# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

*OF*

| | |
|---|---|
| **Applicant:** | Leltek Inc.<br>6F-3.,No.293,Sec.1,Beixin Rd.,Xindian Dist., New Taipei City 23143,Taiwan,R.O.C. |
| **Product Name:** | LELTEK Ultrasound Imaging System |
| **Brand Name:** | LELTEK |
| **Model No.:** | LU700C, LU700L |
| **Model Difference:** | Difference in power consumption, ultrasonic probe frequency bandwidth and appearance |
| **Report Number:** | T190305W05-RP1 |
| **FCC ID:** | 2ASEA-LU700 |
| **FCC Rule Part:** | §15.247, Cat: DTS |
| **Issue Date:** | Apr. 24, 2019 |
| **Date of Test:** | Mar. 07, 2019 ~ Mar. 16, 2019 |
| **Date of EUT Received:** | Mar. 07, 2019 |
| **Issued by:** | Compliance Certification Services Inc.Wugu Lab.<br>No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)<br>service@ccsrf.com |

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.
The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory).

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Tested By: Henry Chiang

Henry Chiang / Engineer

Approved By: Kevin Tsai

Kevin Tsai / Deputy Manager

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# Revision History

| Report Number | Revision | Description | Effected Page | Issue Date | Revised By |
|---|---|---|---|---|---|
| T190305W05-RP1 | Rev.00 | Initial creation of document | All | Mar. 28, 2019 | Elle Chang |
| T190305W05-RP1 | Rev.01 | Updated the frequency range, channels and model difference | Page 1, 5 | Apr. 24, 2019 | Elle Chang |

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# 1 GENERAL INFORMATION

## 1.1 Product description

| | |
|---|---|
| Product Name: | LELTEK Ultrasound Imaging System |
| Brand Name: | LELTEK |
| Model No.: | LU700C, LU700L |
| Model Difference: | Difference in power consumption, ultrasonic probe frequency bandwidth and appearance |
| Product HW / SW Version: | 1 / 1 |
| Radio HW / SW Version: | 1 / 1 |
| Power Supply: | 3.7Vdc from Rechargeable Battery |

| Wi-Fi 802.11 | Frequency Range | Channels | Rated Power (dBm) | Modulation Technology |
|---|---|---|---|---|
| b | 2412-2462 | 11 | 11.78 | DSSS, |
| g | | | 15.18 | OFDM |
| Antenna Type: | | Chip Antenna, Gain: 1.5dBi | | |
| Modulation type: | | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM | | |
| Transition Rate: | | 802.11 b: 1/2/5.5/11 Mbps<br>802.11 g: 6/9/12/18/24/36/48/54 Mbps | | |

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## 1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v05r01

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

## 1.3 Test Facility

Compliance Certification Services Inc. Wugu Lab. No.11, Wugong 6th Rd.,

Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.) (TAF code 1309)

FCC Designation number: TW1309

## 1.4 Special Accessories

There are no special accessories used while test was conducted.

## 1.5 Equipment Modifications

There was no modification incorporated into the EUT.

## 1.6 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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# 2 SYSTEM TEST CONFIGURATION

## 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

## 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

## 2.3 Test Procedure

### 2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz,. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

### 2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

### 2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

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## 2.4 Configuration of Tested System

**Fig. 2-1 Conducted Emission Configuration**

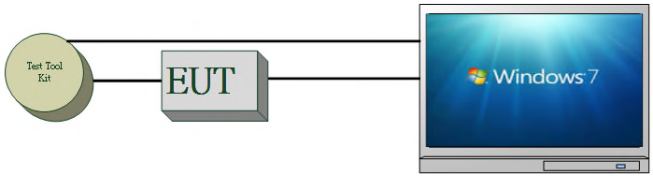


**Fig. 2-2 Radiated Emission Configuration**

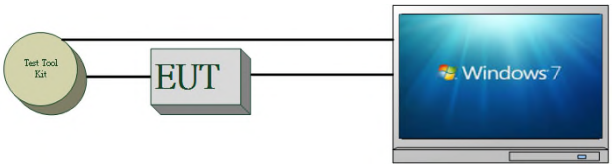


**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1 | Bluetooth Test Software | N/A | N/A | N/A | N/A | N/A |
| 2 | Test Tool Kit | N/A | N/A | N/A | N/A | N/A |
| 3 | Notebook | Lenovo | T470 | P0001293 | N/A | Un-Shielded |

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# 3 SUMMARY OF TEST RESULTS

| FCC Rules | Description Of Test | Result |
|---|---|---|
| §15.207(a) | AC Power Line Conducted Emission | Compliant |
| §15.247(b) (3) | Peak Output Power | Compliant |
| §15.247(a)(2) | 6dB & 99% Emission Bandwidth | Compliant |
| §15.247(d) | Conducted Band Edge and Spurious Emission | Compliant |
| §15.247(d) | Radiated Band Edge and Spurious Emission | Compliant |
| §15.247(e) | Power Spectral Density | Compliant |
| §15.203 §15.247(b) | Antenna Requirement | Compliant |

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# 4 DESCRIPTION OF TEST MODES

## 4.1 Operated in 2400 ~ 2483.5MHz Band

11 channels are provided for 802.11b, 802.11g

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---|---|---|---|
| 1 | 2412 MHz | 7 | 2442 MHz |
| 2 | 2417 MHz | 8 | 2447 MHz |
| 3 | 2422 MHz | 9 | 2452 MHz |
| 4 | 2427 MHz | 10 | 2457 MHz |
| 5 | 2432 MHz | 11 | 2462 MHz |
| 6 | 2437 MHz | | |

## 4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

**AC POWER LINE CONDUCTED EMISSION TEST:**

| | |
|---|---|
| **Test Condition** | AC Power line conducted emission for line and neutral |
| **Worst Case** | Operation in normal mode |

**RADIATED EMISSION TEST:**

| RADIATED EMISSION TEST (BELOW 1 GHz) | | | | |
|---|---|---|---|---|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| 802.11g | 1 to 11 | 1,6,11 | OFDM | 6 |

| RADIATED EMISSION TEST (ABOVE 1 GHz) | | | | |
|---|---|---|---|---|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| 802.11b | 1 to 11 | 1, 6, 11 | DSSS | 1 |
| 802.11g | 1 to 11 | 1, 6, 11 | OFDM | 6 |

**Note:**

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11b/g WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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## ANTENNA PORT CONDUCTED MEASUREMENT:

| CONDUCTED TEST | | | | |
|---|---|---|---|---|
| MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) |
| 802.11b | 1 to 11 | 1, 6, 11 | DSSS | 1 |
| 802.11g | 1 to 11 | 1, 6, 11 | OFDM | 6 |

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# 5 MEASUREMENT UNCERTAINTY

| PARAMETER | UNCERTAINTY |
|---|---|
| AC Powerline Conducted Emission | +/- 1.2575 dB |
| Peak Output Power | +/- 1.92 dB |
| 6dB Bandwidth | +/- 61.248 Hz |
| 100 kHz Bandwidth of Frequency Band Edges | +/- 1.92 dB |
| Peak Power Density | +/- 1.996 dB |
| 3M Semi Anechoic Chamber / 30M~200M | +/- 4.12 dB |
| 3M Semi Anechoic Chamber / 200M~1000M | +/- 4.68 dB |
| 3M Semi Anechoic Chamber / 1G~8G | +/- 5.18 dB |
| 3M Semi Anechoic Chamber / 8G~18G | +/- 5.47 dB |
| 3M Semi Anechoic Chamber / 18G~26G | +/- 3.81 dB |
| 3M Semi Anechoic Chamber / 26G~40G | +/- 3.87 dB |

***Note:***

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

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# 6 CONDUCTED EMISSION TEST

## 6.1 Standard Applicable

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range MHz | Limits dB(uV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Note<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

## 6.2 Measurement Equipment Used

| Conduction(RF) | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| CABLE | EMCI | CFD300-NL | CERF | 06/29/2018 | 06/28/2019 |
| EMI Test Receiver | R&S | ESCI | 100064 | 07/24/2018 | 07/23/2019 |
| LISN | SCHWARZBECK | NSLK 8127 | 8127-541 | 01/31/2019 | 01/30/2020 |
| LISN | SCHAFFNER | NNB 41 | 03/10013 | 02/13/2019 | 02/12/2020 |
| Software | EZ-EMC(CCS-3A1-CE) | | | | |

## 6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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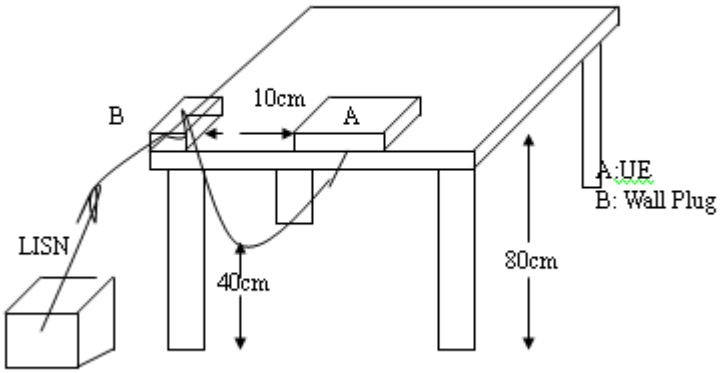
## 6.4 Test SET-UP (Block Diagram of Configuration)




## 6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

## 6.6 Measurement Result

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closet to the limit.

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# AC POWER LINE CONDUCTED EMISSION TEST DATA

| | | | |
|---|---|---|---|
| **Description:** | **Operation** | **Date:** | **2019/3/8** |
| **Line:** | **L1** | **Temp.(℃)/Hum.(%):** | **25(℃)/58%** |
| **Test Voltage:** | **AC 120V/60Hz** | **Test By:** | **Henry** |

| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dBuV) | (dB) | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | |
| 1 | 0.1780 | 46.68 | 32.87 | 0.15 | 46.83 | 33.02 | 64.58 | 54.58 | -17.75 | -21.56 | Pass |
| 2 | 0.2980 | 43.46 | 36.06 | 0.15 | 43.61 | 36.21 | 60.30 | 50.30 | -16.69 | -14.09 | Pass |
| 3 | 0.3220 | 45.54 | 36.02 | 0.16 | 45.70 | 36.18 | 59.66 | 49.66 | -13.96 | -13.48 | Pass |
| 4 | 11.8140 | 39.15 | 34.61 | 0.51 | 39.66 | 35.12 | 60.00 | 50.00 | -20.34 | -14.88 | Pass |
| 5* | 15.6820 | 45.15 | 39.50 | 0.59 | 45.74 | 40.09 | 60.00 | 50.00 | -14.26 | -9.91 | Pass |
| 6 | 18.4300 | 41.06 | 38.06 | 0.66 | 41.72 | 38.72 | 60.00 | 50.00 | -18.28 | -11.28 | Pass |

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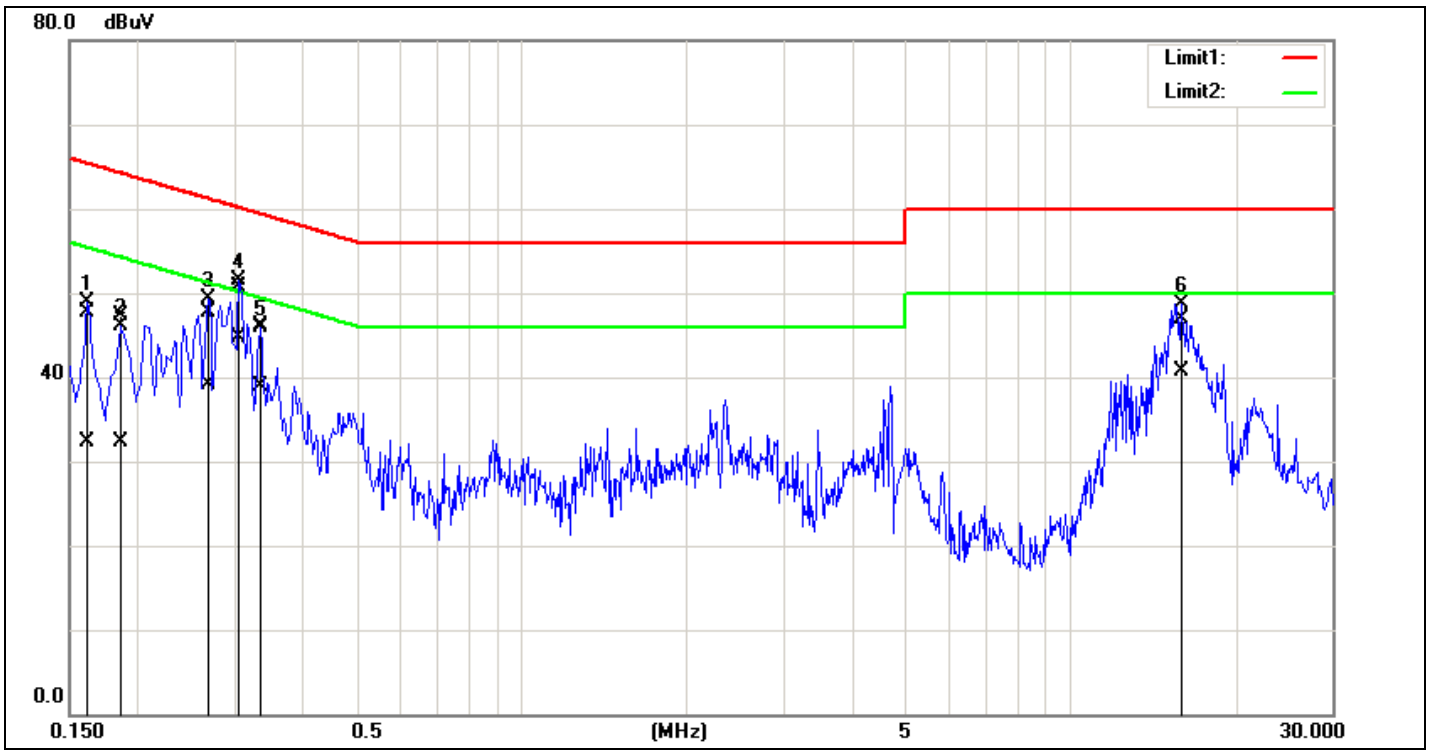
| | | | |
|---|---|---|---|
| **Description:** | **Operation** | **Date:** | **2019/3/8** |
| **Line:** | **N** | **Temp.(℃)/Hum.(%):** | **25(℃)/58%** |
| **Test Voltage:** | **AC 120V/60Hz** | **Test By:** | **Henry** |




| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak result | Average result | QuasiPeak limit | Average limit | QuasiPeak margin | Average margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dBuV) | (dB) | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | |
| 1 | 0.1620 | 47.65 | 32.14 | 0.10 | 47.75 | 32.24 | 65.36 | 55.36 | -17.61 | -23.12 | Pass |
| 2 | 0.1860 | 47.13 | 32.23 | 0.10 | 47.23 | 32.33 | 64.21 | 54.21 | -16.98 | -21.88 | Pass |
| 3 | 0.2700 | 47.59 | 38.98 | 0.10 | 47.69 | 39.08 | 61.12 | 51.12 | -13.43 | -12.04 | Pass |
| 4* | 0.3060 | 50.64 | 44.66 | 0.11 | 50.75 | 44.77 | 60.08 | 50.08 | -9.33 | -5.31 | Pass |
| 5 | 0.3340 | 45.91 | 38.89 | 0.11 | 46.02 | 39.00 | 59.35 | 49.35 | -13.33 | -10.35 | Pass |
| 6 | 15.8860 | 46.41 | 40.32 | 0.48 | 46.89 | 40.80 | 60.00 | 50.00 | -13.11 | -9.20 | Pass |

