

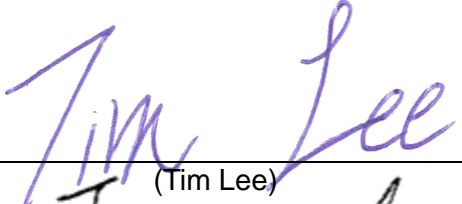
# FCC Radio Test Report

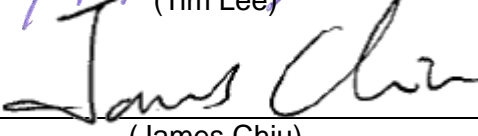
## FCC ID: VTV-T082RFBHS

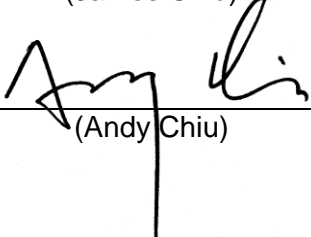
This report concerns (check one):  Original Grant  Class I Change  Class II Change

**Project No.** : 1902T043  
**Equipment** : Barcode Printer  
**Test Model** : TDM-20  
**Series Model** : DTE20, FNE20, CNE20, B-E20, LPE20, TDM-20(W), TDM-20(D)  
**Applicant** : TSC Auto ID Technology Co., Ltd.  
**Address** : 9F., No. 95, Minquan Rd. Xindian Dist. New Taipei City 23141,

**Date of Receipt** : 2019/4/2  
**Date of Test** : 2019/4/2 ~ 2019/4/26  
**Issued Date** : 2019/5/6  
**Tested by** : BTL Inc.

**Testing Engineer** :   
 (Tim Lee)

**Technical Manager** :   
 (James Chiu)

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### **Declaration**

**BTL** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

**BTL's** reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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**BTL's** laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

**BTL** is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

### **Limitation**

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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### REPORT ISSUED HISTORY

| Report Version | Description     | Issued Date |
|----------------|-----------------|-------------|
| R00            | Original Issue. | 2019/5/6    |

## 1. CERTIFICATION

Equipment : Barcode Printer  
Brand Name : TSC  
Test Model : TDM-20  
Series Model : DTE20, FNE20, CNE20, B-E20, LPE20, TDM-20(W), TDM-20(D)  
Applicant : TSC Auto ID Technology Co., Ltd.  
Manufacturer : TSC Auto ID Technology Co., Ltd.  
Address : No. 35, Sec. 2, Ligong 1st Rd., Wujie Town, I-Lan County 26841, TAIWAN  
Factory : 1. TSC Auto ID Technology Co., Ltd.  
2. Tianjin TSC Auto ID Technology Co., Ltd.(ID NO.:67208)  
Address : 1. No. 35, Sec. 2, Ligong 1st Rd., Wujie Town, I-Lan County 26841, TAIWAN  
2. 2nd Fl., No. 165, Huanghai Road, 300457 Tianjin Economic-Tech.  
Deve.Area, PEOPLE'S REPUBLIC OF CHINA  
Date of Test : 2019/4/2 ~ 2019/4/26  
Test Sample : Engineering Sample  
Standard(s) : FCC Part15, Subpart C (15.247)/ ANSI C63.10-2013

The above equipment has been tested and found in compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-1-1902T043) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO/IEC 17025 quality assessment standard and technical standard(s).

**Test results included in this report is only for the Bluetooth EDR part.**

## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

| Applied Standard(s): FCC Part15, Subpart C (15.247) |                                     |          |        |
|---|-------------------------------------|----------|--------|
| Standard(s) Section                                 | Test Item                           | Judgment | Remark |
| 15.207  | Conducted Emission                  | PASS     |        |
| 15.247(d)   | Antenna conducted Spurious Emission | PASS     |        |
| 15.247 (a)(1)                                       | Hopping Channel Separation          | PASS     |        |
| 15.247(a)(1)  | Bandwidth                           | PASS     |        |
| 15.247 (b)(1)                                       | Peak Output Power                   | PASS     |        |
| 15.247(d)<br>15.209                                 | Radiated Spurious Emission          | PASS     |        |
| 15.247 (a)(1)(iii)                                  | Number of Hopping Frequency         | PASS     |        |
| 15.247 (a)(1)(iii)                                  | Dwell Time                          | PASS     |        |
| 15.205  | Restricted Bands                    | PASS     |        |
| 15.203  | Antenna Requirement                 | PASS     |        |

Note:

(1) "N/A" denotes test is not applicable in this test report



## 2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

### Conducted emission Test:

**C05:** (VCCI RN: C-14742; FCC RN:674415; FCC DN:TW0659)

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

### Radiated emission Test (Below 1 GHz):

**CB15:** (VCCI RN: R-20020; FCC RN:674415; FCC DN:TW0659)

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

### Radiated emission Test (Above 1 GHz):

**CB15:** (VCCI RN: G-20031; FCC RN:674415; FCC DN:TW0659)

No. 68-1, Ln. 169, Sec. 2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

## 2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The BTL measurement uncertainty is less than the CISPR 16-4-2  $U_{cispr}$  requirement.

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 %.

### A. Conducted emission test:

| Test Site | Method | Measurement Frequency Range | U,(dB) |
|-----------|--------|-----------------------------|--------|
| C05       | CISPR  | 150 kHz ~ 30MHz             | 2.68   |

### B. Radiated emission test:

| Test Site    | Method | Measurement Frequency Range | U,(dB) |
|--------------|--------|-----------------------------|--------|
| CB15<br>(3m) | CISPR  | 9kHz ~ 150kHz               | 2.82   |
|              |        | 150kHz ~ 30MHz              | 2.58   |

| Test Site    | Method | Measurement Frequency Range | Ant. | U,(dB) |
|--------------|--------|-----------------------------|------|--------|
| CB15<br>(3m) | CISPR  | 30MHz ~ 200MHz              | V    | 4.20   |
|              |        | 30MHz ~ 200MHz              | H    | 3.64   |
|              |        | 200MHz ~ 1,000MHz           | V    | 4.56   |
|              |        | 200MHz ~ 1,000MHz           | H    | 3.90   |

| Test Site    | Method | Measurement Frequency Range | Ant. | U,(dB) |
|--------------|--------|-----------------------------|------|--------|
| CB15<br>(3m) | CISPR  | 1GHz ~ 6GHz                 | V    | 4.46   |
|              |        | 1GHz ~ 6GHz                 | H    | 4.40   |
|              |        | 6GHz ~ 18GHz                | V    | 3.88   |
|              |        | 6GHz ~ 18GHz                | H    | 4.00   |

| Test Site    | Method | Measurement Frequency Range | U,(dB) |
|--------------|--------|-----------------------------|--------|
| CB15<br>(1m) | CISPR  | 18 ~ 26.5 GHz               | 4.62   |
|              |        | 26.5 ~ 40 GHz               | 5.12   |

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our  $U_{lab}$  values in CISPR 16-4-2 terminology. Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called  $U_{CISPR}$ , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz: 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz: 5.2 dB

It can be seen that our  $U_{lab}$  values are smaller than  $U_{CISPR}$ .

Note: unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

|                         |   |
|-------------------------|---|
| Equipment               | Barcode Printer   |
| Brand Name              | TSC   |
| Test Model              | TDM-20  |
| Series Model            | DTE20, FNE20, CNE20, B-E20, LPE20, TDM-20(W), TDM-20(D)   |
| Model Difference        | Different model distribute to different area.   |
| Power Source            | DC voltage supplied from AC/DC Adapter.   |
| Power Rating            | # 1 CWT/2AAJ012F:<br>I/P: 100-240V~ 50/60 Hz 0.35A<br>O/P: 12.0V---1.0A<br># 2 BILLION/BA018-120100AXx:<br>I/P: 100-240V~ 0.5A 50/60 Hz<br>O/P: 12.0V---1.0A<br># 3 Shen Zhen/SOY-1200100xx:<br>I/P: 100-240V~ 0.3A 50/60 Hz<br>O/P: 12.0V---1.0A |
| Products Covered        | 3 * Power supply:<br>1. CWT/2AAJ012F<br>2. BILLION/BA018-120100AXx<br>3. Shen Zhen/SOY-1200100xx  |
| Operation Frequency     | 2402~2480 MHz   |
| Modulation Technology   | GFSK, $\pi/4$ -DQPSK, 8DPSK   |
| Bit Rate of Transmitter | 1/2/3Mbps   |
| Output Power Max.       | 1 Mbps:-3.79dBm<br>2 Mbps: -3.89dBm<br>3 Mbps: -3.55dBm   |

**Note:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's 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          | Antenna Type | Connector | Gain (dBi) |
|------|-------|----------------|--------------|-----------|------------|
| 1    | ACX   | AT3216-A2R4PAA | Chip         | N/A       | 1.5        |

### 3.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Following mode(s) as (were) found to be the worst case(s) and selected for the final test.

| Test Items                                  | Test mode  | Channel  | Note     |
|---|------------|----------|----------|
| Conducted Emission                          | 1 Mbps     | 39       | -        |
| Transmitter Radiated Emissions (BELOW 1GHz) | 1 Mbps     | 39       | -        |
| Transmitter Radiated Emissions (ABOVE 1GHz) | 1/3 Mbps   | 00/78    | Bandedge |
|   | 1/3 Mbps   | 00/39/78 | Harmonic |
| Number of Hopping Frequency                 | 1/3 Mbps   | 00/39/78 | -        |
| Average TIME OF OCCUPANCY                   | 1/3 Mbps   | 00/39/78 | -        |
| Hopping Channel Separation                  | 1/3 Mbps   | 00/39/78 | -        |
| Bandwidth                                   | 1/3 Mbps   | 00/39/78 | -        |
| Peak Output Power                           | 1/2/3 Mbps | 00/39/78 | -        |
| Antenna conducted Spurious Emission         | 1/3 Mbps   | 00/39/78 | -        |

**Note:**

- (1) The measurements are performed at the high, middle, low available channels.
- (2) The measurements for Hopping Channel Separation, Bandwidth and Peak Output Power were tested during 1Mbps, 2Mbps and 3Mbps, the worst case are 1Mbps and 3Mbps, only worst case was documented.
- (3) All adapter are evaluated, the Shen Zhen/SOY-1200100US is the worst and recorded as below test data.

### 3.3 TABLE OF PARAMETERS OF TEXT 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 | ISRT_V2.1.28.4678 |          |          |
|-----------------------|-------------------|----------|----------|
| Frequency             | 2402 MHz          | 2441 MHz | 2480 MHz |
| Parameters(1Mbps)     | DEF               | DEF      | DEF      |
| Parameters(3Mbps)     | DEF               | DEF      | DEF      |

### 3.4 DUTY CYCLE

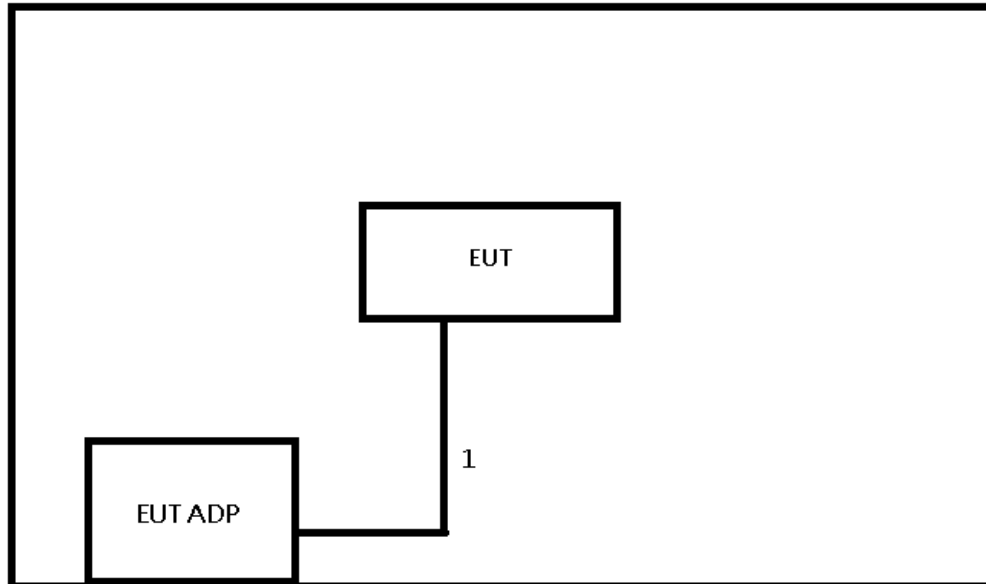
If duty cycle is  $\geq 98\%$ , duty factor is not required.  
 If duty cycle is  $< 98\%$ , duty factor shall be considered.

| Bluetooth_1M   | Bluetooth_3M   |
|--|--|
| Duty cycle = $2.920 \text{ ms} / 3.760 \text{ ms} = 77.66\%$<br>Duty Factor = $10 * \log(1 / 0.7766) = 1.10$ | Duty cycle = $2.920 \text{ ms} / 3.760 \text{ ms} = 77.66\%$<br>Duty Factor = $10 * \log(1 / 0.7766) = 1.10$ |

**Note:**

For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1/3 MHz and the video bandwidth is 3 kHz (Duty cycle  $< 98\%$ ).

**3.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED**



**3.6 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.

| Item | Equipment | Mfr/Brand | Model/Type No. | FCC ID | Series No. |
|------|-----------|-----------|----------------|--------|------------|
| -    | -         | -         | -              | -      | -          |

| Item | Shielded Type | Ferrite Core | Length | Note        |
|------|---------------|--------------|--------|-------------|
| 1    | NO            | NO           | 0.5m   | Power Cable |

## 4. EMC EMISSION TEST

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 POWER LINE CONDUCTED EMISSION LIMITS (Frequency Range 150KHz-30MHz)

| Frequency of Emission (MHz) | Conducted Limit (dBμV) |           |
|-----------------------------|------------------------|-----------|
|                             | Quasi-peak             | Average   |
| 0.15 -0.50                  | 66 to 56*              | 56 to 46* |
| 0.50 -5.0                   | 56                     | 46        |
| 5.0 -30.0                   | 60                     | 50        |

Note:

- (1) The limit of " \* " decreases with the logarithm of the frequency
- (2) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)  
 Margin Level = Measurement Value - Limit Value

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    |

#### 4.1.2 TEST PROCEDURE

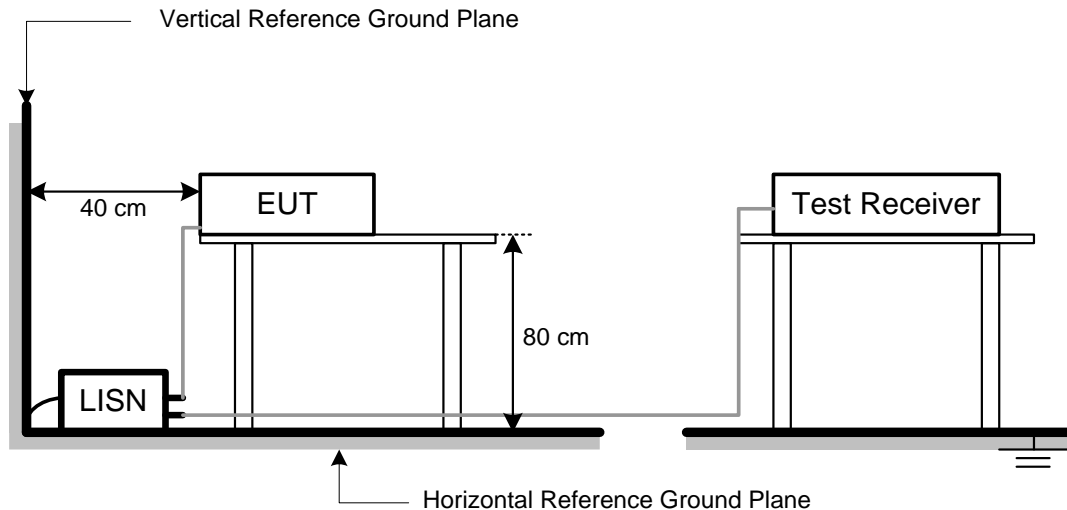
- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. 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.
- c. 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.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### 4.1.3 DEVIATION FROM TEST STANDARD

No deviation



#### 4.1.4 TEST SETUP



#### 4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting/receiving data or hopping on mode.

#### 4.1.6 EUT TEST CONDITIONS

Temperature: 25°C

Relative Humidity: 45%

Test Voltage: AC 120V/60Hz

#### 4.1.7 TEST RESULTS

Please refer to the Appendix A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 'Note'. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "\*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150KHz to 30MHz.

## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 RADIATED EMISSION LIMITS (Frequency Range 9KHz -1000MHz)

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequency (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                             |
| 960~1000        | 500                               | 3                             |

### LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

| Frequency (MHz) | (dBuV/m) (at 3 meters) |         |
|-----------------|------------------------|---------|
|                 | 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).
- (4) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use)  
 Margin Level = Measurement Value - Limit Value

| Spectrum Parameter                         | Setting  |
|--|--|
| Attenuation                                | Auto   |
| Start Frequency                            | 1000 MHz   |
| Stop Frequency                             | 10th carrier harmonic                            |
| RBW / VBW<br>(emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

| Spectrum Receiver Parameter | Setting                            |
|-----------------------------|------------------------------------|
| Attenuation                 | Auto                               |
| Start ~ Stop Frequency      | 9KHz ~90KHz for PK/AVG detector    |
| Start ~ Stop Frequency      | 90KHz ~110KHz for QP detector      |
| Start ~ Stop Frequency      | 110KHz ~490KHz for PK/AVG detector |
| Start ~ Stop Frequency      | 490KHz ~30MHz for QP detector      |
| Start ~ Stop Frequency      | 30MHz~1000MHz for QP detector      |

#### 4.2.2 TEST PROCEDURE

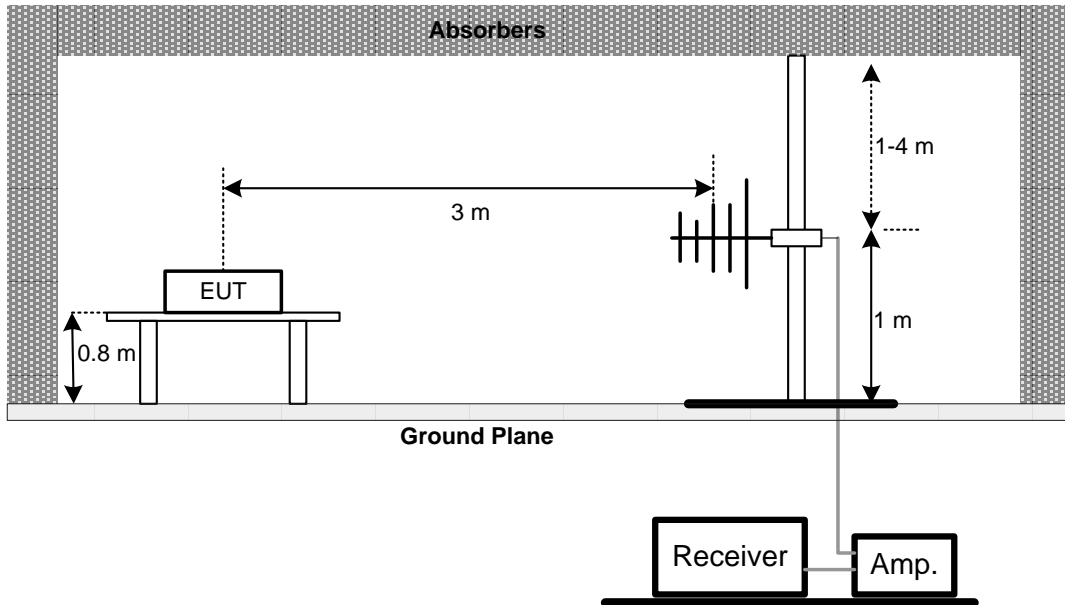
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. 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 find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### 4.2.3 DEVIATION FROM TEST STANDARD

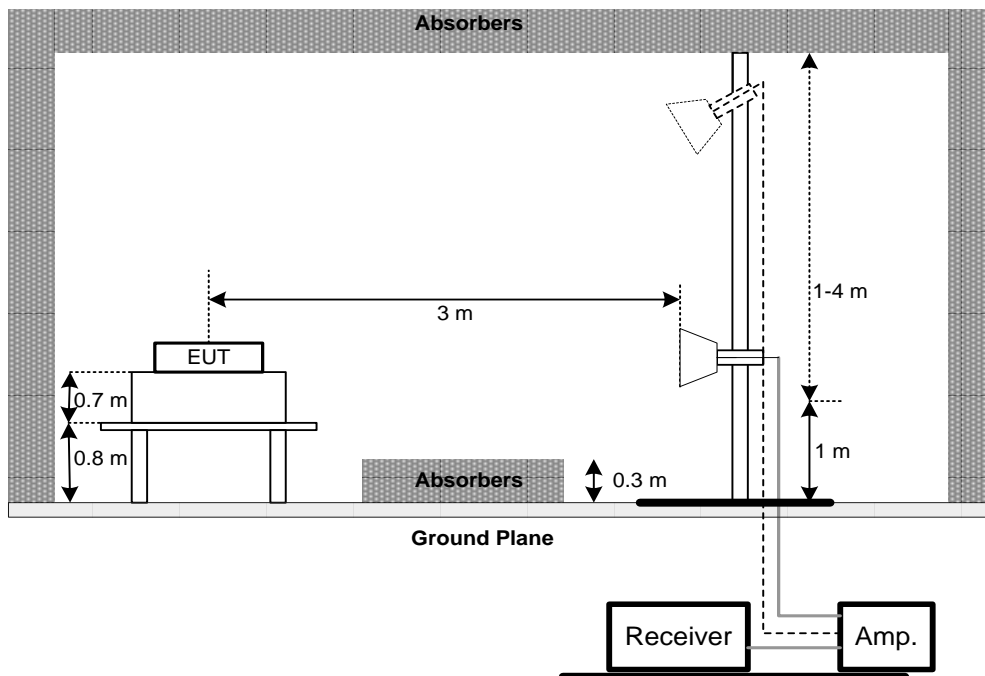
No deviation

**4.2.4 TEST SETUP**

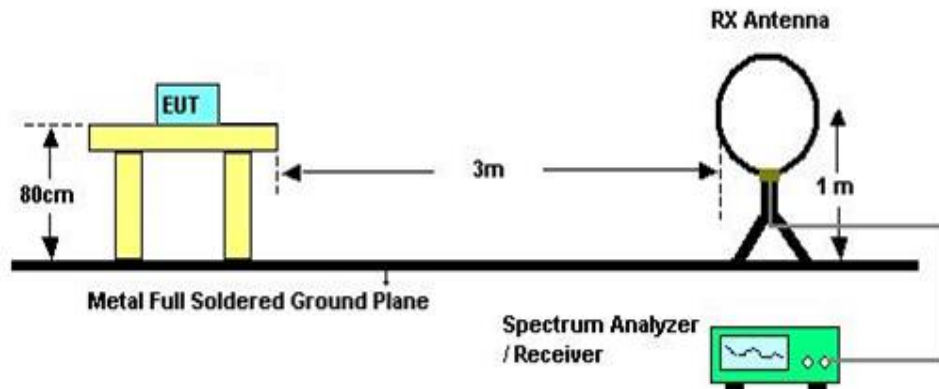
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



(C) For Radiated Emissions Below 30MHz



#### 4.2.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.6 EUT TEST CONDITIONS

Temperature: 23°C

Relative Humidity: 70%

Test Voltage: AC 120V/60Hz

#### 4.2.7 TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the Appendix B

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor =  $40 \log(\text{specific distance} / \text{test distance})$  (dB).
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.

#### 4.2.7 TEST RESULTS (30MHZ TO 1000 MHZ)

Please refer to the Appendix C.

#### 4.2.7 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Appendix D.

Remark:

- (1) No limit: This is fundamental signal, the judgment is not applicable. For fundamental signal judgment was referred to Peak output test.

## 5. NUMBER OF HOPPING CHANNEL

### 5.1 APPLIED PROCEDURES

| FCC Part15 (15.247) , Subpart C |                           |                       |        |
|---------------------------------|---------------------------|-----------------------|--------|
| Section                         | Test Item                 | Frequency Range (MHz) | Result |
| 15.247(a)(1)(iii)               | Number of Hopping Channel | 2400-2483.5           | PASS   |

| Spectrum Parameters | Setting                     |
|---------------------|-----------------------------|
| Attenuation         | Auto                        |
| Span Frequency      | > Operating Frequency Range |
| RBW                 | 100 KHz                     |
| VBW                 | 100 KHz                     |
| Detector            | Peak                        |
| Trace               | Max Hold                    |
| Sweep Time          | Auto                        |

#### 5.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW=100KHz, VBW=100KHz, Sweep time = Auto.

#### 5.1.2 DEVIATION FROM STANDARD

No deviation.

#### 5.1.3 TEST SETUP



#### 5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 5.1.5 EUT TEST CONDITIONS

Test Voltage: AC 120V/60Hz

#### 5.1.6 TEST RESULTS

Please refer to the Appendix E

## 6. AVERAGE TIME OF OCCUPANCY

### 6.1 APPLIED PROCEDURES / LIMIT

| FCC Part15 (15.247) , Subpart C |                           |        |                       |        |
|---------------------------------|---------------------------|--------|-----------------------|--------|
| Section                         | Test Item                 | Limit  | Frequency Range (MHz) | Result |
| 15.247(a)(1)(iii)               | Average Time of Occupancy | 0.4sec | 2400-2483.5           | PASS   |

#### 6.1.1 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer
- b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- h. Measure the maximum time duration of one single pulse.
- i. Measure the maximum time duration of one single pulse.  
A Period Time = (channel number)\*0.4

For Normal Mode (79 Channel):

DH1 Time Solt: Reading \* (1600/2)\*31.6/(channel number)

DH3 Time Solt: Reading \* (1600/2)\*31.6/(channel number)

DH5 Time Solt: Reading \* (1600/2)\*31.6/(channel number)

For AFH Mode (20 Channel):

DH1 Time Solt: Reading \* (1600/2)\*8/(channel number)

DH3 Time Solt: Reading \* (1600/4)\*8/(channel number)

DH5 Time Solt: Reading \* (1600/6)\*8/(channel number)

#### 6.1.2 DEVIATION FROM STANDARD

No deviation.

#### 6.1.3 TEST SETUP



#### **6.1.4 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### **6.1.5 EUT TEST CONDITIONS**

Test Voltage: AC 120V/60Hz

#### **6.1.6 TEST RESULTS**

Please refer to the Appendix F



## 7. HOPPING CHANNEL SEPARATION MEASUREMENT

### 7.1 APPLIED PROCEDURES / LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 KHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

| Spectrum Parameter | Setting                                       |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | > Measurement Bandwidth or Channel Separation |
| RBW                | 30 KHz  |
| VBW                | 100 KHz                                       |
| Detector           | Peak  |
| Trace              | Max Hold                                      |
| Sweep Time         | Auto  |

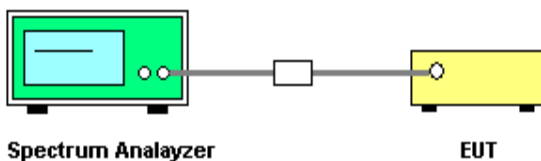
#### 7.1.1 TEST PROCEDURE

- a. The EUT must have its hopping function enabled
- b. Span = wide enough to capture the peaks of two adjacent channels
  - Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span
  - Video (or Average) Bandwidth (VBW)  $\geq$  RBW
  - Sweep = Auto
  - Detector function = Peak
  - Trace = Max Hold

#### 7.1.2 DEVIATION FROM STANDARD

No deviation.

#### 7.1.3 TEST SETUP



#### 7.1.4 EUT TEST CONDITIONS

Test Voltage: AC 120V/60Hz

#### 7.1.5 TEST RESULTS

Please refer to the Appendix G

## 8. BANDWIDTH TEST

### 8.1 APPLIED PROCEDURES

| FCC Part15 (15.247) , Subpart C |           |                       |
|---------------------------------|-----------|-----------------------|
| Section                         | Test Item | Frequency Range (MHz) |
| 15.247(a)(2)                    | Bandwidth | 2400-2483.5           |

| Spectrum Parameter | Setting   |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | > Measurement Bandwidth or Channel Separation           |
| RBW                | 30 KHz (20dB Bandwidth) / 30 KHz (Channel Separation)   |
| VBW                | 100 KHz (20dB Bandwidth) / 100 KHz (Channel Separation) |
| Detector           | Peak  |
| Trace              | Max Hold  |
| Sweep Time         | Auto  |

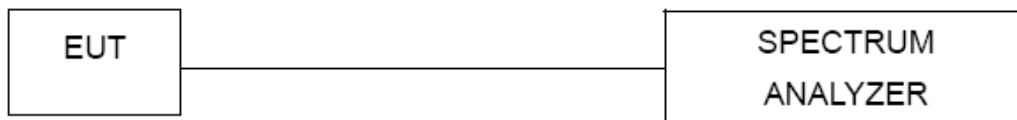
#### 8.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep Time = Auto.

#### 8.1.2 DEVIATION FROM STANDARD

No deviation.

#### 8.1.3 TEST SETUP



#### 8.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 8.1.5 EUT TEST CONDITIONS

Test Voltage: AC 120V/60Hz

#### 8.1.6 TEST RESULTS

Please refer to the Appendix H

## 9. PEAK OUTPUT POWER TEST

### 9.1 APPLIED PROCEDURES / LIMIT

| FCC Part15 (15.247) , Subpart C |                   |  |                       |        |
|---------------------------------|-------------------|--|-----------------------|--------|
| Section                         | Test Item         | Limit  | Frequency Range (MHz) | Result |
| 15.247(b)(1)                    | Peak Output Power | 1 Watt or 30dBm<br>( hopping channel >75)<br>0.125Watt or 21dBm<br>(hopping channel <75) | 2400-2483.5           | PASS   |

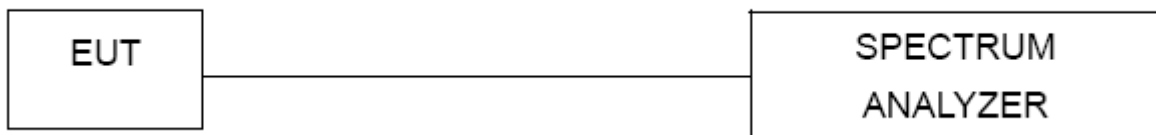
#### 9.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 3MHz, VBW= 3MHz, Sweep time = Auto.

#### 9.1.2 DEVIATION FROM STANDARD

No deviation.

#### 9.1.3 TEST SETUP



#### 9.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 9.1.5 EUT TEST CONDITIONS

Test Voltage: AC 120V/60Hz

#### 9.1.6 TEST RESULTS

Please refer to the Appendix I

## 10. ANTENNA CONDUCTED SPURIOUS EMISSION

### 10.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

#### 10.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.
- c. Offset=antenna gain+cable loss

#### 10.1.2 DEVIATION FROM STANDARD

No deviation.

#### 10.1.3 TEST SETUP



#### 10.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 10.1.5 EUT TEST CONDITIONS

Test Voltage: AC 120V/60Hz

#### 10.1.6 TEST RESULTS

Please refer to the Appendix J

## 11. MEASUREMENT INSTRUMENTS LIST

| Conducted Emission Measurement |                      |              |                          |            |                  |
|--------------------------------|----------------------|--------------|--------------------------|------------|------------------|
| Item                           | Kind of Equipment    | Manufacturer | Type No.                 | Serial No. | Calibrated until |
| 1                              | TWO-LINE V-NETWORK   | R&S          | ENV216                   | 101050     | 2020/3/7         |
| 2                              | Test Cable           | EMCI         | EMCCFD300-BM-BMR-6000    | 170715     | 2019/8/7         |
| 3                              | EMI Test Receiver    | R&S          | ESR7                     | 101433     | 2019/12/4        |
| 4                              | Measurement Software | EZ           | EZ_EMCI (Version NB-03A) | N/A        | N/A              |

| Radiated Emission Measurement |                          |              |                     |            |                  |
|-------------------------------|--------------------------|--------------|---------------------|------------|------------------|
| Item                          | Kind of Equipment        | Manufacturer | Type No.            | Serial No. | Calibrated until |
| 1                             | Preamplifier             | EMCI         | 012645B             | 980267     | 2020/4/11        |
| 2                             | Preamplifier             | EMCI         | EMC02325            | 980217     | 2020/4/11        |
| 3                             | Preamplifier             | EMCI         | EMC2654045          | 980030     | 2020/4/11        |
| 4                             | Test Cable               | EMCI         | EMC104-SM-S M-8000  | 8m         | 2020/4/11        |
| 5                             | Test Cable               | EMCI         | EMC104-SM-S M-800   | 150207     | 2020/4/11        |
| 6                             | Test Cable               | EMCI         | EEMC104-SM-S M-3000 | 151205     | 2020/4/11        |
| 7                             | MXE EMI Receiver         | Agilent      | N9038A              | MY55420127 | 2020/1/26        |
| 8                             | Signal Analyzer          | Agilent      | N9010A              | MY52220990 | 2019/5/22        |
| 9                             | Loop Ant                 | EMCO         | 6502                | 42960      | 2019/5/3         |
| 10                            | Horn Ant                 | SCHWARZBECK  | BBHA 9120D          | 9120D-1342 | 2019/5/2         |
| 11                            | Horn Ant                 | Schwarzbeck  | BBHA 9170           | 187        | 2019/8/16        |
| 12                            | Trilog-Broadband Antenna | Schwarzbeck  | VULB 9168           | 9168-548   | 2020/3/21        |
| 13                            | 5dB Attenuator           | EMCI         | EMCI-N-6-05         | AT-N0623   | 2020/3/21        |

| Number of Hopping Channel |                   |              |           |            |                  |
|---------------------------|-------------------|--------------|-----------|------------|------------------|
| Item                      | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1                         | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

| Average Time of Occupancy |                   |              |           |            |                  |
|---------------------------|-------------------|--------------|-----------|------------|------------------|
| Item                      | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1                         | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

| Hopping Channel Separation Measurement |                   |              |           |            |                  |
|--|-------------------|--------------|-----------|------------|------------------|
| Item                                   | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1                                      | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

| Bandwidth |                   |              |           |            |                  |
|-----------|-------------------|--------------|-----------|------------|------------------|
| Item      | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1         | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

| Peak Output Power |                   |              |           |            |                  |
|-------------------|-------------------|--------------|-----------|------------|------------------|
| Item              | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1                 | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

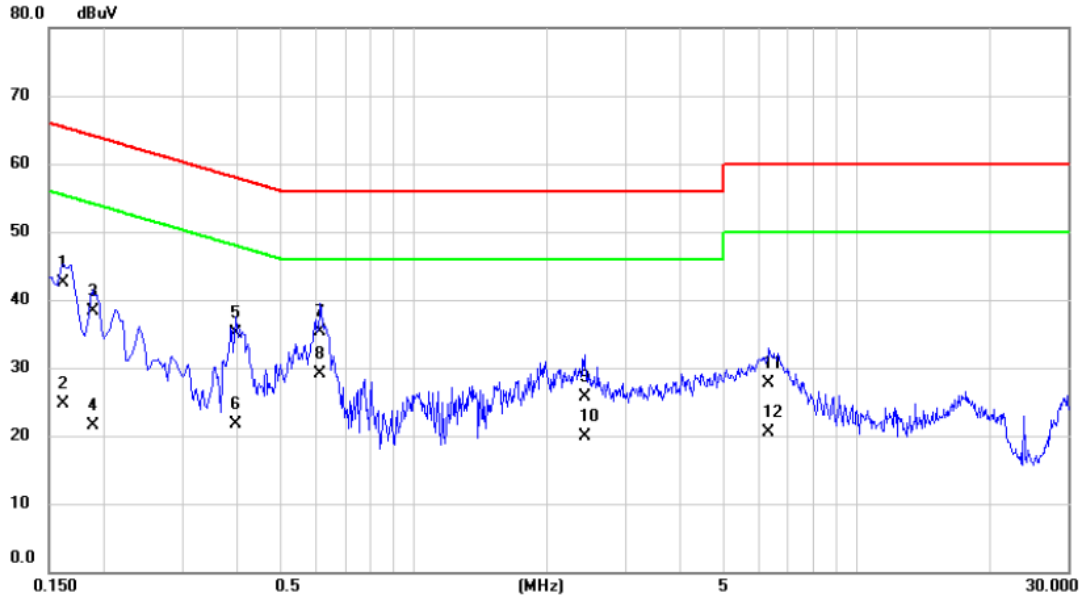
| Antenna Conducted Spurious Emission |                   |              |           |            |                  |
|-------------------------------------|-------------------|--------------|-----------|------------|------------------|
| Item                                | Kind of Equipment | Manufacturer | Type No.  | Serial No. | Calibrated until |
| 1                                   | Spectrum Analyzer | R&S          | R&S/FSP30 | 100854     | 2019/5/26        |

Remark: "N/A" denotes no model name, serial no. or calibration specified.  
 All calibration period of equipment list is one year.

