ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	T-mobile Usa, Inc. 12920 Se 38th Street, Bellevue, Washington, United States, 98006.
Manufacturer:	T-mobile Usa, Inc. 12920 Se 38th Street, Bellevue, Washington, United States, 98006.
Product Name:	SyncUP Kids Watch V2
Brand Name:	T-Mobile
Model No.:	TMUS-SKW-2
Report Number:	TERF2402000331ER
FCC ID	2ASXC-TMO-SKW-02
Date of EUT Received:	March 06, 2024
Date of Test:	March 06, 2024～April 16, 2024
Issue Date:	April 30, 2024

Approved By Jazz Huang

Jazz Huang

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
TERF2402000331ER	00	Original.	April 24, 2024	Kate Lai	
TERF2402000331ER	01	Revise: Product Name	April 30, 2024	Kate Lai	*

Note:

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

2、 Variant information of main and 2nd source is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
The AC power line conducted Emissions and Spurious Emissions were added to measure the above differences. The rest of the internal circuit board wiring technology and radio frequency functions of the main components are the same. Please refer to the 1.4 Basic Differences of Source for details.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	SyncUP Kids Watch V2
Brand Name:	T-Mobile
Model No.:	TMUS-SKW-2
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	X5A23L4047E4C040
Power Supply:	3.87Vdc from Rechargeable Li-ion Battery
Test Software (Name/Version)	QRCT/4.0.88.1

1.2 RF Specification

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	BLE 1M: 2.81 dBm BLE 2M: 2.93 dBm

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PIFA	Suzhou Ariconn Communications Co., Ltd.	DQ623112500	2402 – 2480	-3.81

Note: Antenna information is provided by the applicant.

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1.4 Basic Differences of Source

	Model No.	Supplier
USB Cable(Data Cable) Main source	KCA-ET-5-0329	KSD CO., LTD
USB Cable(Data Cable) 2nd source	WJE240010B	GREATLAND ELECTRONICS TAIWAN LTD
PCB Main source	QNT0733	AT&S(China)Co., LTD
PCB 2nd source	6590409-G00-0T	COMPEQ MANUFACTURING CO.,LTD.
Memory Main source	FAPEA3216-58C2930	Longsys Electronics Co., Ltd.
Memory 2nd source	32CP16-M4MTC2W-GA68	KINGSTON TECHNOLOGY COMPANY
B71 Duplexer Main source	B39681B1266P810	RF360 Europe GmbH
B71 Duplexer 2nd source	SAYRH634MBA0C0A	MURATA
A+G sensor Main source	LSM6DSOWTR	STMicroelectronics
A+G sensor 2nd source	ICM-42607-P	TDK TAIWAN CORP.TDK XIAMEN CO.,LTD
Crystal for PMIC Main source	EXS00A-CS12755	Nihon Dempa Kogyo Co., Ltd.
Crystal for PMIC 2nd source	OW38470002	TAIWAN X'TAL CORPATION
Baromete Main source	LPS22DFTR	STMicroelectronics
Barometer 2nd source	ICP-20100	TDK TAIWAN CORP.TDK XIAMEN CO.,LTD
Display Main source	TA014XVHM52-00	Tianma Micro-Electronics CO., LTD.
Display 2nd source	ONO-0141C40719	Truly Semiconductors Ltd.
Speaker Main source	MS07-015008-002H	Luxshare Precision Limited
Speaker 2nd source	KDSG150808C-08PF	KINGSTATE ELECTRONICS

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1.5 Test Methodology of Applied Standards

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

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.

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.

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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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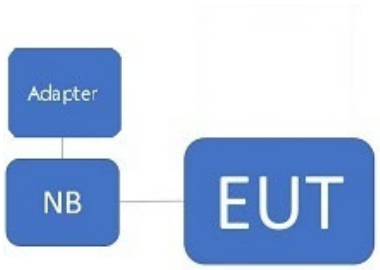
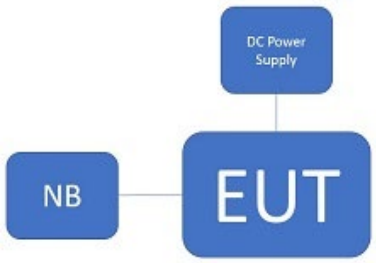
2.5 Test Configuration

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.	CAL DUE.
Notebook	Lenovo	T14	PF-380WLW	N/A	N/A
Adapter	Lenovo	ADLX65YAC3D	N/A	N/A	N/A

Conducted Emission Test Site: Conducted 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T14	PF-380WLW	N/A	N/A

Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T14	PF-380WLW	N/A	N/A

2nd Source

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T14	PF-380WLW	N/A	N/A
Adapter	Lenovo	ADLX65YAC3D	N/A	N/A	N/A

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T14	PF-380WLW	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

2400~2483.5 MHz							
CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

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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

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

2nd Source

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

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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 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
LISN	SCHWARZBECK	NSLK 8127	1040	09/06/2023	09/05/2024
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2023	06/21/2024
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2023	06/21/2024
EMI Test Receiver	R&S	ESCI 7	100759	08/21/2023	08/20/2024

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071571	06/07/2023	06/06/2024
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Power Meter	Anritsu	ML2496A	1242004	10/24/2023	10/23/2024
Power Sensor	Anritsu	MA2411B	1207365	10/24/2023	10/23/2024
Power Sensor	Anritsu	MA2411B	1207368	10/24/2023	10/23/2024
DC Power Supply	Agilent	E3640A	KR93300208	09/12/2023	09/11/2024
DC Block	Mini-Circuits	BLK-18-S+	31129	12/12/2023	12/11/2024

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	COM-POWER	AL-130R	10160104	12/04/2023	12/03/2024
Horn Antenna	RF SPIN	DRH0844	LE2D05A0844	07/03/2023	07/02/2024
Horn Antenna	SCHWARZBECK	BBHA9120D	D803	01/12/2024	01/11/2025
Bi-log Antenna	TESEO	CBL 6112D	35242 & AT-N0555	12/18/2023	12/17/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY60242081	10/17/2023	10/16/2024
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
Site Cal	SGS	SAC 1	N/A	08/31/2023	08/30/2024
Pre-Amplifier	EMCI	EMC184045B	980135	08/31/2023	08/30/2024
Pre-Amplifier	HP	8447D	2944A09469	08/31/2023	08/30/2024
Pre-Amplifier	EMCI	EMC118A45SEE	980933	07/31/2023	07/30/2024
4G High Pass Filter	WI	WHKX4.0	22	12/12/2023	12/11/2024
Band Reject Filter 2400-2483.5	EWT	EWT-14-0166	M3	12/12/2023	12/11/2024
Coaxial Cables	Huber Suhner	SUCOFLEX 102	RX Cable 18G-40G MY2630/2+805062/2	08/31/2023	08/30/2024
Coaxial Cable	EMCI	EMC104-SM-SM-8000+EMC106-SM-SM-7600	RX Cable 9K-18G(160125+150817)	09/12/2023	09/11/2024

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2nd Source

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	RF SPIN	DRH0844	LE2D05A0844	07/03/2023	07/02/2024
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/23/2023	09/22/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY63440386	02/06/2024	02/05/2025
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
Site Cal	SGS	SAC 3	N/A	08/31/2023	08/30/2024
Pre-Amplifier	EMCI	EMC184045B	980135	08/31/2023	08/30/2024
Pre-Amplifier	EMCI	EMC118A45SEE	980868	08/31/2023	08/30/2024
4G High Pass Filter	WI	WHKX4.0	22	12/12/2023	12/11/2024
Band Reject Filter 2400-2483.5	EWT	EWT-14-0166	M3	12/12/2023	12/11/2024
Coaxial Cables	Huber Suhner	SUCOFLEX 102	RX Cable 18G-40G MY2630/2+805062/2	08/31/2023	08/30/2024
Coaxial Cables	EMCI+Huber Suhner	EMC107-SM-SM-1000+EMC107-SM-SM-1500+EMC107-SM-SM-8000+SUCOFLEX 104PEA	RX Cable 9K-18G (221110+221106+221212+MY4251/4PEA)	08/31/2023	08/30/2024

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

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7 CONDUCTED EMISSION TEST

7.1 Standard Applicable:

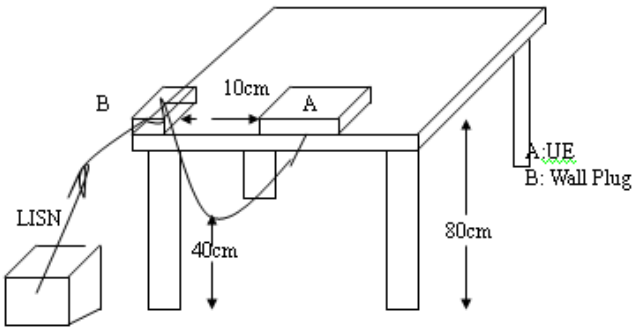
Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

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 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:

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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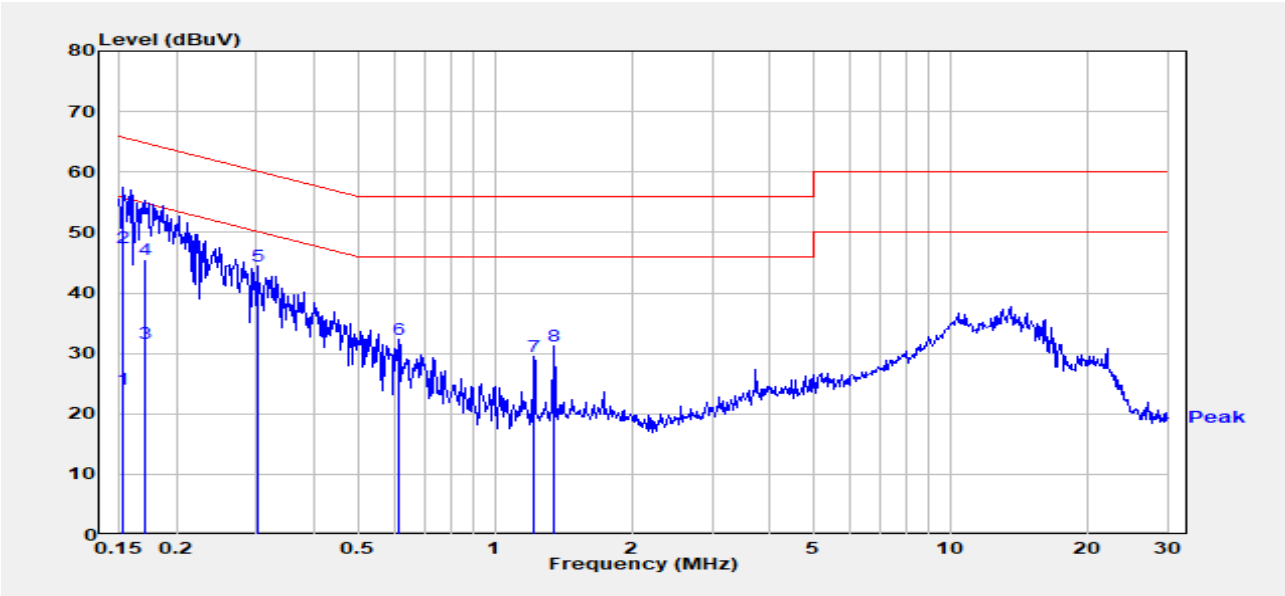
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2402000331ER	Test Site	:Conduction 1
Operation Mode	:BLE	Test Date	:2024-04-01
Power	:120V/60Hz	Temp./Humi.	:24.9℃/61%
Probe	:L	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	13.90	10.13	24.03	55.82	-31.79
0.153	QP	37.40	10.13	47.53	65.82	-18.29
0.171	Average	21.60	10.13	31.73	54.90	-23.17
0.171	QP	35.50	10.13	45.63	64.90	-19.27
0.300	Peak	34.29	10.14	44.43	60.24	-15.81
0.617	Peak	22.23	10.18	32.40	56.00	-23.60
1.223	Peak	19.18	10.20	29.38	56.00	-26.62
1.352	Peak	21.01	10.20	31.20	56.00	-24.80

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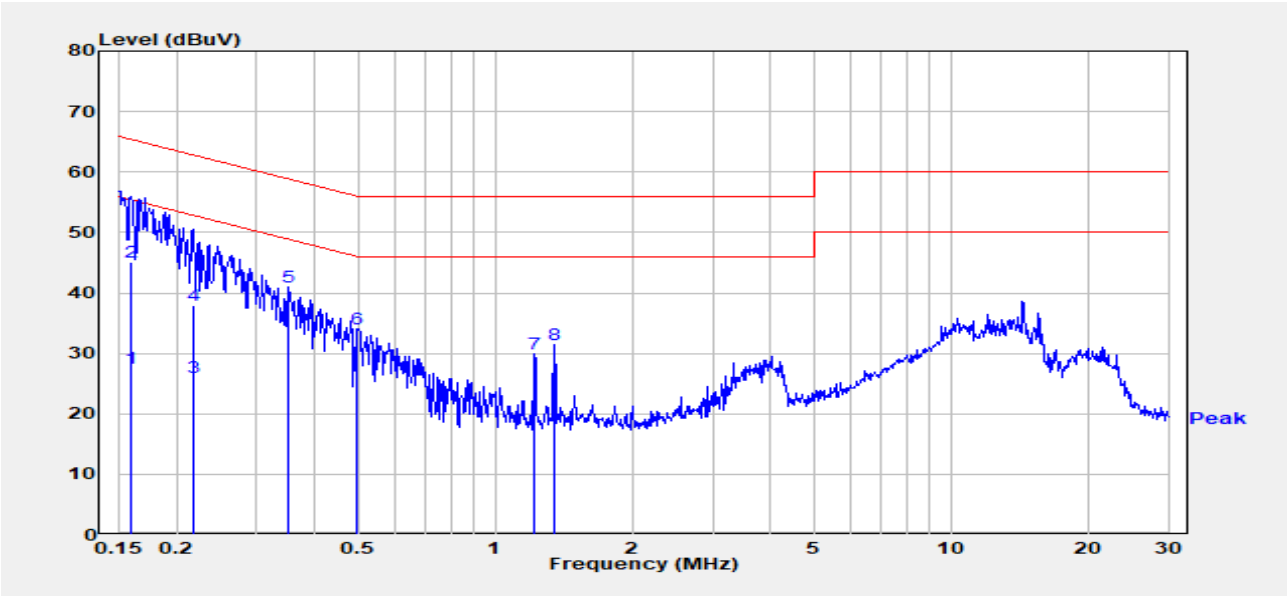
Report Number	:TERF2402000331ER	Test Site	:Conduction 1
Operation Mode	:BLE	Test Date	:2024-04-01
Power	:120V/60Hz	Temp./Humi.	:24.9℃/61%
Probe	:N	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.159	Average	17.40	10.12	27.52	55.52	-28.00
0.159	QP	35.00	10.12	45.12	65.52	-20.40
0.217	Average	15.90	10.12	26.02	52.92	-26.90
0.217	QP	27.80	10.12	37.92	62.92	-25.00
0.352	Peak	30.88	10.14	41.03	58.91	-17.89
0.499	Peak	23.94	10.16	34.10	56.01	-21.91
1.223	Peak	19.70	10.19	29.89	56.00	-26.11
1.352	Peak	21.15	10.19	31.34	56.00	-24.66

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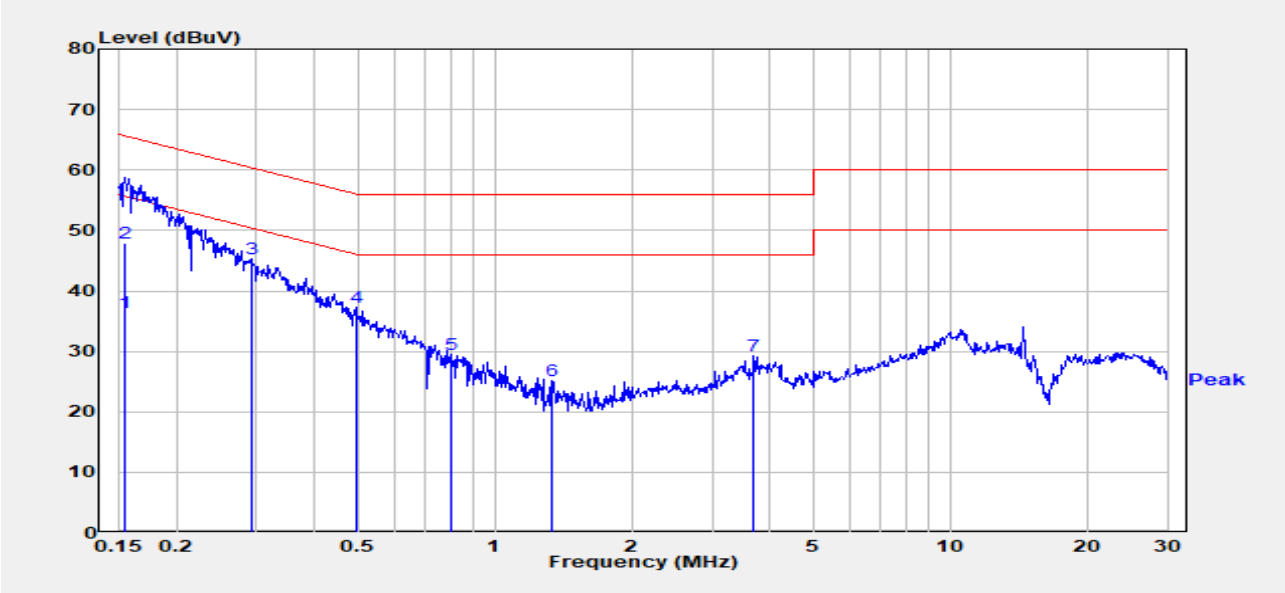
2nd Source