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# 7 DUTY CYCLE OF TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

**Formula:**

Duty Cycle = Ton / (Ton+Toff)

**Measurement Procedure:**

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

**Duty Cycle:**

| | Duty Cycle (%) | Duty Factor (dB) | 1/T (kHz) | VBW setting (kHz) |
|---|---|---|---|---|
| 802.11b | 96.94 | 0.13 | 0.09 | 1.00 |
| 802.11g | 93.02 | 0.31 | 0.53 | 1.00 |

*b = 96.94%, g = 93.02%*

Duty Cycle Factor: 10 * log(1/0.9694) = 0.13
Duty Cycle Factor: 10 * log(1/0.9302) = 0.31

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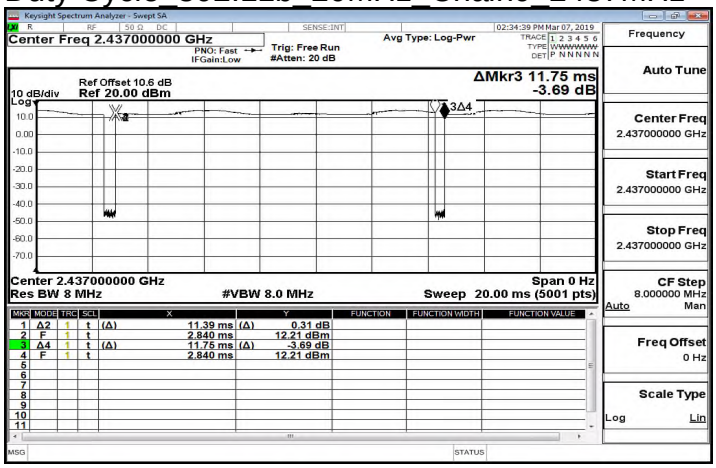
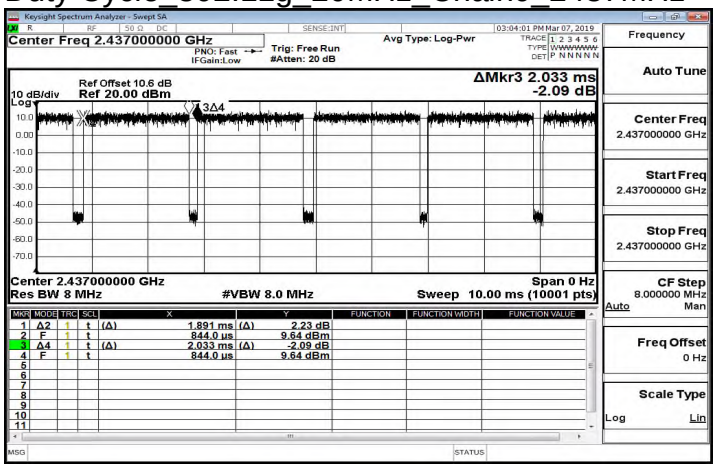
## 7.1 DUTY CYCLE TEST SIGNAL Measurement Result

Duty Cycle_802.11b_20MHz_Chain0_2437MHz




Duty Cycle_802.11g_20MHz_Chain0_2437MHz

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# 8 PEAK OUTPUT POWER MEASUREMENT

## 8.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

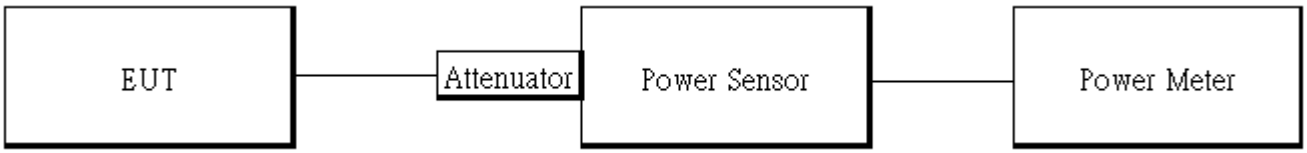
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

## 8.2 Measurement Equipment Used

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Power Meter | Anritsu | ML2496A | 1242004 | 10/23/2018 | 10/22/2019 |
| Power Sensor | Anritsu | MA2411B | 1207365 | 10/23/2018 | 10/22/2019 |
| Power Sensor | Anritsu | MA2411B | 1207368 | 10/24/2018 | 10/23/2019 |
| Attenuator | Marvelous | MVE2213-10 | RF80 | 02/26/2019 | 02/25/2020 |

## 8.3 Test Set-up

Power Meter:




## 8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
   **Power Meter:**
   It is used as the auxiliary test equipment to conduct the output power measurement.
4. Record the max. Reading as observed from Spectrum or Power Meter.

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## 8.5 Measurement Result

| 802.11b Ch0 | | | | | |
|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Peak Output Power (dBm) | Limit (dBm) | RESULT |
| 1 | 2412 | 1 | 11.74 | 30.00 | PASS |
| 6 | 2437 | 1 | **11.78** | 30.00 | PASS |
| 11 | 2462 | 1 | 11.75 | 30.00 | PASS |
| 802.11b Ch0 | | | | | |
| CH | Freq. (MHz) | Data Rate | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| 1 | 2412 | 1 | 9.36 | 30.00 | PASS |
| 6 | 2437 | 1 | **9.39** | 30.00 | PASS |
| 11 | 2462 | 1 | 9.37 | 30.00 | PASS |

| 802.11g Ch0 | | | | | |
|---|---|---|---|---|---|
| CH | Freq. (MHz) | Data Rate | Peak Output Power (dBm) | Limit (dBm) | RESULT |
| 1 | 2412 | 6 | 15.09 | 30.00 | PASS |
| 6 | 2437 | 6 | **15.18** | 30.00 | PASS |
| 11 | 2462 | 6 | 15.13 | 30.00 | PASS |
| 802.11g Ch0 | | | | | |
| CH | Freq. (MHz) | Data Rate | Max. Avg. Output include tune up tolerance Power (dBm) | Limit (dBm) | RESULT |
| 1 | 2412 | 6 | 8.18 | 30.00 | PASS |
| 6 | 2437 | 6 | **8.34** | 30.00 | PASS |
| 11 | 2462 | 6 | 8.24 | 30.00 | PASS |

**** Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.***

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# 9 6DB BANDWIDTH MEASUREMENT

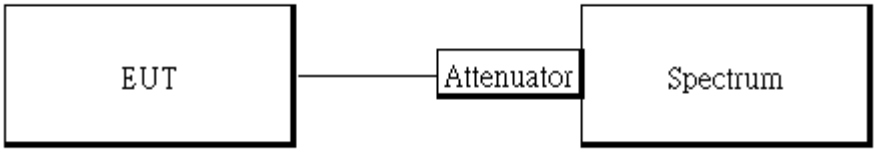
## 9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

## 9.2 Measurement Equipment Used

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Spectrum Analyzer | Agilent | N9010A | MY53400256 | 11/21/2018 | 11/20/2019 |
| Attenuator | Marvelous | MVE2213-10 | RF80 | 02/26/2019 | 02/25/2020 |
| DC Block | PASTERNACK | PE8210 | RF29 | 02/26/2019 | 02/25/2020 |

## 9.3 Test Set-up




## 9.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. For 6dB Bandwidth:

   Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=peak, Sweep=auto.
5. Mark the peak frequency and –6dB (upper and lower) frequency.
6. For 99% Bandwidth:

   Set the spectrum analyzer as RBW=1%, VBW = 3*RBW, Span = 30M/50MHz, Detector=Sample, Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all frequency of interest measured was complete.

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## 9.5 Measurement Result

### 6dB Bandwidth

802.11b Ch0

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2412 | 9122.00 | > 500 | PASS |
| 2437 | **9124.00** | > 500 | PASS |
| 2462 | **9124.00** | > 500 | PASS |

802.11g Ch0

| Freq. (MHz) | 6dB BW (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2412 | 15100.00 | > 500 | PASS |
| 2437 | 15120.00 | > 500 | PASS |
| 2462 | **15130.00** | > 500 | PASS |

**Refer to next page for plots*

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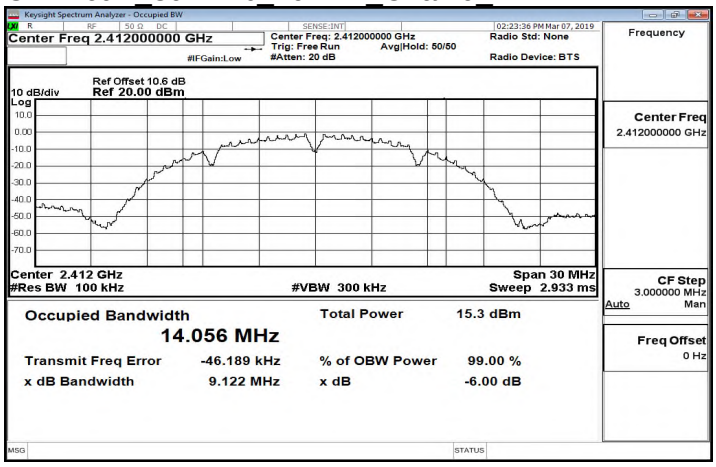
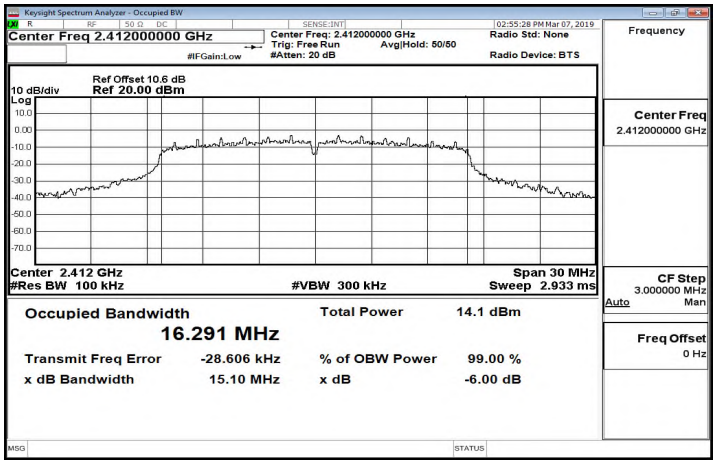
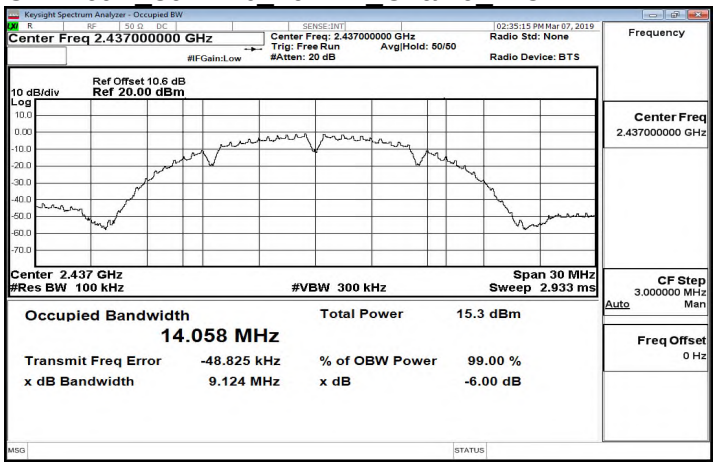
OBW 6dB_802.11b_20MHz_Chain0_2412MHz



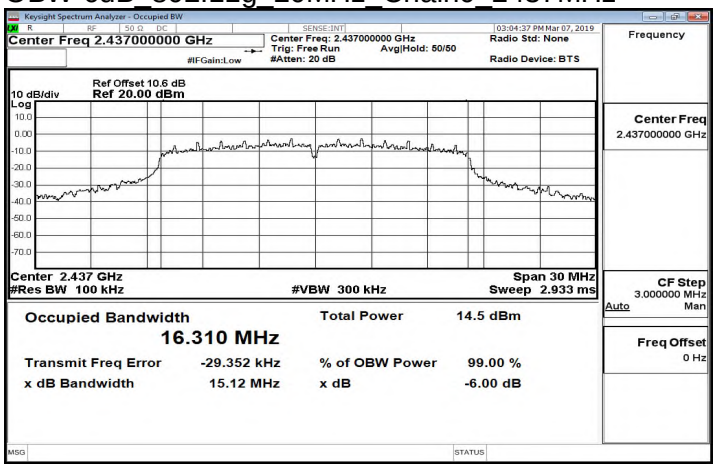

OBW 6dB_802.11g_20MHz_Chain0_2412MHz



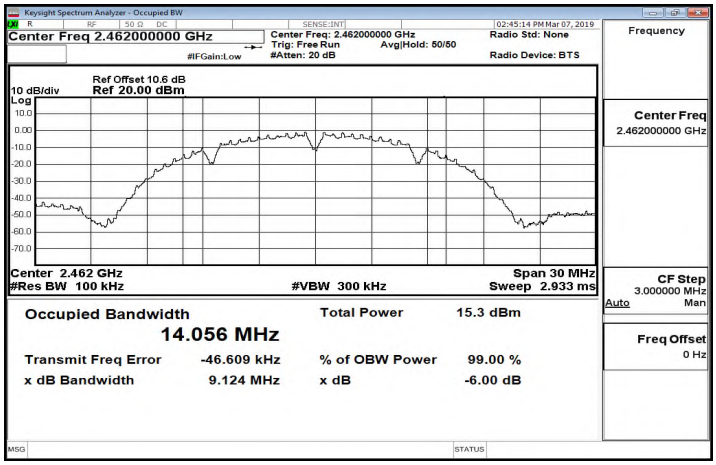

OBW 6dB_802.11b_20MHz_Chain0_2437MHz



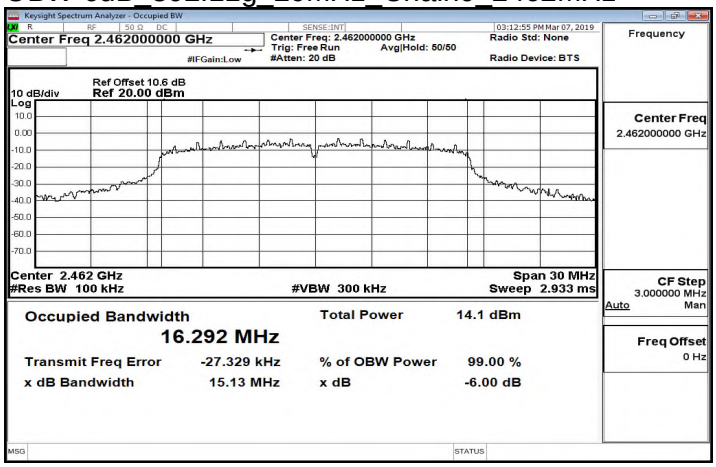

OBW 6dB_802.11g_20MHz_Chain0_2437MHz




OBW 6dB_802.11b_20MHz_Chain0_2462MHz




OBW 6dB_802.11g_20MHz_Chain0_2462MHz

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# 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

## 10.1 Standard Applicable

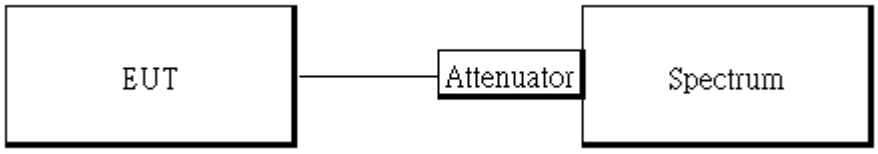
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

## 10.2 Measurement Equipment Used

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Spectrum Analyzer | Agilent | N9010A | MY53400256 | 11/21/2018 | 11/20/2019 |
| Attenuator | Marvelous | MVE2213-10 | RF80 | 02/26/2019 | 02/25/2020 |
| DC Block | PASTERNACK | PE8210 | RF29 | 02/26/2019 | 02/25/2020 |

## 10.3 Test SET-UP




## 10.4 Measurement Procedure

**Reference Level of Emission Limit:**

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.

