

TEST REPORT

Applicant Name: TopTech International Inc
Address: PYNG SOON 17870 Castleton St., Ste 215, City of Industry, California, 91748, United States
Report Number: 2401Z45125E-RF-00A
FCC ID: 2BDON-9179066

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type: MOON SPEAKER
Model No.: 9179066
Multiple Model(s) No.: 9176640, 9179065
Trade Mark: N/A
Date Received: 2024-11-29
Issue Date: 2025-03-26

| | |
|--------------|-------|
| Test Result: | Pass▲ |
|--------------|-------|

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

Prepared and Checked By:

GaLa Liu
RF Engineer

Approved By:

Michelle Zeng
RF Supervisor

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

This report cannot be reproduced except in full, without prior written approval of the Company. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP or any agency of the U.S. Government.

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

Bay Area Compliance Laboratories Corp. (Shenzhen)

5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China
Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

TABLE OF CONTENTS

| | |
|---|-----------|
| DOCUMENT REVISION HISTORY | 3 |
| GENERAL INFORMATION..... | 4 |
| PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)..... | 4 |
| OBJECTIVE | 4 |
| TEST METHODOLOGY | 4 |
| MEASUREMENT UNCERTAINTY | 5 |
| TEST FACILITY | 5 |
| SYSTEM TEST CONFIGURATION..... | 6 |
| SUMMARY OF TEST RESULTS | 9 |
| TEST EQUIPMENT LIST | 10 |
| REQUIREMENTS AND TEST PROCEDURES | 12 |
| AC LINE CONDUCTED EMISSIONS..... | 12 |
| RADIATED EMISSIONS..... | 14 |
| 20 dB EMISSION BANDWIDTH..... | 17 |
| CHANNEL SEPARATION TEST | 19 |
| QUANTITY OF HOPPING CHANNEL TEST | 20 |
| TIME OF OCCUPANCY (DWELL TIME) | 21 |
| PEAK OUTPUT POWER MEASUREMENT | 22 |
| BAND EDGES..... | 23 |
| ANTENNA REQUIREMENT | 24 |
| TEST DATA AND RESULTS..... | 25 |
| AC LINE CONDUCTED EMISSIONS..... | 25 |
| RADIATED EMISSIONS..... | 28 |
| 20 dB EMISSION BANDWIDTH..... | 52 |
| CHANNEL SEPARATION | 55 |
| NUMBER OF HOPPING FREQUENCY | 57 |
| MAXIMUM CONDUCTED OUTPUT POWER | 59 |
| 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE..... | 62 |
| TIME OF OCCUPANCY (DWELL TIME) | 65 |
| RF EXPOSURE EVALUATION | 68 |
| EUT PHOTOGRAPHS..... | 69 |
| TEST SETUP PHOTOGRAPHS | 70 |

DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|--------------------|-------------------------|------------------|
| 0 | 2401Z45125E-RF-00A | Original Report | 2025-03-26 |

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

| | |
|--|--|
| Product | MOON SPEAKER |
| Tested Model | 9179066 |
| Multiple Model(s) | 9176640, 9179065 |
| Frequency Range | 2402~2480MHz |
| Transmit Peak Power | 4.54dBm |
| Modulation Technique | Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK |
| Antenna Specification[#] | -0.58dBi (provided by the applicant) |
| Voltage Range | DC 3.7V from Battery or DC 5V from type-c USB port |
| Sample serial number | 2V8R-1 (Assigned by BACL, Shenzhen) |
| Sample/EUT Status | Good condition |
| Adapter Information | N/A |

Note: The multiple models are electrically identical with the test model except for model name and color. Please refer to the declaration letter[#] for more detail, which was provided by manufacturer.

Objective

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

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

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

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

Each test item follows test standards and with no deviation.

Measurement Uncertainty

| Parameter | | Uncertainty |
|------------------------------------|-----------------------------|--|
| Occupied Channel Bandwidth | | 109.2kHz(k=2, 95% level of confidence) |
| RF output power, conducted | | 0.86dB(k=2, 95% level of confidence) |
| AC Power Lines Conducted Emissions | 9kHz-150kHz | 3.63dB(k=2, 95% level of confidence) |
| | 150kHz-30MHz | 3.66dB(k=2, 95% level of confidence) |
| Radiated Emissions | 0.009MHz~30MHz | 3.60dB(k=2, 95% level of confidence) |
| | 30MHz~200MHz (Horizontal) | 5.32dB(k=2, 95% level of confidence) |
| | 30MHz~200MHz (Vertical) | 5.43dB(k=2, 95% level of confidence) |
| | 200MHz~1000MHz (Horizontal) | 5.77dB(k=2, 95% level of confidence) |
| | 200MHz~1000MHz (Vertical) | 5.73dB(k=2, 95% level of confidence) |
| | 1GHz - 6GHz | 5.34dB(k=2, 95% level of confidence) |
| | 6GHz - 18GHz | 5.40dB(k=2, 95% level of confidence) |
| | 18GHz - 40GHz | 5.64dB(k=2, 95% level of confidence) |
| Temperature | | ±1°C |
| Humidity | | ±1% |
| Supply voltages | | ±0.4% |

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

Test Facility

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

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

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

EUT was tested with Channel 0, 39 and 78.

EUT Exercise Software

| | |
|--------------------------------|------------------------|
| Exercise Software [#] | Fcc_assist_1.0.2.2.exe |
| Power Level [#] | 10 |

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

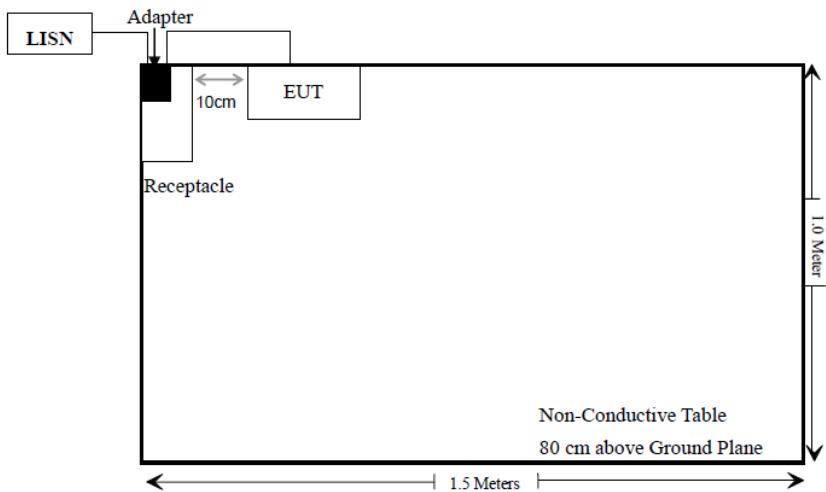
| Manufacturer | Description | Model | Serial Number |
|--------------|-------------|-------------|---------------|
| OUPU | Receptacle | PDU-OP1606K | 6971041358020 |
| Unknown | Adapter | Unknown | Unknown |

External I/O Cable

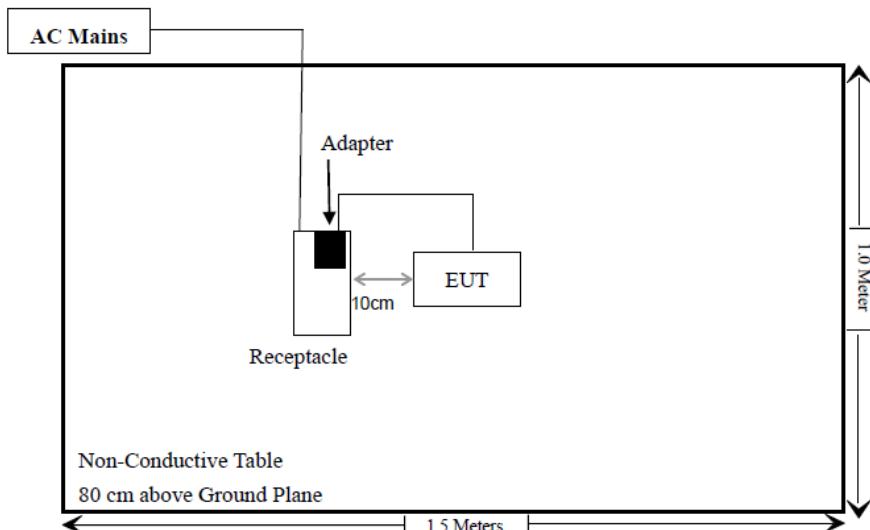
| Cable Description | Length (m) | From Port | To |
|------------------------------------|------------|------------|--------------|
| Un-shielding Detachable USB Cable | 1 | EUT | Adapter |
| Un-shielded Un-Detachable AC Cable | 1 | Receptacle | LISN/AC Main |

Block Diagram of Test Setup

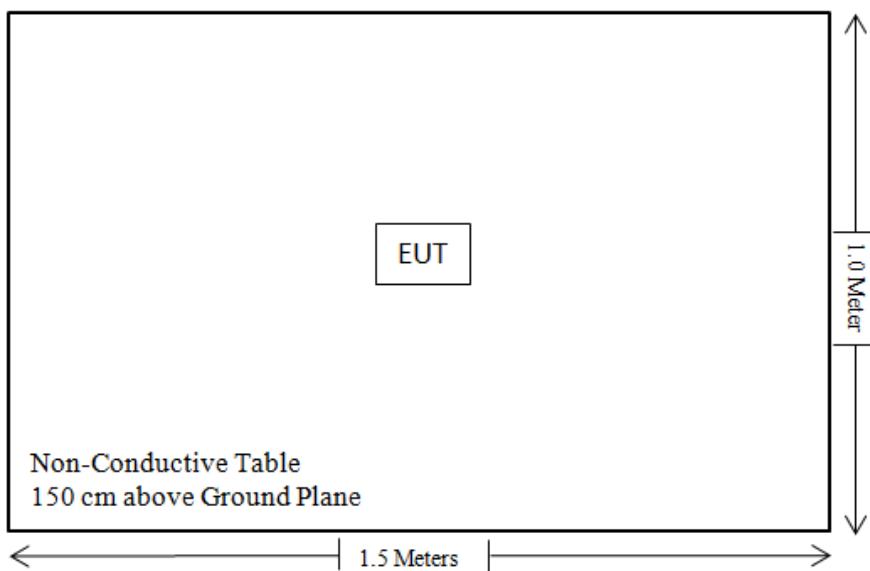
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



SUMMARY OF TEST RESULTS

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

TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------------------------|-----------------------------------|-----------------|------------------------|------------------|----------------------|
| Conducted Emission Test | | | | | |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 101120 | 2024/12/04 | 2025/12/03 |
| Rohde & Schwarz | Transient Limiter | ESH3Z2 | DE25985 | 2024/05/21 | 2025/05/20 |
| Rohde & Schwarz | LISN | ENV216 | 101613 | 2024/12/04 | 2025/12/03 |
| Unknown | CE Cable | Unknown | UF A210B-1-0720-504504 | 2024/05/21 | 2025/05/20 |
| Audix | EMI Test software | E3 | 191218(V9) | NCR | NCR |
| 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 |
| 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 | 2024/12/04 | 2025/12/03 |
| Unknown | RF Cable | UFA147 | 219661 | 2024/12/04 | 2025/12/03 |
| UTIFLEX | RF Cable | NO. 13 | 232308-001 | 2024/06/18 | 2025/06/17 |
| A.H.System | Pre-amplifier | PAM-1840VH | 190 | 2024/06/18 | 2025/06/17 |
| Electro-Mechanics Co | Horn Antenna | 3116 | 9510-2270 | 2023/09/18 | 2026/09/17 |
| JD | Multiplex Switch Test Control Set | DT7220SCU | DS79903 | 2024/09/09 | 2025/09/08 |
| Audix | EMI Test software | E3 | 191218(V9) | NCR | NCR |

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|--------------------------|-------------------|---------|---------------|------------------|----------------------|
| RF Conducted Test | | | | | |
| R&S | Spectrum Analyzer | FSU26 | 200120 | 2024/12/04 | 2025/12/03 |
| Unknown | 10dB Attenuator | Unknown | F-03-EM190 | 2024/06/27 | 2025/06/26 |

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

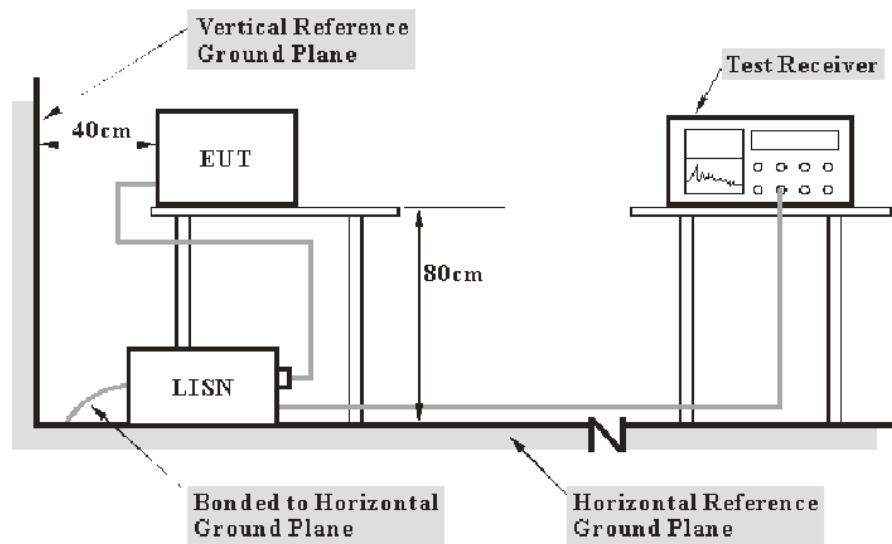
REQUIREMENTS AND TEST PROCEDURES

AC Line Conducted Emissions

Applicable Standard

FCC §15.207(a)

