

TEST REPORT

Applicant Name : FCC: Porta Phone Company Inc
IC: PORTA PHONE CO., INC.
Address : FCC: 145 Dean Knauss Drive Narragansett, Rhode Island 02882
United States
IC: 145 Dean Knauss Drive Narragansett, RI 02882, United States of America
Report Number : 2401V84614E-RFB
FCC ID: B4HDBX2M
IC: 3064A-DBX2M

Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247 ISSUE 3, AUGUST 2023

Sample Description

Product Type: Full Duplex 900 MHz / 2.4 GHz Transceiver-Main
Model No.: DBX2-MS
Multiple Model(s) No.: DBX2-MD
Trade Mark: Dual Band Wireless
Date Received: 2024/07/09
Issue Date: 2024/08/30

Test Result:	Pass▲
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▲ In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

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Andy Yu
RF Engineer

Approved By:

Nancy Wang

Nancy Wang
RF Supervisor

Note: The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401V84614E-RFB	Original Report	2024/08/30

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	DBX2-MS,DBX2-MD
FVIN	N/A
Product	Full Duplex 900 MHz / 2.4 GHz Transceiver-Main
Tested Model	DBX2-MS
Multiple Model(s)	DBX2-MD
Frequency Range	905-925MHz
Maximum conducted Peak output power	22.94dBm
Modulation Technique	GFSK
Antenna Specification [#]	0dBi(It is provided by the applicant)
Voltage Range	DC3.7V from battery
Sample number	DBX2-MS : 2O2M-2 (RF), 2O2M-1(RE) DBX2-MD: 2O2M-3 (RE) (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	N/A
Note: The Multiple models are electrically identical with the test model except for model number, appearance and the number of speaker. Please refer to the declaration letter [#] for more detail, which was provided by manufacturer.	

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-247 Issue 3, August 2023, RSS-GEN Issue 5, Feb. 2021 Amendment 2 of the Innovation, Science and Economic Development Canada rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and RSS-247 Issue 3, August 2023, RSS-GEN Issue 5, Feb. 2021 Amendment 2 of the Innovation, Science and Economic Development Canada rules.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Frequency		213.55 Hz(k=2, 95% level of confidence)
RF output power, conducted		0.72 dB(k=2, 95% level of confidence)
Unwanted Emission, conducted		1.75 dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9 kHz~150 KHz	3.94dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.84dB(k=2, 95% level of confidence)
Radiated Emissions	9kHz - 30MHz	3.30dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	4.48dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	4.55dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	4.85dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.05dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.35dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.44dB(k=2, 95% level of confidence)
	18GHz - 40GHz	5.16dB(k=2, 95% level of confidence)
Temperature		±1°C
Humidity		±1%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 715558, the FCC Designation No. : CN5045.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	905.00	11	910.50	22	916.00	33	921.50
1	905.50	12	911.00	23	916.50	34	922.00
2	906.00	13	911.50	24	917.00	35	922.50
3	906.50	14	912.00	25	917.50	36	923.00
4	907.00	15	912.50	26	918.00	37	923.50
5	907.50	16	913.00	27	918.50	38	924.00
6	908.00	17	913.50	28	919.00	39	924.50
7	908.50	18	914.00	29	919.50	40	925.00
8	909.00	19	914.50	30	920.00	/	/
9	909.50	20	915.00	31	920.50	/	/
10	910.00	21	915.50	32	921.00	/	/

Note:

1. The equipment has designed 41 channels totally, but only 26 channels selected from the 41 channels active at same time, which were separated by more than 500kHz.
2. EUT was test in channel 0, 20, 40.

EUT Exercise Software

EUT was configured to testing mode by applicant and power level is default*.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

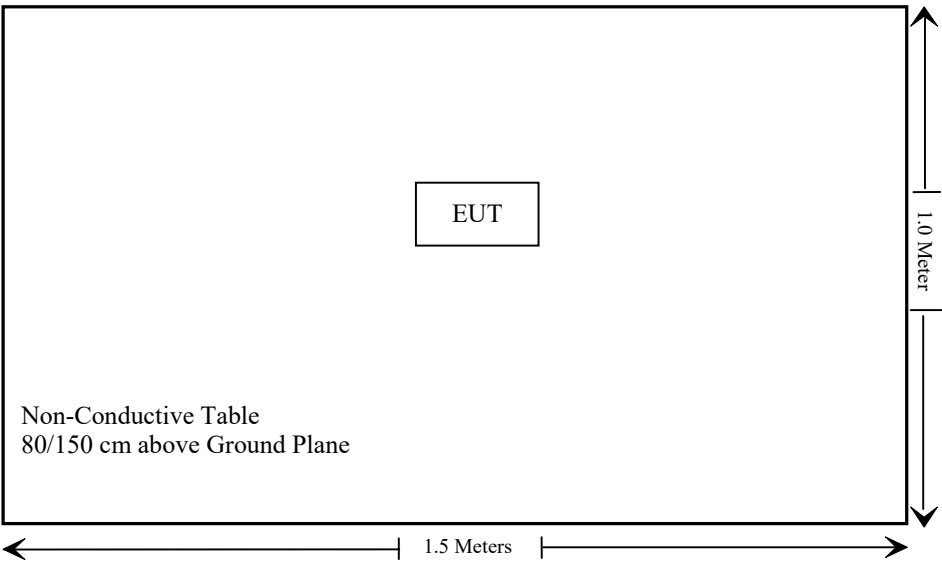
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emission:



SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description of Test	Result
§15.247 (i), §2.1093	RSS-102	RF Exposure	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207(a)	RSS-Gen §8.8	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209 & §15.247(d)	RSS-247 § 5.5	Radiated Emissions	Compliant
§15.247(a)(1)(i)	RSS- Gen§6.7, RSS-247 § 5.1 (c)	99% Occupied Bandwidth & 20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	RSS-247 § 5.1 (b)	Channel Separation Test	Compliant
§15.247(a)(1)(i)	RSS-247 § 5.1 (c)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(i)	RSS-247 § 5.1 (c)	Quantity of hopping channel Test	Compliant
§15.247(b)(2)	RSS-247§ 5.4(a)	Peak Output Power Measurement	Compliant
§15.247(d)	RSS-247 § 5.5	Band edges	Compliant

Not Applicable: the device powered by battery only

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emission test					
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2024/05/21	2025/05/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
Unknown	Cable	Chamber A Cable 1	N/A	2024/06/18	2025/06/17
Unknown	Cable	XH500C	J-10M-A	2024/06/18	2025/06/17
BACL	Active Loop Antenna	1313-1A	4031911	2024/05/14	2027/05/13
Unknown	Cable	2Y194	0735	2024/05/21	2025/05/20
Unknown	Cable	PNG214	1354	2024/05/21	2025/05/20
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
COM-POWER	Pre-amplifier	PA-122	181919	2024/06/18	2025/06/17
Schwarzbeck	Horn Antenna	BBHA9120D(1 201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	735	2024/06/18	2025/06/17
Unknown	RF Cable	UFA147	219661	2024/06/18	2025/06/17
JD	Multiplex Switch Test Control Set	DT7220FSU	DQ77926	2024/06/18	2025/06/17
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
RF Conducted Test					
R&S	SPECTRUM ANALYZER	FSV40-N	102259	2024/01/16	2025/01/15
Unknown	10dB Attenuator	Unknown	F-03-EM065	2024/06/27	2025/06/26
Unknown	RF Cable	65475	01670515	2024/06/27	2025/06/26

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), 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.

Measurement Result

Please refer to SAR test report: 2401V84614E-SAA.

RSS-102 – RF EXPOSURE

Applicable Standard

According to RSS-102, 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 guideline.

Result

Compliance. Please refer to SAR test report: 2401V84614E-SAB.

FCC §15.203 & RSS-GEN §6.8– ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device. Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has one internal antennas arrangements which were permanently attached and the gain are 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Type	Antenna Gain	Impedance
Monopole	0dBi	50Ω

Result: Compliant.

