ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	Acer Incorporated 8F., No. 88, Sec. 1, Xintai 5th Rd., Xizhi, New Taipei City 22181, Taiwan
Manufacturer:	Gredmann Taiwan Ltd. 9F, No. 170, Sec. 3, Min Chuan E. Road, Songshan Dist., Taipei, 105, Taiwan
Product Name:	Wireless Gaming Controller
Brand Name:	Acer
FCC Model No.:	PGR300, PGR301
ISED Model No.:	PGR300
Model Difference:	Exterior difference and Marketing purpose
Report Number:	TERF2402000457ER
FCC ID	HLZPGR300
IC:	1754F-PGR300
Date of EUT Received:	February 15, 2024
Date of Test:	February 27,2024～April 12,2024
Issue Date:	April 24, 2024

Jazz Huang

Approved By _____
Jazz Huang

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.

The results of this report relate only to the sample identified in this report.

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2402000457ER	00	Original	April 24, 2024	Sharon Kuo	

Note:

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

2、 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 electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

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 21
10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT 24
11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT 28
12 FREQUENCY SEPARATION 49
13 NUMBER OF HOPPING FREQUENCY 51
14 TIME OF OCCUPANCY (DWELL TIME) 53
15 ANTENNA REQUIREMENT 56

1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Wireless Gaming Controller
Brand Name:	Acer
FCC Model No.:	PGR300, PGR301
ISED Model No.:	PGR300
Model Difference:	Exterior difference and Marketing purpose
Hardware Version:	V1.2
Firmware Version:	V12.15
EUT Series No.:	Conducted: PGR300-3 Radiated, Conduction: PGR300-2
Power Supply:	1.5 Vdc from Battery*2, 5 Vdc from USB port
Test Software (Name/Version)	FCCTestTool / 2.3

1.2 RF Specification

Radio Technology:	BT BR
Channel number:	79 channels
Modulation type:	GFSK
Transmit Power:	3.35 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	≦ 0.4s

1.3 Antenna Designation

Antenna Type	Supplier	Antenna Model No.	Freq. (MHz)	Peak Antenna Gain (dBi)
PCB antenna	Shenzhen Innosystem Technology Ltd	MARB AT V1.0	2402-2480	0.00

Note:

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

1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247
FCC KDB 558074 D01 15.247 Meas. Guidance v05r02
RSS-247 issue 3 Aug. 2023
RSS-Gen, Issue 5 April 2018, Amendment 2 (February 2021), Amendment 1 (March 2019)
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 2		
		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.

2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-ane choic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

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

2.5 Test Configuration

Conduction Setup

Conducted Setup

Radiated Setup

2.6 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L440	R9-00W5LW 14/03	N/A	N/A
Adapter	Lenovo	ADLX90NLC3A	N/A	N/A	N/A
USB(female) to USB Type C (male) adapter	NEON	EUC1	N/A	N/A	N/A

Conducted Emission Test Site: Conducted 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	T440P	PB-03ECDS 14/08	N/A	N/A
Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L440	R9-00W5LW 14/03	N/A	N/A

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
§15.247(d) §15.209	RSS-247 §5.5 RSS-Gen §8.9	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d) §15.209	RSS-247 §5.5 RSS-Gen §8.9	Radiated Band Edge and Spurious Emission	Compliant
§15.205	RSS-Gen § 8.10	Restricted Bands	Compliant
§15.247(a)(1)	RSS-247 §5.1 b	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 d	Number of hopping frequency Time of Occupancy	Compliant
§15.203	N/A	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

2400~2483.5 MHz							
CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)	CH	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

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.

ANTNNA PORT CONDUCTED TEST				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
Peak Output Power, 20dB Band Width, Spurious Emission				
Bluetooth	0 to 78	0,39,78	GFSK	DH5
Band Edge				
Bluetooth	0 to 78	0,78	GFSK	DH5
Frequency Separation				
Bluetooth	0 to 78	0,1,2, 38,39,40, 76,77,78	GFSK	DH5
Number of Hopping Frequency, Hopping Band edge				
Bluetooth	0 to 78	0 to 78	GFSK	DH5
Time of Occupancy(Dwell time)				
Bluetooth	0 to 78	39	GFSK	DH1/DH3/DH5

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

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

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	1.54	dB
Output Power measurement	+/-	0.97	dB
Emission Bandwidth	+/-	1.38	Hz
Conducted emission measurement	+/-	0.77	dB
Frequency Separation	+/-	1.48	Hz
Number of hopping frequency	+/-	1.48	Hz
Time of Occupancy	+/-	1.48	Hz
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.15**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.02**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Radiated Spurious Emission	**+/-**	**2**	**dB**	33GHz-50GHz
	+/-	**1.59**	**dB**	50GHz-60GHz
	+/-	**1.7**	**dB**	60GHz-90GHz
	+/-	**1.64**	**dB**	90GHz-140GHz
	+/-	**3.83**	**dB**	140GHz-220GHz

Note:

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

6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	Audix	e3	Ver. 9.210616	N.C.R	N.C.R
LISN	SCHWARZBECK	NSLK 8127	1040	09/06/2023	09/05/2024
Coaxial Cables	EMC Instruments Corp.	EMCCFD300-BM-BM-3000	161207	06/22/2023	06/21/2024
Pulse Limiter	SCHWARZBECK	VTSD 9561F-N	793	06/22/2023	06/21/2024
EMI Test Receiver	R&S	ESCI 7	100759	08/21/2023	08/20/2024

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted 1					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY59071571	06/07/2023	06/06/2024
Test Software	SGS	Radio Test Software	Ver. 21	N.C.R	N.C.R
Power Meter	Anritsu	ML2496A	1242004	10/24/2023	10/23/2024
Power Sensor	Anritsu	MA2411B	1207365	10/24/2023	10/23/2024
Power Sensor	Anritsu	MA2411B	1207368	10/24/2023	10/23/2024
DC Block	Mini-Circuits	BLK-18-S+	31129	12/12/2023	12/11/2024

6.3 Radiated Measurement

Radiated Emission Test Site: SAC 3					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	COM-POWER	AL-130R	10160104	12/04/2023	12/03/2024
Horn Antenna	RF SPIN	DRH0844	LE2D05A0844	07/03/2023	07/02/2024
Bi-log Antenna	SCHWARZBECK	VULB9168	378	08/09/2023	08/08/2024
Horn Antenna	SCHWARZBECK	BBHA9120D	1441	09/23/2023	09/22/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010B	MY63440386	02/06/2024	02/05/2025
EMI Test Receiver	R&S	ESCI 7	100759	08/21/2023	08/20/2024
Pre-Amplifier	EMCI	EMC184045B	980135	08/31/2023	08/30/2024
Pre-Amplifier	HP	8447D	2944A07676	08/31/2023	08/30/2024
Pre-Amplifier	EMCI	EMC118A45SEE	980868	08/31/2023	08/30/2024
Attenuator	Mini-Circuits	BW-S10W2+	16	12/12/2023	12/11/2024
Bandreject Filter 2400-2483.5	EWT	EWT-54-0038	M2	12/12/2023	12/11/2024
4G High Pass Filter	WI	WHKX4.0	22	12/12/2023	12/11/2024
Coaxial Cables	EMCI+Huber Suhner	EMC107-SM-SM-1000+EMC107-SM-SM-1500+EMC107-SM-SM-8000+SUCOFLEX 104PEA	RX Cable 9K-18G (221110+221106+221212+MY4251/4PEA)	08/31/2023	08/30/2024
Coaxial Cables	Huber Suhner	SUCOFLEX 102	RX Cable 18G-40G MY2630/2+805062/2	08/31/2023	08/30/2024
Site Cal	SGS	SAC 3	N/A	08/31/2023	08/30/2024
Test Software	audix	e3	Ver. 9.210616	N.C.R	N.C.R

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

7 CONDUCTED EMISSION TEST

7.1 Standard Applicable

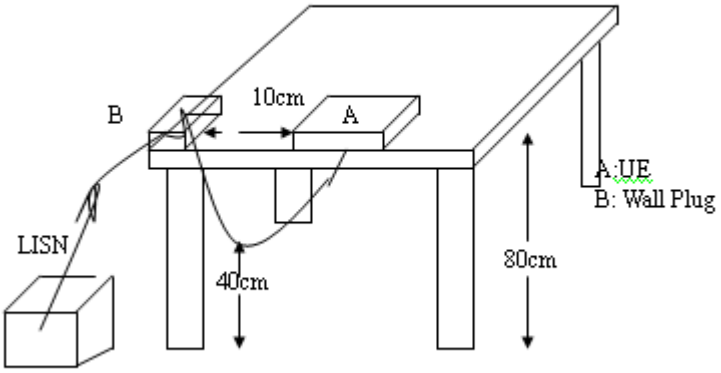
Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

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 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.		

7.2 EUT Setup:

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

7.3 Test Setup



7.4 Measurement Procedure

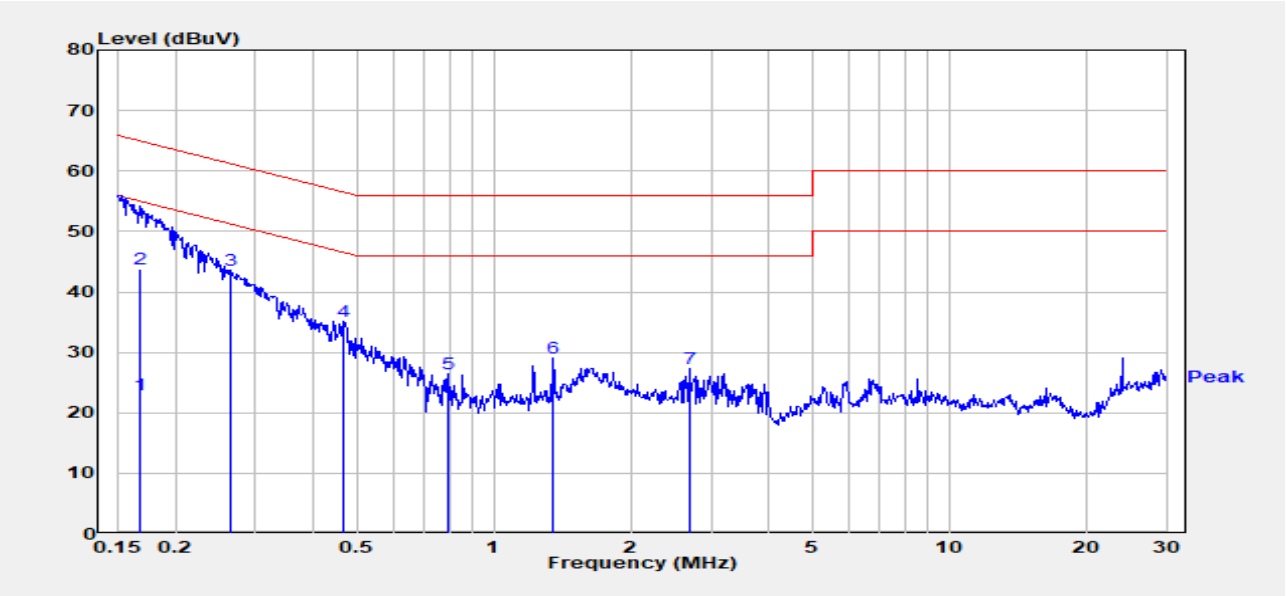
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

7.5 Measurement Result

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closest to the limit.