## APPENDIX A - CONDUCTED EMISSION

Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

### Line

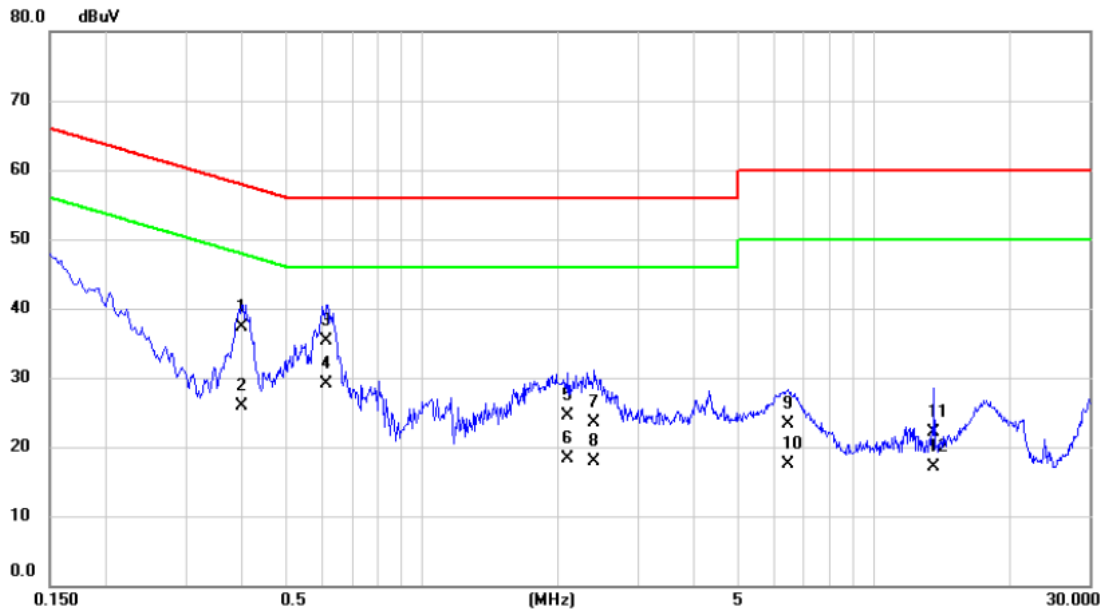


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.1613       | 33.00                    | 9.59                    | 42.59                    | 65.40         | -22.81     | QP       |         |
| 2   |     | 0.1613       | 15.20                    | 9.59                    | 24.79                    | 55.40         | -30.61     | AVG      |         |
| 3   |     | 0.1883       | 28.80                    | 9.58                    | 38.38                    | 64.11         | -25.73     | QP       |         |
| 4   |     | 0.1883       | 12.00                    | 9.58                    | 21.58                    | 54.11         | -32.53     | AVG      |         |
| 5   |     | 0.3975       | 25.50                    | 9.58                    | 35.08                    | 57.91         | -22.83     | QP       |         |
| 6   |     | 0.3975       | 12.10                    | 9.58                    | 21.68                    | 47.91         | -26.23     | AVG      |         |
| 7   |     | 0.6157       | 25.70                    | 9.59                    | 35.29                    | 56.00         | -20.71     | QP       |         |
| 8   | *   | 0.6157       | 19.50                    | 9.59                    | 29.09                    | 46.00         | -16.91     | AVG      |         |
| 9   |     | 2.4338       | 16.10                    | 9.69                    | 25.79                    | 56.00         | -30.21     | QP       |         |
| 10  |     | 2.4338       | 10.30                    | 9.69                    | 19.99                    | 46.00         | -26.01     | AVG      |         |
| 11  |     | 6.3308       | 18.00                    | 9.78                    | 27.78                    | 60.00         | -32.22     | QP       |         |
| 12  |     | 6.3308       | 10.70                    | 9.78                    | 20.48                    | 50.00         | -29.52     | AVG      |         |



Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

### Neutral

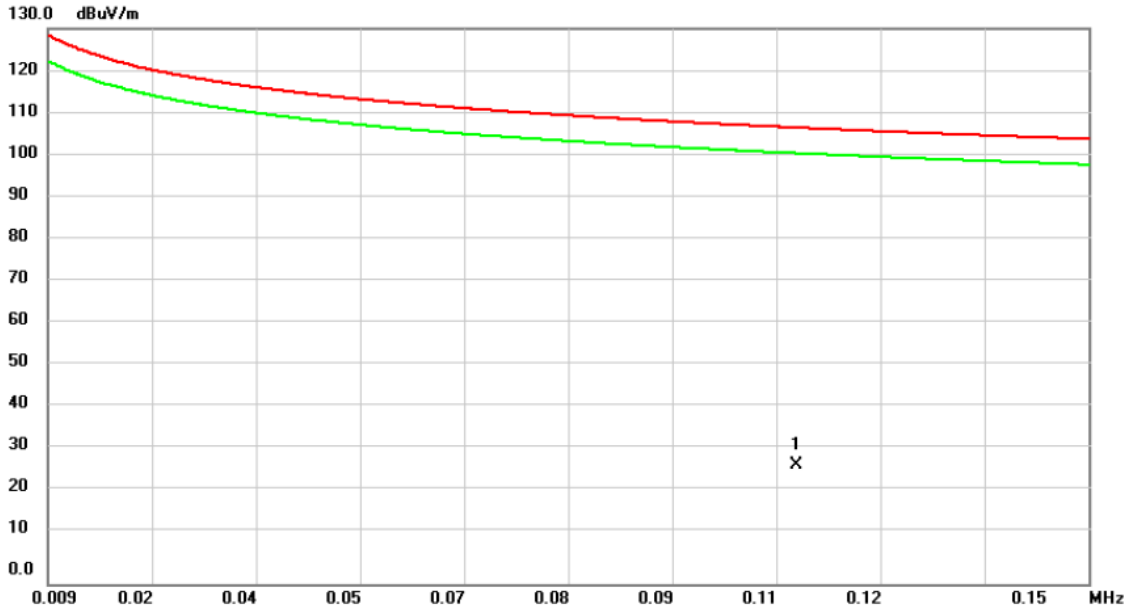


| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.3997       | 27.70                    | 9.63                    | 37.33                    | 57.86         | -20.53     | QP       |         |
| 2   |     | 0.3997       | 16.20                    | 9.63                    | 25.83                    | 47.86         | -22.03     | AVG      |         |
| 3   |     | 0.6157       | 25.60                    | 9.64                    | 35.24                    | 56.00         | -20.76     | QP       |         |
| 4   | *   | 0.6157       | 19.40                    | 9.64                    | 29.04                    | 46.00         | -16.96     | AVG      |         |
| 5   |     | 2.1030       | 14.80                    | 9.71                    | 24.51                    | 56.00         | -31.49     | QP       |         |
| 6   |     | 2.1030       | 8.50                     | 9.71                    | 18.21                    | 46.00         | -27.79     | AVG      |         |
| 7   |     | 2.3978       | 13.80                    | 9.73                    | 23.53                    | 56.00         | -32.47     | QP       |         |
| 8   |     | 2.3978       | 8.10                     | 9.73                    | 17.83                    | 46.00         | -28.17     | AVG      |         |
| 9   |     | 6.4320       | 13.50                    | 9.83                    | 23.33                    | 60.00         | -36.67     | QP       |         |
| 10  |     | 6.4320       | 7.60                     | 9.83                    | 17.43                    | 50.00         | -32.57     | AVG      |         |
| 11  |     | 13.5600      | 12.20                    | 9.94                    | 22.14                    | 60.00         | -37.86     | QP       |         |
| 12  |     | 13.5600      | 7.10                     | 9.94                    | 17.04                    | 50.00         | -32.96     | AVG      |         |

## APPENDIX B - RADIATED EMISSION (9KHZ-30MHZ)

Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

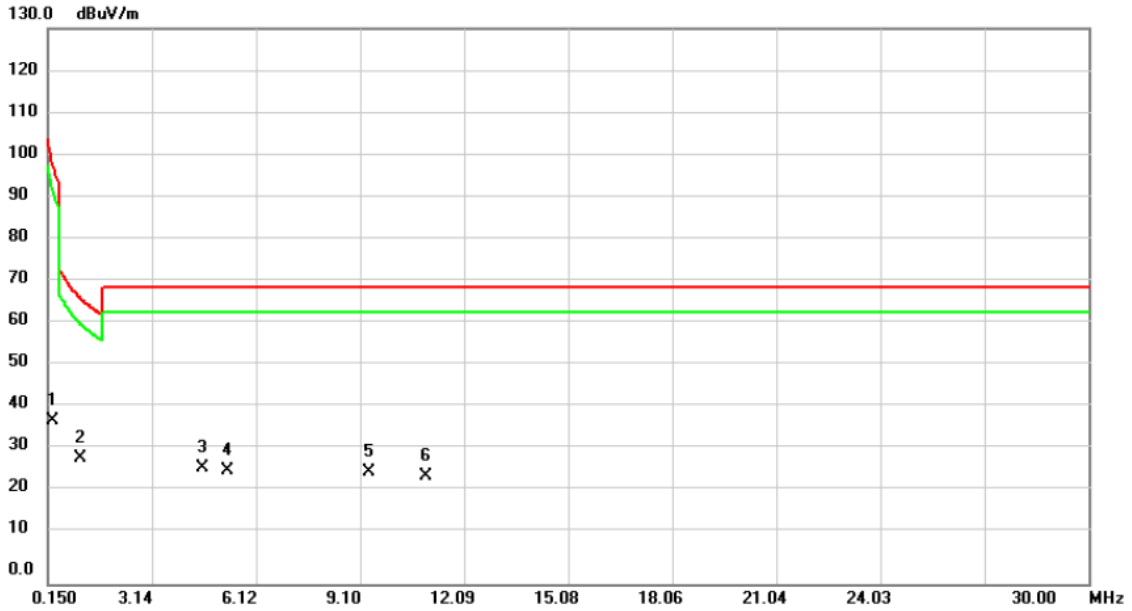
Ant 90°



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit  | Over   | Detector | Comment |
|-----|-----|--------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz    | dBuV          | dB             | dBuV/m      | dBuV/m | dB     |          |         |
| 1   | *   | 0.1105 | 12.41         | 15.43          | 27.84       | 106.74 | -78.90 | AVG      |         |

Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

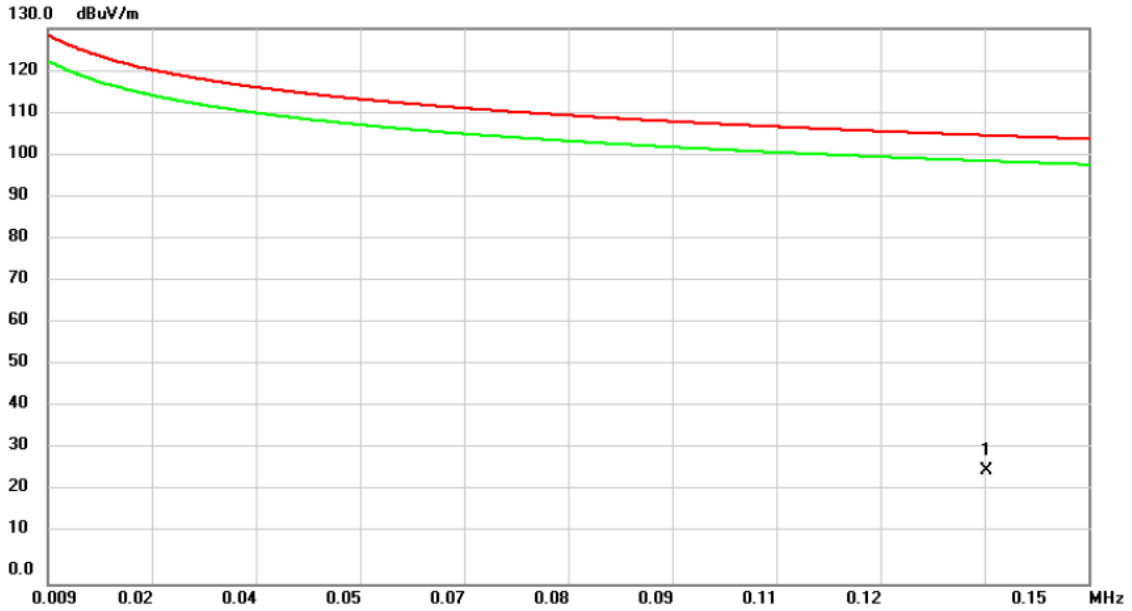
Ant 90°



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1   |     | 0.2694       | 30.01                    | 8.03                    | 38.04                      | 99.00           | -60.96     | AVG      |         |
| 2   | *   | 1.0750       | 30.07                    | -0.54                   | 29.53                      | 66.98           | -37.45     | QP       |         |
| 3   |     | 4.5975       | 30.96                    | -3.88                   | 27.08                      | 69.54           | -42.46     | QP       |         |
| 4   |     | 5.2842       | 30.52                    | -3.96                   | 26.56                      | 69.54           | -42.98     | QP       |         |
| 5   |     | 9.3734       | 30.95                    | -4.71                   | 26.24                      | 69.54           | -43.30     | QP       |         |
| 6   |     | 10.9855      | 29.89                    | -4.81                   | 25.08                      | 69.54           | -44.46     | QP       |         |

Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

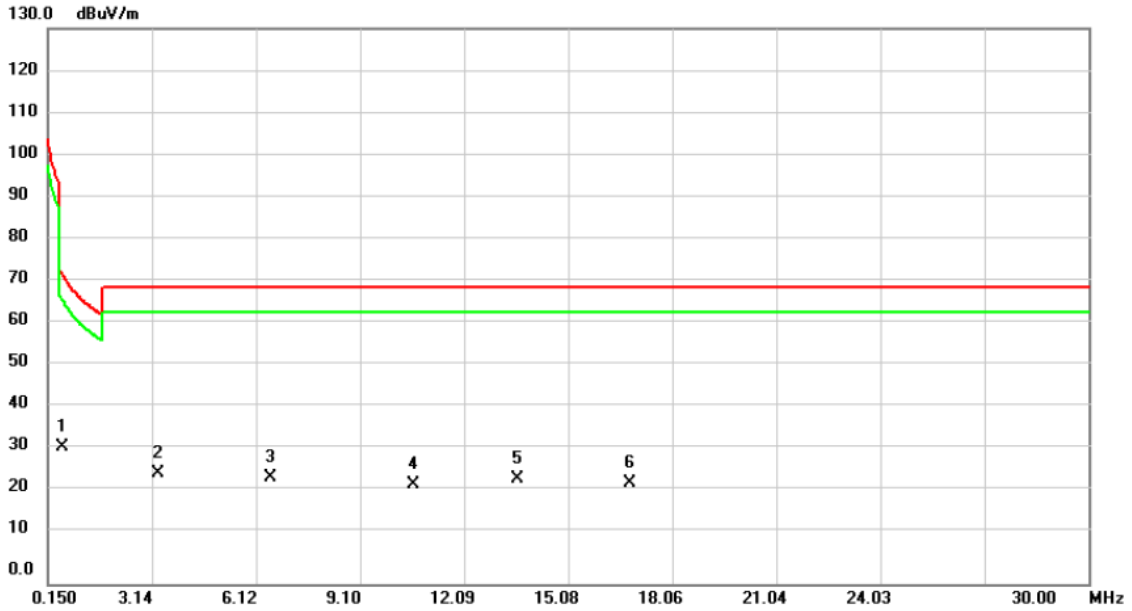
Ant 0°



| No. | Mk. | Freq.  | Reading Level | Correct Factor | Measurement | Limit  | Over   | Detector | Comment |
|-----|-----|--------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz    | dBuV          | dB             | dBuV/m      | dBuV/m | dB     |          |         |
| 1   | *   | 0.1361 | 12.51         | 13.98          | 26.49       | 104.93 | -78.44 | AVG      |         |

Test Mode: TX Mode 2441MHz \_CH39\_1Mbps

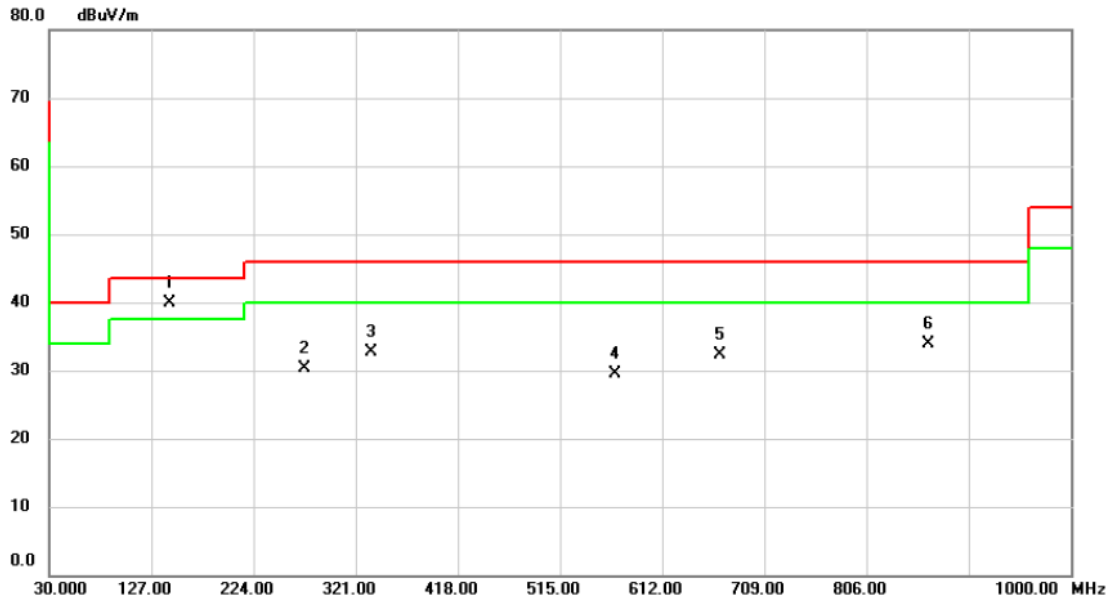
Ant 0°



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1   | *   | 0.5480       | 28.82                    | 3.07                    | 31.89                      | 72.83           | -40.94     | QP       |         |
| 2   |     | 3.2942       | 29.58                    | -3.70                   | 25.88                      | 69.54           | -43.66     | QP       |         |
| 3   |     | 6.5180       | 28.96                    | -4.08                   | 24.88                      | 69.54           | -44.66     | QP       |         |
| 4   |     | 10.6174      | 28.01                    | -4.77                   | 23.24                      | 69.54           | -46.30     | QP       |         |
| 5   |     | 13.6024      | 29.50                    | -4.82                   | 24.68                      | 69.54           | -44.86     | QP       |         |
| 6   |     | 16.8262      | 29.28                    | -5.74                   | 23.54                      | 69.54           | -46.00     | QP       |         |

