



427 West 12800 South  
Draper, UT 84020

## Test Report Certification

|                                  |                                  |
|----------------------------------|----------------------------------|
| <b>FCC ID</b>                    | SWX-LTULRR                       |
| <b>Equipment Under Test</b>      | LTU-LR                           |
| <b>Test Report Serial Number</b> | TR3679_01                        |
| <b>Date of Test(s)</b>           | October 30th, - November 5, 2019 |
| <b>Report Issue Date</b>         | November 13, 2019                |

| <b>Test Specification</b>     | <b>Applicant</b>                                                  |
|-------------------------------|-------------------------------------------------------------------|
| 47 CFR FCC Part 15, Subpart E | Ubiquiti Inc.<br>685 Third Avenue<br>New York, NY 10019<br>U.S.A. |



## Certification of Engineering Report

This report has been prepared by Unified Compliance Laboratory (UCL) to document compliance of the device described below with the requirement of Federal Communication Commissions (FCC) Part 15, Subpart E. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

|                     |               |
|---------------------|---------------|
| <b>Applicant</b>    | Ubiquiti Inc. |
| <b>Manufacturer</b> | Ubiquiti Inc. |
| <b>Brand Name</b>   | LTU           |
| <b>Model Number</b> | LTU-LR        |
| <b>FCC ID</b>       | SWX-LTULRR    |

On this 13 day of November 2019, I individually and for Unified Compliance Laboratory certify that the statements made in this engineering report are true, complete and correct to the best of my knowledge and are made in good faith.

Although NVLAP has accredited the Unified Compliance Laboratory testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government.

Unified Compliance Laboratory



Written By: Clay Allred



Reviewed By: Alex Macon

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| <b>Revision History</b> |                         |                   |
|-------------------------|-------------------------|-------------------|
| <b>Revision</b>         | <b>Description</b>      | <b>Date</b>       |
| 01                      | Original Report Release | November 13, 2019 |

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## 1 Client Information

### 1.1 Applicant

|                     |                                                                   |
|---------------------|-------------------------------------------------------------------|
| <b>Company</b>      | Ubiquiti Inc.<br>685 Third Avenue<br>New York, NY 10017<br>U.S.A. |
| <b>Contact Name</b> | Mark Feil                                                         |
| <b>Title</b>        | Compliance Manager                                                |

### 1.2 Manufacturer

|                     |                                                                   |
|---------------------|-------------------------------------------------------------------|
| <b>Company</b>      | Ubiquiti Inc.<br>685 Third Avenue<br>New York, NY 10017<br>U.S.A. |
| <b>Contact Name</b> | Mark Feil                                                         |
| <b>Title</b>        | Compliance Manager                                                |

## 2 Equipment Under Test (EUT)

### 2.1 Identification of EUT

|                        |                                    |
|------------------------|------------------------------------|
| <b>Brand Name</b>      | LTU                                |
| <b>Model Number</b>    | LTU-LR                             |
| <b>Serial Number</b>   | N/A                                |
| <b>Dimensions (cm)</b> | 51.2      x    38.6      x    25.8 |

### 2.2 Description of EUT

The LTU-LR is a fixed point-to-point or point to multiple point transceiver, intended for outdoor use, operating in the UNII-1, UNII-2A/2C and UNII-3 frequency bands. A Bluetooth LE transceiver is included for device management. An Ethernet port is used for data transfer and to provide power using a POE-24V-5X-HD POE supply.

The UNII transceiver uses 5 modulation bandwidths with channels spaced 5 MHz apart. Modulation bandwidths of 10 MHz, 20 MHz, 30 MHz, 40 MHz, and 50 MHz are used. There are 2 transmit chains, one for vertically polarized and one for horizontally polarized transmission. The table below shows the channels used in each band with the different modulation bandwidths and maximum power settings. This report covers the circuitry of the device subject to FCC Part 15, Subpart E. The circuitry of the device subject to FCC Part 15 Subpart B was found to be compliant.

| Band   | Modulation Bandwidth | Frequency (MHz)                                                                                            |
|--------|----------------------|------------------------------------------------------------------------------------------------------------|
| UNII-1 | 10 MHz               | 5160, 5165, 5170, 5175, 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225, 5230, 5235, 5240, 5245 |
|        | 20 MHz               | 5165, 5170, 5175, 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225, 5230, 5235, 5240             |
|        | 30 MHz               | 5170, 5175, 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225, 5230, 5235                         |
|        | 40 MHz               | 5175, 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225, 5230                                     |
|        | 50 MHz               | 5180, 5185, 5190, 5195, 5200, 5205, 5210, 5215, 5220, 5225                                                 |

## 2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

| Brand Name<br>Model Number<br>Serial Number      | Description                                       | Name of Interface Ports /<br>Interface Cables                  |
|--------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------|
| BN: LTU<br>MN: LTU-LR<br>SN: N/A                 | Point-to-Point / Point-to-Multi-Point Transceiver | PoE – Shielded RJ-45 Input (4 meters) See Section 2.4 (Note 2) |
| BN: Ubiquiti In.<br>MN: POE-24V-5X-HD<br>SN: N/A | PoE Power supply                                  | See Section 2.4                                                |
| BN: Dell<br>MN: XPS<br>SN: N/A                   | Laptop Computer                                   | Ethernet Non-Shielded Cat 5e to PoE PSU                        |

Notes: (1) EUT

(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

## 2.4 Interface Ports on EUT

| Name of Ports        | No. of Ports Fitted to EUT | Cable Description/Length            |
|----------------------|----------------------------|-------------------------------------|
| LTU-LR PoE/Data in   | 1                          | Shielded Cat 5e cable (4 meters)    |
| PoE PSU AC mains     | 1                          | 3 Conductor power cord (40 cm)      |
| PoE PSU PoE/Data out | 1                          | Shielded Cat 5e cable (8 meters)    |
| PoE PSU Data in      | 1                          | Non-shielded Cat 5e cable (1 meter) |

## 2.5 Operating Environment

|                     |          |
|---------------------|----------|
| Power Supply        | 120 VAC  |
| AC Mains Frequency  | 60 Hz    |
| Temperature         | 22.9 C   |
| Humidity            | 21.0%    |
| Barometric Pressure | 12.5 psi |

## 2.6 Operating Modes

The LTU-LR was tested while the UNII transceiver was in a constant transmit mode at the upper, middle, and lower channels for each modulation bandwidth and frequency band. The Bluetooth LE transceiver was active while testing the UNII-1 transceiver to assess any transmitter interactions.

## 2.7 EUT Exercise Software

Ubiquiti test software and firmware were used to control the transceivers of the EUT. (ART)

## 2.8 Block Diagram of Test Configuration

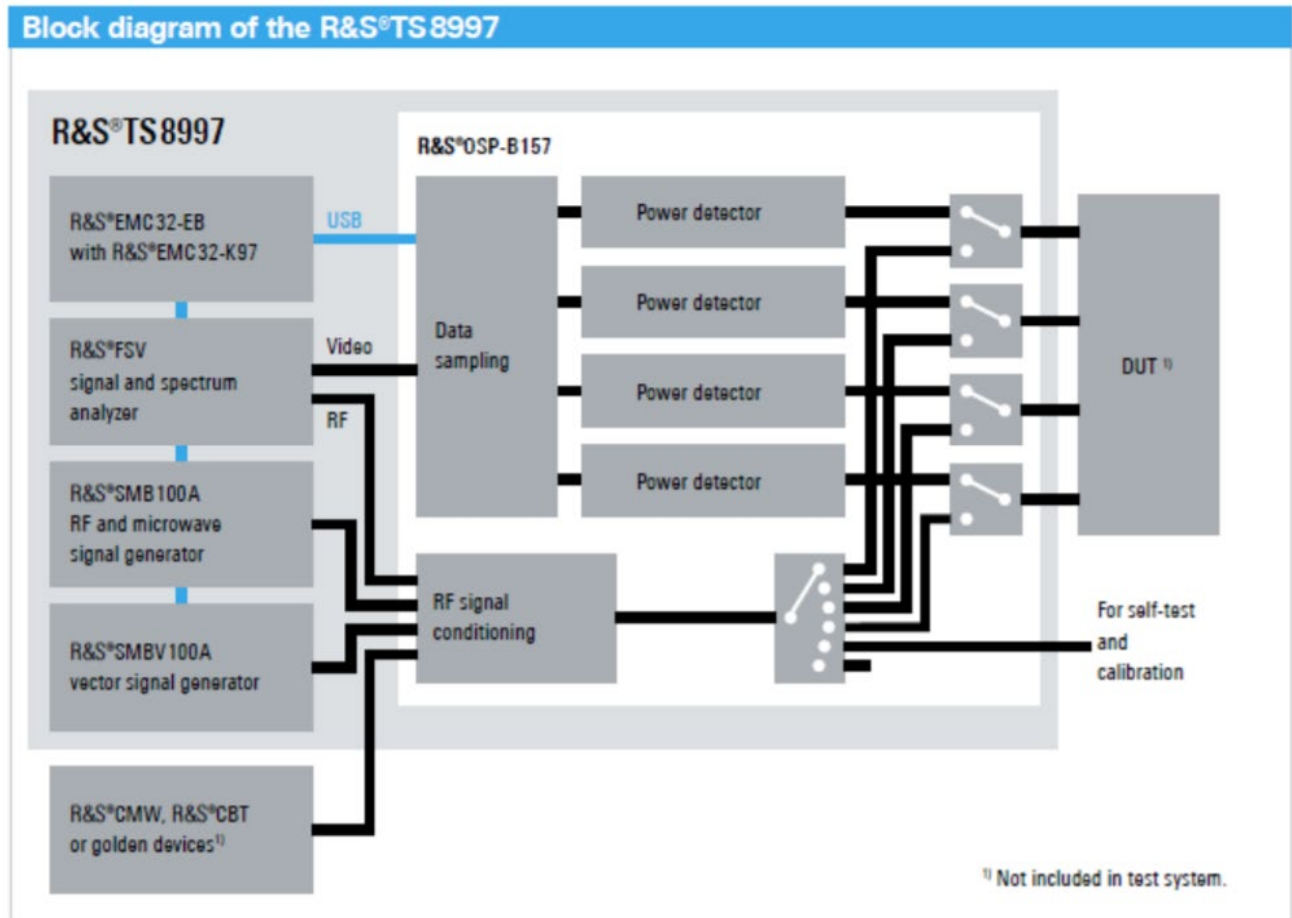


Diagram 1: Test Configuration Block Diagram

## 2.9 Modification Incorporated/Special Accessories on EUT

There were no modifications made to the EUT during testing to comply with the specification.

