ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Qualcomm Technologies, Inc. 5775 Morehouse Drive, San Diego, CA 92121-1714, United States
Manufacturer:	Qualcomm Technologies, Inc. 5775 Morehouse Drive, San Diego, CA 92121-1714, United States
Product Name:	Tri-Radio LGA Module for IoT applications
Brand Name:	Qualcomm
Model No.:	QCC743M-1
Report Number:	TERF2501000461ER
FCC ID	J9C-QCC743M1
Date of EUT Received:	January 20, 2025
Date of Test:	January 20, 2025～June 6, 2025
Issue Date:	June 20, 2025

Approved By _____
Jim Chang

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 C63.10:2020 and the energy emitted by the sample EUT comply with FCC rule part §15.247.

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
TERF2501000461ER	00	Original	Jun. 20, 2025	Candice Li	

Note:

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

2、 Variant information of HW SKU is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

Contents

1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Tri-Radio LGA Module for IoT applications
Brand Name:	Qualcomm
Model No.:	QCC743M-1
HW SKU:	QCC743M-1B, QCC743M-1U, QCC743M-1P
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	02B102149C007B
Power Supply:	3.3 Vdc from
Test Software (Name/Version)	Qconn RCT /Version 1.8.9

1.2 RF Specification

Radio Technology:	Thread
Frequency Range:	2405 – 2480MHz
Channel number:	16 channels
Modulation type:	O-QPSK
Transmit Power:	20.79 dBm

1.3 HW SKU Difference Table

HW SKU	QCC743M-1B	QCC743M-1U	QCC743M-1P
Antenna type	1 type: PIFA (for PCB printed antenna)	3 types: PIFA, Mono-pole, Dipole (for an-tenna connector on board)	3 types: PIFA, Monopole, Dipole (for SiP module. It has RF pad connect to ex-ternal PCB which has PCB ANT or RF connector)
RF connector	Switch connector	MHF4 connector	No
PCB dimension	12.28*17.28mm	12.28*12.28mm	12.28*12.28mm

Note: The QCC743M-1U, QCC743M-1B, and QCC743M-1P modules are designed to support two crystals (40 MHz and 32.768 kHz). However, depending on the hardware configuration, the modules may be shipped with either two crystals (40 MHz and 32.768 kHz) or only one crystal (40 MHz).

1.4 Antenna Designation

Antenna Type	Antenna Part No.	Freq.	Peak Antenna Gain (dBi)
PIFA Antenna	QCC743M-1B	2.4GHz	2.49
PIFA Antenna	RFPCA441010EMABY01		3.19
Monopole Antenna	RFPCA501010EMABY01		3.12
Dipole Antenna	RFPCA521010EMABY01		3.37

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. The antenna information is provided by the applicant, and the laboratory shall not be held liable for the accuracy, completeness, or reliability of any applicant-supplied data.

1.5 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
FCC KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10:2020

1.6 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 2		
		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 C	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.

Temperature:	17-23	°C	Relative Humidity:	47-71	%
Test site	Conducted 2		Test Start:	01/22/2025	
Test Engineer:	Dannis_Chen		Test Done:	05/05/2025	

1.7 Special Accessories

There are no special accessories used while test was conducted.

1.8 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 Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference 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 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 Measurement Results Explanation Example

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

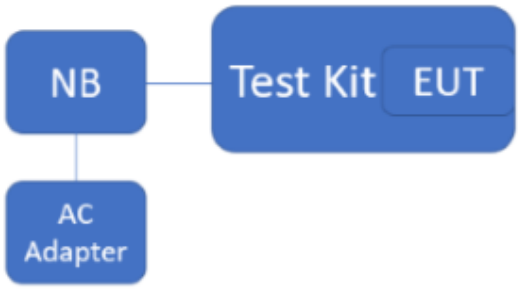
Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

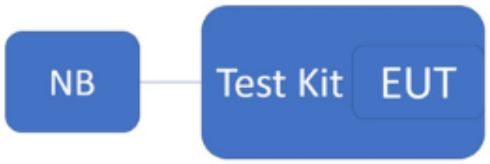
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

2.5 Test Configuration

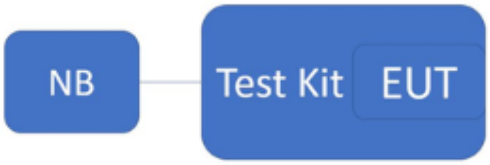
Conduction Setup



Conducted Setup



Radiated Setup



2.6 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
QCC743 carrier board	Fii	95.3562T00	N/A	N/A	N/A
USB3.0 to USB-C data cable	UGREEN	40888	N/A	N/A	N/A
Notebook	HP	HSN-Q35C-4	5CD2428X3N	N/A	N/A
AC Adapter	HP	TPN-LA16	N/A	N/A	N/A

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
QCC743 carrier board	Fii	95.3562T00	N/A	N/A	N/A
USB3.0 to USB-C data cable	UGREEN	40888	N/A	N/A	N/A
Notebook	Lenovo	T440P	PB-02Y6RK 14/07	N/A	N/A

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
QCC743 carrier board	Fii	95.3562T00	N/A	N/A	N/A
USB3.0 to USB-C data cable	UGREEN	40888	N/A	N/A	N/A
Notebook	HP	HSN-Q35C-4	5CD2428X3N	N/A	N/A

3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	Emission Bandwidth	Compliant
§15.209 §15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.209 §15.247(d)	Radiated Spurious Emission	Compliant
§15.205	Restricted Bands	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

2400~2483.5 MHz			
CH	Freq. (MHz)	CH	Freq. (MHz)
11	2405	21	2455
12	2410	22	2460
13	2415	23	2465
14	2420	24	2470
15	2425	25	2475
16	2430	26	2480
17	2435		
18	2440		
19	2445		
20	2450		

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.

CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Thread	11 to 26	11,18,24,25,26	O-QPSK	0.25

TRANSMIT RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Thread	11 to 26	18	O-QPSK	0.25
TRANSMIT RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Thread	11 to 26	11,18,26	O-QPSK	0.25

Note:

1. The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.
2. Radiated test was done with 50ohm terminator on antenna port.

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	1.54	dB
Output Power measurement	+/-	0.97	dB
Emission Bandwidth	+/-	1.38	Hz
Conducted emission measurement	+/-	0.77	dB
Peak Power Density	+/-	0.61	dB
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.1**	**dB**	30MHz - 1000MHz
	+/-	**3.37**	**dB**	1GHz - 18GHz
	+/-	**3.83**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.1**	**dB**	30MHz - 1000MHz
	+/-	**3.37**	**dB**	1GHz - 18GHz
	+/-	**3.83**	**dB**	18GHz - 40GHz
Radiated Spurious Emission	**+/-**	**2**	**dB**	33GHz-50GHz
	+/-	**1.59**	**dB**	50GHz-60GHz
	+/-	**1.71**	**dB**	60GHz-90GHz
	+/-	**1.64**	**dB**	90GHz-140GHz
	+/-	**3.84**	**dB**	140GHz-220GHz

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2024	06/21/2025
EMI Test Receiver	R&S	ESCI 7	100759	08/28/2024	08/27/2025
LISN	SCHWARZBECK	NSLK 8127	1040	09/07/2024	09/06/2025
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2024	06/21/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
Attenuator	Mini-Circuits	BW-S10W2+	14	12/11/2024	12/10/2025
DC Block	Mini-Circuits	BLK-18-S+	31129	12/11/2024	12/10/2025
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	07/08/2024	07/07/2025
Power Meter	Anritsu	ML2496A	2138003	10/09/2024	10/08/2025
Power Sensor	Anritsu	MA2411B	1911393	10/09/2024	10/08/2025
Power Sensor	Anritsu	MA2411B	1911394	10/09/2024	10/08/2025
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL. (mm/dd/yyyy)	CAL DUE. (mm/dd/yyyy)
4G High Pass Filter	WI	WHKX4.0	22	12/11/2024	12/10/2025
Attenuator	Mini-Circuits	BW-S10W2+	16	12/11/2024	12/10/2025
Band Reject Filter 2400-2483.5	EWT	EWT-14-0166	M3	12/11/2024	12/10/2025
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/09/2024	08/08/2025
Coaxial Cables	EMCI+Huber Suhner	EMC107-SM-SM-1000 +SUCOFLEX 104PEA +EMC107-SM-SM-1500 +SUCOFLEX 106	RX Cable 9K-18G (221110+MY4251/4PEA+221106+76096/6)	08/30/2024	08/29/2025
Coaxial Cables	Huber Suhner	SUCOFLEX 102	RX Cable 18G-40G MY2630/2+805062/2	08/30/2024	08/29/2025
EMI Test Receiver	R&S	ESCI 7	100759	08/28/2024	08/27/2025
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071541	07/08/2024	07/07/2025
Horn Antenna	RF SPIN	DRH0844	LE2D05A0844	07/10/2024	07/09/2025
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/23/2024	09/22/2025
Loop Antenna	COM-POWER	AL-130R	10160104	12/19/2024	12/18/2025
Pre-Amplifier	EMCI	EMC118A45SEE	980868	08/30/2024	08/29/2025
Pre-Amplifier	EMCI	EMC184045SEE	9080939	08/30/2024	08/29/2025
Pre-Amplifier	HP	8447D	2944A07676	08/30/2024	08/29/2025
Site Cal	SGS	SAC 3	N/A	08/30/2024	08/29/2025
SMA Termination	RF Microwave WOKEN	WTER-18S2	N/A	N/A	N/A
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R

NOTE: *N.C.R refers to Not Calibrated Required.*

7 CONDUCTED EMISSION TEST

7.1 Standard Applicable:

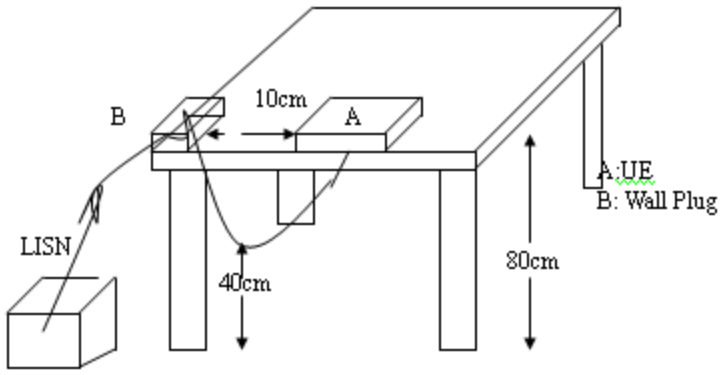
Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

7.2 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

7.3 Test Setup



7.4 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

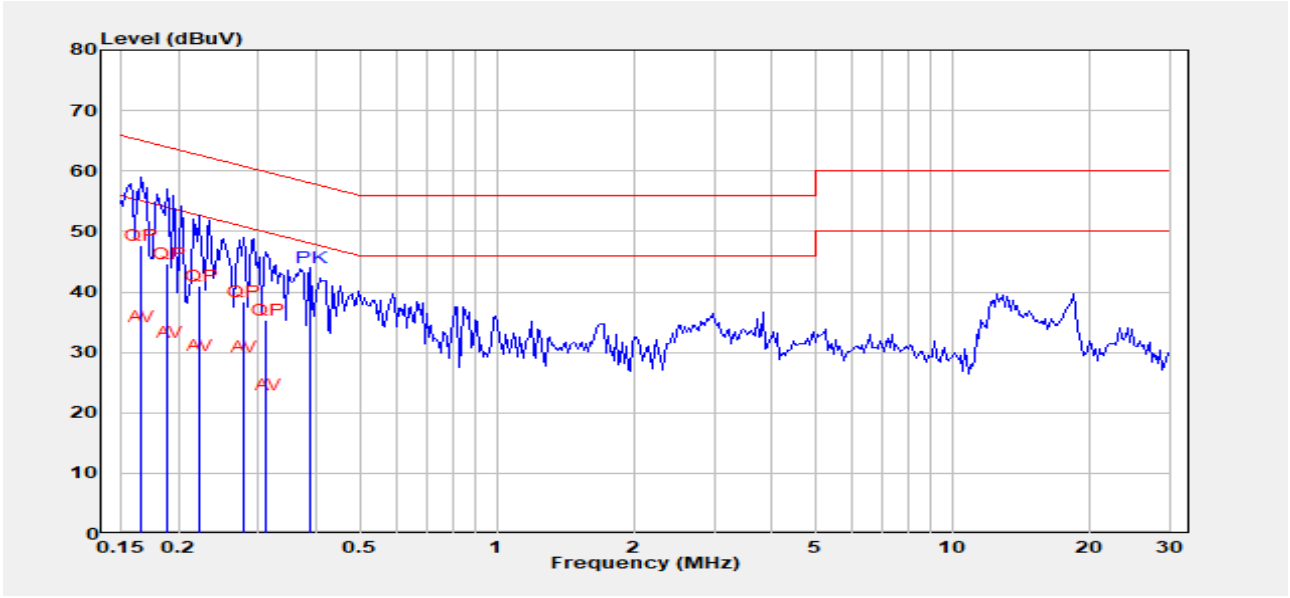
7.5 Measurement Result:

Note1: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closest to the limit.