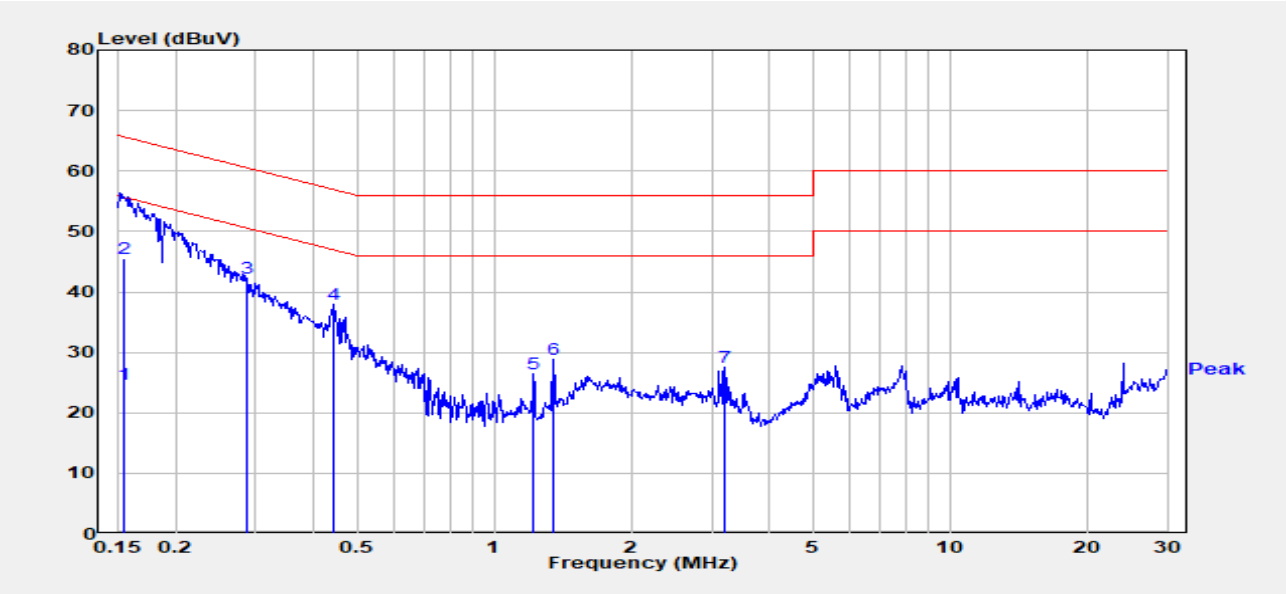
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2402000457ER	Test Site	:Conduction 1
Operation Mode	:BT	Test Date	:2024-04-12
Power	:120V/60Hz	Temp./Humi.	:22.6℃/52%
Probe	:L	Engineer	:Nick Lin



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.168	Average	12.80	10.13	22.93	55.08	-32.15
0.168	QP	33.70	10.13	43.83	65.08	-21.25
0.264	Peak	33.50	10.14	43.63	61.29	-17.66
0.466	Peak	24.96	10.16	35.12	56.58	-21.46
0.792	Peak	16.31	10.19	26.50	56.00	-29.50
1.352	Peak	18.91	10.20	29.11	56.00	-26.89
2.692	Peak	17.11	10.24	27.35	56.00	-28.65

Report Number	:TERF2402000457ER	Test Site	:Conduction 1
Operation Mode	:BT	Test Date	:2024-04-12
Power	:120V/60Hz	Temp./Humi.	:22.6℃/52%
Probe	:N	Engineer	:Nick Lin



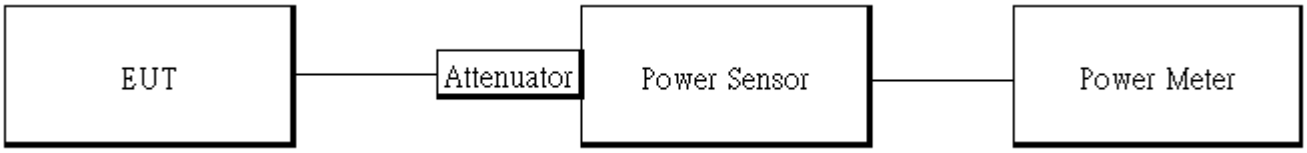
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.154	Average	14.60	10.12	24.72	55.78	-31.06
0.154	QP	35.50	10.12	45.62	65.78	-20.16
0.286	Peak	32.05	10.14	42.19	60.63	-18.44
0.444	Peak	27.80	10.16	37.96	56.98	-19.02
1.223	Peak	16.33	10.19	26.52	56.00	-29.48
1.352	Peak	18.56	10.19	28.75	56.00	-27.25
3.190	Peak	17.37	10.27	27.63	56.00	-28.37

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. Duty cycle of test signal is < 98 %, duty factor shall be considered.
4. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB band-width)
5. Record the max. reading.
6. Repeat above procedures until all default test channel is completed.

8.4 Peak & Average Power Measurement Result

1M BR mode (Peak):

CH	Freq. (MHz)	Power Setting	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-5	2.98	1.986	1000
Mid	2441	-5	3.26	2.118	1000
High	2480	-5	**3.35**	2.163	1000

1M BR mode (Average):

CH	Freq. (MHz)	Power Setting	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	-5	1.89	1.546	1000
Mid	2441	-5	2.11	1.626	1000
High	2480	-5	2.20	1.660	1000

8.5 EIRP Measurement Result

1M BR mode EIRP

Channel	Frequency (MHz)	Power Setting	Avg. Output Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	-5	1.89	0.00	1.546	4000
Mid	2441	-5	2.11	0.00	1.626	4000
High	2480	-5	2.20	0.00	1.660	4000

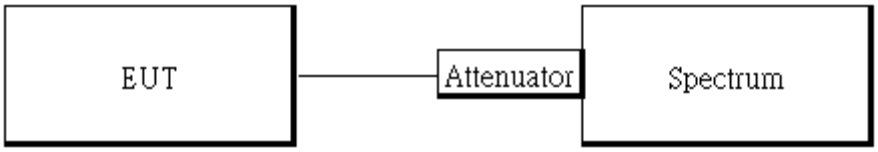
EIRP = Average Power + Gain

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 ≥ 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

9.4 20dB Bandwidth

GFSK

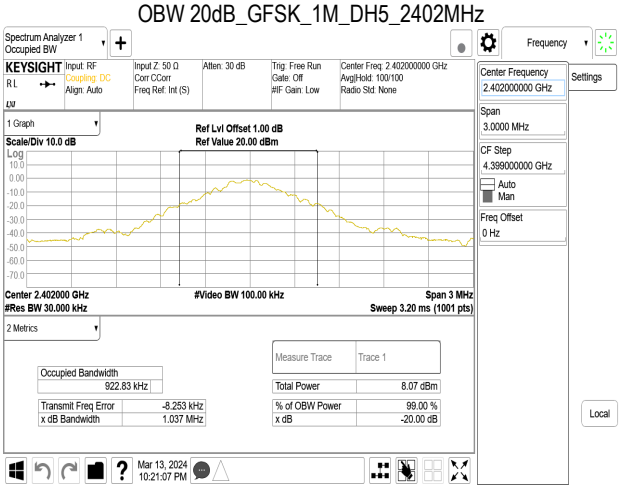
CH	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.037	0.69
Mid	1.034	0.69
High	1.035	0.69

9.5 99% Bandwidth

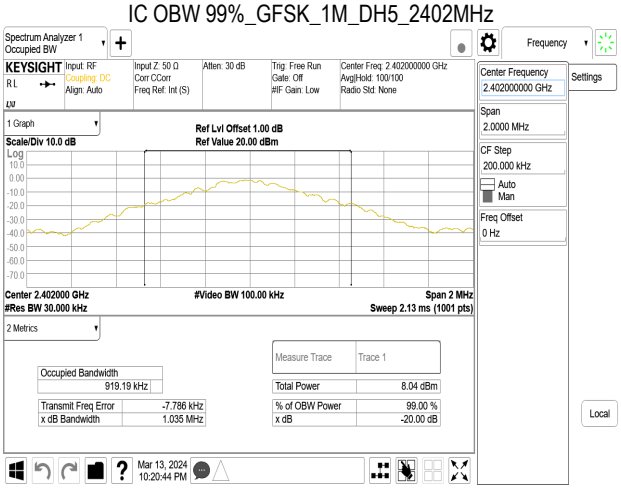
GFSK

CH	99% BW (MHz)
Low	0.91919
Mid	0.9209
High	0.92168

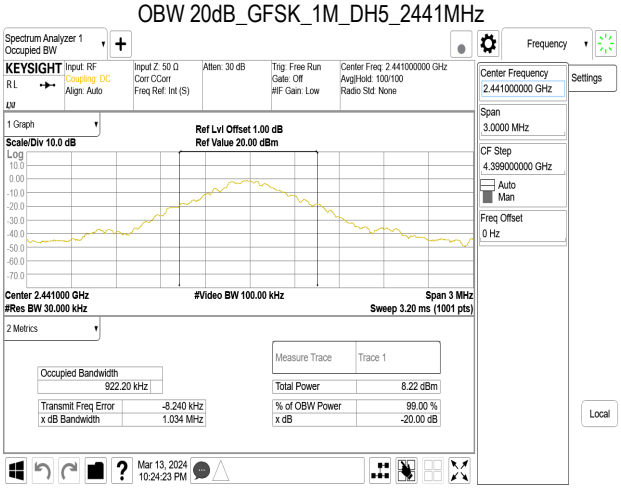
OBW 20dB_GFSK_1M_DH5_2402MHz



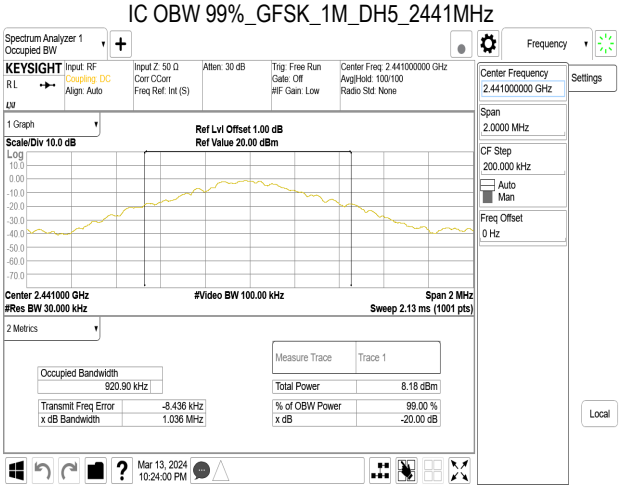
IC OBW 99%_GFSK_1M_DH5_2402MHz



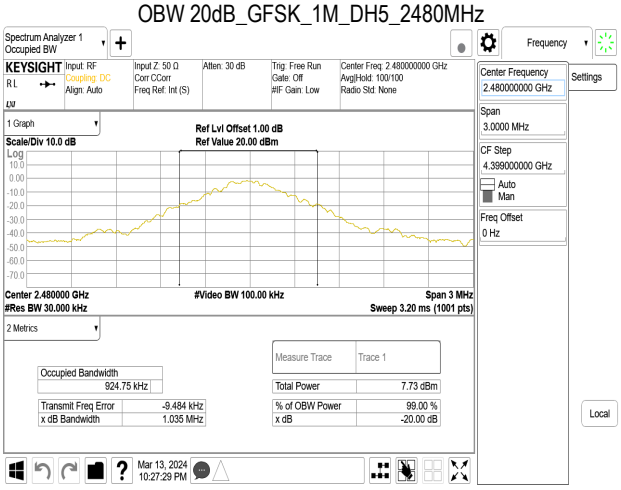
OBW 20dB_GFSK_1M_DH5_2441MHz



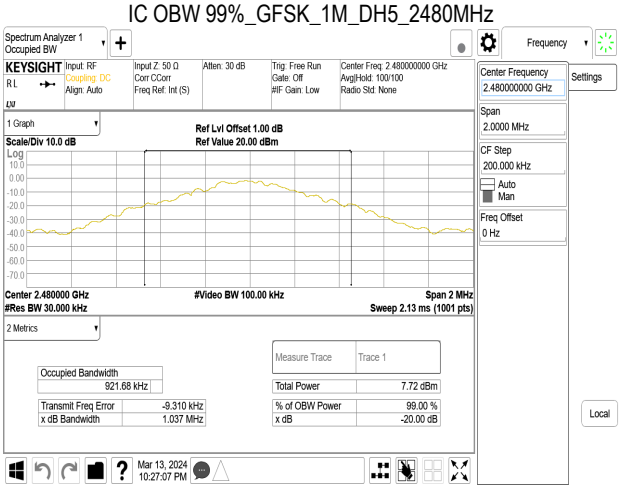
IC OBW 99%_GFSK_1M_DH5_2441MHz



OBW 20dB_GFSK_1M_DH5_2480MHz



IC OBW 99%_GFSK_1M_DH5_2480MHz

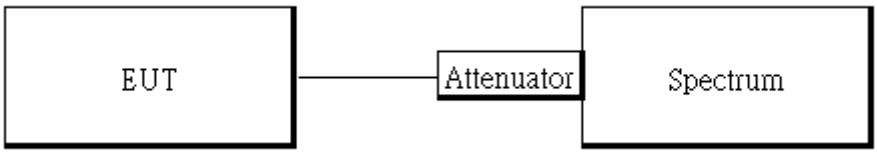


10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

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, below 2.4GHz and above 2.4835GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

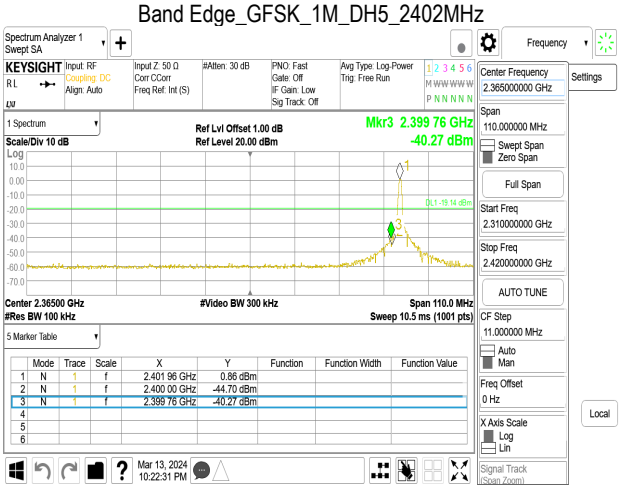
10.3.2 Conducted Spurious Emission:

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.

