TEST REPORT

Applicant Name:	Meizhou Guo Wei Electronics Co., Ltd.
Address:	AD1 Section, Economic Development Area, Dongsheng Industrial District, Meizhou, Guangdong, China.
Report Number:	2401Z105001E-RFB
FCC ID:	2ARRB-02814
IC:	20353-02814

Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2;

RSS-247 ISSUE 4, July 24, 2025▼

Sample Description

Product Type:	Wireless Car Adapter for Android Auto
Model No.:	MA2
Multiple Model(s) No.:	N/A
Trade Mark:	N/A
Date Received:	2024-11-19
Issue Date:	2025-11-05

Test Result:	Pass▲

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

Prepared and Checked By:

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Bruce Lin
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Approved By:

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

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401Z105001E-RFB	Original Report	2025-11-05

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	MA2
FVIN	v1.1.8
Frequency Range	2402~2480MHz
Transmit Peak Power	3.90dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification#	4.18dBi (provided by the applicant)
Voltage Range	DC 5V from USB Port
Sample serial number	2UJT-2 for Radiated Emissions Test 2UJT-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 Commissions rules and RSS-247 Issue 4, July 24, 2025▾, RSS-GEN Issue 5, Feb. 2021Amendment 2 of the Innovation, Science and Economic Development Canada rules.

Test Methodology

All measurements contained in this report were conducted with RSS-Gen, RSS-247 and ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 ▾.

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℃
Humidity		±1%
Supply voltages		±0.4%

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

Test Facility

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

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

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel	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#	SecureCRT
Power Level#	Default

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

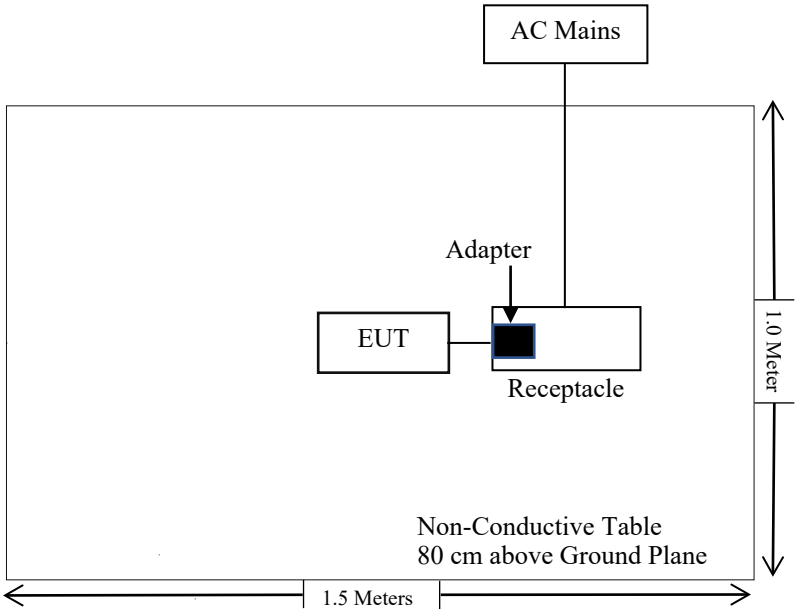
Manufacturer	Description	Model	Serial Number
HuaJin	Adapter	HJ-0502000W20US	N/A

External I/O Cable

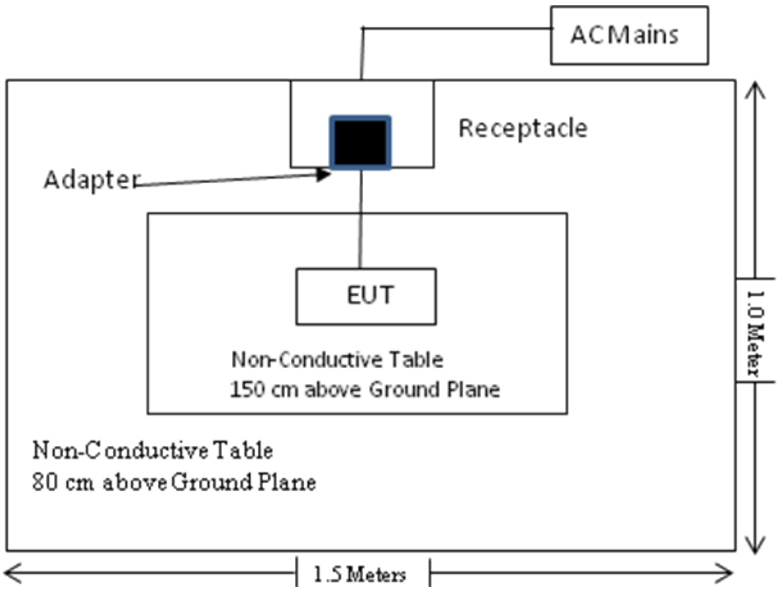
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.8	EUT	Adapter
Unshielded Un-detachable AC Cable	1.0	Receptacle	AC Mains

Block Diagram of Test Setup

For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



SUMMARY OF TEST RESULTS

Rules		Description of Test	Result
FCC §15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207(a)	RSS-Gen §8.8	AC Line Conducted Emissions	Not Applicable
FCC §15.205, §15.209, §15.247(d)	RSS-247 §6.6, RSS-GEN §8.10	Radiated Emissions	Compliant
FCC §15.247(a)(1)	RSS-247 §6.2.1(a), RSS-GEN §6.7	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
FCC §15.247(a)(1)	RSS-247 §6.2.1(b), §6.2.3.1(a)	Channel Separation Test	Compliant
FCC §15.247(a)(1)(iii)	RSS-247 §6.2.3.1(b)	Quantity of hopping channel Test	Compliant
FCC §15.247(b)(1)	RSS-247 §6.2.3.1(a) & §6.2.3.2	Peak Output Power Measurement	Compliant
FCC §15.247(d)	RSS-247 §6.6	Band edges	Compliant
FCC §15.247(a)(1)(iii)	RSS-247 §6.2.3.1(b)	Time of Occupancy (Dwell Time)	Compliant
FCC §15.247(d)	RSS-247 §6.6	Conducted Spurious Emission	Compliant
FCC §15.247 (i), §1.1307 (b) (3) & §2.1091	/	MPE-Based Exemption	Compliant
/	RSS-102 § 6.6	Field reference level exposure exemption limits	Compliant

Not Applicable: This device is a vehicle-mounted device.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
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	Chamber Cable 1	F-03-EM236	2024/06/18	2025/06/17
Unknown	Cable	XH500C	J-10M-A	2024/06/18	2025/06/17
BACL	Active Loop Antenna	1313-1A	4031911	2024/05/14	2027/05/13
Unknown	Cable	2Y194	0735	2024/12/04	2025/12/03
Unknown	Cable	PNG214	1354	2024/12/04	2025/12/03
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
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	DT7220SCU	DS79903	2024/09/09	2025/09/08
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
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSU26	200982	2024/12/04	2025/12/03
Rohde&Schwarz	Spectrum Analyzer	FSV40-N	102259	2024/12/04	2025/12/03
Unknown	10dB Attenuator	Unknown	F-03-EM122	2024/06/27	2025/06/26
Unknown	10dB Attenuator	Unknown	F-03-EM122	2025/06/26	2026/06/25

*** 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

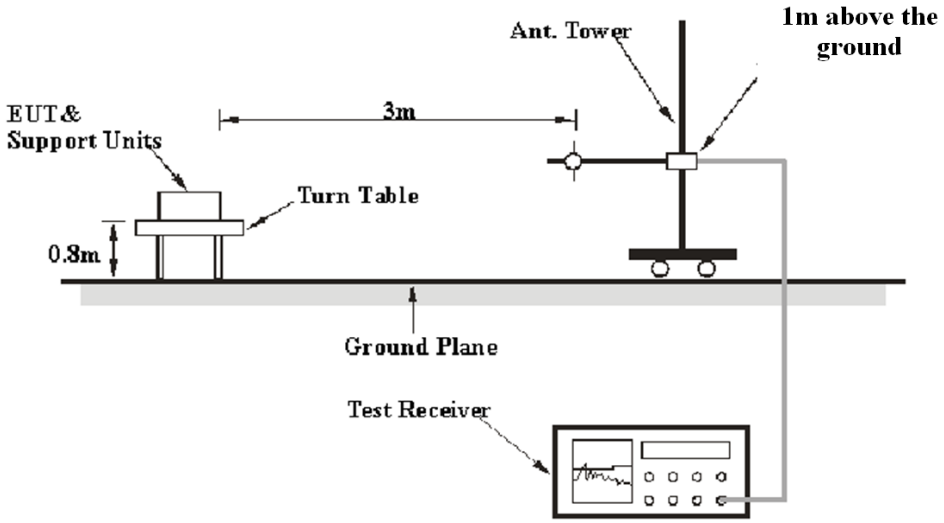
Radiated Emissions

Applicable Standard

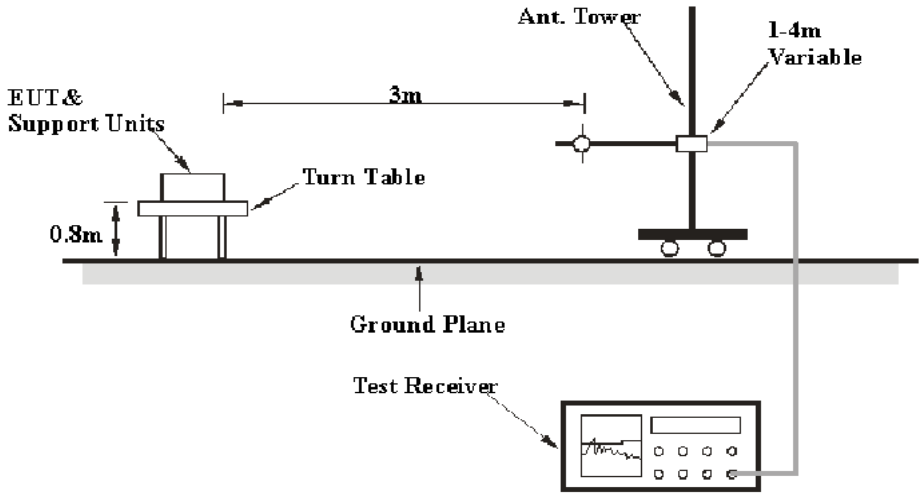
FCC §15.205; §15.209; §15.247(d); RSS-247§ 6.6; RSS-GEN § 8.10

EUT Setup

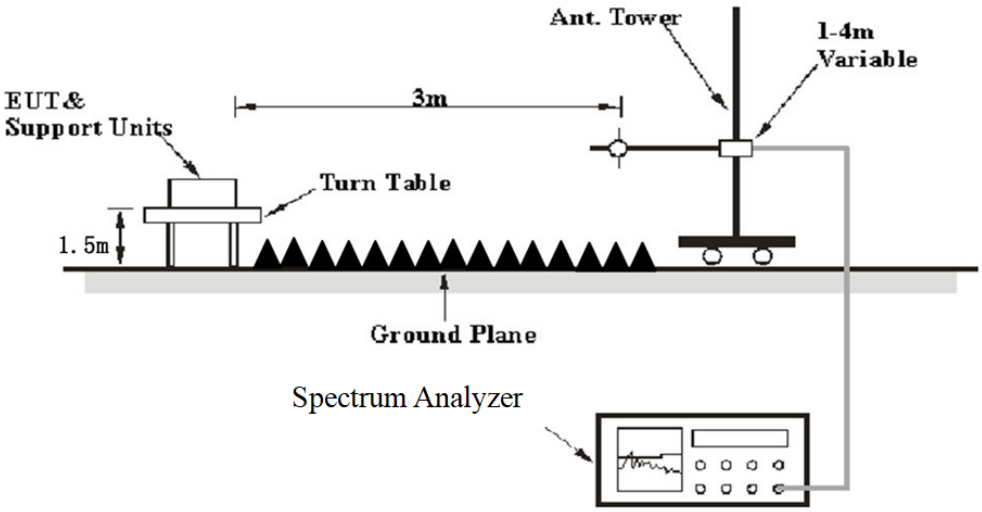
9 kHz-30MHz:



30MHz-1GHz:



Above 1GHz:



The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2020. The specification used was the FCC 15.209, FCC 15.247, RSS-247, RSS-Gen limits.

EMI Test Receiver & Spectrum Analyzer Setup

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

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

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

20 dB Emission Bandwidth & 99% Occupied Bandwidth

According to FCC §15.247(a) (1):

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.

According to RSS-247 § 6.2.1 (a), RSS-Gen § 6.7:

The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. 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.

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

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

Test Procedure

Test Method: ANSI C63.10-2020 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 at least 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 (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2.

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.

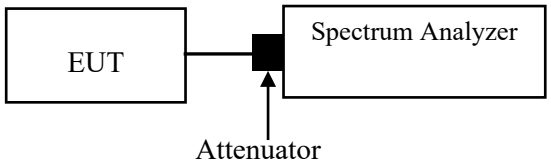
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).

h) Determine the "−xx dB down amplitude" using [(reference value) - 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 unmodulated 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 dBc 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 dBc bandwidth shall be reported by providing spectral 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).



Note: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Channel Separation Test

According to FCC §15.247(a) (1):

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.

According to RSS-247 § 6.2.1 (b):

The hopping channel carrier frequencies shall be separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

According to RSS-247 § 6.2.3.1 (a):

FHS operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

Test Procedure

Test Method: ANSI C63.10a-2024 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) $\geq 1/10^{th}$ the RBW.

d) Sweep: No faster than coupled (auto) time.

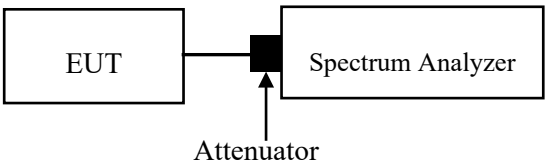
e) Detector function: Peak.

f) Trace: Max-hold.

g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A spectral plot of the data shall be included in the test report.

Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the carrier separation need only be measured for one of those modulation schemes or data rates.



Note 1: The limit is 2/3*20 dB bandwidth
Note 2: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Quantity of Hopping Channel Test

Applicable Standard

According to FCC §15.247(a) (1) (iii):

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.

According to RSS-247 § 6.2.3.1 (b):

FHS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

Test Method: ANSI C63.10a-2024 Clause 7.8.3

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

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it could 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 $\geq 1/10^{th}$ the RBW.

d) Sweep: No faster than coupled (auto) time.

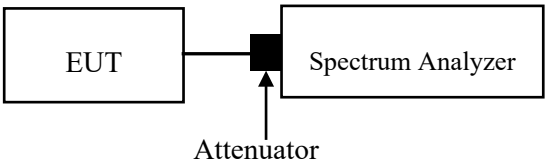
e) Detector function: Peak.

f) Trace: Max-hold.

g) Allow the trace to stabilize.

It might prove necessary to break the span up into subranges 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. A spectral plot of the data shall be included in the test report.

Where the device shares the same channel plan (carrier frequencies and number of channels) across multiple data rates or modulation schemes then the number of channels need only be measured for one of those modulation schemes or data rates.



Note: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Time of Occupancy (Dwell Time)

Applicable Standard

According to FCC §15.247(a) (1) (iii):

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.

According to RSS-247 § 6.2.3.1 (b):

FHS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 s within a period of 0.4 s, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.4

Use the following spectrum analyzer settings to determine the dwell time per hop:

a) Span: Zero span, centered on a hopping channel.

b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected transmission time per hop.

c) Sweep time: Set so that the start of the first transmission and end of the last transmission for the hop are clearly captured. Setting the sweep time to be slightly longer than the hopping period per channel (hopping period = 1/hopping rate) should achieve this.

d) Use a video trigger, where possible with a trigger delay, so that the start of the transmission is clearly observed. The trigger level might need adjustment to reduce the chance of triggering when the system hops on an adjacent channel.

e) Detector function: Peak.

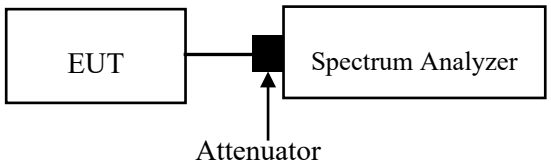
f) Trace: Clear-write, single sweep.

g) Place markers at the start of the first transmission on the channel and at the end of the last transmission. The dwell time per hop is the time between these two markers.

To determine the number of hops on a channel in the regulatory observation period repeat the measurement using a longer sweep time. When the device uses a single hopping sequence the period of measurement should be sufficient to capture at least 2 hops. When the device uses a dynamic hopping sequence, or the sequence varies, the period of measurement may need to capture multiple hops to better determine the average time of occupancy. Count the number of hops on the channel across the sweep time.

The average number of hops on the same channel within the regulatory observation period is calculated from the number of hops on the channel divided by the spectrum analyzer sweep time multiplied by the regulatory observation period. For example, if three hops are counted with an analyzer sweep time of 500 ms and the regulatory observation period is 10 s, then the number of hops in that ten seconds is 3 / 0.5 × 10, or 60 hops.

The average time of occupancy is calculated by multiplying the dwell time per hop by the number of hops in the observation period.



Note: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Peak Output Power Measurement

Applicable Standard

According to FCC §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.

According to RSS-247§6.2.3.2:

The following transmitter output power and e.i.r.p. requirements shall apply:

a. if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 1.0 W.

b. if the hopset uses less than 75 hopping channels the maximum peak conducted output power shall not exceed 0.125 W.

c. the e.i.r.p. shall not exceed 4 W, except as provided in sections 6.5 a) and b).

Test Procedure

Test Method: ANSI C63.10-2020 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. Frequency hopping shall be disabled for this test. Use the following spectrum analyzer settings:

a) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

b) RBW > 20 dB bandwidth of the emission being measured.

c) VBW ≥ RBW.

d) Sweep: No faster than coupled (auto) time.

e) Detector function: Peak.

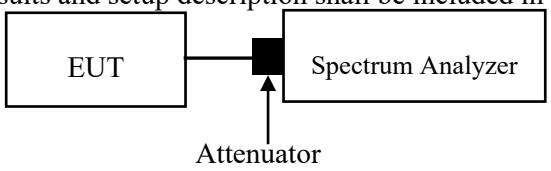
f) Trace: Max-hold.

g) Allow trace to stabilize.

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

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

j) A spectral plot of the test results and setup description shall be included in the test report.



Note 1: 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 add with offset into test equipment, the total offset consists of attenuator and/or RF cable loss
Note 2: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Band Edges

Applicable Standard

According to FCC §15.247(d),

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)).

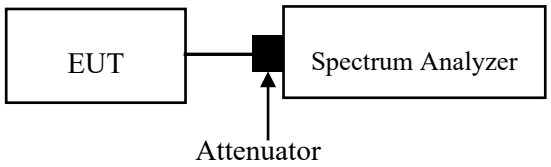
According to RSS-247 § 6.6,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device, or hybrid system is operating,, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power– based on either an RF conducted or a radiated measurement– provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 dB instead of 20dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.7.2 & Clause 6.10

1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products that fall outside of the authorized band of operation.
2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2.
3) Attenuation: Auto (at least 10 dB preferred).
4) Sweep time: No faster than coupled (auto) time.
5) Resolution bandwidth: 100 kHz.
6) Video bandwidth: 300 kHz.
7) Detector: Peak.
8) Trace: Max-hold.



Note: Offset (10.5dB) = Attenuator (10dB) + Cable loss (0.5dB)

Conducted Spurious Emission

Applicable Standard

According to FCC §15.247(d),

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)).

