

ELECTROMAGNETIC EMISSIONS **COMPLIANCE REPORT**



Applicant:	Quanta Computer Inc No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan
Manufacturer:	Quanta Computer Inc No.188, Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan
Product Name:	QOCA Wearable Wireless Digital Stethoscope
Brand Name:	Quanta, QOCA
Model No.:	steth03
Report Number:	TERF2401000148E2
FCC ID	HFSMHE
Date of EUT Received:	January 24, 2024
Date of Test:	January 25, 2024 \sim February 19, 2024
Issue Date:	July 8, 2024

Approved By

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.

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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Revision History								
Report Number	Revision	Description	Issue Date	Revised By	Remark			
TERF2401000148E2	00	Original	June 26, 2024	Candice Li				
TERF2401000148E2	01	Modify 1.1 EUT Series No., 1.3 antenna type, 2.6 Con- trol Unit(s), 4.2 the worst case of transmit radiated emission test (below 1 GHz)	Jul 8, 2024	Candice Li	*			

Note:

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

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GENERAL INFORMATION 1

1.1 **Product Description**

Product Name:	QOCA Wearable Wireless Digital Stethoscope
Brand Name:	Quanta, QOCA
Model No.:	steth03
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	(21)MHEXS233002U (Conducted) (21)MHEXS233002L (Conduction, Radiated)
Power Supply:	3.85 Vdc from Battery 5 Vdc from AC Adapter
Test Software (Name/Version)	XDS-L1100NTP-CC2642R_BLE-Device Control Panel/v2.27.0

1.2 **RF** Specification

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	BLE 1M: 4.44 dBm BLE 2M: 4.37 dBm

1.3 **Antenna Designation**

Antenna	Freq.	Peak Antenna
Type	(MHz)	Gain (dBi)
FPC	2402 – 2480	-0.06

Note: Antenna information is provided by the applicant.

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

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1.5 **Test Facility**

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB identifier
		SAC 1		
		SAC 2		
		SAC 3		
		Conduction 1		
	No.134, Wu Kung Road, New Taipei	Conducted 1	T14/0007	
	Industrial Park, Wuku District, New	Conducted 2	TW0027	
	Taipei City, Taiwan.	Conducted 3	_	TW3702
		Conducted 4	_	
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.		Conduction C	_	
(TAF code 3702)		SAC C	 TW0028	
		SAC D		
		SAC G		
	No 2, Kaji 1et Rd., Guishan District	Conducted A		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conducted B		
	Tabyuan City, Taiwan 555	Conducted C	_	
		Conducted D	_	
		Conducted E		
		Conducted F		
		Conducted G		

tion 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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SYSTEM TEST CONFIGURATION 2

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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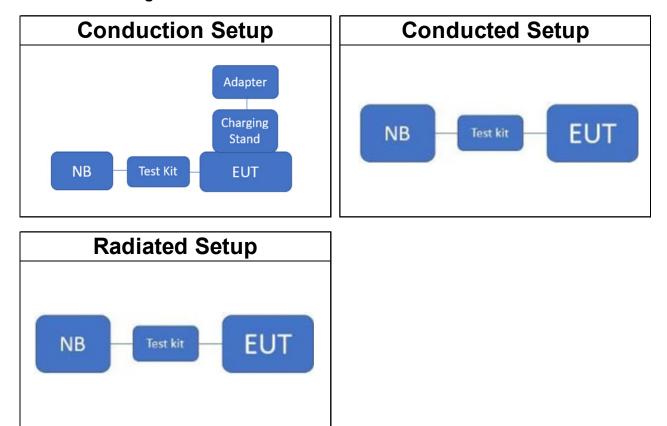
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2.5 **Test Configuration**



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.
Notebook	Lenovo	L480	P0002332	N/A	N/A
Adapter	Lapo	WT-02CA	N/A	N/A	N/A
USB Cable	KWorld	Z2110	N/A	N/A	N/A
USB Cable	MI	SJX10ZM	N/A	N/A	N/A
Charging stand	Quanta	CR1	N/A	N/A	N/A
Test Kit	texas instruments	cc2642R	N/A	N/A	N/A
	C	onducted Emission 1	Test Site: Conducted	E	
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Kit	texas instruments	cc2642R	N.C.R	N.C.R	N.C.R
USB Cable	Kworld	Z2110	N.C.R	N.C.R	N.C.R
Notebook Lenovo		T480	P0002332	N.C.R	N.C.R
		Radiated Emissio	n Test Site: SAC D		
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	P0002332	N/A	N/A
USB Cable	KWorld	Z2110	N/A	N/A	N/A
Test Kit	texas instruments	cc2642R	N/A	N/A	N/A

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SUMMARY OF TEST RESULTS 3

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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DESCRIPTION OF TEST MODES 4

4.1 **Operating Frequencies**

	2400~2483.5 MHz							
СН	Freq. (MHz)	СН	Freq. (MHz)	СН	Freq. (MHz)	СН	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	

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.

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CONDUCTED TEST						
MODEAVAILABLE CHANNELTESTED CHANNELMODULATIONDATA 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		
Bluetooth LE	0 to 39	20	GFSK	2		
	TRANSMIT RAD	DIATED EMISSION T	EST (ABOVE 1 GHz)			
MODEAVAILABLE CHANNELTESTED CHANNELMODULATIONDATA 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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MEASUREMENT UNCERTAINTY 5

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 E	missio	on Measu	iremen	t Uncertainty
	+/-	1.89	dB	9kHz~30MHz
Polarization: Vertical	+/-	4.15	dB	30MHz - 1000MHz
Polarization. Vertical	+/-	3.43	dB	1GHz - 18GHz
	+/-	3.86	dB	18GHz - 40GHz
	+/-	1.89	dB	9kHz~30MHz
Polarization: Horizontal	+/-	4.02	dB	30MHz - 1000MHz
	+/-	3.43	dB	1GHz - 18GHz
	+/-	3.86	dB	18GHz - 40GHz
	+/-	2	dB	33GHz-50GHz
Dedicted Onumieuro Envio	+/-	1.59	dB	50GHz-60GHz
Radiated Spurious Emis- sion	+/-	1.7	dB	60GHz-90GHz
5.0H	+/-	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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MEASUREMENT EQUIPMENT USED 6

	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	974	06/19/2023	06/18/2024				
EMI Test Receiver	R&S	ESCI	101342	04/24/2023	04/23/2024				
Coaxial Cable	EC La b	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2023	03/26/2024				
Pulse Limiter	EC La b	VTSD 9561F-N	485	03/27/2023	03/26/2024				
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R				

6.1 **Emission from AC power line**

6.2 **Conducted Measurement**

	C	onducted Emission 1	Test Site: Conducted	E	
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/07/2023	07/06/2024
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Attenuator	Marvelous	MVE2213-10	RF06	11/15/2023	11/14/2024
DC Block	PASTERNACK	PE8210	RF157	11/15/2023	11/14/2024
DC Power Supply	Gwinstek	SPD-3606	GEV923152	05/10/2023	05/09/2024
Power Meter	Anritsu	ML2496A	1326001	08/22/2023	08/21/2024
Power Sensor	Anritsu	MA2411B	1315048	08/22/2023	08/21/2024
Power Sensor	Anritsu	MA2411B	1315049	08/22/2023	08/21/2024

6.3 **Radiated Measurement**

		Radiated Emissic	on Test Site: SAC D		
EQUIPMENT TYPE	MFR	MODEL NUMBER SERIAL NUMBER		LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK VULB 9168 9168-617		12/14/2023	12/13/2024	
Horn Antenna	Schwarzbeck	BBHA9120D	1341	05/26/2023	05/25/2024
Loop Antenna	ETS.LINDGREN	6502	143303	05/23/2023	05/22/2024
Horn Antenna	SCHWARZBECK	BBHA9170	185	08/21/2023	08/20/2024
3m Site NSA	SGS	966 chamber D	N/A	04/30/2023	04/29/2024
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/29/2023	03/28/2024
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC12630SE	980273	11/15/2023	11/14/2024
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/15/2023	11/14/2024
Coaxial Cable	Huber+Suhner	EMC106-SM-SM- 7200	150703	11/15/2023	11/14/2024

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

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CONDUCTED EMISSION TEST 7

7.1 **Standard Applicable:**

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

Frequency range		imits BµV)
MHz	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
NL (

Note

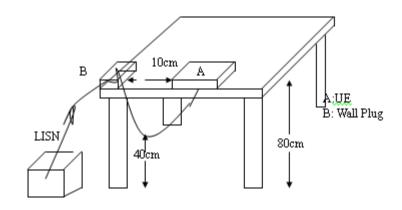
1. The lower limit shall apply at the transition frequencies

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**



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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 Test Mode Power Probe	:TERF240 :BLE :120V/60H :L1		Test Sit Test Da Temp./I Engine	ate : Humi. :	:Conductio :2024-02-1 :24.0°C/54 :Sam Huar	9 %	
80 Level (dBuV)						
70.0							
60.0							
50.0							
40.0	i m			5			
30.0 YVV		A ALAMA A	www.w	WWW	An MANA Marine	W WAA	
20.0						·	
10.0							
0.15	0.5		2	5	10	20 30	
		Freque	ency (MHz)				
Freq.	Detector Mode	Spectrum Reading Level	Factor	Acti F\$		Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBj	μV	dBµV	dB
0.231	Peak	25.33	10.64	35.	97	62.40	-26.43
0.464	Peak	32.93	10.62	43.	55	56.62	-13.07
0.753	Peak	28.65	10.66	39.		56.00	-16.69
1.296	Peak	24.85	10.72	35.		56.00	-20.43
4.366	Peak	23.52	10.92	34.		56.00	-21.56
21.001	Peak	20.87	11.19	32.	05	60.00	-27.95

