

Page: 1 of 63

# **ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**





Applicant: Quanta Computer Inc.

No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City

33377, Taiwan

**Product Name:** Clover Station Solo

**Brand Name:** clover

Model No.: C501

**Model Difference:** N/A

E2/2021/70074 Report Number:

**FCC ID** HFS-C501F

**Issue Date:** August 24, 2021

**Date of Test:** July 16, 2021  $\sim$  July 31, 2021

Date of EUT Received: July 15, 2021

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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Page: 2 of 63

Revision History						
Report Number	Revision	Description	Issue Date	Revised By		
E2/2021/70074	00	Original	August 24, 2021	Ariel Chang		

#### Note:

1. Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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Page: 3 of 63

# **Table of Contents**

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	6
3	SUMMARY OF TEST RESULTS	9
4	DESCRIPTION OF TEST MODES	10
5	MEASUREMENT UNCERTAINTY	12
6	CONDUCTED EMISSION TEST	13
7	PEAK OUTPUT POWER MEASUREMENT	19
8	EMISSION BANDWIDTH MEASUREMENT	22
9	CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT	25
10	RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT	31
11	POWER SPECTRAL DENSITY	60
12	ANTENNA REQUIREMENT	63

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Page: 4 of 63

#### **GENERAL INFORMATION** 1

#### **Product Description** 1.1

Product Name:	Clover Station Solo
Brand Name:	clover
Model No.:	C501
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	C051UQ12570003
Power Supply:	24V from AC/DC Adapter or 3.8V from Rechargeable Li-ion Polymer Battery

#### 1.2 **RF Specification**

Radio Technology:	BLE
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	BLE 1M: 1.81 dBm BLE 2M: 1.96 dBm

## 1.3 Antenna Designation

Antenna Type	Freq. (MHz)	Antenna No.	Peak Antenna Gain (dBi)	Worst Antenna Gain
PIFA	2402 2400	WIFI-1	-1.04	
PIFA	2402 – 2480	WIFI-2	1.27	V

#### Note:

- 1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
- Antenna information is provided by the applicant.

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Page: 5 of 63

## 1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 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		TW3702
		Conducted 4	-	
		Conducted 5		
000 Taiman I tal		Conducted 6		
SGS Taiwan Ltd. Central RF Lab.		Conduction C	TW0028	
(TAF code 3702)		SAC C		
(1A1 Code 3702)		SAC D		
		SAC G		
	No 2 Kaji 1at Dd. Cujahan Diatriat	Conducted A		
	No.2, Keji 1st Rd., Guishan District,	Conducted B		
	Taoyuan City, Taiwan 333	Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G	1	

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

## 1.6 Special Accessories

There are no special accessories used while test was conducted.

## 1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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Page: 6 of 63

## 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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Page: 7 of 63

#### 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\*9m\*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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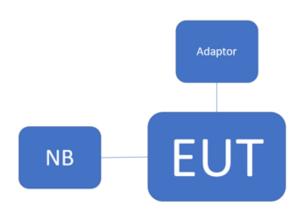
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Page: 8 of 63

## Test Configuration

#### 2.5.1 **Conducted Setup & Radiated Setup**



#### 2.5.2 **Conduction Setup**



## 2.6 Control Unit(s)

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER
Notebook	Lenovo	L430	P0000195
Notebook	Lenovo	T470	P0001293
Adaptor	N/A	N/A	N/A

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Page: 9 of 63

# 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



Page: 10 of 63

## **DESCRIPTION OF TEST MODES**

## **Operating Frequencies**

			1		1
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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Page: 11 of 63

### 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		
F	RADIATED EM	ISSION TEST (ABO	VE 1 GHz)			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)		
Bluetooth LE	0 to 39	0,20,39	GFSK	1		

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

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)		
Bluetooth LE 2M	0 to 39	20	GFSK	2		
R	ADIATED EM	ISSION TEST (A	BOVE 1 GHz)			
MODE AVAILABLE TESTED MODULATION RATE (Mbps)						
Bluetooth LE 2M	0 to 39	0,20,39	GFSK	2		

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

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Page: 12 of 63

## **MEASUREMENT UNCERTAINTY**

Test Items	Ur	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					
	+/-	2.64	dB	9kHz~30MHz	
Polarization: Vertical	+/-	4.93	dB	30MHz - 1000MHz	
Polarization, vertical	+/-	4.81	dB	1GHz - 18GHz	
	+/-	4.52	dB	18GHz - 40GHz	
	+/-	2.64	dB	9kHz~30MHz	
   Polarization: Horizontal	+/-	4.45	dB	30MHz - 1000MHz	
Polarization: norizontal	+/-	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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Page: 13 of 63

## CONDUCTED EMISSION TEST

## 6.1 Standard Applicable:

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

Fraguanay ranga	Limits (dBµV)				
Frequency range 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

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

	Radiated Emission Test Site: Conduction C								
EQUIPMENT TYPE MFR		MODEL NUM- BER SERIAL NUMBER		LAST CAL.	CAL DUE.				
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R				
LISN SCHWARZBECK Mess-Elektronik		NSLK8127	974	04/19/2021	04/18/2022				
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022				
Coaxial Ca- ble	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				
Test Software	audix	e3	20923 sgs Ver.6	N.C.R	N.C.R				

## 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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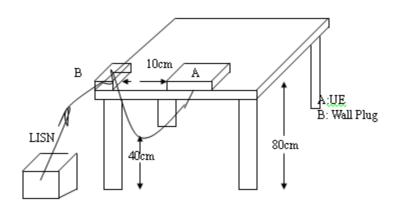
<sup>1.</sup> The lower limit shall apply at the transition frequencies

<sup>2.</sup> The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.



Page: 14 of 63

## 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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Page: 15 of 63

## AC POWER LINE CONDUCTED EMISSION TEST DATA

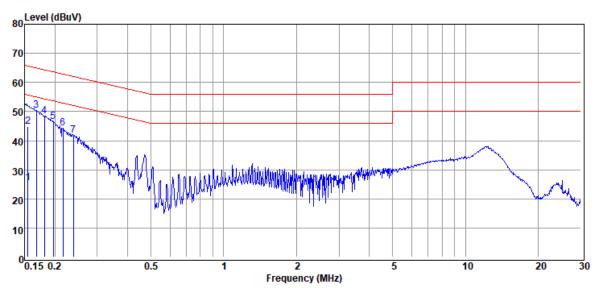
Report Number :E2/2021/70074 Test Site :Conduction Room C

