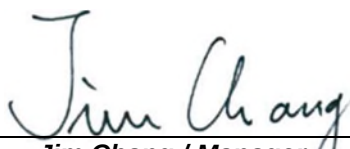


ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Darfon Electronics Czech s.r.o.
Turanka 1315/112, 627 00 Brno, Czech Republic.
Manufacturer: Darfon Electronics Czech s.r.o.
Turanka 1315/112, 627 00 Brno, Czech Republic.
Product Name: Mouse
Brand Name: QPAD
Model No.: DX-900
Model Difference: N/A
Report Number: E2/2021/30051
FCC ID 2AZDI-DX-900
IC: 27074-DX900
Issue Date: May 19, 2021
Date of Test: March 12, 2021 - May 17, 2021
Date of EUT Received: March 12, 2021

Approved By


Jim Chang / Manager

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, ISSED RSS-247.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/30051	Rev.00	Original.	May 19, 2021	Ariel Chang

Note:

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

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1 GENERAL INFORMATION

1.1 Product Description

Product Name	Mouse
Brand Name	QPAD
Model No.	DX-900
Model Difference	N/A
Hardware Version	02
Firmware Version	0202
Power Supply	1. EUT from host system. (DC 3.7V) 2. EUT from Lithium Battery. Rating: DC 3.7V, 690mAh, 2.553Wh

1.2 RF Specification

Radio Technology	2.4GHz
Frequency Range	2402 – 2480MHz
Channel number	40 channels
Modulation type	GFSK
Transmit Power	-1.91 dBm

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Internal Antenna	N/A	N/A	2400-2500	-2.07	-

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1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5, Amendment 2, February 2021

ANSI C63.10:2013

1.5 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction A	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		
Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.				

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1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is 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 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 Radiated Emission & Conducted (Antenna Port)
& Conduction(AC power line) Emission**



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	S0011721	N/A	N/A
3.	Notebook	Lenovo	L440	P0000367	N/A	N/A
4.	Notebook	Lenovo	L420	S0012467	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	RSS-247 §5.4 d	Peak Output Power	Compliant
§15.247(a)(2)	RSS-247 §5.2 a RSS-Gen §6.7	Emission Bandwidth	Compliant
§15.247(d) §15.205 §15.209	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10	Radiated & Conducted Band Edge and Spurious Emission	Compliant
§15.247(e)	RSS-247 §5.2 b	Peak Power Density	Compliant
§15.203 §15.247(b)	N/A	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2402 ~ 2480MHz Band

40 channels are provided for 2.4G

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
0	2404 MHz	14	2434 MHz	28	2462 MHz
1	2406 MHz	15	2436 MHz	29	2464 MHz
2	2408 MHz	16	2438 MHz	30	2466 MHz
3	2410 MHz	17	2440 MHz	31	2468 MHz
4	2412 MHz	18	2442 MHz	32	2470 MHz
5	2414 MHz	19	2444 MHz	33	2472 MHz
6	2416 MHz	20	2446 MHz	34	2474 MHz
7	2418 MHz	21	2448 MHz	35	2476 MHz
8	2420 MHz	22	2450 MHz	36	2478 MHz
9	2422 MHz	23	2452 MHz	37	2402 MHz
10	2424 MHz	24	2454 MHz	38	2426 MHz
11	2428 MHz	25	2456 MHz	39	2480 MHz
12	2430 MHz	26	2458 MHz		
13	2432 MHz	27	2460 MHz		

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

RADIATED EMISSION TEST (BELOW 1 GHz)			
MODE	AVAILABLE FREQUENCY	TESTED FREQUENCY	ANTENNA PORT
2.4G	2402-2480	2442	ch0

RADIATED EMISSION TEST (ABOVE 1 GHz)			
MODE	AVAILABLE FREQUENCY	TESTED FREQUENCY	ANTENNA PORT
2.4G	2402-2480	2402,2442,2480	ch0

Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case position was reported.

CONDUCTED TEST			
MODE	AVAILABLE FREQUENCY	TESTED FREQUENCY	ANTENNA PORT
2.4G	2402-2480	2402,2442,2480	ch0

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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 & 99% Bandwidth	+/- 1.53 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.69 dB
Peak Power Density	+/- 1.53 dB
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	+/- 1 %

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

Note:

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

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

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

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/24/2020	06/23/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021

6.3 EUT Setup:

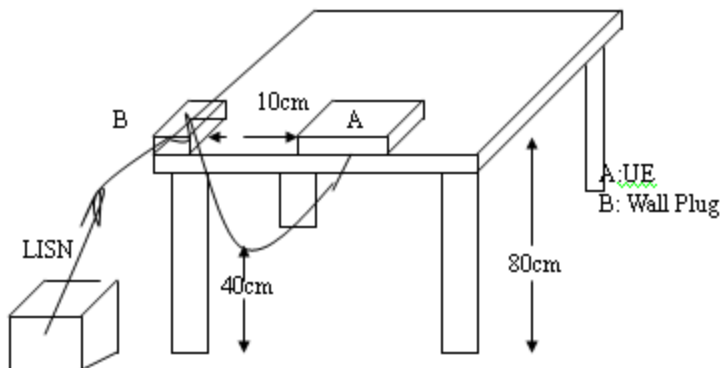
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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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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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :E2/2021/30051

Test Site :Conduction Room C

Test Mode :2.4G

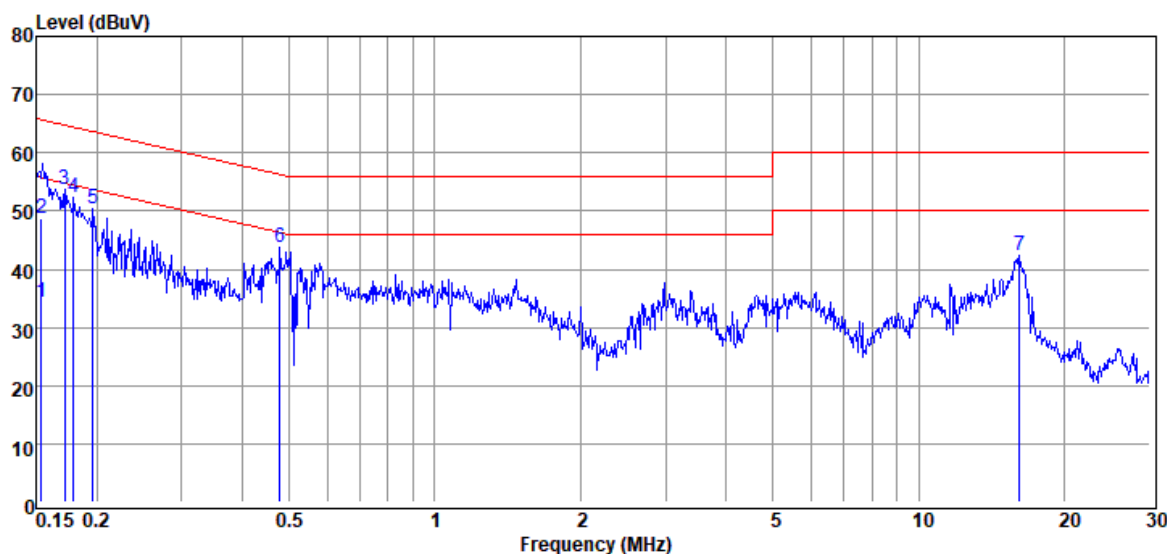
Test Date :2021-04-26

Power :120V/60Hz

Temp./Humi. :24.3/62

Probe :L1

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	23.97	10.30	34.27	55.81	-21.54
0.15	QP	38.38	10.30	48.68	65.81	-17.13
0.17	Peak	43.31	10.30	53.61	64.86	-11.25
0.18	Peak	42.16	10.30	52.46	64.50	-12.04
0.20	Peak	40.03	10.30	50.33	63.76	-13.43
0.48	Peak	33.56	10.31	43.87	56.36	-12.49
16.14	Peak	31.45	10.81	42.26	60.00	-17.74

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Report Number :E2/2021/30051