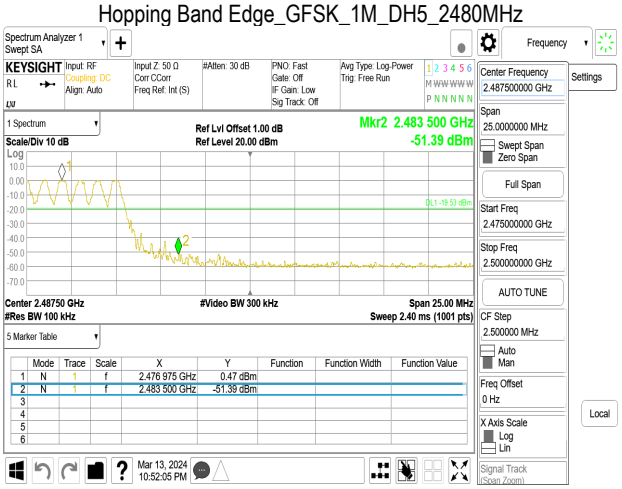
10.4 Measurement Result

See next page for test plots.

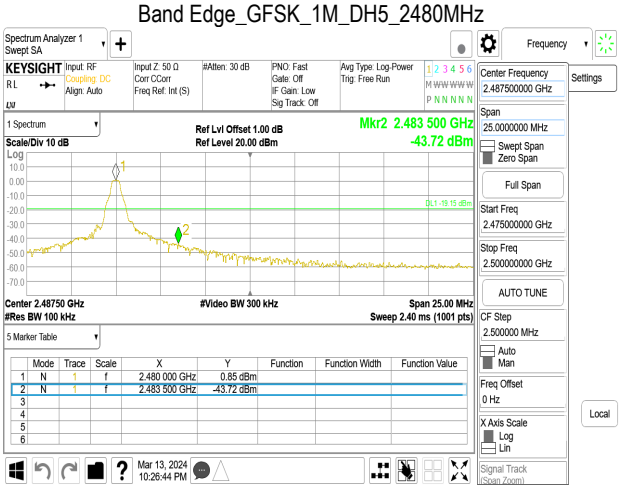
Band Edge_GFSK_1M_DH5_2402MHz



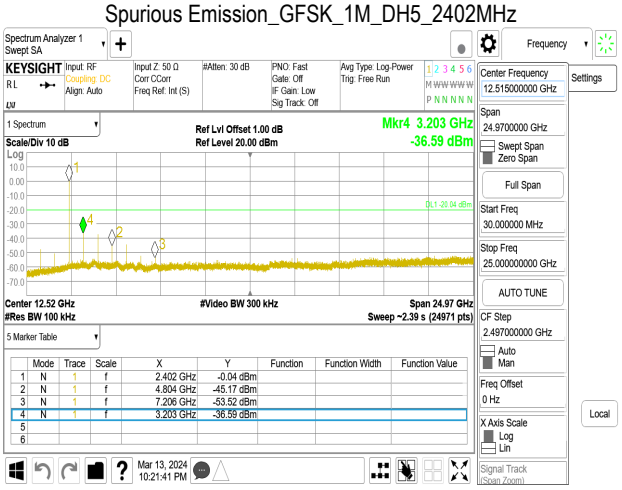
Hopping Band Edge_GFSK_1M_DH5_2480MHz



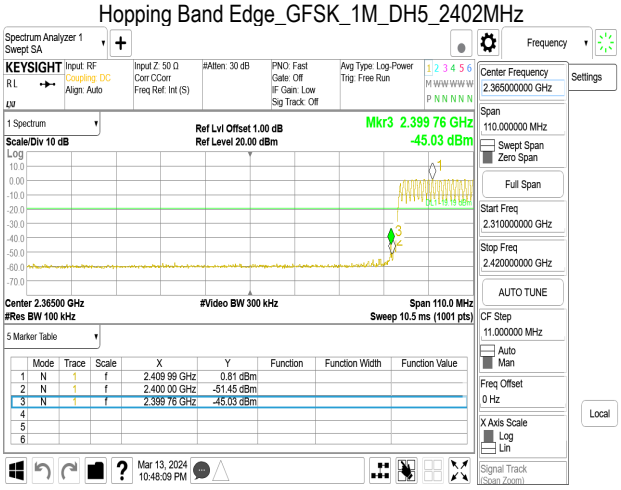
Band Edge_GFSK_1M_DH5_2480MHz



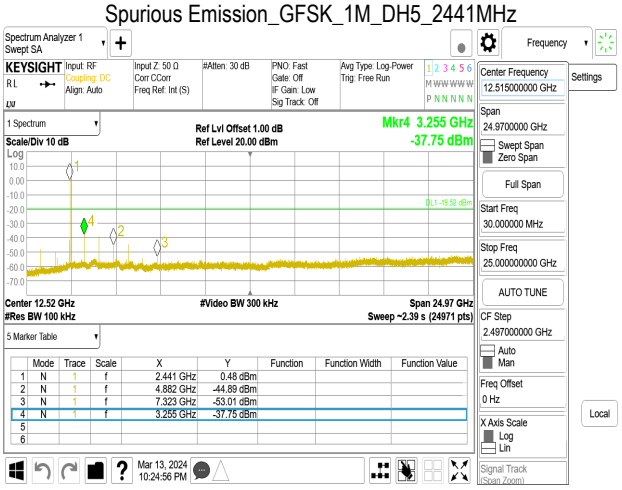
Spurious Emission_GFSK_1M_DH5_2402MHz



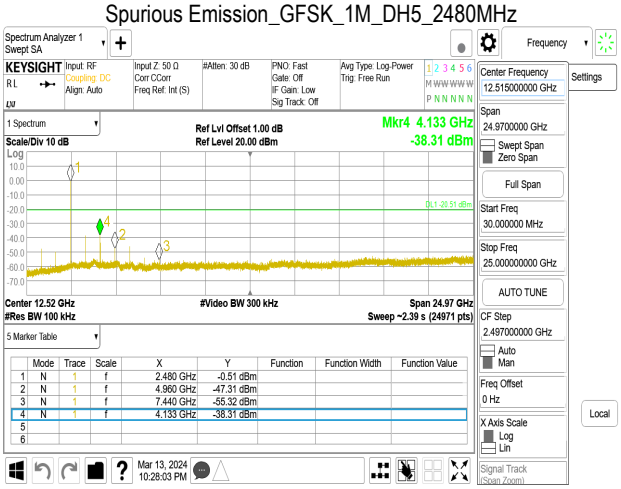
Hopping Band Edge_GFSK_1M_DH5_2402MHz



Spurious Emission_GFSK_1M_DH5_2441MHz



Spurious Emission_GFSK_1M_DH5_2480MHz



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.

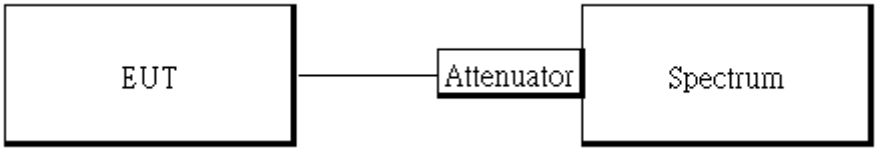
Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

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

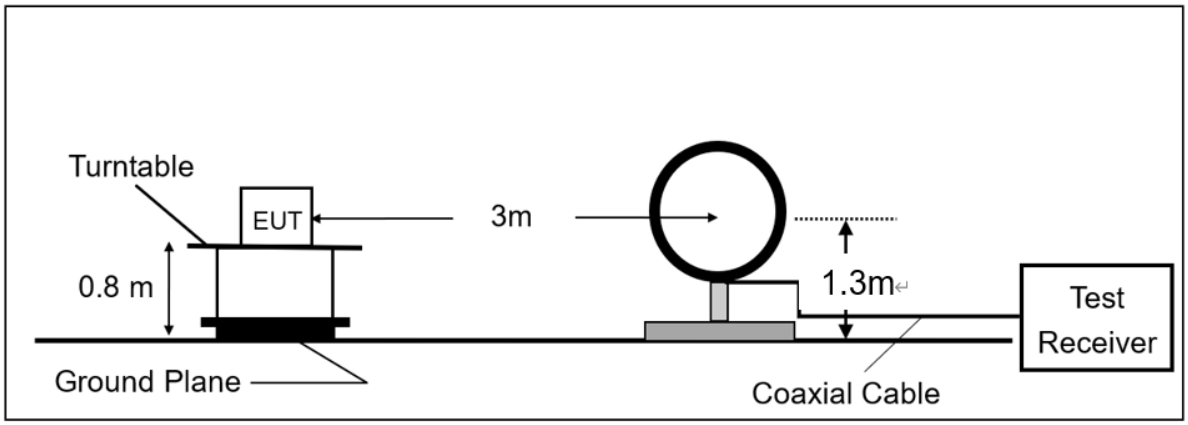
11.2 Test Setup

11.2.1 Duty Cycle Correction Factor

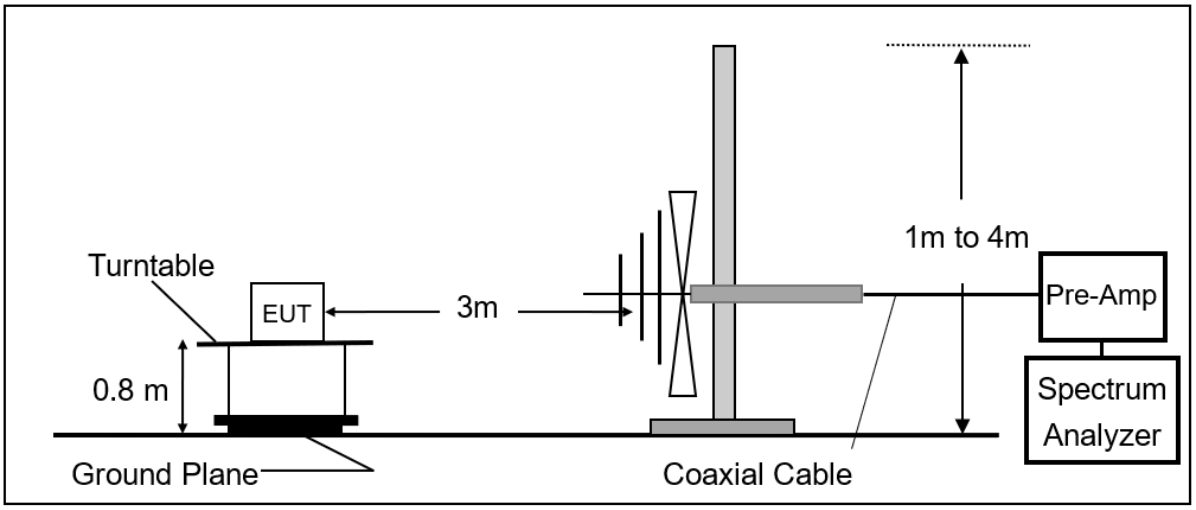


11.2.2 Radiated Emission

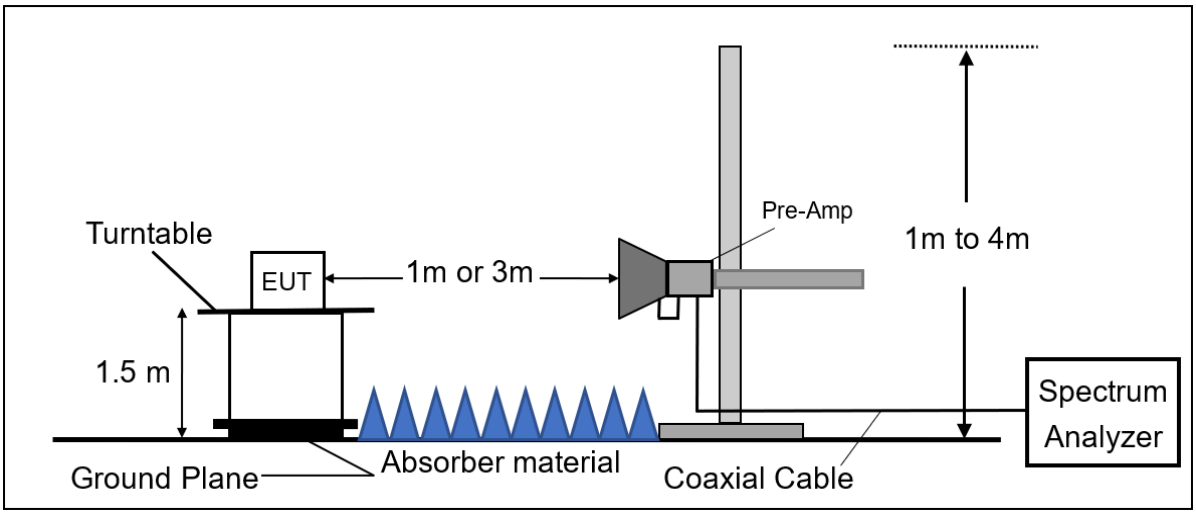
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



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



(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=100ms.
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.

