# FCC Radio Test Report

## FCC ID: H4IMS2065

**This report concerns (check one):** ☒**Original Grant** ☐**Class II Change**

| | |
|---|---|
| **Project No.** | : 1706044 |
| **Equipment** | : Wireless Mouse |
| **Test Model** | : TPC-L001M |
| **Serial Model** | : N/A |
| **Applicant** | : Lite-On Technology Corp. |
| **Address** | : 16F, 392 , Ruey Kuang Road, Neihu, Taipei 11492, Taiwan, R.O.C |

| | |
|---|---|
| **Date of Receipt** | : Jun. 15, 2017 |
| **Date of Test** | : Jun. 15, 2017 ~ Jun. 29, 2017 |
| **Issued Date** | : Jun. 30, 2017 |
| **Tested by** | : BTL Inc. |

**Testing Engineer** : Rush Kao
(Rush Kao)

**Technical Manager** : James Chiu
(James Chiu)

**Authorized Signatory** : Andy Chiu
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**BTL INC.**

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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).

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## 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.

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# REPORT ISSUED HISTORY

| Issued No. | Description | Issued Date |
|---|---|---|
| BTL-FCCP-1-1706044 | Original Issue. | Jun. 30, 2017 |

## 1. CERTIFICATION

| | | |
|---|---|---|
| Equipment | : | Wireless Mouse |
| Brand Name | : | HP |
| Test Model | : | TPC-L001M |
| Serial Model | : | N/A |
| Applicant | : | Lite-On Technology Corp. |
| Date of Test | : | Jun. 15, 2017 ~ Jun. 29, 2017 |
| 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-1-1706044) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

## 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

| Applied Standard(s): FCC Part15 (15.247) , Subpart C | | | |
|---|---|---|---|
| Standard(s) Section | Test Item | Judgment | Remark |
| 15.207 | Conducted Emission | N/A | NOTE (1) |
| 15.247(d) | Antenna conducted Spurious Emission | PASS | |
| 15.247(a)(2) | 6dB Bandwidth | PASS | |
| 15.247(b)(3) | Output Power | PASS | |
| 15.247(e) | Power Spectral Density | PASS | |
| 15.203 | Antenna Requirement | PASS | |
| 15.209/15.205 | Transmitter Radiated Emissions | PASS | |
| 15.209/15.205 | Band Edge Emissions | PASS | |

NOTE:

(1)" N/A" denotes test is not applicable to this device.

### 2.1 TEST FACILITY

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

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

**CB15:** (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

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

**CB15:** (FCC RN:674415; FCC DN:TW0659)
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

## 2.2 MEASUREMENT UNCERTAINTY

**The measurement uncertainty is not specified by FCC rules for reference only.**

The reported uncertainty of measurement **y** ± **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**%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

The BTL measurement uncertainty is less than the CISPR 16-4-2 $U_{cispr}$ requirement.

A. Radiated Measurement :

| Test Site | Method | Measurement Frequency Range | U,(dB) |
|---|---|---|---|
| CB15 (3m) | CISPR | 9kHz ~ 150kHz | 2.96 |
| | | 150kHz ~ 30MHz | 2.74 |

| Test Site | Method | Measurement Frequency Range | Ant. | U,(dB) |
|---|---|---|---|---|
| CB15 (3m) | CISPR | 30MHz ~ 200MHz | V | 4.76 |
| | | 30MHz ~ 200MHz | H | 4.28 |
| | | 200MHz ~ 1,000MHz | V | 5.08 |
| | | 200MHz ~ 1,000MHz | H | 4.50 |

| Test Site | Method | Measurement Frequency Range | Ant. | U,(dB) |
|---|---|---|---|---|
| CB15 (3m) | CISPR | 1GHz ~ 6GHz | V | 4.48 |
| | | 1GHz ~ 6GHz | H | 4.50 |
| | | 6GHz ~ 18GHz | V | 4.30 |
| | | 6GHz ~ 18GHz | H | 4.14 |

| Test Site | Method | Measurement Frequency Range | U,(dB) |
|---|---|---|---|
| CB15 (1m) | CISPR | 18 ~ 26.5 GHz | 4.72 |
| | | 26.5 ~ 40 GHz | 5.20 |

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

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 $U_{CISPR}$.

# 3. GENERAL INFORMATION

## 3.1 DESCRIPTION OF EUT

| | | |
|---|---|---|
| Product Name | Wireless Mouse | |
| Brand | HP | |
| Test Model | TPC-L001M | |
| Series Model | N/A | |
| Model Difference | N/A | |
| Product Description | Operation Frequency | 2403-2480 MHz |
| | Modulation Technology | GFSK |
| | Bit Rate of Transmitter | 2 Mbps |
| | Output Power (Max.) | 1.86dBm |
| Power Source | Supplied from 2*AAA battery | |
| EUT Power Rating | DC 3V 30mA | |

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

3. Table for Filed Antenna:

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | Note |
|---|---|---|---|---|---|---|
| 1 | N/A | N/A | PIFA | N/A | -3.85 | |

## 3.2 DESCRIPTION OF TEST MODES

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

| Pretest Mode | Description |
|---|---|
| Mode 1 | TX Mode |

The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

| **For Conducted Test** | |
|---|---|
| Final Test Mode | Description |
| - | - |

| **For Radiated Test** | |
|---|---|
| Final Test Mode | Description |
| Mode 1 | TX Mode **NOTE (1)** |

Note:

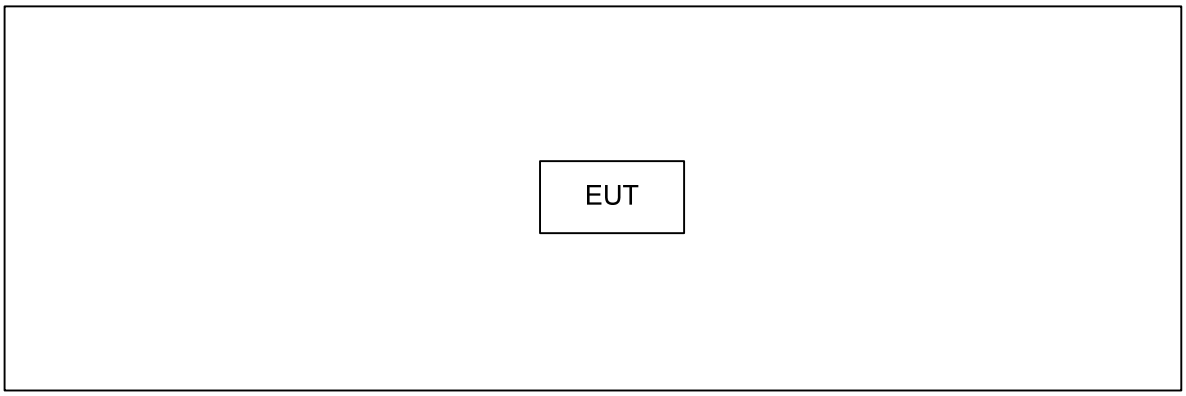
(1) The measurements are performed at the high, middle, low available channels.

## 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 WLAN

| Test Software Version | N/A | | |
|---|---|---|---|
| Frequency (MHz) | 2403 | 2441 | 2480 |
| - | DEF | DEF | DEF |

## 3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED




## 3.5 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 |
|---|---|---|---|---|
| - | - | - | - | - |

Note:
(1) The support equipment was authorized by Declaration of Conformity (DOC).

# 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. | 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 - Amplifier Gain(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 |

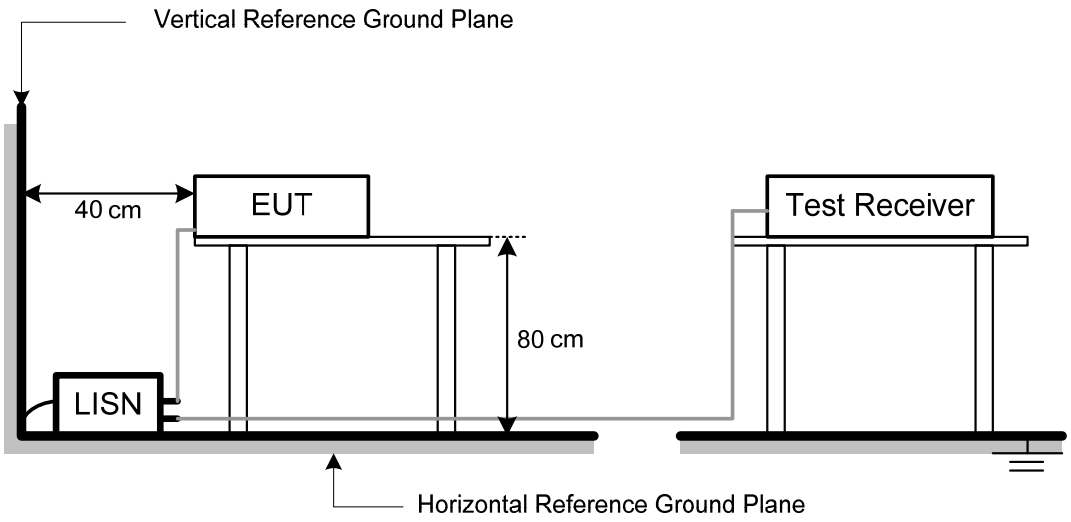
### 4.1.2 TEST PROCEDURE

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 equipments 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: N/A
Relative Humidity: N/A
Test Voltage: N/A

### 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.
(3) " N/A" denotes test is not applicable to this device.

## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 RADIATED EMISSION LIMITS

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.

LIMITS OF RADIATED EMISSION MEASUREMENT (9KHz-1000MHz)

| 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 (Emission in restricted band) | RBW 1MHz VBW 3MHz peak detector for Pk value<br>RMS detector for AV value |

| 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

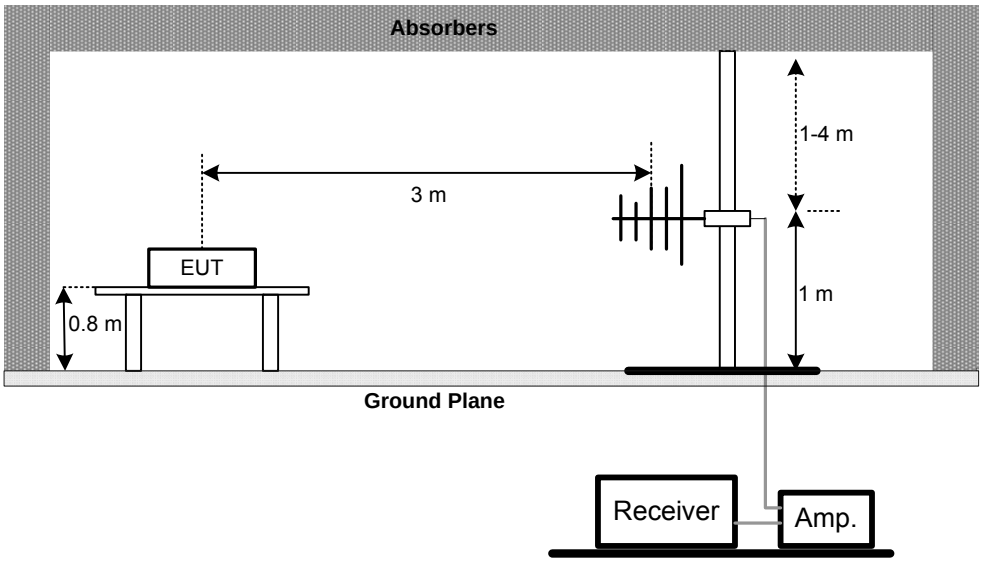
a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The measuring distance 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 0.8 m or 1.5 m, 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. 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.
e. 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)
f. 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)
g. For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 4.2.3 DEVIATION FROM TEST STANDARD