## APPENDIX C - RADIATED EMISSION (30MHZ TO 1000MHZ)

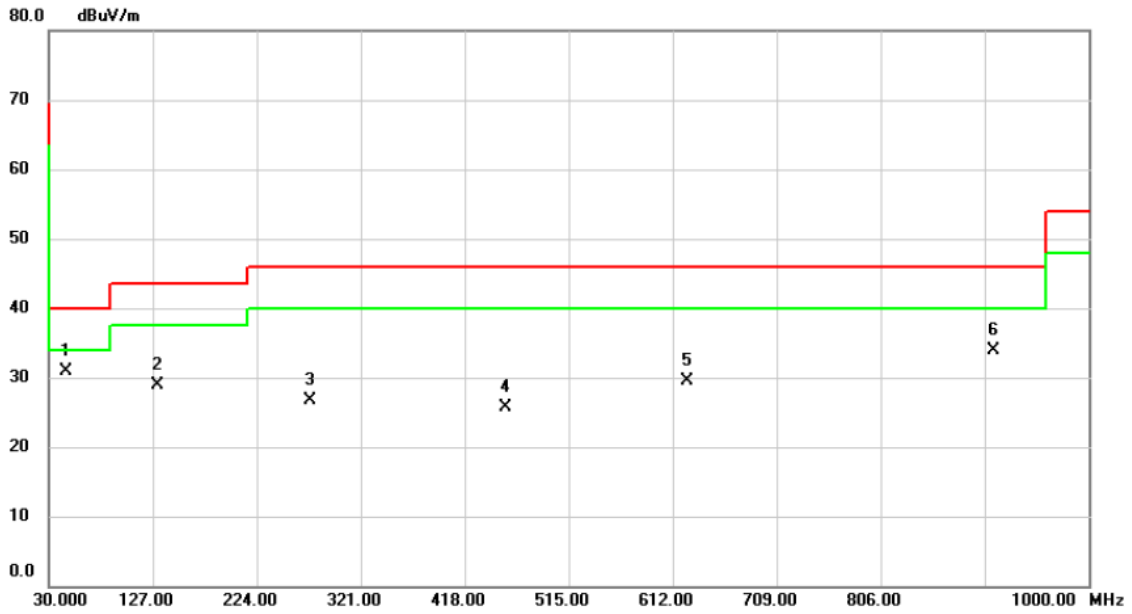
|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2441MHz _CH39_1Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1   | *   | 144.4600     | 48.65                    | -8.73                   | 39.92                      | 43.50           | -3.58      | QP       |         |
| 2   |     | 272.5000     | 38.27                    | -7.96                   | 30.31                      | 46.00           | -15.69     | QP       |         |
| 3   |     | 335.5500     | 39.37                    | -6.58                   | 32.79                      | 46.00           | -13.21     | QP       |         |
| 4   |     | 567.3800     | 31.05                    | -1.46                   | 29.59                      | 46.00           | -16.41     | QP       |         |
| 5   |     | 666.3200     | 31.75                    | 0.54                    | 32.29                      | 46.00           | -13.71     | QP       |         |
| 6   |     | 864.2000     | 29.63                    | 4.26                    | 33.89                      | 46.00           | -12.11     | QP       |         |



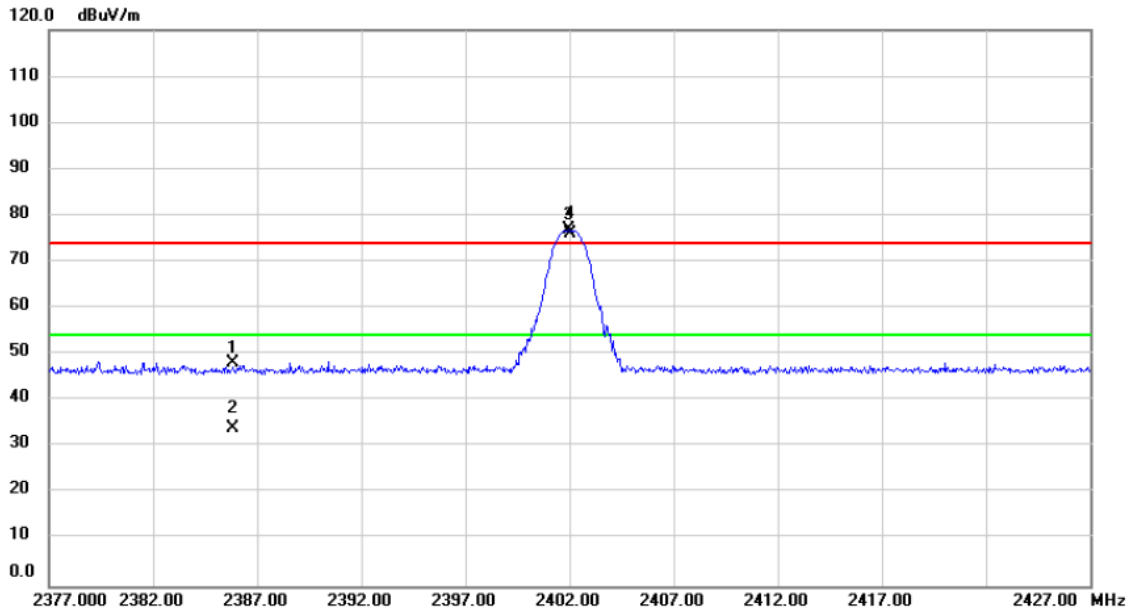
|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2441MHz _CH39_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1   | *   | 45.5200      | 39.10                    | -8.20                   | 30.90                      | 40.00           | -9.10      | QP       |         |
| 2   |     | 131.8500     | 38.58                    | -9.72                   | 28.86                      | 43.50           | -14.64     | QP       |         |
| 3   |     | 273.4700     | 34.70                    | -7.94                   | 26.76                      | 46.00           | -19.24     | QP       |         |
| 4   |     | 455.8300     | 29.48                    | -3.69                   | 25.79                      | 46.00           | -20.21     | QP       |         |
| 5   |     | 625.5800     | 29.69                    | -0.11                   | 29.58                      | 46.00           | -16.42     | QP       |         |
| 6   |     | 911.7300     | 28.83                    | 5.17                    | 34.00                      | 46.00           | -12.00     | QP       |         |

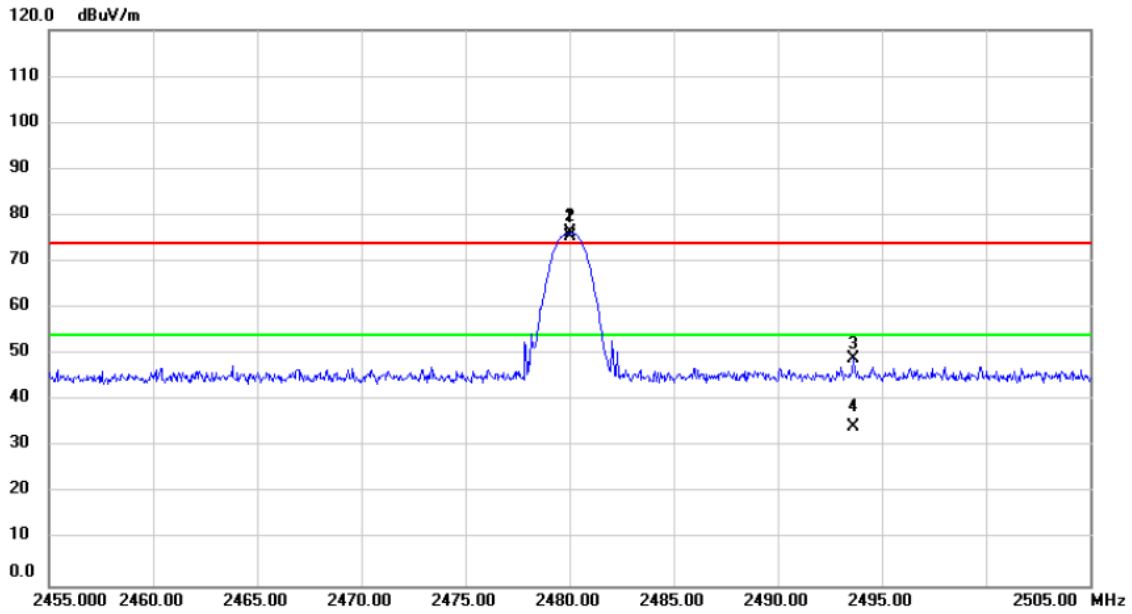
## APPENDIX D - RADIATED EMISSION (ABOVE 1000MHZ)

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2402MHz _CH00_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



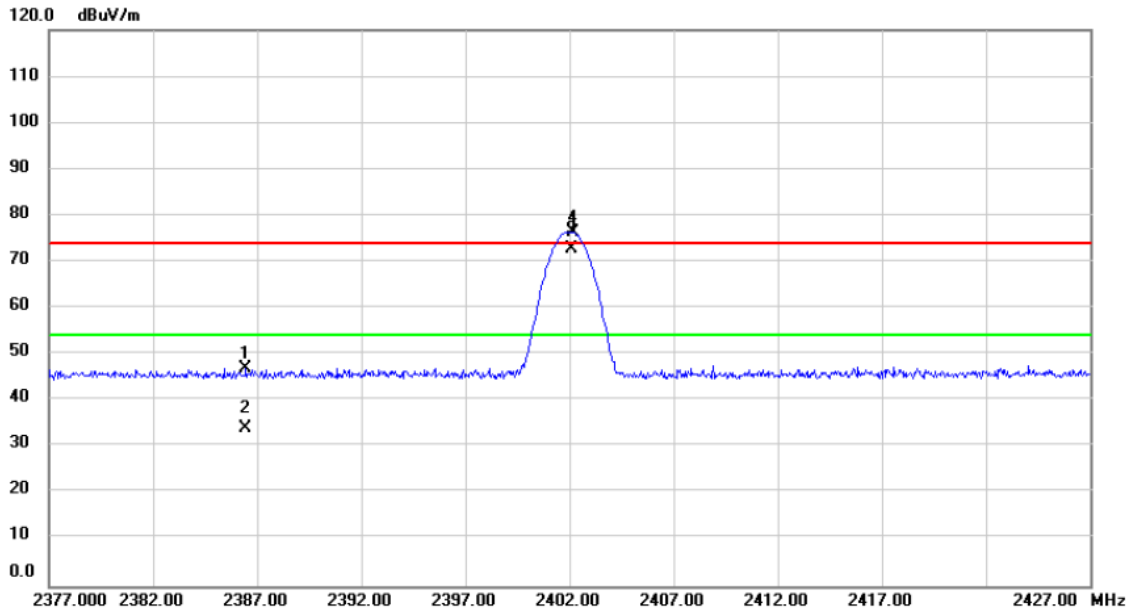
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment  |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|----------|
| 1       | 2385.840     | 17.43                    | 30.85                   | 48.28                      | 74.00           | -25.72     | peak     |          |
| 2       | 2385.840     | 3.18                     | 30.85                   | 34.03                      | 54.00           | -19.97     | AVG      |          |
| 3 X     | 2401.950     | 45.90                    | 30.91                   | 76.81                      | 74.00           | 2.81       | peak     | No Limit |
| 4 *     | 2402.050     | 45.20                    | 30.91                   | 76.11                      | 54.00           | 22.11      | AVG      | No Limit |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2480MHz _CH78_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



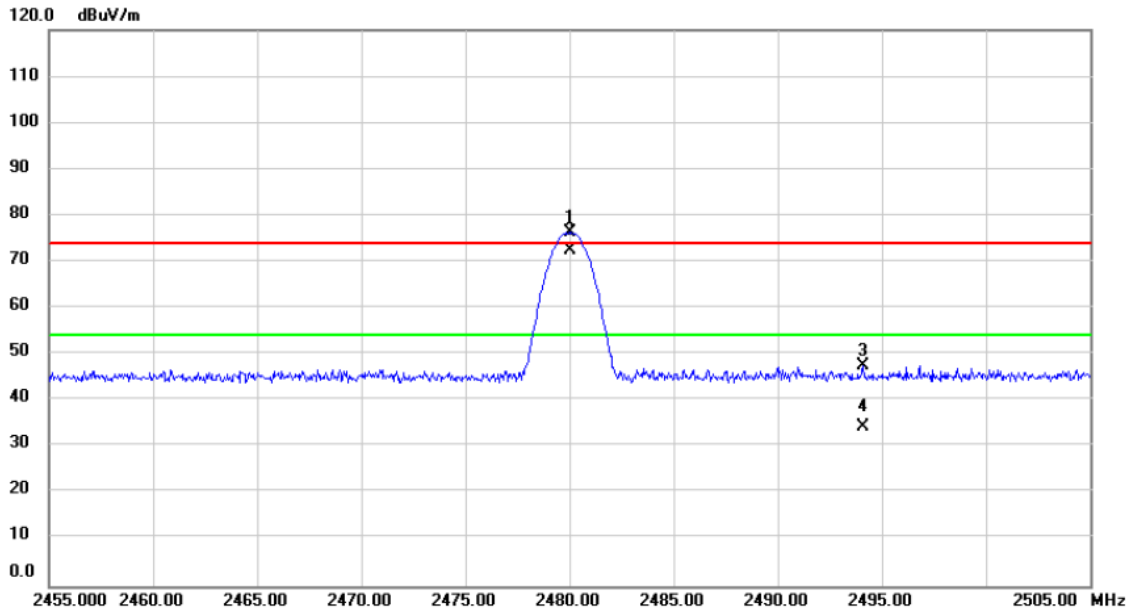
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment  |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|----------|
| 1   | X   | 2480.000     | 45.04                    | 31.17                   | 76.21                      | 74.00           | 2.21       | peak     | No Limit |
| 2   | *   | 2480.000     | 44.30                    | 31.17                   | 75.47                      | 54.00           | 21.47      | AVG      | No Limit |
| 3   |     | 2493.650     | 17.86                    | 31.21                   | 49.07                      | 74.00           | -24.93     | peak     |          |
| 4   |     | 2493.650     | 3.20                     | 31.21                   | 34.41                      | 54.00           | -19.59     | AVG      |          |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2402MHz _CH00_3Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



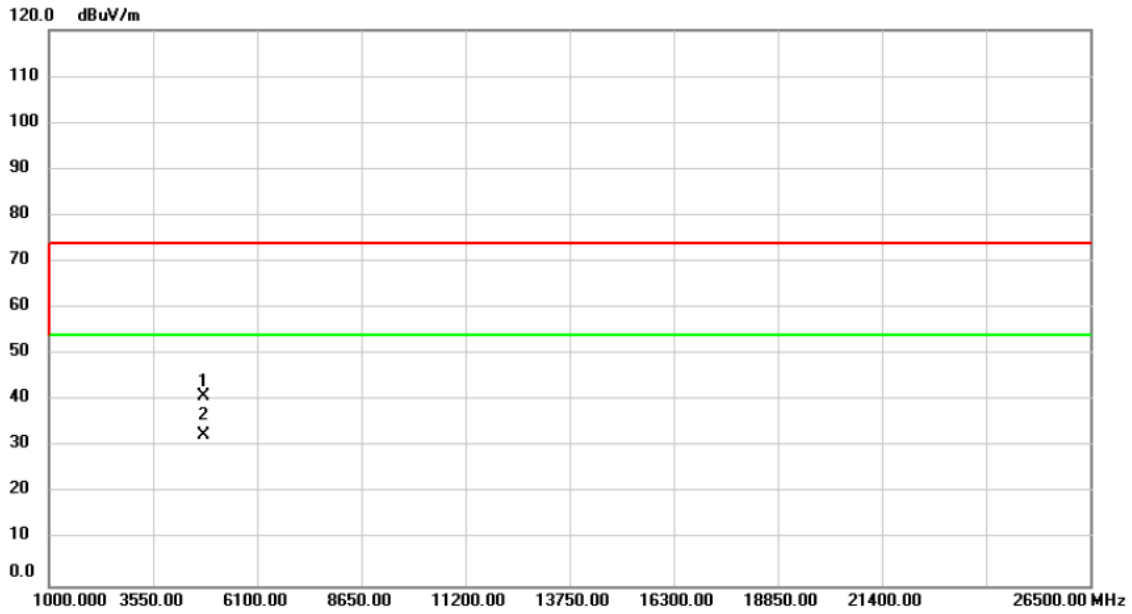
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment  |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|----------|
| 1   |     | 2386.450     | 16.13                    | 30.85                   | 46.98                      | 74.00           | -27.02     | peak     |          |
| 2   |     | 2386.450     | 3.22                     | 30.85                   | 34.07                      | 54.00           | -19.93     | AVG      |          |
| 3   | *   | 2402.100     | 41.73                    | 30.91                   | 72.64                      | 54.00           | 18.64      | AVG      | No Limit |
| 4   | X   | 2402.150     | 45.53                    | 30.91                   | 76.44                      | 74.00           | 2.44       | peak     | No Limit |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2480MHz _CH78_3Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



