FCC PART 15.247

TEST REPORT

For

Pointguard AB

Ekeby Bruk 2N, SE-75263 Uppsala, Sweden

Tested Model: EP-BTM-ITOP-6
FCC ID: 2BG9Q-SBTDBT6

Report Type:	**Equipment Name:**
Original Report	Smarttrig BT Dual Bluetooth Transceiver

Report Number:	RSC240618001-0B
Date of Report Issue:	2024-07-17
Reviewed By:	Sula Huang
Prepared By:	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	Pointguard AB
Address	Ekeby Bruk 2N, SE-75263 Uppsala, Sweden
Email	info@pointguard.se
Product	Smarttrig BT Dual Bluetooth Transceiver
Tested Model	EP-BTM-ITOP-6
FCC ID	2BG9Q-SBTDBT6
Radio Mode*	Bluetooth
Frequency Range*	2402MHz-2480MHz
Modulation Type*	GFSK, π/4-DQPSK, 8DPSK
RF output power	-1.36 dBm
Voltage Range	DC 5-24V(Typical:12V)
Measure approximately	99 mm (L) x 55 mm (W) x 18 mm (H)
Sample serial number	240618002/01 (RF Radiated Test) 240618002/02 (RF Conducted Test) (assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received: 2024-06-18

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 **Pointguard AB** 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 Bluetooth BDR and EDR mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: 2BG9Q-SBTDBT6

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 A2LA (Lab code: 4324.01) and the FCC designation No. CN1186 under the FCC KDB 974614 D01. 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 for testing in engineering mode.

For Bluetooth, 79 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	41	2443
1	2403	42	2444
2	2404	43	2445
…	…	…	…
38	**2440**	76	2478
39	**2441**	77	2479
40	2442	78	**2480**

EUT was tested with channel 0, 38 and 78.(Note: 20dB bandwidth\Peak output power\Radiated spurious emissions was tested with channel 0, 39 and 78.)

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software*

The setting by the software is as following table:

Test Mode	Test Software Version	BR BlueletSuite		
BDR Mode (GFSK)	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level	7	7	7
EDR Mode (π/4-DQPSK)	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	2Mbps	2Mbps	2Mbps
	Power Level	7	7	7
EDR Mode (8DPSK)	Test Frequency	2402MHz	2440MHz	2480MHz
	Data Rate	3Mbps	3Mbps	3Mbps
	Power Level	7	7	7

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Daihatsu	Active Power	SG-1000	CO-900042664
DELL	Laptop	E5430	BTXWLX1
Unknown	USB to TTL	No	No

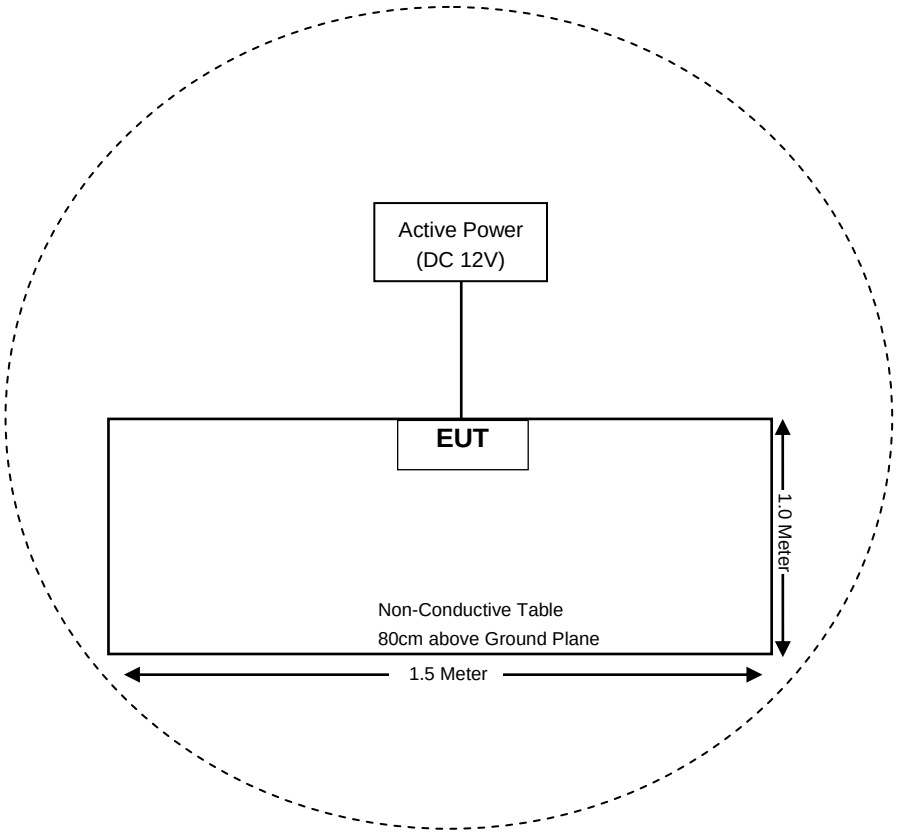
External I/O Cable

Cable Description	Length (m)	From	To
Unshielded DC Power Cable	1.8	Active Power	EUT

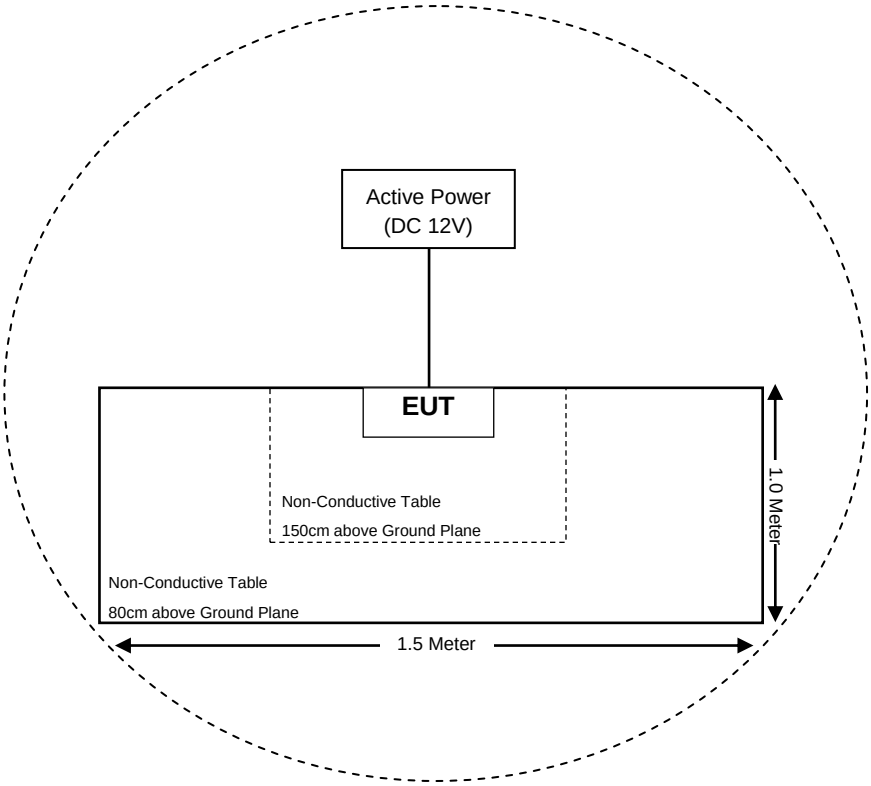
Block Diagram of Test Setup

Spurious Emissions

Below 1GHz:



Above 1GHz:



Note: When it was setup ok. The device can continuously transmitting after remove the fixture and the laptop.

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 & §1.1310 & §2.1091	MaximuM Permissible exposure (MPE)	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)(1)	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

Not Applicable: The device is vehicle use.

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	Spectrum Analyzer	FSU26	200835	2024-04-11	2025-04-10
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
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	2023-05-12	2024-05-11
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	2023-04-12	2024-04-11

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 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE

Applicable Standard

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

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Per 447498 D01 General RF Exposure Guidance v06**,** simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where:
S = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Bluetooth	2402-2480	1.32	1.36	-1.0	0.79	20	0.0002	1.0

Result: The device meets RF exposure evaluation at ⩾20cm distance.

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 integrated antenna and the maximum antenna gain is 1.32dBi, which fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance

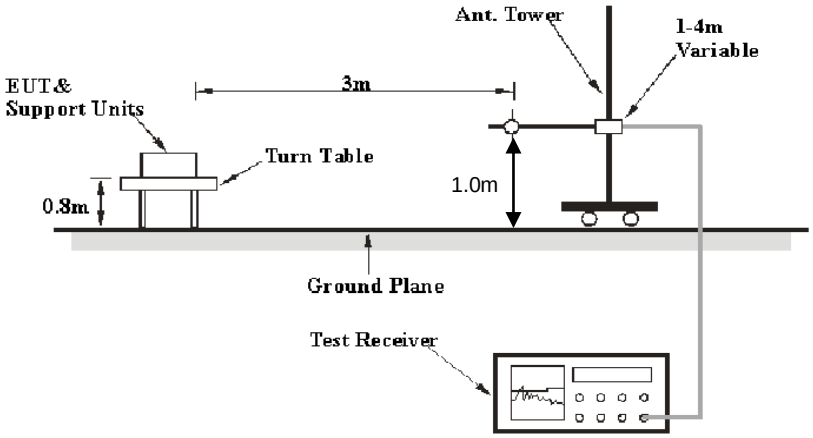
FCC §15.209, §15.205 & §15.247(d) - RADIATED SPURIOUS EMISSIONS & BAND EDGE

Applicable Standard

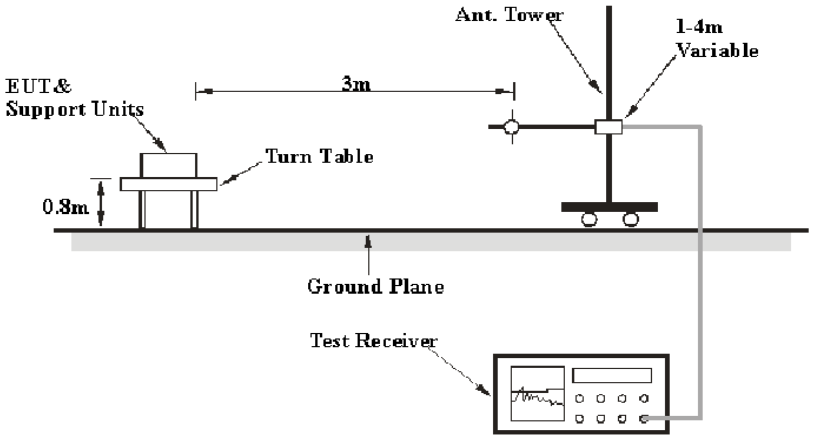
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

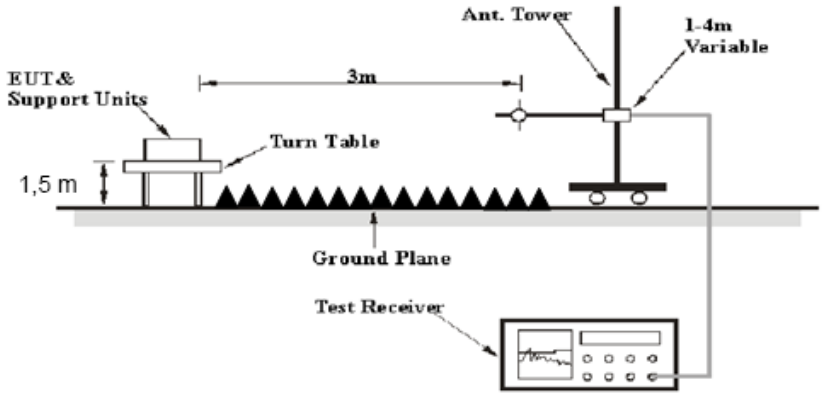
9kHz - 30MHz:



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 & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	Measurement
9 kHz – 90 kHz	200 Hz	1 kHz	AV
90 kHz –110 kHz	200 Hz	1 kHz	QP
110 kHz – 150 kHz	200 Hz	1 kHz	AV
150 kHz – 490 kHz	9 kHz	30 kHz	AV
490 kHz – 30 MHz	9 kHz	30 kHz	QP
30 MHz – 1000 MHz	120 kHz	300 kHz	QP
Above 1 GHz	1 MHz	3 MHz	PK
	1 MHz	3 MHz	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.

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	AV

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:

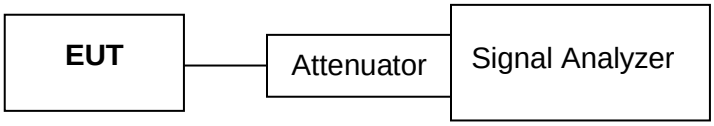
Margin = Limit –Corrected Amplitude

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:	2024-06-20	2024-06-24
Temperature:	22 °C	25 °C
Relative Humidity:	64 %	67 %
ATM Pressure:	96.3 kPa	95.7 kPa

The testing was performed by Colin Jiang.

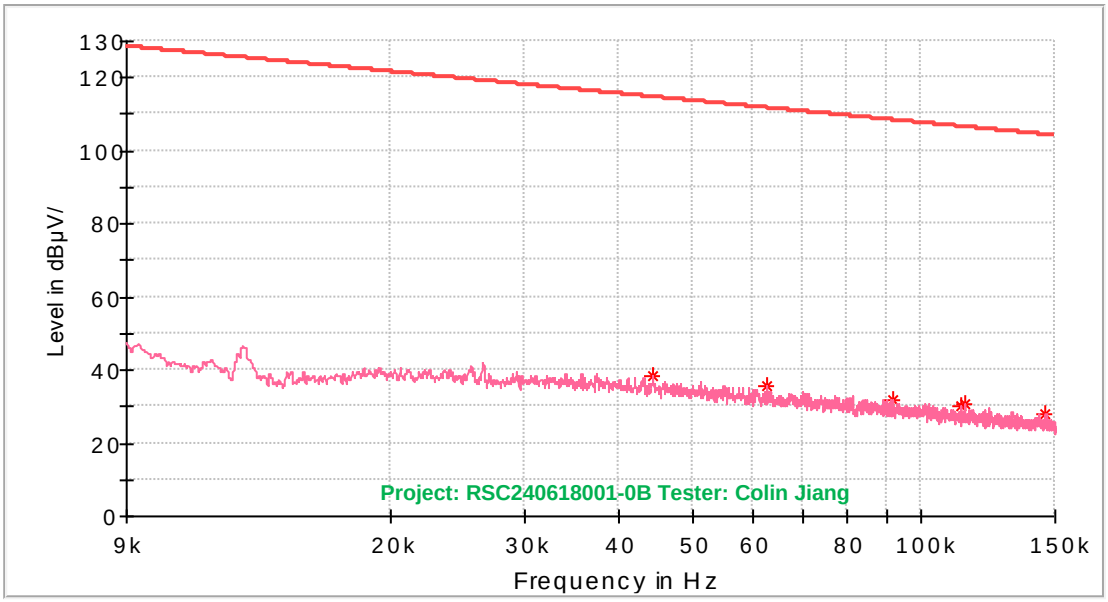
Test Mode: Transmitting

Note: Pre-scan and configuration EUT with X, Y and Z-axis, the Y-axis is the worst case.

Radiated Spurious Emissions:

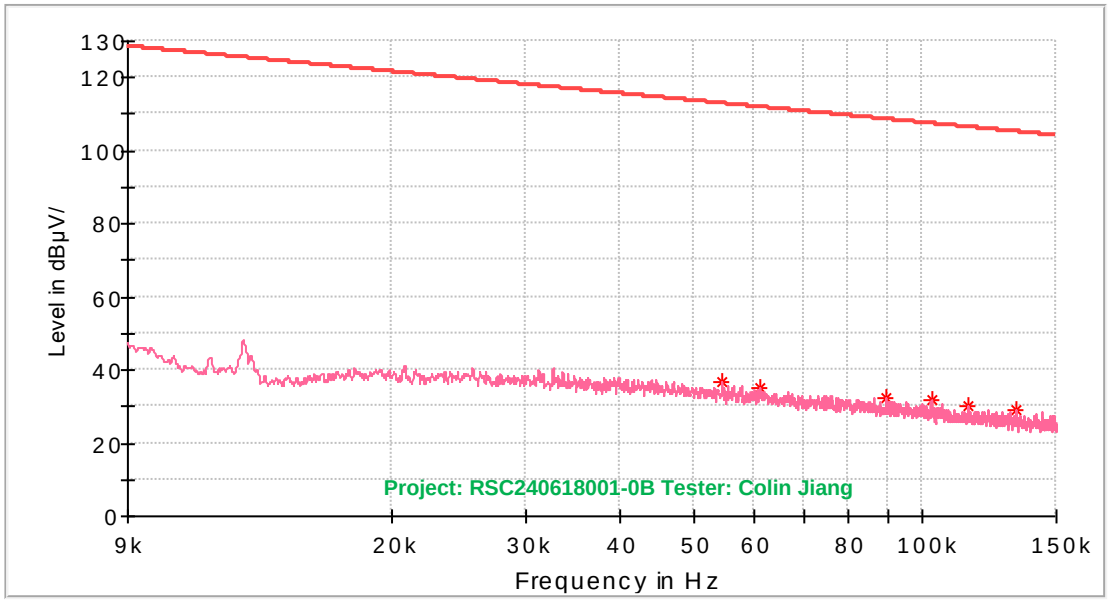
1) 9 kHz to 150 kHz_GFSK_ low channel_worst case

Parallel



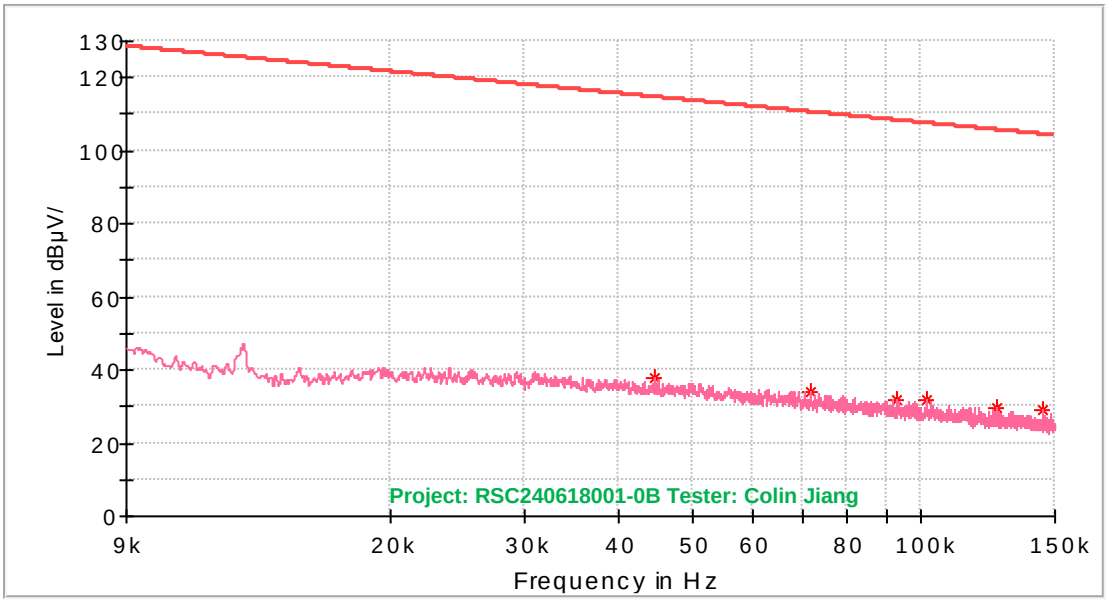
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.044338	38.42	114.66	76.24	100.0	0.0	20.1
0.062580	35.52	111.67	76.14	100.0	0.0	17.6
0.091802	31.94	108.34	76.40	100.0	0.0	14.7
0.112935	30.17	106.54	76.37	100.0	0.0	13.0
0.113939	30.47	106.46	75.99	100.0	0.0	12.9
0.145929	28.01	104.32	76.31	100.0	0.0	10.8

Perpendicular



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.051194	36.99	113.41	76.42	100.0	0.0	19.2
0.063074	35.58	111.60	76.02	100.0	0.0	17.6
0.085440	33.96	108.96	75.01	100.0	0.0	15.3
0.085492	34.39	108.96	74.57	100.0	0.0	15.3
0.101390	31.78	107.48	75.69	100.0	0.0	13.9
0.118751	31.22	106.10	74.88	100.0	0.0	12.6

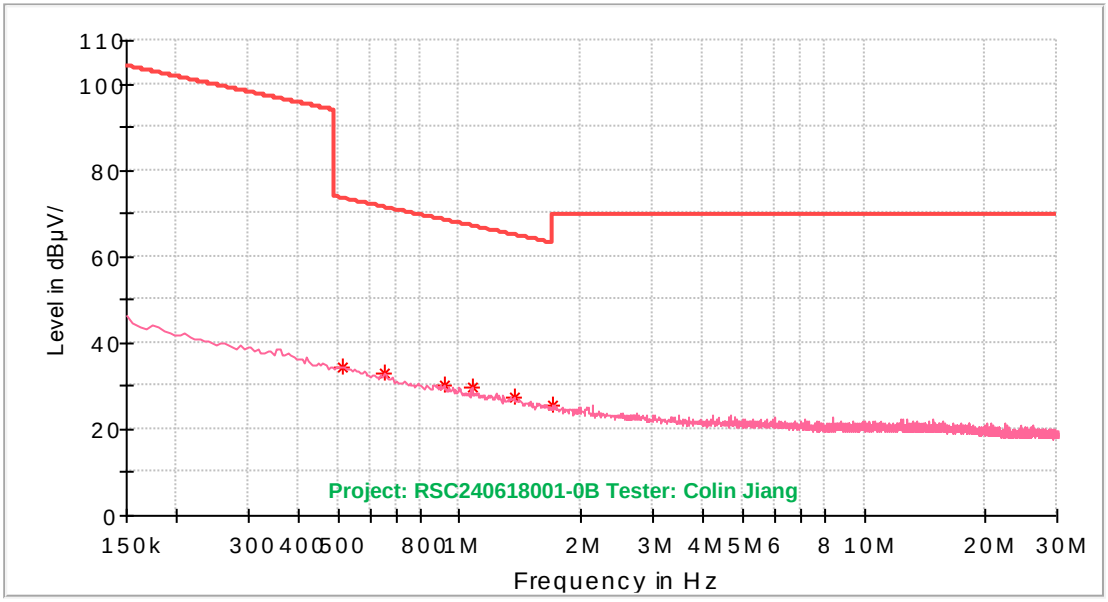
Ground Parallel



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.044655	37.95	114.60	76.65	100.0	0.0	20.0
0.071569	34.04	110.50	76.46	100.0	0.0	16.6
0.092842	32.02	108.24	76.22	100.0	0.0	14.6
0.101708	31.72	107.45	75.73	100.0	0.0	13.9
0.125730	29.40	105.61	76.20	100.0	0.0	12.1
0.144906	29.09	104.38	75.28	100.0	0.0	10.9

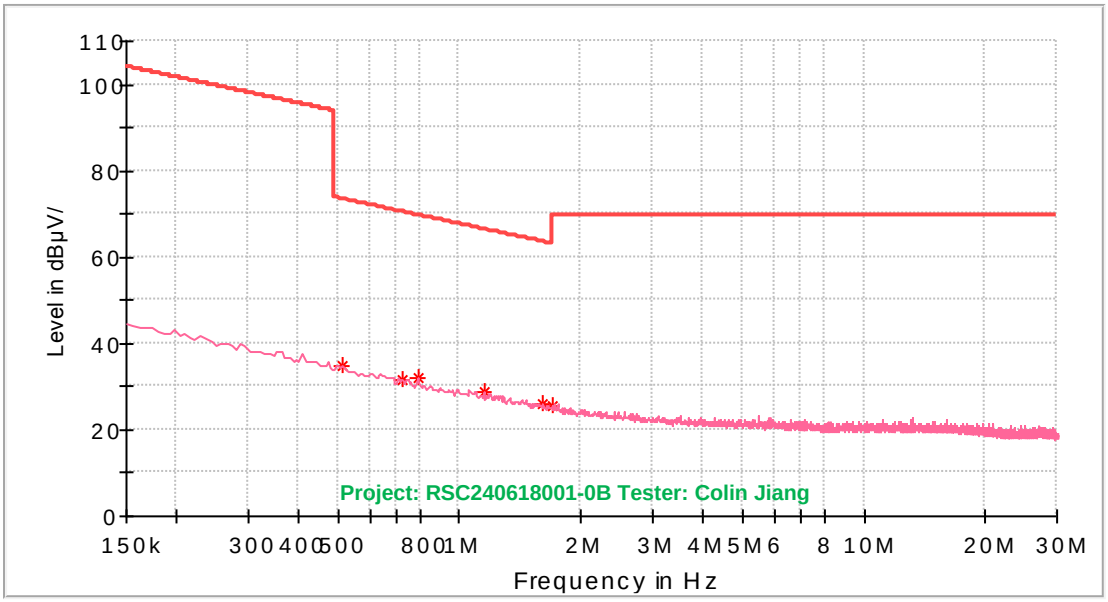
2) 150 kHz to 30 MHz_ GFSK_ low channel _worst case

Parallel



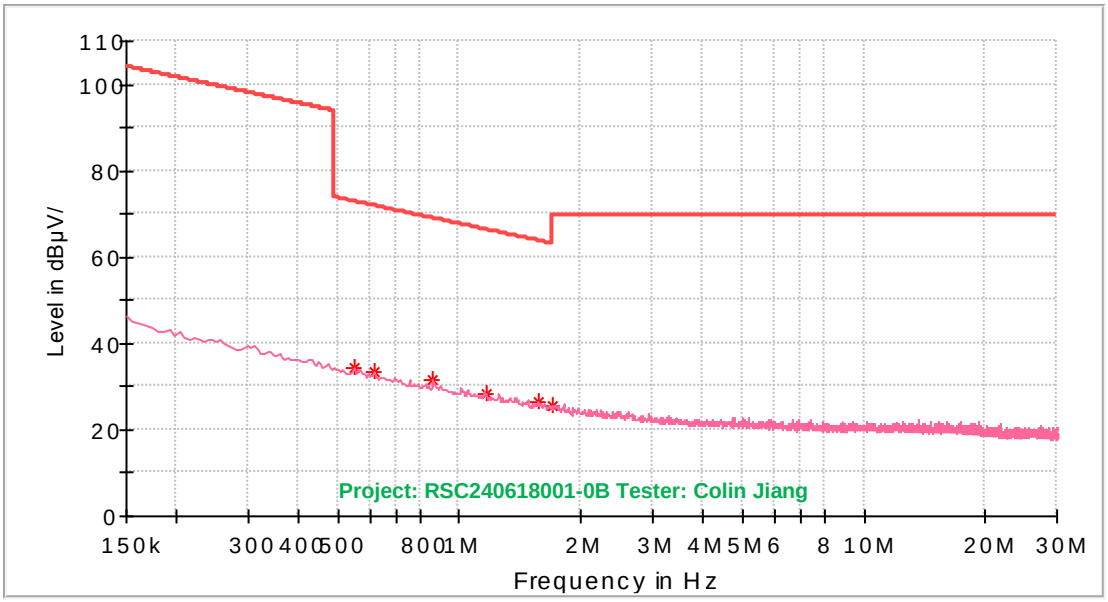
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.514170	34.47	73.38	38.91	100.0	164.0	0.4
0.651480	32.75	71.33	38.58	100.0	115.0	-1.4
0.914160	29.95	68.40	38.45	100.0	25.0	-3.6
1.075350	29.66	66.99	37.33	100.0	127.0	-4.4
1.361910	27.45	64.95	37.49	100.0	90.0	-5.6
1.702200	25.52	63.01	37.49	100.0	115.0	-6.6

