

# 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 Wireless Digital Stethoscope
Model No.:	Q-steth-w1
Model Difference:	N/A
Report Number:	E2/2021/80008
FCC ID	HFSMH9
Issue Date:	November 2, 2021
Date of Test:	August 4, 2021 ~ September 29, 2021
Date of EUT Received:	August 4, 2021

my lin 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	Report Number         Revision         Description         Issue Date         Revised By					
E2/2021/80008	00	Original	November 2, 2021	Ariel Chang		

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# 1 GENERAL INFORMATION

## 1.1 **Product Description**

Product Name	QOCA Wireless Digital Stethoscope		
Model No.	Q-steth-w1		
Model Difference	N/A		
Hardware Version	N/A		
Firmware Version	N/A		
Power Supply	3.85V / 220mAh from battery		

### 1.2 **RF Specification**

Radio Technology	BLE
Frequency Range	2402 – 2480MHz
Channel number	40 channels
Modulation type	GFSK
Transmit Power	BLE 1M: 2.58 dBm BLE 2M: 2.59 dBm

### 1.3 Antenna Designation

Antenna Type	Freq. (MHz)	Peak Antenna Gain (dBi)			
PCB	2400 - 2500	0.825			
Note:					
1. Antenna information is provided by the applicant.					

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### 1.4 Test Methodology of Applied Standards

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

### 1.5 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB identifier
		SAC 1	_	
		SAC 3		
		Conduction 1		
	No.134, Wu Kung Road, New Taipei	Conducted 1		
	Industrial Park, Wuku District, New	Conducted 2	TW0027	
	Taipei City, Taiwan.	Conducted 3		
		Conducted 4		
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.		Conduction C		TW3702
(TAF code 3702)		SAC C		
		SAC D		
	No 2 Koji 1et Pd. Gujeban District	SAC G		
		Conducted A		
	-	Conduction C         SAC C         SAC D         SAC G         Conducted A         Conducted B         Conducted C	TW0028	
	rabydan oliy, raiwan ooo		-	
		Conducted D	-	
		Conducted E	-	
		Conducted F	-	
		Conducted G		
	ame is remarked on the equipmen			s an indica-
tion where	measurements occurred in specif	ric test site and add	dress.	

### **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.

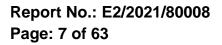
#### 2.3.3 **Radiated Emissions**

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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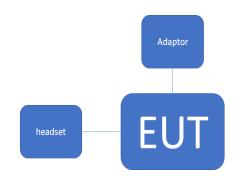


#### 2.5 Test Configuration

Fig. 7-1 Conducted Emission & Radiated Emission Configuration



Fig. 7-2 Conduction Configuration



### 2.6 Control Unit(s)

ltem	Equipment	Mfr/Brand	Version	Model/ Type No.	Series No.
1	Bluetooth Test Software	SmartRF_Studio	7-2.22.0	N/A	N/A
2	Notebook	Lenovo	N/A	T470	P0001293
3	Notebook	Lenovo	N/A	L430	P0000195
4	Test Kit	TI	N/A	CC26X2R1 Launchpad	N/A
5	Type C USB Cable	Quanta	N/A	DDEMU110080	N/A
6	Charger	Quanta	N/A	Q-steth-w1-C1	N/A
7	Adapter	Sony	N/A	AC-0400-TW	3504600
8	headphone	ASUS	N/A	ZenEar	AHSU001

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# **3 SUMMARY OF TEST RESULTS**

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

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#### **DESCRIPTION OF TEST MODES** 4

### 4.1 Operating Frequencies

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2402 MHz	15	2430 MHz	29	2458 MHz
2	2404 MHz	16	2432 MHz	30	2460 MHz
3	2406 MHz	17	2434 MHz	31	2462 MHz
4	2408 MHz	18	2436 MHz	32	2464 MHz
5	2410 MHz	19	2438 MHz	33	2466 MHz
6	2412 MHz	20	2440 MHz	34	2468 MHz
7	2414 MHz	21	2442 MHz	35	2470 MHz
8	2416MHz	22	2444 MHz	36	2472 MHz
9	2418 MHz	23	2446 MHz	37	2474 MHz
10	2420 MHz	24	2448 MHz	38	2476 MHz
11	2422 MHz	25	2450 MHz	39	2478 MHz
12	2424 MHz	26	2452 MHz	40	2480 MHz
13	2426 MHz	27	2454 MHz		
14	2428 MHz	28	2456 MHz		

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### 4.2 The Worst Test Modes and Channel Details

- 1. The EUT has been tested under operating condition.
- 2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- 3. The field strength of radiation emission was measured as EUT three orthogonal planes, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested and recorded.
- 4. Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)		
Bluetooth LE	0 to 39	20	GFSK	1		
Bluetooth LE	0 to 39	20	GFSK	2		
	RADIATED EMISSION TEST (ABOVE 1 GHz)					
MODE AVAILABLE TESTED MODULATION RATE (Mbps)						
Bluetooth LE	0 to 39	0,20,39	GFSK	1		
Bluetooth LE	0 to 39	0,20,39	GFSK	2		
Note: The field strength of radiation emission was measured as EUT stand-up position						

(H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case E2 position was reported.

CONDUCTED TEST					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	
Bluetooth LE	0 to 39	0,20,39	GFSK	1	
Bluetooth LE	0 to 39	0,20,39	GFSK	2	

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#### **MEASUREMENT UNCERTAINTY** 5

Test Items	Uı	ncertaint	y
AC Power Line Conducted Emission	+/-	2.34	dB
Peak Output Power	+/-	1	dB
6dB Bandwidth & 99% Bandwidth	+/-	1.53	Hz
100 kHz Bandwidth Of Frequency Band Edges	+/-	1.69	dB
Peak Power Density	+/-	1.53	dB
Temperature	+/-	0.4	°C
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty					
Polarization: Vertical	+/-	2.64	dB	9kHz~30MHz	
	+/-	4.93	dB	30MHz - 1000MHz	
	+/-	4.81	dB	1GHz - 18GHz	
	+/-	4.52	dB	18GHz - 40GHz	
	+/-	2.64	dB	9kHz~30MHz	
Polarization: Horizontal	+/-	4.45	dB	30MHz - 1000MHz	
	+/-	4.81	dB	1GHz - 18GHz	
	+/-	4.52	dB	18GHz - 40GHz	

### 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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#### CONDUCTED EMISSION TEST 6

## 6.1 Standard Applicable:

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

Frequency range		mits 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

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

#### **Measurement Equipment Used:** 6.2

Radiated Emission Test Site: Conduction C							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Test Software	audix	e3	210322 sgs Ver.9	N.C.R	N.C.R		
LISN	SCHWARZ- BECK Mess- Elektronik	NSLK8127	974	04/19/2021	04/18/2022		
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022		
Coaxial Cable	EC Lab	RF-HY- CAB-250	RF-HY- CAB-250-01	03/27/2021	03/26/2022		
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022		

# 6.3 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.

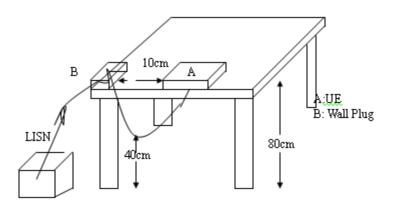
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# 6.4 Test SET-UP (Block Diagram of Configuration)



### 6.5 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

### 6.6 Measurement Result:

Note: Refer to next page for measurement data and plots. Note2: The \* reveals the worst-case results that closet to the limit.

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# AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2021/80008	Test Site	:Conductio	n C	
Test Mode	:BLE 1M	Test Date	:2021-09-1	4	
Power	:120V/60Hz	Temp./Humi.	:24.3/57		
Probe	:L1	Engineer	:Andy Wan	g	
80 Level (	dBuV)				
70.0					
60.0					
50.0 245					
40.0					
30.0	and produced and a	man	Annon me		
20.0		The here	- W	$\frown$	
10.0					
0.15	0.5 1 Frequen	2 5 ncy (MHz)	10	20 30	
Freq.	Detector Spectrum Mode Reading Level		ctual FS	Limit	Margin
MHz	PK/QP/AV dBµV		BμV	dBµV	dB
0.450	10.00	40.00	0.00		00.05
0.156 0.156	Average 16.30 QP 37.50		6.60 7.80	55.65 65.65	-29.05 -17.85
0.150	Average 15.90		7.80 6.20	54.86	-17.65
0.172	QP 36.60		6.90	54.80 64.86	-28.00
0.200	Peak 38.28		8.58	63.62	-15.05
0.215	Peak 35.30		5.60	63.01	-17.40
0.232	Peak 32.82		3.12	62.39	-19.27
0.249	Peak 30.50		0.80	61.78	-20.98