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

Factor & Over Limit Calculation

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

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

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

$$\text{Over Limit} = \text{Level} - \text{Limit}$$

$$\text{Level} = \text{Read Level} + \text{Factor}$$

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

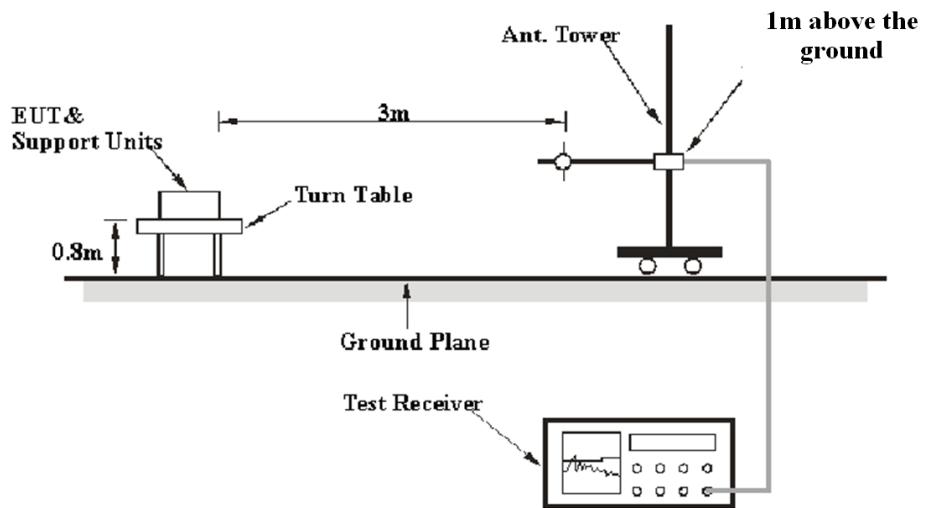
Radiated Emissions

Applicable Standard

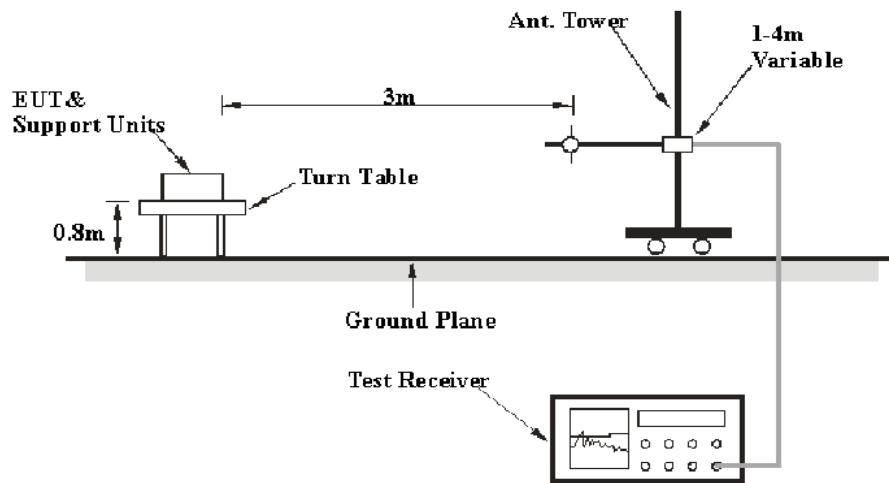
FCC §15.205; §15.209; §15.247(d)

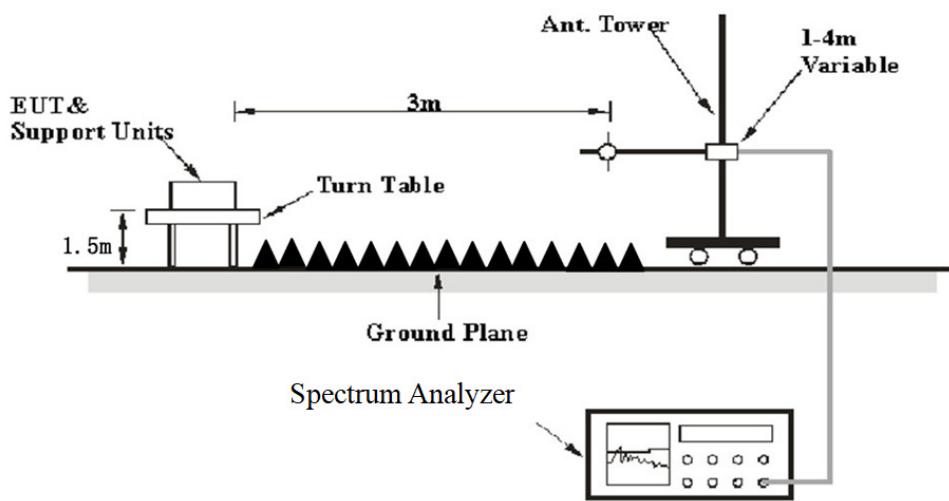
EUT Setup

9 kHz-30MHz:



30MHz-1GHz:



Above 1GHz:

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

EMI Test Receiver & Spectrum Analyzer Setup

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

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

For Duty cycle measurement:

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

Duty cycle=On time/100milliseconds, On time= $N1 \cdot L1 + N2 \cdot L2 + \dots + Nn-1 \cdot Ln-1 + Nn \cdot Ln$,

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:

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

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

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

20 dB Emission Bandwidth

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

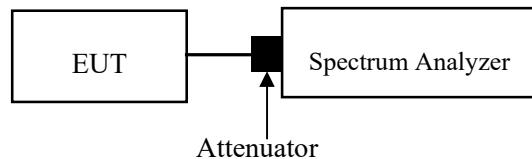
Test Procedure

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

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

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

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



Channel Separation Test

Applicable Standard

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

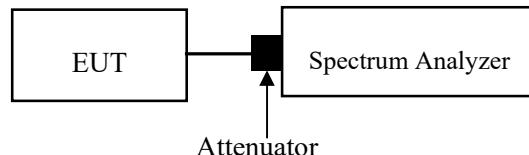
Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.2

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

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

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



Note: The limit is $2/3 \times 20$ dB bandwidth

Quantity of Hopping Channel Test

Applicable Standard

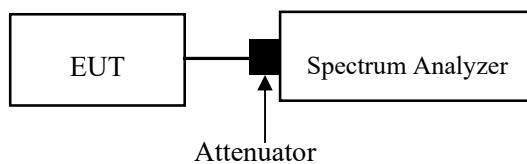
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.3

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

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



Time of Occupancy (Dwell Time)

Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.4

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

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

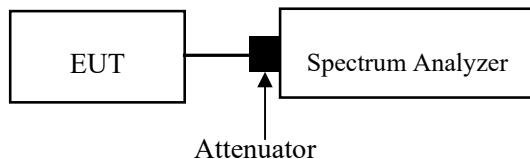
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

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

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

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

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



Peak Output Power Measurement

Applicable Standard

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

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.5

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

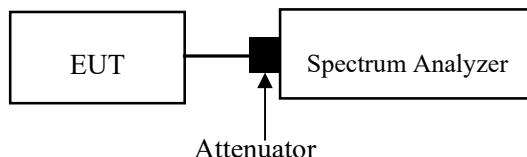
a) Use the following spectrum analyzer settings:

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

b) Allow trace to stabilize.

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

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



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

Band Edges

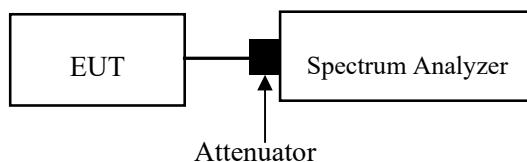
Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.6 & Clause 6.10

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



ANTENNA REQUIREMENT

Applicable Standard

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

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

Antenna Connector Construction

The EUT has an internal antenna arrangement, which was permanently attached, the antenna gain[#] is -0.58dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant

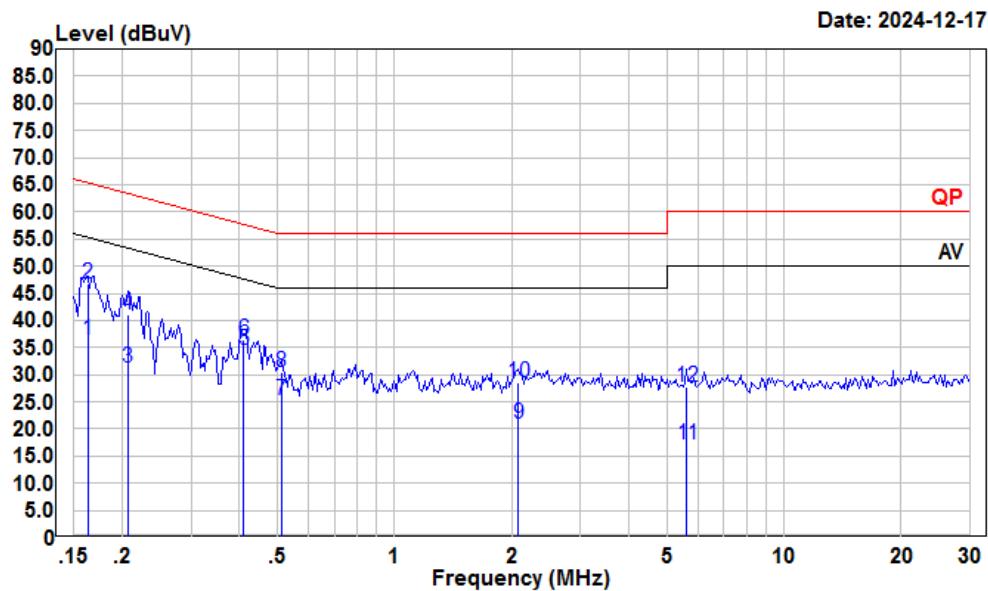
TEST DATA AND RESULTS

AC Line Conducted Emissions

Environmental Conditions

| | | | |
|--------------------|---|-----------------------|----------|
| Temperature (°C) | 24.2 | Relative Humidity (%) | 55 |
| ATM Pressure (kPa) | 101.3 | Test engineer | Macy Shi |
| Test date | 2024/12/17 | | |
| EUT operation mode | Transmitting(Maximum output power mode, EDR (8DPSK) Middle Channel) | | |

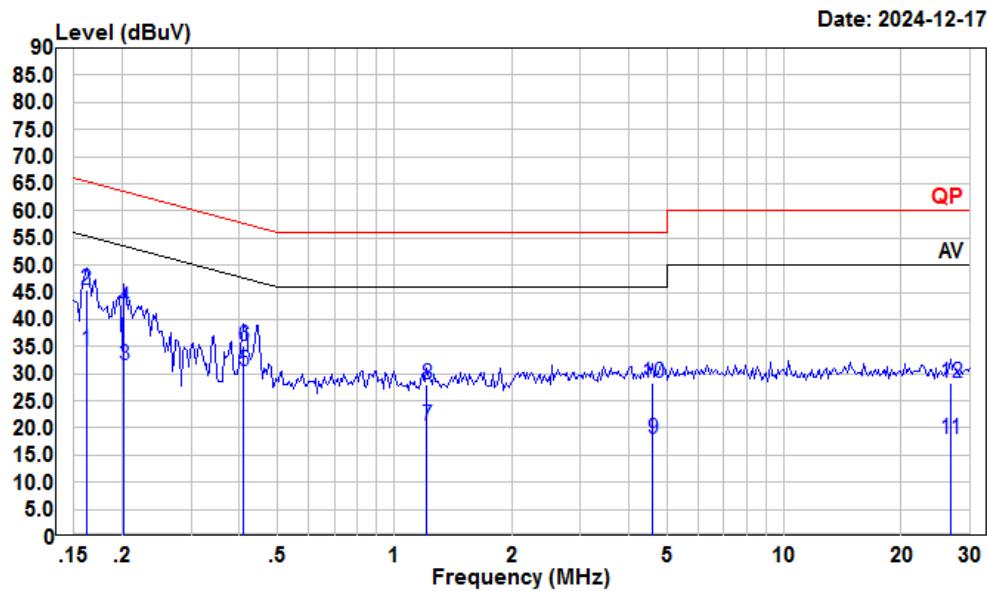
AC 120V 60 Hz, Line



Condition: Line
 Project : 2401Z45125E-RF
 tester : Macy.shi
 Note : Transmitting
 Detector : RBW:9KHz VBW:Auto SWT:Auto

| | Freq | Read Level | LISN Level | Cable Factor | Limit Loss | Over Line | Over Limit | Remark |
|----|-------|------------|------------|--------------|------------|-----------|------------|---------|
| | MHz | dBuV | dBuV | dB | dB | dBuV | dB | |
| 1 | 0.163 | 15.47 | 36.45 | 10.87 | 10.11 | 55.30 | -18.85 | Average |
| 2 | 0.163 | 25.77 | 46.75 | 10.87 | 10.11 | 65.30 | -18.55 | QP |
| 3 | 0.206 | 10.49 | 31.37 | 10.79 | 10.09 | 53.36 | -21.99 | Average |
| 4 | 0.206 | 20.15 | 41.03 | 10.79 | 10.09 | 63.36 | -22.33 | QP |
| 5 | 0.410 | 13.88 | 34.54 | 10.56 | 10.10 | 47.64 | -13.10 | Average |
| 6 | 0.410 | 15.86 | 36.52 | 10.56 | 10.10 | 57.64 | -21.12 | QP |
| 7 | 0.513 | 4.55 | 25.19 | 10.50 | 10.14 | 46.00 | -20.81 | Average |
| 8 | 0.513 | 9.93 | 30.57 | 10.50 | 10.14 | 56.00 | -25.43 | QP |
| 9 | 2.077 | 0.08 | 20.85 | 10.58 | 10.19 | 46.00 | -25.15 | Average |
| 10 | 2.077 | 7.75 | 28.52 | 10.58 | 10.19 | 56.00 | -27.48 | QP |
| 11 | 5.623 | -3.38 | 17.22 | 10.42 | 10.18 | 50.00 | -32.78 | Average |
| 12 | 5.623 | 7.26 | 27.86 | 10.42 | 10.18 | 60.00 | -32.14 | QP |

AC 120V 60 Hz, Neutral



Condition: Neutral

Project : 2401Z45125E-RF

tester : Macy.shi

Note : Transmitting

Detector : RBW:9KHz VBW:Auto SWT:Auto

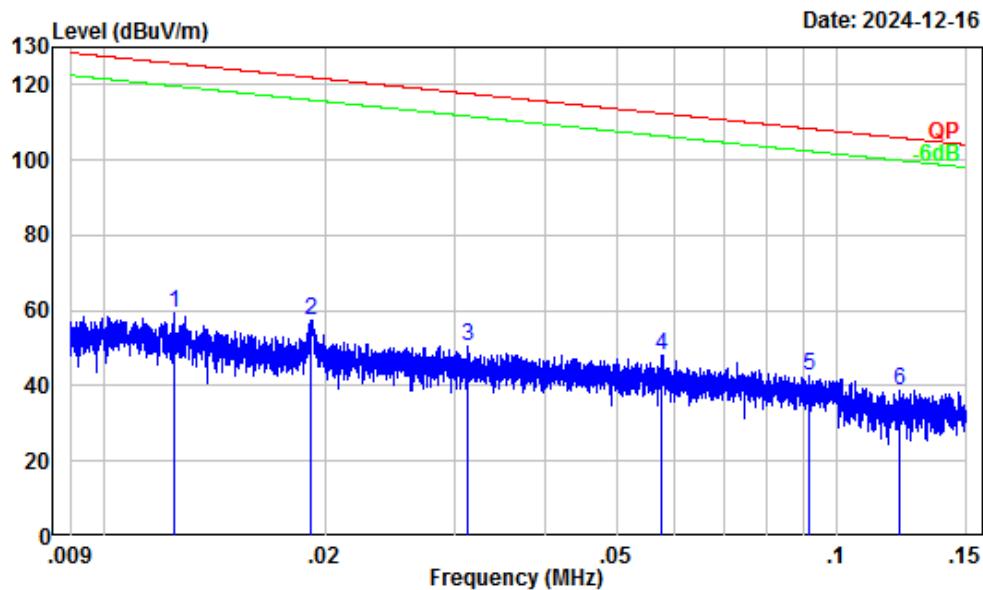
| Freq | Read | | LISN Level | Cable Factor | Limit Loss | Line Limit | Over Limit | Remark |
|------|--------|-------|------------|--------------|------------|------------|------------|---------|
| | MHz | dBuV | | | | | | |
| 1 | 0.162 | 13.64 | 34.30 | 10.55 | 10.11 | 55.38 | -21.08 | Average |
| 2 | 0.162 | 24.66 | 45.32 | 10.55 | 10.11 | 65.38 | -20.06 | QP |
| 3 | 0.202 | 10.99 | 31.48 | 10.40 | 10.09 | 53.54 | -22.06 | Average |
| 4 | 0.202 | 21.67 | 42.16 | 10.40 | 10.09 | 63.54 | -21.38 | QP |
| 5 | 0.410 | 9.79 | 30.53 | 10.64 | 10.10 | 47.64 | -17.11 | Average |
| 6 | 0.410 | 14.30 | 35.04 | 10.64 | 10.10 | 57.64 | -22.60 | QP |
| 7 | 1.210 | -0.46 | 20.44 | 10.76 | 10.14 | 46.00 | -25.56 | Average |
| 8 | 1.210 | 7.09 | 27.99 | 10.76 | 10.14 | 56.00 | -28.01 | QP |
| 9 | 4.598 | -2.66 | 18.00 | 10.47 | 10.19 | 46.00 | -28.00 | Average |
| 10 | 4.598 | 7.57 | 28.23 | 10.47 | 10.19 | 56.00 | -27.77 | QP |
| 11 | 26.699 | -2.93 | 17.83 | 10.56 | 10.20 | 50.00 | -32.17 | Average |
| 12 | 26.699 | 7.58 | 28.34 | 10.56 | 10.20 | 60.00 | -31.66 | QP |