According to RSS-247 § 6.6,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device, or hybrid system is operating,, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power– based on either an RF conducted or a radiated measurement– provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 6.3.2, the attenuation required shall be 30 dB instead of 20dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

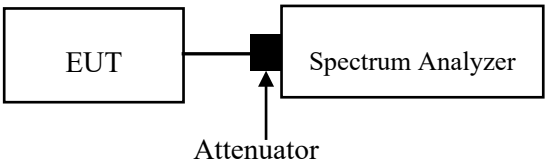
Test Procedure

Test Method: ANSI C63.10-2020 Clause 7.8.7.1

To demonstrate compliance with the relative out-of-band emissions requirements conducted spurious emissions shall be measured for the transmit frequencies, per 5.5 and 5.6, and at the maximum transmit powers. Frequency hopping shall be disabled for this test with the exception of measurements at the allocated band-edges which shall be repeated with hopping enabled.

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The frequency range of testing shall span 30 MHz to 10 times the operating frequency and this may be done in a single sweep or, to aid resolution, across a number of sweeps. The resolution bandwidth shall be 100 kHz, video bandwidth 300 kHz, and a coupled sweep time with a peak detector.

The limit is based on the highest in-band level across all channels measured using the same instrument settings (resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector). To help clearly demonstrate compliance a display line may be set at the required offset (typically 20 dB) below the highest in-band level. Where the highest in-band level is not clearly identified in the out-of-band measurements a separate spectral plot showing the in-band level shall be provided.



Note 1: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the worst case cable loss was add with offset into test equipment, the total offset consists of attenuator and/or RF cable and/or power splitter loss
Note 2: Offset (13.5dB) = Attenuator (10dB) + Cable loss (3.5dB)

ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

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 res ponsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.
c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

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

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

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

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

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

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached for Bluetooth and the maximum antenna gain# is 4.18dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Gain#	Impedance	Frequency Range
PCB	4.18dBi	50Ω	2.4~2.5GHz

Result: Compliant

TEST DATA AND RESULTS

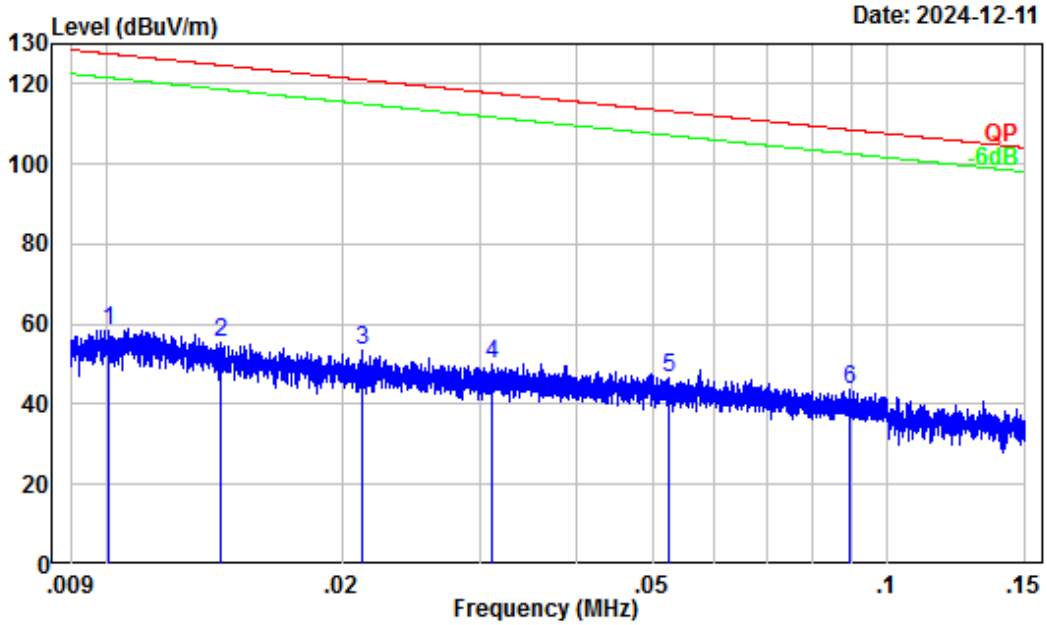
Radiated Emissions

Environmental Conditions

Temperature (℃)	24.5~25	**Relative Humidity (%)**	50~50.4
ATM Pressure (kPa):	101~101.7	**Test engineer:**	Carl Zhu & Zenos Qiao
Test date:	2024.12.11~2024.12.23		
EUT operation mode:	Below 1GHz: Transmitting (Maximum output power mode, 8DPSK High Channel) Above 1GHz: Transmitting		
Note:	1. After pre-scan in the X, Y and Z axes of orientation, the worst case z-axis of orientation were recorded. 2. For the radiated spurious emission below 30MHz, only the worst case (parallel) was recorded. 3. 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. 4. The spurious emission from 9 kHz-30MHz of IC RSS-GEN standard, the unit of final result on the test plots are dBμV/m, so the limit should be added by 51,5 dB from dBμA/m to dBμV/m		

Below 1GHz:

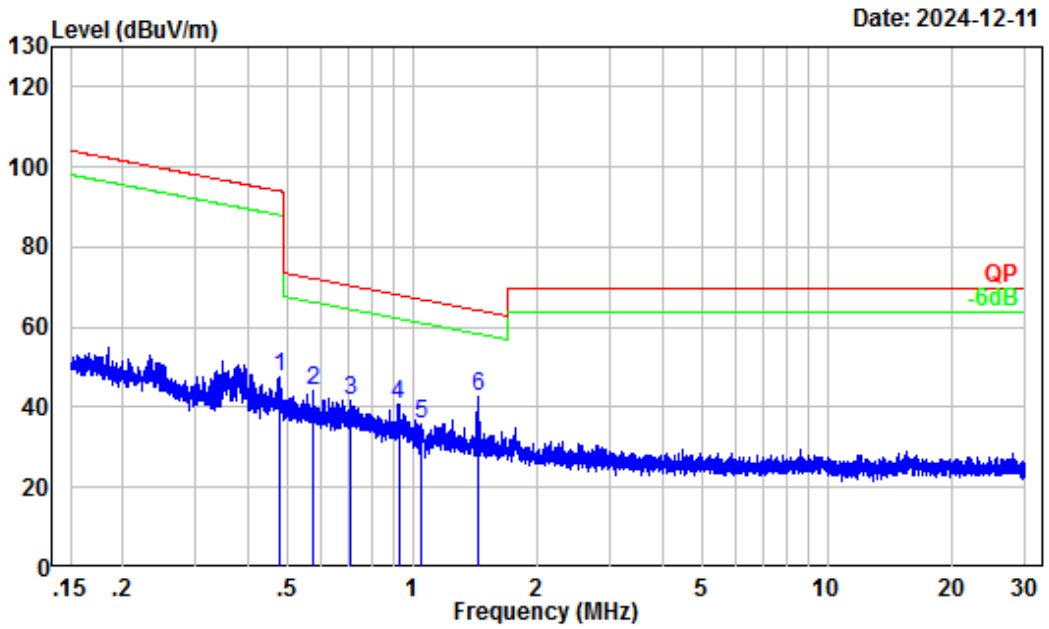
9kHz-150kHz



Site : Chamber A
Condition : 3m
Project Number : 2401Z105001E-RF
Test Mode : Transmitting
Detector PK RBW: 0.3KHz VBW:1KHz
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	32.29	26.25	58.54	127.56	-69.02	Peak
2	0.01	31.54	23.83	55.37	124.69	-69.32	Peak
3	0.02	30.16	23.19	53.35	121.06	-67.71	Peak
4	0.03	28.37	21.56	49.93	117.72	-67.79	Peak
5	0.05	26.14	20.52	46.66	113.19	-66.53	Peak
6	0.09	22.76	21.04	43.80	108.60	-64.80	Peak

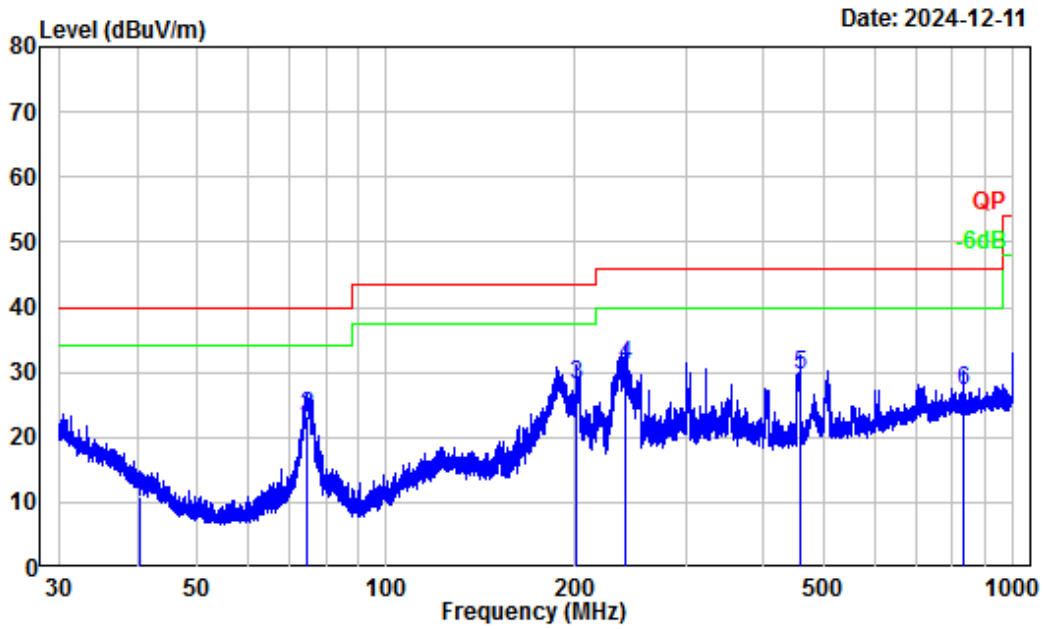
150kHz-30MHz



Site : Chamber A
Condition : 3m
Project Number : 2401Z105001E-RF
Test Mode : Transmitting
Detector PK RBW: 10KHz VBW:30KHz
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.48	6.82	40.81	47.63	94.02	-46.39	Peak
2	0.58	5.45	38.67	44.12	72.35	-28.23	Peak
3	0.71	3.83	37.93	41.76	70.53	-28.77	Peak
4	0.93	1.76	38.72	40.48	68.16	-27.68	Peak
5	1.04	1.08	34.67	35.75	67.09	-31.34	Peak
6	1.44	-0.03	42.94	42.91	64.25	-21.34	Peak

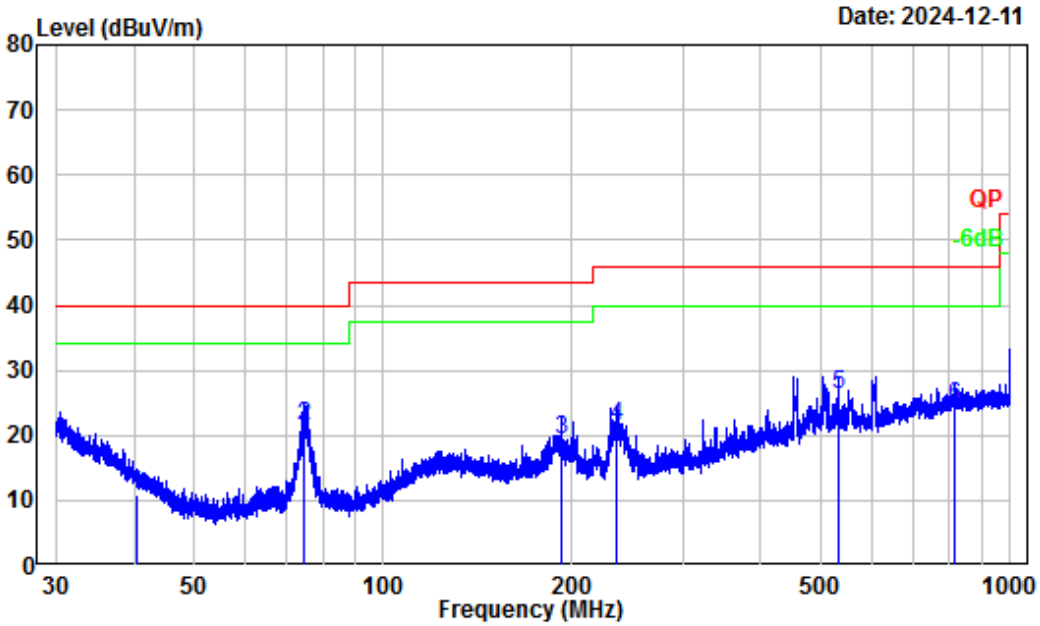
30MHz-1GHz_Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number : 2401Z105001E-RF
Test Mode : Transmitting
Detector: Peak RBW/VBW: 100/300kHz
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.346	-12.61	23.36	10.75	40.00	-29.25	QP
2	74.788	-17.84	41.18	23.34	40.00	-16.66	QP
3	200.600	-13.11	41.04	27.93	43.50	-15.57	QP
4	239.987	-13.32	44.34	31.02	46.00	-14.98	QP
5	457.507	-7.19	36.89	29.70	46.00	-16.30	QP
6	833.682	-1.86	28.98	27.12	46.00	-18.88	QP

30MHz-1GHz_Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number : 2401Z105001E-RF
Test Mode : Transmitting
Detector: Peak RBW/VBW: 100/300kHz
Tester : Carl Zhu

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.311	-12.59	23.45	10.86	40.00	-29.14	QP
2	74.788	-17.84	39.21	21.37	40.00	-18.63	QP
3	192.419	-13.99	33.38	19.39	43.50	-24.11	QP
4	235.920	-13.50	34.96	21.46	46.00	-24.54	QP
5	532.197	-5.76	31.94	26.18	46.00	-19.82	QP
6	815.610	-2.03	26.61	24.58	46.00	-21.42	QP

Above 1GHz:

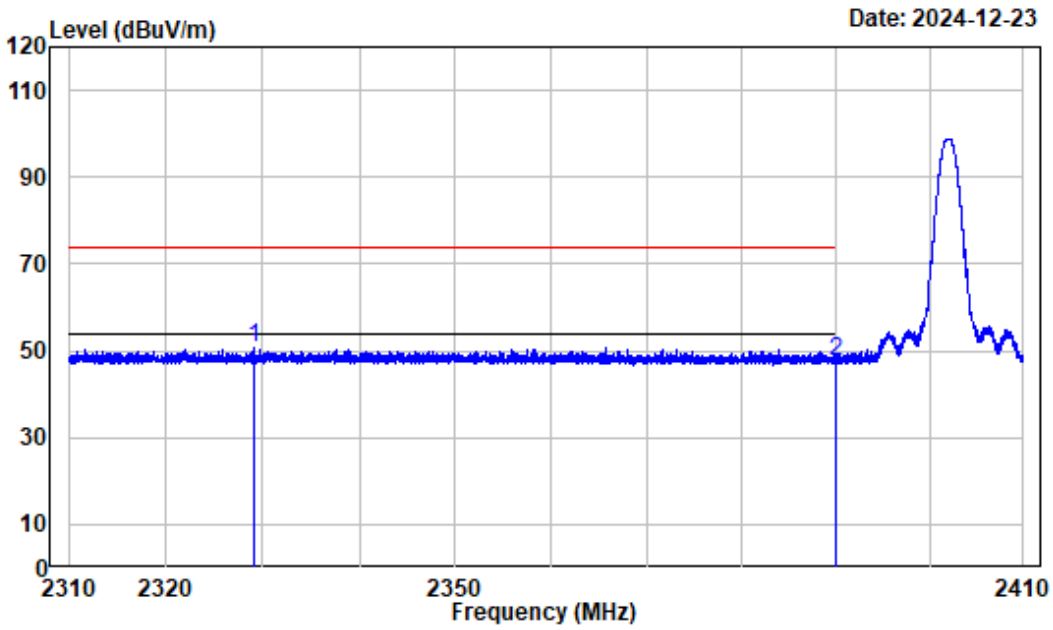
Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave					
Maximum output power mode, EDR (8DPSK)							
Low Channel							
4804	52.13	PK	H	-7.79	44.34	74	-29.66
4804	51.51	PK	V	-7.79	43.72	74	-30.28
Middle Channel							
4882	52.21	PK	H	-7.58	44.63	74	-29.37
4882	51.58	PK	V	-7.58	44	74	-30.00
High Channel							
4960	52.39	PK	H	-7.57	44.82	74	-29.18
4960	51.76	PK	V	-7.57	44.19	74	-29.81

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

DH5:

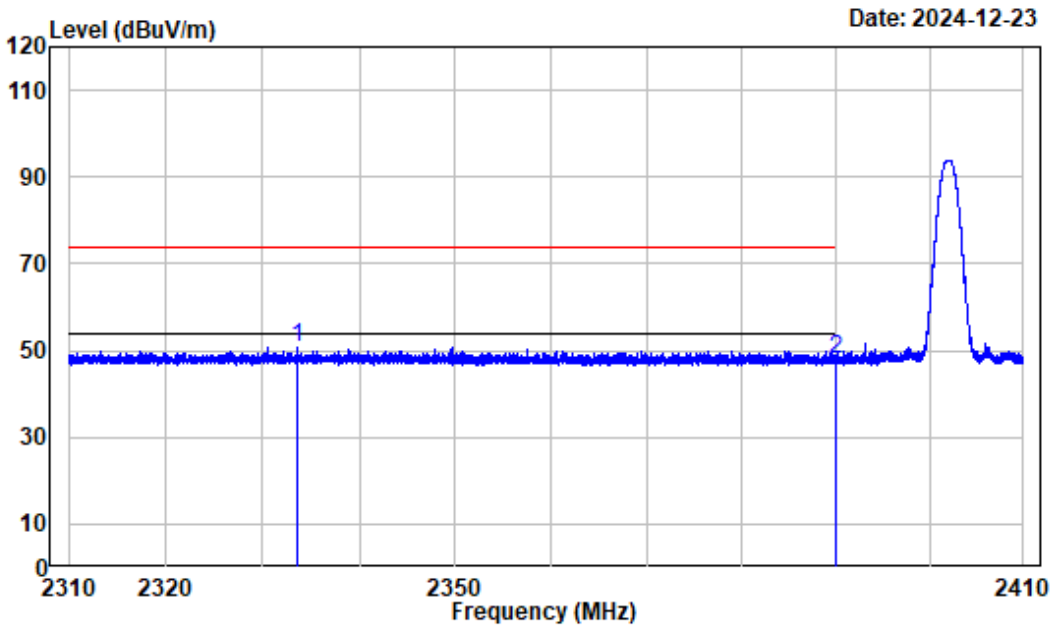
Left Band edge_Horizontal



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-DH5-2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2329.175	-10.83	61.69	50.86	74.00	-23.14	Peak
2	2390.000	-10.97	58.58	47.61	74.00	-26.39	Peak

