FCC PART 15.247

TEST REPORT

For

Wireless-wear Science and Technology Development LLC

2108 N ST STE N SACRAMENTO, CA 95816 United States

Tested Model: W01
FCC ID: 2BKGM-W01

Report Type:	**Product Name:**
Original Report	Humidity Monitoring Controller

Report Number:	RSC240715003-0C
Date of Report Issue:	2024-08-12
Reviewed By:	Sula Huang
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: +86-28-65525123 Fax: +86-28-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Wireless-wear Science and Technology Development LLC
Address	2108 N ST STE N SACRAMENTO, CA 95816 United States
Email	info@wireless-wear.com
Product	Humidity Monitoring Controller
Tested Model	W01
FCC ID	2BKGM-W01
Frequency*	Bluetooth LE (1M): 2402-2480MHz
Modulation Type*	Bluetooth LE (1M): GFSK
RF output power	-6.54 dBm
Voltage Range	DC 3.0V Lithium battery
Measure approximately	31.5 mm (L) x 18.9 mm (W) x 3.5 mm (H)
Sample serial number	240715003/02, 240715003/03 (Assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received: 2024-07-15

Note: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Objective

This report is prepared on behalf of **Wireless-wear Science and Technology Development LLC** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Part 15 Subpart C, section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No.

Measurement Uncertainty

Item			Measurement Uncertainty	U_{cispr}
Radiated Emission	9kHz-30MHz		4.48dB	-
	30MHz-200MHz	H	4.34dB	6.3dB
	30MHz-200MHz	V	4.59dB	6.3dB
	200MHz-1GHz	H	4.69dB	6.3dB
	200MHz-1GHz	V	5.79dB	6.3dB
	1GHz-6GHz		4.58dB	5.2dB
	6GHz-18GHz		4.58dB	5.5dB
	18GHz-40GHz		5.50dB	-

Item	Measurement Uncertainty
RF output power, conducted	±0.61dB
Occupied Bandwidth	±1.69%
Power Spectrum Density, conducted	±2.52dB
Humidity	±5%
Temperature	±1℃
Voltage(DC)	±0.4%
Time	1%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the corresponding inclusion factor K when the inclusion probability is about 95%.

Test Methodology

All measurements contained in this report were conducted with:

1. ANSI C63.10-2020 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

2. KDB558074 D01 15.247 Meas Guidance v05r02.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Bay Area Compliance Laboratories Corp. (Chengdu) lab is accredited to ISO/IEC 17025 by NVLAP (Lab code: 600346-0) and the FCC designation No.: CN5056. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration*

The system was configured in testing mode, which was provided by manufacturer.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
..	…	38	2478
19	**2440**	39	**2480**

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software*

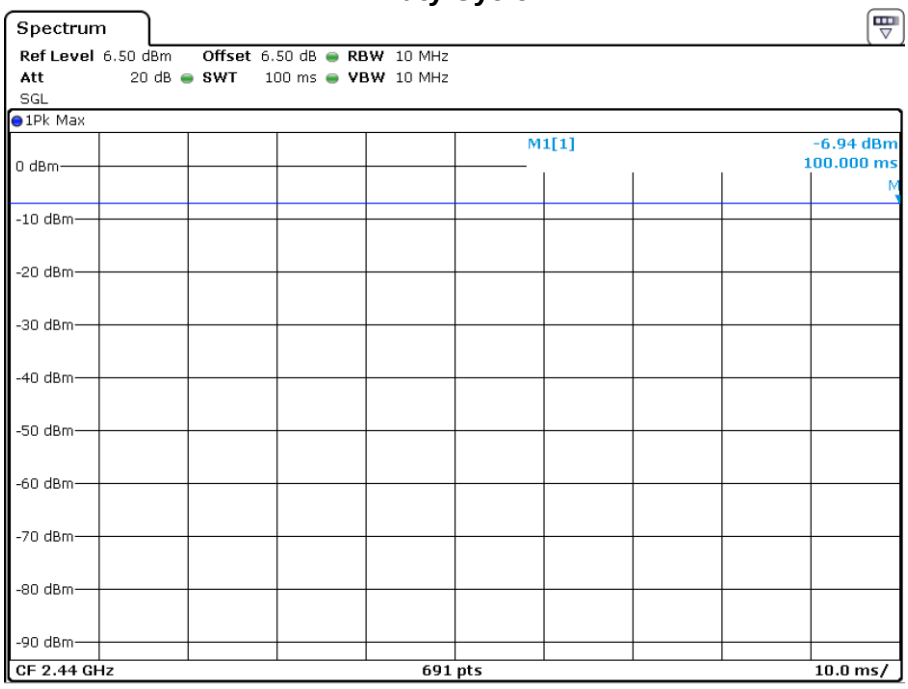
The setting by the software is as following table:

Test Mode	Test Software Version	LeKit_v3.0.4.2		
BLE (1M)	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	-15	-15	-15

Duty Cycle information is below:

Mode	T_{on}	T_p	1/T	Duty Cycle
	(ms)	(ms)	(kHz)	(%)
BLE (1M)	100	100	Any	100

Duty Cycle



Project No:RSC240715003-0C Tester:Murphy Guo
Date: 24.JUL.2024 16:58:18

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Local			
Lenovo	Laptop	L540	No
Unknown	USB to TLL	No	No

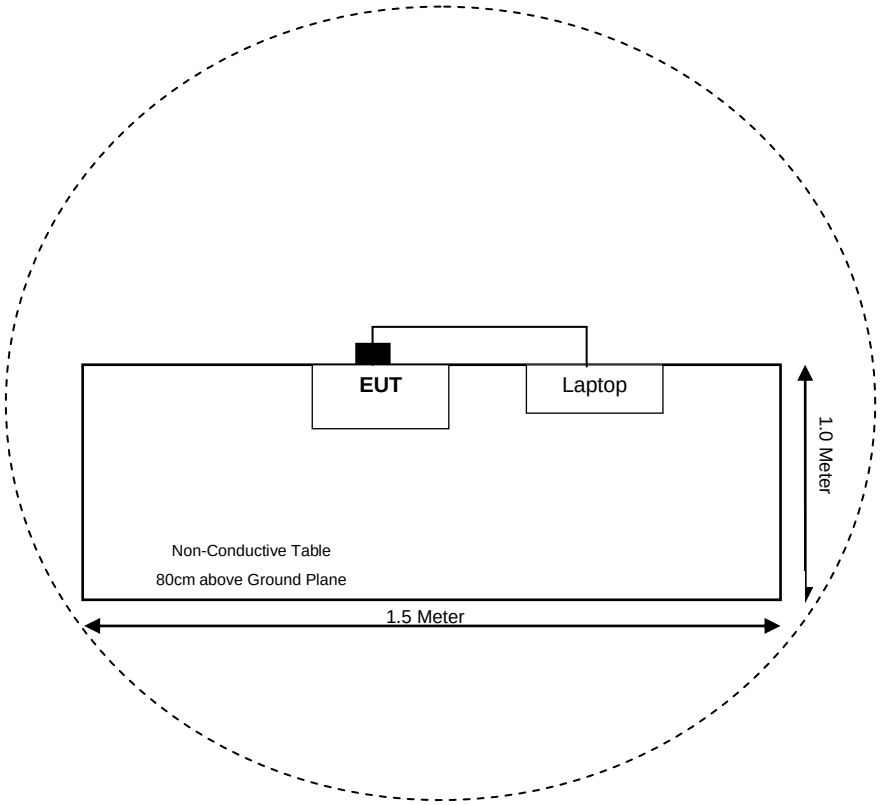
External I/O Cable

Cable Description	Length (m)	From	To
USB cable	1.0	USB to TLL	Laptop

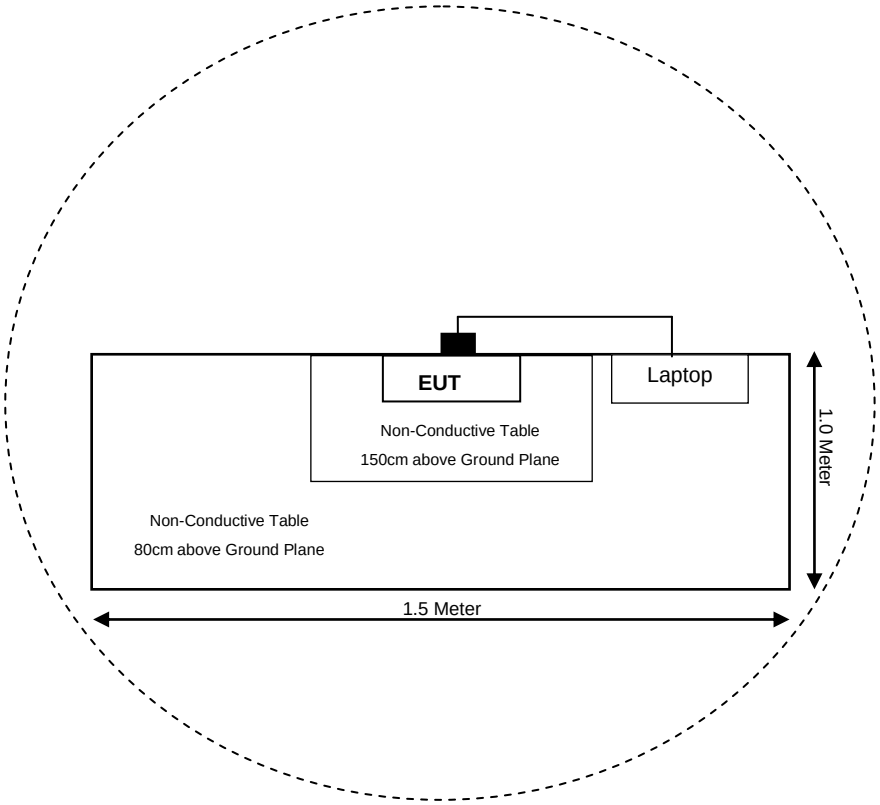
Block Diagram of Test Setup

Spurious Emissions

Below 1GHz:



Above 1GHz:


EUT
Laptop
Non-Conductive Table
150cm above Ground Plane
Non-Conductive Table
80cm above Ground Plane
1.0 Meter
1.5 Meter

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 & §1.1310 & §2.1093	RF EXPOSURE	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Raidated Spurious Emissions	Compliance
§15.247(d)	Conducted Spurious Emissions at Antenna Terminal	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum conducted output power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Not Applicable: The EUT is battery operated device.

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

TEST EQUIPMENTS LIST

Manufacturer	Description	Model Number	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions (9kHz-30MHz)					
EMCT	Semi-Anechoic Chamber	966	001	2023-04-15	2028-04-14
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2024-04-11	2025-04-10
BACL CORP	Active Loop Antenna	1313-1A	4031411	2024-05-20	2025-05-19
Xin Hang Xun Wei Bo	RF Cable (Below 1GHz)	XH500A-N/J-N/J-2M-A	T-E271	2023-11-30	2024-11-29
Xin Hang Xun Wei Bo	RF Cable (Below 1GHz)	XH500A-N/J-N/J-7M-A	T-E268	2023-11-30	2024-11-29
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR
Radiated Emissions (30MHz-1GHz)					
EMCT	Semi-Anechoic Chamber	966	001	2023-04-15	2028-04-14
SONOMA INSTRUMENT	Pre-Amplifier	310 N	186684	2023-08-08	2024-08-07
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2024-01-24	2025-01-23
INMET	Attenuator	18N-6dB	64671	2024-01-24	2025-01-23
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2024-04-11	2025-04-10
HUBER+SUHENER	RF Cable (Below 1GHz)	L-E-015	MY4345/EA	2023-11-30	2024-11-29
Xin Hang Xun Wei Bo	RF Cable (Below 1GHz)	XH500A-N/J-N/J-2M-A	T-E271	2023-11-30	2024-11-29
Xin Hang Xun Wei Bo	RF Cable (Below 1GHz)	XH500A-N/J-N/J-7M-A	T-E268	2023-11-30	2024-11-29
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR
Radiated Emissions (1GHz-18GHz)					
EMCT	Semi-Anechoic Chamber	966	001	2023-04-15	2028-04-14
Rohde & Schwarz	Signal Analyzer	FSV40	101943	2024-04-10	2025-04-09
Rohde & Schwarz	EMI Test Receiver	ESIB40	100215	2024-04-10	2025-04-09
ETS	Horn Antenna	3115	003-6076	2023-08-16	2024-08-15
A.H. Systems, inc.	Pre-Amplifier	PAM-0118P	509	2023-11-11	2024-11-10
MICRO-TRONICS	2.4GHz Notch Filter	BRM50702	G396	2024-05-18	2025-05-17
Xin Hang Xun Wei Bo	RF Cable (Above 1GHz)	XH500A-SMA/J-N/J-2M-A	L-E-016	2024-01-05	2025-01-04
Xin Hang Xun Wei Bo	RF Cable (Above 1GHz)	XH500A-SMA/J-N/J-5M-A	L-E-017	2024-01-05	2025-01-04
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR

Manufacturer	Description	Model Number	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions (18GHz-25GHz)					
EMCT	Semi-Anechoic Chamber	966	001	2023-04-15	2028-04-14
Rohde & Schwarz	Signal Analyzer	FSV40	101943	2024-04-10	2025-04-09
Rohde & Schwarz	EMI Test Receiver	ESIB40	100215	2024-04-10	2025-04-09
A.H.Systems,inc	Horn Antenna	SAS-574	505	2023-08-14	2024-08-13
EM Electronics Corporation	Pre-Amplifier	EM18G40	060725	2024-04-10	2025-04-09
HUBER+SUHNER	RF Cable (Above 18GHz)	T-E222	25551/2	2023-10-16	2024-10-15
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSV40	101943	2024-04-10	2025-04-09
MIDWEST	6dB Attenuator	219	AA4305	2024-03-01	2025-03-01
Astrolab	RF Coaxial Cable	MINIREND-5	1206	2023-10-18	2024-10-17
FLUKE	Multimeter	FLUKE 1587	27870099	2024-04-10	2025-04-09

