

TEST REPORT

Report Number: 104799910MPK-006
Project Number: G104799910
Original Issue Date: November 12, 2021
Revision Date: February 7, 2022

Testing performed on
Minibadge
Model Number: C1000

FCC ID: QGZC1000
IC: 4362A-C1000

to

FCC Part 15 Subpart C (15.247)
ISED RSS-247 Issue 2

For

Vocera Communications, Inc.

Test Performed by:
Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:
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Prepared by: _____

Minh Ly

Date: February 7, 2022

Reviewed by: _____


Krishna K Vemuri

Date: February 7, 2022

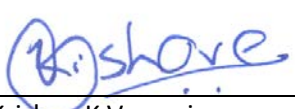
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| Report No. 104799910MPK-006 | |
|-------------------------------|---|
| Equipment Under Test: | Minibadge |
| Model Number: | C1000 |
| Applicant: | Vocera Communications, Inc. |
| Contact: | Prakash Guda |
| Address: | Vocera Communications, Inc. 525 Race St, Ste 150 San Jose, CA 95126 |
| Country: | USA |
| Tel. Number: | (408) 882-5100 |
| Email: | Pguda@vocera.com |
| Applicable Regulation: | FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 2 |
| Date of Test: | October 04 – 22, 2021 |

We attest to the accuracy of this report:



Minh Ly
Senior Project Engineer



Krishna K Vemuri
EMC Manager

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1.0 Summary of Tests

| Test | Reference FCC | Reference Industry Canada | Result |
|---|------------------------------|------------------------------|--------------------------------|
| RF Output Power | 15.247(b)(3) | RSS-247, 5.4.d) | Complies |
| 6 dB Bandwidth | 15.247(a)(2) | RSS-247, 5.2.a) | Complies |
| Power Density | 15.247(e) | RSS-247, 5.2.b) | Complies |
| Out of Band Antenna Conducted Emission | 15.247(d) | RSS-247, 5.5 | Complies |
| Transmitter Radiated Emissions | 15.247(d), 15.209, 15.205 | RSS-247, 5.5 | Complies |
| AC Line Conducted Emission | 15.207 | RSS-GEN | Complies |
| Antenna Requirement | 15.203 | RSS-GEN | Complies (Internal Antenna) |

EUT receive date: October 04, 2021

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: October 06, 2021

Test completion date: October 22, 2021

The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

Vocera Communications, Inc. supplied the following description of the EUT:

A small, lightweight, wearable communication device designed to simplify hospital communication and workflow and improve staff safety. A user can “wake up” and operate the device using only their voice, to stay connected even under restrictive PPE. They can make and receive calls; listen and respond to messages and alarm notifications. Visual indicators enable fast triaging of events. A dedicated panic button provides a direct connection to security personnel. The device can be used as a smartphone companion, or by itself.

For more information, see user’s manual provided by the manufacturer.

This test report covers only the 2.4GHz BLE radio.

Information about the BLE radio is presented below:

| | |
|-------------------------------------|--|
| Applicant | Vocera Communications, Inc. |
| Model No. | C1000 |
| FCC Identifier | QGZC1000 |
| IC Identifier | 4362A-C1000 |
| Type of transmission | Digital Transmission System (DTS) |
| Rated RF Output | 2.97 dBm |
| Antenna(s) & Gain | Internal Antenna, Gain: +1.45 dBi |
| Frequency Range | 2402 – 2480 MHz |
| Type of modulation/data rate | GFSK/1Mbit/s |
| Number of Channel(s) | 40 |
| Applicant Name & Address | Vocera Communications, Inc. 525 Race St, Ste 150 San Jose, CA 95126 USA |

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents “Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247” (KDB 558074 D01 DTS Meas Guidance v05r02), and RSS-247 Issue 2, RSS-GEN Issue 5.

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “Data Sheet” of this report.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn’t take into account the measurement uncertainty.

Estimated Measurement Uncertainty

| Measurement | Expanded Uncertainty (k=2) | | |
|--|----------------------------|-----------------|-----------|
| | 0.15 MHz – 1 GHz | 1 GHz – 2.5 GHz | > 2.5 GHz |
| RF Power and Power Density – antenna conducted | - | 0.7 dB | - |
| Unwanted emissions – antenna conducted | 1.1 dB | 1.3 dB | 1.9 dB |
| Bandwidth – antenna conducted | - | 30 Hz | - |

| Measurement | Expanded Uncertainty (k=2) | | | |
|------------------------------|----------------------------|--------------|-----------------|----------------|
| | 0.15 MHz – 30MHz | 30 – 200 MHz | 200 MHz – 1 GHz | 1 GHz – 18 GHz |
| Radiated emissions | - | 4.7 | 4.6 | 5.1 dB |
| AC mains conducted emissions | 2.1 dB | - | - | - |

3.0 System Test Configuration

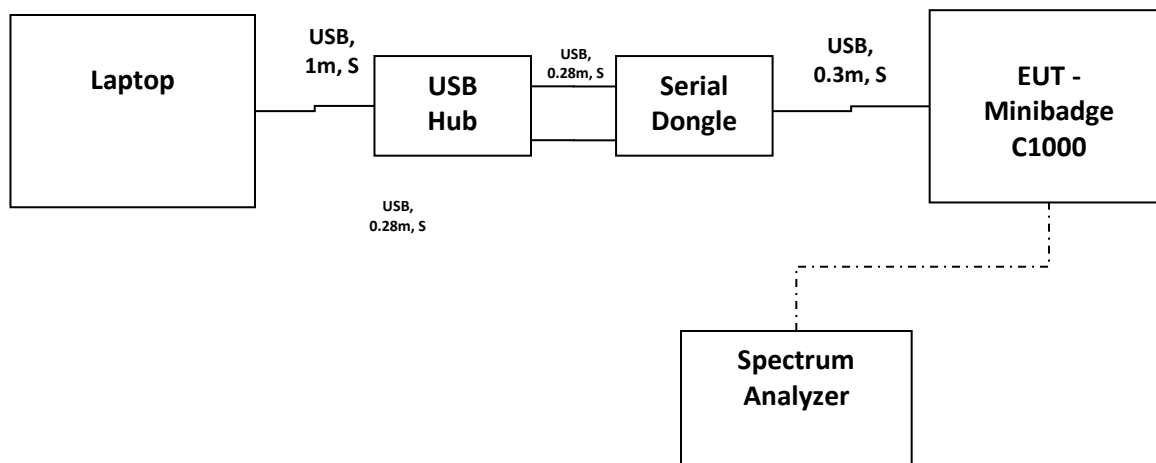
3.1 Support Equipment

| Support Equipment | | |
|-------------------|--------------|---------------|
| Description | Manufacturer | Model |
| Laptop | Lenovo | T440P |
| USB Hub | Tendak | CP-029-BK |
| Serial Dongle | Vocera | 210-01516-B04 |

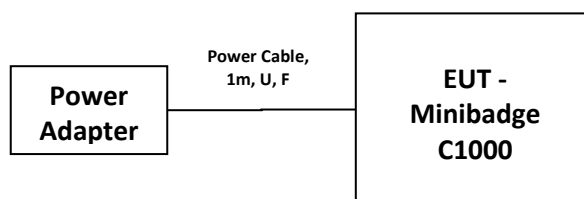
3.2 Block Diagram of Test Setup

| Equipment Under Test | | | |
|----------------------------|-----------------------------|---------------|------------------|
| Description | Manufacturer | Model | Serial Number/ID |
| Minibadge – Conducted Unit | Vocera Communications, Inc. | C1000 | AA3301J26008A6 |
| Minibadge – Radiated Unit | Vocera Communications, Inc. | C1000 | AA3301J2600878 |
| Power Adapter | Vocera | WB-10E05R | D0714N55000843 |
| Wired Headset | Vocera | V5000 Headset | 230-02162 |

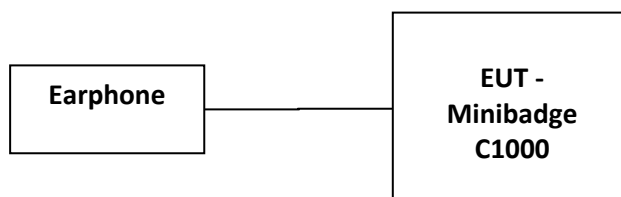
Antenna was removed and co-axial connector was installed for Conducted Measurements.



Radiated Measurements Charging Mode



Radiated Measurements Normal Mode



S = Shielded
U = Unshielded

F = With Ferrite
m = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. Different orientation of the EUT were tested and only the worse-case emissions were reported.

The EUT was tested in 2 configurations with EUT in horizontal and upright positions:

- A/ Charging mode: tested with power adapter
- B/ Normal mode: tested in battery mode and earphone.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Vocera Communications, Inc..

3.5 Mode of Operation during Test

During the transmitter tests, the transmitter was setup to transmit maximum communication and RF power levels.

EUT was placed into transmit mode at the lowest (2402MHz) middle (2440MHz), and highest (2480MHz) channels.

3.6 Modifications Required for Compliance

No modifications were made by the manufacturer or Intertek to the EUT in order to bring the EUT into compliance.

3.7 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

4.1 6-dB Bandwidth and 99% Occupied Bandwidth FCC Rule: 15.247(a)(2); RSS-247, 5.2.a) and RSS-GEN;

4.1.1 Requirement

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

4.1.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

For FCC 6dB Channel Bandwidth the Procedure described in the FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used to determine the DTS occupied bandwidth. Section 11.8.1 Option 1 of ANSI 63.10 was used.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

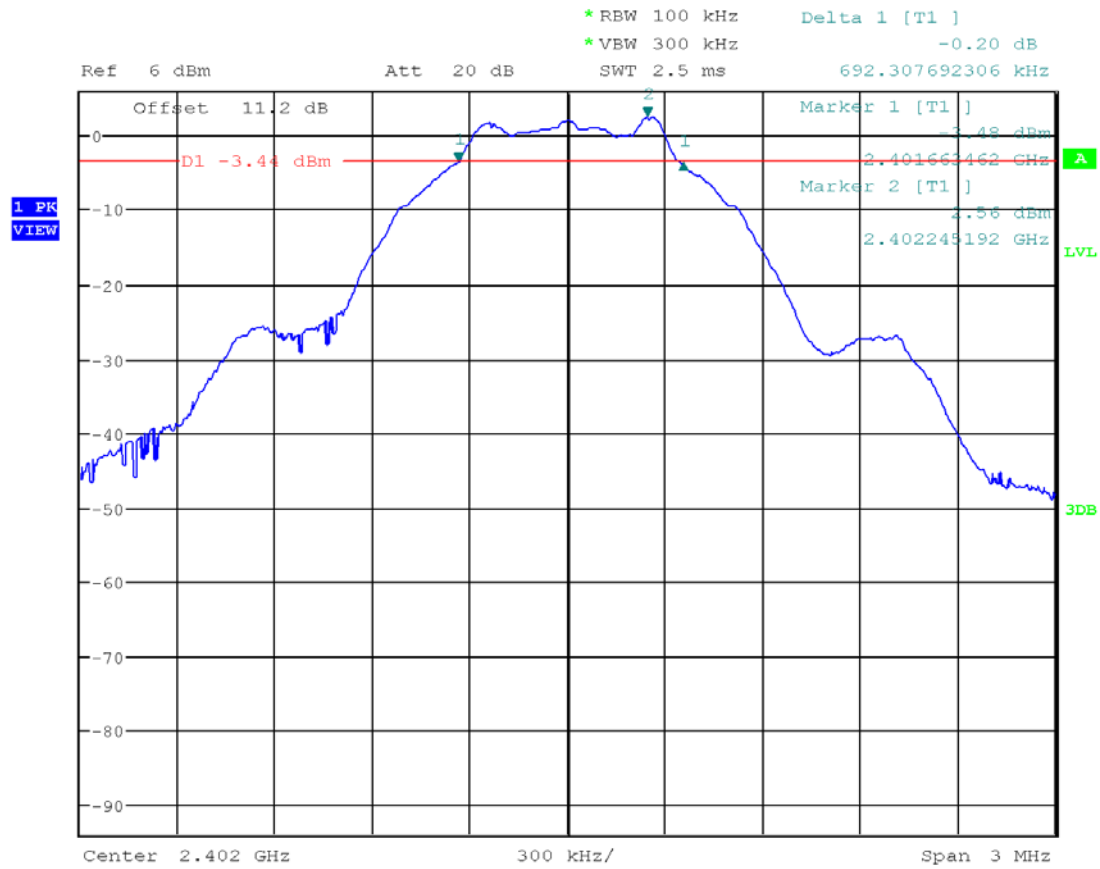
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

| Frequency (MHz) | 6-dB bandwidth FCC 15.247 & RSS-GEN, kHz | Occupied bandwidth, RSS-GEN, MHz | Plot |
|-----------------|---|--|------|
| 2402 | 692.30 | -- | 1.1 |
| | -- | 1.052 | 1.4 |
| 2440 | 677.88 | -- | 1.2 |
| | -- | 1.057 | 1.5 |
| 2480 | 677.88 | -- | 1.3 |
| | -- | 1.052 | 1.6 |

