

**ELECTROMAGNETIC EMISSIONS**  
**CLASS II PERMISSIVE CHANGE TEST REPORT**



**Applicant:** Cisco Systems Inc.  
125 West Tasman Dr, Bldg. P, San Jose, California, 95134  
USA

**Manufacturer:** Cisco Systems Inc.  
125 West Tasman Dr, Bldg. P, San Jose, California, 95134  
USA

**Product Name:** FM4500EMB-HW

**Brand Name:** Cisco Fluidmesh FM4500 EMBEDDED

**Model No.:** FM4500EMB

**Model Difference:** N/A

**Report Number:** ER/2021/A0115

**FCC ID** R5SX500E

**Date of EUT Received:** October 28, 2021

**Date of Test:** March 1, 2022 ~ April 6, 2022

**Issue Date:** May 19, 2022

Approved By \_\_\_\_\_

**Blue Yang**

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.26:2015 and the energy emitted by the sample EUT comply with FCC rule part §90 Subpart Y.

The results of this report relate only to the sample identified in this report.

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## Revision History

| Report Number | Revision | Description                                      | Issue Date   | Revised By    | Remark |
|---------------|----------|--------------------------------------------------|--------------|---------------|--------|
| ER/2021/A0115 | 00       | Original                                         | May 5, 2022  | Violetta Tang | *      |
| ER/2021/A0115 | 01       | Revise typo of the product description on page 4 | May 19, 2022 | Violetta Tang |        |
|               |          |                                                  |              |               |        |
|               |          |                                                  |              |               |        |
|               |          |                                                  |              |               |        |
|               |          |                                                  |              |               |        |
|               |          |                                                  |              |               |        |

**Note:**

- 1、The remark "\*" indicates modification of the report upon requests from certification body.

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## 1 GENERAL INFORMATION

### 1.1 Product Description

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:                  | FM4500EMB-HW                                                                                                                                                                                                                                                                                                                                                                                                        |
| Brand Name:                    | Cisco Fluidmesh FM4500 EMBEDDED                                                                                                                                                                                                                                                                                                                                                                                     |
| Model No.:                     | FM4500EMB                                                                                                                                                                                                                                                                                                                                                                                                           |
| Model Difference:              | N/A                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Hardware Version:              | N/A                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Firmware Version:              | N/A                                                                                                                                                                                                                                                                                                                                                                                                                 |
| EUT Series No.:                | 3500170840 / 3500171248                                                                                                                                                                                                                                                                                                                                                                                             |
| Class II<br>Permissive Change: | FM4500EMB module INSTALLED IN FM3500, FM4500                                                                                                                                                                                                                                                                                                                                                                        |
| Host Information:              | Product Name: FM3500ENDO-HW<br>Brand Name: Cisco Fluidmesh FM3500 ENDO<br>Model Name: FM3500, FM4500<br>Model Differences as below.<br>1. Some passive components of the DCIN circuit are mounted on PCB in FM4500 model.<br>2. Antenna connectors are different: RPSMA on FM3500, QMA on FM4500.<br>3. Bottom part of FM4500 enclosure has M12 connectors instead of RJ45 ports: M12 DCIN port is added on FM4500. |
| Power Supply:                  | 56Vdc                                                                                                                                                                                                                                                                                                                                                                                                               |

### 1.2 RF Specification

WLAN 4.9GHz:

| Wi-Fi            | Frequency Range | Channels                          | Rated Power (dBm) | Modulation Technology | Test Mode  |
|------------------|-----------------|-----------------------------------|-------------------|-----------------------|------------|
| 11j<br>(20MHz)   | 4960~4980       | 2                                 | 22.51             | OFDM                  | Mode 1 & 3 |
| 11j<br>(20MHz)   | 4960~4980       | 2                                 | 15.16             | OFDM                  | Mode 2 & 4 |
| Modulation type  |                 | 64QAM, 16QAM, QPSK, BPSK for OFDM |                   |                       |            |
| Data Rate        |                 | 802.11 j_20MHz: 6 – 54Mbps        |                   |                       |            |
| Type of Emission |                 | 20MHz=17M7W7D                     |                   |                       |            |

Note: For the detailed of test mode, please refer to section 4.5 in this report.

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## 1.3 Antenna Designation

| Antenna Type  | Supplier        | Antenna Part No. | Freq. (MHz) | Peak Antenna Gain (dBi) | Directional Gain (dBi) |
|---------------|-----------------|------------------|-------------|-------------------------|------------------------|
| Direction     | Fluidmesh       | FM-TUBE          | 4960~4980   | 14.60                   | 17.61                  |
| Omnidirection | Fluidmesh       | FM-SHARK-DUAL    | 4960~4980   | 13.00                   | 16.01                  |
| Direction     | Fluidmesh       | FM-HORN-90       | 4960~4980   | 10.00                   | 13.01                  |
| Omnidirection | Fluidmesh       | FM-OMNI-5-V      | 4960~4980   | 4.00                    | 7.52                   |
| Omnidirection | Fluidmesh       | FM-OMNI-5-H      | 4960~4980   | 5.00                    |                        |
| Omnidirection | MP Antenna LTD. | 08-ANT-0985      | 4960~4980   | 3.00                    | 6.01                   |

**Note:**

1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
2. Antenna information is provided by the applicant.

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## 1.4 Test Methodology of Applied Standards

FCC Part 90, Subpart Y

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

ANSI C63.26:2015

## 1.5 Test Facility

| Laboratory                                                                                                                                                                   | Test Site Address                                                                         | Test Site Name | FCC Designation number | IC CAB identifier |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------|------------------------|-------------------|
| SGS Taiwan Ltd.<br>Central RF Lab.<br>(TAF code 3702)                                                                                                                        | No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. | SAC 1          | TW0027                 | TW3702            |
|                                                                                                                                                                              |                                                                                           | SAC 3          |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conduction 1   |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 1    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 2    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 3    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 4    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 5    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted 6    |                        |                   |
|                                                                                                                                                                              | No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333                            | Conduction A   | TW0028                 |                   |
|                                                                                                                                                                              |                                                                                           | SAC C          |                        |                   |
|                                                                                                                                                                              |                                                                                           | SAC D          |                        |                   |
|                                                                                                                                                                              |                                                                                           | SAC G          |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted A    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted B    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted C    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted D    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted E    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted F    |                        |                   |
|                                                                                                                                                                              |                                                                                           | Conducted G    |                        |                   |
| <b>Note:</b> Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address. |                                                                                           |                |                        |                   |

## 1.6 Special Accessories

There are no special accessories used while test was conducted.

## 1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

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

### 2.2 EUT Exercise

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

### 2.3 Test Procedure

#### 2.3.1 Conducted Measurement at Antenna Port

The EUT is placed on a table which is 0.8 m above ground plane. A low loss of RF cable was used to connect the antenna port of EUT to measurement equipment.

