

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

Applicant: Quanta Computer Inc.
No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City
33377, Taiwan

Manufacturer: Quanta Computer Inc.
No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City
33377, Taiwan

Product Name: Clover Mini

Brand Name: Clover

Model No.: C305

Model Difference: N/A

Report Number: E2/2022/20120

FCC ID HFS-C305

IC: 1787B-C305

Issue Date: April 14, 2022

Date of Test: March 14, 2022 ~ March 21, 2022

Date of EUT Received: February 22, 2022

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.

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Revision History					
Report Number	Revision	Description	Issue Date	Revised By	Remark
E2/2022/20120	00	Original	April 14, 2022	Yuri Tsai	

Note:

- 1、The remark "" indicates modification of the report upon requests from certification body.

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Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	6
3	SUMMARY OF TEST RESULTS.....	9
4	DESCRIPTION OF TEST MODES	10
5	MEASUREMENT UNCERTAINTY	12
6	MEASUREMENT EQUIPMENT USED.....	13
7	CONDUCTED EMISSION TEST	15
8	PEAK OUTPUT POWER MEASUREMENT.....	19
9	EMISSION BANDWIDTH MEASUREMENT	22
10	CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT	29
11	RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT	34
12	FREQUENCY SEPARATION	70
13	NUMBER OF HOPPING FREQUENCY	73
14	TIME OF OCCUPANCY (DWELL TIME).....	75
15	ANTENNA REQUIREMENT	80

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Clover Mini
Brand Name:	Clover
Model No.:	C305
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	C035UT20430016
Power Supply:	12V from Adapter
Test Software (Name/Version)	QRCT / 4.0.00163.0

1.2 RF Specification

Radio Technology:	BT BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Transmit Power:	6.52 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$

1.3 Antenna Designation

Antenna Type	Freq. (MHz)	Peak Antenna Gain (dBi)
PIFA	2402-2480	1.78

Note: Antenna information is provided by the applicant.

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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		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conducted 4	TW0028	
		Conducted 5		
		Conducted 6		
		Conduction C		
		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.

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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*6m*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:

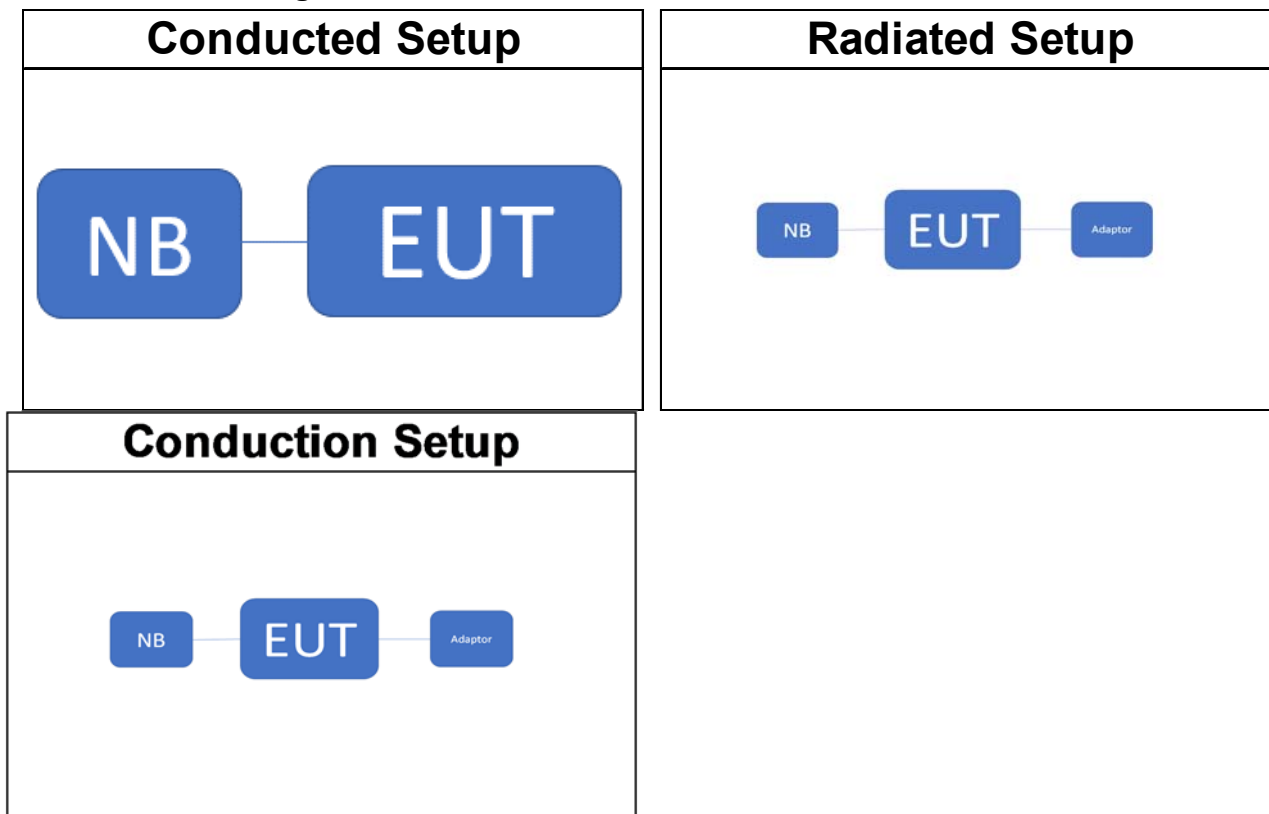
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Test Configuration



2.6 Control Unit(s)

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	PF-1PG38Y	N/A	N/A
AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	Clover	FSP040-RHBN3	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	N/A	N/A
Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Adapter	Clover	FSP040-RHBN3	N/A	N/A	N/A
Notebook	Lenovo	T470	P0001293	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)(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

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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		

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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 The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.
- 4 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	DH5/3DH5
<p>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.</p>				

ANTNNA 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	DH5
	0 to 78	0,39,78	$\pi/4$ -DQPSK	2DH5
	0 to 78	0,39,78	8-DPSK	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 $\pi/4$ -DQPSK 8-DPSK	DH5 2DH5 3DH5
Number of hopping frequency				
Bluetooth	0 to 78	0,78	GFSK/8-DPSK	DH5/3DH5
Time of Occupancy(Dwell time)				
Bluetooth	0 to 78	39	GFSK	DH1/DH3/DH5
			$\pi/4$ -DQPSK	2DH1/2DH3/2DH5
			8-DPSK	3DH1/3DH3/3DH5

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Output Power measurement	+/- 1 dB
Emission Bandwidth	+/- 1.53 Hz
Undesignable radiated emission measurement	+/- 1.68 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	+/- 2.57 dB	9kHz~30MHz
	+/- 4.85 dB	30MHz - 1000MHz
	+/- 4.45 dB	1GHz - 18GHz
	+/- 4.24 dB	18GHz - 40GHz
Polarization: Horizontal	+/- 2.57 dB	9kHz~30MHz
	+/- 4.37 dB	30MHz - 1000MHz
	+/- 4.45 dB	1GHz - 18GHz
	+/- 4.24 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 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess- Elektronik	NSLK8127	974	04/19/2021	04/18/2022
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022
Coaxial 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
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1326001	08/12/2021	08/11/2022
Power Sensor	Anritsu	MA2411B	1315048	08/12/2021	08/11/2022
Power Sensor	Anritsu	MA2411B	1315049	08/12/2021	08/11/2022
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R
Attenuator	Marvelous	MVE2213-10	RF13	11/18/2021	11/17/2022
Attenuator	Marvelous	MVE2213-10	RF14	11/18/2021	11/17/2022
Attenuator	Marvelous	MVE2213-10	RF12	11/18/2021	11/17/2022
DC Block	PASTERNAK	PE8210	RF151	11/18/2021	11/17/2022

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6.3 Radiated Measurement

Radiated Emission Test Site: SAC D					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-617	11/12/2021	11/11/2022
Horn Antenna	Schwarzbeck	BBHA9170	185	08/06/2021	08/05/2022
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/04/2021	06/03/2022
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
3m Site NSA	SGS	966 chamber D	N/A	07/12/2021	07/11/2022
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/01/2021	05/31/2022
Pre-Amplifier	EMC Instruments	EMC184045B	980135	10/27/2021	10/26/2022
Pre-Amplifier	EMC Instruments	EMC9135	980234	11/18/2021	11/17/2022
Pre-Amplifier	EMC Instruments	EMC12630SE	980273	11/18/2021	11/17/2022
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/18/2021	11/17/2022
Coaxial Cable	Huber Suhner	EMC106-SM-SM-7200	150703	11/18/2021	11/17/2022
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/18/2021	11/17/2022
Attenuator	Marvelous	WATT-218FS-10	RF17	11/18/2021	11/17/2022
Lowpass Filter	Woken	EWT-56-0019	RF173	11/18/2021	11/17/2022
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/18/2021	11/17/2022
Band Rejection Filter	Micro-Tronics	BRM50701-01	RF201	11/18/2021	11/17/2022

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

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7 CONDUCTED EMISSION TEST

7.1 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

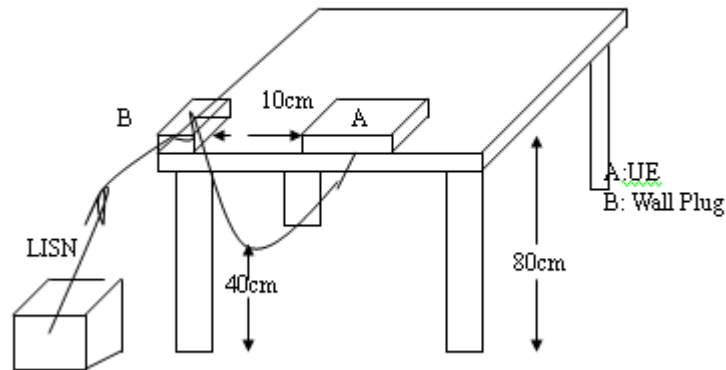
Note

- The lower limit shall apply at the transition frequencies
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

7.2 EUT Setup

- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/60Hz power source.

7.3 Test Setup



7.4 Measurement Procedure

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

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7.5 Measurement Result

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

Note2: The * reveals the worst-case results that closet to the limit.

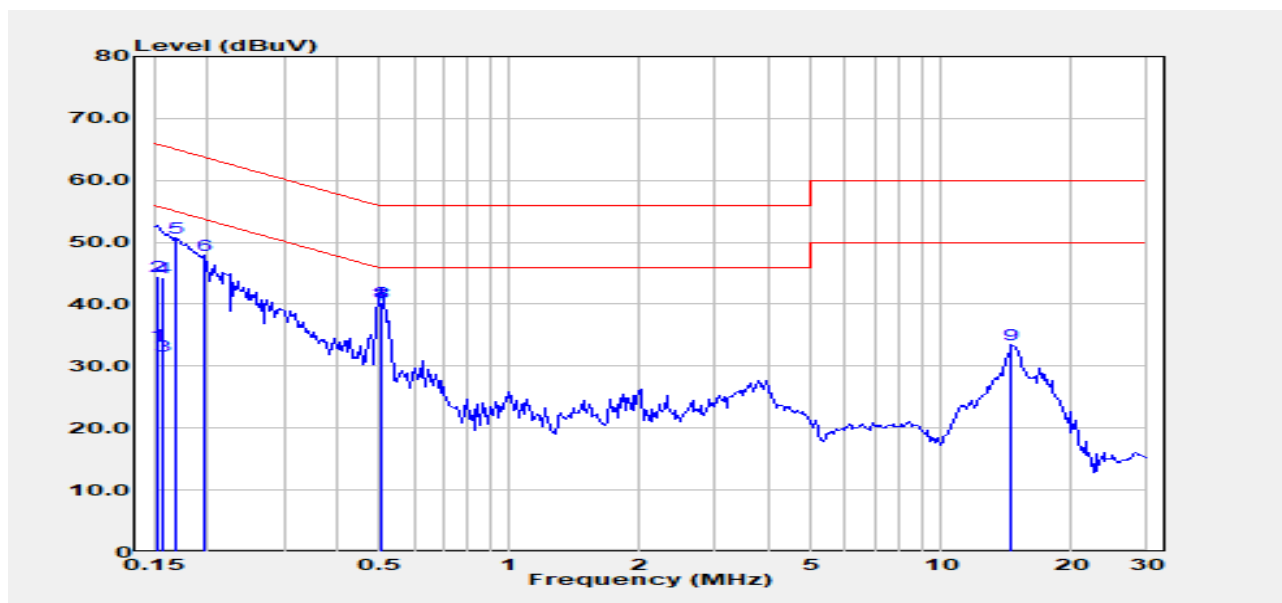
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2022/20120	Test Site	:Conduction C
Test Mode	:BT	Test Date	:2022-03-21
Power	:120V/60Hz	Temp./Humi.	:21.3/66
Probe	:L1	Engineer	:Andy Wang
Note:	: Adapter:FSP040-RHBN3		



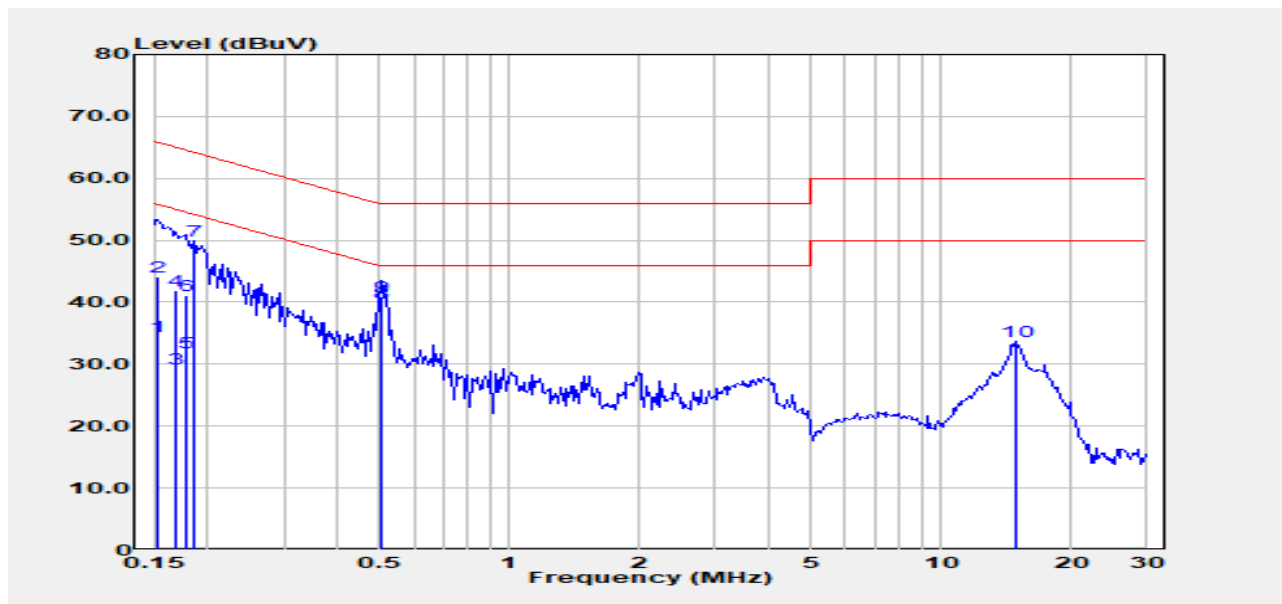
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	23.20	10.30	33.50	55.82	-22.32
0.153	QP	34.30	10.30	44.60	65.82	-21.22
0.158	Average	21.30	10.30	31.60	55.56	-23.96
0.158	QP	34.10	10.30	44.40	65.56	-21.16
0.169	Peak	40.40	10.30	50.70	65.03	-14.34
0.195	Peak	37.56	10.30	47.86	63.80	-15.94
0.502	Average	29.50	10.31	39.81	46.00	-6.19
0.502	QP	29.90	10.31	40.21	56.00	-15.79
14.594	Peak	22.79	10.78	33.56	60.00	-26.44

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Report Number :E2/2022/20120 Test Site :Conduction C
 Test Mode :BT Test Date :2022-03-21
 Power :120V/60Hz Temp./Humi. :21.3/66
 Probe :N Engineer :Andy Wang
 Note: : Adapter:FSP040-RHBN3



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.153	Average	24.20	10.31	34.51	55.82	-21.31
0.153	QP	33.90	10.31	44.21	65.82	-21.61
0.169	Average	19.00	10.31	29.31	55.03	-25.73
0.169	QP	31.50	10.31	41.81	65.03	-23.23
0.178	Average	21.50	10.30	31.80	54.59	-22.79
0.178	QP	30.80	10.30	41.10	64.59	-23.49
0.185	Peak	39.61	10.30	49.91	64.24	-14.33
0.507	Average	29.60	10.32	39.92	46.00	-6.08
0.507	QP	30.50	10.32	40.82	56.00	-15.18
14.907	Peak	22.76	10.87	33.63	60.00	-26.37

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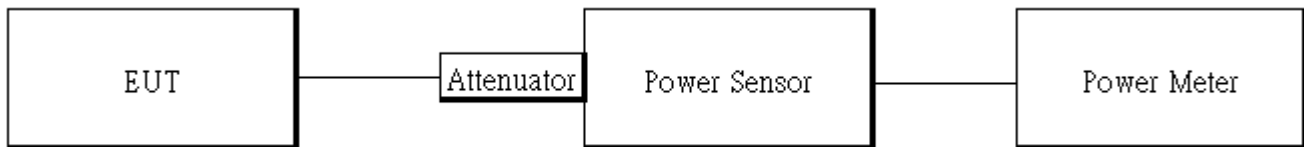
8 PEAK OUTPUT POWER MEASUREMENT

8.1 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.