Test Mode :BLE 1M **Test Date** :2021-07-27

Power :120V/60Hz Temp./Humi. :24.4/55

Probe :L1 Engineer :Jack Tseng

Note: : Adapter:FSP120-AABN3



Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
Average	15.30	10.30	25.60	55.74	-30.14
QP	34.60	10.30	44.90	65.74	-20.84
Peak	40.10	10.30	50.40	65.08	-14.68
Peak	38.16	10.30	48.46	64.42	-15.96
Peak	36.16	10.30	46.46	63.71	-17.25
Peak	34.12	10.30	44.42	62.96	-18.54
Peak	31.56	10.30	41.86	62.13	-20.27
	Mode PK/QP/AV  Average QP Peak Peak Peak Peak Peak	Mode PK/QP/AV  Average 15.30 QP 34.60 Peak 40.10 Peak 38.16 Peak 36.16 Peak 34.12	Mode PK/QP/AV         Reading Level dBμV         dB           Average         15.30         10.30           QP         34.60         10.30           Peak         40.10         10.30           Peak         38.16         10.30           Peak         36.16         10.30           Peak         34.12         10.30	Mode PK/QP/AV         Reading Level dB μV         FS dB μV           Average         15.30         10.30         25.60           QP         34.60         10.30         44.90           Peak         40.10         10.30         50.40           Peak         38.16         10.30         48.46           Peak         36.16         10.30         46.46           Peak         34.12         10.30         44.42	Mode PK/QP/AV         Reading Level dBμV         FS dBμV         dBμV           Average         15.30         10.30         25.60         55.74           QP         34.60         10.30         44.90         65.74           Peak         40.10         10.30         50.40         65.08           Peak         38.16         10.30         48.46         64.42           Peak         36.16         10.30         46.46         63.71           Peak         34.12         10.30         44.42         62.96

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Page: 16 of 63

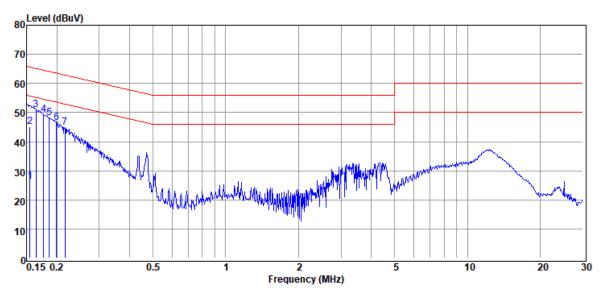
Report Number :E2/2021/70074 Test Site :Conduction Room C

Test Mode : BLE 1M **Test Date** :2021-07-27

Power :120V/60Hz Temp./Humi. :24.4/55

Probe :N Engineer :Jack Tseng

: Adapter:FSP120-AABN3 Note:



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Average	16.10	10.31	26.41	55.74	-29.33
0.15	QP	34.70	10.31	45.01	65.74	-20.73
0.16	Peak	40.64	10.31	50.95	65.25	-14.30
0.18	Peak	39.04	10.30	49.34	64.64	-15.30
0.19	Peak	37.82	10.30	48.12	64.20	-16.08
0.20	Peak	36.17	10.30	46.47	63.62	-17.15
0.22	Peak	34.46	10.30	44.76	62.96	-18.20

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Page: 17 of 63

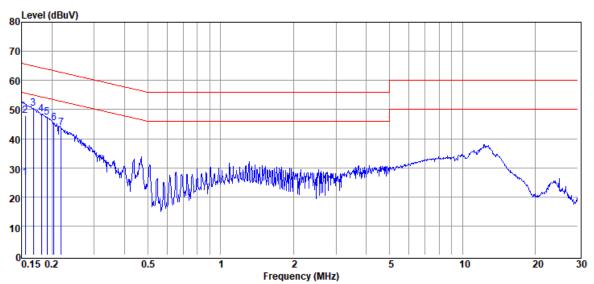
Report Number :E2/2021/70074 **Test Site** :Conduction Room C

Test Mode :BLE 2M **Test Date** : 2021-07-27

Power :120V/60Hz Temp./Humi. :24.4/55

Probe :L1 Engineer :Jack Tseng

Note: : Adapter:FSP120-AABN3



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Average	16.44	10.22	26.66	55.69	-29.03
0.16	QP	37.66	10.22	47.88	65.69	-17.81
0.17	Peak	40.18	10.22	50.40	65.08	-14.68
0.18	Peak	38.24	10.22	48.46	64.42	-15.96
0.19	Peak	37.09	10.22	47.31	63.98	-16.67
0.20	Peak	35.04	10.22	45.26	63.45	-18.19
0.22	Peak	33.50	10.22	43.72	62.88	-19.16

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Page: 18 of 63

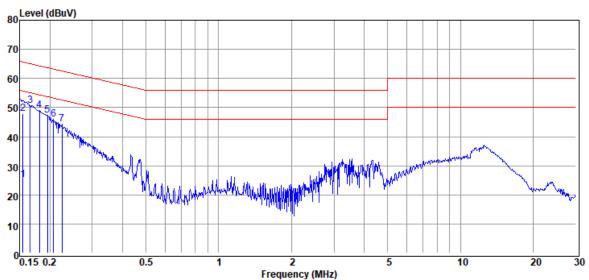
Report Number :E2/2021/70074 Test Site :Conduction Room C

Test Mode : BLE 2M **Test Date** :2021-07-27

Power :120V/60Hz Temp./Humi. :24.4/55

Probe :N Engineer :Jack Tseng

Note: : Adapter:FSP120-AABN3



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμ̈V	dB	dΒμV	dΒμV	dB
0.15	Average	14.87	10.21	25.08	55.74	-30.66
0.15	QP	37.58	10.21	47.79	65.74	-17.95
0.17	Peak	40.52	10.21	50.73	65.16	-14.43
0.18	Peak	38.66	10.21	48.87	64.42	-15.55
0.20	Peak	37.18	10.21	47.39	63.80	-16.41
0.21	Peak	35.77	10.21	45.98	63.32	-17.34
0.22	Peak	33.98	10.21	44.19	62.66	-18.47

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Page: 19 of 63

## 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.

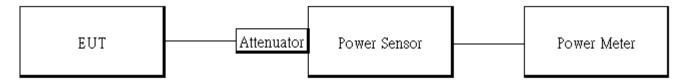
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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 NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Power Meter	Anritsu	ML2496A	1804002	04/14/2021	04/13/2022			
Power Sensor	Anritsu	MA2411B	1726105	04/14/2021	04/13/2022			
Power Sensor	Anritsu	MA2411B	1726106	04/14/2021	04/13/2022			
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021			
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021			
Coaxial Cables	Woken	00100A1F2A196C	RF59	11/19/2020	11/18/2021			
Coaxial Cables	Woken	00100A1F2A196C	RF68	11/19/2020	11/18/2021			

### 7.3 Test Set-up:



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Page: 20 of 63

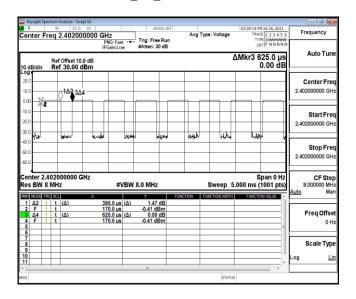
### **Measurement Procedure:**

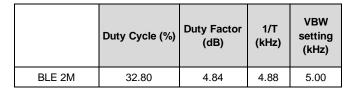
- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
- 4. Record the max. Reading as observed from Power Meter.
- 5. Repeat above procedures until all test default channel measured was complete.