## 2.10 Deviation, Opinions Additional Information or Interpretations from Test Standard

There were no deviations, opinions, additional information or interpretations from the test specification.

### 3 Test Specification, Method and Procedures

#### 3.1 Test Specification

|                        |                                                                                                                                                                                       |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title</b>           | 47 CFR FCC Part 15, Subpart E, Section 15.407<br>Limits and methods of measurement of radio interference characteristics of<br>Unlicensed National Information Infrastructure Devices |
| <b>Purpose of Test</b> | The tests were performed to demonstrate initial compliance                                                                                                                            |

#### 3.2 Methods & Procedures

##### 3.2.1 47 CFR FCC Part 15 Section 15.407

See test standard for details.

#### 3.3 FCC Part 15, Subpart E

##### 3.3.1 Summary of Tests

| <b>FCC Section</b>                                                                                        | <b>IC Section</b>      | <b>Environmental Phenomena</b>       | <b>Frequency Range (MHZ)</b> | <b>Result</b> |
|-----------------------------------------------------------------------------------------------------------|------------------------|--------------------------------------|------------------------------|---------------|
| 15.407(a)                                                                                                 | N/A                    | Antenna requirements                 | Structural Requirement       | Compliant     |
| 15.407(b)                                                                                                 | RSS-Gen                | Conducted Disturbance at Mains Port  | 0.15 to 30                   | Compliant     |
| 15.407(a)                                                                                                 | RSS-247 §6.2.2, §6.2.3 | Bandwidth Requirement                | 2400 to 2483.5               | Compliant     |
| 15.407(a)                                                                                                 | RSS-247 §6.2.2, §6.2.3 | Peak Output Power                    | 2400 to 2483.5               | Compliant     |
| 15.407(b)                                                                                                 | RSS-247 §6.2.2, §6.2.3 | Antenna Conducted Spurious Emissions | 0.009 to 25000               | Compliant     |
| 15.407(b)                                                                                                 | RSS-247 §6.2.2, §6.2.3 | Radiated Spurious Emissions          | 0.009 to 25000               | Compliant     |
| 15.407(a)                                                                                                 | RSS-247 §6.2.2, §6.2.3 | Peak Power Spectral Density          | 2400 to 2483.5               | Compliant     |
| The testing was performed according to the procedures in ANSI C63.10-2013, KDB 789033 and 47 CFR Part 15. |                        |                                      |                              |               |

#### 3.4 Results

In the configuration tested, the EUT complied with the requirements of the specification.

#### 3.5 Test Location

Testing was performed at the Unified Compliance Laboratory 3-Meter chamber located at 427 West 12800 South, Draper, UT 84020. Unified Compliance Laboratory is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Code 600241-0 which is effective until 30 June 2020.

## 4 Test Equipment

### 4.1 Conducted Emissions at Mains Ports

| Type of Equipment | Manufacturer        | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|-------------------|---------------------|--------------|--------------|--------------------------|-------------------------|
| EMI Receiver      | AFJ                 | FFT3010      | UCL-2500     | 12/14/2018               | 4/17/2020               |
| Transient Limiter | Com-Power           | LIT-930A     | UCL-2496     | 2/11/2019                | 2/11/2020               |
| LISN              | AFJ                 | LS16C/10     | UCL-2512     | 12/14/2018               | 4/17/2020               |
| Cat6 ISN          | Teseq               | ISN T8-Cat6  | UCL-2971     | 2/11/2019                | 5/21/2020               |
| ISN               | Teseq               | ISN T800     | UCL-2974     | 2/19/2019                | 5/21/2020               |
| LISN              | Com-Power           | LIN-120C     | UCL-2612     | 2/11/2019                | 2/11/2020               |
| AC Power Source   | Laplace Instruments | AC1000A      | UCL-2857     | N/A                      | N/A                     |
| Monitoring Probe  | Teseq               | MD 4070A     | UCL-2980     | 3/16/2019                | 5/21/2020               |
| Test Software     | UCL                 | Revision 1   | UCL-3107     | N/A                      | N/A                     |

Table 1: List of equipment used for Conducted Emissions Testing at Mains Port

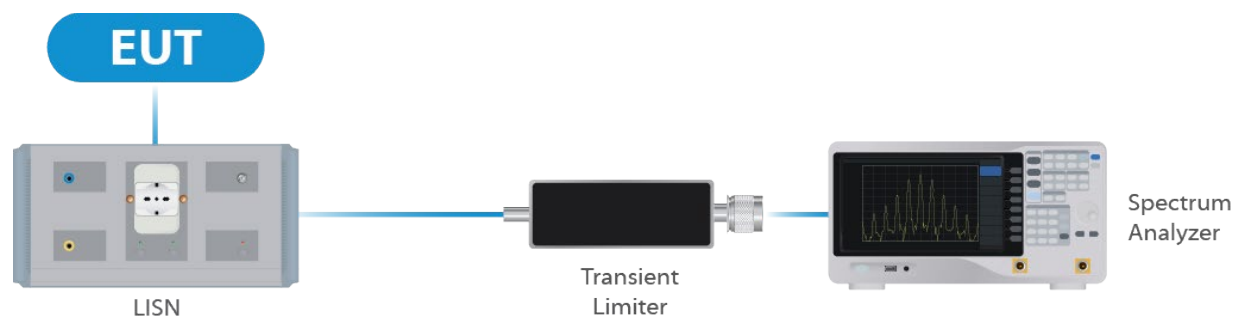


Figure 1: Conducted Emissions Test

### 4.2 Direct Connect at the Antenna Port Tests

| Type of Equipment       | Manufacturer | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|-------------------------|--------------|--------------|--------------|--------------------------|-------------------------|
| Spectrum Analyzer       | R&S          | FSV40        | UCL-2861     | 06/12/2019               | 06/12/2020              |
| Signal Generator        | R&S          | SMB100A      | UCL-2864     | N/A                      | N/A                     |
| Vector Signal Generator | R&S          | SMBV100A     | UCL-2873     | N/A                      | N/A                     |
| Switch Extension        | R&S          | OSP-B157WX   | UCL-2867     | 06/13/2019               | 06/13/2020              |
| Switch Extension        | R&S          | OSP-150W     | UCL-2870     | 06/14/2019               | 06/14/2020              |

Table 2: List of equipment used for Direct Connect at the Antenna Port

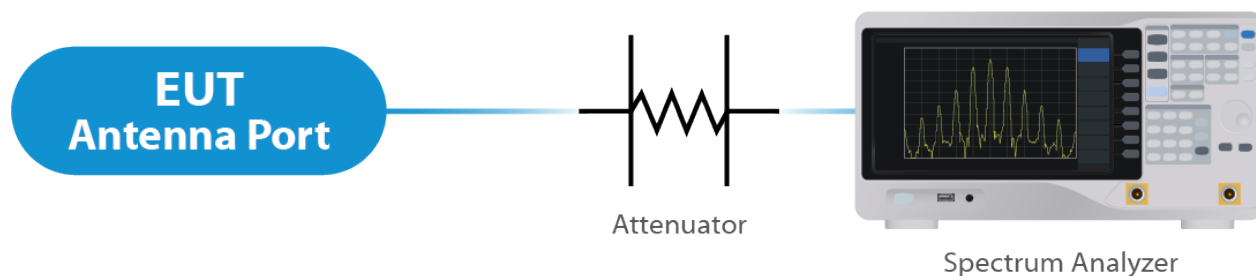
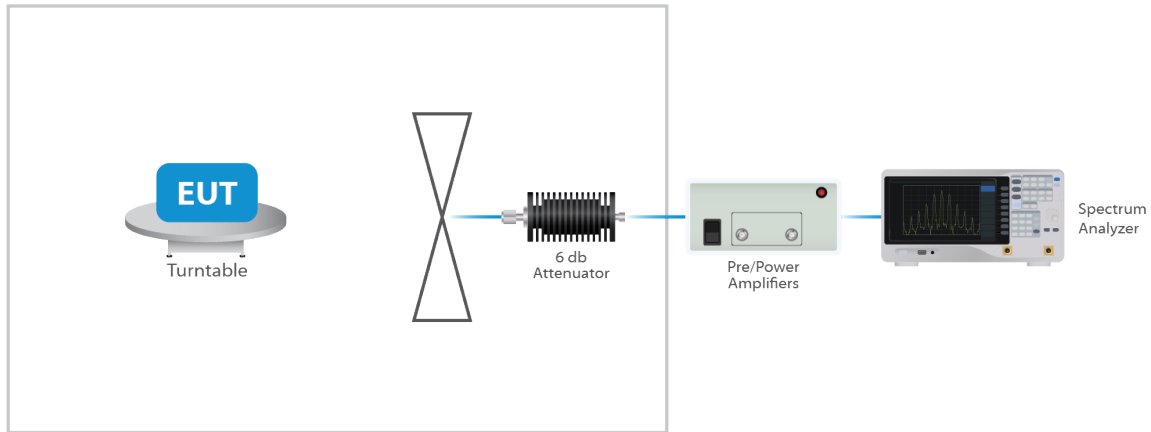


