



# FCC RADIO TEST REPORT

Applicant : Ubiquiti Networks, Inc.  
Address : 685 Third Avenue, 27th Floor New York, New York  
10017 USA  
Equipment : UniFi Dream Machine PRO  
Model No. : UDM-Pro  
Trade Name : UBIQUITI  
FCC ID : SWX-UDMPRO

**I HEREBY CERTIFY THAT :**

The sample was received on Jun. 27, 2019 and the testing was completed on Jul. 11, 2019 at CerpPASS Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of CerpPASS Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





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# 1. Summary of Test Procedure and Test Results

## 1.1 Applicable Standards

ANSI C63.4:2014

ANSI C63.10:2013

FCC Rules and Regulations Part 15 Subpart C §15.249

| FCC Rule  | Description of Test              | Result |
|-----------|----------------------------------|--------|
| 15.203    | Antenna Requirement              | PASS   |
| 15.207    | AC Power Line Conducted Emission | PASS   |
| 15.249(a) | Radiated Spurious Emission       | PASS   |

\*The principle of judgment is made according to the laboratory's reporting control and measurement uncertainty standard procedures.

\*This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report(TEFV1906225).



## 2. Test Configuration of Equipment under Test

### 2.1 Feature of Equipment under Test

|                       |                       |
|-----------------------|-----------------------|
| Frequency Range       | 2402MHz~2480MHz       |
| Modulation Type       | GFSK                  |
| Modulation Technology | DTS                   |
| Data Rate             | GFSK: 1Mbps           |
| Antenna Type          | Internal Antenna      |
| Antenna Gain          | 2402MHz~2480MHz: 0dBi |

Note:

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

### 2.2 Carrier Frequency of Channels

| Channel    | Frequency (MHz) | Channel    | Frequency (MHz) | Channel    | Frequency (MHz) |
|------------|-----------------|------------|-----------------|------------|-----------------|
| <b>*00</b> | <b>2402</b>     | 14         | 2430            | 28         | 2458            |
| 01         | 2404            | 15         | 2432            | 29         | 2460            |
| 02         | 2406            | 16         | 2434            | 30         | 2462            |
| 03         | 2408            | 17         | 2436            | 31         | 2464            |
| 04         | 2410            | 18         | 2438            | 32         | 2466            |
| 05         | 2412            | <b>*19</b> | <b>2440</b>     | 33         | 2468            |
| 06         | 2414            | 20         | 2442            | 34         | 2470            |
| 07         | 2416            | 21         | 2444            | 35         | 2472            |
| 08         | 2418            | 22         | 2446            | 36         | 2474            |
| 09         | 2420            | 23         | 2448            | 37         | 2476            |
| 10         | 2422            | 24         | 2450            | 38         | 2478            |
| 11         | 2424            | 25         | 2452            | <b>*39</b> | <b>2480</b>     |
| 12         | 2426            | 26         | 2454            | --         | --              |
| 13         | 2428            | 27         | 2456            | --         | --              |

Note: Channels remarked \* are selected to perform test.

### 2.3 Test Mode and Test Software

- During testing, the interface cables and equipment positions were varied according to ANSI C63.10.
- The complete test system included Notebook and EUT for RF test.
- An executive program, " HCI command " underwin7 was executed to transmit and receive data via Bluetooth.
- The following test modes were performed for the test:  
Test Mode 1. GFSK (1Mbps)



## 2.4 Description of Test System

| Radiated Emissions               |       |        |             |                        |
|----------------------------------|-------|--------|-------------|------------------------|
| Equipment                        | Brand | Model  | Length/Type | Power cord/Length/Type |
| Notebook                         | ASUS  | P2430U | N/A         | Adapter / 1.8m / NS    |
| Network cable                    | N/A   | N/A    | 15m / NS    | N/A                    |
| AC Power Line Conducted Emission |       |        |             |                        |
| Equipment                        | Brand | Model  | Length/Type | Power cord/Length/Type |
| Notebook                         | ASUS  | P2430U | N/A         | Adapter / 1.8m / NS    |
| Network cable                    | N/A   | N/A    | 15m / NS    | N/A                    |

## 2.5 General Information of Test

|                               |   |  |
|-------------------------------|---|--|
| Test Site                     | <b>CerpPASS Technology Corporation Test Laboratory</b><br>Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.)<br>Tel:+886-3-3226-888<br>Fax:+886-3-3226-881<br>Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C.<br>Tel: +886-2-2663-8582 |  |
|                               | FCC   | TW1079, TW1061, TW1439   |
|                               | IC  | 4934E-1, 4934E-2   |
|                               | VCCI  | T-2205 for Telecommunication test<br>C-4663 for Conducted emission test<br>R-4399, R-4218 for Radiated emission test<br>G-10812, G-10813 for radiated disturbance above 1GHz |
| Frequency Range Investigated: | Conducted: from 150kHz to 30 MHz<br>Radiation: from 30 MHz to 25,000MHz   |  |
| Test Distance:                | The test distance of radiated emission from antenna to EUT is 3 M.  |  |

| Test Item          | Test Site | Tested Date | Environmental Conditions | Tested By  |
|--------------------|-----------|-------------|--------------------------|------------|
| Radiated Emissions | 3M02-NK   | 2019/07/11  | 23°C / 61%               | Nick Guan  |
| RF Conduction      | CON01-NK  | 2019/07/11  | 22°C / 63%               | Leon Huang |



## 2.6 Measurement Uncertainty

| Measurement Item                       | Uncertainty          |
|--|----------------------|
| Radiated Spurious Emission(9KHz~30MHz) | $\pm 3.405\text{dB}$ |
| Radiated Spurious Emission(30MHz~1GHz) | $\pm 5.326\text{dB}$ |
| Radiated Spurious Emission(1GHz~25GHz) | $\pm 5.918\text{dB}$ |
| 20dB Bandwidth                         | $\pm 4.40\%$         |
| Occupied Bandwidth                     | $\pm 4.41\%$         |
| Duty Cycle                             | $\pm 0.17\%$         |

**3. Test Equipment and Ancillaries Used for Tests**

| Test Item           | Radiated Emissions          |             |                 |                  |            |
|---------------------|-----------------------------|-------------|-----------------|------------------|------------|
| Test Site           | Semi Anechoic Room(3M02-NK) |             |                 |                  |            |
| Instrument          | Manufacturer                | Model No    | Serial No       | Calibration Date | Valid Date |
| Bilog Antenna       | Schwarzbeck                 | VULB9168    | 275             | 2018/09/17       | 2019/09/16 |
| Active Loop Antenna | EMCO                        | 6507        | 40855           | 2019/05/24       | 2020/05/23 |
| Horn Antenna        | EMCO                        | 3115        | 31589           | 2019/04/01       | 2020/03/31 |
| Horn Antenna        | EMCO                        | 3116        | 31974           | 2018/09/07       | 2019/09/06 |
| EMI Receiver        | ROHDE & SCHWARZ             | ESCI        | 101423          | 2019/05/14       | 2020/05/13 |
| Spectrum Analyzer   | ROHDE & SCHWARZ             | FSP 40      | 100047          | 2019/03/28       | 2020/03/27 |
| Preamplifier        | EM Electronics corp.        | EM330       | 60660           | 2019/03/11       | 2020/03/10 |
| Preamplifier        | EMC INSTRUMENTS             | EMC051845SE | 980333          | 2018/09/18       | 2019/09/17 |
| Bluetooth Tester    | ROHDE & SCHWARZ             | CBT         | 101133          | 2019/04/07       | 2020/04/06 |
| Cable-3in1(30M-1G)  | HARBOUR INDUSTRIES          | LL142       | CCE1316         | 2018/09/12       | 2019/09/11 |
| Cable-0.5m(1G-40G)  | Rapidtek                    | 40GHZ 50CM  | 38MS-38MS50314  | 2019/04/09       | 2020/04/08 |
| Cable-3m(1G-40G)    | Rapidtek                    | 40GHZ 300CM | 38MS-38MS300314 | 2019/04/09       | 2020/04/08 |
| Cable-8m(1G-40G)    | Rapidtek                    | 40GHZ 800CM | 38MS-38MS800314 | 2019/04/10       | 2020/04/09 |
| E3                  | AUDIX                       | v8.2014-8-6 | RK-000529       | NA               | NA         |

| Test Item           | RF Conducted    |          |             |                  |            |
|---------------------|-----------------|----------|-------------|------------------|------------|
| Test Site           | RFCON01-NK      |          |             |                  |            |
| Instrument          | Manufacturer    | Model No | Serial No   | Calibration Date | Valid Date |
| Spectrum Analyzer   | ROHDE & SCHWARZ | FSP 40   | 100047      | 2019/03/28       | 2020/03/27 |
| Bluetooth Tester    | ROHDE & SCHWARZ | CBT      | 101133      | 2019/04/07       | 2020/04/06 |
| Attenuator          | KEYSIGHT        | 8491B    | MY39250705  | 2018/09/04       | 2019/09/03 |
| TEMP & HUMI CHAMBER | T-MACHINE       | TMJ-9712 | T-12-040111 | 2018/08/30       | 2019/08/29 |
| Power Sensor        | Anritsu         | MA2411B  | 1207295     | 2019/04/11       | 2020/04/10 |

| Test Item                            | AC Power Line Conducted Emission |             |           |                  |            |
|--------------------------------------|----------------------------------|-------------|-----------|------------------|------------|
| Test Site                            | CON01-NK                         |             |           |                  |            |
| Instrument                           | Manufacturer                     | Model No    | Serial No | Calibration Date | Valid Date |
| EMI Receiver                         | ROHDE & SCHWARZ                  | ESCI        | 100821    | 2018/9/12        | 2019/09/11 |
| Line Impedance Stabilization Network | Schwarzbeck                      | NSLK 8127   | 8127-740  | 2019/5/22        | 2020/05/21 |
| Pulse Limiter                        | ROHDE & SCHWARZ                  | ESH3-Z2     | 101933    | 2018/9/4         | 2019/09/03 |
| E3                                   | AUDIX                            | v8.2014-8-6 | RK-000531 | NA               | NA         |