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Report Number Test Mode Power Probe	:E2/2021/80008 :BLE 1M :120V/60Hz :N	Test Site Test Date Temp./Humi. Engineer	:Conduction :2021-09-1 :24.3/57 :Andy Wan	4	
80 Level (	dBuV)				
70.0					
60.0					
50.0 2 5					
40.0	M				
30.0	My man				
20.0	" " When my	Monter	many	$\sim$	
10.0					
0.15	0.5 1 Freque	2 5 ency (MHz)	10	20 30	
Freq.	Detector Spectrum		ctual FS	Limit	Margin
MHz F	Mode Reading Level PK/QP/AV dBµV		rs Βμν	dBµV	dB
0.160	Average 14.80	10.31 2	5.11	55.47	-30.36
0.160	Average 14.80 QP 38.60		8.91	55.47 65.47	-30.36
0.180	Average 13.70		4.00	54.50	-30.50
0.180	QP 35.60		4.00 5.90	64.50	-18.60
0.206	Peak 38.92		9.22	63.36	-14.13
0.222	Peak 36.76		7.07	62.74	-15.68
0.229	Peak 35.22		5.52	62.48	-16.96
0.249	Peak 33.13		3.44	61.78	-18.34

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Report Number Test Mode Power Probe	:E2/2021/ :BLE 2M :120V/60 :L1		Test Site Test Dat Temp./H Enginee	e :2021-( lumi. :24.3/5	7	
80 Level (	dBuV)					
70.0						
60.0						
50.0 2 11						
<b>40.0</b>	MALL O					
30.0	- Marine (	home	m	Junior		
20.0			V.v.	Yor -	marine has	
10.0						
0.15	0.	5 1 Freque	2 ency (MHz)	5 10	20 30	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz I	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV	dBµV	dB
0.155	Average	17.20	10.30	27.50	55.74	-28.24
0.155	QP	39.50	10.30	49.80	65.74	-15.94
0.165 0.165	Average QP	12.90 36.60	10.30 10.30	23.20 46.90	55.21 65.21	-32.01 -18.31
0.180	Average	15.10	10.30	25.40	54.50	-29.10
0.180	QP	35.70	10.30	46.00	64.50	-18.50
0.195	Average	13.90	10.30	24.20	53.80	-29.60
0.195	QP	32.60	10.30	42.90	63.80	-20.90
0.204	Average	14.20	10.30	24.50	53.45	-28.95
0.204	QP	27.60	10.30	37.90	63.45	-25.55
0.213	Peak	38.76	10.30	49.06	63.10	-14.03

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Report Number Test Mode Power Probe	:E2/2021/80 :BLE 2M :120V/60Hz :N	008	Test Site Test Date Temp./Humi Engineer	:Conductio :2021-09-1 . :24.3/57 :Andy Wan	4	
80 Level (	dBuV)					
70.0						
60.0						
50.0 2 7						
40.0	N					
30.0	MA	allotano he	<b>.</b>			
20.0 10.0		weedings and the second	Manan	Marin Mari	MAN A	
0.15	0.5	1 Freque	2 5 ncy (MHz)	10	20 30	
Freq.		Spectrum ading Level	Factor	Actual FS	Limit	Margin
MHz F	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.156	Average	13.30	10.31	23.61	55.65	-32.04
0.156	QP	38.40	10.31	48.71	65.65	-16.94
0.162	Average	12.60	10.31	22.91	55.38	-32.48
0.162	QP	36.30	10.31	46.61	65.38	-18.78
0.180	Average	12.60	10.30	22.90	54.50	-31.60
0.180	QP	34.20		44.50	64.50	-20.00
0.200	Peak	37.80		48.10	63.62	-15.53
0.208	Peak	36.53		46.83	63.27	-16.44
0.215	Peak	36.08	10.30	46.38	63.01	-16.63

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# 7 PEAK OUTPUT POWER MEASUREMENT

# 7.1 Standard Applicable:

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

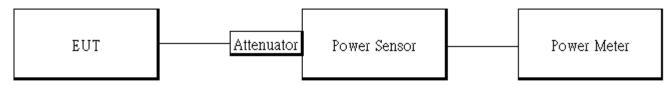
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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.

## 7.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted G												
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.							
Power Meter	Anritsu	ML2496A	1512003	07/27/2021	07/26/2022							
Power Sensor	Anritsu	MA2411B	1339378	07/27/2021	07/26/2022							
Power Sensor	Anritsu	MA2411B	1339379	07/27/2021	07/26/2022							
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021							
Attenuator	Marvelous	MVE2213-10	RF11	11/19/2020	11/18/2021							
Coaxial Cables	Woken	00100A1F2A196C	RF57	11/19/2020	11/18/2021							

### 7.3 Test Set-up:



### 7.4 Measurement Procedure:

- 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

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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.

# 7.5 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	0.33	0.01
BLE 2M	100.00	0.00	0.33	0.01

	pectrum Analyzer -									
	RF 50	000000 (	GHz		SE:INT	Avg Typ	e: Voltage	TR	AM Aug 17, 2021	Frequency
	Ref Offset		PNO: Fast ↔ IFGain:Low	≓ Trig: Free #Atten: 30				1	DET P NNNN B.000 ms	Auto Tun
0 dB/div	Ref 30.00	dBm							0.01 dB	
20.0		***						<b>4</b> 3∆4 —		Center Fre 2.402000000 GH
20.0										Start Fre 2.402000000 GH
40.0 50.0 50.0										<b>Stop Fre</b> 2.402000000 GH
enter 2. tes BW		GHz	#VB\	V 8.0 MHz	611		Sweep t	5.000 ms	Span 0 Hz (1001 pts)	CF Ste 8.000000 M⊢ <u>Auto</u> Ma
1 Δ2 2 F 3 Δ4 4 F 5	1 t (Δ) 1 t 1 t (Δ) 1 t (Δ) 1 t		3.000 ms (Δ) 1.000 ms 3.000 ms (Δ) 1.000 ms	0.01 c 2.38 dB	dB Im dB				E	Freq Offse 0 ⊢
6 7 8										Scale Typ
9 10 11										Log <u>L</u>
< <u>i</u>				m					•	
SG							STATU	S		

#### BLE\_1M\_LowCH00-2402

#### BLE\_2M\_LowCH00-2402

	ctrum Analyzer - Swept SA						
Center Fr	RF 50 Ω DC			SE:INT	vg Type: Voltage	11:45:07 AM Aug 17, 20 TRACE 1 2 3 4	5.6 Frequency
	Ref Offset 10.4 dE	PNO: Fast IFGain:Low	#Atten: 30	Run dB		ΔMkr3 3.000 m 0.01 d	Auto Tune
10 dB/div 20.0 10.0		•				3∆4	Center Freq 2.402000000 GHz
-10.0 -20.0 -30.0	//\@						Start Free 2.402000000 GHz
-40.0 -60.0 -60.0							Stop Free 2.402000000 GH
Center 2.4 Res BW 8		#V	BW 8.0 MHz	FUNCTION		Span 0 H 5.000 ms (1001 pt	Hz CF Step 8.000000 MH Auto Mar
1 Δ2 1 2 F 1 3 Δ4 1 4 F 1 5	t (Δ) t t (Δ) t	3.000 ms 1.000 ms 3.000 ms 1.000 ms	2.39 dE	1B im 1B			Freq Offse
6 7 8 9 10							Scale Type
11 <			m	-	STAT		. •

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### 7.6 Output Power:

### 7.6.1 Peak & Avg

#### BLE 1M mode:

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	5	2.58	30
Mid	2442	5	2.51	30
High	2480	5	2.34	30
СН	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	5	2.51	30
Mid	2442	5	2.45	30
High	2480	5	2.28	30

\*Note: Measured by power meter, cable loss 10.4 dB + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.

#### BLE 2M mode:

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	5	2.59	30
Mid	2442	5	2.50	30
High	2480	5	2.35	30
СН	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	5	2.52	30
Mid	2442	5	2.25	30
High	2480	5	2.28	30

\*Note: Measured by power meter, cable loss 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 8

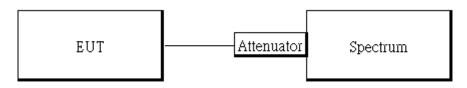
#### **Standard Applicable** 8.1

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

#### 8.2 **Measurement Equipment Used**

	Conducted Emission Test Site: Conducted G												
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.								
Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022								
Test Software	SGS Taiwan	Radio Test Soft- ware	Ver.21	N.C.R	N.C.R								
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021								
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021								
Coaxial Ca- bles	Woken	00100A1F2A196C	RF57	11/19/2020	11/18/2021								

## 8.3 Test Set-up:



### 8.4 Measurement Procedure:

- 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 spectrum analyzer.
- 4. 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 for -6dB Bandwidth test.

