ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Quanta Computer Inc. No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City 33377, Taiwan
Product Name:	Clover Station Pro Terminal
Brand Name:	clover
Model No.:	C503
HVIN:	C503W
Model Difference:	N/A
Report Number:	E2/2021/60097
FCC ID	HFS-CX03W
IC:	1787B-CX03W
Issue Date:	Aug. 03, 2021
Date of Test:	Jul. 01, 2021～Jul. 15, 2021
Date of EUT Received:	Jul. 01, 2021

Approved By _____
Jay Lin

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, ISED RSS-247.

Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/60097	Rev.00	Original.	Aug. 03, 2021	Yi-Shan Tsai

Contents

1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Clover Station Pro Terminal
Brand Name:	clover
Model No.:	C503
HVIN:	C503W
Model Difference:	N/A
Hardware Version:	C503W
Firmware Version:	N/A
EUT Series No.:	PJ216216001 (Radiated) C053UQ11620145 (Conducted) C153UQ11620149 (Conduction)
Power Supply:	12V from AC/DC Adapter

1.2 RF Specification

Radio Technology:	BT BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + π/4DQPSK + 8DPSK
Transmit Power:	6.24 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	≦ 0.4s

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
PIFA	SAA	GD9321-15-001-R	2402~2480	-0.20	
	Luxshare-ICT	LA81FP018-1H	2402~2480	0.9	V

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

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
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.

1.6 Special Accessories

There is no special accessory used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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.

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-ane choic 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.

2.5 Configuration of Tested System

Fig. 2-1 Conduction (AC Power Line) Configuration & Radiated Emission

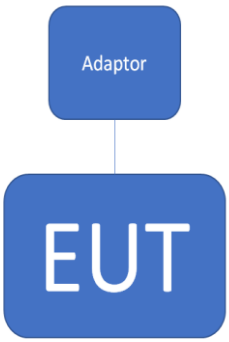


Fig. 2-2 Conducted (Antenna Port)

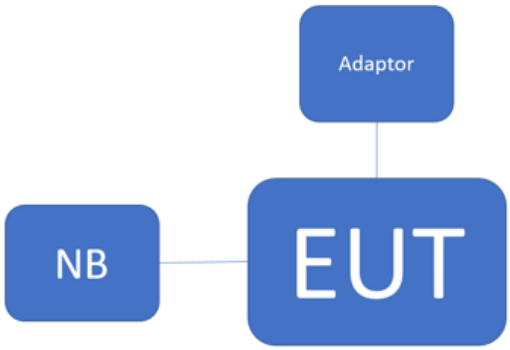


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	Bluetooth Test Software	N/A	N/A	N/A	N/A	N/A
2	Adapter	clover	FSP040-RHBN3	N/A	N/A	N/A
3	Notebook	Lenovo	L440	P0000367	N/A	N/A

3 SUMMARY OF TEST RESULTS

FCC Rules	IC Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	RSS-247 §5.4 b	Peak Output Power	Compliant
§15.247(a)(1)	RSS-247 §5.1 b RSS-Gen §6.7	Emission Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10	Conducted & Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	RSS-247 §5.1 b	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 d	Number of hopping frequency Time of Occupancy	Compliant
§15.203	N/A	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2402 MHz	21	2422 MHz	41	2442 MHz	71	2462 MHz
2	2403 MHz	22	2423 MHz	42	2443 MHz	72	2463 MHz
3	2404 MHz	23	2424 MHz	43	2444 MHz	73	2464 MHz
4	2405 MHz	24	2425 MHz	44	2445 MHz	74	2465 MHz
5	2406 MHz	25	2426 MHz	45	2446 MHz	75	2466 MHz
6	2407 MHz	26	2427 MHz	46	2447 MHz	76	2467 MHz
7	2408 MHz	27	2428 MHz	47	2448 MHz	77	2468 MHz
8	2409 MHz	28	2429 MHz	48	2449 MHz	78	2469 MHz
9	2410 MHz	29	2430 MHz	49	2450 MHz	79	2470 MHz
10	2411 MHz	30	2431 MHz	50	2451 MHz	70	2471 MHz
11	2412 MHz	31	2432 MHz	51	2452 MHz	71	2472 MHz
12	2413 MHz	32	2433 MHz	52	2453 MHz	72	2473 MHz
13	2414 MHz	33	2434 MHz	53	2454 MHz	73	2474 MHz
14	2415 MHz	34	2435 MHz	54	2455 MHz	74	2475 MHz
15	2416 MHz	35	2436 MHz	55	2456 MHz	75	2476 MHz
16	2417 MHz	36	2437 MHz	56	2457 MHz	76	2477 MHz
17	2418 MHz	37	2438 MHz	57	2458 MHz	77	2478 MHz
18	2419 MHz	38	2439 MHz	58	2459 MHz	78	2479 MHz
19	2420 MHz	39	2440 MHz	59	2460 MHz	79	2480 MHz
20	2421 MHz	40	2441 MHz	60	2461 MHz		

4.2 The Worst Test Modes and Channel Details

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
RADIATED EMISSION TEST (BELOW 1 GHz)				
Bluetooth	0 to 78	39	GFSK	DH5
RADIATED EMISSION TEST (ABOVE 1 GHz)				
Bluetooth	0 to 78	0,39,78	GFSK, 8-DPSK	DH5
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.				

ANTENNA PORT CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
Peak Output Power, 20dB Band Width				
Bluetooth	0 to 78	0,39,78	GFSK, π/4-DQPSK, 8-DPSK	DH5/2DH5/3DH5
Band Edge				
Bluetooth	0 to 78	0,78	GFSK, 8-DPSK	DH5/3DH5
Frequency Separation				
Bluetooth	0 to 78	0,1,2,38,39,40,76,77,78	GFSK, π/4-DQPSK	DH5/2DH5
Number of hopping frequency				
Bluetooth	0 to 78	0 to 78	GFSK, π/4-DQPSK	DH5/2DH5
Time of Occupancy (Dwell time)				
Bluetooth	0 to 78	0,39,78	GFSK	DH5
			π/4-DQPSK	2DH5
			8-DPSK	3DH5

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	2.34	dB
Peak Output Power	+/-	1	dB
Emission Bandwidth	+/-	1.53	Hz
100 kHz Bandwidth Of Frequency Band Edges	+/-	1.69	dB
Frequency Separation	+/-	1.53	Hz
Number of hopping frequency	+/-	1.53	Hz
Time of Occupancy	+/-	1.53	Hz
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.

6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

Frequency range MHz	Limits dB(uV)	
	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.		

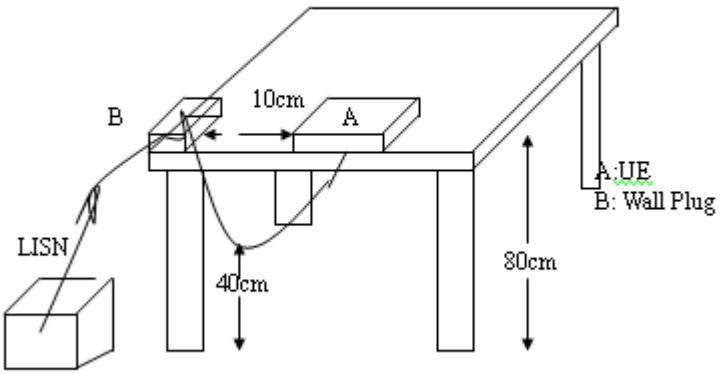
6.2 Measurement Equipment Used

Radiated Emission Test Site: Conduction A					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUM-BER**	**LAST CAL.**	**CAL DUE.**
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R
LISN	SCHWARZBECK Mess-El-ektronik	NSLK8127	973	03/25/2021	03/24/2022
EMI Test Receiver	R&S	ESCI	101342	04/27/2021	04/26/2022
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2021	03/26/2022
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022

6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
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.

6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

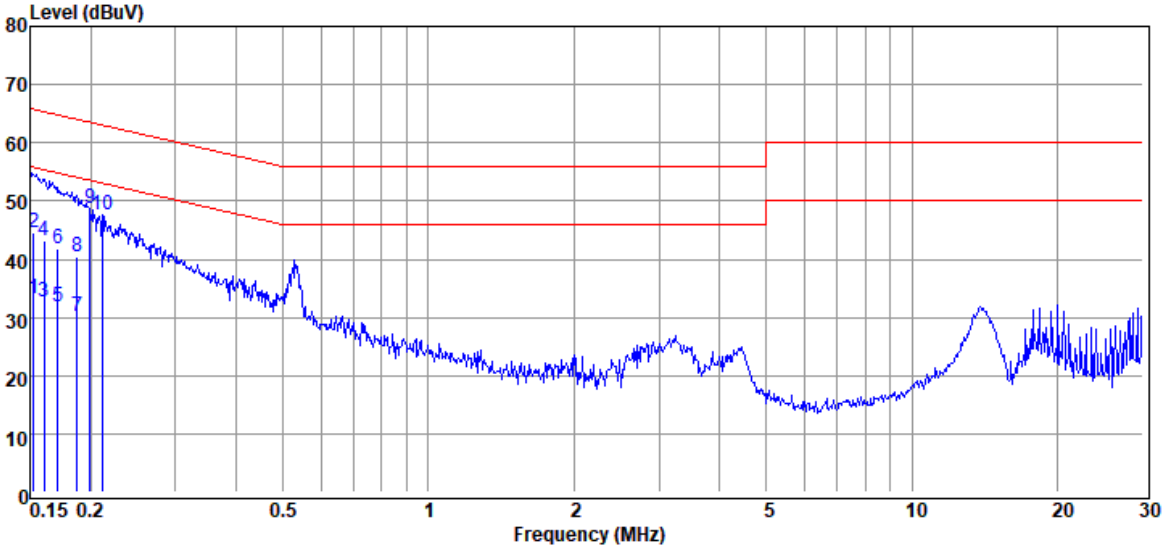
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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.

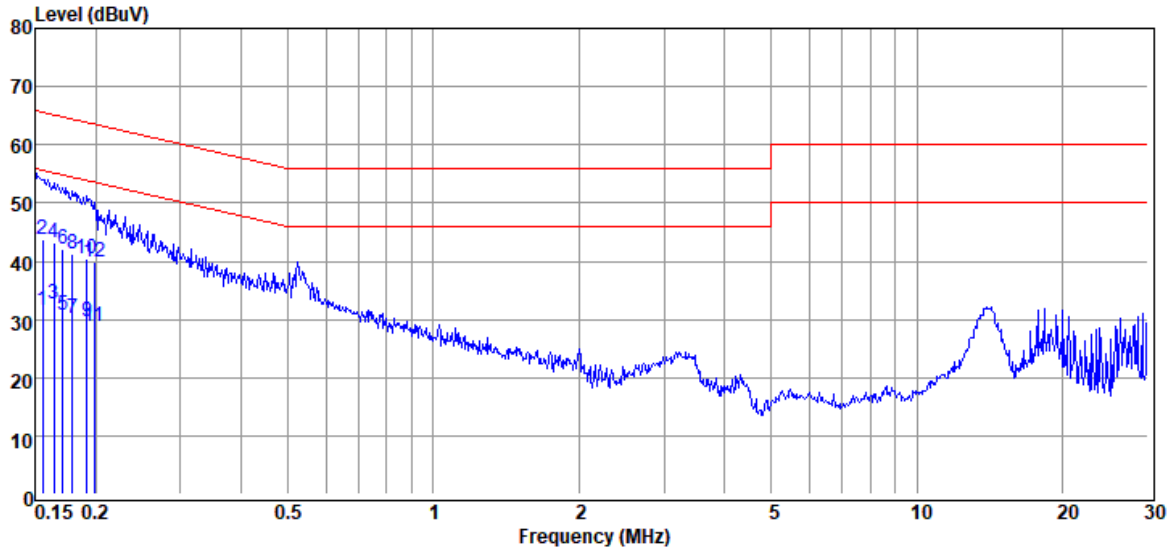
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2021/60097	Test Site	:Conduction Room C
Test Mode	:BT	Test Date	:2021-07-09
Power	:120V/60Hz	Temp./Humi.	:24.8/54
Probe	:L1	Engineer	:Ashton Chiu
Note:	: Adapter:FSP040-RHBN3		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.15	Average	23.12	10.22	33.34	55.87	-22.53
0.15	QP	34.32	10.22	44.54	65.87	-21.33
0.16	Average	22.33	10.22	32.55	55.43	-22.88
0.16	QP	32.98	10.22	43.20	65.43	-22.23
0.17	Average	21.52	10.22	31.74	54.90	-23.16
0.17	QP	31.65	10.22	41.87	64.90	-23.03
0.19	Average	19.85	10.22	30.07	54.15	-24.08
0.19	QP	30.22	10.22	40.44	64.15	-23.71
0.20	Peak	38.52	10.30	48.82	63.62	-14.80
0.21	Peak	37.39	10.30	47.69	63.14	-15.45

Report Number	:E2/2021/60097	Test Site	:Conduction Room C
Test Mode	:BT	Test Date	:2021-07-09
Power	:120V/60Hz	Temp./Humi.	:24.8/54
Probe	:N	Engineer	:Ashton Chiu
Note:	: Adapter:FSP040-RHBN3		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV	Limit dBµV	Margin dB
0.16	Average	21.38	10.21	31.59	55.69	-24.10
0.16	QP	33.62	10.21	43.83	65.69	-21.86
0.16	Average	22.33	10.21	32.54	55.25	-22.71
0.16	QP	32.92	10.21	43.13	65.25	-22.12
0.17	Average	20.65	10.21	30.86	54.90	-24.04
0.17	QP	31.89	10.21	42.10	64.90	-22.80
0.18	Average	19.85	10.21	30.06	54.50	-24.44
0.18	QP	31.05	10.21	41.26	64.50	-23.24
0.19	Average	19.52	10.21	29.73	53.93	-24.20
0.19	QP	30.13	10.21	40.34	63.93	-23.59
0.20	Average	18.64	10.21	28.85	53.67	-24.82
0.20	QP	29.61	10.21	39.82	63.67	-23.85

7 PEAK OUTPUT POWER MEASUREMENT

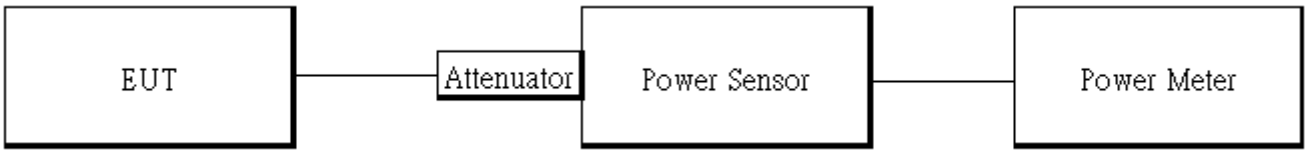
7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.
The e.i.r.p. shall not exceed 4 W.

7.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	**MFR**	**MODEL NUM-BER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Soft-ware	Ver.21	N.C.R	N.C.R

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 ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB band-width)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

7.5 Peak & Average Power Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	**6.24**	4.207	1000
Mid	2441	8	5.52	3.565	1000
High	2480	8	6.19	4.159	1000

1M BR mode (Average):

CH	Freq. (MHz)	Power set	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	5.82	3.815	1000
Mid	2441	8	5.39	3.455	1000
High	2480	8	5.98	3.958	1000

2M EDR mode (Peak):

CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	**5.49**	3.540	125
Mid	2441	8	4.61	2.891	125
High	2480	8	5.36	3.436	125

2M EDR mode (Average):

CH	Freq. (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	2.41	1.740	125
Mid	2441	8	2.21	1.662	125
High	2480	8	2.92	1.957	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	**5.46**	3.516	125
Mid	2441	8	4.54	2.844	125
High	2480	8	5.33	3.412	125

NOTE: cable loss as 11.5dB that offsets in the spectrum

3M EDR mode (Average):

CH	Freq. (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	2.89	1.943	125
Mid	2441	8	2.20	1.658	125
High	2480	8	3.05	2.016	125

****Note: Max. Output include tune up tolerance Power measured by using average detector.***

7.6 EIRP Measurement Result

1M BR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	8	5.82	0.90	4.694	4000
Mid	2441	8	5.39	0.90	4.251	4000
High	2480	8	5.98	0.90	4.870	4000

2M EDR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	8	2.41	0.90	2.140	4000
Mid	2441	8	2.21	0.90	2.044	4000
High	2480	8	2.92	0.90	2.407	4000

3M EDR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	8	2.89	0.90	2.391	4000
Mid	2441	8	2.20	0.90	2.039	4000
High	2480	8	3.05	0.90	2.480	4000

Note: EIRP = Average Power + Gain

8 EMISSION BANDWIDTH MEASUREMENT

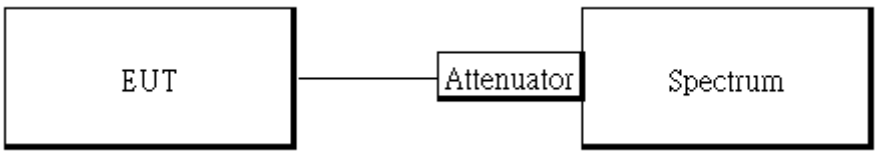
8.1 Standard Applicable

For frequency hopping systems operating in the 2400 MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

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 ANSI C63.10:2013.
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= 1 % to 5% of OBW ,
   VBW = 3 X RBW,
   Span= 2 to 5 times of the OBW,
   Sweep=auto,
   Detector = Peak, and Max hold for 20dB Bandwidth test.
5. Mark the peak frequency and –20dB (upper and lower) frequency
6. Set the spectrum analyzer as
   RBW= 1 % to 5% of 99% Bandwidth ,
   VBW ≥ 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.
7. Mark the peak frequency and 99%dB (upper and lower) frequency
8. Repeat above procedures until all test default channel is completed