#### **Duty Factor:** 7.5

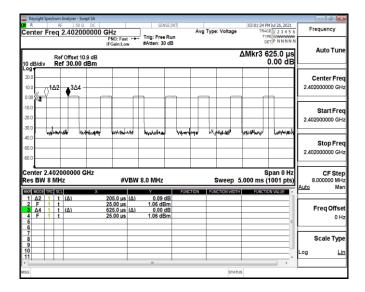
	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log ( 1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE	63.20	1.99	2.53	3.00

BLE\_1M\_LowCH00-2402





BLE\_2M\_LowCH00-2402



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Page: 21 of 63

## **Output Power:**

#### 7.6.1 Peak & Avg

### **BLE mode:**

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit (dBm)
Low	2402	default	1.81	30
Mid	2442	default	1.74	30
High	2480	default	1.55	30
СН	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	default	1.67	30
Mid	2442	default	1.57	30
High	2480	default	1.34	30

<sup>\*</sup>Note: Measured by power meter, cable loss 10.9 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	default	1.96	30
Mid	2442	default	1.90	30
High 2480		default	1.71	30
BLE 2M mode:				
CH Frequency (MHz)		Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit (dBm)
Low	2402	default	1.66	30
Mid	2442	default	1.59	30
High	2480	default	1.30	30

<sup>\*</sup>Note: Measured by power meter, cable loss 10.9 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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Page: 22 of 63

## **EMISSION BANDWIDTH MEASUREMENT**

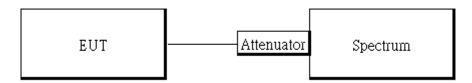
## **Standard Applicable**

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

## **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	
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021	
DC Block	PASTERNACK	PE8210	RF151	11/19/2020	11/18/2021	
Coaxial Ca- bles	Woken	00100A1F2A196C	RF59	11/19/2020	11/18/2021	
Coaxial Ca- bles	Woken	00100A1F2A196C	RF68	11/19/2020	11/18/2021	
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N/A	N/A	

## 8.3 Test Set-up:



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Page: 23 of 63

### 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

### **Measurement Result:**

#### **BLE** mode

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6857	≧ 0.5	PASS
2442	0.6844	≧ 0.5	PASS
2480	0.6841	≧ 0.5	PASS

#### **BLE 2M mode**

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result
2402	1.158	≥ 0.5	PASS
2442	1.159	≧ 0.5	PASS
2480	1.157	≧ 0.5	PASS

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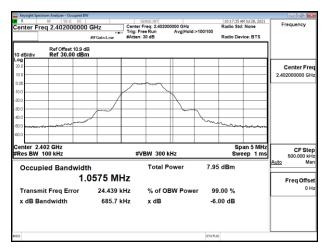
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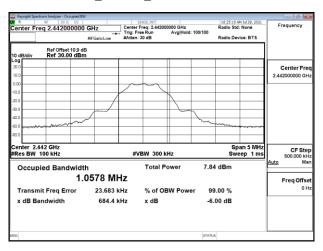


Page: 24 of 63

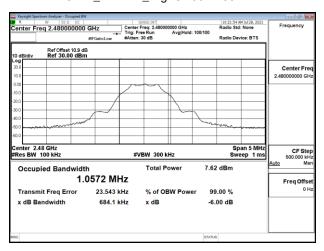
#### OBW\_BLE 1M\_LowCH00-2402MHz



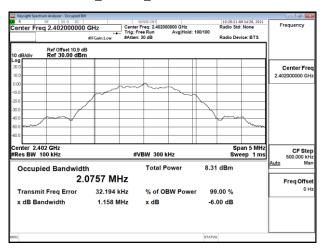
#### OBW\_BLE 1M\_MidCH20-2442MHz



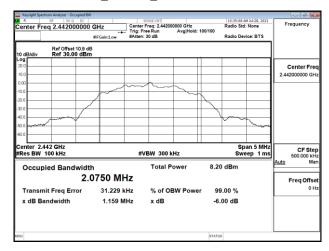
#### OBW\_BLE 1M\_HighCH39-2480MHz



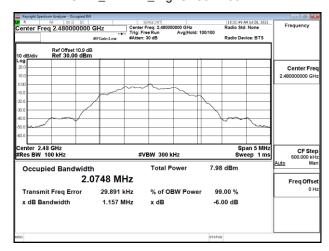
#### OBW\_BLE 2M\_LowCH00-2402MHz



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



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



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Page: 25 of 63

### CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

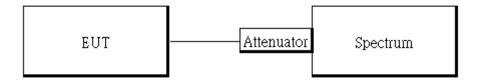
## 9.1 Standard Applicable

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).

#### 9.2 **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
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNACK	PE8210	RF151	11/19/2020	11/18/2021
Coaxial Ca- bles	Woken	00100A1F2A196C	RF59	11/19/2020	11/18/2021
Coaxial Ca- bles	Woken	00100A1F2A196C	RF68	11/19/2020	11/18/2021
Test Software	SGS Taiwan	Radio Test Soft- ware	Ver.21	N/A	N/A

#### **Test SET-UP:** 9.3



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Page: 26 of 63

## **Measurement Procedure**

#### 9.4.1 **Reference Level of Emission Limit:**

- 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.

#### 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.
- 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 =
- 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.
- 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.
- Repeat above procedures until all default test channel measured were complete.

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Page: 27 of 63

### 9.5 Measurement Result

BLE\_1M:

### **Reference Level of Limit**

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	1.117	-18.88
2442	0.99	-19.01
2480	0.81	-19.19

NOTE: cable loss as 10.9dB 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	1.06	-18.94
2442	0.95	-19.05
2480	0.73	-19.27

NOTE: cable loss as 10.9dB that offsets in the spectrum

NOTE: Refer to next page for plots.

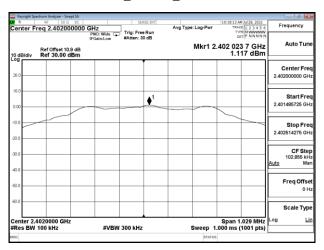
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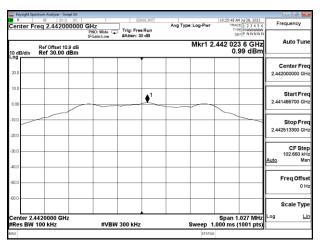


Page: 28 of 63

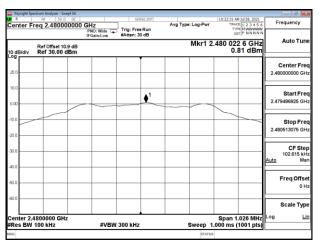
#### Reference Level\_BLE 1M\_LowCH00-2402MHz



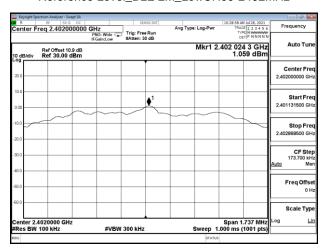
#### Reference Level\_BLE 1M\_MidCH20-2442MHz



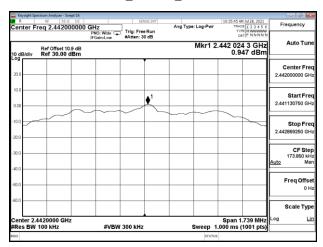
### Reference Level\_BLE 1M\_HighCH39-2480MHz



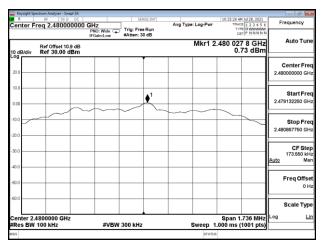
#### Reference Level\_BLE 2M\_LowCH00-2402MHz