8.2 Test Setup



8.3 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 bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

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8.4 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	5.74	3.750	1000
Mid	2441	8	5.16	3.281	1000
High	2480	8	6.52	4.487	1000

1M BR mode (Average):

CH	Freq. (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	5.71	3.720	1000
Mid	2441	8	5.15	3.270	1000
High	2480	8	6.50	4.462	1000

2M EDR mode (Peak):

CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	4.76	2.992	125
Mid	2441	8	4.18	2.618	125
High	2480	8	5.67	3.690	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	2.22	1.665	125
Mid	2441	8	1.69	1.474	125
High	2480	8	3.13	2.054	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8	5.24	3.342	125
Mid	2441	8	4.58	2.871	125
High	2480	8	6.02	3.999	125

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	2.36	1.720	125
Mid	2441	8	1.70	1.477	125
High	2480	8	3.12	2.049	125

NOTE: cable loss as dB that offsets in the spectrum

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

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8.5 EIRP Measurement Result

1M BR 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	5.71	1.78	5.604	4000
Mid	2441	8	5.15	1.78	4.926	4000
High	2480	8	6.50	1.78	6.722	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	2.22	1.78	2.509	4000
Mid	2441	8	1.69	1.78	2.221	4000
High	2480	8	3.13	1.78	3.094	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	2.36	1.78	2.591	4000
Mid	2441	8	1.70	1.78	2.226	4000
High	2480	8	3.12	1.78	3.087	4000

* **Note:** EIRP = Average Power + Gain

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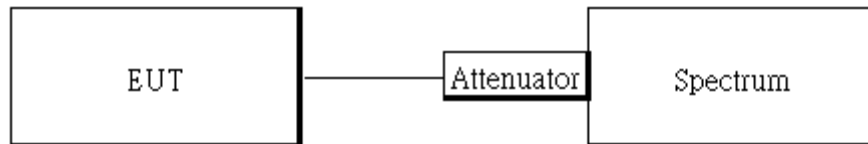
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9 EMISSION BANDWIDTH MEASUREMENT

9.1 Standard Applicable

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

9.2 Test Setup



9.3 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 \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.
7. Mark the peak frequency and 99%dB (upper and lower) frequency
8. Repeat above procedures until all test default channel is completed

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9.4 20dB Bandwidth

GFSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.9348	0.62
Mid	0.9362	0.62
High	0.9369	0.62

$\pi/4$ -DQPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.280	0.85
Mid	1.280	0.85
High	1.280	0.85

8-DPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.293	0.86
Mid	1.289	0.86
High	1.293	0.86

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9.5 99% Bandwidth

GFSK

CH	99% BW (MHz)
Low	0.84608
Mid	0.8456
High	0.84499

$\pi/4$ -DQPSK

CH	99% BW (MHz)
Low	1.1707
Mid	1.1697
High	1.1699

8-DPSK

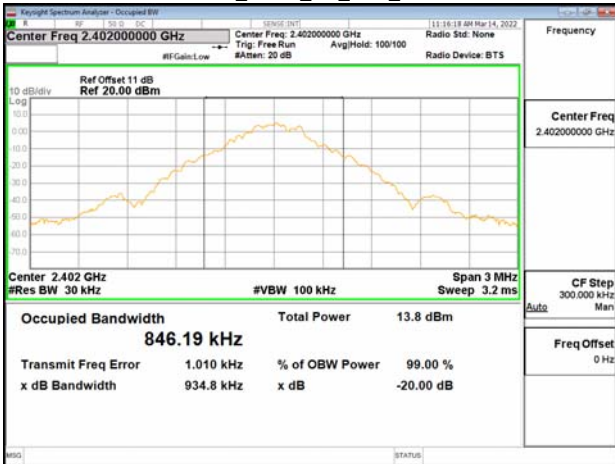
CH	99% BW (MHz)
Low	1.1747
Mid	1.1734
High	1.1747

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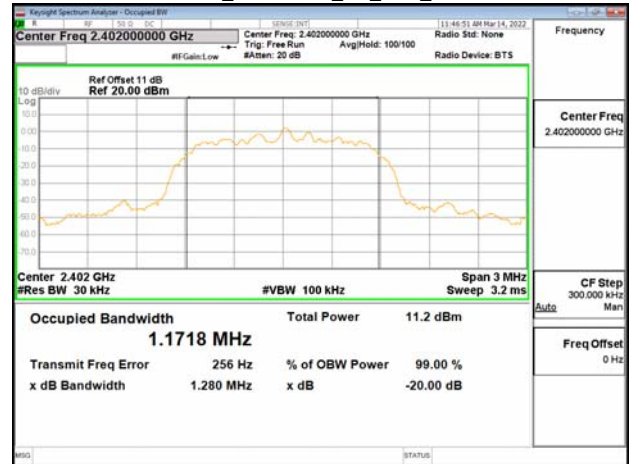
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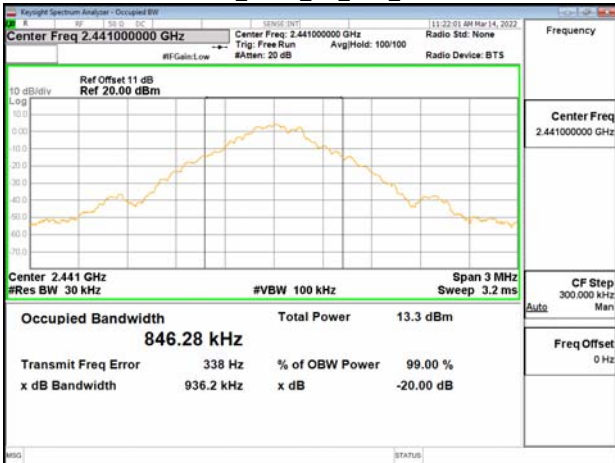
OBW 20dB_GFSK_1M_DH5_2402MHz



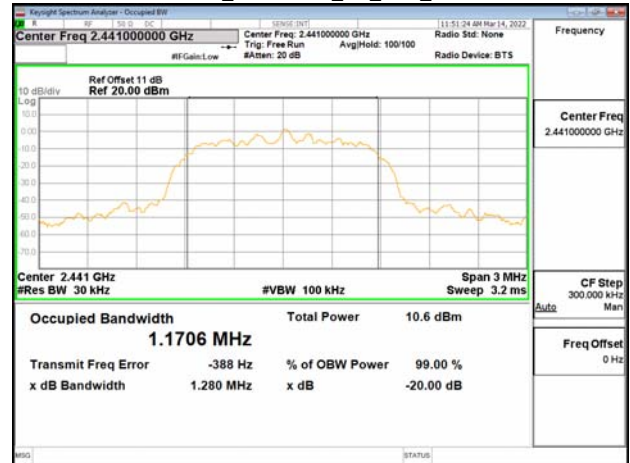
OBW 20dB_π/4QPSK_2M_DH5_2402MHz



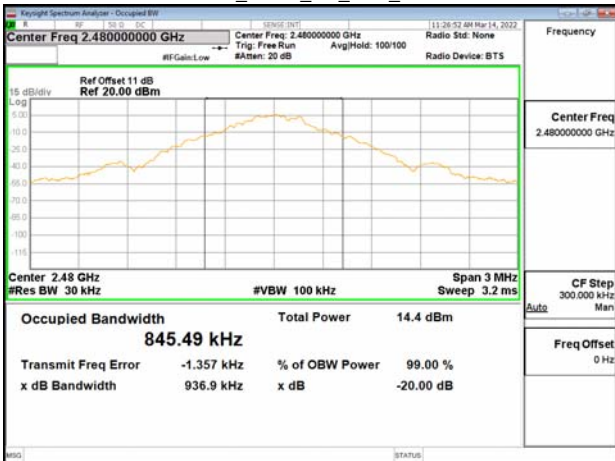
OBW 20dB_GFSK_1M_DH5_2441MHz



OBW 20dB_π/4QPSK_2M_DH5_2441MHz



OBW 20dB_GFSK_1M_DH5_2480MHz



OBW 20dB_π/4QPSK_2M_DH5_2480MHz

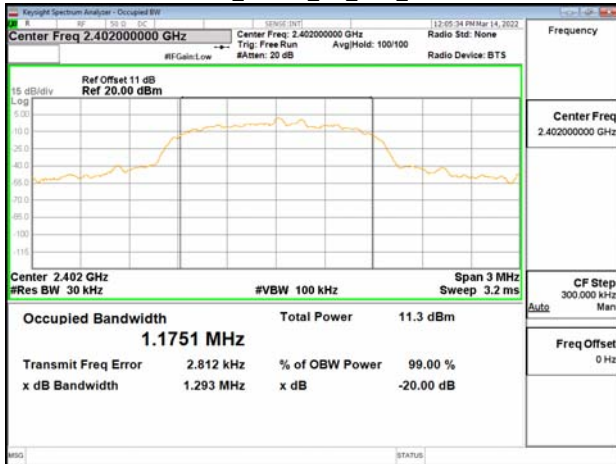


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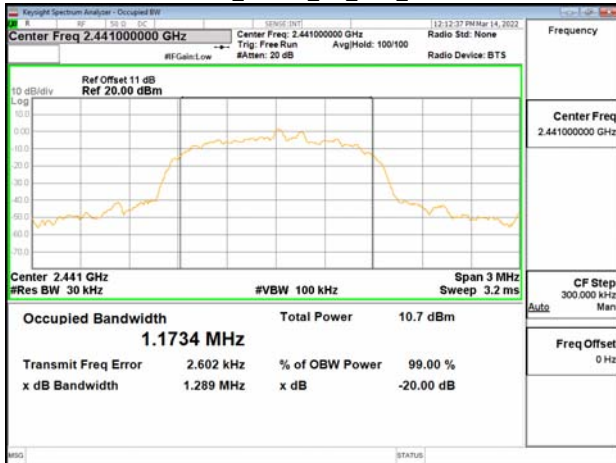
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OBW 20dB_8DPSK_3M_DH5_2402MHz



OBW 20dB_8DPSK_3M_DH5_2441MHz



OBW 20dB_8DPSK_3M_DH5_2480MHz

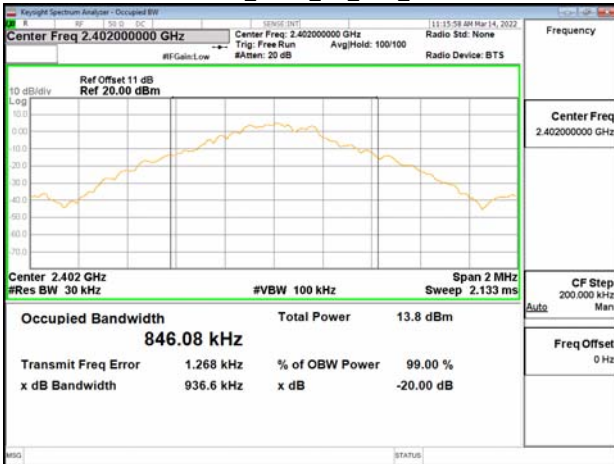


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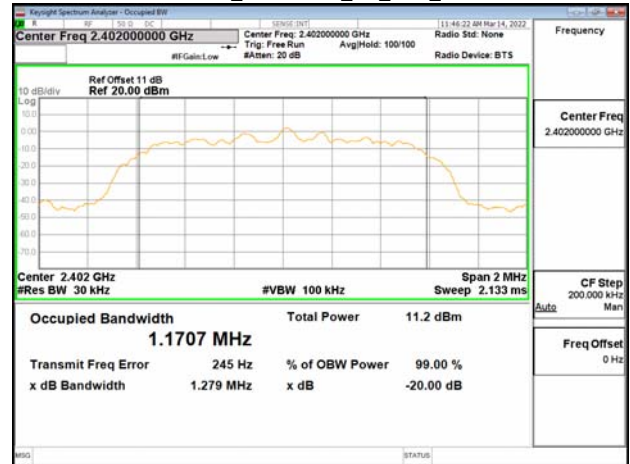
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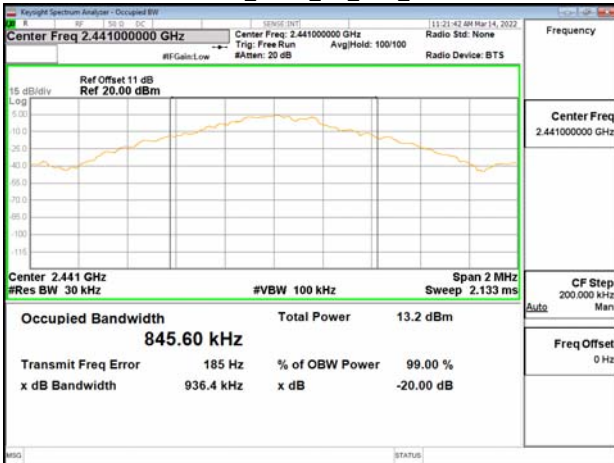
IC OBW 99%_GFSK_1M_DH5_2402MHz



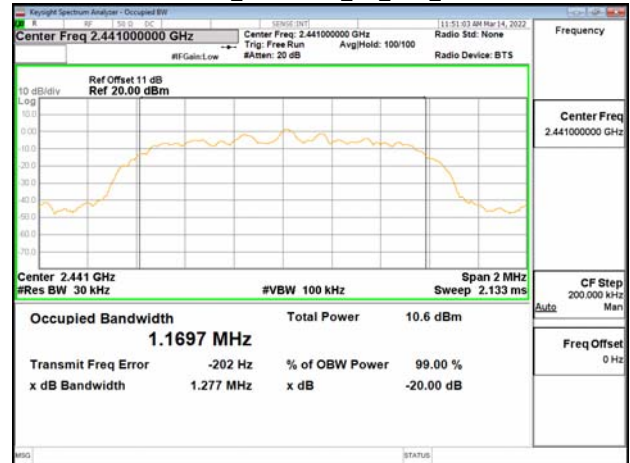
IC OBW 99%_π/4DQPSK_2M_DH5_2402MHz



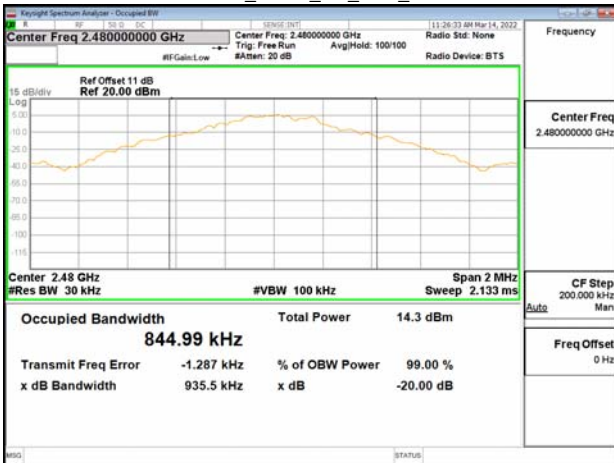
IC OBW 99%_GFSK_1M_DH5_2441MHz



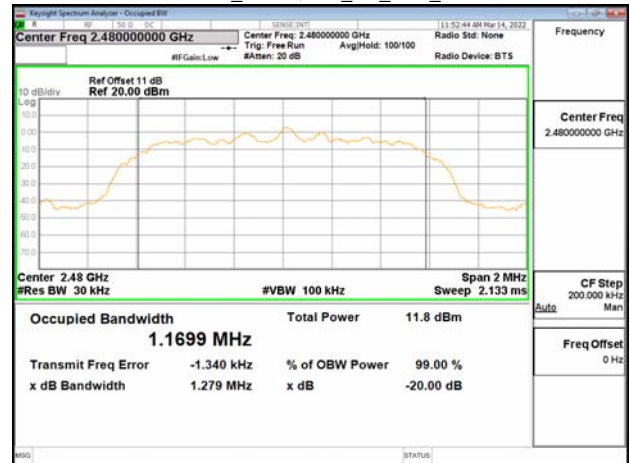
IC OBW 99%_π/4DQPSK_2M_DH5_2441MHz



IC OBW 99%_GFSK_1M_DH5_2480MHz



IC OBW 99%_π/4DQPSK_2M_DH5_2480MHz

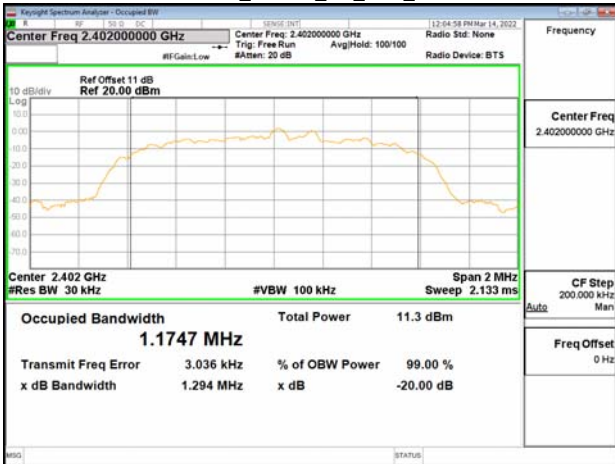


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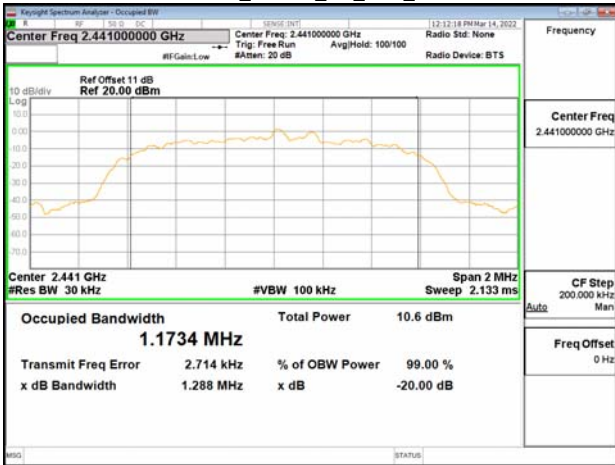
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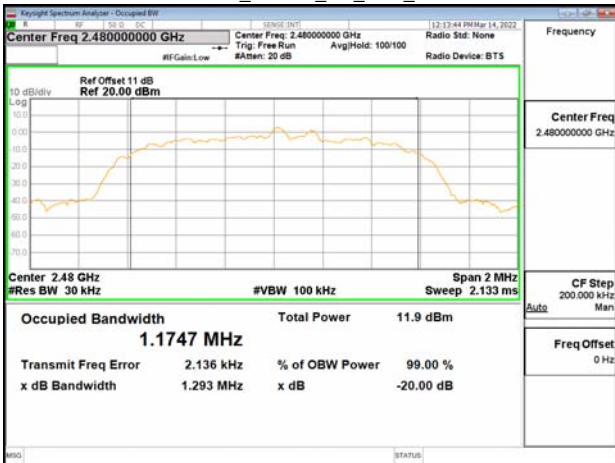
IC OBW 99%_8DPSK_3M_DH5_2402MHz



IC OBW 99%_8DPSK_3M_DH5_2441MHz



IC OBW 99%_8DPSK_3M_DH5_2480MHz



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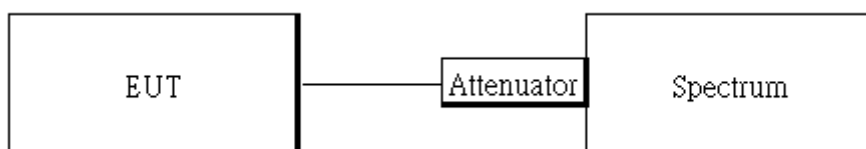
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10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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, 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.