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*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 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.

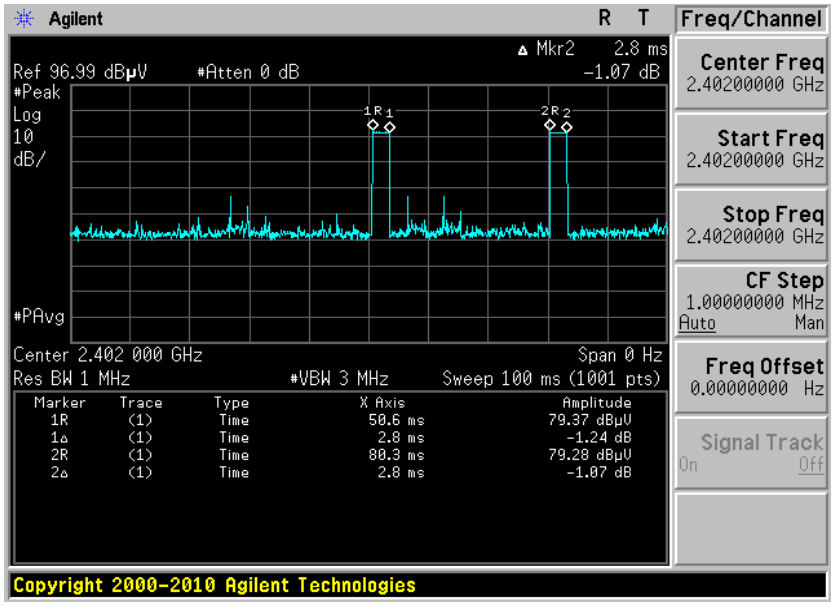
11.6 Measurement Result:

11.6.1 Duty Cycle Correction Factor

Bluetooth 1M

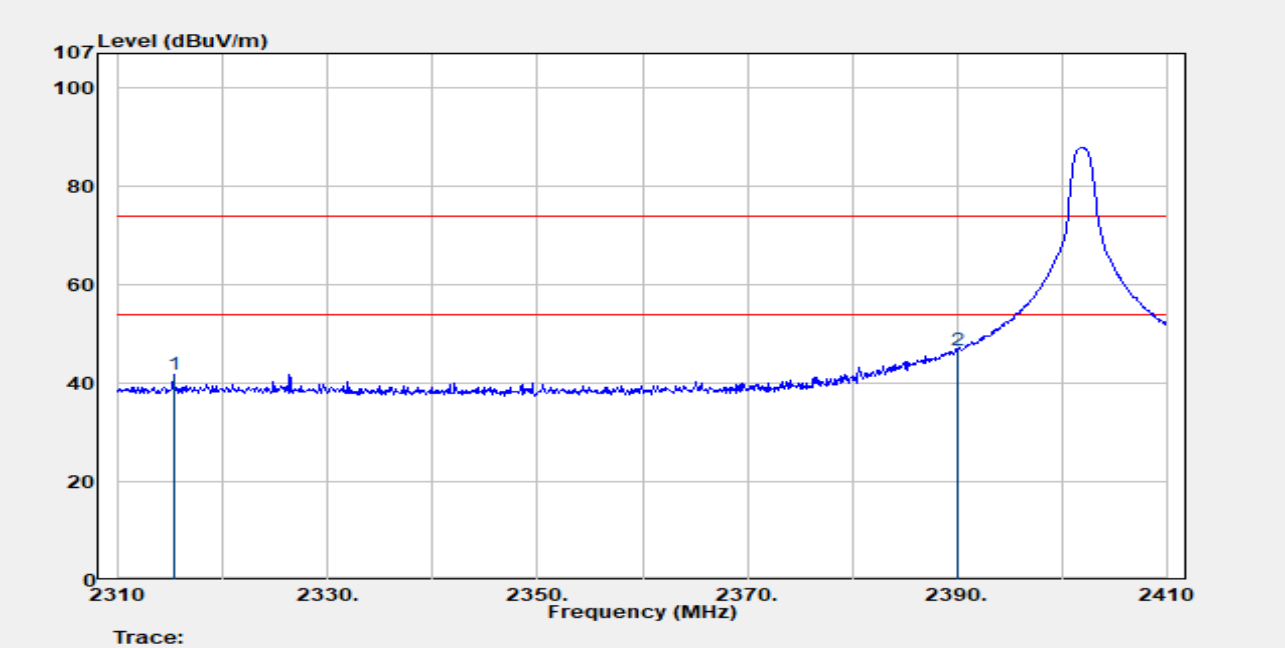
Time ON of 100ms: 5.600 ms
Duty Cycle=5.6ms / 100ms= 0.056
Duty Cycle correction factor=20 LOG 0.056 = -25.04 dB

11.6.2 Duty Cycle test plot



11.6.3 Bandedge Result

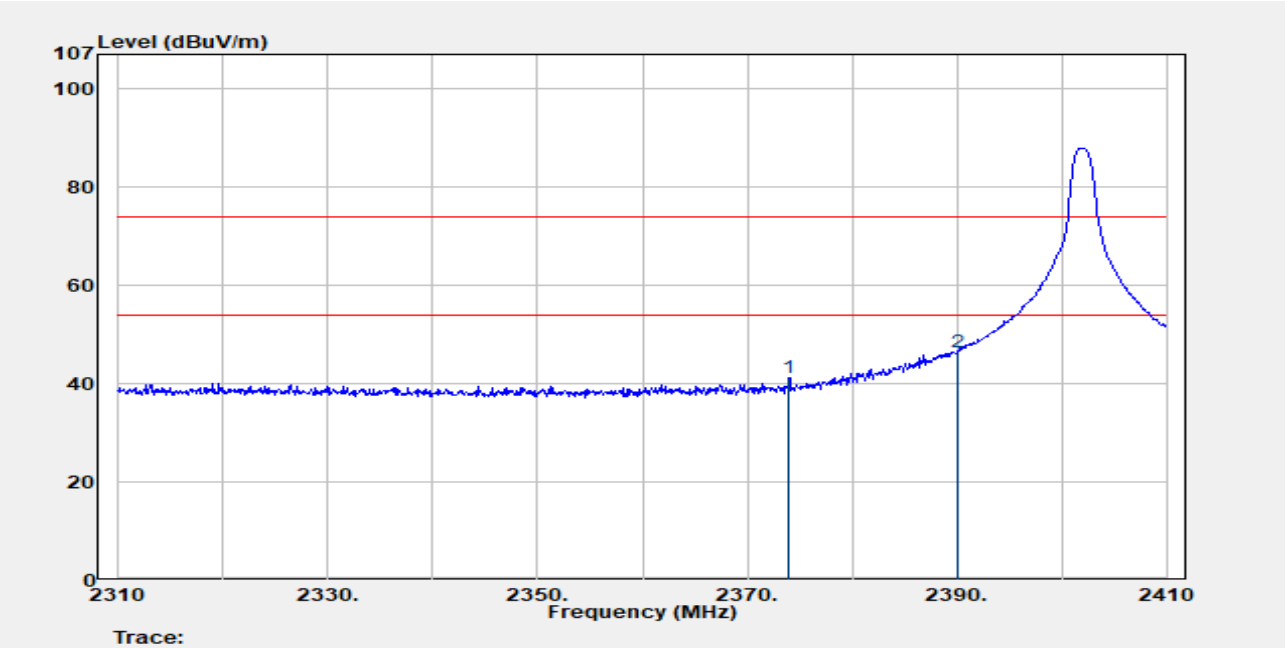
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2315.300	Peak	46.40	-4.52	41.87	74.00	-32.13
2390.000	Peak	51.23	-4.64	46.59	74.00	-27.41

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)
2315.300	Average	41.87	-25.04	16.83	54.00	-37.17
2390.000	Average	46.59	-25.04	21.55	54.00	-32.45

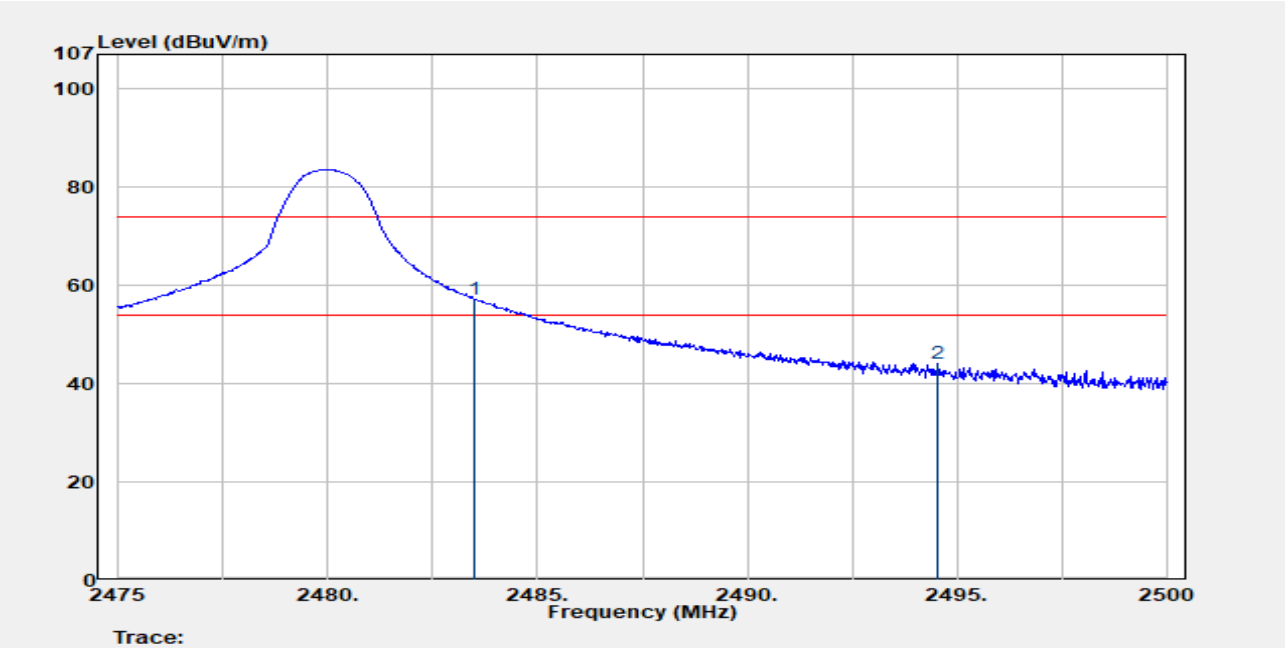
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2374.000	Peak	45.80	-4.62	41.18	74.00	-32.82
2390.000	Peak	51.15	-4.64	46.50	74.00	-27.50

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)
2374.000	Average	41.18	-25.04	16.14	54.00	-37.86
2390.000	Average	46.50	-25.04	21.46	54.00	-32.54

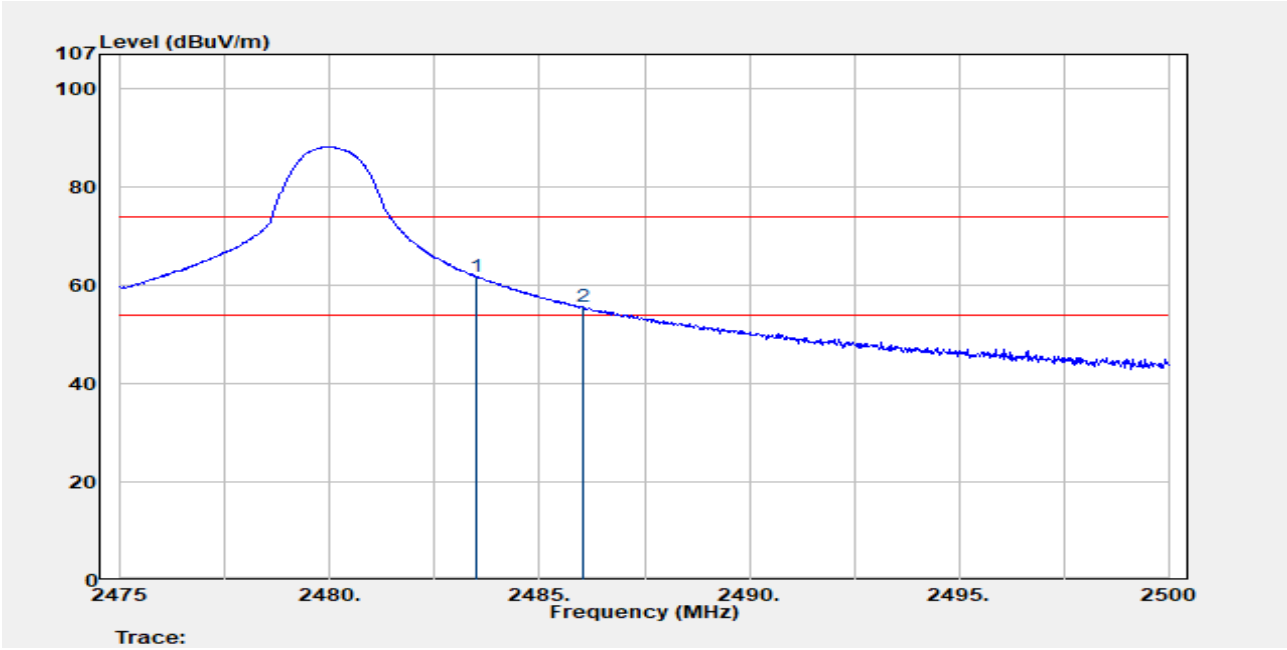
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