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



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



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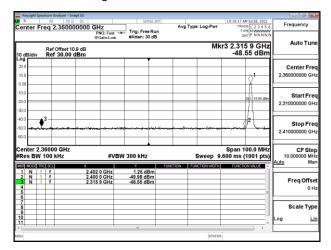
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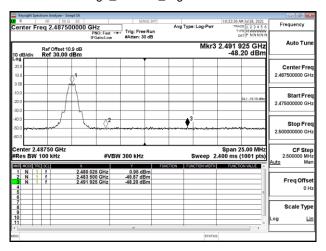


Page: 29 of 63

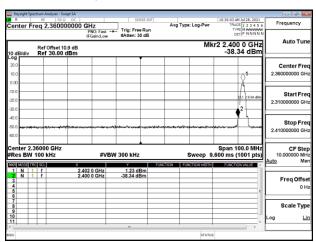
#### Band Edge\_BLE 1M\_LowCH00-2402MHz



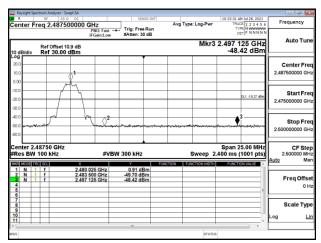
#### Band Edge\_BLE 1M\_HighCH39-2480MHz



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



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

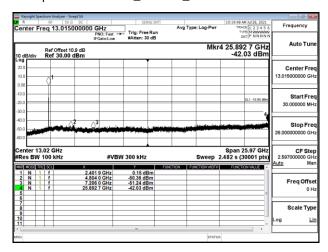


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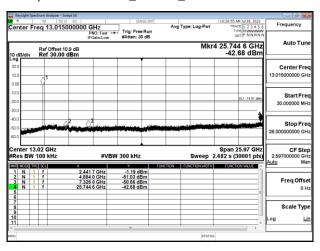


Page: 30 of 63

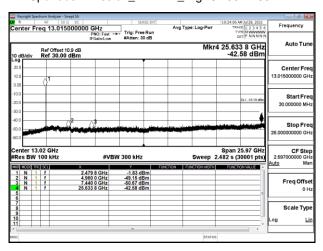
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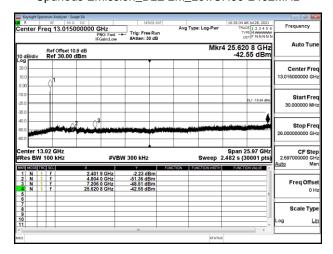
#### Spurious Emission\_BLE 1M\_MidCH20-2442MHz



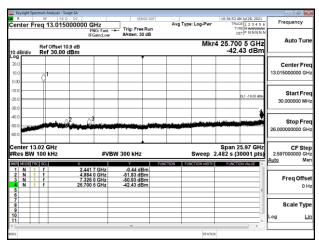
#### Spurious Emission\_BLE 1M\_HighCH39-2480MHz



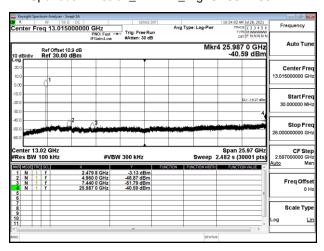
#### Spurious Emission\_BLE 2M\_LowCH00-2402MHz



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



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



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Page: 31 of 63

## 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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Page: 32 of 63

## 10.2 Measurement Equipment Used

10.2 Measurement Equipment Osed							
	Radiated Emission Test Site: SAC D						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021		
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/04/2021	06/03/2022		
Horn Antenna	Schwarzbeck	BBHA9170	184	12/11/2020	12/10/2021		
Loop Anten- na	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022		
3m Site NSA	SGS	966 chamber D	N/A	07/12/2021	07/11/2022		
Spectrum Analyzer	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 Fil- ter	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 Ca- ble	Huber Suhner	EMC106-SM-SM-7200	150703	11/19/2020	11/18/2021		
Coaxial Ca- ble	Huber+Suhner	RG 214/U	W21.01	11/19/2020	11/18/2021		
Coaxial Ca- ble	Huber Suhner	SUCOFLEX 104	MY17413/4	11/19/2020	11/18/2021		
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R		
USB Cable	廣寰	Z2110	N/A	N.C.R	N.C.R		
Notebook	Lenovo	T470	P0001293	N/A	N/A		

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

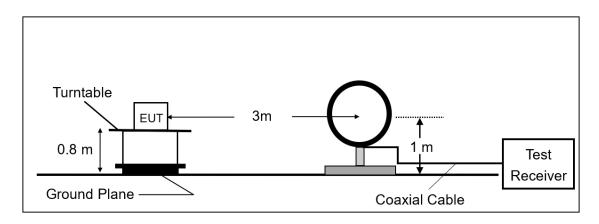
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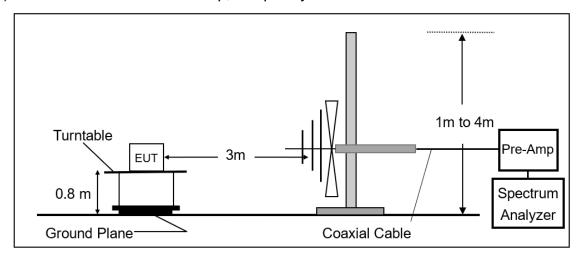
Page: 33 of 63

### 10.3 Test SET-UP

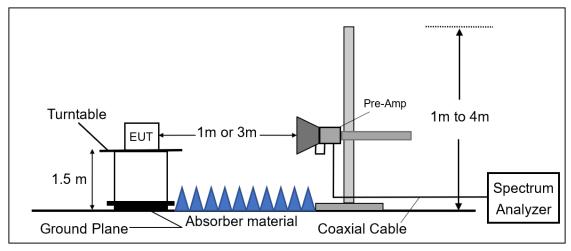
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



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



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Page: 34 of 63

#### 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.
- 8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.
- 9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 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.

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. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製



Page: 35 of 63

#### **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

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)

 $Factor(dB) = Antenna\ Factor(dB\mu V/m) + Cable\ Loss(dB) - Pre\_Amplifier\ Gain(dB)$ 

## 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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Page: 36 of 63

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

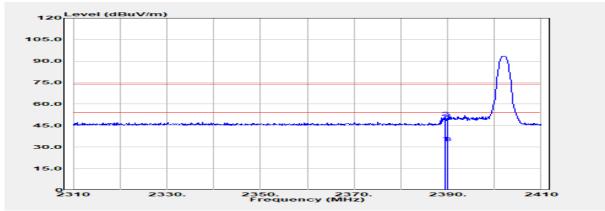
#### 10.7.1 **Radiated Band Edge Measurement Result**

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M :2021-07-30 Test Date

Test Frequency :2402 MHz Temp./Humi. :22.3/64 Test Mode :BE CH LOW Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



	Freq.	Detector Mode	Spectrum	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP/AV	Reading Level dBµV	dB	rა dBµV/m	dBµV/m	dB
	2389.500	Average	41.19	-7.87	33.32	54.00	-20.68
	2389.500	Peak	58.73	-7.87	50.85	74.00	-23.15
	2390.000	Average	41.07	-7.89	33.18	54.00	-20.82
	2390.000	Peak	57.30	-7.89	49.41	74.00	-24.59

