

# TEST REPORT

Applicant Name: MacB IT Solutions LLC  
Address: 2900 West Georgia Rd PIEDMONT, SC 29673 United States  
Report Number: 2401A39666E-RF-00A  
FCC ID: 2BGQA-BUZZBOXX

## Test Standard (s)

FCC PART 15.247

## Sample Description

Product Type: BuzzBoxx  
Model No.: BuzzBoxx  
Multiple Model(s) No.: N/A  
Trade Mark: N/A  
Date Received: 2024-12-06  
Issue Date: 2025-02-28

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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Allen Bai  
RF Engineer

## Approved By:

Nancy Wang

Nancy Wang  
RF Supervisor

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401A39666E-RF-00A	Original Report	2025-02-28

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Frequency Range	2402~2480MHz
Transmit Peak Power	12.63dBm
Modulation Technique	Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Specification <sup>#</sup>	-4.32dBi (provided by the applicant)
Voltage Range	DC 5V from USB Port
Sample serial number	2VO2-1 for Conducted and Radiated Emissions Test 2VO2-1 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	N/A

### 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		109.2kHz(k=2, 95% level of confidence)
RF output power, conducted		0.86dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz-150kHz	3.63dB(k=2, 95% level of confidence)
	150kHz-30MHz	3.66dB(k=2, 95% level of confidence)
Radiated Emissions	0.009MHz~30MHz	3.60dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	5.32dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	5.43dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	5.77dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.73dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.34dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.40dB(k=2, 95% level of confidence)
	18GHz - 40GHz	5.64dB(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.

## 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

Exercise Software <sup>#</sup>	EspRFTTestTool_v3.6_Manual.exe
Power Level <sup>#</sup>	7

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

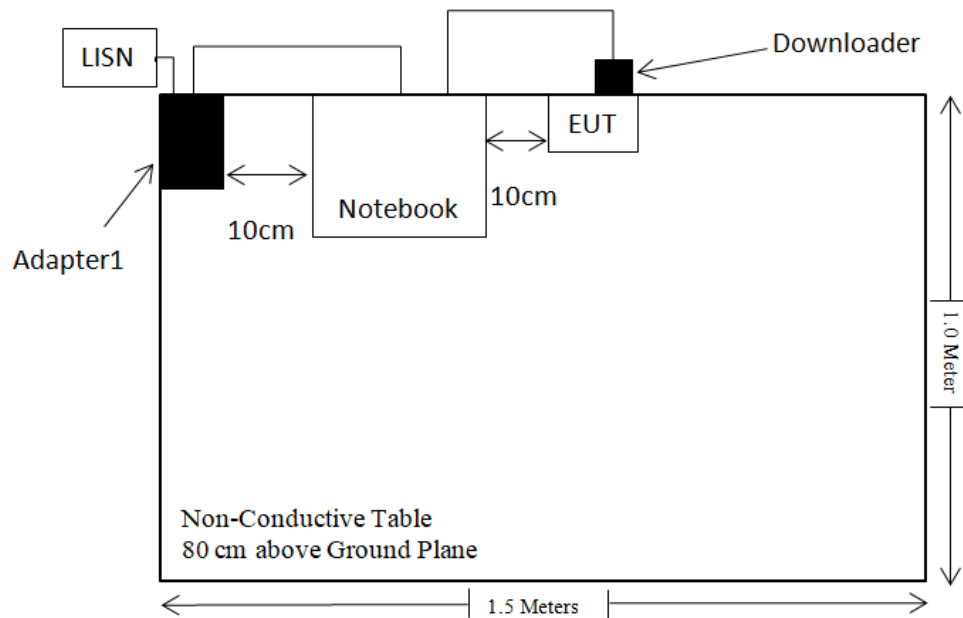
Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	DESKTOP-9V9ZN6E	1062222901869
Lenovo	Adapter 1	ADLX65NDC3A	Unknown
UMICIGI	Adapter 2	QZ-02002AC00	Unknown
LILYGO	Downloader	CH9102F*T-U2T USB To TTL	Unknown

### External I/O Cable

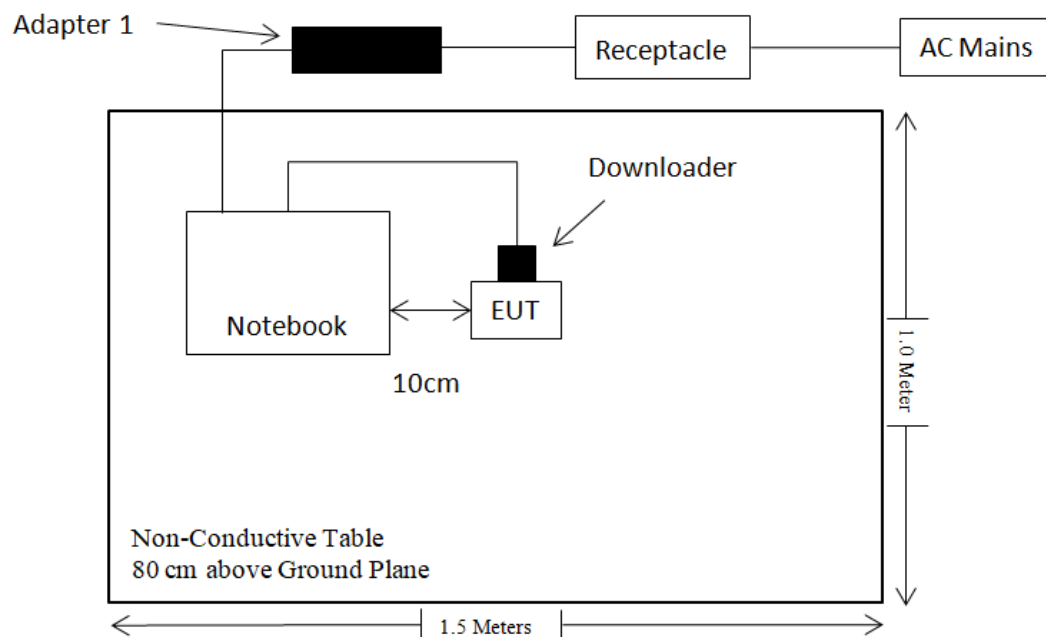
Cable Description	Length (m)	From Port	To
Un-shielded Detachable AC cable	1.5	Adapter1	LISN/ Receptacle
Shielded Un-detachable DC Cable	1.2	Notebook	Adapter1
Un-shielded Detachable Type-c Cable	1.5	Adapter2	EUT
Un-shielded Detachable USB Cable	1.2	Notebook	Downloader
Un-shielded Un-Detachable AC cable	1.5	Receptacle	AC Mains

### Block Diagram of Test Setup

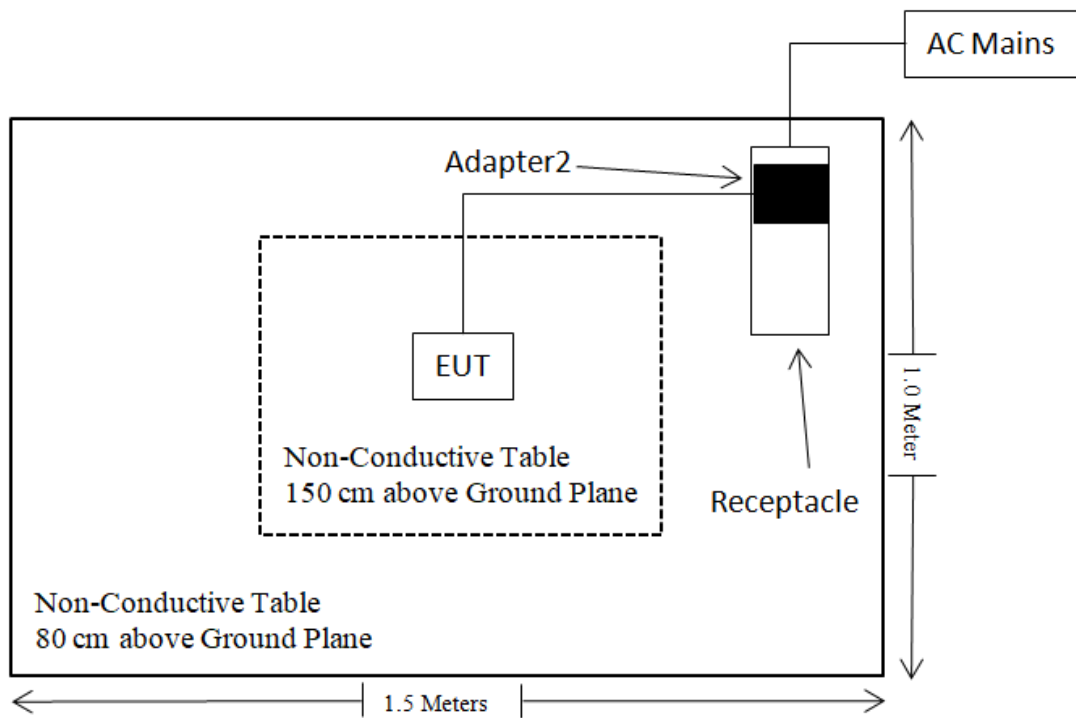
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:





**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207(a)	AC Line Conducted Emissions	Compliant
FCC §15.205, §15.209, §15.247(d)	Radiated Spurious Emission	Compliant
FCC §15.247(a)(1)	20 dB Emission Bandwidth	Compliant
FCC §15.247(a)(1)	Channel Separation	Compliant
FCC §15.247(a)(1)(iii)	Number of Hopping Frequency	Compliant
FCC §15.247(a)(1)(iii)	Time of Occupancy (dwell time)	Compliant
FCC §15.247(b)(1)	Maximum Conducted Output Power	Compliant
FCC §15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (i), §1.1307 (b) (3) & §2.1091	MPE-Based Exemption	Compliant

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Conducted Emission Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2024/12/04	2025/12/03
Rohde & Schwarz	LISN	ENV216	101613	2024/12/04	2025/12/03
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2024/05/21	2025/05/20
Unknown	CE Cable	Unknown	UF A210B-1-0720-504504	2024/05/21	2025/05/20
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
<b>Radiated Emission Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2024/12/04	2025/12/03
Sonoma instrument	Pre-amplifier	310N	186238	2024/05/21	2025/05/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
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	2024/12/04	2025/12/03
Unknown	Cable	PNG214	1354	2024/12/04	2025/12/03
Rohde&Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
A.H.System	Preamplifier	PAM-0118P	489	2024/11/15	2025/11/14
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	0735	2024/12/06	2025/12/05
Unknown	RF Cable	UFA147	219661	2024/12/06	2025/12/05
Unknown	RF Cable	XH750A-N	J-10M	2024/12/06	2025/12/05
JD	Filter Switch Unit	DT7220FSU	DS79906	2024/09/09	2025/09/08
JD	Multiplex Switch Test Control Set	DT7220FSU	DQ77926	2024/06/18	2025/06/17
A.H.System	Pre-amplifier	PAM-1840VH	190	2024/06/18	2025/06/17
Electro-Mechanics Co	Horn Antenna	3116	9510-2270	2023/09/18	2026/09/17
UTIFLEX	RF Cable	NO. 13	232308-001	2024/12/18	2025/12/17
Audix	EMI Test software	E3	191218(V9)	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV40-N	102259	2024/12/04	2025/12/03
R&S	Spectrum Analyzer	FSU26	200120	2024/12/04	2025/12/03
MARCONI	10dB Attenuator	6534/3	2942	2024/06/27	2025/06/26
Micro-Tronics	RF Cable	8082135	W1113	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).

