

Page 1 of 77

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Microsoft Corporation

One Microsoft Way Redmond, WA 98052-6399, U.S.A

Portable Computing Device **Product Name:**

Brand Name: Microsoft

Model No.: 1958, 1959

Model Difference: The difference between 1958 and 1959 models is the C-Cover.

1958 - Config 1 and 1959 - Config 2

E2/2020/70038 **Report Number:**

FCC ID: C3K1958

FCC Rule Part: §15.247, Cat: DTS

Feb. 24, 2021 Issue Date:

Date of Test: Jul. 08, 2020 ~ Dec. 14, 2020

Date of EUT Received: Jul. 06, 2020

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:

Blue Yang / Asst. Manager

Mlen Lay





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Page 2 of 77

Revision History				
Report Number	Revision	Description	Issue Date	Remark
E2/2020/70038	Rev.00	Original.	Feb. 24, 2021	Revised By: Tiffany Kao

Note:

1 Multiple Model numbers or Trademarks The variant model numbers are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.

2 · Disclaimer

Antenna information and Variant information between model numbers are provided by the applicant, the test results of this report are applicable to the sample EUT received.

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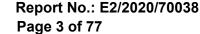




Table of Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	7
3	SUMMARY OF TEST RESULTS	10
4	DESCRIPTION OF TEST MODES	11
5	MEASUREMENT UNCERTAINTY	13
6	CONDUCTED EMISSION TEST	14
7	PEAK OUTPUT POWER MEASUREMENT	32
8	6dB BANDWIDTH MEASUREMENT	36
9	CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT	39
10	RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT	45
11	POWER SPECTRAL DENSITY	74
12	ANTENNA REQUIREMENT	77

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Page 4 of 77

GENERAL INFORMATION

Product Description

Product Name:	Portable Computing Device
Brand Name:	Microsoft
Model No.:	1958, 1959
Model Difference:	The difference between 1958 and 1959 models is the C-Cover. 1958 - Config 1 and 1959 - Config 2
HW Version (Product):	EV2
SW Version (Product):	MTEOS.1.311.0
HW Version (Radio):	N/A
SW Version (Radio):	21.80.2.1
Radio Test Tool & Version:	DRTU: 21.21080.0.0-10722
Power Supply:	From Rechargeable Lithium-Ion Polymer Battery or 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: 7.63 dBm BLE 2M: 7.51 dBm	

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Page 5 of 77

1.2 Antenna Designation

Antenna Type	Config	Chain 0 / Chain 1	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
DIEA	Config 1	Chain 0	2402-2480	1.5	
PIFA	Config 2	Chain 0	2402-2480	2.2	V

Note: Pre-scanned was done on the above 2 antennas, the Config 2 cover type results higher emission at 2.4GHz. Therefore, the completed set of measurement was done on the antenna to be presented on this test report.

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Page 6 of 77

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

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)
No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: 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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Page 7 of 77

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 8 of 77

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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Page 9 of 77

2.5 Configuration of Tested System

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



Fig 2-2 Radiated Emission







Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	DRTU	INTEL	21.80.2.1	N/A	N/A	N/A

Note: The EUT is tested with all external accessory ports populated.

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Page 10 of 77

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)	6dB Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.205 §15.209 §15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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Page 11 of 77

DESCRIPTION OF TEST MODES

Operated in 2400 ~ 2483.5MHz Band

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		

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Page 12 of 77

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	2440	GFSK	1		
Bluetooth LE	2402 to 2480	2440	GFSK	2		
	RADIATED EMISSION TEST (ABOVE 1 GHz)					
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1		
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	2		

Note: The field strength of radiation emission was measured for Bluetooth LE Transmitter for channel Low, Mid and High, the worst case NB position was reported.

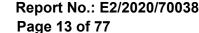
ANTENNA PORT CONDUCTED MEASUREMENT					
MODE	DDE AVAILABLE TESTED MODULATION DATA RAT (Mbps)		DATA RATE (Mbps)		
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1	
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	2	

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SGS

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
6dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Peak Power Density	+/- 1.3 dB
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission Measurement Uncertainty				
	9kHz~30MHz: +-2.3dB			
	30MHz - 180MHz: +/- 3.37dB			
Polarization: Vertical	180MHz -417MHz: +/- 3.19dB			
Polarization. Vertical	0.417GHz-1GHz: +/- 3.19dB			
	1GHz - 18GHz: +/- 4.04dB			
	18GHz - 40GHz: +/- 4.04dB			
	9kHz~30MHz: +-2.3dB			
	30MHz - 167MHz: +/- 4.22dB			
Polarization: Horizontal	167MHz -500MHz: +/- 3.44dB			
Polarization. Horizontal	0.5GHz-1GHz: +/- 3.39dB			
	1GHz - 18GHz: +/- 4.08dB			
	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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Page 14 of 77

CONDUCTED EMISSION TEST

6.1 Standard Applicable:

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

Frequency range		nits 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

Measurement Equipment Used:

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
LISN	SCHWARZBECK Mess- Elektronik		974	03/25/2020	03/24/2021			
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021			

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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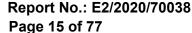
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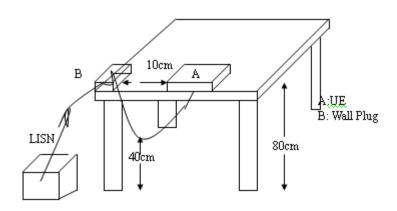
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^{1.} The lower limit shall apply at the transition frequencies

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



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

Measurement Result: 6.6

Note: Refer to next page for measurement data and plots.

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Page 16 of 77

AC POWER LINE CONDUCTED EMISSION TEST DATA

Engineer

:Kailin

Adapter 1

Mode: BLE (1M)

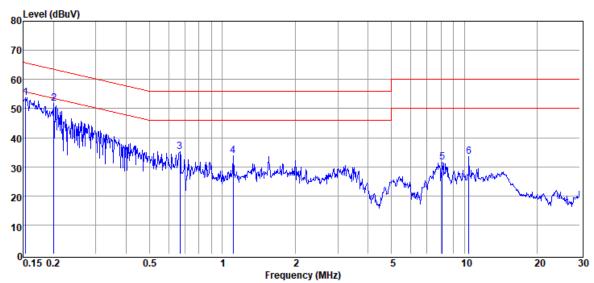
Report Number :E2/2020/70038 Test Site :Conduction Room C

Test Mode :BLE 1M Test Date :2020-08-14

Power :120V/60Hz Temp./Humi. :24.3/62

Probe :L1

Note: : EUT_Config 1



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	43.58	10.22	53.80	65.78	-11.98
0.20	Peak	41.53	10.22	51.75	63.58	-11.83
0.67	Peak	24.87	10.31	35.18	56.00	-20.82
1.11	Peak	23.38	10.44	33.82	56.00	-22.18
8.11	Peak	20.90	10.64	31.54	60.00	-28.46
10.45	Peak	22.75	10.71	33.46	60.00	-26.54

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Page 17 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

Power :120V/60Hz

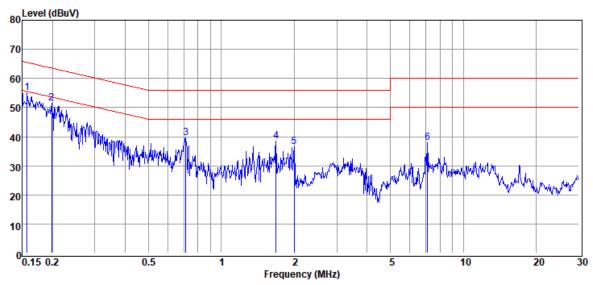
Probe :N

Note: : EUT_Config 1 Test Site :Conduction Room C

Test Date :2020-08-14

:24.3/62 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Peak	44.76	10.21	54.97	65.60	-10.63
0.20	Peak	41.16	10.21	51.37	63.67	-12.30
0.71	Peak	29.17	10.33	39.50	56.00	-16.50
1.68	Peak	27.94	10.44	38.38	56.00	-17.62
2.00	Peak	25.97	10.45	36.42	56.00	-19.58
7.10	Peak	27.37	10.62	37.99	60.00	-22.01

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Page 18 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

:120V/60Hz Power

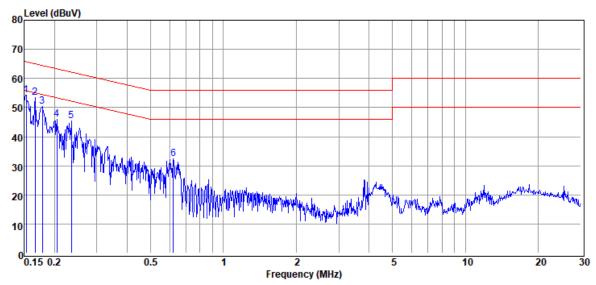
Probe :L1

Note: : EUT_Config 2 Test Site :Conduction Room C

Test Date :2020-08-14

:24.1/61 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	44.10	10.22	54.32	65.82	-11.50
0.17	Peak	43.15	10.22	53.37	65.12	-11.75
0.18	Peak	40.10	10.22	50.32	64.55	-14.23
0.21	Peak	35.64	10.22	45.86	63.40	-17.54
0.24	Peak	35.28	10.22	45.50	62.26	-16.76
0.62	Peak	22.23	10.29	32.52	56.00	-23.48

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Page 19 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