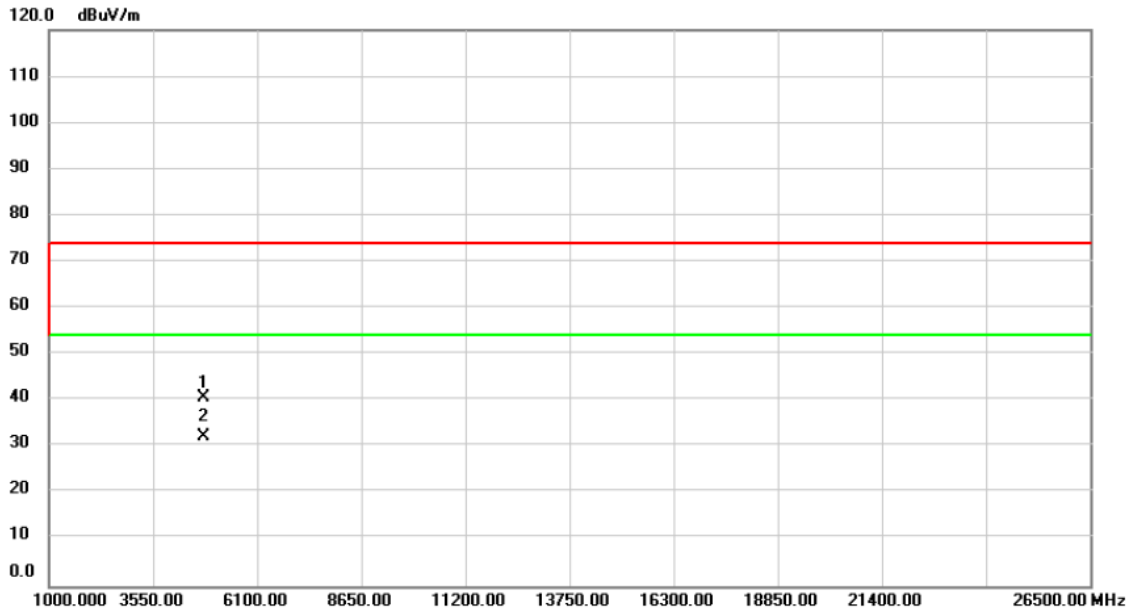
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment  |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|----------|
| 1   | X   | 2480.000     | 45.07                    | 31.17                   | 76.24                      | 74.00           | 2.24       | peak     | No Limit |
| 2   | *   | 2480.050     | 41.26                    | 31.17                   | 72.43                      | 54.00           | 18.43      | AVG      | No Limit |
| 3   |     | 2494.100     | 16.28                    | 31.21                   | 47.49                      | 74.00           | -26.51     | peak     |          |
| 4   |     | 2494.100     | 3.18                     | 31.21                   | 34.39                      | 54.00           | -19.61     | AVG      |          |

|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2402MHz _CH00_1Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4804.000     | 53.19                    | -12.17                  | 41.02                      | 74.00           | -32.98     | peak     |         |
| 2 *     | 4804.000     | 44.66                    | -12.17                  | 32.49                      | 54.00           | -21.51     | AVG      |         |

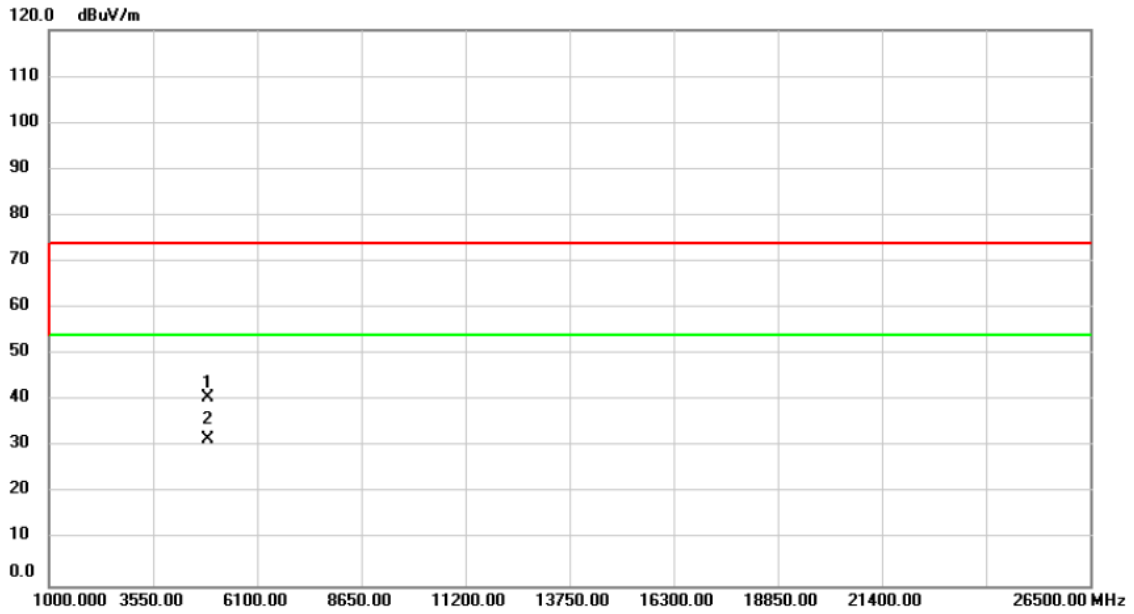
|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2402MHz _CH00_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4804.000     | 52.87                    | -12.17                  | 40.70                      | 74.00           | -33.30     | peak     |         |
| 2 *     | 4804.000     | 44.35                    | -12.17                  | 32.18                      | 54.00           | -21.82     | AVG      |         |

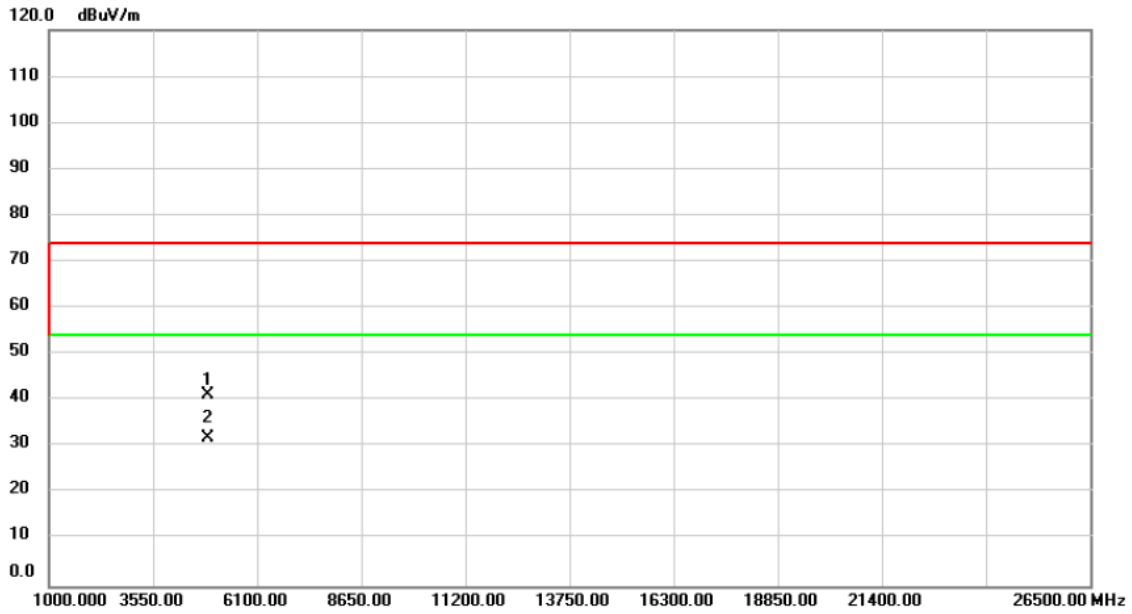


|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2441MHz _CH39_1Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



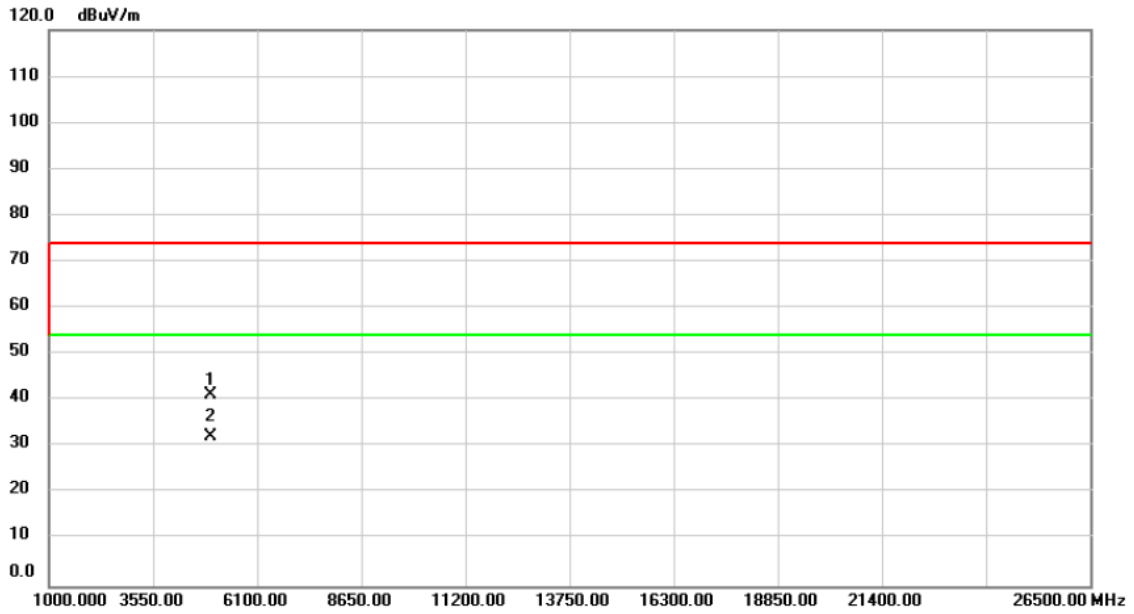
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4882.000     | 52.75                    | -12.08                  | 40.67                      | 74.00           | -33.33     | peak     |         |
| 2 *     | 4882.000     | 43.80                    | -12.08                  | 31.72                      | 54.00           | -22.28     | AVG      |         |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2441MHz _CH39_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



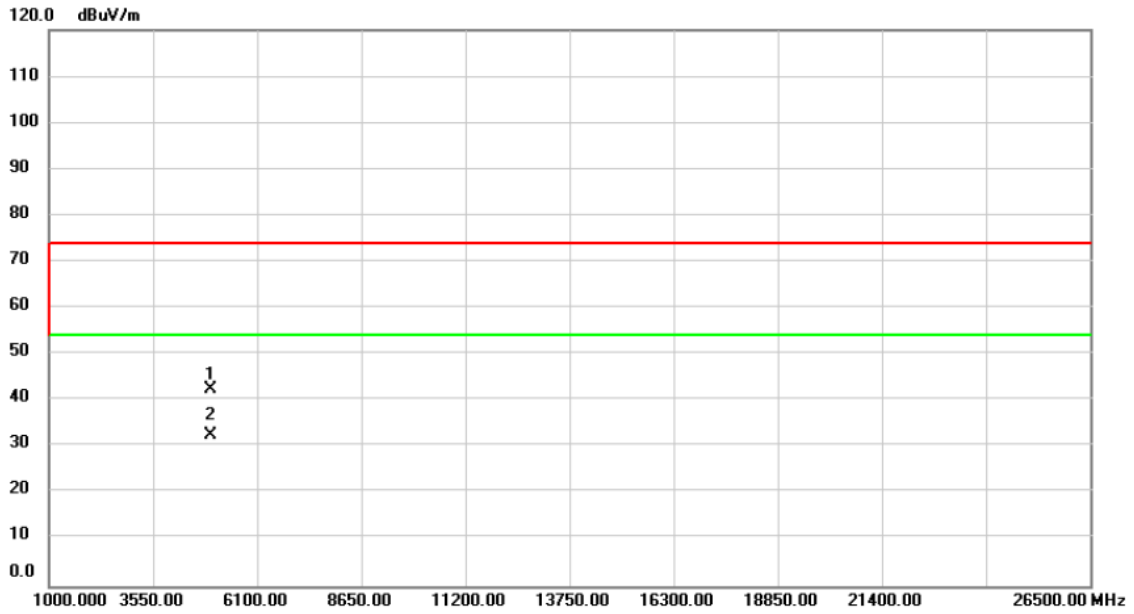
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4882.000     | 53.44                    | -12.08                  | 41.36                      | 74.00           | -32.64     | peak     |         |
| 2 *     | 4882.000     | 43.93                    | -12.08                  | 31.85                      | 54.00           | -22.15     | AVG      |         |

|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2480MHz _CH78_1Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



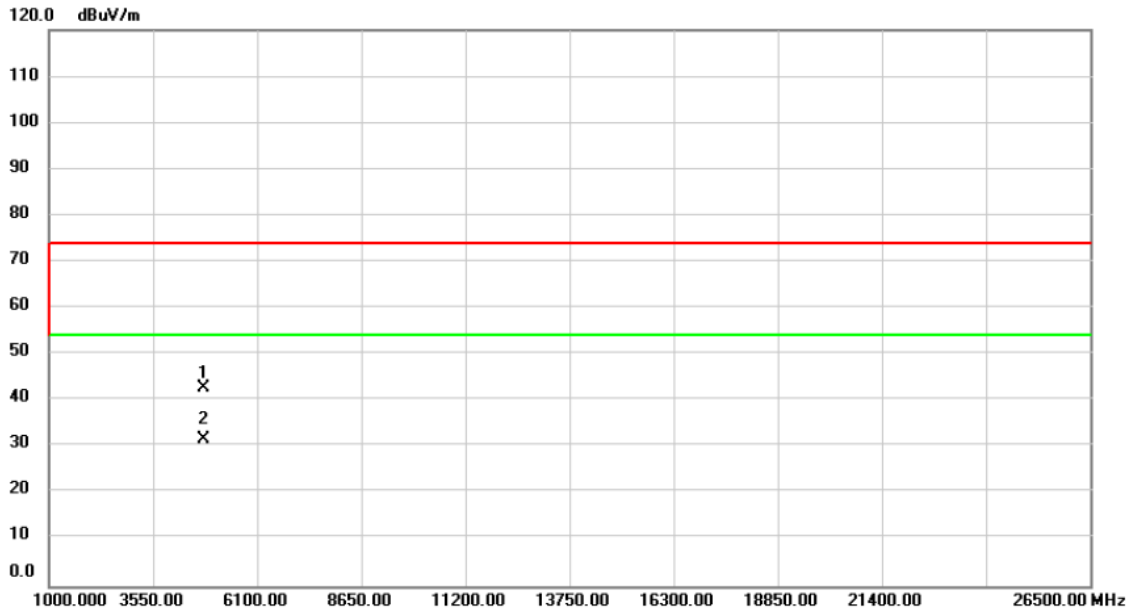
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4960.000     | 53.36                    | -11.97                  | 41.39                      | 74.00           | -32.61     | peak     |         |
| 2 *     | 4960.000     | 44.08                    | -11.97                  | 32.11                      | 54.00           | -21.89     | AVG      |         |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2480MHz _CH78_1Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



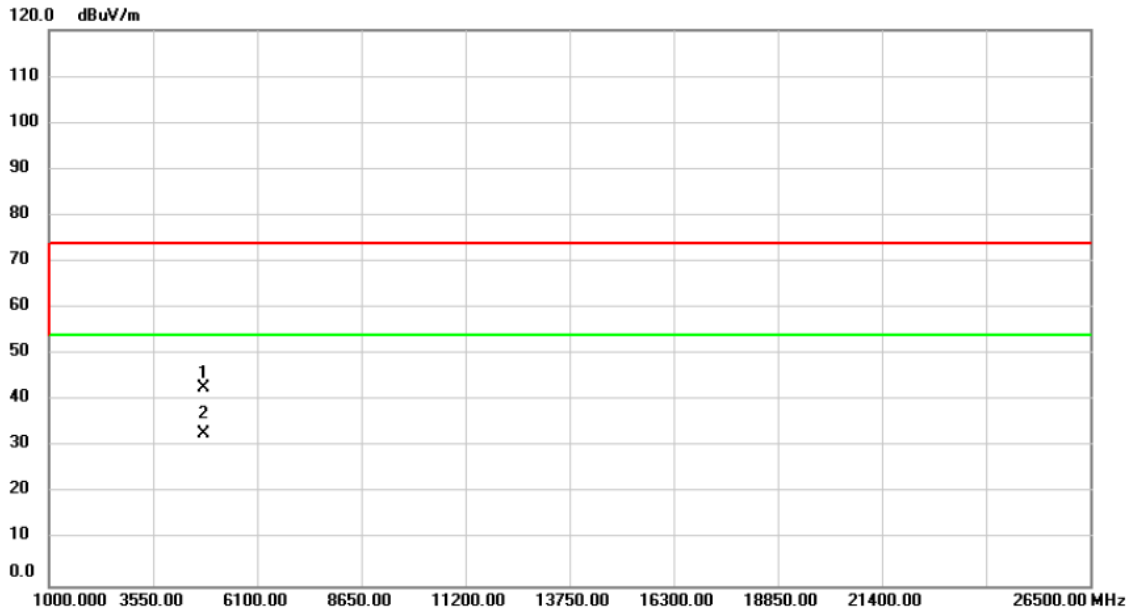
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4960.000     | 54.33                    | -11.97                  | 42.36                      | 74.00           | -31.64     | peak     |         |
| 2 *     | 4960.000     | 44.44                    | -11.97                  | 32.47                      | 54.00           | -21.53     | AVG      |         |

|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2402MHz _CH00_3Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



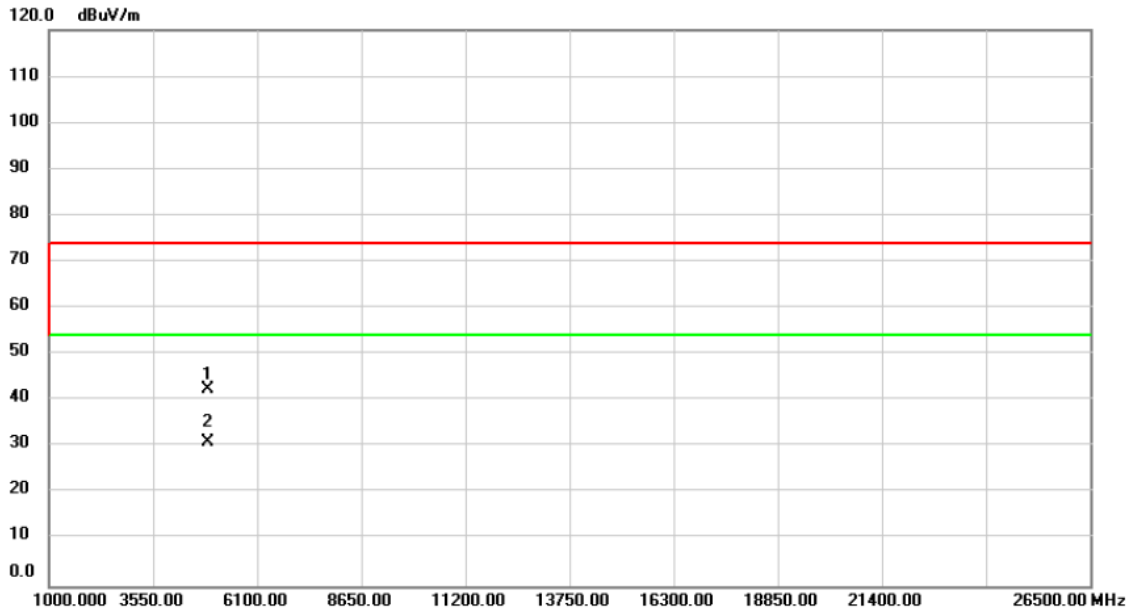
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4804.000     | 54.98                    | -12.17                  | 42.81                      | 74.00           | -31.19     | peak     |         |
| 2 *     | 4804.000     | 43.83                    | -12.17                  | 31.66                      | 54.00           | -22.34     | AVG      |         |

|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2402MHz _CH00_3Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