Radiated Emissions**Environmental Conditions**

| | | | |
|----------------------------|--|------------------------------|-----------------------|
| Temperature (°C) | 24.0-26.0 | Relative Humidity (%) | 50.0-54.0 |
| ATM Pressure (kPa): | 101.2 | Test engineer: | Anson Su & Zenos Qiao |
| Test date: | 2024/12/16-2024/12/19 | | |
| EUT operation mode: | Below 1GHz: Transmitting (Maximum output power mode, EDR (8DPSK), Middle Channel) Above 1GHz: Transmitting (Maximum output power mode, EDR (8DPSK)) | | |
| Note: | <ol style="list-style-type: none">1. For the radiated spurious emission below 30MHz, only the worst case (parallel) was recorded.2. For the radiated spurious emission below 30MHz, When the test result of peak was less than the limit of QP/Average more than 6dB, just peak value were recorded.3. After pre-scan in the X, Y and Z axes of orientation, the worst case z-axis of orientation were recorded. | | |

Below 1GHz:

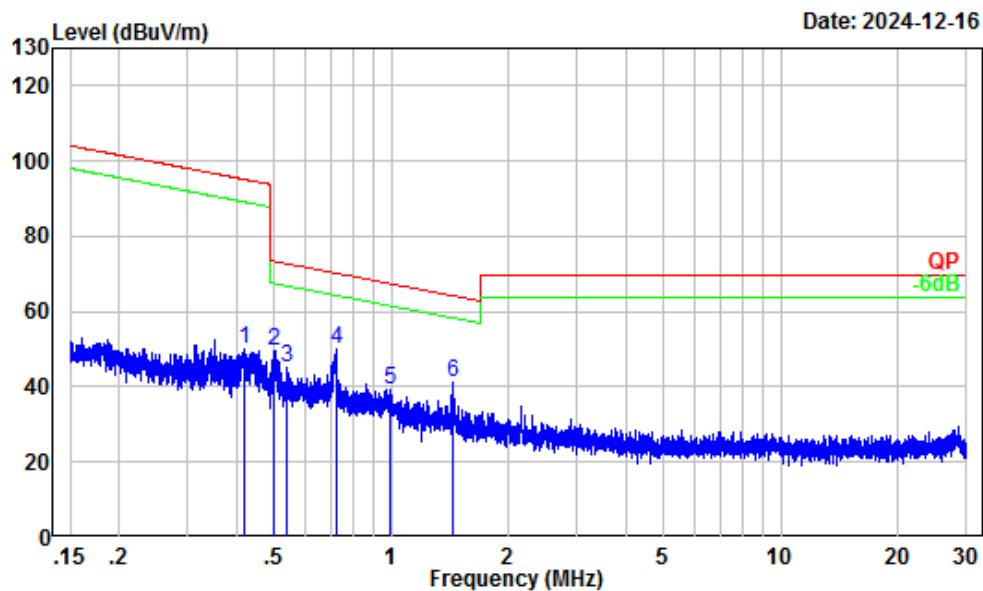
9kHz-150kHz



Site : Chamber A
Condition : 3m
Project Number : 2401Z45125E-RF
Test Mode : Transmitting
Detector QP RBW: 0.3KHz VBW:1KHz
Tester : Anson Su

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|--------|-------|-------|-------|--------|--------|--------|
| | | MHz | dB/m | dBuV | dBuV/m | dBuV/m | |
| 1 | 0.01 | 31.83 | 27.62 | 59.45 | 125.68 | -66.23 | Peak |
| 2 | 0.02 | 30.56 | 26.88 | 57.44 | 121.96 | -64.52 | Peak |
| 3 | 0.03 | 28.37 | 22.26 | 50.63 | 117.70 | -67.07 | Peak |
| 4 | 0.06 | 25.63 | 22.61 | 48.24 | 112.38 | -64.14 | Peak |
| 5 | 0.09 | 22.58 | 20.05 | 42.63 | 108.35 | -65.72 | Peak |
| 6 | 0.12 | 20.73 | 18.19 | 38.92 | 105.91 | -66.99 | Peak |

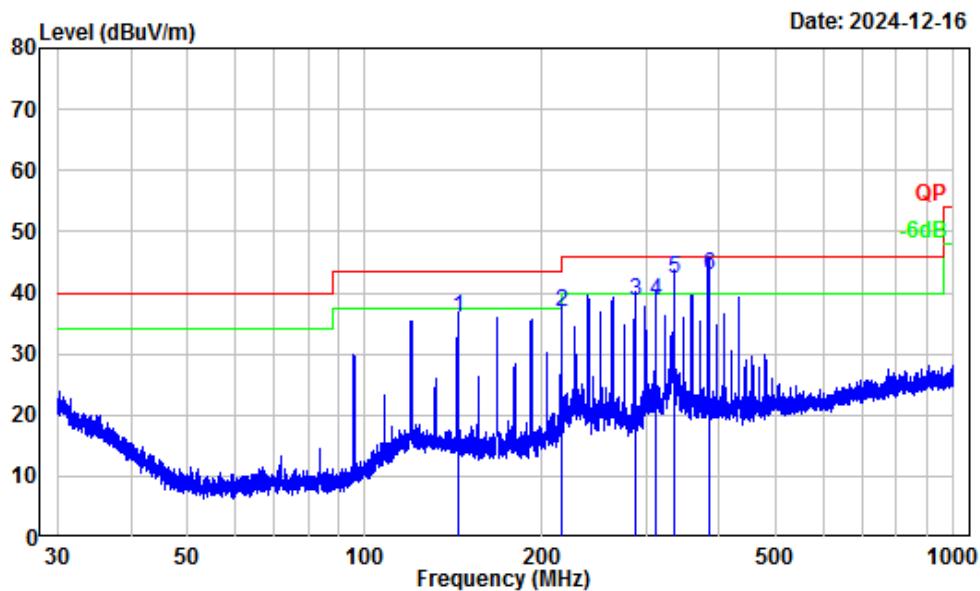
150kHz-30MHz



Site : Chamber A
Condition : 3m
Project Number : 2401Z45125E-RF
Test Mode : Transmitting
Detector QP RBW: 10KHz VBW:30KHz
Tester : Anson Su

| | Freq | Factor | Read Level | Limit Level | Line | Over Limit | Remark |
|---|------|--------|------------|-------------|--------|------------|--------|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 0.42 | 7.91 | 42.03 | 49.94 | 95.13 | -45.19 | Peak |
| 2 | 0.50 | 6.39 | 43.13 | 49.52 | 73.60 | -24.08 | Peak |
| 3 | 0.54 | 5.90 | 39.32 | 45.22 | 72.93 | -27.71 | Peak |
| 4 | 0.72 | 3.65 | 46.61 | 50.26 | 70.35 | -20.09 | Peak |
| 5 | 0.99 | 1.26 | 38.06 | 39.32 | 67.55 | -28.23 | Peak |
| 6 | 1.44 | -0.03 | 41.30 | 41.27 | 64.23 | -22.96 | Peak |

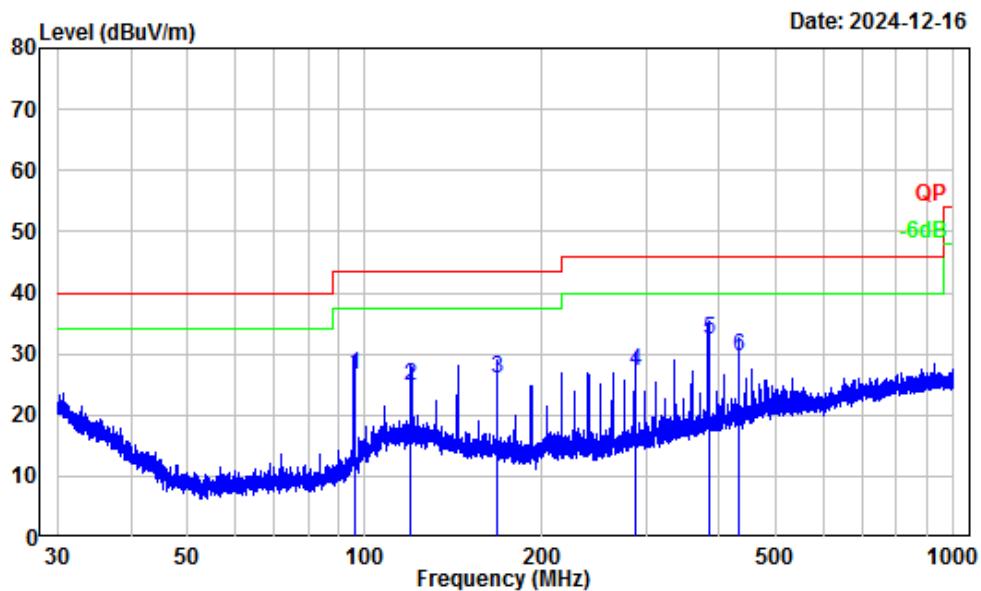
30MHz-1GHz_Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number : 2401Z45125E-RF
Test Mode : Transmitting
Detector QP RBW: 120KHz
Tester : Anson Su

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|--------|--------|-------|-------|--------|--------|--------|
| | | MHz | dB/m | dBuV | dBuV/m | dBuV/m | |
| 1 | 143.64 | -12.14 | 48.00 | 35.86 | 43.50 | -7.64 | QP |
| 2 | 215.65 | -14.20 | 50.97 | 36.77 | 43.50 | -6.73 | QP |
| 3 | 287.49 | -11.22 | 49.90 | 38.68 | 46.00 | -7.32 | QP |
| 4 | 311.63 | -11.01 | 49.80 | 38.79 | 46.00 | -7.21 | QP |
| 5 | 335.15 | -10.53 | 52.74 | 42.21 | 46.00 | -3.79 | QP |
| 6 | 383.43 | -9.05 | 51.99 | 42.94 | 46.00 | -3.06 | QP |

30MHz-1GHz_Verical



Site : Chamber A
Condition : 3m Vertical
Project Number : 2401Z45125E-RF
Test Mode : Transmitting
Detector QP RBW: 120KHz
Tester : Anson Su

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|--------|--------|-------|-------|--------|--------|--------|
| | | MHz | dB/m | dBuV | dBuV/m | dBuV/m | |
| 1 | 95.89 | -17.06 | 43.49 | 26.43 | 43.50 | -17.07 | QP |
| 2 | 119.80 | -11.47 | 36.30 | 24.83 | 43.50 | -18.67 | QP |
| 3 | 167.75 | -13.00 | 38.82 | 25.82 | 43.50 | -17.68 | QP |
| 4 | 287.49 | -11.22 | 38.50 | 27.28 | 46.00 | -18.72 | QP |
| 5 | 383.43 | -9.05 | 41.38 | 32.33 | 46.00 | -13.67 | QP |
| 6 | 431.22 | -7.80 | 37.44 | 29.64 | 46.00 | -16.36 | QP |

Above 1GHz:

| Frequency (MHz) | Reading (dB μ V) | Detector (PK/Ave) | Polar (H/V) | Factor (dB/m) | Corrected Amplitude (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|---|----------------------|-------------------|-------------|---------------|------------------------------------|----------------------|-------------|
| Maximum output power mode: 8DPSK | | | | | | | |
| Low Channel | | | | | | | |
| 4804 | 65.55 | PK | H | -7.79 | 57.76 | 74 | -16.24 |
| 4804 | 64.02 | PK | V | -7.79 | 56.23 | 74 | -17.77 |
| Middle Channel | | | | | | | |
| 4882 | 65.21 | PK | H | -7.58 | 57.63 | 74 | -16.37 |
| 4882 | 63.68 | PK | V | -7.58 | 56.1 | 74 | -17.9 |
| High Channel | | | | | | | |
| 4960 | 64.8 | PK | H | -7.57 | 57.23 | 74 | -16.77 |
| 4960 | 63.25 | PK | V | -7.57 | 55.68 | 74 | -18.32 |

Note:

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

Corrected Amplitude/Level = Factor + Reading

Margin = Corrected Amplitude/Level - Limit

The other spurious emission which is in the noise floor level was not recorded.

| Field Strength of Average | | | | | | | |
|----------------------------------|-------------------------------------|-------------|-----------------------------------|------------------------------|----------------------|-------------|----------|
| Frequency (MHz) | Peak Measurement @3m (dB μ V/m) | Polar (H/V) | Duty Cycle Correction Factor (dB) | Average Level (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Comment |
| Low Channel | | | | | | | |
| 4804 | 57.76 | H | -24.73 | 33.03 | 54 | -20.97 | Harmonic |
| 4804 | 56.23 | V | -24.73 | 31.5 | 54 | -22.5 | Harmonic |
| Middle Channel | | | | | | | |
| 4882 | 57.63 | H | -24.73 | 32.9 | 54 | -21.1 | Harmonic |
| 4882 | 56.1 | V | -24.73 | 31.37 | 54 | -22.63 | Harmonic |
| High Channel | | | | | | | |
| 4960 | 57.23 | H | -24.73 | 32.5 | 54 | -21.5 | Harmonic |
| 4960 | 55.68 | V | -24.73 | 30.95 | 54 | -23.05 | Harmonic |