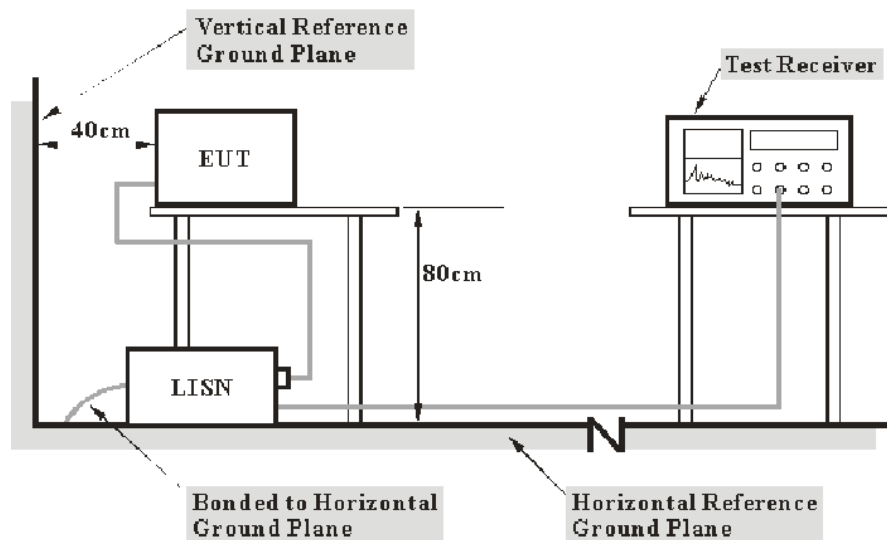
## REQUIREMENTS AND TEST PROCEDURES

### 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 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

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:

$$\text{Factor} = \text{LISN VDF} + \text{Cable Loss}$$

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:

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

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

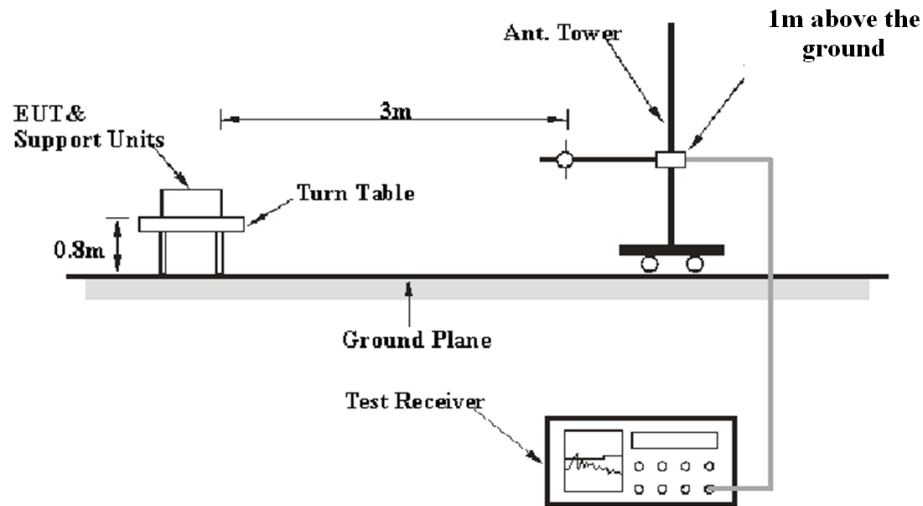
## Radiated Emissions

### 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= $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$ ,

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:

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



## 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.

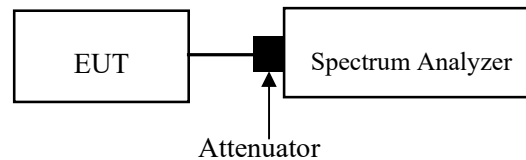
### Test Procedure

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

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (\text{OBW}/\text{RBW})]$  below the reference level.
- d) Steps a) through c) might require iteration to adjust within the specified tolerances.
- e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “–xx dB down” requirement; that is, if the requirement calls for measuring the –20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- f) Set detection mode to peak and trace mode to max hold.
- g) Determine the reference value: Set the EUT to transmit an un-modulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- h) Determine the “–xx dB down amplitude” using  $[(\text{reference value}) - \text{xx}]$ . Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- i) If the reference value is determined by an un-modulated carrier, then turn the EUT modulation on, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-xx dB down amplitude” determined in step h). If a marker is below this “-xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “-xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).



## Channel Separation Test

### Applicable Standard

Frequency hopping systems 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.

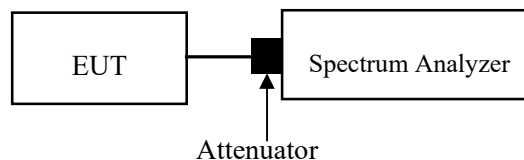
### Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.2

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: Wide enough to capture the peaks of two adjacent channels.
- b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- c) Video (or average) bandwidth (VBW)  $\geq$  RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined.



Note: The limit is  $\frac{2}{3} \times 20$  dB bandwidth

## Quantity of Hopping Channel Test

### Applicable Standard

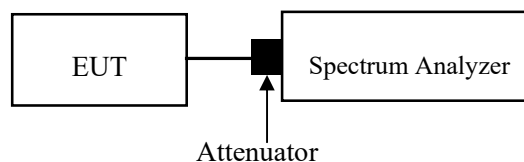
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress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

- a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c) VBW  $\geq$  RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.

It might prove necessary to break the span up into sub ranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels.



## 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

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: Zero span, centered on a hopping channel.
- b) RBW shall be  $\leq$  channel spacing and where possible RBW should be set  $\gg 1 / T$ , where T is the expected dwell time per channel.
- c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- d) Detector function: Peak.
- e) Trace: Max hold.

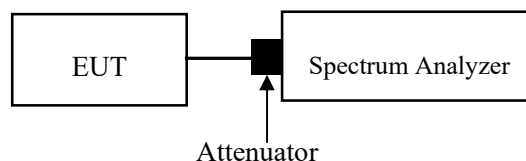
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

$$\begin{aligned} &(\text{Number of hops in the period specified in the requirements}) = (\text{number of hops on spectrum analyzer}) \\ &\times (\text{period specified in the requirements} / \text{analyzer sweep time}) \end{aligned}$$

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.



## 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

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

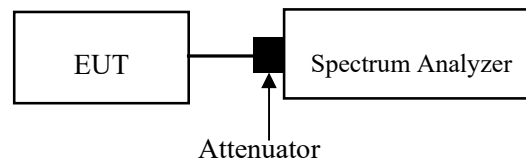
a) Use the following spectrum analyzer settings:

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the cable loss was added with offset into test equipment, the total offset consists of attenuator and/or RF cable loss

## Band Edges

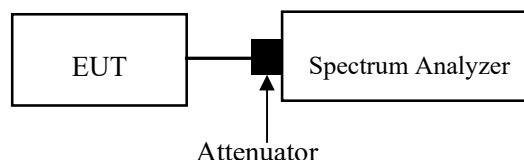
### Applicable Standard

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.



## **ANTENNA REQUIREMENT**

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### **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.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### **Antenna Connector Construction**

The EUT has an internal antenna arrangement, which was permanently attached, the antenna gain<sup>#</sup> is -4.32dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result: Compliant**



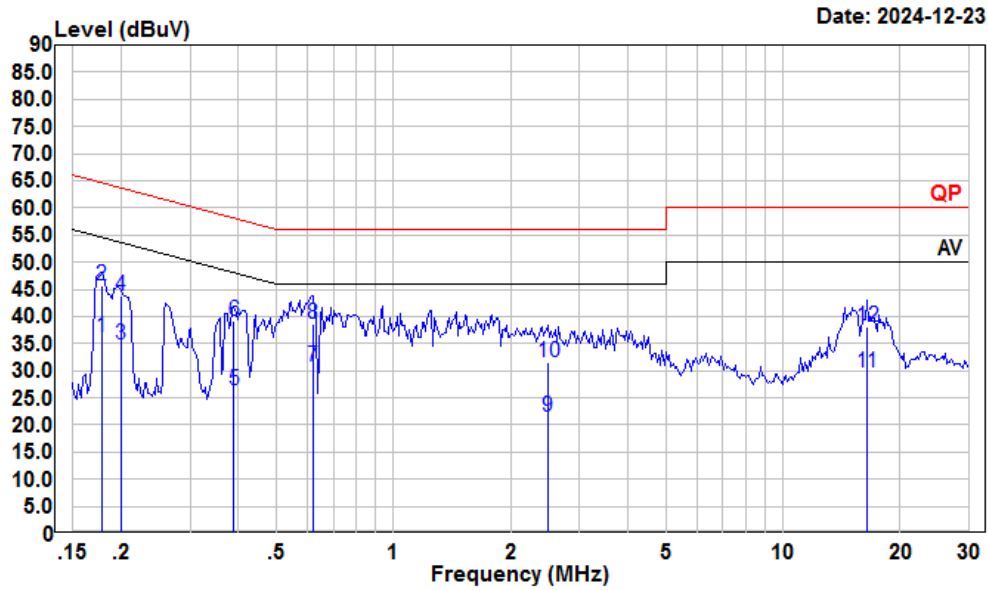
TEST DATA AND RESULTS

AC Line Conducted Emissions

Environmental Conditions

Temperature (°C)	24.5	Relative Humidity (%)	40.2
ATM Pressure (kPa)	101.4	Test engineer	Macy Shi
Test date	2024/12/23		
EUT operation mode	Transmitting (Maximum output power mode, EDR (8DPSK) High Channel)		

## AC 120V 60 Hz, Line



Condition: Line

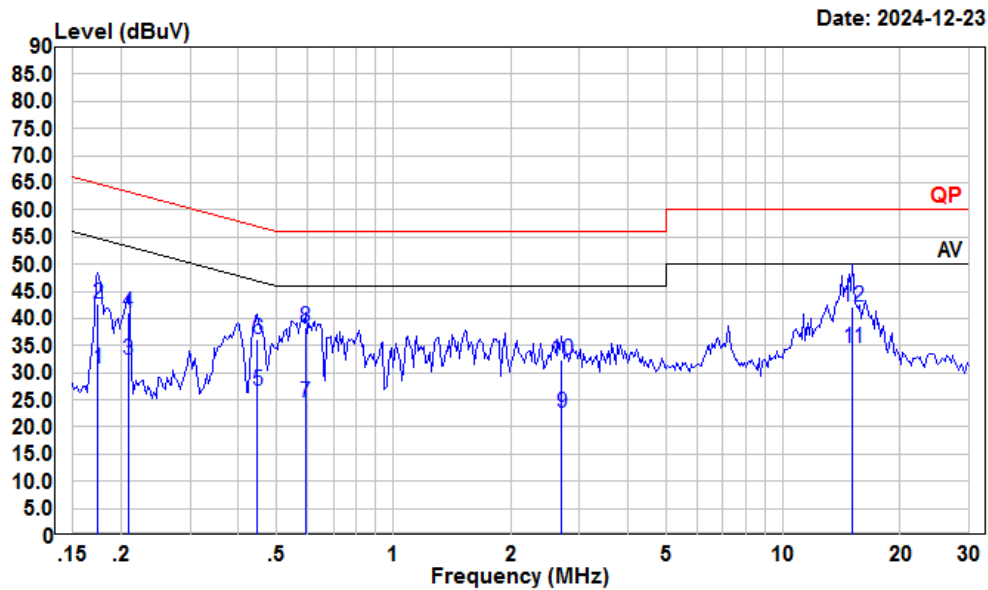
Project : 2401A39666E-RF

tester : Macy.shi Note:Transmitting

Setting : RBW:9kHz VBW:Auto SWT:Auto

	Freq	Read Level	LISN Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.178	15.56	36.06	10.40	10.10	54.59	-18.53	Average
2	0.178	25.28	45.78	10.40	10.10	64.59	-18.81	QP
3	0.200	14.33	34.82	10.40	10.09	53.62	-18.80	Average
4	0.200	23.32	43.81	10.40	10.09	63.62	-19.81	QP
5	0.389	6.10	26.45	10.25	10.10	48.08	-21.63	Average
6	0.389	18.74	39.09	10.25	10.10	58.08	-18.99	QP
7	0.621	10.31	30.77	10.33	10.13	46.00	-15.23	Average
8	0.621	18.20	38.66	10.33	10.13	56.00	-17.34	QP
9	2.487	1.09	21.59	10.33	10.17	46.00	-24.41	Average
10	2.487	11.09	31.59	10.33	10.17	56.00	-24.41	QP
11	16.398	8.89	29.52	10.42	10.21	50.00	-20.48	Average
12	16.398	17.50	38.13	10.42	10.21	60.00	-21.87	QP