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	62.06	-4.85	57.21	74.00	-16.79
2494.550	Peak	48.96	-4.84	44.13	74.00	-29.87

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)
2483.500	Average	57.21	-25.04	32.17	54.00	-21.83
2494.550	Average	44.13	-25.04	19.09	54.00	-34.91

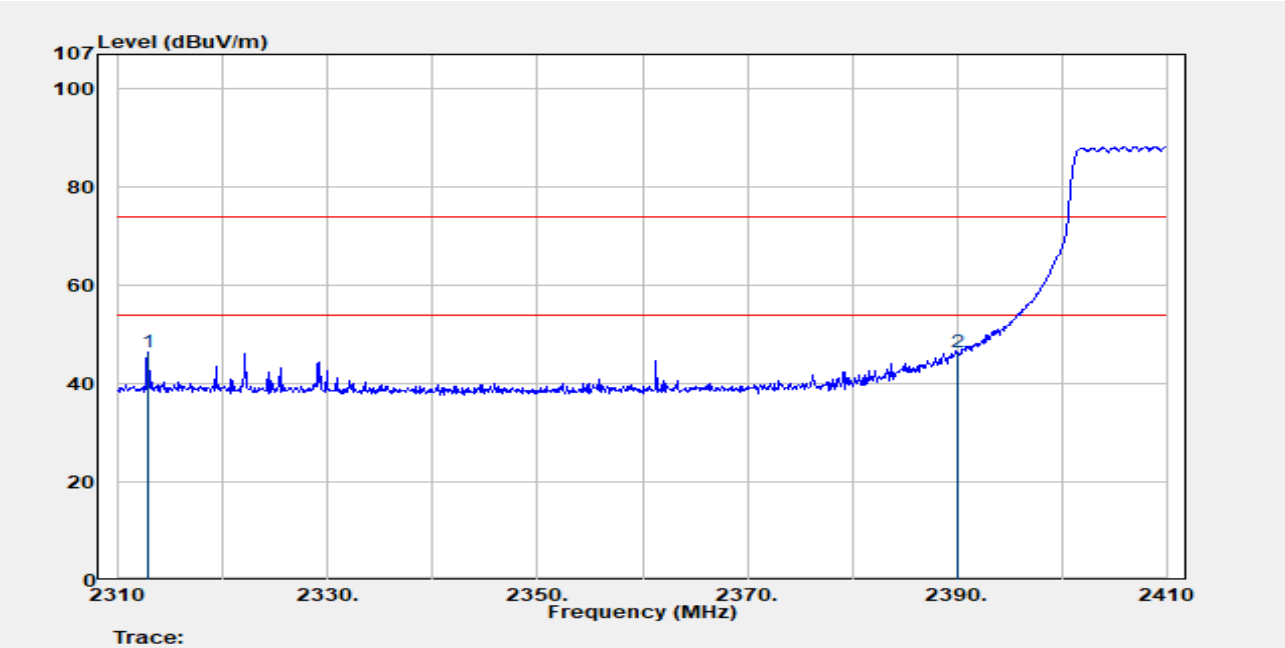
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



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	66.63	-4.85	61.78	74.00	-12.22
2486.050	Peak	60.50	-4.85	55.65	74.00	-18.35

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)
2483.500	Average	61.78	-25.04	36.74	54.00	-17.26
2486.050	Average	55.65	-25.04	30.61	54.00	-23.39

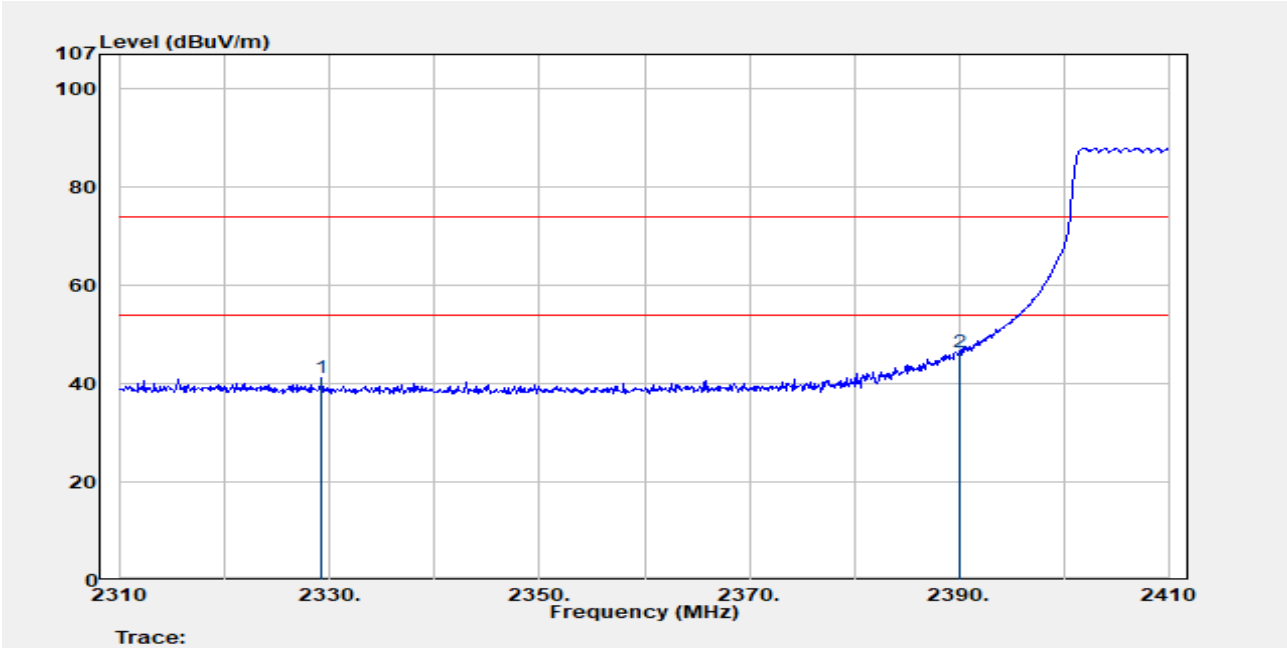
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR Hopping	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2312.900	Peak	50.80	-4.52	46.28	74.00	-27.72
2390.000	Peak	50.91	-4.64	46.27	74.00	-27.73

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)
2312.900	Average	46.28	-25.04	21.24	54.00	-32.76
2390.000	Average	46.27	-25.04	21.23	54.00	-32.77

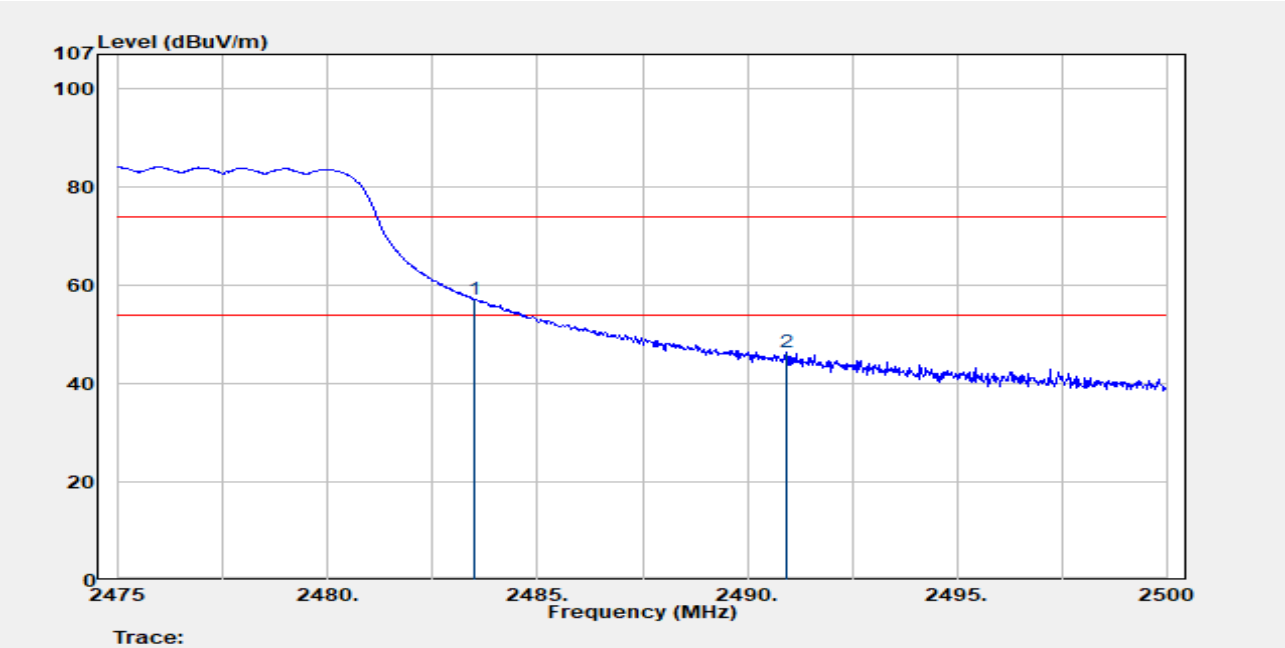
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR Hopping	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2329.200	Peak	45.74	-4.55	41.19	74.00	-32.81
2390.000	Peak	51.10	-4.64	46.46	74.00	-27.54

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)
2329.200	Average	41.19	-25.04	16.15	54.00	-37.85
2390.000	Average	46.46	-25.04	21.42	54.00	-32.58

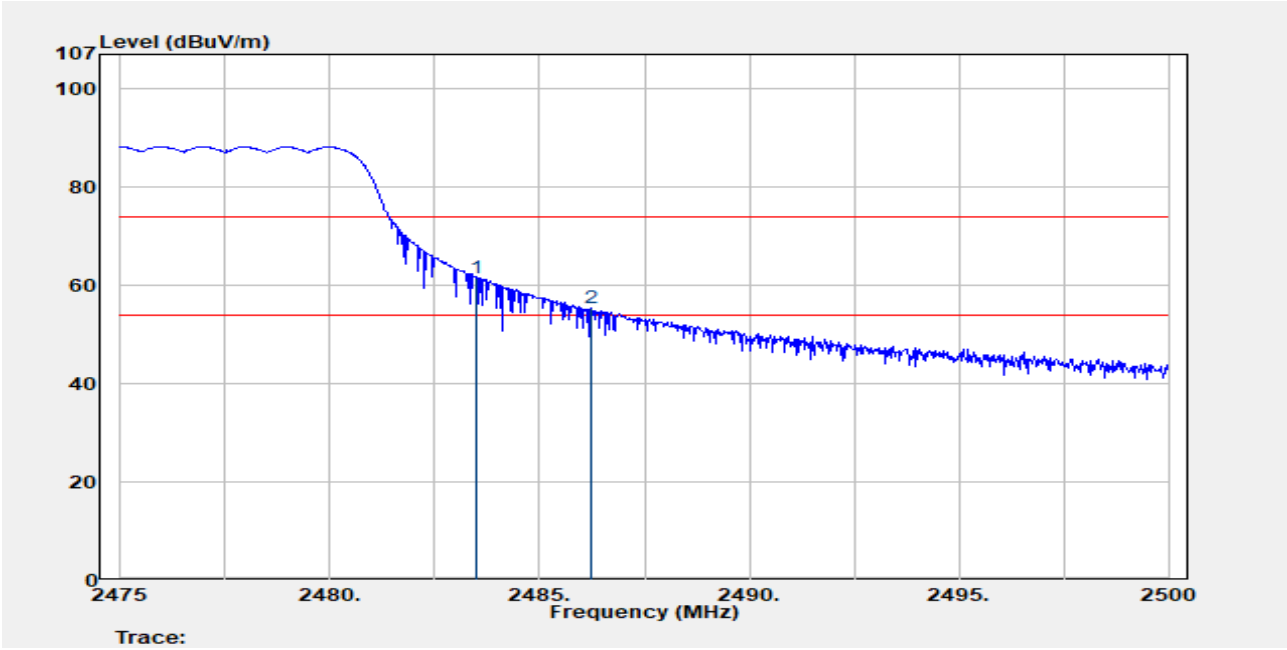
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR Hopping	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