10.2 Test Setup



10.3 Measurement Procedure

10.3.1 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.

10.3.2 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.

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10.4 Measurement Result

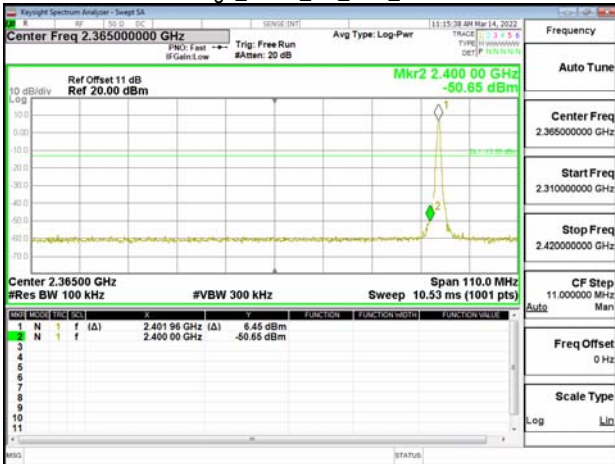
See next page for test plots.

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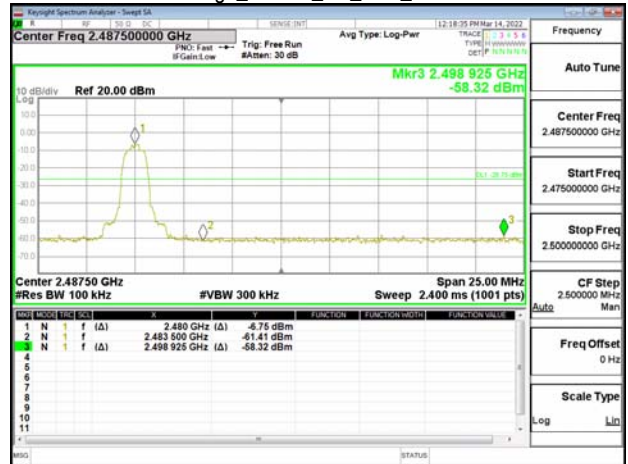
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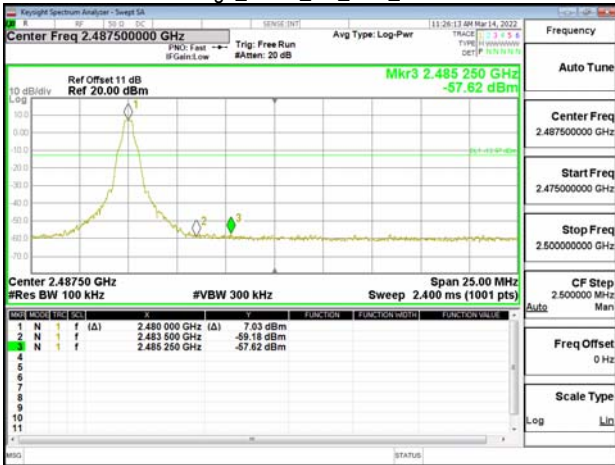
Band Edge_GFSK_1M_DH5_2402MHz



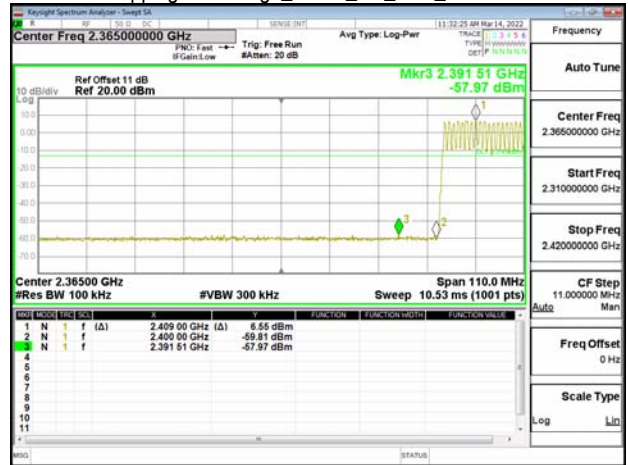
Band Edge_8DPSK_3M_DH5_2480MHz



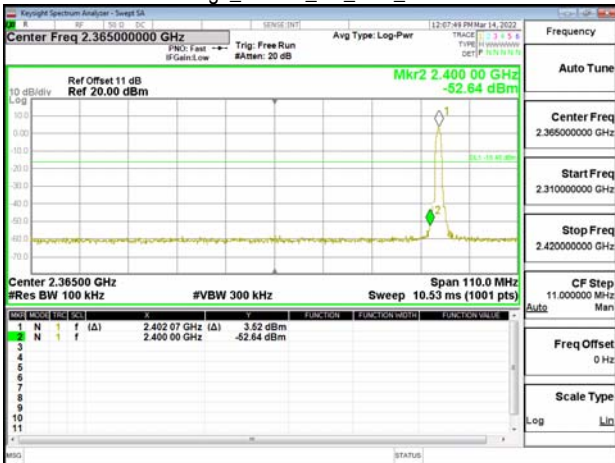
Band Edge_GFSK_1M_DH5_2480MHz



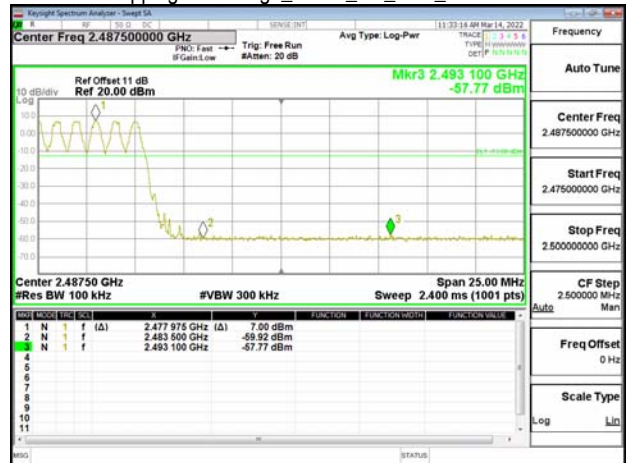
Hopping Band Edge_GFSK_1M_DH5_2402MHz



Band Edge_8DPSK_3M_DH5_2402MHz



Hopping Band Edge_GFSK_1M_DH5_2480MHz



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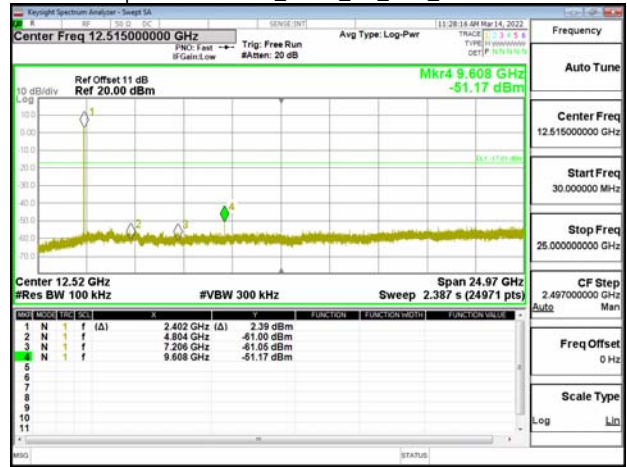
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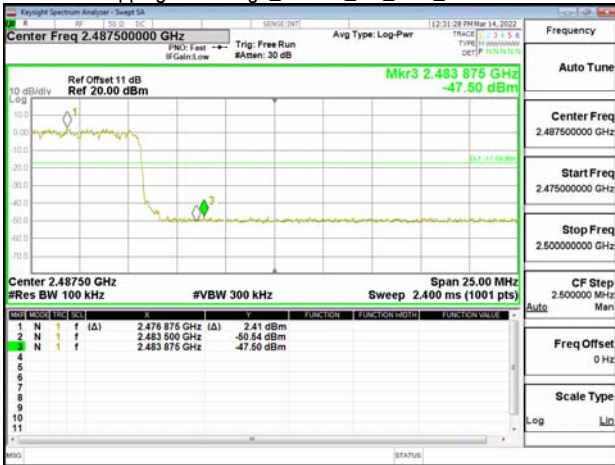
Hopping Band Edge_8DPSK_3M_DH5_2402MHz



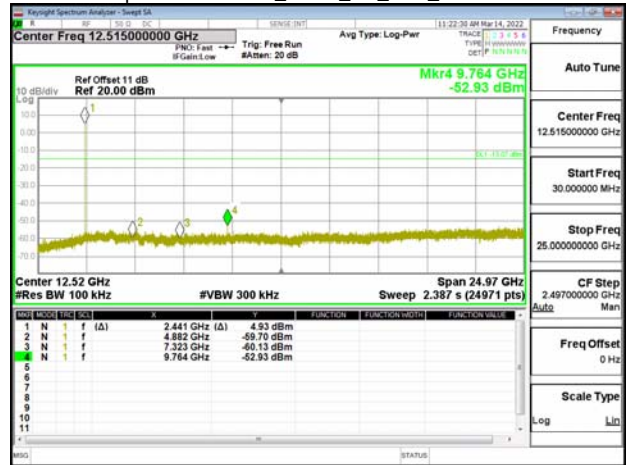
Spurious Emission_GFSK_1M_DH5_2402MHz



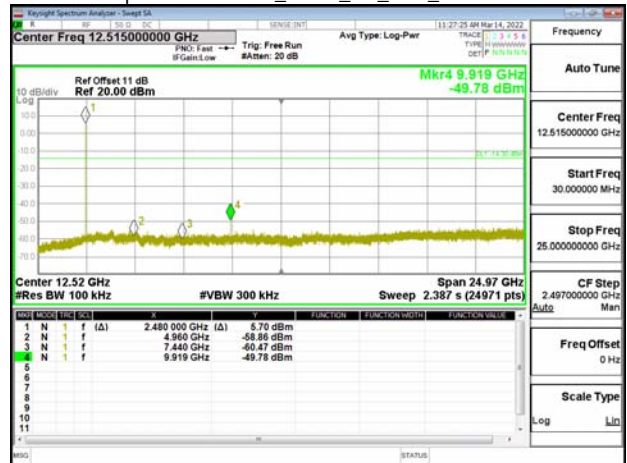
Hopping Band Edge_8DPSK_3M_DH5_2480MHz



Spurious Emission_GFSK_1M_DH5_2441MHz



Spurious Emission_GFSK_1M_DH5_2480MHz

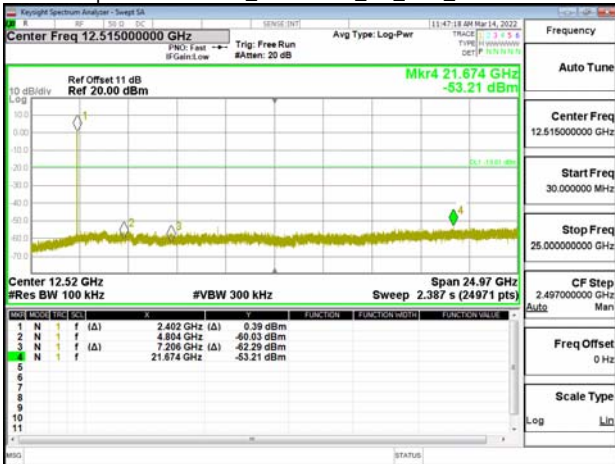


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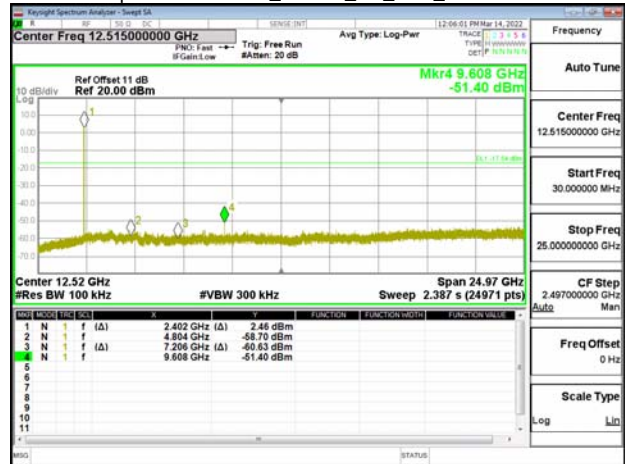
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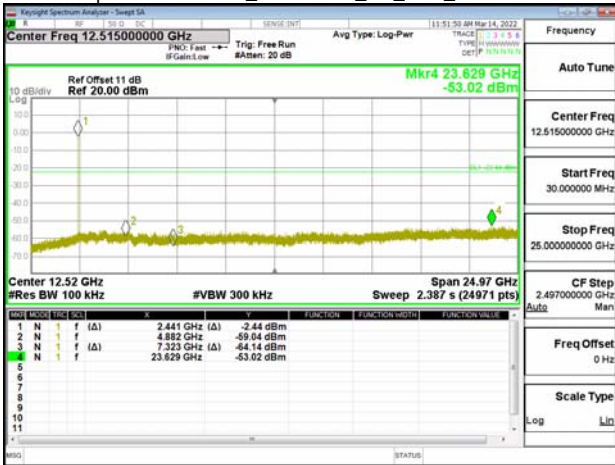
Spurious Emission_π/4DQPSK_2M_DH5_2402MHz



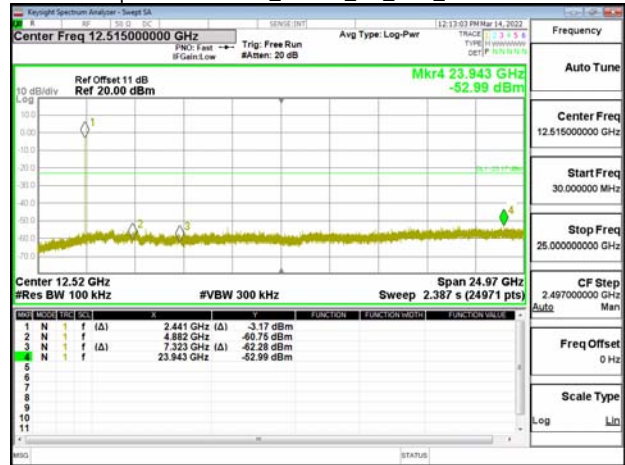
Spurious Emission_8DPSK_3M_DH5_2402MHz



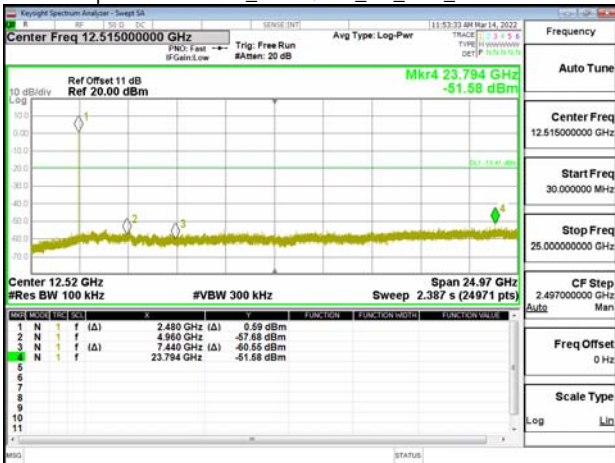
Spurious Emission_π/4DQPSK_2M_DH5_2441MHz



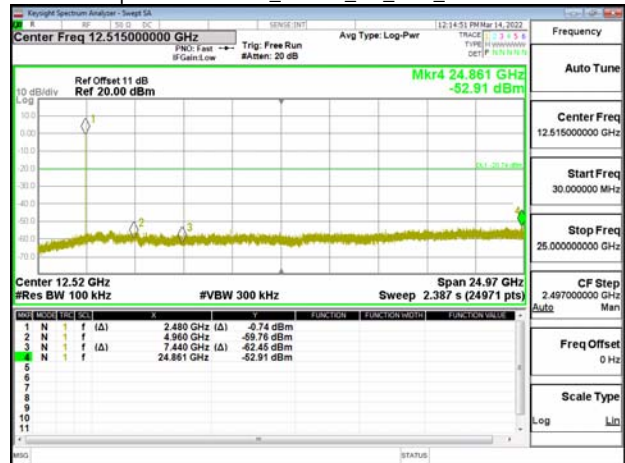
Spurious Emission_8DPSK_3M_DH5_2441MHz



Spurious Emission_π/4DQPSK_2M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2480MHz



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11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

11.1 Standard Applicable

11.1.1 Duty Cycle Correction Factor

According to 15. 35(c) and RSS-Gen §8.2, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification.

11.1.2 Spurious Emission

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.

