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ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT





Applicant: Wacom Co., Ltd.

2-510-1 Toyonodai, Kazo-shi, Saitama 349-1148 Japan

Manufacturer: Wacom Co., Ltd.

2-510-1 Toyonodai, Kazo-shi, Saitama 349-1148 Japan

Product Name: Creative Pen Tablet

Brand Name: Wacom Model No.: PTK670

Family Model No.: PTK670******(* may be alphanumeric/symbol or blank)

Model Difference: For marketing purpose **Report Number:** TERF2406001846E2

FCC ID HV4PTK670

Date of EUT Received: May 27, 2024

Date of Test: July 8, 2024~July 17, 2024

Issue Date: October 9, 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.

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Revision History							
Report Number	Revision	Description	Issue Date	Revised By	Remark		
TERF2406001846E2	00	Original	August 14, 2024	Karen Huang			
TERF2406001846E2	01	Update section 2.6	October 9, 2024	Karen Huang	*		

Note:

- 1. The remark "*" indicates modification of the report upon requests from certification
- 2 · Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received. And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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GENERAL INFORMATION

1.1 **Product Description**

Product Name:	Creative Pen Tablet
Brand Name:	Wacom
Model No.:	PTK670
Family Model No.:	PTK670******(* may be alphanumeric/symbol or blank)
Model Difference:	For marketing purpose
EUT Series No.:	4EHS1K1000072 (Conduction) 4EHS1K1000071 (Conducted) 4EHS1K1000074 (Radiated)
Power Supply:	3.7Vdc from Rechargeable Battery Or 5Vdc from USB Port
Test Software (Name/Version)	SmartSinppets Toolbox v5.0.24.4128

RF Specification 1.2

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	3.21dBm

1.3 **Antenna Designation**

Antenna Type	Freq.	Peak Antenna Gain (dBi)
PCB trace antenna	2.4GHz	-0.5

Note:

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1.4 **Test Methodology of Applied Standards**

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 15,247 Meas Guidance v05r02 ANSI C63.10:2013

1.5 **Test Facility**

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB
		SAC 1		
		SAC 2		
		SAC 3		
	No 424 Wu Kung Bood New Toinei	Conduction 1	_	
	No.134, Wu Kung Road, New Taipei	Conducted 1	TW0027	TW3702
	Industrial Park, Wuku District, New Taipei City, Taiwan.	Conducted 2	1 00027	
	raiper City, Taiwan.	Conducted 3		
		Conducted 4		
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.		Conduction C	-	
(TAF code 3702)		SAC C		
		SAC D		
		SAC G		
	No.2, Keji 1st Rd., Guishan District,	Conducted A		
	Taoyuan City, Taiwan 333	Conducted B	TW0028	
	radyuan Ony, raiwan 333	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.

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1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

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

2.3.2 Conducted Test (RF)

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

2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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2.4 **Measurement Results Explanation Example**

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

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

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

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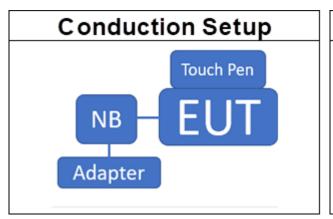
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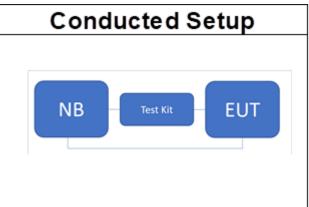
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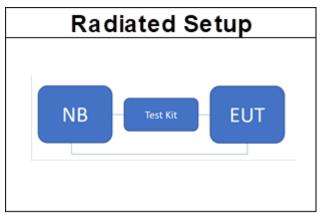