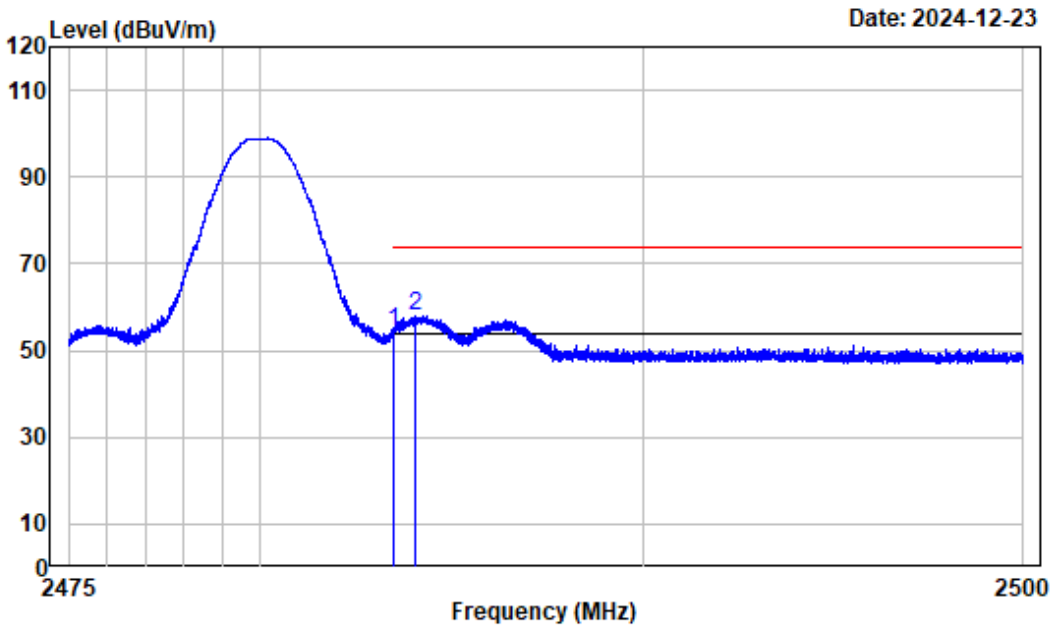
Left Band edge_Vertical



Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-DH5-2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2333.488	-10.85	61.66	50.81	74.00	-23.19	Peak
2	2390.000	-10.97	59.03	48.06	74.00	-25.94	Peak

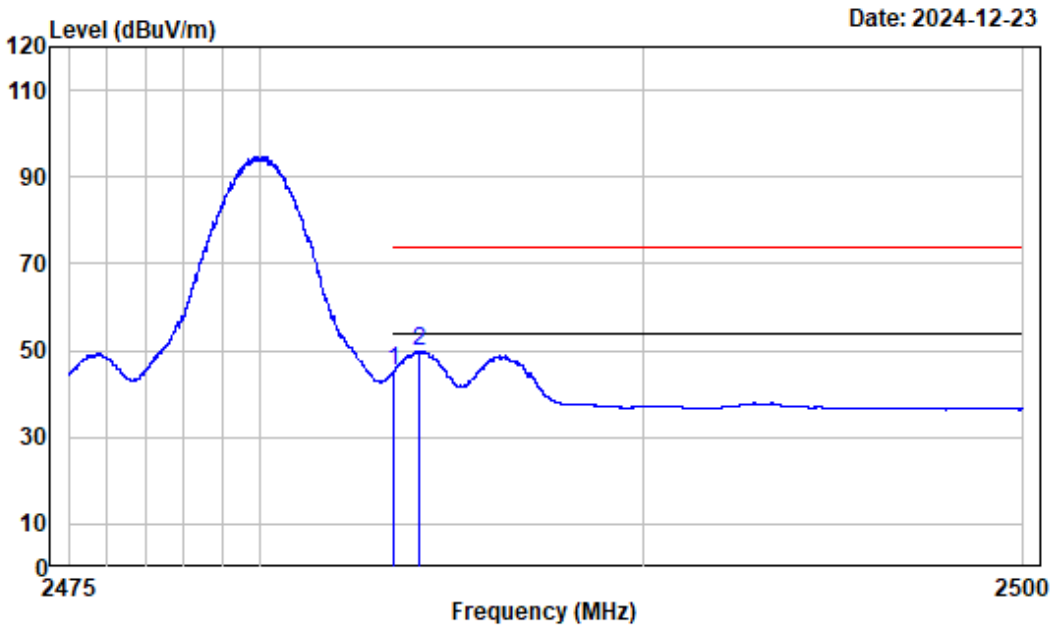
Right Band edge_Horizontal _Peak



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	65.43	54.50	74.00	-19.50	Peak
2	2484.044	-10.93	68.93	58.00	74.00	-16.00	Peak

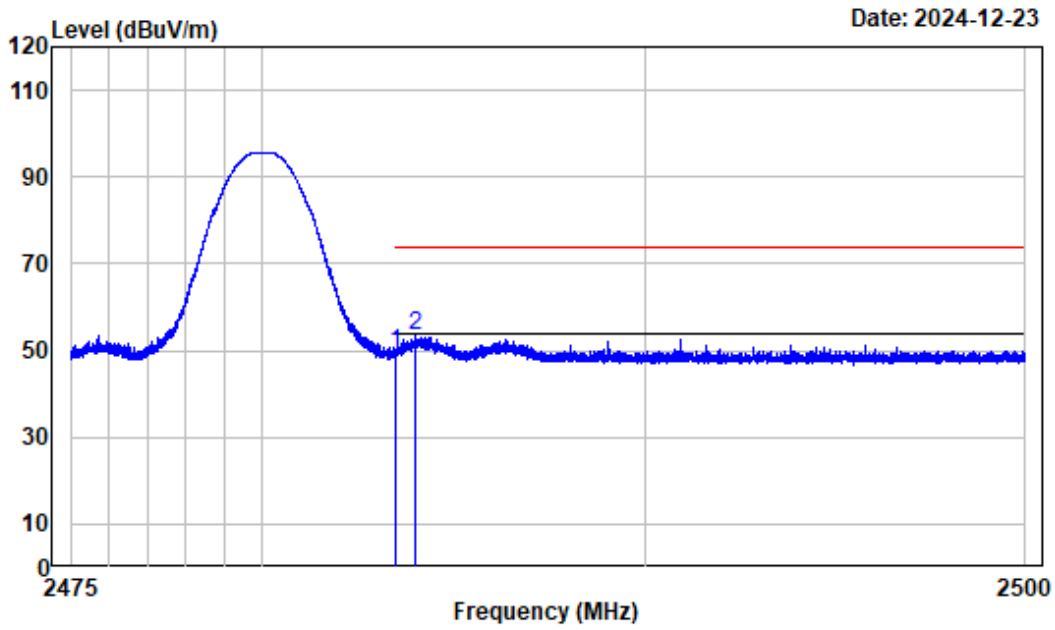
Right Band edge_Horizontal_Average



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:10Hz Detector:Peak
Note : BT-DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	56.03	45.10	54.00	-8.90	Average
2	2484.128	-10.93	60.75	49.82	54.00	-4.18	Average

Right Band edge_Vertical

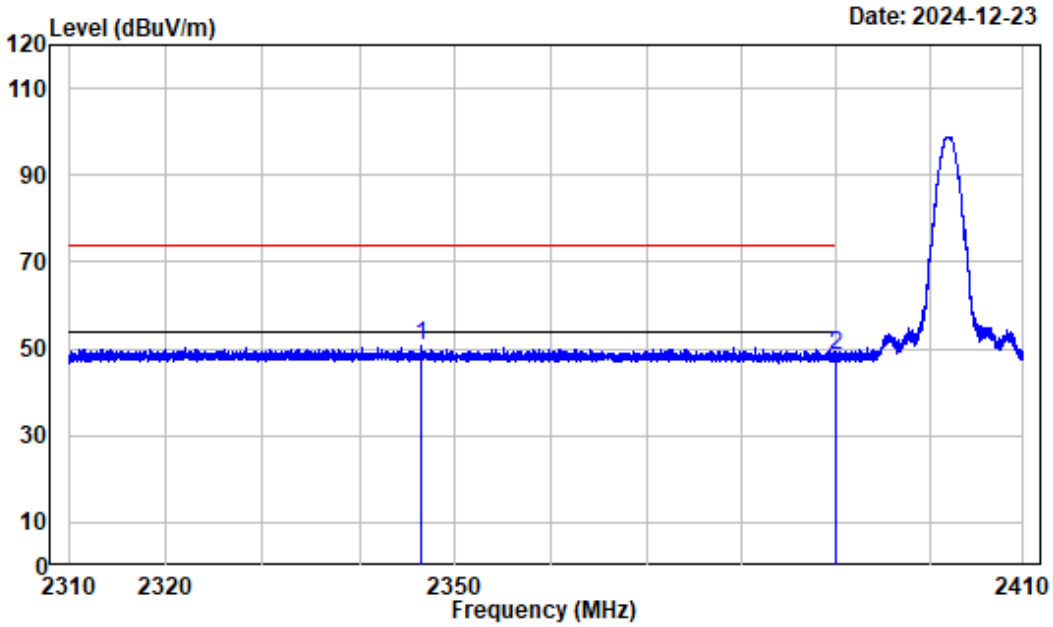


Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	60.38	49.45	74.00	-24.55	Peak
2	2484.003	-10.93	64.20	53.27	74.00	-20.73	Peak

2DH5:

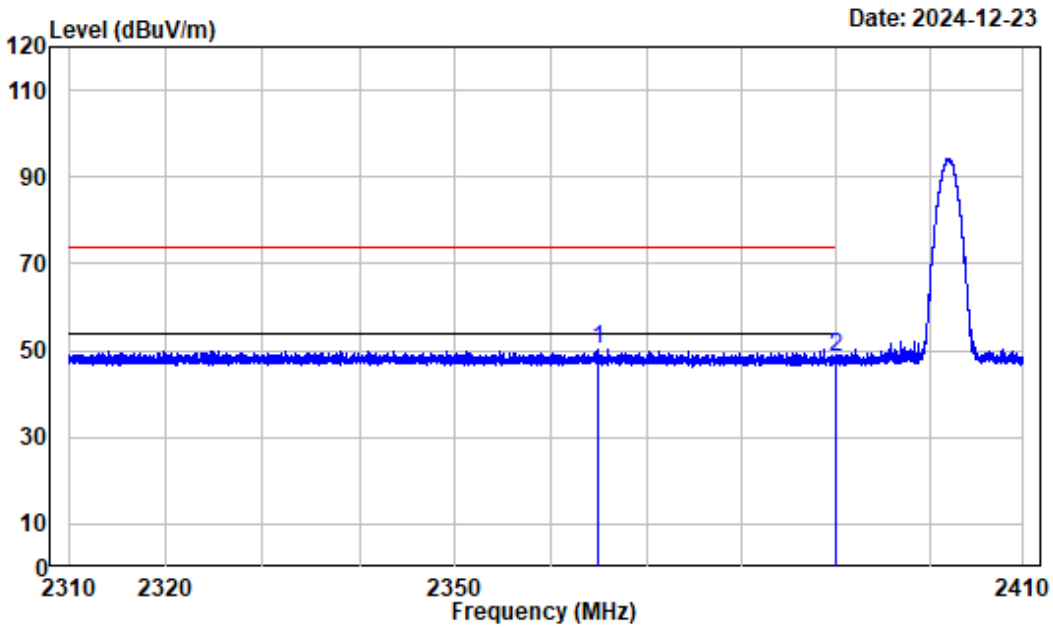
Left Band edge_Horizontal



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-2DH5-2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2346.475	-10.87	61.39	50.52	74.00	-23.48	Peak
2	2390.000	-10.97	59.33	48.36	74.00	-25.64	Peak

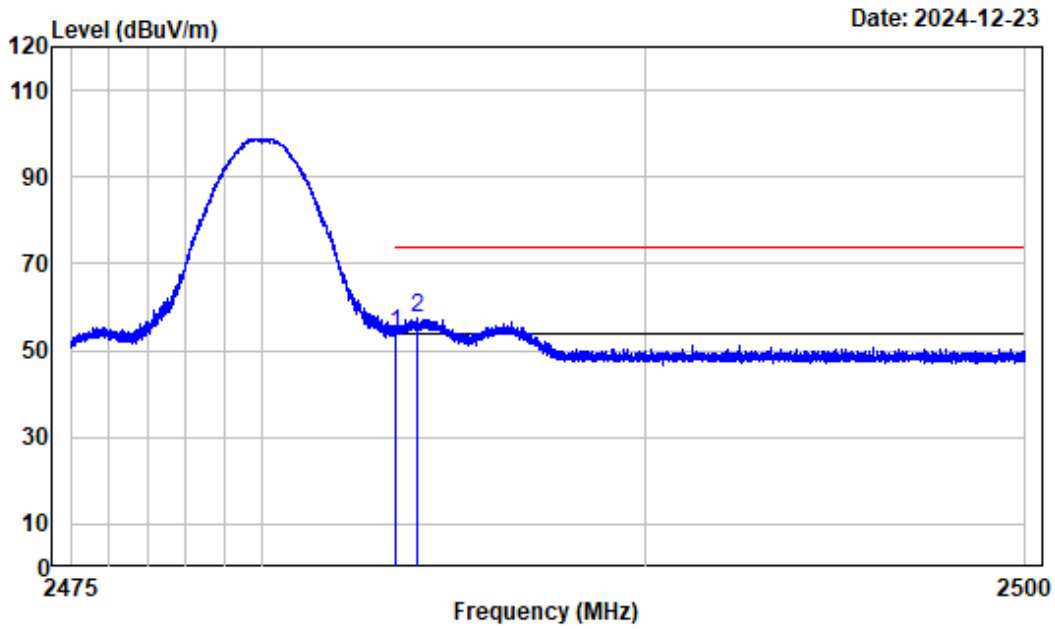
Left Band edge_Vertical



Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-2DH5-2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2364.913	-10.91	61.27	50.36	74.00	-23.64	Peak
2	2390.000	-10.97	59.49	48.52	74.00	-25.48	Peak

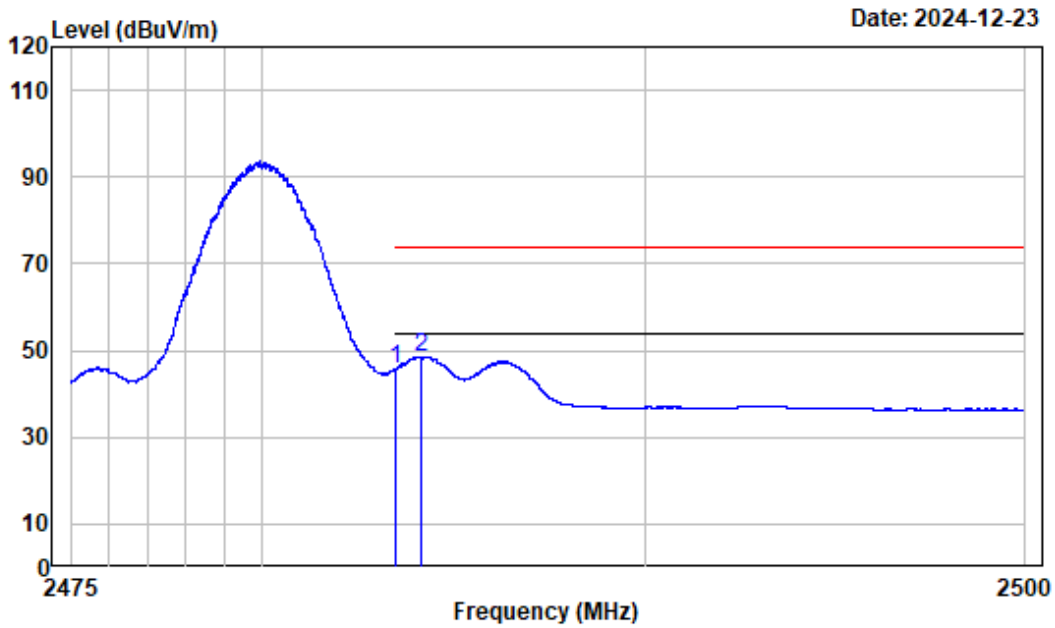
Right Band edge_Horizontal _Peak



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-2DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	64.89	53.96	74.00	-20.04	Peak
2	2484.059	-10.93	68.42	57.49	74.00	-16.51	Peak

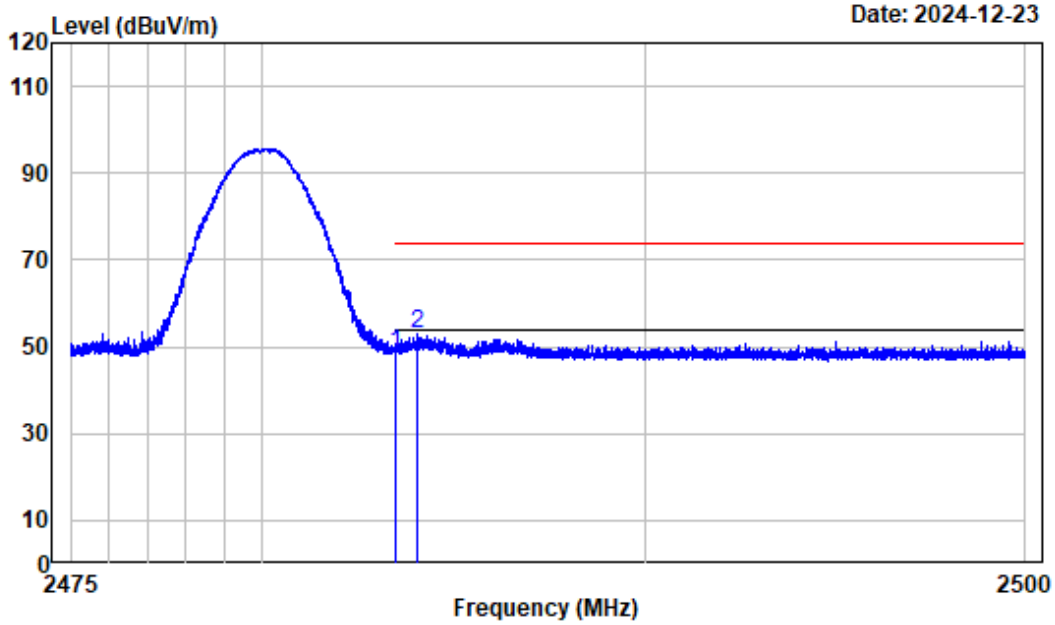
Right Band edge_Horizontal_Average



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:10Hz Detector:Peak
Note : BT-2DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	56.56	45.63	54.00	-8.37	Average
2	2484.144	-10.93	59.60	48.67	54.00	-5.33	Average

Right Band edge_Vertical

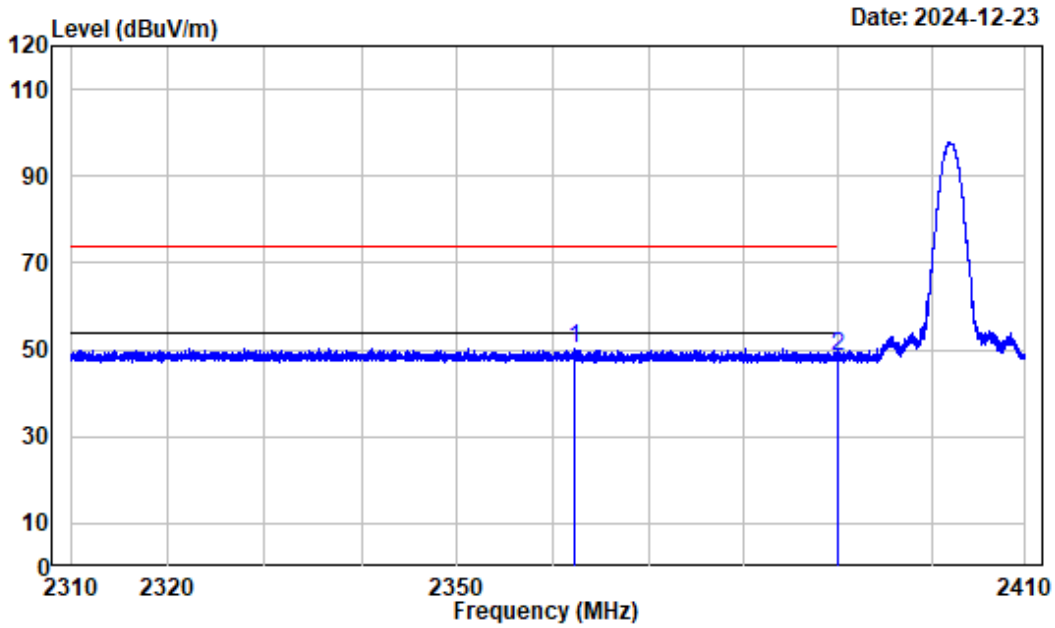


Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-2DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	59.52	48.59	74.00	-25.41	Peak
2	2484.056	-10.93	63.94	53.01	74.00	-20.99	Peak