Repeat above procedures until all test default channel is completed

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### 8.5 Measurement Result:

#### BLE 1M mode

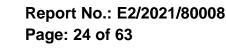
Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.701	$\ge 0.5$	PASS
2442	0.7181	≧ 0.5	PASS
2480	0.7277	<b>≧ 0.5</b>	PASS

#### BLE 2M mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.344	≧ 0.5	PASS
2442	1.397	≧ 0.5	PASS
2480	1.36	≧ 0.5	PASS

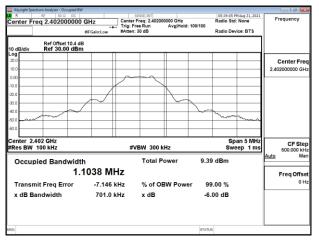
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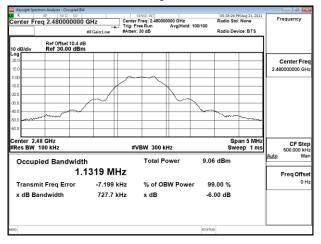
#### OBW\_BLE 1M\_LowCH00-2402MHz



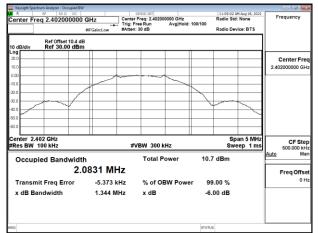
#### OBW\_BLE 1M\_MidCH20-2442MHz

🔤 Keysight Spectr	rum Analyzer - Occupied BW									
Center Fre	RF 50 Ω DC eq 2.442000000	GHz #FGain:Low			0000 GHz Avg Hold:	100/100	Radio Std		Fr	requency
10 dB/div	Ref Offset 10.4 dE Ref 30.00 dBm			_						
20.0										Center Free 2000000 GH
-10.0										
40.0 50.0	man	$\frown$					men	mar a		
60.0 Center 2.4										
#Res BW 1			#VE	3W 300 k	Hz			an 5 MHz eep 1 ms		CF Step 500.000 kH Ma
Occupi	ied Bandwidt 1.	հ 1073 MH	Iz	Total P	ower	9.33	dBm		Auto	Freq Offse
Transmi x dB Ba	it Freq Error ndwidth	-5.808 ki 718.1 ki		% of OE x dB	W Powe		.00 % 00 dB			он
15G						STATUS				

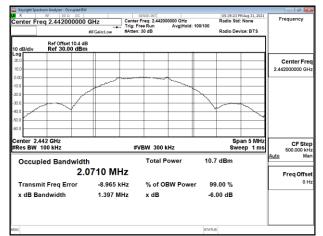
#### OBW\_BLE 1M\_HighCH39-2480MHz



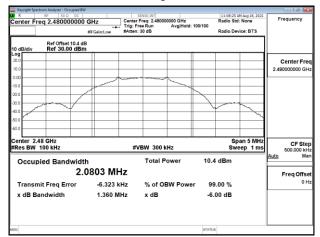
#### OBW\_BLE 2M\_LowCH00-2402MHz



#### OBW\_BLE 2M\_MidCH20-2442MHz



#### OBW\_BLE 2M\_HighCH39-2480MHz



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# 9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

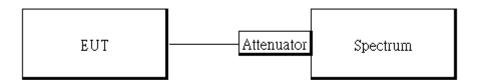
# 9.1 Standard Applicable

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).

	Conducted Emission Test Site: Conducted G												
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.								
Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022								
Test Software	SGS Taiwan	Radio Test Soft- ware	Ver.21	N.C.R	N.C.R								
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021								
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021								
Coaxial Ca- bles	Woken	00100A1F2A196C	RF57	11/19/2020	11/18/2021								

### 9.2 Measurement Equipment Used:

### 9.3 Test SET-UP:



### 9.4 Measurement Procedure

### 9.4.1 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.

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(株計方分 就何) (DAR 58本 (注) 内執之(株の) 見) (可可DAR 58本(注) 内部DAR 5 本年 2 不可 音 図 計 「 (下 1 部 7 内 就 何) を This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <u>http://www.sqs.com.tw/Terms-and-Conditions</u> and for electronic format documents, subject to Terms and Conditions for Electronic Documents at <u>http://www.sqs.com.tw/Terms-and-Conditions</u>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

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- 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.

#### 9.4.2 **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.
- 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.
- 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.

#### 9.4.3 **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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#### Measurement Result 9.5

BLE 1M_Reference Level of Limit									
Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)							
2402	2.29	-17.71							
2442	2.12	-17.88							
2480	1.98	-18.02							

NOTE: cable loss as 10.4dB that offsets in the spectrum NOTE: Refer to next page for plots.

#### BLE 2M\_Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	1.19	-18.81
2442	1.05	-18.95
2480	0.52	-19.48

NOTE: cable loss as 10.4dB that offsets in the spectrum NOTE: Refer to next page for plots.

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#### Reference Level\_BLE 1M\_LowCH00-2402MHz

Keysight Sp R	ectrum Analyzer - Sw										
	RF 50 0 reg 2.40200		7	1	VSE:INT	Avg Type	Log-Pwr	TR	AM Aug 18, 2021	F	requency
		PI	iO: Wide 🖵 Sain:Low	#Atten: 3	Run 0 dB			т	VPE MWWWWW DET P NNNNN		
dB/div	Ref Offset 10 Ref 30.00 (						Mkr1 2		16 6 GHz 29 dBm		Auto Tur
9											Center Fre
.0											02000000 GH
.0	_	<u> </u>								F	
		1								24	Start Fre 01476350 GI
0										2.4	1470300 0
0											Stop Fre
0										2.4	02523650 G
											CF Ste
0								-			104.730 ki
0										Auto	M
											Freq Offs
											01
0								-			Scale Typ
nter 2	4020000 GH	7						Span	1.047 MHz	Log	
	100 kHz	-	#VBW	300 kHz		:	Sweep	1.000 ms	(1001 pts)	Ľ.	
							STATU	IS			

#### Reference Level\_BLE 1M\_MidCH20-2442MHz

	ectrum Analyzer - Swept SA					- 0 Ø <b></b>
Center F	RF 50 Ω DC req 2.442000000 GH	z	ISE:INT	Avg Type: Log-Pw	11:01:08 AM Aug 18, 202 VT TRACE 1 2 3 4 5	Frequency
10 dB/div	Ph IFC Ref Offset 10.4 dB Ref 30.00 dBm	io: Wide 🖵 Trig: Fre Sain:Low #Atten: 3		Mkr1	2.442 243 2 GH 2.12 dBn	Auto Tune
20.0						Center Free 2.442000000 GHz
0.00			·	<b>1</b>		Start Free 2.441466675 GH
-10.0						<b>Stop Fre</b> 2.442533325 GH
-30.0						CF Step 106.665 kH Auto Ma
-50.0						Freq Offse 0 H
-60.0						Scale Type
Center 2. #Res BW	4420000 GHz 100 kHz	#VBW 300 kHz	•	Sweep	Span 1.067 MH 1.000 ms (1001 pts	Log <u>Lir</u>
MSG					TUS	

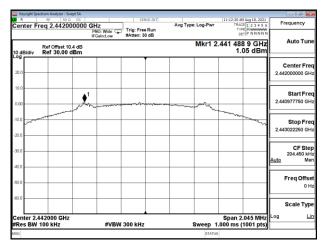
#### Reference Level\_BLE 1M\_HighCH39-2480MHz

Keysight Spe	RF 50 Q	pt SA DC			SE:INT			10.57.40.4	M Aug 18, 2021	_	00
enter F	req 2.48000	0000 GHz	:	Trig: Free		Avg Type	: Log-Pwr	TRA	CE 1 2 3 4 5 6	F	requency
Ref Offset 10.4 dB         Mk: Wide											Auto Tun
og 20.0											Center Fre 80000000 GH
0.00		<u></u>			·····					2.47	Start Fre 19462250 G⊦
10.0										2.48	Stop Fre 80537750 G⊦
0.0										Auto	CF Ste 107.550 kł Ma
0.0											Freq Offs 0 H
50.0											Scale Typ
enter 2.4 Res BW	4800000 GHz 100 kHz		#VBW	300 kHz			Sweep	Span 7 1.000 ms	.076 MHz (1001 pts)	Log	L
ia.							STAT	us			

#### Reference Level\_BLE 2M\_LowCH00-2402MHz

R RF Center Freq 2	50 Q DC	PNO: Wide	SENSE:INT	: Log-Pwr	11:05:39 AM Aug 18, 2 TRACE 1 2 3 4 TYPE M WWW DFT P N N	5 6	Frequency
10 dB/div Ref	Offset 10.4 dB	IFGain:Low	#Atten: 30 dB	 Mkr1 2	.402 487 9 G 1.19 dE	Hz	Auto Tun
20.0						2.4	Center Fre 02000000 G⊦
0.00	and the second se	Marine and		 *1		2.4	Start Fre
20.0						~ 2.4	Stop Fre
30.0						Auto	CF Ste 201.600 ki
50.0							Freq Offs 0 F
60.0					Onen 2016 M	Log	Scale Typ
Center 2.4020 #Res BW 100		#VBV	300 kHz	Sweep 1	Span 2.016 N .000 ms (1001 p	ts)	E

#### Reference Level\_BLE 2M\_MidCH20-2442MHz



#### Reference Level\_BLE 2M\_HighCH39-2480MHz

Frequency	M Aug 18, 2021 CE 1 2 3 4 5 6 PE M WWWWW FT P N N N N N	TRAC	e: Log-Pwr	Avg	NSE:INT	1	NO: Wide		RF 50 5	enter F
Auto Tur		479 957	Mkr1 2.4		0 dB	#Atten: 3	FGain:Low		Ref Offset 1 Ref 30.00	dB/div
Center Fre 2.48000000 GF										0.0
Start Fre 2.478980000 Gi			- marine				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- Andrew		.00
Stop Fre 2.481020000 Gi	- Andrew Con									1.0
CF Ste 204.000 ki Auto M										1.0
Freq Offs 01										0.0
Scale Ty				-						1.0
.og L	2.040 MHz (1001 pts)	Span 2	Sween 1		•	/ 300 kHz	#VBW		80000 GHz	

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#### Band Edge\_BLE 1M\_LowCH00-2402MHz

