

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



Applicant: Taijet Bointec Co. LTD.
4F,#114,Zhouzi St., Neihu-Taipei 11493,Taiwan
Product Name: DGF109A (a.k.a. DGF104A)
Brand Name: Bointec
Model No.: DGF109A, DGF104A
Model Difference: Marketing Different
Report Number: ER/2021/90003
FCC ID 2AMAF-DGF109A104A
IC: 23942-DGF109A104A
Issue Date: November 30, 2021
Date of Test: October 25, 2021~November 1, 2021
Date of EUT Received: September 8, 2021

Approved By

Blue Yang

We hereby certify that:

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

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
ER/2021/90003	00	Original.	November 30, 2021	Yuri Tsai

Note:

- 1、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received and are assessed as identical in hardware and firmware to each other.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	DGF109A (a.k.a. DGF104A)
Brand Name:	Bointec
Model No.:	DGF109A, DGF104A
Model Difference:	Marketing Different
Hardware Version:	v01
Firmware Version:	v01
EUT Series No.:	Conducted: 20A7870094E6 Radiated: 20A7870094E6
Power Supply:	3.3V

1.2 RF Specification

Radio Technology:	BT BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Transmit Power:	7.97dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)
Dipole	INVAX /Cortec	NB1363-B310BX	2402 – 2480MHz	3.62

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

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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:

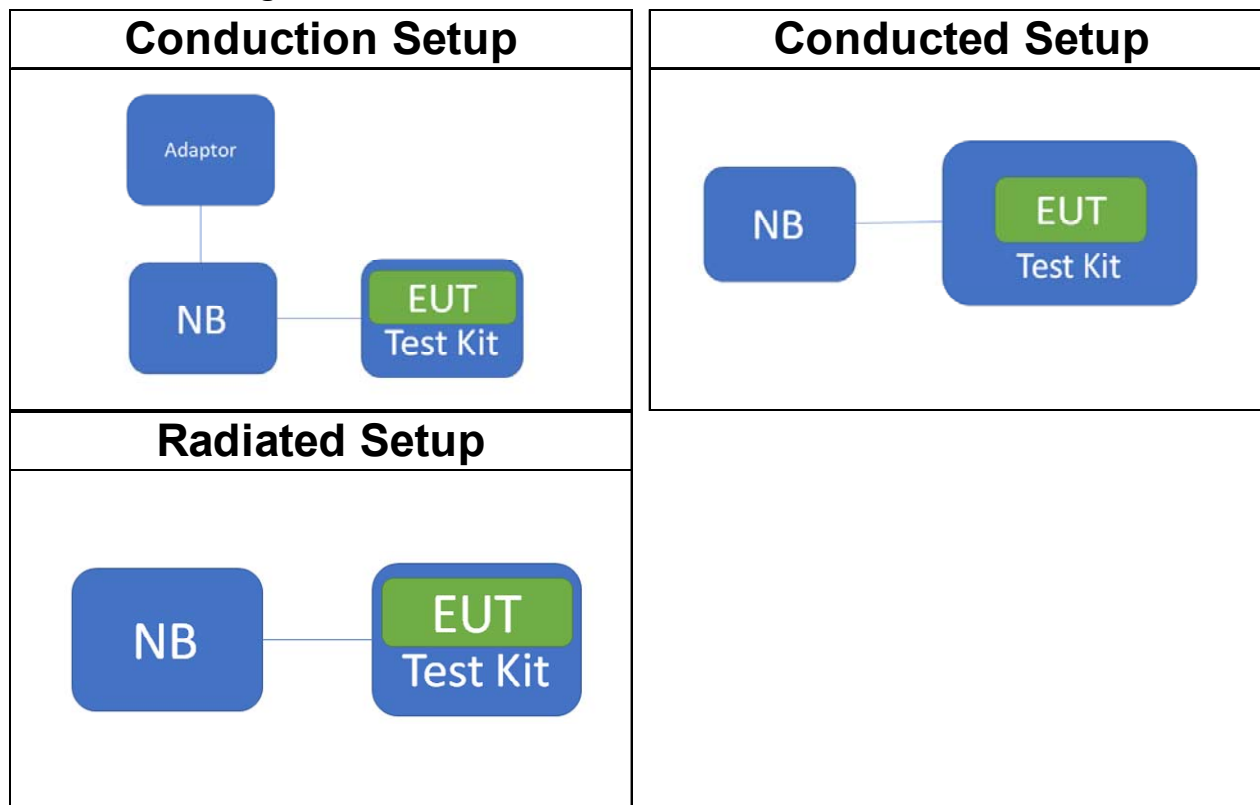
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Test Configuration



2.6 Control Unit(s)

Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L430	R9-WGNK5 13/01	N/A	N/A
Adapter	Lenovo	92P1158	N/A	N/A	N/A
Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A
Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L430	R9-WGNK5 13/01	N/A	N/A

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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

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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 radiation emission was measured as EUT three orthogonal planes, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested and recorded.
- 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
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	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 to 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
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.

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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

Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI 7	100759	08/26/2021	08/25/2022
LISN	SCHWARZBECK	NSLK 8127	8127-465	04/09/2021	04/08/2022
Coaxial Cables	N/A	Coaxial Cable	161207	12/07/2020	12/06/2021
Test Software	audix	e3	Ver. 9 210322	N.C.R	N.C.R

Note: N.C.R refers to No calibration required

6.3 EUT Setup

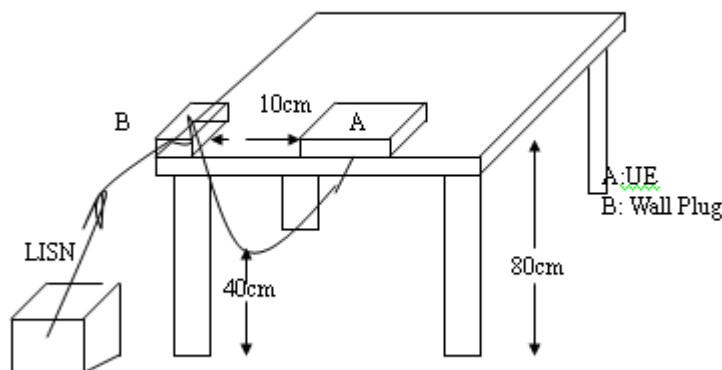
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground 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.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :ER-2021-90003

Test Site :Conduction 1

Test Mode :Operation BT

Test Date :2021-10-28

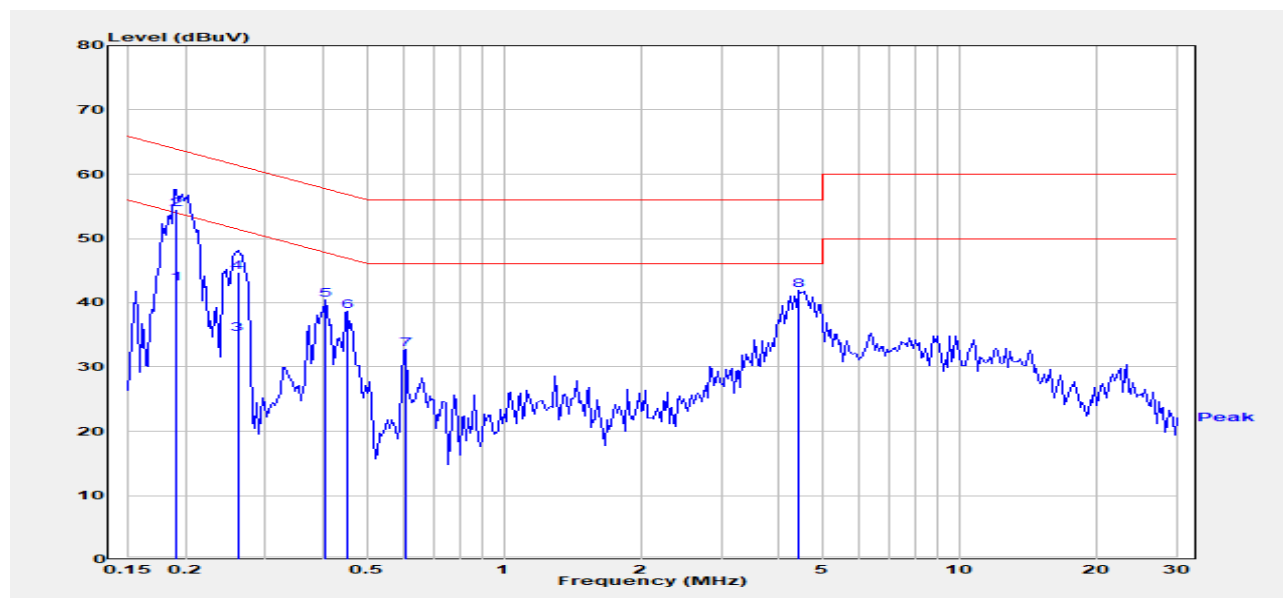
Power :120V/60Hz

Temp./Humi. :24.8/61

Probe :L

Engineer :Nick Lin

Note: :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.191	Average	40.88	2.12	43.00	53.98	-10.98
0.191	QP	52.37	2.12	54.49	63.98	-9.49
0.260	Average	33.03	2.12	35.15	51.42	-16.27
0.260	QP	42.56	2.12	44.68	61.42	-16.74
0.406	Peak	38.32	2.12	40.44	57.73	-17.28
0.452	Peak	36.59	2.12	38.71	56.85	-18.13
0.608	Peak	30.58	2.12	32.70	56.00	-23.30
4.454	Peak	39.25	2.74	41.98	56.00	-14.02

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Report Number :ER-2021-90003

Test Site :Conduction 1

Test Mode :Operation BT

Test Date :2021-10-28

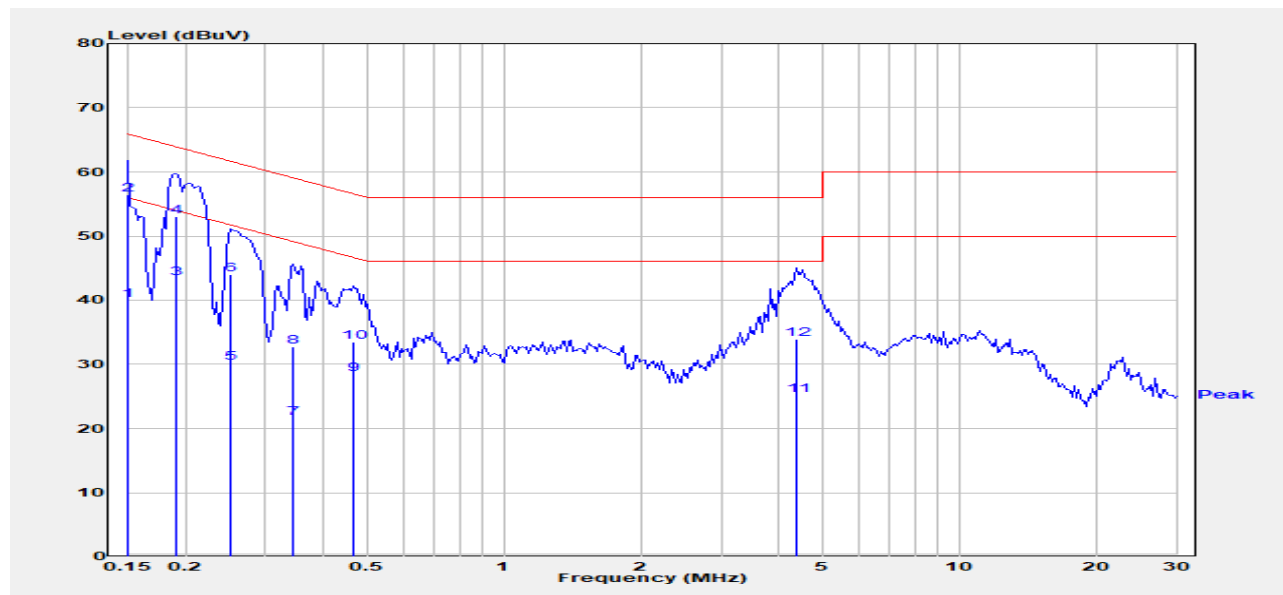
Power :120V/60Hz

Temp./Humi. :24.8/61

Probe :N

Engineer :Nick Lin

Note: :



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.150	Average	37.92	2.12	40.04	56.00	-15.96
0.150	QP	54.38	2.12	56.50	66.00	-9.50
0.191	Average	41.07	2.27	43.34	53.98	-10.64
0.191	QP	50.83	2.27	53.10	63.98	-10.88
0.252	Average	28.00	2.24	30.24	51.69	-21.45
0.252	QP	41.79	2.24	44.03	61.69	-17.66
0.343	Average	19.49	2.16	21.65	49.13	-27.48
0.343	QP	30.64	2.16	32.80	59.13	-26.33
0.466	Average	26.28	2.12	28.40	46.58	-18.18
0.466	QP	31.29	2.12	33.41	56.58	-23.17
4.407	Average	23.03	2.19	25.22	46.00	-20.78
4.407	QP	31.77	2.19	33.96	56.00	-22.04

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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.

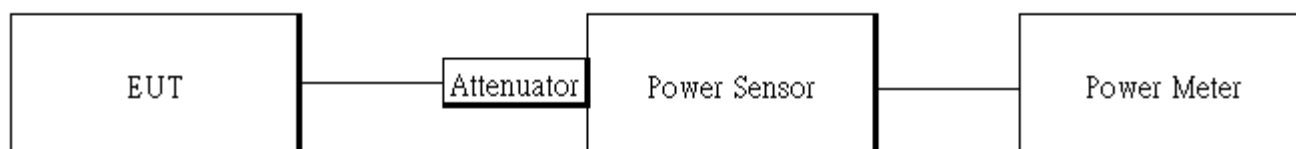
The e.i.r.p. shall not exceed 4 W.

7.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021
Power Meter	Anritsu	ML2496A	1804001	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726104	03/02/2021	03/01/2022
Power Sensor	Anritsu	MA2411B	1726107	03/02/2021	03/01/2022

Note: N.C.R refers to No calibration required

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

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7.5 Peak & Average Power Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.59	3.622	1000
Mid	2441	6.61	4.581	1000
High	2480	7.02	5.035	1000

1M BR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.53	3.569	1000
Mid	2441	6.56	4.524	1000
High	2480	6.98	4.983	1000

2M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	7.12	5.152	125
Mid	2441	7.85	6.095	125
High	2480	7.94	6.223	125

2M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.22	3.323	125
Mid	2441	5.90	3.886	125
High	2480	6.39	4.350	125

3M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	7.46	5.572	125
Mid	2441	7.91	6.180	125
High	2480	7.97	6.266	125

3M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	5.25	3.346	125
Mid	2441	6.05	4.023	125
High	2480	6.43	4.390	125

NOTE: cable loss as 0.27dB that offsets in the spectrum

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

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7.6 EIRP Measurement Result

1M BR mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	5.53	3.62	8.213	4000
Mid	2441	6.56	3.62	10.411	4000
High	2480	6.98	3.62	11.469	4000

2M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	5.22	3.62	7.647	4000
Mid	2441	5.90	3.62	8.944	4000
High	2480	6.39	3.62	10.012	4000

3M EDR mode EIRP

Channel	Frequency (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	5.25	3.62	7.700	4000
Mid	2441	6.05	3.62	9.258	4000
High	2480	6.43	3.62	10.104	4000

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

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8 EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

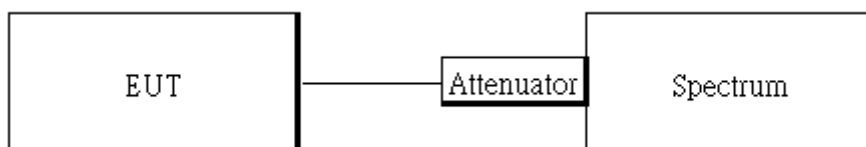
For frequency hopping systems operating in the 2400 MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

Note: N.C.R refers to No calibration required

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 $\geq$ 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

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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	0.9537	0.64
Mid	0.954	0.64
High	0.9531	0.64

$\pi/4$ -DQPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.284	0.86
Mid	1.283	0.86
High	1.286	0.86

8-DPSK

CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.296	0.86
Mid	1.299	0.87
High	1.300	0.87

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8.6 99% Bandwidth

GFSK

CH	99% BW (MHz)
Low	0.90162
Mid	0.90169
High	0.90257

$\pi/4$ -DQPSK

CH	99% BW (MHz)
Low	1.1807
Mid	1.1846
High	1.1881

8-DPSK

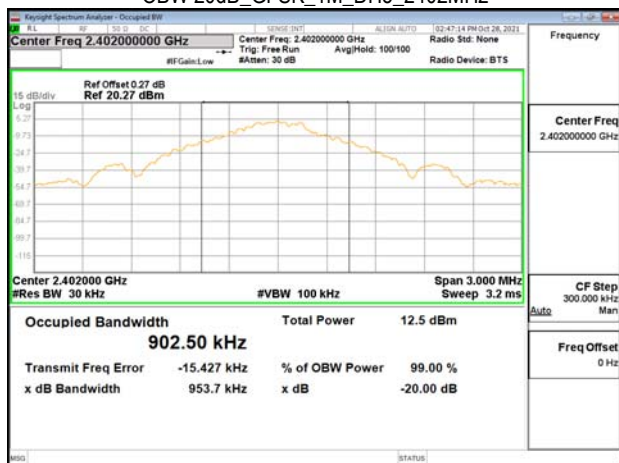
CH	99% BW (MHz)
Low	1.1858
Mid	1.1914
High	1.1960

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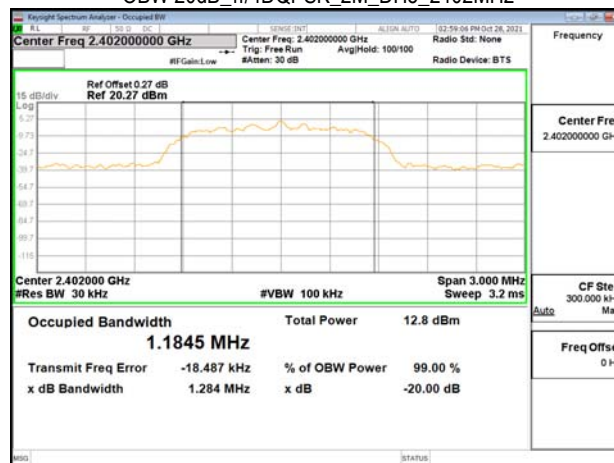
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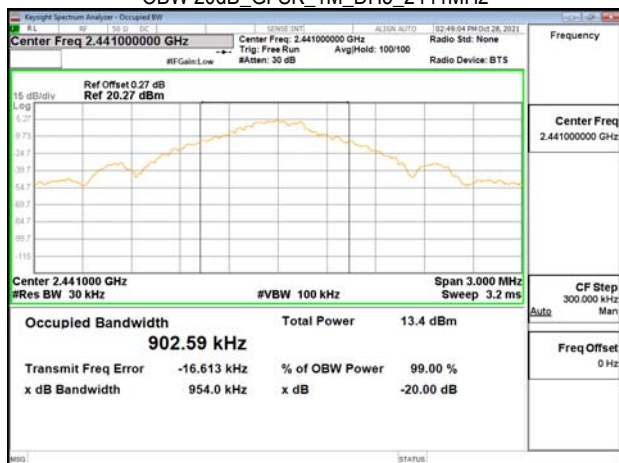
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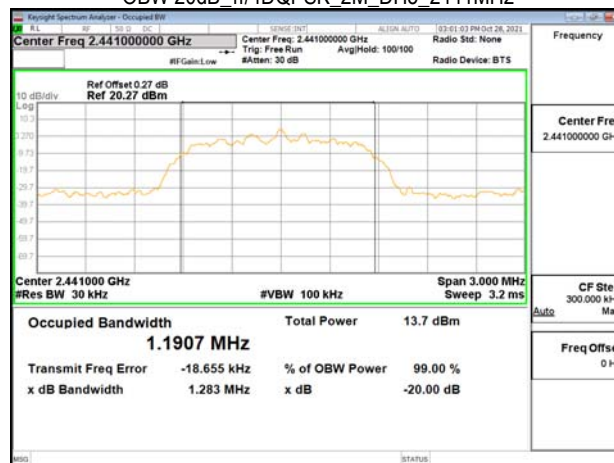
OBW 20dB_π/4DQPSK_2M_DH5_2402MHz