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8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

**Conducted Band Edge:**

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker 1 – 20dBm
8. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

**Conducted Spurious Emission:**

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

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## 10.5 Measurement Result

| Reference Level of Limit 802.11b mode | | |
|---|---|---|
| Freq. (MHz) | PSD (dBm) | Reference Level of Limit (dBm) |
| 2412 | -1.08 | -21.08 |
| 2437 | -1.08 | -21.08 |
| 2462 | -1.05 | -21.05 |

| Reference Level of Limit 802.11g mode | | |
|---|---|---|
| Freq. (MHz) | PSD (dBm) | Reference Level of Limit (dBm) |
| 2412 | -3.09 | -23.09 |
| 2437 | -2.64 | -22.64 |
| 2462 | -3.10 | -23.10 |

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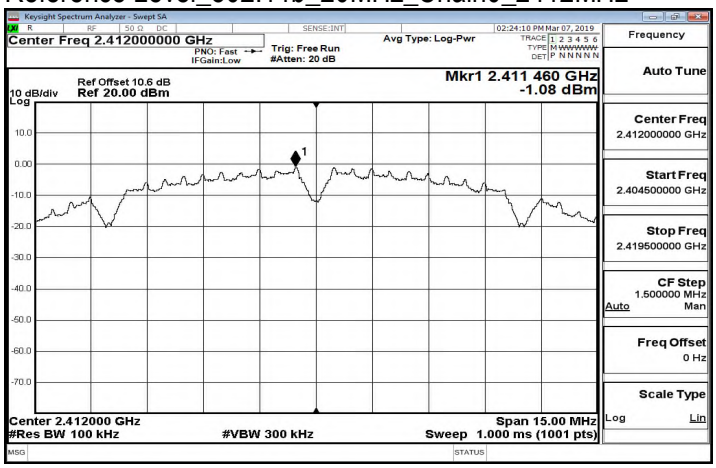
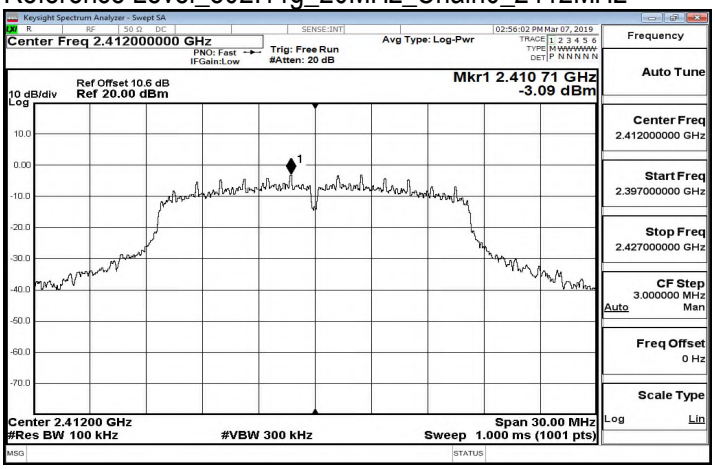
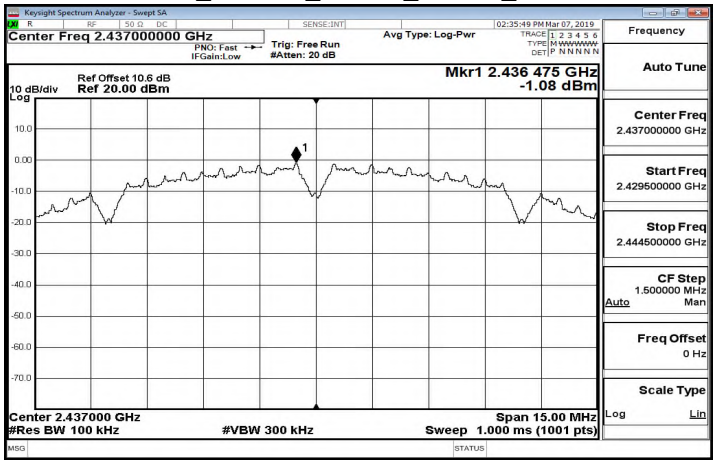
Reference Level_802.11b_20MHz_Chain0_2412MHz



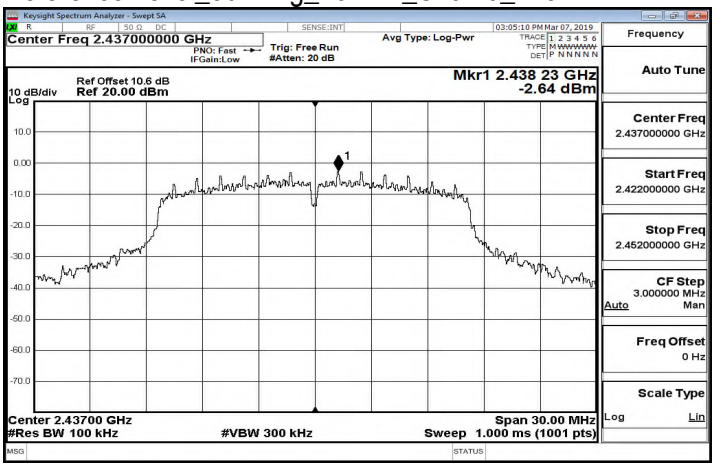

Reference Level_802.11g_20MHz_Chain0_2412MHz



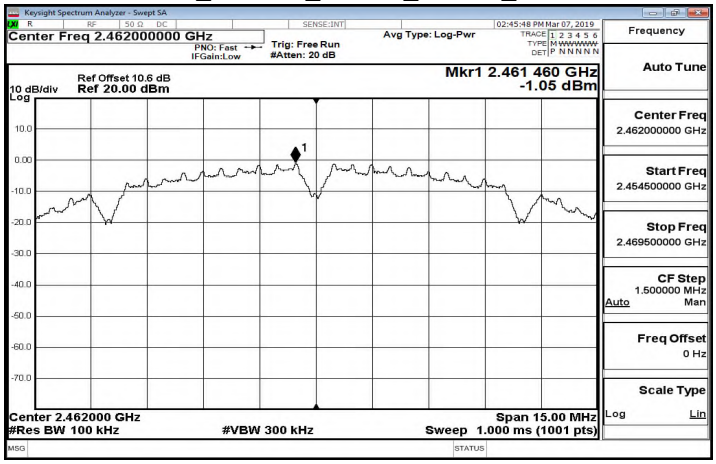

Reference Level_802.11b_20MHz_Chain0_2437MHz



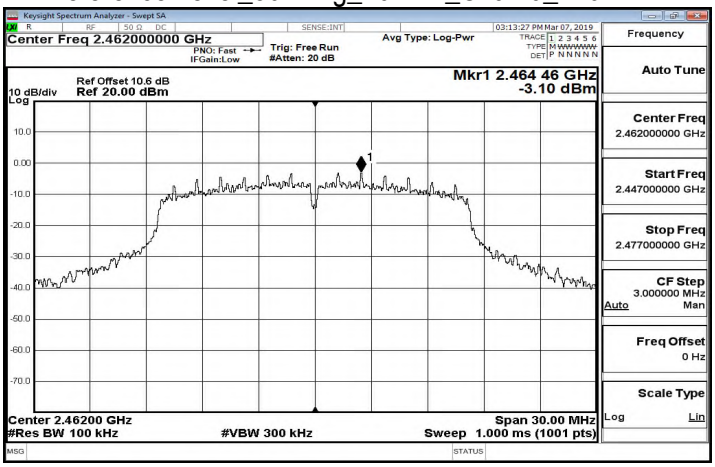

Reference Level_802.11g_20MHz_Chain0_2437MHz




Reference Level_802.11b_20MHz_Chain0_2462MHz




Reference Level_802.11g_20MHz_Chain0_2462MHz

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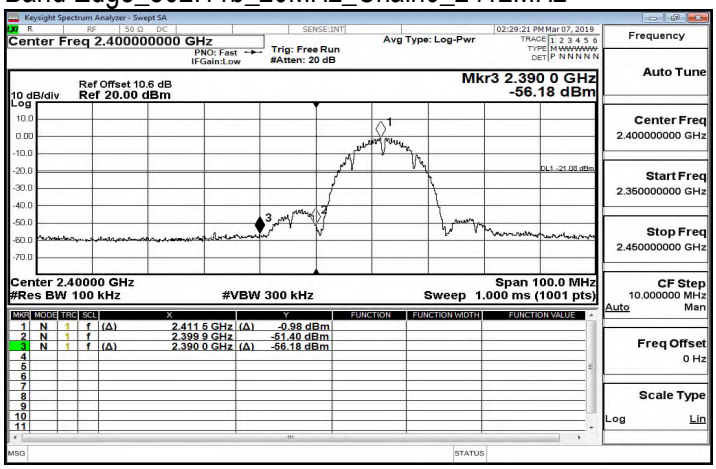
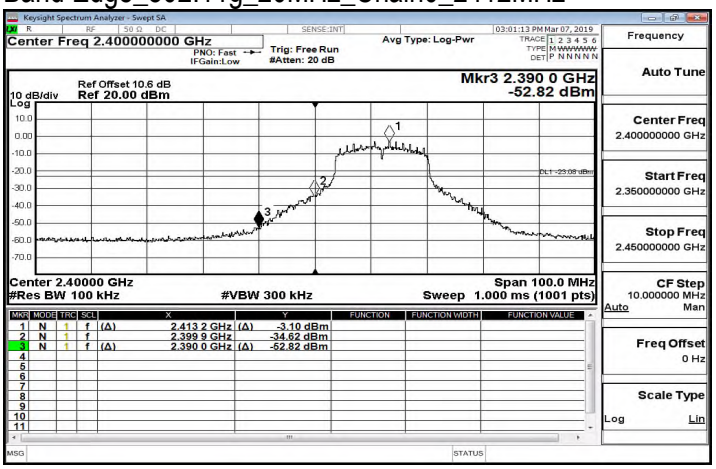
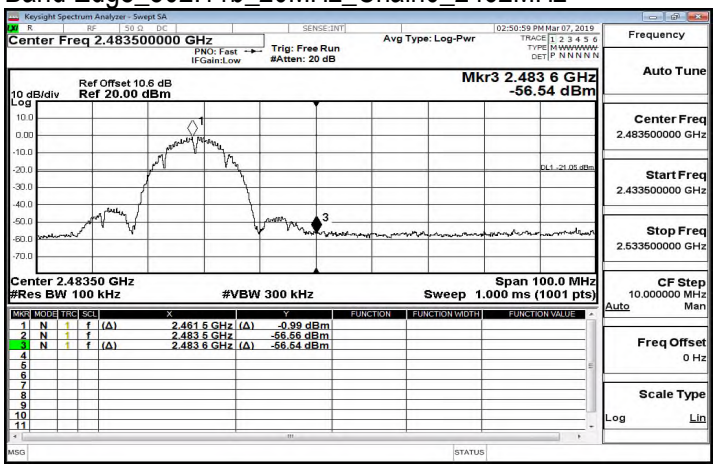
Band Edge_802.11b_20MHz_Chain0_2412MHz



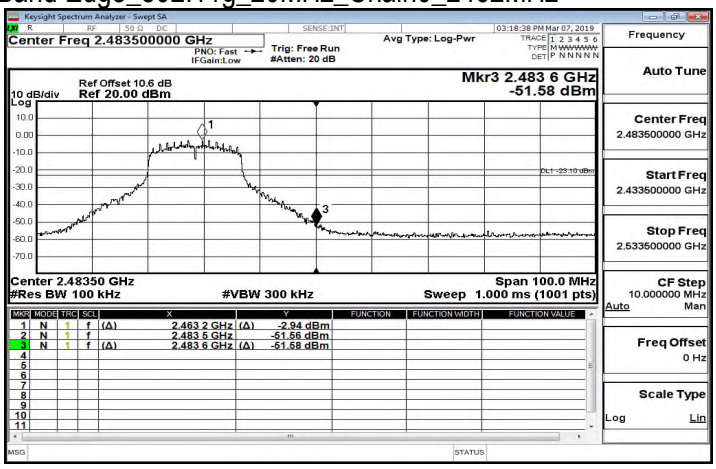

Band Edge_802.11g_20MHz_Chain0_2412MHz




Band Edge_802.11b_20MHz_Chain0_2462MHz




Band Edge_802.11g_20MHz_Chain0_2462MHz

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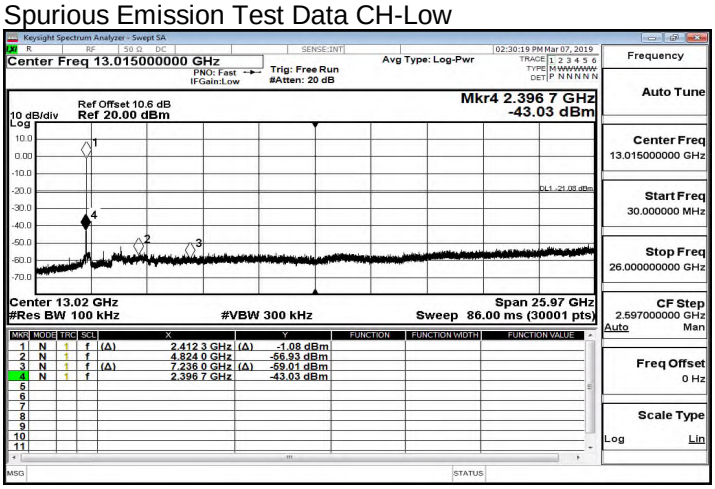
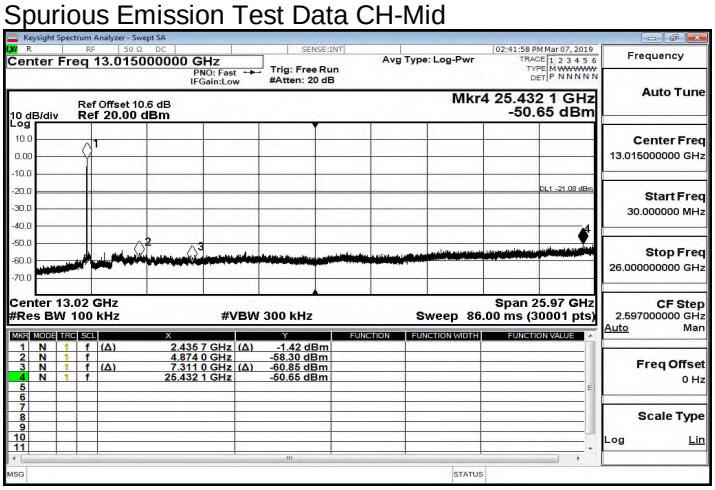
802.11b