Report Number	:TERF2402000331ER	Test Site	:Conduction 1
Operation Mode	:BLE	Test Date	:2024-04-16
Power	:120V/60Hz	Temp./Humi.	:24.7℃/63%
Probe	:L	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.154	Average	26.20	10.13	36.33	55.78	-19.45
0.154	QP	37.80	10.13	47.93	65.78	-17.85
0.292	Peak	35.07	10.14	45.21	60.46	-15.25
0.497	Peak	27.14	10.16	37.31	56.05	-18.75
0.804	Peak	19.32	10.19	29.50	56.00	-26.50
1.331	Peak	15.02	10.20	25.22	56.00	-30.78
3.700	Peak	18.88	10.28	29.16	56.00	-26.84

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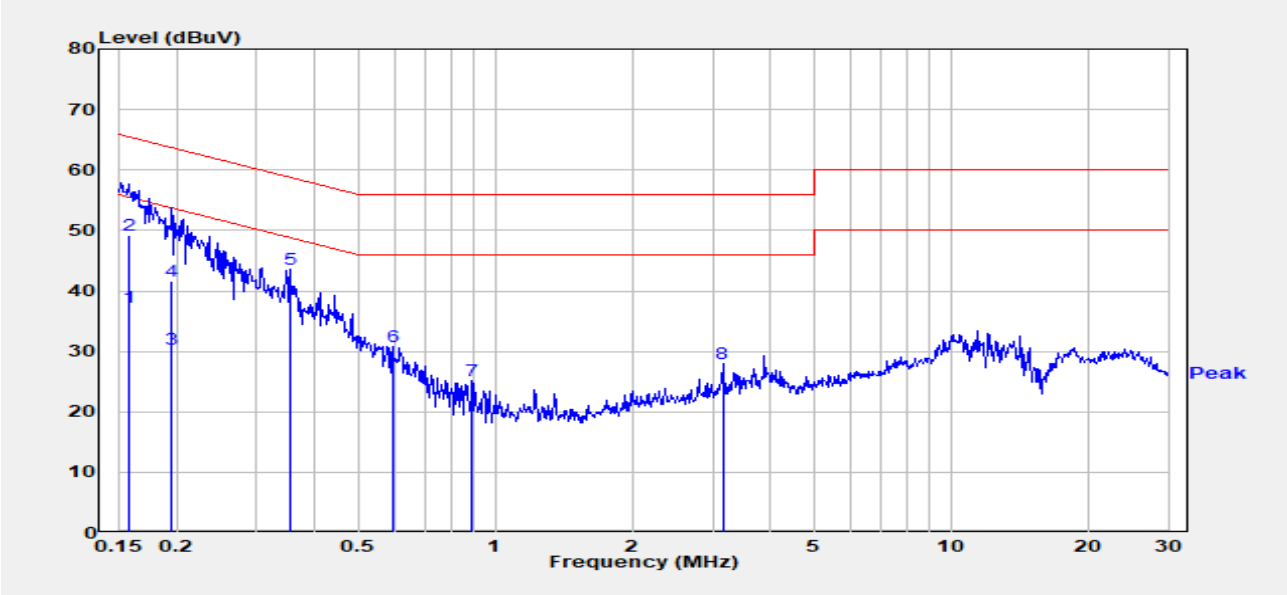
Report Number	:TERF2402000331ER	Test Site	:Conduction 1
Operation Mode	:BLE	Test Date	:2024-04-16
Power	:120V/60Hz	Temp./Humi.	:24.7℃/63%
Probe	:N	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.156	Average	27.10	10.12	37.22	55.65	-18.43
0.156	QP	39.10	10.12	49.22	65.65	-16.43
0.195	Average	20.20	10.12	30.32	53.80	-23.48
0.195	QP	31.40	10.12	41.52	63.80	-22.28
0.354	Peak	33.39	10.14	43.54	58.87	-15.33
0.595	Peak	20.67	10.17	30.84	56.00	-25.16
0.890	Peak	14.90	10.19	25.08	56.00	-30.92
3.156	Peak	17.79	10.27	28.05	56.00	-27.95

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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

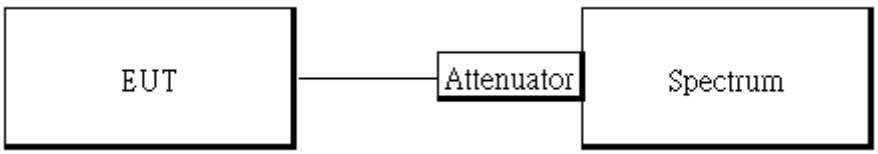
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

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.

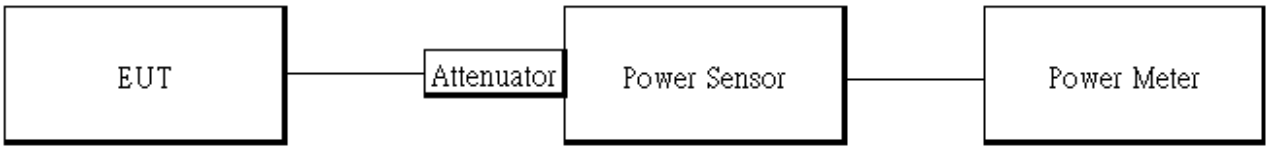
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

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	63.20	1.99	2.53	3.00
BLE 2M	32.80	4.84	4.88	5.00

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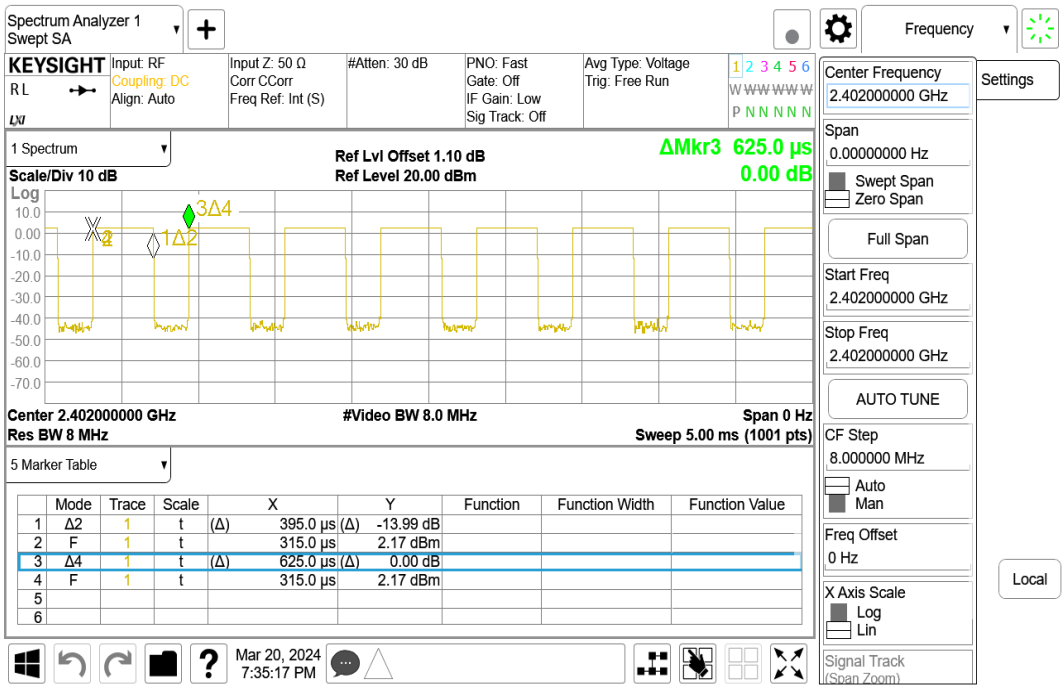
BLE_1M_LowCH00-2402



BLE_2M_LowCH00-2402

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8.5 Output Power:

8.5.1 Peak & Avg

BLE 1M mode:

CH	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	Required Limit (dBm)
Low	2402	default	**2.81**	30
Mid	2442	default	2.57	30
High	2480	default	2.38	30
CH	**Frequency (MHz)**	**Power Setting**	**Avg. Output Power (dBm)**	**Required Limit (dBm)**
Low	2402	default	2.58	30
Mid	2442	default	2.35	30
High	2480	default	2.20	30

Note:

1.Measured by power meter, cable loss 1.4 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 Output Power (dBm)	Required Limit (dBm)
Low	2402	default	**2.93**	30
Mid	2442	default	2.74	30
High	2480	default	2.53	30
CH	**Frequency (MHz)**	**Power set**	**Avg. Output Power (dBm)**	**Required Limit (dBm)**
Low	2402	default	2.60	30
Mid	2442	default	2.33	30
High	2480	default	2.29	30

Note:

1.Measured by power meter, cable loss 1.4 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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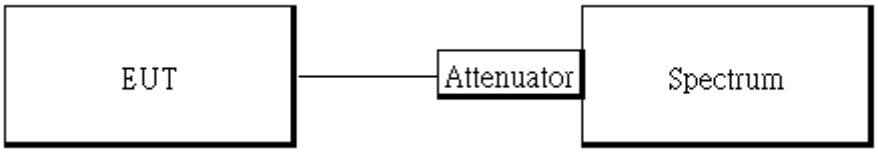
9 EMISSION BANDWIDTH MEASUREMENT

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	0.6705	≧ 0.5	PASS
2442	0.6718	≧ 0.5	PASS
2480	0.6721	≧ 0.5	PASS

BLE 2M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.136	≧ 0.5	PASS
2442	1.137	≧ 0.5	PASS
2480	1.139	≧ 0.5	PASS

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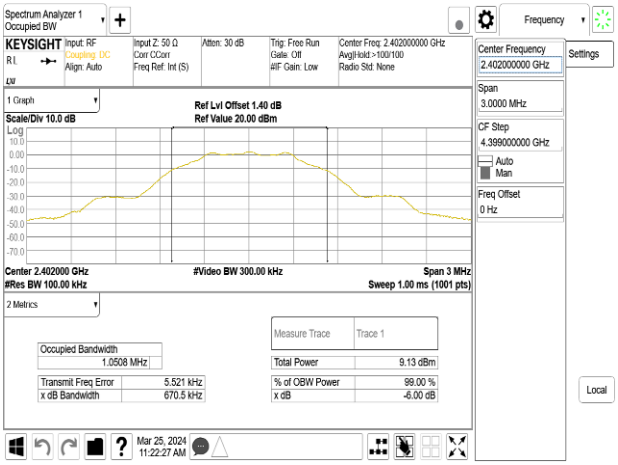
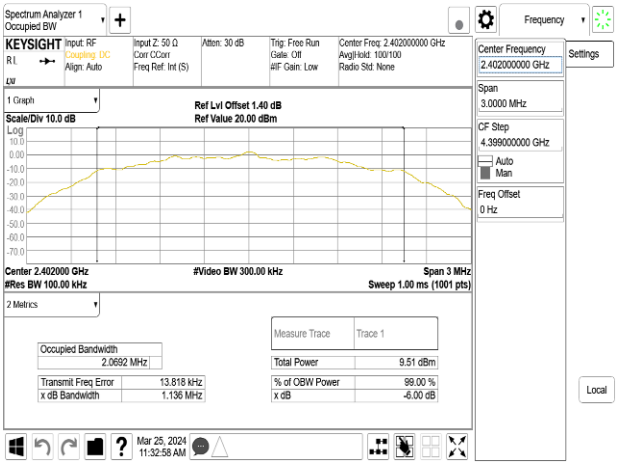
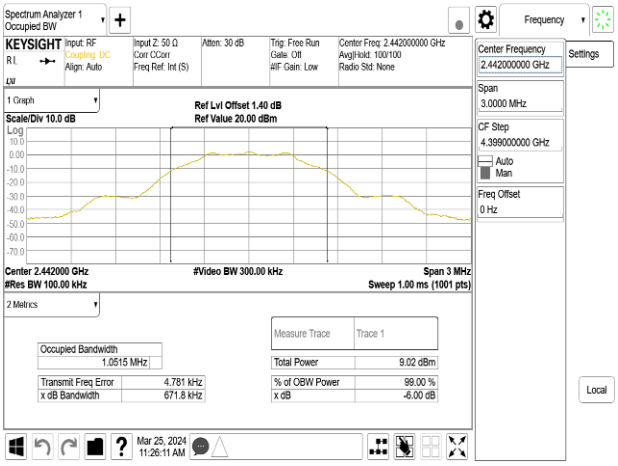
OBW_BLE 1M_LowCH00-2402MHz



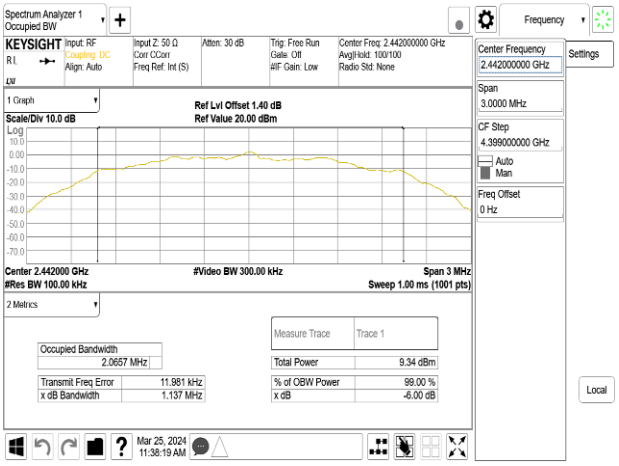
OBW_BLE 2M_LowCH00-2402MHz



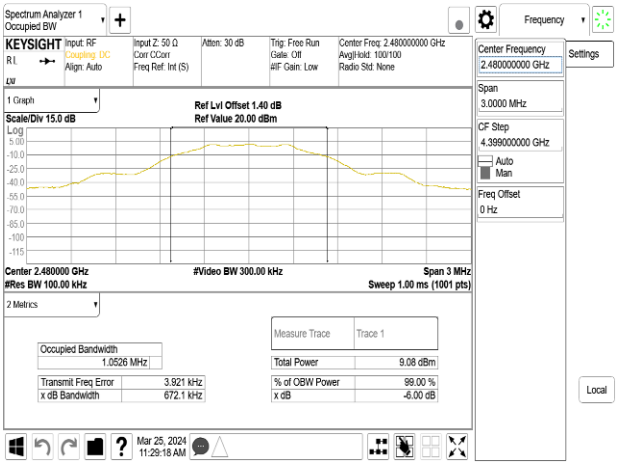
OBW_BLE 1M_MidCH20-2442MHz



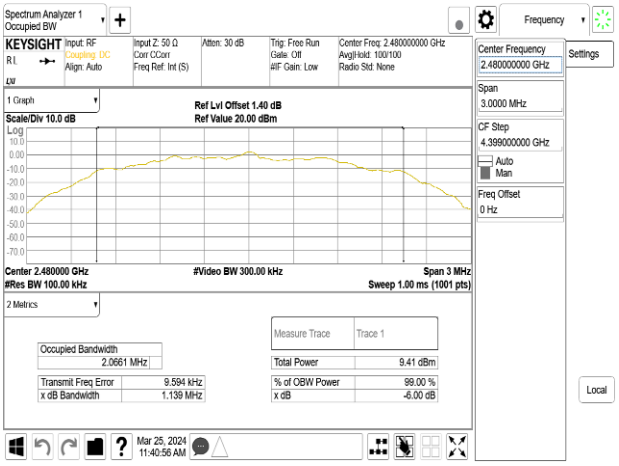
OBW_BLE 2M_MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



OBW_BLE 2M_HighCH39-2480MHz



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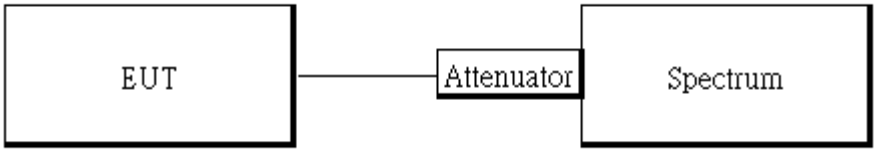
10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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	2.46	-17.54
2442	2.33	-17.67
2480	2.41	-17.59

Note:

1.cable loss as 1.4dB that offsets in the spectrum
2.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	2.42	-17.58
2442	2.24	-17.76
2480	2.32	-17.68

Note:

1.cable loss as 1.4dB that offsets in the spectrum
2.Refer to next page for plots.