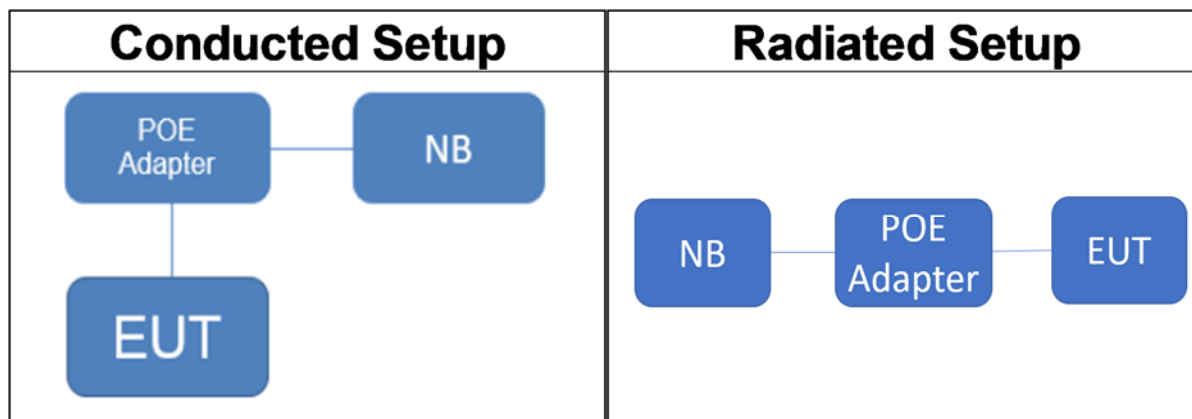
#### 2.3.2 Radiated Emissions (ERP/EIRP)

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

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## 2.4 Test Configuration



## 2.5 Control Unit(s)

| Conducted Emission Test Site: Conducted 2 |           |                     |               |           |          |
|-------------------------------------------|-----------|---------------------|---------------|-----------|----------|
| EQUIPMENT TYPE                            | MFR       | MODEL NUMBER        | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| POE Adapter                               | Fluidmesh | POE29U-1AT(PL)      | PHI242904KX   | N/A       | N/A      |
| Test Software                             | SGS       | Radio Test Software | Ver. 21       | N.C.R     | N.C.R    |
| Notebook                                  | Lenovo    | T440P               | PC-089AH5     | N/A       | N/A      |

| Radiated Emission Test Site: SAC 3 |         |               |                |           |          |
|------------------------------------|---------|---------------|----------------|-----------|----------|
| EQUIPMENT TYPE                     | MFR     | MODEL NUMBER  | SERIAL NUMBER  | LAST CAL. | CAL DUE. |
| Test Software                      | audix   | e3            | Ver. 9 210322  | N.C.R     | N.C.R    |
| Notebook                           | Lenovo  | L430          | R9-WGNK5 13/01 | N/A       | N/A      |
| POE Adapter                        | PHIHONG | POE29U1AT(PL) | PHI242904KM    | N/A       | N/A      |

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### 3 SUMMARY OF TEST RESULTS

| FCC Rules                | Description Of Test                         | Result    |
|--------------------------|---------------------------------------------|-----------|
| 2.1049 ;<br>§90.209      | Emission Bandwidth                          | Compliant |
| §90.1215(a)              | Maximum<br>Transmitter Power                | Compliant |
| §90.1215(a)(b)           | Peak Power Spectral Density                 | Compliant |
| §90.210(L) (M)           | Transmit Spectrum Mask                      | Compliant |
| 2.1051;<br>§90.210(L)(M) | Transmitter Conducted<br>Unwanted Emissions | Compliant |
| 2.1053;<br>§90.210(L)(M) | Transmitter Radiated<br>Unwanted Emissions  | Compliant |
| 2.1055;<br>§90.213       | Frequency Stability                         | Compliant |
| §90.1215(e)              | Peak Excursion                              | Compliant |

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 802.11j Band

2 channels are provided for 20M

| CHANNEL | FREQUENCY<br>(MHz) |
|---------|--------------------|
| 192     | 4960               |
| 196     | 4980               |

### 4.2 The Worst Test Modes and Channel Details

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

The given UE is pre-scanned among below modes.

| Modulation                               | Transmission Chain                      |                                         |                              |                              | Single<br>Transmission<br>Spatial | Multiple<br>Transmission<br>Spatial     |
|------------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------|------------------------------|-----------------------------------|-----------------------------------------|
| <input checked="" type="checkbox"/> OFDM | <input checked="" type="checkbox"/> Ch0 | <input checked="" type="checkbox"/> Ch1 | <input type="checkbox"/> Ch2 | <input type="checkbox"/> Ch3 | <input type="checkbox"/> 1TX      | <input checked="" type="checkbox"/> 2TX |

4. Therefore, below summary is the modes of test configuration that yield the highest reading and generate the highest emission chosen to carry out the relevantly mandatory test items.

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#### 4.3 Radiated Emission Test:

| RADIATED EMISSION TEST (BELOW 1 GHz) |                      |                   |                |            |                  |              |
|--------------------------------------|----------------------|-------------------|----------------|------------|------------------|--------------|
| MODE                                 | FREQUENCY BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) | ANTENNA PORT |
| 802.11j                              | 4960~4980            | 192 to 196        | 192,196        | OFDM       | 6                | MIMO         |

| RADIATED EMISSION TEST (ABOVE 1 GHz) |                      |                   |                |            |                  |              |
|--------------------------------------|----------------------|-------------------|----------------|------------|------------------|--------------|
| MODE                                 | FREQUENCY BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) | ANTENNA PORT |
| 802.11j                              | 4960~4980            | 192 to 196        | 192,196        | OFDM       | 6                | MIMO         |

**Note:** The field strength of radiation emission was measured as EUT three orthogonal plans, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested, and recorded.

#### 4.4 Antenna Port Conducted Measurement:

| CONDUCTED TEST |                      |                   |                |            |                  |              |
|----------------|----------------------|-------------------|----------------|------------|------------------|--------------|
| MODE           | FREQUENCY BAND (MHz) | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION | DATA RATE (Mbps) | ANTENNA PORT |
| 802.11j        | 4960~4980            | 192 to 196        | 192,196        | OFDM       | 6                | MIMO         |

#### 4.5 Test mode:

Mode 1: Point-to-point and point-to-multipoint operations with FM-TUBE antenna.

Mode 2: Non-point-to-point and non-point-to-multipoint operations with FM-TUBE antenna.

Mode 3: Point-to-point and point-to-multipoint operations with FM-SHARK-DUAL antenna.

Mode 4: Non-point-to-point and non-point-to-multipoint operations with FM-SHARK-DUAL antenna.