Figure 2: Direct Connect at the Antenna Port Test

### 4.3 Radiated Emissions

| Type of Equipment         | Manufacturer       | Model Number | Asset Number | Date of Last Calibration | Due Date of Calibration |
|---------------------------|--------------------|--------------|--------------|--------------------------|-------------------------|
| EMI Receiver              | Keysight           | N9038A       | UCL-2778     | 11/26/2018               | 5/3/2020                |
| Pre-Amplifier             | Sonoma Instruments | 310N         | UCL-2889     | 9/13/2018                | 5/16/2020               |
| Double Ridge Horn Antenna | Scwarzbeck         | BBHA 9120D   | UCL-3065     | 4/11/2019                | 6/3/2020                |
| Log Periodic              | Scwarzbeck         | STLP 9129    | UCL-3068     | 4/11/2019                | 6/3/2020                |
| 15 - 40 GHz Horn Antenna  | Scwarzbeck         | BBHA 9170    | UCL-2487     | 2/15/2017                | 4/16/2020               |
| 18 – 40 GHz Amplifier     | Scwarzbeck         | BBV 9721     | UCL-2490     | 4/1/2019                 | 4/1/2020                |
| 0.5 – 18 GHz Amplifier    | Scwarzbeck         | BBV 9718C    | UCL-2493     | 4/1/2019                 | 4/1/2020                |
| Loop Antenna              | Com-Power          | AL-130R      | UCL-2596     | 10/26/2018               | 4/23/2020               |
| Test Software             | UCL                | Revision 1   | UCL-3108     | N/A                      | N/A                     |

Table 3:List of equipment used for Radiated Emissions



**Figure 3: Radiated Emissions Test**

## 4.4 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or Unified Compliance Laboratory personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request.

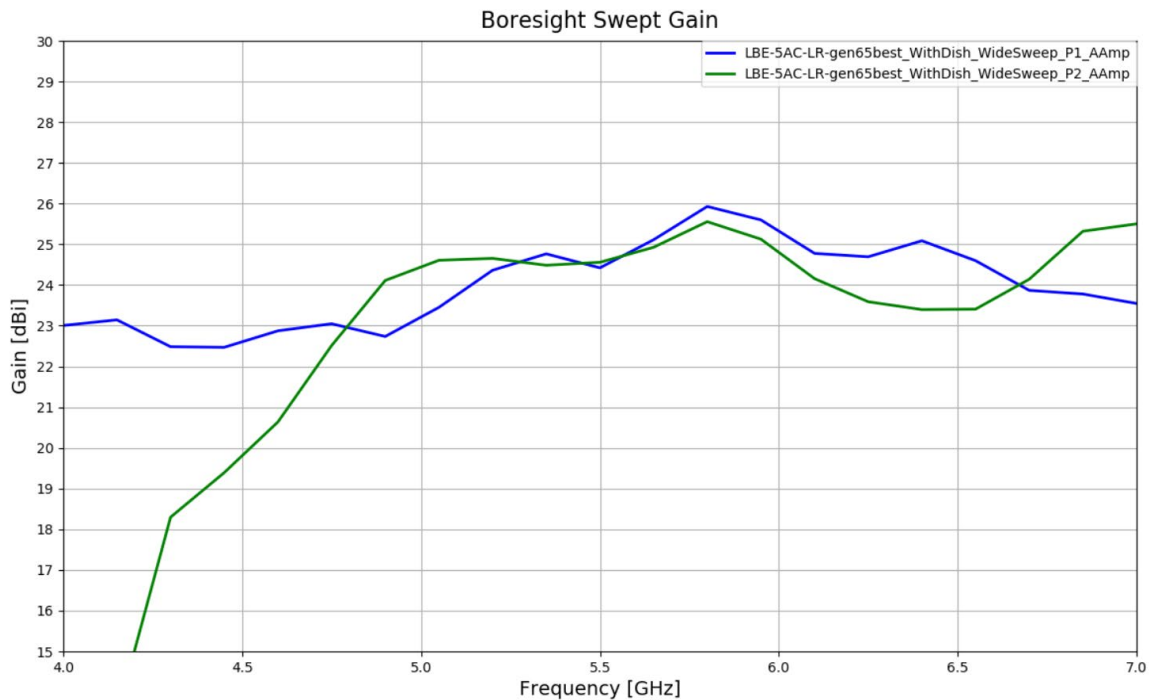
## 4.5 Measurement Uncertainty

| Test                                  | Uncertainty ( $\pm$ dB) | Confidence (%) |
|---------------------------------------|-------------------------|----------------|
| Conducted Emissions                   | 1.44                    | 95             |
| Radiated Emissions (9 kHz to 30 MHz)  | 2.50                    | 95             |
| Radiated Emissions (30 MHz to 1 GHz)  | 3.95                    | 95             |
| Radiated Emissions (1 GHz to 18 GHz)  | 5.56                    | 95             |
| Radiated Emissions (18 GHz to 40 GHz) | 5.16                    | 95             |
| <b>Direct Connect Tests</b>           | <b>K Factor</b>         | <b>Value</b>   |
| Emissions Bandwidth                   | 2                       | 2.0%           |
| Output Power                          | 2                       | 1.0 dB         |
| Peak Power Spectral Density           | 2                       | 1.3 dB         |
| Band Edge                             | 2                       | 0.8 dB         |
| Transmitter Spurious Emissions        | 2                       | 1.8 dB         |

## 5 Test Results

### 5.1 §15.203 Antenna Requirements

The EUT uses an Omni and an optional accessory Dish antenna. The Maximum gain of the Omni antenna is 3 dBi and the optional Dish antenna gain curve is in the graph below. The antennas are not user replaceable.