Test Site :Conduction Room C

Test Mode :2.4G

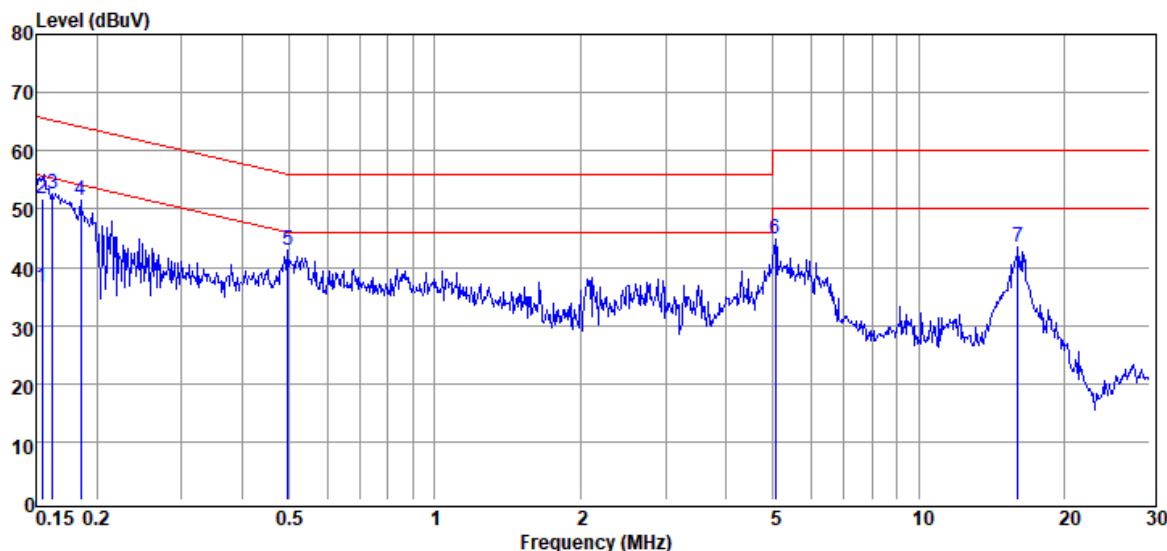
Test Date :2021-04-26

Power :120V/60Hz

Temp./Humi. :24.3/62

Probe :N

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	26.10	10.31	36.41	55.75	-19.34
0.15	QP	41.51	10.31	51.82	65.75	-13.93
0.16	Peak	42.42	10.31	52.73	65.34	-12.61
0.19	Peak	41.13	10.30	51.43	64.24	-12.81
0.50	Peak	32.53	10.32	42.85	56.05	-13.20
5.06	Peak	34.25	10.59	44.84	60.00	-15.16
16.06	Peak	32.62	10.90	43.52	60.00	-16.48

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7 PEAK OUTPUT POWER MEASUREMENT

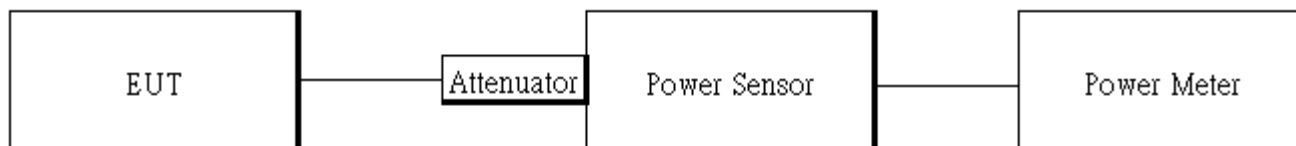
7.1 Standard Applicable:

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

7.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1512003	07/23/2020	07/22/2021
Power Sensor	Anritsu	MA2411B	1339378	07/23/2020	07/22/2021
Power Sensor	Anritsu	MA2411B	1339379	07/23/2020	07/22/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
Attenuator	Marvelous	MVE2213-10	RF10	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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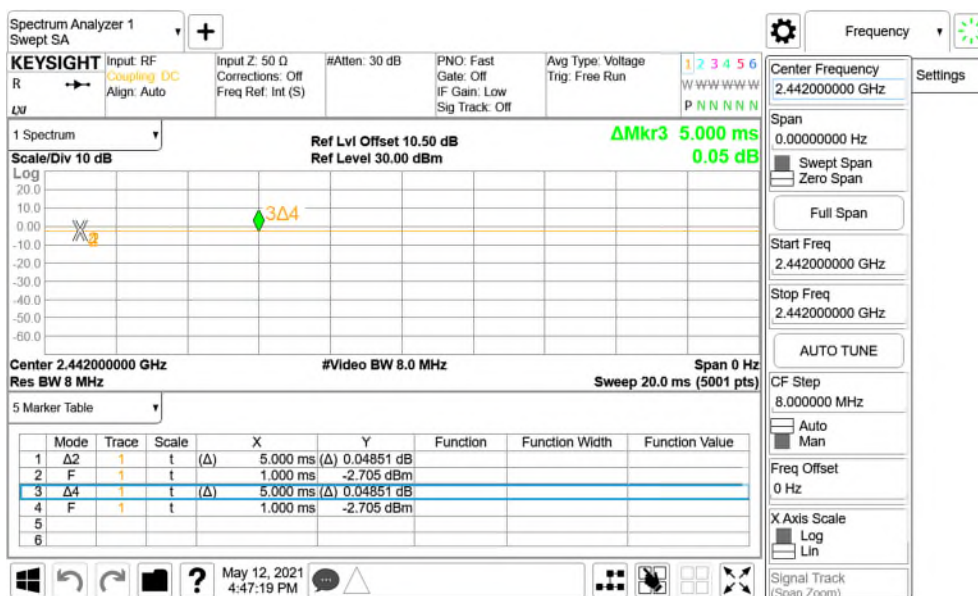
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7.5 Duty Factor:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
2.4G	100.00	0.00	0.00	0.01

Duty Cycle_2.4G_Chain0_2442MHz



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7.6 Output Power:

7.6.1 Peak & Avg

2.4G Ch0					
CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Limit (dBm)	RESULT
Low	2402	default	-1.91	30.00	PASS
Mid	2442	default	-2.61	30.00	PASS
High	2480	default	-3.09	30.00	PASS
2.4G Ch0					
CH	Freq. (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Limit (dBm)	RESULT
Low	2402	default	-2.25	30.00	PASS
Mid	2442	default	-2.98	30.00	PASS
High	2480	default	-3.45	30.00	PASS

7.6.2 EIRP

2.4G Ch0						
CH	Freq. (MHz)	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	RESULT
Low	2402	-2.25	-2.07	-4.32	36	PASS
Mid	2442	-2.98	-2.07	-5.05	36	PASS
High	2480	-3.45	-2.07	-5.52	36	PASS

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8 EMISSION BANDWIDTH MEASUREMENT

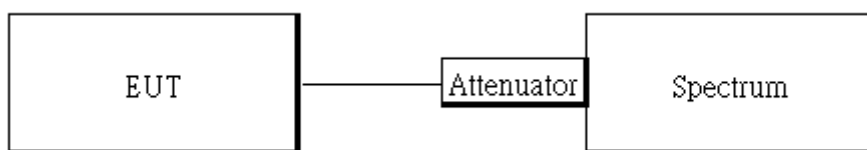
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/24/2020	06/23/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021

8.3 Test Set-up:



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8.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as
RBW= 100 kHz ,
VBW = 3 X RBW,
Span= large enough to capture all products of the modulation process,
Sweep=auto,
Detector = Peak, and Max hold for -6dB Bandwidth test.
5. Set the spectrum analyzer as
RBW= 1 % to 5% of 99% Bandwidth ,
VBW $\geq$ 3 X RBW,
Span= large enough to capture all products of the modulation process,
Sweep=auto,
Detector = Peak, and Max hold for 99% Bandwidth test.
6. Mark the peak frequency and 99%dB (upper and lower) frequency
7. Repeat above procedures until all test default channel is completed

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8.5 Measurement Result:

8.5.1 6dB Bandwidth

2.4G Ch0			
Freq. (MHz)	6dB BW (kHz)	Limit (kHz)	Result
2402	913.20	> 500	PASS
2442	912.50	> 500	PASS
2480	904.20	> 500	PASS