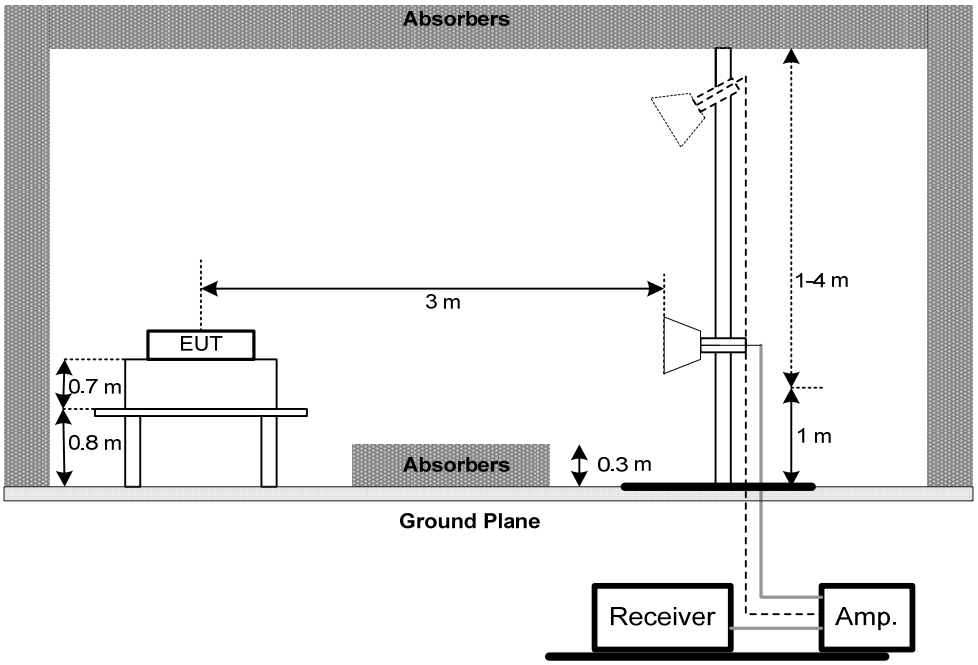
No deviation

### 4.2.4 TEST SETUP

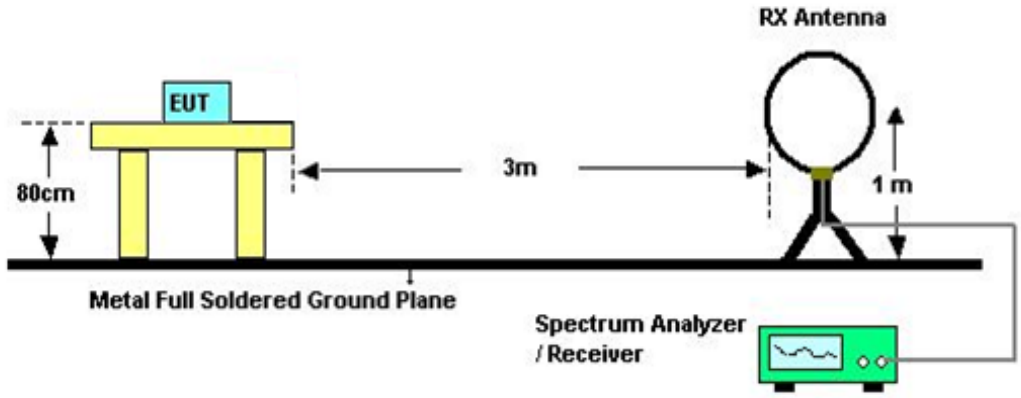
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz




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



(C) For radiated emissions below 30MHz




### 4.2.5 EUT OPERATING CONDITIONS

The EUT 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.

### 4.2.6 EUT TEST CONDITIONS

Temperature: 23°C
Relative Humidity: 70%
Test Voltage: DC 3V

### 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 (specific distance / test distance) (dB).
(3) Limit line = specific limits (dBuV) + distance extrapolation factor.

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

Please refer to the Appendix C.

Remark:

(1) Measuring frequency range from 30MHz to 1000MHz.
(2) If the peak scan value lower limit more than 20dB, then this signal data does not show in table.

### 4.2.9TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Appendix D.

Remark:

(1) 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.

(2) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission

(3) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(4) EUT Orthogonal Axis:
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(5) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna

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

## 5. BANDWIDTH TEST

### 5.1 APPLIED PROCEDURES / LIMIT

| FCC Part15 (15.247) , Subpart C | | | | |
|---|---|---|---|---|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(2) | Bandwidth | >= 500KHz (6dB bandwidth) | 2400-2483.5 | PASS |

#### 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=300KHz, Sweep time = 2.5 ms.

#### 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

Temperature: 25°C Relative Humidity: 60% Test Voltage: DC 3V

#### 5.1.6 TEST RESULTS

Please refer to the Appendix E.

## 6. CONDUCTED OUTPUT POWER TEST

### 6.1 APPLIED PROCEDURES / LIMIT

| FCC Part15 (15.247) , Subpart C | | | | |
|---|---|---|---|---|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(b)(3) | Maximum Output Power | 1 watt or 30dBm | 2400-2483.5 | PASS |

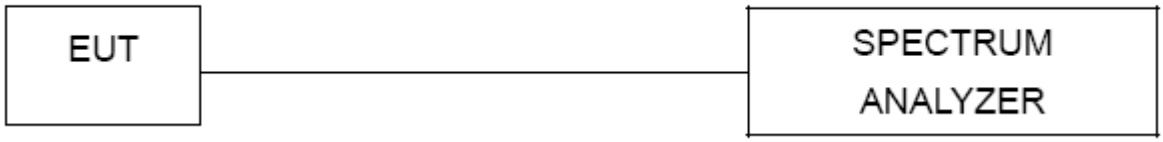
#### 6.1.1 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. The maximum conducted output power was performed in accordance with method 9.1.2 of FCC KDB 558074 D01 DTS Meas Guidance v03r05.

#### 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

Temperature: 25°C  Relative Humidity: 60%  Test Voltage: DC 3V

#### 6.1.6 TEST RESULTS

Please refer to the Appendix F.

## 7. ANTENNA CONDUCTED SPURIOUS EMISSION

### 7.1 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.

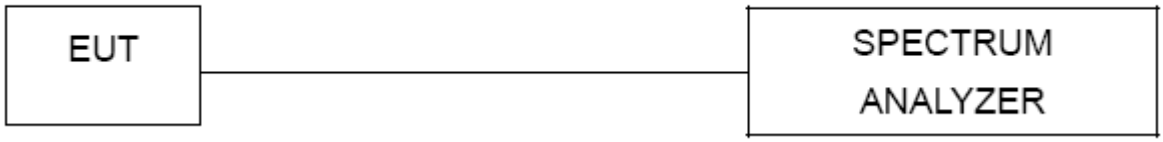
#### 7.1.1 TEST PROCEDURE

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=300KHz, Sweep time = 10 ms.
c. Offset=antenna gain+cable loss

#### 7.1.2 DEVIATION FROM STANDARD

No deviation.

#### 7.1.3 TEST SETUP




#### 7.1.4 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.

#### 7.1.5 EUT OPERATION CONDITIONS

Temperature: 25°C Relative Humidity: 60% Test Voltage: DC 3V

#### 7.1.6 TEST RESULTS

Please refer to the Appendix G.

## 8. POWER SPECTRAL DENSITY TEST

### 8.1 APPLIED PROCEDURES / LIMIT

| FCC Part15 (15.247) , Subpart C | | | | |
|---|---|---|---|---|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(e) | Power Spectral Density | 8 dBm (in any 3KHz) | 2400-2483.5 | PASS |

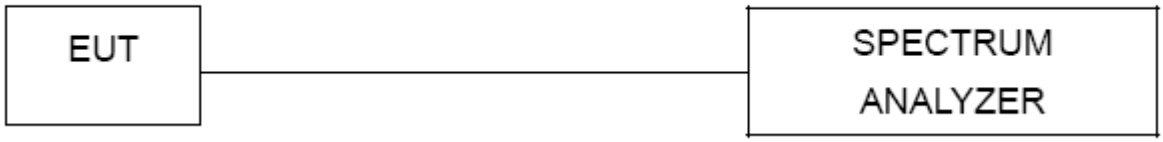
#### 8.1.1 TEST PROCEDURE

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=3KHz, VBW=10 KHz, 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

Temperature: 25°C  Relative Humidity: 60%  Test Voltage: DC 3V

#### 8.1.6 TEST RESULTS

Please refer to the Appendix H.

## 9. MEASUREMENT INSTRUMENTS LIST

| Radiated Emission Measurement | | | | | |
|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1 | Preamplifier | EMCI | 012645B | 980267 | Feb. 28, 2018 |
| 2 | Preamplifier | EMCI | EMC02325 | 980217 | Dec. 29, 2017 |
| 3 | Test Cable | EMCI | EMC104-SM-SM-8000 | 8m | Jan. 04, 2018 |
| 4 | Test Cable | EMCI | EMC104-SM-SM-800 | 150207 | Jan. 04, 2018 |
| 5 | Test Cable | EMCI | EEMC104-SM-SM-3000 | 151205 | Jan. 04, 2018 |
| 6 | MXE EMI Receiver | Agilent | N9038A | MY55420127 | Jan. 09, 2018 |
| 7 | Signal Analyzer | Agilent | N9010A | MY52220990 | Feb. 22, 2018 |
| 8 | Loop Ant | EMCO | 6502 | 42960 | Nov. 24, 2017 |
| 9 | Horm Ant | SCHWARZBECK | BBHA 9120D | 9120D-1342 | Feb. 28, 2018 |
| 10 | Trilog-Broadband Antenna | Schwarzbeck | VULB 9168 | 9168-548 | Jan. 16, 2018 |
| 11 | 5dB Attenuator | EMCI | EMCI-N-6-05 | AT-N0623 | Jan. 16, 2018 |

| 6dB Bandwidth Measurement | | | | | |
|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1 | Spectrum Analyzer | R&S | R&S/FSP30 | 100854 | May 25, 2018 |

| Conducted Output Power Measurement | | | | | |
|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1 | Power Meter | Anritsu | ML2495A | 1128008 | Aug. 17, 2017 |
| 2 | Power Sensor | Anritsu | MA2411B | 1126001 | Aug. 17, 2017 |

| Antenna Conducted Spurious Emission Measurement | | | | | |
|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1 | Spectrum Analyzer | R&S | R&S/FSP30 | 100854 | May 25, 2018 |

| Power Spectral Density Measurement | | | | | |
|---|---|---|---|---|---|
| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Calibrated until |
| 1 | Spectrum Analyzer | R&S | R&S/FSP30 | 100854 | May 25, 2018 |

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

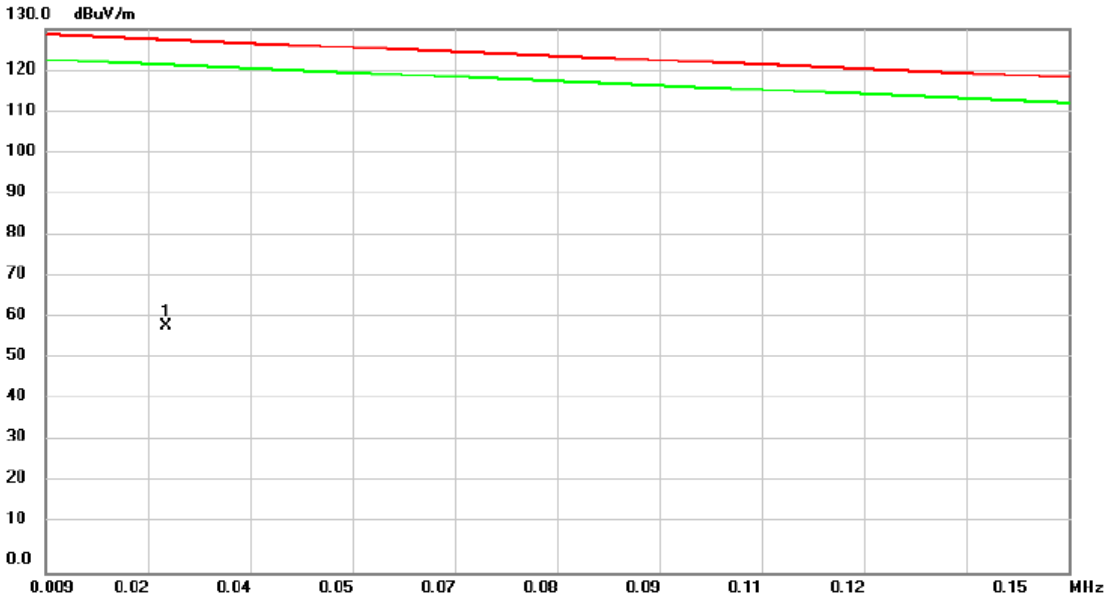
**Test Mode: N/A**

Note: “N/A” denotes test is not applicable to this device.

