

TEST REPORT

Product Name : Wireless Human Presence Sensor
Model Number : LWR01
FCC ID : 2AFIW-LWR01

Prepared for : GL Technologies (Hong Kong) Limited
Address : Unit 601, Building 5W, Hong Kong Science Park, Shatin,
N.T., Hong Kong

Prepared by : EMTEK (SHENZHEN) CO., LTD.
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Report Number : ENS2504150120W00102R
Date(s) of Tests : April 21, 2025 to May 20, 2025
Date of issue : May 22, 2025

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Modified Information

Version	Report No.	Revision Date	Summary
Ver.1.0	ENS2504150120W00102R	/	Original Report

1 TEST RESULT CERTIFICATION

Applicant : GL Technologies (Hong Kong) Limited
Address : Unit 601, Building 5W, Hong Kong Science Park, Shatin, N.T., Hong Kong
Manufacturer : GL Technologies (Hong Kong) Limited
Address : Unit 601, Building 5W, Hong Kong Science Park, Shatin, N.T., Hong Kong
EUT : Wireless Human Presence Sensor
Model Name : LWR01
Trademark : Lafaer

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2 , Subpart J FCC 47 CFR Part 15, Subpart C	PASS

The above equipment was tested by EMTEK(SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the above table standards requirement.

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

Date of Test : April 21, 2025 to May 20, 2025

Prepared by : 
Una Yu/Editor

Reviewer : 
Joe Xia/Supervisor

Approved & Authorized Signer : 
Lisa Wang/Manager

2 EUT TECHNICAL DESCRIPTION

Product Name:	Wireless Human Presence Sensor
Model Number:	LWR01
Device Type:	Thread
Wireless Protocol:	IEEE 802.15.4
Modulation:	DSSS, QPSK
Operating Frequency Range:	2405-2480MHz
Number of Channels:	16 Channels
Antenna Type:	Integrated Antenna
Antenna Gain:	0.55dBi (Note: The antenna information is provided by the customers, which will have a certain impact on the test results.)
Power Supply:	Battery AA (1.5Vx2) AC 120V/60Hz by Adapter
Temperature Range:	0°C~40°C

Note: for more details, please refer to the User's manual of the EUT.

3 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark
15.247(a)(2)	DTS (6dB) Bandwidth	PASS	
15.247(b)(3)	Maximum Peak Conducted Output Power	PASS	
15.247(e)	Maximum Power Spectral Density Level	PASS	
15.247(d)	Unwanted Emission Into Non-Restricted Frequency Bands	PASS	
15.247(d) 15.209	Unwanted Emission Into Restricted Frequency Bands (conducted)	PASS	
15.247(d) 15.209	Radiated Spurious Emission	PASS	
15.207	Conducted Emission Test	PASS	
15.247(b)	Antenna Application	PASS	

NOTE 1: The results of this report do not take into account the uncertainty..

NOTE 2: According to FCC OET KDB 558074, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is filing to comply with the above table standards requirement.

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:
 FCC 47 CFR Part 2, Subpart J
 FCC 47 CFR Part 15, Subpart C
 FCC KDB 558074 D01 DTS Meas Guidance v04

4.2 MEASUREMENT EQUIPMENT USED

For Conducted Emission Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESCI	101384	2024/5/11 2025/5/9	1Year
AMN	Rohde & Schwarz	ENV216	101161	2024/5/10 2025/5/9	1Year

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Pre-Amplifier	Bonn	BLMA 011001N	2213967A	2024/10/18	1Year
EMI Test Receiver	Rohde & Schwarz	ESR7	102551	2024/10/18	1Year
Bilog Antenna	Schwarzbeck	VULB9163	9163142	2024/7/8	2Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	2023/6/2	2Year
Pre-Amplifier	Bonn	BLMA 0118-5G	2213967B-01	2024/10/18	1Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	2024/5/10 2025/5/9	1Year
Horn antenna	Schwarzbeck	BBHA9170	9170-399	2023/5/12 2025/5/11	2Year
Pre-Amplifier	Lunar EM	LNA18G26-40	J1012131010 001	2024/5/11 2025/5/9	1Year
Pre-Amplifier	Lunar EM	LNA26G40-40	J1013131028 001	2024/5/11 2025/5/9	1Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2023/5/12 2025/5/11	2Year
Wideband Radio Communication Tester	R&S	CMW500	171168	2024/9/18	1Year
Coaxial Cable	TIMES	NmNm-7-C1570 2	N/A	2024/5/23	1Year
Coaxial Cable	TIMES	HF290-NMSM-6. 5M	N/A	2024/5/23	1Year

For Other Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Wideband Radio Communication Tester	R&S	CMW500	171168	2024/9/18	1Year
Frequency Extender	R&S	CMW-Z800A	100430	2024/9/18	1Year
Spectrum Analyzer	R&S	FSV3044	101289	2024/12/17	1Year
Analog Signal Generator	R&S	SMB100A	183237	2024/9/18	1Year
Vector Signal	R&S	SMM100A	101808	2024/9/18	1Year

Generator					
RF Control Unit(Power Meter)	Tonscend	JS0806-2	22C8060567	2024/9/18	1Year
Temperature&Humidity Chamber	ESPEC	EL-02KA	12107166	2024/5/11 2025/5/10	1 Year
DC Power Supply	KEYSIGHT	E3642A	MY53030016	2024/9/18	1 Year



4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

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.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	7	2435	13	2465
2	2410	8	2440	14	2470
3	2415	9	2445	15	2475
4	2420	10	2450	16	2480
5	2425	11	2455		
6	2430	12	2460		

Test Frequency and Channel:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	9	2445	16	2480

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

Site Description

EMC Lab.

: **Accredited by CNAS**

The Certificate Registration Number is L2291

The Laboratory has been assessed and proved to be in compliance with
CNAS-CL01 (identical to ISO/IEC 17025:2017)

Accredited by FCC

Designation Number: CN1204

Test Firm Registration Number: 882943

Accredited by A2LA

The Certificate Number is 4321.01

Accredited by Industry Canada

The Conformity Assessment Body Identifier is CN0008

Name of Firm : EMTEK (SHENZHEN) CO., LTD.

Site Location : Building 69, Majialong Industry Zone, Nanshan District, Shenzhen,
Guangdong, China

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

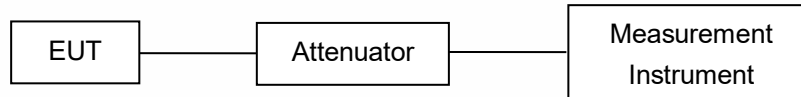
Measurement Uncertainty for a level of Confidence of 95%



7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP 1

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.4. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.4-2014 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

Above 30MHz:

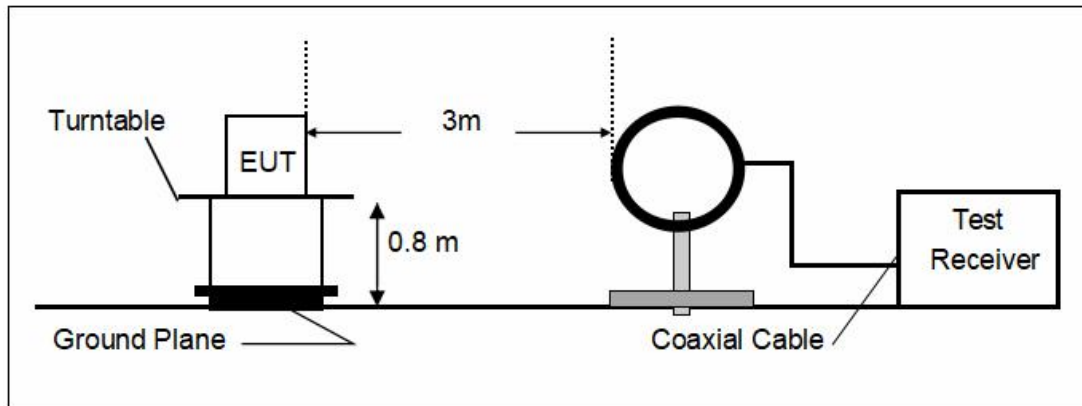
The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

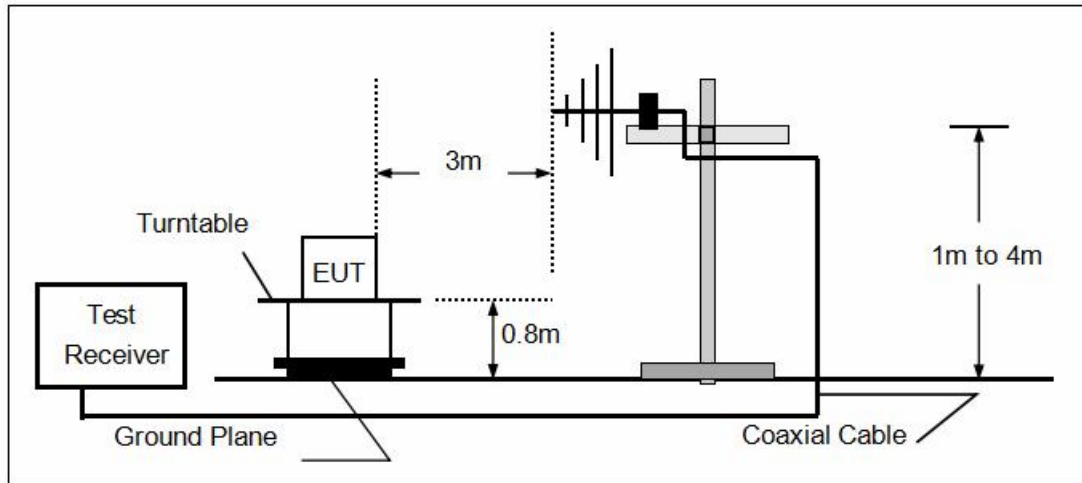
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