Perpendicular



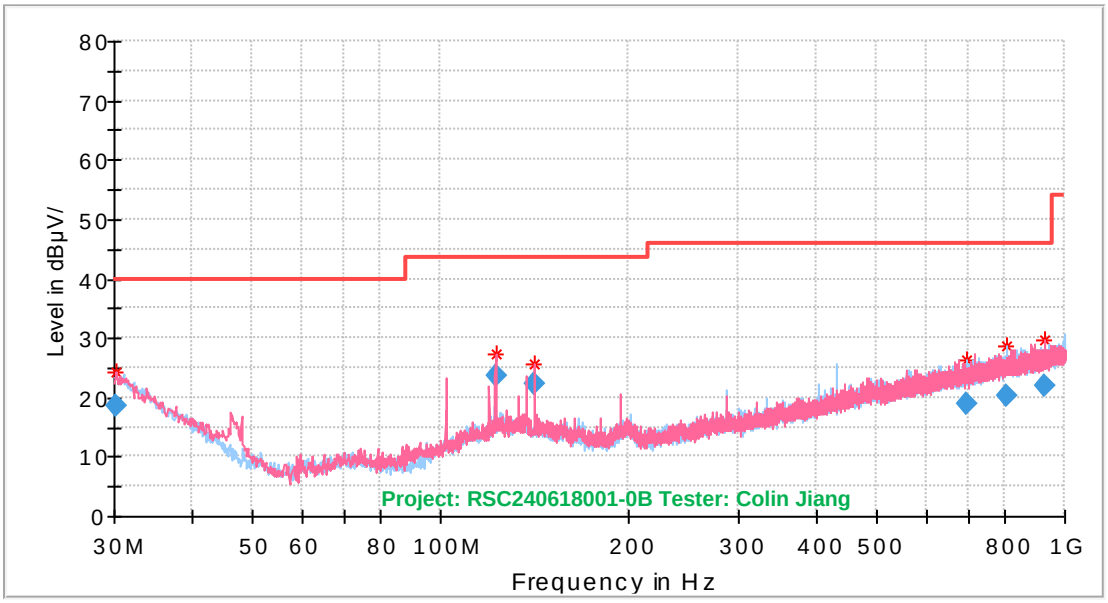
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.514170	34.72	73.38	38.66	100.0	196.0	0.4
0.723120	31.74	70.43	38.69	100.0	188.0	-2.1
0.788790	31.93	69.68	37.74	100.0	1.0	-2.8
1.146990	28.64	66.43	37.79	100.0	151.0	-4.8
1.612650	25.96	63.48	37.52	100.0	0.0	-6.3
1.696230	25.47	63.04	37.58	100.0	144.0	-6.6

Ground Parallel



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.549990	34.14	72.80	38.66	100.0	14.0	-0.1
0.615660	33.35	71.82	38.48	100.0	100.0	-0.9
0.860430	31.46	68.92	37.46	100.0	260.0	-3.3
1.164900	28.43	66.30	37.87	100.0	280.0	-4.8
1.570860	26.64	63.71	37.07	100.0	160.0	-6.2
1.702200	25.67	63.01	37.34	100.0	116.0	-6.6

3) 30 MHz to 1 GHz_ GFSK_ low channel _worst case

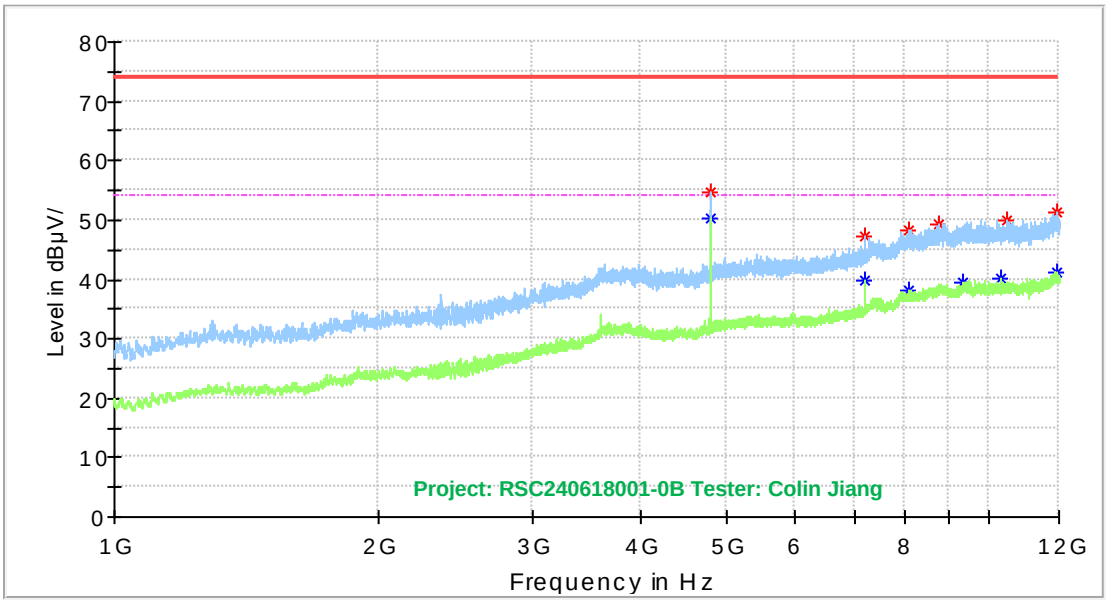


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.261360	18.68	40.00	21.32	1000.0	120.000	104.0	V	14.0	-3.3
122.513750	23.65	43.50	19.85	1000.0	120.000	108.0	V	331.0	-11.0
141.186250	22.14	43.50	21.36	1000.0	120.000	124.0	V	285.0	-11.0
696.348500	19.04	46.00	26.96	1000.0	120.000	124.0	H	67.0	-2.9
807.272250	20.34	46.00	25.66	1000.0	120.000	103.0	H	28.0	-1.0
929.883750	21.85	46.00	24.15	1000.0	120.000	103.0	V	213.0	0.9

4) 1 GHz-12 GHz

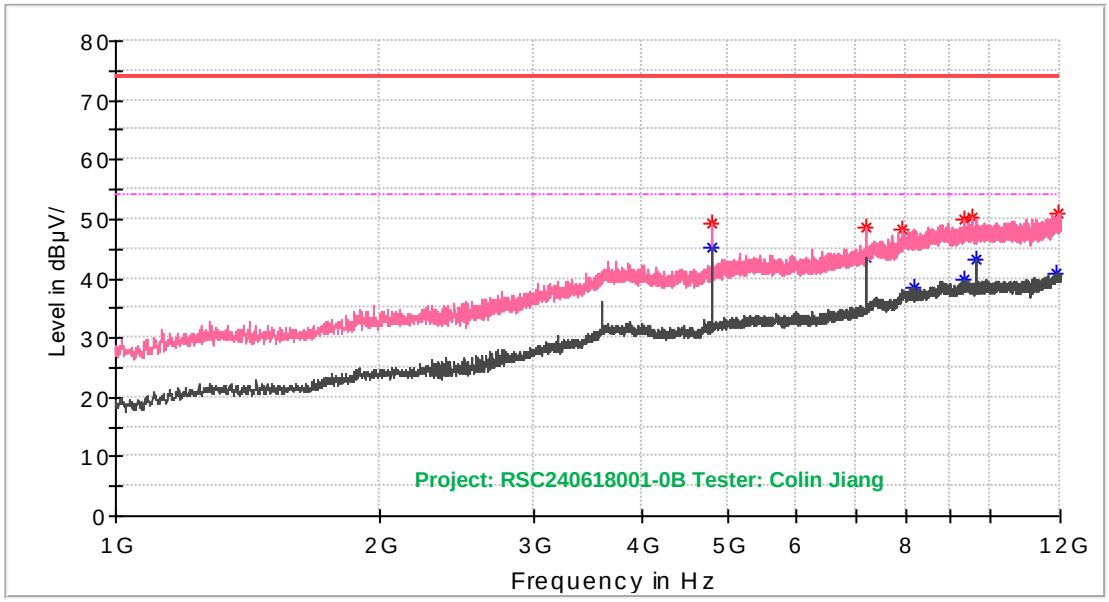
BDR Mode (GFSK)

Low Channel_Horizontal



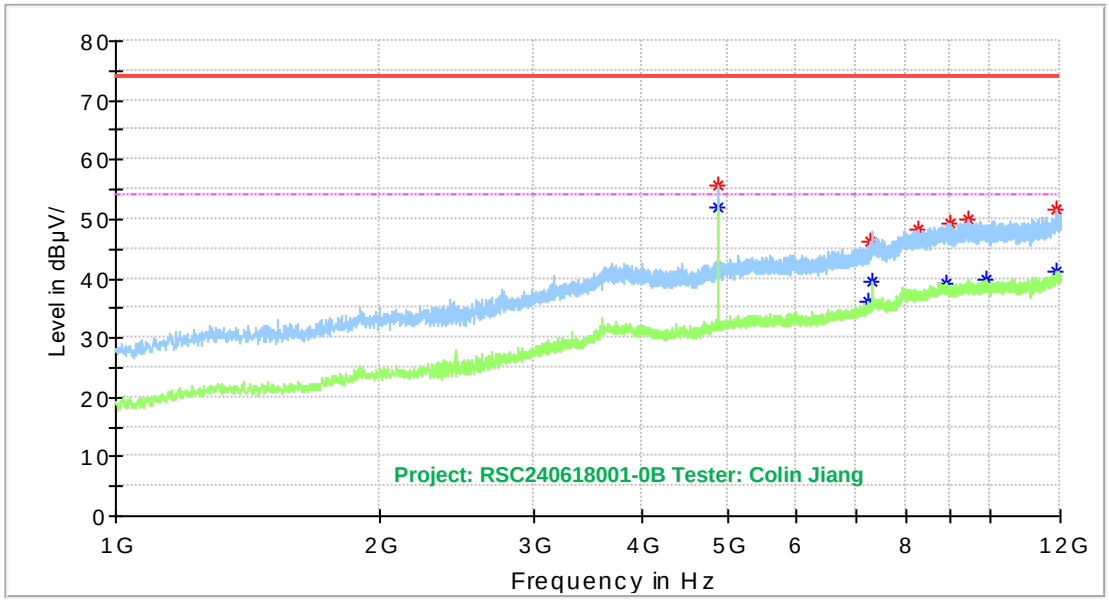
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	---	50.43	54.00	3.57	150.0	H	244.0	-5.2
4803.800000	54.67	---	74.00	19.33	150.0	H	244.0	-5.2
7206.200000	---	39.70	54.00	14.30	200.0	H	23.0	-2.2
7206.200000	47.28	---	74.00	26.72	150.0	H	134.0	-2.2
8087.300000	48.29	---	74.00	25.71	200.0	H	146.0	0.1
8106.000000	---	38.14	54.00	15.86	150.0	H	359.0	0.1
8768.200000	49.36	---	74.00	24.64	150.0	H	286.0	1.6
9297.300000	---	39.47	54.00	14.53	200.0	H	233.0	1.5
10326.900000	---	40.06	54.00	13.94	150.0	H	272.0	1.9
10457.800000	49.99	---	74.00	24.01	200.0	H	188.0	2.1
11919.700000	51.37	---	74.00	22.63	150.0	H	210.0	4.3
11919.700000	---	41.32	54.00	12.68	150.0	H	210.0	4.3

Low Channel_Vertical



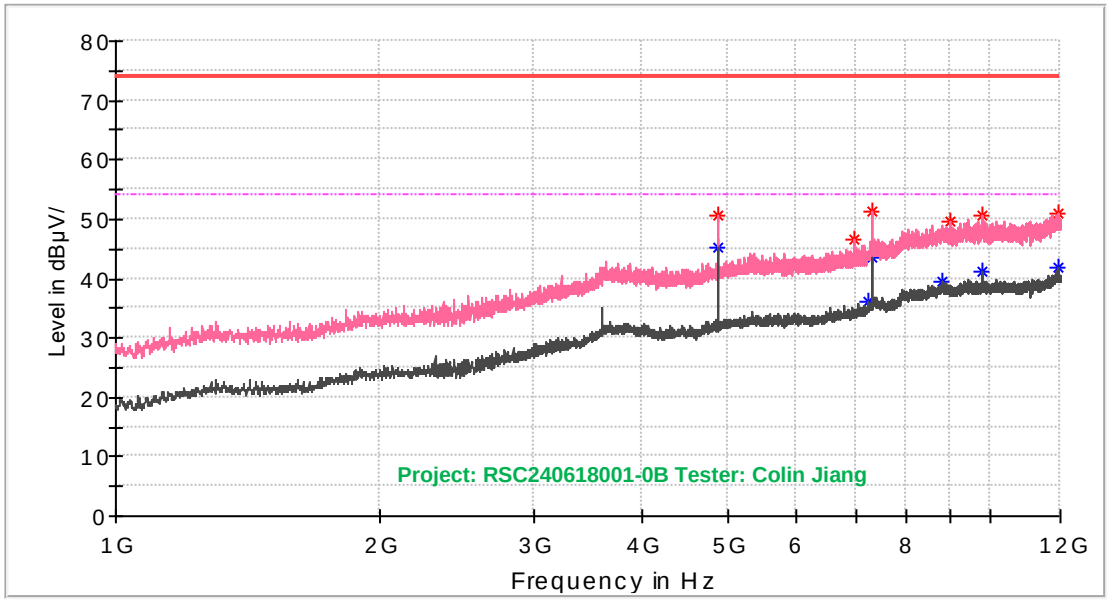
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	---	45.20	54.00	8.80	200.0	V	70.0	-5.2
4804.900000	49.33	---	74.00	24.67	200.0	V	70.0	-5.2
7206.200000	48.47	---	74.00	25.53	200.0	V	70.0	-2.2
7206.200000	---	43.42	54.00	10.58	200.0	V	70.0	-2.2
7935.500000	48.25	---	74.00	25.75	150.0	V	20.0	0.2
8177.500000	---	38.58	54.00	15.42	200.0	V	255.0	0.2
9321.500000	---	39.75	54.00	14.25	200.0	V	227.0	1.6
9335.800000	49.83	---	74.00	24.17	200.0	V	284.0	1.6
9508.500000	50.27	---	74.00	23.73	150.0	V	0.0	1.8
9608.600000	---	43.22	54.00	10.78	200.0	V	84.0	1.5
11873.500000	---	40.88	54.00	13.12	200.0	V	290.0	4.2
11924.100000	51.12	---	74.00	22.88	200.0	V	220.0	4.3

Middle Channel_Horizontal



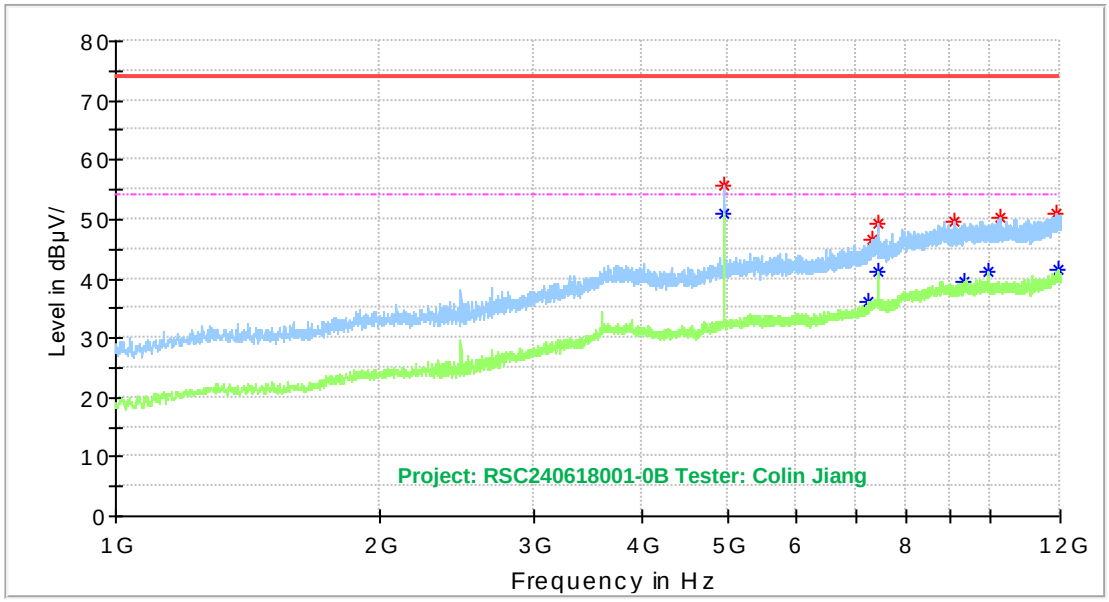
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	55.71	---	74.00	18.29	150.0	H	236.0	-5.1
4881.900000	---	52.13	54.00	1.87	150.0	H	236.0	-5.1
7231.500000	---	36.16	54.00	17.84	150.0	H	14.0	-2.1
7272.200000	46.21	---	74.00	27.79	200.0	H	339.0	-1.8
7323.900000	---	39.42	54.00	14.58	150.0	H	125.0	-1.4
8262.200000	48.25	---	74.00	25.75	150.0	H	167.0	0.2
8898.000000	---	39.28	54.00	14.72	200.0	H	0.0	1.6
8977.200000	49.43	---	74.00	24.57	150.0	H	145.0	1.0
9442.500000	49.96	---	74.00	24.04	200.0	H	246.0	1.7
9850.600000	---	39.93	54.00	14.07	200.0	H	325.0	1.6
11870.200000	51.79	---	74.00	22.21	150.0	H	28.0	4.2
11897.700000	---	41.13	54.00	12.87	150.0	H	8.0	4.1

Middle Channel_Vertical



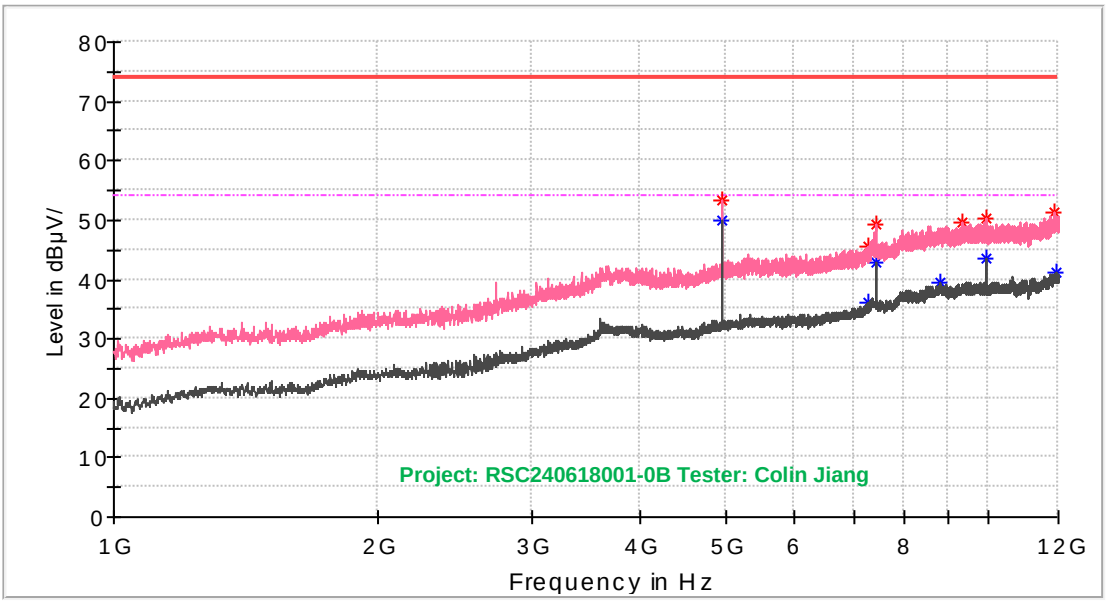
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	---	45.17	54.00	8.83	200.0	V	190.0	-5.1
4881.900000	50.62	---	74.00	23.38	200.0	V	190.0	-5.1
6970.800000	46.52	---	74.00	27.48	200.0	V	332.0	-2.8
7250.200000	---	35.97	54.00	18.03	200.0	V	55.0	-2.0
7322.800000	---	43.39	54.00	10.61	200.0	V	85.0	-1.4
7323.900000	51.21	---	74.00	22.79	200.0	V	70.0	-1.4
8802.300000	---	39.61	54.00	14.39	200.0	V	339.0	1.7
8983.800000	49.52	---	74.00	24.48	150.0	V	69.0	1.0
9763.700000	50.70	---	74.00	23.30	150.0	V	90.0	1.5
9764.800000	---	41.07	54.00	12.93	200.0	V	99.0	1.5
11930.700000	51.03	---	74.00	22.97	150.0	V	240.0	4.4
11961.500000	---	41.79	54.00	12.21	200.0	V	204.0	4.5

High Channel_Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	55.61	---	74.00	18.39	150.0	H	207.0	-4.7
4960.000000	---	51.06	54.00	2.94	200.0	H	243.0	-4.7
7245.800000	---	36.08	54.00	17.92	200.0	H	0.0	-2.0
7298.600000	46.45	---	74.00	27.55	150.0	H	83.0	-1.7
7439.400000	49.29	---	74.00	24.71	150.0	H	145.0	-1.3
7440.500000	---	41.11	54.00	12.89	150.0	H	139.0	-1.3
9081.700000	49.62	---	74.00	24.38	200.0	H	300.0	0.9
9344.600000	---	39.42	54.00	14.58	200.0	H	200.0	1.6
9921.000000	---	41.05	54.00	12.95	200.0	H	100.0	1.4
10251.000000	50.23	---	74.00	23.77	150.0	H	27.0	1.9
11884.500000	50.80	---	74.00	23.20	150.0	H	69.0	4.2
11961.500000	---	41.40	54.00	12.60	200.0	H	344.0	4.5

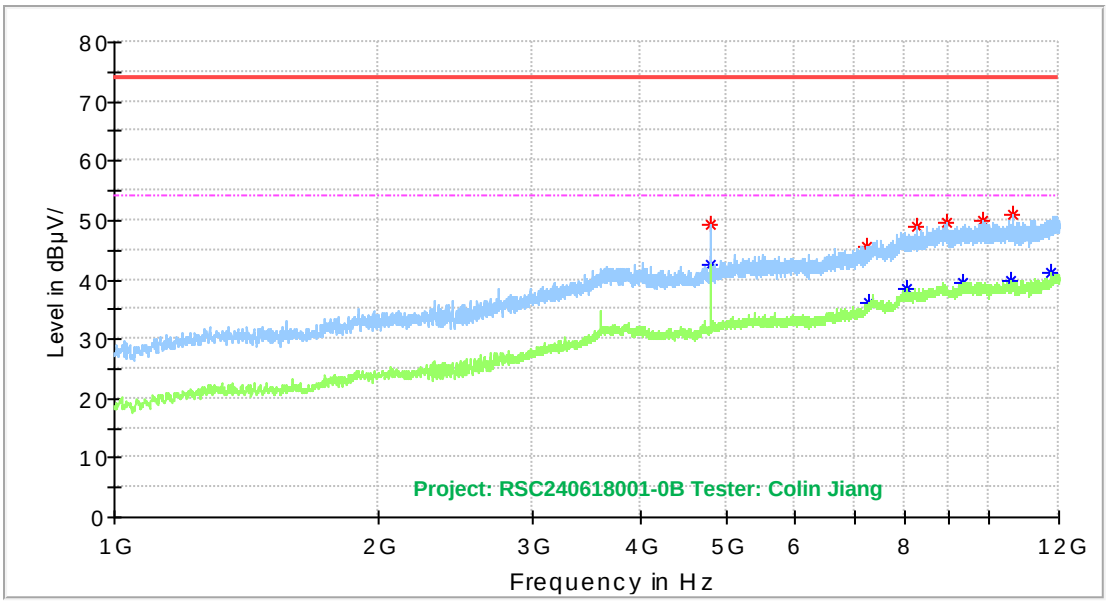
High Channel_Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	---	50.01	54.00	3.99	200.0	V	180.0	-4.7
4960.000000	53.42	---	74.00	20.58	200.0	V	180.0	-4.7
7289.800000	---	36.15	54.00	17.85	150.0	V	110.0	-1.7
7294.200000	45.48	---	74.00	28.52	200.0	V	209.0	-1.7
7440.500000	49.14	---	74.00	24.86	200.0	V	84.0	-1.3
7440.500000	---	42.95	54.00	11.05	200.0	V	84.0	-1.3
8773.700000	---	39.42	54.00	14.58	150.0	V	104.0	1.6
9333.600000	49.75	---	74.00	24.25	150.0	V	90.0	1.6
9921.000000	---	43.60	54.00	10.40	150.0	V	90.0	1.4
9921.000000	50.46	---	74.00	23.54	150.0	V	90.0	1.4
11855.900000	51.22	---	74.00	22.78	150.0	V	0.0	4.3
11936.200000	---	41.20	54.00	12.80	150.0	V	159.0	4.4

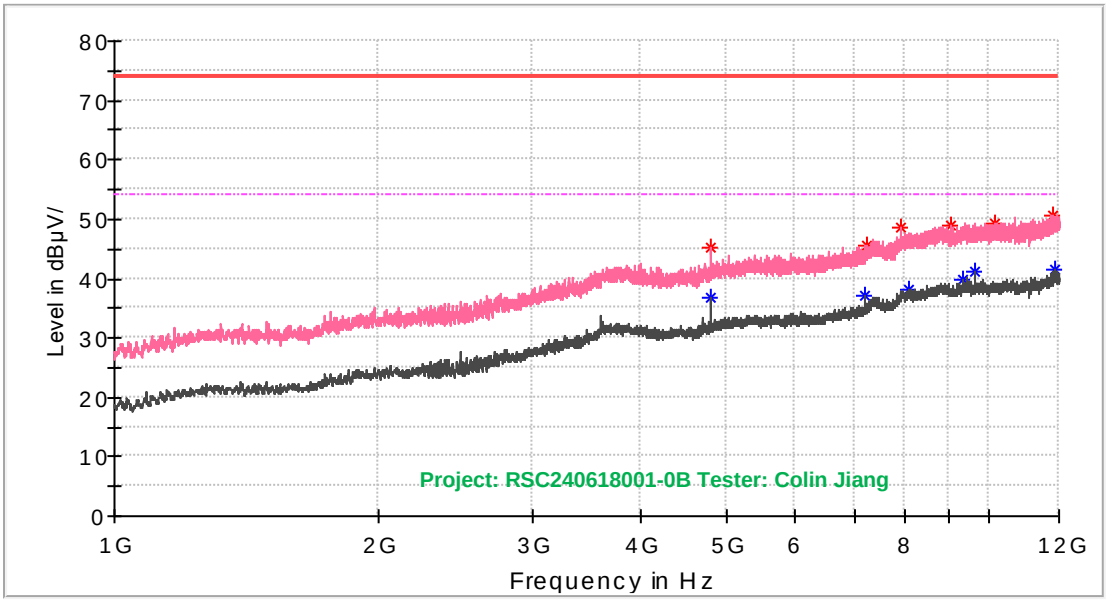
EDR Mode (π/4-DQPSK)

Low Channel_Horizontal



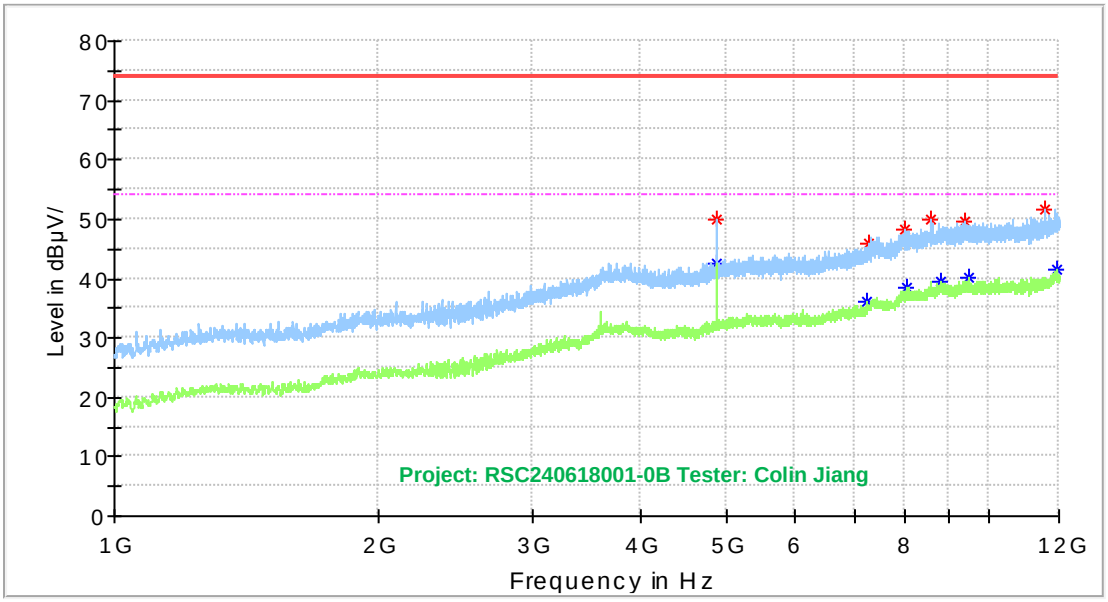
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	49.19	---	74.00	24.81	150.0	H	200.0	-5.2
4803.800000	---	42.55	54.00	11.45	150.0	H	200.0	-5.2
7234.800000	45.58	---	74.00	28.42	150.0	H	68.0	-2.0
7273.300000	---	36.04	54.00	17.96	200.0	H	250.0	-1.8
8029.000000	---	38.47	54.00	15.53	150.0	H	95.0	0.1
8258.900000	48.84	---	74.00	25.16	200.0	H	156.0	0.2
8938.700000	49.56	---	74.00	24.44	200.0	H	305.0	1.2
9325.900000	---	39.44	54.00	14.56	150.0	H	172.0	1.6
9803.300000	49.88	---	74.00	24.12	200.0	H	9.0	1.3
10549.100000	---	39.68	54.00	14.32	200.0	H	113.0	2.1
10618.400000	50.89	---	74.00	23.11	150.0	H	214.0	1.8
11751.400000	---	41.27	54.00	12.73	150.0	H	47.0	3.8