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

| Test Mode | TX Mode_2403 MHz |
|---|---|

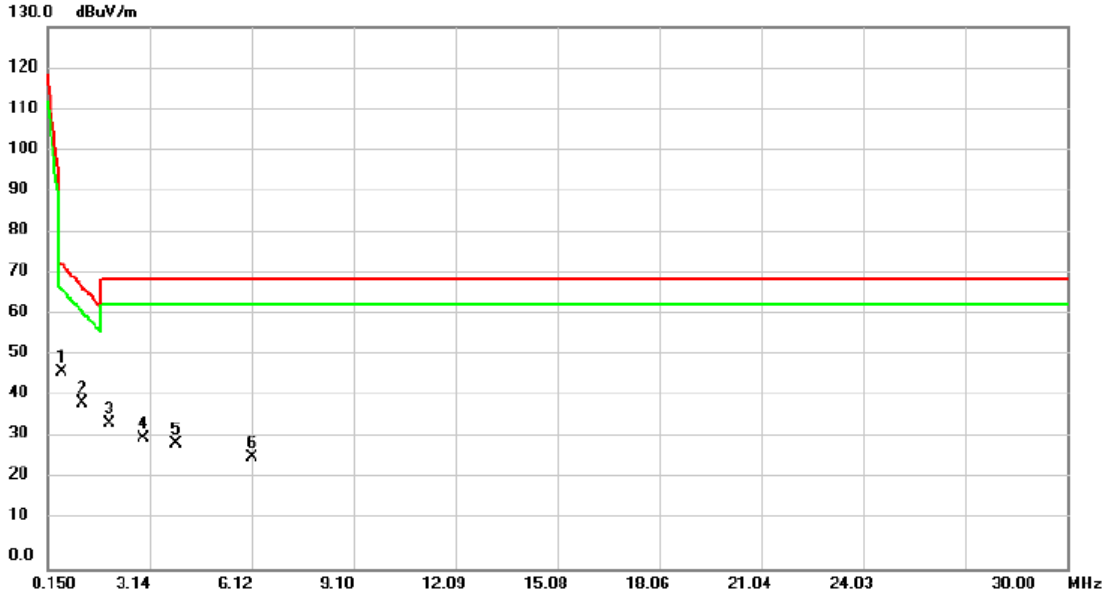
## Open




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 0.0256 | 42.90 | 16.21 | 59.11 | 127.32 | -68.21 | peak | |

| Test Mode | TX Mode_2403 MHz |
|---|---|

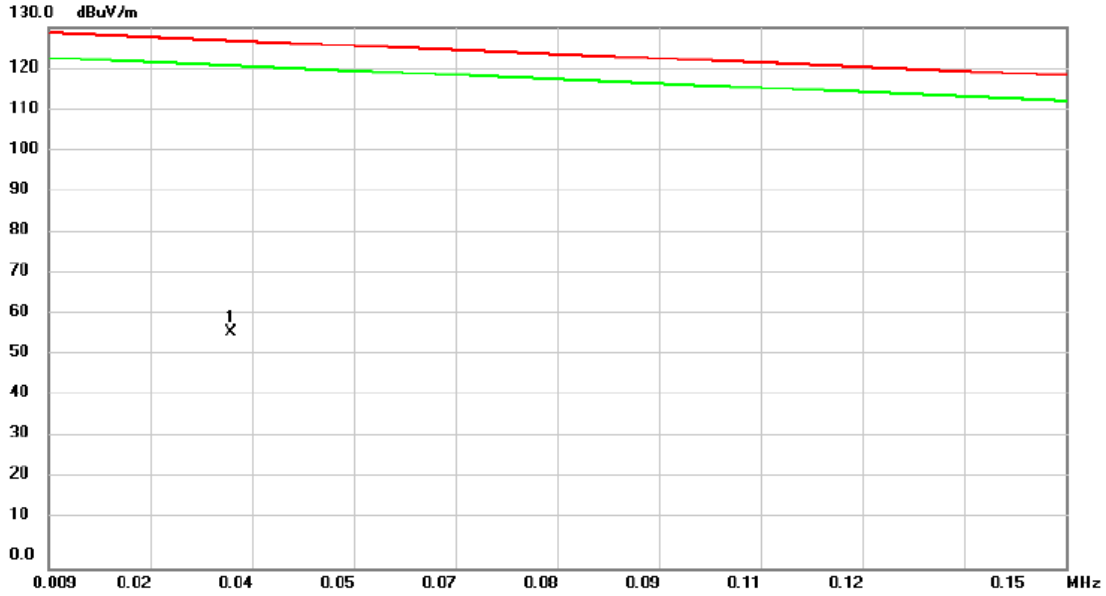
## Open




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 0.5675 | 35.40 | 11.83 | 47.23 | 73.11 | -25.88 | peak | |
| 2 | | 1.1650 | 28.03 | 11.93 | 39.96 | 67.78 | -27.82 | peak | |
| 3 | | 1.9410 | 23.39 | 11.58 | 34.97 | 69.54 | -34.57 | peak | |
| 4 | | 2.9560 | 20.15 | 11.12 | 31.27 | 69.54 | -38.27 | peak | |
| 5 | | 3.9110 | 18.67 | 11.24 | 29.91 | 69.54 | -39.63 | peak | |
| 6 | | 6.1497 | 15.55 | 11.38 | 26.93 | 69.54 | -42.61 | peak | |

| Test Mode | TX Mode_2403 MHz |
|---|---|

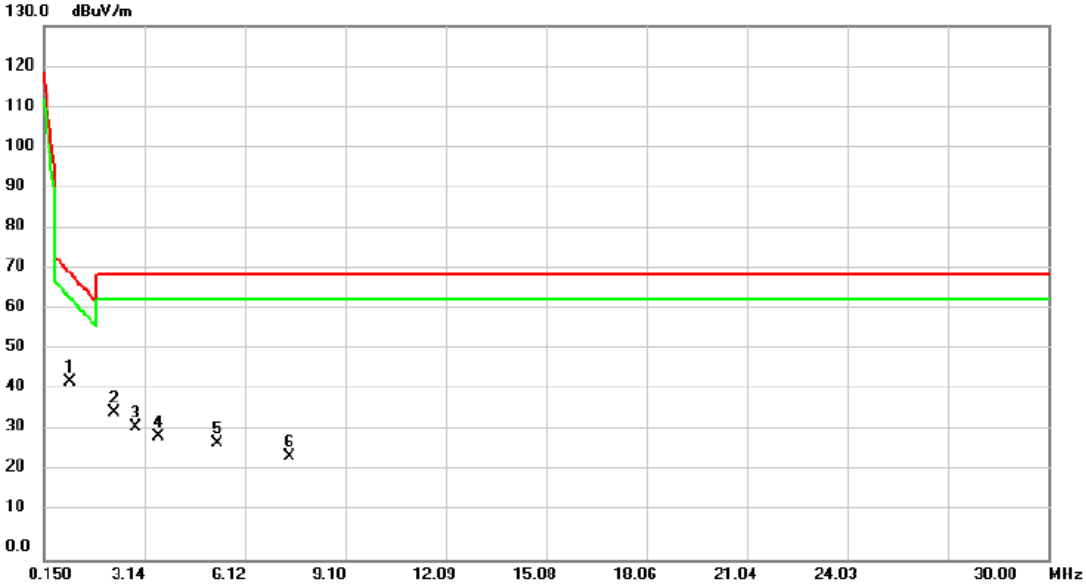
Close




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 0.0342 | 42.25 | 14.58 | 56.83 | 126.70 | -69.87 | peak | |

| Test Mode | TX Mode_2403 MHz |
|---|---|

## Close

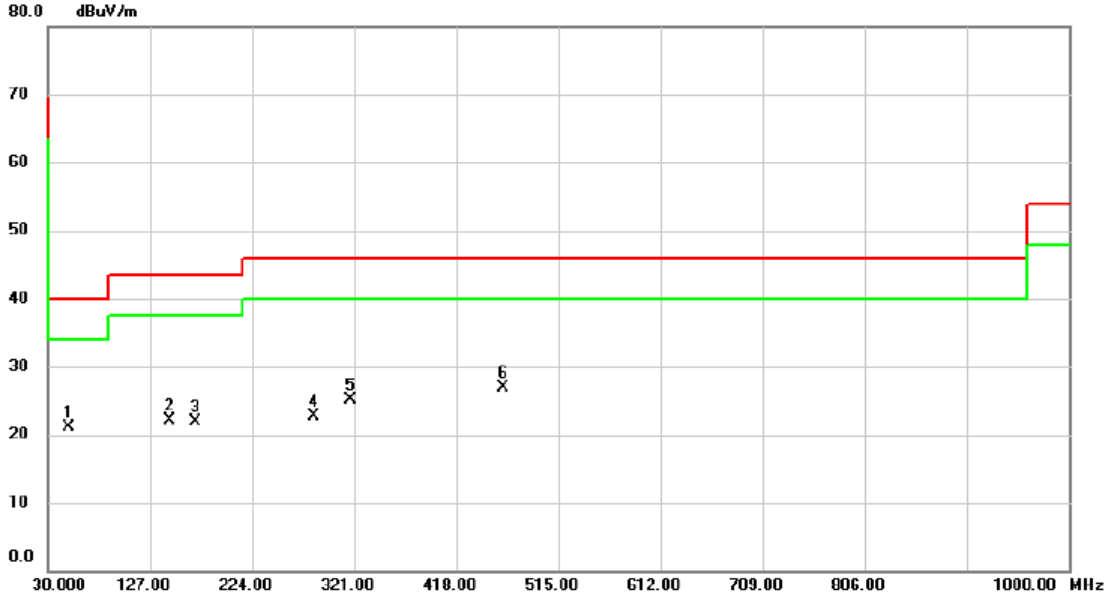



| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 0.9261 | 31.48 | 11.97 | 43.45 | 69.91 | -26.46 | peak | |
| 2 | | 2.2395 | 24.62 | 11.44 | 36.06 | 69.54 | -33.48 | peak | |
| 3 | | 2.8664 | 21.25 | 11.16 | 32.41 | 69.54 | -37.13 | peak | |
| 4 | | 3.5530 | 18.85 | 11.18 | 30.03 | 69.54 | -39.51 | peak | |
| 5 | | 5.2842 | 16.97 | 11.39 | 28.36 | 69.54 | -41.18 | peak | |
| 6 | | 7.4633 | 13.78 | 11.35 | 25.13 | 69.54 | -44.41 | peak | |

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

| Test Mode | TX Mode_2403 MHz |
|---|---|

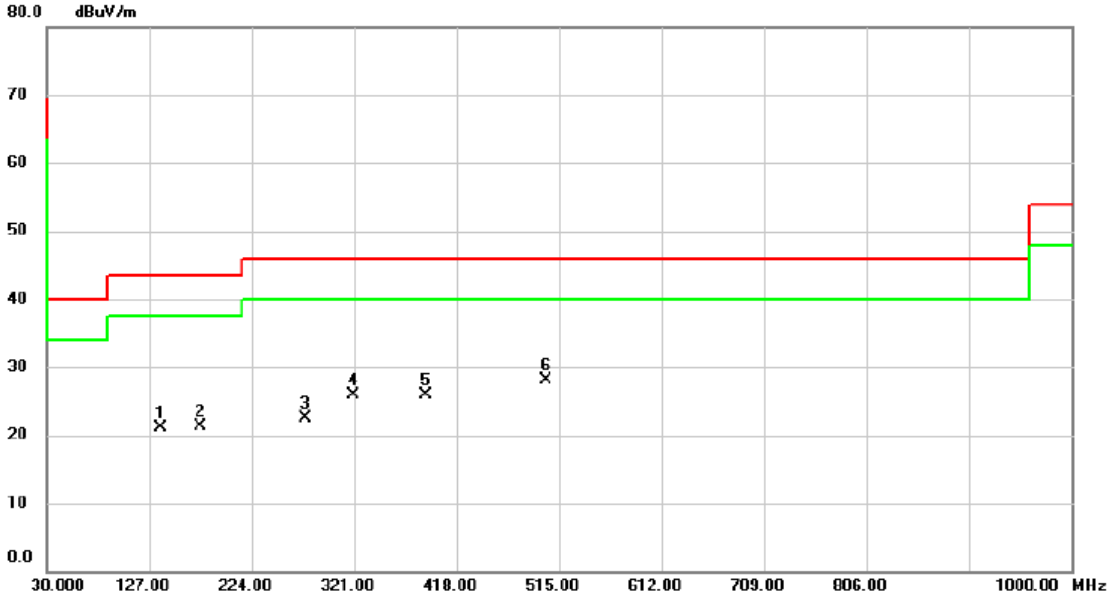
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | * | 49.4000 | 29.41 | -8.33 | 21.08 | 40.00 | -18.92 | peak | |
| 2 | | 145.4300 | 31.17 | -9.05 | 22.12 | 43.50 | -21.38 | peak | |
| 3 | | 169.6800 | 30.53 | -8.60 | 21.93 | 43.50 | -21.57 | peak | |
| 4 | | 282.2000 | 30.64 | -7.95 | 22.69 | 46.00 | -23.31 | peak | |
| 5 | | 318.0900 | 32.06 | -7.04 | 25.02 | 46.00 | -20.98 | peak | |
| 6 | | 462.6200 | 30.35 | -3.35 | 27.00 | 46.00 | -19.00 | peak | |