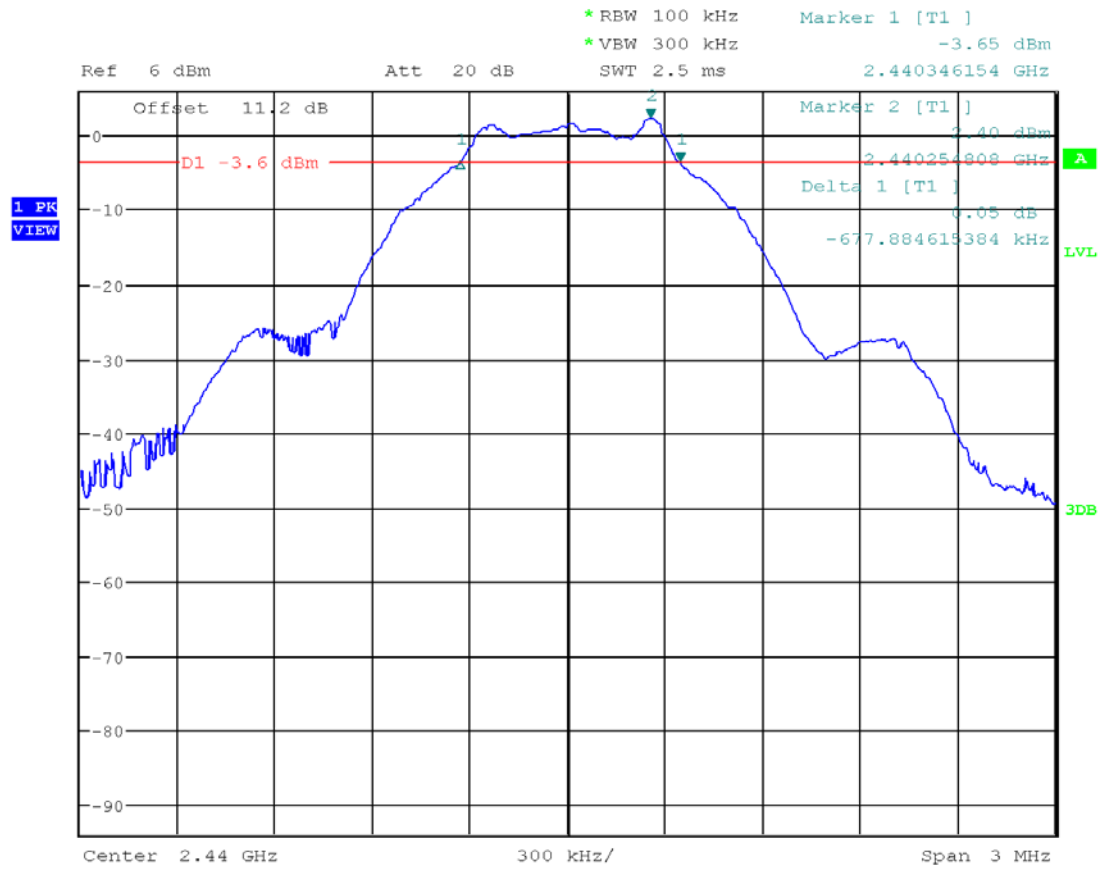
| Tested By | Test Date | Results |
|-----------|------------------|----------|
| Minh Ly | October 18, 2021 | Complies |

Plot 1. 1



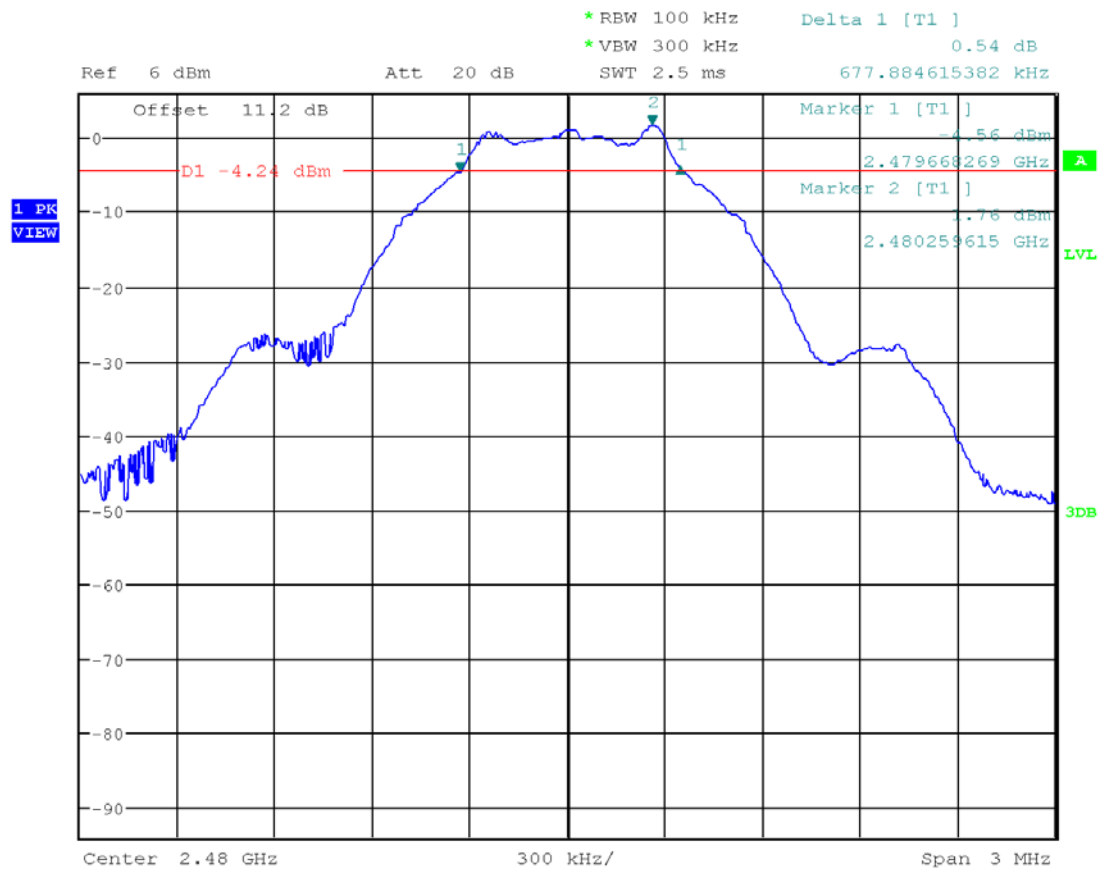
Date: 18.OCT.2021 22:21:41

Plot 1. 2



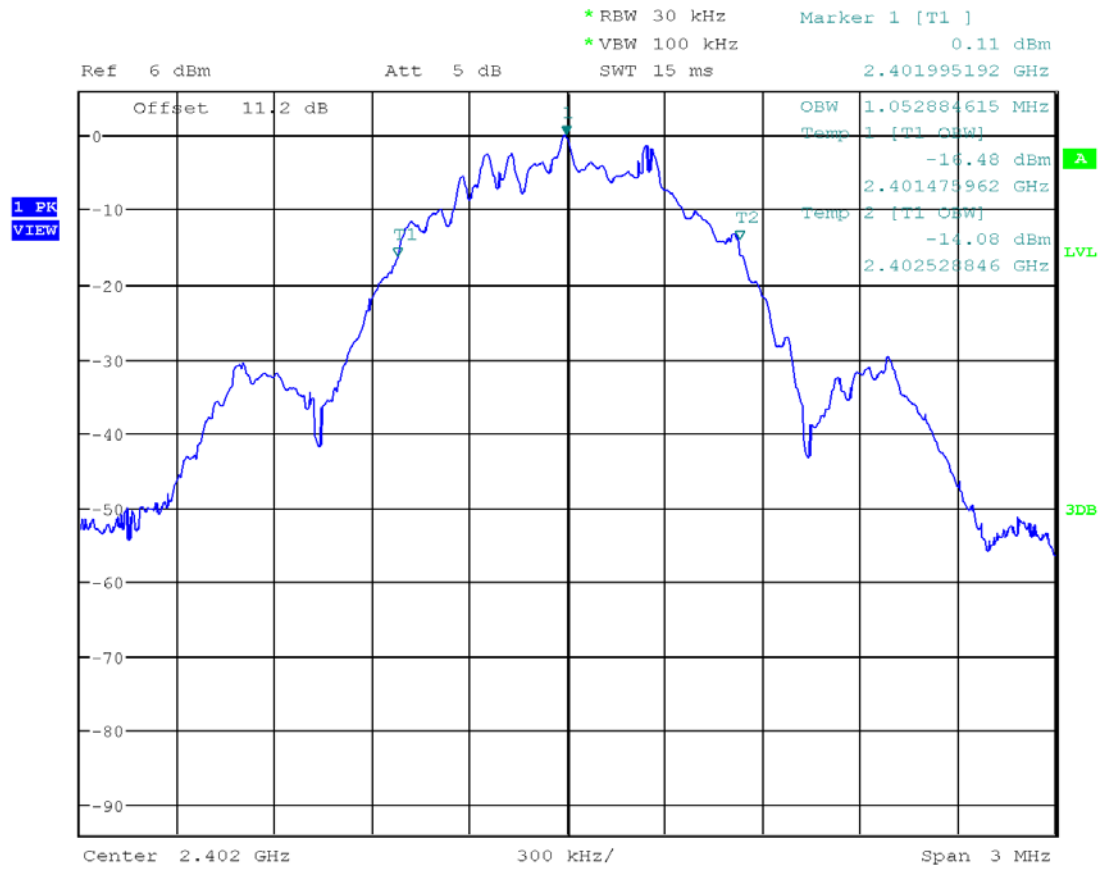
Date: 18.OCT.2021 22:23:21

Plot 1.3



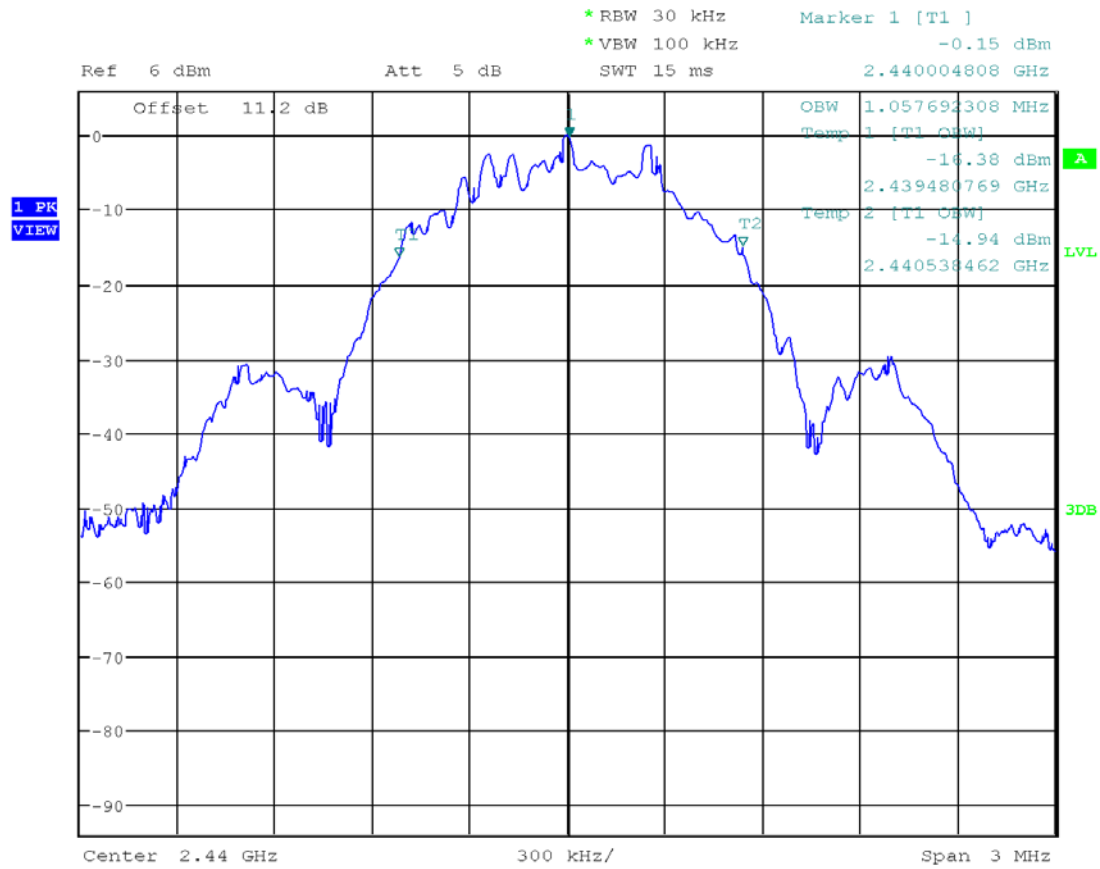
Date: 18.OCT.2021 22:24:48

Plot 1. 4



Date: 18.OCT.2021 22:27:13

Plot 1.5



Date: 18.OCT.2021 22:26:43

```
* RBW 30 kHz      Marker 1 [T1 ]
* VBW 100 kHz      -0.91 dBm
SWT 15 ms          2.479990385 GHz
```



Results

Complies

4.2 Maximum Peak Conducted Output Power at Antenna Terminals FCC Rule: 15.247(b)(3); RSS-247, 5.4.d);

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt or 30 dBm. For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used. Specifically, section 11.9.1.1 $RBW \geq DTS$ bandwidth in ANSI 63.10.

1. Set the $RBW \geq DTS$ Bandwidth
2. Set the $VBW \geq 3 \times RBW$
3. Set the span $\geq 3 \times RBW$
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max Hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

A spectrum analyzer was connected to the antenna port of the transmitter.