Power :120V/60Hz

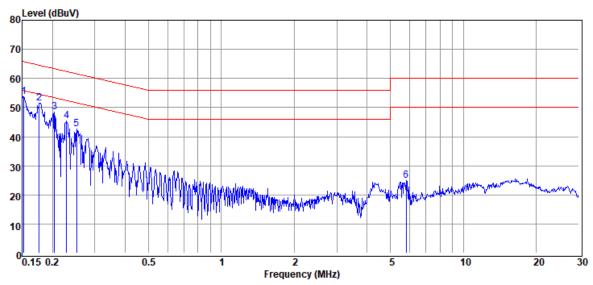
Probe :N

Note: : EUT_Config 2 Test Site :Conduction Room C

Test Date :2020-08-14

:24.1/61 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	43.58	10.21	53.79	65.87	-12.08
0.18	Peak	41.18	10.21	51.39	64.64	-13.25
0.20	Peak	38.31	10.21	48.52	63.45	-14.93
0.23	Peak	35.13	10.21	45.34	62.48	-17.14
0.25	Peak	32.53	10.21	42.74	61.69	-18.95
5.81	Peak	14.46	10.56	25.02	60.00	-34.98

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Page 20 of 77

Mode: BLE (2M)

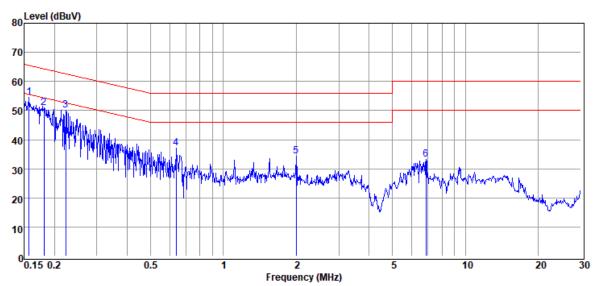
Report Number **Test Site** :Conduction Room C :E2/2020/70038

Test Mode :BLE 2M **Test Date** :2020-08-14

Power :120V/60Hz Temp./Humi. :24.3/62

Probe :L1 Engineer :Kailin

Note: : EUT_Config 1



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμ̈V	dB	dΒμV	dΒμV	dB
0.16	Peak	44.29	10.22	54.51	65.60	-11.09
0.18	Peak	40.58	10.22	50.80	64.42	-13.62
0.22	Peak	40.01	10.22	50.23	62.70	-12.47
0.64	Peak	26.76	10.29	37.05	56.00	-18.95
2.00	Peak	23.75	10.45	34.20	56.00	-21.80
6.88	Peak	22.70	10.60	33.30	60.00	-26.70

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Page 21 of 77

Report Number :E2/2020/70038

Test Mode :BLE 2M

Power :120V/60Hz

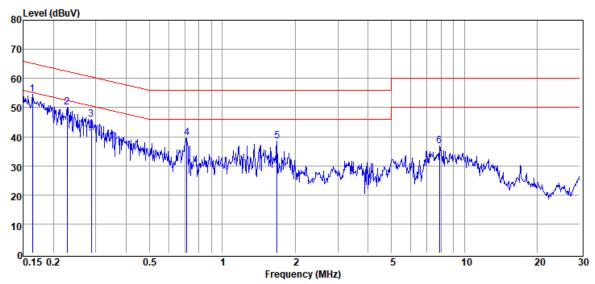
Probe :N

Note: : EUT_Config 1 Test Site :Conduction Room C

Test Date :2020-08-14

:24.3/62 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Peak	44.36	10.21	54.57	65.25	-10.68
0.23	Peak	39.78	10.21	49.99	62.52	-12.53
0.29	Peak	35.62	10.22	45.84	60.59	-14.75
0.71	Peak	29.17	10.33	39.50	56.00	-16.50
1.68	Peak	27.94	10.44	38.38	56.00	-17.62
7.89	Peak	26.07	10.65	36.72	60.00	-23.28

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Page 22 of 77

Report Number :E2/2020/70038

Test Mode :BLE 2M

Power :120V/60Hz

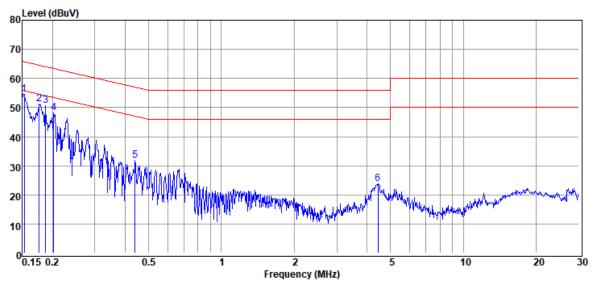
Probe :L1

Note: : EUT_Config 2 Test Site :Conduction Room C

Test Date :2020-08-14

:24.1/61 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	44.34	10.22	54.56	65.82	-11.26
0.18	Peak	40.92	10.22	51.14	64.64	-13.50
0.19	Peak	40.49	10.22	50.71	64.15	-13.44
0.20	Peak	38.07	10.22	48.29	63.49	-15.20
0.44	Peak	21.49	10.22	31.71	57.07	-25.36
4.43	Peak	13.44	10.49	23.93	56.00	-32.07

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Page 23 of 77

Report Number :E2/2020/70038

Test Mode :BLE 2M

Power :120V/60Hz

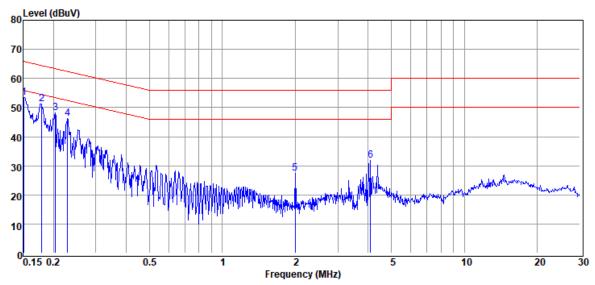
Probe :N

Note: : EUT_Config 2 Test Site :Conduction Room C

Test Date :2020-08-14

:24.1/61 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	43.27	10.21	53.48	65.91	-12.43
0.18	Peak	41.01	10.21	51.22	64.50	-13.28
0.20	Peak	37.85	10.21	48.06	63.45	-15.39
0.23	Peak	35.89	10.21	46.10	62.48	-16.38
2.00	Peak	16.82	10.45	27.27	56.00	-28.73
4.09	Peak	21.27	10.49	31.76	56.00	-24.24

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Page 24 of 77

Adapter 2

Mode: BLE (1M)

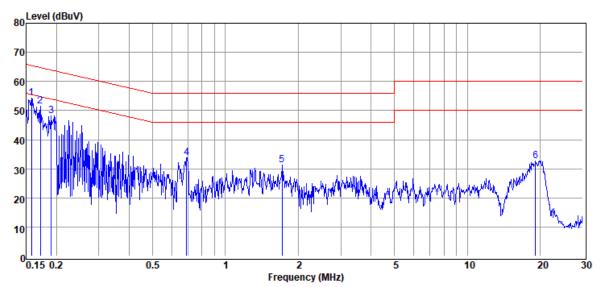
Report Number **Test Site** :E2/2020/70038 :Conduction Room C

Test Mode :BLE 1M **Test Date** :2020-09-02

Temp./Humi. Power :120V/60Hz :23.4/64

Probe :L1 Engineer :Kailin

: EUT_Config 1 Note:



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Peak	44.09	10.22	54.31	65.56	-11.25
0.17	Peak	41.27	10.22	51.49	64.86	-13.37
0.19	Peak	37.97	10.22	48.19	64.02	-15.83
0.69	Peak	23.58	10.33	33.91	56.00	-22.09
1.72	Peak	20.92	10.45	31.37	56.00	-24.63
19.12	Peak	21.91	10.84	32.75	60.00	-27.25

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Page 25 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

Power :120V/60Hz

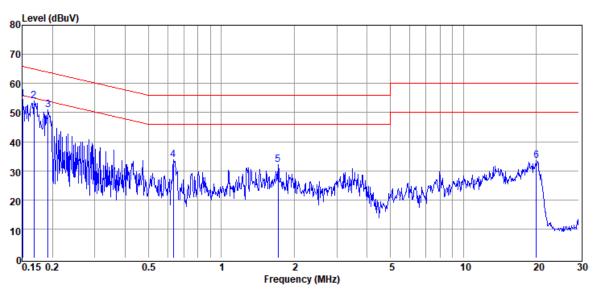
Probe :N

Note: : EUT_Config 1 Test Site :Conduction Room C

Test Date :2020-09-02

:23.4/64 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	44.37	10.21	54.58	65.96	-11.38
0.17	Peak	43.70	10.21	53.91	65.08	-11.17
0.19	Peak	40.66	10.21	50.87	63.93	-13.06
0.63	Peak	23.48	10.29	33.77	56.00	-22.23
1.72	Peak	21.56	10.45	32.01	56.00	-23.99
20.06	Peak	22.57	10.86	33.43	60.00	-26.57

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Page 26 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

:120V/60Hz Power

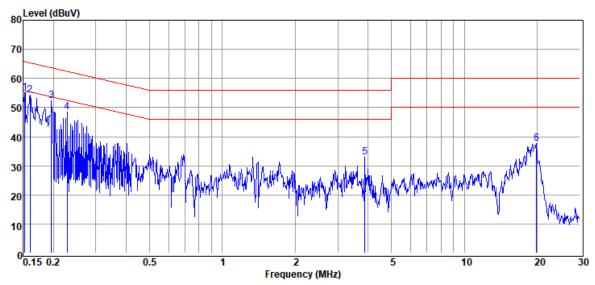
Probe :L1

Note: : EUT_Config 2 **Test Site** :Conduction Room C

Test Date :2020-09-02

:23.5/64 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	44.92	10.22	55.14	65.87	-10.73
0.16	Peak	43.97	10.22	54.19	65.43	-11.24
0.20	Peak	41.99	10.22	52.21	63.76	-11.55
0.23	Peak	38.14	10.22	48.36	62.52	-14.16
3.88	Peak	22.44	10.48	32.92	56.00	-23.08
19.85	Peak	26.80	10.85	37.65	60.00	-22.35