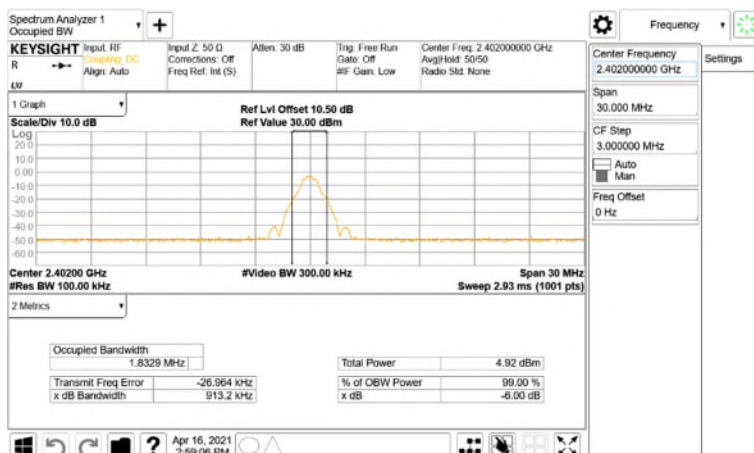
**Refer to next page for plots*

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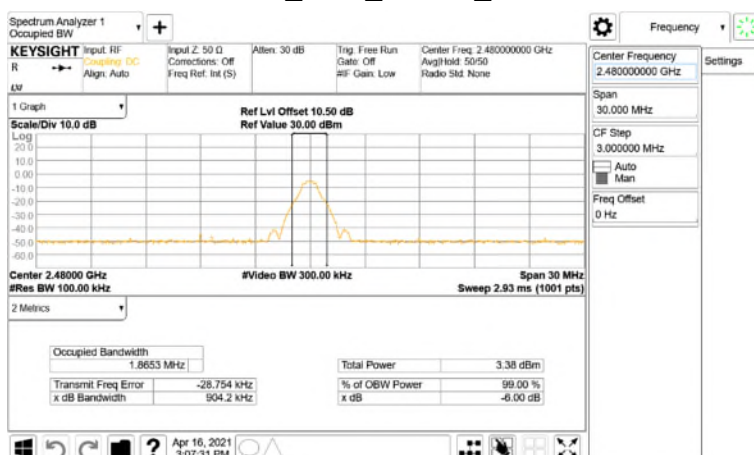
OBW 6dB_2.4G_Chain0_2402MHz



OBW 6dB_2.4G_Chain0_2442MHz



OBW 6dB_2.4G_Chain0_2480MHz



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8.5.2 99%Bandwidth

2.4G Ch0	
Freq. (MHz)	99% BW (MHz)
2402	2.0071
2442	2.0117
2480	2.0336

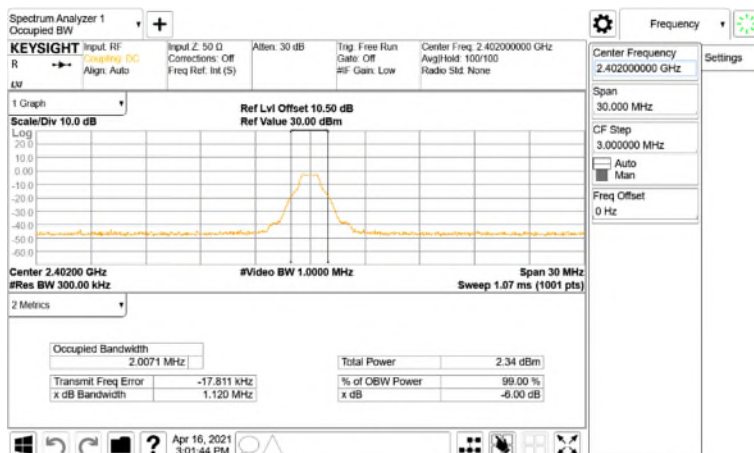
**Refer to next page for plots*

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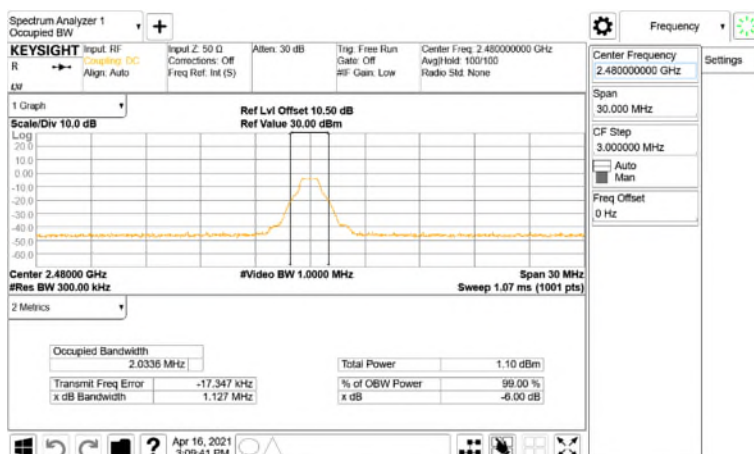
IC OBW 99%_2.4G_Chain0_2402MHz



IC OBW 99%_2.4G_Chain0_2442MHz



IC OBW 99%_2.4G_Chain0_2480MHz



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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

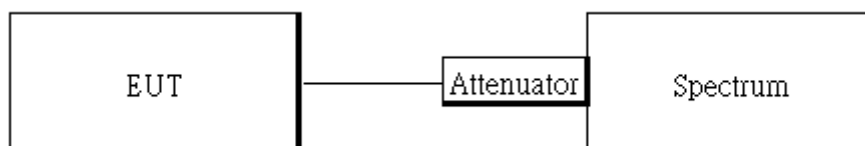
9.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

9.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/24/2020	06/23/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	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.

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

9.4.2 Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = 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

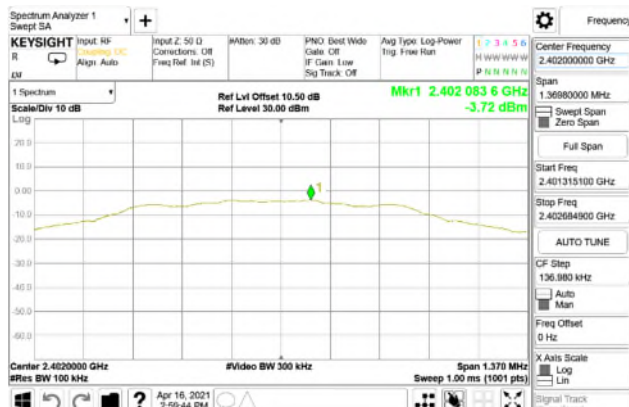
Reference Level of Limit 2.4G			
Freq. (MHz)	PSD (dBm)	Offset	Reference Level of Limit (dBm)
2402	-3.72	10.50	-23.72
2442	-3.60	10.50	-23.60
2480	-5.18	10.50	-25.18

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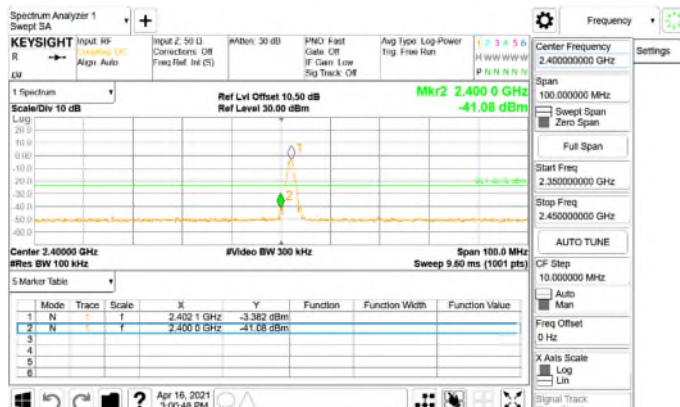
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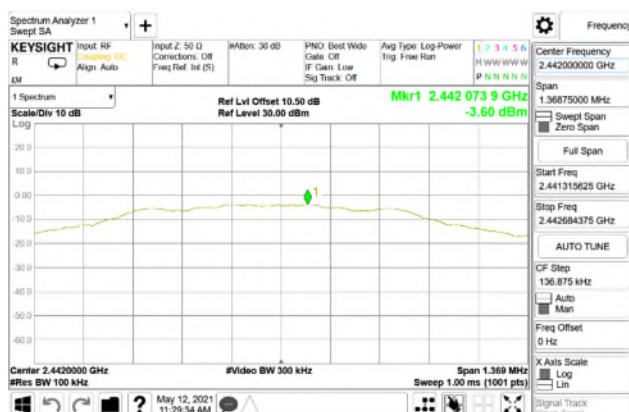
Reference Level_2.4G_Chain0_2402MHz



