ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Quanta Computer Inc. No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City, Taiwan
Manufacturer:	Quanta Computer Inc. No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City, Taiwan
Product Name:	QOCA Portable ECG Monitoring Device
Brand Name:	Quanta
Model No.:	ecg106a
Report Number:	TERF2212002628E2
FCC ID	HFSCIKA
Date of EUT Received:	December 07, 2022
Date of Test:	December 09,2022～January 03, 2024
Issue Date:	January 24, 2024

Approved By _____
Jay Lin

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 C63.10:2013 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.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2212002628E2	00	Original.	January 24, 2024	Kate Lai	

Note:

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

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	QOCA Portable ECG Monitoring Device
Brand Name:	Quanta
Model No.:	ecg106a
Hardware Version:	REV.B
Firmware Version:	N/A
EUT Series No.:	TE_SP_20221209402
Power Supply:	1.8 Vdc
Test Software (Name/Version)	STM32CubeMonitor-RF/2.8.1

1.2 RF Specification

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	BLE 1M: 0.88 dBm BLE 2M: 0.91 dBm

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
FPC Antenna	Pulse (Suzhou) Wireless Products co.	TQ23733	2402 – 2480	-2.4

Note: Antenna information is provided by the applicant.

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1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
FCC KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10:2013

1.5 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 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.

1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted 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.

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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.

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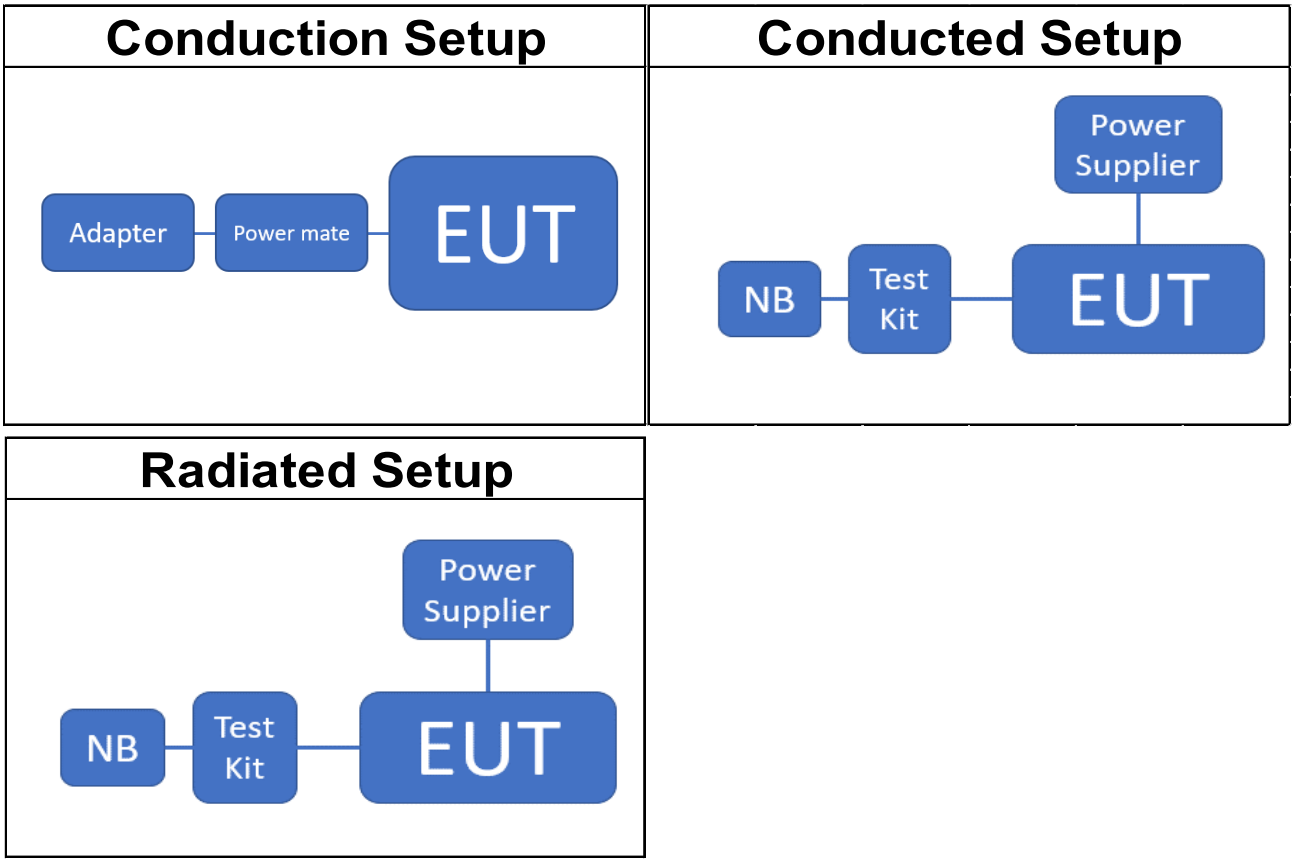
2.5 Test Configuration



2.6 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	Sony	AC-0400-TW	3504600	N/A	N/A
Power mate	Quanta	CR1	N/A	N/A	N/A
USB Cable	Greatland Electronics	WJE210248B	N/A	N/A	N/A
Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Kit	Oneping	OP-1010-3	N/A	N/A	N/A
Type-C to RJ45 Network Adapter	e-sense	01-rjc188	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	N/A	N/A
Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T470	P0001293	N/A	N/A
Test Kit	Oneping	OP-1010-3	N/A	N/A	N/A

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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
§15.247(d) §15.209	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d) §15.209	Radiated Band Edge and Spurious Emission	Compliant
§15.205	Restricted Bands	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operating Frequencies

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
0	2402 MHz	14	2430 MHz	28	2458 MHz
1	2404 MHz	15	2432 MHz	29	2460 MHz
2	2406 MHz	16	2434 MHz	30	2462 MHz
3	2408 MHz	17	2436 MHz	31	2464 MHz
4	2410 MHz	18	2438 MHz	32	2466 MHz
5	2412 MHz	19	2440 MHz	33	2468 MHz
6	2414 MHz	20	2442 MHz	34	2470 MHz
7	2416MHz	21	2444 MHz	35	2472 MHz
8	2418 MHz	22	2446 MHz	36	2474 MHz
9	2420 MHz	23	2448 MHz	37	2476 MHz
10	2422 MHz	24	2450 MHz	38	2478 MHz
11	2424 MHz	25	2452 MHz	39	2480 MHz
12	2426 MHz	26	2454 MHz		
13	2428 MHz	27	2456 MHz		

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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. The field strength of radiation 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.
4. 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)
Bluetooth LE	0 to 39	0,20,39	GFSK	1
Bluetooth LE	0 to 39	0,20,39	GFSK	2

RADIATED EMISSION TEST (BELOW 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	20	GFSK	1
Bluetooth LE	0 to 39	20	GFSK	2
RADIATED EMISSION TEST (ABOVE 1 GHz)				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)
Bluetooth LE	0 to 39	0,20,39	GFSK	1
Bluetooth LE	0 to 39	0,20,39	GFSK	2

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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
	+/-	**4.15**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.02**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Radiated Spurious Emission	**+/-**	**2**	**dB**	33GHz-50GHz
	+/-	**1.59**	**dB**	50GHz-60GHz
	+/-	**1.7**	**dB**	60GHz-90GHz
	+/-	**1.64**	**dB**	90GHz-140GHz
	+/-	**3.83**	**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.

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6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	04/13/2022	04/12/2023
EMI Test Receiver	R&S	ESCI	101342	04/25/2022	04/24/2023
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2022	03/26/2023
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2022	03/26/2023
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/08/2022	06/07/2023
Power Meter	Anritsu	ML2496A	1804002	04/27/2022	04/26/2023
Power Sensor	Anritsu	MA2411B	1726105	04/27/2022	04/26/2023
Power Sensor	Anritsu	MA2411B	1726106	04/27/2022	04/26/2023
DC Power Supply	HOLA	DP-3003	D7070035	06/09/2022	06/08/2023
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Attenuator	Marvelous	MVE2213-10	RF06	11/16/2022	11/15/2023
Attenuator	Woken	WATT-218FS-10	RF19	11/16/2022	11/15/2023
Attenuator	Woken	WATT-218FS-10	RF22	11/16/2022	11/15/2023
DC Block	PASTERNACK	PE8210	RF158	11/16/2022	11/15/2023

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6.3 Radiated Measurement

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/11/2022	11/10/2023
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/02/2023	11/01/2024
Horn Antenna	Schwarzbeck	BBHA9170	184	12/15/2022	12/14/2023
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/06/2022	01/05/2023
Loop Antenna	ETS.LINDGREN	6502	143303	05/14/2022	05/13/2023
Loop Antenna	ETS.LINDGREN	6502	148045	10/13/2023	10/12/2024
3m Site NSA	SGS	966 chamber C	N/A	03/02/2022	03/01/2023
3m Site NSA	SGS	966 chamber C	N/A	03/02/2023	03/01/2024
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/01/2022	03/31/2023
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/29/2023	03/28/2024
DC Power Supply	HOLA	DP-3003	D7070035	06/09/2022	06/08/2023
DC Power Supply	HOLA	DP-3003	D7070035	06/12/2023	06/11/2024
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Pre-Amplifier	EMC Instruments	EMC330	980096	11/16/2022	11/15/2023
Pre-Amplifier	EMC Instruments	EMC330	980096	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/16/2022	11/15/2023
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	10/25/2022	10/24/2023
Attenuator	Woken	WATT-218FS-10	RF16	11/16/2022	11/15/2023
Coaxial Cable	Huber Suhner	EMC106-SM-SM-9100	150704	11/16/2022	11/15/2023
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/16/2022	11/15/2023
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/16/2022	11/15/2023
Coaxial Cable	Huber+Suhner	RG 214/U	W22.03	11/15/2023	11/14/2024

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable:

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

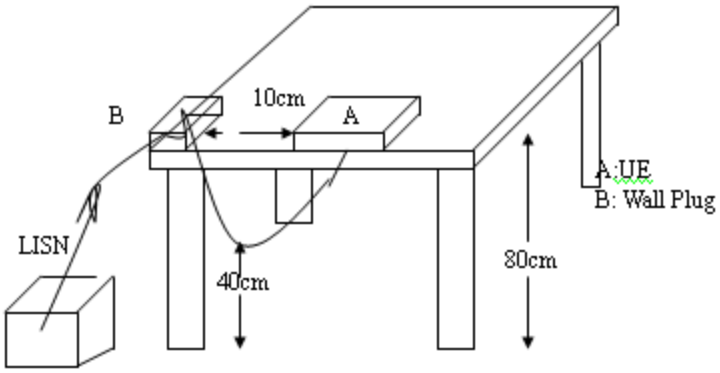
Frequency range MHz	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

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 120/60Hz power source.

7.3 Test Setup



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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:

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

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

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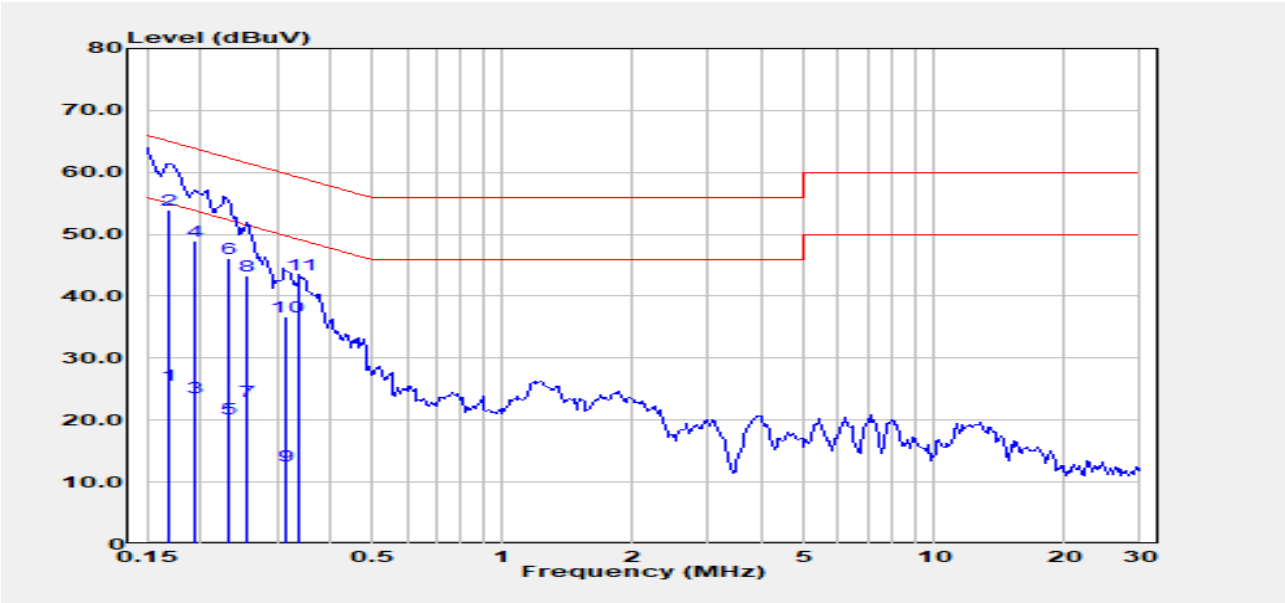
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2212002628E2	Test Site	:Conduction C
Test Mode	:BLE	Test Date	:2022-12-16
Power	:120V/60Hz	Temp./Humi.	:20.4/62
Probe	:L1	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.169	Average	15.30	10.27	25.57	55.03	-29.46
0.169	QP	43.60	10.27	53.87	65.03	-11.16
0.193	Average	13.30	10.27	23.57	53.89	-30.32
0.193	QP	38.70	10.27	48.97	63.89	-14.92
0.232	Average	9.90	10.28	20.18	52.39	-32.21
0.232	QP	35.80	10.28	46.08	62.39	-16.31
0.255	Average	12.80	10.28	23.08	51.60	-28.52
0.255	QP	33.00	10.28	43.28	61.60	-18.32
0.315	Average	2.30	10.29	12.59	49.84	-37.25
0.315	QP	26.30	10.29	36.59	59.84	-23.25
0.339	Peak	33.27	10.30	43.56	59.22	-15.66