8.5 20dB Bandwidth

GFSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.7579	0.51
Mid	0.7565	0.50
High	0.7593	0.51

π/4-DQPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.156	0.77
Mid	1.156	0.77
High	1.152	0.77

8-DPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.154	0.77
Mid	1.157	0.77
High	1.154	0.77

8.6 99% Bandwidth

GFSK

CH	99% BW (MHz)
Low	0.7797
Mid	0.7808
High	0.7795

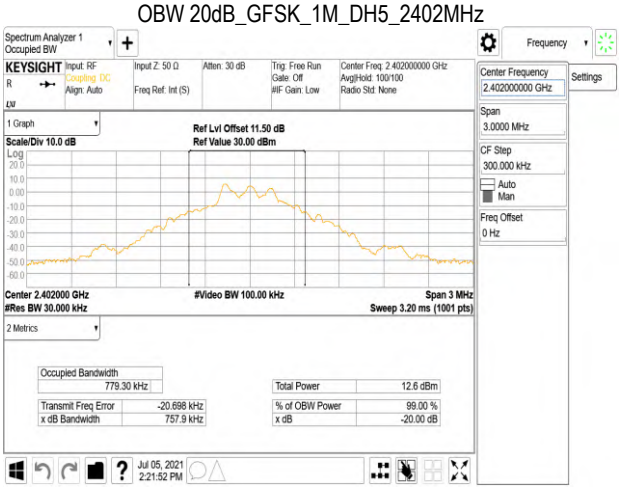
π/4-DQPSK

CH	99% BW (MHz)
Low	1.0886
Mid	1.0882
High	1.0878

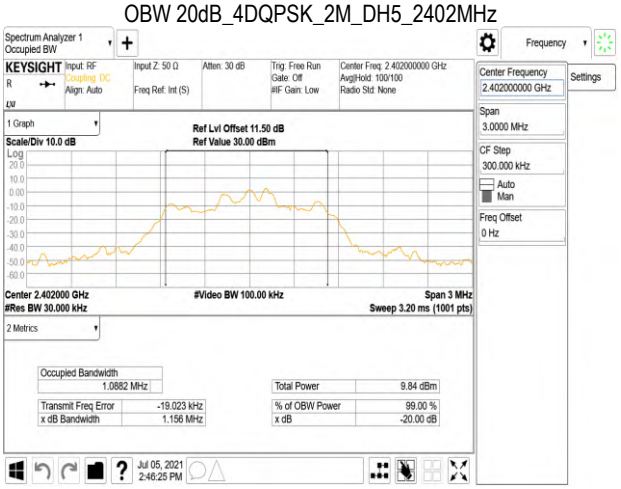
8-DPSK

CH	99% BW (MHz)
Low	1.0863
Mid	1.0855
High	1.0851

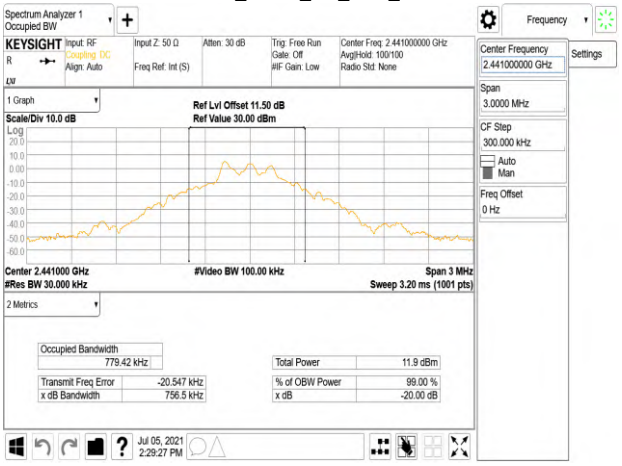
OBW 20dB_GFSK_1M_DH5_2402MHz



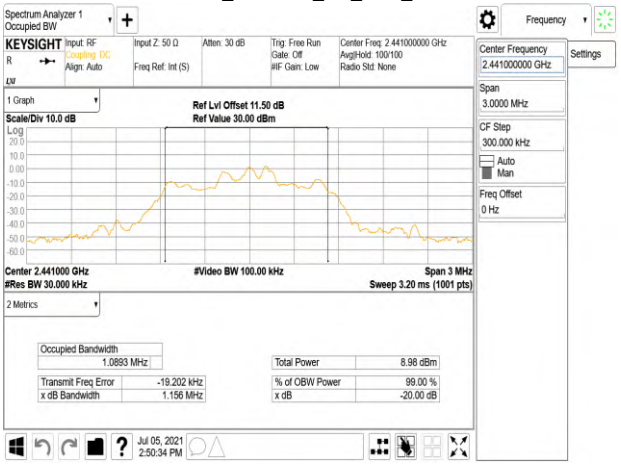
OBW 20dB_4DQPSK_2M_DH5_2402MHz



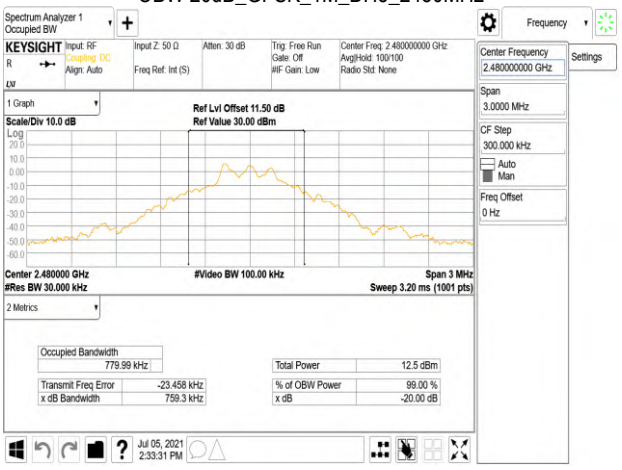
OBW 20dB_GFSK_1M_DH5_2441MHz



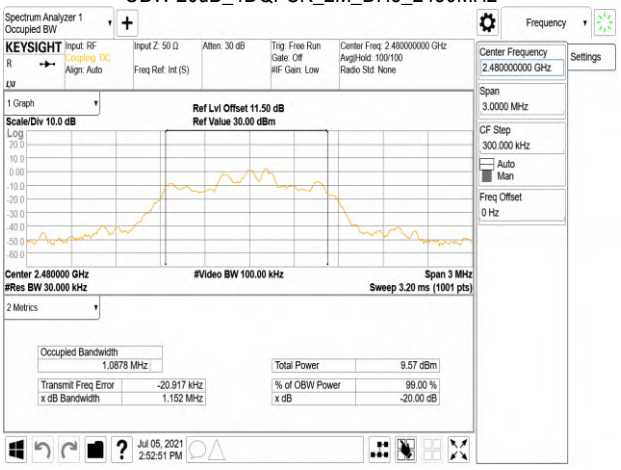
OBW 20dB_4DQPSK_2M_DH5_2441MHz



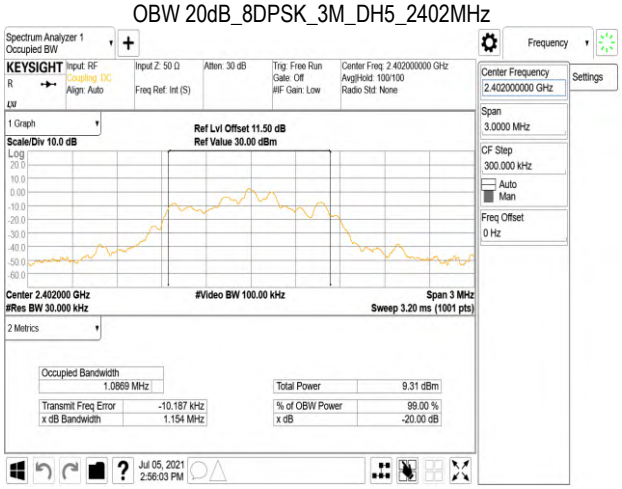
OBW 20dB_GFSK_1M_DH5_2480MHz



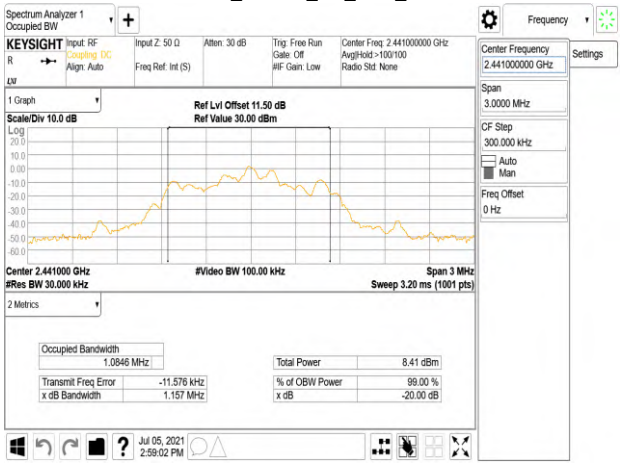
OBW 20dB_4DQPSK_2M_DH5_2480MHz



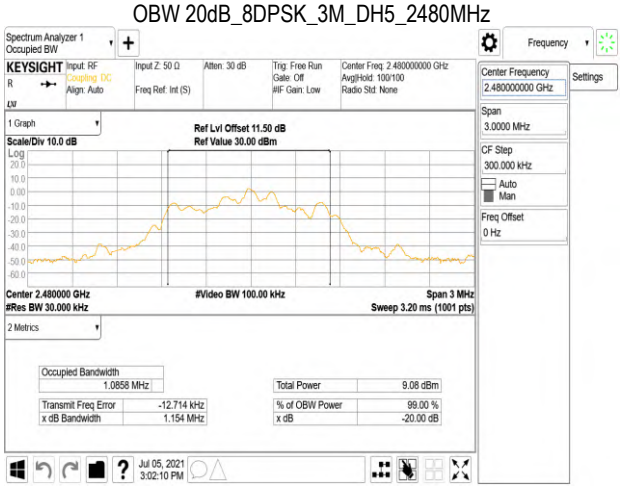
OBW 20dB_8DPSK_3M_DH5_2402MHz



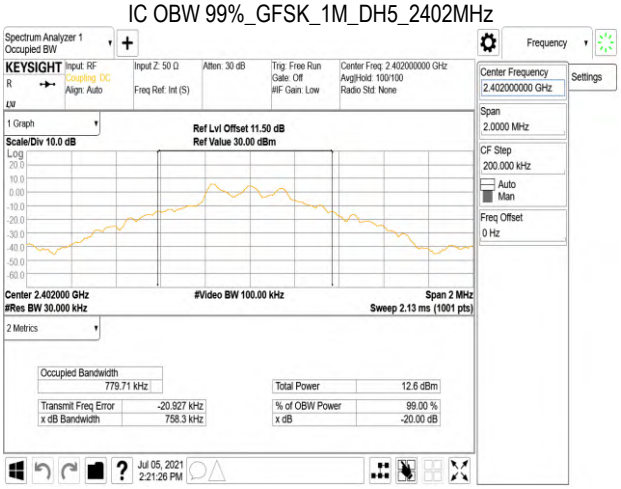
OBW 20dB_8DPSK_3M_DH5_2441MHz



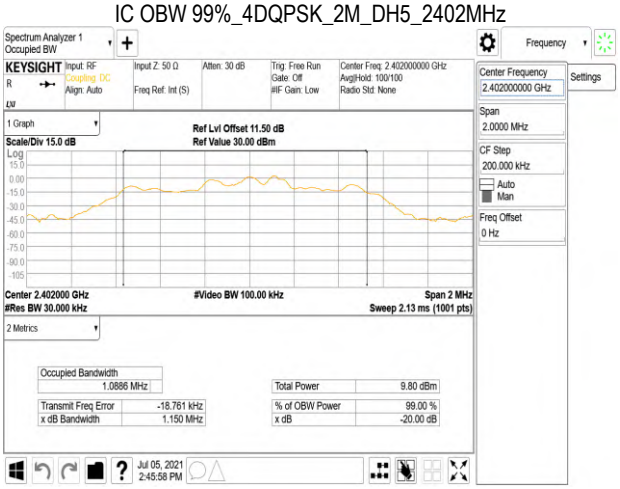
OBW 20dB_8DPSK_3M_DH5_2480MHz



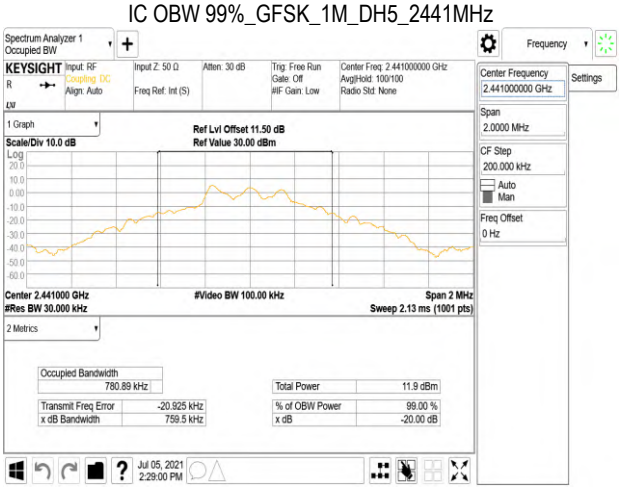
IC OBW 99%_GFSK_1M_DH5_2402MHz



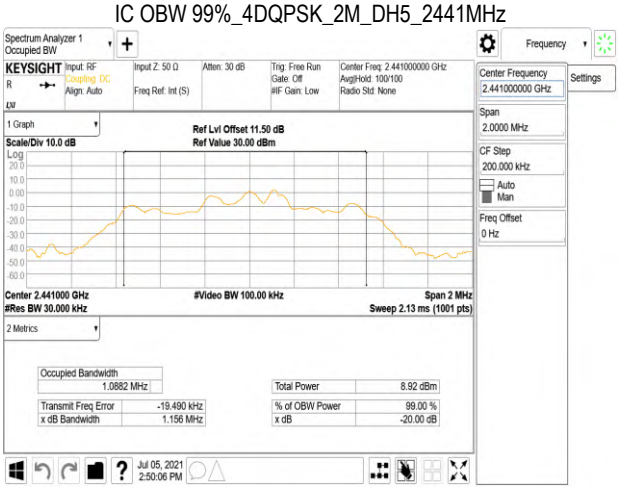
IC OBW 99%_4DQPSK_2M_DH5_2402MHz



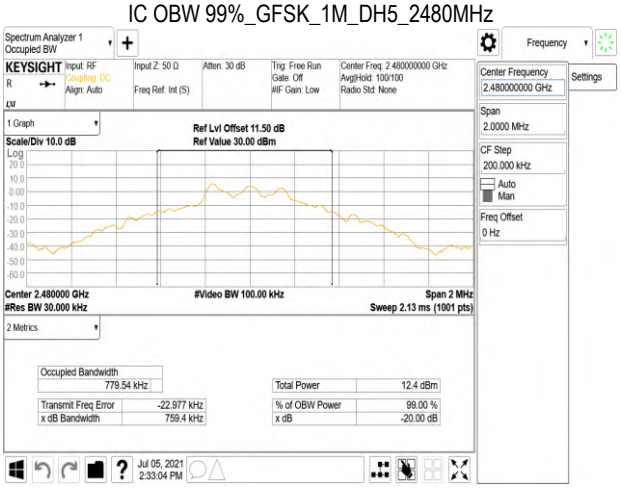
IC OBW 99%_GFSK_1M_DH5_2441MHz



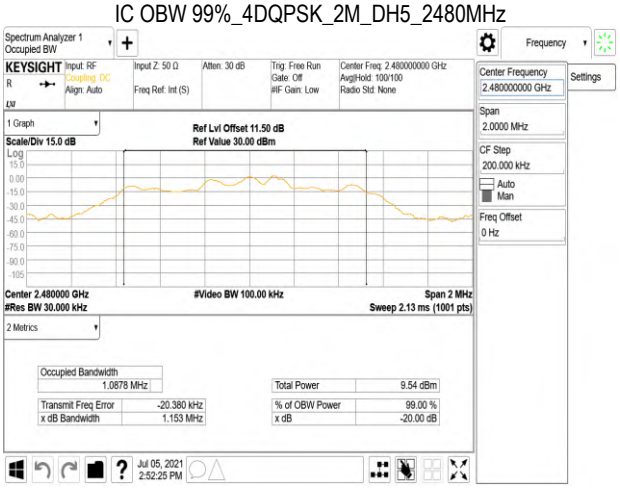
IC OBW 99%_4DQPSK_2M_DH5_2441MHz



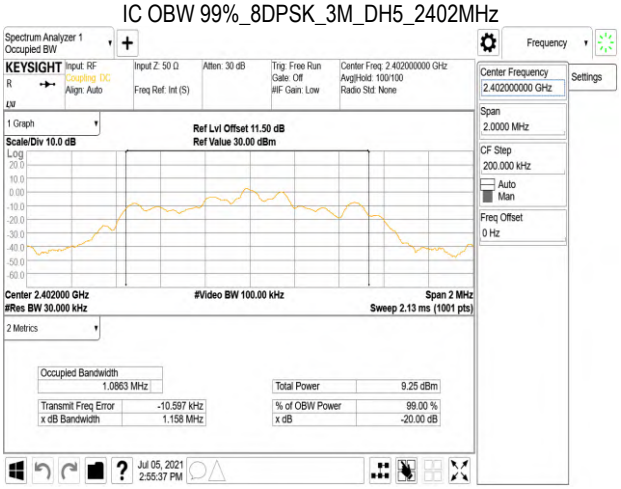
IC OBW 99%_GFSK_1M_DH5_2480MHz



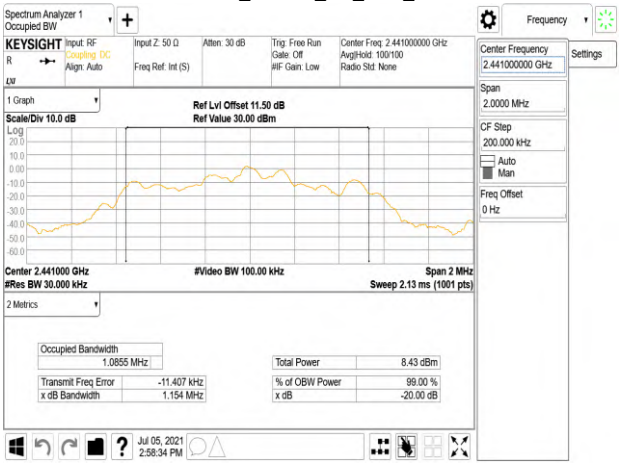
IC OBW 99%_4DQPSK_2M_DH5_2480MHz



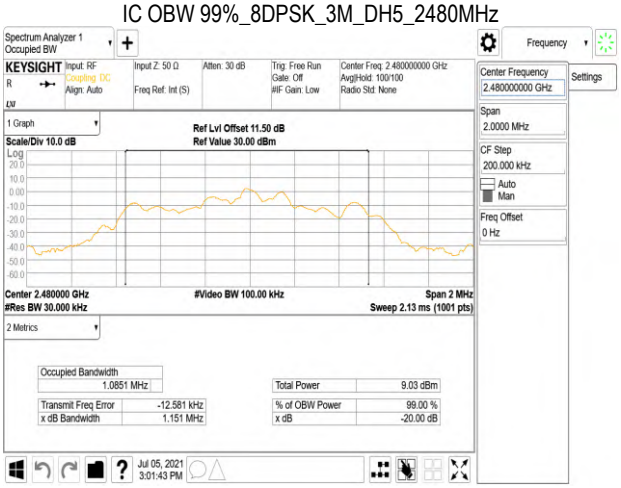
IC OBW 99%_8DPSK_3M_DH5_2402MHz



IC OBW 99%_8DPSK_3M_DH5_2441MHz



IC OBW 99%_8DPSK_3M_DH5_2480MHz



9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

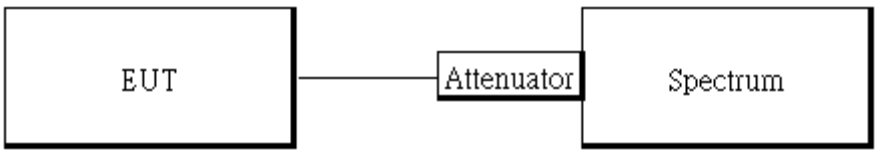
9.1 Standard Applicable

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 D					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