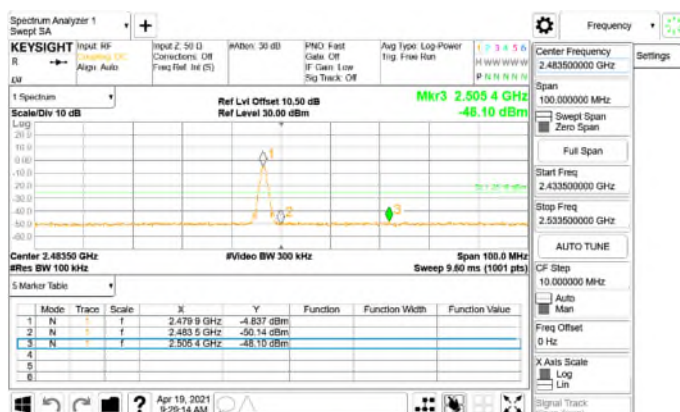
Band Edge_2.4G_Chain0_2402MHz



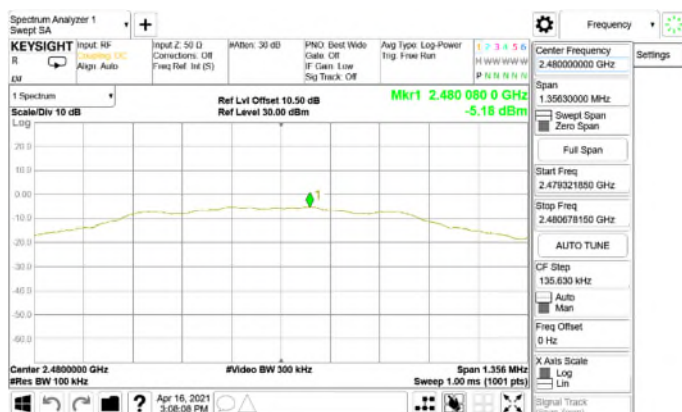
Reference Level_2.4G_Chain0_2442MHz



Band Edge_2.4G_Chain0_2480MHz



Reference Level_2.4G_Chain0_2480MHz

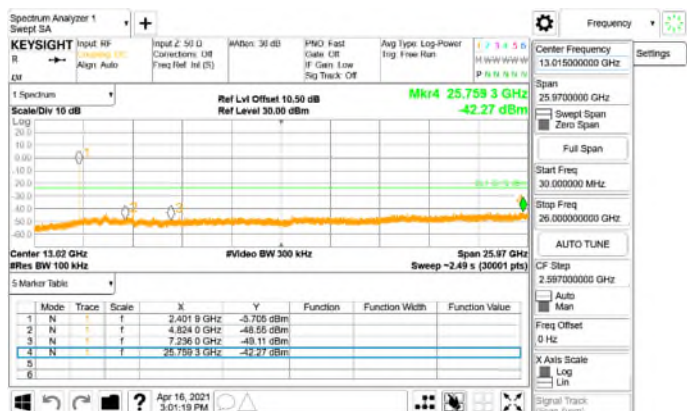


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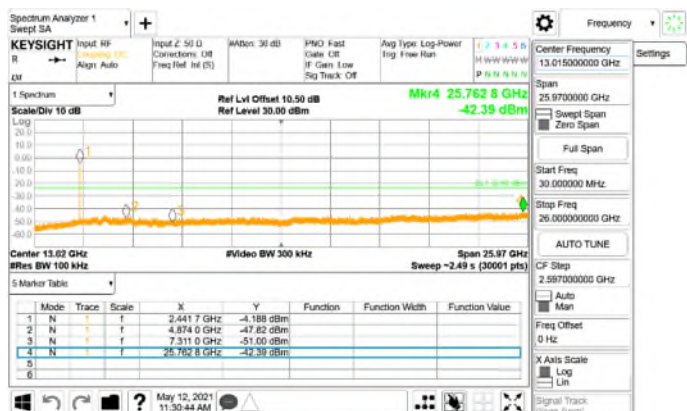
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Spurious Emission_2.4G_Chain0_2402MHz



Spurious Emission_2.4G_Chain0_2442MHz



Spurious Emission_2.4G_Chain0_2480MHz



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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 and RSS-Gen §8.9 Table 5 and 6 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13.2.a 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 (dBμV/m) = 20 log Emission level (μV/m)

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10.2 Measurement Equipment Used

Radiated Emission Test Site: SAC C					
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
Loop Antenna	ETS.LINDGREN	6502	148045	10/19/2020	10/18/2021
EMI Test Receiver	R&S	ESU 40	100363	04/29/2020	04/28/2021
EMI Test Receiver	R&S	ESU 40	100363	04/28/2021	04/27/2022
Pre-Amplifier	EMC Instruments	EMC330	980096	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2020	10/26/2021
Attenuator	Marvelous	WATT-218FS-10	RF20	11/19/2020	11/18/2021
Band Rejection Filter	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
Notebook	Lenovo	L440	P0000367	N/A	N/A

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

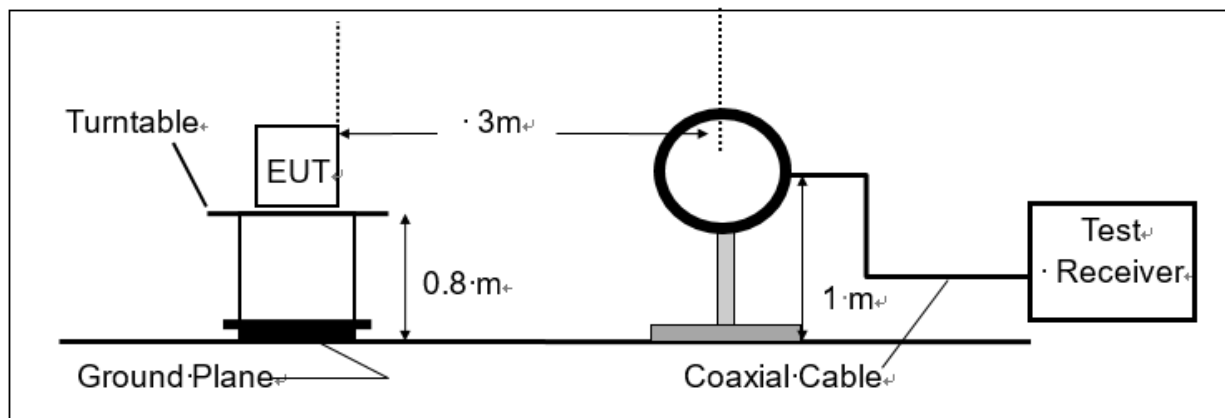
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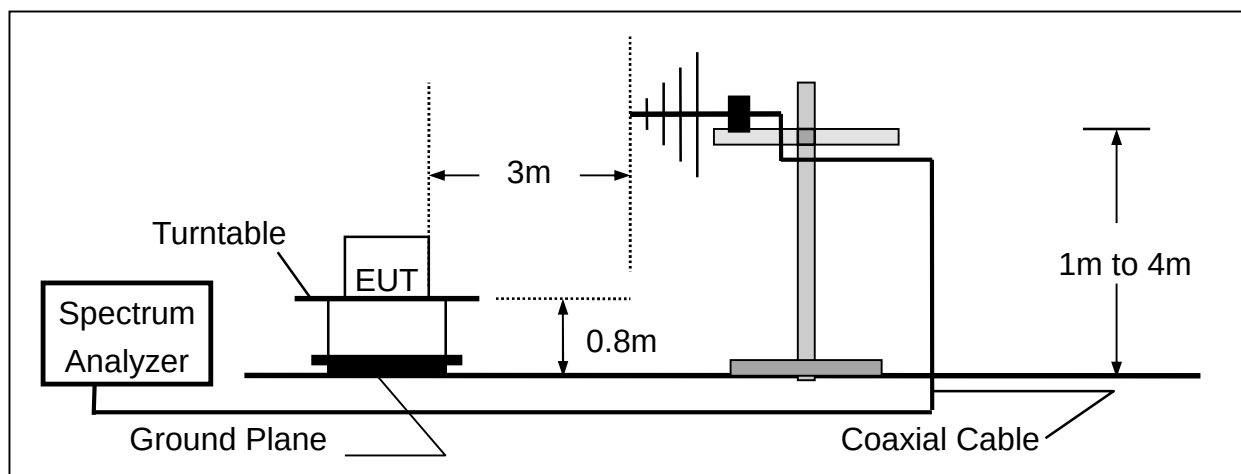
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10.3 Test SET-UP

