ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

FCC Applicant:	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/A0111
FCC ID	R5SX500E
Issue Date:	January 17, 2022
Date of Test:	November 25, 2021 ~ December 29, 2021
Date of EUT Received:	October 28, 2021

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.

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
ER/2021/A0111	00	Original.	January 17, 2022	Karen Huang	

Note:

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

Table of Contents

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.:	4500152873
Power Supply:	56Vdc

1.2 RF Specification

WLAN 4.9GHz:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology
11j (20MHz)	4960~4980	2	22.83dBm	OFDM
Modulation type		64QAM, 16QAM, QPSK, BPSK for OFDM		
Data Rate		802.11 j_20MHz: 6 – 54Mbps		
Type of Emission		20MHz=17M6W7D		

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Directional Gain (dBi)
Omnidirection	MP Antenna, LTD.	08-ANT-0985	4960~4980	3.0	6.01
Omnidirection	Fluidmesh	FM-OMNI-5-V	4960~4980	4.0	7.52
Omnidirection	Fluidmesh	FM-OMNI-5-H	4960~4980	5.0	7.52

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.

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. Central RF Lab. (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		
Note: 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.

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

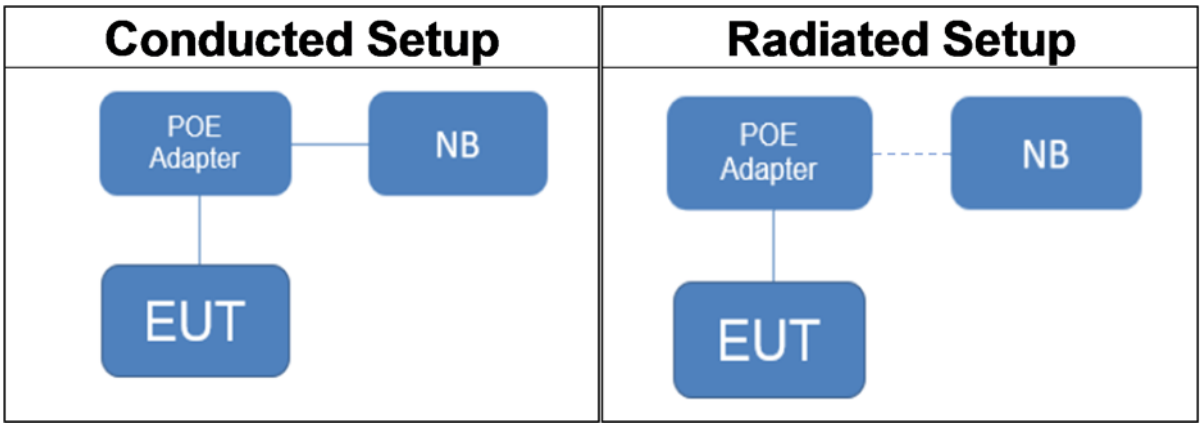
2.3.1 Conducted Measurement at Antenna Port

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 emis-sion 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.

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.
Notebook	Lenovo	L430	R9-WGNK5 13/01	N/A	N/A
POE Adapter	PHIHONG	POE29U1A T(PL)	PHI242904L4	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)	PHI242904L4	N/A	N/A

3 SUMMARY OF TEST RESULTS

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

4 DESCRIPTION OF TEST MODES

4.1 Operated in 802.11j Band

2 channels are provided for 20M

CHANNEL	FREQUENCY (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.
4.

Modulation	Transmission Chain				Single Transmission Spatial	Multiple Transmission Spatial
☒ OFDM	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☐ 1TX	☒ 2TX

5. 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.

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 Mesurement:

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

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.

6 EMISSION BANDWIDTH & OCCUPIED BANDWIDTH MEASUREMENT

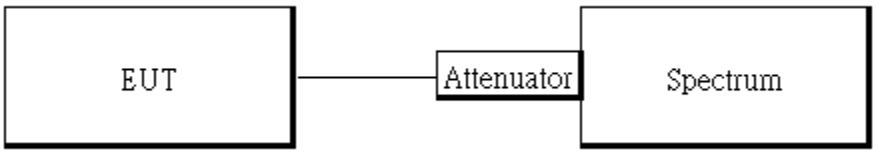
6.1 Standard Applicable

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

6.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

6.3 Test Set-up



6.4 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. 99% Bandwidth Measurement: set resolution BW as close to 1% of the selected span without it is being lower than 1%, & VBW = 3 XRBW. Detector = Peak or Sample, where sample must be selected whenever it is appropriate, Trace Mode = Max Hold
5. . Mark the peak frequency and -26dB (upper and lower) frequency.
6. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.

6.5 Measurement Results

Ch0			
CH	Frequency (MHz)	99% BW (MHz)	26dB BW (MHz)
192	4960	17.6	19.53
196	4980	17.594	19.48

Ch1			
CH	Frequency (MHz)	99% BW (MHz)	26dB BW (MHz)
192	4960	17.61	19.42
196	4980	17.601	19.64

Bandwidth_chain0_4960MHz

Bandwidth_chain1_4960MHz

Bandwidth_chain0_4980MHz

Bandwidth_chain1_4980MHz

7 THE MAXIMUM OUTPUT POWER MEASUREMENT

7.1 Standard Applicable

According to FCC Part 90 §90.1215

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

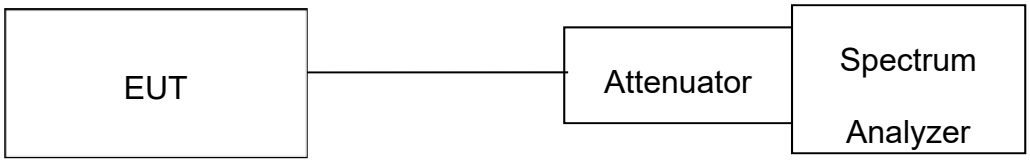
(a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain 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 an tennas 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.

7.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

7.3 Test Set-up



7.4 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 ≥ 3 x RBW.
4. Set the span ≥ 2 x to 3 x RBW.
5. Sweep time = auto couple.
6. Detector = RMS.
7. Ensure that the number of measurement points ≥ 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.

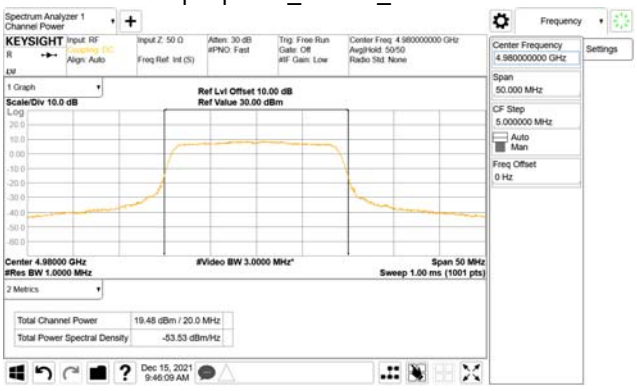
7.5 Measurement Results

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	13	19.35	20.15	22.78	33	PASS
196	4980	3	13	19.48	20.14	**22.83**	33	PASS

Output power_Chain0_4960MHz

Output power_Chain1_4960MHz

Output power_Chain0_4980MHz



Output power_Chain1_4980MHz

8 POWER SPECTRAL DENSITY

8.1 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.

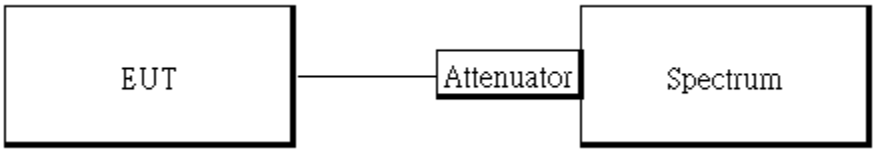
(2) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz.

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.