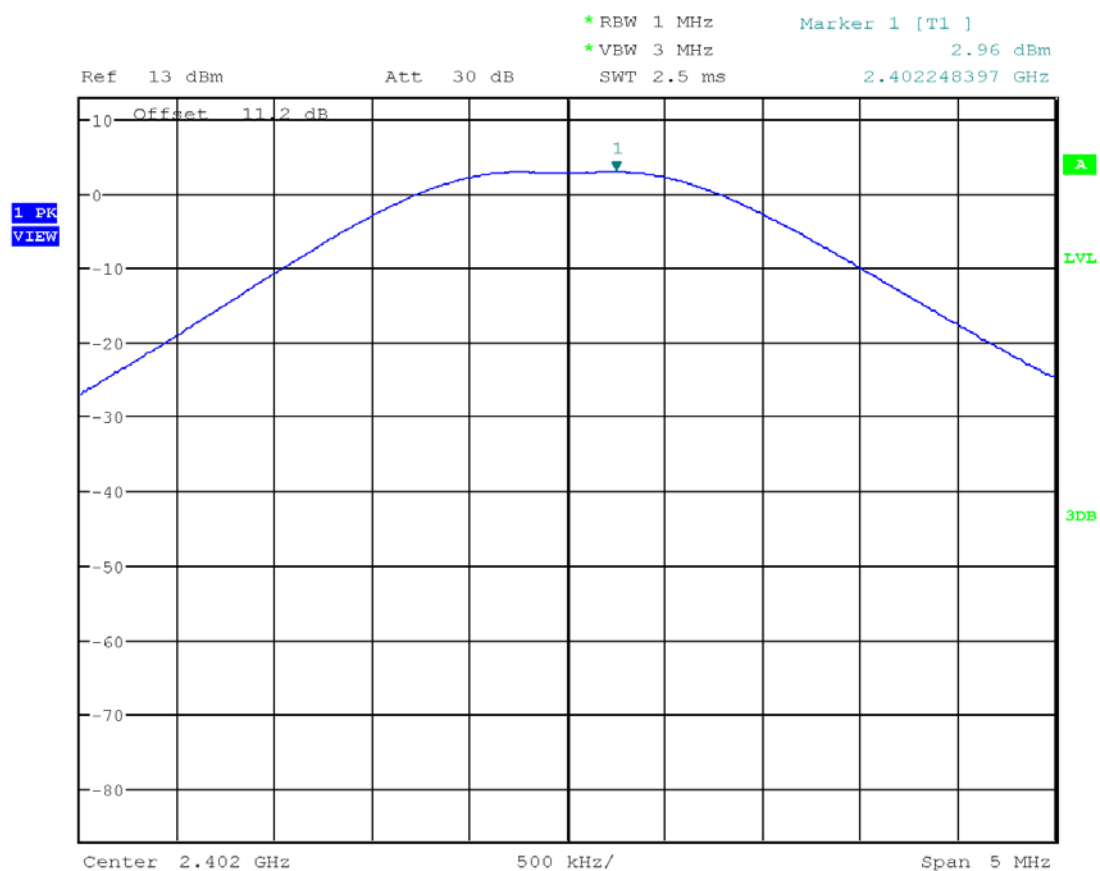
4.2.3 Test Result

Refer to the following plots 2.1 – 2.3 for the test details.

| Frequency | Conducted Power (peak) | | Plot |
|-----------|------------------------|-------|------|
| | dBm | mW | |
| 2402 | 2.96 | 1.976 | 2.1 |
| 2442 | 2.97 | 1.981 | 2.2 |
| 2480 | 2.30 | 1.698 | 2.3 |

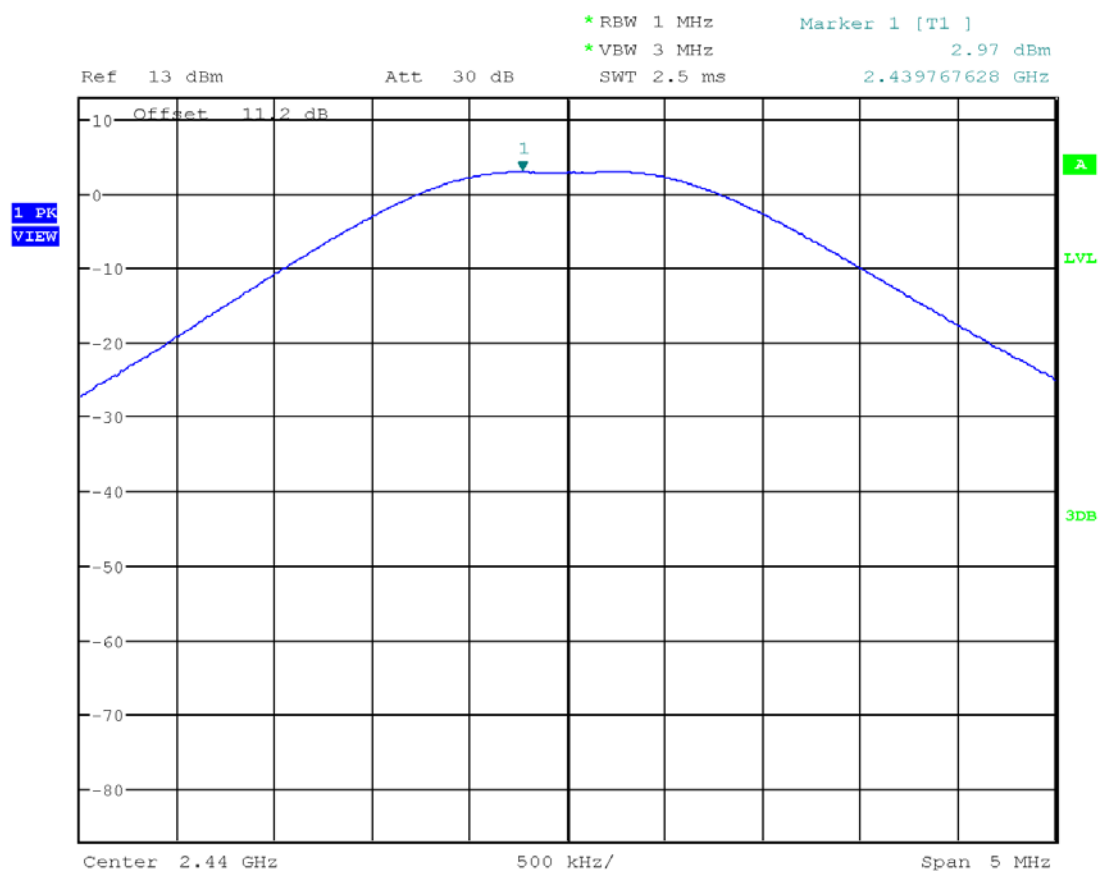
| Tested By | Test Date | Results |
|-----------|------------------|----------|
| Minh Ly | October 14, 2021 | Complies |

Plot 2.1



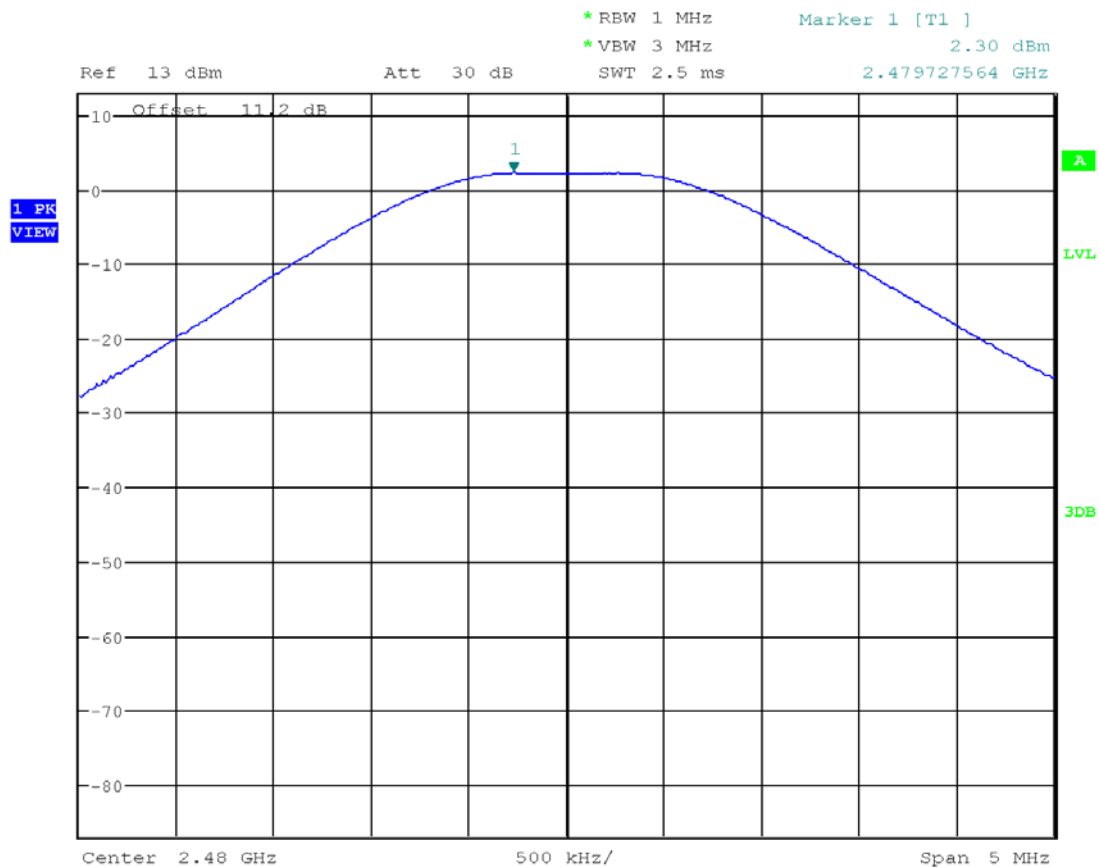
Date: 14.OCT.2021 22:16:07

Plot 2.2



Date: 14.OCT.2021 22:17:46

Plot 2.3



Date: 14.OCT.2021 22:18:31

Results

Complies

4.3 Maximum Power Spectral Density FCC: 15.247 (e); RSS-247, 5.2.b);

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.10.2 Method PKPSD (peak PSD) of ANSI 63.10.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

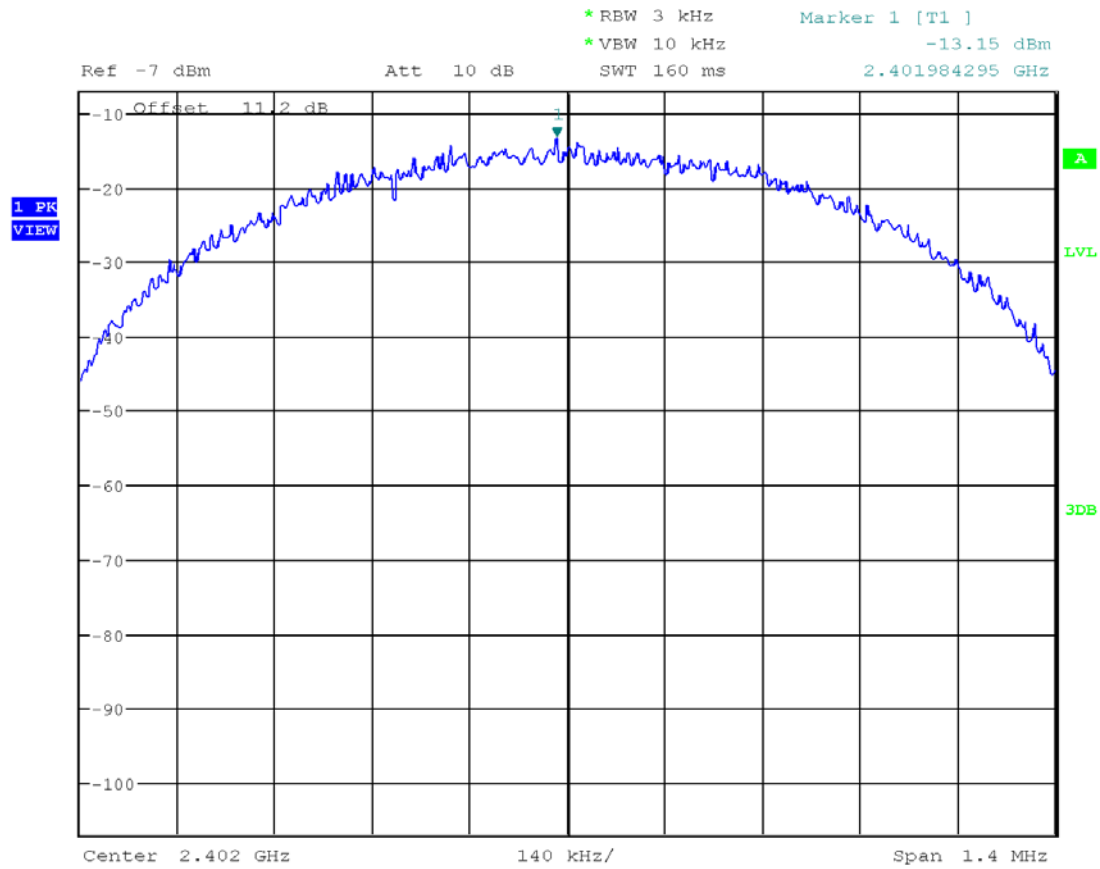
4.3.3 Test Result

Refer to the following plots for the test result

| Frequency, MHz | Maximum Power Spectral Density, dBm | Maximum Power Spectral Density Limit, dBm | Margin, dB | Plot |
|----------------|-------------------------------------|---|------------|------|
| 2402 | -13.15 | 8.0 | -21.15 | 3.1 |
| 2440 | -14.34 | 8.0 | -22.34 | 3.2 |
| 2480 | -14.44 | 8.0 | -22.44 | 3.3 |

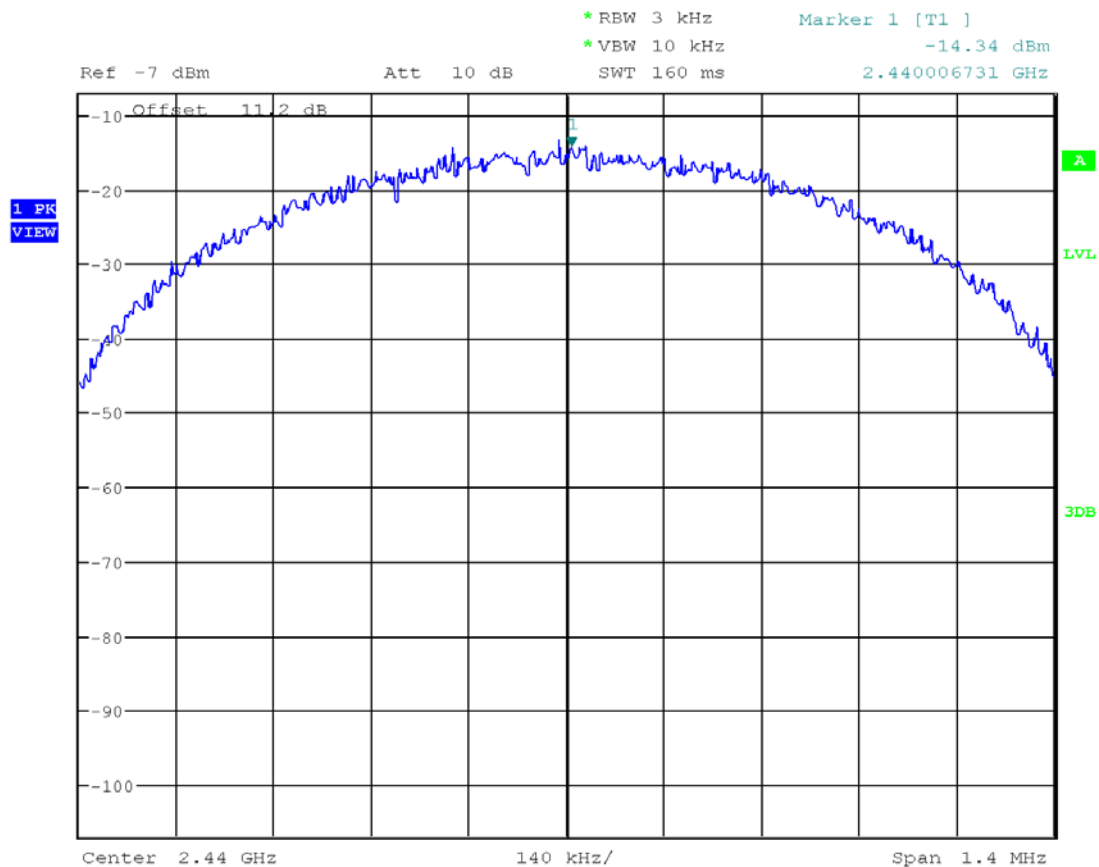
| Tested By | Test Date | Results |
|-----------|------------------|----------|
| Minh Ly | October 18, 2021 | Complies |