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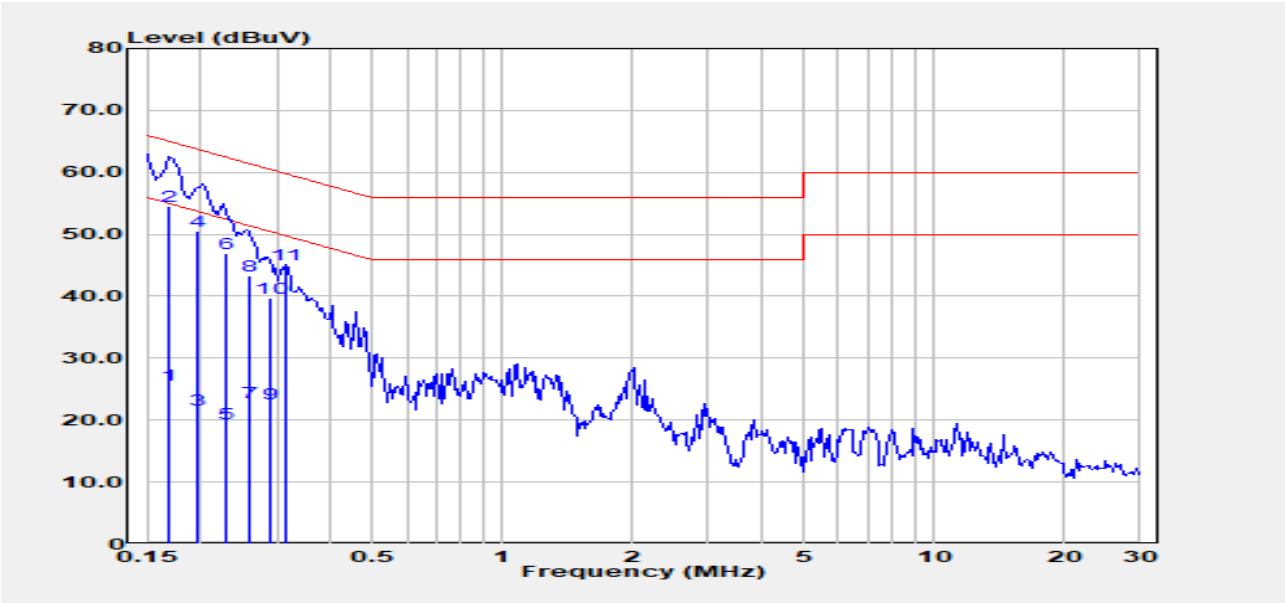
Report Number	:TERF2212002628E2	Test Site	:Conduction C
Test Mode	:BLE	Test Date	:2022-12-16
Power	:120V/60Hz	Temp./Humi.	:20.4/62
Probe	:N	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.169	Average	15.30	10.28	25.58	55.03	-29.46
0.169	QP	44.20	10.28	54.48	65.03	-10.56
0.198	Average	11.40	10.27	21.67	53.71	-32.04
0.198	QP	40.30	10.27	50.57	63.71	-13.14
0.229	Average	9.20	10.27	19.47	52.48	-33.00
0.229	QP	36.70	10.27	46.97	62.48	-15.50
0.258	Average	12.50	10.28	22.78	51.51	-28.73
0.258	QP	33.00	10.28	43.28	61.51	-18.23
0.289	Average	12.40	10.28	22.68	50.54	-27.86
0.289	QP	29.50	10.28	39.78	60.54	-20.76
0.315	Peak	34.86	10.29	45.15	59.84	-14.69

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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

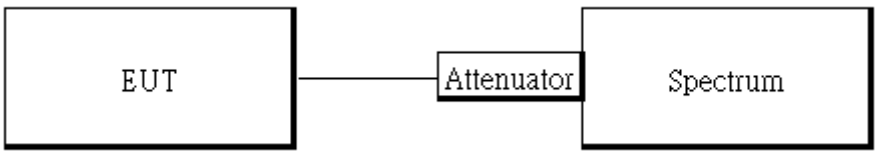
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

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.

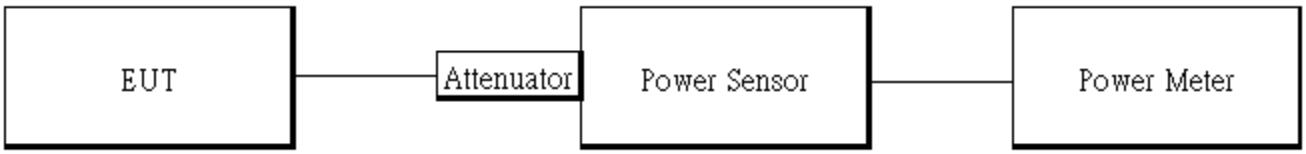
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

8.2 Test Setup

8.2.1 Duty Cycle



8.2.2 Output Power



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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:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE 1M	66.67	1.76	2.38	3.00
BLE 2M	37.60	4.25	4.26	5.00

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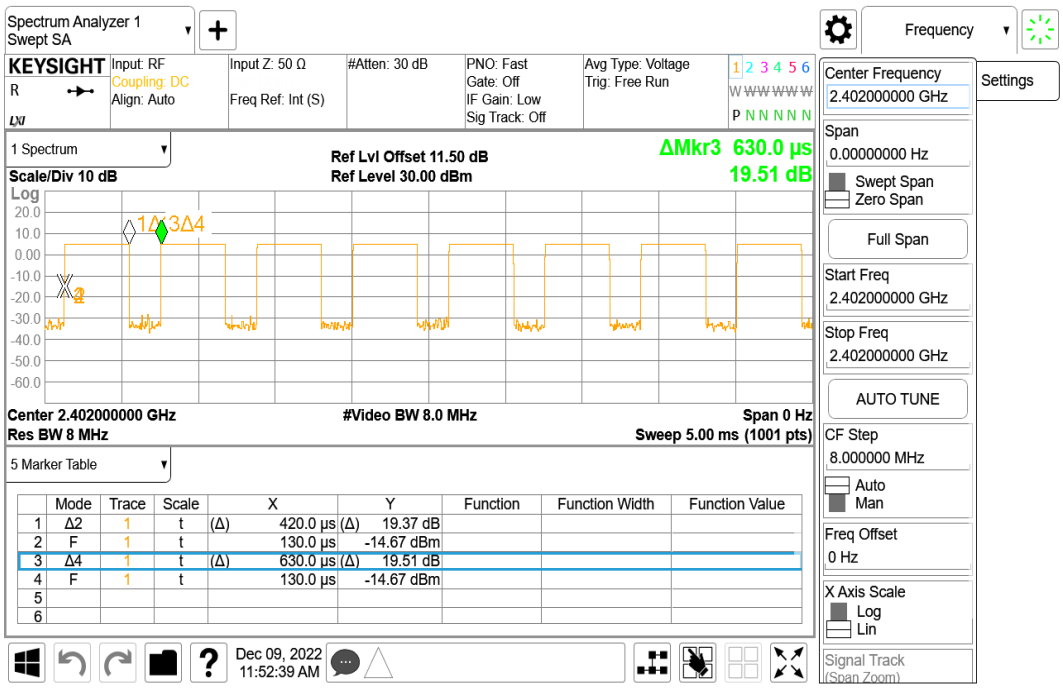
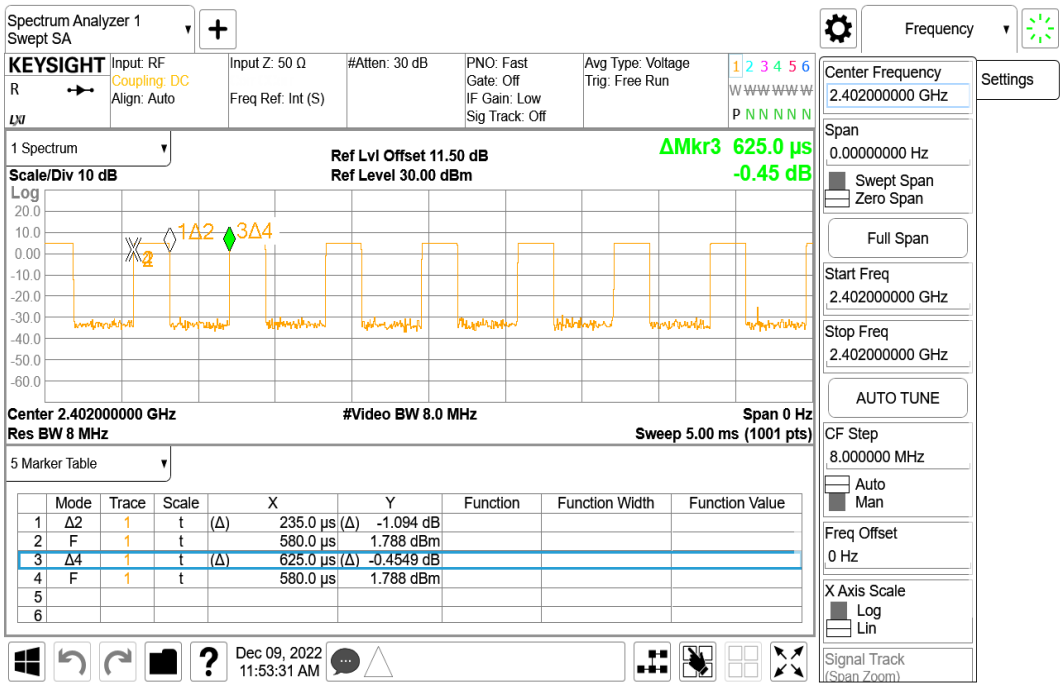
BLE_1M_LowCH00-2402



BLE_2M_LowCH00-2402



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8.5 Output Power:

8.5.1 Peak & Avg

BLE 1M mode:

CH	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	26	0.72	30
Mid	2442	26	**0.88**	30
High	2480	26	0.87	30
CH	**Frequency (MHz)**	**Power set**	**Max. Avg. Output include tune up tolerance Power (dBm)**	**Required Limit (dBm)**
Low	2402	26	0.52	30
Mid	2442	26	0.67	30
High	2480	26	0.53	30

Note: Measured by power meter, cable loss 11.5 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

BLE 2M mode:

CH	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	26	0.78	30
Mid	2442	26	**0.91**	30
High	2480	26	0.88	30
CH	**Frequency (MHz)**	**Power set**	**Max. Avg. Output include tune up tolerance Power (dBm)**	**Required Limit (dBm)**
Low	2402	26	0.60	30
Mid	2442	26	0.78	30
High	2480	26	0.77	30

Note: Measured by power meter, cable loss 11.5 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

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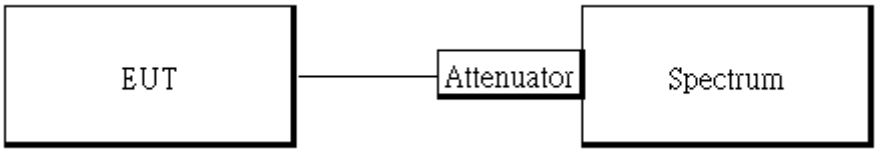
9 EMISSION BANDWIDTH MEASUREMENT

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.