8.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

8.3 Test Set-up



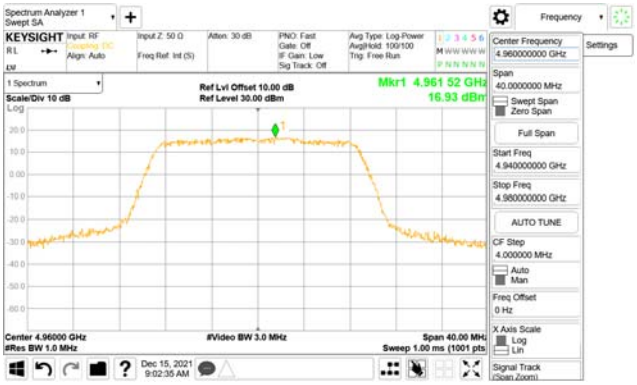
8.4 Measurement Procedure

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 ≥ 3 × RBW.
6. Set the number of points in sweep ≥ 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).

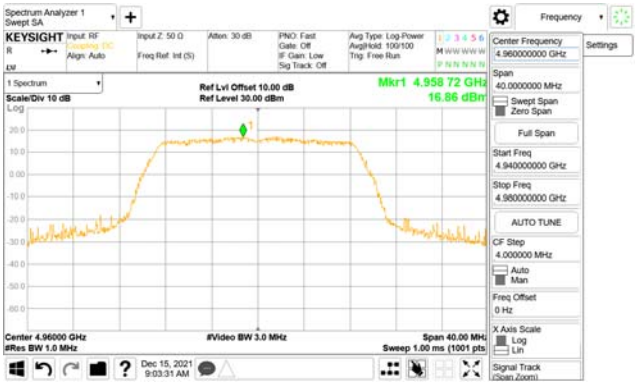
8.5 Measurement Results

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	16.93	16.86	0.00	19.91	21.00	-1.09
4980	16.42	16.65	0.00	19.55	21.00	-1.45

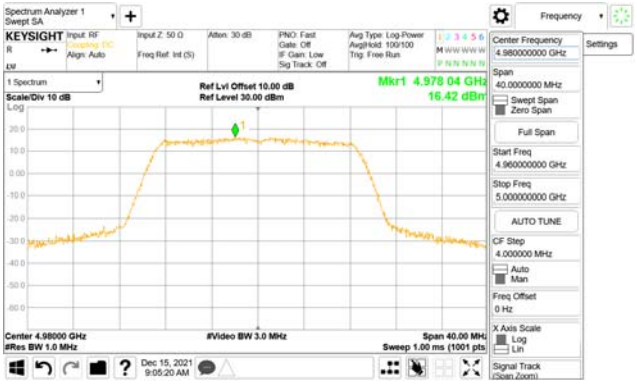
Power Density_ Chain0_4960MHz



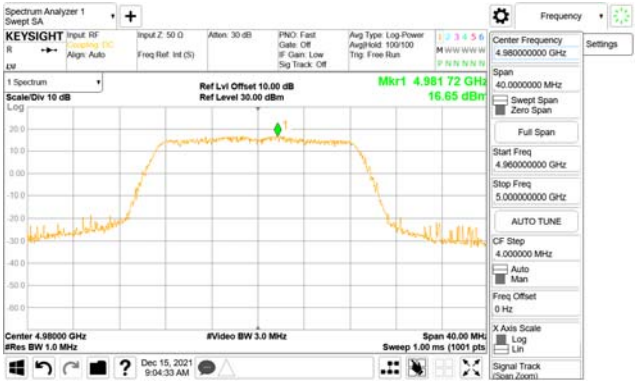
Power Density_ Chain1_4960MHz



Power Density_ Chain0_4980MHz



Power Density_ Chain1_4980MHz



9 TRANSMIT SPECTRUM MASK

9.1 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)

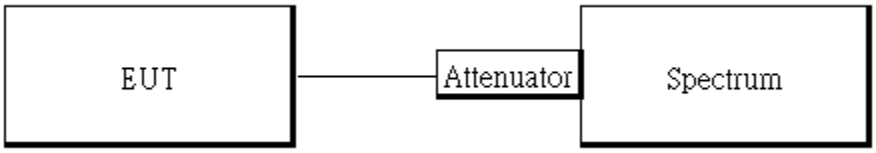
Authorized Bandwidth (BW)	Low-power Transmitter	High-power Transmitter
0 - 45 %	0dB	0dB
45 - 50 %	219 log (% of (BW) / 45) dB	568 log (% of (BW) / 45) dB
50 - 55 %	10 + 242 log (% of BW / 50) dB	26 + 145 log (% of BW / 50) dB
55 - 100 %	20 + 31 log (% of (BW)/ 55) dB	32 + 31 log (% of (BW)/ 55) dB
100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

Note: The zero dB reference is measured relative to the highest average power of the fundamental emissionmeasured 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 The power spectral density is the power measured within the resolution bandwidth of the measurement

9.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

9.3 Test Set-up



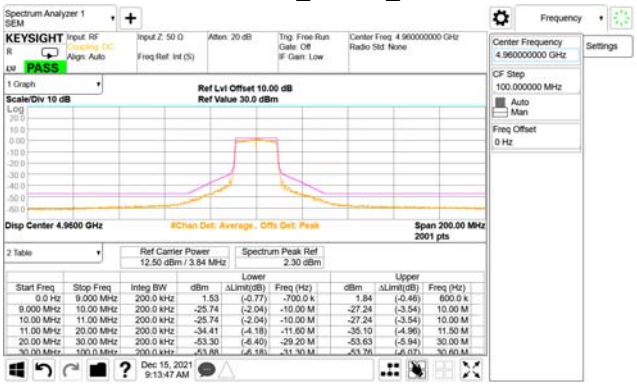
9.4 Measurement Procedure

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.

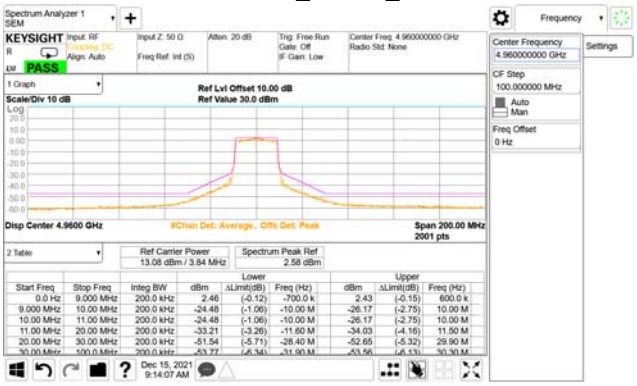
9.5 Measurement Results

**Refer to next page for plots.*

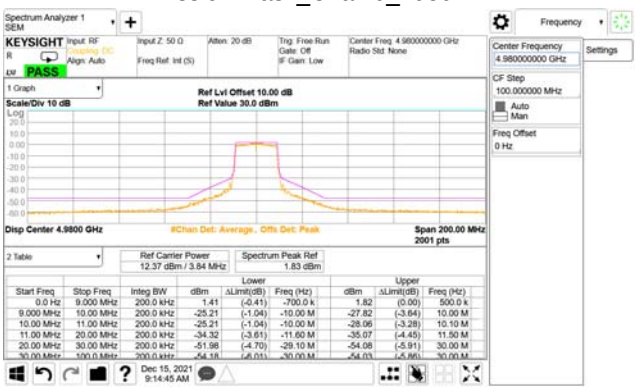
Emission Mask_Chain0_4960MHz



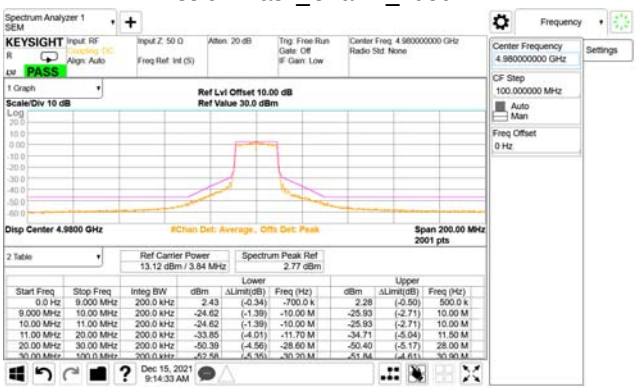
Emission Mask_Chain1_4960MHz



Emission Mask_Chain0_4980MHz



Emission Mask_Chain1_4980MHz



10 TRANSMITTER CONDUCTED UNWANTED EMISSIONS

10.1 Standard Applicable

Refer as FCC Part 90 §90.210(L)(M).