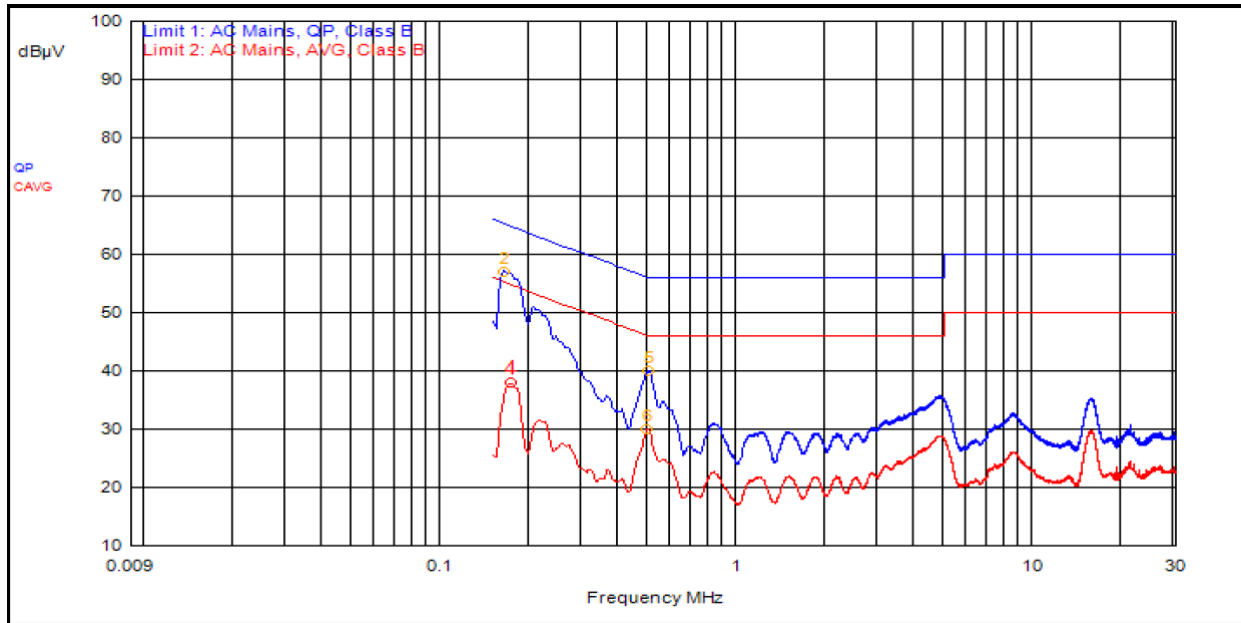


**Graph 1: Dish Antenna Gain Curve**

#### Results

The EUT complied with the specification

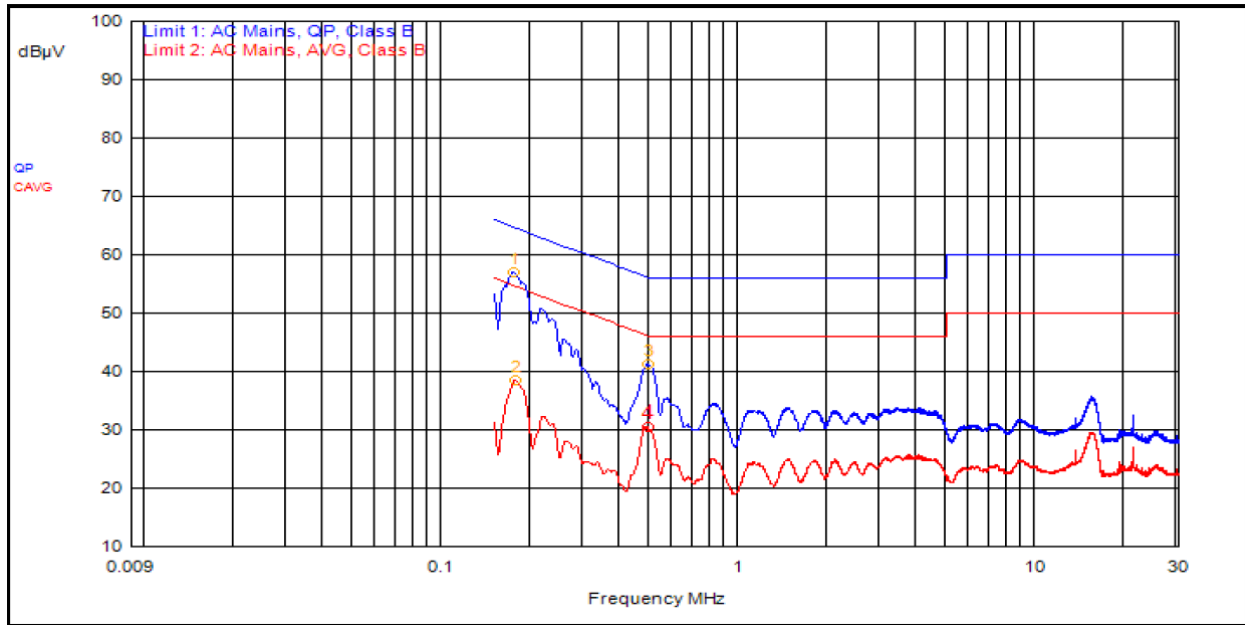
## 5.2 Conducted Emissions at Mains Ports Data



**Graph 2: Line Conductor**

| Frequency (MHZ) | Line   | Detector | Receiver Reading (dBμV) | Probe / LISN (dB) | Cable / Atten Factor (dB) | Meas. Level (dBμV) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------|----------|-------------------------|-------------------|---------------------------|--------------------|----------------|-------------|
| 0.162           | Line 1 | QP       | 44.9                    | 12.2              | 0.0                       | 57.1               | 65.4           | -8.2        |
| 0.501           | Line 1 | QP       | 27.6                    | 12.3              | 0.0                       | 39.9               | 56.0           | -16.1       |
| 0.495           | Line 1 | AVG      | 17.7                    | 12.3              | 0.0                       | 29.9               | 46.1           | -16.1       |
| 0.171           | Line 1 | AVG      | 25.6                    | 12.2              | 0.0                       | 37.9               | 54.9           | -17.1       |

**Table 4: Line Conductor**



**Graph 3: Neutral Conductor**

| Frequency (MHZ) | Line | Detector | Receiver Reading (dBμV) | Probe / LISN (dB) | Cable / Atten Factor (dB) | Meas. Level (dBμV) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------|----------|-------------------------|-------------------|---------------------------|--------------------|----------------|-------------|
| 0.174           | Neut | QP       | 44.7                    | 12.2              | 0.0                       | 57.0               | 64.8           | -7.8        |
| 0.492           | Neut | QP       | 29.0                    | 12.3              | 0.0                       | 41.2               | 56.1           | -14.9       |
| 0.489           | Neut | AVG      | 18.3                    | 12.3              | 0.0                       | 30.6               | 46.2           | -15.6       |
| 0.177           | Neut | AVG      | 26.3                    | 12.2              | 0.0                       | 38.6               | 54.6           | -16.0       |

**Table 5: Neutral Conductor**

### Result

The EUT complied with the specification limit.

### 5.3 §15.403(i) 26 dB Emissions Bandwidth

| Nominal BW (MHz) | Frequency (MHz) | 99% Bandwidth (MHz) | 26 dB Bandwidth (MHz) |
|------------------|-----------------|---------------------|-----------------------|
| 10               | 5160            | 9.45                | 10.50                 |
| 10               | 5200            | 10.65               | 19.85                 |
| 10               | 5245            | 11.75               | 21.05                 |
| 20               | 5165            | 18.90               | 20.90                 |
| 20               | 5200            | 18.90               | 20.70                 |
| 20               | 5240            | 23.80               | 45.60                 |
| 30               | 5170            | 28.20               | 31.05                 |
| 30               | 5200            | 28.35               | 34.05                 |
| 30               | 5235            | 30.30               | 56.10                 |
| 40               | 5175            | 37.75               | 41.55                 |
| 40               | 5200            | 38.00               | 41.40                 |
| 40               | 5230            | 37.75               | 43.65                 |
| 50               | 5180            | 47.00               | 51.75                 |
| 50               | 5200            | 47.25               | 52.25                 |
| 50               | 5225            | 47.00               | 52.25                 |

**Table 6: Bandwidth Emissions**

#### Result

The 26 dB bandwidths are reported for information purposes. Please see Annex for all bandwidth measurements.

## 5.4 §15.407(a)(1) Maximum Average Output Power

The maximum average RF conducted output power measured for this device was 25.2\* dBm or 331.13 mW. The limit is 30 dBm, or 1W. The antenna has a gain of 3 dBi.

| Nominal BW (MHz) | Frequency (MHz) | Data Rate | TP Setting | Measured EIRP | Conducted Output Power |
|------------------|-----------------|-----------|------------|---------------|------------------------|
| 10               | 5160            | vt0       | 18         | 20.5          | 17.5                   |
| 10               | 5200            | vt0       | 30         | 27.4          | 24.4                   |
| 10               | 5245            | vt0       | 30         | 28.2          | 25.2                   |
| 20               | 5165            | vt0       | 18         | 19.9          | 16.9                   |
| 20               | 5200            | vt0       | 23         | 23.2          | 20.2                   |
| 20               | 5240            | vt0       | 30         | 28.2          | 25.2                   |
| 30               | 5170            | vt0       | 18         | 20.8          | 17.8                   |
| 30               | 5200            | vt0       | 24         | 24.3          | 21.3                   |
| 30               | 5235            | vt0       | 29         | 27.3          | 24.3                   |
| 40               | 5175            | vf0       | 18         | 19.8          | 16.8                   |
| 40               | 5200            | vf0       | 20         | 19.6          | 16.6                   |
| 40               | 5230            | vf0       | 26         | 25.1          | 22.1                   |
| 50               | 5180            | vf0       | 18         | 18.6          | 15.6                   |
| 50               | 5200            | vf0       | 18         | 18.6          | 15.6                   |
| 50               | 5225            | vf0       | 18         | 18.6          | 15.6                   |

**Table 7: 3dBi Antenna**

| Nominal BW (MHz) | Frequency (MHz) | Data Rate | TP Setting | Conducted Output Power (dBm) |
|------------------|-----------------|-----------|------------|------------------------------|
| 10               | 5160            | vt0       | -5         | -5.5                         |
| 10               | 5200            | vt0       | 7          | 1.4                          |
| 10               | 5245            | vt0       | 7          | 2.2                          |
| 20               | 5165            | vt0       | -5         | -6.1                         |
| 20               | 5200            | vt0       | 0          | -2.8                         |
| 20               | 5240            | vt0       | 7          | 2.2                          |
| 30               | 5170            | vt0       | -5         | -5.2                         |
| 30               | 5200            | vt0       | 1          | -1.7                         |
| 30               | 5235            | vt0       | 6          | 1.3                          |
| 40               | 5175            | vf0       | -5         | -6.2                         |
| 40               | 5200            | vf0       | -3         | -6.4                         |
| 40               | 5230            | vf0       | 3          | -0.9                         |
| 50               | 5180            | vf0       | -5         | -7.4                         |
| 50               | 5200            | vf0       | -5         | -7.4                         |
| 50               | 5225            | vf0       | -5         | -7.4                         |

**Table 8: 26dBi Antenna**

### Result

In the configuration tested, the maximum average RF output power was less than 1 watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots in attached Annex).

## **5.5 §15.407(b) Spurious Emissions**

### **5.5.1 Conducted Spurious Emissions**

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. The graphs show the measurement data from spurious emissions noted across the frequency range when transmitting at the lowest frequency, middle frequency and upper frequency. Shown below are plots with the EUT turned to the upper and lower channels with the antenna gain of 3 dBi accounted for. These demonstrate compliance with the provisions of this section at the band edges.

#### **Result**

Conducted spurious emissions were attenuated below the limit; therefore, the EUT complies with the specification. See annex for results.