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Page: 37 of 63

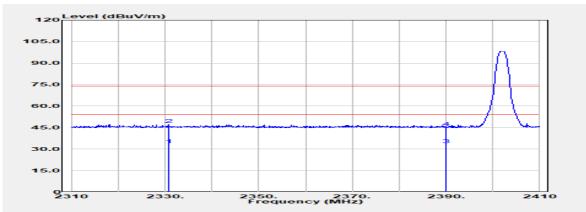
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-30

Test Frequency :2402 MHz Temp./Humi. :22.3/64

Antenna Pol. :Horizontal Test Mode :BE CH LOW

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
•	Mode	Reading Level		FS	@3m	9
		•		_	_	
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
		•		•	•	
2330.700	Average	40.86	-7.63	33.23	54.00	-20.77
2330.700	Peak	54.96	-7.63	47.32	74.00	-26.68
2390.000	Average	40.92	-7.89	33.03	54.00	-20.97
2390.000	Peak	52.89	-7.89	45.01	74.00	-28.99
	· Jun	JUU		10.01	, 1.00	_0.00

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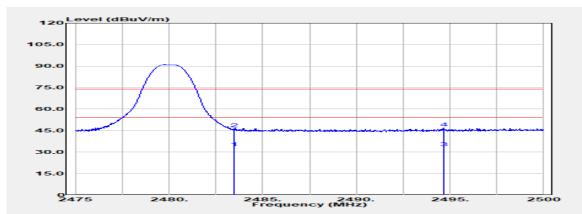
Page: 38 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-30

Test Frequency :2480 MHz Temp./Humi. :22.3/64 Test Mode :BE CH HIGH Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



Frea.	Detector	Spectrum	Factor	Actual	Limit	Margin
		•				
		•		. •	_	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
		•			•	
2483.500	Average	41.25	-8.15	33.10	54.00	-20.90
2483 500	Peak	54 38	-8 15	46 23	74 00	-27.77
2494.650	Average	40.90	-7.89	33.01	54.00	-20.99
2494 650	Peak	54 90	-7 89	47 01	74 00	-26.99
	Freq.  MHz  2483.500 2483.500 2494.650 2494.650	Mode PK/QP/AV 2483.500 Average 2483.500 Peak 2494.650 Average	Mode PK/QP/AVReading Level dBμV2483.500Average 41.252483.500Peak 54.382494.650Average 40.90	Mode PK/QP/AV         Reading Level dBμV         dB           2483.500         Average Av	Mode PK/QP/AVReading Level dBμVFS dBμV/m2483.500Average A1.25-8.1533.102483.500Peak 54.38-8.1546.232494.650Average 40.90-7.8933.01	Mode PK/QP/AVReading Level dBμVFS dBμV/m@3m dBμV/m2483.500Average Average Avera

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Page: 39 of 63

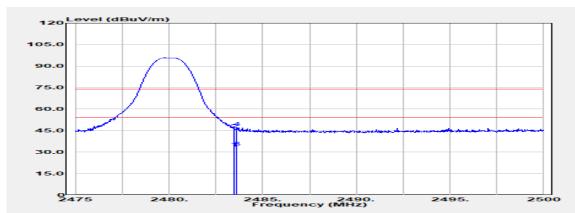
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-30

Test Frequency :2480 MHz Temp./Humi. :22.3/64

Test Mode :BE CH HIGH Antenna Pol. :Horizontal

EUT Pol :H Plane Engineer :Andy Wang



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
•	Mode	•		FS	@3m	J
N 41 1—		•	٩D	_	_	٩D
IVIHZ	PK/QP/AV	αΒμν	aB	aBµv/m	aBµv/m	dB
0.400 500	Δ.	40.04	0.45	00.70	54.00	04.00
2483.500	Average	40.94	-8.15	32.78	54.00	-21.22
2483.500	Peak	53.87	-8.15	45.72	74.00	-28.28
	Averege		0 15			-20.75
2403.023	Average	41.40	-0.13	33.23	54.00	-20.75
2483.625	Peak	55.22	-8.15	47.07	74.00	-26.93
	Freq.  MHz  2483.500 2483.500 2483.625 2483.625	MHz Mode PK/QP/AV 2483.500 Average 2483.500 Peak 2483.625 Average	Mode PK/QP/AV Reading Level dBμV  2483.500 Average 40.94 2483.500 Peak 53.87 2483.625 Average 41.40	MHzMode PK/QP/AVReading Level dBμVdB2483.500Average A0.94-8.152483.500Peak 53.87-8.152483.625Average 41.40-8.15	MHzMode PK/QP/AVReading Level dBμVFS dBμV/m2483.500Average A0.94-8.1532.782483.500Peak 53.87-8.1545.722483.625Average A1.40-8.1533.25	MHzMode PK/QP/AVReading Level dBμVFS dBμV/m@3m dBμV/m2483.500Average Average A

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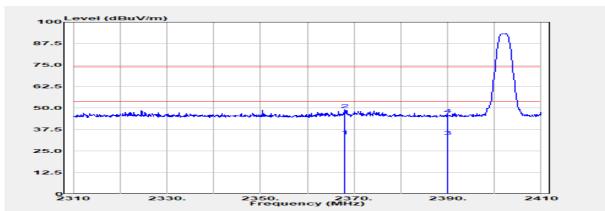
Page: 40 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-30

Test Frequency :2402 MHz Temp./Humi. :22.3/64 Test Mode :BE CH LOW Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Jack Tseng



requestey (min2)							
	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
	MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
	2368.000	Average	41.39	-7.66	33.73	54.00	-20.27
	2368.000	Peak	56.89	-7.66	49.23	74.00	-24.77
	2390.000	Average	41.55	-7.89	33.66	54.00	-20.34
	2390.000	Peak	54.36	-7.89	46.48	74.00	-27.52

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Page: 41 of 63

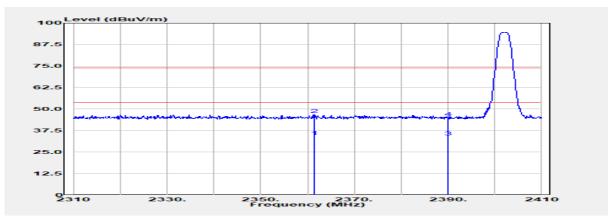
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 2M Test Date :2021-07-30

Temp./Humi. :22.3/64 Test Frequency :2402 MHz

Test Mode :BE CH LOW Antenna Pol. :Horizontal

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
2361.400	Average	41.81	-7.83	33.98	54.00	-20.02
2361.400	Peak	54.73	-7.83	46.91	74.00	-27.09
2390.000	Average	41.65	-7.89	33.76	54.00	-20.24
2390.000	Peak	53.04	-7.89	45.15	74.00	-28.85

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Page: 42 of 63

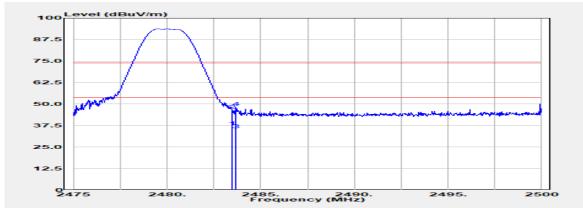
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-30