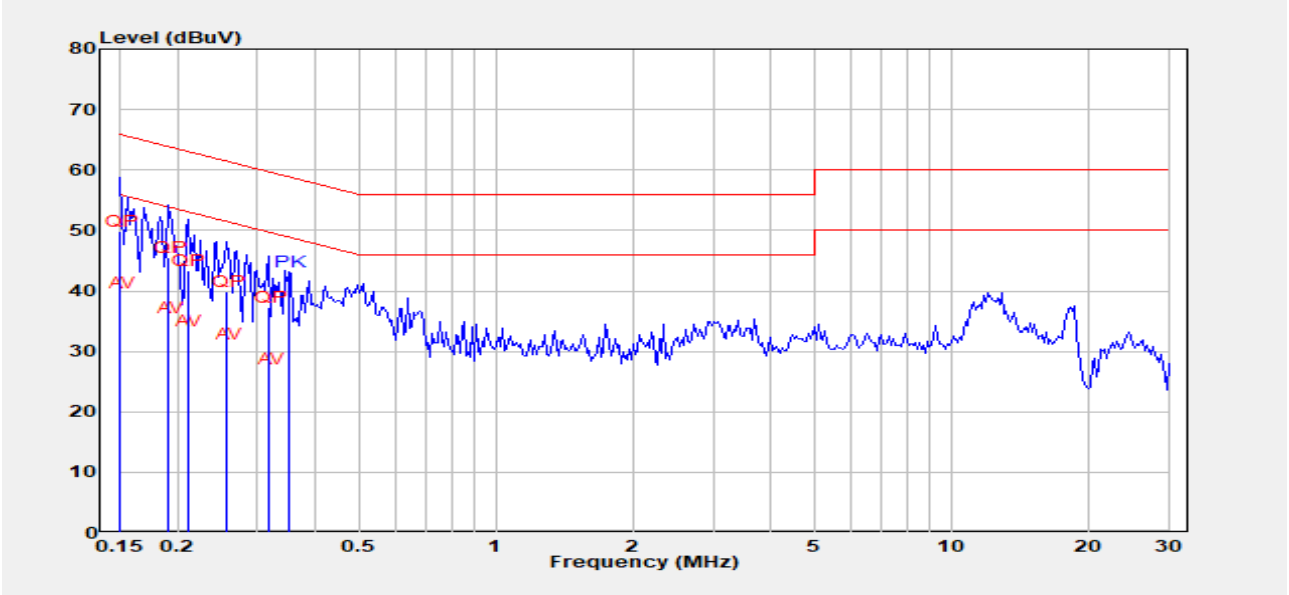
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2501000461ER	Test Site	:Conduction 1
Operation Mode	:Thread	Test Date	:2025-02-13
Power	:120V/60Hz	Temp./Humi.	:21.3℃/61%
Probe	:L	Engineer	:Nick Lin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.165	Average	24.23	10.13	34.36	55.21	-20.85
0.165	QP	37.54	10.13	47.67	65.21	-17.54
0.189	Average	21.63	10.13	31.76	54.06	-22.30
0.189	QP	34.58	10.13	44.71	64.06	-19.35
0.222	Average	19.44	10.13	29.57	52.74	-23.17
0.222	QP	30.89	10.13	41.02	62.74	-21.72
0.277	Average	19.08	10.14	29.22	50.90	-21.68
0.277	QP	28.22	10.14	38.36	60.90	-22.54
0.312	Average	12.78	10.14	22.92	49.93	-27.00
0.312	QP	25.23	10.14	35.37	59.93	-24.55
0.389	Peak	33.78	10.15	43.93	58.08	-14.15

Report Number	:TERF2501000461ER	Test Site	:Conduction 1
Operation Mode	:Thread	Test Date	:2025-02-13
Power	:120V/60Hz	Temp./Humi.	:21.3℃/61%
Probe	:N	Engineer	:Nick Lin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.150	Average	29.66	10.12	39.78	56.00	-16.22
0.150	QP	39.73	10.12	49.85	66.00	-16.15
0.191	Average	25.44	10.12	35.56	53.98	-18.42
0.191	QP	35.33	10.12	45.45	63.98	-18.53
0.211	Average	23.31	10.12	33.43	53.18	-19.75
0.211	QP	33.28	10.12	43.40	63.18	-19.78
0.258	Average	20.99	10.13	31.12	51.51	-20.39
0.258	QP	29.77	10.13	39.90	61.51	-21.61
0.318	Average	16.93	10.14	27.07	49.75	-22.68
0.318	QP	27.23	10.14	37.37	59.75	-22.38
0.350	Peak	32.94	10.14	43.08	58.96	-15.88

8 PEAK OUTPUT POWER MEASUREMENT

8.1 Standard Applicable:

8.1.1 Duty Cycle

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

8.1.2 FCC

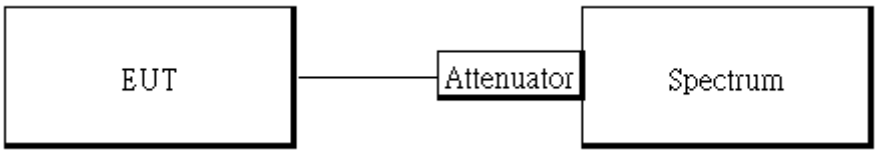
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

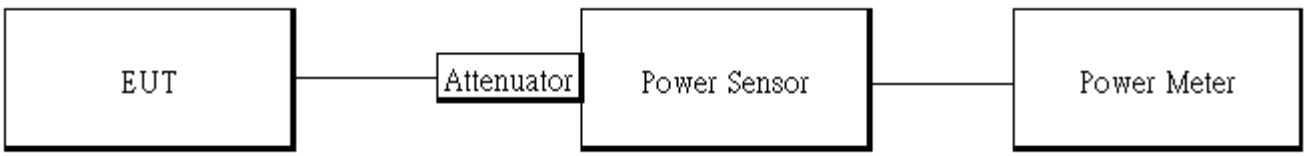
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

8.2 Test Setup

8.2.1 Duty Cycle



8.2.2 Output Power



8.3 Measurement Procedure:

8.3.1 Duty Cycle

1. Place the EUT on the table and set it in transmitting mode.
2. Set span = Zero
3. RBW = 8MHz, VBW = 8MHz,
4. Detector = Peak

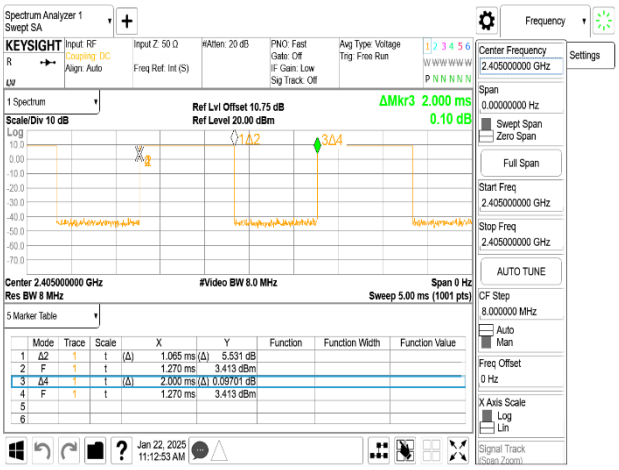
8.3.2 Output Power

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
4. Record the max. Reading as observed from Power Meter.
5. Repeat above procedures until all test default channel measured was complete.

8.4 Duty Factor:

Mode	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
Thread	53.25	2.74	0.94	1.00

Thread_LowCH11-2405MHz



8.5 Output Power:

8.5.1 Peak & Avg

Thread mode:

CH	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	Required Limit (dBm)
11	2405	20	**20.79**	30
18	2440	20	20.76	30
24	2470	20	20.60	30
25	2475	19	19.21	30
26	2480	10	10.21	30
CH	**Frequency (MHz)**	**Power Setting**	**Avg. Output Power (dBm)**	**Required Limit (dBm)**
11	2405	20	20.51	30
18	2440	20	20.49	30
24	2470	20	20.53	30
25	2475	19	19.19	30
26	2480	10	10.04	30

Note:

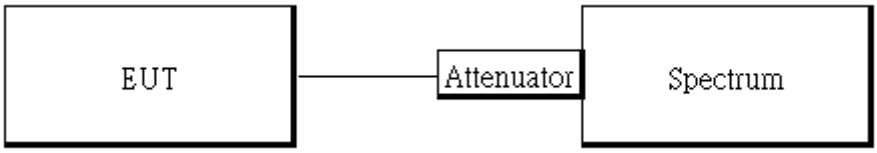
1.Measured by power meter, cable loss 10.75 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

9 EMISSION BANDWIDTH MEASUREMENT

9.1 Standard Applicable

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

9.2 Test Setup



9.3 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 spectrum analyzer.

9.3.1 6dB BW measurements

1. The testing follows the Measurement Procedure of the KDB 558074 D01.
2. Set the spectrum analyzer as
   RBW= 100 kHz,
   VBW = 3 X RBW,
   Span= 2 to 5 times of the OBW,
   Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of -6dB.
4. Repeat above procedures until all test default channel is completed.

9.3.2 99% BW measurements

1. The testing follows the Measurement Procedure of the RSS-Gen section 6.7.
2. Set the spectrum analyzer as
   RBW= 1 % to 5% of 99% and -6dB Bandwidth,
   VBW ≥ 3 X RBW,
   Span= large enough to capture all products of the modulation process
   Sweep=auto, Detector = Peak, and Max hold.
3. Mark the upper and lower frequencies of 99% and -6dB.
4. Repeat above procedures until all test default channel is completed.

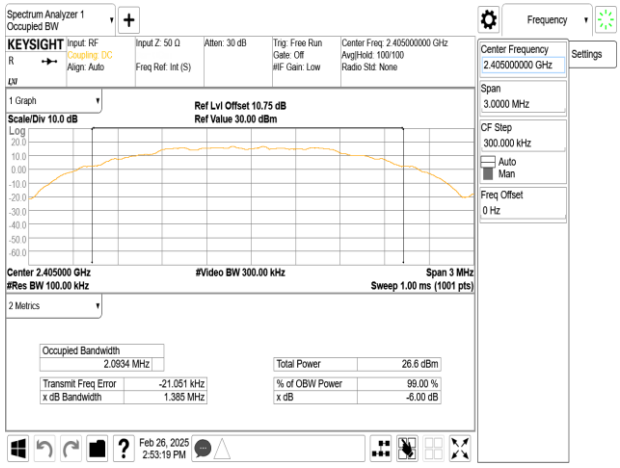
9.4 Measurement Result:

9.4.1 6dB BW measurements

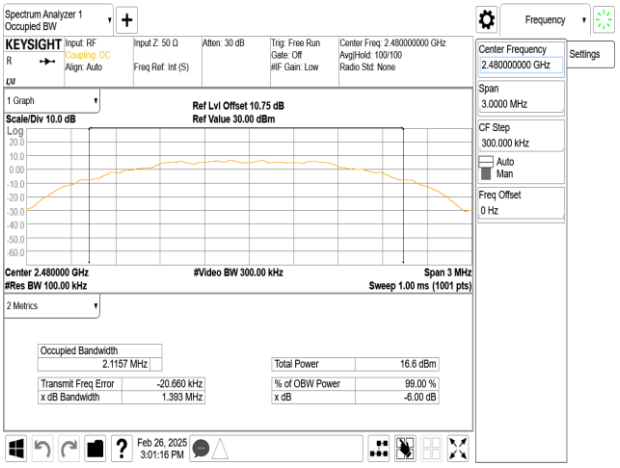
Thread mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2405	1.385	≧ 0.5	PASS
2440	1.385	≧ 0.5	PASS
2480	1.393	≧ 0.5	PASS