(l) Emission Mask L. For low power transmitters (20 dBm or less) operating

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

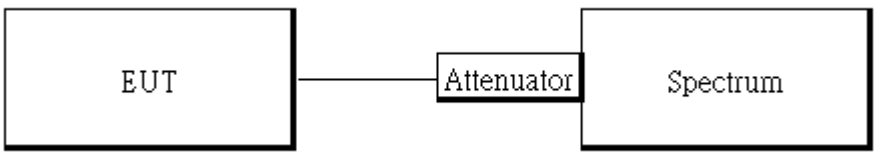
(m) Emission Mask M. For high power transmitters (greater that 20 dBm)

(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

10.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

10.3 Test SET-UP



10.4 Measurement Procedure

Refer as ANSI/TIA-603-D-2010, clause 3.2.13 for conducted measurement

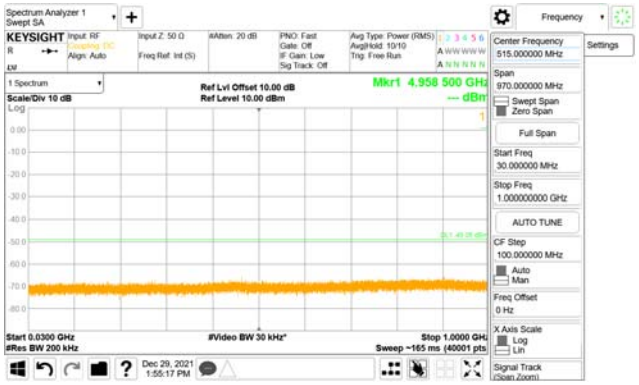
For conducted measurements on devices with multiple transmit chains using options given below:

(i) Option 1: measure and sum the spectra across the transmitter outputs.

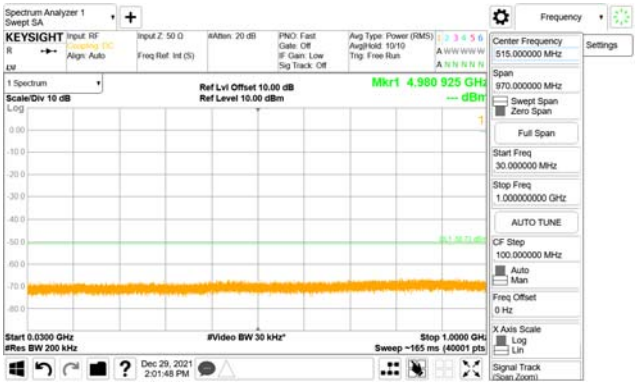
sweep 30 MHz and up to 10th harmonic of the fundamental or 40GHz whichever is the lesser. Measurements weremade at the low, mid and high channels.The Conducted Spurious Emissions Limit is obtained by the following plots. Note: only noise floor was measurable above 26GHz.

10.5 Measurement Result

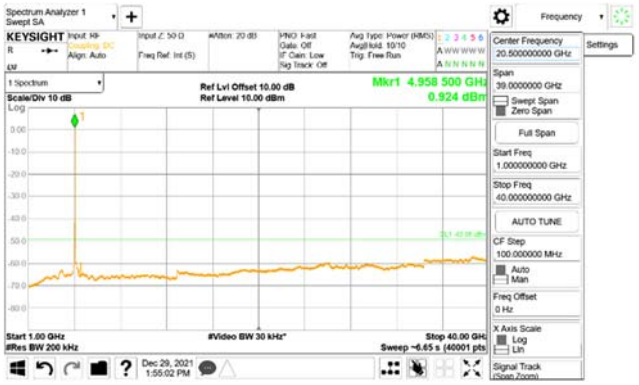
Spurious Emissions_ Chain0_4960MHz_LF



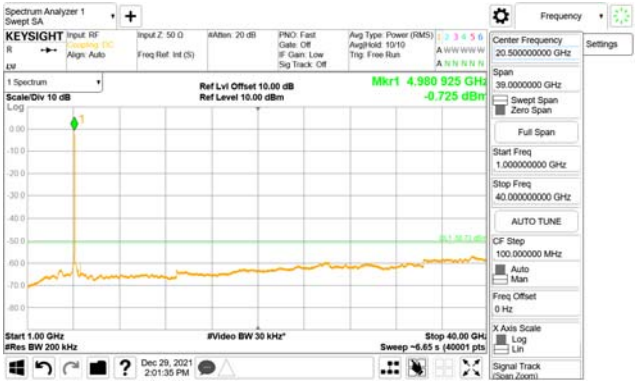
Spurious Emissions_ Chain0_4980MHz_LF



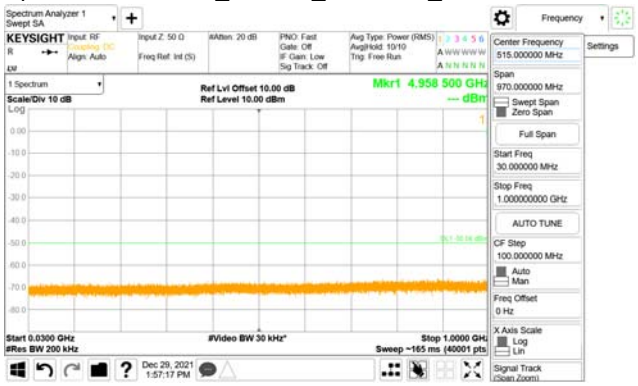
Spurious Emissions_ Chain0_4960MHz_HF



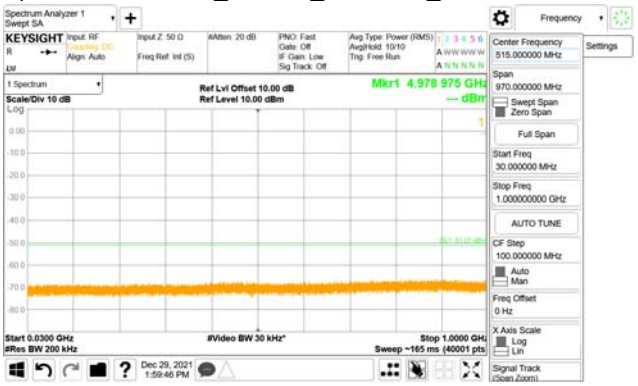
Spurious Emissions_ Chain0_4980MHz_HF



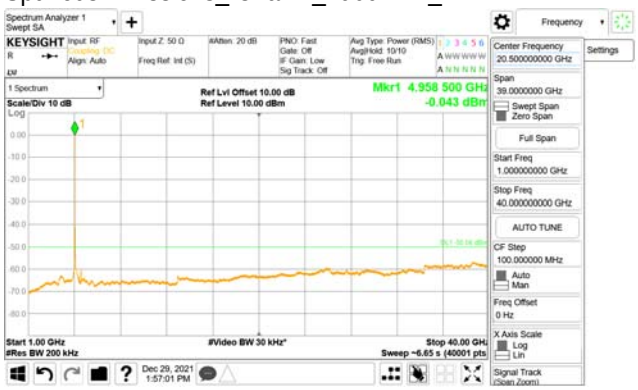
Spurious Emissions_ Chain1_4960MHz_LF



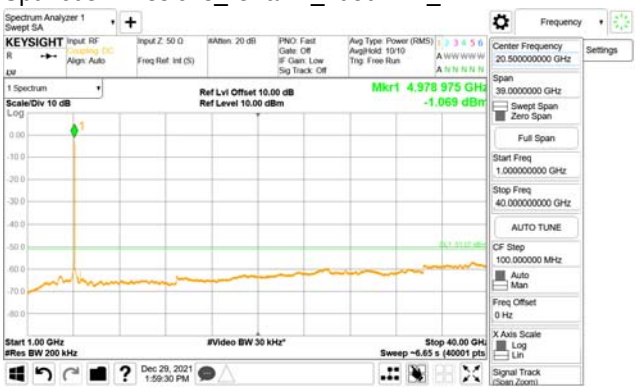
Spurious Emissions_ Chain1_4980MHz_LF



Spurious Emissions_ Chain1_4960MHz_HF



Spurious Emissions_ Chain1_4980MHz_HF



11 PEAK EXCURSION

11.1 Standard Applicable

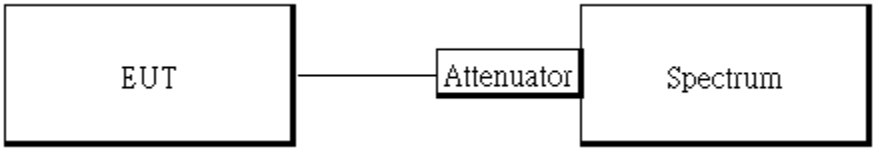
According to FCC Part 90 §90.1215 (e)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