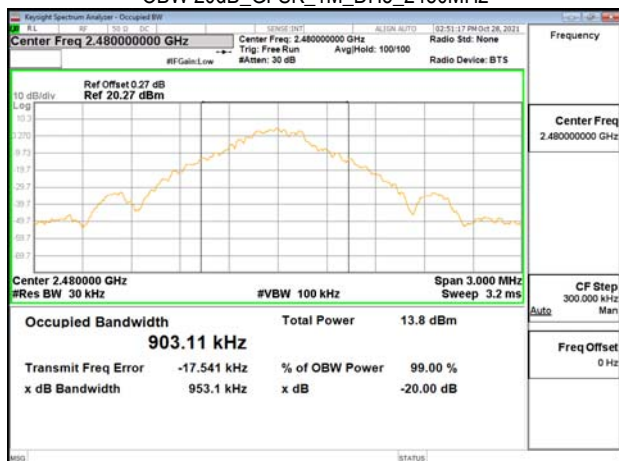
OBW 20dB_GFSK_1M_DH5_2441MHz



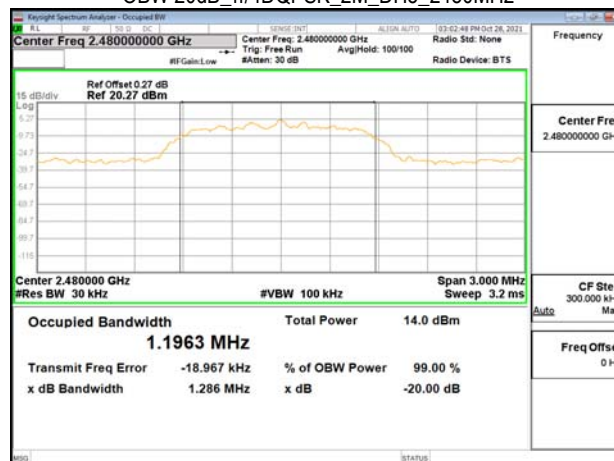
OBW 20dB_π/4DQPSK_2M_DH5_2441MHz



OBW 20dB_GFSK_1M_DH5_2480MHz



OBW 20dB_π/4DQPSK_2M_DH5_2480MHz

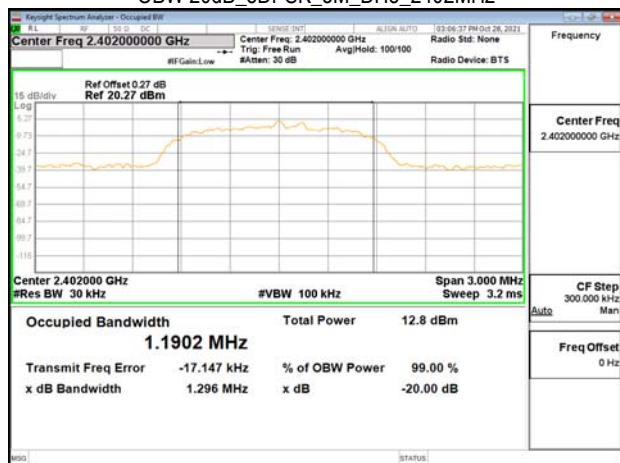


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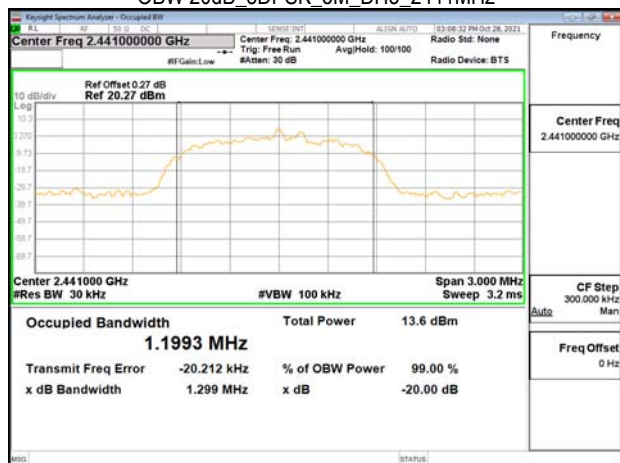
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OBW 20dB_8DPSK_3M_DH5_2402MHz



OBW 20dB_8DPSK_3M_DH5_2441MHz



OBW 20dB_8DPSK_3M_DH5_2480MHz

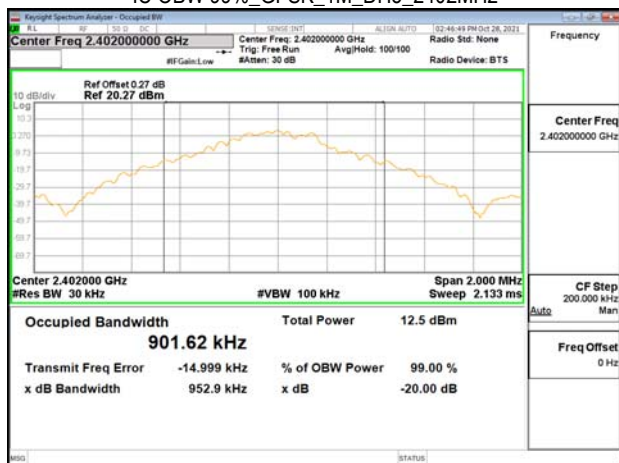


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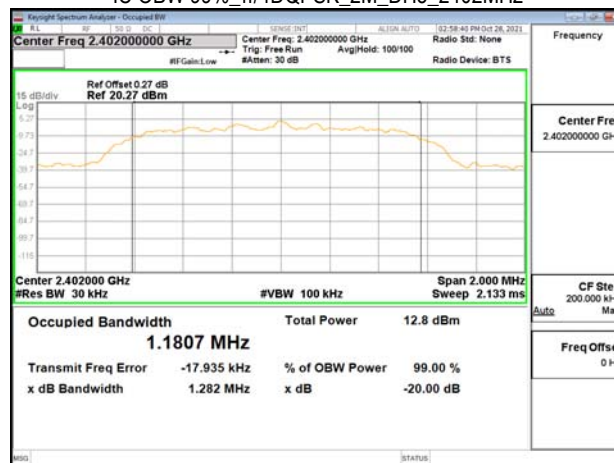
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IC OBW 99%_GFSK_1M_DH5_2402MHz



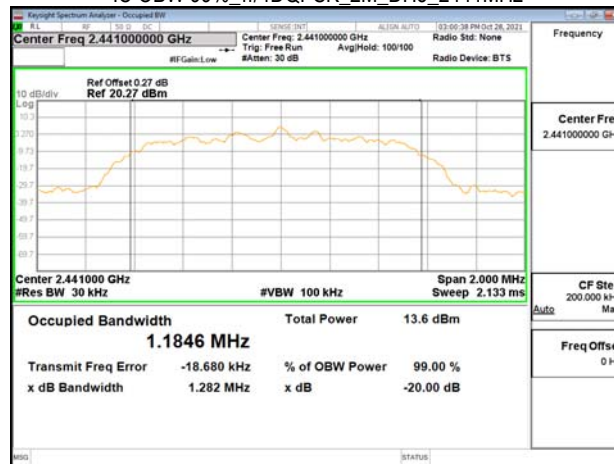
IC OBW 99%_π/4DQPSK_2M_DH5_2402MHz



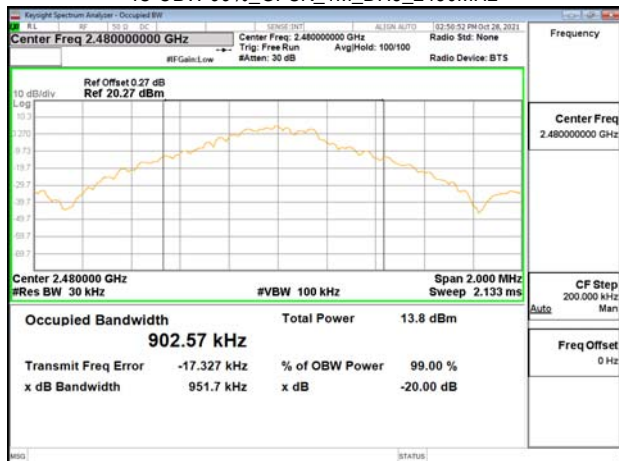
IC OBW 99%_GFSK_1M_DH5_2441MHz



IC OBW 99%_π/4DQPSK_2M_DH5_2441MHz



IC OBW 99%_GFSK_1M_DH5_2480MHz



IC OBW 99%_π/4DQPSK_2M_DH5_2480MHz

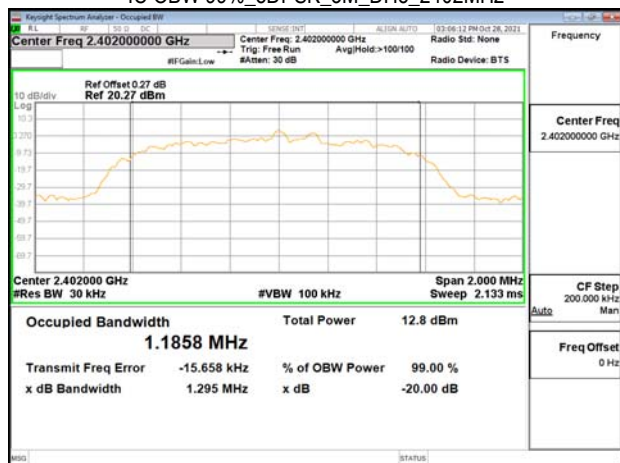


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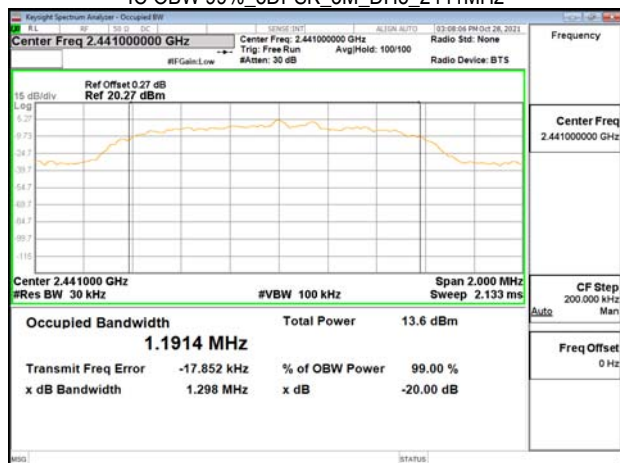
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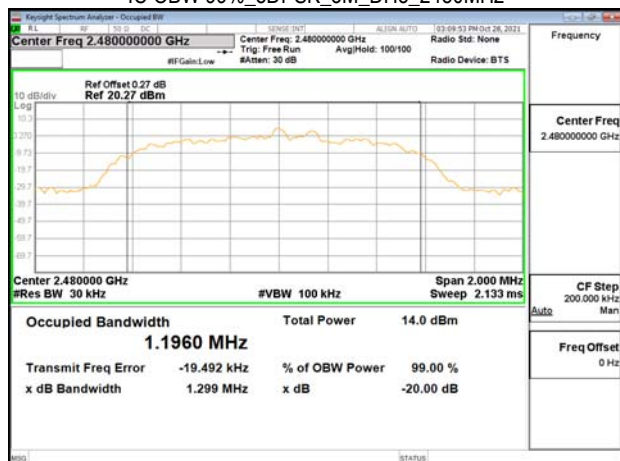
IC OBW 99%_8DPSK_3M_DH5_2402MHz



IC OBW 99%_8DPSK_3M_DH5_2441MHz



IC OBW 99%_8DPSK_3M_DH5_2480MHz



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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

9.1 Standard Applicable

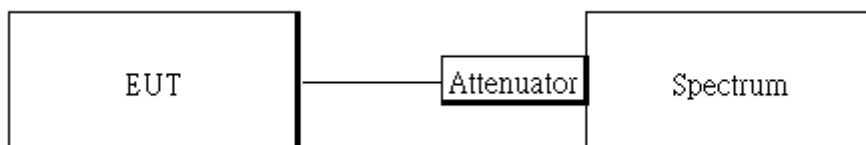
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

Note: N.C.R refers to No calibration required

9.3 Test SET-UP



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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

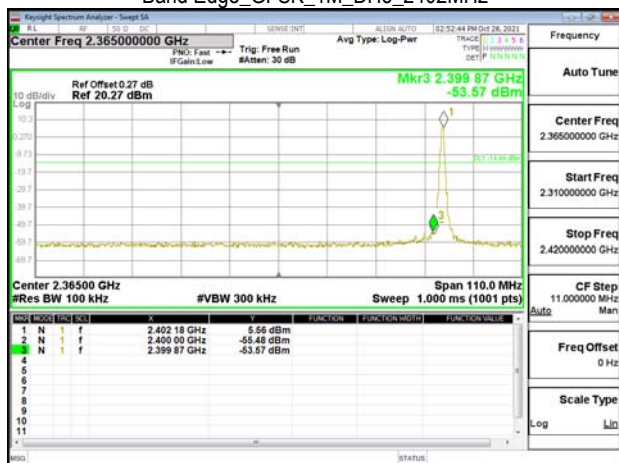
See next page for test plots.

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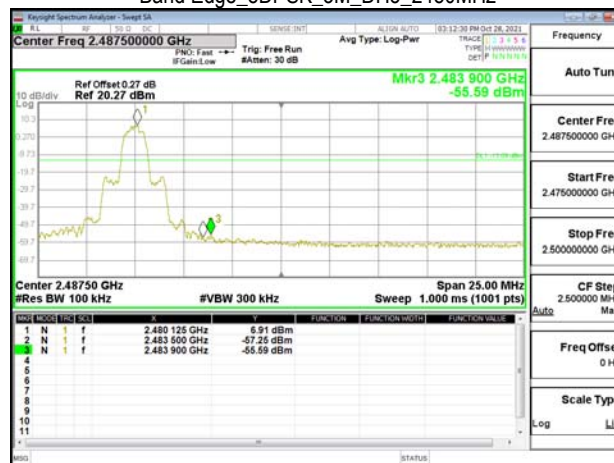
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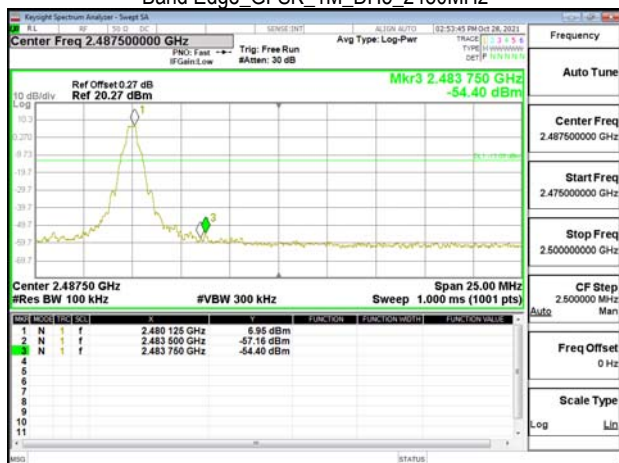
Band Edge_GFSK_1M_DH5_2402MHz



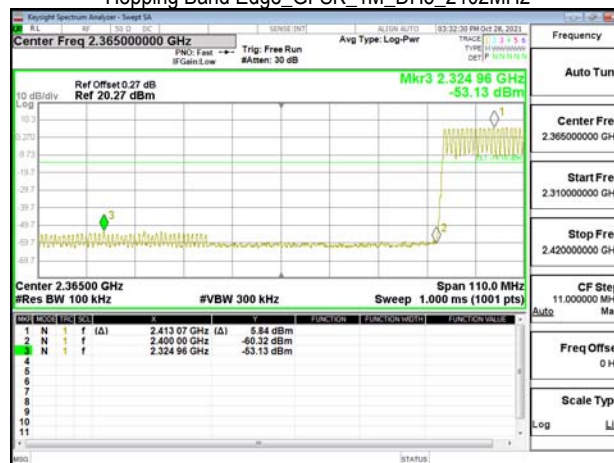
Band Edge_8DPSK_3M_DH5_2480MHz



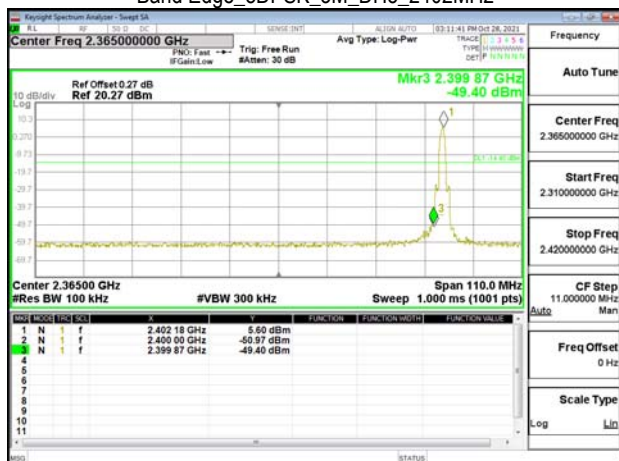
Band Edge_GFSK_1M_DH5_2480MHz



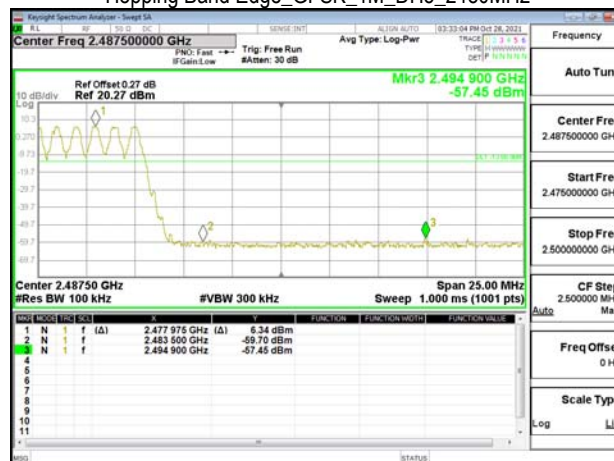
Hopping Band Edge_GFSK_1M_DH5_2402MHz



Band Edge_8DPSK_3M_DH5_2402MHz



Hopping Band Edge_GFSK_1M_DH5_2480MHz

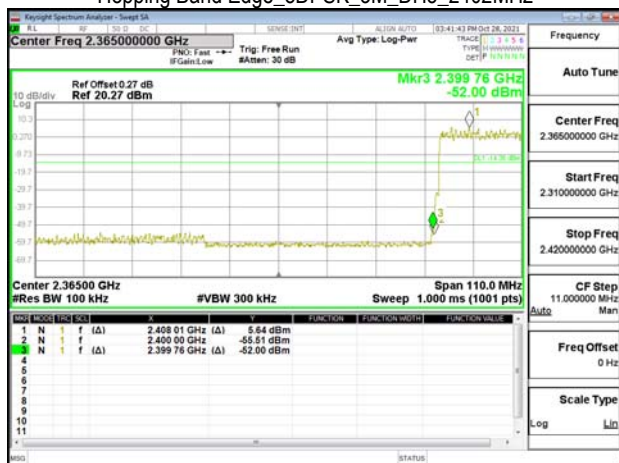


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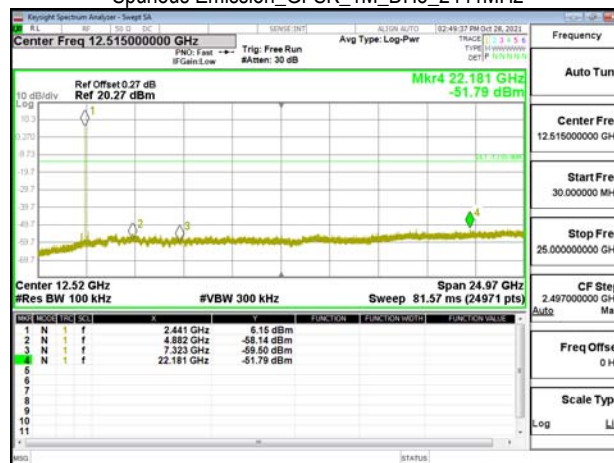
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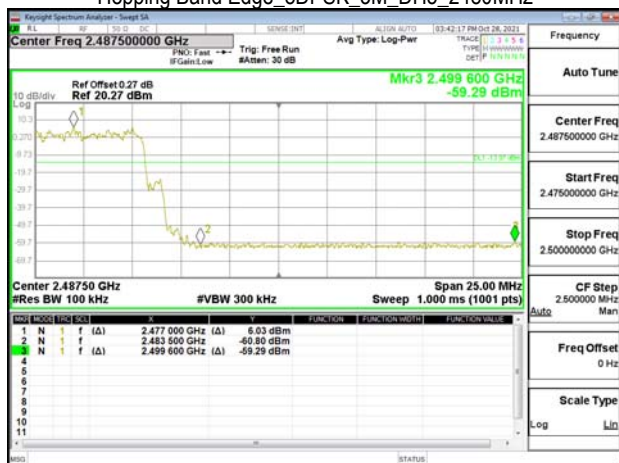
Hopping Band Edge_8DPSK_3M_DH5_2402MHz



