*An IIA Company*

# Test Report – FCC 15F Ultra_Wideband Operation
# Applicant: SUBPAC Inc.

**Approved for Release By:**

**Signature:** Bruno Clavier

**Name & Title:** Bruno Clavier, General Manager

**Date of Signature** 4/19/2022

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## 1. Customer Information

Applicant: SUBPAC Inc.
Address: 540 Howard Street
San Francisco, California, 94105, United States

### 1.1 Test Result Summary

The following test procedure was used ANSI C63.10-2015. Full test results are available in this report.

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

| Clauses | Description of the Requirements | Result (Pass, Fail or N/A) |
|---|---|---|
| 15.503(a) | 10dB Bandwidth | Pass |
| FCC 15.517(b) | UWB Bandwidth | Pass |
| FCC 15.517(c), 15.209(a), 15.205(a), (b) | Radiated Field Strength of Spurious Emissions | Pass |
| FCC 15.517(d) | Radiated Field Strength of Spurious Emissions | Pass |
| 2.1046, FCC 15.503(d) | Radiated Field Strength of the Fundamental | Pass |

# 2. Location of Testing

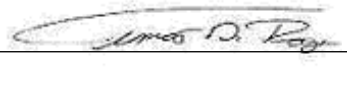
## 2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA"). Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780
FCC Designation # US1070
FCC site registration is under A2LA certificate # 0955.01
ISED Canada test site registration # 2056A
EU Notified Body # 1177
For all designations see A2LA scope # 0955.01

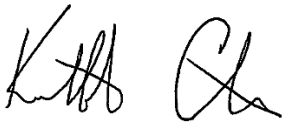
2.2 Testing was performed, reviewed by

Dates of Testing: 1/27/2022 – 2/4/2022

Signature:  Sr. EMC Engineer EMC-003838-NE

Name & Title: Tim Royer, EMC Engineer

Date of Signature 4/19/2022

Signature: 

Name & Title: Kristoffer Costa, EMC Technician

Date of Signature 4/19/2022

## 3. Test Sample(s) (EUT/DUT)

The test sample was received: 1/27/2022

### 3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

| Identification | |
|---|---|
| FCC ID: | 2AEJU-C1A |
| Brief Description | C1 Desk-mount audio control and UWB wireless interface device |
| Model(s) # | SUBPAC C1 |
| Firmware version | n/a |
| Software version | n/a |
| Serial Number | n/a |

| Technical Characteristics | |
|---|---|
| Technology | Ultra Wide Band Device |
| Frequency Range | 6674.9 – 7475.9 |
| Bandwidth & Emission Class | 817.3 MHz |
| Device Category | Indoor UWB System |
| Antenna Connector | n/a |
| Voltage Rating (AC or Batt.) | 5VDC USB Type C |

| Antenna Characteristics | | | |
|---|---|---|---|
| Antenna | Frequency Range | Mode / BW | Antenna Gain |
| 1 | n/a | n/a | 0 dBi |

- Note: Information such as antenna gain, firmware/software numbers are provide by manufacturer and cannot be validated by the test lab..

### 3.2 Configuration of EUT

| Band (MHz) | Mode | Number of Ant. |
|---|---|---|
| 6674.9 – 7475.9 | Transmit | 1 |

Operating conditions during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

Peripherals used during Testing:

A laptop was used to program the EUT.

### 3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power-line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

## 4. Test methods & Applicable Regulatory Limits

### 4.1 Test methods/Standards/Guidance

The measurement was performed as per FCC 15F. Full test results are available in this report.

Limits and Regulatory Limits:

1) FCC 15F
2) KDB 393764 D01 UWB FAQ v02

## 5. Measurement Uncertainty

| Parameter | Uncertainty (dB) |
|---|---|
| Conducted Emissions | ± 3.14 dB |
| Radiated Emissions (9kHz – 30 MHz) | ± 3.08 dB |
| Radiated Emissions (30 – 200 MHz) | ± 2.16 dB |
| Radiated Emissions (200 – 1000 MHz) | ± 2.15 dB |
| Radiated Emissions (1 GHz – 18 GHz) | ± 2.14 dB |
| Radiated Emissions (18 GHz – 40 GHz) | ± 2.31 dB |
| Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2. | |

## 6. Environmental Conditions

Temperature & Humidity

Measurements performed at the test site did not exceed the following:

| Parameter | Measurement |
|---|---|
| Temperature | 23 C +/- 5% |
| Humidity | 55% +/- 5% |
| Barometric Pressure | 30.05 in Hg |
| Note: Specific environmental conditions that are applicable to a specific test are available in the test result section. | |

## 7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

### List of Test Equipment

| Test Equipment | | | | | | |
|---|---|---|---|---|---|---|
| Type | Device | Manufacturer | Model | SN# | Current Cal | Cal Due |
| Antenna | Biconical 1057 | Eaton | 94455-1 | 1057 | 10/16/20 | 10/16/2023 |
| Antenna, NSA | Log-Periodic 1243 | Eaton | 96005 | 1243 | 5/4/21 | 5/3/2024 |
| Antenna | Double-Ridged Horn/ETS Horn 1 | ETS-Lindgren | 3117 | 00035923 | 2/25/20 | 2/24/2023 |
| CHAMBER | CHAMBER | Panashield | 3M | N/A | 3/12/19 | 3/11/2022 |
| Pre-amp | Pre-amp | RF-LAMBDA | RLNA00M45GA | NA | 2/27/19 | 2/26/2022 |
| Receiver | EMI Test Receiver R&S ESU 40 | Rohde & Schwarz | ESU 40 | 100320 | 5/27/21 | 5/26/2024 |
| Function Generator | Function Generator | Standford | DS340 | 25200 | 1/13/21 | 1/13/2024 |
| Signal Generator | Signal Generator HP 8648C | HP | 8648C | 3847A04696 | 3/31/21 | 3/30/2024 |
| | | | | | | |

| Software | | | |
|---|---|---|---|
| Software | Author | Version | Validation on |
| ESU Firmware | Rohde & Schwarz | 4.43 SP3; BIOS v5.1-24-3 | 2018 |
| RSCommander | Rohde & Schwarz | 1.6.4 | 2014 |
| ScopeExplorer | LeCroy | v2.25.0.0 | 2009 |
| Field Strength | Timco | v4.10.7.0 | 2016 |

## 8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

### Units of measurement

Unless noted otherwise in the referenced standard, the measurements of ac power-line conducted emissions and conducted power output will be reported in units of dBµV. Unless noted otherwise in the referenced standard, the measurements of radiated emissions will be reported in units of decibels, referenced to one microvolt per meter (dBµV/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dBµV if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

### Example:

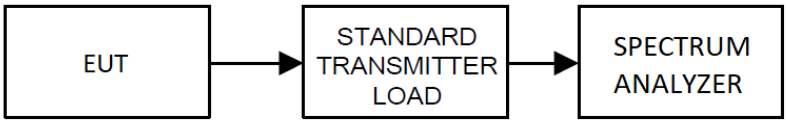
| Freq (MHz) | Meter Reading | + ACF | +CL | = FS |
|---|---|---|---|---|
| 33 | 20 dBµV | + 10.36 dB/m | +0.40 dB | =30.36 dBµV/m @ 3m |

EIRP = Pcond (dBm) + dBi

## 8.1 OCCUPIED BANDWIDTH

Limits from FCC 15.503(a) and test procedure from ANSI C63.10.