	50 AM Aug 18, 2021	10-52-54						pt SA DC	Analyzer - Swi	ht Spectrum	R
Frequency	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P NNNNN	TF	e: Log-Pwr	Avg 1	Run		Z NO: Fast * Sain:Low	0000 GH			
Auto Tur	400 0 GHz 3.95 dBm		Mk						f Offset 10 f 30.00 (		dB
Center Fre 2.360000000 GH	î										<b>°g</b> 10.0
Start Fre 2.310000000 GH	0(1)-17.71 dBm										0.00 0.0 10.0
<b>Stop Fre</b> 2.41000000 Gł	2	Ver-year (2.000+	15-dition-manife	-	(annotationan	to an	1.an.us	an a	a providence	ular kanada ka	0.0
CF Ste 10.000000 Mi Auto Mi	n 100.0 MHz is (1001 pts)	.600 ms	Sweep 9	CTION	EIR	/ 300 kHz	#VB	×	kHz	r 2.3600 3W 100	ente Res
Freq Offs					3m	2.00 df -43.95 df		2.402 2.400		1 f	1   2   3   4   5
Scale Ty											6 7 8 9
											0
	,		STATUS	-			-			-	a

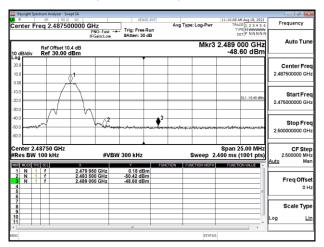
#### Band Edge\_BLE 1M\_HighCH39-2480MHz

Keysight Sp	ectrum Analyzer - Swi	ept SA						_	- [@ <b>-</b> ×
Center F	req 2.48750	00000 GHz PNO: Fas	Trig: Free	Run	pe: Log-Pwr	TRAC	Aug 18, 2021 E 1 2 3 4 5 6		equency
10 dB/div	Ref Offset 10 Ref 30.00 d	IFGain:Lo	w #Atten: 3	0 dB	Mkr3	2.495 3	00 GHz 31 dBm		Auto Tune
20.0 10.0 0.00	\$	1							enter Fred 500000 GH:
-10.0 -20.0 -30.0		h					DL1 -10.02 dBm	2.475	Start Free
-40.0 -50.0	and N	h				*********	and the second states	2.500	Stop Free
Center 2. #Res BW		#\	/BW 300 kHz	FUNCTION F	Sweep 2	.400 ms (	. /		CF Stej 500000 MH Ma
1 N 1 2 N 1 3 N 1 4 5 6	1	2.479 750 GHz 2.483 500 GHz 2.495 300 GHz	2.10 dE -50.30 dE -49.31 dE	3m			≡.	F	F <b>req Offse</b> 0 H
7 8 9 10 11							<u>.</u>	Log	Scale Type
MSG					STATUS	5	,		

#### Band Edge\_BLE 2M\_LowCH00-2402MHz

🔤 Keysight Spe	ctrum Analyzer - Swe					- 6 ×
Center Fr	reg 2.36000	0000 GHz	SENSE:INT	Avg Type: Log-Pwr	11:06:44 AM Aug 18, 2021 TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 10. Ref 30.00 d		Trig: Free Run #Atten: 30 dB	Mk	r2 2.400 0 GHz -30.39 dBm	Auto Tune
20.0 10.0						Center Fred 2.360000000 GHz
-10.0 -20.0 -30.0					0L1 10.01 dBm	Start Free 2.310000000 GH:
-40.0 -50.0 <b>/ диниски</b> -60.0	ynan yn an of maeth	etalmun-stationannaha	<b>36343</b> 444444444444444444444444444444444	ประวัตรมหลงค่ายกรูกรูกราชกับไม่สามารถ		Stop Free 2.410000000 GH
Center 2.3 #Res BW		#VB	W 300 kHz	Sweep 9	Span 100.0 MHz .600 ms (1001 pts)	CF Stej 10.000000 MH <u>Auto</u> Ma
1 N 1 2 N 1 3 4 5	f	2.402 2 GHz 2.400 0 GHz	0.46 dBm -30.39 dBm			Freq Offse 0 H
6 7 8 9						Scale Typ
10						Log <u>Lir</u>
usa				STATUS	8	

#### Band Edge\_BLE 2M\_HighCH39-2480MHz



#### Spurious Emission\_BLE 1M\_LowCH00-2402MHz

🧧 Keysight Spectrum Analyzer - S					
Center Freg 13.015		SENSE:INT	Avg Type: Log-Pwr	10:53:21 AM Aug 18, 2021 TRACE 1 2 3 4 5 6	Frequency
Center Freq 13.01	PNO: Fast + IFGain:Low	Trig: Free Run #Atten: 30 dB			Auto Tune
Ref Offset 1 10 dB/div Ref 30.00			IVI.	-41.45 dBm	
20.0					Center Fre
10.0					13.015000000 GH
-10.0				DL1 -17.71 dBm	Start Fre
-20.0					30.000000 MH
-40.0	3			and the second	Stop Fre
-50.0					26.00000000 GH
Center 13.02 GHz				Span 25.97 GHz	CF Ste
#Res BW 100 kHz	#VB	W 300 kHz		2.482 s (30001 pts)	2.597000000 GH Auto Ma
MORE MODE THE SOL 1 N 1 f 2 N 1 f	2.401 9 GHz 4.804 0 GHz	2.27 dBm -41.45 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
3 N 1 f 4 N 1 f 5	7.206 0 GHz 4.804 2 GHz	-41.45 dBm -50.68 dBm -41.45 dBm			Freq Offse 0 H
6 7 8 9					Scale Typ
9 10 11					Log <u>Li</u>
ISG			STATL	s	

#### Spurious Emission\_BLE 1M\_MidCH20-2442MHz

- Ø									inalyzer - Swe		Spect	ysight	
Frequency	M Aug 18, 2021	TRAC	e: Log-Pwr	Avg Typ	SE:INT	1		00000 G	50 Q 3.0150	RF eq 1	Fre	ter	R en
	T P NNNNN	DE			dB	#Atten: 30	IO: Fast ← iain:Low						
Auto Tur	2 2 GHz 76 dBm		Mkr						Offset 10. 30.00 d			B/div	
Center Fre													.0g 20.0
13.015000000 GH													10.0
										Y		L	0.00
Start Fre	0L1 -17.00 dBm									+		⊢	10.0
30.000000 M										+	_		20.0
	4							2	~	1			10.0
Stop Fre	-		م بندر معد ش	منبله مرمد ب		line and here			n de alle				50.0
26.00000000 G												-	50.0
CF Ste	5.97 GHz	Snan 2							287	02.0	13 (	ter	'en
2.597000000 G	0001 pts)		Sweep 2			300 kHz	#VB					s Bi	
Auto M	ON VALUE	FUNCTION	NCTION WIDTH	TION FI		Y 0.89 dE		× 2.441		SCL	TRC	MODE N	98 1
Freq Offs	_				m	-45.36 dE	) GHz	4,884		f	1	N	2
Preq Ons	_				m m	-51.72 dE -42.76 dE		7.326		1	1	NN	3
											_	_	5 6
Scale Ty	_												7 8
													9
Log L													1

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#### Spurious Emission\_BLE 1M\_HighCH39-2480MHz

	-					ISE:INT	1		DC DC	Analyzer - Swe	t Spectrum	Keysig R
Frequency	5 6	M Aug 18, 20 CE 1 2 3 4 5 PE M WWW	TRA	Log-Pwr	Avg Type		1	Hz Ю: Fast ↔	00000 G			
Auto Tun	z	et  P NNNI 0 2 GH 08 dBr	4 21.81	Mkr		0 dB	#Atten: 3	Sain:Low	IFC 4 dB	Offset 10.		0 dB/
Center Fre 13.015000000 GH										1		
Start Fre 30.000000 MH	Den	DL1 -10.02 dt										
Stop Fre 26.00000000 GH		<b>اردېن داده</b>	<b>♦</b> 4	<b>utin</b> i i				Mataka	2	~		10.0 10.0 10.0
CF Ste 2.597000000 GH Auto Ma		25.97 GH 80001 pt	.482 s (3	Sweep 2		FUN	300 kHz	#VBW		kHz	13.02 W 100	Res
Freq Offs 0 F						3m 3m 3m	0.63 df -44.76 df -51.08 df -43.08 df	) GHz ) GHz	2.479 4.960 7.440 21.810			1 N 2 N 3 N 4 N 5
Scale Typ												6 7 8 9
Log L	÷	,				_						0
				STATUS								a