## 4. Antenna Requirements

### 4.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### 4.2 Antenna Construction and Directional Gain

|              |                  |
|--------------|------------------|
| Antenna Type | Internal Antenna |
| Antenna Gain | 0 dBi            |



## 5. Test of AC Power Line Conducted Emission

### 5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

| Frequency (MHz) | Quasi Peak (dB $\mu$ V) | Average (dB $\mu$ V) |
|-----------------|-------------------------|----------------------|
| 0.15 – 0.5      | 66-56*                  | 56-46*               |
| 0.5 – 5.0       | 56                      | 46                   |
| 5.0 – 30.0      | 60                      | 50                   |

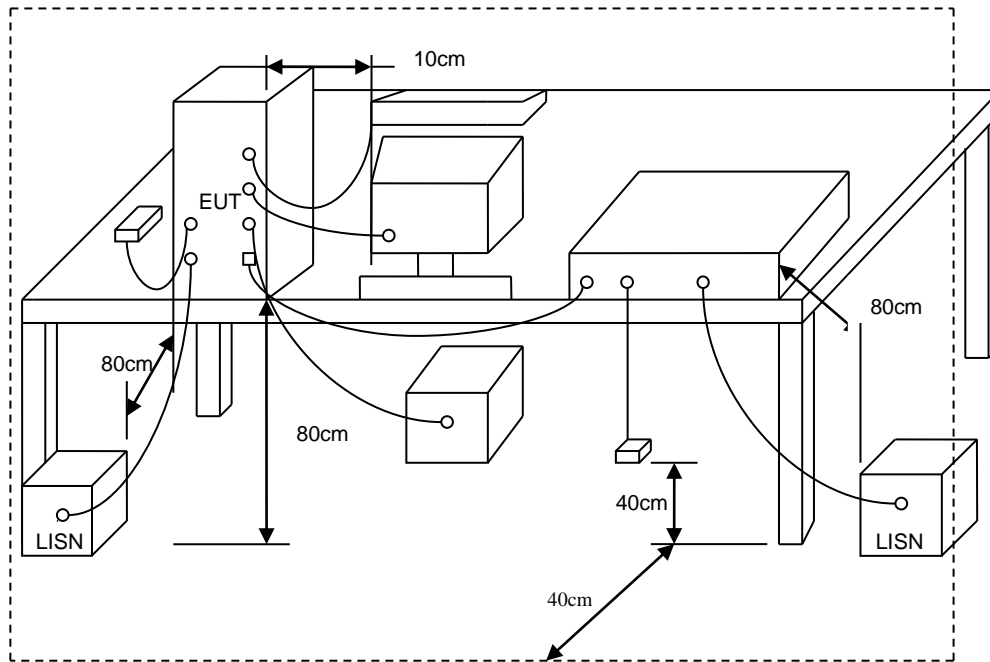
\*Decreases with the logarithm of the frequency.

### 5.2 Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connecting to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



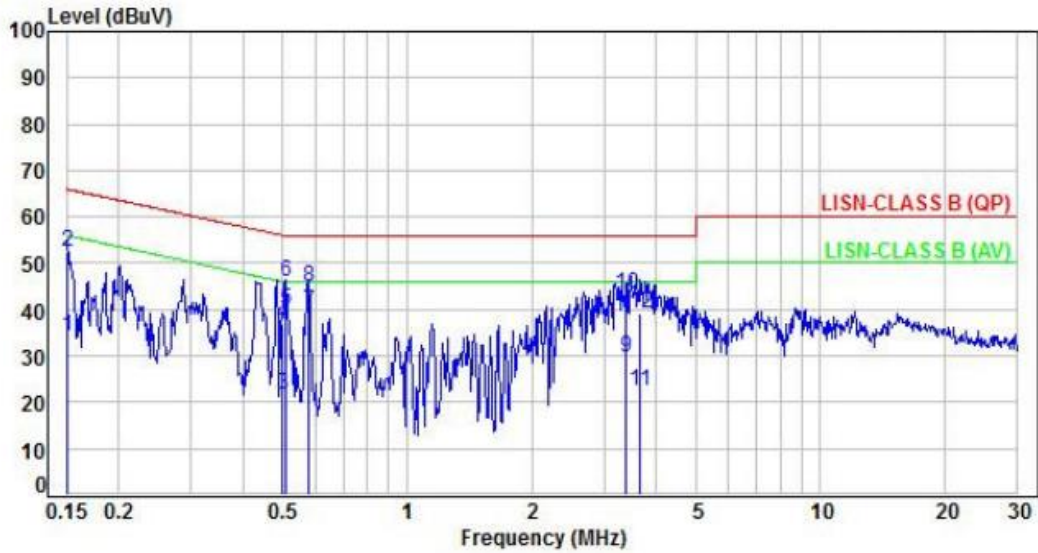
### 5.3 Typical Test Setup





5.4 Test Result and Data

|           |                 |           |        |
|-----------|-----------------|-----------|--------|
| Power     | : AC120V / 60Hz | Pol/Phase | : LINE |
| Test Mode | : Mode 1        |           | :      |

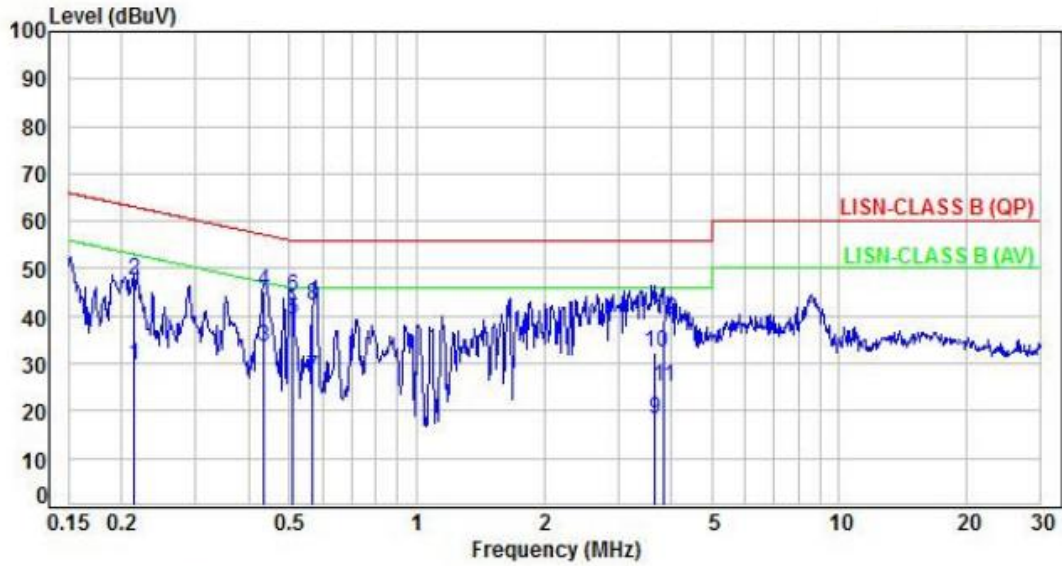


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.15            | 9.92        | 24.35          | 34.27        | 55.98        | -21.71      | Average  | P   |
| 2   | 0.15            | 9.92        | 42.43          | 52.35        | 65.98        | -13.63      | QP       | P   |
| 3   | 0.50            | 9.94        | 11.78          | 21.72        | 46.06        | -24.34      | Average  | P   |
| 4   | 0.50            | 9.94        | 26.82          | 36.76        | 56.06        | -19.30      | QP       | P   |
| 5   | 0.51            | 9.95        | 29.97          | 39.92        | 46.00        | -6.08       | Average  | P   |
| 6   | 0.51            | 9.95        | 36.00          | 45.95        | 56.00        | -10.05      | QP       | P   |
| 7   | 0.58            | 9.95        | 29.64          | 39.59        | 46.00        | -6.41       | Average  | P   |
| 8   | 0.58            | 9.95        | 35.01          | 44.96        | 56.00        | -11.04      | QP       | P   |
| 9   | 3.38            | 10.07       | 19.58          | 29.65        | 46.00        | -16.35      | Average  | P   |
| 10  | 3.38            | 10.07       | 33.28          | 43.35        | 56.00        | -12.65      | QP       | P   |
| 11  | 3.66            | 10.09       | 12.45          | 22.54        | 46.00        | -23.46      | Average  | P   |
| 12  | 3.66            | 10.09       | 29.12          | 39.21        | 56.00        | -16.79      | QP       | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