| Test Mode | TX Mode_2403 MHz |
|---|---|

**Horizontal**

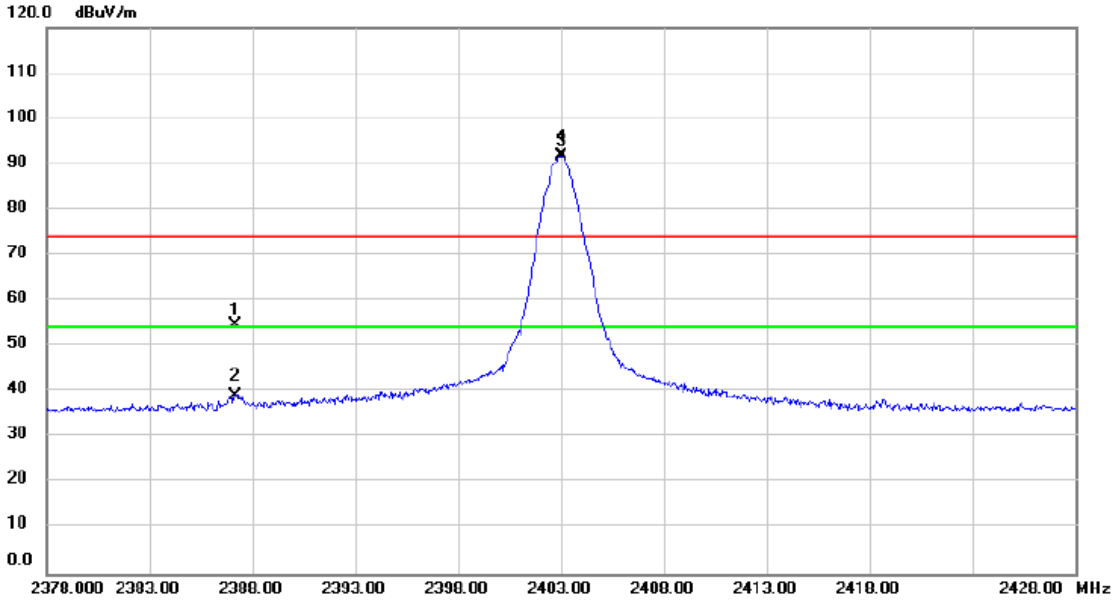



| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 137.6700 | 30.45 | -9.25 | 21.20 | 43.50 | -22.30 | peak | |
| 2 | | 175.5000 | 30.51 | -9.15 | 21.36 | 43.50 | -22.14 | peak | |
| 3 | | 275.4100 | 30.81 | -8.22 | 22.59 | 46.00 | -23.41 | peak | |
| 4 | | 320.0300 | 32.89 | -6.99 | 25.90 | 46.00 | -20.10 | peak | |
| 5 | | 388.9000 | 31.17 | -5.23 | 25.94 | 46.00 | -20.06 | peak | |
| 6 | * | 502.3900 | 30.74 | -2.69 | 28.05 | 46.00 | -17.95 | peak | |

# APPENDIX D -RADIATED EMISSION (ABOVE 1000MHZ)

| Test Mode | TX Mode_2403 MHz |
|---|---|

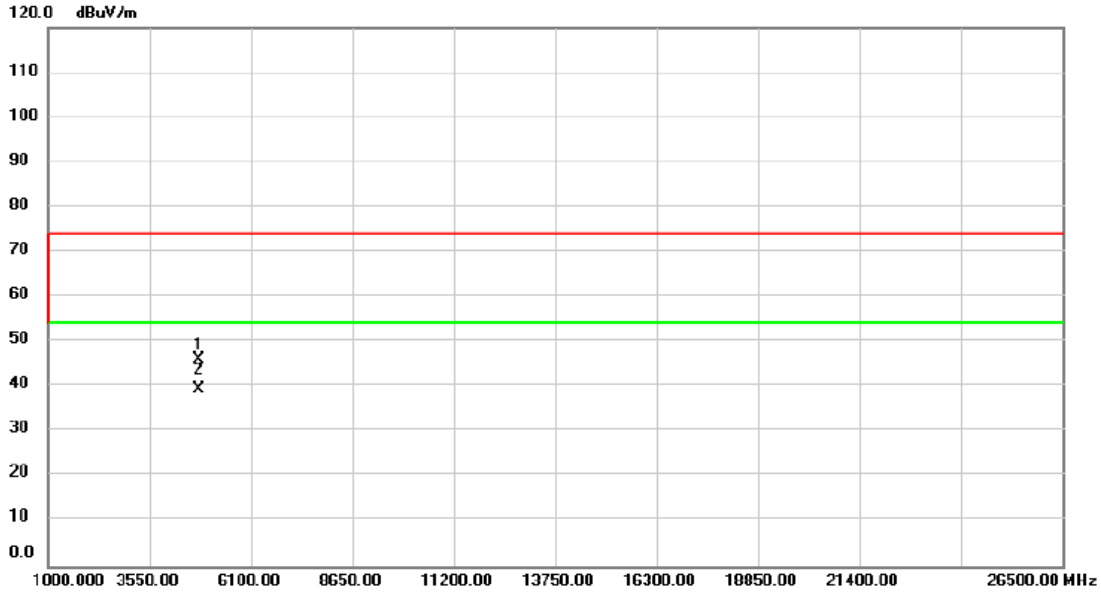
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 2387.156 | 23.68 | 31.05 | 54.73 | 74.00 | -19.27 | peak | |
| 2 | | 2387.156 | 8.18 | 31.05 | 39.23 | 54.00 | -14.77 | AVG | |
| 3 | X | 2403.000 | 60.95 | 31.11 | 92.06 | 74.00 | 18.06 | peak | No Limit |
| 4 | * | 2403.000 | 60.56 | 31.11 | 91.67 | 54.00 | 37.67 | AVG | No Limit |

| Test Mode | TX Mode_2403 MHz |
|---|---|

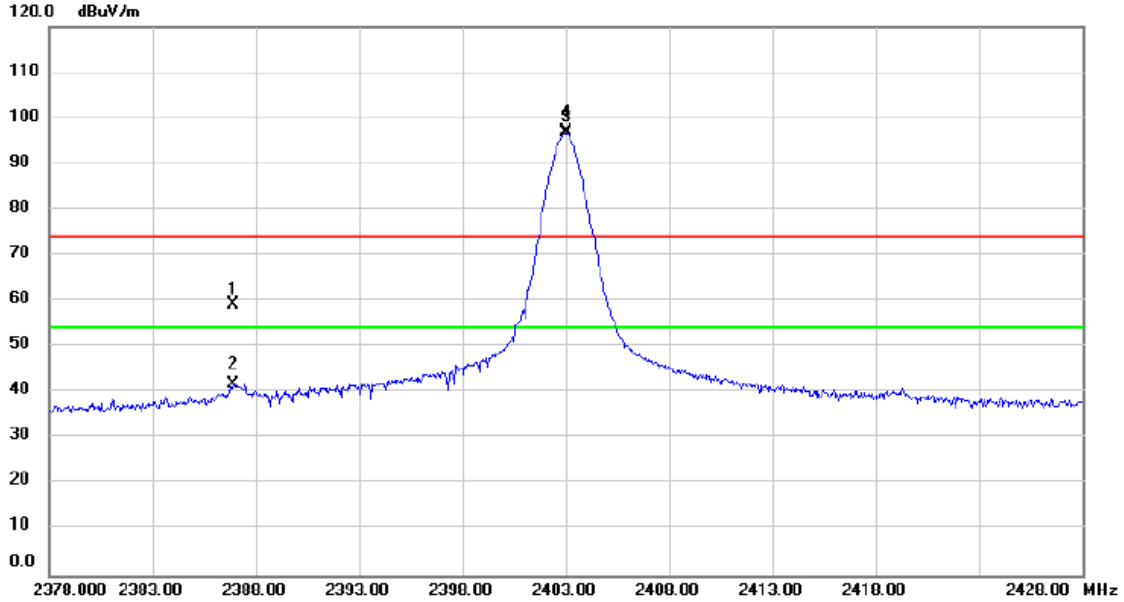
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4806.000 | 57.44 | -11.40 | 46.04 | 74.00 | -27.96 | peak | |
| 2 | * | 4806.000 | 50.94 | -11.40 | 39.54 | 54.00 | -14.46 | AVG | |

| Test Mode | TX Mode_2403 MHz |
|---|---|

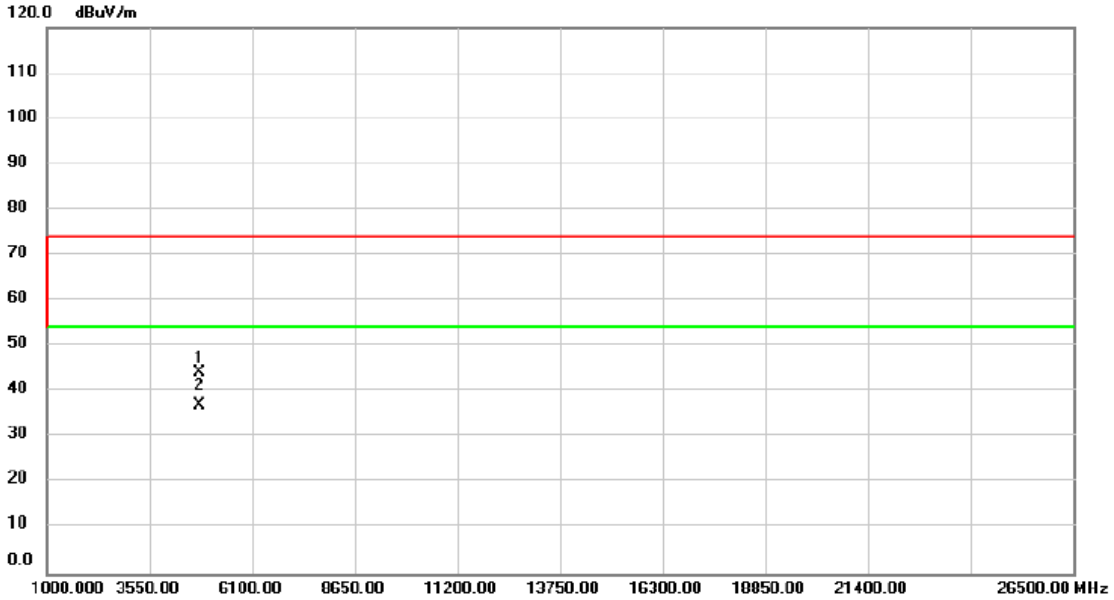
**Horizontal**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 2386.916 | 28.26 | 31.05 | 59.31 | 74.00 | -14.69 | peak | |
| 2 | | 2386.916 | 10.78 | 31.05 | 41.83 | 54.00 | -12.17 | AVG | |
| 3 | X | 2403.000 | 65.91 | 31.11 | 97.02 | 74.00 | 23.02 | peak | No Limit |
| 4 | * | 2403.000 | 65.63 | 31.11 | 96.74 | 54.00 | 42.74 | AVG | No Limit |

| Test Mode | TX Mode_2403 MHz |
|---|---|

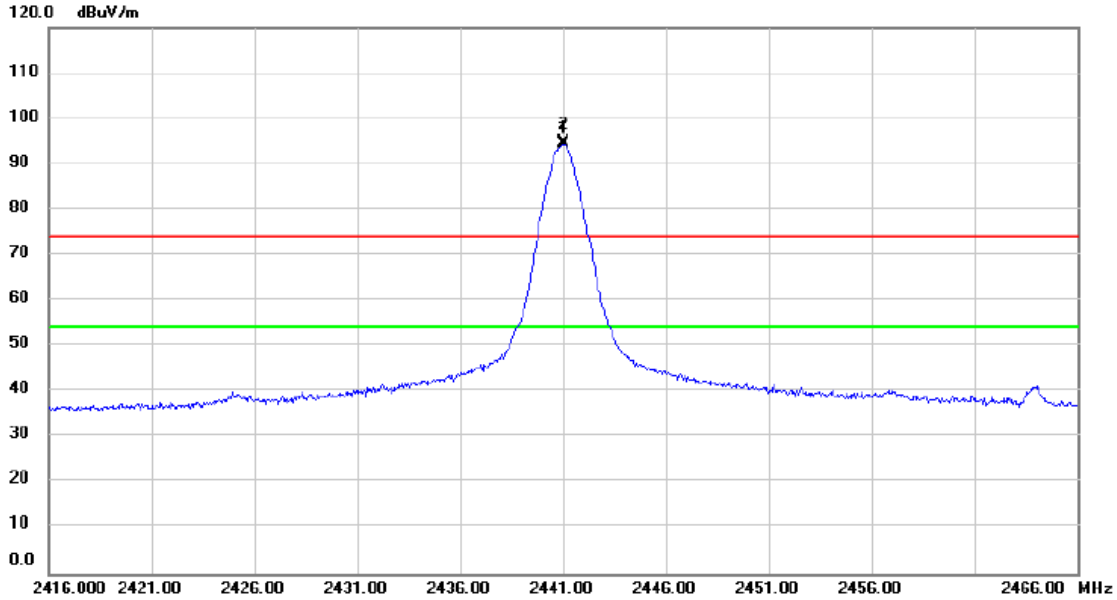
**Horizontal**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4806.000 | 55.71 | -11.40 | 44.31 | 74.00 | -29.69 | peak | |
| 2 | * | 4806.000 | 48.58 | -11.40 | 37.18 | 54.00 | -16.82 | AVG | |

