TEST REPORT

Applicant Name:	Loewe Technology GmbH
Address:	Industriestrasse 11, 96317 Kronach, Germany
Report Number:	2401S39342E-RF-00A
FCC ID:	2AZD4-64510D10

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	We. BEAM
Model No.:	64510D10
Multiple Model(s) No.:	N/A
Trade Mark:	We. by Loewe.
Date Received:	2024/04/25
Issue Date:	2024/07/12

Test Result:	Pass▲

▲ In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Bruce Lin

RF Engineer

Approved By:

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.

This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "▼".

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401S39342E-RF-00A	Original Report	2024/07/12

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	We. BEAM
Tested Model	64510D10
Multiple Model(s)	N/A
Frequency Range	Bluetooth: 2402~2480MHz
Transmit Peak Power	9.42dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification#	2.11dBi (provided by the applicant)
Voltage Range	DC 20.0V from adapter
Sample serial number	2KFJ-2 for Conducted and Radiated Emissions Test 2KFJ-1 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	Model: P6514I Input: AC 100-240V, 50/60Hz, 1.5A Output: DC 5.0V/9.0V/12.0V/15.0V, 3.0A or 20.0V, 3.25A, 65.0W, Max

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.207, 15.205, 15.209 and 15.247 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.

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.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		0.72 dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz-150kHz	3.94dB(k=2, 95% level of confidence)
	150kHz-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℃
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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	41	2443
2	2404	42	2444
…	…	…	…
…	…	…	…
36	2438	75	2477
37	2439	76	2478
38	2440	77	2479
39	2441	78	2480

EUT was tested with Channel 0, 39 and 78.

EUT Exercise Software

"WCN_Conbo_Tool"# exercise software was used and the power level is 7#. The software and power level was provided by the applicant.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

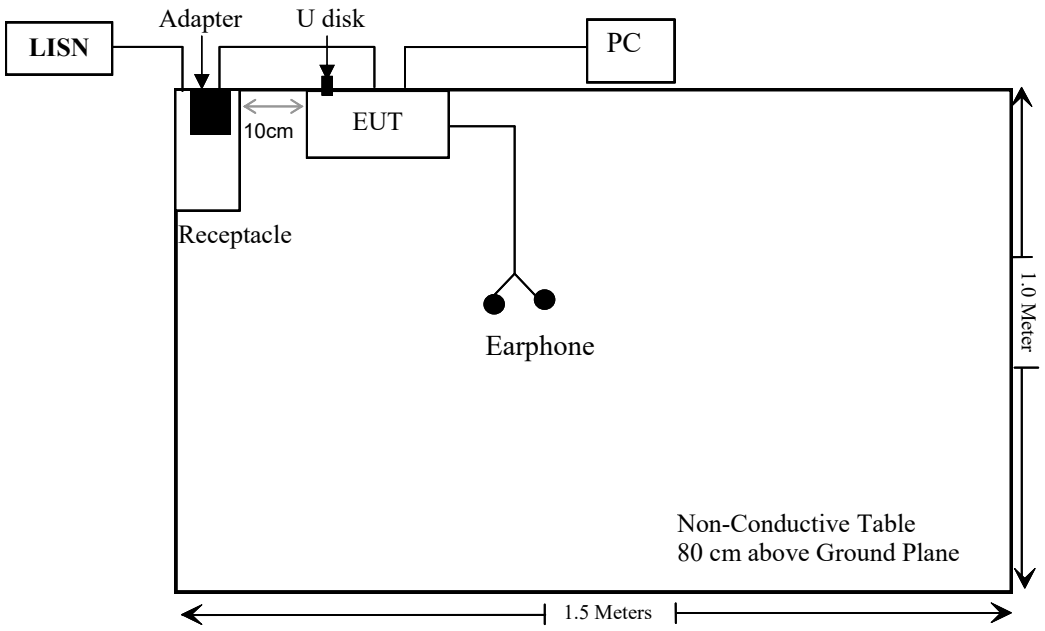
Manufacturer	Description	Model	Serial Number
Xiao mi	Earphone	Unknown	Unknown
Kingston	U disk	Unknown	Unknown
Lenovo	PC	TIANYI510Pro-18ICB	R3NO28B21001

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielded Un-Detachable DC Cable	1.0	EUT	Adapter
Un-shielded Detachable HDMI cable	1.6	EUT	PC
Un-shielded Detachable Audio cable	1.2	EUT	Earphone

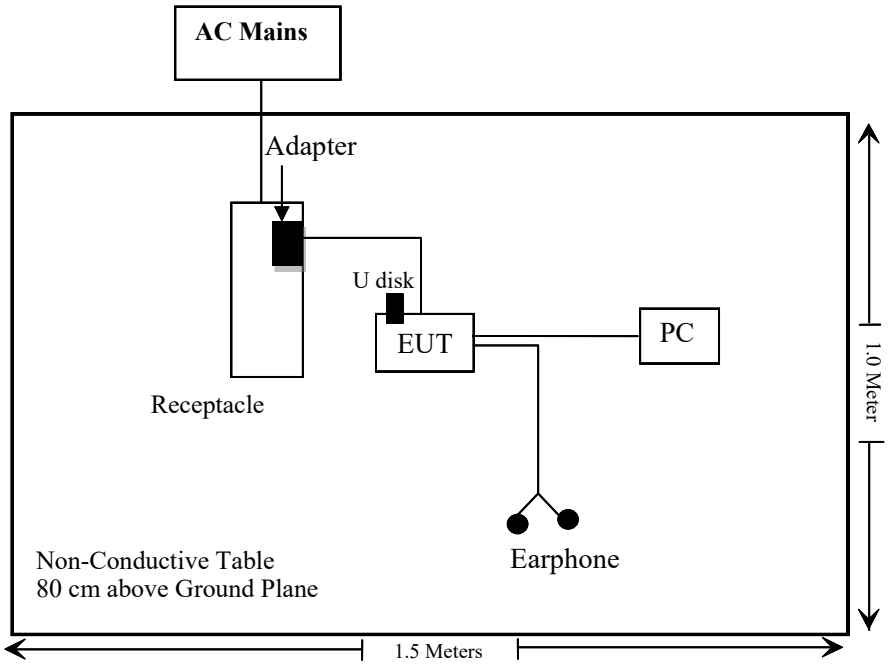
Block Diagram of Test Setup

For conducted emission

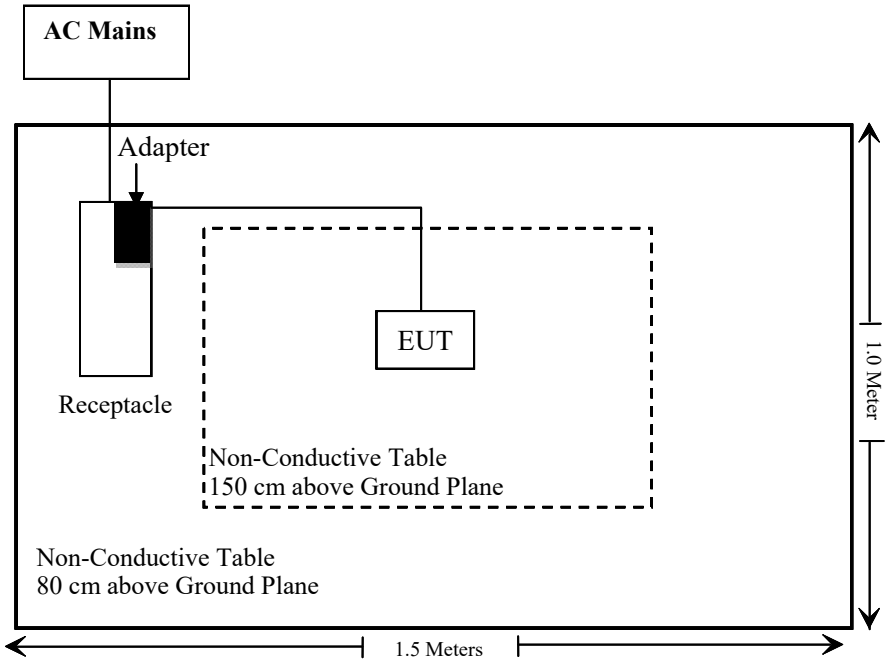


For Radiated Emissions:

Below 1GHz



Above 1GHz



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC 15.247 (i), §1.1307 (b) & §2.1091	MPE-Based Exemption	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207(a)	AC Line Conducted Emissions	Compliant
FCC §15.205, §15.209, §15.247(d)	Radiated Emissions	Compliant
FCC §15.247(a)(1)	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
FCC §15.247(a)(1)	Channel Separation Test	Compliant
FCC §15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
FCC §15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
FCC §15.247(b)(1)	Peak Output Power Measurement	Compliant
FCC §15.247(d)	Band edges	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2024/01/16	2025/01/15
Rohde & Schwarz	LISN	ENV216	101613	2024/01/16	2025/01/15
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2023/08/03	2024/08/02
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2023/06/08	2024/06/07
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
BACL	Active Loop Antenna	1313-1A	4031911	2024/03/21	2025/03/20
Unknown	Cable	Chamber Cable 1	F-03-EM236	2023/08/03	2024/08/02
Unknown	Cable	Chamber Cable 4	EC-007	2023/08/03	2024/08/02
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
COM-POWER	Pre-amplifier	PA-122	181919	2023/06/29	2024/06/28
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	0735	2023/10/08	2024/10/07
Unknown	RF Cable	UFA147	219661	2023/10/08	2024/10/07
Unknown	RF Cable	XH750A-N	J-10M	2023/10/08	2024/10/07
JD	Multiplex Switch Test Control Set	DT7220FSU	DQ77926	NCR	NCR
SNSD	2.4G Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2023/08/03	2024/08/02
A.H.System	Pre-amplifier	PAM-1840VH	190	2023/08/02	2024/08/01
Electro-Mechanics Co	Horn Antenna	3116	9510-2270	2023/09/18	2026/09/17
UTIFLEX	RF Cable	NO. 13	232308-001	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
RF Conducted Test					
R&S	spectrum analyzer	FSV40	101942	2023/12/18	2024/12/17
Unknown	10dB Attenuator	Unknown	F-03-EM122	2023/07/04	2024/07/03
Unknown	RF Cable	65475	01670515	2023/07/04	2024/07/03

*** 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 1.1307 (B) & §2.1091- MPE-BASED EXEMPTION

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemptionfrom further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

R is the minimum separation distance in meters
f = frequency in MHz

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Result

Mode	Frequency (MHz)	Tune up conducted power#	Antenna Gain#		ERP		Evaluation Distance (m)	ERP Limit (mW)
		(dBm)	(dBi)	(dBd)	(dBm)	(mW)		
BT	2402-2480	9.5	2.11	-0.04	9.46	8.83	0.2	768
BLE	2402-2480	8.0	2.11	-0.04	7.96	6.25	0.2	768
2.4G Wi-Fi	2412-2462	28.5	2.34	0.19	28.69	739.61	0.2	768
5.2G Wi-Fi	5180-5240	13.5	3.19	1.04	14.54	28.44	0.2	768
5.3G Wi-Fi	5260-5320	19.0	3.19	1.04	20.04	100.93	0.2	768
5.6G Wi-Fi	5500-5720	17.0	3.19	1.04	18.04	63.68	0.2	768
5.8G Wi-Fi	5745-5825	18.5	3.19	1.04	19.54	89.95	0.2	768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT and Wi-Fi can transmit at same time. The 2.4G and 5G Wi-Fi cannot transmit at same time.
3. 0dBd=2.15dBi

Simultaneous transmitting consideration (worst case):

The ratio=ERP_{BT}/limit+$ERP_{2.4G\ Wi\text{-}Fi}$/limit = 8.83/768+739.61/768 =0.975＜1.0,
so simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §15.203 - 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.

Antenna Connector Construction

The EUT has one internal antenna arrangement, which was permanently attached, the antenna gain[#] is 2.11dBi, fulfill the requirement of this section. Please refer to the EUT photos.

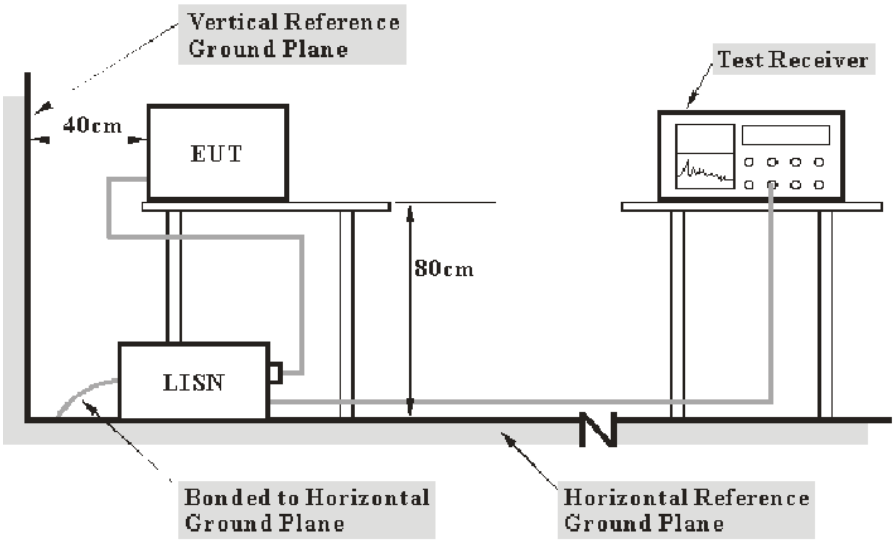
Result: Compliant

FCC §15.207 (a) - AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Factor & Over Limit Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

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

Over Limit = Level – Limit
Level = Read Level + Factor

Note: The term "cable loss" refers to the combination of a cable and a 10dB transient limiter (attenuator).