## 5.5.2 Radiated Spurious Emissions in the Restricted Bands of § 15.205

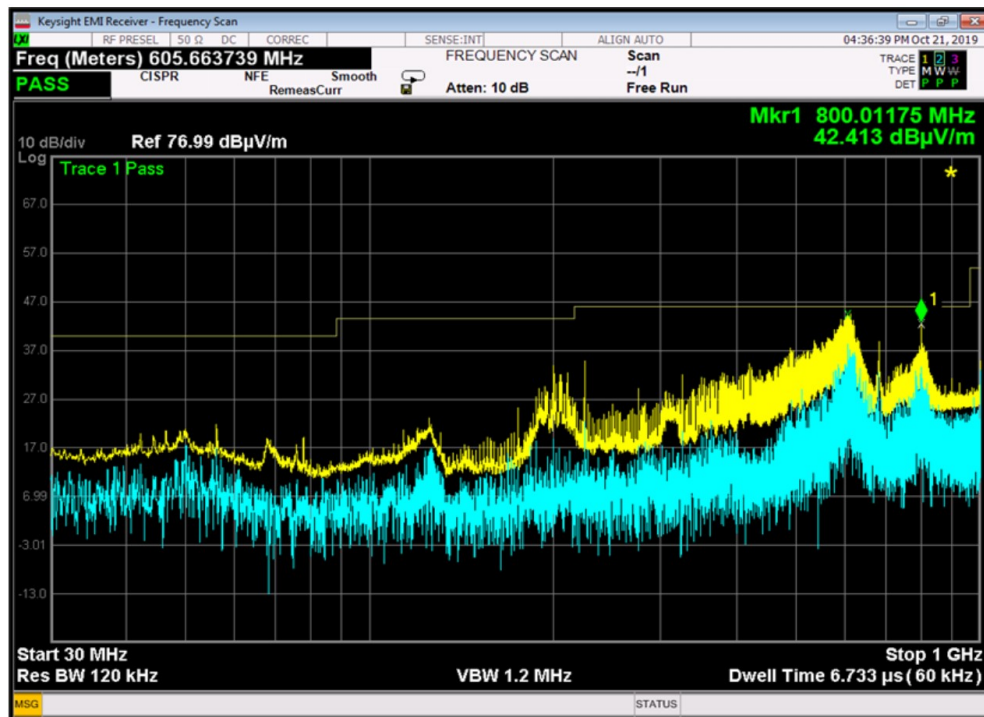
The EUT uses various power settings based on the channel in use. In order to reduce test time, the radiated spurious emissions at the lowest, middle, and highest channel were measured at the maximum power of TP30.

### Result

All emissions in the restricted bands of § 15.205 met the limits specified in § 15.209; therefore, the EUT complies with the specification. See Annex for Conducted Band edge plots.

| Frequency (MHZ) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 605.66          | H                | QP       | 43.5                    | -6.9                   | 46.0           | -2.5        |
| 800.01          | H                | QP       | 40.3                    | -2.0                   | 46.0           | -5.7        |
| 48.36           | V                | QP       | 24.0                    | -12.1                  | 40.0           | -16.0       |
| 199.99          | V                | QP       | 32.6                    | -15.2                  | 43.5           | -11.0       |
| 603.08          | V                | QP       | 25.1                    | -6.9                   | 46.0           | -10.9       |
| 605.30          | V                | QP       | 39.9                    | -6.9                   | 46.0           | -6.1        |
| 800.01          | V                | QP       | 31.0                    | -4.6                   | 46.0           | -15.0       |

Table 9: 30-1000MHz Frequency Range

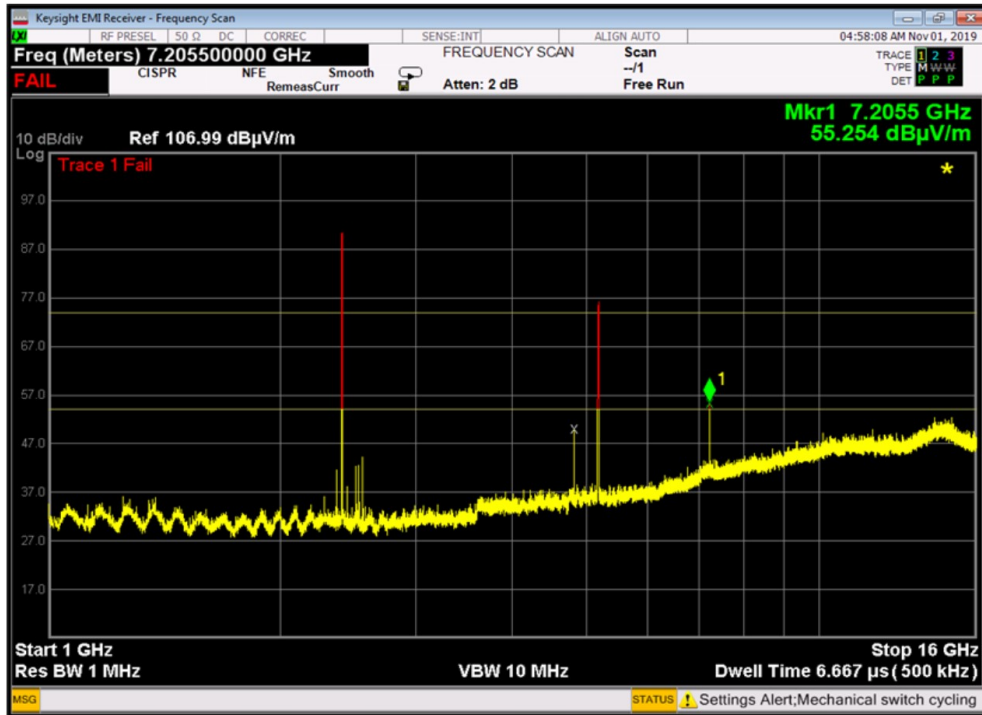


Graph 4: Worst Case Receiver Plot (Horizontal, at 5160MHz, 10MHz BW)

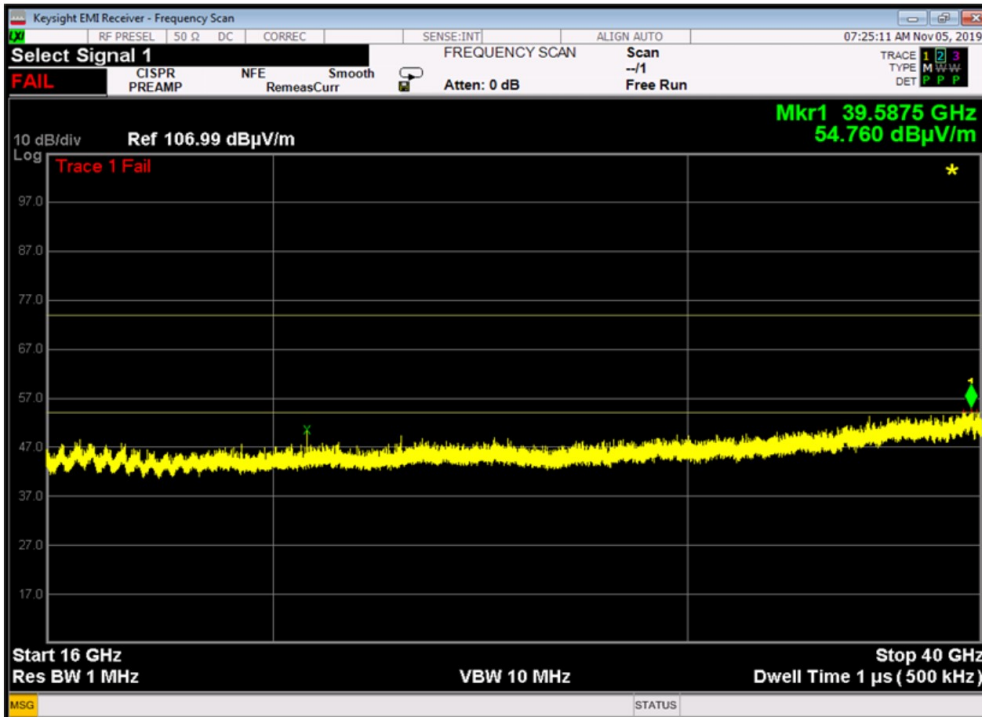
| Frequency (GHZ) | Transceiver BW (MHz) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 24.98           | 30                   | V                | P        | 47.7                    | 8.2                    | 74.0           | -26.3       |
| 24.98           | 30                   | V                | A        | 36.4                    | 8.2                    | 54.0           | -17.6       |
| 20.66           | 20                   | V                | P        | 52.5                    | 6.0                    | 74.0           | -21.5       |
| 20.66           | 20                   | V                | A        | 44.6                    | 6.0                    | 54.0           | -9.4        |
| 20.64           | 10                   | V                | P        | 56.0                    | 6.0                    | 74.0           | -18.0       |
| 20.64           | 10                   | V                | A        | 39.2                    | 6.0                    | 54.0           | -14.8       |
| 4.80            | 50                   | H                | P        | 48.7                    | 0.3                    | 74.0           | -25.3       |
| 7.21            | 50                   | H                | P        | 54.0                    | 8.2                    | 74.0           | -20.0       |
| 7.21            | 50                   | H                | A        | 45.7                    | 8.2                    | 54.0           | -8.3        |
| 4.80            | 50                   | H                | P        | 49.0                    | 0.3                    | 74.0           | -25.0       |
| 7.21            | 50                   | H                | P        | 54.6                    | 8.2                    | 74.0           | -19.4       |
| 7.21            | 50                   | H                | A        | 45.2                    | 8.2                    | 54.0           | -8.8        |
| 4.80            | 40                   | V                | P        | 48.6                    | 0.3                    | 74.0           | -25.4       |
| 7.21            | 40                   | V                | P        | 54.2                    | 8.2                    | 74.0           | -19.8       |
| 7.21            | 40                   | V                | A        | 46.0                    | 8.2                    | 54.0           | -8.0        |
| 4.80            | 40                   | H                | P        | 49.5                    | 0.3                    | 74.0           | -24.5       |
| 7.21            | 40                   | H                | P        | 53.5                    | 8.2                    | 74.0           | -20.5       |
| 7.21            | 40                   | H                | A        | 45.9                    | 8.2                    | 54.0           | -8.1        |
| 4.80            | 30                   | H                | P        | 48.9                    | 0.3                    | 74.0           | -25.1       |
| 7.21            | 30                   | H                | P        | 55.3                    | 8.2                    | 74.0           | -18.7       |
| 7.21            | 30                   | H                | A        | 46.4                    | 8.2                    | 54.0           | -7.6        |
| 4.80            | 30                   | V                | P        | 49.8                    | 0.3                    | 74.0           | -24.2       |
| 7.21            | 30                   | V                | P        | 54.4                    | 8.2                    | 74.0           | -19.6       |
| 7.21            | 30                   | V                | A        | 45.3                    | 8.2                    | 54.0           | -8.7        |
| 4.80            | 20                   | V                | P        | 50.0                    | 0.3                    | 74.0           | -24.0       |
| 7.21            | 20                   | V                | P        | 55.0                    | 8.2                    | 74.0           | -19.0       |
| 7.21            | 20                   | V                | A        | 47.5                    | 8.2                    | 54.0           | -6.5        |
| 4.80            | 20                   | H                | P        | 50.2                    | 0.3                    | 74.0           | -23.8       |
| 7.21            | 20                   | H                | P        | 56.1                    | 8.2                    | 74.0           | -17.9       |
| 7.21            | 20                   | H                | A        | 46.9                    | 8.2                    | 54.0           | -7.1        |
| 7.21            | 10                   | H                | P        | 54.6                    | 8.2                    | 74.0           | -19.4       |
| 7.21            | 10                   | H                | A        | 45.4                    | 8.2                    | 54.0           | -8.6        |
| 4.80            | 10                   | V                | P        | 52.8                    | 0.3                    | 74.0           | -21.2       |
| 7.21            | 10                   | V                | P        | 54.0                    | 8.2                    | 74.0           | -20.0       |
| 7.21            | 10                   | V                | A        | 46.2                    | 8.2                    | 54.0           | -7.8        |
| 4.80            | 10                   | V                | A        | 46.0                    | 0.3                    | 54.0           | -8.0        |