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9.4 Measurement Result:

9.4.1 6dB BW measurements

BLE 1M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6743	≧ 0.5	PASS
2442	0.6742	≧ 0.5	PASS
2480	0.6731	≧ 0.5	PASS

BLE 2M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.131	≧ 0.5	PASS
2442	1.130	≧ 0.5	PASS
2480	1.130	≧ 0.5	PASS

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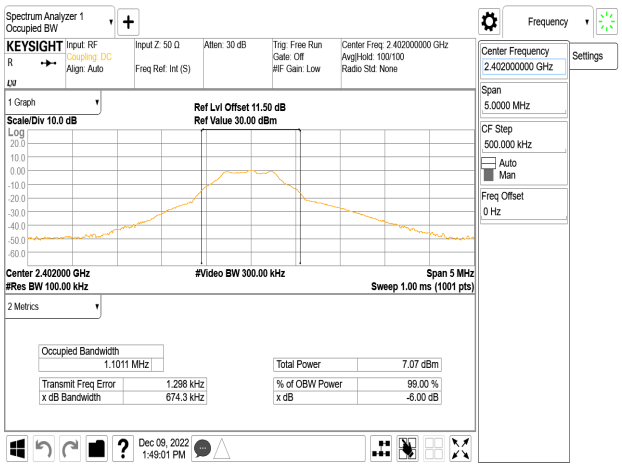
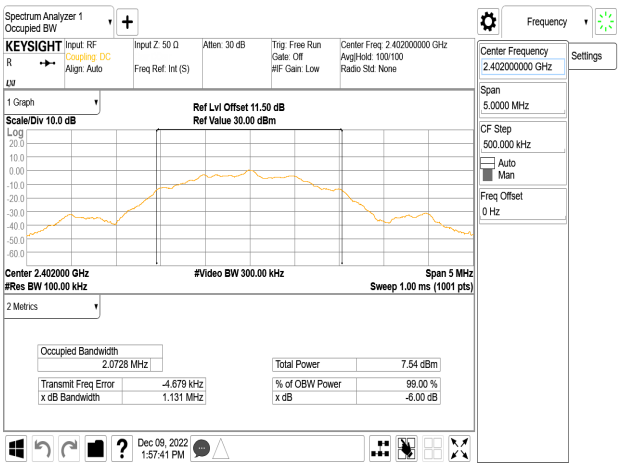
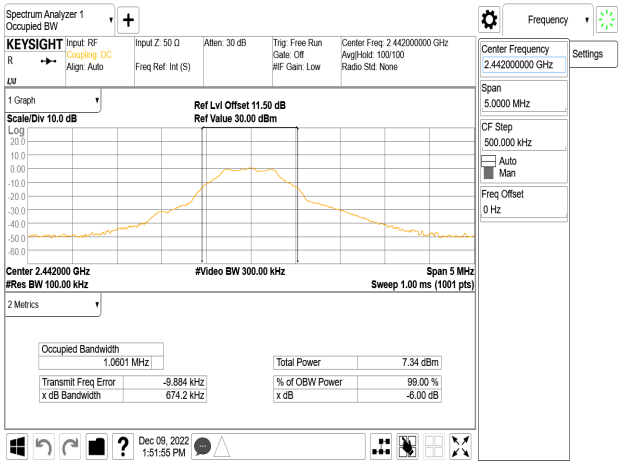
OBW_BLE 1M_LowCH00-2402MHz



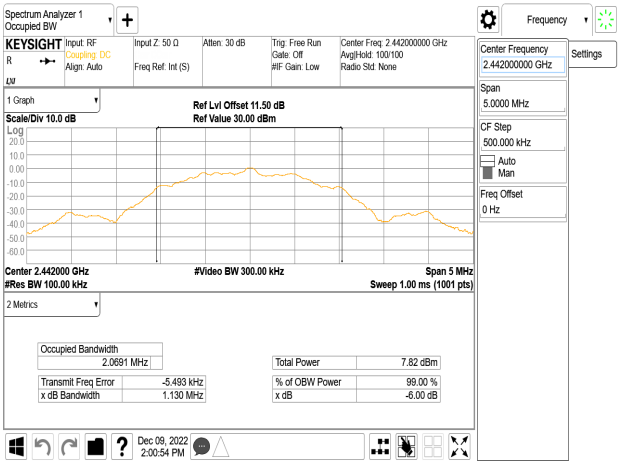
OBW_BLE 2M_LowCH00-2402MHz



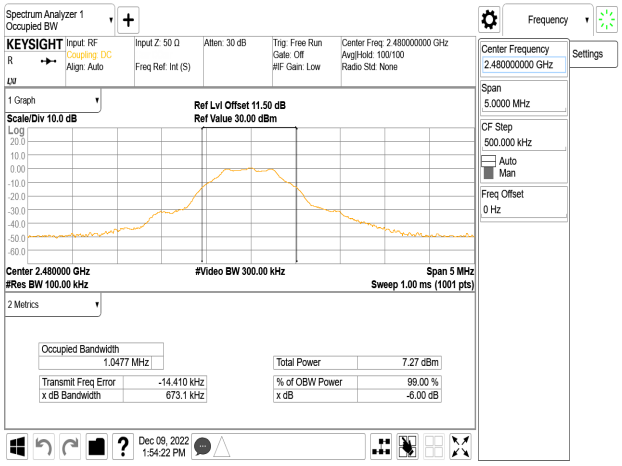
OBW_BLE 1M_MidCH20-2442MHz



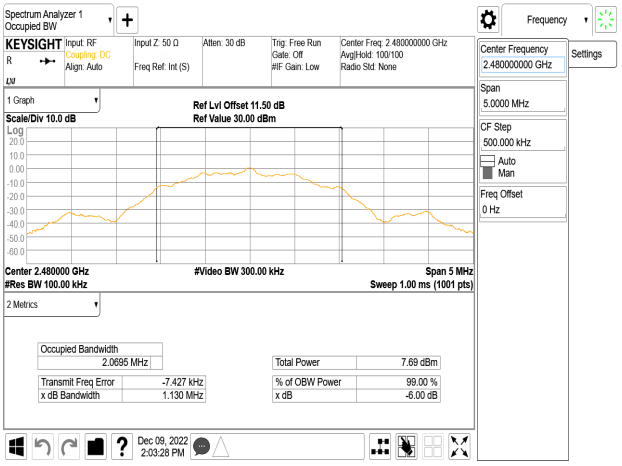
OBW_BLE 2M_MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



OBW_BLE 2M_HighCH39-2480MHz



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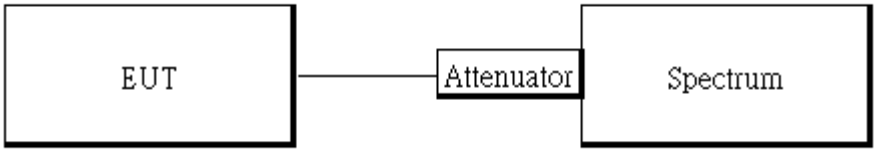
10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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.

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10.3.2 Conducted Band Edge:

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 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.

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10.4 Measurement Result

BLE 1M_Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	0.26	-19.74
2442	0.53	-19.47
2480	0.46	-19.54

NOTE: cable loss as 11.5dB that offsets in the spectrum

NOTE: Refer to next page for plots.

BLE 2M_Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	0.28	-19.72
2442	0.55	-19.45
2480	0.45	-19.55

NOTE: cable loss as 11.5dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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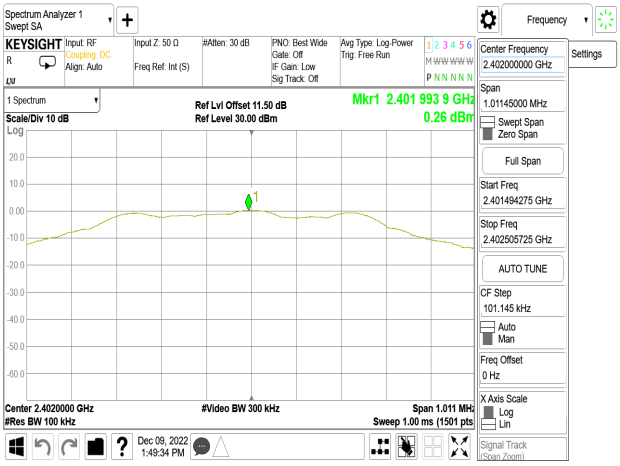
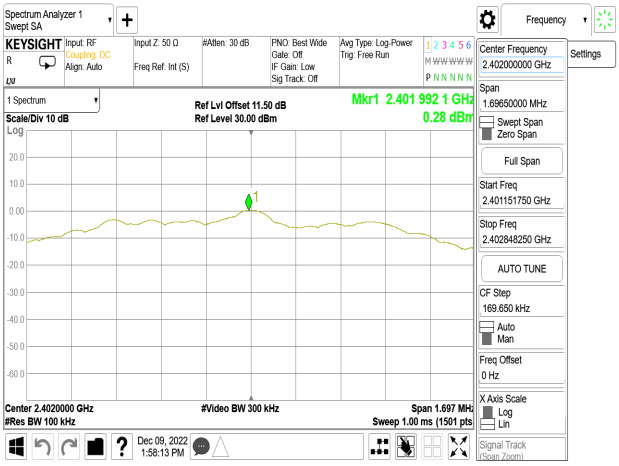
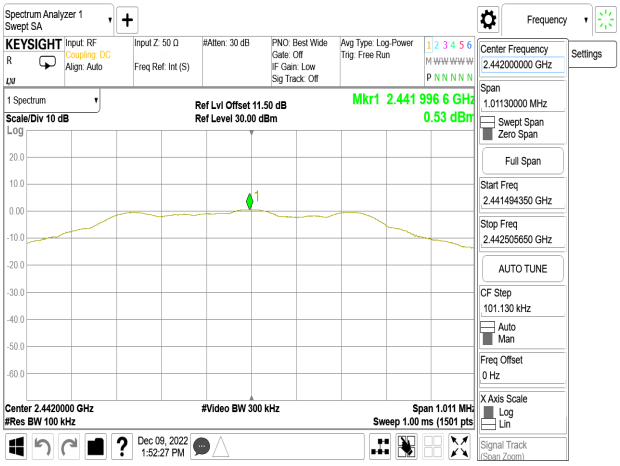
Reference Level_BLE 1M_LowCH00-2402MHz



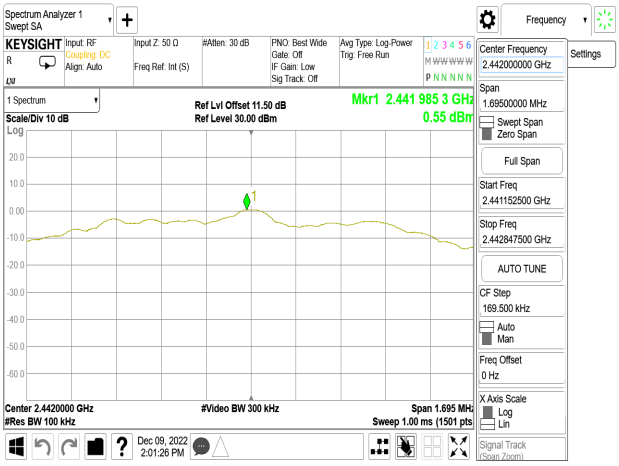
Reference Level_BLE 2M_LowCH00-2402MHz



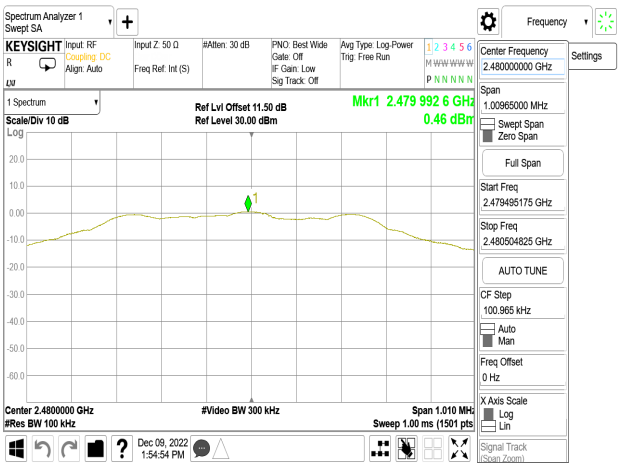
Reference Level_BLE 1M_MidCH20-2442MHz



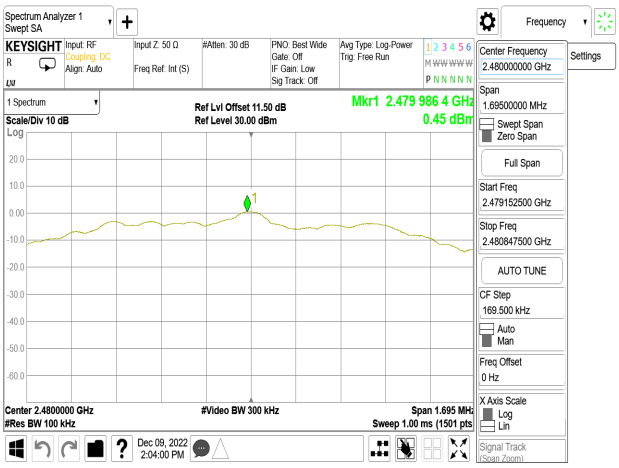
Reference Level_BLE 2M_MidCH20-2442MHz



Reference Level_BLE 1M_HighCH39-2480MHz



Reference Level_BLE 2M_HighCH39-2480MHz



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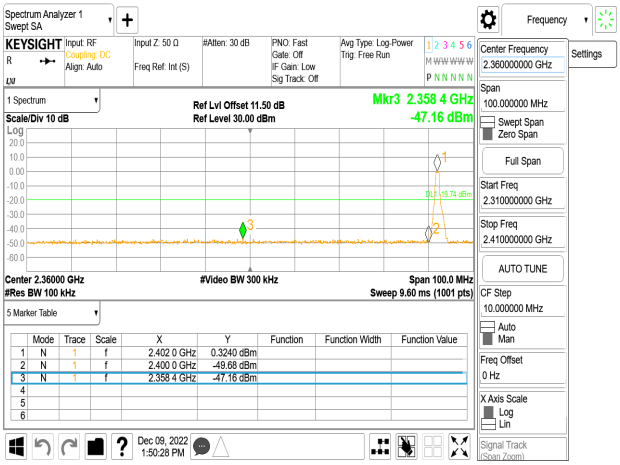
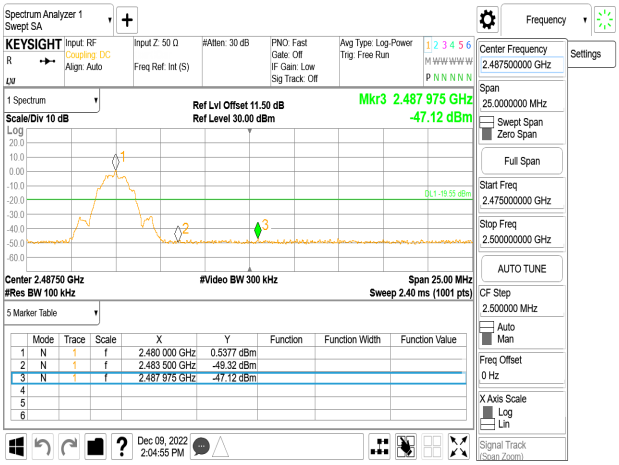
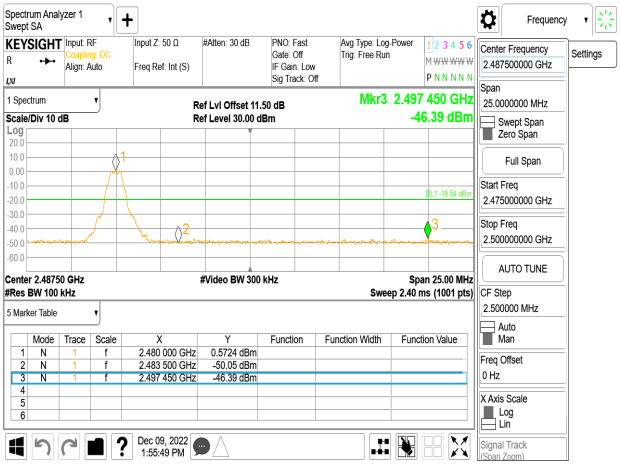
Band Edge_BLE 1M_LowCH00-2402MHz