|           |                 |           |           |
|-----------|-----------------|-----------|-----------|
| Power     | : AC120V / 60Hz | Pol/Phase | : NEUTRAL |
| Test Mode | : Mode 1        |           | :         |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|-----|-----------------|-------------|----------------|--------------|--------------|-------------|----------|-----|
| 1   | 0.21            | 9.95        | 19.55          | 29.50        | 53.07        | -23.57      | Average  | P   |
| 2   | 0.21            | 9.95        | 37.50          | 47.45        | 63.07        | -15.62      | QP       | P   |
| 3   | 0.43            | 9.96        | 23.58          | 33.54        | 47.17        | -13.63      | Average  | P   |
| 4   | 0.43            | 9.96        | 35.18          | 45.14        | 57.17        | -12.03      | QP       | P   |
| 5   | 0.51            | 9.96        | 29.12          | 39.08        | 46.00        | -6.92       | Average  | P   |
| 6   | 0.51            | 9.96        | 34.30          | 44.26        | 56.00        | -11.74      | QP       | P   |
| 7   | 0.56            | 9.96        | 16.97          | 26.93        | 46.00        | -19.07      | Average  | P   |
| 8   | 0.56            | 9.96        | 32.06          | 42.02        | 56.00        | -13.98      | QP       | P   |
| 9   | 3.66            | 10.10       | 8.01           | 18.11        | 46.00        | -27.89      | Average  | P   |
| 10  | 3.66            | 10.10       | 22.33          | 32.43        | 56.00        | -23.57      | QP       | P   |
| 11  | 3.83            | 10.11       | 15.09          | 25.20        | 46.00        | -20.80      | Average  | P   |
| 12  | 3.83            | 10.11       | 28.98          | 39.09        | 56.00        | -16.91      | QP       | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



## 6. Test of Spurious Emission (Radiated)

### 6.1 Test Limit

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) | Measurement Distance (meters) |
|-----------------------|--|--|-------------------------------|
| 902-928 MHz           | 50   | 500  | 3                             |
| 2400-2483.5 MHz       | 50   | 500  | 3                             |
| 5725-5875 MHz         | 50   | 500  | 3                             |
| 24.0-24.25 GHz        | 250  | 2500   | 3                             |

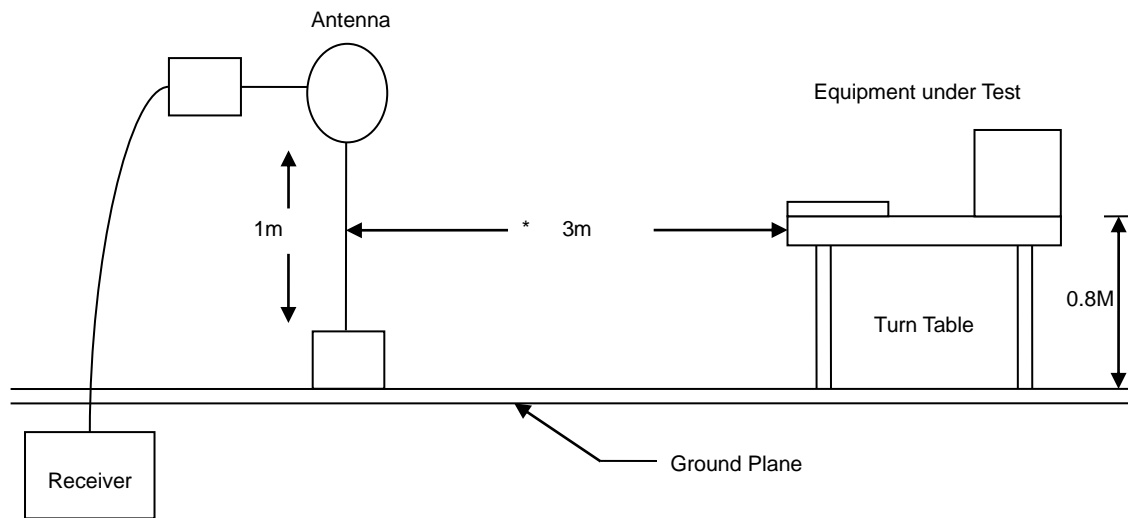
### 6.2 Test Procedures

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- i. "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

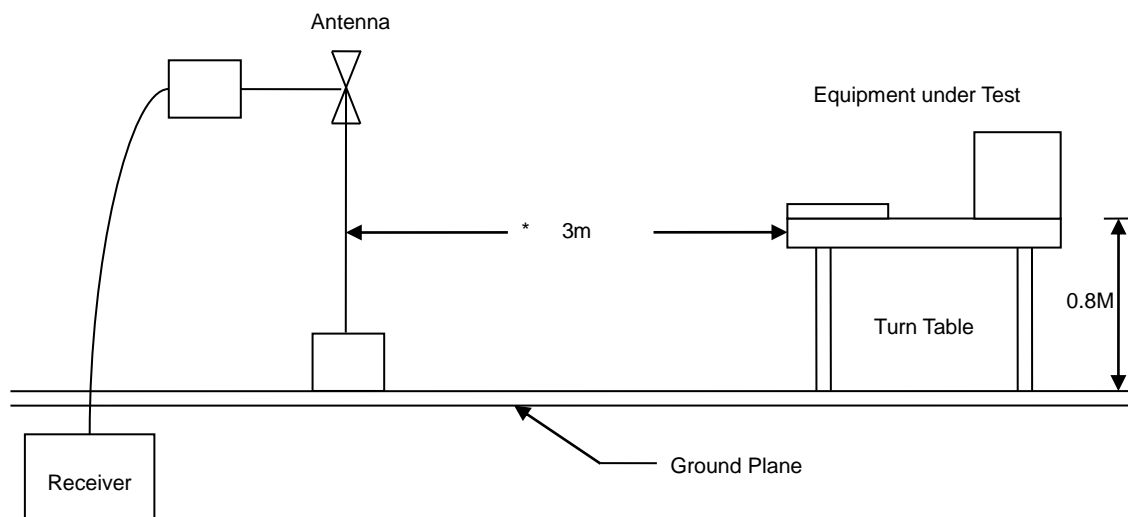


### 6.3 Typical Test Setup

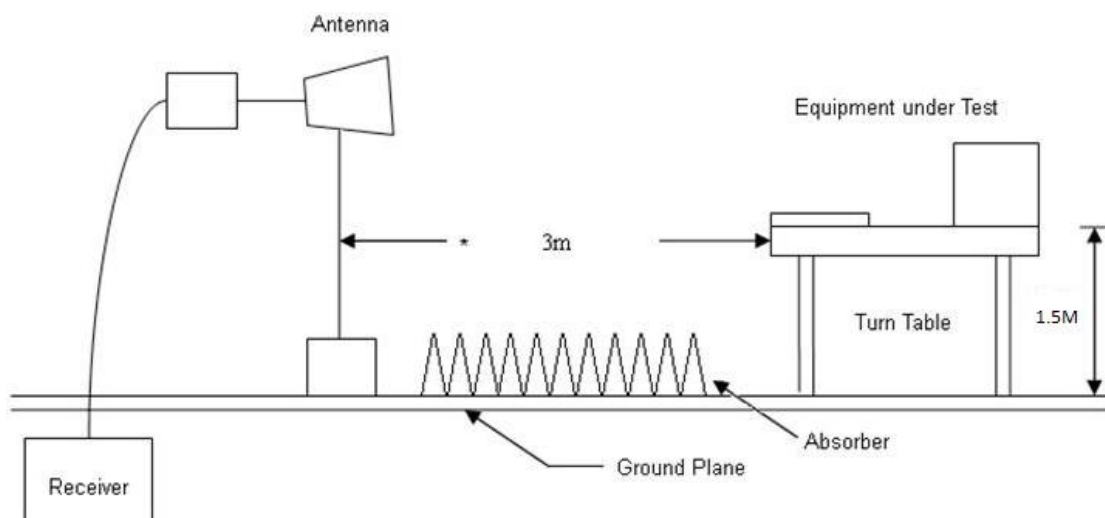
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup

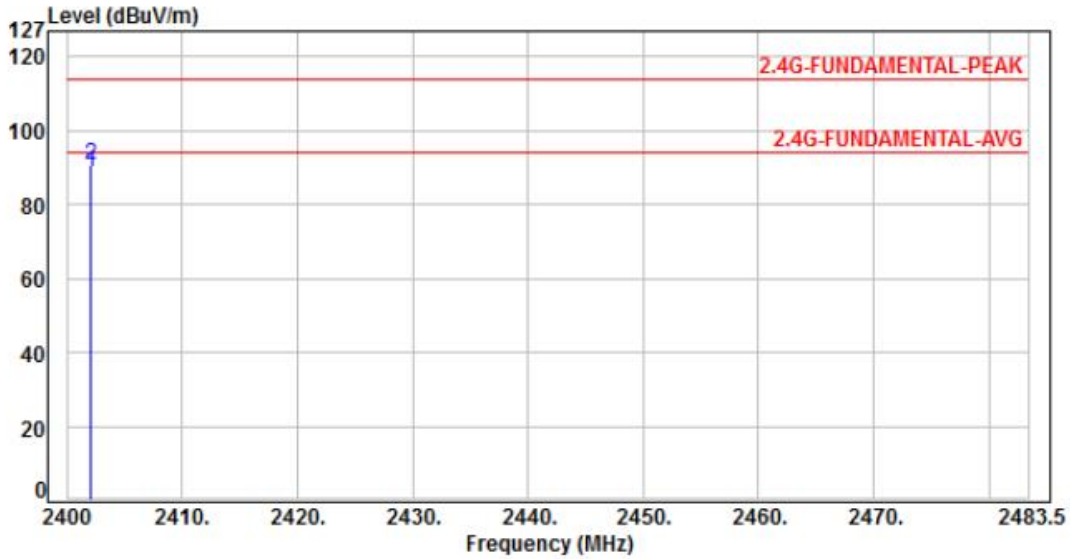




### 6.4 Test Result and Data

#### 6.4.1 Test Result of Fundamental Emission

|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH00  |           | :          |



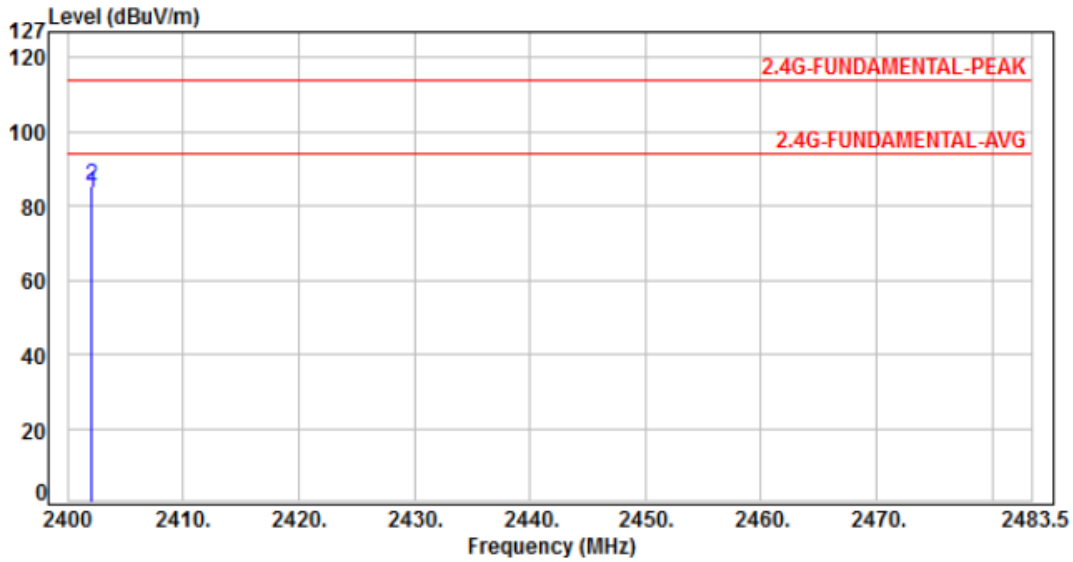
| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2402.00         | -18.17      | 106.92         | 88.75          | 94.00          | -5.25       | Average  | 100         | 146           | P   |
| 2   | 2402.00         | -18.17      | 108.77         | 90.60          | 114.00         | -23.40      | Peak     | 100         | 146           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor





|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1, CH00  |           | :            |

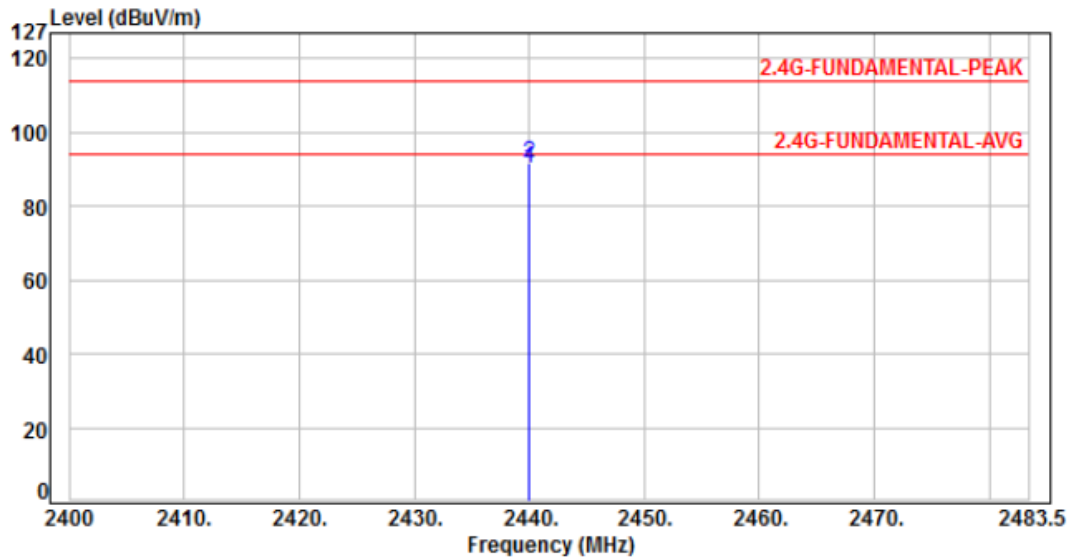


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2402.00         | -18.17      | 101.89         | 83.72          | 94.00          | -10.28      | Average  | 100         | 107           | P   |
| 2   | 2402.00         | -18.17      | 103.63         | 85.46          | 114.00         | -28.54      | Peak     | 100         | 107           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH19  |           | :          |

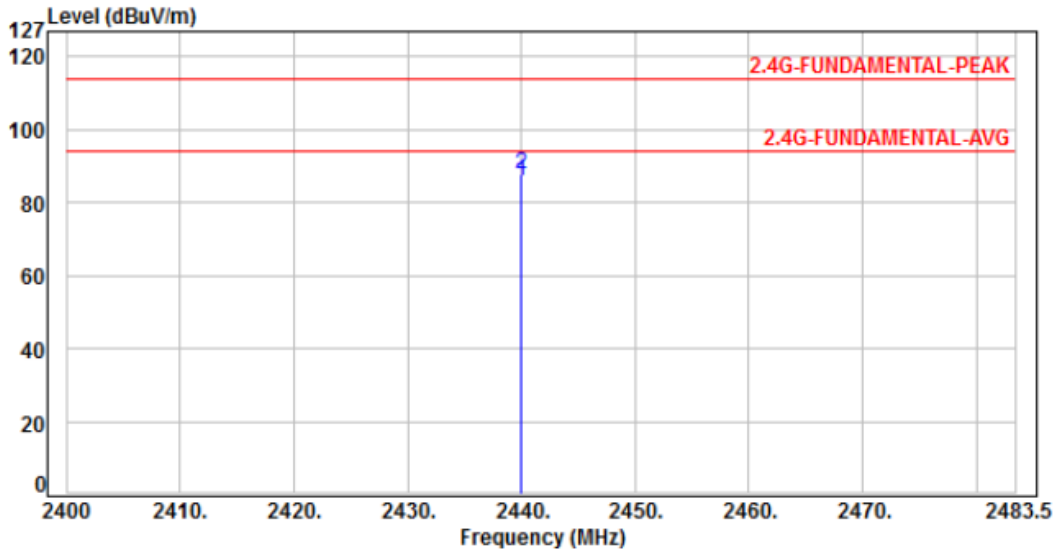


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2440.00         | -17.99      | 108.15         | 90.16          | 94.00          | -3.84       | Average  | 117         | 145           | P   |
| 2   | 2440.00         | -17.99      | 109.89         | 91.90          | 114.00         | -22.10      | Peak     | 117         | 145           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1, CH19  |           | :            |