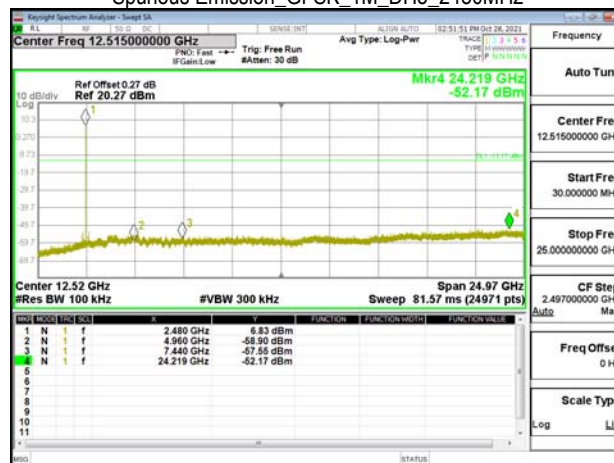
Spurious Emission_GFSK_1M_DH5_2441MHz



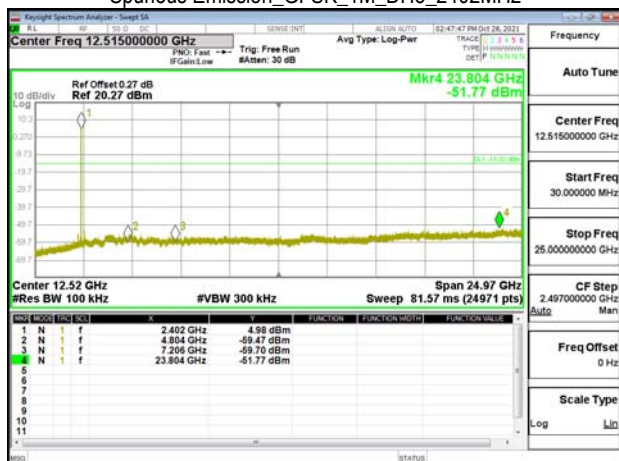
Hopping Band Edge_8DPSK_3M_DH5_2480MHz



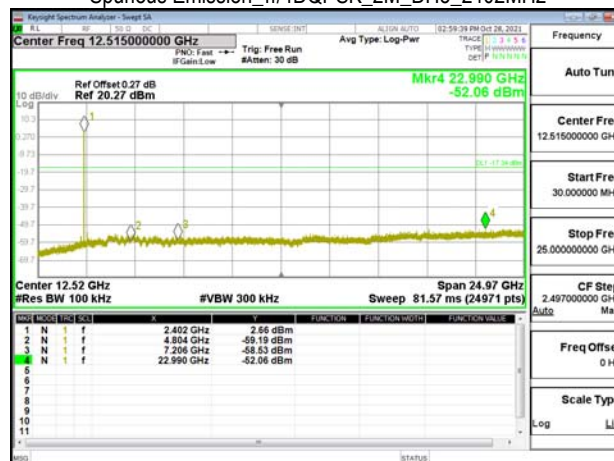
Spurious Emission_GFSK_1M_DH5_2480MHz



Spurious Emission_GFSK_1M_DH5_2402MHz



Spurious Emission_π/4DQPSK_2M_DH5_2402MHz

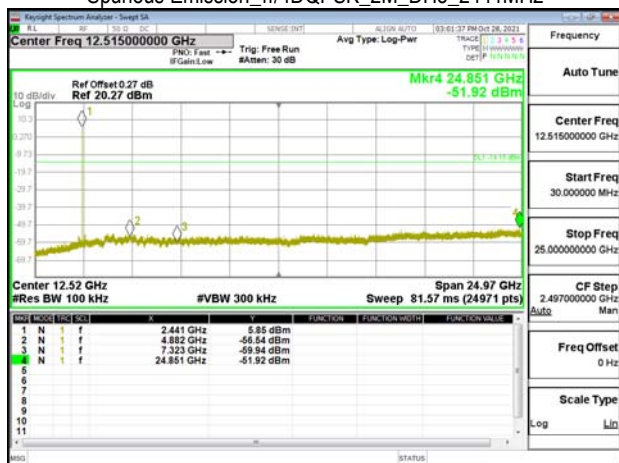


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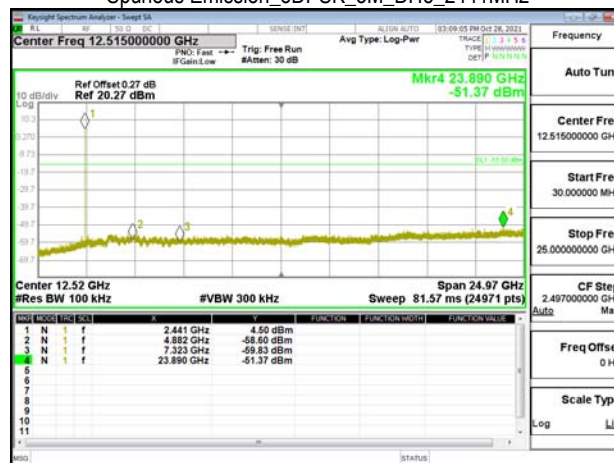
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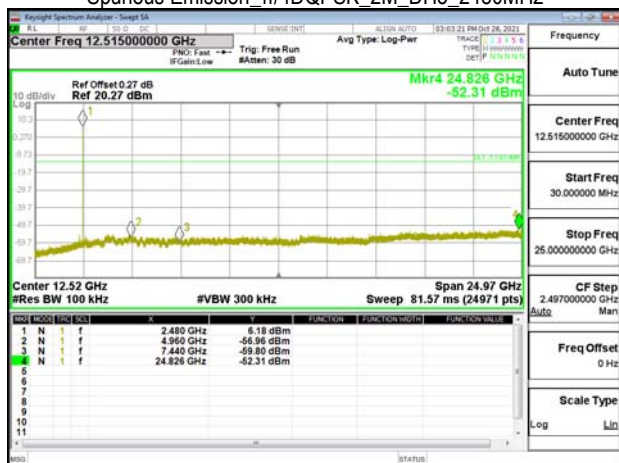
Spurious Emission_π/4QPSK_2M_DH5_2441MHz



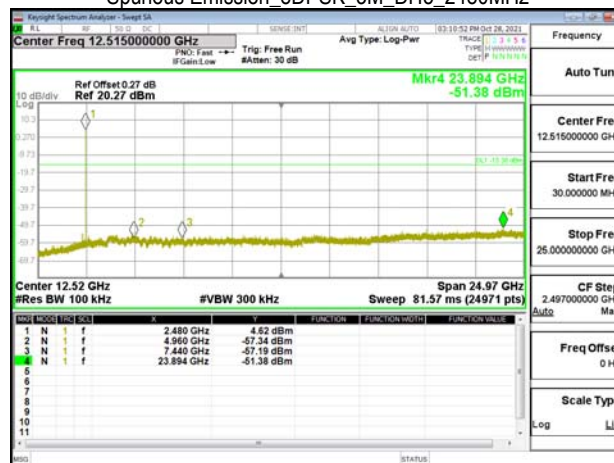
Spurious Emission_8DPSK_3M_DH5_2441MHz



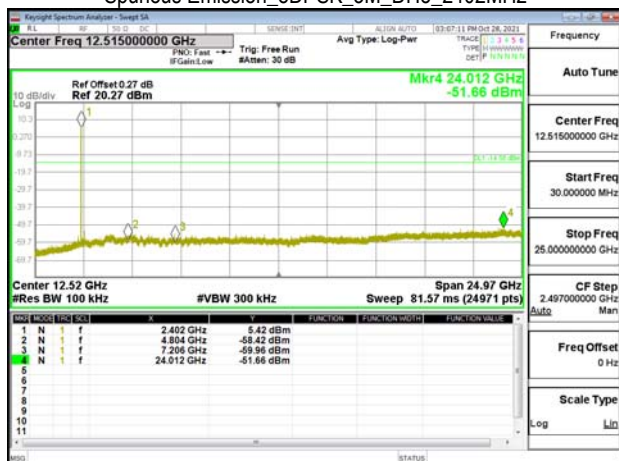
Spurious Emission_π/4QPSK_2M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2480MHz



Spurious Emission_8DPSK_3M_DH5_2402MHz



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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.

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10.2 Measurement Equipment Used

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Horn Antenna	SCHWARZBECK	BBHA9170	184	12/11/2020	12/10/2021
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/27/2021	09/26/2022
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/20/2021	08/19/2022
Loop Antenna	ETS.LINDGREN	6502	148045	09/29/2021	09/28/2022
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
EMI Test Receiver	R&S	ESCI 7	100759	08/26/2021	08/25/2022
Pre-Amplifier	HP	8449B	3008A00578	12/16/2020	12/15/2021
Pre-Amplifier	EMC Instruments	EMC184045B	980135	12/16/2020	12/15/2021
Pre-Amplifier	HP	8447D	2944A07676	12/16/2020	12/15/2021
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M1	12/16/2020	12/15/2021
High Pass Filter	WI	WHKX4.0/18G-10SS	22	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2636/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104	340057/4	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 104PEA	800052/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2621/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2617/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY2630/2	12/16/2020	12/15/2021
Coaxial Cable	Huber Suhner	SUCOFLEX 102	MY22962/2	12/16/2020	12/15/2021
Site Cal	SGS	SAC 3	N/A	01/01/2021	12/31/2021
Test Software	audix	e3	Ver. 9 210322	N.C.R	N.C.R

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

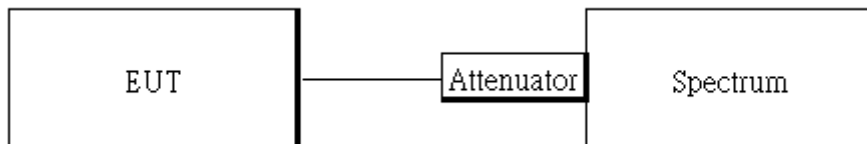
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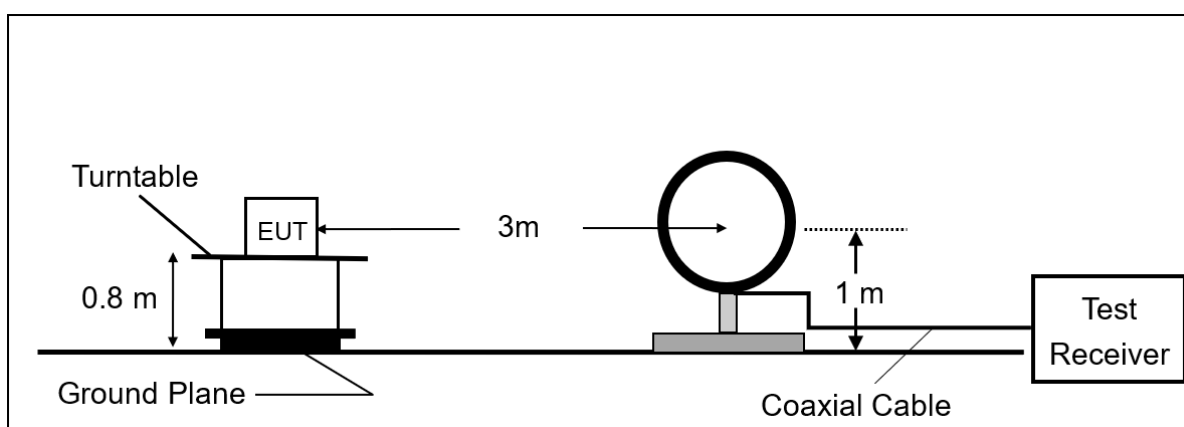
10.3 Test SET-UP

10.3.1 Duty Cycle Correction Factor

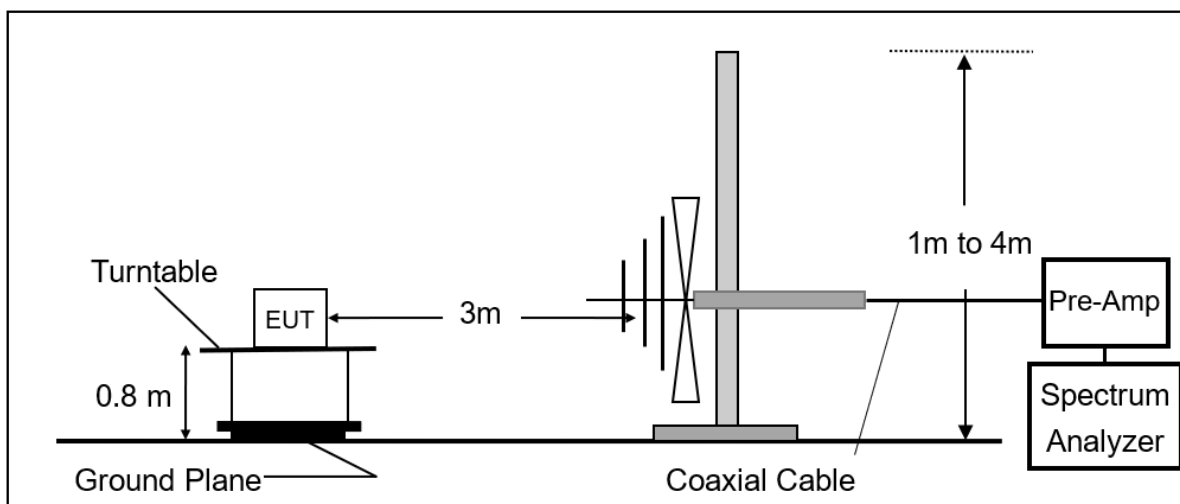


10.3.2 Radiated Emission

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



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

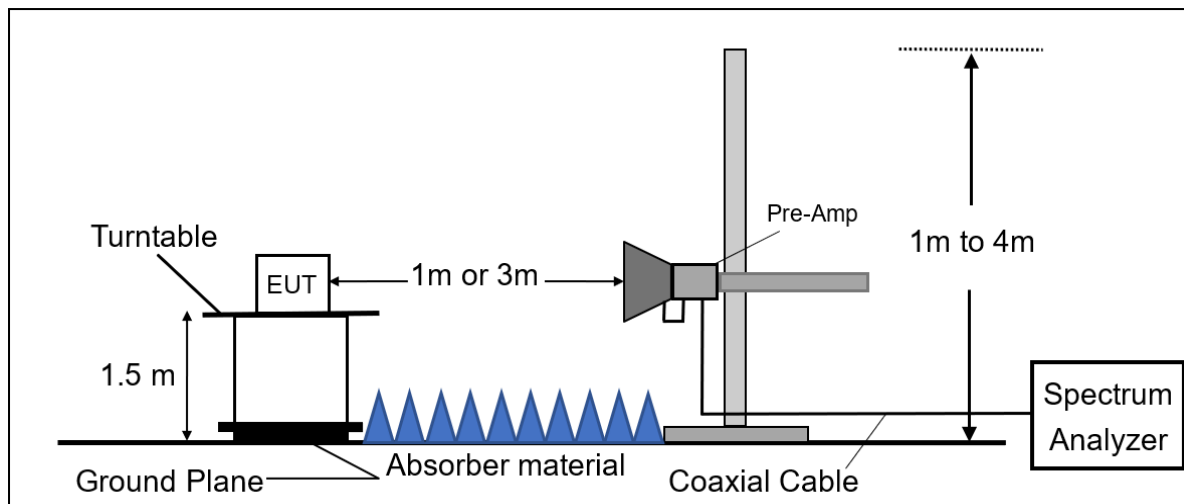


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(C) Radiated Emission Test Set-Up, Frequency Above 1 GHz.



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10.4 Measurement Procedure

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. 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.

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10.5 Field Strength Calculation

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

$$FS = RA + AF + CL - AG$$

Where *FS* = Field Strength

RA = Reading Amplitude

AF = Antenna Factor

CL = Cable Attenuation Factor (Cable Loss)

AG = Amplifier Gain

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

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

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

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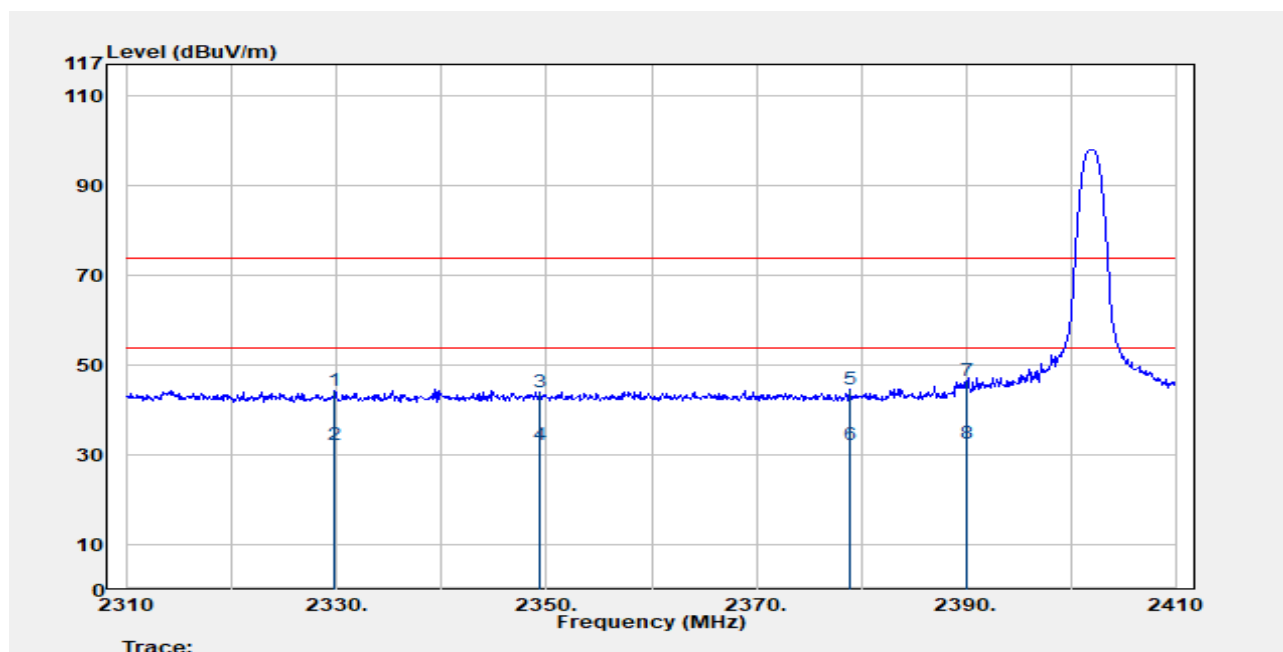
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10.7 Measurement Result:

10.7.1 Bandedge Result

Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2329.800	Peak	43.20	1.08	44.28	74.00	-29.72
2329.800	Average	31.39	1.08	32.47	54.00	-21.53
2349.400	Peak	43.13	1.00	44.13	74.00	-29.87
2349.400	Average	31.31	1.00	32.31	54.00	-21.69
2378.900	Peak	43.70	0.94	44.64	74.00	-29.36
2378.900	Average	31.39	0.94	32.33	54.00	-21.67
2390.000	Peak	45.83	0.92	46.74	74.00	-27.26
2390.000	Average	31.88	0.92	32.80	54.00	-21.20

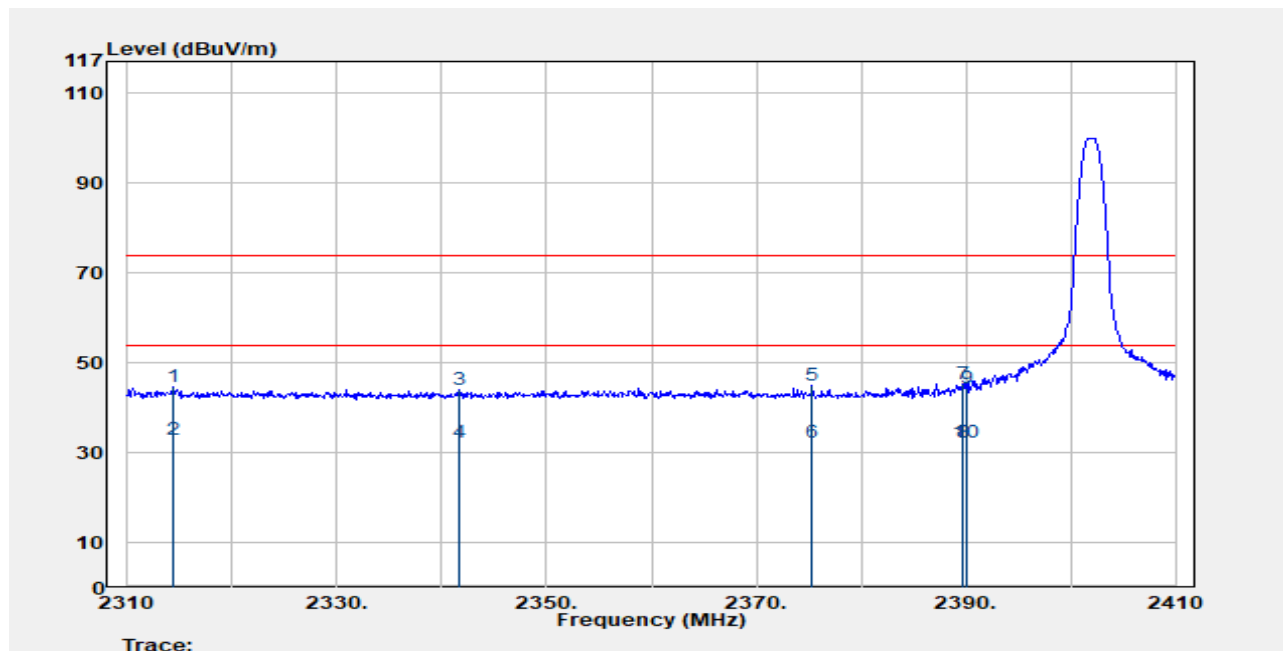
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 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2314.300	Peak	43.43	1.15	44.58	74.00	-29.42
2314.300	Average	31.95	1.15	33.10	54.00	-20.90
2341.600	Peak	43.18	1.04	44.21	74.00	-29.79
2341.600	Average	31.18	1.04	32.22	54.00	-21.78
2375.300	Peak	43.94	0.95	44.89	74.00	-29.11
2375.300	Average	31.32	0.95	32.27	54.00	-21.73
2389.700	Peak	44.31	0.92	45.23	74.00	-28.77
2389.700	Average	31.52	0.92	32.44	54.00	-21.56
2390.000	Peak	43.53	0.92	44.44	74.00	-29.56
2390.000	Average	31.51	0.92	32.43	54.00	-21.57

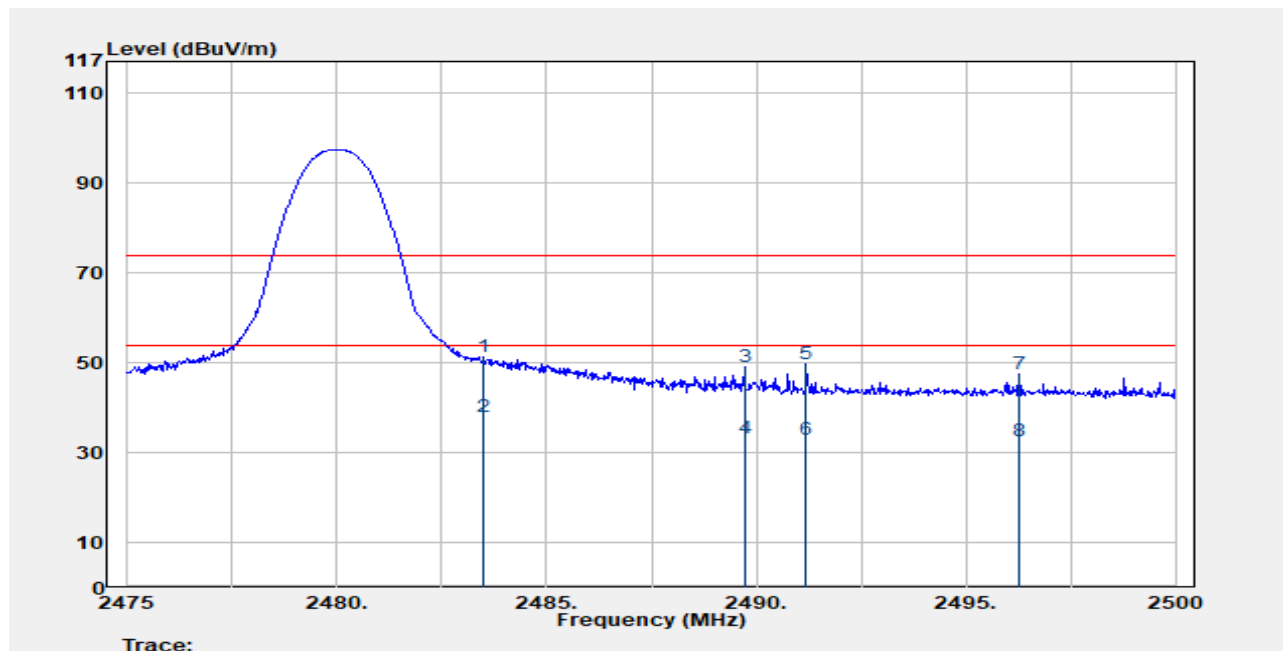
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