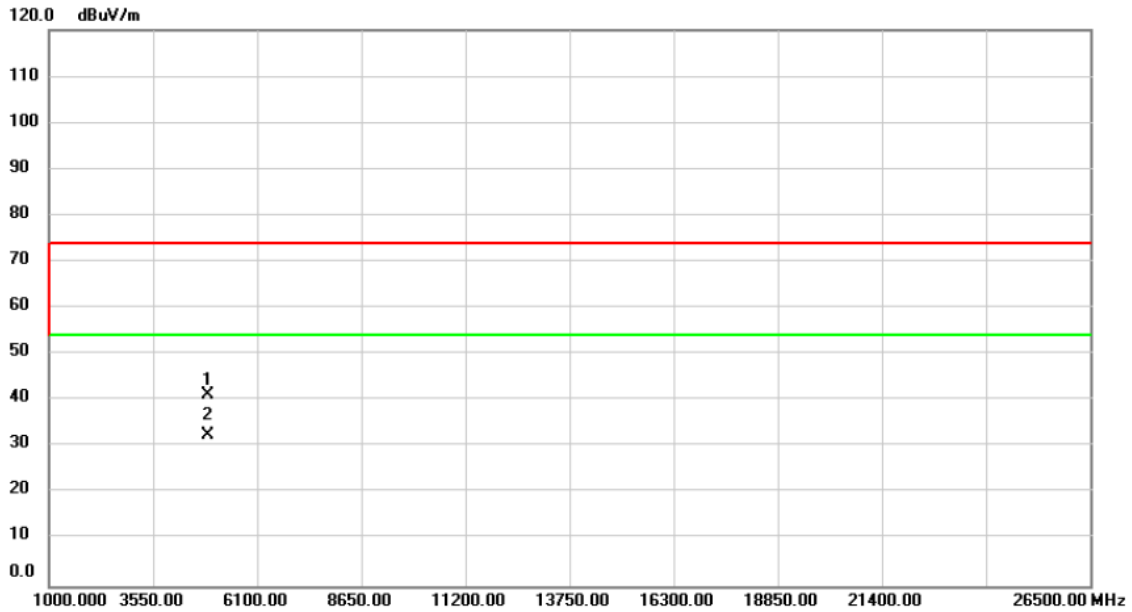
| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4804.000     | 54.87                    | -12.17                  | 42.70                      | 74.00           | -31.30     | peak     |         |
| 2 *     | 4804.000     | 45.17                    | -12.17                  | 33.00                      | 54.00           | -21.00     | AVG      |         |

|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2441MHz _CH39_3Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4882.000     | 54.42                    | -12.08                  | 42.34                      | 74.00           | -31.66     | peak     |         |
| 2 *     | 4882.000     | 43.26                    | -12.08                  | 31.18                      | 54.00           | -22.82     | AVG      |         |

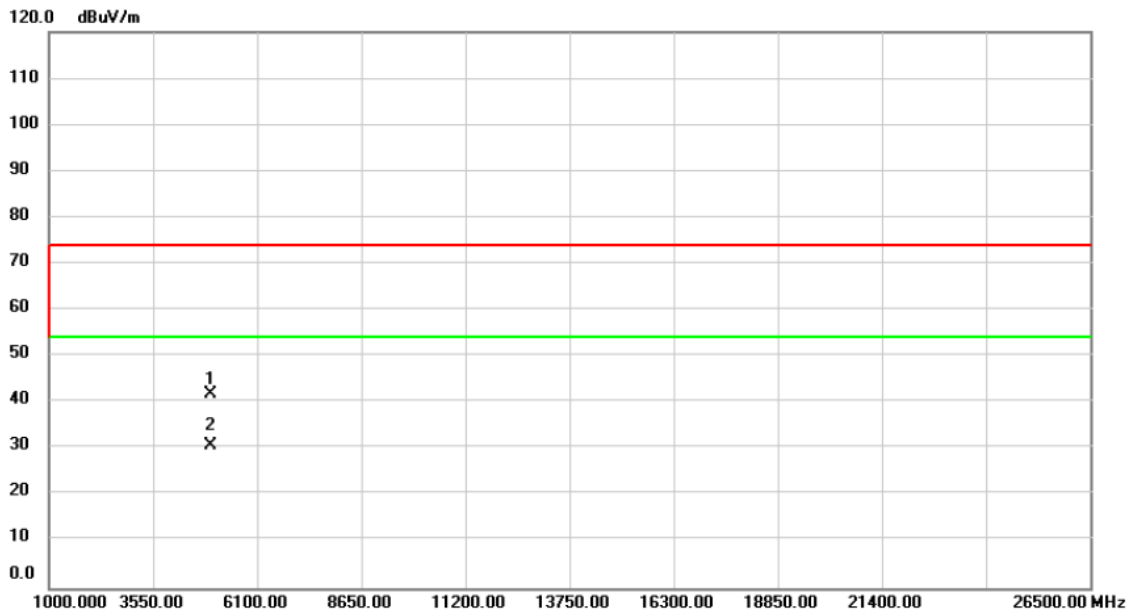
|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2441MHz _CH39_3Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4882.000     | 53.27                    | -12.08                  | 41.19                      | 74.00           | -32.81     | peak     |         |
| 2 *     | 4882.000     | 44.77                    | -12.08                  | 32.69                      | 54.00           | -21.31     | AVG      |         |

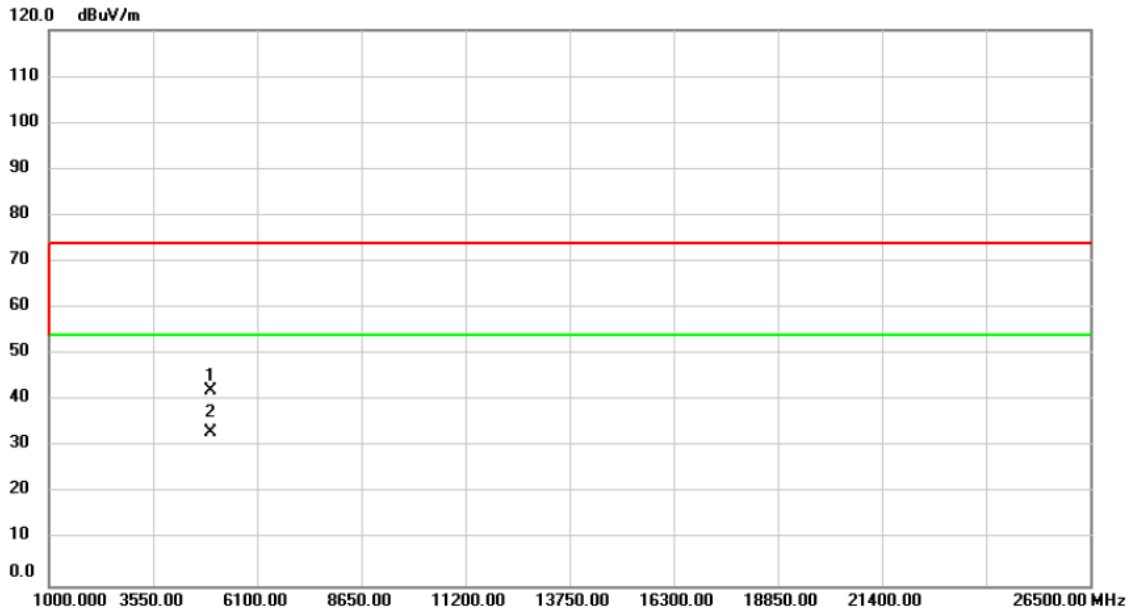


|           |                             |              |          |
|-----------|-----------------------------|--------------|----------|
| Test Mode | TX Mode 2480MHz _CH78_3Mbps | Polarization | Vertical |
|-----------|-----------------------------|--------------|----------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4960.000     | 53.96                    | -11.97                  | 41.99                      | 74.00           | -32.01     | peak     |         |
| 2 *     | 4960.000     | 42.82                    | -11.97                  | 30.85                      | 54.00           | -23.15     | AVG      |         |

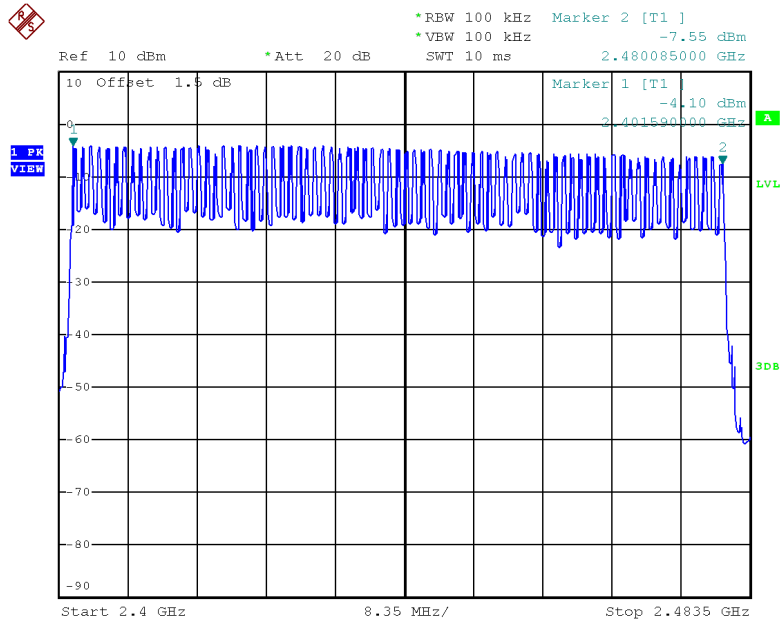
|           |                             |              |            |
|-----------|-----------------------------|--------------|------------|
| Test Mode | TX Mode 2480MHz _CH78_3Mbps | Polarization | Horizontal |
|-----------|-----------------------------|--------------|------------|



| No. Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|---------|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|---------|
| 1       | 4960.000     | 54.08                    | -11.97                  | 42.11                      | 74.00           | -31.89     | peak     |         |
| 2 *     | 4960.000     | 45.25                    | -11.97                  | 33.28                      | 54.00           | -20.72     | AVG      |         |

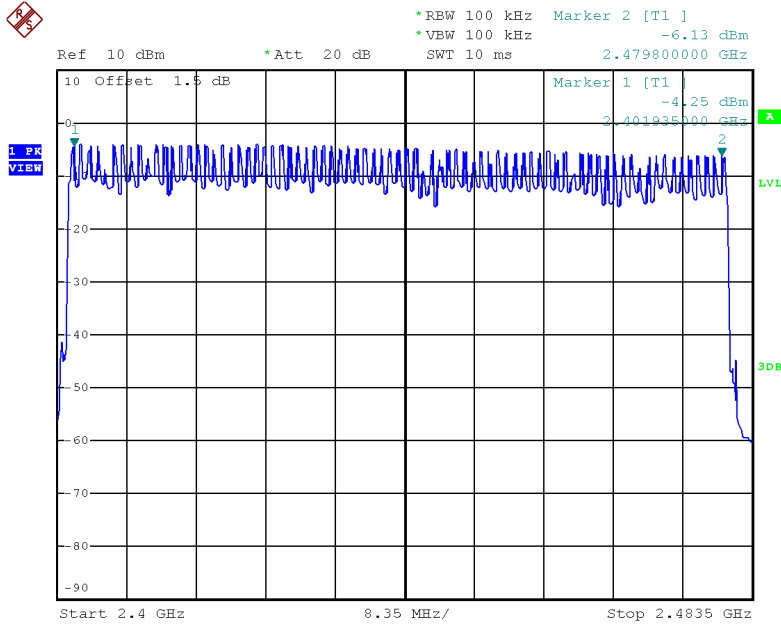
## APPENDIX E - NUMBER OF HOPPING CHANNEL

**Test Mode**                      **Hopping Mode\_1Mbps**  
Number of Hopping Channel                      79



Date: 23.APR.2019 17:25:27

**Test Mode**                      **Hopping Mode\_3Mbps**  
Number of Hopping Channel                      79

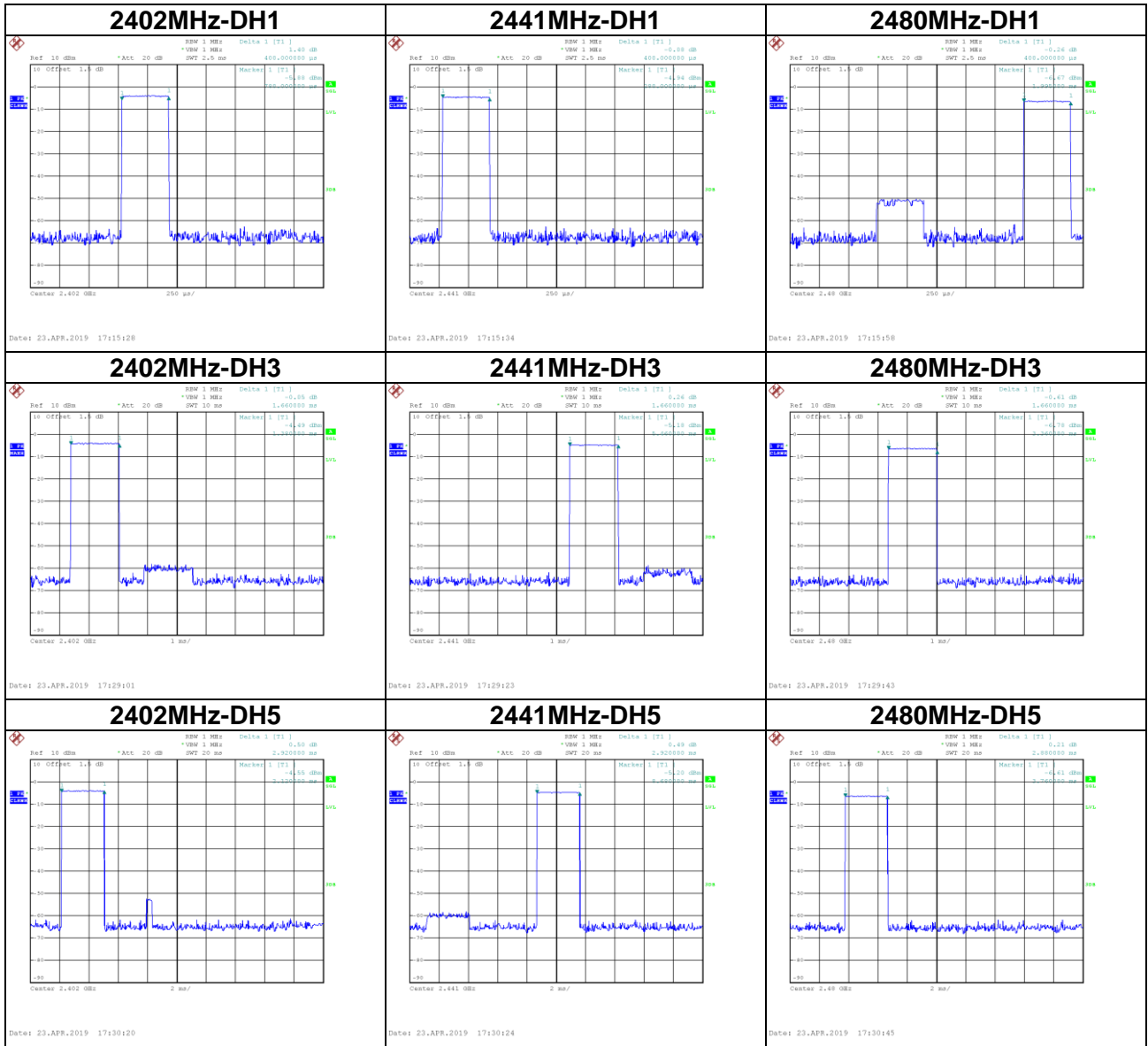


Date: 23.APR.2019 17:59:57

## APPENDIX F - AVERAGE TIME OF OCCUPANCY

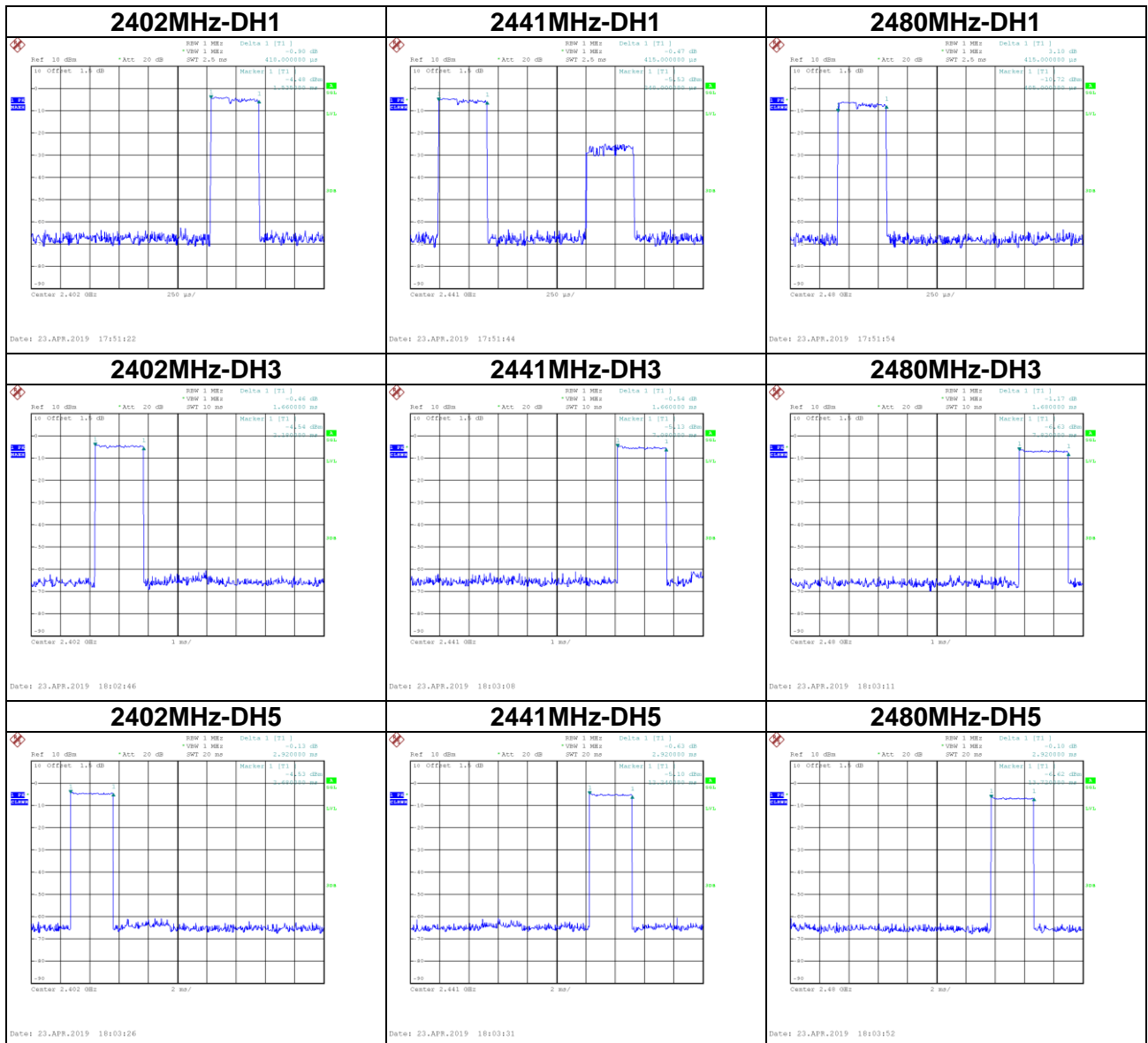
Test Mode : TX Mode\_1Mbps

| Data Packet | Frequency (MHz) | Pulse Duration (ms) | Dwell Time (s) | Limits (s) | Test Result |
|-------------|-----------------|---------------------|----------------|------------|-------------|
| DH5         | 2402 MHz        | 2.9200              | 0.3115         | 0.4000     | Pass        |
| DH3         | 2402 MHz        | 1.6600              | 0.2656         | 0.4000     | Pass        |
| DH1         | 2402 MHz        | 0.4000              | 0.1280         | 0.4000     | Pass        |
| DH5         | 2441 MHz        | 2.9200              | 0.3115         | 0.4000     | Pass        |
| DH3         | 2441 MHz        | 1.6600              | 0.2656         | 0.4000     | Pass        |
| DH1         | 2441 MHz        | 0.4000              | 0.1280         | 0.4000     | Pass        |
| DH5         | 2480 MHz        | 2.8800              | 0.3072         | 0.4000     | Pass        |
| DH3         | 2480 MHz        | 1.6600              | 0.2656         | 0.4000     | Pass        |
| DH1         | 2480 MHz        | 0.4000              | 0.1280         | 0.4000     | Pass        |