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Report Number	:TERF2401000148	E2 Test Site	:Conduction	С	
Test Mode	:BLE	Test Date	:2024-02-19		
Power	:120V/60Hz	Temp./Humi.	:24.0°℃/54%		
Probe	:N	Engineer	:Sam Huang		
		0	5		
80 Level (dBuV)				
70.0					
60.0					
50.0					
50.0					
40.0	2 3				
30.0	W WWW LAMALE	two-many WW	Annales .	6	
20.0	da, kadawa	AND A REAL OF A REAL OF	The second s		
20.0					
10.0					
0.15	0.5 1	2 5	10 2	20 30	
0.15	0.5	2 5 Frequency (MHz)	10 2		
Freq.	Detector Spectru			Limit Mar	gin
MHz I	Mode Reading L PK/QP/AV dBµV		FS dBµV d	dBµV dE	2
		dD	ασμνικο		<u> </u>
0.225	Peak 22.12	10.64	32.77 (62.61 -29.	.85
0.460	Peak 29.66	10.61	40.26	56.69 -16.	
0.747	Peak 25.24			56.00 -20.	
1.232	Peak 21.93			56.00 -23.	
4.917	Peak 20.59			56.00 -24.	
21.001	Peak 18.30	11.19	29.48	60.00 -30.	.52

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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

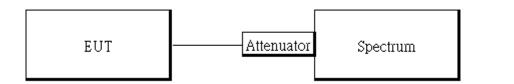
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

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.

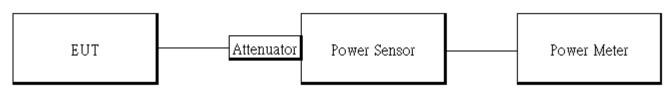
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

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	100.00	0.00	2.78	0.01
BLE 2M	100.00	0.00	2.78	0.01

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BLE_1M_LowCH00-2402

	pectrum A	Analyzer - Swept SA								
Center F	req 2	50 Ω DC 2.402000000			NSE:INT	Avg Ty	ALIGN AUTO	TRAC	M Feb 02, 2024	Frequency
10 dB/div		Offset 10.15 dB f 30.00 dBm	PNO: Fast IFGain:Low	#Atten: 3			Δ	Mkr3 3	.000 ms 0.03 dB	Auto Tune
20.0 10.0		X						3∆4		Center Fred 2.402000000 GH:
-10.0 -20.0 -30.0										Start Fred 2.402000000 GHz
-40.0 -50.0 -60.0										Stop Fred 2.402000000 GH:
4 Center 2 Res BW	8 MH:	-	#VE	BW 8.0 MHz	FUN	CTION	Sweep 5	.000 ms (pan 0 Hz 1001 pts)	CF Step 8.000000 MH: <u>Auto</u> Mar
1 Δ2 2 F 3 Δ4 4 F 5 6	1 t 1 t 1 t 1 t	(Δ) (Δ)	3.000 ms (, 1.000 ms 3.000 ms (, 1.000 ms	3.73 di	3m dB				=	Freq Offse 0 Hi
0 7 8 9 10 11										Scale Type
MSG				III			STATU	в	•	

BLE 2M LowCH00-2402

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	_{RL} nter	Fre	RF ≥q		50 Ω 200	DC 0000) GH	Z		1	NSE:I		Avg		: Voltage	04:41	TRACE	Feb 02, 2	156	F	requency
┢			Bof	050	+ 10	15 dB	IFG	IO: Fast Sain:Lov		#Atten: 3						\Mkr	DET	PNN	NNN		Auto Tune
	dB/div			f 30.			•										-0	.05 (dВ		
20.	0		+													▲ 3∆4	-				Center Freq
0.0					\rightarrow	< <u>a</u>										Y				2.4	52000000 GH2
-10.																					
-20.	o		_														_			2.40	Start Freq 2000000 GHz
-30.			-													-			_		
-40.	-																				Stop Freq
-50.			-																	2.40	02000000 GHz
-60.			-													-			_	<u> </u>	
	nter s BW				00 G	Hz		#\	/BW	/ 8.0 MHz	:		1	Ę	weep :	5.000 n		oan 0 001 p			CF Step 8.000000 MHz
	MODE	TRC				x				Y		FUNC	CTION	FUN	CTION WIDTH	FL	UNCTION	VALUE	^	<u>Auto</u>	Man
1		1	t	(<u></u>)			3.0	00 ms 00 ms	<u>(</u> Δ)	-0.05 3.78 d									-11		
3 4	∆4	1	t	(Δ)			3.0	00 ms 00 ms	(∆)	-0.05 3.78 d	dB										Freq Offset
5			•				1.0	00 1115		J./ 6 U	ып								E		0 Hz
6 7																					
8 9 10																			- 1		Scale Type
10 11																			_	Log	Lin
11	1	I		ł						III						1			۳	<u> </u>	
MSG															STATU	s					

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8.5 **Output Power:**

8.5.1 Peak & Avg

BLE 1M mode:

СН	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	Required Limit (dBm)
Low	2402	5	4.44	30
Mid	2442	5	4.17	30
High	2480	5	3.68	30
СН	Frequency	Power	Avg. Output Power	Required Limit
	(MHz)	Setting	(dBm)	(dBm)
Low	(MHz) 2402	Setting 5	(dBm) 4.26	(dBm) 30
	, ,	-	. ,	

*Note:

1.Measured by power meter, cable loss 10.15 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:

СН	Frequency (MHz)	Power set	Peak Output Power (dBm)	Required Limit (dBm)
Low	2402	5	4.37	30
Mid	2442	5	4.08	30
High	2480	5	3.55	30
СН	Frequency (MHz)	Power set	Avg. Output Power (dBm)	Required Limit (dBm)
Low	2402	5	4.20	30
Mid	2442	5	3.99	30
High	2480	5	3.45	30

*Note:

1.Measured by power meter, cable loss 10.15 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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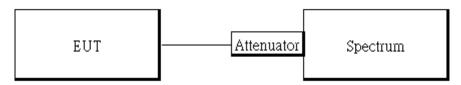


9 EMISSION BANDWIDTH MEASUREMENT

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	0.7113	\ge 0.5	PASS
2442	0.6959	\ge 0.5	PASS
2480	0.7105	≧ 0.5	PASS

BLE 2M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.329	\ge 0.5	PASS
2442	1.37	\ge 0.5	PASS
2480	1.294	\ge 0.5	PASS

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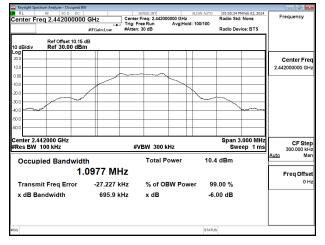
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OBW_BLE 1M_LowCH00-2402MHz

	trum Analyzer - Occupied BV	ſ					- 2 -	
Contor Fr	RF 50 Ω DC eq 2.402000000	CH-	SENSE:INT Center Freg: 2,4020			:29 PM Feb 02, 2024 Std: None	Frequency	
	eq 2.40200000	#FGain:Low		Avg Hold: 100	0/100	Device: BTS		
10 dB/div	Ref Offset 10.15 (Ref 30.00 dBn							
20.0							Center Freq	
10.0							2.402000000 GHz	
0.00								
-10.0		Δ						
-30.0		·			~~~			
40.0	1					-		
-50.0								
-60.0								
Center 2.4 #Res BW	02000 GHz 100 kHz		#VBW 300	kHz		an 3.000 MHz Sweep 1 ms	CF Step 300.000 kHz	
Occup	ied Bandwidt	h	Total F	Power	10.5 dBm	n	<u>Auto</u> Mar	
	1.	1040 M	Hz				Freq Offse	
Transm	it Freq Error	-27.822	kHz % of O	BW Power	99.00 %	, 0	0 H:	
x dB Ba	indwidth	711.3	kHz xdB		-6.00 dE	3		
ISG					STATUS		t	

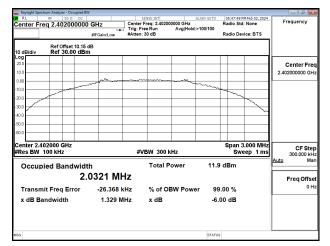
OBW_BLE 1M_MidCH20-2442MHz



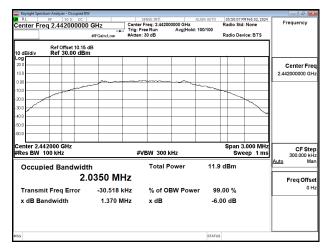
OBW_BLE 1M_HighCH39-2480MHz

Keysight Spectrum Analyzer - Occupied 8' RL RF 50 Ω DC enter Freq 2.480000000) GHz Cente	SENSE:INT ALIGN / rr Freq: 2.480000000 GHz Free Run Avg Hold: 100/1 n: 30 dB	Radio Std: None	Frequency		
Ref Offset 10.15 D dB/div Ref 30.00 dB	dB		Radio Device. B 13			
og 0.0				Center Fred 2.480000000 GH2		
0.0						
enter 2.480000 GHz Res BW 100 kHz	#	VBW 300 kHz	Span 3.000 MHz Sweep 1 ms	CF Ste 300.000 kH		
Occupied Bandwid	th 1099 MHz	Total Power	9.82 dBm	<u>Auto</u> Ma		
Transmit Freq Error	-28.514 kHz	% of OBW Power	99.00 %	Freq Offs 0 H		
x dB Bandwidth	710.5 kHz	x dB	-6.00 dB			
			STATUS			

