



FCC RF Test Report

APPLICANT : Weifang Goertek Electronics Co., Ltd
EQUIPMENT : Wireless Device
MODEL NAME : G0DNE
FCC ID : SZGG0DNE
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter
TEST DATE(S) : Jan. 16, 2024 ~ Mar. 11, 2024

We, Sporton International Inc. (Shenzhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (ShenZhen)

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055

People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3N1513A	Rev. 01	Initial issue of report	Mar. 15, 2024



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	Number of Channels	$\geq 15\text{Chs}$	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	$\leq 0.4\text{sec/channel}$	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	-	Report only	-
3.4	-	99% Bandwidth	-	Report only	-
3.5	15.247(b)(1)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
3.6	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 15.08 dB at 2488.74 MHz
3.9	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 12.93 dB at 0.16 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



1 General Description

1.1 Applicant

Weifang Goertek Electronics Co., Ltd

Gaoxin 2 Road, Free Trade Zone, Weifang, Shandong, 261205, P.R.China

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Wireless Device
Model Name	G0DNE
FCC ID	SZGG0DNE
SN Code	Conducted: LZAG6501311301M13BFC0049 Conduction: 3B27LZABEC7947 Radiation: 3B11C5124

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.3 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2404 MHz ~ 2478 MHz
Number of Channels	72
Carrier Frequency of Each Channel	2402+n*1 MHz; n=2~22, 26~78
Maximum Output Power to Antenna	BLE (1Mbps) : 6.78 dBm (0.0048 W)
99% Occupied Bandwidth	BLE (1Mbps) : 0.070MHz
Antenna Type / Gain	PCB Antenna type with gain 0.5 dBi
Type of Modulation	BLE (1Mbps) : ASK

1.4 Modification of EUT

No modifications are made to the EUT during all test items.



1.5 Testing Location

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-SZ TH01-SZ	CN1256	421272

Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH01-SZ	CN1256	421272

1.6 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH01-SZ	AUDIX	E3	6.2009-8-24
2.	CO01-SZ	AUDIX	E3	6.120613b



1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 15 Subpart C §15.247
- ♦ FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

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

2.2 Test Mode

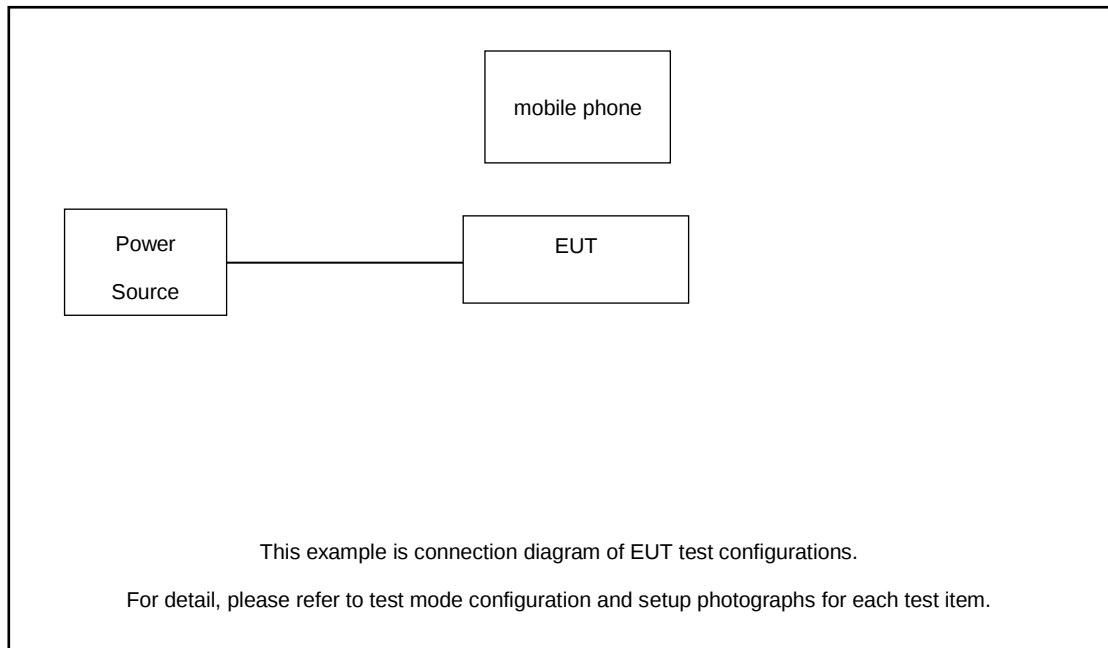
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

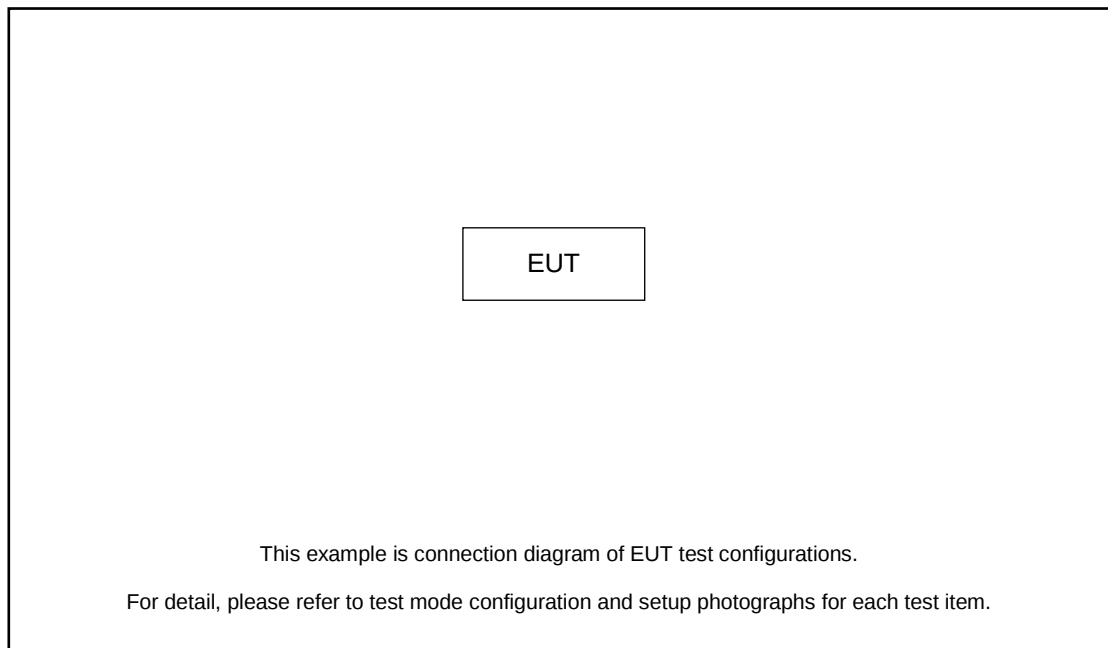
Summary table of Test Cases	
Test Item	Modulation / Data Rate
	BLE ASK 1Mbps
Conducted Test Cases	Mode 1: CH02_2404 MHz
	Mode 2: CH22_2424 MHz
	Mode 3: CH26_2428 MHz
	Mode 4: CH76_2478 MHz
Radiated Test Cases	BLE ASK 1Mbps
	Mode 1: CH02_2404 MHz
	Mode 2: CH22_2424 MHz
	Mode 3: CH26_2428 MHz
	Mode 4: CH76_2478 MHz
AC Conducted Emission	Mode 1 : BT Link + EUT

2.3 Connection Diagram of Test System

For Conducted Emission:



For Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Model Name	FCC ID	Data Cable	Power Cord
1.	Mobile Phone	NA	NA	NA	NA
2.	USB Cable	NA	NA	NA	NA
3.	Adapter	NA	NA	NA	NA

2.5 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the mobile phone.

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 1.30 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.30 + 10 = 11.30 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation;
RBW = 300kHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

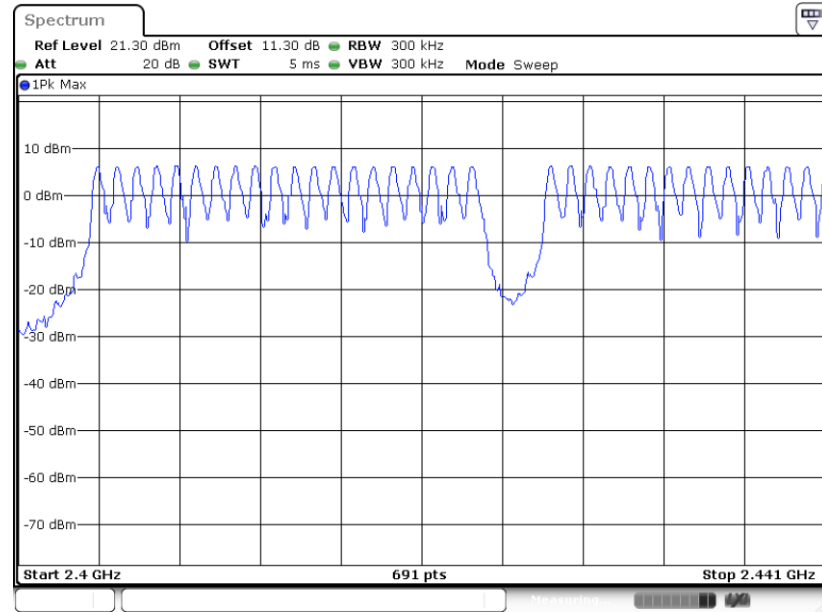


3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.

