

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Product Name:	Quanta Computer Inc. No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City 33377, Taiwan Clover Station Solo
Brand Name:	clover
Model No.:	C501
Model Difference:	N/A
Report Number:	E2/2021/10083
FCC ID	HFS-C501
FCC Rule Part:	§15.247, Cat: DTS
Issue Date:	Feb. 24, 2021
Date of Test:	Jan. 12, 2021 ~ Feb. 02, 2021
Date of EUT Received:	Jan. 12, 2021

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 tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Approved By:

Jim Chang / Manager



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Revision History						
Report Number Revision Description Issue Date Revised By						
E2/2021/10083	Rev.00	Original.	Feb. 24, 2021	Yuri Tsai		

Note:

1 · Disclaimer

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

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GENERAL INFORMATION

1.1 **Product Description**

Product Name:	Clover Station Solo
Brand Name:	clover
Model No.:	C501
Model Difference:	N/A
Hardware Version:	N/A
Software Version:	N/A
EUT Series No.:	C051UQ04920016
Power Supply:	24Vdc from AC/DC Adapter

Radio Technology:	Bluetooth LE Single mode
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	BLE 1M: 1.22 dBm BLE 2M: 1.42 dBm

1.2 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak An- tenna Gain (dBi)	Worst Antenna Gain
PCB	Quanta	BT antenna	2402-2480	1.27	V



1.3 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

1.4 Test Facility

Laboratory		Test Site Address	FCC Designa-
Laboratory		Test Sile Address	tion number
		No.134, Wu Kung Road, New Taipei In-	
SGS Taiwan Ltd.		dustrial Park, Wuku District, New Taipei	TW0027
Central RF Lab.		City, Taiwan.	
(TAF code 3702)		No.2, Keji 1st Rd., Guishan District,	T\4/0029
	\boxtimes	Taoyuan City, Taiwan 333	TW0028

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

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

2.3.2 Conducted Test (RF)

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

2.3.3 Radiated Emissions

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

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2.4 Measurement Results Explanation Example

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

Radiated emission below 30MHz is measured in a 9m*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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2.5 Configuration of Tested System

Fig. 2-1 Conducted (Antenna Port) Emission Configuration



Fig 2-2 Radiated Emission



Fig 2-3 Conduction (AC Power Line) Radiated Emission



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
1	Bluetooth Test Software	N/A	N/A	N/A

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SUMMARY OF TEST RESULTS 3

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	Emission Bandwidth	Compliant
§15.247(d) §15.205 §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



DESCRIPTION OF TEST MODES

Operated in 2400 ~ 2483.5MHz Band 4.1

40 channels are provided for Bluetooth LE

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		



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. Investigation has been done on all the possible configurations for searching the worst case.

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz) MODULATION		DATA RATE (Mbps)		
RADIATED EMISSION TEST (BELOW 1 GHz)						
Bluetooth LE	2402 to 2480	2442	GFSK	1		
Bluetooth LE	2402 to 2480	2442	GFSK	2		
	RADIATED EMISSION TEST (ABOVE 1 GHz)					
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	1		
Bluetooth LE	2402 to 2480	2402, 2442, 2480	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 Bluetooth LE Transmitter for channel Low, Mid and High, the worst case H position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT						
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)		
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	1		
Bluetooth LE	2402 to 2480	2402, 2442, 2480	GFSK	2		

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Peak Output Power	+/- 1 dB
6dB Bandwidth	+/- 1.54 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.69 dB
Peak Power Density	+/- 1.54 dB
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 1%

Radiated Spurious Emission Measurement Uncertainty								
	+/-	2.64	dB	9kHz~30MHz: +-2.3dB				
Polarization: Vertical	+/-	4.93	dB	30MHz - 1000MHz: +/- 3.37dB				
Polarization. Vertical	+/-	4.81	dB	1GHz - 18GHz: +/- 4.04dB				
	+/-	4.52	dB	18GHz - 40GHz: +/- 4.04dB				
	+/-	2.64	dB	9kHz~30MHz: +-2.3dB				
Polarization: Horizontal	+/-	4.45	dB	30MHz - 1000MHz: +/- 4.22dB				
	+/-	4.81	dB	1GHz - 18GHz: +/- 4.08dB				
	+/-	4.52	dB	18GHz - 40GHz: +/- 4.08dB				

Note:

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

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

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

Frequency range	Limits dB(µV)						
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

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

6.2 Measurement Equipment Used:

Conducted Emission Test Site										
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.					
TYPE		NUMBER	NUMBER	CAL.						
			Ver.							
Test Software	audix	e3	6.11-20180	N.C.R	N.C.R					
			419c							
	SCHWARZBECK	NSLK8127	074	03/25/2020	02/24/2024					
LISN	Mess-Elektronik	NOLKO 121	974	03/25/2020	03/24/2021					
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021					
Capyial Cable	FOLah	RF-HY-CAB-25	RF-HY-CA	03/27/2020	02/26/2024					
Coaxial Cable	EC Lab	0	B-250-01	03/21/2020	03/20/2021					
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2020	03/26/2021					

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

6.3 EUT Setup:

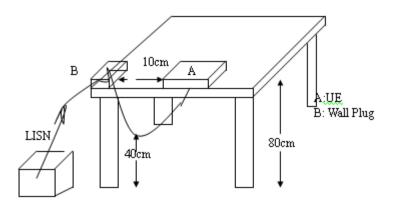
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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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 plan.
- 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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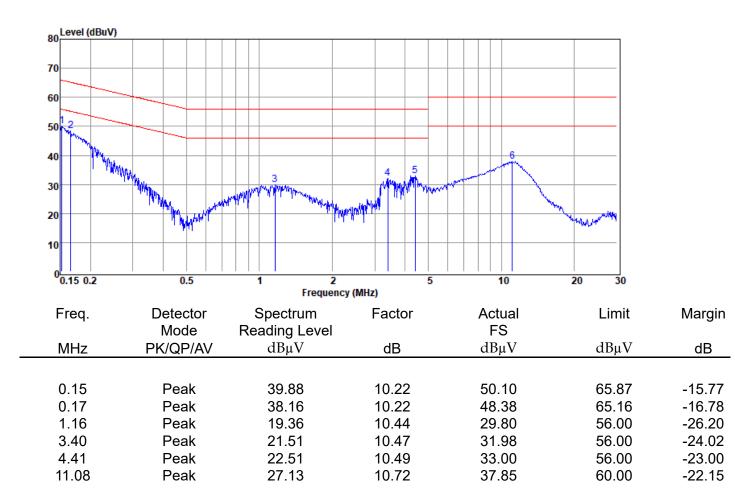
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2021/10083
Test Mode	:BLE 1M
Power	:120V/60Hz
Probe	:L1
Note:	: Adapter:FSP120-AABN3

Test Site :Conduction Room C Test Date :2021-01-28 Temp./Humi. :21.4/61 Engineer :Ashton Chiu