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Page 27 of 77

Report Number :E2/2020/70038

Test Mode :BLE 1M

Power :120V/60Hz

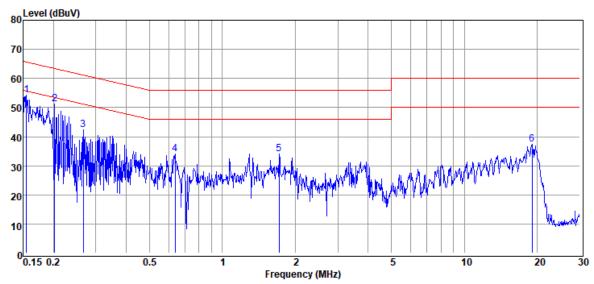
Probe :N

Note: : EUT_Config 2 Test Site :Conduction Room C

Test Date :2020-09-02

:23.5/64 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	43.97	10.21	54.18	65.74	-11.56
0.20	Peak	41.05	10.21	51.26	63.49	-12.23
0.27	Peak	32.08	10.21	42.29	61.25	-18.96
0.64	Peak	23.68	10.29	33.97	56.00	-22.03
1.72	Peak	23.49	10.45	33.94	56.00	-22.06
19.02	Peak	26.58	10.85	37.43	60.00	-22.57

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Page 28 of 77

Mode: BLE (2M)

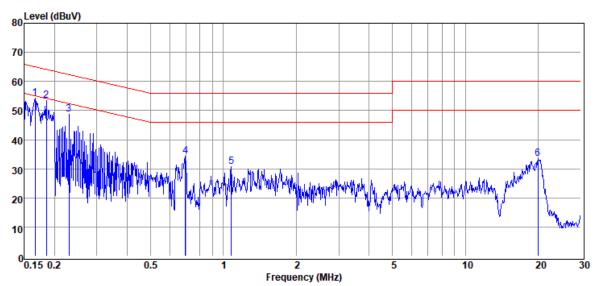
Report Number **Test Site** :Conduction Room C :E2/2020/70038

Test Mode :BLE 2M **Test Date** :2020-09-02

Power :120V/60Hz Temp./Humi. :23.4/64

Probe :L1 Engineer :Kailin

Note: : EUT_Config 1



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.17	Peak	44.04	10.22	54.26	65.12	-10.86
0.19	Peak	43.14	10.22	53.36	64.24	-10.88
0.23	Peak	38.61	10.22	48.83	62.44	-13.61
0.70	Peak	24.08	10.33	34.41	56.00	-21.59
1.08	Peak	20.26	10.44	30.70	56.00	-25.30
19.95	Peak	22.71	10.85	33.56	60.00	-26.44

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Page 29 of 77

Report Number :E2/2020/70038

Test Mode :BLE 2M

Power :120V/60Hz

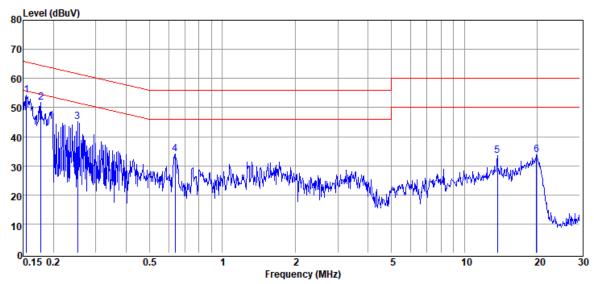
Probe :N

Note: : EUT_Config 1 Test Site :Conduction Room C

Test Date :2020-09-02

:23.4/64 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.15	Peak	43.93	10.21	54.14	65.74	-11.60
0.18	Peak	41.51	10.21	51.72	64.59	-12.87
0.25	Peak	34.84	10.21	45.05	61.69	-16.64
0.64	Peak	23.86	10.29	34.15	56.00	-21.85
13.70	Peak	22.60	10.78	33.38	60.00	-26.62
19.85	Peak	23.05	10.86	33.91	60.00	-26.09

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Page 30 of 77

Report Number :E2/2020/70038

Test Mode :BLE 2M

Power :120V/60Hz

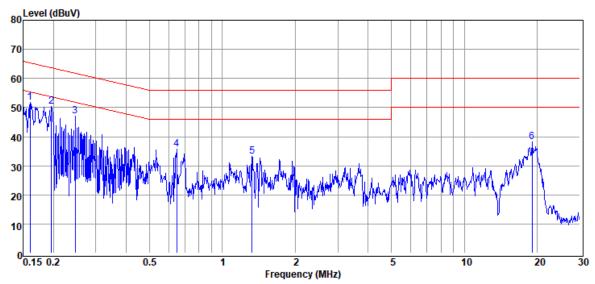
Probe :L1

Note: : EUT_Config 2 **Test Site** :Conduction Room C

Test Date :2020-09-02

:23.5/64 Temp./Humi.

Engineer :Kailin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Peak	41.42	10.22	51.64	65.43	-13.79
0.20	Peak	40.27	10.22	50.49	63.76	-13.27
0.25	Peak	36.86	10.22	47.08	61.86	-14.78
0.65	Peak	25.39	10.31	35.70	56.00	-20.30
1.32	Peak	22.84	10.44	33.28	56.00	-22.72
19.02	Peak	27.23	10.84	38.07	60.00	-21.93

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Page 31 of 77

Report Number Test Site :Conduction Room C :E2/2020/70038

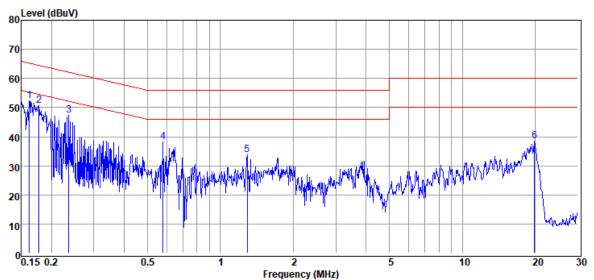
Test Mode :BLE 2M **Test Date** :2020-09-02

:23.5/64 Power :120V/60Hz Temp./Humi.

Probe :N Engineer :Kailin

: EUT_Config 2

Note:



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.16	Peak	42.10	10.21	52.31	65.34	-13.03
0.18	Peak	40.38	10.21	50.59	64.59	-14.00
0.24	Peak	37.08	10.21	47.29	62.22	-14.93
0.58	Peak	28.05	10.26	38.31	56.00	-17.69
1.29	Peak	23.20	10.44	33.64	56.00	-22.36
19.85	Peak	27.50	10.86	38.36	60.00	-21.64

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Page 32 of 77

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.

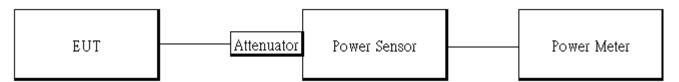
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

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.						
Power Meter	Anritsu	ML2496A	1804002	04/06/2020	04/05/2021					
Power Sensor	Anritsu	MA2411B	1726105	04/06/2020	04/05/2021					
Power Sensor	Anritsu	MA2411B	1726106	04/06/2020	04/05/2021					
Attenuator	Marvelous	WATT-218FS-10	RF268	11/20/2019	11/19/2020					
l Pex4 Cables	Woken	00100A1H6460 27	RF508	06/01/2020	05/31/2021					

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.
- 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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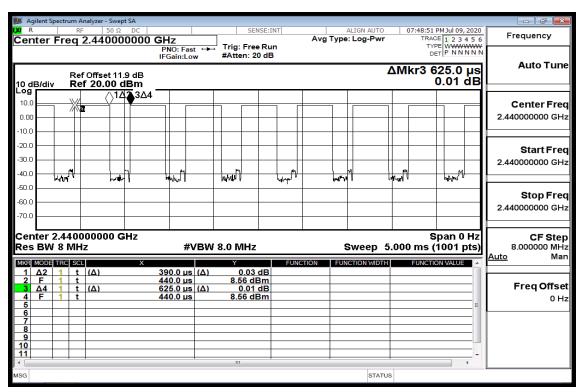
Page 33 of 77

7.5 Duty Factor:

Mode: 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

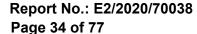
Duty Cycle Factor:10*log(1/(62/100))=2.08



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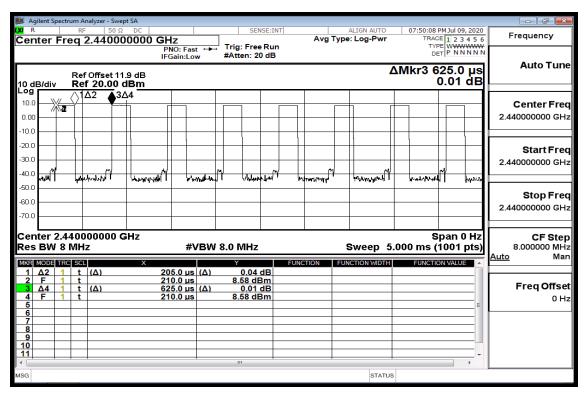




Mode: BLE (2M)

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
BLE	32.80	4.84	4.88	5.00

Duty Cycle Factor:10*log(1/(32.8/100))=4.84



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Page 35 of 77

7.6 Output Power:

7.6.1 Peak & Avg

Mode: BLE (1M)