Test Data

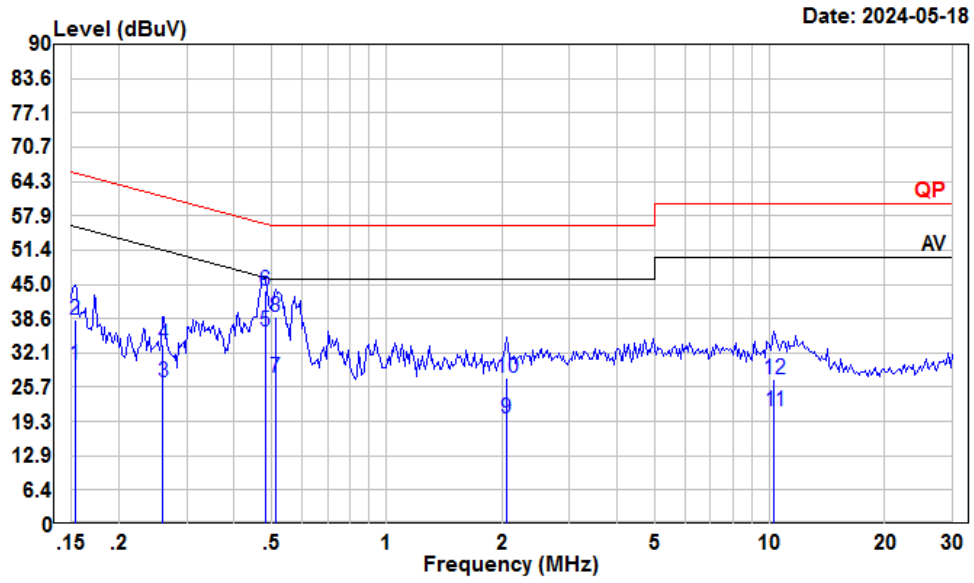
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	62 %
ATM Pressure:	101 kPa

The testing was performed by Macy Shi on 2024-05-18.

EUT operation mode: Transmitting (Maximum output power mode, 8DPSK Middle Channel)

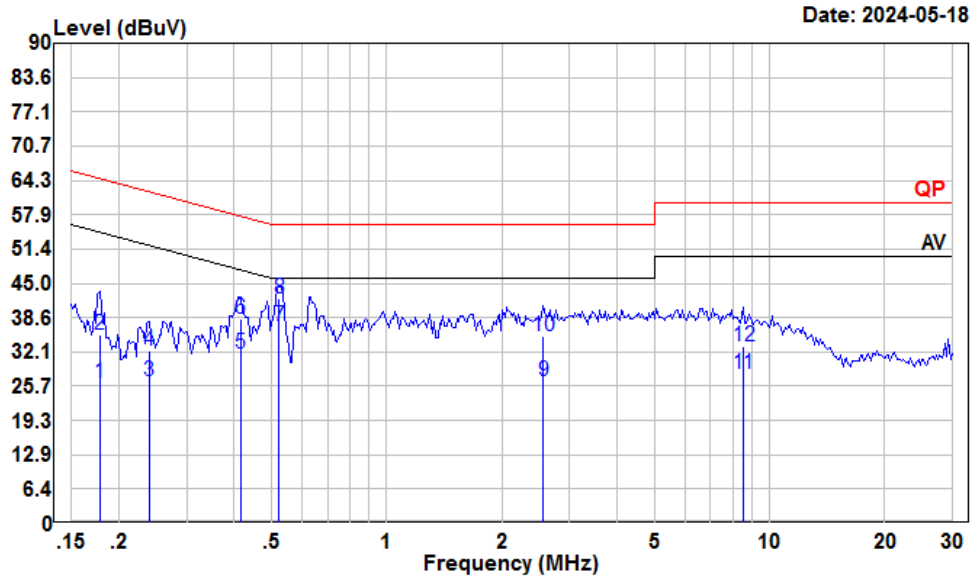
AC 120V/60 Hz, Line



Condition: Line
Project : 2401S39342E-RF
Tester : Macy shi
Note : BT

	Freq	Read Level	LISN Level	Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.15	8.77	29.81	10.89	10.15	55.82	-26.01	Average
2	0.15	17.20	38.24	10.89	10.15	65.82	-27.58	QP
3	0.26	5.67	26.57	10.71	10.19	51.42	-24.85	Average
4	0.26	12.88	33.78	10.71	10.19	61.42	-27.64	QP
5	0.48	15.57	36.24	10.51	10.16	46.32	-10.08	Average
6	0.48	23.07	43.74	10.51	10.16	56.32	-12.58	QP
7	0.51	6.81	27.47	10.50	10.16	46.00	-18.53	Average
8	0.51	18.19	38.85	10.50	10.16	56.00	-17.15	QP
9	2.06	-0.87	19.91	10.59	10.19	46.00	-26.09	Average
10	2.06	6.81	27.59	10.59	10.19	56.00	-28.41	QP
11	10.29	0.31	21.16	10.60	10.25	50.00	-28.84	Average
12	10.29	6.41	27.26	10.60	10.25	60.00	-32.74	QP

AC 120V/60 Hz, Neutral



Condition: Neutral
Project : 2401S39342E-RF
Tester : Macy shi
Note : BT

	Freq	Read Level	LISN Level	Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.18	5.88	26.49	10.48	10.13	54.59	-28.10	Average
2	0.18	14.78	35.39	10.48	10.13	64.59	-29.20	QP
3	0.24	5.98	26.62	10.46	10.18	52.13	-25.51	Average
4	0.24	11.85	32.49	10.46	10.18	62.13	-29.64	QP
5	0.41	11.04	31.89	10.64	10.21	47.55	-15.66	Average
6	0.41	17.49	38.34	10.64	10.21	57.55	-19.21	QP
7	0.52	16.12	36.99	10.70	10.17	46.00	-9.01	Average
8	0.52	21.24	42.11	10.70	10.17	56.00	-13.89	QP
9	2.57	6.11	26.73	10.40	10.22	46.00	-19.27	Average
10	2.57	14.54	35.16	10.40	10.22	56.00	-20.84	QP
11	8.50	6.97	27.96	10.75	10.24	50.00	-22.04	Average
12	8.50	12.30	33.29	10.75	10.24	60.00	-26.71	QP

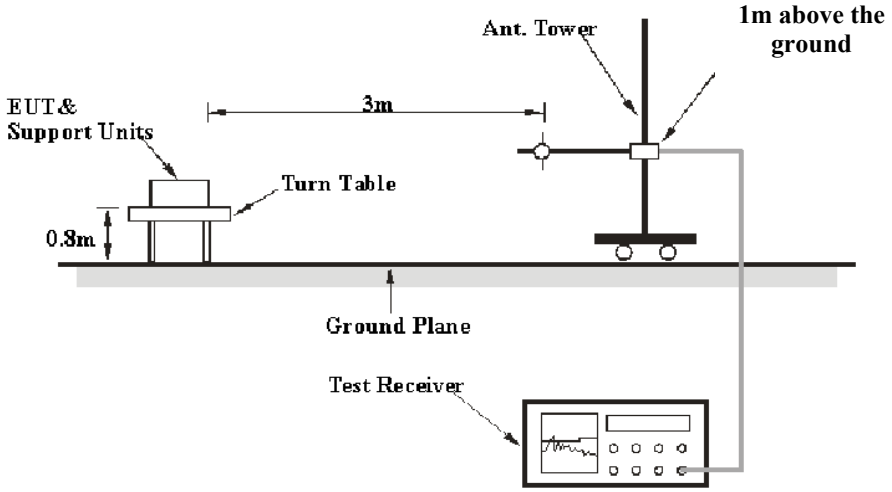
FCC §15.205, §15.209 & §15.247(d) - RADIATED EMISSIONS

Applicable Standard

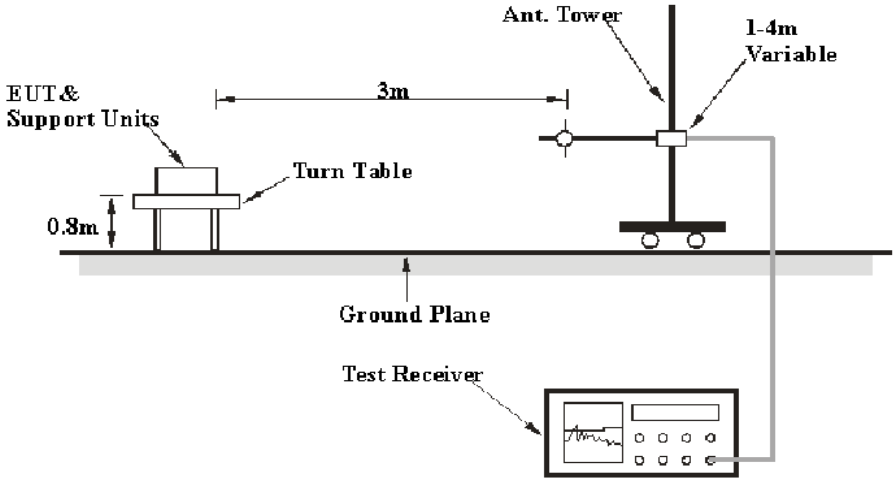
FCC §15.205; §15.209; §15.247(d)

EUT Setup

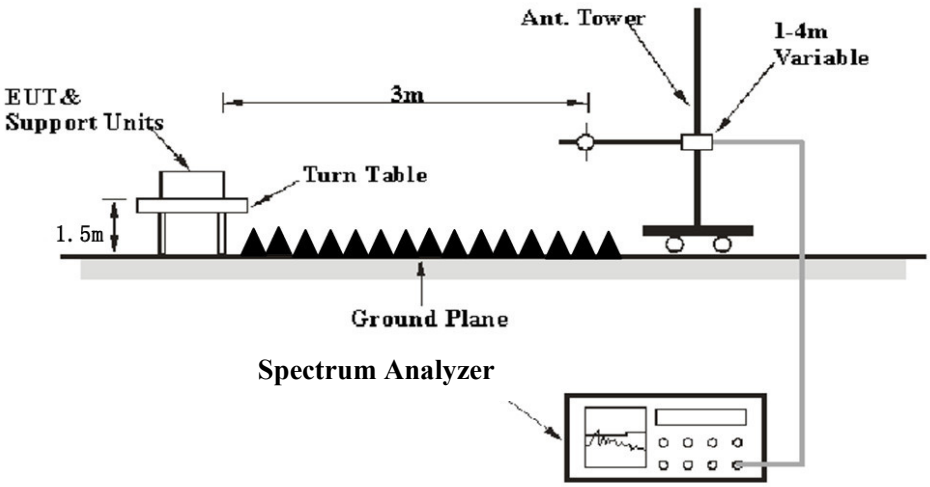
9 kHz-30MHz:



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 and FCC 15.247 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 & Band Edge			
	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=N1*L1+N2*L2+…Nn-1*Ln-1+Nn*Ln,
Where N1 is number of type 1 pulses, L1 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:

Factor = Antenna Factor + Cable Loss - 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:

Over Limit/Margin = Level/Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	25~25.5 ℃
Relative Humidity:	50~54 %
ATM Pressure:	101 kPa

The testing was performed by Warren Huang on 2024-05-10 for below 1GHz and Zenos Qiao from 2024-05-08 to 2024-05-09 for above 1GHz.