## AC 120V 60 Hz, Neutral



Condition: Neutral

Project : 2401A39666E-RF

tester : Macy.shi Note:Transmitting

Setting : RBW:9kHz VBW:Auto SWT:Auto

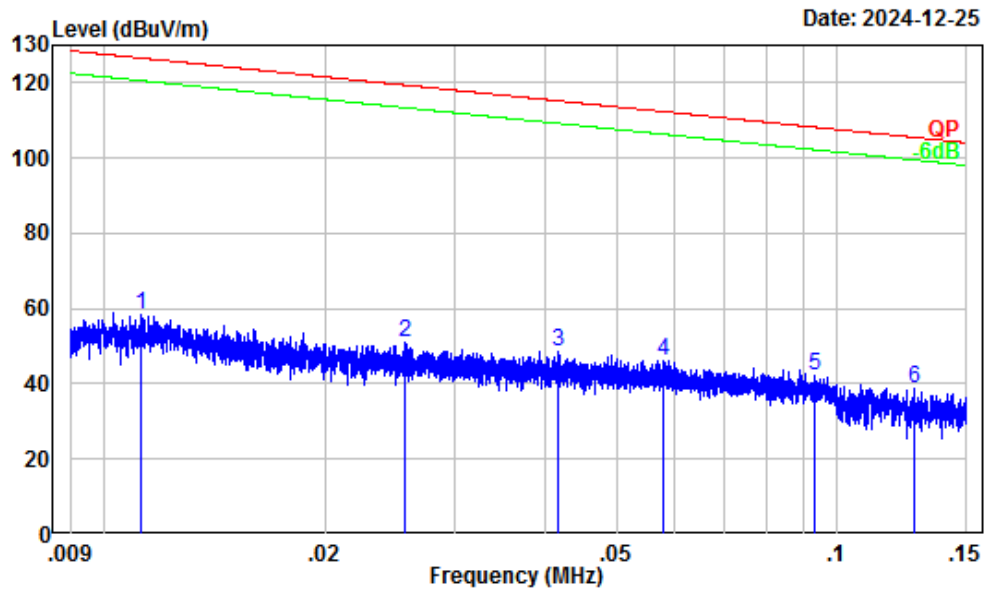
		Read		LISN	Cable	Limit	Over	
	Freq	Level	Level	Factor	Loss	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.174	10.34	30.85	10.41	10.10	54.77	-23.92	Average
2	0.174	22.13	42.64	10.41	10.10	64.77	-22.13	QP
3	0.208	11.62	32.32	10.61	10.09	53.27	-20.95	Average
4	0.208	20.49	41.19	10.61	10.09	63.27	-22.08	QP
5	0.447	5.89	26.79	10.78	10.12	46.93	-20.14	Average
6	0.447	15.36	36.26	10.78	10.12	56.93	-20.67	QP
7	0.595	3.78	24.55	10.65	10.12	46.00	-21.45	Average
8	0.595	17.50	38.27	10.65	10.12	56.00	-17.73	QP
9	2.707	2.09	22.49	10.23	10.17	46.00	-23.51	Average
10	2.707	12.05	32.45	10.23	10.17	56.00	-23.55	QP
11	15.066	13.96	34.58	10.40	10.22	50.00	-15.42	Average
12	15.066	21.57	42.19	10.40	10.22	60.00	-17.81	QP

**Radiated Emissions****Environmental Conditions**

<b>Temperature (°C)</b>	24.5	<b>Relative Humidity (%)</b>	37.1-50.2
<b>ATM Pressure (kPa):</b>	101.4	<b>Test engineer:</b>	Anson Su & Zenos Qaio
<b>Test date:</b>	2024/12/25-2024/12/27		
<b>EUT operation mode:</b>	Below 1GHz: Transmitting (Maximum output power mode, 8DPSK High Channel) Above 1GHz: Transmitting(Maximum output power mode, EDR (8DPSK))		
<b>Note:</b>	1. For the radiated spurious emission below 30MHz, only the worst case (parallel) was recorded. 2. For the radiated spurious emission below 30MHz, When the test result of peak was less than the limit of QP/Average more than 6dB, just peak value were recorded. 3. After pre-scan in the X, Y and Z axes of orientation, the worst case z-axis of orientation were recorded.		

Below 1GHz:

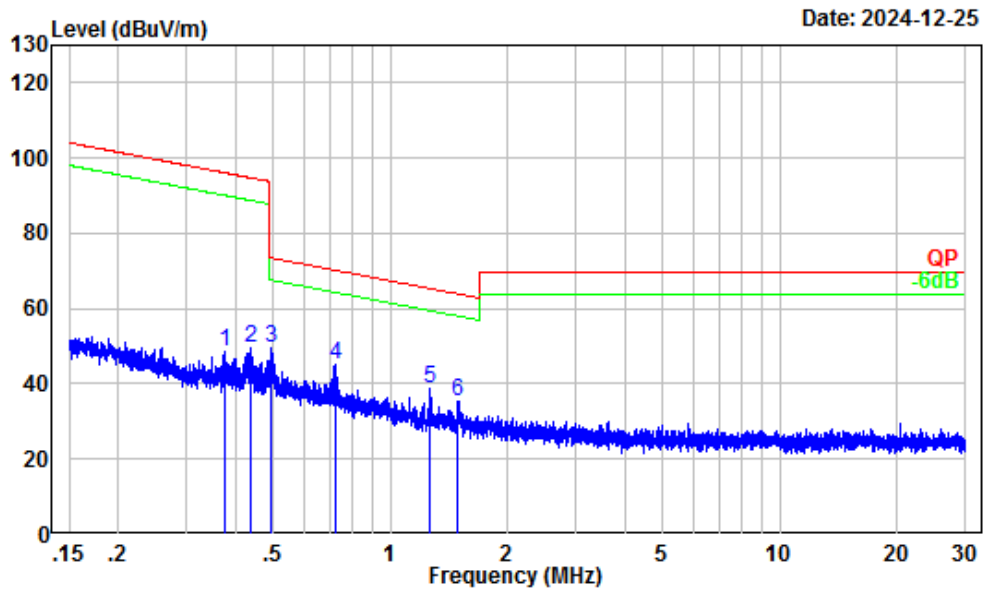
9kHz-150kHz



Site : Chamber A  
Condition : 3m  
Project Number: 2401A39666E-RF  
Test Mode : BT Transmitting  
Setting PK RBW: 0.3KHz VBW:1KHz  
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	32.06	26.34	58.40	126.59	-68.19	Peak
2	0.03	29.30	21.54	50.84	119.38	-68.54	Peak
3	0.04	27.27	21.20	48.47	115.20	-66.73	Peak
4	0.06	25.61	20.53	46.14	112.35	-66.21	Peak
5	0.09	22.47	19.82	42.29	108.21	-65.92	Peak
6	0.13	20.38	18.45	38.83	105.50	-66.67	Peak

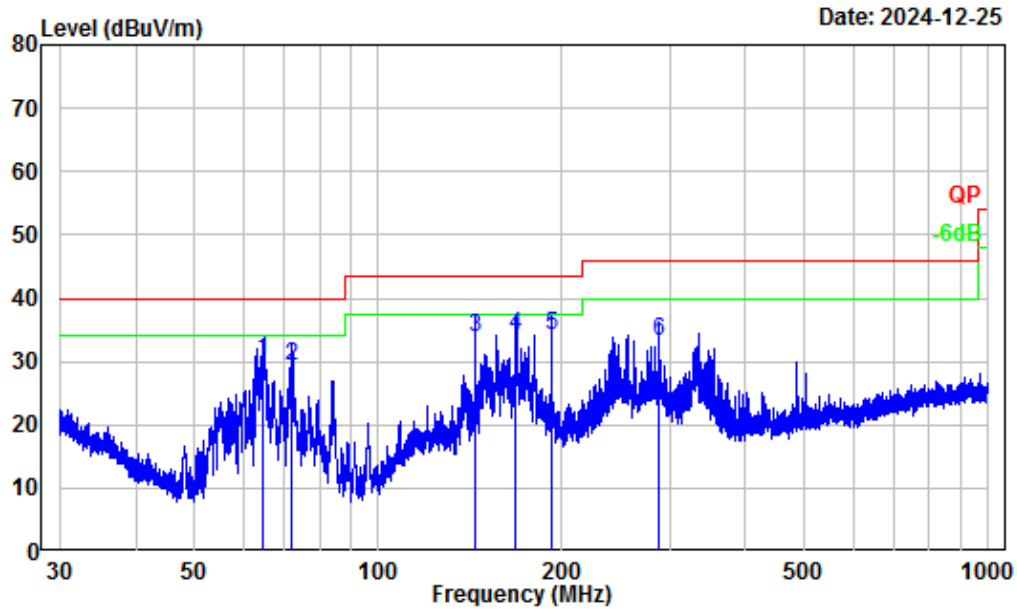
## 150kHz-30MHz



Site : Chamber A  
Condition : 3m  
Project Number: 2401A39666E-RF  
Test Mode : BT Transmitting  
Setting PK RBW: 10KHz VBW:30KHz  
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.38	8.75	39.64	48.39	96.10	-47.71	Peak
2	0.44	7.57	41.75	49.32	94.76	-45.44	Peak
3	0.50	6.46	42.86	49.32	73.68	-24.36	Peak
4	0.72	3.68	41.60	45.28	70.38	-25.10	Peak
5	1.27	0.45	38.10	38.55	65.36	-26.81	Peak
6	1.50	-0.19	35.70	35.51	63.90	-28.39	Peak

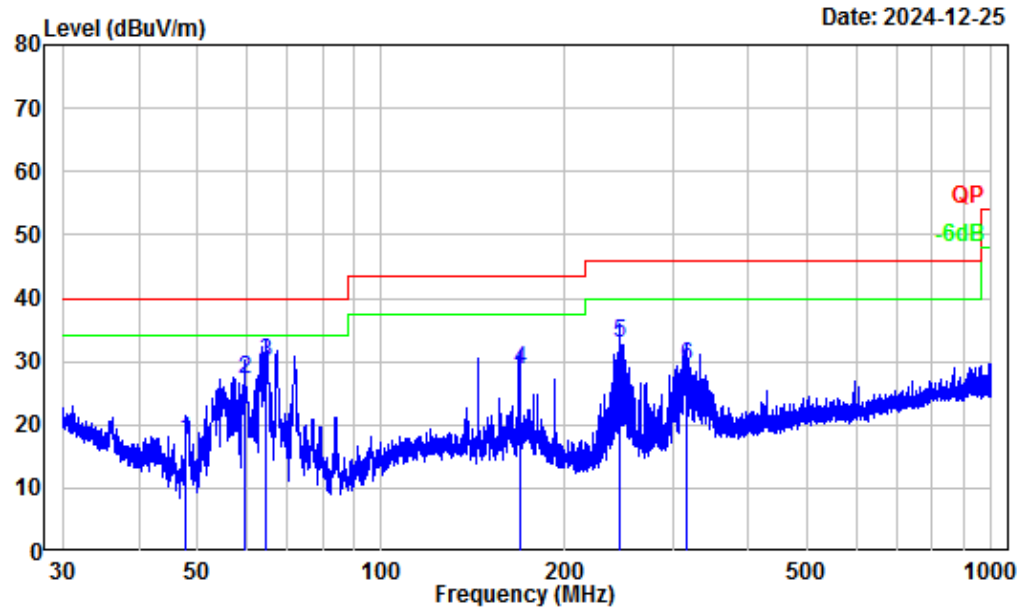
## 30MHz-1GHz\_Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number : 2401A39666E-RF  
Test Mode : BT Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Anson Su

	Freq Factor		Read	Limit	Over	Remark
	MHz	dB/m	Level	Level	Limit	
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
1	64.83	-18.00	48.20	30.20	40.00	-9.80 QP
2	71.99	-17.85	47.09	29.24	40.00	-10.76 QP
3	144.40	-12.18	46.10	33.92	43.50	-9.58 QP
4	168.27	-13.03	47.20	34.17	43.50	-9.33 QP
5	192.50	-13.98	48.09	34.11	43.50	-9.39 QP
6	288.62	-11.22	44.50	33.28	46.00	-12.72 QP

30MHz-1GHz\_Vertical



Site : Chamber A  
Condition : 3m Vertical  
Project Number : 2401A39666E-RF  
Test Mode : BT Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Anson Su

	Freq Factor		Read	Limit	Over	Remark
	MHz	dB/m	Level	Line	Limit	
			dBuV	dBuV/m	dBuV/m	dB
1	47.89	-17.30	34.70	17.40	40.00	-22.60 QP
2	59.78	-18.14	45.20	27.06	40.00	-12.94 QP
3	64.86	-18.00	47.75	29.75	40.00	-10.25 QP
4	168.41	-13.04	41.70	28.66	43.50	-14.84 QP
5	246.17	-13.19	46.17	32.98	46.00	-13.02 QP
6	317.56	-10.86	40.00	29.14	46.00	-16.86 QP



**Above 1GHz:**

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave					
8DPSK							
Low Channel							
4804	52.53	PK	H	-7.79	44.74	74	-29.26
4804	51.68	PK	V	-7.79	43.89	74	-30.11
Middle Channel							
4882	53.32	PK	H	-7.58	45.74	74	-28.26
4882	52.57	PK	V	-7.58	44.99	74	-29.01
High Channel							
4960	53.48	PK	H	-7.57	45.91	74	-28.09
4960	52.64	PK	V	-7.57	45.07	74	-28.93

Note:

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

Corrected Amplitude = Factor + Reading

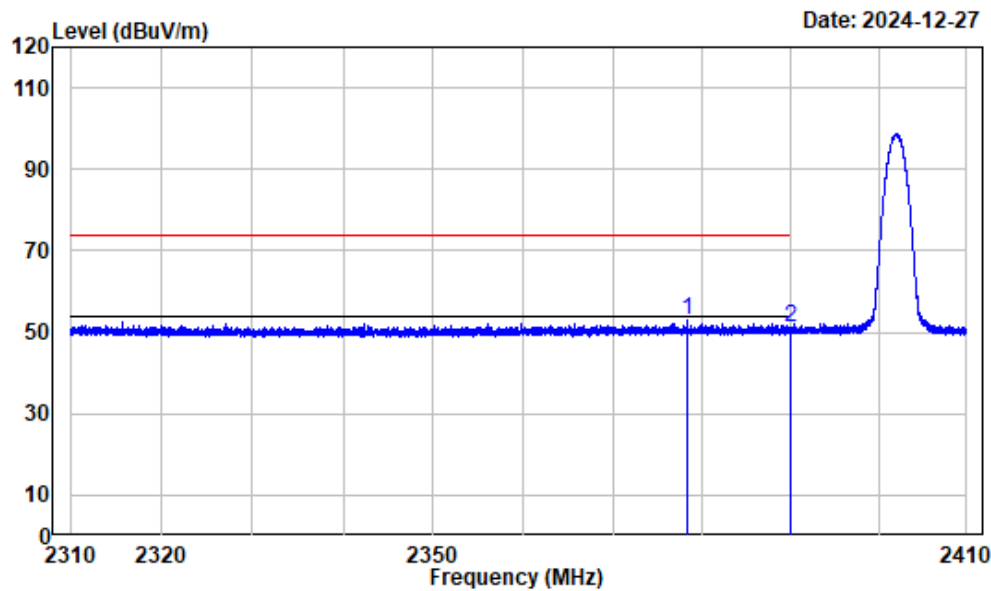
Margin = Corrected. Amplitude - Limit

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

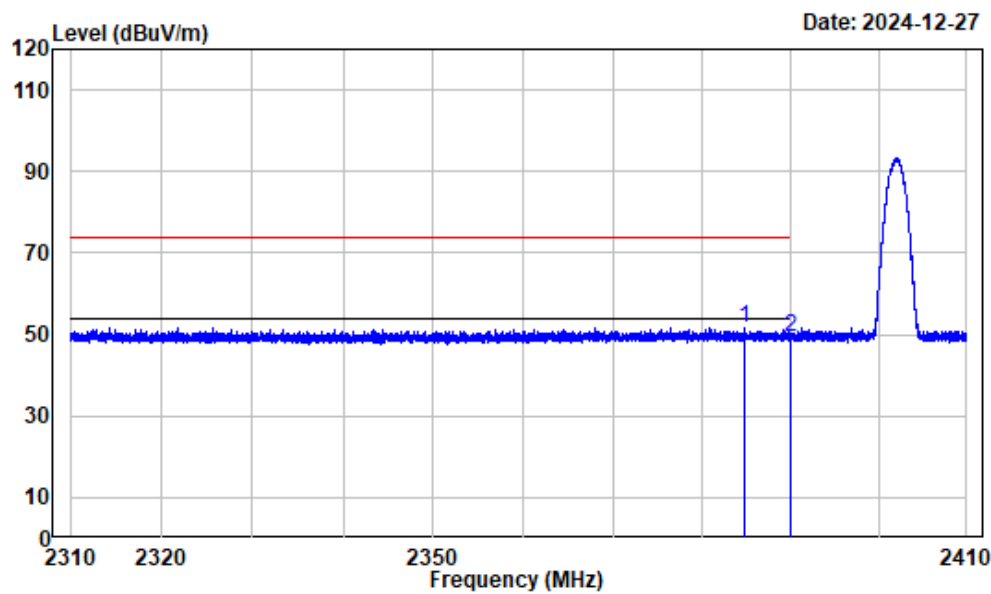
Left Band edge\_Horizontal



Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2402

Freq		Factor	Read Level	Level	Limit Line	Over Limit	Remark
MHz		dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2378.333	-10.96	63.73	52.77	74.00	-21.23	Peak
2	2390.000	-10.98	62.07	51.09	74.00	-22.91	Peak

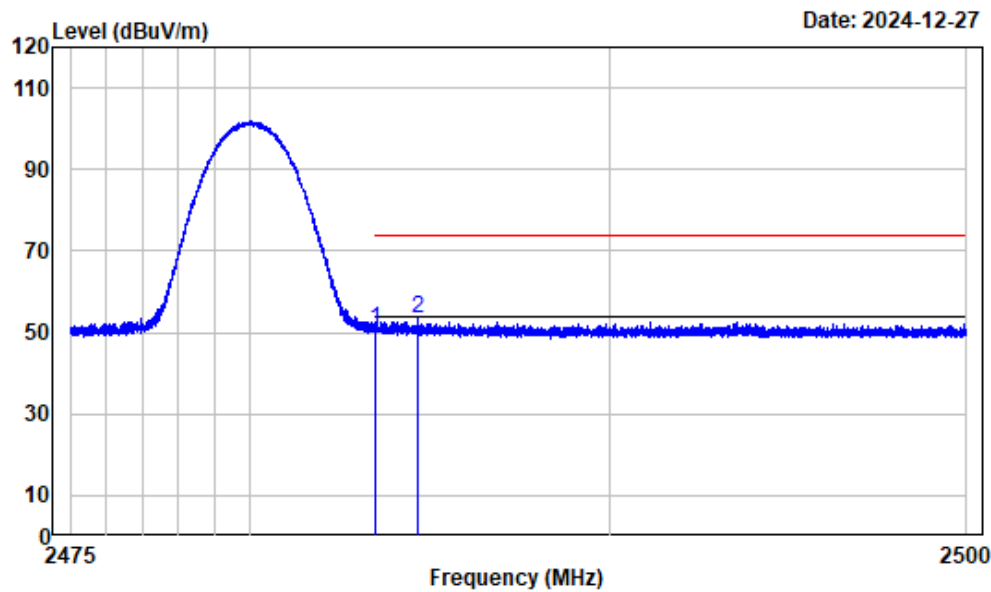
Left Band edge\_Vertical



Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2402

		Read		Limit	Over	Remark
Freq	Factor	Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 2384.872	-10.97	62.77	51.80	74.00	-22.20	Peak
2 2390.000	-10.98	60.54	49.56	74.00	-24.44	Peak

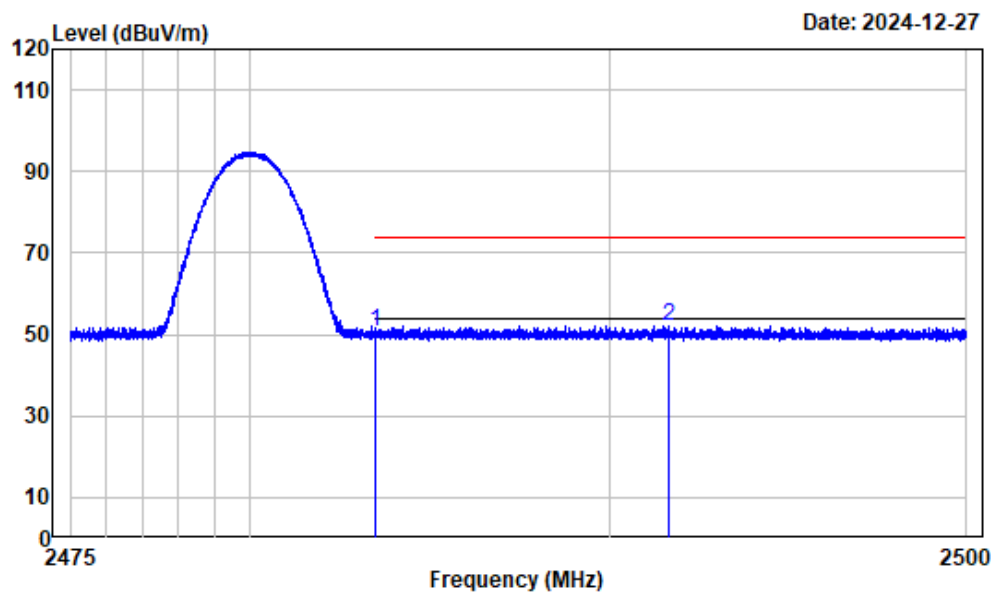
Right Band edge\_Horizontal



Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

		Read		Limit	Over	Remark
Freq	Factor	Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.97	61.65	50.68	74.00	-23.32 Peak
2	2484.642	-10.97	64.34	53.37	74.00	-20.63 Peak

Right Band edge\_Vertical

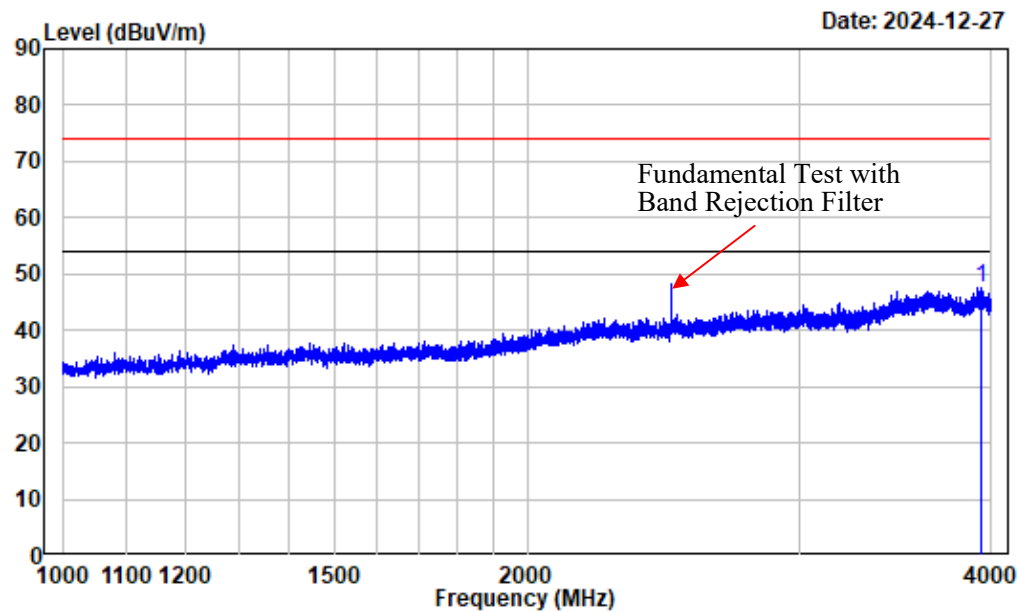


Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

		Read		Limit	Over	Remark
Freq Factor		Level	Level	Line	Limit	
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 2483.500	-10.97	61.61	50.64	74.00	-23.36	Peak
2 2491.649	-10.98	63.22	52.24	74.00	-21.76	Peak

Listed with the worst harmonic margin test plot

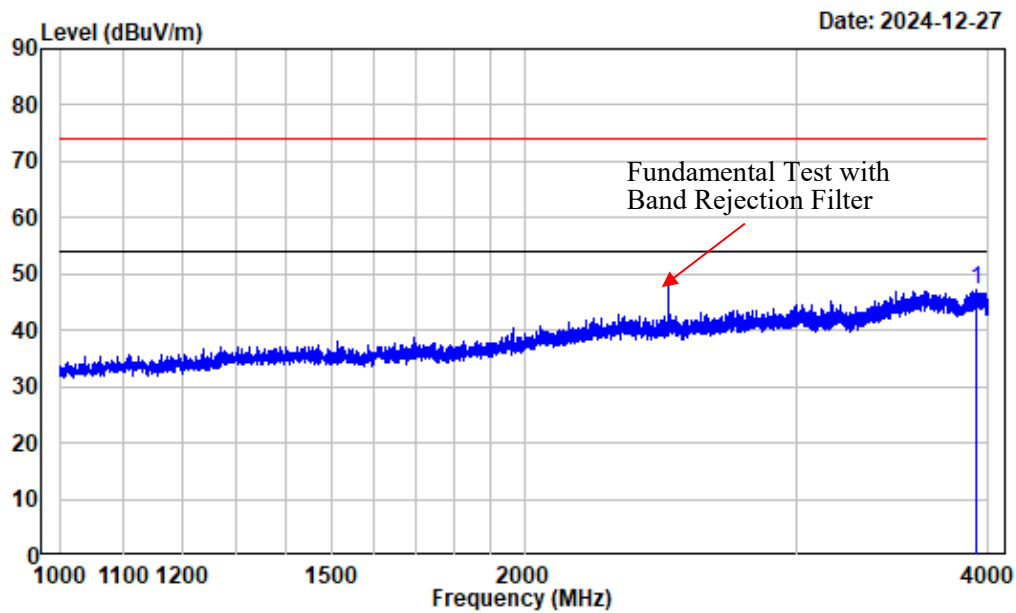
1-4GHz\_Horizontal



Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3936.992	-9.47	57.15	47.68	74.00	-26.32	Peak