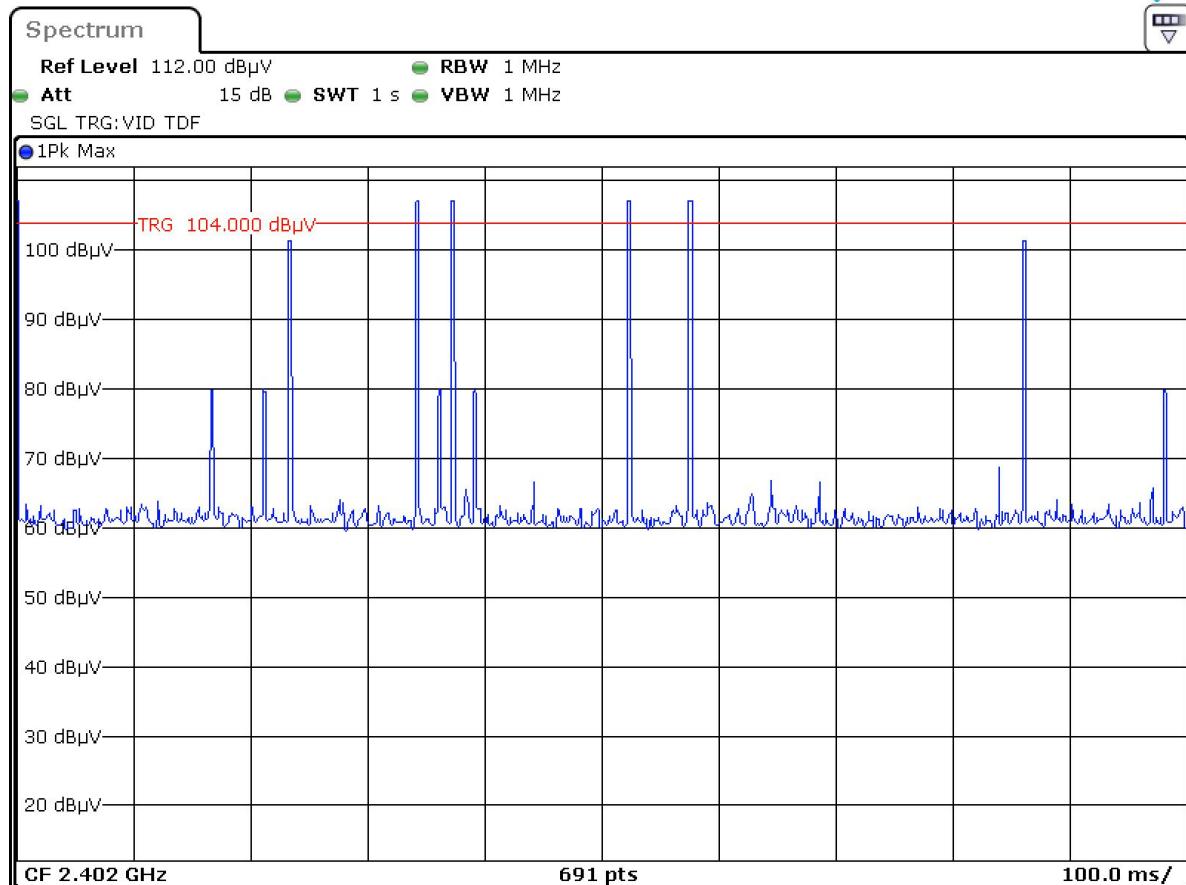
Note: Average level= Peak level + Duty Cycle Corrected Factor

Margin = Average level - Limit

Worst case duty cycle:

Duty cycle = Ton/100ms = $2.899*2/100=0.05798$ Duty Cycle Corrected Factor = $20\lg(\text{Duty cycle}) = 20\lg 0.05798 = -24.73$

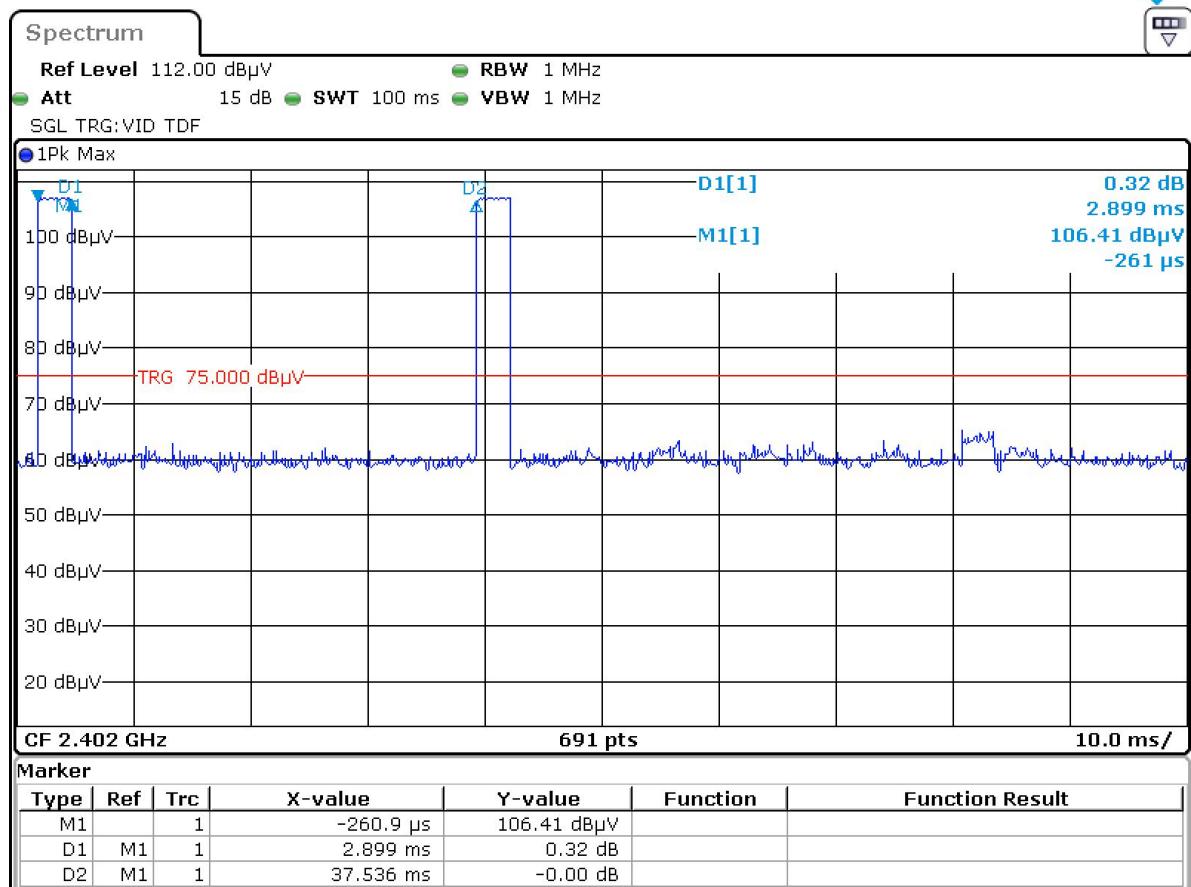
Duty Cycle_BT-1s



ProjectNo.:2401Z45125E-RF Tester:Zenos Qiao

Date: 19.DEC.2024 18:03:36

Duty Cycle_BT-100ms

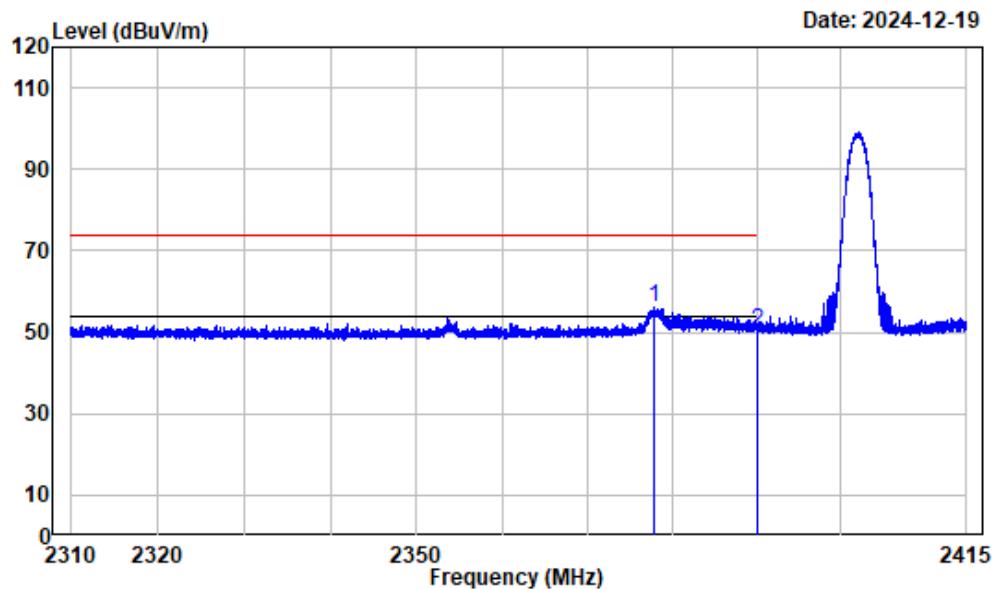


ProjectNo.:2401Z45125E-RF Tester:Zenos Qiao

Date: 19.DEC.2024 18:04:42

Test plots

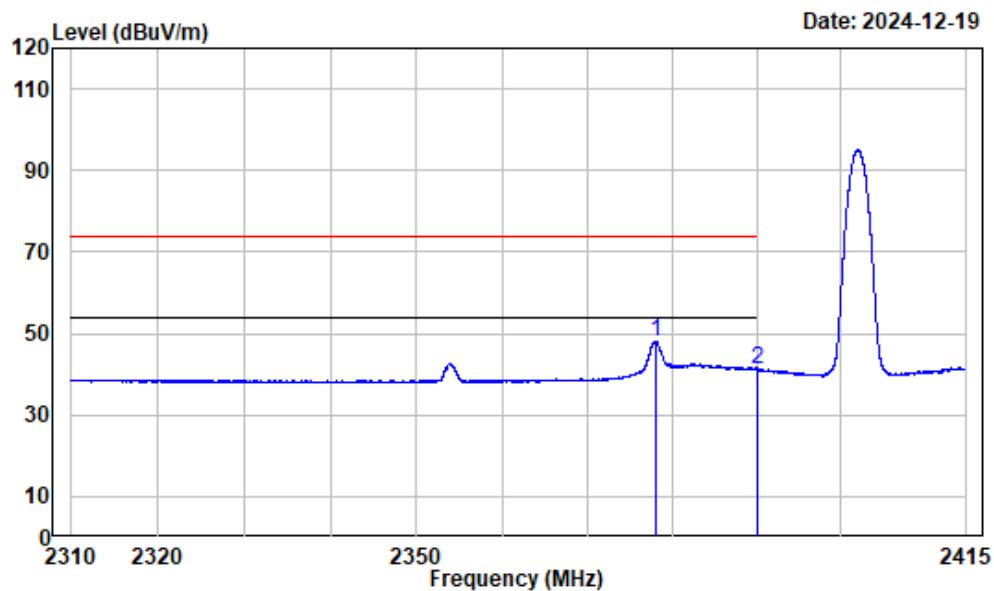
Left Band edge_Horizontal_Peak



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | Over | Remark |
|------|----------|--------|-------|-------|--------|-------------|
| | | MHz | dB/m | dBuV | dBuV/m | |
| 1 | 2377.917 | -10.96 | 66.93 | 55.97 | 74.00 | -18.03 Peak |
| 2 | 2390.000 | -10.98 | 61.15 | 50.17 | 74.00 | -23.83 Peak |

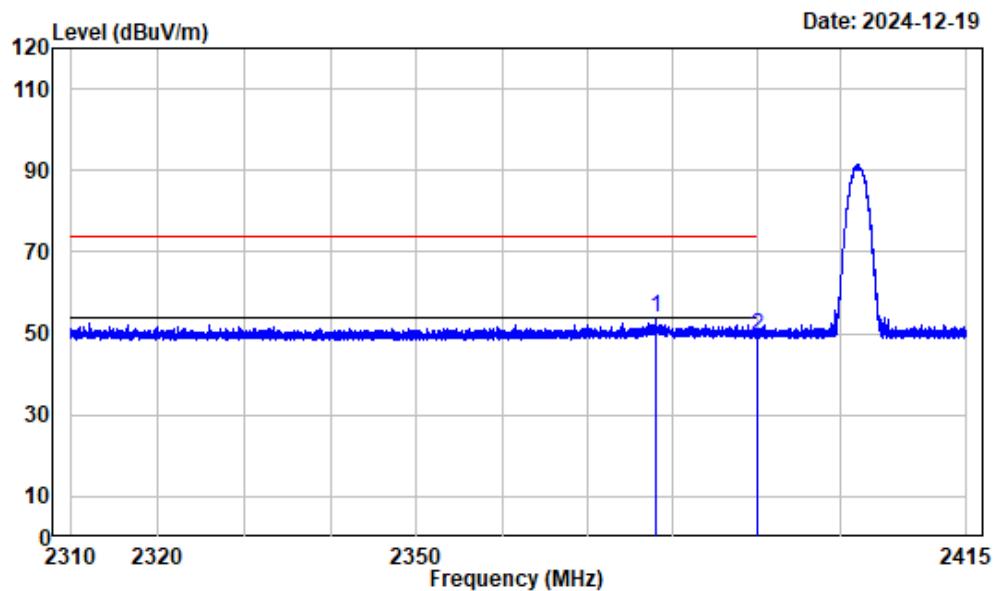
Left Band edge_Horizontal_Average



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| | Freq | Read Factor | Level | Limit Level | Line | Over Limit | Remark |
|---|----------|-------------|-------|-------------|--------|------------|---------|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2377.983 | -10.96 | 58.96 | 48.00 | 54.00 | -6.00 | Average |
| 2 | 2390.000 | -10.98 | 52.16 | 41.18 | 54.00 | -12.82 | Average |

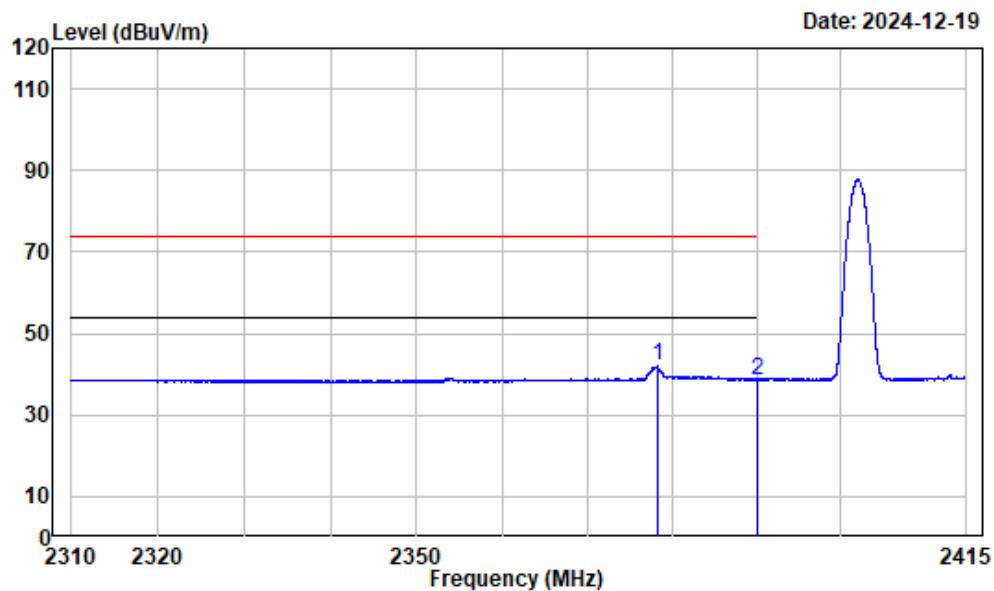
Left Band edge_Vertical_Peak



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|----------|--------|-------|-------|--------|--------|--------|
| | | MHz | dB/m | dBuV | dBuV/m | | |
| 1 | 2378.101 | -10.96 | 65.00 | 54.04 | 74.00 | -19.96 | Peak |
| 2 | 2390.000 | -10.98 | 60.46 | 49.48 | 74.00 | -24.52 | Peak |