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	Peak	50.54	0.67	51.21	74.00	-22.79
2483.500	Average	37.28	0.67	37.95	54.00	-16.05
2489.725	Peak	48.37	0.65	49.02	74.00	-24.98
2489.725	Average	32.52	0.65	33.17	54.00	-20.83
2491.200	Peak	49.16	0.64	49.80	74.00	-24.20
2491.200	Average	32.34	0.64	32.98	54.00	-21.02
2496.275	Peak	46.87	0.62	47.49	74.00	-26.51
2496.275	Average	32.05	0.62	32.67	54.00	-21.33

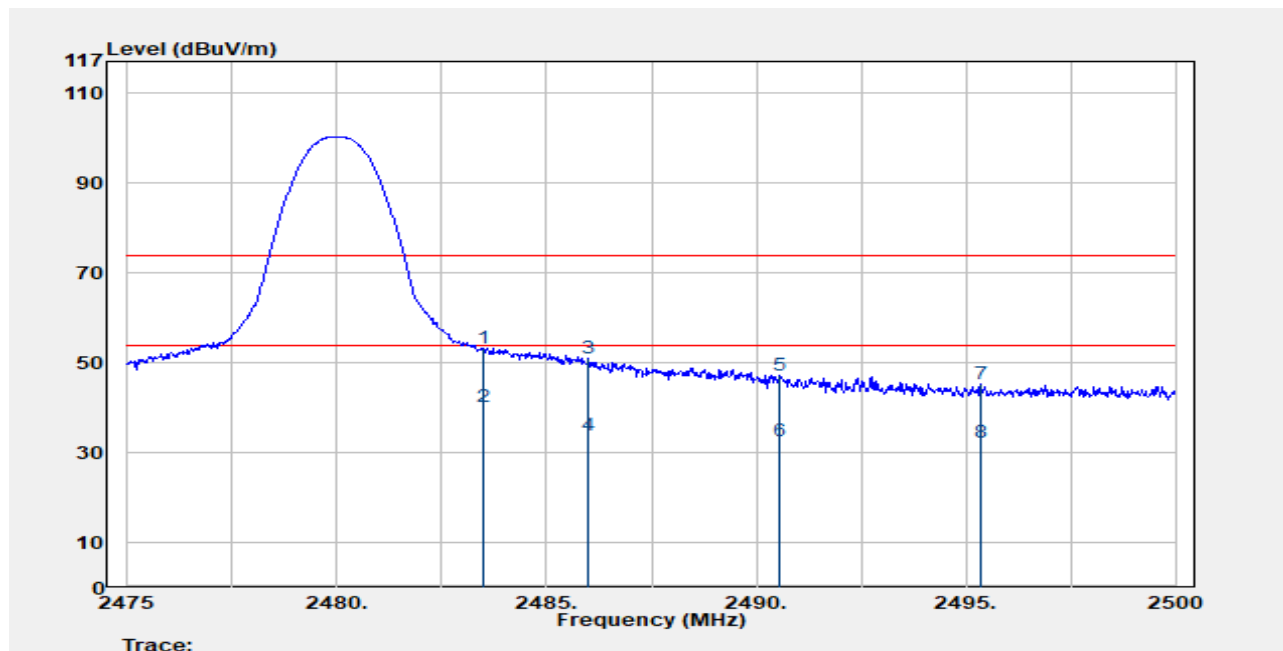
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 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Peak	52.76	0.67	53.43	74.00	-20.57
2483.500	Average	39.64	0.67	40.31	54.00	-13.69
2486.000	Peak	50.40	0.66	51.06	74.00	-22.94
2486.000	Average	33.22	0.66	33.88	54.00	-20.12
2490.575	Peak	46.63	0.64	47.28	74.00	-26.72
2490.575	Average	31.97	0.64	32.61	54.00	-21.39
2495.375	Peak	44.65	0.62	45.27	74.00	-28.73
2495.375	Average	31.69	0.62	32.31	54.00	-21.69

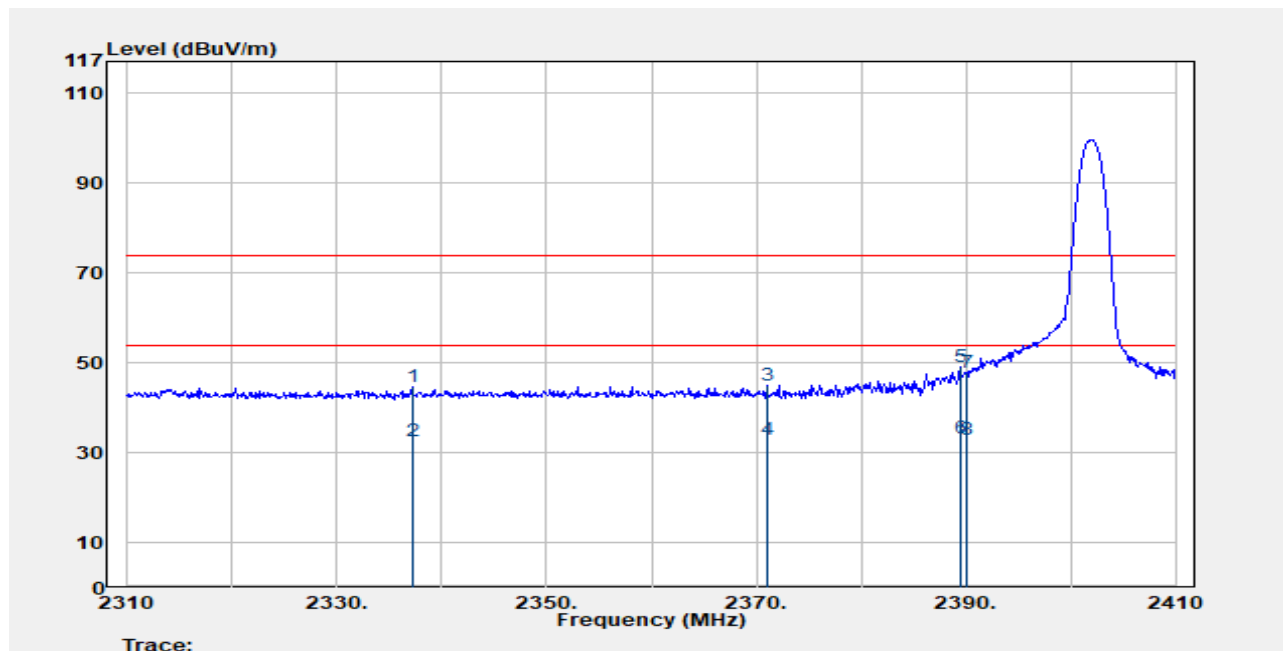
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 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2337.200	Peak	43.75	1.05	44.81	74.00	-29.19
2337.200	Average	31.49	1.05	32.54	54.00	-21.46
2371.000	Peak	44.20	0.96	45.16	74.00	-28.84
2371.000	Average	31.98	0.96	32.94	54.00	-21.06
2389.500	Peak	48.32	0.92	49.23	74.00	-24.77
2389.500	Average	32.45	0.92	33.37	54.00	-20.63
2390.000	Peak	47.08	0.92	48.00	74.00	-26.00
2390.000	Average	32.00	0.92	32.92	54.00	-21.08

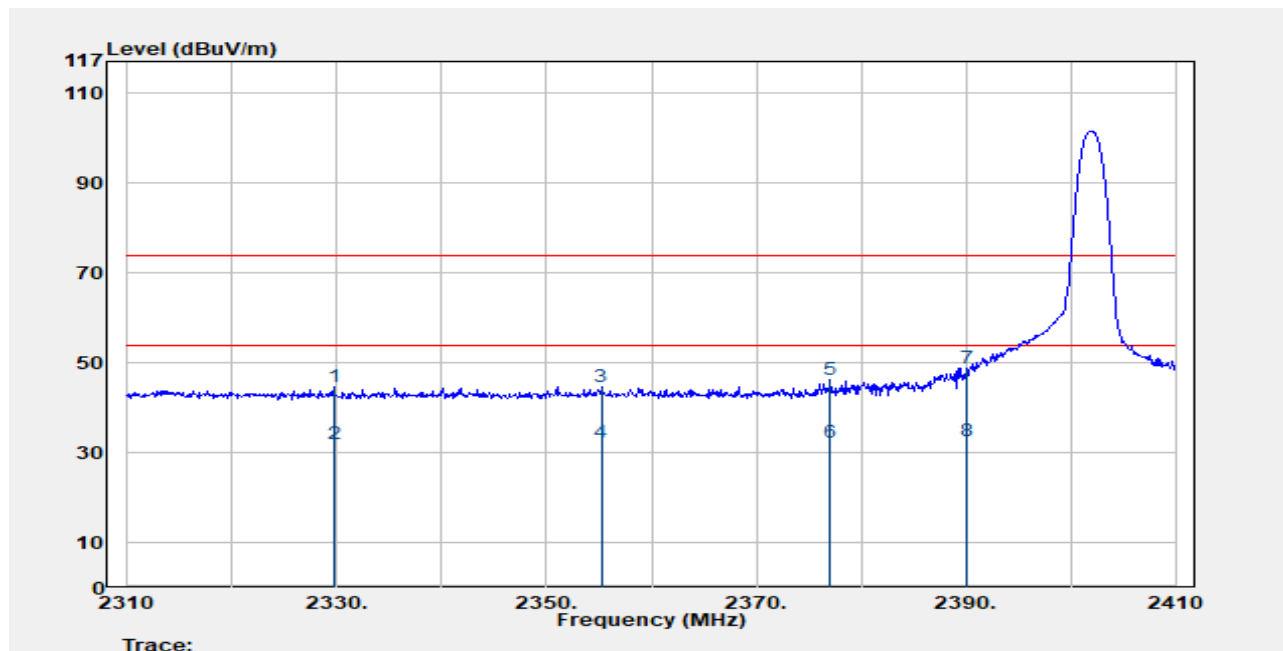
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 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
2329.700	Peak	43.52	1.08	44.60	74.00	-29.40
2329.700	Average	31.07	1.08	32.15	54.00	-21.85
2355.200	Peak	43.75	0.99	44.74	74.00	-29.26
2355.200	Average	31.27	0.99	32.26	54.00	-21.74
2377.100	Peak	45.22	0.94	46.17	74.00	-27.83
2377.100	Average	31.29	0.94	32.23	54.00	-21.77
2390.000	Peak	47.92	0.92	48.84	74.00	-25.16
2390.000	Average	31.70	0.92	32.62	54.00	-21.38

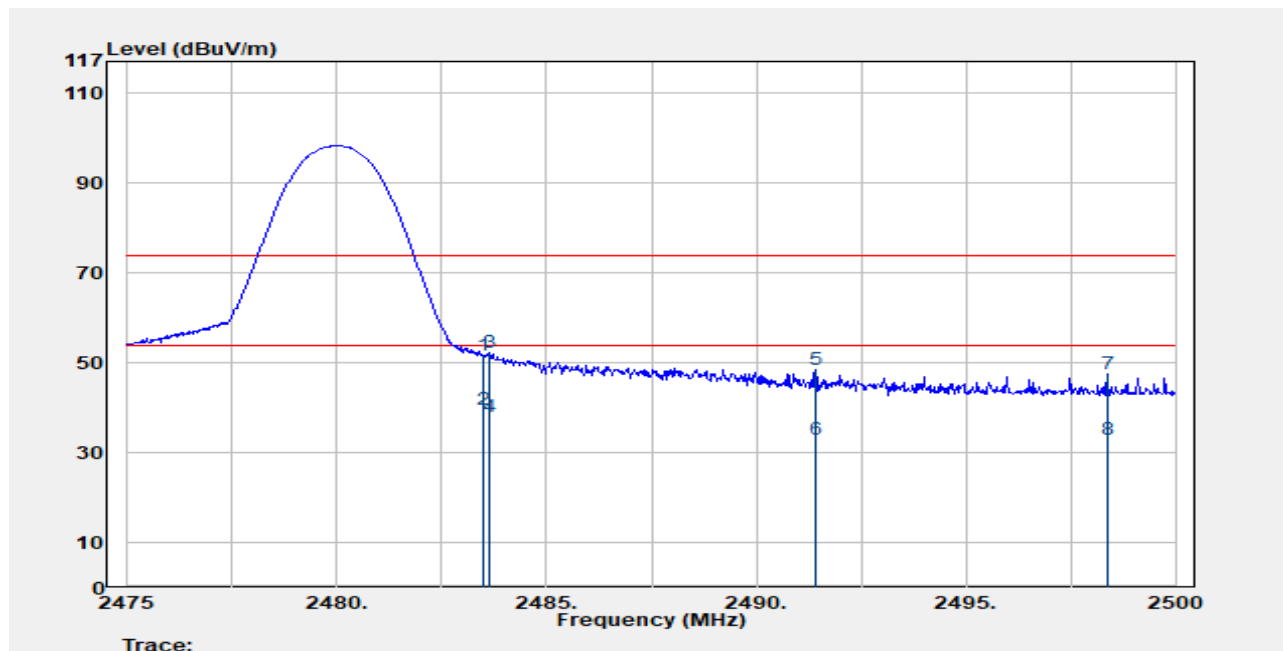
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 Operation Mode :BT EDR(3M)
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Peak	51.07	0.67	51.74	74.00	-22.26
2483.500	Average	39.11	0.67	39.78	54.00	-14.22
2483.625	Peak	51.59	0.67	52.26	74.00	-21.74
2483.625	Average	37.25	0.67	37.92	54.00	-16.08
2491.425	Peak	47.77	0.64	48.40	74.00	-25.60
2491.425	Average	32.34	0.64	32.98	54.00	-21.02
2498.375	Peak	47.04	0.61	47.66	74.00	-26.34
2498.375	Average	32.21	0.61	32.82	54.00	-21.18

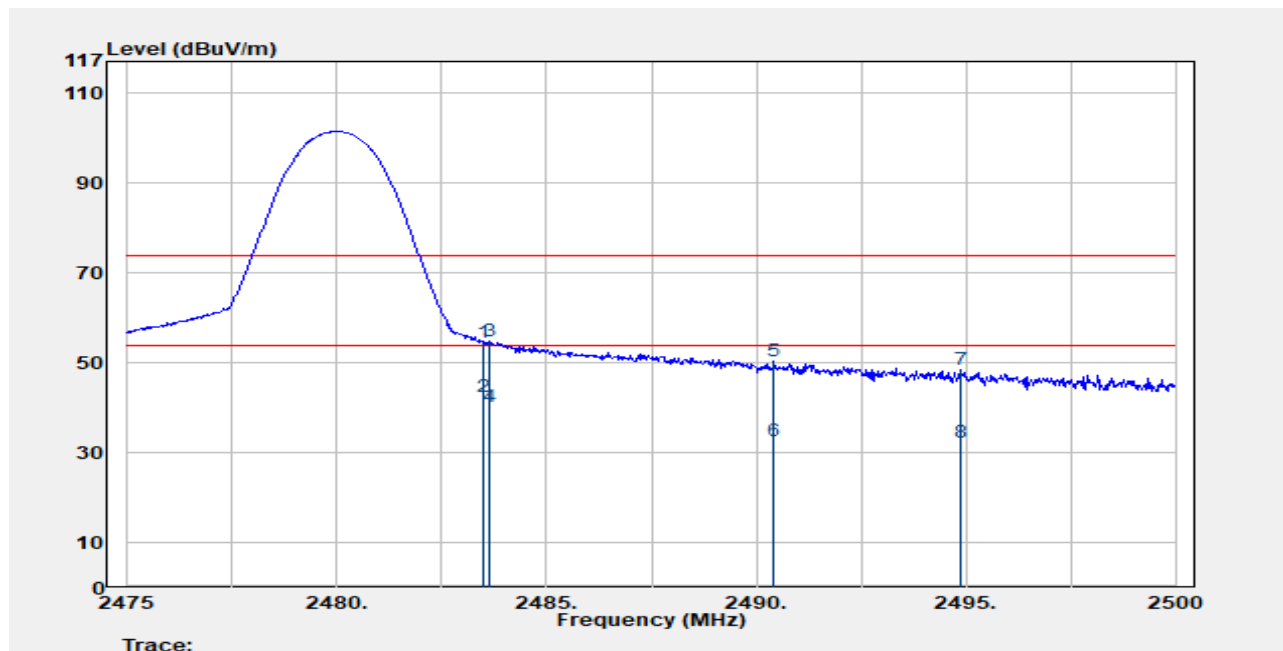
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Report Number :ER-2021-90003
 Operation Mode :BT EDR(3M)
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



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	Peak	53.75	0.67	54.42	74.00	-19.58
2483.500	Average	41.80	0.67	42.47	54.00	-11.53
2483.625	Peak	54.09	0.67	54.76	74.00	-19.24
2483.625	Average	39.73	0.67	40.40	54.00	-13.60
2490.425	Peak	49.85	0.64	50.49	74.00	-23.51
2490.425	Average	32.03	0.64	32.67	54.00	-21.33
2494.875	Peak	47.92	0.63	48.55	74.00	-25.45
2494.875	Average	31.77	0.63	32.40	54.00	-21.60

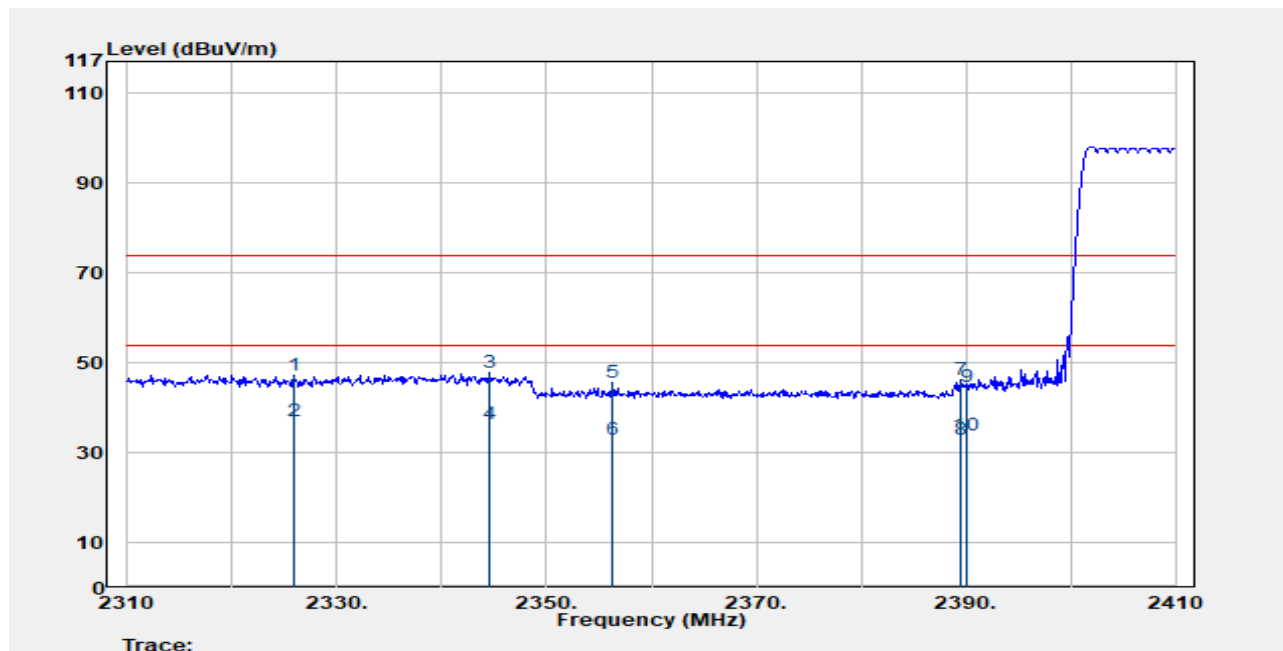
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Report Number :ER-2021-90003
 Operation Mode :BT BR + Hopping
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2325.900	Peak	46.05	1.10	47.15	74.00	-26.85
2325.900	Average	36.03	1.10	37.13	54.00	-16.87
2344.600	Peak	46.80	1.02	47.83	74.00	-26.17
2344.600	Average	35.53	1.02	36.55	54.00	-17.45
2356.300	Peak	44.55	0.99	45.54	74.00	-28.46
2356.300	Average	31.83	0.99	32.82	54.00	-21.18
2389.600	Peak	45.47	0.92	46.39	74.00	-27.61
2389.600	Average	32.03	0.92	32.95	54.00	-21.05
2390.000	Peak	43.82	0.92	44.74	74.00	-29.26
2390.000	Average	33.02	0.92	33.94	54.00	-20.06