Setup

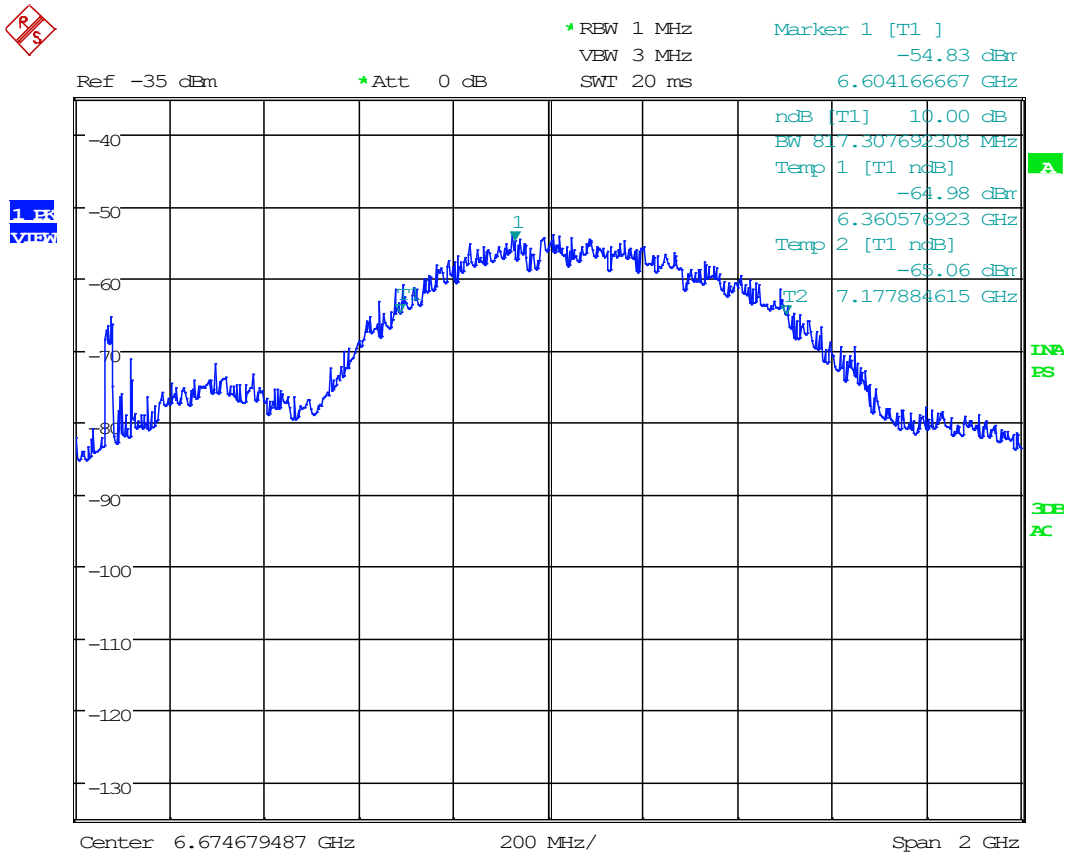



| Tuned Frequency (MHz) | Measured 10 dB BW (MHz) | Occupied Bandwidth Limit (MHz) | Margin (MHz) |
|---|---|---|---|
| 6674.6 | 817.30 | >500 | 317.3 |
| 7475.9 | 625.00 | >500 | 125 |
| 7741.9 | 644.23 | >500 | 144.23 |

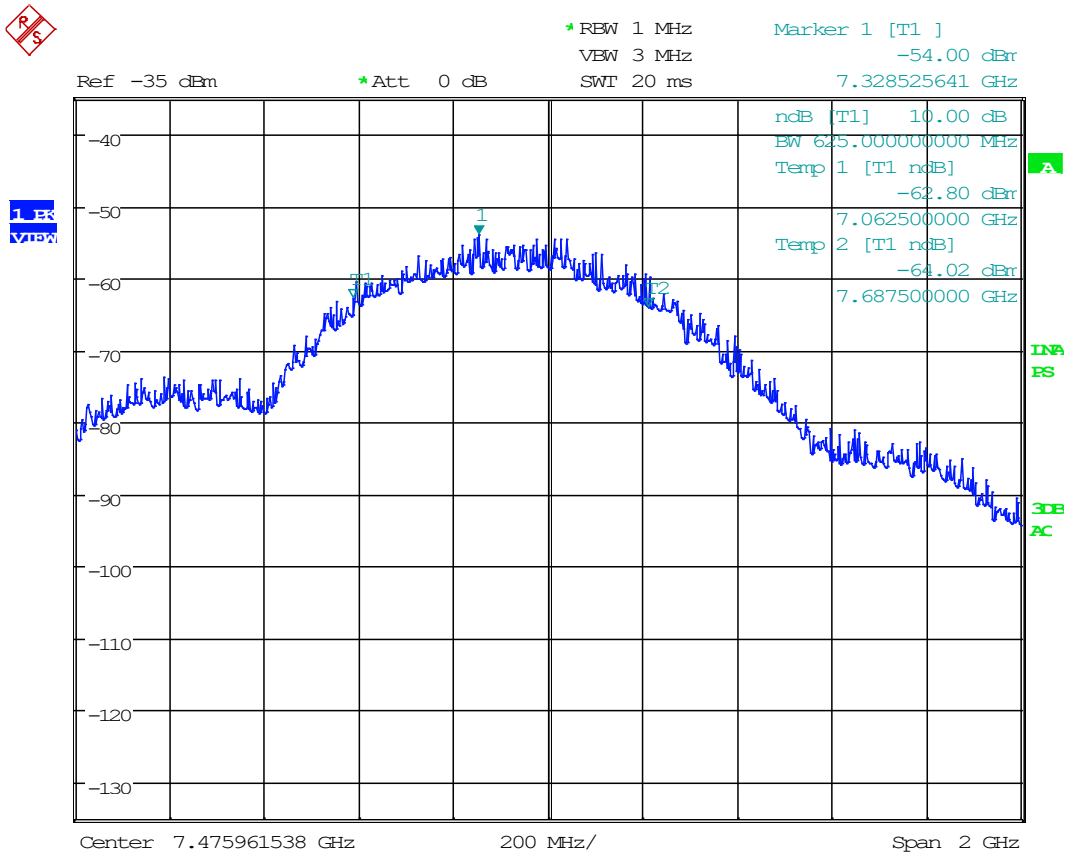
For a UWB device emission spectrum, the entire fundamental bandwidth (that portion of the spectrum between the outermost −10 dB points) must be fully contained within the authorized frequency band (3100 MHz and 10,600 MHz). As stated Q3 of KDB 393764 D01 UWB FAQ v02