9.3 Test SET-UP



9.4 Measurement Procedure

9.4.1 Conducted Band Edge:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
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 center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

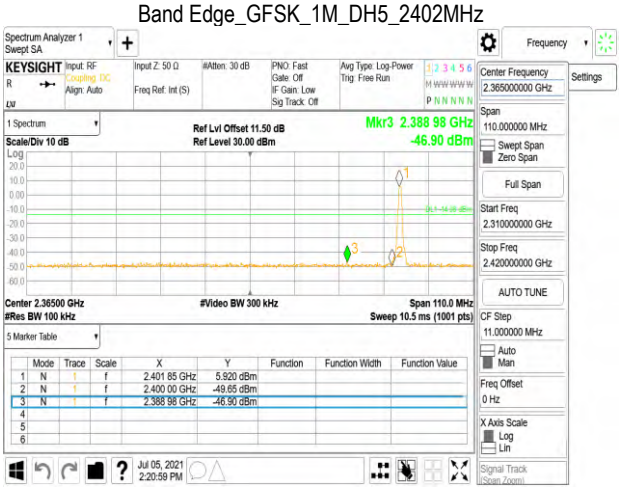
9.4.2 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows ANSI C63.10:2013.
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.

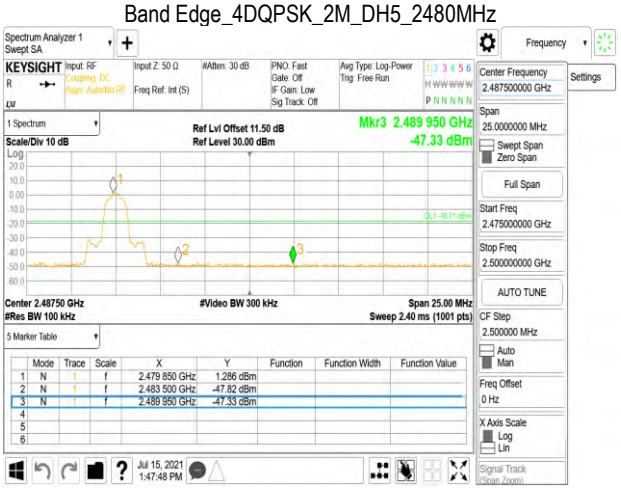
9.5 Measurement Result

See next page for test plots.