Test Mode : TX Mode\_3Mbps

| Data Packet | Frequency | Pulse Duration(ms) | Dwell Time(s) | Limits(s) | Test Result |
|-------------|-----------|--------------------|---------------|-----------|-------------|
| 3DH5        | 2402 MHz  | 2.9200             | 0.3115        | 0.4000    | Pass        |
| 3DH3        | 2402 MHz  | 1.6600             | 0.2656        | 0.4000    | Pass        |
| 3DH1        | 2402 MHz  | 0.4100             | 0.1312        | 0.4000    | Pass        |
| 3DH5        | 2441 MHz  | 2.9200             | 0.3115        | 0.4000    | Pass        |
| 3DH3        | 2441 MHz  | 1.6600             | 0.2656        | 0.4000    | Pass        |
| 3DH1        | 2441 MHz  | 0.4150             | 0.1328        | 0.4000    | Pass        |
| 3DH5        | 2480 MHz  | 2.9200             | 0.3115        | 0.4000    | Pass        |
| 3DH3        | 2480 MHz  | 1.6800             | 0.2688        | 0.4000    | Pass        |
| 3DH1        | 2480 MHz  | 0.4150             | 0.1328        | 0.4000    | Pass        |

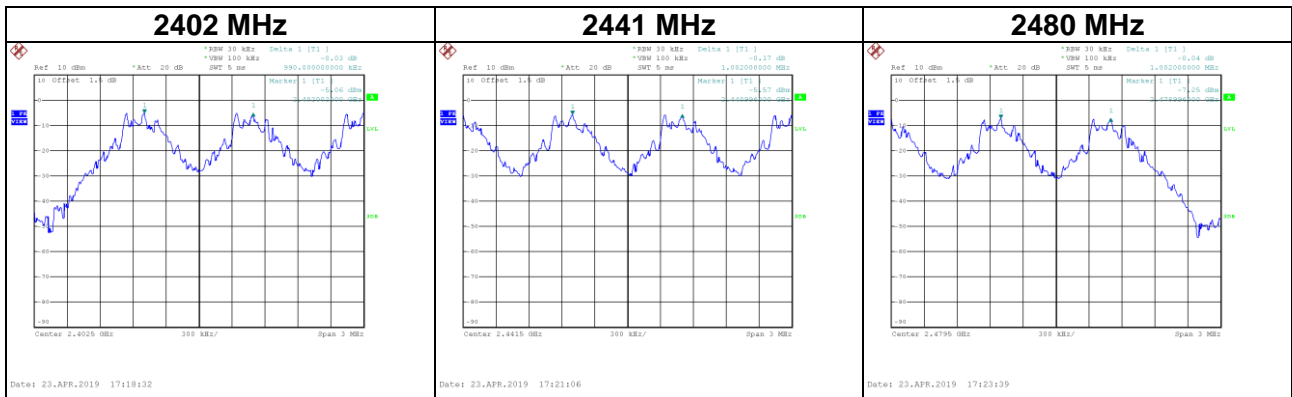


## APPENDIX G - HOPPING CHANNEL SEPARATION MEASUREMENT



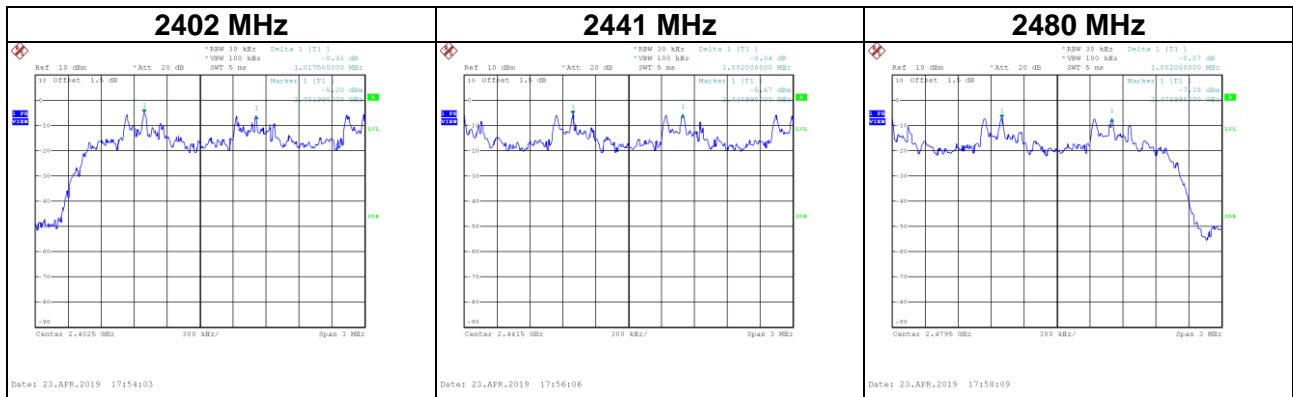
Test Mode : Hopping on \_1Mbps

| Frequency (MHz) | Channel Separation (MHz) | 2/3 of 20dB Bandwidth (MHz) | Test Result |
|-----------------|--------------------------|-----------------------------|-------------|
| 2402            | 0.990                    | 0.621                       | Pass        |
| 2441            | 1.002                    | 0.627                       | Pass        |
| 2480            | 1.002                    | 0.624                       | Pass        |



Test Mode : Hopping on \_3Mbps

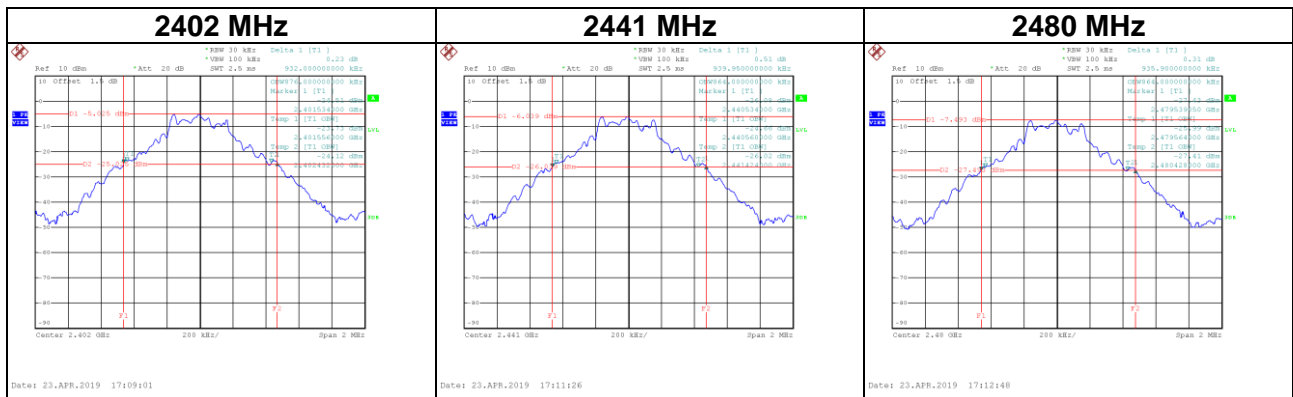
| Frequency (MHz) | Channel Separation (MHz) | 2/3 of 20dB Bandwidth (MHz) | Test Result |
|-----------------|--------------------------|-----------------------------|-------------|
| 2402            | 1.018                    | 0.835                       | Pass        |
| 2441            | 1.002                    | 0.838                       | Pass        |
| 2480            | 1.002                    | 0.839                       | Pass        |



## APPENDIX H - BANDWIDTH

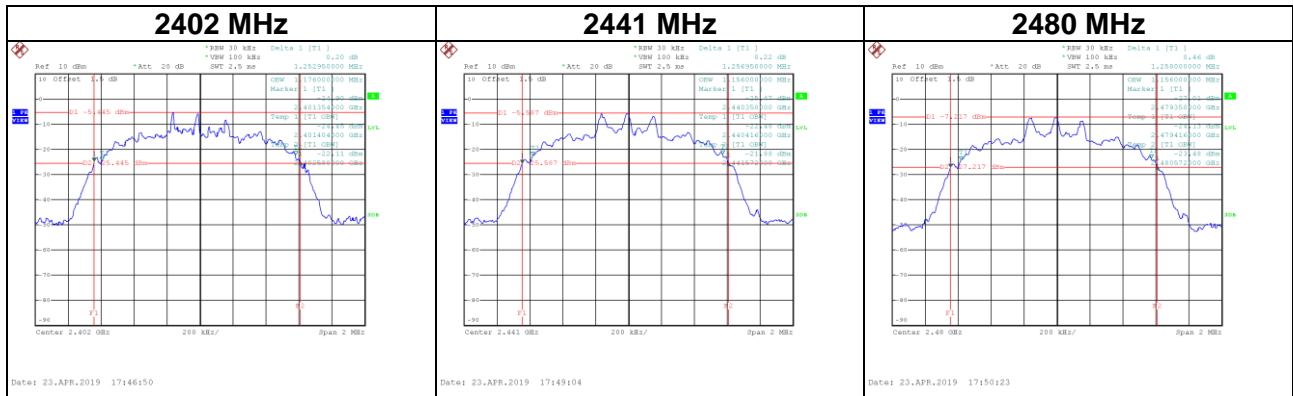
Test Mode : TX Mode \_1Mbps

| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Occupied BW (MHz) | Test Result |
|-----------------|----------------------|-----------------------|-------------|
| 2402            | 0.932                | 0.876                 | Pass        |
| 2441            | 0.940                | 0.864                 | Pass        |
| 2480            | 0.936                | 0.864                 | Pass        |



Test Mode : TX Mode \_3Mbps

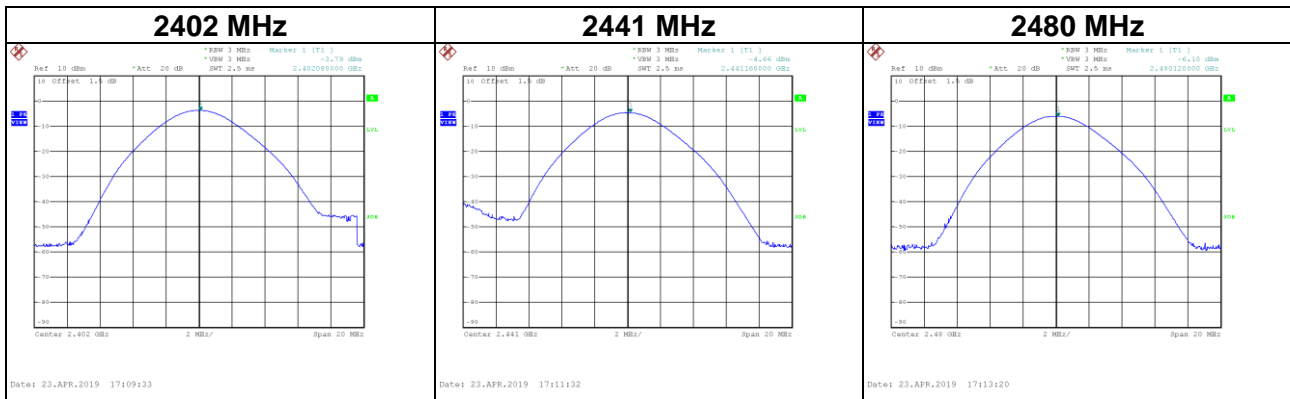
| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Occupied BW (MHz) | Test Result |
|-----------------|----------------------|-----------------------|-------------|
| 2402            | 1.253                | 1.176                 | Pass        |
| 2441            | 1.257                | 1.156                 | Pass        |
| 2480            | 1.258                | 1.156                 | Pass        |



## APPENDIX I - PEAK OUTPUT POWER

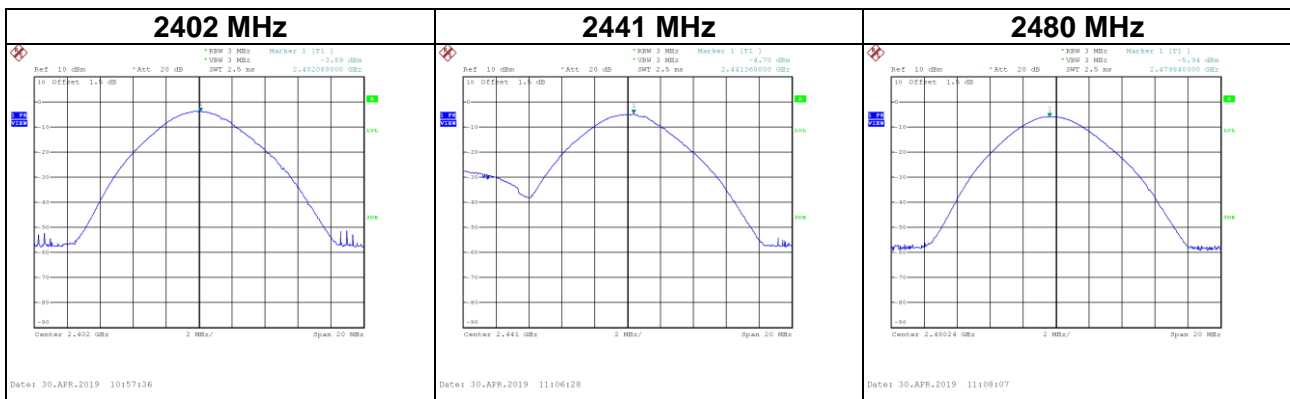
Test Mode : TX Mode \_1Mbps

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) | Max. Limit (dBm) | Max. Limit (W) | Test Result |
|-----------------|-----------------------|---------------------|------------------|----------------|-------------|
| 2402            | -3.79                 | 0.0004              | 21.00            | 0.1250         | Pass        |
| 2441            | -4.66                 | 0.0003              | 21.00            | 0.1250         | Pass        |
| 2480            | -6.10                 | 0.0002              | 21.00            | 0.1250         | Pass        |



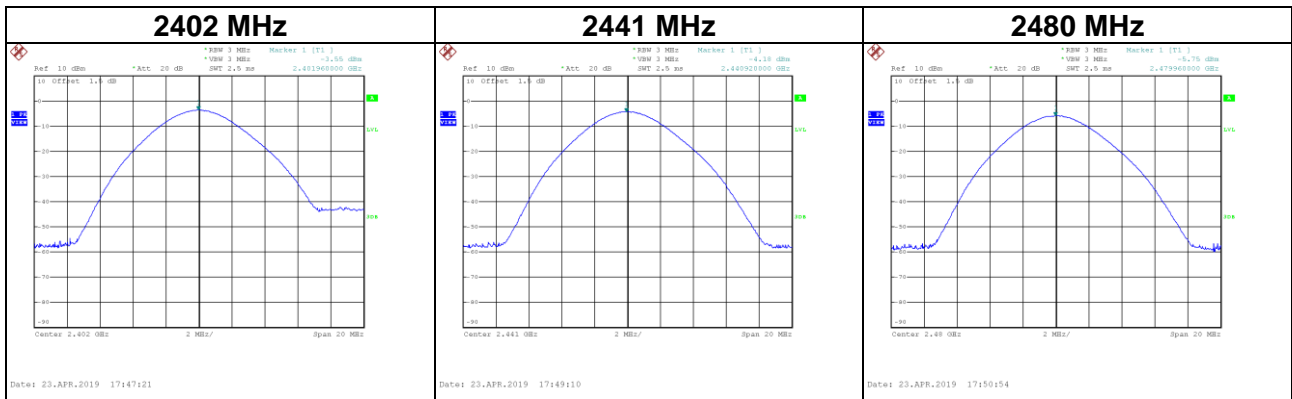
Test Mode : TX Mode \_2Mbps

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) | Max. Limit (dBm) | Max. Limit (W) | Test Result |
|-----------------|-----------------------|---------------------|------------------|----------------|-------------|
| 2402            | -3.89                 | 0.0004              | 21.00            | 0.1250         | Pass        |
| 2441            | -4.70                 | 0.0003              | 21.00            | 0.1250         | Pass        |
| 2480            | -5.94                 | 0.0003              | 21.00            | 0.1250         | Pass        |