Plot 3.1



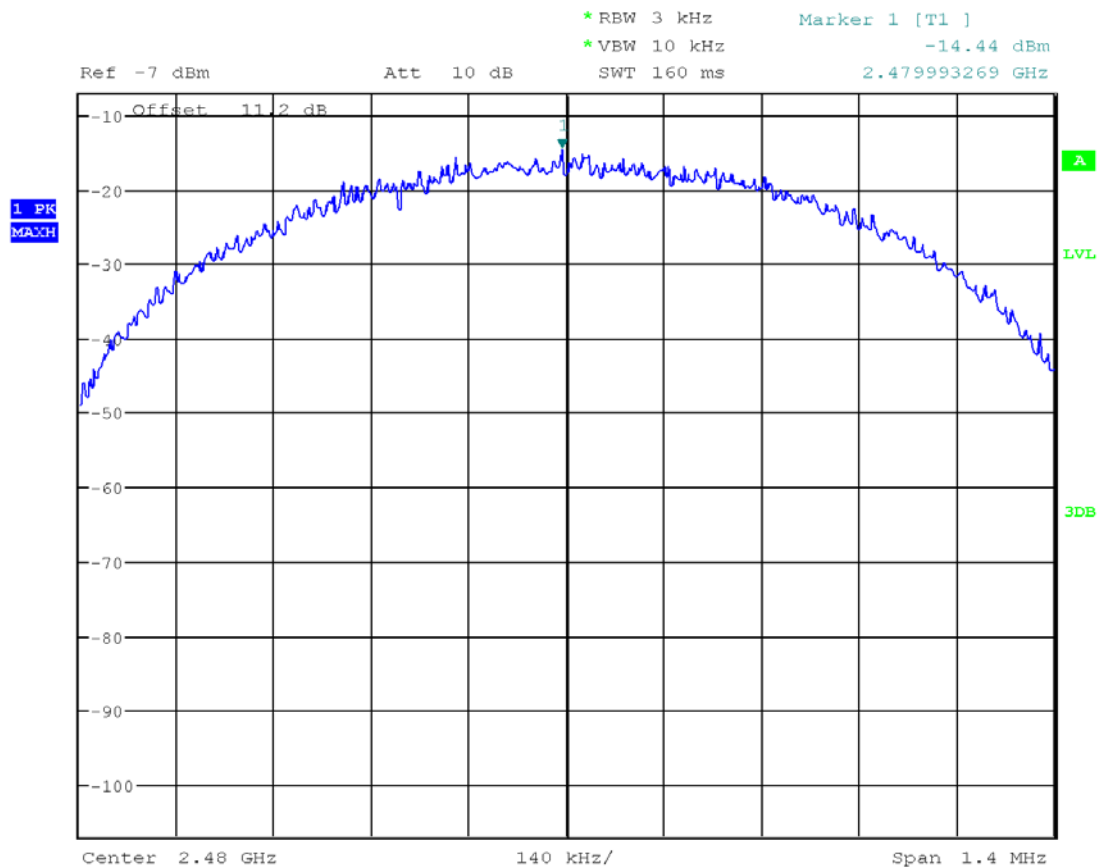
Date: 18.OCT.2021 22:28:32

Plot 3.2



Date: 18.OCT.2021 22:29:07

Plot 3.3



Date: 18.OCT.2021 22:29:53

Results

Complies

4.4 Out of Band Antenna Conducted Emission
FCC: 15.247(d); RSS-247, 5.5;

4.4.1 Requirement

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

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)

4.4.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.11 DTS Emissions in non-restricted frequency bands of ANSI 63.10.

A spectrum analyzer was connected to the antenna port of the transmitter.

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq 3 \times$ RBW.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

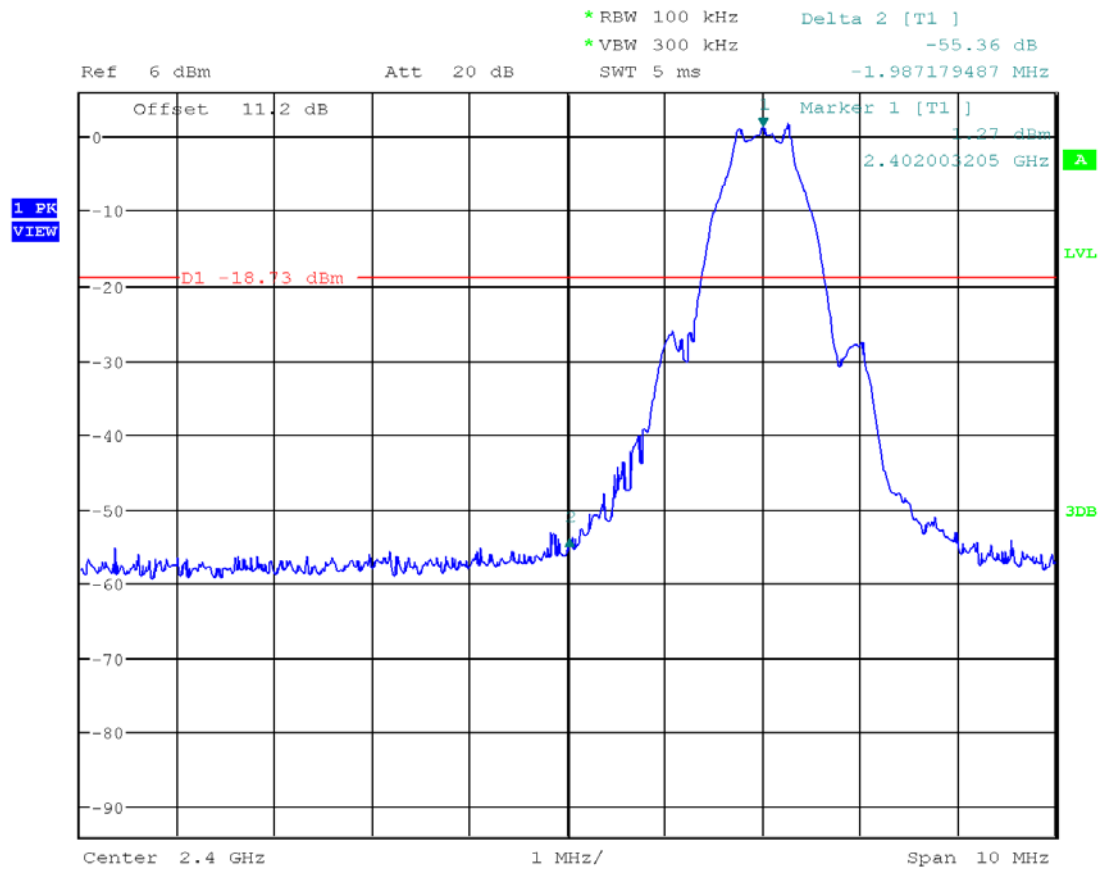
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

Refer to the following plots 4.1 – 4.5 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

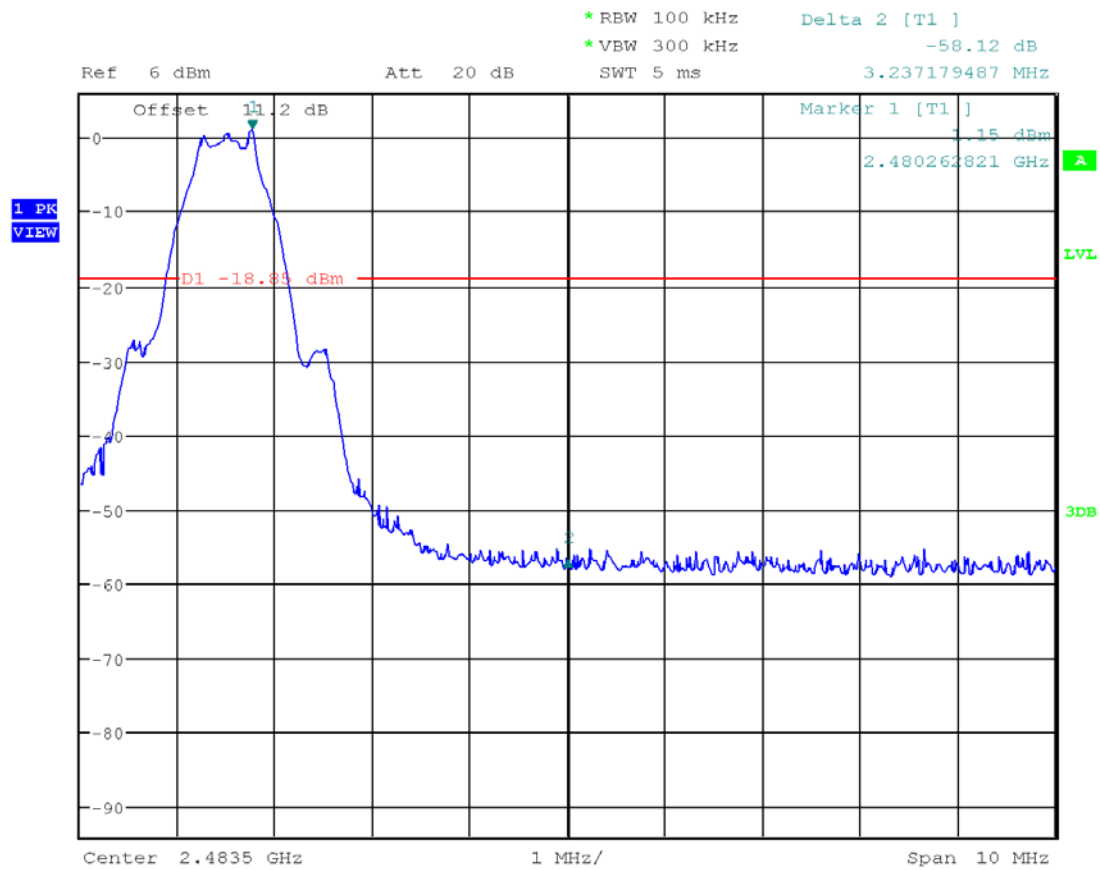
| Tested By | Test Date | Results |
|-----------|------------------|----------|
| Minh Ly | October 19, 2021 | Complies |

Tx @ Low Channel, 2402 MHz Band Edge
Plot 4.1



Date: 18.OCT.2021 22:33:42

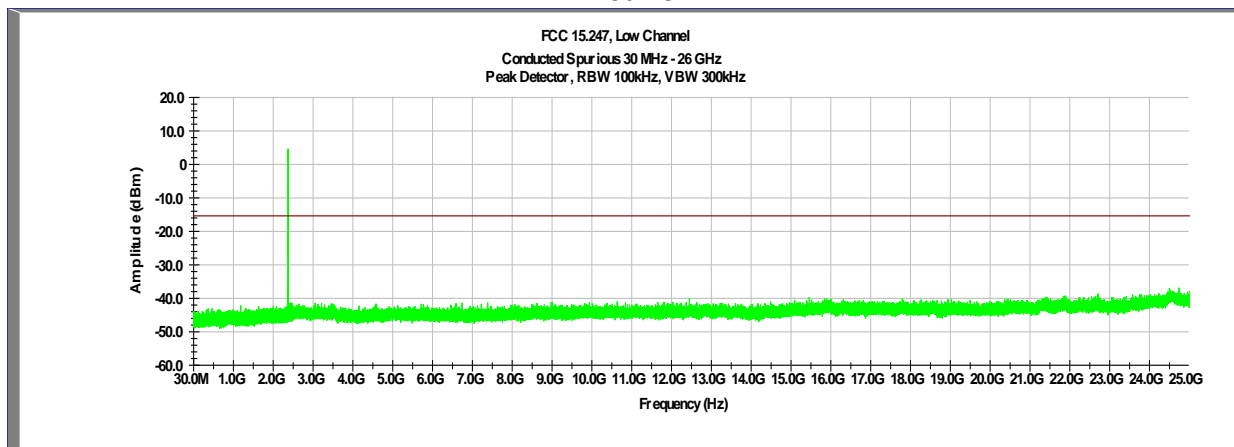
Tx @ High Channel, 2480 MHz Band Edge
Plot 4.2