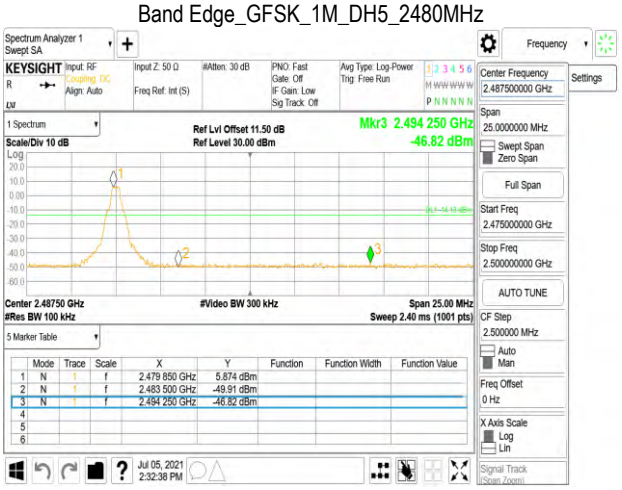
Band Edge_GFSK_1M_DH5_2402MHz



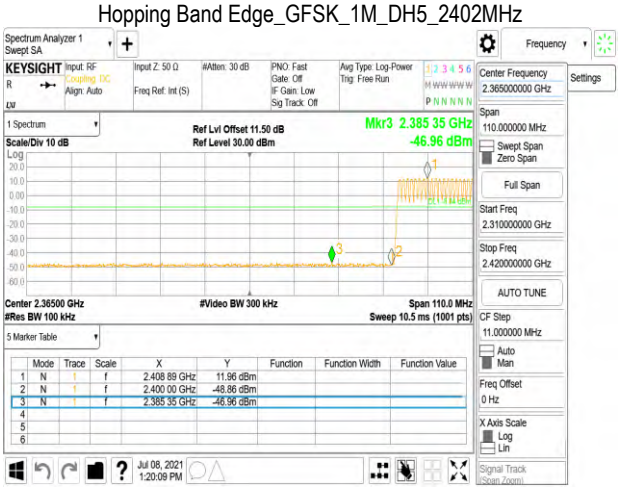
Band Edge_4DQPSK_2M_DH5_2480MHz



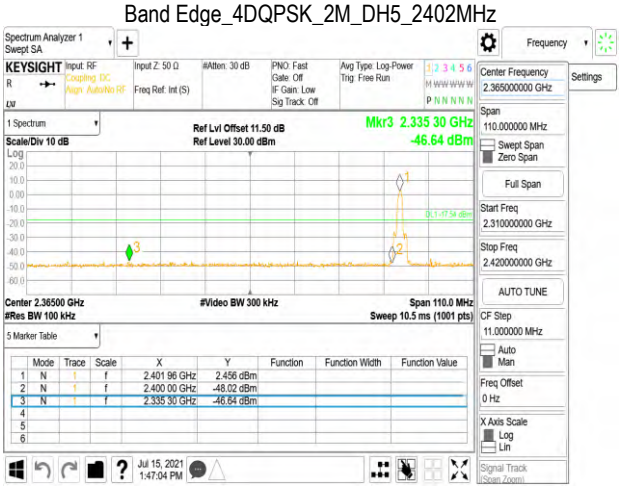
Band Edge_GFSK_1M_DH5_2480MHz



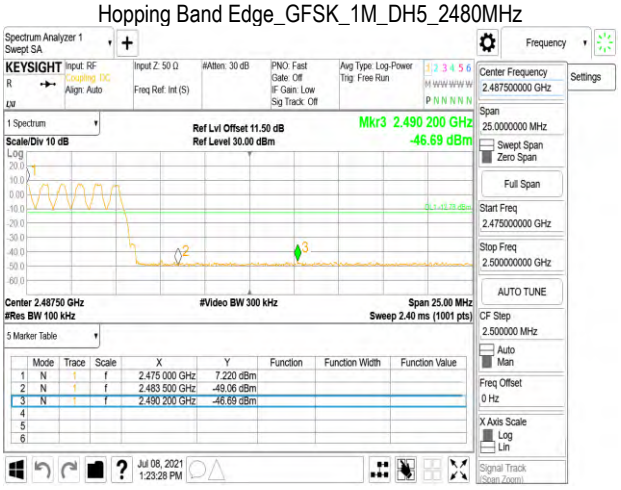
Hopping Band Edge_GFSK_1M_DH5_2402MHz



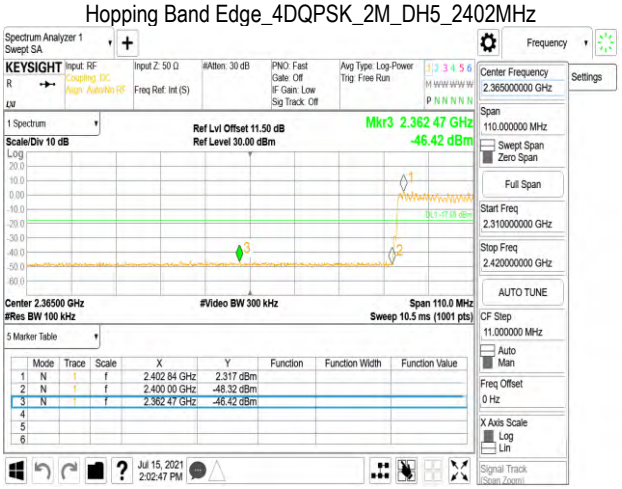
Band Edge_4DQPSK_2M_DH5_2402MHz



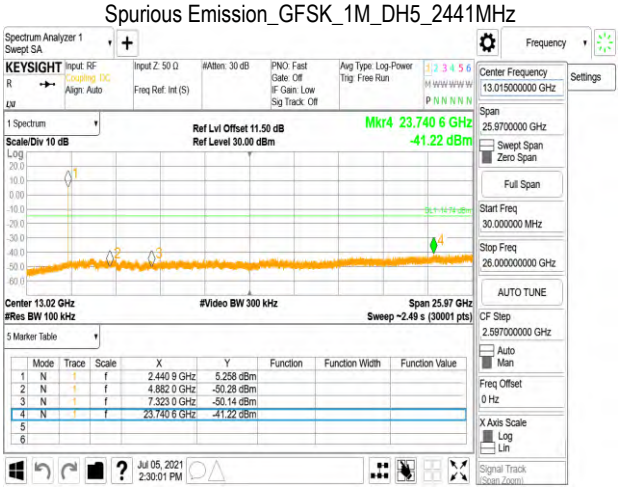
Hopping Band Edge_GFSK_1M_DH5_2480MHz



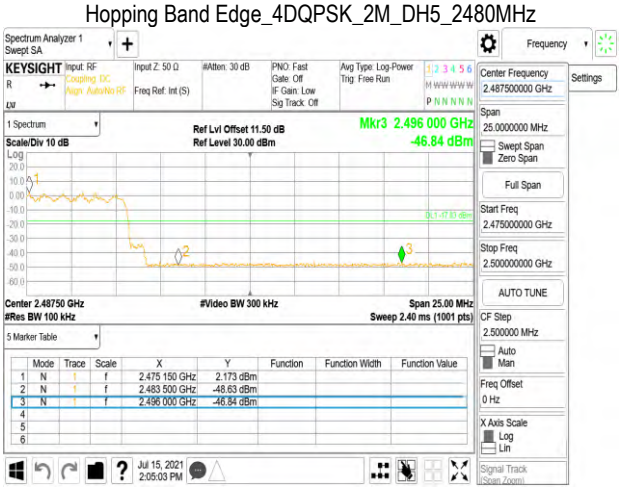
Hopping Band Edge_4DQPSK_2M_DH5_2402MHz



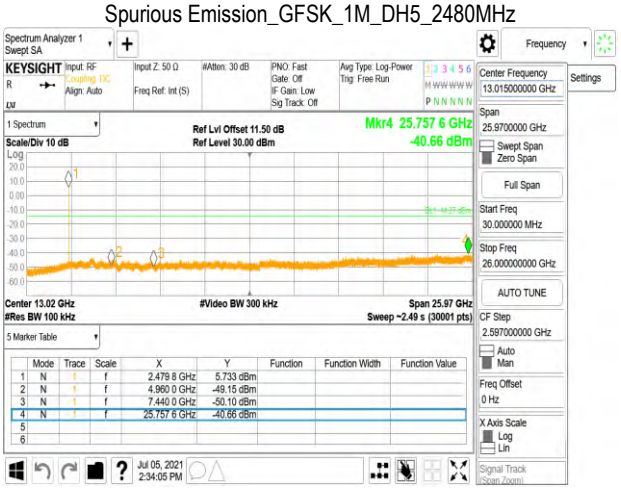
Spurious Emission_GFSK_1M_DH5_2441MHz



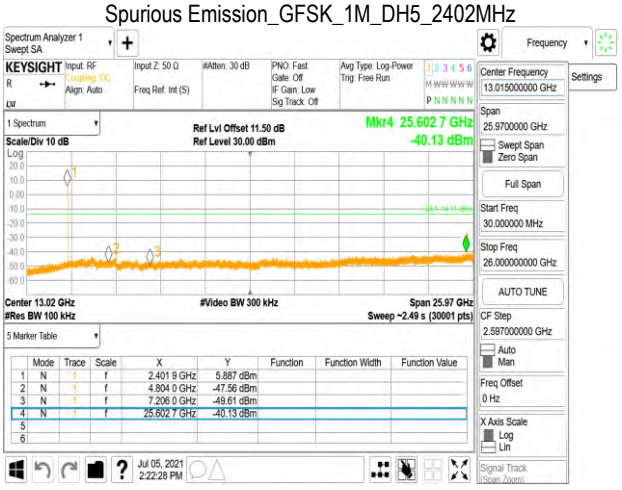
Hopping Band Edge_4DQPSK_2M_DH5_2480MHz



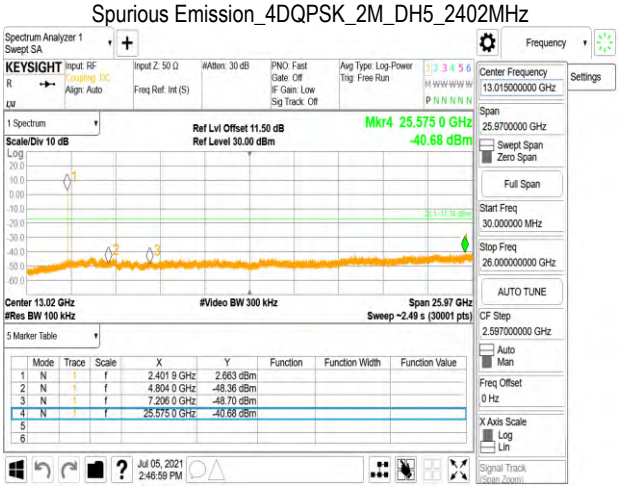
Spurious Emission_GFSK_1M_DH5_2480MHz



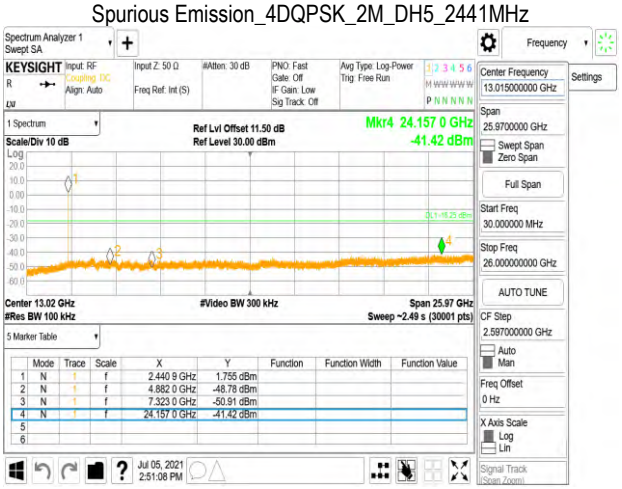
Spurious Emission_GFSK_1M_DH5_2402MHz



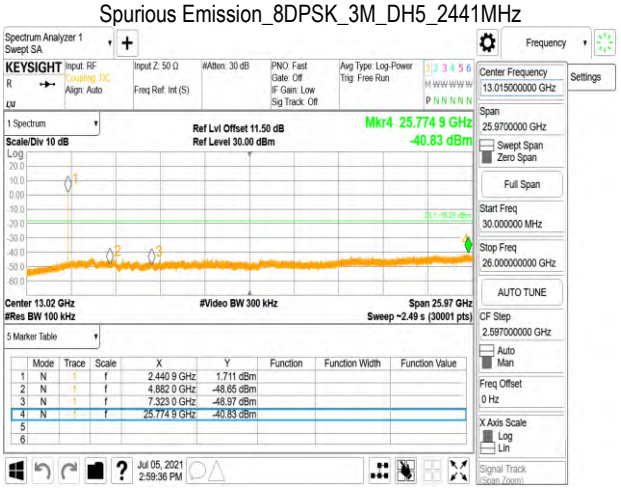
Spurious Emission_4DQPSK_2M_DH5_2402MHz



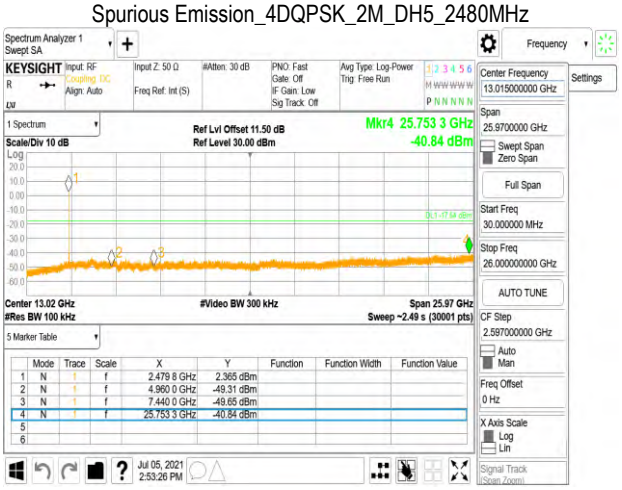
Spurious Emission_4DQPSK_2M_DH5_2441MHz



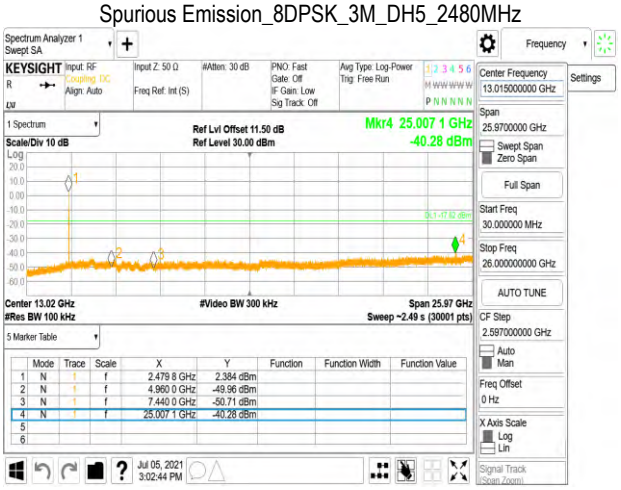
Spurious Emission_8DPSK_3M_DH5_2441MHz



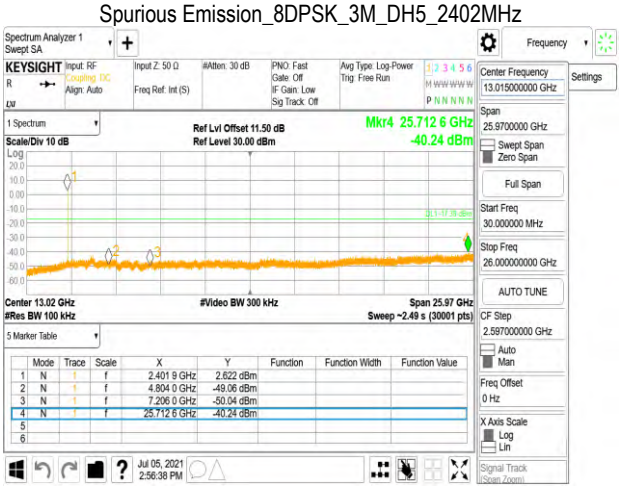
Spurious Emission_4DQPSK_2M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2402MHz



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.*

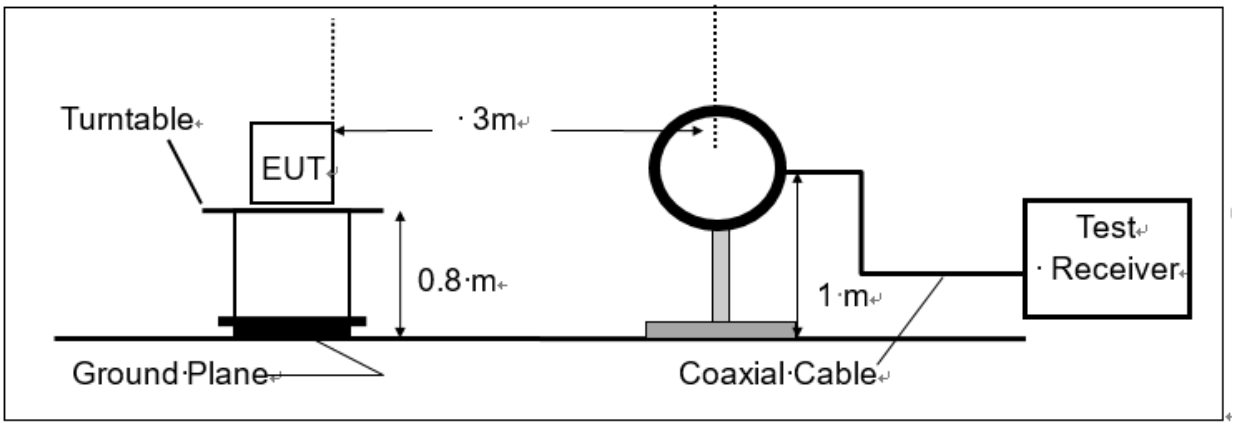
10.2 Measurement Equipment Used

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	05/07/2021	05/06/2022
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

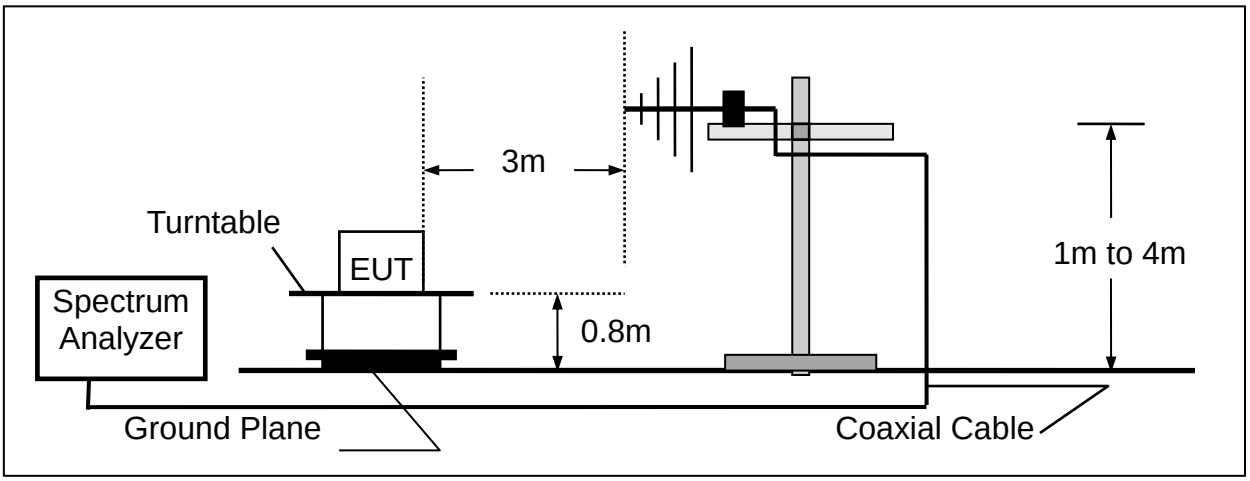
NOTE: *N.C.R refers to Not Calibrated Required.*

10.3 Test SET-UP

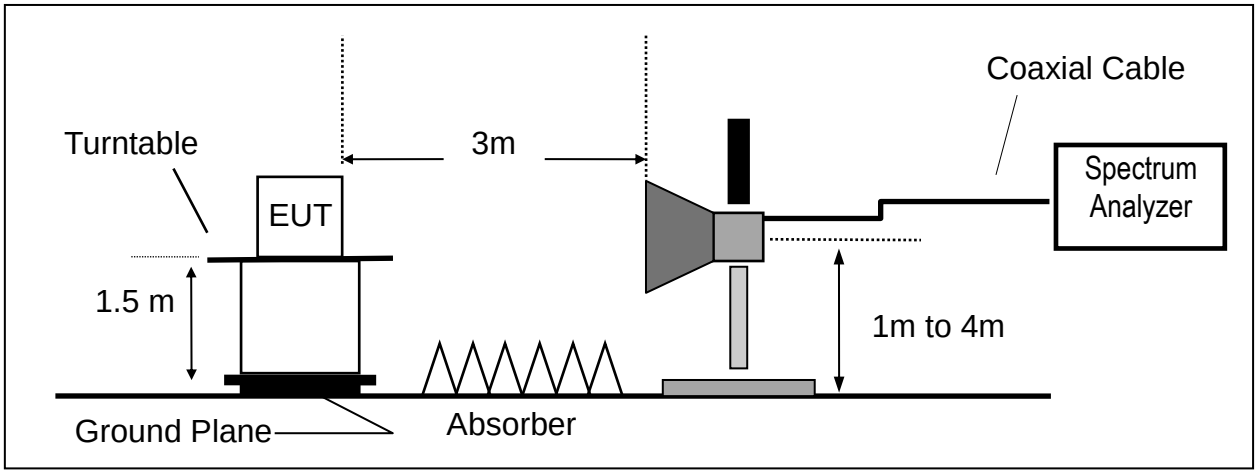
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



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



10.4 Measurement Procedure

10.4.1 Radiated Emission

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Emission Measurements at frequency above 1 GHz.
9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

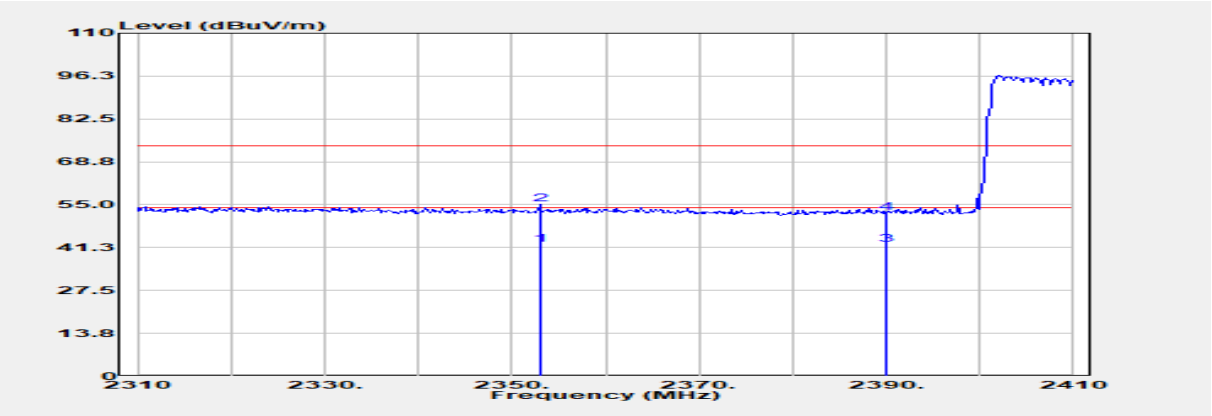
10.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

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:

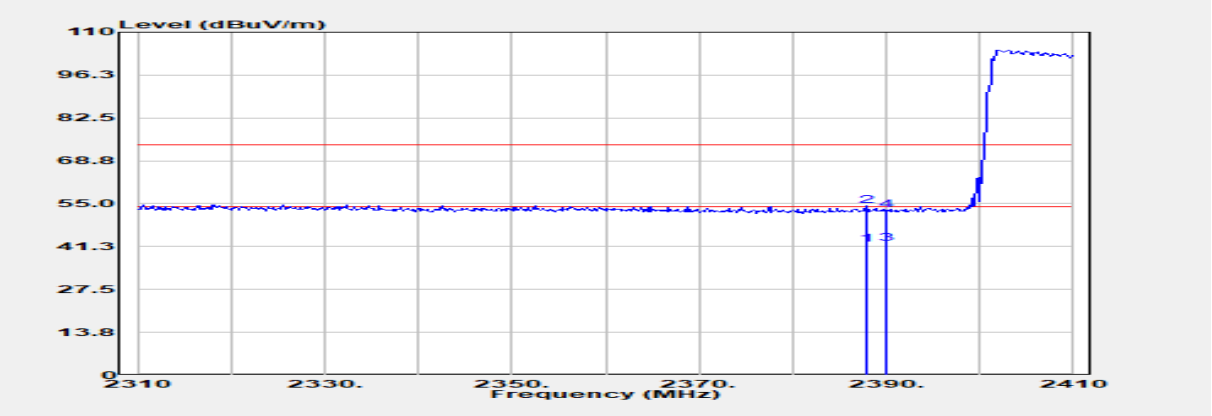
10.7.1 Radiated Bandedge Result (Hopping Mode)

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR Hopping	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.1/54
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2352.949	Average	36.66	5.40	42.06	54.00	-11.94
2352.949	Peak	49.64	5.40	55.05	74.00	-18.95
2390.000	Average	36.96	5.18	42.14	54.00	-11.86
2390.000	Peak	47.28	5.18	52.46	74.00	-21.54

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR Hopping	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.1/54
Test Mode	:BE CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2387.885	Average	36.77	5.09	41.86	54.00	-12.14
2387.885	Peak	49.18	5.09	54.27	74.00	-19.73
2390.000	Average	37.00	5.18	42.18	54.00	-11.82
2390.000	Peak	47.83	5.18	53.01	74.00	-20.99

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR Hopping	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.1/54
Test Mode	:BE CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu

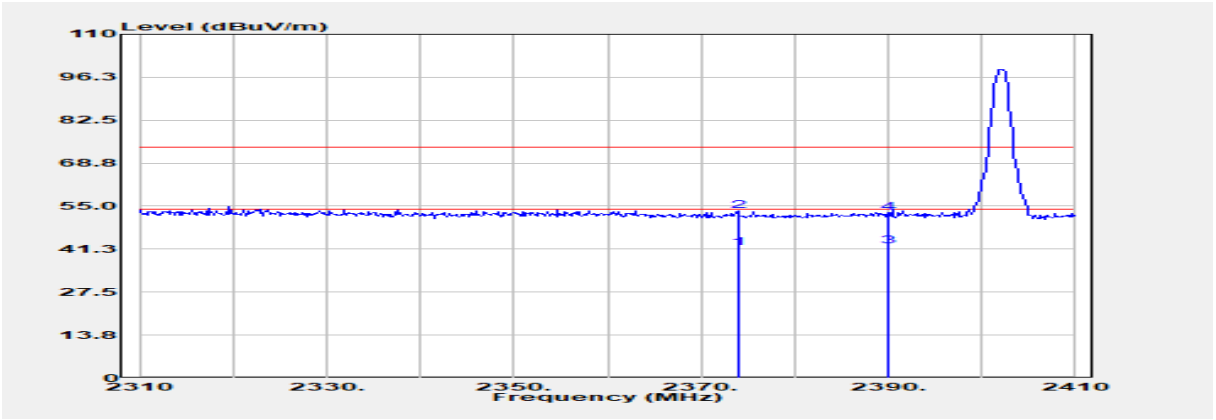
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.13	4.04	41.17	54.00	-12.83
2483.500	Peak	47.97	4.04	52.00	74.00	-22.00
2485.817	Average	36.90	4.01	40.91	54.00	-13.09
2485.817	Peak	48.92	4.01	52.94	74.00	-21.06

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR Hopping	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.1/54
Test Mode	:BE CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.43	4.04	41.47	54.00	-12.53
2483.500	Peak	48.79	4.04	52.82	74.00	-21.18
2485.817	Average	37.34	4.01	41.35	54.00	-12.65
2485.817	Peak	48.90	4.01	52.91	74.00	-21.09

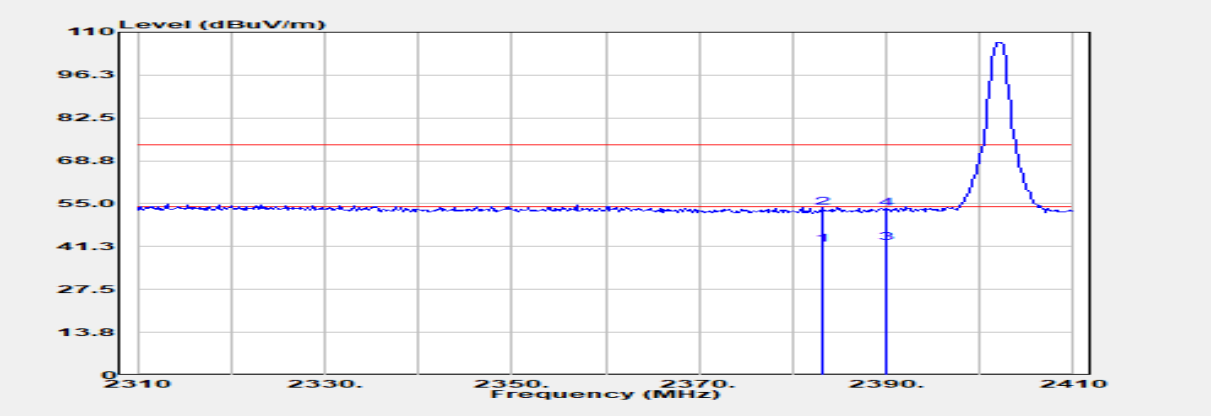
10.7.2 Radiated Bandedge Result (Non-Hopping Mode)

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.6/55
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