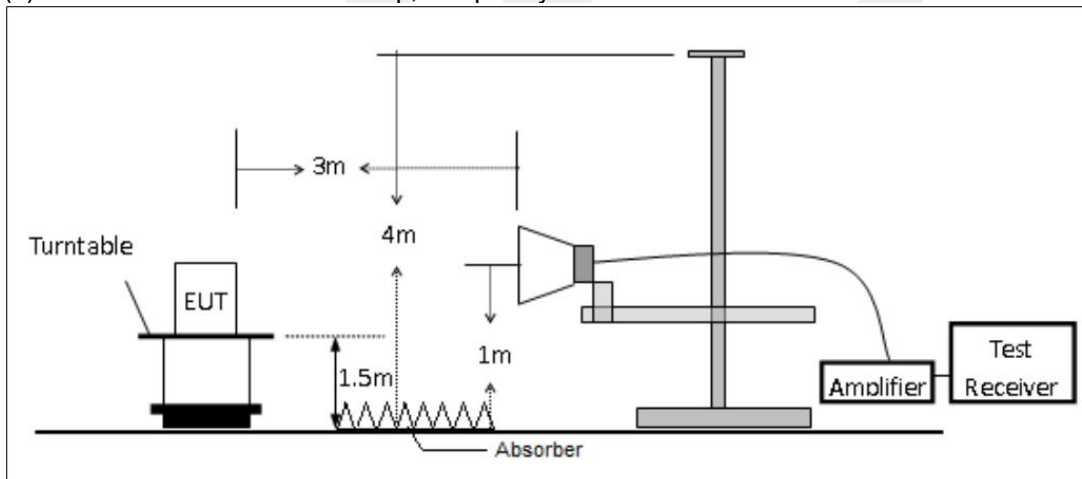
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

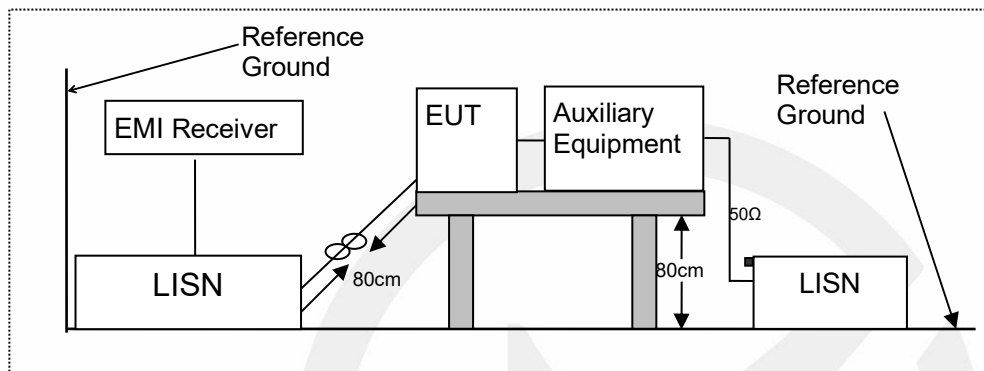


7.3 CONDUCTED EMISSION TEST SETUP

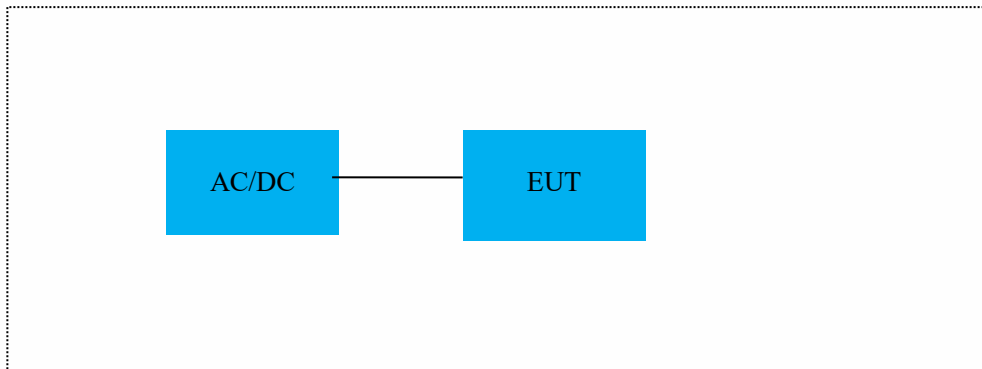
The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

According to the requirements in Section 13.1.4.1 of ANSI C63.4-2014 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



7.5 SUPPORT EQUIPMENT

Adapter : Manufacturer: HUAWEI
Model: HW-100400C01
Input: 100-240V~50/60Hz, 1.2A
Output: 5V, 2A
FCC

Notes:

- 1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8 TEST REQUIREMENTS

8.1 DTS (6DB) BANDWIDTH

8.1.1 Applicable Standard

According to FCC Part 15.247(a)(2) and KDB 558074 DTS 01 Meas. Guidance v04

8.1.2 Conformance Limit

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

8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.1.4 Test Procedure

The EUT was operating in O-QPSK mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 100 kHz.

Set the video bandwidth (VBW) = 300 kHz.

Set Span = 2 times OBW

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

Allow the trace to stabilize.

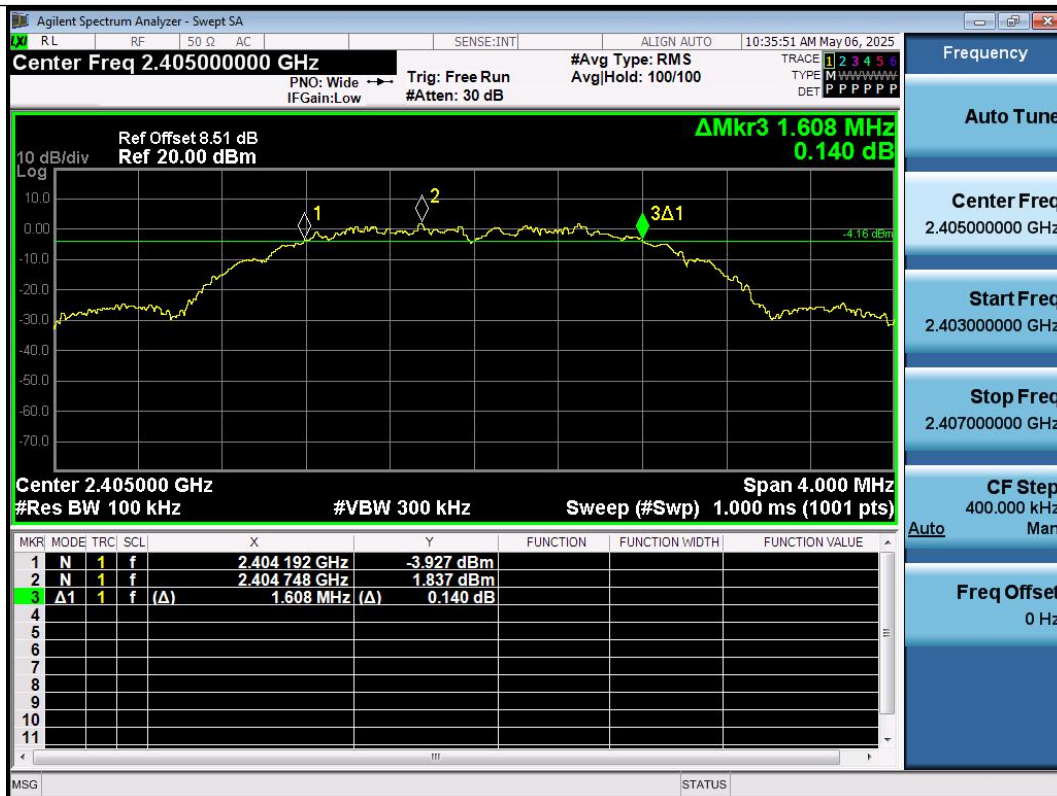
Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Measure and record the results in the test report.