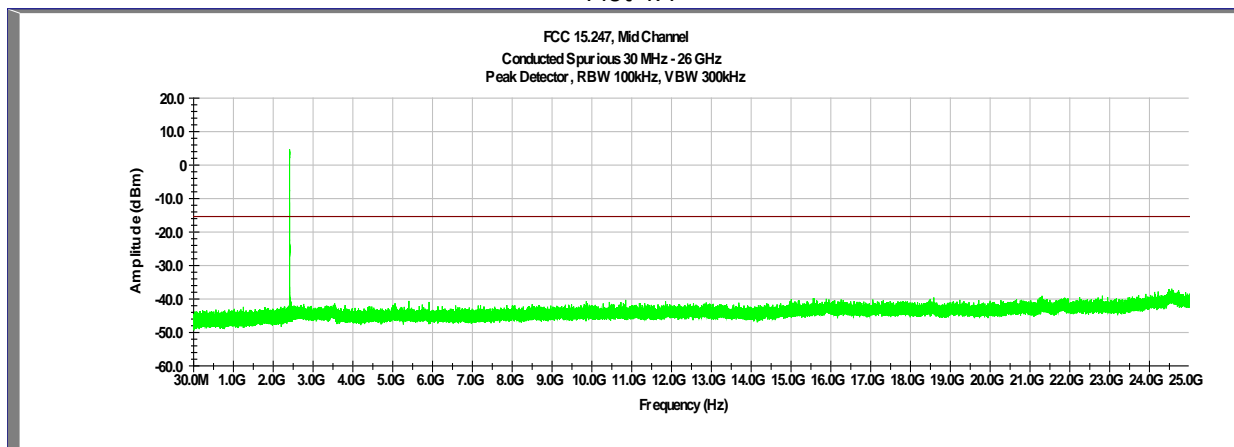
Date: 18.OCT.2021 22:31:48

| | |
|---------|----------|
| Results | Complies |
|---------|----------|

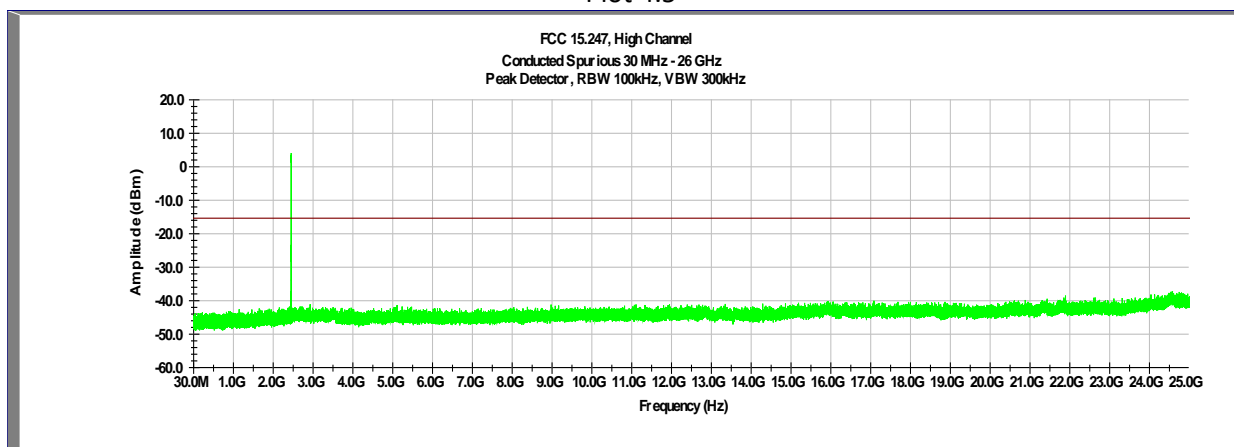
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Plot 4.4



Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious
Plot 4.5



Results

Complies

4.5 Transmitter Radiated Emissions FCC Rules: 15.247(d), 15.209, 15.205; RSS-247, 5.5;

4.5.1 Requirement

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) (see §15.205(c)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.5.2 Procedure

Radiated emission measurements were performed from 9 kHz to 26.5 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 9kHz to 26.5GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26.5GHz.

Correlation measurements were performed below 30MHz between 10m ALSE and Open Field site according to FCC KDB 414788 D01 Radiated Test Site v01r01 section 2. All readings were within the acceptable tolerance.

4.5.3 Field Strength Calculation

Field Strength Calculation

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

$FS = RA + AF + CF - AG$; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB(μ V); AF = Antenna Factor in dB(1/m)

CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

RA = 52.0 dB(μ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 \text{ dB}(\mu\text{V/m})$.

Level in μ V/m = Common Antilogarithm $[(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$.

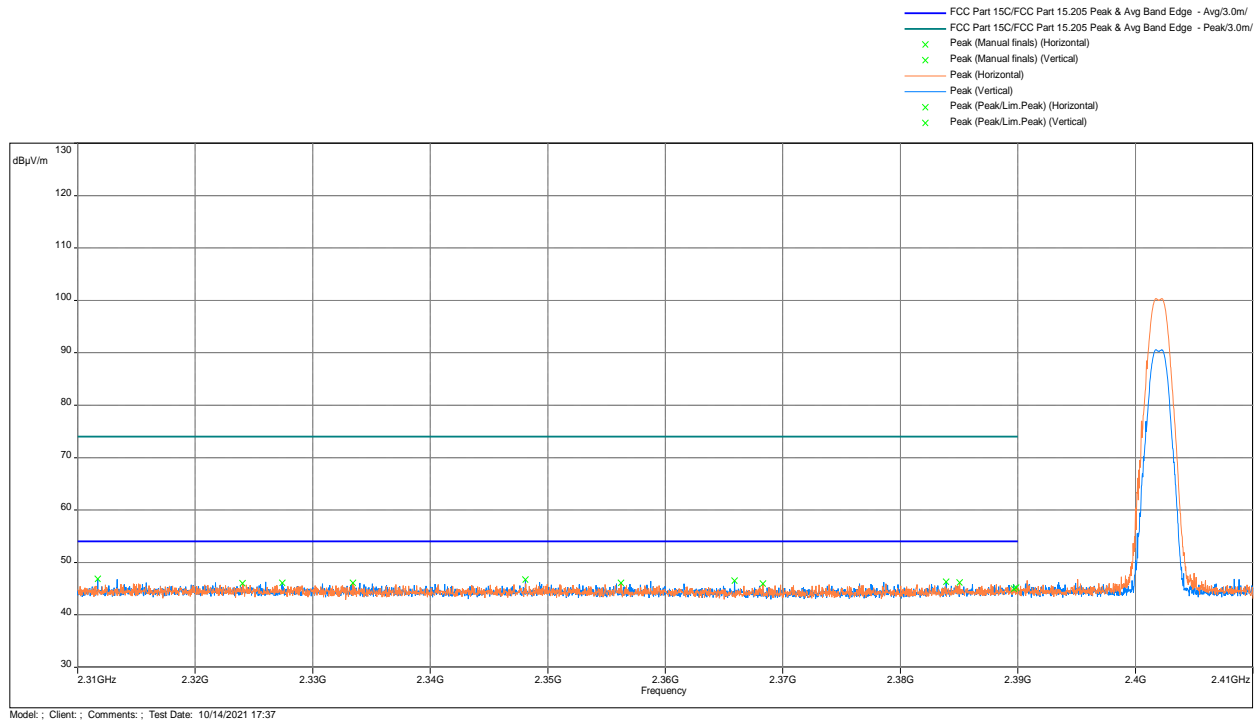
4.5.4 Test Results

All testing in this section were performed by radiated measurements.

| Tested By | Test Date | Results |
|-----------|-----------------------|----------|
| Minh Ly | October 14 – 19, 2021 | Complies |

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

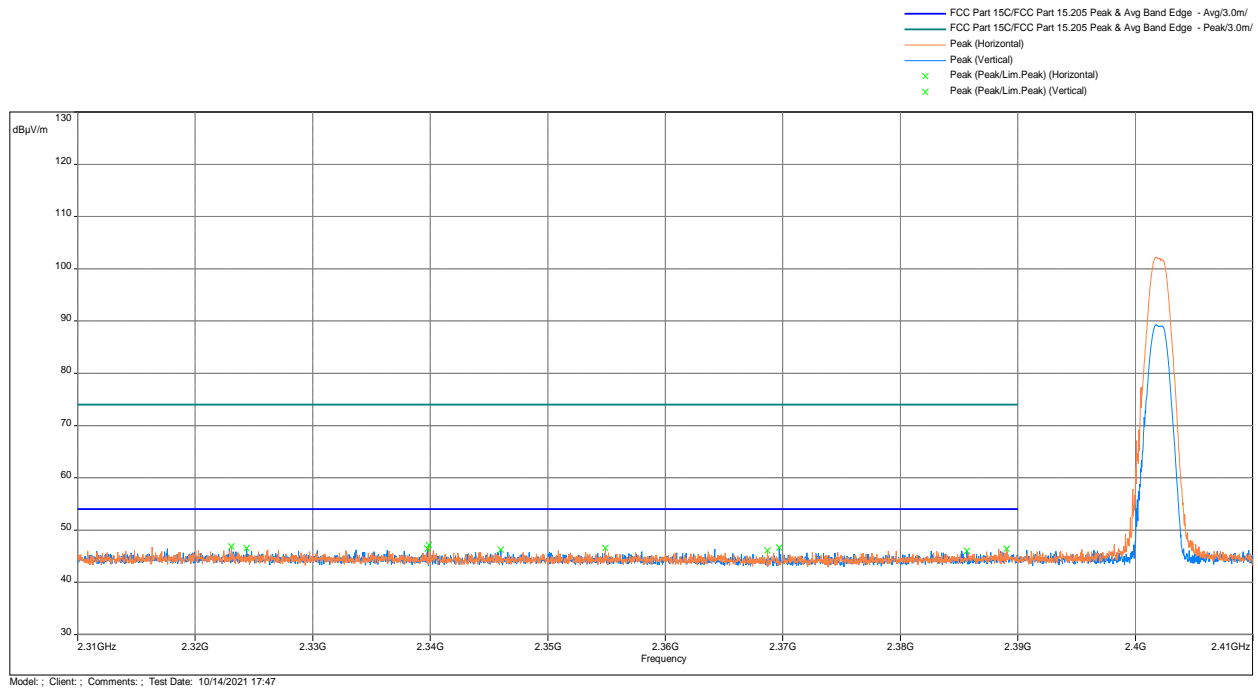
**Out-of-Band Radiated spurious emissions at the Band-edge @1m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
Charging Mode**



| Freq. MHz | Peak@3m dB(μV/m) | Ave Limit dB(μV/m) | Margin dB | Azimuth deg | Height m | Polarity | Correction dB |
|--------------|---------------------|-----------------------|--------------|----------------|-------------|------------|------------------|
| 2390.0 | 45.0 | 54.0 | -9.0 | 172.5 | 1.5 | Vertical | 21.6 |
| 2390.0 | 45.2 | 54.0 | -8.8 | 0.0 | 2.0 | Horizontal | 21.6 |

Note: Correction = AF + CF + DCF – Preamp

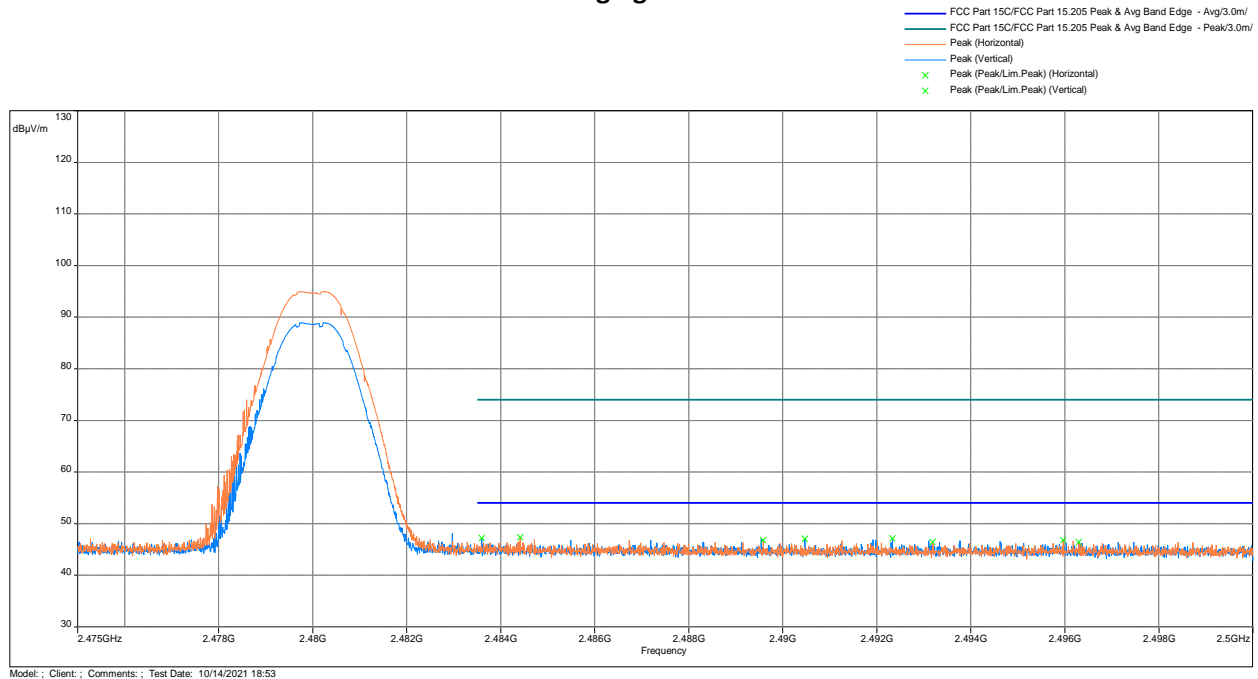
**Out-of-Band Radiated spurious emissions at the Band-edge @1m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
Normal Mode**



| Freq. MHz | Peak@3m dB(μV/m) | Ave Limit dB(μV/m) | Margin dB | Azimuth deg | Height m | Polarity | Correction dB |
|--------------|---------------------|-----------------------|--------------|----------------|-------------|------------|------------------|
| 2390.0 | 45.2 | 54.0 | -8.8 | 240 | 1.5 | Horizontal | 21.6 |
| 2390.0 | 45.2 | 54.0 | -8.8 | 36 | 1.5 | Vertical | 21.6 |

Note: Correction = AF + CF + DCF – Preamp

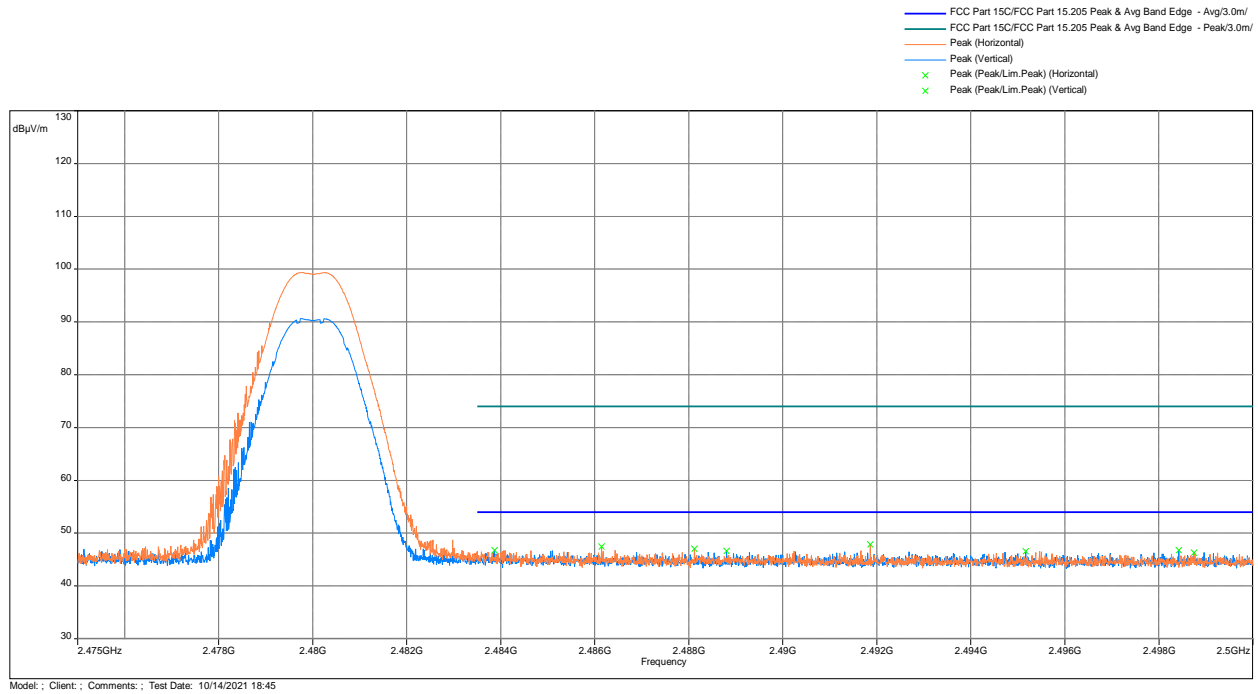
Out-of-Band Radiated spurious emissions at the Band-edge @1m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
Charging Mode



| Freq. MHz | Peak@3m dB(μV/m) | Ave Limit dB(μV/m) | Margin dB | Azimuth deg | Height m | Polarity | Correction dB |
|--------------|---------------------|-----------------------|--------------|----------------|-------------|------------|------------------|
| 2483.5 | 46.0 | 54.0 | -8.1 | 166.0 | 2.0 | Horizontal | 22.0 |
| 2483.5 | 47.2 | 54.0 | -6.8 | 54.8 | 2.0 | Vertical | 22.0 |