OBW_BLE 2M_LowCH00-2402MHz



OBW BLE 2M MidCH20-2442MHz



OBW_BLE 2M_HighCH39-2480MHz

	it Freq Error ndwidth	-27.940 kHz 1.294 MHz	% of OBW Powe x dB		.00 % 00 dB		01
Occupi	ied Bandwidt 2.	հ 0551 MHz	Total Power	11.2	dBm		Auto Man Freq Offset
enter 2.48 Res BW 1	30000 GHz 100 kHz	Ť	VBW 300 kHz			ep 1 ms	CF Ste 300.000 k
0.0							
0.0							
0.0							
0.0					-		
.00		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		many			
0.0					_		Center Free 2.480000000 GH
og 0.0							
0 dB/div	Ref Offset 10.15 o Ref 30.00 dBn						
		Trig:	Free Run Avg Hold n: 30 dB	:>100/100	Radio Dev	vice: BTS	
enter Fre	q 2.48000000	GHz Cente	r Freg: 2.48000000 GHz		Radio Std	: None	Frequency

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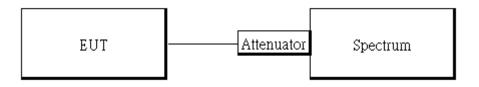


10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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**

Reference Level of Emission Limit: 10.3.1

- 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.
- 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**

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	3.53	-16.47
2442	3.41	-16.59
2480	2.79	-17.21
*Noto:	•	-

BLF 1M Reference Level of Limit

*Note:

1.cable loss as 10.15dB 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	2.25	-17.75
2442	2.14	-17.86
2480	2.02	-17.98

*Note:

1.cable loss as 10.15dB that offsets in the spectrum 2. Refer to next page for plots.

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Reference Level_BLE 1M_LowCH00-2402MHz