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## 5 MEASUREMENT UNCERTAINTY

| Test Items                                               | Uncertainty |
|----------------------------------------------------------|-------------|
| Power Density                                            | +/- 1.62 dB |
| RF Power Output                                          | +/- 1 dB    |
| ERP/ EIRP measurement                                    | +/- 3 dB    |
|                                                          | +/- 3 dB    |
| Emission Bandwidth                                       | +/- 1.53 Hz |
| Out of Band Emissions at Antenna Terminals and Band Edge | +/- 1.68 dB |
| Peak to Average Ratio                                    | +/- 1 dB    |
| Frequency Stability vs. Temperature                      | +/- 1.53 Hz |
| Frequency Stability vs. Voltage                          | +/- 1.53 Hz |
| Temperature                                              | +/- 0.4 °C  |
| Humidity                                                 | +/- 3.5 %   |
| DC / AC Power Source                                     | +/- 1 %     |

| Radiated Spurious Emission Measurement Uncertainty |             |                 |  |
|----------------------------------------------------|-------------|-----------------|--|
| Polarization: Vertical                             | +/- 2.64 dB | 9kHz~30MHz      |  |
|                                                    | +/- 4.93 dB | 30MHz - 1000MHz |  |
|                                                    | +/- 4.81 dB | 1GHz - 18GHz    |  |
|                                                    | +/- 4.52 dB | 18GHz - 40GHz   |  |
| Polarization: Horizontal                           | +/- 2.64 dB | 9kHz~30MHz      |  |
|                                                    | +/- 4.45 dB | 30MHz - 1000MHz |  |
|                                                    | +/- 4.81 dB | 1GHz - 18GHz    |  |
|                                                    | +/- 4.52 dB | 18GHz - 40GHz   |  |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 6 MEASUREMENT EQUIPMENT USED

### 6.1 Conducted Measurement

| Conducted Emission Test Site: Conducted 2 |               |                  |               |            |            |
|-------------------------------------------|---------------|------------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR           | MODEL NUMBER     | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EXA Spectrum Analyzer                     | KEYSIGHT      | N9010B           | MY60240503    | 12/09/2021 | 12/08/2022 |
| Temperature Chamber                       | Giant Force   | GTH-150-40-CP-AR | MAA0512-018   | 05/19/2021 | 05/18/2022 |
| AC Power Source                           | Gwinstek      | APS-7050E        | GEV171679     | 09/28/2021 | 09/27/2022 |
| Attenuator                                | Mini-Circuit  | BW-S10W2+        | 4             | 12/14/2021 | 12/13/2022 |
| DC Block                                  | Mini-Circuits | BLK-18-S+        | 1             | 12/14/2021 | 12/13/2022 |

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## 6.2 Radiated Measurement

| Radiated Emission Test Site: SAC 3 |                 |                 |               |            |            |
|------------------------------------|-----------------|-----------------|---------------|------------|------------|
| EQUIPMENT TYPE                     | MFR             | MODEL NUMBER    | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Bi-log Antenna                     | SCHWARZBECK     | VULB9168        | 378           | 08/20/2021 | 08/19/2022 |
| Horn Antenna                       | SCHWARZBECK     | BBHA9120D       | 1441          | 09/27/2021 | 09/26/2022 |
| Horn Antenna                       | SCHWARZBECK     | BBHA9170        | 184           | 12/16/2021 | 12/15/2022 |
| Bi-log Antenna                     | SCHWARZBECK     | VULB9168        | 300           | 10/19/2021 | 10/18/2022 |
| Horn Antenna                       | SCHWARZBECK     | BBHA9120D       | 603           | 05/18/2021 | 05/17/2022 |
| Horn Antenna                       | SCHWARZBECK     | BBHA9170        | 185           | 08/02/2021 | 08/01/2022 |
| PXA Spectrum Analyzer              | Agilent         | N9030A          | MY53120760    | 04/27/2021 | 04/26/2022 |
| Signal Generator                   | R&S             | SMBV100A        | 263084        | 01/11/2022 | 01/10/2023 |
| Pre-Amplifier                      | HP              | 8449B           | 3008A00578    | 12/16/2021 | 12/15/2022 |
| Pre-Amplifier                      | HP              | 8447D           | 2944A07676    | 12/16/2021 | 12/15/2022 |
| Pre-Amplifier                      | EMC Instruments | EMC184045B      | 980135        | 10/27/2021 | 10/26/2022 |
| High Pass Filter                   | WI              | WHKX7.0/18G-8SS | 45            | 12/14/2021 | 12/13/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | MY2636/2      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 104    | 340057/4      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 104PEA | 800052/2      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | MY2621/2      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | MY2617/2      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 104    | 160125        | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 106    | 76096/6       | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | MY2630/2      | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | MY22962/2     | 12/16/2021 | 12/15/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 102    | SN 520430/2   | 12/16/2021 | 12/15/2022 |
| Site Cal                           | SGS             | SAC 3           | N/A           | 01/01/2022 | 12/31/2022 |

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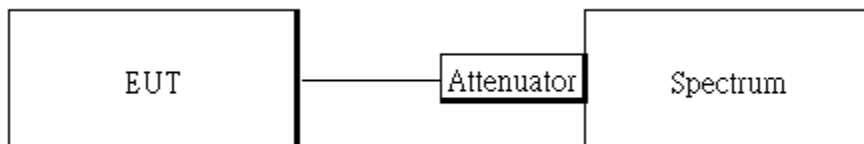
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## 7 EMISSION BANDWIDTH & OCCUPIED BANDWIDTH MEASUREMENT

### 7.1 Standard Applicable

According to FCC Part 90 §90.209. No Limit required.

### 7.2 Test Set-up



### 7.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the.
3. 26dB Bandwidth Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on.
4. Mark the peak frequency and -26dB (upper and lower) frequency.
5. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.