| Test Mode | TX Mode_2441 MHz |
|---|---|

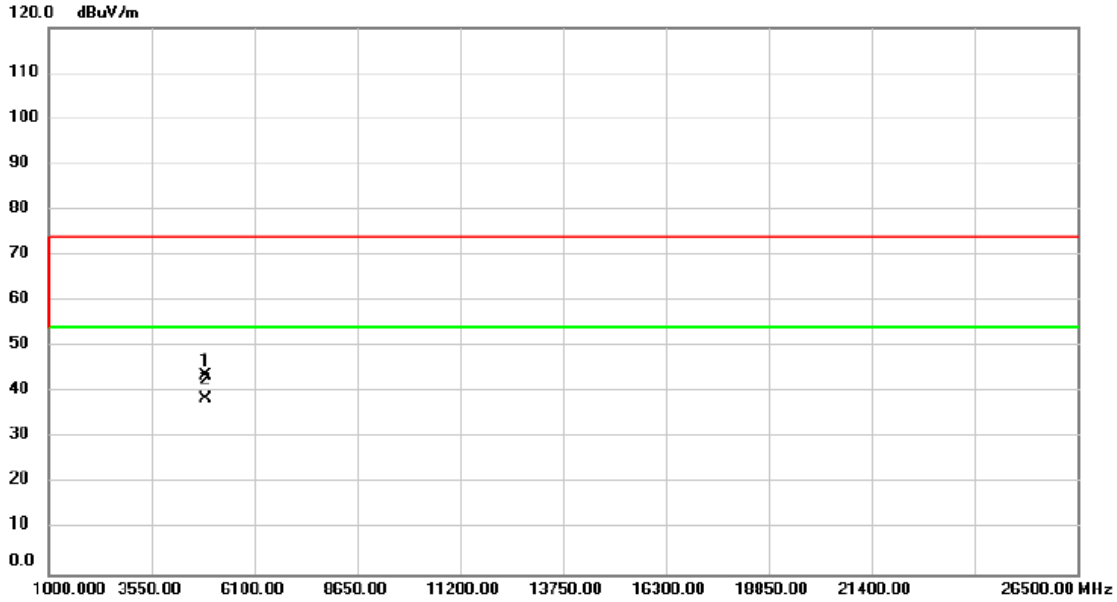
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | X | 2441.000 | 63.36 | 31.25 | 94.61 | 74.00 | 20.61 | peak | No Limit |
| 2 | * | 2441.000 | 63.04 | 31.25 | 94.29 | 54.00 | 40.29 | AVG | No Limit |

| Test Mode | TX Mode_2441 MHz |
|---|---|

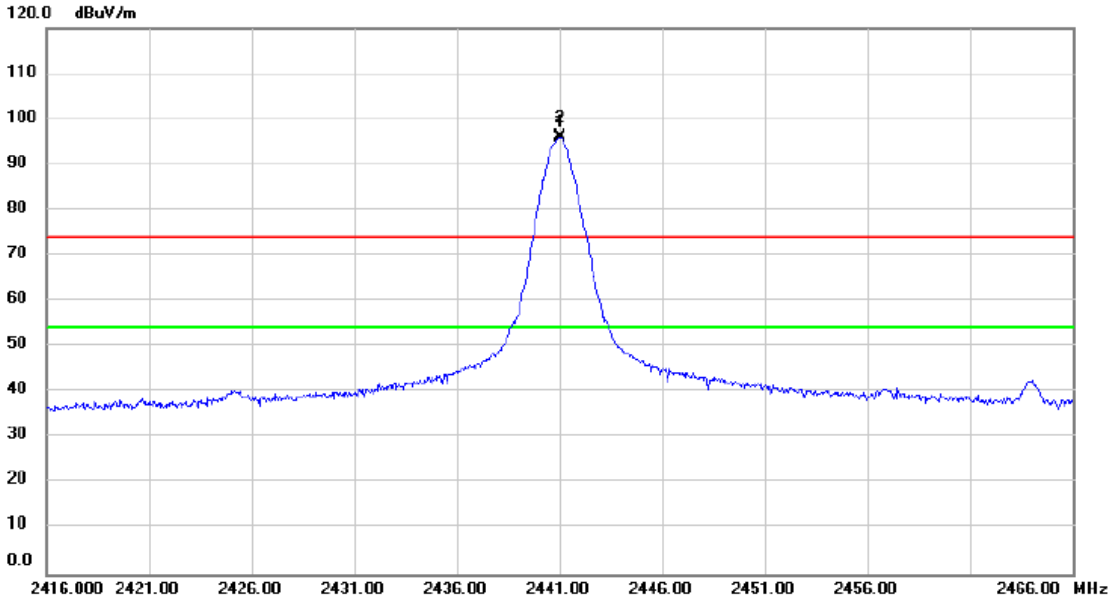
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4882.000 | 54.89 | -11.28 | 43.61 | 74.00 | -30.39 | peak | |
| 2 | * | 4882.000 | 49.83 | -11.28 | 38.55 | 54.00 | -15.45 | AVG | |

| Test Mode | TX Mode_2441 MHz |
|---|---|

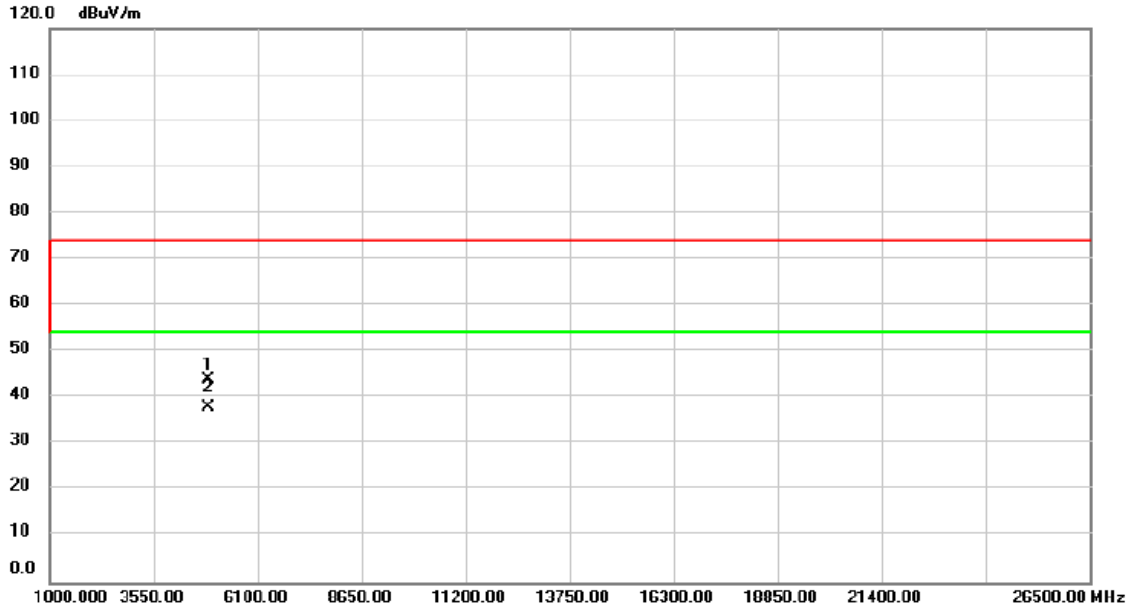
**Horizontal**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | X | 2441.000 | 64.79 | 31.25 | 96.04 | 74.00 | 22.04 | peak | No Limit |
| 2 | * | 2441.000 | 64.49 | 31.25 | 95.74 | 54.00 | 41.74 | AVG | No Limit |

| Test Mode | TX Mode_2441 MHz |
|---|---|

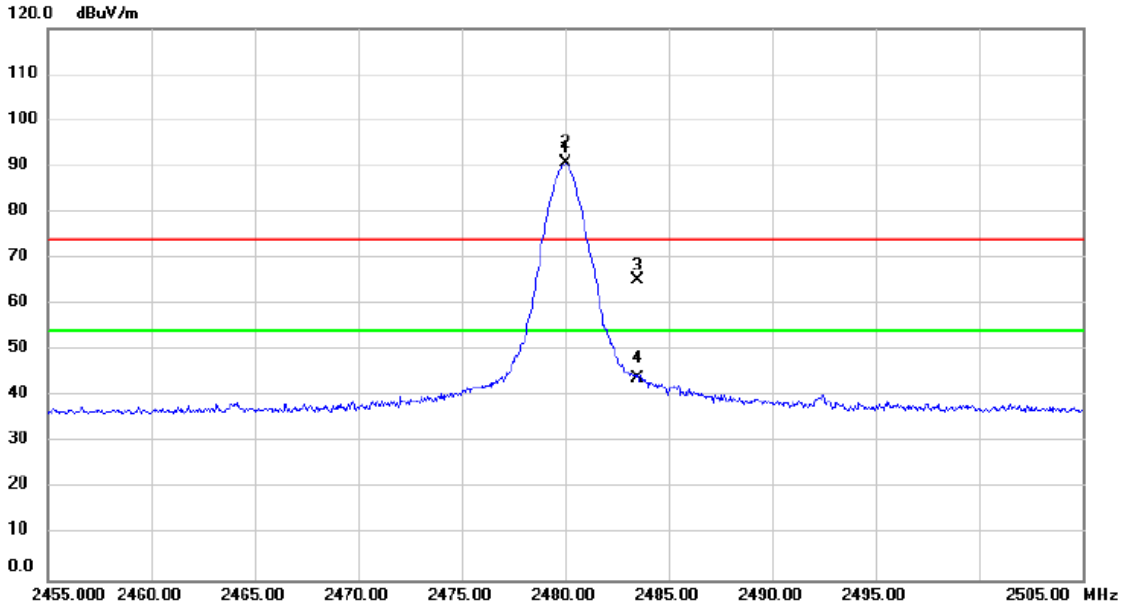
**Horizontal**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4882.000 | 55.21 | -11.28 | 43.93 | 74.00 | -30.07 | peak | |
| 2 | * | 4882.000 | 49.23 | -11.28 | 37.95 | 54.00 | -16.05 | AVG | |

| Test Mode | TX Mode_2480 MHz |
|---|---|

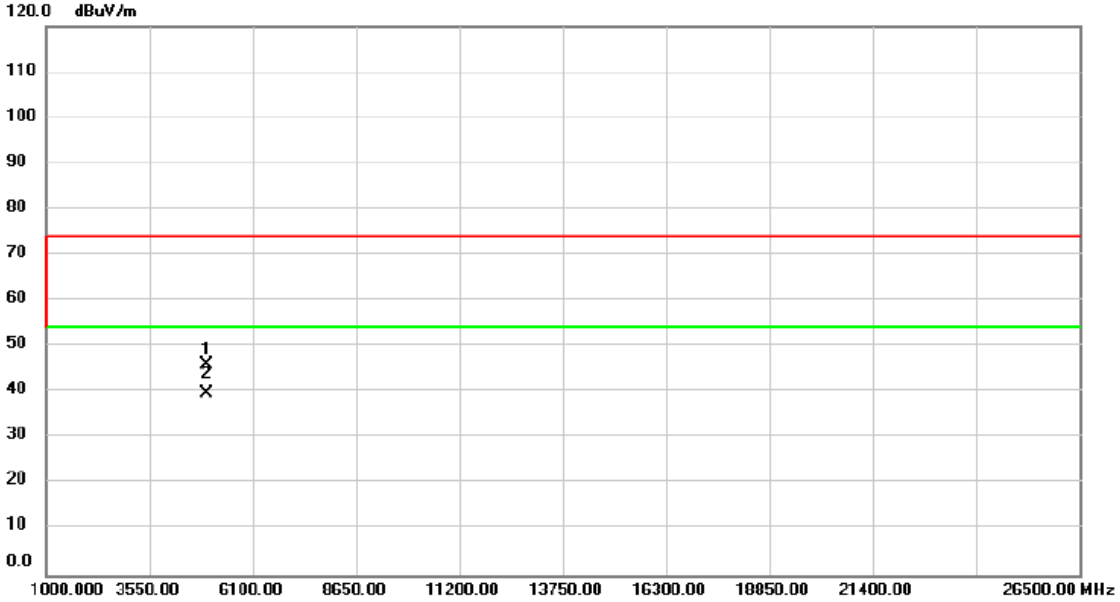
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | X | 2480.000 | 59.42 | 31.39 | 90.81 | 74.00 | 16.81 | peak | No Limit |
| 2 | * | 2480.000 | 59.27 | 31.39 | 90.66 | 54.00 | 36.66 | AVG | No Limit |
| 3 | | 2483.500 | 33.76 | 31.41 | 65.17 | 74.00 | -8.83 | peak | |
| 4 | | 2483.500 | 12.61 | 31.41 | 44.02 | 54.00 | -9.98 | AVG | |