	ectrum Analyzer - Swe							_		08
RL enter F	RF 50 Q reg 2.40200	0000 GH			SE:INT	ALIGN AUTO	TRAI	M Feb 02, 2024 E 1 2 3 4 5 6	F	requency
		PNO	Wide	Trig: Free #Atten: 30	Run) dB		D			Auto Tun
0 dB/div	Ref Offset 10. Ref 30.00 d					Mkr1 2		1 2 GHz 53 dBm		Auto Tuli
⁵ g										Center Fre
10.0									2.40	2000000 GH
0.0	-	1								Start Fre
		~~~				 m			2.40	1466525 GH
								m		Stop Fre
0.0									2.40	2533475 GH
										CF Ste
0.0									Auto	106.695 ki
0.0	_									
50.0	_					 				Freq Offs
50.0										
										Scale Typ
	4020000 GHz 100 kHz		#VBW 3	300 kHz		Sweep	Span 1 1.000 ms	.067 MHz (1501 pts)	Log	L
9G						 STATU	_			

### Reference Level_BLE 1M_MidCH20-2442MHz

	ectrum Analyzer - Swep								@	×
Center F	RF 50 Ω req 2.442000	0000 GH	Z IO: Wide 🕞	]	Run	Log-Pwr	TRA	PM Feb 02, 2024 CE 1 2 3 4 5 6 PE M WWWWW ET P NNNNN	Frequency	/
10 dB/div	Ref Offset 10.1 Ref 30.00 dE	5 dB	Sain:Low	#Atten: 3		 Mkr1 2	2.441 71	6 8 GHz 41 dBm	Auto T	une
20.0									Center 1 2.442000000	
0.00						 m			Start F 2.441478075	
-10.0									Stop F 2.442521925	
-30.0									CF 9 104.385 <u>Auto</u>	
-50.0									Freq O	ffset 0 Hz
-60.0									Scale T	
Center 2.4 #Res BW	420000 GHz 100 kHz		#VBW	300 kHz		Sweep	Span ' 1.000 ms	1.044 MHz (1501 pts)	Log	Lin
MSG						STATL	s		t	

### Reference Level_BLE 1M_HighCH39-2480MHz

- 0 - 0					ectrum Analyzer - Swept SA	
Frequency	05:02:48 PM Feb 02, 2024 TRACE 1 2 3 4 5 6	ALIGN AUTO	SENSE:INT		RF 50 Ω DC	RL
	TYPE MWWWWW DET P NNNNN	vg type. Logir wi	Trig: Free Run #Atten: 30 dB	PNO: Wide IFGain:Low	req 2.48000000	enter F
Auto Tune	.480 211 7 GHz 2.79 dBm	Mkr1 2		3	Ref Offset 10.15 dB Ref 30.00 dBm	0 dB/div
Center Fre 2.480000000 GF						20.0
Start Fre 2.479467125 GF		-		~		10.0
<b>Stop Fr</b> 2.480532875 G						20.0
CF Ste 106.575 ki Auto M						0.0
Freq Offs 0						0.0
Scale Ty						50.0
Log L	Span 1.066 MHz .000 ms (1501 pts)			#VBW	1800000 GHz 100 kHz	

### Reference Level_BLE 2M_LowCH00-2402MHz

- 8								um Analyzer - Si		
Frequency	05:48:11 PM Feb 02, 2024 TRACE 1 2 3 4 5 6	ALIGN AUTO Type: Log-Pwr	A	INSE:INT		iHz		RF 50 € q 2.4020		u Ce
Auto Tu	.401 868 4 GHz 2.25 dBm	Mkr1 2			Trig: Fre #Atten: 3	PNO: Wide 🕞 FGain:Low	0.15 dB	Ref Offset 1 Ref 30.00	B/div	10
Center Fr 2.402000000 G				-						20.
<b>Start Fr</b> 2.401003250 G	m		~~~~	w		a fragmant darmin	from.	maynow		10.
<b>Stop Fr</b> 2.402996750 G	www.www.							Junior		10.
CF Sti 199.350 k Auto M										30. 40.
Freq Offs 0										50.
Scale Ty				-				-		60.
Log <u>L</u>	Span 1.994 MHz .000 ms (1501 pts)	Sweep 1		<u> </u>	/ 300 kHz	#VBV	z	20000 GH	ter 2.4 s BW 1	

### Reference Level_BLE 2M_MidCH20-2442MHz

	ectrum Analyzer - Swep						
Center F	RF 50 Ω req 2.442000	0000 GHz	SENSE:	Avg	ALIGN AUTO Type: Log-Pwr	05:50:30 PM Feb 02, 2024 TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 10.1 Ref 30.00 di		#Atten: 30 di		Mkr1 2	.442 450 7 GHz 2.14 dBm	
20.0							Center Fre 2.442000000 GH
0.00		, when any work	<u>man manna</u>		marso la marso	m	Start Fre 2.440972500 GF
-10.0	- mar and a start						Stop Fre 2.443027500 GF
30.0							CF Ste 205.500 ki Auto Mi
50.0							Freq Offs 01
60.0							Scale Typ
Center 2. #Res BW	442000 GHz 100 kHz	#V	BW 300 kHz		Sweep 1	Span 2.055 MHz .000 ms (1501 pts)	Log <u>L</u>
MSG					STATUS	5	

### Reference Level_BLE 2M_HighCH39-2480MHz

RL	RF 50 Q req 2.48000	DC		SEN	SE:INT		ALIGN AUTO		M Feb 02, 2024	F	requency
enterr	1eq 2.48000	PNO	Wide	Trig: Free #Atten: 30			-	TY Di			
dB/div	Ref Offset 10. Ref 30.00 d						Mkr1 2		4 0 GHz 02 dBm		Auto Tui
'g											Center Fre
0.0										2.48	30000000 G
1.0		▲1									Start Fr
00	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Marine	~~~~~	- - - - 	Spenda Dyna		www.			2.47	79029500 G
0.0								-	mar		Stop Fr
0.0										2.48	30970500 G
											CF St
										<u>Auto</u>	194.100 k N
-											Freq Offs
0.0											. 0
0.0											Scale Ty
	4800000 GHz	2			·	1		Span 1	.941 MHz	Log	ļ
a BW	100 kHz		#VBW 3	00 kHz			Sweep 1		1501 pts)		

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### Band Edge_BLE 1M_LowCH00-2402MHz

A LIMA ATTO         DESCRIPTION         DESCRIPTION         Frequency           Avg Type: Log-Pwr         The CEI 23 4 5 0 0 0 GHz         Frequency         Frequency           Mkr2 2.400 0 GHz         Auto Tune         Auto Tune         Auto Tune           -43.36 dBm         Center Freq         2.36000000 GHz         Start Freq           -41         -42         Start Freq         2.31000000 GHz           -42         -41000000 GHz         Stop Freq         2.41000000 GHz           -45.95 m 100.0 MHz         CF Step         1.0000000 MHz         CF Step	Avg Type: Log-Pv	SENSE:INT Trig: Free Run #Atten: 30 dB	<b>Hz</b> NO: Fast ↔ Gain:Low	00000 GH		Freq		en
MKr2 2.400 0 GHz -43.36 dBm -1 2.3000000 GHz 2.3000000 GHz 2.3000000 GHz 2.3000000 GHz 2.3000000 GHz 2.3000000 GHz Start Freq 2.3000000 GHz 2.3000000 GHz Start Freq 2.3000000 GHz Conter Freq 2.4000000 GHz	I	Trig: Free Run #Atten: 30 dB	NO: Fast 🔸	P	2.00000			
A3.36 dBm     A3.36 dBm     Center Freq     2.3000000 GHz     Span 100.0 MHz     Span 100.0 MHz     Sysee p 5.600 ms (100 pts)	1							
2 36000000 GH2 2 36000000 GH2 2 36000000 GH2 2 36000000 GH2 2 3600000 GH2 2 3600000 GH2 2 3600000 GH2 2 3600000 GH2 2 36000000 GH2 2 3600000 GH2 2 3600000 GH2 2 36000000 GH2 2 36000000 GH2 2 36000000 GH2 2 36000000 GH2 2 3600000 GH2 2 4000000 GH2 2 400000 GH2 2 400000 GH2 2 4000000 GH2 2 400000 GH2 2 4000000 GH2 2 40000000 GH2 2 40000000 GH2 2 40000000					f Offset 10 ef 30.00		B/div	10 di
Span 100.0 MHz Sweep 9.600 ms (100 pt pts)								.og 20.0
2.31000000 GH: 2.31000000 GH: 2.1000000 GH: 2.1000000 GH: Span 100.0 MHz Sweep 9.600 ms (1001 pts)							-	10.0
2.31000000 GH 2.31000000 GH Span 100.0 MHz Sweep 9.600 ms (1001 pts) Sweep 100000 HH								0.00
Spen 100.0 MHz Sweep 9.600 ms (100 pts)				_			_	-20.0
Stop Free 2.41000000 GH Span 100.0 MHz Sweep 5.600 ms (1001 pts)								30.0
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TION FUNCTION WIDTH FUNCTION VALUE A	<u> </u>	300 kHz		×	L	N 100	s BV	#Re
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Log Li						-		10 11
STATUS								< 1

### Band Edge_BLE 1M_HighCH39-2480MHz

	ght S	ipect		Analyze	r - Swe																	
X RL Cente		-	RF	2 4 0	50 Q	DC		Lin				ENSE:	INT	Ave		ALIGN AUTO	05		CE 1 2 3			requency
Jenite		rie	، p:	2.40	750	0000	F	PNO:	Fast n:Low	, <b>*</b>	Trig: Fr #Atten:				1300	-		TY D	PE MW	INNN		Auto Tu
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ente Res	BV	N 1	00	kHz	łz				#V	BW	/ 300 kH	z				Sweep :	2.400	ms	·	pts)	Auto	CF St 2.500000 M
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6 7 8	-	_	_						_			_								=		0 Scale Ty
9 0 1																					Log	
sg																STAT	JS				£	

### Band Edge_BLE 2M_LowCH00-2402MHz

	ipectrum Analyzer - Sv					
RL			SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:48:51 PM Feb 02, 2024 TRACE 1 2 3 4 5 6	Frequency
enter i	Freq 2.3600	PNO: Fast ~ IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type. Log-Fwi	TYPE MWWWW DET P NNNNN	