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## 7.4 Measurement Results

### 7.4.1 Test mode: Mode 1

| Ch0 |                 |              |               |
|-----|-----------------|--------------|---------------|
| CH  | Frequency (MHz) | 99% BW (MHz) | 26dB BW (MHz) |
| 192 | 4960            | 17.607       | 19.87         |
| 196 | 4980            | 17.612       | 19.81         |

| Ch1 |                 |              |               |
|-----|-----------------|--------------|---------------|
| CH  | Frequency (MHz) | 99% BW (MHz) | 26dB BW (MHz) |
| 192 | 4960            | 17.59        | 20.01         |
| 196 | 4980            | 17.618       | 20.09         |

### 7.4.2 Test mode: Mode 2

| Ch0 |                 |              |               |
|-----|-----------------|--------------|---------------|
| CH  | Frequency (MHz) | 99% BW (MHz) | 26dB BW (MHz) |
| 192 | 4960            | 17.588       | 19.9          |
| 196 | 4980            | 17.615       | 19.88         |

| Ch1 |                 |              |               |
|-----|-----------------|--------------|---------------|
| CH  | Frequency (MHz) | 99% BW (MHz) | 26dB BW (MHz) |
| 192 | 4960            | 17.626       | 20.07         |
| 196 | 4980            | 17.484       | 19.32         |

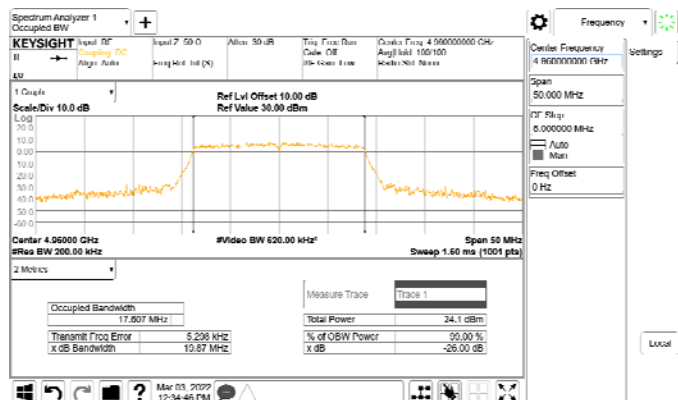
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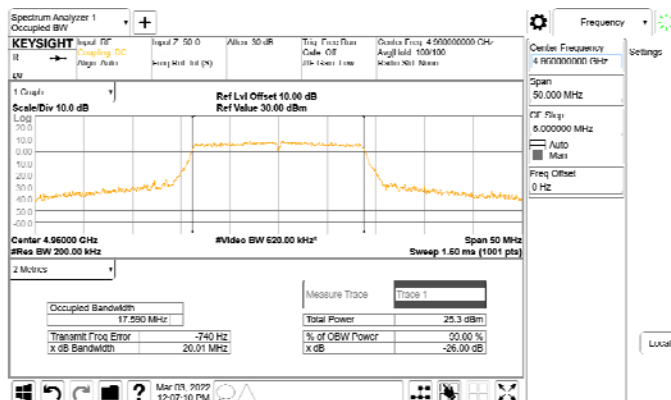
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Test mode: Mode 1

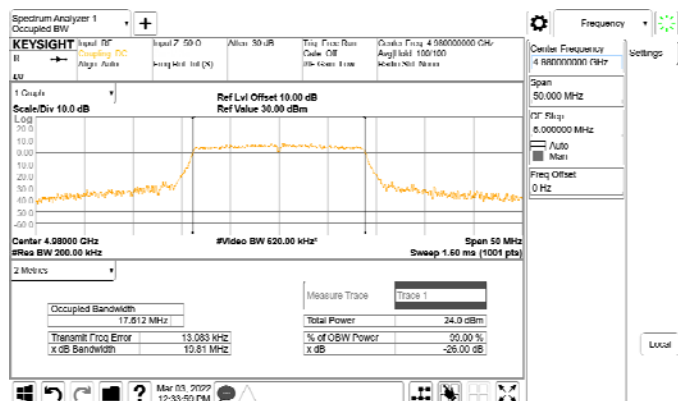
Bandwidth\_Chain0\_4960MHz



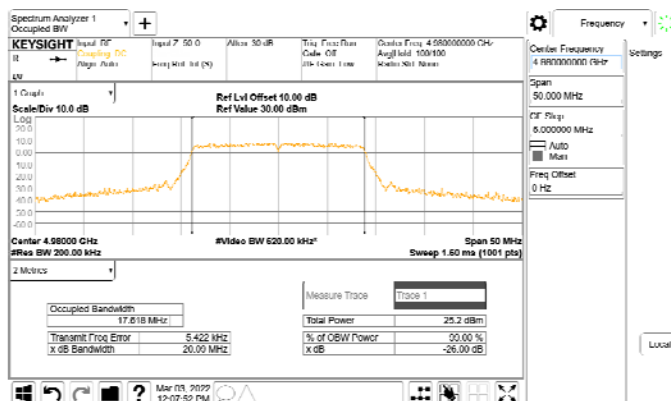
Bandwidth\_Chain1\_4960MHz



Bandwidth\_Chain0\_4980MHz



Bandwidth\_Chain1\_4980MHz



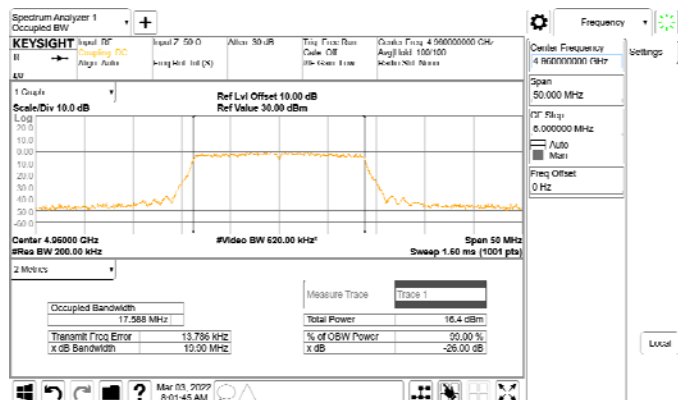
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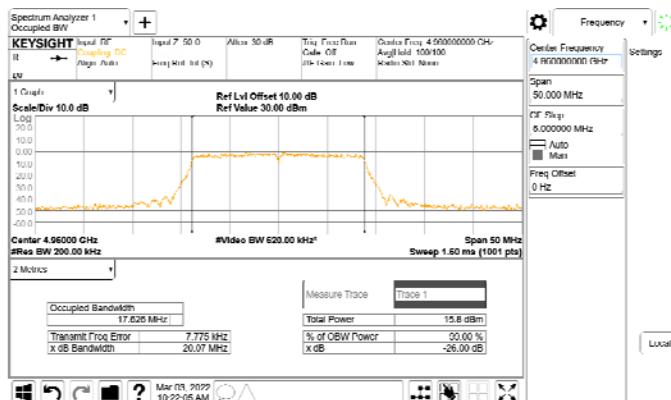
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Test mode: Mode 2