| Test Mode | TX Mode_2480 MHz |
|---|---|

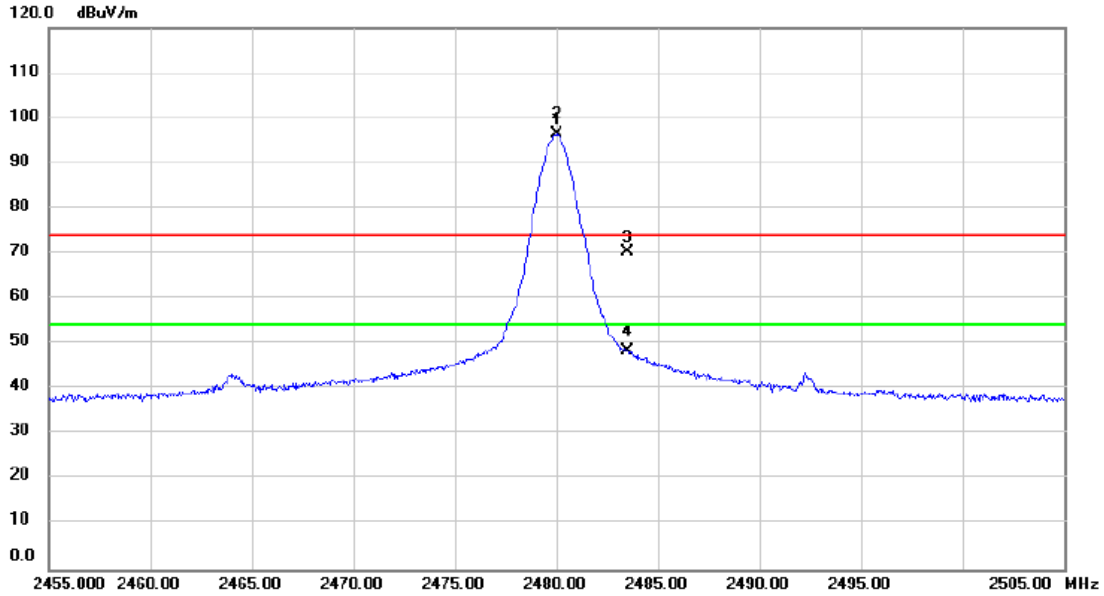
**Vertical**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4960.000 | 57.24 | -11.15 | 46.09 | 74.00 | -27.91 | peak | |
| 2 | * | 4960.000 | 50.86 | -11.15 | 39.71 | 54.00 | -14.29 | AVG | |

| Test Mode | TX Mode_2480 MHz |
|---|---|

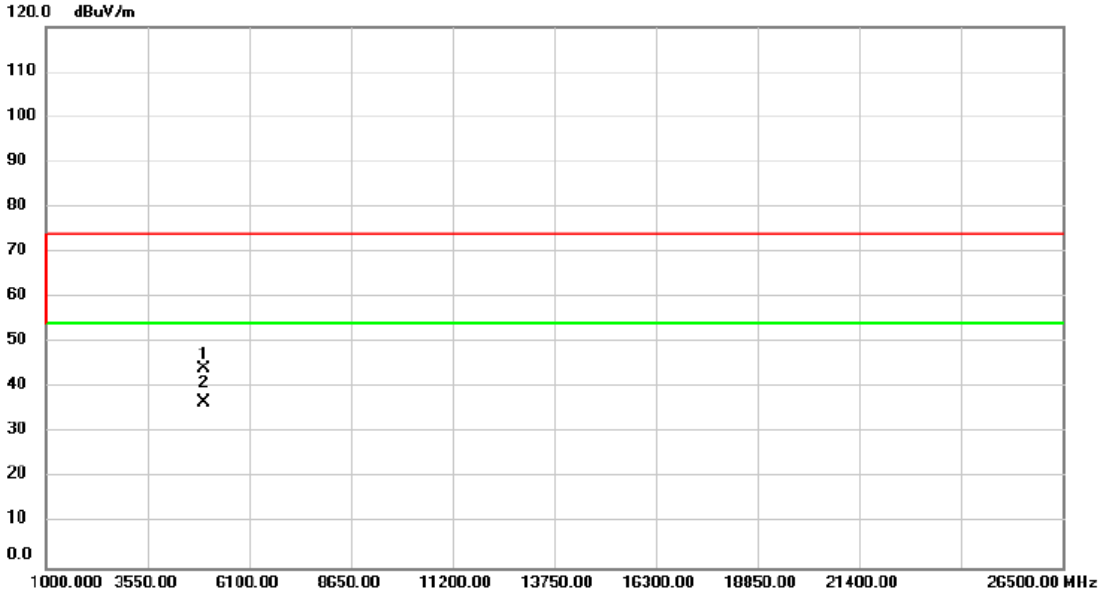
**Horizontal**




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | X | 2480.000 | 65.00 | 31.39 | 96.39 | 74.00 | 22.39 | peak | No Limit |
| 2 | * | 2480.000 | 64.92 | 31.39 | 96.31 | 54.00 | 42.31 | AVG | No Limit |
| 3 | | 2483.500 | 38.87 | 31.41 | 70.28 | 74.00 | -3.72 | peak | |
| 4 | | 2483.500 | 16.91 | 31.41 | 48.32 | 54.00 | -5.68 | AVG | |

| Test Mode | TX Mode_2480 MHz |
|---|---|

**Horizontal**



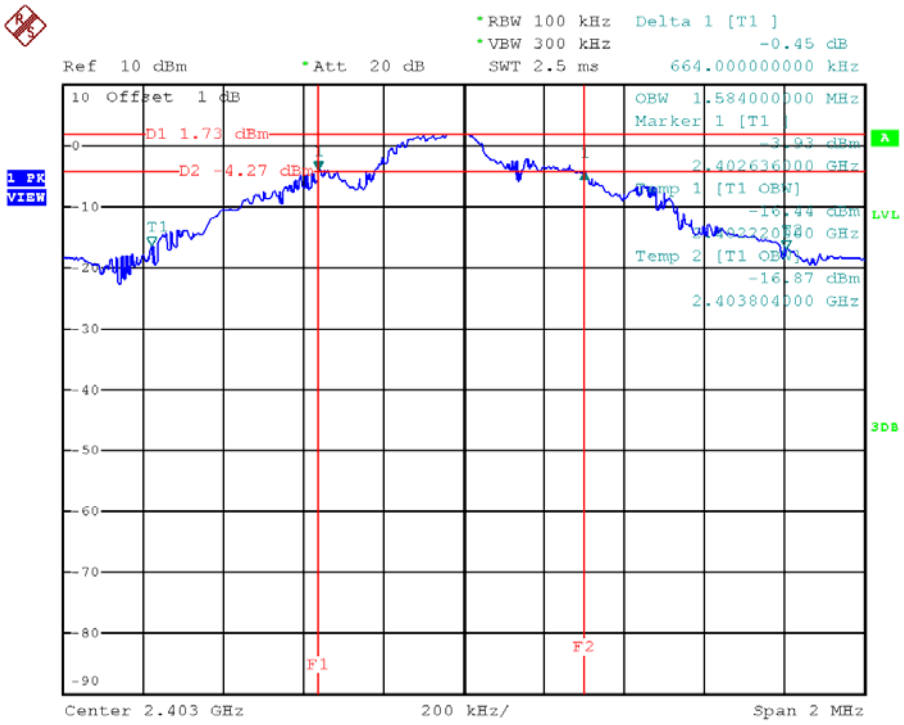

| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Margin | | |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector | Comment |
| 1 | | 4960.000 | 55.37 | -11.15 | 44.22 | 74.00 | -29.78 | peak | |
| 2 | * | 4960.000 | 48.05 | -11.15 | 36.90 | 54.00 | -17.10 | AVG | |

# APPENDIX E - BANDWIDTH

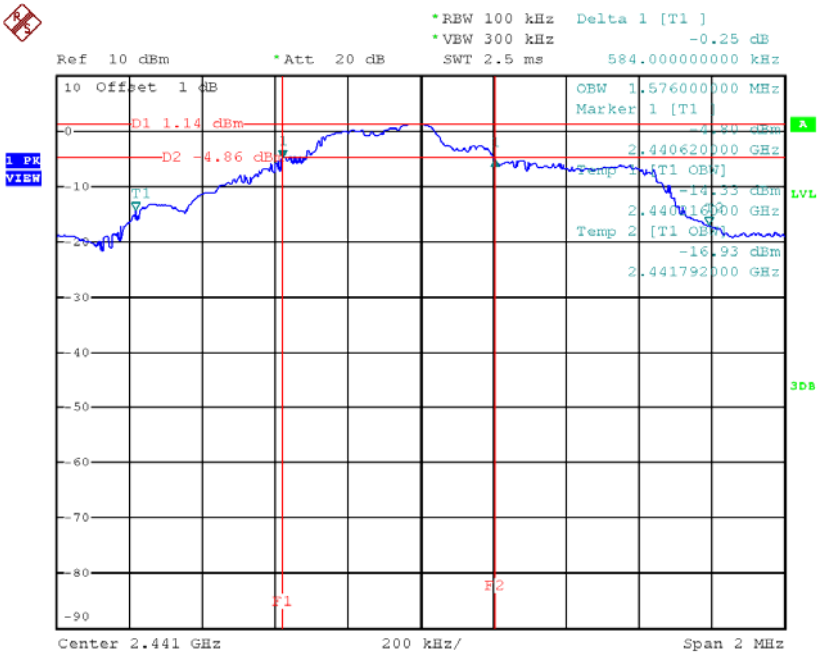
| Test Mode: | TX Mode_2403 MHz/2441 MHz/2480 MHz |
|---|---|

| Frequency (MHz) | 6dB Bandwidth (MHz) | 99% Occupied BW (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|
| 2403 | 0.66 | 1.58 | 500 | Complies |
| 2441 | 0.58 | 1.58 | 500 | Complies |
| 2480 | 0.58 | 1.65 | 500 | Complies |

**TX Mode_2403 MHz**

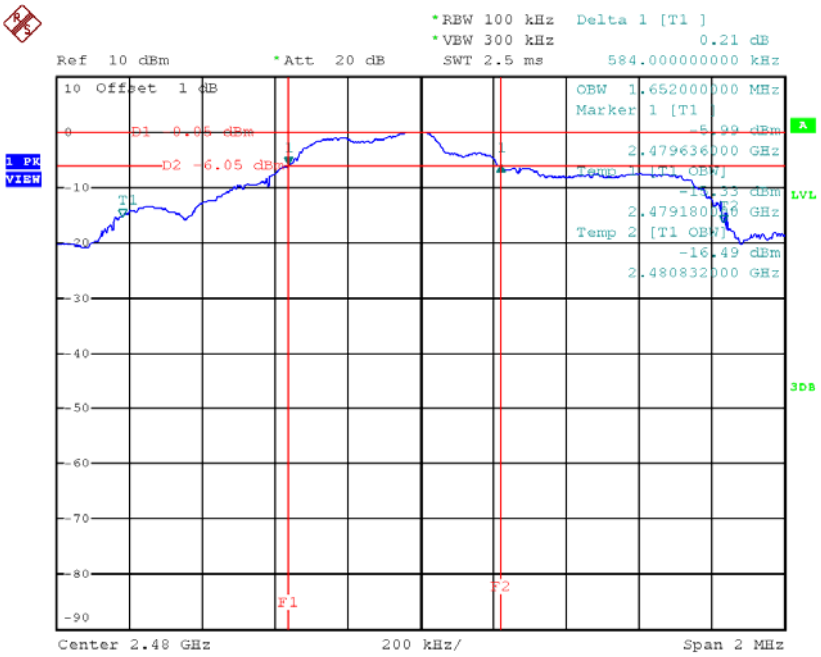


## TX Mode_2441 MHz




Date: 26.JUN.2017 12:18:40

## TX Mode_2480 MHz




Date: 26.JUN.2017 12:34:01

# APPENDIX F - CONDUCTED POWER TEST

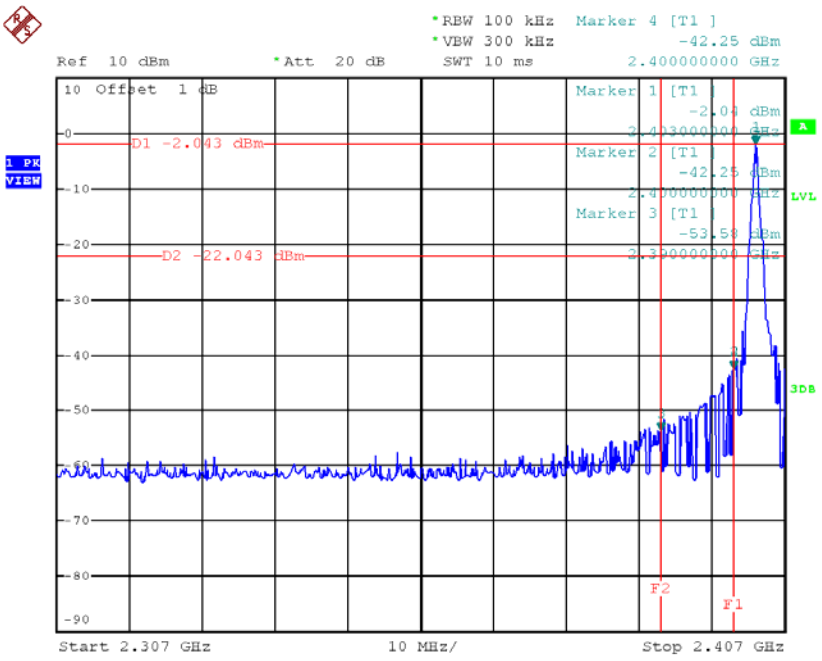
| Test Mode: | TX Mode_2403 MHz/2441 MHz/2480 MHz |
|---|---|