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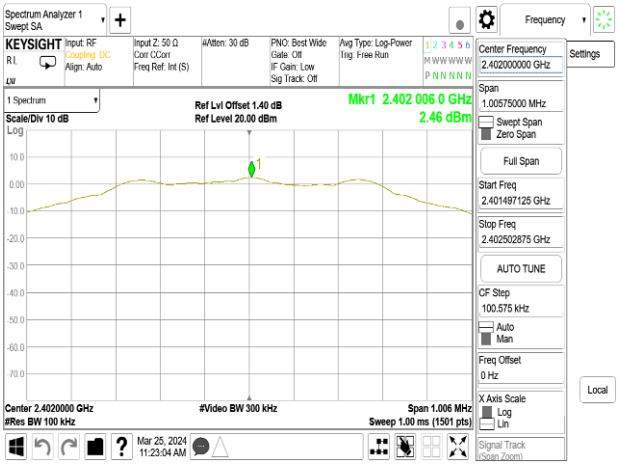
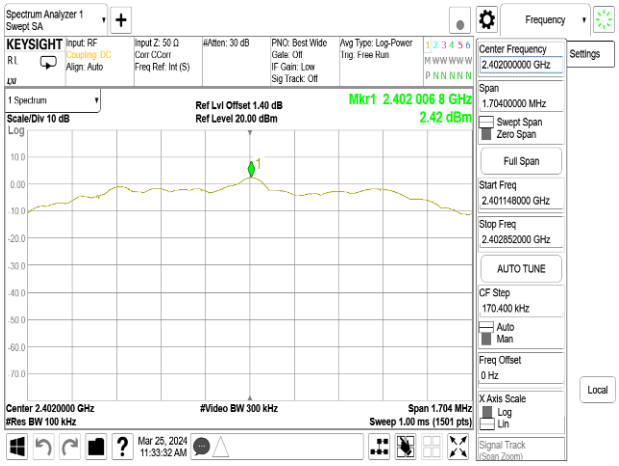
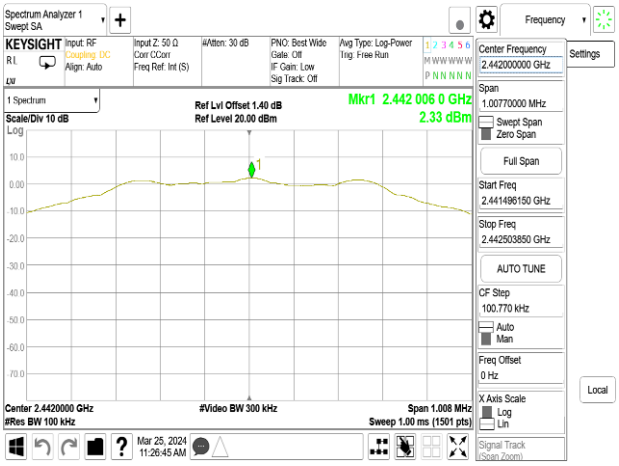
Reference Level_BLE 1M_LowCH00-2402MHz



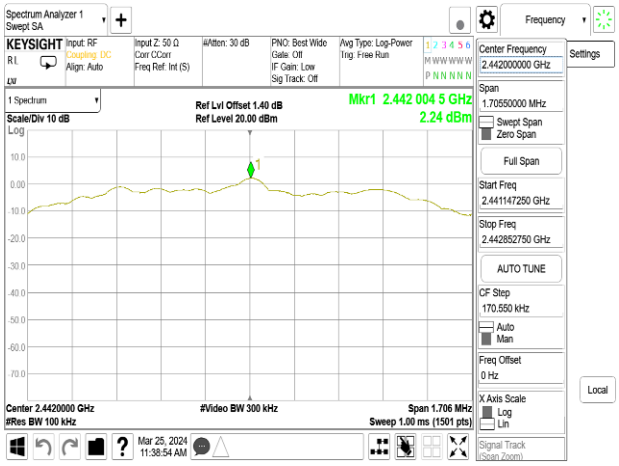
Reference Level_BLE 2M_LowCH00-2402MHz



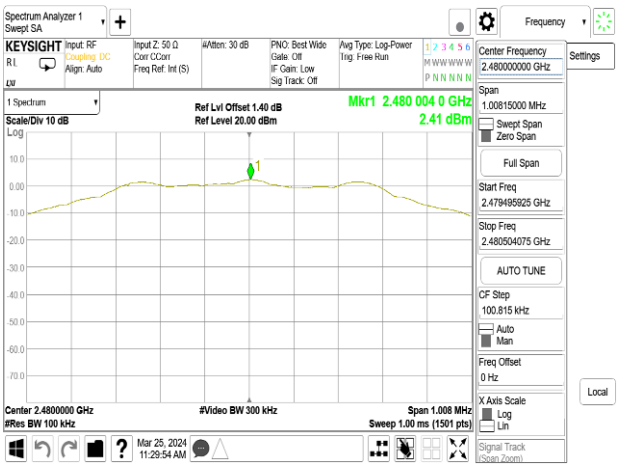
Reference Level_BLE 1M_MidCH20-2442MHz



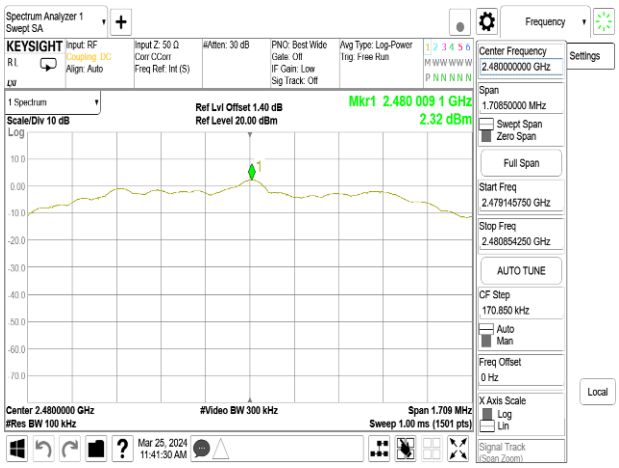
Reference Level_BLE 2M_MidCH20-2442MHz



Reference Level_BLE 1M_HighCH39-2480MHz



Reference Level_BLE 2M_HighCH39-2480MHz



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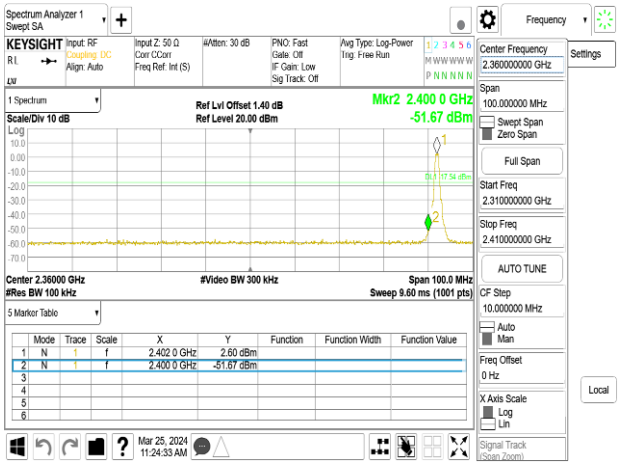
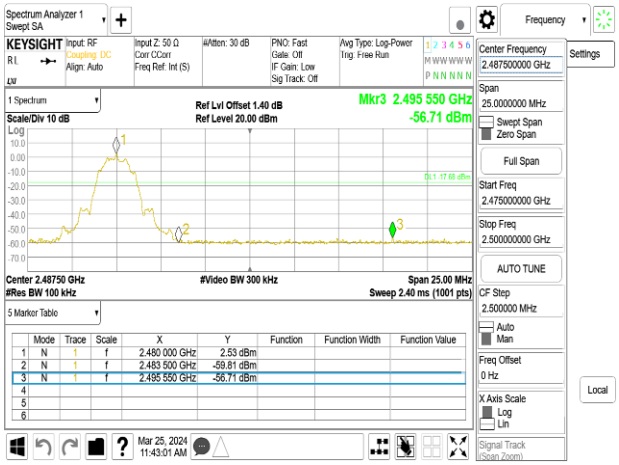
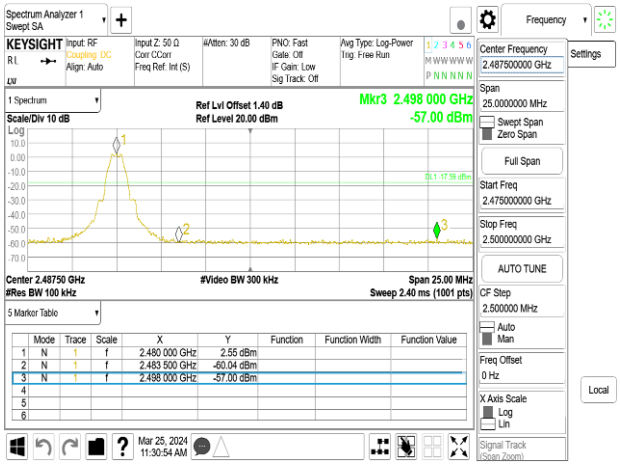
Band Edge_BLE 1M_LowCH00-2402MHz



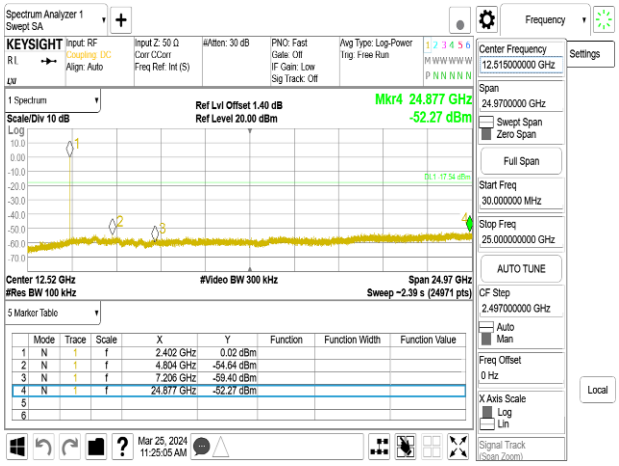
Band Edge_BLE 2M_HighCH39-2480MHz



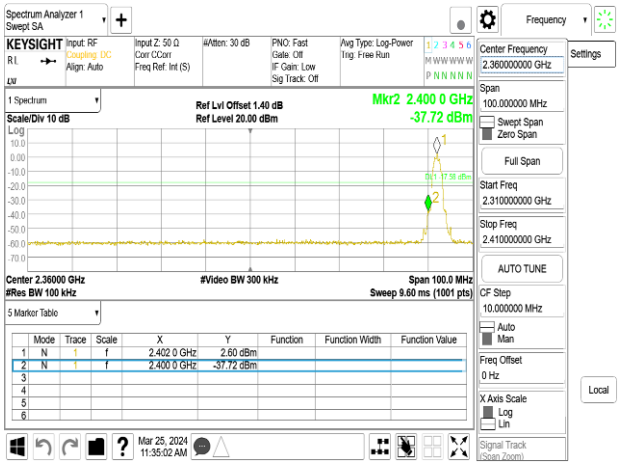
Band Edge_BLE 1M_HighCH39-2480MHz



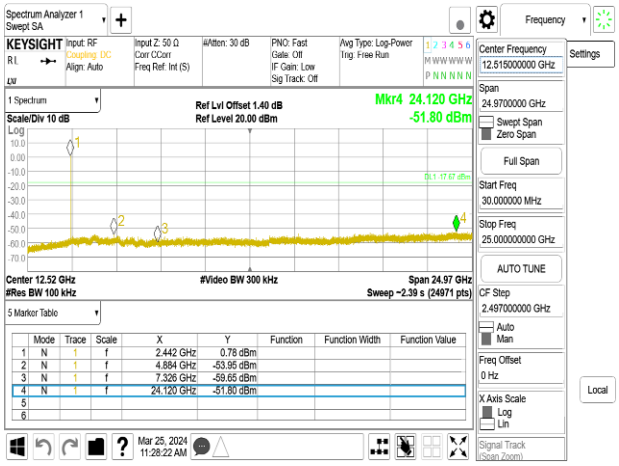
Spurious Emission_BLE 1M_LowCH00-2402MHz



Band Edge_BLE 2M_LowCH00-2402MHz



Spurious Emission_BLE 1M_MidCH20-2442MHz



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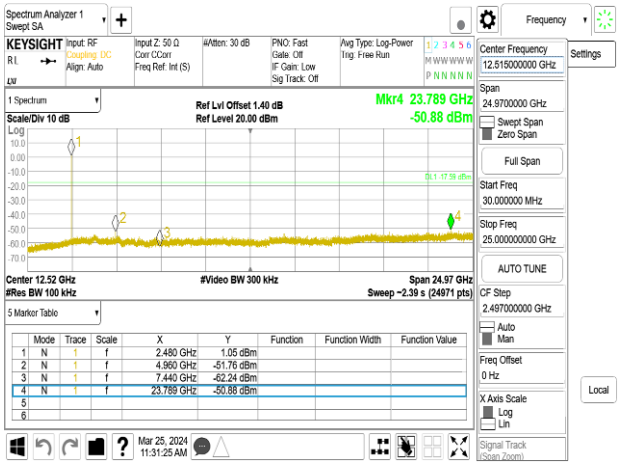
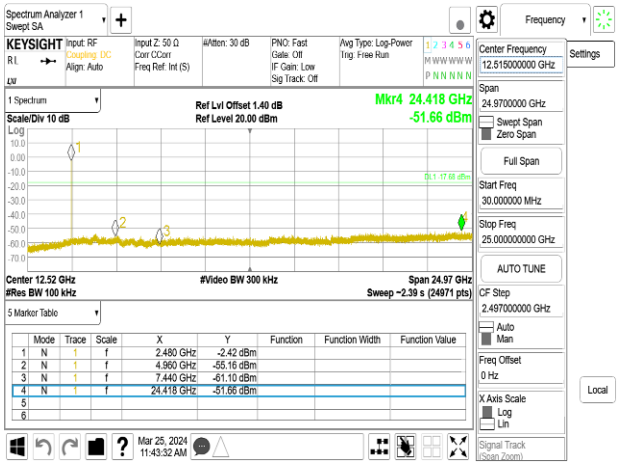
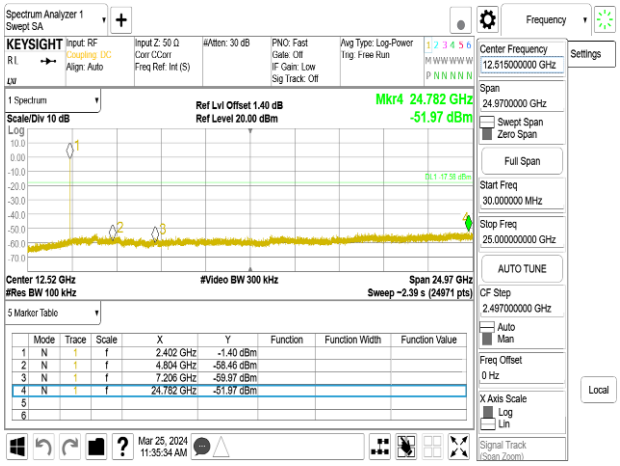
Spurious Emission_BLE 1M_HighCH39-2480MHz



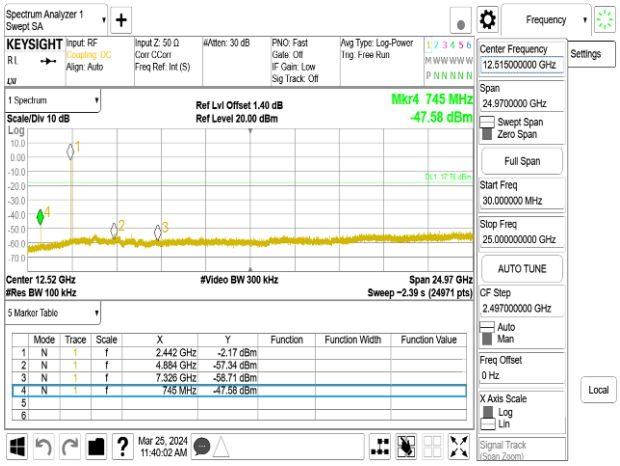
Spurious Emission_BLE 2M_HighCH39-2480MHz