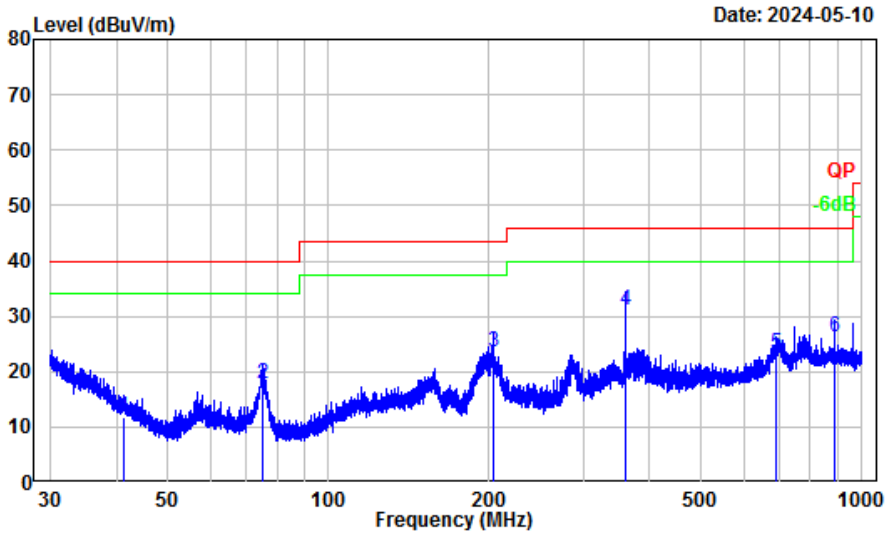
Test mode: Transmitting

9 kHz-30MHz: *(Maximum output power mode, 8DPSK Middle Channel)*

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

30MHz-1GHz: *(Maximum output power mode, 8DPSK Middle Channel)*

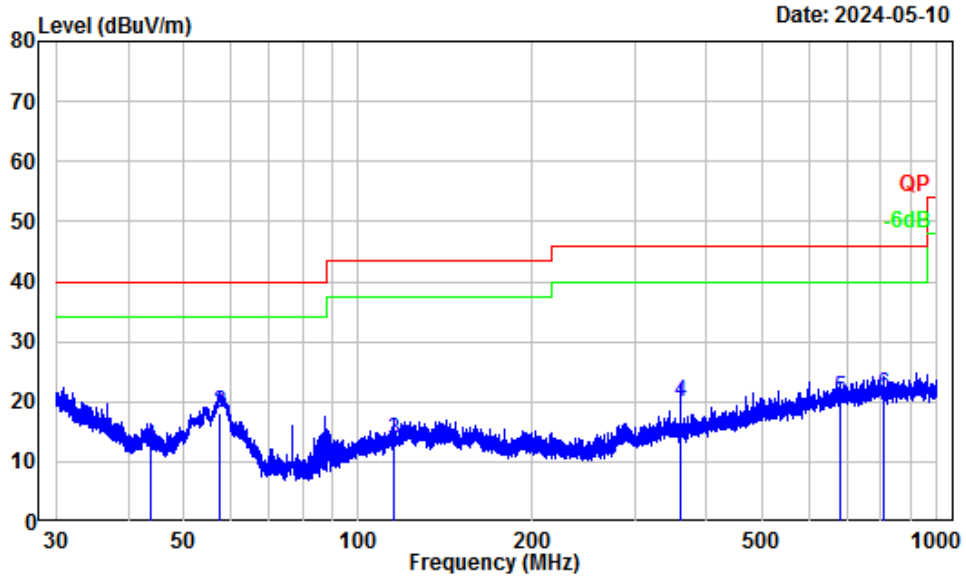
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401S39342E-RF
Note : BT
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.19	-12.28	24.00	11.72	40.00	-28.28	QP
2	75.25	-17.91	35.58	17.67	40.00	-22.33	QP
3	203.97	-13.55	37.18	23.63	43.50	-19.87	QP
4	360.13	-11.71	42.95	31.24	46.00	-14.76	QP
5	689.26	-6.29	29.61	23.32	46.00	-22.68	QP
6	889.95	-4.52	30.82	26.30	46.00	-19.70	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401S39342E-RF
Note : BT
Tester : Warren Huang

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	43.72	-15.12	27.42	12.30	40.00	-27.70	QP
2	57.70	-18.81	36.85	18.04	40.00	-21.96	QP
3	115.42	-13.46	27.10	13.64	43.50	-29.86	QP
4	359.97	-11.99	31.77	19.78	46.00	-26.22	QP
5	679.07	-6.78	27.18	20.40	46.00	-25.60	QP
6	808.49	-5.35	26.59	21.24	46.00	-24.76	QP

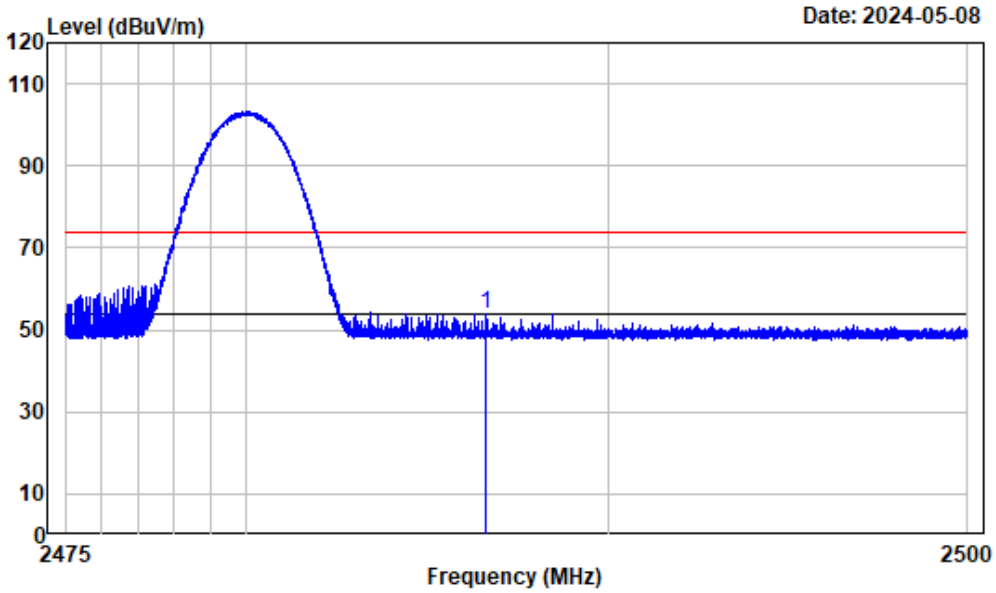
Above 1GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/AV					
8DPSK							
Low Channel 2402MHz							
2359.54	54.89	PK	H	-2.93	51.96	74	-22.04
2357.25	54.64	PK	V	-2.93	51.71	74	-22.29
4804.00	46.94	PK	H	2.42	49.36	74	-24.64
4804.00	47.26	PK	V	2.42	49.68	74	-24.32
Middle Channel 2441MHz							
4882.00	47.23	PK	H	2.58	49.81	74	-24.19
4882.00	47.49	PK	V	2.58	50.07	74	-23.93
High Channel 2480MHz							
2486.64	57.12	PK	H	-3.17	53.95	74	-20.05
2483.89	56.45	PK	V	-3.17	53.28	74	-20.72
4960.00	47.57	PK	H	2.68	50.25	74	-23.75
4960.00	47.88	PK	V	2.68	50.56	74	-23.44

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was less than the limit of average, so just peak values were recorded.

Test plots for Band Edge Measurements (Radiated):

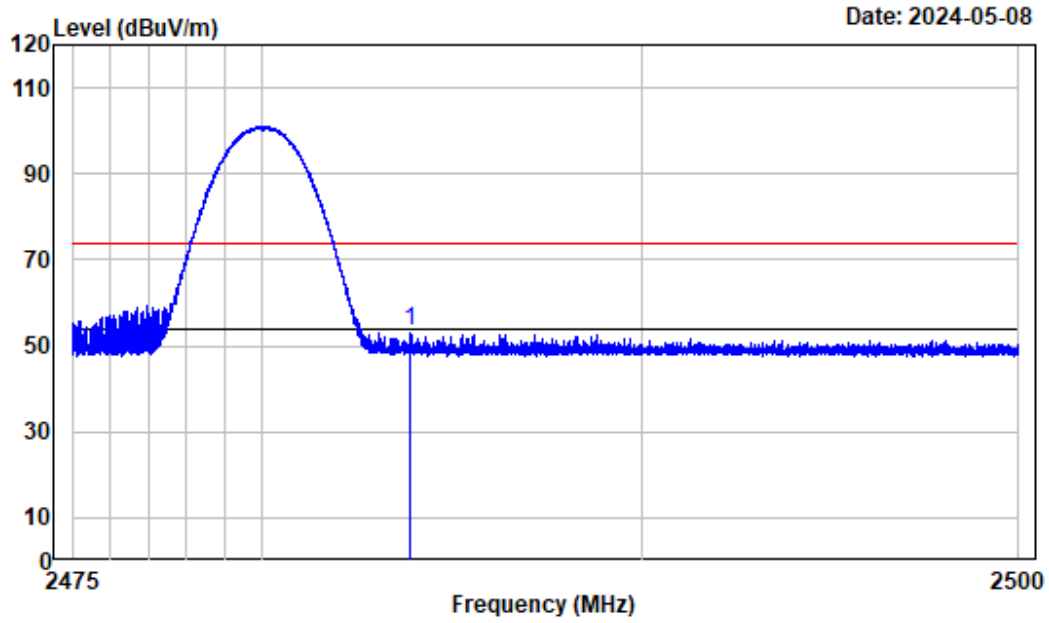
8DPSK			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Horizontal**



Condition : Horizontal
Project No.: 2401S39342E-RF
Tester : Zenos Qiao
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2486.644	-3.17	57.12	53.95	74.00	-20.05	Peak

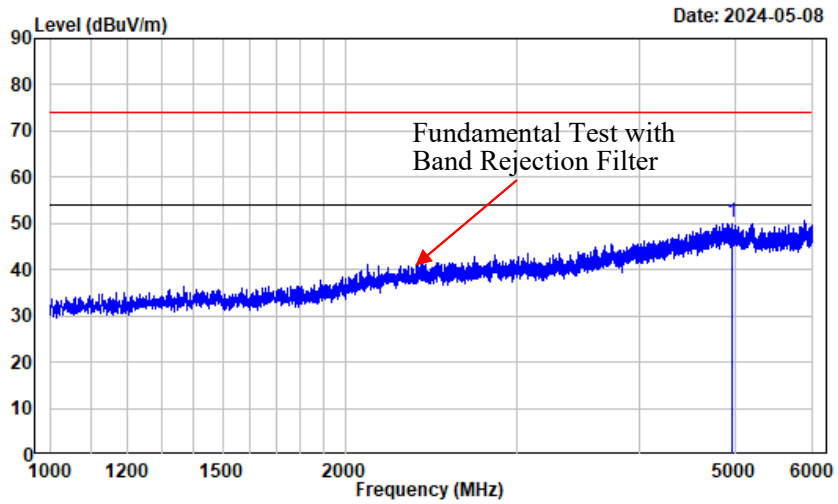
8DPSK			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Vertical**



Condition : Vertical
Project No.: 2401S39342E-RF
Tester : Zenos Qiao
Note : BT-3DH5-2480

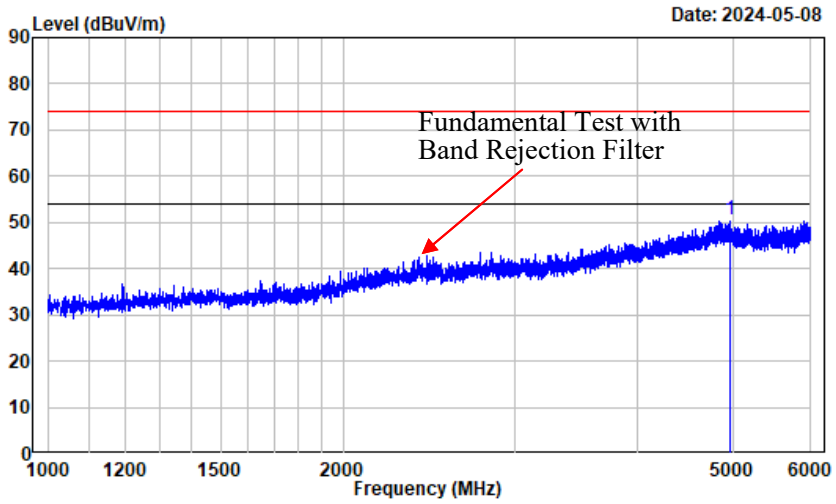
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.891	-3.17	56.45	53.28	74.00	-20.72	Peak

Test plots for Harmonic and spurious emissions Measurements:

Horizontal	
1-6GHz	 Condition : Horizontal Project No.: 2401S39342E-RF Tester : Zenos Qiao Note : BT-3DH5-2480 Freq / Factor / Read Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 4960.000 2.68 47.57 50.25 74.00 -23.75 Peak