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	62.08	-4.85	57.22	74.00	-16.78
2490.950	Peak	51.16	-4.84	46.32	74.00	-27.68

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)
2483.500	Average	57.22	-25.04	32.18	54.00	-21.82
2490.950	Average	46.32	-25.04	21.28	54.00	-32.72

Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR Hopping	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Bandedge	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin

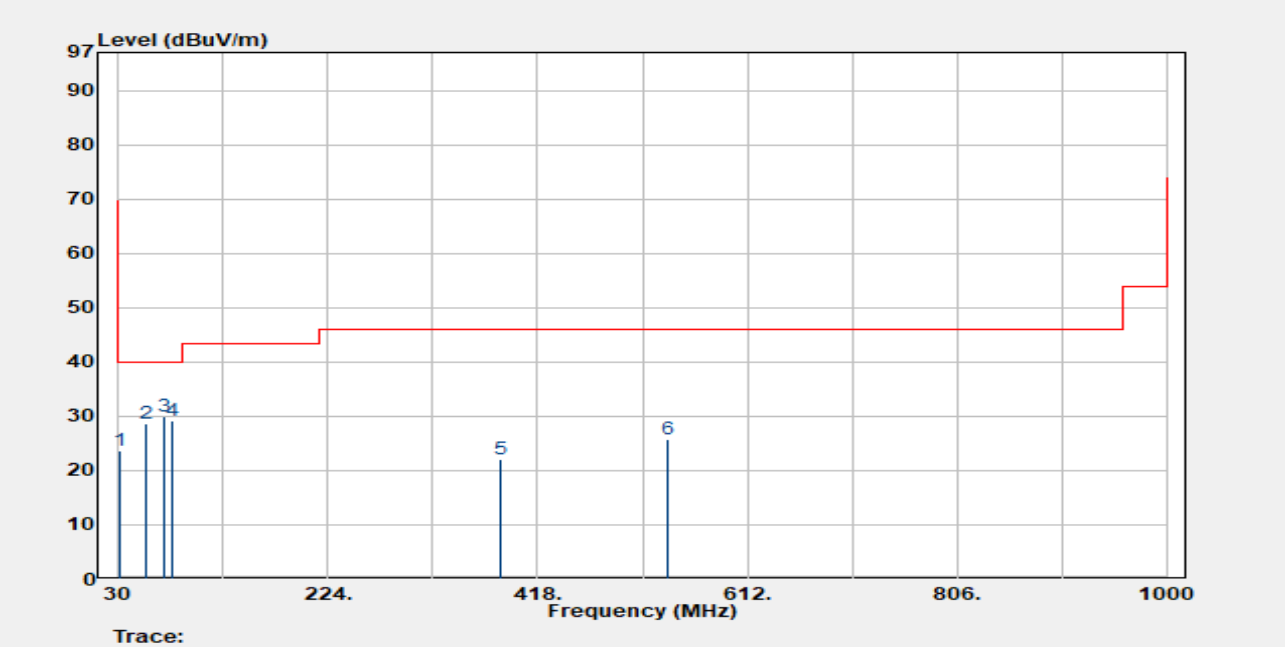


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
2483.500	Peak	66.46	-4.85	61.61	74.00	-12.39
2486.225	Peak	60.12	-4.85	55.28	74.00	-18.72

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)
2483.500	Average	61.61	-25.04	36.57	54.00	-17.43
2486.225	Average	55.28	-25.04	30.24	54.00	-23.76

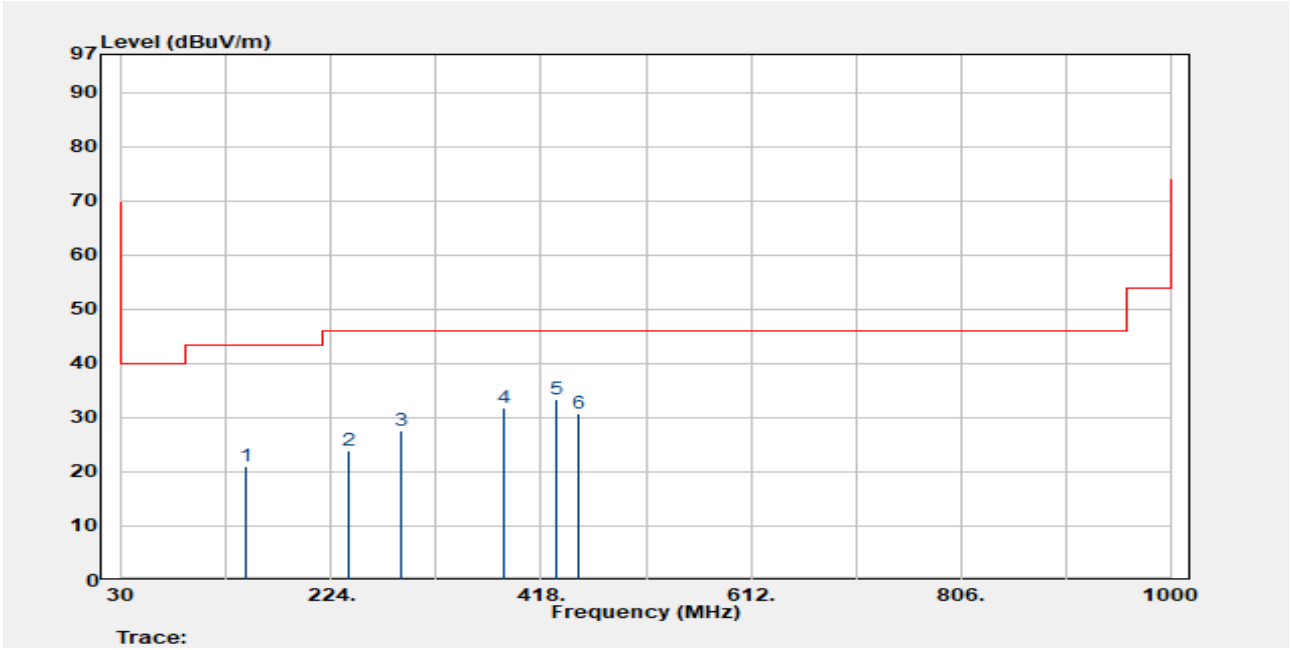
11.6.4 Radiated Spurious Emission

Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-04-09
Test Frequency	:2441 MHz	Temp./Humi.	:21℃/64%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



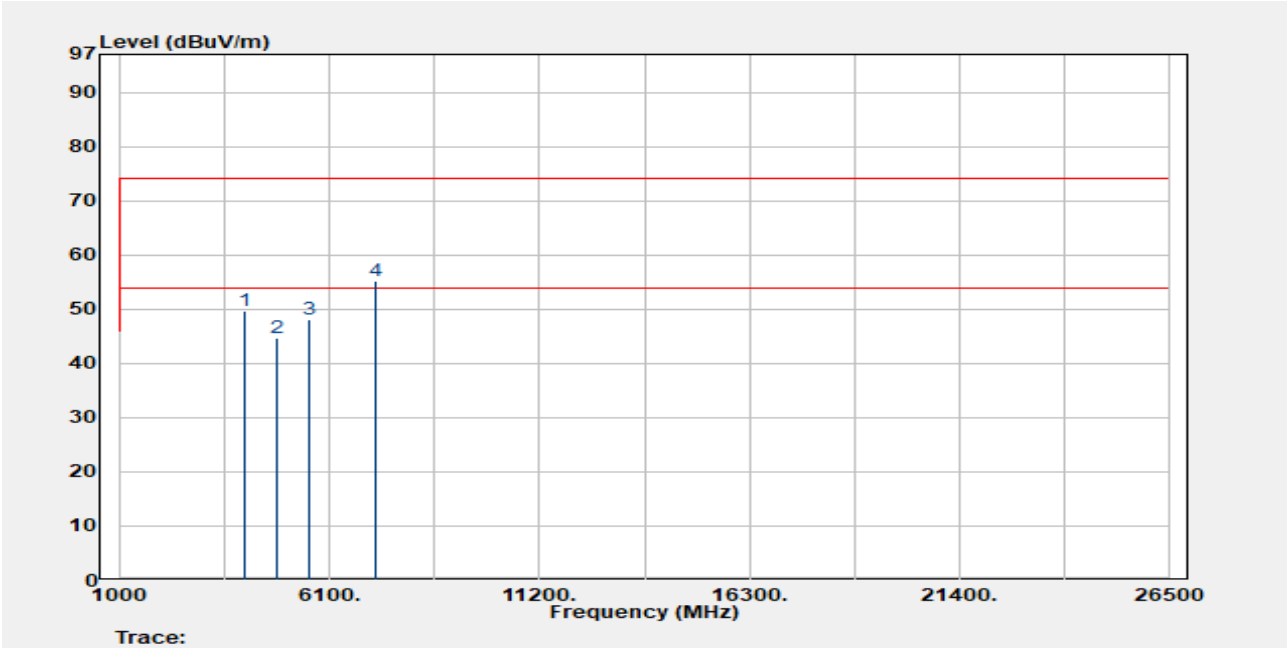
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
30.970	Peak	33.92	-10.21	23.71	40.00	-16.29
56.190	Peak	37.72	-9.08	28.64	40.00	-11.36
72.680	Peak	41.92	-11.90	30.02	40.00	-9.98
80.440	Peak	42.33	-13.19	29.14	40.00	-10.86
384.050	Peak	27.75	-5.73	22.02	46.00	-23.98
538.280	Peak	28.98	-3.13	25.85	46.00	-20.15

Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-04-09
Test Frequency	:2441 MHz	Temp./Humi.	:21℃/64%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
144.460	Peak	29.64	-8.71	20.93	43.50	-22.57
240.490	Peak	33.34	-9.47	23.87	46.00	-22.13
288.020	Peak	35.26	-7.56	27.70	46.00	-18.30
384.050	Peak	37.53	-5.73	31.80	46.00	-14.20
431.580	Peak	37.85	-4.55	33.31	46.00	-12.69
452.920	Peak	34.73	-4.06	30.67	46.00	-15.33

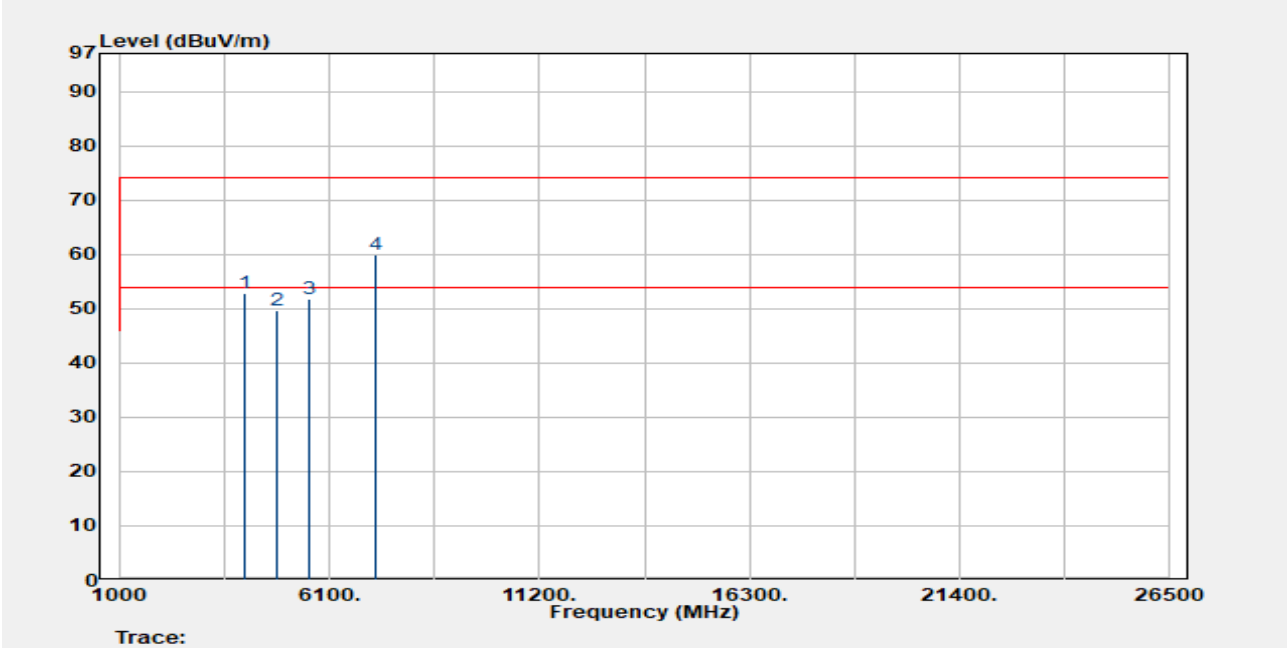
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4003.000	Peak	50.75	-1.11	49.63	74.00	-24.37
4804.000	Peak	44.85	-0.27	44.58	74.00	-29.42
5606.000	Peak	45.81	2.25	48.06	74.00	-25.94
7206.000	Peak	48.61	6.51	55.12	74.00	-18.88