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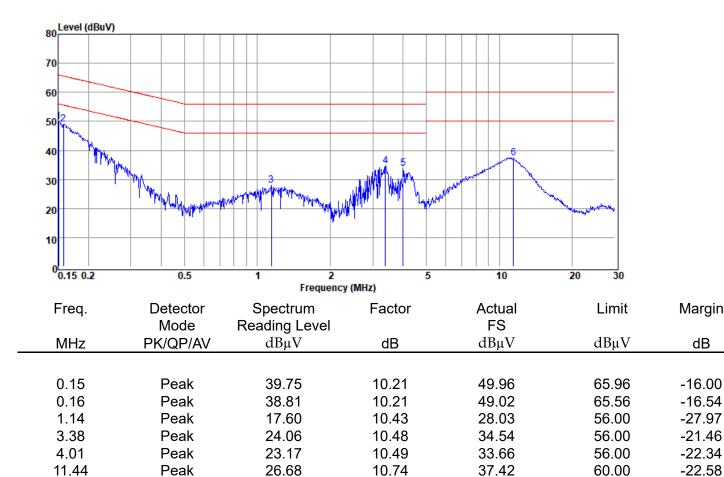
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Report Number	:E2/2021/10083	Test Site	:Conduction Room
Test Mode	:BLE 1M	Test Date	:2021-01-28
Power	:120V/60Hz	Temp./Humi.	:21.4/61
Probe	:N	Engineer	:Ashton Chiu
Note:	: Adapter:FSP120-AABN3		



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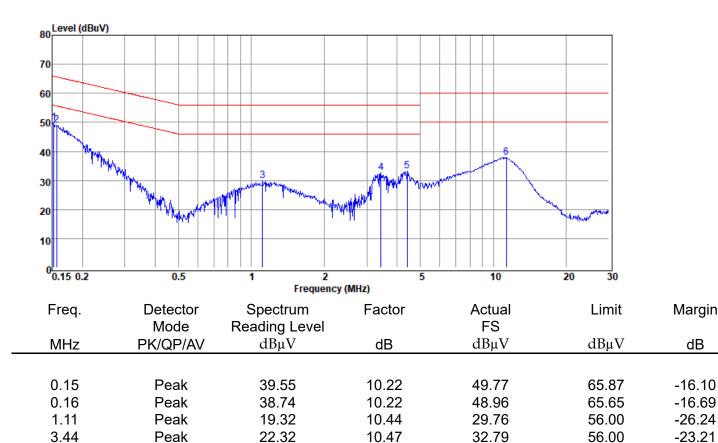
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Report Number	:E2/2021/10083	Test Site	:Conduction Room
Test Mode	:BLE 2M	Test Date	:2021-01-28
Power	:120V/60Hz	Temp./Humi.	:21.0/60
Probe	:L1	Engineer	:Ashton Chiu
Note:	: Adapter:FSP120-AABN3		



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Peak

Peak

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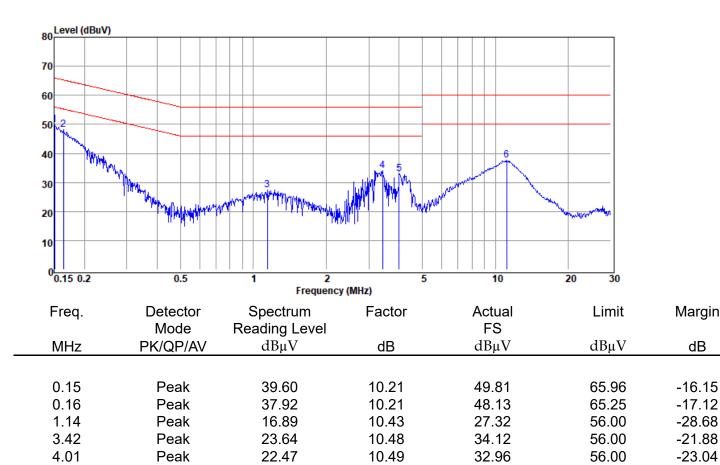
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Report Number	:E2/2021/10083	Test Site	:Conduction Room C
Test Mode	:BLE 2M	Test Date	:2021-01-28
Power	:120V/60Hz	Temp./Humi.	:21.0/60
Probe	:N	Engineer	:Ashton Chiu
Note:	: Adapter:FSP120-AABN3		



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26.96

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10.73

37.69

60.00

-22.31

Peak

11.14

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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.

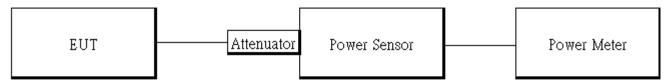
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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									
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.				
TYPE		NUMBER	NUMBER	CAL.					
EXA Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	02/20/2020	02/19/2021				
Power Sensor	Anritsu	MA2411B	1339378	07/23/2020	07/22/2021				
Power Sensor	Anritsu	MA2411B	1339379	07/23/2020	07/22/2021				
Power Meter	Anritsu	ML2496A	1804002	04/06/2020	04/05/2021				
Attenuator	Marvelous	MVE2213-10	RF12	11/19/2020	11/18/2021				
Attenuator	Marvelous	MVE2213-10	RF13	11/19/2020	11/18/2021				
DC Block	PASTERNACK	PE8210	RF151	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 port to the power meter.
- 4. Record the max. Reading as observed from Power Meter.
- 5. Repeat above procedures until all test default channel measured was complete.

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7.5 Duty Factor:

BLE 1M

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)	
BLE	62.00	2.08	2.56	3.00	

	ight Spe		Analyzer														
Cente	er Fr	eq		50 Ω 200	DC 000					SENSE:IN		Avg Type	e: Voltage		PM Feb 02, 2021 ACE 1 2 3 4 5 6 YPE WWWWWWW	L	requency
10 dB/	/div		Offse				NO: Fast Gain:Lov		#Atten:					ΔMkr3	^{625.0} µs -0.02 dB		Auto Tune
Log -			< <mark>.</mark>	\Diamond	∆ <u>2</u> 3	8∆4 —											Center Freq 42000000 GHz
-20.0 - -30.0 -							Platel		0.4 cm 10		Lyng Miles Rel		414			2.44	Start Fred 42000000 GH2
-50.0 -60.0 -70.0		nhunghi			PART.				herry		Pathone		M124			2.44	Stop Fred 42000000 GH;
Cente Res E	3W 8	MH	z	0 G	Hz ×		#\	вw	8.0 MH	Iz	FUNC		Sweep	5.000 ms	Span 0 Hz (1001 pts)	<u>Auto</u>	CF Stej 8.000000 MH Ma
1 Δ 2 F 3 Δ 4 F 5 6	F 1	t t t	(Δ) (Δ)			51 62	0.0 µs 5.0 µs 5.0 µs 5.0 µs		0.38	07 dB dBm 2 dB dBm							Freq Offse 0 H
7 8 9 10																Log	Scale Type
11 ∢															-		
MSG													STA	TUS			



BLE 2M

	Duty Cycle (%)	Duty Factor (dB)	1/T (kHz)	VBW setting (kHz)	
BLE 2M	33.00	4.81	4.88	5.00	

	Spectrum		er - Swep	ot SA																
Center	Freq		50 Ω	DC 0000	GHz	z			SENSE		A	vg Typ	e: Vol	tage		TRACE	Feb 02, 2 1 2 3 4	5 6	F	requency
10 dB/div			et 11.4			D: Fast ain:Low			Free R n: 20 d						ΔMkr	DE	25.0 j 0.01 c	us N		Auto Tune
Log 10.0		ו	∧ ^{1∆2}		Δ4 -													_		Center Fred 42000000 GH:
-20.0	N							L. L. Ly Lucks							(hall where				2.4	Start Fred 42000000 GH:
-50.0 -60.0 -70.0	howenty	W	Mrand	n		ntration t		Ar Polynowsky	1991	(weiningen)	[Junto	(Juliona)		h	an a		handhaa		2.4	Stop Fred 42000000 GH;
Center Res BW	/ 8 MH	IZ	00 GI	Hz		#V	вw	8.0 M	Hz	FUN				ep (5.000 m	ıs (1	pan 0 001 p NVALUE		Auto	CF Step 8.000000 MH: Mar
1 Δ2 2 F 3 Δ4 4 F 5		<u>(</u> Δ)			565 625	.0 µs .0 µs .0 µs .0 µs		0.3	.14 dE 7 dBm .01 dB 7 dBm	1								Ξ		Freq Offse 0 H;
6 7 8 9 10																			Log	Scale Type
11																	•	-		<u></u>
MSG														STATU	s				c	