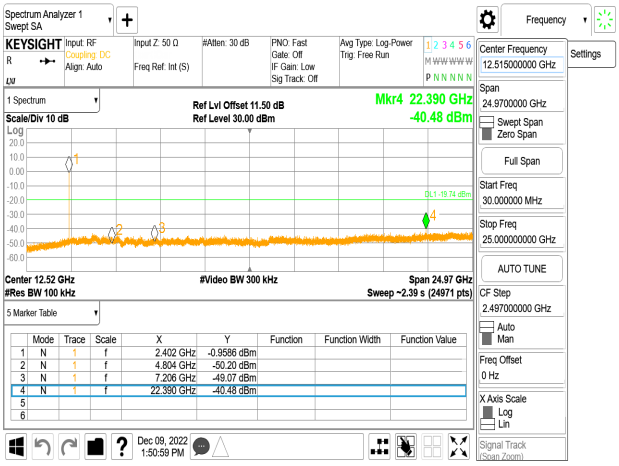
Band Edge_BLE 2M_HighCH39-2480MHz



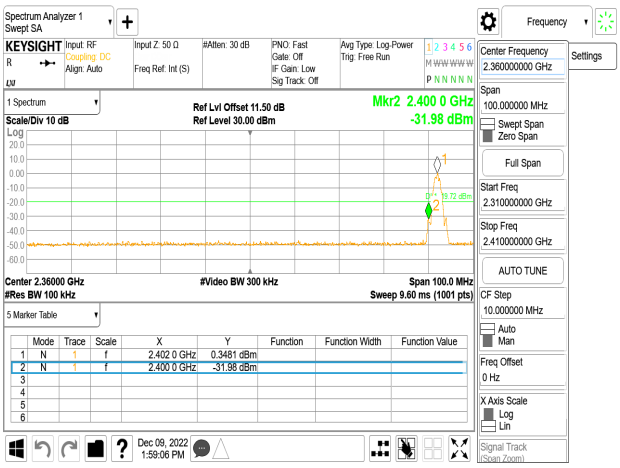
Band Edge_BLE 1M_HighCH39-2480MHz



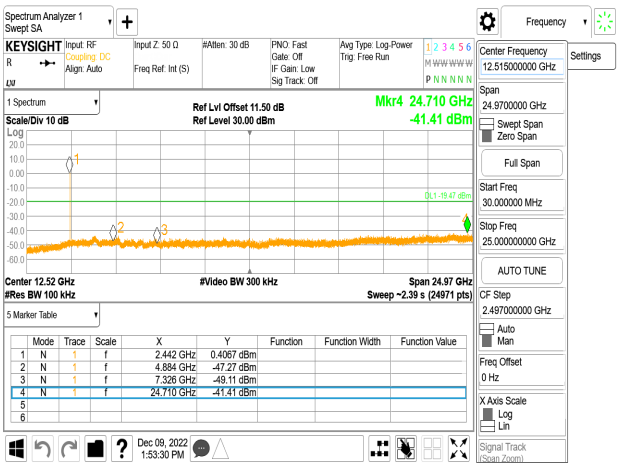
Spurious Emission_BLE 1M_LowCH00-2402MHz



Band Edge_BLE 2M_LowCH00-2402MHz



Spurious Emission_BLE 1M_MidCH20-2442MHz



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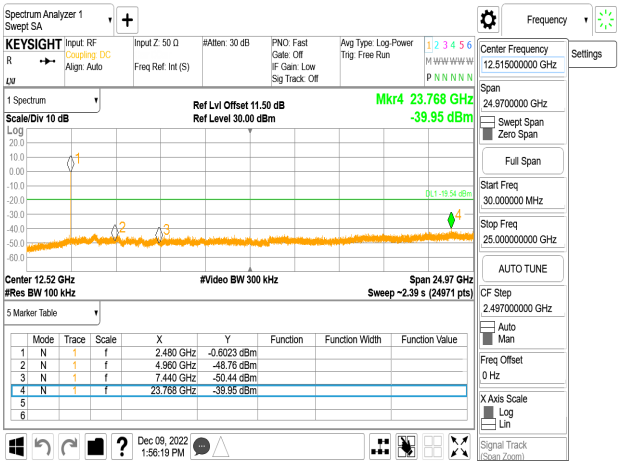
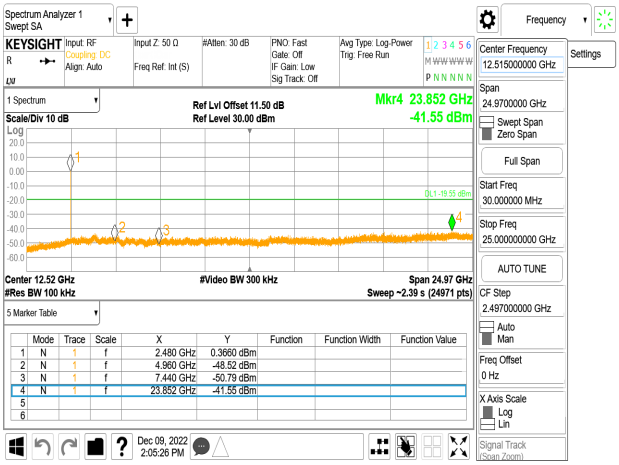
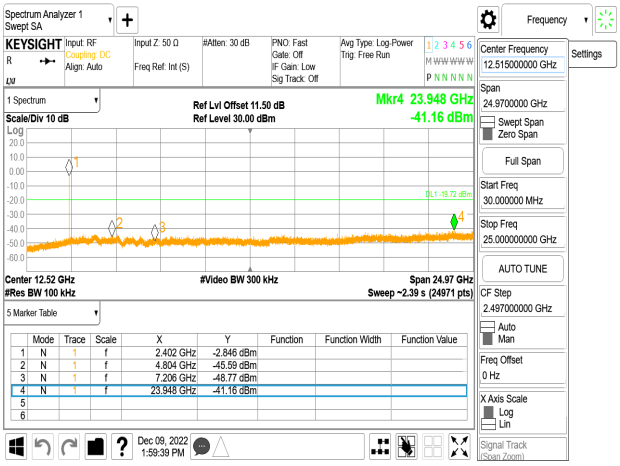
Spurious Emission_BLE 1M_HighCH39-2480MHz



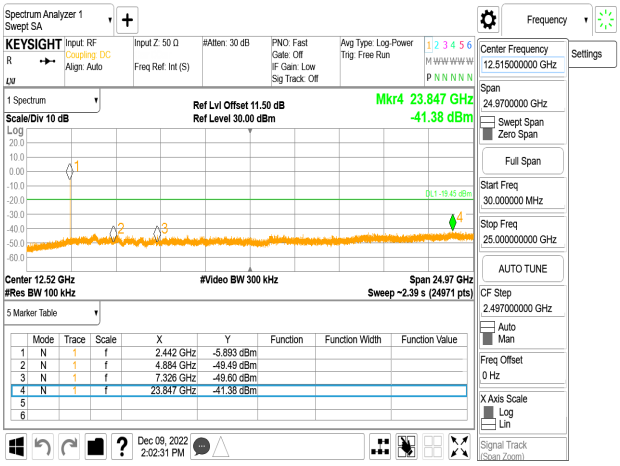
Spurious Emission_BLE 2M_HighCH39-2480MHz



Spurious Emission_BLE 2M_LowCH00-2402MHz



Spurious Emission_BLE 2M_MidCH20-2442MHz



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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

Spurious Emission

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.

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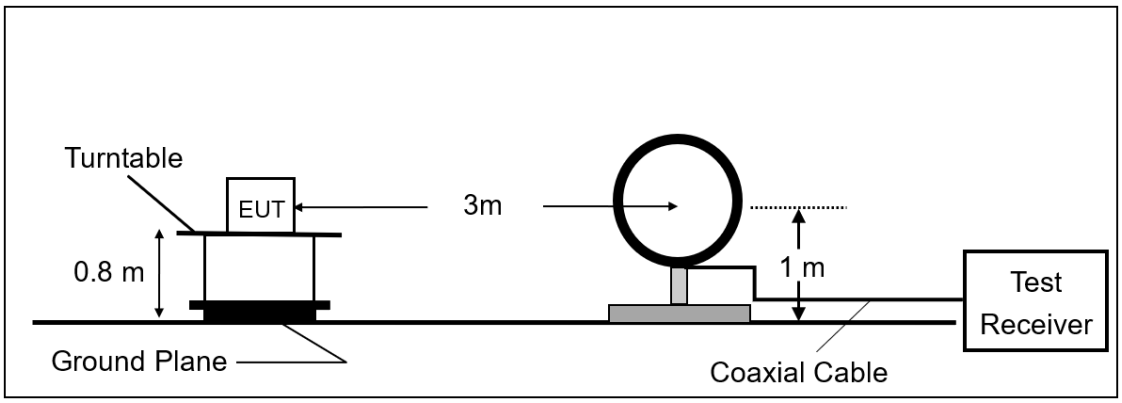
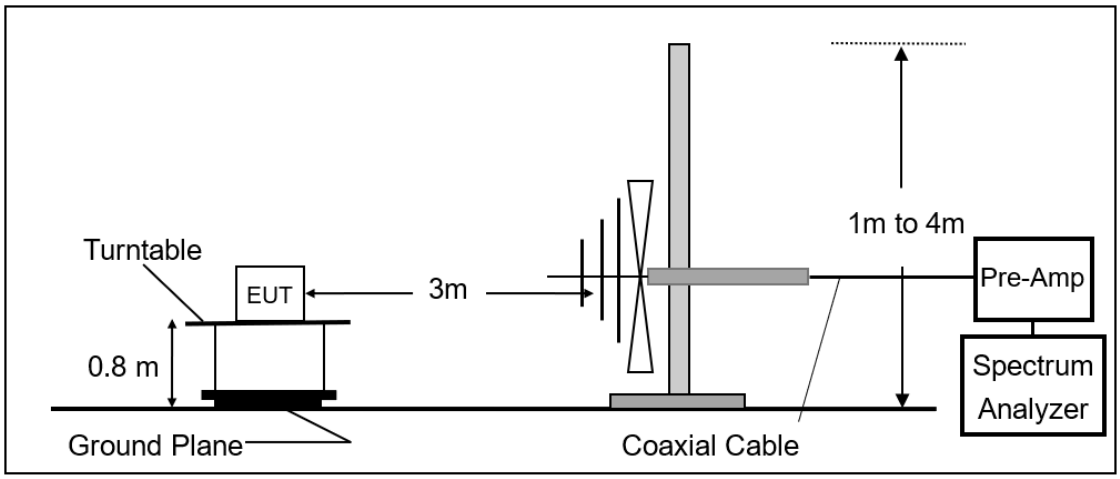
11.1 Test Setup

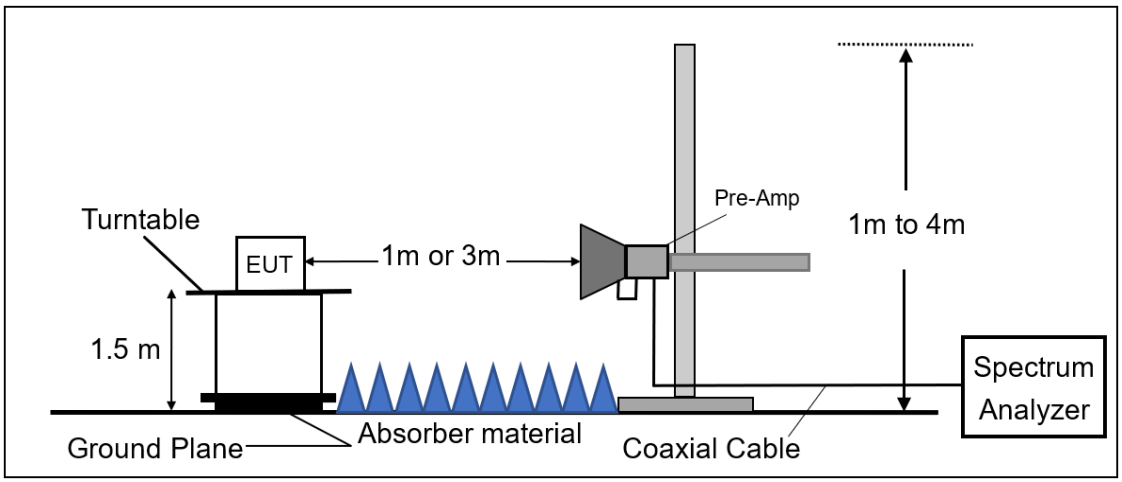
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



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



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11.2 Measurement Procedure

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.
12. Repeat above procedures until all default test channel measured were complete.