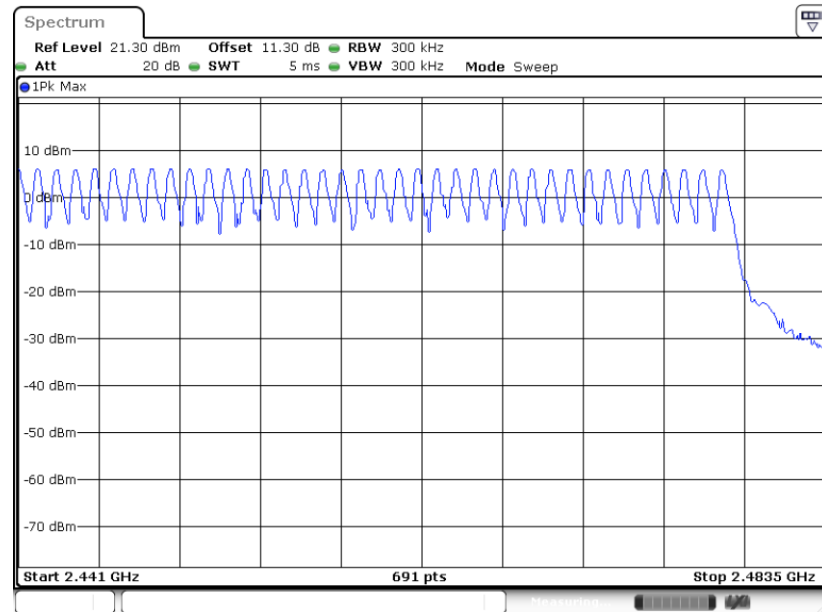


Number of Hopping Channel Plot on Channel 02



Date: 11.MAR.2024 15:45:33

Number of Hopping Channel Plot on Channel 76



Date: 11.MAR.2024 15:49:03

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

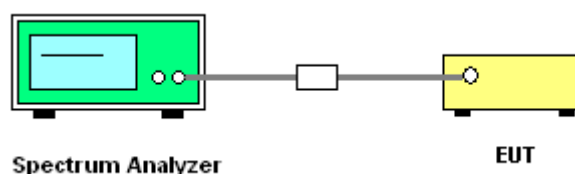
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels;
RBW = 300kHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.



Channel Separation Plot on Channel 02



Date: 11.MAR.2024 16:31:41

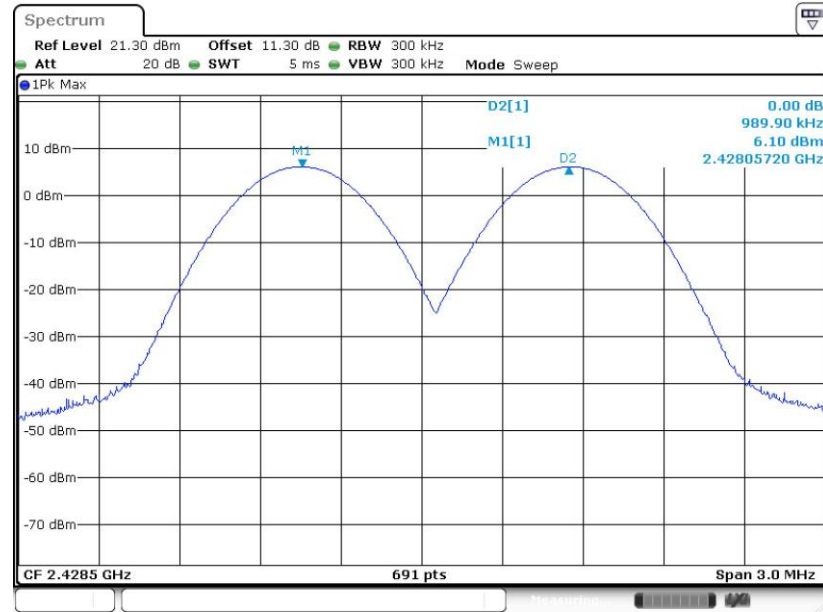
Channel Separation Plot on Channel 22



Date: 11.MAR.2024 16:39:05



Channel Separation Plot on Channel 26



Date: 11.MAR.2024 16:43:12

Channel Separation Plot on Channel 76



Date: 11.MAR.2024 16:48:39

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

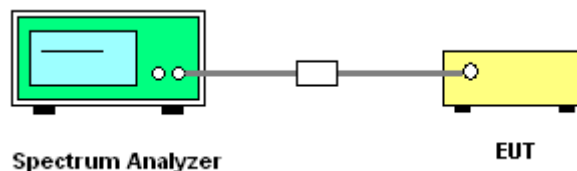
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

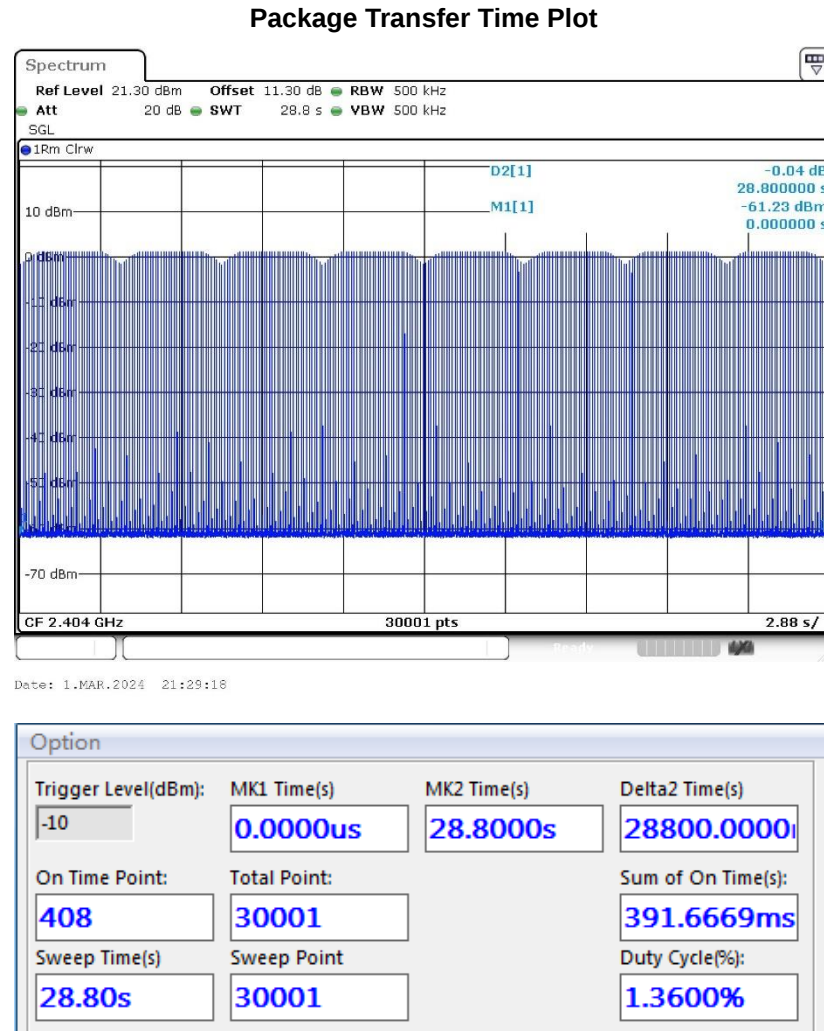
1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 100kHz; VBW $\geq$ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Teme

Please refer to Appendix A.



Remark:

1. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time.
2. The observation Occupancy time is hopping channel 72 channels x 400ms = 28.8sec using sweep point 30001. The total hops is finally counted via computer analysis.

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

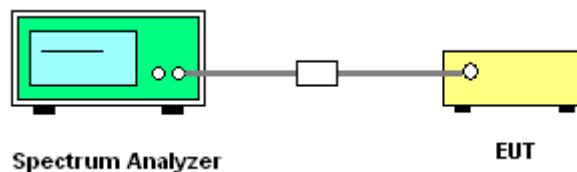
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
The RBW is set to 1% to 5% of the 99% OBW, the VBW is set to 3 times the RBW;
Sweep = auto; Detector function = peak;
Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
The RBW is set to 1% to 5% of the 99% OBW, the VBW is set to 3 times the RBW;
Sweep = auto; Detector function = peak;
Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