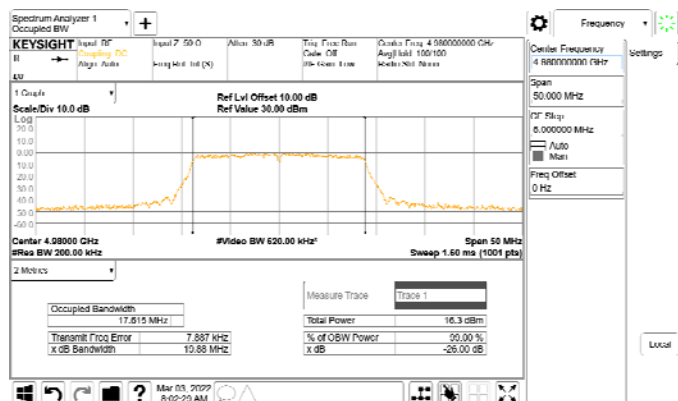
Bandwidth\_Chain0\_4960MHz



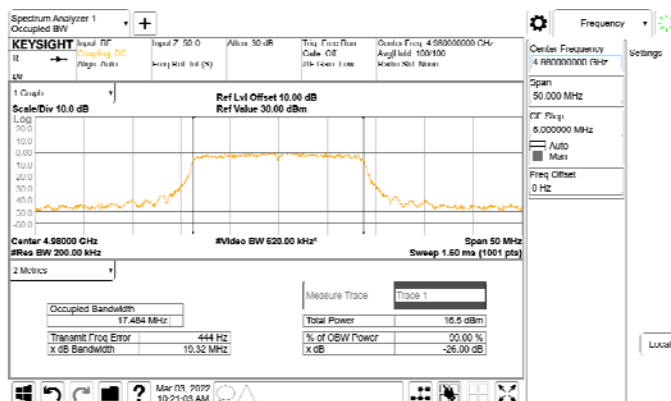
Bandwidth\_Chain1\_4960MHz



Bandwidth\_Chain0\_4980MHz



Bandwidth\_Chain1\_4980MHz



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## 8 THE MAXIMUM OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

According to FCC Part 90 §90.1215

| Channel Bandwidth<br>(MHz) | Low Power Device<br>Peak<br>Transmitter Power<br>(dBm) | High Power Device<br>Peak<br>Transmitter Power<br>(dBm) |
|----------------------------|--------------------------------------------------------|---------------------------------------------------------|
| 1                          | 7                                                      | 20                                                      |
| 5                          | 14                                                     | 27                                                      |
| 10                         | 17                                                     | 30                                                      |
| 15                         | 18.8                                                   | 31.8                                                    |
| 20                         | 20                                                     | 33                                                      |

(a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(b) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz.

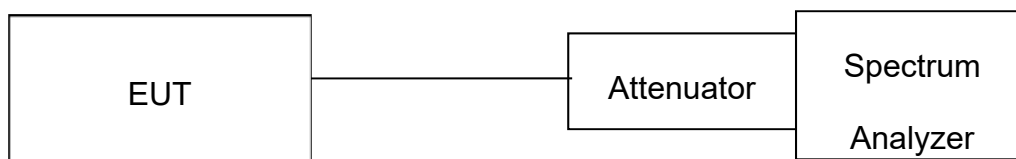
Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

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## 8.2 Test Set-up



## 8.3 Measurement Procedure

1. Set the Spectrum analyzer to Channel Power Function
2. Set the RBW = 1% to 5% of the OBW
3. Set the VBW  $\geq 3 \times$  RBW.
4. Set the span  $\geq 2 \times$  to  $3 \times$  RBW.
5. Sweep time = auto couple.
6. Detector = RMS.
7. Ensure that the number of measurement points  $\geq$  span/RBW
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level.

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## 8.4 Measurement Results

### 8.4.1 Test Mode: Mode 1

| 802.11j_2TX |                 |           |           |                  |       |                   |                             |        |
|-------------|-----------------|-----------|-----------|------------------|-------|-------------------|-----------------------------|--------|
| CH          | Frequency (MHz) | Data Rate | Power set | Avg. POWER (dBm) |       | TOTAL POWER (dBm) | Conducted Power LIMIT (dBm) | RESULT |
|             |                 |           |           | CH 0             | CH 1  |                   |                             |        |
| 192         | 4960            | 3         | 17        | 19.37            | 19.58 | 22.49             | 33                          | PASS   |
| 196         | 4980            | 3         | 17        | 19.38            | 19.61 | <b>22.51</b>      | 33                          | PASS   |

### 8.4.2 Test Mode: Mode 2

| 802.11j_2TX |                 |           |           |                  |       |                   |                             |        |
|-------------|-----------------|-----------|-----------|------------------|-------|-------------------|-----------------------------|--------|
| CH          | Frequency (MHz) | Data Rate | Power set | Avg. POWER (dBm) |       | TOTAL POWER (dBm) | Conducted Power LIMIT (dBm) | RESULT |
|             |                 |           |           | CH 0             | CH 1  |                   |                             |        |
| 192         | 4960            | 6         | 9         | 12.09            | 12.15 | 15.13             | 24.39                       | PASS   |
| 196         | 4980            | 6         | 9         | 12.12            | 12.17 | <b>15.16</b>      | 24.39                       | PASS   |

Note: Power LIMIT=33-(17.61-9)=24.39

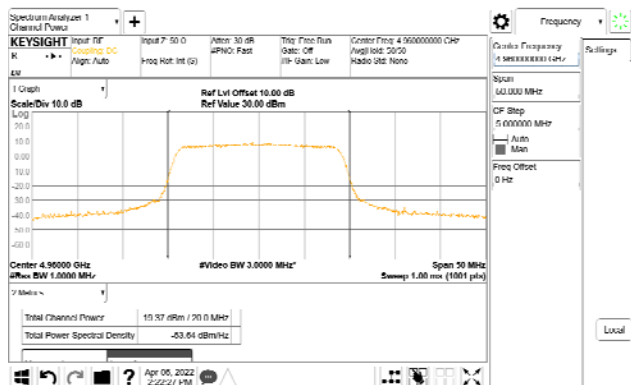
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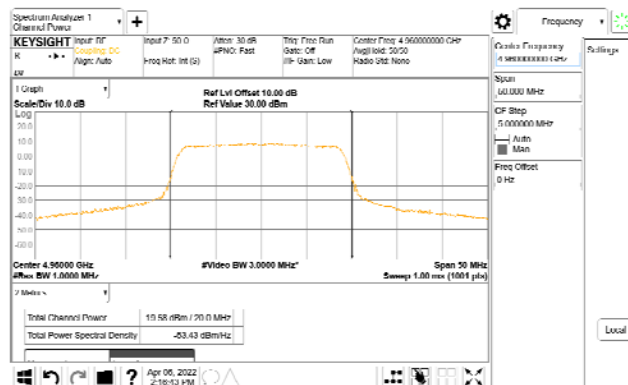
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## Test Mode: Mode 1