7.6 Output Power:

7.6.1 Peak & Avg

BLE 1M

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit
Low	2402	default	1.22	1 Watt = 30 dBm
Mid	2442	default	0.16	1 Watt = 30 dBm
High	2480	default	0.93	1 Watt = 30 dBm
СН	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
Low	2402	default	0.96	1 Watt = 30 dBm
Mid	2442	default	-0.22	1 Watt = 30 dBm
High	2480	default	0.68	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss 11.1 dB + Duty cycle factor has been offseted to the

BLE 2M

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit
0	2402	default	1.42	1 Watt = 30 dBm
20	2442	default	0.43	1 Watt = 30 dBm
39	2480	default	1.14	1 Watt = 30 dBm
BLE 2M	mode:			
CH Frequency (MHz)		Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
0	2402	default	0.99	1 Watt = 30 dBm
20	2442	default	-0.28	1 Watt = 30 dBm
39	2480	default	0.55	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss as 11.1 dB that offsets on the power meter in Peak



8 EMISSION BANDWIDTH MEASUREMENT

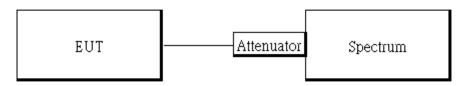
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

	Conducted Emission Test Site									
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.					
EXA Spectrum An- alyzer	KEYSIGHT	N9010A	MY5712029 0	02/20/2020	02/19/2021					
Attenuator	Marvelous	MVE2213-10	RF12	11/19/2020	11/18/2021					
DC Block	PASTERNACK	PE8210	RF155	11/19/2020	11/18/2021					
Coaxial Cables	Woken	00100A1F1A18 5C	RF84	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.
- 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.

5. Repeat above procedures until all test default channel is completed

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8.5 Measurement Result:

BLE 1M

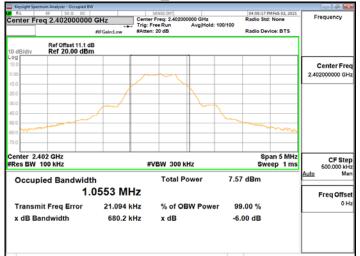
Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6802	> 0.5	PASS
2442	0.6847	> 0.5	PASS
2480	0.6826	> 0.5	PASS

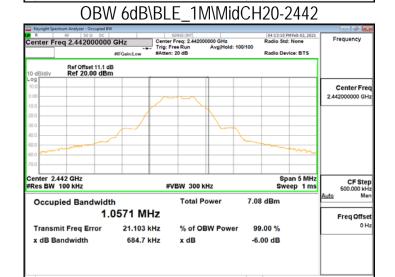
BLE 2M

Frequency (MHz)	6dB BW (MHz)	BW (MHz)	Result
2402	1.155	> 0.5	PASS
2442	1.159	> 0.5	PASS
2480	1.158	> 0.5	PASS



OBW 6dB\BLE 1M\LowCH00-2402

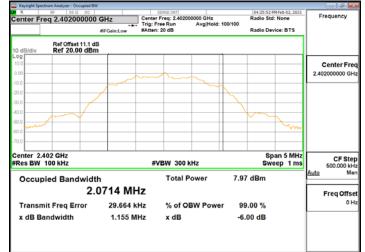




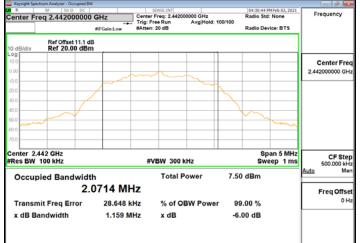
OBW 6dB\BLE_1M\HighCH39-2480

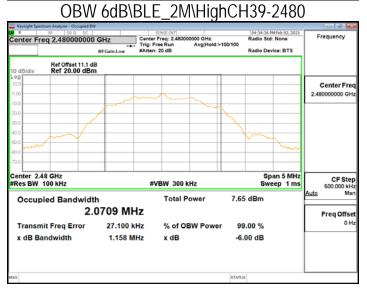


OBW 6dB\BLE 2M\LowCH00-2402



OBW 6dB\BLE_2M\MidCH20-2442





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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

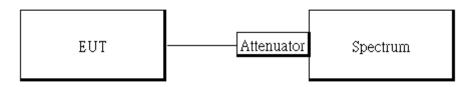
9.1 Standard Applicable

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).

9.2 Measurement Equipment Used:

	Conducted Emission Test Site									
EQUIPMENT TYPE	MFR	_		LAST CAL.	CAL DUE.					
		NUNDER	NUMBER							
EXA Spectrum An- alyzer	KEYSIGHT	N9010A	MY57120290	02/20/202 0	02/19/2021					
Attenuator	Marvelous	MVE2213-10	RF12	11/19/2020	11/18/2021					
DC Block	PASTERNACK	PE8210	RF155	11/19/2020	11/18/2021					
Coaxial Cables	Woken	00100A1F1A 185C	RF84	11/19/2020	11/18/2021					

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.
- 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.

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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 = 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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9.5 Measurement Result

BLE 1M

Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	0.76	-19.24
2442	0.27	-19.73
2480	0.45	-19.55

NOTE: cable loss as 11.1dB that offsets in the spectrum NOTE: Refer to next page for plots.

BLE 2M

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	0.76	-19.24
2442	0.27	-19.73
2480	0.44	-19.56

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

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ווא ינער אינער אינע



Reference Level\BLE_1M\LowCH00-2402



Reference Level\BLE_1M\MidCH20-2442



Reference Level\BLE_1M\HighCH39-2480

Keysight Spectrum Analyzer - Swept SA					
R R 50 Ω DC enter Freq 2.48000000	0 GHz PNO: Wide Trig:	SENSE:INT	Avg Type: Log-Pw	04:20:18 PM Feb 02, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P NNNNN	Frequency
Ref Offset 11.1 dB	IFGain:Low #Atte	n: 20 dB	Mkr1	2.480 022 5 GHz 0.45 dBm	A
1.0		1			Center Fre 2.480000000 G
0					Start Fr 2.479250000 G
					Stop Fr 2.480750000 G
					CF St 150.000 k Auto N
0					Freq Offs 0
0					Scale Ty
enter 2.4800000 GHz tes BW 100 kHz	#VBW 300 k	.Hz	Sweep	Span 1.500 MHz 1.000 ms (1001 pts)	Log <u>l</u>
a			STAT		

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Reference Level\BLE_2M\LowCH00-2402

R	cctrum Analyzer - Swept SA N ^f 50 Ω DC req 2.402000000	GHz	SENSE:INT	Avg Type: Log-Pwr	04:26:24 PM Feb 02, 2021 TRACE 1 2 3 4 5 6 TVPE MWWWWW	Frequency
10 dB/div	Ref Offset 11.1 dB Ref 20.00 dBm		Atten: 20 dB	Mkr1 2	2.402 024 0 GHz 0.76 dBm	Auto Tur
10.0			1			Center Fre 2.402000000 GH
0.00						Start Fr 2.401250000 G
20.0						Stop Fr 2.402750000 G
10.0						CF St 150.000 k Auto M
50.0						Freq Offs 0
70.0						Scale Ty
Center 2.4 Res BW	4020000 GHz 100 kHz	#VBW 30	0 kHz	Sweep	Span 1.500 MHz 1.000 ms (1001 pts)	Log <u>l</u>