11.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

11.3 Test Set-up



11.4 Measurement Procedure

Use one of the procedures presented in KDB971168 D01 4.1 to measure the total peak power and record as PPk. Use one of the applicable procedures presented KDB971168 D01 4.2 to measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

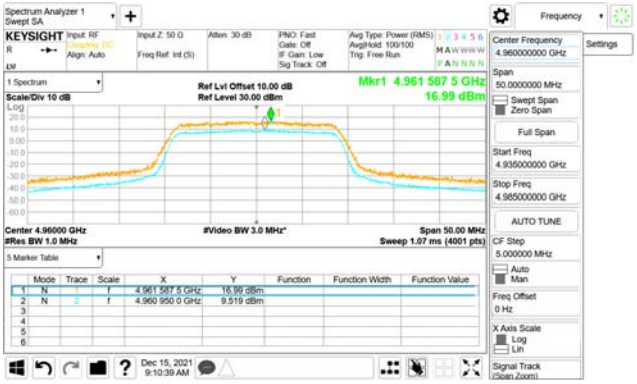
PAPR (dB) = PPk(dBm) - PAvg(dBm).

11.5 Measurement Results

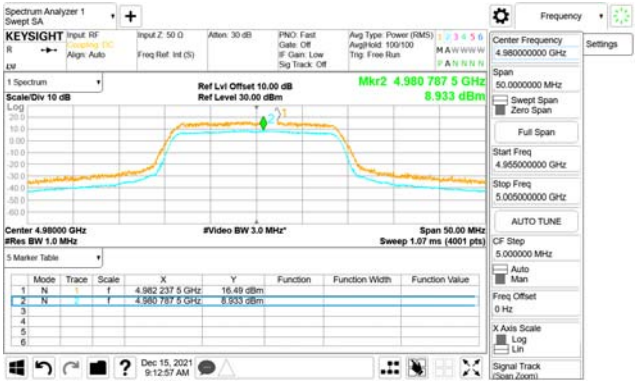
Ch0						
Channel bandwidth: 20MHz						
CH	Frequency (MHz)	Mark1 (dBm)	Mark2 (dBm)	PAPR (dB)	Limit (dB)	RESULT
192	4960	16.99	9.519	7.471	13	PASS
196	4980	16.49	8.933	7.557	13	PASS

Ch1						
Channel bandwidth: 20MHz						
CH	Frequency (MHz)	Mark1 (dBm)	Mark2 (dBm)	PAPR (dB)	Limit (dB)	RESULT
192	4960	17.03	10.1	6.93	13	PASS
196	4980	16.82	9.653	7.167	13	PASS

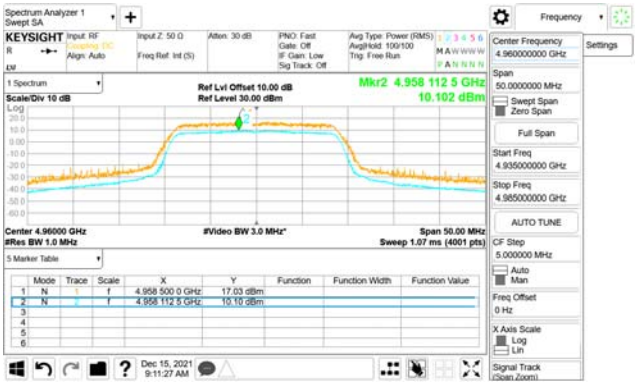
Peak Excursion_Chain0_ 4960MHz



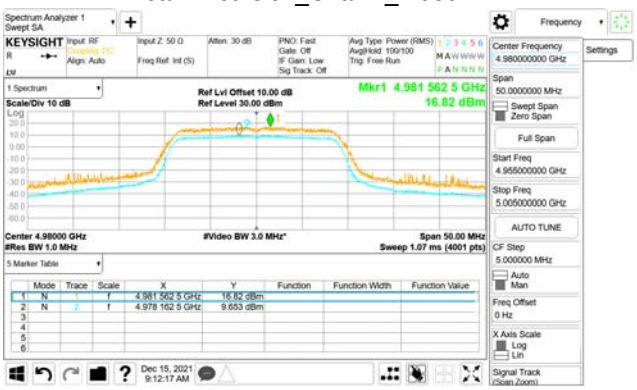
Peak Excursion_Chain0_ 4980MHz



Peak Excursion_Chain1_ 4960MHz



Peak Excursion_Chain1_ 4980MHz



12 TRANSMITTER RADIATED UNWANTED EMISSIONS

12.1 Standard Applicable

Refer as FCC Part 90 §90.210(L)(M).

(l) Emission Mask L. For low power transmitters (20 dBm or less) operating

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

(m) Emission Mask M. For high power transmitters (greater that 20 dBm)

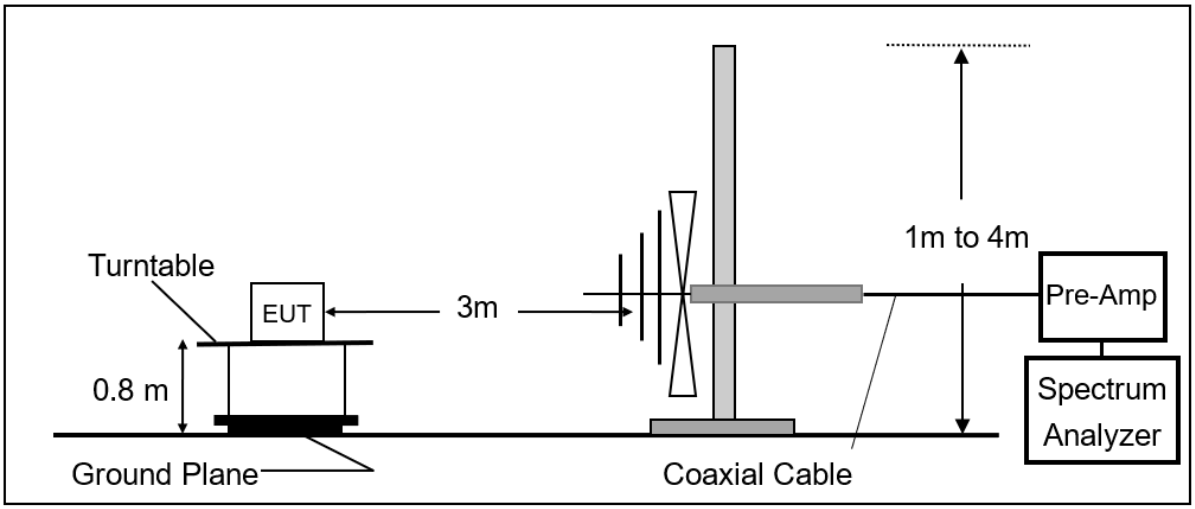
(6) On any frequency removed from the assigned frequency between above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.

