# TEST REPORT

| | |
|---|---|
| **Application No.:** | GZCR2110021203AT |
| **Applicant:** | KanDao Technology Co., Ltd. |
| **Address of Applicant:** | 201 Sino-Steel building, Maqueling Industrial District, Maling Area, Yuehai Street, Nanshan, Shenzhen, China |
| **Manufacturer:** | KanDao Technology Co., Ltd. |
| **Address of Manufacturer:** | 201 Sino-Steel building, Maqueling Industrial District, Maling Area, Yuehai Street, Nanshan, Shenzhen, China |
| **Factory:** | SKY LIGHT ELECTRONIC (SHENZHEN) LIMITED |
| **Address of Factory:** | 1F-2F OF NO.9, 1F-5F OF NO.8, ANTUOSHAN HIGH-TECH. INDUSTRIAL PARK, SHAER COMMUNITY, SHAJING STREET, BAO'AN DISTRICT, SHENZHEN CITY, GUANGDONG PROVINCE, CHINA |
| **Equipment Under Test (EUT):** | |
| **EUT Name:** | Kandao Obsidian Pro |
| **Model No.:** | OSP0415 |
| **Trade Mark:** | KanDao |
| **Standard(s) :** | 47 CFR Part 15, Subpart C 15.247 |
| **Date of Receipt:** | 2021-10-18 |
| **Date of Test:** | 2021-10-18 to 2021-10-28 |
| **Date of Issue:** | 2021-10-29 |
| **Test Result:** | **Pass*** |

* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian
EMC Laboratory Manager

通标标准技术服务有限公司广州分公司
检验检测专用章
Inspection & Testing Services
SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Testing Center EEC Laboratory.

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| Revision Record | | | | |
|---|---|---|---|---|
| **Version** | **Chapter** | **Date** | **Modifier** | **Remark** |
| *01* | | *2021-10-29* | | *Original* |
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| | | | | |
|---|---|---|---|---|
| **Authorized for issue by** | | | | |
| | | **Curry Wu/Project Engineer** | | |
| | | **Ricky Liu/Reviewer** | | |

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# 2 Test Summary

| Radio Spectrum Technical Requirement | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Antenna Requirement | 47 CFR Part 15, Subpart C 15.247 | N/A | 47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4) | Pass |

| Radio Spectrum Matter Part | | | | |
|---|---|---|---|---|
| **Item** | **Standard** | **Method** | **Requirement** | **Result** |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | Pass |
| Conducted Peak Output Power | | ANSI C63.10 (2013) Section 11.9.1.3 | 47 CFR Part 15, Subpart C 15.247(b)(3) | Pass |
| Minimum 6dB Bandwidth | | ANSI C63.10 (2013) Section 11.8.1 | 47 CFR Part 15, Subpart C 15.247a(2) | Pass |
| Power Spectrum Density | | ANSI C63.10 (2013) Section 11.10.2 | 47 CFR Part 15, Subpart C 15.247(e) | Pass |
| Conducted Band Edges Measurement | | ANSI C63.10 (2013) Section 11.13.3.2 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Conducted Spurious Emissions | | ANSI C63.10 (2013) Section 11.11 | 47 CFR Part 15, Subpart C 15.247(d) | Pass |
| Radiated Emissions which fall in the restricted bands | | ANSI C63.10 (2013) Section 6.10.5 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions (Below 1GHz) | | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |
| Radiated Spurious Emissions (Above 1GHz) | | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.209 | Pass |

**Note:**

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

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# 4 General Information

## 4.1 Details of E.U.T.

| | |
|---|---|
| Power supply: | DC 20V powered by an adapter.<br>Adapter Model: GST220A20<br>Input: AC 100-240V, 50/60Hz, 4.0A<br>Output: DC 20V 11A. |
| Operation Frequency: | 2402MHz to 2480MHz |
| Bluetooth Version: | V5.0 |
| Modulation Type: | GFSK |
| Number of Channels: | 40 |
| Date Rate: | 1Mbps |
| Channel Spacing: | 2MHz |
| Antenna Type: | Dipole Antenna |
| Antenna Gain: | 5.0dBi |

## 4.2 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|---|---|---|---|
| -- | -- | -- | -- |
| The EUT has been tested as an independent unit. | | | |

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## 4.3 Measurement Uncertainty

| Test Item | Measurement Uncertainty |
|---|---|
| Conducted Emissions at AC Power Line (150kHz-30MHz) | ±3.12dB |
| Conducted Peak Output Power | ± 0.75dB |
| Minimum 6dB Bandwidth | ± 3% |
| Power Spectrum Density | ± 2.84dB |
| Conducted Band Edges Measurement | ± 0.75dB |
| Conducted Spurious Emissions | ± 0.75dB |
| Radiated Emissions which fall in the restricted bands | ±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz) |
| Radiated Spurious Emissions (Below 1GHz) | ±5.06dB (3m); ±4.46dB (10m) |
| Radiated Spurious Emissions (Above 1GHz) | ±5.08dB (1GHz-6GHz);±5.14dB(above 6GHz) |

Remark:

The $U_{lab}$ (lab Uncertainty) is less than $U_{cispr}$ (CISPR Uncertainty), so the test results

– compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

– non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

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## 4.4 Test Location

All tests were performed at:

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Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

## 4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

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## 4.6 Deviation from Standards

None

## 4.7 Abnormalities from Standard Conditions

None

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# 5 Equipment List

| Conducted Emissions at AC Power Line (150kHz-30MHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Shielding Room | ChangZhou ZhongYu | 8m x 3m x 3.8m | EMC0306 | N/A | N/A |
| Two-Line V-Network | Rohde & Schwarz | ENV216 | EMC0118 | 2021-01-08 | 2022-01-06 |
| Two-Line V-Network-GZ | Rohde & Schwarz | ENV216 | EMC2135 | 2021-09-24 | 2022-09-23 |
| Coaxial Cable | HangTianXing | 2m | EMC0107 | 2020-09-09 | 2022-09-08 |
| Test Software E3c | Audix | Ver. 5.4.1221b | GZE100-62 | N/A | N/A |
| EMI Test Receiver(9kHz-3.6GHz) | Rohde & Schwarz | ESR4 | EMC2221 | 2021-06-01 | 2022-05-31 |

| Conducted Peak Output Power | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Power Meter (U2021XA_Ch2) | Agilent Technologies | U2021XA_Ch2 | SEM009-02 | 2021-05-19 | 2022-05-18 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |
| Test Software | TST | V2.0 | GZE100-78 | N/A | N/A |

| Minimum 6dB Bandwidth | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer(10Hz-44GHz) | Agilent Technologies | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |
| Test Software | TST | V2.0 | GZE100-78 | N/A | N/A |

| Power Spectrum Density | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer(10Hz-44GHz) | Agilent Technologies | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |
| Test Software | TST | V2.0 | GZE100-78 | N/A | N/A |

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| Conducted Band Edges Measurement | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer(10Hz-44GHz) | Agilent Technologies | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |
| Test Software | TST | V2.0 | GZE100-78 | N/A | N/A |

| Conducted Spurious Emissions | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EXA Signal Analzer(10Hz-44GHz) | Agilent Technologies | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| 6dB Attenuator | HP | 8491A | EMC2062 | 2020-04-15 | 2022-04-14 |
| MI CABLE | SGS-EMC | 0.8M | EMC2136 | 2019-11-02 | 2021-11-01 |
| Test Software | TST | V2.0 | GZE100-78 | N/A | N/A |

| Radiated Emissions which fall in the restricted bands | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EMI Test Receiver(20Hz-26.5GHz) | Rohde & Schwarz | ESIB26 | EMC0522 | 2021-01-08 | 2022-01-07 |
| Chamber cable(Above 1GHz) | Scoflex | KMKM-8.0m | EMC0545 | 2020-09-09 | 2022-09-08 |
| Horn Antenna(1GHz-18GHz) | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120D | EMC2026 | 2019-09-25 | 2022-09-24 |
| 1GHz-26.5 GHz Pre-Amplifier | Agilent | 8449B | EMC0521 | 2021-01-08 | 2022-01-07 |
| 2.4GHz Filter | Micro-Tronics | BRM 50702 | EMC2069 | 2021-01-08 | 2022-01-07 |
| 966 Anechoic Chamber | C.R.T | 9m x 6m x 6m | EMC2142 | 2020-12-20 | 2023-12-19 |
| MXE EMI Receiver(10Hz-8.4GHz) | Keysight | N9038A | EMC2139 | 2020-11-13 | 2021-11-12 |
| EXA Signal Analyzer(10Hz-44GHz) | Keysight | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| Test Software E3 | Audix | Ver.6.120110a | GZE100-61 | N/A | N/A |
| Notch Filter (5150-5880) | Mico-Tronics | BRM50716 | EMC2168 | 2021-07-29 | 2022-07-28 |
| Horn Antenna(14-40GHz) | SCHWARZBECK | BBHA 9170 | EMC2041 | 2020-06-28 | 2023-06-27 |
| Microwave Broadband Preamplifier (18-40GHz) | SCHWARZBECK | BBV 9721 | EMC2172 | 2021-09-08 | 2022-09-07 |