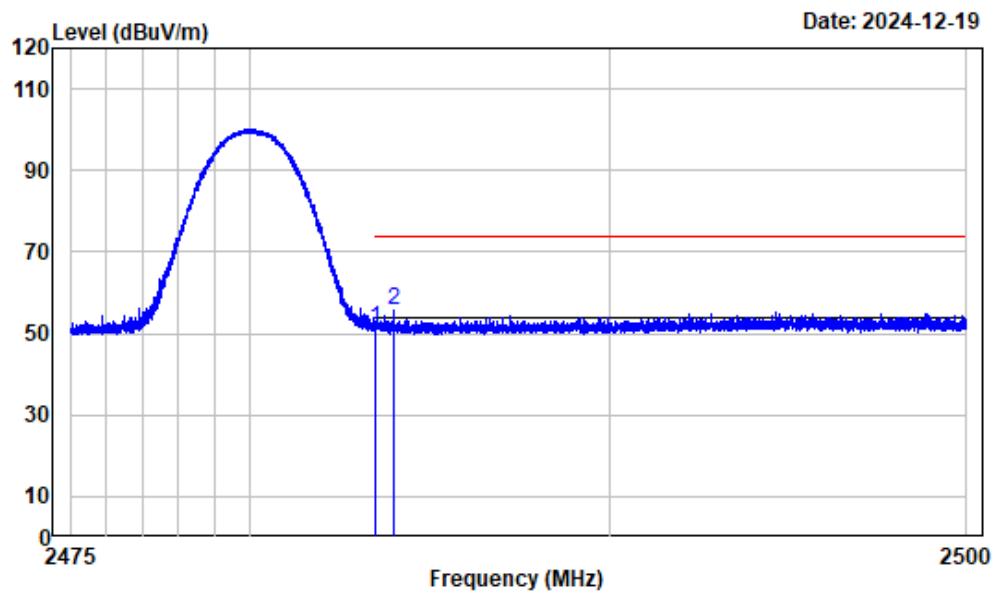
Left Band edge_Vertical_Average



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| | Freq | Read Factor | Level | Limit Level | Over Line | Limit | Remark |
|---|----------|-------------|-------|-------------|-----------|--------|---------|
| 1 | 2378.245 | -10.96 | 52.89 | 41.93 | 54.00 | -12.07 | Average |
| 2 | 2390.000 | -10.98 | 49.69 | 38.71 | 54.00 | -15.29 | Average |

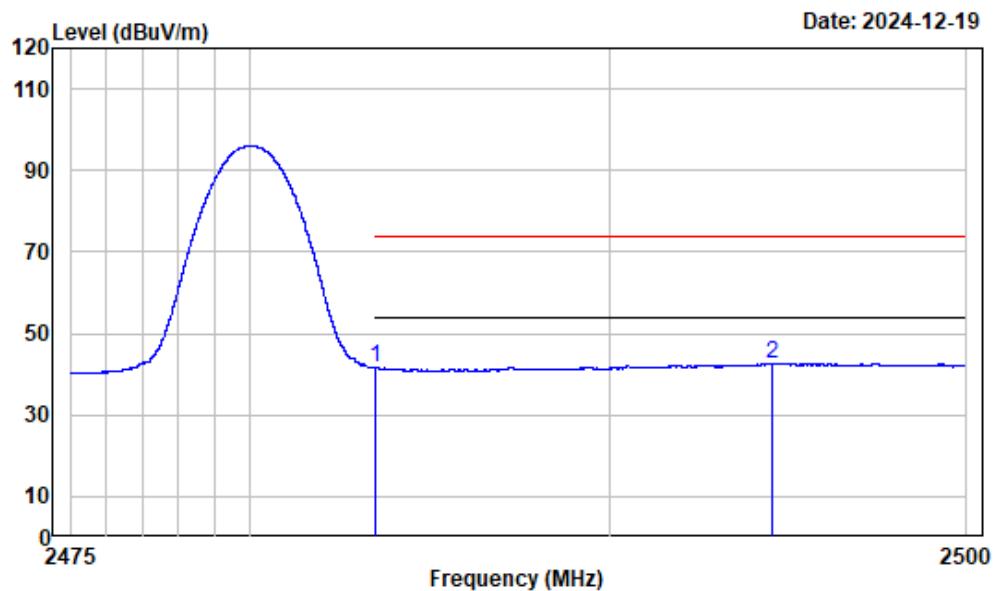
Right Band edge_Horizontal_Peak



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2480

| | Freq | Read Factor | Level | Limit Level | Over Line | Limit | Remark |
|---|----------|-------------|-------|-------------|-----------|--------|--------|
| 1 | 2483.500 | -10.97 | 61.97 | 51.00 | 74.00 | -23.00 | Peak |
| 2 | 2484.010 | -10.97 | 66.78 | 55.81 | 74.00 | -18.19 | Peak |

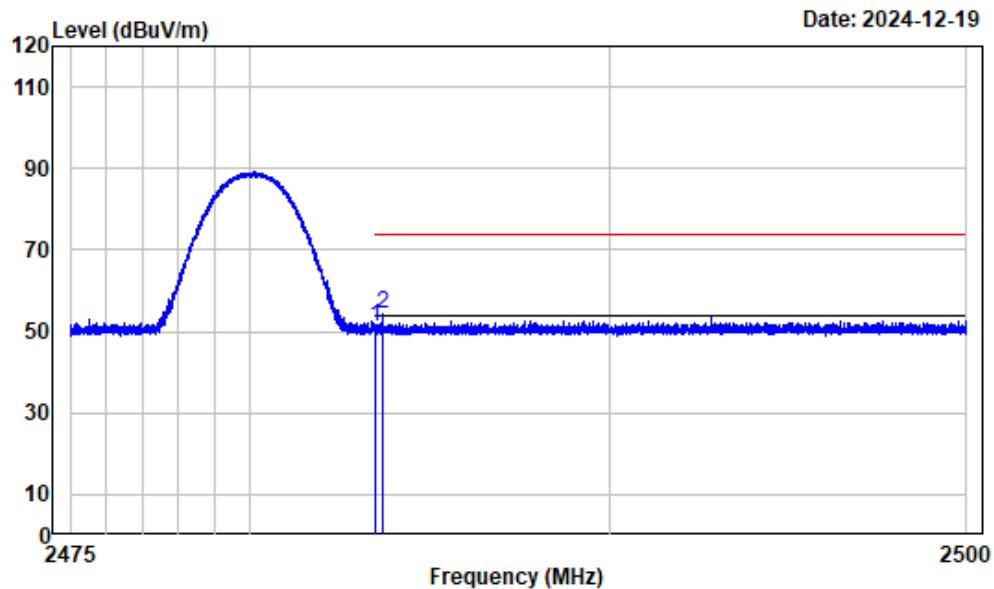
Right Band edge_Horizontal_Average



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2480

| | Freq | Read Factor | Level | Limit Level | Over Line | Limit | Remark |
|---|----------|-------------|-------|-------------|-----------|--------|---------|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2483.500 | -10.97 | 52.66 | 41.69 | 54.00 | -12.31 | Average |
| 2 | 2494.565 | -10.99 | 53.77 | 42.78 | 54.00 | -11.22 | Average |

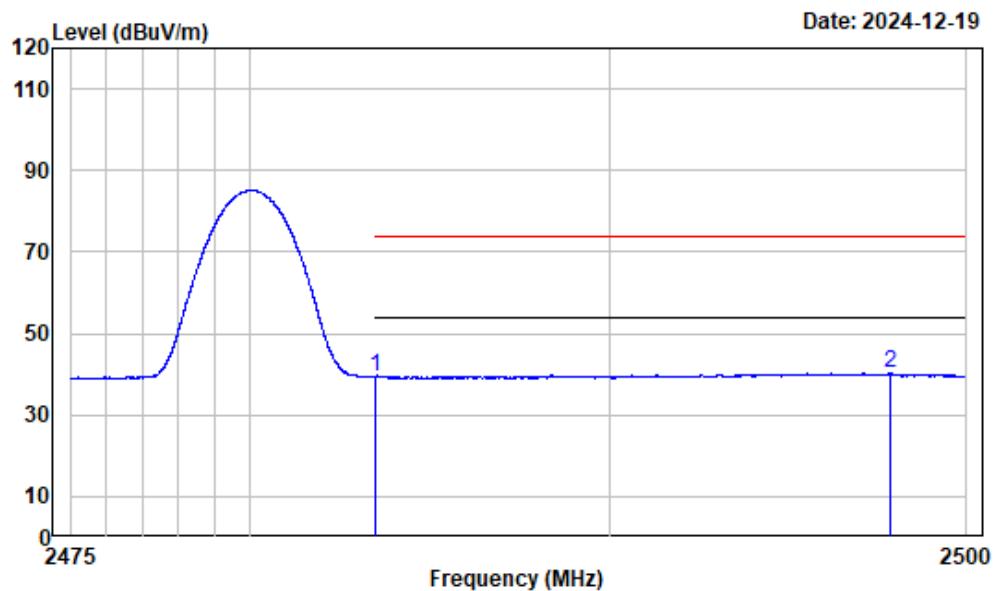
Right Band edge_Vertical_Peak



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2480

| | Freq | Read Factor | Level | Limit Level | Over Line | Limit | Remark |
|---|----------|-------------|-------|-------------|-----------|--------|--------|
| 1 | 2483.500 | -10.97 | 62.01 | 51.04 | 74.00 | -22.96 | Peak |
| 2 | 2483.695 | -10.97 | 65.20 | 54.23 | 74.00 | -19.77 | Peak |

Right Band edge_Vertical_Average

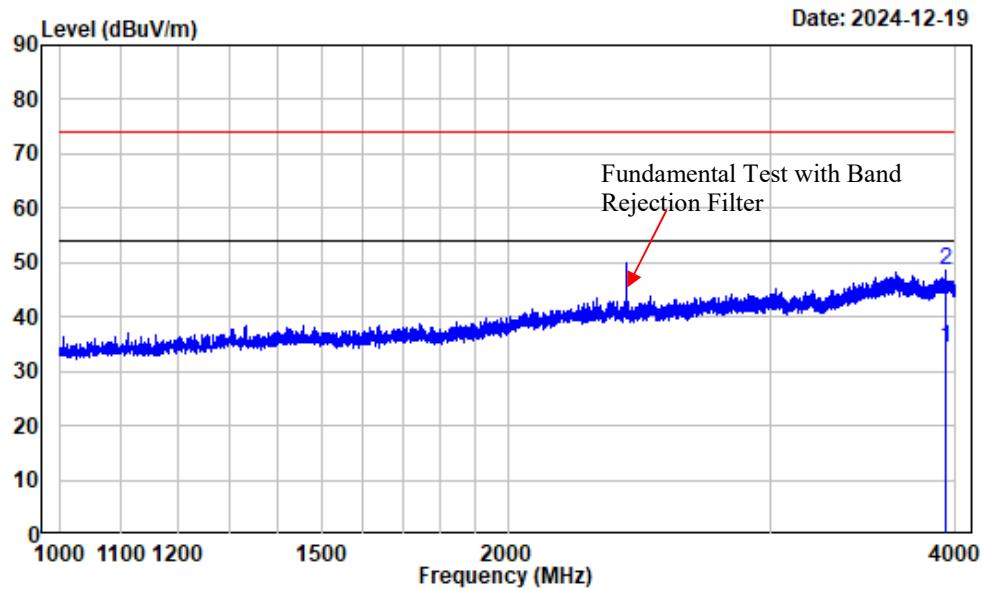


Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2480

| | Freq | Read Factor | Level | Limit Level | Line | Over Limit | Remark |
|---|----------|-------------|-------|-------------|-------|------------|---------|
| 1 | 2483.500 | -10.97 | 50.48 | 39.51 | 54.00 | -14.49 | Average |
| 2 | 2497.884 | -11.00 | 51.20 | 40.20 | 54.00 | -13.80 | Average |

Listed with the worst harmonic margin test plot

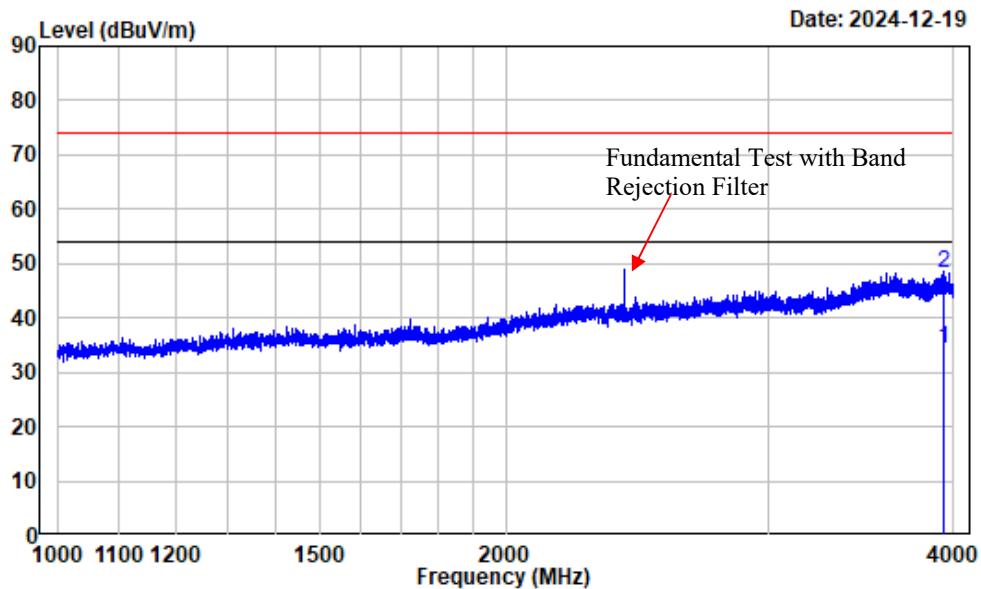
1-4GHz_Horizontal



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | Limit | Over | Remark |
|------|----------|-------|-------|-------|----------------------|
| | | Level | Level | Line | |
| 1 | 3942.618 | -9.40 | 43.87 | 34.47 | 54.00 -19.53 Average |
| 2 | 3942.618 | -9.40 | 57.83 | 48.43 | 74.00 -25.57 Peak |

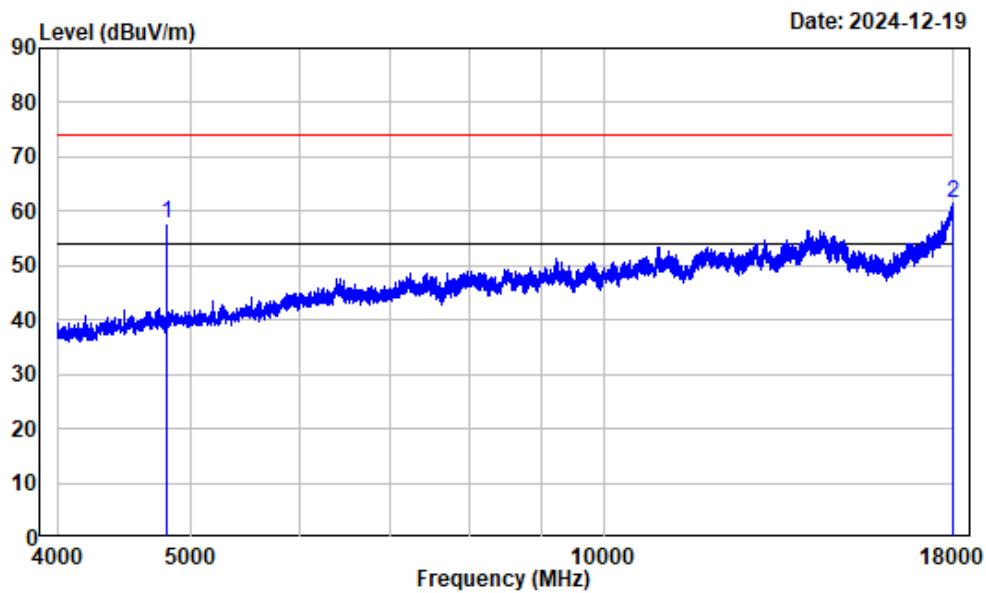
1-4GHz_Vertical



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|----------|-------|-------|-------|--------|--------|---------|
| | | MHz | dB/m | dBuV | dBuV/m | | |
| 1 | 3938.492 | -9.45 | 43.65 | 34.20 | 54.00 | -19.80 | Average |
| 2 | 3938.492 | -9.45 | 57.61 | 48.16 | 74.00 | -25.84 | Peak |

