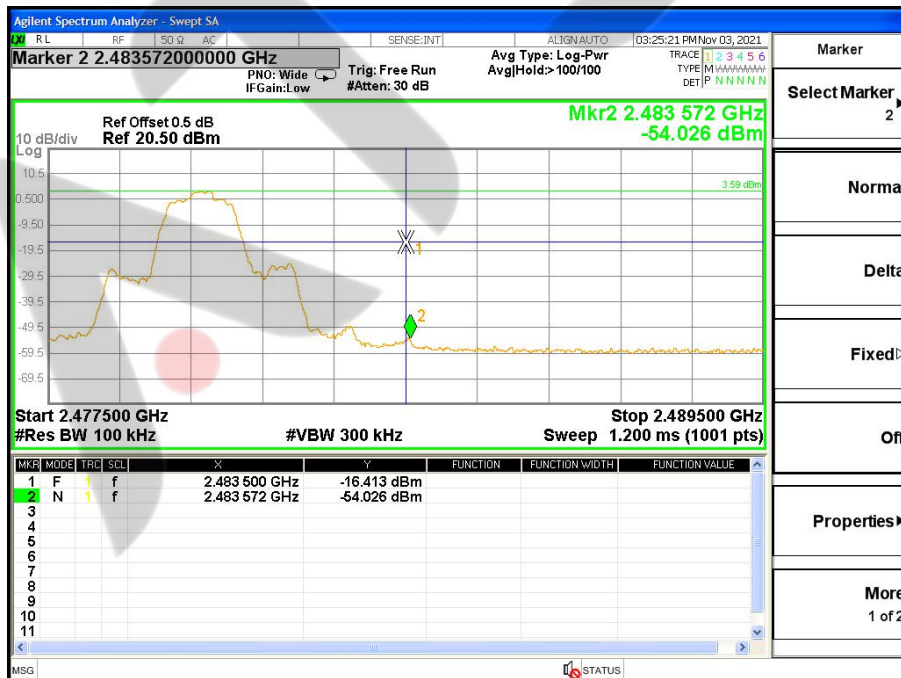


For Band edge(it's also the reference level for conducted spurious emission)

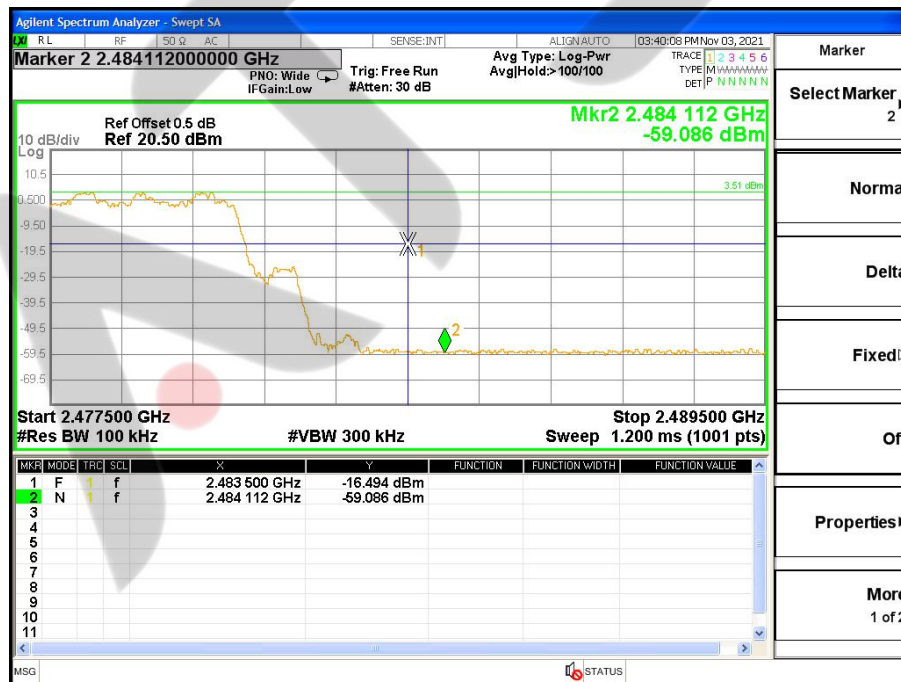
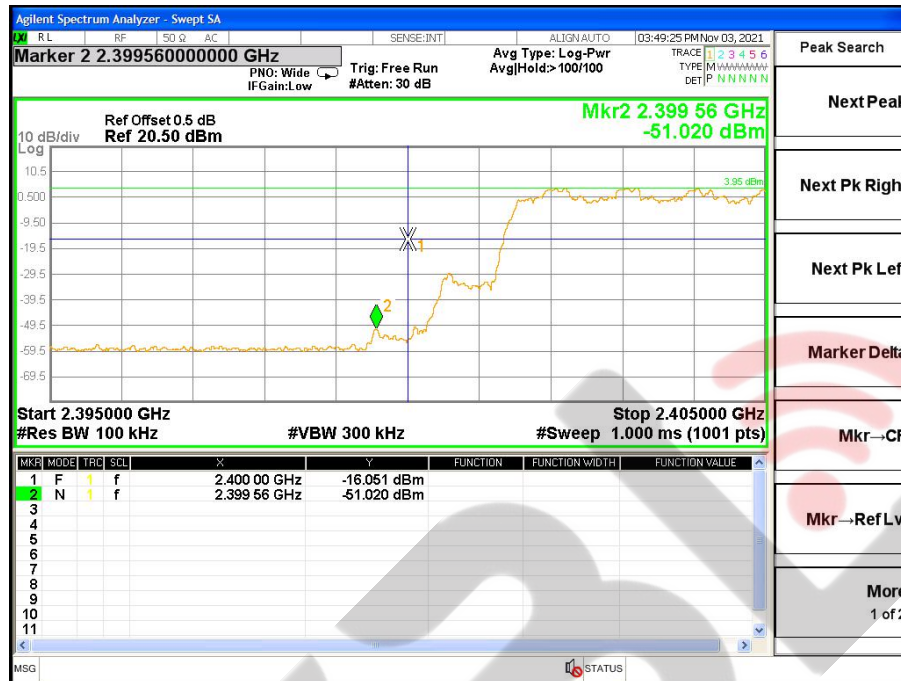
CH 00