$f_L$ = 6.405448718 GHz
$F_H$ = 8.266025641 GHz

### 8.1.1 Test Data: 10 dB Occupied Bandwidth Measurement Plot, 6674.6 MHz



### 8.1.2 Test Data: 10 dB Occupied Bandwidth Measurement Plot, 7475.9 MHz

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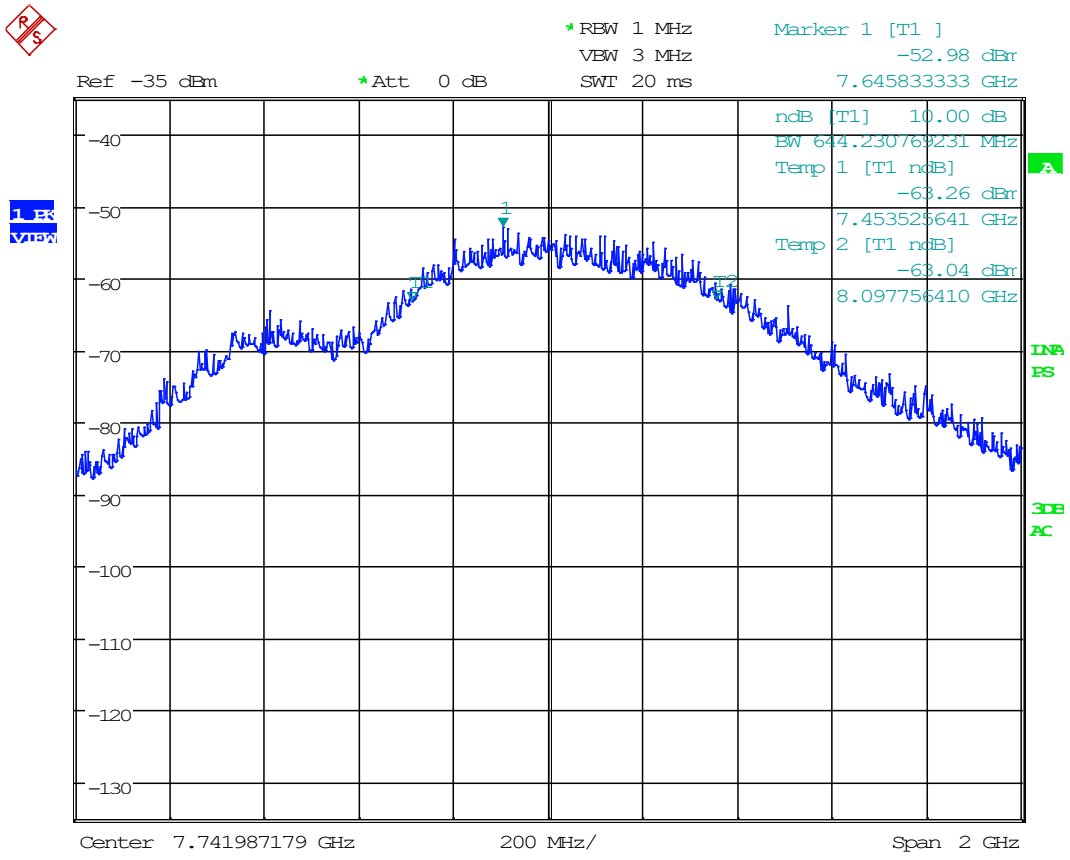
### 8.1.3 Test Data: 10 dB Occupied Bandwidth Measurement Plot, 7741.9 MHz

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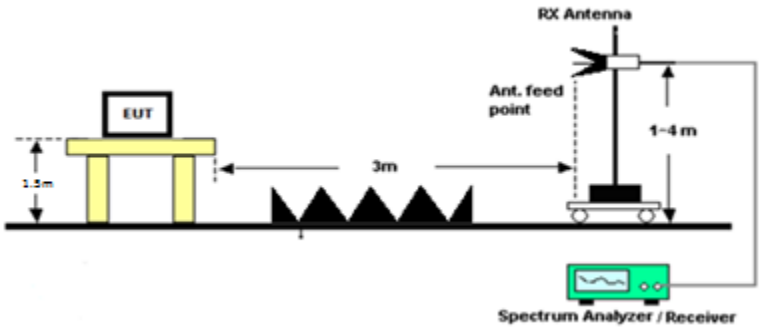
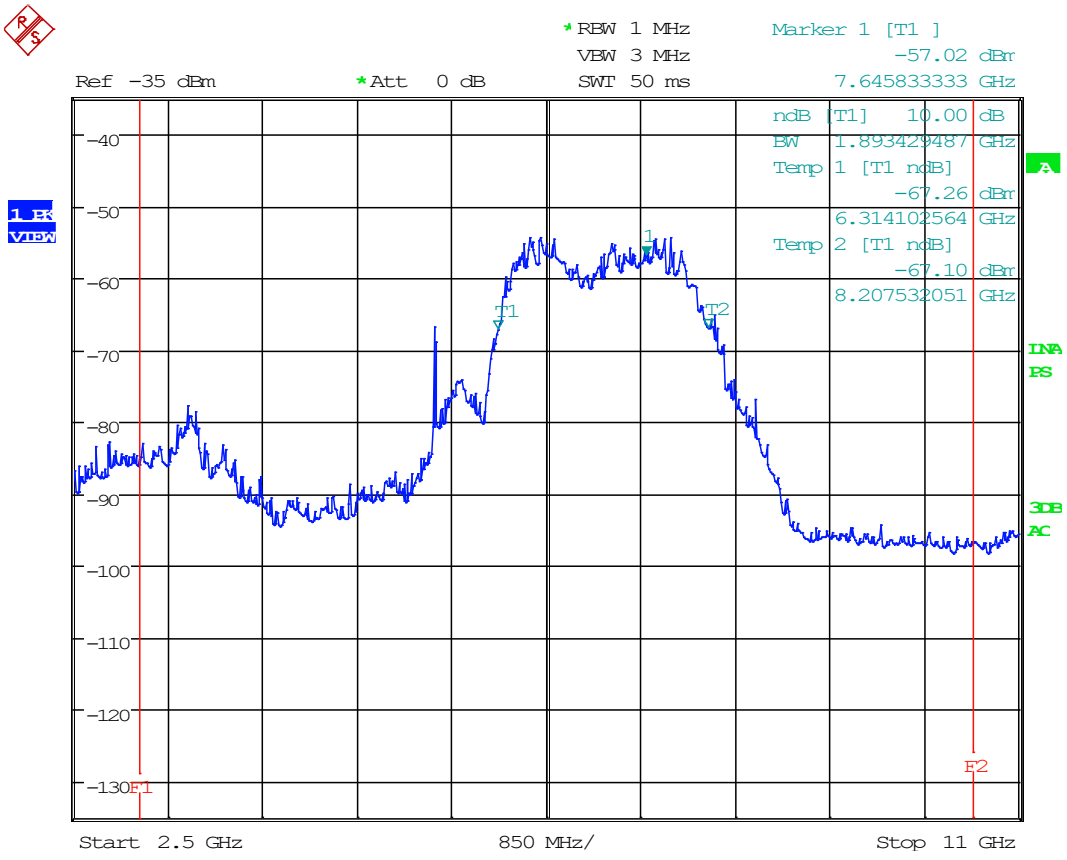
## 8.1 UWB BANDWIDTH