FCC §15.205, §15.209 & §15.247(d) & RSS-247§ 5.5 – RADIATED EMISSIONS

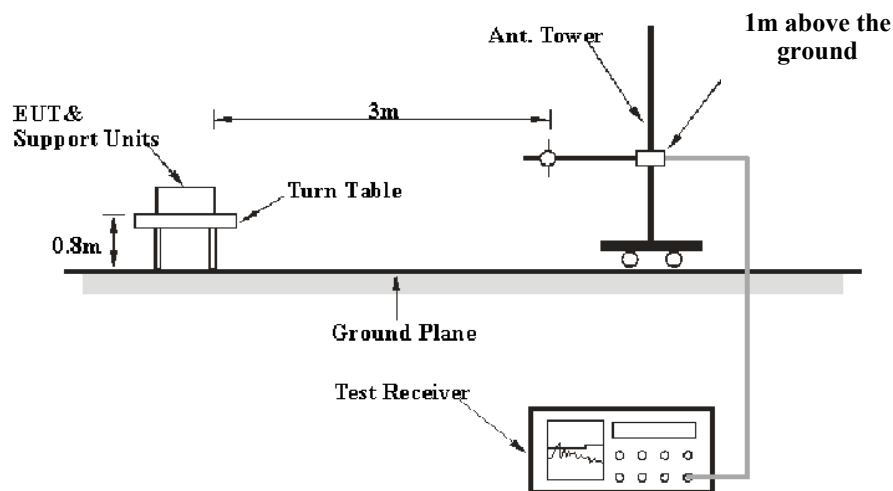
Applicable Standard

FCC §15.205; §15.209; §15.247(d) and RSS-247 §5.5

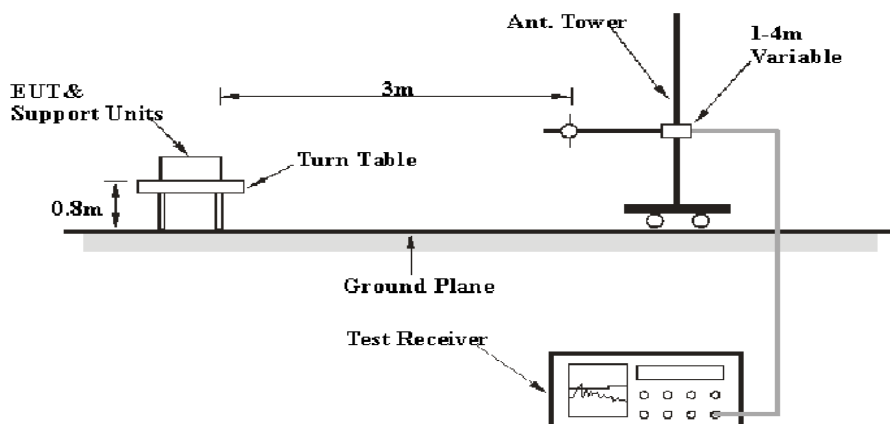
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

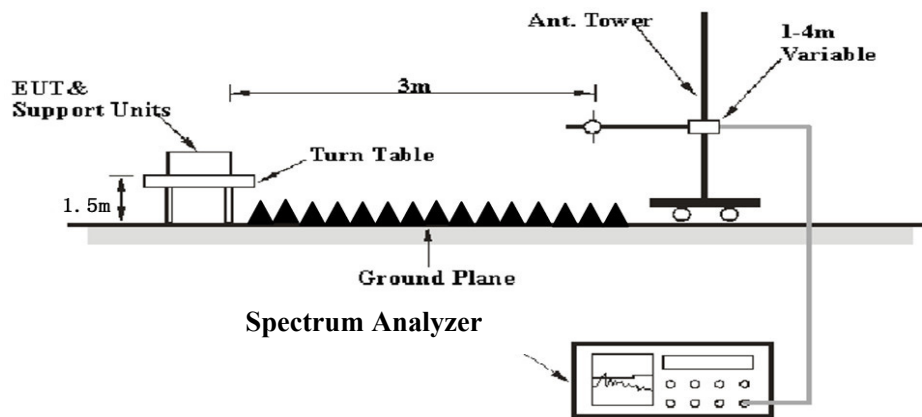
EUT Setup

9 kHz-30MHz:



30MHz-1GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247 limits and RSS-247/RSS-Gen limits.

EMI Test Receiver & Spectrum Analyzer Setup

The EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	/	/	200 Hz	QP
	300 Hz	1 kHz	/	PK
150 kHz – 30 MHz	/	/	9 kHz	QP
	10 kHz	30 kHz	/	PK
30 MHz – 1000 MHz	/	/	120 kHz	QP
	100 kHz	300 kHz	/	PK
Above 1 GHz	Harmonics			
	1MHz	3 MHz	/	PK
	Average Emission Level=Peak Emission Level+20*log(Duty cycle)			
	Other Emissions			
	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Average

For Duty cycle measurement:

Use the duty cycle factor correction factor method per 15.35(c).

Duty cycle=On time/100milliseconds, On time= $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$,

Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulse, etc.

Test Procedure

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

All final data was recorded in Quasi-peak detection mode except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz, average detection modes for frequency bands 9–90 kHz and 110–490 kHz, peak and average detection modes for frequencies above 1 GHz.

For 9 kHz-30MHz, the report shall list the six emissions with the smallest margin relative to the limit, for each of the three antenna orientations (parallel, perpendicular, and ground-parallel) unless the margin is greater than 20 dB.

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.

All emissions under the average limit and under the noise floor have not recorded in the report.

Factor & Over Limit/Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Over Limit/Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

$$\begin{aligned}\text{Over Limit/Margin} &= \text{Level/Corrected Amplitude} - \text{Limit} \\ \text{Level / Corrected Amplitude} &= \text{Read Level} + \text{Factor}\end{aligned}$$

Test Data

Environmental Conditions

Temperature:	22~25.6 °C
Relative Humidity:	50~ 54 %
ATM Pressure:	101.0 kPa

The testing was performed by Shy Jiang from 2024-07-17 to 2024-07-18 for below 1GHz and Dylan Yang from 2024-08-12 to 2024-08-30 for above 1GHz.

EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case z-axis of orientation was recorded)

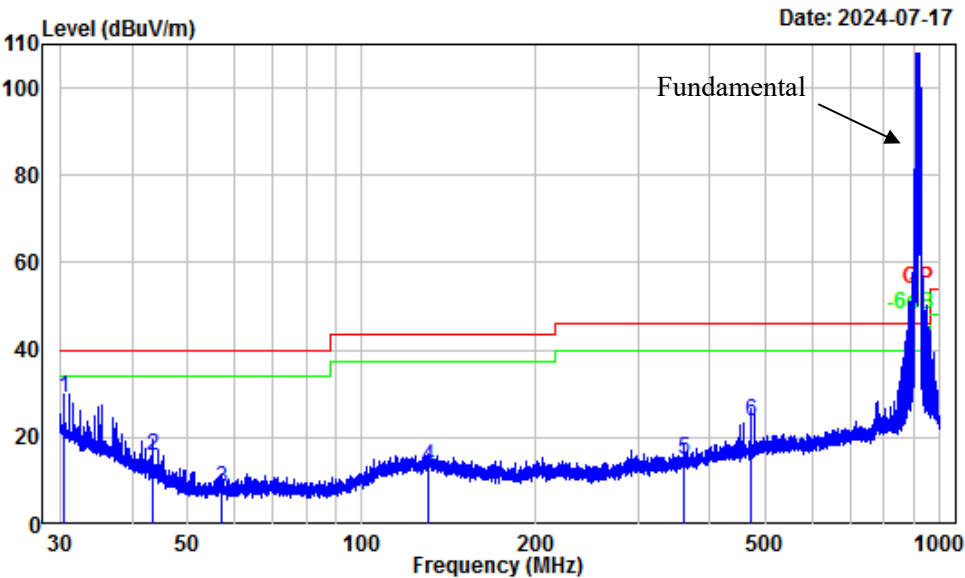
9 kHz-30MHz: *(Maximum output power mode, High channel)*

The amplitude of spurious emissions attenuated more than 20 dB below the limit was not recorded.

30MHz-1GHz: (Maximum output mode GFSK High channel)

For Model: DBX2-MS

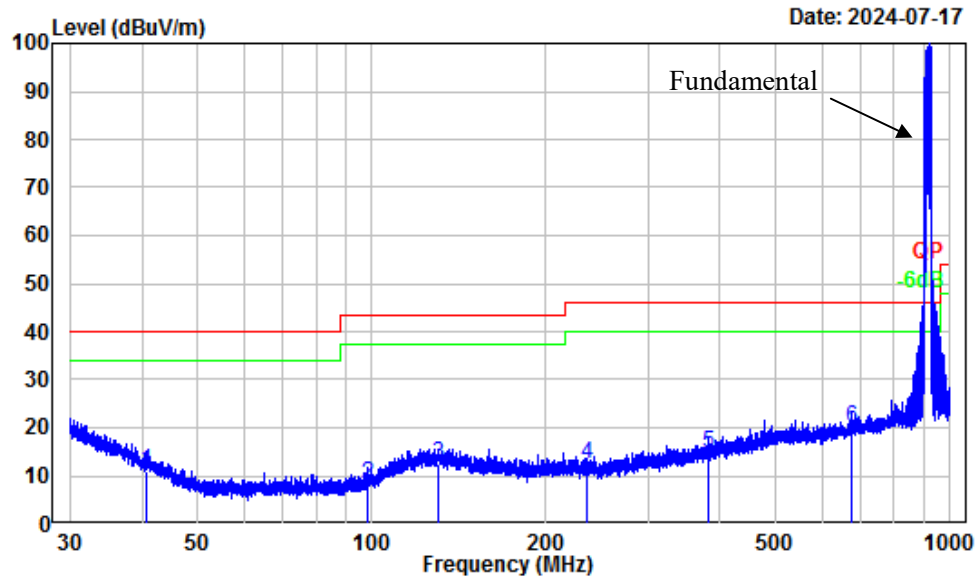
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401V84614E-RF
Test Mode : Transmitting
Tester : Shy Jiang

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	30.56	-4.95	34.02	29.07	40.00	-10.93 QP
2	43.45	-13.71	29.30	15.59	40.00	-24.41 QP
3	56.99	-17.77	25.92	8.15	40.00	-31.85 QP
4	130.49	-12.09	25.28	13.19	43.50	-30.31 QP
5	359.50	-11.72	26.80	15.08	46.00	-30.92 QP
6	471.76	-9.01	32.65	23.64	46.00	-22.36 QP