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) | Max. Limit (dBm) | Max. Limit (W) | Result |
|---|---|---|---|---|---|
| 2403 | 1.86 | 0.0015 | 30.00 | 1.00 | Complies |
| 2441 | 1.32 | 0.0014 | 30.00 | 1.00 | Complies |
| 2480 | 0.23 | 0.0011 | 30.00 | 1.00 | Complies |

# APPENDIX G - ANTENNA CONDUCTED SPURIOUS EMISSION

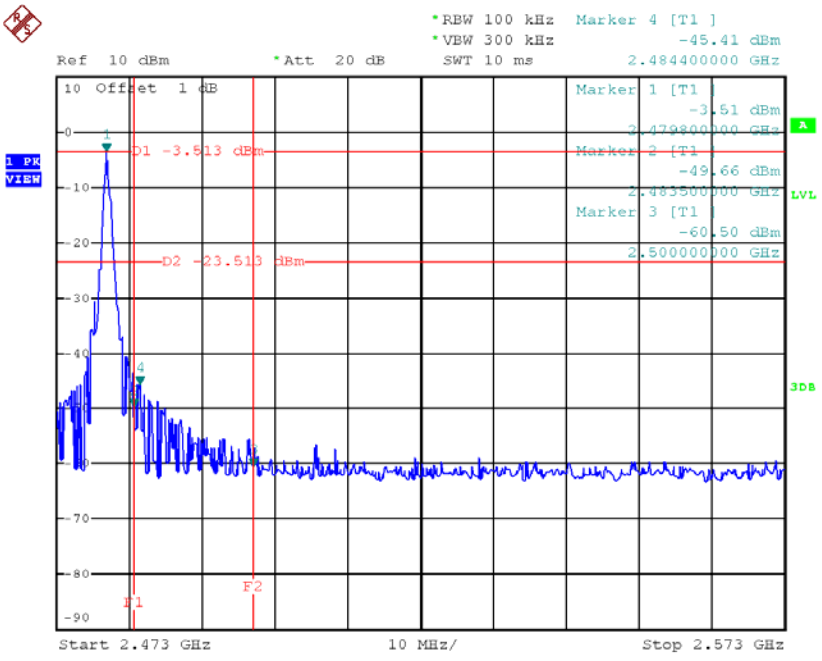
| Test Mode: | TX Mode_2403 MHz/2441 MHz/2480 MHz |
|---|---|