BLE 1M

СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
Low	2402	7.52	1 Watt = 30 dBm
Mid	2440	7.63	1 Watt = 30 dBm
High	2480	7.58	1 Watt = 30 dBm
СН	Frequency (MHz)	Avg. Output Power (dBm)	Required Limit
Low	2402	7.42	1 Watt = 30 dBm
Mid	2440	7.48	1 Watt = 30 dBm
High	2480	7.45	1 Watt = 30 dBm

^{*}Note: Measured by power meter, cable loss as 11.9dB that offsets on the power meter in Peak

Mode: BLE (2M)

BLE 2M

СН	Frequency (MHz)	Peak Power Output (dBm)	Required Limit
Low	2402	7.31	1 Watt = 30 dBm
Mid	2440	7.51	1 Watt = 30 dBm
High	2480	7.44	1 Watt = 30 dBm
СН	Frequency (MHz)	Avg. Output Power (dBm)	Required Limit
Low	2402	7.20	1 Watt = 30 dBm
Mid	2440	7.46	1 Watt = 30 dBm
High	2480	7.37	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss as 11.9dB that offsets on the power meter in Peak

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^{*}Note: Measured by power meter, as cable loss+ Duty cycle factor that offsets on the power meter

^{*}Note: Max. Output include tune up tolerance Power is average power

^{*}Note: Measured by power meter, as cable loss+ Duty cycle factor that offsets on the power meter

^{*}Note: Max. Output include tune up tolerance Power is average power



Page 36 of 77

6DB BANDWIDTH MEASUREMENT

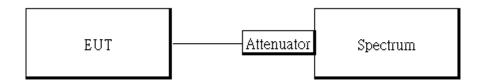
8.1 Standard Applicable

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

Measurement Equipment Used

Conducted Emission Test Site									
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
Spectrum Analyzer	KEYSIGHT	N9010A	MY53400256	11/21/2019	11/20/2020				
DC Block	PASTERNACK	PE8210	RF256	11/20/2019	11/19/2020				
Attenuator	Marvelous	WATT-218FS-10	RF268	11/20/2019	11/19/2020				
Coaxial Cables	Woken	00100A1F1A185 C	RF219	11/20/2019	11/19/2020				
I Pex4 Cables	Woken	00100A1H64602 7	RF508	06/01/2020	05/31/2021				

8.3 Test Set-up:



8.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set the spectrum analyzer as

RBW= 100,

VBW = 3 X RBW

Span=1.5 times of the EBW,

Sweep=auto,

Detector = Peak, and Max hold for 6dB Bandwidth test.

- 5. Mark the peak frequency and –6dB (upper and lower) frequency
- 6. Repeat above procedures until all test default channel is completed

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Page 37 of 77

Measurement Result:

Mode: BLE (1M)

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	0.6723	> 0.5	PASS
2440	0.6863	> 0.5	PASS
2480	0.684	> 0.5	PASS

Mode: BLE (2M)

Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2402	1.111	> 0.5	PASS
2440	1.121	> 0.5	PASS
2480	1.127	> 0.5	PASS

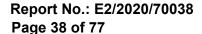
Note: detector (peak) and trace settings (max hold) for test plots.

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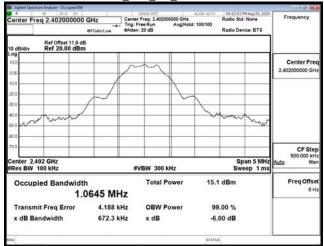
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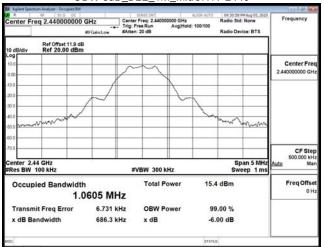




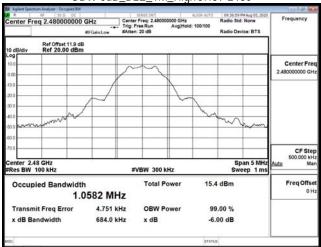
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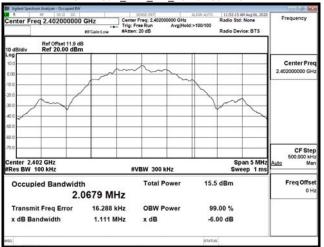




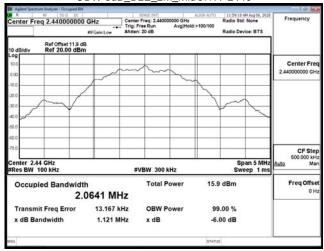
OBW 6dB_BLE_1M_HighCH39-2480



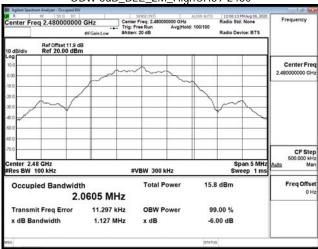
OBW 6dB_BLE_2M_LowCH00-2402



OBW 6dB BLE 2M MidCH19-2440



OBW 6dB_BLE_2M_HighCH39-2480



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Page 39 of 77

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).

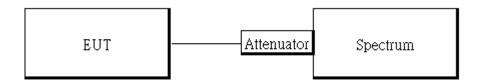
Measurement Equipment Used:

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Spectrum Analyzer	KEYSIGHT	N9010A	MY53400256	11/21/2019	11/20/2020			
DC Block	PASTERNACK	PE8210	RF256	11/20/2019	11/19/2020			
Attenuator	Marvelous	WATT-218FS-10	RF268	11/20/2019	11/19/2020			
Coaxial Cables	Woken	00100A1F1A185 C	RF219	11/20/2019	11/19/2020			
I Pex4 Cables	Woken	00100A1H64602 7	RF508	06/01/2020	05/31/2021			

Note: The measurement was taken place with the long duration of the time, and additional equipment list as shown blow indicate those equipment of which has been subject to undertake the calibration in intermediate period of time of the measurement.

Conducted Emission Test Site								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Spectrum Analyzer	KEYSIGHT	N9010A	MY53400256	11/20/2020	11/19/2021			
DC Block	PASTERNACK	PE8210	RF152	11/19/2020	11/18/2021			
Attenuator	Marvelous	WATT-218FS-10	RF19	11/19/2020	11/18/2021			
Coaxial Cables	Woken	00100A1F1A185 C	RF219	11/19/2020	11/18/2021			

Test SET-UP:

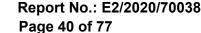


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Measurement Procedure

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.
- 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.
- Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
- Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
- 6. Mark the highest reading of the emission as the reference level measurement.
- 7. Marker on frequency, 2399.9MHz and 2483.6MHz, and examine shall 100 kHz immediately outside the authorized (2400~2483.5MHz) be attenuated by 20dB at least relative to the maximum emission of power.
- 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.
- Repeat above procedures until all default test channel measured were complete.

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Page 41 of 77

9.5 Measurement Result

Mode: BLE (1M)

Reference Level of Limit

Telefolice Ecvel of Ellillit								
Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)						
2402	8.35	-11.65						
2440	8.67	-11.33						
2480	8.61	-11.39						

NOTE: cable loss as 11.9dB that offsets in the spectrum

NOTE: Refer to next page for plots.

Mode: BLE (2M)

Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2402	8.36	-11.64
2440	8.66	-11.34
2480	8.61	-11.39

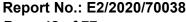
NOTE: cable loss as 11.9dB that offsets in the spectrum

NOTE: Refer to next page for plots.

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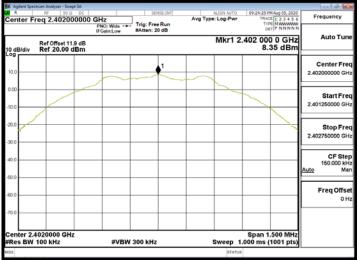
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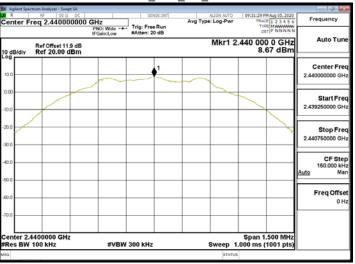
Page 42 of 77



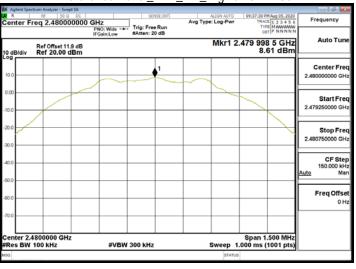
Reference Level BLE 1M LowCH00-2402



1M MidCH19-2440 Reference Level BLE



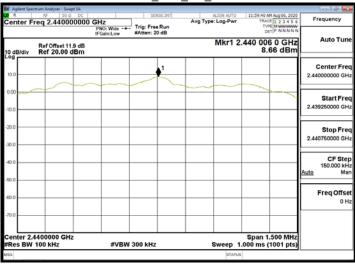
Reference Level BLE 1M HighCH39-2480



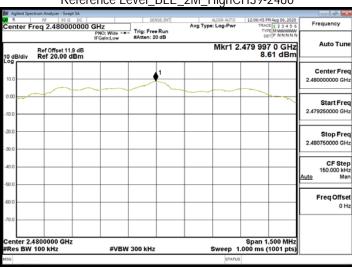
Reference Level BLE 2M LowCH00-2402



Reference Level_BLE_2M_MidCH19-2440



Reference Level BLE 2M HighCH39-2480



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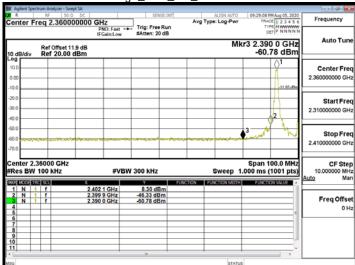
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Page 43 of 77