Temp./Humi. :22.3/64 Test Frequency :2480 MHz

Test Mode :BE CH HIGH Antenna Pol. :Horizontal

**EUT Pol** :H Plane :Jack Tseng 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	44.96	-8.15	36.81	54.00	-17.19
2483.500	Peak	54.53	-8.15	46.37	74.00	-27.63
2483.700	Average	43.14	-8.15	34.99	54.00	-19.01
2483.700	Peak	56.16	-8.15	48.01	74.00	-25.99

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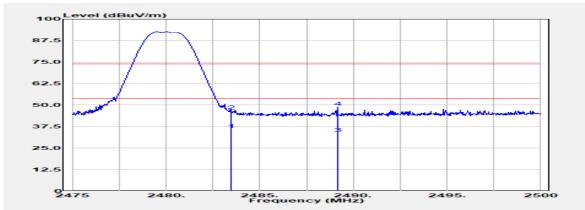
Page: 43 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-30

Temp./Humi. :22.3/64 Test Frequency :2480 MHz Test Mode :BE CH HIGH Antenna Pol. :Vertical

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBµV/m	dBµV/m	dB
2483.500	Average	43.99	-8.15	35.83	54.00	-18.17
2483.500	Peak	54.78	-8.15	46.63	74.00	-27.37
2489.150	Average	41.74	-8.17	33.57	54.00	-20.43
2489.150	Peak	57.05	-8.17	48.88	74.00	-25.12

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Page: 44 of 63

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

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-26

Test Frequency :2442 MHz Temp./Humi. :22.1/67 Test Mode :TX CH MID Antenna Pol. :Vertical

**EUT Pol** :H Plane :Andy Wang Engineer



Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
PK/QP/AV	dΒμ̈V	dB	dBμV/m	dBµV/m	dB
Peak	49.02	-22.38	26.64	43.50	-16.86
Peak	32.98	-16.86	16.11	43.50	-27.39
Peak	31.93	-13.88	18.05	46.00	-27.95
Peak	32.66	-9.08	23.59	46.00	-22.41
Peak	34.62	-6.67	27.94	46.00	-18.06
Peak	33.89	-4.04	29.86	54.00	-24.14
	Mode PK/QP/AV Peak Peak Peak Peak Peak	Mode PK/QP/AV Reading Level dBµV  Peak 49.02 Peak 32.98 Peak 31.93 Peak 32.66 Peak 34.62	Mode PK/QP/AV         Reading Level dBμV         dB           Peak         49.02         -22.38           Peak         32.98         -16.86           Peak         31.93         -13.88           Peak         32.66         -9.08           Peak         34.62         -6.67	Mode PK/QP/AVReading Level dBμVFS dBμV/mPeak49.02-22.3826.64Peak32.98-16.8616.11Peak31.93-13.8818.05Peak32.66-9.0823.59Peak34.62-6.6727.94	Mode PK/QP/AV         Reading Level dBμV         FS dBμV/m         @3m dBμV/m           Peak         49.02         -22.38         26.64         43.50           Peak         32.98         -16.86         16.11         43.50           Peak         31.93         -13.88         18.05         46.00           Peak         32.66         -9.08         23.59         46.00           Peak         34.62         -6.67         27.94         46.00

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Page: 45 of 63

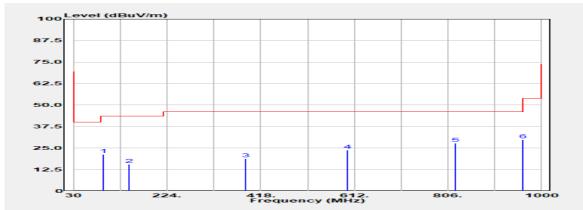
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-26

Temp./Humi. :22.1/67 Test Frequency :2442 MHz

Antenna Pol. :Horizontal Test Mode :TX CH MID

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV/m	dBµV/m	dB
92.080	Peak	44.57	-23.16	21.40	43.50	-22.10
146.400	Peak	32.51	-16.91	15.60	43.50	-27.90
386.960	Peak	32.93	-14.08	18.85	46.00	-27.15
598.420	Peak	32.77	-8.93	23.84	46.00	-22.16
820.550	Peak	34.51	-6.72	27.79	46.00	-18.21
962.170	Peak	34.59	-4.85	29.75	54.00	-24.25

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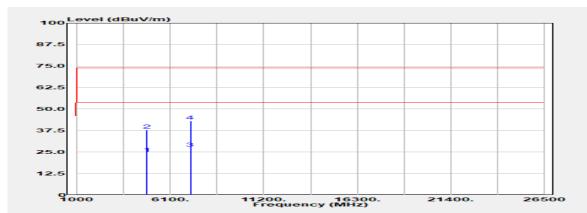
Page: 46 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2402 MHz Temp./Humi. :21.9/63 Test Mode :TX CH LOW Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	N 41 1—	Mode	Reading Level	٩D	FS	@3m	٩D
_	MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
	4804.000	Average	27.43	-3.04	24.39	54.00	-29.61
	4804.000	Peak	40.78	-3.04	37.74	74.00	-36.26
	7206.000	Average	24.33	2.98	27.31	54.00	-26.69
	7206.000	Peak	40.05	2.98	43.03	74.00	-30.97

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Page: 47 of 63

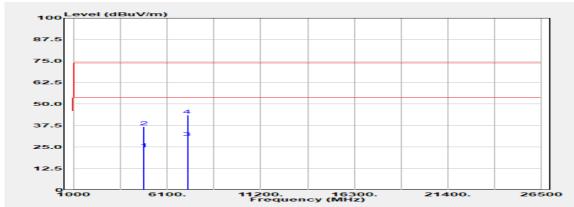
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2402 MHz Temp./Humi. :21.9/63

Test Mode :TX CH LOW Antenna Pol. :Horizontal

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.000	Average	27.20	-3.04	24.15	54.00	-29.85
4804.000	Peak	39.92	-3.04	36.88	74.00	-37.12
7206.000	Average	27.65	2.98	30.63	54.00	-23.37
7206.000	Peak	40.66	2.98	43.64	74.00	-30.36
	MHz 4804.000 4804.000 7206.000	Mode PK/QP/AV 4804.000 Average 4804.000 Peak 7206.000 Average	Mode Reading Level dBμV  4804.000 Average 27.20 4804.000 Peak 39.92 7206.000 Average 27.65	Mode PK/QP/AV         Reading Level dBμV         dB           4804.000         Average Av	MHz         Mode PK/QP/AV         Reading Level dBμV         FS dBμV/m           4804.000         Average Averag	MHz         Mode PK/QP/AV         Reading Level dBμV         FS dBμV/m         @3m dBμV/m           4804.000         Average Av

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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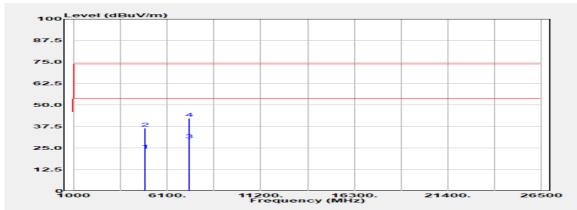
Page: 48 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2442 MHz Temp./Humi. :21.9/63 Test Mode :TX CH MID Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
4884.000	Average	26.93	-3.20	23.73	54.00	-30.27
4884.000	Peak	39.81	-3.20	36.60	74.00	-37.40
7326.000	Average	26.54	3.24	29.78	54.00	-24.22
7326.000	Peak	39.19	3.24	42.43	74.00	-31.57