#### Spurious Emission\_BLE 2M\_LowCH00-2402MHz

										Analyzer - Swe			
Frequency	6	M Aug 18, 20 E 1 2 3 4 5 E M WWWW	TRAC	: Log-Pwr	Avg Type	Run	1	Hz IO: Fast ↔	00000 G		⊮ Freq		Cen
Auto Tur	z	5 0 GH 43 dBr	r4 4.80	Mk			#Atten: 3	ain:Low	4 dB	f Offset 10. f 30.00 d		B/div	
Center Fre 13.015000000 GH										1	0		.0g 20.0 10.0
Start Fre 30.000000 MH		OL.1 -18.81 dE											10.0 20.0 30.0
Stop Fre 26.00000000 GF			<u>, in a station</u>	u bi da Jacá	ing to the state of the state o			, a gitte a gi	3	~		-	40.0 50.0 50.0
CF Ste 2.597000000 GH Auto Ma	s)	5.97 GH 0001 pt	2.482 s (3	<u> </u>	TION FUI		300 kHz	#VBW	~	kHz	13.02 N 100	s BV	Re
Freq Offs 0 H			Folicito			3m 3m 3m	-0.54 df -45.43 df -50.42 df -41.43 df	) GHz ) GHz	2.401 9 4.804 0 7.206 0 4.805 0		1 f 1 f 1 f 1 f	N N N	1 2 3 4 5
Scale Typ	l	_											6 7 8 9
	•									-		_	11
				STATUS									sa

#### Spurious Emission\_BLE 2M\_MidCH20-2442MHz

	ectrum Analyzer - Swe						
Center F	reg 13.0150	00000 GHz	SENSE:INT	Avg Type: L	og-Pwr TRA	M Aug 18, 2021 CE 1 2 3 4 5 6	Frequency
	Ref Offset 10	PNO: Fast + IFGain:Low	Trig: Free Run #Atten: 30 dB		Mkr4 4.88		Auto Tune
10 dB/div	Ref 30.00 d				-43.	44 dBm	
20.0	<b>0</b> 1						Center Fre 13.015000000 GH
-10.0						0L1 -16.95 dBm	Start Fre 30.000000 MH
40.0 50.0 60.0			-				Stop Fre 26.000000000 GH
	100 kHz	#VB	W 300 kHz		weep 2.482 s (3	. ,	CF Ste 2.597000000 GH Auto Ma
2 N 1 3 N 1 4 N 1 5	f f f	2.441 7 GHz 4.884 0 GHz 7.326 0 GHz 4.882 9 GHz	0.72 dBm -45.99 dBm -51.90 dBm -43.44 dBm	FUNCTION FUNCT	ON WOTH FUNCTI	ON VALUE	Freq Offse 0 H
6 7 8 9						=	Scale Typ
10 11						-	Log <u>Li</u>
MSG			т		STATUS	•	

#### Spurious Emission\_BLE 2M\_HighCH39-2480MHz

00									inalyzer - Swe		ysight S	Key
Frequency	Aug 18, 2021 E 1 2 3 4 5 6	TRAC	: Log-Pwr	Avg Type	SE:INT	1	Hz	00000 G	50 Q 3.0150	req	ter	cen
Auto Tur	PNNNN	r4 4.630	Mk			#Atten: 3	iO:Fast ← Sain:Low	4 dB	Offset 10 ' 30.00 c		B/div	
Center Fre 13.015000000 GF										0		.0g 20.0 10.0 0.00
Start Fre 30.000000 Mi	0L1 -19.48 dBm								<b>▲</b> 4		_	10.0 20.0 30.0
Stop Fre 26.000000000 Gi	, and the second se		in District of	<b>utrastil</b>	-	in a starte s	, 	2	C		-	40.0 50.0 50.0
CF Ste 2.597000000 GI Auto M	5.97 GHz 0001 pts)	.482 s (3	<u> </u>			300 kHz	#VB			3.02 / 100	s BV	Re
Freq Offs 01	N VALUE	FUNCTION	CTION WIDTH	TION	lm Im	-0.38 dE -48.16 dE -51.33 dE -37.65 dE	) GHz ) GHz	× 2.479 4.960 7.440 4.630		1 f 1 f 1 f 1 f	N N N N	1 2 3 4 5 6
Scale Tyr												8 9 10
	•		STATUS		'	ш					'	

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# 10 RADIATED BANDEDGE 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 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:

1. The lower limit shall apply at the transition frequencies.

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## **10.2 Measurement Equipment Used**

Radiated Emission Test Site: SAC D									
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
Broadband An- tenna	Schwarzbeck	VULB 9168	9168-617	11/11/2020	11/10/2021				
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/04/2021	06/03/2022				
Horn Antenna	Schwarzbeck	BBHA9170	184	12/11/2020	12/10/2021				
Loop Antenna	ETS.LIND- GREN	6502	143303	05/07/2021	05/06/2022				
3m Site NSA	SGS	966 chamber D	N/A	07/12/2021	07/11/2022				
Spectrum Ana- lyzer	KEYSIGHT	N9010A	MY54510568	03/22/2021	03/21/2022				
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	10/27/2020	10/26/2021				
Pre-Amplifier	EMC Instru- ments	EMC9135	980234	11/19/2020	11/18/2021				
Pre-Amplifier	EMC Instru- ments	EMC12630SE	980271	11/19/2020	11/18/2021				
Attenuator	Marvelous	WATT-218FS- 10	RF25	11/19/2020	11/18/2021				
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/19/2020	11/18/2021				
Lowpass Filter	Woken	EWT-56-0019	RF173	11/19/2020	11/18/2021				
Notch Filter	Woken	EWT-54-0038	RF178	11/19/2020	11/18/2021				
Coaxial Cable	Huber Su- hner	EMC106-SM- SM-7200	150703	11/19/2020	11/18/2021				
Coaxial Cable	Huber+Su- hner	RG 214/U	W21.01	11/19/2020	11/18/2021				
Coaxial Cable	Huber Su- hner	SUCOFLEX 104	MY17413/4	11/19/2020	11/18/2021				
Test Software	audix	e3	210322 sgs Ver.9	N.C.R	N.C.R				

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

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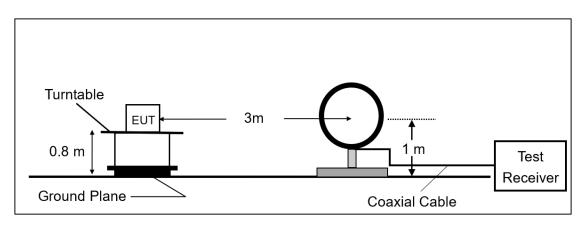
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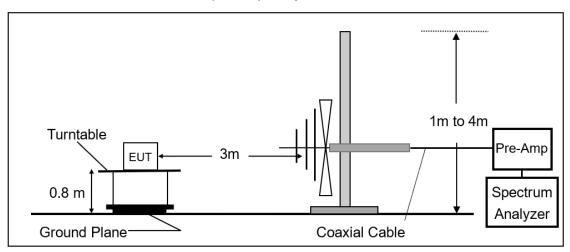


### 10.3 Test SET-UP

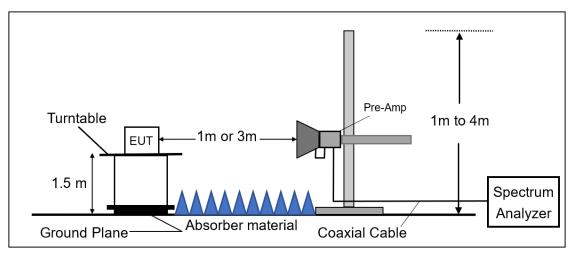
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



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



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### **10.4 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.
- 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.</li>
- 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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#### **Field Strength Calculation** 10.5

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)

## 10.6 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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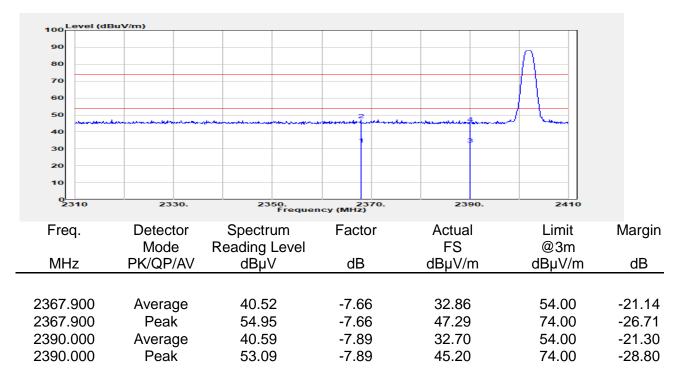
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#### 10.7 **Measurement Result:**

#### 10.7.1 **Radiated Band Edge Measurement Result**

Report Number	:E2/2021/80008	Test Site	:SAC D
Operation Mode	:BLE 1M	Test Date	:2021-08-18
Test Frequency	:2402 MHz	Temp./Humi.	:22.3/64
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Andy Wang



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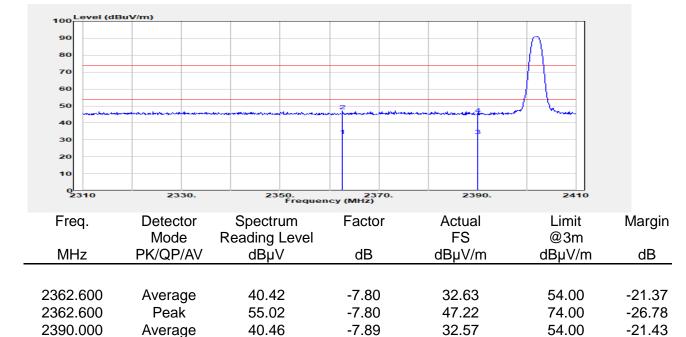
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Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 1M
Test Frequency	:2402 MHz
Test Mode	:BE CH LOW
EUT Pol	:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.3/64
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