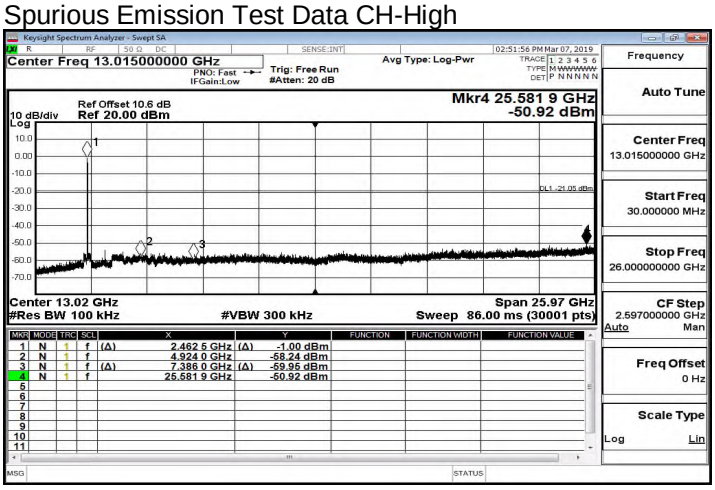
Spurious Emission Test Data CH-Low




Spurious Emission Test Data CH-Mid

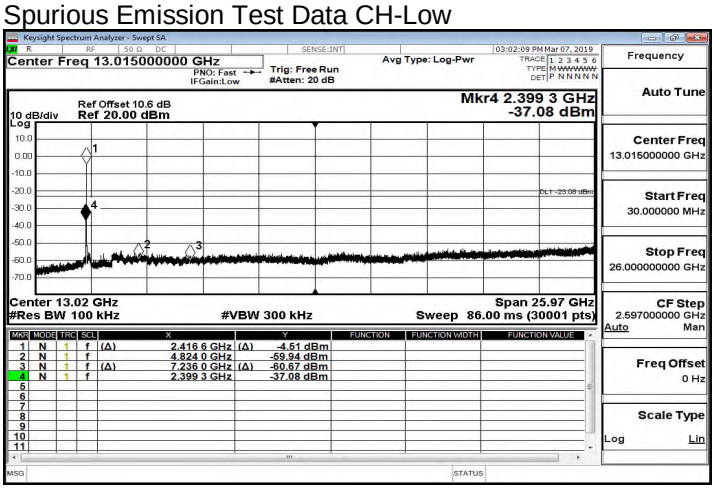



Spurious Emission Test Data CH-High

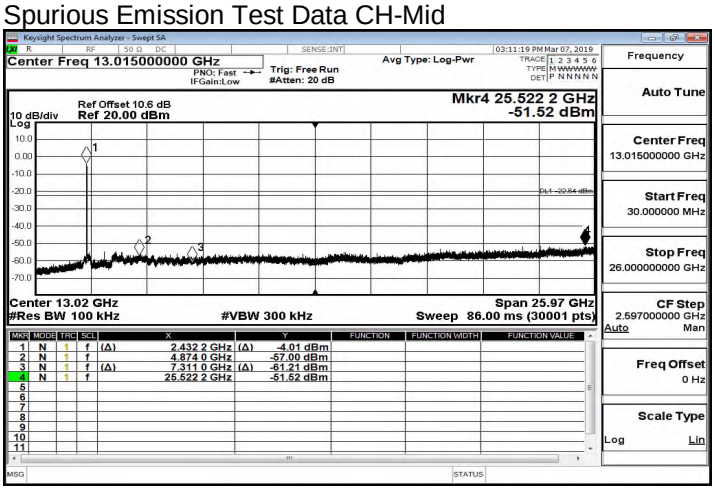



802.11g

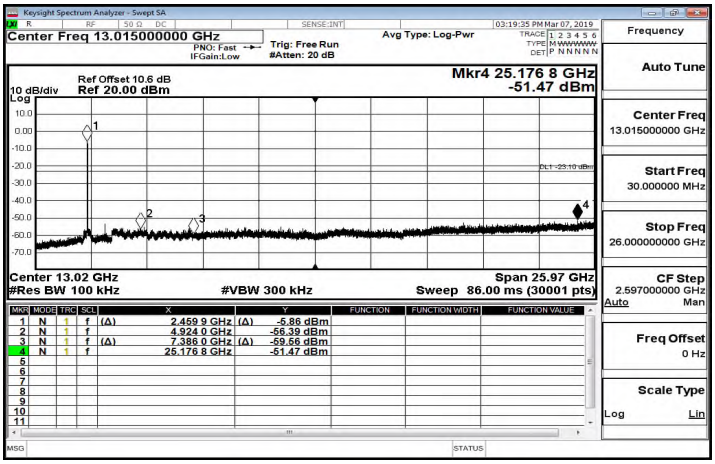
Spurious Emission Test Data CH-Low




Spurious Emission Test Data CH-Mid




Spurious Emission Test Data CH-High

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# 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## 11.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 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 the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.
And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

| Frequency (MHz) | Field strength (microvolts/meter) | Distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Note:**
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBµV/m) = 20 log Emission level (dBµV/m)

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## 11.2 Measurement Equipment Used:

| 966A Chamber | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT TYPE** | **MFR** | **MODEL NUMBER** | **SERIAL NUMBER** | **LAST CAL.** | **CAL DUE.** |
| Band Reject Filters | MICRO TRONICS | BRM 50702 | 120 | 02/26/2019 | 02/25/2020 |
| Bilog Antenna | Sunol Sciences | JB3 | A030105 | 07/13/2018 | 07/12/2019 |
| Cable | HUBER SUHNER | SUCOFLEX 104PEA | 25157 | 02/26/2019 | 02/25/2020 |
| Cable | HUBER SUHNER | SUCOFLEX 104PEA | 20995 | 02/26/2019 | 02/25/2020 |
| Digital Ther-mo-Hygro Meter | WISEWIND | 1206 | D07 | 01/30/2019 | 01/29/2020 |
| double Ridged Guide Horn Antenna | ETC | MCTD 1209 | DRH13M02003 | 08/20/2018 | 08/19/2019 |
| Loop Ant | COM-POWER | AL-130 | 121051 | 03/21/2018 | 03/20/2019 |
| Pre-Amplifier | EMEC | EM330 | 060609 | 02/26/2019 | 02/25/2020 |
| Pre-Amplifier | HP | 8449B | 3008A00965 | 02/26/2019 | 02/25/2020 |
| PSA Series Spectrum Analyzer | Agilent | E4446A | MY46180323 | 05/31/2018 | 05/30/2019 |
| Antenna Tower | CCS | CC-A-1F | N/A | N.C.R | N.C.R |
| Controller | CCS | CC-C-1F | N/A | N.C.R | N.C.R |
| Turn Table | CCS | CC-T-1F | N/A | N.C.R | N.C.R |
| Software | e3 V6.11-20180413 | | | | |

***NOTE: N.C.R refers to Not Calibrated Required***.

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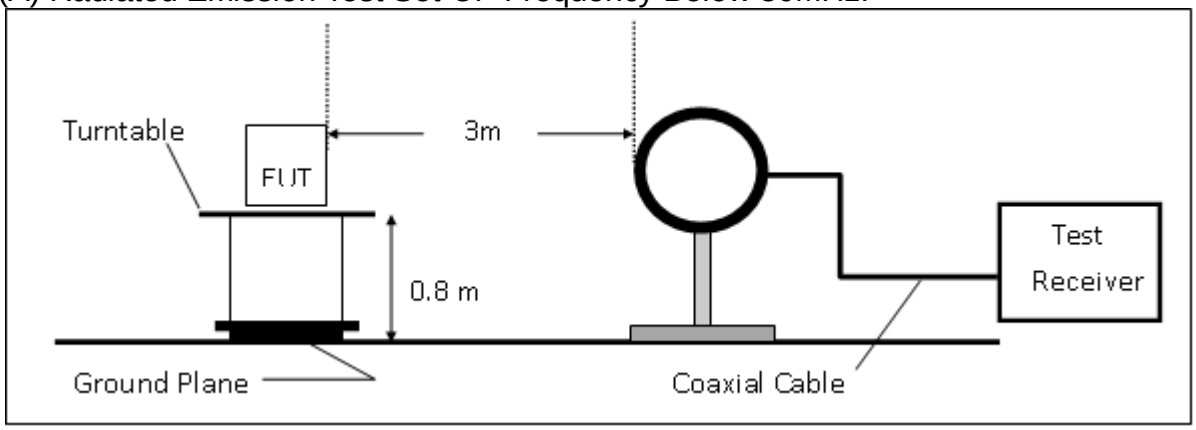
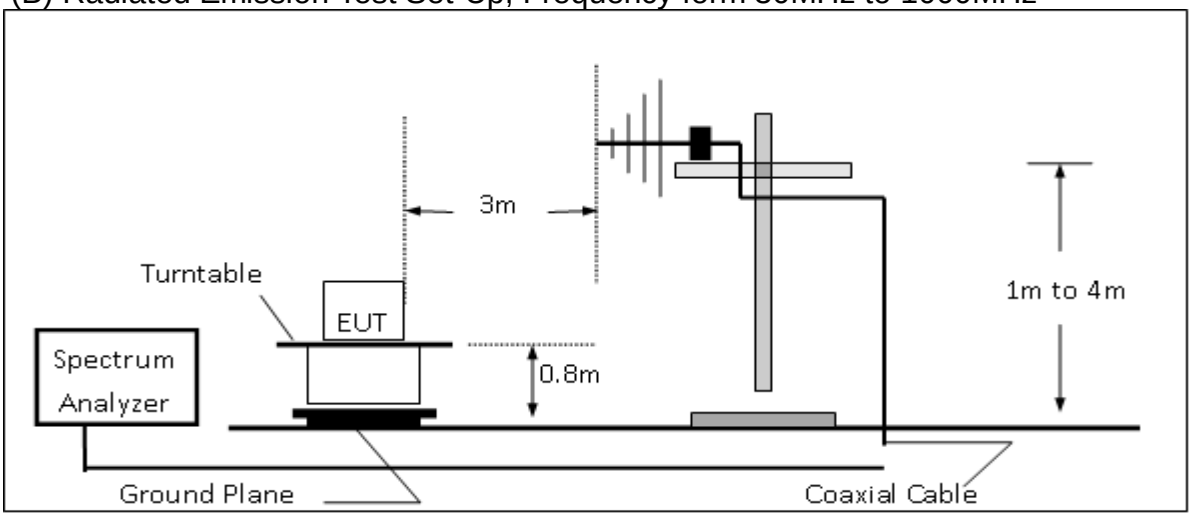
## 11.3 Test SET-UP

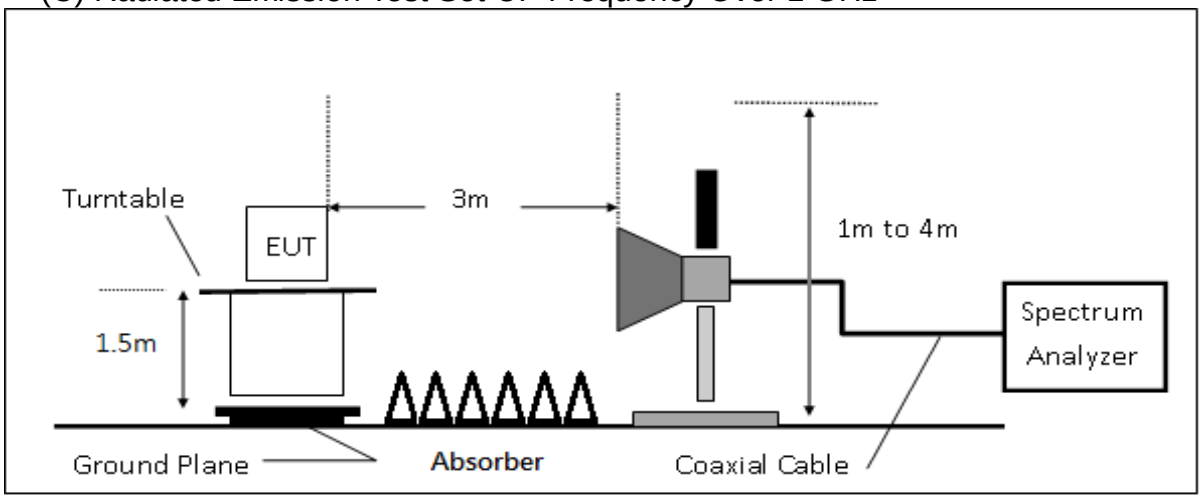
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.