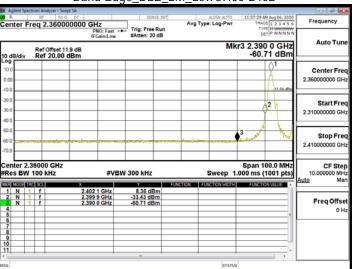
Band Edge BLE 1M LowCH00-2402



Band Edge_BLE_1M_HighCH39-2480



Band Edge BLE 2M LowCH00-2402



Band Edge_BLE_2M_HighCH39-2480



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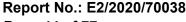
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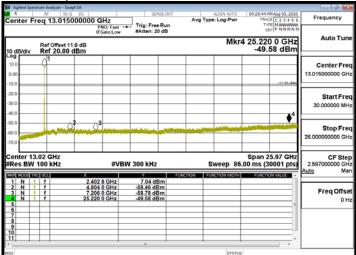
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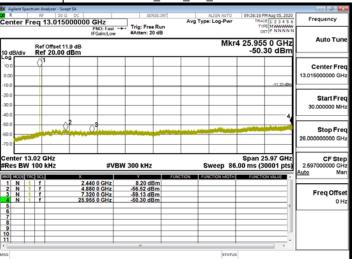
Page 44 of 77



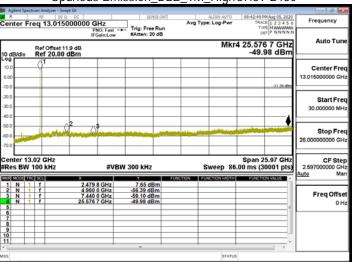
Spurious Emission BLE 1M LowCH00-2402



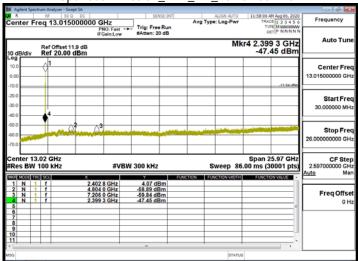
1M MidCH19-2440 Spurious Emission BLE



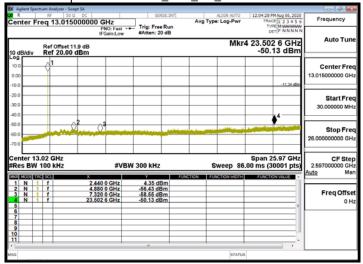
Spurious Emission BLE 1M HighCH39-2480



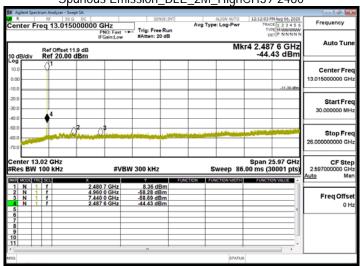
Spurious Emission BLE 2M LowCH00-2402



Spurious Emission BLE 2M MidCH19-2440



Spurious Emission BLE 2M HighCH39-2480



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Page 45 of 77

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.
- Emission level (dBμV/m) = 20 log Emission level (μV/m)

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Page 46 of 77

10.2 Measurement Equipment Used

966 Chamber								
EQUIPMENT	MFR	MODEL	SERIAL	LAST	CAL DUE.			
TYPE		NUMBER	NUMBER	CAL.				
Broadband Antenna	SCHWAZBECK	VULB 9168	9168-617	11/04/2019	11/03/2020			
Horn Antenna	Schwarzbeck	BBHA9170	184	12/25/2019	12/24/2020			
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/22/2020	06/21/2021			
Loop Antenna	ETS.LINDGREN	6502	143303	04/28/2020	04/27/2021			
3m Site NSA	SGS	966 chamber D	N/A	07/12/2020	07/11/2021			
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/08/2020	07/07/2021			
Pre-Amplifier	EMC Instruments	EMC184045B	980135	11/20/2019	11/19/2020			
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/20/2019	11/19/2020			
Pre-Amplifier	EMC Instruments	EMC12630SE	980271	11/20/2019	11/19/2020			
Attenuator	Woken	WATT-218FS-10	RF25	11/20/2019	11/19/2020			
High Pass Filter	R&S	F13 HPF 3GHz	RF64	11/20/2019	11/19/2020			
Low Pass Filter	EWT	EWT-56-0019	RF46	11/20/2019	11/19/2020			
Notch Filter	EWT	EWT-54-0038	RF55	11/20/2019	11/19/2020			
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17388/4	11/20/2019	11/19/2020			
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/20/2019	11/19/2020			
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/20/2019	11/19/2020			

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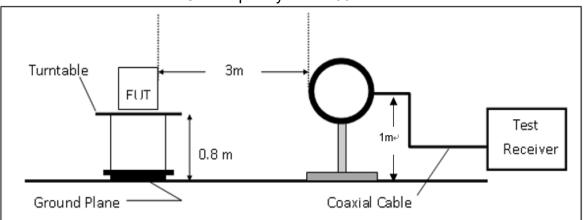
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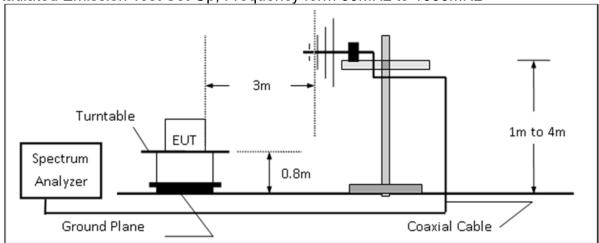


10.3 Test SET-UP

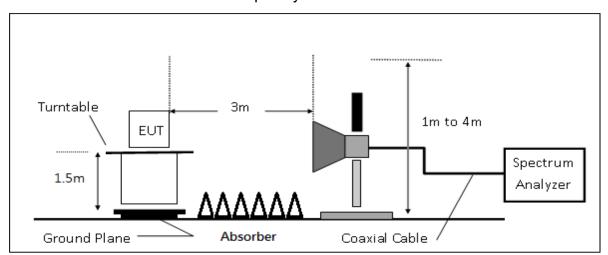
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



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



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



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Page 48 of 77

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.
- 6. 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 as referring to section 7.5 of this report 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 set VBW as referring to section 7.5 of this report if average reading is measured.
- 11. Repeat above procedures until all default test channel measured were complete.

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Page 49 of 77

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

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 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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Page 50 of 77

10.7.1 Radiated Band Edge Measurement Result

Mode: BLE (1M)

Report Number :E2/2020/70038 Test Site :966 Chamber D

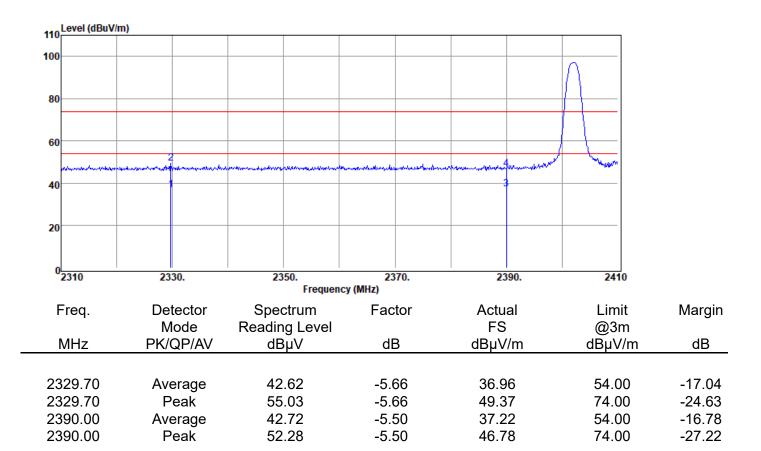
Test Date :2020-08-13 **Operation Mode** :BLE 1M

Test Frequency Temp./Humi. :2402 MHz :23.4/61

Test Mode :BE CH LOW Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 51 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

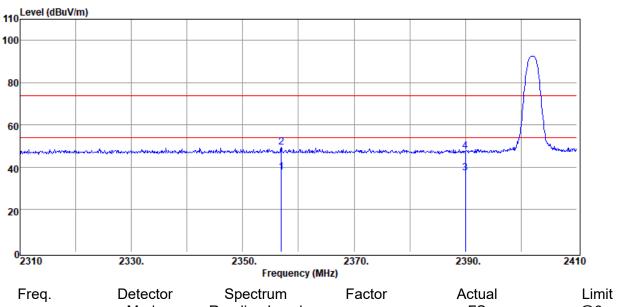
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :BE CH LOW Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
PK/QP/AV	dΒμV	dB	dBµV/m	dΒμV/m	dB
					·
Average	43.12	-5.59	37.53	54.00	-16.47
Peak	54.98	-5.59	49.39	74.00	-24.61
Average	42.98	-5.50	37.48	54.00	-16.52
Peak	53.25	-5.50	47.75	74.00	-26.25
	Mode PK/QP/AV Average Peak Average	Mode Reading Level PK/QP/AV dBµV Average 43.12 Peak 54.98 Average 42.98	Mode PK/QP/AV Reading Level dBμV dB Average Peak Peak Average 42.98 43.12 -5.59 -5.59 -5.50	Mode PK/QP/AV Reading Level dBμV FS dBμV/m Average 43.12 -5.59 37.53 Peak 54.98 -5.59 49.39 Average 42.98 -5.50 37.48	Mode PK/QP/AV Reading Level dB μV FS dB μV/m @3m dB μV/m Average 43.12 -5.59 37.53 54.00 Peak 54.98 -5.59 49.39 74.00 Average 42.98 -5.50 37.48 54.00