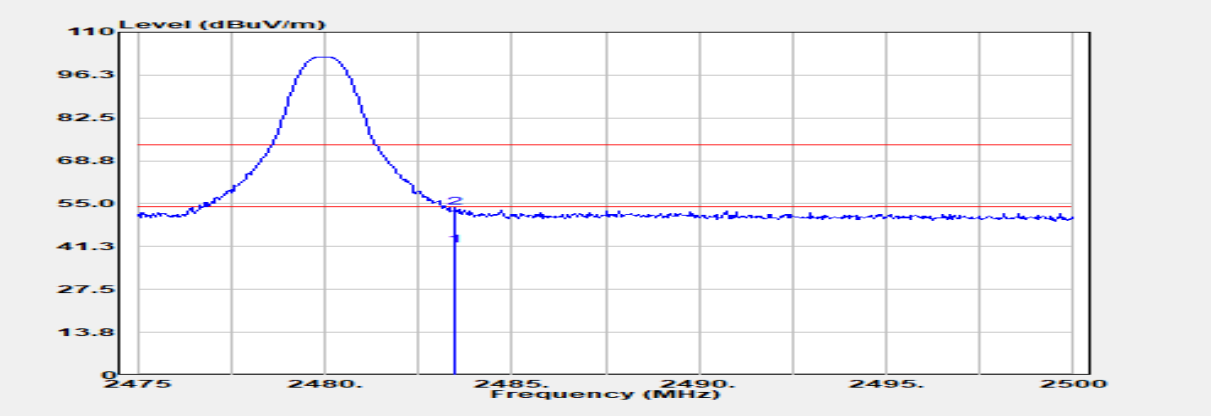
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2373.942	Average	36.79	4.87	41.66	54.00	-12.34
2373.942	Peak	48.68	4.87	53.55	74.00	-20.45
2390.000	Average	36.87	5.18	42.05	54.00	-11.95
2390.000	Peak	47.64	5.18	52.82	74.00	-21.18

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.6/55
Test Mode	:BE CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



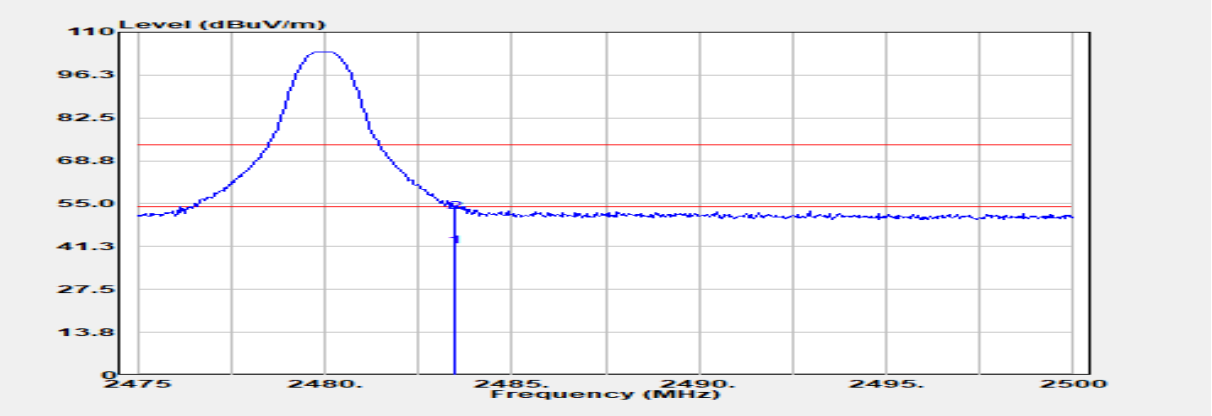
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2383.077	Average	37.16	4.88	42.04	54.00	-11.96
2383.077	Peak	48.85	4.88	53.73	74.00	-20.27
2390.000	Average	37.15	5.18	42.33	54.00	-11.67
2390.000	Peak	48.37	5.18	53.55	74.00	-20.45

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.6/55
Test Mode	:BE CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



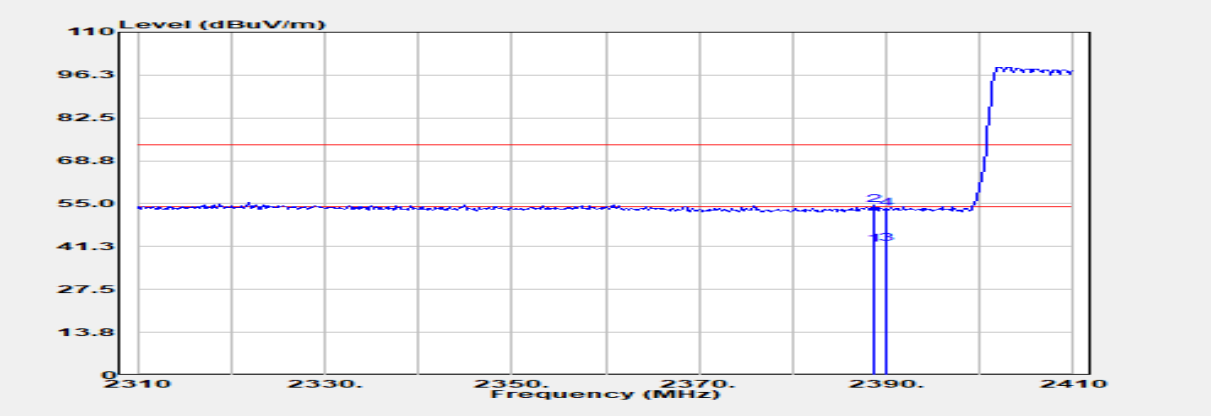
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.500	Average	37.62	4.04	41.66	54.00	-12.34
2483.500	Peak	49.79	4.04	53.83	74.00	-20.17

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.6/55
Test Mode	:BE CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



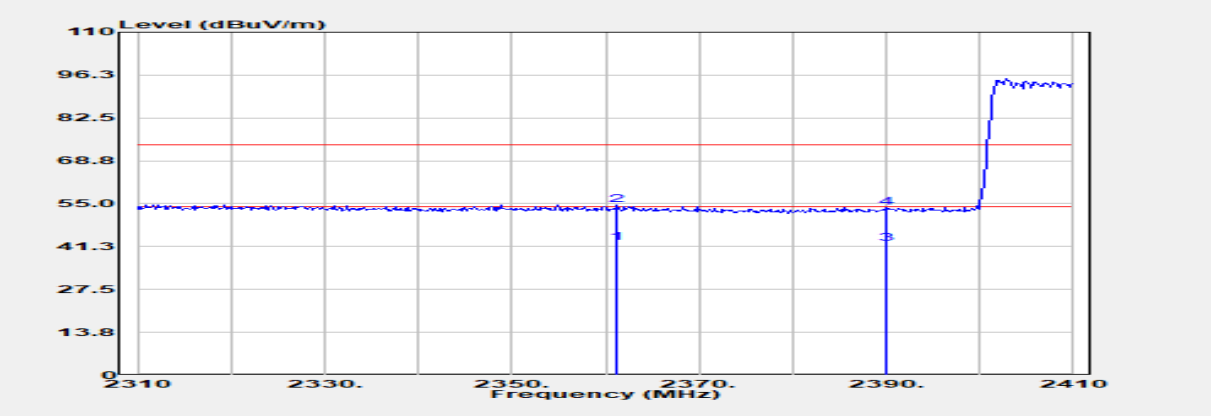
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
2483.500	Average	37.37	4.04	41.41	54.00	-12.59
2483.500	Peak	48.27	4.04	52.31	74.00	-21.69

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR Hopping	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.5/61
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



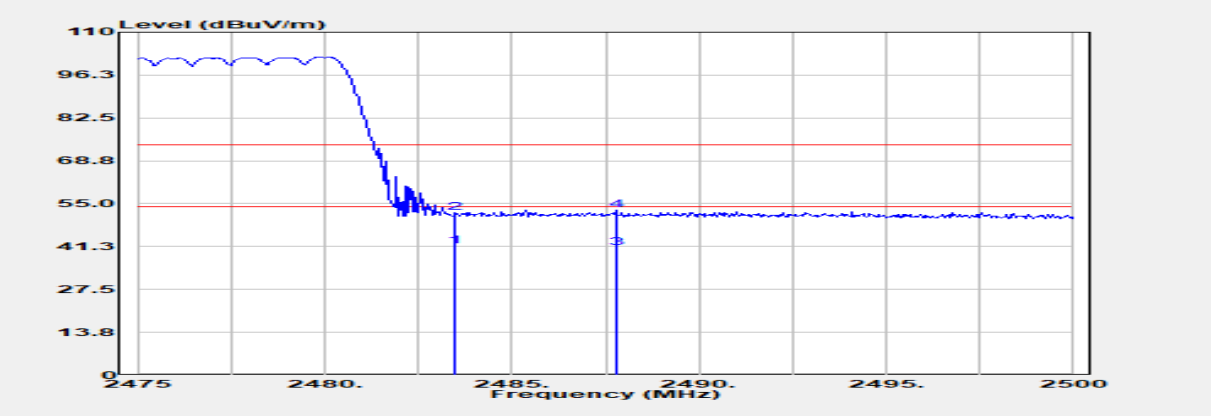
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2388.686	Average	36.85	5.12	41.97	54.00	-12.03
2388.686	Peak	49.45	5.12	54.58	74.00	-19.42
2390.000	Average	37.08	5.18	42.26	54.00	-11.74
2390.000	Peak	48.25	5.18	53.43	74.00	-20.57

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR Hopping	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.5/61
Test Mode	:BE CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



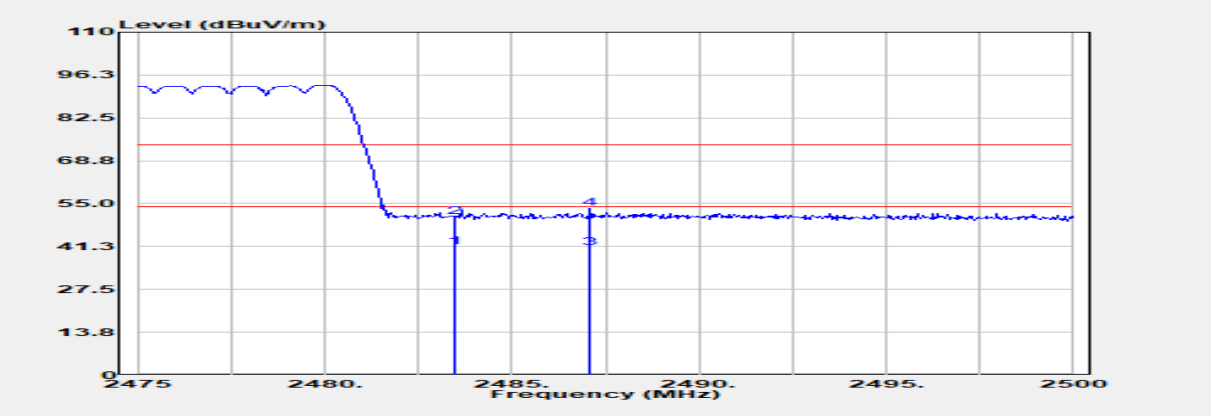
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2361.282	Average	37.09	5.40	42.49	54.00	-11.51
2361.282	Peak	49.11	5.40	54.51	74.00	-19.49
2390.000	Average	36.91	5.18	42.09	54.00	-11.91
2390.000	Peak	48.58	5.18	53.76	74.00	-20.24

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR Hopping	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.5/61
Test Mode	:BE CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



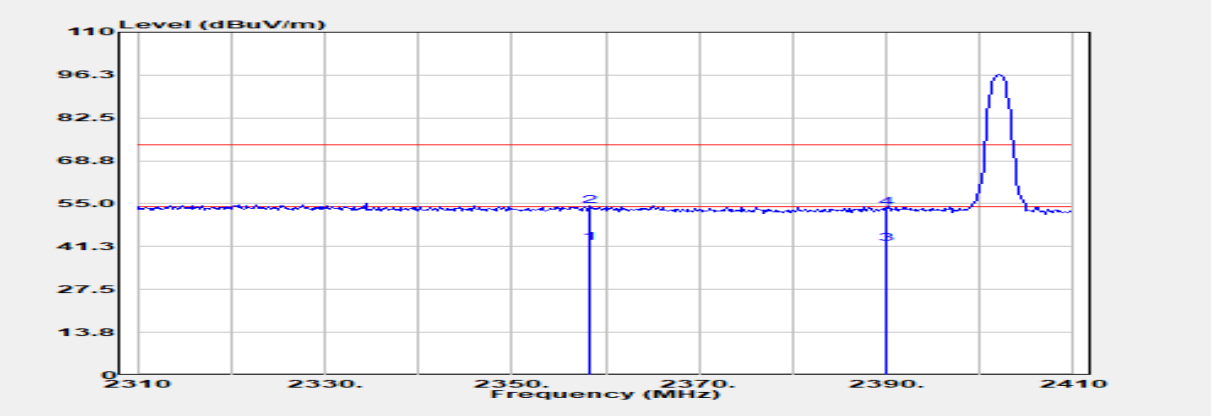
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.20	4.04	41.24	54.00	-12.76
2483.500	Peak	48.06	4.04	52.09	74.00	-21.91
2487.781	Average	36.83	4.00	40.83	54.00	-13.17
2487.781	Peak	48.96	4.00	52.95	74.00	-21.05

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR Hopping	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.5/61
Test Mode	:BE CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



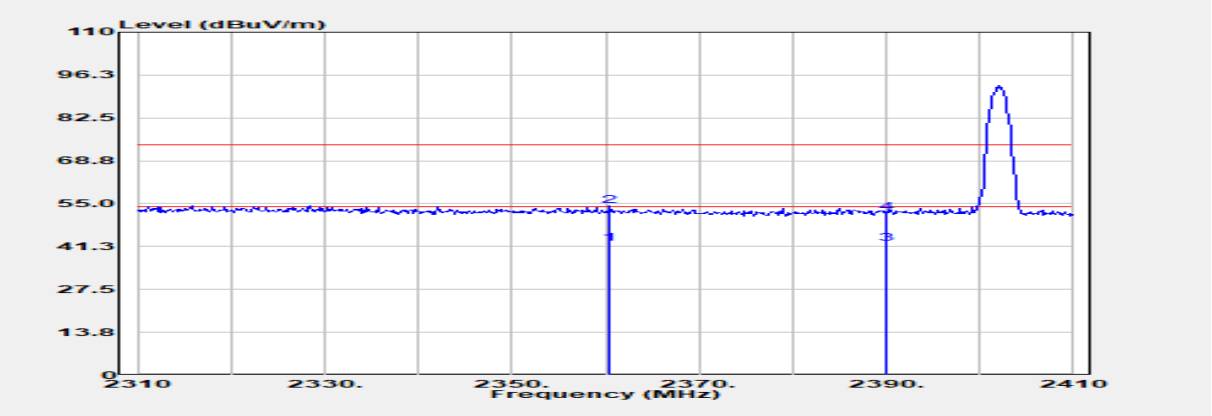
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.02	4.04	41.06	54.00	-12.94
2483.500	Peak	46.79	4.04	50.82	74.00	-23.18
2487.099	Average	36.77	4.00	40.77	54.00	-13.23
2487.099	Peak	49.61	4.00	53.61	74.00	-20.39

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.0/55
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



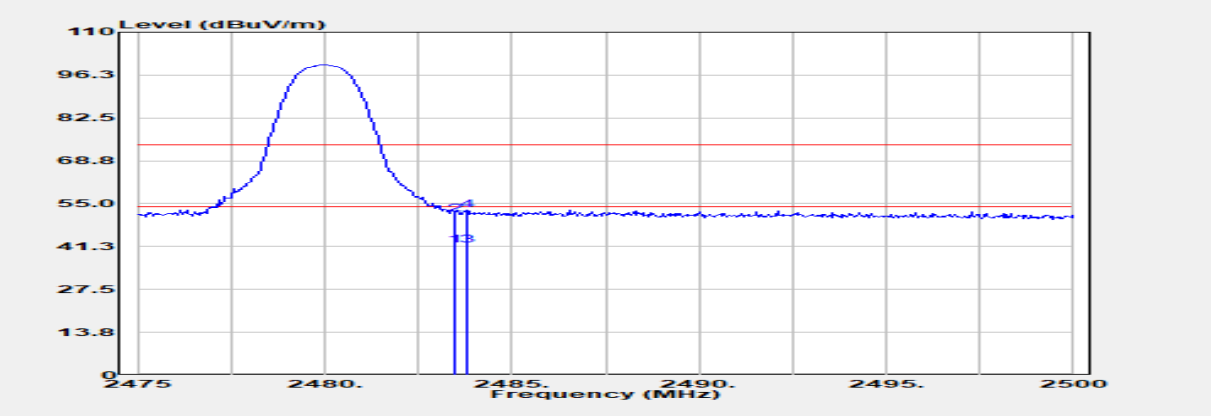
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2358.397	Average	37.12	5.45	42.57	54.00	-11.43
2358.397	Peak	48.83	5.45	54.28	74.00	-19.72
2390.000	Average	36.92	5.18	42.10	54.00	-11.90
2390.000	Peak	48.66	5.18	53.85	74.00	-20.15

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.0/55
Test Mode	:BE CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



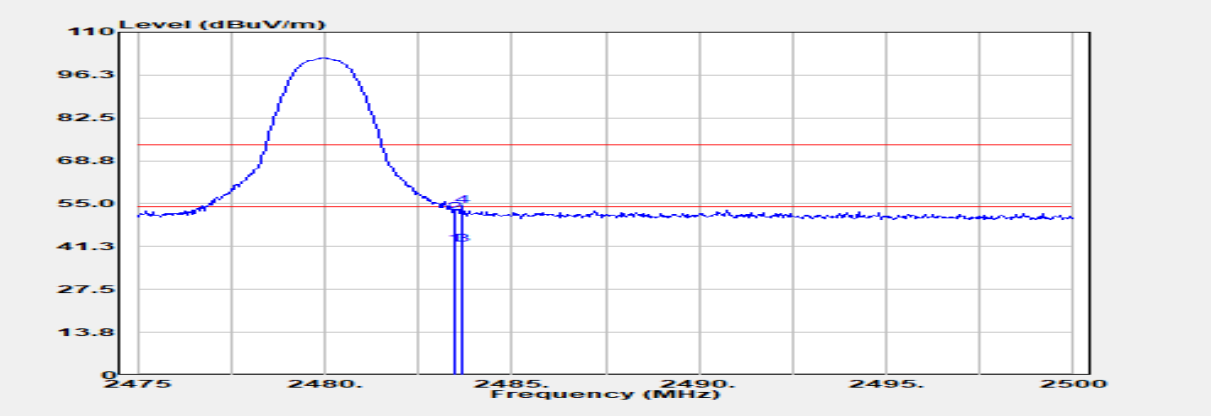
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2360.481	Average	36.79	5.44	42.23	54.00	-11.77
2360.481	Peak	48.74	5.44	54.18	74.00	-19.82
2390.000	Average	37.06	5.18	42.24	54.00	-11.76
2390.000	Peak	46.87	5.18	52.05	74.00	-21.95