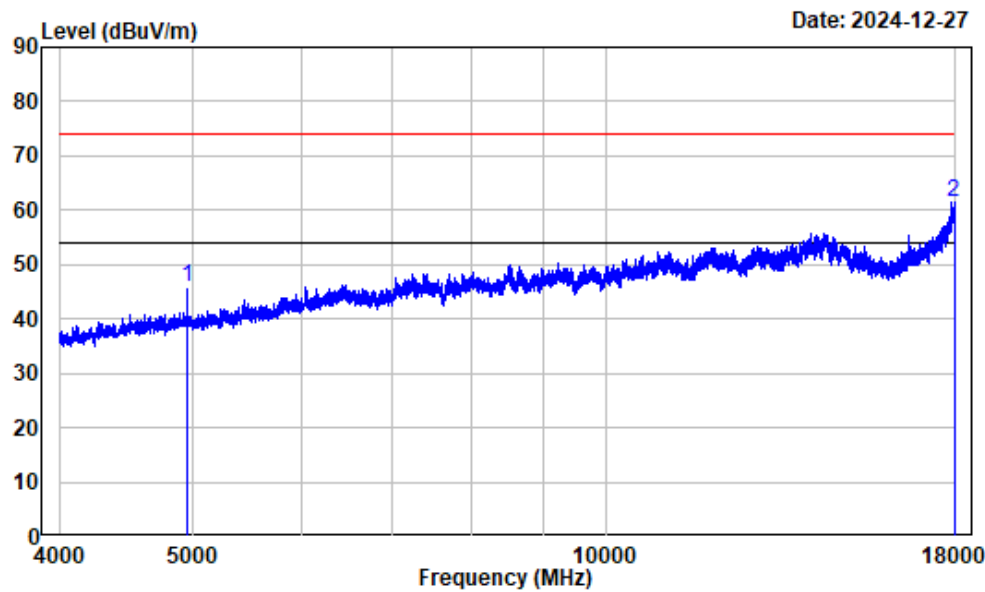
1-4GHz\_Vertical



Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

Freq Factor		Read Level	Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	
1	3923.865	-9.59	56.95	47.36	74.00 -26.64 Peak

4-18GHz\_Horizontal\_Peak

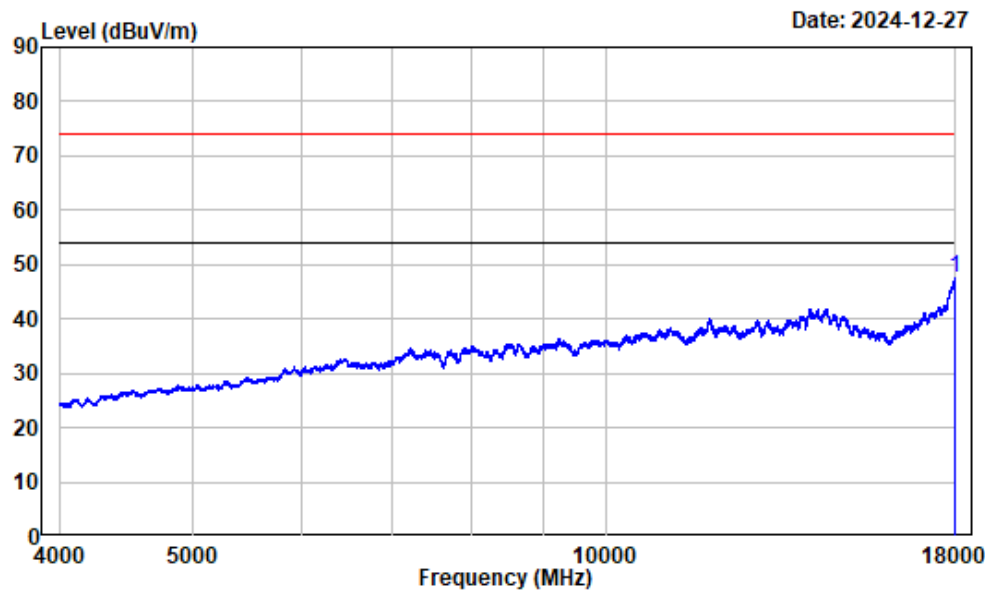


Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

Freq		Factor	Read Level	Level	Limit Line	Over Limit	Remark
MHz		dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	-7.57	53.48	45.91	74.00	-28.09	Peak
2	17956.240	12.98	48.43	61.41	74.00	-12.59	Peak



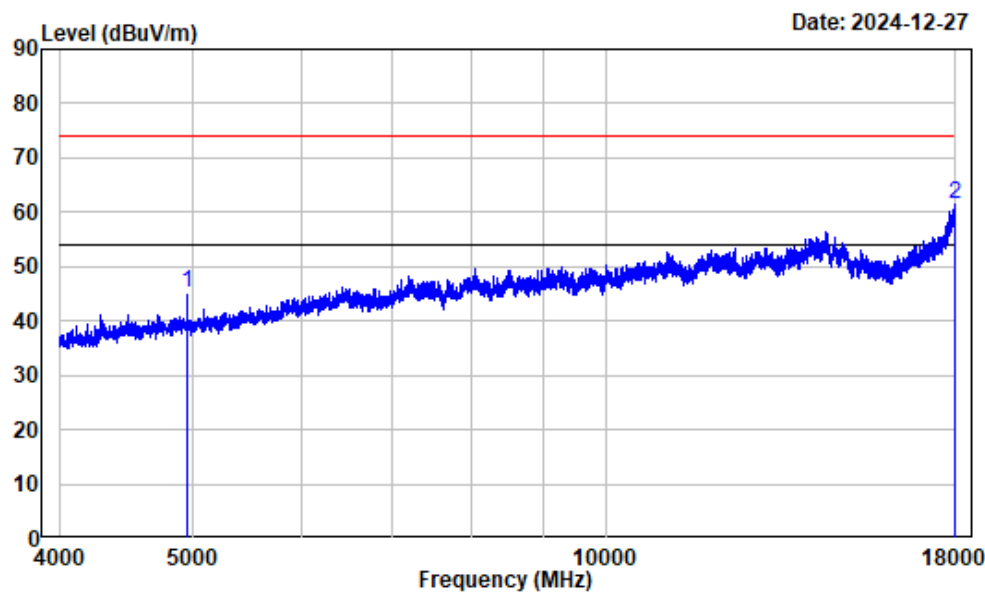
4-18GHz\_Horizontal\_Average



Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak  
Note : BT-3DH5-2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 17991.250	13.16	34.36	47.52	54.00	-6.48	Average

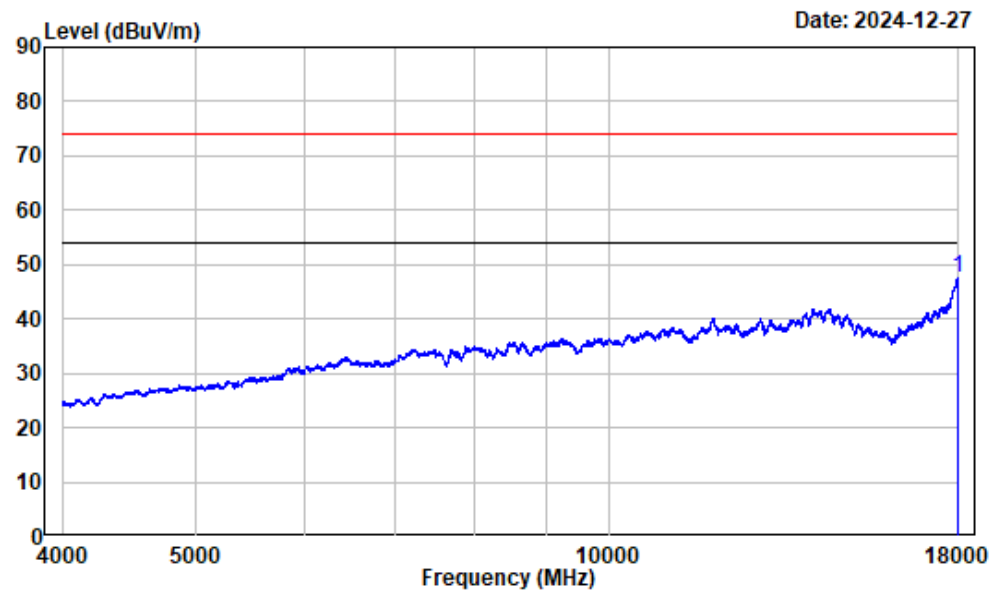
4-18GHz\_Vertical\_Peak



Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
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	-7.57	52.64	45.07	74.00	-28.93	Peak
2	17989.500	13.16	48.36	61.52	74.00	-12.48	Peak

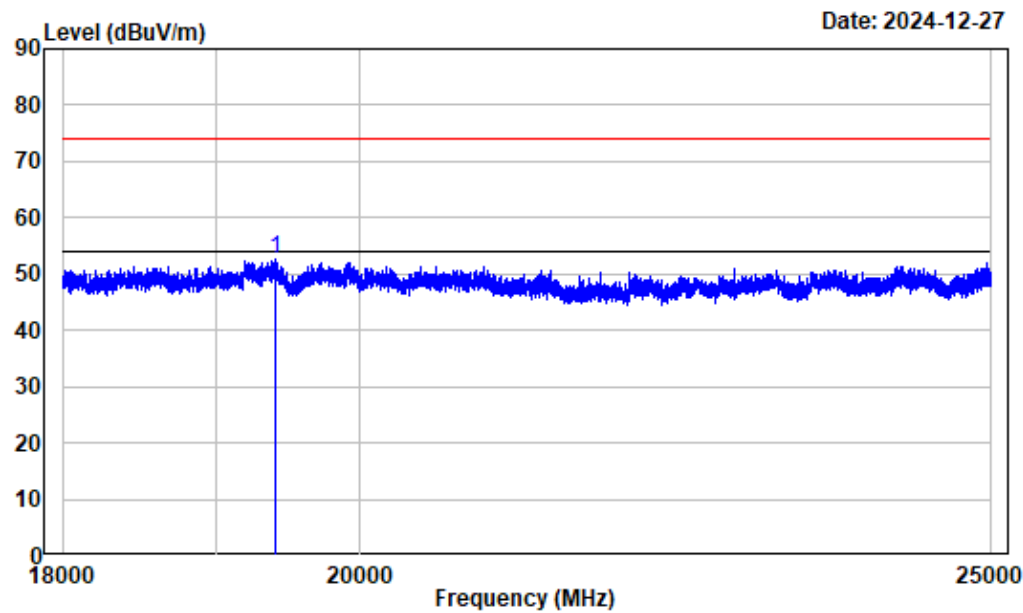
4-18GHz\_Vertical\_Average



Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak  
Note : BT-3DH5-2480

Freq Factor		Read Level		Limit	Over	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1 17998.630	13.20	34.50	47.70	54.00	-6.30	Average

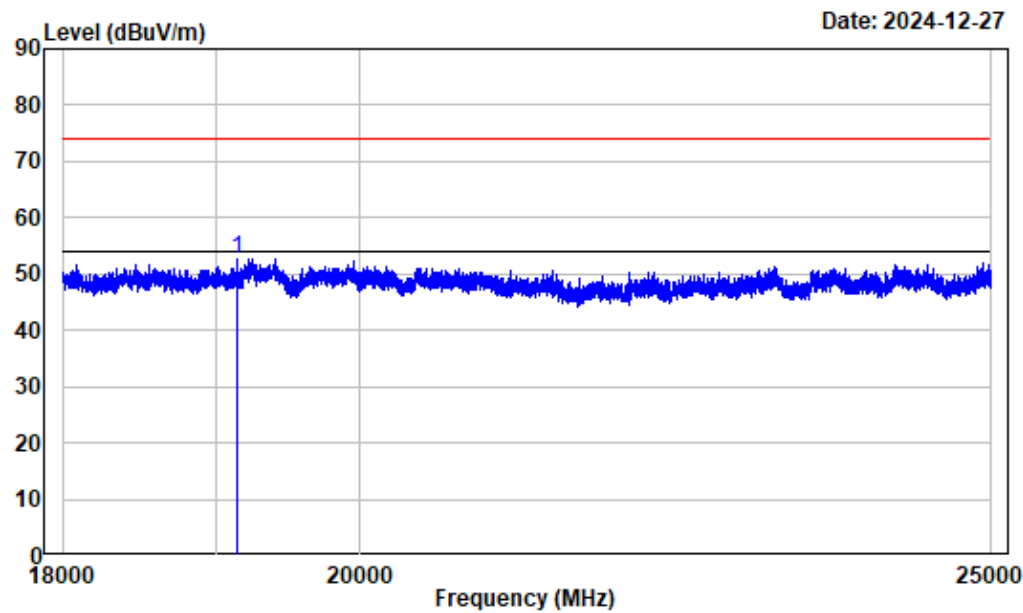
18-25GHz\_Horizontal



Condition : Horizontal  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	19408.050	15.09	37.56	52.65	74.00	-21.35	Peak