**CH01 (Lower)**



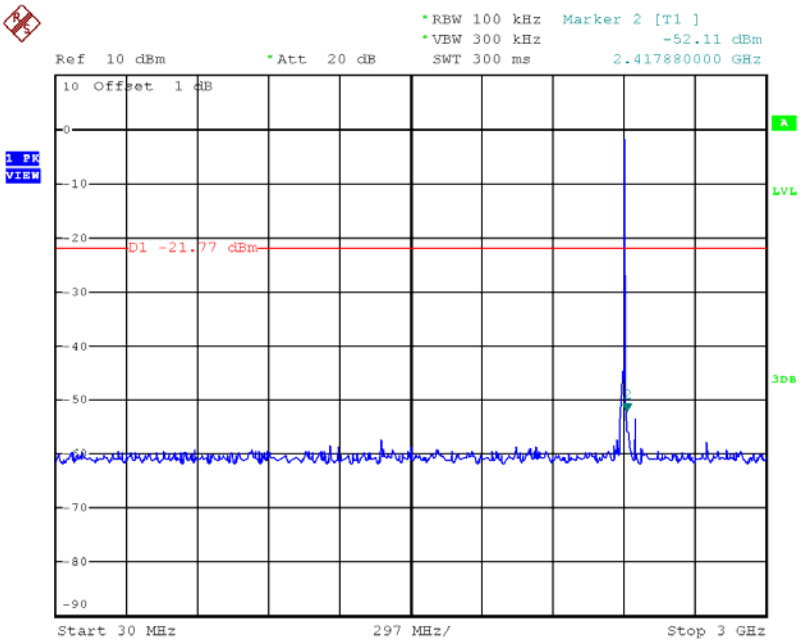

Date: 26.JUN.2017 12:11:27

**CH78 (upper)**



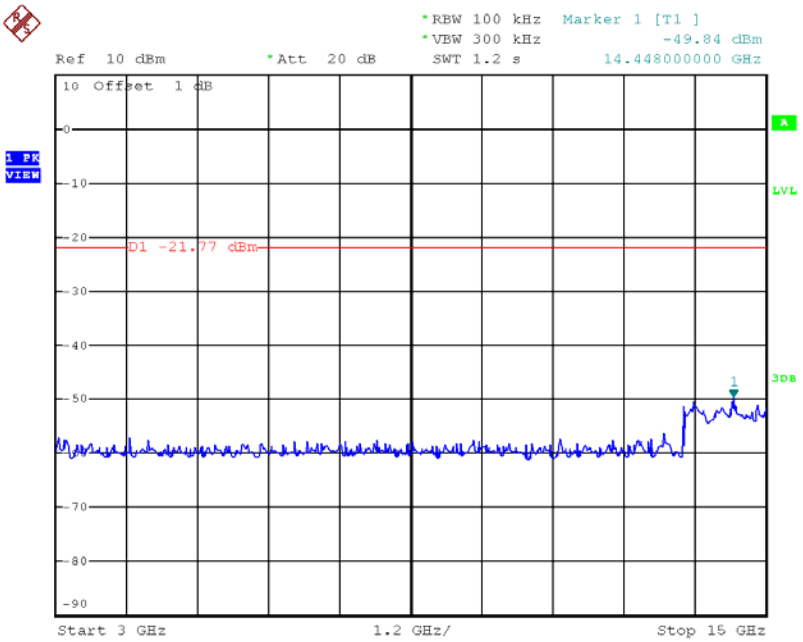

Date: 26.JUN.2017 12:35:33

## CH01 (10 Harmonic of the frequency)



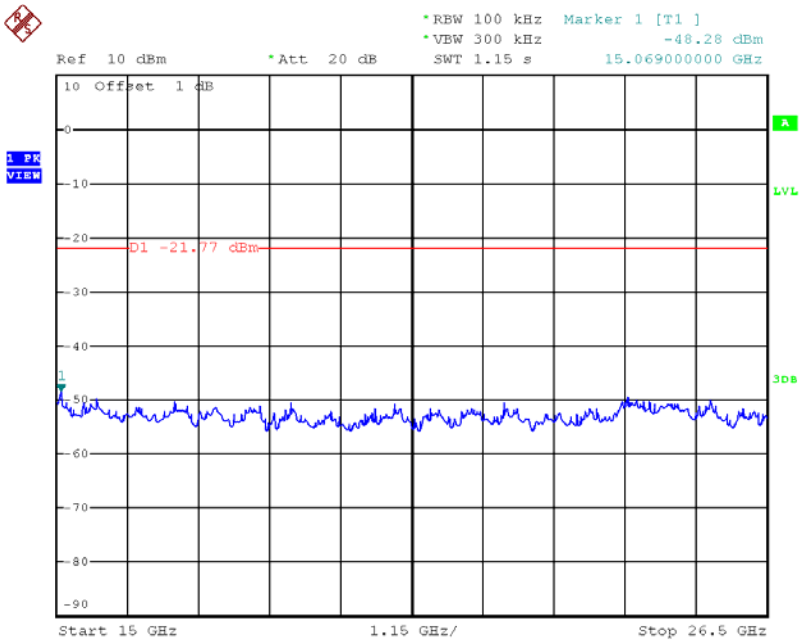

Date: 26.JUN.2017 12:11:40

## CH01 (10 Harmonic of the frequency)



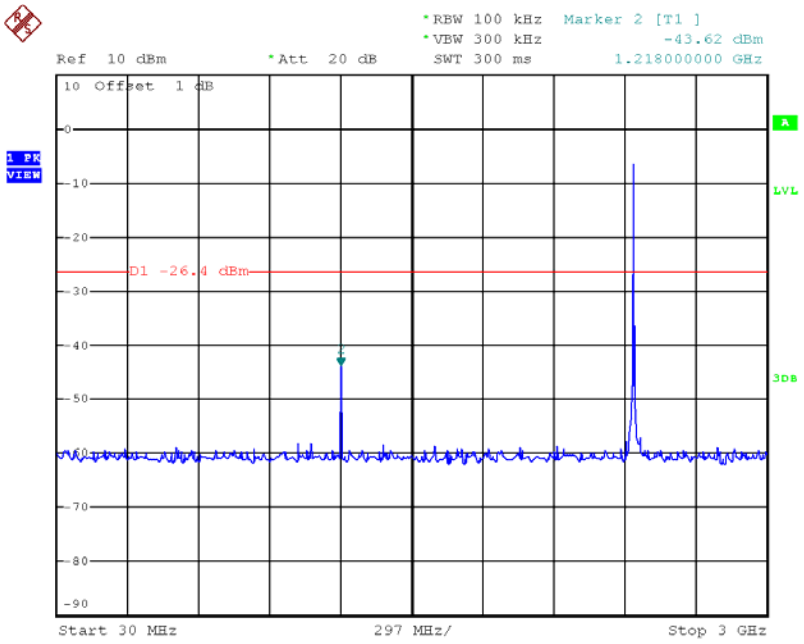

Date: 26.JUN.2017 12:11:47

## CH01 (10 Harmonic of the frequency)



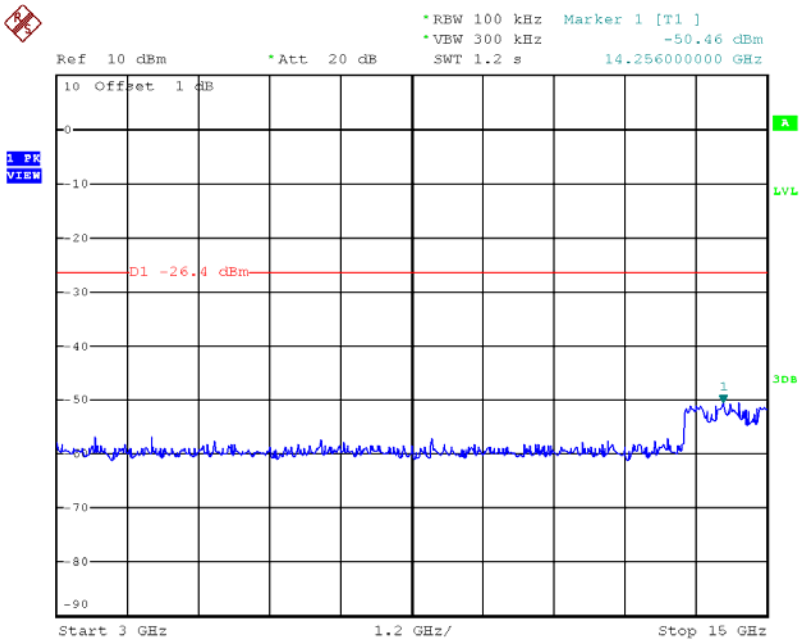

Date: 26.JUN.2017 12:11:54

## CH39 (10 Harmonic of the frequency)



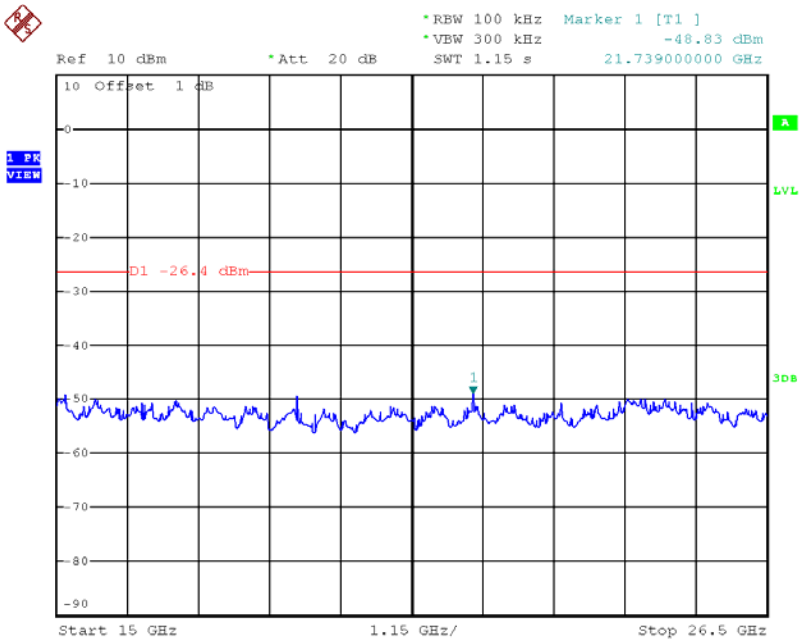

Date: 26.JUN.2017 12:21:12

## CH39 (10 Harmonic of the frequency)



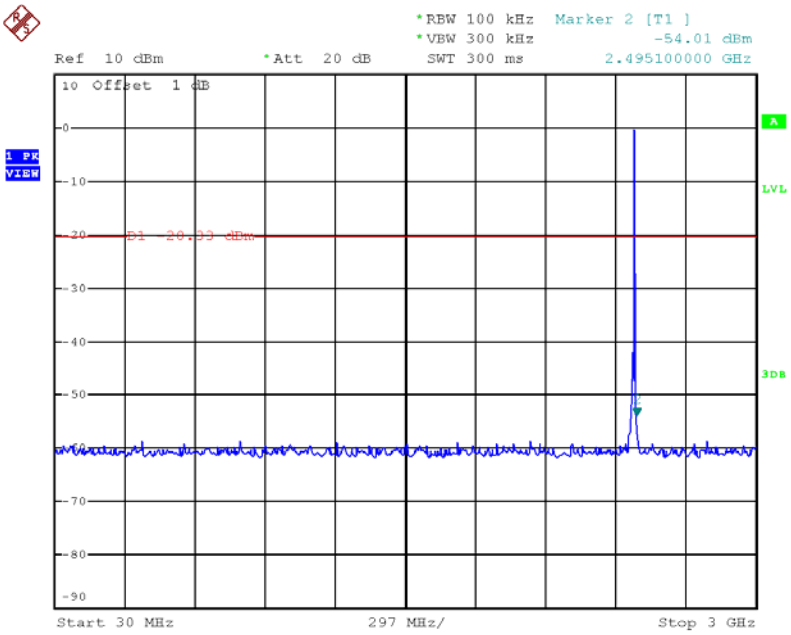

Date: 26.JUN.2017 12:21:18

## CH39 (10 Harmonic of the frequency)

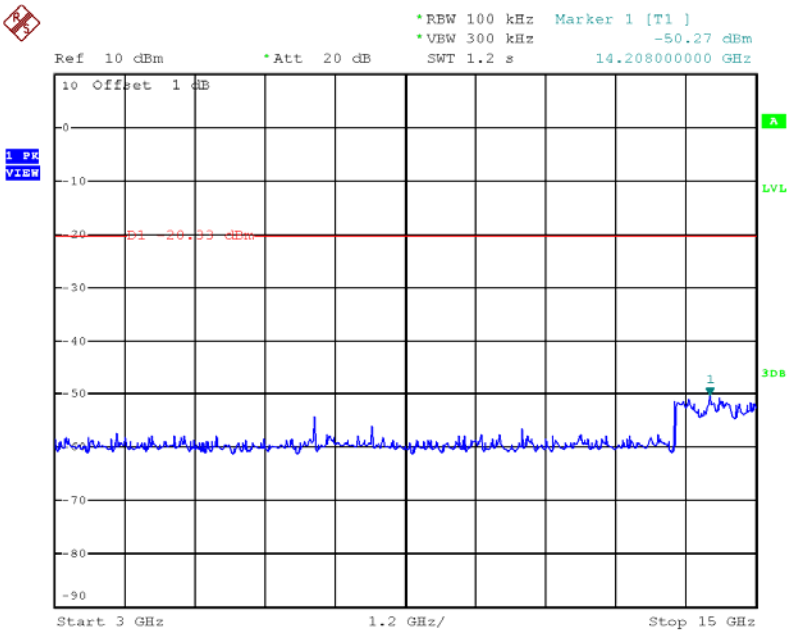



Date: 26.JUN.2017 12:21:25

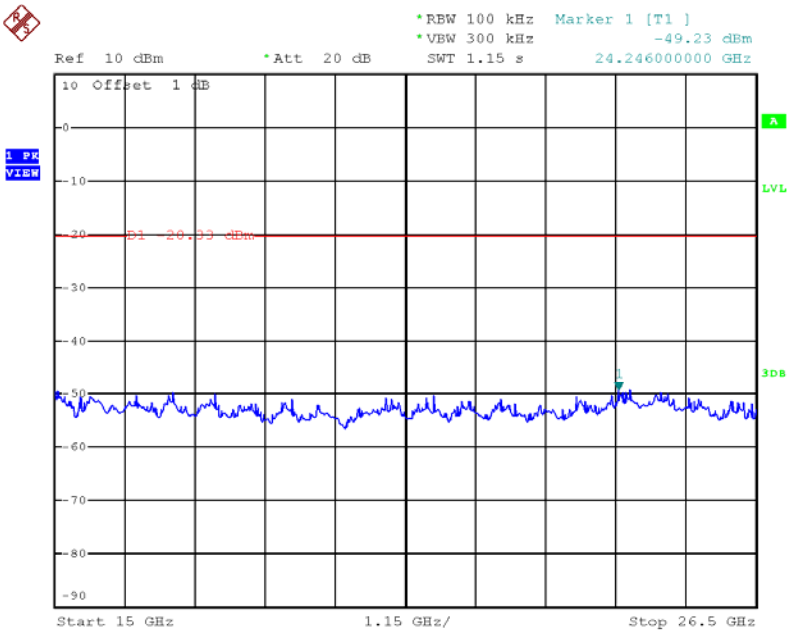
## CH78 (10 Harmonic of the frequency)




Date: 26.JUN.2017 12:26:36




Date: 26.JUN.2017 12:26:43



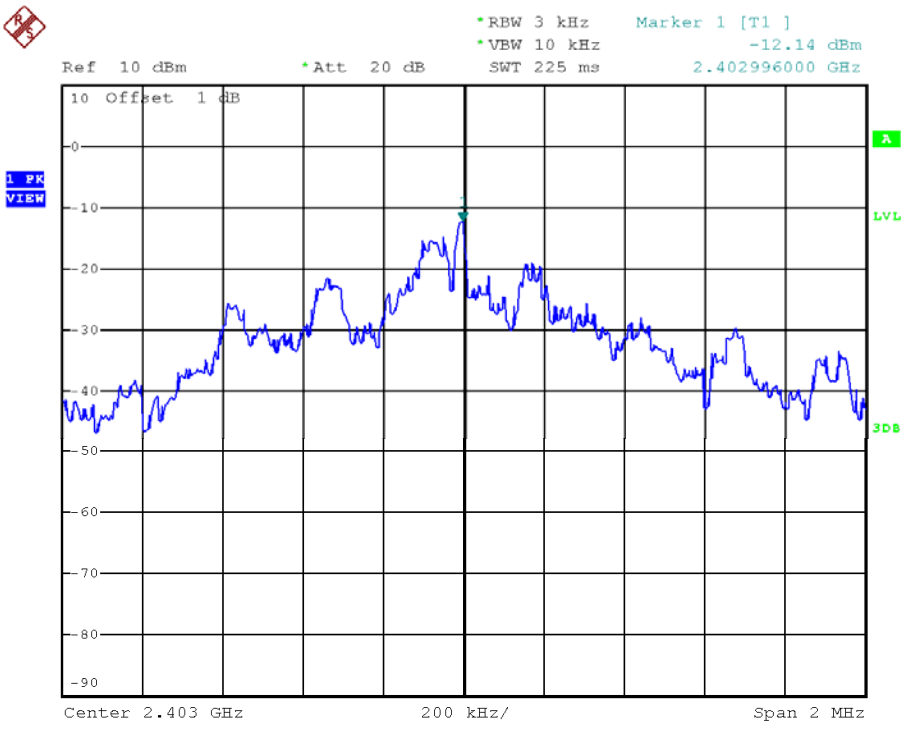

Date: 26.JUN.2017 12:26:49

# APPENDIX H - POWER SPECTRAL DENSITY TEST

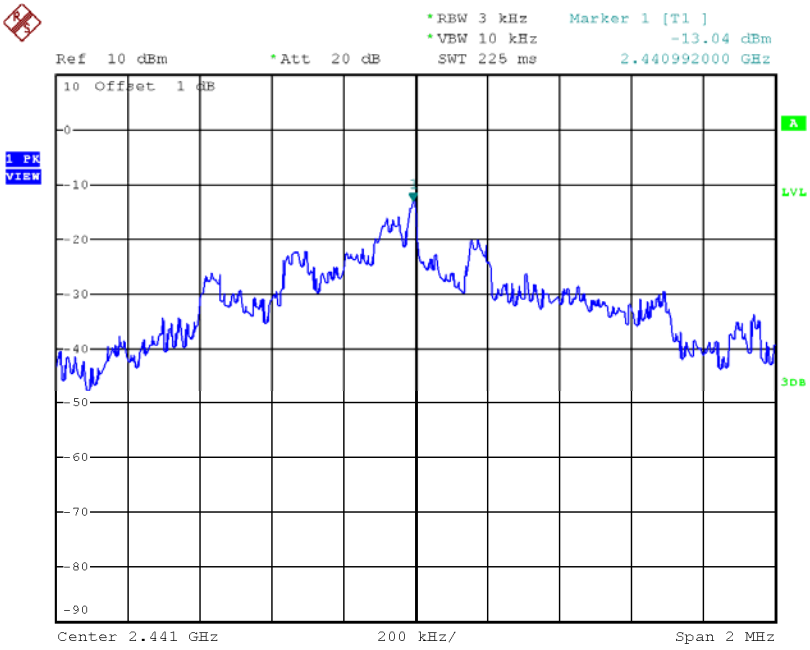
| Test Mode: | TX Mode_2403 MHz/2441 MHz/2480 MHz |
|---|---|

| Frequency (MHz) | Power Density (dBm/3kHz) | Max. Limit (dBm/3kHz) | Result |
|---|---|---|---|
| 2403 | -12.14 | 8.00 | Complies |
| 2441 | -13.04 | 8.00 | Complies |
| 2480 | -14.19 | 8.00 | Complies |

**TX CH01**

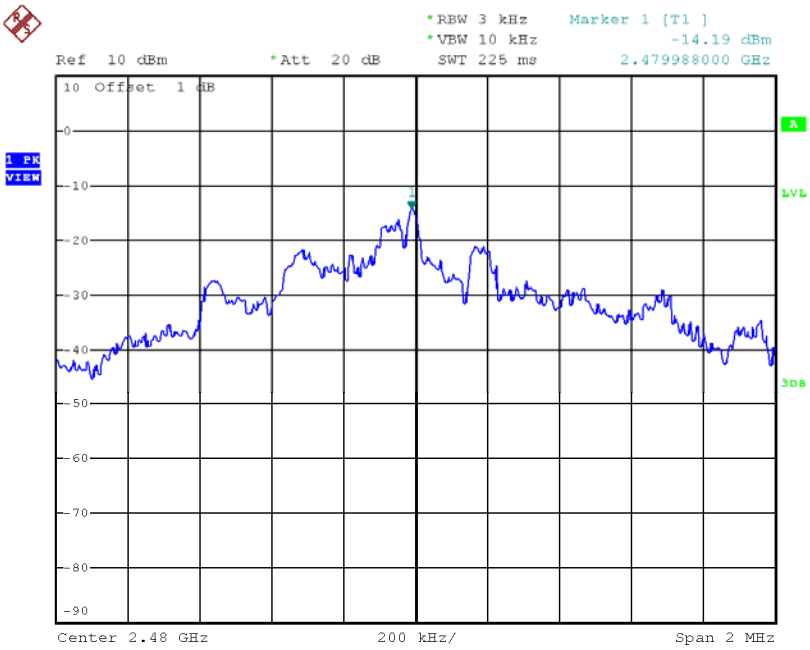


## TX CH39




Date: 26.JUN.2017 12:22:22

## TX CH78




Date: 26.JUN.2017 12:25:54