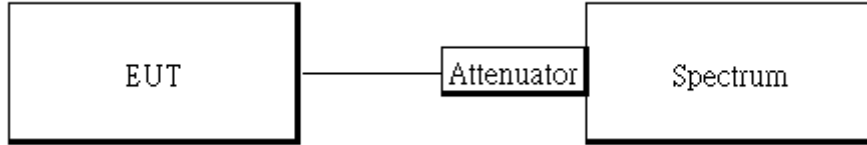
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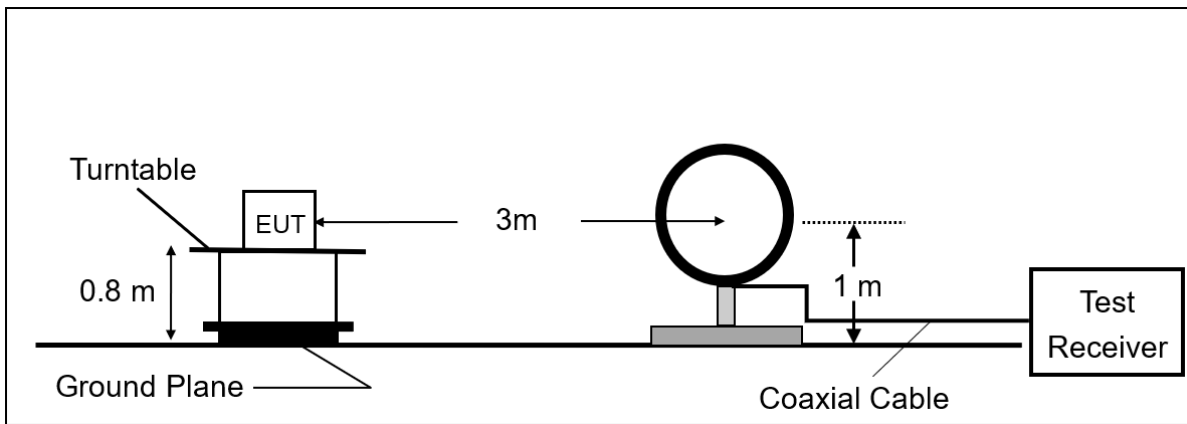
11.2 Test Setup

11.2.1 Duty Cycle Correction Factor

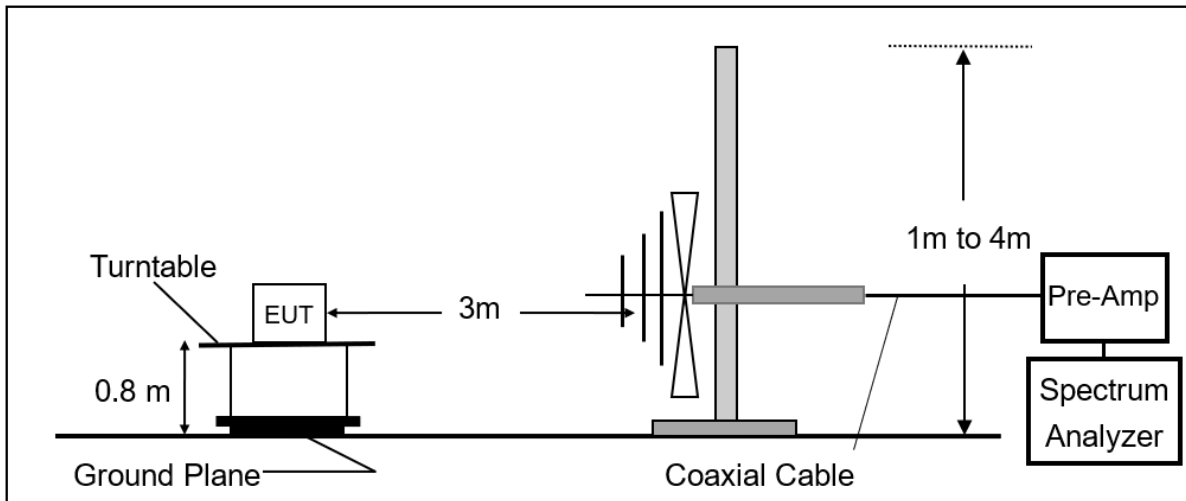


11.2.2 Radiated Emission

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



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

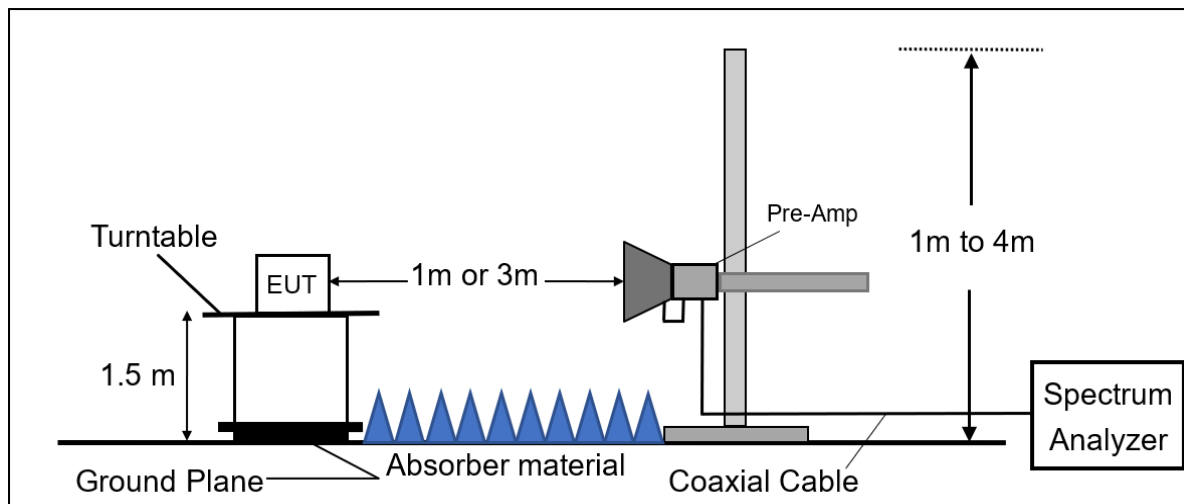


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(C) Radiated Emission Test Set-Up, Frequency Above 1 GHz.



11.3 Measurement Procedure

11.3.1 Duty Cycle Correction Factor

1. Adjust and configure any EUT switches, controls, or input data streams to ensure that the EUT is transmitting or encoded to obtain the “worst-case” pulse ON time.
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, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep = 2~8ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

11.3.2 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.

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7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. According to C63.10:2013 Section 7.5 Procedure for determining the average value of pulsed emissions with duty cycle correction factor $20 \log (T_{on}/100ms)$.
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.
12. Repeat above procedures until all default test channel measured were complete.

11.4 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)

Average value(dBμV/m)=Peak Actual FS(dBμV/m)+ Duty Cycle Correction Factor(dB)

Duty Cycle Correction Factor(dB) = $20 \log (T_{on}/100 \text{ ms})$

11.5 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.

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11.6 Measurement Result:

11.6.1 Duty Cycle Correction Factor

BR			
Time ON of 100ms:	72.800	ms	
Duty Cycle=72.8ms / 100ms=	0.728	%	
Duty Cycle correction factor=20 LOG 0.728=		-2.76	dB

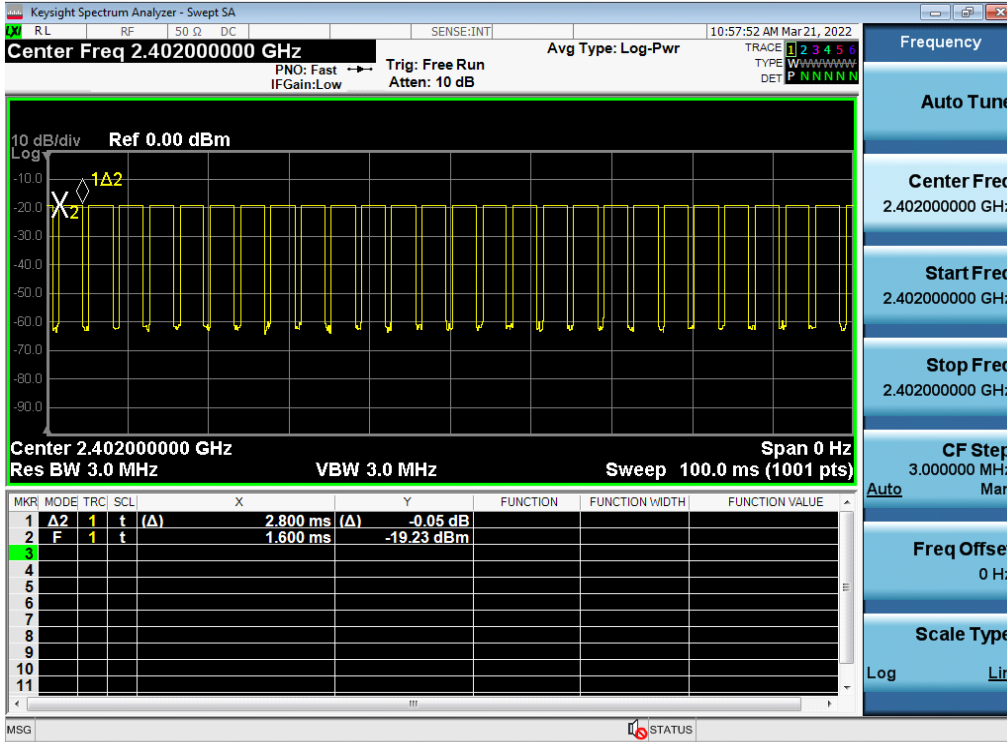
EDR			
Time ON of 100ms:	75.296	ms	
Duty Cycle=75.296ms / 100ms=	0.75296	%	
Duty Cycle correction factor=20 LOG 0.75296=		-2.46	dB

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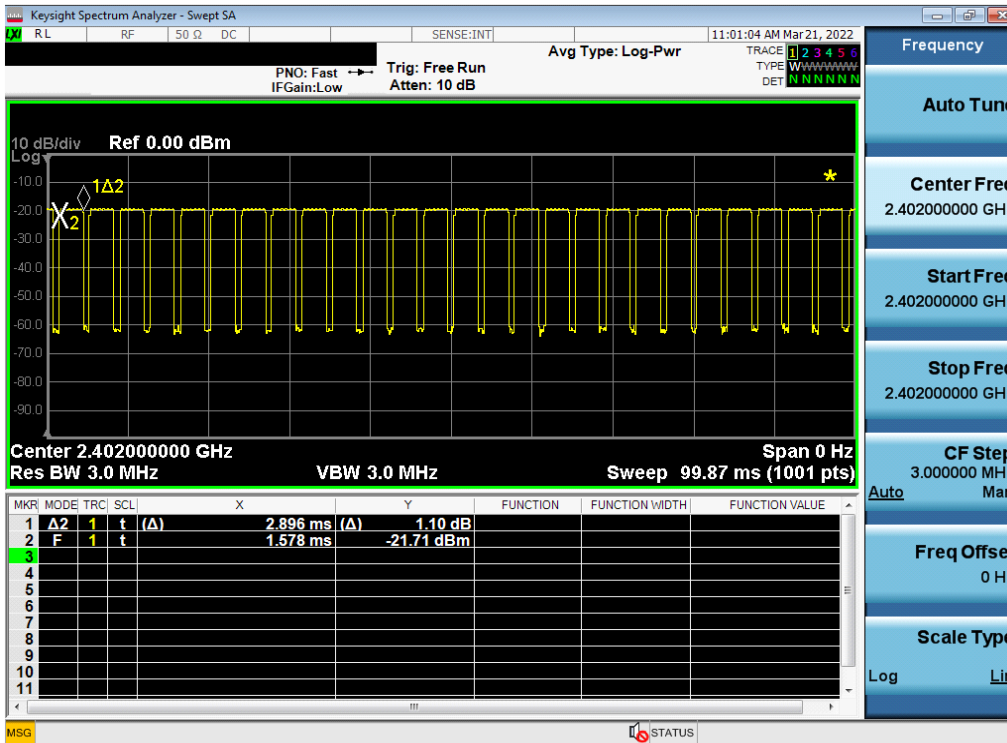
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11.6.2 Duty Cycle test plot

BR



EDR



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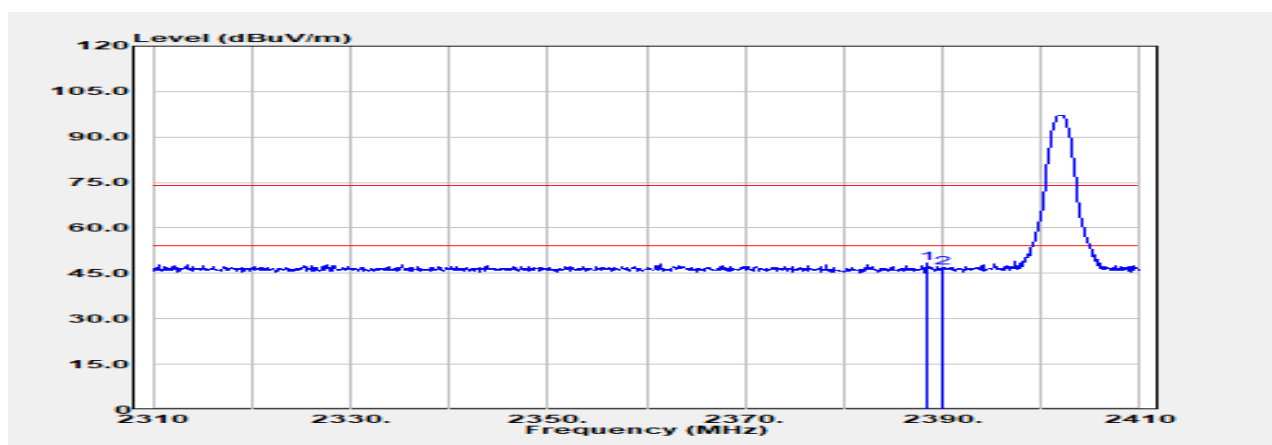
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11.6.3 Bandedge Result

Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2388.500	Peak	54.07	-5.69	48.39	74.00	-25.61
2390.000	Peak	52.51	-5.69	46.82	74.00	-27.18
Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2388.500	Average	48.39	-2.76	45.63	54.00	-8.37
2390.000	Average	46.82	-2.76	44.06	54.00	-9.94

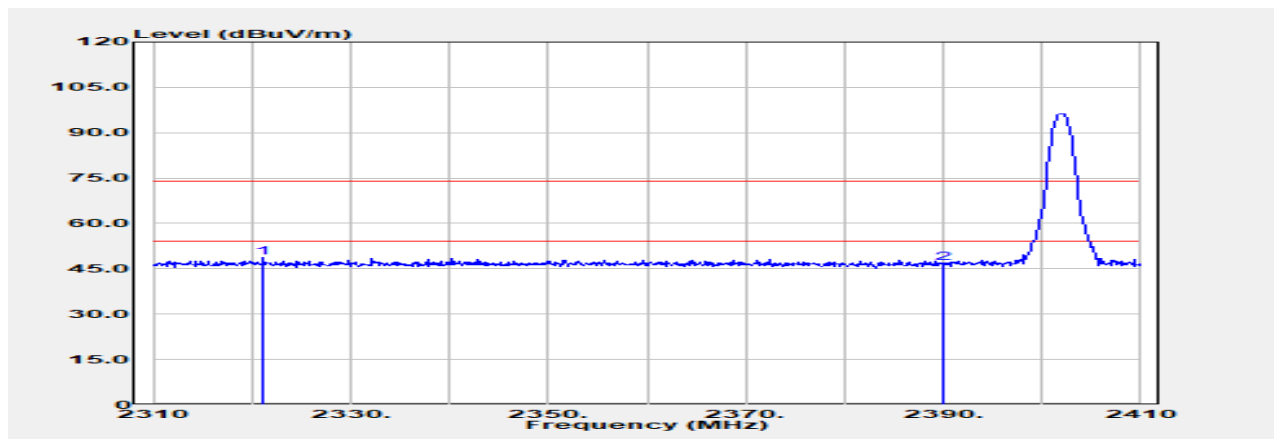
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2321.200	Peak	54.31	-5.58	48.72	74.00	-25.28
2390.000	Peak	52.65	-5.69	46.95	74.00	-27.05

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2321.200	Average	48.72	-2.76	45.96	54.00	-8.04
2390.000	Average	46.95	-2.76	44.19	54.00	-9.81

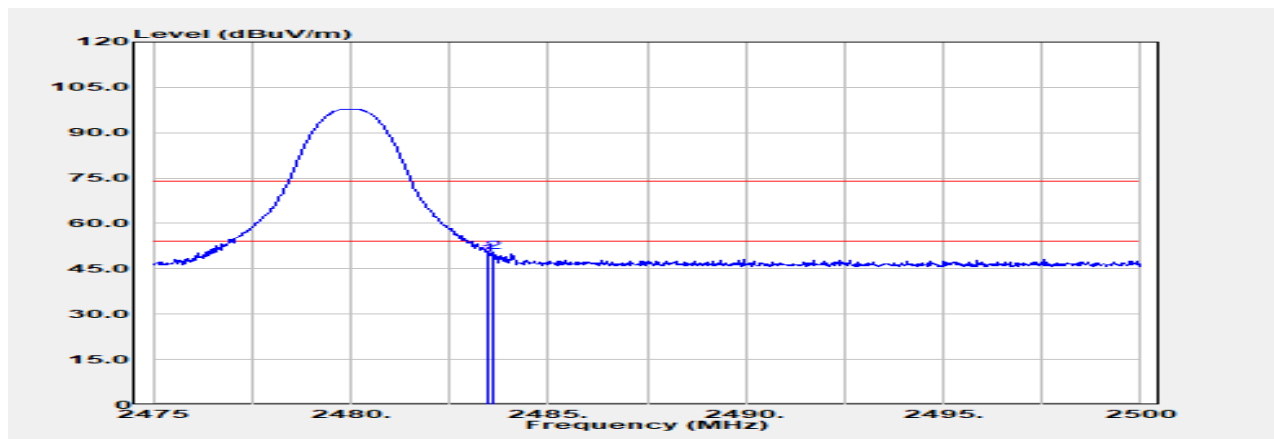
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	55.63	-5.94	49.69	74.00	-24.31
2483.600	Peak	56.50	-5.94	50.56	74.00	-23.44

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	49.69	-2.76	46.93	54.00	-7.07
2483.600	Average	50.56	-2.76	47.80	54.00	-6.20

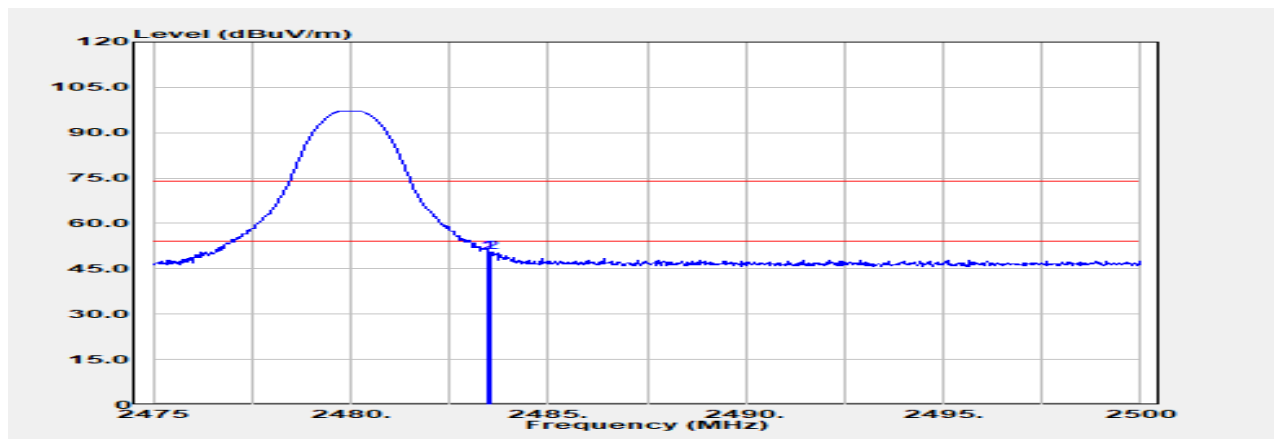
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	56.48	-5.94	50.54	74.00	-23.46
2483.525	Peak	56.55	-5.94	50.61	74.00	-23.39