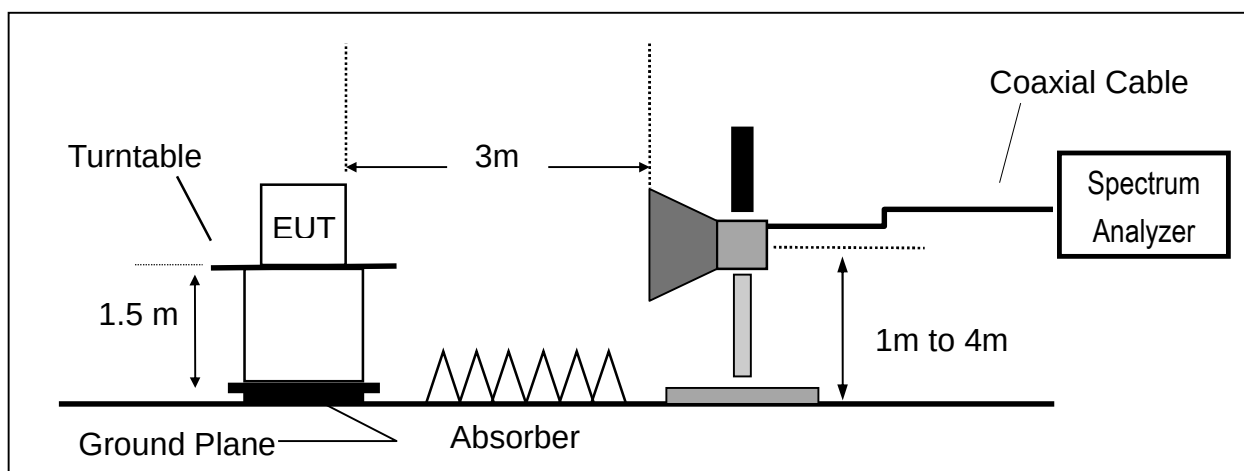
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-UP, Frequency 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.
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=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

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 $20 \cdot \log(uV/m)$

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/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) & RSS-GEN §6.13.2 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 :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2402 MHz

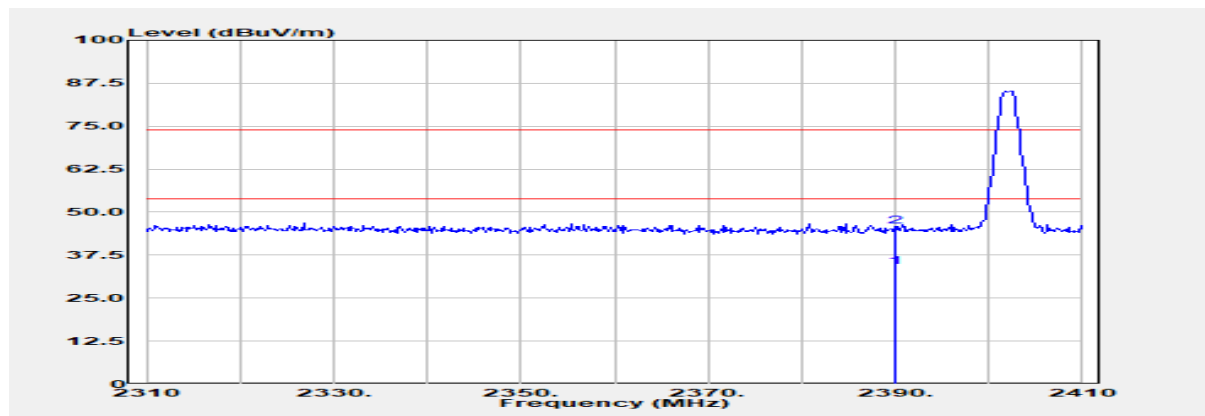
Temp./Humi. :23.9/65

Test Mode :BE CH LOW

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2390.000	Average	28.83	5.18	34.01	54.00	-19.99
2390.000	Peak	40.79	5.18	45.97	74.00	-28.03

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Report Number :E2/2021/30051

Operation Mode :2.4G

Test Frequency :2402 MHz

Test Mode :BE CH LOW

EUT Pol :E2 Plane

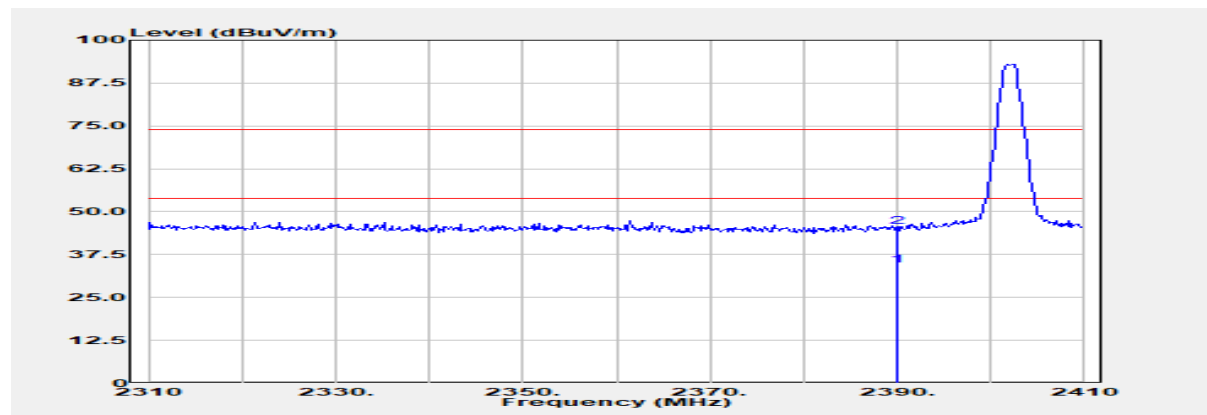
Test Site :966 Chamber C

Test Date :2021-04-24

Temp./Humi. :23.9/65

Antenna Pol. :Horizontal

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2390.000	Average	29.11	5.18	34.29	54.00	-19.71
2390.000	Peak	40.39	5.18	45.57	74.00	-28.43

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2480 MHz

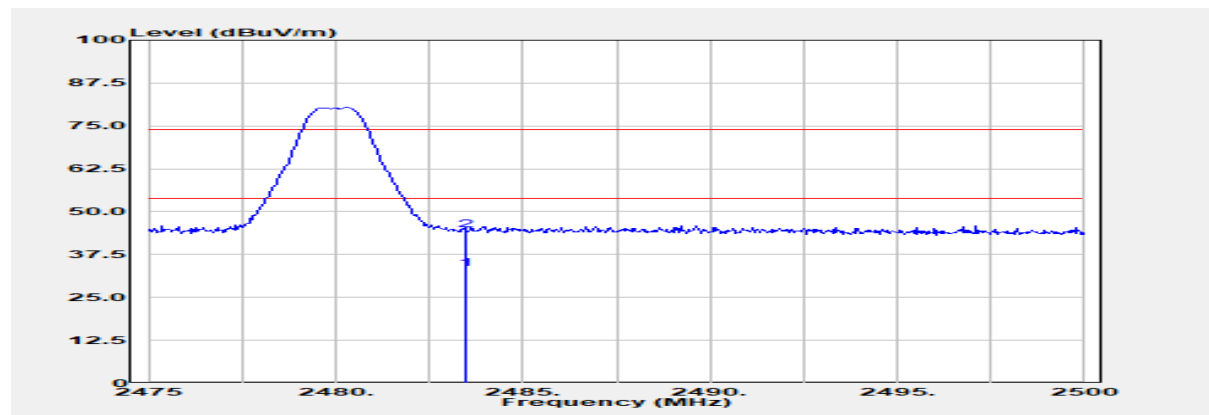
Temp./Humi. :23.9/65

Test Mode :BE CH HIGH

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Average	29.31	4.04	33.35	54.00	-20.65
2483.500	Peak	40.63	4.04	44.67	74.00	-29.33