18-25GHz\_Vertical



Condition : Vertical  
Project No. : 2401A39666E-RF  
Tester : Zenos Qiao  
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak  
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	19148.140	15.30	37.48	52.78	74.00	-21.22	Peak

20 dB Emission Bandwidth

Test Information:

Sample No.:	2VO2-1	Test Date:	2024/12/20
Test Site:	RF	Test Mode:	Transmitting
Tester:	Usain Ou	Test Result:	N/A

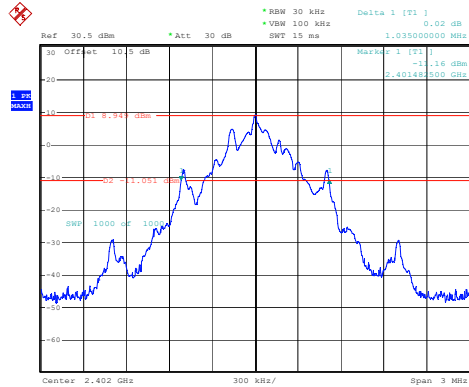
Environmental Conditions:

Temperature: (°C):	25.1	Relative Humidity: (%)	43	ATM Pressure: (kPa)	101
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Test Data:

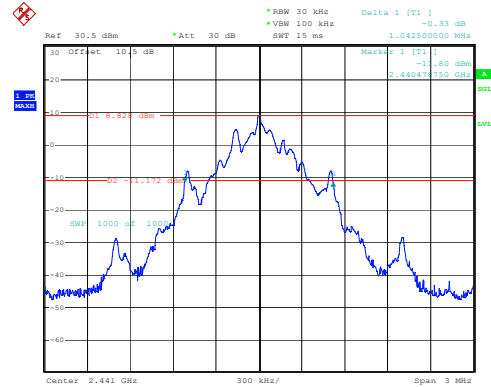
Mode	Channel	Result (MHz)
DH1	Low Channel	1.035
	Middle Channel	1.043
	High Channel	1.043
2DH1	Low Channel	1.301
	Middle Channel	1.305
	High Channel	1.301
3DH1	Low Channel	1.283
	Middle Channel	1.283
	High Channel	1.283

DH1\_Low 1.035MHz



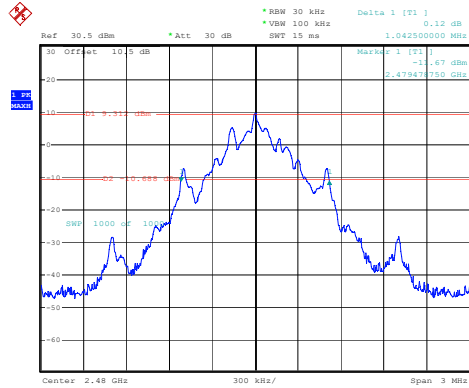
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:39:03

DH1\_Middle 1.043MHz



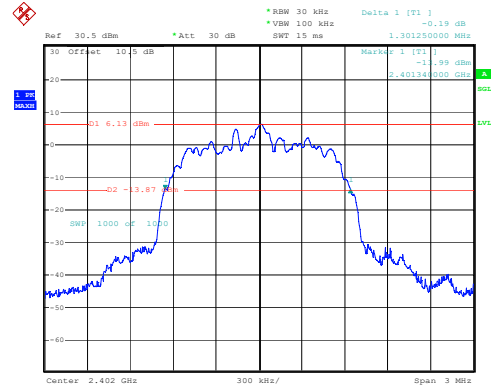
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:40:23

DH1\_High 1.043MHz



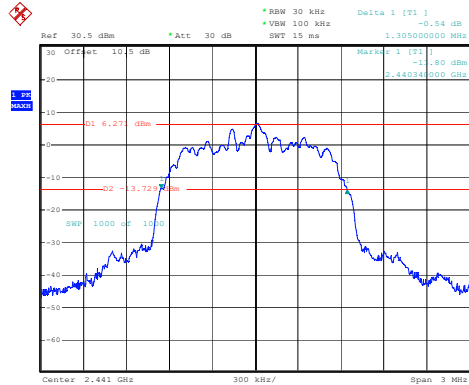
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:42:50

2DH1\_Low 1.301MHz



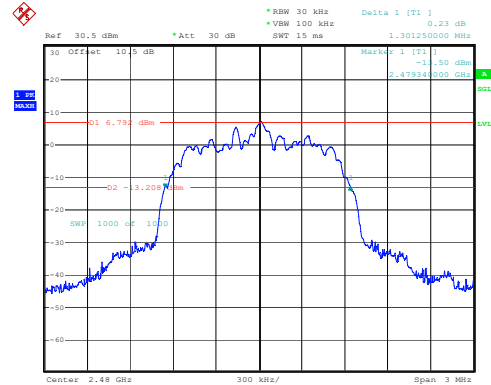
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:45:27

2DH1\_Middle 1.305MHz



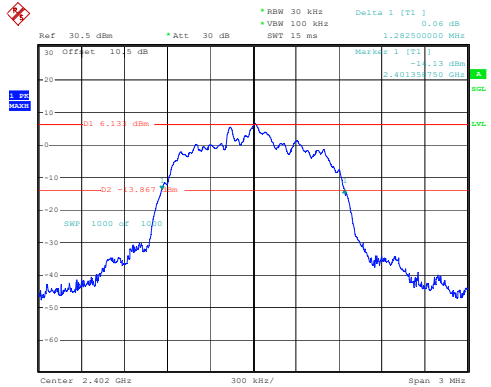
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:46:48

2DH1\_High 1.301MHz



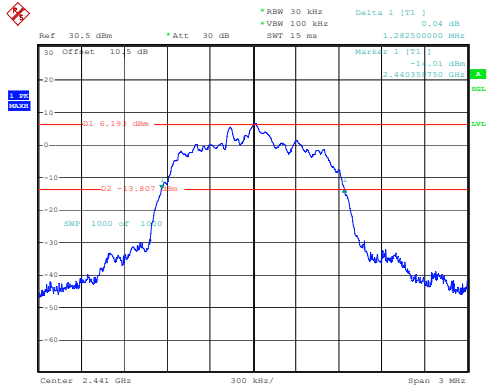
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:48:18

3DH1\_Low 1.283MHz



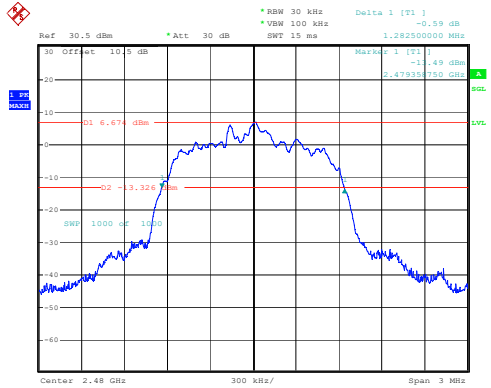
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:49:49

3DH1\_Middle 1.283MHz



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:51:10

3DH1\_High 1.283MHz



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:58:32



Channel Separation

Test Information:

Sample No.:	2VO2-1	Test Date:	2024/12/30
Test Site:	RF	Test Mode:	Transmitting
Tester:	Usain Ou	Test Result:	Pass

Environmental Conditions:

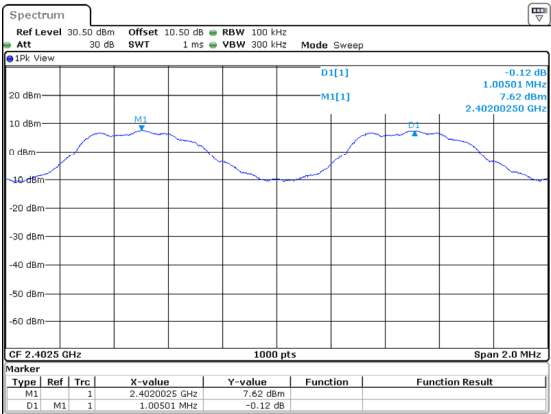
Temperature: (°C):	25.1	Relative Humidity: (%)	43	ATM Pressure: (kPa)	101
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Test Data:

Mode	Channel	Result (MHz)	Limit (MHz)	Verdict
DH1	Low Channel	1.005	0.867	Pass
	Middle Channel	1.007	0.870	Pass
	High Channel	1.005	0.867	Pass

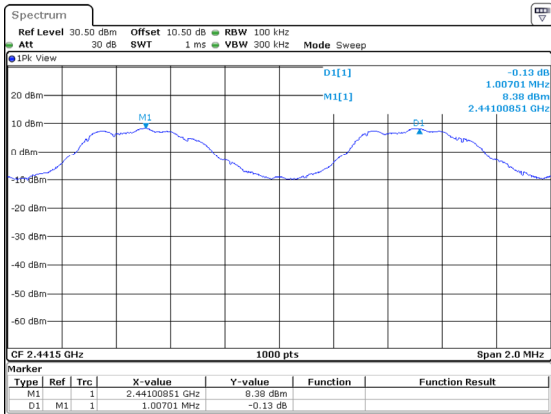
Note: Only the BDR (GFSK) mode result is reported since EDR ( $\pi/4$ -DQPSK) and EDR (8DPSK) modes have the exact same channel plan, and the limit is the maximum 20dB bandwidth \*2/3

DH1\_Low 1.005MHz



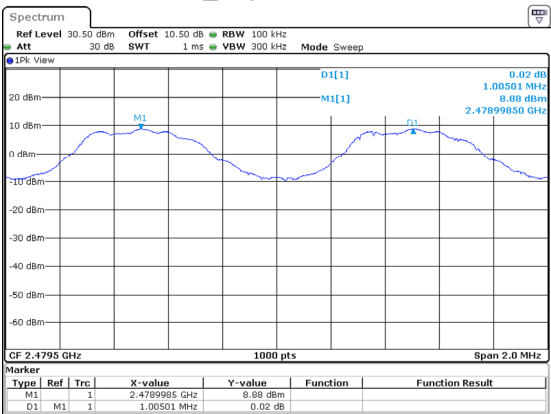
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 30.DEC.2024 22:21:51

DH1\_Middle 1.007MHz



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 30.DEC.2024 22:14:06

DH1\_High 1.005MHz



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 30.DEC.2024 22:17:39

Number of Hopping Frequency

Test Information:

Sample No.:	2VO2-1	Test Date:	2024/12/20~2024/12/21
Test Site:	RF	Test Mode:	Transmitting
Tester:	Usain Ou	Test Result:	Pass

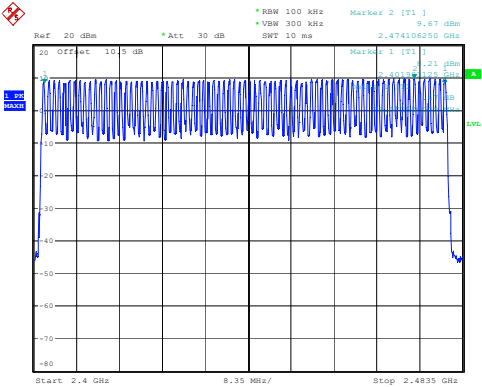
Environmental Conditions:

Temperature: (°C):	25.1	Relative Humidity: (%)	43	ATM Pressure: (kPa)	101
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Test Data:

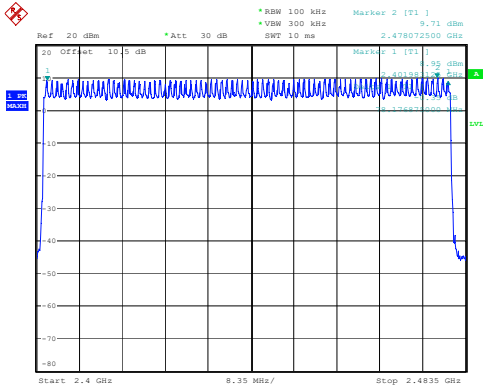
Mode	Channel	Result	Limit	Verdict
DH1	Hopping Channel	79	15	Pass
2DH1	Hopping Channel	79	15	Pass
3DH1	Hopping Channel	79	15	Pass

DH1\_Hopping 79



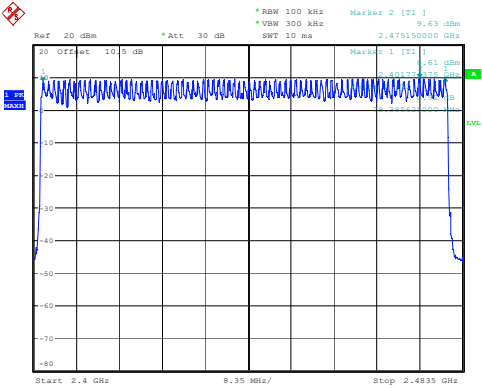
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:03:56