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11.3 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)

11.4 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.

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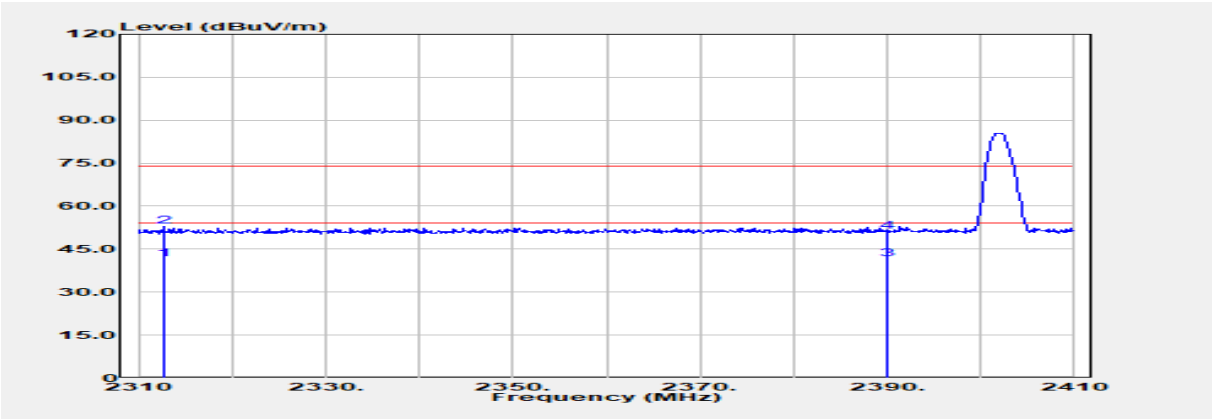
11.4.1 Radiated Band Edge Measurement Result

Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2312.600	Average	37.33	4.06	41.39	54.00	-12.61
2312.600	Peak	48.83	4.06	52.89	74.00	-21.11
2390.000	Average	37.46	4.03	41.49	54.00	-12.51
2390.000	Peak	47.15	4.03	51.18	74.00	-22.82

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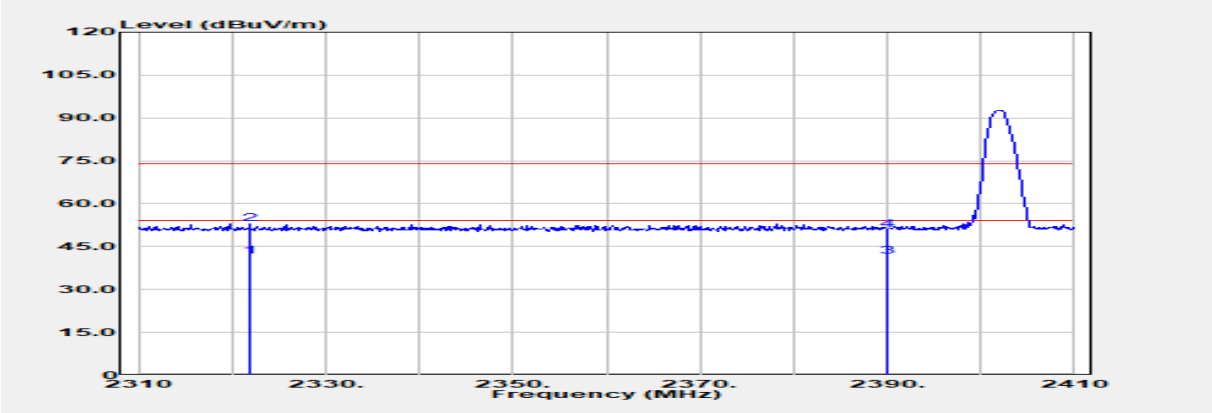
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2321.900	Average	37.36	4.02	41.38	54.00	-12.62
2321.900	Peak	49.06	4.02	53.08	74.00	-20.92
2390.000	Average	37.54	4.03	41.57	54.00	-12.43
2390.000	Peak	46.70	4.03	50.74	74.00	-23.26

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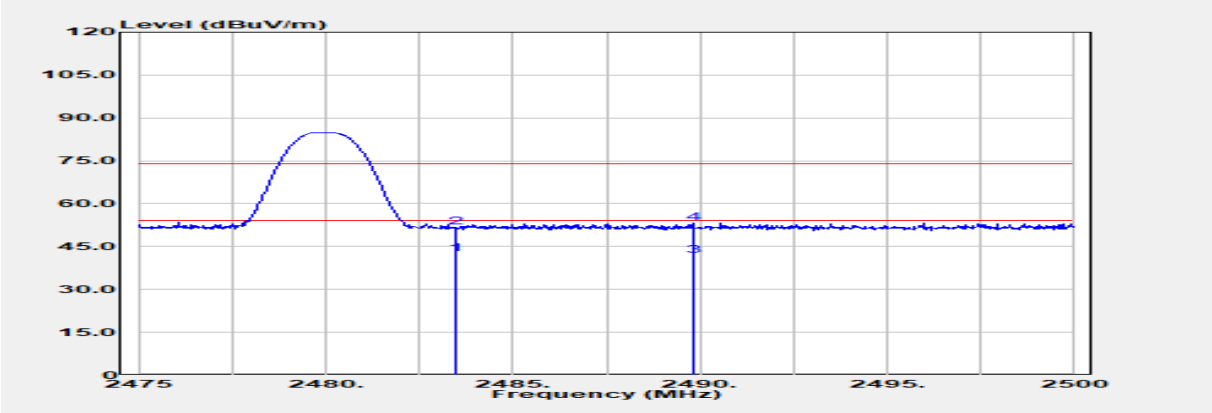
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	38.08	4.20	42.28	54.00	-11.72
2483.500	Peak	47.38	4.20	51.59	74.00	-22.41
2489.825	Average	37.69	4.18	41.87	54.00	-12.13
2489.825	Peak	49.16	4.18	53.35	74.00	-20.65

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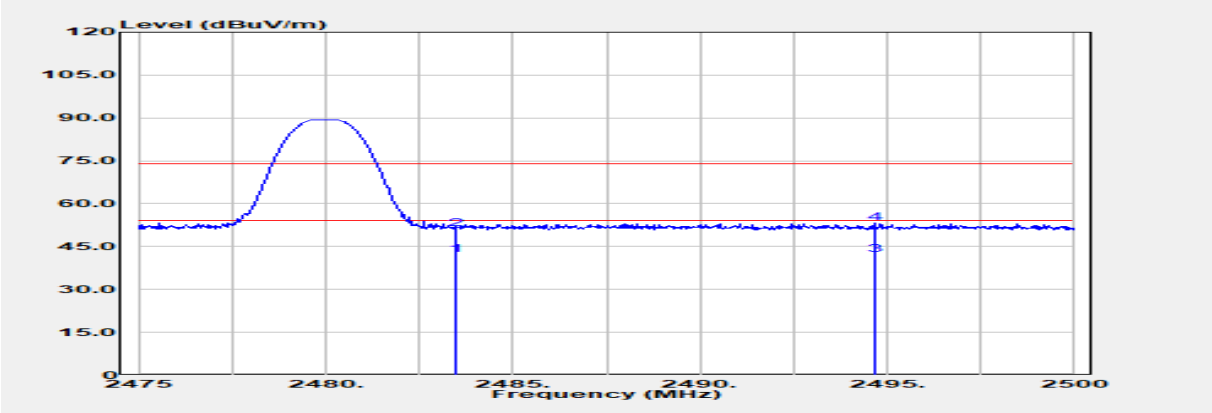
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	37.79	4.20	41.99	54.00	-12.01
2483.500	Peak	46.85	4.20	51.06	74.00	-22.94
2494.650	Average	37.89	4.17	42.06	54.00	-11.94
2494.650	Peak	49.09	4.17	53.26	74.00	-20.74

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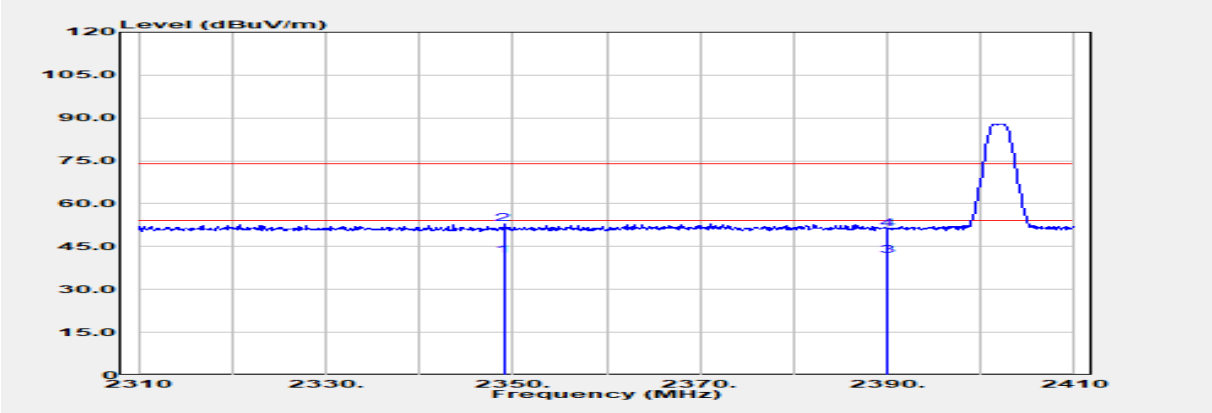
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2349.000	Average	37.82	3.89	41.71	54.00	-12.29
2349.000	Peak	49.00	3.89	52.89	74.00	-21.11
2390.000	Average	37.77	4.03	41.80	54.00	-12.20
2390.000	Peak	47.11	4.03	51.14	74.00	-22.86

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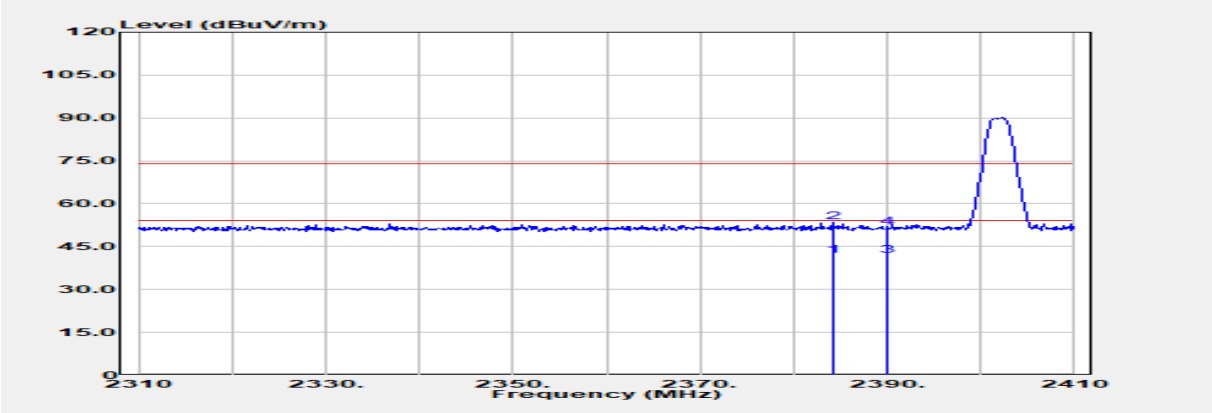
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2384.200	Average	37.80	4.01	41.81	54.00	-12.19
2384.200	Peak	49.66	4.01	53.67	74.00	-20.33
2390.000	Average	37.85	4.03	41.88	54.00	-12.12
2390.000	Peak	47.67	4.03	51.70	74.00	-22.30

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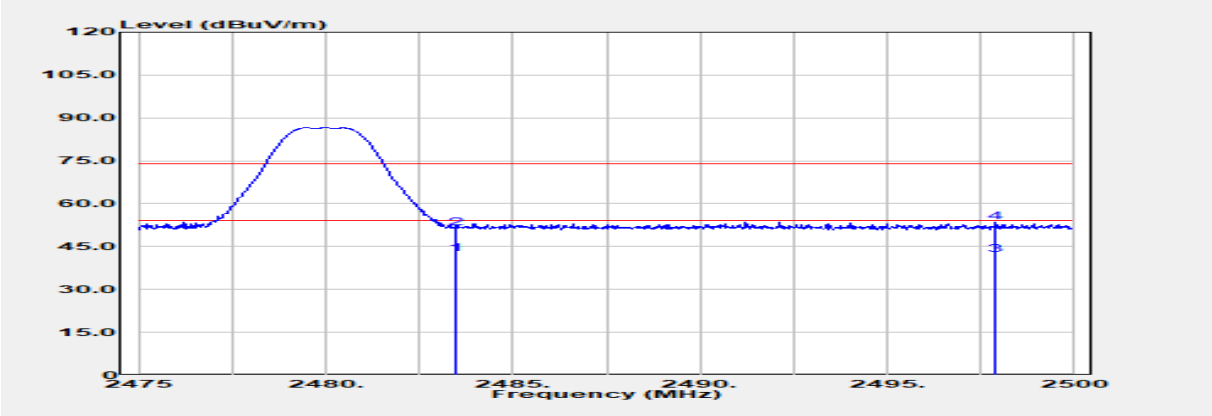
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	38.17	4.20	42.37	54.00	-11.63
2483.500	Peak	47.30	4.20	51.50	74.00	-22.50
2497.900	Average	37.90	4.16	42.06	54.00	-11.94
2497.900	Peak	49.36	4.16	53.52	74.00	-20.48