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2.5 **Test Configuration**







Control Unit(s) 2.6

AC Power-Line Conducted Emission Test Site: Conduction C							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Notebook	HP	HSN-Q35C-4	N/A	N/A	N/A		
Adapter	HP	TPN-LA16	N/A	N/A	N/A		
Touch Pen	Wacom	ACP-500-02	N/A	N/A	N/A		
Touch Pen	Wacom	ACP-501E-00	N/A	N/A	N/A		
Touch Pen	Wacom	CP-923-031B-2	N/A	N/A	N/A		
USB Cable	ACON	STJ-A434	N/A	N/A	N/A		
		Conducted Emiss	ion Test Site: Condu	cted C			
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Notebook	Lenovo	L480	P0002332	N/A	N/A		
Testkit	Dialog	PRO-MB(376-18-B)	N/A	N/A	N/A		
USB Cable	MI	SJX10ZM	N/A	N/A	N/A		
USB Cable	multicomp pro	SPC20060	N/A	N/A	N/A		

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Radiated Emission Test Site: SAC C							
EQUIPMENT TYPE MFR MODEL NUMBER SERIAL NUMBER LAST CAL. CAL DUE.							
Notebook	HP	HSN-Q35C-4	N/A	N/A	N/A		
Testkit	Dialog	PRO-MB(376-18-B)	N/A	N/A	N/A		
USB Cable	ACON	STJ-A434	N/A	N/A	N/A		
USB Cable	multicomp pro	SPC20060	N/A	N/A	N/A		

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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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DESCRIPTION OF TEST MODES

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

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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	
	TRANSMIT RAI	DIATED EMISSION TE	ST (BELOW 1 GHz)		
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	0 to 39	20	GFSK	1	
	TRANSMIT RAI	DIATED EMISSION TI	EST (ABOVE 1 GHz)		
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	0 to 39	0,20,39	GFSK	1	

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5 MEASUREMENT UNCERTAINTY

Test Items	Uı	ncertaint	ty
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				
	+/-	1.89	dB	9kHz~30MHz
Polarization: Vertical	+/-	4.15	dB	30MHz - 1000MHz
Foldrization. Vertical	+/-	3.43	dB	1GHz - 18GHz
	+/-	3.86	dB	18GHz - 40GHz
Polarization: Horizontal	+/-	1.89	dB	9kHz~30MHz
	+/-	4.02	dB	30MHz - 1000MHz
Folarization. Horizontal	+/-	3.43	dB	1GHz - 18GHz
	+/-	3.86	dB	18GHz - 40GHz
	+/-	2	dB	33GHz-50GHz
Radiated Spurious Emission	+/-	1.59	dB	50GHz-60GHz
	+/-	1.7	dB	60GHz-90GHz
	+/-	1.64	dB	90GHz-140GHz
	+/-	3.83	dB	140GHz-220GHz

Note:

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

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6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

	AC Power-Line Conducted Emission Test Site: Conduction C				
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2024	03/26/2025
EMI Test Receiver	R&S	ESCI	101342	04/29/2024	04/28/2025
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	04/22/2024	04/21/2025
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2024	03/26/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Attenuator	Marvelous	MVE2213-10	RF06	11/15/2023	11/14/2024
Attenuator	Woken	WATT-218FS-10	RF17	11/15/2023	11/14/2024
Attenuator	Woken	WATT-218FS-10	RF19	11/15/2023	11/14/2024
Coaxial Cables	Woken	00100A1F1A185C	RF56	11/15/2023	11/14/2024
DC Block	PASTERNACK	PE8210	RF155	11/15/2023	11/14/2024
Power Meter	Anritsu	ML2496A	2138005	09/25/2023	09/24/2024
Power Sensor	Anritsu	MA2411B	1911395	09/25/2023	09/24/2024
Power Sensor	Anritsu	MA2411B	1911396	09/25/2023	09/24/2024
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071573	05/24/2024	05/23/2025
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

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6.3 **Radiated Measurement**