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)
4003.000	Average	49.63	-25.04	24.59	54.00	-29.41
4804.000	Average	44.58	-25.04	19.54	54.00	-34.46
5606.000	Average	48.06	-25.04	23.02	54.00	-30.98
7206.000	Average	55.12	-25.04	30.08	54.00	-23.92

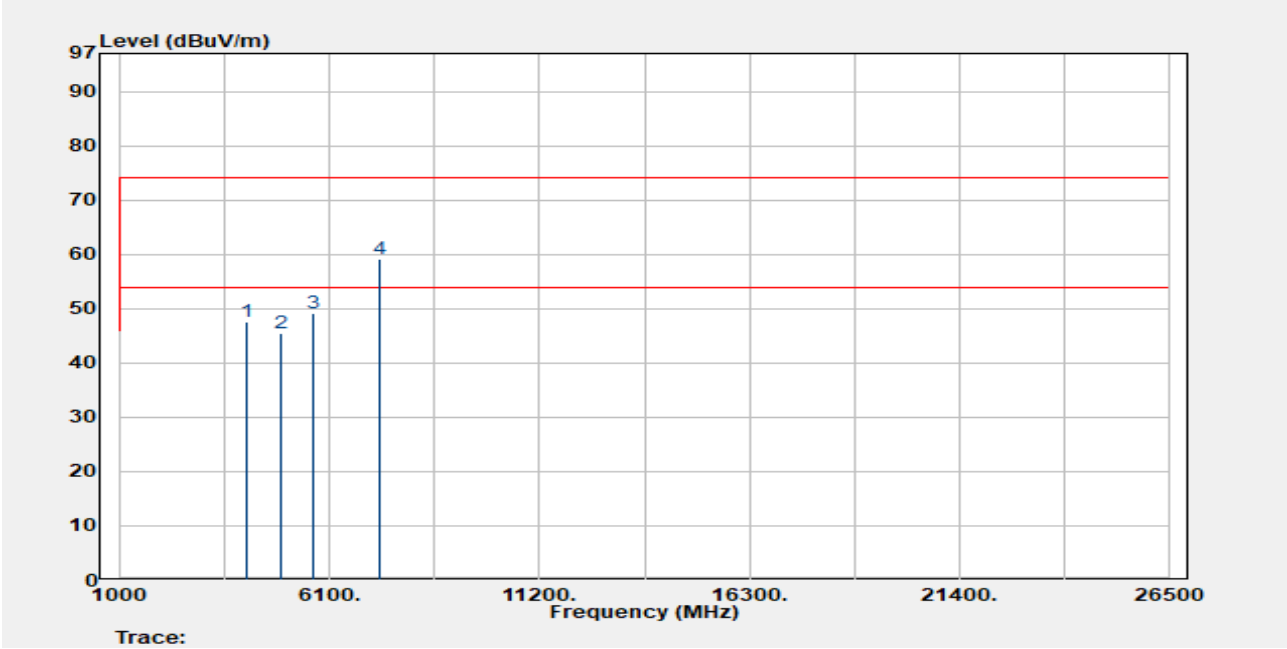
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2402 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4003.000	Peak	53.89	-1.11	52.77	74.00	-21.23
4804.000	Peak	49.86	-0.27	49.59	74.00	-24.41
5606.000	Peak	49.56	2.25	51.81	74.00	-22.19
7206.000	Peak	53.30	6.51	59.80	74.00	-14.20

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)
4003.000	Average	52.77	-25.04	27.73	54.00	-26.27
4804.000	Average	49.59	-25.04	24.55	54.00	-29.45
5606.000	Average	51.81	-25.04	26.77	54.00	-27.23
7206.000	Average	59.80	-25.04	34.76	54.00	-19.24

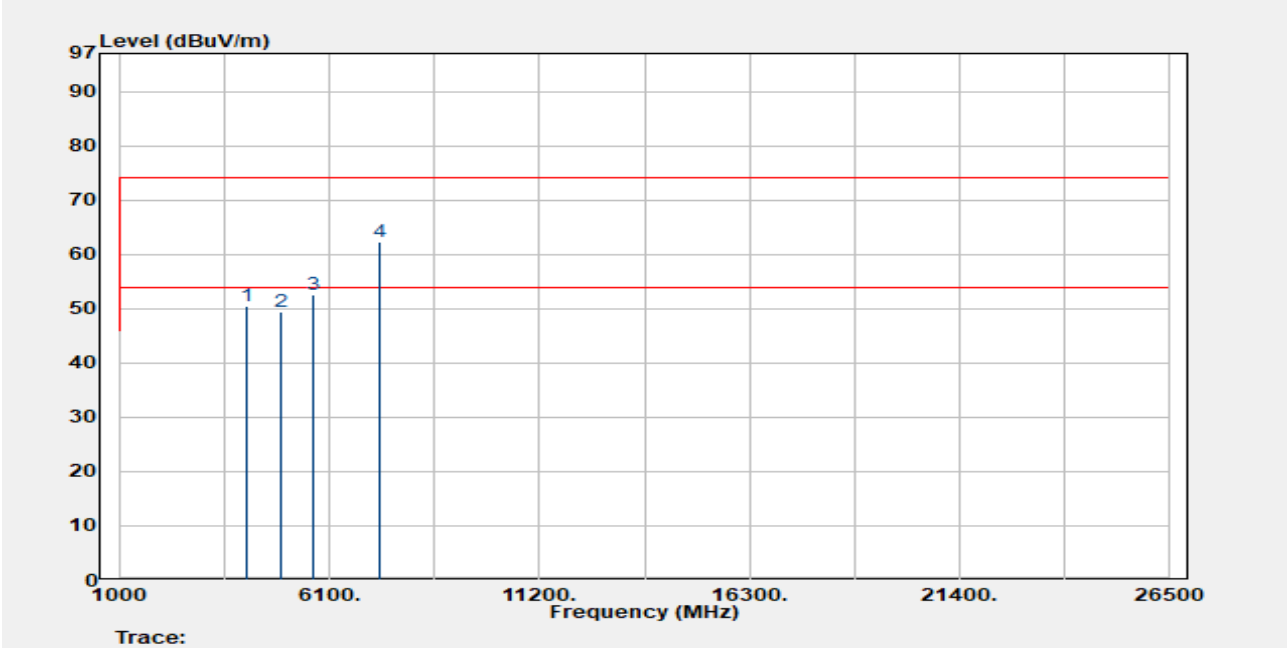
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2441 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4066.000	Peak	48.74	-1.17	47.57	74.00	-26.43
4882.000	Peak	45.37	0.21	45.58	74.00	-28.42
5697.000	Peak	46.23	2.85	49.08	74.00	-24.92
7323.000	Peak	52.78	6.24	59.02	74.00	-14.98

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)
4066.000	Average	47.57	-25.04	22.53	54.00	-31.47
4882.000	Average	45.58	-25.04	20.54	54.00	-33.46
5697.000	Average	49.08	-25.04	24.04	54.00	-29.96
7323.000	Average	59.02	-25.04	33.98	54.00	-20.02

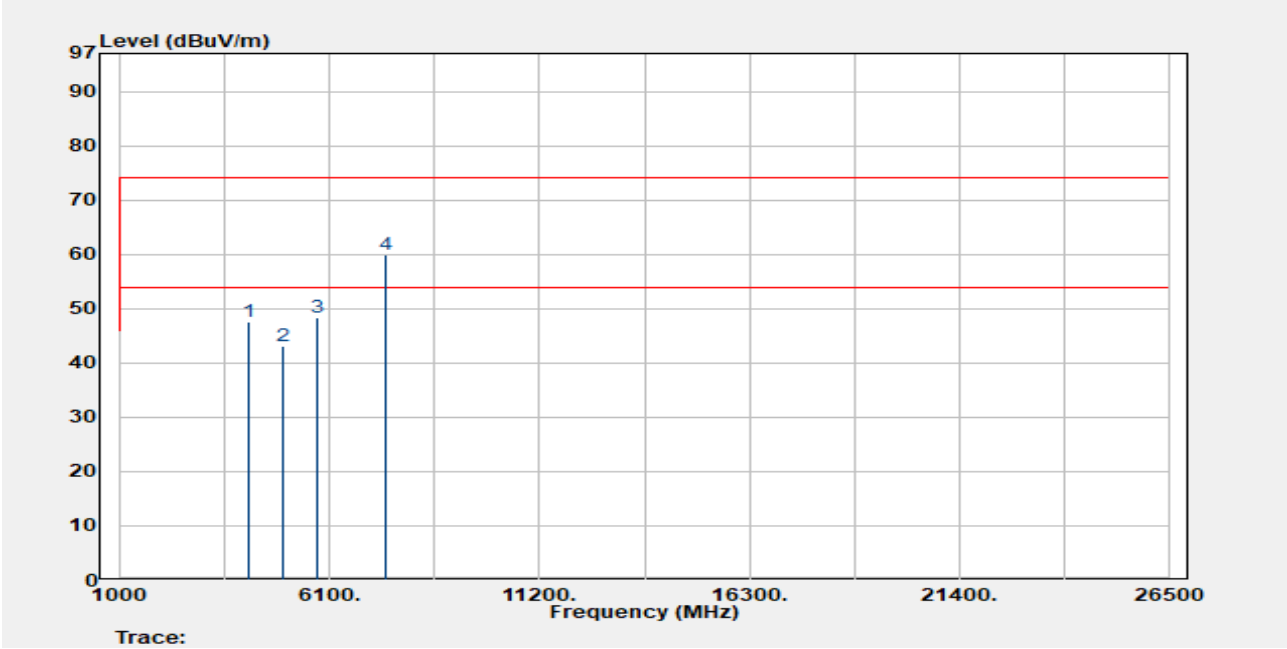
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2441 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4066.000	Peak	51.62	-1.17	50.45	74.00	-23.55
4882.000	Peak	49.18	0.21	49.39	74.00	-24.61
5697.000	Peak	49.75	2.85	52.61	74.00	-21.39
7323.000	Peak	55.96	6.24	62.20	74.00	-11.80

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)
4066.000	Average	50.45	-25.04	25.41	54.00	-28.59
4882.000	Average	49.39	-25.04	24.35	54.00	-29.65
5697.000	Average	52.61	-25.04	27.57	54.00	-26.43
7323.000	Average	62.20	-25.04	37.16	54.00	-16.84

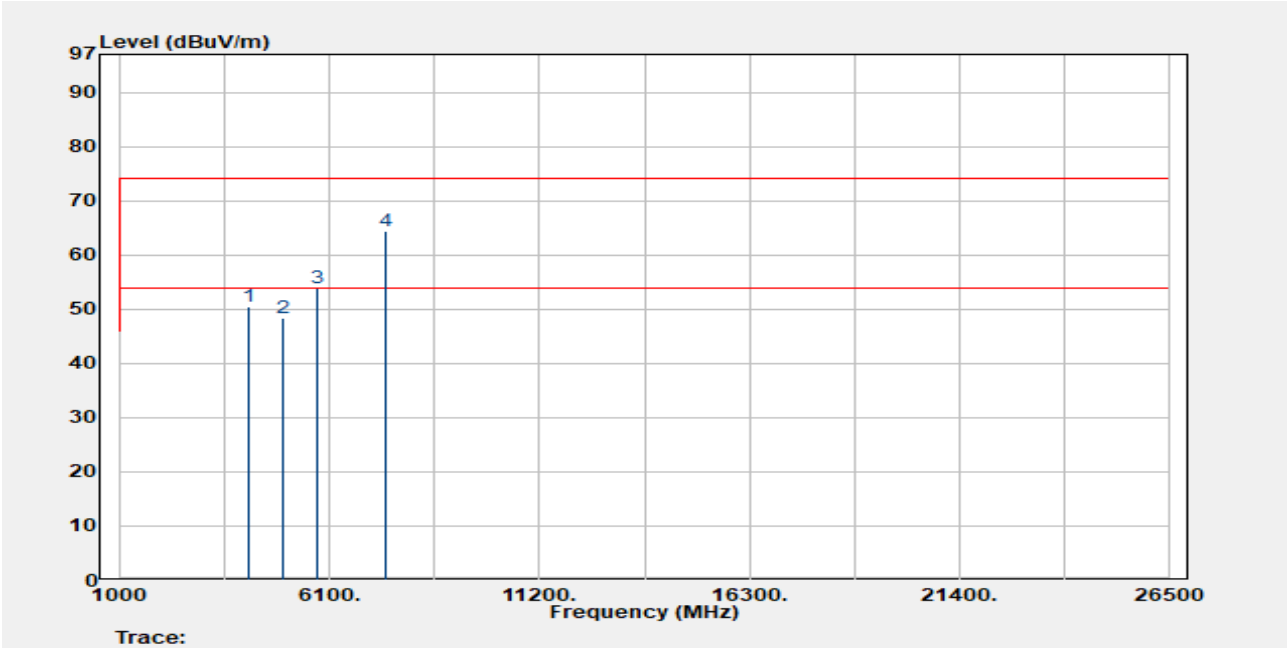
Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4136.000	Peak	48.44	-0.76	47.68	74.00	-26.32
4960.000	Peak	42.20	0.81	43.02	74.00	-30.98
5788.000	Peak	44.98	3.33	48.30	74.00	-25.70
7440.000	Peak	53.92	5.99	59.91	74.00	-14.09