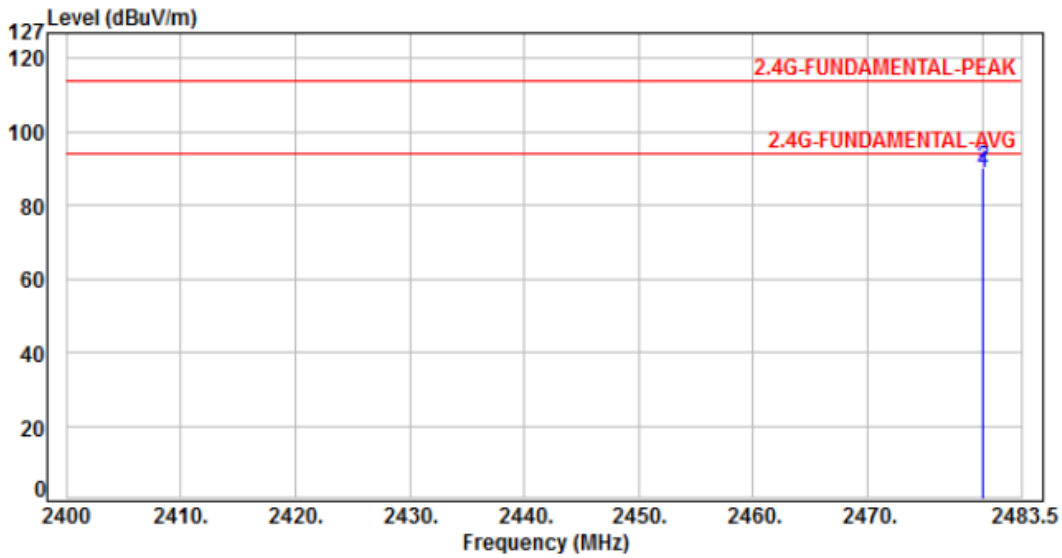


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2440.00         | -17.99      | 103.84         | 85.85          | 94.00          | -8.15       | Average  | 100         | 103           | P   |
| 2   | 2440.00         | -17.99      | 105.81         | 87.82          | 114.00         | -26.18      | Peak     | 100         | 103           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH39  |           | :          |

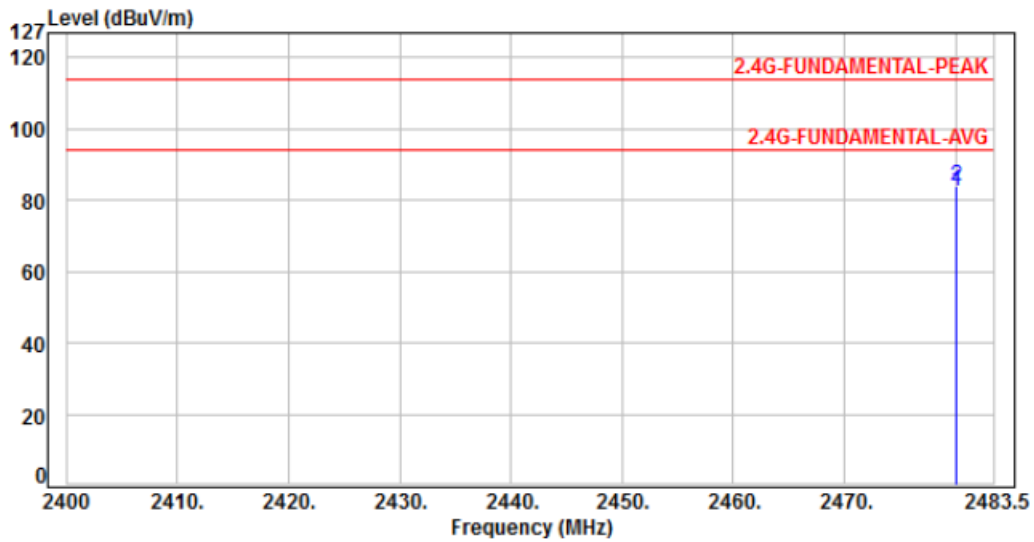


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2480.00         | -17.87      | 106.75         | 88.88          | 94.00          | -5.12       | Average  | 122         | 160           | P   |
| 2   | 2480.00         | -17.87      | 108.20         | 90.33          | 114.00         | -23.67      | Peak     | 122         | 160           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1,CH39   |           | :            |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2480.00         | -17.87      | 100.25         | 82.38          | 94.00          | -11.62      | Average  | 100         | 108           | P   |
| 2   | 2480.00         | -17.87      | 101.97         | 84.10          | 114.00         | -29.90      | Peak     | 100         | 108           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor

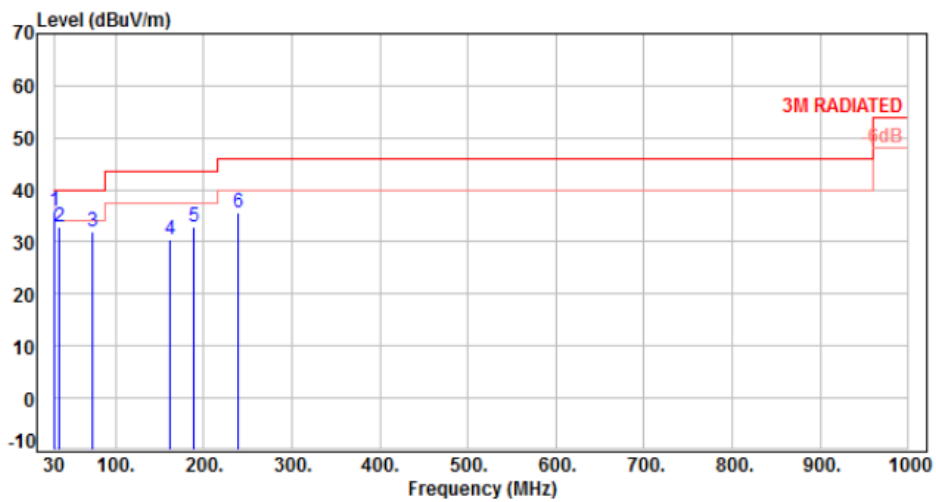


### 6.5 Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

### 6.6 Test Result and Data (30MHz ~ 1GHz)

|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1        |           | :          |

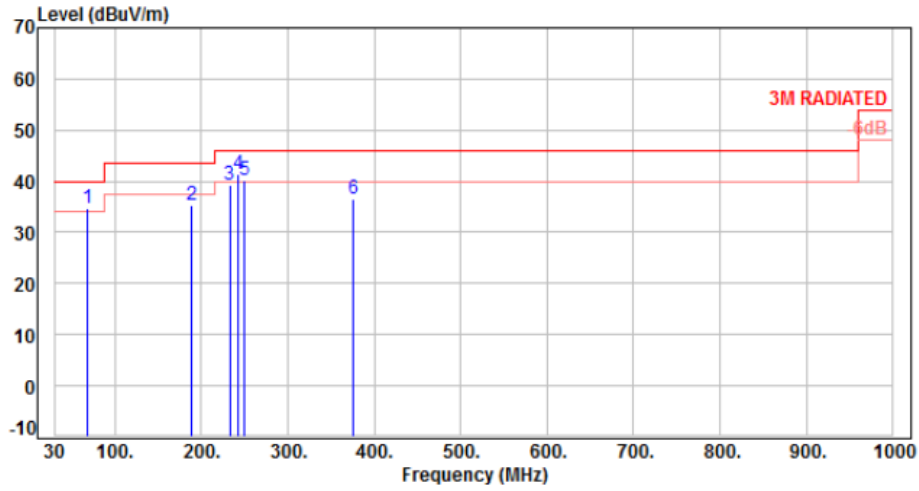


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 30.55           | -10.54      | 46.39          | 35.85          | 40.00          | -4.15       | QP       | 100         | 290           | P   |
| 2   | 36.39           | -10.16      | 43.00          | 32.84          | 40.00          | -7.16       | QP       | 100         | 300           | P   |
| 3   | 72.92           | -12.12      | 44.09          | 31.97          | 40.00          | -8.03       | QP       | 100         | 360           | P   |
| 4   | 160.95          | -9.42       | 39.89          | 30.47          | 43.50          | -13.03      | Peak     | 400         | 0             | P   |
| 5   | 189.08          | -11.88      | 44.69          | 32.81          | 43.50          | -10.69      | Peak     | 400         | 0             | P   |
| 6   | 238.55          | -10.83      | 46.32          | 35.49          | 46.00          | -10.51      | Peak     | 400         | 0             | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1        |           | :            |