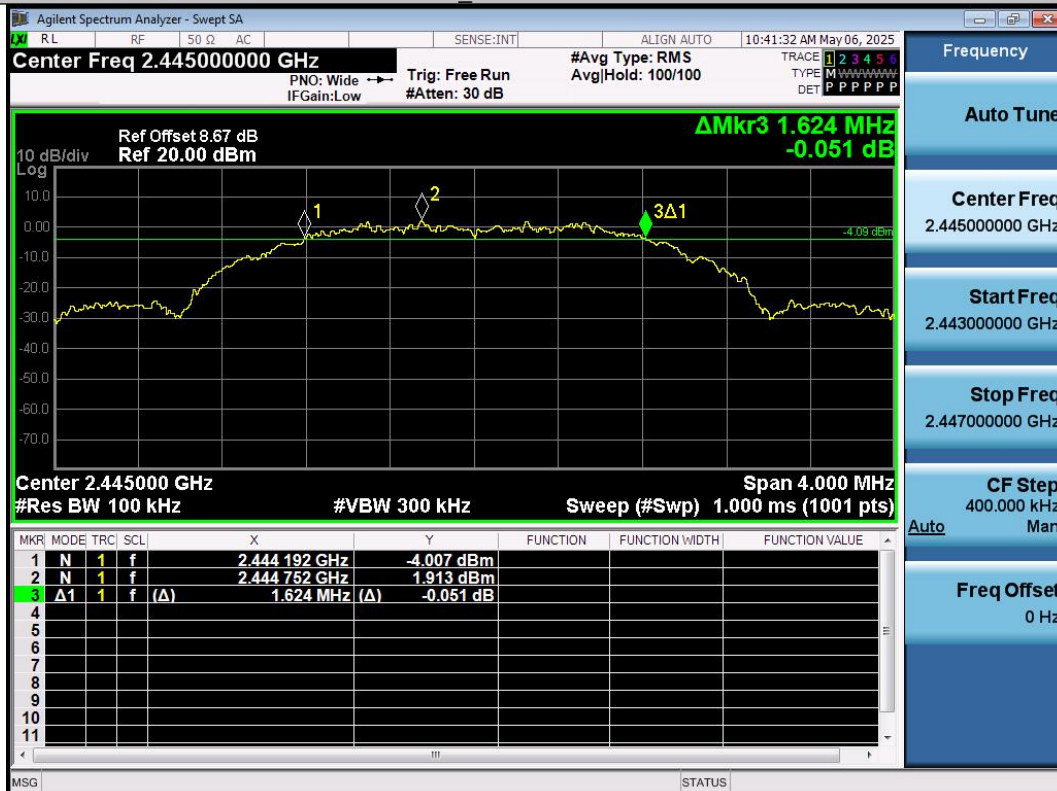
8.1.5 Test Results

Temperature : 25°C ATM Pressure: 1011 mbar
Humidity : 45 % Test Engineer: GJ

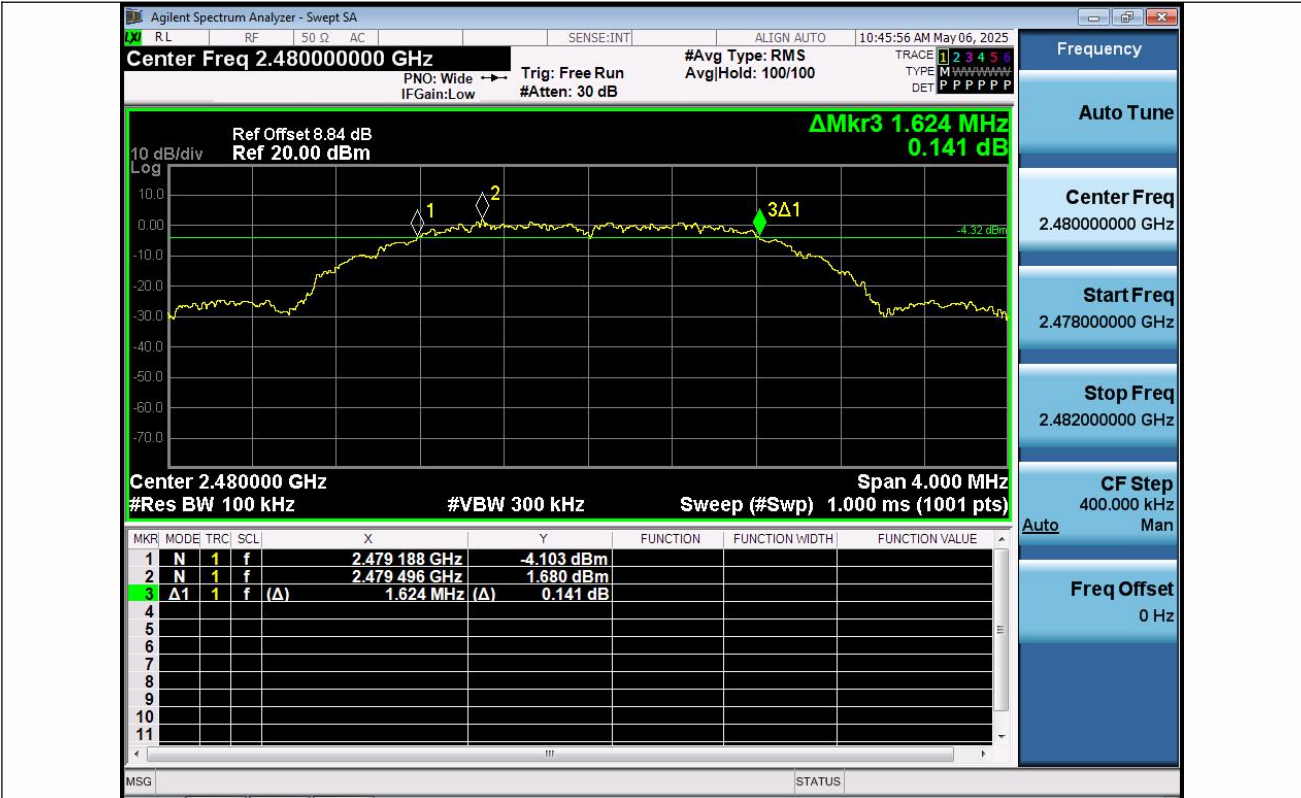
TestMode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
Thread_2M	Ant1	2405	1.608	2404.192	2405.800	0.5	PASS
Thread_2M	Ant1	2445	1.624	2444.192	2445.816	0.5	PASS
Thread_2M	Ant1	2480	1.624	2479.188	2480.812	0.5	PASS



Thread_2M-Ant1-2405-PASS



Thread_2M-Ant1-2445-PASS



Thread_2M-Ant1-2480-PASS

8.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

1.1.1 Applicable Standard

According to FCC Part 15.247(b)(3) and KDB 558074 DTS 01 Meas. Guidance v04

8.2.1 Conformance Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

1.1.2 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

1.1.3 Test Procedure

■ According to FCC Part 15.247(b)(3)

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The testing follows FCC public Notice DA 00-705 Measurement Guidelines.

The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum output power setting and enable the EUT transmit continuously.

Measure the conducted output power with cable loss and record the results in the test report.

Measure and record the results in the report.

■ According to FCC Part 15.247(b)(4):

Conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note: If antenna Gain exceeds 6 dBi, then Output power Limit = 30 - (Gain - 6)

1.1.4 Test Results

Temperature : 25°C

ATM Pressure: 1011 mbar

Humidity : 45 %

Test Engineer: GJ

TestMode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
Thread_2M	Ant1	2405	5.53	≤30	6.08	≤36	PASS
Thread_2M	Ant1	2445	5.67	≤30	6.22	≤36	PASS
Thread_2M	Ant1	2480	5.74	≤30	6.29	≤36	PASS

8.3 MAXIMUM POWER SPECTRAL DENSITY

1.1.5 Applicable Standard

According to FCC Part 15.247(e) and KDB 558074 DTS 01 Meas. Guidance v04

1.1.6 Conformance Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

1.1.7 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

1.1.8 Test Procedure

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance
The transmitter output (antenna port) was connected to the spectrum analyzer
Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 3 kHz
Set the VBW to: 10 kHz.
Set Detector = peak.
Set Sweep time = auto couple.
Set Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level within the RBW.
Note: If antenna Gain exceeds 6 dBi, then PSD Limit=8-(Gain - 6)

1.1.9 Test Results

Temperature : 25°C ATM Pressure: 1011 mbar
Humidity : 45 % Test Engineer: GJ

TestMode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
Thread_2M	Ant1	2405	-9.59	≤8.00	PASS
Thread_2M	Ant1	2445	-9.45	≤8.00	PASS
Thread_2M	Ant1	2480	-10.06	≤8.00	PASS





8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

1.1.10 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 DTS 01 Meas. Guidance v04

1.1.11 Conformance Limit

According to FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

1.1.12 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

1.1.13 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to ≥ 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW $\geq 3 \times$ RBW.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

■ Emission level measurement

Set the center frequency and span to encompass frequency range to be measured.

Set the RBW = 100 kHz.

Set the VBW = 300 kHz.

Set Detector = peak

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements. Report the three highest emissions relative to the limit.

1.1.14 Test Results

Temperature : 25°C
Humidity : 45 %

ATM Pressure: 1011 mbar
Test Engineer: GJ

Reference level measurement

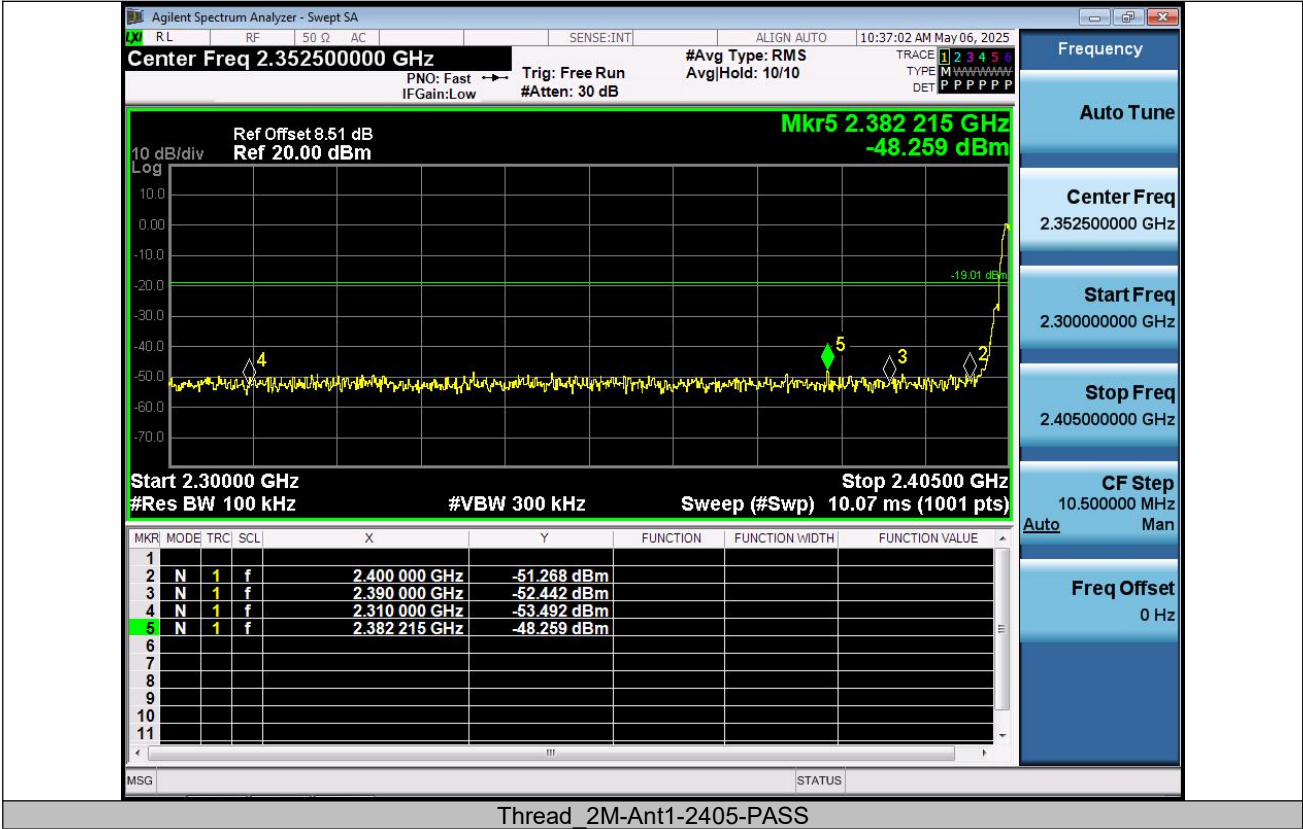
TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm]
Thread_2M	Ant1	2405	2405.52	0.99
Thread_2M	Ant1	2445	2445.34	0.11
Thread_2M	Ant1	2480	2480.48	1.09