-7.89

45.28

74.00

-28.72

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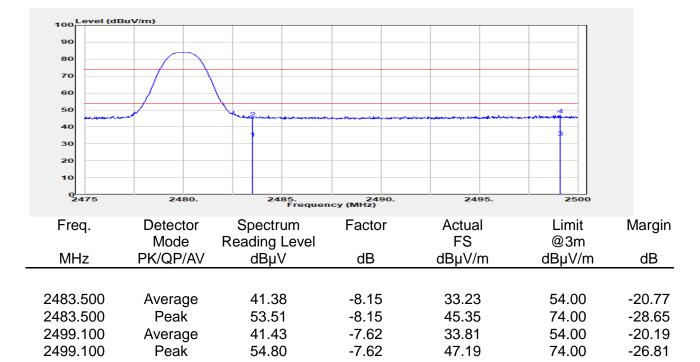
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Report Number	:E2/2021/80008
Operation Mode	:BLE 1M
Test Frequency	:2480 MHz
Test Mode	:BE CH HIGH
EUT Pol	:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.3/64
Antenna Pol.	:Vertical
Engineer	:Andy Wang



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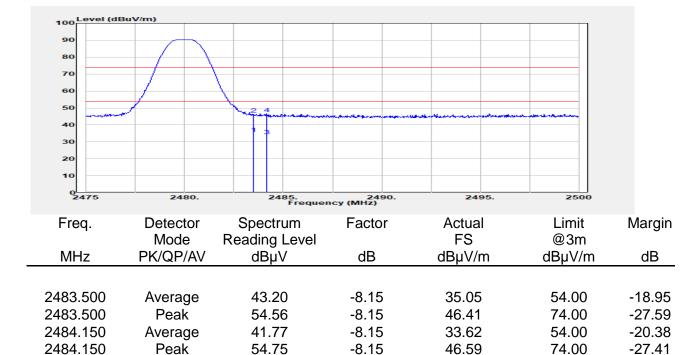
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:E2/2021/80008
:BLE 1M
:2480 MHz
:BE CH HIGH
:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.3/64
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



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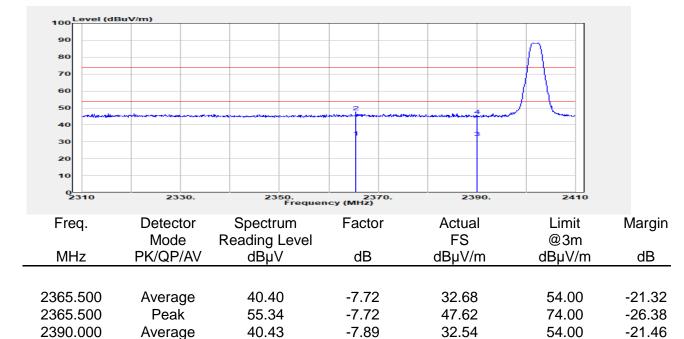
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Peak

Report Number :E2/2021/80008 Operation Mode :BLE 2M Test Frequency :2402 MHz Test Mode :BE CH LOW EUT Pol :H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.3/64 Antenna Pol. :Vertical :Andy Wang Engineer



-7.89

45.55

74.00

-28.45

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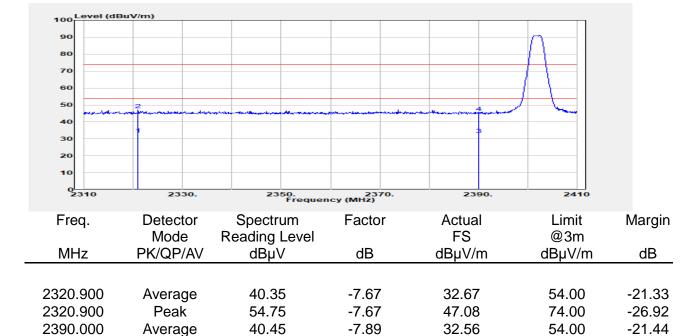
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Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2402 MHz
Test Mode	:BE CH LOW
EUT Pol	:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.3/64
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



-7.89

45.45

74.00

-28.55

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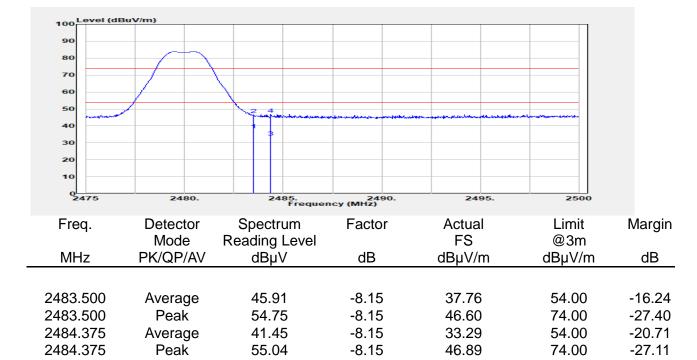
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:E2/2021/80008
:BLE 2M
:2480 MHz
:BE CH HIGH
:H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.3/64 Antenna Pol. :Vertical :Andy Wang Engineer



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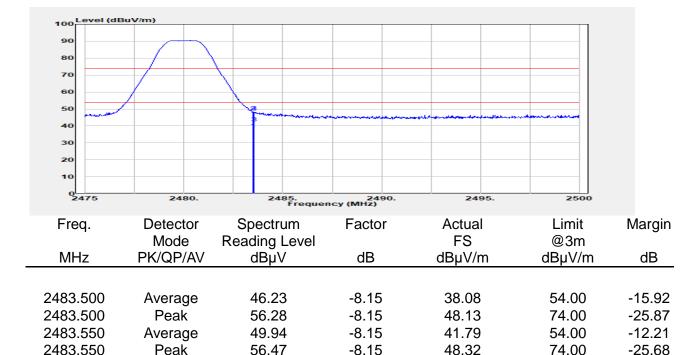
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Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2480 MHz
Test Mode	:BE CH HIGH
EUT Pol	:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.3/64
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



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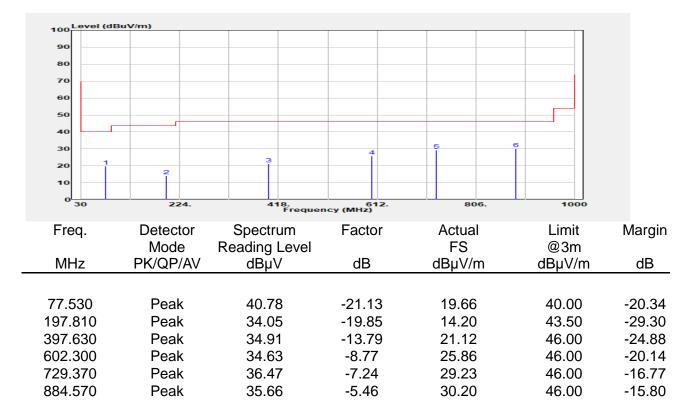
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#### 10.7.2 **Radiated Spurious Emission**

Report Number	:E2/2021/80008
Operation Mode	:BLE 1M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site :SAC D Test Date :2021-09-22 Temp./Humi. :22.8/61 Antenna Pol. :Vertical :Andy Wang Engineer



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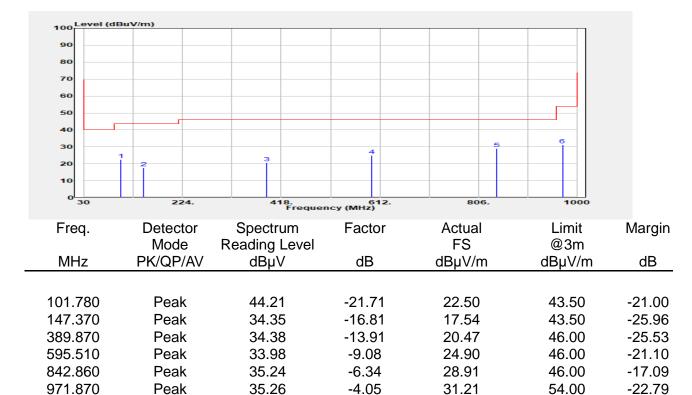
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Report Number	:E2/2021/80008	
Operation Mode	:BLE 1M	
Test Frequency	:2442 MHz	
Test Mode	:TX CH MID	
EUT Pol	:H Plane	
Operation Mode Test Frequency Test Mode	:BLE 1M :2442 MHz :TX CH MID	

Test Site :SAC D Test Date :2021-09-22 Temp./Humi. :22.8/61 Antenna Pol. :Horizontal :Andy Wang Engineer



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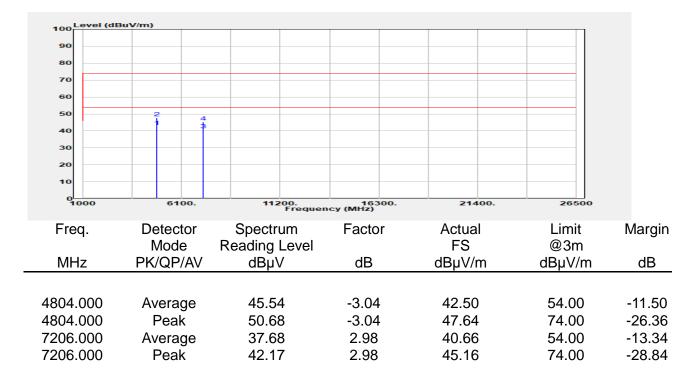
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Report Number :E2/2021/80008 **Operation Mode : BLE 1M** Test Frequency :2402 MHz Test Mode :TX CH LOW EUT Pol :H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.8/65 Antenna Pol. :Vertical Engineer :Andy Wang