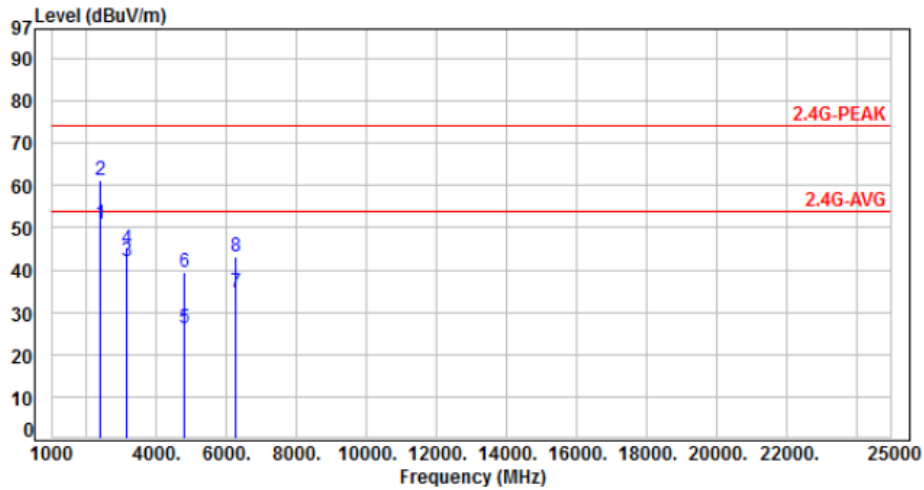
| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 67.83           | -11.24      | 46.00          | 34.76          | 40.00          | -5.24       | Peak     | 100         | 0             | P   |
| 2   | 189.08          | -11.88      | 47.10          | 35.22          | 43.50          | -8.28       | Peak     | 100         | 0             | P   |
| 3   | 232.73          | -11.37      | 50.69          | 39.32          | 46.00          | -6.68       | Peak     | 100         | 0             | P   |
| 4   | 243.40          | -10.55      | 52.04          | 41.49          | 46.00          | -4.51       | Peak     | 100         | 0             | P   |
| 5   | 249.22          | -10.40      | 50.47          | 40.07          | 46.00          | -5.93       | Peak     | 100         | 0             | P   |
| 6   | 375.32          | -6.51       | 43.14          | 36.63          | 46.00          | -9.37       | Peak     | 100         | 0             | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



### 6.7 Test Result and Data (1GHz ~ 25GHz)

|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH00  |           | :          |



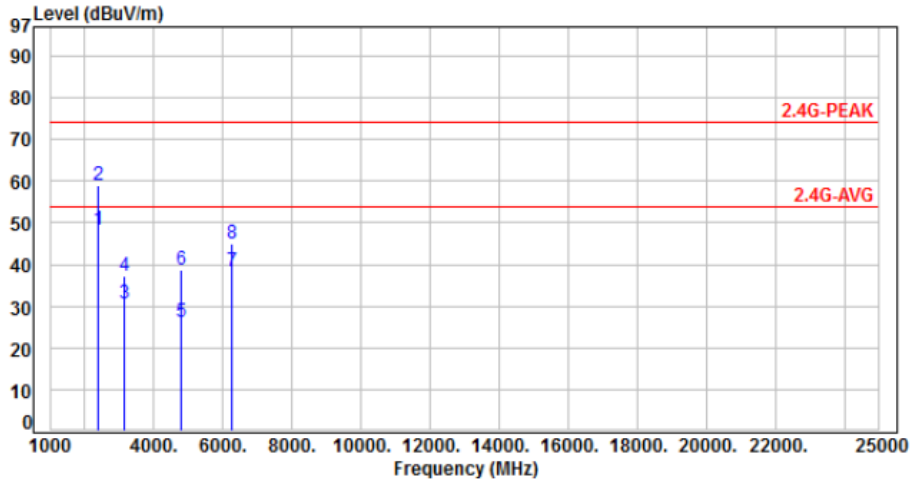
| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2400.00         | -18.18      | 69.04          | 50.86          | 54.00          | -3.14       | Average  | 100         | 146           | P   |
| 2   | 2400.00         | -18.18      | 79.29          | 61.11          | 74.00          | -12.89      | Peak     | 100         | 146           | P   |
| 3   | 3125.00         | -15.20      | 57.40          | 42.20          | 54.00          | -11.80      | Average  | 124         | 173           | P   |
| 4   | 3125.00         | -15.20      | 60.33          | 45.13          | 74.00          | -28.87      | Peak     | 124         | 173           | P   |
| 5   | 4804.00         | -12.12      | 38.46          | 26.34          | 54.00          | -27.66      | Average  | 100         | 179           | P   |
| 6   | 4804.00         | -12.12      | 51.55          | 39.43          | 74.00          | -34.57      | Peak     | 100         | 179           | P   |
| 7   | 6250.00         | -10.46      | 45.24          | 34.78          | 54.00          | -19.22      | Average  | 266         | 166           | P   |
| 8   | 6250.00         | -10.46      | 53.79          | 43.33          | 74.00          | -30.67      | Peak     | 266         | 166           | P   |

Note: Level=Reading+Factor  
Margin=Level-Limit  
Factor=Antenna Factor + cable loss - Amplifier Factor





|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1, CH00  |           | :            |

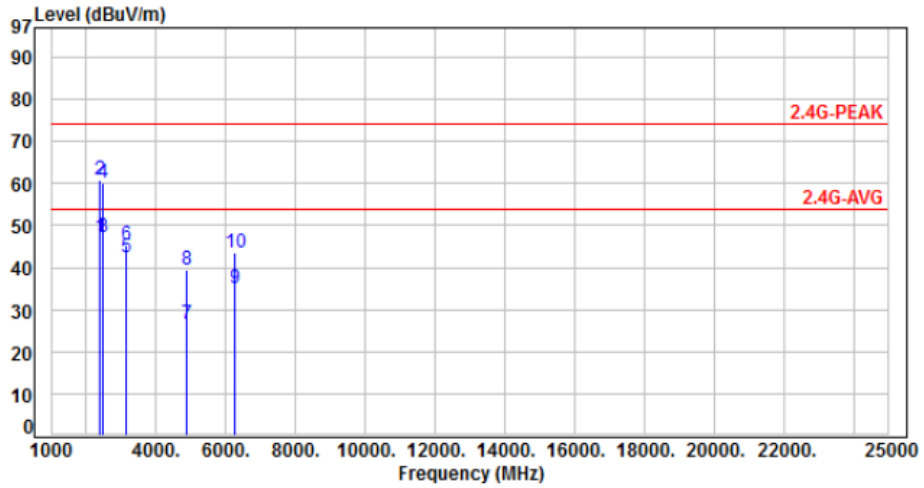


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2400.00         | -18.18      | 66.34          | 48.16          | 54.00          | -5.84       | Average  | 100         | 107           | P   |
| 2   | 2400.00         | -18.18      | 77.22          | 59.04          | 74.00          | -14.96      | Peak     | 100         | 107           | P   |
| 3   | 3125.00         | -15.20      | 45.84          | 30.64          | 54.00          | -23.36      | Average  | 100         | 116           | P   |
| 4   | 3125.00         | -15.20      | 52.53          | 37.33          | 74.00          | -36.67      | Peak     | 100         | 116           | P   |
| 5   | 4804.00         | -12.12      | 38.41          | 26.29          | 54.00          | -27.71      | Average  | 100         | 123           | P   |
| 6   | 4804.00         | -12.12      | 50.83          | 38.71          | 74.00          | -35.29      | Peak     | 100         | 123           | P   |
| 7   | 6250.00         | -10.46      | 48.90          | 38.44          | 54.00          | -15.56      | Average  | 113         | 339           | P   |
| 8   | 6250.00         | -10.46      | 55.63          | 45.17          | 74.00          | -28.83      | Peak     | 113         | 339           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH19  |           | :          |

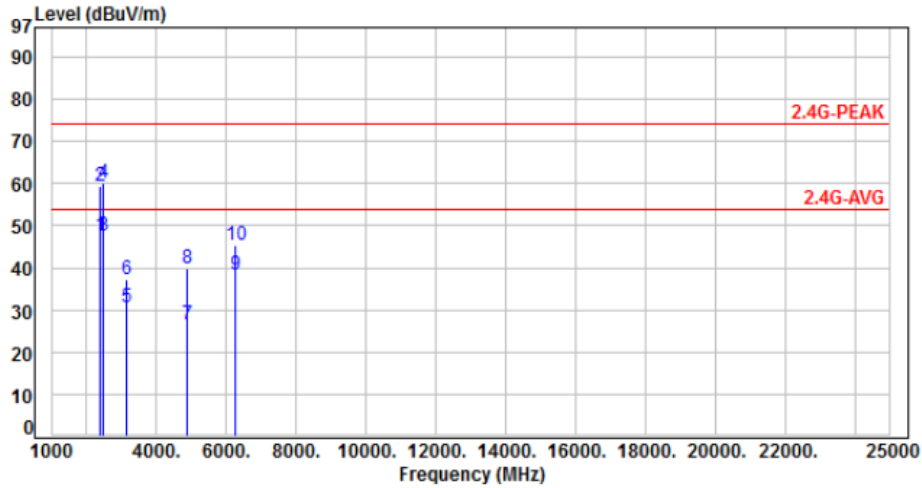


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2400.00         | -18.18      | 65.34          | 47.16          | 54.00          | -6.84       | Average  | 117         | 145           | P   |
| 2   | 2400.00         | -18.18      | 78.91          | 60.73          | 74.00          | -13.27      | Peak     | 117         | 145           | P   |
| 3   | 2483.50         | -17.85      | 65.10          | 47.25          | 54.00          | -6.75       | Average  | 117         | 145           | P   |
| 4   | 2483.50         | -17.85      | 77.89          | 60.04          | 74.00          | -13.96      | Peak     | 117         | 145           | P   |
| 5   | 3125.00         | -15.20      | 57.46          | 42.26          | 54.00          | -11.74      | Average  | 122         | 174           | P   |
| 6   | 3125.00         | -15.20      | 60.47          | 45.27          | 74.00          | -28.73      | Peak     | 122         | 174           | P   |
| 7   | 4880.00         | -11.86      | 38.58          | 26.72          | 54.00          | -27.28      | Average  | 100         | 182           | P   |
| 8   | 4880.00         | -11.86      | 51.19          | 39.33          | 74.00          | -34.67      | Peak     | 100         | 182           | P   |
| 9   | 6250.00         | -10.46      | 45.31          | 34.85          | 54.00          | -19.15      | Average  | 263         | 169           | P   |
| 10  | 6250.00         | -10.46      | 53.86          | 43.40          | 74.00          | -30.60      | Peak     | 263         | 169           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1, CH19  |           | :            |