Band edge measurements

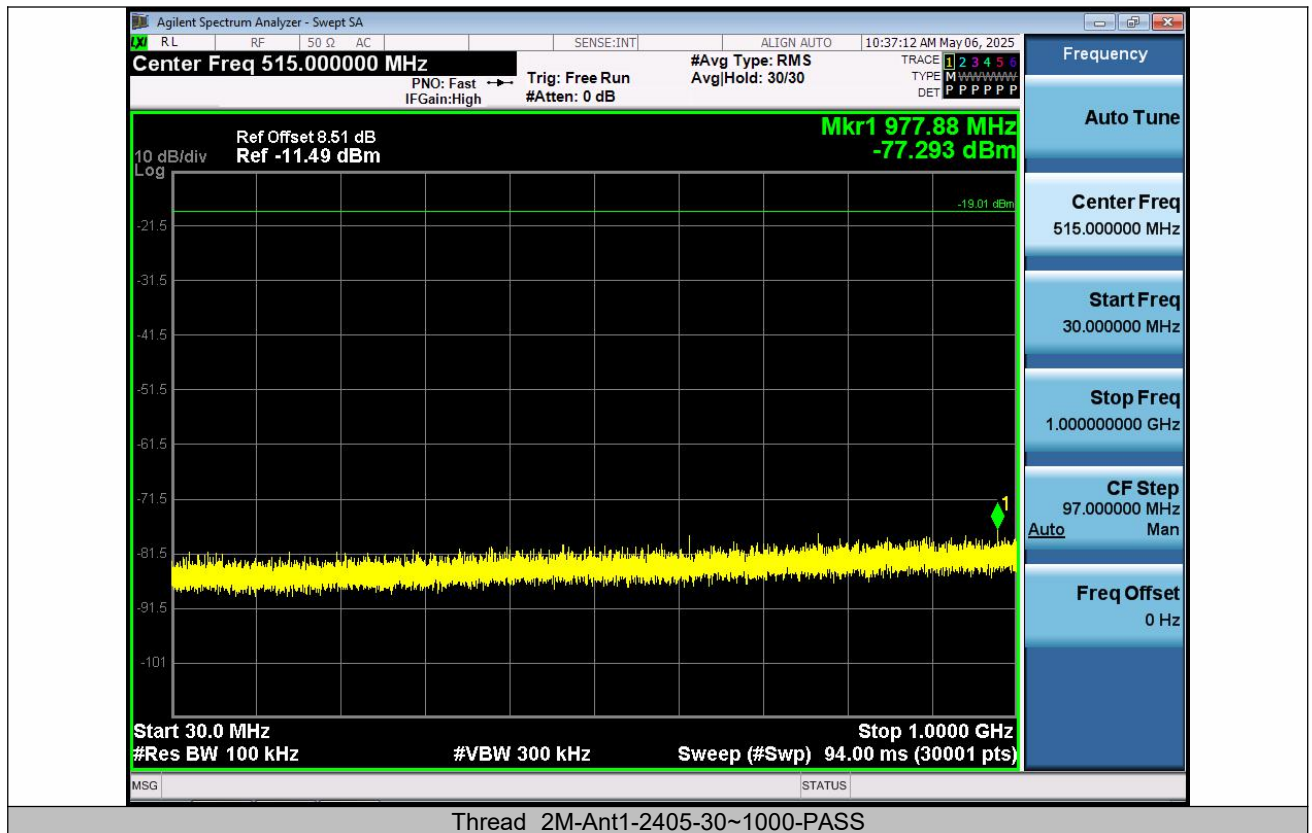
TestMode	Antenna	ChName	Frequency[MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
Thread_2M	Ant1	Low	2405	0.99	-48.26	≤-19.01	PASS
Thread_2M	Ant1	High	2480	1.09	-46.26	≤-18.91	PASS

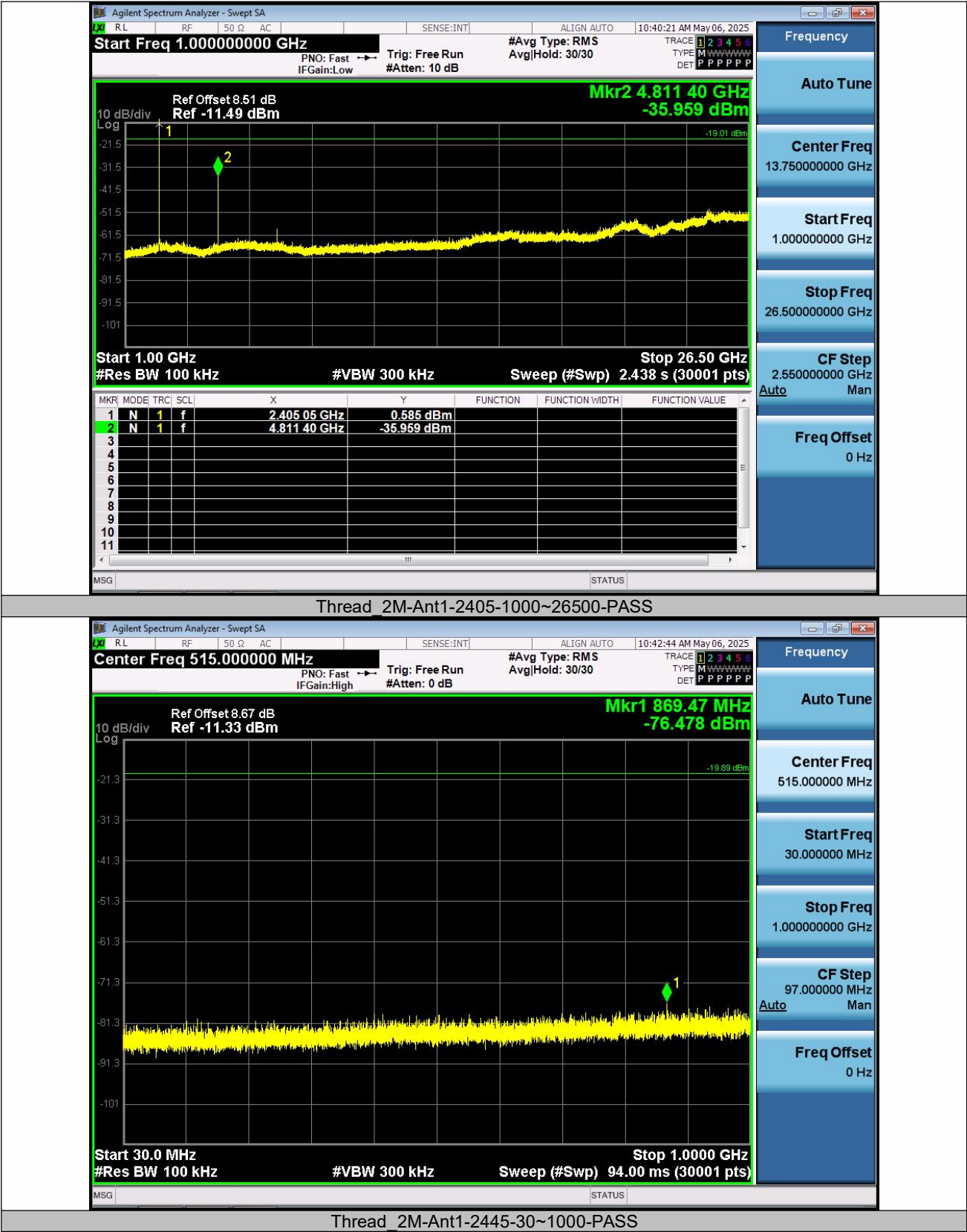




Conducted Spurious Emission

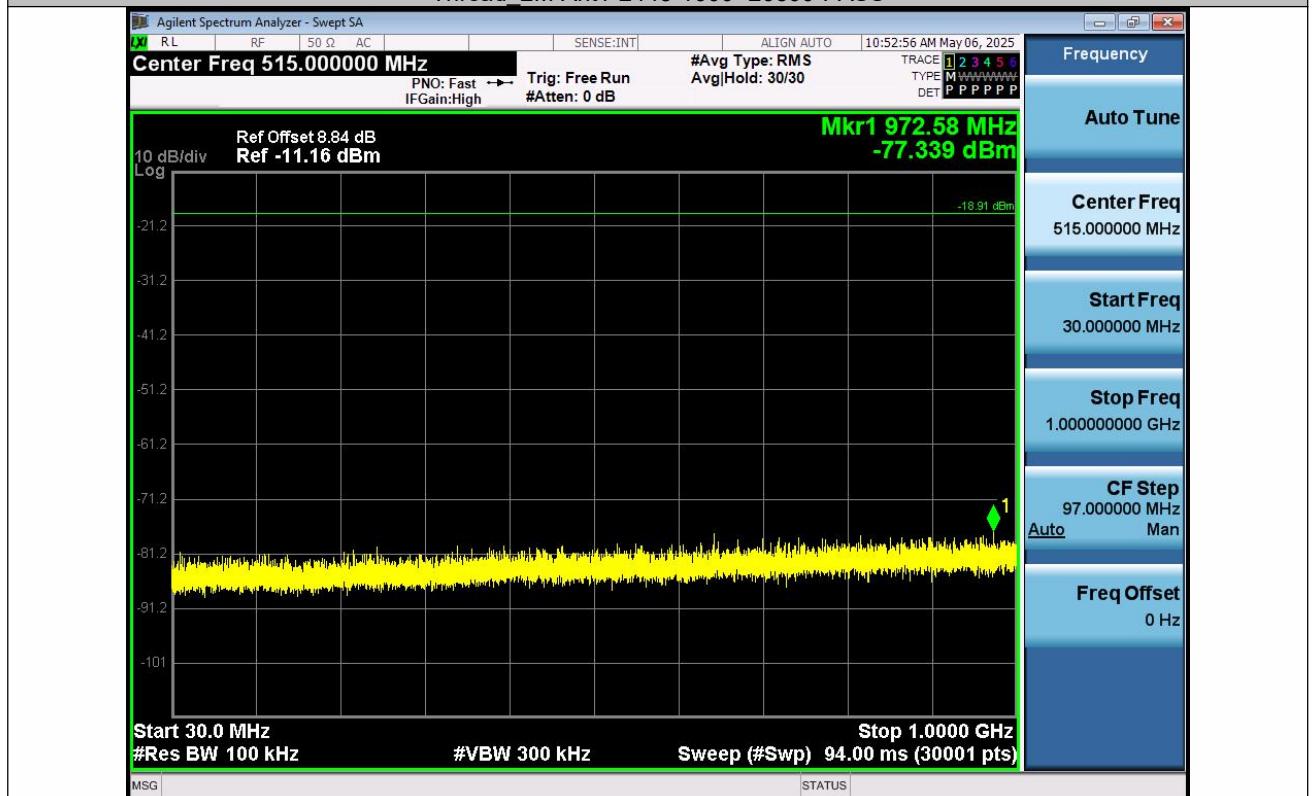
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
Thread_2M	Ant1	2405	30~1000	0.99	-77.29	≤-19.01	PASS
Thread_2M	Ant1	2405	1000~26500	0.99	-35.96	≤-19.01	PASS
Thread_2M	Ant1	2445	30~1000	0.11	-76.48	≤-19.89	PASS
Thread_2M	Ant1	2445	1000~26500	0.11	-36.26	≤-19.89	PASS
Thread_2M	Ant1	2480	30~1000	1.09	-77.34	≤-18.91	PASS
Thread_2M	Ant1	2480	1000~26500	1.09	-36.27	≤-18.91	PASS