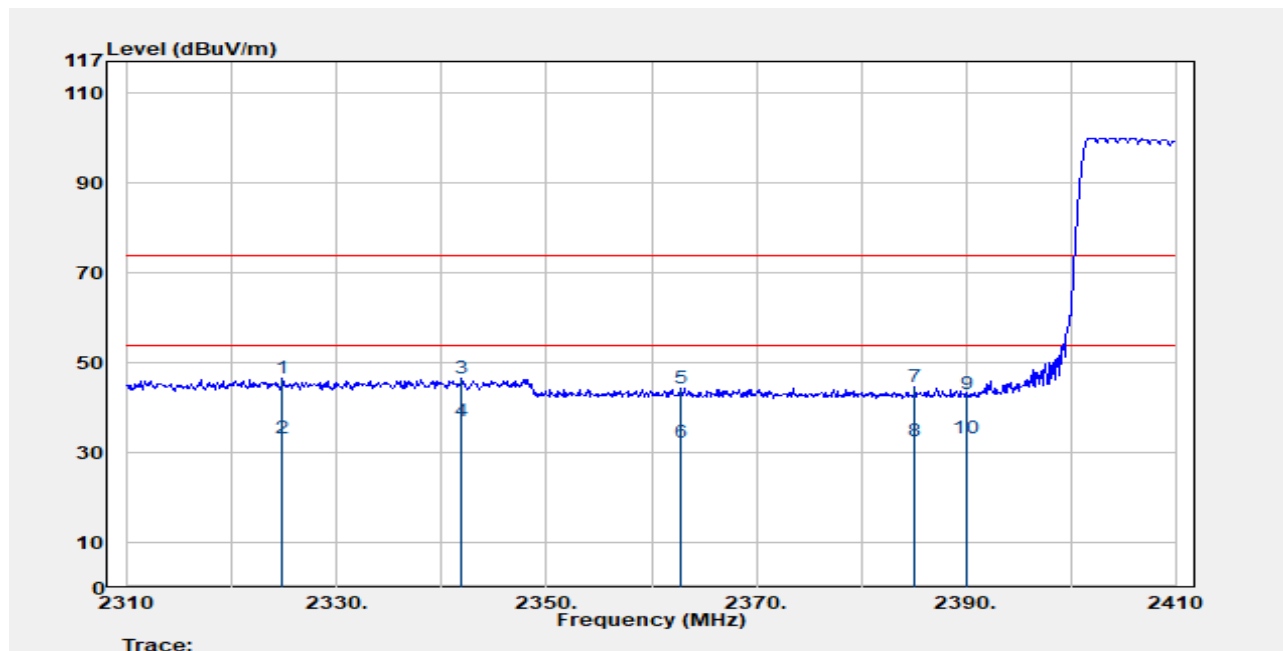
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Report Number :ER-2021-90003
 Operation Mode :BT BR + Hopping
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2324.800	Peak	45.42	1.10	46.53	74.00	-27.47
2324.800	Average	32.03	1.10	33.13	54.00	-20.87
2341.900	Peak	45.51	1.03	46.55	74.00	-27.45
2341.900	Average	36.20	1.03	37.23	54.00	-16.77
2362.700	Peak	43.40	0.97	44.38	74.00	-29.62
2362.700	Average	31.44	0.97	32.41	54.00	-21.59
2385.100	Peak	43.90	0.93	44.82	74.00	-29.18
2385.100	Average	31.65	0.93	32.58	54.00	-21.42
2390.000	Peak	42.34	0.92	43.25	74.00	-30.75
2390.000	Average	32.33	0.92	33.25	54.00	-20.75

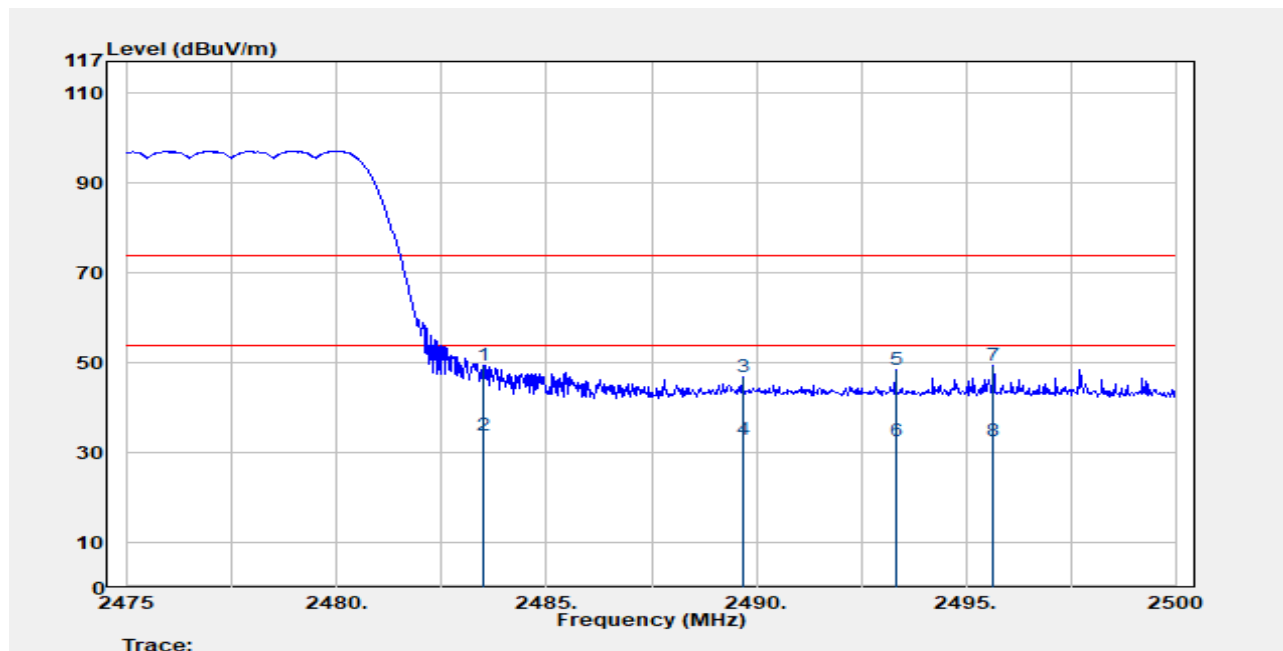
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Report Number :ER-2021-90003
 Operation Mode :BT BR + Hopping
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Peak	48.86	0.67	49.53	74.00	-24.47
2483.500	Average	33.12	0.67	33.79	54.00	-20.21
2489.675	Peak	46.27	0.65	46.92	74.00	-27.08
2489.675	Average	32.18	0.65	32.83	54.00	-21.17
2493.325	Peak	47.84	0.63	48.47	74.00	-25.53
2493.325	Average	31.93	0.63	32.56	54.00	-21.44
2495.650	Peak	48.87	0.62	49.49	74.00	-24.51
2495.650	Average	32.11	0.62	32.73	54.00	-21.27

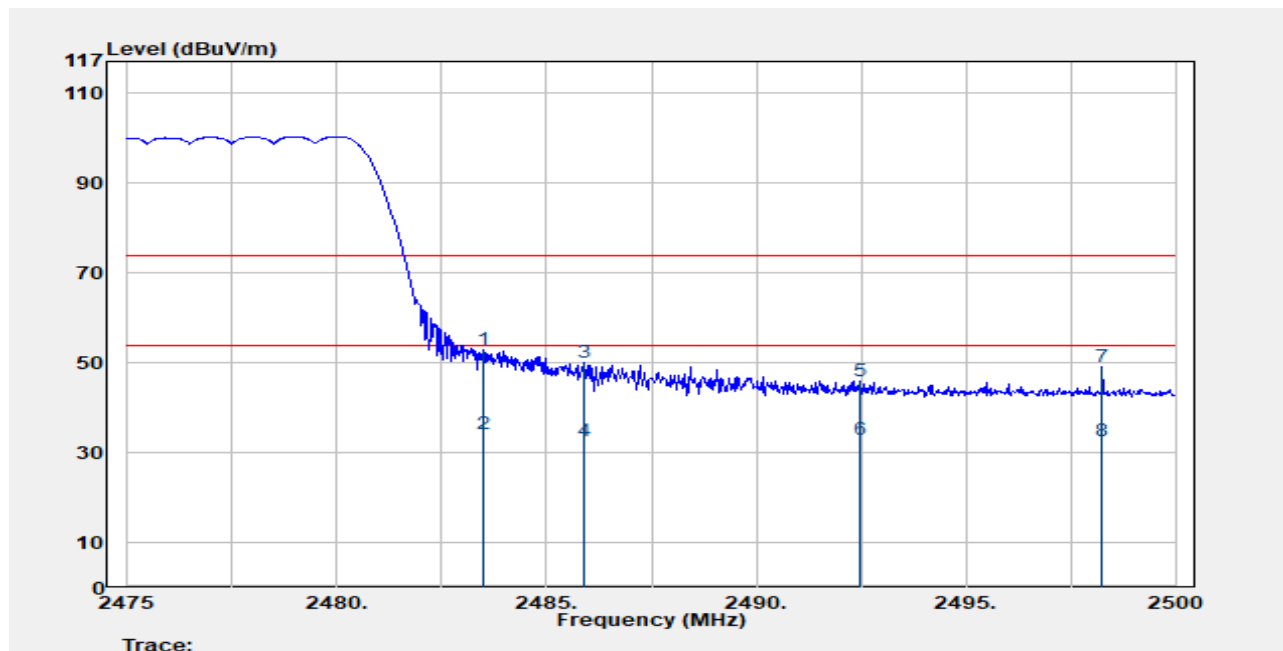
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Report Number :ER-2021-90003
 Operation Mode :BT BR + Hopping
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



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	Peak	52.41	0.67	53.08	74.00	-20.92
2483.500	Average	33.52	0.67	34.19	54.00	-19.81
2485.900	Peak	49.55	0.66	50.21	74.00	-23.79
2485.900	Average	32.11	0.66	32.77	54.00	-21.23
2492.475	Peak	45.50	0.63	46.13	74.00	-27.87
2492.475	Average	32.32	0.63	32.95	54.00	-21.05
2498.250	Peak	48.39	0.61	49.00	74.00	-25.00
2498.250	Average	32.14	0.61	32.75	54.00	-21.25

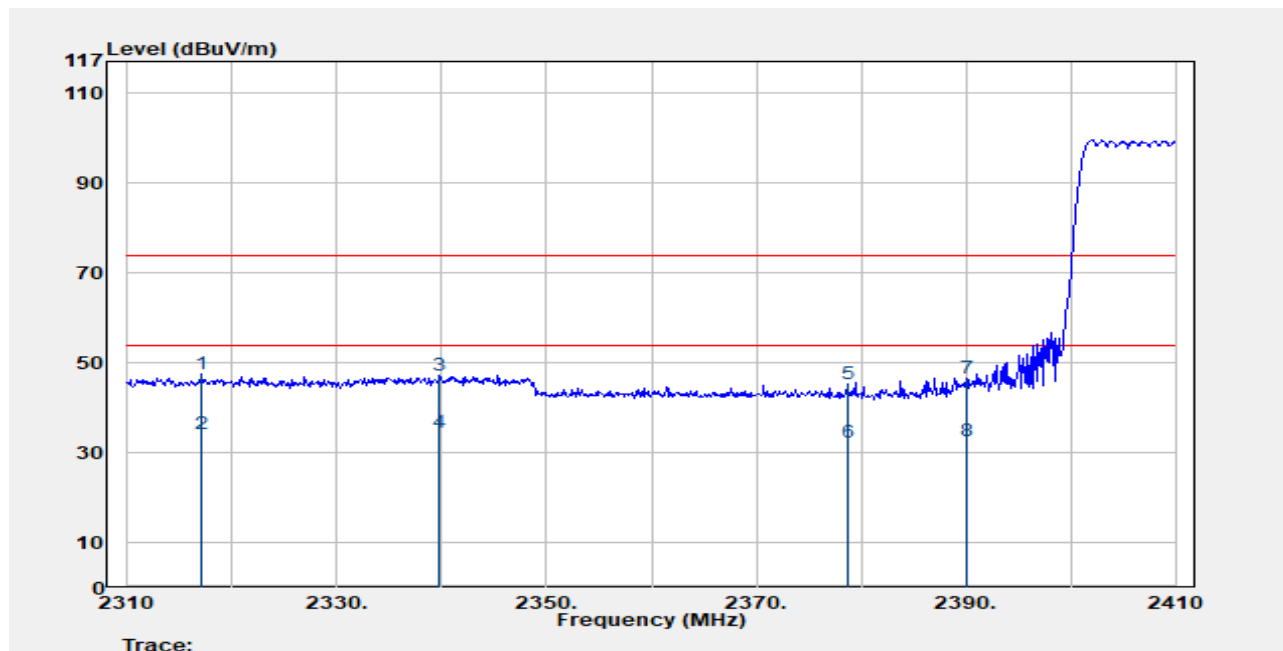
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Report Number :ER-2021-90003
 Operation Mode :BT EDR(3M) + Hopping
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2317.100	Peak	46.34	1.14	47.47	74.00	-26.53
2317.100	Average	33.26	1.14	34.40	54.00	-19.60
2339.800	Peak	46.14	1.04	47.18	74.00	-26.82
2339.800	Average	33.36	1.04	34.40	54.00	-19.60
2378.700	Peak	44.47	0.94	45.41	74.00	-28.59
2378.700	Average	31.53	0.94	32.47	54.00	-21.53
2390.000	Peak	45.85	0.92	46.76	74.00	-27.24
2390.000	Average	31.64	0.92	32.56	54.00	-21.44

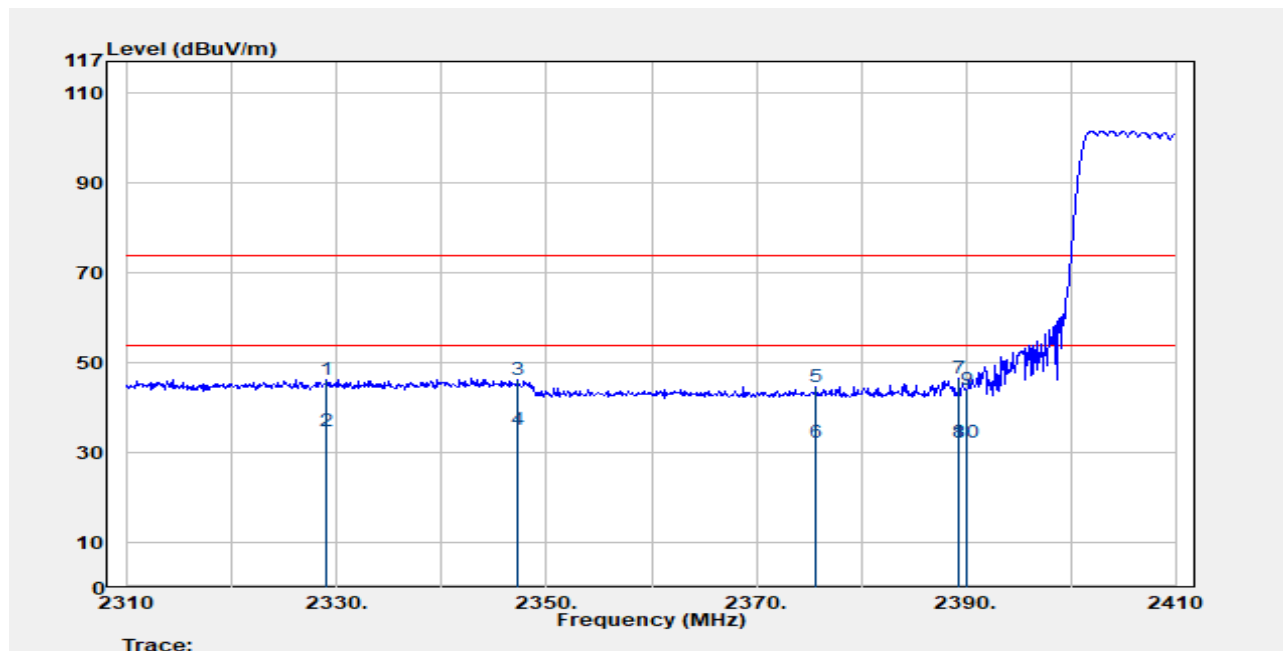
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Report Number :ER-2021-90003
 Operation Mode :BT EDR(3M) + Hopping
 Test Frequency :2402 MHz
 Test Mode :Bandedge CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2329.000	Peak	45.35	1.09	46.44	74.00	-27.56
2329.000	Average	33.70	1.09	34.79	54.00	-19.21
2347.300	Peak	45.22	1.01	46.24	74.00	-27.76
2347.300	Average	34.34	1.01	35.35	54.00	-18.65
2375.700	Peak	43.74	0.95	44.68	74.00	-29.32
2375.700	Average	31.35	0.95	32.30	54.00	-21.70
2389.400	Peak	45.76	0.92	46.67	74.00	-27.33
2389.400	Average	31.42	0.92	32.34	54.00	-21.66
2390.000	Peak	43.28	0.92	44.19	74.00	-29.81
2390.000	Average	31.57	0.92	32.49	54.00	-21.51

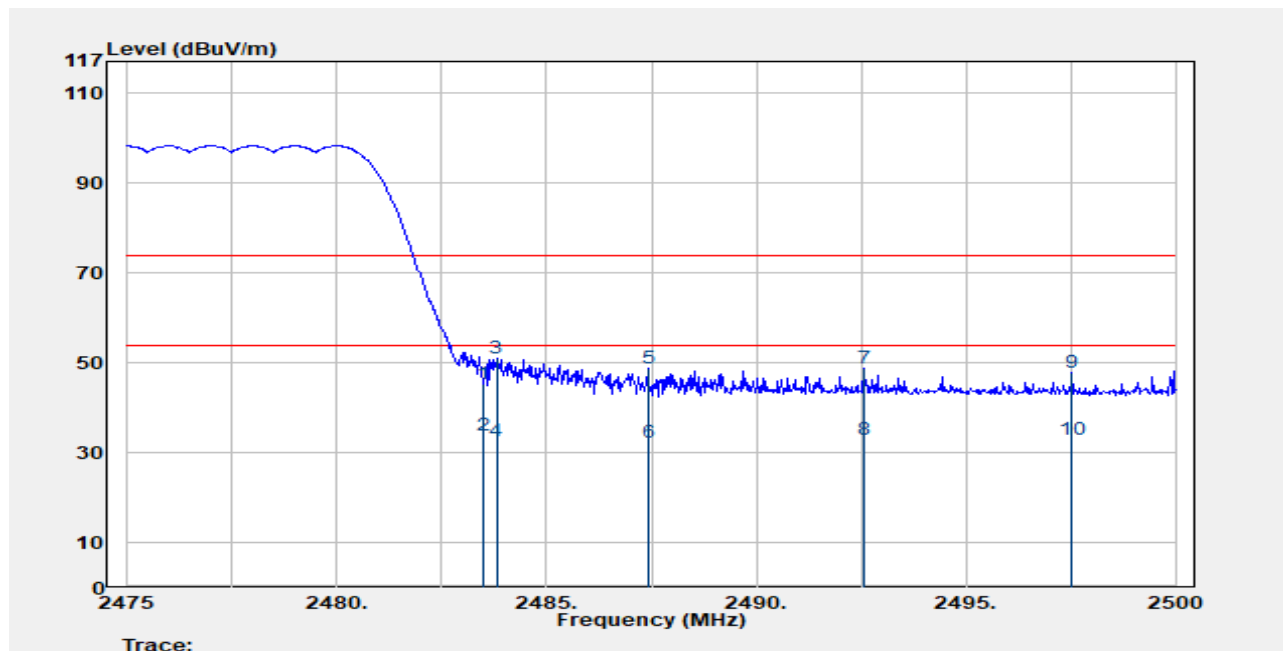
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Report Number :ER-2021-90003
 Operation Mode :BT EDR(3M) + Hopping
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Peak	44.73	0.67	45.40	74.00	-28.60
2483.500	Average	33.11	0.67	33.78	54.00	-20.22
2483.800	Peak	50.36	0.67	51.02	74.00	-22.98
2483.800	Average	31.91	0.67	32.58	54.00	-21.42
2487.425	Peak	48.26	0.65	48.91	74.00	-25.09
2487.425	Average	31.66	0.65	32.31	54.00	-21.69
2492.550	Peak	48.14	0.63	48.78	74.00	-25.22
2492.550	Average	32.42	0.63	33.05	54.00	-20.95
2497.525	Peak	47.26	0.62	47.87	74.00	-26.13
2497.525	Average	32.32	0.62	32.94	54.00	-21.06

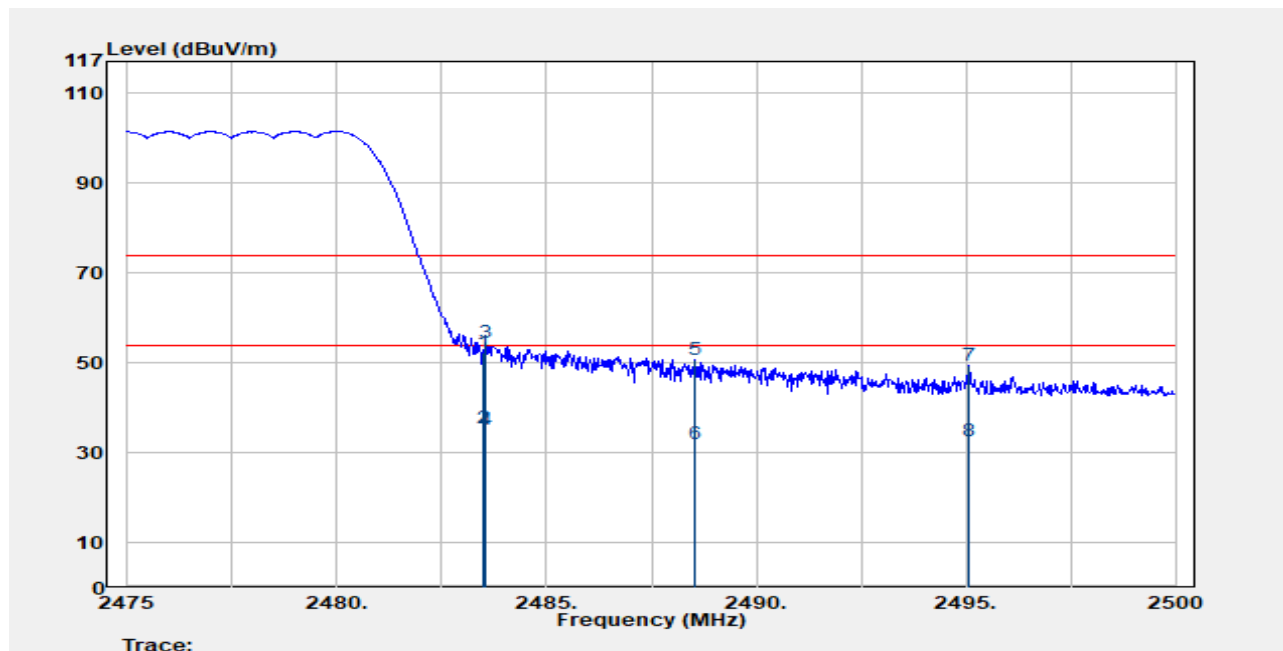
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Report Number :ER-2021-90003
 Operation Mode :BT EDR(3M) + Hopping
 Test Frequency :2480 MHz
 Test Mode :Bandedge CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.9/65
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
2483.500	Peak	51.56	0.67	52.23	74.00	-21.77
2483.500	Average	34.97	0.67	35.64	54.00	-18.36
2483.550	Peak	53.96	0.67	54.63	74.00	-19.37
2483.550	Average	34.60	0.67	35.27	54.00	-18.73
2488.525	Peak	50.10	0.65	50.75	74.00	-23.25
2488.525	Average	31.38	0.65	32.03	54.00	-21.97
2495.075	Peak	48.68	0.62	49.31	74.00	-24.69
2495.075	Average	32.09	0.62	32.71	54.00	-21.29