Note: Correction = AF + CF + DCF – Preamp

Out-of-Band Radiated spurious emissions at the Band-edge @1m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
Normal Mode



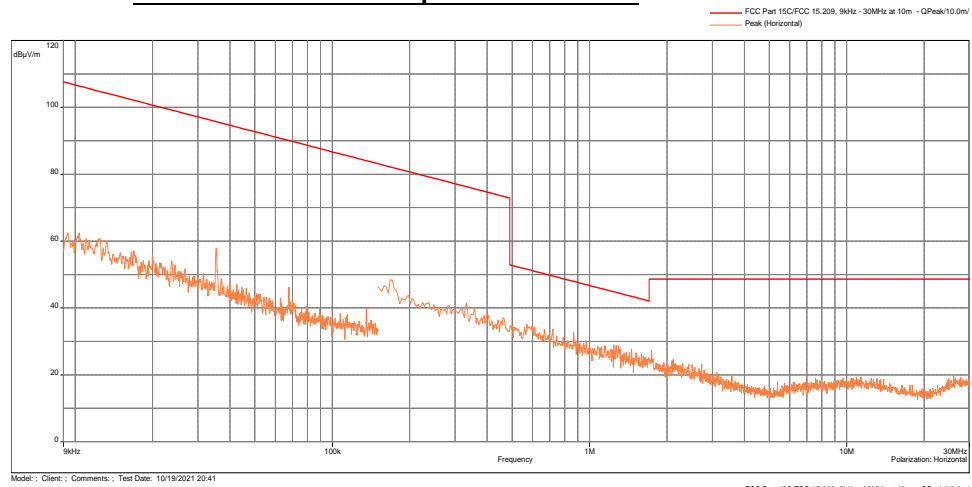
| Freq. MHz | Peak@3m dB(μV/m) | Ave Limit dB(μV/m) | Margin dB | Azimuth deg | Height m | Polarity | Correction dB |
|--------------|---------------------|-----------------------|--------------|----------------|-------------|------------|------------------|
| 2483.5 | 46.1 | 54.0 | -7.9 | 0.0 | 2.0 | Vertical | 22.0 |
| 2483.5 | 46.6 | 54.0 | -7.5 | 297.5 | 1.5 | Horizontal | 22.0 |

Note: Correction = AF + CF + DCF – Preamp

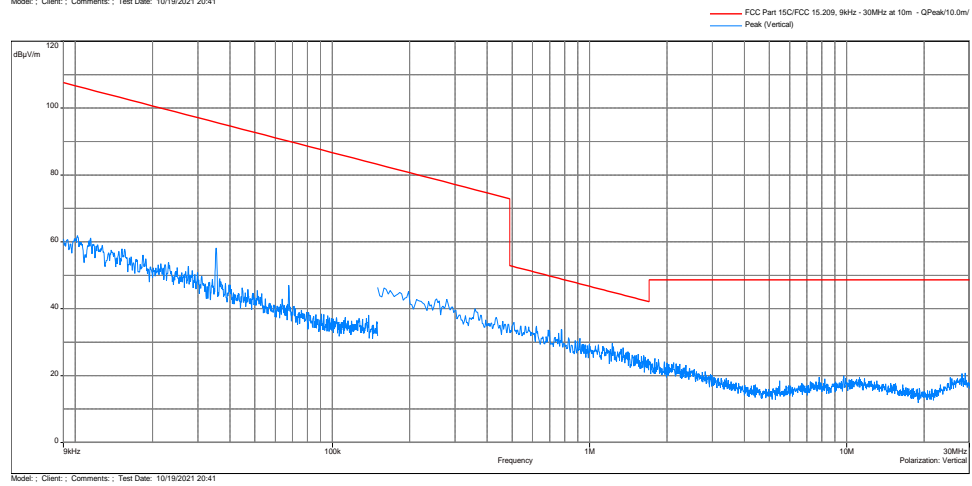
| | |
|----------------|-----------------|
| Results | Complies |
|----------------|-----------------|

Out-of-Band Radiated Spurious Emissions

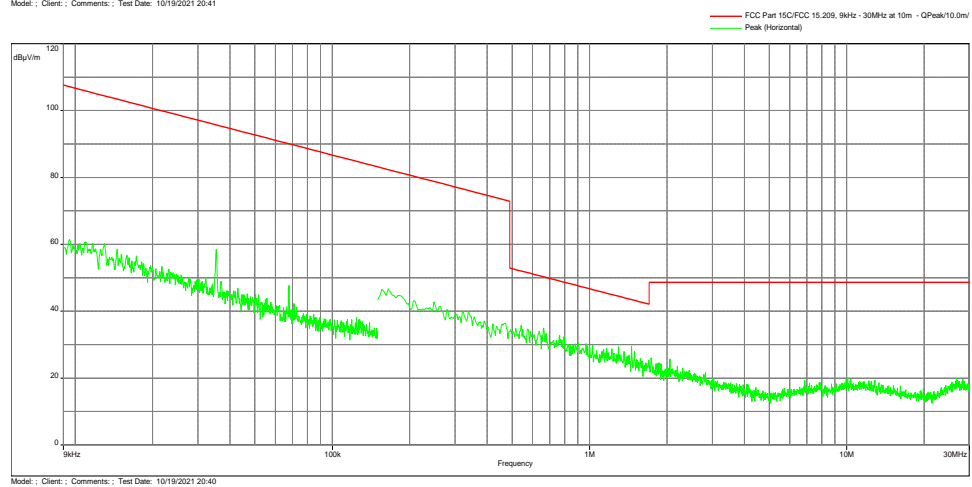
Antenna Position -
Coaxial



Antenna Position -
Coplanar

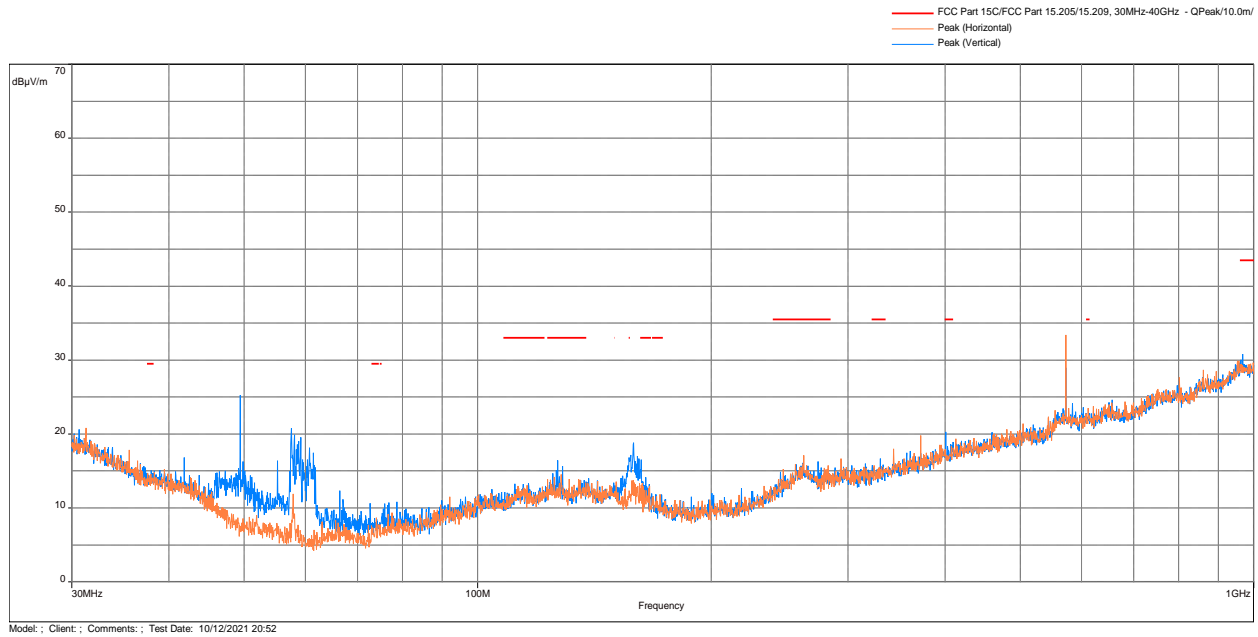


Antenna Position -
Horizontal

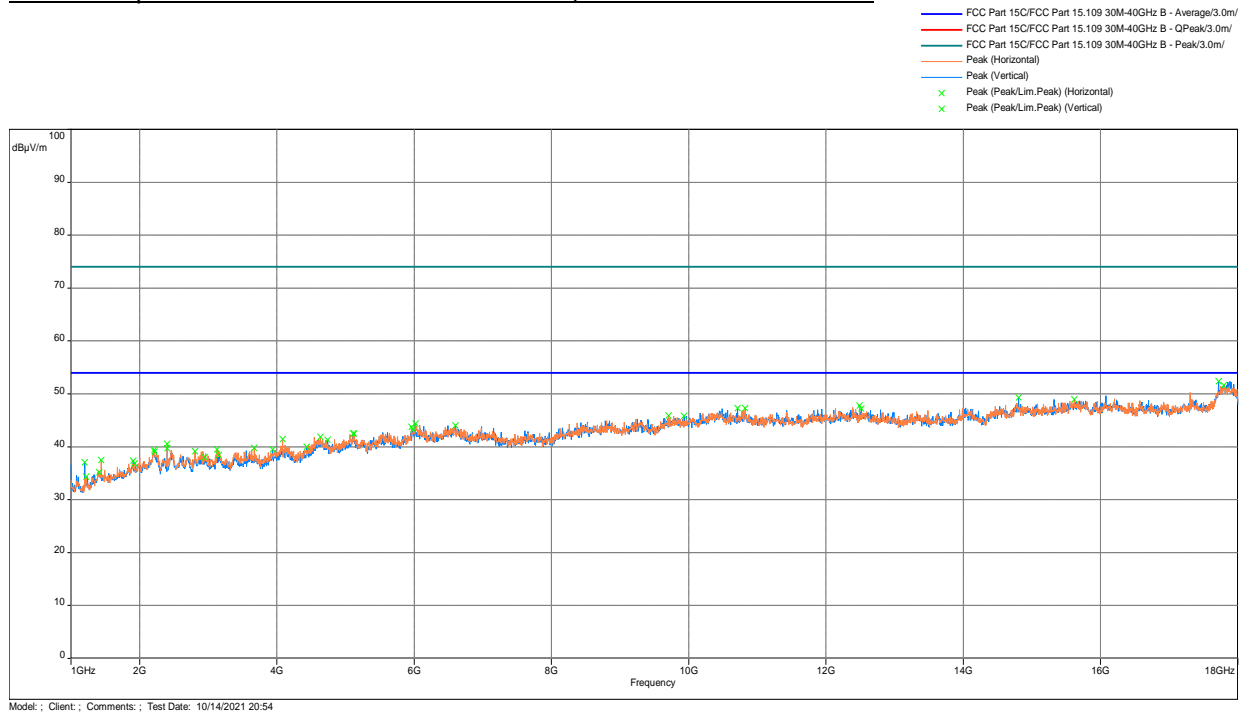


Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz

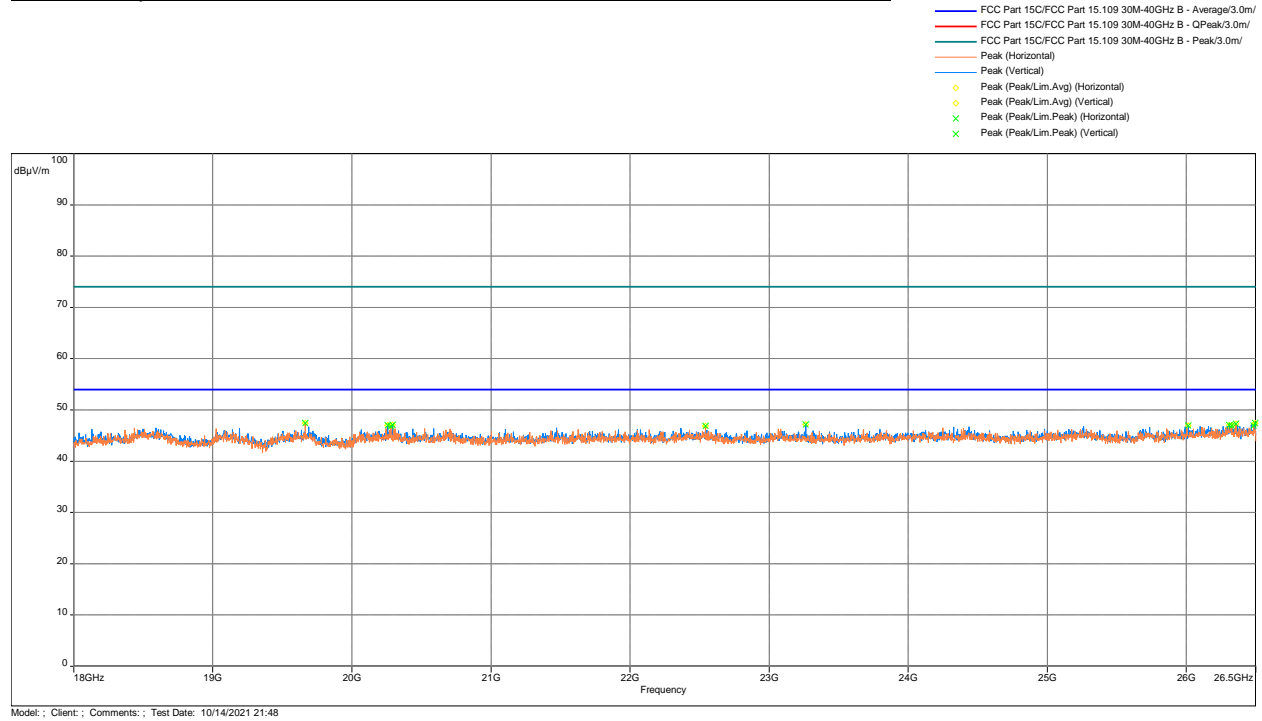
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak Limit.