(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz




(C) Radiated Emission Test Set-UP Frequency Over 1 GHz

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## 11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

## 11.5 Field Strength Calculation

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

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

| | |
|---|---|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude | AG = Amplifier Gain |
| AF = Antenna Factor | |

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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## 11.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

## 11.7 Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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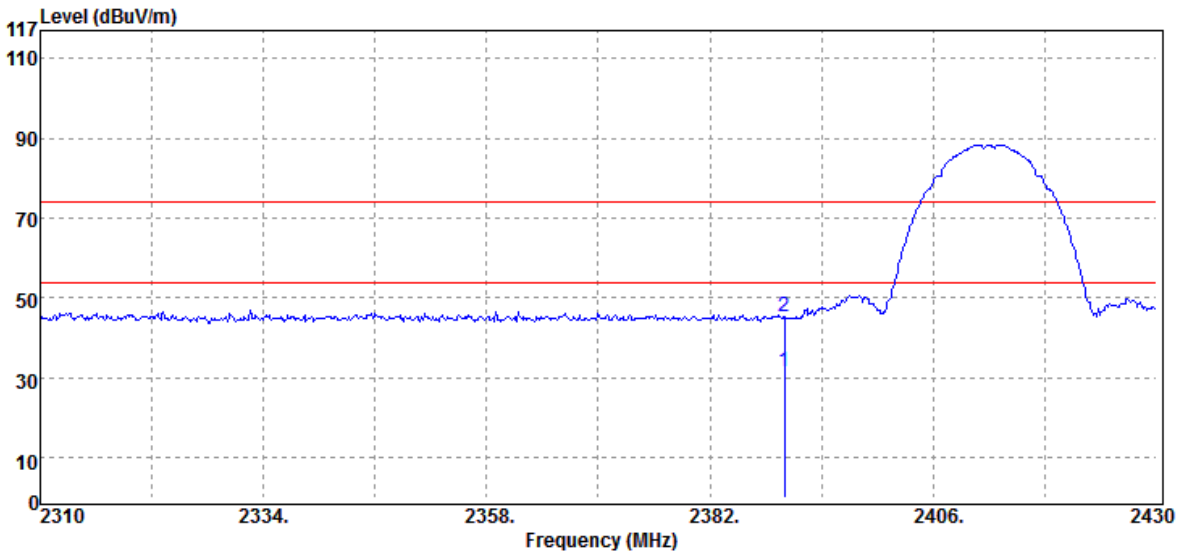
## Radiated Band Edge Measurement Result

| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2390.00 | Average | 35.09 | -3.33 | 31.76 | 54.00 | -22.24 |
| 2390.00 | Peak | 48.85 | -3.33 | 45.52 | 74.00 | -28.48 |

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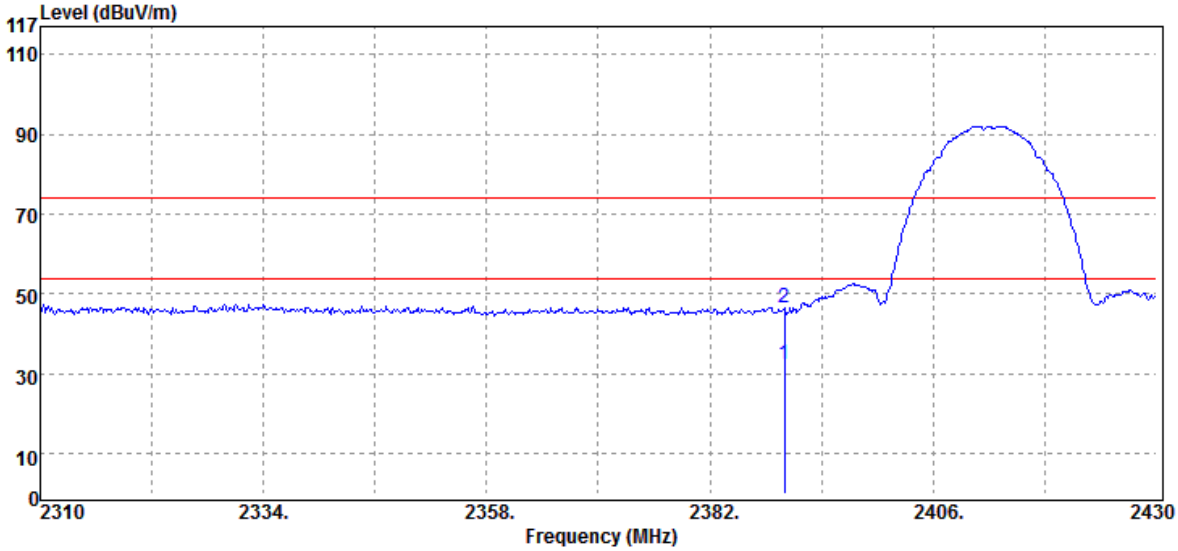
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2390.00 | Average | 35.58 | -3.33 | 32.25 | 54.00 | -21.75 |
| 2390.00 | Peak | 49.77 | -3.33 | 46.44 | 74.00 | -27.56 |

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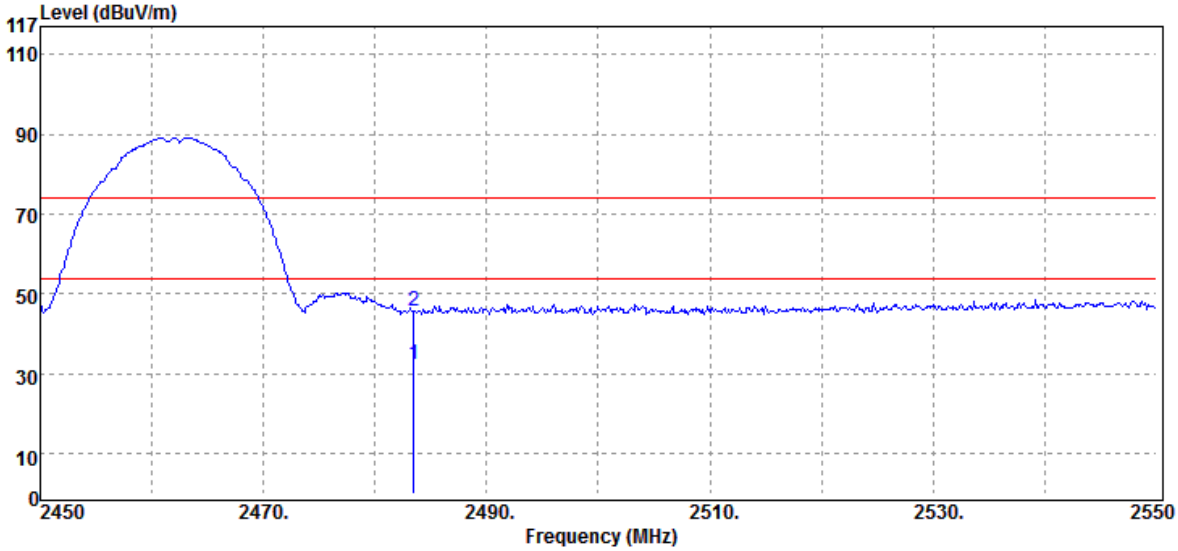
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.50 | Average | 35.15 | -2.72 | 32.43 | 54.00 | -21.57 |
| 2483.50 | Peak | 48.47 | -2.72 | 45.75 | 74.00 | -28.25 |

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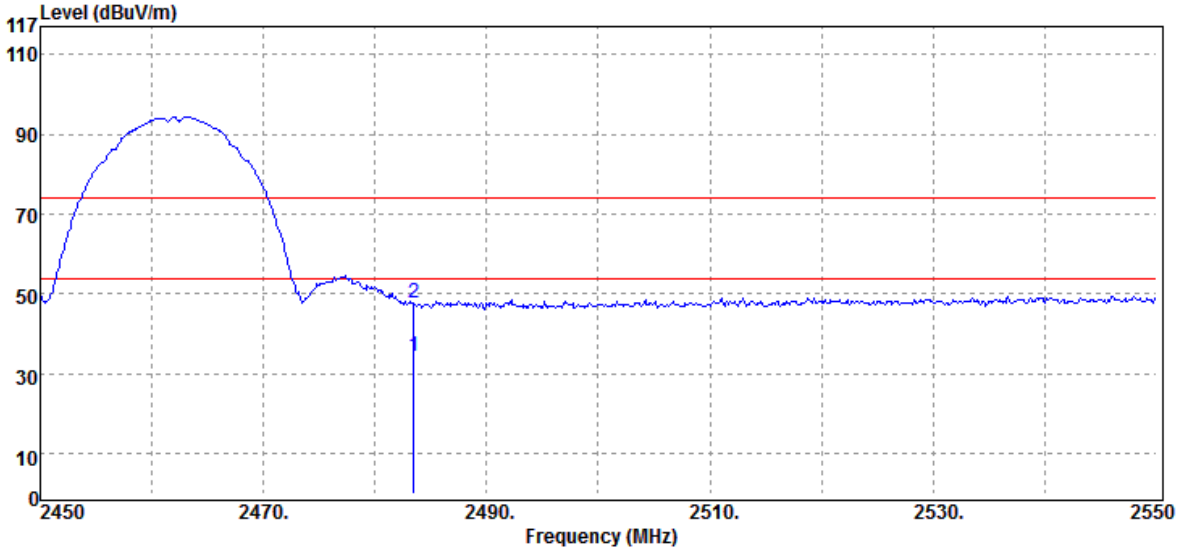
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.50 | Average | 37.29 | -2.72 | 34.57 | 54.00 | -19.43 |
| 2483.50 | Peak | 50.29 | -2.72 | 47.57 | 74.00 | -26.43 |

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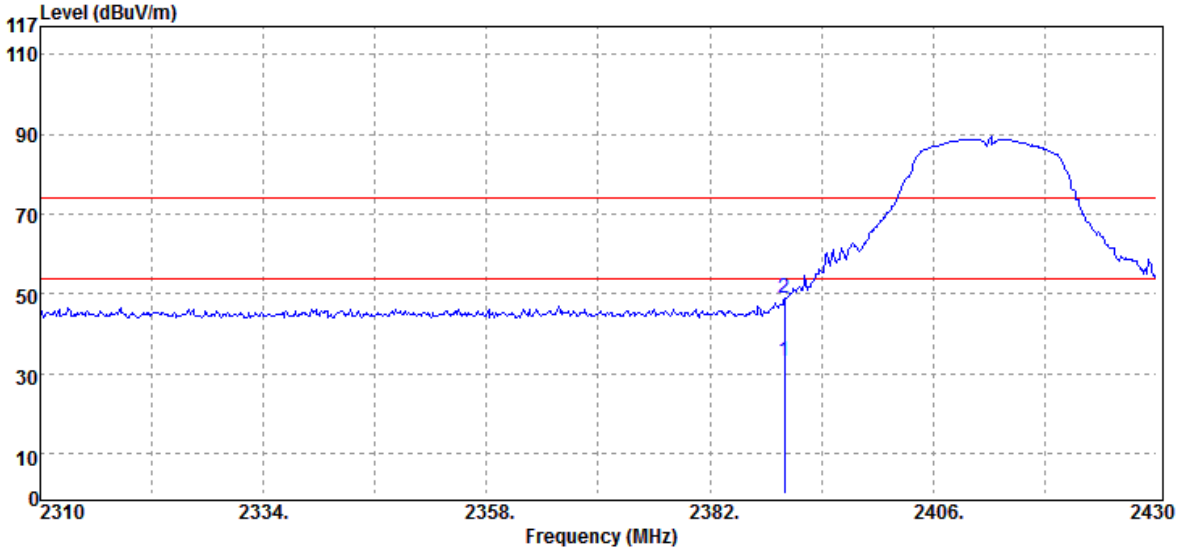
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2390.00 | Average | 36.48 | -3.33 | 33.15 | 54.00 | -20.85 |
| 2390.00 | Peak | 52.33 | -3.33 | 49.00 | 74.00 | -25.00 |

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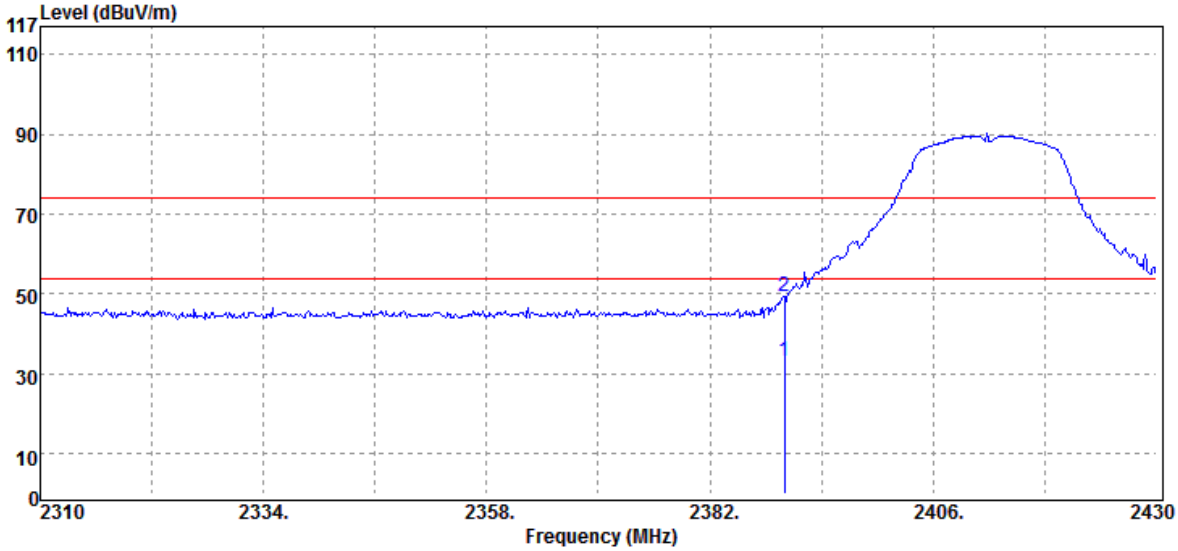
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2390.00 | Average | 36.71 | -3.33 | 33.38 | 54.00 | -20.62 |
| 2390.00 | Peak | 52.79 | -3.33 | 49.46 | 74.00 | -24.54 |

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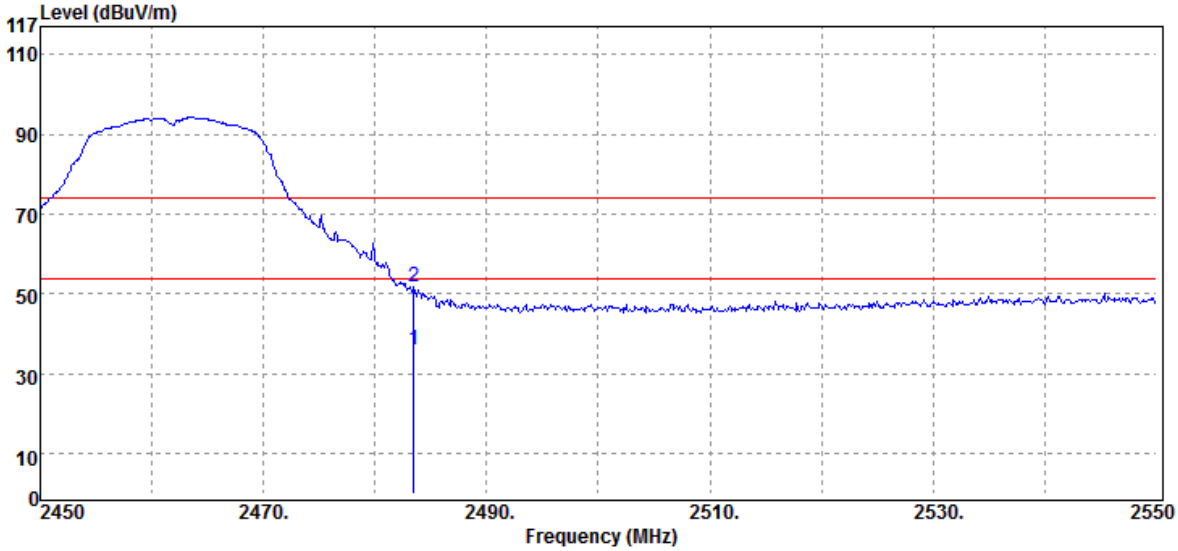
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.50 | Average | 38.65 | -2.72 | 35.93 | 54.00 | -18.07 |
| 2483.50 | Peak | 54.52 | -2.72 | 51.80 | 74.00 | -22.20 |