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)
4136.000	Average	47.68	-25.04	22.64	54.00	-31.36
4960.000	Average	43.02	-25.04	17.98	54.00	-36.02
5788.000	Average	48.30	-25.04	23.26	54.00	-30.74
7440.000	Average	59.91	-25.04	34.87	54.00	-19.13

Report Number	:TERF2402000457ER	Test Site	:SAC 3
Operation Mode	:BR	Test Date	:2024-03-19
Test Frequency	:2480 MHz	Temp./Humi.	:21℃/59%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E2 Plane	Engineer	:Nick Lin



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
4136.000	Peak	51.36	-0.76	50.59	74.00	-23.41
4960.000	Peak	47.64	0.81	48.45	74.00	-25.55
5788.000	Peak	50.64	3.33	53.97	74.00	-20.03
7440.000	Peak	58.47	5.99	64.45	74.00	-9.55

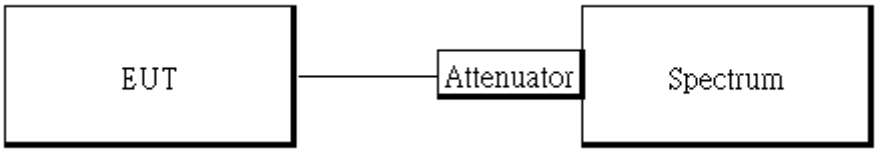
Freq. MHz	Detector Mode AV	Peak Actual FS (dBµV/m)	Duty Cycle Factor (dB)	Average Value (dBuV/m)	Average Limit@3m (dBuV/m)	Margin (dB)
4136.000	Average	50.59	-25.04	25.55	54.00	-28.45
4960.000	Average	48.45	-25.04	23.41	54.00	-30.59
5788.000	Average	53.97	-25.04	28.93	54.00	-25.07
7440.000	Average	64.45	-25.04	39.41	54.00	-14.59

12 FREQUENCY SEPARATION

12.1 Standard Applicable

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

12.2 Test Setup



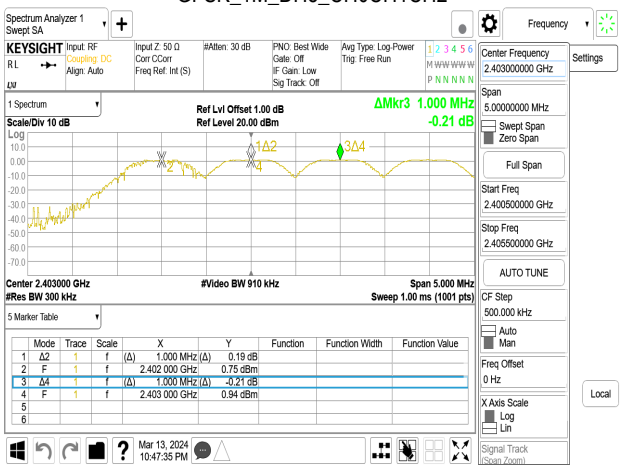
12.3 Measurement Procedure

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 ≥ 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.

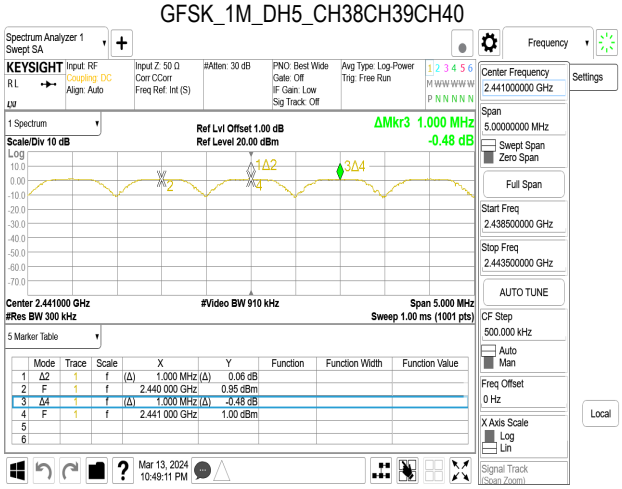
12.4 Measurement Result

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

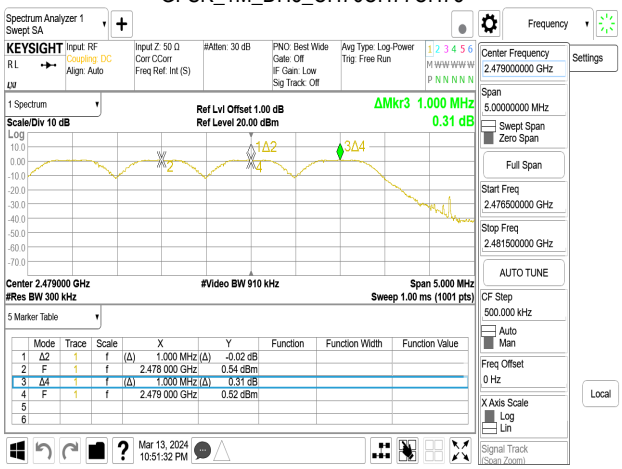
GFSK_1M_DH5_CH0CH1CH2



GFSK_1M_DH5_CH38CH39CH40



GFSK_1M_DH5_CH76CH77CH78

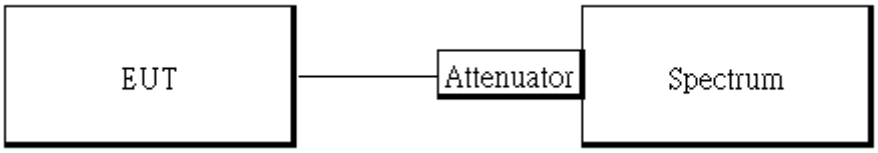


13 NUMBER OF HOPPING FREQUENCY

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

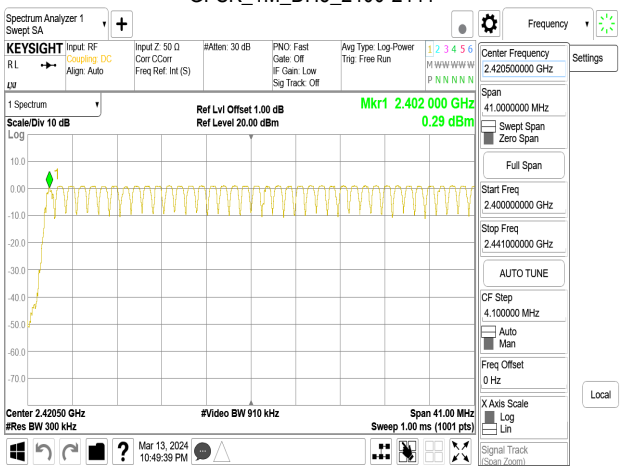
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW = 30% of the channel spacing, VBW ≥ RBW., Detector = Peak
6. Max hold, view and count how many channel in the band.

13.4 Measurement Result

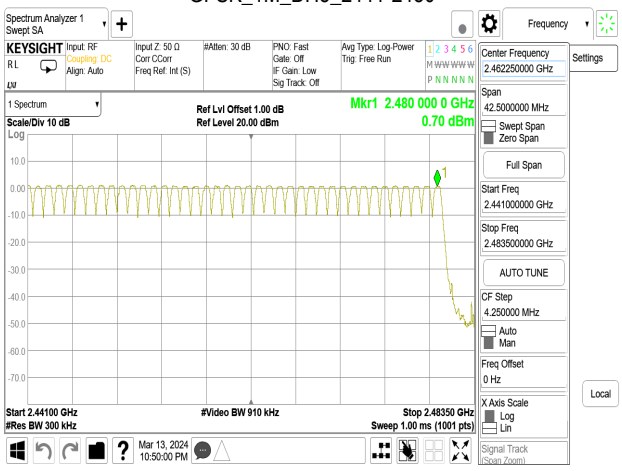
Tabular Data of Total Channel Number

	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	

GFSK_1M_DH5_2400-2441



GFSK_1M_DH5_2441-2480

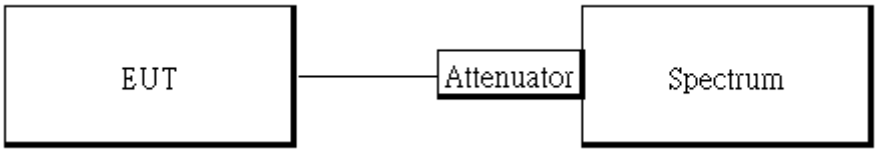


14 TIME OF OCCUPANCY (DWELL TIME)

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 C63.10:2013.
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.

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.

14.4 Measurement Result

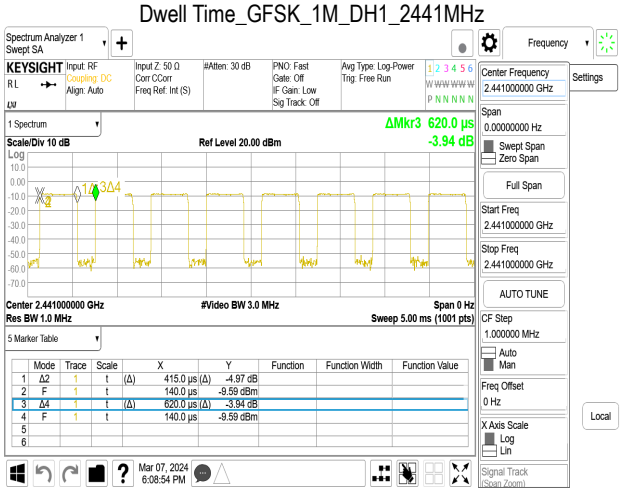
GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
Mid	DH1	132.80	400
	DH3	259.20	400
	DH5	300.80	400

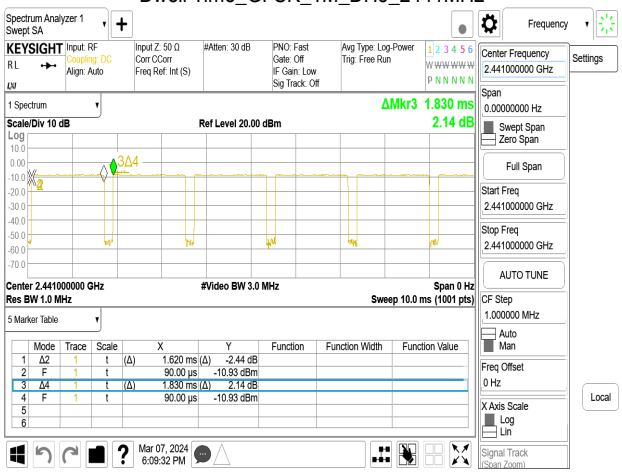
GFSK (1Mbps):

CH Mid	DH1 time slot	=	0.415	*	(1600/2/79)	*	31.6	=	132.80 (ms)
	DH3 time slot	=	1.620	*	(1600/4/79)	*	31.6	=	259.20 (ms)
	DH5 time slot	=	2.820	*	(1600/6/79)	*	31.6	=	300.80 (ms)

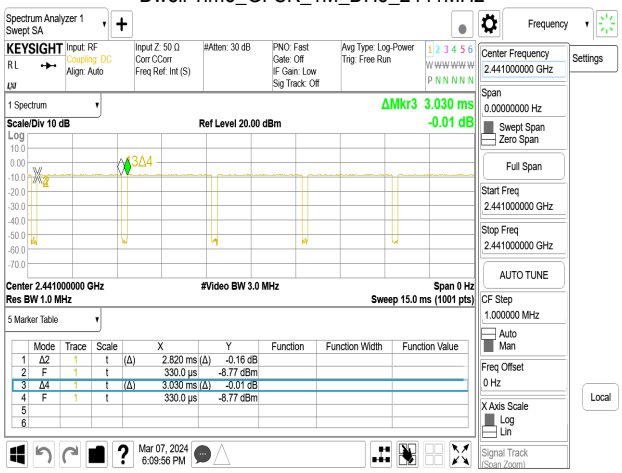
Dwell Time_GFSK_1M_DH1_2441MHz



Dwell Time_GFSK_1M_DH3_2441MHz



Dwell Time_GFSK_1M_DH5_2441MHz



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 complies with this requirement and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~