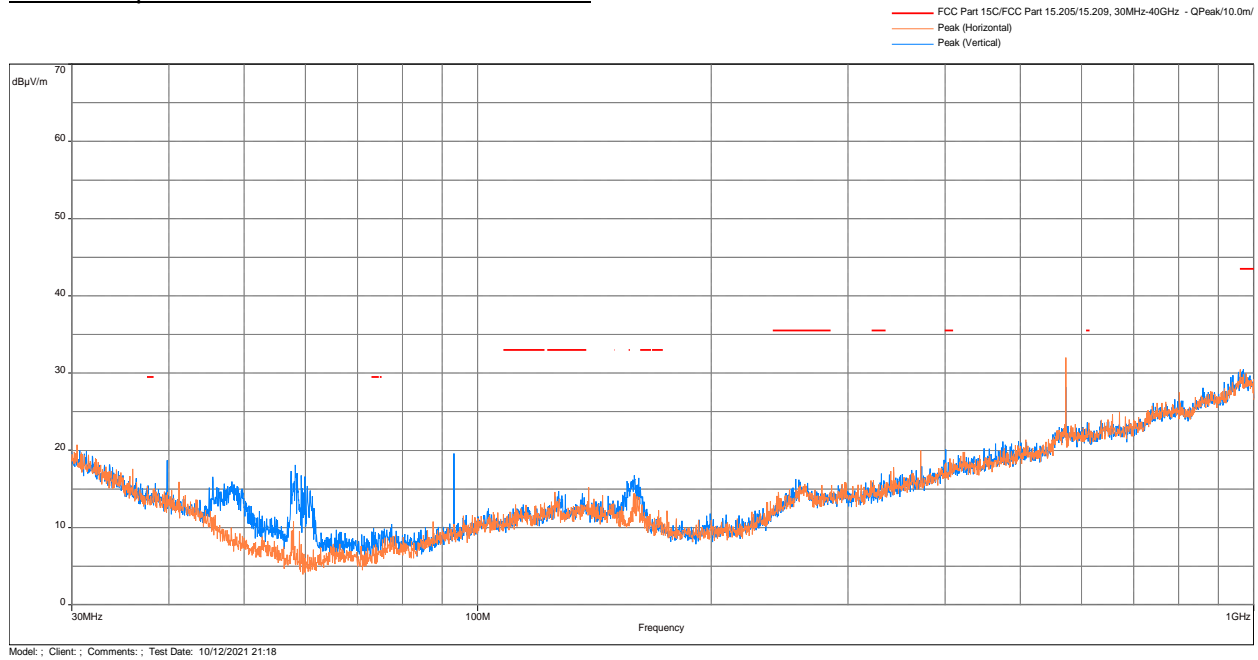
| Frequency (MHz) | Peak @3m (dBμV/m) | Lim. Ave @3m (dBμV/m) | Margin dB | Height (m) | Angle (°) | Comment | Correction (dB) |
|-----------------|-------------------|-----------------------|-----------|------------|-----------|------------|-----------------|
| 5961.733 | 43.7 | 54.0 | -10.3 | 3.5 | 99.3 | Horizontal | -2.0 |
| 5986.667 | 43.3 | 54.0 | -10.7 | 3.2 | 58.3 | Vertical | -1.7 |
| 17717.800 | 52.4 | 54.0 | -1.6 | 1.5 | 170.8 | Vertical | 9.3 |
| 17795.433 | 51.6 | 54.0 | -2.4 | 1.7 | 2.0 | Horizontal | 10.2 |

Note: Correction = AF + CF - Preamp

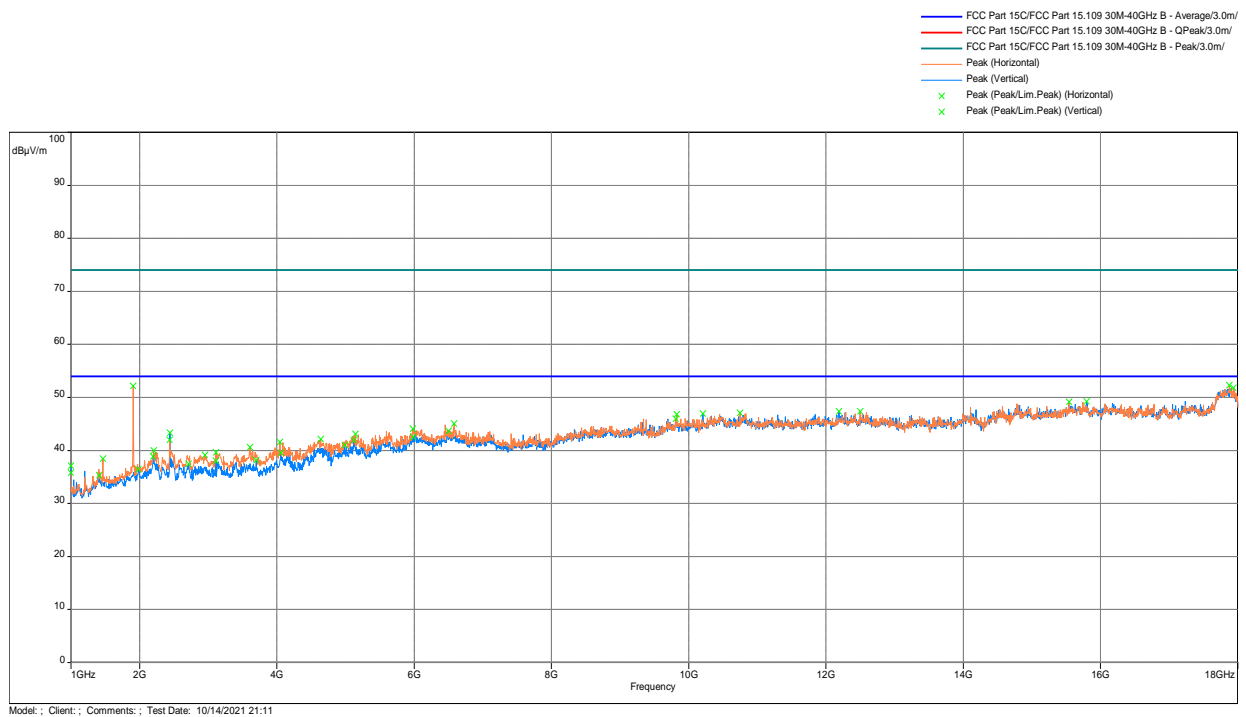
| | |
|----------------|-----------------|
| Results | Complies |
|----------------|-----------------|

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz

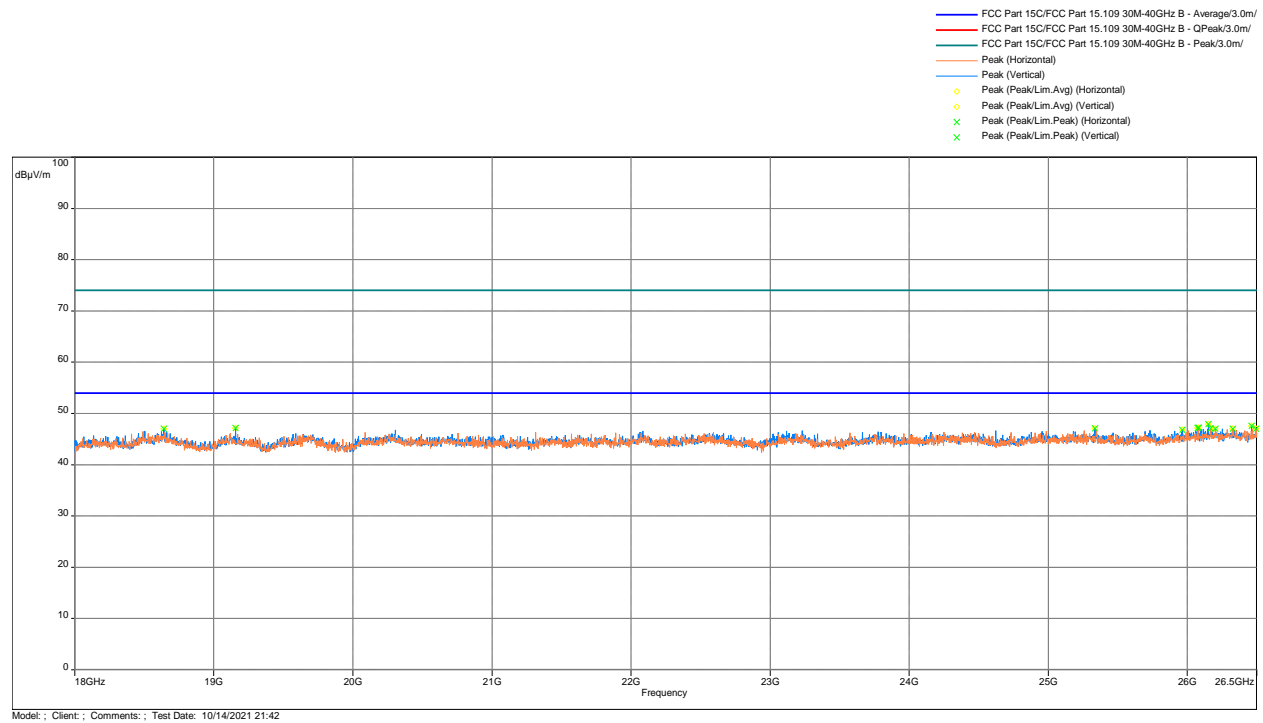
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak Limit.



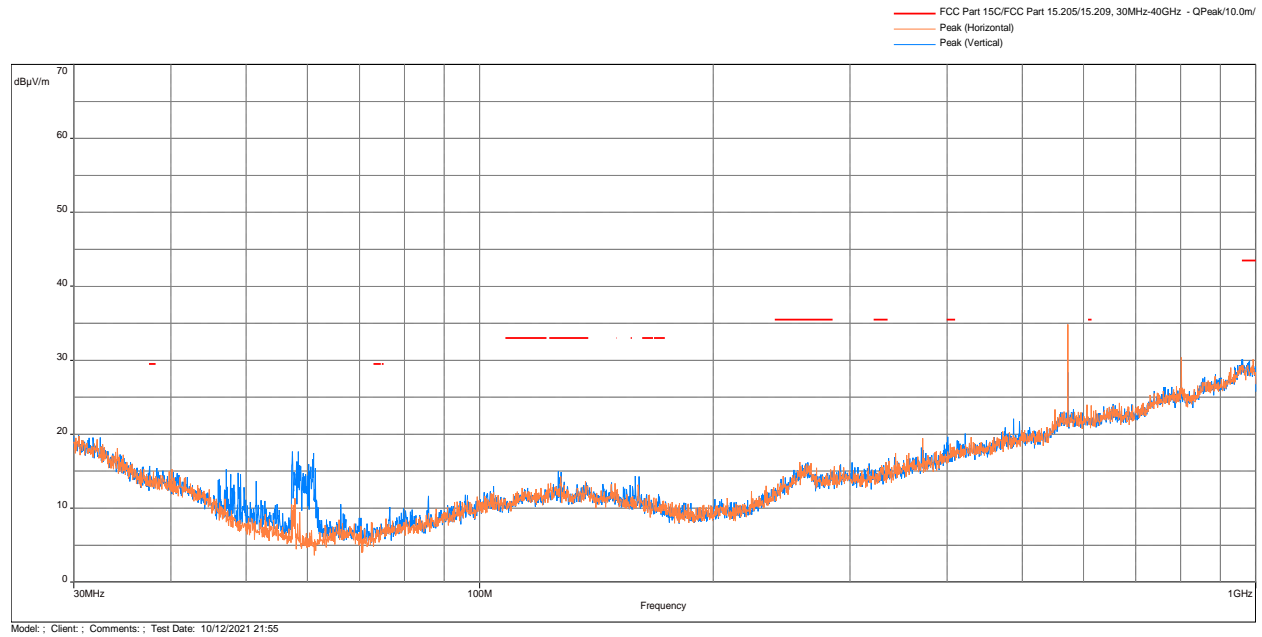
| Frequency (MHz) | Peak @3m (dBμV/m) | Lim. Ave @3m (dBμV/m) | Margin dB | Height (m) | Angle (°) | Comment | Correction (dB) |
|-----------------|-------------------|-----------------------|-----------|------------|-----------|------------|-----------------|
| 1908.933 | 52.2 | 54.0 | -1.8 | 2.5 | 182.5 | Horizontal | -11.8 |
| 5982.133 | 44.1 | 54.0 | -10.0 | 3.2 | 140.3 | Horizontal | -1.8 |
| 6582.800 | 45.1 | 54.0 | -8.9 | 1.8 | 0.3 | Horizontal | -1.7 |
| 17877.600 | 52.3 | 54.0 | -1.7 | 2.9 | 140.3 | Horizontal | 10.2 |