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Page: 49 of 63

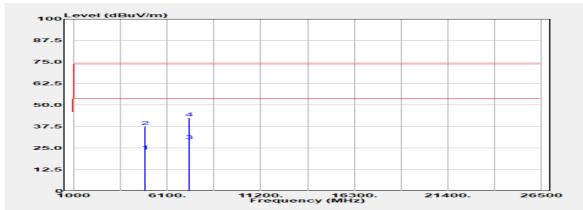
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2442 MHz Temp./Humi. :21.9/63

Test Mode :TX CH MID Antenna Pol. :Horizontal

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
4884.000	Average	26.54	-3.20	23.33	54.00	-30.67
4884.000	Peak	40.84	-3.20	37.64	74.00	-36.36
7326.000	Average	25.97	3.24	29.21	54.00	-24.79
7326.000	Peak	39.30	3.24	42.54	74.00	-31.46

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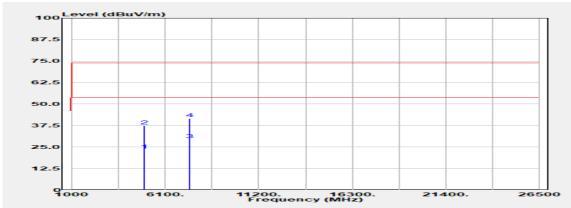
Page: 50 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2480 MHz Temp./Humi. :21.9/63 Test Mode :TX CH HIGH Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



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	26.31	-2.87	23.43	54.00	-30.57
4960.000	Peak	40.24	-2.87	37.36	74.00	-36.64
7440.000	Average	25.43	3.85	29.28	54.00	-24.72
7440.000	Peak	37.82	3.85	41.67	74.00	-32.33

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Page: 51 of 63

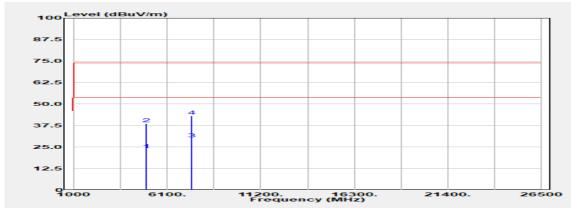
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 1M Test Date :2021-07-31

Test Frequency :2480 MHz Temp./Humi. :21.9/63

Test Mode :TX CH HIGH Antenna Pol. :Horizontal

**EUT Pol** :H Plane Engineer :Andy Wang



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	26.39	-2.87	23.51	54.00	-30.49
4960.000	Peak	41.55	-2.87	38.67	74.00	-35.33
7440.000	Average	25.89	3.85	29.74	54.00	-24.26
7440.000	Peak	39.14	3.85	42.99	74.00	-31.01

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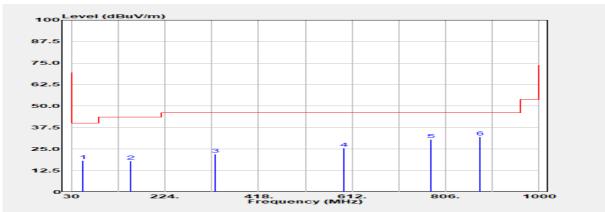
Page: 52 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-26

Test Frequency :2442 MHz Temp./Humi. :22.1/67 Test Mode :TX CH MID Antenna Pol. :Vertical

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBμV	dB	dBµV/m	dBμV/m	dB
53.280	Peak	35.88	-17.64	18.24	40.00	-21.76
153.190	Peak	34.98	-16.86	18.11	43.50	-25.39
328.760	Peak	37.28	-15.29	22.00	46.00	-24.00
595.510	Peak	34.66	-9.08	25.59	46.00	-20.41
775.930	Peak	37.41	-6.72	30.68	46.00	-15.32
877.780	Peak	38.36	-6.36	32.00	46.00	-14.00

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Page: 53 of 63

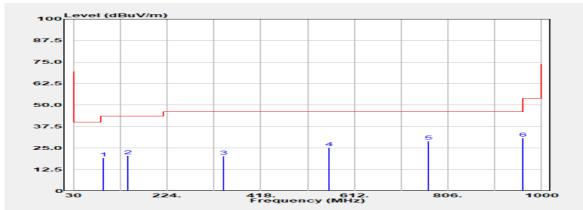
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-26

Temp./Humi. :22.1/67 Test Frequency :2442 MHz

Test Mode :TX CH MID Antenna Pol. :Horizontal

**EUT Pol** :H Plane Engineer :Andy Wang



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
92.080	Peak	42.57	-23.16	19.40	43.50	-24.10
143.490	Peak	37.38	-16.86	20.51	43.50	-22.99
341.370	Peak	35.53	-15.30	20.23	46.00	-25.77
560.590	Peak	36.00	-10.64	25.36	46.00	-20.64
766.230	Peak	35.69	-6.62	29.07	46.00	-16.93
962.170	Peak	35.59	-4.85	30.75	54.00	-23.25

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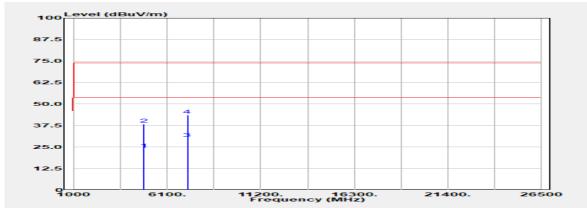
Page: 54 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2402 MHz Antenna Pol. :Vertical Test Mode :TX CH LOW

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
'	Mode	Reading Level		FS	@3m	J
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
4804.000	Average	26.89	-3.04	23.85	54.00	-30.15
4804.000	Peak	41.37	-3.04	38.33	74.00	-35.67
7206.000	Average	27.20	2.98	30.18	54.00	-23.82
7206.000	Peak	40.67	2.98	43.66	74.00	-30.34

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Page: 55 of 63

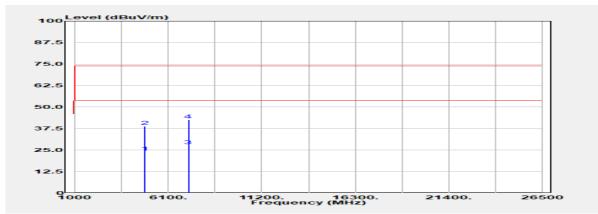
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2402 MHz

Test Mode :TX CH LOW Antenna Pol. :Horizontal

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
						_
4804.000	Average	26.89	-3.04	23.85	54.00	-30.15
4804.000	Peak	41.98	-3.04	38.94	74.00	-35.06
7206.000	Average	24.55	2.98	27.53	54.00	-26.47
7206.000	Peak	39.61	2.98	42.60	74.00	-31.40

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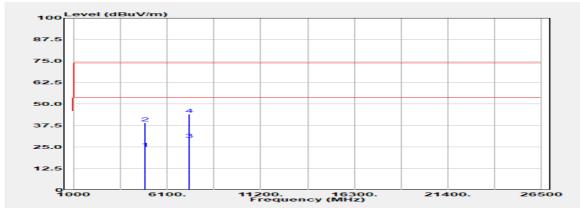
Page: 56 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2442 MHz Test Mode :TX CH MID Antenna Pol. :Vertical