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.0/55
Test Mode	:BE CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.63	4.04	41.67	54.00	-12.33
2483.500	Peak	47.48	4.04	51.51	74.00	-22.49
2483.774	Average	37.48	4.03	41.51	54.00	-12.49
2483.774	Peak	49.00	4.03	53.03	74.00	-20.97

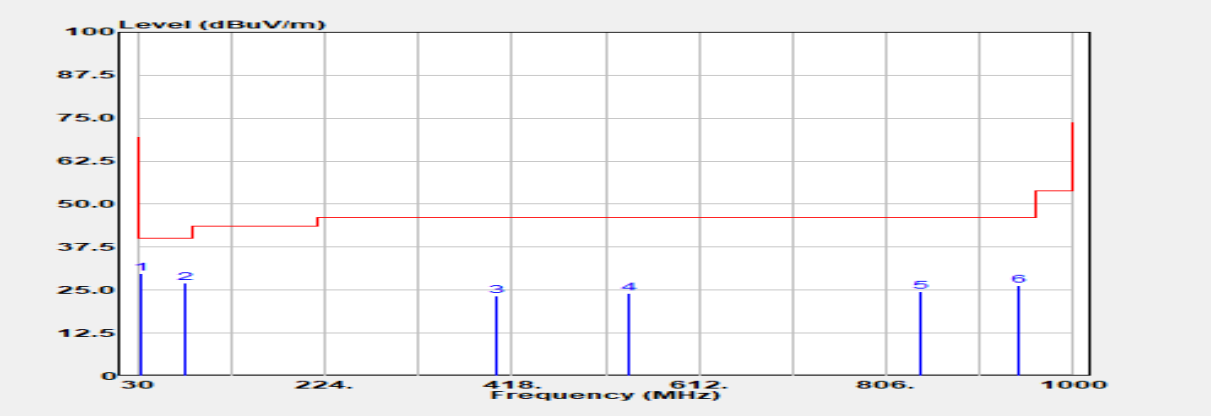
Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.0/55
Test Mode	:BE CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Average	37.95	4.04	41.99	54.00	-12.01
2483.500	Peak	47.99	4.04	52.02	74.00	-21.98
2483.694	Average	37.97	4.03	42.00	54.00	-12.00
2483.694	Peak	50.37	4.03	54.40	74.00	-19.60

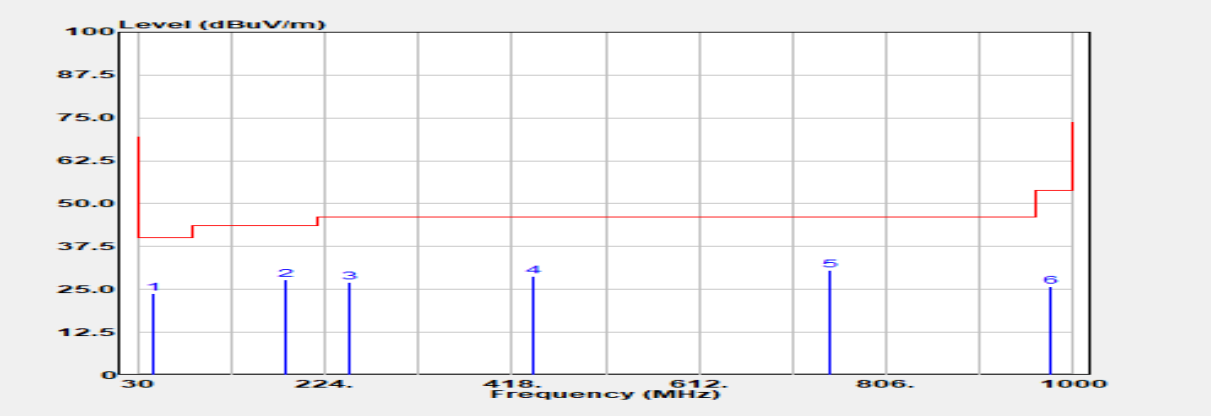
10.7.3 Radiated Spurious Emission form 30MHz to 1000MHz:

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-05
Test Frequency	:2441 MHz	Temp./Humi.	:23.2/54
Test Mode	:TX CH MID	Antenna Pol.	:VERTICAL
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
34.663	Peak	38.57	-8.86	29.71	40.00	-10.29
78.189	Peak	48.85	-21.71	27.15	40.00	-12.85
403.077	Peak	35.54	-12.29	23.25	46.00	-22.75
538.317	Peak	33.42	-9.37	24.05	46.00	-21.95
841.442	Peak	30.85	-6.31	24.54	46.00	-21.46
942.484	Peak	31.84	-5.55	26.29	46.00	-19.71

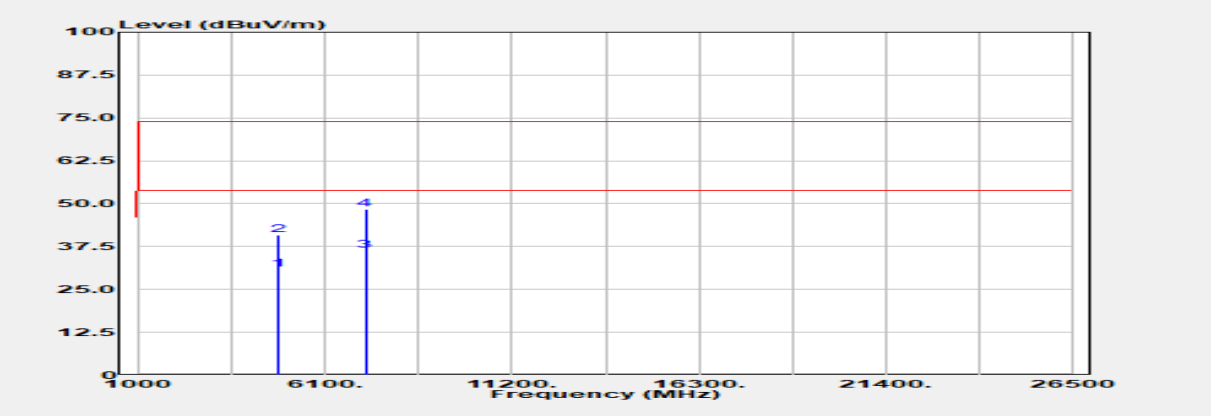
Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-05
Test Frequency	:2441 MHz	Temp./Humi.	:23.2/54
Test Mode	:TX CH MID	Antenna Pol.	:HORIZONTAL
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
45.545	Peak	39.83	-16.14	23.69	40.00	-16.31
183.894	Peak	47.98	-20.19	27.78	43.50	-15.72
249.183	Peak	43.23	-16.22	27.01	46.00	-18.99
440.385	Peak	40.66	-11.80	28.86	46.00	-17.14
746.619	Peak	38.27	-7.79	30.48	46.00	-15.52
976.683	Peak	31.41	-5.51	25.91	54.00	-28.09

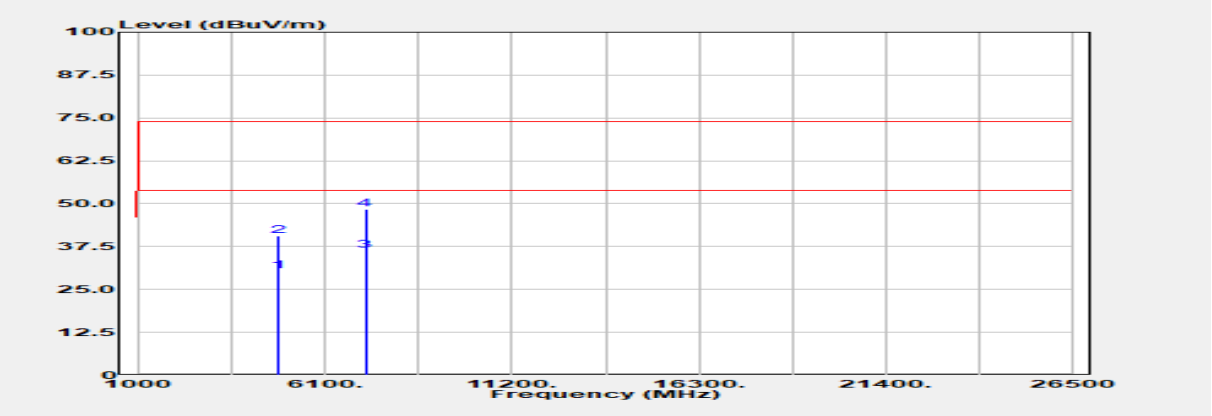
10.7.4 Radiated Spurious Emission above 1 GHz:

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



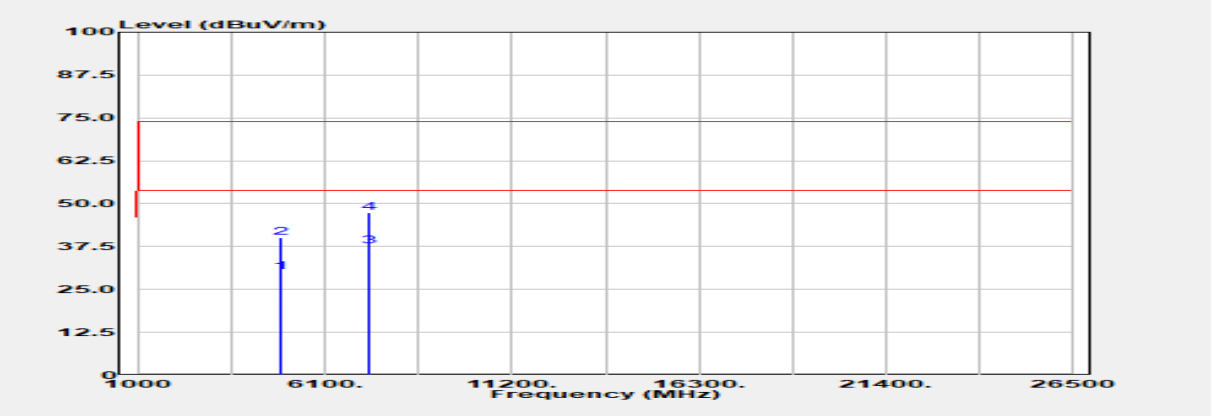
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4804.000	Average	19.98	10.87	30.85	54.00	-23.15
4804.000	Peak	30.02	10.87	40.89	74.00	-33.11
7206.000	Average	19.12	17.27	36.39	54.00	-17.61
7206.000	Peak	30.98	17.27	48.25	74.00	-25.75

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



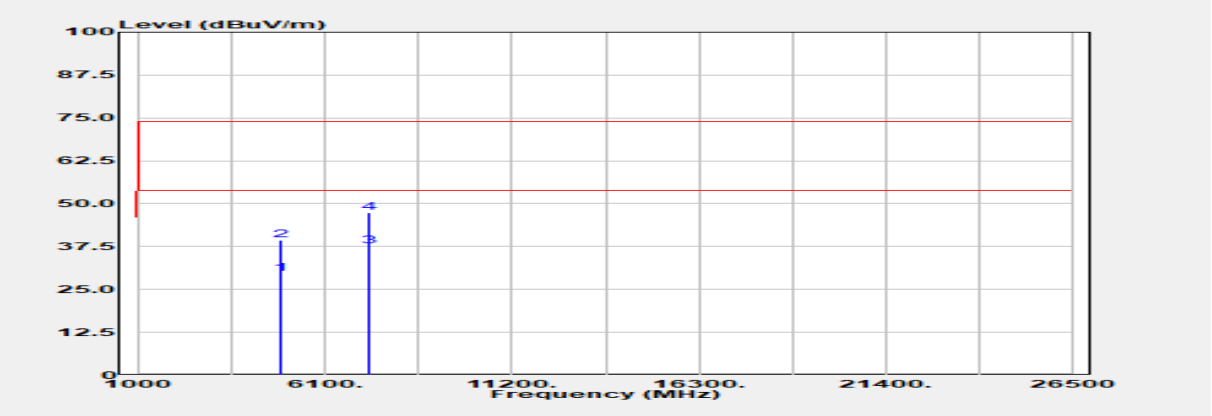
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4804.000	Average	19.57	10.87	30.45	54.00	-23.55
4804.000	Peak	29.63	10.87	40.50	74.00	-33.50
7206.000	Average	19.08	17.27	36.35	54.00	-17.65
7206.000	Peak	31.06	17.27	48.33	74.00	-25.67

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2441 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



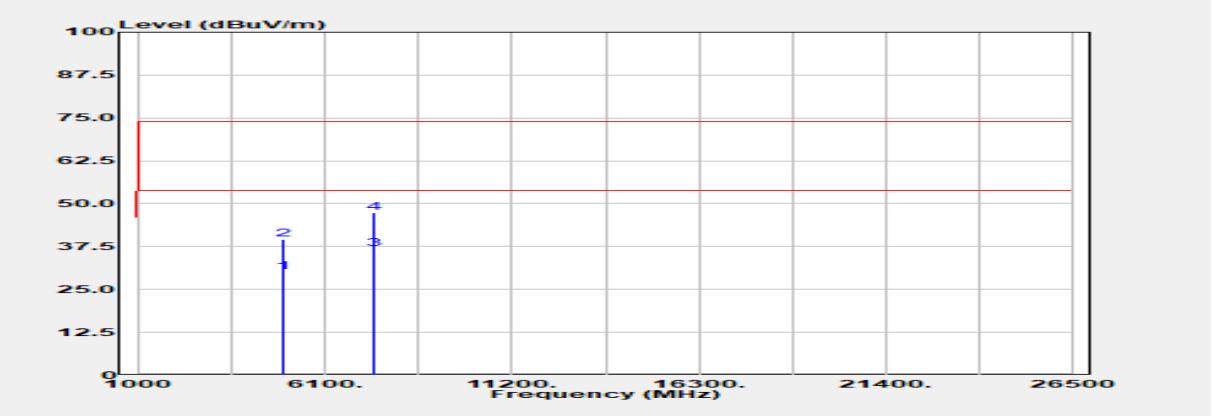
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4882.000	Average	20.01	10.12	30.13	54.00	-23.87
4882.000	Peak	30.10	10.12	40.22	74.00	-33.78
7323.000	Average	19.05	18.49	37.54	54.00	-16.46
7323.000	Peak	28.89	18.49	47.38	74.00	-26.62

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2441 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH MID	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



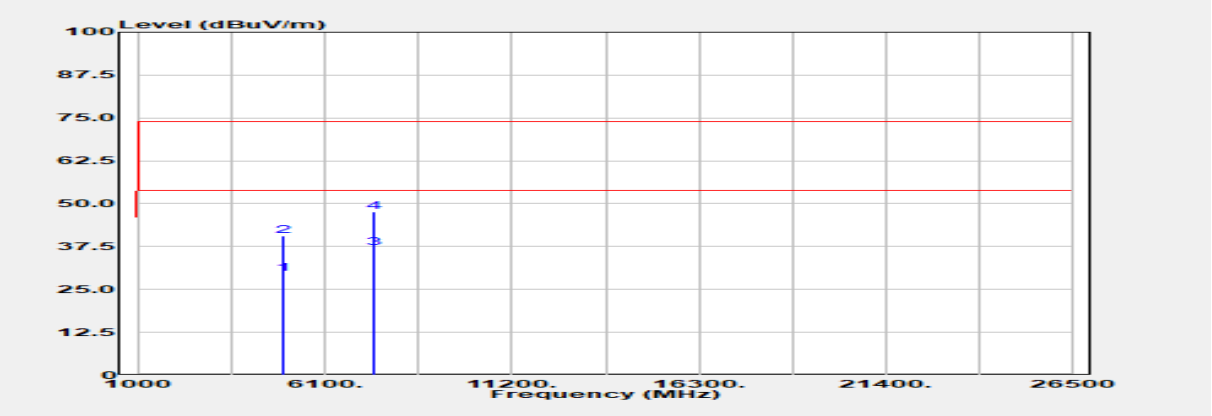
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4882.000	Average	19.52	10.12	29.64	54.00	-24.36
4882.000	Peak	29.34	10.12	39.46	74.00	-34.54
7323.000	Average	19.08	18.49	37.57	54.00	-16.43
7323.000	Peak	28.90	18.49	47.39	74.00	-26.61