CH 78

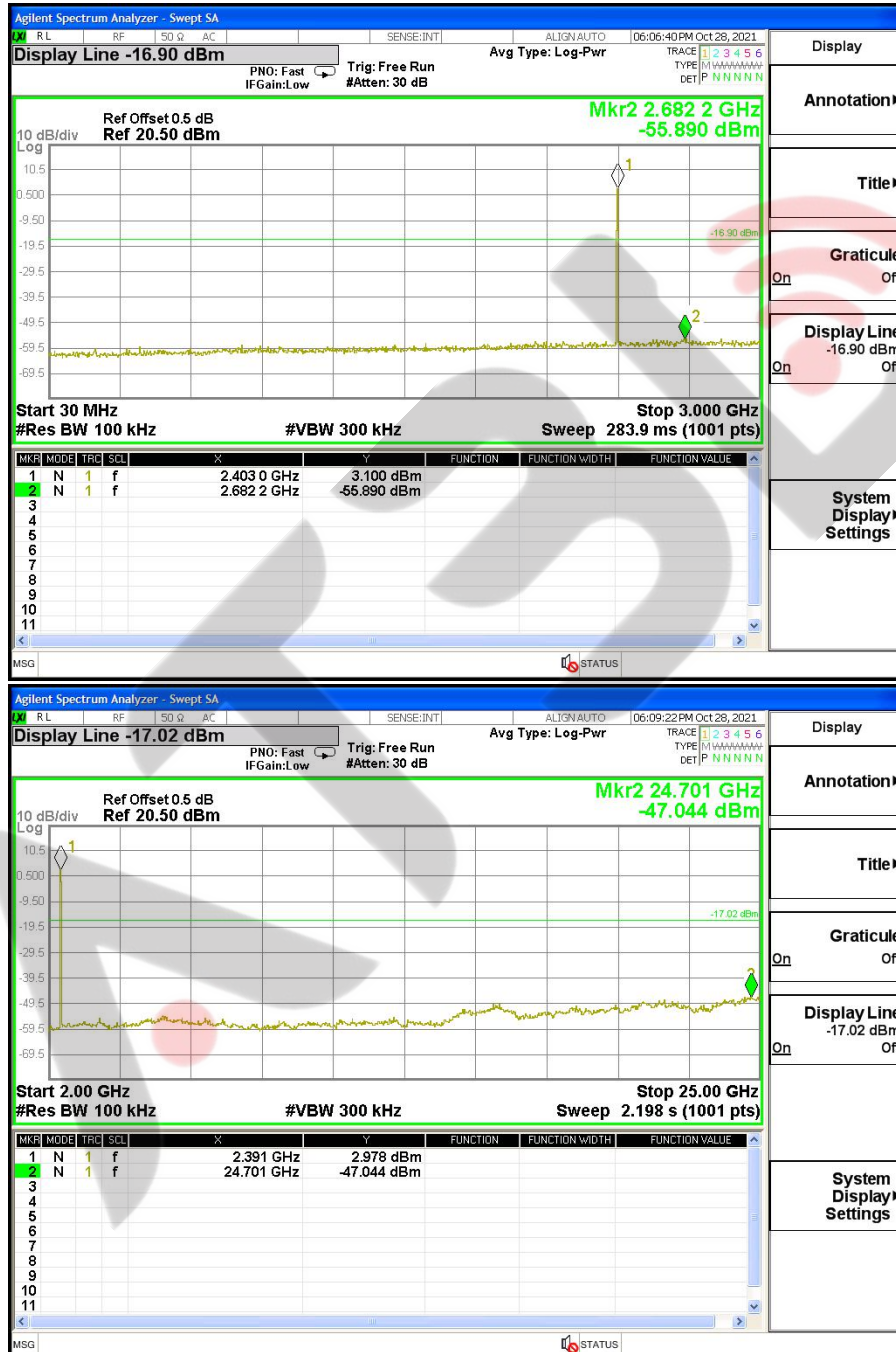


For Hopping Band edge

 $\pi/4$ -DQPSK


|              |                           |                    |        |
|--------------|---------------------------|--------------------|--------|
| Temperature: | 25°C                      | Relative Humidity: | 50%    |
| Test Mode:   | 8DPSK(3Mbps) -00/39/78 CH | Test Voltage:      | AC120V |

CH 00



## CH 39