12.2 Measurement Equipment Used:

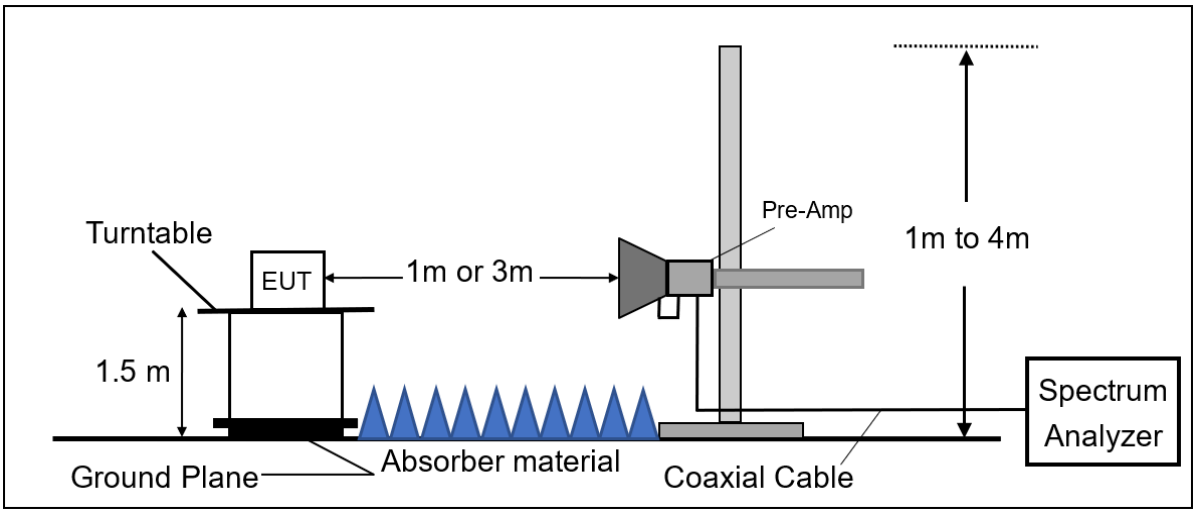
Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/20/2021	08/19/2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/27/2021	09/26/2022
Horn Antenna	SCHWARZBECK	BBHA9170	184	12/11/2020	12/10/2021
Bi-log Antenna	SCHWARZBECK	VULB9168	1208	06/30/2021	06/29/2022
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	Agilent	N5183A	MY50140591	12/27/2020	12/26/2021
Pre-Amplifier	HP	8449B	3008A00578	12/16/2020	12/15/2021
Pre-Amplifier	HP	8447D	2944A07676	12/16/2020	12/15/2021
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2021	10/26/2022
High Pass Filter	WI	WHKX7.0/18G-8SS	45	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2636/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104	340057/4	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104PEA	800052/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2621/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2617/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104	160125	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 106	76096/6	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2630/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY22962/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	SN 520430/2	12/16/2020	12/15/2021
Site Cal	SGS	SAC 3	N/A	01/01/2021	12/31/2021

12.3 Test SET-UP

(A) Radiated Emission Test Set-Up, Frequency from 30MHz to 1000MHz.



(B) Radiated Emission Test Set-Up, Frequency Above 1 GHz



12.4 Measurement Procedure

The EUT was placed on a non-conductive; the measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method.

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

ERP (dBm) = SG Level(dBm) + Antenna Gain(dBd) + Cable Loss(dB)

EIRP (dBm) = SG Level(dBm) + Antenna Gain(dBi) + Cable Loss(dB)

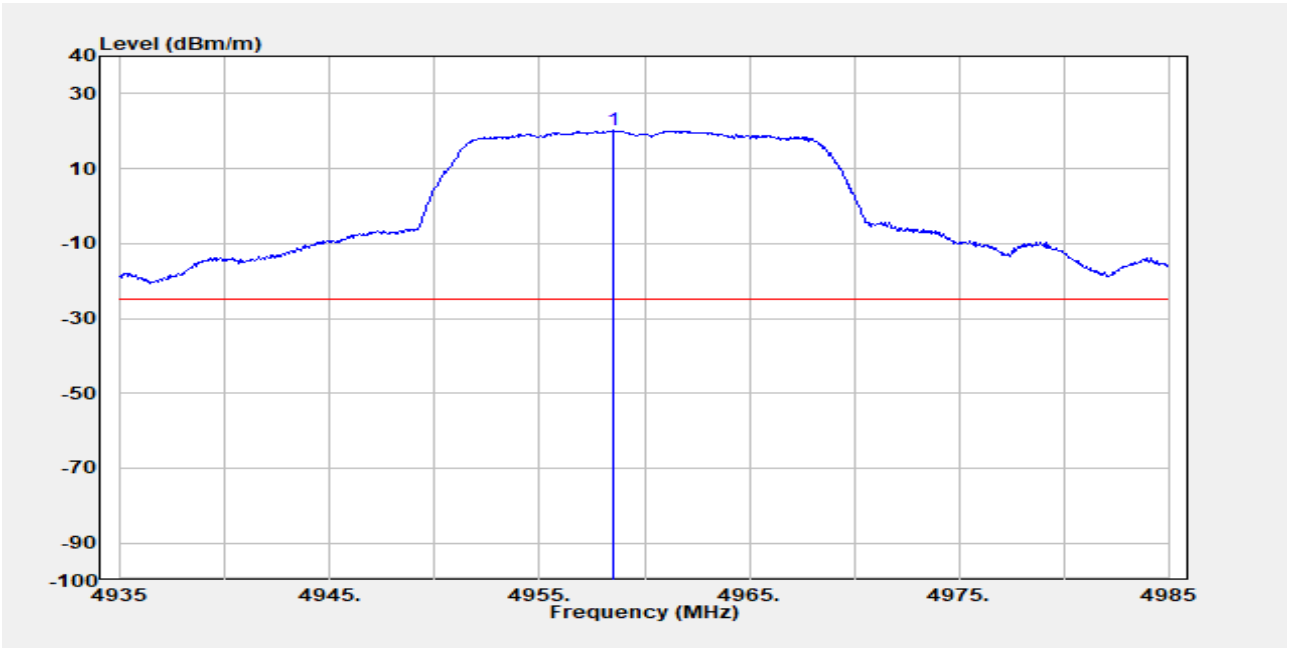
12.5 Measurement Result

Note:

1. *Refer to next page spectrum analyzer data chart and tabular data sheets.*
2. *Measurements are completed at peak and average level, the mark of average is the highest emission in restricted bands*

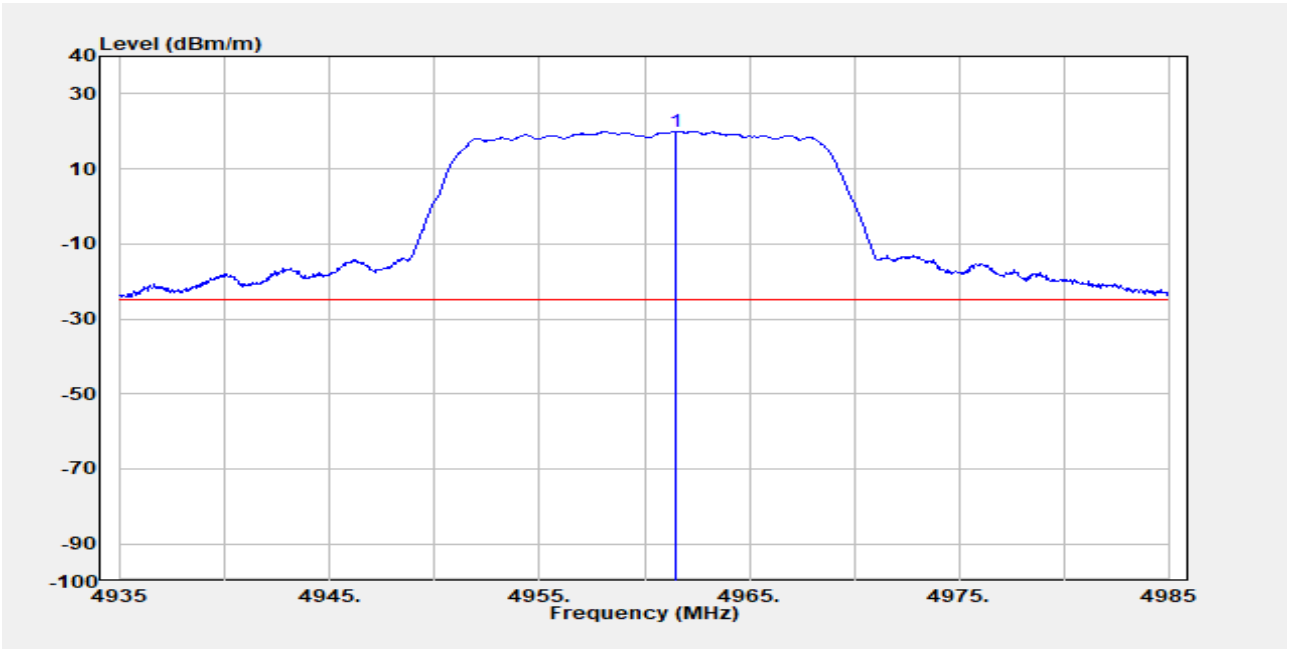
12.5.1 Radiated Measurement Result

Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Main CH Low	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Vertical
Test Frequency	:4960 MHz	Engineer	:Ricky Chen