OBW_Thread_LowCH11-2405MHz



OBW_Thread_HighCH26-2480MHz



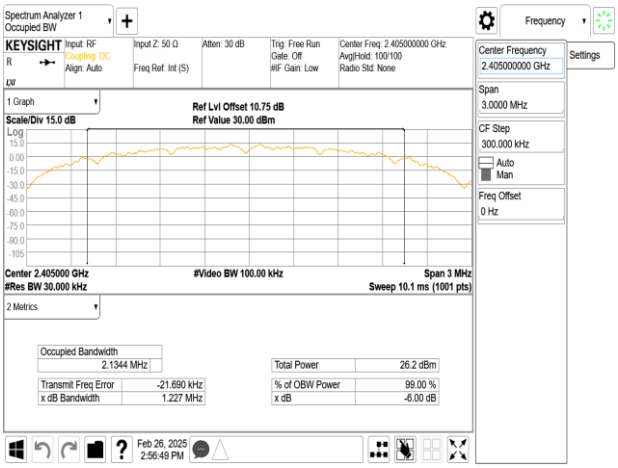
OBW_Thread_MidCH18-2440MHz

9.4.2 99% Bandwidth

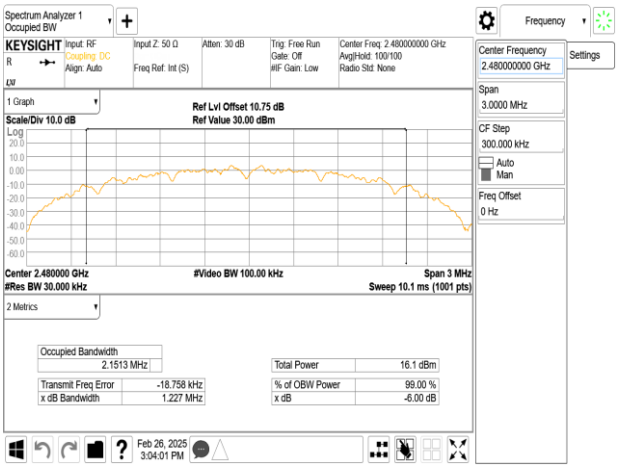
Thread mode

Frequency (MHz)	99%Bandwidth (MHz)
2405	2.1344
2440	2.1361
2480	2.1513

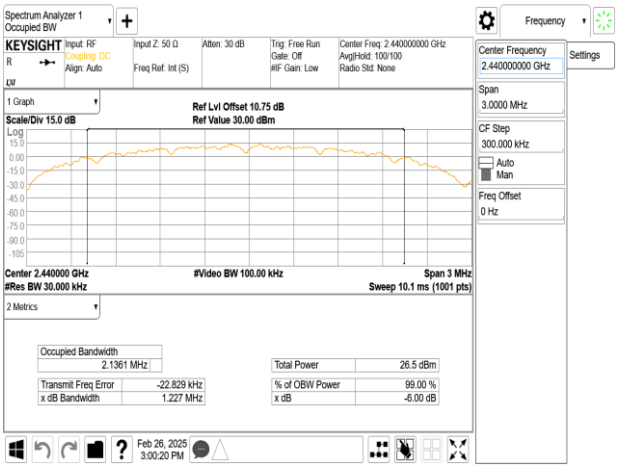
IC OBW_Thread_LowCH11-2405MHz



IC OBW_Thread_HighCH26-2480MHz



IC OBW_Thread_MidCH18-2440MHz

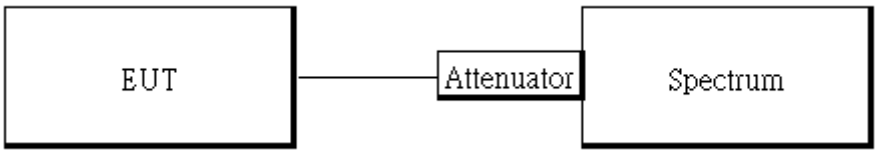


10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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. In addition, 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).

10.2 Test Setup



10.3 Measurement Procedure

10.3.1 Reference Level of Emission Limit:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

10.3.2 Conducted Band Edge:

In any 100 kHz bandwidth outside the frequency band

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Set DL as the limit = reading on marker of reference level measurement – 20dBm
7. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

10.3.3 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set RBW = 100 kHz & VBW=300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

10.4 Measurement Result

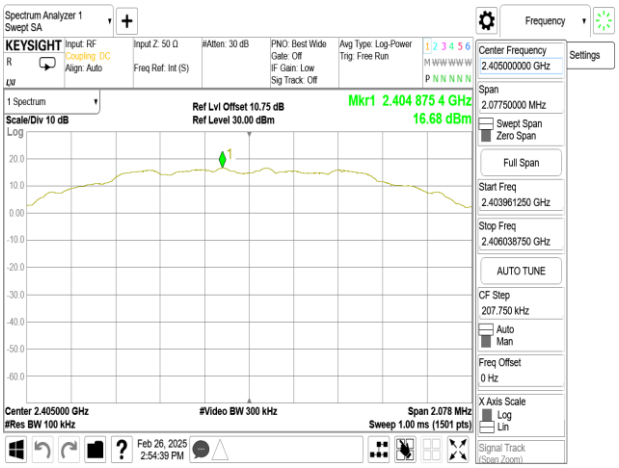
Thread_Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2405	16.68	-3.32
2440	17.03	-2.97
2480	6.60	-13.40

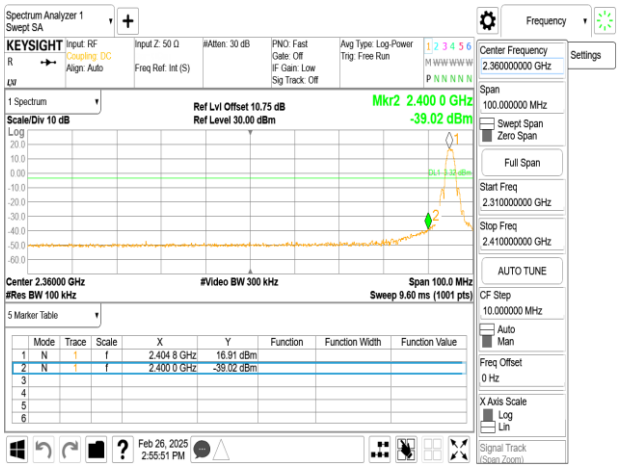
Note:

1.cable loss as 10.75dB that offsets in the spectrum
2.Refer to next page for plots.

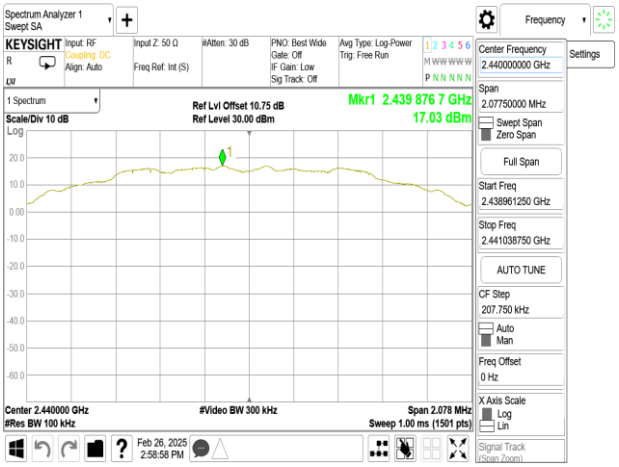
Reference Level_Thread_LowCH11-2405MHz



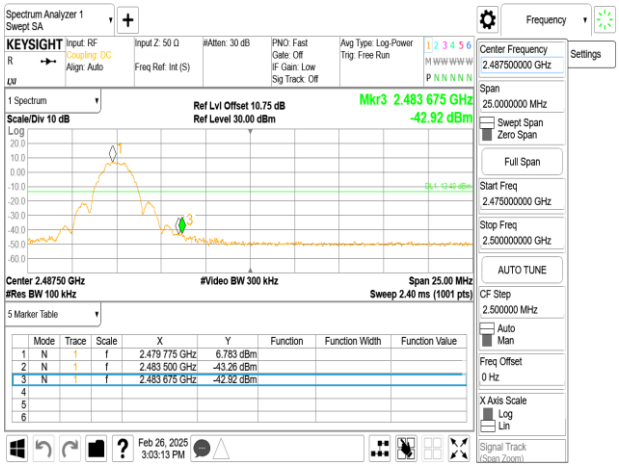
Band Edge_Thread_LowCH11-2405MHz



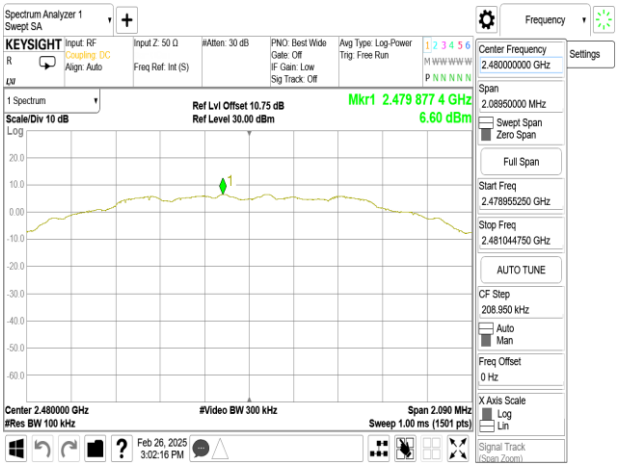
Reference Level_Thread_MidCH18-2440MHz



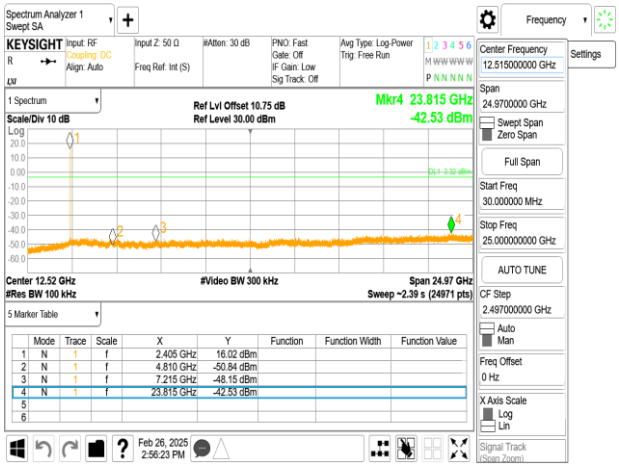
Band Edge_Thread_HighCH26-2480MHz



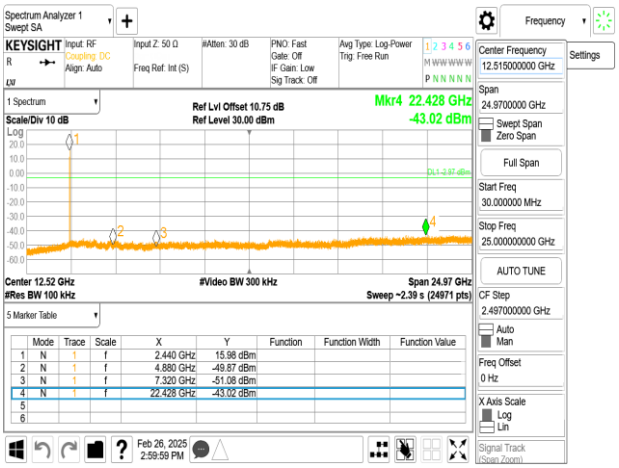
Reference Level_Thread_HighCH26-2480MHz



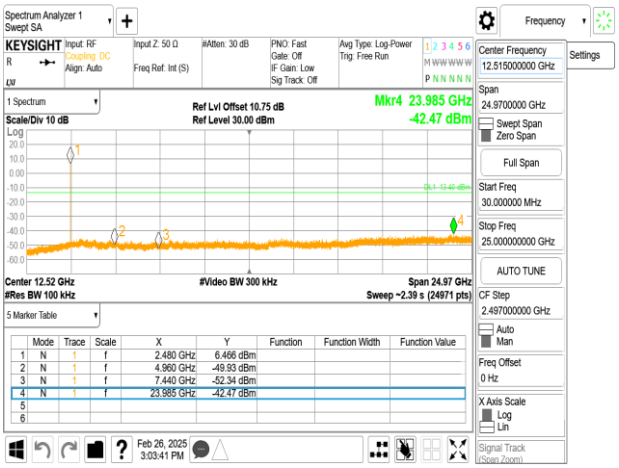
Spurious Emission_Thread_LowCH11-2405MHz



Spurious Emission_Thread_MidCH18-2440MHz



Spurious Emission_Thread_HighCH26-2480MHz



11 BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

11.1 Standard Applicable

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. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

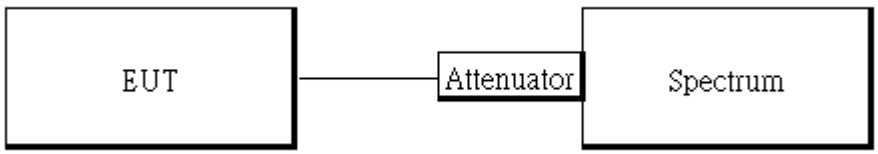
And according to §15.33(a) (1) for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note: The lower limit shall apply at the transition frequencies.