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Chengdu) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 & §1.1310 & §2.1093 - RF EXPOSURE

Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] . [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
• f(GHz) is the RF channel transmit frequency in GHz
• Power and distance are rounded to the nearest mW and mm before calculation
• The result is rounded to one decimal place for comparison
• 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result
The max conducted power including tune-up tolerance is -6.0 dBm (0.25mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 0.25/5*(√2.48) = 0.1< 3.0

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Information*

The EUT has one PCB antenna and the maximum antenna gain is 0dBi, which fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance

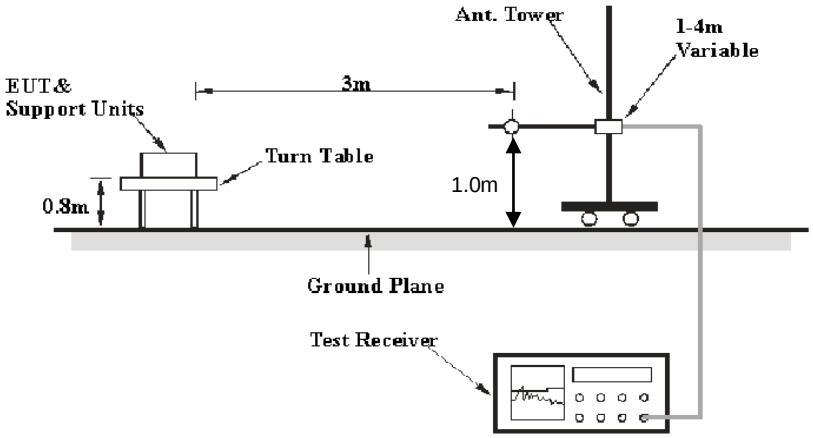
FCC §15.209, §15.205 & §15.247(d) - RADIATED SPURIOUS EMISSIONS

Applicable Standard

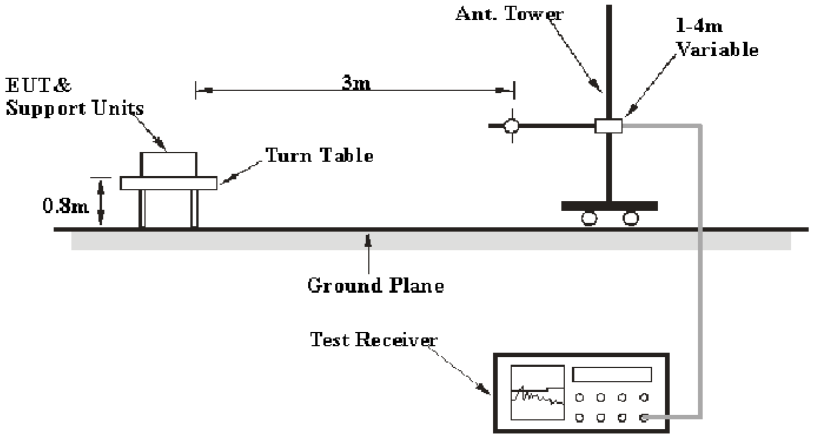
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

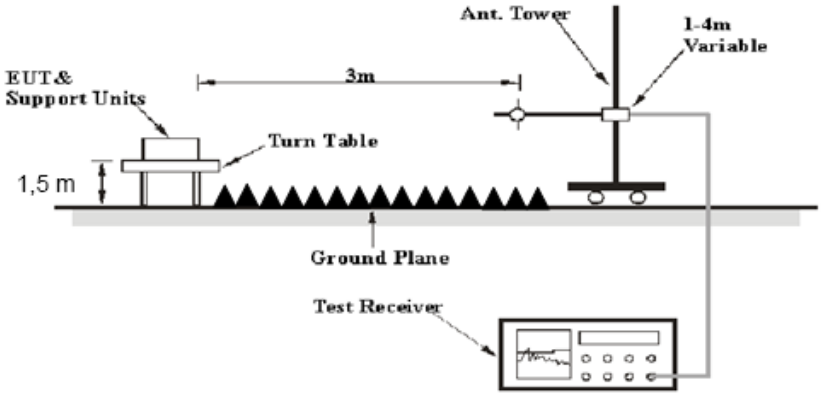
9kHz - 30MHz:



30MHz - 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2020. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Signal Analyzer Setup

The system was investigated from 9 kHz to 25 GHz.

During the radiated emission test, the EMI test receiver or Signal Analyzer was set with the following configurations:

The test software EMC 32 setting is as below:

Frequency Range	RBW	Video B/W	Measurement
9 kHz – 150 kHz	200 Hz	1 kHz	PK
150 kHz – 30 MHz	9 kHz	30 kHz	PK
30 MHz – 1000 MHz	120 kHz	300 kHz	QP
Above 1 GHz	1 MHz	3 MHz	PK
	1 MHz	3 MHz	CISPR AV

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (MaxPeak or QuasiPeak)= Meter Reading + Antenna Loss + Cable Loss- Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

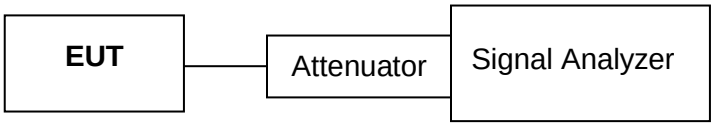
Margin = Limit –Corrected Amplitude

Conducted Spurious Emission At Antenna Port:

Connect the antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector.

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = No faster than coupled (auto) time.
f) Trace mode = max-hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum unwanted emissions amplitude level.

Test Setup Block



Test Data

Test Environment Conditions

Test Measurement:	Radiated	Conducted
Test Date:	2024-07-24	2024-07-24
Temperature:	24.7 °C	24.7 °C
Relative Humidity:	67 %	67 %
ATM Pressure:	95.3 kPa	96.3 kPa

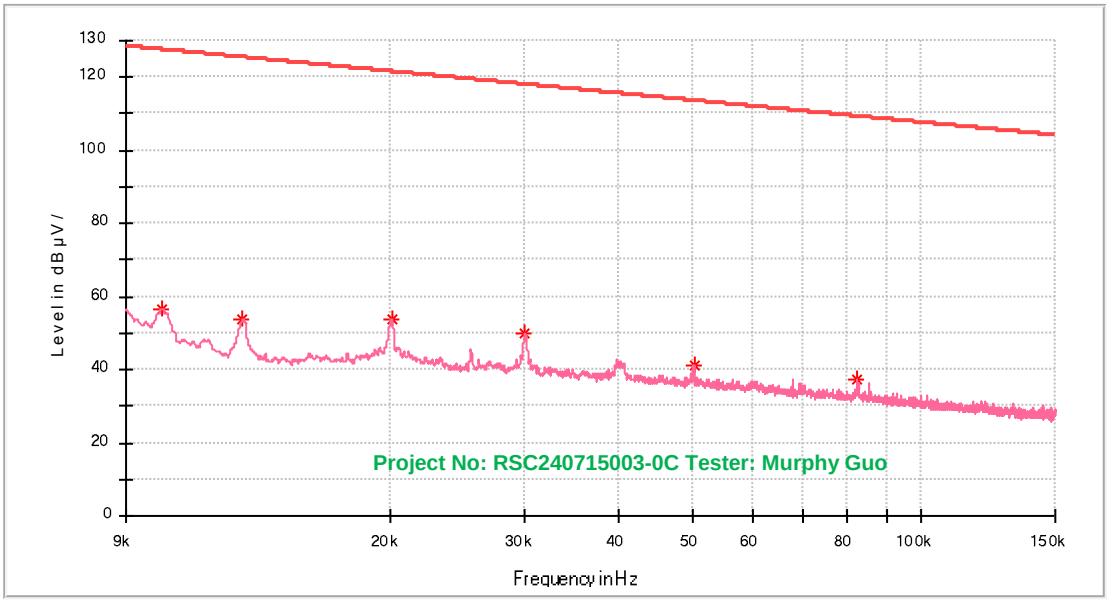
The testing was performed by Murphy Guo.

Test Mode: Transmitting

Radiated Spurious Emissions:

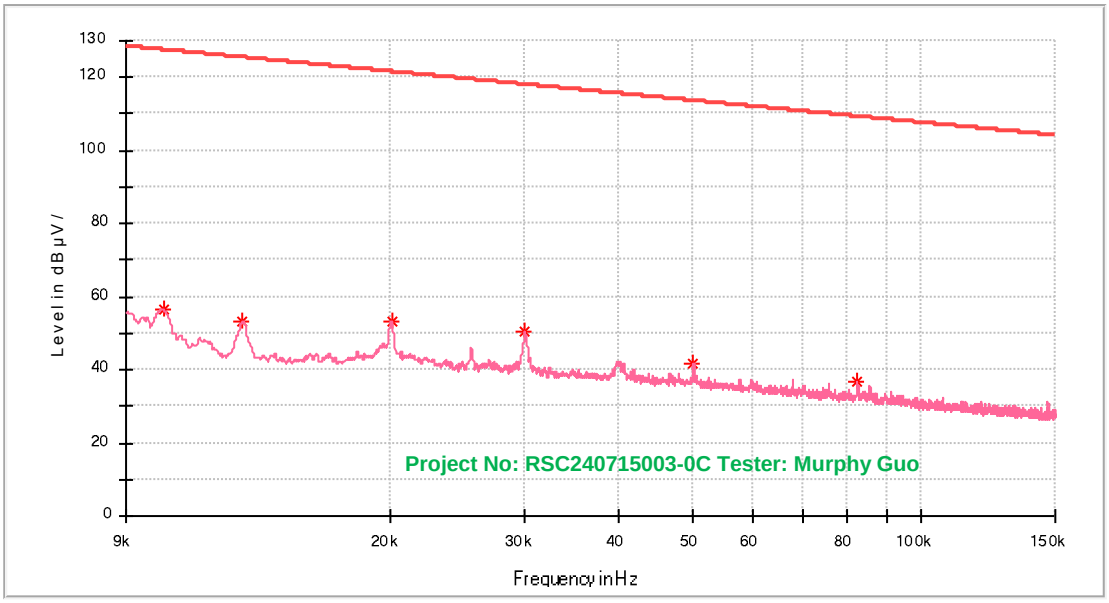
1) 9 kHz to 150 kHz_low channel_worst case

Parallel



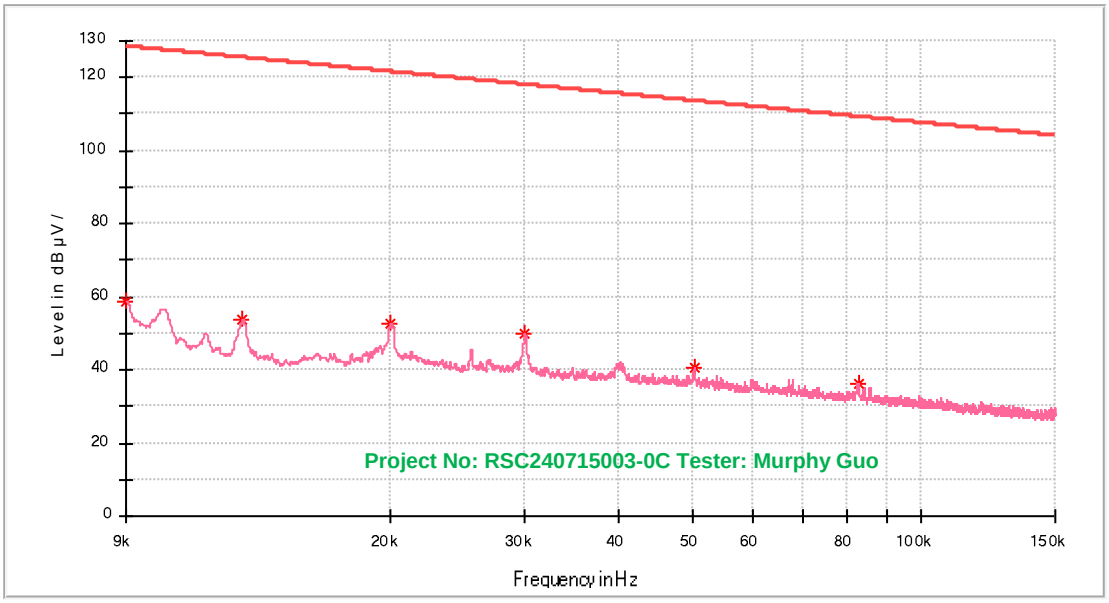
Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.010040	56.72	127.55	70.84	100.0	V	4.0	25.5
0.012825	53.54	125.43	71.88	100.0	V	60.0	22.9
0.020121	53.66	121.52	67.86	100.0	V	235.0	23.2
0.030132	49.90	118.01	68.11	100.0	V	2.0	22.2
0.050225	41.40	113.57	72.17	100.0	V	0.0	19.3
0.082443	37.39	109.27	71.88	100.0	V	53.0	15.5

Perpendicular



Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.010075	56.70	127.52	70.82	100.0	V	119.0	25.4
0.012825	53.48	125.43	71.95	100.0	V	245.0	22.9
0.020104	53.15	121.52	68.37	100.0	V	325.0	23.2
0.030115	50.62	118.01	67.39	100.0	V	359.0	22.2
0.050207	41.60	113.58	71.98	100.0	V	0.0	19.3
0.082320	36.95	109.29	72.34	100.0	V	58.0	15.5