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	50.54	-2.76	47.78	54.00	-6.22
2483.525	Average	50.61	-2.76	47.85	54.00	-6.15

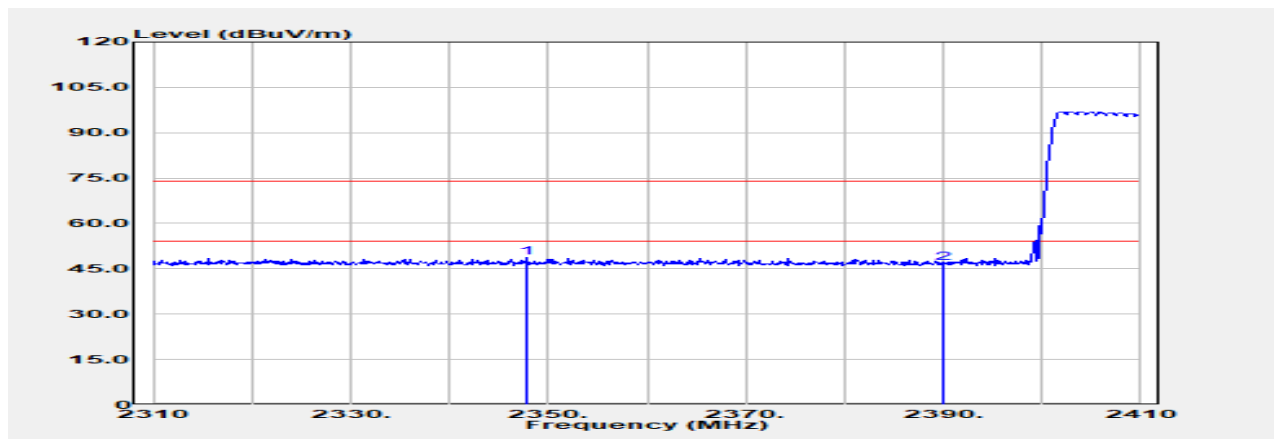
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Report Number :E2/2022/20120
 Operation Mode :BT BR HOPPING
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2347.900	Peak	54.15	-5.54	48.61	74.00	-25.39
2390.000	Peak	52.73	-5.69	47.04	74.00	-26.96

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2347.900	Average	48.61	-2.76	45.85	54.00	-8.15
2390.000	Average	47.04	-2.76	44.28	54.00	-9.72

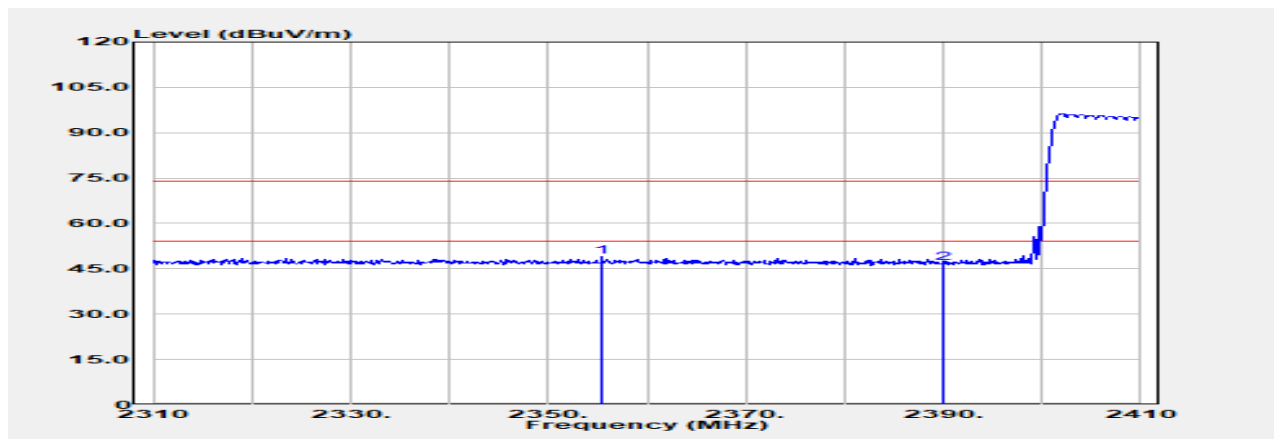
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 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2355.400	Peak	54.45	-5.56	48.90	74.00	-25.10
2390.000	Peak	52.58	-5.69	46.88	74.00	-27.12

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2355.400	Average	48.90	-2.76	46.14	54.00	-7.86
2390.000	Average	46.88	-2.76	44.12	54.00	-9.88

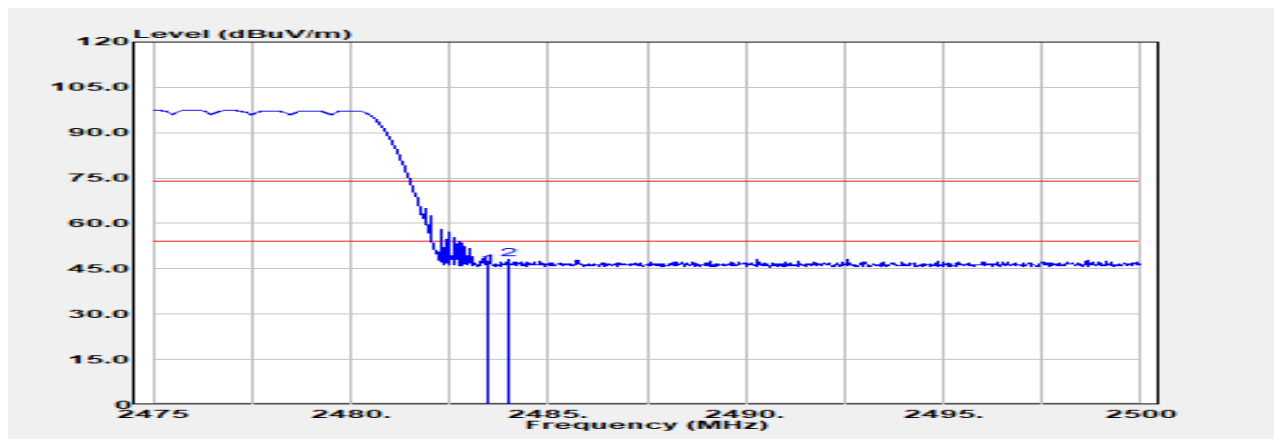
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Report Number :E2/2022/20120
 Operation Mode :BT BR HOPPING
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	51.87	-5.94	45.93	74.00	-28.07
2483.975	Peak	54.02	-5.94	48.08	74.00	-25.92

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	45.93	-2.76	43.17	54.00	-10.83
2483.975	Average	48.08	-2.76	45.32	54.00	-8.68

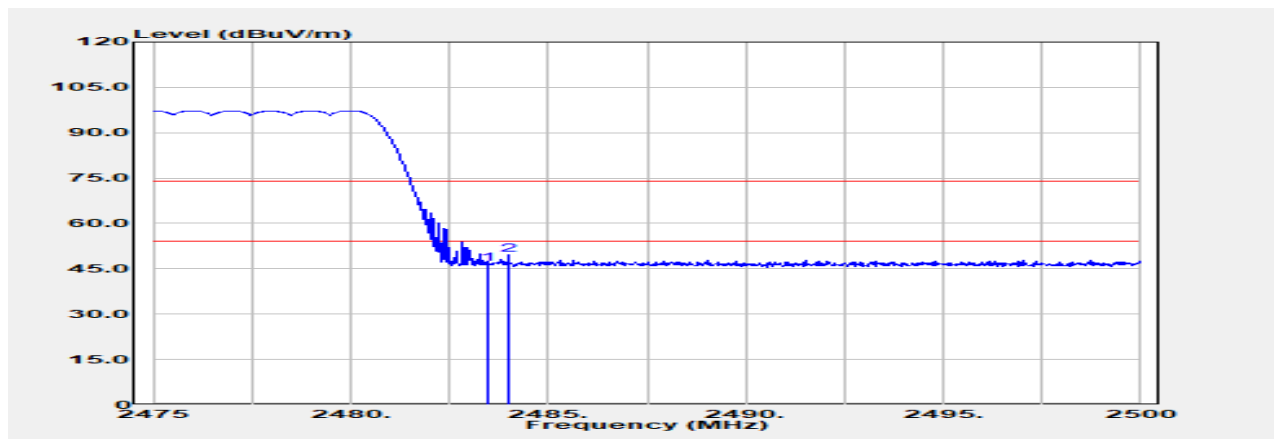
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Report Number :E2/2022/20120
 Operation Mode :BT BR HOPPING
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	52.47	-5.94	46.53	74.00	-27.47
2484.000	Peak	55.64	-5.94	49.70	74.00	-24.30

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	46.53	-2.76	43.77	54.00	-10.23
2484.000	Average	49.70	-2.76	46.94	54.00	-7.06

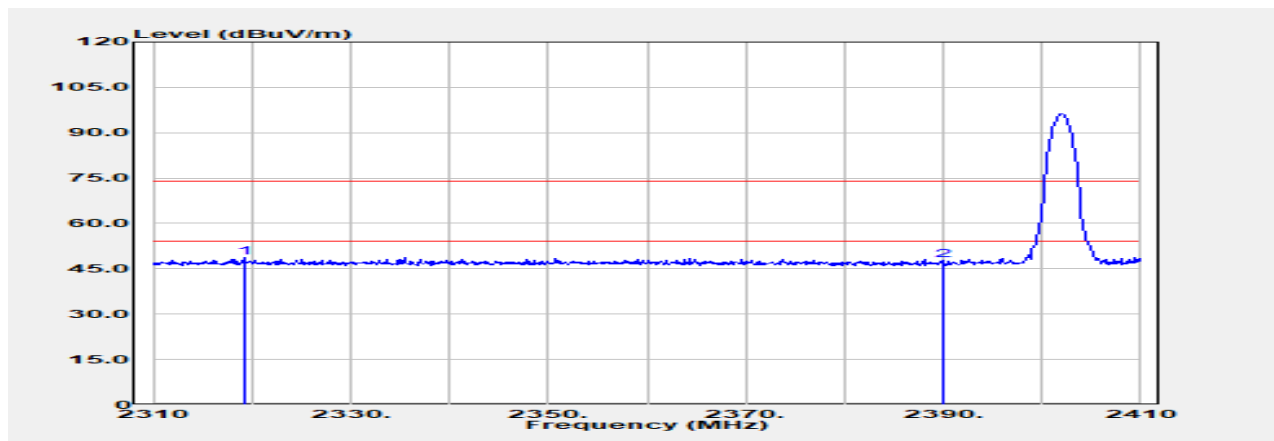
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2319.200	Peak	54.24	-5.59	48.66	74.00	-25.34
2390.000	Peak	53.51	-5.69	47.82	74.00	-26.18

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2319.200	Average	48.66	-2.46	46.20	54.00	-7.80
2390.000	Average	47.82	-2.46	45.36	54.00	-8.64

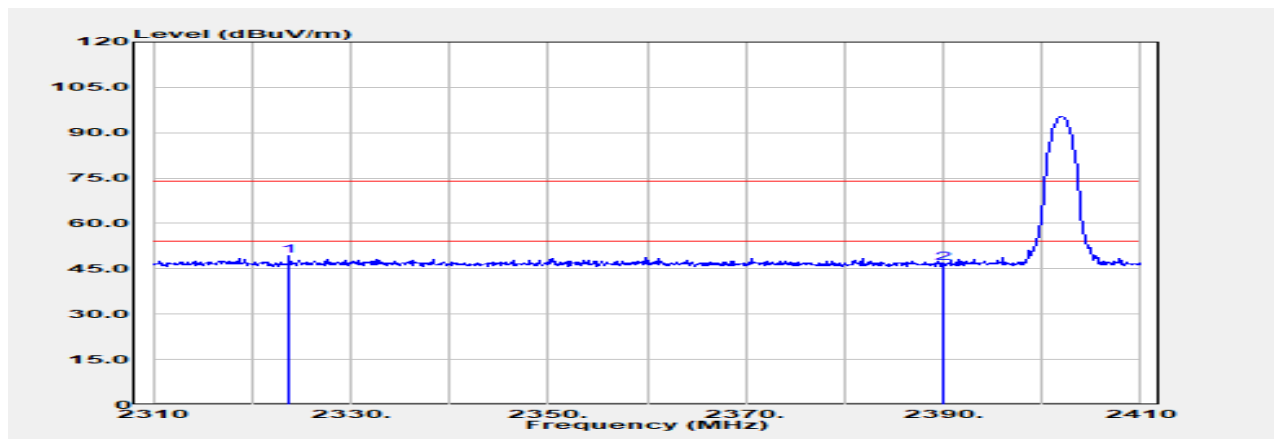
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2323.800	Peak	55.05	-5.58	49.47	74.00	-24.53
2390.000	Peak	52.54	-5.69	46.84	74.00	-27.16

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2323.800	Average	49.47	-2.46	47.01	54.00	-6.99
2390.000	Average	46.84	-2.46	44.38	54.00	-9.62

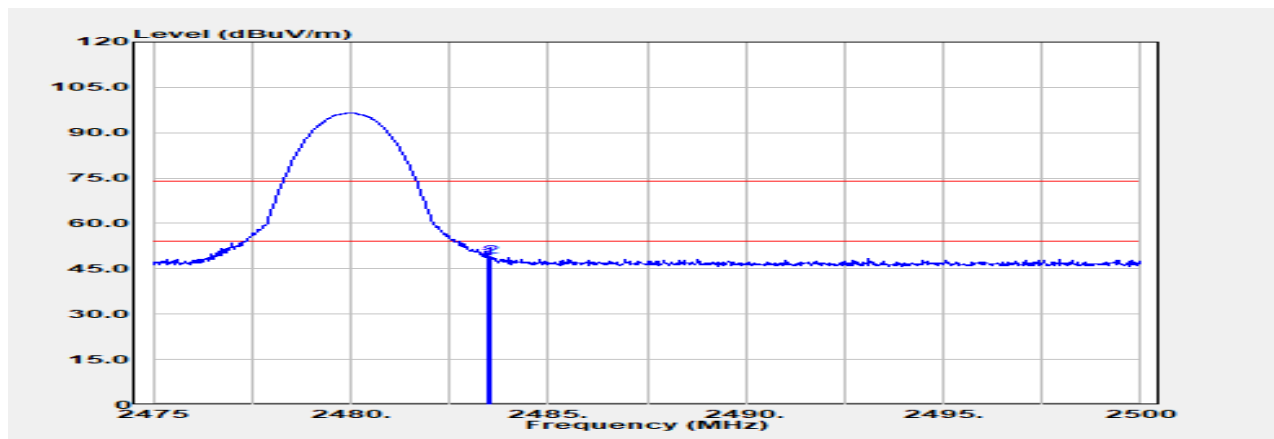
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	54.47	-5.94	48.53	74.00	-25.47
2483.525	Peak	55.09	-5.94	49.15	74.00	-24.85

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	48.53	-2.46	46.07	54.00	-7.93
2483.525	Average	49.15	-2.46	46.69	54.00	-7.31

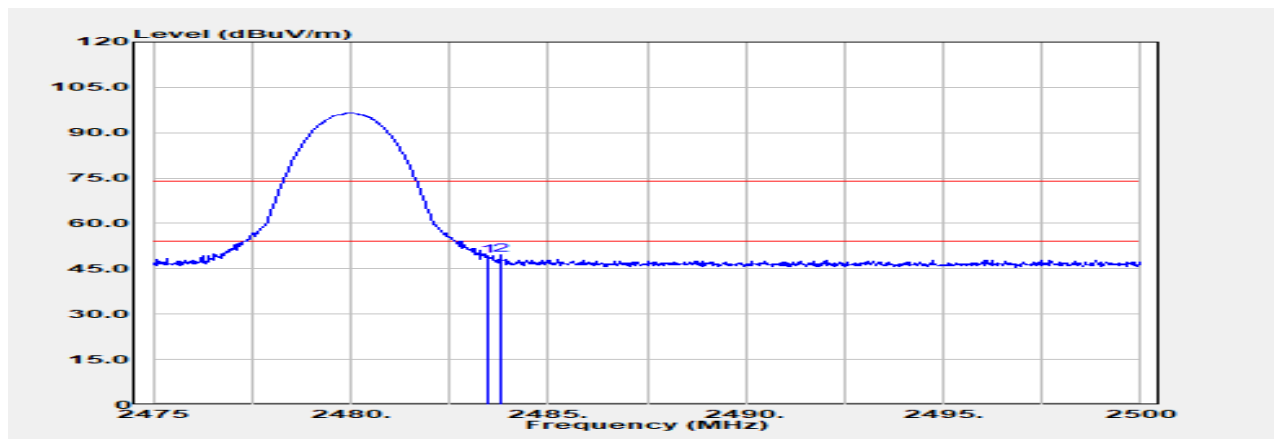
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	55.38	-5.94	49.44	74.00	-24.56
2483.800	Peak	55.53	-5.94	49.59	74.00	-24.41

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	49.44	-2.46	46.98	54.00	-7.02
2483.800	Average	49.59	-2.46	47.13	54.00	-6.87