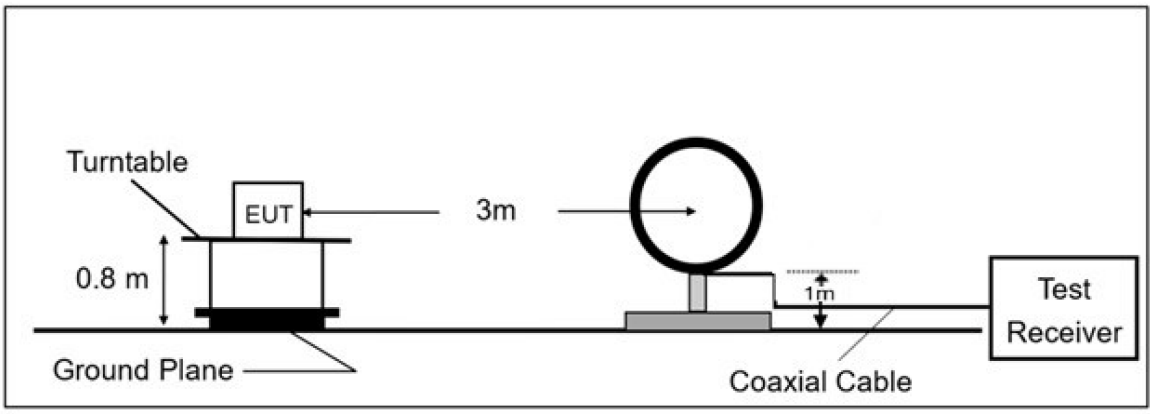
11.2 Test Setup

11.2.1 Bandedge & Emission

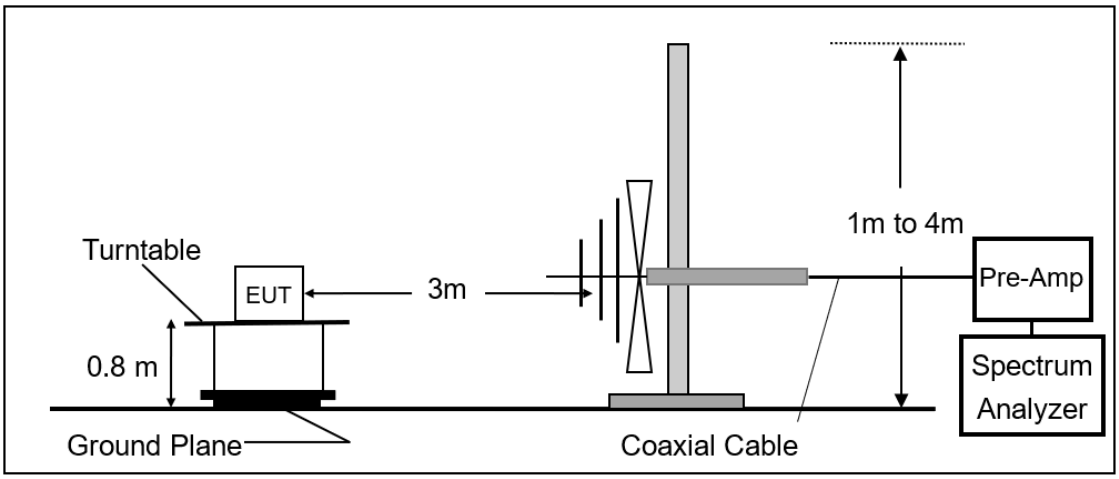


11.2.2 Radiated Spurious Emission

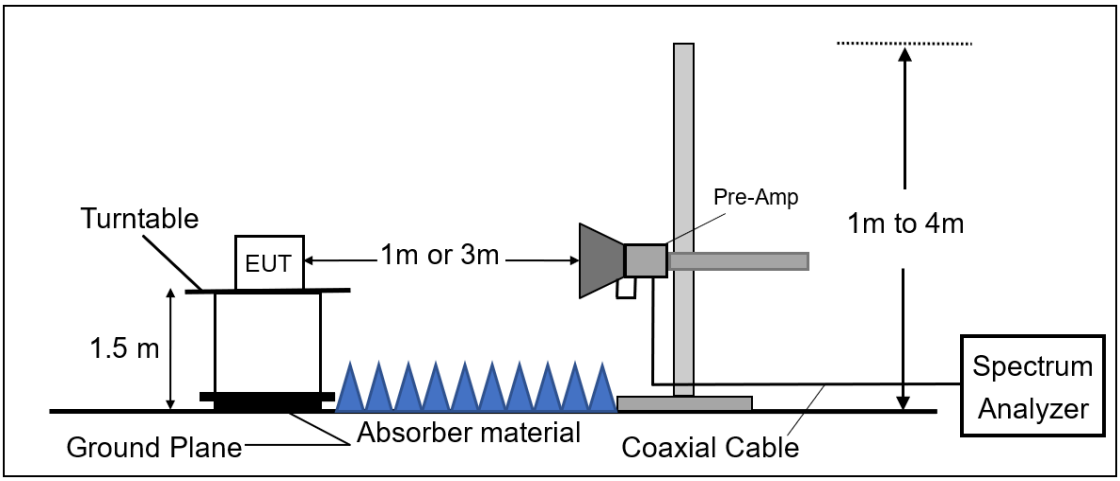
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



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



11.3 Measurement Procedure

11.3.1 Bandedge measurements

1. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz, Detector = Peak for Maximum Emission Measurements at frequency above 1 GHz, Sweep time = No faster than coupled (auto) time, Trace mode = max-hold, Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time and number of sweep points may be lengthened for low duty cycle applications.)
2. Set the spectrum analyzer as RBW=100 KHz, VBW=300KHz, Detector = RMS for Maximum Emission Measurements at frequency above 1 GHz, Sweep time = AUTO
3. Compute the power by integrating the spectrum over 1 MHz using the instrument's band-power measurement function with band limits set equal to the emission frequency (femission) ± 0.5 MHz. If the spectrum analyzer does not have a band-power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission ± 0.5 MHz.
4. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle.

11.3.2 Radiated Spurious Emission measurements

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.

9. When 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.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

11.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where *FS = Field Strength* *CL = Cable Attenuation Factor (Cable Loss)*
RA = Reading Amplitude *AG = Amplifier Gain*
AF = Antenna Factor

*The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)*

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

11.5 Test Results of Radiated Spurious Emissions from 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

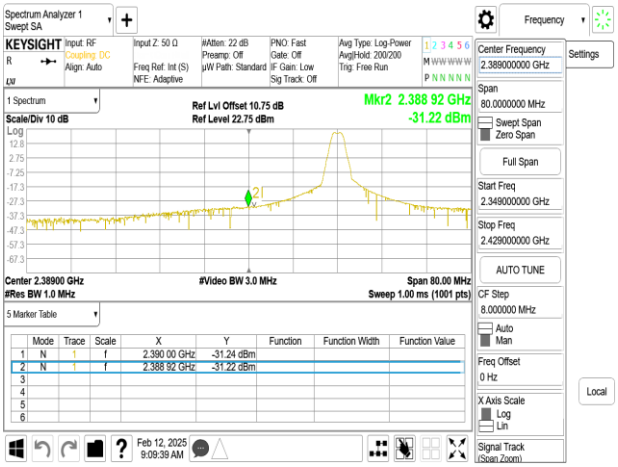
11.5.1 CBE

Thread

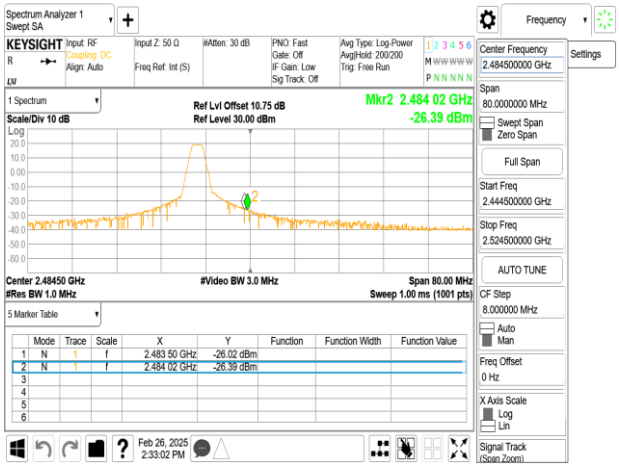
Channel	Frequency (MHz)	Raw Value(dBm) Chain 0	Duty factor (dB)	Antenna Peak Gain (dBi) Chain 0	EIRP (dBm)	Emission Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	
11	2405	-31.220	N/A	3.37	-27.85	67.35	-6.65	74	PK
		-58.443	2.74	3.37	-52.33	42.87	-11.13	54	AV
24	2470	-29.100	N/A	3.37	-25.73	69.47	-4.53	74	PK
		-55.367	2.74	3.37	-49.26	45.94	-8.06	54	AV
25	2475	-26.020	N/A	3.37	-22.65	72.55	-1.45	74	PK
		-54.022	2.74	3.37	-47.91	47.29	-6.71	54	AV
26	2480	-25.130	N/A	3.37	-21.76	73.44	-0.56	74	PK
		-52.179	2.74	3.37	-46.07	49.13	-4.87	54	AV