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| Radiated Spurious Emissions (Below 1GHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| Chamber cable | HangTianXing | N/A | EMC0542 | 2020-09-09 | 2022-09-08 |
| Trilog Broadband Antenna(25MHz-1GHz)-Lab | SCHWARZBECK MESS-ELEKTRONIK | VULB 9168 | SEM003-18 | 2019-02-22 | 2022-02-22 |
| Amplifier(9kHz-1.3GHz) | HP | 8447F | EMC2065 | 2021-05-19 | 2022-05-18 |
| Active Loop Antenna-RED | ETS-Lindgren | 6502 | EMC2190 | 2019-12-27 | 2021-12-26 |
| 10m Semi-Anechoic Chamber | ETS | N/A | EMC0530 | 2019-10-20 | 2022-10-19 |
| Test Software E3 | Audix | Ver.6.120110a | GZE100-61 | N/A | N/A |
| EMI Test Receiver(1Hz-8GHz) | Rohde & Schwarz | ESW8 | EMC2220 | 2021-05-26 | 2022-05-25 |

| Radiated Spurious Emissions (Above 1GHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EMI Test Receiver(20Hz-26.5GHz) | Rohde & Schwarz | ESIB26 | EMC0522 | 2021-01-08 | 2022-01-07 |
| Chamber cable(Above 1GHz) | Scoflex | KMKM-8.0m | EMC0545 | 2020-09-09 | 2022-09-08 |
| Horn Antenna(1GHz-18GHz) | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120D | EMC2026 | 2019-09-25 | 2022-09-24 |
| 1GHz-26.5 GHz Pre-Amplifier | Agilent | 8449B | EMC0521 | 2021-01-08 | 2022-01-07 |
| 2.4GHz Filter | Micro-Tronics | BRM 50702 | EMC2069 | 2021-01-08 | 2022-01-07 |
| 966 Anechoic Chamber | C.R.T | 9m x 6m x 6m | EMC2142 | 2020-12-20 | 2023-12-19 |
| MXE EMI Receiver(10Hz-8.4GHz) | Keysight | N9038A | EMC2139 | 2020-11-13 | 2021-11-12 |
| EXA Signal Analyzer(10Hz-44GHz) | Keysight | N9010A | EMC2138 | 2021-09-16 | 2022-09-15 |
| Test Software E3 | Audix | Ver.6.120110a | GZE100-61 | N/A | N/A |
| Notch Filter (5150-5880) | Mico-Tronics | BRM50716 | EMC2168 | 2021-07-29 | 2022-07-28 |
| Horn Antenna(14-40GHz) | SCHWARZBECK | BBHA 9170 | EMC2041 | 2020-06-28 | 2023-06-27 |
| Microwave Broadband Preamplifier (18-40GHz) | SCHWARZBECK | BBV 9721 | EMC2172 | 2021-09-08 | 2022-09-07 |

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| General used equipment | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| DMM | Fluke | 73 | EMC0006 | 2021-07-05 | 2022-07-05 |
| DMM | Fluke | 73 | EMC0007 | 2021-07-05 | 2022-07-05 |

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# 6 Radio Spectrum Technical Requirement

## 6.1 Antenna Requirement

### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

### 6.1.2 Conclusion

15.203 Requirement:

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of 15.211, 15.213, 15.217, 15.219, 15.221, or 15.236. 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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna port is integrated on the main PCB and it Connect to the RP-SMA connector through the RF cable, the EUT use a Non-standard connector dipole antenna, it can be replaced by user, and the user should use the antenna provided by the manufacturer.

The best case gain of the antenna is 5.0dBi.

Antenna location: Refer to external photo.

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# 7 Radio Spectrum Matter Test Results

## 7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10 (2013) Section 6.2
Limit:

| Frequency of emission(MHz) | Conducted limit(dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| *Decreases with the logarithm of the frequency. | | |
| Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz | | |

### 7.1.1 E.U.T. Operation

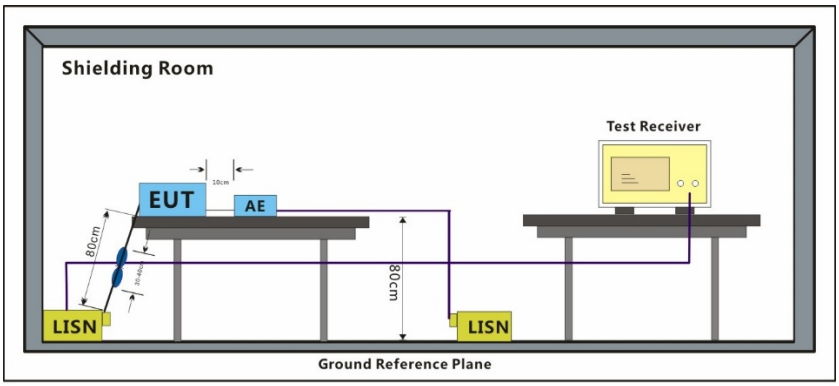
Operating Environment:

Temperature: 22.5 °C Humidity: 53.4 % RH Atmospheric Pressure: 1003 mbar

### 7.1.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.1.3 Test Setup Diagram

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### 7.1.4 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

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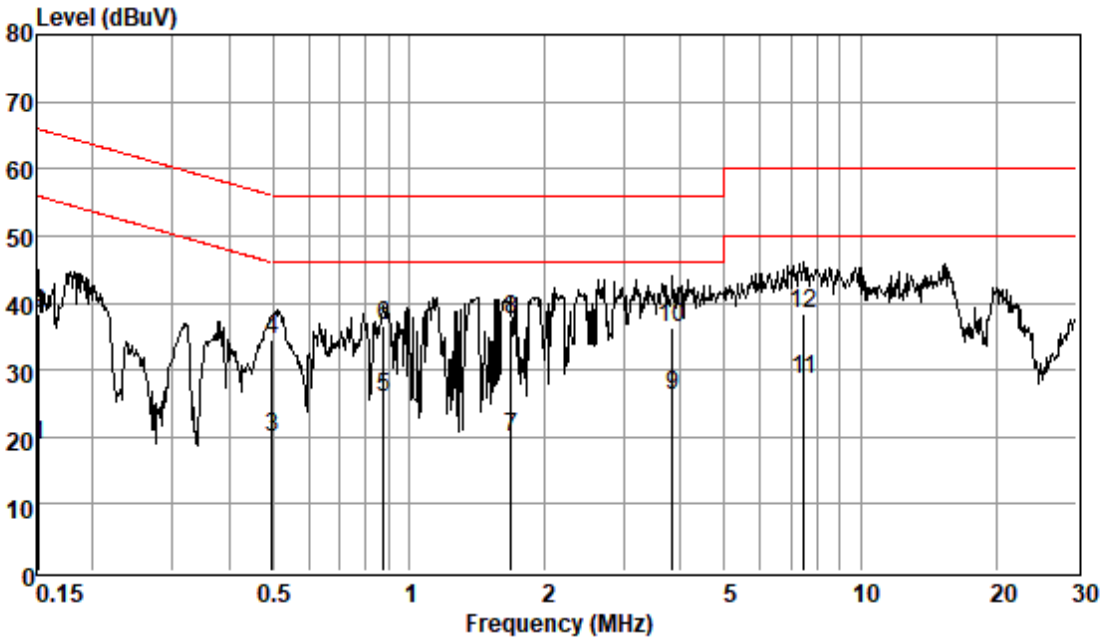
Test Mode: 02; Polarity: Neutral; Modulation:GFSK; ; Channel:Low