Limits from FCC 15.517(b) and test procedure from ANSI C63.10.

Setup

| Radiated Test Setup, Above 1000 MHz |
| --- |
|  |

### 8.1.1 Test Data: UWB Bandwidth Measurement Plot

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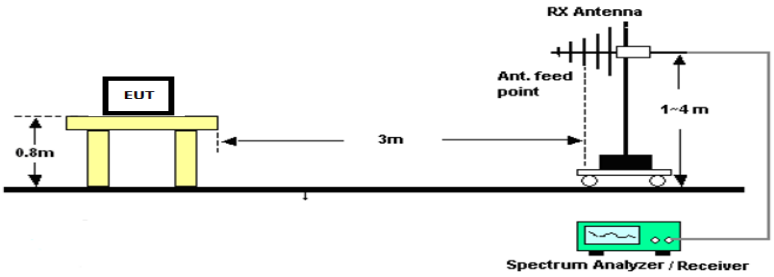
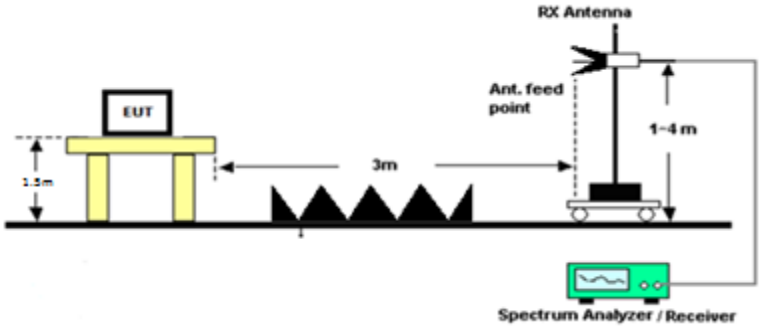
## 8.2 Radiated Field Strength of Spurious Emissions

Limits from FCC 15.517(c) & 15.209 and test procedure from ANSI C63.10

### Radiated Test Setup, 30 – 1000 MHz




### Radiated Test Setup, Above 1000 MHz



### 8.2.1 Radiated Emissions, 6674.6 MHz

| Tuned Frequency (MHz) | Emission Frequency (MHz) | 15.205 Restricted Band | 15.205, 15.35, 15.247(d) Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Duty Cycle Correction (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6674.60 | 13349.20 | X | AVG | -32.10 | H | 12.67 | 0.00 | 39.67 | 3.00 | 20.24 | -77.13 | -51.30 | 25.83 |
| 6674.60 | 13349.20 | X | AVG | -33.21 | V | 12.67 | 0.00 | 39.67 | 3.00 | 19.13 | -78.24 | -51.30 | 26.94 |
| 6674.60 | 20023.80 | X | AVG | -33.77 | H | 16.55 | 0.00 | 44.35 | 3.00 | 27.14 | -70.24 | -51.30 | 18.94 |
| 6674.60 | 20023.80 | X | AVG | -33.15 | V | 16.55 | 0.00 | 44.35 | 3.00 | 27.76 | -69.62 | -51.30 | 18.32 |
| 6674.60 | 26698.40 | | AVG | -33.21 | H | 18.68 | 0.00 | 46.56 | 3.00 | 32.03 | -65.35 | -51.30 | 14.05 |
| 6674.60 | 26698.40 | | AVG | -34.11 | V | 18.68 | 0.00 | 46.56 | 3.00 | 31.13 | -66.25 | -51.30 | 14.95 |
| 6674.60 | 33373.00 | | AVG | -35.21 | H | 21.58 | 0.00 | 49.51 | 3.00 | 35.88 | -61.50 | -51.30 | 10.20 |
| 6674.60 | 33373.00 | | AVG | -35.80 | V | 21.58 | 0.00 | 49.51 | 3.00 | 35.29 | -62.09 | -51.30 | 10.79 |

### 8.2.2 Radiated Emissions, 7475.9 MHz

| Tuned Frequency (MHz) | Emission Frequency (MHz) | 15.205 Restricted Band | 15.205, 15.35, 15.247(d) Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Duty Cycle Correction (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7475.90 | 14951.80 | | AVG | -35.97 | H | 13.60 | 0.00 | 40.29 | 3.00 | 17.92 | -79.46 | -51.30 | 28.16 |
| 7475.90 | 14951.80 | | AVG | -32.73 | V | 13.60 | 0.00 | 40.29 | 3.00 | 21.16 | -76.22 | -51.30 | 24.92 |
| 7475.90 | 22427.70 | X | AVG | -35.78 | H | 16.98 | 0.00 | 44.83 | 3.00 | 26.02 | -71.35 | -51.30 | 20.05 |
| 7475.90 | 22427.70 | X | AVG | -34.58 | V | 16.98 | 0.00 | 44.83 | 3.00 | 27.22 | -70.15 | -51.30 | 18.85 |
| 7475.90 | 29903.60 | | AVG | -31.01 | H | 20.09 | 0.00 | 46.31 | 3.00 | 35.39 | -61.99 | -51.30 | 10.69 |
| 7475.90 | 29903.60 | | AVG | -27.44 | V | 20.09 | 0.00 | 46.31 | 3.00 | 38.96 | -58.42 | -51.30 | 7.12 |
| 7475.90 | 37379.50 | | AVG | -37.84 | H | 22.08 | 0.00 | 45.89 | 3.00 | 30.13 | -67.25 | -51.30 | 15.95 |
| 7475.90 | 37379.50 | | AVG | -35.79 | V | 22.08 | 0.00 | 45.89 | 3.00 | 32.18 | -65.20 | -51.30 | 13.90 |