	Radiated Emission Test Site: SAC C				
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
3m Site NSA	SGS	966 chamber C	N/A	03/02/2024	03/01/2025
Active Loop Antenna	COM-POWER	AL-130R	10160105	12/04/2023	12/03/2024
Attenuator	Woken	WATT-218FS-10	RF17	11/15/2023	11/14/2024
Band Reject Filter	WI	WRC JV2300/2700- 2240/2760-40/12SS	RF203	11/15/2023	11/14/2024
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-300	11/02/2023	11/01/2024
Coaxial Cable	Huber+Suhner	RG 214/U	W22.03	11/15/2023	11/14/2024
Coaxial Cable	Huber+Suhner	SUCOFLEX 104	MY17388/4	11/15/2023	11/14/2024
EMI Test Receiver	R&S	ESCI	101342	04/29/2024	04/28/2025
Highpass Filter	R&S	F13 HPF 3GHz	RF175	11/15/2023	11/14/2024
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/24/2024	01/23/2025
Horn Antenna	SCHWARZBECK	BBHA9170	185	08/21/2023	08/20/2024
Lowpass Filter	Woken	EWT-56-0019	RF173	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC118A45SE	980789	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	11/15/2023	11/14/2024
Pre-Amplifier	EMC Instruments	EMC330	980096	11/15/2023	11/14/2024
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/10/2024	04/09/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

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

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CONDUCTED EMISSION TEST

7.1 **Standard Applicable:**

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

Frequency range	Limits (dBµV)		
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	

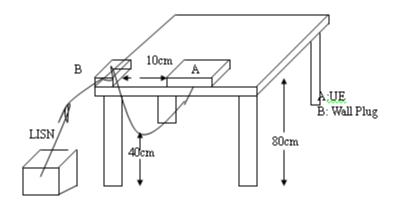
Note

- 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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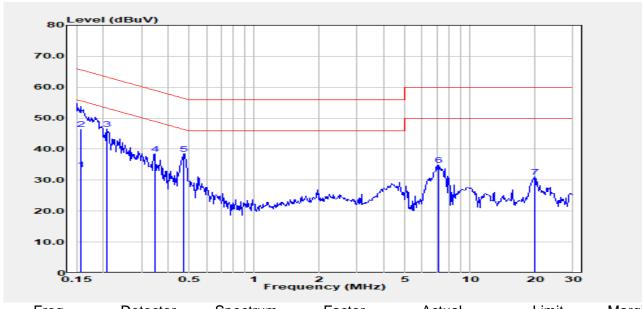
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2406001846E2 Test Site :Conduction C

Test Mode :BLE Test Date :2024-07-15 Temp./Humi. :23.4°C/50% Power :120V/60Hz

Probe :Howard Huang :L1 Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.157	Average	22.70	10.69	33.39	55.65	-22.26
0.157	QP	35.80	10.69	46.49	65.65	-19.16
0.209	Peak	35.86	10.68	46.54	63.25	-16.71
0.345	Peak	27.81	10.65	38.46	59.09	-20.63
0.472	Peak	27.86	10.63	38.49	56.48	-17.99
7.144	Peak	23.96	10.97	34.93	60.00	-25.07
19.958	Peak	19.88	11.15	31.03	60.00	-28.97

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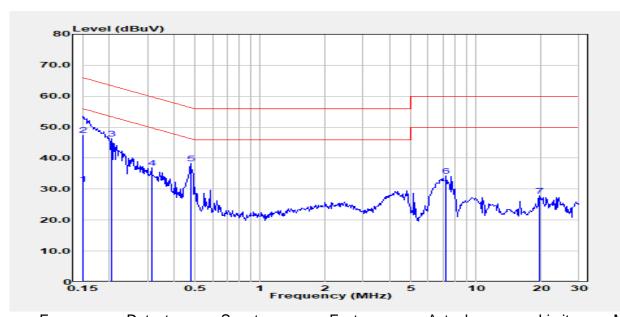


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Report Number :TERF2406001846E2 Test Site :Conduction C

Test Mode :BLE **Test Date** :2024-07-15 Power :120V/60Hz Temp./Humi. :23.4°C/50%

Probe :N Engineer :Howard Huang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.151	Average	21.10	10.67	31.77	55.93	-24.16
0.151	QP	36.80	10.67	47.47	65.93	-18.46
0.205	Peak	35.56	10.67	46.23	63.39	-17.16
0.314	Peak	26.17	10.64	36.81	59.86	-23.06
0.476	Peak	27.74	10.62	38.36	56.41	-18.05
7.266	Peak	23.29	10.99	34.28	60.00	-25.72
19.789	Peak	16.66	11.24	27.90	60.00	-32.10

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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**

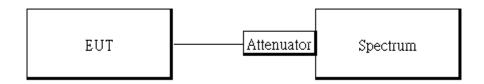
For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

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.