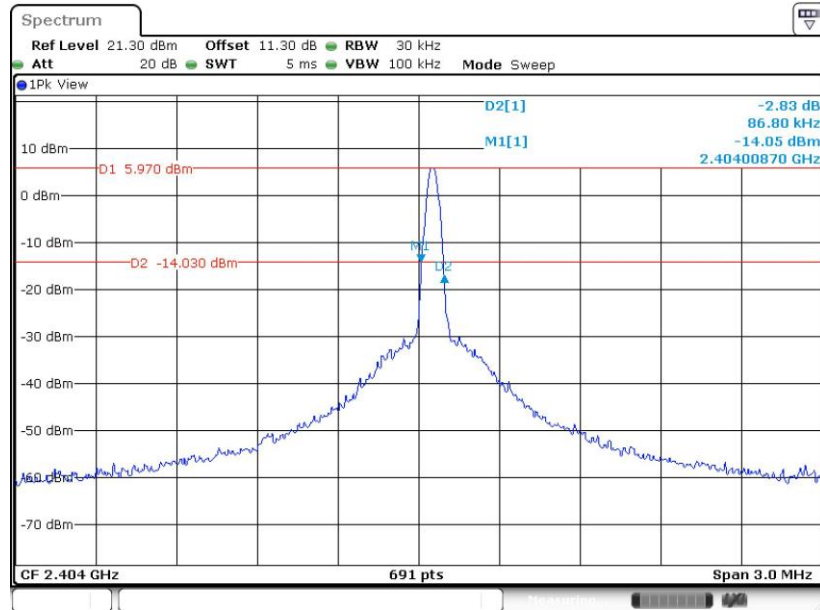


3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

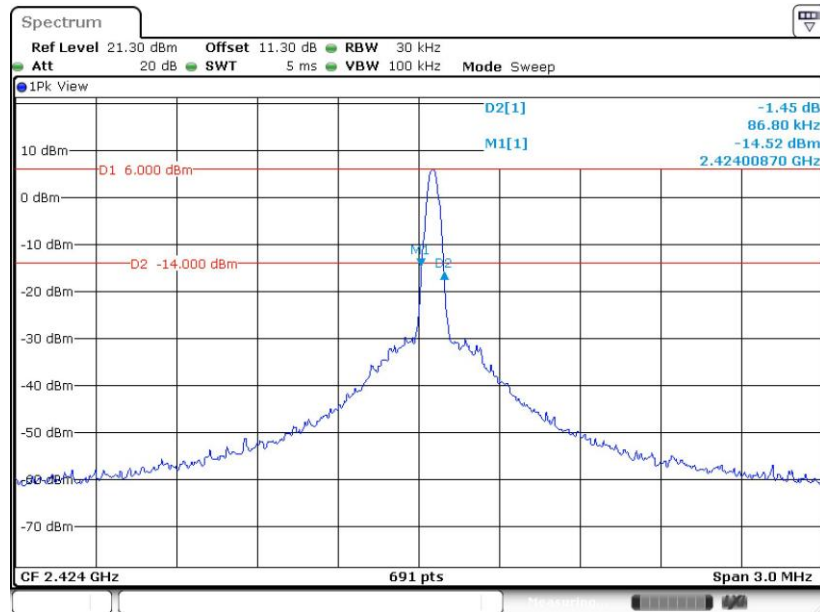


20 dB Bandwidth Plot on Channel 02



Date: 11.MAR.2024 18:12:12

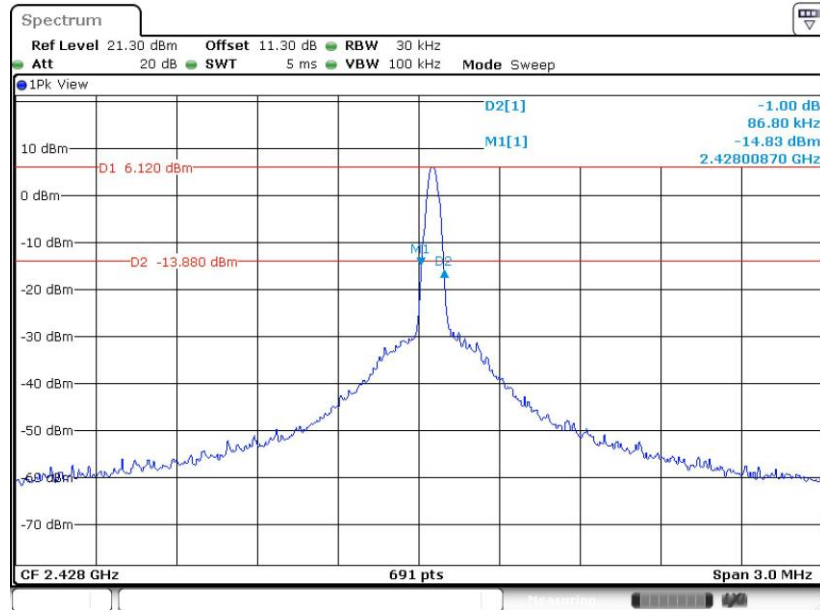
20 dB Bandwidth Plot on Channel 22



Date: 11.MAR.2024 18:07:28

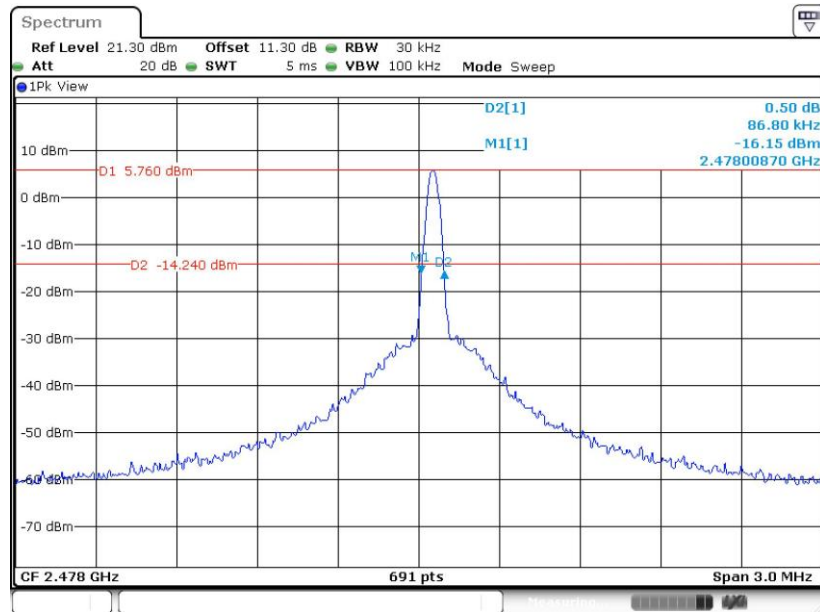


20 dB Bandwidth Plot on Channel 26



Date: 11.MAR.2024 18:08:54

20 dB Bandwidth Plot on Channel 76



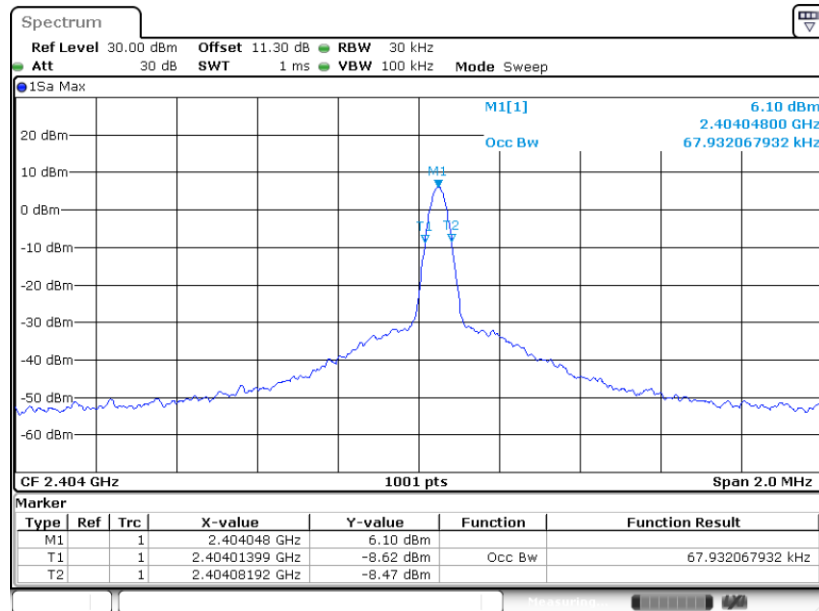
Date: 11.MAR.2024 18:10:41



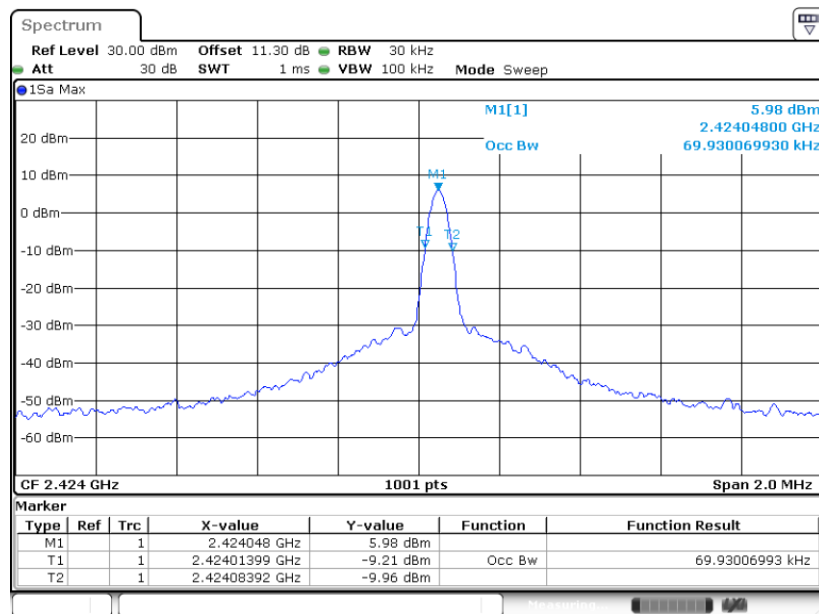
3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

99% Occupied Bandwidth Plot on Channel 02

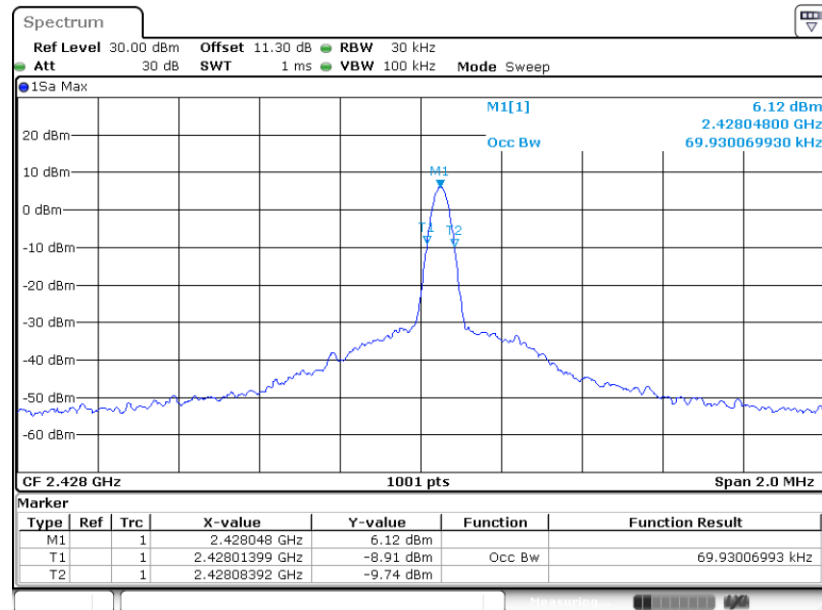


99% Occupied Bandwidth Plot on Channel 22



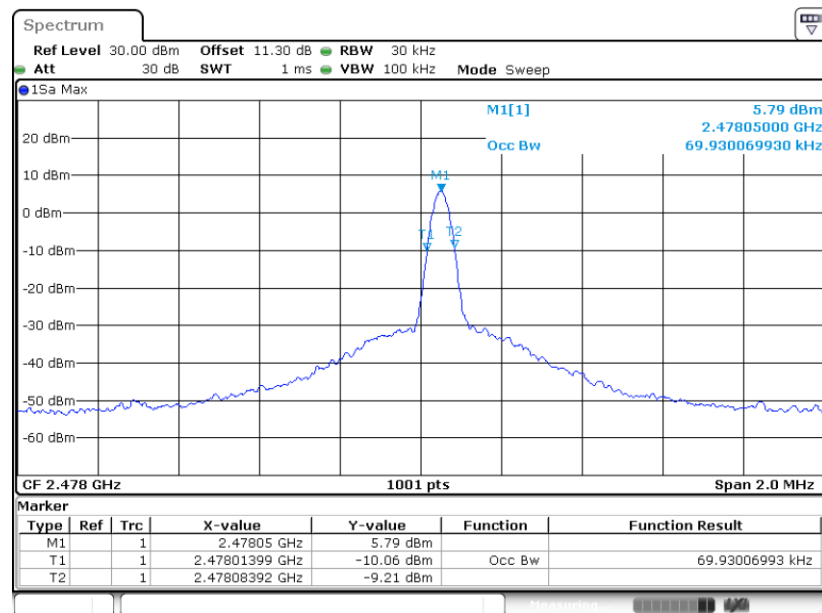


99% Occupied Bandwidth Plot on Channel 26



Date: 16 JAN 2024 15:51:53

99% Occupied Bandwidth Plot on Channel 76



Date: 16 JAN 2024 15:53:53

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.5 Output Power Measurement

3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following:
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