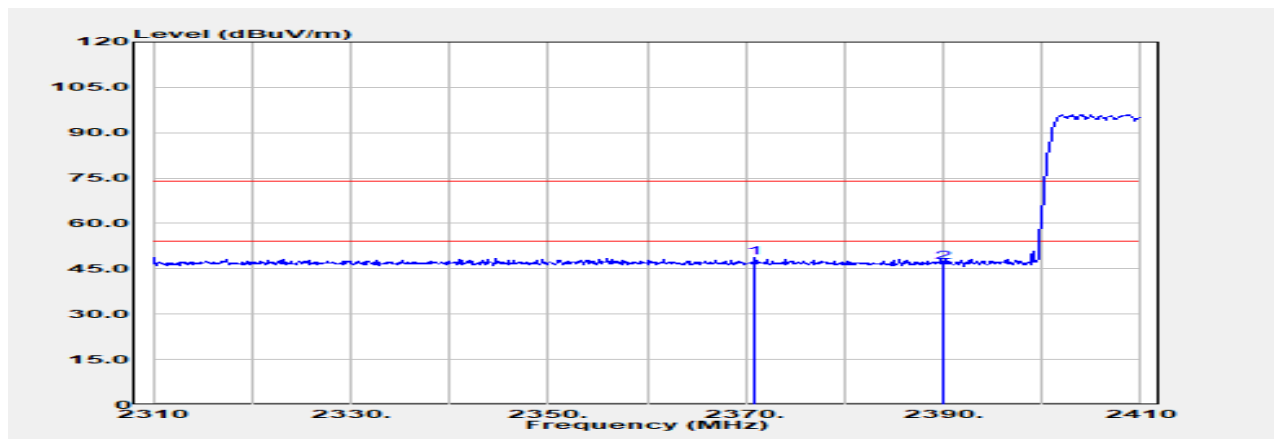
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M HOPPING
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2371.000	Peak	54.39	-5.62	48.77	74.00	-25.23
2390.000	Peak	52.76	-5.69	47.07	74.00	-26.93

Freq. MHz	Detector Mode AV	Peak Actual FS (dBμV/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2371.000	Average	48.77	-2.46	46.31	54.00	-7.69
2390.000	Average	47.07	-2.46	44.61	54.00	-9.39

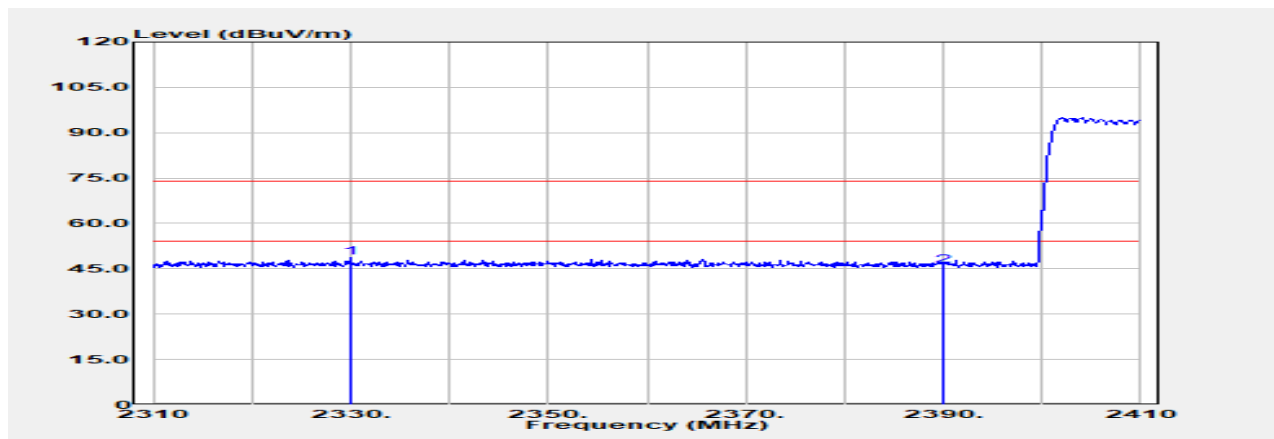
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M HOPPING
 Test Frequency :2402 MHz
 Test Mode :BE CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2329.900	Peak	54.40	-5.57	48.83	74.00	-25.17
2390.000	Peak	51.70	-5.69	46.00	74.00	-28.00

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2329.900	Average	48.83	-2.46	46.37	54.00	-7.63
2390.000	Average	46.00	-2.46	43.54	54.00	-10.46

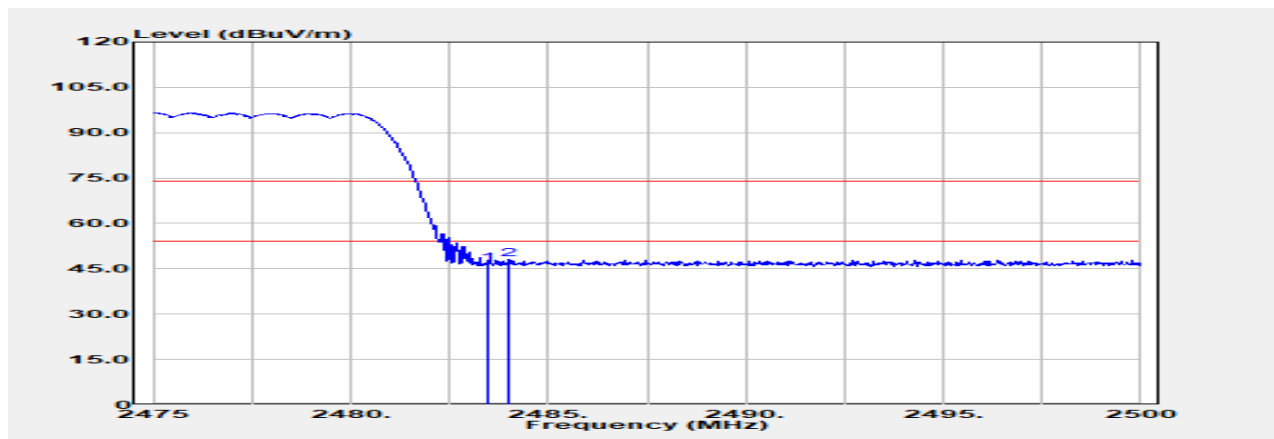
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M HOPPING
 Test Frequency :2480 MHz
 Test Mode :BE CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	52.65	-5.94	46.71	74.00	-27.29
2484.000	Peak	53.95	-5.94	48.00	74.00	-26.00

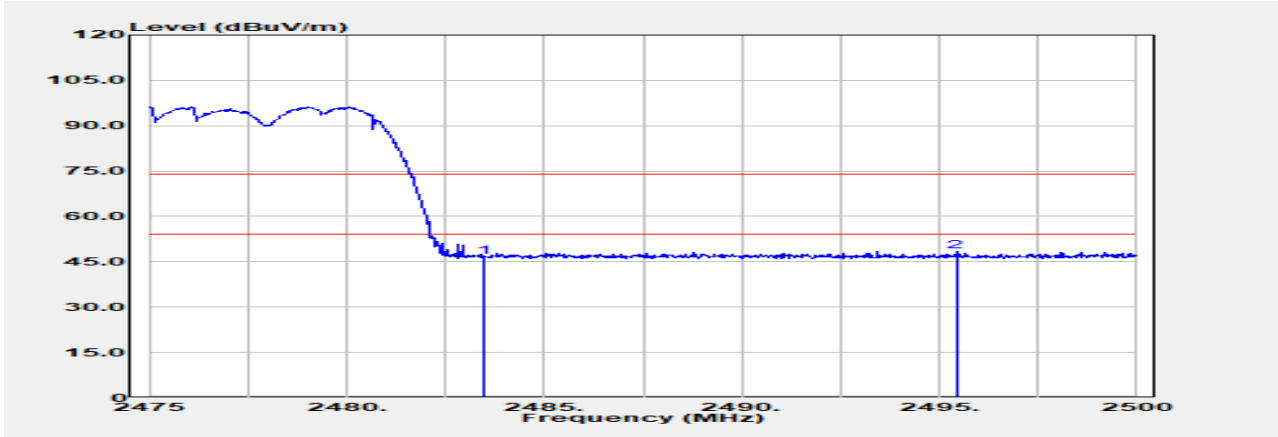
Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	46.71	-2.46	44.25	54.00	-9.75
2484.000	Average	48.00	-2.46	45.54	54.00	-8.46

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Report Number	:E2/2022/20120	Test Site	:SAC D
Operation Mode	:BT EDR 3M HOPPING	Test Date	:2022-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:22.3/63
Test Mode	:BE CH HIGH	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
2483.500	Peak	52.67	-5.94	46.73	74.00	-27.27
2495.425	Peak	54.52	-5.97	48.55	74.00	-25.45

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
2483.500	Average	46.73	-2.46	44.27	54.00	-9.73
2495.425	Average	48.55	-2.46	46.09	54.00	-7.91

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11.6.4 Radiated Spurious Emission

Report Number :E2/2022/20120

Test Site :SAC D

Operation Mode :BT BR

Test Date :2022-03-19

Test Frequency :2441 MHz

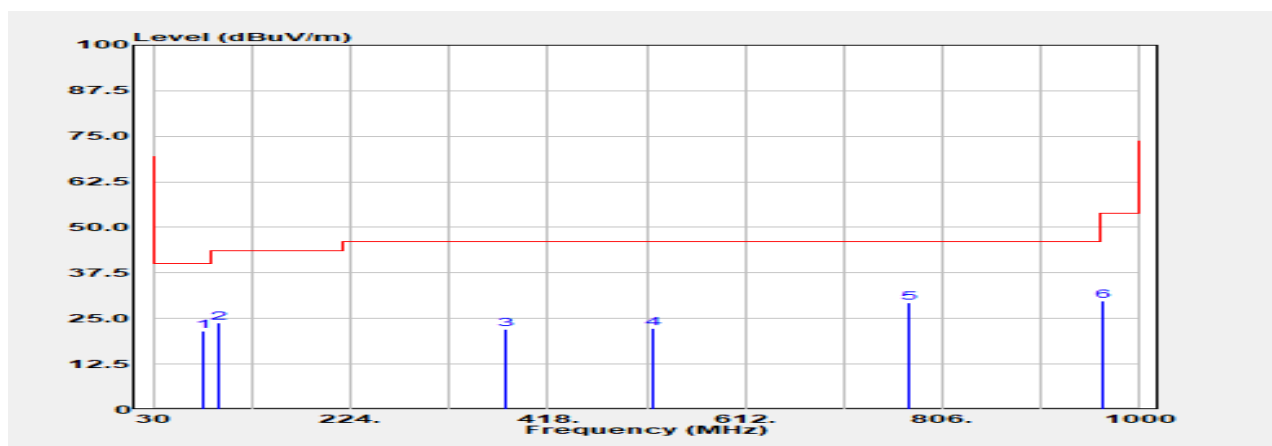
Temp./Humi. :22.3/63

Test Mode :TX CH MID

Antenna Pol. :Vertical

EUT Pol :E2 Plane

Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
79.470	Peak	43.37	-21.85	21.51	40.00	-18.49
94.020	Peak	46.29	-22.38	23.91	43.50	-19.59
377.260	Peak	35.83	-13.79	22.04	46.00	-23.96
520.820	Peak	33.10	-10.84	22.26	46.00	-23.74
773.990	Peak	35.91	-6.61	29.29	46.00	-16.71
963.140	Peak	34.14	-4.27	29.87	54.00	-24.13

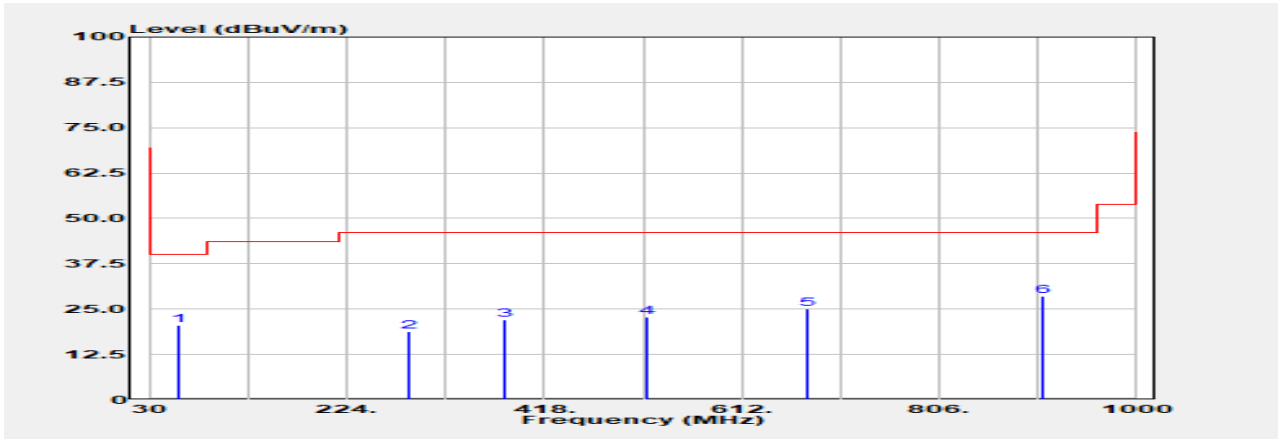
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
60.070	Peak	38.38	-17.87	20.51	40.00	-19.49
285.110	Peak	35.04	-16.34	18.71	46.00	-27.29
378.230	Peak	35.96	-13.80	22.16	46.00	-23.84
518.880	Peak	33.75	-11.01	22.74	46.00	-23.26
676.990	Peak	33.18	-8.08	25.10	46.00	-20.90
906.880	Peak	33.86	-5.42	28.45	46.00	-17.55

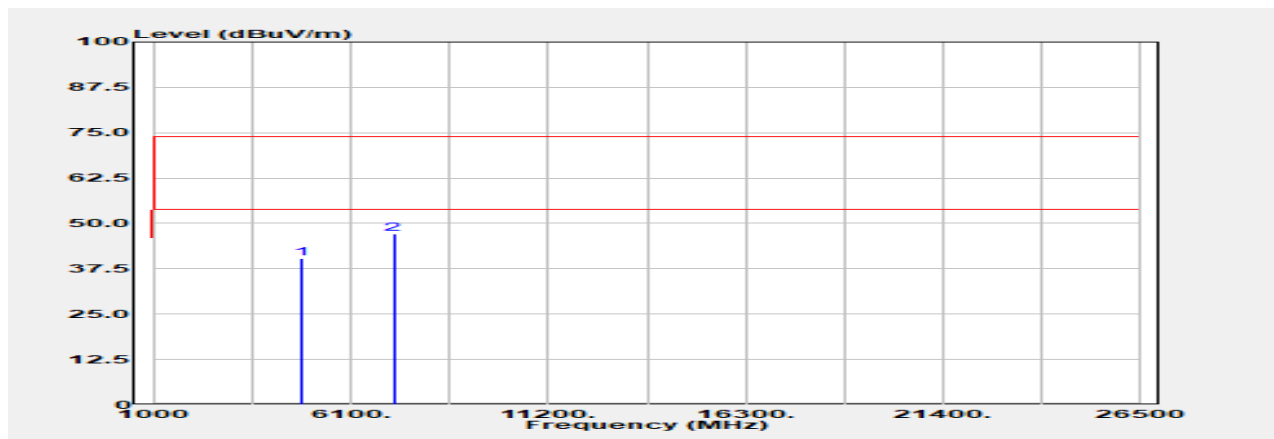
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4804.000	Peak	40.52	-0.29	40.23	74.00	-33.77
7206.000	Peak	40.54	6.56	47.10	74.00	-26.90

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4804.000	Average	40.23	-2.76	37.47	54.00	-16.53
7206.000	Average	47.10	-2.76	44.34	54.00	-9.66

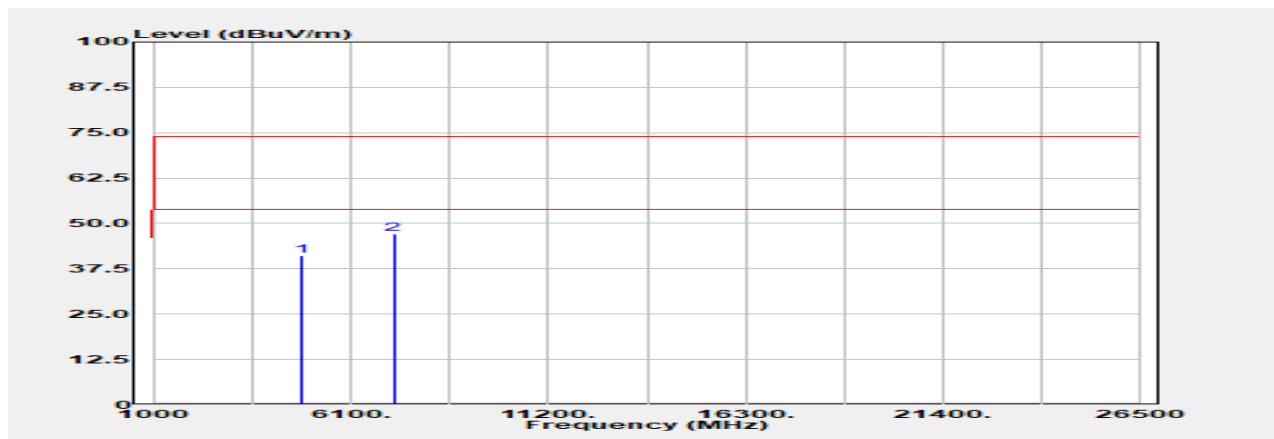
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4804.000	Peak	41.42	-0.29	41.13	74.00	-32.87
7206.000	Peak	40.59	6.56	47.15	74.00	-26.85

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4804.000	Average	41.13	-2.76	38.37	54.00	-15.63
7206.000	Average	47.15	-2.76	44.39	54.00	-9.61

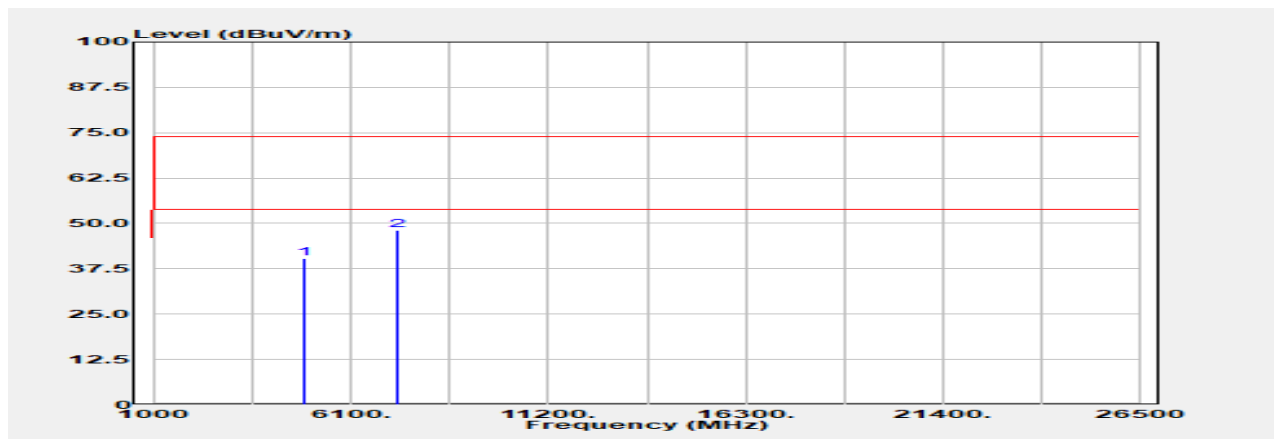
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4882.000	Peak	40.86	-0.40	40.46	74.00	-33.54
7323.000	Peak	41.25	6.94	48.19	74.00	-25.81