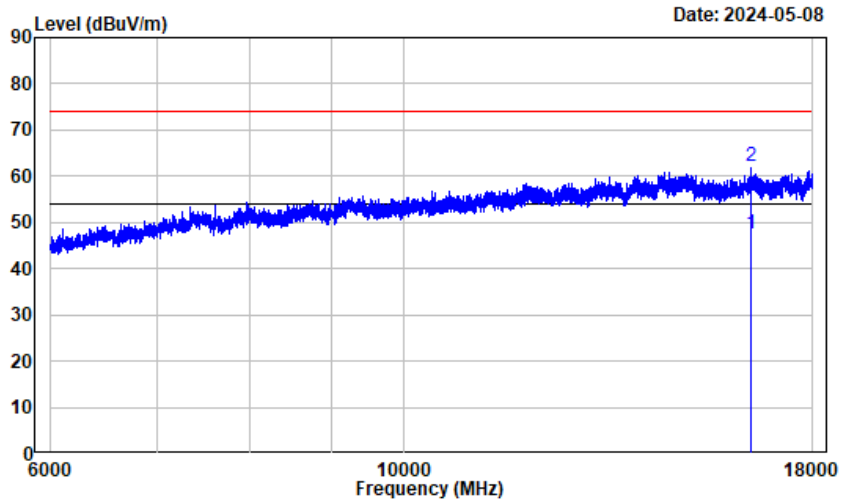
Vertical

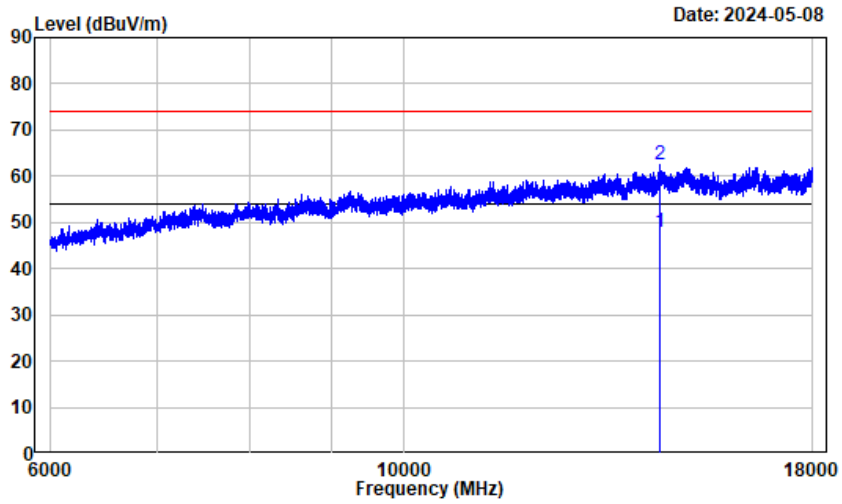
1-6GHz

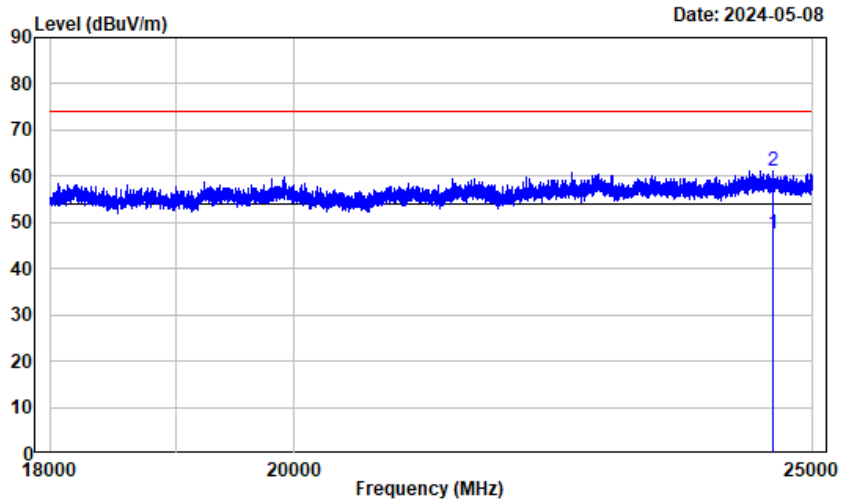


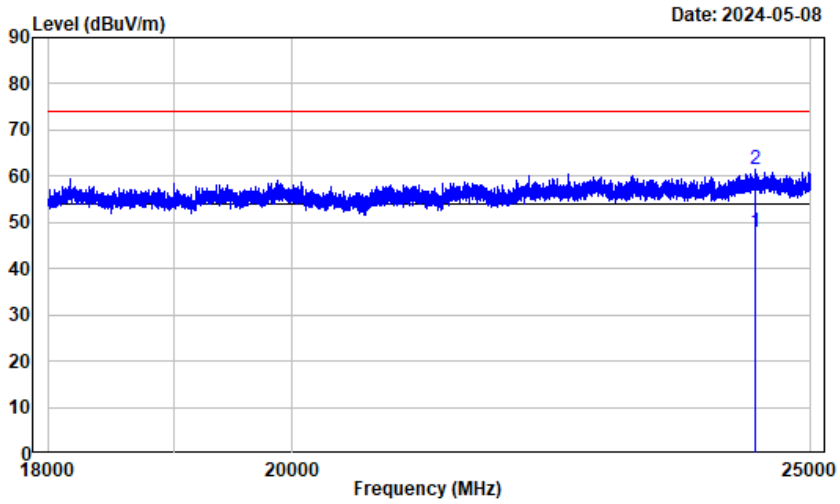
Condition : Vertical
Project No.: 2401S39342E-RF
Tester : Zenos Qiao
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.68	47.88	50.56	74.00	-23.44	Peak

Horizontal	
6-18GHz	 Condition : Horizontal Project No.: 2401S39342E-RF Tester : Zenos Qiao Note : BT-3DH5-2480 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark 1 16471.500 MHz 15.64 dB/m 32.04 dBuV 47.68 dBuV/m 54.00 dBuV/m -6.32 dB Average 2 16471.500 MHz 15.64 dB/m 46.39 dBuV 62.03 dBuV/m 74.00 dBuV/m -11.97 dB Peak

Vertical	
6-18GHz	 Condition : Vertical Project No.: 2401S39342E-RF Tester : Zenos Qiao Note : BT-3DH5-2480 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 14455.500 17.37 30.48 47.85 54.00 -6.15 Average 2 14455.500 17.37 44.97 62.34 74.00 -11.66 Peak

Horizontal	
18-25GHz	 Condition : Horizontal Project No.: 2401S39342E-RF Tester : Zenos Qiao Note : BT-3DH5-2480 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 24574.750 18.90 28.58 47.48 54.00 -6.52 Average 2 24574.750 18.90 42.39 61.29 74.00 -12.71 Peak

Vertical	
18-25GHz	 Condition : Vertical Project No.: 2401S39342E-RF Tester : Zenos Qiao Note : BT-3DH5-2480 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark 1 24408.500 MHz 18.79 dB/m 28.93 dBuV 47.72 dBuV/m 54.00 dBuV/m -6.28 dB Average 2 24408.500 MHz 18.79 dB/m 42.65 dBuV 61.44 dBuV/m 74.00 dBuV/m -12.56 dB Peak

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

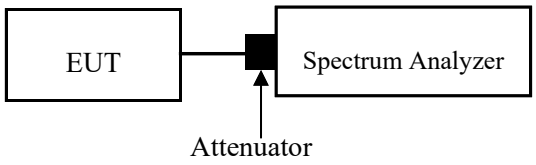
Applicable Standard

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 C63.10-2013 Clause 7.8.2

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.



Test Data

Environmental Conditions

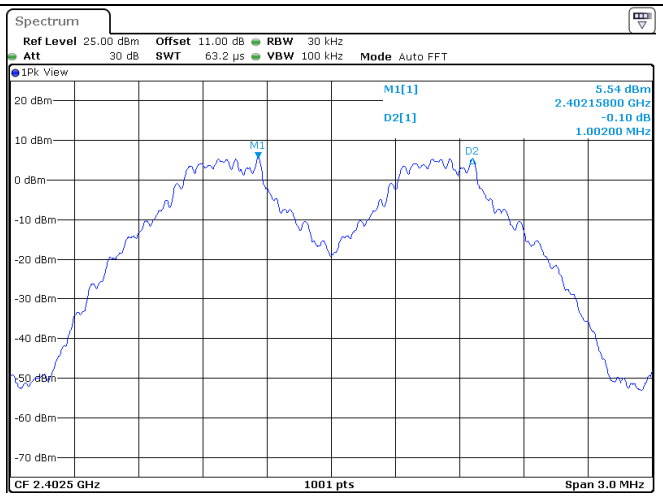
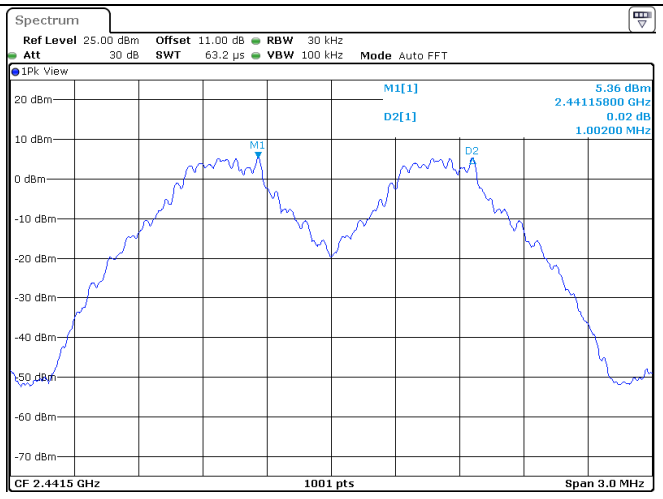
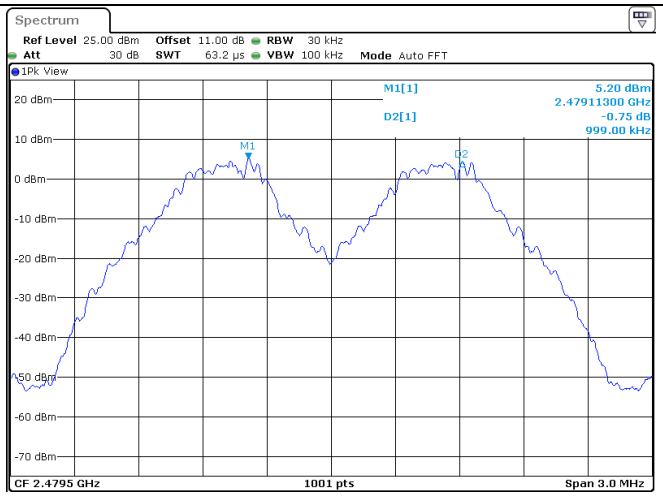
Temperature:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

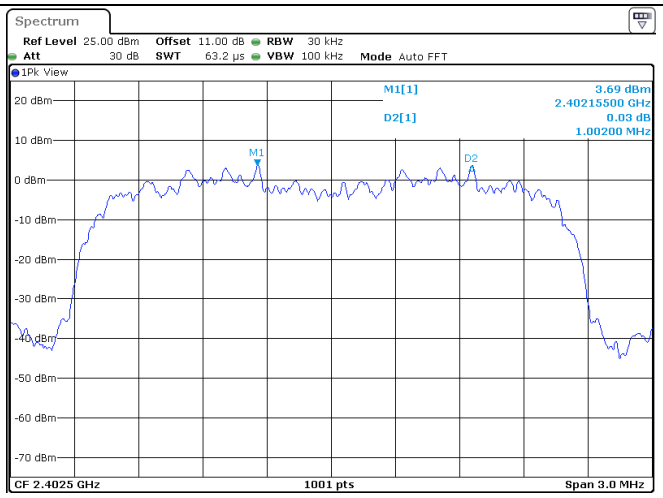
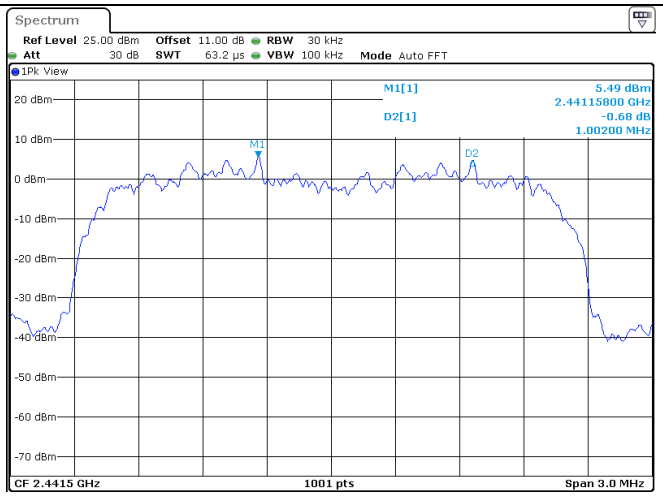
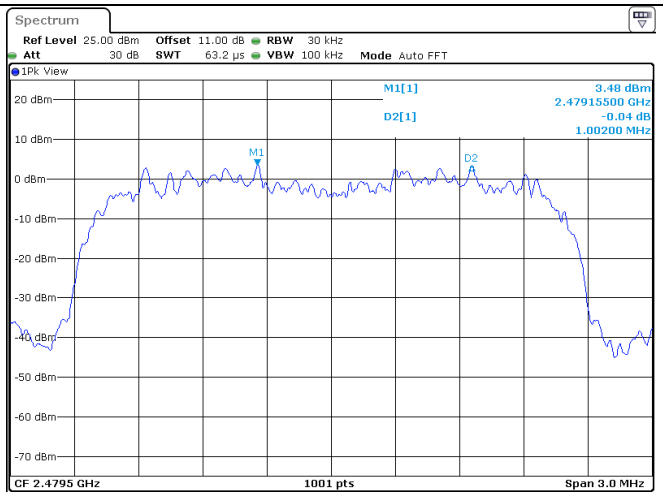
The testing was performed by Cheeb Huang from 2024-05-09 to 2024-05-31.

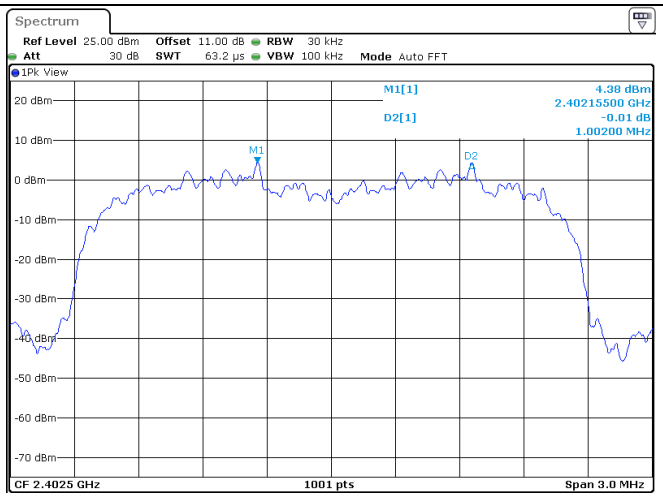
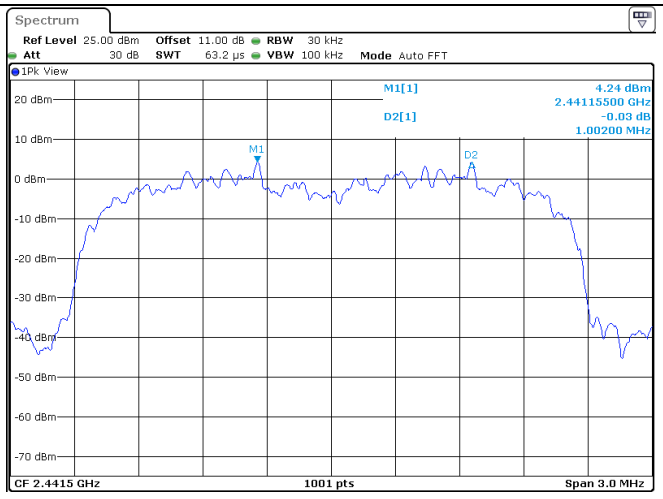
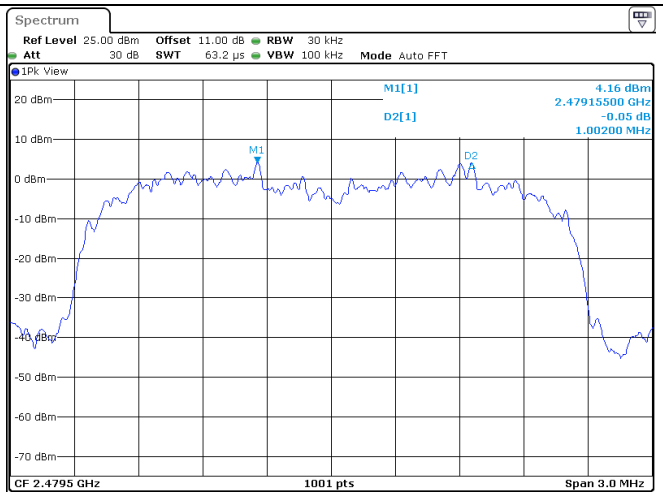
EUT operation mode: Transmitting

Test Result: Compliant.