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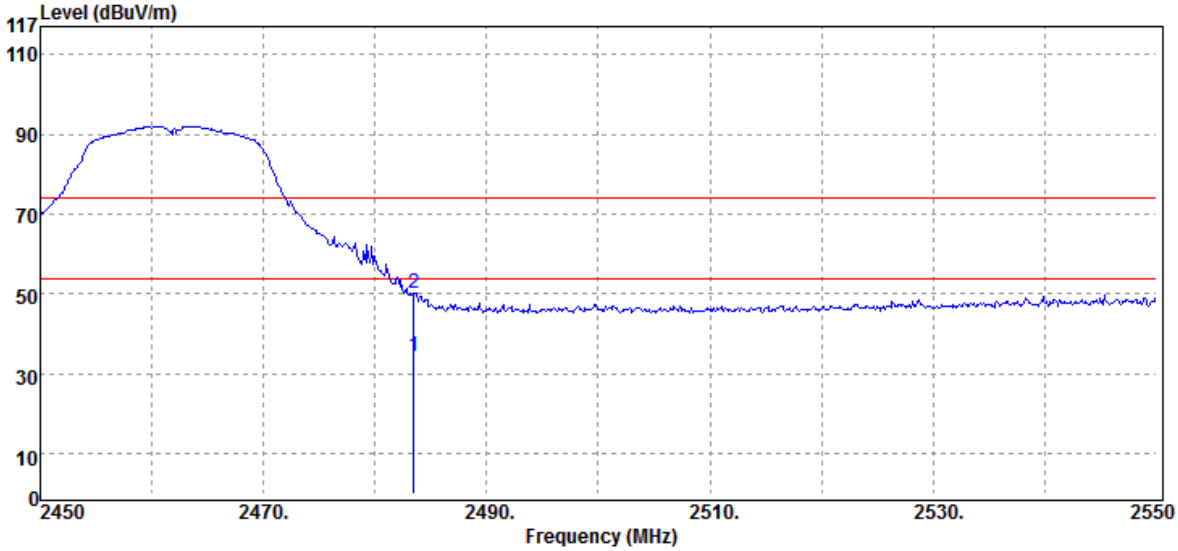
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :21 deg_C / 62 RH |
| Operation Mode | :Bandedge CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.50 | Average | 37.23 | -2.72 | 34.51 | 54.00 | -19.49 |
| 2483.50 | Peak | 53.02 | -2.72 | 50.30 | 74.00 | -23.70 |

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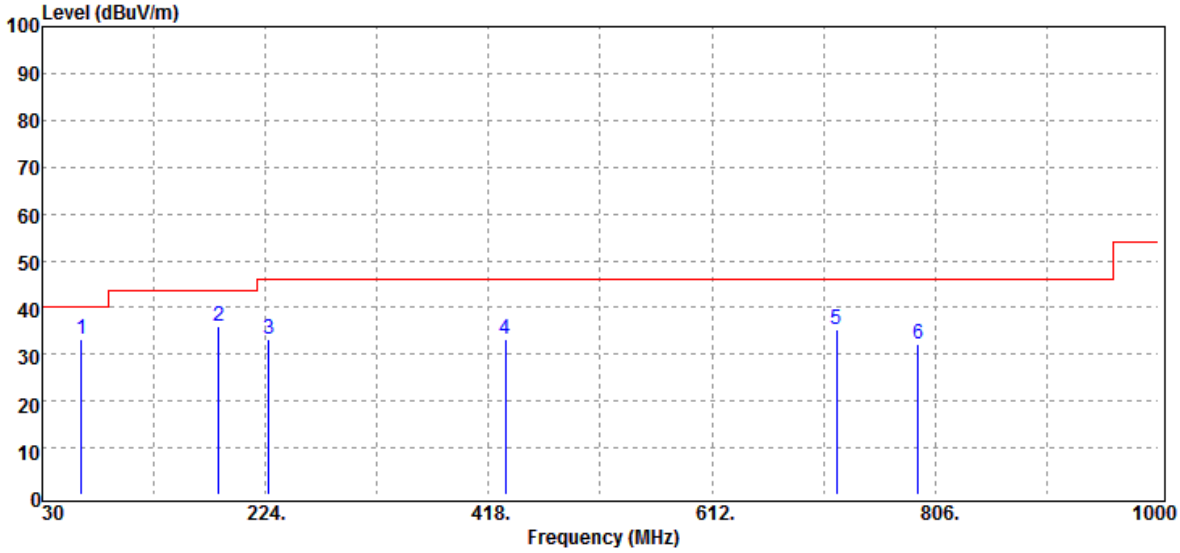
## Below 1GHz Worst-Case Data:

## Radiated Spurious Emission Measurement Result

| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 63.95 | Peak | 48.01 | -14.74 | 33.27 | 40.00 | -6.73 |
| 183.26 | Peak | 46.62 | -10.62 | 36.00 | 43.50 | -7.50 |
| 226.91 | Peak | 43.49 | -10.31 | 33.18 | 46.00 | -12.82 |
| 432.55 | Peak | 36.85 | -3.79 | 33.06 | 46.00 | -12.94 |
| 720.64 | Peak | 34.07 | 1.33 | 35.40 | 46.00 | -10.60 |
| 791.45 | Peak | 29.68 | 2.44 | 32.12 | 46.00 | -13.88 |

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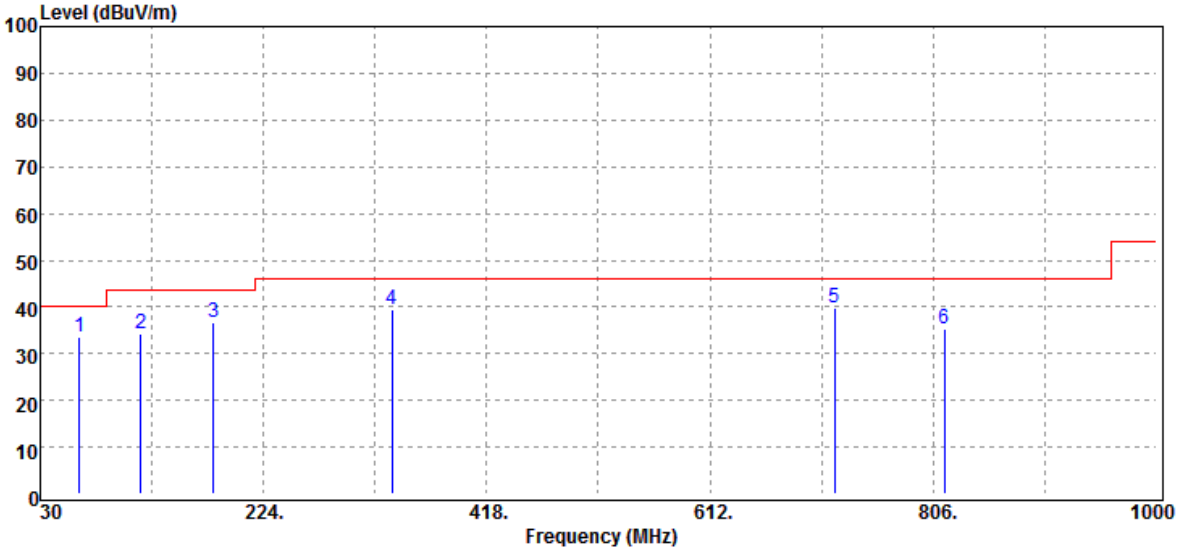
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-15 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 63.95 | Peak | 48.18 | -14.74 | 33.44 | 40.00 | -6.56 |
| 117.30 | Peak | 42.83 | -8.51 | 34.32 | 43.50 | -9.18 |
| 180.35 | Peak | 47.34 | -10.60 | 36.74 | 43.50 | -6.76 |
| 335.55 | Peak | 45.77 | -6.48 | 39.29 | 46.00 | -6.71 |
| 720.64 | Peak | 38.59 | 1.33 | 39.92 | 46.00 | -6.08 |
| 815.70 | Peak | 31.69 | 3.65 | 35.34 | 46.00 | -10.66 |

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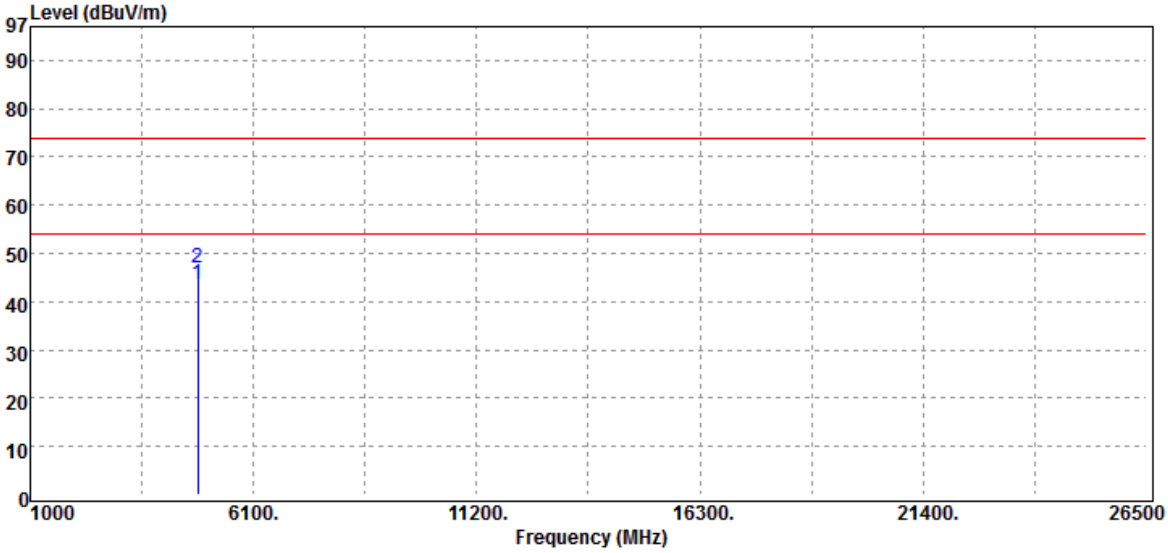
## Above 1GHz Data:

## Radiated Spurious Emission Measurement Result

| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4824.00 | Average | 40.97 | 2.75 | 43.72 | 54.00 | -10.28 |
| 4824.00 | Peak | 44.13 | 2.75 | 46.88 | 74.00 | -27.12 |

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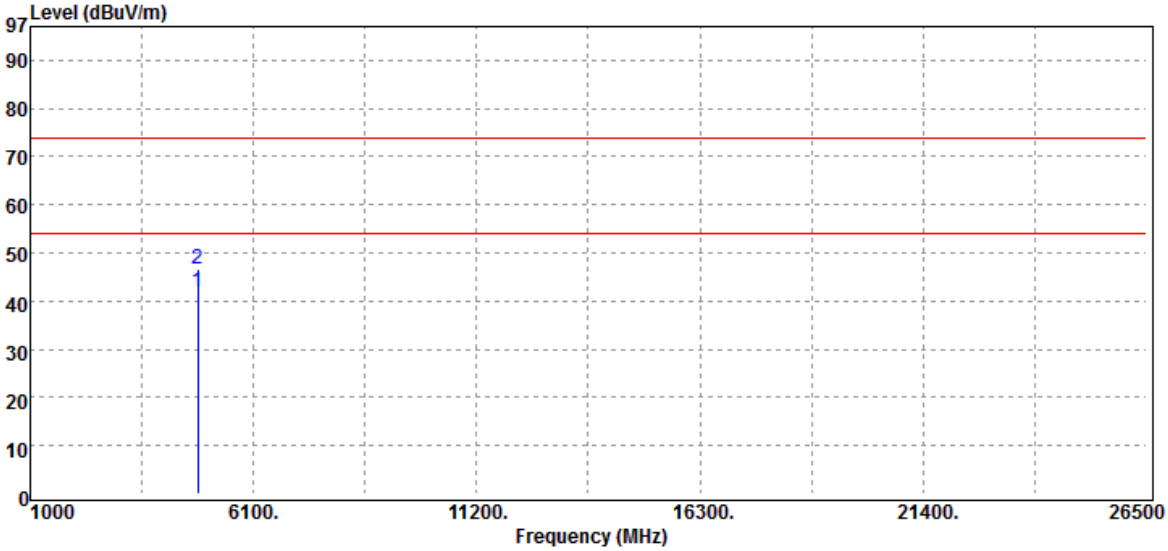
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4824.00 | Average | 39.24 | 2.75 | 41.99 | 54.00 | -12.01 |
| 4824.00 | Peak | 43.97 | 2.75 | 46.72 | 74.00 | -27.28 |

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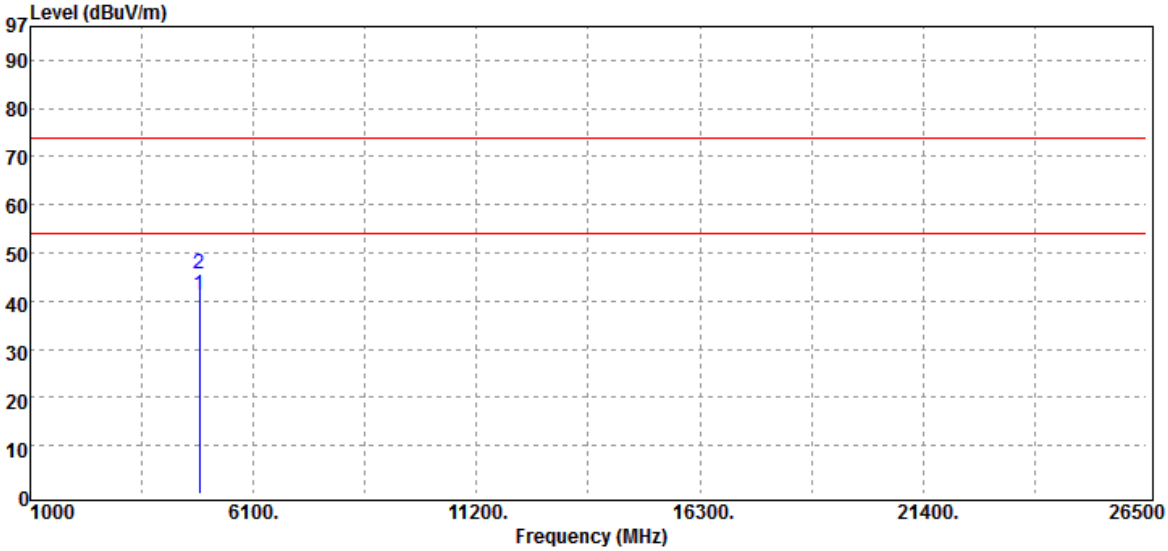
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4874.00 | Average | 38.38 | 2.95 | 41.33 | 54.00 | -12.67 |
| 4874.00 | Peak | 42.82 | 2.95 | 45.77 | 74.00 | -28.23 |