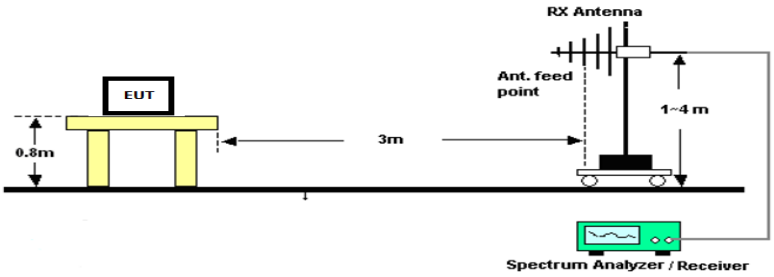
### 8.2.3 Radiated Emissions, 7741.9 MHz

| Tuned Frequency (MHz) | Emission Frequency (MHz) | 15.205 Restricted Band | 15.205, 15.35, 15.247(d) Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Duty Cycle Correction (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7741.90 | 15483.80 | X | AVG | -45.45 | H | 14.06 | 0.00 | 41.39 | 3.00 | 10.00 | -87.38 | -51.30 | 36.08 |
| 7741.90 | 15483.80 | X | AVG | -46.09 | V | 14.06 | 0.00 | 41.39 | 3.00 | 9.36 | -88.02 | -51.30 | 36.72 |
| 7741.90 | 23225.70 | | AVG | -46.44 | H | 17.85 | 0.00 | 45.15 | 3.00 | 16.56 | -80.82 | -51.30 | 29.52 |
| 7741.90 | 23225.70 | | AVG | -48.95 | V | 17.85 | 0.00 | 45.15 | 3.00 | 14.05 | -83.33 | -51.30 | 32.03 |
| 7741.90 | 30967.60 | | AVG | -44.80 | H | 20.09 | 0.00 | 47.02 | 3.00 | 22.32 | -75.06 | -51.30 | 23.76 |
| 7741.90 | 30967.60 | | AVG | -43.62 | V | 20.09 | 0.00 | 47.02 | 3.00 | 23.50 | -73.88 | -51.30 | 22.58 |
| 7741.90 | 38709.50 | X | AVG | -44.80 | H | 22.72 | 0.00 | 45.84 | 3.00 | 23.77 | -73.61 | -51.30 | 22.31 |
| 7741.90 | 38709.50 | X | AVG | -49.70 | V | 22.72 | 0.00 | 45.84 | 3.00 | 18.87 | -78.51 | -51.30 | 27.21 |

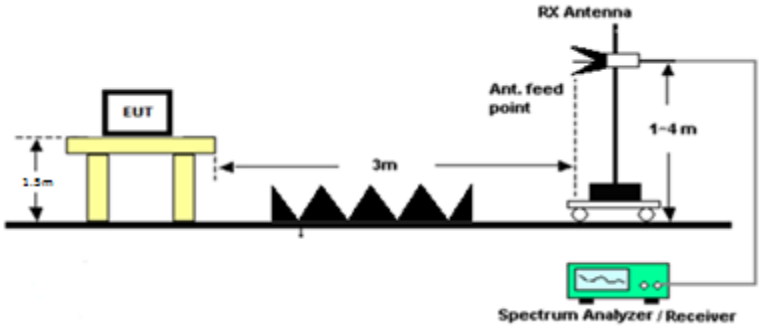
## 8.3 Radiated Field Strength of Spurious Emissions