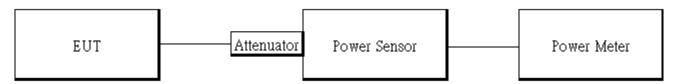
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

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.

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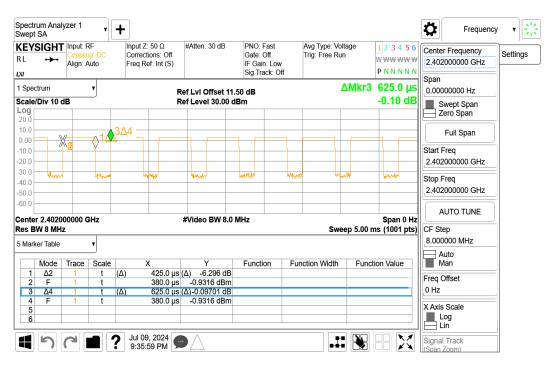


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8.4 **Duty Factor:**

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE 1M	68.00	1.67	2.35	3.00

BLE_1M_LowCH00-2402



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Output Power:

8.5.1 Peak & Avg

BLE 1M mode:

СН	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	Required Limit (dBm)
Low	2402	14	3.21	30
Mid	2442	14	3.05	30
High	2480	14	2.79	30
СН	Frequency (MHz)	Power Setting	Avg. Output Power (dBm)	Required Limit (dBm)
Low	2402	14	2.98	30
Mid	2442	14	2.87	30
High	2480	14	2.74	30

^{*}Note:

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^{1.}Measured by power meter, cable loss 11.5 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.



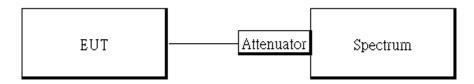
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EMISSION BANDWIDTH MEASUREMENT

9.1 **Standard Applicable**

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

9.2 **Test Setup**



9.3 **Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

9.3.1 6dB BW measurements

- 1. The testing follows the Measurement Procedure of the KDB 558074 D01.
- 2. Set the spectrum analyzer as

RBW = 100 kHz,

VBW = 3 X RBW.

Span= 2 to 5 times of the OBW,

Sweep=auto, Detector = Peak, and Max hold.

- 3. Mark the upper and lower frequencies of -6dB.
- 4. Repeat above procedures until all test default channel is completed.

9.4 **Measurement Result:**

9.4.1 6dB BW measurements

BLE 1M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.7002	≥ 0.5	PASS
2442	0.7056	≥ 0.5	PASS
2480	0.7153	≥ 0.5	PASS

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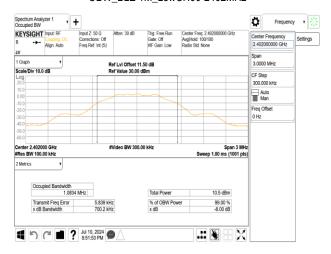
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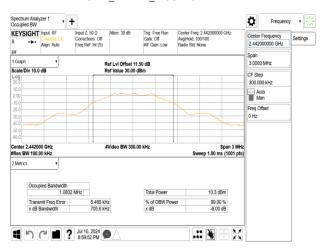


Page: 26 of 49

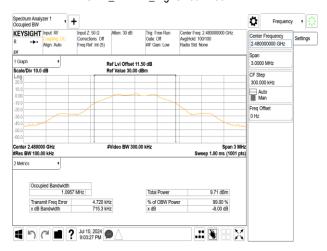
OBW_BLE 1M_LowCH00-2402MHz



OBW BLE 1M MidCH20-2442MHz



OBW_BLE 1M_HighCH39-2480MHz



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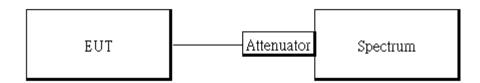
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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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.

Measurement Result 10.4

BLE 1M Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	3.57	-16.43
2442	3.38	-16.62
2480	2.99	-17.01

*Note:

1.cable loss as 11.5dB that offsets in the spectrum 2.Refer to next page for plots.