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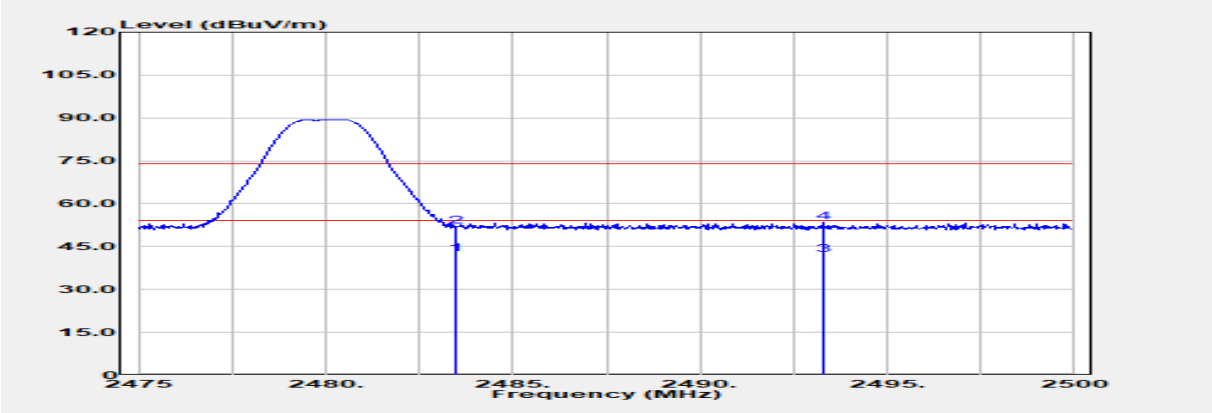
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2483.500	Average	38.26	4.20	42.46	54.00	-11.54
2483.500	Peak	47.83	4.20	52.03	74.00	-21.97
2493.300	Average	37.89	4.17	42.07	54.00	-11.93
2493.300	Peak	49.28	4.17	53.45	74.00	-20.55

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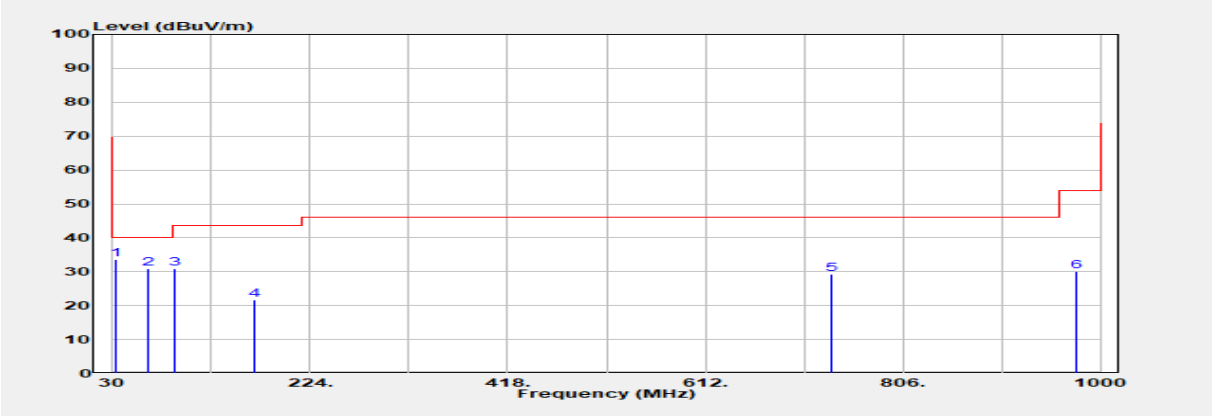
11.4.2 Radiated Spurious Emission

Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2024-01-03
Test Frequency	:2442 MHz	Temp./Humi.	:18.9℃/55%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
32.910	Peak	51.26	-17.55	33.71	40.00	-6.29
64.920	Peak	48.42	-17.55	30.87	40.00	-9.13
91.110	Peak	52.54	-21.66	30.88	43.50	-12.62
168.710	Peak	37.86	-16.21	21.65	43.50	-21.85
735.190	Peak	33.64	-4.35	29.29	46.00	-16.71
975.750	Peak	30.99	-0.86	30.13	54.00	-23.87

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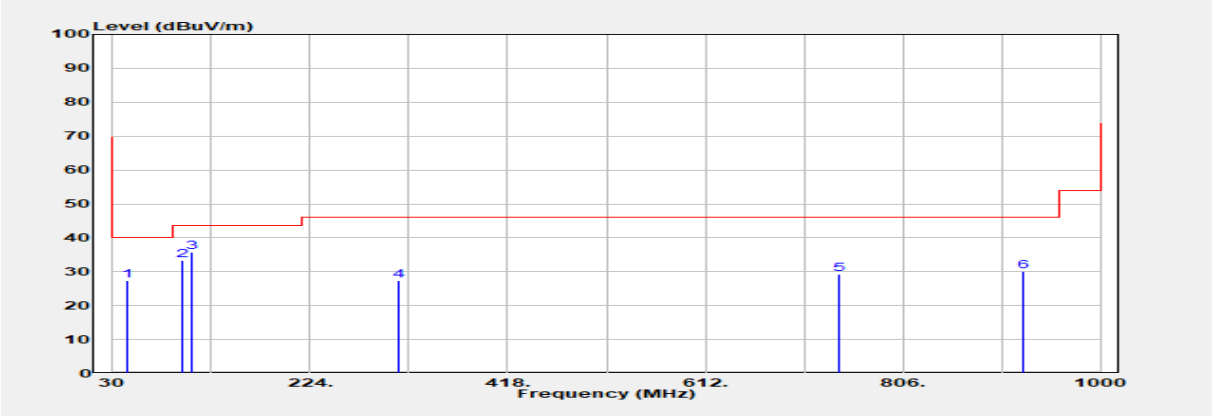
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2024-01-03
Test Frequency	:2442 MHz	Temp./Humi.	:18.9℃/55%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
44.550	Peak	43.52	-16.05	27.47	40.00	-12.53
97.900	Peak	54.44	-21.03	33.41	43.50	-10.09
107.600	Peak	55.28	-19.50	35.77	43.50	-7.73
311.300	Peak	41.81	-14.35	27.46	46.00	-18.54
742.950	Peak	33.20	-4.01	29.19	46.00	-16.81
924.340	Peak	31.29	-1.17	30.12	46.00	-15.88

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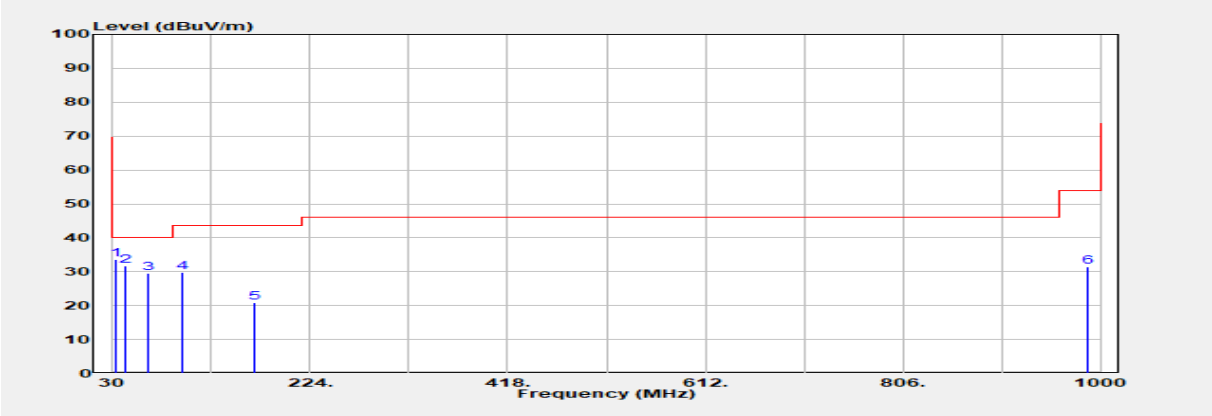
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2024-01-03
Test Frequency	:2442 MHz	Temp./Humi.	:18.9℃/55%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
32.910	Peak	51.22	-17.55	33.67	40.00	-6.33
41.640	Peak	48.27	-16.46	31.81	40.00	-8.19
63.950	Peak	46.73	-17.30	29.43	40.00	-10.57
98.870	Peak	50.78	-20.89	29.89	43.50	-13.61
168.710	Peak	37.07	-16.21	20.85	43.50	-22.65
987.390	Peak	31.87	-0.57	31.30	54.00	-22.70

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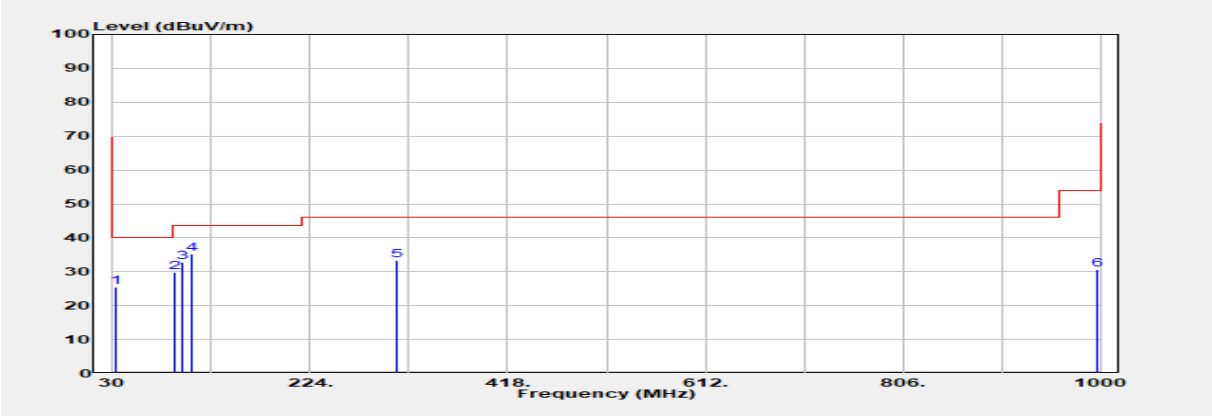
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2024-01-03
Test Frequency	:2442 MHz	Temp./Humi.	:18.9℃/55%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
32.910	Peak	43.15	-17.55	25.60	40.00	-14.40
91.110	Peak	51.53	-21.66	29.86	43.50	-13.64
97.900	Peak	53.72	-21.03	32.69	43.50	-10.81
107.600	Peak	54.75	-19.50	35.24	43.50	-8.26
308.390	Peak	47.78	-14.52	33.27	46.00	-12.73
997.090	Peak	31.37	-0.74	30.63	54.00	-23.37

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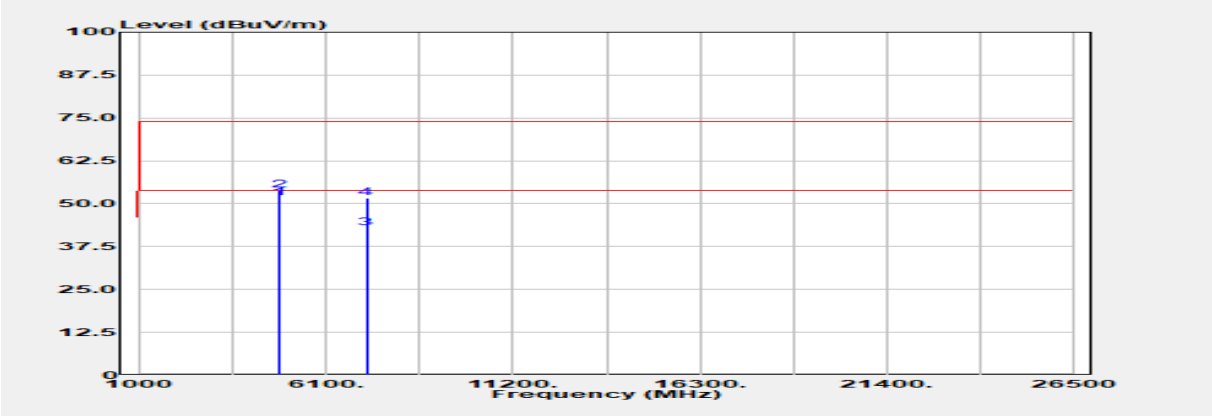
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.000	Average	39.26	12.35	51.61	54.00	-2.39
4804.000	Peak	41.49	12.35	53.85	74.00	-20.15
7206.000	Average	22.99	19.76	42.74	54.00	-11.26
7206.000	Peak	31.78	19.76	51.54	74.00	-22.46

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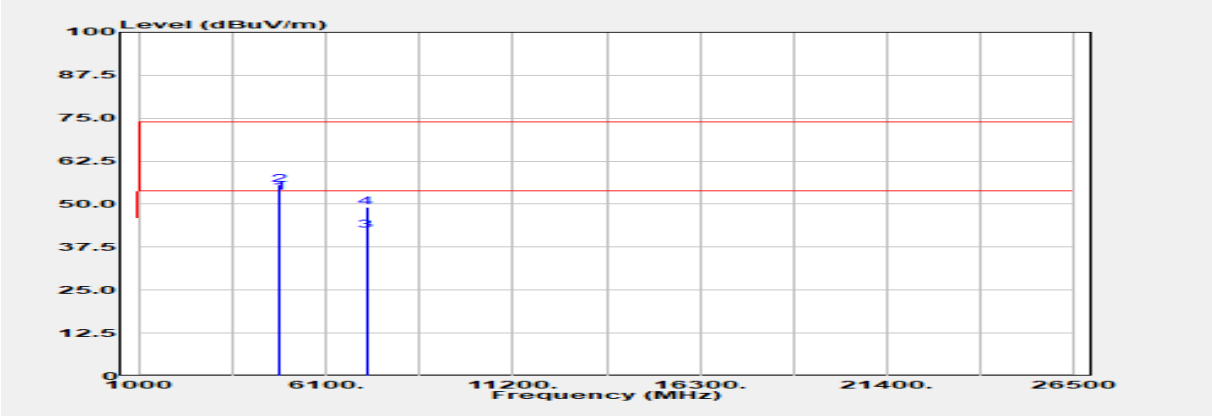
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.000	Average	41.02	12.35	53.37	54.00	-0.63
4804.000	Peak	43.25	12.35	55.60	74.00	-18.40
7206.000	Average	22.67	19.76	42.43	54.00	-11.57
7206.000	Peak	29.29	19.76	49.05	74.00	-24.95