Thread 2M-Ant1-2445-1000~26500-PASS



Thread 2M-Ant1-2480-30~1000-PASS



8.5 RADIATED SPURIOUS EMISSION

1.1.15 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 DTS 01 Meas. Guidance v04

1.1.16 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to FCC Part 15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part 15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	2400/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

1.1.17 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

1.1.18 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz for

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 9kHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 200Hz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

1.1.19 Test Results

Temperature : 25°C ATM Pressure: 1011 mbar
Humidity : 45 % Test Engineer: CZF

All of the configurations or modes are tested, the data of the worst case is recorded as below.

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

Note: Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Test mode: Thread Frequency: Channel 1: 2405MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
7636.875	V	56.44	74.00	17.56	peak
9931.875	V	61.99	74.00	12.01	peak
12590.625	V	64.71	74.00	9.29	peak
7636.875	V	39.53	54.00	14.47	AVG
9931.875	V	42.95	54.00	11.05	AVG
12590.625	V	45.25	54.00	8.75	AVG
4807.5	H	53.94	74.00	20.06	peak
8195.625	H	58.32	74.00	15.68	peak
9888.75	H	62.45	74.00	11.55	peak
4807.5	H	48.56	54.00	5.44	AVG
8195.625	H	35.99	54.00	18.01	AVG
9888.75	H	39.24	54.00	14.76	AVG

Test mode: Thread Frequency: Channel 9: 2445MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
8690.625	V	57.48	74.00	16.52	peak
9892.5	V	62.30	74.00	11.70	peak
11340	V	62.72	74.00	11.28	peak
8690.625	V	8690.625	54.00	12.52	AVG
9892.5	V	9892.5	54.00	11.15	AVG
11340	V	11340	54.00	13.22	AVG
4890	H	52.28	74.00	21.72	peak
7989.375	H	56.88	74.00	17.12	peak
9930	H	61.56	74.00	12.44	peak
4890	H	48.74	54.00	5.26	AVG
7989.375	H	34.66	54.00	19.34	AVG
9930	H	39.70	54.00	14.30	AVG

Test mode: Thread Frequency: Channel 16: 2480MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
7665	V	56.02	74.00	17.98	peak
9909.375	V	62.22	74.00	11.78	peak
11958.75	V	63.44	74.00	10.56	peak
7665	V	39.71	54.00	14.29	AVG
9909.375	V	43.10	54.00	10.90	AVG
11958.75	V	40.95	54.00	13.05	AVG
4957.5	H	51.68	74.00	22.32	peak
8006.25	H	55.93	74.00	18.07	peak
9922.5	H	62.41	74.00	11.59	peak
4957.5	H	48.49	54.00	5.51	AVG
8006.25	H	35.33	54.00	18.67	AVG
9922.5	H	39.68	54.00	14.32	AVG

- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
 (2) Emission Level= Reading Level+Correct Factor.
 (3) Correct Factor= Ant_F + Cab_L - Preamp
 (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

Test mode: Thread Frequency: Channel 1: 2405MHz

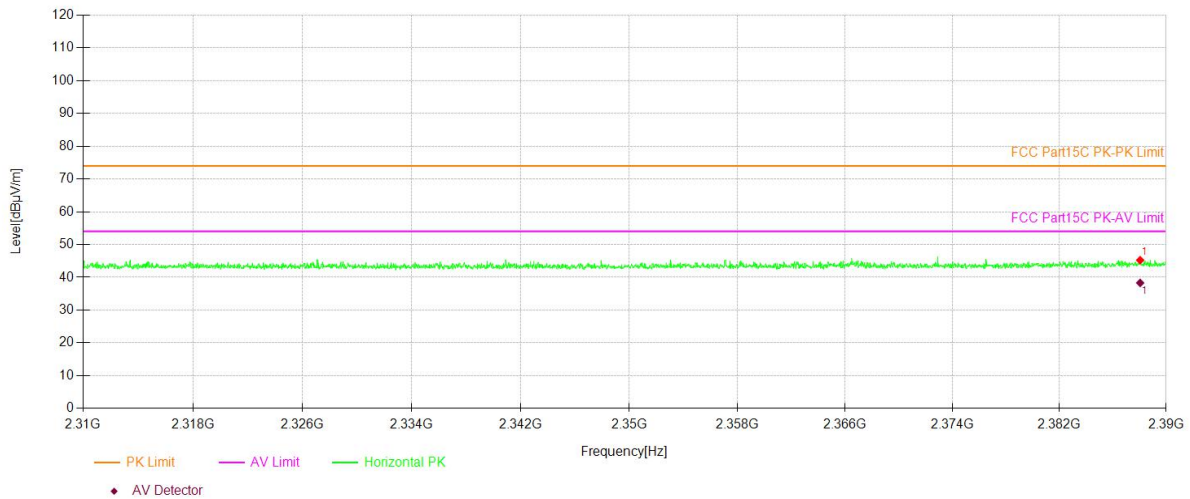
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
2389.62	V	44.60	74.00	29.40	peak
2389.62	V	37.79	54.00	16.21	AVG
2387.86	H	45.21	74.00	28.79	peak
2387.86	H	37.71	54.00	16.29	AVG

Test mode: Thread Frequency: Channel 16: 2480MHz

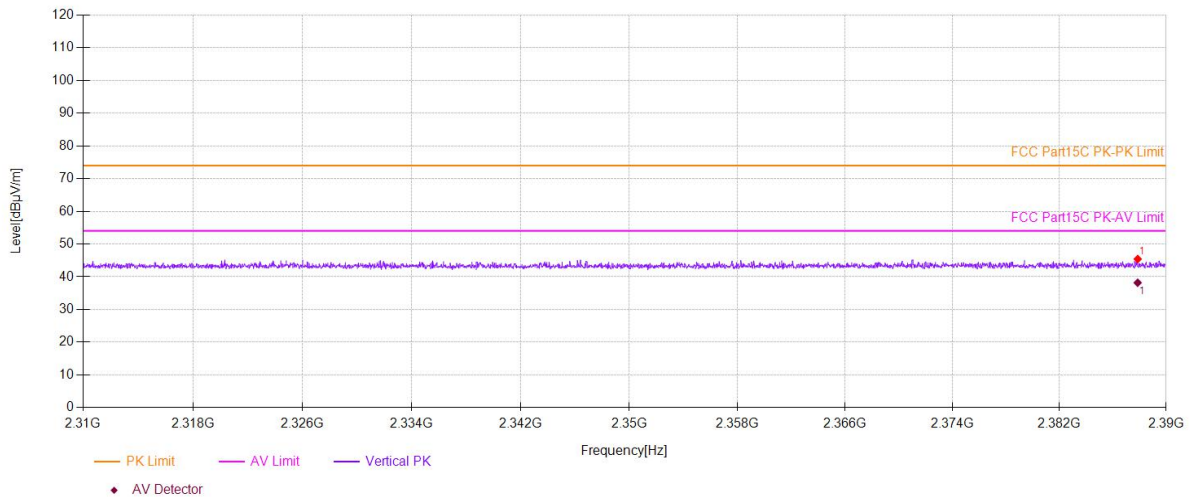
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)	Limit 3m(dBuV/m)	Over(dB)	Detector
2483.62	V	48.61	74.00	25.39	peak
2483.62	V	38.06	54.00	15.94	AVG
2483.69	H	54.67	74.00	19.33	peak
2483.69	H	42.27	54.00	11.73	AVG

- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
 (2) Emission Level= Reading Level+Correct Factor.
 (3) Correct Factor= Ant_F + Cab_L - Preamp
 ((4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