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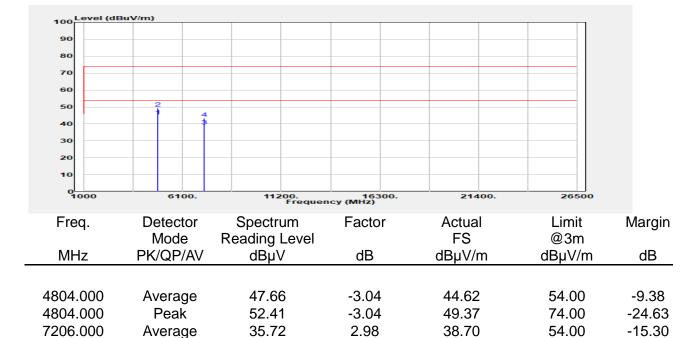
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Peak

Report Number	:E2/2021/80008		
Operation Mode	:BLE 1M		
Test Frequency	:2402 MHz		
Test Mode	:TX CH LOW		
EUT Pol	:H Plane		

Test Site	:SAC D			
Test Date	:2021-08-18			
Temp./Humi.	:22.8/65			
Antenna Pol.	:Horizontal			
Engineer	:Andy Wang			



2.98

43.34

74.00

-30.66

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40.36

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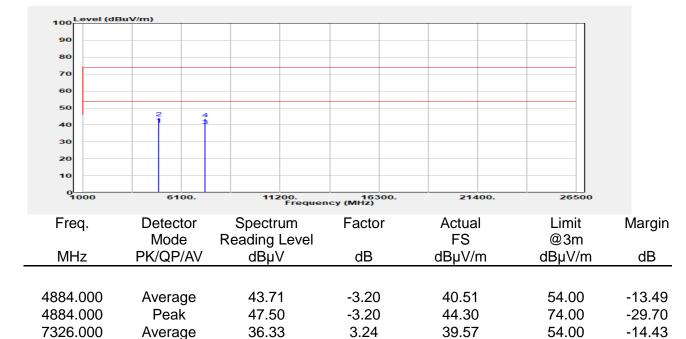
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Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 1M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site	:SAC D		
Test Date	:2021-08-18		
Temp./Humi.	:22.8/65		
Antenna Pol.	:Vertical		
Engineer	:Andy Wang		



3.24

43.50

74.00

-30.50

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40.26

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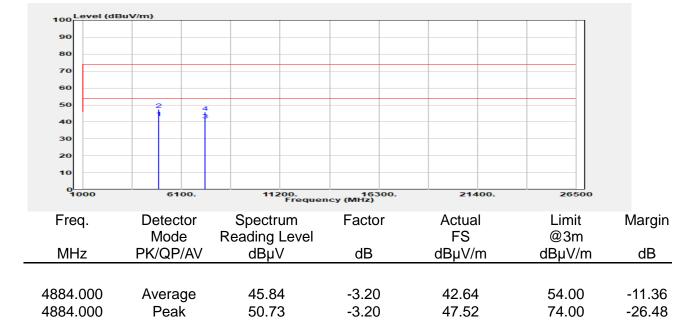
7326.000

Average

Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 1M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site	:SAC D		
Test Date	:2021-08-18		
Temp./Humi.	:22.8/65		
Antenna Pol.	:Horizontal		
Engineer	:Andy Wang		



3.24

3.24

41.17

45.75

54.00

74.00

-12.83

-28.25

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37.93

42.51

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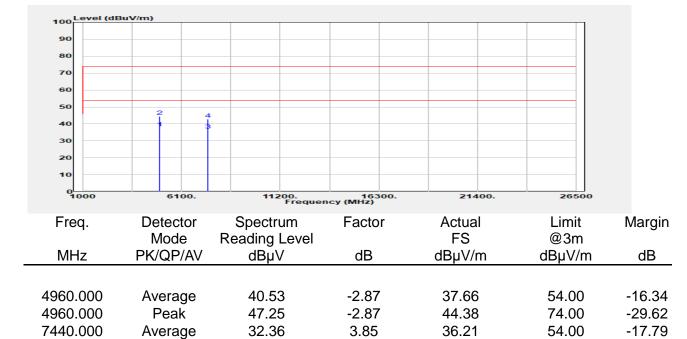
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Peak

Report Number	:E2/2021/80008		
Operation Mode	:BLE 1M		
Test Frequency	:2480 MHz		
Test Mode	:TX CH HIGH		
EUT Pol	:H Plane		

Test Site:SAC DTest Date:2021-08-18Temp./Humi.:22.8/65Antenna Pol.:VerticalEngineer:Andy Wang



3.85

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38.99

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42.84

74.00

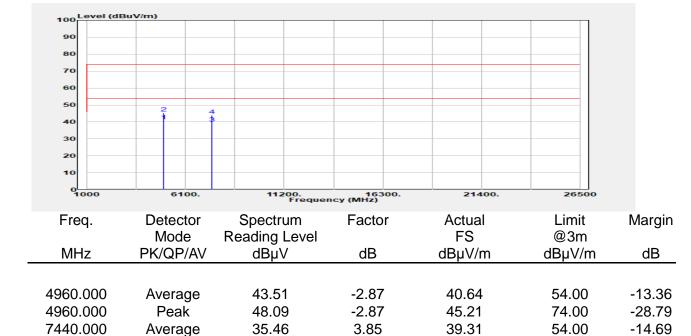
-31.16



Peak

Report Number	:E2/2021/80008		
Operation Mode	:BLE 1M		
Test Frequency	:2480 MHz		
Test Mode	:TX CH HIGH		
EUT Pol	:H Plane		

Test Site	:SAC D		
Test Date	:2021-08-18		
Temp./Humi.	:22.8/65		
Antenna Pol.	:Horizontal		
Engineer	:Andy Wang		



3.85

43.94

74.00

-30.06

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40.09

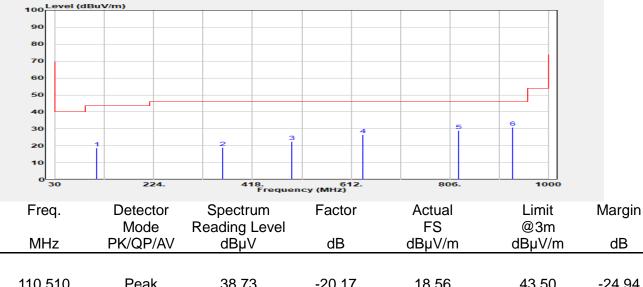
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Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site :SAC D Test Date :2021-09-22 Temp./Humi. :22.8/61 Antenna Pol. :Vertical :Andy Wang Engineer



110.510	Peak	38.73	-20.17	18.56	43.50	-24.94
358.830	Peak	34.03	-14.94	19.08	46.00	-26.92
495.600	Peak	34.90	-12.27	22.63	46.00	-23.37
635.280	Peak	35.08	-8.57	26.51	46.00	-19.49
823.460	Peak	35.65	-6.76	28.89	46.00	-17.11
930.160	Peak	35.90	-4.93	30.97	46.00	-15.03

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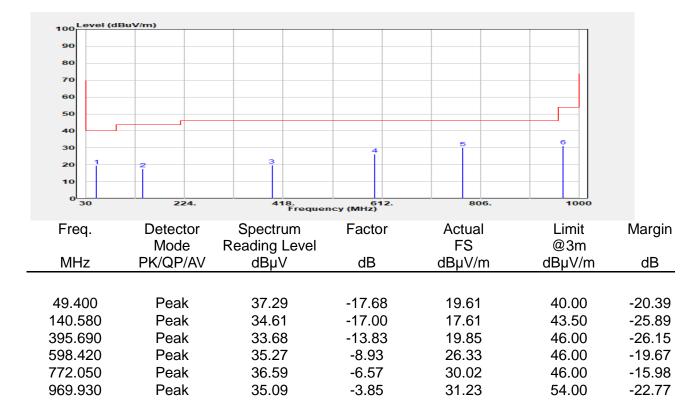
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Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site :SAC D Test Date :2021-09-22 Temp./Humi. :22.8/61 Antenna Pol. :Horizontal :Andy Wang Engineer



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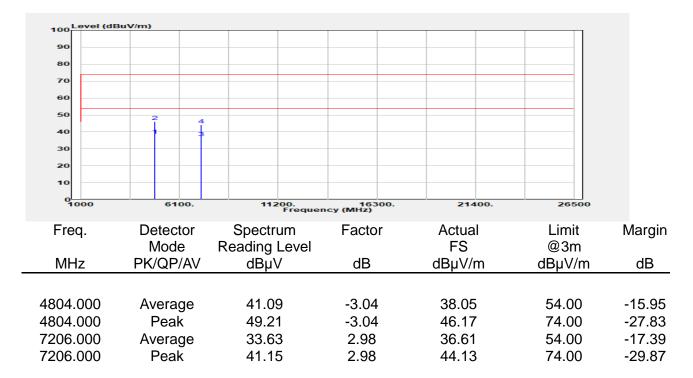
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Report Number :E2/2021/80008 **Operation Mode :BLE 2M** Test Frequency :2402 MHz Test Mode :TX CH LOW EUT Pol :H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.8/65 Antenna Pol. :Vertical Engineer :Andy Wang