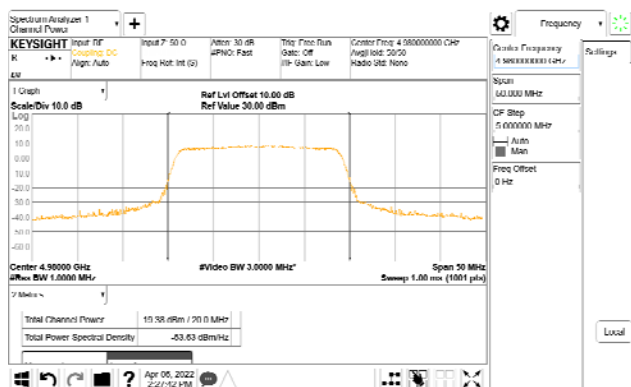
### Output power\_Chain0\_4960MHz



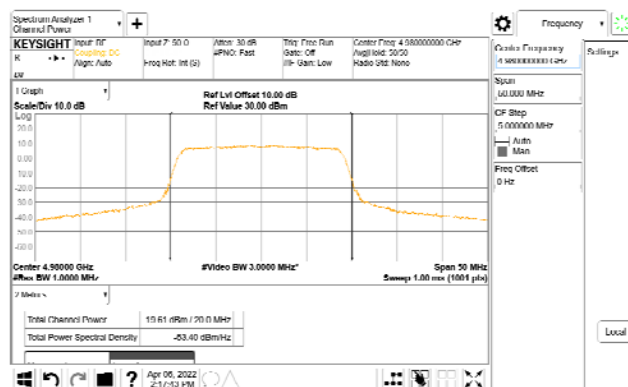
### Output power\_Chain1\_4960MHz



### Output power\_Chain0\_4980MHz



### Output power\_Chain1\_4980MHz



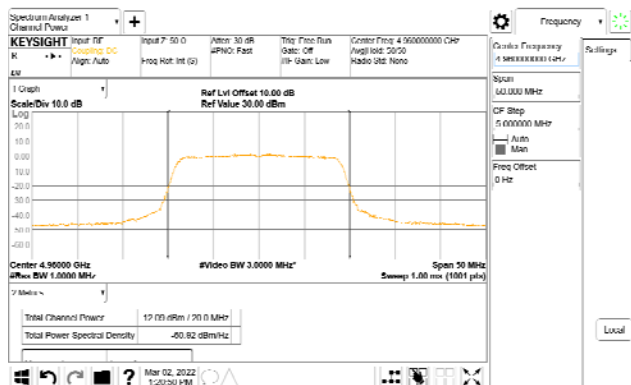
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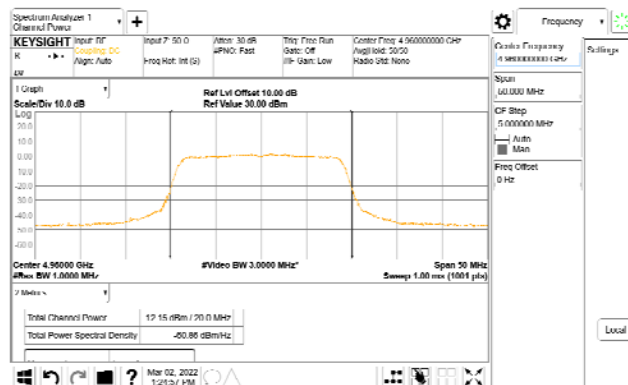
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## Test Mode: Mode 2

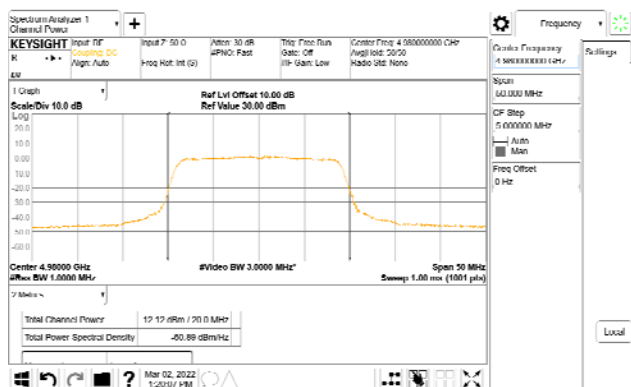
### Output power\_Chain0\_4960MHz



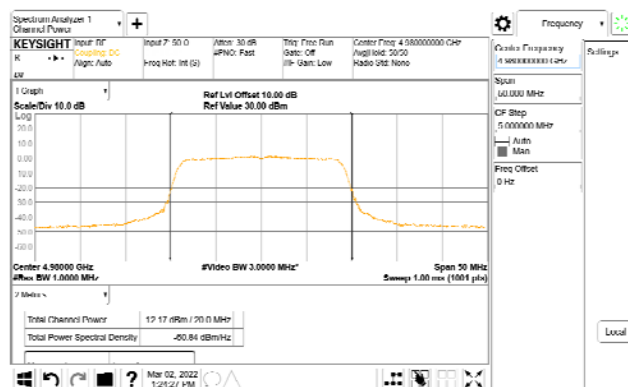
### Output power\_Chain1\_4960MHz



### Output power\_Chain0\_4980MHz



### Output power\_Chain1\_4980MHz



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## 9 POWER SPECTRAL DENSITY

### 9.1 Standard Applicable

According to FCC Part 90 §90.1215 Power limits.

(1) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

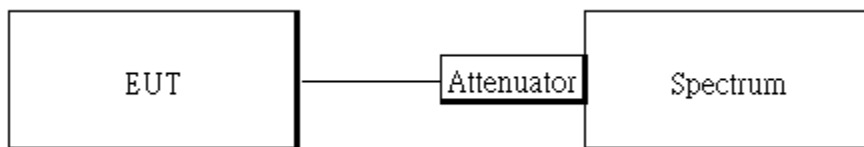
(2) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

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## 9.2 Test Set-up



## 9.3 Measurement Procedure

1. Set the analyzer center frequency to the OBW center frequency.
2. The testing follows the Measurement Procedure of ANSI C63.26 - 2015.
3. Set the span to 1.5 times the OBW bandwidth.
4. Set the RBW to the specified reference bandwidth (often 1 MHz).
5. Set the VBW  $\geq 3 \times$  RBW.
6. Set the number of points in sweep  $\geq$  span / RBW.

NOTE: This requirement is applicable only to final measurement. It can be violated for preliminary (pre-scan) measurements when necessary for wide span measurements.

7. Detector = peak.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level within the specified reference bandwidth (PSD).