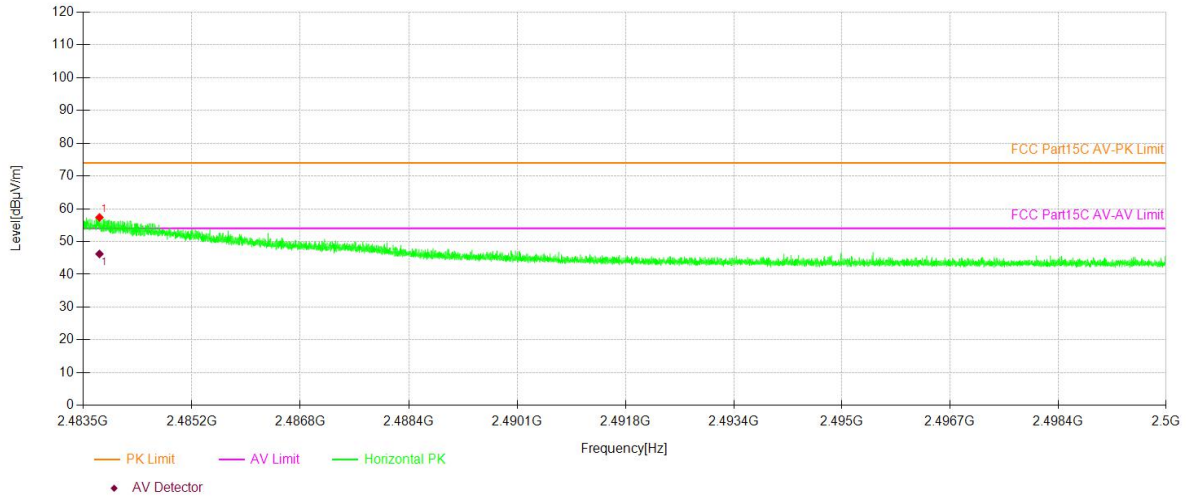
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	O-QPSK		
	☒ Channel 1: 2405MHz	☐ Channel 16: 2480MHz	Polarity: H



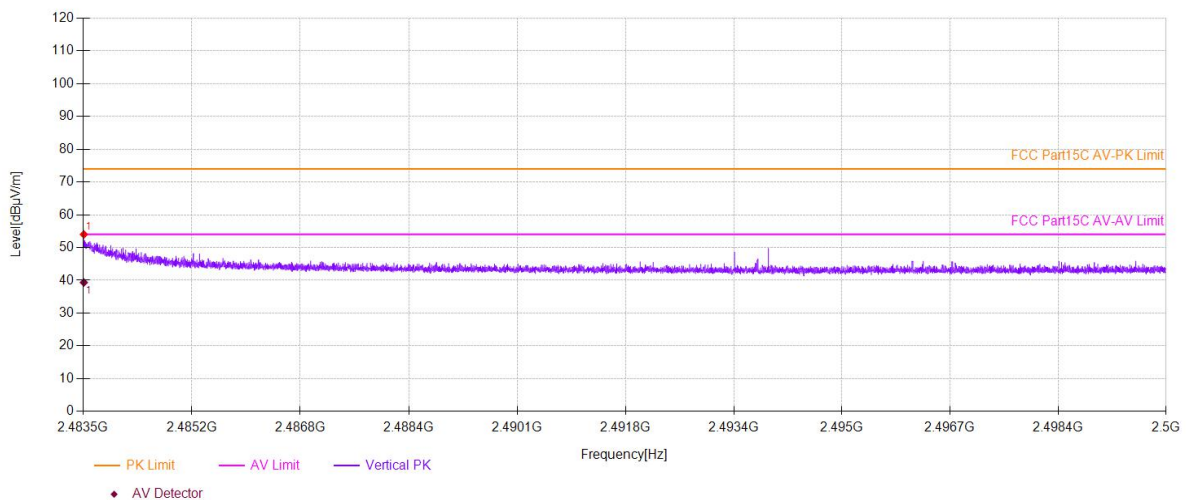
Test Model	Spurious Emission in Restricted Band 2310-2390MHz		
	O-QPSK		
	☒ Channel 1: 2405MHz	☐ Channel 16: 2480MHz	Polarity: V



Test Model Spurious Emission in Restricted Band 2483.5-2500MHz
O-QPSK
☐ Channel 1: 2405MHz ☒ Channel 16: 2480MHz Polarity: H

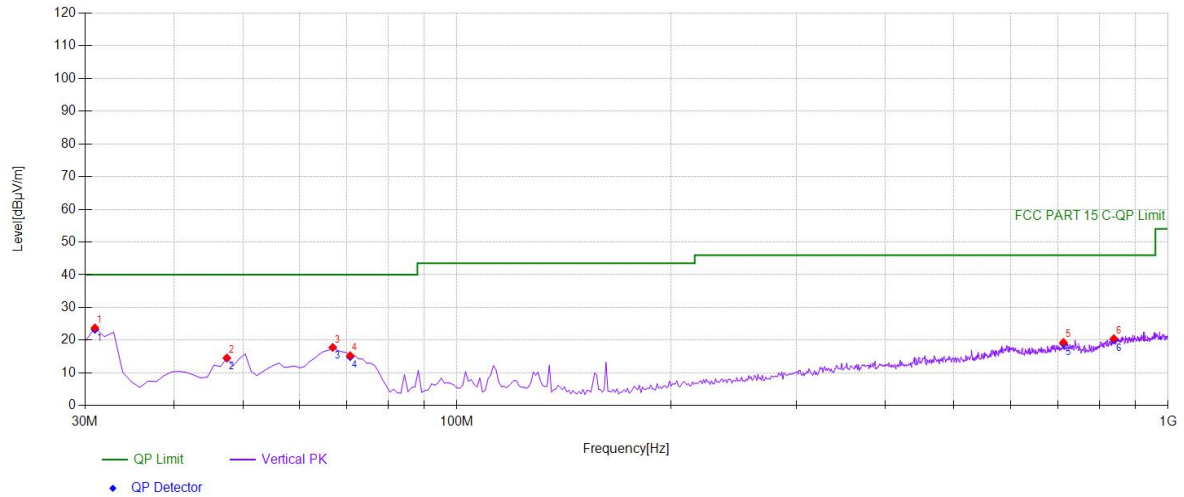


Test Model Spurious Emission in Restricted Band 2483.5-2500MHz
O-QPSK
☐ Channel 1: 2405MHz ☒ Channel 16: 2480MHz Polarity: V



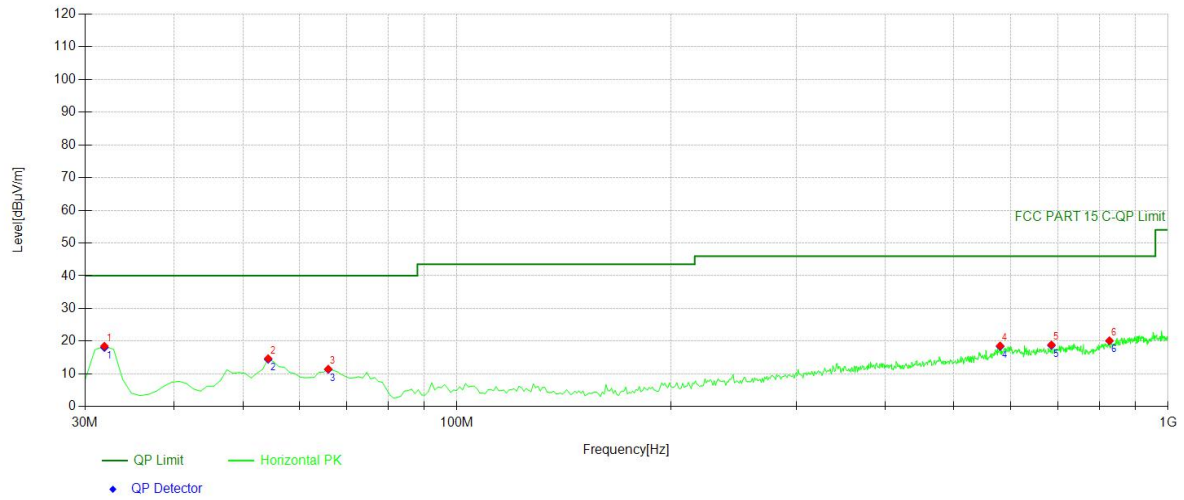
■ Spurious Emission below 1GHz (30MHz to 1GHz)

Test mode: Thread Frequency: Channel 1: 2405MHz



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	48.47	-24.67	23.80	PK	40.00	16.20	Vertical
2	47.4775	37.01	-22.39	14.62	PK	40.00	25.38	Vertical
3	66.8969	42.14	-24.34	17.80	PK	40.00	22.20	Vertical
4	70.7808	40.20	-24.88	15.32	PK	40.00	24.68	Vertical
5	712.592	31.15	-11.77	19.38	PK	46.00	26.62	Vertical
6	838.818	30.92	-10.39	20.53	PK	46.00	25.47	Vertical

Final Data List					
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	30.971	-24.67	23.32	40.00	16.68
2	47.4775	-22.39	14.50	40.00	25.50
3	66.8969	-24.34	17.78	40.00	22.22
4	70.7808	-24.88	14.98	40.00	25.02
5	712.5926	-11.77	18.96	46.00	27.04
6	838.8188	-10.39	20.20	46.00	25.80



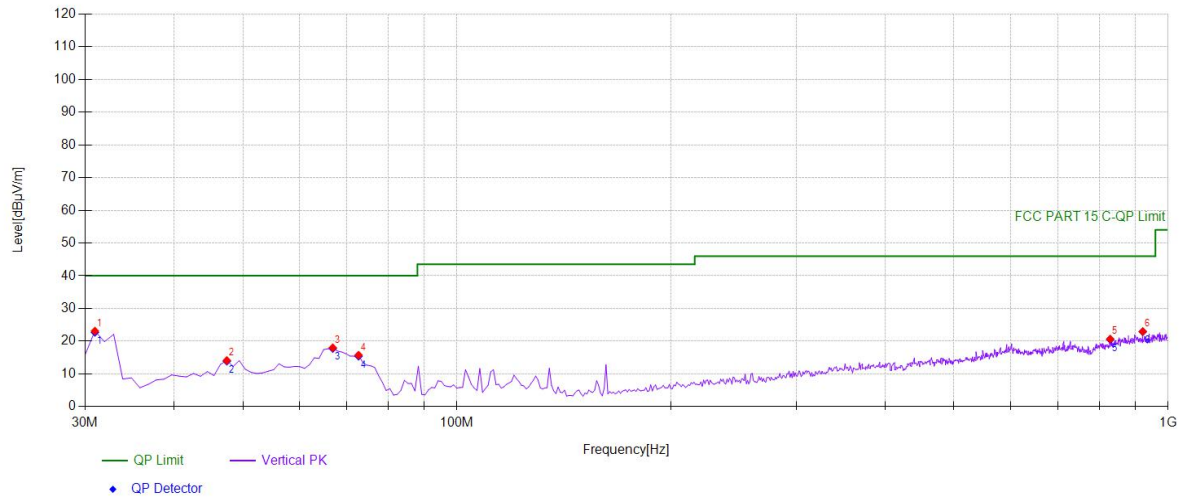
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	31.9419	43.04	-24.54	18.50	PK	40.00	21.50	Horizontal
2	54.2743	37.31	-22.60	14.71	PK	40.00	25.29	Horizontal
3	65.9259	35.72	-24.21	11.51	PK	40.00	28.49	Horizontal
4	580.540	31.73	-13.12	18.61	PK	46.00	27.39	Horizontal
5	685.405	31.37	-12.45	18.92	PK	46.00	27.08	Horizontal
6	827.167	30.77	-10.62	20.15	PK	46.00	25.85	Horizontal