Test Modes	Test Frequency (MHz)	Channel Separation (MHz)	Limits (MHz)
BDR Mode (GFSK)	2402	1.002	0.574
	2441	1.002	0.574
	2480	0.999	0.574
EDR Mode (π/4-DQPSK)	2402	1.002	0.880
	2441	1.002	0.880
	2480	1.002	0.880
EDR Mode (8DPSK)	2402	1.002	0.868
	2441	1.002	0.868
	2480	1.002	0.868

BDR Mode (GFSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (π/4-DQPSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (8DPSK)	
Low Channel	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 10:36:14
Middle Channel	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 10:37:13
High Channel	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 10:37:55

FCC §15.247(a) (1) - 20 dB EMISSION BANDWIDTH

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

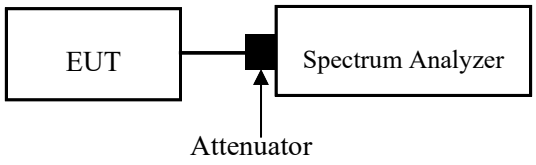
Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2

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 Data

Environmental Conditions

Temperature:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

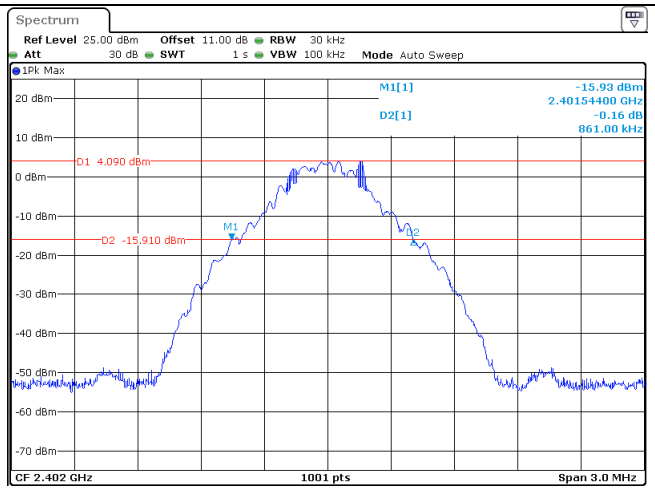
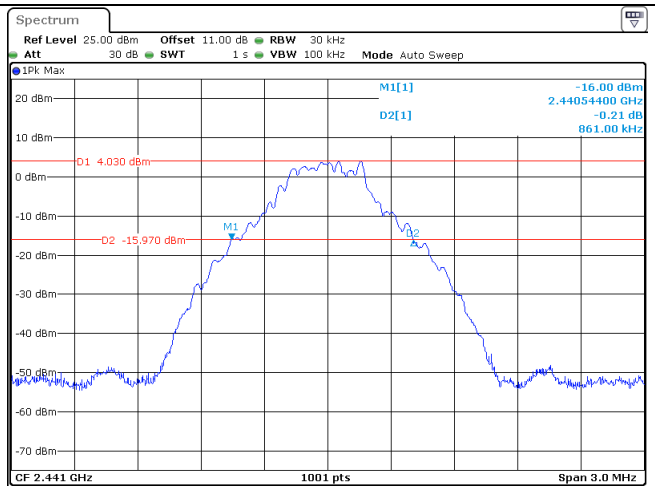
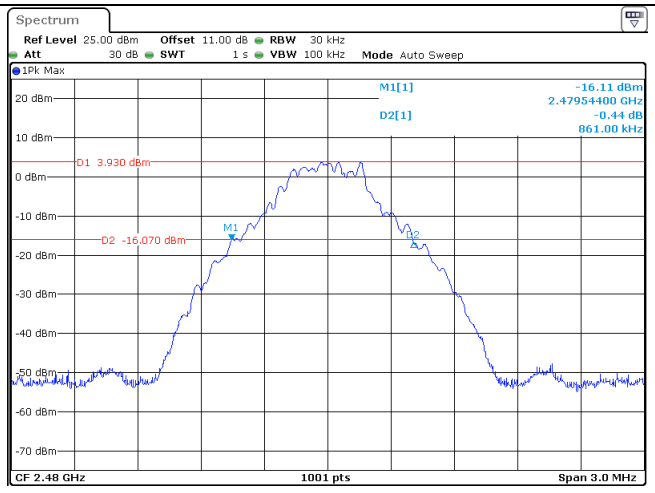
The testing was performed by Cheeb Huang on 2024-05-09.

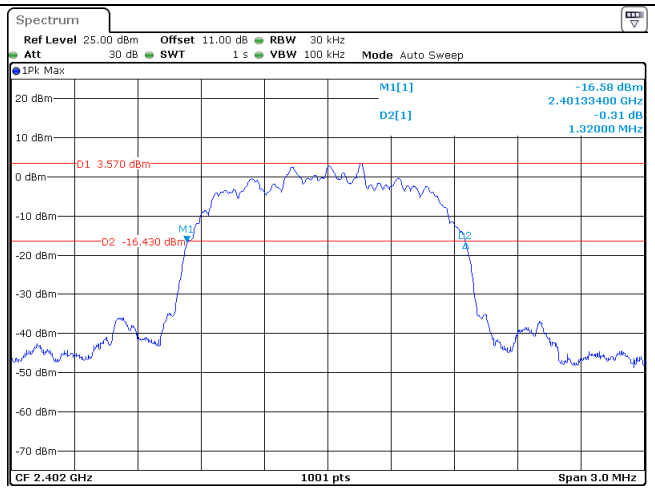
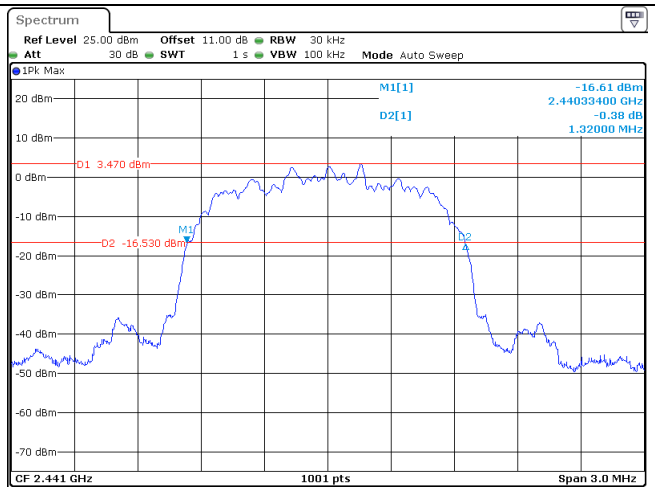
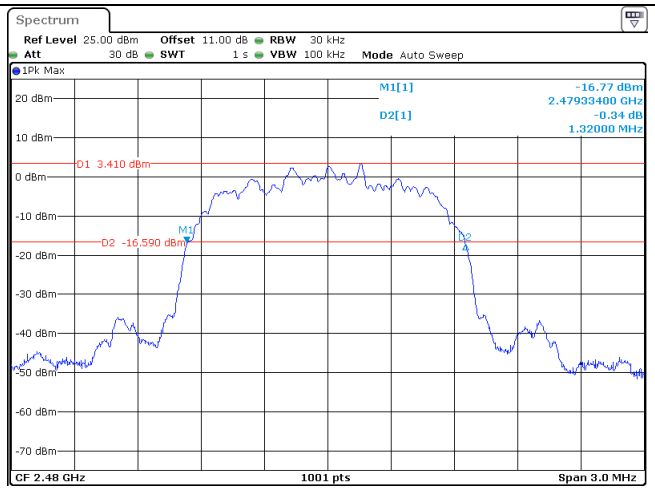
EUT operation mode: Transmitting

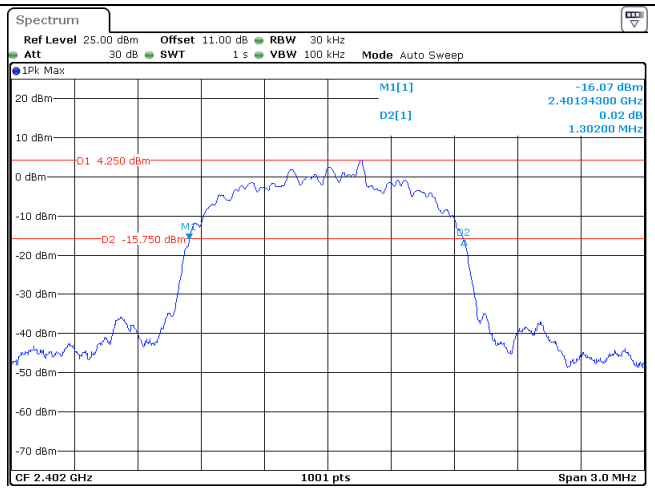
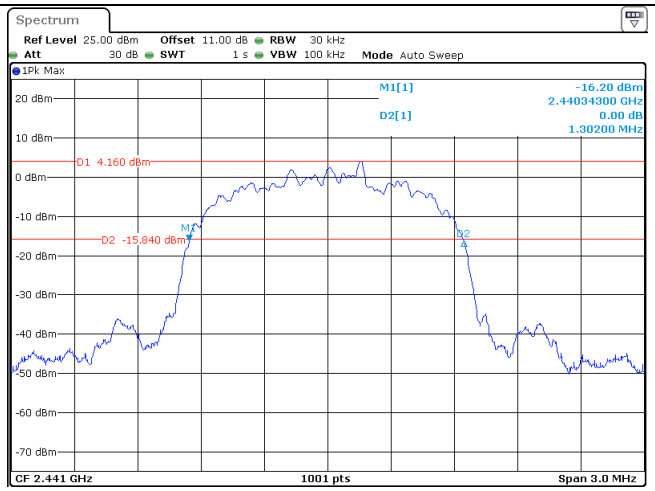
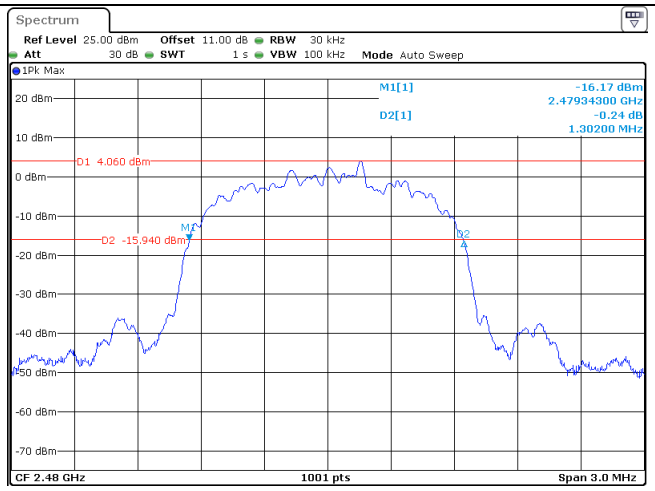
Test Result: Compliant.

Test Modes	Test Channel	Test Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Lowest	2402	0.861
	Middle	2441	0.861
	Highest	2480	0.861
EDR Mode (π/4-DQPSK)	Lowest	2402	1.320
	Middle	2441	1.320
	Highest	2480	1.320
EDR Mode (8DPSK)	Lowest	2402	1.302
	Middle	2441	1.302
	Highest	2480	1.302

20 dB Bandwidth

BDR Mode (GFSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (π/4-DQPSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (8DPSK)	
Low Channel	
Middle Channel	
High Channel	

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.