Note: If peak measurements are below the average limit, average measurements may not have been recorded.  
Note: No harmonics noted from the 5Ghz transceiver with the 50-ohm loads applied to the RF output. See below for worst case plots of the data noted above.

**Table 10: Transmitting on the Lowest Frequency for Each of the Bandwidths Noted**



Graph 5: Worst Case Receiver Plot (1-16GHz; Vertical, at 5165MHz, 20MHz BW)



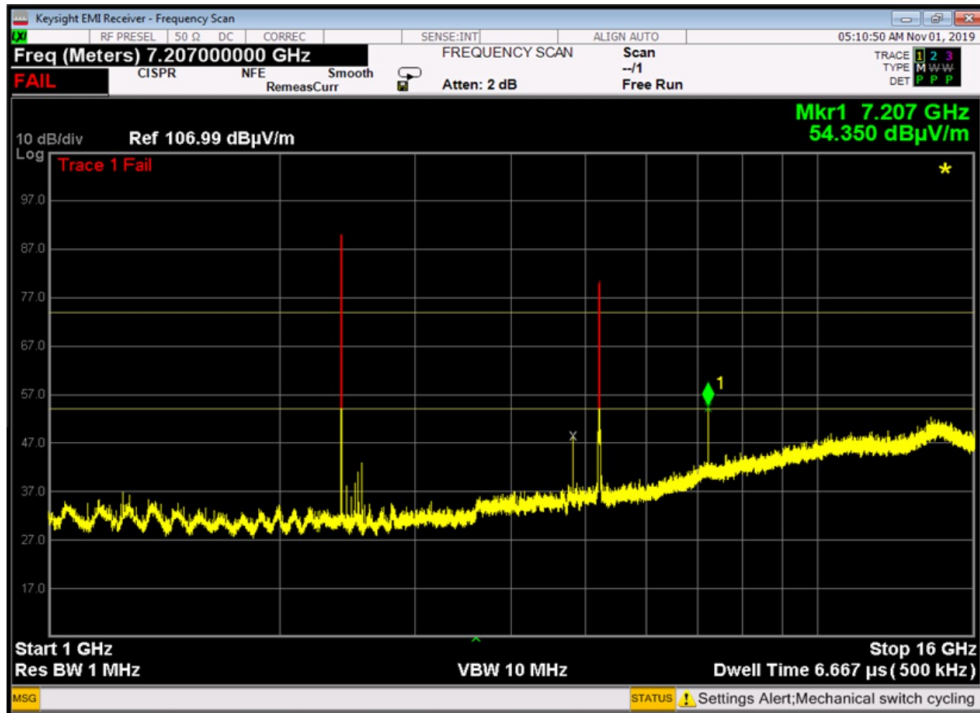
Graph 6: Worst Case Receiver Plot (16-40GHz; Vertical, at 5165MHz, 20MHz BW)

| Frequency (GHz) | Transceiver BW (MHz) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 16.73           | 50                   | V                | P        | 49.5                    | 14.0                   | 74.0           | -24.5       |
| 16.75           | 40                   | H                | P        | 48.6                    | 13.8                   | 74.0           | -25.4       |
| 16.75           | 40                   | H                | A        | 37.2                    | 13.8                   | 54.0           | -16.8       |
| 20.80           | 20                   | H                | P        | 50.8                    | 6.2                    | 74.0           | -23.2       |
| 20.80           | 20                   | H                | A        | 38.7                    | 6.2                    | 54.0           | -15.3       |
| 20.80           | 20                   | V                | P        | 51.8                    | 6.2                    | 74.0           | -22.2       |
| 20.80           | 20                   | V                | A        | 38.8                    | 6.2                    | 54.0           | -15.2       |
| 20.80           | 10                   | V                | P        | 55.2                    | 6.2                    | 74.0           | -18.8       |
| 20.80           | 10                   | V                | A        | 42.0                    | 6.2                    | 54.0           | -12.0       |
| 20.80           | 10                   | H                | P        | 53.1                    | 6.2                    | 74.0           | -20.9       |
| 20.80           | 10                   | H                | A        | 39.7                    | 6.2                    | 74.0           | -34.3       |
| 4.80            | 50                   | V                | P        | 49.1                    | 0.3                    | 74.0           | -24.9       |
| 7.21            | 50                   | V                | P        | 54.4                    | 8.2                    | 74.0           | -19.6       |
| 7.21            | 50                   | V                | A        | 45.2                    | 8.2                    | 54.0           | -8.8        |
| 4.80            | 50                   | H                | P        | 47.8                    | 0.3                    | 74.0           | -26.2       |
| 7.21            | 50                   | H                | P        | 54.0                    | 8.2                    | 74.0           | -20.0       |
| 7.21            | 50                   | H                | A        | 44.9                    | 8.2                    | 54.0           | -9.1        |
| 4.80            | 40                   | H                | P        | 48.0                    | 0.3                    | 74.0           | -26.0       |
| 7.21            | 40                   | H                | P        | 53.6                    | 8.2                    | 74.0           | -20.4       |
| 7.21            | 40                   | H                | A        | 45.9                    | 8.2                    | 54.0           | -8.1        |
| 4.80            | 40                   | V                | P        | 49.6                    | 0.3                    | 74.0           | -24.4       |
| 7.21            | 40                   | V                | P        | 54.1                    | 8.2                    | 74.0           | -19.9       |
| 7.21            | 40                   | V                | A        | 46.1                    | 8.2                    | 54.0           | -7.9        |
| 4.80            | 30                   | V                | P        | 49.6                    | 0.3                    | 74.0           | -24.4       |
| 7.21            | 30                   | V                | P        | 54.3                    | 8.2                    | 74.0           | -19.7       |
| 7.21            | 30                   | V                | A        | 45.3                    | 8.2                    | 54.0           | -8.7        |
| 4.80            | 30                   | H                | P        | 48.7                    | 0.3                    | 74.0           | -25.3       |
| 7.21            | 30                   | H                | P        | 54.9                    | 8.2                    | 74.0           | -19.1       |
| 7.21            | 30                   | H                | A        | 45.8                    | 8.2                    | 54.0           | -8.2        |
| 4.80            | 20                   | H                | P        | 48.6                    | 0.3                    | 74.0           | -25.4       |
| 7.21            | 20                   | H                | P        | 55.1                    | 8.2                    | 74.0           | -18.9       |
| 7.21            | 20                   | H                | A        | 46.1                    | 8.2                    | 54.0           | -7.9        |
| 4.80            | 20                   | V                | P        | 49.8                    | 0.3                    | 74.0           | -24.2       |
| 7.21            | 20                   | V                | P        | 55.2                    | 8.2                    | 74.0           | -18.8       |
| 7.21            | 20                   | V                | A        | 46.1                    | 8.2                    | 54.0           | -7.9        |
| 4.70            | 10                   | V                | P        | 51.4                    | 0.3                    | 74.0           | -22.6       |
| 4.70            | 10                   | V                | A        | 44.6                    | 0.3                    | 54.0           | -9.4        |
| 7.21            | 10                   | V                | P        | 54.1                    | 8.2                    | 74.0           | -19.9       |
| 7.21            | 10                   | V                | A        | 45.0                    | 8.2                    | 54.0           | -9.0        |
| 7.60            | 10                   | V                | P        | 51.0                    | 8.5                    | 74.0           | -23.0       |
| 7.60            | 10                   | V                | A        | 37.5                    | 8.5                    | 54.0           | -16.5       |
| 15.61           | 10                   | V                | P        | 52.3                    | 15.5                   | 74.0           | -21.7       |
| 15.61           | 10                   | V                | A        | 41.6                    | 15.5                   | 54.0           | -12.4       |