3DH5:

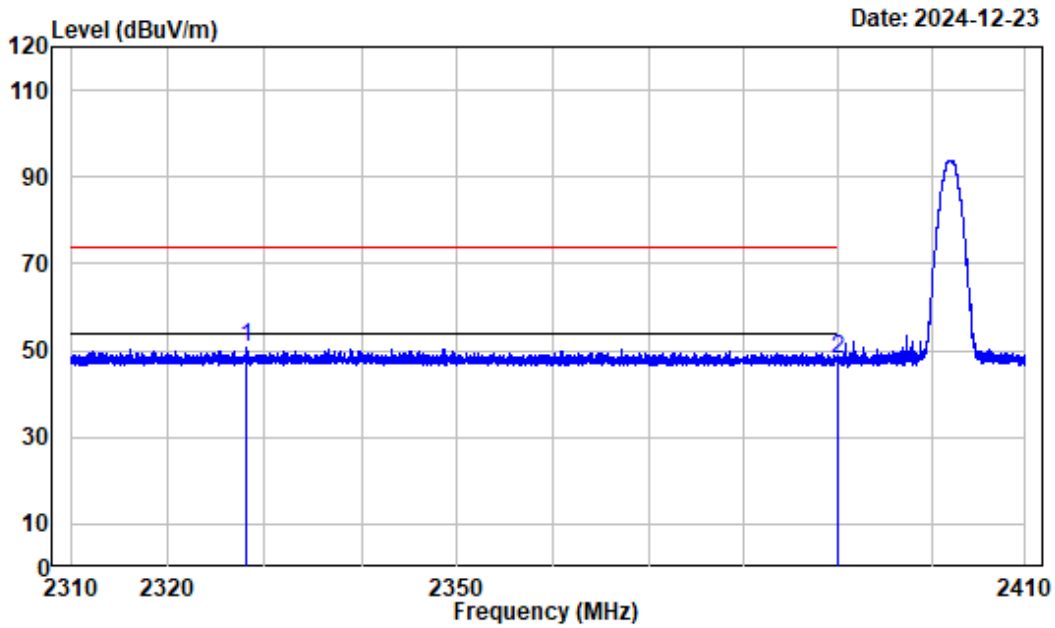
Left Band edge_Horizontal



Condition : Horizontal
Project Number : 2401Z105001E-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	2362.163	-10.91	61.33	50.42	74.00	-23.58	Peak
2	2390.000	-10.97	59.24	48.27	74.00	-25.73	Peak

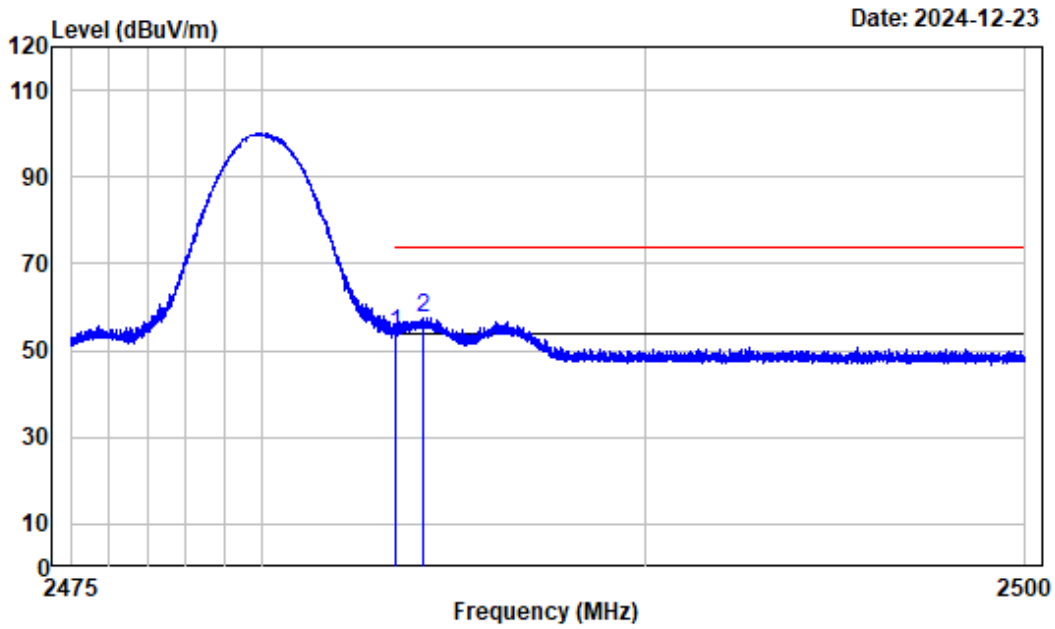
Left Band edge_Vertical



Condition : Vertical
Project Number : 2401Z105001E-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	2328.087	-10.83	61.65	50.82	74.00	-23.18	Peak
2	2390.000	-10.97	59.04	48.07	74.00	-25.93	Peak

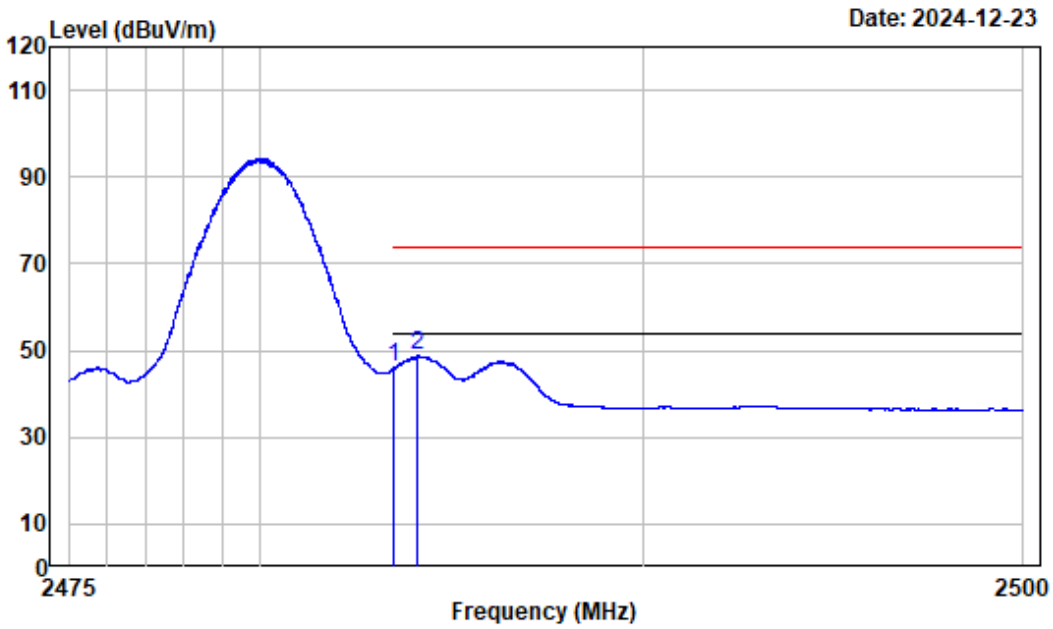
Right Band edge_Horizontal _Peak



Condition : Horizontal
Project Number : 2401Z105001E-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	2483.500	-10.93	64.77	53.84	74.00	-20.16	Peak
2	2484.184	-10.93	68.52	57.59	74.00	-16.41	Peak

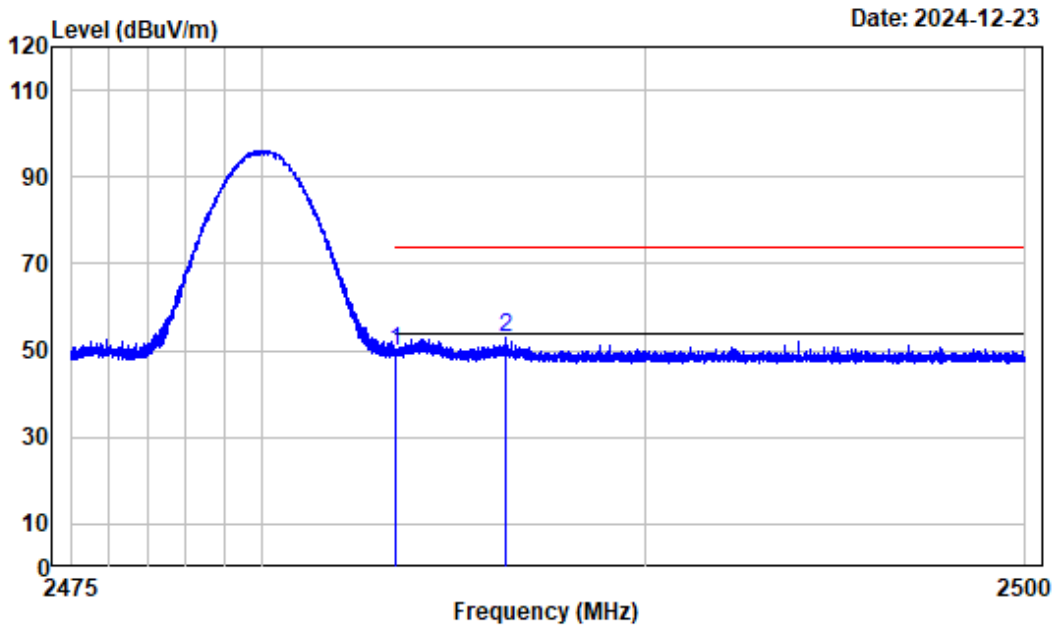
Right Band edge_Horizontal_Average



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:10Hz 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	2483.500	-10.93	56.92	45.99	54.00	-8.01	Average
2	2484.122	-10.93	59.69	48.76	54.00	-5.24	Average

Right Band edge_Vertical

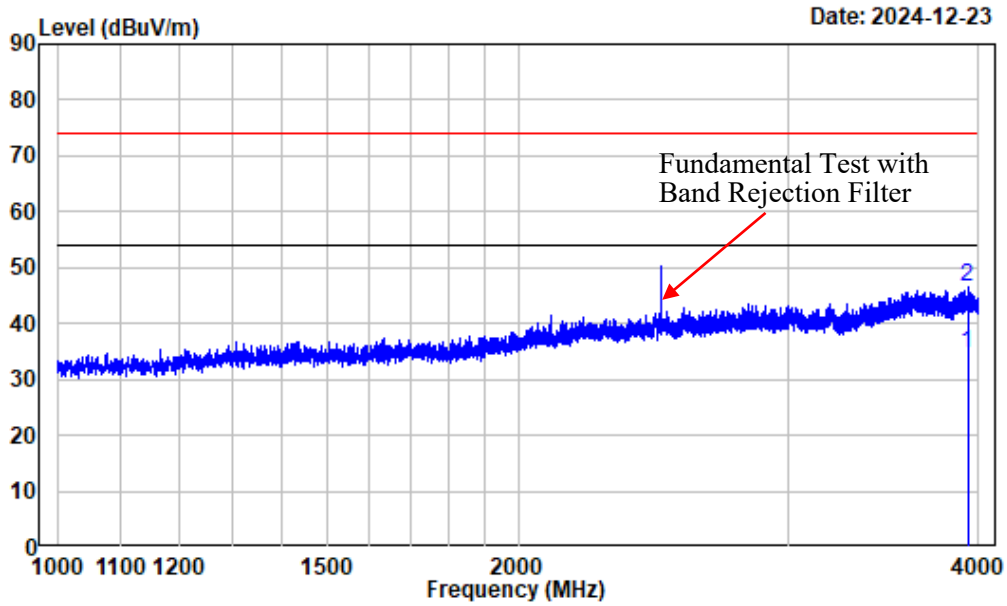


Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-10.93	60.57	49.64	74.00	-24.36	Peak
2	2486.384	-10.92	63.78	52.86	74.00	-21.14	Peak

Listed with the worst case test plot

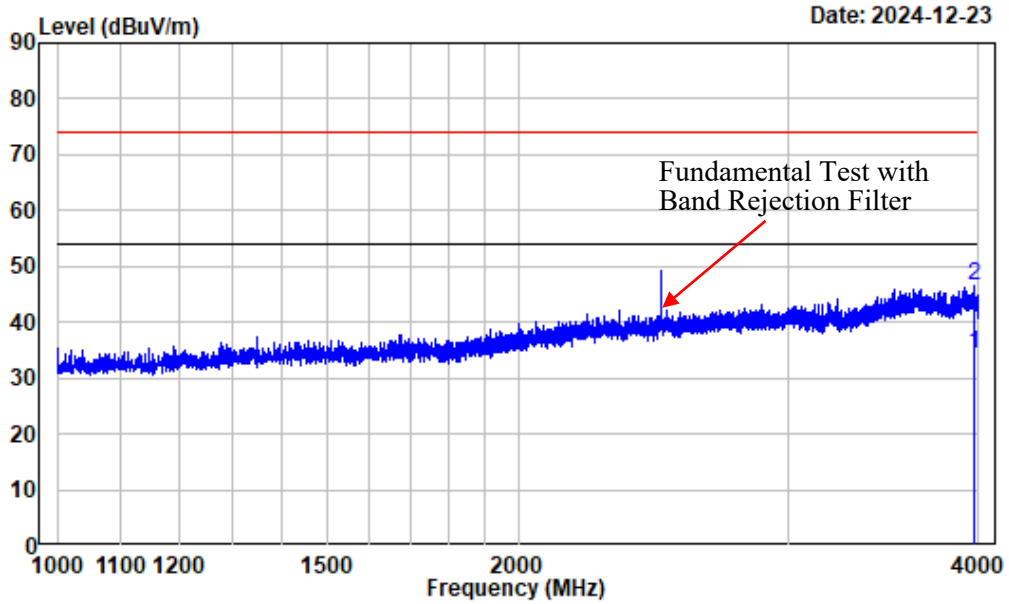
1-4GHz Horizontal




```
Condition        : Horizontal
Project Number   : 2401Z105001E-RF
Tester           : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
                 : Average reading: RBW:1MHz VBW:1kHz 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	3934.742	-9.55	44.26	34.71	54.00	-19.29	Average
2	3934.742	-9.55	56.21	46.66	74.00	-27.34	Peak

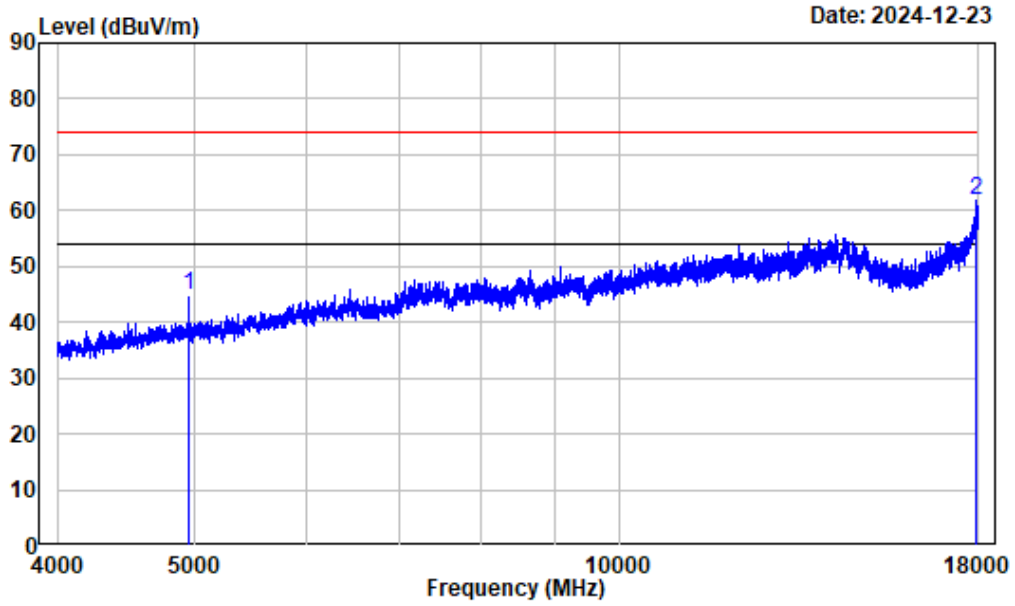
1-4GHz_Vertical




```
Condition        : Vertical
Project Number   : 2401Z105001E-RF
Tester           : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
                 : Average reading: RBW:1MHz VBW:1kHz 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	3975.247	-9.30	43.51	34.21	54.00	-19.79	Average
2	3975.247	-9.30	55.84	46.54	74.00	-27.46	Peak

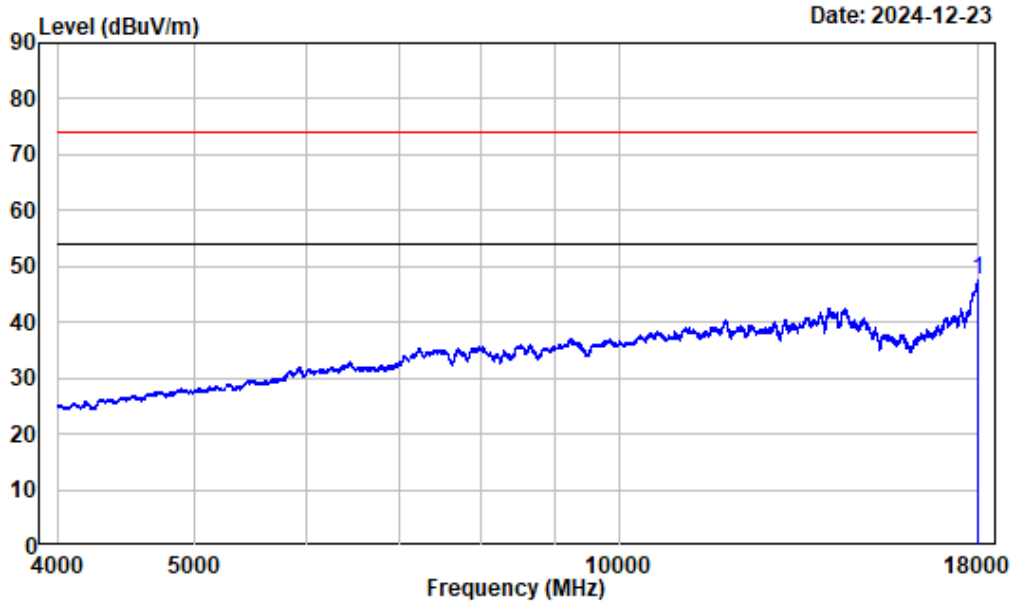
4-18GHz_Horizontal_Peak



Condition : Horizontal
Project Number : 2401Z105001E-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	52.39	44.82	74.00	-29.18	Peak
2	17907.240	12.74	48.92	61.66	74.00	-12.34	Peak