Peak

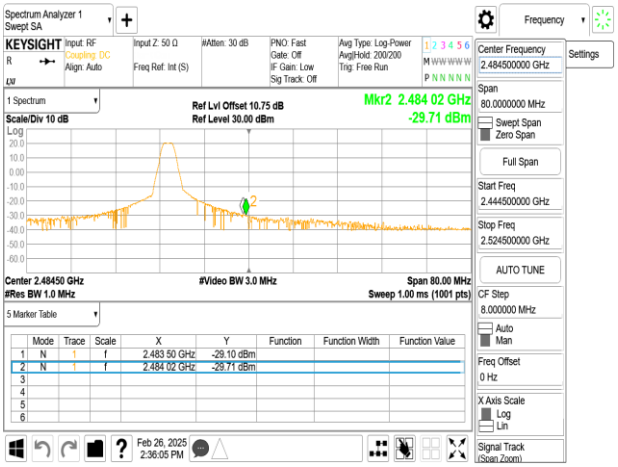
Thread_Chain0_2405MHz



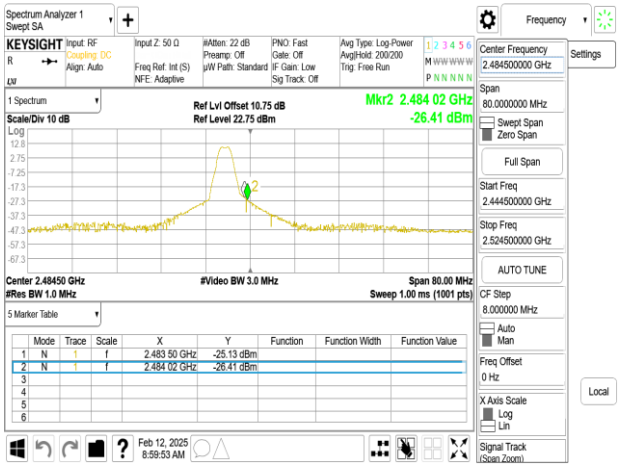
Thread_Chain0_2475MHz



Thread_Chain0_2470MHz

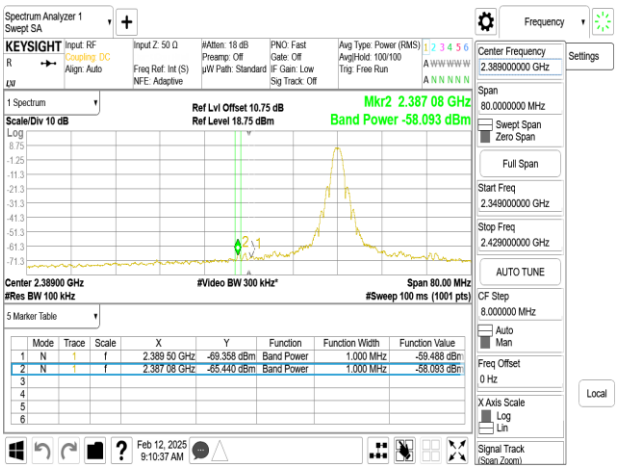


Thread_Chain0_2480MHz

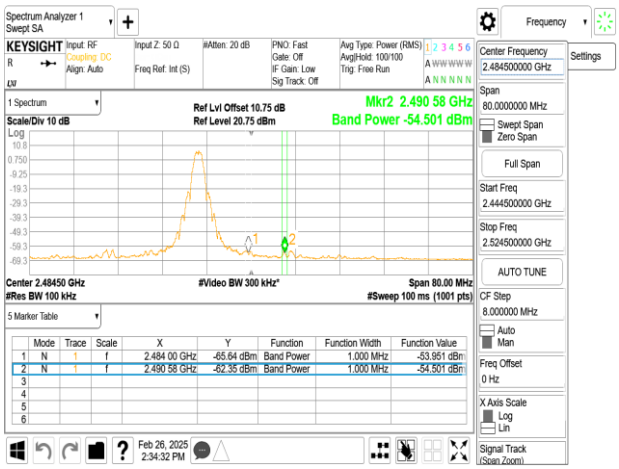


Average

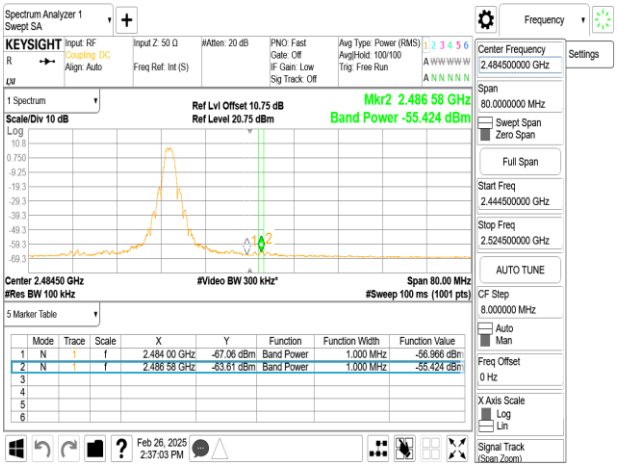
Thread_Chain0_2405MHz



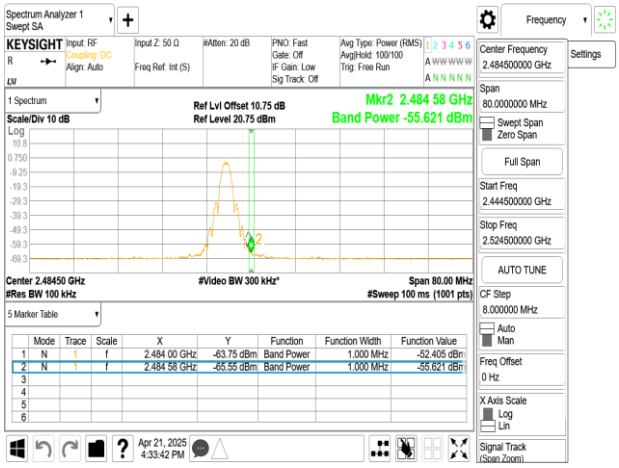
Thread_Chain0_2475MHz



Thread_Chain0_2470MHz

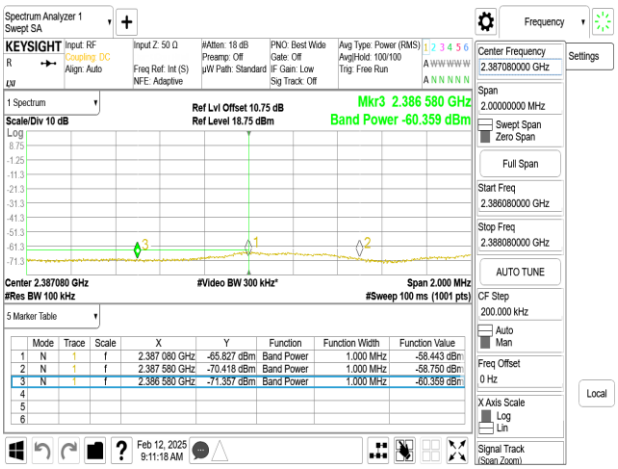


Thread_Chain0_2480MHz

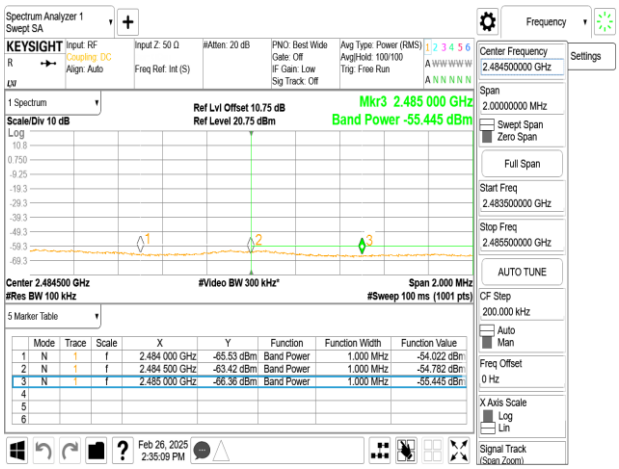


Average IM

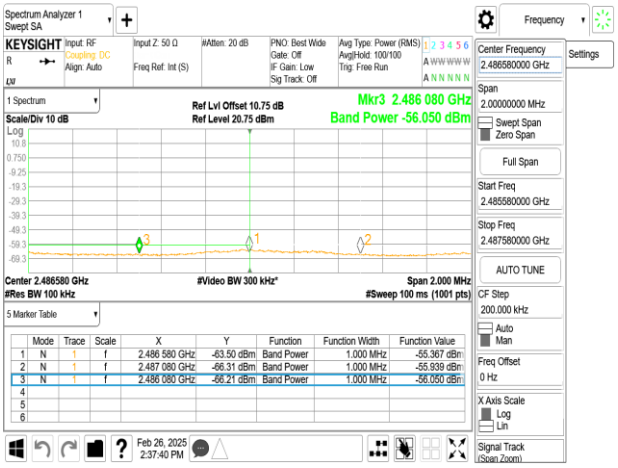
Thread_Chain0_2405MHz



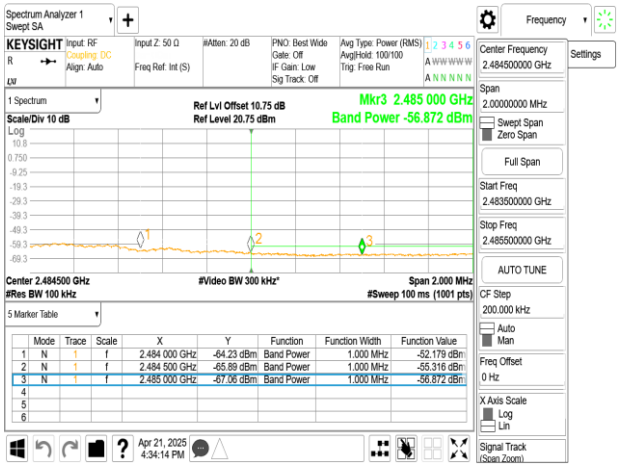
Thread_Chain0_2475MHz



Thread_Chain0_2470MHz



Thread_Chain0_2480MHz



11.5.1 Conducted Emission

30MHz~1GHz

Thread

Channel	Frequency (MHz)	Raw Value(dBm)	Correction Factor(dB)	EIRP (dBm)	Emission Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	
		Chain 0	Chain 0					
18	2440	-82.210	8.07	-74.14	21.06	-18.94	40	PK
		-82.730	8.07	-74.66	20.54	-22.96	43.5	PK
		-61.118	8.07	-53.05	42.15	-3.85	46	PK
		-79.600	8.07	-71.53	23.67	-22.33	46	PK
		-64.350	8.07	-56.28	38.92	-7.08	46	PK
		-77.150	8.07	-69.08	26.12	-27.88	54	PK

Note:
Correction Factor=maximum ground reflection factor+Antenna Gain

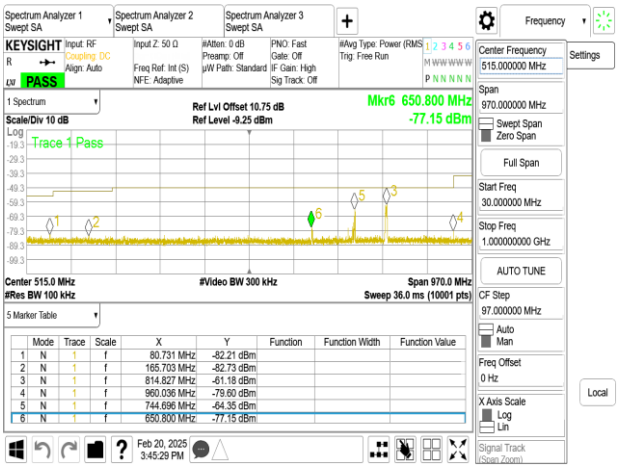
1~26.5GHz

Thread

Channel	Frequency (MHz)	Raw Value(dBm)	Duty factor (dB)	Antenna Peak Gain	EIRP (dBm)	Emission Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	
		Chain 0		Chain 0					
11	2405	-35.870	N/A	3.37	-32.50	62.70	-11.30	74	PK
		-55.291	2.74	3.37	-49.18	46.02	-7.98	54	AV
18	2440	-40.140	N/A	3.37	-36.77	58.43	-15.57	74	PK
		-57.002	2.74	3.37	-50.89	44.31	-9.69	54	AV
26	2480	-49.570	N/A	3.37	-46.20	49.00	-25.00	74	PK
		-62.380	2.74	3.37	-56.27	38.93	-15.07	54	AV

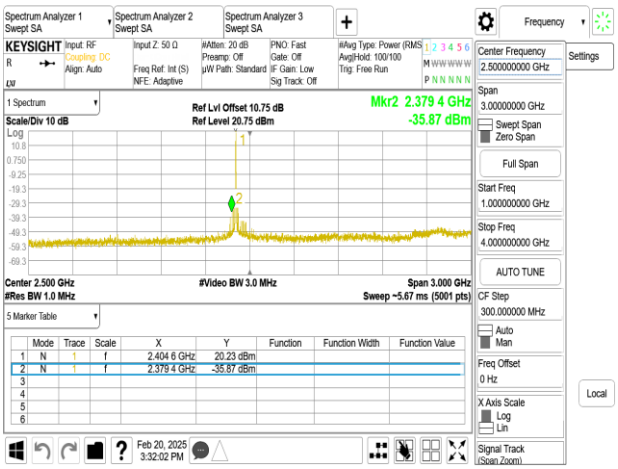
Peak (30MHz~1GHz)

Thread_Chain0_2440MHz_0.03MHz-1GHz

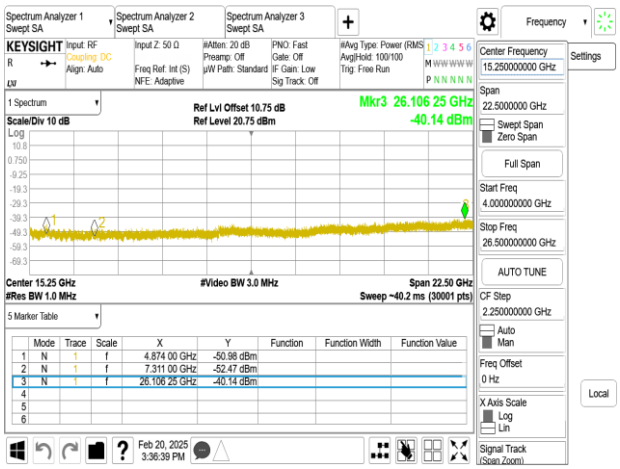


Peak (1~26.5GHz)