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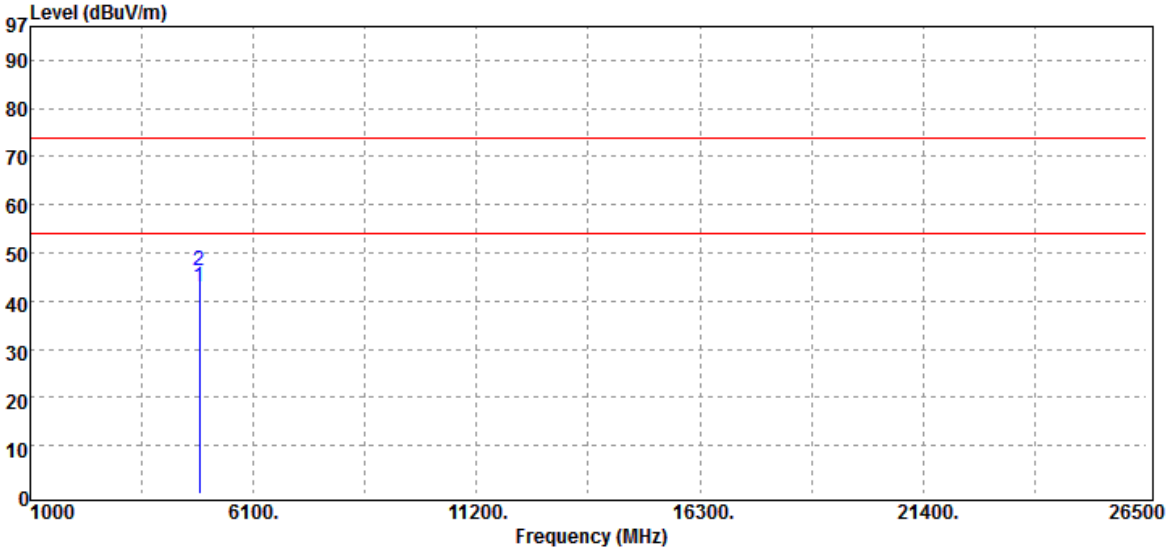
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-15 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4874.00 | Average | 39.94 | 2.95 | 42.89 | 54.00 | -11.11 |
| 4874.00 | Peak | 43.50 | 2.95 | 46.45 | 74.00 | -27.55 |

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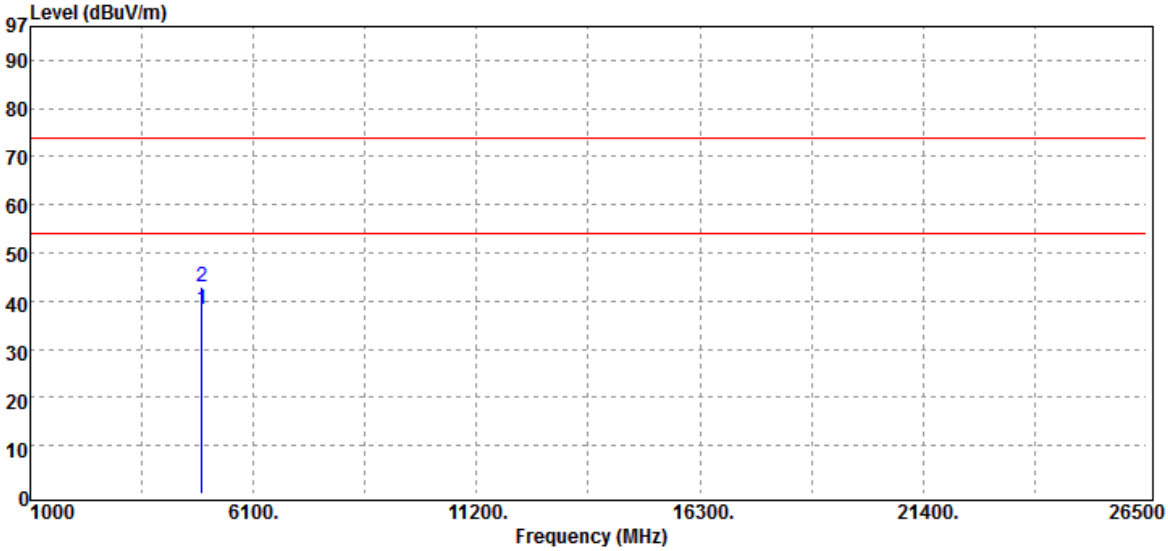
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-16 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4924.00 | Average | 35.07 | 3.34 | 38.41 | 54.00 | -15.59 |
| 4924.00 | Peak | 39.60 | 3.34 | 42.94 | 74.00 | -31.06 |

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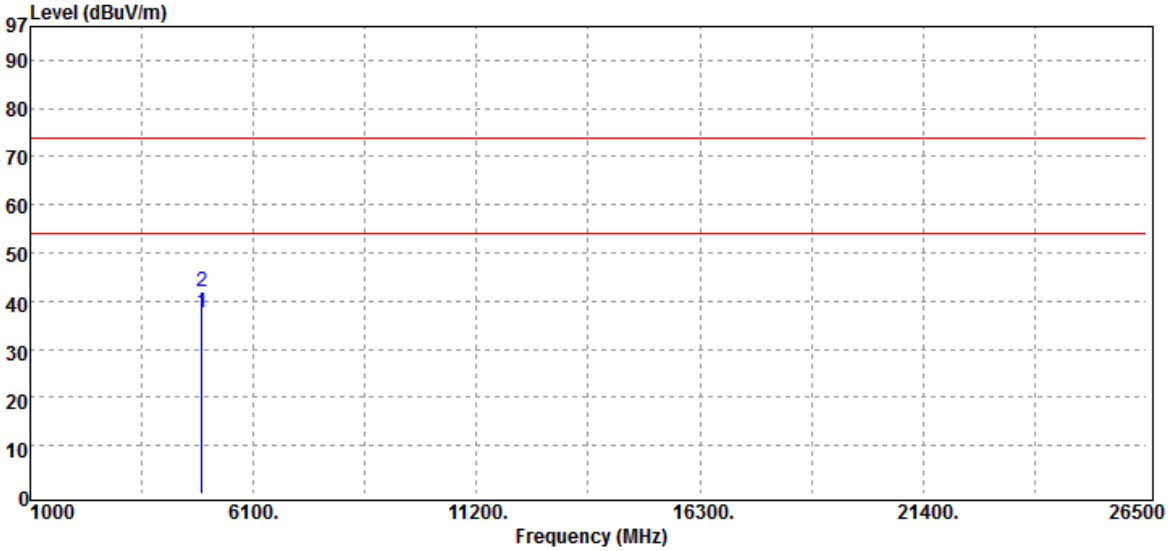
| | | | |
|---|---|---|---|
| Operation Band | :802.11b | Test Date | :2019-03-16 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4924.00 | Average | 34.18 | 3.34 | 37.52 | 54.00 | -16.48 |
| 4924.00 | Peak | 38.50 | 3.34 | 41.84 | 74.00 | -32.16 |

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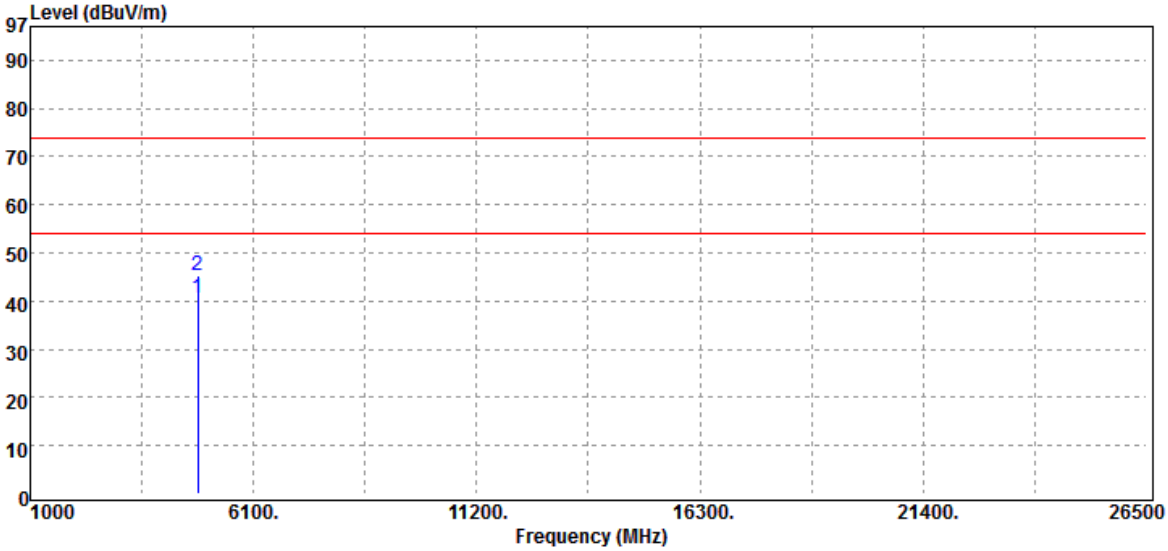
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4824.00 | Average | 37.72 | 2.75 | 40.47 | 54.00 | -13.53 |
| 4824.00 | Peak | 42.49 | 2.75 | 45.24 | 74.00 | -28.76 |

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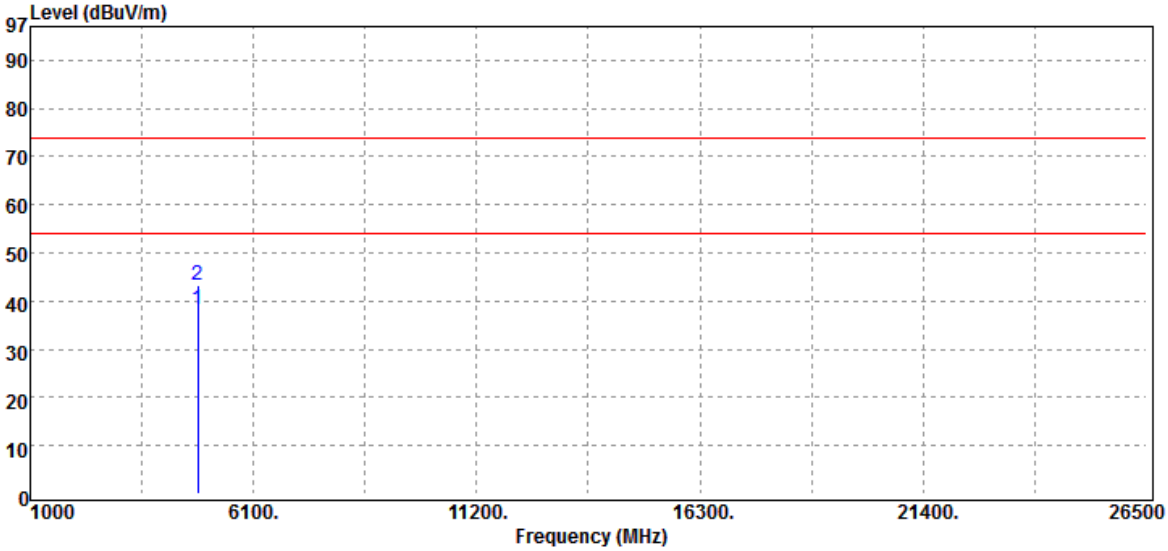
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2412 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH LOW | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4824.00 | Average | 35.47 | 2.75 | 38.22 | 54.00 | -15.78 |
| 4824.00 | Peak | 40.52 | 2.75 | 43.27 | 74.00 | -30.73 |

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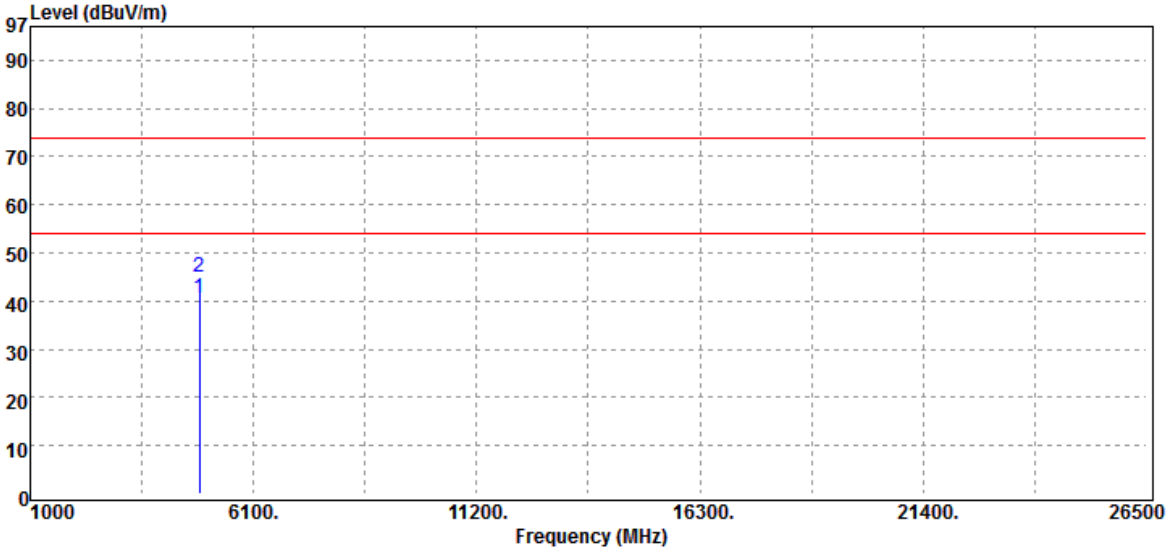
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4874.00 | Average | 37.64 | 2.95 | 40.59 | 54.00 | -13.41 |
| 4874.00 | Peak | 42.17 | 2.95 | 45.12 | 74.00 | -28.88 |

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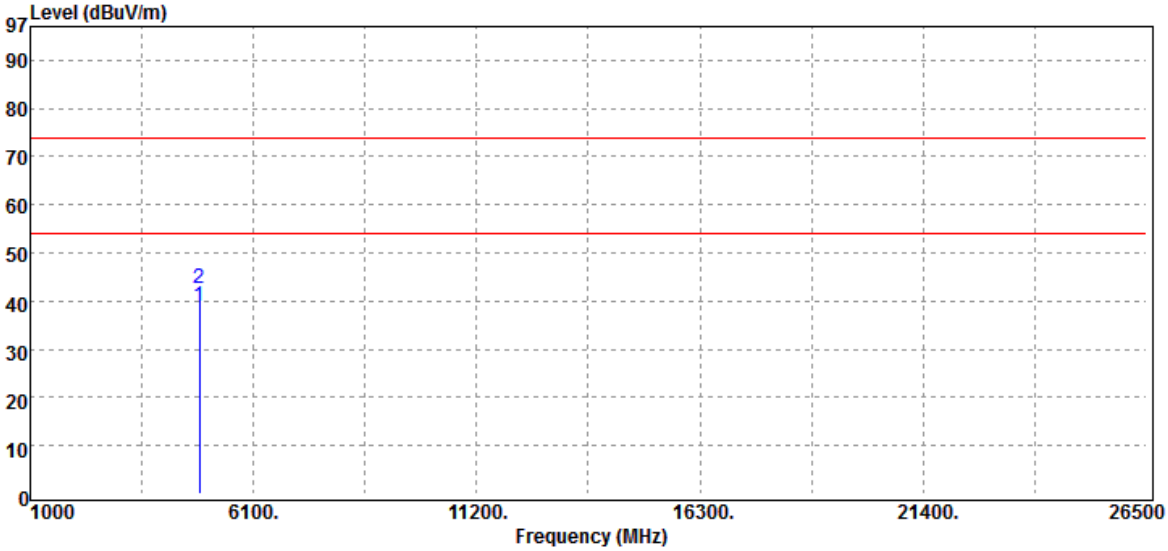
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2437 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH MID | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4874.00 | Average | 35.84 | 2.95 | 38.79 | 54.00 | -15.21 |
| 4874.00 | Peak | 39.67 | 2.95 | 42.62 | 74.00 | -31.38 |