Reference Level\BLE_2M\MidCH20-2442



Reference Level\BLE_2M\HighCH39-2480

	um Analyzer - Swept SA					
R	RF 50 Ω DC		SENSE:INT	Avg Type: Log-Pwr	04:35:08 PM Feb 02, 2021 TRACE 1 2 3 4 5 6	Frequency
Center Fre	q 2.48000000	PNO: Wide	Trig: Free Run	Avg Type: Log-Pwr	TYPE NWWWWWW DET P NNNNN	,
		IFGain:Low	#Atten: 20 dB			
	Ref Offset 11.1 dB Ref 20.00 dBm			Mkr1 2	.480 025 5 GHz 0.44 dBm	Auto Tune
10.0			ľ			Center Freq 2,48000000 GHz
			♦ ¹			2.48000000 GH2
0.00						Start Freq 2.479250000 GHz
-10.0						2.47520000 0H2
-20.0						Stop Freq 2.480750000 GHz
-30.0						
-40.0						CF Step 150.000 kHz
-50.0						<u>Auto</u> Man
60.0						Freq Offse
						0 H3
-70.0						Scale Type
Center 2.48	00000 GHz	#VBW	300 kHz	Sween 1	Span 1.500 MHz .000 ms (1001 pts)	Log <u>Lir</u>
ASG		"•• D•••		STATUS		
ora.				STATUS		

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Band Edge\BLE_1M\LowCH00-2402

Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω DC Center Freq 2.36000000	0 GHz PNO: Fast - Trig: Fr		04:08:04 PM Feb 02, 2021 : Log-Pwr TRACE 1 2 3 4 5 TYPE MWWWWW DET P N N N N	6 Frequency
Ref Offset 11.1 dB	IFGain:Low #Atten:	20 dB	Mkr2 2.400 0 GHz -52.34 dBm	Auto Tun
00 10.0 10.0			Q ¹	Center Fre 2.36000000 GH
20.0			De1 -19 24 dBn	Start Fre 2.310000000 GH
50.0 60.0	and a state of the	-14164444444444444444444444444444444444		Stop Fre 2.41000000 GH
enter 2.36000 GHz Res BW 100 kHz	#VBW 300 kH	iz s	Span 100.0 MH weep 9.600 ms (1001 pts	10.000000 MH
	2.402 0 GHz (Δ) 0.86 2.400 0 GHz -52.34		CTION WOTH FUNCTION VALUE	Auto Ma
6 7 8 9				Scale Typ
10				Log Li
sg			STATUS	

Band Edge\BLE_1M\HighCH39-2480

Keysight Spectrum Analyzer - Swept SA					
Center Freq 2.487500000	GHz	SENSE:INT	Avg Type: Log-Pwr	04:21:34 PM Feb 02, 2021 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 11.1 dB 10 dB/div Ref 20.00 dBm	PNO: Fast IFGain:Low	Trig: Free Run #Atten: 20 dB	Mkr3	2.498 200 GHz -58.10 dBm	Auto Tune
10.0 0.00 -10.0					Center Freq 2.487500000 GHz
-20.0				DL 1 -19 55 dBm	Start Free 2.475000000 GH2
-50.0 -60.0 -70.0	a la company	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1, 10 ¹² 17, 11. 19. 19. 19. 19. 19. 19. 19. 19. 19.	3	Stop Free 2.500000000 GH
Center 2.48750 GHz #Res BW 100 kHz	#VBW	300 kHz	Sweep 2	Span 25.00 MHz 2.400 ms (1001 pts)	CF Step 2.500000 MHz Auto Man
1 N 1 f (Δ) 2.48 2 N 1 f 2.48	0 025 GHz (Δ) 3 500 GHz 8 200 GHz (Δ)	0.62 dBm -60.46 dBm -58.10 dBm		5 CALCULA 11-COL	Freq Offsel 0 Hz
8 9 10					Scale Type
41 « MSG		н	STATU	s , *	

Report No.: E2/2021/10083 Page: 30 of 64

Band Edge\BLE 2M\LowCH00-2402

Keysight Spectrum Analyzer - Swept					
R R ^I 50 Ω		SENSE:INT		04:27:39 PM Feb 02, 2021	Frequency
Center Freq 2.360000		Trig: Free Run	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	requercy
	PNO: Fast	#Atten: 20 dB		DET P NNNN N	
	Indalit.Low	Written: 20 ab			Auto Tur
Ref Offset 11.1	dB		MK	r2 2.400 0 GHz	, and the
10 dB/div Ref 20.00 dE	3m			-43.50 dBm	
og		Ţ			
10.0					Center Fre
0.00				Y	2.360000000 GI
10.0				/1	
10.0				CL1 19 24 dDn	
20.0					Start Fre
30.0					2.31000000 G
40.0				2	2.310000000
50.0					
60.0 Automation and a state	and the second state of the second states of the second states of the second states of the second states of the	And the second sec	سرما ماعيريتها مايد بيدير وواد	annual Mun	Stop Fre
					2.41000000 GH
70.0					
Center 2.36000 GHz		A		Span 100.0 MHz	05.01
Res BW 100 kHz	#\/D\M	300 kHz	Sween 0	.600 ms (1001 pts)	CF Ste 10.000000 Mi
Res BW 100 KHZ	#4844	300 KH2	Sweep a	.000 ms (1001 pts)	Auto Ma
MKR MODE TRC SCL	x		NCTION FUNCTION WOTH	FUNCTION VALUE	
1 N 1 f (Δ) 2 N 1 f	2.402 0 GHz (Δ)	0.86 dBm			
2 N 1 f 3	2.400 0 GHz	-43.50 dBm			Freq Offs
4					01
6					
6					
8					Scale Typ
9					
					Log L
10					

Band Edge\BLE_2M\HighCH39-2480

Keysight Spectrum Analys							
R R	50 Ω DC		SENSE			36:23 PM Feb 02, 2021	Frequency
Center Freq 2.4	87500000	GHZ PNO: Fast - IFGain:Low	Trig: Free R #Atten: 20 d	un	e: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWWW DET P NNNNN	
10 dB/div Ref 20	set 11.1 dB .00 dBm					95 425 GHz -58.65 dBm	Auto Tune
0.00	, la						Center Free 2.487500000 GH
20.0 30.0 40.0	\square					DL1 -19.56 dBm	Start Fre 2.475000000 GH
50.0 60.0	, 	la la		****		,,	Stop Fre 2.50000000 GH
Center 2.48750 G Res BW 100 kH:		#VB	W 300 kHz	FUNCTION FUR	Sweep 2.400	oan 25.00 MHz ms (1001 pts)	CF Ste 2.500000 MH <u>Auto</u> Ma
1 N 1 f (Δ) 2 N 1 f 3 N 1 f (Δ) 4 6 6 7	2,483	025 GHz (Δ 500 GHz 425 GHz (Δ	-60.04 dBm				Freq Offse 0 H
9							Scale Typ
10 11							Log <u>Li</u>
						•	
SG					STATUS		