Low Channel_Vertical



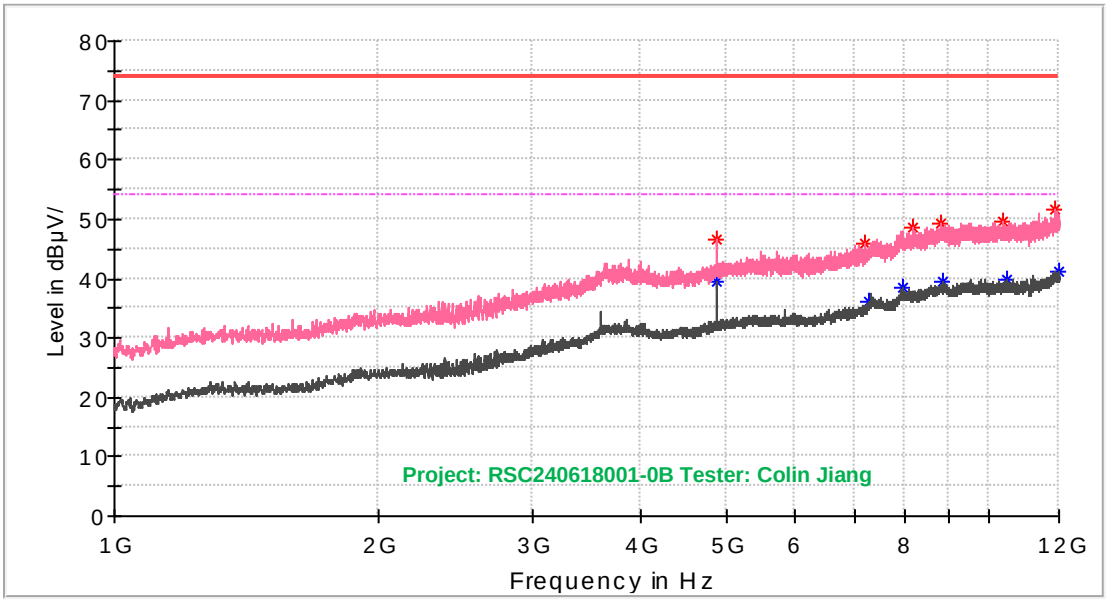
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	45.25	---	74.00	28.75	200.0	V	184.0	-5.2
4803.800000	---	36.88	54.00	17.12	200.0	V	184.0	-5.2
7206.200000	---	37.00	54.00	17.00	150.0	V	91.0	-2.2
7251.300000	45.69	---	74.00	28.31	150.0	V	42.0	-2.0
7933.300000	48.66	---	74.00	25.34	150.0	V	323.0	0.2
8065.300000	---	38.23	54.00	15.77	150.0	V	0.0	0.1
9012.400000	48.99	---	74.00	25.01	150.0	V	91.0	0.9
9297.300000	---	39.84	54.00	14.16	200.0	V	205.0	1.5
9608.600000	---	41.05	54.00	12.95	150.0	V	91.0	1.5
10161.900000	49.43	---	74.00	24.57	200.0	V	0.0	1.9
11809.700000	50.62	---	74.00	23.38	150.0	V	0.0	3.8
11851.500000	---	41.36	54.00	12.64	200.0	V	289.0	4.3

Middle Channel_Horizontal



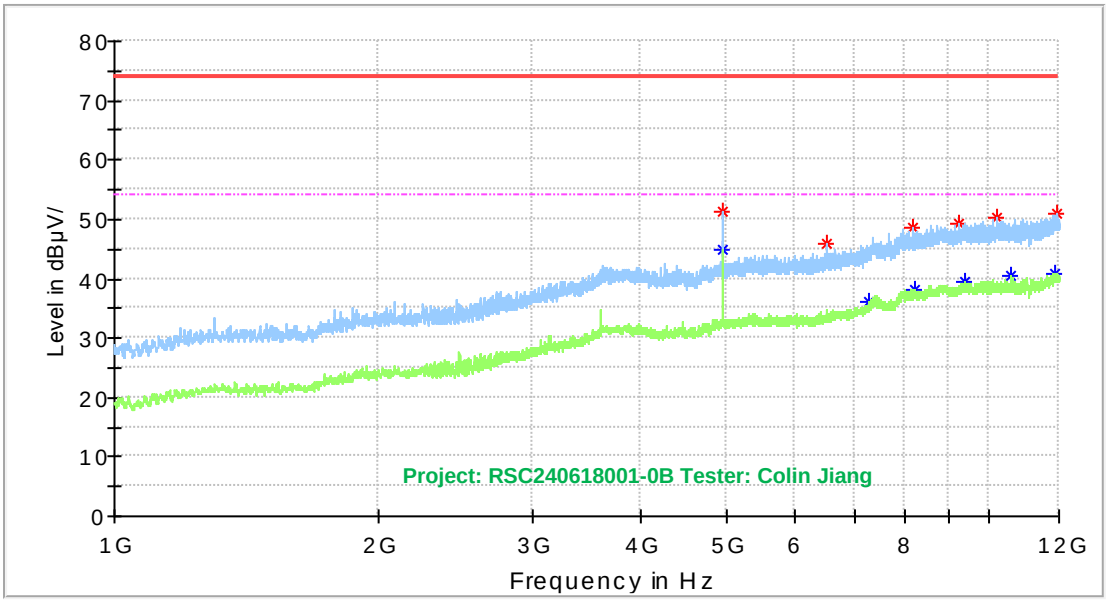
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	---	42.69	54.00	11.31	200.0	H	232.0	-5.1
4881.900000	50.11	---	74.00	23.89	150.0	H	232.0	-5.1
7251.300000	---	36.00	54.00	18.00	200.0	H	121.0	-2.0
7293.100000	45.89	---	74.00	28.11	200.0	H	106.0	-1.7
8000.400000	48.11	---	74.00	25.89	200.0	H	218.0	0.1
8060.900000	---	38.34	54.00	15.66	200.0	H	0.0	0.1
8555.900000	49.79	---	74.00	24.21	200.0	H	176.0	1.0
8804.500000	---	39.50	54.00	14.50	150.0	H	275.0	1.7
9386.400000	49.46	---	74.00	24.54	200.0	H	121.0	1.7
9464.500000	---	40.29	54.00	13.71	200.0	H	332.0	1.7
11536.900000	51.61	---	74.00	22.39	200.0	H	0.0	2.7
11951.600000	---	41.42	54.00	12.58	200.0	H	295.0	4.5

Middle Channel_Vertical



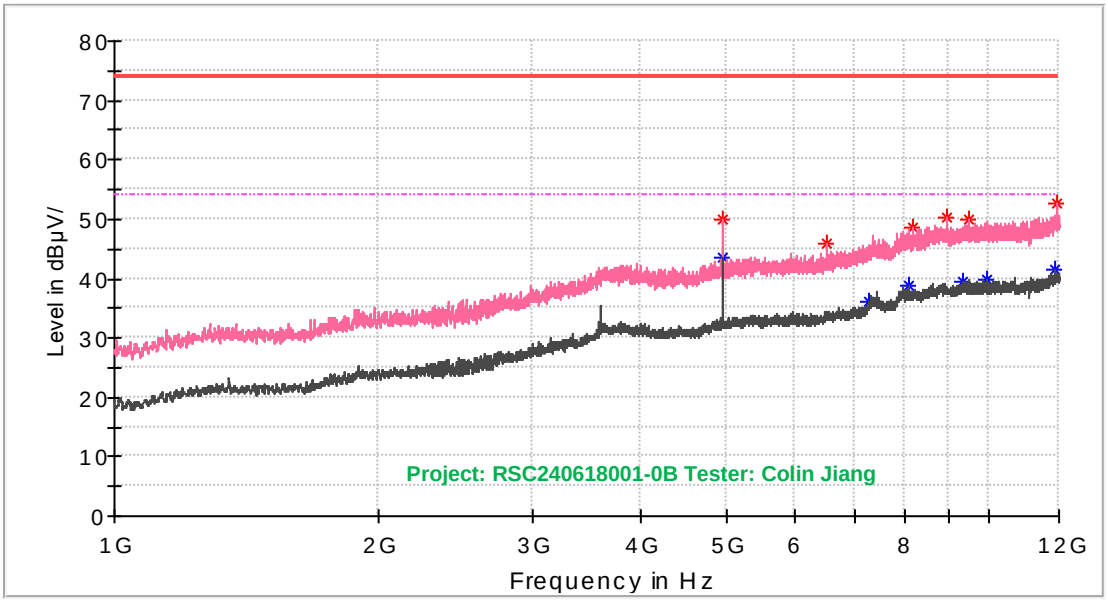
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	---	39.62	54.00	14.38	200.0	V	187.0	-5.1
4883.000000	46.55	---	74.00	27.45	200.0	V	180.0	-5.1
7210.600000	45.77	---	74.00	28.23	150.0	V	0.0	-2.1
7268.900000	---	36.06	54.00	17.94	200.0	V	263.0	-1.9
7964.100000	---	38.35	54.00	15.65	200.0	V	85.0	0.3
8184.100000	48.75	---	74.00	25.25	150.0	V	134.0	0.2
8782.500000	49.21	---	74.00	24.79	150.0	V	61.0	1.6
8835.300000	---	39.50	54.00	14.50	150.0	V	162.0	1.5
10359.900000	49.47	---	74.00	24.53	150.0	V	11.0	2.0
10455.600000	---	39.93	54.00	14.07	200.0	V	194.0	2.1
11885.600000	51.50	---	74.00	22.50	200.0	V	358.0	4.2
11969.200000	---	41.28	54.00	12.72	200.0	V	0.0	4.4

High Channel_Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	51.40	---	74.00	22.60	150.0	H	137.0	-4.7
4960.000000	---	44.94	54.00	9.06	150.0	H	137.0	-4.7
6529.700000	45.79	---	74.00	28.21	200.0	H	285.0	-3.4
7293.100000	---	35.98	54.00	18.02	200.0	H	150.0	-1.7
8184.100000	48.48	---	74.00	25.52	200.0	H	164.0	0.2
8207.200000	---	38.15	54.00	15.85	200.0	H	236.0	0.4
9207.100000	49.32	---	74.00	24.68	150.0	H	169.0	1.2
9351.200000	---	39.43	54.00	14.57	200.0	H	321.0	1.6
10174.000000	50.20	---	74.00	23.80	200.0	H	229.0	1.9
10557.900000	---	40.36	54.00	13.64	200.0	H	206.0	2.0
11849.300000	---	41.01	54.00	12.99	150.0	H	147.0	4.3
11940.600000	50.93	---	74.00	23.07	150.0	H	52.0	4.5

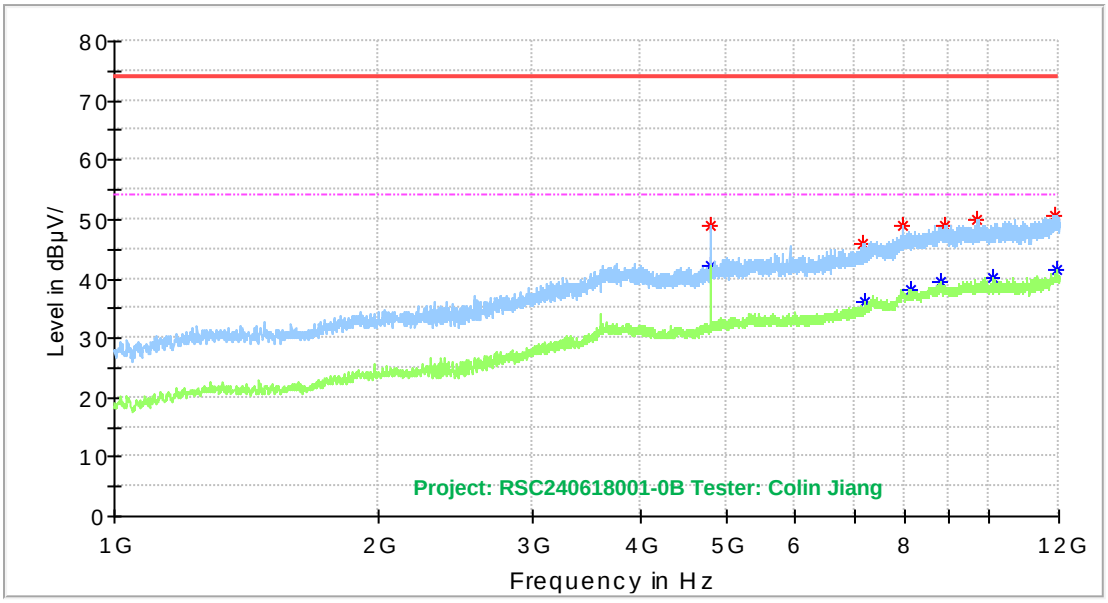
High Channel_Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	---	43.64	54.00	10.36	200.0	V	187.0	-4.7
4960.000000	49.86	---	74.00	24.14	200.0	V	187.0	-4.7
6508.800000	45.75	---	74.00	28.25	200.0	V	153.0	-3.5
7295.300000	---	36.14	54.00	17.86	200.0	V	0.0	-1.7
8065.300000	---	38.71	54.00	15.29	200.0	V	230.0	0.1
8156.600000	48.44	---	74.00	25.56	150.0	V	84.0	0.0
8944.200000	50.31	---	74.00	23.69	200.0	V	216.0	1.2
9321.500000	---	39.60	54.00	14.40	150.0	V	46.0	1.6
9492.000000	49.92	---	74.00	24.08	150.0	V	210.0	1.8
9921.000000	---	39.83	54.00	14.17	200.0	V	160.0	1.4
11886.700000	---	41.57	54.00	12.43	150.0	V	63.0	4.1
11962.600000	52.70	---	74.00	21.30	150.0	V	189.0	4.5

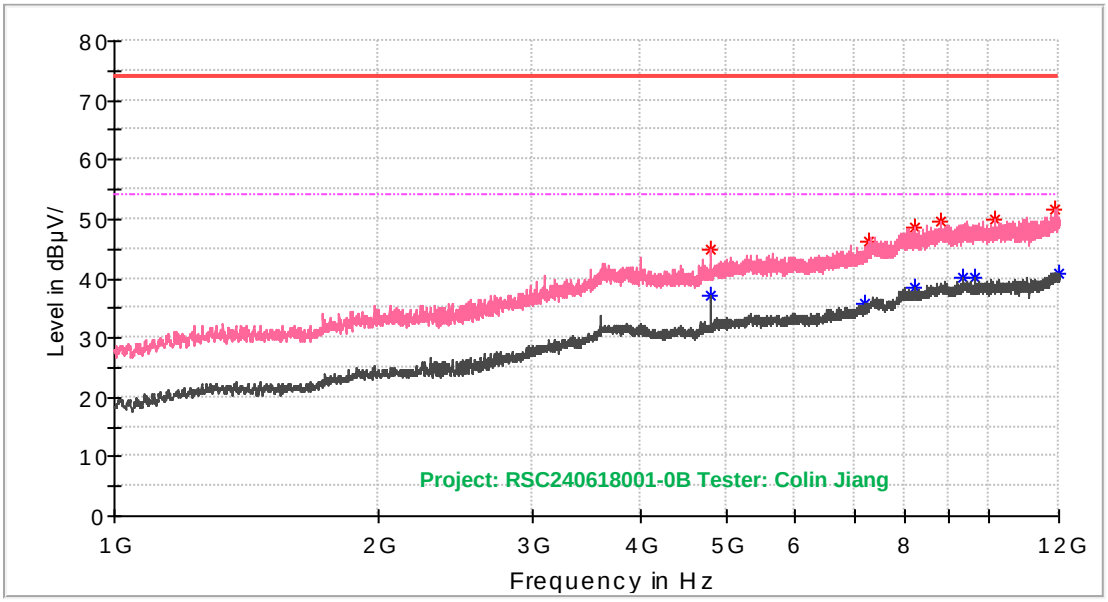
EDR Mode (8DPSK)

Low Channel_Horizontal



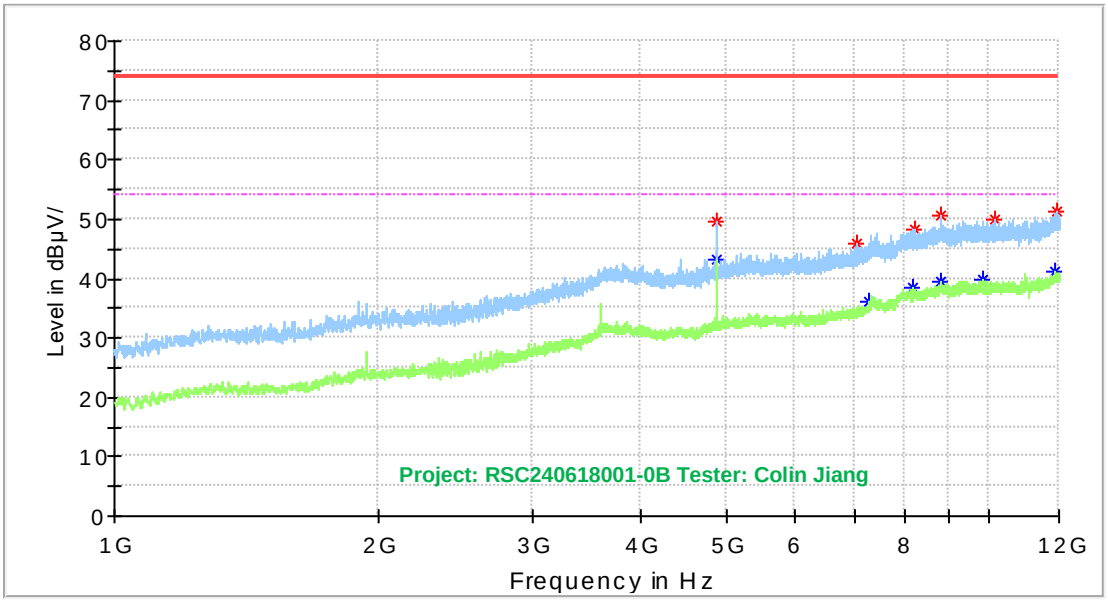
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	48.96	---	74.00	25.04	200.0	H	233.0	-5.2
4803.800000	---	42.26	54.00	11.74	200.0	H	233.0	-5.2
7150.100000	46.05	---	74.00	27.95	200.0	H	85.0	-2.3
7199.600000	---	36.17	54.00	17.83	150.0	H	59.0	-2.2
7944.300000	48.88	---	74.00	25.12	200.0	H	282.0	0.3
8111.500000	---	38.27	54.00	15.73	200.0	H	334.0	0.1
8802.300000	---	39.48	54.00	14.52	150.0	H	45.0	1.7
8911.200000	48.97	---	74.00	25.03	150.0	H	326.0	1.5
9653.700000	50.10	---	74.00	23.90	150.0	H	31.0	1.5
10065.100000	---	40.08	54.00	13.92	200.0	H	355.0	1.6
11847.100000	50.75	---	74.00	23.25	150.0	H	94.0	4.3
11942.800000	---	41.60	54.00	12.40	200.0	H	358.0	4.5

Low Channel_Vertical



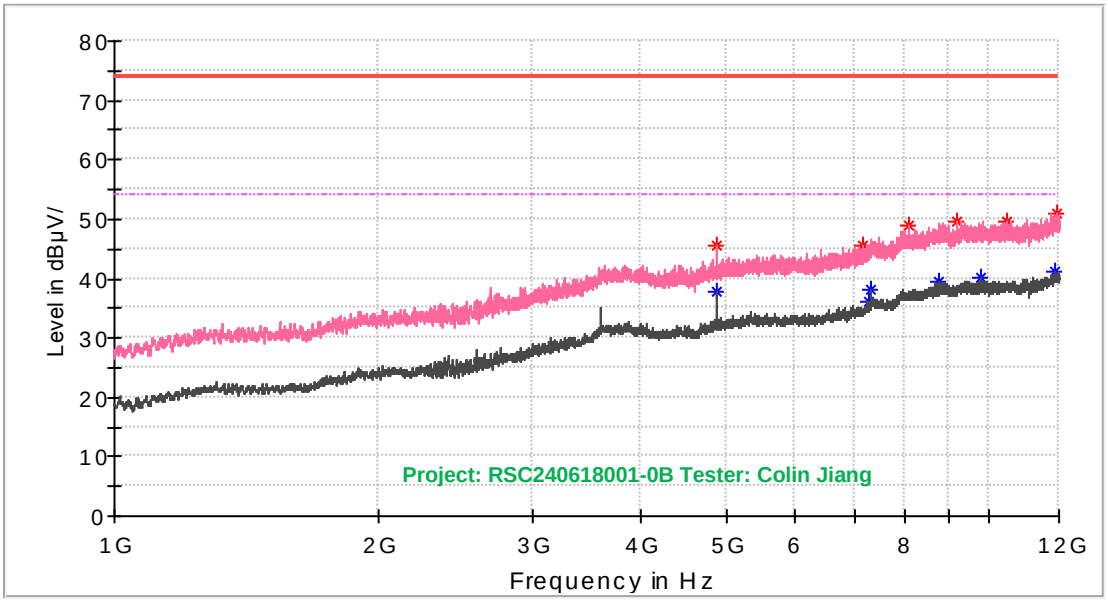
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4803.800000	44.81	---	74.00	29.19	150.0	V	168.0	-5.2
4803.800000	---	37.27	54.00	16.73	200.0	V	347.0	-5.2
7206.200000	---	35.82	54.00	18.18	150.0	V	34.0	-2.2
7283.200000	46.11	---	74.00	27.89	150.0	V	27.0	-1.8
8224.800000	---	38.35	54.00	15.65	150.0	V	175.0	0.3
8225.900000	48.71	---	74.00	25.29	150.0	V	91.0	0.3
8805.600000	49.53	---	74.00	24.47	150.0	V	0.0	1.7
9297.300000	---	40.28	54.00	13.72	200.0	V	222.0	1.5
9608.600000	---	40.02	54.00	13.98	150.0	V	69.0	1.5
10130.000000	50.00	---	74.00	24.00	200.0	V	284.0	1.8
11851.500000	51.70	---	74.00	22.30	200.0	V	284.0	4.3
11972.500000	---	40.98	54.00	13.02	150.0	V	48.0	4.4

Middle Channel_Horizontal



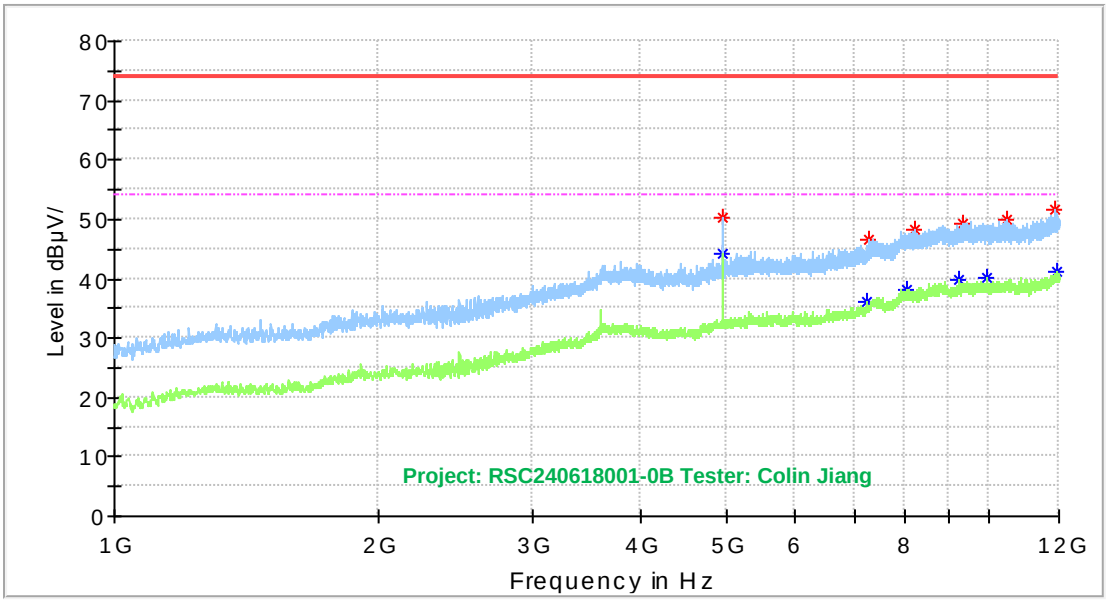
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	49.76	---	74.00	24.24	150.0	H	215.0	-5.1
4881.900000	---	43.29	54.00	10.71	150.0	H	215.0	-5.1
7062.100000	45.87	---	74.00	28.13	200.0	H	176.0	-2.6
7276.600000	---	36.27	54.00	17.73	150.0	H	8.0	-1.8
8179.700000	---	38.51	54.00	15.49	200.0	H	333.0	0.2
8213.800000	48.43	---	74.00	25.57	200.0	H	358.0	0.3
8795.700000	50.57	---	74.00	23.43	200.0	H	191.0	1.7
8811.100000	---	39.58	54.00	14.42	200.0	H	226.0	1.7
9808.800000	---	39.69	54.00	14.31	150.0	H	0.0	1.4
10145.400000	49.87	---	74.00	24.13	200.0	H	333.0	1.9
11855.900000	---	41.24	54.00	12.76	150.0	H	99.0	4.3
11957.100000	51.17	---	74.00	22.83	200.0	H	170.0	4.5