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## 9.4 Measurement Results

### 9.4.1 Test Mode: Mode 1

| POWER DENSITY 802.11j MODE |                        |                        |                  |                           |                 |             |
|----------------------------|------------------------|------------------------|------------------|---------------------------|-----------------|-------------|
| Frequency (MHz)            | Ch0 meas PSD (dBm/MHz) | Ch1 meas PSD (dBm/MHz) | Duty Factor (dB) | Total Corr'd PSD(dBm/MHz) | Limit (dBm/MHz) | Margin (dB) |
| 4960                       | 16.37                  | 16.39                  | 0.00             | 19.39                     | 21.00           | -1.61       |
| 4980                       | 16.03                  | 16.29                  | 0.00             | 19.17                     | 21.00           | -1.83       |

### 9.4.2 Test Mode: Mode 2

| POWER DENSITY 802.11j MODE |                        |                        |                  |                           |                 |             |
|----------------------------|------------------------|------------------------|------------------|---------------------------|-----------------|-------------|
| Frequency (MHz)            | Ch0 meas PSD (dBm/MHz) | Ch1 meas PSD (dBm/MHz) | Duty Factor (dB) | Total Corr'd PSD(dBm/MHz) | Limit (dBm/MHz) | Margin (dB) |
| 4960                       | 9.10                   | 9.14                   | 0.00             | 12.13                     | 12.39           | -0.26       |
| 4980                       | 9.02                   | 9.11                   | 0.00             | 12.08                     | 12.39           | -0.31       |

Note: Limit=21-(17.61-9)=12.39

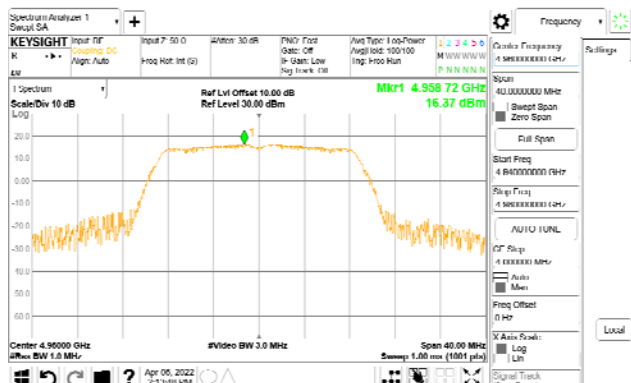
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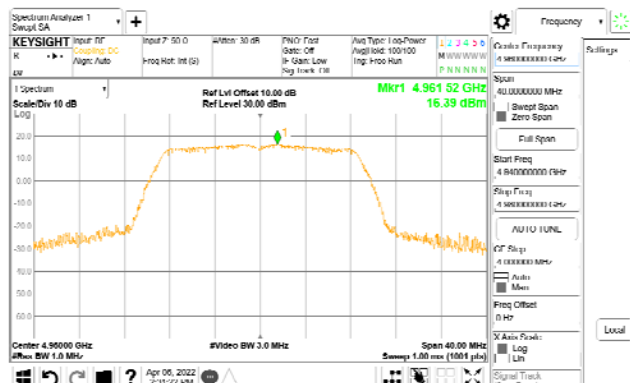
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Test Mode: Mode 1

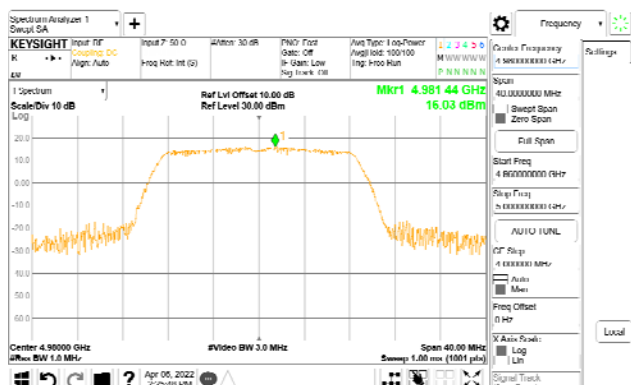
Power Density\_Chain0\_ 4960MHz



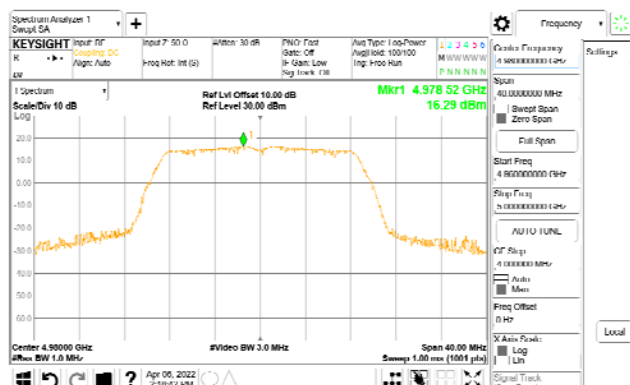
Power Density\_Chain1\_ 4960MHz



Power Density\_Chain0\_ 4980MHz



Power Density\_Chain1\_ 4980MHz



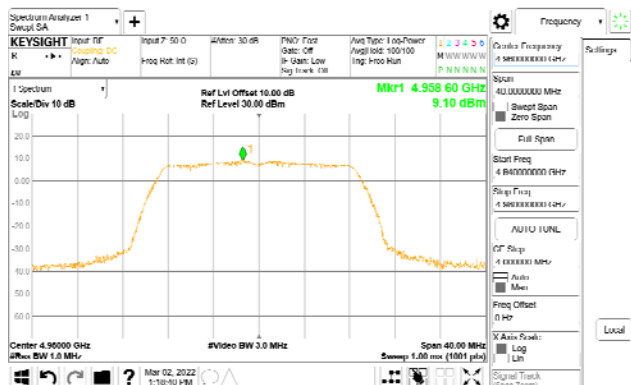
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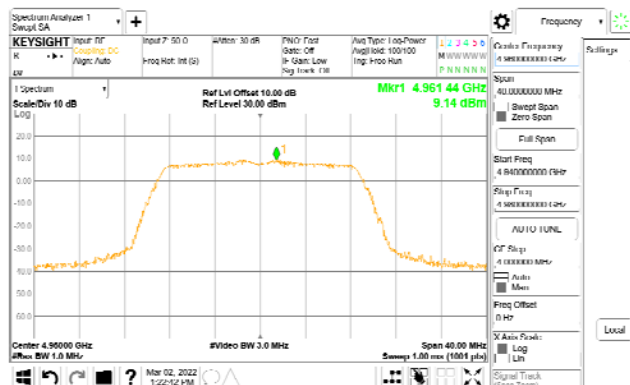
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## Test Mode: Mode 2