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2480 MHz

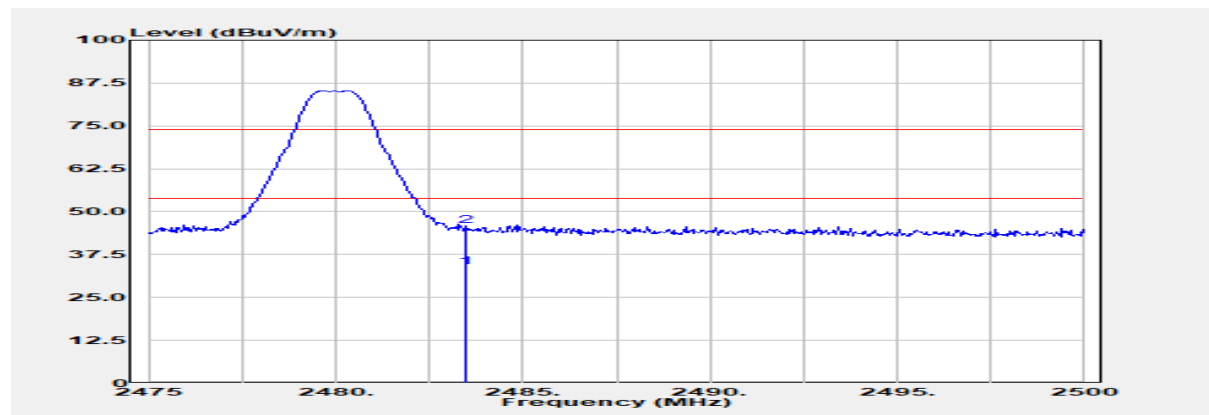
Temp./Humi. :23.9/65

Test Mode :BE CH HIGH

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Average	29.91	4.04	33.95	54.00	-20.05
2483.500	Peak	41.74	4.04	45.77	74.00	-28.23

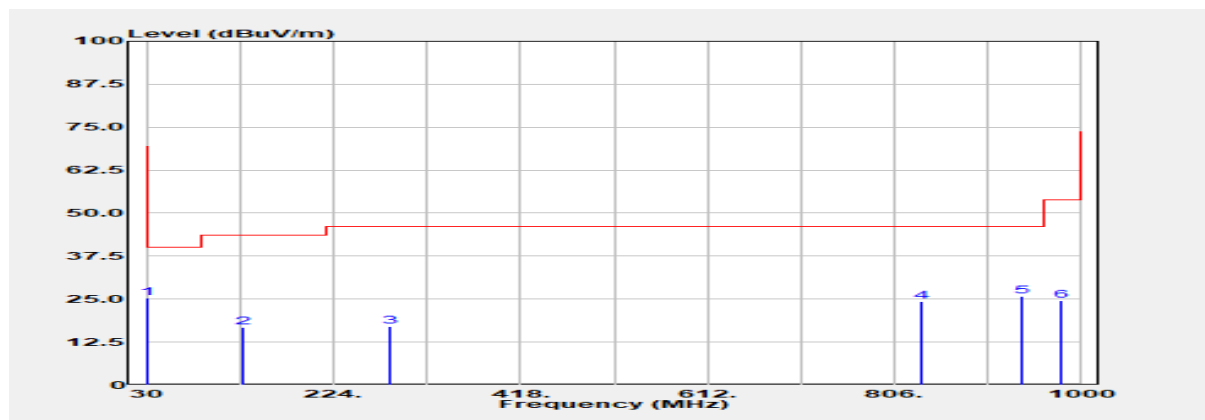
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10.7.2 Radiated Spurious Emission from 30MHz to 1000MHz

Report Number	:E2/2021/30051	Test Site	:966 Chamber C
Operation Mode	:2.4G	Test Date	:2021-05-12
Test Frequency	:2442 MHz	Temp./Humi.	:23.6/66
Test Mode	:Tx CH MID	Antenna Pol.	:VERTICAL
EUT Pol	:E2 Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
31.554	Peak	32.64	-7.29	25.35	40.00	-14.65
129.487	Peak	33.58	-16.89	16.69	43.50	-26.81
281.827	Peak	32.77	-15.65	17.12	46.00	-28.88
833.670	Peak	31.11	-6.84	24.26	46.00	-21.74
937.821	Peak	31.39	-5.62	25.77	46.00	-20.23
978.237	Peak	29.61	-5.15	24.46	54.00	-29.54

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-05-12

Test Frequency :2442 MHz

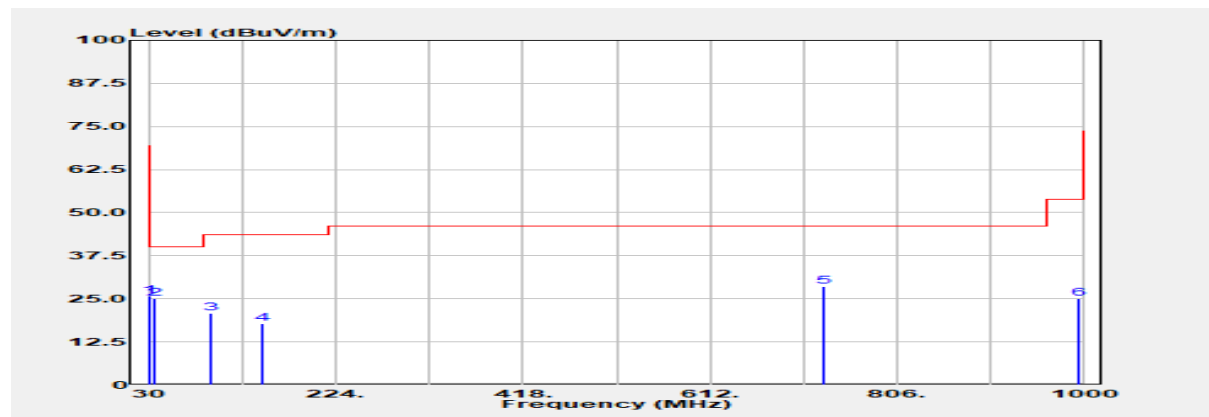
Temp./Humi. : 23.6/66

Test Mode :Tx CH MID

Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
30.000	Peak	32.22	-6.45	25.76	40.00	-14.24
36.218	Peak	35.14	-10.03	25.11	40.00	-14.89
95.288	Peak	41.45	-20.74	20.71	43.50	-22.79
148.141	Peak	35.61	-17.89	17.72	43.50	-25.78
729.519	Peak	36.48	-7.96	28.52	46.00	-17.48
993.782	Peak	29.96	-4.86	25.10	54.00	-28.90

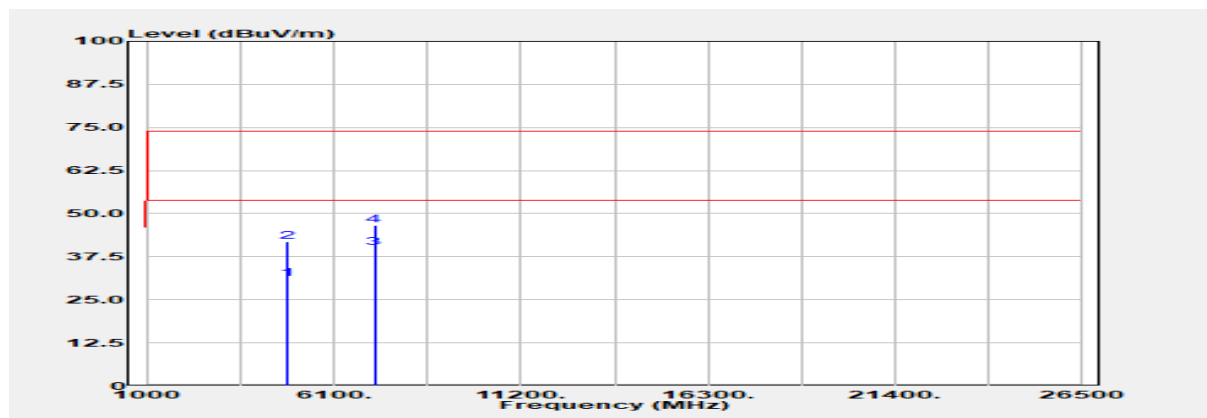
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10.7.3 Radiated Spurious Emission above 1GHz