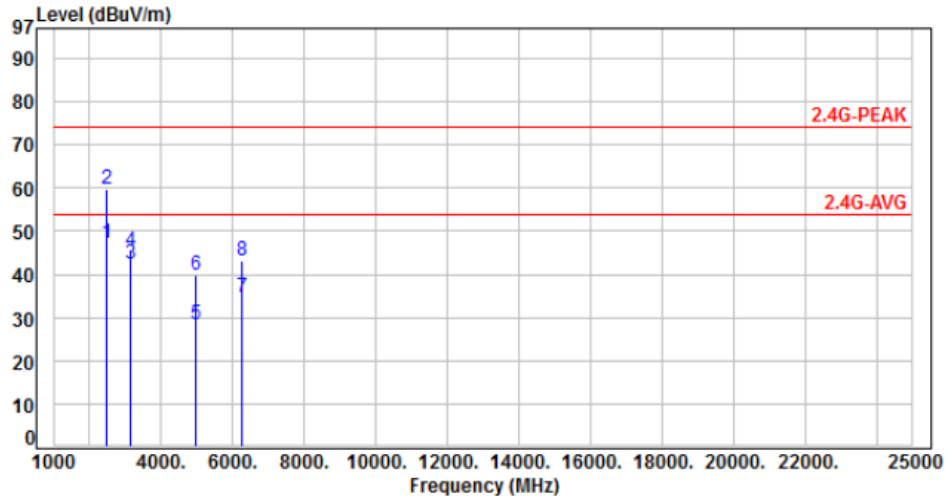


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2400.00         | -18.18      | 65.75          | 47.57          | 54.00          | -6.43       | Average  | 100         | 103           | P   |
| 2   | 2400.00         | -18.18      | 77.52          | 59.34          | 74.00          | -14.66      | Peak     | 100         | 103           | P   |
| 3   | 2483.50         | -17.85      | 65.53          | 47.68          | 54.00          | -6.32       | Average  | 100         | 103           | P   |
| 4   | 2483.50         | -17.85      | 77.86          | 60.01          | 74.00          | -13.99      | Peak     | 100         | 103           | P   |
| 5   | 3125.00         | -15.20      | 45.79          | 30.59          | 54.00          | -23.41      | Average  | 100         | 123           | P   |
| 6   | 3125.00         | -15.20      | 52.31          | 37.11          | 74.00          | -36.89      | Peak     | 100         | 123           | P   |
| 7   | 4880.00         | -11.86      | 38.45          | 26.59          | 54.00          | -27.41      | Average  | 100         | 131           | P   |
| 8   | 4880.00         | -11.86      | 51.52          | 39.66          | 74.00          | -34.34      | Peak     | 100         | 131           | P   |
| 9   | 6250.00         | -10.46      | 48.77          | 38.31          | 54.00          | -15.69      | Average  | 112         | 341           | P   |
| 10  | 6250.00         | -10.46      | 55.70          | 45.24          | 74.00          | -28.76      | Peak     | 112         | 341           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |            |
|-----------|-----------------|-----------|------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : VERTICAL |
| Test Mode | : Mode 1, CH39  |           | :          |

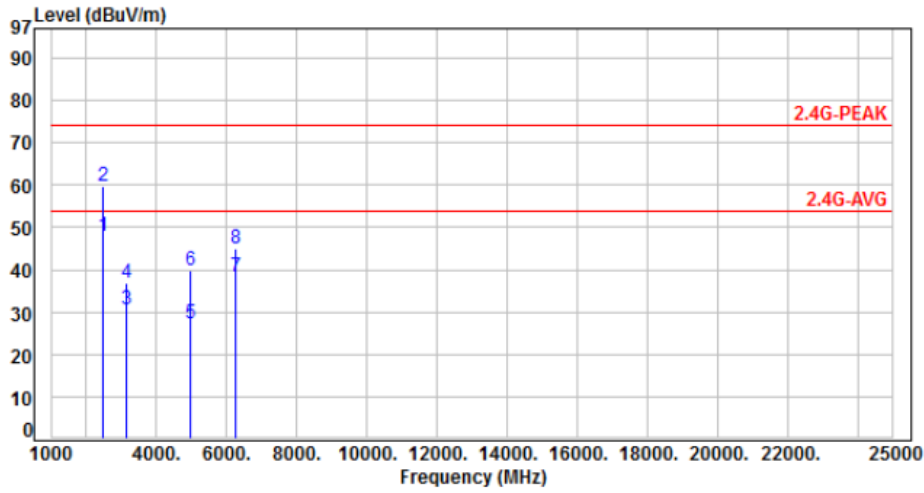


| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2483.50         | -17.85      | 65.14          | 47.29          | 54.00          | -6.71       | Average  | 122         | 160           | P   |
| 2   | 2483.50         | -17.85      | 77.48          | 59.63          | 74.00          | -14.37      | Peak     | 122         | 160           | P   |
| 3   | 3125.00         | -15.20      | 57.59          | 42.39          | 54.00          | -11.61      | Average  | 119         | 172           | P   |
| 4   | 3125.00         | -15.20      | 60.58          | 45.38          | 74.00          | -28.62      | Peak     | 119         | 172           | P   |
| 5   | 4960.00         | -11.68      | 39.92          | 28.24          | 54.00          | -25.76      | Average  | 171         | 168           | P   |
| 6   | 4960.00         | -11.68      | 51.64          | 39.96          | 74.00          | -34.04      | Peak     | 171         | 168           | P   |
| 7   | 6250.00         | -10.46      | 45.29          | 34.83          | 54.00          | -19.17      | Average  | 261         | 163           | P   |
| 8   | 6250.00         | -10.46      | 53.78          | 43.32          | 74.00          | -30.68      | Peak     | 261         | 163           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



|           |                 |           |              |
|-----------|-----------------|-----------|--------------|
| Power     | : AC120V / 60Hz | Pol/Phase | : HORIZONTAL |
| Test Mode | : Mode 1, CH39  |           | :            |



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|-----|-----------------|-------------|----------------|----------------|----------------|-------------|----------|-------------|---------------|-----|
| 1   | 2483.50         | -17.85      | 65.83          | 47.98          | 54.00          | -6.02       | Average  | 100         | 108           | P   |
| 2   | 2483.50         | -17.85      | 77.73          | 59.88          | 74.00          | -14.12      | Peak     | 100         | 108           | P   |
| 3   | 3125.00         | -15.20      | 45.71          | 30.51          | 54.00          | -23.49      | Average  | 100         | 121           | P   |
| 4   | 3125.00         | -15.20      | 52.24          | 37.04          | 74.00          | -36.96      | Peak     | 100         | 121           | P   |
| 5   | 4960.00         | -11.68      | 38.86          | 27.18          | 54.00          | -26.82      | Average  | 100         | 129           | P   |
| 6   | 4960.00         | -11.68      | 51.61          | 39.93          | 74.00          | -34.07      | Peak     | 100         | 129           | P   |
| 7   | 6250.00         | -10.46      | 48.69          | 38.23          | 54.00          | -15.77      | Average  | 114         | 339           | P   |
| 8   | 6250.00         | -10.46      | 55.61          | 45.15          | 74.00          | -28.85      | Peak     | 114         | 339           | P   |

Note: Level=Reading+Factor  
 Margin=Level-Limit  
 Factor=Antenna Factor + cable loss - Amplifier Factor