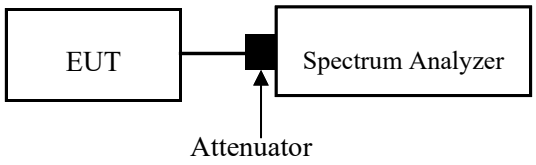
Test Procedure

Test Method: ANSI C63.10-2013 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 Data

Environmental Conditions

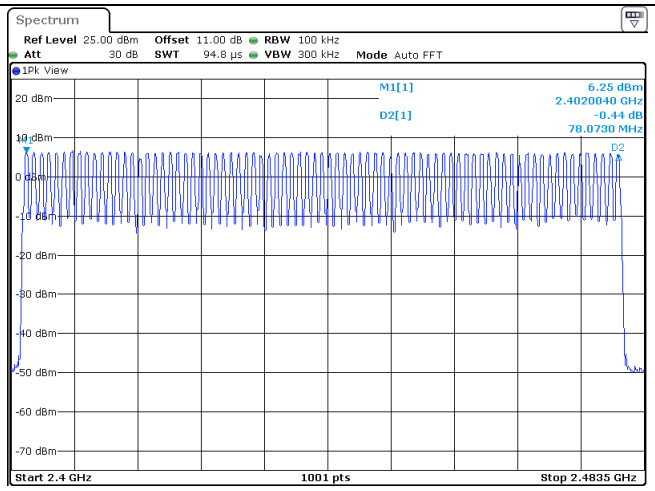
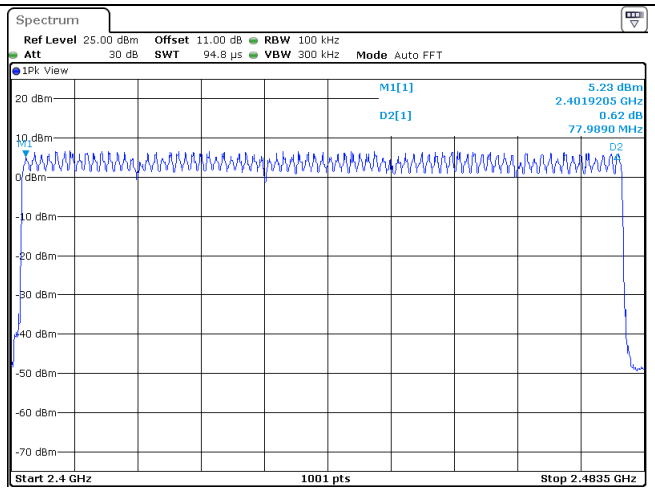
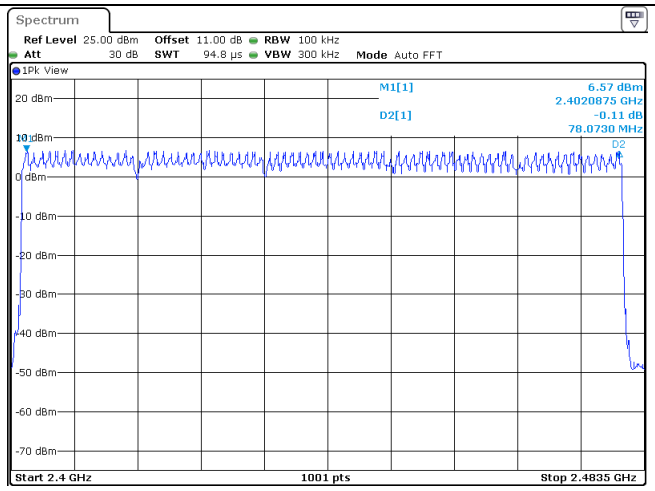
Temperature:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

The testing was performed by Cheeb Huang on 2024-05-09.

EUT operation mode: Transmitting

Test Result: Compliant.

Test Modes	Frequency Range (MHz)	Number of Hopping Channel	Limits
GFSK	2400-2483.5	79	≥15
π/4-DQPSK	2400-2483.5	79	≥15
8DPSK	2400-2483.5	79	≥15

Hopping Channel	
GFSK	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 10:56:19
π/4-DQPSK	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 11:04:09
8DPSK	 ProjectNo.:2401S39342E-RF Tester:Cheeb Huang Date: 9.MAY.2024 11:12:25

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

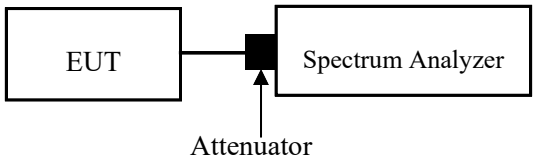
Applicable Standard

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 C63.10-2013 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:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

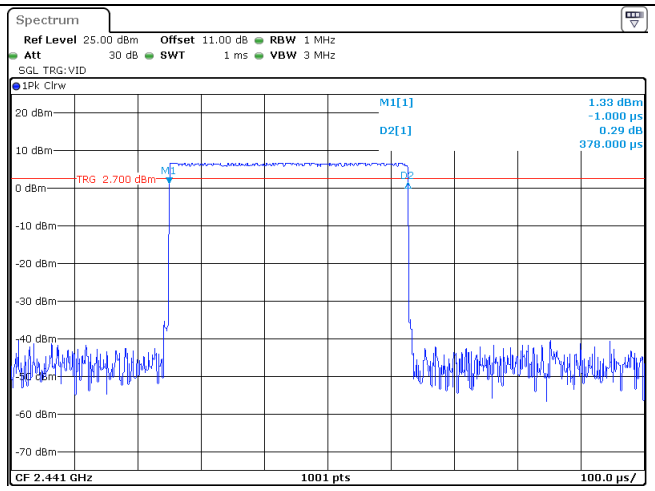
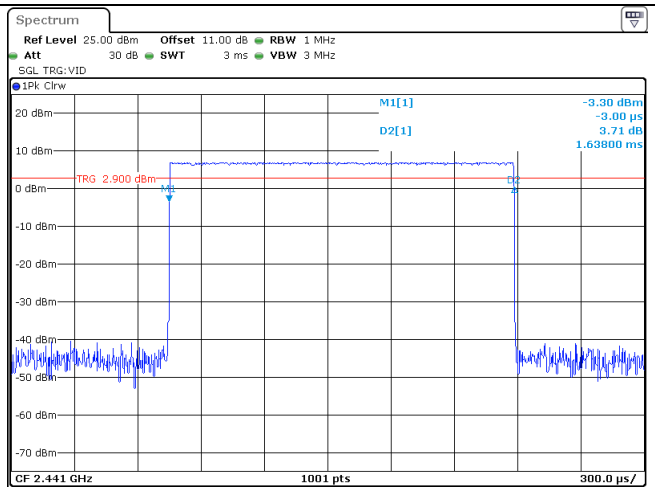
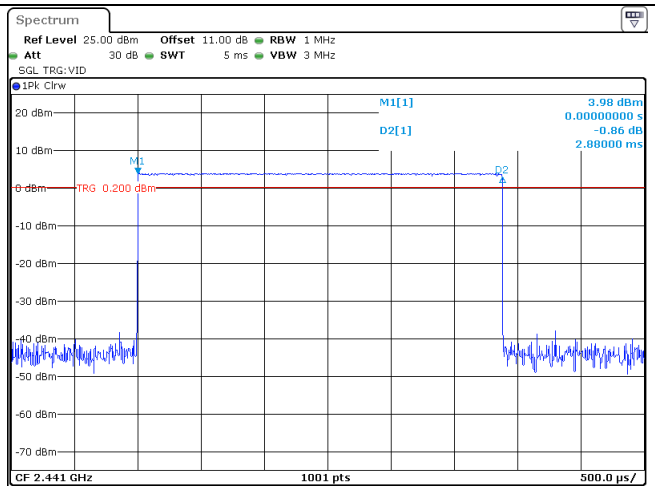
The testing was performed by Cheeb Huang from 2024-05-09 to 2024-05-31.

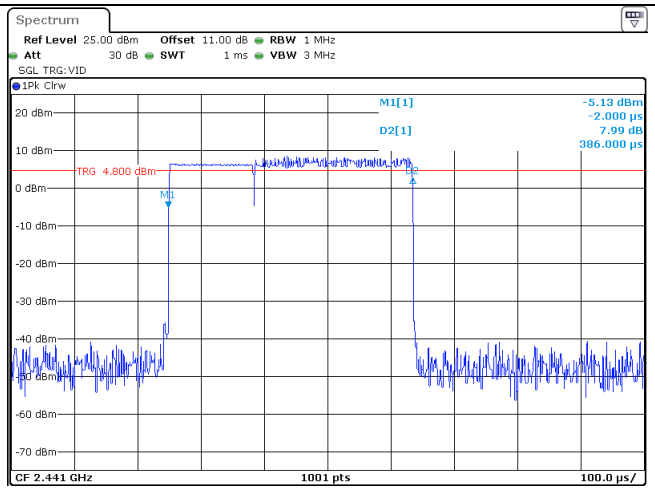
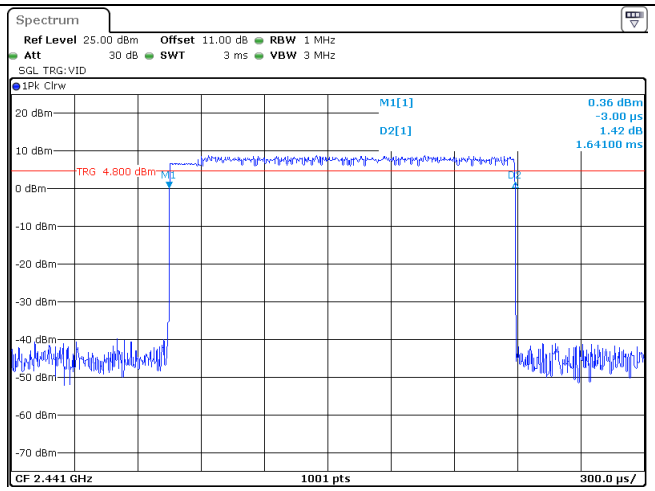
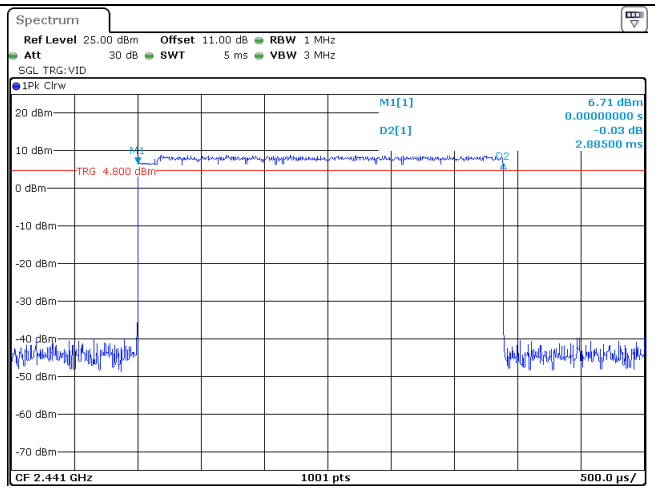
EUT operation mode: Transmitting

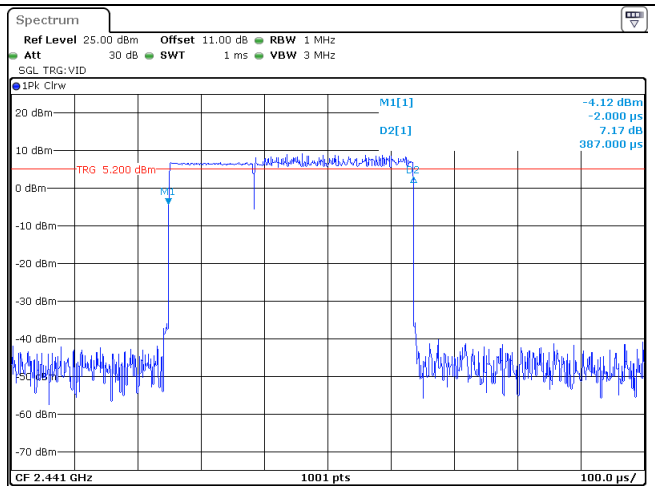
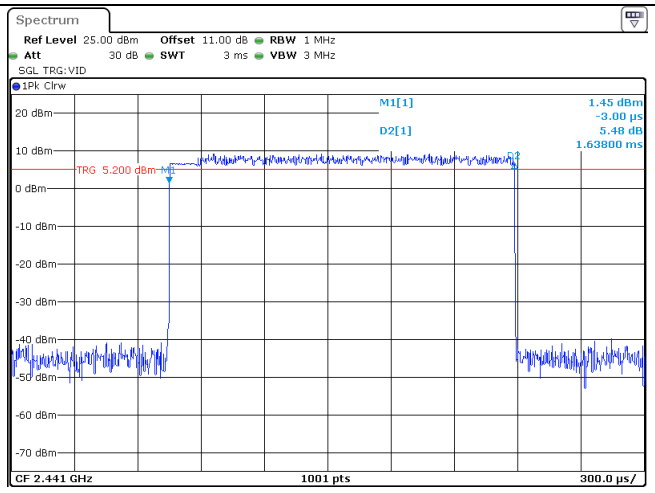
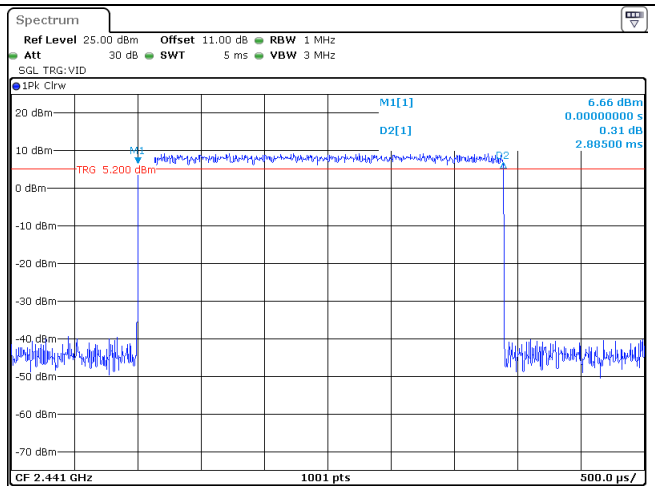
Test Result: Compliant.