Report Number	:E2/2021/30051	Test Site	:966 Chamber C
Operation Mode	:2.4G	Test Date	:2021-04-24
Test Frequency	:2402 MHz	Temp./Humi.	:23.8/64
Test Mode	:Tx CH LOW	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4804.000	Average	20.12	10.87	30.99	54.00	-23.01
4804.000	Peak	30.89	10.87	41.77	74.00	-32.23
7206.000	Average	22.80	17.27	40.07	54.00	-13.93
7206.000	Peak	29.31	17.27	46.58	74.00	-27.42

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2402 MHz

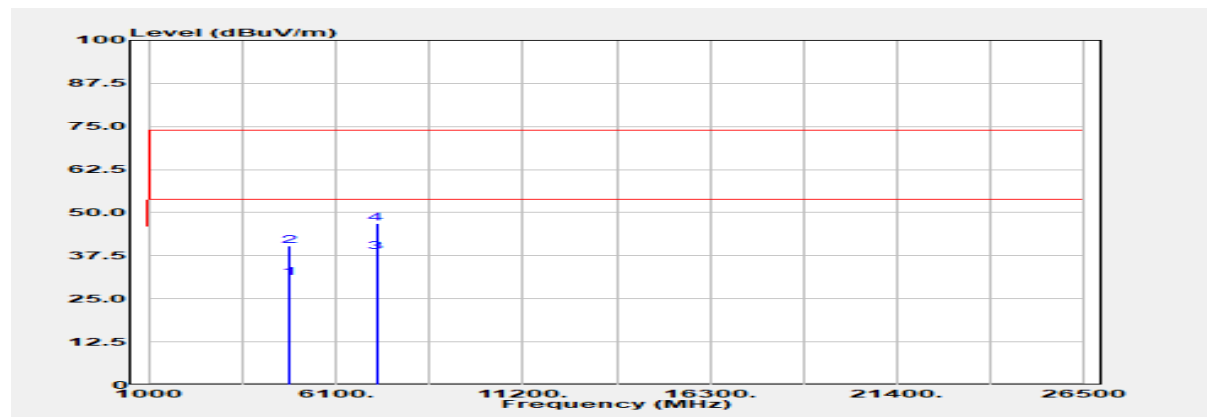
Temp./Humi. :23.8/64

Test Mode :Tx CH LOW

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4804.000	Average	20.18	10.87	31.05	54.00	-22.95
4804.000	Peak	29.54	10.87	40.41	74.00	-33.59
7206.000	Average	21.33	17.27	38.60	54.00	-15.40
7206.000	Peak	29.62	17.27	46.89	74.00	-27.11

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-05-12

Test Frequency :2442 MHz

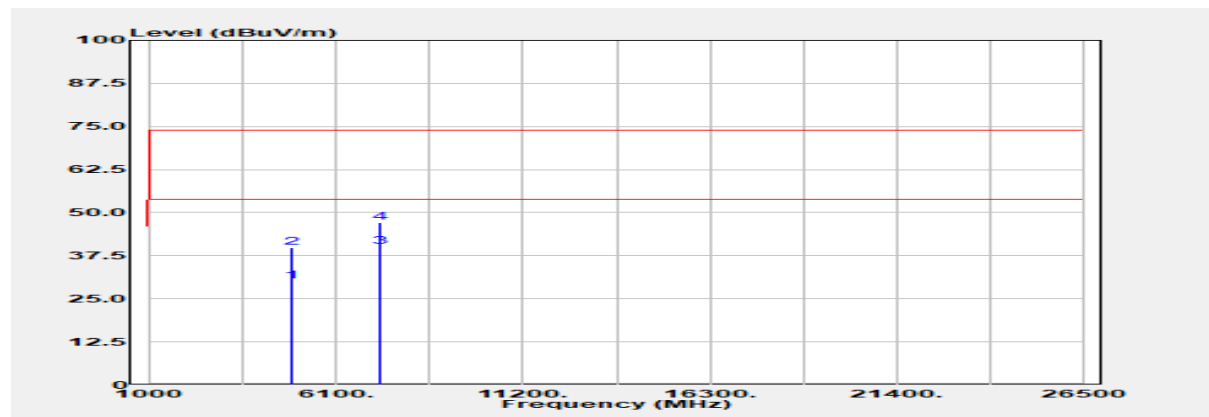
Temp./Humi. :23.6/67

Test Mode :Tx CH MID

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4884.000	Average	19.88	10.16	30.03	54.00	-23.97
4884.000	Peak	29.69	10.16	39.84	74.00	-34.16
7326.000	Average	21.81	18.20	40.01	54.00	-13.99
7326.000	Peak	28.89	18.20	47.09	74.00	-26.91

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-05-12

Test Frequency :2442 MHz

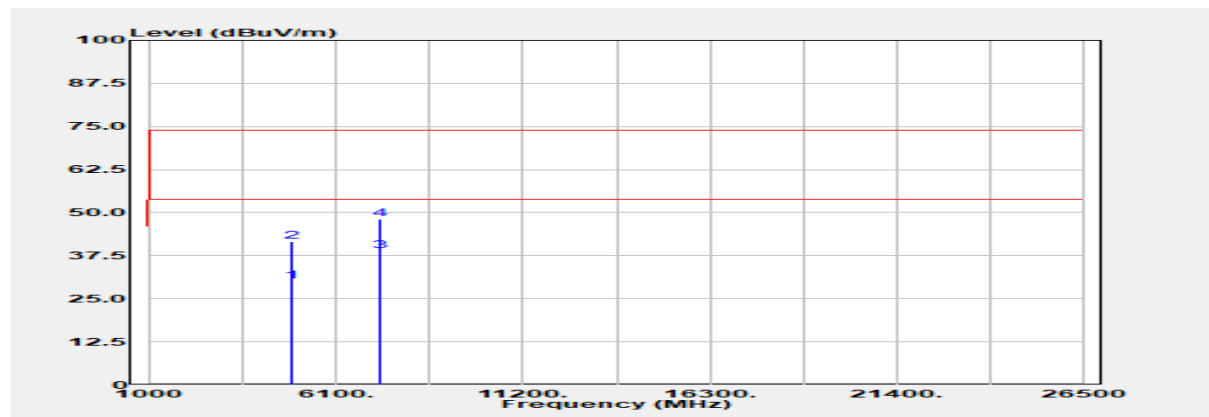
Temp./Humi. :23.6/67

Test Mode :Tx CH MID

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4884.000	Average	19.92	10.16	30.08	54.00	-23.92
4884.000	Peak	31.39	10.16	41.54	74.00	-32.46
7326.000	Average	20.64	18.20	38.84	54.00	-15.16
7326.000	Peak	29.84	18.20	48.04	74.00	-25.96

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Report Number :E2/2021/30051

Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2480 MHz

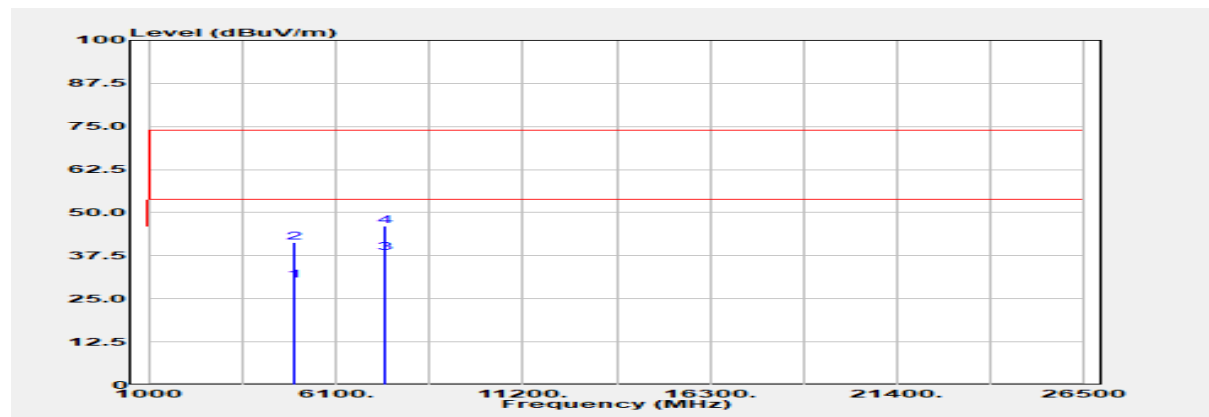
Temp./Humi. :23.5/67

Test Mode :Tx CH HIGH

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Average	20.07	10.20	30.27	54.00	-23.73
4960.000	Peak	31.27	10.20	41.47	74.00	-32.53
7440.000	Average	20.57	17.86	38.43	54.00	-15.57
7440.000	Peak	28.36	17.86	46.23	74.00	-27.77

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Test Site :966 Chamber C

Operation Mode :2.4G

Test Date :2021-04-24

Test Frequency :2480 MHz

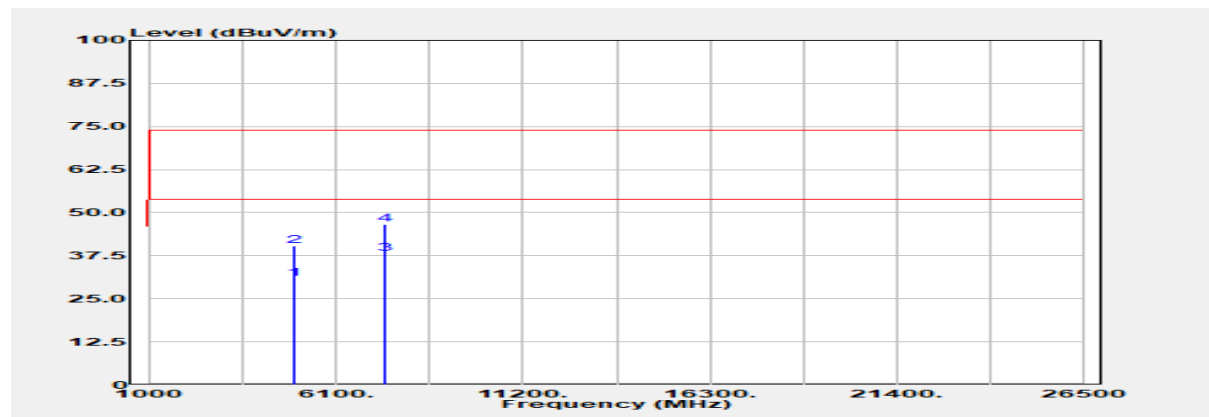
Temp./Humi. :23.5/67

Test Mode :Tx CH HIGH

Antenna Pol. :Horizontal

EUT Pol :E2 Plane

Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Average	20.64	10.20	30.84	54.00	-23.16
4960.000	Peak	30.03	10.20	40.23	74.00	-33.77
7440.000	Average	20.19	17.86	38.05	54.00	-15.95
7440.000	Peak	28.71	17.86	46.58	74.00	-27.42

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11 POWER SPECTRAL DENSITY

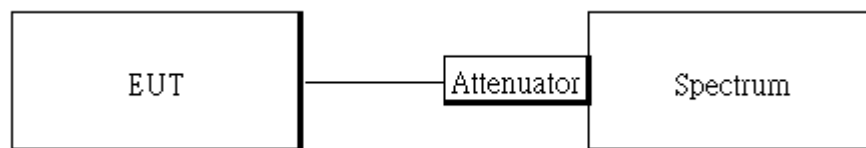
11.1 Standard Applicable:

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

11.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/24/2020	06/23/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021

11.3 Test Set-up:



11.4 Measurement Procedure:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

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11.5 Measurement Result:

Gain	-2.07		dB
Mimo support	SISO		
POWER DENSITY 2.4G			
Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2402	-15.29	8.00	PASS
2442	-15.11	8.00	PASS
2480	-16.68	8.00	PASS

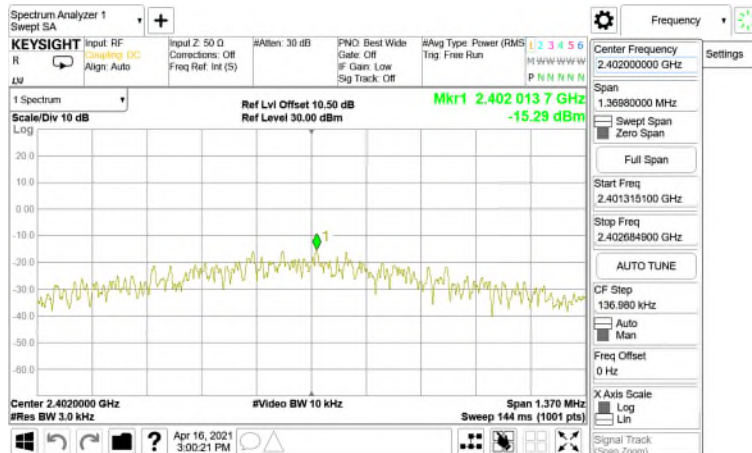
**Refer to next page for plots*

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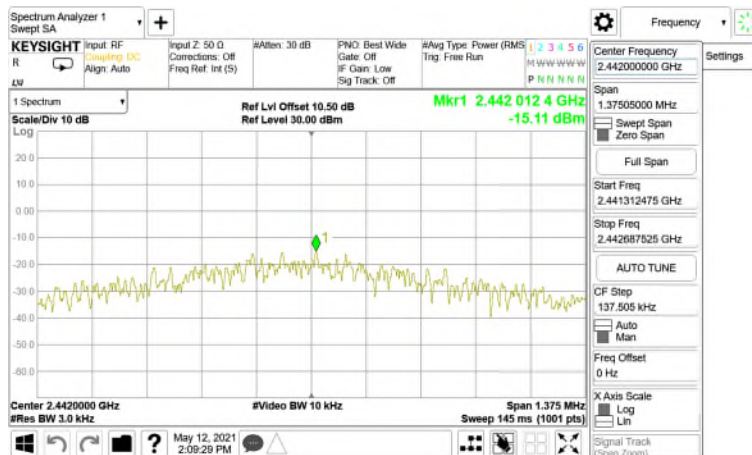
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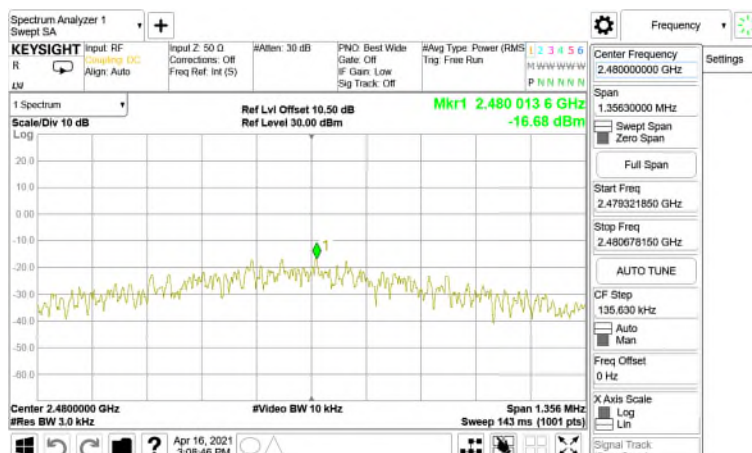
Power Density_2.4G_Chain0_2402MHz



Power Density_2.4G_Chain0_2442MHz



Power Density_2.4G_Chain0_2480MHz



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12 ANTENNA REQUIREMENT

12.1 Standard Applicable:

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

12.2 Antenna Connected Construction:

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

~ End of Report ~

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