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Report Number **Test Site** :966 Chamber D :E2/2020/70038

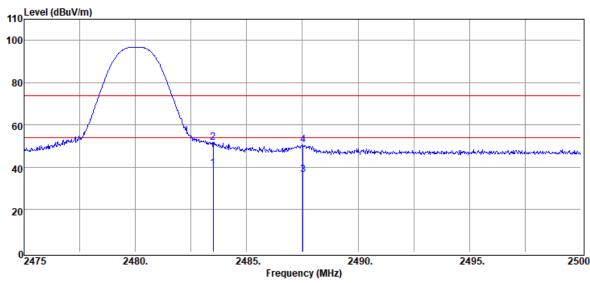
Operation Mode :BLE 1M **Test Date** :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :BE CH HIGH Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV/m	dBμV/m	dB
2483.50	Average	45.19	-5.56	39.63	54.00	-14.37
2483.50	Peak	57.19	-5.56	51.63	74.00	-22.37
2487.53	Average	41.95	-5.57	36.38	54.00	-17.62
2487.53	Peak	56.12	-5.57	50.55	74.00	-23.45

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Page 53 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

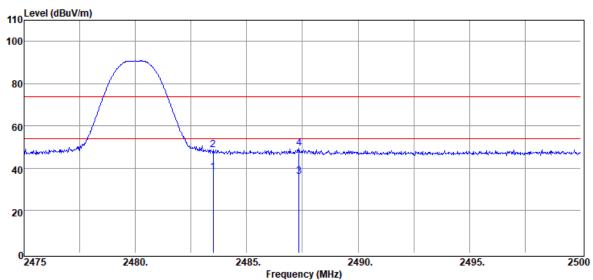
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :BE CH HIGH Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



			•			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
 MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	43.46	-5.56	37.90	54.00	-16.10
2483.50	Peak	54.22	-5.56	48.66	74.00	-25.34
2487.35	Average	41.78	-5.56	36.22	54.00	-17.78
2487.35	Peak	54.94	-5.56	49.38	74.00	-24.62

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Page 54 of 77



Mode: BLE (2M)

Report Number **Test Site** :966 Chamber D :E2/2020/70038

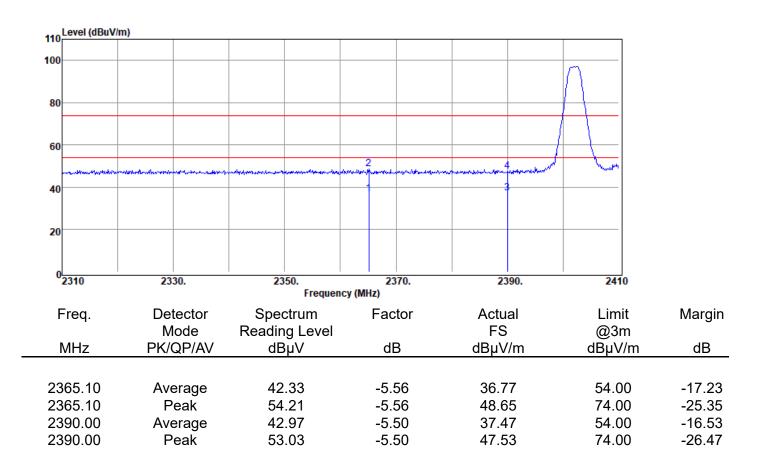
Test Date Operation Mode :BLE 2M :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :BE CH LOW Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2

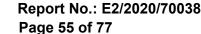


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Report Number Test Site :966 Chamber D :E2/2020/70038

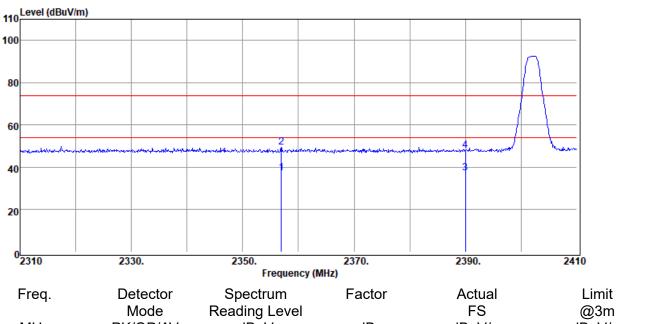
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :BE CH LOW Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
2356.90	Average	43.03	-5.59	37.44	54.00	-16.56
2356.90	Peak	54.98	-5.59	49.39	74.00	-24.61
2390.00	Average	42.88	-5.50	37.38	54.00	-16.62
2390.00	Peak	53.29	-5.50	47.79	74.00	-26.21

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Page 56 of 77

Report Number **Test Site** :966 Chamber D :E2/2020/70038

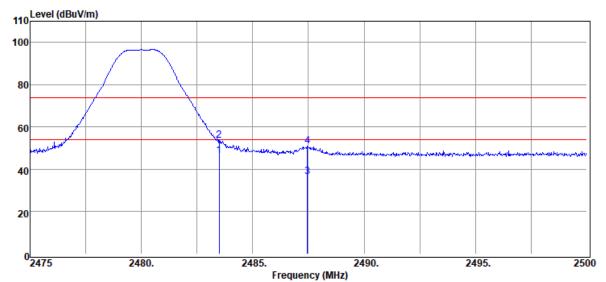
Operation Mode :BLE 2M **Test Date** :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :BE CH HIGH Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBµV/m	dB
2483.50	Average	51.96	-5.56	46.40	54.00	-7.60
2483.50	Peak	59.41	-5.56	53.85	74.00	-20.15
2487.45	Average	42.00	-5.56	36.44	54.00	-17.56
2487.45	Peak	56.53	-5.56	50.97	74.00	-23.03

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Page 57 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

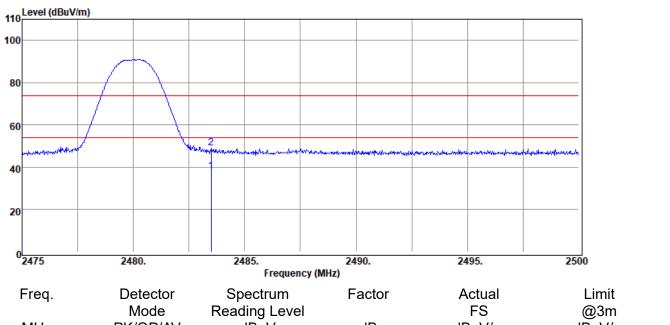
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :BE CH HIGH Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



			•			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBμV/m	dB
2483.50	Average	43.49	-5.56	37.93	54.00	-16.07
2483.50	Peak	54.63	-5.56	49.07	74.00	-24.93

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Page 58 of 77



10.7.2 Radiated Spurious Emission from 30MHz to 1000MHz

Mode: BLE (1M)

Report Number :E2/2020/70038 Test Site :966 Chamber D

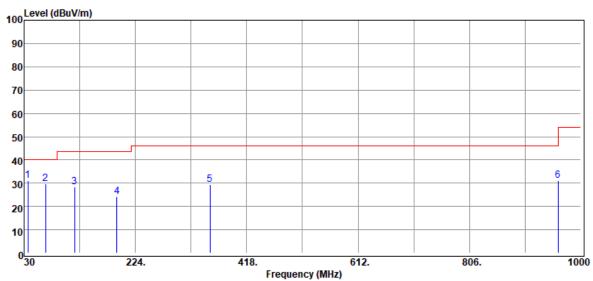
Operation Mode :BLE 1M Test Date :2020-08-14

Test Frequency :2440 MHz Temp./Humi. :23.7/58

Test Mode :TX CH MID Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



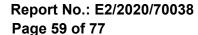
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
36.79	Peak	49.01	-17.92	31.09	40.00	-8.91
67.83	Peak	48.32	-18.66	29.66	40.00	-10.34
118.27	Peak	47.17	-18.88	28.29	43.50	-15.21
191.99	Peak	42.36	-18.18	24.18	43.50	-19.32
353.98	Peak	43.36	-14.04	29.32	46.00	-16.68
960.23	Peak	35.52	-4.32	31.20	54.00	-22.80

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Report Number Test Site :966 Chamber D :E2/2020/70038

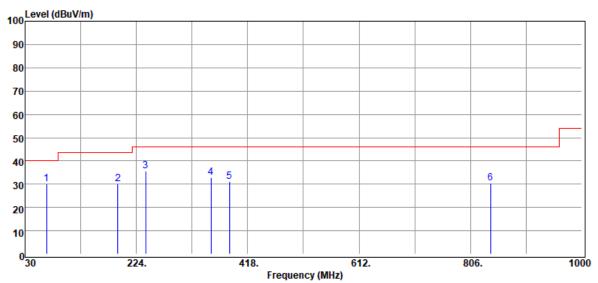
Operation Mode :BLE 1M **Test Date** :2020-08-14

Test Frequency :2440 MHz Temp./Humi. :23.7/58

Test Mode :TX CH MID Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2

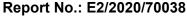


Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
67.83	Peak	48.86	-18.66	30.20	40.00	-9.80
191.99	Peak	48.43	-18.18	30.25	43.50	-13.25
240.49	Peak	52.76	-16.97	35.79	46.00	-10.21
353.98	Peak	46.78	-14.04	32.74	46.00	-13.26
385.99	Peak	44.10	-13.02	31.08	46.00	-14.92
840.92	Peak	36.75	-6.18	30.57	46.00	-15.43

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Page 60 of 77



Mode: BLE (2M)