Pol :NEUTRAL
Mode :
Model :

| Frequenc MHz | Read Level dBuV | Cable Loss dB | LISN Factor dB | Measured Level dBuV | Limit Line dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.15 | 9.15 | 0.06 | 9.55 | 18.76 | 55.91 | -37.15 | Average |
| 0.15 | 28.88 | 0.06 | 9.55 | 38.49 | 65.91 | -27.42 | QP |
| 0.50 | 10.18 | 0.07 | 9.55 | 19.80 | 46.01 | -26.21 | Average |
| 0.50 | 24.85 | 0.07 | 9.55 | 34.47 | 56.01 | -21.54 | QP |
| 0.88 | 16.28 | 0.07 | 9.55 | 25.90 | 46.00 | -20.10 | Average |
| 0.88 | 27.06 | 0.07 | 9.55 | 36.68 | 56.00 | -19.32 | QP |
| 1.68 | 10.24 | 0.11 | 9.55 | 19.90 | 46.00 | -26.10 | Average |
| 1.68 | 27.90 | 0.11 | 9.55 | 37.56 | 56.00 | -18.44 | QP |
| 3.84 | 16.44 | 0.16 | 9.56 | 26.16 | 46.00 | -19.84 | Average |
| 3.84 | 26.61 | 0.16 | 9.56 | 36.33 | 56.00 | -19.67 | QP |
| 7.49 | 18.77 | 0.21 | 9.58 | 28.56 | 50.00 | -21.44 | Average |
| 7.49 | 28.60 | 0.21 | 9.58 | 38.39 | 60.00 | -21.61 | QP |

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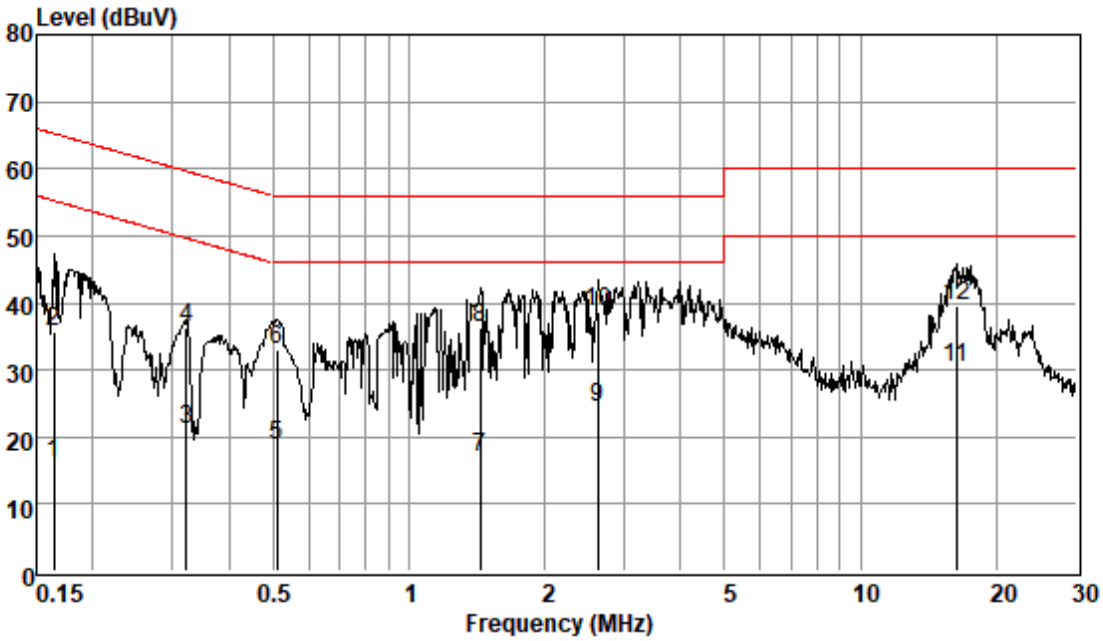
Test Mode: 02; Polarity: Line; Modulation:GFSK; ; Channel:Low




Pol :LINE
Mode :
Model :

| Frequenc MHz | Read Level dBuV | Cable Loss dB | LISN Factor dB | Measured Level dBuV | Limit Line dBuV | Over Limit dB | Remark |
|---|---|---|---|---|---|---|---|
| 0.16 | 6.43 | 0.06 | 9.62 | 16.11 | 55.25 | -39.14 | Average |
| 0.16 | 26.10 | 0.06 | 9.62 | 35.78 | 65.25 | -29.47 | QP |
| 0.32 | 11.33 | 0.06 | 9.62 | 21.01 | 49.66 | -28.65 | Average |
| 0.32 | 26.64 | 0.06 | 9.62 | 36.32 | 59.66 | -23.34 | QP |
| 0.51 | 9.03 | 0.07 | 9.63 | 18.73 | 46.00 | -27.27 | Average |
| 0.51 | 23.17 | 0.07 | 9.63 | 32.87 | 56.00 | -23.13 | QP |
| 1.44 | 7.26 | 0.10 | 9.61 | 16.97 | 46.00 | -29.03 | Average |
| 1.44 | 26.68 | 0.10 | 9.61 | 36.39 | 56.00 | -19.61 | QP |
| 2.62 | 14.66 | 0.14 | 9.62 | 24.42 | 46.00 | -21.58 | Average |
| 2.62 | 28.77 | 0.14 | 9.62 | 38.53 | 56.00 | -17.47 | QP |
| 16.31 | 20.37 | 0.32 | 9.75 | 30.44 | 50.00 | -19.56 | Average |
| 16.31 | 29.49 | 0.32 | 9.75 | 39.56 | 60.00 | -20.44 | QP |

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## 7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)
Test Method: ANSI C63.10 (2013) Section 11.9.1.3
Limit:

| Frequency range(MHz) | Output power of the intentional radiator(watt) |
|---|---|
| 902-928 | 1 for ≥50 hopping channels |
| | 0.25 for 25≤ hopping channels <50 |
| | 1 for digital modulation |
| 2400-2483.5 | 1 for ≥75 non-overlapping hopping channels |
| | 0.125 for all other frequency hopping systems |
| | 1 for digital modulation |
| 5725-5850 | 1 for frequency hopping systems and digital modulation |

### 7.2.1 E.U.T. Operation

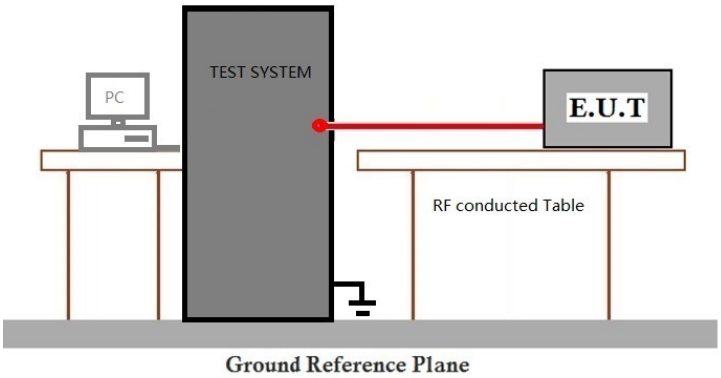
Operating Environment:

Temperature: 21.6 °C Humidity: 51.8 % RH Atmospheric Pressure: 1003 mbar

### 7.2.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.2.3 Test Setup Diagram

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### 7.2.4 Measurement Procedure and Data

cable loss=0.9dB

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## 7.3 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)

Test Method: ANSI C63.10 (2013) Section 11.8.1

Limit:

≥500 kHz

### 7.3.1 E.U.T. Operation

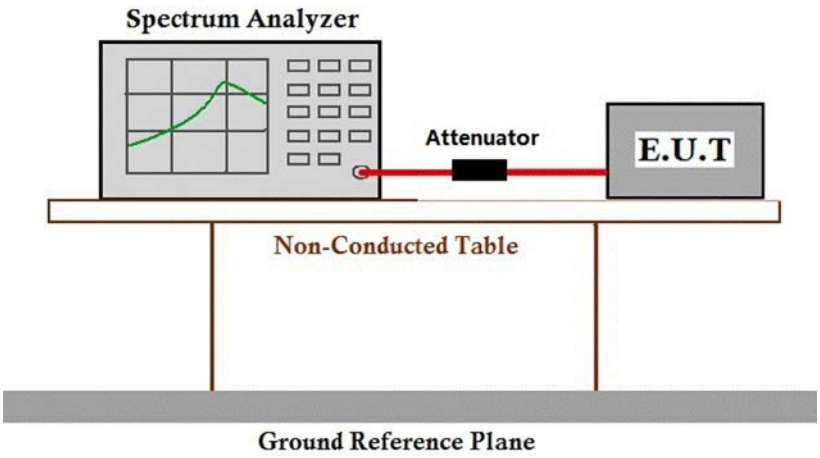
Operating Environment:

Temperature: 21.6 °C Humidity: 51.8 % RH Atmospheric Pressure: 1003 mbar

### 7.3.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| **Final test** | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.3.3 Test Setup Diagram




### 7.3.4 Measurement Procedure and Data

cable loss=0.9dB

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## 7.4 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

### 7.4.1 E.U.T. Operation

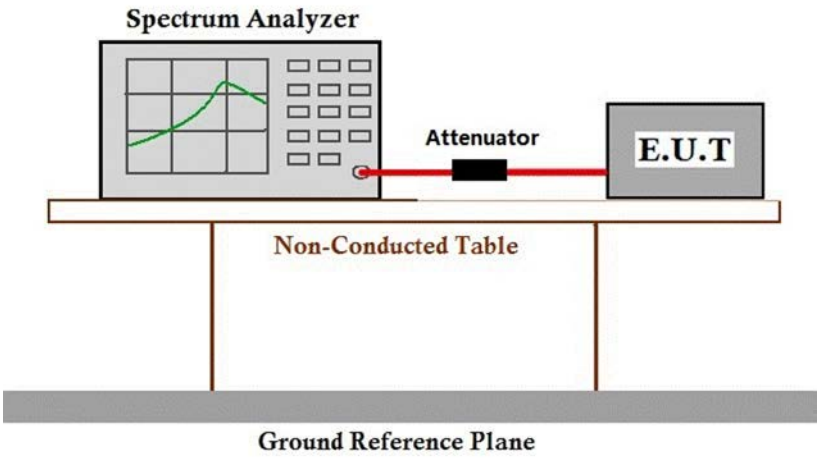
Operating Environment:

Temperature: 21.6 °C Humidity: 51.8 % RH Atmospheric Pressure: 1003 mbar

### 7.4.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| **Final test** | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.4.3 Test Setup Diagram




### 7.4.4 Measurement Procedure and Data

cable loss=0.9dB

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## 7.5 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.13.3.2

Limit:

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).

### 7.5.1 E.U.T. Operation

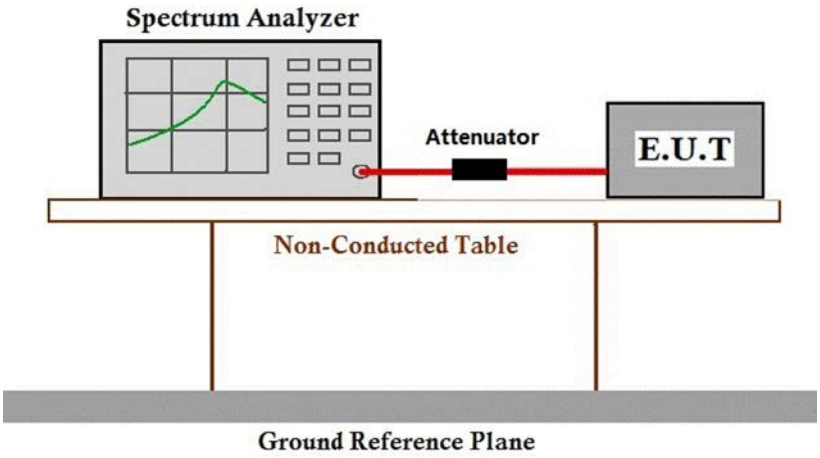
Operating Environment:

Temperature: 21.6 °C Humidity: 51.8 % RH Atmospheric Pressure: 1003 mbar

### 7.5.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.5.3 Test Setup Diagram




### 7.5.4 Measurement Procedure and Data

cable loss=0.9dB

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## 7.6 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 11.11

Limit:

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).

### 7.6.1 E.U.T. Operation

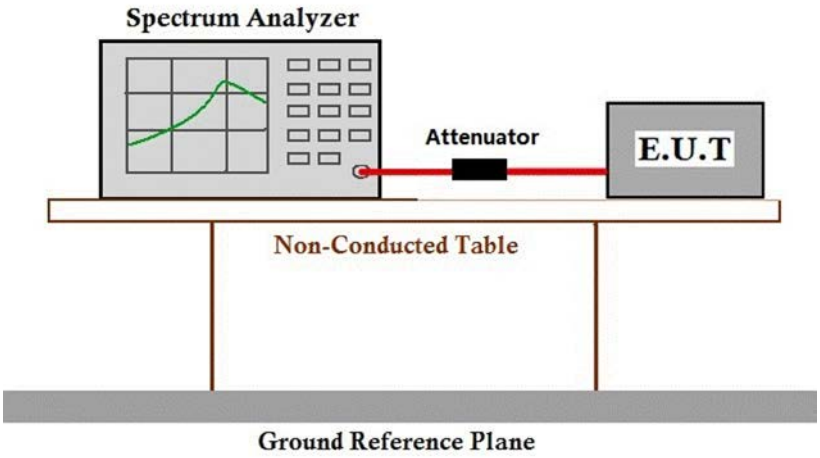
Operating Environment:

Temperature: 21.6 °C Humidity: 51.8 % RH Atmospheric Pressure: 1003 mbar

### 7.6.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.6.3 Test Setup Diagram




### 7.6.4 Measurement Procedure and Data

cable loss=0.9dB

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## 7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

### 7.7.1 E.U.T. Operation

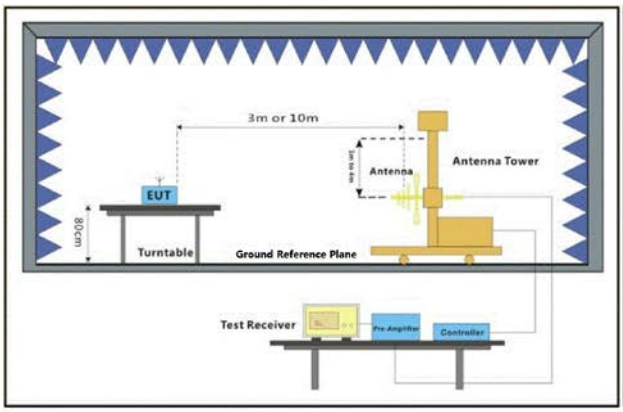
Operating Environment:

Temperature: 21.7 °C Humidity: 52.8 % RH Atmospheric Pressure: 1003 mbar

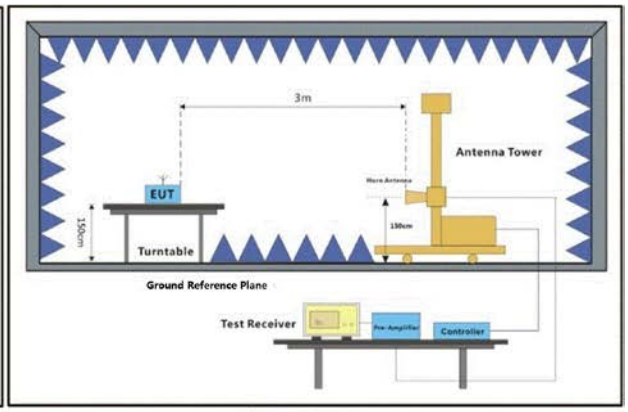
### 7.7.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.7.3 Test Setup Diagram