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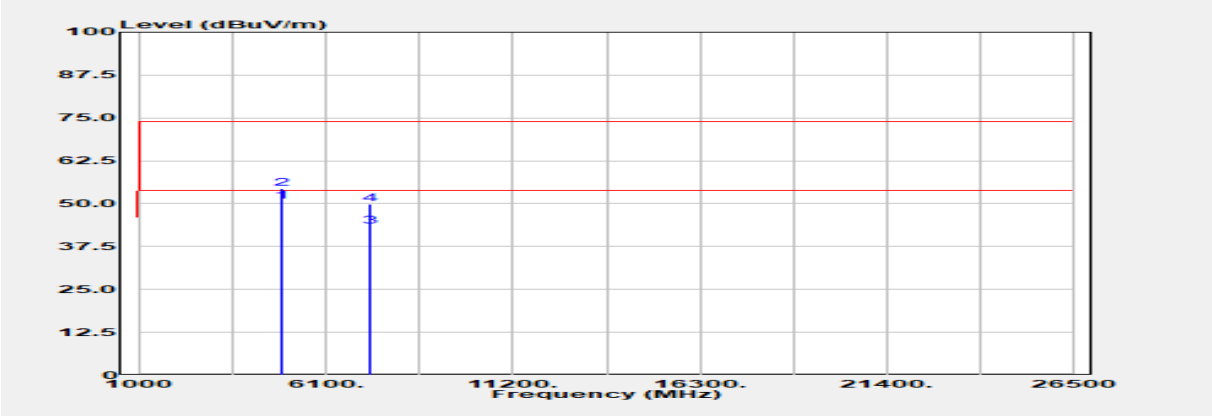
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2442 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	38.10	12.53	50.63	54.00	-3.37
4884.000	Peak	41.79	12.53	54.31	74.00	-19.69
7326.000	Average	22.57	20.69	43.26	54.00	-10.74
7326.000	Peak	29.12	20.69	49.82	74.00	-24.18

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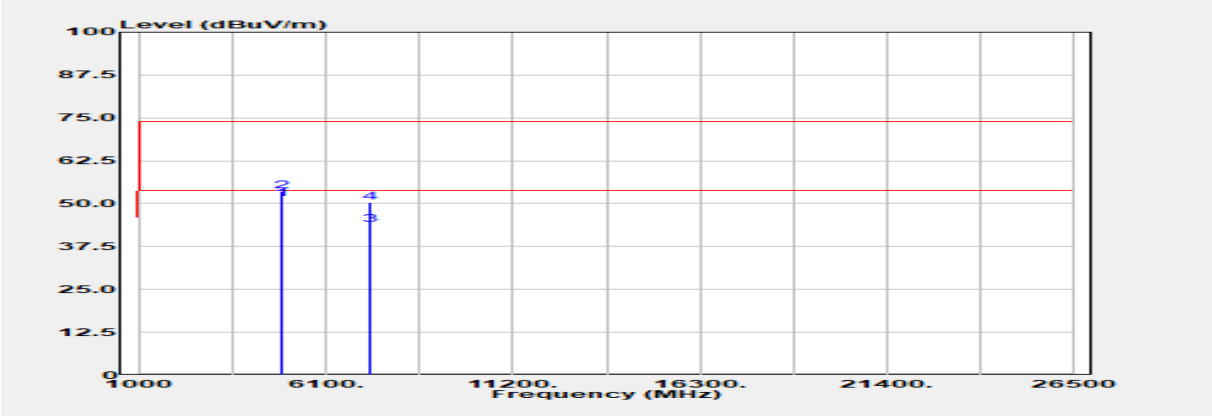
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2442 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	38.79	12.53	51.32	54.00	-2.68
4884.000	Peak	41.11	12.53	53.63	74.00	-20.37
7326.000	Average	23.23	20.69	43.92	54.00	-10.08
7326.000	Peak	29.60	20.69	50.30	74.00	-23.70

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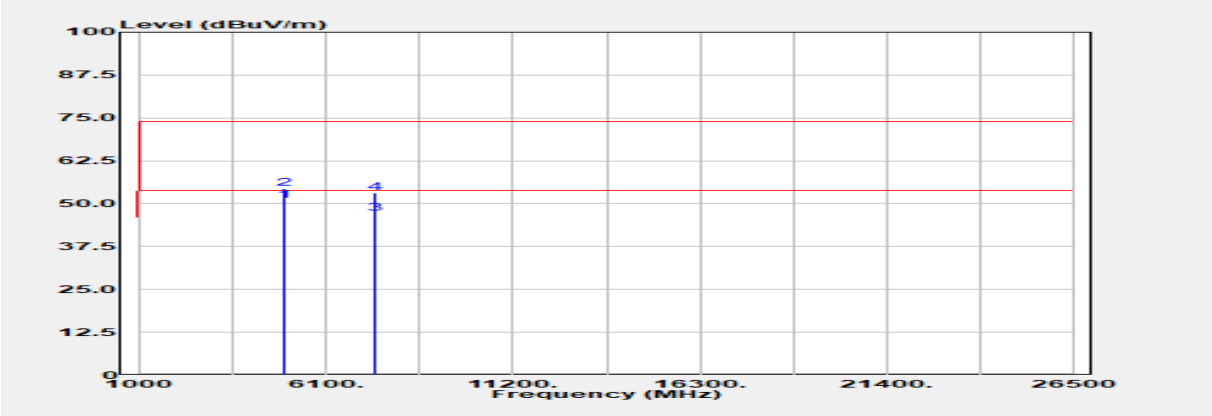
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	38.39	12.49	50.88	54.00	-3.12
4960.000	Peak	41.95	12.49	54.44	74.00	-19.56
7440.000	Average	26.47	20.58	47.05	54.00	-6.95
7440.000	Peak	32.50	20.58	53.09	74.00	-20.91

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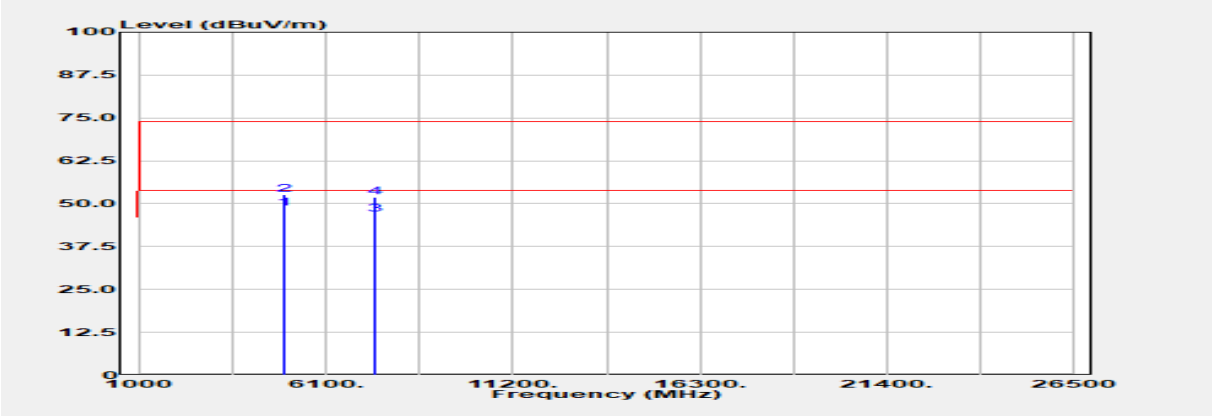
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 1M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	36.24	12.49	48.73	54.00	-5.27
4960.000	Peak	40.21	12.49	52.69	74.00	-21.31
7440.000	Average	26.27	20.58	46.85	54.00	-7.15
7440.000	Peak	31.27	20.58	51.85	74.00	-22.15

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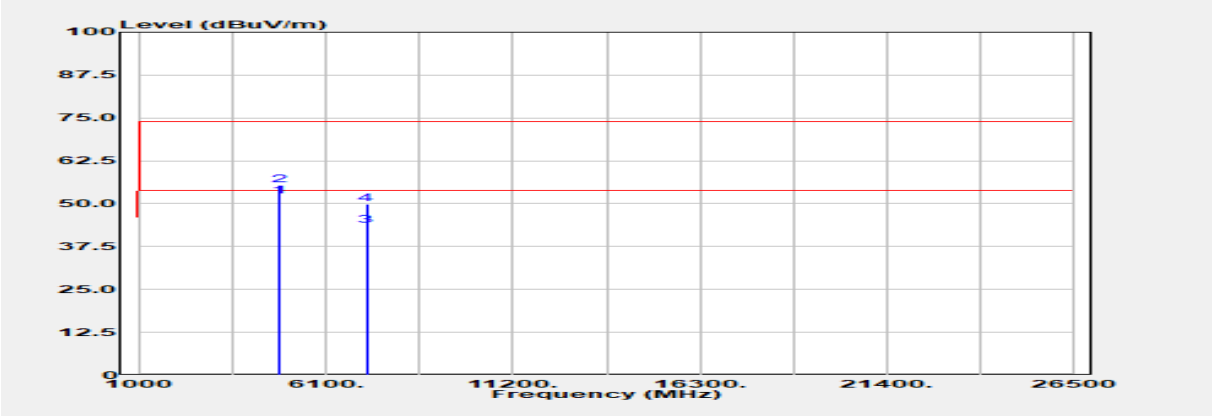
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.000	Average	39.83	12.35	52.19	54.00	-1.81
4804.000	Peak	43.12	12.35	55.47	74.00	-18.53
7206.000	Average	23.85	19.76	43.61	54.00	-10.39
7206.000	Peak	30.01	19.76	49.77	74.00	-24.23

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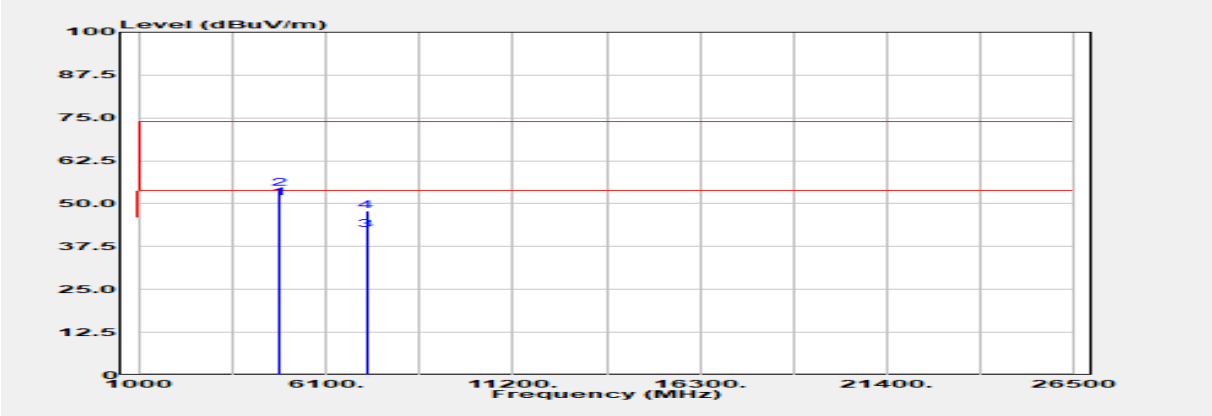
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2402 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.000	Average	39.29	12.35	51.65	54.00	-2.35
4804.000	Peak	42.02	12.35	54.37	74.00	-19.63
7206.000	Average	22.71	19.76	42.47	54.00	-11.53
7206.000	Peak	28.16	19.76	47.92	74.00	-26.08

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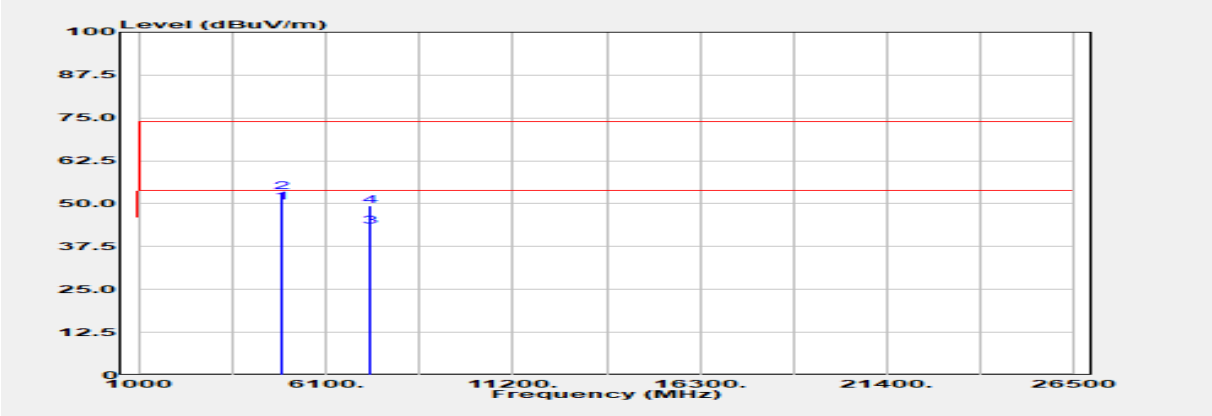
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2442 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	37.82	12.53	50.35	54.00	-3.65
4884.000	Peak	40.84	12.53	53.36	74.00	-20.64
7326.000	Average	22.68	20.69	43.37	54.00	-10.63
7326.000	Peak	28.69	20.69	49.38	74.00	-24.62