Limits from FCC 15.517(d) and test procedure from ANSI C63.10

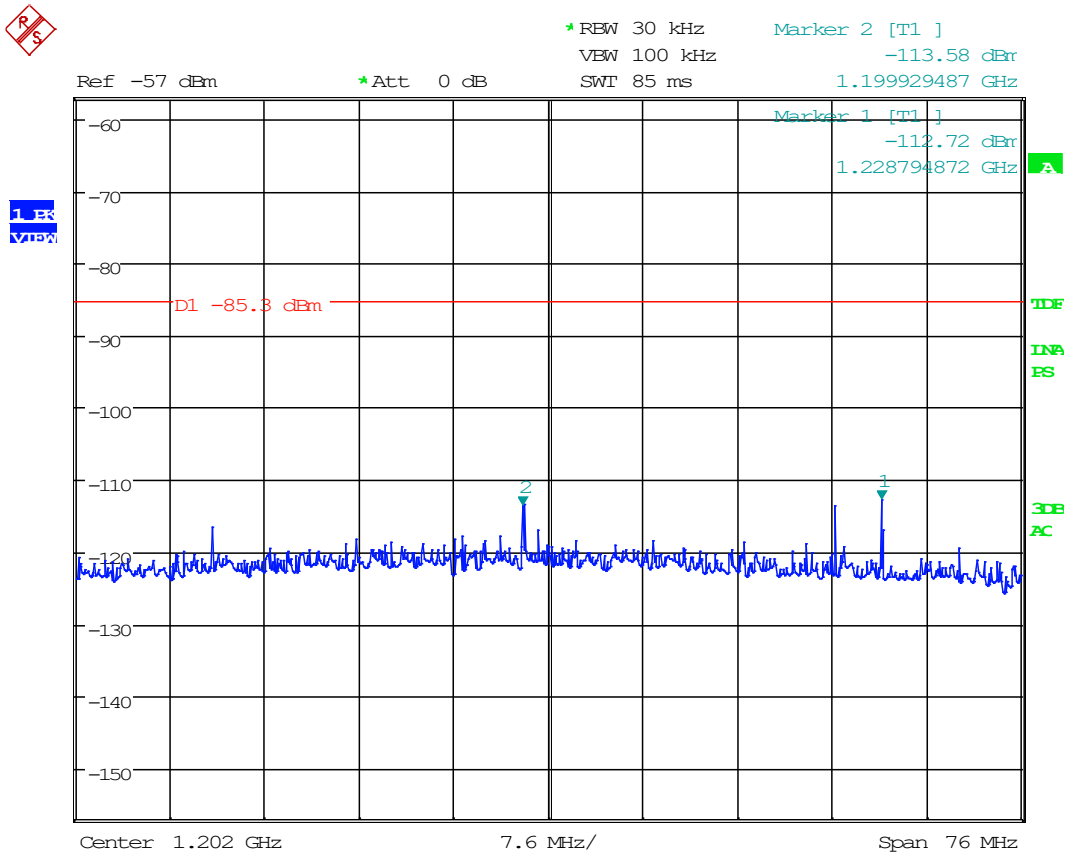
### Radiated Test Setup, 30 – 1000 MHz




### Radiated Test Setup, Above 1000 MHz



### 8.3.1 Radiated Emissions of 1164 - 1240 MHz for 6674.6 MHz Fundamental

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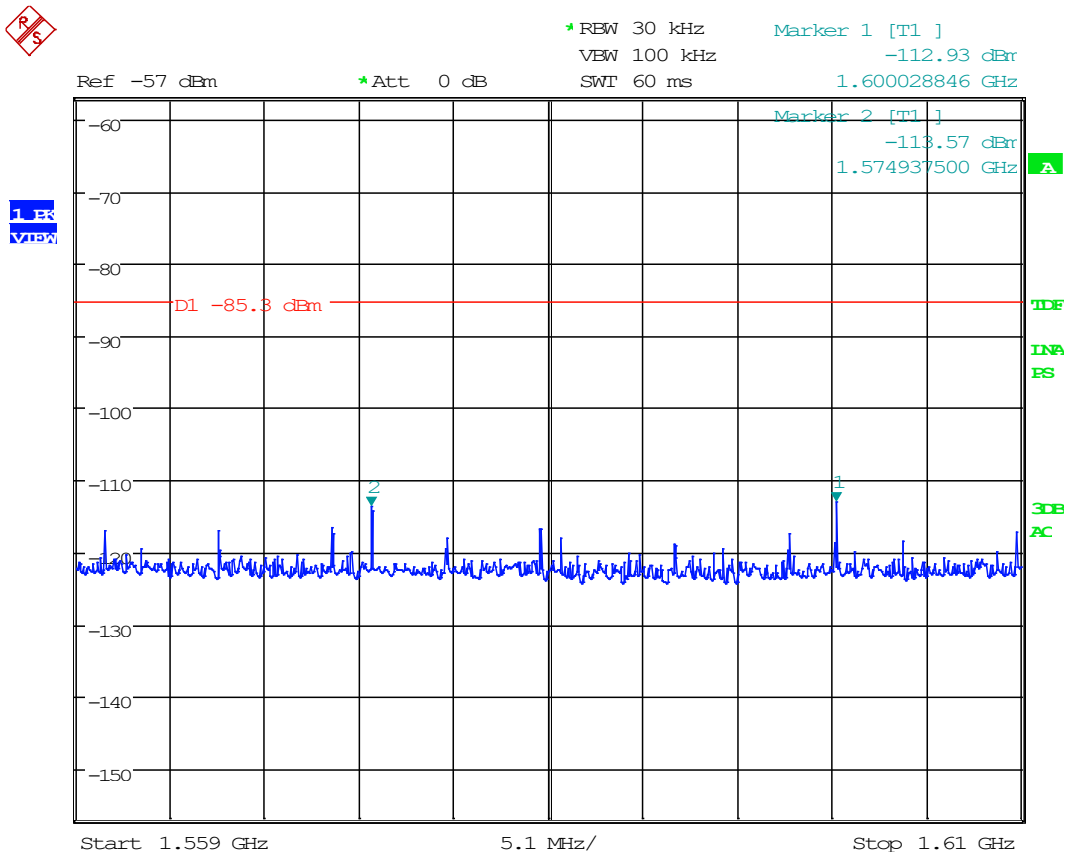
### 8.3.2 Radiated Emissions, 1559 - 1610 MHz for 6674.6 MHz fundamental

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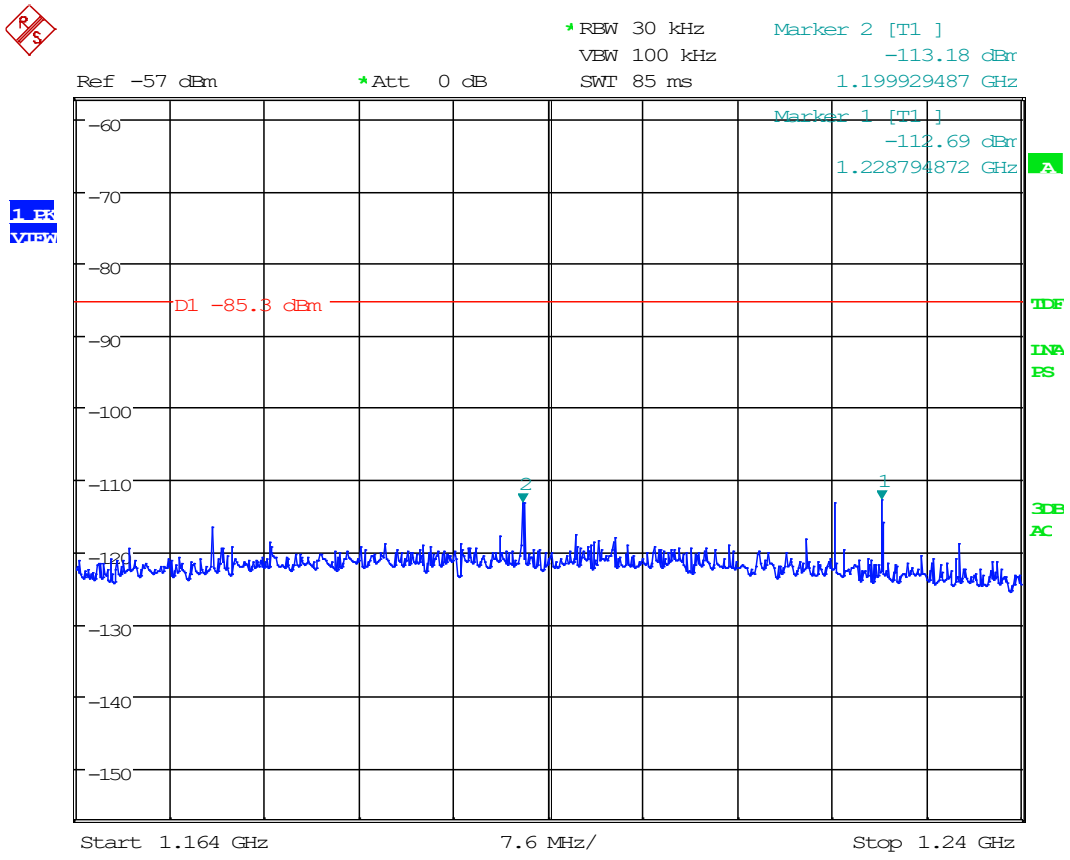
### 8.3.3 Radiated Emissions of 1164 - 1240 MHz for 7475.9 MHz Fundamental