2DH1\_Hopping 79



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:58:02

3DH1\_Hopping 79



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:46:28

Maximum Conducted Output Power

Test Information:

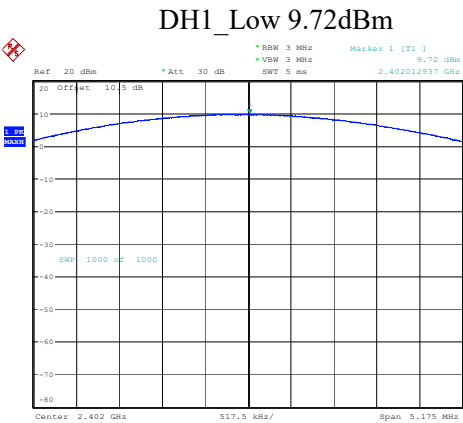
Sample No.:	2VO2-1	Test Date:	2024/12/20
Test Site:	RF	Test Mode:	Transmitting
Tester:	Usain Ou	Test Result:	Pass

Environmental Conditions:

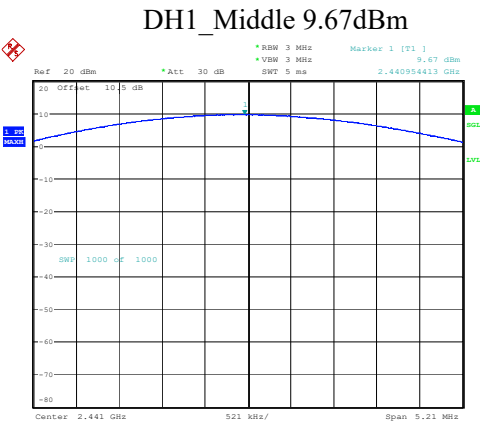
Temperature: (°C):	25.1	Relative Humidity: (%)	43	ATM Pressure: (kPa)	101
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Test Data:

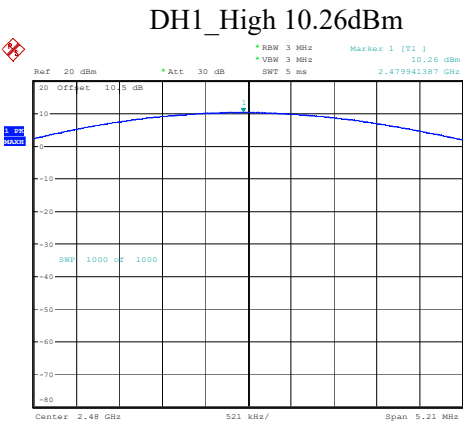
Mode	Channel	Result (dBm)	Limit (dBm)	Verdict
DH1	Low Channel	9.72	21.00	Pass
	Middle Channel	9.67	21.00	Pass
	High Channel	10.26	21.00	Pass
2DH1	Low Channel	11.57	21.00	Pass
	Middle Channel	11.72	21.00	Pass
	High Channel	12.30	21.00	Pass
3DH1	Low Channel	11.97	21.00	Pass
	Middle Channel	12.09	21.00	Pass
	High Channel	12.63	21.00	Pass



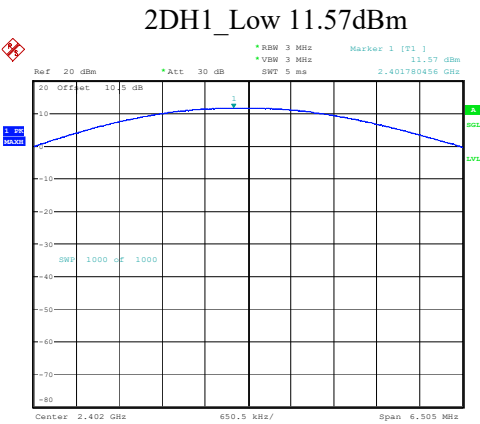
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:39:30



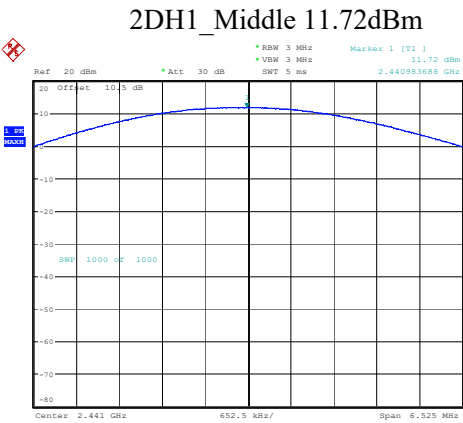
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:41:58



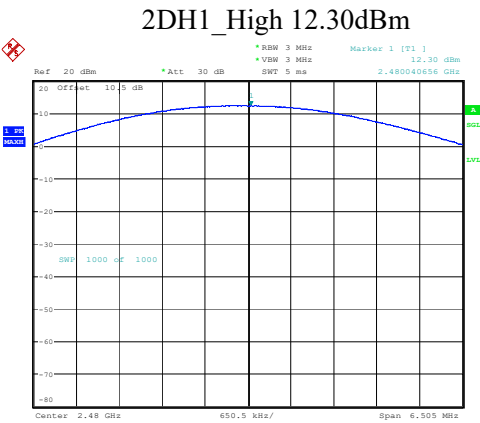
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:44:23



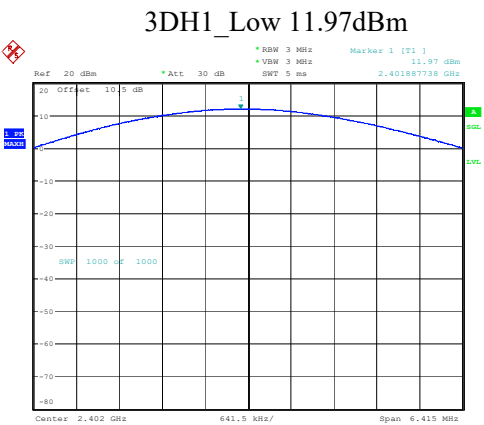
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:45:55



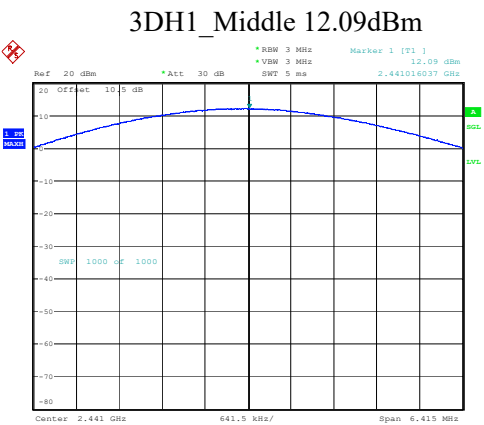
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:47:26



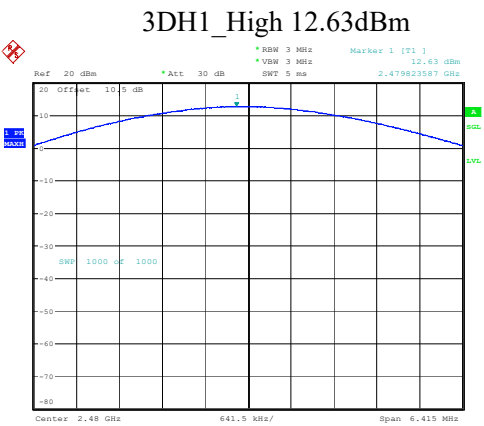
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:48:46



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:50:16



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:57:33



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 22:59:00

100 kHz Bandwidth of Frequency Band Edge

Test Information:

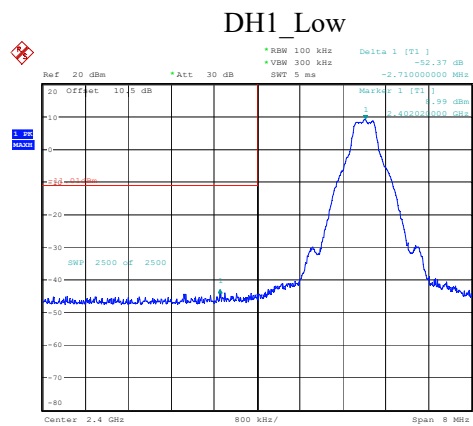
Sample No.:	2VO2-1	Test Date:	2024/12/20~2025/02/10
Test Site:	RF	Test Mode:	Transmitting
Tester:	Usain Ou	Test Result:	Pass

Environmental Conditions:

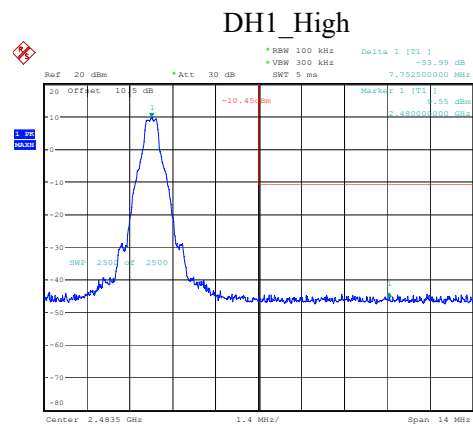
Temperature: (°C):	23.2-25.1	Relative Humidity: (%)	43-47	ATM Pressure: (kPa)	101
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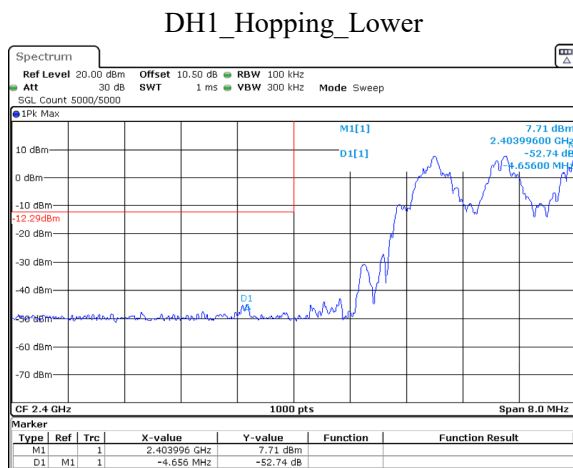
Test Data:



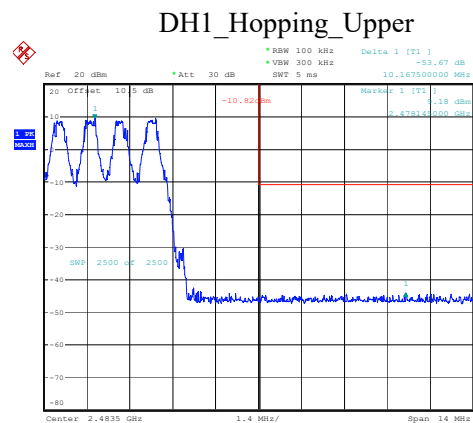
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:10:32



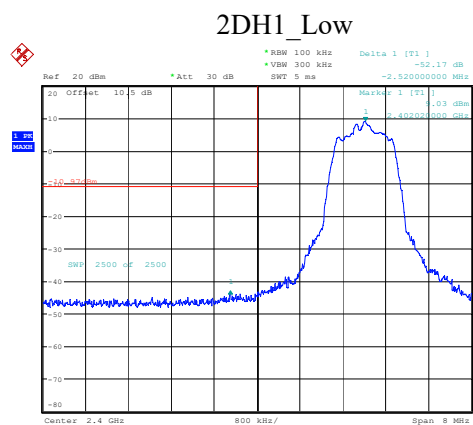
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:08:56



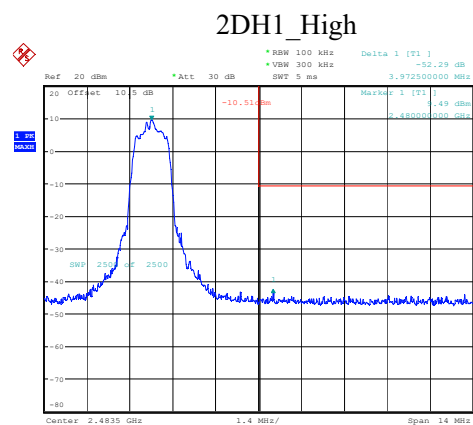
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 10.FEB.2025 20:00:04