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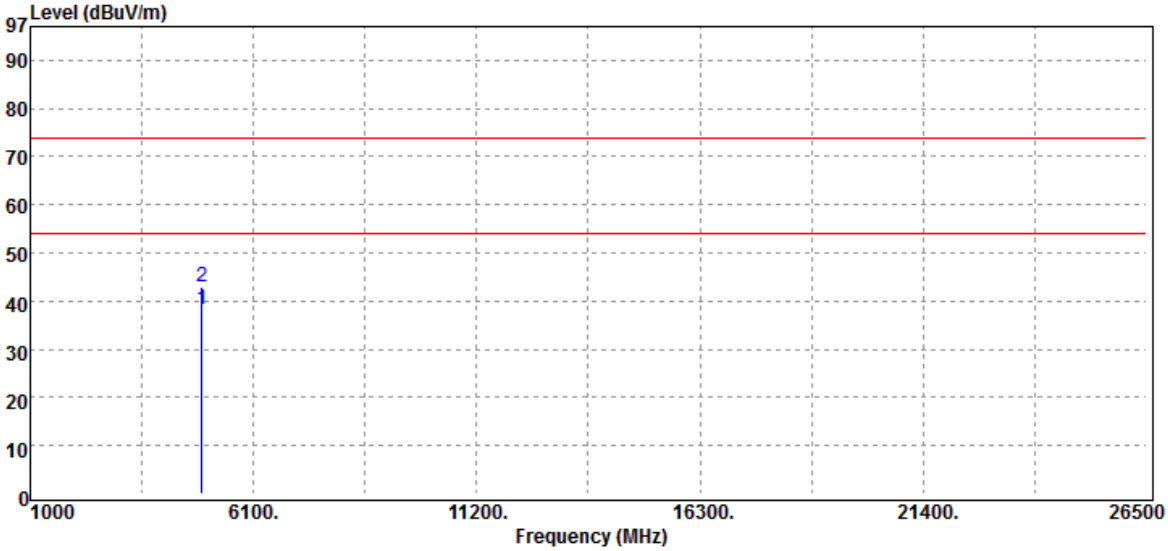
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :VERTICAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4924.00 | Average | 35.04 | 3.34 | 38.38 | 54.00 | -15.62 |
| 4924.00 | Peak | 39.47 | 3.34 | 42.81 | 74.00 | -31.19 |

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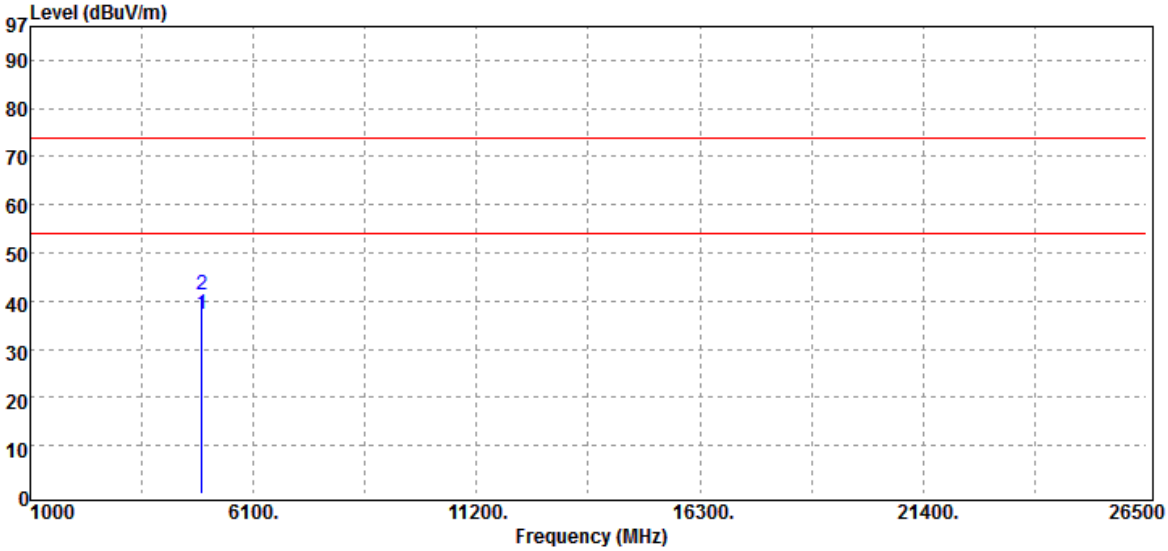
| | | | |
|---|---|---|---|
| Operation Band | :802.11g | Test Date | :2019-03-16 |
| Fundamental Frequency | :2462 MHz | Temp./Humi. | :20 deg_C / 52 RH |
| Operation Mode | :Tx CH HIGH | Engineer | :Wei |
| EUT Pol. | :E2 Plane | Measurement Antenna Pol. | :HORIZONTAL |




| Freq. MHz | Detector Mode PK/QP/AV | Spectrum Reading Level dBµV | Factor dB | Actual FS dBµV/m | Limit @3m dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4924.00 | Average | 33.85 | 3.34 | 37.19 | 54.00 | -16.81 |
| 4924.00 | Peak | 37.86 | 3.34 | 41.20 | 74.00 | -32.80 |

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# 12 POWER SPECTRAL DENSITY

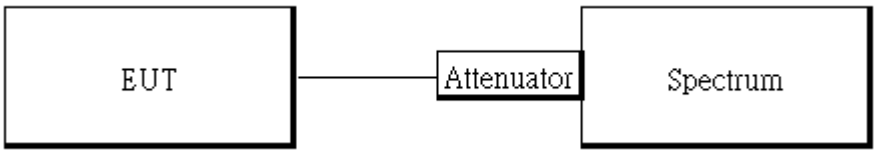
## 12.1 Standard Applicable

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

## 12.2 Measurement Equipment Used

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Spectrum Analyzer | Agilent | N9010A | MY53400256 | 11/21/2018 | 11/20/2019 |
| Attenuator | Marvelous | MVE2213-10 | RF80 | 02/26/2019 | 02/25/2020 |
| DC Block | PASTERNACK | PE8210 | RF29 | 02/26/2019 | 02/25/2020 |

## 12.3 Test Set-up




## 12.4 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz & VBW = 10 kHz.
5. For defining Restricted Band Edge Limit:
   Set the RBW = 100kHz & VBW = 300 kHz
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.

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## 12.5 Measurement Result

| POWER DENSITY 802.11b | | | |
|---|---|---|---|
| Freq. (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2412 | -15.19 | 8.00 | PASS |
| 2437 | -15.15 | 8.00 | PASS |
| 2462 | -15.18 | 8.00 | PASS |

| POWER DENSITY 802.11g | | | |
|---|---|---|---|
| Freq. (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 2412 | -18.57 | 8.00 | PASS |
| 2437 | -17.51 | 8.00 | PASS |
| 2462 | -17.87 | 8.00 | PASS |

*Refer to next page for plots

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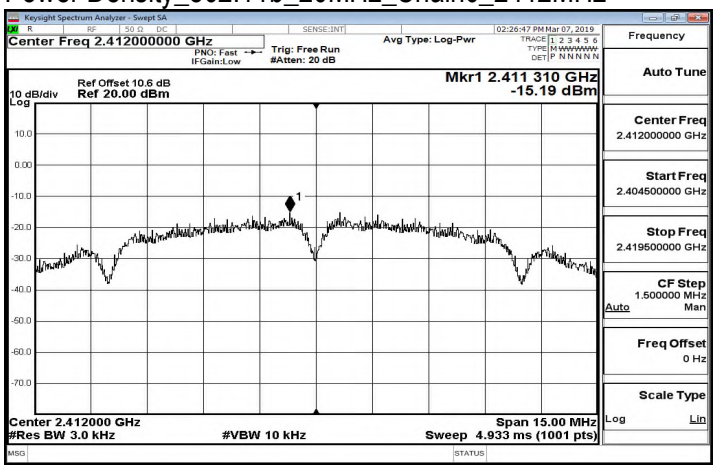
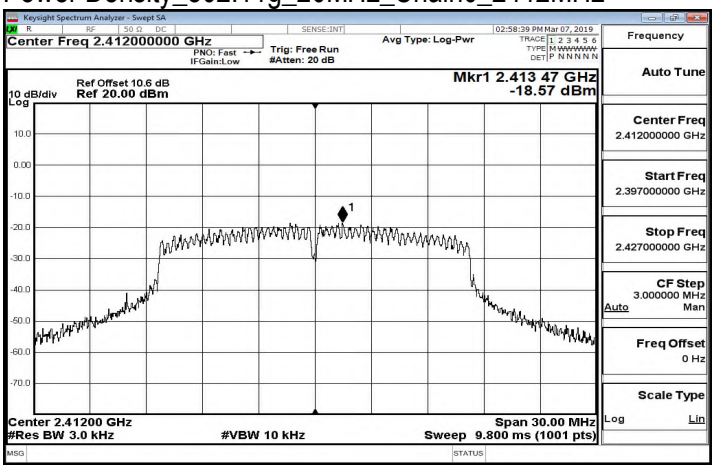
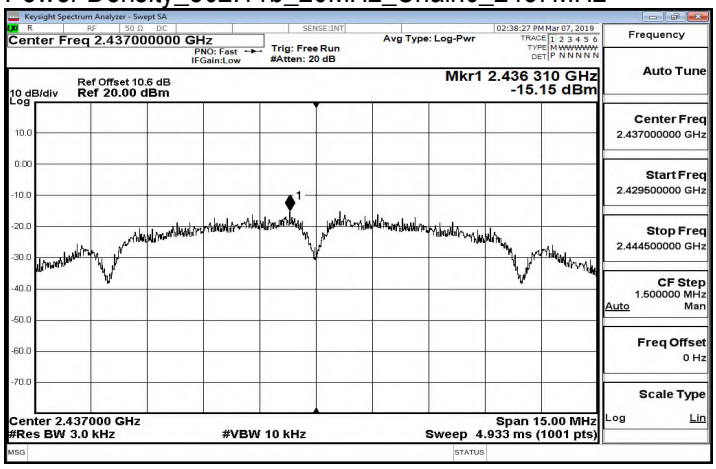
Power Density_802.11b_20MHz_Chain0_2412MHz



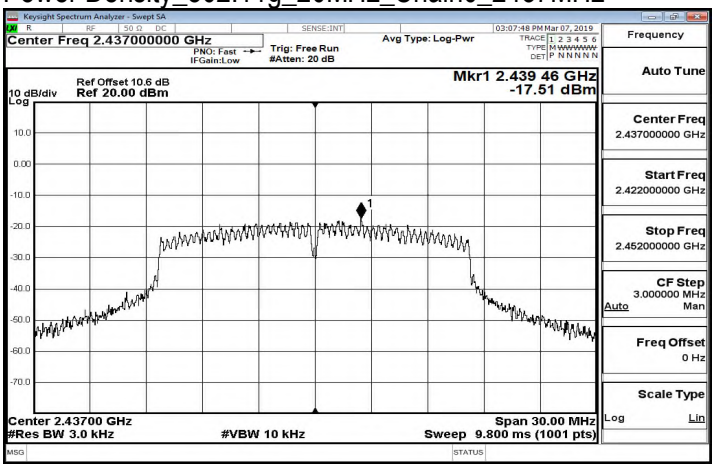

Power Density_802.11g_20MHz_Chain0_2412MHz



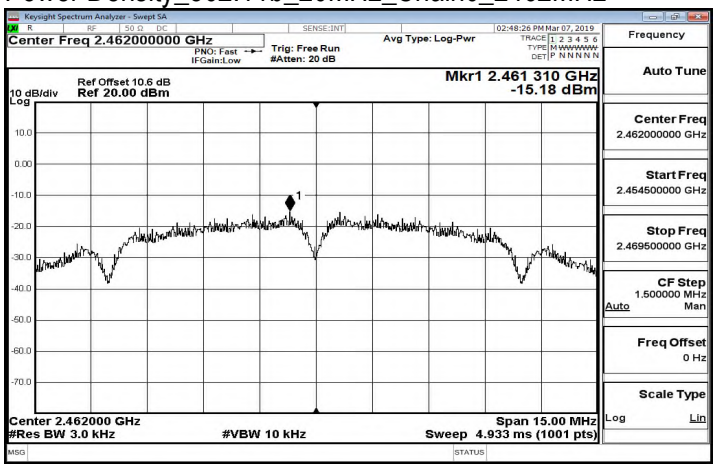

Power Density_802.11b_20MHz_Chain0_2437MHz



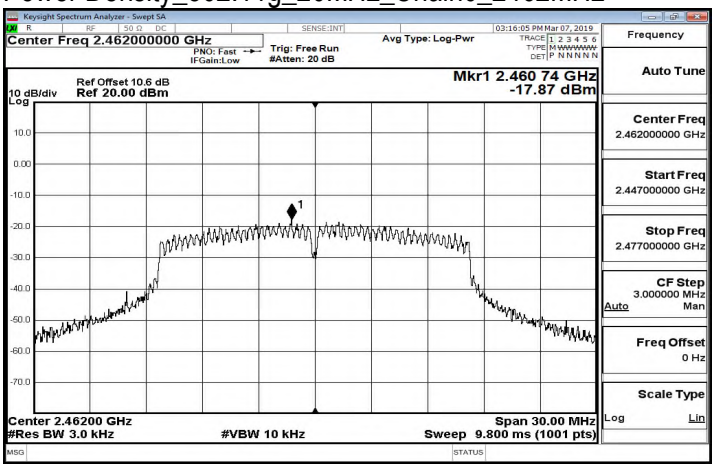

Power Density_802.11g_20MHz_Chain0_2437MHz




Power Density_802.11b_20MHz_Chain0_2462MHz




Power Density_802.11g_20MHz_Chain0_2462MHz

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# 13 ANTENNA REQUIREMENT

## 13.1 Standard Applicable

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

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

## 13.2 Antenna Connected Construction

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

***~ End of Report ~***

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