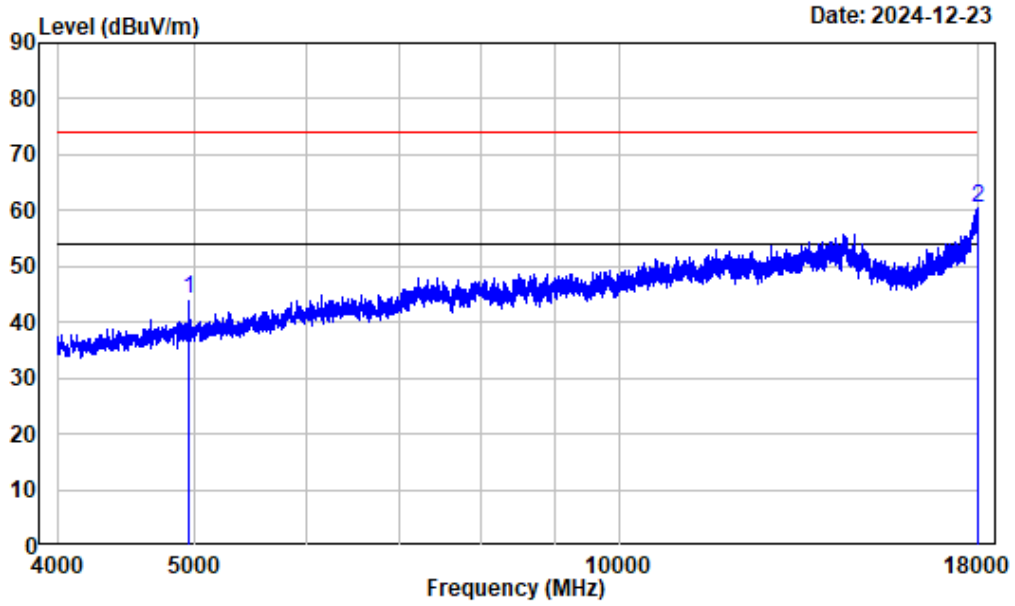
4-18GHz_Horizontal_Average



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz 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	17994.750	13.17	34.41	47.58	54.00	-6.42	Average

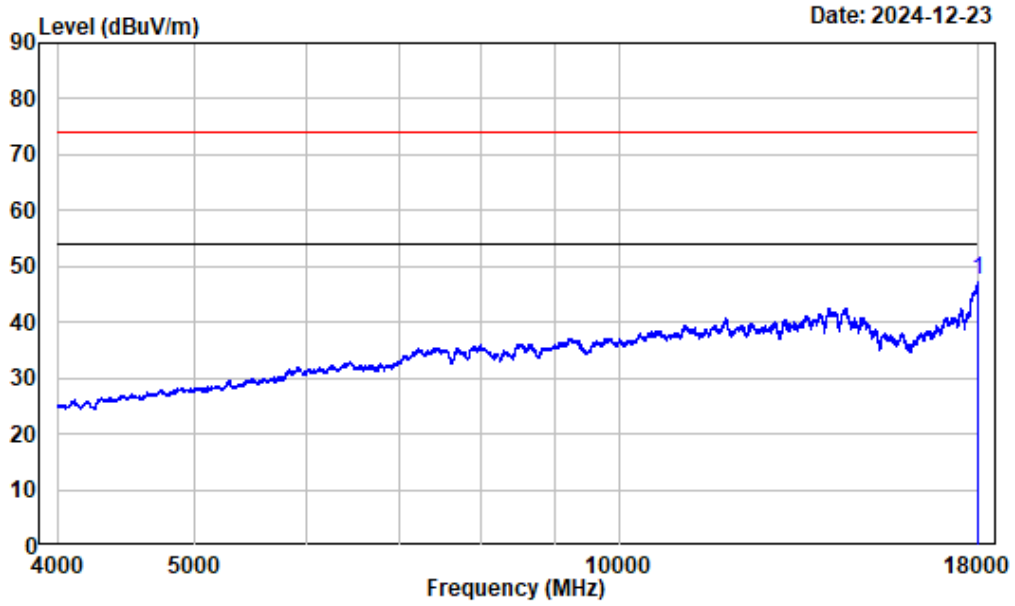
4-18GHz_Vertical_Peak



Condition : Vertical
Project Number : 2401Z105001E-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	51.76	44.19	74.00	-29.81	Peak
2	17973.750	13.08	47.26	60.34	74.00	-13.66	Peak

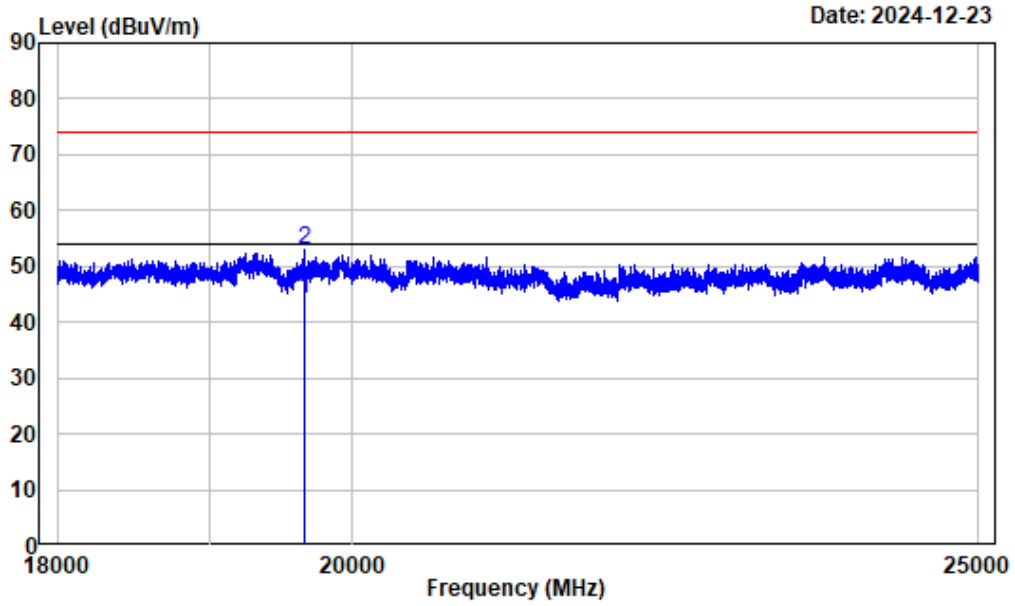
4-18GHz_Vertical_Average



Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz 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	17998.250	13.19	34.42	47.61	54.00	-6.39	Average

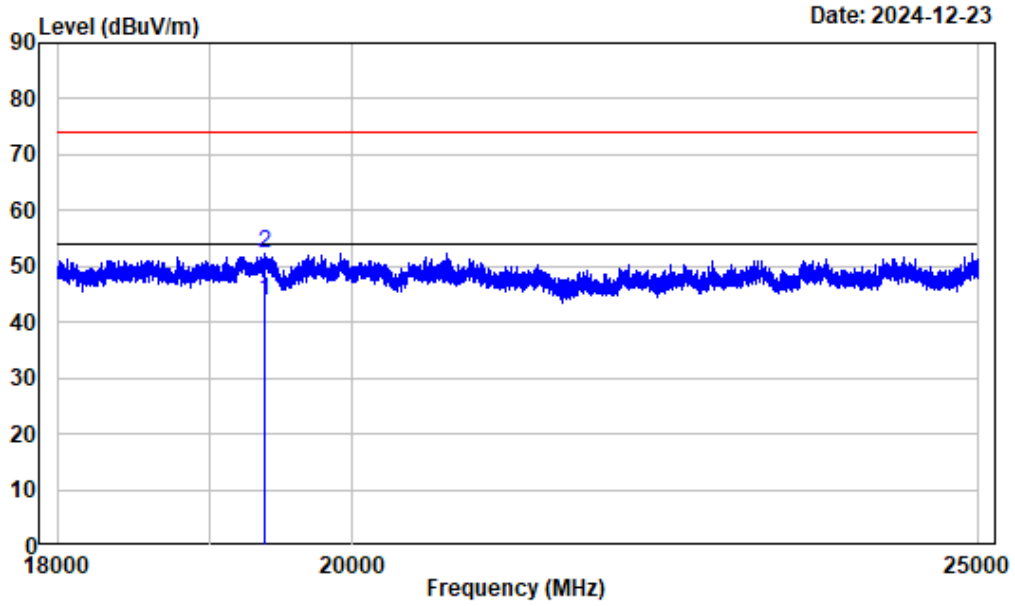
18-25GHz_Horizontal



Condition : Horizontal
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
: Average reading: RBW:1MHz VBW:1kHz 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	19662.710	15.39	28.91	44.30	54.00	-9.70	Average
2	19662.710	15.39	37.47	52.86	74.00	-21.14	Peak

18-25GHz_Vertical



Condition : Vertical
Project Number : 2401Z105001E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak
: Average reading: RBW:1MHz VBW:1kHz 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	19385.300	15.11	28.71	43.82	54.00	-10.18	Average
2	19385.300	15.11	37.27	52.38	74.00	-21.62	Peak

20 dB Emission Bandwidth

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/01/07
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

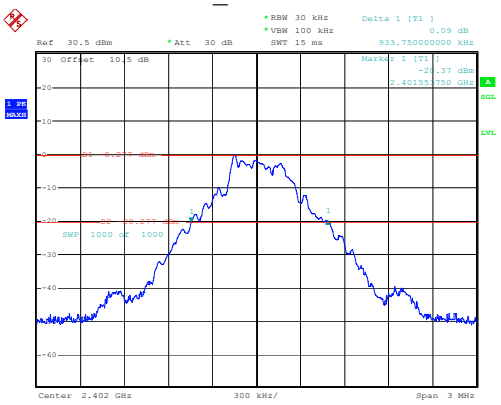
Environmental Conditions:

Temperature: (°C):	25~25.7	**Relative Humidity: (%)**	45~49	**ATM Pressure: (kPa)**	101

Test Data:

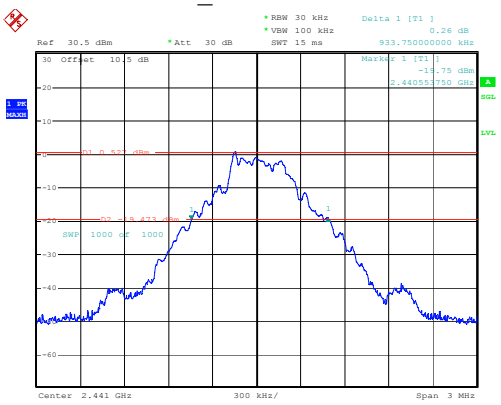
Mode	Channel	Result (MHz)
DH1	Low Channel	0.934
	Middle Channel	0.934
	High Channel	0.941
2DH1	Low Channel	1.208
	Middle Channel	1.200
	High Channel	1.208
3DH1	Low Channel	1.208
	Middle Channel	1.208
	High Channel	**1.211**

DH1_Low 0.934MHz



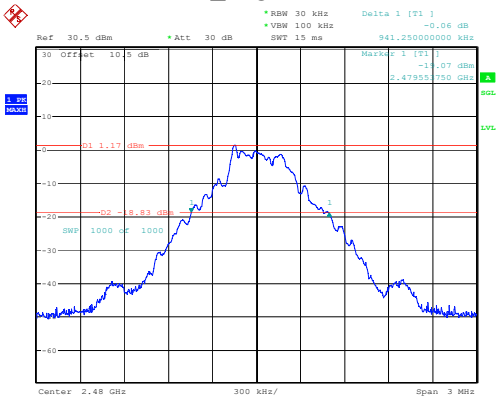
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 05:56:02

DH1_Middle 0.934MHz



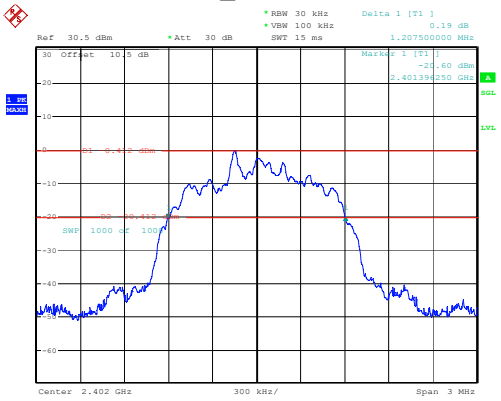
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 05:59:15

DH1_High 0.941MHz



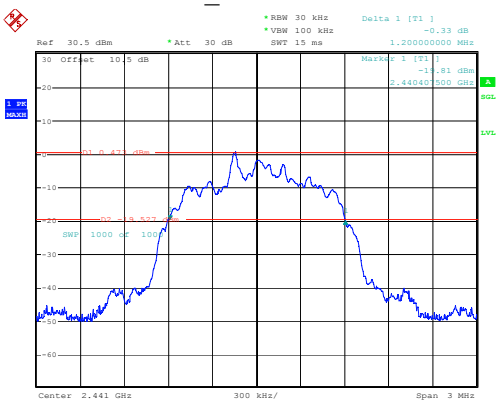
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:01:22

2DH1_Low 1.208MHz



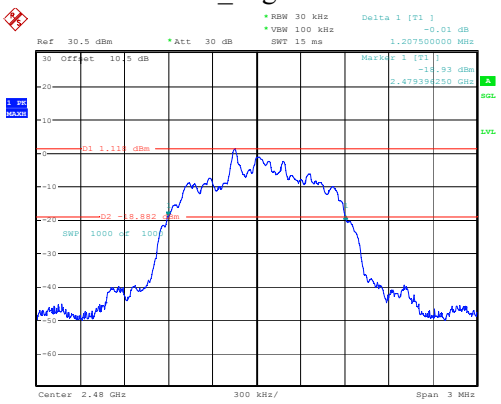
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:08:25

2DH1_Middle 1.200MHz



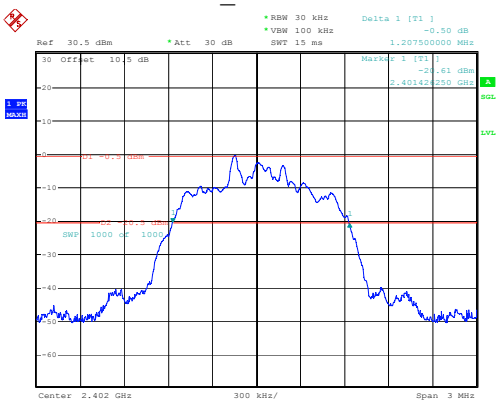
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:11:50

2DH1_High 1.208MHz



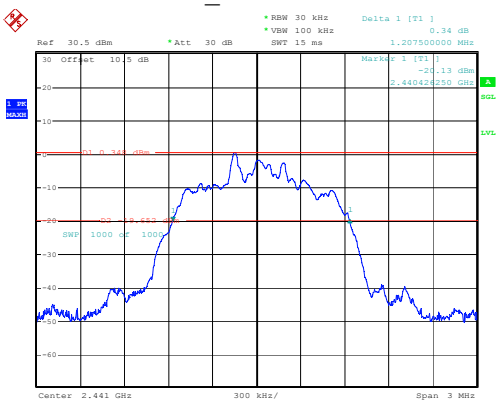
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:14:32

3DH1_Low 1.208MHz



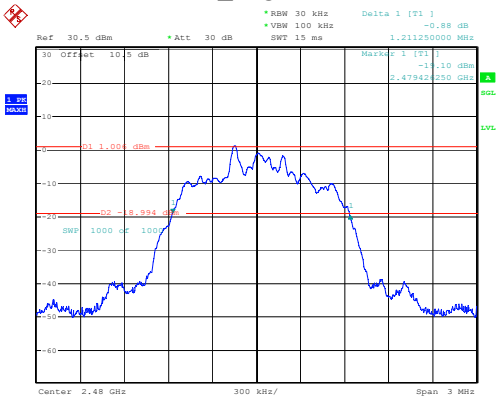
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:18:55

3DH1_Middle 1.208MHz



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:21:57

3DH1_High 1.211MHz



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:24:06

99% Occupied Bandwidth

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/01/07
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

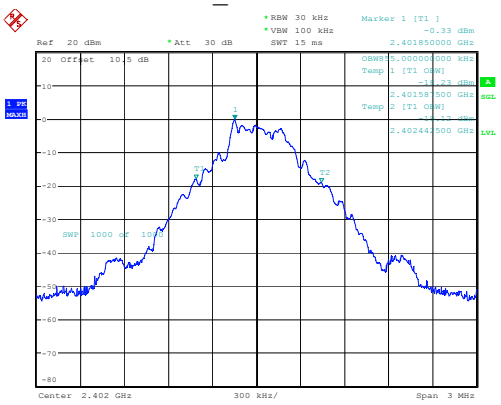
Environmental Conditions:

Temperature: (°C):	25~25.7	**Relative Humidity: (%)**	45~49	**ATM Pressure: (kPa)**	101

Test Data:

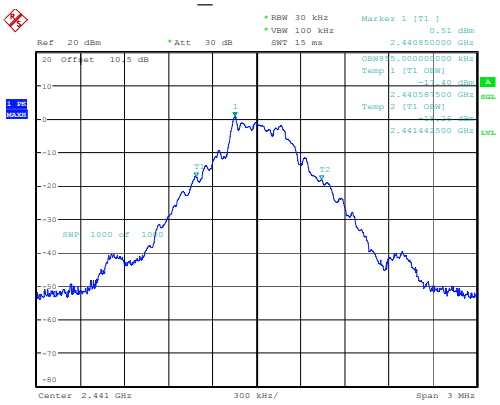
Mode	Channel	99% OBW (MHz)
DH1	Low Channel	0.855
	Middle Channel	0.855
	High Channel	0.855
2DH1	Low Channel	1.133
	Middle Channel	**1.136**
	High Channel	**1.136**
3DH1	Low Channel	1.110
	Middle Channel	1.114
	High Channel	1.114

DH1_Low 0.855MHz



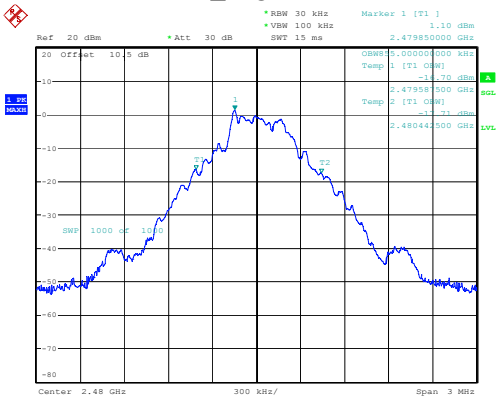
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 05:57:32

DH1_Middle 0.855MHz



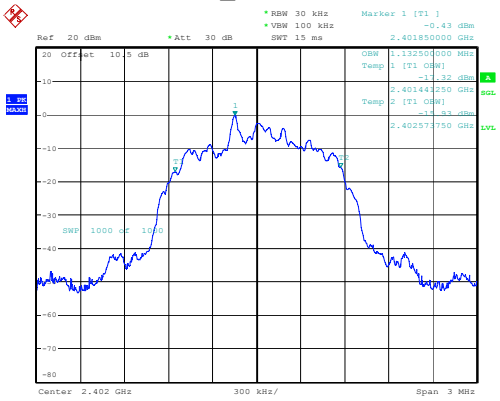
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 05:59:49