10 dB/div	Ref Offset 1 Ref 30.00			Mk	r2 2.400 0 GHz -29.30 dBm	Auto Tun
20.0 10.0					1	Center Fre 2.360000000 GH
20.0					2	Start Fre 2.310000000 GH
40.0			ana	angente and served from the states	guerran and	Stop Fre 2.410000000 GH
	2.36000 GHz V 100 kHz	#VB	₩ 300 kHz	Sweep 9	Span 100.0 MHz .600 ms (1001 pts)	CF Ste 10.000000 MH Auto Ma
1 N 2 N 3 4 5	1 f (Δ) 1 f	2.402 2 GHz (Δ 2.400 0 GHz			E	Freq Offs 0 H
6 7 8 9						Scale Typ
10						Log <u>Li</u>
i i i i i i i i i i i i i i i i i i i				STATUS		L

### Band Edge_BLE 2M_HighCH39-2480MHz

Keysight Spectrum Analyzer - Swept SA					- @ <b>*</b>
Center Freq 2.487500000 GH	7	Avg Type	Log-Pwr T	9 PM Feb 02, 2024 RACE 1 2 3 4 5 6	Frequency
Ph IFG Ref Offset 10.15 dB 10 dB/div Ref 30.00 dBm	N: Fast Trig: Fre Sain:Low #Atten: 3		Mkr3 2.490	025 GHz 8.71 dBm	Auto Tune
2000 1000					Center Freq 2.487500000 GHz
-10.0				DL1 -17.98 dBm	Start Fred 2.475000000 GHz
-40.0 -50.0	n and a second s	3- 	and the second	1000-00-000 m	Stop Fred 2.500000000 GHz
Center 2.48750 GHz #Res BW 100 kHz	#VBW 300 kHz		Sweep 2.400 m		CF Step 2.500000 MH2 Auto Mar
1 N 1 f (Δ) 2.479 950 2 N 1 f 2.483 500 3 N 1 f (Δ) 2.490 025 4 5	0 GHz (Δ) 1.46 df 0 GHz -49.91 df 5 GHz (Δ) -48.71 df	Bm 3m		E	Freq Offset 0 Hz
6 7 8 9					Scale Type
10				• [	Log <u>Lin</u>
MSG	π		STATUS	,	

### Spurious Emission_BLE 1M_LowCH00-2402MHz

	Spectrum Analyzer - !									- a	×
Center	RF 50 Freq 12.51	5000000 G	Hz		SE:INT		ALIGN AUTO e: Log-Pwr	TRAI	M Feb 02, 2024 DE 1 2 3 4 5 6	Frequency	
10 dB/div	Ref Offset Ref 30.00	10.15 dB	NO: Fast 🔸 Sain:Low	#Atten: 30			M	kr4 24.0	073 GHz 52 dBm	Auto T	une
20.0 10.0	- Q1				·					Center F 12.515000000	
-10.0 -20.0 -30.0									DL1 -16.47 dBm	Start F 30.000000	
-40.0 -50.0 -60.0		0 ²	3 Antioniput			<b>i ti t</b> i ti				Stop F 25.000000000	
	12.52 GHz V 100 kHz	×	#VBW	300 kHz	FIIM	CTION FUT	Sweep :	2.387 s (2	4.97 GHz 4971 pts)	CF S 2.497000000 Auto	
1 N 2 N	1 f (Δ) 1 f 1 f (Δ) 1 f (Δ)	4.80	2 GHz (Δ) 4 GHz 6 GHz (Δ) 3 GHz	0.75 dE -50.91 dE -50.89 dE -41.52 dE	m m m					FreqOf	<b>fse</b> он
7 8 9					-					Scale T	ур
10 11									-	Log	Li
MSG				π			STATUS	5		I	_

### Spurious Emission_BLE 1M_MidCH20-2442MHz

00									nalyzer - Swe		t Specti	ysight I
Frequency	PM Feb 02, 2024 ACE 1 2 3 4 5 6	TRA	ALIGN AUTO	Avg Typ	SE:INT		z	DC 0000 GI	50 Q 2.5150	RF cq 1	Fre	
Auto Tur	DET P NNNN	0			Run ) dB	#Atten: 3	Fast 🔸					
AutoTur	.786 GHz .82 dBm		М						Offset 10. 30.00 d			B/di
Center Fre												
12.515000000 GH										01		
Start Fre	DL1 -16.59 dBm											
30.000000 MH												
Stop Fre	<b>♦</b> ⁴							2	0			_
25.00000000 GH	and the second se		ideo di Alegan Northeri Para				i di si	<b>harun</b> M	in the second		-	<b>i</b> nterio
CF Ste 2.497000000 GH	24.97 GHz (24971 pts)		Sweep 2			300 kHz	#VBW				12.5 W 1	L
<u>Auto</u> Ma	TION VALUE	FUNCT	ICTION WIDTH	TION		Y 0.39 di	Hz (Δ)	×	(Δ)		TIRC 1	MODE
Freq Offs 0 F	=				lm Im	-48.18 dE -49.06 dE -41.82 dE	Hz Hz (Δ)	4.884	(Δ) (Δ)	f	1 1 1	N N N
Scale Typ							-					
Log <u>L</u>	-						-					
	•		STATUS							-	-	

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# Report No.: TERF2401000148E2 Page: 30 of 62



### Spurious Emission_BLE 1M_HighCH39-2480MHz

- 8 <u>-</u>										Analyzer - Swe		
Frequency	Feb 02, 2024	05:03:50 P	LIGN AUTO		SE:INT	SEN		11-	00000 G		RF	L
Auto Tur		TYI Di		Ang tipe		Trig: Free #Atten: 30		IC: Fast Sain:Lov	PI	12.5150	req	ller
AutoTur	99 GHz 28 dBm		M							Offset 10 1 30.00 c		B/div
Center Fre												_
12.515000000 GH										1	4	
Start Fre	DL1 -17.21 dBm											_
30.000000 MH	4											
Stop Fre		أطرياني وتقترب ونغ	فالعاقد للأمريده	التربيد ورواف	لمافانيا بي ب	analiseste et en en en	للدعرية	3	2	auguer		
25.00000000 GH			No. of Concession, Name	r Agricenti de la Constanti de	post a second							
CF Ste 2.497000000 GH	4.97 GHz 4971 pts)	Span 2 2.387 s (2	Sweep 2			300 kHz	вw	#V			2.52 (	
<u>Auto</u> Ma	N VALUE	FUNCTI	CTION WIDTH	TION FUN	FUN	Y			x		RC SCL	
Freq Offs	_				m m	-0.44 dE -51.14 dE -50.76 dE -42.28 dE		0 GHz 0 GHz 0 GHz 9 GHz	4.96	(Δ) (Δ)	1 f	N N N
01	=								20100		-	
Scale Typ											-	
Log <u>L</u>				_				_				
			STATUS									

### Spurious Emission_BLE 2M_LowCH00-2402MHz

Keysight Spee	ctrum Analyzer - Sw										8
	req 12.5150		Hz IO: Fast 🔸	SENSE		Avg Ty	ALIGN AUTO	TRA	PM Feb 02, 2024 CE 1 2 3 4 5 6 PE MWWWWW ET P NNNN	Frequ	ency
0 dB/div	Ref Offset 10 Ref 30.00 (	1FG	iain:Low	#Atten: 30 d			М	kr4 24.	553 GHz 36 dBm		to Tun
.0g 20.0 10.0	Q1									Cen 12.515000	terFre 0000 G⊦
20.0									0L1 -17.75 dBm		art Fre
40.0 50.0 50.0	and the second second	2	3 Letip eliticati	<b>natur</b> a da			-			St 25.00000	op Fre
enter 12 Res BW	100 kHz	×	#VBW	300 kHz		ICTION F	Sweep	2.387 s (2	24.97 GHz 24971 pts)	2.49700 Auto	CF Ste 2000 GI Ma
1 N 1 2 N 1 3 N 1 4 N 1 5	f (Δ) f f (Δ) f	2.40	2 GHz (Δ) 4 GHz 5 GHz (Δ) 8 GHz	0.26 dBn -51.43 dBn -50.01 dBn -41.36 dBn	1	CIION	UNCTION WIDTH	FONCT		Fre	q Offs 0 ⊦
0 7 8 9 10										Sca Log	ale Typ L
sg				17			STATU	s	,		

### Spurious Emission_BLE 2M_MidCH20-2442MHz

	ectrum Analyzer - Swept					Ø 💌
Center F	RF 50 Ω req 12.51500	0000 GHz PN0: Fast	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	05:51:13 PM Feb 02, 2024 TRACE 1 2 3 4 5 6 TYPE M	Frequency
10 dB/div	Ref Offset 10.15 Ref 30.00 dB	IFGain:Low	#Atten: 30 dB	М	kr4 24.711 GHz -42.26 dBm	Auto Tun
20.0 10.0	1					Center Fre 12.515000000 GH
20.0					DL1 -17.88 dBm	Start Fre 30.000000 MH
40.0 50.0 60.0		3				Stop Fre 25.00000000 GH
	100 kHz		300 kHz	•	Span 24.97 GHz 2.387 s (24971 pts)	CF Ste 2.497000000 GH Auto Ma
1 N 1 2 N 1 3 N 1 4 N 1 5 6	f (Δ) f f (Δ)	× 2.442 GHz (Δ) 4.884 GHz 7.326 GHz (Δ) 24.711 GHz	-0.27 dBm -51.17 dBm -50.34 dBm -42.26 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse 0 H
6 7 8 9 10 11						Scale Typ
< sc	+ +	1	87	STATU	*	

### Spurious Emission_BLE 2M_HighCH39-2480MHz

X RL	RE 50.0 DC							
Center Fre	q 12.5150000	00 GHz	SENSE:IN	Avg Type	ALIGN AUTO : Log-Pwr	05:54:01 PMF TRACE	123456	Frequency
10 dB/div	Ref Offset 10.15 dl Ref 30.00 dBm	PNO: Fast IFGain:Low	HTrig: Free Rur #Atten: 30 dB		Mł	(r4 23.84	4 GHz 2 dBm	Auto Tun
20.0	Q ¹							Center Fre 12.515000000 GF
20.0						0.	1 -17.98 dBm	Start Fro 30.000000 Mi
40.0 50.0 50.0	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	3						<b>Stop Fr</b> 25.00000000 G
enter 12.5 Res BW 10	00 kHz		V 300 kHz			Span 24. .387 s (249	971 pts)	CF St 2.497000000 G Auto M
1 N 1 2 N 1 3 N 1 4 N 1 5 6	f (Δ) f f (Δ)	2.480 GHz (Δ) 4.960 GHz 7.440 GHz (Δ) 23.844 GHz	-49.19 dBm	FUNCTION	ICTION WIDTH	FUNCTION	VALUE ×	Freq Offs 0
0 7 8 9 0								Scale Ty
							*	

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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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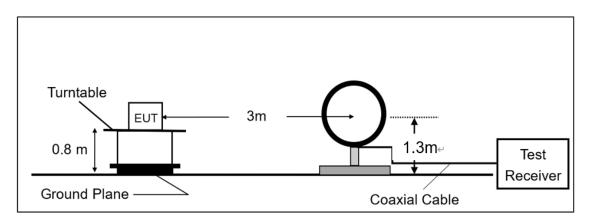
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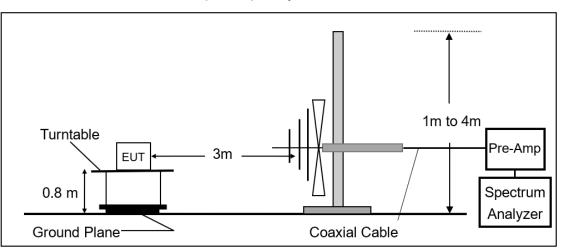


#### 11.1 **Test Setup**

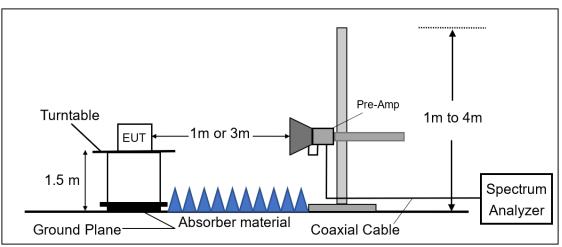