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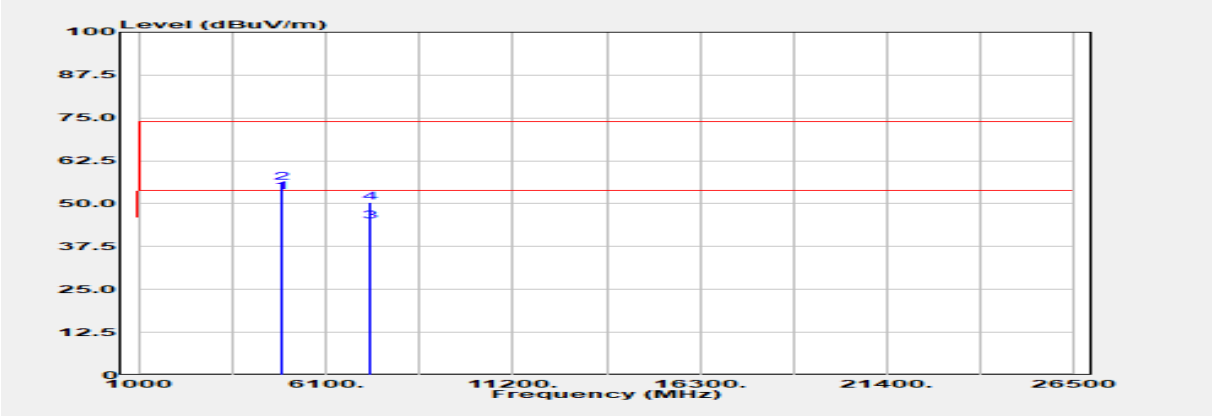
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2442 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.000	Average	40.87	12.53	53.40	54.00	-0.60
4884.000	Peak	43.71	12.53	56.24	74.00	-17.76
7326.000	Average	24.24	20.69	44.93	54.00	-9.07
7326.000	Peak	29.70	20.69	50.39	74.00	-23.61

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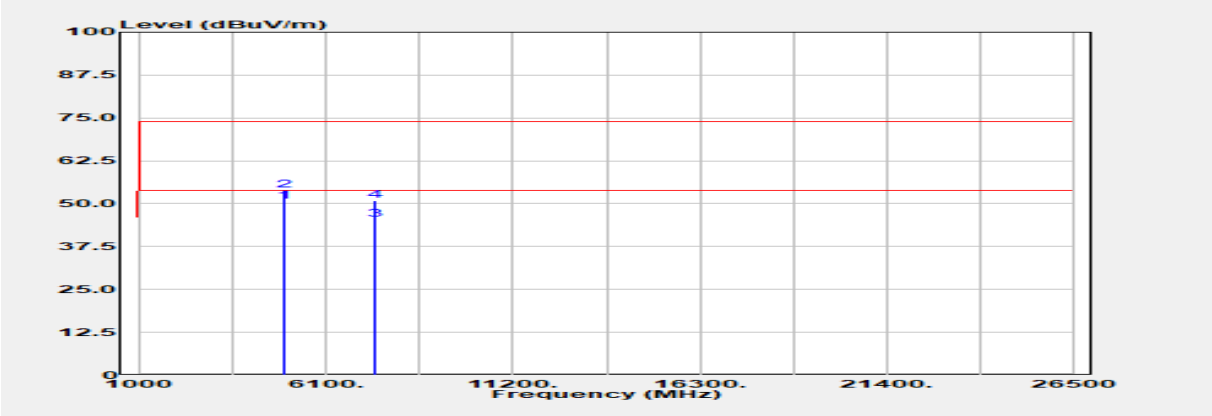
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	38.19	12.49	50.68	54.00	-3.32
4960.000	Peak	41.38	12.49	53.87	74.00	-20.13
7440.000	Average	24.68	20.58	45.26	54.00	-8.74
7440.000	Peak	30.27	20.58	50.85	74.00	-23.15

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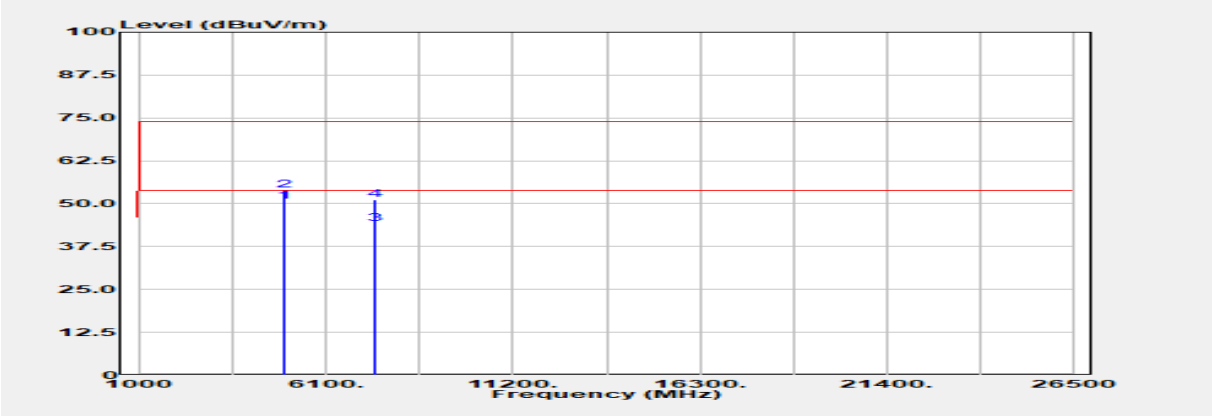
Report Number	:TERF2212002628E2	Test Site	:SAC C
Operation Mode	:BLE 2M	Test Date	:2022-12-16
Test Frequency	:2480 MHz	Temp./Humi.	:25.3/62
Test Mode	:Tx	Antenna Pol.	:HORIZONTAL
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4960.000	Average	38.24	12.49	50.72	54.00	-3.28
4960.000	Peak	41.34	12.49	53.83	74.00	-20.17
7440.000	Average	23.62	20.58	44.20	54.00	-9.80
7440.000	Peak	30.45	20.58	51.03	74.00	-22.97

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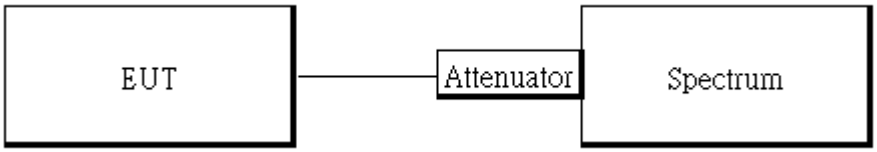
12 POWER SPECTRAL DENSITY

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.

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12.4 Measurement Result:

BLE 1M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-14.400	8	PASS
2442	-13.860	8	PASS
2480	-13.800	8	PASS

NOTE: cable loss as 11.5dB that offsets in the spectrum

BLE 2M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-14.360	8	PASS
2442	-14.120	8	PASS
2480	-13.940	8	PASS

NOTE: cable loss as 11.5dB that offsets in the spectrum

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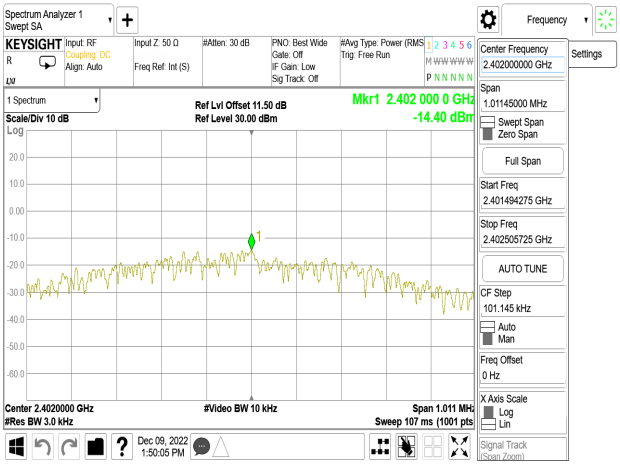
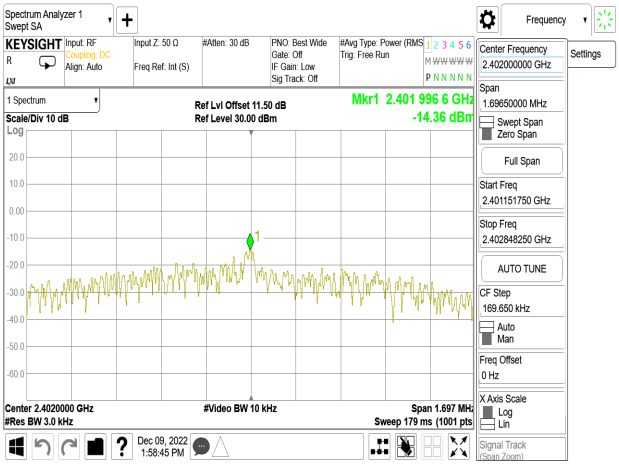
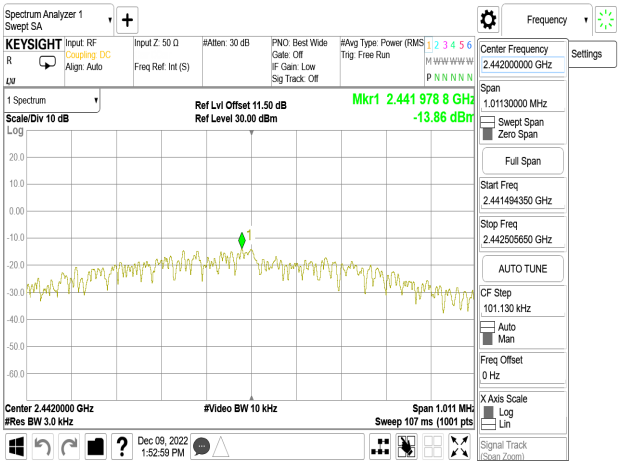
PSD_BLE 1M_LowCH00-2402MHz



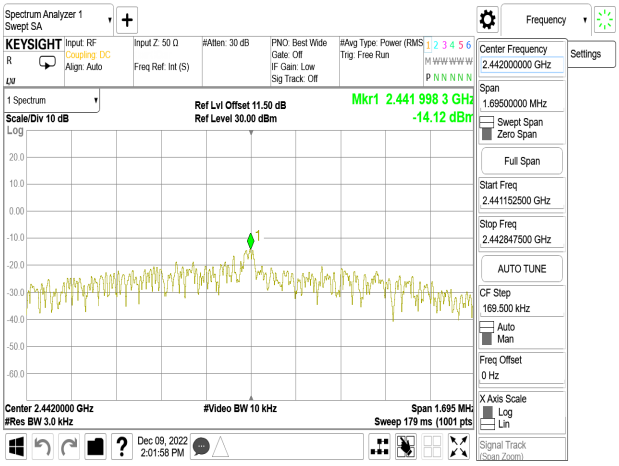
PSD_BLE 2M_LowCH00-2402MHz



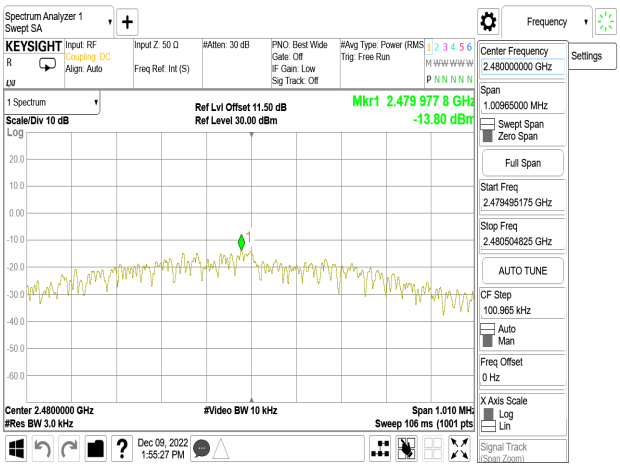
PSD_BLE 1M_MidCH20-2442MHz



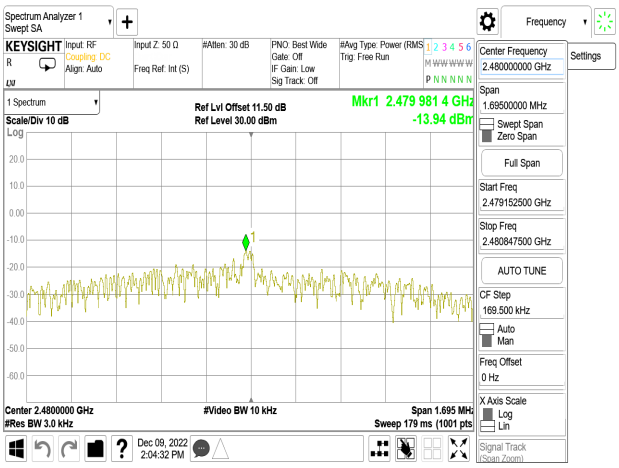
PSD_BLE 2M_MidCH20-2442MHz



PSD_BLE 1M_HighCH39-2480MHz



PSD_BLE 2M_HighCH39-2480MHz



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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 ~

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