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Spurious Emission\BLE 1M\LowCH00-2402

						r - Swept SA		Spect		
Frequency	04:08:41 PM Feb 02, 2021 TRACE 1 2 3 4 5 6	e: Log-Pwr		SENSE:1	247	50 Q DC	R ¹	Ere		R
	DET P NNNNN			#Atten: 20 dB	PNO: Fast FGain:Low		<u>q 13</u> .	FIC	iter	201
Auto Tur	r4 9.607 7 GHz -50.16 dBm	Mk				et 11.1 dB 00 dBm			B/div	
Center Fre				Ĭ						.og 10.0
13.015000000 GH							¢¹		-	0.00
	DL1 -19.24 dBm								1	10.0 20.0
Start Fre									1	
30.000000 MH									1	30.0
					4				1	40.0
Stop Fre	and the second				3	A. (Una 1			50.0
26.00000000 GH	and the state of the state of the			and the state of the state of the					100	60.0
							-		- T	70.0
CF Ste	Span 25.97 GHz			A			2 GH	13.0	nter	:er
2.597000000 GI	.482 s (30001 pts)	Sweep 2		300 kHz	#VBW		00 kH			
Auto Ma	FUNCTION VALUE	INCTION WOTH	FUNCTION	Y		х	SCL	TRC	MOOE	205
	1			-3.89 dBm	9 GHz (Δ)		1 (Δ	1	N	1
Freq Offs				-60.45 dBm -59.55 dBm	4 0 GHz 5 0 GHz (Δ)		f (A	1	N	23
0				-50.16 dBm	7 7 GHz	9.60	1	1	N	4 5
Scale Typ										6 7 8
Log L										9
										11
	,	STATUS					-	-	-	
		ainiua								-

Spurious Emission\BLE 1M\MidCH20-2442

	ectrum An	ilyzer - Swept S											6
Center F	req 13	50 g 0 3.015000	000 GI	HZ O: Fast		Trig: Free		Avg Type	: Log-Pwr	TRA	MFeb 02, 2021 CE 1 2 3 4 5 6 PE MWWWWW	Frequ	ency
10 dB/div		ffset 11.1 d 20.00 dBi	IFG	ain:Low		#Atten: 20	dB		Mkr	4 25.47	et P NNNNN 2 8 GHz 98 dBm	Au	to Tune
10.0 0.00 -10.0	0 ¹											Cen 13.015000	ter Fre
-20.0 -30.0 -40.0											0L1 -19.73 dDn		art Fre
-50.0 -60.0 -70.0		v . 0 ²	Q ³		4							St 26.000000	op Fre 1000 G⊦
Center 1: #Res BW	100 k			#V	вw	300 kHz		ACTION FUR	Sweep	2.482 s (3	25.97 GHz 0001 pts)	2.597000 Auto	CF Ste 1000 GH Ma
1 N 2 N 3 N 4 N 5	1 C	5) 5)	2.441 7 4.884 0 7.326 0 25.472 8	GHz GHz		-8.11 dB -58.94 dB -61.20 dB -51.98 dB	m m m					Fre	q Offse 0 H
7 8 9 10 11												Sca Log	ile Typ Li
4 MSG				_	-	18			STATU	5	, [*]		

Spurious Emission\BLE 1M\HighCH39-2480

									nałyzer - Swep	rum A	Spect	sight	
Frequency	PM Feb 02, 2021				SENSE:1	-		DC		RF			R
	ACE 1 2 3 4 5 6 YPE MWWWWW DET P NNNNN	TY	rpe: Log-Pwr		Free Ru n: 20 dB		Z Fast in:Low		3.0150	eq 1	Fre	ter	en
Auto Tur	4 0 GHz .09 dBm		Mkr4						Offset 11. 20.00 d			Bídiv	
Center Fre 13.015000000 GF										01			og 10.0 1.00
Start Fre 30.000000 MH	01.1 -19 55 dBm												0.0
Stop Fre 26.00000000 Gi					-			Q³	Ŷ				1.0 1.0 1.0
CF Ste 2.597000000 GI Auto M	25.97 GHz 30001 pts)	2.482 s (3			Hz	300 ki	#VBW			02 G	N 1	s Bl	Re
Freq Offs	TON VALUE	FUNCT	FUNCTION W/DTH	FUNCTION	1 dBm	-1.27 -57.14 -61.31 -52.09	GHz (A)	4.960 0	(Δ) (Δ)	1	1 1 1 1	N N N N N	1 2 3 4 5
													67
Scale Typ	_												8
Scale Typ													8 9 0 1

台灣檢驗科技股份有限公司

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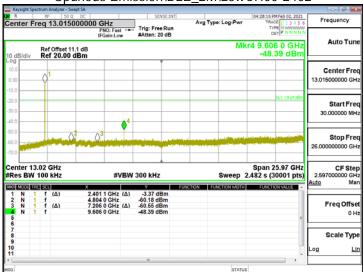
t (886-2) 2299-3279

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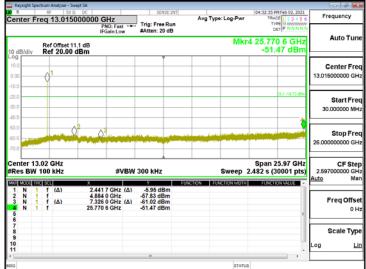
f (886-2) 2298-0488

No.134,Wu Kung Road, N

Spurious Emission/BLE 2M/LowCH00-2402



Spurious Emission\BLE 2M\MidCH20-2442



Spurious Emission\BLE 2M\HighCH39-2480

								Analyzer -	ectrum	signt op	
Frequency	0 1 2 3 4 5 6	04:37:01 P	e: Log-Pwr		SENSE:1N		9 DC		RJ	tor F	R
	PNNNN	TY	A. Log-r W	~~**	Trig: Free Run #Atten: 20 dB	NO: Fast Gain:Low	PI	13.01	req		en
Auto Tu	2 7 GHz 35 dBm		Mkr				11.1 dB) dBm	f Offset f 20.0	Ref Re	3/div	
Center Fr											0.0
13.015000000 G								1	0		00
									Ĭ		
	0L1 -19.56 dBm										1.0
Start Fr											1.0
30.000000 M											0.0
	4						A2				
Stop Fr	the state of the state	and the second		make the same of		3	Δ				
26.00000000 G	and the second party in the	section from the	a section of the section of	the second second	and the second se						0.0
									_		0.0
CF Ste	5.97 GHz								3.02		
2.597000000 G		2.482 s (3	Sweep 2		300 kHz	#VBW		kHz	100	5 BW	₹e
Auto M					Y		х		rici sci		
Auto M	N VALUE	FUNCT	JNCTION WOTH	FUNCTION							
	N VALUE	EUNCTI	JNCTION WIDTH	FUNCTION	-2.55 dBm -56,21 dBm	8 GHz (Δ) 0 GHz	4,960	(Δ)	1	N ·	2
FreqOffs	IN VALUE	FUNCT	JNCTION WOTH	FUNCTION	-2.55 dBm -56.21 dBm -61.96 dBm	0 GHz 0 GHz (Δ)	4.960	(Δ) (Δ)		N ·	2
	N VALUE	FUNCT	JNCTION WIDTH	FUNCTION	-2.55 dBm -56.21 dBm	0 GHz 0 GHz (Δ)	4,960			N	2345
Freq Offs	W VALUE	FUNCTI	UNCTION WIDTH	FUNCTION	-2.55 dBm -56.21 dBm -61.96 dBm	0 GHz 0 GHz (Δ)	4.960			N ·	234567
FreqOffs	IN VALUE	FUNCT	JNCTION WIDTH	FUNCTION	-2.55 dBm -56.21 dBm -61.96 dBm	0 GHz 0 GHz (Δ)	4.960			N ·	2345678
Freq Offs 0 Scale Ty	N VALUE	FUNCTI	JNCTION WIDTH	FUNCTION	-2.55 dBm -56.21 dBm -61.96 dBm	0 GHz 0 GHz (Δ)	4.960			N ·	1 2 3 4 5 6 7 8 9 0
Freq Offs	N VALUE	FUNCT	INCTION WIDTH	FUNCTION	-2.55 dBm -56.21 dBm -61.96 dBm	0 GHz 0 GHz (Δ)	4.960			N ·	2 3 4 5 6 7 8 9 0