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(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( $dB\mu V/m$ ) = SPA. Reading level( $dB\mu V$ ) + Factor(dB) Factor(dB) = Antenna Factor( $dB\mu V/m$ ) + 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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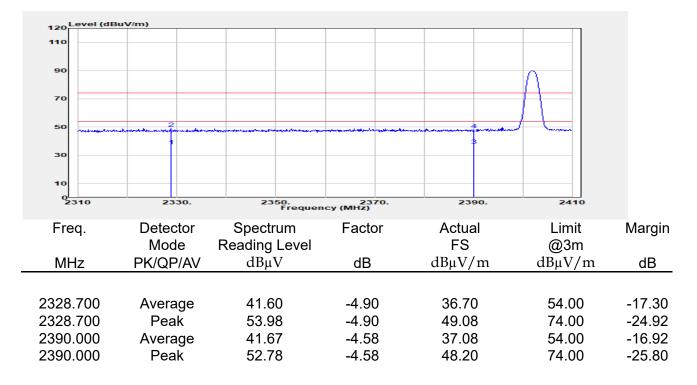
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#### 11.4.1 **Radiated Band Edge Measurement Result**

Report Number	:TERF2401000148E2	Test Site	:SAC D
Operation Mode	:BLE 1M	Test Date	:2024-02-19
Test Frequency	:2402 MHz	Temp./Humi.	: <b>22.9</b> ℃/61%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Sam Huang



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Report Numbe Operation Moo Test Frequenc Test Mode EUT Pol	de :BLE 1M	lz je	Ti Ti A	est Date :: emp./Humi. :: ntenna Pol. :I		
120 Level (dBu 110 90	V/m)					
70 50 30		the second s		2 7 1 3		
10 0 2310	2330.	2350. Frequen	2370. cy (MHz)	2390.	2410	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2381.100 2381.100 2390.000 2390.000	Average Peak Average Peak	41.65 53.95 41.78 52.33	-4.64 -4.64 -4.58 -4.58	37.01 49.31 37.20 47.75	54.00 74.00 54.00 74.00	-16.99 -24.69 -16.80 -26.25

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Report Numbe Operation Moo Test Frequenc Test Mode EUT Pol	de :BLE 1M	łz je		Test Date :2 Temp./Humi. :2 Antenna Pol. :V		
120 Level (dBu 110 90 70	V/m)					
30		3				
10 0 2475	2480.	2485. Frequen	2490. Icy (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.500 2483.500 2485.700 2485.700	Average Peak Average Peak	41.86 52.39 41.75 54.06	-5.30 -5.30 -5.32 -5.32	36.56 47.08 36.43 48.74	54.00 74.00 54.00 74.00	-17.44 -26.92 -17.57 -25.26

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Report Number Operation Moo Test Frequence Test Mode EUT Pol	de :BLE 1M	Z	T T A	ēst Date :2 ēmp./Humi. :2 Antenna Pol. :H		
120 Level (dBu 110 90	V/m)					
70						
30		1 3	a ta tha ann an agus an San Ann an San Ann			
10						
2475	2480.	2485. Frequen	2490. cy (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.500	Average	41.89	-5.30	36.59	54.00	-17.41
2483.500	Peak	51.86	-5.30	46.56	74.00	-27.44
2484.350	Average	41.82	-5.31	36.51	54.00	-17.49
2484.350	Peak	54.82	-5.31	49.51	74.00	-24.49

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Report Numbe Operation Moo Test Frequenc Test Mode EUT Pol	de :BLE 2M	lz je	T T A	۲est Date :2 ۲emp./Humi. :2 Antenna Pol. :۷		
120 Level (dBu 110 90	V/m)					
70					+	
50		and the second sec	na fa se state de serate	1 3		
30						
0 2310	2330.	2350. Frequen	2370. cy (MHz)	2390.	2410	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
2385.900 2385.900 2390.000	Average Peak Average	41.57 53.84 41.70	-4.61 -4.61 -4.58	36.96 49.24 37.12	54.00 74.00 54.00	-17.04 -24.76 -16.88
2390.000	Peak	52.25	-4.58	47.67	74.00	-26.33

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Report Number:TERF2401000148E2Test Site:SAC DOperation Mode:BLE 2MTest Date:2024-02-19Test Frequency:2402 MHzTemp./Humi.:22.9°C/61%Test Mode:BandedgeAntenna Pol.:HorizontalEUT Pol:E2 PlaneEngineer:Sam Huang	
120 Level (dBuV/m) 110	
70	
50 methodown our second for a second for the second	
30	
10	
0 2310 2330. 2350. 2370. 2390. 2410 Frequency (MHz) 2390. 2410	
Freq. Detector Spectrum Factor Actual Limit	Margin
Mode Reading Level FS @3m	0
MHz PK/QP/AV $dB\mu V$ dB $dB\mu V/m$ $dB\mu V/m$	dB
2344.200 Average 41.44 -4.85 36.58 54.00	-17.42
2344.200 Peak 54.46 -4.85 49.60 74.00	-24.40
2390.000 Average 41.70 -4.58 37.12 54.00	-16.88
2390.000 Peak 51.90 -4.58 47.32 74.00	-26.68

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Report Numbe Operation Moe Test Frequenc Test Mode EUT Pol	de :BLE 2M	lz je	T T A	ēst Date :2 ēmp./Humi. :2 Antenna Pol. :V		
120 Level (dBu 110 90	IV/m)					
50		3			*****	
10 0 2475	2480.	2485. Frequen	2490. cy (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	Reading Level dBµV	dB	dBµV/m	dBµV/m	dB
2483.500 2483.500 2483.650 2483.650	Average Peak Average Peak	43.11 53.43 42.81 53.93	-5.30 -5.30 -5.31 -5.31	37.81 48.13 37.51 48.62	54.00 74.00 54.00 74.00	-16.19 -25.87 -16.49 -25.38

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Report Numbe Operation Mo Test Frequenc Test Mode EUT Pol	de :BLE 2M	lz e	ר ר <i>ן</i>	۲est Date :: ۲emp./Humi. :: Antenna Pol. :		
120 Level (dBa 110 90 70 50 30	uV/m)					
10 0 2475	2480.	2485. Frequen	2490. cy (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.500 2483.500 2483.825 2483.825	Average Peak Average Peak	44.30 53.62 43.28 54.86	-5.30 -5.30 -5.31 -5.31	38.99 48.32 37.97 49.55	54.00 74.00 54.00 74.00	-15.01 -25.68 -16.03 -24.45

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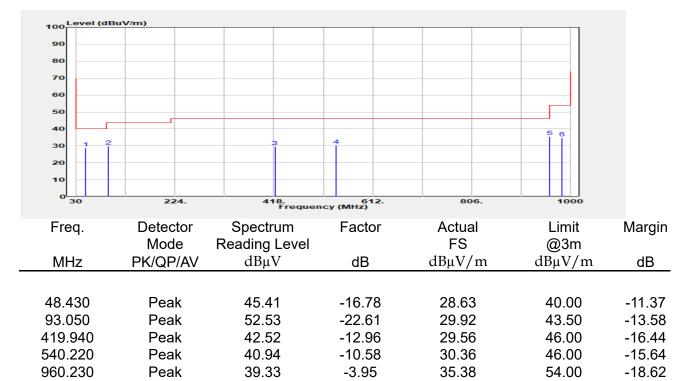
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#### 11.4.2 **Radiated Spurious Emission**

Report Number	:TERF2401000148E2	Test Site	:SAC D
<b>Operation Mode</b>	:BLE 1M	Test Date	:2024-02-19
Test Frequency	:2442 MHz	Temp./Humi.	:22.9 °C/61%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Sam Huang



-4.27

34.73

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39.00

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984.480

Peak

f (886-2) 2298-0488

54.00

-19.27



Report Numbe	r :TERF24	01000148E2		Test Site	:SAC D	
Operation Mod	le :BLE 1M			Test Date	:2024-02-19	
Test Frequenc	y :2442 MF	łz		Temp./Humi.	:22.9 °C/61%	
Test Mode	:Tx			Antenna Pol.	:Horizontal	
EUT Pol	:E2 Plane	e		Engineer	:Sam Huang	
100 Level (dBu	V/m)	1 1	1 1			
90						
80						
70 60						
50						
40					6	
30 1	2	3 4	5			
20						
10						
30	224.	418. Frequen	612. cy (MHz)	806.	1000	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
N 41 1-	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
00.050	<b>.</b> .	40.00	47.00	00.40	40.00	44 50
63.950	Peak	46.30	-17.88	28.42	40.00	-11.58
180.350 299.660	Peak Peak	46.90 47.51	-18.07 -15.67	28.84 31.84	43.50 46.00	-14.66 -14.16
419.940	Peak	43.89	-12.96	30.93	46.00	-14.10
589.690	Peak	40.69	-9.52	31.17	46.00	-14.83
960.230	Peak	38.97	-3.95	35.02	54.00	-18.98

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Report Numbe	r :TERF240	1000148E2		Test Site	:SAC D	
Operation Mod	le :BLE 2M			Test Date	:2024-02-19	
Test Frequency	y :2442 MH	z		Temp./Humi.	:22.9 ℃/61%	
Test Mode	:Tx			Antenna Pol	:Vertical	
EUT Pol	:E2 Plane			Engineer	:Sam Huang	
100 Level (dBu) 90	V/m)					
70						
60 50						
40	J				6	
30 1 2		3	5			
20 10						
0 30	224.	418. Frequer	612. icy (MHz)	806.	1000	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/n	n dBµV/m	dB
62.980	Peak	46.50	-17.86	28.63	40.00	-11.37
93.050	Peak	51.12	-22.61	28.51	43.50	-14.99
324.880	Peak	39.19	-14.86	24.32	46.00	-21.68
419.940 540.220	Peak Peak	42.12 40.55	-12.96 -10.58	29.16 29.97	46.00 46.00	-16.84 -16.03
960.230	Peak	40.55 39.62	-10.56	29.97 35.67	46.00 54.00	-16.03
300.230	i can	00.02	-0.50	55.07	54.00	-10.00

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Report Numbe	r :TERF240	01000148E2		Test Site	:SAC D	
Operation Mod	e :BLE 2M			Test Date	:2024-02-19	
Test Frequency	y :2442 MH	Iz		Temp./Humi.	:22.9 ℃/61%	
Test Mode	:Tx			Antenna Pol.	:Horizontal	
EUT Pol	:E2 Plane	)		Engineer	:Sam Huang	