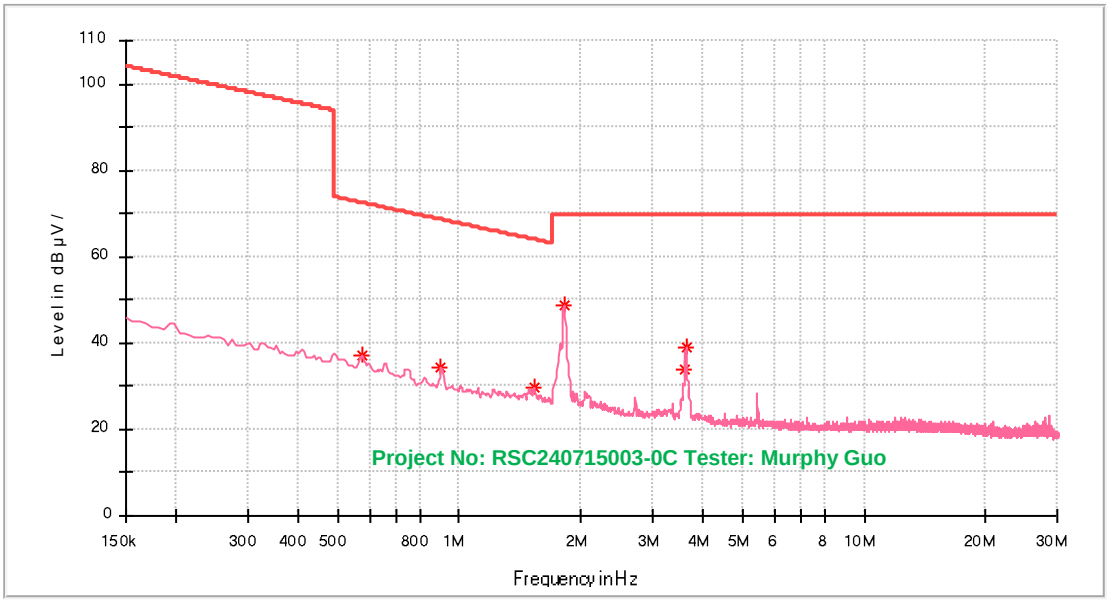
Ground Parallel



Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.009018	58.73	128.48	69.75	100.0	V	34.0	28.5
0.012825	53.69	125.43	71.73	100.0	V	203.0	22.9
0.020051	52.77	121.55	68.78	100.0	V	73.0	23.2
0.030132	50.06	118.01	67.95	100.0	V	359.0	22.2
0.050313	40.63	113.56	72.93	100.0	V	359.0	19.3
0.082567	36.42	109.26	72.84	100.0	V	69.0	15.5

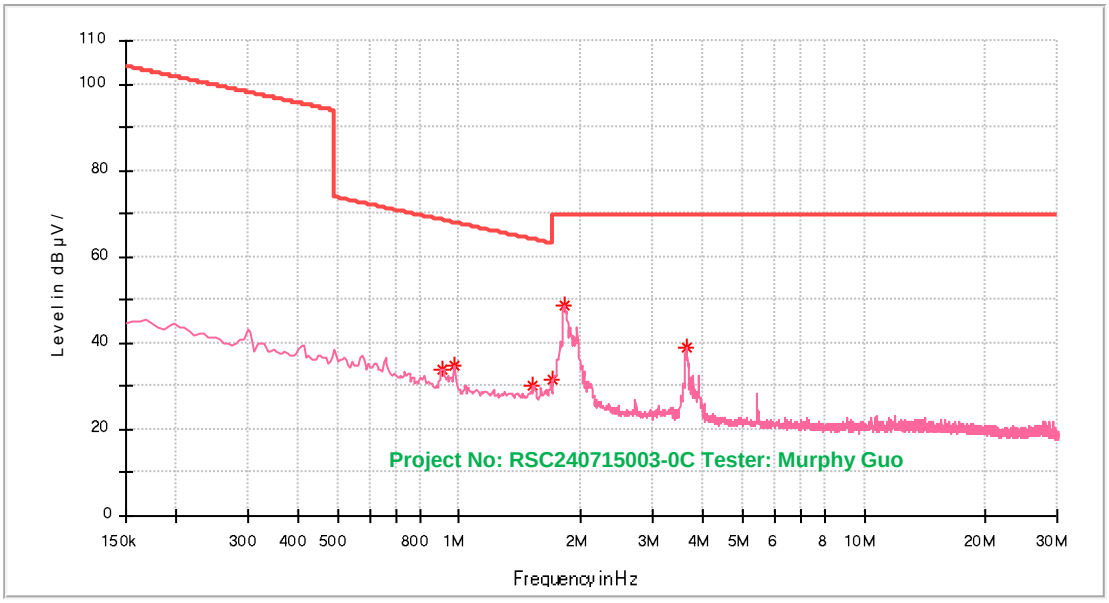
2) 150 kHz to 30 MHz_High channel_worst case

Parallel



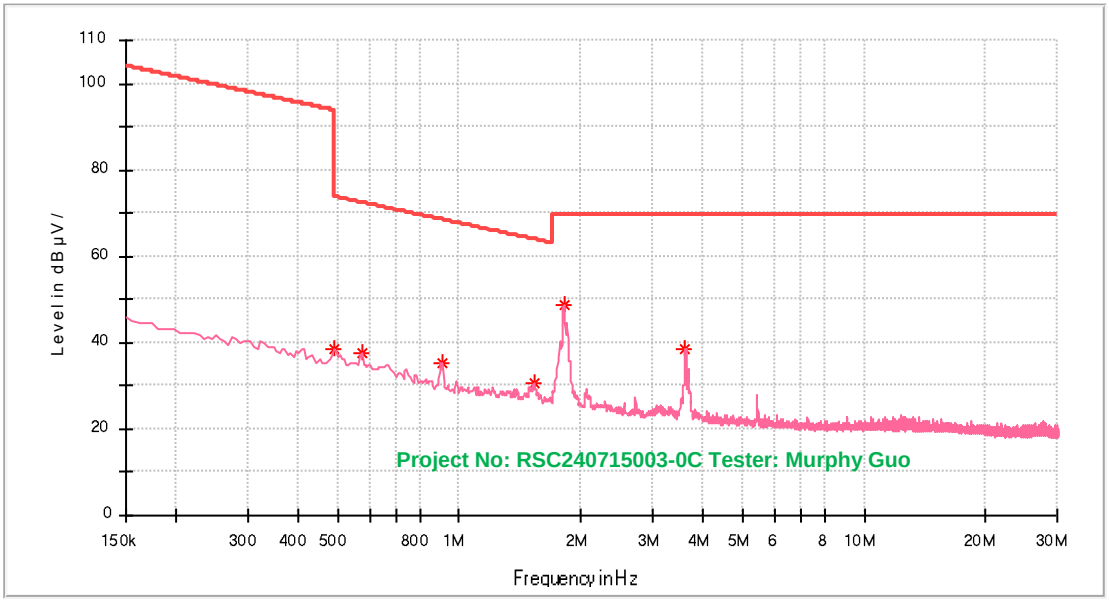
Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.573870	36.99	72.43	35.45	100.0	66.0	-0.4
0.902220	34.20	68.51	34.32	100.0	150.0	-3.6
1.535040	29.68	63.91	34.23	100.0	1.0	-6.1
1.809660	48.69	69.50	20.81	100.0	22.0	-6.9
3.600660	33.84	69.50	35.66	100.0	166.0	-8.4
3.630510	38.98	69.50	30.52	100.0	13.0	-8.4

Perpendicular



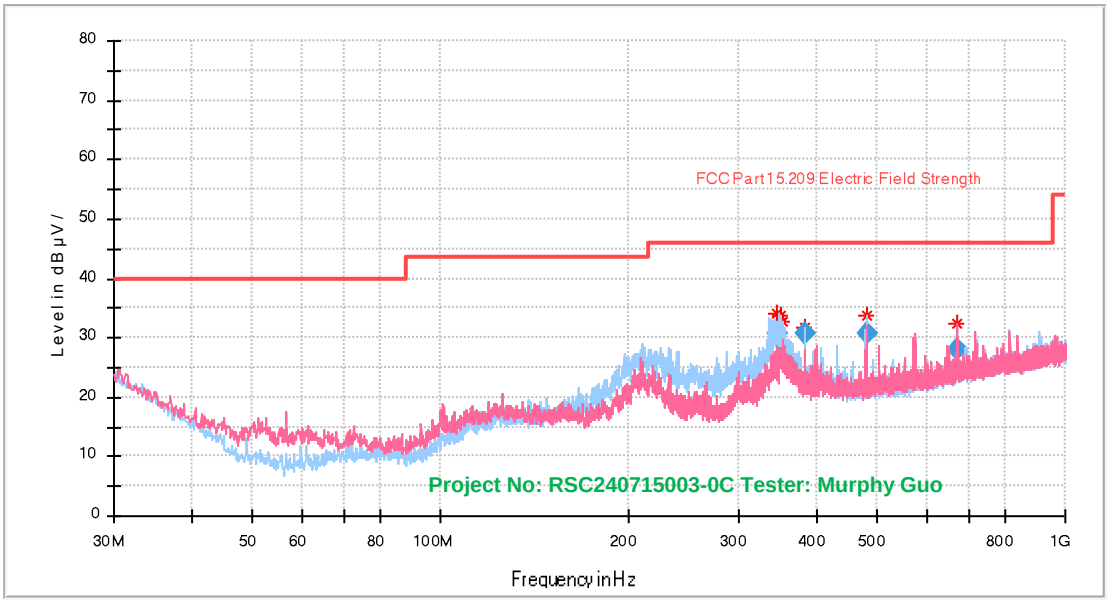
Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.908190	34.03	68.46	34.42	100.0	359.0	-3.6
0.973860	35.03	67.85	32.82	100.0	71.0	-4.0
1.523100	30.25	63.98	33.73	100.0	0.0	-6.1
1.702200	31.65	63.01	31.37	100.0	63.0	-6.6
1.809660	48.70	69.50	20.80	100.0	19.0	-6.9
3.630510	38.83	69.50	30.67	100.0	19.0	-8.4

Ground Parallel



Frequency (MHz)	MaxPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.490290	38.60	73.79	35.19	100.0	75.0	0.8
0.573870	37.65	72.43	34.78	100.0	63.0	-0.4
0.908190	35.10	68.46	33.35	100.0	174.0	-3.6
1.529070	30.84	63.94	33.11	100.0	19.0	-6.1
1.809660	48.60	69.50	20.90	100.0	27.0	-6.9
3.618570	38.71	69.50	30.79	100.0	15.0	-8.4

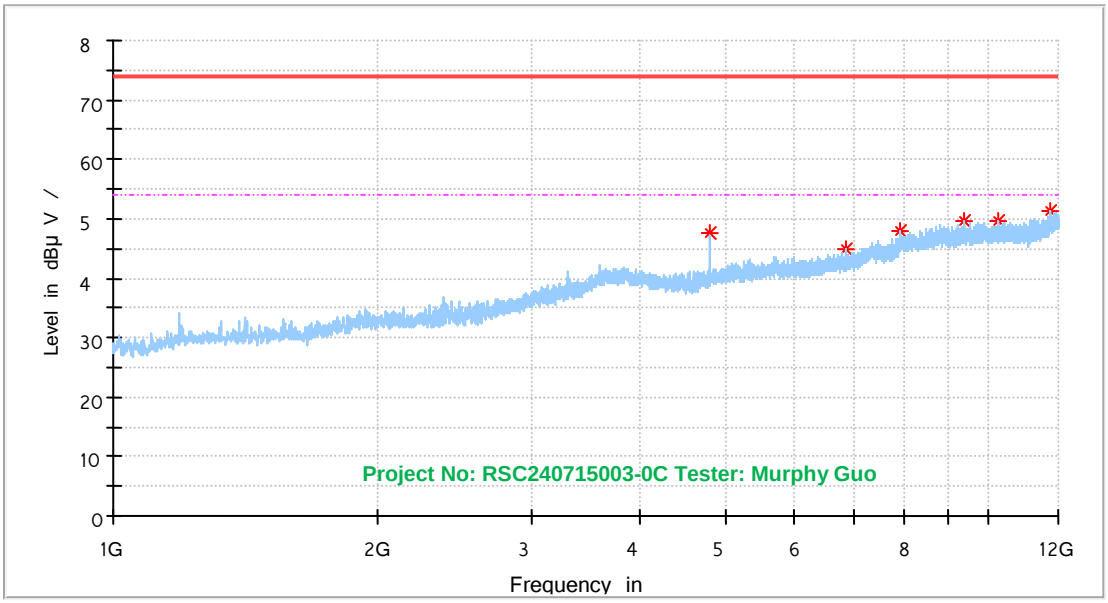
3) 30 MHz-1 GHz_ High channel_worst case



Frequency (MHz)	QuasiPeak (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
346.094750	30.57	46.00	15.43	1000.0	120.000	104.0	H	235.0	-9.0
349.833500	26.68	46.00	19.32	1000.0	120.000	107.0	H	201.0	-8.8
353.433750	26.25	46.00	19.75	1000.0	120.000	106.0	H	209.0	-8.6
383.252000	30.82	46.00	15.18	1000.0	120.000	103.0	H	227.0	-8.1
479.982500	30.71	46.00	15.29	1000.0	120.000	104.0	H	258.0	-5.7
670.714000	28.16	46.00	17.84	1000.0	120.000	118.0	V	325.0	-3.2