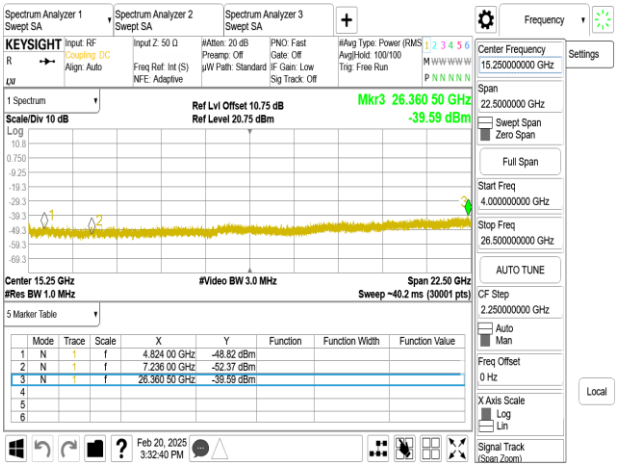
Thread_Chain0_2405MHz_1-4GHz



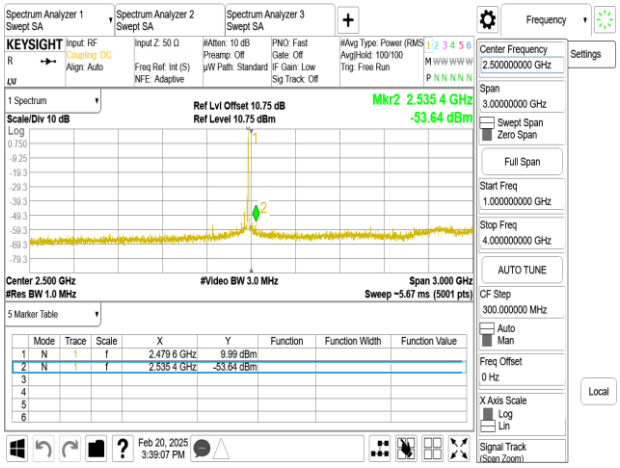
Thread_Chain0_2440MHz_4-26.5GHz



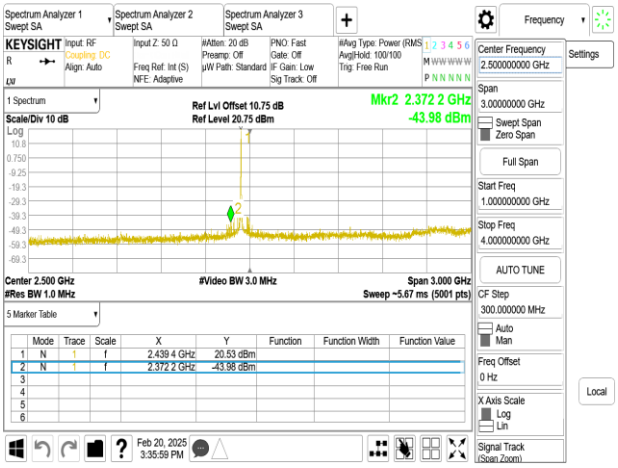
Thread_Chain0_2405MHz_4-26.5GHz



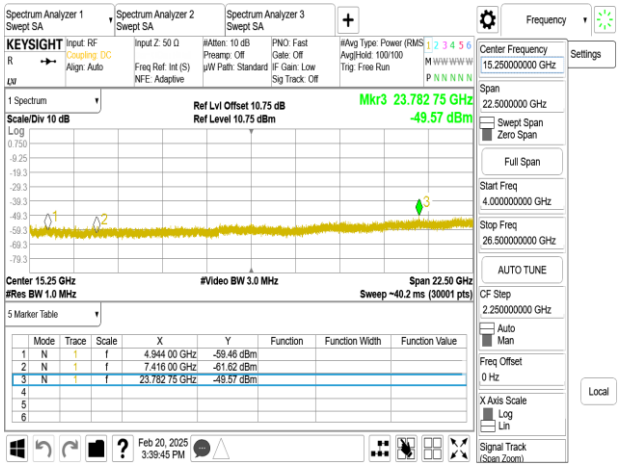
Thread_Chain0_2480MHz_1-4GHz



Thread_Chain0_2440MHz_1-4GHz

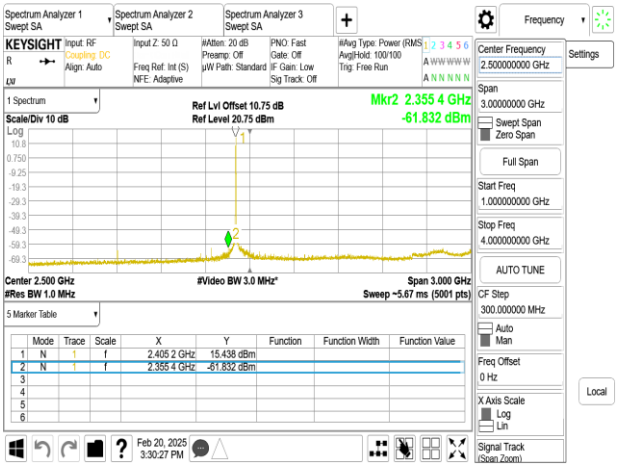


Thread_Chain0_2480MHz_4-26.5GHz

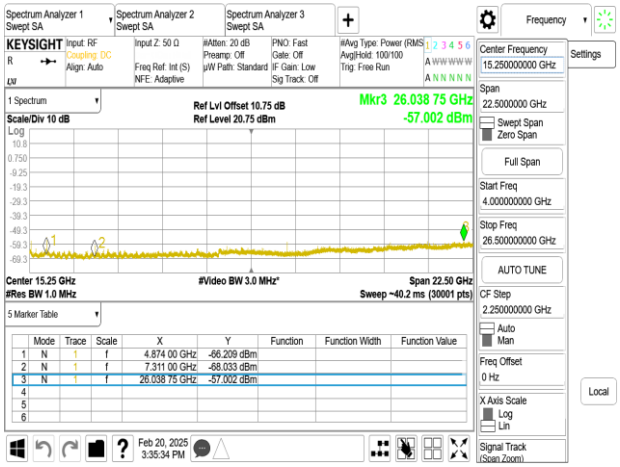


Average (1~26.5GHz)

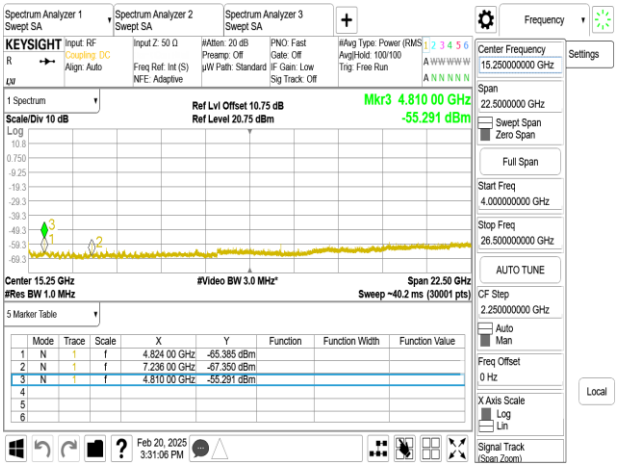
Thread_Chain0_2405MHz_1-4GHz



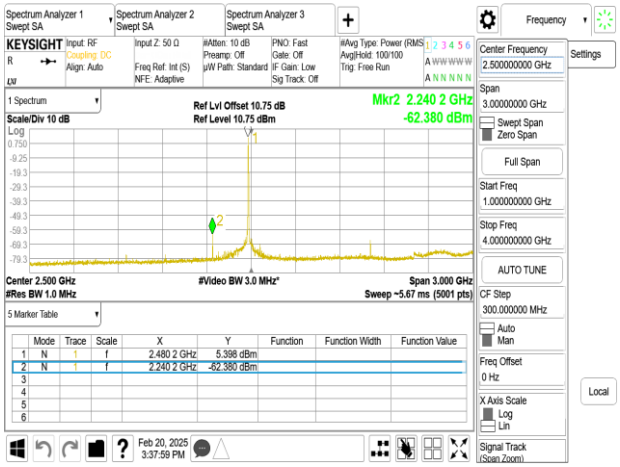
Thread_Chain0_2440MHz_4-26.5GHz



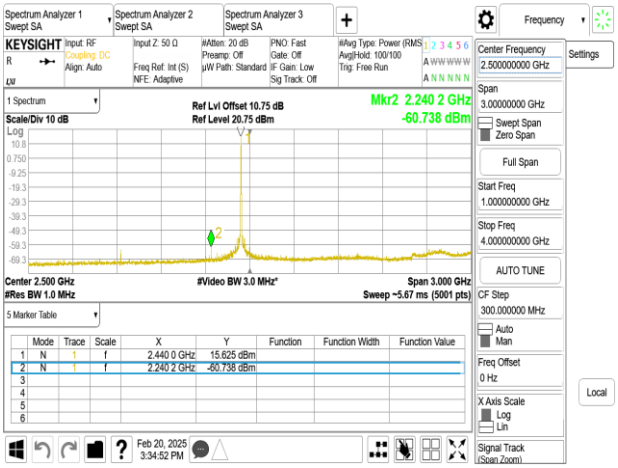
Thread_Chain0_2405MHz_4-26.5GHz



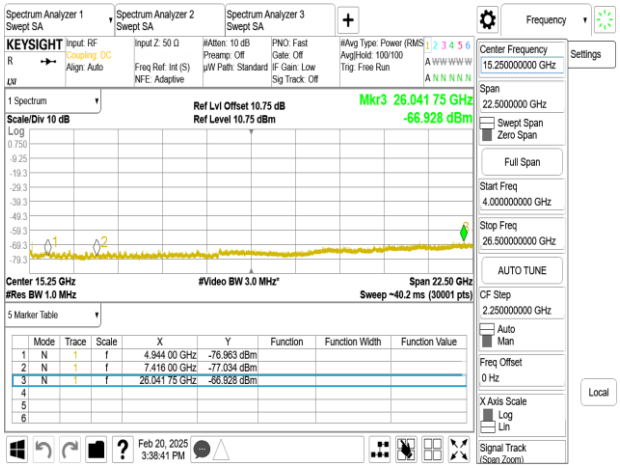
Thread_Chain0_2480MHz_1-4GHz



Thread_Chain0_2440MHz_1-4GHz

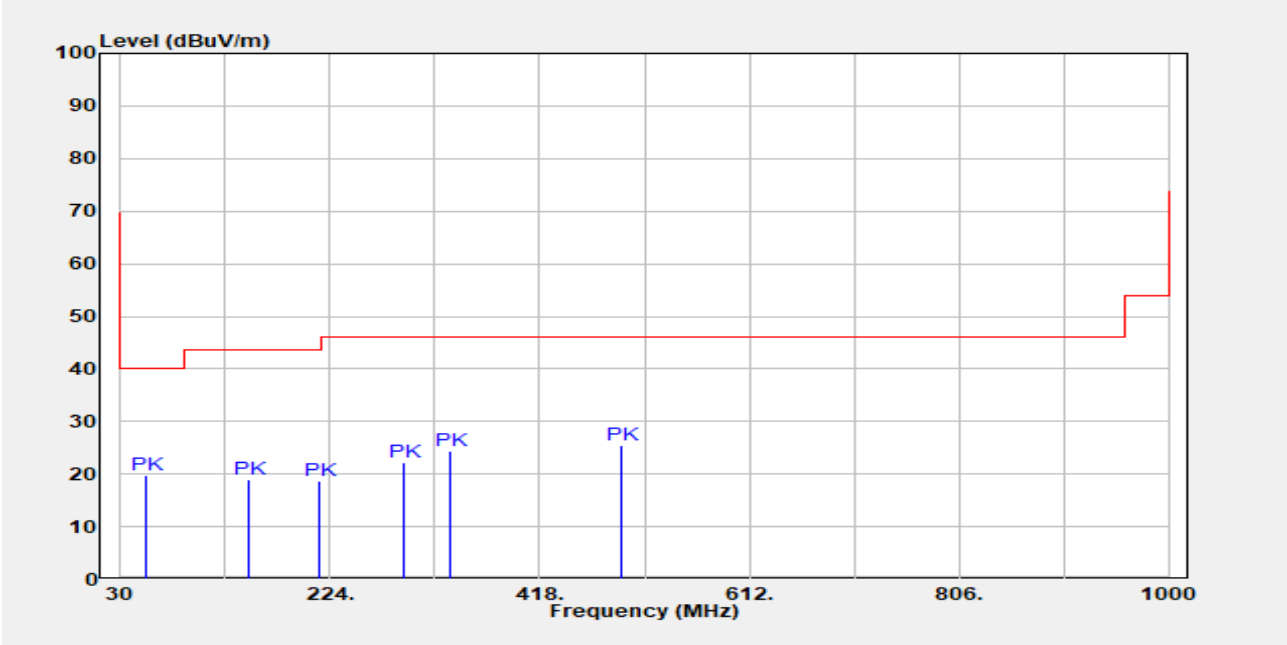


Thread_Chain0_2480MHz_4-26.5GHz



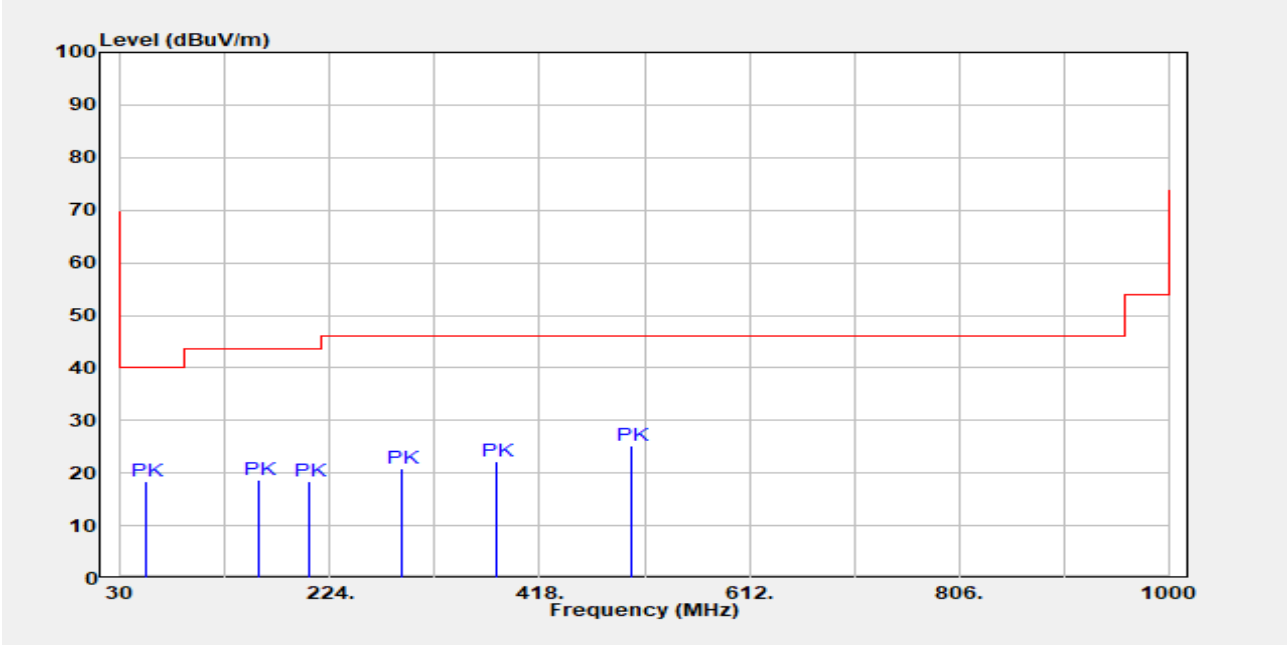
11.5.2 Radiated Spurious Emission

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2440 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Nick Lin