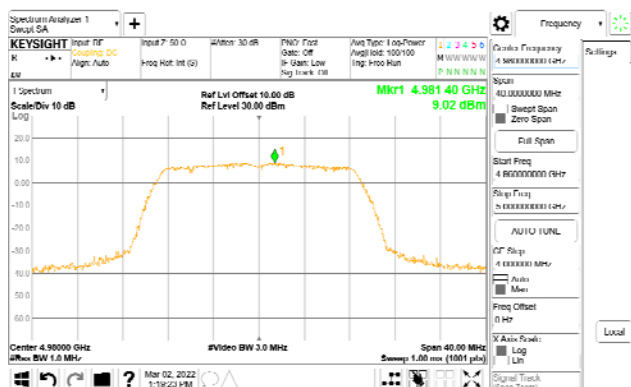
## Power Density\_Chain0\_ 4960MHz



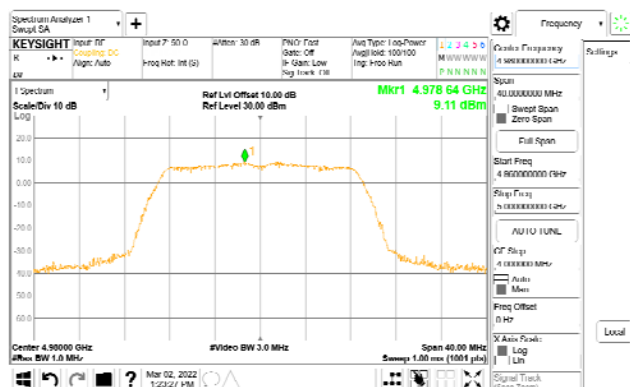
## Power Density\_Chain1\_ 4960MHz



## Power Density\_Chain0\_ 4980MHz



## Power Density\_Chain1\_ 4980MHz



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## 10 TRANSMIT SPECTRUM MASK

### 10.1 Standard Applicable

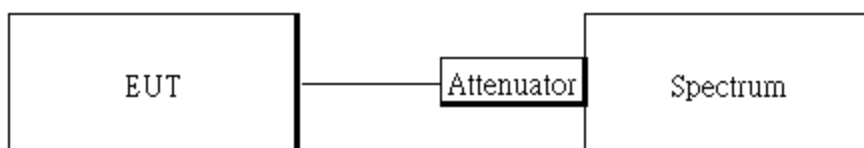
According to FCC Part 90 §90.210 with FCC 04-265

(Emissions Mask L for low power, Emissions Mask M for high power)

| Authorized Bandwidth (BW) | Low-power Transmitter                                 | High-power Transmitter                                                          |
|---------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------|
| 0 - 45 %                  | 0dB                                                   | 0dB                                                                             |
| 45 - 50 %                 | $219 \log (\% \text{ of } (BW) / 45) \text{ dB}$      | $568 \log (\% \text{ of } (BW) / 45) \text{ dB}$                                |
| 50 - 55 %                 | $10 + 242 \log (\% \text{ of } (BW) / 50) \text{ dB}$ | $26 + 145 \log (\% \text{ of } (BW) / 50) \text{ dB}$                           |
| 55 - 100 %                | $20 + 31 \log (\% \text{ of } (BW) / 55) \text{ dB}$  | $32 + 31 \log (\% \text{ of } (BW) / 55) \text{ dB}$                            |
| 100 - 150 %               | $28 + 68 \log (\% \text{ of } (BW) / 100) \text{ dB}$ | $40 + 57 \log (\% \text{ of } (BW) / 100) \text{ dB}$                           |
| Above 150 %               | 50 dB                                                 | 50 dB or $55 + 10 \log (P) \text{ dB}$ ,<br>Whichever is the lesser attenuation |

Note: The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement.

### 10.2 Test Set-up



### 10.3 Measurement Procedure

The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz.

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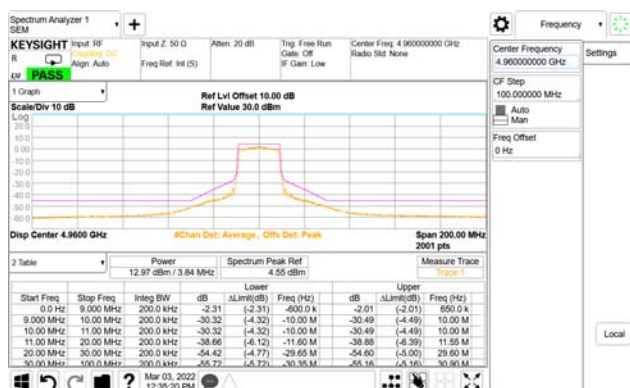
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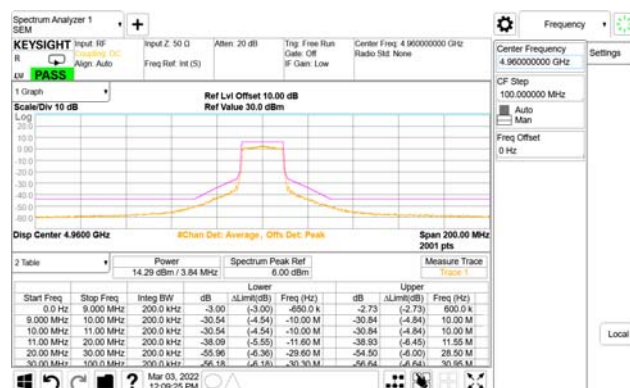
## 10.4 Measurement Results

### 10.4.1 Test Mode: Mode 1

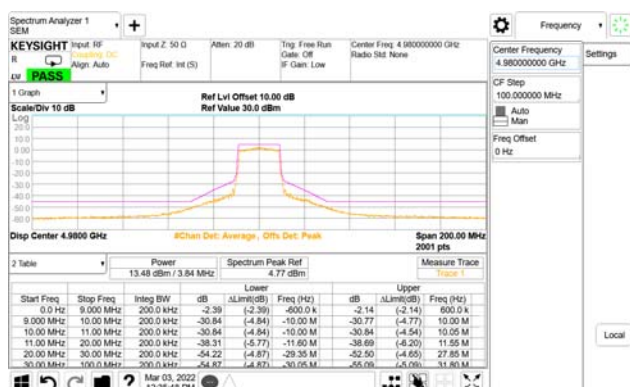
Emission Mask\_Chain0\_4960MHz



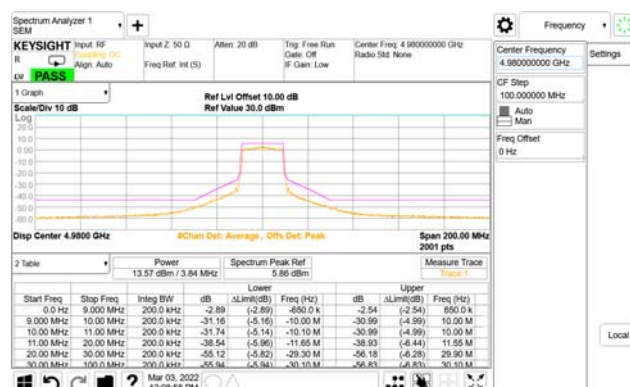
Emission Mask\_Chain1\_4960MHz



Emission Mask\_Chain0\_4980MHz



Emission Mask\_Chain1\_4980MHz



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