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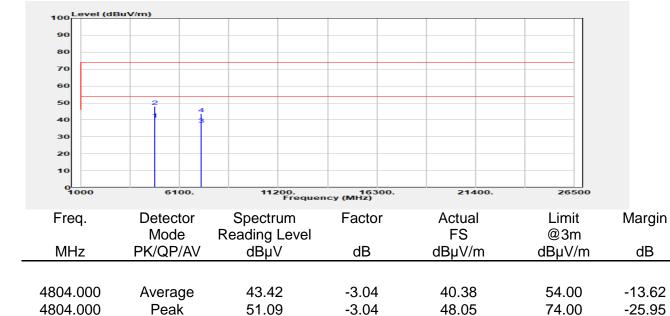
7206.000

Average

Peak

:E2/2021/80008
:BLE 2M
:2402 MHz
:TX CH LOW
:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.8/65
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



2.98

2.98

37.50

43.67

54.00

74.00

-16.50

-30.33

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34.52

40.68

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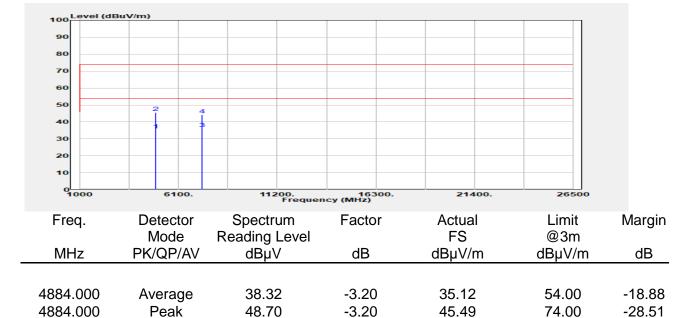
7326.000

Average

Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.8/65 Antenna Pol. :Vertical :Andy Wang Engineer



3.24

3.24

36.08

44.18

54.00

74.00

-17.92

-29.82

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32.84

40.94

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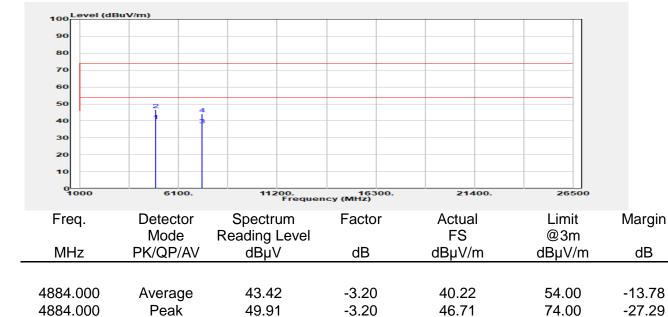
7326.000

Average

Peak

Report Number	:E2/2021/80008
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plane

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.8/65
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



3.24

3.24

37.71

44.14

54.00

74.00

-16.29

-29.86

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t (886-2) 2299-3279

34.47

40.90

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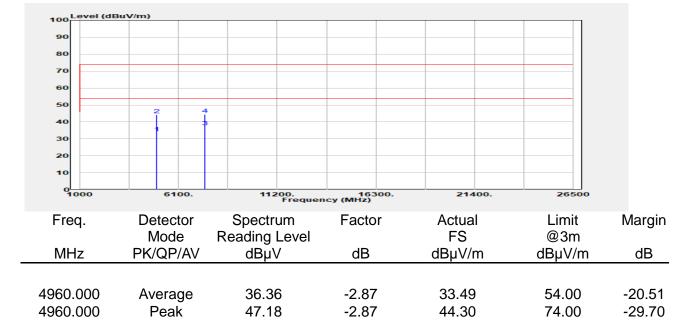
7440.000

Average

Peak

:E2/2021/80008
:BLE 2M
:2480 MHz
:TX CH HIGH
:H Plane

Test Site :SAC D Test Date :2021-08-18 Temp./Humi. :22.8/65 Antenna Pol. :Vertical :Andy Wang Engineer



3.85

3.85

37.06

44.52

54.00

74.00

-16.94

-29.48

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33.21

40.67

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:E2/2021/80008
:BLE 2M
:2480 MHz
:TX CH HIGH
:H Plane

Peak

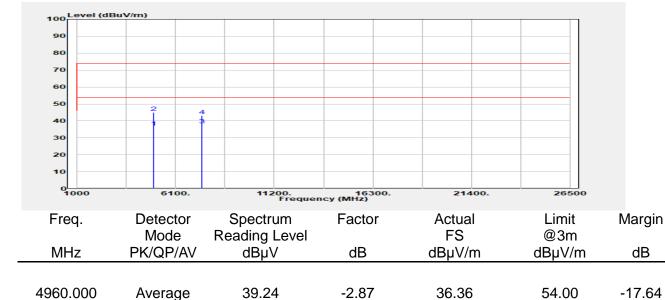
Average

Peak

4960.000 7440.000

7440.000

Test Site	:SAC D
Test Date	:2021-08-18
Temp./Humi.	:22.8/65
Antenna Pol.	:Horizontal
Engineer	:Andy Wang



-2.87

3.85

3.85

45.12

37.76

43.16

74.00

54.00

74.00

-28.88

-16.24

-30.84

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t (886-2) 2299-3279

47.99

33.91

39.31

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# **11 POWER SPECTRAL DENSITY**

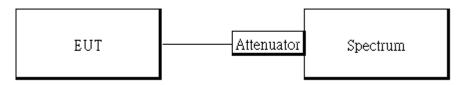
## 11.1 Standard Applicable:

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.

### **11.2 Measurement Equipment Used:**

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.
Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021
Coaxial Ca- bles	Woken	00100A1F2A196C	RF57	11/19/2020	11/18/2021

### 11.3 Test Set-up:



### **11.4 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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### **11.5 Measurement Result:**

### BLE 1M mode

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-10.080	8	PASS
2442	-10.386	8	PASS
2480	-10.060	8	PASS

NOTE: cable loss as 10.4dB that offsets in the spectrum **BIF2M** mode

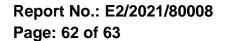
Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result	
2402	-12.860	8	PASS	
2442	-12.490	8	PASS	
2480	-12.530	8	PASS	

NOTE: cable loss as 10.4dB that offsets in the spectrum

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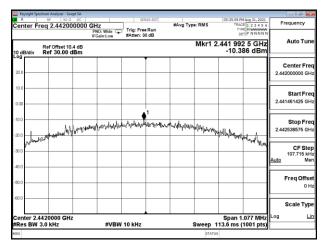




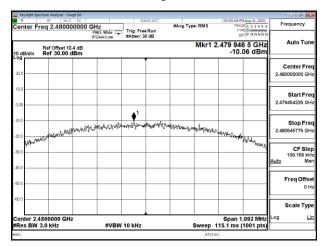
### PSD\_BLE 1M\_LowCH00-2402MHz

Frequency	MAug 31, 2021 2E 1 2 3 4 5 6 PE MWWWWW	TRAC	ype: RMS	#Avg	SENSE:INT	Hz NO: Wide 🔾	00000 G	req 2.4020	R enter F
Auto Tun	Prior Mail         Composition         Composition <thcomposition< th=""> <thcomposition< th=""></thcomposition<></thcomposition<>								
Center Fre 2.402000000 GH								-	0.0
Start Fre 2.401474250 GF			_						00
<b>Stop Fre</b> 2.402525750 GH	Mary 1	- mangerly	wilningwa	-Turkhway	revit.derailen.velder	welseling to	undustras	ANNAL AND AND A	1.0
CF Ste 105.150 kł Auto Ma									
Freq Offs 01									
Scale Typ				-					1.0
Log L	enter 2.4020000 GHz Span 1.052 MHz Sweep 110.9 ms (1001 pts)								

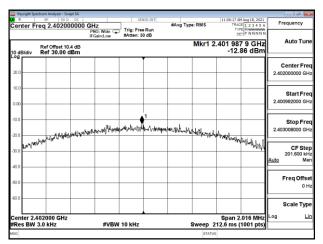
#### PSD\_BLE 1M\_MidCH20-2442MHz



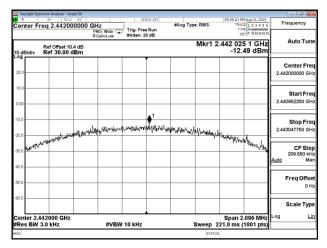
#### PSD\_BLE 1M\_HighCH39-2480MHz



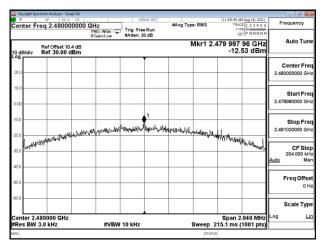
#### PSD\_BLE 2M\_LowCH00-2402MHz



#### PSD\_BLE 2M\_MidCH20-2442MHz



#### PSD\_BLE 2M\_HighCH39-2480MHz



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## **12 ANTENNA REQUIREMENT**

### 12.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

### 12.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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