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:31:22

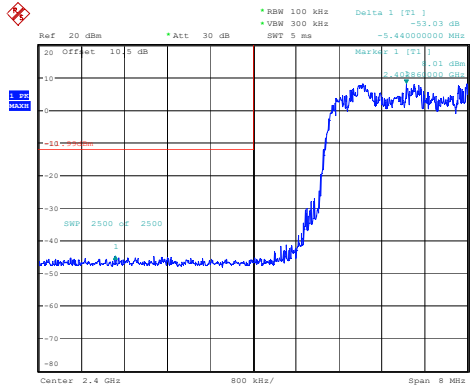


ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:12:54



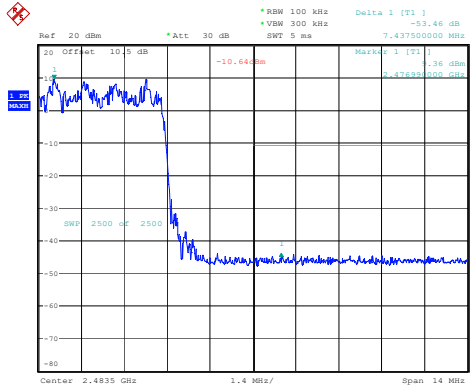
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:23:54

2DH1\_Hopping\_Lower



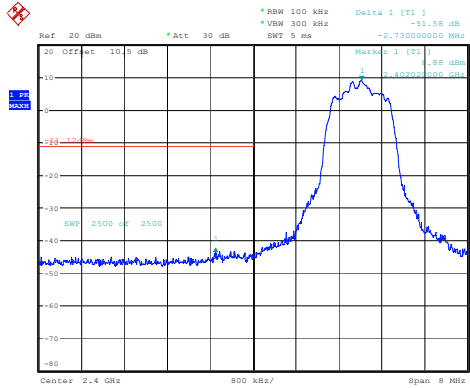
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:33:34

2DH1\_Hopping\_Upper



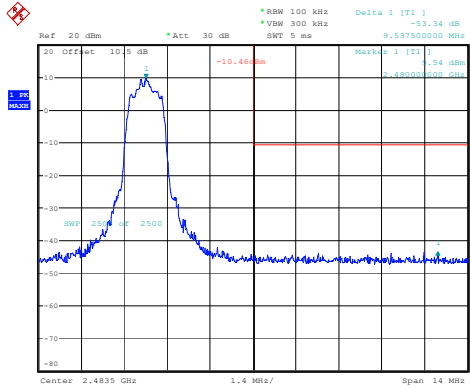
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:36:29

3DH1\_Low



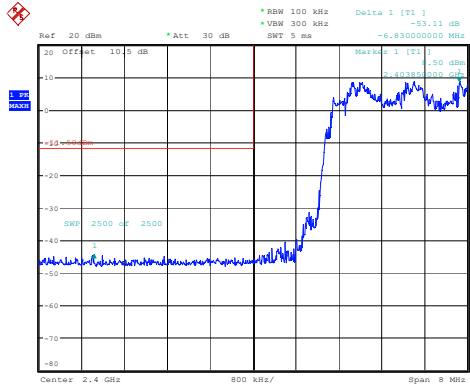
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:25:39

3DH1\_High



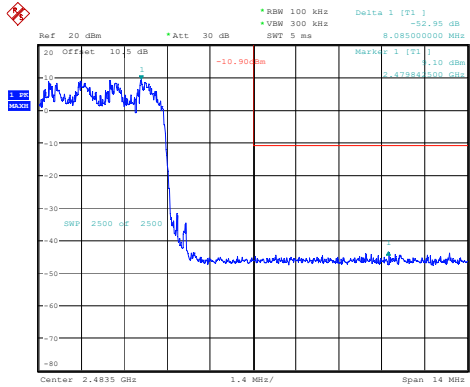
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:28:05

3DH1\_Hopping\_Lower



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:38:04

3DH1\_Hopping\_Upper



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 20.DEC.2024 23:40:09

**Time of Occupancy (dwell time)**

**Test Information:**

<b>Sample No.:</b>	2VO2-1	<b>Test Date:</b>	2024/12/21
<b>Test Site:</b>	RF	<b>Test Mode:</b>	Transmitting
<b>Tester:</b>	Usain Ou	<b>Test Result:</b>	Pass

**Environmental Conditions:**

<b>Temperature:</b> (°C):	25.1	<b>Relative Humidity:</b> (%)	43	<b>ATM Pressure:</b> (kPa)	101
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**Test Data:**

Mode	Channel	Pulse width (ms)	Dwell time (s)	Limit (s)	Verdict
DH1	Hopping Channel	0.386	0.124	0.400	Pass
DH3	Hopping Channel	1.650	0.264	0.400	Pass
DH5	Hopping Channel	2.913	0.311	0.400	Pass
2DH1	Hopping Channel	0.398	0.127	0.400	Pass
2DH3	Hopping Channel	1.661	0.266	0.400	Pass
2DH5	Hopping Channel	2.925	0.312	0.400	Pass
3DH1	Hopping Channel	0.399	0.128	0.400	Pass
3DH3	Hopping Channel	1.661	0.266	0.400	Pass
3DH5	Hopping Channel	<b>2.931</b>	0.313	0.400	Pass

**Note:**

DH1:Dwell time=Pulse width (ms) × (1600/2/79) ×31.6 s

DH3:Dwell time=Pulse width (ms) × (1600/4/79) ×31.6 s

DH5:Dwell time=Pulse width (ms) × (1600/6/79) ×31.6 s

2DH1: Dwell time=Pulse width (ms) × (1600/2/79) ×31.6 s

2DH3: Dwell time=Pulse width (ms) × (1600/4/79) ×31.6 s

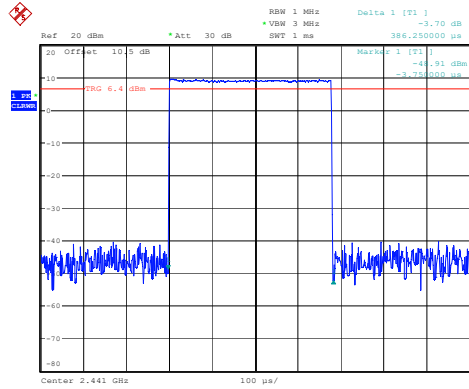
2DH5: Dwell time=Pulse width (ms) × (1600/6/79) ×31.6 s

3DH1: Dwell time=Pulse width (ms) × (1600/2/79) ×31.6 s

3DH3: Dwell time=Pulse width (ms) × (1600/4/79) ×31.6 s

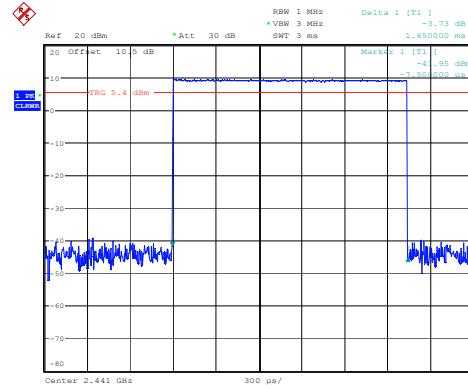
3DH5: Dwell time=Pulse width (ms) × (1600/6/79) ×31.6 s

### DH1\_Hopping 0.386ms



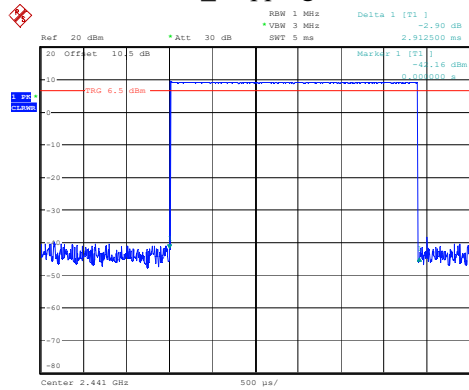
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:05:03

### DH3\_Hopping 1.650ms



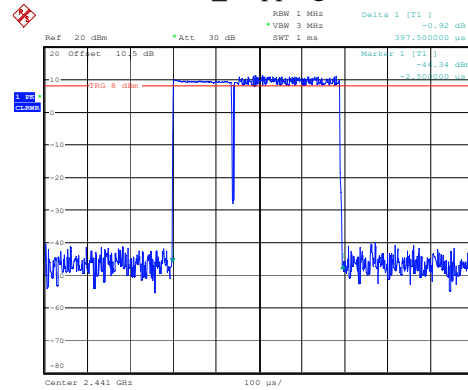
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:06:09

### DH5\_Hopping 2.913ms



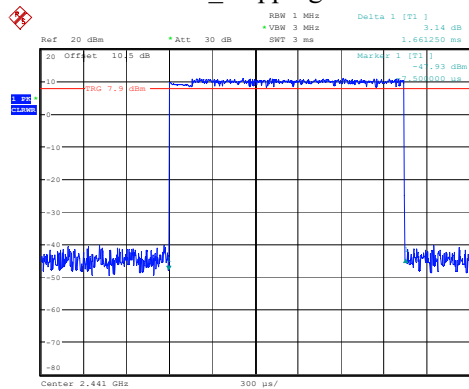
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:07:02

### 2DH1\_Hopping 0.398ms



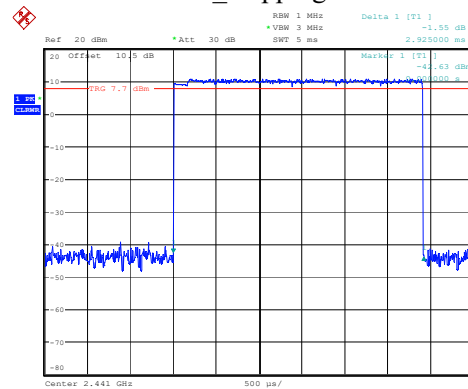
ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:08:22

### 2DH3\_Hopping 1.661ms

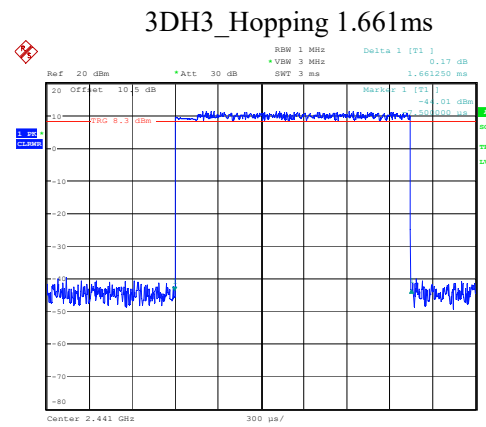


ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:09:56

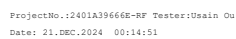
### 2DH5\_Hopping 2.925ms



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:11:18



ProjectNo.:2401A39666E-RF Tester:Usain Ou  
Date: 21.DEC.2024 00:15:43



## RF EXPOSURE EVALUATION

### MPE-Based Exemption

#### Applicable Standard

According to subpart 15.247 (i) and 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 v01 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)(3)(i)(C)] to support an exemption from 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	$0.0128 R^2 f$ .
1,500-100,000	$19.2 R^2$ .

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 <sup>#</sup> (dBm)	Antenna Gain <sup>#</sup>		ERP		Evaluation Distance (m)	ERP Limit (mW)
			(dBi)	(dBd)	(dBm)	(mW)		
BT	2402-2480	13.0	-4.32	-6.47	6.53	4.50	0.2	768
BLE	2402-2480	10.5	-4.32	-6.47	4.03	2.53	0.2	768
2.4GWi-Fi	2412-2462	24.0	-4.32	-6.47	17.53	56.62	0.2	768
LTE B2	1850-1910	25.0	1.55	-0.60	24.40	275.42	0.2	768
LTE B4	1710-1755	25.0	1.23	-0.92	24.08	255.86	0.2	768
LTE B5	824-849	25.0	-4.62	-6.77	18.23	66.53	0.2	422
LTE B7	2500-2570	25.0	1.78	-0.37	24.63	290.40	0.2	768
LTE B25	1850-1915	25.0	1.55	-0.60	24.40	275.42	0.2	768
LTE B26	814-849	25.0	-4.62	-6.77	18.23	66.53	0.2	417
LTE B38	2570-2620	25.0	1.58	-0.57	24.43	277.33	0.2	768
LTE B41	2496-2690	25.0	1.78	-0.37	24.63	290.40	0.2	768
LTE B66	1710-1780	25.0	1.60	-0.55	24.45	278.61	0.2	768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.

2. The BT and 2.4G Wi-Fi cannot transmit at same time.

3. 0dBd=2.15dBi

Simultaneous transmitting consideration (worst case):

The ratio=  $ERP_{2.4G\ Wi-Fi}/limit + ERP_{LTE\ B7}/limit = 56.62/768 + 290.40/768 = 0.452 < 1.0$

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**

## **EUT PHOTOGRAPHS**

Please refer to the attachment 2401A39666E-RF External photo and 2401A39666E-RF Internal photo.



## **TEST SETUP PHOTOGRAPHS**

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Please refer to the attachment 2401A39666E-RF-00A Test Setup photo.

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