Final Data List

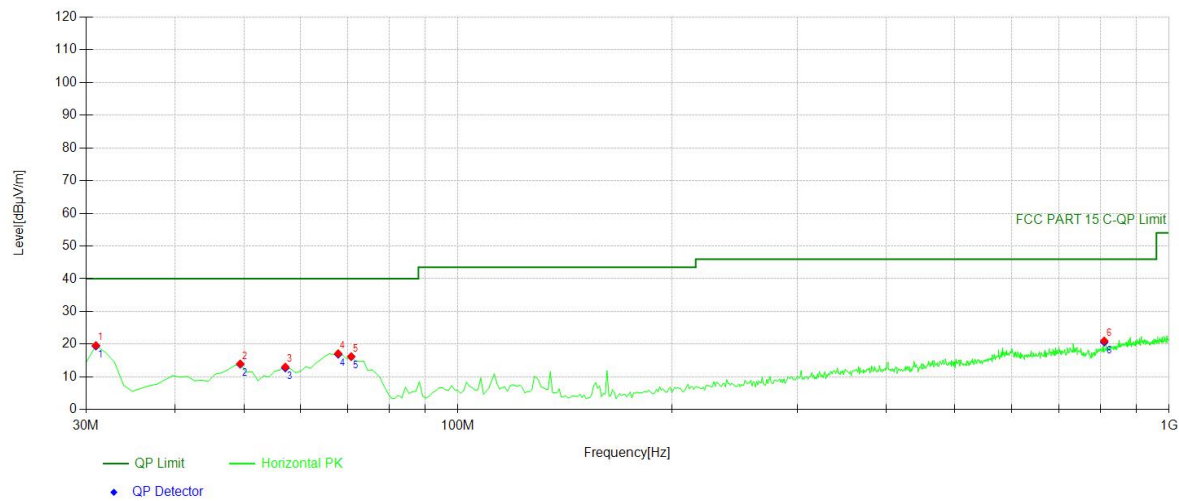
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	31.9419	-24.54	18.08	40.00	21.92
2	54.2743	-22.60	14.47	40.00	25.53
3	65.9259	-24.21	11.37	40.00	28.63
4	580.5405	-13.12	18.39	46.00	27.61
5	685.4054	-12.45	18.70	46.00	27.30
6	827.1672	-10.62	20.11	46.00	25.89

Test mode: Thread Frequency: Channel 9: 2445MHz



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	47.80	-24.67	23.13	PK	40.00	16.87	Vertical
2	47.4775	36.52	-22.39	14.13	PK	40.00	25.87	Vertical
3	66.8969	42.35	-24.34	18.01	PK	40.00	21.99	Vertical
4	72.7227	40.95	-25.19	15.76	PK	40.00	24.24	Vertical
5	829.109	31.27	-10.59	20.68	PK	46.00	25.32	Vertical
6	921.351	31.57	-8.61	22.96	PK	46.00	23.04	Vertical

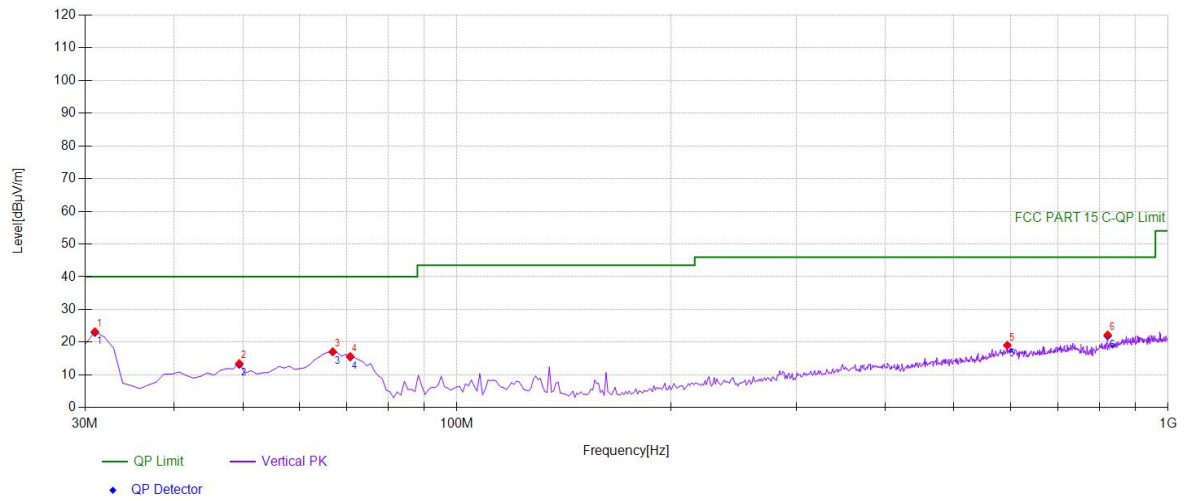
Final Data List					
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	30.971	-24.67	22.72	40.00	17.28
2	47.4775	-22.39	13.90	40.00	26.10
3	66.8969	-24.34	17.78	40.00	22.22
4	72.7227	-25.19	15.44	40.00	24.56
5	829.1091	-10.59	20.54	46.00	25.46
6	921.3514	-8.61	22.92	46.00	23.08



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	44.31	-24.67	19.64	PK	40.00	20.36	Horizontal
2	49.4194	36.10	-22.10	14.00	PK	40.00	26.00	Horizontal
3	57.1872	36.08	-23.00	13.08	PK	40.00	26.92	Horizontal
4	67.8679	41.64	-24.48	17.16	PK	40.00	22.84	Horizontal
5	70.7808	41.12	-24.88	16.24	PK	40.00	23.76	Horizontal
6	810.660	31.90	-10.86	21.04	PK	46.00	24.96	Horizontal

Final Data List					
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	30.971	-24.67	19.43	40.00	20.57
2	49.4194	-22.10	13.89	40.00	26.11
3	57.1872	-23.00	12.74	40.00	27.26
4	67.8679	-24.48	16.92	40.00	23.08
5	70.7808	-24.88	16.18	40.00	23.82
6	810.6607	-10.86	20.66	46.00	25.34

Test mode: Thread Frequency: Channel 16: 2480MHz

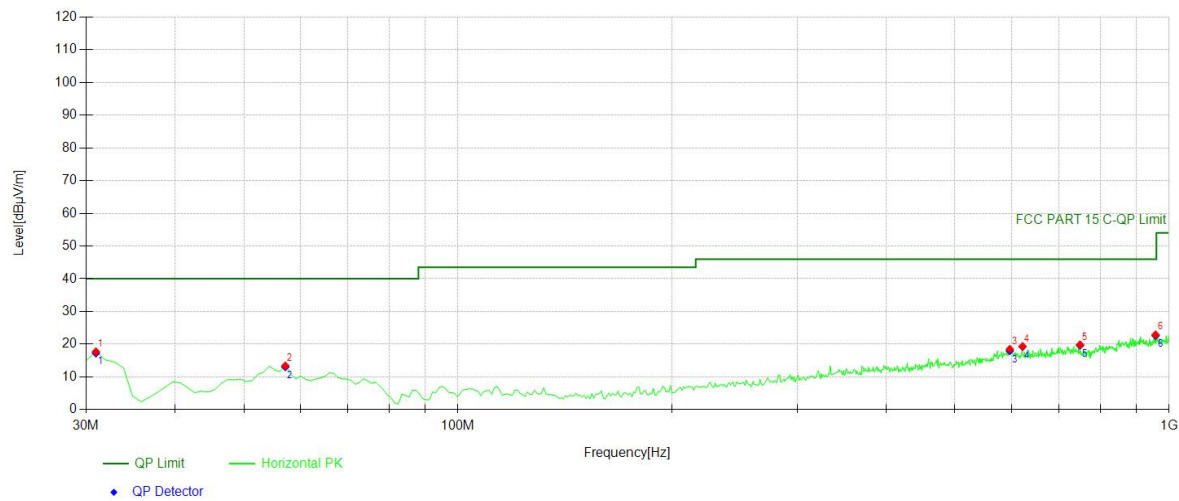


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	47.94	-24.67	23.27	PK	40.00	16.73	Vertical
2	49.4194	35.63	-22.10	13.53	PK	40.00	26.47	Vertical
3	66.8969	41.48	-24.34	17.14	PK	40.00	22.86	Vertical
4	70.7808	40.58	-24.88	15.70	PK	40.00	24.30	Vertical
5	594.134	31.52	-12.44	19.08	PK	46.00	26.92	Vertical
6	822.312	32.98	-10.68	22.30	PK	46.00	23.70	Vertical

Final Data List

NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	30.971	-24.67	22.95	40.00	17.05
2	49.4194	-22.10	13.21	40.00	26.79
3	66.8969	-24.34	17.00	40.00	23.00
4	70.7808	-24.88	15.48	40.00	24.52
5	594.1341	-12.44	19.04	46.00	26.96
6	822.3123	-10.68	21.93	46.00	24.07