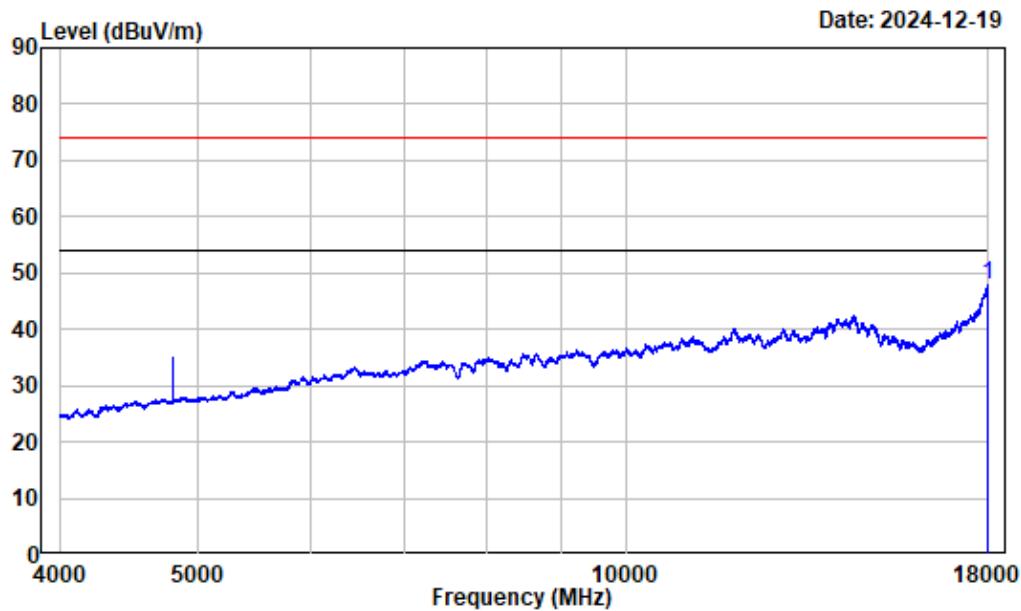
4-18GHz_Horizontal_Peak



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2402

| | Freq | Read Factor | Level | Limit Level | Over Line | Over Limit | Remark |
|---|-----------|-------------|-------|-------------|-----------|------------|--------|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 4804.000 | -7.79 | 65.55 | 57.76 | 74.00 | -16.24 | Peak |
| 2 | 17986.000 | 13.13 | 48.20 | 61.33 | 74.00 | -12.67 | Peak |

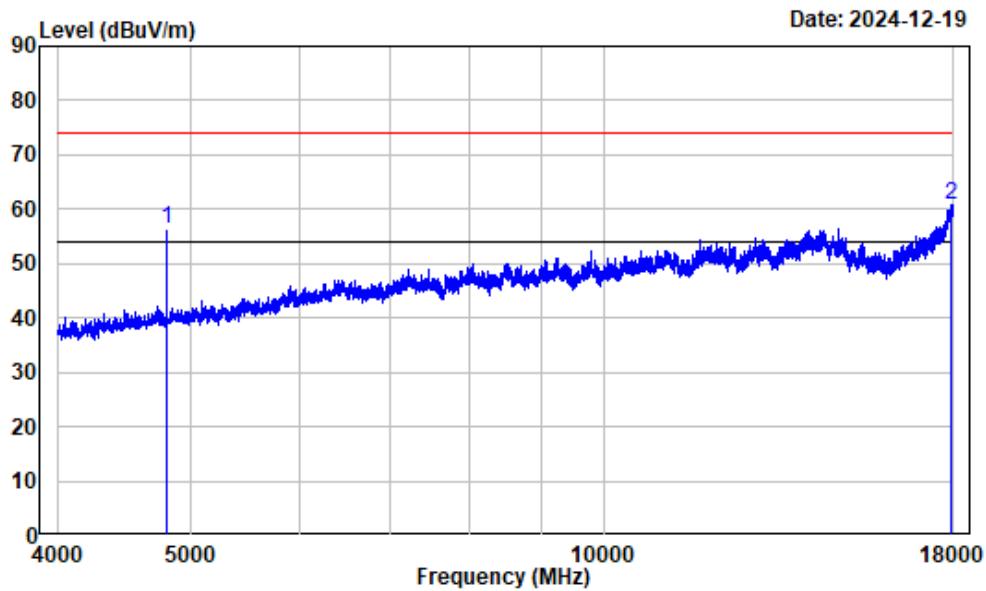
4-18GHz_Horizontal_Average



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|-----------|-------|-------|-------|--------|-------|---------|
| | | MHz | dB/m | dBuV | dBuV/m | | |
| 1 | 17988.460 | 13.13 | 34.59 | 47.72 | 54.00 | -6.28 | Average |

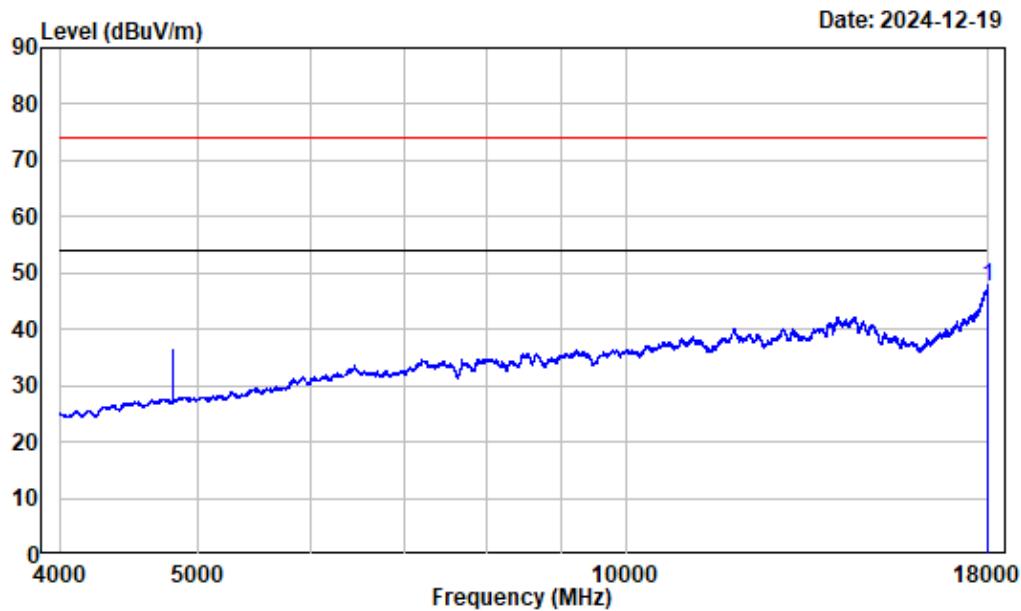
4-18GHz_Vertical_Peak



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
Note : BT-3DH5-2402

| | Freq | Read Factor | Level | Limit Level | Over Line | Limit | Remark |
|---|-----------|-------------|-------|-------------|-----------|--------|--------|
| | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 4804.000 | -7.79 | 64.02 | 56.23 | 74.00 | -17.77 | Peak |
| 2 | 17931.740 | 12.86 | 48.03 | 60.89 | 74.00 | -13.11 | Peak |

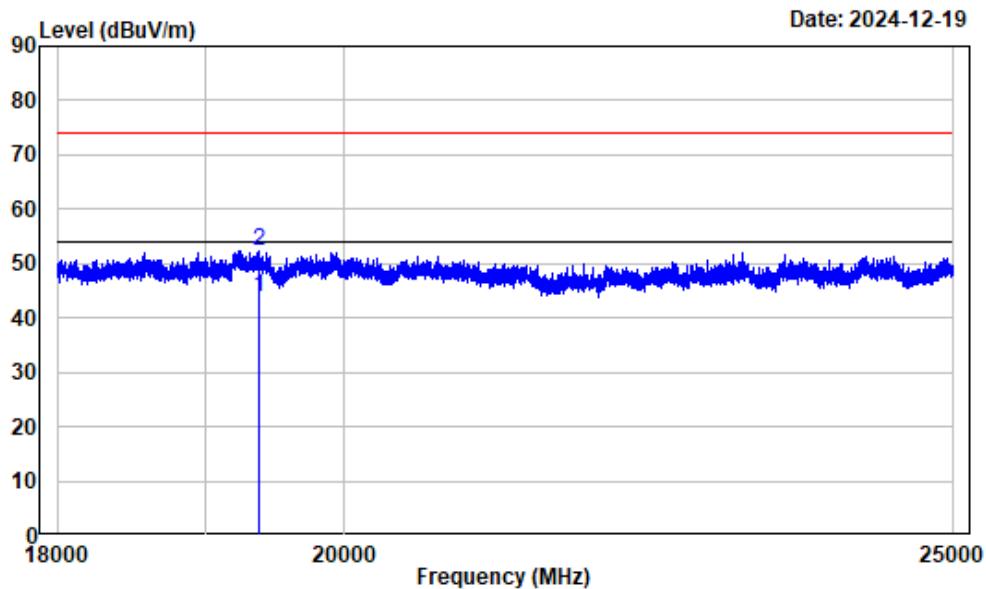
4-18GHz_Vertical_Average



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|-----------|-------|-------|-------|--------|-------|---------|
| | | MHz | dB/m | dBuV | dBuV/m | | |
| 1 | 17989.520 | 13.16 | 34.29 | 47.45 | 54.00 | -6.55 | Average |

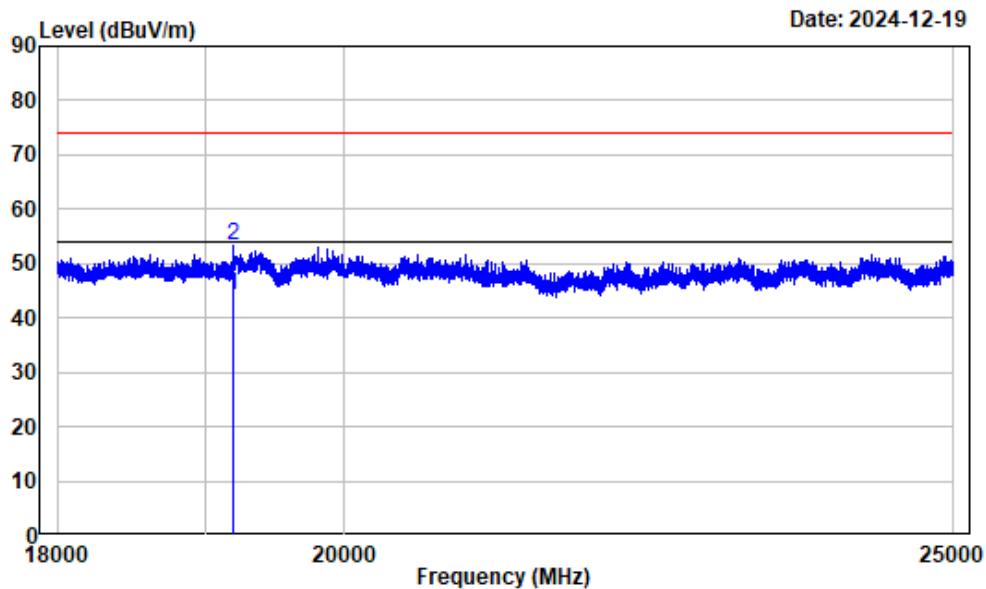
18-25GHz_Horizontal



Condition : Horizontal
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|-----------|-------|-------|------------------|---------------------|--------|---------|
| | | MHz | dB/m | dB _{UV} | dB _{UV} /m | | |
| 1 | 19380.920 | 15.11 | 28.58 | 43.69 | 54.00 | -10.31 | Average |
| 2 | 19380.920 | 15.11 | 37.26 | 52.37 | 74.00 | -21.63 | Peak |

18-25GHz_Vertical



Condition : Vertical
Project No. : 2401Z45125E-RF
Tester : Zenos Qiao
Spectrum setting: Peak reading:RBW:1MHz VBW:3MHz Detector:Peak
: Average reading:RBW:1MHz VBW:1kHz Detector:Peak
Note : BT-3DH5-2402

| Freq | Factor | Read | | Limit | | Over | Remark |
|------|-----------|-------|-------|-------|-------|--------|---------|
| | | Level | Level | Line | Line | | |
| 1 | 19200.650 | 15.32 | 28.77 | 44.09 | 54.00 | -9.91 | Average |
| 2 | 19200.650 | 15.32 | 37.98 | 53.30 | 74.00 | -20.70 | Peak |

20 dB Emission Bandwidth**Test Information:**

| | | | |
|--------------------|----------|---------------------|--------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/12 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | N/A |

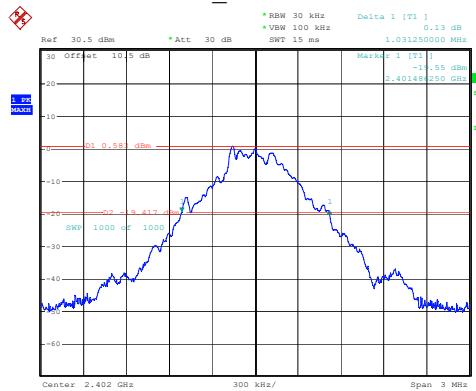
Environmental Conditions:

| | | | | | |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|
| Temperature: (°C): | 23.0 | Relative Humidity: (%) | 43 | ATM Pressure: (kPa) | 101.0 |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|

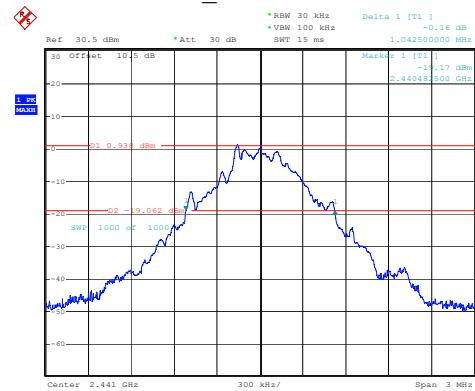
Test Data:

| Mode | Channel | Result (MHz) |
|-------------|----------------|---------------------|
| DH1 | Low Channel | 1.031 |
| | Middle Channel | 1.043 |
| | High Channel | 1.050 |
| 2DH1 | Low Channel | 1.309 |
| | Middle Channel | 1.313 |
| | High Channel | 1.297 |
| 3DH1 | Low Channel | 1.271 |
| | Middle Channel | 1.279 |
| | High Channel | 1.294 |