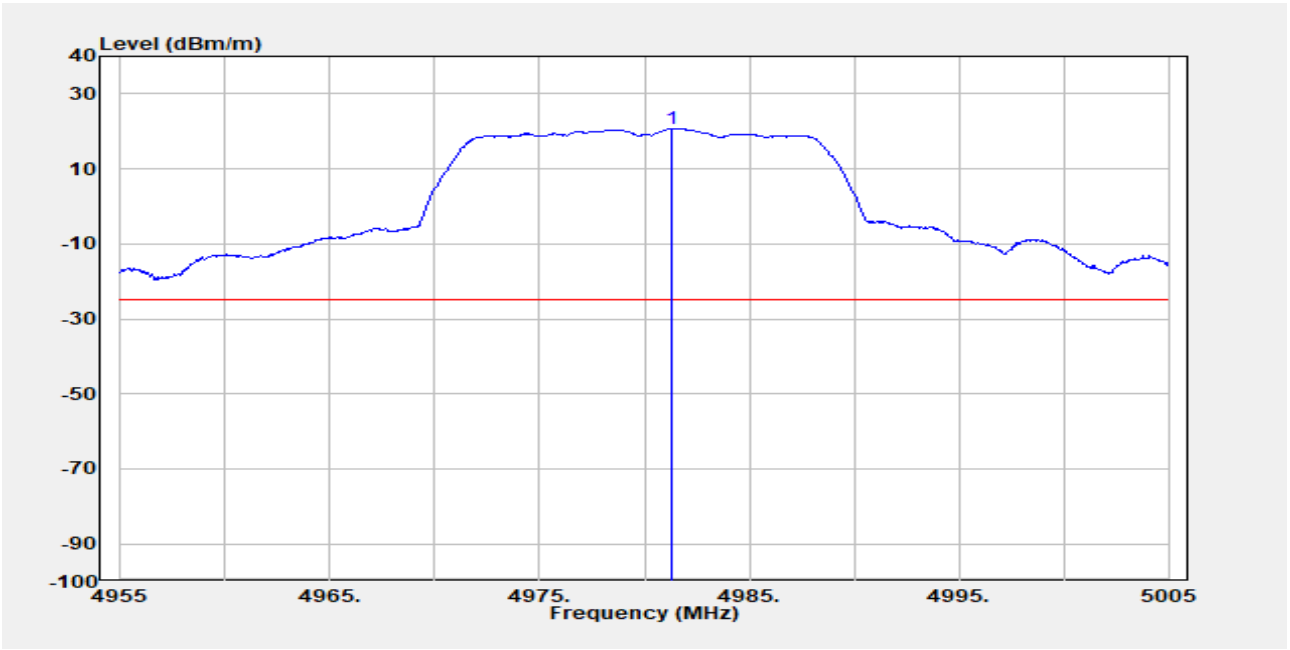
Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
4958.550	20.12	14.18	12.77	-6.82		

Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Main CH Low	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Horizontal
Test Frequency	:4960 MHz	Engineer	:Ricky Chen



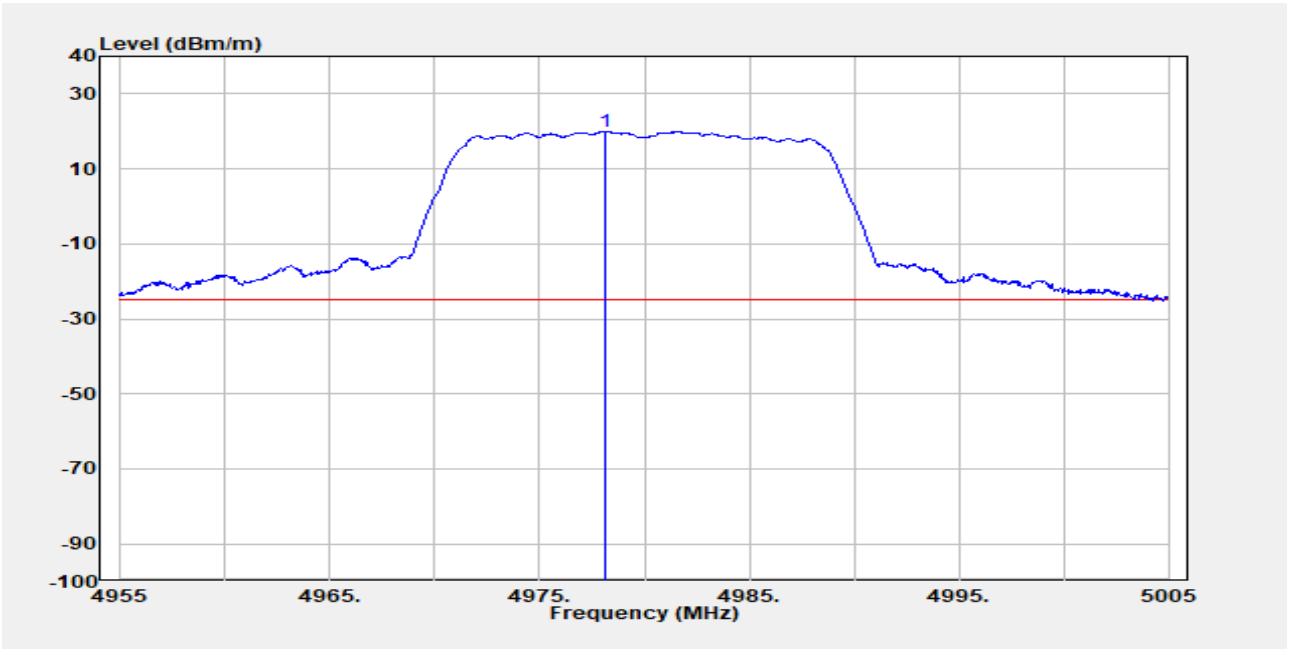
Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
4961.500	19.93	14.01	12.75	-6.83		

Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Main CH High	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Vertical
Test Frequency	:4980 MHz	Engineer	:Ricky Chen



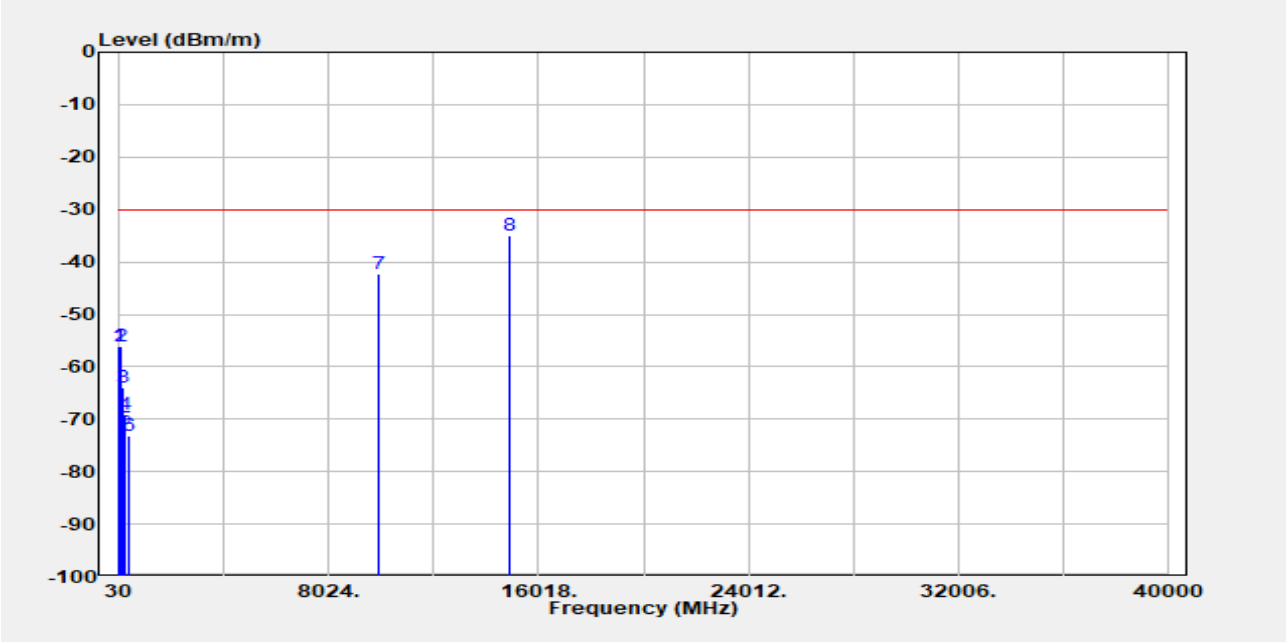
Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
4981.300	20.67	14.84	12.67	-6.85		

Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Main CH High	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Horizontal
Test Frequency	:4980 MHz	Engineer	:Ricky Chen



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
4978.100	19.99	14.15	12.69	-6.85		

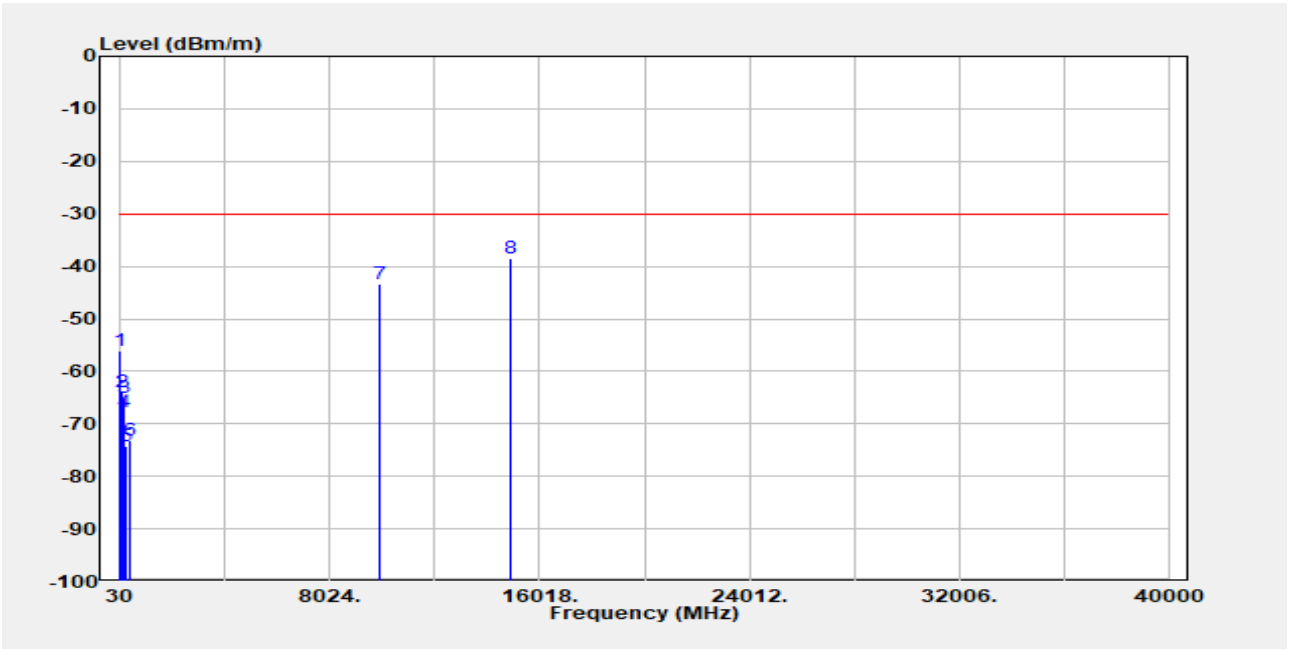
Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Tx CH Low	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Vertical
Test Frequency	:4960 MHz	Engineer	:Jack Liu



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
34.850	-56.14	-32.08	-23.49	-0.57	-30.07	-26.07
54.250	-56.05	-44.99	-10.39	-0.67	-30.07	-25.98
174.530	-63.99	-60.61	-2.14	-1.25	-30.07	-33.92
200.720	-69.16	-66.21	-1.60	-1.34	-30.07	-39.09
241.460	-71.88	-68.51	-1.89	-1.48	-30.07	-41.81
364.650	-73.06	-69.75	-1.59	-1.72	-30.07	-42.99
9920.000	-42.37	27.73	11.34	-10.00	-30.07	-12.30
14880.000	-35.06	39.25	12.34	-12.42	-30.07	-4.99

*Note: Limit= Worst EIRP-50 dB=19.93-50=-30.07dBm

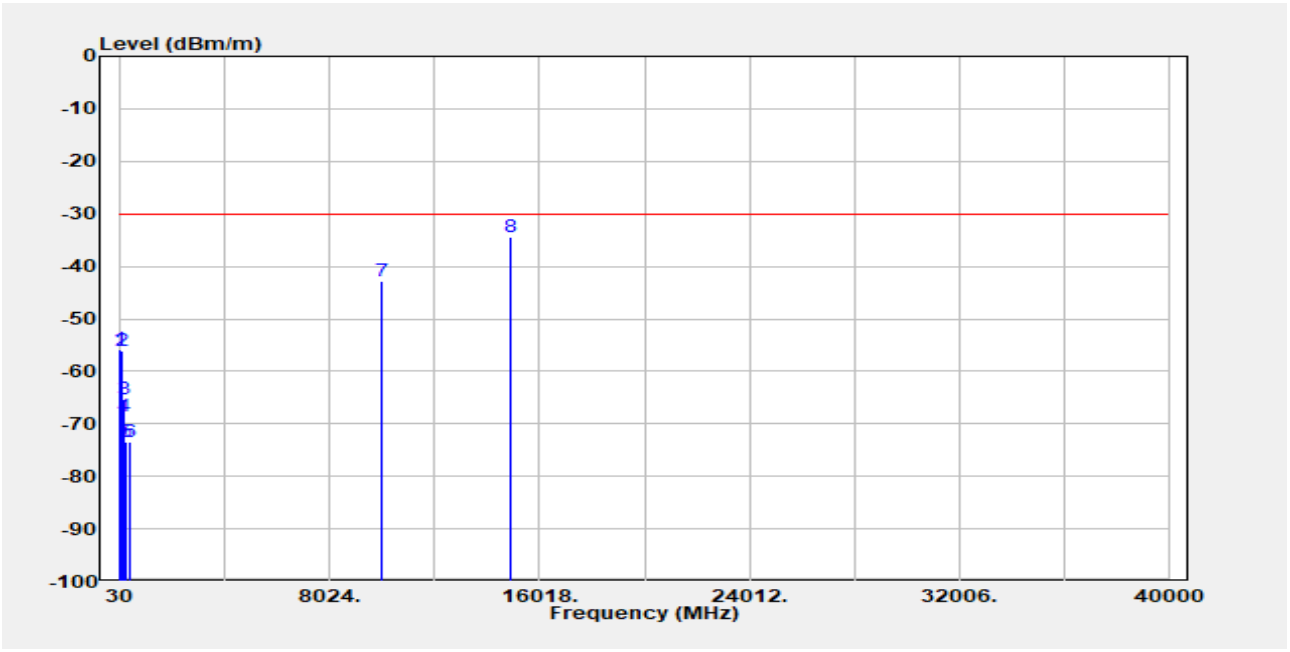
Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Tx CH Low	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Horizontal
Test Frequency	:4960 MHz	Engineer	:Jack Liu



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
30.970	-56.05	-28.88	-26.62	-0.54	-30.07	-25.98
55.220	-63.87	-53.14	-10.04	-0.68	-30.07	-33.80
160.950	-64.92	-60.01	-3.69	-1.21	-30.07	-34.85
188.110	-67.71	-65.01	-1.44	-1.26	-30.07	-37.64
229.820	-74.21	-71.41	-1.38	-1.43	-30.07	-44.14
360.770	-73.26	-69.87	-1.68	-1.71	-30.07	-43.19
9920.000	-43.33	28.70	11.34	-10.00	-30.07	-13.26
14880.000	-38.49	37.09	12.34	-12.42	-30.07	-8.42