Vertical

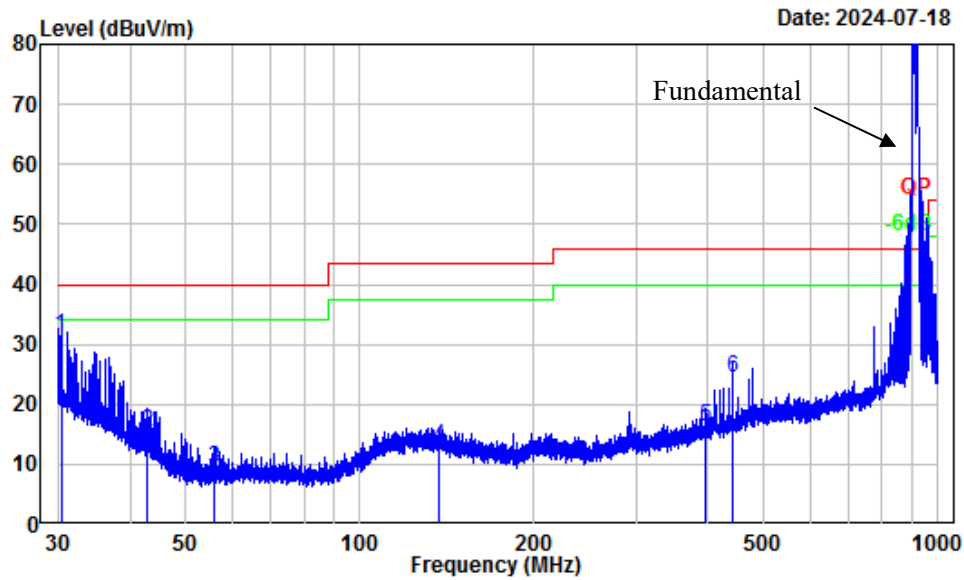


Site : Chamber A
Condition : 3m Vertical
Project Number: 2401V84614E-RF
Test Mode : Transmitting
Tester : Shy Jiang

		Read		Limit	Over	Remark
Freq Factor		Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.65 -13.38	24.30	10.92	40.00	-29.08	QP
2	98.23 -17.27	25.45	8.18	43.50	-35.32	QP
3	130.15 -12.57	24.99	12.42	43.50	-31.08	QP
4	234.89 -14.86	27.36	12.50	46.00	-33.50	QP
5	381.75 -11.34	25.90	14.56	46.00	-31.44	QP
6	677.58 -6.82	26.90	20.08	46.00	-25.92	QP

For Model: DBX2-MD

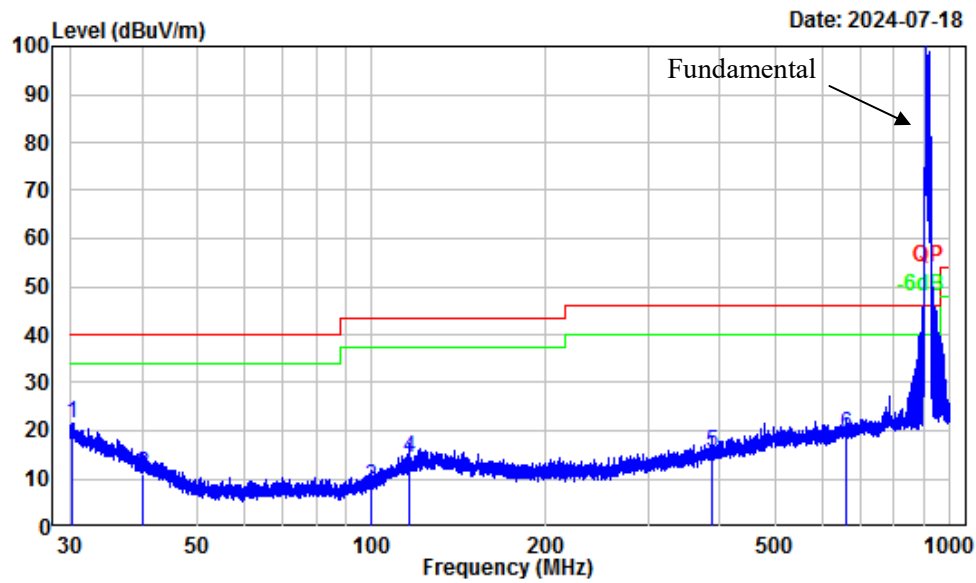
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401V84614E-RF
Test Mode : Transmitting
Tester : Shy Jiang

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	Line	Limit	
1	30.40	-4.83	36.33	31.50	40.00	-8.50	QP
2	42.84	-13.33	28.67	15.34	40.00	-24.66	QP
3	55.88	-17.78	27.23	9.45	40.00	-30.55	QP
4	136.76	-12.48	25.46	12.98	43.50	-30.52	QP
5	396.94	-10.68	26.89	16.21	46.00	-29.79	QP
6	441.94	-9.75	34.15	24.40	46.00	-21.60	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401V84614E-RF
Test Mode : Transmitting
Tester : Shy Jiang

	Freq Factor		Read Level		Limit	Over	Remark
	MHz	dB/m	dBuV	dBuV/m	Line	Limit	
1	30.28	-6.74	28.24	21.50	40.00	-18.50	QP
2	40.21	-13.13	24.16	11.03	40.00	-28.97	QP
3	99.83	-16.96	25.23	8.27	43.50	-35.23	QP
4	115.93	-13.38	27.62	14.24	43.50	-29.26	QP
5	387.99	-11.15	26.44	15.29	46.00	-30.71	QP
6	663.18	-6.98	26.32	19.34	46.00	-26.66	QP

Above 1GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
Low Channel(905MHz)							
2715.00	71.95	PK	H	-2.49	69.46	74.00	-4.54
2715.00	70.16	PK	V	-2.49	67.67	74.00	-6.33
3620.00	69.37	PK	H	-1.94	67.43	74.00	-6.57
3620.00	70.15	PK	V	-1.94	68.21	74.00	-5.79
4525.00	52.04	PK	H	1.19	53.23	74.00	-20.77
4525.00	49.59	PK	V	1.19	50.78	74.00	-23.22
Middle Channel(915MHz)							
2745.00	70.96	PK	H	-2.49	68.47	74.00	-5.53
2745.00	70.15	PK	V	-2.49	67.66	74.00	-6.34
3660.00	68.95	PK	H	-1.84	67.11	74.00	-6.89
3660.00	69.88	PK	V	-1.84	68.04	74.00	-5.96
4575.00	51.41	PK	H	1.29	52.70	74.00	-21.30
4575.00	49.54	PK	V	1.29	50.83	74.00	-23.17
High Channel(925MHz)							
2775.00	68.55	PK	H	-2.46	66.09	74.00	-7.91
2775.00	66.24	PK	V	-2.46	63.78	74.00	-10.22
3700.00	65.35	PK	H	-1.54	63.81	74.00	-10.19
3700.00	68.23	PK	V	-1.54	66.69	74.00	-7.31
4625.00	49.87	PK	H	0.99	50.86	74.00	-23.14
4625.00	49.69	PK	V	0.99	50.68	74.00	-23.32

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Corrected. Amplitude - Limit

Other emissions which were more than 20dB below limit or on noise floor level was not recorded.