Middle Channel_Vertical



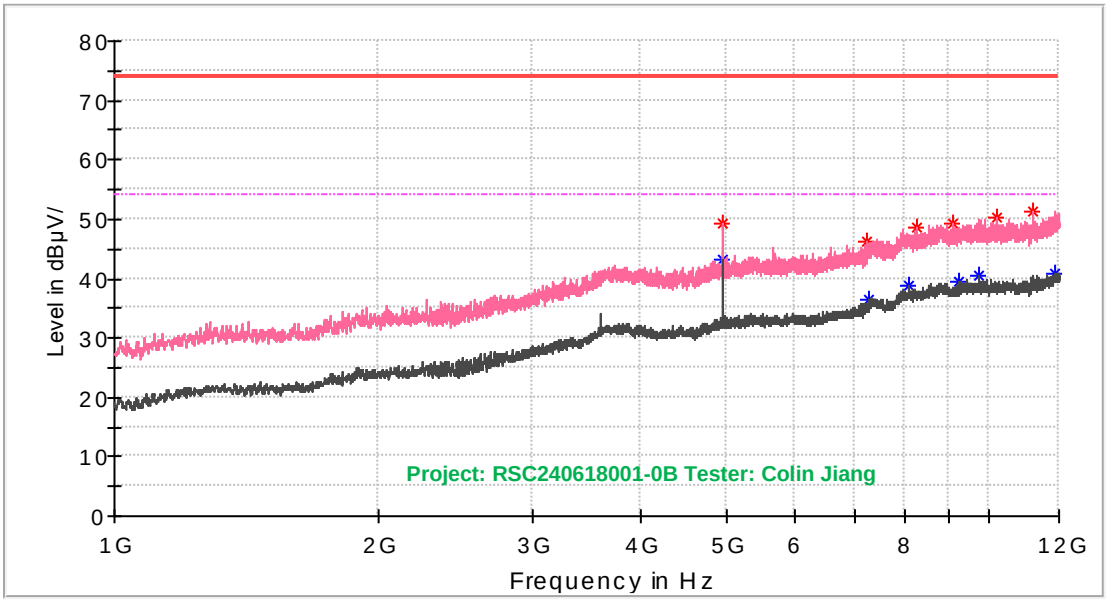
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4881.900000	45.68	---	74.00	28.32	200.0	V	353.0	-5.1
4881.900000	---	37.81	54.00	16.19	200.0	V	353.0	-5.1
7161.100000	45.69	---	74.00	28.31	200.0	V	222.0	-2.3
7289.800000	---	36.18	54.00	17.82	200.0	V	0.0	-1.7
7322.800000	---	38.30	54.00	15.70	200.0	V	85.0	-1.4
8099.400000	48.93	---	74.00	25.07	200.0	V	243.0	0.1
8745.100000	---	39.38	54.00	14.62	200.0	V	63.0	1.5
9196.100000	49.62	---	74.00	24.38	150.0	V	14.0	1.3
9764.800000	---	40.26	54.00	13.74	200.0	V	106.0	1.5
10452.300000	49.72	---	74.00	24.28	200.0	V	353.0	2.1
11849.300000	---	41.05	54.00	12.95	200.0	V	285.0	4.3
11939.500000	50.94	---	74.00	23.06	150.0	V	319.0	4.5

High Channel_Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	---	44.35	54.00	9.65	150.0	H	130.0	-4.7
4960.000000	50.21	---	74.00	23.79	200.0	H	254.0	-4.7
7244.700000	---	35.98	54.00	18.02	150.0	H	252.0	-2.0
7286.500000	46.60	---	74.00	27.40	200.0	H	226.0	-1.8
8033.400000	---	38.25	54.00	15.75	200.0	H	302.0	0.1
8208.300000	48.19	---	74.00	25.81	200.0	H	295.0	0.4
9203.800000	---	39.76	54.00	14.24	150.0	H	67.0	1.3
9328.100000	49.25	---	74.00	24.75	150.0	H	137.0	1.6
9921.000000	---	40.20	54.00	13.80	150.0	H	238.0	1.4
10438.000000	49.94	---	74.00	24.06	200.0	H	260.0	2.1
11857.000000	51.66	---	74.00	22.34	200.0	H	323.0	4.3
11959.300000	---	41.23	54.00	12.77	150.0	H	252.0	4.5

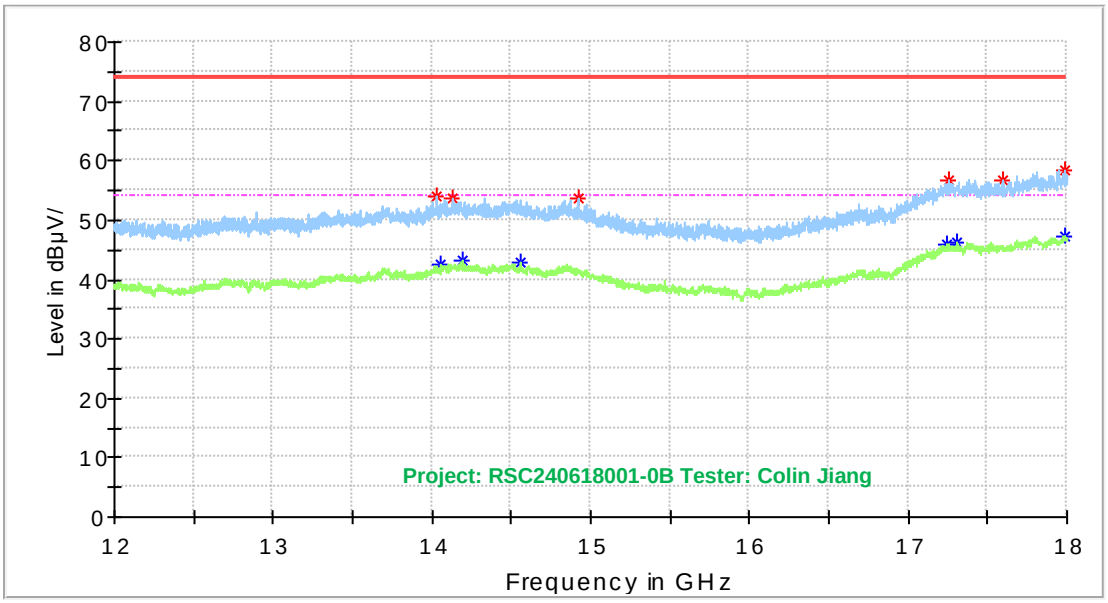
High Channel_Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	---	43.26	54.00	10.74	200.0	V	206.0	-4.7
4961.100000	49.39	---	74.00	24.61	200.0	V	185.0	-4.7
7256.800000	46.33	---	74.00	27.67	150.0	V	140.0	-1.9
7275.500000	---	36.32	54.00	17.68	200.0	V	220.0	-1.8
8069.700000	---	38.69	54.00	15.31	200.0	V	297.0	0.1
8236.900000	48.51	---	74.00	25.49	200.0	V	26.0	0.2
9087.200000	49.44	---	74.00	24.56	150.0	V	260.0	0.9
9215.900000	---	39.44	54.00	14.56	150.0	V	183.0	1.1
9727.400000	---	40.48	54.00	13.52	150.0	V	274.0	1.6
10166.300000	50.21	---	74.00	23.79	200.0	V	150.0	1.9
11226.700000	51.31	---	74.00	22.69	150.0	V	56.0	2.8
11846.000000	---	40.95	54.00	13.05	200.0	V	338.0	4.3

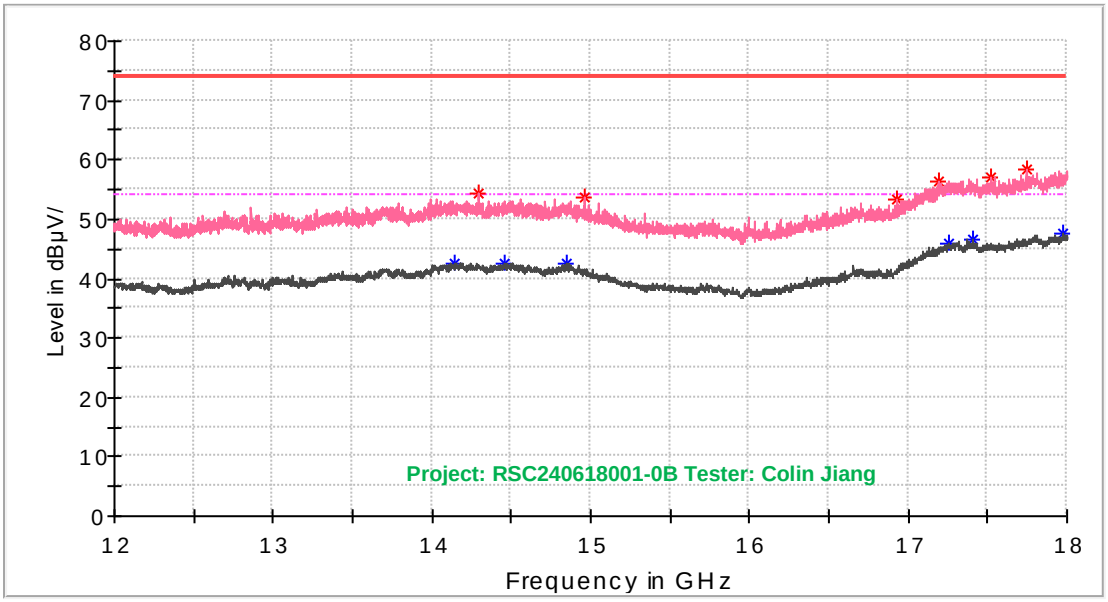
5) 12 GHz-18 GHz_ GFSK_ low channel _worst case

Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
14025.600000	53.94	---	74.00	20.06	150.0	H	103.0	7.4
14060.400000	---	42.55	54.00	11.45	150.0	H	256.0	7.3
14136.000000	53.65	---	74.00	20.35	150.0	H	88.0	7.2
14188.800000	---	43.21	54.00	10.79	150.0	H	3.0	7.2
14559.600000	---	42.78	54.00	11.22	150.0	H	118.0	7.3
14918.400000	53.69	---	74.00	20.31	150.0	H	147.0	6.7
17239.200000	---	45.83	54.00	8.17	150.0	H	67.0	10.2
17252.400000	56.70	---	74.00	17.30	150.0	H	168.0	10.3
17312.400000	---	46.30	54.00	7.70	150.0	H	173.0	10.5
17590.800000	56.82	---	74.00	17.18	150.0	H	0.0	9.9
17982.000000	58.38	---	74.00	15.62	150.0	H	1.0	11.6
17991.600000	---	47.39	54.00	6.61	150.0	H	3.0	11.7

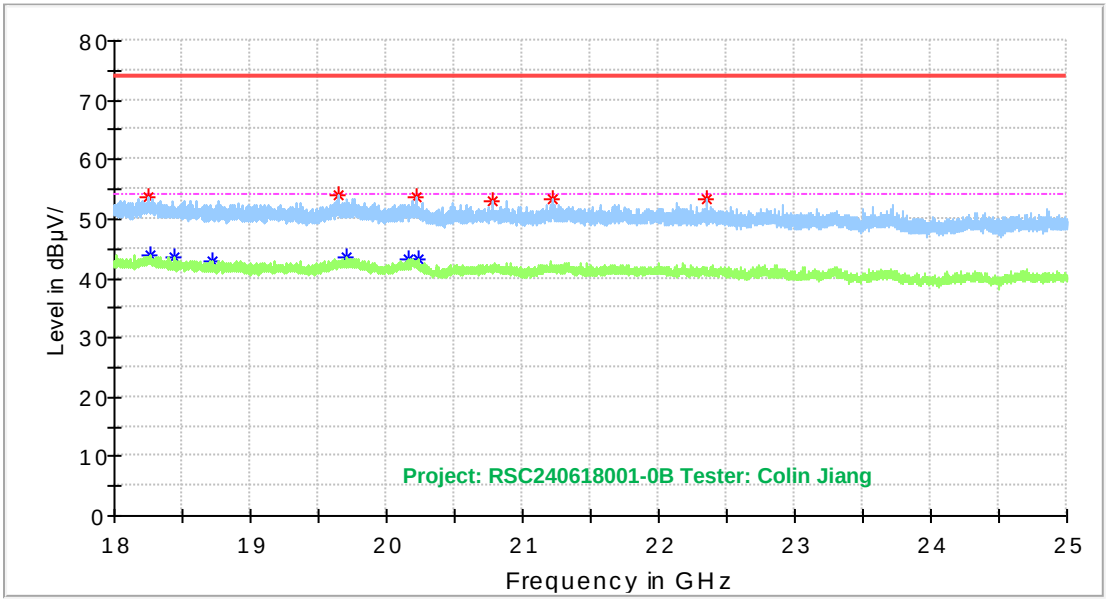
Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
14148.000000	---	42.59	54.00	11.41	150.0	V	113.0	7.2
14295.600000	54.28	---	74.00	19.72	150.0	V	95.0	7.2
14461.200000	---	42.56	54.00	11.44	150.0	V	0.0	7.2
14844.000000	---	42.63	54.00	11.37	150.0	V	144.0	7.1
14962.800000	53.72	---	74.00	20.28	150.0	V	33.0	6.5
16934.400000	53.39	---	74.00	20.61	150.0	V	75.0	6.6
17187.600000	56.27	---	74.00	17.73	150.0	V	242.0	9.8
17257.200000	---	45.88	54.00	8.12	150.0	V	128.0	10.3
17410.800000	---	46.60	54.00	7.40	150.0	V	108.0	10.6
17527.200000	57.13	---	74.00	16.87	150.0	V	159.0	9.9
17742.000000	58.26	---	74.00	15.74	150.0	V	33.0	10.5
17977.200000	---	47.58	54.00	6.42	150.0	V	150.0	11.5

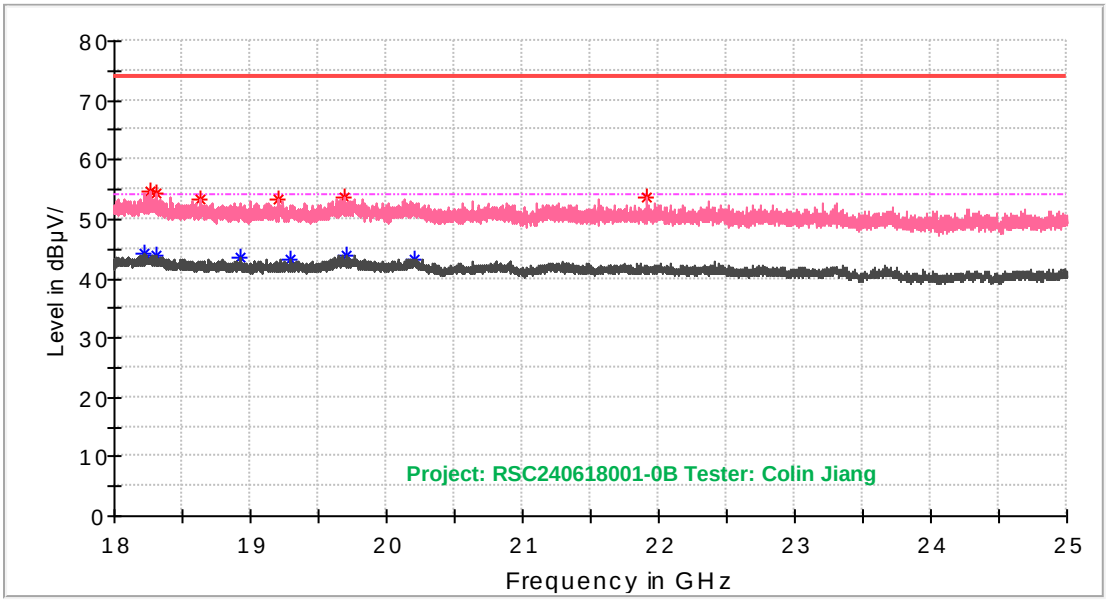
6) 18 GHz-25 GHz_ GFSK_ low channel_worst case

Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18248.500000	53.58	---	74.00	20.42	100.0	H	253.0	6.4
18259.000000	---	43.96	54.00	10.04	100.0	H	279.0	6.4
18439.600000	---	43.69	54.00	10.31	100.0	H	0.0	6.3
18723.800000	---	42.98	54.00	11.02	100.0	H	205.0	5.9
19644.300000	54.06	---	74.00	19.94	100.0	H	152.0	7.0
19709.400000	---	43.54	54.00	10.46	100.0	H	248.0	7.1
20167.200000	---	43.16	54.00	10.84	100.0	H	318.0	7.2
20216.200000	53.76	---	74.00	20.24	100.0	H	244.0	7.2
20234.400000	---	43.09	54.00	10.91	100.0	H	351.0	7.1
20777.600000	53.16	---	74.00	20.84	100.0	H	67.0	6.5
21222.800000	53.31	---	74.00	20.69	100.0	H	200.0	6.8
22346.300000	53.19	---	74.00	20.81	100.0	H	179.0	6.7

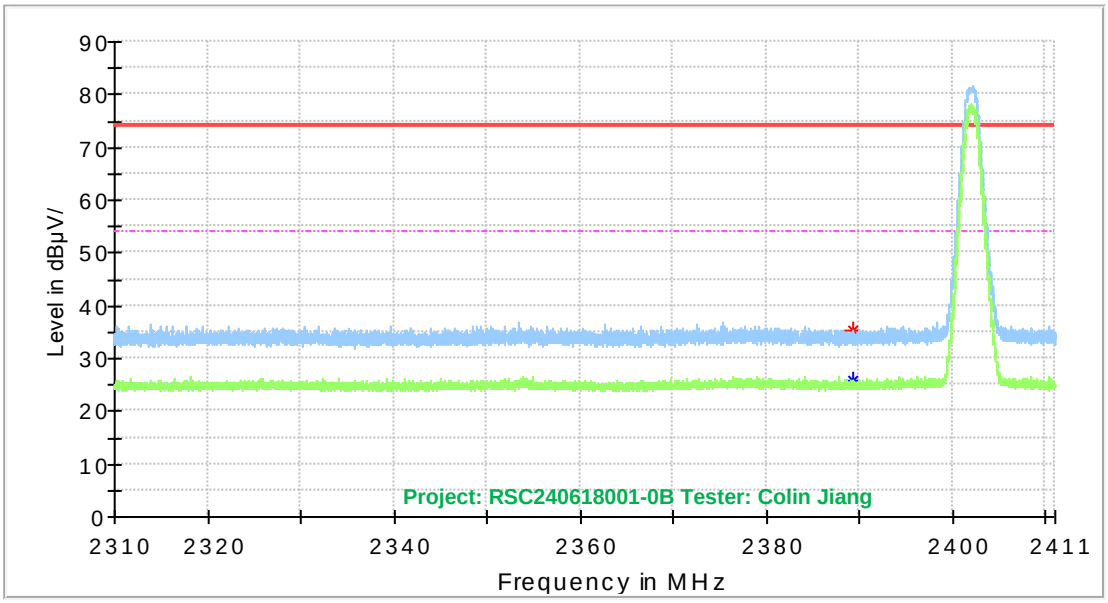
Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18223.300000	---	44.07	54.00	9.93	100.0	V	306.0	6.4
18269.500000	54.55	---	74.00	19.45	100.0	V	0.0	6.4
18303.800000	---	43.74	54.00	10.26	100.0	V	144.0	6.3
18315.700000	54.33	---	74.00	19.67	100.0	V	315.0	6.3
18630.000000	53.47	---	74.00	20.53	100.0	V	0.0	6.2
18924.000000	---	43.71	54.00	10.29	100.0	V	310.0	6.4
19208.200000	53.23	---	74.00	20.77	100.0	V	214.0	6.2
19296.400000	---	43.34	54.00	10.66	100.0	V	201.0	6.6
19697.500000	53.52	---	74.00	20.48	100.0	V	81.0	7.1
19703.100000	---	43.92	54.00	10.08	100.0	V	310.0	7.1
20210.600000	---	43.25	54.00	10.75	100.0	V	219.0	7.3
21908.100000	53.64	---	74.00	20.36	100.0	V	175.0	6.5

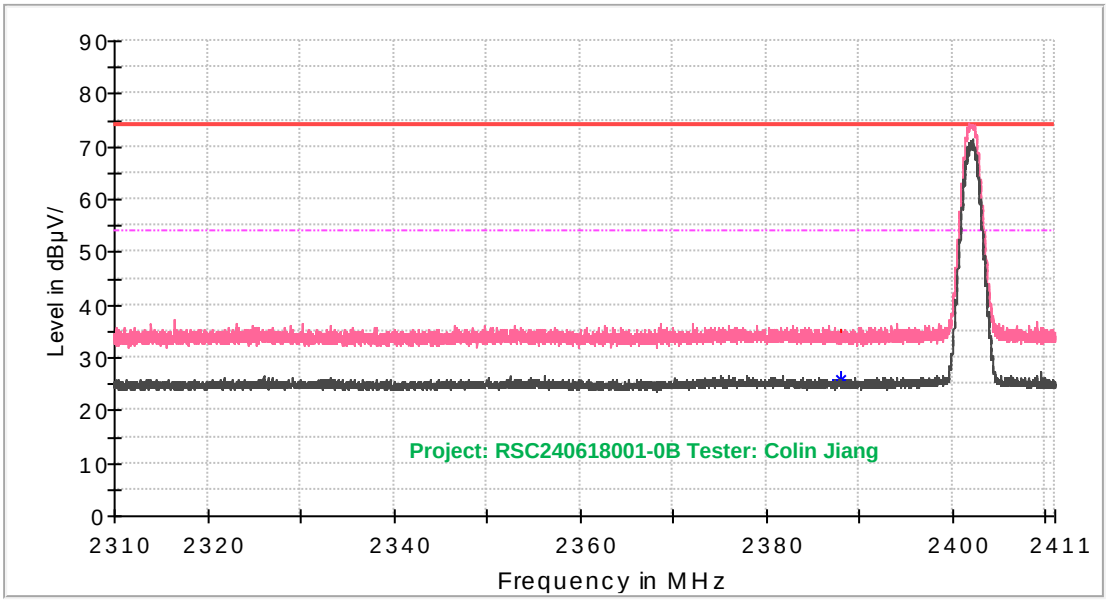
Band Edge (3DH5)_Worst case

Left_ Horizontal



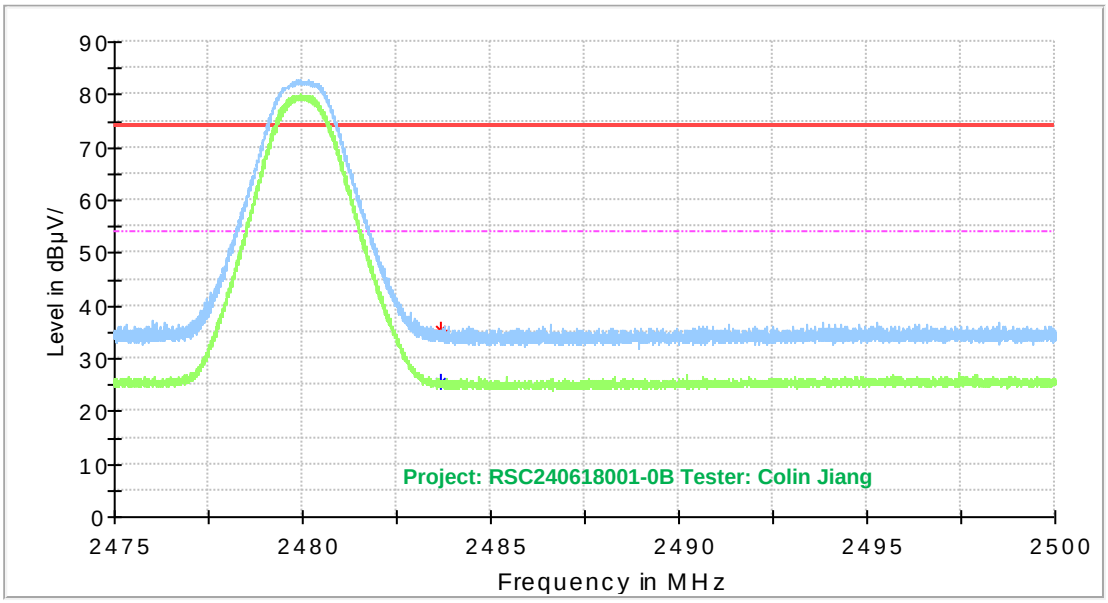
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2389.295100	35.40	---	74.00	38.60	150.0	H	142.0	-12.4
2389.315300	---	25.90	54.00	28.10	150.0	H	0.0	-12.4

Left_Vertical



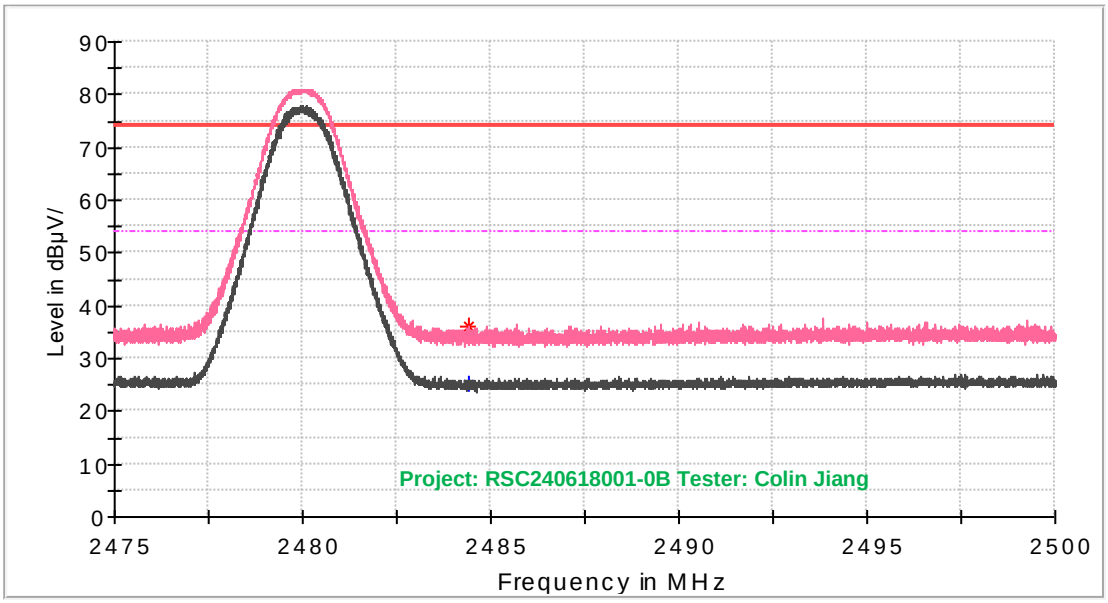
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2387.931600	33.77	---	74.00	40.23	150.0	V	358.0	-12.4
2388.073000	---	25.91	54.00	28.09	150.0	V	0.0	-12.4

Right_Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2483.652500	---	25.50	54.00	28.50	150.0	H	60.0	-12.4
2483.662500	35.50	---	74.00	38.50	150.0	H	272.0	-12.4

Right_Vertical



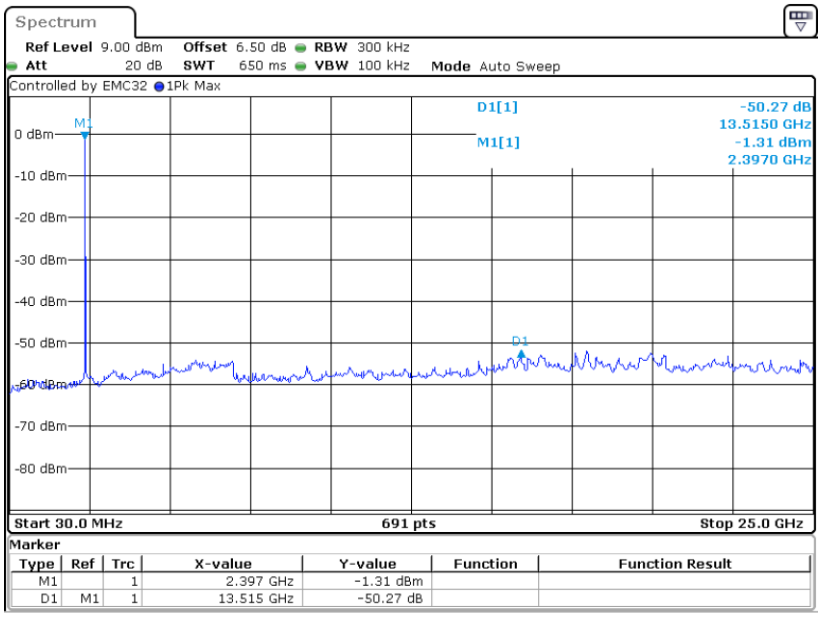
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2484.432500	36.26	---	74.00	37.74	150.0	V	42.0	-12.4
2484.435000	---	24.99	54.00	29.01	150.0	V	142.0	-12.4

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

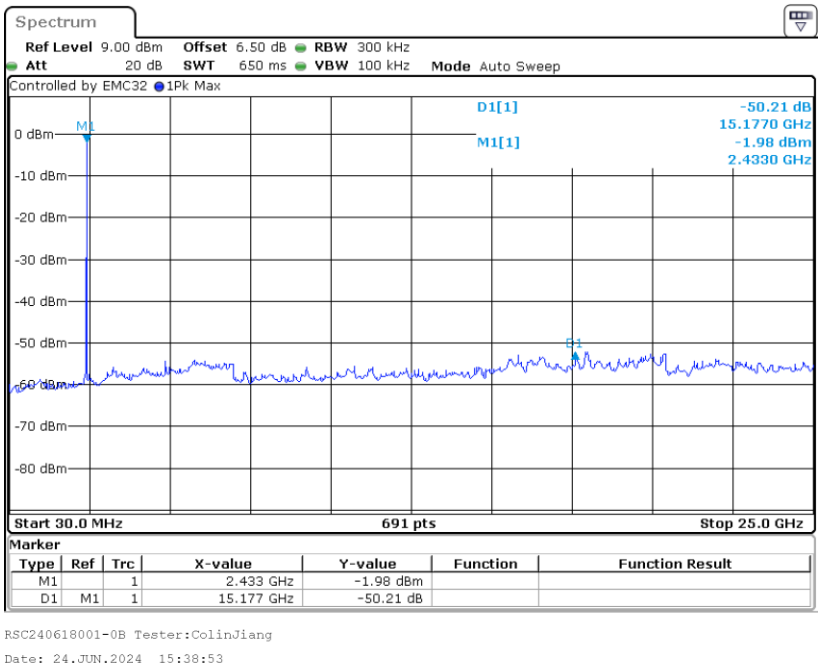
Conducted Spurious Emission At Antenna Port:

BDR Mode (GFSK)_worst case

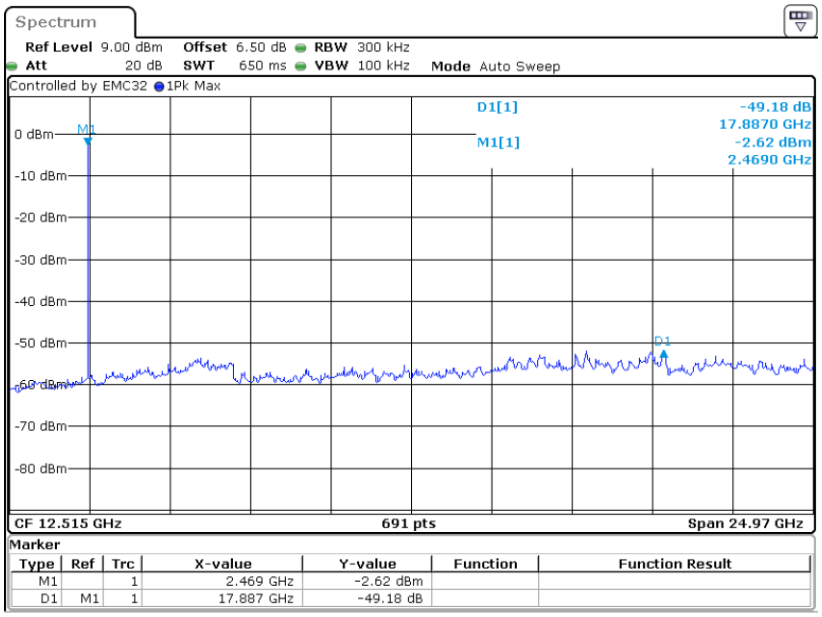
Low Channel



Middle Channel



High Channel



RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:44:29

FCC §15.247(A) (1) - CHANNEL SEPARATION TEST

Applicable Standard

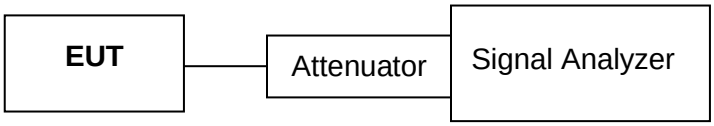
Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.2

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ⩾ RBW.
d) Sweep: No faster than coupled (auto) time.
e) Detector function: Peak.
f) Trace: Max-hold.
g) Allow the trace to stabilize.
Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	67 %
ATM Pressure:	95.7 kPa

The testing was performed by Colin Jiang on 2024-06-24.