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



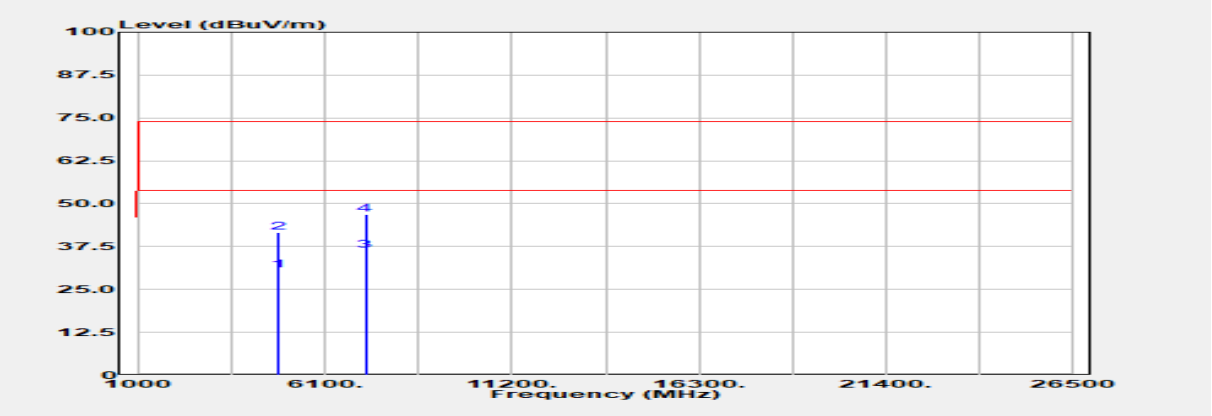
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.000	Average	19.84	10.20	30.04	54.00	-23.96
4960.000	Peak	29.44	10.20	39.64	74.00	-34.36
7440.000	Average	19.05	17.86	36.91	54.00	-17.09
7440.000	Peak	29.45	17.86	47.31	74.00	-26.69

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT BR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:22.8/51
Test Mode	:TX CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



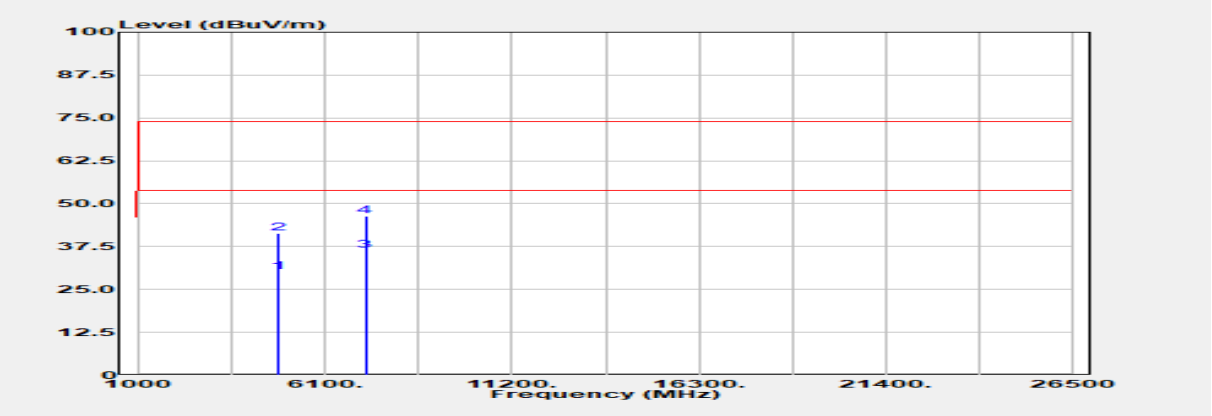
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.000	Average	19.46	10.20	29.66	54.00	-24.34
4960.000	Peak	30.48	10.20	40.69	74.00	-33.31
7440.000	Average	19.18	17.86	37.04	54.00	-16.96
7440.000	Peak	29.85	17.86	47.71	74.00	-26.29

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH LOW	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



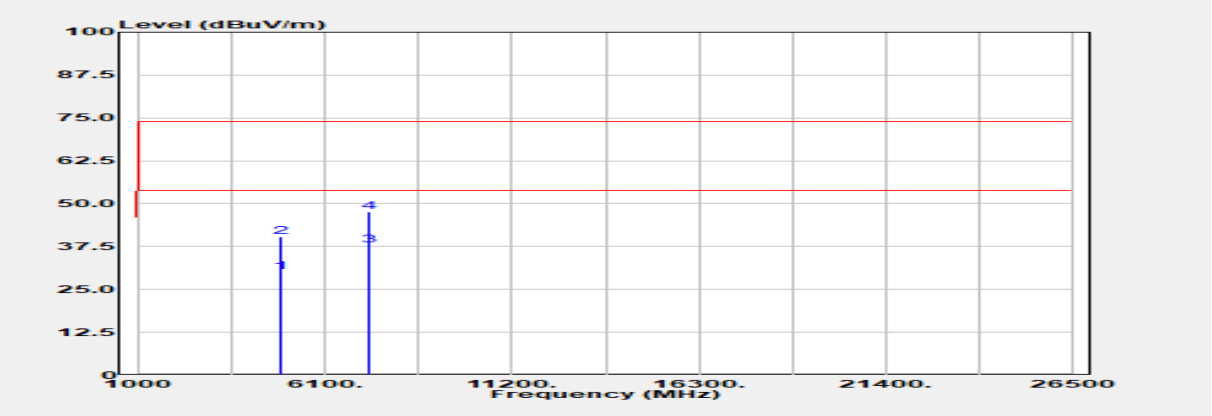
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4804.000	Average	19.58	10.87	30.45	54.00	-23.55
4804.000	Peak	30.82	10.87	41.69	74.00	-32.31
7206.000	Average	19.18	17.27	36.45	54.00	-17.55
7206.000	Peak	29.52	17.27	46.79	74.00	-27.21

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2402 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH LOW	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



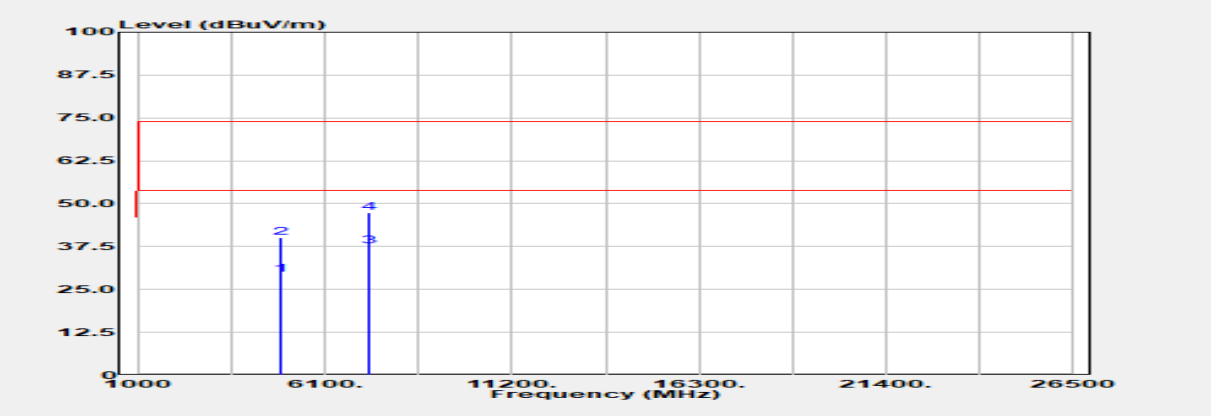
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
4804.000	Average	19.20	10.87	30.07	54.00	-23.93
4804.000	Peak	30.48	10.87	41.35	74.00	-32.65
7206.000	Average	19.01	17.27	36.28	54.00	-17.72
7206.000	Peak	29.07	17.27	46.35	74.00	-27.65

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2441 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



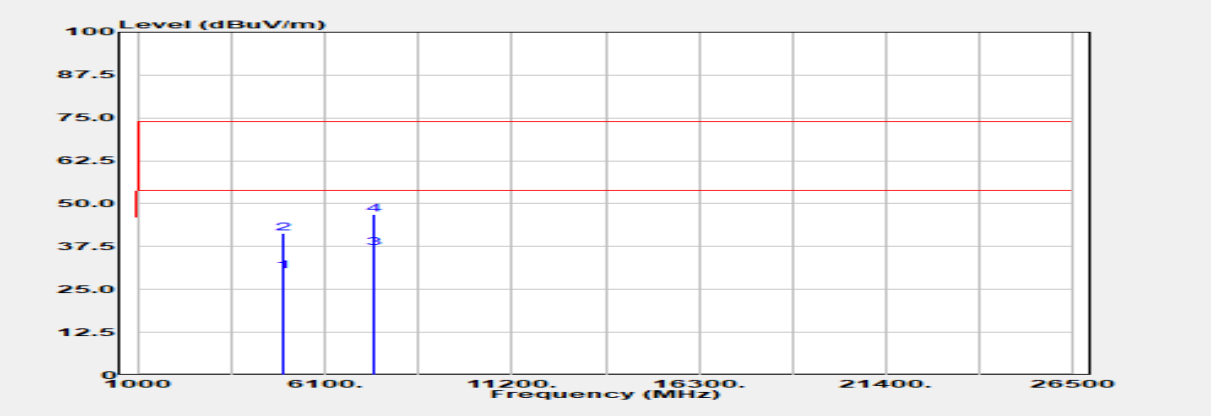
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4882.000	Average	19.89	10.12	30.01	54.00	-23.99
4882.000	Peak	30.19	10.12	40.30	74.00	-33.70
7323.000	Average	19.25	18.49	37.74	54.00	-16.26
7323.000	Peak	29.19	18.49	47.68	74.00	-26.32

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2441 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH MID	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



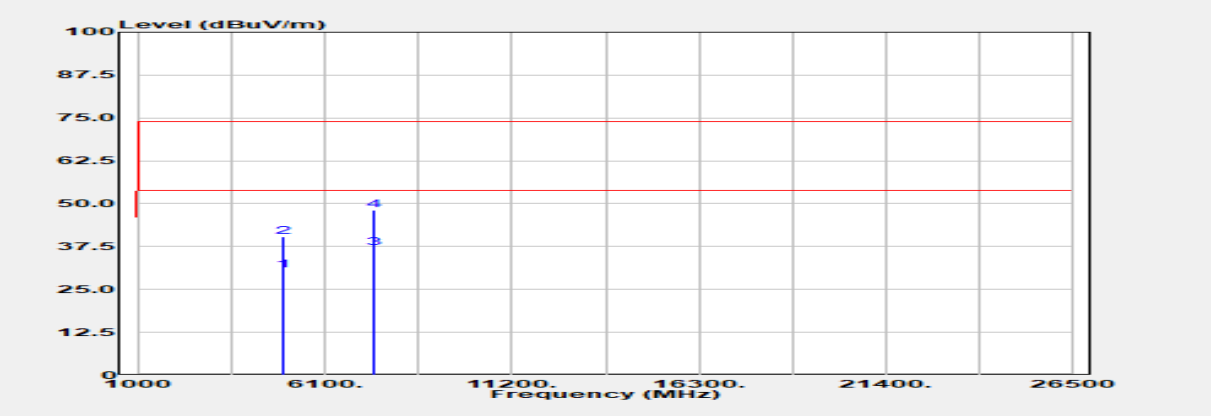
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4882.000	Average	19.23	10.12	29.35	54.00	-24.65
4882.000	Peak	29.86	10.12	39.98	74.00	-34.02
7323.000	Average	19.14	18.49	37.63	54.00	-16.37
7323.000	Peak	28.81	18.49	47.30	74.00	-26.70

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH HIGH	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.000	Average	20.02	10.20	30.22	54.00	-23.78
4960.000	Peak	31.11	10.20	41.31	74.00	-32.69
7440.000	Average	19.28	17.86	37.14	54.00	-16.86
7440.000	Peak	29.13	17.86	46.99	74.00	-27.01

Report Number	:E2/2021/60097	Test Site	:966 Chamber C
Operation Mode	:BT EDR	Test Date	:2021-07-06
Test Frequency	:2480 MHz	Temp./Humi.	:23.0/54
Test Mode	:TX CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:H Plane	Engineer	:Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4960.000	Average	20.45	10.20	30.65	54.00	-23.35
4960.000	Peak	30.04	10.20	40.25	74.00	-33.75
7440.000	Average	19.35	17.86	37.21	54.00	-16.79
7440.000	Peak	30.14	17.86	48.00	74.00	-26.00

11 FREQUENCY SEPARATION

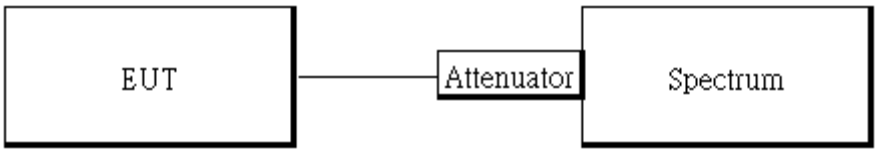
11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

11.3 Test Set-up



11.4 Measurement Procedure

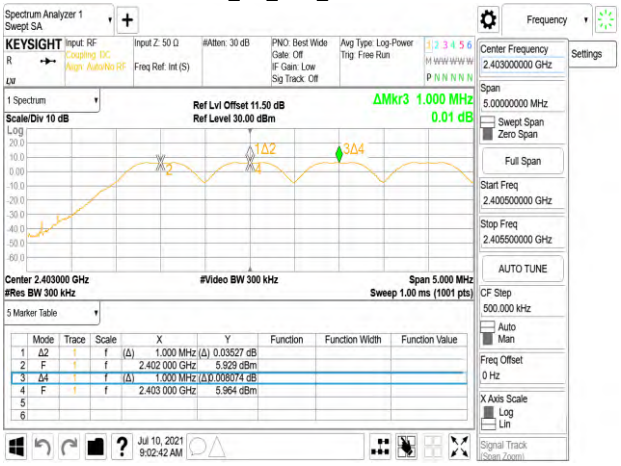
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = middle of hopping channel.
5. Set the spectrum analyzer as RBW, VBW=100 kHz, Adjust Span to 5MHz, Sweep = auto.
6. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

11.5 Measurement Result

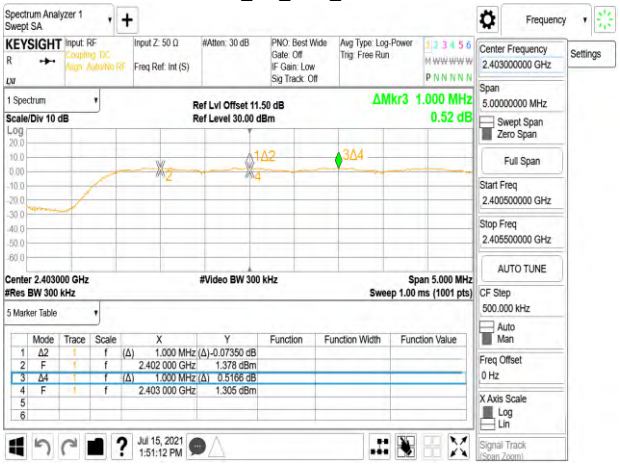
Channel separation (MHz)	Limit	Result
1	≧25 kHz or 2/3 times 20dB bandwidth	PASS

11.6 Frequency Separation Test Plots

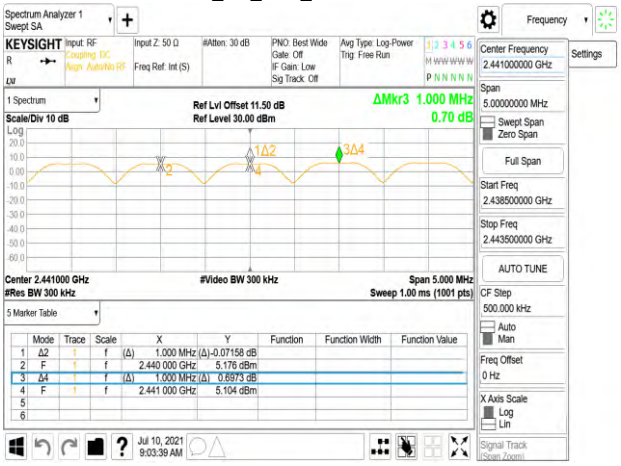
GFSK_1M_DH5_CH0CH1CH2



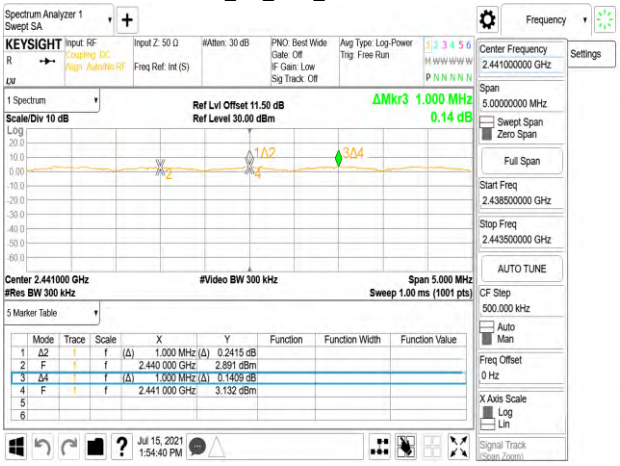
4DQPSK_2M_DH5_CH0CH1CH2



GFSK_1M_DH5_CH38CH39CH40

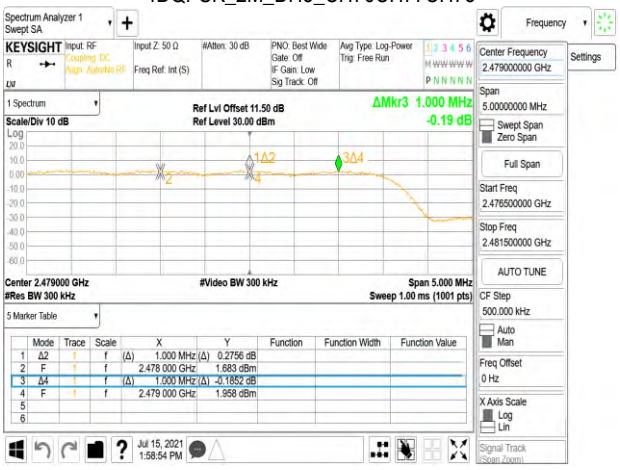


4DQPSK_2M_DH5_CH38CH39CH40



GFSK_1M_DH5_CH76CH77CH78

4DQPSK_2M_DH5_CH76CH77CH78



12 NUMBER OF HOPPING FREQUENCY

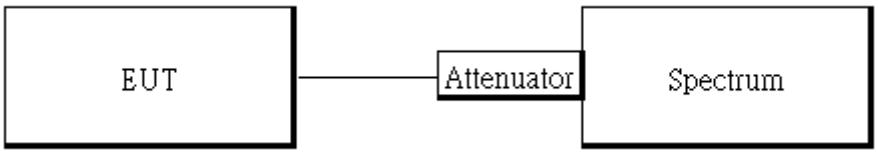
12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUM-BER**	**LAST CAL.**	**CAL DUE.**
Spectrum Ana-lyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

12.3 Test Set-up



12.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
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 spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW=430kHz, VBW=1.5MHz., Detector = Peak
6. Max hold, view and count how many channel in the band.