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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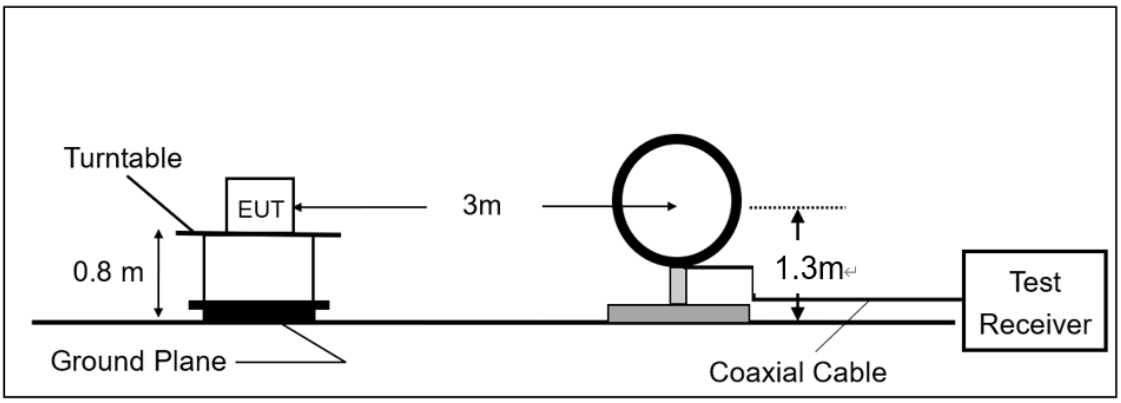
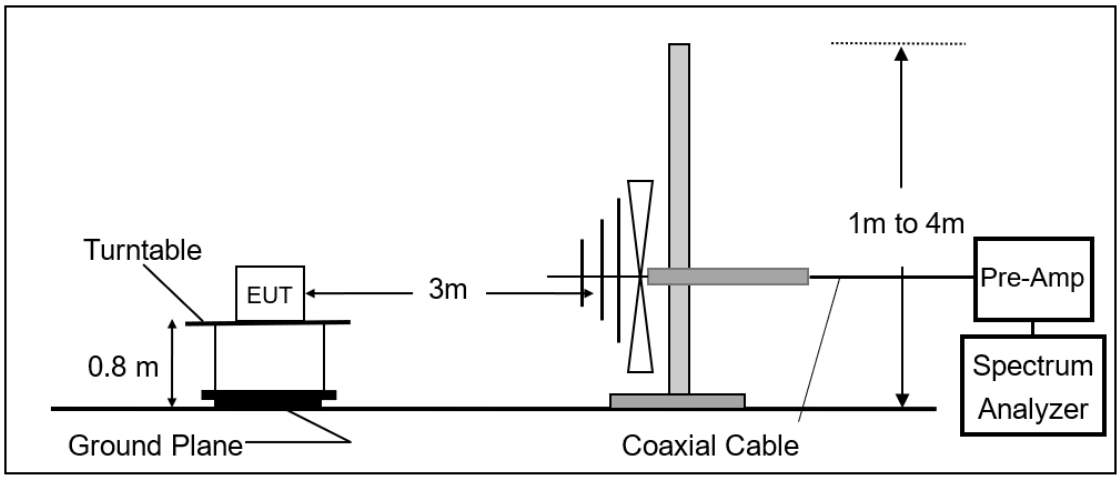
11.1 Test Setup

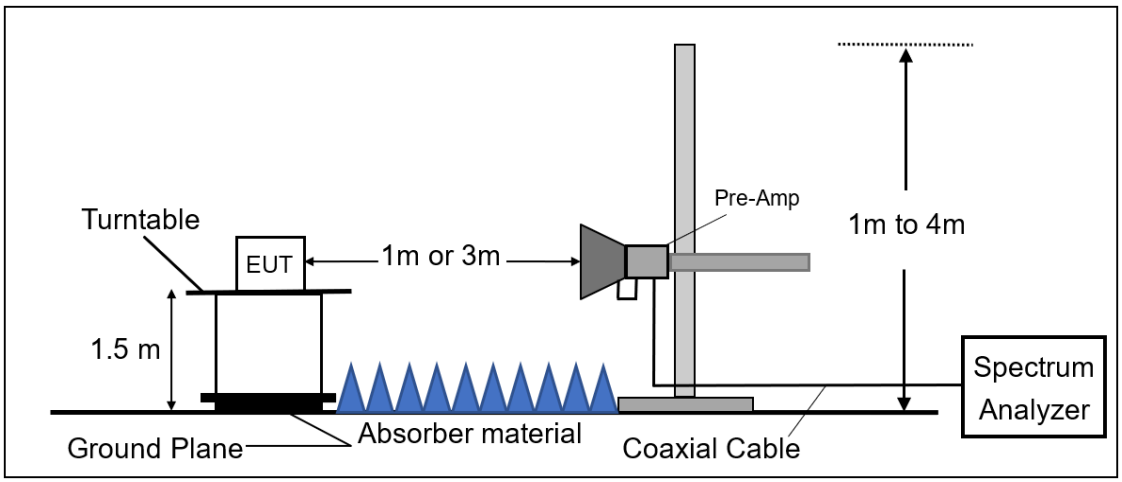
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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

*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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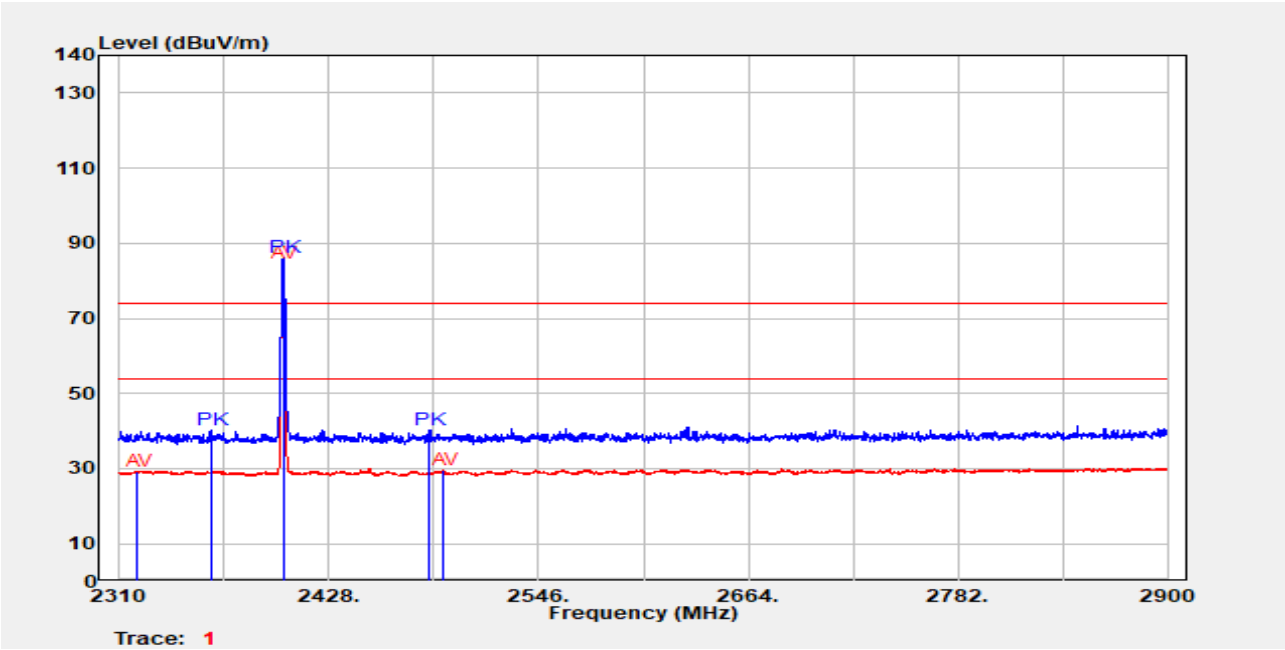
11.4.1 Radiated Band Edge Measurement Result

Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2320.03	Average	31.97	-2.59	29.39	54.00	-24.61
2361.15	Peak	42.77	-2.71	40.06	74.00	-33.94
2402.00	Average	87.39	-2.81	84.59	-	-
2402.00	Peak	88.75	-2.81	85.94	-	-
2484.70	Peak	43.10	-2.76	40.34	74.00	-33.66
2492.37	Average	32.25	-2.71	29.54	54.00	-24.46

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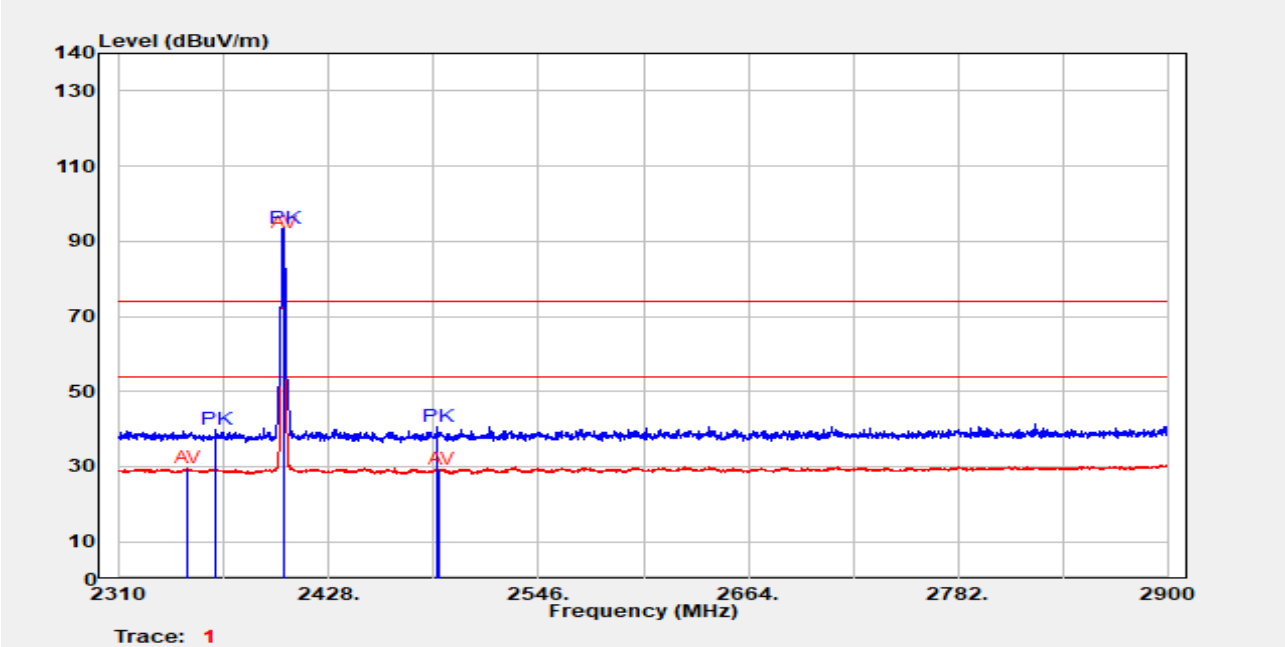
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2347.58	Average	32.22	-2.81	29.41	54.00	-24.59
2364.10	Peak	42.57	-2.71	39.86	74.00	-34.14
2402.00	Average	94.83	-2.81	92.02	-	-
2402.00	Peak	96.30	-2.81	93.50	-	-
2489.03	Peak	43.44	-2.71	40.73	74.00	-33.27
2490.21	Average	32.03	-2.70	29.34	54.00	-24.66

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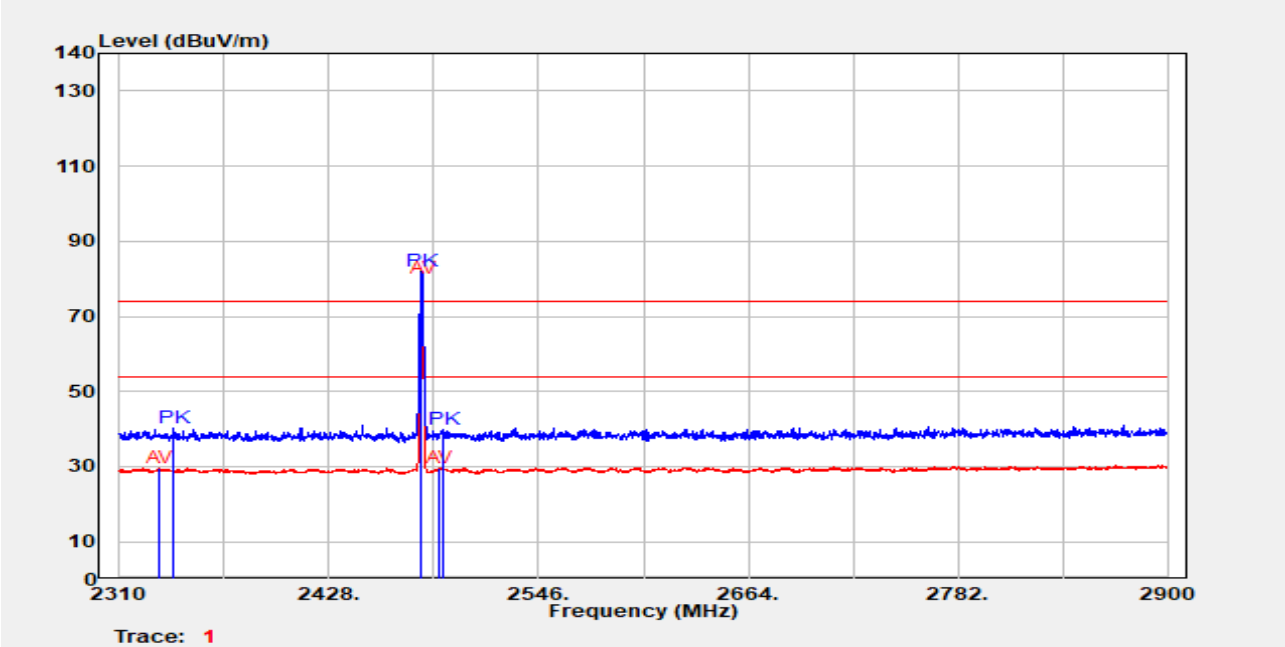
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2331.84	Average	32.20	-2.63	29.57	54.00	-24.43
2340.30	Peak	42.99	-2.80	40.19	74.00	-33.81
2480.00	Average	82.88	-2.82	80.06	-	-
2480.00	Peak	84.75	-2.82	81.93	-	-
2489.81	Average	32.25	-2.70	29.56	54.00	-24.44
2491.78	Peak	42.54	-2.71	39.84	74.00	-34.16

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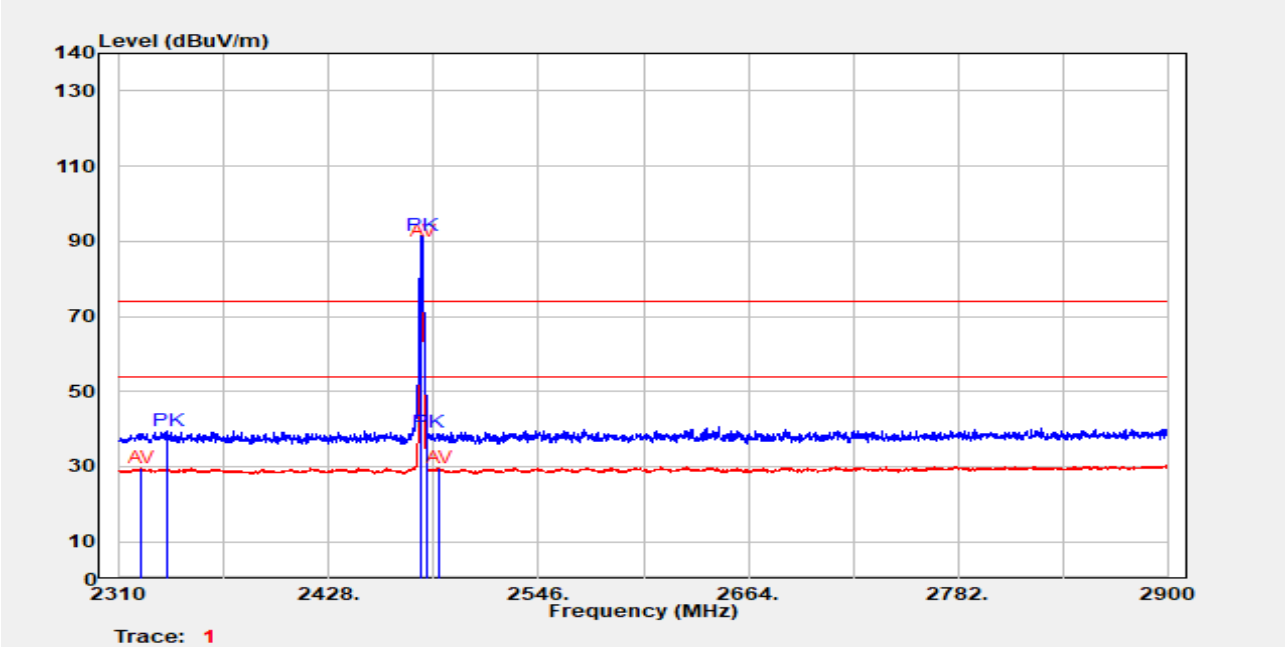
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2322.00	Average	32.07	-2.59	29.48	54.00	-24.52
2336.36	Peak	42.10	-2.73	39.37	74.00	-34.63
2480.00	Average	92.61	-2.82	89.79	-	-
2480.00	Peak	94.25	-2.82	91.43	-	-
2483.52	Peak	41.74	-2.77	38.96	74.00	-35.04
2489.42	Average	32.20	-2.70	29.50	54.00	-24.50