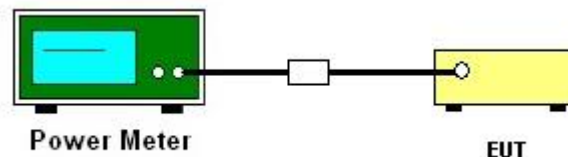
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

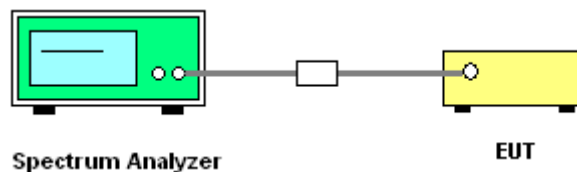
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

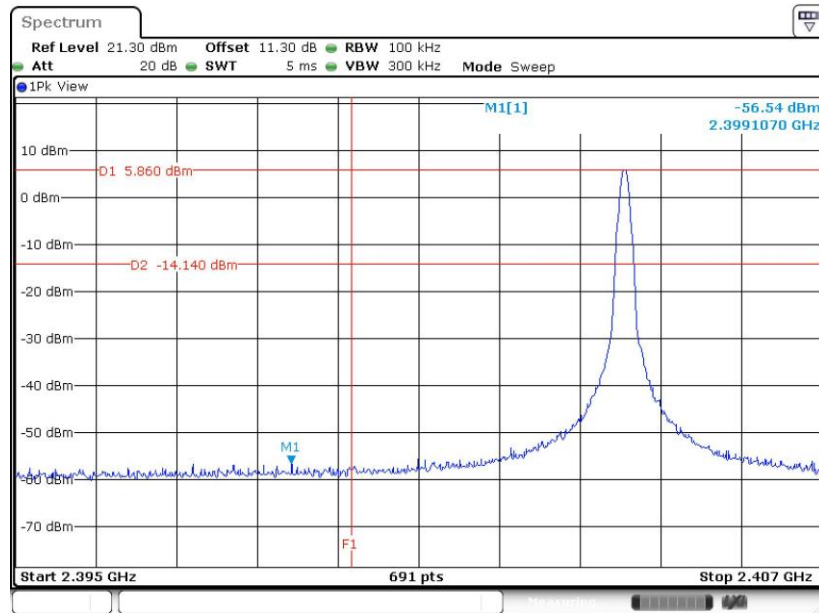
3.6.4 Test Setup





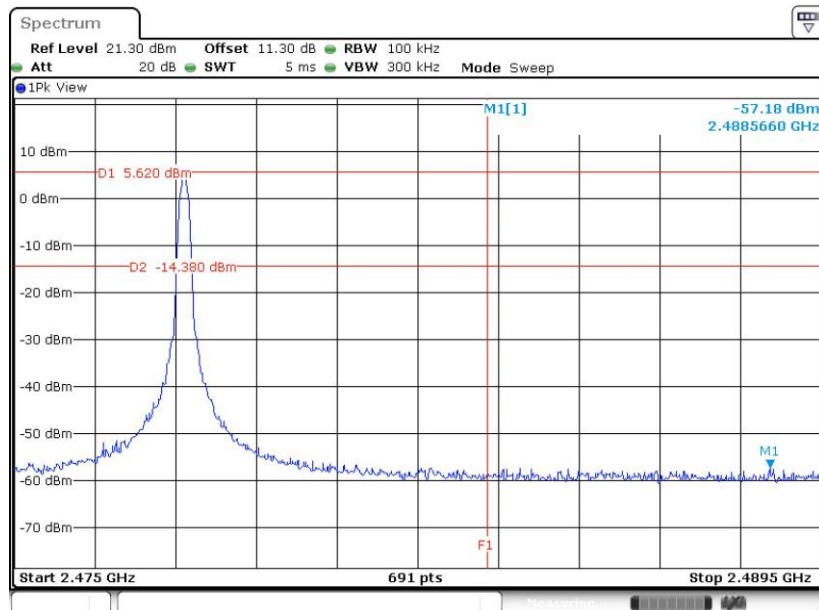
3.6.5 Test Result of Conducted Band Edges

Low Band Edge Plot on Channel 02



Date: 11.MAR.2024 16:59:23

High Band Edge Plot on Channel 76

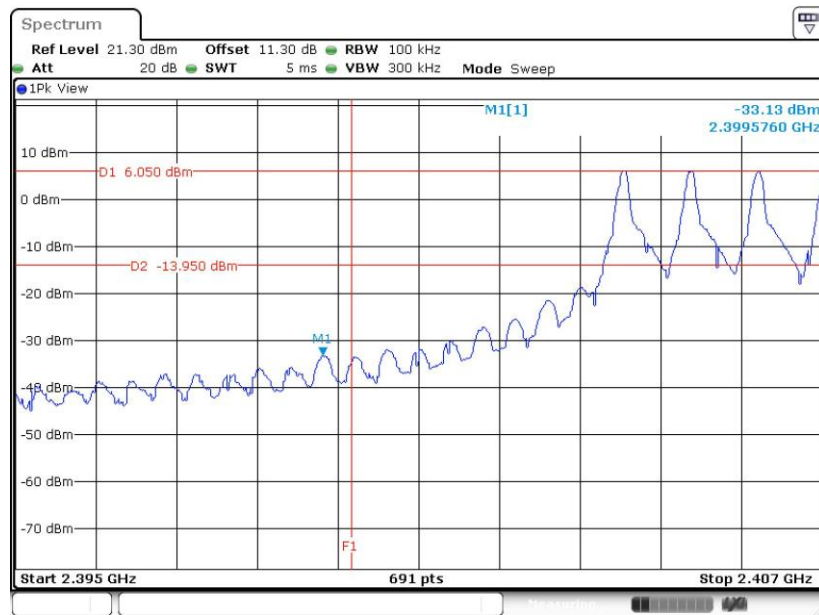


Date: 11.MAR.2024 17:03:10



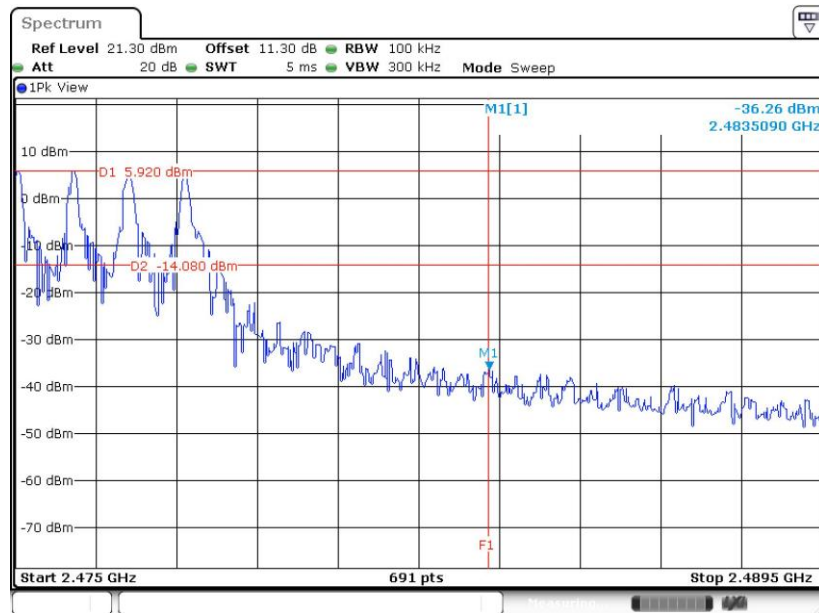
3.6.6 Test Result of Conducted Hopping Mode Band Edges

Hopping Mode Low Band Edge Plot



Date: 11.MAR.2024 16:01:53

Hopping Mode High Band Edge Plot



Date: 11.MAR.2024 16:07:20

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

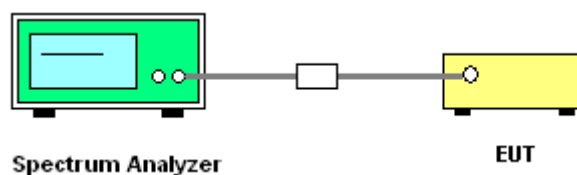
3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

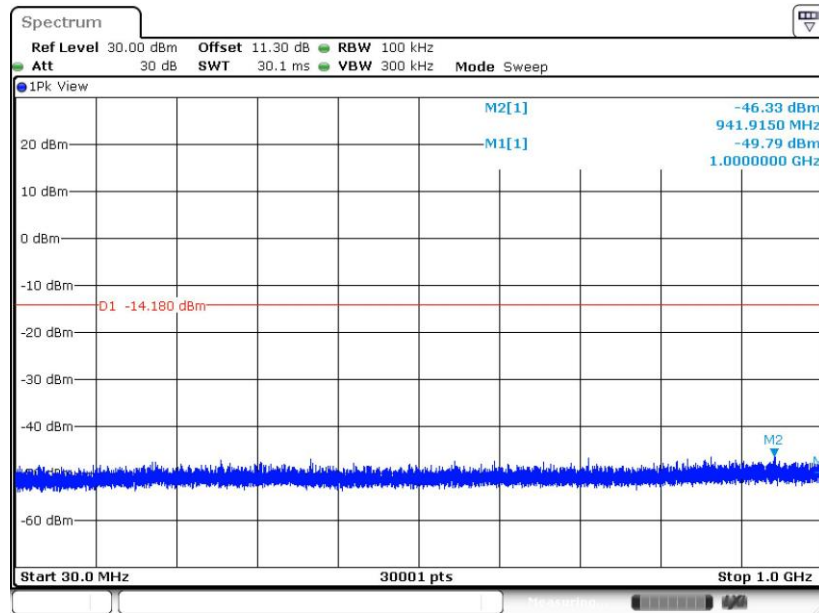
3.7.4 Test Setup





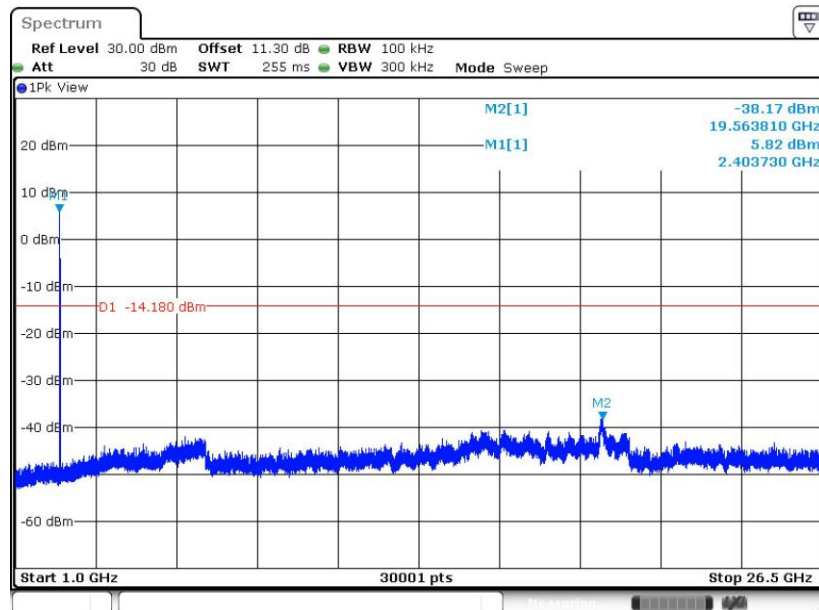
3.7.5 Test Result of Conducted Spurious Emission