Test Result: Compliance.

Please refer to following tables and plots.

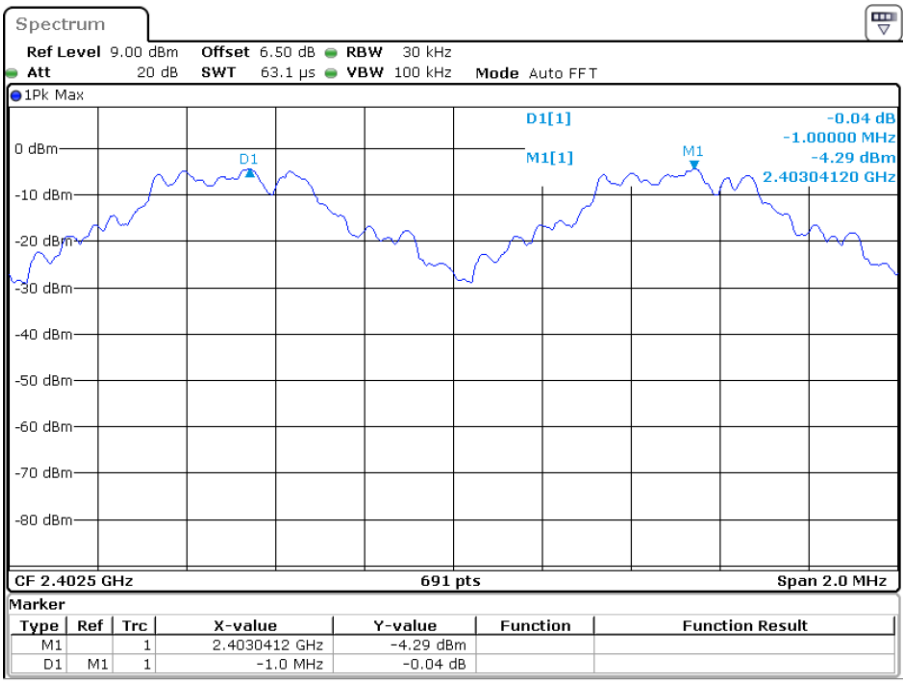
Test Mode: Transmitting

Mode	Channel	Channel Frequency (MHz)	Result (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402-2403	1.000	0.63
	Middle	2440-2441	1.000	0.64
	High	2480-2479	1.000	0.64
EDR (π/4-DQPSK)	Low	2402-2403	1.000	0.91
	Middle	2440-2441	1.000	0.91
	High	2480-2479	1.000	0.91
EDR (8DPSK)	Low	2402-2403	1.000	0.90
	Middle	2440-2441	1.000	0.90
	High	2480-2479	1.000	0.90

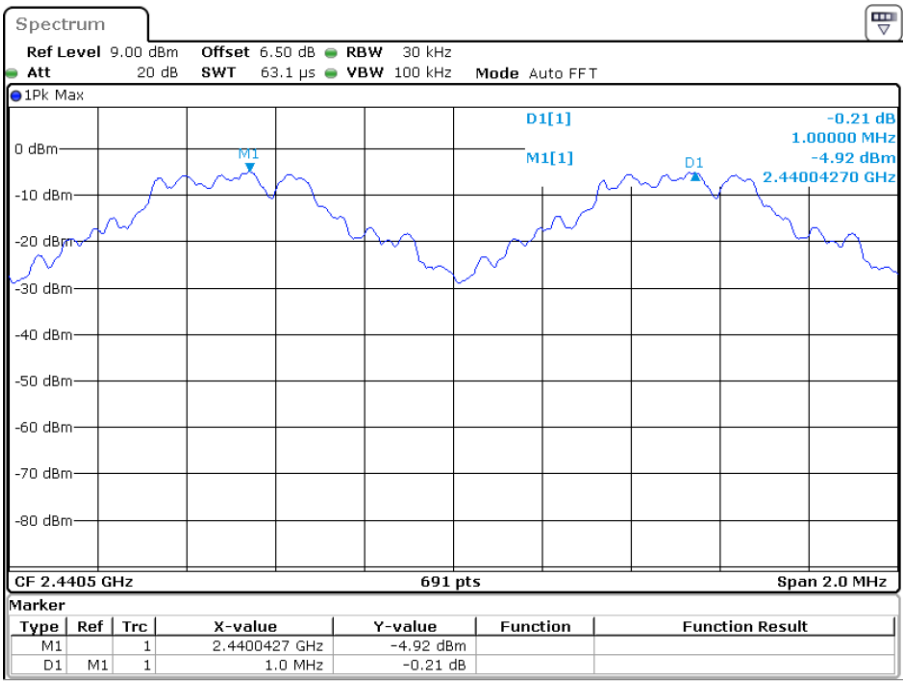
Note: Limit= (2/3) × 20dB bandwidth

BDR Mode (GFSK):

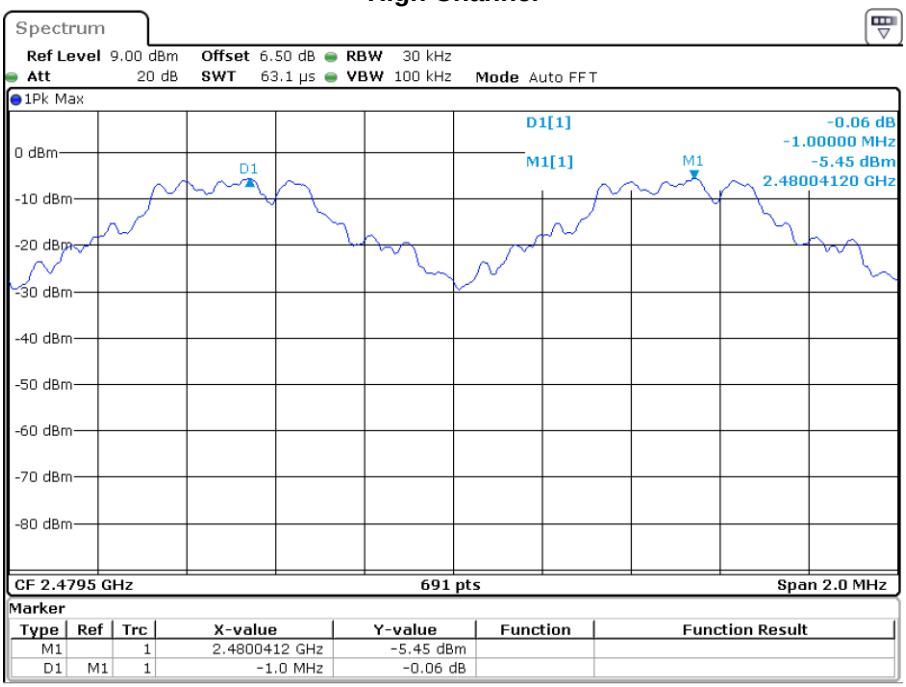
Low Channel



Middle Channel



High Channel

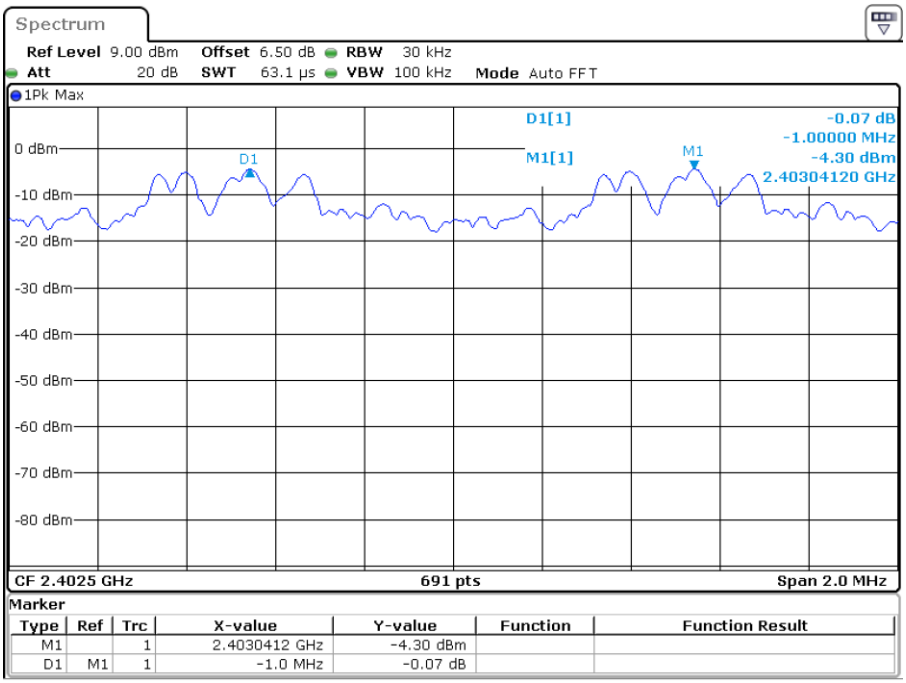


RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 16:47:23

EDR Mode (π/4-DQPSK):

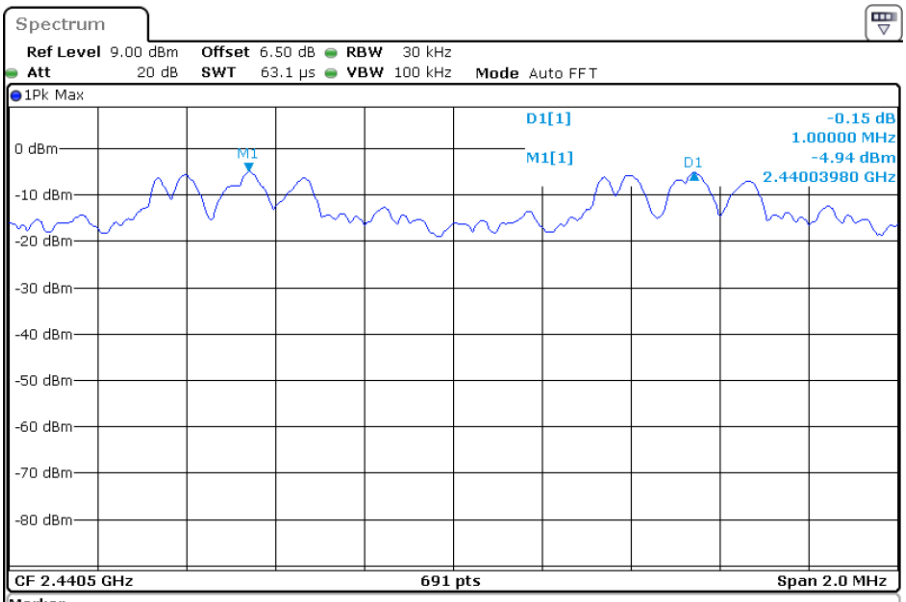
Low Channel



RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 16:53:46

Middle Channel



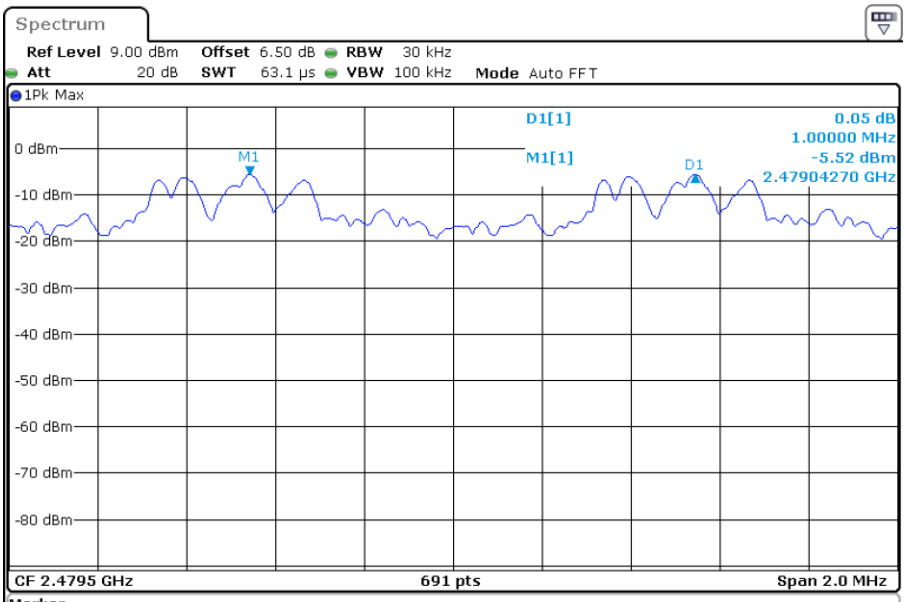
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400398 GHz	-4.94 dBm		
D1	M1	1	1.0 MHz	-0.15 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 16:52:06

High Channel



Marker

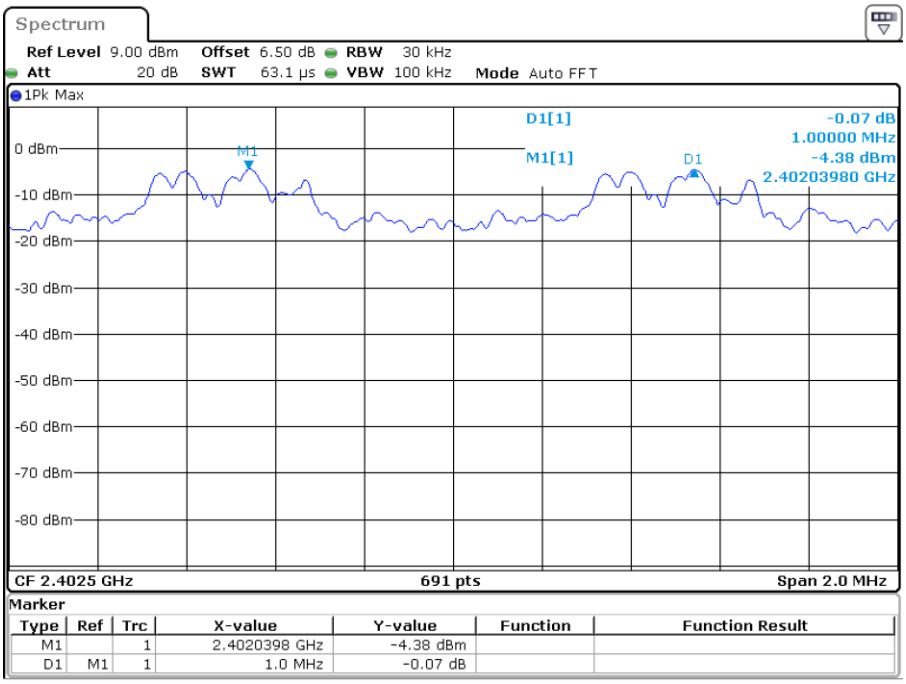
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4790427 GHz	-5.52 dBm		
D1	M1	1	1.0 MHz	0.05 dB		

RSC240618001-0B Tester:ColinJiang

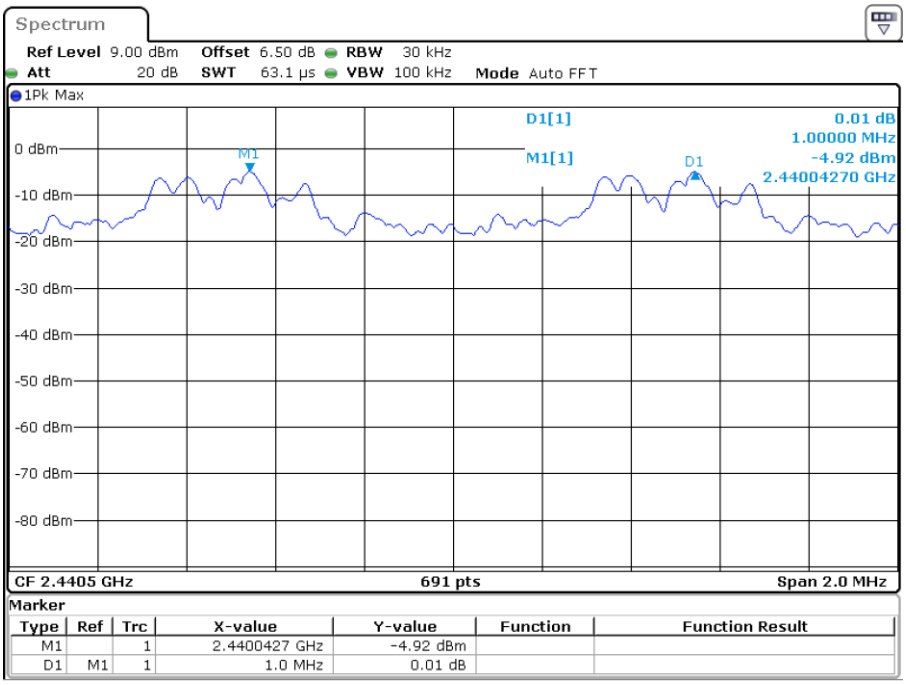
Date: 24.JUN.2024 16:49:49

EDR Mode (8DPSK):

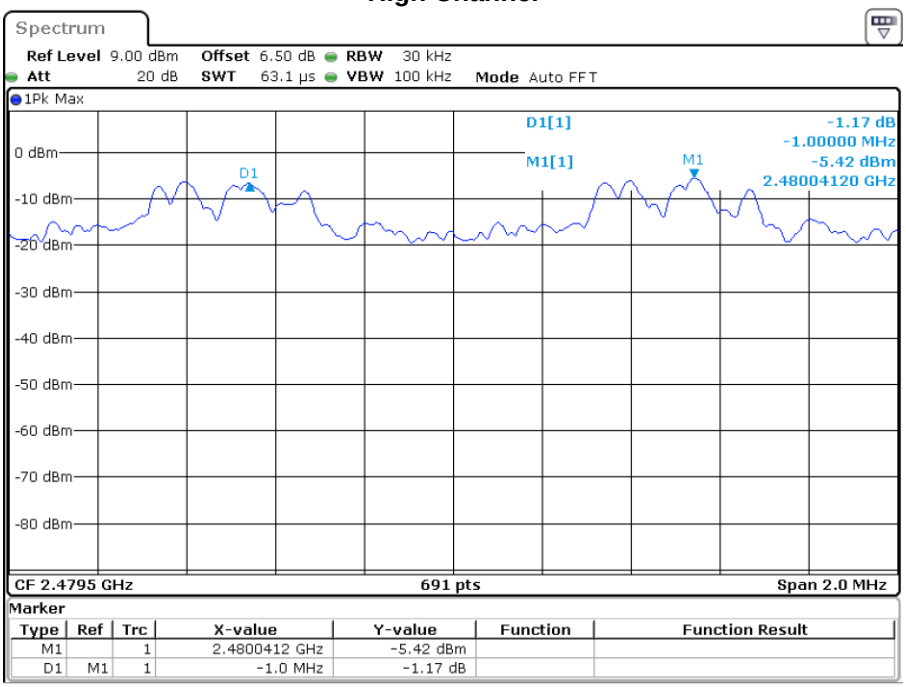
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

Applicable Standard

Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.6 & Clause 6.9.2

The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:

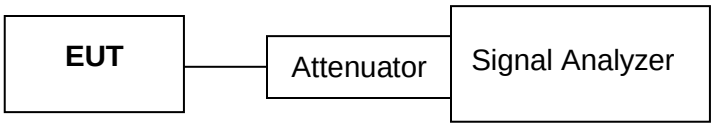
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / 20 dB bandwidth if the device is not transmitting continuously.

• The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW/ 20dB bandwidth and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	67 %
ATM Pressure:	95.7 kPa

The testing was performed by Colin Jiang on 2024-06-24.

Test Result: Compliance.

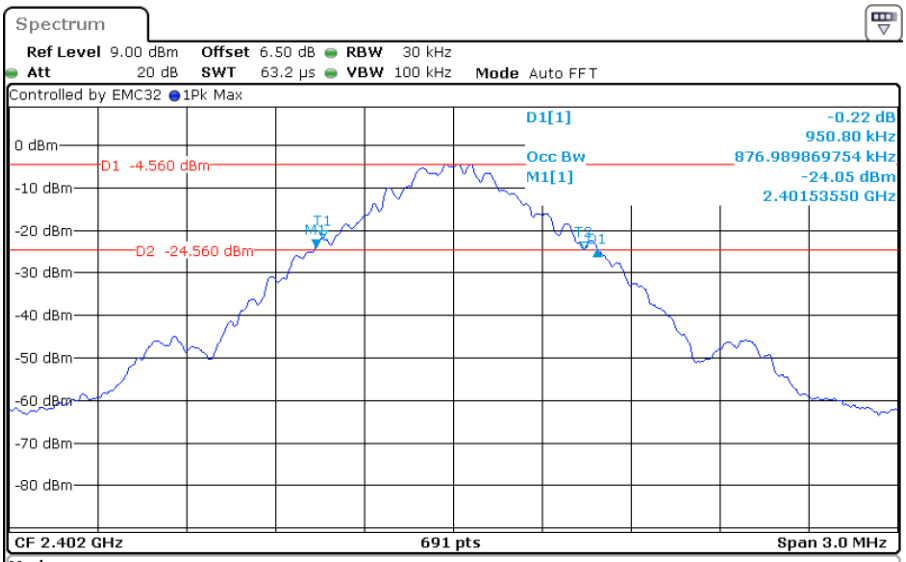
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.951
	Middle	2441	0.955
	High	2480	0.955
EDR Mode (π/4-DQPSK)	Low	2402	1.368
	Middle	2441	1.368
	High	2480	1.363
EDR Mode (8DPSK)	Low	2402	1.350
	Middle	2441	1.350
	High	2480	1.350

BDR Mode (GFSK):

Low Channel



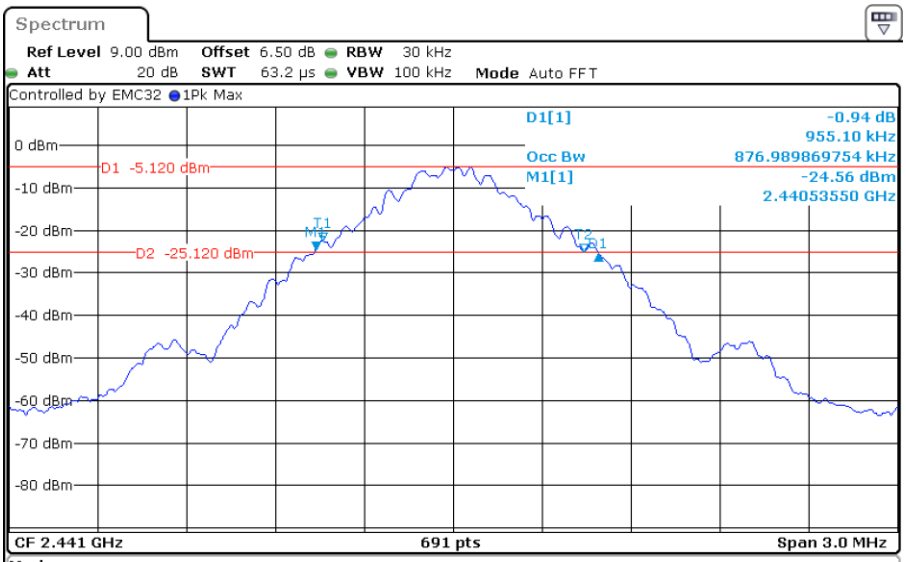
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4015355 GHz	-24.05 dBm		
T1		1	2.40156151 GHz	-21.91 dBm	Occ Bw	876.989869754 kHz
T2		1	2.40243849 GHz	-24.55 dBm		
D1	M1	1	950.8 kHz	-0.22 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:04:04

Middle Channel



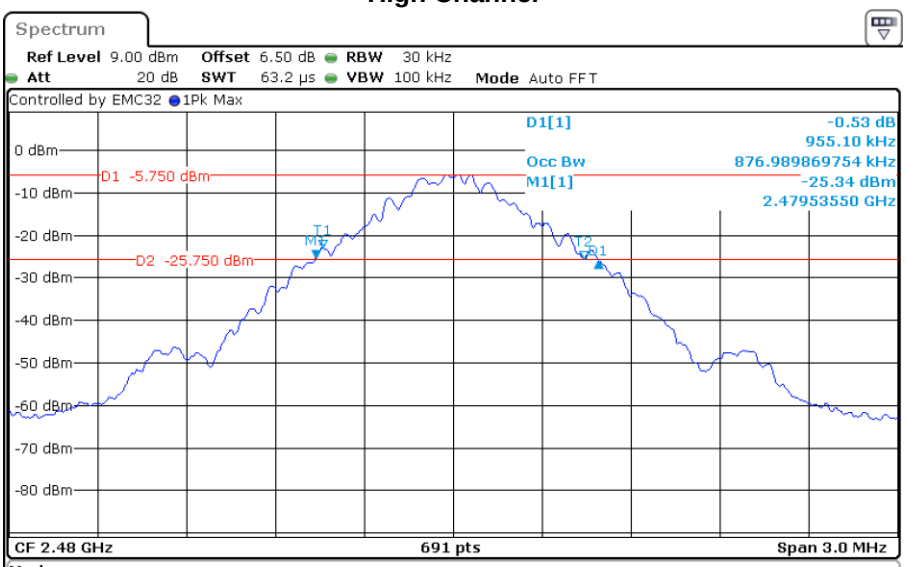
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4405355 GHz	-24.56 dBm		
T1		1	2.44056151 GHz	-22.46 dBm	Occ Bw	876.989869754 kHz
T2		1	2.44143849 GHz	-25.14 dBm		
D1	M1	1	955.1 kHz	-0.94 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:07:00