DH1_High 0.855MHz



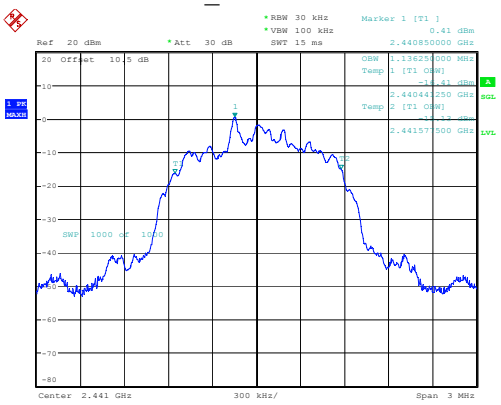
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:03:29

2DH1_Low 1.133MHz



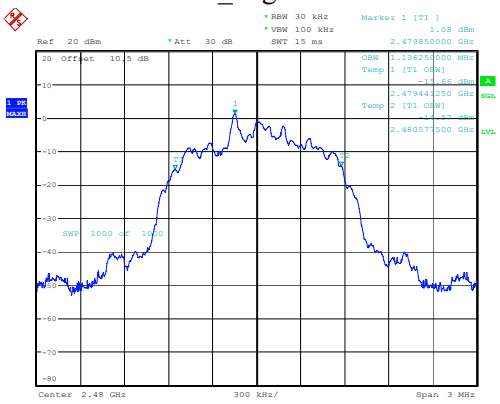
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:09:55

2DH1_Middle 1.136MHz



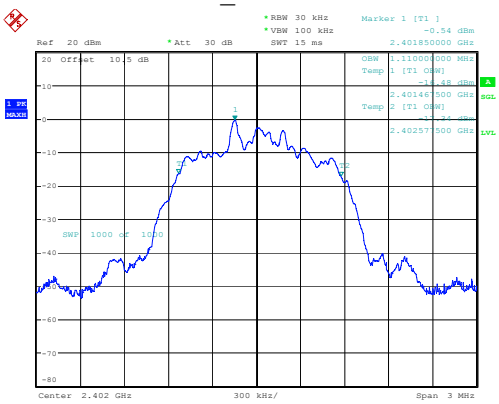
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:12:24

2DH1_High 1.136MHz



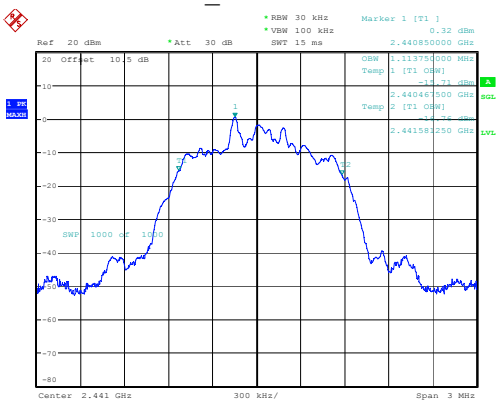
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:16:45

3DH1_Low 1.110MHz



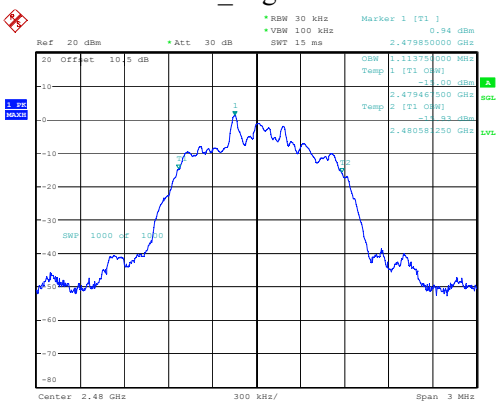
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:20:25

3DH1_Middle 1.114MHz



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:22:31

3DH1_High 1.114MHz



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:26:13

Channel Separation

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/01/08
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

Environmental Conditions:

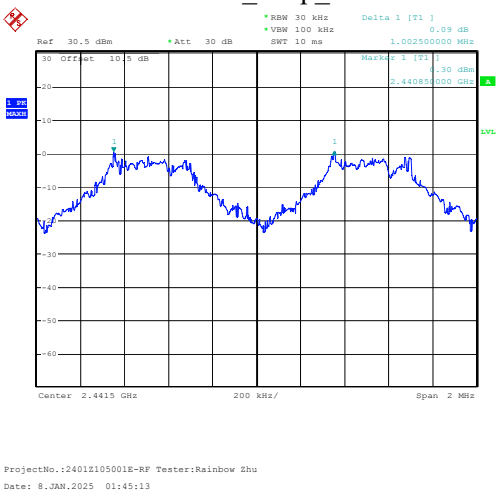
Temperature: (°C):	25~25.7	**Relative Humidity: (%)**	45~49	**ATM Pressure: (kPa)**	101

Test Data:

Mode	Channel	Result (MHz)	Limit (MHz)	Verdict
DH1	Hop_ Mid	**1.003**	0.807	Pass

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

DH1_ Hop_ Mid



Number of Hopping Frequency

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/02/10
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

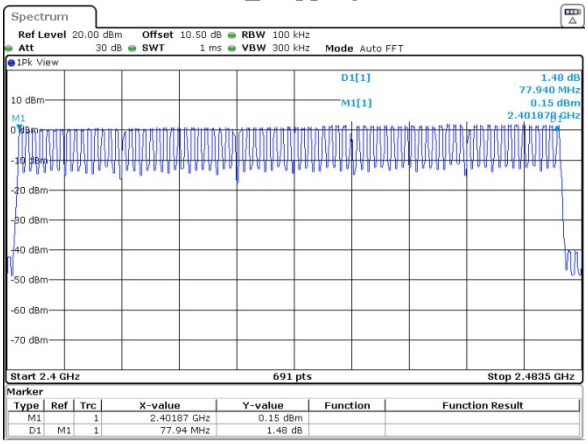
Environmental Conditions:

Temperature: (°C):	25~25.7	**Relative Humidity: (%)**	45~49	**ATM Pressure: (kPa)**	101

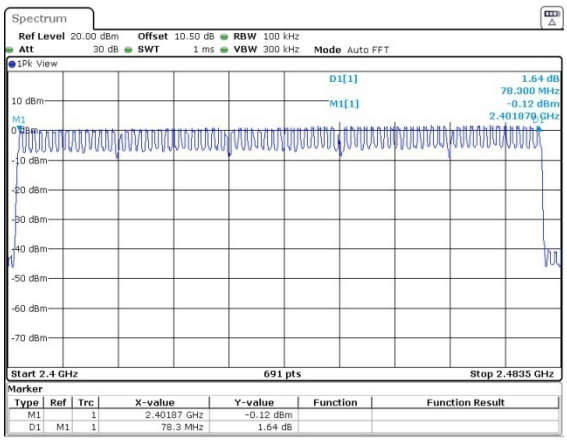
Test Data:

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

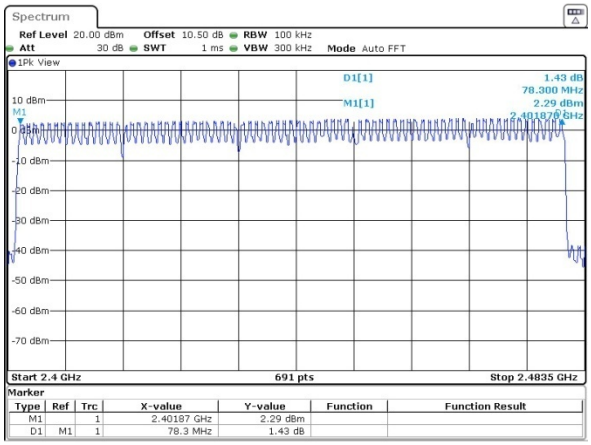
DH1_Hopping 79



2DH1_Hopping 79



3DH1_Hopping 79



Maximum Conducted Output Power

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/01/07
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

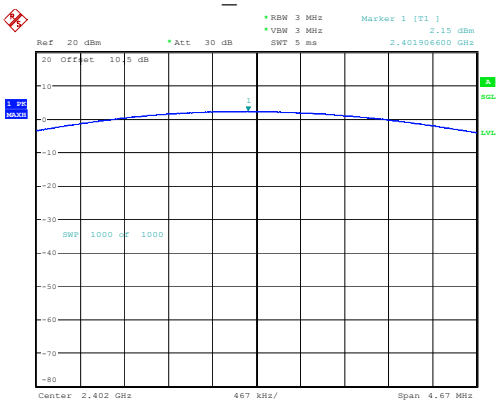
Environmental Conditions:

Temperature: (°C):	25~25.7	**Relative Humidity: (%)**	45~49	**ATM Pressure: (kPa)**	101

Test Data:

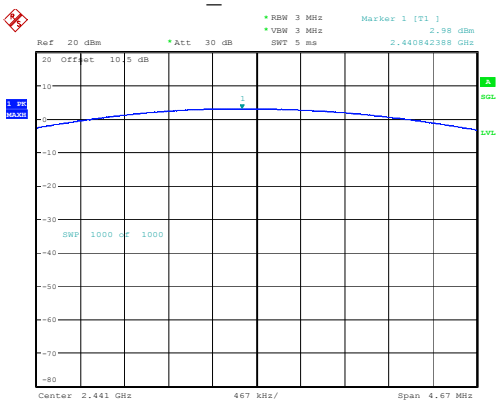
Mode	Channel	Result (dBm)	Limit (dBm)	EIRP (dBm)	EIRP Limit_IC (dBm)	Verdict
DH1	Low Channel	2.15	21.00	6.33	36.00	Pass
	Middle Channel	2.98	21.00	7.16	36.00	Pass
	High Channel	3.60	21.00	7.78	36.00	Pass
2DH1	Low Channel	2.06	21.00	6.24	36.00	Pass
	Middle Channel	2.89	21.00	7.07	36.00	Pass
	High Channel	3.58	21.00	7.76	36.00	Pass
3DH1	Low Channel	2.38	21.00	6.56	36.00	Pass
	Middle Channel	3.27	21.00	7.45	36.00	Pass
	High Channel	**3.90**	21.00	8.08	36.00	Pass

DH1_Low 2.15dBm



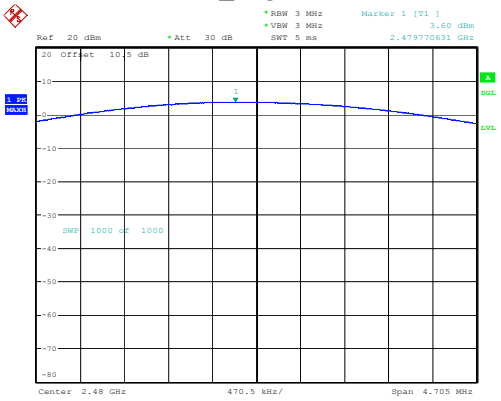
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:05:35

DH1_Middle 2.98dBm



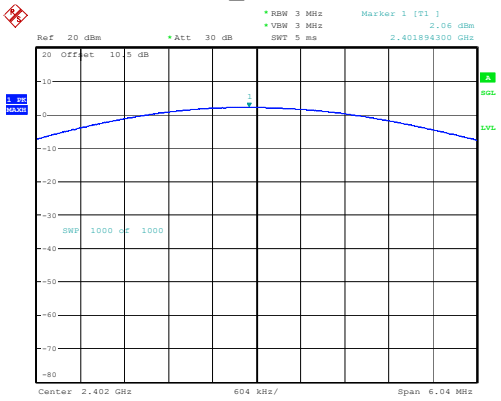
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:06:43

DH1_High 3.60dBm



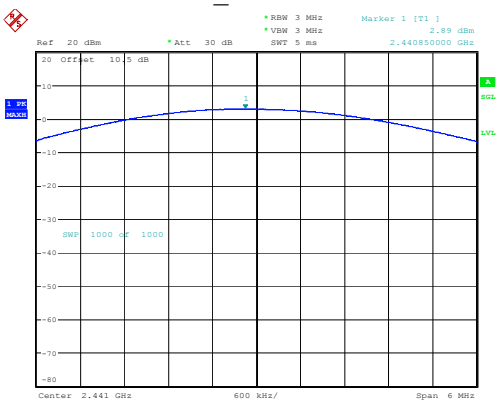
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:03:49

2DH1_Low 2.06dBm



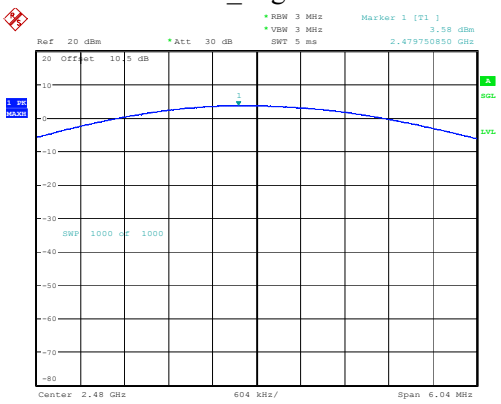
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:10:15

2DH1_Middle 2.89dBm



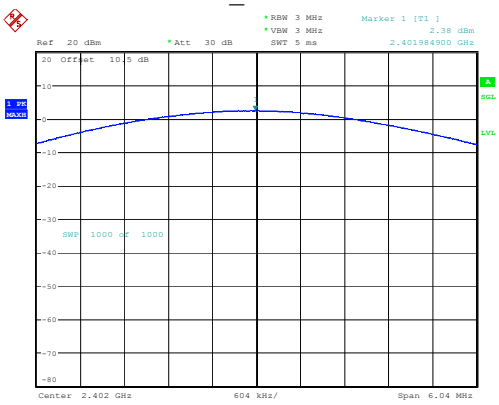
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:12:45

2DH1_High 3.58dBm



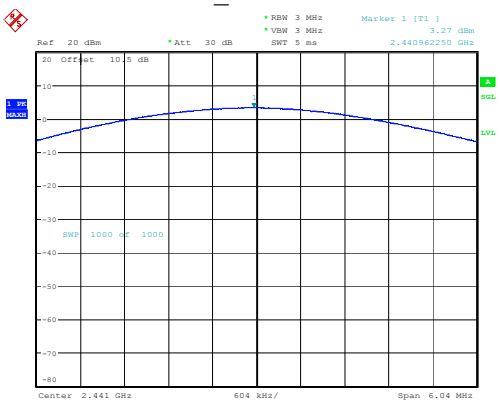
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:17:23

3DH1_Low 2.38dBm



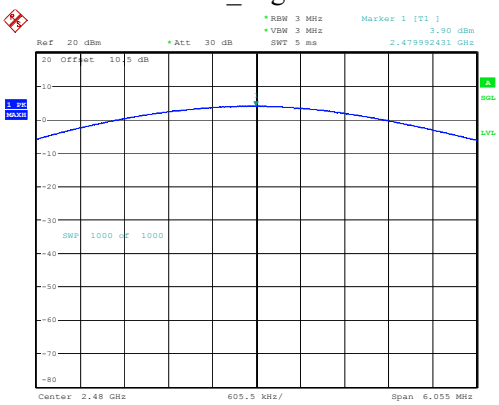
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:20:45

3DH1_Middle 3.27dBm



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:22:52

3DH1_High 3.90dBm



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 7.JAN.2025 06:27:03

100 kHz Bandwidth of Frequency Band Edge

Test Information:

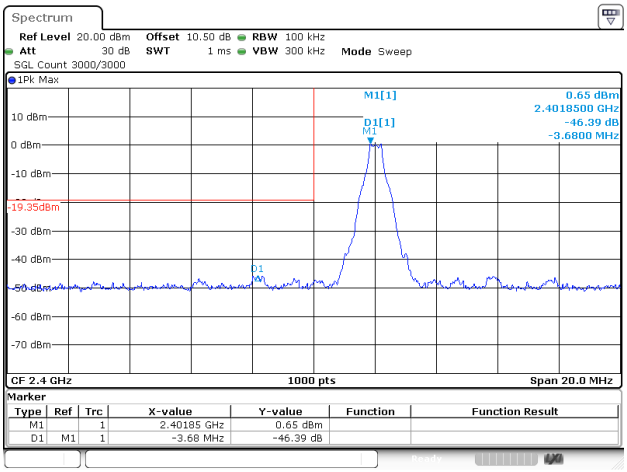
Sample No.:	2UJT-1	**Test Date:**	2025/10/13~2025/11/05
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

Environmental Conditions:

Temperature: (°C):	24.2~26.5	**Relative Humidity: (%)**	44~54	**ATM Pressure: (kPa)**	100.7~101.5

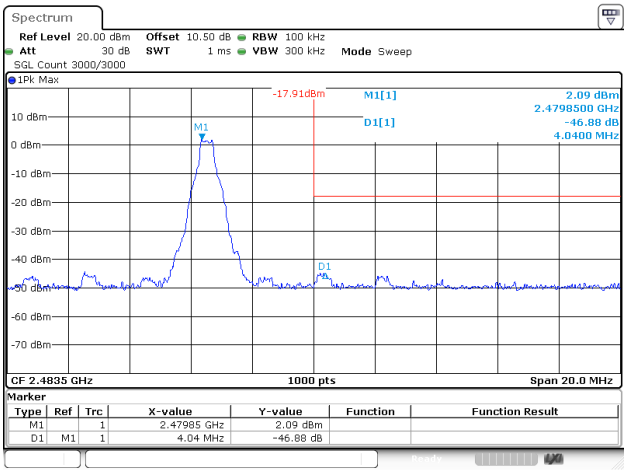
Test Data:

DH1_Low



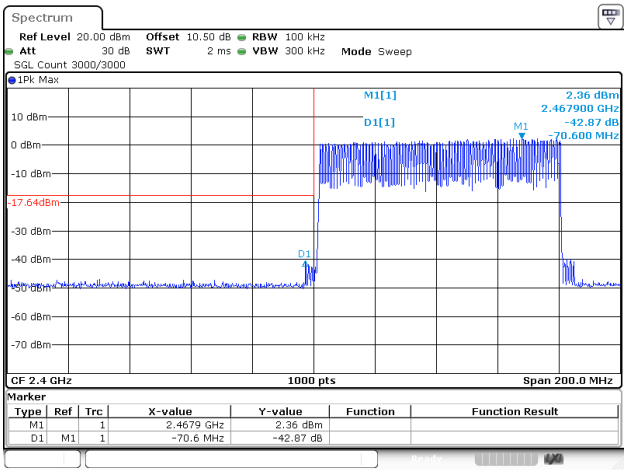
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:23:15

DH1_High



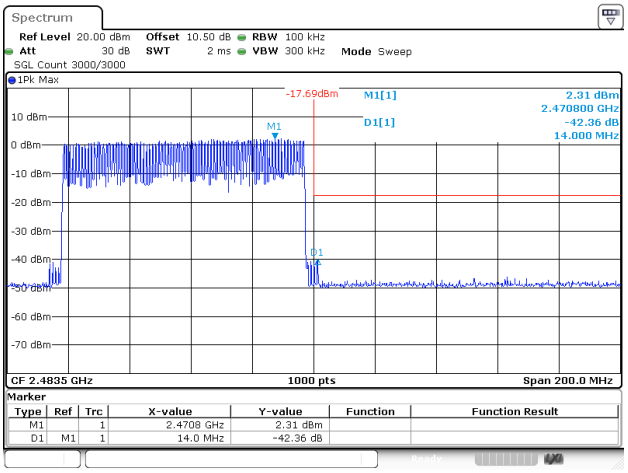
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:25:00