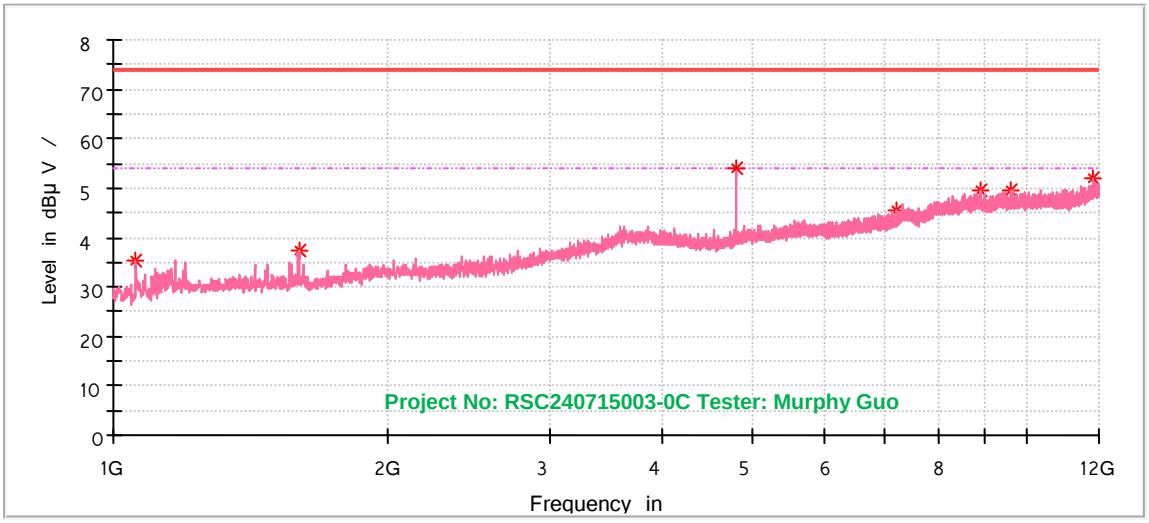
4) 1 GHz-12 GHz

Low Channel_Horizontal



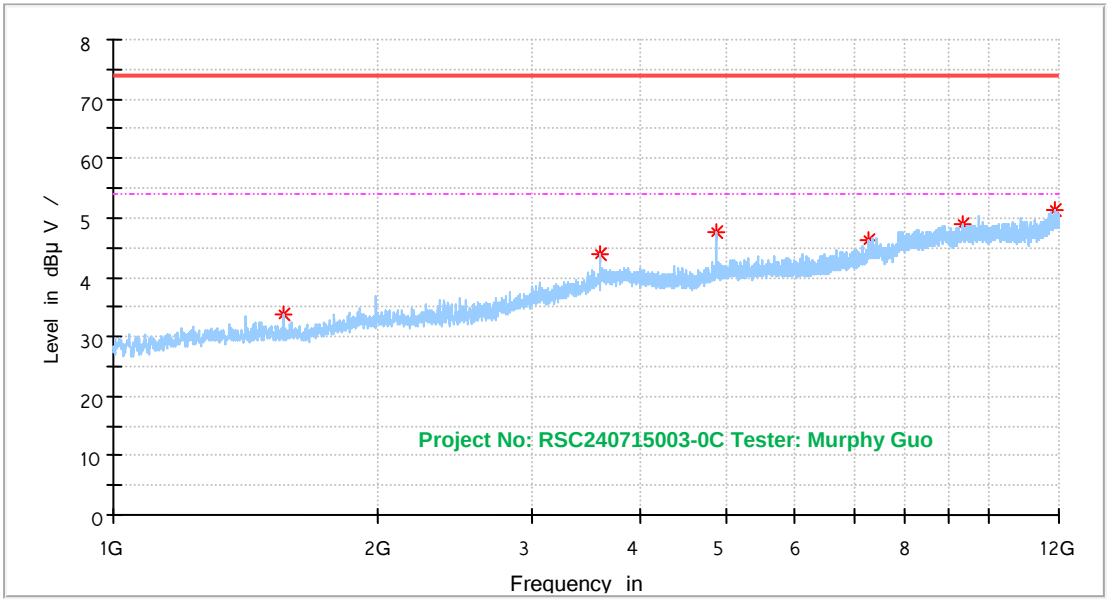
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4804.900000	---	41.75	54.00	12.25	150.0	H	188.0	-5.7
4804.900000	47.57	---	74.00	26.43	150.0	H	150.0	-5.7
6875.100000	45.01	---	74.00	28.99	200.0	H	325.0	-3.0
6875.100000	---	36.24	54.00	17.76	150.0	H	68.0	-3.0
7921.200000	48.04	---	74.00	25.96	150.0	H	106.0	0.0
7921.200000	---	38.76	54.00	15.24	150.0	H	55.0	0.0
9357.800000	---	40.28	54.00	13.72	200.0	H	251.0	1.4
9357.800000	49.76	---	74.00	24.24	150.0	H	322.0	1.4
10225.700000	49.49	---	74.00	24.51	200.0	H	109.0	1.8
10225.700000	---	40.91	54.00	13.09	150.0	H	181.0	1.8
11738.200000	51.46	---	74.00	22.54	150.0	H	8.0	4.0
11738.200000	---	42.52	54.00	11.48	200.0	H	238.0	4.0

Low Channel_Vertical



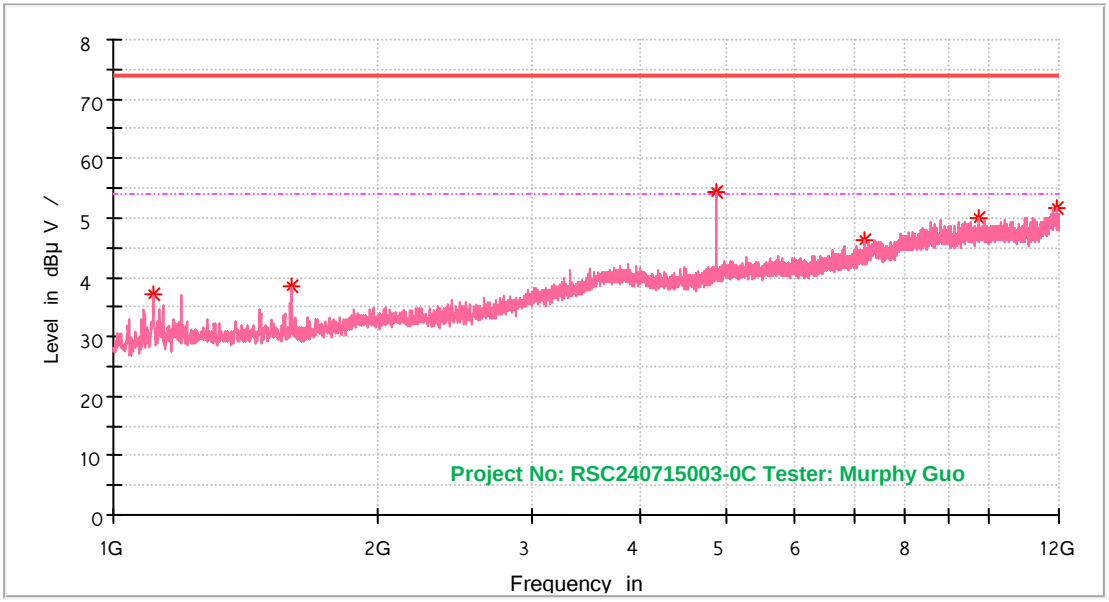
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1059.400000	35.46	---	74.00	38.54	150.0	V	99.0	-19.2
1059.400000	---	26.44	54.00	27.56	150.0	V	93.0	-19.2
1599.500000	---	27.09	54.00	26.91	150.0	V	74.0	-16.4
1599.500000	37.25	---	74.00	36.75	200.0	V	110.0	-16.4
4804.900000	---	49.53	54.00	4.47	200.0	V	351.0	-5.7
4804.900000	54.04	---	74.00	19.96	200.0	V	351.0	-5.7
7201.800000	45.57	---	74.00	28.43	150.0	V	118.0	-2.4
7201.800000	---	36.39	54.00	17.61	200.0	V	180.0	-2.4
8911.200000	49.47	---	74.00	24.53	200.0	V	174.0	1.4
8911.200000	---	39.93	54.00	14.07	150.0	V	0.0	1.4
9594.300000	49.40	---	74.00	24.60	200.0	V	208.0	1.4
9594.300000	---	40.24	54.00	13.76	150.0	V	174.0	1.4
11849.300000	51.98	---	74.00	22.02	200.0	V	345.0	4.7
11849.300000	---	42.63	54.00	11.37	150.0	V	106.0	4.7

Middle Channel_Horizontal



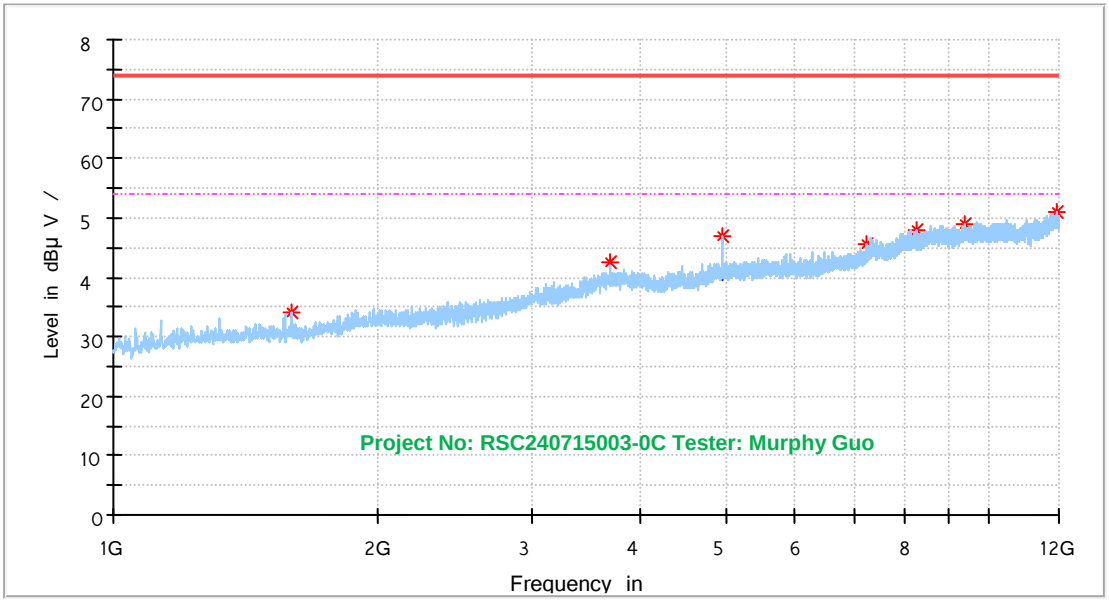
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1566.500000	---	26.24	54.00	27.76	150.0	H	123.0	-16.6
1566.500000	33.85	---	74.00	40.15	150.0	H	123.0	-16.6
3591.600000	---	34.84	54.00	19.16	150.0	H	42.0	-6.5
3591.600000	43.86	---	74.00	30.14	150.0	H	42.0	-6.5
4880.800000	---	40.33	54.00	13.67	150.0	H	80.0	-5.5
4880.800000	47.55	---	74.00	26.45	200.0	H	286.0	-5.5
7290.900000	46.09	---	74.00	27.91	150.0	H	219.0	-1.7
7290.900000	---	36.13	54.00	17.87	200.0	H	274.0	-1.7
9328.100000	---	40.24	54.00	13.76	200.0	H	187.0	1.4
9328.100000	48.78	---	74.00	25.22	200.0	H	249.0	1.4
11880.100000	51.29	---	74.00	22.71	150.0	H	151.0	4.6
11880.100000	---	42.05	54.00	11.95	200.0	H	218.0	4.6

Middle Channel_Vertical



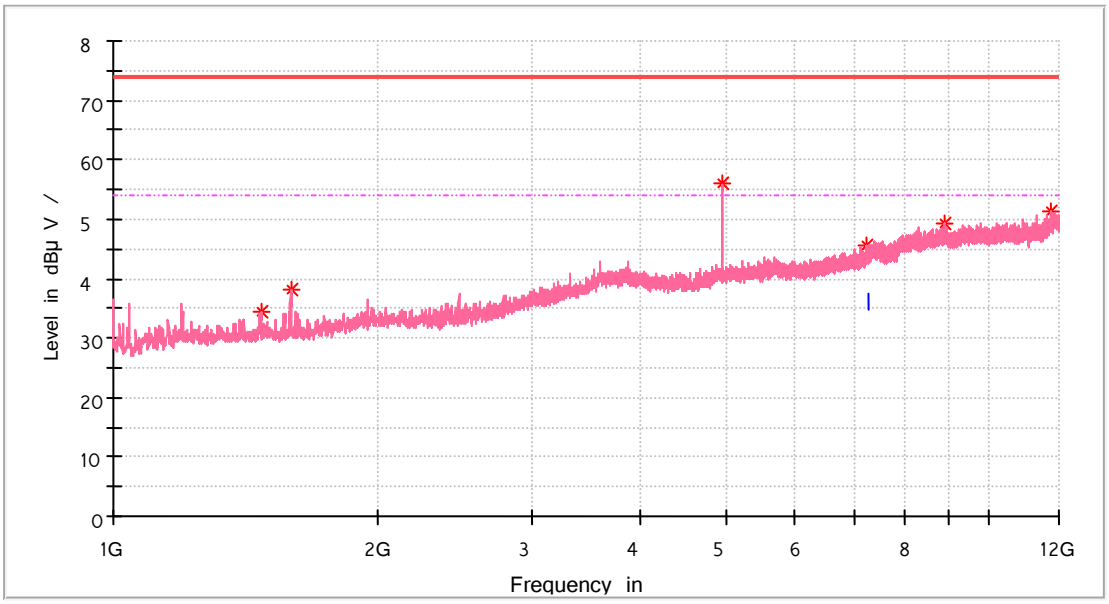
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1112.200000	---	27.07	54.00	26.93	150.0	V	78.0	-18.7
1112.200000	37.13	---	74.00	36.87	150.0	V	78.0	-18.7
1596.200000	38.34	---	74.00	35.66	150.0	V	54.0	-16.4
1596.200000	---	27.78	54.00	26.22	200.0	V	64.0	-16.4
4880.800000	---	48.40	54.00	5.60	150.0	V	172.0	-5.5
4880.800000	54.39	---	74.00	19.61	150.0	V	197.0	-5.5
7188.600000	46.26	---	74.00	27.74	150.0	V	128.0	-2.4
7188.600000	---	36.56	54.00	17.44	200.0	V	277.0	-2.4
9718.600000	---	41.01	54.00	12.99	150.0	V	78.0	1.7
9718.600000	49.93	---	74.00	24.07	200.0	V	320.0	1.7
11961.500000	---	42.17	54.00	11.83	200.0	V	348.0	4.9
11961.500000	51.66	---	74.00	22.34	200.0	V	246.0	4.9