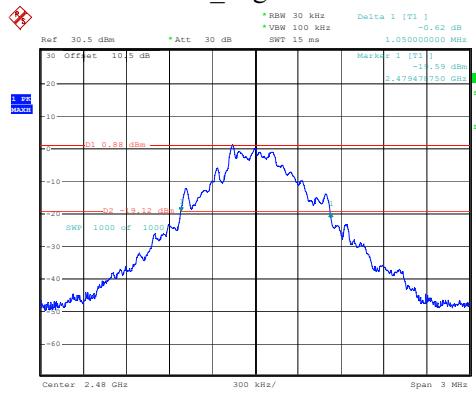
DH1_Low 1.031MHz



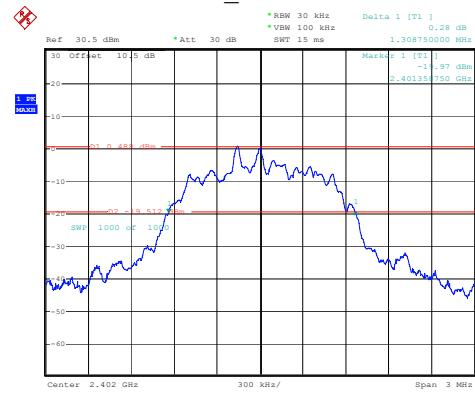
DH1_Middle 1.043MHz



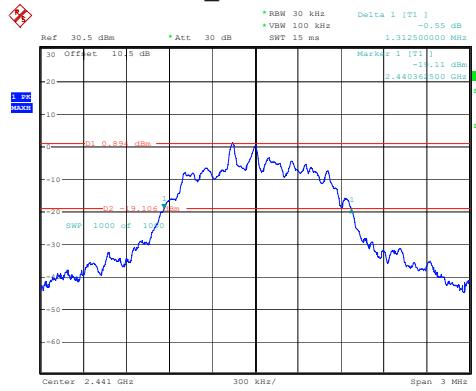
DH1_High 1.050MHz



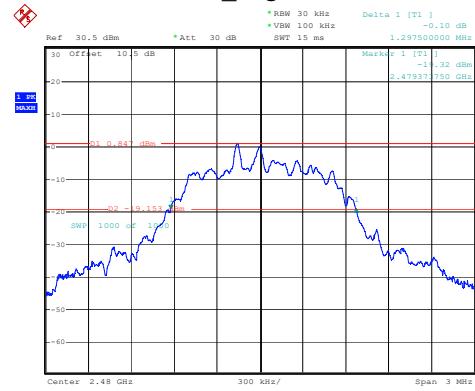
2DH1_Low 1.309MHz



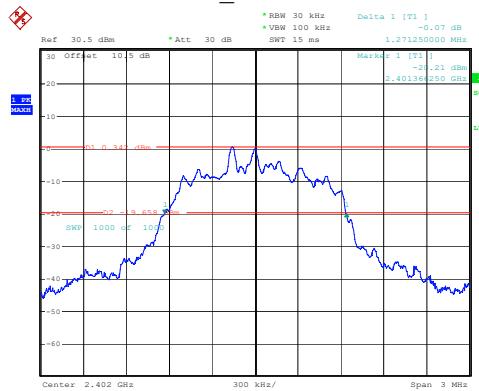
2DH1_Middle 1.313MHz



2DH1_High 1.297MHz



3DH1_Low 1.271MHz



Channel Separation

Test Information:

| | | | |
|-------------|----------|--------------|--------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/30 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | Pass |

Environmental Conditions:

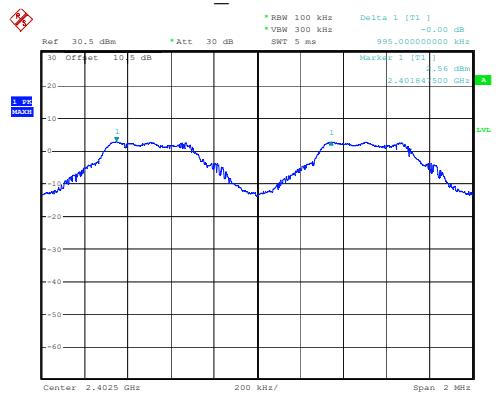
| | | | | | |
|--------------------|------|------------------------|----|---------------------|-------|
| Temperature: (°C): | 23.0 | Relative Humidity: (%) | 43 | ATM Pressure: (kPa) | 101.0 |
|--------------------|------|------------------------|----|---------------------|-------|

Test Data:

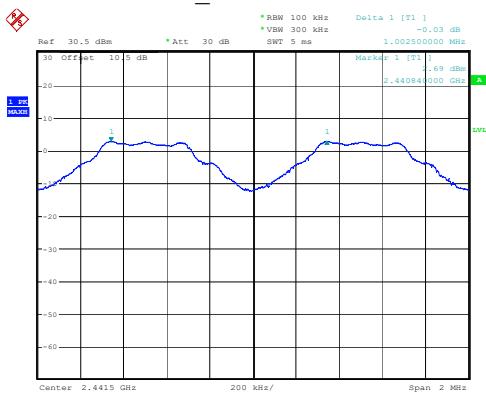
| Mode | Channel | Result (MHz) | Limit (MHz) | Verdict |
|---------|----------------|--------------|-------------|---------|
| Hop_DH1 | Low Channel | 0.995 | 0.875 | Pass |
| | Middle Channel | 1.003 | | Pass |
| | High Channel | 1.003 | | Pass |

Note: Only the BDR (DH1 GFSK) mode result is reported since EDR 2DH1 ($\pi/4$ -DQPSK) and EDR 3DH1 (8DPSK) modes have the exact same channel plan, and the limit is the maximum 20dB bandwidth *2/3

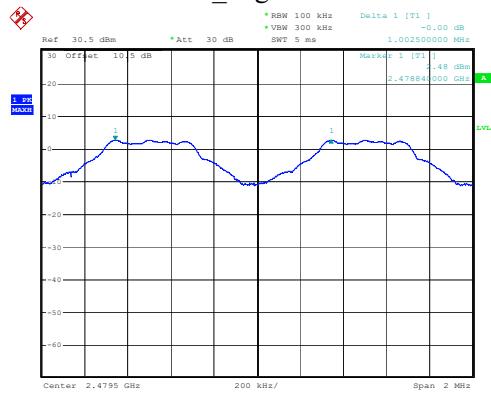
DH1_Low 0.995MHz



DH1_Middle 1.003MHz



DH1_High 1.003MHz



Number of Hopping Frequency**Test Information:**

| | | | |
|--------------------|----------|---------------------|--------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/12 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | Pass |

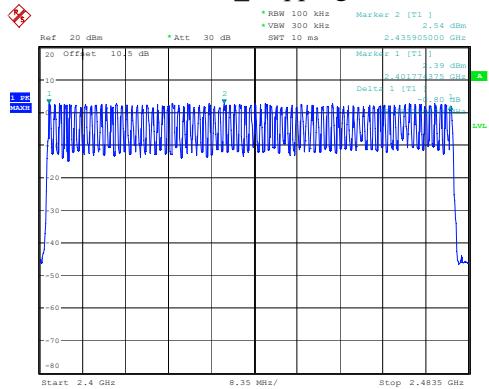
Environmental Conditions:

| | | | | | |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|
| Temperature: (°C): | 23.0 | Relative Humidity: (%) | 43 | ATM Pressure: (kPa) | 101.0 |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|

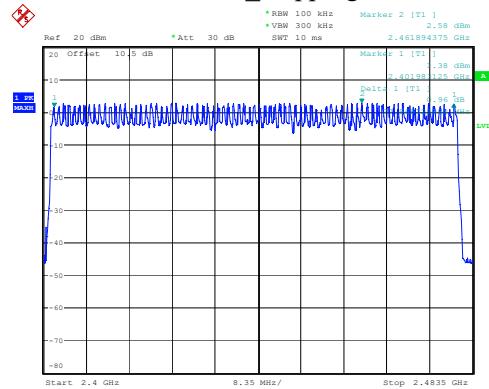
Test Data:

| 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



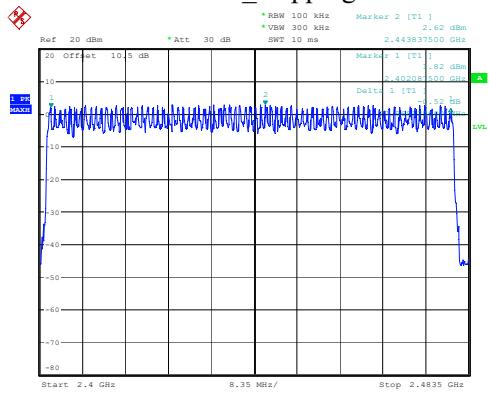
2DH1_Hopping 79



ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:28:07

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:31:53

3DH1_Hopping 79



ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:35:27

Maximum Conducted Output Power**Test Information:**

| | | | |
|--------------------|----------|---------------------|--------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/12 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | Pass |

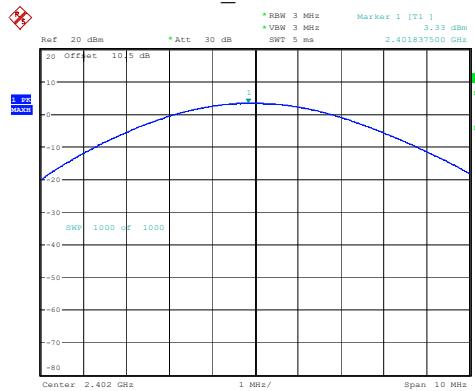
Environmental Conditions:

| | | | | | |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|
| Temperature: (°C): | 23.0 | Relative Humidity: (%) | 43 | ATM Pressure: (kPa) | 101.0 |
|------------------------------|------|----------------------------------|----|-------------------------------|-------|

Test Data:

| Mode | Channel | Result (dBm) | Limit (dBm) | Verdict |
|-------------|----------------|---------------------|--------------------|----------------|
| DH1 | Low Channel | 3.33 | 21.00 | Pass |
| | Middle Channel | 3.63 | 21.00 | Pass |
| | High Channel | 3.57 | 21.00 | Pass |
| 2DH1 | Low Channel | 3.80 | 21.00 | Pass |
| | Middle Channel | 4.05 | 21.00 | Pass |
| | High Channel | 3.98 | 21.00 | Pass |
| 3DH1 | Low Channel | 4.31 | 21.00 | Pass |
| | Middle Channel | 4.54 | 21.00 | Pass |
| | High Channel | 4.46 | 21.00 | Pass |

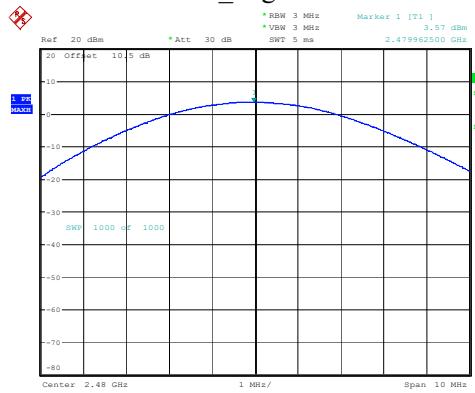
DH1_Low 3.33dBm



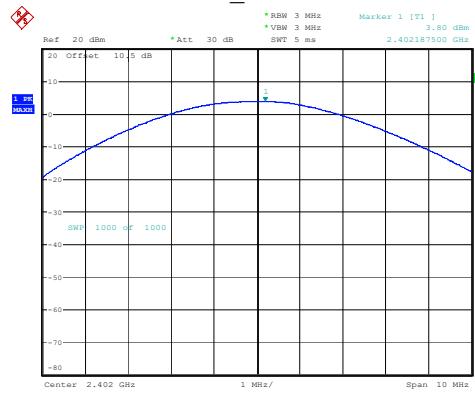
DH1_Middle 3.63dBm



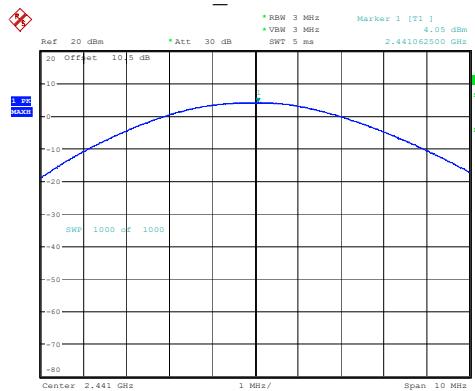
DH1_High 3.57dBm



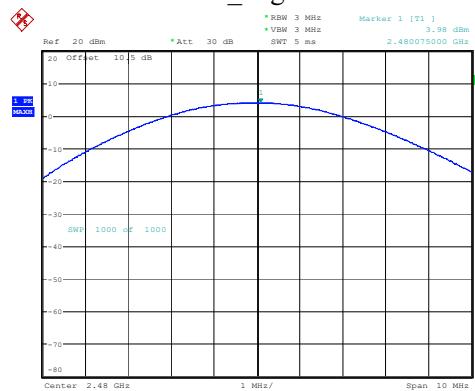
2DH1_Low 3.80dBm



2DH1_Middle 4.05dBm



2DH1_High 3.98dBm



3DH1_Low 4.31dBm



3DH1_Middle 4.54dBm



ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 11:41:38

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 11:42:19

3DH1_High 4.46dBm



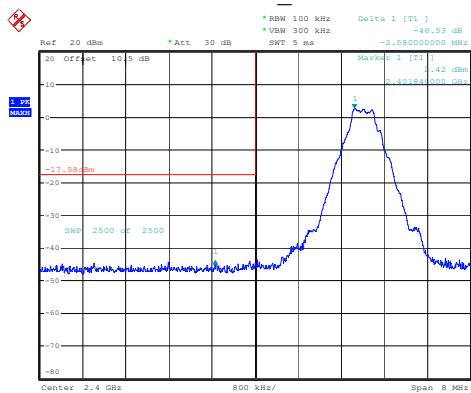
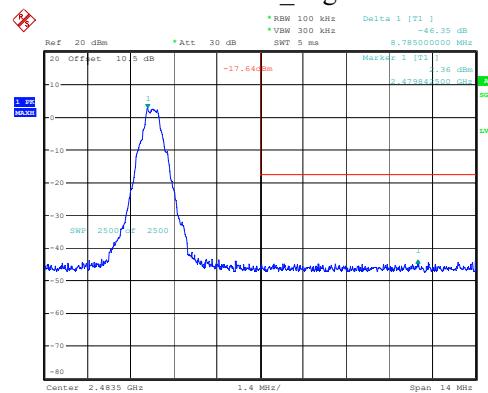
ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 11:42:51

100 kHz Bandwidth of Frequency Band Edge**Test Information:**

| | | | |
|--------------------|----------|---------------------|-----------------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/12~2024/12/30 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | Pass |