DH1_Hopping_Lower



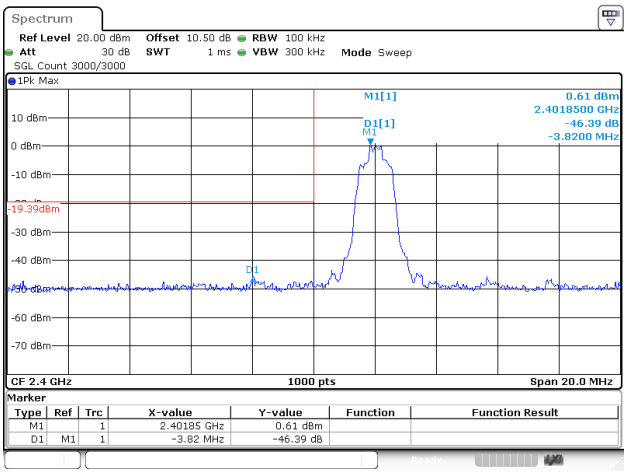
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:31:18

DH1_Hopping_Upper



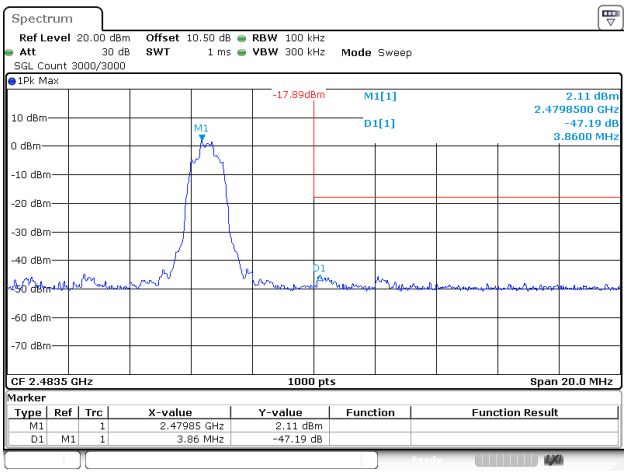
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:33:15

2DH1_Low



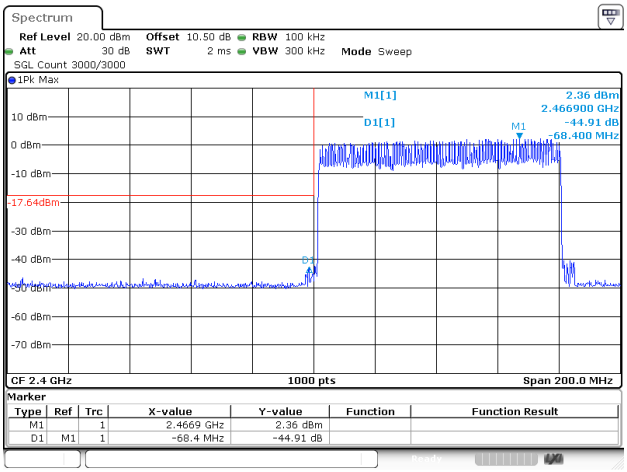
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:27:39

2DH1_High



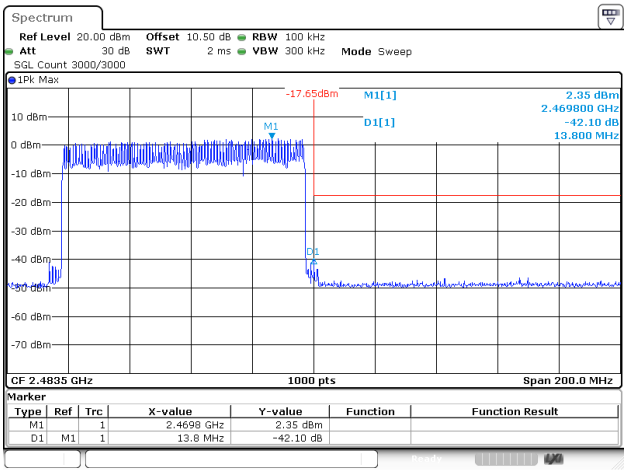
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:30:01

2DH1_Hopping_Lower



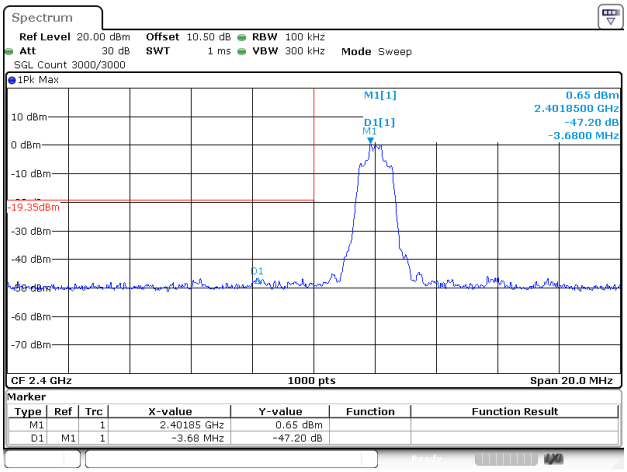
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:35:16

2DH1_Hopping_Upper



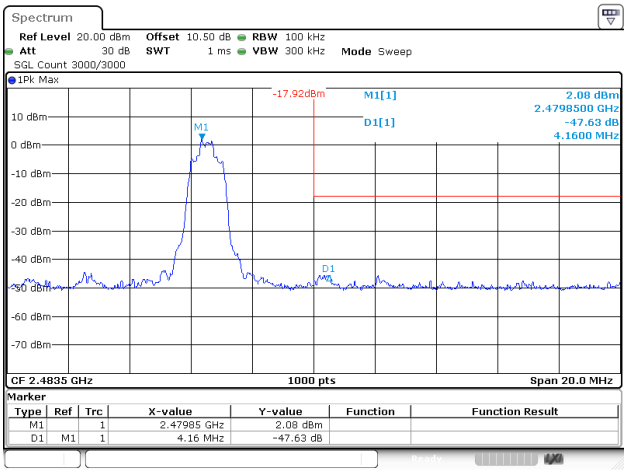
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:36:16

3DH1_Low



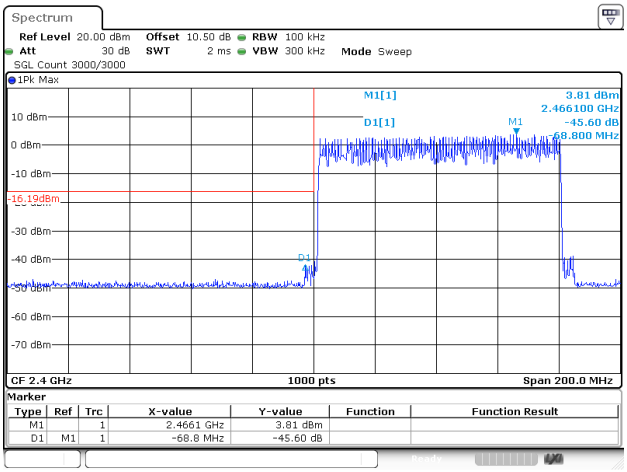
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:34:20

3DH1_High



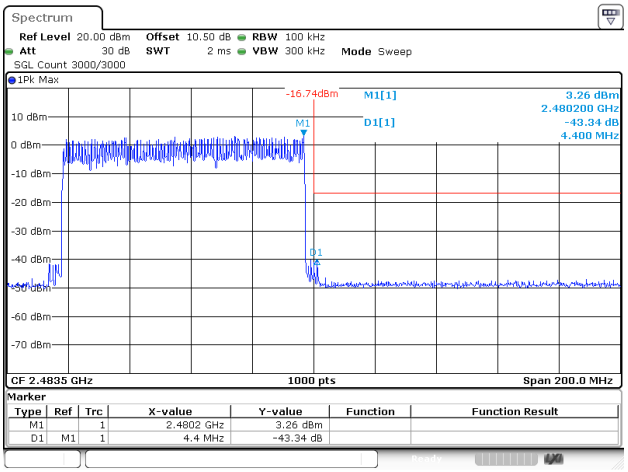
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 5.NOV.2025 10:36:42

3DH1_Hopping_Lower



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:45:29

3DH1_Hopping_Upper



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:46:28

Time of Occupancy (dwell time)

Test Information:

Sample No.:	2UJT-1	**Test Date:**	2025/10/13
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

Environmental Conditions:

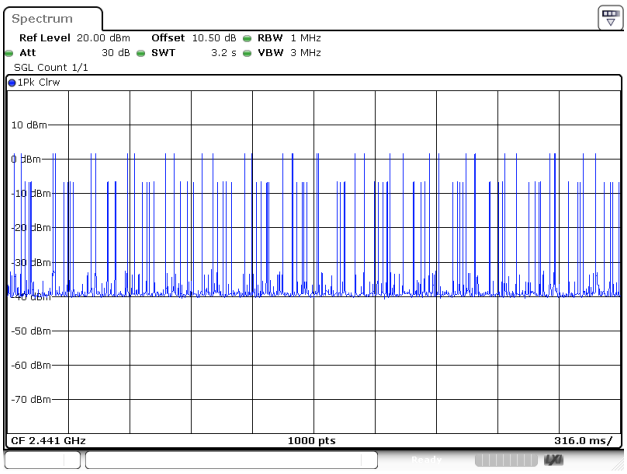
Temperature: (°C):	26.5	**Relative Humidity: (%)**	54	**ATM Pressure: (kPa)**	101.5

Test Mode	Channel	BurstWidth (ms)	TotalHops (Num)	Result (s)	Limit (s)	Verdict
DH1	Hopping Channel	0.392	320	0.125	≤ 0.4	Pass
DH3	Hopping Channel	1.652	150	0.248	≤ 0.4	Pass
DH5	Hopping Channel	2.908	120	0.349	≤ 0.4	Pass
2DH1	Hopping Channel	0.402	320	0.129	≤ 0.4	Pass
2DH3	Hopping Channel	1.658	170	0.282	≤ 0.4	Pass
2DH5	Hopping Channel	**2.913**	130	0.379	≤ 0.4	Pass
3DH1	Hopping Channel	0.397	310	0.123	≤ 0.4	Pass
3DH3	Hopping Channel	1.655	140	0.232	≤ 0.4	Pass
3DH5	Hopping Channel	**2.913**	130	0.379	≤ 0.4	Pass

Note 1: A period time = 0.4*79 = 31.6(S), Result = BurstWidth * Totalhops
Note 2: Totalhops = Hopping Number in 3.16s*10
Note 3: Hopping Number in 3.16s = Total of highest signals in 3.16s(Second high signals were other channel)

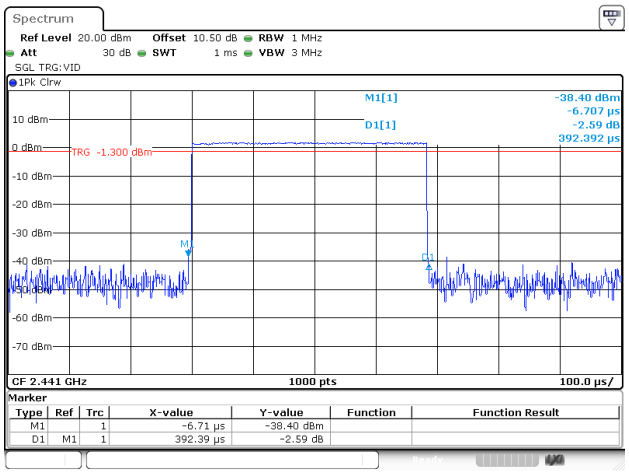
Test Data:

DH1_Hopping



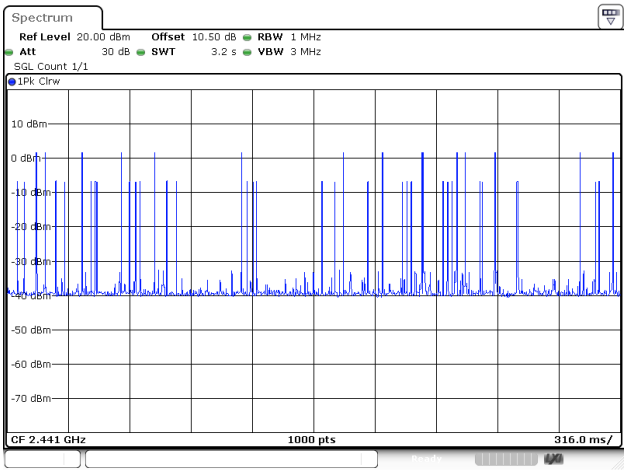
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:07:44

DH1_Hopping



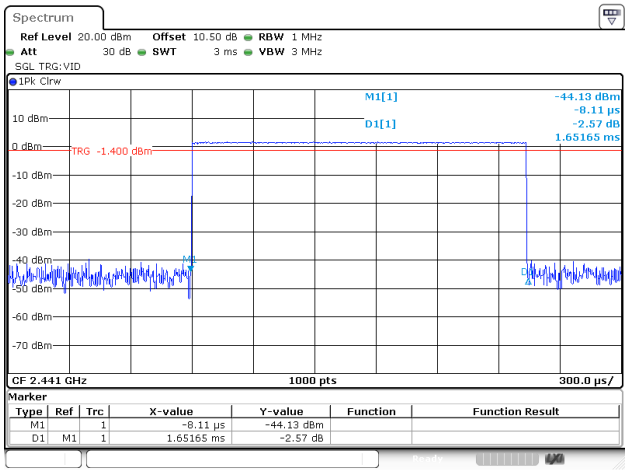
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:08:19

DH3_Hopping



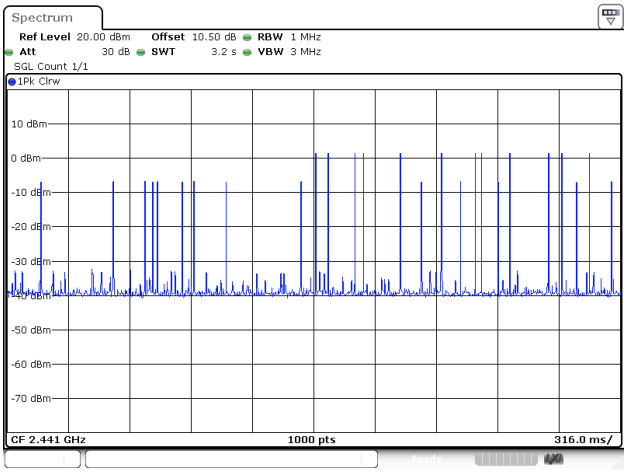
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:09:15

DH3_Hopping



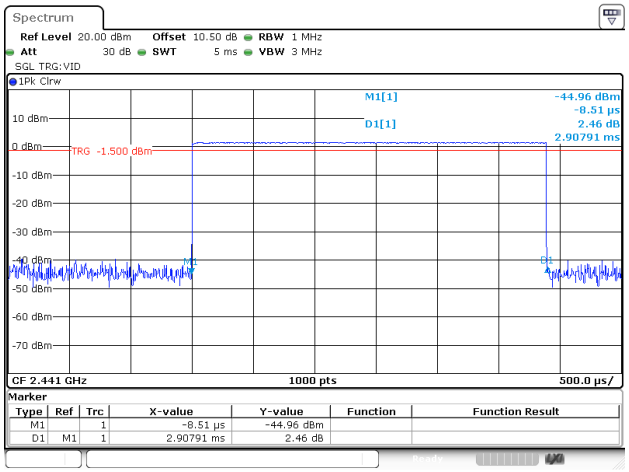
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:09:47

DH5_Hopping



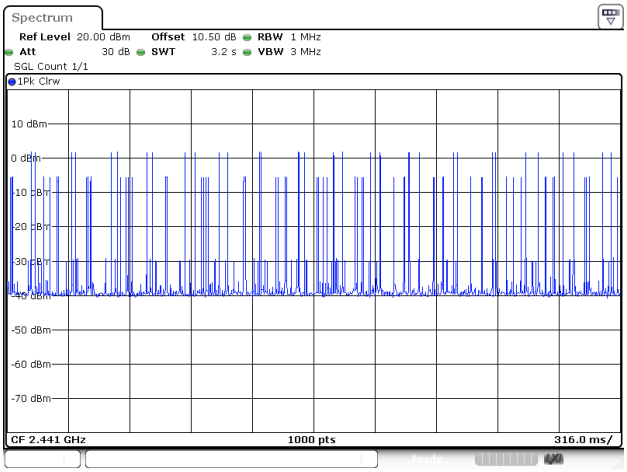
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:12:38

DH5_Hopping



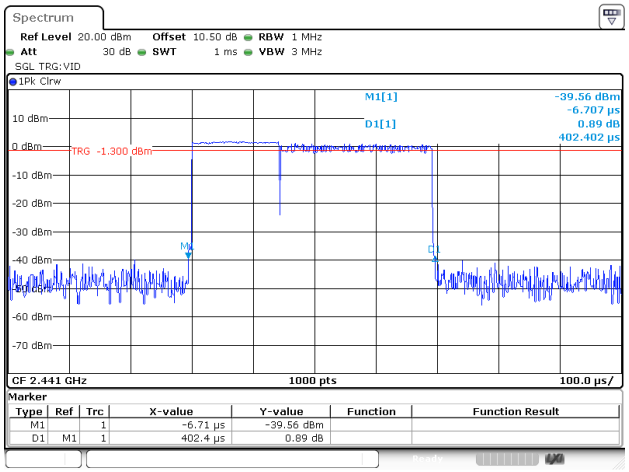
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:13:15

2DH1_Hopping



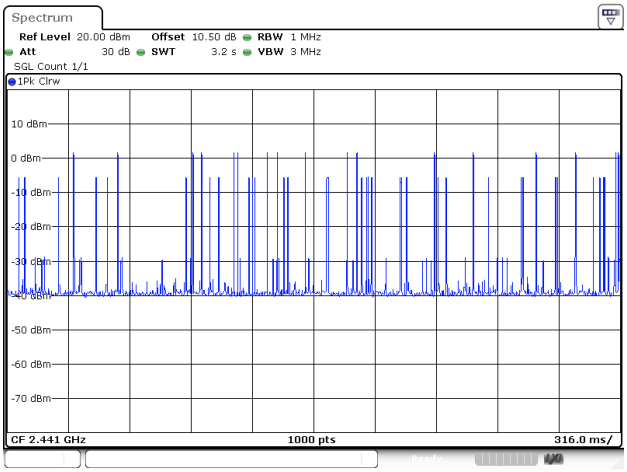
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:14:07

2DH1_Hopping



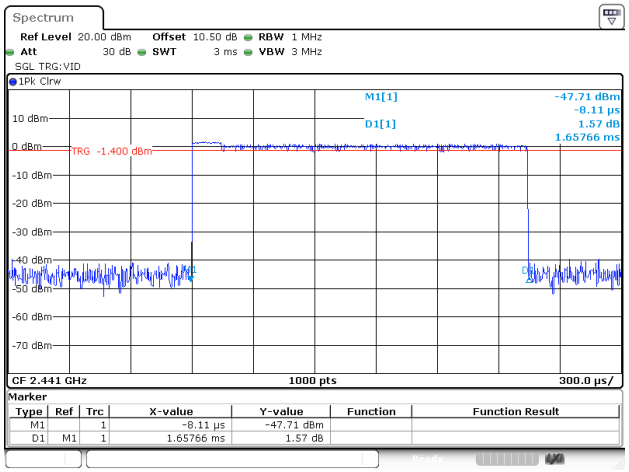
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:14:34