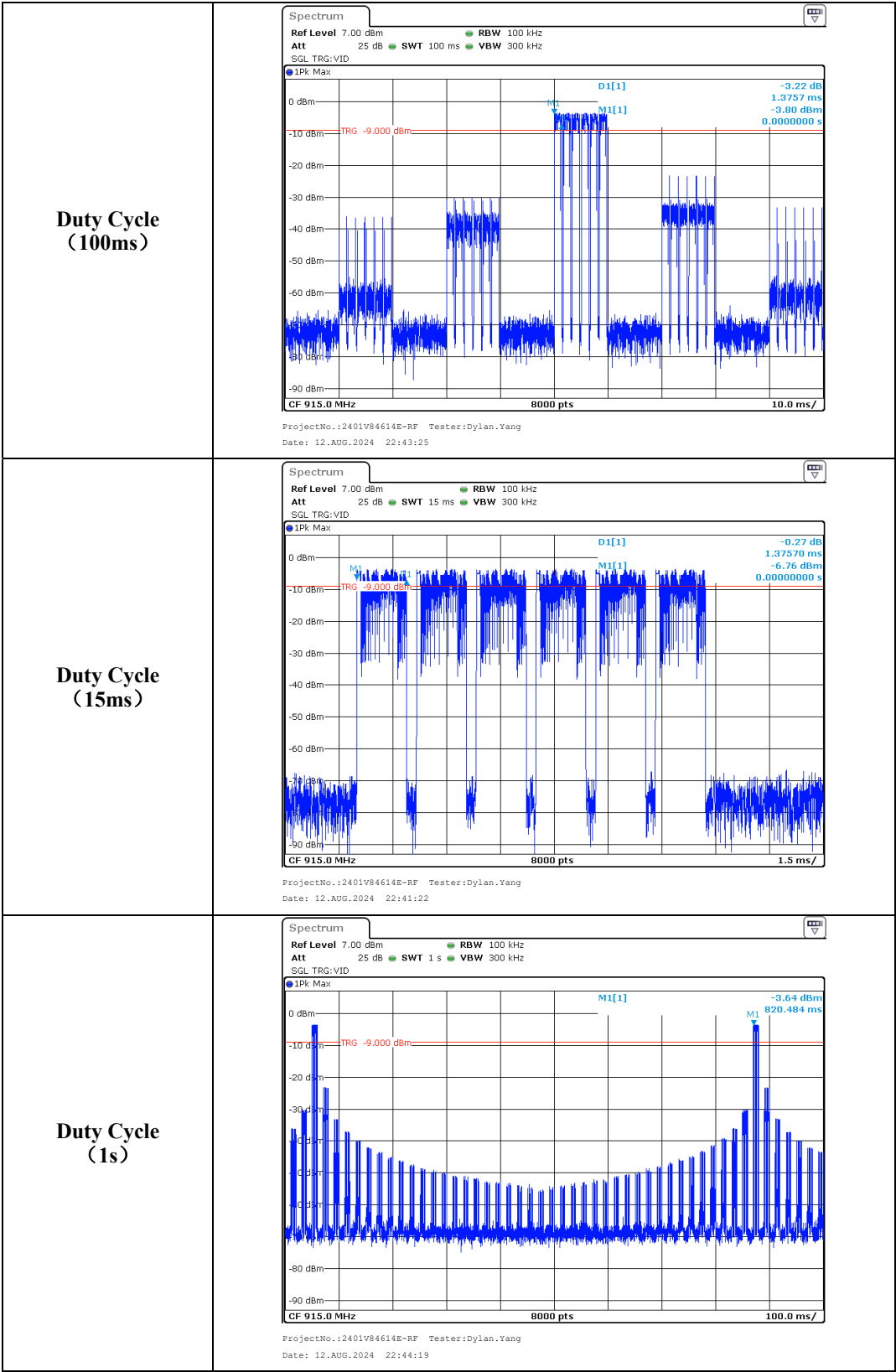
Field Strength of Average							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/RSS-247		
					Limit (dBμV/m)	Margin (dB)	Comment
Low Channel(905MHz)							
2715.00	69.46	H	-21.67	47.79	54.00	-6.21	Harmonic
2715.00	67.67	V	-21.67	46.00	54.00	-8.00	Harmonic
3620.00	67.43	H	-21.67	45.76	54.00	-8.24	Harmonic
3620.00	68.21	V	-21.67	46.54	54.00	-7.46	Harmonic
4525.00	53.23	H	-21.67	31.56	54.00	-22.44	Harmonic
4525.00	50.78	V	-21.67	29.11	54.00	-24.89	Harmonic
Middle Channel(915MHz)							
2745.00	68.47	H	-21.67	46.80	54.00	-7.20	Harmonic
2745.00	67.66	V	-21.67	45.99	54.00	-8.01	Harmonic
3660.00	67.11	H	-21.67	45.44	54.00	-8.56	Harmonic
3660.00	68.04	V	-21.67	46.37	54.00	-7.63	Harmonic
4575.00	52.7	H	-21.67	31.03	54.00	-22.97	Harmonic
4575.00	50.83	V	-21.67	29.16	54.00	-24.84	Harmonic
High Channel(925MHz)							
2775.00	66.09	H	-21.67	44.42	54.00	-9.58	Harmonic
2775.00	63.78	V	-21.67	42.11	54.00	-11.89	Harmonic
3700.00	63.81	H	-21.67	42.14	54.00	-11.86	Harmonic
3700.00	66.69	V	-21.67	45.02	54.00	-8.98	Harmonic
4625.00	50.86	H	-21.67	29.19	54.00	-24.81	Harmonic
4625.00	50.68	V	-21.67	29.01	54.00	-24.99	Harmonic

Note: Average level= Peak level+ Duty Cycle Corrected Factor

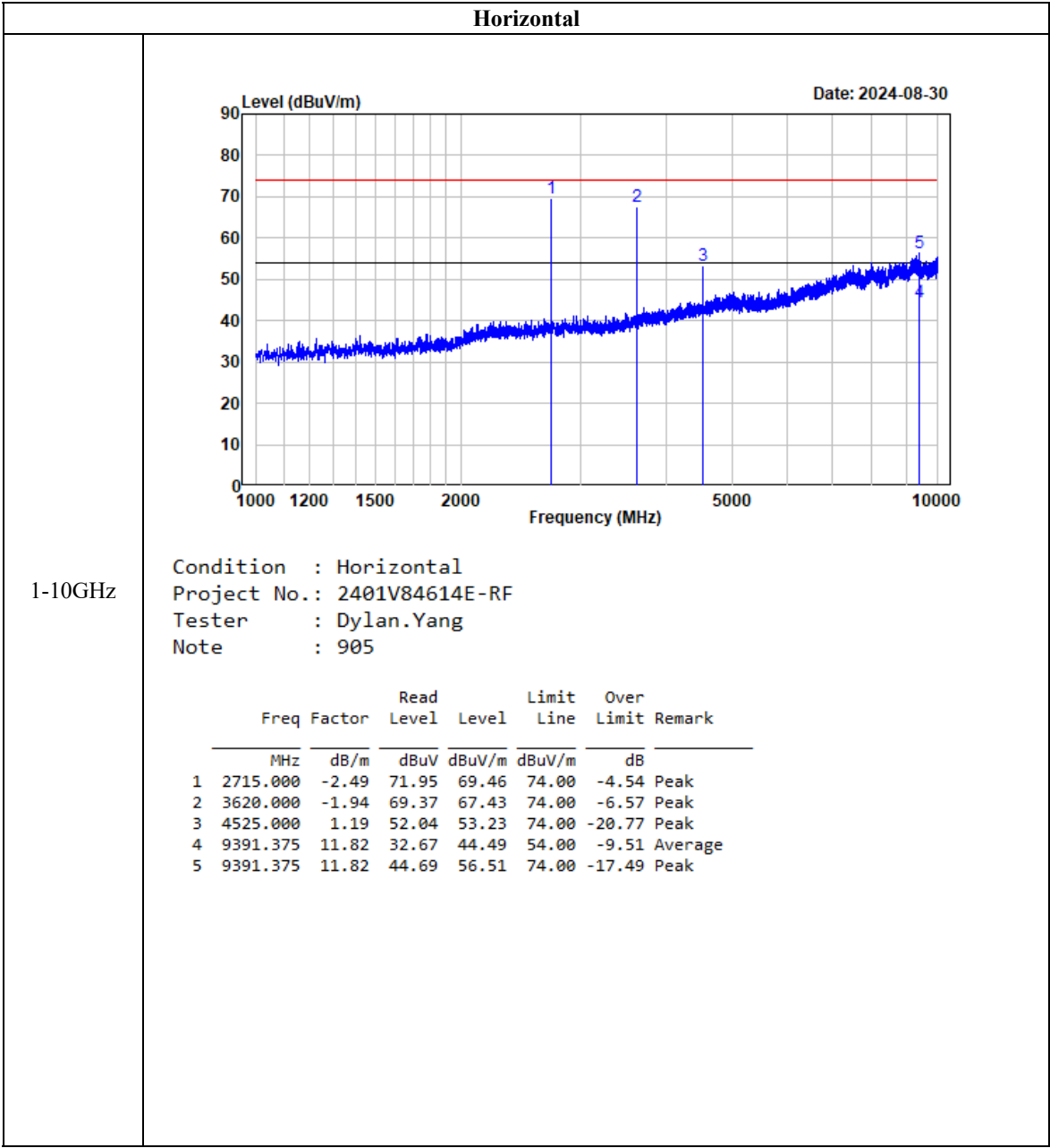
Worst case duty cycle:

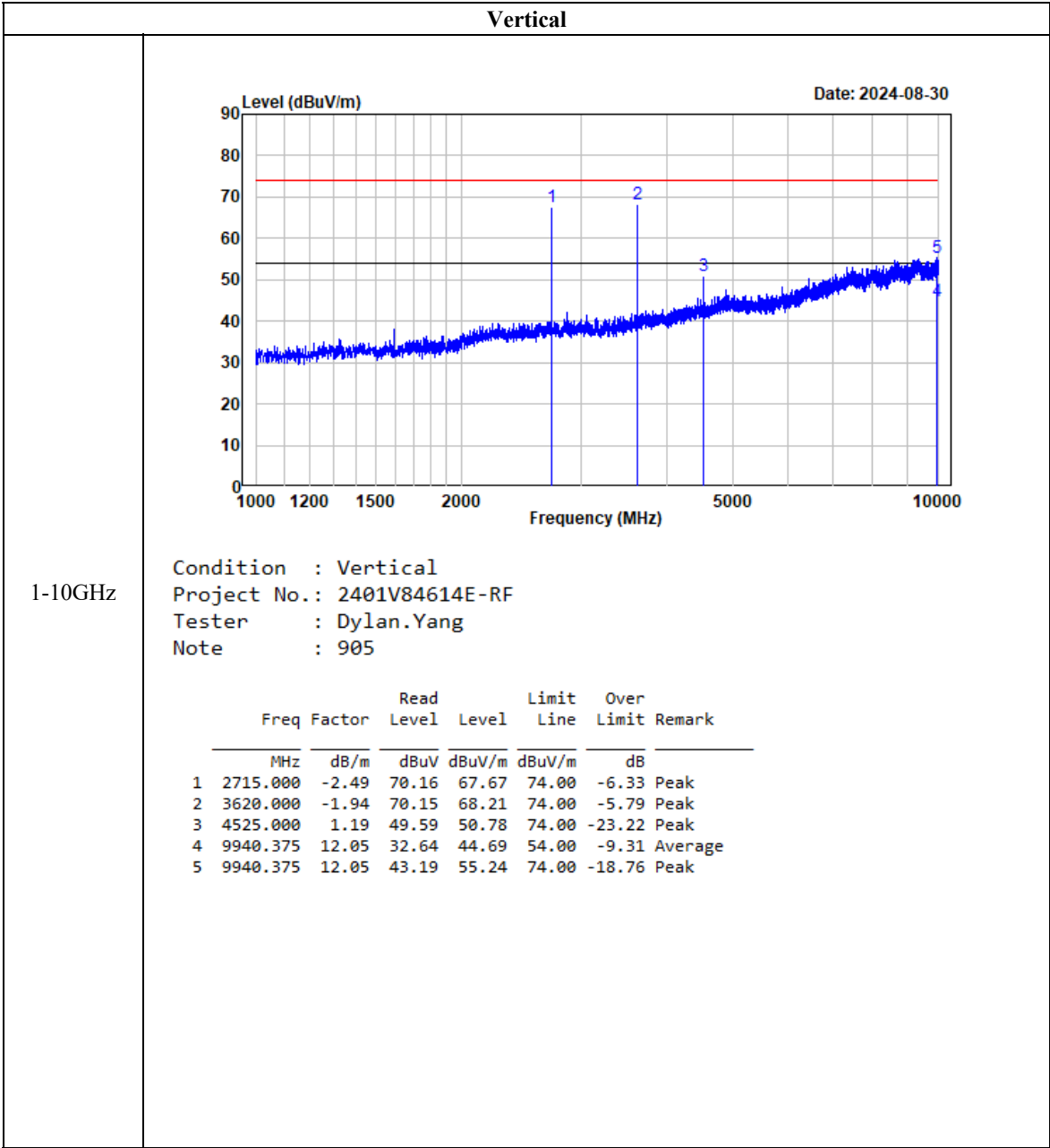
Duty cycle = $T_{on}/100ms = 1.3757*6/100=0.0825$

Duty Cycle Corrected Factor = $20lg(Duty\ cycle) = 20lg0.0825 = -21.67$



Test plots for worst Harmonic and Emissions Measurements:





FCC §15.247(a) (1) & RSS-247 § 5.1 (b)-CHANNEL SEPARATION TEST

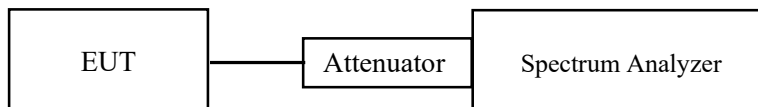
Applicable Standard

Frequency hopping systems (FHSs) shall have hopping 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

According to ANSI C63.10-2013 section 7.8.2

1. Set the EUT in transmitting mode, maxhold the channel and in Operating mode, RBW was start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel, VBW $\geq$ RBW max-hold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.



Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Rainbow Zhu on 2024-07-30.

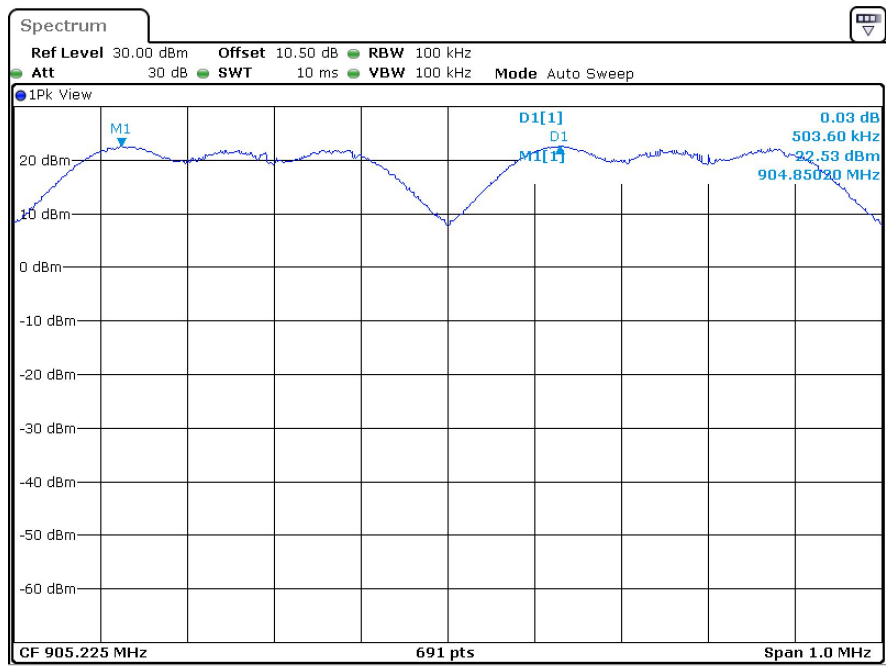
EUT operation mode: Transmitting

Test Result: Compliant.

Test Channel	Test Frequency (MHz)	Channel Separation (MHz)	Limits (MHz)
Hopping	905	0.504	0.333
Note: Limit ≥ 20 dB bandwidth			

Please refer to the below plots:

Lowest



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 17:37:39

FCC §15.247(a) (1) (i) & RSS-GEN § 6.7 & RSS-247 § 5.1 (a) (c)–99% OCCUPIED BANDWIDTH & 20 dB EMISSION BANDWIDTH

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “20 dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 20 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

Test Procedure

According to ANSI C63.10-2013 section 7.8.7

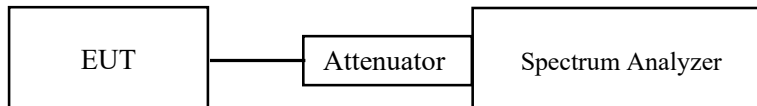
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

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 resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 20 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Rainbow Zhu on 2024-07-30.

EUT operation mode: Transmitting

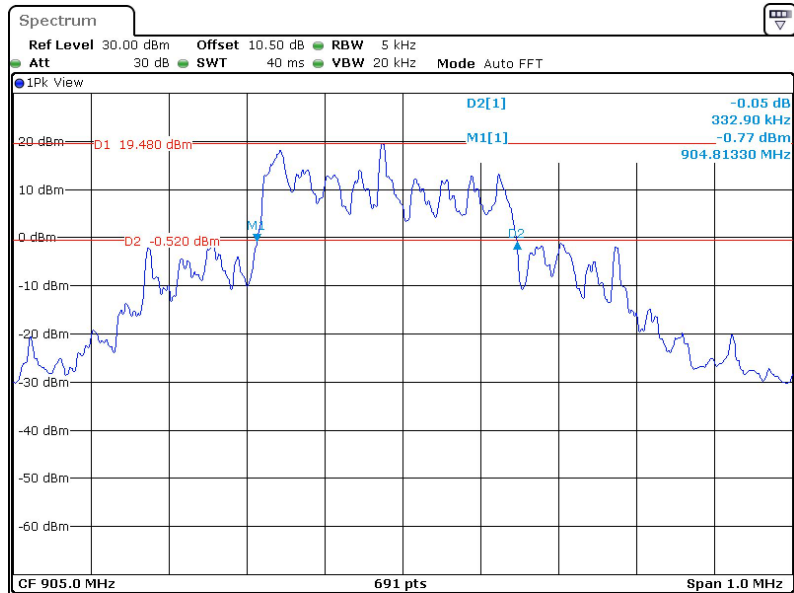
Test Result: Compliant.