High Channel



Marker

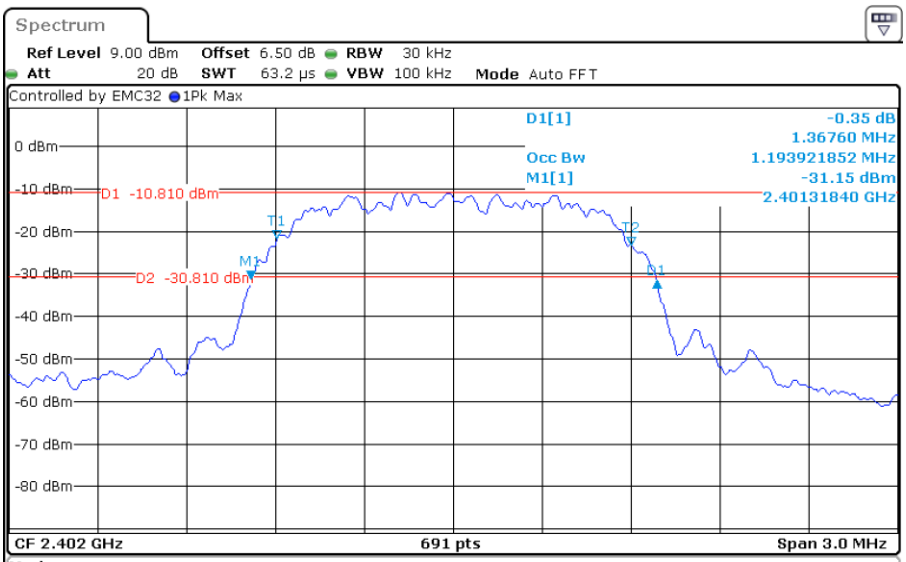
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4795355 GHz	-25.34 dBm		
T1		1	2.47956151 GHz	-23.12 dBm	Occ Bw	876.989869754 kHz
T2		1	2.48043849 GHz	-25.69 dBm		
D1	M1	1	955.1 kHz	-0.53 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:10:24

EDR Mode (π/4-DQPSK):

Low Channel



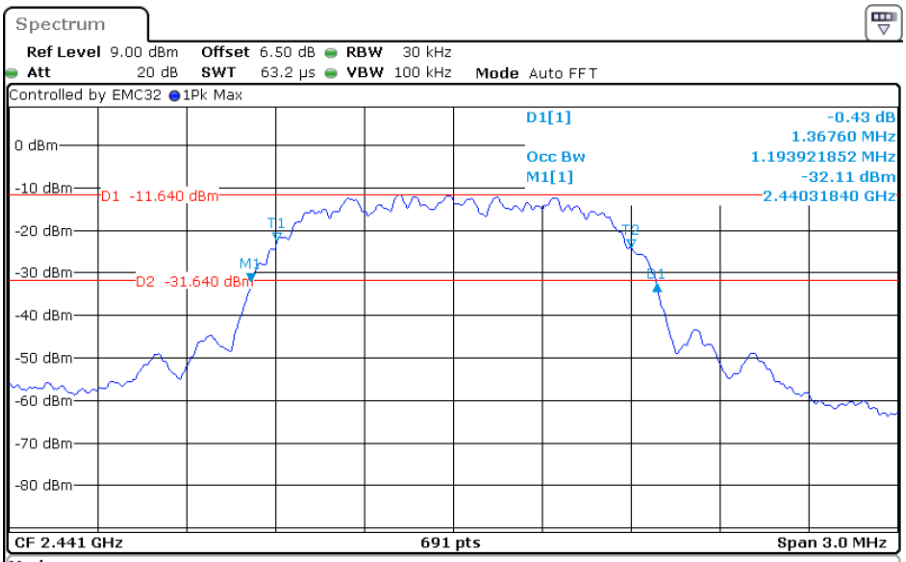
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4013184 GHz	-31.15 dBm		
T1		1	2.40140521 GHz	-21.70 dBm	Occ Bw	1.193921852 MHz
T2		1	2.40259913 GHz	-23.21 dBm		
D1	M1	1	1.3676 MHz	-0.35 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:22:44

Middle Channel



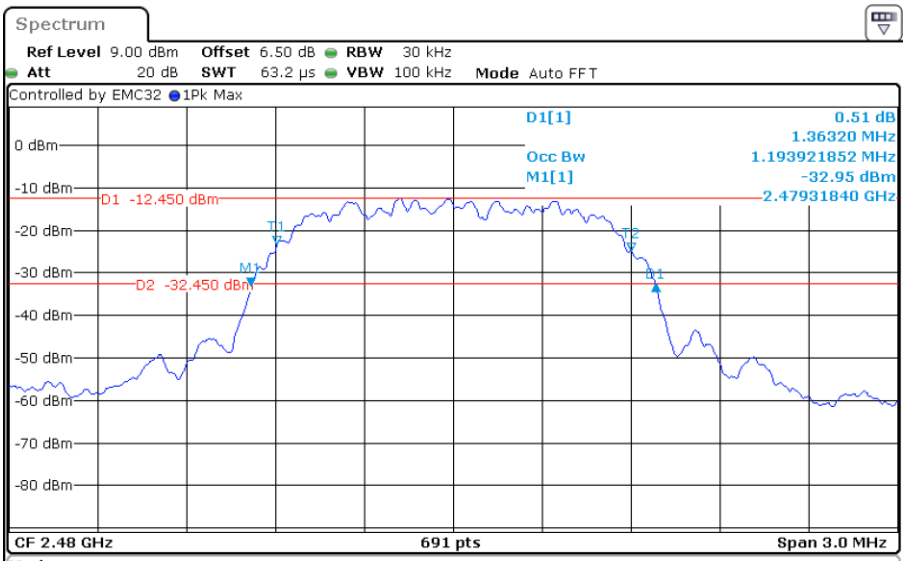
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4403184 GHz	-32.11 dBm		
T1		1	2.44040521 GHz	-22.46 dBm	Occ Bw	1.193921852 MHz
T2		1	2.44159913 GHz	-24.04 dBm		
D1	M1	1	1.3676 MHz	-0.43 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:19:11

High Channel



Marker

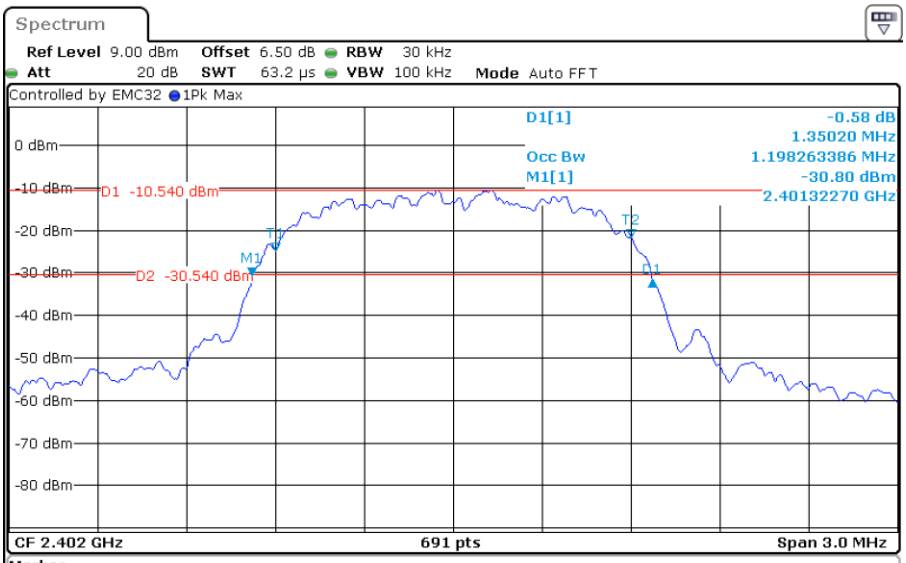
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4793184 GHz	-32.95 dBm		
T1		1	2.47940521 GHz	-23.35 dBm	Occ Bw	1.193921852 MHz
T2		1	2.48059913 GHz	-24.90 dBm		
D1	M1	1	1.3632 MHz	0.51 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:12:39

EDR Mode (8DPSK):

Low Channel



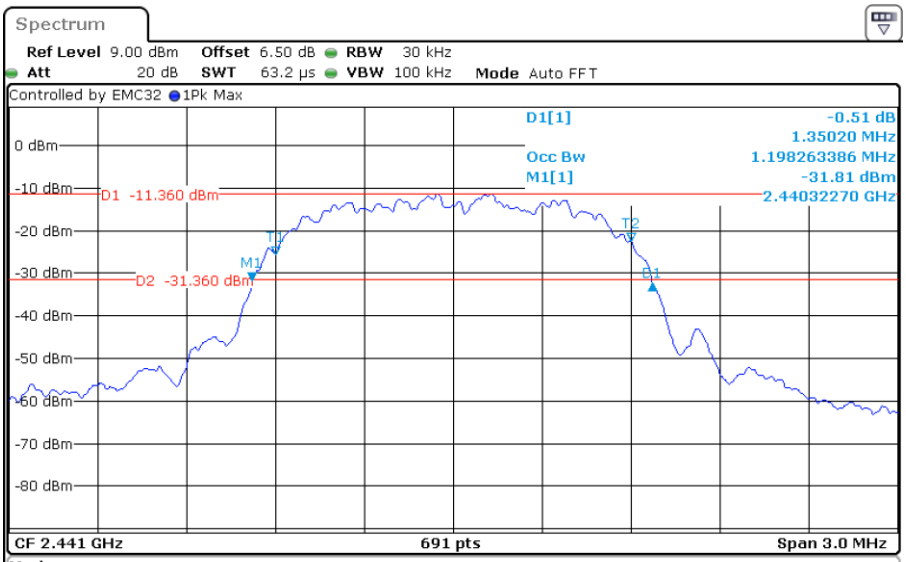
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4013227 GHz	-30.80 dBm		
T1		1	2.40140087 GHz	-24.79 dBm	Occ Bw	1.198263386 MHz
T2		1	2.40259913 GHz	-21.65 dBm		
D1	M1	1	1.3502 MHz	-0.58 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:25:24

Middle Channel



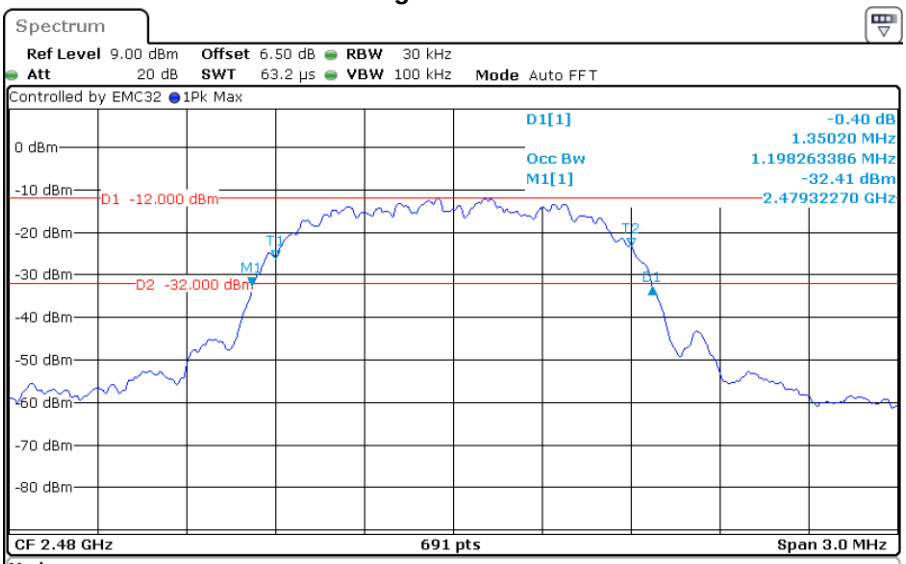
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4403227 GHz	-31.81 dBm		
T1		1	2.44040087 GHz	-25.58 dBm	Occ Bw	1.198263386 MHz
T2		1	2.44159913 GHz	-22.51 dBm		
D1	M1	1	1.3502 MHz	-0.51 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:27:18

High Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4793227 GHz	-32.41 dBm		
T1		1	2.47940087 GHz	-26.16 dBm	Occ Bw	1.198263386 MHz
T2		1	2.48059913 GHz	-23.18 dBm		
D1	M1	1	1.3502 MHz	-0.40 dB		

RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 15:31:01

FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

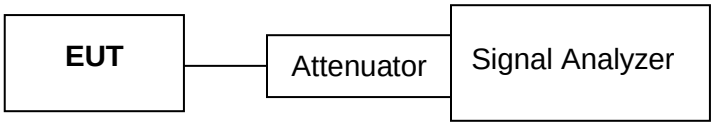
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.3

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	67 %
ATM Pressure:	95.7 kPa

The testing was performed by Colin Jiang on 2024-06-24.

Test Result: Compliance.

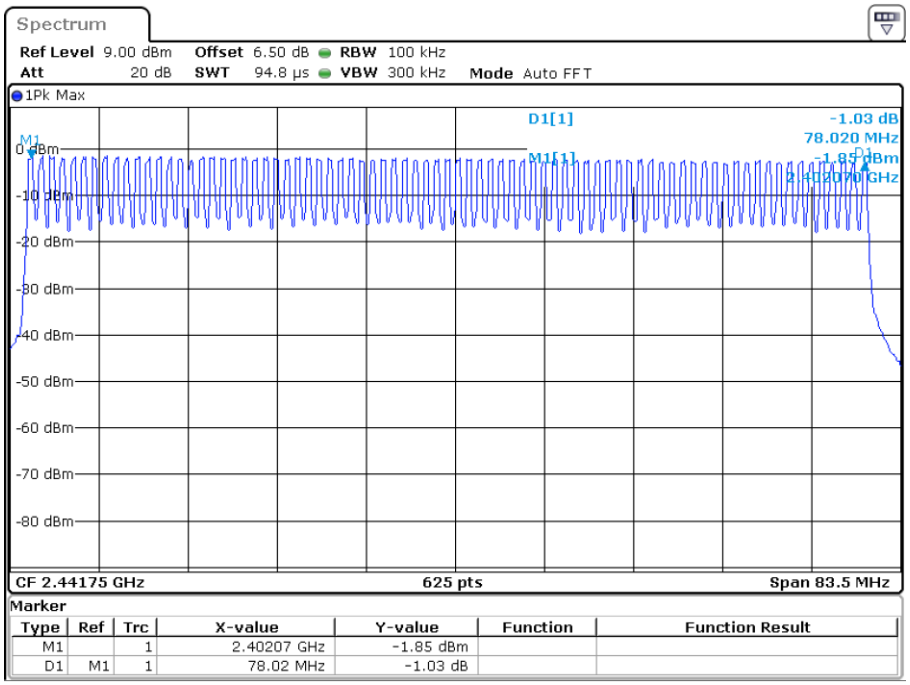
Please refer to following tables and plots.

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2402-2480	79	≥15

Number of Hopping Channels



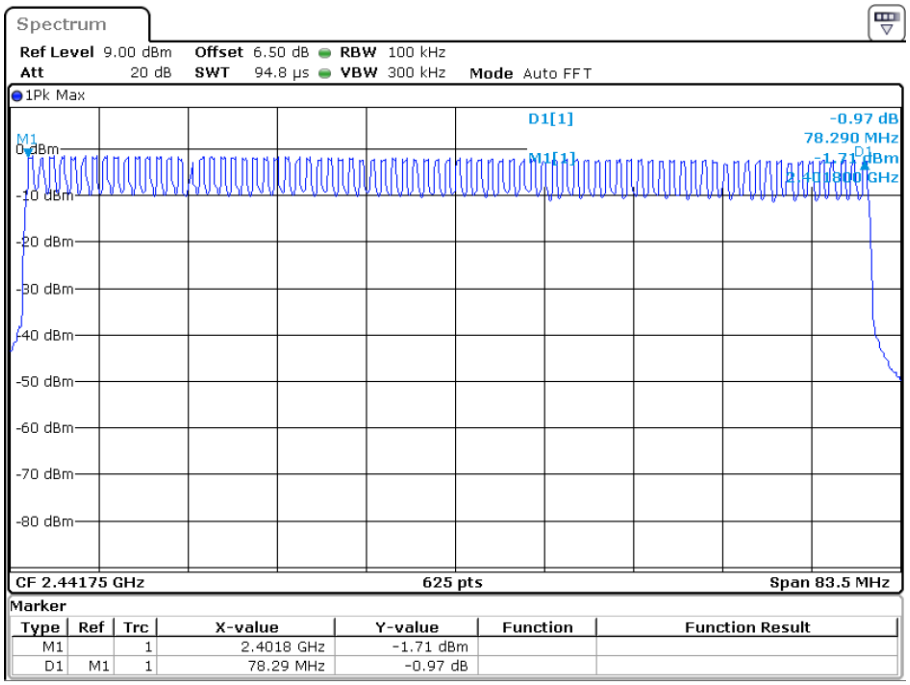
Project:RSC240618001-0B Tester:Colin Jiang

Date: 24.JUN.2024 20:51:39

EDR Mode (π/4-DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2402-2480	79	≥15

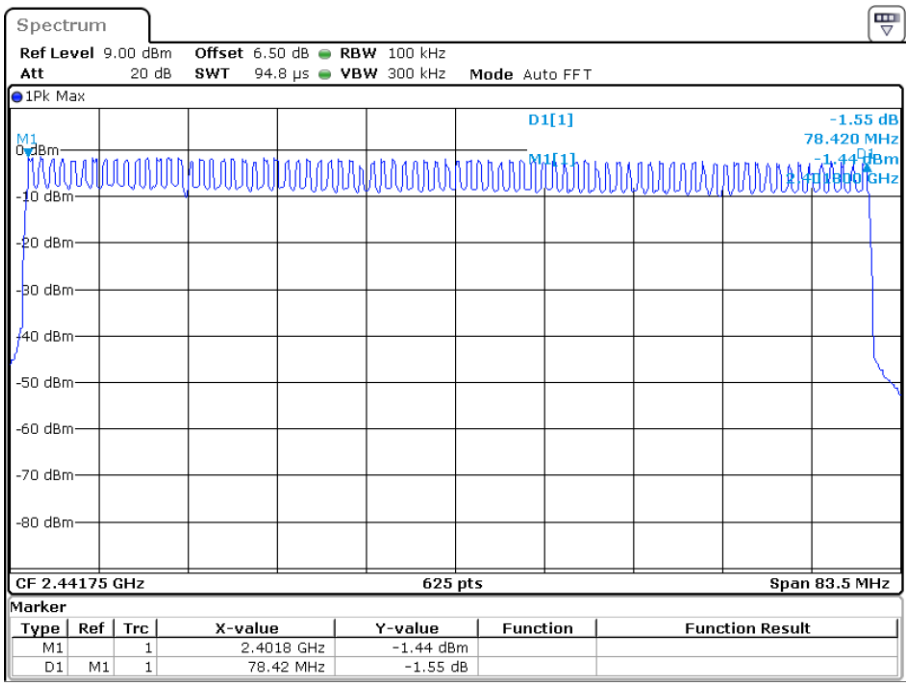
Number of Hopping Channels



EDR Mode (8DPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2402-2480	79	≥15

Number of Hopping Channels



FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

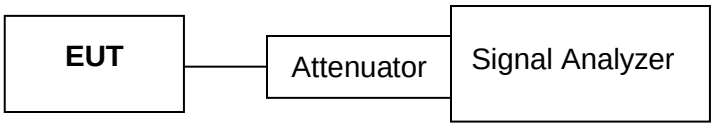
Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.4

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses



Test Data

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	64 %
ATM Pressure:	95.3 kPa

The testing was performed by Colin Jiang on 2024-06-25.

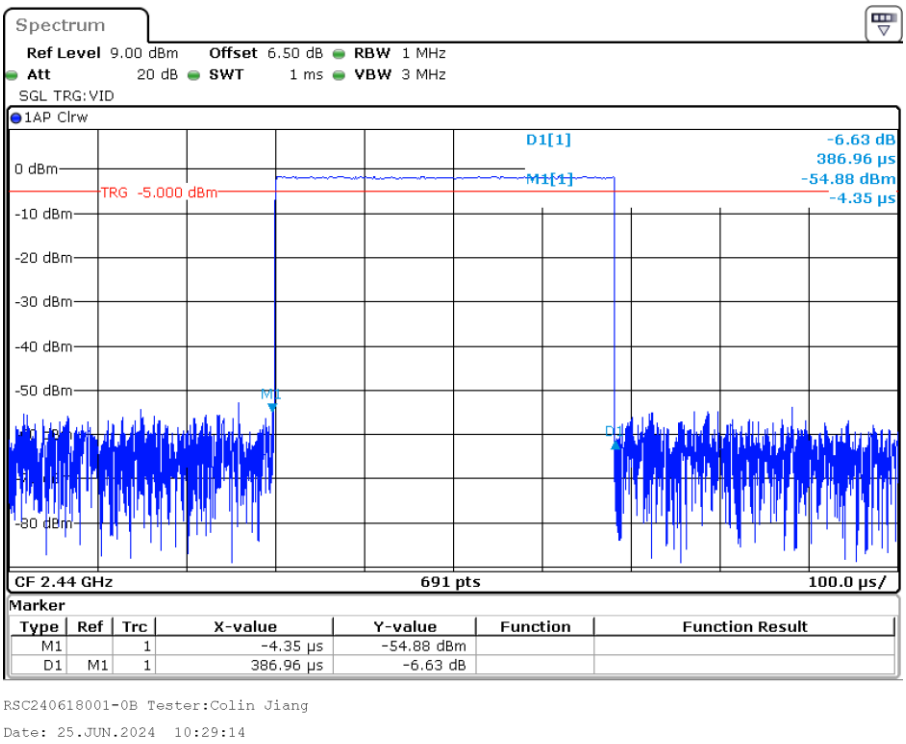
Test Result: Compliance. Please refer to following tables and plots

Test Mode: Transmitting

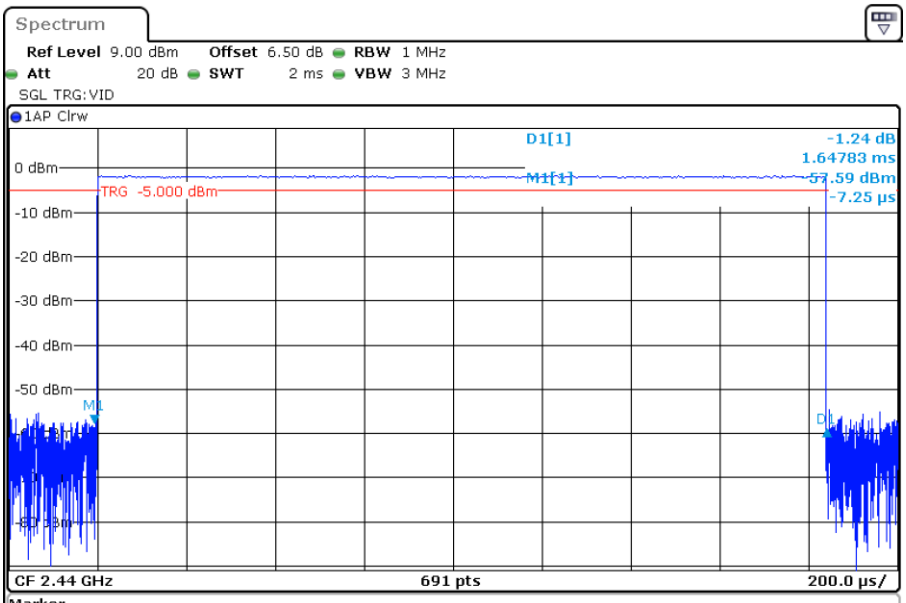
Mode	Packet type	Channel	Frequency (MHz)	Puse width (ms)	Result (s)	Limit (s)
BDR Mode (GFSK)	DH1	Middle	2440	0.387	0.124	0.4
	DH3	Middle	2440	1.648	0.264	
	DH5	Middle	2440	2.906	0.310	
EDR Mode (π/4-DQPSK)	2DH1	Middle	2440	0.396	0.127	
	2DH3	Middle	2440	1.654	0.265	
	2DH5	Middle	2440	2.912	0.311	
EDR Mode (8DPSK)	3DH1	Middle	2440	0.397	0.127	
	3DH3	Middle	2440	1.654	0.265	
	3DH5	Middle	2440	2.912	0.311	
DH1/2DH1/3DH1:Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s DH3/2DH3/3DH3:Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s DH5/2DH5/3DH5:Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s						

BDR Mode (GFSK)

DH1: Middle Channel



DH3: Middle Channel



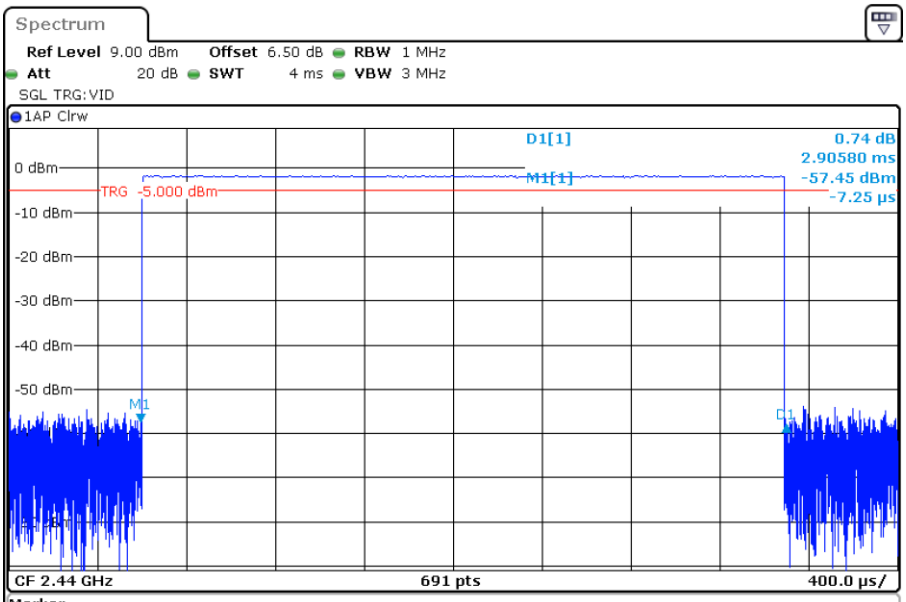
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	-7.25 µs	-57.59 dBm		
D1	M1	1	1.64783 ms	-1.24 dB		