30MHz-1GHz




Above 1GHz

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### 7.7.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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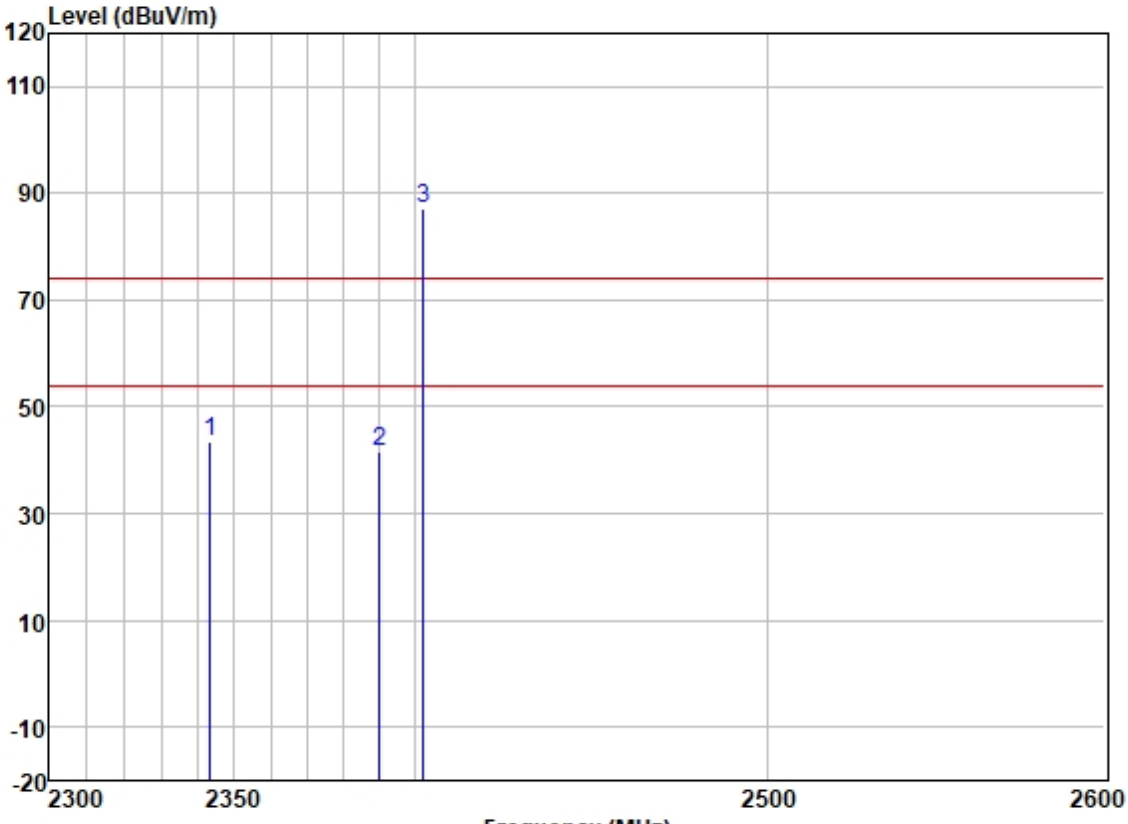
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2343.426 | 50.50 | 27.24 | 3.38 | 37.61 | 43.51 | 74.00 | -30.49 | HORIZONTAL | Peak |
| 2 | 2390.000 | 48.24 | 27.33 | 3.48 | 37.59 | 41.46 | 74.00 | -32.54 | HORIZONTAL | Peak |
| 3 * | 2402.000 | 93.75 | 27.35 | 3.50 | 37.59 | 87.01 | 74.00 | 13.01 | HORIZONTAL | Peak |

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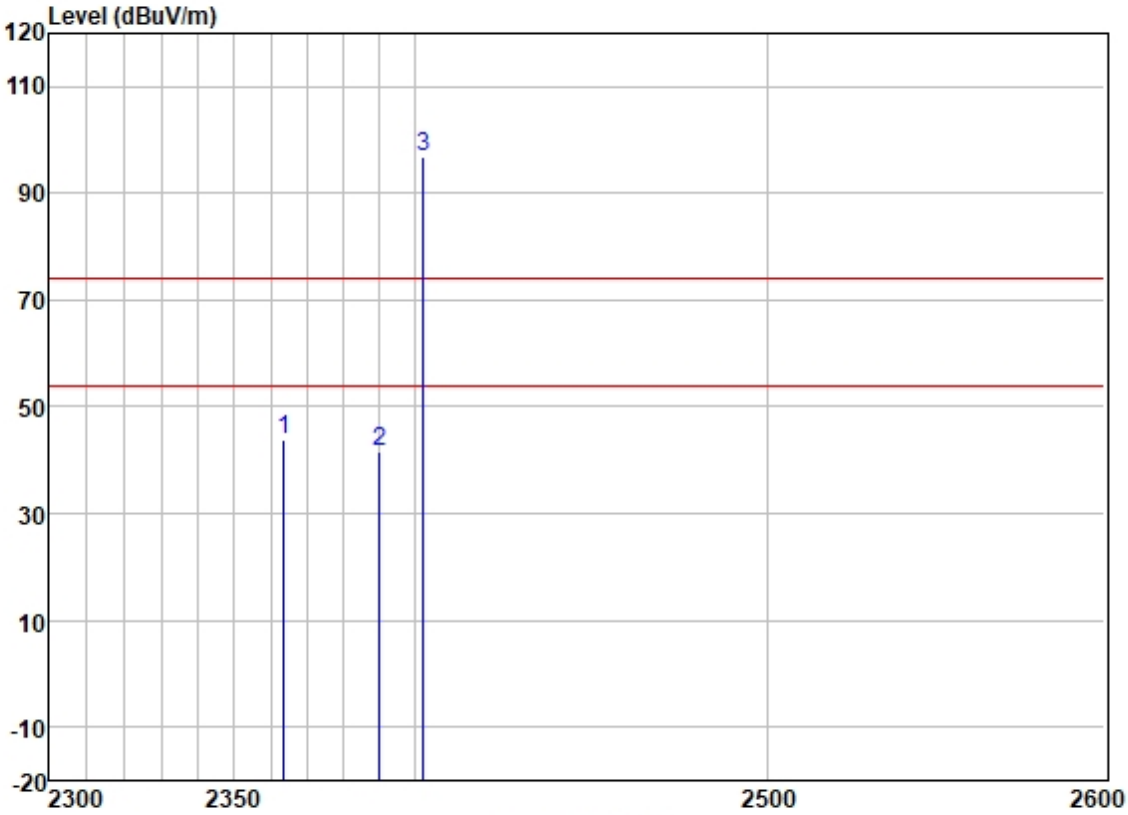
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; ; Channel:Low




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 2363.573 | 50.62 | 27.28 | 3.43 | 37.60 | 43.73 | 74.00 | -30.27 | VERTICAL | Peak |
| 2 | 2390.000 | 48.51 | 27.33 | 3.48 | 37.59 | 41.73 | 74.00 | -32.27 | VERTICAL | Peak |
| 3 * | 2402.000 | 103.60 | 27.35 | 3.50 | 37.59 | 96.86 | 74.00 | 22.86 | VERTICAL | Peak |

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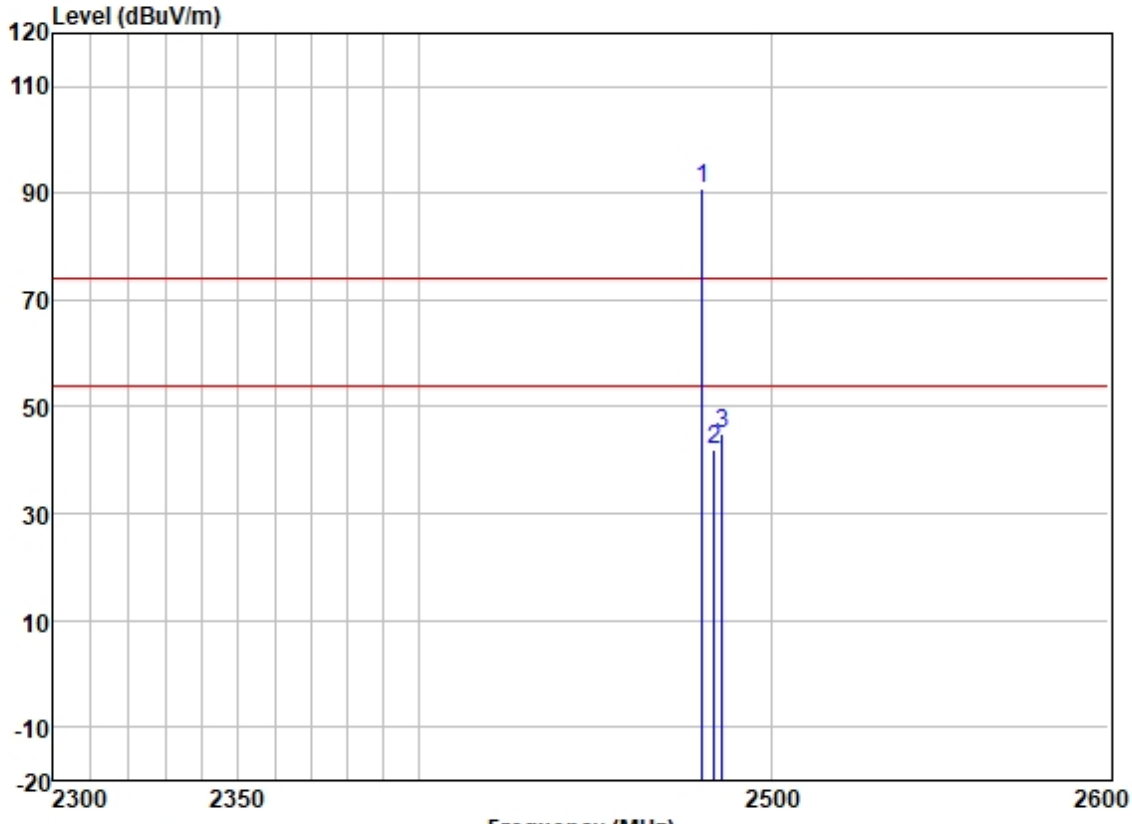
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:High