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10.7.2 Radiated Spurious Emission

Report Number :ER-2021-90003

Operation Mode :BT BR

Test Frequency :2441 MHz

Test Mode :Tx CH Mid

EUT Pol :E2 Plane

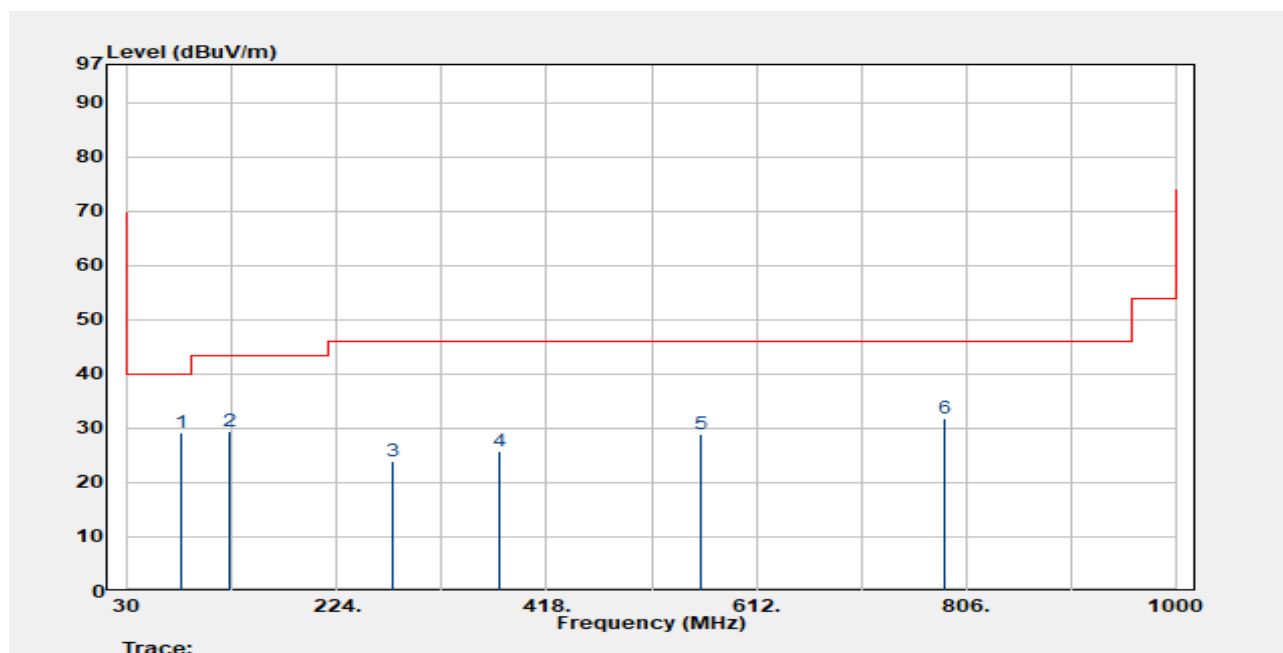
Test Site :SAC 3

Test Date :2021-11-01

Temp./Humi. :25.8/66

Antenna Pol. :Vertical

Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
80.440	Peak	41.46	-12.15	29.31	40.00	-10.69
125.060	Peak	38.71	-9.19	29.52	43.50	-13.98
275.410	Peak	30.87	-6.82	24.05	46.00	-21.95
374.350	Peak	30.56	-4.67	25.89	46.00	-20.11
560.590	Peak	30.12	-1.24	28.88	46.00	-17.12
785.630	Peak	29.35	2.39	31.74	46.00	-14.26

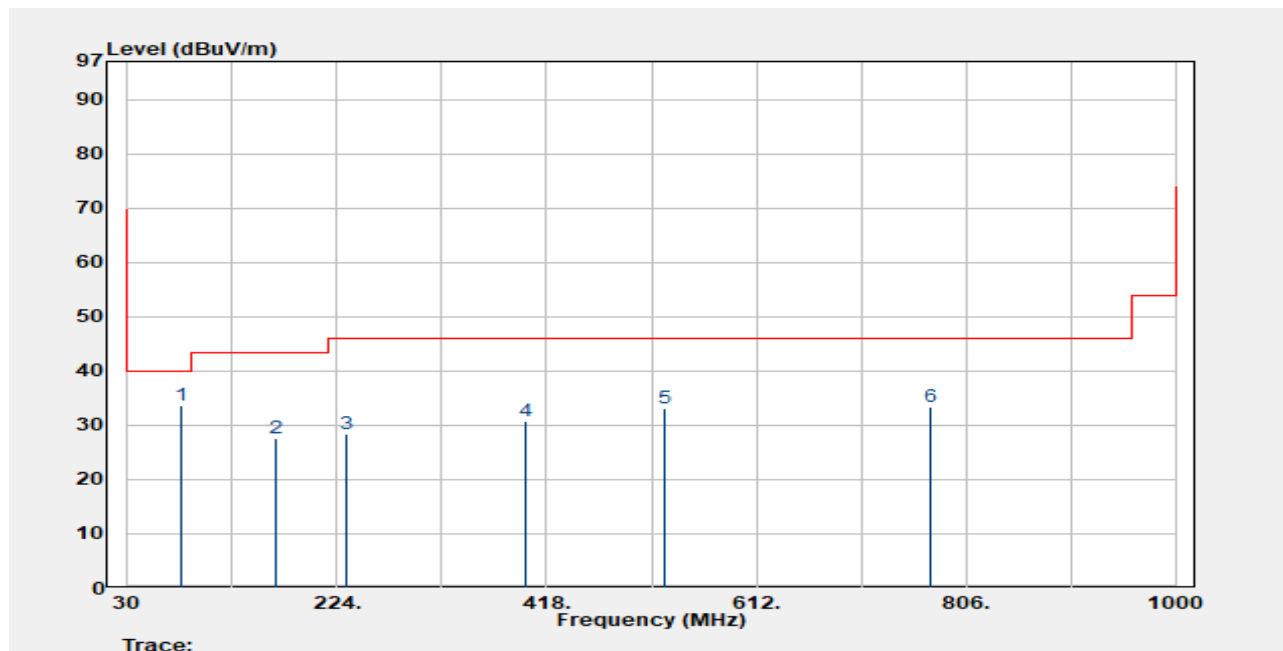
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
80.440	Peak	45.73	-12.15	33.58	40.00	-6.42
166.770	Peak	35.07	-7.53	27.54	43.50	-15.96
232.730	Peak	37.03	-8.71	28.32	46.00	-17.68
398.600	Peak	35.16	-4.36	30.80	46.00	-15.20
527.610	Peak	35.80	-2.71	33.09	46.00	-12.91
773.990	Peak	31.32	2.13	33.45	46.00	-12.55

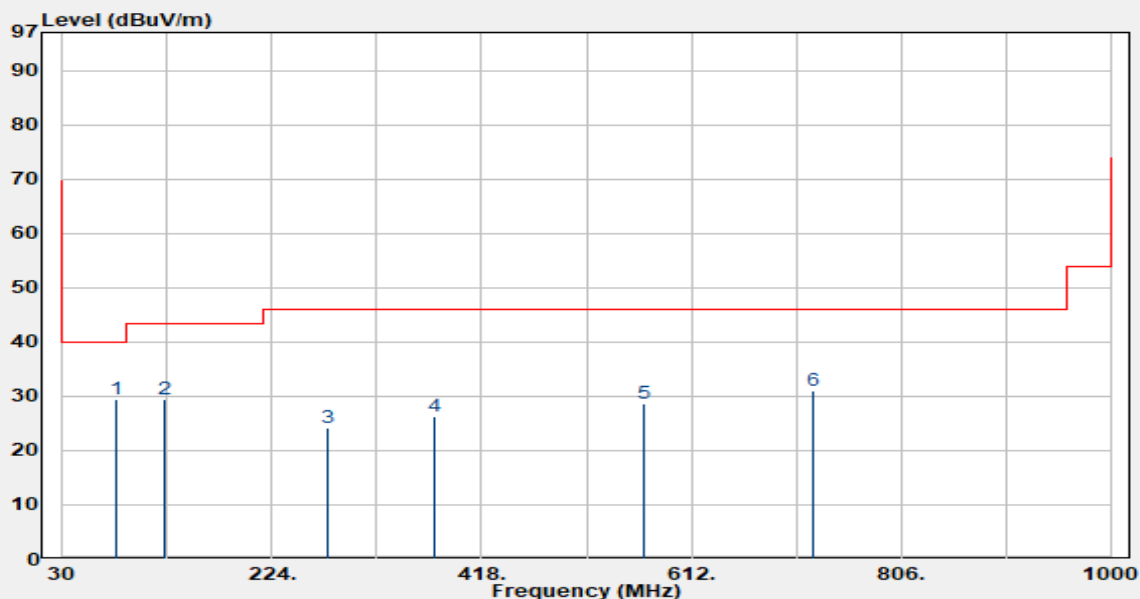
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
80.440	Peak	41.61	-12.15	29.46	40.00	-10.54
125.060	Peak	38.71	-9.19	29.52	43.50	-13.98
275.410	Peak	30.90	-6.82	24.08	46.00	-21.92
373.380	Peak	30.88	-4.68	26.20	46.00	-19.80
567.380	Peak	29.39	-0.86	28.52	46.00	-17.48
724.520	Peak	29.63	1.51	31.14	46.00	-14.86

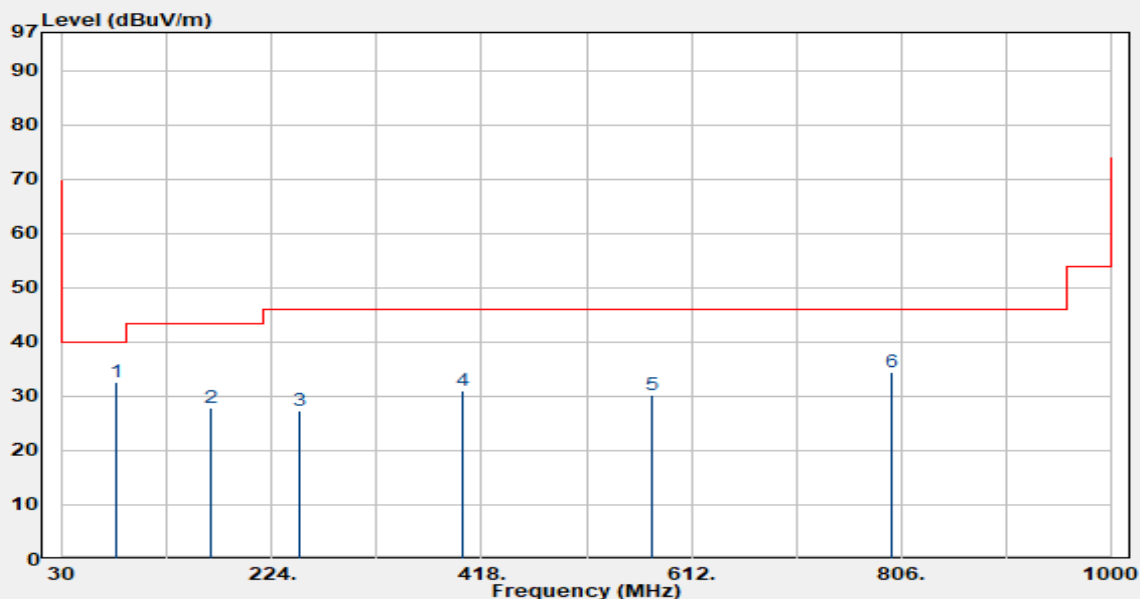
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
80.440	Peak	44.80	-12.15	32.65	40.00	-7.35
166.770	Peak	35.27	-7.53	27.74	43.50	-15.76
249.220	Peak	35.19	-7.92	27.28	46.00	-18.72
399.570	Peak	35.35	-4.38	30.97	46.00	-15.03
576.110	Peak	30.59	-0.42	30.17	46.00	-15.83
798.240	Peak	31.73	2.77	34.50	46.00	-11.50

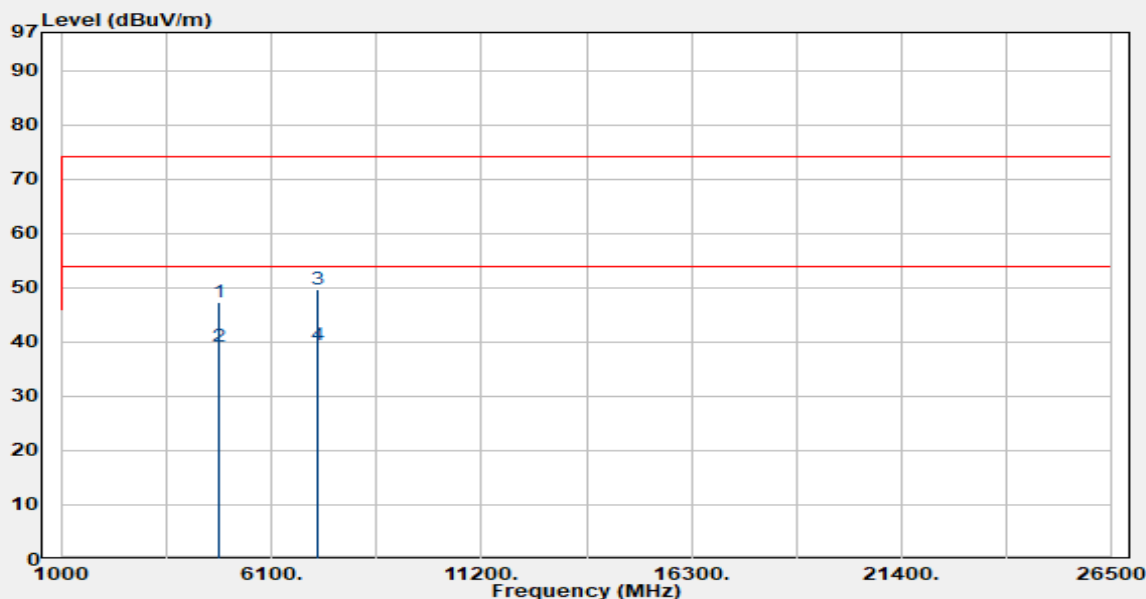
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4804.000	Peak	40.20	7.14	47.34	74.00	-26.66
4804.000	Average	32.05	7.14	39.19	54.00	-14.81
7206.000	Peak	35.01	14.60	49.61	74.00	-24.39
7206.000	Average	24.76	14.60	39.36	54.00	-14.64

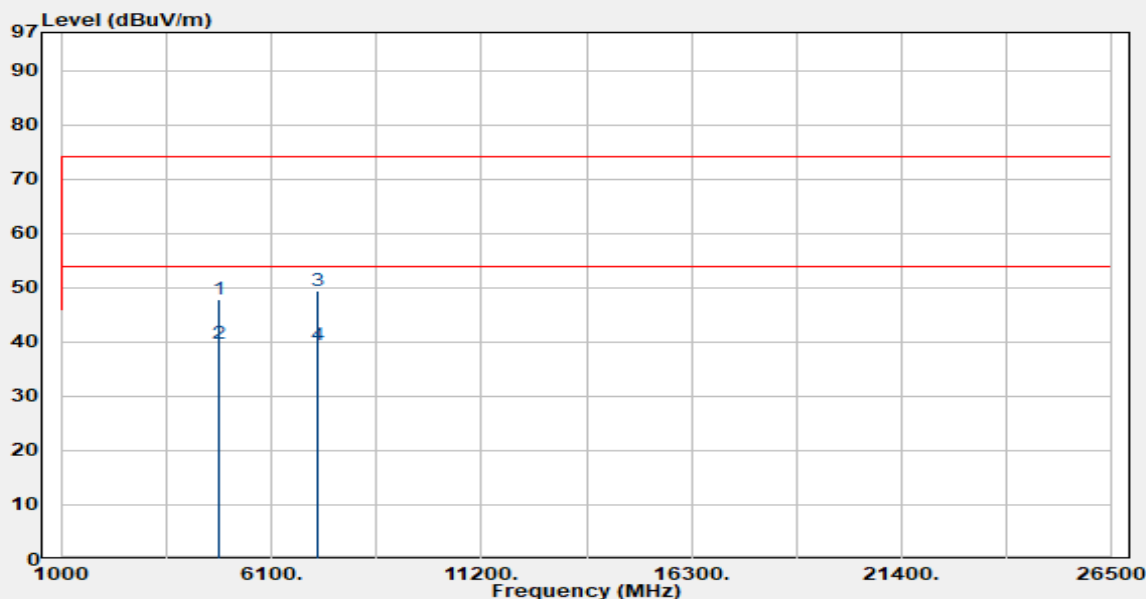
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2402 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4804.000	Peak	40.71	7.14	47.85	74.00	-26.15
4804.000	Average	32.62	7.14	39.76	54.00	-14.24
7206.000	Peak	34.73	14.60	49.34	74.00	-24.66
7206.000	Average	24.92	14.60	39.52	54.00	-14.48

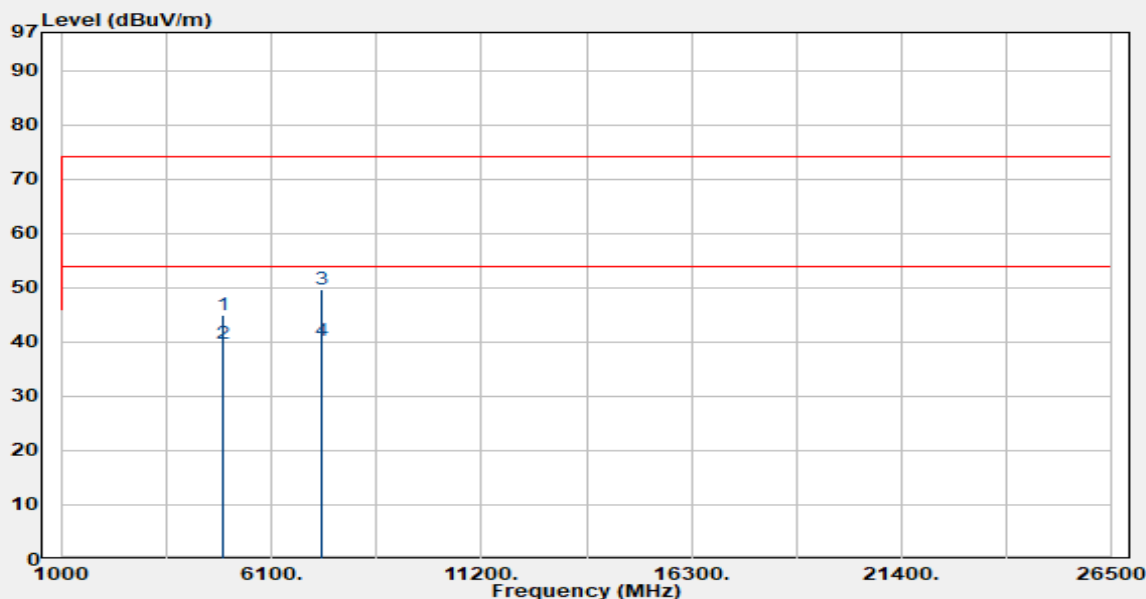
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4882.000	Peak	37.33	7.64	44.98	74.00	-29.02
4882.000	Average	31.92	7.64	39.56	54.00	-14.44
7323.000	Peak	34.53	15.27	49.80	74.00	-24.20
7323.000	Average	24.90	15.27	40.17	54.00	-13.83

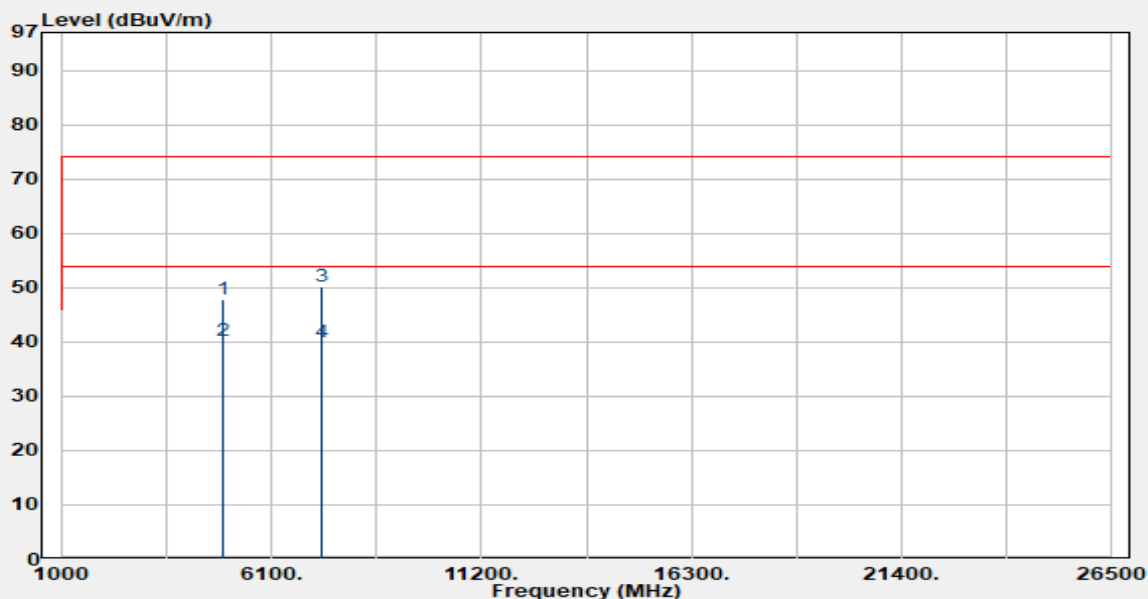
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4882.000	Peak	40.23	7.64	47.87	74.00	-26.13
4882.000	Average	32.61	7.64	40.25	54.00	-13.75
7323.000	Peak	34.99	15.27	50.26	74.00	-23.74
7323.000	Average	24.58	15.27	39.85	54.00	-14.15