High Channel_Horizontal



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1595.100000	---	26.22	54.00	27.78	150.0	H	122.0	-16.6
1595.100000	34.15	---	74.00	39.85	200.0	H	349.0	-16.4
3685.100000	---	35.32	54.00	18.68	200.0	H	81.0	-6.3
3685.100000	42.48	---	74.00	31.52	200.0	H	256.0	-6.3
4961.100000	---	40.86	54.00	13.14	150.0	H	85.0	-5.2
4961.100000	46.85	---	74.00	27.15	200.0	H	54.0	-5.2
7240.300000	45.68	---	74.00	28.32	200.0	H	263.0	-2.1
7240.300000	---	36.54	54.00	17.46	150.0	H	214.0	-2.1
8243.500000	---	38.68	54.00	15.32	150.0	H	54.0	0.1
8243.500000	47.88	---	74.00	26.12	200.0	H	330.0	0.1
9349.000000	---	40.05	54.00	13.95	150.0	H	220.0	1.4
9349.000000	49.04	---	74.00	24.96	150.0	H	2.0	1.4
11928.500000	---	42.20	54.00	11.80	150.0	H	79.0	4.8
11928.500000	51.02	---	74.00	22.98	200.0	H	263.0	4.8

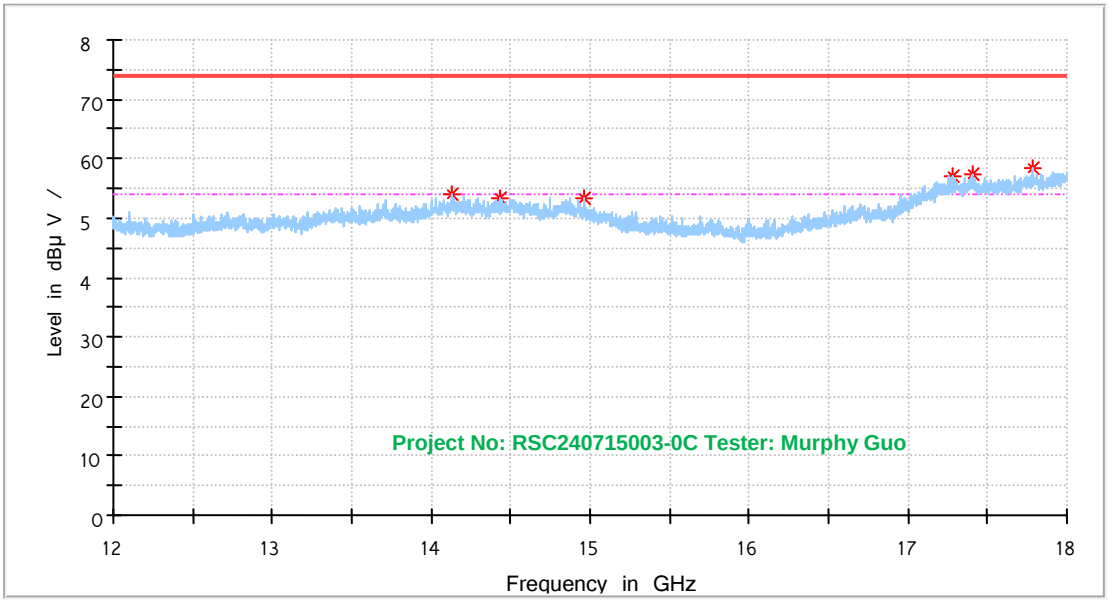
High Channel_Vertical



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1473.000000	34.38	---	74.00	39.62	150.0	V	111.0	-16.6
1473.000000	---	28.35	54.00	25.65	150.0	V	111.0	-16.6
1594.000000	38.21	---	74.00	35.79	200.0	V	129.0	-16.4
1594.000000	---	28.54	54.00	25.46	200.0	V	102.0	-16.4
4961.100000	56.15	---	74.00	17.85	200.0	V	343.0	-5.2
4961.100000	---	53.16	54.00	0.84	150.0	V	185.0	-5.2
7249.100000	45.63	---	74.00	28.37	150.0	V	166.0	-2.1
7249.100000	---	36.10	54.00	17.90	150.0	V	18.0	-2.1
8882.600000	49.15	---	74.00	24.85	200.0	V	70.0	1.4
8882.600000	---	39.91	54.00	14.09	200.0	V	318.0	1.4
11750.300000	51.24	---	74.00	22.76	200.0	V	84.0	4.2
11750.300000	---	41.90	54.00	12.10	200.0	V	37.0	4.2

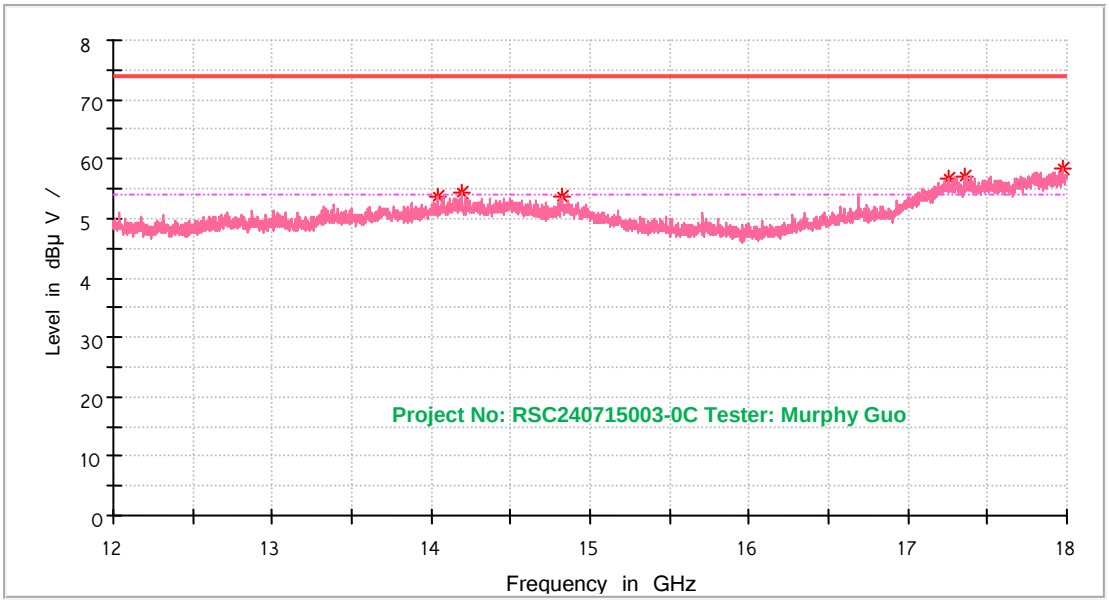
5) 12 GHz-18 GHz_High channel_worst case

Horizontal



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
14132.400000	54.05	---	74.00	19.95	150.0	H	275.0	7.2
14132.400000	---	42.63	54.00	11.37	150.0	H	275.0	7.2
14437.200000	53.41	---	74.00	20.59	150.0	H	172.0	7.1
14437.200000	---	42.69	54.00	11.31	150.0	H	1.0	7.1
14965.200000	53.36	---	74.00	20.64	150.0	H	51.0	6.5
14965.200000	---	42.80	54.00	11.20	150.0	H	62.0	6.5
17281.200000	57.04	---	74.00	16.96	150.0	H	46.0	10.5
17281.200000	---	45.79	54.00	8.21	150.0	H	36.0	10.5
17402.400000	57.32	---	74.00	16.68	150.0	H	139.0	10.7
17402.400000	---	46.38	54.00	7.62	150.0	H	71.0	10.7
17788.800000	58.39	---	74.00	15.61	150.0	H	25.0	11.2
17788.800000	---	47.65	54.00	6.35	150.0	H	139.0	11.2

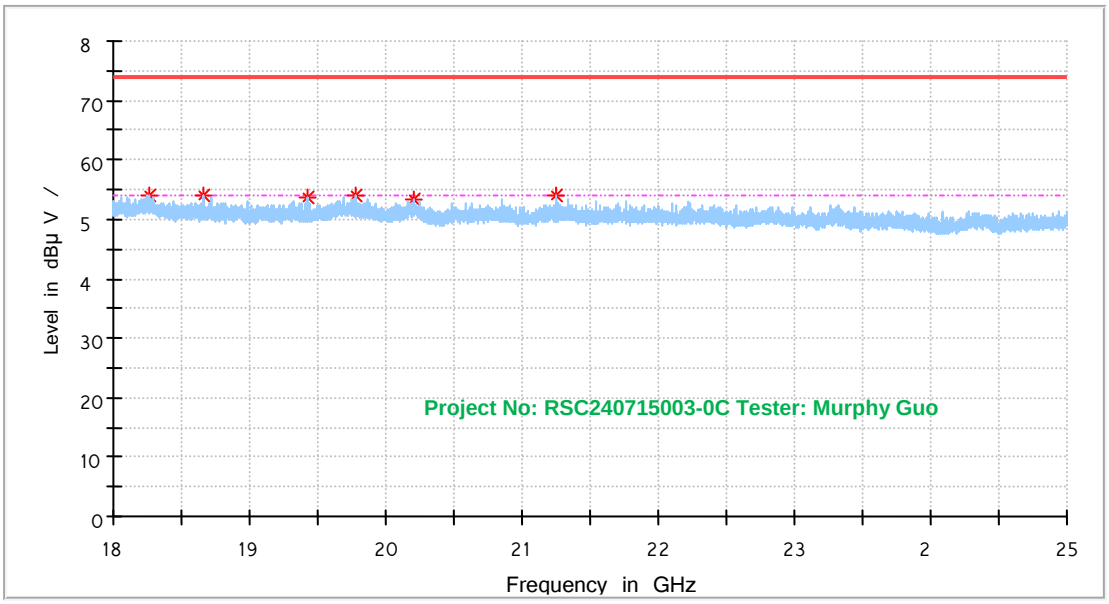
Vertical



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
14041.200000	53.71	---	74.00	20.29	150.0	V	77.0	7.4
14041.200000	---	42.94	54.00	11.06	150.0	V	162.0	7.4
14193.600000	54.24	---	74.00	19.76	150.0	V	295.0	7.2
14193.600000	---	42.85	54.00	11.15	150.0	V	280.0	7.2
14823.600000	53.81	---	74.00	20.19	150.0	V	255.0	7.2
14823.600000	---	42.40	54.00	11.60	150.0	V	270.0	7.2
17260.800000	56.80	---	74.00	17.20	150.0	V	230.0	10.4
17260.800000	---	46.04	54.00	7.96	150.0	V	250.0	10.4
17361.600000	57.20	---	74.00	16.80	150.0	V	0.0	10.3
17361.600000	---	46.39	54.00	7.61	150.0	V	356.0	10.3
17978.400000	---	47.54	54.00	6.46	150.0	V	306.0	11.5
17978.400000	58.38	---	74.00	15.62	150.0	V	147.0	11.5

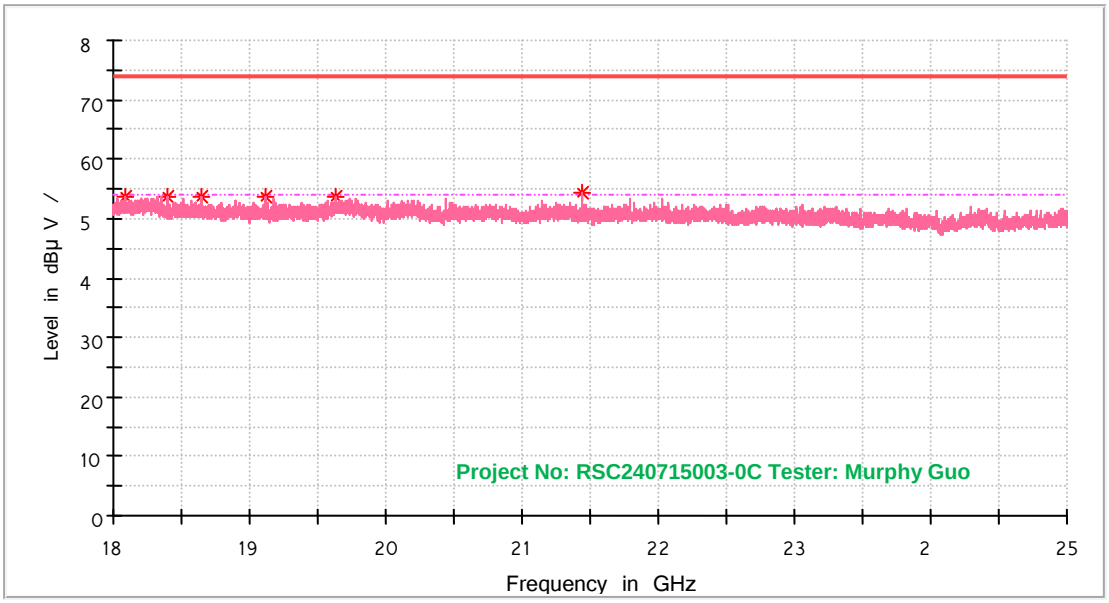
6) 18 GHz-25 GHz_High channel_worst case

Horizontal



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18269.500000	---	43.98	54.00	10.02	100.0	H	339.0	6.4
18269.500000	54.05	---	74.00	19.95	100.0	H	314.0	6.4
18662.200000	---	43.53	54.00	10.47	100.0	H	323.0	6.1
18662.200000	53.90	---	74.00	20.10	100.0	H	359.0	6.1
19420.300000	53.76	---	74.00	20.24	100.0	H	247.0	6.4
19420.300000	---	43.75	54.00	10.25	100.0	H	359.0	6.4
19773.800000	53.85	---	74.00	20.15	100.0	H	310.0	7.2
19773.800000	---	43.22	54.00	10.78	100.0	H	145.0	7.2
20201.500000	53.32	---	74.00	20.68	100.0	H	154.0	7.3
20201.500000	---	43.39	54.00	10.61	100.0	H	260.0	7.3
21243.800000	---	43.41	54.00	10.59	100.0	H	181.0	6.7
21243.800000	54.04	---	74.00	19.96	100.0	H	216.0	6.7