2DH3_Hopping



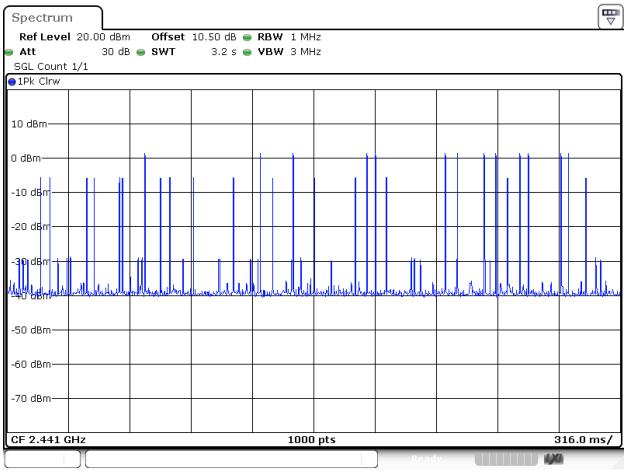
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:15:30

2DH3_Hopping



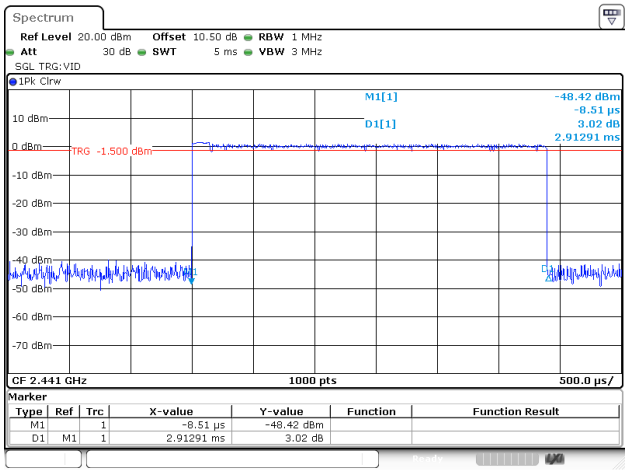
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:16:03

2DH5_Hopping



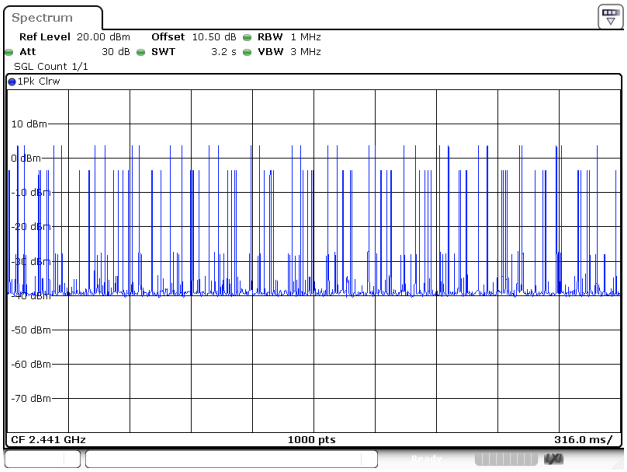
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:21:40

2DH5_Hopping



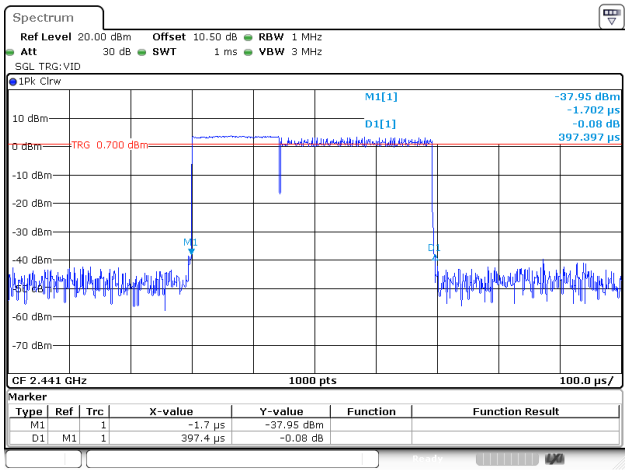
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:22:08

3DH1_Hopping



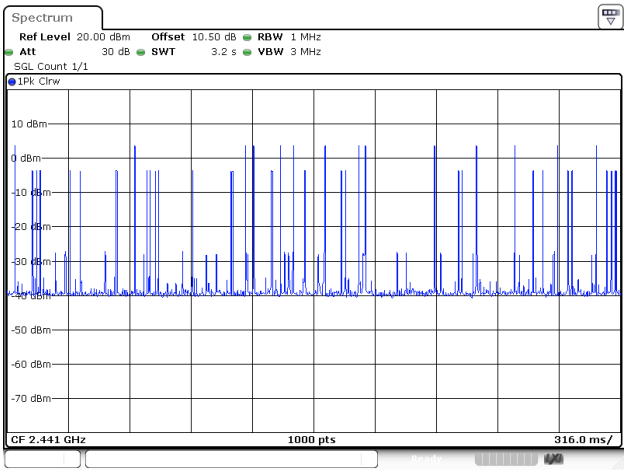
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:23:06

3DH1_Hopping



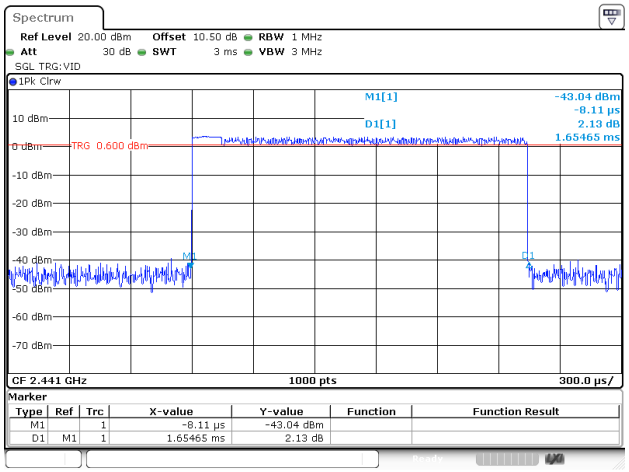
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:24:51

3DH3_Hopping



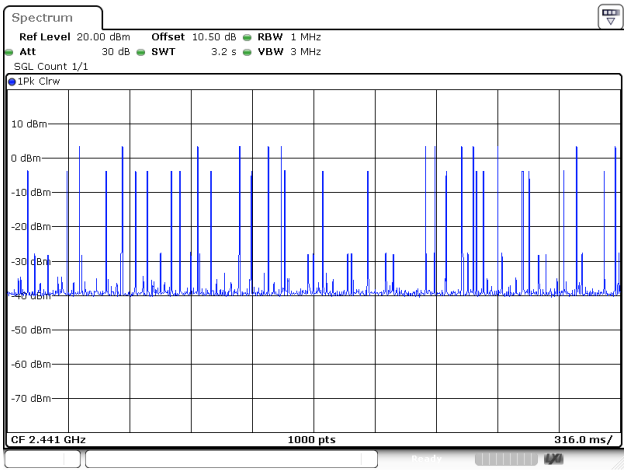
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:25:39

3DH3_Hopping



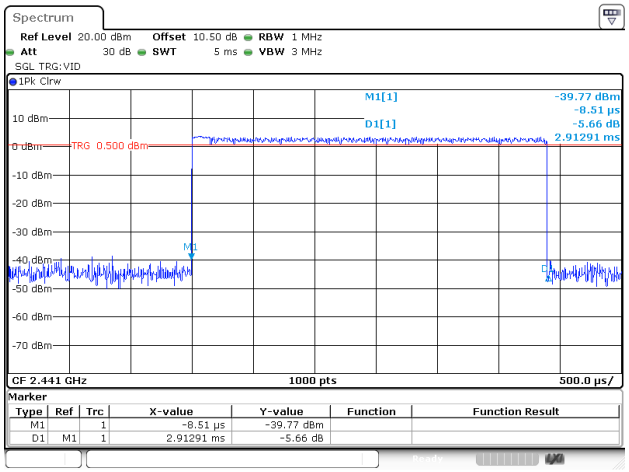
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:26:22

3DH5_Hopping



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:27:28

3DH5_Hopping



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 18:28:03

Conducted Spurious Emission

Test Information:

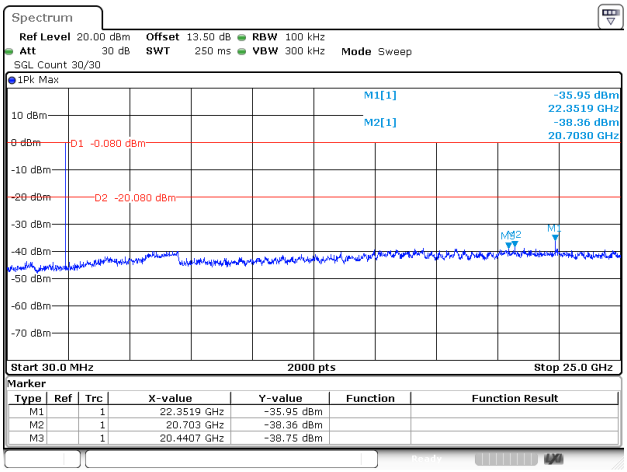
Sample No.:	2UJT-1	**Test Date:**	2025/10/13
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Rainbow Zhu	**Test Result:**	Pass

Environmental Conditions:

Temperature: (°C):	26.5	**Relative Humidity: (%)**	54	**ATM Pressure: (kPa)**	101.5

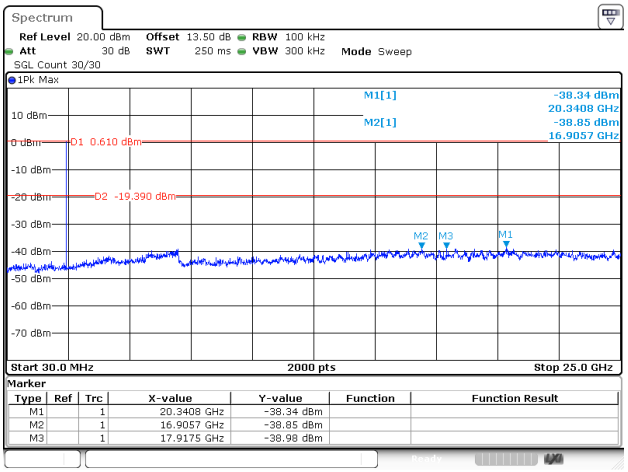
Test Data:

DH1_Low



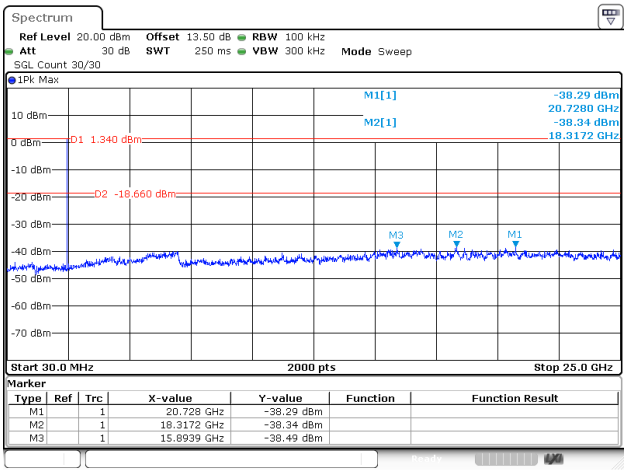
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:07:22

DH1_Middle



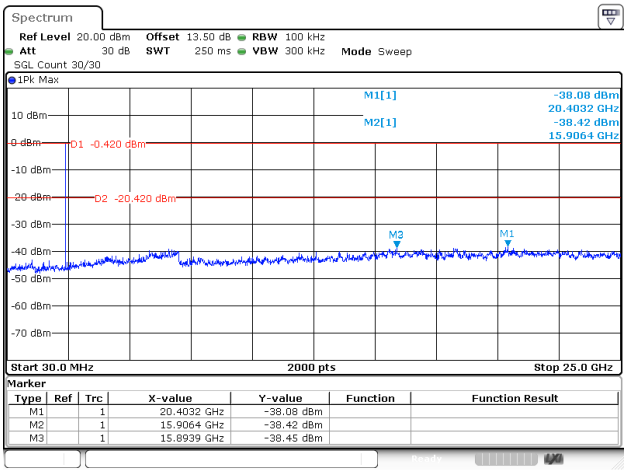
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:09:15

DH1_High



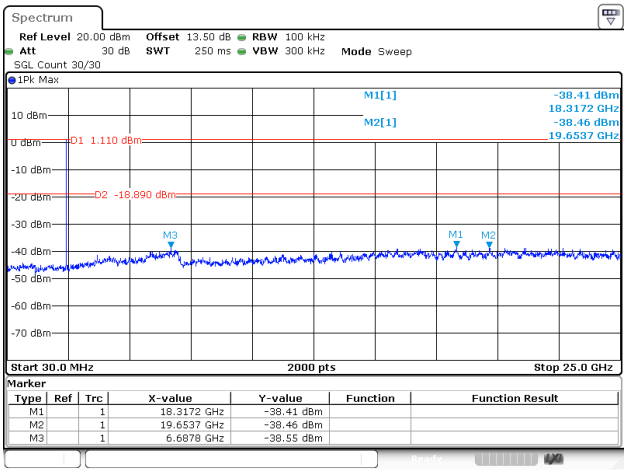
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:10:48

2DH1_Low



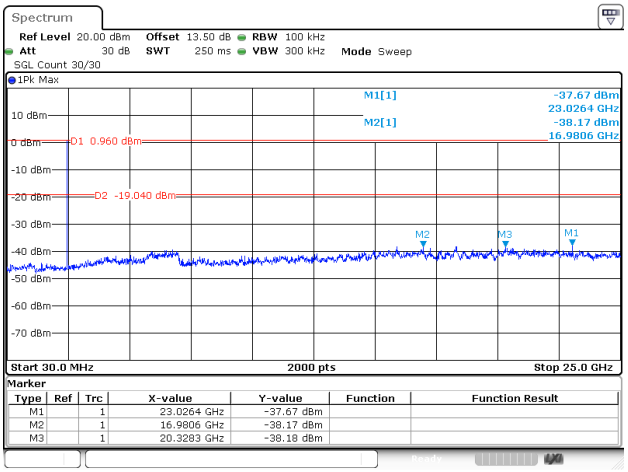
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:13:19

2DH1_Middle



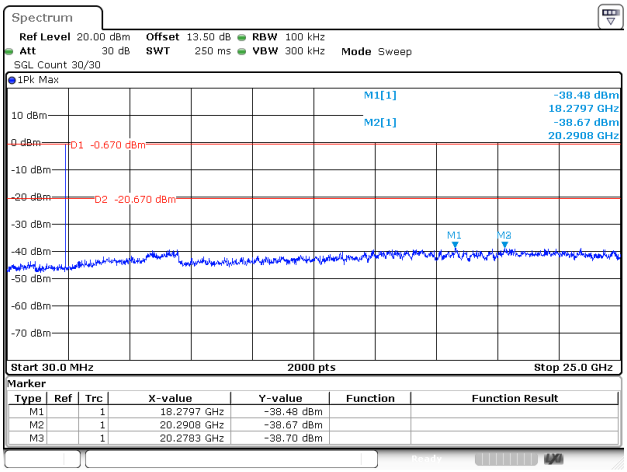
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:14:47

2DH1_High



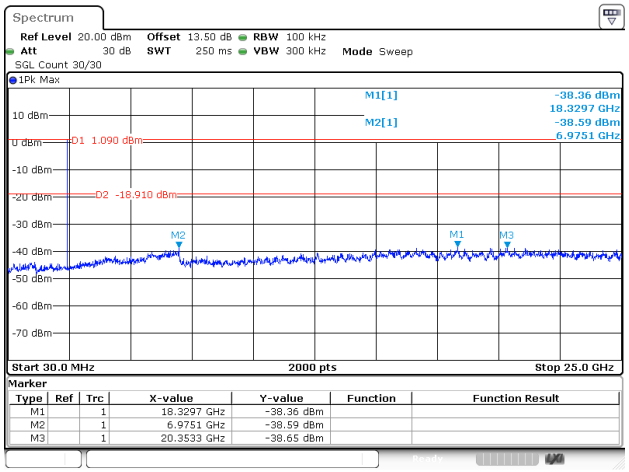
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:16:16

3DH1_Low



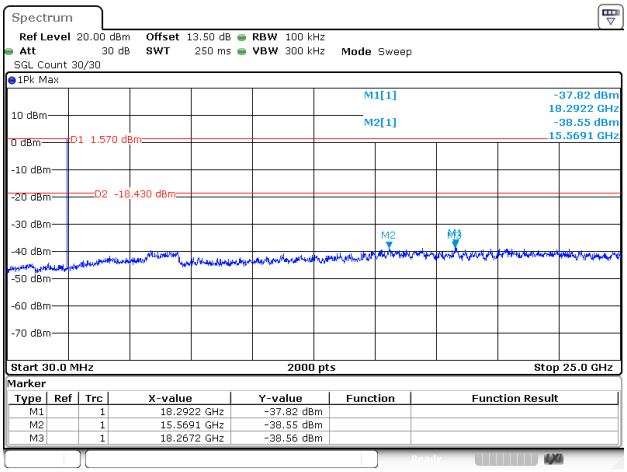
ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:17:54

3DH1_Middle



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:19:30

3DH1_High



ProjectNo.:2401Z105001E-RF Tester:Rainbow Zhu
Date: 13.OCT.2025 19:23:32

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 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^2f.
1,500-100,000	19.2R^2.

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

Result

Mode	Frequency (MHz)	Tune up conducted power#(dBm)	Antenna Gain#		ERP		Evaluation Distance (m)	ERP Limit (mW)
			(dBi)	(dBd)	(dBm)	(mW)		
BT	2402-2480	4.5	4.18	2.03	6.53	4.50	0.2	768
5.2G Wi-Fi	5180-5240	13.5	0.74	-1.41	12.09	16.18	0.2	768
5.8G Wi-Fi	5745-5825	12.5	3.47	1.32	13.82	24.10	0.2	768

Note:
The tune up conducted power and antenna gain was declared by the applicant.
The BT and Wi-Fi cannot transmit at the same time

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

Result: Compliant

Field reference level exposure exemption limits

Applicable Standard

According to RSS-102 Issue 6§6.6:

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

• below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)

• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 4.49/f0.5 W (adjusted for tune-up tolerance), where f is in MHz

• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)

• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10{-}2f$ 0.6834 W (adjusted for tune-up tolerance), where f is in MHz

• at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance) In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

Calculated Data:

Mode	Frequency (MHz)	Conducted output power including Tune-up Tolerance# (dBm)	Antenna Gain#	EIRP		Exemption limits (mW)	Exemption
				(dBm)	(mW)		
Bluetooth	2402-2480	4.5	4.18	8.68	7.38	2676	Yes
5.8G Wi-Fi	5745-5825	12.5	3.47	15.97	39.54	4857	Yes

Note:
1. The antenna gain and Conducted output power including Tune-up Tolerance was declared and provided by the manufacturer
2. The BT and Wi-Fi cannot transmit at the same time.

Result: Compliant

EUT PHOTOGRAPHS

Please refer to the attachment 2401Z105001E-RF External photo and 2401Z105001E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401Z105001E-RF-TSPA Test Setup photo.

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