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Level [dBμV/m]	Detector	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.971	42.39	-24.67	17.72	PK	40.00	22.28	Horizontal
2	57.1872	36.41	-23.00	13.41	PK	40.00	26.59	Horizontal
3	597.047	30.78	-12.28	18.50	PK	46.00	27.50	Horizontal
4	622.292	32.59	-13.26	19.33	PK	46.00	26.67	Horizontal
5	749.489	31.64	-11.79	19.85	PK	46.00	26.15	Horizontal
6	957.277	31.03	-8.13	22.90	PK	46.00	23.10	Horizontal

Final Data List					
NO.	Freq. [MHz]	Factor [dB/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]
1	30.971	-24.67	17.27	40.00	22.73
2	57.1872	-23.00	13.06	40.00	26.94
3	597.047	-12.28	18.01	46.00	27.99
4	622.2923	-13.26	19.26	46.00	26.74
5	749.4895	-11.79	19.63	46.00	26.37
6	957.2773	-8.13	22.60	46.00	23.40

8.6 CONDUCTED EMISSIONS TEST

8.6.1 Applicable Standard

According to FCC Part 15.207(a)

8.6.2 Conformance Limit

Frequency(MHz)	Conducted Emission Limit	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

8.6.3 Test Configuration

Test according to clause 7.3 conducted emission test setup

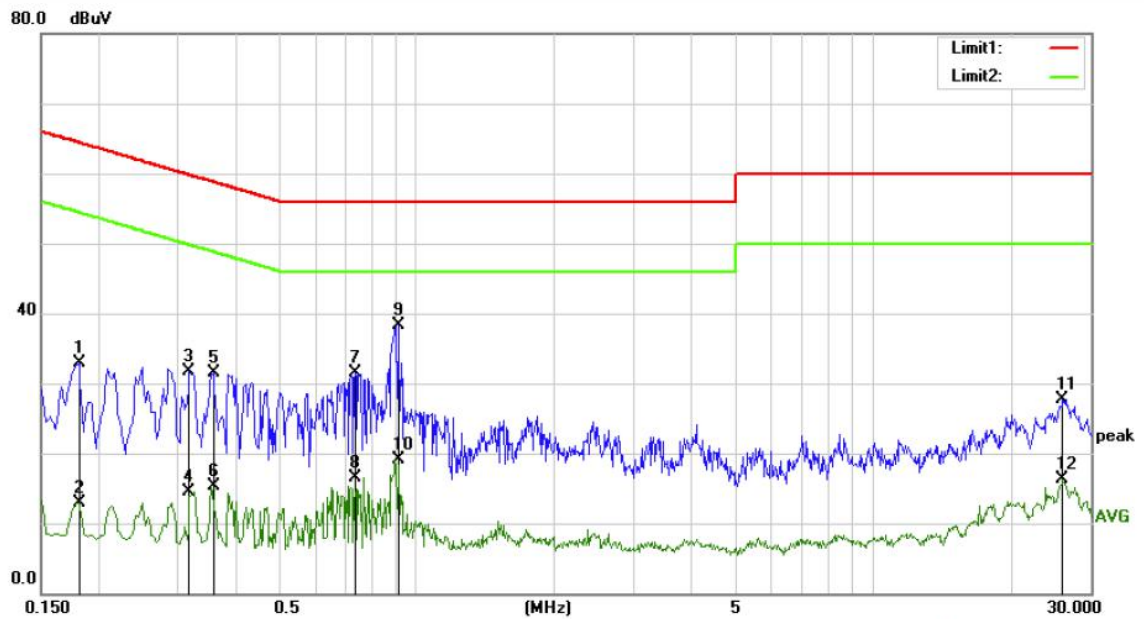
8.6.4 Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Repeat above procedures until all frequency measured were complete.

8.6.5 Test Results

PASS

The 120V & 240V voltage have been tested, and the worst result recorded was report as below.

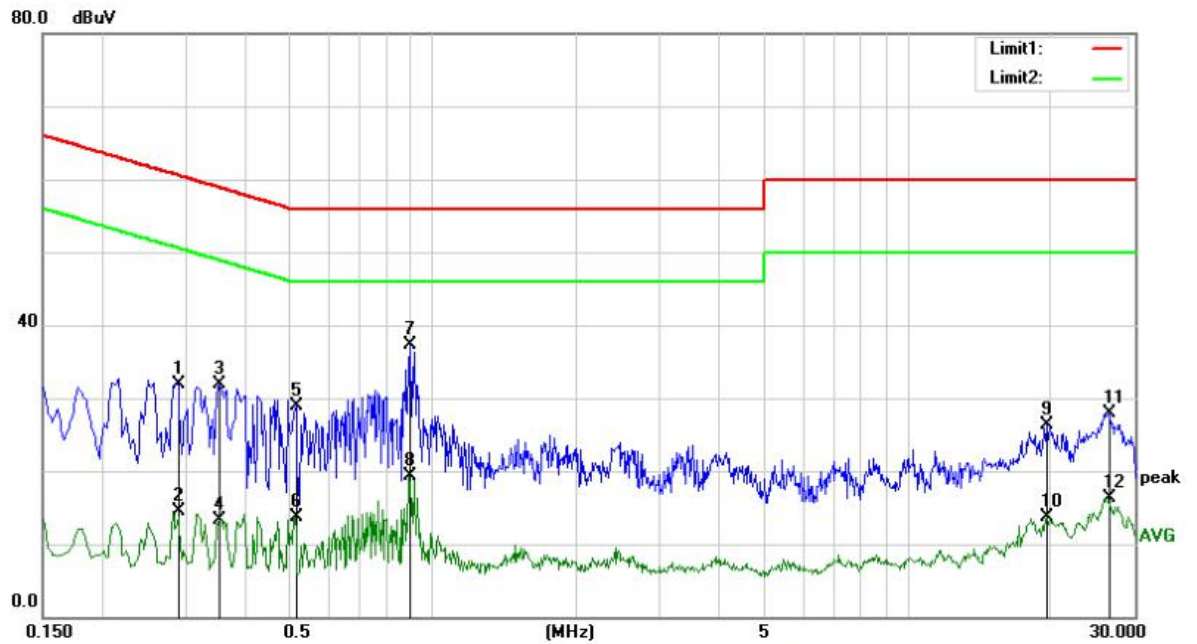


Site Conduction #1

Phase: **N**

Temperature: 24.9

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV	dBuV	dB		
1		0.1820	23.05	9.91	32.96	64.39	-31.43	QP	
2		0.1820	3.02	9.91	12.93	54.39	-41.46	AVG	
3		0.3180	21.80	9.92	31.72	59.76	-28.04	QP	
4		0.3180	4.62	9.92	14.54	49.76	-35.22	AVG	
5		0.3580	21.62	9.91	31.53	58.77	-27.24	QP	
6		0.3580	5.42	9.91	15.33	48.77	-33.44	AVG	
7		0.7340	21.62	9.96	31.58	56.00	-24.42	QP	
8		0.7340	6.47	9.96	16.43	46.00	-29.57	AVG	
9	*	0.9100	28.34	10.00	38.34	56.00	-17.66	QP	
10		0.9100	9.08	10.00	19.08	46.00	-26.92	AVG	
11		26.1060	16.86	10.86	27.72	60.00	-32.28	QP	
12		26.1060	5.43	10.86	16.29	50.00	-33.71	AVG	



Site Conduction #1				Phase: L1		Temperature: 24.9		
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector Comment
1		0.2900	21.99	9.92	31.91	60.52	-28.61	QP
2		0.2900	4.54	9.92	14.46	50.52	-36.06	AVG
3		0.3540	21.91	9.91	31.82	58.87	-27.05	QP
4		0.3540	3.49	9.91	13.40	48.87	-35.47	AVG
5		0.5140	19.07	9.93	29.00	56.00	-27.00	QP
6		0.5140	3.72	9.93	13.65	46.00	-32.35	AVG
7	*	0.8980	27.23	10.00	37.23	56.00	-18.77	QP
8		0.8980	9.22	10.00	19.22	46.00	-26.78	AVG
9		19.5820	15.60	10.62	26.22	60.00	-33.78	QP
10		19.5820	3.08	10.62	13.70	50.00	-36.30	AVG
11		26.4940	17.04	10.87	27.91	60.00	-32.09	QP
12		26.4940	5.39	10.87	16.26	50.00	-33.74	AVG

8.7 ANTENNA APPLICATION

8.7.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

8.7.2 Result

PASS

Temperature : 25°C ATM Pressure: 1011 mbar
Humidity : 45 % Test Engineer: GJ

The EUT is integrated antenna, the antenna gain is 0.55 dBi.

Note: ☒ Antenna use a permanently attached antenna which is not replaceable.
☐ Not using a standard antenna jack or electrical connector for antenna replacement
☐ The antenna has to be professionally installed (please provide method of installation)

which in accordance to section 15.203, please refer to the internal photos.

Detail of factor for radiated emission

Frequency(MHz)	Ant_F(dB)	Cab_L(dB)	Preamp(dB)	Correct Factor(dB)
0.009	20.6	0.03	\	20.63
0.15	20.7	0.1	\	20.8
1	20.9	0.15	\	21.05
10	20.1	0.28	\	20.38
30	18.8	0.45	\	19.25
30	11.7	0.62	27.9	-15.58
100	12.5	1.02	27.8	-14.28
300	12.9	1.91	27.5	-12.69
600	19.2	2.92	27	-4.88
800	21.1	3.54	26.6	-1.96
1000	22.3	4.17	26.2	0.27
1000	25.6	1.76	41.4	-14.04
3000	28.9	3.27	43.2	-11.03
5000	31.1	4.2	44.6	-9.3
8000	36.2	5.95	44.7	-2.55
10000	38.4	6.3	43.9	0.8
12000	38.5	7.14	42.3	3.34
15000	40.2	8.15	41.4	6.95
18000	45.4	9.02	41.3	13.12
18000	37.9	1.81	47.9	-8.19
21000	37.9	1.95	48.7	-8.85
25000	39.3	2.01	42.8	-1.49
28000	39.6	2.16	46.0	-4.24
31000	41.2	2.24	44.5	-1.06
34000	41.5	2.29	46.6	-2.81
37000	43.8	2.30	46.4	-0.3
40000	43.2	2.50	42.2	3.5

--- End of Report ---

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