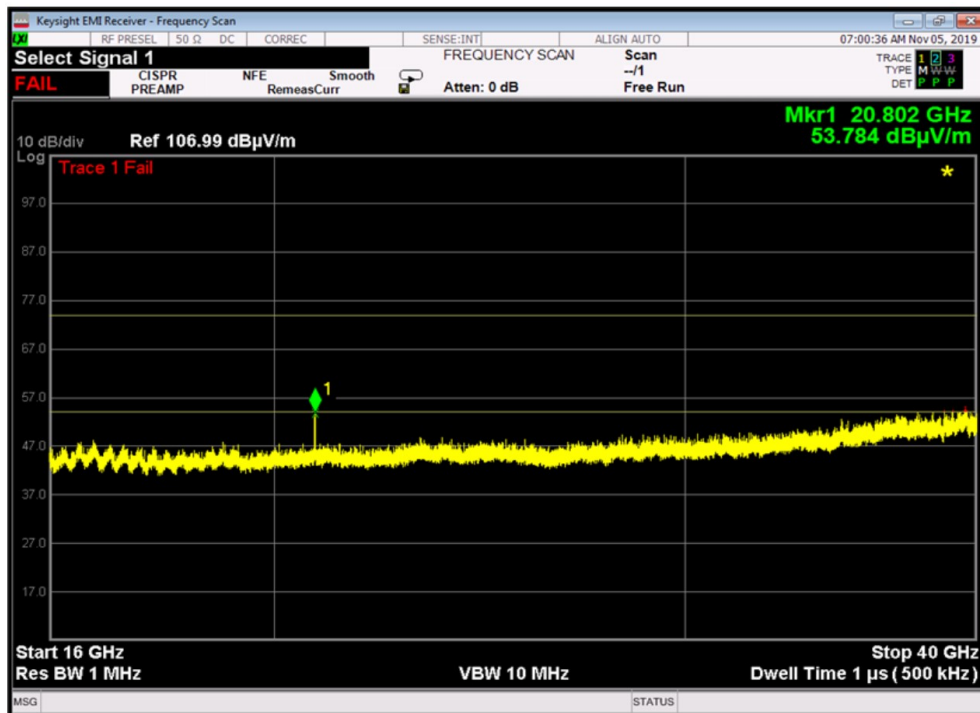
| Frequency (GHZ) | Transceiver BW (MHz) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 7.21            | 10                   | H                | P        | 54.8                    | 8.2                    | 74.0           | -19.2       |
| 7.21            | 10                   | H                | A        | 45.5                    | 8.2                    | 54.0           | -8.5        |
| 10.40           | 10                   | H                | P        | 53.7                    | 13.6                   | 74.0           | -20.4       |
| 10.40           | 10                   | H                | A        | 41.8                    | 13.6                   | 54.0           | -12.2       |
| 13.94           | 10                   | H                | P        | 47.4                    | 16.9                   | 74.0           | -26.6       |
| 13.94           | 10                   | H                | A        | 36.7                    | 16.9                   | 54.0           | -17.3       |

Note: If peak measurements are below the average limit, average measurements may not have been recorded.  
Note: No harmonics noted from the 5Ghz transceiver with the 50-ohm loads applied to the RF output. See below for worst case plots of the data noted above.

**Table 11: Transmitting on the Middle Frequency (5200MHz)**



Graph 7: Worst Case Receiver Plot (1-16GHz; Horizontal, at 5200MHz, 20MHz BW)

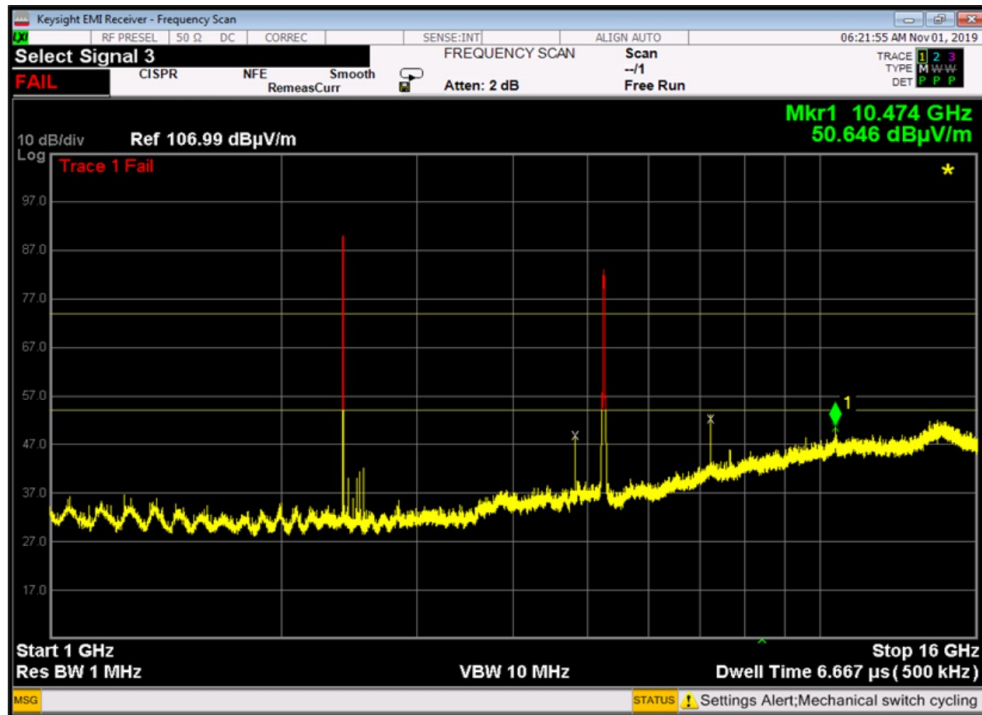


Graph 8: Worst Case Receiver Plot (16-40GHz; Vertical, at 5200MHz, 10MHz BW)