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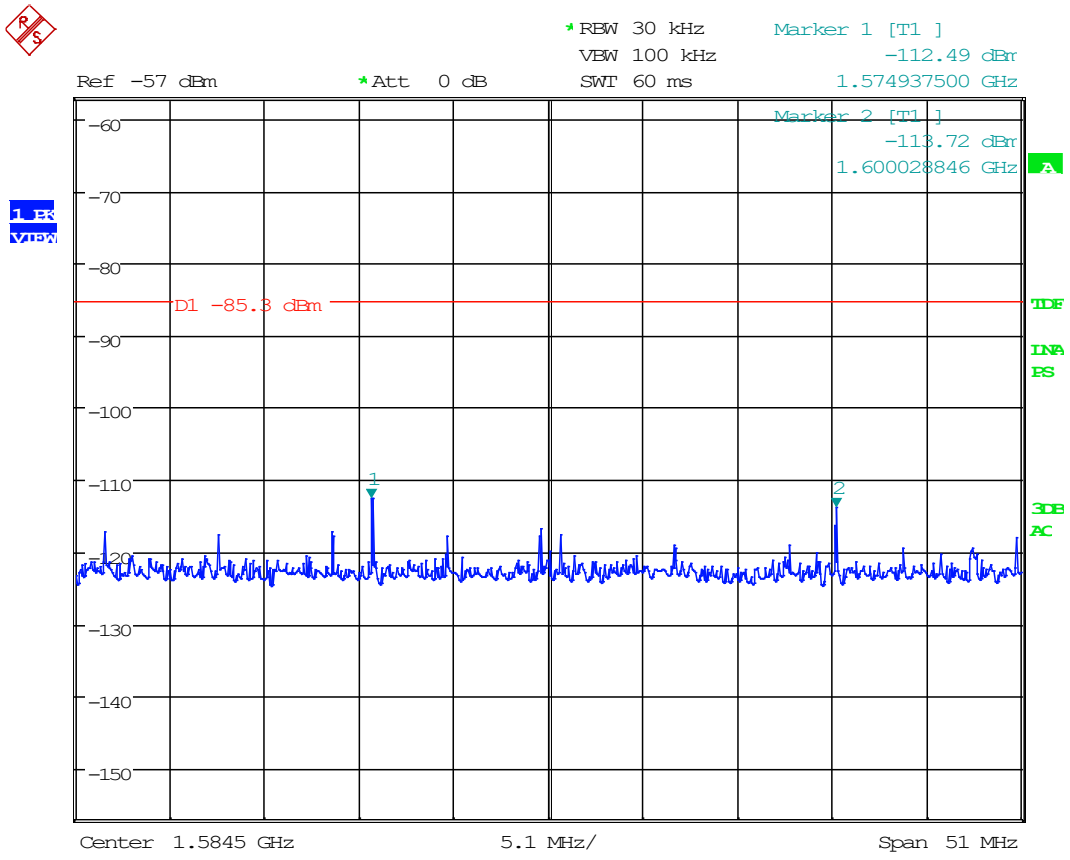
### 8.3.4 Radiated Emissions, 1559 - 1610 MHz for 7475.9 MHz fundamental

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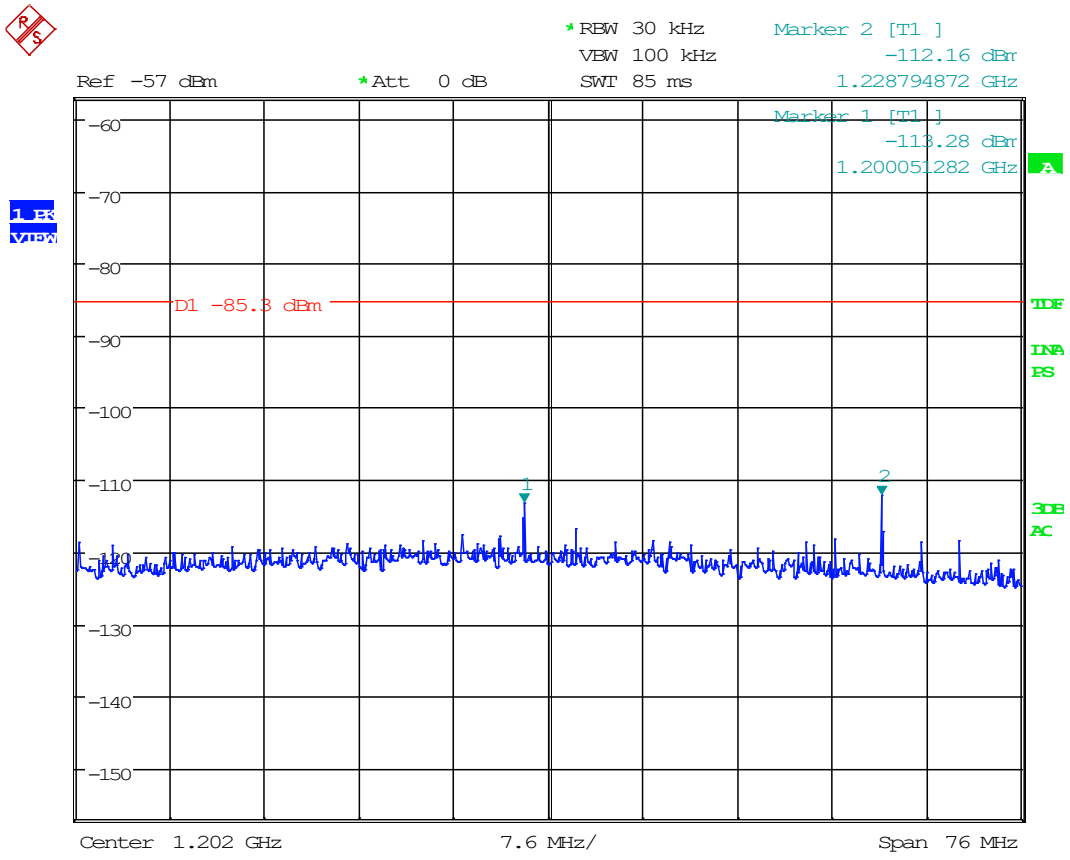
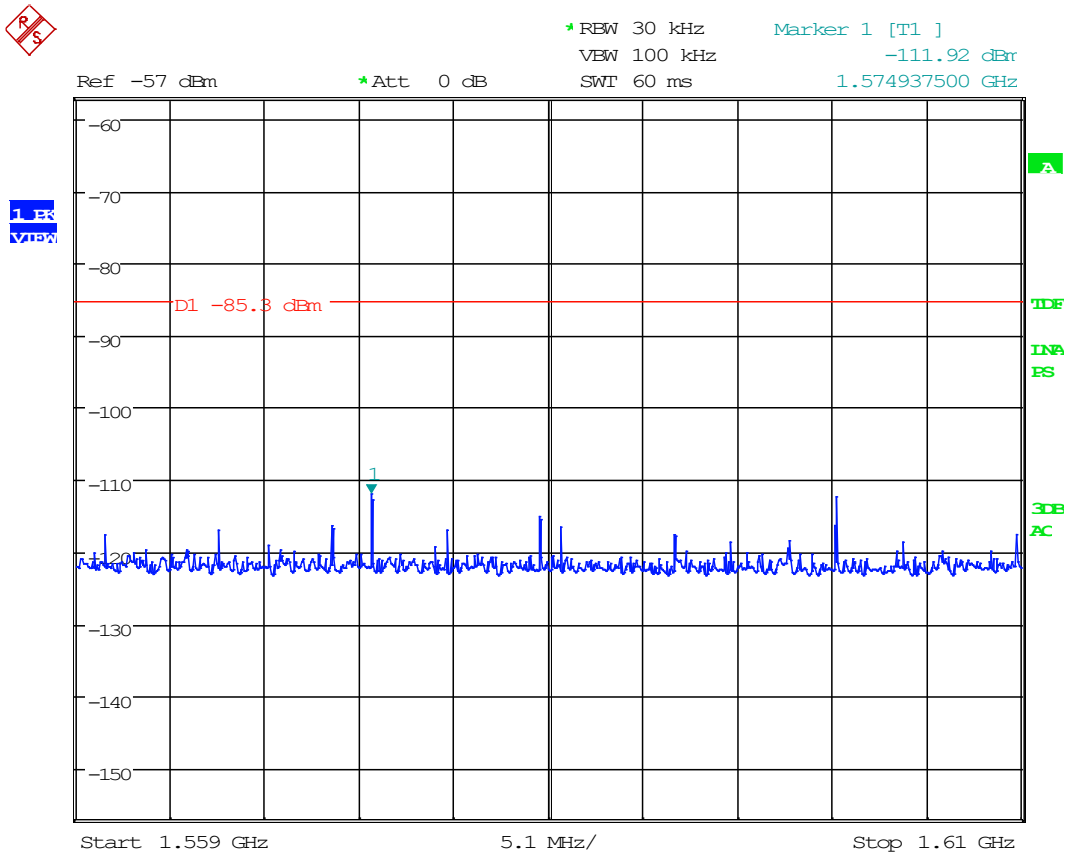
### 8.3.5 Radiated Emissions of 1164 - 1240 MHz for 7741.9 MHz Fundamental