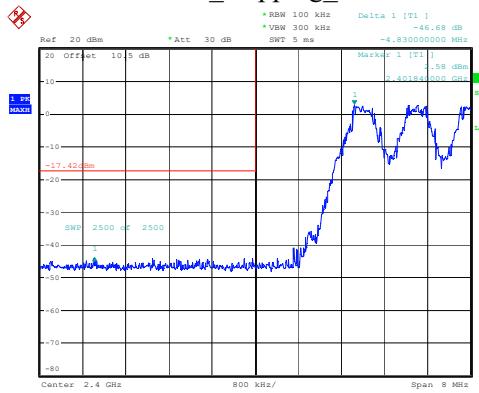
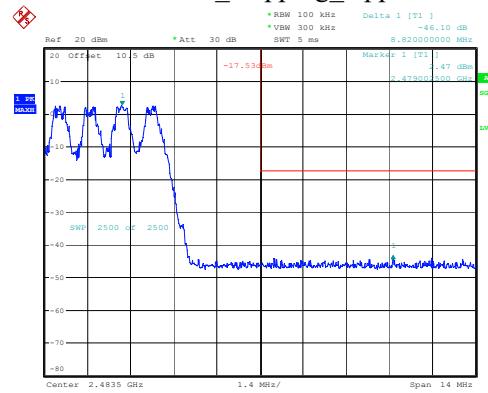
Environmental Conditions:

| | | | | | |
|------------------------------|-------|----------------------------------|-------|-------------------------------|-----|
| Temperature: (°C): | 23-26 | Relative Humidity: (%) | 43-47 | ATM Pressure: (kPa) | 101 |
|------------------------------|-------|----------------------------------|-------|-------------------------------|-----|

Test Data:**DH1_Low****DH1_High**

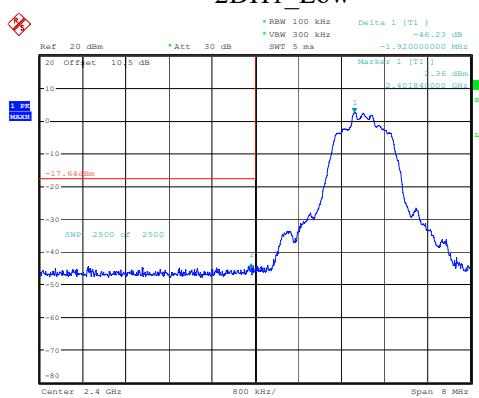
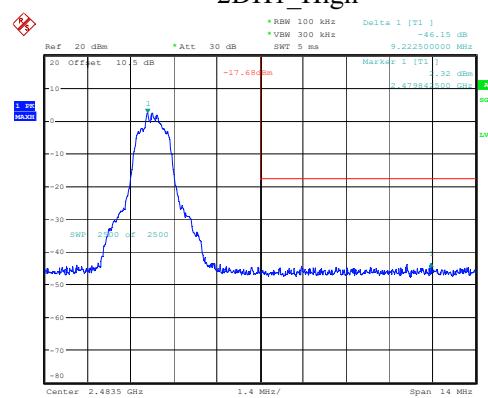
ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 11:51:03

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 11:57:36

DH1_Hopping_Lower**DH1_Hopping_Upper**

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 30.DEC.2024 11:59:42

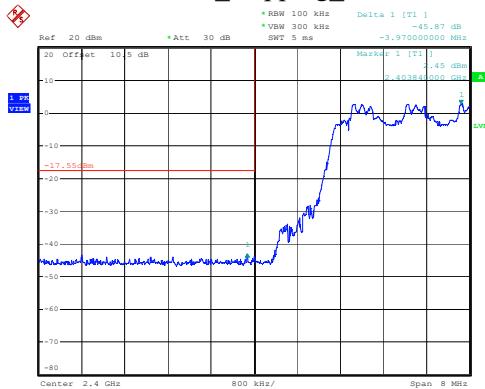
ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 30.DEC.2024 12:01:29

2DH1_Low**2DH1_High**

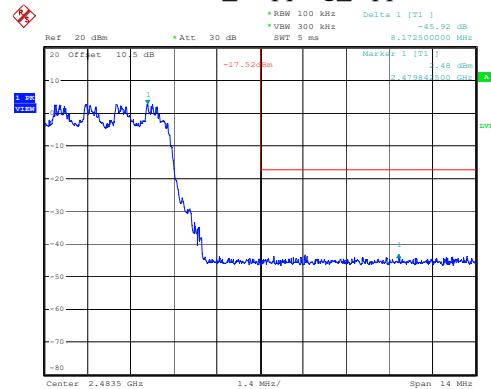
ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:01:10

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:10:20

2DH1_Hopping_Lower

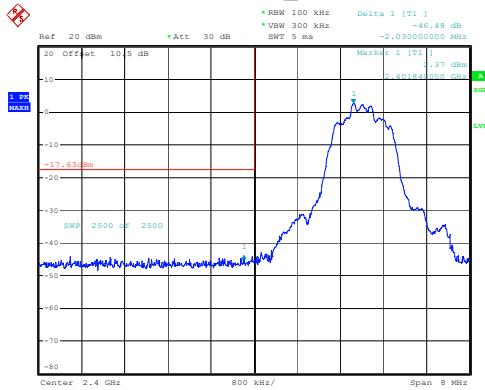


2DH1_Hopping_Upper

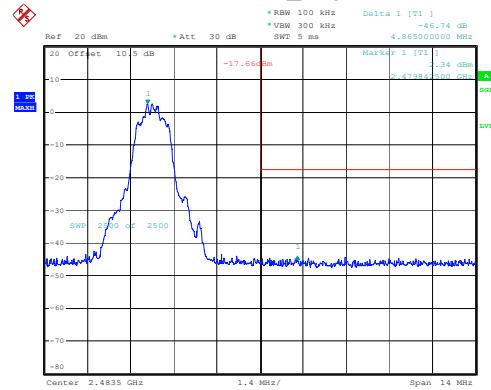


ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 30.DEC.2024 12:22:04

3DH1_Low

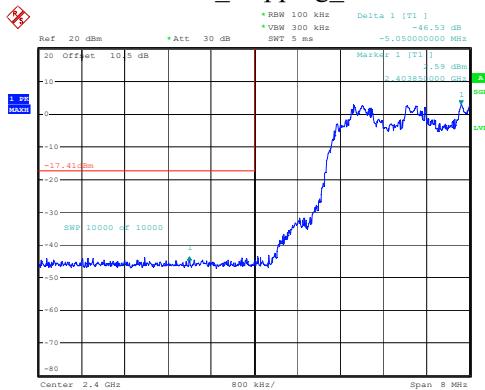


3DH1_High

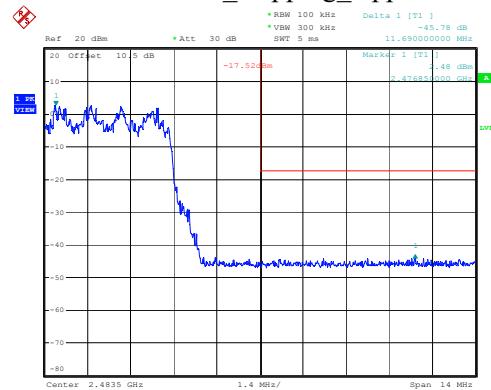


ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 12.DEC.2024 12:14:05

3DH1_Hopping_Lower



3DH1_Hopping_Upper



ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 30.DEC.2024 12:48:02

ProjectNo.:2401Z45125E-RF Tester:Brian Li
Date: 30.DEC.2024 12:53:09

Time of Occupancy (dwell time)**Test Information:**

| | | | |
|--------------------|----------|---------------------|-----------------------|
| Sample No.: | 2V8R-1 | Test Date: | 2024/12/12~2024/12/30 |
| Test Site: | RF | Test Mode: | Transmitting |
| Tester: | Brian Li | Test Result: | Pass |

Environmental Conditions:

| | | | | | |
|---------------------------|-------|-------------------------------|-------|----------------------------|-------|
| Temperature: (°C): | 23-26 | Relative Humidity: (%) | 43-47 | ATM Pressure: (kPa) | 101.0 |
|---------------------------|-------|-------------------------------|-------|----------------------------|-------|

Test Data:

| Mode | Channel | Pulse width (ms) | Dwell time (s) | Limit (s) | Verdict |
|-------------|-----------------|-------------------------|-----------------------|------------------|----------------|
| DH1 | Hopping Channel | 0.385 | 0.123 | 0.400 | Pass |
| DH3 | Hopping Channel | 1.654 | 0.265 | 0.400 | Pass |
| DH5 | Hopping Channel | 2.919 | 0.311 | 0.400 | Pass |
| 2DH1 | Hopping Channel | 0.395 | 0.126 | 0.400 | Pass |
| 2DH3 | Hopping Channel | 1.658 | 0.265 | 0.400 | Pass |
| 2DH5 | Hopping Channel | 2.925 | 0.312 | 0.400 | Pass |
| 3DH1 | Hopping Channel | 0.395 | 0.126 | 0.400 | Pass |
| 3DH3 | Hopping Channel | 1.658 | 0.265 | 0.400 | Pass |
| 3DH5 | Hopping Channel | 2.925 | 0.312 | 0.400 | Pass |

Note:

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

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

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

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

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

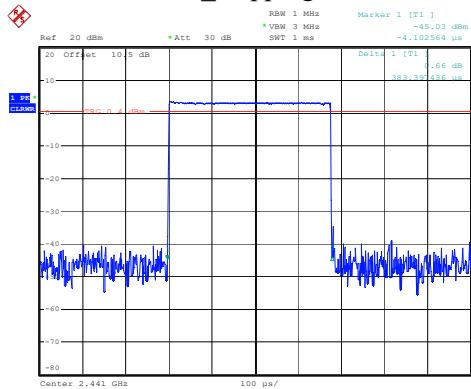
2DH5: Dwell time=Pulse width (ms) × (1600/6/79) ×31.6 s

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

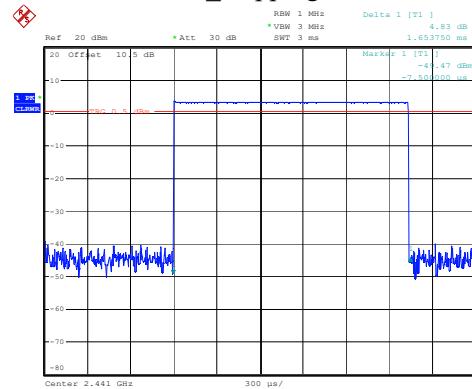
3DH3: Dwell time=Pulse width (ms) × (1600/4/79) ×31.6 s

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

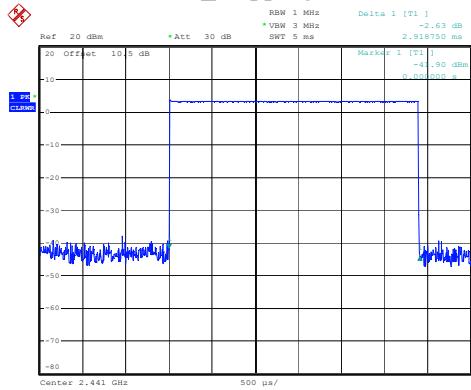
DH1_Hopping 0.385ms



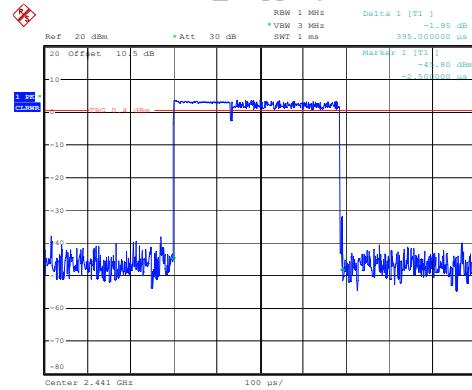
DH3_Hopping 1.654ms



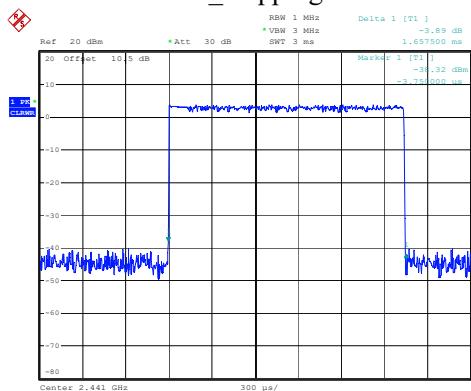
DH5_Hopping 2.919ms



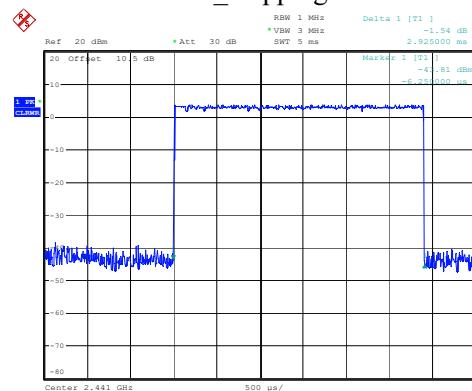
2DH1_Hopping 0.395ms



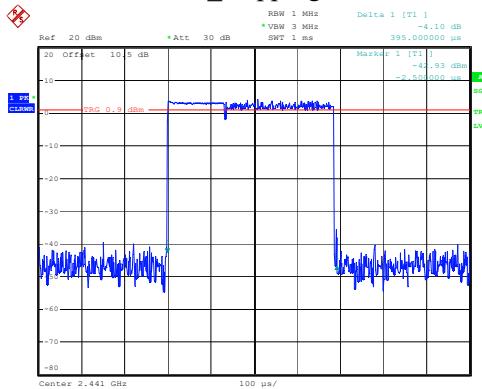
2DH3_Hopping 1.658ms



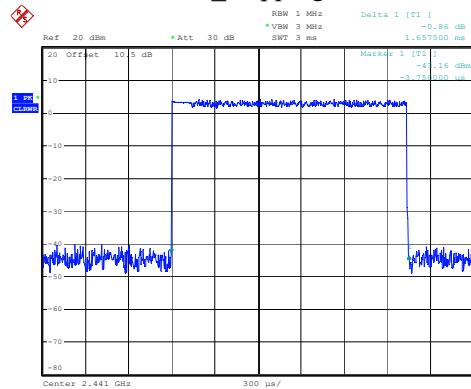
2DH5_Hopping 2.925ms



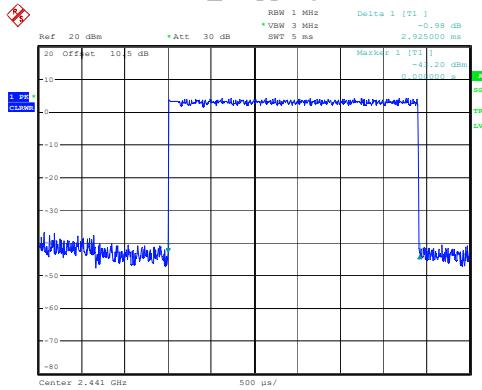
3DH1_Hopping 0.395ms



3DH3_Hopping 1.658ms



3DH5_Hopping 2.925ms



RF EXPOSURE EVALUATION

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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 V01

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 (W) |
|-----------|-----------------|--|---------------------------|-------|-------|-------|-------------------------|---------------|
| | | | (dBi) | (dBd) | (dBm) | (W) | | |
| Bluetooth | 2402-2480 | 5 | -0.58 | -2.73 | 2.27 | 0.002 | 0.2 | 0.768 |

Note: The tune up conducted power[#] and antenna gain[#] were declared by the applicant.

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

Result: Compliant

EUT PHOTOGRAPHS

Please refer to the attachment 2401Z45125E-RF External photo and 2401Z45125E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401Z45125E-RF-00A Test Setup photo.

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