Note: Correction = AF + CF - Preamp

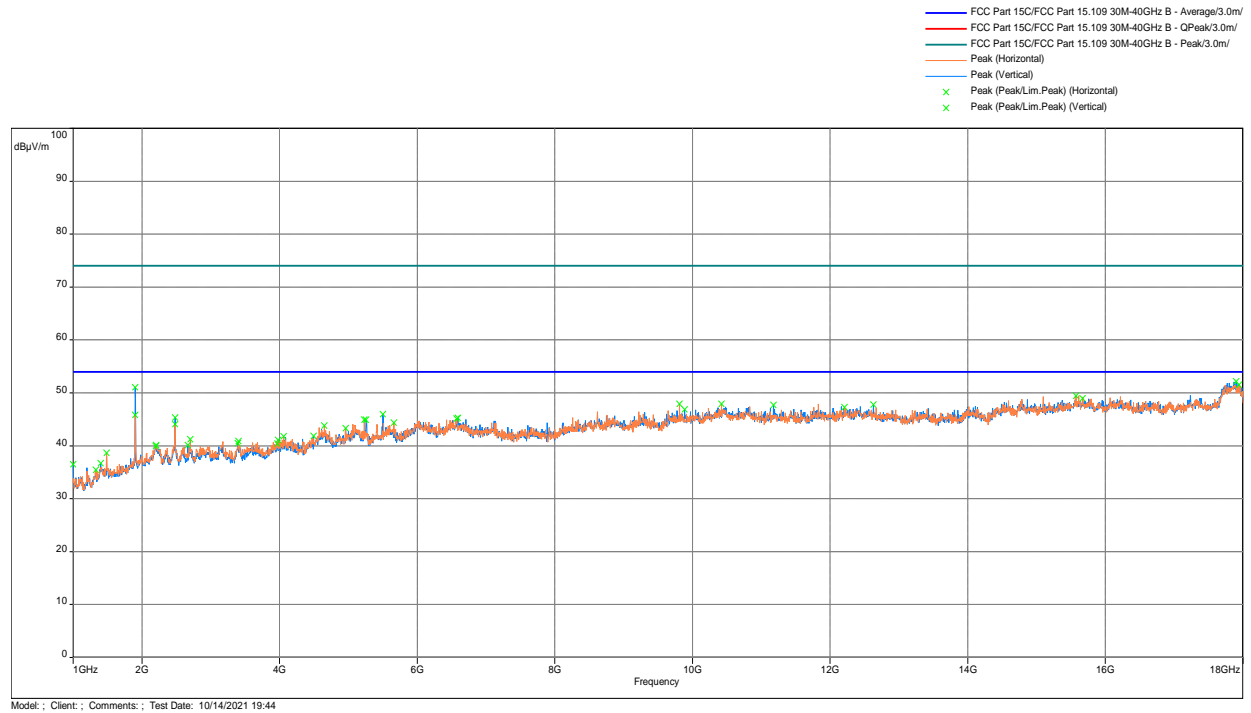
| | |
|----------------|-----------------|
| Results | Complies |
|----------------|-----------------|

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz

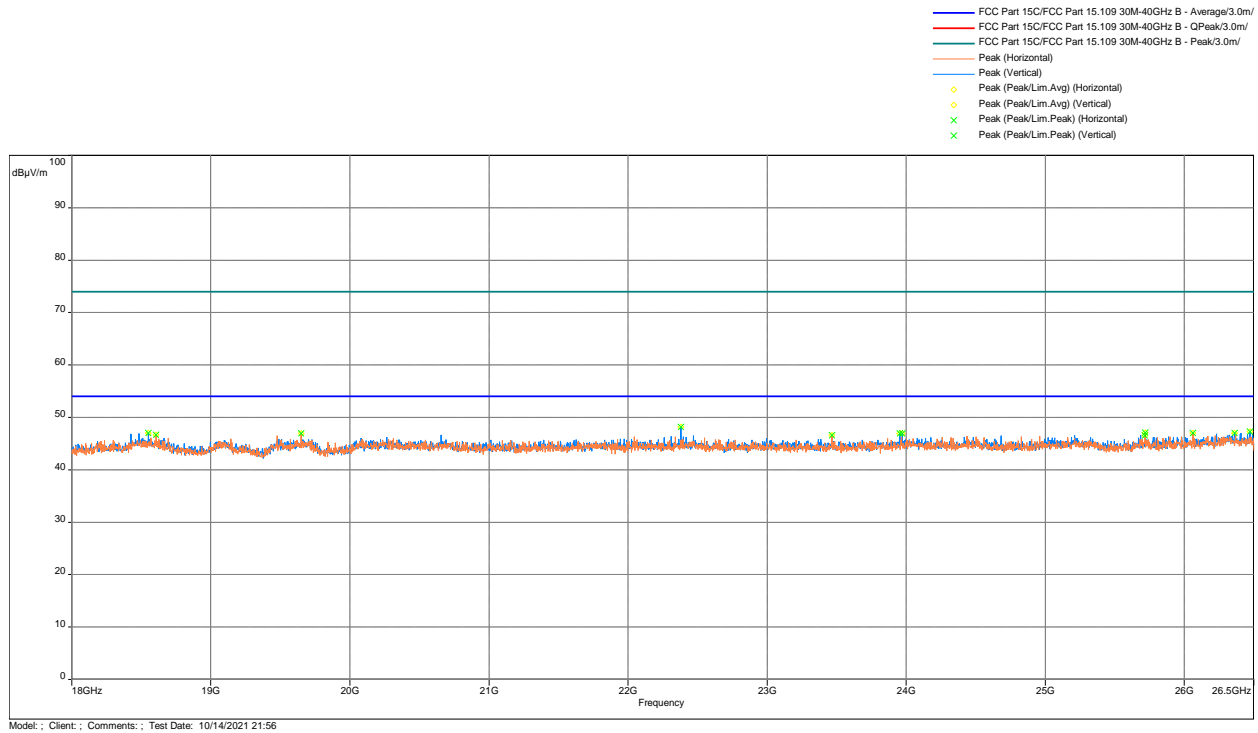
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit.



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Peak Limit.



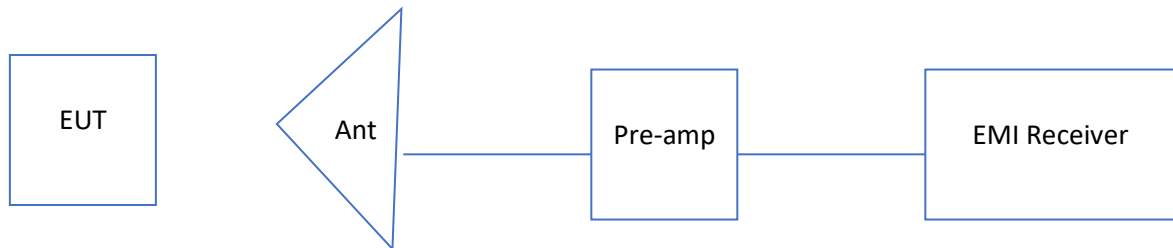
| Frequency (MHz) | Peak @3m (dBμV/m) | Lim. Ave @3m (dBμV/m) | Margin dB | Height (m) | Angle (°) | Comment | Correction (dB) |
|-----------------|-------------------|-----------------------|-----------|------------|-----------|------------|-----------------|
| 1902.133 | 45.8 | 54.0 | -8.2 | 3.5 | 98.5 | Horizontal | -11.8 |
| 1903.267 | 51.0 | 54.0 | -3.0 | 2.5 | 262.0 | Vertical | -11.8 |
| 5502.733 | 46.0 | 54.0 | -8.0 | 2.5 | 83.3 | Vertical | -3.0 |
| 17899.700 | 52.2 | 54.0 | -1.9 | 1.5 | 89.3 | Vertical | 10.2 |
| 17941.067 | 51.5 | 54.0 | -2.5 | 3.6 | 356.3 | Horizontal | 9.8 |

Note: Correction = AF + CF - Preamp

| | |
|----------------|-----------------|
| Results | Complies |
|----------------|-----------------|

4.5.5 Test Setup Configuration

The following photographs show the testing configurations used.



4.6 AC Line Conducted Emission
FCC: 15.207; RSS-GEN;

4.6.1 Requirement

| Frequency Band MHz | Class B Limit dB(μV) | | Class A Limit dB(μV) | |
|-----------------------|----------------------|------------|----------------------|---------|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| 0.15-0.50 | 66 to 56 * | 56 to 46 * | 79 | 66 |
| 0.50-5.00 | 56 | 46 | 73 | 60 |
| 5.00-30.00 | 60 | 50 | 73 | 60 |

Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.

4.6.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

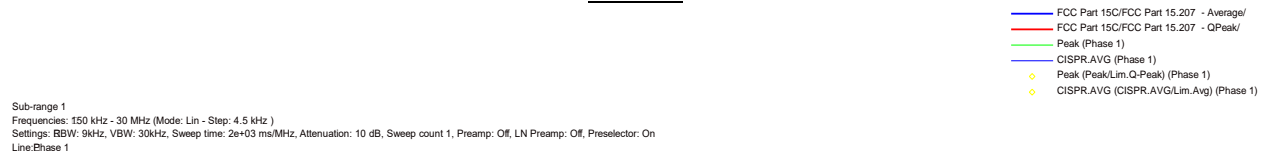
Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.10-2013.

| Tested By | Test Date | Results |
|-----------|------------------|----------|
| Minh Ly | October 12, 2021 | Complies |

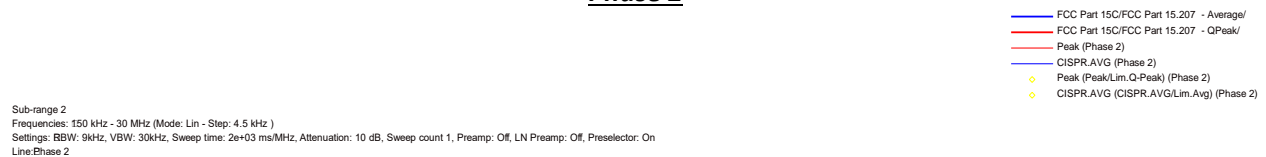
4.6.3 Test Result

15.207: Conducted Emissions 120VAC 60Hz

Phase 1



Phase 2



4.6.3 Test Results (Continued)

| Frequency (MHz) | Q-Peak (dBμV) | Limit Q-Peak (dBμV) | Margin Q-Peak (dB) | Line | Correction (dB) |
|-----------------|---------------|---------------------|--------------------|---------|-----------------|
| 0.150 | 50.7 | 66.0 | -15.3 | Phase 2 | 11.0 |
| 0.164 | 48.5 | 65.3 | -16.8 | Phase 2 | 11.0 |
| 0.168 | 47.1 | 65.1 | -17.9 | Phase 1 | 11.0 |
| 0.177 | 46.4 | 64.6 | -18.2 | Phase 1 | 11.0 |
| 0.200 | 44.1 | 63.6 | -19.6 | Phase 2 | 11.0 |
| 0.213 | 42.9 | 63.1 | -20.2 | Phase 2 | 11.0 |
| 0.290 | 39.9 | 60.5 | -20.6 | Phase 1 | 11.0 |
| 0.294 | 39.4 | 60.4 | -21.0 | Phase 2 | 11.0 |

| Frequency (MHz) | CISPR AVG (dBμV) | Limit Avg (dBμV) | Margin Avg (dB) | Line | Correction (dB) |
|-----------------|------------------|------------------|-----------------|---------|-----------------|
| 0.150 | 26.7 | 56.0 | -29.3 | Phase 2 | 11.0 |
| 0.168 | 26.3 | 55.1 | -28.8 | Phase 1 | 11.0 |
| 0.200 | 23.6 | 53.6 | -30.1 | Phase 1 | 11.0 |
| 0.299 | 19.6 | 50.3 | -30.7 | Phase 1 | 11.0 |
| 0.303 | 18.8 | 50.2 | -31.3 | Phase 2 | 11.0 |
| 0.501 | 12.5 | 46.0 | -33.5 | Phase 2 | 11.0 |
| 0.560 | 12.8 | 46.0 | -33.2 | Phase 1 | 11.0 |
| 18.650 | 11.8 | 50.0 | -38.2 | Phase 1 | 11.4 |

| | |
|----------------|----------------------------|
| Results | Complies by 15.3 dB |
|----------------|----------------------------|

5.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

| Equipment | Manufacturer | Model/Type | Asset # | Cal Int | Cal Due |
|---------------------------|-------------------|----------------------|-----------|---------|----------|
| EMI Receiver | Rohde and Schwarz | ESU40 | ITS 00961 | 12 | 03/09/22 |
| LISN | FCC | FCC-LISN-50-50 | ITS 00551 | 12 | 11/16/21 |
| Horn Antenna | ETS Lindgren | 3117PA | ITS 01636 | 12 | 12/17/21 |
| 18-40GHz Preamp | uComp Nordic | MCNS-50-18004000335P | ITS 01799 | 12 | 03/19/22 |
| Pyramidal Horn Antenna | EMCO | 3160-09 | ITS 00571 | # | # |
| Loop Antenna | EMCO | 6512 | ITS 01598 | 12 | 11/03/21 |
| BI-Log Antenna | Teseq | CBL 6111D | ITS 01505 | 12 | 03/22/22 |
| Pre-Amplifier | Sonoma Instrument | 310N | ITS 00942 | 12 | 04/19/22 |
| RF Cable | Mega Phase | TM40-K1K1-59 | ITS 01655 | 12 | 10/05/21 |
| RF Cable | Mega Phase | TM40-K1K1-19 | ITS 01155 | 12 | 04/28/22 |
| Notch Filter | MICRO-TRONICS | BRM50702 | ITS 01166 | 12 | 06/29/22 |
| RF Cable | Mega Phase | EMC1-K1K1-236 | ITS 01484 | 12 | 06/29/22 |
| 10m Semi-anechoic chamber | Panashield | 10m Chamber | ITS 00984 | 36 | 07/29/23 |

Calibration not required.

Software used for emission compliance testing utilized the following:

| Name | Manufacturer | Version | Template/Profile |
|--------------|----------------|-----------|---|
| BAT-EMC | Nexio | 3.20.0.14 | ESU and ESR Intertek Emissions Template |
| Tile | Quantum Change | 3.4.K.22 | Conducted Spurious_30M-26GHz |
| RS Commander | Rohde Schwarz | 1.6.4 | Not Applicable (Screen grabber) |

6.0 Document History

| Revision/ Job Number | Writer Initials | Reviewers Initials | Date | Change |
|-------------------------|--------------------|-----------------------|-------------------|-----------------------|
| 1.0 / G104799910 | ML | KV | November 12, 2021 | Original document |
| 1.1 / G104799910 | AS | KV | February 7, 2022 | Updated Block Diagram |

END OF REPORT