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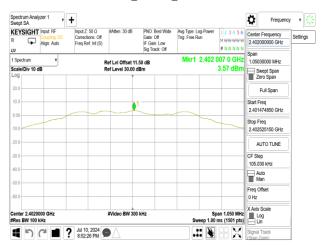
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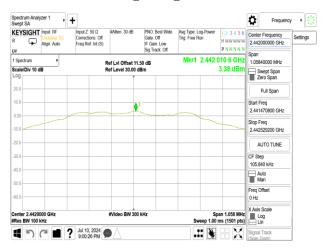


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Reference Level BLE 1M LowCH00-2402MHz



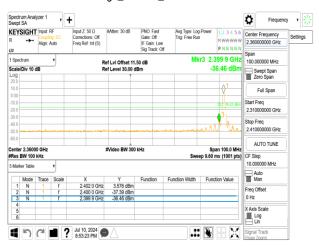
Reference Level BLE 1M_MidCH20-2442MHz



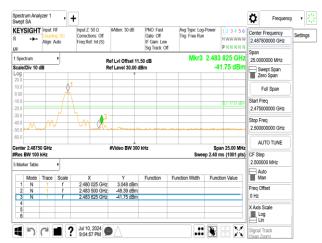
Reference Level_BLE 1M_HighCH39-2480MHz



Band Edge BLE 1M LowCH00-2402MHz



Band Edge_BLE 1M_HighCH39-2480MHz



Spurious Emission_BLE 1M_LowCH00-2402MHz



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Spurious Emission_BLE 1M_MidCH20-2442MHz



Spurious Emission_BLE 1M_HighCH39-2480MHz



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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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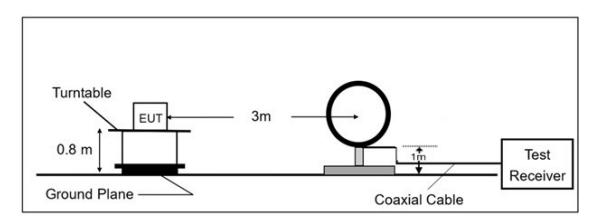


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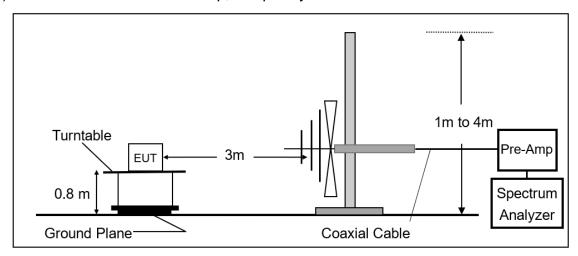


11.1 **Test Setup**

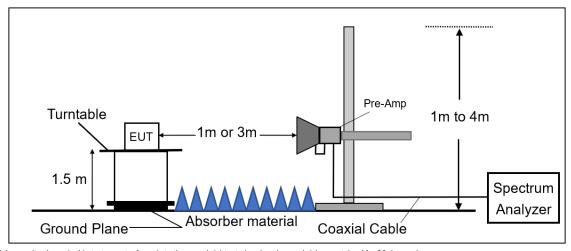
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(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

- 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.
- Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.
- 9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 12. Repeat above procedures until all default test channel measured were complete.

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11.3 Field Strength Calculation

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

FS = RA + AF + CL - AG

Where FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

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

Actual $FS(dB\mu V/m) = SPA$. Reading level $(dB\mu V) + Factor(dB)$

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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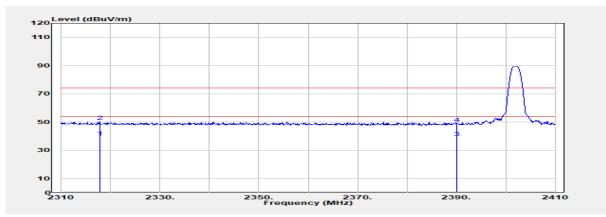
11.4.1 **Radiated Band Edge Measurement Result**

Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Test Frequency :2402 MHz Temp./Humi. :23.5°C/54%