RSC240618001-0B Tester:Colin Jiang

Date: 25.JUN.2024 09:38:46

DH5: Middle Channel



Marker

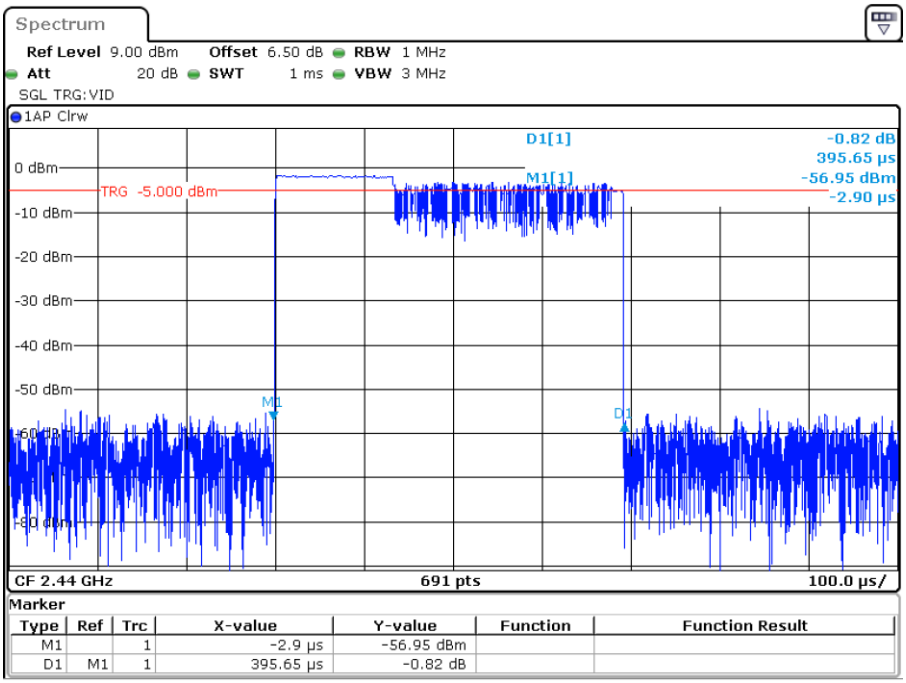
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	-7.25 µs	-57.45 dBm		
D1	M1	1	2.9058 ms	0.74 dB		

RSC240618001-0B Tester:Colin Jiang

Date: 25.JUN.2024 10:04:59

EDR Mode (π/4-DQPSK)

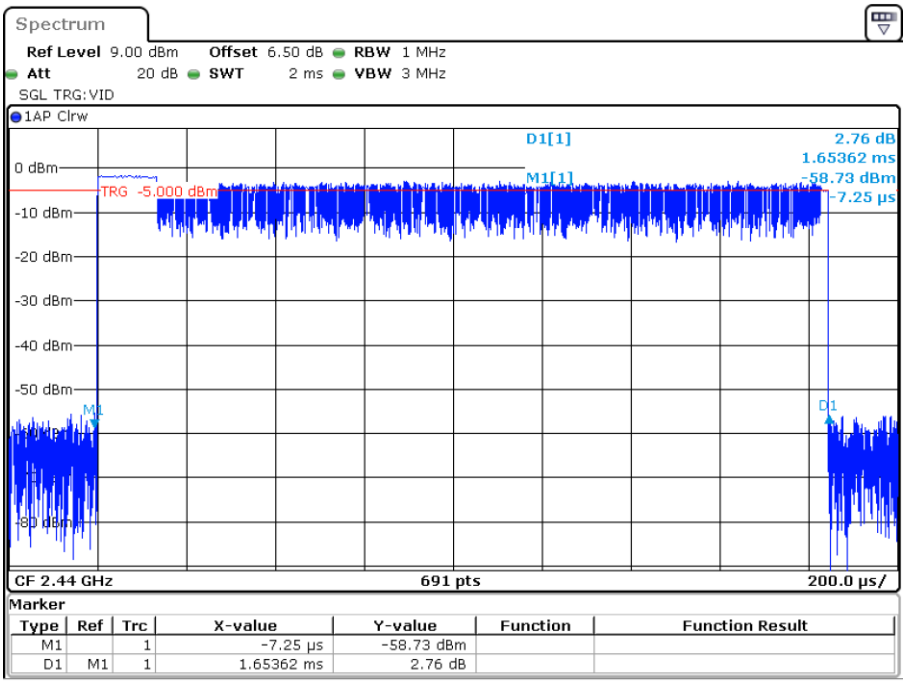
2DH1: Middle Channel



RSC240618001-0B Tester:Colin Jiang

Date: 25.JUN.2024 10:22:06

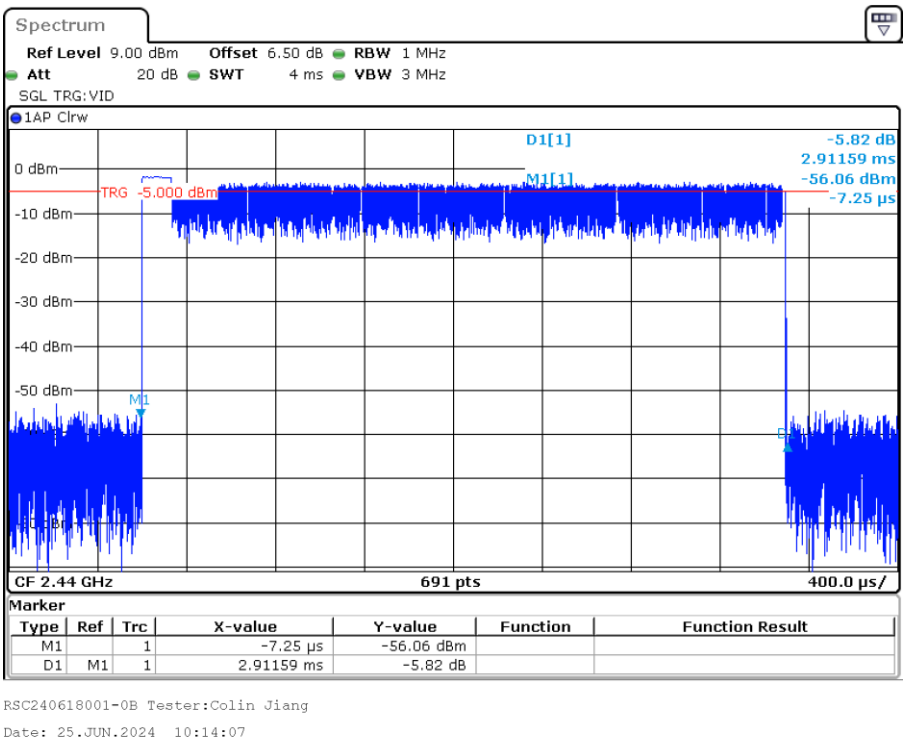
2DH3: Middle Channel



RSC240618001-0B Tester:Colin Jiang

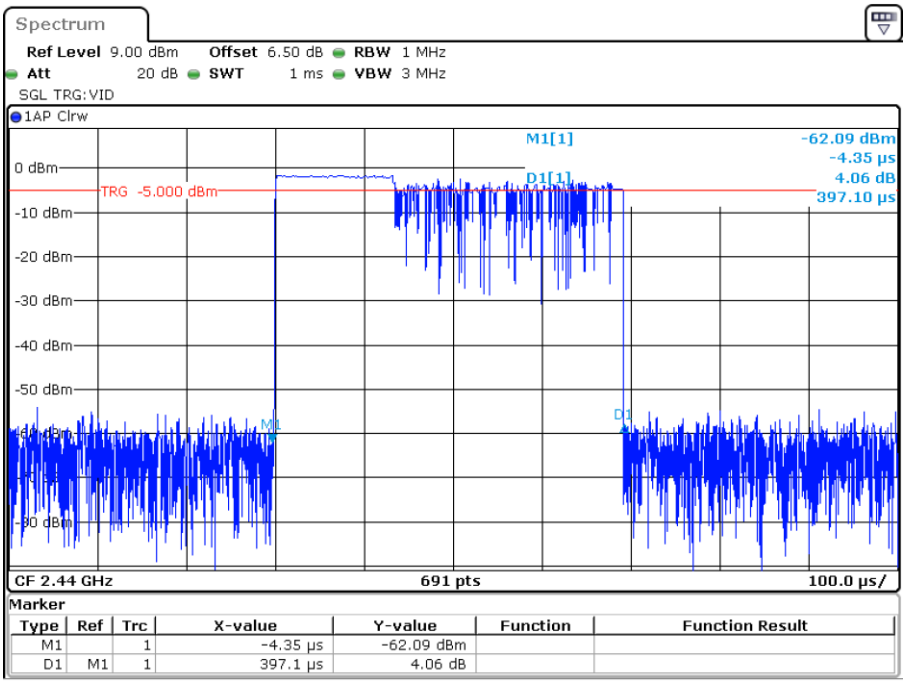
Date: 25.JUN.2024 09:43:54

2DH5: Middle Channel

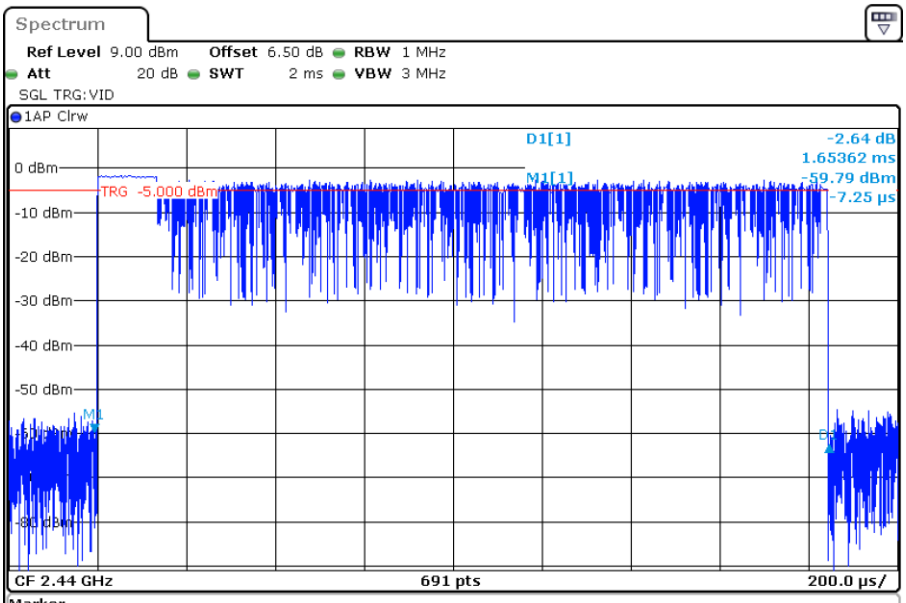


EDR Mode (8DPSK):

3DH1: Middle Channel



3DH3: Middle Channel



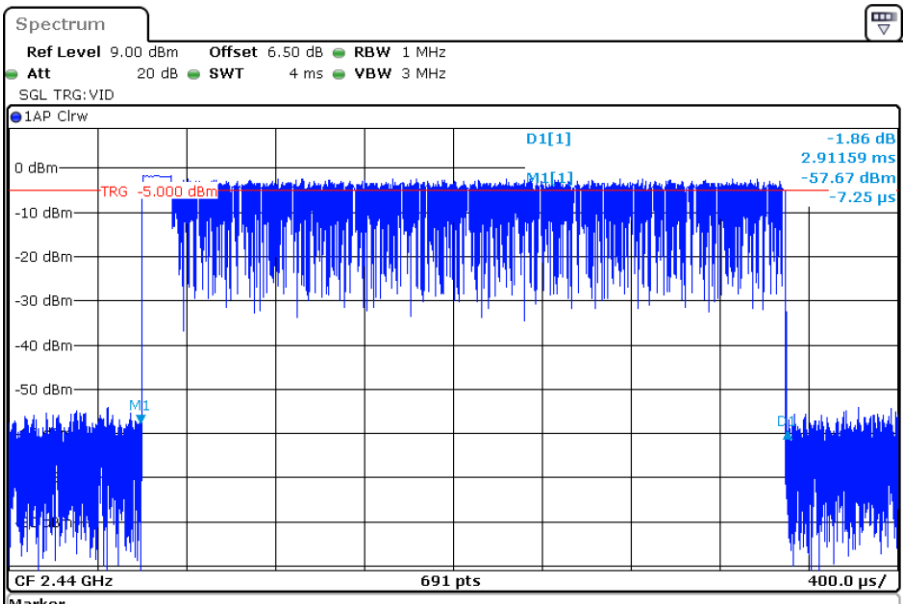
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	-7.25 µs	-59.79 dBm		
D1	M1	1	1.65362 ms	-2.64 dB		

RSC240618001-0B Tester:Colin Jiang

Date: 25.JUN.2024 09:48:18

3DH5: Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	-7.25 µs	-57.67 dBm		
D1	M1	1	2.91159 ms	-1.86 dB		

RSC240618001-0B Tester:Colin Jiang

Date: 25.JUN.2024 10:08:17

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

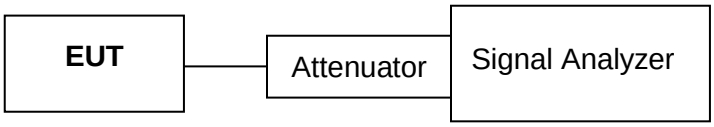
According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725- 5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.5

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	67 %
ATM Pressure:	95.7 kPa

The testing was performed by Colin Jiang on 2024-06-24.

Test Result: Compliance. Please refer to following tables and plots

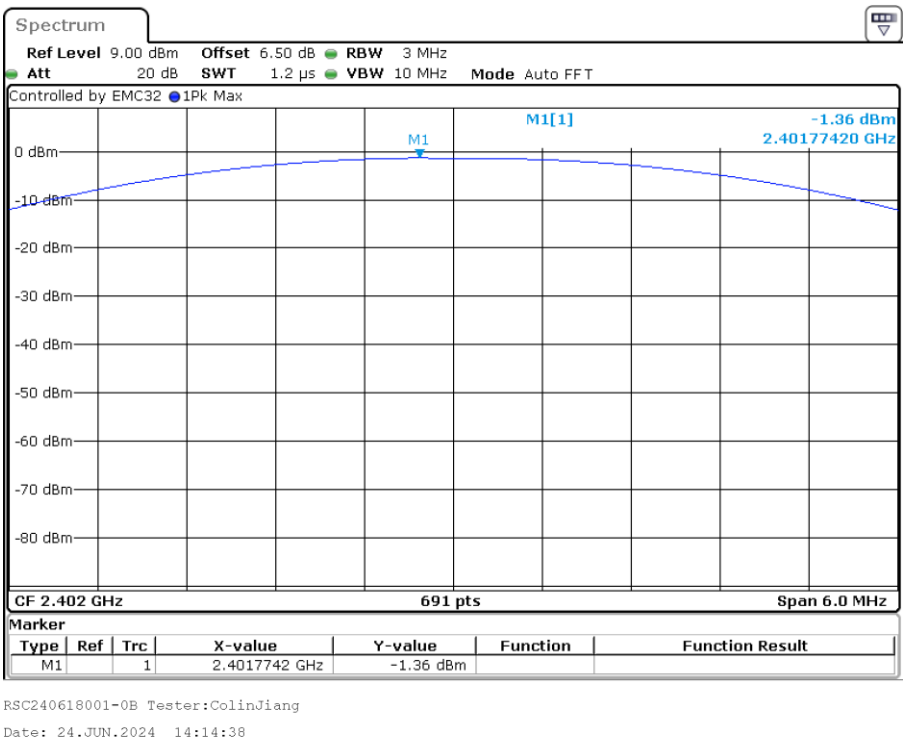
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Result (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	-1.36	21
	Middle	2441	-1.92	
	High	2480	-2.39	
EDR Mode (π/4-DQPSK)	Low	2402	-1.91	
	Middle	2441	-2.52	
	High	2480	-3.01	
EDR Mode (8DPSK)	Low	2402	-1.64	
	Middle	2441	-2.15	
	High	2480	-2.60	

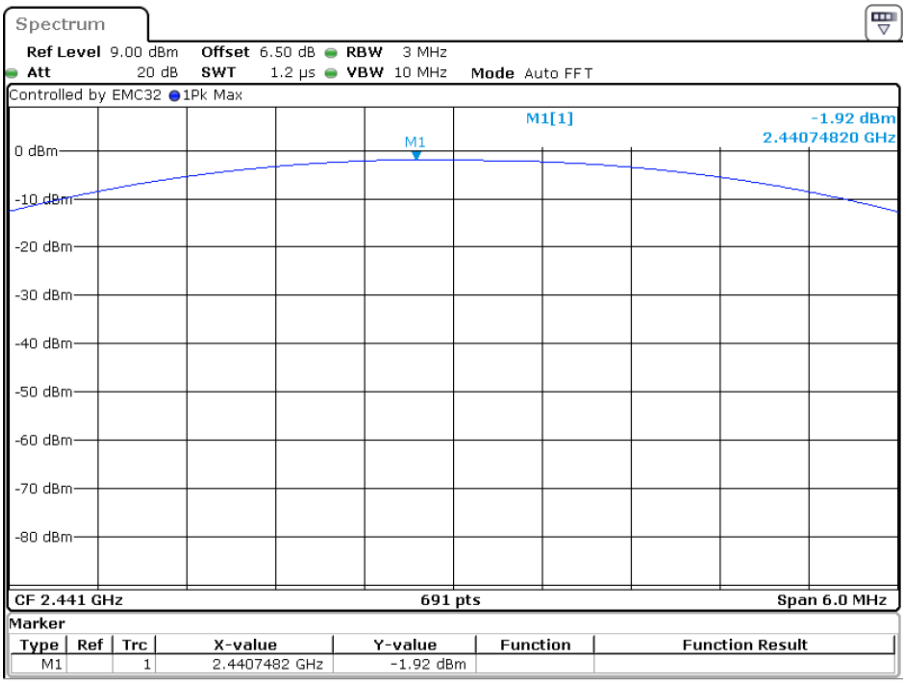
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

Low Channel



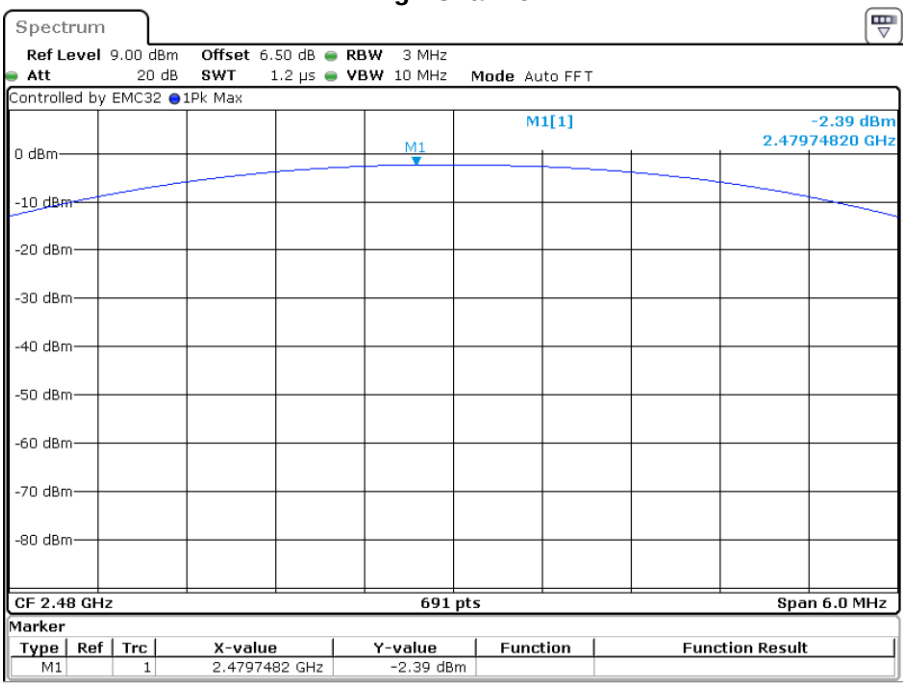
Middle Channel



RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 14:13:46

High Channel

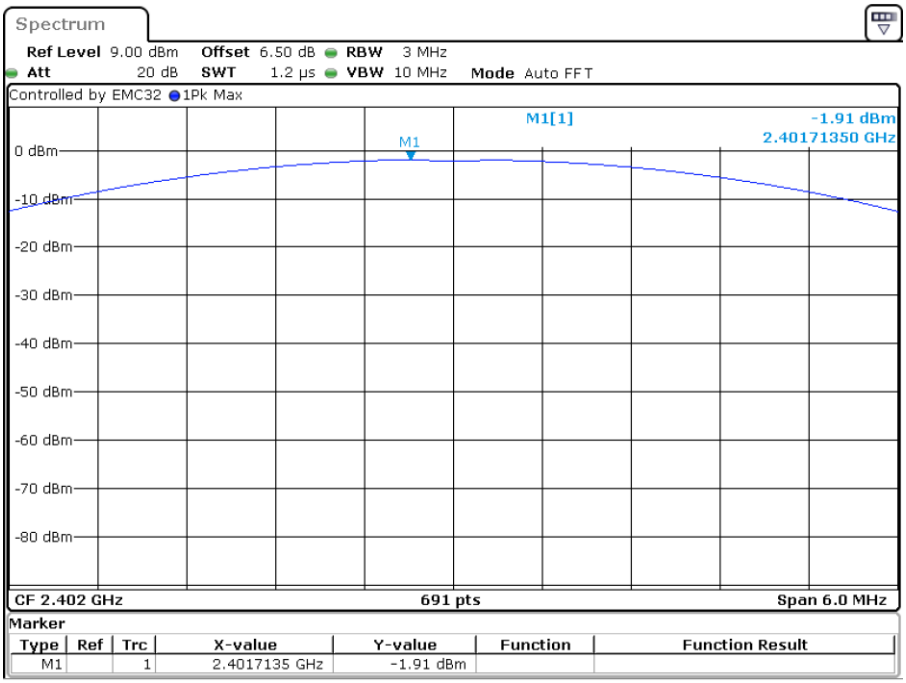


RSC240618001-0B Tester:ColinJiang

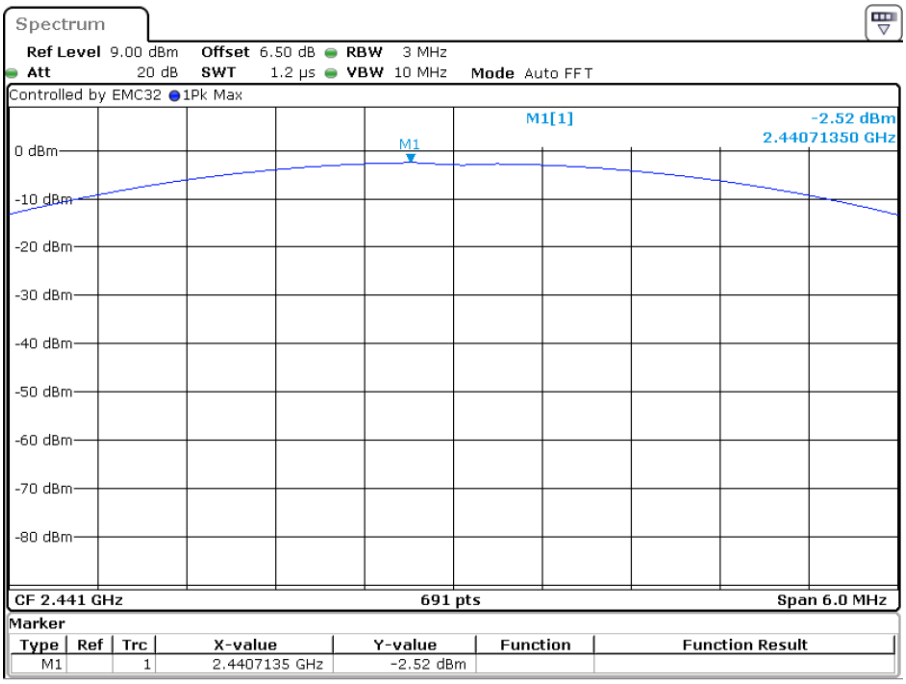
Date: 24.JUN.2024 14:11:59

EDR Mode (π/4-DQPSK):

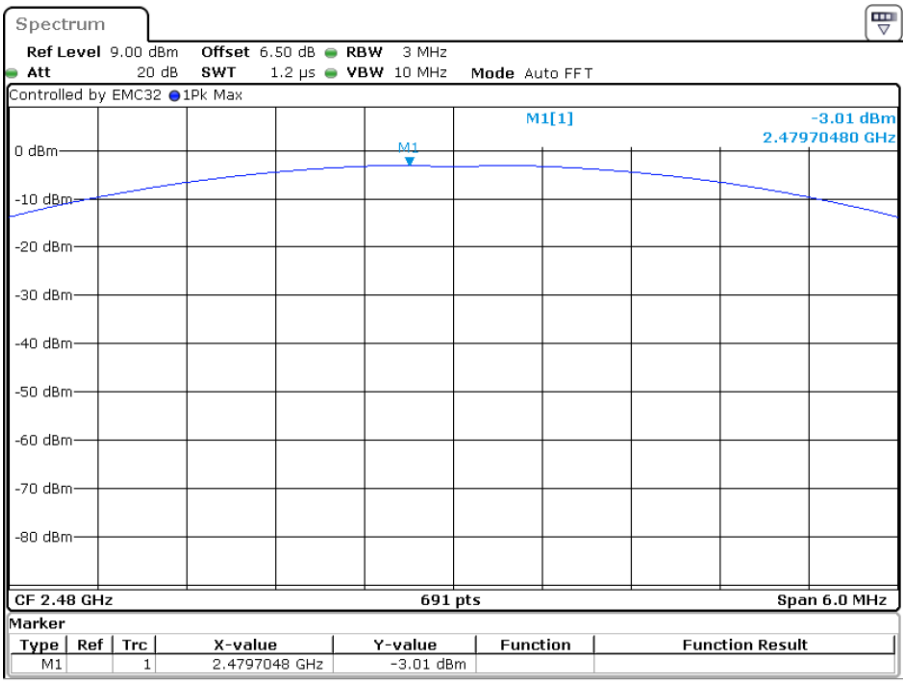
Low Channel



Middle Channel

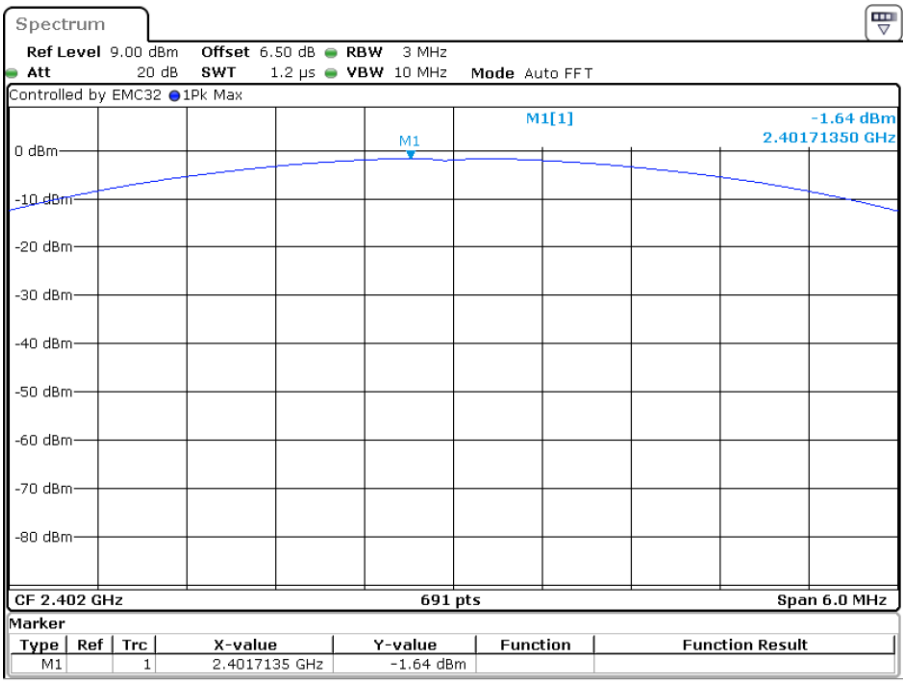


High Channel

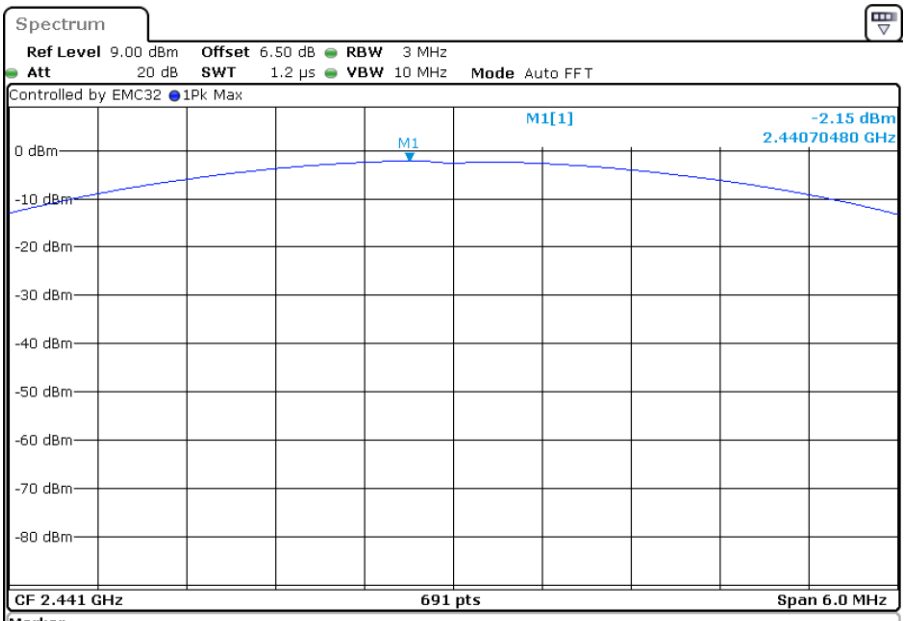


EDR Mode (8DPSK):

Low Channel



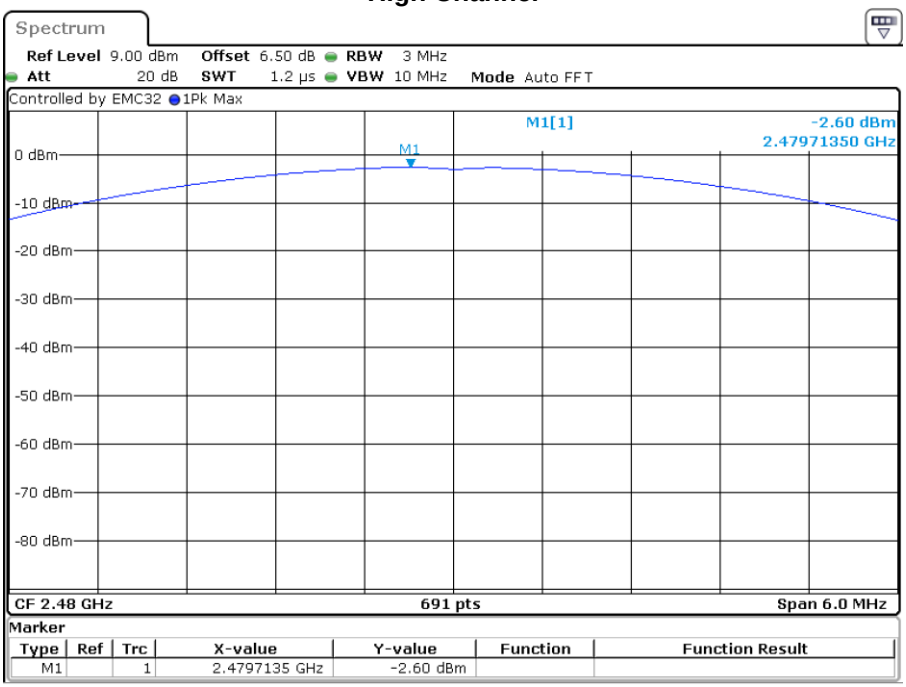
Middle Channel



RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 14:23:14

High Channel



RSC240618001-0B Tester:ColinJiang

Date: 24.JUN.2024 14:21:29

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

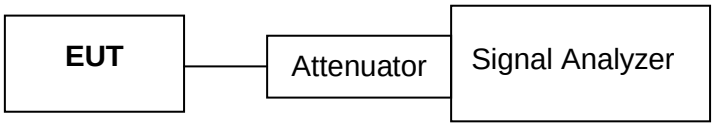
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

Test Method: ANSI C63.10-2020 Clause 7.8.7.2

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.