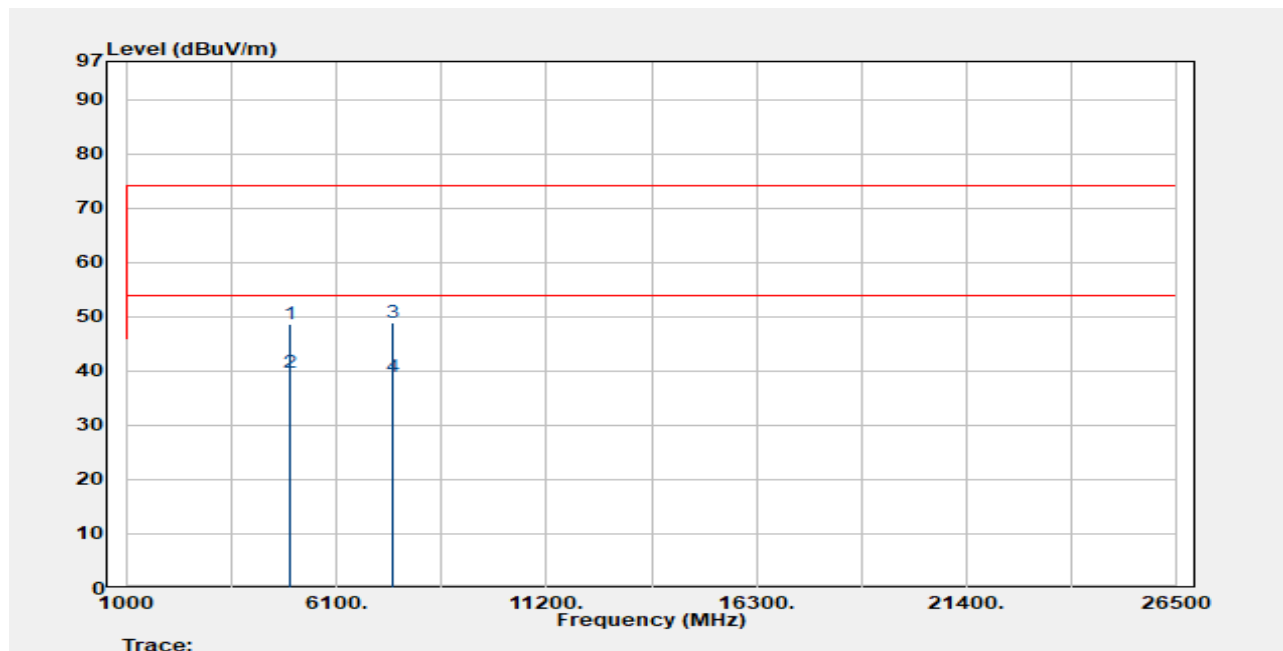
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :Tx CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Peak	40.65	7.95	48.60	74.00	-25.40
4960.000	Average	31.82	7.95	39.77	54.00	-14.23
7440.000	Peak	34.15	14.61	48.77	74.00	-25.23
7440.000	Average	24.29	14.61	38.90	54.00	-15.10

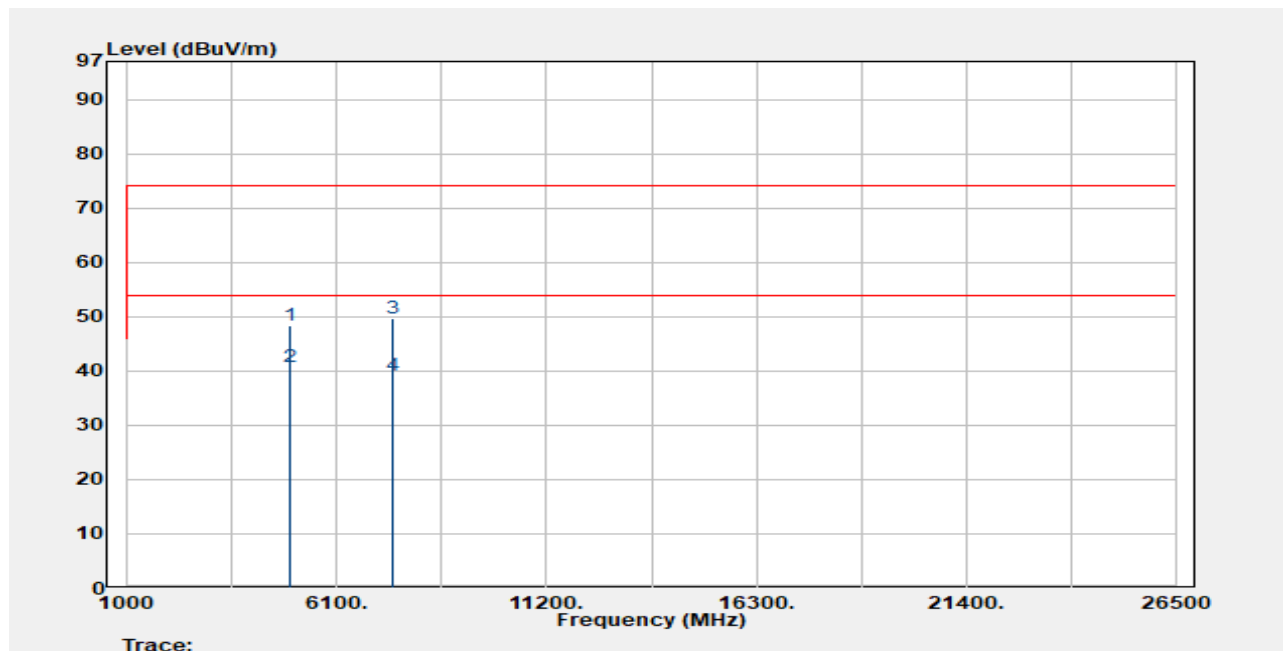
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Report Number :ER-2021-90003
 Operation Mode :BT BR
 Test Frequency :2480 MHz
 Test Mode :Tx CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Peak	40.44	7.95	48.39	74.00	-25.61
4960.000	Average	32.74	7.95	40.69	54.00	-13.31
7440.000	Peak	35.02	14.61	49.64	74.00	-24.36
7440.000	Average	24.67	14.61	39.28	54.00	-14.72

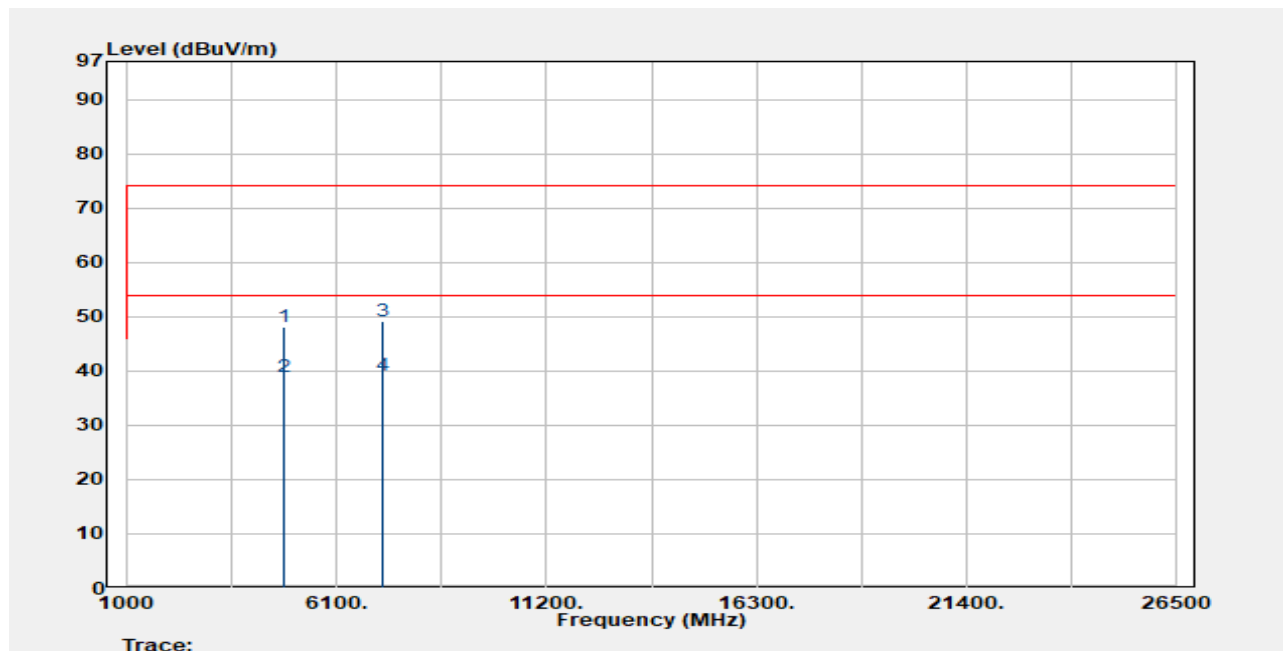
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2402 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



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	Peak	40.90	7.14	48.04	74.00	-25.96
4804.000	Average	31.86	7.14	39.00	54.00	-15.00
7206.000	Peak	34.60	14.60	49.20	74.00	-24.80
7206.000	Average	24.65	14.60	39.25	54.00	-14.75

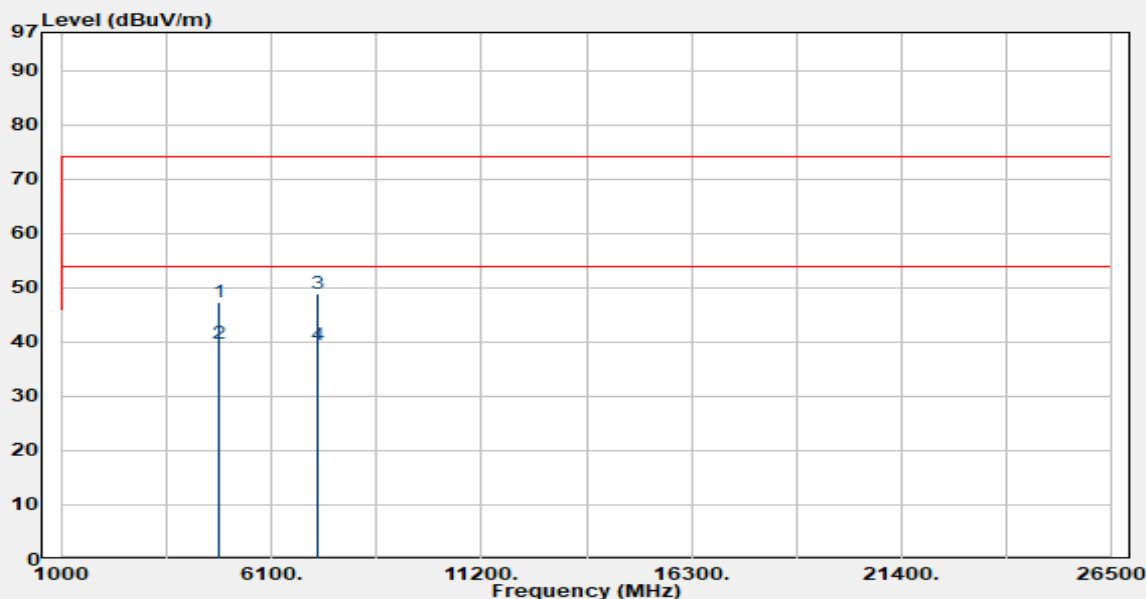
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2402 MHz
 Test Mode :Tx CH Low
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



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	Peak	40.13	7.14	47.27	74.00	-26.73
4804.000	Average	32.44	7.14	39.58	54.00	-14.42
7206.000	Peak	34.36	14.60	48.96	74.00	-25.04
7206.000	Average	24.76	14.60	39.36	54.00	-14.64

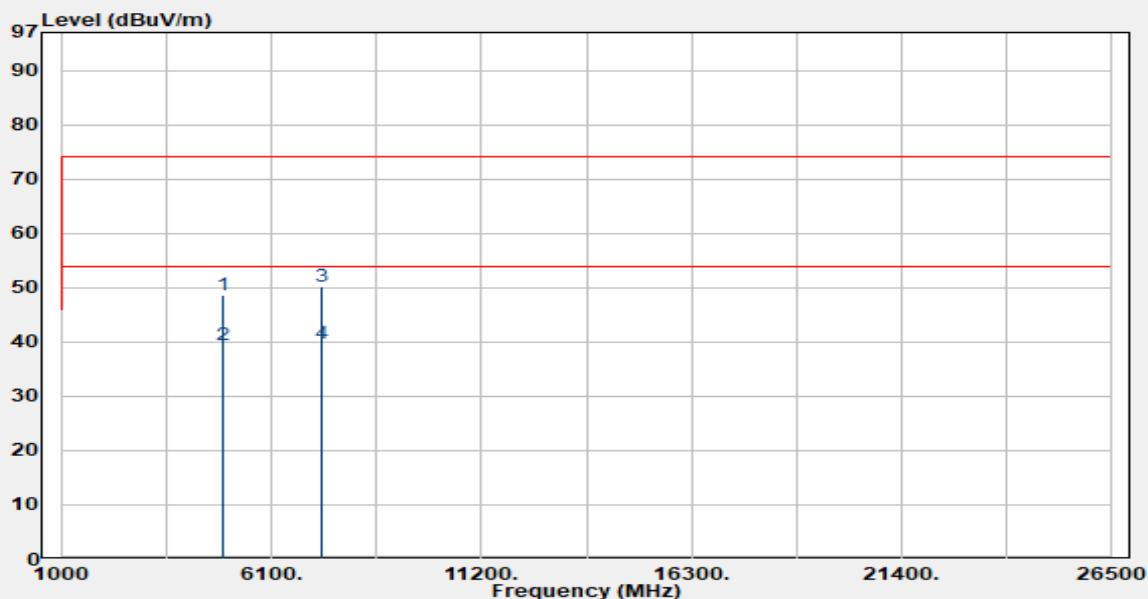
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4882.000	Peak	40.89	7.64	48.53	74.00	-25.47
4882.000	Average	31.68	7.64	39.32	54.00	-14.68
7323.000	Peak	35.06	15.27	50.33	74.00	-23.67
7323.000	Average	24.42	15.27	39.69	54.00	-14.31

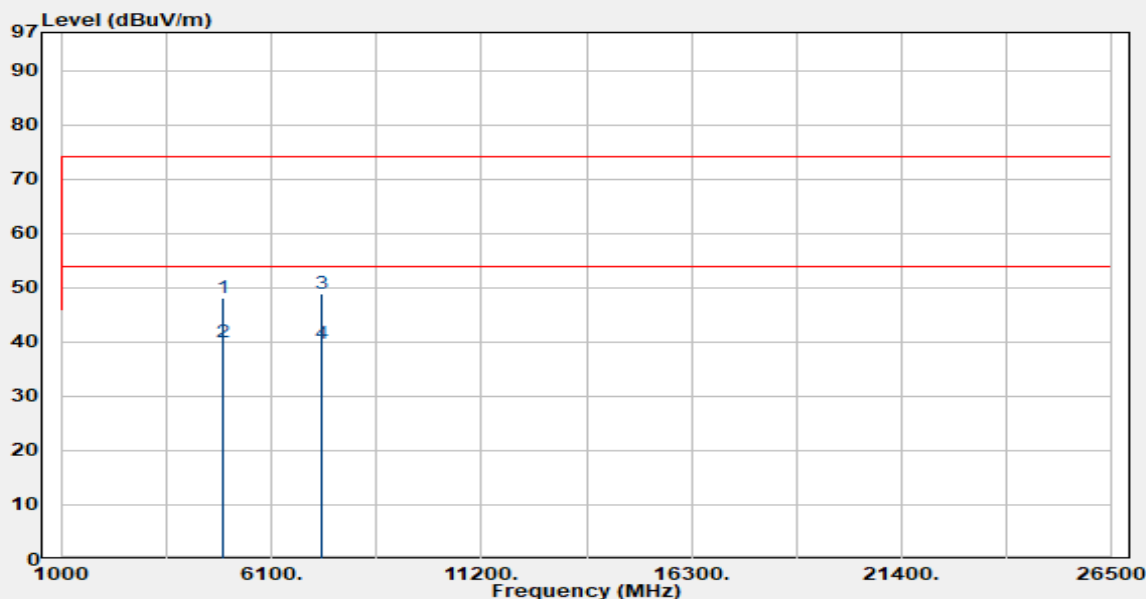
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2441 MHz
 Test Mode :Tx CH Mid
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4882.000	Peak	40.45	7.64	48.09	74.00	-25.91
4882.000	Average	32.35	7.64	39.99	54.00	-14.01
7323.000	Peak	33.75	15.27	49.02	74.00	-24.98
7323.000	Average	24.43	15.27	39.70	54.00	-14.30

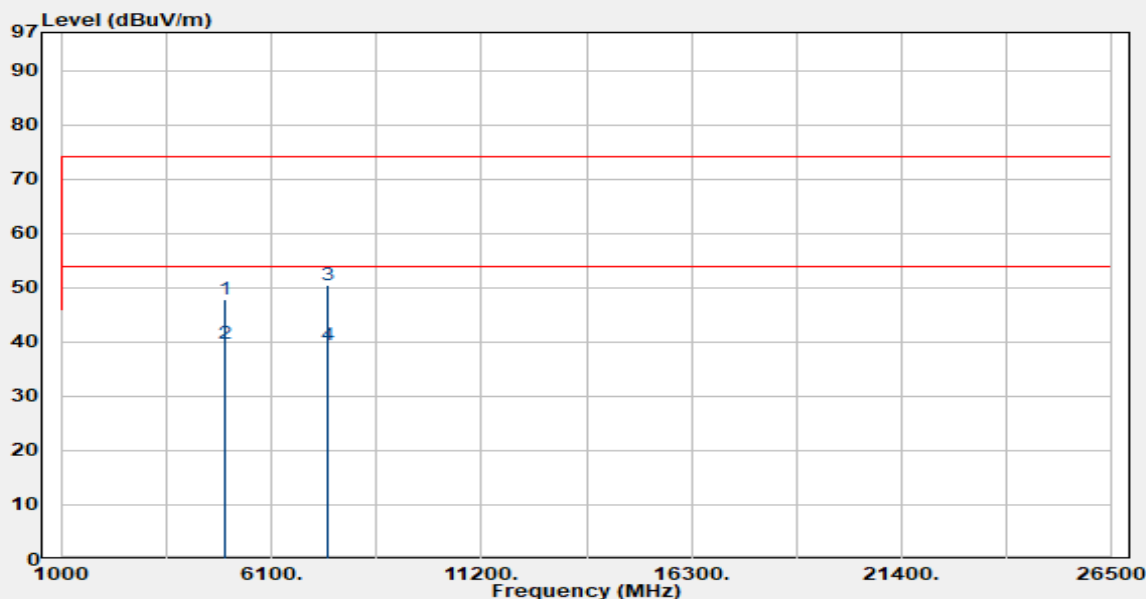
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2480 MHz
 Test Mode :Tx CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Vertical
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Peak	39.78	7.95	47.73	74.00	-26.27
4960.000	Average	31.82	7.95	39.77	54.00	-14.23
7440.000	Peak	35.94	14.61	50.56	74.00	-23.44
7440.000	Average	24.82	14.61	39.43	54.00	-14.57

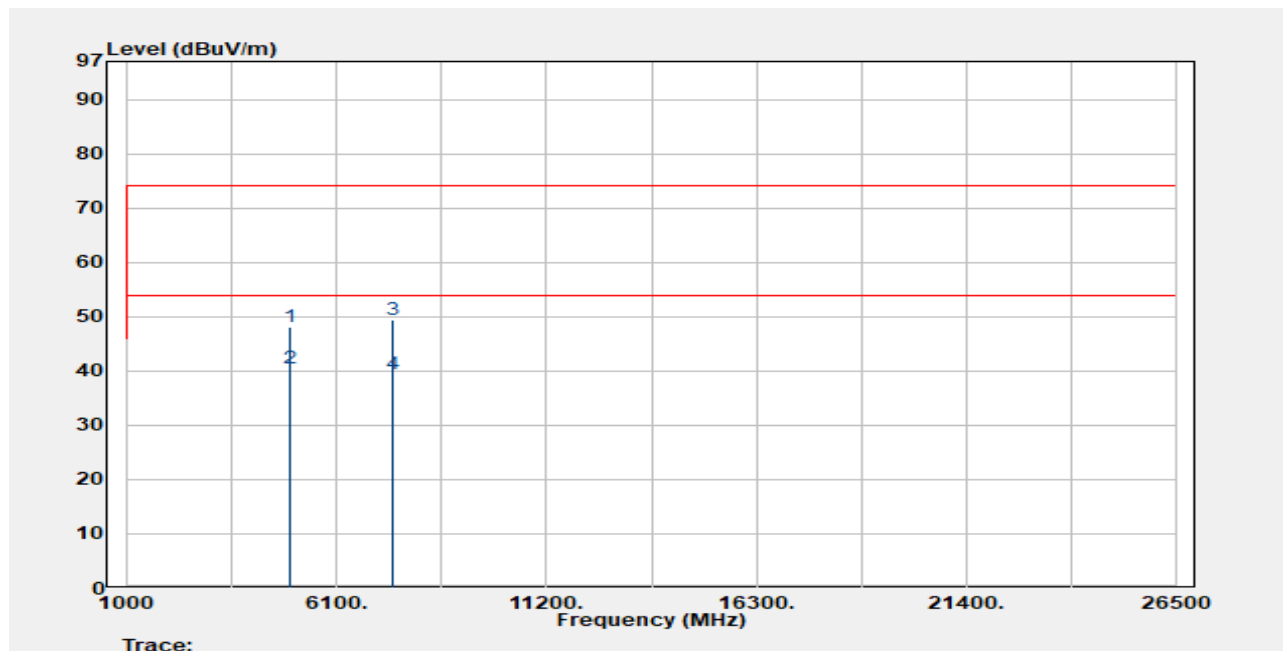
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Report Number :ER-2021-90003
 Operation Mode :BT EDR (3M)
 Test Frequency :2480 MHz
 Test Mode :Tx CH High
 EUT Pol :E2 Plane

Test Site :SAC 3
 Test Date :2021-11-01
 Temp./Humi. :25.8/66
 Antenna Pol. :Horizontal
 Engineer :Jack Liu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
4960.000	Peak	40.18	7.95	48.13	74.00	-25.87
4960.000	Average	32.61	7.95	40.56	54.00	-13.44
7440.000	Peak	34.68	14.61	49.30	74.00	-24.70
7440.000	Average	24.83	14.61	39.44	54.00	-14.56

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11 FREQUENCY SEPARATION

11.1 Standard Applicable

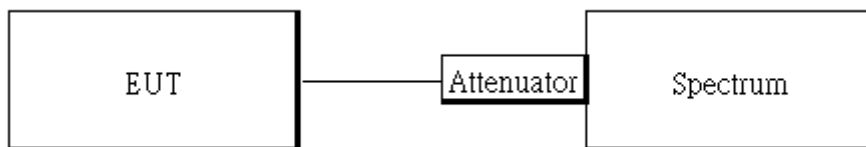
Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

11.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

Note: N.C.R refers to No calibration required

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 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.