### 6.8 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                 | MHz                   | MHz             | GHz             |
|---------------------|-----------------------|-----------------|-----------------|
| 0.09000 – 0.11000   | 16.42000 – 16.42300   | 399.9 – 410.0   | 4.500 – 5.250   |
| 0.49500 – 0.505**   | 16.69475 – 16.69525   | 608.0 – 614.0   | 5.350 – 5.460   |
| 2.17350 – 2.19050   | 16.80425 – 16.80475   | 960.0 – 1240.0  | 7.250 – 7.750   |
| 4.12500 – 4.12800   | 25.50000 – 25.67000   | 1300.0 – 1427.0 | 8.025 – 8.500   |
| 4.17725 – 4.17775   | 37.50000 – 38.25000   | 1435.0 – 1626.5 | 9.000 – 9.200   |
| 4.20725 – 4.20775   | 73.00000 – 74.60000   | 1645.5 – 1646.5 | 9.300 – 9.500   |
| 6.21500 – 6.21800   | 74.80000 – 75.20000   | 1660.0 – 1710.0 | 10.600 – 12.700 |
| 6.26775 – 6.26825   | 108.00000 – 121.94000 | 1718.8 – 1722.2 | 13.250 – 13.400 |
| 6.31175 – 6.31225   | 123.00000 – 138.00000 | 2200.0 – 2300.0 | 14.470 – 14.500 |
| 8.29100 – 8.29400   | 149.90000 – 150.05000 | 2310.0 – 2390.0 | 15.350 – 16.200 |
| 8.36200 – 8.36600   | 156.52475 – 156.52525 | 2483.5 – 2500.0 | 17.700 – 21.400 |
| 8.37625 – 8.38675   | 156.70000 – 156.90000 | 2655.0 – 2900.0 | 22.010 – 23.120 |
| 8.41425 – 8.41475   | 162.01250 – 167.17000 | 3260.0 – 3267.0 | 23.600 – 24.000 |
| 12.29000 – 12.29300 | 167.72000 – 173.20000 | 3332.0 – 3339.0 | 31.200 – 31.800 |
| 12.51975 – 12.52025 | 240.00000 – 285.00000 | 3345.8 – 3358.0 | 36.430 – 36.500 |
| 12.57675 – 12.57725 | 322.00000 – 335.40000 | 3600.0 – 4400.0 | Above 38.6      |
| 13.36000 – 13.41000 |                       |                 |                 |

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

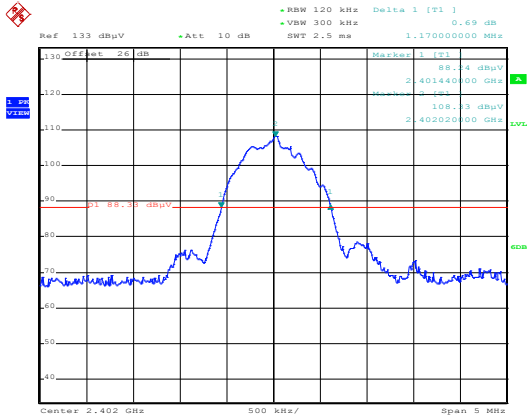


6.9 20dB Bandwidth Measurement Data

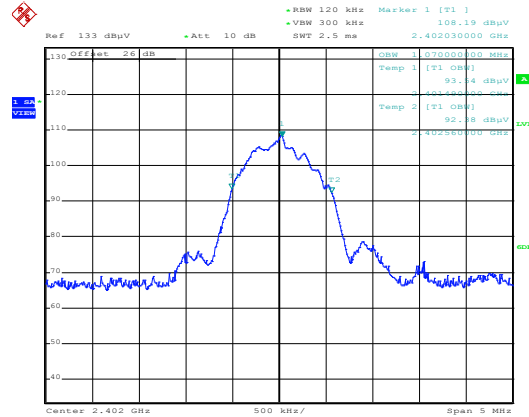
| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Occupied BW(MHz) | Frequency range MHz (20dB Down) fL > 902 MHz | Frequency range MHz (20dB Down) fH < 928 MHz |
|-----------------|----------------------|----------------------|--|--|
| 2402.000        | 1.17                 | 1.07                 | 2401.4400                                    | -  |
| 2440.000        | 1.16                 | 1.08                 | -  | -  |
| 2480.000        | 1.17                 | 1.07                 | -  | 2480.6100                                    |



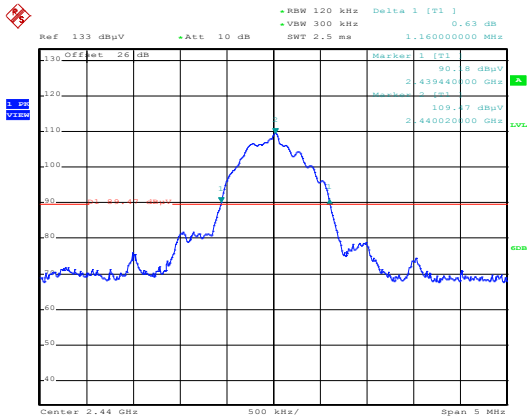
20dB Bandwidth  
2402 MHz  
CH00



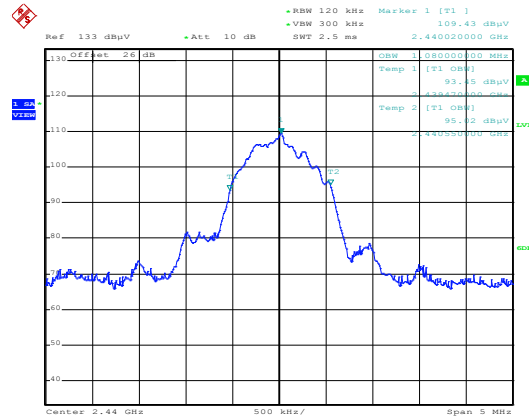
99% OBW  
2402 MHz  
CH00



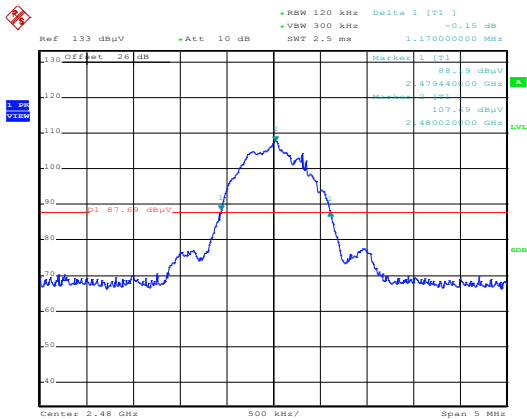
2440 MHz  
CH19



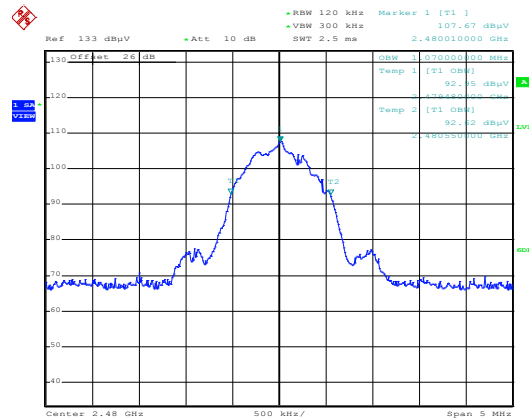
2440 MHz  
CH19



2480 MHz  
C39



2480 MHz  
C39







## 7. Radio Frequency Exposure

### 7.1 Applicable Standards

The measurements shown in this test report were made in accordance with the procedures given in FCC Part 2 (Section 2.1091)

KDB 447498

IEEE C95.1:2005

### 7.2 EUT Specification

|                                   |  |
|-----------------------------------|--|
| <b>Frequency band (Operating)</b> | 2402MHz~2480MHz  |
| <b>Device category</b>            | <input type="checkbox"/> Portable (<20cm separation)<br><input checked="" type="checkbox"/> Mobile (>20cm separation)  |
| <b>Exposure classification</b>    | <input type="checkbox"/> Occupational/Controlled exposure<br><input checked="" type="checkbox"/> General Population/Uncontrolled exposure  |
| <b>Antenna diversity</b>          | <input checked="" type="checkbox"/> Single antenna<br><input type="checkbox"/> Multiple antennas<br><input type="checkbox"/> Tx diversity<br><input type="checkbox"/> Rx diversity<br><input type="checkbox"/> Tx/Rx diversity |
| <b>Evaluation applied</b>         | <input checked="" type="checkbox"/> MPE Evaluation*<br><input type="checkbox"/> SAR Evaluation<br><input type="checkbox"/> N/A   |

**Remark:**

1. The maximum Fundamental Emission is 91.9dBuV/m at 2440MHz (with 0dBi antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm<sup>2</sup> even if the calculation indicates that the power density would be larger.



### 7.3 Test Results

No non-compliance noted.

### 7.4 Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

Where  $E$  = Field strength in Volts / meter

$P$  = Power in Watts

$G$  = Numeric antenna gain

$d$  = Distance in meters

$S$  = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>



### 7.5 Maximum Permissible Exposure

| Antenna Gain (dBi) | Antenna Gain (linear) | Test distance (m) | Fundamental Emission (dBuV/m) | Fundamental Emission (V/m) | Fundamental Power (W) | Fundamental Power (dBm) |
|--------------------|-----------------------|-------------------|-------------------------------|----------------------------|-----------------------|-------------------------|
| 0                  | 1                     | 3                 | 91.9                          | 0.039355                   | 0.000464645           | -3.328787               |

| Max. Fundamental Power (dBm) | Antenna Gain(dBi) | Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) |
|------------------------------|-------------------|---------------|-------------------------------------|-----------------------------|
| -3.33                        | 0                 | 20            | 0.00009                             | 1                           |