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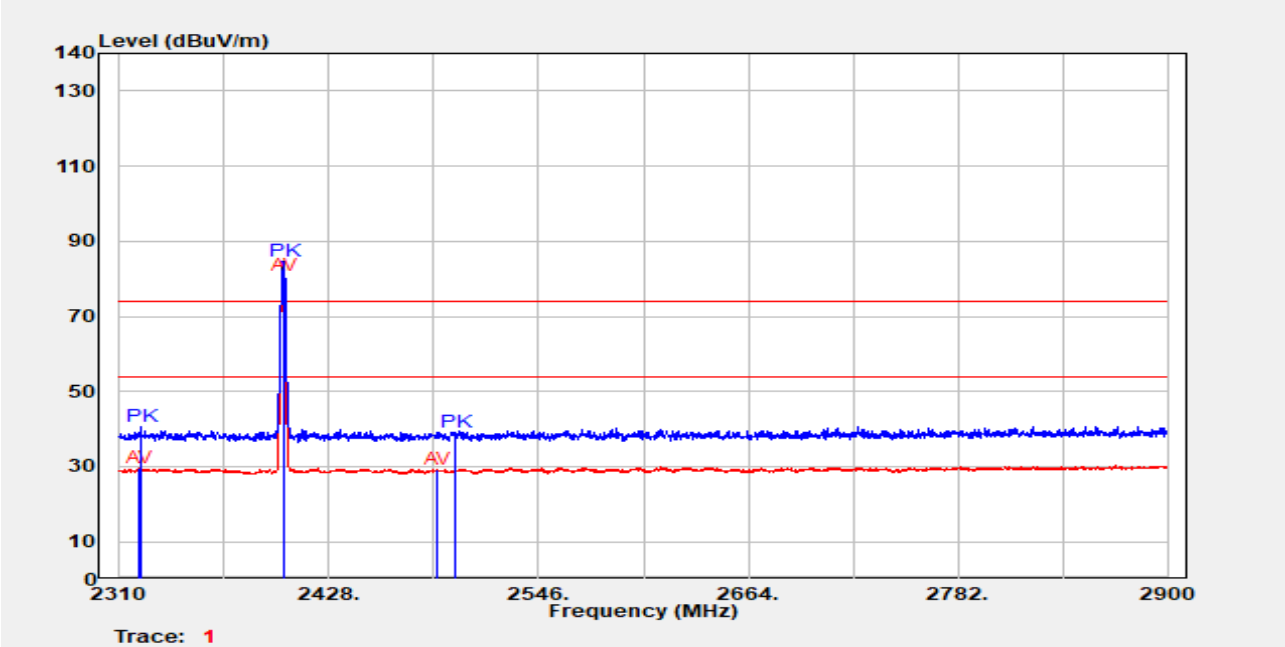
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2320.43	Average	32.06	-2.59	29.48	54.00	-24.52
2321.80	Peak	43.03	-2.59	40.44	74.00	-33.56
2402.00	Average	83.76	-2.81	80.96	-	-
2402.00	Peak	87.35	-2.81	84.55	-	-
2488.83	Average	32.03	-2.71	29.33	54.00	-24.67
2498.47	Peak	41.90	-2.76	39.14	74.00	-34.86

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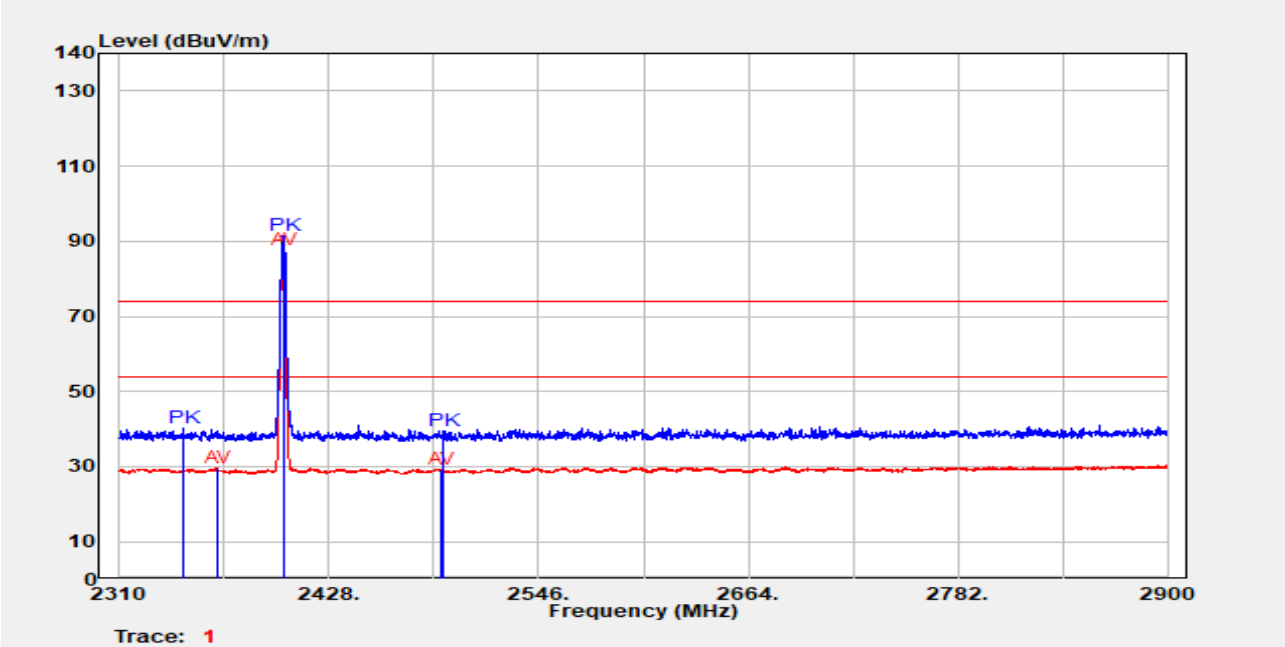
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2345.81	Peak	42.86	-2.81	40.05	74.00	-33.95
2364.69	Average	32.25	-2.71	29.54	54.00	-24.46
2402.00	Average	90.50	-2.81	87.70	-	-
2402.00	Peak	94.27	-2.81	91.47	-	-
2490.60	Average	32.01	-2.70	29.31	54.00	-24.69
2492.57	Peak	42.22	-2.71	39.51	74.00	-34.49

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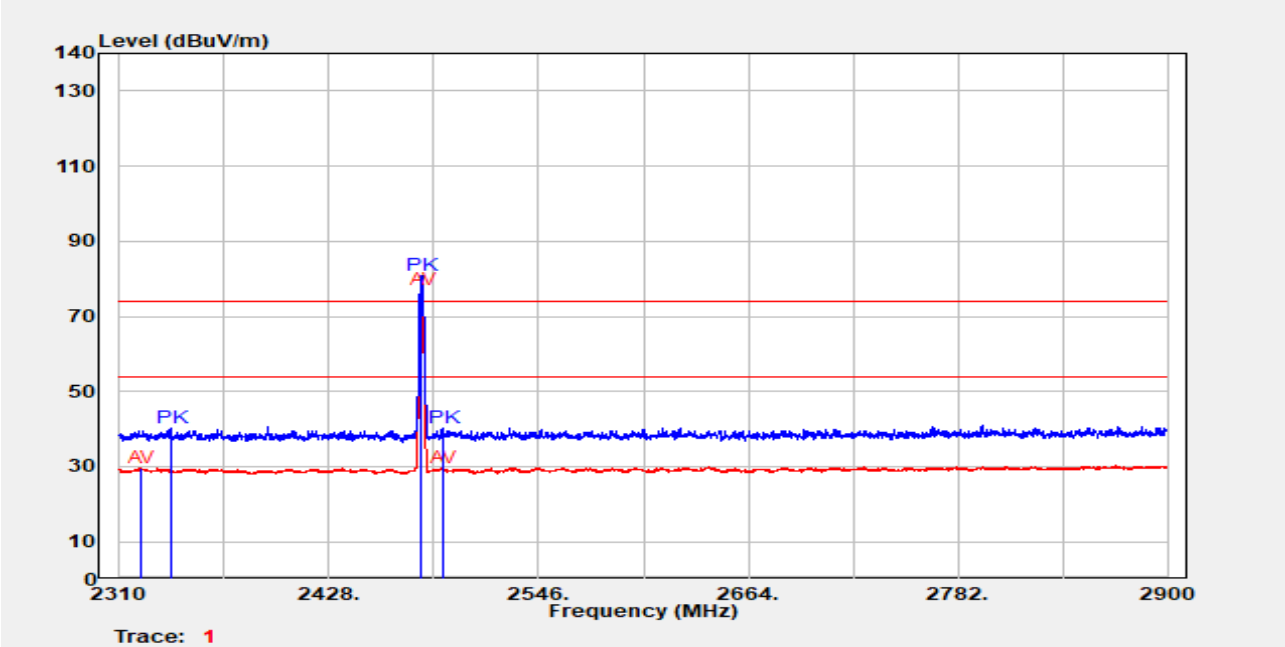
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2322.00	Average	32.11	-2.59	29.52	54.00	-24.48
2338.53	Peak	42.87	-2.77	40.10	74.00	-33.90
2480.00	Average	79.81	-2.82	76.99	-	-
2480.00	Peak	83.82	-2.82	81.00	-	-
2491.78	Average	32.20	-2.71	29.50	54.00	-24.50
2492.17	Peak	43.10	-2.71	40.39	74.00	-33.61

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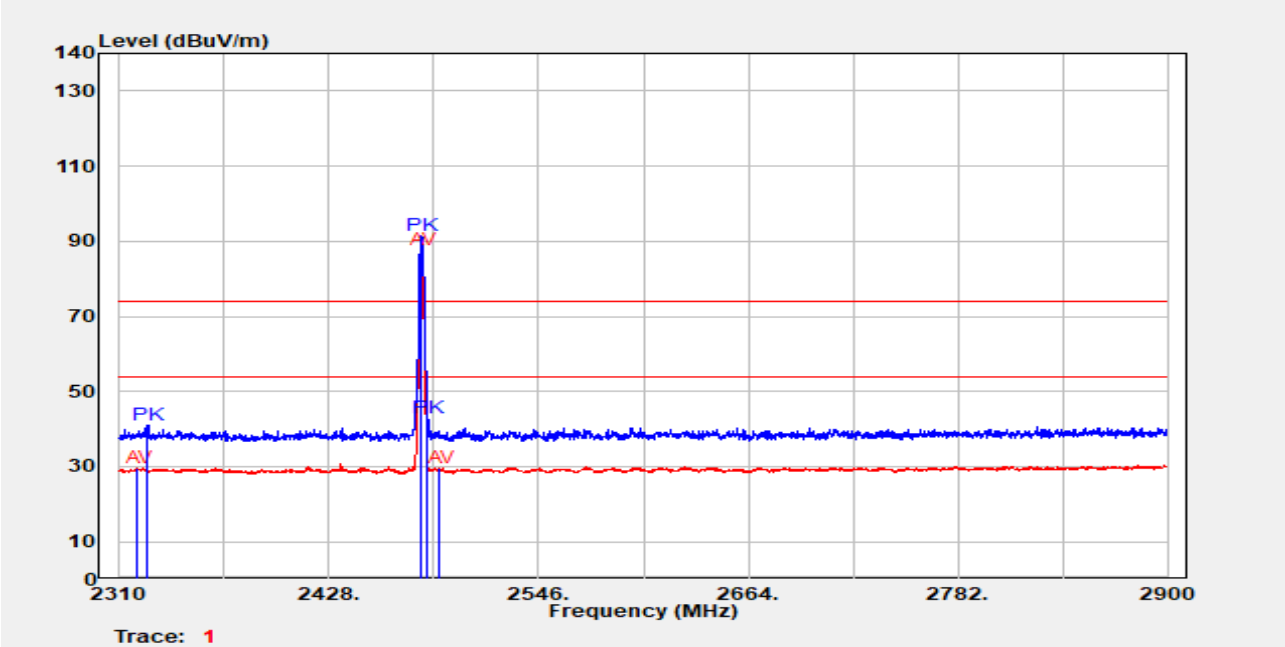
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2320.23	Average	32.03	-2.59	29.45	54.00	-24.55
2325.94	Peak	43.68	-2.59	41.09	74.00	-32.91
2480.00	Average	90.63	-2.82	87.81	-	-
2480.00	Peak	94.23	-2.82	91.42	-	-
2483.52	Peak	45.60	-2.77	42.82	74.00	-31.18
2490.40	Average	32.34	-2.70	29.64	54.00	-24.36

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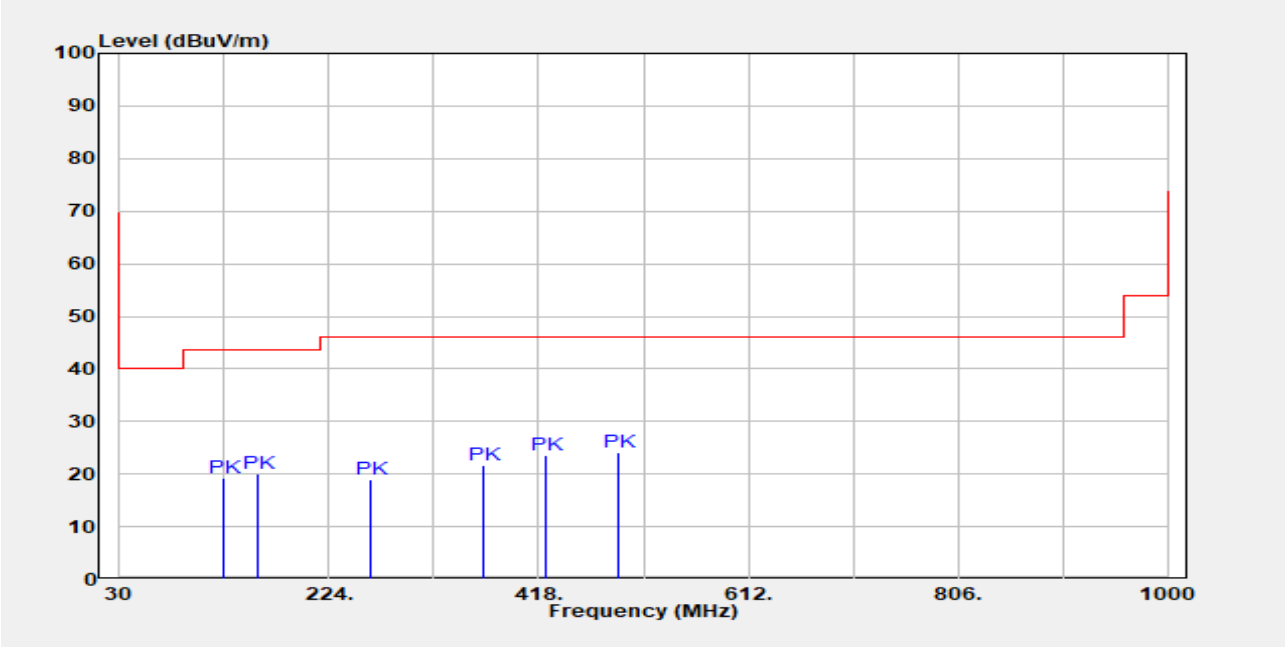
11.4.2 Radiated Spurious Emission

Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
126.03	Peak	31.03	-11.67	19.36	43.50	-24.14
157.07	Peak	33.44	-13.26	20.18	43.50	-23.32
261.83	Peak	27.49	-8.46	19.03	46.00	-26.97
366.59	Peak	29.39	-7.61	21.78	46.00	-24.22
423.82	Peak	29.39	-5.83	23.56	46.00	-22.44
491.72	Peak	29.11	-5.11	24.00	46.00	-22.00