CSE Plot on Ch 02



Date: 11.MAR.2024 17:09:41

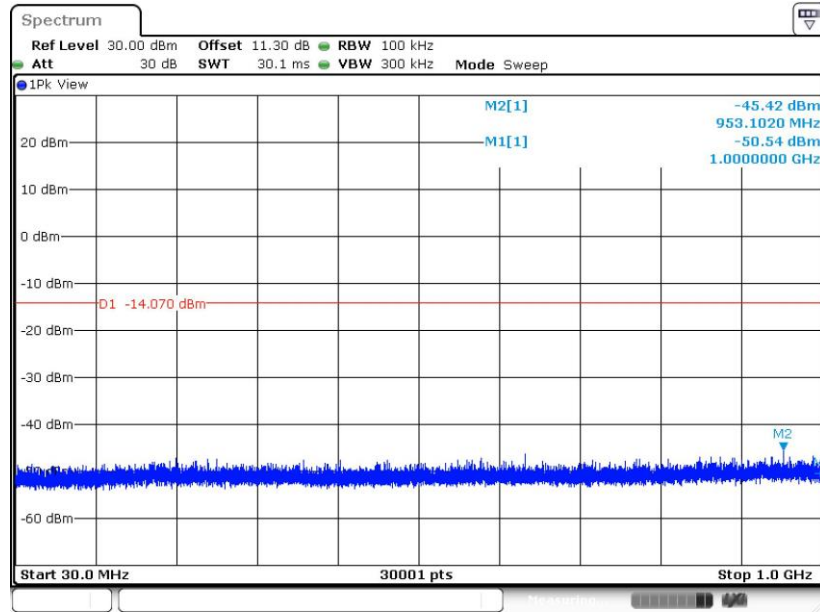
CSE Plot on Ch 02



Date: 11.MAR.2024 17:08:59

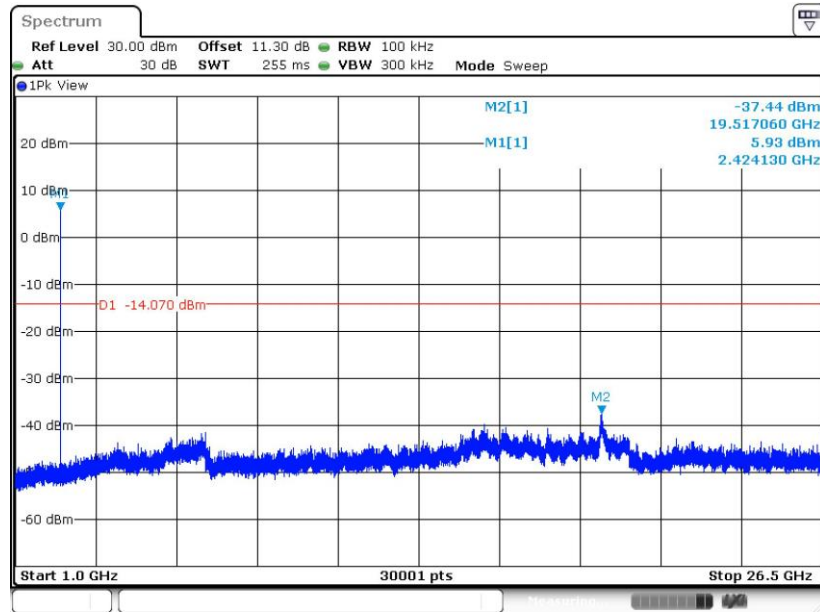


CSE Plot on Ch 22



Date: 11.MAR.2024 17:12:47

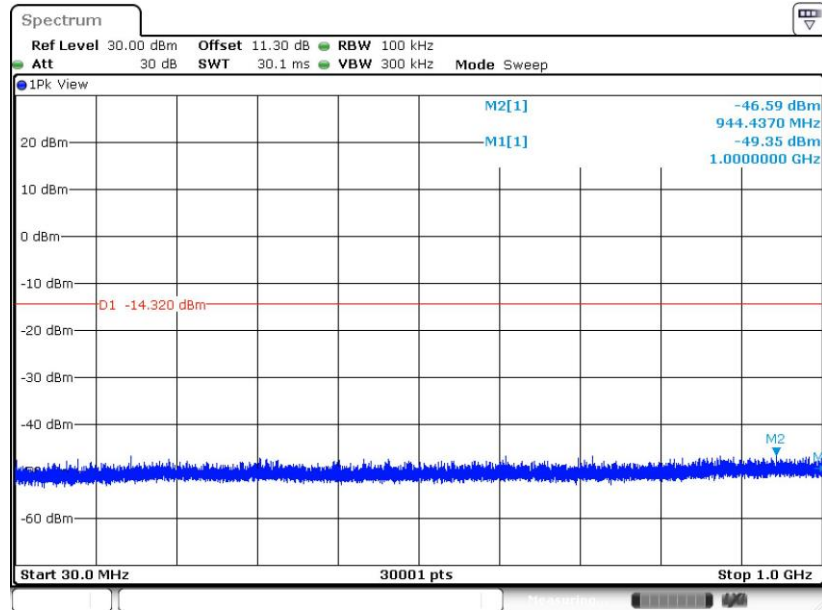
CSE Plot on Ch 22



Date: 11.MAR.2024 17:12:14

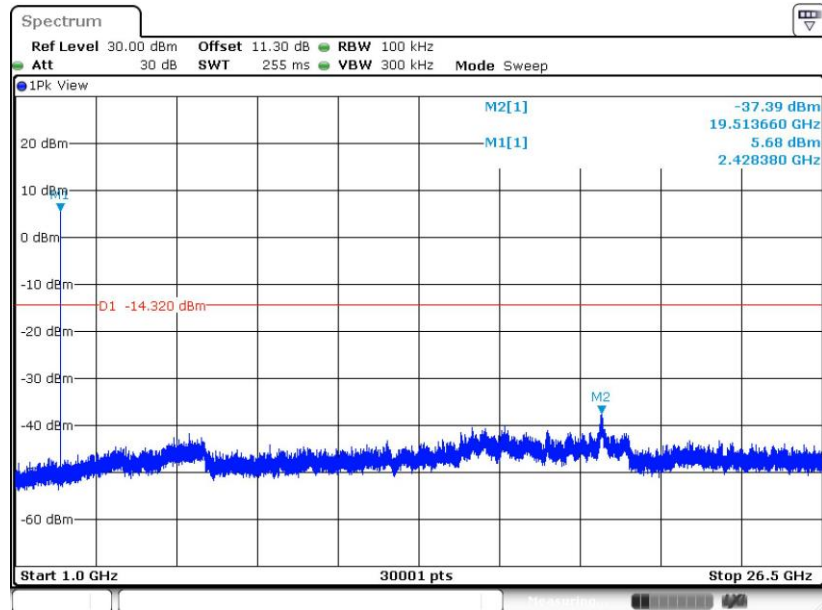


CSE Plot on Ch 26



Date: 11.MAR.2024 17:15:14

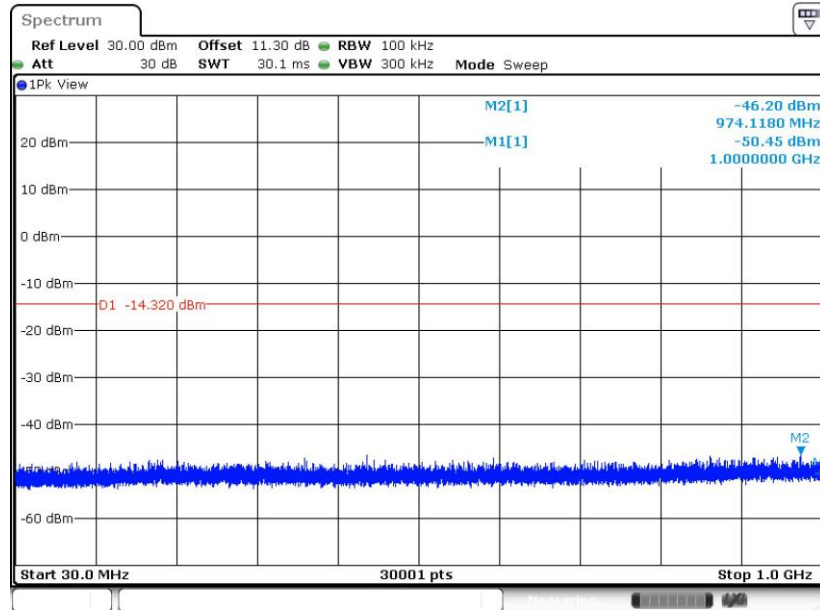
CSE Plot on Ch 26



Date: 11.MAR.2024 17:14:27

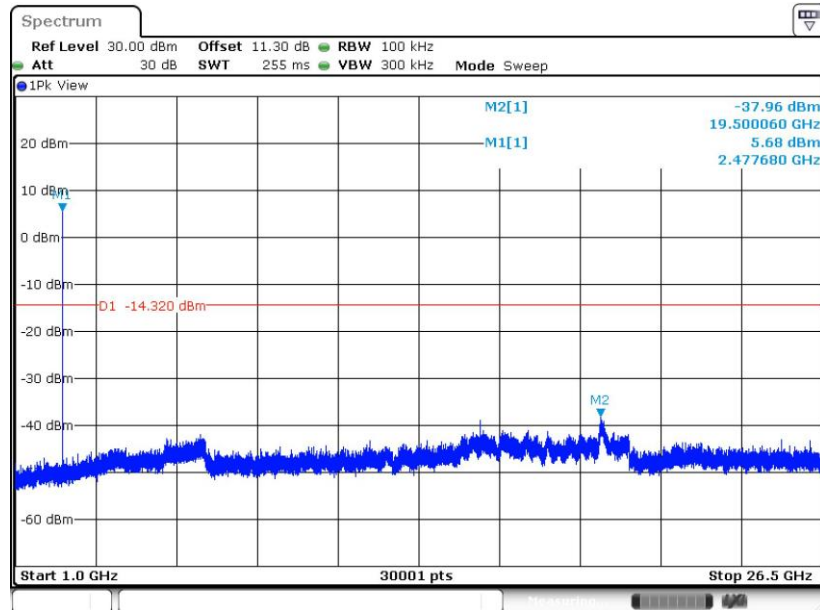


CSE Plot on Ch 76



Date: 11.MAR.2024 17:17:12

CSE Plot on Ch 76



Date: 11.MAR.2024 17:16:44

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.8.2 Measuring Instruments

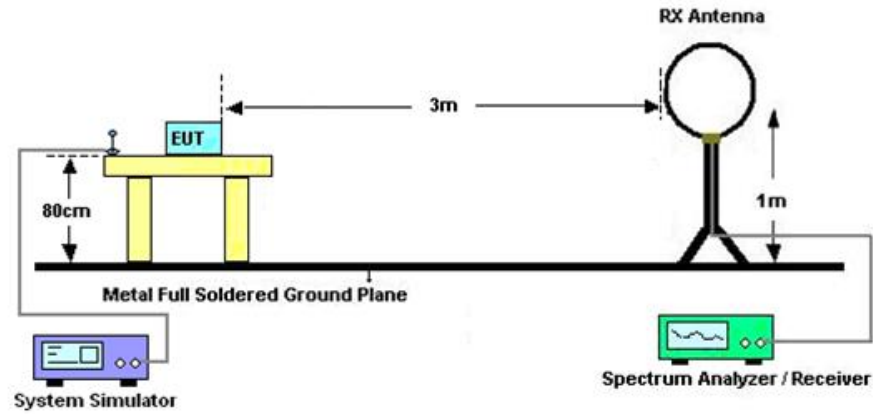
The measuring equipment is listed in the section 4 of this test report.

3.8.3 Test Procedures

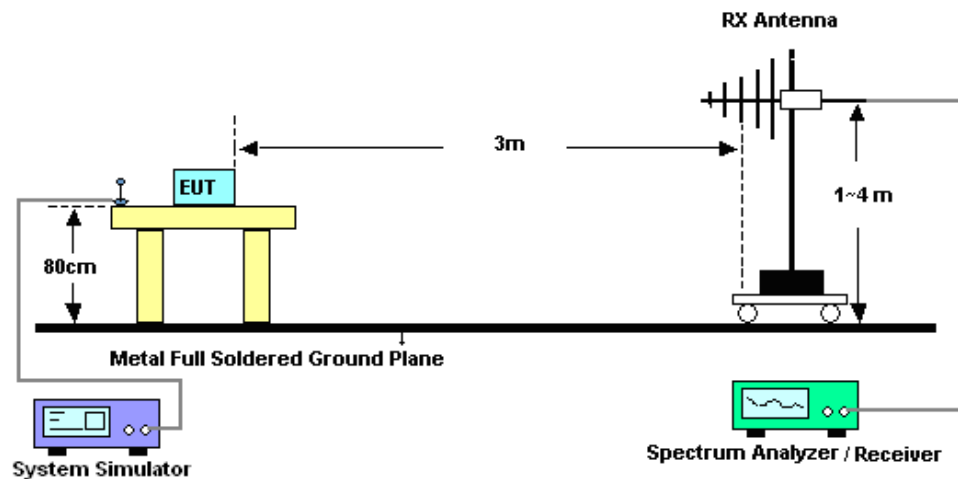
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
 - (4) For average measurement: use duty cycle = 100%.
VBW = 10 Hz.
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.8.4 Test Setup

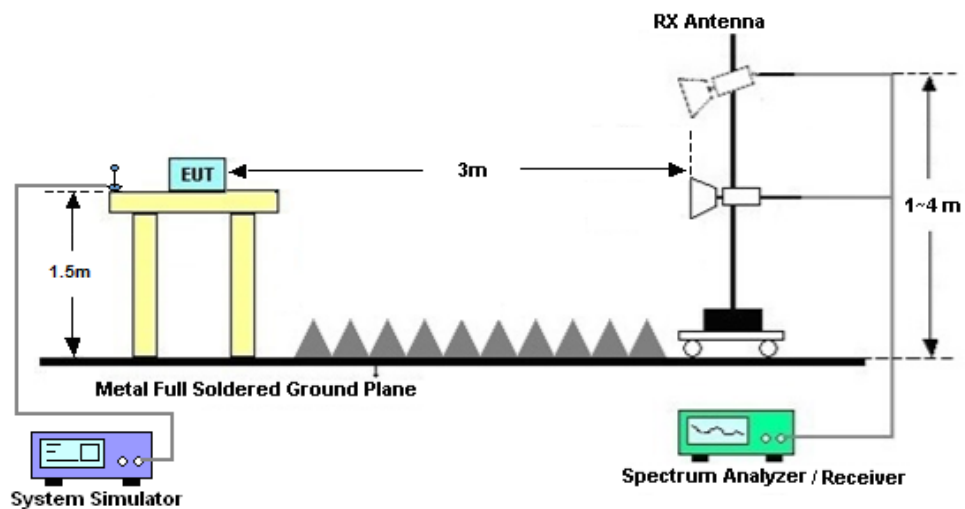
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 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 line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.8.8 Duty cycle

Please refer to Appendix D.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

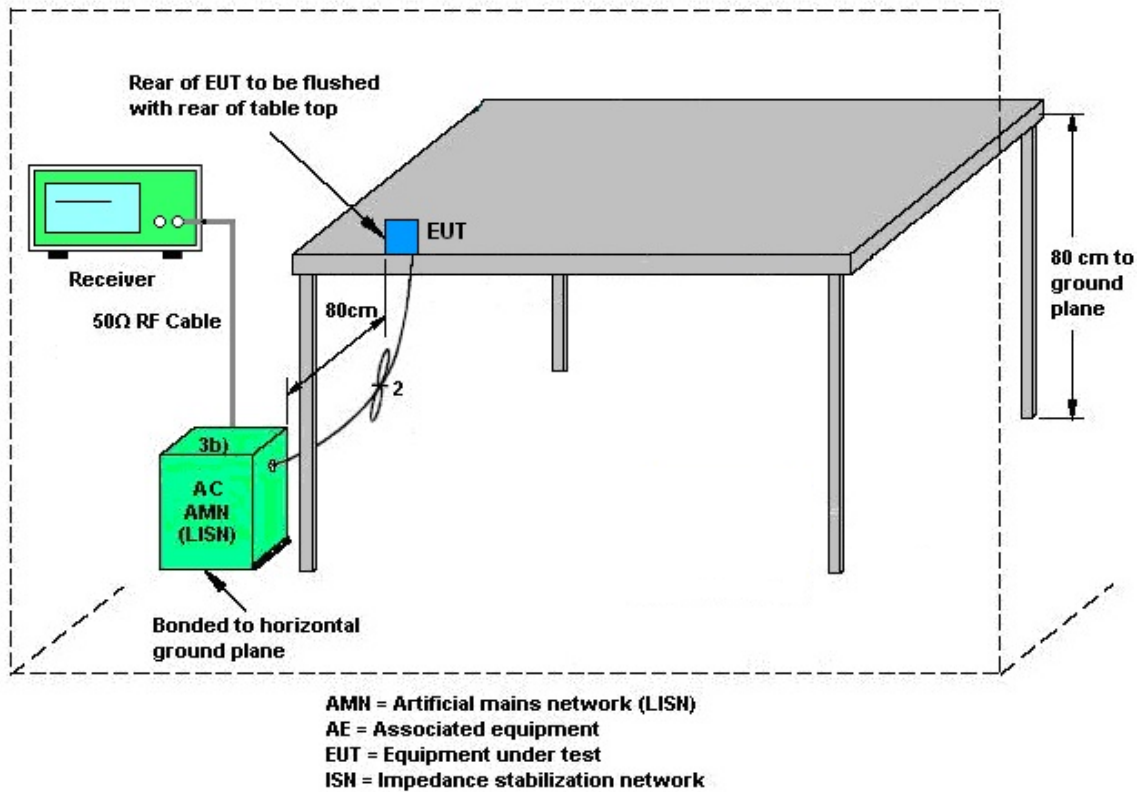
3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.10 Antenna Requirements

3.10.1 Standard Applicable

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

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 06, 2023	Jan. 16, 2024~ Mar. 11, 2024	Apr. 05, 2024	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 29, 2023	Jan. 16, 2024~ Mar. 11, 2024	Dec. 28, 2024	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Aug. 21, 2023	Jan. 16, 2024~ Mar. 11, 2024	Aug. 20, 2024	Conducted (TH01-SZ)