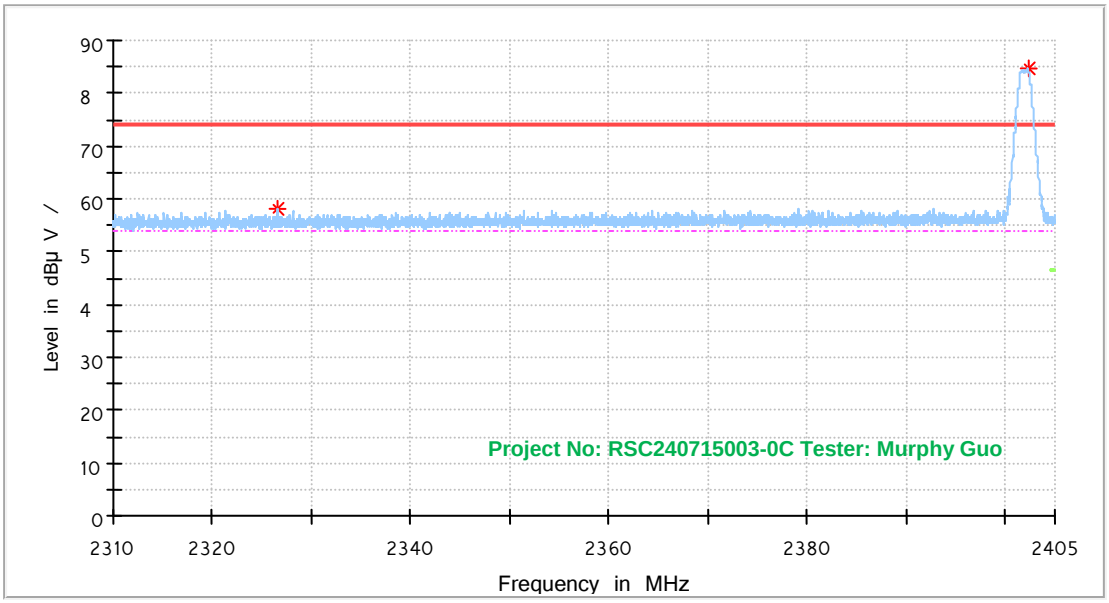
Vertical



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18083.300000	53.53	---	74.00	20.47	100.0	V	249.0	6.3
18083.300000	---	44.32	54.00	9.68	100.0	V	64.0	6.3
18392.000000	---	44.29	54.00	9.71	100.0	V	147.0	6.1
18392.000000	53.76	---	74.00	20.24	100.0	V	134.0	6.1
18641.900000	---	43.66	54.00	10.34	100.0	V	55.0	6.2
18641.900000	53.72	---	74.00	20.28	100.0	V	295.0	6.2
19119.300000	53.79	---	74.00	20.21	100.0	V	2.0	6.1
19119.300000	---	43.29	54.00	10.71	100.0	V	187.0	6.1
19635.200000	53.54	---	74.00	20.46	100.0	V	299.0	7.0
19635.200000	---	43.99	54.00	10.01	100.0	V	10.0	7.0
21434.900000	---	43.46	54.00	10.54	100.0	V	263.0	6.7
21434.900000	54.37	---	74.00	19.63	100.0	V	174.0	6.7

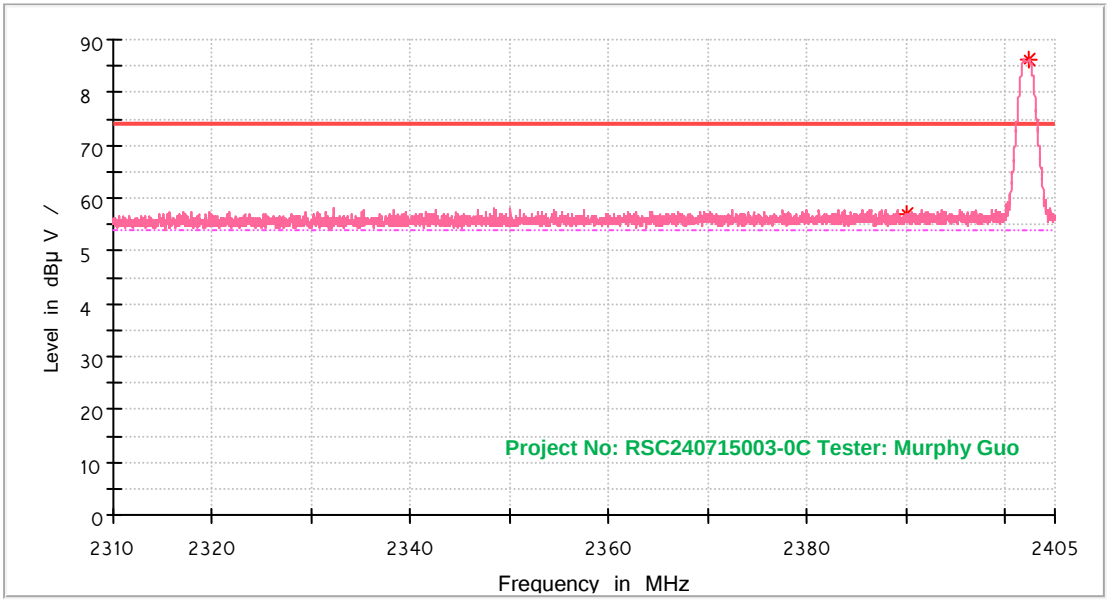
Band Edge(Tested without Pre-Amplifier):

Left_ Horizontal



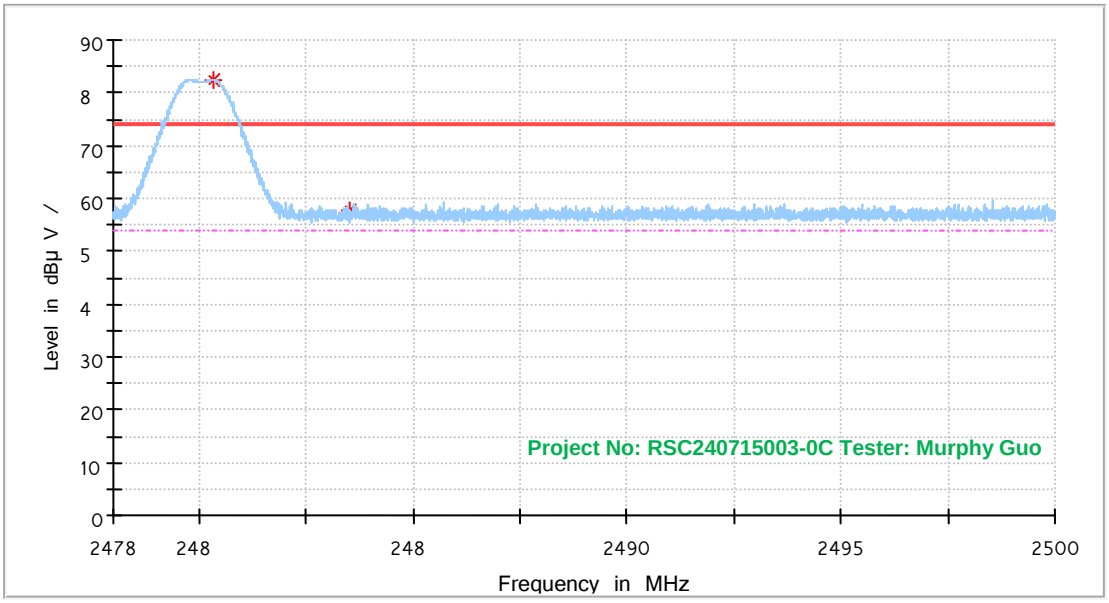
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2326.511000	58.24	---	74.00	15.76	108.0	H	110.0	30.9
2326.511000	---	48.54	54.00	5.46	108.0	H	319.0	30.9
2402.340000	---	83.31	---	---	108.0	H	122.0	31.3
2402.340000	84.51	---	---	---	108.0	H	122.0	31.3

Left_Vertical



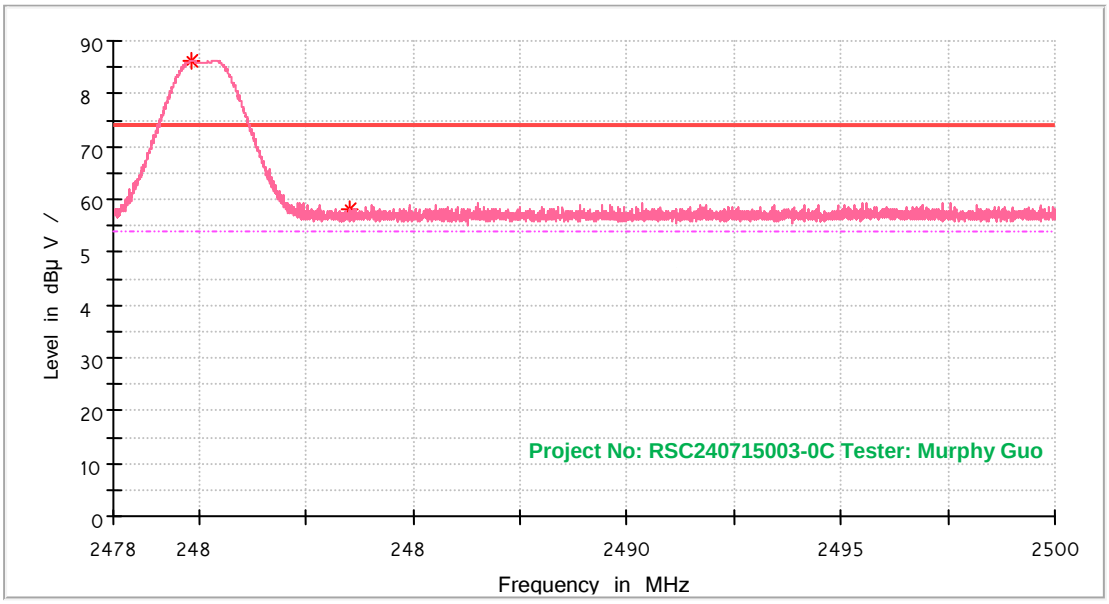
Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.028000	---	47.30	54.00	6.70	155.0	V	239.0	31.3
2390.028000	56.88	---	74.00	17.12	155.0	V	228.0	31.3
2402.378000	---	84.75	---	---	155.0	V	110.0	31.3
2402.378000	86.17	---	---	---	155.0	V	113.0	31.3

Right_Horizontal



Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2480.362800	---	81.18	---	---	142.0	H	88.0	31.3
2480.362800	82.49	---	---	---	142.0	H	88.0	31.3
2483.517600	57.85	---	74.00	16.15	142.0	H	234.0	31.3
2483.517600	---	47.86	54.00	6.14	142.0	H	318.0	31.3

Right_Vertical

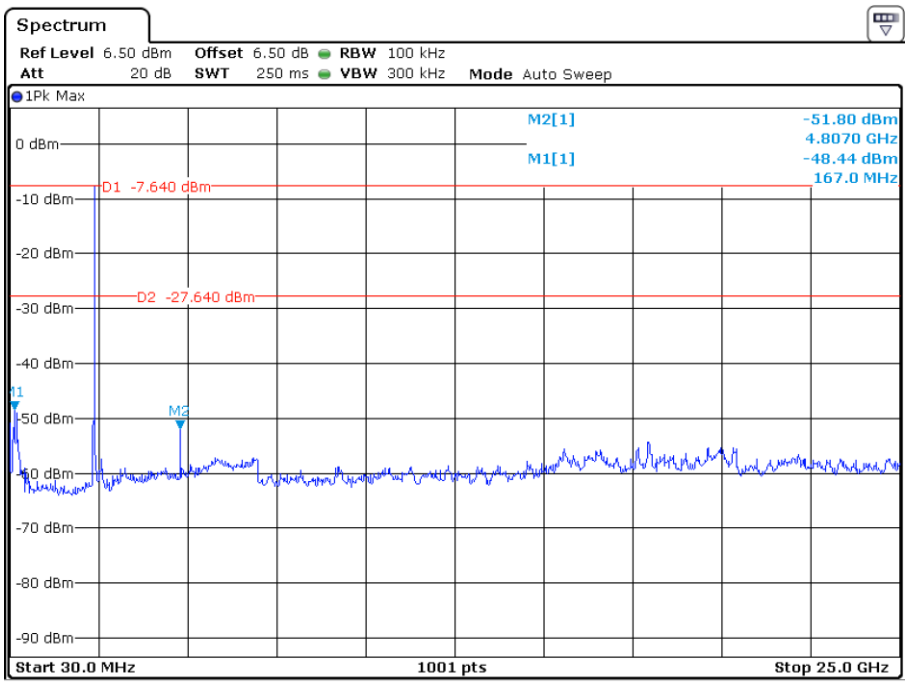


Frequency (MHz)	MaxPeak (dBµ V/m)	Average (dBµ V/m)	Limit (dBµ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2479.817200	86.26	---	---	---	105.0	V	130.0	31.3
2479.817200	---	85.05	---	---	105.0	V	133.0	31.3
2483.504400	58.07	---	74.00	15.93	105.0	V	184.0	31.3
2483.504400	---	47.87	54.00	6.13	105.0	V	64.0	31.3

Note:
Corrected Amplitude (MaxPeak or QuasiPeak) = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor or Antenna factor (RX) + Cable Loss
Margin = Limit- Corr. Amplitude

Conducted Spurious Emission At Antenna Port:

Low Channel



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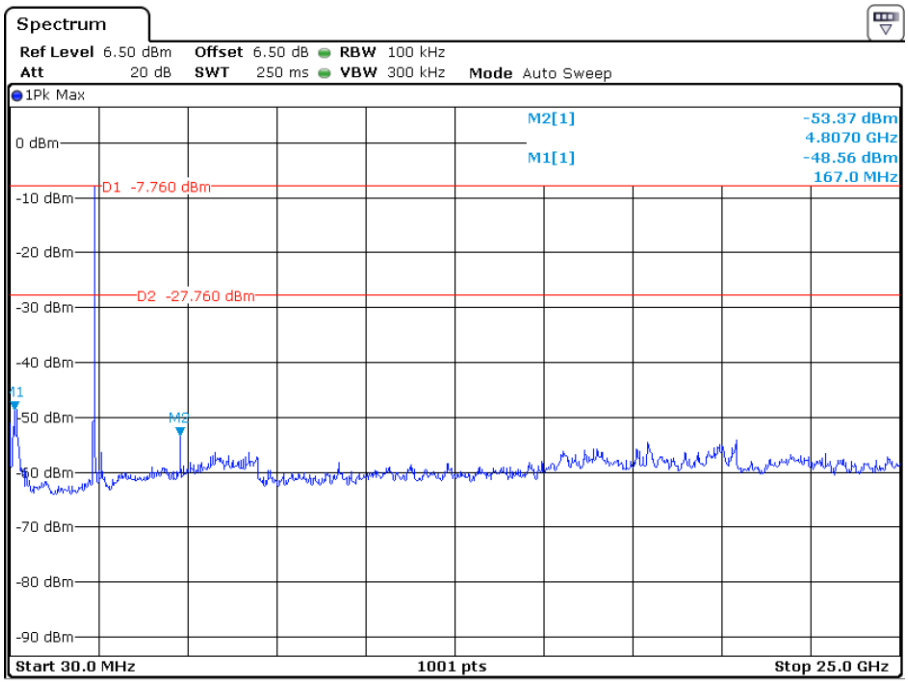
Middle Channel



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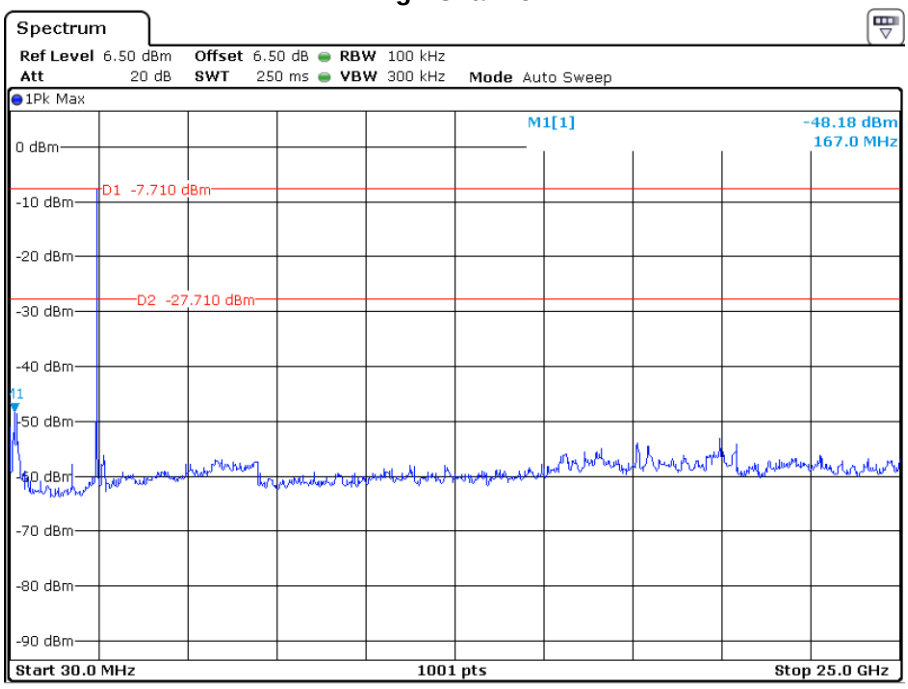
High Channel



Project No:RSC240715003-0C Tester:Murphy Guo
Date: 24.JUL.2024 17:11:58

FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

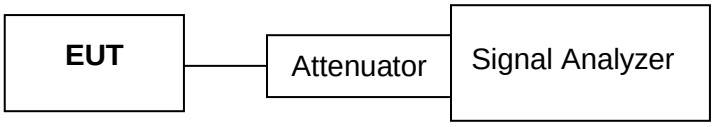
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz bands.
The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

ANSI C63.10-2020 Clause 11.8.1 Option 1

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3×RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Setup Block



Note: Offset (6.5dB) = 6dB Attenuator(6dB) + RF cable loss(0.5dB)

Test Data

Environmental Conditions

Temperature:	24.7 °C
Relative Humidity:	67 %
ATM Pressure:	96.3 kPa

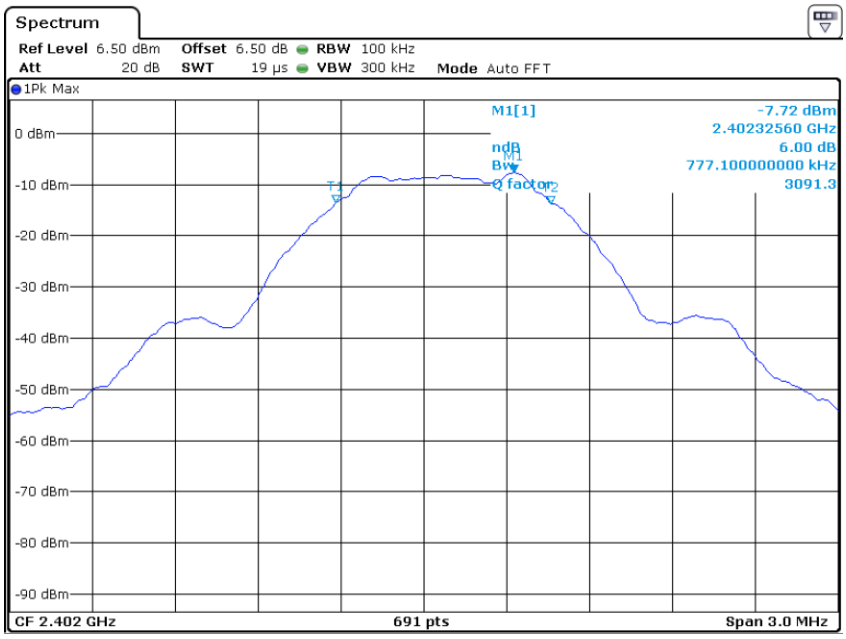
The testing was performed by Murphy Guo on 2024-07-24.

Test Mode: Transmitting

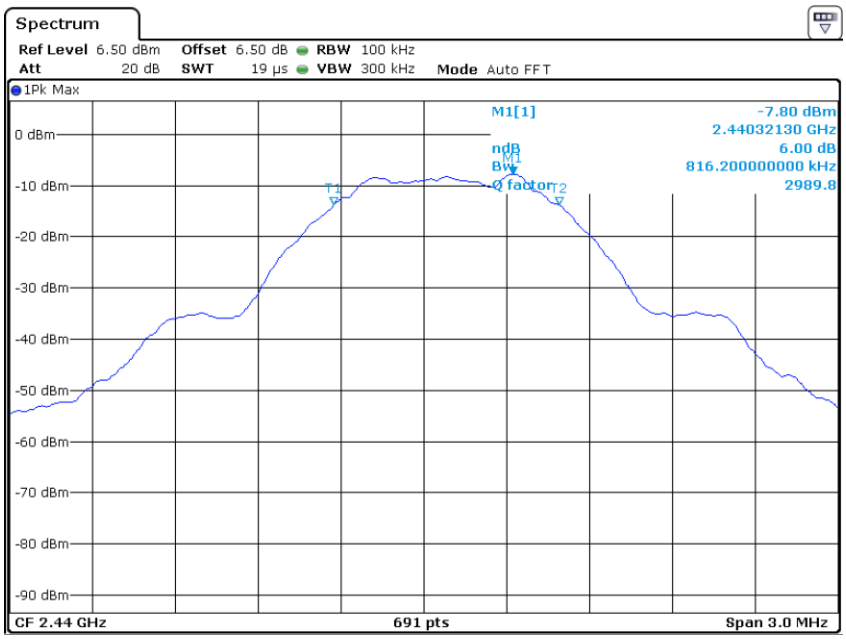
Test Result: Compliance. Please refer to the following table and plots.

Mode	Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)
LE 1M	Low	2402	777.10	≥ 500
	Middle	2440	816.20	≥ 500
	High	2480	816.20	≥ 500

Low Channel



Middle Channel



Project No:RSC240715003-0C Tester:Murphy Guo

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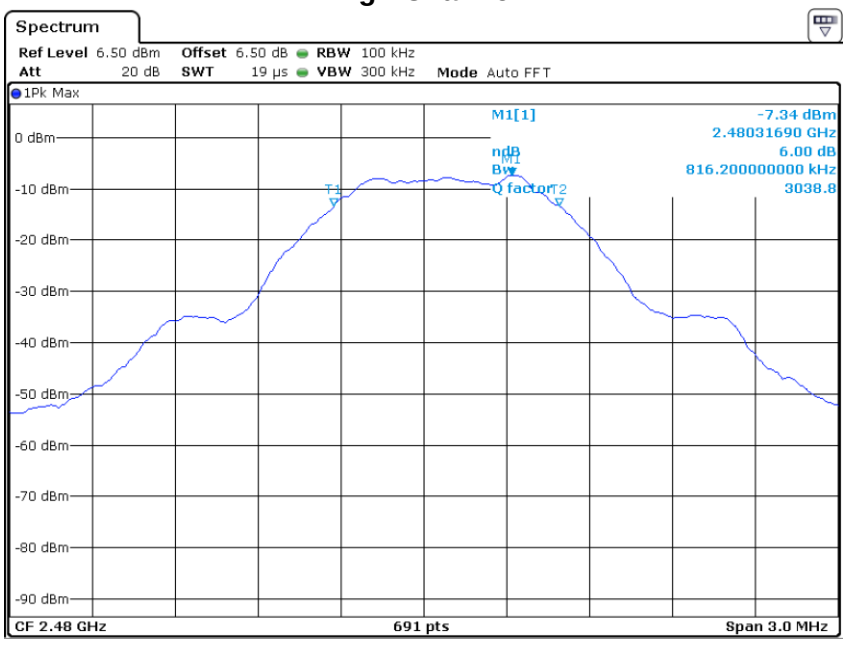
High Channel



Project No:RSC240715003-0C Tester:Murphy Guo

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FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

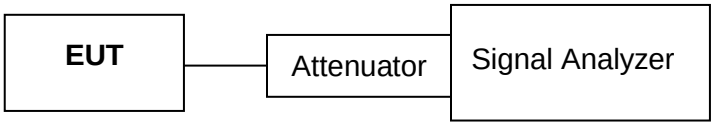
Test Procedure

ANSI C63.10-2020 Clause 11.9.1.1 RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = No faster than coupled (auto) time.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	24.7 °C
Relative Humidity:	67 %
ATM Pressure:	96.3 kPa

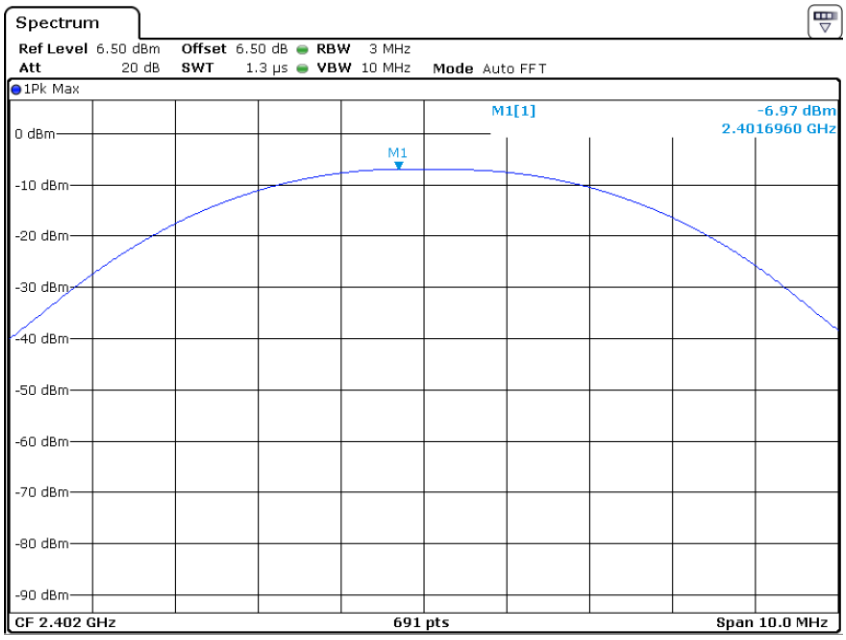
The testing was performed by Murphy Guo on 2024-07-24.