Report Number **Test Site** :966 Chamber D :E2/2020/70038

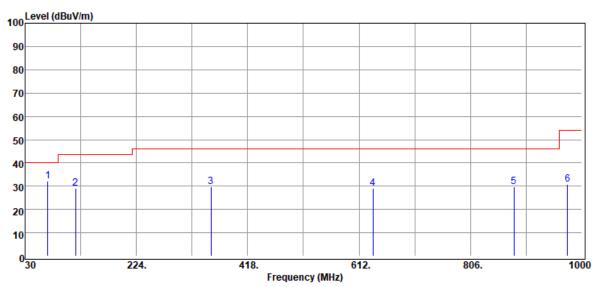
Test Date Operation Mode :BLE 2M :2020-08-14

Test Frequency :2440 MHz Temp./Humi. :23.7/58

Test Mode :TX CH MID Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



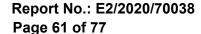
	Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
	IVII IZ	TIVQITAV	αυμν	чь	αυμν/ιιι	αυμν/π	чь
	69.77	Peak	51.39	-19.07	32.32	40.00	-7.68
	118.27	Peak	47.89	-18.88	29.01	43.50	-14.49
;	353.98	Peak	43.73	-14.04	29.69	46.00	-16.31
(636.25	Peak	37.17	-8.10	29.07	46.00	-16.93
	881.66	Peak	35.57	-5.64	29.93	46.00	-16.07
!	974.78	Peak	34.87	-4.12	30.75	54.00	-23.25

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Report Number Test Site :966 Chamber D :E2/2020/70038

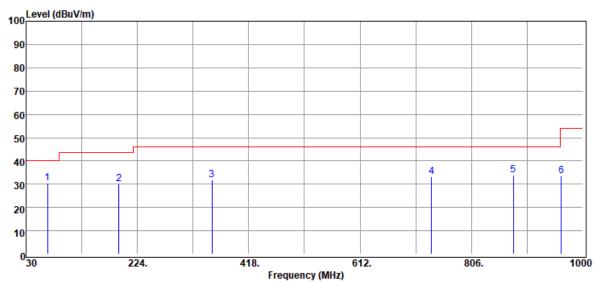
Operation Mode :BLE 2M **Test Date** :2020-08-14

Test Frequency :2440 MHz Temp./Humi. :23.7/58

Test Mode :TX CH MID Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dΒμV/m	dB
67.83	Peak	49.06	-18.66	30.40	40.00	-9.60
191.99	Peak	48.12	-18.18	29.94	43.50	-13.56
353.98	Peak	45.71	-14.04	31.67	46.00	-14.33
736.16	Peak	40.38	-7.15	33.23	46.00	-12.77
878.75	Peak	39.46	-5.68	33.78	46.00	-12.22
962.17	Peak	37.79	-4.27	33.52	54.00	-20.48

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Page 62 of 77

10.7.3 Radiated Spurious Emission above 1GHz

Mode: BLE (1M)

Report Number :E2/2020/70038 Test Site :966 Chamber D

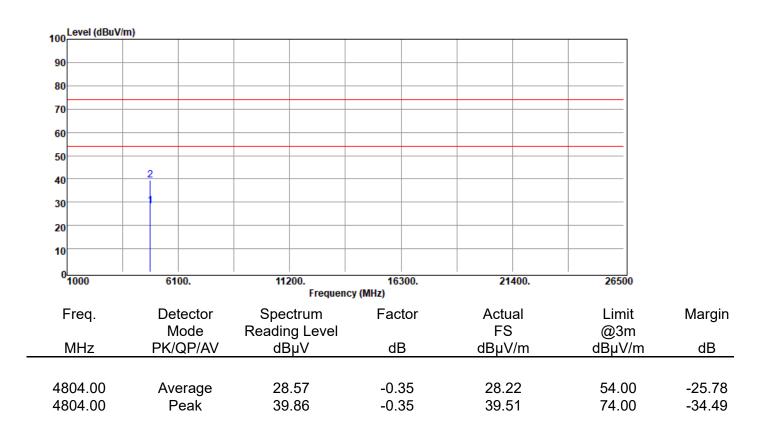
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :TX CH LOW Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 63 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

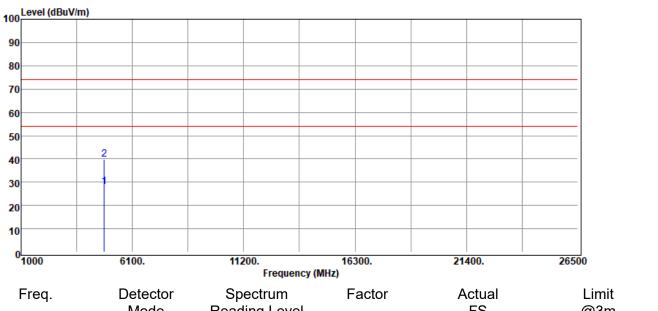
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :TX CH LOW Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



				•			
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
	MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBμV/m	dB
4	804.00	Average	28.52	-0.35	28.17	54.00	-25.83
4	804.00	Peak	40.27	-0.35	39.92	74.00	-34.08

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Page 64 of 77

Report Number :E2/2020/70038 Test Site :966 Chamber D

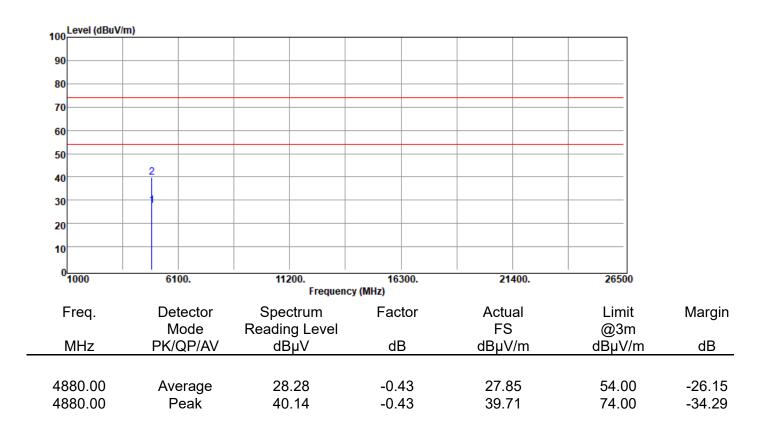
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2440 MHz Temp./Humi. :23.4/61

Test Mode :TX CH MID Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 65 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

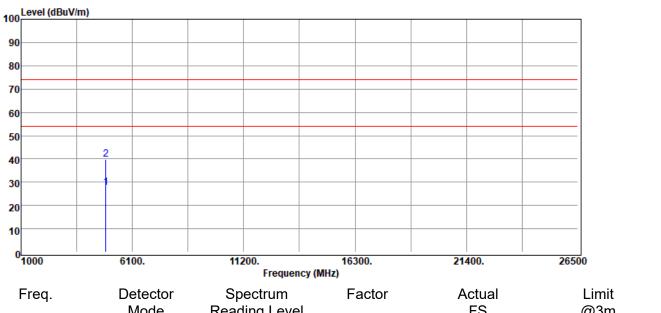
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2440 MHz Temp./Humi. :23.4/61

Test Mode :TX CH MID Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
4880.00	Average	28.27	-0.43	27.84	54.00	-26.16
4880.00	Peak	40.20	-0.43	39.77	74.00	-34.23

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Page 66 of 77

Report Number :E2/2020/70038 Test Site :966 Chamber D

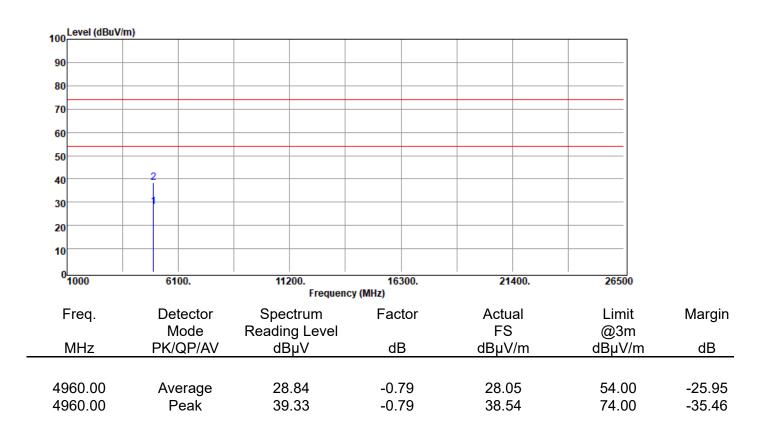
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :TX CH HIGH Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 67 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

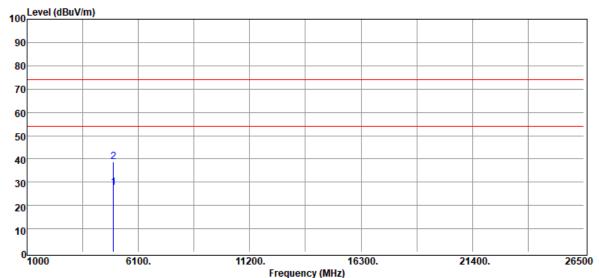
Operation Mode :BLE 1M Test Date :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :TX CH HIGH Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



			•			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
4960.00	Average	28.60	-0.79	27.81	54.00	-26.19
4960.00	Peak	39.67	-0.79	38.88	74.00	-35.12

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Page 68 of 77

Mode: BLE (2M)