Test Mode Antenna Pol. :Vertical :Bandedge

EUT Pol :E2 Plane Engineer :Howard Huang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2317.800	Average	43.08	-3.73	39.35	54.00	-14.65
2317.800	Peak	54.00	-3.73	50.27	74.00	-23.73
2390.000	Average	43.11	-4.25	38.86	54.00	-15.14
2390.000	Peak	53.44	-4.25	49.19	74.00	-24.81

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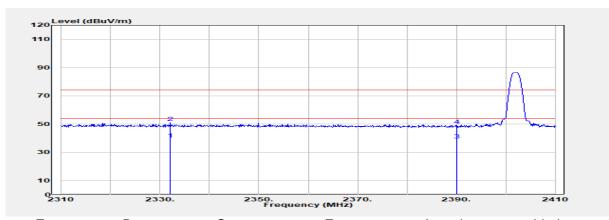


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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Temp./Humi. :23.5°C/54% Test Frequency :2402 MHz Antenna Pol. :Horizontal Test Mode :Bandedge

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2332.100	Average	43.02	-3.82	39.20	54.00	-14.80
2332.100	Peak	54.73	-3.82	50.92	74.00	-23.08
2390.000	Average	43.09	-4.25	38.85	54.00	-15.15
2390.000	Peak	53.44	-4.25	49.19	74.00	-24.81

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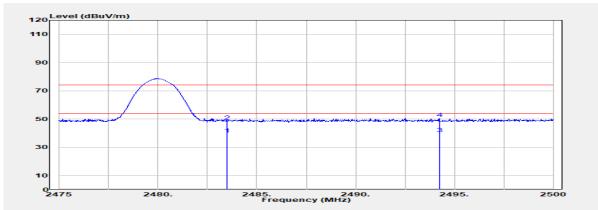
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Temp./Humi. :23.5°C/54% Test Frequency :2480 MHz

Test Mode :Bandedge Antenna Pol. :Vertical

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.500	Average	43.18	-3.82	39.36	54.00	-14.64
2483.500	Peak	52.32	-3.82	48.50	74.00	-25.50
2494.250	Average	43.23	-3.71	39.52	54.00	-14.48
2494.250	Peak	54.16	-3.71	50.45	74.00	-23.55

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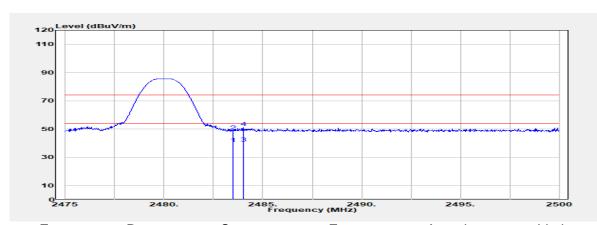


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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Temp./Humi. :23.5°C/54% Test Frequency :2480 MHz Antenna Pol. :Horizontal Test Mode :Bandedge

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.500	Average	43.40	-3.82	39.58	54.00	-14.42
2483.500	Peak	52.44	-3.82	48.62	74.00	-25.38
2484.025	Average	43.69	-3.81	39.87	54.00	-14.13
2484.025	Peak	54.73	-3.81	50.91	74.00	-23.09

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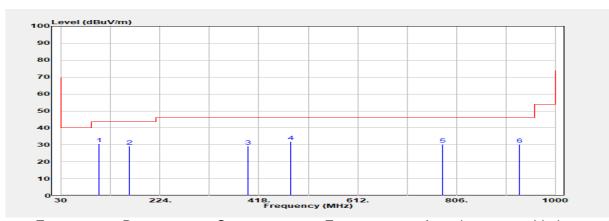
11.4.2 **Radiated Spurious Emission**

Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Test Frequency :2442 MHz Temp./Humi. :23.5°C/54%

Test Mode :Tx Antenna Pol. :Vertical

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
103.720	Peak	50.61	-20.10	30.51	43.50	-12.99
162.890	Peak	45.14	-15.86	29.28	43.50	-14.22
396.660	Peak	41.13	-11.98	29.15	46.00	-16.85
480.080	Peak	41.72	-9.72	32.00	46.00	-14.00
778.840	Peak	34.01	-3.75	30.26	46.00	-15.74
930.160	Peak	31.28	-1.01	30.27	46.00	-15.73