11.5 Measurement Result

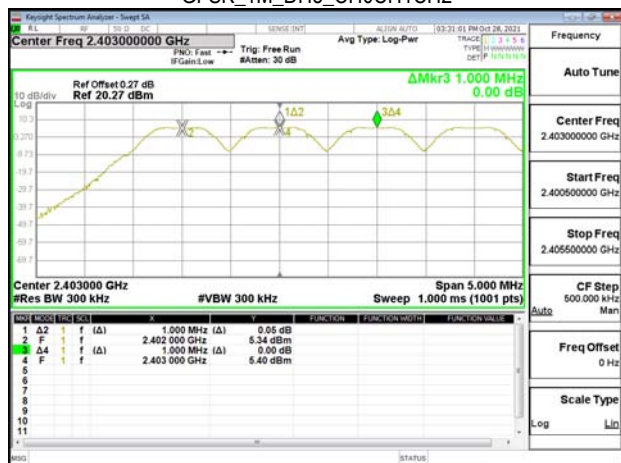
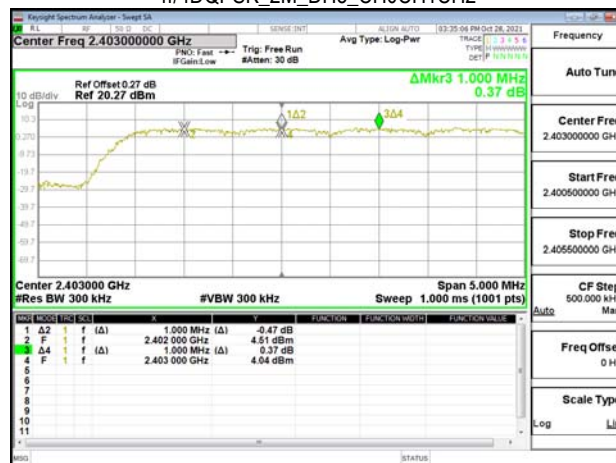
Channel separation (MHz)	Limit	Result
1	$\geq 25\text{ kHz}$ or $2/3\text{ times } 20\text{dB bandwidth}$	PASS

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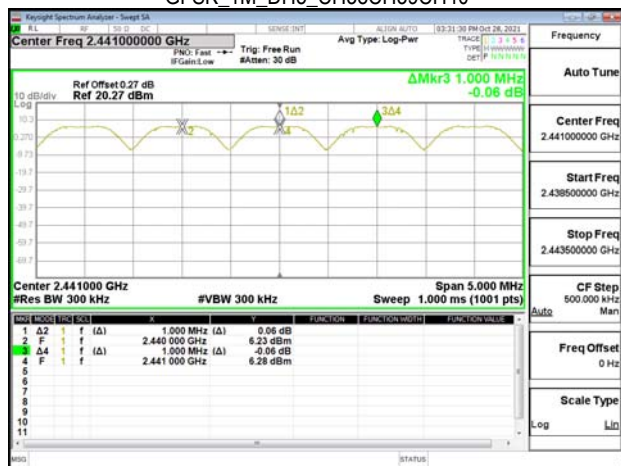
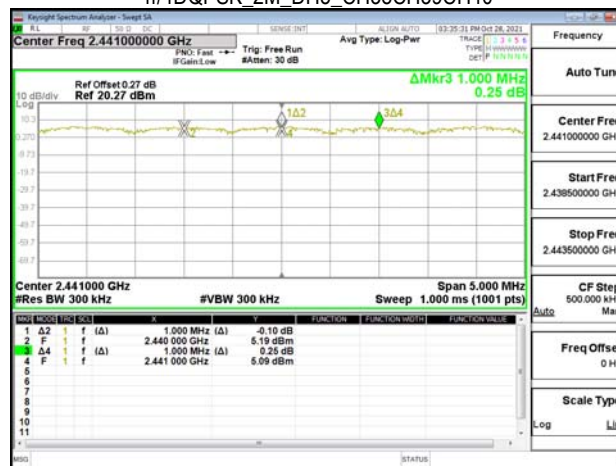
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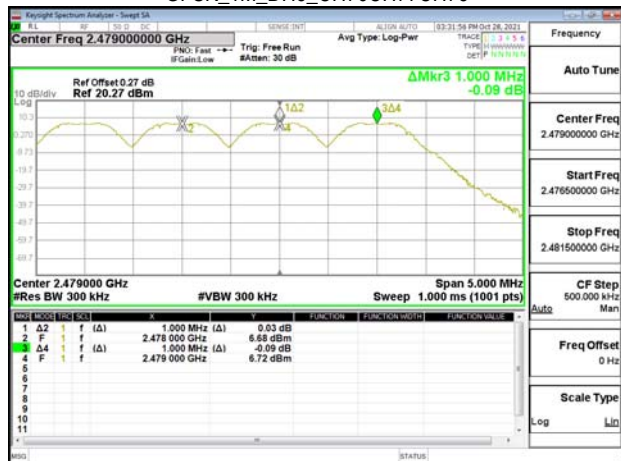
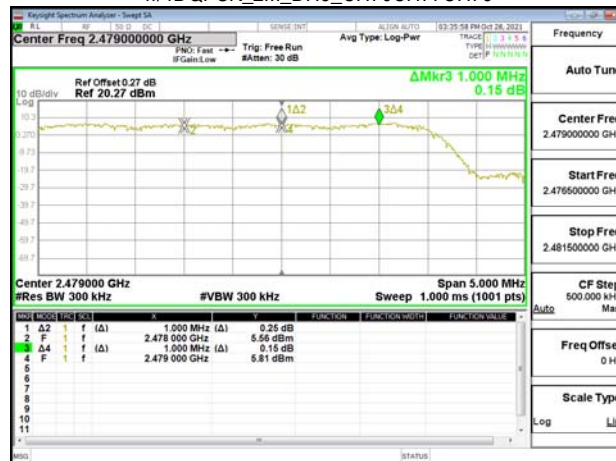
GFSK_1M_DH5_CH0CH1CH2


 $\pi/4$ DQPSK_2M_DH5_CH0CH1CH2


GFSK_1M_DH5_CH38CH39CH40


 $\pi/4$ DQPSK_2M_DH5_CH38CH39CH40


GFSK_1M_DH5_CH76CH77CH78

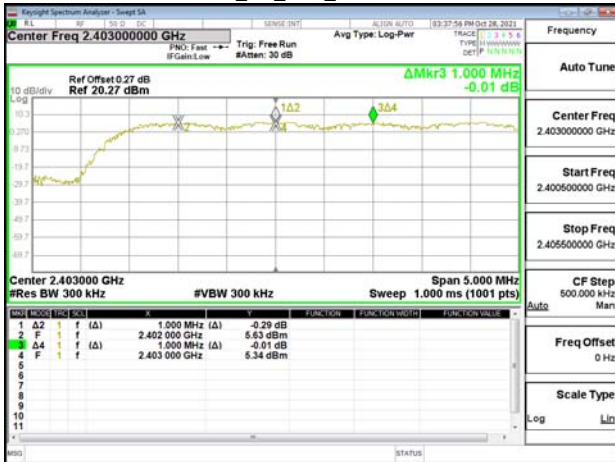

 $\pi/4$ DQPSK_2M_DH5_CH76CH77CH78


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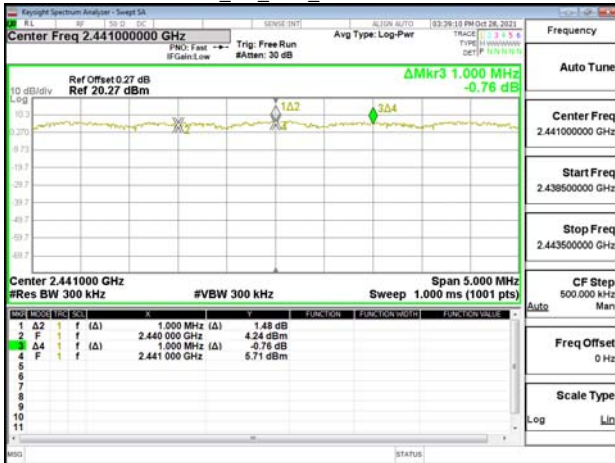
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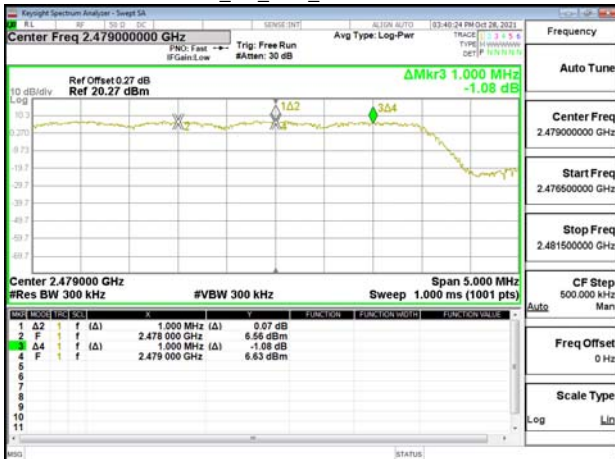
8DPSK_3M_DH5_CH0CH1CH2



8DPSK_3M_DH5_CH38CH39CH40



8DPSK_3M_DH5_CH76CH77CH78



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12 NUMBER OF HOPPING FREQUENCY

12.1 Standard Applicable

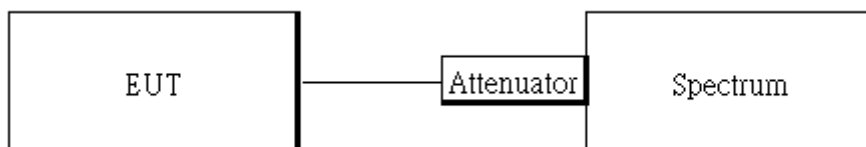
Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

Note: N.C.R refers to No calibration required

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

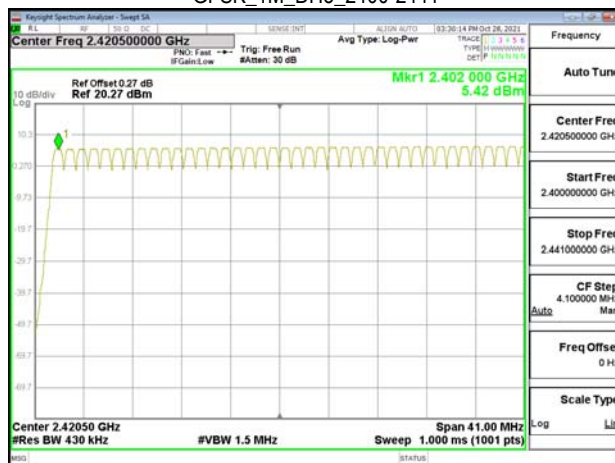
	Channel Number	Limit
2.4 GHz – 2.441 GHz	40	≥15
2.441 GHz – 2.4835 GHz	39	
2.4 GHz ~2.4835 GHz	(40+39) = 79	

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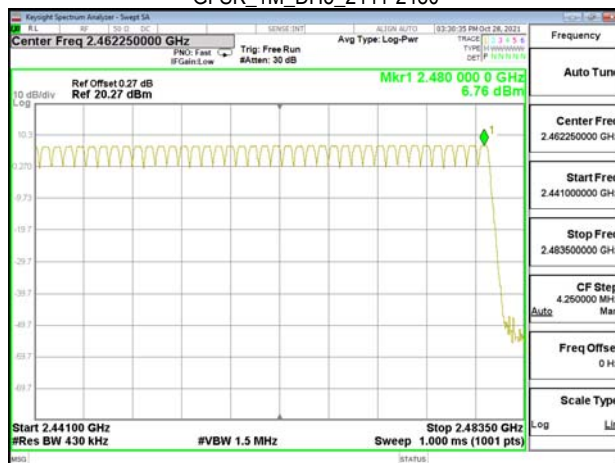
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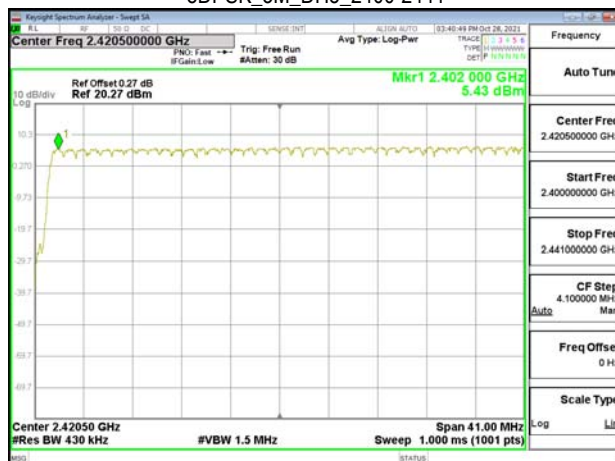
GFSK_1M_DH5_2400-2441



GFSK_1M_DH5_2441-2480



8DPSK_3M_DH5_2400-2441



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8DPSK_3M_DH5_2441-2480



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13 TIME OF OCCUPANCY (DWELL TIME)

13.1 Standard Applicable

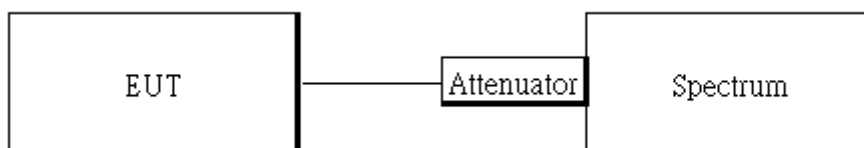
Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

13.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/27/2021	04/26/2022
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Attenuator	Mini-Circuit	BW-S10W2+	4	12/16/2020	12/15/2021
DC Block	Mini-Circuits	BLK-18-S+	1	12/16/2020	12/15/2021

Note: N.C.R refers to No calibration required

13.3 Test Set-up



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13.4 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

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.

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13.5 Tabular Result of the Measurement

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
Mid	DH1	123.20	400ms	3.00
	DH3	262.40	400ms	1.00
	DH5	308.80	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	264.00	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	262.40	400ms	1.00
	3DH5	308.80	400ms	1.00

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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)

$\pi/4$ -DQPSK (2Mbps):

CH Mid	2DH1 time slot	=	0.390	*	(1600/2/79)	*	31.6	=	124.80	(ms)
	2DH3 time slot	=	1.650	*	(1600/4/79)	*	31.6	=	264.00	(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	=	1.640	*	(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)

GFSK (1Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	DH5	154.40	400
$\pi/4$ DQPSK (2Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	2DH5	154.40	400
8-DPSK (3Mbps) for AFH Mode			
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	3DH5	154.40	400

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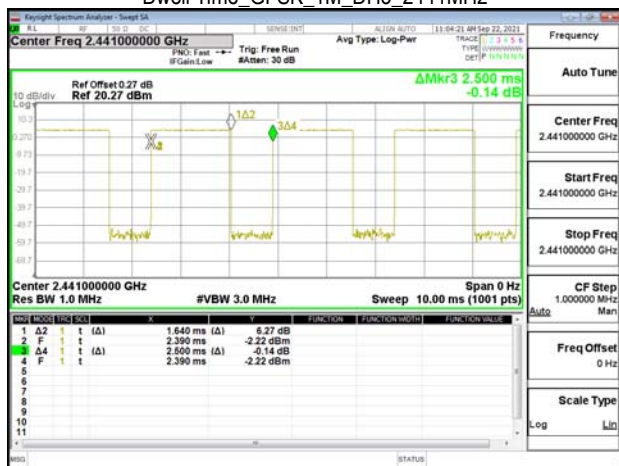
Dwell Time_GFSK_1M_DH1_2441MHz



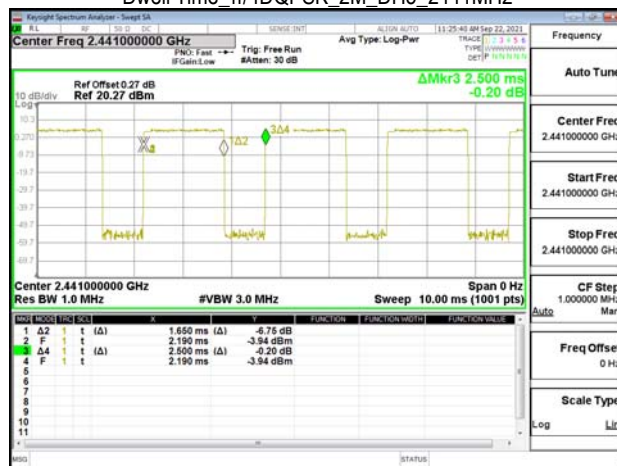
Dwell Time_π/4DQPSK_2M_DH5_2441MHz



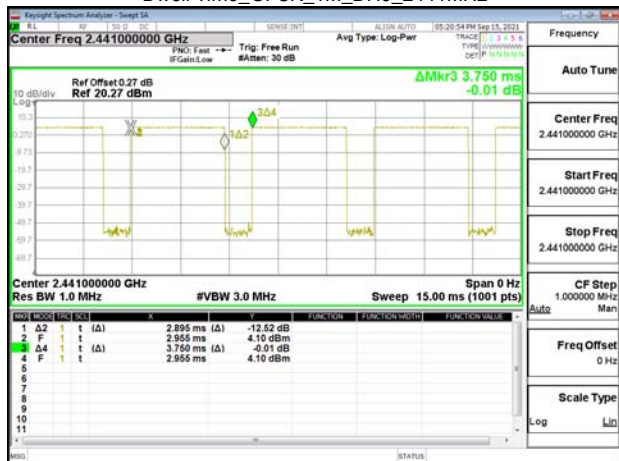
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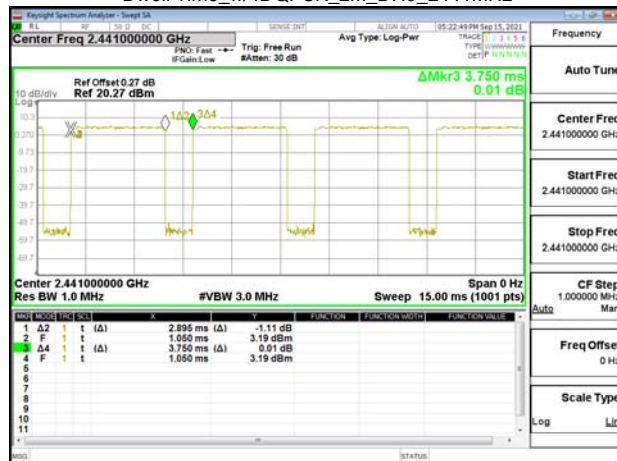
Dwell Time_π/4DQPSK_2M_DH5_2441MHz



Dwell Time_GFSK_1M_DH5_2441MHz



Dwell Time_π/4DQPSK_2M_DH5_2441MHz



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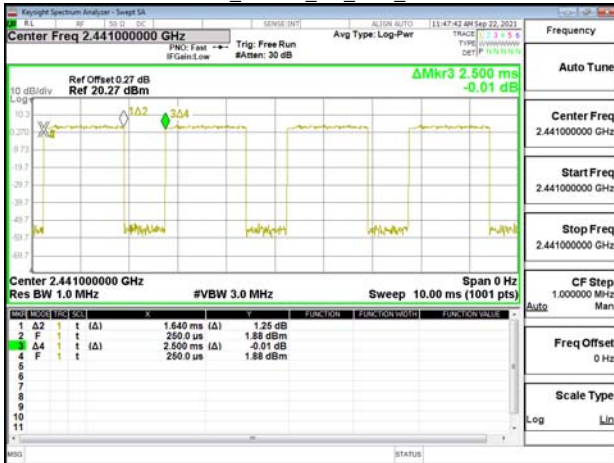
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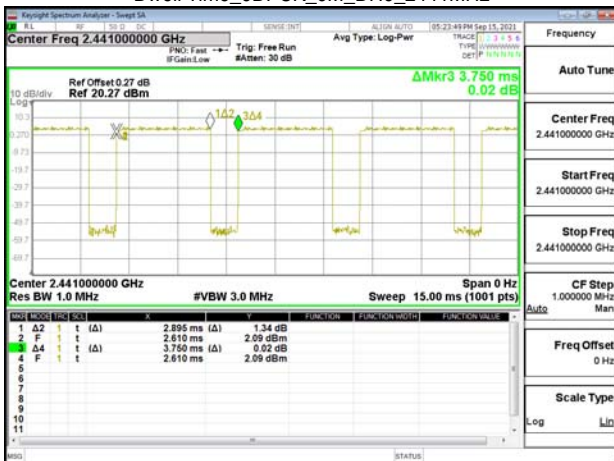
Dwell Time_8DPSK_3M_DH1_2441MHz



Dwell Time_8DPSK_3M_DH3_2441MHz



Dwell Time_8DPSK_3M_DH5_2441MHz



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14 ANTENNA REQUIREMENT

14.1 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.

14.2 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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