Mode	Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)	Limit(MHz)
GFSK	Low	905	0.443	0.333	0.25<BW≤0.5
	Middle	915	0.444	0.333	0.25<BW≤0.5
	High	925	0.443	0.333	0.25<BW≤0.5

Please refer to the below plots:

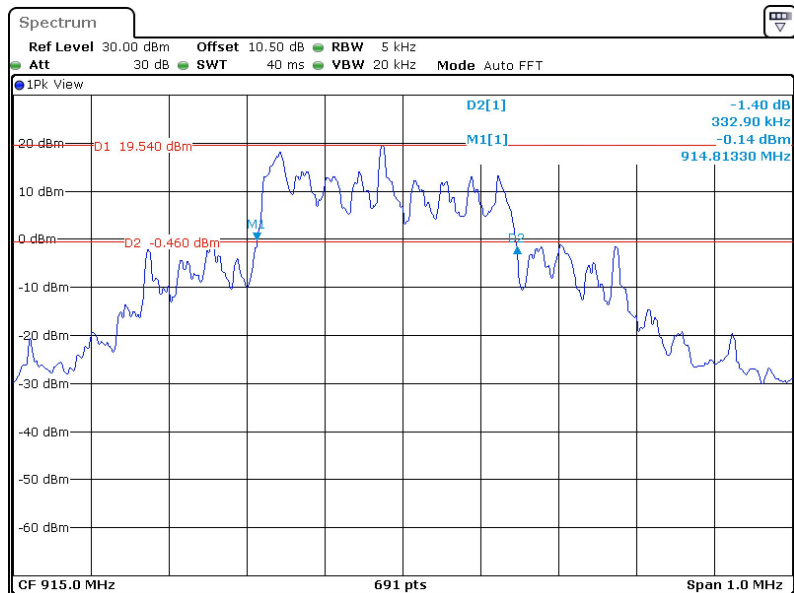
20 dB Emission Bandwidth

Low Channel



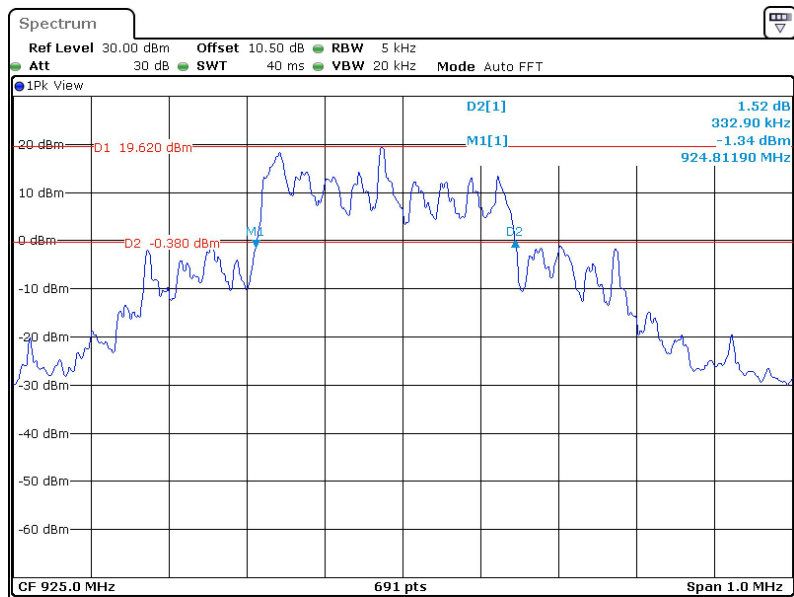
ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 15:02:37

Middle Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 15:05:19

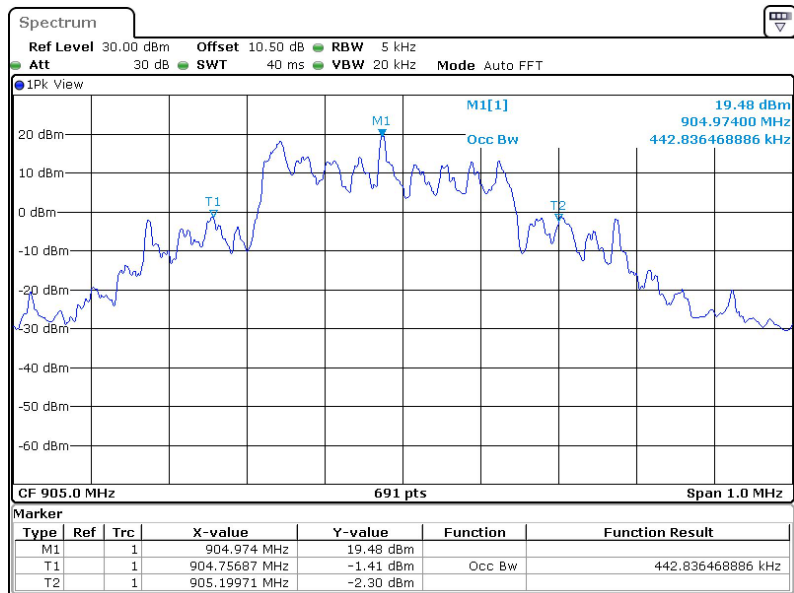
High Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 15:07:49

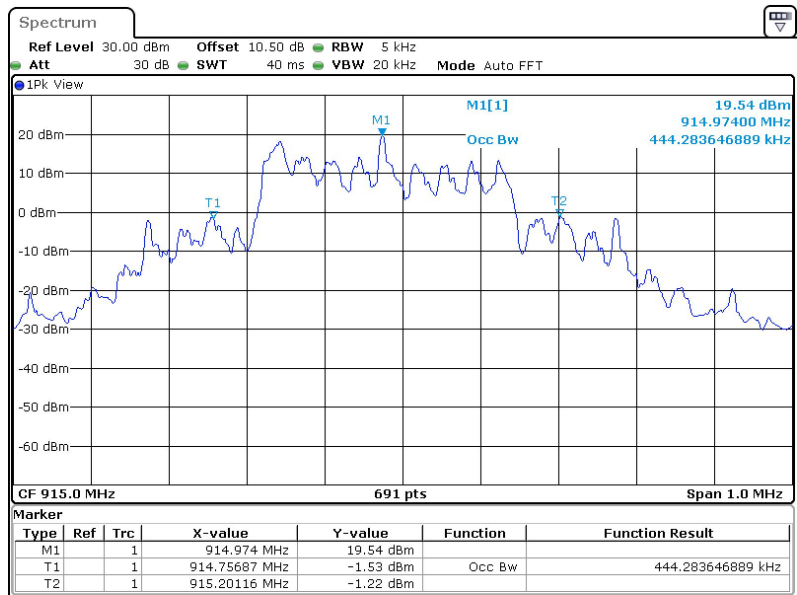
99% Occupied Bandwidth

Low Channel



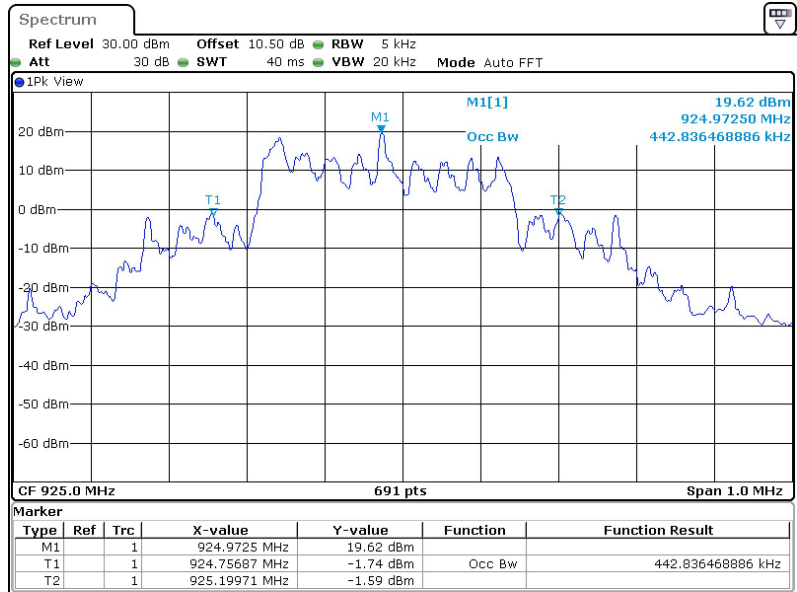
ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:56:48

Middle Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:55:05

High Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:56:00

FCC §15.247(a) (1) (i) & RSS-247 § 5.1 (c)-QUANTITY OF HOPPING CHANNEL TEST

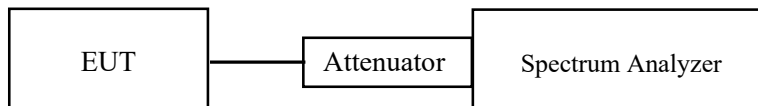
Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

According to ANSI C63.10-2013 section 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 Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

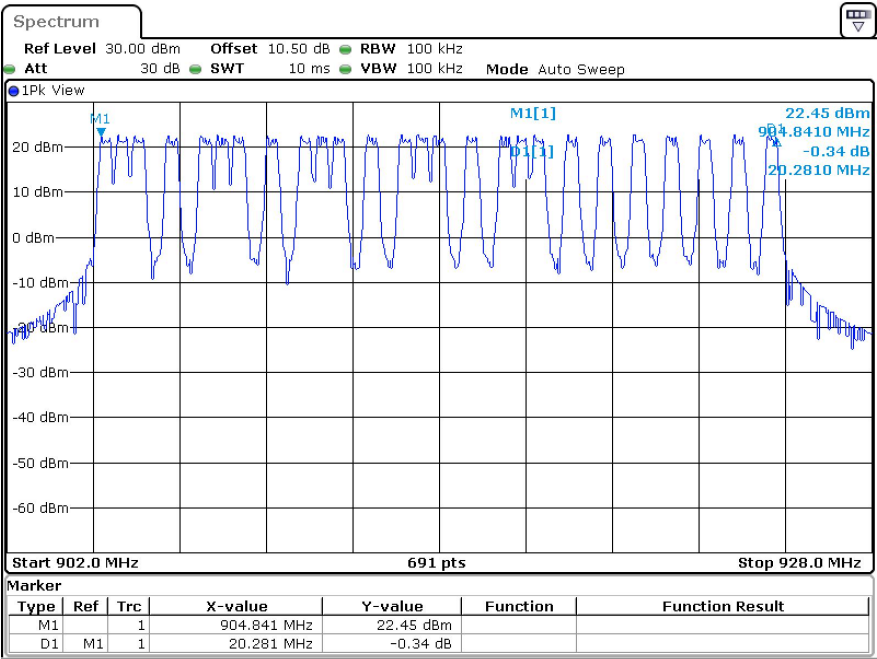
The testing was performed by Rainbow Zhu on 2024-07-30.