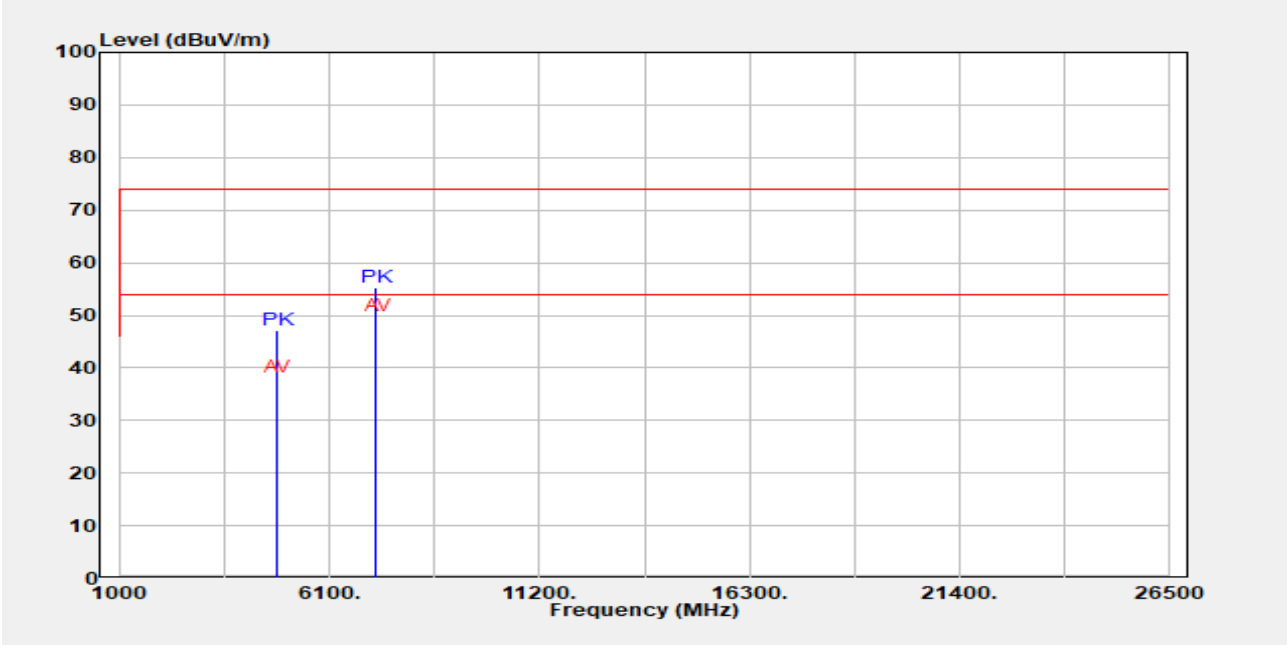
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
54.25	Peak	28.38	-8.73	19.65	40.00	-20.35
149.31	Peak	27.10	-8.26	18.84	43.50	-24.66
213.33	Peak	28.98	-10.33	18.65	43.50	-24.85
292.87	Peak	29.47	-7.12	22.35	46.00	-23.65
334.58	Peak	30.72	-6.35	24.37	46.00	-21.63
493.66	Peak	28.82	-3.43	25.39	46.00	-20.61

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2440 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Nick Lin



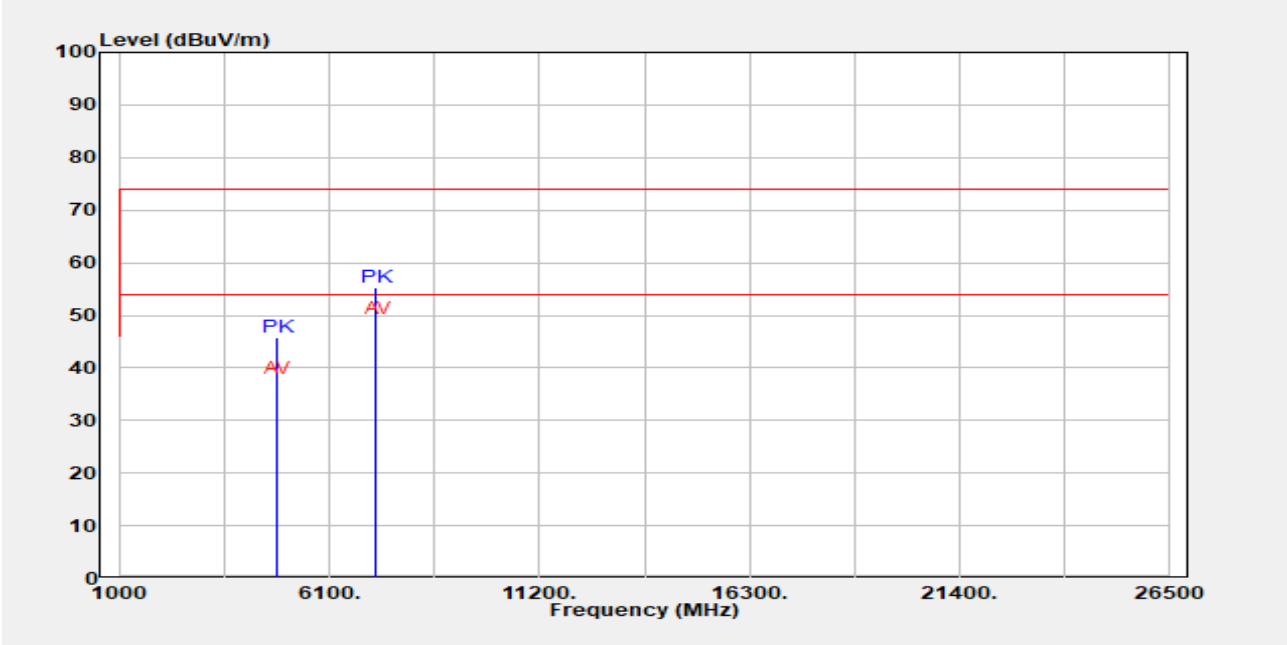
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
53.28	Peak	27.23	-8.68	18.55	40.00	-21.45
158.04	Peak	27.04	-8.21	18.83	43.50	-24.67
203.63	Peak	29.29	-10.84	18.45	43.50	-25.05
290.93	Peak	28.12	-7.19	20.93	46.00	-25.07
378.23	Peak	27.74	-5.62	22.12	46.00	-23.88
502.39	Peak	28.66	-3.32	25.34	46.00	-20.66

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2405 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Nick Lin



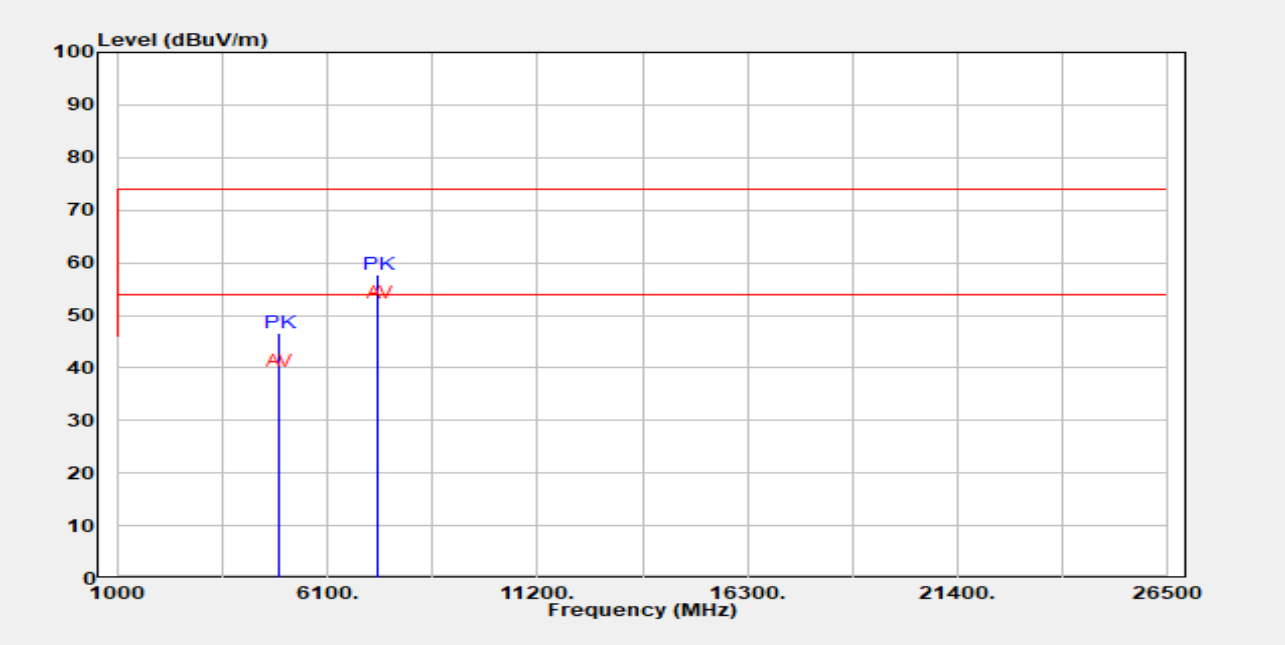
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4810.00	Peak	46.88	0.20	47.08	74.00	-26.92
4810.00	Average	38.01	0.20	38.21	54.00	-15.79
7215.00	Peak	49.93	5.40	55.33	74.00	-18.67
7215.00	Average	44.35	5.40	49.75	54.00	-4.25

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2405 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Nick Lin