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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.
- 2. Emission level (dB μ V/m) = 20 log Emission level (μ V/m)

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10.2 Measurement Equipment Used

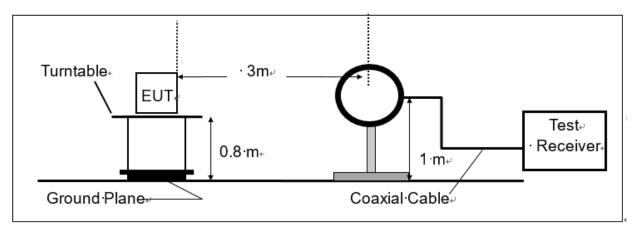
	966 Chamber												
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.								
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021								
Horn Antenna	Schwarzbeck	BBHA9170	185	07/30/2020	07/29/2021								
Horn Antenna	Schwarzbeck	BBHA9120D	1187	01/11/2021	01/10/2022								
Loop Antenna	ETS.LINDGREN	6502	143303	04/28/2020	04/27/2021								
EMI Test Receiver	R&S	ESU 40	100363	04/29/2020	04/28/2021								
Bluetooth Test Set	Anritsu	MT8852B	6k00006107	08/11/2019	08/10/2020								
Bluetooth Test Set	R&S	CBT	101140	05/04/2020	05/03/2021								
Pre-Amplifier	EMC Instru- ments	EMC330	980096	11/19/2020	11/18/2021								
Pre-Amplifier	EMC Instru- ments	EMC0011830	980199	11/19/2020	11/18/2021								
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	10/27/2020	10/26/2021								
Attenuator	Marvelous	WATT-218FS-10	RF20	11/19/2020	11/18/2021								
Band Rejection Fil- ter	Micro-Tronics	BRM50701-01	RF201	11/19/2020	11/18/2021								
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/19/2020	11/18/2021								
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/19/2020	11/18/2021								
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R								

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

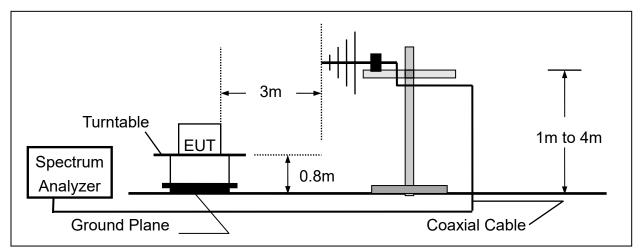


10.3 Test SET-UP

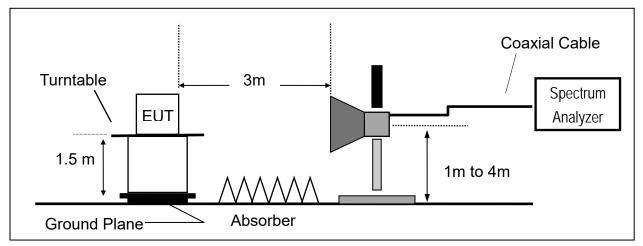
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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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 plan.
- 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=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
- Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 8. 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.
- 9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 11.Repeat above procedures until all default test channel measured were complete.

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10.5 Field Strength Calculation

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

FS = RA + AF + CL - AG

Where FS = Field Strength RA = Reading Amplitude AF = Antenna Factor CL = Cable Attenuation Factor (Cable Loss) AG = Amplifier Gain

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

Actual FS($dB\mu V/m$) = SPA. Reading level($dB\mu V$) + Factor(dB) Factor(dB) = Antenna Factor($dB\mu V/m$) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

10.6 Test Results of Radiated Spurious Emissions form 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.

10.7 Measurement Result:

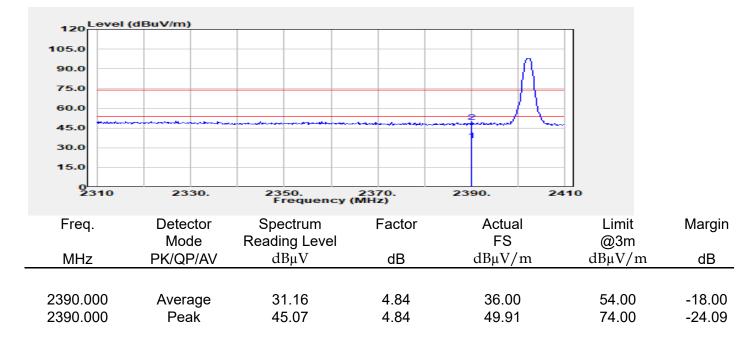
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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10.7.1 **Radiated Band Edge Measurement Result**

Report Number	:E2/2021/10083	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-01-20
Test Frequency	:2402 MHz	Temp./Humi.	:21.4/65
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plan	Engineer	:Enzo Chang



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Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [;] :BLE 1M :2402 MH; :BE CH L0 :H Plan	z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chambe :2021-01-20 :21.4/65 :Horizontal :Enzo Chang	
120 Level (d	BuV/m)					
105.0						
90.0					η	
75.0						
60.0						
45.0	~~~~				tem	
30.0				1		
15.0						
0 2310	2330.	2350. Frequenc	2370. y (MHz)	2390.	2410	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/n	n dBµV/	m dB
2390.000	Average	31.15	4.84	35.99	54.00	
2390.000	Peak	43.00	4.84	47.84	74.00	-26.16



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 1M :2480 MHz :BE CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer		;
120 Level (d	BuV/m)					
105.0						
90.0						
75.0	$ \rightarrow \rightarrow$					
60.0						
45.0		Mana and a second		and a second	- American	
30.0						
15.0						
2475	2480.	2485. Frequency	2490. / (MHz)	2495.	2500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/n	n dBµV/m	dB
	_					
2483.500	Average	31.26	3.90	35.16	54.00	-18.84
2483.500	Peak	42.69	3.90	46.59	74.00	-27.41



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [,] :BLE 1M :2480 MHz :BE CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.4/65 :Horizontal :Enzo Chang	>
120 Level (d	BuV/m)					
105.0						
90.0						
75.0	-/-					
60.0						
45.0		1	ann an			
30.0						
15.0						
2475	2480.	2485. Frequency	2490. (MHz)	2495.	2500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/m	dB
2483.500	Average	31.29	3.90	35.19	54.00	-18.81
2483.500	Peak	44.04	3.90	47.94	74.00	-26.06



Report Number Operation Mode Test Frequency Test Mode EUT Pol		z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chambe :2021-01-20 :22.8/57 :Vertical :Enzo Chang	r C
120 Level (d	BuV/m)					
105.0						
90.0				/	7	
75.0						
60.0						
45.0			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	anna the	have	
30.0						
15.0						
0 2310	2330.	2350. Frequency	2370. (MHz)	2390.	2410	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBµV/n	n dBµV/1	m dB
2390.000	Average	31.08	4.84	35.92	54.00	-18.08
2390.000	Peak	43.02	4.84	47.86	74.00	-26.14



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ :BLE 2M :2402 MH :BE CH L0 :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer		D
120 Level (d	BuV/m)					
105.0						
90.0					Δ	
75.0						
60.0						
45.0			errore wanter			
30.0				1		
15.0						
0 2310	2330.	2350.	2370.	2390.	2410	
2310	2330.	Frequenc	y (MHz)	2390.	2410	
Freq.	Detector	Spectrum	Factor	Actual	Lin	nit Margin
	Mode	Reading Level		FS	@3	
MHz	PK/QP/AV	dBµV	dB	dBµV/1	n dBµV	//m dB
2390.000	Average	31.11	4.84	35.95	54.0	
2390.000	Peak	44.52	4.84	49.36	74.0	00 -24.64