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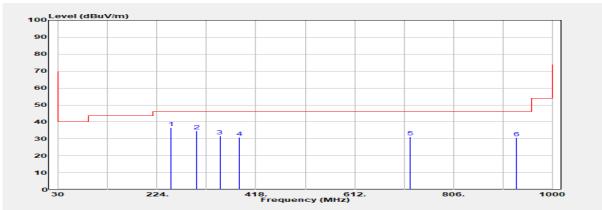
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-15 Test Frequency :2442 MHz Temp./Humi. :23.5 $^{\circ}$ C/54%

Test Mode :Tx Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Howard Huang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
251.160	Peak	53.38	-16.85	36.53	46.00	-9.47
301.600	Peak	49.83	-15.07	34.75	46.00	-11.25
347.190	Peak	45.54	-13.77	31.77	46.00	-14.23
385.020	Peak	43.47	-12.52	30.94	46.00	-15.06
721.610	Peak	35.83	-4.79	31.05	46.00	-14.95
930.160	Peak	31.74	-1.01	30.72	46.00	-15.28

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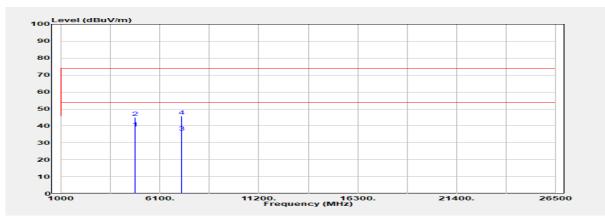
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16 Temp./Humi. :22.7°C/55% Test Frequency :2402 MHz

Test Mode :Tx Antenna Pol. :Vertical

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.000	Average	38.07	0.66	38.73	54.00	-15.27
4804.000	Peak	44.36	0.66	45.01	74.00	-28.99
7206.000	Average	29.31	6.89	36.20	54.00	-17.80
7206.000	Peak	39.01	6.89	45.91	74.00	-28.09

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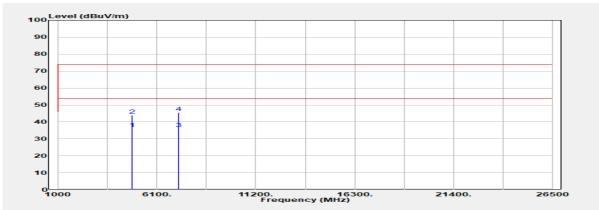
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16 Temp./Humi. :22.7°C/55% Test Frequency :2402 MHz

Antenna Pol. :Horizontal Test Mode :Tx

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.000	Average	35.25	0.66	35.91	54.00	-18.09
4804.000	Peak	43.12	0.66	43.78	74.00	-30.22
7206.000	Average	29.05	6.89	35.94	54.00	-18.06
7206.000	Peak	38.63	6.89	45.53	74.00	-28.47

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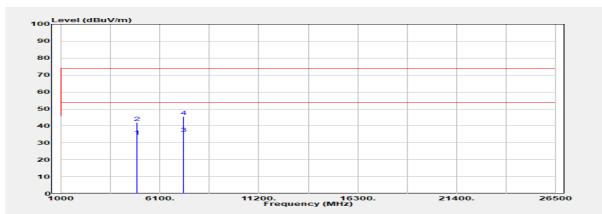
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16
Test Frequency :2442 MHz Temp./Humi. :22.7°C/55%

Test Mode :Tx Antenna Pol. :Vertical

EUT Pol :E2 Plane Engineer :Howard Huang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4884.000	Average	33.50	0.41	33.91	54.00	-20.09
4884.000	Peak	41.59	0.41	42.00	74.00	-32.00
7326.000	Average	29.00	6.38	35.38	54.00	-18.62
7326.000	Peak	39.09	6.38	45.47	74.00	-28.53