### 8.3.6 Radiated Emissions, 1559 - 1610 MHz for 7741.9 MHz fundamental

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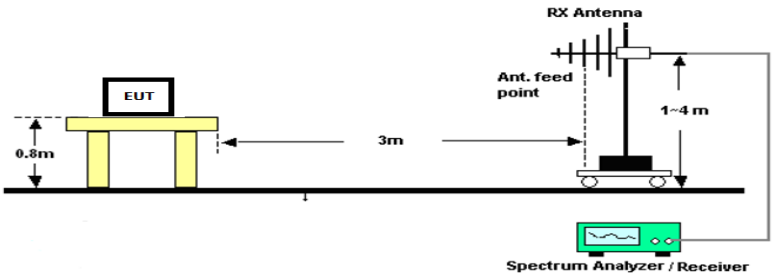
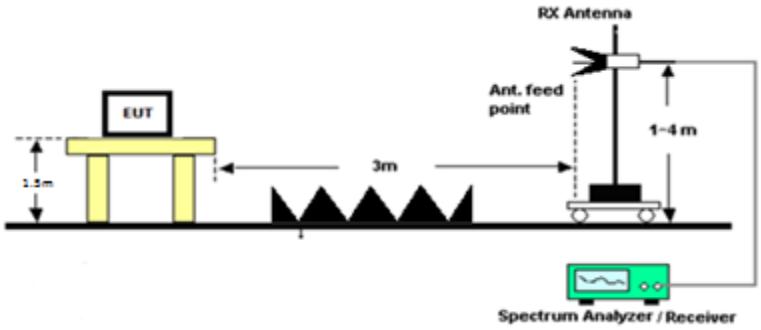
## 8.4 Radiated Field Strength of the Fundamental

Limits from FCC 15.503(d) and test procedure from ANSI C63.10

### Radiated Test Setup, 30 – 1000 MHz




### Radiated Test Setup, Above 1000 MHz



### 8.4.1 Radiated Emissions, Fundamental Data

| Tuned Frequency (MHz) | Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) | Meter Reading (dBµV) | Correction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6674.60 | PK | 48.59 | H | 9.14 | 35.69 | 3.00 | 93.42 | -3.96 | 0.00 | 3.96 | 34.62 | 13.97 |
| 6674.60 | PK | 49.74 | V | 9.14 | 35.69 | 3.00 | 94.57 | -2.81 | 0.00 | 2.81 | 35.77 | 13.97 |
| 7475.90 | PK | 47.99 | H | 9.63 | 35.97 | 3.00 | 93.59 | -3.79 | 0.00 | 3.79 | 34.02 | 13.97 |
| 7475.90 | PK | 49.43 | V | 9.63 | 35.97 | 3.00 | 95.03 | -2.35 | 0.00 | 2.35 | 35.46 | 13.97 |
| 7741.90 | PK | 50.36 | H | 10.12 | 35.87 | 3.00 | 96.35 | -1.02 | 0.00 | 1.02 | 36.39 | 13.97 |
| 7741.90 | PK | 50.81 | V | 10.12 | 35.87 | 3.00 | 96.80 | -0.57 | 0.00 | 0.57 | 36.84 | 13.97 |

## 9. ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT are in a separate document.

## 10. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate document.

## 11. History of Test Report Changes

| Test Report # | Revision # | Description | Date of Issue |
|---|---|---|---|
| TR_0532-22_FCC_15F Ultra_Wideband Operation_ | 1 | Initial release | 2/8/2022 |
| | 2 | Updated Pages 3,6,8,10,11,14,16,20,27 | 4/11/2022 |
| | 3 | Updated Page 29 | 4/19/2022 |

END OF TEST REPORT