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4882.000	Average	40.46	-2.76	37.70	54.00	-16.30
7323.000	Average	48.19	-2.76	45.43	54.00	-8.57

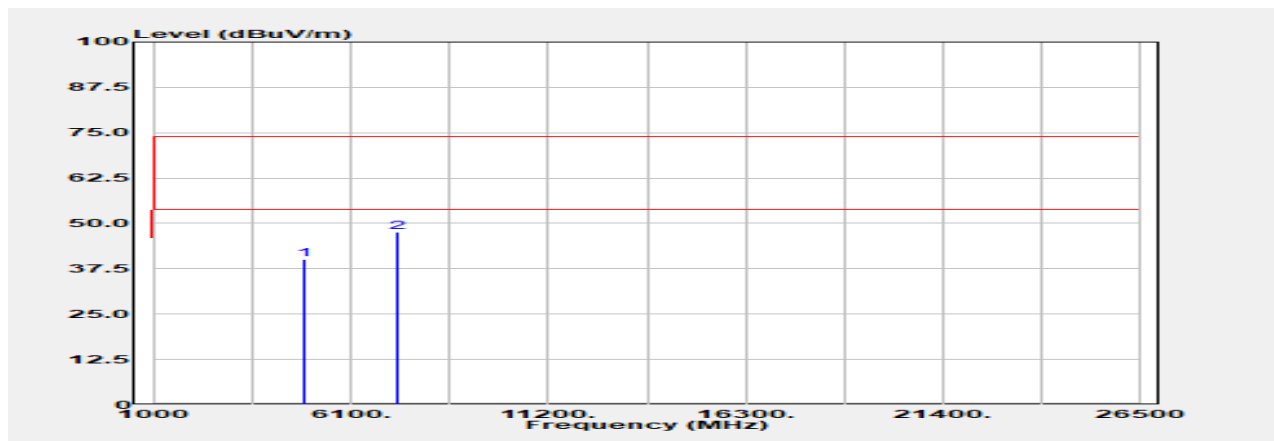
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4882.000	Peak	40.54	-0.40	40.14	74.00	-33.86
7323.000	Peak	40.57	6.94	47.51	74.00	-26.49

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4882.000	Average	40.14	-2.76	37.38	54.00	-16.62
7323.000	Average	47.51	-2.76	44.75	54.00	-9.25

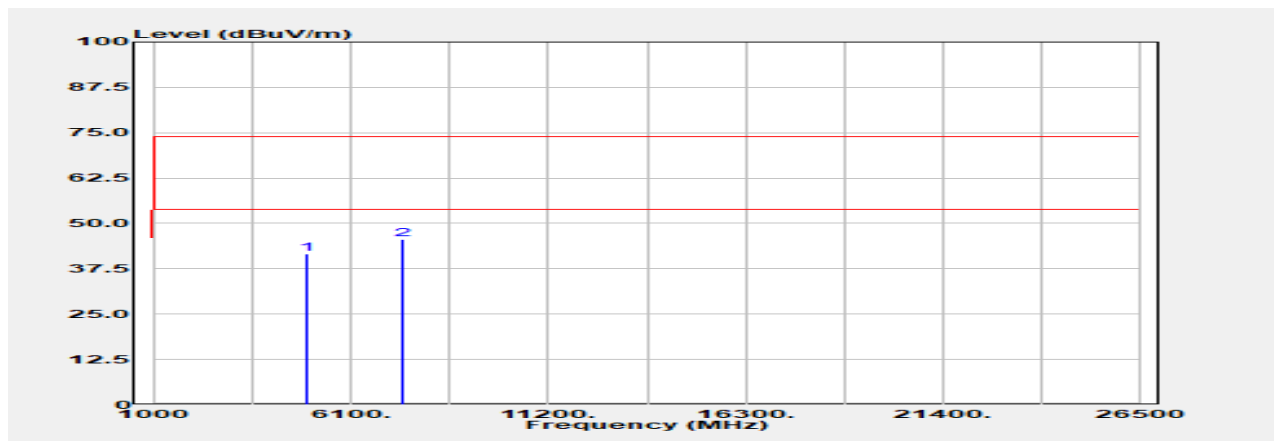
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4960.000	Peak	41.14	0.50	41.64	74.00	-32.36
7440.000	Peak	38.90	6.71	45.61	74.00	-28.39

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4960.000	Average	41.64	-2.76	38.88	54.00	-15.12
7440.000	Average	45.61	-2.76	42.85	54.00	-11.15

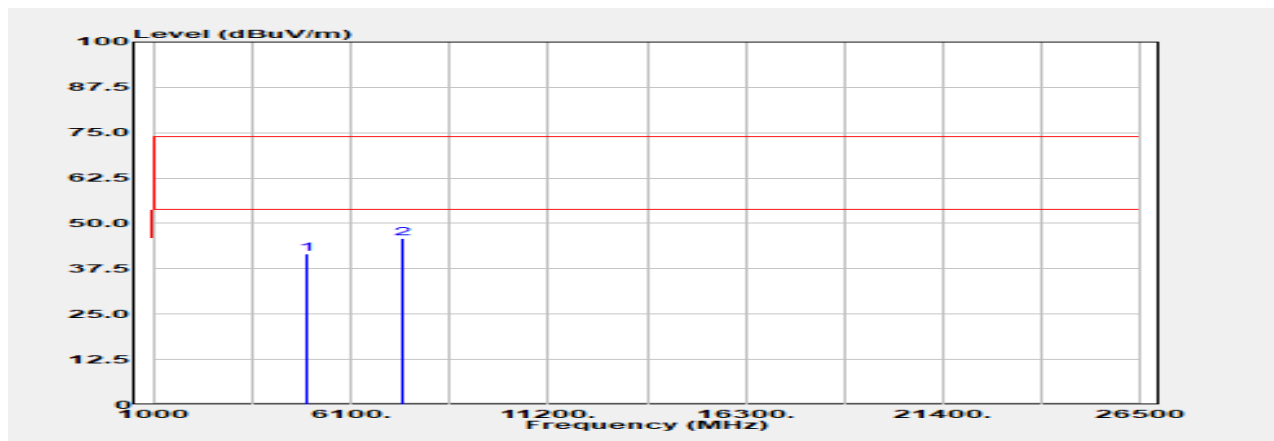
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Report Number :E2/2022/20120
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4960.000	Peak	41.17	0.50	41.67	74.00	-32.33
7440.000	Peak	39.19	6.71	45.89	74.00	-28.11

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4960.000	Average	41.67	-2.76	38.91	54.00	-15.09
7440.000	Average	45.89	-2.76	43.13	54.00	-10.87

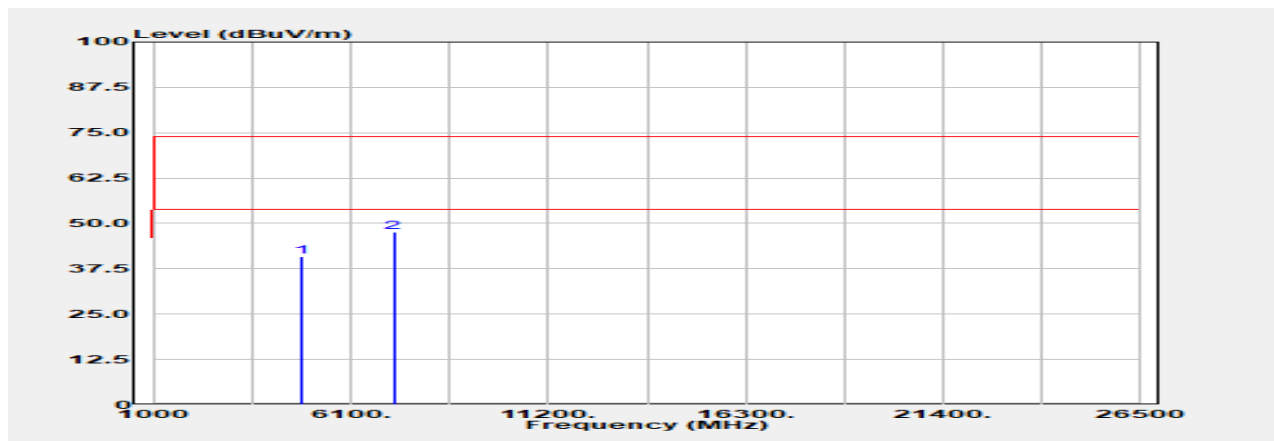
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2402 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4804.000	Peak	41.21	-0.29	40.92	74.00	-33.08
7206.000	Peak	41.14	6.56	47.70	74.00	-26.30

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4804.000	Average	40.92	-2.46	38.46	54.00	-15.54
7206.000	Average	47.70	-2.46	45.24	54.00	-8.76

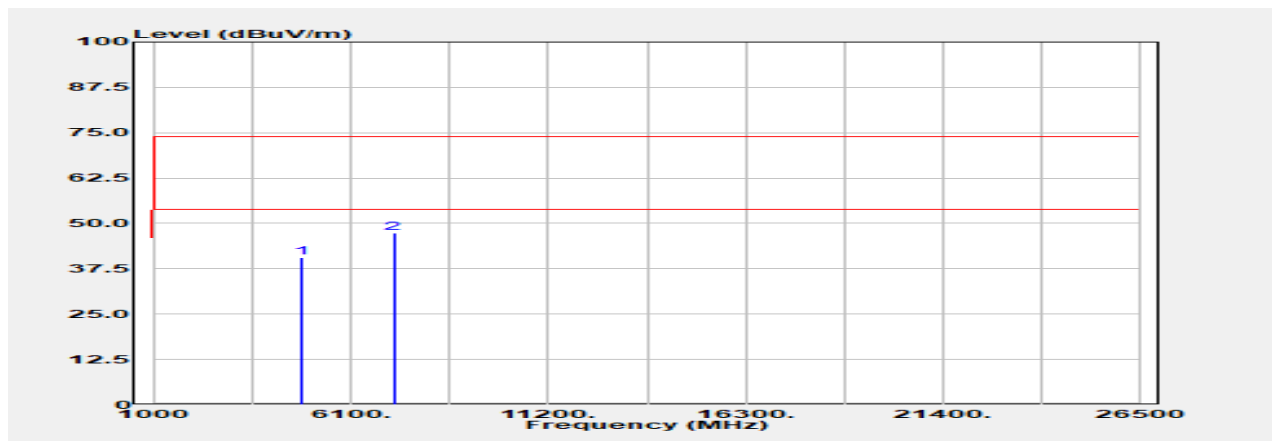
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2402 MHz
 Test Mode :TX CH LOW
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4804.000	Peak	40.82	-0.29	40.53	74.00	-33.47
7206.000	Peak	40.83	6.56	47.40	74.00	-26.60

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4804.000	Average	40.53	-2.46	38.07	54.00	-15.93
7206.000	Average	47.40	-2.46	44.94	54.00	-9.06

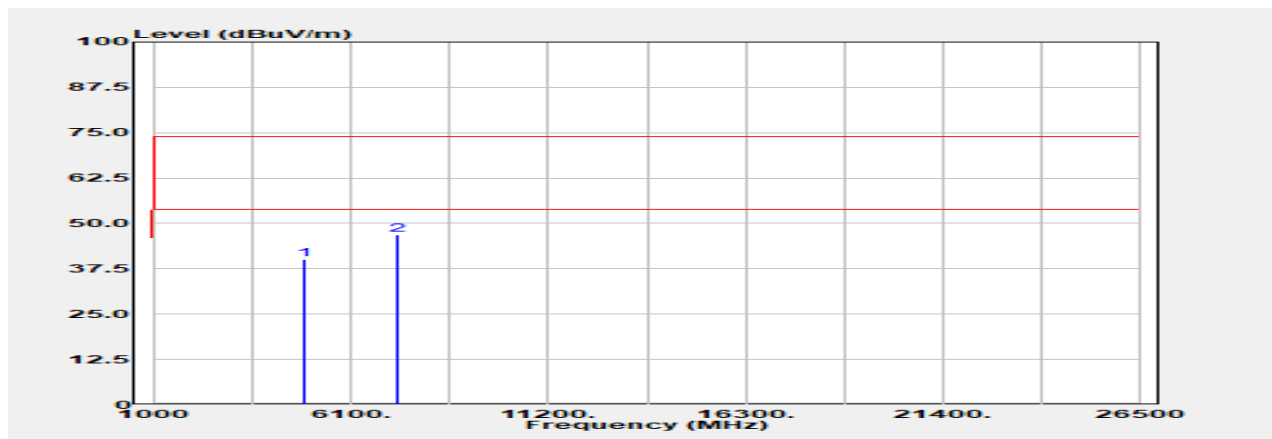
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Report Number :E2/2022/20120
Operation Mode :BT EDR 3M
Test Frequency :2441 MHz
Test Mode :TX CH MID
EUT Pol :E2 Plane

Test Site :SAC D
Test Date :2022-03-19
Temp./Humi. :22.3/63
Antenna Pol. :Vertical
Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4882.000	Peak	40.51	-0.40	40.11	74.00	-33.89
7323.000	Peak	39.99	6.94	46.92	74.00	-27.08

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4882.000	Average	40.11	-2.46	37.65	54.00	-16.35
7323.000	Average	46.92	-2.46	44.46	54.00	-9.54

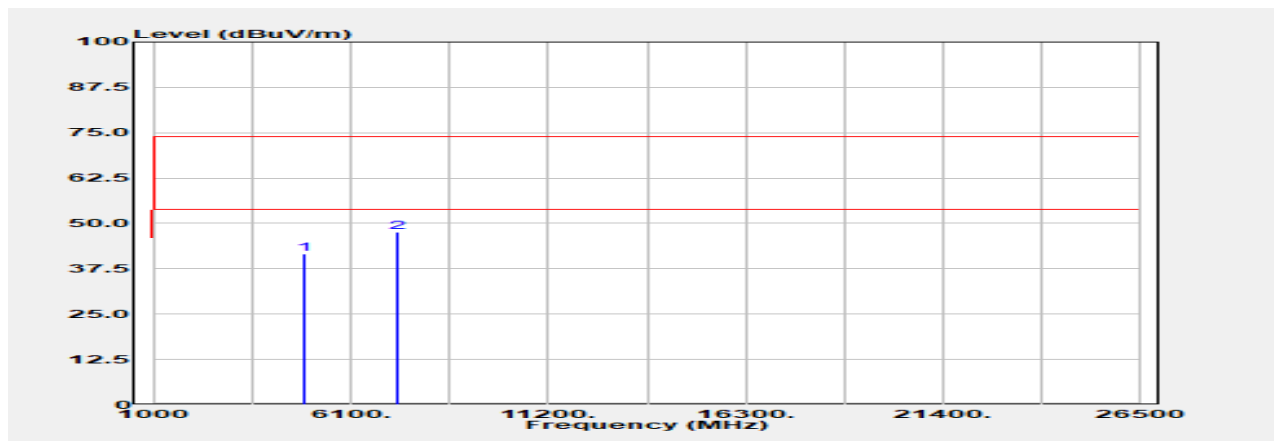
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2441 MHz
 Test Mode :TX CH MID
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4882.000	Peak	42.09	-0.40	41.69	74.00	-32.31
7323.000	Peak	40.77	6.94	47.71	74.00	-26.29

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4882.000	Average	41.69	-2.46	39.23	54.00	-14.77
7323.000	Average	47.71	-2.46	45.25	54.00	-8.75

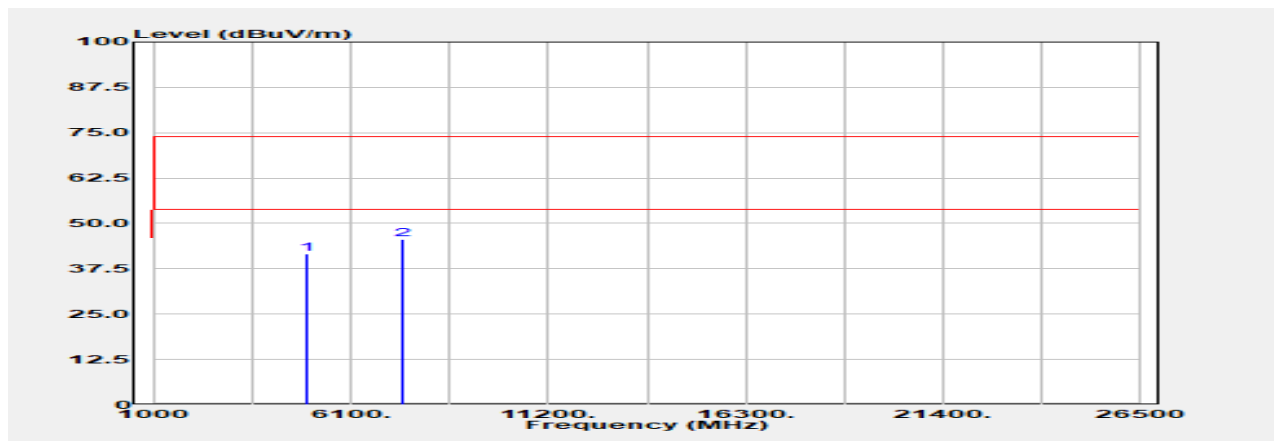
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2480 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Vertical
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4960.000	Peak	41.00	0.50	41.50	74.00	-32.50
7440.000	Peak	38.89	6.71	45.60	74.00	-28.40

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4960.000	Average	41.50	-2.46	39.04	54.00	-14.96
7440.000	Average	45.60	-2.46	43.14	54.00	-10.86