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 2M :2480 MHz :BE CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Vertical :Enzo Chang	
120 Level (d	BuV/m)					
105.0						
90.0						
75.0	/					
60.0						
45.0				where does place - the second second	and the second	
30.0						
15.0						
2475	2480.	2485. Frequency	2490. (MHz)	2495.	2500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/r	n dBµV/m	dB
0.400 500	•	04 54			54.00	40.50
2483.500	Average	31.51	3.90	35.41	54.00	-18.59
2483.500	Peak	42.87	3.90	46.77	74.00	-27.23



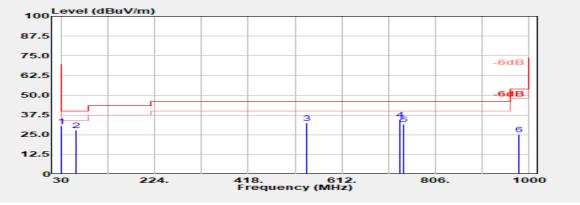
Report Number Operation Mode Test Frequency Test Mode EUT Pol		Ζ		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber (:2021-01-20 :22.8/57 :Horizontal :Enzo Chang	2
120 Level (d	BuV/m)					
105.0						
90.0						
75.0	$ / \rangle$					
60.0						
45.0		Ma Zandan manana		-	and the second second	
30.0						
15.0						
0 2475	2480.			2495.	2500	
2475	2480.	2485. Frequency	2490. y (MHz)	2495.	2500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBµV/n	n dBµV/m	dB
2483.500	Average	31.61	3.90	35.51	54.00	-18.49
2483.500	Peak	43.05	3.90	46.95	74.00	-27.05



10.7.2 Radiated Spurious Emission from 30MHz to 1000MHz

:E2/2021/10083	Т
:BLE 1M	Т
:2442 MHz	Т
:TX CH MID	A
:H Plan	E
	:2442 MHz :TX CH MID

Test Site	:966 Chamber C
Test Date	:2021-01-20
Temp./Humi.	:21.8/63
Antenna Pol.	:Vertical
Engineer	:Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
30.000	Peak	37.19	-6.45	30.73	40.00	-9.27
61.090	Peak	51.69	-23.91	27.78	40.00	-12.22
538.317	Peak	41.73	-9.37	32.35	46.00	-13.65
732.628	Peak	42.34	-7.68	34.66	46.00	-11.34
740.401	Peak	38.99	-7.17	31.81	46.00	-14.19
979.792	Peak	30.04	-4.79	25.24	54.00	-28.76

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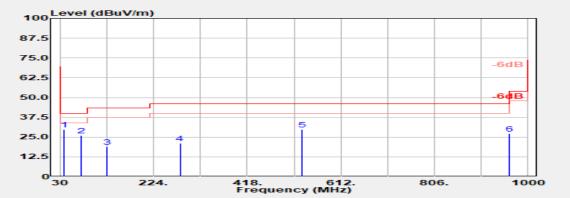
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Report Number	:E2/2021/10083
Operation Mode	:BLE 1M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plan

Test Site	:966 Chamber C
Test Date	:2021-01-20
Temp./Humi.	:21.8/63
Antenna Pol.	:Vertical
Engineer	:Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
37.772	Peak	40.54	-10.79	29.74	40.00	-10.26
73.526	Peak	48.21	-22.10	26.12	40.00	-13.88
126.378	Peak	35.49	-16.78	18.72	43.50	-24.78
278.718	Peak	36.87	-15.69	21.18	46.00	-24.82
532.099	Peak	39.73	-10.06	29.67	46.00	-16.33
961.138	Peak	33.21	-5.96	27.26	54.00	-26.74

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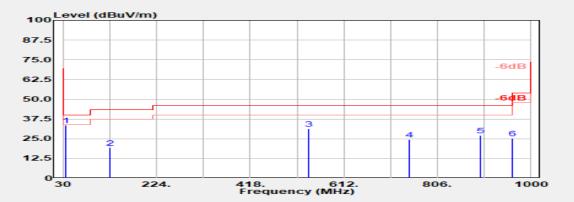
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Report Number	:E2/2021/10083
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plan

Test Site :966 Chamber C Test Date :2021-01-20 Temp./Humi. :21.8/62 Antenna Pol. :Vertical Engineer :Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
36.218	Peak	43.49	-10.03	33.46	40.00	-6.54
126.378	Peak	35.96	-16.78	19.18	43.50	-24.32
538.317	Peak	40.80	-9.37	31.42	46.00	-14.58
746.619	Peak	32.49	-7.79	24.70	46.00	-21.30
894.295	Peak	32.84	-5.51	27.33	46.00	-18.67
961.138	Peak	31.38	-5.96	25.43	54.00	-28.57

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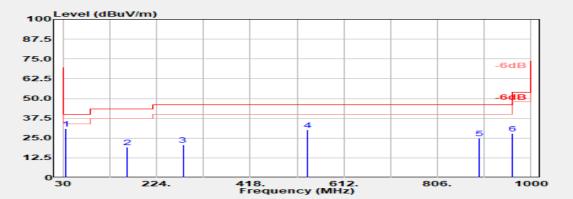
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Report Number	:E2/2021/10083
Operation Mode	:BLE 2M
Test Frequency	:2442 MHz
Test Mode	:TX CH MID
EUT Pol	:H Plan

Test Site	:966 Chamber C
Test Date	:2021-01-20
Temp./Humi.	:21.8/62
Antenna Pol.	:Horizontal
Engineer	:Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
36.218	Peak	40.98	-10.03	30.95	40.00	-9.05
162.131	Peak	38.65	-19.42	19.23	43.50	-24.27
278.718	Peak	36.30	-15.69	20.61	46.00	-25.39
536.763	Peak	39.42	-9.27	30.15	46.00	-15.85
892.740	Peak	30.82	-5.82	25.00	46.00	-21.00
961.138	Peak	33.73	-5.96	27.77	54.00	-26.23

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.

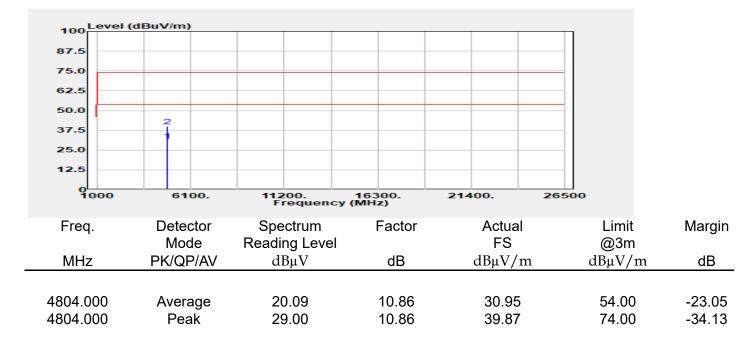
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10.7.3 **Radiated Spurious Emission above 1GHz**

Report Number	:E2/2021/10083	Test Site	:966 Chamber C
Operation Mode	:BLE 1M	Test Date	:2021-01-20
Test Frequency	:2402 MHz	Temp./Humi.	:21.9/56
Test Mode	:TX CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plan	Engineer	:Enzo Chang



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Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 1M :2402 MHz :TX CH LC :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.9/56 :Horizontal :Enzo Chang	
100 Level (dl	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
1000	6100.	11200. Frequenc	16300. cy (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/m	dB
4804.000	Average	20.12	10.86	30.98	54.00	-23.02
4804.000	Peak	29.68	10.86	40.54	74.00	-33.46