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 * | 2480.000 | 97.22 | 27.47 | 3.60 | 37.57 | 90.72 | 74.00 | 16.72 | HORIZONTAL | Peak |
| 2 | 2483.500 | 48.69 | 27.48 | 3.53 | 37.57 | 42.13 | 74.00 | -31.87 | HORIZONTAL | Peak |
| 3 | 2485.794 | 51.68 | 27.48 | 3.53 | 37.57 | 45.12 | 74.00 | -28.88 | HORIZONTAL | Peak |

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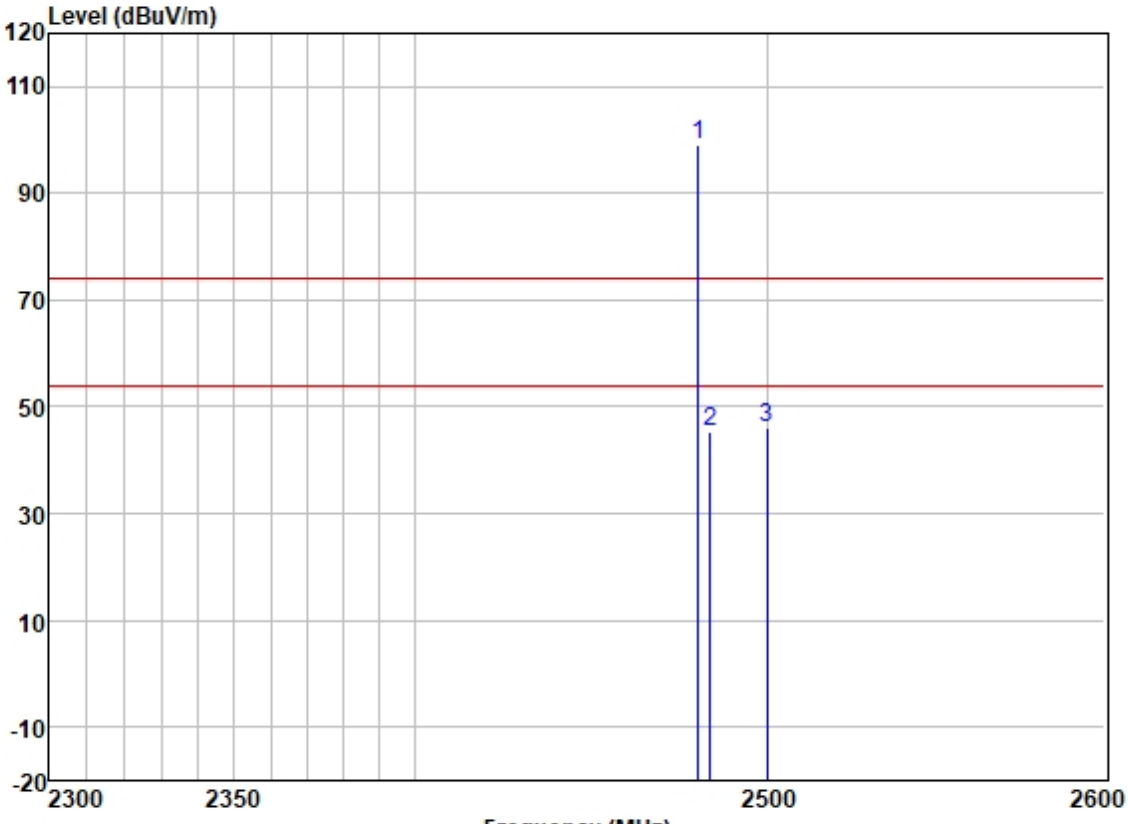
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; ; Channel:High




race: (Discrete)

| | | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | * | 2480.000 | 105.60 | 27.47 | 3.60 | 37.57 | 99.10 | 74.00 | 25.10 | VERTICAL | Peak |
| 2 | | 2483.500 | 51.81 | 27.48 | 3.53 | 37.57 | 45.25 | 74.00 | -28.75 | VERTICAL | Peak |
| 3 | | 2499.824 | 52.63 | 27.50 | 3.40 | 37.56 | 45.97 | 74.00 | -28.03 | VERTICAL | Peak |

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## 7.8 Radiated Spurious Emissions (Below 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

### 7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 21.7 °C Humidity: 52.8 % RH Atmospheric Pressure: 1003 mbar

### 7.8.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.8.3 Test Setup Diagram

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### 7.8.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

3) Scan from 9kHz to 1 GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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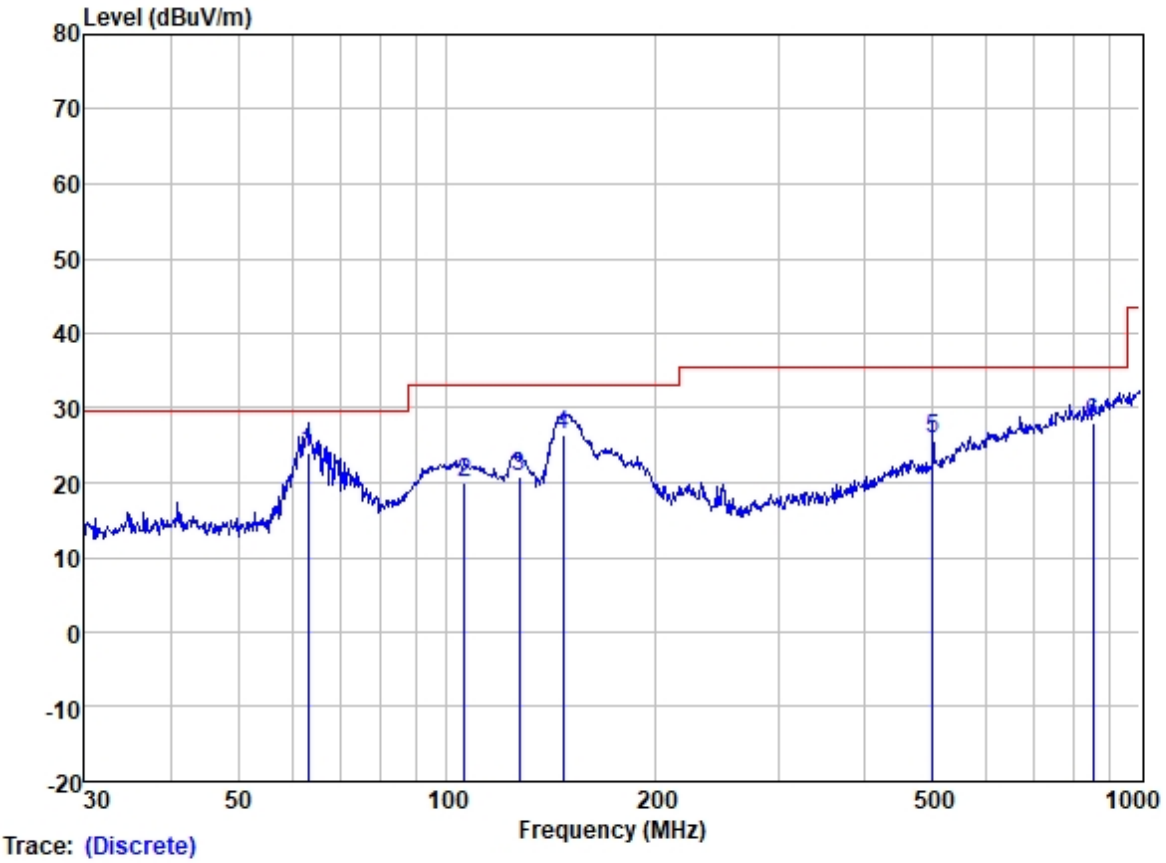
Test Mode: 02; Polarity: Vertial; Modulation:GFSK; ; Channel:Low