Test Mode: Transmitting

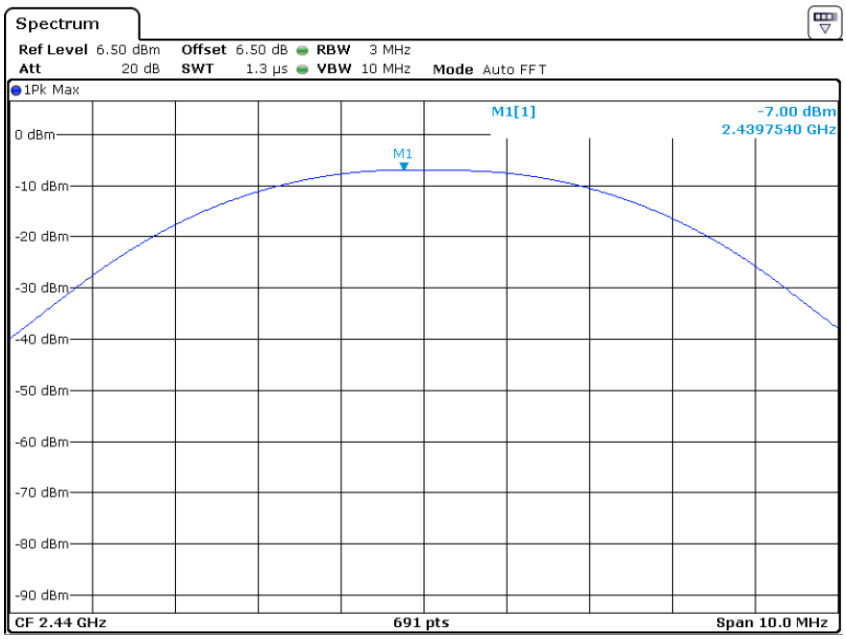
Test Result: Compliance. Please refer to the following table and plots.

Mode	Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
LE 1M	Low	2402	-6.97	≤30
	Middle	2440	-7.00	≤30
	High	2480	-6.54	≤30

Low Channel



Middle Channel



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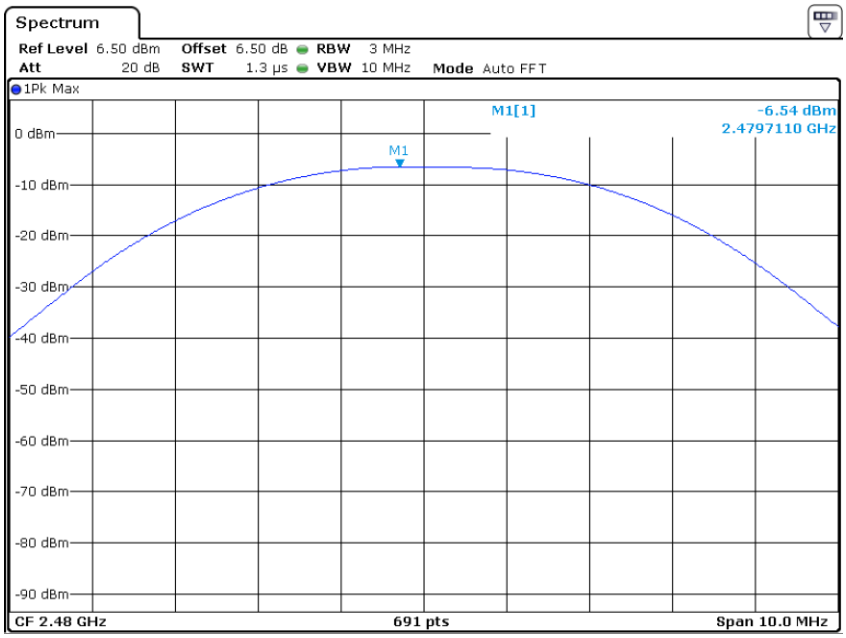
High Channel



Project No:RSC240715003-0C Tester:Murphy Guo
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FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

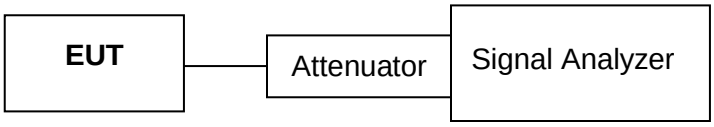
Applicable Standard

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including100 kHz bandwidth from band edge.
2. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
3. Repeat above procedures until all measured frequencies were complete.

Test Setup Block



Test Data

Environmental Conditions

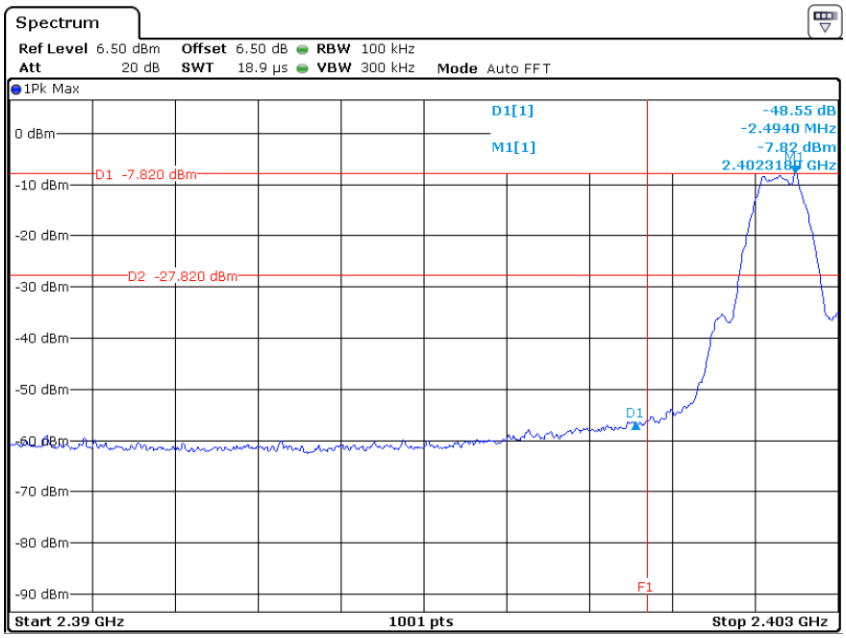
Temperature:	24.7 °C
Relative Humidity:	67 %
ATM Pressure:	96.3 kPa

The testing was performed by Murphy Guo on 2024-07-24.

Test mode: Transmitting

Test Result: Compliance. Please refer to following plots.

Band Edge, Left Side



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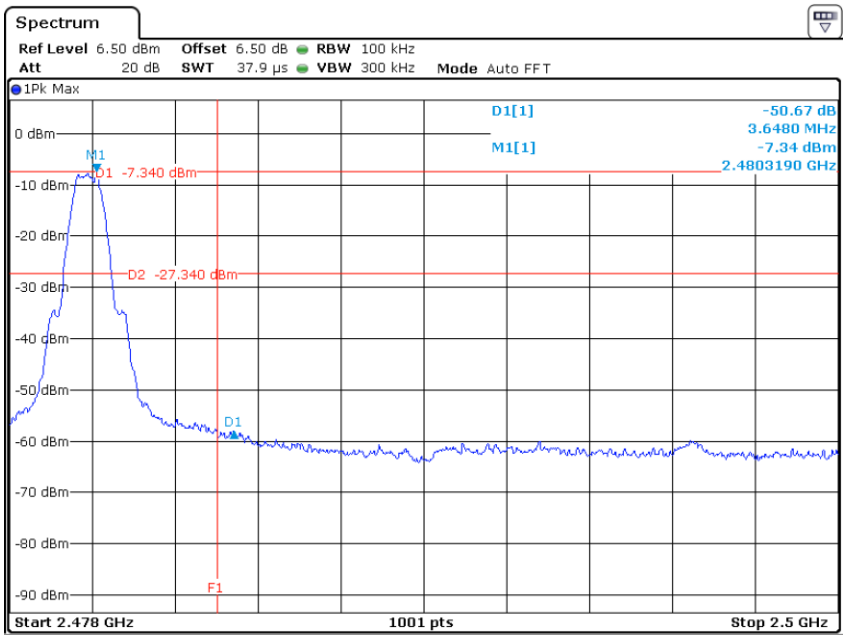
Band Edge, Right Side



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FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

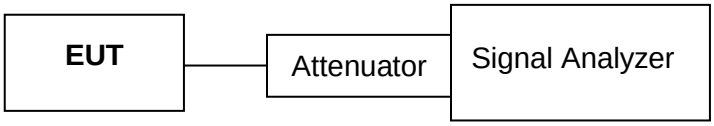
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

ANSI C63.10-2020 Clause 11.10.2(PKPSD)

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3×RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	24.7 °C
Relative Humidity:	67 %
ATM Pressure:	96.3 kPa

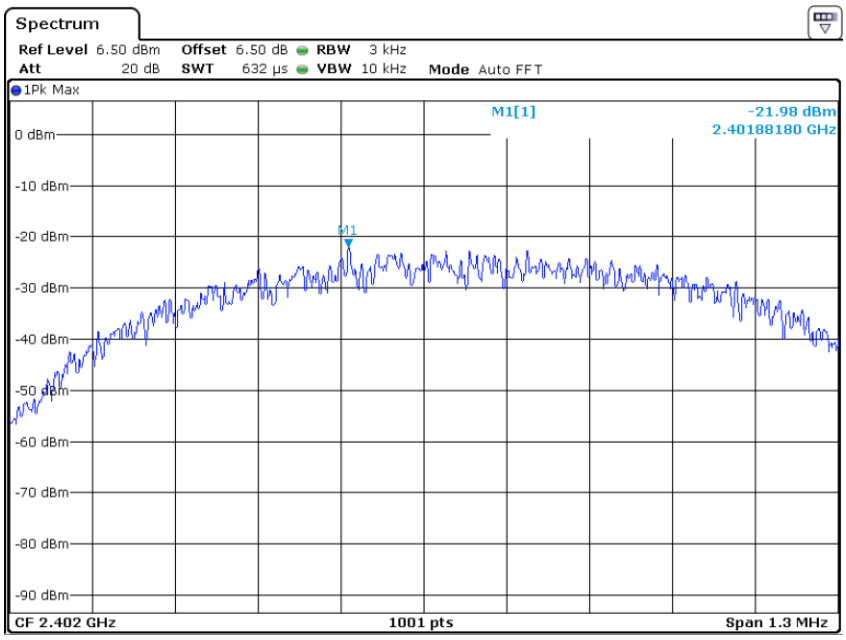
The testing was performed by Murphy Guo on 2024-07-24.

Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table and plots

Mode	Channel	Frequency (MHz)	PKPSD (dBm/3kHz)	Limit (dBm/3kHz)
LE 1M	Low	2402	-21.98	≤8
	Middle	2440	-22.17	≤8
	High	2480	-21.05	≤8

Power Spectral Density, Low Channel



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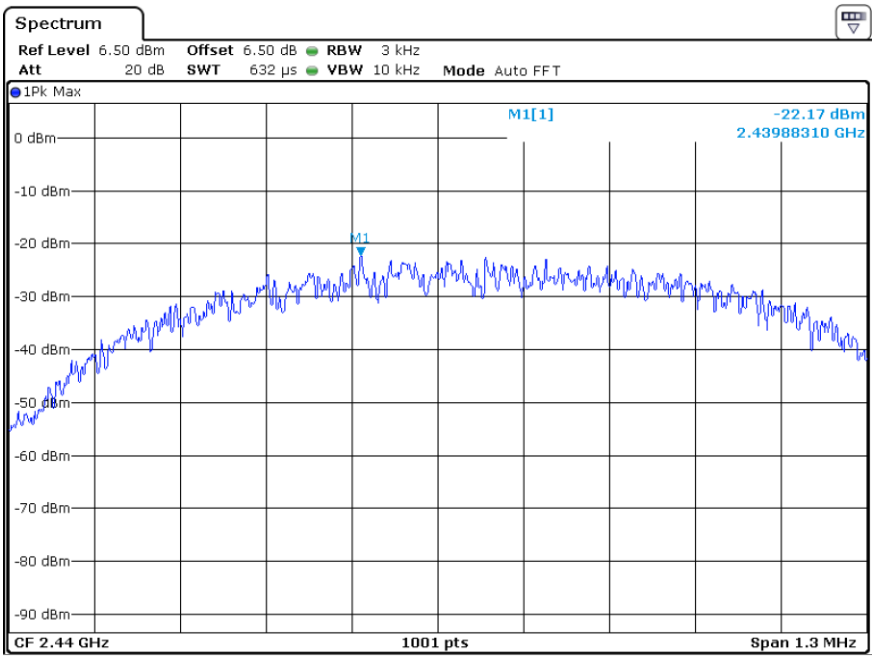
Power Spectral Density, Middle Channel



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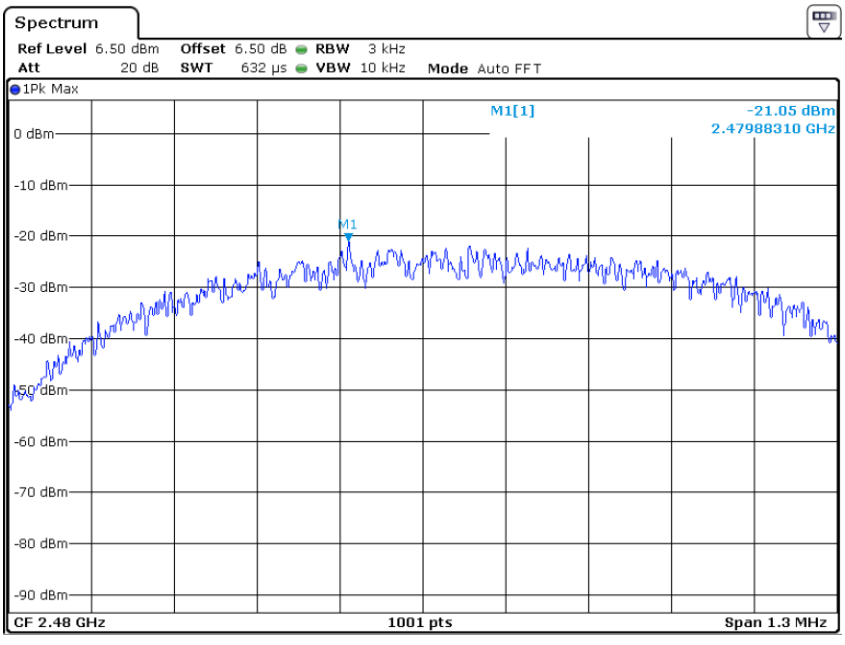
Power Spectral Density, High Channel



Project No:RSC240715003-0C Tester:Murphy Guo
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END OF REPORT