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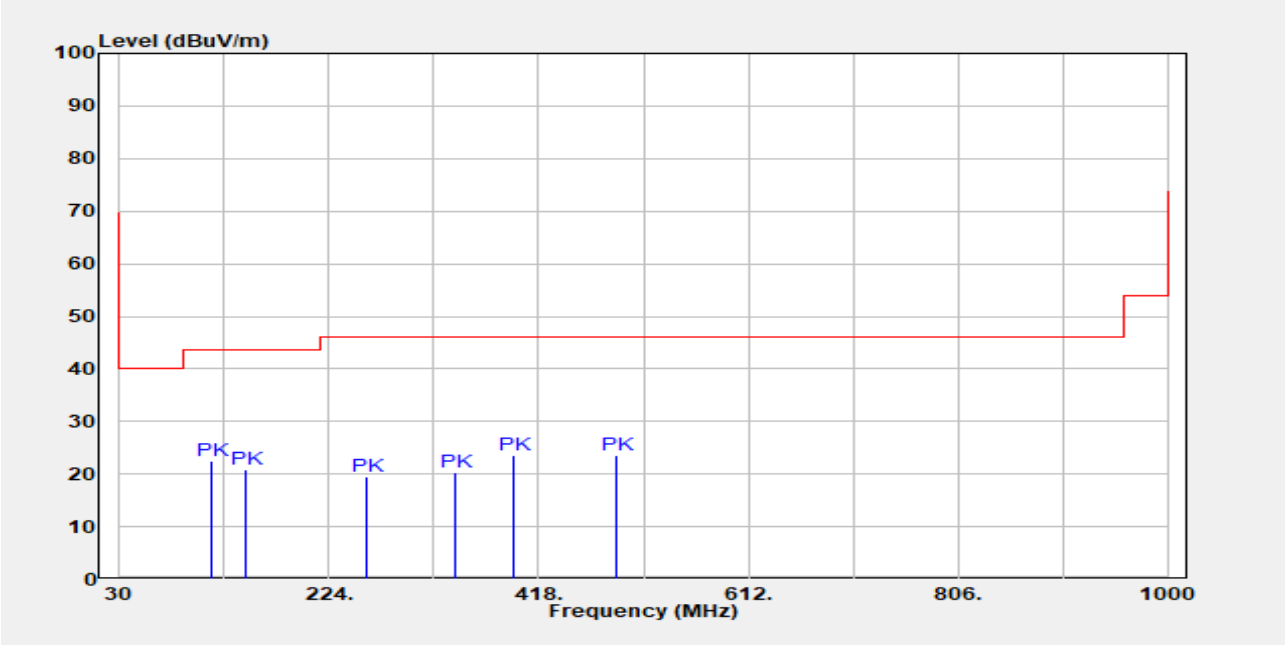
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
115.36	Peak	34.22	-11.79	22.43	43.50	-21.07
147.37	Peak	33.43	-12.63	20.80	43.50	-22.70
257.95	Peak	28.22	-8.59	19.63	46.00	-26.37
341.37	Peak	28.37	-8.16	20.21	46.00	-25.79
394.72	Peak	30.46	-6.86	23.60	46.00	-22.40
489.78	Peak	28.63	-5.09	23.55	46.00	-22.45

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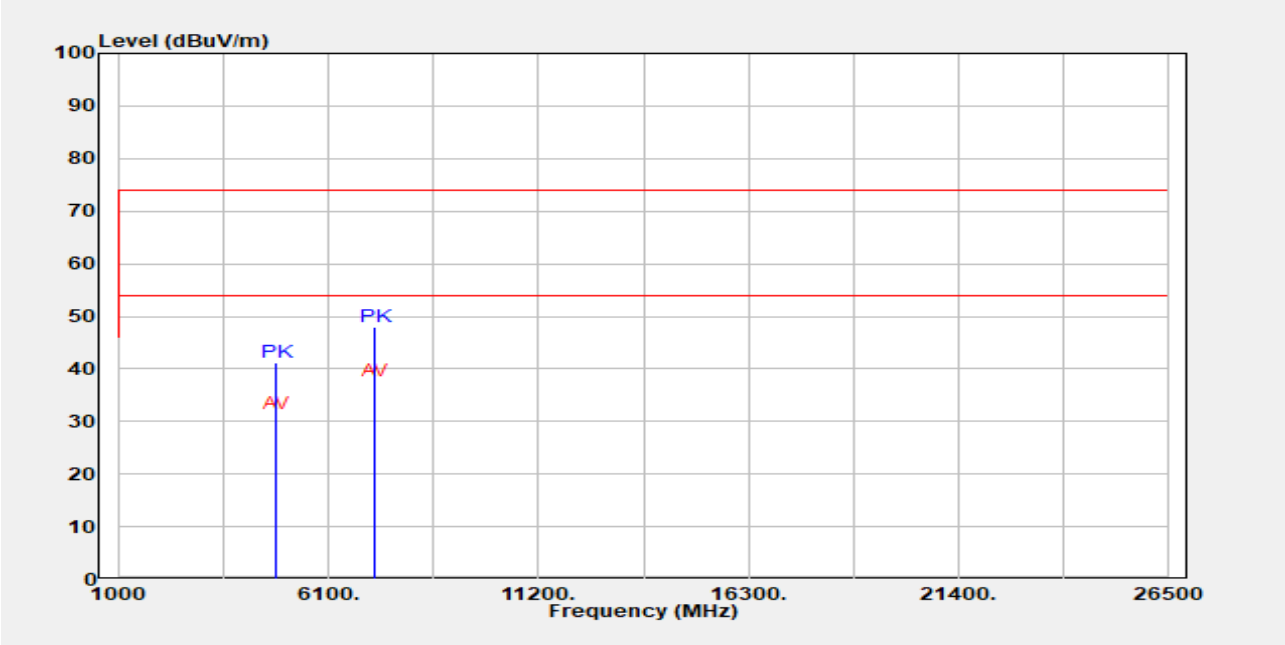
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.00	Average	29.47	2.05	31.52	54.00	-22.48
4804.00	Peak	39.02	2.05	41.07	74.00	-32.93
7206.00	Average	29.34	8.46	37.80	54.00	-16.20
7206.00	Peak	39.41	8.46	47.88	74.00	-26.12

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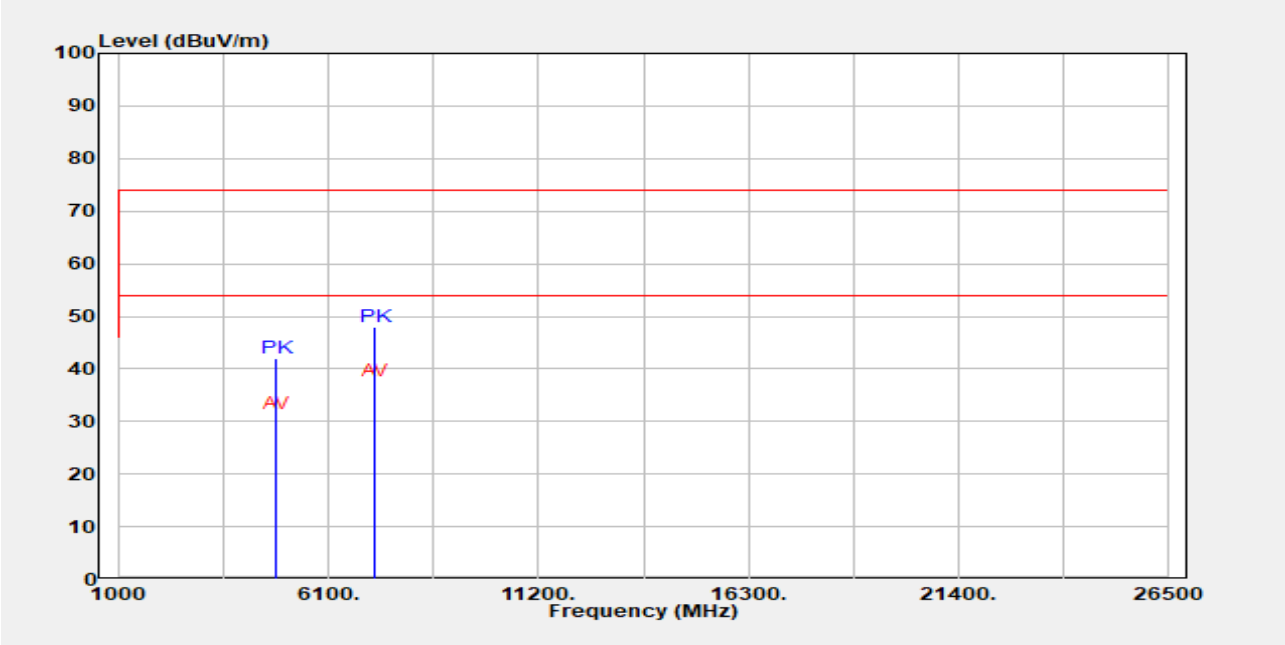
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.00	Average	29.38	2.05	31.43	54.00	-22.57
4804.00	Peak	39.97	2.05	42.02	74.00	-31.98
7206.00	Average	29.30	8.46	37.76	54.00	-16.24
7206.00	Peak	39.44	8.46	47.91	74.00	-26.09

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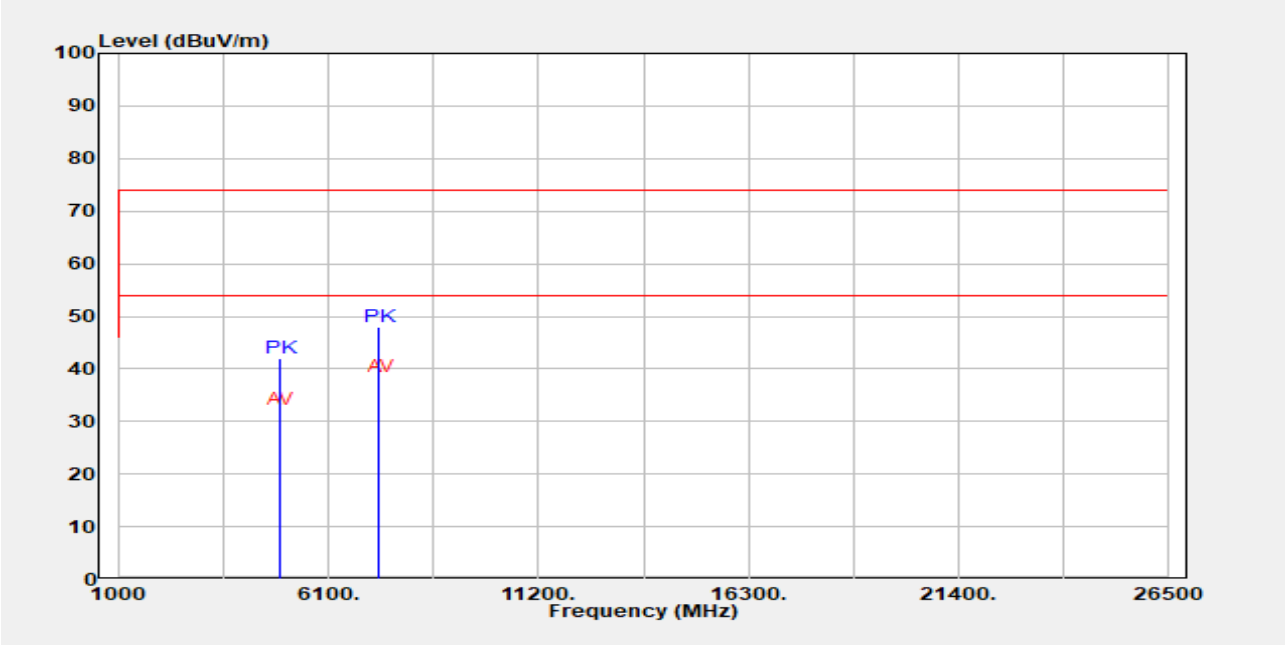
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.00	Average	29.62	2.57	32.19	54.00	-21.81
4884.00	Peak	39.55	2.57	42.12	74.00	-31.88
7326.00	Average	29.55	8.90	38.45	54.00	-15.55
7326.00	Peak	38.98	8.90	47.89	74.00	-26.11

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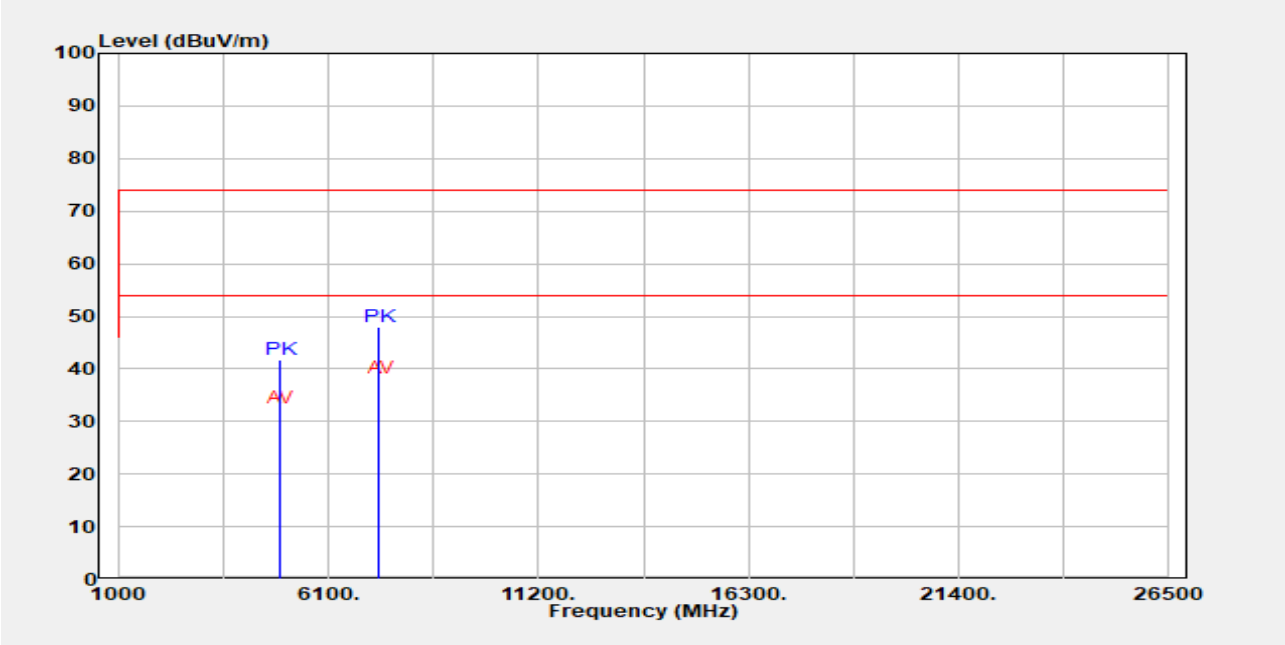
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.00	Average	29.82	2.57	32.39	54.00	-21.61
4884.00	Peak	39.09	2.57	41.66	74.00	-32.34
7326.00	Average	29.36	8.90	38.26	54.00	-15.74
7326.00	Peak	39.07	8.90	47.98	74.00	-26.02

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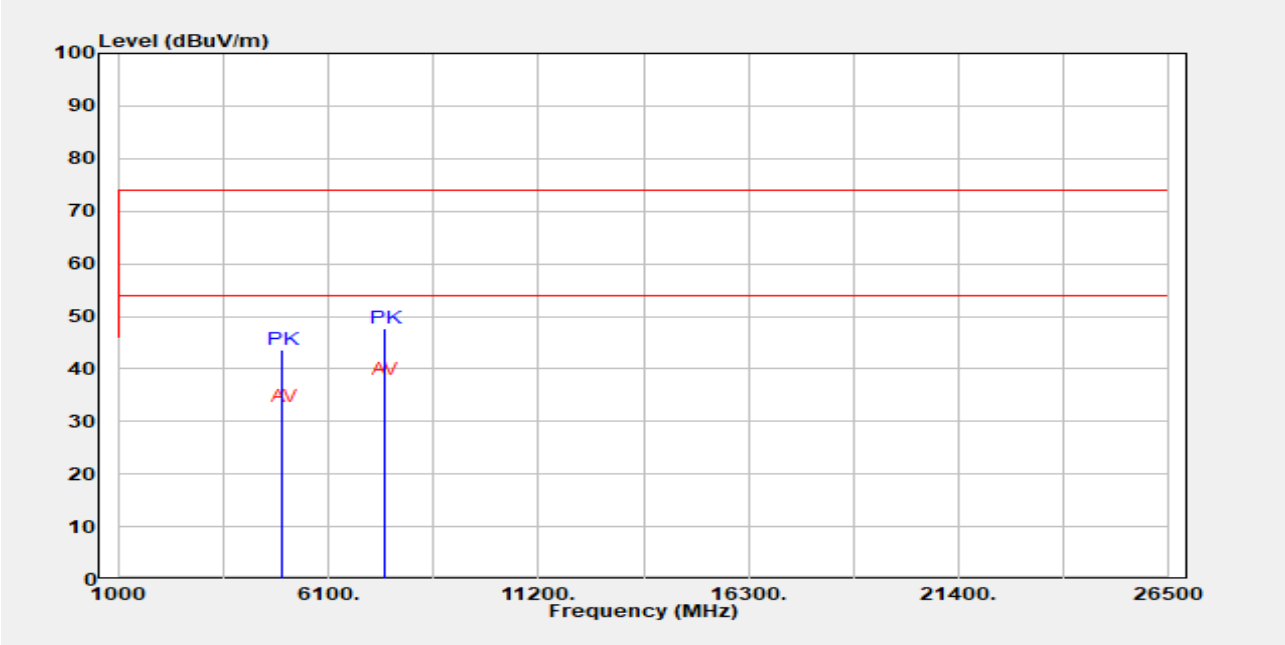
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Average	29.68	3.19	32.87	54.00	-21.13
4960.00	Peak	40.47	3.19	43.66	74.00	-30.34
7440.00	Average	29.22	8.59	37.81	54.00	-16.19
7440.00	Peak	38.99	8.59	47.57	74.00	-26.43