100 Level (dBu)	//m)		1 1			
90						
80						
70 60						
50						
40					6	
30 1	2	3 4	5			
20						
30	224.	418. Frequen	612. cy (MHz)	806.	1000	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
	<b>_</b> .				10.00	10.00
63.950	Peak	47.29	-17.88	29.40	40.00	-10.60
180.350	Peak	47.17	-18.07	29.11	43.50	-14.39
299.660 419.940	Peak Peak	47.18 44.14	-15.67 -12.96	31.51 31.18	46.00 46.00	-14.49 -14.82
589.690	Peak	40.44	-12.90	30.92	46.00	-14.82
960.230	Peak	38.84	-3.95	34.89	54.00	-19.11

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EUT Pol :E2 Plane Engineer :Sam Huang
100 Level (dBuV/m)
90
80
70
50         2         4           40         1         1
30
20
10
йоо 6100. 11200. 16300. 21400. 26500 Frequency (MHz)
Freq. Detector Spectrum Factor Actual Limit Margin
Mode Reading Level FS @3m
$MHz PK/QP/AV dB\mu V dB dB\mu V/m dB\mu V/m dB$
4804.000 Average 40.06 0.98 41.04 54.00 -12.96
4804.000 Peak 46.30 0.98 47.29 74.00 -26.71
7206.000 Average 28.82 8.13 36.95 54.00 -17.05
7206.000 Peak 39.47 8.13 47.60 74.00 -26.40

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e∷BLE 1M :2402 MH :Tx	Iz		Test Date :2 Temp./Humi. :2 Antenna Pol. :H	2024-02-19 22.9  ℃/61% Horizontal	
m)					
6100.	11200. Frequen	1630( cy (MHz)	0. 21400.	26500	
Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
Average Peak Average Peak	42.00 47.78 28.06 39.73	0.98 0.98 8.13 8 13	42.98 48.77 36.18 47.86	54.00 74.00 54.00 74.00	-11.02 -25.23 -17.82 -26.14
	BLE 1M :2402 MH :Tx :E2 Plane	:2402 MHz :Tx :E2 Plane	:BLE 1M :2402 MHz :Tx :E2 Plane	:BLE 1M       Test Date       :2         :2402 MHz       Temp./Humi.       :2         :Tx       Antenna Pol.       :H         :E2 Plane       Engineer       :S	:BLE 1M       Test Date       :2024-02-19         :2402 MHz       Temp./Humi.       :22.9 °C/61%         :Tx       Antenna Pol.       :Horizontal         :E2 Plane       Engineer       :Sam Huang         ************************************

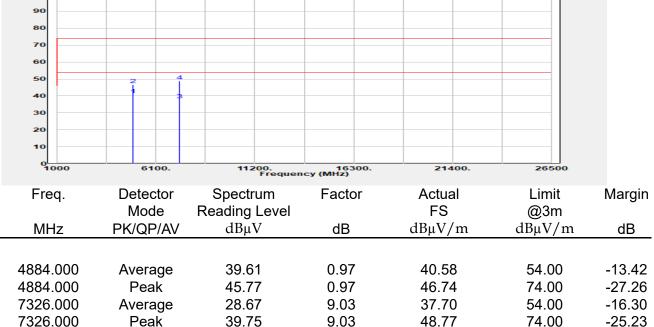
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Report Number :TERF2401000148E2					Test	t S
Operation Mode :BLE 1M					Test	t D
Test Frequency	:2442 MHz				Tem	۱p.
Test Mode	:Tx				Ante	en
EUT Pol	:E2 Plane				Eng	in
100 Level (dBuV/r	n)					
90						
80						-
70		-				
60						

Test Site	:SAC D
Test Date	:2024-02-19
Temp./Humi.	:22.9 °C/61%
Antenna Pol.	:Vertical
Engineer	:Sam Huang



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Report Number Operation Moo Test Frequence Test Mode EUT Pol	de :BLE 1M	Ιz		Test Date :20 Temp./Humi. :22 Antenna Pol. :He		
100 Level (dBu	V/m)					
80						
70 60						
50	2 4					
40	3					
30						
10						
9	6100.	11200. Frequen	16300. cy (MHz)	21400.	26500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4884.000	Average	40.70	0.97	41.67	54.00	-12.33
4884.000 7326.000	Peak Average	47.06 28.37	0.97 9.03	48.03 37.40	74.00 54.00	-25.97 -16.60
7326.000	Peak	39.38	9.03	48.41	74.00 74.00	-25.59

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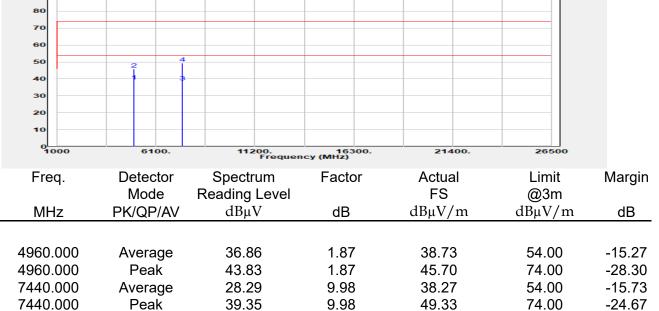
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Report Number	Test Site	
<b>Operation Mode</b>	:BLE 1M	Test Date
Test Frequency	:2480 MHz	Temp./Hu
Test Mode	:Tx	Antenna
EUT Pol	:E2 Plane	Engineer
100 Level (dBuV/m	0	
90		
80		
70		
60		
50	4	
	2	

Test Site	:SAC D				
Test Date	:2024-02-19				
Temp./Humi.	:22.9 °C/61%				
Antenna Pol.	:Vertical				
Engineer	:Sam Huang				



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Margin

dB

-16.19

-27.91 -15.93

-24.74

54.00

74.00

54.00

74.00



4960.000

4960.000

7440.000

7440.000

Average

Peak

Average

Peak

Image: sevel (dBuV/m)       Image: sevel (dBuV/m)	Report Numbe Operation Mod Test Frequenc Test Mode EUT Pol	de :BLE 1M y :2480 M⊦ :Tx	:2480 MHz			:SAC D :2024-02-19 :22.9 °C/61% :Horizontal :Sam Huang
90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90       90 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
so       so <td< td=""><td>100 Level (dBu</td><td>V/m)</td><td></td><td></td><td></td><td></td></td<>	100 Level (dBu	V/m)				
70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70       70 <td< td=""><td>90</td><td></td><td></td><td></td><td></td><td></td></td<>	90					
60       2       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4       4	80					
Freq.     Detector     Spectrum     Factor     Actual     Limit       Mode     Reading Level     FS     @3m	70					
40     2     40     40       30     20     10     11200, Frequency (MHz)     21400, 26500       Freq.     Detector     Spectrum     Factor     Actual     Limit       Mode     Reading Level     FS     @3m	60					
30     20     10     11200.     16300.     21400.     26500       Freq.     Detector     Spectrum     Factor     Actual     Limit       Mode     Reading Level     FS     @3m	50					
20     10     6100.     11200. Frequency (MHz)     21400.     26500       Freq.     Detector Mode     Spectrum Reading Level     Factor FS     Actual FS     Limit @3m	40	1 3				
10       6100.       11200. Frequency (MHz)       21400.       26500         Freq.       Detector Mode       Spectrum Reading Level       Factor FS       Actual FS       Limit @3m	30					
Place       6100.       11200. Frequency (MHz)       16300. 21400.       21400.       26500         Freq.       Detector       Spectrum       Factor       Actual       Limit         Mode       Reading Level       FS       @3m	20					
Frequency (MH2) Freq. Detector Spectrum Factor Actual Limit Mode Reading Level FS @3m						
Mode Reading Level FS @3m	1000	6100.	11200. Frequen	16300 icy (MHz)	. 21400	. 26500
Mode Reading Level FS @3m	Freq.	Detector	Spectrum	Factor	Actual	Limit
	·	Mode			FS	@3m
	MHz	PK/QP/AV	dBµV	dB	dBµV/m	—

35.95

44.22

28.08

39.28

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1.87

1.87

9.98

9.98

37.81

46.09

38.07

49.26

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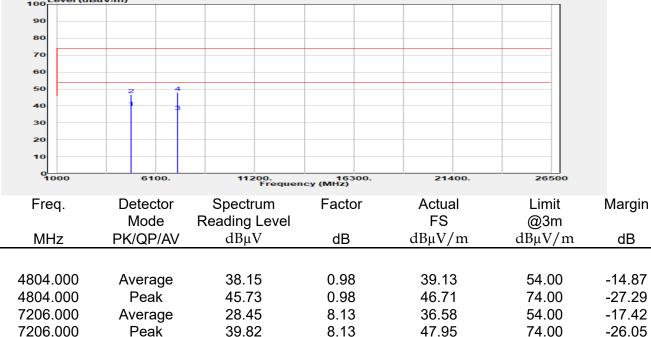
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Report Number	:TERF2401000148E2
Operation Mode	:BLE 2M
Test Frequency	:2402 MHz
Test Mode	:Tx
EUT Pol	:E2 Plane
100 Level (dBuV/n	n)

Test Site	:SAC D
Test Date	:2024-02-19
Temp./Humi.	:22.9 °C/61%
Antenna Pol.	:Vertical
Engineer	:Sam Huang



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Report Numbe Operation Mod Test Frequenc Test Mode EUT Pol	de :BLE 2M	łz		Test Date :20 Temp./Humi. :22 Antenna Pol. :Ho		
100 Level (dBu 90 80 70 60 50 40 30 20	V/m)					
10 0 1000	6100.	11200. Frequen	16300. су (MHz)	21400.	26500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.000 4804.000 7206.000 7206.000	Average Peak Average Peak	40.05 46.27 28.03 39.13	0.98 0.98 8.13 8.13	41.03 47.25 36.16 47.25	54.00 74.00 54.00 74.00	-12.97 -26.75 -17.84 -26.75

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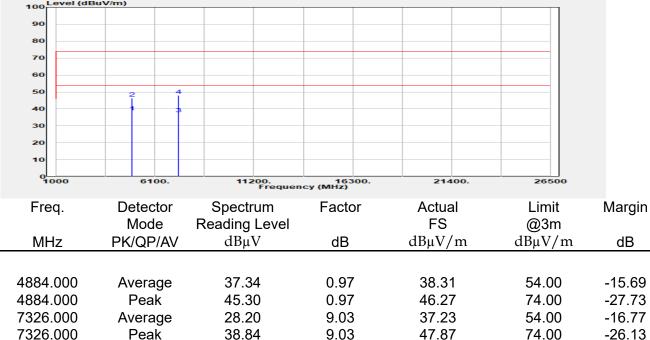
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Report Number	:TERF2401000148E2
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:Tx
EUT Pol	:E2 Plane
400 Level (dBuV/n	n)

Test Site	:SAC D			
Test Date	:2024-02-19			