Test Modes	Packet Type	Test Frequency (MHz)	Pulse width (ms)	Result (s)	Limit (s)
BDR Mode (GFSK)	DH1	2441	0.378	0.121	0.400
	DH3	2441	1.638	0.262	0.400
	DH5	2441	2.880	0.307	0.400
EDR Mode (π/4-DQPSK)	2DH1	2441	0.386	0.124	0.400
	2DH3	2441	1.641	0.263	0.400
	2DH5	2441	2.885	0.308	0.400
EDR Mode (8DPSK)	3DH1	2441	0.387	0.124	0.400
	3DH3	2441	1.638	0.262	0.400
	3DH5	2441	2.885	0.308	0.400

Note:
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	
DH3	
DH5	

EDR Mode (π/4-DQPSK)	
2DH1	
2DH3	
2DH5	

EDR Mode (8DPSK)	
3DH1	
3DH3	
3DH5	

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

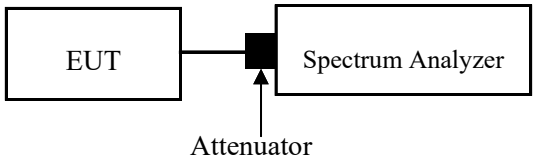
Applicable Standard

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 C63.10-2013 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 Data

Environmental Conditions

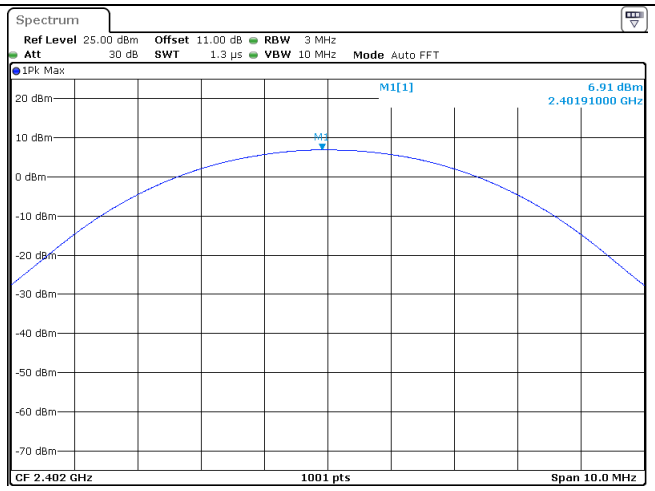
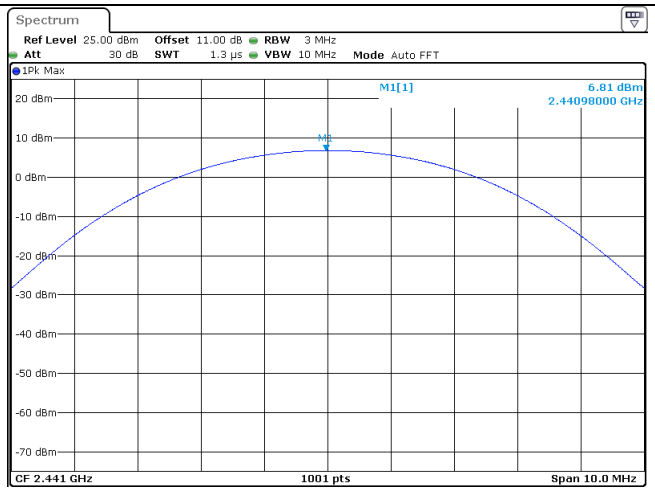
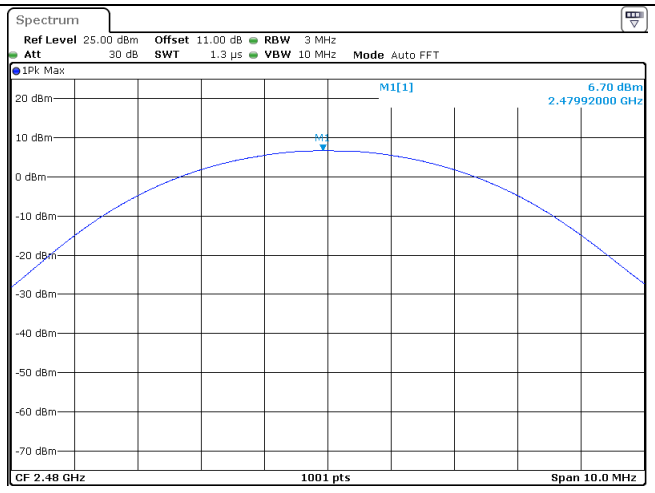
Temperature:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

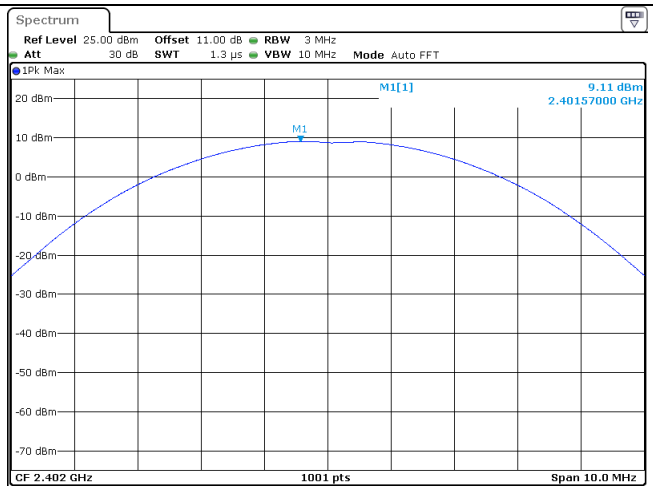
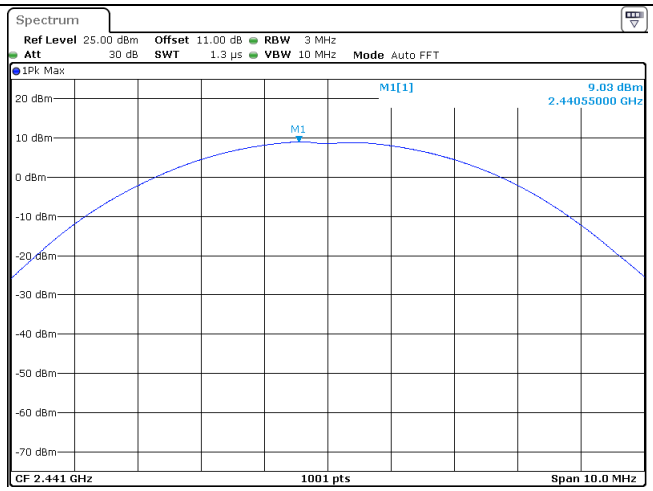
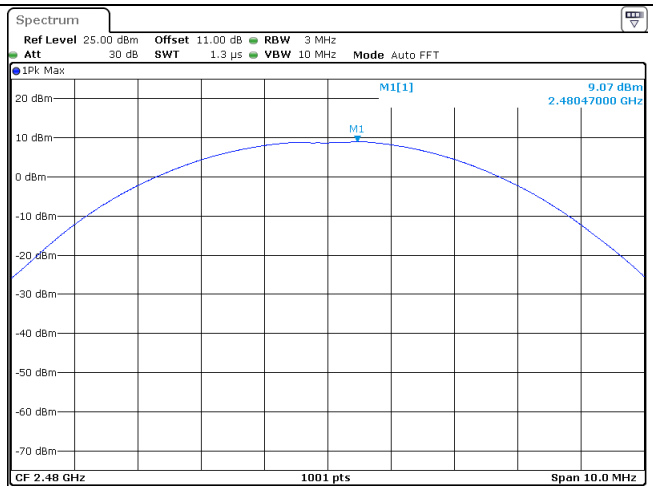
The testing was performed by Cheeb Huang on 2024-05-09.

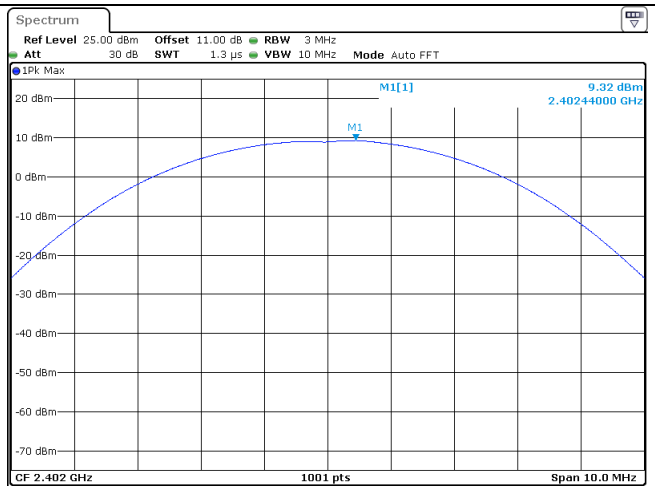
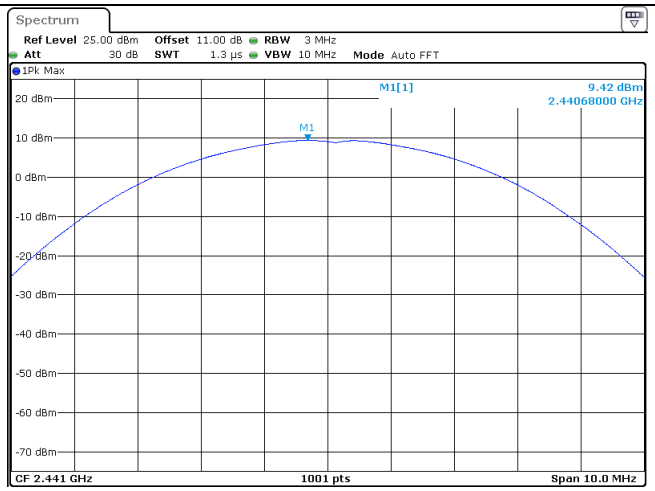
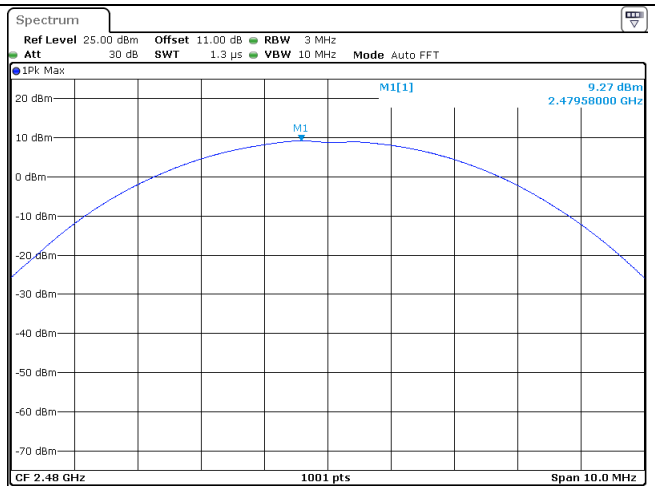
EUT operation mode: Transmitting

Test Result: Compliant.

Test Modes	Test Frequency (MHz)	Peak Conducted Output Power (dBm)	Limits (dBm)
BDR Mode (GFSK)	2402	6.91	21
	2441	6.81	21
	2480	6.70	21
EDR Mode (π/4-DQPSK)	2402	9.11	21
	2441	9.03	21
	2480	9.07	21
EDR Mode (8DPSK)	2402	9.32	21
	2441	9.42	21
	2480	9.27	21

BDR Mode (GFSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (π/4-DQPSK)	
Low Channel	
Middle Channel	
High Channel	

EDR Mode (8DPSK)	
Low Channel	
Middle Channel	
High Channel	

FCC §15.247(d) § 5.5 - BAND EDGES TESTING

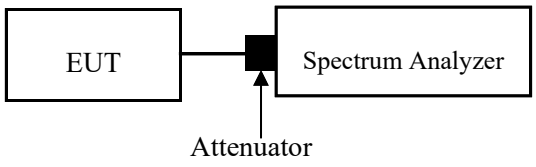
Applicable Standard

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 C63.10-2013 Clause 7.8.6 & Clause 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

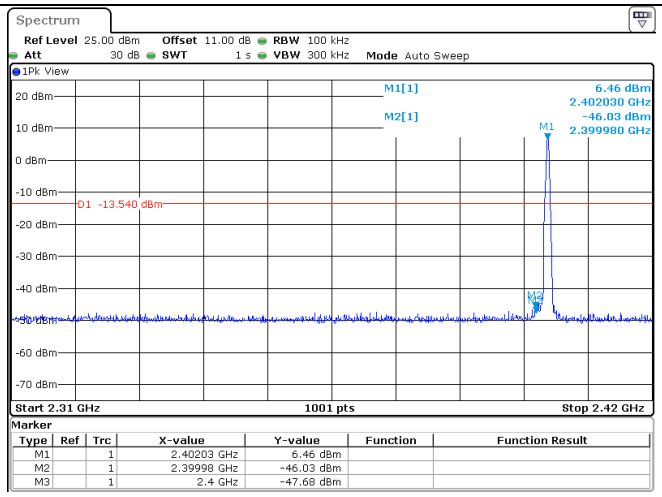
Environmental Conditions

Temperature:	25.1 ℃
Relative Humidity:	46 %
ATM Pressure:	101 kPa

The testing was performed by Cheeb Huang on 2024-05-09.