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [,] :BLE 1M :2442 MHz :TX CH MI :H Plan	Ζ		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.9/56 :Vertical :Enzo Chang	
100 Level (di	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
1000	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	-
MHz	PK/QP/AV	dBµV	dB	dBµV/m	u dBµV/m	dB
4884.000	Average	20.07	10.13	30.20	54.00	-23.80
4884.000	Peak	28.76	10.13	38.89	74.00	-35.11



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [/] :BLE 1M :2442 MHz :TX CH MI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.9/56 :Horizontal :Enzo Chang	
100 Level (dl	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	•					
25.0						
12.5						
1000	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	-
MHz	PK/QP/AV	dBµV	dB	dBµV/m	ı dBµV∕m	dB
4884.000	Average	20.22	10.13	30.35	54.00	-23.65
4884.000	Peak	29.61	10.13	39.74	74.00	-34.26



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [,] :BLE 1M :2480 MHz :TX CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.9/56 :Vertical :Enzo Chang	
100 Level (di	BuV/m)					
87.5						
75.0						
62.5						
50.0						
37.5	2					
25.0						
12.5						
1000	6100.	11200. Frequency	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	U
MHz	PK/QP/AV	dBµV	dB	dBµV/m	u dBµV/m	dB
4960.000	Average	20.18	10.18	30.36	54.00	-23.64
4960.000	Peak	30.34	10.18	40.52	74.00	-33.48



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [/] :BLE 1M :2480 MHz :TX CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :21.9/56 :Horizontal :Enzo Chang	
100 Level (dl	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
9 <mark>1000</mark>	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
-	Mode	Reading Level		FS	@3m	-
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/m	dB
4960.000	Average	21.23	10.18	31.41	54.00	-22.59
4960.000	Peak	30.39	10.18	40.57	74.00	-33.43



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 2M :2402 MHz :TX CH LC :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Vertical :Enzo Chang	
100 Level (de	BuV/m)					
87.5						
75.0						
62.5						
50.0						
37.5	2					
25.0						
12.5						
1000	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBμV	dB	dBµV/m	u dBµV∕m	dB
4804.000	Average	20.15	10.86	31.01	54.00	-22.99
4804.000	Peak	30.34	10.86	41.21	74.00	-32.79



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 2M :2402 MHz :TX CH LC :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Horizontal :Enzo Chang	
Level (di	BuV/m)					
100						
87.5						
75.0						
62.5						
50.0	2					
37.5	- i					
25.0						
12.5						
9000	6100.	11200.	16300.	21400.	26500	
		Frequenc	y (MHz)			
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/m	dB
4804.000	Average	20.18	10.86	31.04	54.00	-22.96
4804.000	Peak	29.58	10.86	40.44	74.00	-33.56



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/1 :BLE 2M :2442 MHz :TX CH MI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Vertical :Enzo Chang	
100 Level (dl	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
1000	6100.	11200. Frequency	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	ı dBµV∕m	dB
4884.000	Average	21.21	10.13	31.34	54.00	-22.66
4884.000	Peak	29.34	10.13	39.47	74.00	-34.53



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [,] :BLE 2M :2442 MHz :TX CH M :H Plan	z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Horizontal :Enzo Chang	
100 Level (di	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
1000	6100.	11200. Frequency	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	ı dBµV/m	dB
4884.000	Average	21.16	10.13	31.29	54.00	-22.71
4884.000	Peak	30.46	10.13	40.58	74.00	-33.42



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ :BLE 2M :2480 MHz :TX CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Vertical :Enzo Chang	
100 Level (di	BuV/m)					
87.5						
75.0						
62.5						
50.0	2					
37.5	1					
25.0						
12.5						
1000	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	_
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/m	dB
4960.000	Average	21.97	10.18	32.15	54.00	-21.85
4960.000	Peak	32.14	10.18	42.32	74.00	-31.68



Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/ [,] :BLE 2M :2480 MHz :TX CH HI :H Plan	Z		Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber C :2021-01-20 :22.8/57 :Horizontal :Enzo Chang	
100 Level (di	BuV/m)					
87.5						
75.0						
62.5						
50.0						
37.5	2					
25.0	1					
12.5						
1000	6100.	11200. Frequenc	16300. y (MHz)	21400.	26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	ı dBµV/m	dB
4960.000	Average	20.14	10.18	30.32	54.00	-23.68
4960.000	Peak	30.31	10.18	40.49	74.00	-33.51



11 POWER SPECTRAL DENSITY

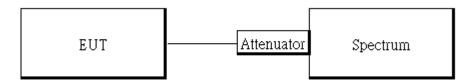
11.1 Standard Applicable:

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						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.	
EXA Spectrum An- alyzer	KEYSIGHT	N9010A		02/20/2020	02/19/2021	
Attenuator	Marvelous	MVE2213-10	RF12	11/19/2020	11/18/2021	
DC Block	PASTERNACK	PE8210	RF155	11/19/2020	11/18/2021	
Coaxial Cables	Woken	00100A1F1A 185C	RF84	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.

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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11.5 Measurement Result:

BLE 1M

Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2402	-13.81	8	PASS
2442	-14.28	8	PASS
2480	-14.13	8	PASS

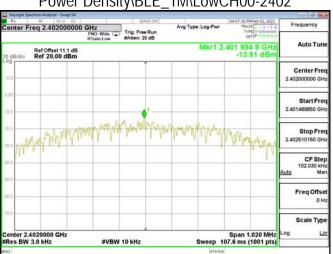
NOTE: cable loss as 11.1dB that offsets in the spectrum

BLE 2M

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-17.28	8	PASS
2442	-17.82	8	PASS
2480	-17.62	8	PASS

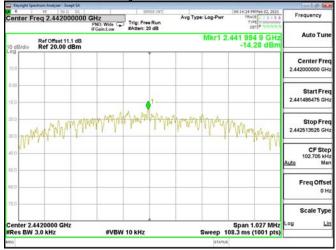
NOTE: cable loss as 11.1dB that offsets in the spectrum



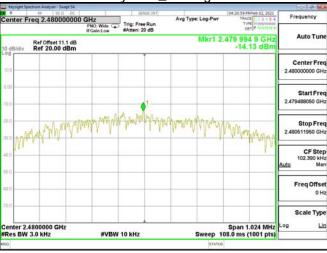


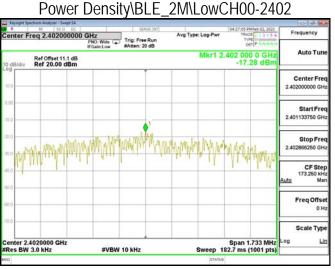
Power Density\BLE_1M\LowCH00-2402

Power Density\BLE_1M\MidCH20-2442

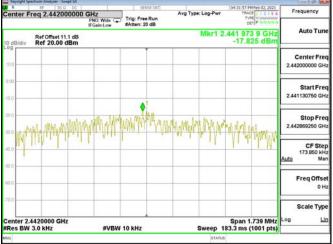


Power Density\BLE_1M\HighCH39-2480

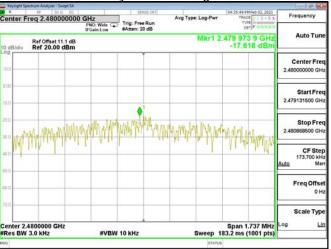




Power Density\BLE_2M\MidCH20-2442



Power Density\BLE_2M\HighCH39-2480



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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 with unique RF connector and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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