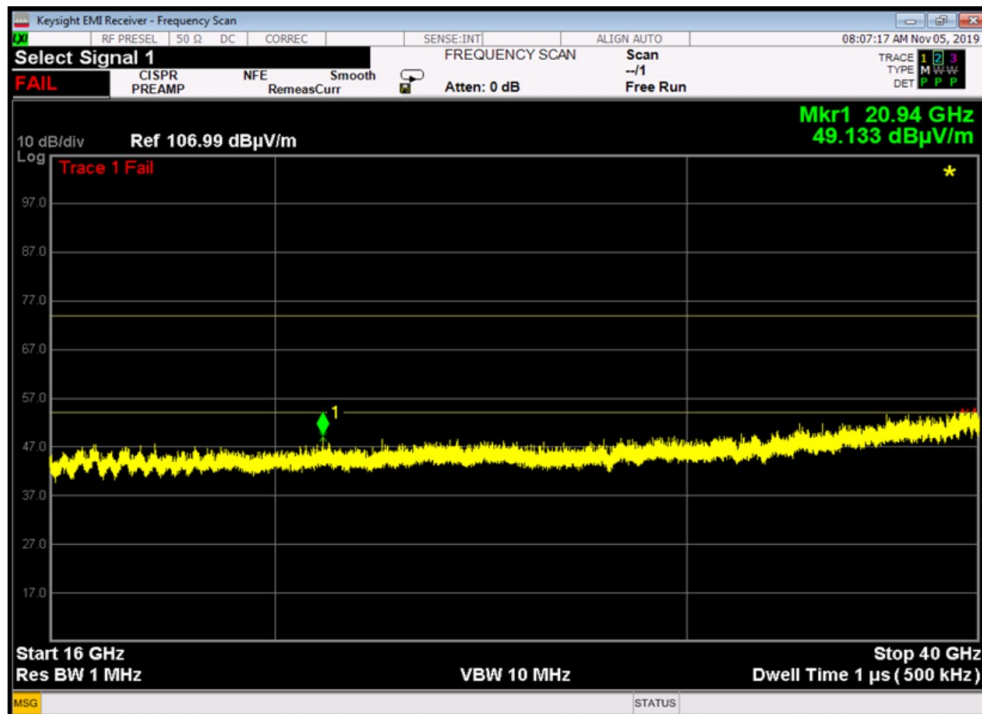
| Frequency (GHz) | Transceiver BW (MHz) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 16.76           | 50                   | H                | P        | 48.7                    | 13.8                   | 74.0           | -25.3       |
| 20.94           | 30                   | V                | P        | 51.6                    | 6.4                    | 74.0           | -22.4       |
| 20.94           | 30                   | V                | A        | 40.4                    | 6.4                    | 54.0           | -13.6       |
| 20.99           | 10                   | H                | P        | 51.9                    | 6.5                    | 74.0           | -22.1       |
| 20.99           | 10                   | H                | A        | 38.7                    | 6.5                    | 54.0           | -15.3       |
| 20.99           | 10                   | V                | P        | 53.5                    | 6.5                    | 74.0           | -20.5       |
| 20.99           | 10                   | V                | A        | 39.7                    | 6.5                    | 54.0           | -14.3       |
| 4.80            | 50                   | H                | P        | 49.1                    | 0.3                    | 74.0           | -24.9       |
| 7.21            | 50                   | H                | P        | 54.1                    | 8.2                    | 74.0           | -19.9       |
| 7.21            | 50                   | H                | A        | 44.8                    | 8.2                    | 54.0           | -9.2        |
| 4.80            | 50                   | V                | P        | 48.7                    | 0.3                    | 74.0           | -25.3       |
| 7.21            | 50                   | V                | P        | 54.3                    | 8.2                    | 74.0           | -19.7       |
| 7.21            | 50                   | V                | A        | 45.3                    | 8.2                    | 54.0           | -8.7        |
| 4.80            | 40                   | V                | P        | 49.3                    | 0.3                    | 74.0           | -24.7       |
| 7.21            | 40                   | V                | P        | 54.2                    | 8.2                    | 74.0           | -19.8       |
| 7.21            | 40                   | V                | A        | 46.2                    | 8.2                    | 54.0           | -7.8        |
| 4.80            | 40                   | H                | P        | 49.4                    | 0.3                    | 74.0           | -24.6       |
| 7.21            | 40                   | H                | P        | 53.5                    | 8.2                    | 74.0           | -20.5       |
| 7.21            | 40                   | H                | A        | 45.8                    | 8.2                    | 54.0           | -8.2        |
| 4.80            | 30                   | V                | P        | 48.8                    | 0.3                    | 74.0           | -25.2       |
| 7.21            | 30                   | V                | P        | 55.5                    | 8.2                    | 74.0           | -18.5       |
| 7.21            | 30                   | V                | A        | 47.7                    | 8.2                    | 54.0           | -6.3        |
| 10.47           | 30                   | V                | P        | 50.6                    | 13.5                   | 74.0           | -23.4       |
| 4.80            | 30                   | H                | P        | 48.2                    | 0.3                    | 74.0           | -25.8       |
| 7.21            | 30                   | H                | P        | 54.1                    | 8.2                    | 74.0           | -19.9       |
| 7.21            | 30                   | H                | A        | 46.1                    | 8.2                    | 54.0           | -7.9        |
| 4.80            | 20                   | V                | P        | 49.5                    | 0.3                    | 74.0           | -24.5       |
| 7.21            | 20                   | V                | P        | 54.3                    | 8.2                    | 74.0           | -19.7       |
| 7.21            | 20                   | V                | A        | 46.4                    | 8.2                    | 54.0           | -7.6        |
| 7.64            | 20                   | V                | P        | 46.4                    | 8.7                    | 74.0           | -27.6       |
| 4.80            | 20                   | H                | P        | 49.9                    | 0.3                    | 74.0           | -24.1       |
| 7.21            | 20                   | H                | P        | 54.3                    | 8.2                    | 74.0           | -19.7       |
| 7.21            | 20                   | H                | A        | 45.3                    | 8.2                    | 54.0           | -8.7        |
| 10.48           | 20                   | H                | P        | 52.9                    | 13.6                   | 74.0           | -21.1       |
| 10.48           | 20                   | H                | A        | 40.5                    | 13.6                   | 54.0           | -13.5       |
| 7.21            | 10                   | H                | P        | 53.5                    | 8.2                    | 74.0           | -20.5       |
| 7.21            | 10                   | H                | A        | 44.2                    | 8.2                    | 54.0           | -9.8        |
| 7.64            | 10                   | H                | P        | 52.5                    | 8.5                    | 74.0           | -21.5       |
| 7.64            | 10                   | H                | A        | 39.3                    | 8.5                    | 54.0           | -14.7       |
| 10.49           | 10                   | H                | P        | 55.8                    | 15.5                   | 74.0           | -18.2       |
| 10.49           | 10                   | H                | A        | 43.5                    | 15.5                   | 54.0           | -10.5       |
| 4.81            | 10                   | V                | P        | 51.5                    | 0.3                    | 74.0           | -22.5       |

| Frequency (GHZ)                                                                                                                                                                                                                                                        | Transceiver BW (MHz) | Antenna Polarity | Detector | Receiver Reading (dBμV) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|----------|-------------------------|------------------------|----------------|-------------|
| 4.81                                                                                                                                                                                                                                                                   | 10                   | V                | A        | 43.9                    | 0.3                    | 54.0           | -10.1       |
| 7.21                                                                                                                                                                                                                                                                   | 10                   | V                | P        | 54.4                    | 8.2                    | 74.0           | -19.6       |
| 7.21                                                                                                                                                                                                                                                                   | 10                   | V                | A        | 46.0                    | 8.2                    | 54.0           | -8.0        |
| 7.65                                                                                                                                                                                                                                                                   | 10                   | V                | P        | 52.4                    | 8.6                    | 74.0           | -21.6       |
| 7.65                                                                                                                                                                                                                                                                   | 10                   | V                | A        | 38.8                    | 8.6                    | 54.0           | -15.2       |
| Note: If peak measurements are below the average limit, average measurements may not have been recorded.<br>Note: No harmonics noted from the 5Ghz transceiver with the 50-ohm loads applied to the RF output. See below for worst case plots of the data noted above. |                      |                  |          |                         |                        |                |             |

**Table 12: Transmitting on the Highest Frequency for Each of the Bandwidths Noted**



Graph 9: Worst Case Receiver Plot (1-16GHz; Horizontal, at 5235MHz, 30MHz BW)



Graph 10: Worst Case Receiver Plot (16-40GHz; Vertical, at 5235MHz, 30MHz BW)

## 5.6 §15.407(a) Maximum Power Spectral Density

The maximum average power spectral density conducted from the intentional radiator of the antenna shall not be greater than 30 dBm in any 500 kHz band during any time interval of continuous transmission.

Results of this testing are summarized.

| Nominal BW (MHz)                                                                                     | Frequency (MHz) | Data Rate | TP Setting | Measured PSD |
|------------------------------------------------------------------------------------------------------|-----------------|-----------|------------|--------------|
| 10                                                                                                   | 5160            | vt0       | 18         | 6.0          |
| 10                                                                                                   | 5200            | vt0       | 30         | 13.1         |
| 10                                                                                                   | 5245            | vt0       | 30         | 13.7         |
| 20                                                                                                   | 5165            | vt0       | 18         | 3.1          |
| 20                                                                                                   | 5200            | vt0       | 23         | 5.7          |
| 20                                                                                                   | 5240            | vt0       | 30         | 10.9         |
| 30                                                                                                   | 5170            | vt0       | 18         | 3.6          |
| 30                                                                                                   | 5200            | vt0       | 24         | 7.4          |
| 30                                                                                                   | 5235            | vt0       | 29         | 9.8          |
| 40                                                                                                   | 5175            | vf0       | 18         | 1.3          |
| 40                                                                                                   | 5200            | vf0       | 20         | 1.3          |
| 40                                                                                                   | 5230            | vf0       | 26         | 6.6          |
| 50                                                                                                   | 5180            | vf0       | 18         | -0.9         |
| 50                                                                                                   | 5200            | vf0       | 18         | -0.7         |
| 50                                                                                                   | 5225            | vf0       | 18         | -0.9         |
| *Note: Mathematically adjusted to subtract the 3dBi antenna which was accounted for by test program. |                 |           |            |              |

**Table 13:3dBi Antenna**

| Nominal BW (MHz)                                                                                     | Frequency (MHz) | Data Rate | TP Setting | Measured PSD |
|------------------------------------------------------------------------------------------------------|-----------------|-----------|------------|--------------|
| 10                                                                                                   | 5160            | vt0       | -5         | -17.0        |
| 10                                                                                                   | 5200            | vt0       | 7          | -9.9         |
| 10                                                                                                   | 5245            | vt0       | 7          | -9.3         |
| 20                                                                                                   | 5165            | vt0       | -5         | -19.9        |
| 20                                                                                                   | 5200            | vt0       | 0          | -17.3        |
| 20                                                                                                   | 5240            | vt0       | 7          | -12.1        |
| 30                                                                                                   | 5170            | vt0       | -5         | -19.4        |
| 30                                                                                                   | 5200            | vt0       | 1          | -15.6        |
| 30                                                                                                   | 5235            | vt0       | 6          | -13.2        |
| 40                                                                                                   | 5175            | vf0       | -5         | -21.7        |
| 40                                                                                                   | 5200            | vf0       | -3         | -21.7        |
| 40                                                                                                   | 5230            | vf0       | 3          | -16.4        |
| 50                                                                                                   | 5180            | vf0       | -5         | -23.9        |
| 50                                                                                                   | 5200            | vf0       | -5         | -23.7        |
| 50                                                                                                   | 5225            | vf0       | -5         | -23.9        |
| *Note: Mathematically adjusted to subtract the 3dBi antenna which was accounted for by test program. |                 |           |            |              |

**Table 14 26dBi Antenna**

### Result

The maximum average power spectral density was less than the limit of 30 dBm; therefore, the EUT complies with the specification.

-- End of Test Report --