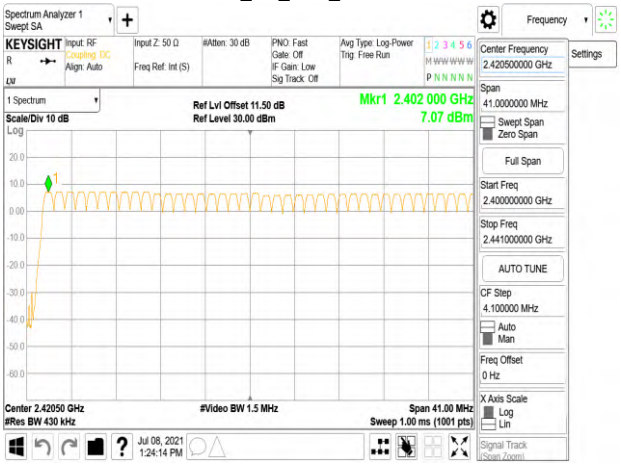
12.5 Measurement Result

Tabular Data of Total Channel Number

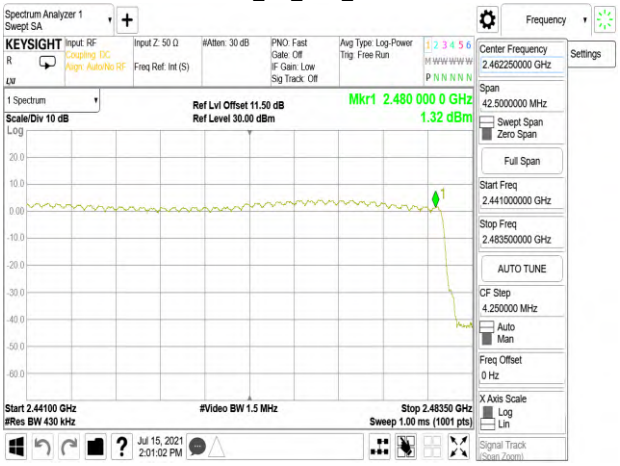
	Channel Number	Limit
2.4 GHz – 2.441 GHz	40	>15
2.441 GHz – 2.4835 GHz	39	
2.4 GHz ~2.4835 GHz	(40+39) = 79	

12.6 Channel Number Test Plots

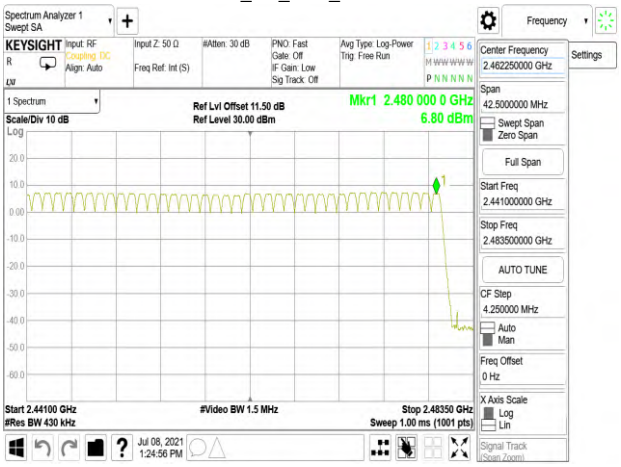
GFSK_1M_DH5_2400-2441



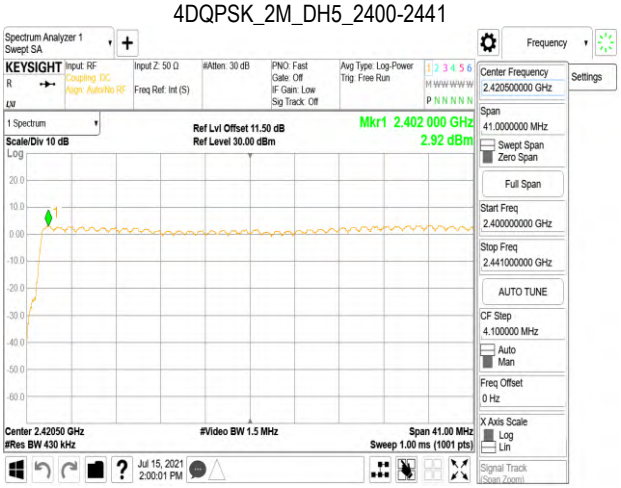
4DQPSK_2M_DH5_2441-2480



GFSK_1M_DH5_2441-2480



4DQPSK_2M_DH5_2400-2441



13 TIME OF OCCUPANCY (DWELL TIME)

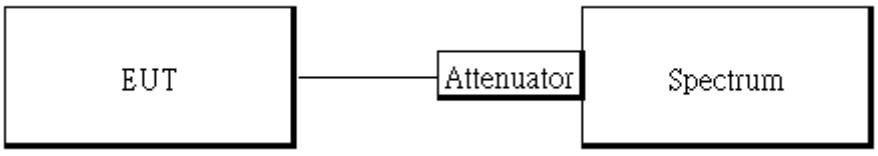
13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

13.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted D					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	KEYSIGHT	N9010B	MY60240506	06/18/2021	06/17/2022
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	RF12	11/19/2020	11/18/2021
Attenuator	Marvelous	WATT-218FS-10	RF16	11/19/2020	11/18/2021
DC Block	PASTER-NACK	PE8210	RF152	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF62	11/19/2020	11/18/2021
Test Software	Qualcomm	QRCT	V4.0.00161.0	N.C.R	N.C.R
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R

13.3 Test Set-up



13.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C6310:2015.
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 center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak,

Adjust Sweep = 2~8ms.

6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

In AFH mode, hopping rate is 800 hop/s with 6 slots in 20 hopping channels with channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 * 20) (S), Hop Over Occupancy Time comes to (800 / 6 / 20)*(0.4 *20) =53.33

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

13.5 Tabular Result of the Measurement

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Mid	DH1	123.20	400ms	2.597	3.00
	DH3	262.40	400ms	0.610	1.00
	DH5	307.20	400ms	0.347	1.00

π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Mid	2DH1	124.80	400ms	2.564	3.00
	2DH3	262.40	400ms	0.610	1.00
	2DH5	307.20	400ms	0.347	1.00

8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	1/T (kHz)	VBW setting (kHz)
Mid	3DH1	124.80	400ms	2.564	3.00
	3DH3	262.40	400ms	0.610	1.00
	3DH5	308.80	400ms	0.345	1.00

GFSK (1Mbps):

CH Mid	DH1 time slot	=	0.385	*	(1600/2/79)	*	31.6	=	123.20	(ms)
	DH3 time slot	=	1.640	*	(1600/4/79)	*	31.6	=	262.40	(ms)
	DH5 time slot	=	2.895	*	(1600/6/79)	*	31.6	=	308.80	(ms)

π/4 -DQPSK (2Mbps):

CH Mid	2DH1 time slot	=	0.390	*	(1600/2/79)	*	31.6	=	124.80	(ms)
	2DH3 time slot	=	1.640	*	(1600/4/79)	*	31.6	=	262.40	(ms)
	2DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)

8-DPSK (3Mbps):

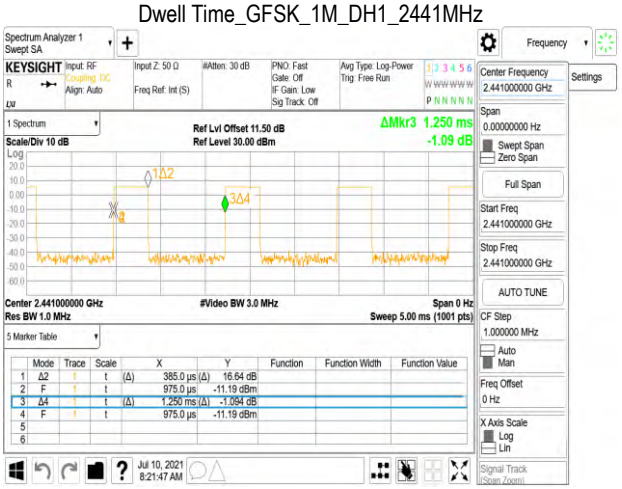
CH Mid	3DH1 time slot	=	0.390	*	(1600/2/79)	*	31.6	=	124.80	(ms)
	3DH3 time slot	=	1.640	*	(1600/4/79)	*	31.6	=	262.40	(ms)
	3DH5 time slot	=	2.895	*	(1600/6/79)	*	31.6	=	308.80	(ms)

A period time = 0.4 (s) * 79 = 31.6 (s)

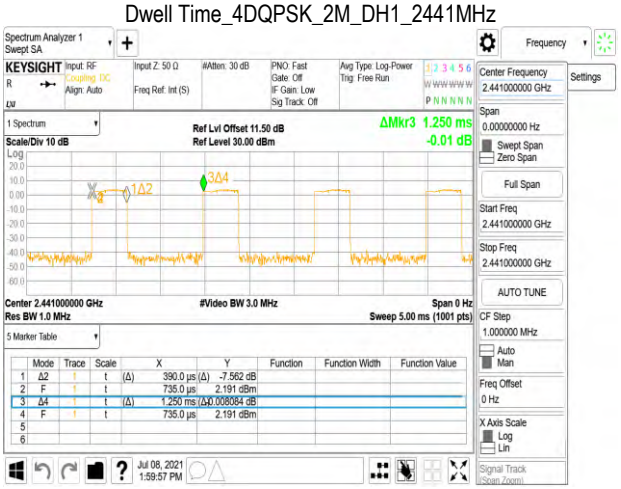
13.6 Measurement Result

Note: Refer to next page for plots.

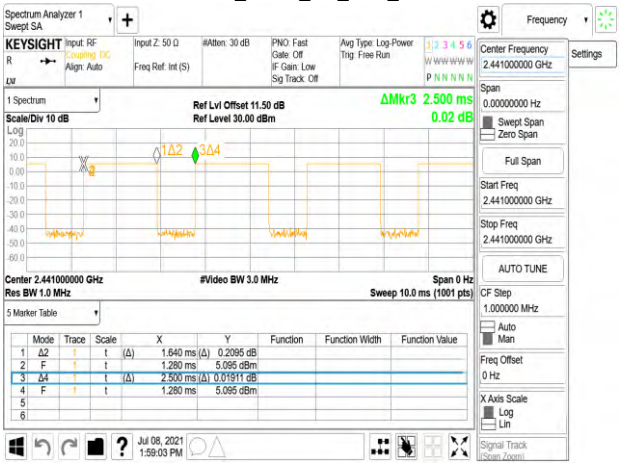
Dwell Time_GFSK_1M_DH1_2441MHz



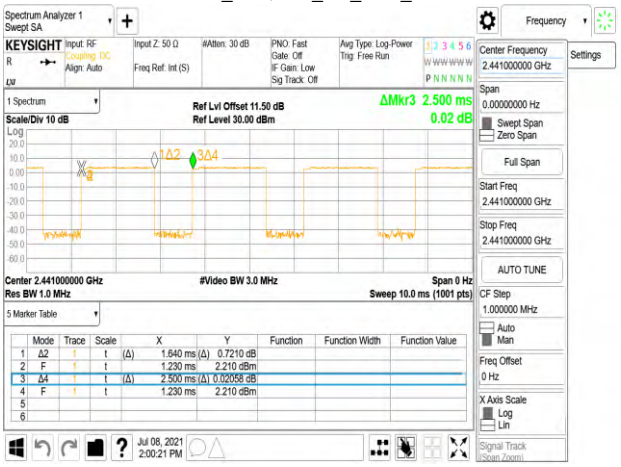
Dwell Time_4DQPSK_2M_DH1_2441MHz



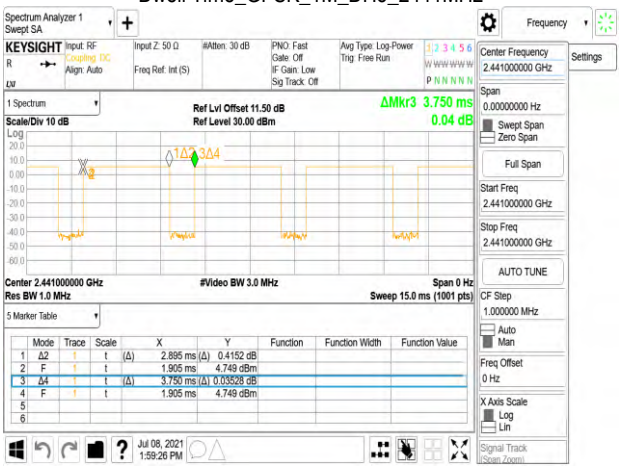
Dwell Time_GFSK_1M_DH3_2441MHz



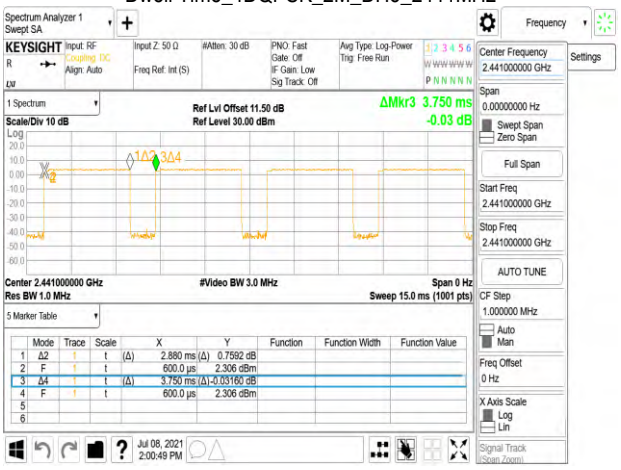
Dwell Time_4DQPSK_2M_DH3_2441MHz



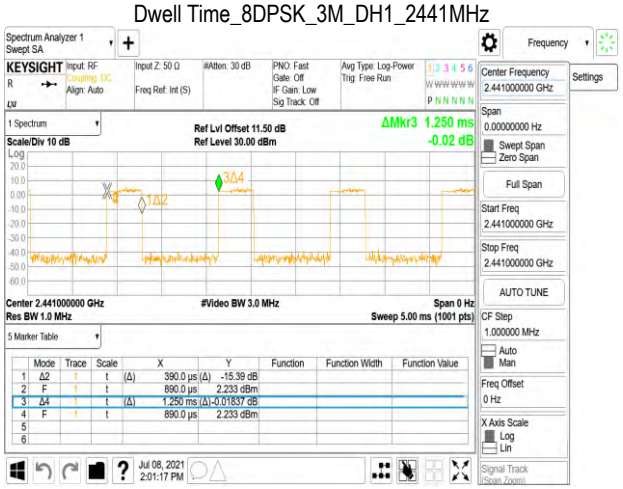
Dwell Time_GFSK_1M_DH5_2441MHz



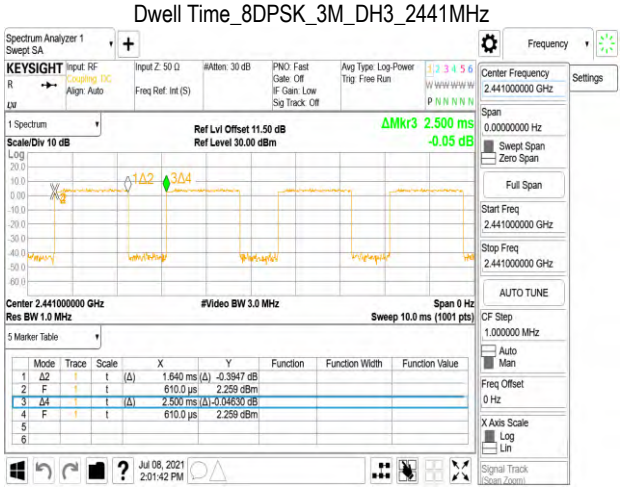
Dwell Time_4DQPSK_2M_DH5_2441MHz



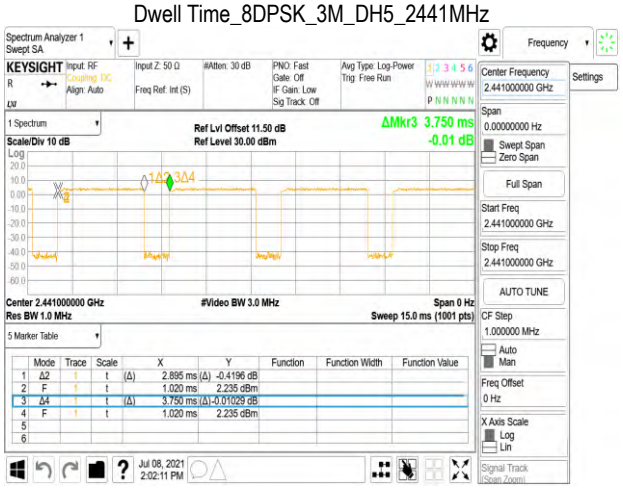
Dwell Time_8DPSK_3M_DH1_2441MHz



Dwell Time_8DPSK_3M_DH3_2441MHz



Dwell Time_8DPSK_3M_DH5_2441MHz



14 ANTENNA REQUIREMENT

14.1 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.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

14.2 Antenna Connected Construction

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

~ End of Report ~