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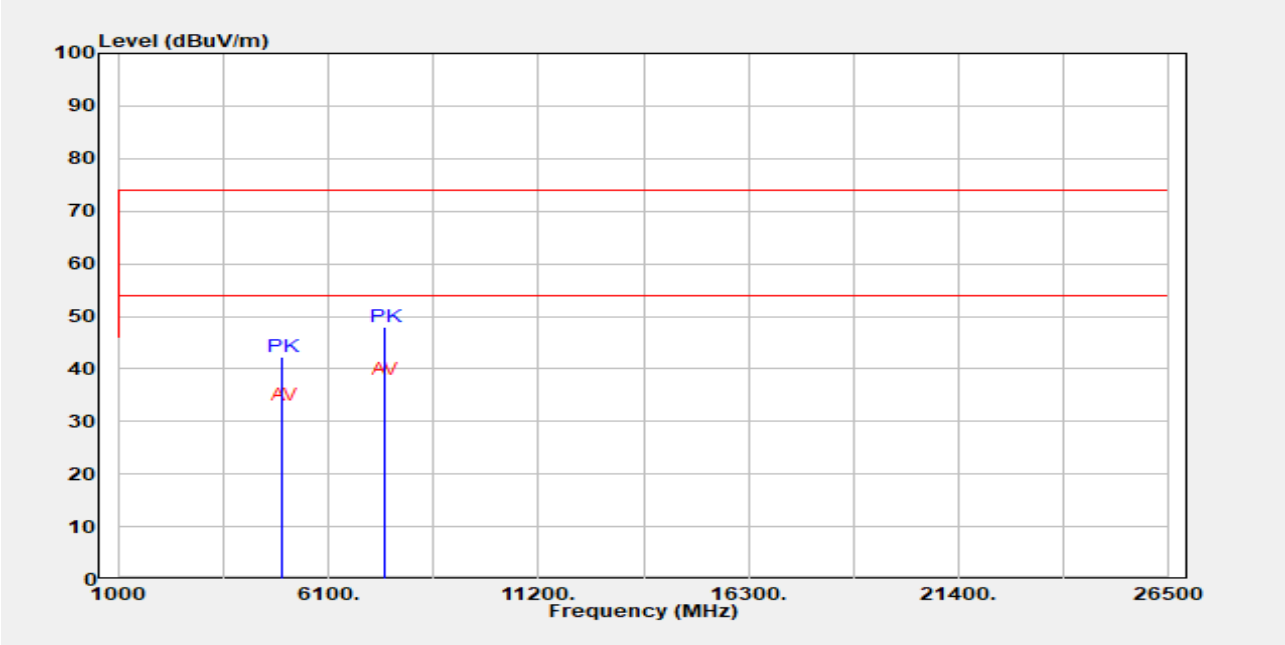
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 1M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Average	29.75	3.19	32.94	54.00	-21.06
4960.00	Peak	39.16	3.19	42.35	74.00	-31.65
7440.00	Average	29.43	8.59	38.02	54.00	-15.98
7440.00	Peak	39.41	8.59	48.00	74.00	-26.00

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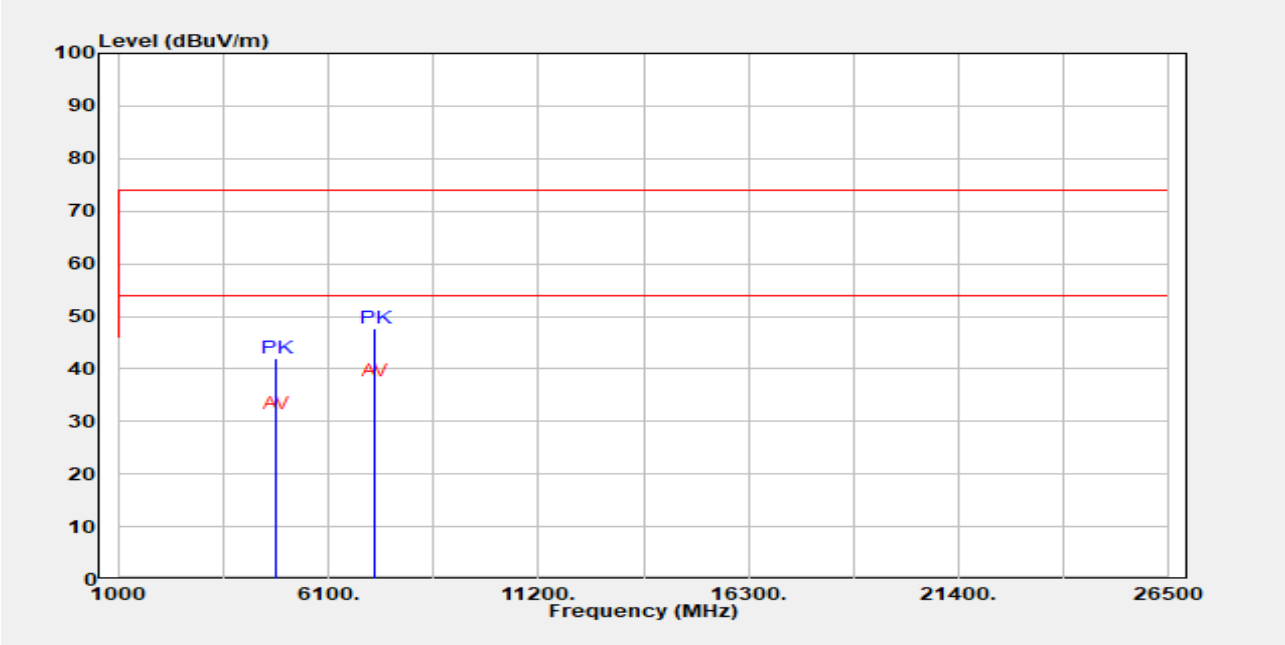
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.00	Average	29.47	2.05	31.52	54.00	-22.48
4804.00	Peak	39.89	2.05	41.93	74.00	-32.07
7206.00	Average	29.21	8.46	37.67	54.00	-16.33
7206.00	Peak	39.20	8.46	47.66	74.00	-26.34

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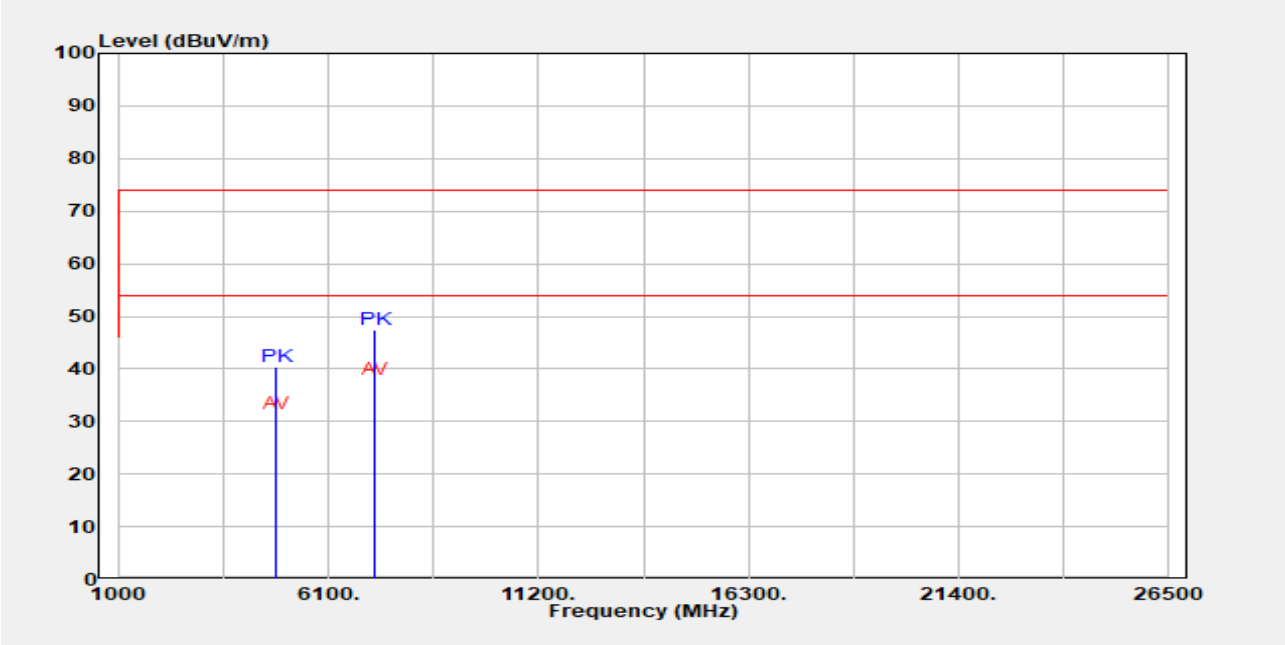
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2402 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4804.00	Average	29.42	2.05	31.47	54.00	-22.53
4804.00	Peak	38.45	2.05	40.50	74.00	-33.50
7206.00	Average	29.49	8.46	37.95	54.00	-16.05
7206.00	Peak	38.95	8.46	47.42	74.00	-26.58

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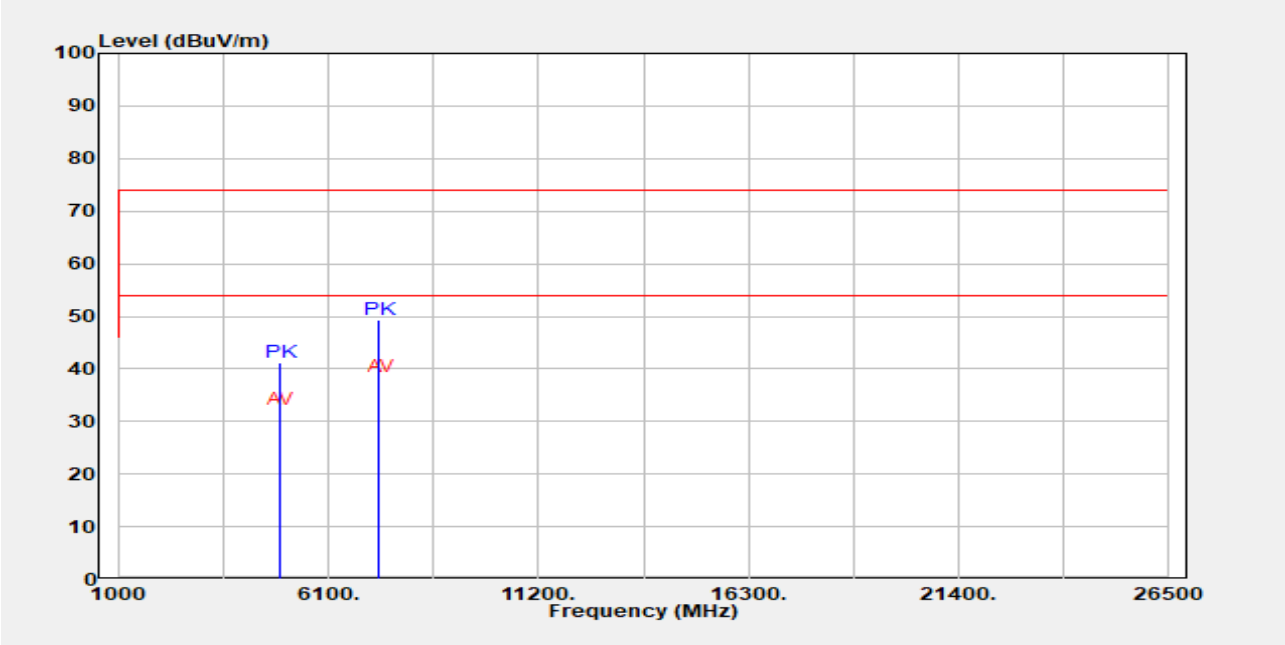
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.00	Average	29.74	2.57	32.31	54.00	-21.69
4884.00	Peak	38.71	2.57	41.28	74.00	-32.72
7326.00	Average	29.54	8.90	38.44	54.00	-15.56
7326.00	Peak	40.42	8.90	49.32	74.00	-24.68

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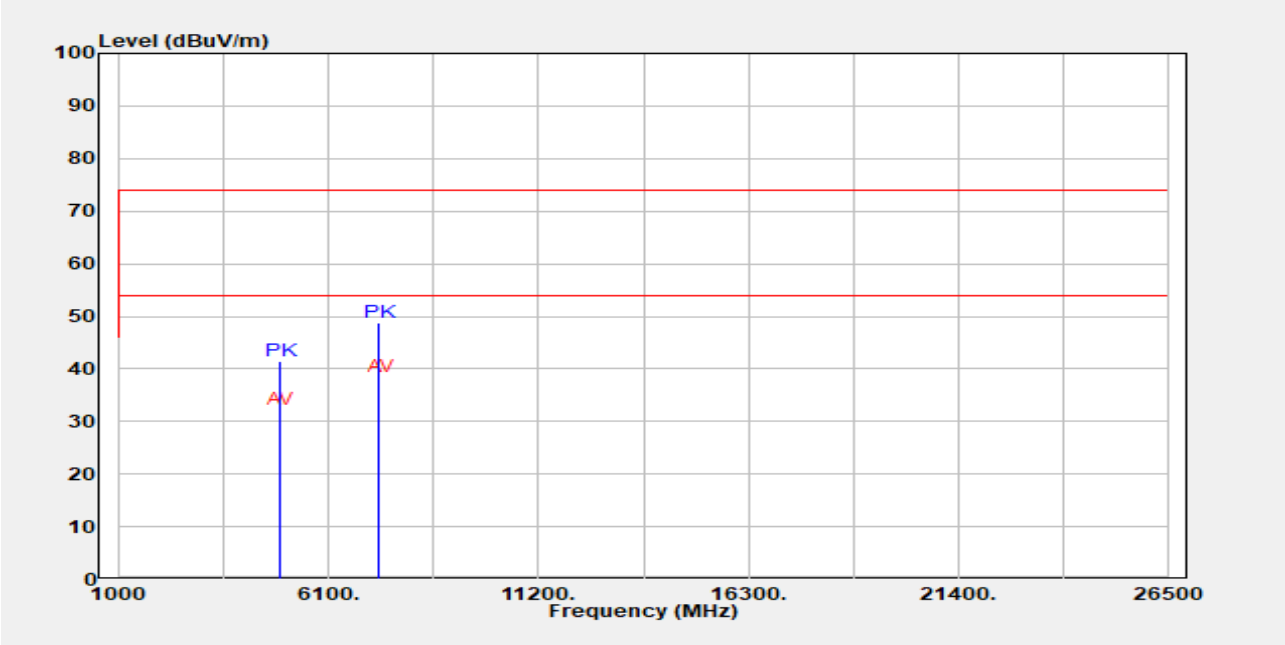
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2442 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
4884.00	Average	29.75	2.57	32.32	54.00	-21.68
4884.00	Peak	38.93	2.57	41.50	74.00	-32.50
7326.00	Average	29.52	8.90	38.42	54.00	-15.58
7326.00	Peak	39.91	8.90	48.82	74.00	-25.18

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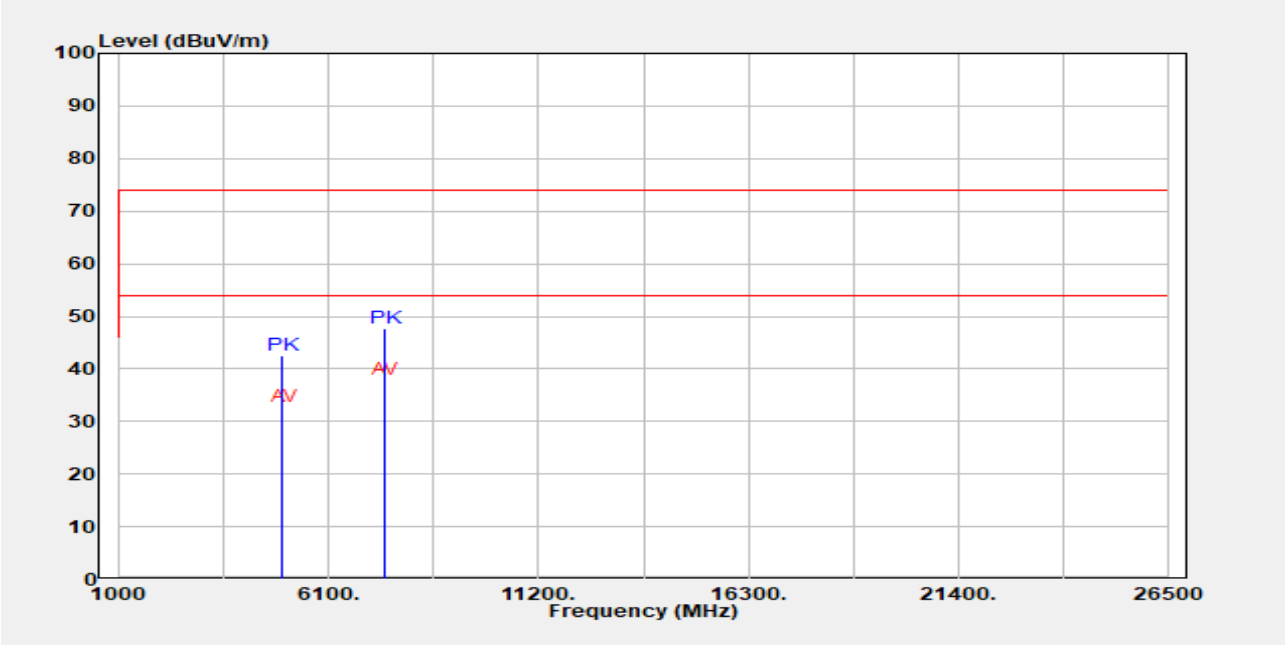
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Average	29.64	3.19	32.83	54.00	-21.17
4960.00	Peak	39.23	3.19	42.41	74.00	-31.59
7440.00	Average	29.31	8.59	37.90	54.00	-16.10
7440.00	Peak	39.18	8.59	47.76	74.00	-26.24