Temp./Humi.	:22.9 °C/61%			
Antenna Pol.	:Vertical			
Engineer	:Sam Huang			



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Report Number Operation Mon Test Frequence Test Mode EUT Pol	de :BLE 2M	łz	ד ד 4	ēst Date :20 ēmp./Humi. :22 Antenna Pol. :Ho		
100 Level (dBu 90 80 70 60 50 40 30 20 10 1000	IV/m)		16300. cy (MHz)		26500	
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor	Actual FS dBμV/m	Limit @3m dBµV/m	Margin dB
4884.000 4884.000 7326.000 7326.000	Average Peak Average Peak	38.46 45.52 28.05 38.85	0.97 0.97 9.03 9.03	39.43 46.49 37.08 47.88	54.00 74.00 54.00 74.00	-14.57 -27.51 -16.92 -26.12

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f (886-2) 2298-0488

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54.00

74.00

54.00

74.00

Margin

dB

-16.64

-27.56 -15.97

-25.00



4960.000

4960.000

7440.000

7440.000

Average

Peak

Average

Peak

	BLE 2M	Iz		Antenna Pol.	:2024-02-19 :22.9 ℃/61%
100 Level (dBuV/	m)				
90					
80					
70					
60					
50	2 4				
40					
30					
20					
10					
0	6100.	11200. Frequen	16300 су (MHz)	. 21400	0. 26500
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m
MHz	PK/QP/AV	dBμV	dB	dBµV/n	-

35.50

44.58

28.05

39.01

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1.87

1.87

9.98

9.98

37.36

46.44

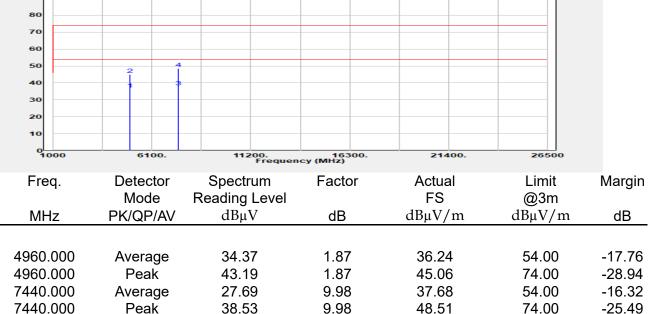
38.03

49.00



Report Number	:TER	F2401	000148	3E2	Test	Site
<b>Operation Mode</b>	:BLE	2M			Test	Date
Test Frequency	:2480	) MHz			Tem	p./H
Test Mode	:Tx				Ante	enna
EUT Pol	:E2 P	lane			Eng	ineer
100 Level (dBuV/n	n)					
90						
80						
70						
60						
50	2	4				

:SAC D Э :2024-02-19 е lumi. :22.9 ℃/61% a Pol. :Horizontal :Sam Huang r



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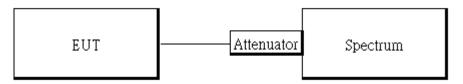
# **12 POWER SPECTRAL DENSITY**

## 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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#### **Measurement Result:** 12.4

### **BLE 1M mode**

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-9.51	8	PASS
2442	-8.90	8	PASS
2480	-9.37	8	PASS

*Note:

1.cable loss as 10.15dB that offsets in the spectrum

### BLE 2M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-11.25	8	PASS
2442	-10.93	8	PASS
2480	-12.71	8	PASS

*Note:

1.cable loss as 10.15dB that offsets in the spectrum

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### Report No.: TERF2401000148E2 Page: 61 of 62



### PSD_BLE 1M_LowCH00-2402MHz

	ectrum Analyzer - Sw										
Center F	req 2.40200	00000 GH	łz	Trig: Free	NSE:INT	#Avg Typ	ALIGN AUTO e: RMS	TRAC	E 1 2 3 4 5 6	F	requency
10 dB/div	Ref Offset 10 Ref 30.00 (	.15 dB	NO:Wide 🕞	#Atten: 3			Mkr1 2	2.402 02	B 8 GHz 51 dBm		Auto Tune
20.0											Center Freq 2000000 GHz
0.00					.1					2.40	Start Freq 1466525 GHz
-10.0	pupunawina	Minlipational	hyalikukan	Wp ^{re} ver ¹⁰ /rw	Lor Mandy ph	urun Mirt	thelywork	harala	n.f.	2.40	Stop Freq 2533475 GHz
-30.0									" AND THE PARTY OF T	<u>Auto</u>	CF Step 106.695 kHz Man
-50.0											Freq Offset 0 Hz
-60.0											Scale Type
Center 2.4 #Res BW	4020000 GH: 3.0 kHz	Z	#VBW	10 kHz	1		Sweep 1	112.5 ms (		Log	Lin

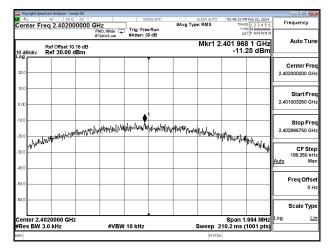
#### PSD_BLE 1M_MidCH20-2442MHz

Keysight Spectrum Analyzer - Swept S	5A			- a - 🛪
Center Freq 2.4420000		NSE:INT AL #Avg Type:	IGN AUTO 05:01:19 PM Feb 02, 2024 RMS TRACE 1 2 3 4 5 6	Frequency
Ref Offset 10.15	PNO: Wide Trig: Fre IFGain:Low #Atten: 3	30 dB	TYPE DET P NNNN Mkr1 2.441 919 6 GHz -8.90 dBm	Auto Tune
20.0				Center Freq 2.442000000 GHz
0.00				Start Free 2.441478075 GH:
-10.0 -20.0 Water Maker and All	de la farren an and a star and a s	nuntrynhiteduninlyntug	rule hover many many that the hover	Stop Frec 2.442521925 GHz
-30.0				CF Step 104.385 kH <u>Auto</u> Mar
-50.0				Freq Offse 0 H
-60.0				Scale Type
Center 2.4420000 GHz #Res BW 3.0 kHz	#VBW 10 kHz	s,	Span 1.044 MHz weep 110.1 ms (1001 pts)	Log <u>Lir</u>
MSG			STATUS	

#### PSD_BLE 1M_HighCH39-2480MHz

BAVE Type: RMS         The Construction         Frequency           Bave Type: RMS         The Construction         Auto Tu           Bave Type: RMS         The Construction         Auto Tu           Bave Type: RMS         Statem: 30 dB         Mkr1 2.479 970 cdHz         Auto Tu           Bave Type: RMS         Statem: 30 dB         -9.37 dBm         -9.37 dBm         -0.4000000 cdHz           Bave Type: RMS         Statem: 10 dB         -9.37 dBm         -9.37 dBm         -0.4000000 cdHz           Bave Type: RMS         -9.37 dBm         -9.37 dBm         -9.37 dBm         -9.37 dBm           Bave Type: RMS         -9.37 dBm         -9.37 dBm         -9.37 dBm         -9.37 dBm         -9.37 dBm           Bave Type: RMS         -9.37 dBm         -9.37 dBm         -9.37 dBm         -9.37 dBm         -9.4000000 cdHz         -9.4000000 cdHz         -2.40000000 cdHz         -2.40000000 cdHz         -2.40000000 cdHz         -2.40000000 cdHz         -2.40000000 cdHz         -2.40000000 cdHz         -2.400		ectrum Analyzer - Swept					- 3 <mark>- </mark>
Instant.com         Auton Tur           Biolity         Ref 075et 10.15 dB         Mkr1 2.479 970 2 GHz         Auton Tur           Biolity         Ref 03.00 dBm         -9.37 dBm         -9.37 dBm         Center Fr           0         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Center F		000 GHz	SENSE:INT	#Avg Type: RMS	05:03:10 PM Feb 02, 2024 TRACE 1 2 3 4 5 6	Frequency
Center Fin 2.48000000 G 3. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5	10 dB/div		IFGain:Low		Mkr1 2	.479 970 2 GHz	Auto Tune
Image: constraint of the second sec	20.0						Center Free 2.480000000 GH:
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.00						Start Free 2.479467125 GH
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	10.0	whetherwyshithereft	Nunduandra	proversition and the second	ahanahannan harrinan	an plymping	Stop Fre 2.480532875 GH
PreqOffs	40.0					- Terrowy Why	106.575 kH
	50.0						Freq Offse 0 H
	60.0						Scale Typ
Inter 2.4800000 GHz Span 1.066 MHz - Span 1.066 MHz - Span 1.066 MHz - Span 1.066 MHz - Sweep 112.4 ms (1001 pts)			#VBW	10 kHz	Sweep 1	Span 1.000 Miliz	Log <u>Lir</u>

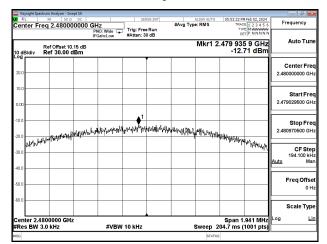
#### PSD_BLE 2M_LowCH00-2402MHz



#### PSD_BLE 2M_MidCH20-2442MHz

RL RL	RF 50 Q	pt SA DC			ISE:INT		LIGN AUTO	05-50-50.0	M Feb 02, 2024		
	req 2.44200	0000 GH	O: Wide	Trig: Free	Run	#Avg Type		TRAC	E 1 2 3 4 5 6 MWWWW T P NNNN	F	requency
0 dB/div	Ref Offset 10. Ref 30.00 d	15 dB	iain:Low	#Atten: 3	0 dB		Mkr1 2	.441 93	6 3 GHz 93 dBm		Auto Tur
	Rel 50.00 u										Center Fre
10.0										2.44	Start Fre
20.0	witter all the start of the sta	pulliapersyst	~HIPLIC/14	yayaya Maliyiy	iliran katai	mannahahah	Monaphicapi	WAR		2.44	Stop Fr 3027500 G
	Will class.								MAN AND AND AND AND AND AND AND AND AND A	Auto	CF Sto 205.500 k
80.0											Freq Offs 0
50.0											Scale Ty
	442000 GHz 3.0 kHz		#VBW	10 kHz			Sweep 2	Span 2 216.7 ms (	.055 MHz 1001 pts)	Log	L

#### 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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