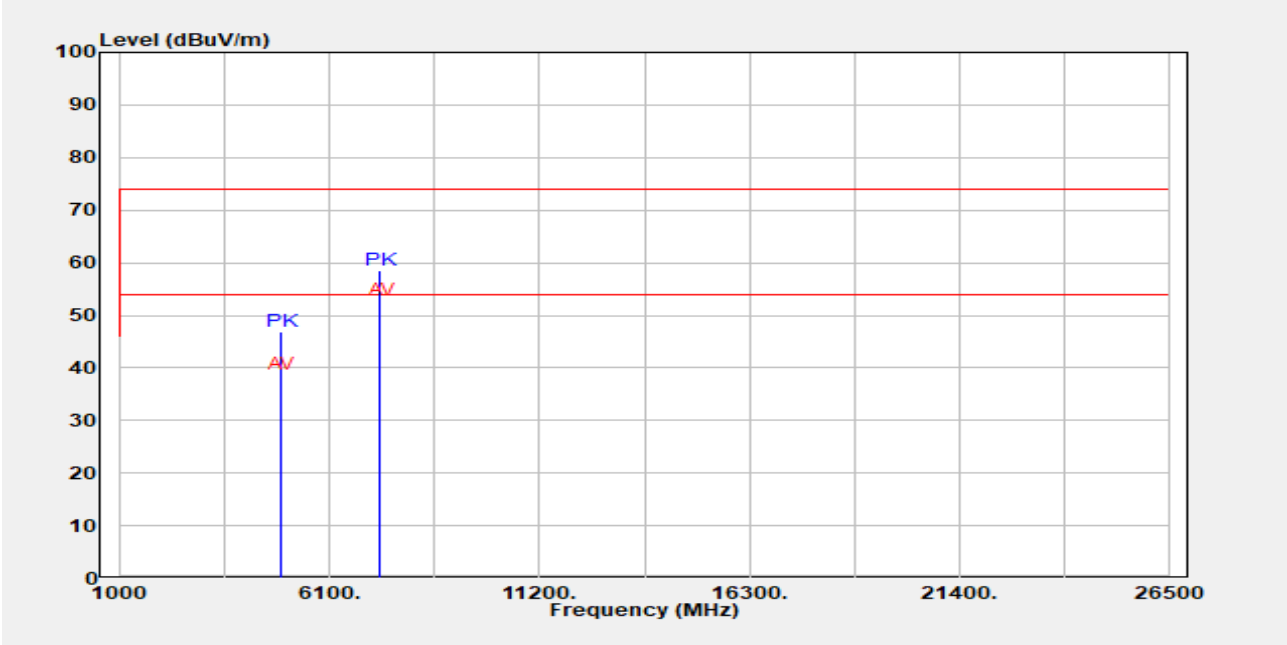
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4810.00	Peak	45.47	0.20	45.67	74.00	-28.33
4810.00	Average	37.64	0.20	37.84	54.00	-16.16
7215.00	Peak	49.92	5.40	55.32	74.00	-18.68
7215.00	Average	44.06	5.40	49.46	54.00	-4.54

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2440 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Nick Lin



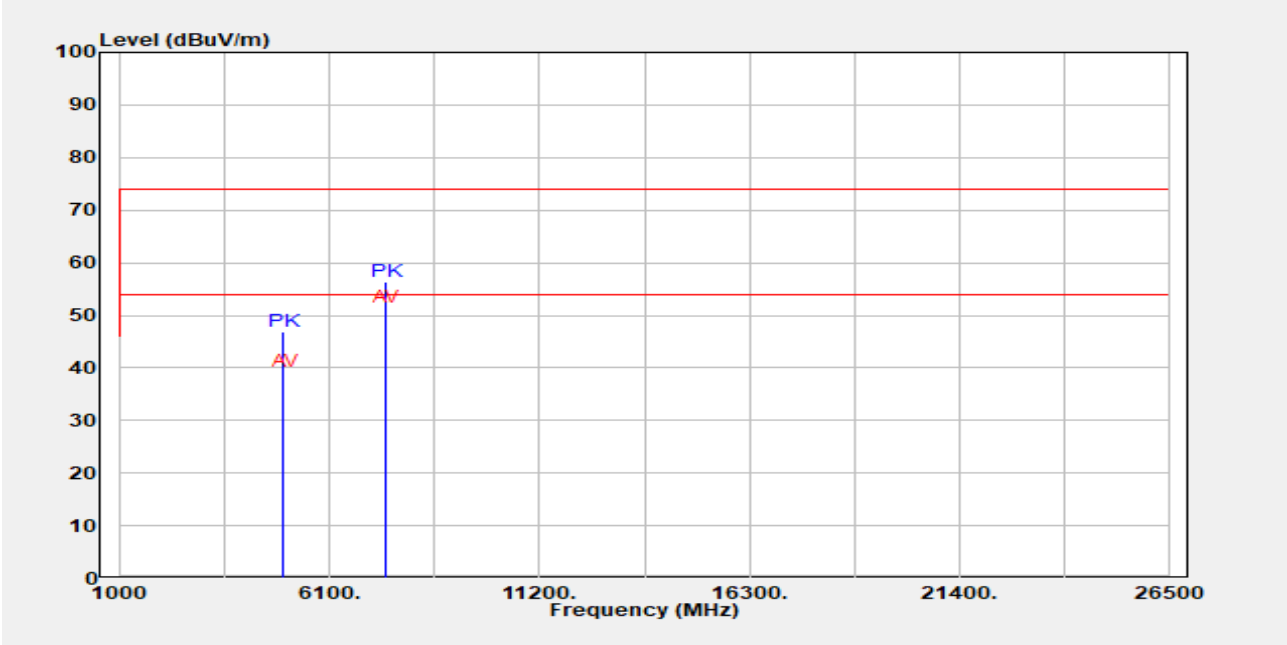
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4880.00	Peak	46.42	0.20	46.62	74.00	-27.38
4880.00	Average	38.99	0.20	39.19	54.00	-14.81
7320.00	Peak	52.21	5.59	57.80	74.00	-16.20
7320.00	Average	46.74	5.59	52.33	54.00	-1.67

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2440 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Nick Lin



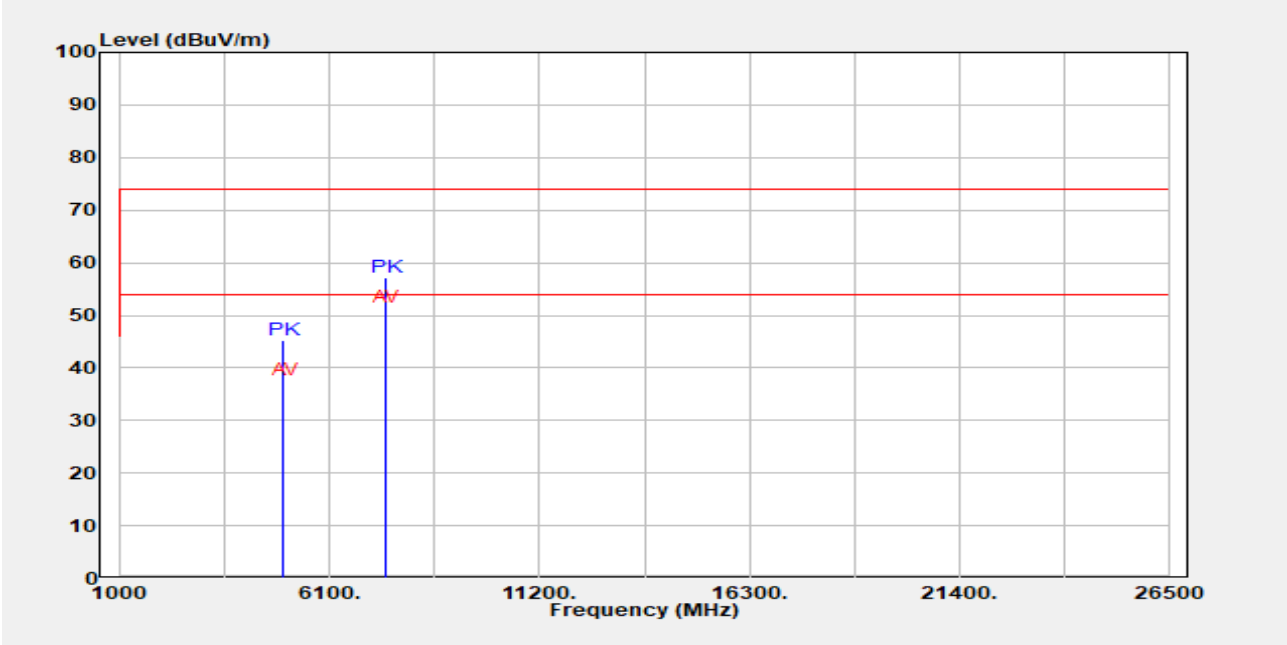
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4880.00	Peak	46.80	0.20	47.00	74.00	-27.00
4880.00	Average	38.54	0.20	38.74	54.00	-15.26
7320.00	Peak	52.89	5.59	58.48	74.00	-15.52
7320.00	Average	47.12	5.59	52.71	54.00	-1.29

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2480 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.00	Peak	46.32	0.46	46.78	74.00	-27.22
4960.00	Average	38.72	0.46	39.18	54.00	-14.82
7440.00	Peak	50.84	5.54	56.38	74.00	-17.62
7440.00	Average	45.95	5.54	51.49	54.00	-2.51

Report Number	:TERF2501000461ER	Test Site	:SAC 3
Operation Mode	:Thread	Test Date	:2025-02-13
Test Frequency	:2480 MHz	Temp./Humi.	:20.5℃/63%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.00	Peak	44.72	0.46	45.18	74.00	-28.82
4960.00	Average	37.23	0.46	37.69	54.00	-16.31
7440.00	Peak	51.63	5.54	57.17	74.00	-16.83
7440.00	Average	45.87	5.54	51.41	54.00	-2.59

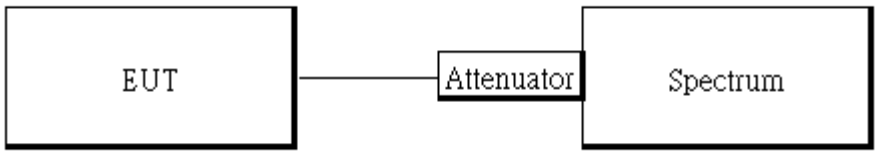
12 POWER SPECTRAL DENSITY

12.1 Standard Applicable:

Per Part 15.247 (e)

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

12.2 Test Setup



12.3 Measurement Procedure:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

12.4 Measurement Result:

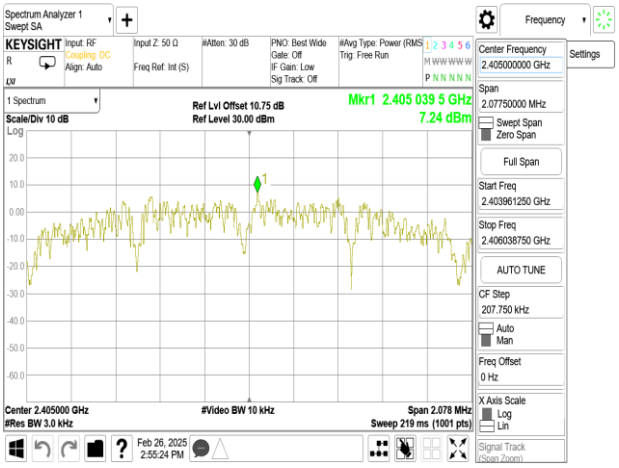
Thread mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2405	7.24	8	PASS
2440	7.45	8	PASS
2480	-2.85	8	PASS

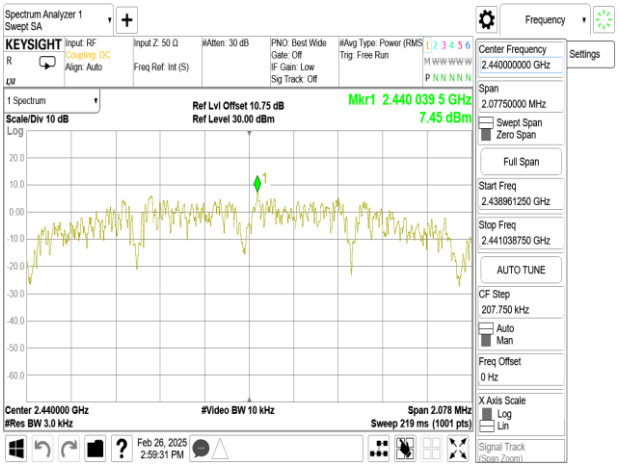
Note:

1.cable loss as 10.75dB that offsets in the spectrum

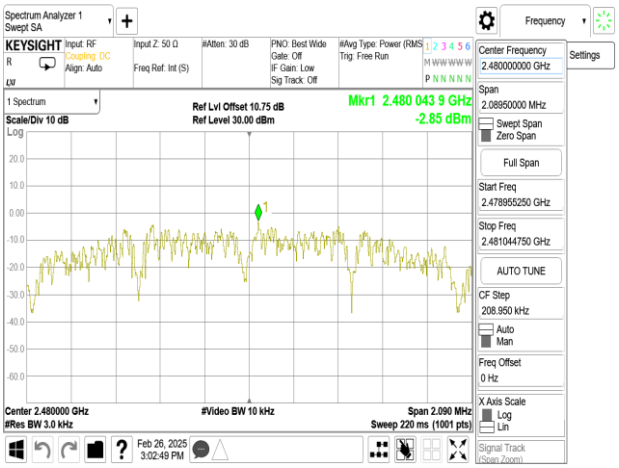
PSD_Thread_LowCH11-2405MHz



PSD_Thread_MidCH18-2440MHz



PSD_Thread_HighCH26-2480MHz



13 ANTENNA REQUIREMENT

13.1 Standard Applicable:

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, 15.221, or § 15.236. 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.

13.2 Antenna Connected Construction:

The antenna complies with this requirement and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~