Thermo meter	Anymetre	JR593	#7	- 10°C ~ 50°C 10%RH~99%RH	Apr. 08, 2023	Jan. 16, 2024~ Mar. 11, 2024	Apr. 07, 2024	Conducted (TH01-SZ)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Dec. 27, 2023	Jan. 18, 2024	Dec. 26, 2024	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Jul. 07, 2023	Jan. 18, 2024	Jul. 06, 2024	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jul. 28, 2022	Jan. 18, 2024	Jul. 27, 2024	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Oct. 24, 2023	Jan. 18, 2024	Oct. 23, 2025	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 08, 2023	Jan. 18, 2024	Jul. 07, 2024	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 08, 2023	Jan. 18, 2024	Apr. 07, 2024	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 04, 2023	Jan. 18, 2024	Apr. 03, 2024	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P-R	1943528	1GHz~18GHz	Oct. 18, 2023	Jan. 18, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5Ghz	Oct. 18, 2023	Jan. 18, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 07, 2023	Jan. 18, 2024	Jul. 06, 2024	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	Oct. 18, 2023	Jan. 18, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jan. 18, 2024	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jan. 18, 2024	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Jul. 06, 2023	Jan. 17, 2024	Jul. 05, 2024	Conduction (CO01-SZ)
AC LISN	R&S	ENV216	100063	9kHz~30MHz	Aug. 21, 2023	Jan. 17, 2024	Aug. 20, 2024	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 16, 2023	Jan. 17, 2024	Oct. 15, 2024	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 07, 2023	Jan. 17, 2024	Jul. 06, 2024	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Spurious Emission & Bandedge	±1.34 dB
Occupied Channel Bandwidth	±0.1 MHz
Conducted Power	±1.34 dB
Conducted Power Spectral Density	±1.32 dB
Frequency	±1.3 Hz