EUT operation mode: Transmitting

Test Result: Compliant.

Mode	Frequency Range (MHz)	Number of Hopping Channel	Limit
GFSK	902-928	26	≥25

Hop



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 16:35:59

FCC §15.247(a) (1) (i) & RSS-247 § 5.1 (c) - TIME OF OCCUPANCY (DWELL TIME)

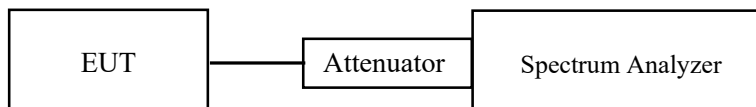
Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Test Procedure

According to ANSI C63.10-2013 section 7.8.4

1. The EUT was worked in channel hopping.
2. Set the RBW to: 10kHz.
3. Set the VBW $\geq 3 \times$ 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:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

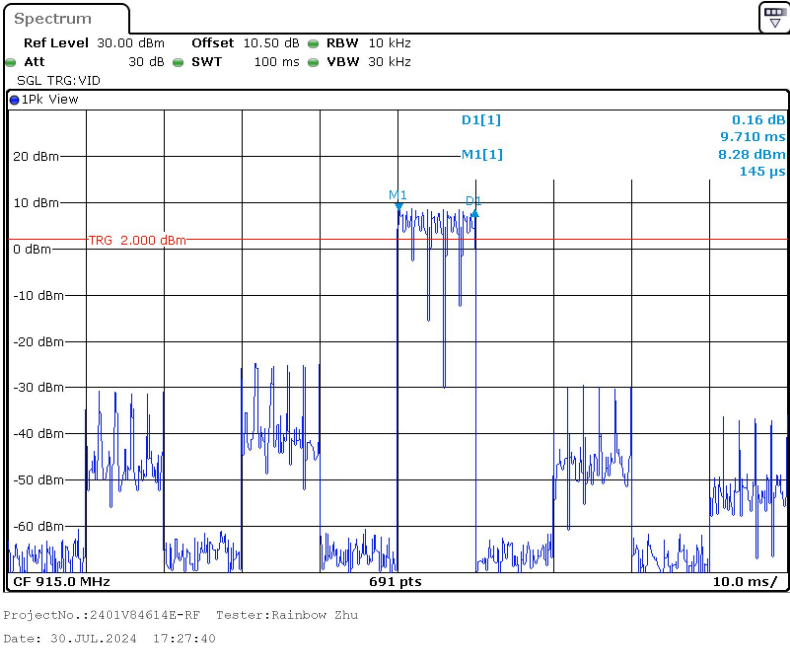
The testing was performed by Rainbow Zhu on 2024-07-30..

EUT operation mode: Transmitting

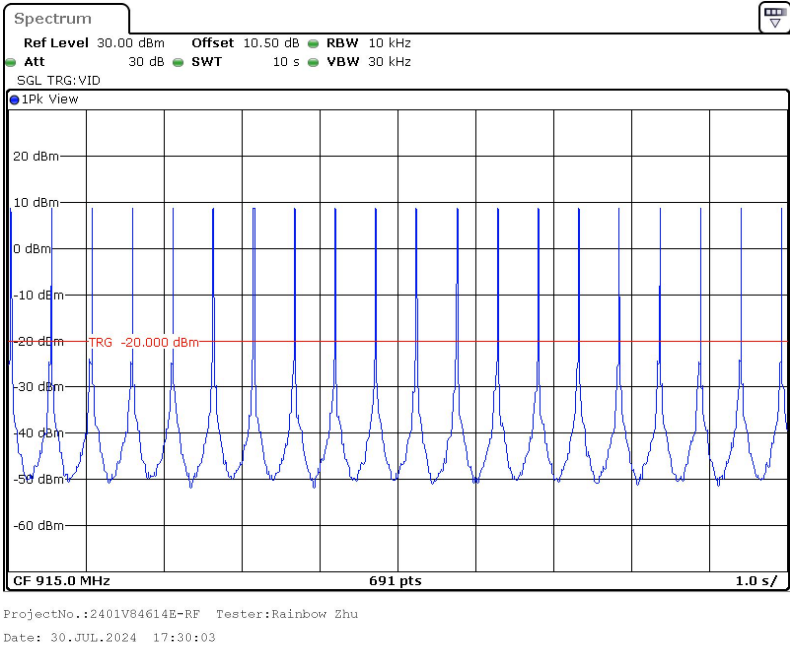
Test Result: Compliant.

Test Frequency (MHz)	Pulse width (ms)	Observation time (s)	Hopping Numbers in Observation time	Dwell Time (s)	Limit (s)
915	9.710	10	20	0.194	0.400
Note: Observation time= 10s					

Pulse Time



Hopping Numbers in 10s



FCC §15.247(b) (2) & RSS-247§ 5.4(a) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

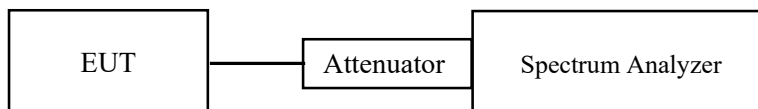
According to §15.247(b) (2), For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

According to RSS-247 § 5.4(a) For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

Test Procedure

According to ANSI C63.10-2013 section 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 Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

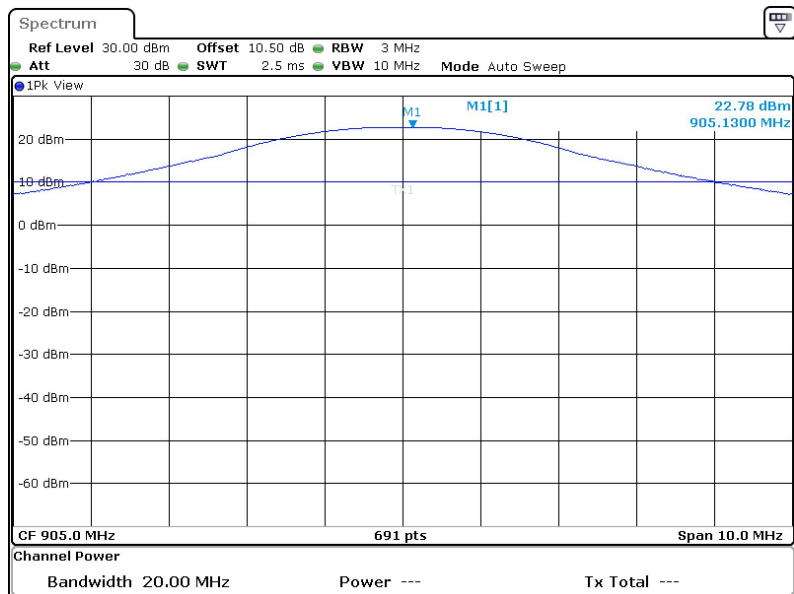
The testing was performed by Rainbow Zhu on 2024-07-30. .

EUT operation mode: Transmitting

Test Result: Compliant.

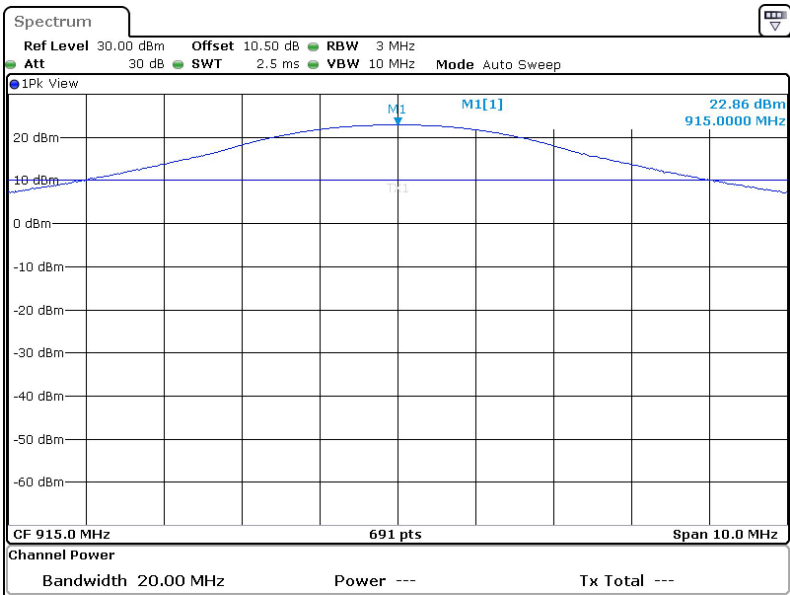
Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
GFSK	Low	905	22.78	24
	Middle	915	22.86	24
	High	925	22.94	24
Note: EIRP Limit for RSS-247:30dBm The antenna gain=0dBi, the maximum EIRP= 22.94dBm<30dBm				