Test Mode : TX Mode \_3Mbps

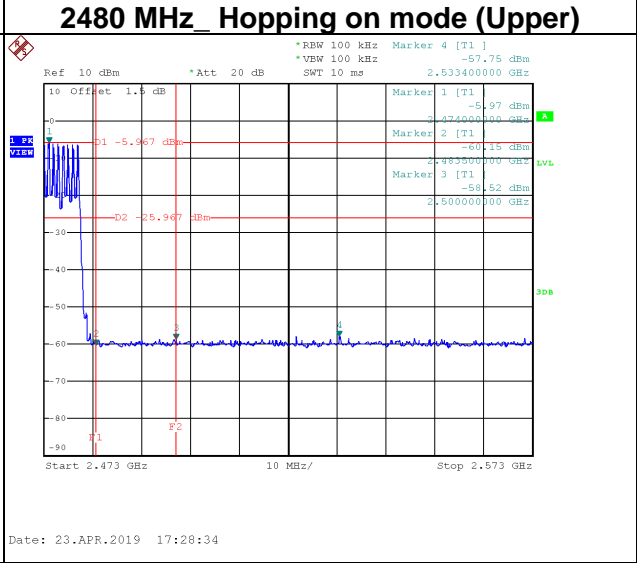
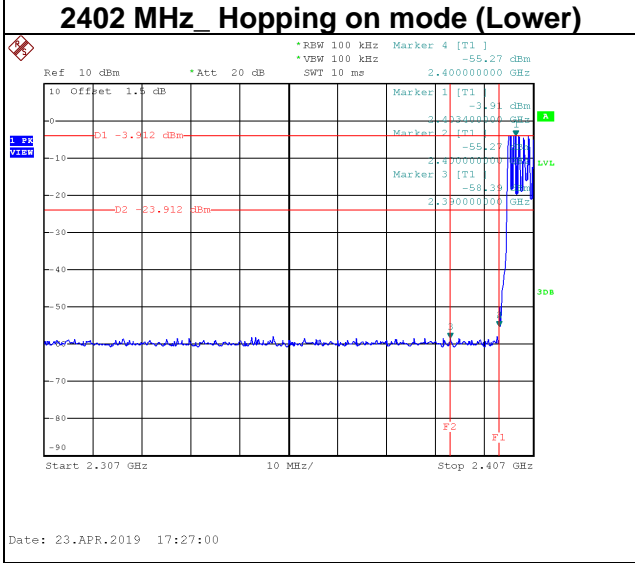
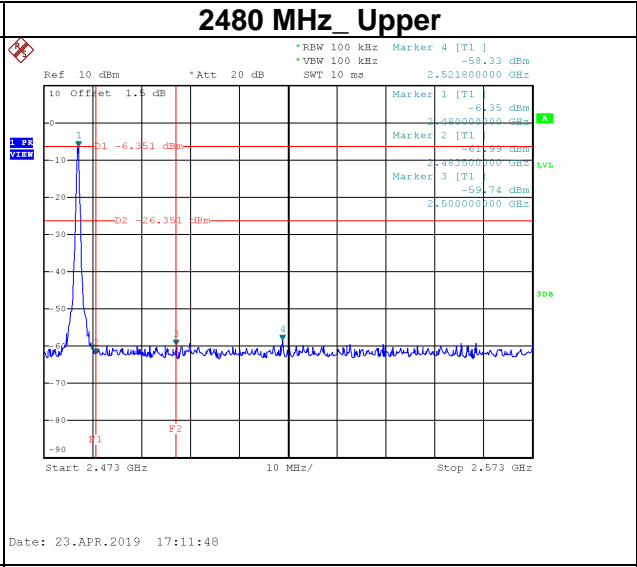
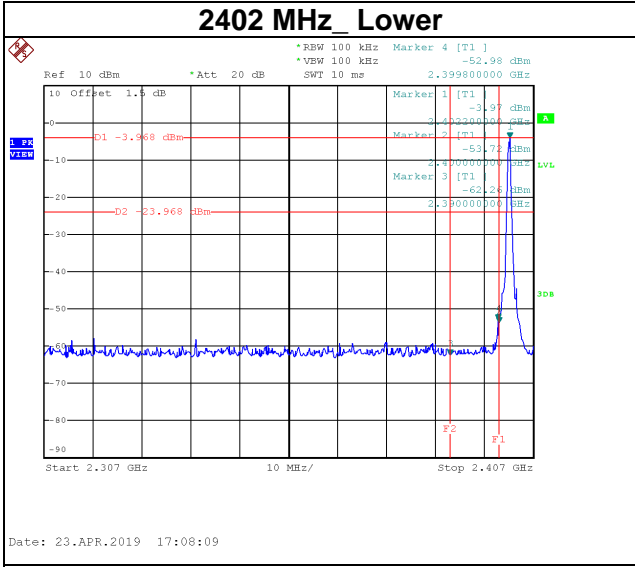
| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) | Max. Limit (dBm) | Max. Limit (W) | Test Result |
|-----------------|-----------------------|---------------------|------------------|----------------|-------------|
| 2402            | -3.55                 | 0.0004              | 21.00            | 0.1250         | Pass        |
| 2441            | -4.18                 | 0.0004              | 21.00            | 0.1250         | Pass        |
| 2480            | -5.75                 | 0.0003              | 21.00            | 0.1250         | Pass        |



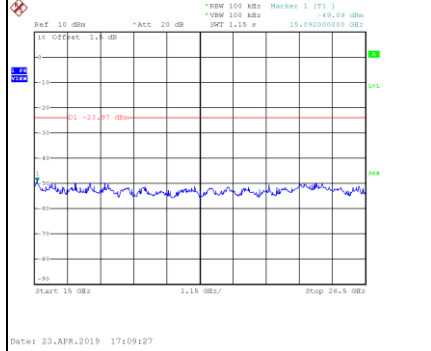
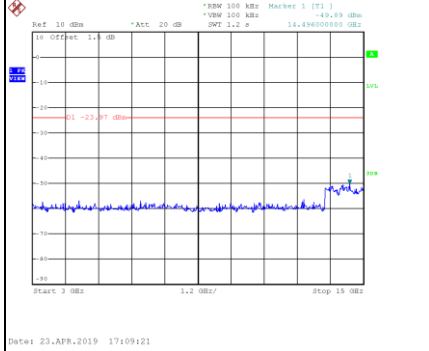
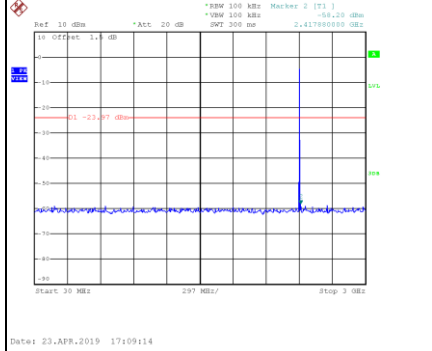


## APPENDIX J - ANTENNA CONDUCTED SPURIOUS EMISSION

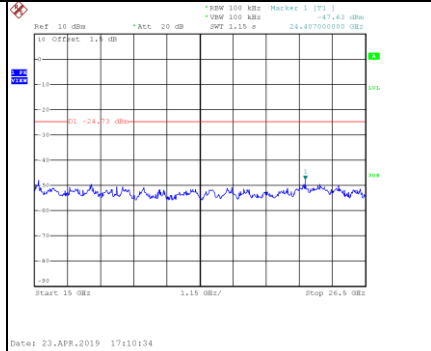
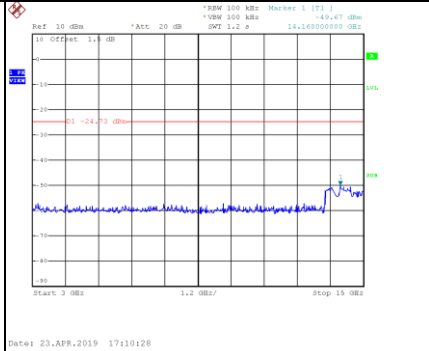
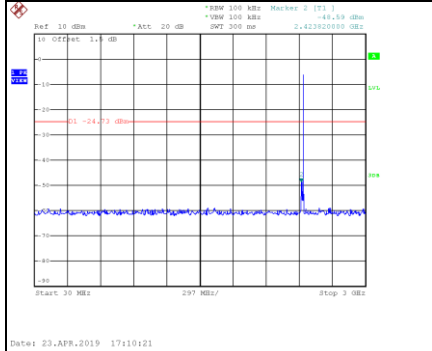
**Test Mode : TX Mode \_ 1Mbps**



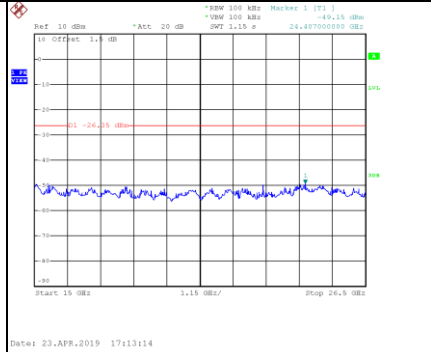
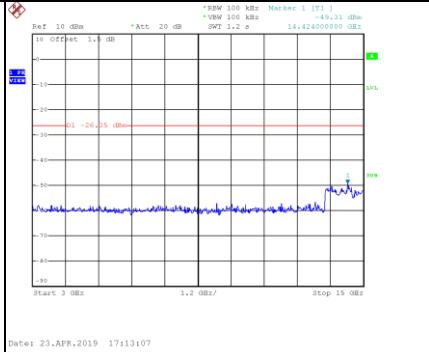
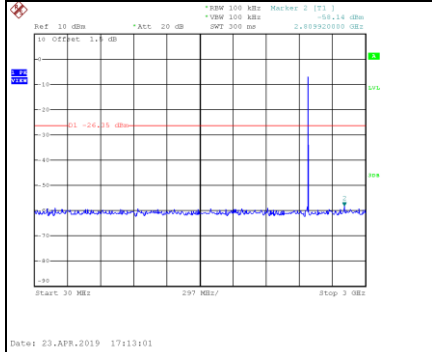
### 2402 MHz – 10 Harmonics



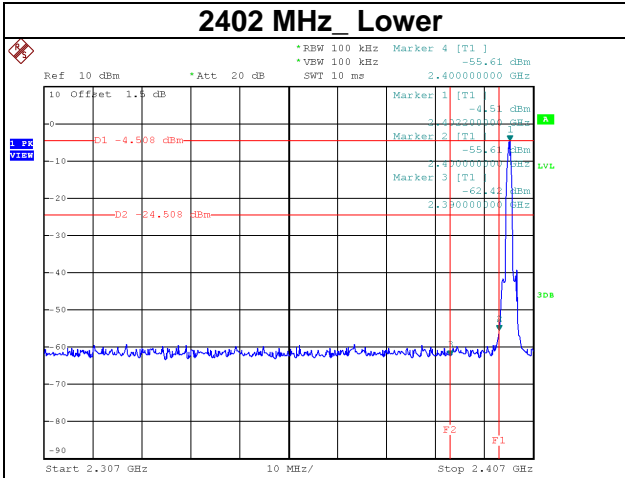
### 2441 MHz – 10 Harmonics



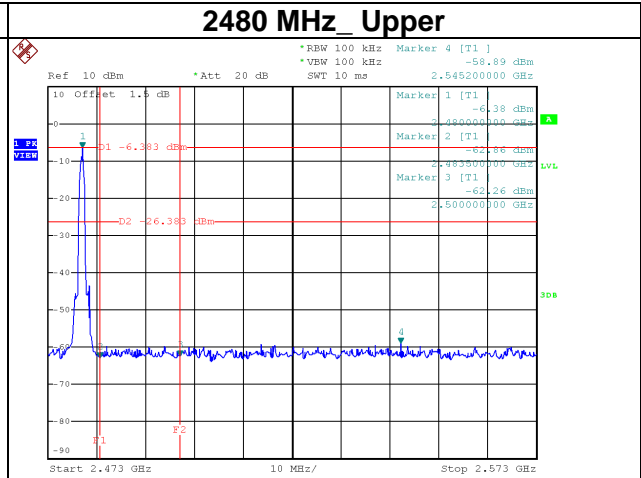
### 2480 MHz – 10 Harmonics



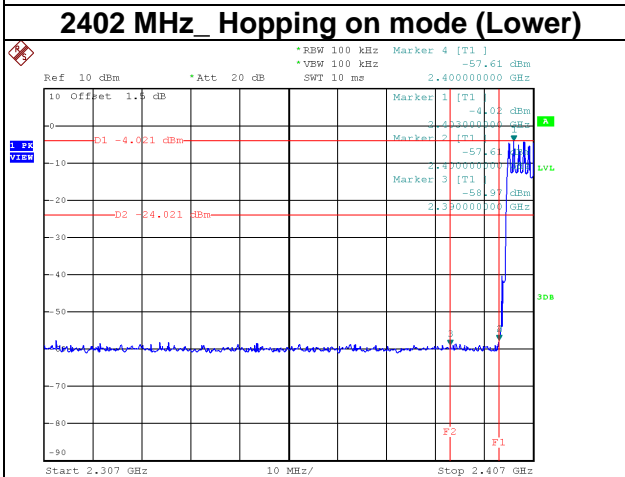
**Test Mode : TX Mode \_3Mbps**



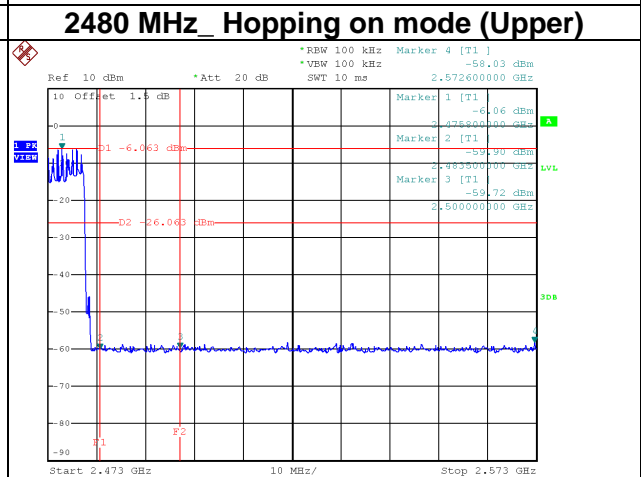
Date: 23.APR.2019 17:46:26



Date: 23.APR.2019 17:49:48

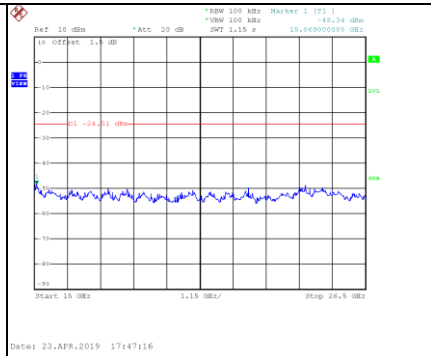
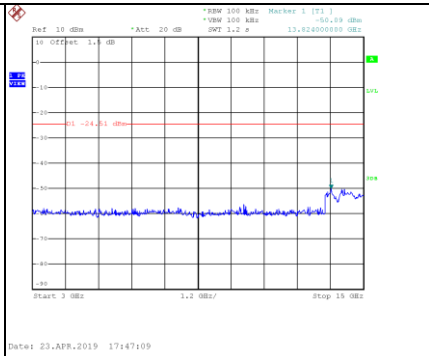
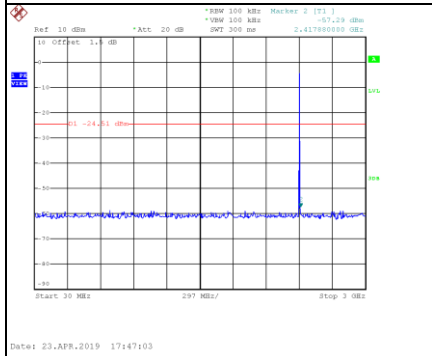


Date: 23.APR.2019 18:01:01

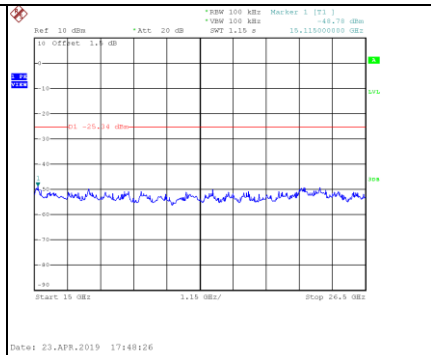
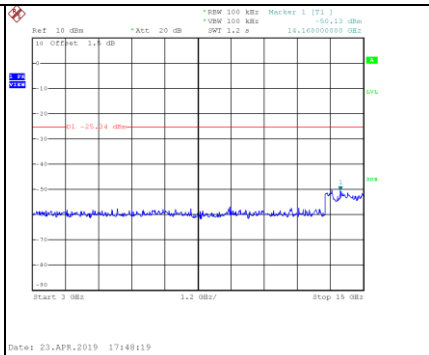
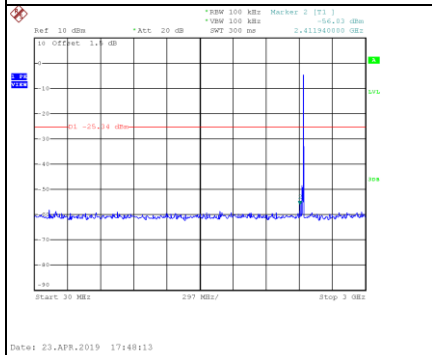


Date: 23.APR.2019 18:02:21

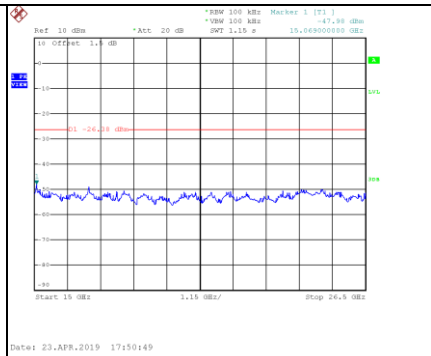
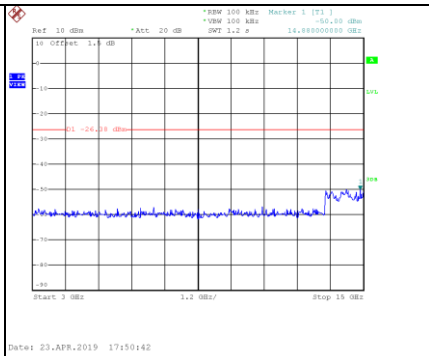
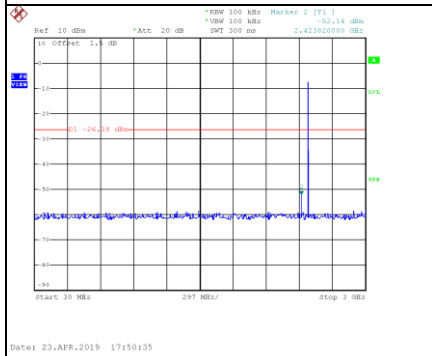
### 2402 MHz – 10 Harmonics



### 2441 MHz – 10 Harmonics



### 2480 MHz – 10 Harmonics



End of Test Report