*Note: Limit= Worst EIRP-50 dB=19.93-50=-30.07dBm

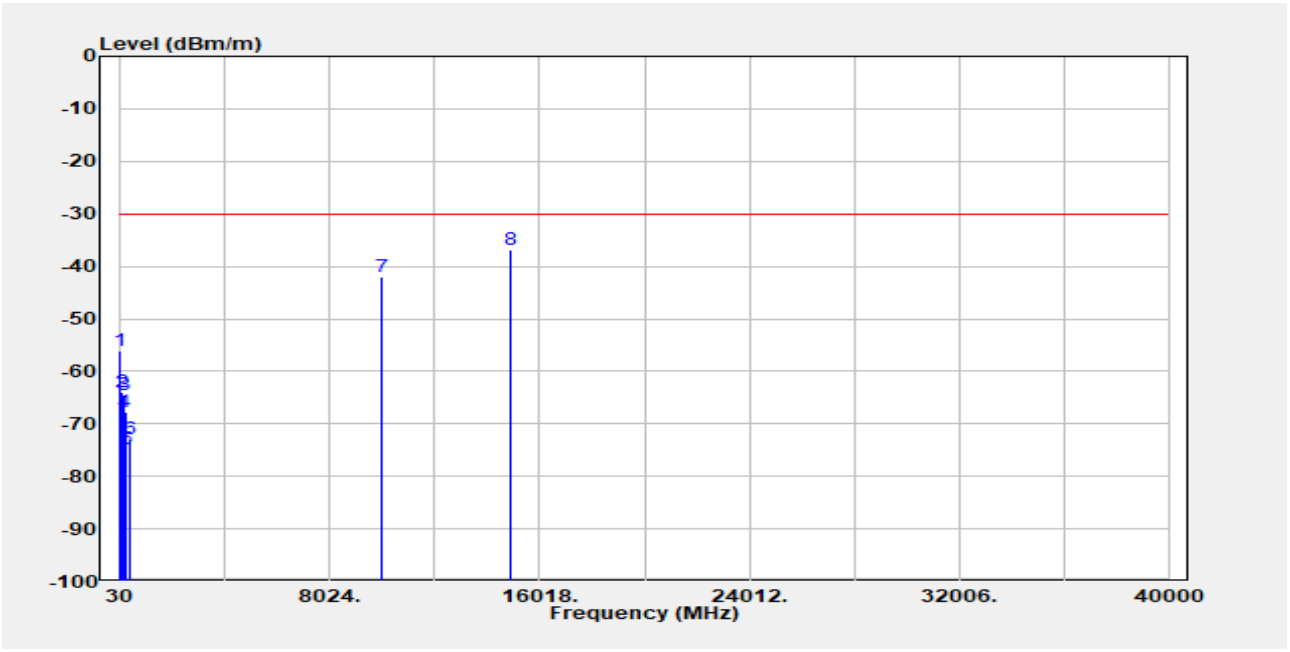
Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Tx CH High	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Vertical
Test Frequency	:4980 MHz	Engineer	:Jack Liu



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
34.850	-55.94	-31.88	-23.49	-0.57	-30.07	-25.87
54.250	-56.00	-44.95	-10.39	-0.67	-30.07	-25.93
173.560	-65.26	-61.77	-2.24	-1.25	-30.07	-35.19
191.020	-68.64	-65.96	-1.41	-1.28	-30.07	-38.57
242.430	-73.35	-69.93	-1.93	-1.49	-30.07	-43.28
360.770	-73.45	-70.06	-1.68	-1.71	-30.07	-43.38
9960.000	-42.79	29.06	11.44	-10.11	-30.07	-12.72
14940.000	-34.44	39.45	12.56	-12.42	-30.07	-4.37

*Note: Limit= Worst EIRP-50 dB=19.93-50=-30.07dBm

Report Number	:ER-2021-A0111	Test Site	:SAC 3
Operation Mode	:4.9G_20M	Test Date	:2021-12-06
Test Mode	:Tx CH High	Temp./Humi.	:22.4/50
EUT Pol	:H Plane	Antenna Pol.	:Horizontal
Test Frequency	:4980 MHz	Engineer	:Jack Liu



Freq.	EIRP/ERP	SG Output Level	Antenna Gain	Cable Loss	Limit	Margin
MHz	dBm	dBm	dBi/dBd	dB	dBm	dB
30.970	-56.00	-28.83	-26.62	-0.54	-30.07	-25.93
55.220	-63.97	-53.25	-10.04	-0.68	-30.07	-33.90
159.980	-64.61	-59.65	-3.75	-1.21	-30.07	-34.54
191.990	-67.72	-64.98	-1.46	-1.28	-30.07	-37.65
229.820	-74.82	-72.02	-1.38	-1.43	-30.07	-44.75
359.800	-72.86	-69.46	-1.70	-1.71	-30.07	-42.79
9960.000	-42.00	30.23	11.44	-10.11	-30.07	-11.93
14940.000	-36.97	37.79	12.56	-12.42	-30.07	-6.90

*Note: Limit= Worst EIRP-50 dB=19.93-50=-30.07dBm

13 FREQUENCY STABILITY MEASUREMENT

13.1 Standard Applicable

According to FCC §2.1055(d) (2) and §90.213

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

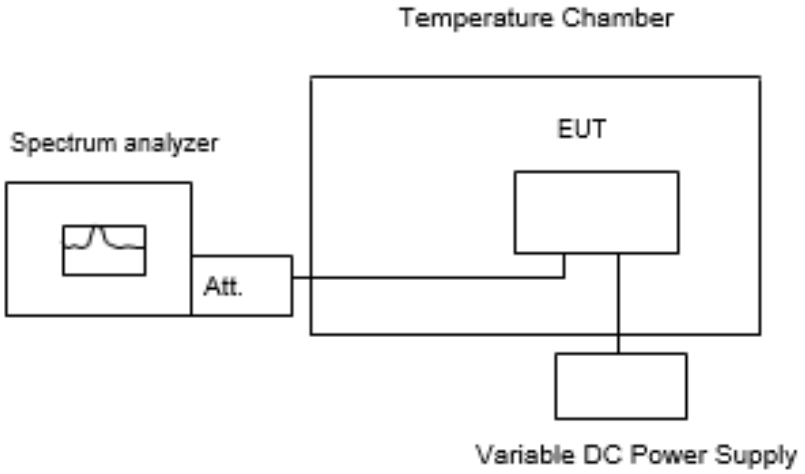
MINIMUM FREQUENCY STABILITY
[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25–50	20	20	50
72–76	5	.....	50
150–174	[5,11] 5	[6] 5	[4,6] 50
216–220	1.0	.....	1.0
220–222 [12]	0.1	1.5	1.5
421–512	[7,11,14] 2.5	[8] 5	[8] 5
806–809	[14] 1.0	1.5	1.5
809–824	[14] 1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14] 0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928 [13]	2.5	2.5	2.5
929–930	1.5	.....	.....
935–940	0.1	1.5	1.5
1427–1435	[9] 300	300	300
Above 2450 [10]	.....	.....	.....

13.2 Measurement Equipment Used

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
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	2	12/14/2021	12/13/2022
DC Block	Mini-Circuits	BLK-18-S+	1	12/14/2021	12/13/2022

13.3 Test Set-up



Note: *Measurement setup for testing on Antenna connector*

13.4 Measurement Procedure

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum ana-lyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to –30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

Set chamber temperature to 25℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint as declared by the manufacturer, record the maximum frequency change.

13.5 Measurement Result

Test Temp.(℃)	Test Voltage(V)	Channel	Nominal Center Frequency (MHz)	Calculated Center Frequency (MHz)	Deviation (ppm)	Limit (ppm)	Result
50	120	192	4960	4960.02	4.03	10	PASS
40		192	4960	4960.033	6.65	10	PASS
30		192	4960	4960.013	2.62	10	PASS
20		192	4960	4960.024	4.84	10	PASS
10		192	4960	4960.016	3.23	10	PASS
0		192	4960	4960.001	0.20	10	PASS
-10		192	4960	4960.033	6.65	10	PASS
-20		192	4960	4960.045	9.07	10	PASS
-30		192	4960	4959.99	2.02	10	PASS

Test Temp.(℃)	Test Voltage(V)	Channel	Nominal Center Frequency (MHz)	Calculated Center Frequency (MHz)	Deviation (ppm)	Limit (ppm)	Result
25	138	192	4960	4960.009	1.81	10	PASS
	120	192	4960	4959.998	0.40	10	PASS
	102	192	4960	4960.031	6.25	10	PASS

~ End of Report ~