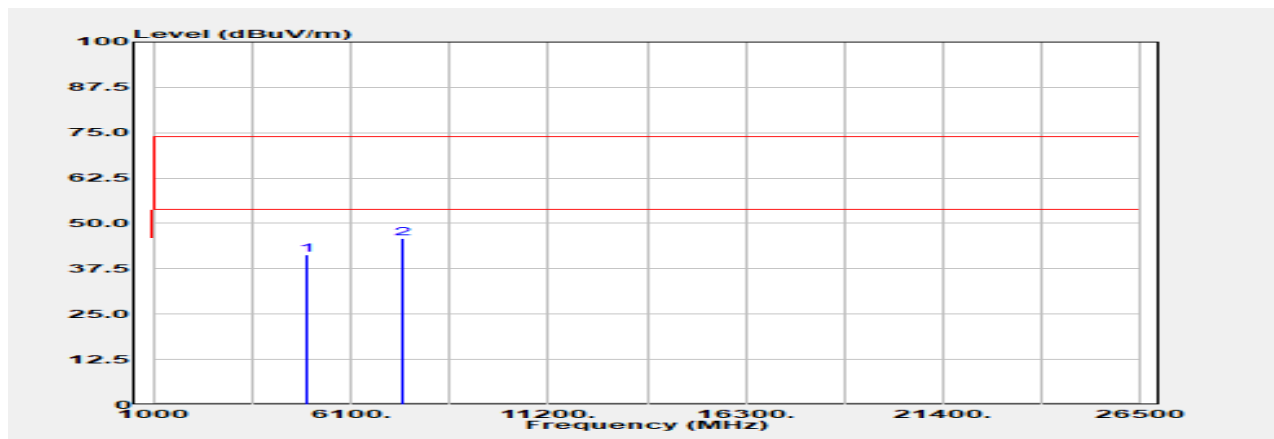
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Report Number :E2/2022/20120
 Operation Mode :BT EDR 3M
 Test Frequency :2480 MHz
 Test Mode :TX CH HIGH
 EUT Pol :E2 Plane

Test Site :SAC D
 Test Date :2022-03-19
 Temp./Humi. :22.3/63
 Antenna Pol. :Horizontal
 Engineer :Andy Wang



Freq. MHz	Detector Mode PK/QP	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
4960.000	Peak	40.90	0.50	41.39	74.00	-32.61
7440.000	Peak	39.05	6.71	45.76	74.00	-28.24

Freq. MHz	Detector Mode AV	Peak Actual FS (dB μ V/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4960.000	Average	41.39	-2.46	38.93	54.00	-15.07
7440.000	Average	45.76	-2.46	43.30	54.00	-10.70

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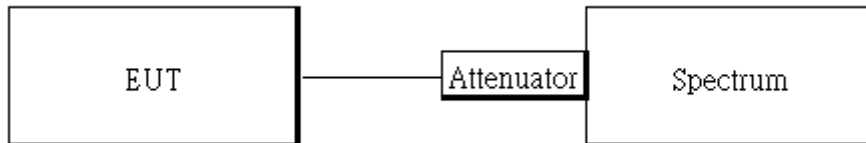
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12 FREQUENCY SEPARATION

12.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the $\frac{2}{3} \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

12.2 Test Setup



12.3 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 RBW approximately 30% of the channel spacing, $VBW \geq RBW$.
6. Adjust Span to Wide enough to capture the peaks of two adjacent channels.
7. Sweep = auto.
8. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

12.4 Measurement Result

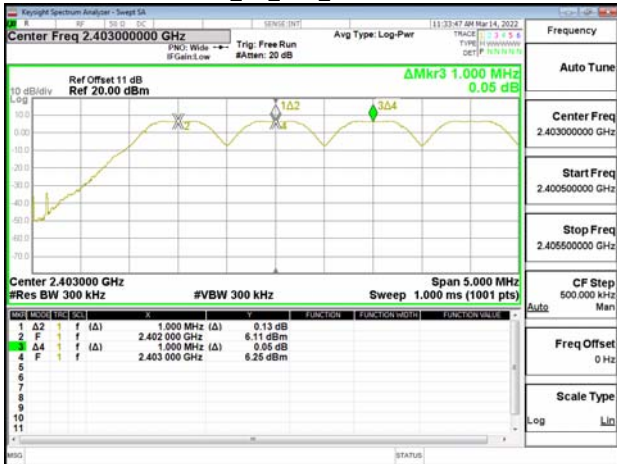
Channel separation (MHz)	Limit	Result
1	≥ 25 kHz or $\frac{2}{3}$ times 20dB bandwidth	PASS

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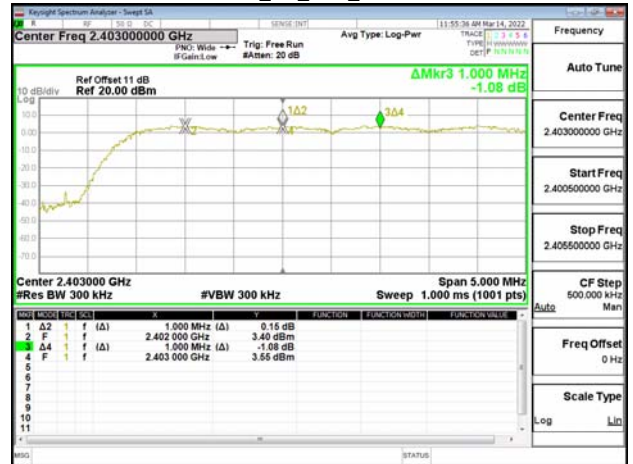
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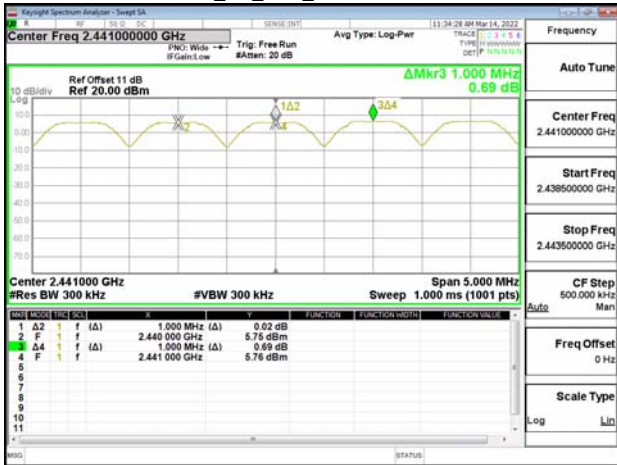
GFSK_1M_DH5_CH0CH1CH2



π /4DQPSK_2M_DH5_CH0CH1CH2



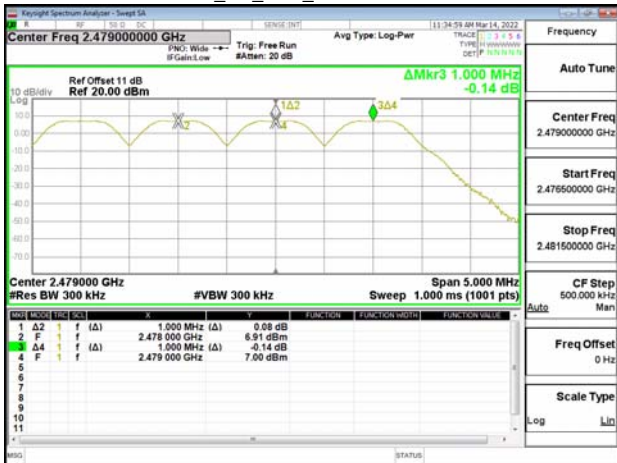
GFSK_1M_DH5_CH38CH39CH40



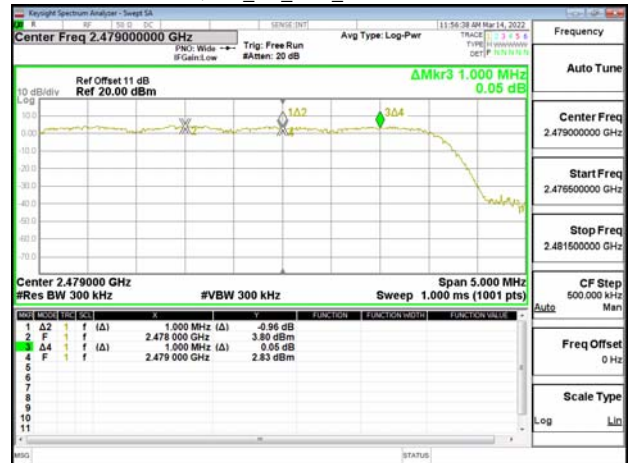
π /4DQPSK_2M_DH5_CH38CH39CH40



GFSK_1M_DH5_CH76CH77CH78



π /4DQPSK_2M_DH5_CH76CH77CH78



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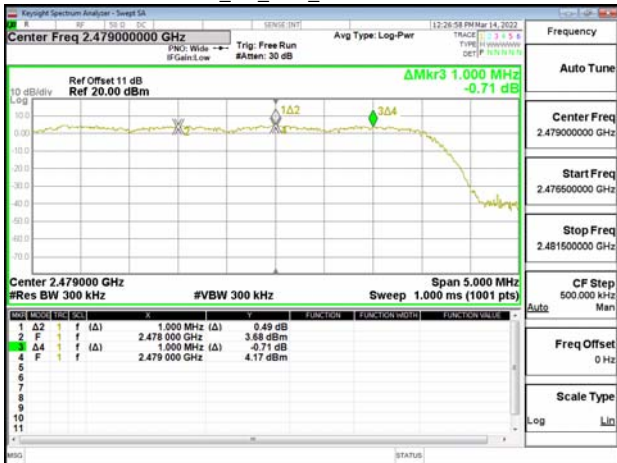
8DPSK_3M_DH5_CH0CH1CH2



8DPSK_3M_DH5_CH38CH39CH40



8DPSK_3M_DH5_CH76CH77CH78



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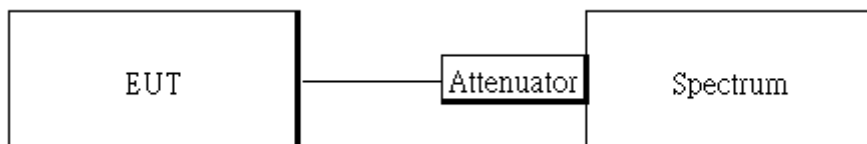
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13 NUMBER OF HOPPING FREQUENCY

13.1 Standard Applicable

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

13.2 Test Setup



13.3 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.

13.4 Measurement Result

Tabular Data of Total Channel Number

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

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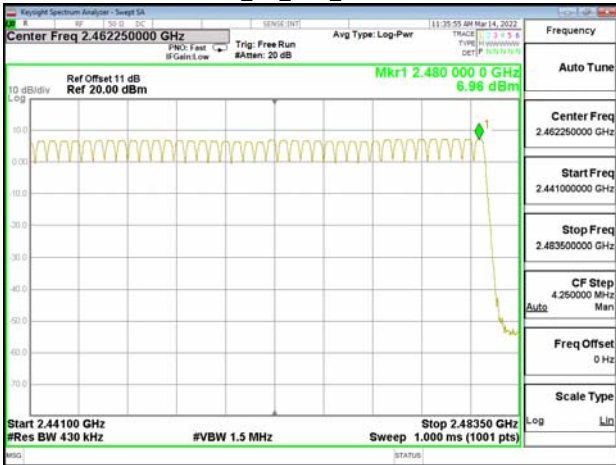
GFSK_1M_DH5_2400-2441



8DPSK_3M_DH5_2400-2441



GFSK_1M_DH5_2441-2480



8DPSK_3M_DH5_2441-2480



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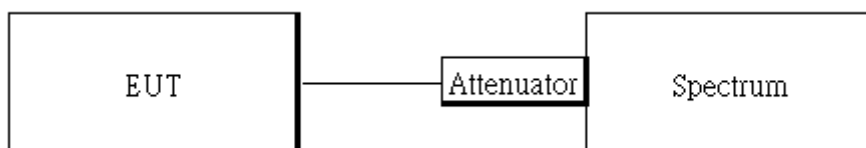
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14 TIME OF OCCUPANCY (DWELL TIME)

14.1 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.

14.2 Test Setup



14.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2015.
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

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.

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14.4 Measurement Result

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
Mid	DH1	121.60	400ms	3.00
	DH3	262.40	400ms	1.00
	DH5	307.20	400ms	1.00

$\pi/4$ DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
Mid	2DH1	124.80	400ms	3.00
	2DH3	262.40	400ms	1.00
	2DH5	308.80	400ms	1.00

8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
Mid	3DH1	124.80	400ms	3.00
	3DH3	260.80	400ms	1.00
	3DH5	308.80	400ms	1.00

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GFSK (1Mbps):

CH Mid	DH1 time slot	=	0.380	*	(1600/2/79)	*	31.6	=	121.60	(ms)
	DH3 time slot	=	1.640	*	(1600/4/79)	*	31.6	=	262.40	(ms)
	DH5 time slot	=	2.880	*	(1600/6/79)	*	31.6	=	307.20	(ms)

$\pi/4$ -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	=	2.895	*	(1600/6/79)	*	31.6	=	308.80	(ms)

8-DPSK (3Mbps):

CH Mid	3DH1 time slot	=	0.390	*	(1600/2/79)	*	31.6	=	124.80	(ms)
	3DH3 time slot	=	1.630	*	(1600/4/79)	*	31.6	=	260.80	(ms)
	3DH5 time slot	=	2.895	*	(1600/6/79)	*	31.6	=	308.80	(ms)

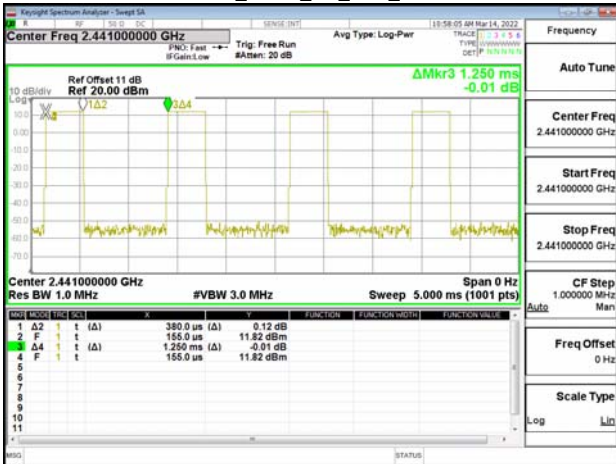
A period time = 0.4 (s) * 79 = 31.6 (s)

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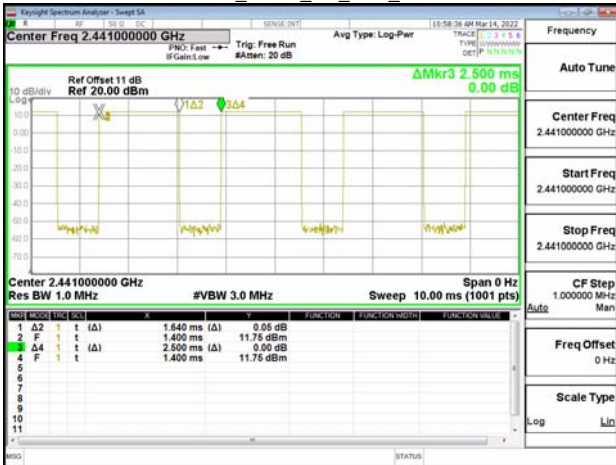
Dwell Time_GFSK_1M_DH1_2441MHz



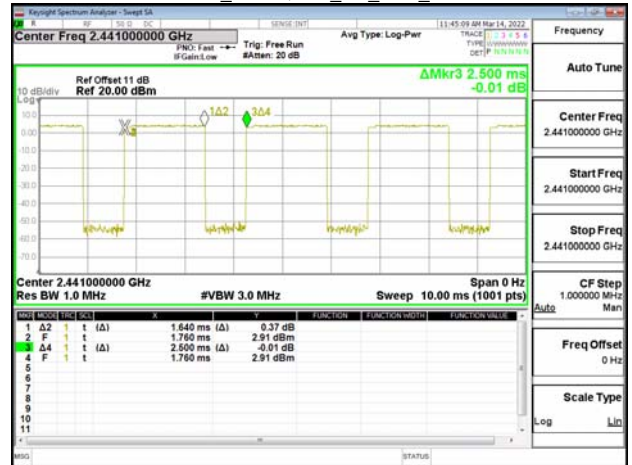
Dwell Time_π/4DQPSK_2M_DH1_2441MHz



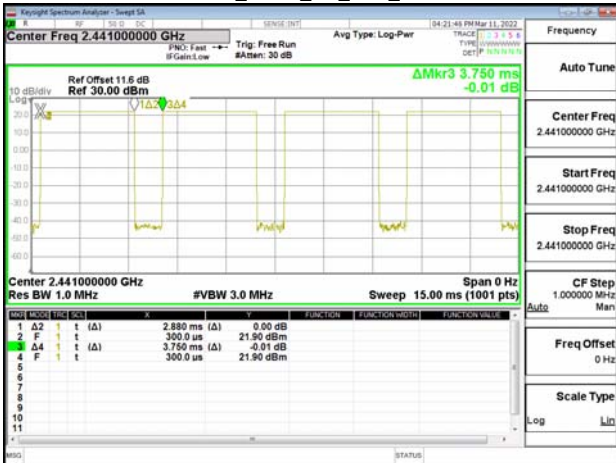
Dwell Time_GFSK_1M_DH3_2441MHz



Dwell Time_π/4DQPSK_2M_DH3_2441MHz



Dwell Time_GFSK_1M_DH5_2441MHz



Dwell Time_π/4DQPSK_2M_DH5_2441MHz



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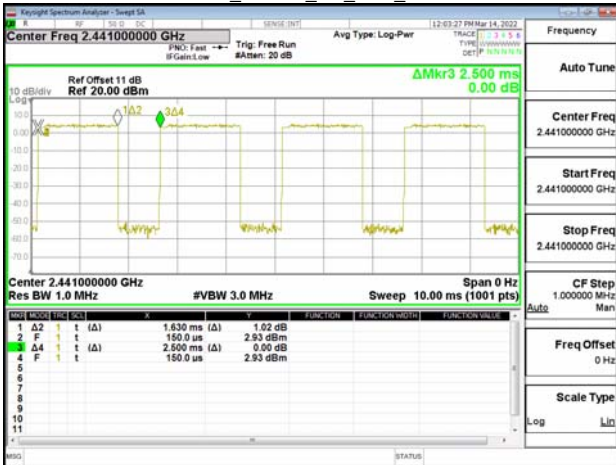
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Dwell Time_8DPSK_3M_DH1_2441MHz



Dwell Time_8DPSK_3M_DH3_2441MHz



Dwell Time_8DPSK_3M_DH5_2441MHz



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15 ANTENNA REQUIREMENT

15.1 Standard Applicable

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

15.2 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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