Site : SGS
Job :
Model :
Power :
Test Mode : BLE(1M)

| | Freq | Read Level | Anterna Factor | Cable Loss | Preamp Factor | Measured Level | Limit Line | Over Limit | Pol/ Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dBuV | | |
| 1 | 63.09 | 36.79 | 13.00 | 1.31 | 27.15 | 23.95 | 29.50 | -5.55 | VERTICAL | QP |
| 2 | 106.01 | 35.29 | 10.00 | 1.77 | 27.07 | 19.99 | 33.10 | -13.11 | VERTICAL | QP |
| 3 | 127.22 | 34.04 | 11.70 | 1.94 | 27.00 | 20.68 | 33.10 | -12.42 | VERTICAL | QP |
| 4 | 146.89 | 37.33 | 13.70 | 2.20 | 26.85 | 26.38 | 33.10 | -6.72 | VERTICAL | QP |
| 5 | 501.18 | 31.53 | 17.93 | 4.43 | 27.98 | 25.91 | 35.60 | -9.69 | VERTICAL | QP |
| 6 | 854.02 | 26.48 | 22.87 | 6.55 | 27.92 | 27.98 | 35.60 | -7.62 | VERTICAL | QP |

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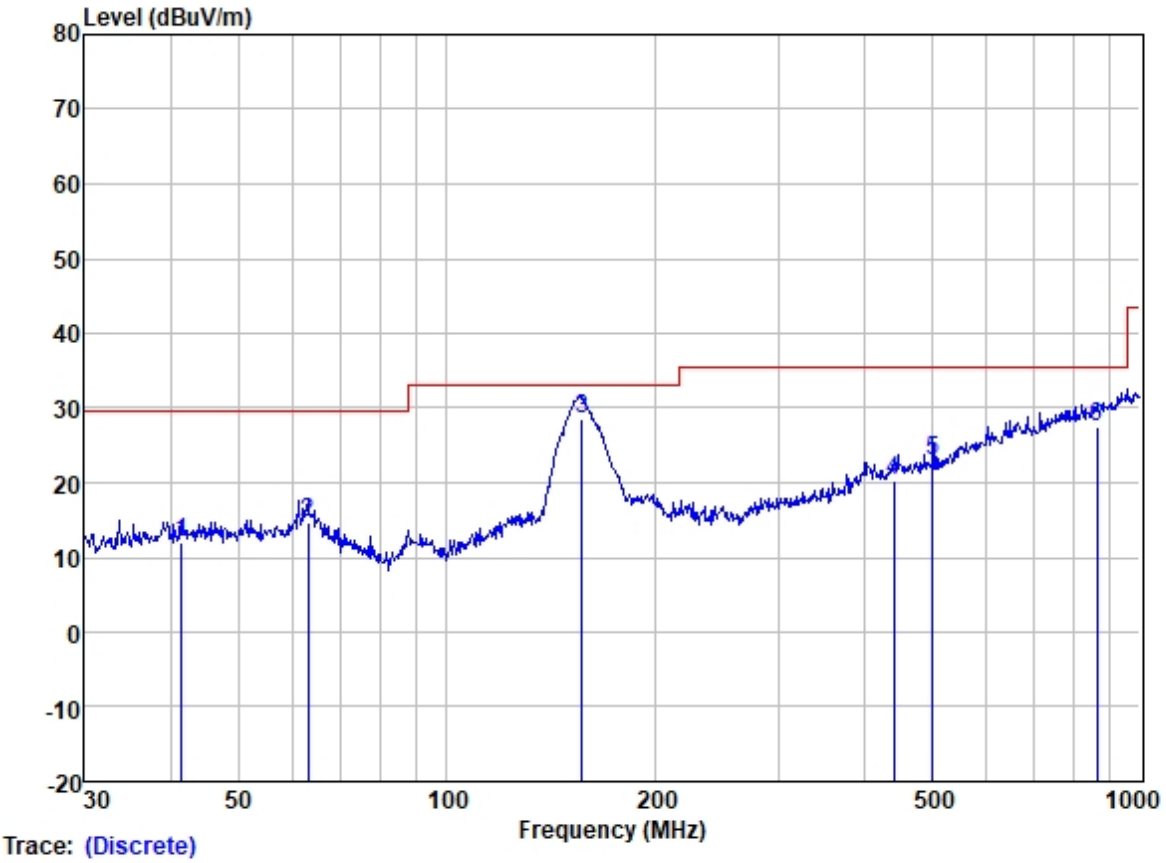
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low




Site : SGS
Job :
Model :
Power :
Test Mode : BLE(1M)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Measured Level | Limit Line | Over Limit | Pol/ Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dBuV | | |
| 1 | 41.42 | 24.38 | 13.65 | 1.11 | 27.17 | 11.97 | 29.50 | -17.53 | HORIZONTAL | QP |
| 2 | 63.09 | 27.58 | 13.00 | 1.31 | 27.15 | 14.74 | 29.50 | -14.76 | HORIZONTAL | QP |
| 3 | 156.46 | 39.34 | 13.70 | 2.30 | 26.81 | 28.53 | 33.10 | -4.57 | HORIZONTAL | QP |
| 4 | 441.74 | 26.53 | 17.07 | 4.16 | 27.59 | 20.17 | 35.60 | -15.43 | HORIZONTAL | QP |
| 5 | 501.18 | 28.65 | 17.93 | 4.43 | 27.98 | 23.03 | 35.60 | -12.57 | HORIZONTAL | QP |
| 6 | 866.09 | 25.79 | 22.93 | 6.71 | 27.90 | 27.53 | 35.60 | -8.07 | HORIZONTAL | QP |

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| Frequency (MHz) | Level @ 10m (dBuV/m) | Level @ 10m (uV/m) | Level @ 3m (uV/m) | Level @ 3m (dBuV/m) | Limit @ 3m (dBuV/m) | Margin (dB) | Ant. Polarization |
|---|---|---|---|---|---|---|---|
| 63.09 | 23.95 | 15.76 | 52.53 | 34.41 | 40.00 | -5.59 | V |
| 106.01 | 19.99 | 9.99 | 33.29 | 30.45 | 43.50 | -13.05 | V |
| 127.22 | 20.68 | 10.81 | 36.05 | 31.14 | 43.50 | -12.36 | V |
| 146.89 | 26.38 | 20.84 | 69.48 | 36.84 | 43.50 | -6.66 | V |
| 501.18 | 25.91 | 19.75 | 65.82 | 36.37 | 46.00 | -9.63 | V |
| 854.02 | 27.98 | 25.06 | 83.54 | 38.44 | 46.00 | -7.56 | V |
| 41.42 | 11.97 | 3.97 | 13.22 | 22.43 | 40.00 | -17.57 | H |
| 63.09 | 14.74 | 5.46 | 18.19 | 25.20 | 40.00 | -14.80 | H |
| 156.46 | 28.53 | 26.70 | 89.00 | 38.99 | 43.50 | -4.51 | H |
| 441.74 | 20.17 | 10.20 | 33.99 | 30.63 | 46.00 | -15.37 | H |
| 501.18 | 23.03 | 14.17 | 47.25 | 33.49 | 46.00 | -12.51 | H |
| 866.09 | 27.53 | 23.80 | 79.32 | 37.99 | 46.00 | -8.01 | H |

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## 7.9 Radiated Spurious Emissions (Above 1GHz)

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |
| Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. | | |

### 7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 51.4 % RH Atmospheric Pressure: 1003 mbar

### 7.9.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description |
|---|---|---|
| Final test | 02 | TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation. |

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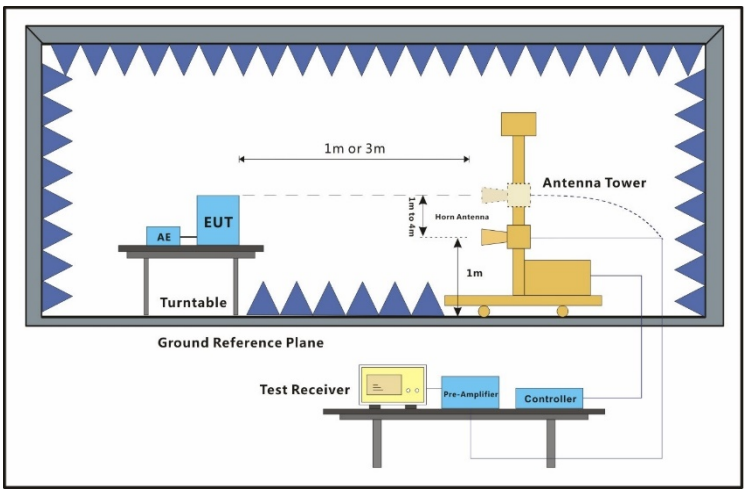
### 7.9.3 Test Setup Diagram