Test Setup Block



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	67 %
ATM Pressure:	95.7 kPa

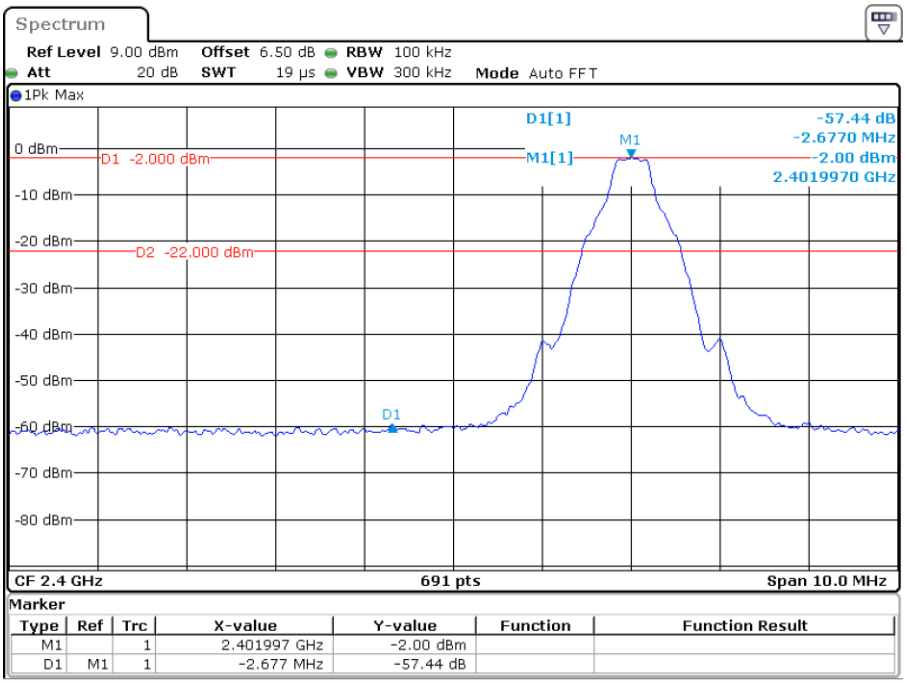
The testing was performed by Colin Jiang on 2024-06-24.

Test Result: Compliance. Please refer to the below plots:

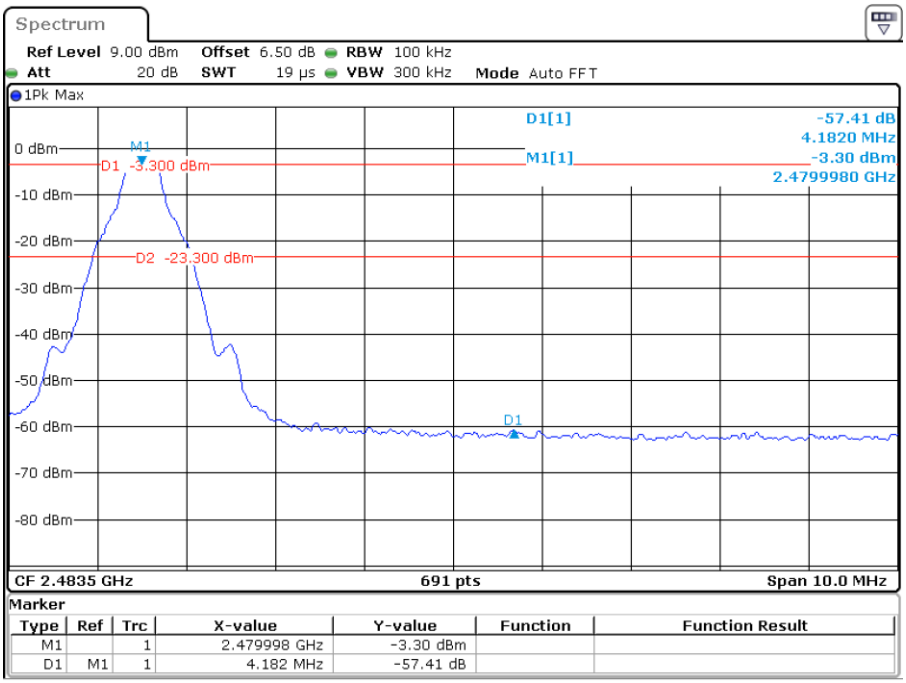
Single Channel

BDR Mode (GFSK):

Band Edge, Left Side

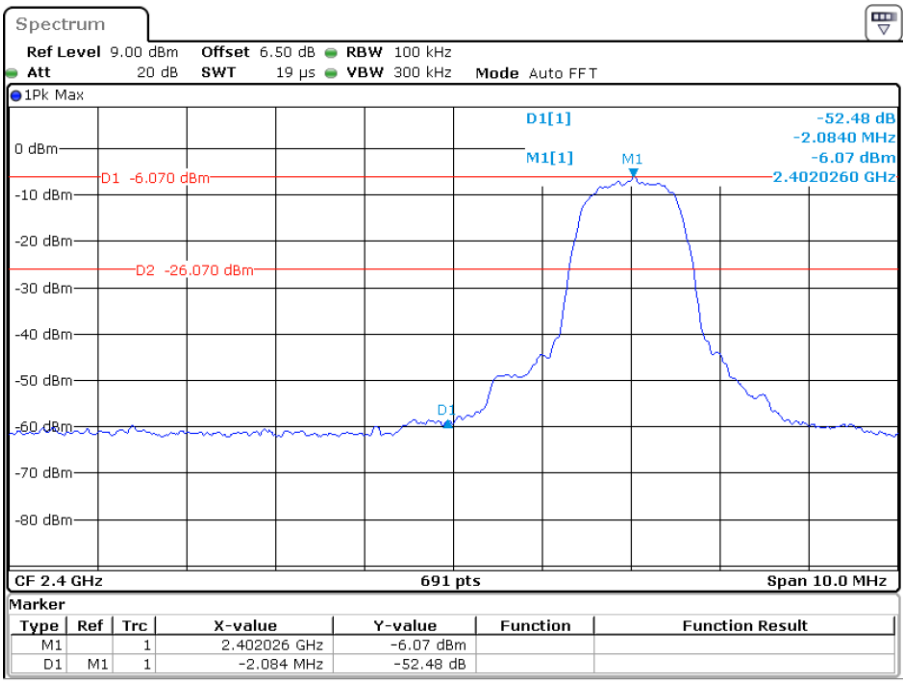


Band Edge, Right Side

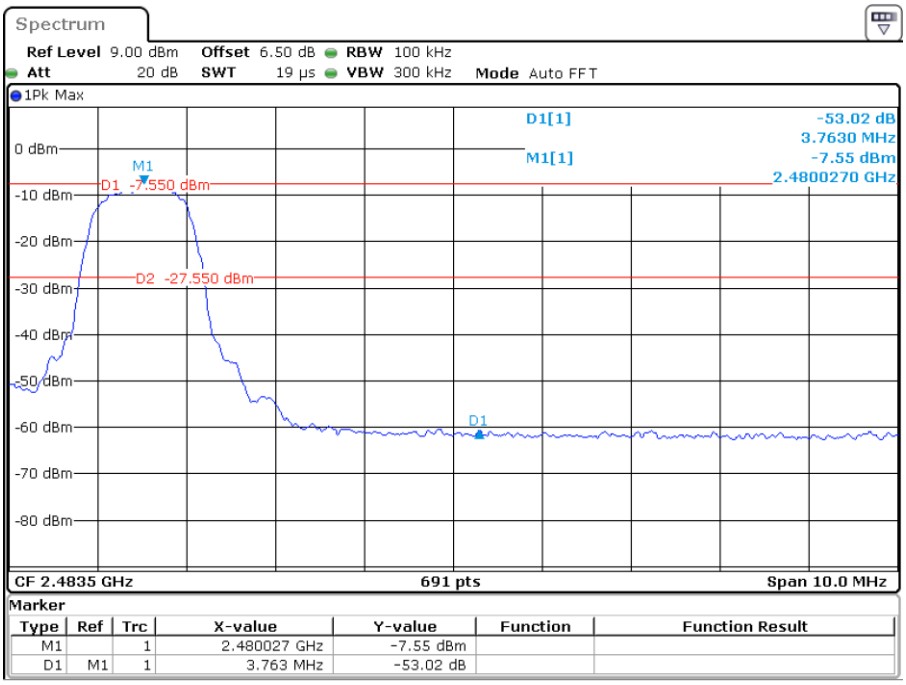


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

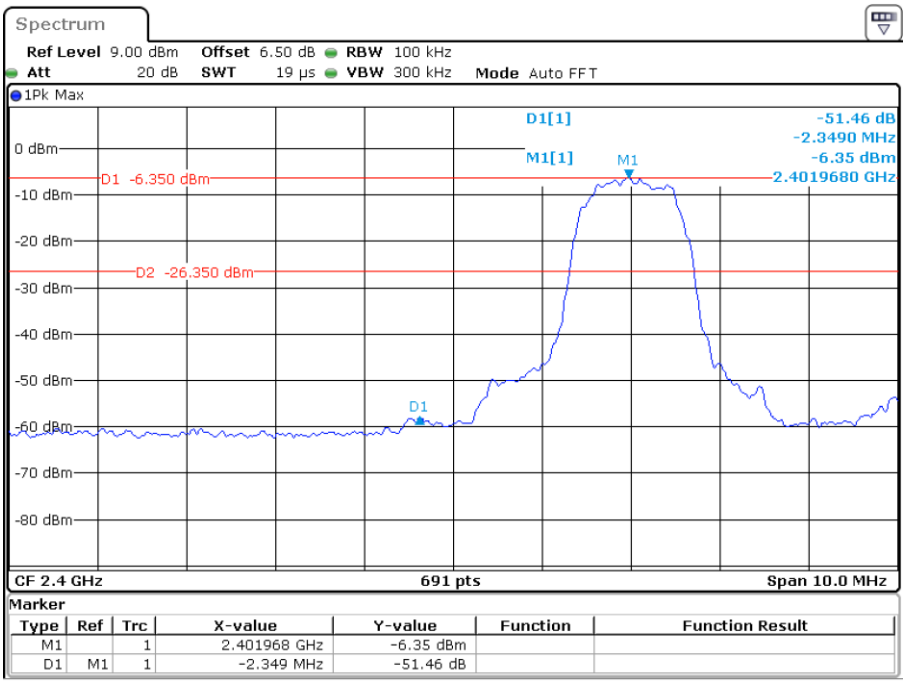


Band Edge, Right Side

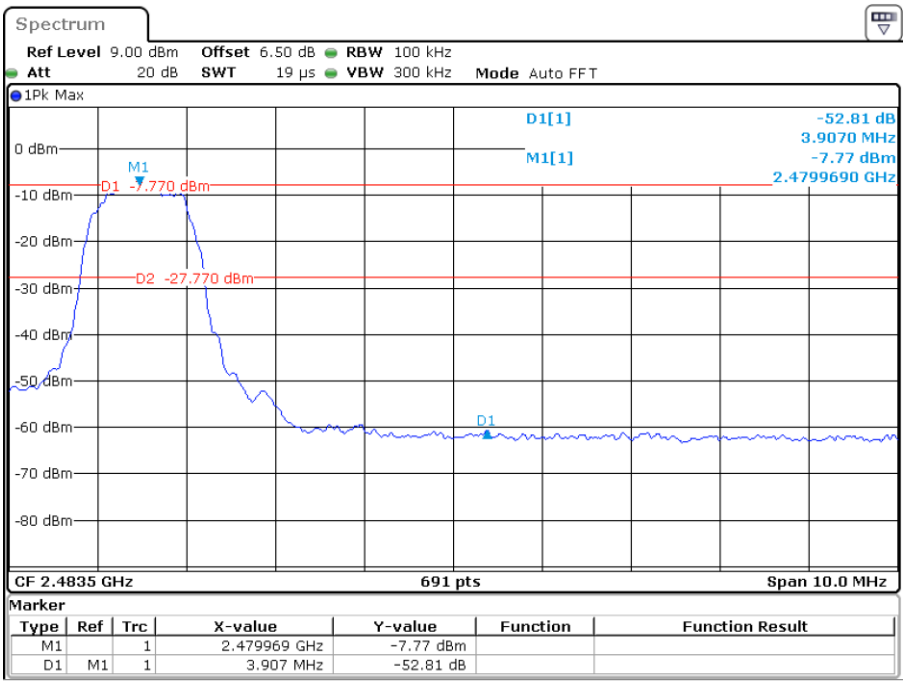


EDR Mode (8DPSK):

Band Edge, Left Side



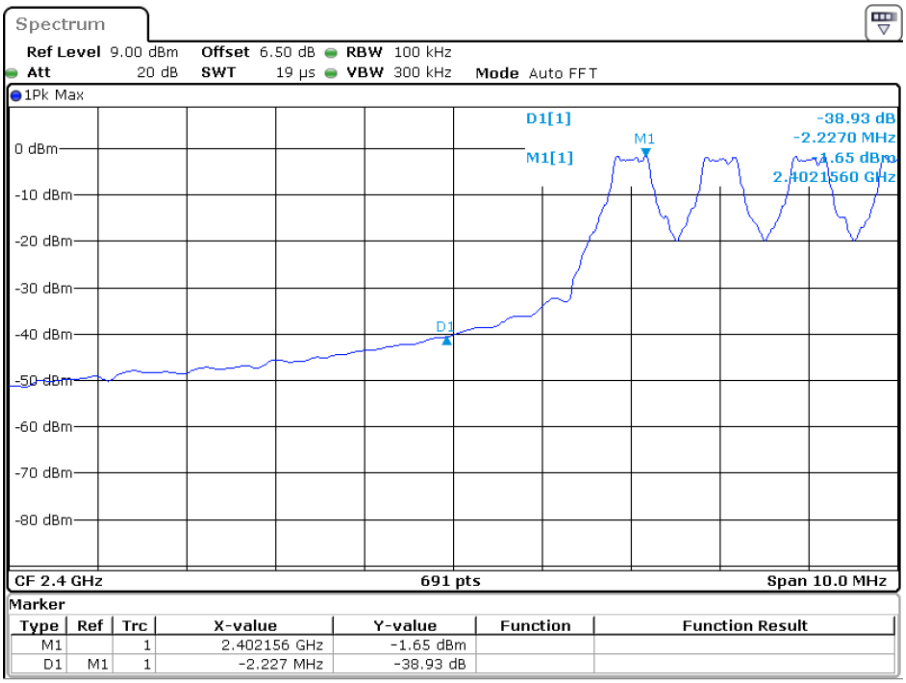
Band Edge, Right Side



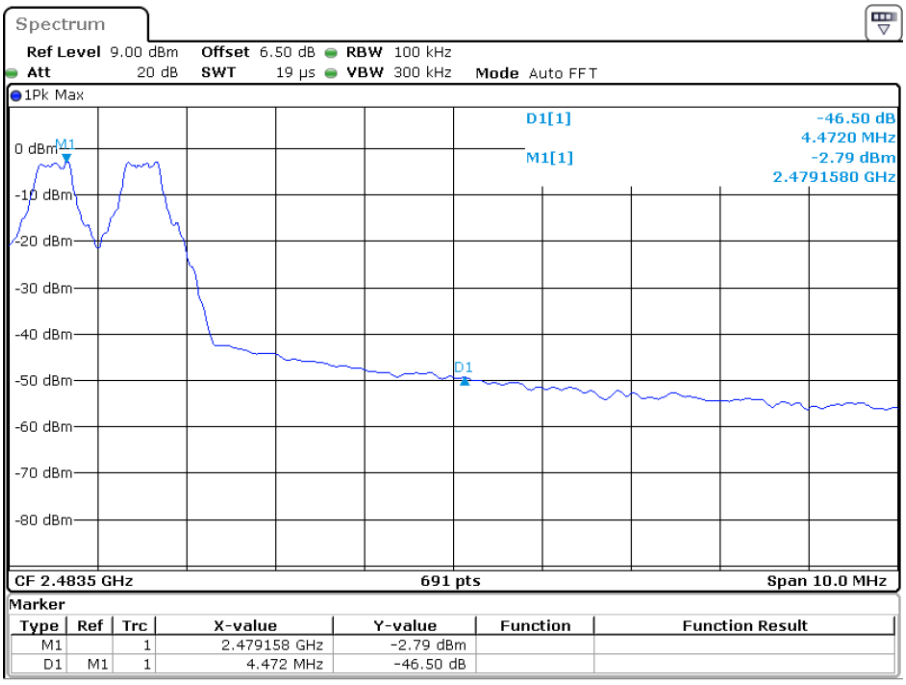
Hopping mode:

BDR Mode (GFSK):

Band Edge, Left Side

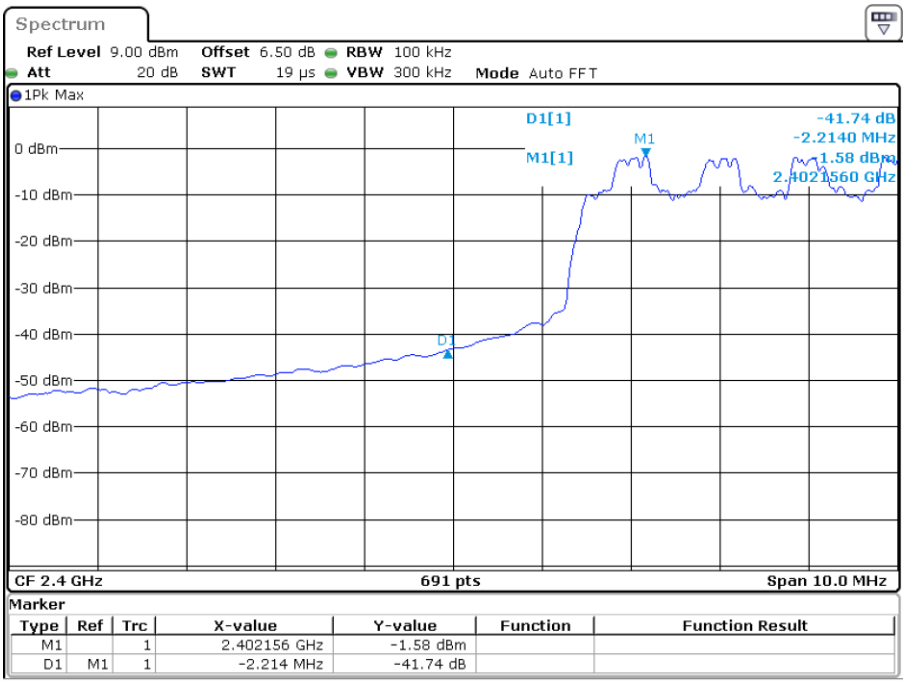


Band Edge, Right Side

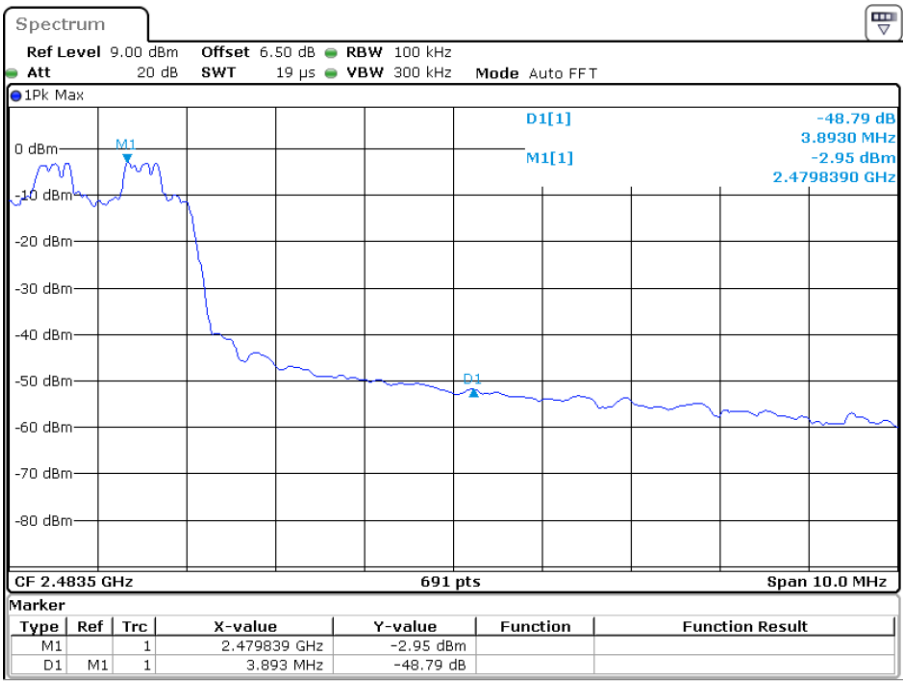


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

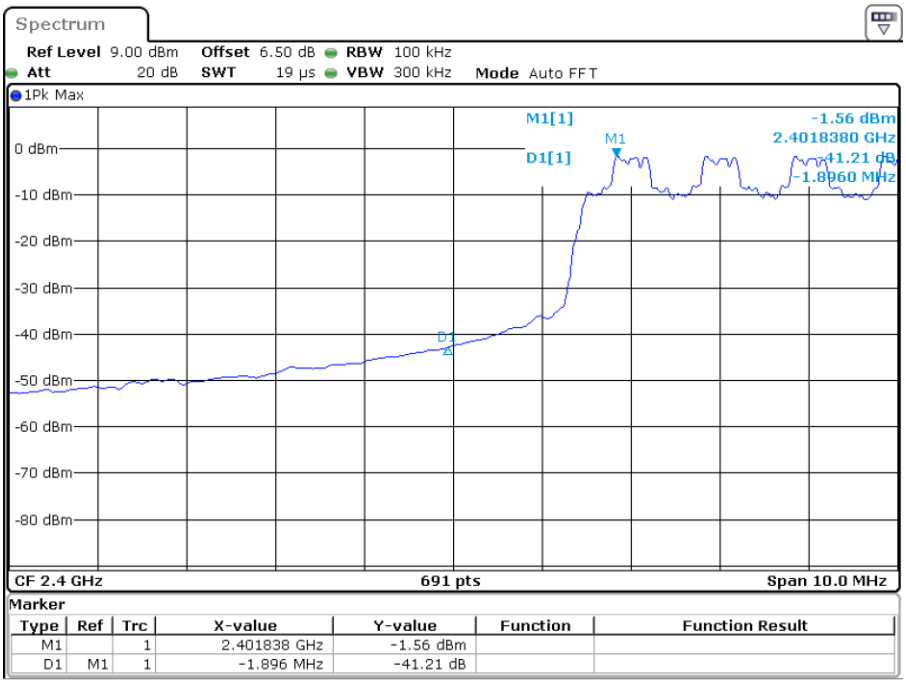


Band Edge, Right Side

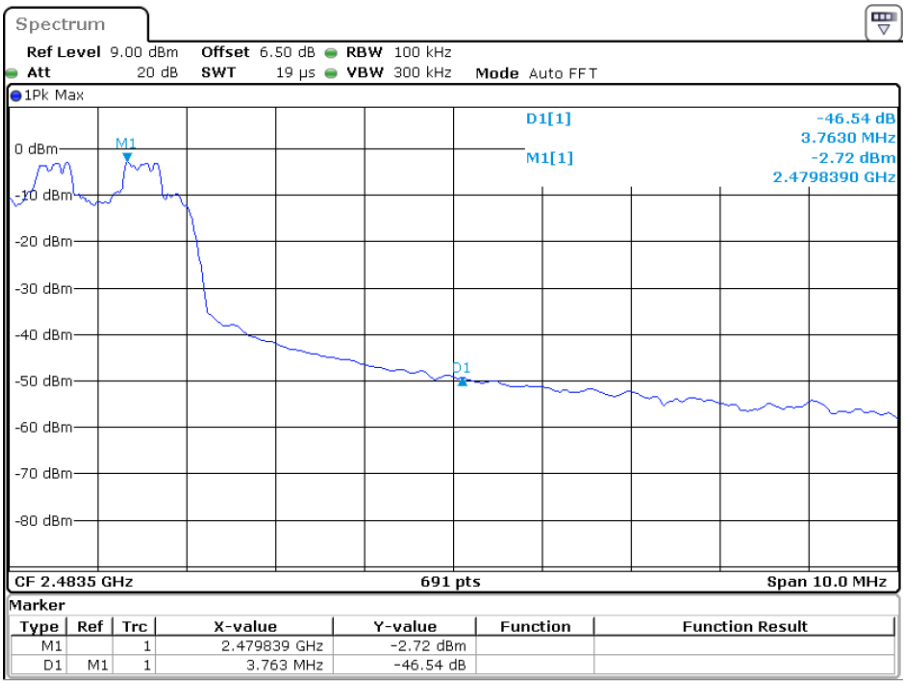


EDR Mode (8DPSK):

Band Edge, Left Side



Band Edge, Right Side



END OF REPORT