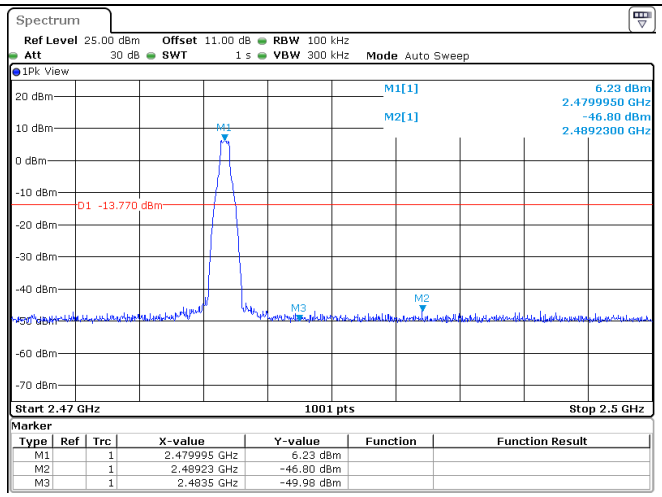
EUT operation mode: Transmitting

Test Result: Compliant.

<table>
<tr><th colspan="2">Band Edge, Single Channel</th></tr>
<tr><td>BDR Mode
(GFSK),
Left Side</td><td>


Marker

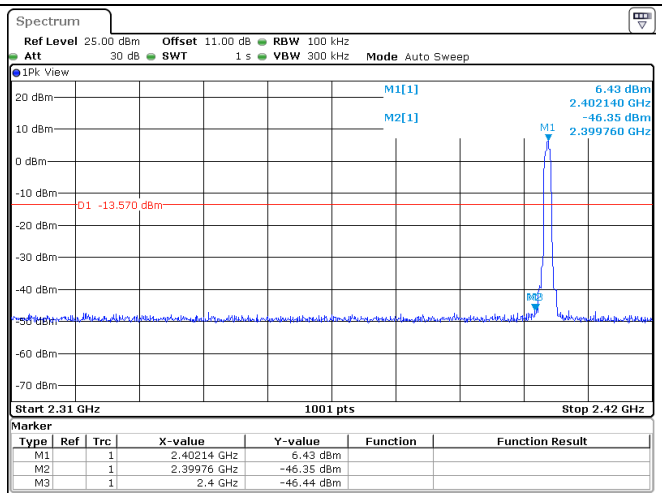
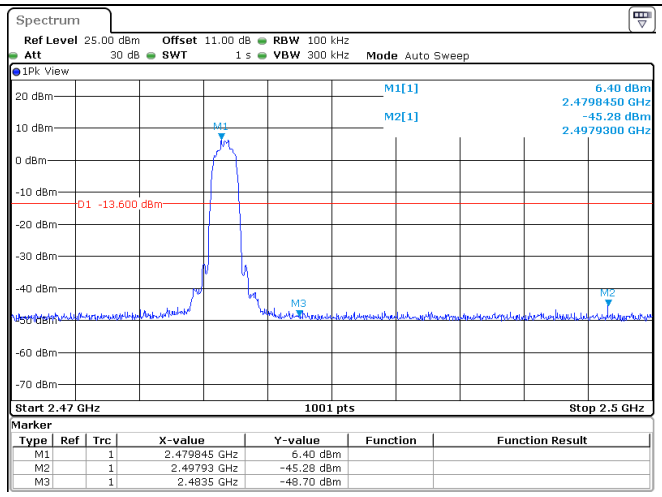
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40203 GHz	6.46 dBm		
M2		1	2.39998 GHz	-46.03 dBm		
M3		1	2.4 GHz	-47.68 dBm		

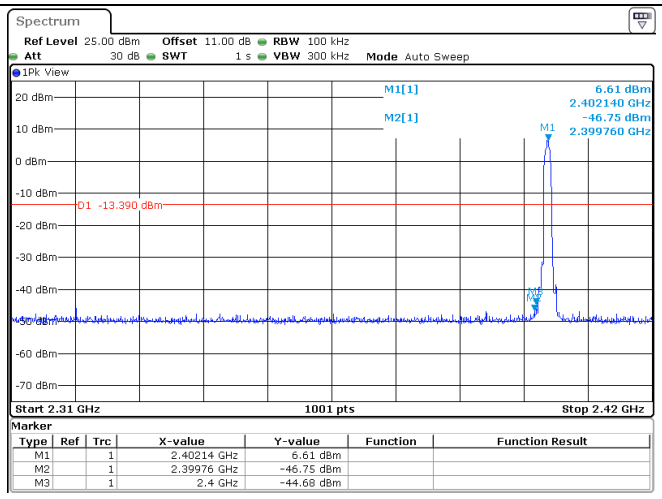
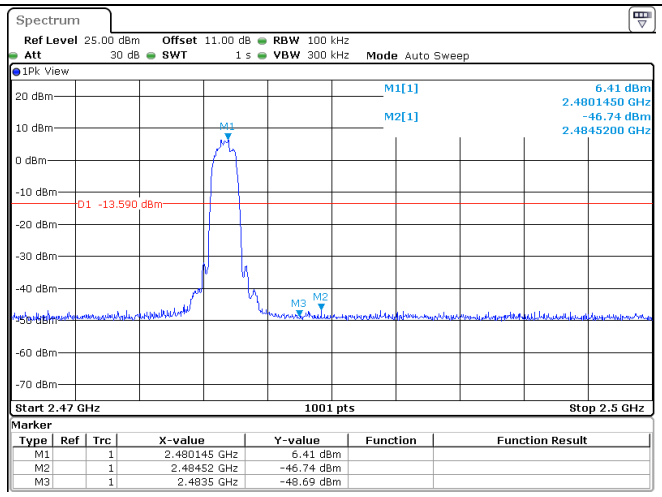
ProjectNo.:2401S39342E-RF Tester:Cheeb Huang
Date: 9.MAY.2024 09:57:30
</td></tr>
<tr><td>BDR Mode
(GFSK),
Right Side</td><td>


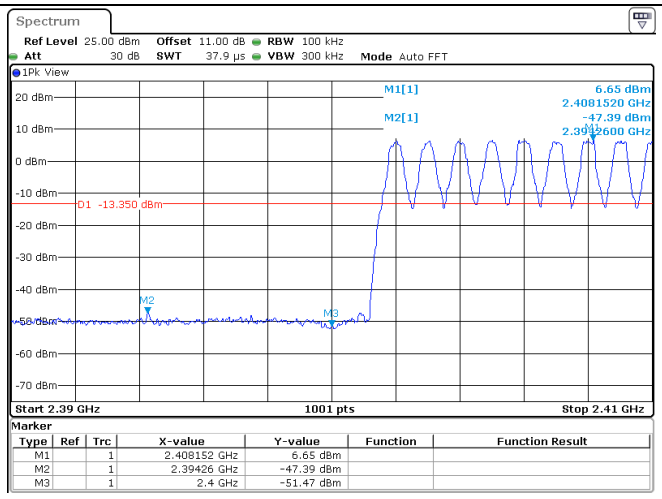
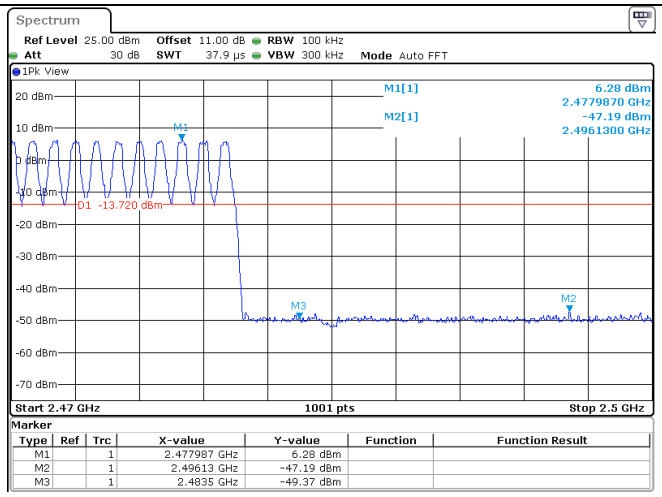
Marker

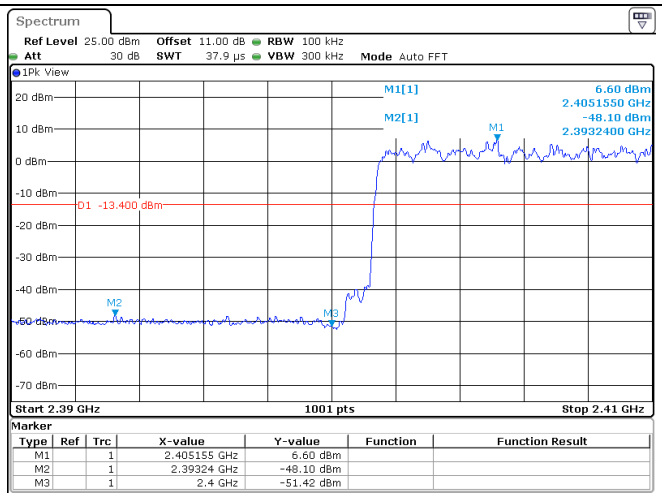
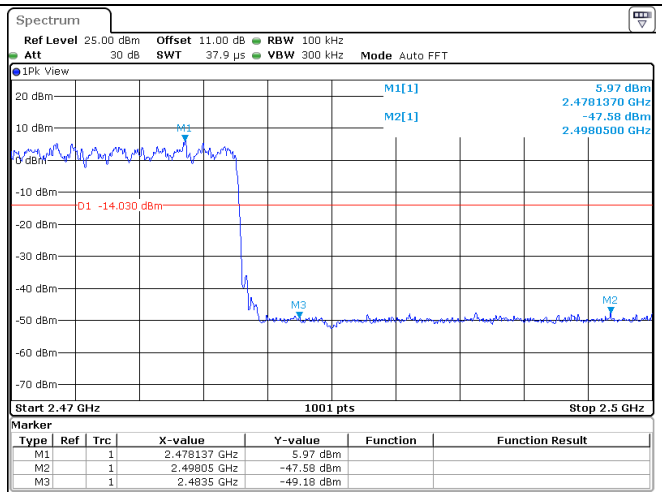
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479995 GHz	6.23 dBm		
M2		1	2.48923 GHz	-46.80 dBm		
M3		1	2.4835 GHz	-49.98 dBm		

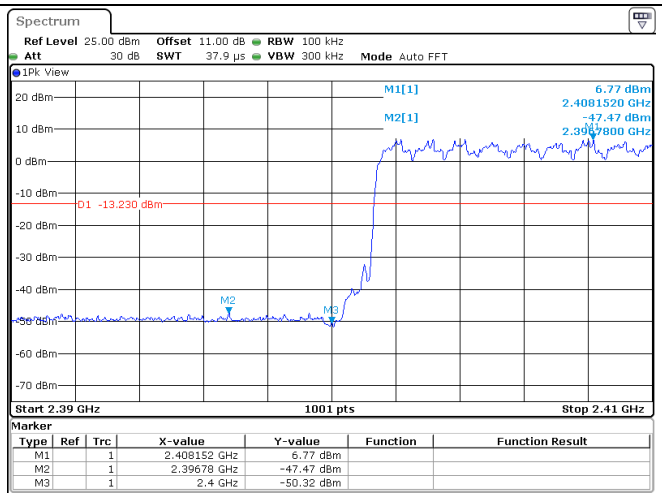
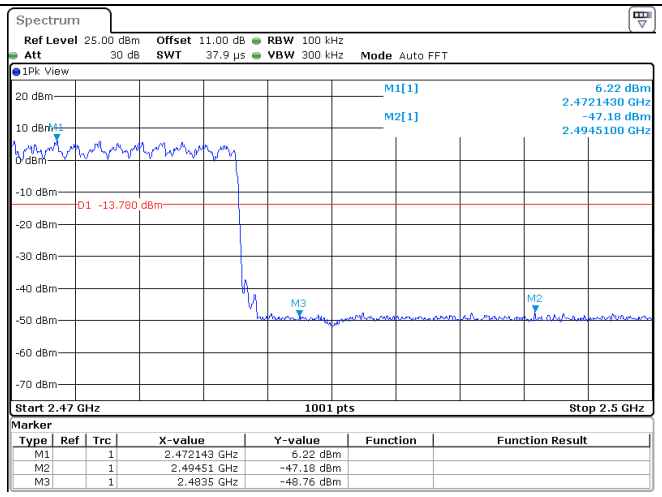
ProjectNo.:2401S39342E-RF Tester:Cheeb Huang
Date: 9.MAY.2024 10:17:38
</td></tr>
</table>

Band Edge, Single Channel	
EDR Mode (π/4-DQPSK), Left Side	
EDR Mode (π/4-DQPSK), Right Side	

Band Edge, Single Channel	
EDR Mode (8DPSK), Left Side	
EDR Mode (8DPSK), Right Side	

Band Edge, Hopping Channel	
BDR Mode (GFSK), Left Side	
BDR Mode (GFSK), Right Side	

Band Edge, Hopping Channel	
EDR Mode (π/4-DQPSK), Left Side	
EDR Mode (π/4-DQPSK), Right Side	

Band Edge, Hopping Channel	
EDR Mode (8DPSK), Left Side	
EDR Mode (8DPSK), Right Side	

EUT PHOTOGRAPHS

Please refer to the attachment 2401S39342E-RF External photo and 2401S39342E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401S39342E-RFA Test Setup photo.

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