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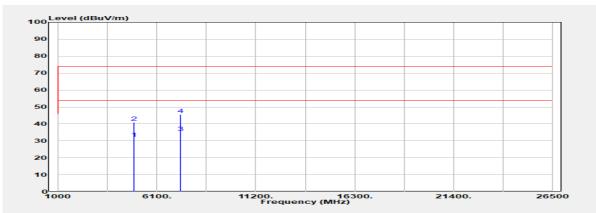
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16 Temp./Humi. :22.7°C/55% Test Frequency :2442 MHz

Antenna Pol. :Horizontal Test Mode :Tx

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4884.000	Average	31.16	0.41	31.57	54.00	-22.43
4884.000	Peak	40.63	0.41	41.04	74.00	-32.96
7326.000	Average	28.62	6.38	35.00	54.00	-19.00
7326.000	Peak	39.28	6.38	45.65	74.00	-28.35

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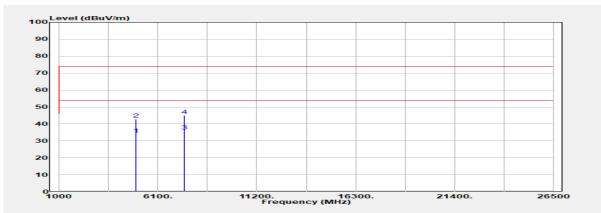
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16 Temp./Humi. :22.7°C/55% Test Frequency :2480 MHz

Test Mode :Tx Antenna Pol. :Vertical

EUT Pol :E2 Plane :Howard Huang Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4960.000	Average	33.22	0.70	33.92	54.00	-20.08
4960.000	Peak	42.16	0.70	42.86	74.00	-31.14
7440.000	Average	29.15	6.52	35.66	54.00	-18.34
7440.000	Peak	38.60	6.52	45.12	74.00	-28.88

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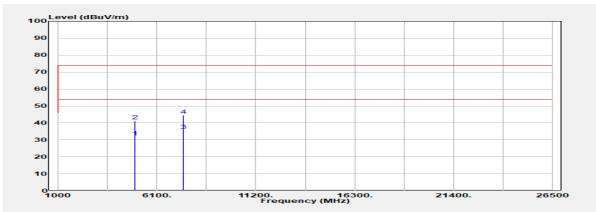
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Report Number :TERF2406001846E2 Test Site :SAC C

Operation Mode :BLE 1M Test Date :2024-07-16
Test Frequency :2480 MHz Temp./Humi. :22.7°C/55%

Test Mode :Tx Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Howard Huang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4960.000	Average	30.91	0.70	31.61	54.00	-22.39
4960.000	Peak	40.37	0.70	41.07	74.00	-32.93
7440.000	Average	29.09	6.52	35.60	54.00	-18.40
7440.000	Peak	38.03	6.52	44.55	74.00	-29.45

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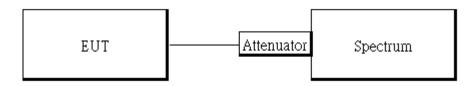
12 POWER SPECTRAL DENSITY

Standard Applicable: 12.1

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



Measurement Procedure: 12.3

- 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.
- Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.

12.4 **Measurement Result:**

BLE 1M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-12.27	8	PASS
2442	-12.03	8	PASS
2480	-12.41	8	PASS

^{*}Note:

1.cable loss as 11.5dB that offsets in the spectrum

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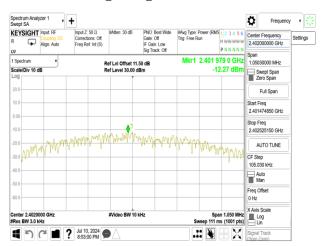
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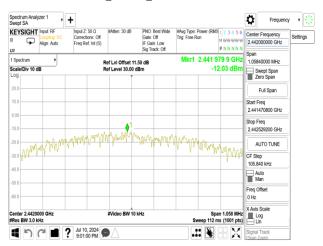


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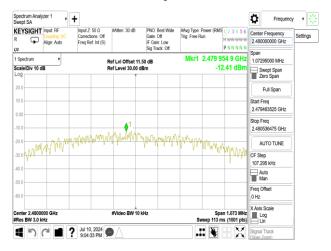
PSD_BLE 1M_LowCH00-2402MHz



PSD_BLE 1M_MidCH20-2442MHz



PSD_BLE 1M_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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