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.7 dB
---	--------

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.8 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.2 dB
---	--------

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0 dB
---	--------

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.3 dB
---	--------

----- THE END -----



Appendix A. Conducted Test Results

Test Engineer:	Sam Zheng	Temperature:	21~25	°C
Test Date:	2024/1/16~2024/3/11	Relative Humidity:	51~54	%

TEST RESULTS DATA									
20dB and 99% Occupied Bandwidth and Hopping Channel Separation									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20dB BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
ASK	1Mbps	1	02	2404	0.087	0.068	0.999	0.0579	Pass
ASK	1Mbps	1	22	2424	0.087	0.070	0.999	0.0579	Pass
ASK	1Mbps	1	26	2428	0.087	0.070	0.990	0.0579	Pass
ASK	1Mbps	1	76	2478	0.087	0.070	0.999	0.0579	Pass

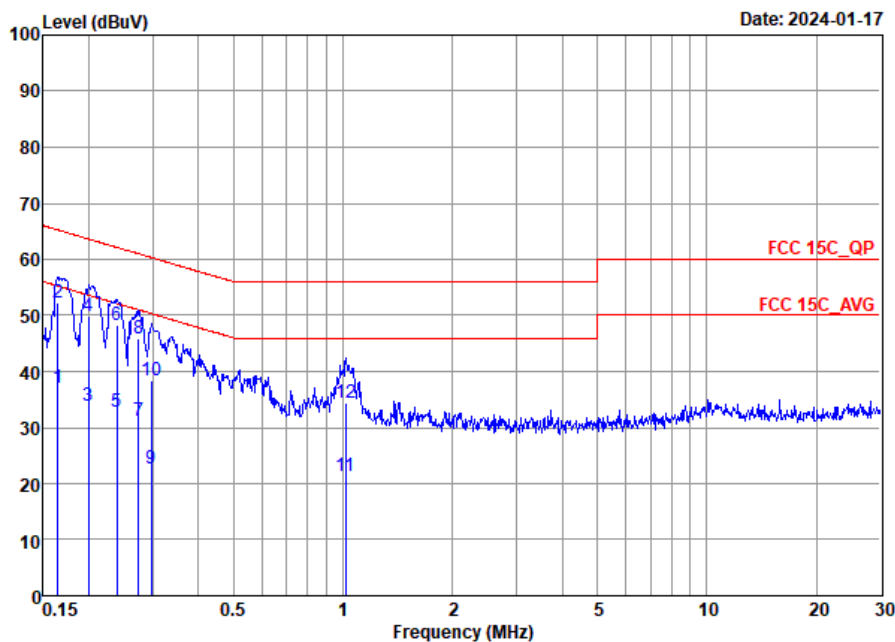
TEST RESULTS DATA				
Dwell Time				
Mod.	Hopping Channel Number Rate	Dwell Time (sec)	Limits (sec)	Pass/Fail
ASK	72	0.39	0.4	Pass

TEST RESULTS DATA						
Peak Power Table						
Mod	CH.	NTX	Peak Power (dBm)	Power Level	Power Limit (dBm)	Test Result
ASK	02	1	6.75	default	20.97	Pass
	22	1	6.70	default	20.97	Pass
	26	1	6.78	default	20.97	Pass
	76	1	6.60	default	20.97	Pass



Appendix B. AC Conducted Emission Test Results

Test Engineer :	FangMing Liang	Temperature :	22~24°C
		Relative Humidity :	44~50%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		

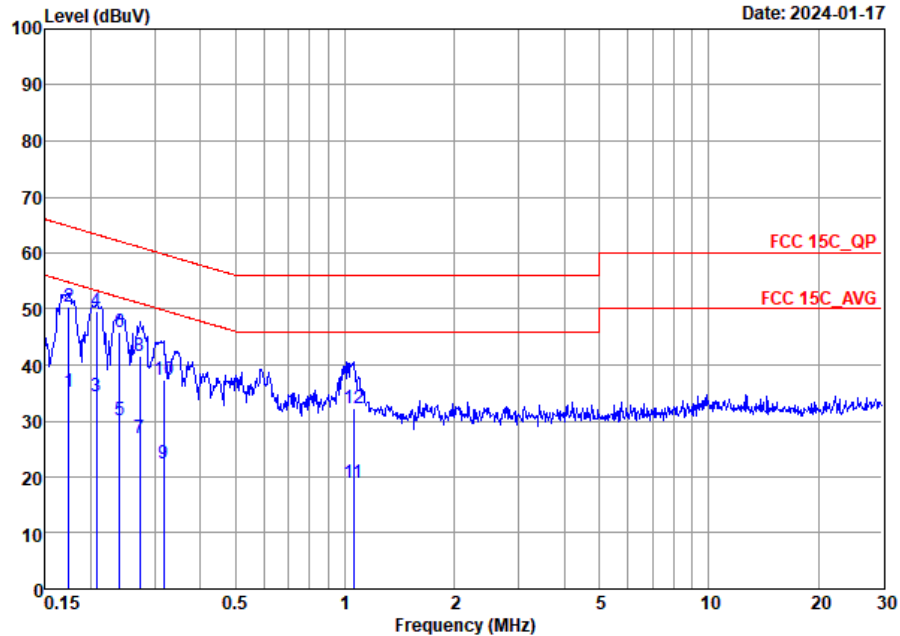


Site : CO01-SZ
Condition: FCC 15C_QP AC LISN 100063_L LINE

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.16	37.12	-18.13	55.25	16.70	10.28	10.14	Average
2 *	0.16	52.32	-12.93	65.25	31.90	10.28	10.14	QP
3	0.20	33.74	-19.88	53.62	13.10	10.49	10.15	Average
4	0.20	49.94	-13.68	63.62	29.30	10.49	10.15	QP
5	0.24	32.85	-19.28	52.13	12.50	10.20	10.15	Average
6	0.24	48.25	-13.88	62.13	27.90	10.20	10.15	QP
7	0.27	31.24	-19.74	50.98	11.01	10.08	10.15	Average
8	0.27	45.74	-15.24	60.98	25.51	10.08	10.15	QP
9	0.30	22.80	-27.52	50.32	2.60	10.05	10.15	Average
10	0.30	38.40	-21.92	60.32	18.20	10.05	10.15	QP
11	1.02	21.30	-24.70	46.00	0.90	10.24	10.16	Average
12	1.02	34.50	-21.50	56.00	14.10	10.24	10.16	QP



Test Engineer :	FangMing Liang	Temperature :	22~24°C
		Relative Humidity :	44~50%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-SZ
Condition: FCC 15C_QP AC LISN 100063_N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.17	35.22	-19.55	54.77	14.60	10.48	10.14	Average
2	0.17	50.52	-14.25	64.77	29.90	10.48	10.14	QP
3	0.21	34.40	-18.92	53.32	14.00	10.25	10.15	Average
4 *	0.21	49.50	-13.82	63.32	29.10	10.25	10.15	QP
5	0.24	30.22	-21.86	52.08	9.90	10.17	10.15	Average
6	0.24	45.82	-16.26	62.08	25.50	10.17	10.15	QP
7	0.27	27.06	-23.97	51.03	6.60	10.31	10.15	Average
8	0.27	41.56	-19.47	61.03	21.10	10.31	10.15	QP
9	0.32	22.38	-27.42	49.80	1.79	10.43	10.16	Average
10	0.32	37.38	-22.42	59.80	16.79	10.43	10.16	QP
11	1.05	18.98	-27.02	46.00	-1.39	10.21	10.16	Average
12	1.05	32.18	-23.82	56.00	11.81	10.21	10.16	QP

Note:

- Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
- Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)