Report Number **Test Site** :966 Chamber D :E2/2020/70038

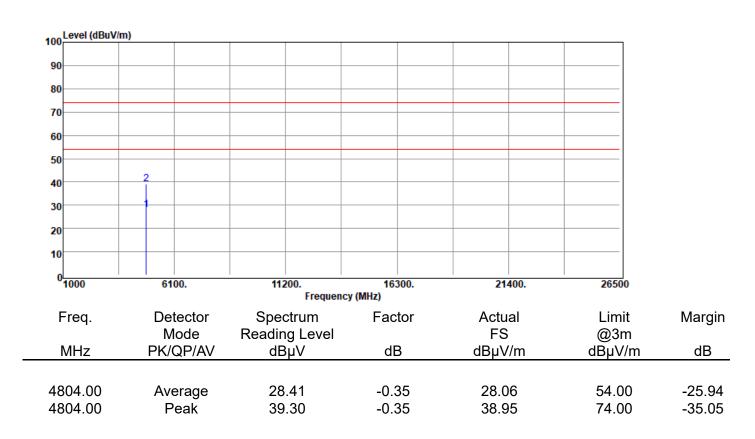
Test Date Operation Mode :BLE 2M :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :TX CH LOW Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 69 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

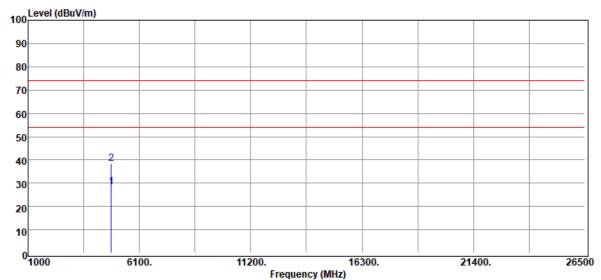
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2402 MHz Temp./Humi. :23.4/61

Test Mode :TX CH LOW Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



			•			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBμV/m	dB
4804.00	Average	28.63	-0.35	28.28	54.00	-25.72
4804.00	Peak	38.66	-0.35	38.31	74.00	-35.69

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Page 70 of 77

Report Number :E2/2020/70038 Test Site :966 Chamber D

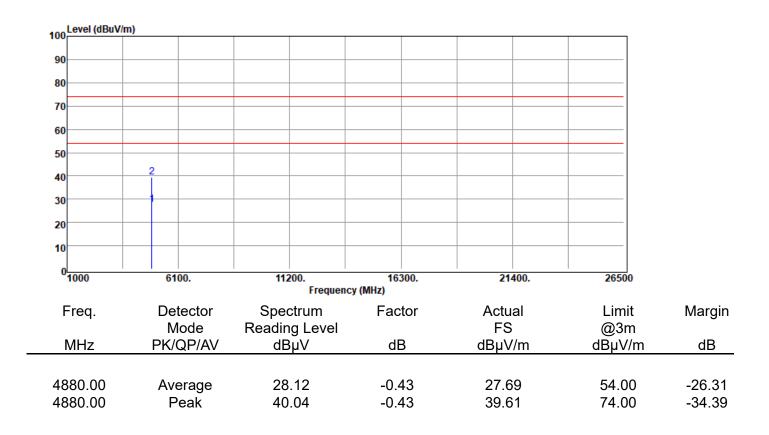
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2440 MHz Temp./Humi. :23.4/61

Test Mode :TX CH MID Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 71 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

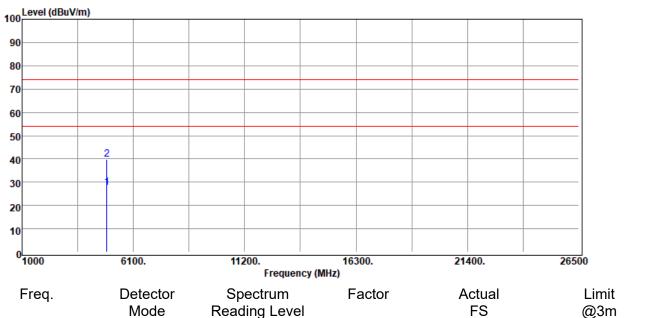
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2440 MHz Temp./Humi. :23.4/61

Test Mode :TX CH MID Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



Freq.	Detector	Spectrum	Factor	Actual FS	Limit	Margin
	Mode	Reading Level	ID		@3m	ID
MHz	PK/QP/AV	dΒμV	dB	dBμV/m	dBμV/m	dB
4880.00	Average	28.11	-0.43	27.68	54.00	-26.32
4880.00	Peak	40.12	-0.43	39.69	74.00	-34.31

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Page 72 of 77

Report Number **Test Site** :966 Chamber D :E2/2020/70038

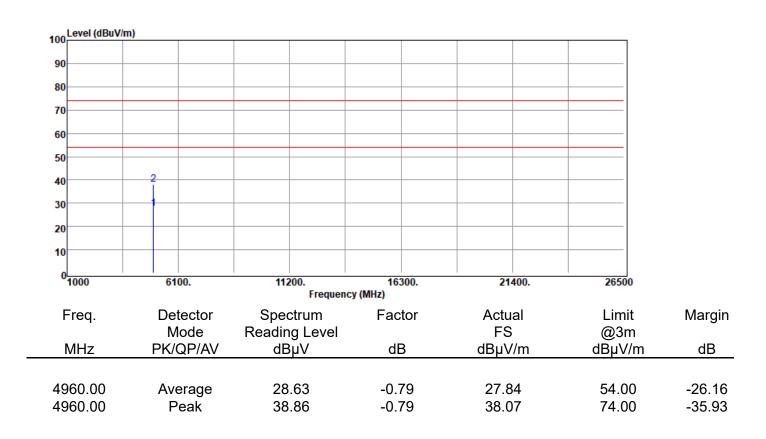
Operation Mode :BLE 2M **Test Date** :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :TX CH HIGH Antenna Pol. :VERTICAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



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Page 73 of 77

Report Number Test Site :966 Chamber D :E2/2020/70038

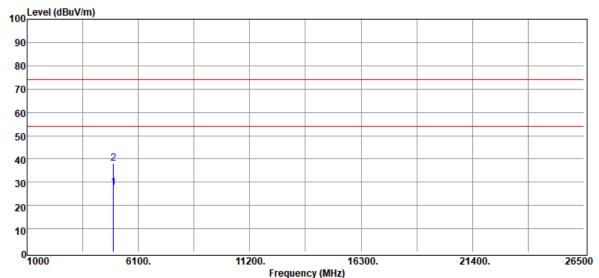
Operation Mode :BLE 2M Test Date :2020-08-13

Test Frequency :2480 MHz Temp./Humi. :23.4/61

Test Mode :TX CH HIGH Antenna Pol. :HORIZONTAL

EUT Pol :NB Plan Engineer :Kailin

EUT :Config 2



			•			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dΒμV	dB	dBµV/m	dBμV/m	dB
4960.00	Average	28.54	-0.79	27.75	54.00	-26.25
4960.00	Peak	38.84	-0.79	38.05	74.00	-35.95

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Page 74 of 77

11 POWER SPECTRAL DENSITY

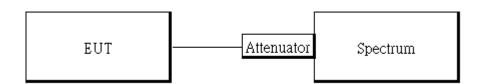
11.1 Standard Applicable:

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.	
Spectrum Analyzer	KEYSIGHT	N9010A	MY53400256	11/20/2020	11/19/2021	
Coaxial Cables	Woken	00100A1F1A 185C	RF219	11/19/2020	11/18/2021	
l Pex4 Cables	Woken	00100A1H64 6027	RF508	06/01/2020	05/31/2021	
Attenuator	Marvelous	WATT-218FS- 10	RF19	11/19/2020	11/18/2021	
DC Block	PASTERNACK	PE8210	RF152	11/19/2020	11/18/2021	

11.3 Test Set-up:



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Page 75 of 77

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.

11.5 Measurement Result:

Mode: BLE (1M)

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-6.588	8	PASS
2440	-6.671	8	PASS
2480	-7.027	8	PASS

NOTE: cable loss as 11.9dB that offsets in the spectrum

Mode: BLE (2M)

Frequency (MHz)	RF Power Density (dBm)	Maximum Limit (dBm)	Result
2402	-9.335	8	PASS
2440	-9.256	8	PASS
2480	-9.116	8	PASS

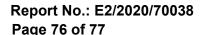
NOTE: cable loss as 11.9dB that offsets in the spectrum

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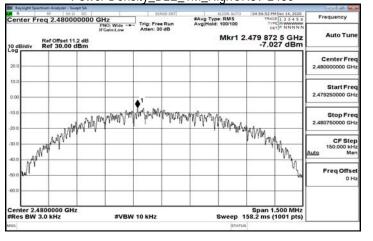
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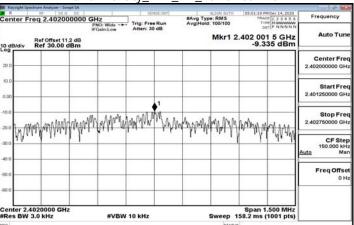
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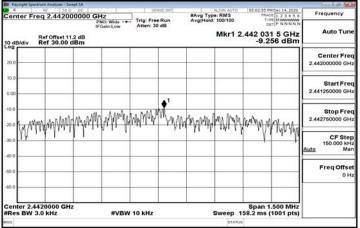
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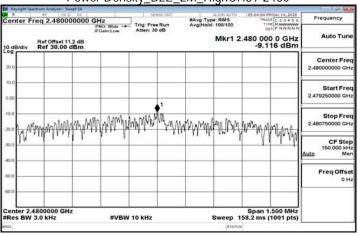
Power Density BLE 2M LowCH00-2402



Power Density_BLE 2M MidCH19-2440



Power Density_BLE 2M_HighCH39-2480



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Page 77 of 77

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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