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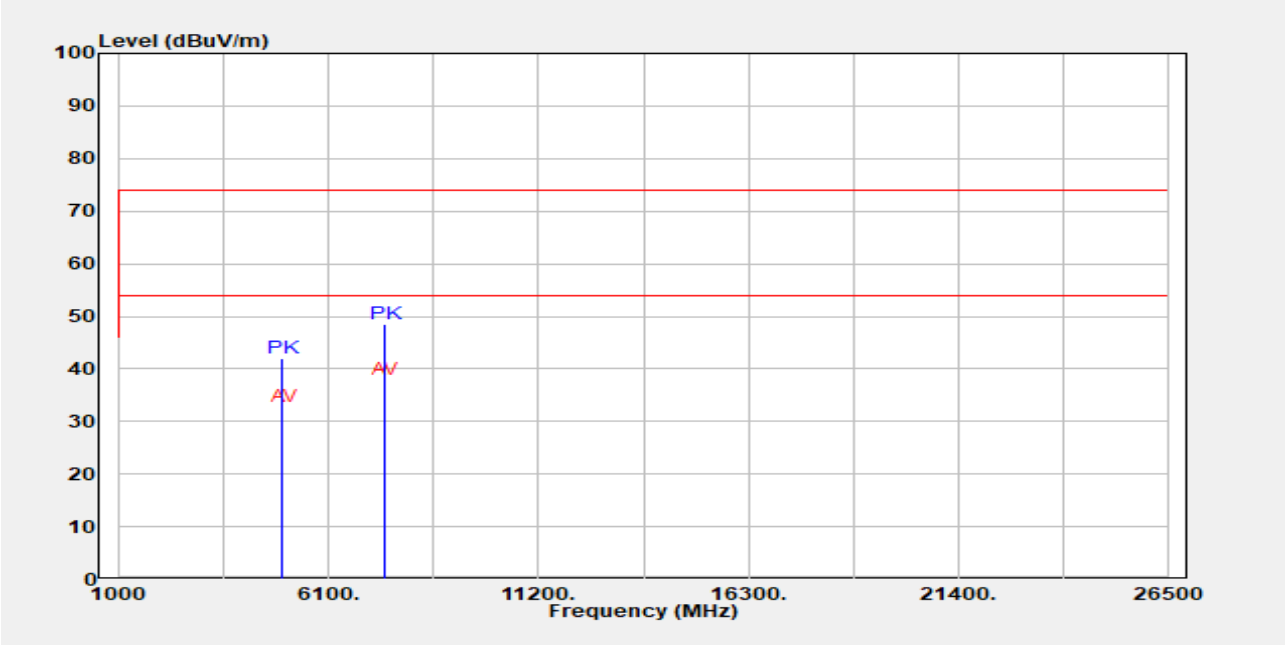
Report Number	:TERF2402000331ER	Test Site	:SAC 1
Operation Mode	:BLE 2M	Test Date	:2024-03-29
Test Frequency	:2480 MHz	Temp./Humi.	:24.6℃/58%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Average	29.72	3.19	32.91	54.00	-21.09
4960.00	Peak	38.76	3.19	41.95	74.00	-32.05
7440.00	Average	29.28	8.59	37.87	54.00	-16.13
7440.00	Peak	39.84	8.59	48.42	74.00	-25.58

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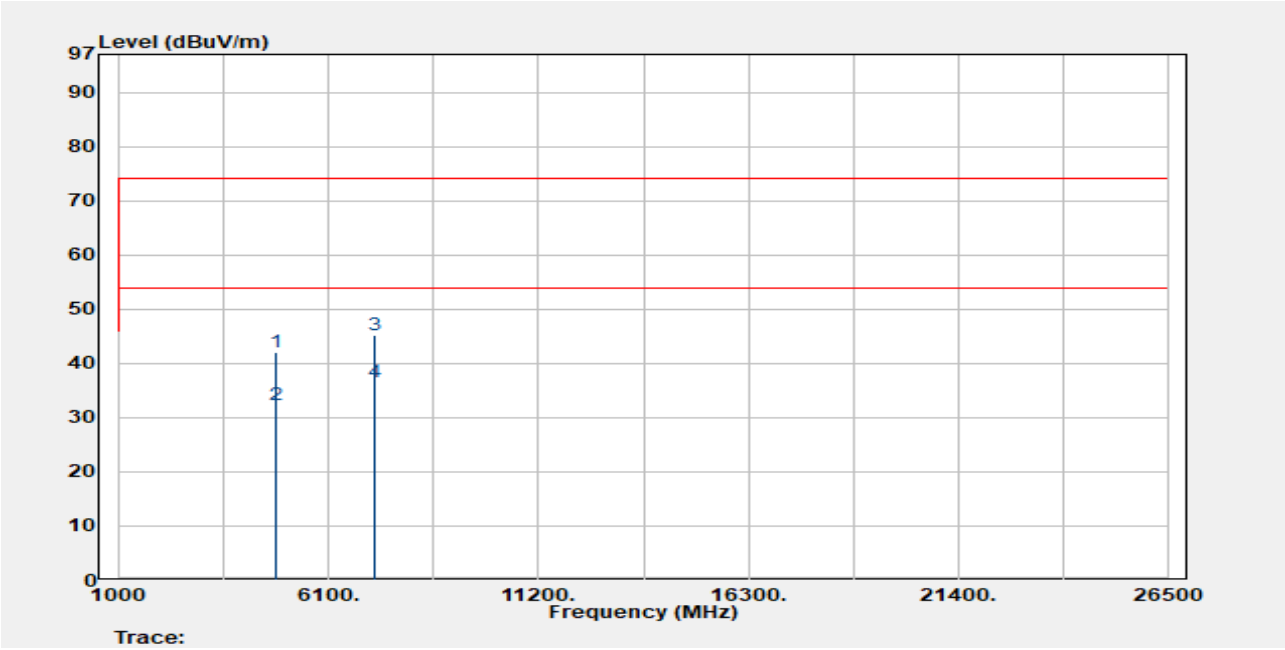
2nd Source

Report Number	:TERF2402000331ER	Test Site	:SAC 3
Operation Mode	:BLE 1M	Test Date	:2024-04-16
Test Frequency	:2402 MHz	Temp./Humi.	:24.4℃/63%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Peak	42.74	-0.56	42.17	74.00	-31.83
4804.000	Average	32.93	-0.56	32.37	54.00	-21.63
7206.000	Peak	40.21	5.09	45.31	74.00	-28.69
7206.000	Average	31.50	5.09	36.59	54.00	-17.41

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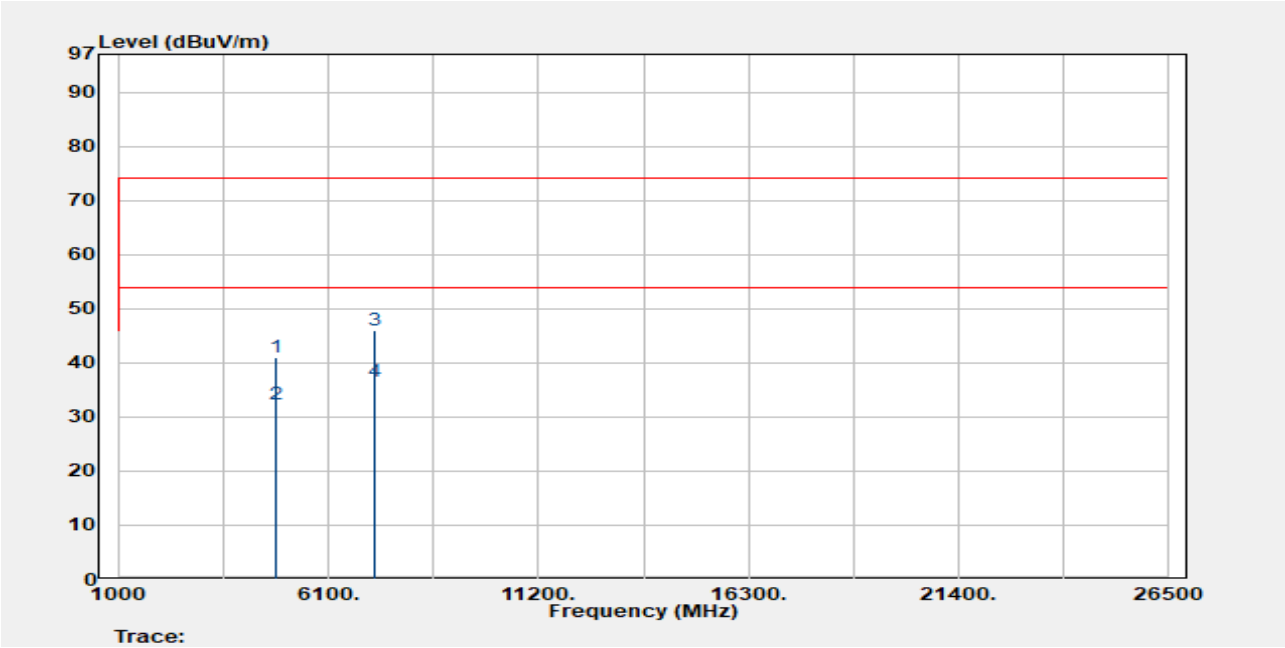
Report Number	:TERF2402000331ER	Test Site	:SAC 3
Operation Mode	:BLE 1M	Test Date	:2024-04-16
Test Frequency	:2402 MHz	Temp./Humi.	:24.4℃/63%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Cooper Hsu



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	Peak	41.66	-0.56	41.10	74.00	-32.90
4804.000	Average	32.86	-0.56	32.30	54.00	-21.70
7206.000	Peak	41.03	5.09	46.12	74.00	-27.88
7206.000	Average	31.38	5.09	36.47	54.00	-17.53

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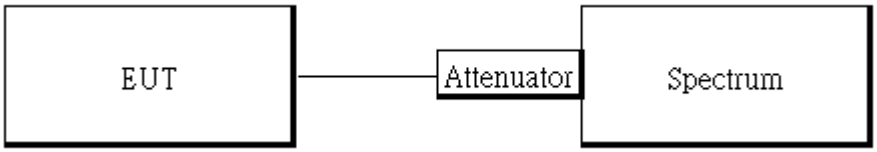
12 POWER SPECTRAL DENSITY

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	-12.13	8	PASS
2442	-12.22	8	PASS
2480	-12.20	8	PASS

Note:

1.cable loss as 1.4dB that offsets in the spectrum

BLE 2M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-15.69	8	PASS
2442	-15.84	8	PASS
2480	-15.76	8	PASS

Note:

1.cable loss as 1.4dB that offsets in the spectrum

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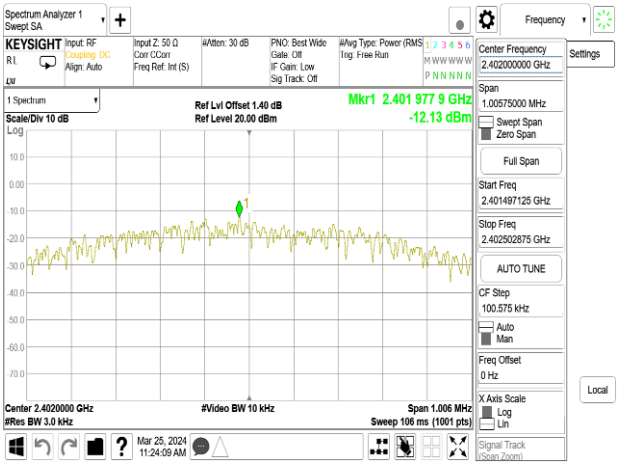
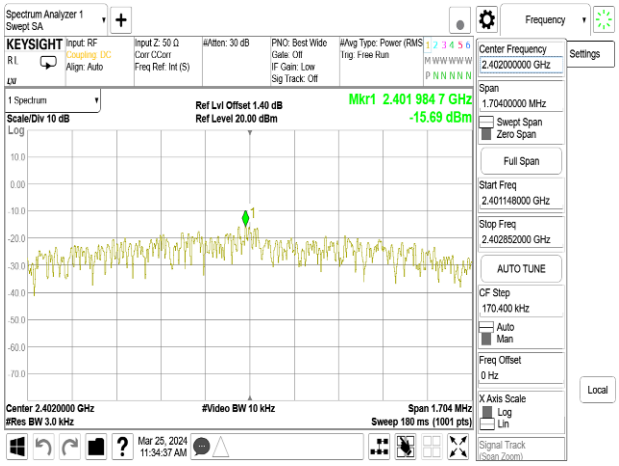
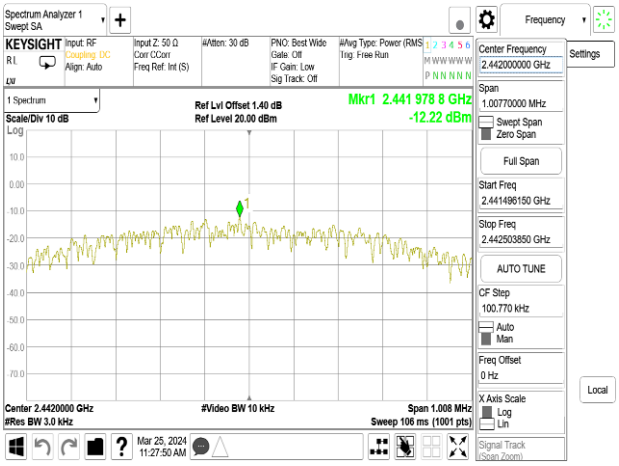
PSD_BLE 1M_LowCH00-2402MHz



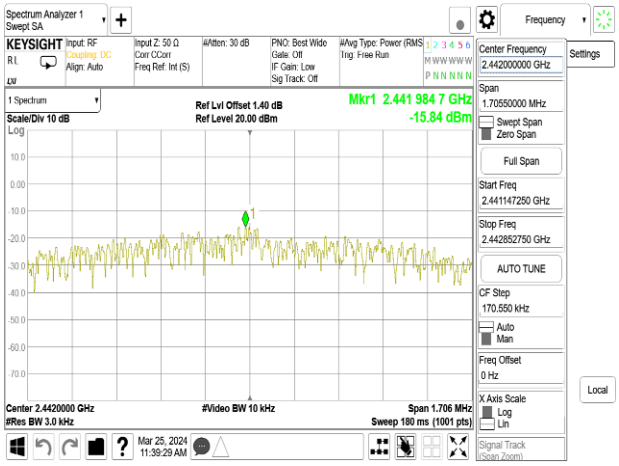
PSD_BLE 2M_LowCH00-2402MHz



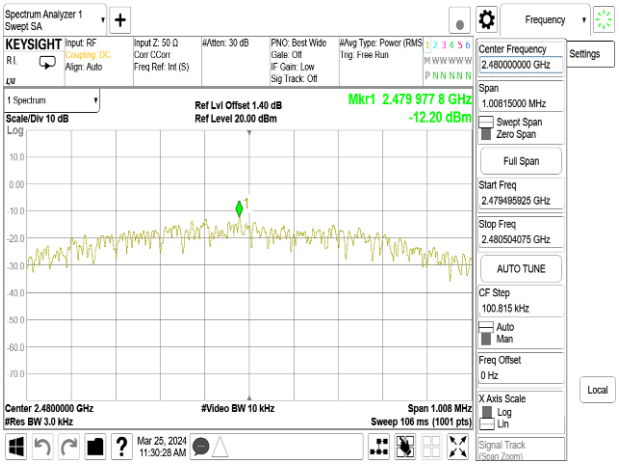
PSD_BLE 1M_MidCH20-2442MHz



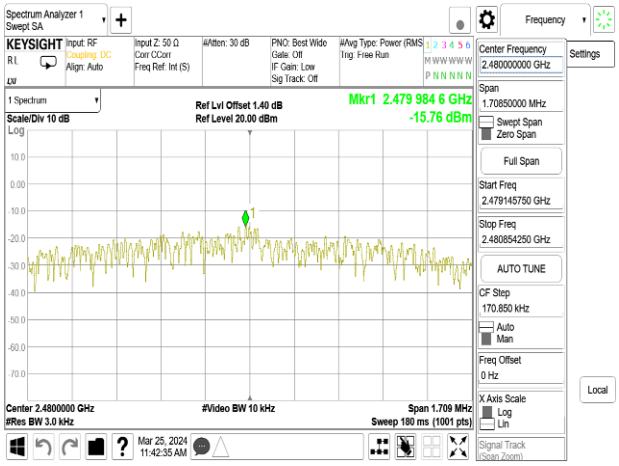
PSD_BLE 2M_MidCH20-2442MHz



PSD_BLE 1M_HighCH39-2480MHz



PSD_BLE 2M_HighCH39-2480MHz



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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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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