Appendix C. Radiated Spurious Emission Test Data

Test Engineer :	Shiwei Wen	Relative Humidity :	48~49%
		Temperature :	24~25℃

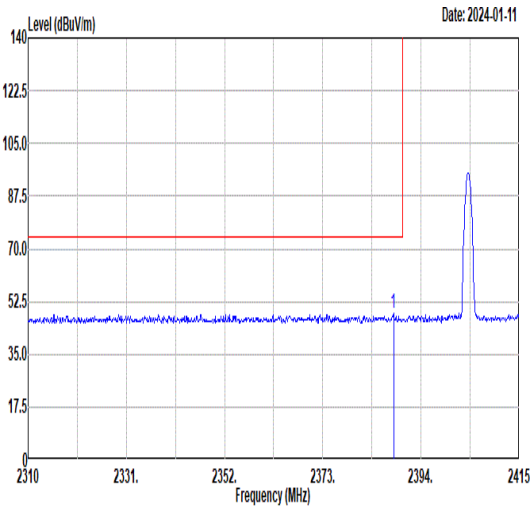
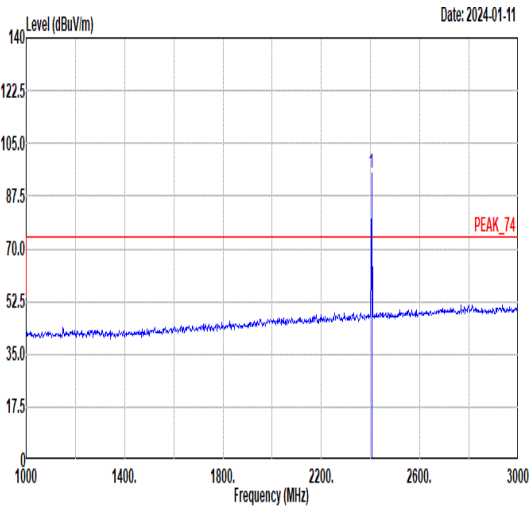
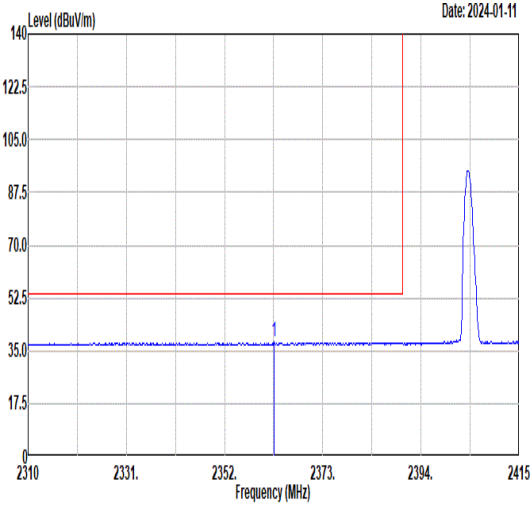
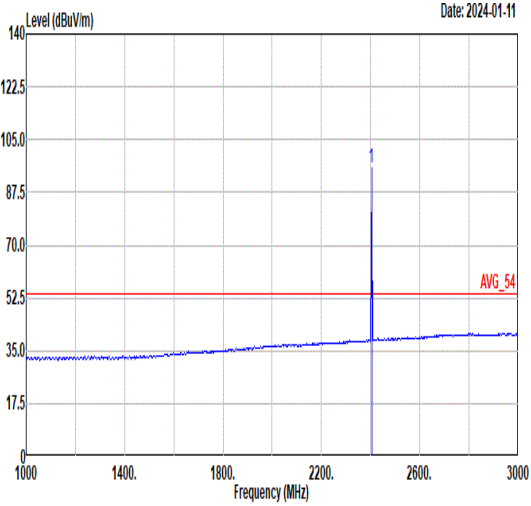
Radiated Spurious Emission Test Modes

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	1	BLE - ASK	CH 02	2404	1Mbps	-
Mode 2	2400-2483.5	1	BLE - ASK	CH 22	2424	1Mbps	-
Mode 3	2400-2483.5	1	BLE - ASK	CH 26	2428	1Mbps	-
Mode 4	2400-2483.5	1	BLE - ASK	CH 76	2478	1Mbps	-
Mode 5	2400-2483.5	1	BLE - ASK	CH 76	2478	1Mbps	LF

Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	BLE - ASK	CH 02	2387.60	37.95	54.00	-16.05	V	AVERAGE	Pass	Band Edge
1	BLE - ASK	CH 02	4808.00	50.22	74.00	-23.78	V	Peak	Pass	Harmonic
2	BLE - ASK	CH 22	-	-	-	-	-	-	-	Band Edge
2	BLE - ASK	CH 22	4848.00	50.15	74.00	-23.85	V	Peak	Pass	Harmonic
3	BLE - ASK	CH 26	-	-	-	-	-	-	-	Band Edge
3	BLE - ASK	CH 26	4856.00	49.96	74.00	-24.04	V	Peak	Pass	Harmonic
4	BLE - ASK	CH 76	2488.74	38.92	54.00	-15.08	H	AVERAGE	Pass	Band Edge
4	BLE - ASK	CH 76	4956.00	49.26	74.00	-24.74	V	Peak	Pass	Harmonic
5	BLE - ASK	CH 76	867.11	28.93	46	-17.07	V	Peak	Pass	LF



		1																																																																																		
Mode		Band Edge																																																																																		
		2400-2483.5_BLE - ASK_CH 02_2404MHz																																																																																		
ANT		1																																																																																		
Pol.		Horizontal					Fundamental																																																																													
Peak																																																																																				
		Limit	Margin	Read	Ant	Cable	Preamp	APos	TPos		Freq	Level	Line	(dB)	Level	Factor	Loss	Factor		Remark	MHz	dBuV/m	dBuV/m		dBuV	dB/m	dB	dB	cm	deg	1	2388.12	48.41	74.00	-25.59	40.48	32.25	7.76	32.08	381 188 PEAK	<table><thead><tr><th></th><th>Limit</th><th>Margin</th><th>Read</th><th>Ant</th><th>Cable</th><th>Preamp</th><th>APos</th><th>TPos</th><th></th></tr><tr><th>Freq</th><th>Level</th><th>Line</th><th>(dB)</th><th>Level</th><th>Factor</th><th>Loss</th><th>Factor</th><th></th><th>Remark</th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dBuV/m</th><th></th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th>cm</th><th>deg</th></tr></thead><tbody><tr><td>1</td><td>2404.00</td><td>95.24</td><td>-----</td><td>-----</td><td>87.23</td><td>32.29</td><td>7.80</td><td>32.08</td><td>381 188 PEAK</td></tr></tbody></table>						Limit	Margin	Read	Ant	Cable	Preamp	APos	TPos		Freq	Level	Line	(dB)	Level	Factor	Loss	Factor		Remark	MHz	dBuV/m	dBuV/m		dBuV	dB/m	dB	dB	cm	deg	1	2404.00	95.24	-----	-----	87.23	32.29	7.80	32.08
	Limit	Margin	Read	Ant	Cable	Preamp	APos	TPos																																																																												
Freq	Level	Line	(dB)	Level	Factor	Loss	Factor		Remark																																																																											
MHz	dBuV/m	dBuV/m		dBuV	dB/m	dB	dB	cm	deg																																																																											
1	2388.12	48.41	74.00	-25.59	40.48	32.25	7.76	32.08	381 188 PEAK																																																																											
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MHz	dBuV/m	dBuV/m		dBuV	dB/m	dB	dB	cm	deg																																																																											
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QPI/ Peak	Data: 3 Date: 2024-01-12 <table><tr><th>Freq</th><th>Level</th><th>Over Limit</th><th>Limit</th><th>ReadAntenna</th><th>Cable</th><th>Preampl</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th>cm</th><th>deg</th></tr><tr><td>1</td><td>56.190</td><td>17.92</td><td>-22.08</td><td>40.00</td><td>31.90</td><td>19.26</td><td>1.70</td><td>34.94</td><td>--- Peak</td></tr><tr><td>2</td><td>149.310</td><td>17.68</td><td>-25.82</td><td>43.50</td><td>31.16</td><td>18.90</td><td>2.32</td><td>34.70</td><td>--- Peak</td></tr><tr><td>3</td><td>321.000</td><td>19.89</td><td>-26.11</td><td>46.00</td><td>31.59</td><td>19.59</td><td>3.31</td><td>34.60</td><td>--- Peak</td></tr><tr><td>4</td><td>463.590</td><td>22.17</td><td>-23.83</td><td>46.00</td><td>30.31</td><td>22.91</td><td>3.45</td><td>34.50</td><td>--- Peak</td></tr><tr><td>5</td><td>709.000</td><td>26.65</td><td>-19.35</td><td>46.00</td><td>30.12</td><td>27.19</td><td>3.74</td><td>34.40</td><td>--- Peak</td></tr><tr><td>6</td><td>872.930</td><td>28.58</td><td>-17.42</td><td>46.00</td><td>29.76</td><td>28.72</td><td>4.40</td><td>34.30</td><td>--- Peak</td></tr></table>					Freq	Level	Over Limit	Limit	ReadAntenna	Cable	Preampl	A/Pos	T/Pos	Remark	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	1	56.190	17.92	-22.08	40.00	31.90	19.26	1.70	34.94	--- Peak	2	149.310	17.68	-25.82	43.50	31.16	18.90	2.32	34.70	--- Peak	3	321.000	19.89	-26.11	46.00	31.59	19.59	3.31	34.60	--- Peak	4	463.590	22.17	-23.83	46.00	30.31	22.91	3.45	34.50	--- Peak	5	709.000	26.65	-19.35	46.00	30.12	27.19	3.74	34.40	--- Peak	6	872.930	28.58	-17.42	46.00	29.76	28.72	4.40	34.30	--- Peak	Data: 4 Date: 2024-01-12 <table><tr><th>Freq</th><th>Level</th><th>Over Limit</th><th>Limit</th><th>ReadAntenna</th><th>Cable</th><th>Preampl</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th>cm</th><th>deg</th></tr><tr><td>1</td><td>33.880</td><td>20.05</td><td>-19.95</td><td>40.00</td><td>35.10</td><td>18.46</td><td>1.27</td><td>34.78</td><td>--- Peak</td></tr><tr><td>2</td><td>159.980</td><td>17.48</td><td>-26.02</td><td>43.50</td><td>31.41</td><td>18.39</td><td>2.38</td><td>34.70</td><td>--- Peak</td></tr><tr><td>3</td><td>323.910</td><td>18.84</td><td>-27.16</td><td>46.00</td><td>30.47</td><td>19.65</td><td>3.32</td><td>34.60</td><td>--- Peak</td></tr><tr><td>4</td><td>442.250</td><td>22.79</td><td>-23.21</td><td>46.00</td><td>31.30</td><td>22.54</td><td>3.45</td><td>34.50</td><td>--- Peak</td></tr><tr><td>5</td><td>616.850</td><td>25.28</td><td>-20.72</td><td>46.00</td><td>30.09</td><td>26.14</td><td>3.62</td><td>34.57</td><td>--- Peak</td></tr><tr><td>6</td><td>867.110</td><td>28.93</td><td>-17.07</td><td>46.00</td><td>30.10</td><td>28.74</td><td>4.39</td><td>34.30</td><td>--- Peak</td></tr></table>					Freq	Level	Over Limit	Limit	ReadAntenna	Cable	Preampl	A/Pos	T/Pos	Remark	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	1	33.880	20.05	-19.95	40.00	35.10	18.46	1.27	34.78	--- Peak	2	159.980	17.48	-26.02	43.50	31.41	18.39	2.38	34.70	--- Peak	3	323.910	18.84	-27.16	46.00	30.47	19.65	3.32	34.60	--- Peak	4	442.250	22.79	-23.21	46.00	31.30	22.54	3.45	34.50	--- Peak	5	616.850	25.28	-20.72	46.00	30.09	26.14	3.62	34.57	--- Peak	6	867.110	28.93	-17.07	46.00	30.10	28.74	4.39	34.30	--- Peak
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Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
BLE ASK	100	-	-	10Hz

Bluetooth LE 1Mbps ASK