Low Channel



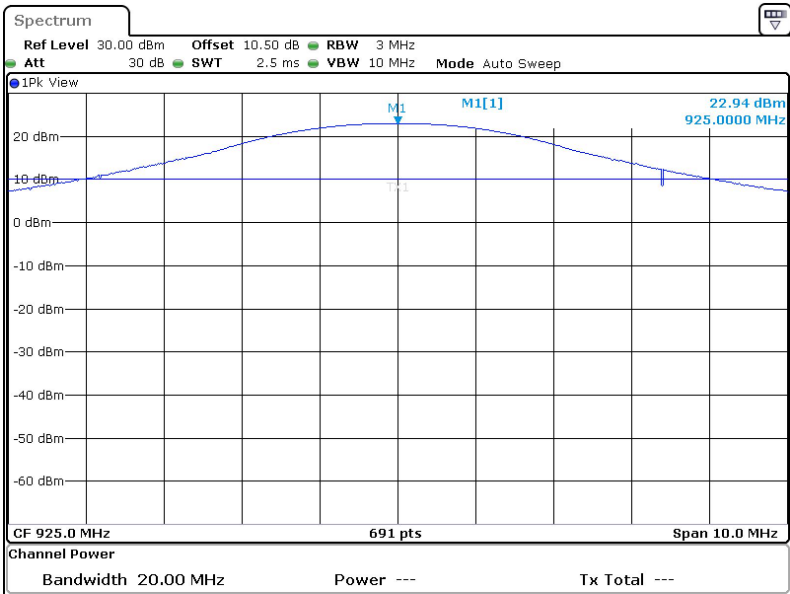
ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:50:48

Middle Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:51:48

High Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 14:49:01

FCC §15.247(d) & RSS-247 § 5.5 - BAND EDGES TESTING

Applicable Standard

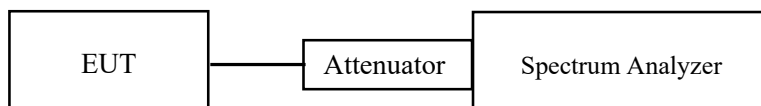
According to FCC §15.247(d) & RSS-247 § 5.5.

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)) & RSS-Gen.

Test Procedure

According to ANSI C63.10-2013 section 6.10

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 a 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 Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

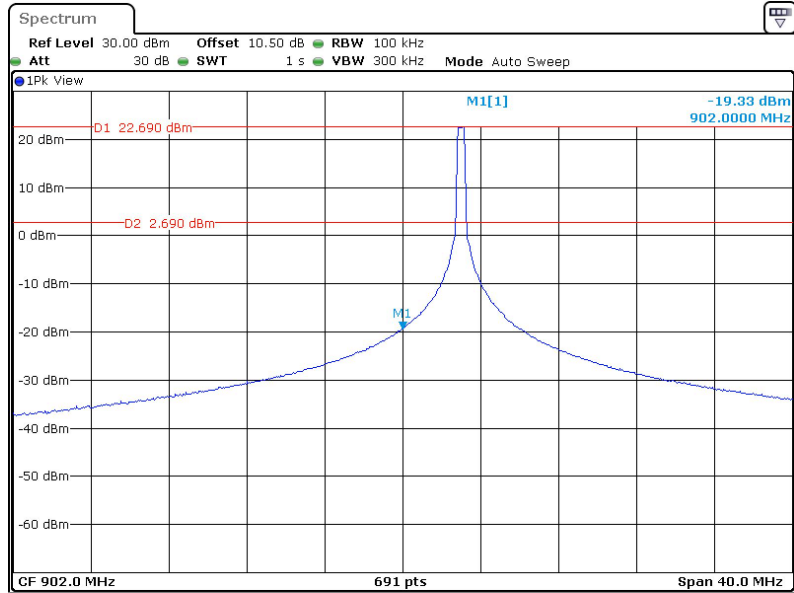
The testing was performed by Rainbow Zhu on 2024-07-30. .

EUT operation mode: Transmitting

Test Result: Compliant.

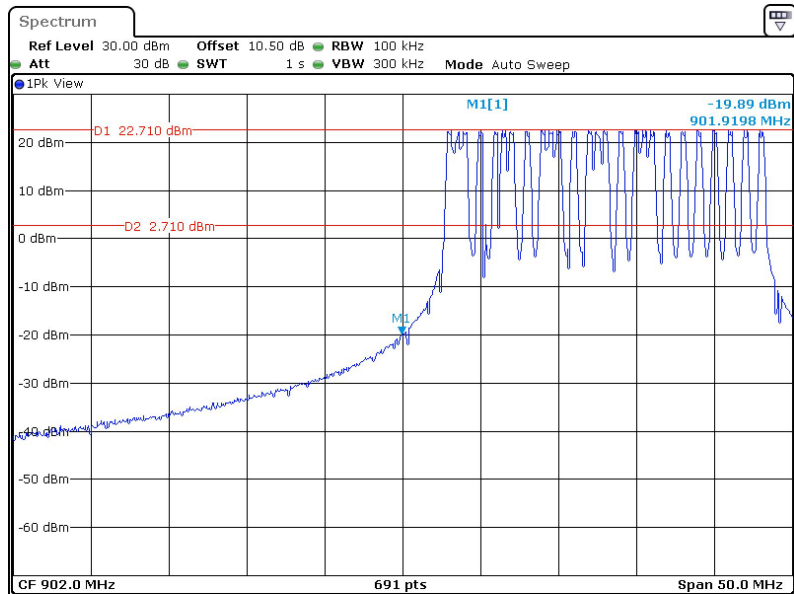
Conducted Band Edge Result:

GFSK_Low Channel



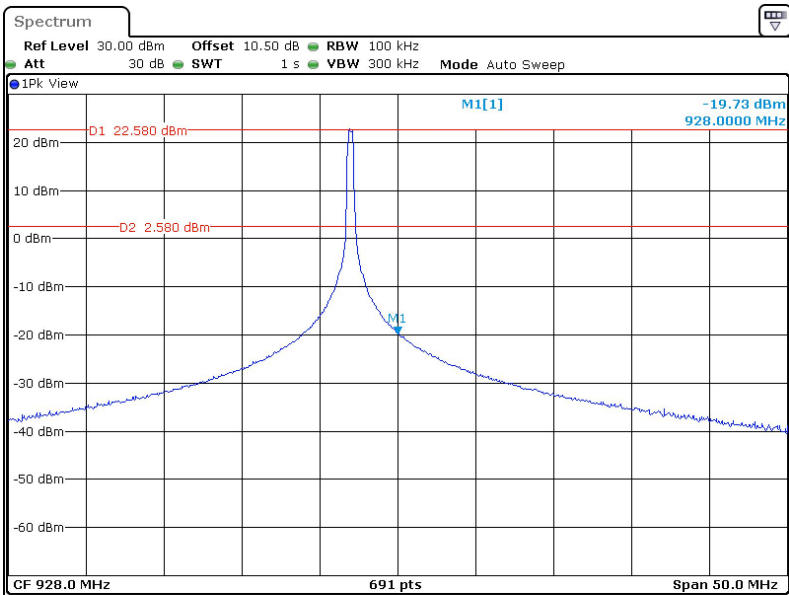
ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 16:27:58

GFSK_Hop_Low Channel



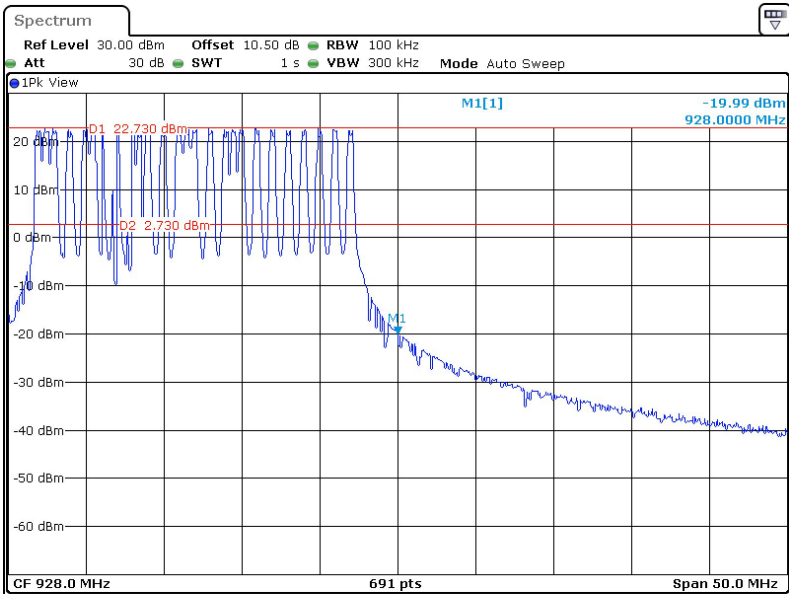
ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 16:49:30

GFSK_High Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 16:30:26

GFSK_Hop_High Channel



ProjectNo.:2401V84614E-RF Tester:Rainbow Zhu
Date: 30.JUL.2024 16:43:49

EUT PHOTOGRAPHS

Please refer to the attachment 2401V84614E-RF External photo and 2401V84614E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401V84614E-RFB Test Setup photo.

******* END OF REPORT *******