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	_
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
		•		•	•	
4884.000	Average	27.50	-3.20	24.30	54.00	-29.70
4004.000	Average	27.50	-3.20	24.50	34.00	-23.70
4884.000	Peak	42.23	-3.20	39.02	74.00	-34.98
7326.000	Average	26.43	3.24	29.67	54.00	-24.33
7326.000	Peak	40.89	3.24	44.13	74.00	-29.87

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Page: 57 of 63

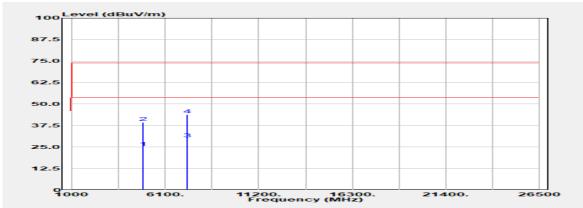
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode :BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2442 MHz

Test Mode :TX CH MID Antenna Pol. :Horizontal

**EUT Pol** :H Plane :Jack Tseng Engineer



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4884.000	Average	28.10	-3.20	24.90	54.00	-29.10
4884.000	Peak	42.62	-3.20	39.42	74.00	-34.58
7326.000	Average	26.56	3.24	29.80	54.00	-24.20
7326.000	Peak	40.56	3.24	43.80	74.00	-30.20

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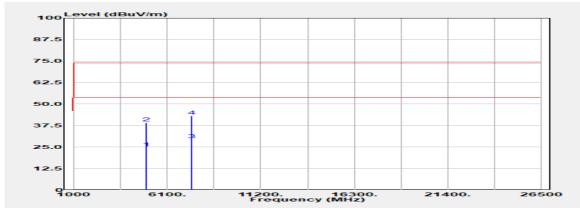
Page: 58 of 63

Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2480 MHz Test Mode :TX CH HIGH Antenna Pol. :Vertical

**EUT Pol** :H Plane :Jack Tseng Engineer



_	D	<b>2</b> 1		A	1	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
N 41 I—		•	٩D	_	_	٩D
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBµV/m	dB
1000 000		07.40	0.07	04.55	<b>5</b> 400	00.45
4960.000	Average	27.42	-2.87	24.55	54.00	-29.45
4960.000	Peak	41.94	-2.87	39.07	74.00	-34.93
		=	_			
7440.000	Average	25.46	3.85	29.31	54.00	-24.69
7440.000	Peak	39.22	3.85	43.07	74.00	-30.93
1 1 10.000	i ouit	00. <u>L</u> L	0.00	10.01	1 1.00	00.00

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Page: 59 of 63

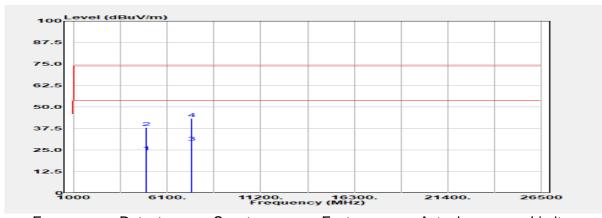
Report Number :E2/2021/70074 Test Site :SAC D

Operation Mode: BLE 2M Test Date :2021-07-31

Temp./Humi. :21.9/63 Test Frequency :2480 MHz

Test Mode :TX CH HIGH Antenna Pol. :Horizontal

**EUT Pol** :H Plane :Jack Tseng Engineer



	Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	·	Mode	Reading Level		FS	@3m	J
	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
-	1411 12	11001710	αυμν	<u> </u>	аБр 17111	αΒμν/ιιι	
	4960.000	Average	26.87	-2.87	24.00	54.00	-30.00
	4960.000	Peak	40.90	-2.87	38.03	74.00	-35.97
	7440.000	Average	25.85	3.85	29.70	54.00	-24.30
		•					
	7440.000	Peak	39.45	3.85	43.30	74.00	-30.70

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Page: 60 of 63

### 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:

	Conduct	ed Emission Test Si	ite: Conducted	l G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022				
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021				
DC Block	PASTERNACK	PE8210	RF151	11/19/2020	11/18/2021				
Coaxial Ca- bles	Woken	00100A1F2A196C	RF59	11/19/2020	11/18/2021				
Coaxial Ca- bles	Woken	00100A1F2A196C	RF68	11/19/2020	11/18/2021				
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N/A	N/A				

### 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.
- Use the peak marker function to determine the maximum amplitude level.

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Page: 61 of 63

### 11.5 Measurement Result:

### BLE 1M:

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-13.431	8	PASS
2442	-13.505	8	PASS
2480	-13.780	8	PASS

NOTE: cable loss as 10.9dB that offsets in the spectrum

# BLE 2M:

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result	
2402	-17.023	8	PASS	
2442	-17.160	8	PASS	
2480	-17.303	8	PASS	

NOTE: cable loss as 10.9dB that offsets in the spectrum

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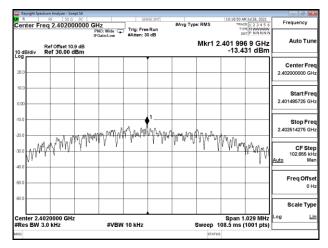
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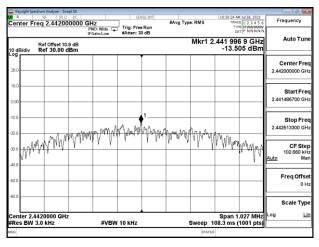


Page: 62 of 63

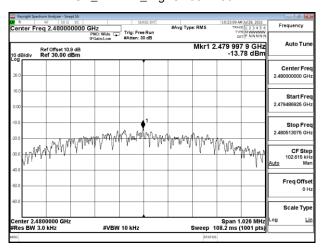
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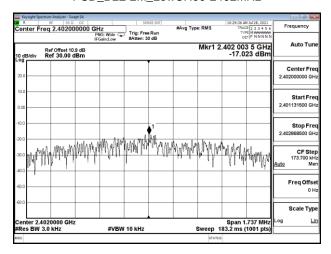
### PSD\_BLE 1M\_MidCH20-2442MHz



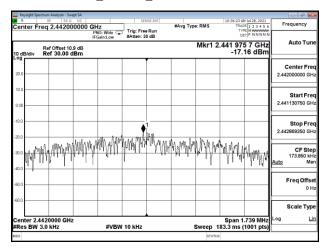
PSD\_BLE 1M\_HighCH39-2480MHz



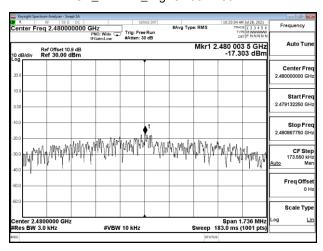
#### PSD\_BLE 2M\_LowCH00-2402MHz



PSD\_BLE 2M\_MidCH20-2442MHz



PSD\_BLE 2M\_HighCH39-2480MHz



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. 除非另有說明,此報告結果僅對測試之樣品負責,同時此樣品僅保留90天。本報告未經本公司書面許可,不可部份複製

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Page: 63 of 63

# 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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