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### 7.9.4 Measurement Procedure and Data

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

2) Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3) The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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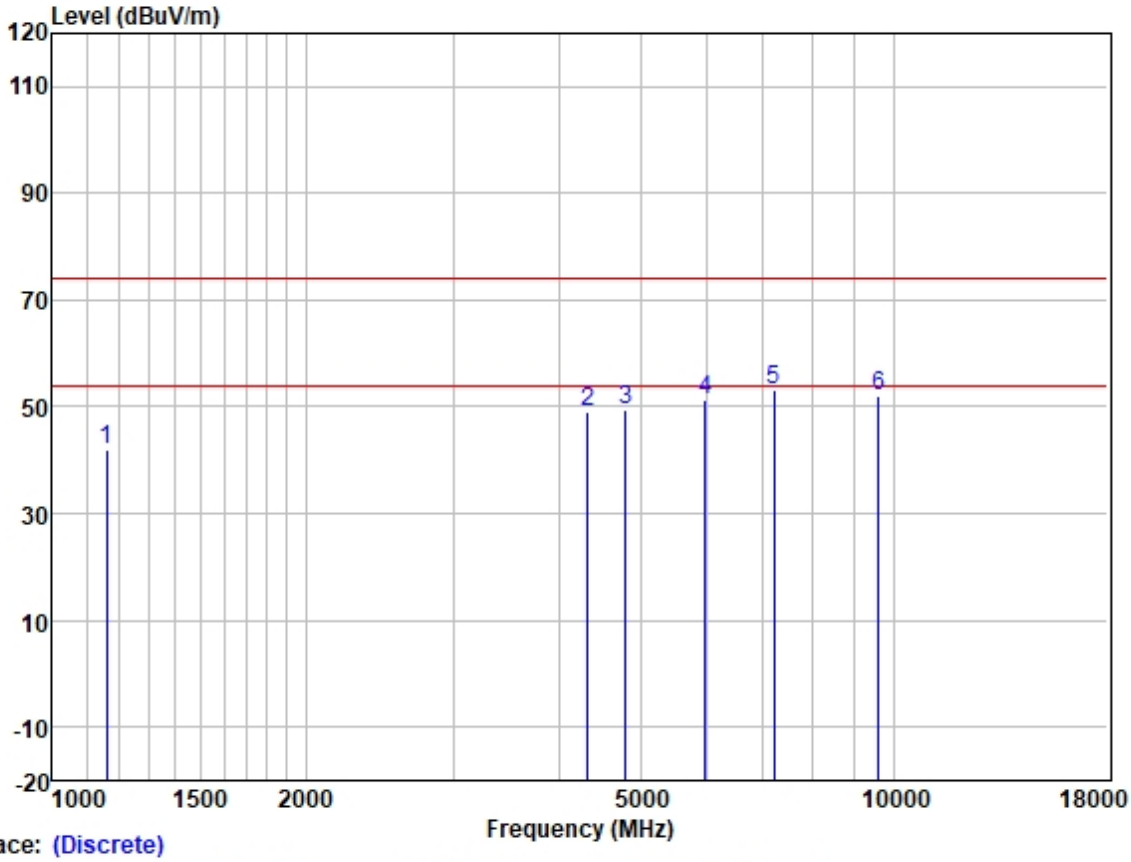
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:Low




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1158.828 | 53.62 | 24.52 | 2.40 | 38.42 | 42.12 | 74.00 | -31.88 | HORIZONTAL | Peak |
| 2 | 4329.354 | 50.62 | 30.54 | 4.67 | 36.81 | 49.02 | 74.00 | -24.98 | HORIZONTAL | Peak |
| 3 | 4804.000 | 49.61 | 31.42 | 5.40 | 36.83 | 49.60 | 74.00 | -24.40 | HORIZONTAL | Peak |
| 4 | 5967.033 | 49.89 | 32.37 | 6.10 | 36.90 | 51.46 | 74.00 | -22.54 | HORIZONTAL | Peak |
| 5 | 7206.000 | 48.90 | 35.54 | 5.98 | 37.38 | 53.04 | 74.00 | -20.96 | HORIZONTAL | Peak |
| 6 | 9608.000 | 44.19 | 38.37 | 7.07 | 37.42 | 52.21 | 74.00 | -21.79 | HORIZONTAL | Peak |

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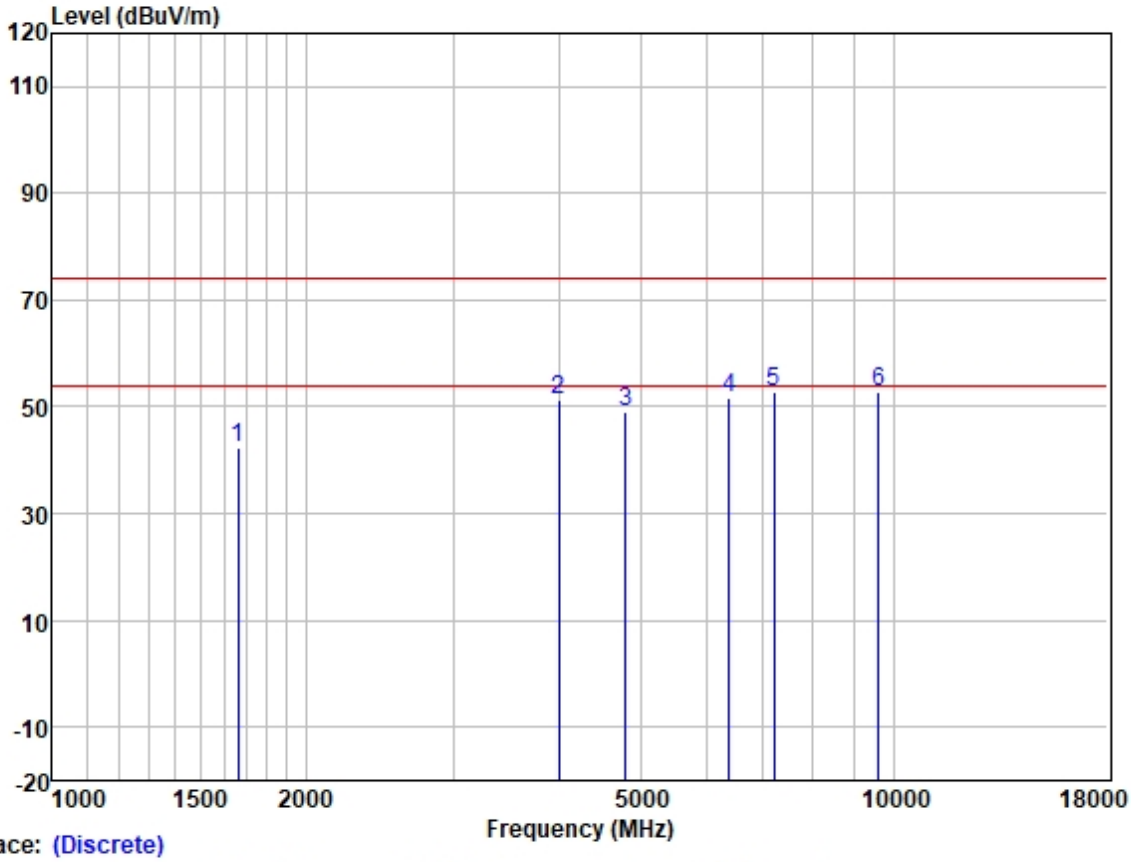
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; ; Channel:Low




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1663.137 | 51.71 | 25.65 | 2.80 | 37.91 | 42.25 | 74.00 | -31.75 | VERTICAL | Peak |
| 2 | 4004.339 | 53.75 | 29.80 | 4.60 | 36.80 | 51.35 | 74.00 | -22.65 | VERTICAL | Peak |
| 3 | 4804.000 | 49.00 | 31.42 | 5.40 | 36.83 | 48.99 | 74.00 | -25.01 | VERTICAL | Peak |
| 4 | 6377.195 | 49.20 | 33.68 | 5.91 | 36.98 | 51.81 | 74.00 | -22.19 | VERTICAL | Peak |
| 5 | 7206.000 | 48.49 | 35.54 | 5.98 | 37.38 | 52.63 | 74.00 | -21.37 | VERTICAL | Peak |
| 6 | 9608.000 | 44.78 | 38.37 | 7.07 | 37.42 | 52.80 | 74.00 | -21.20 | VERTICAL | Peak |

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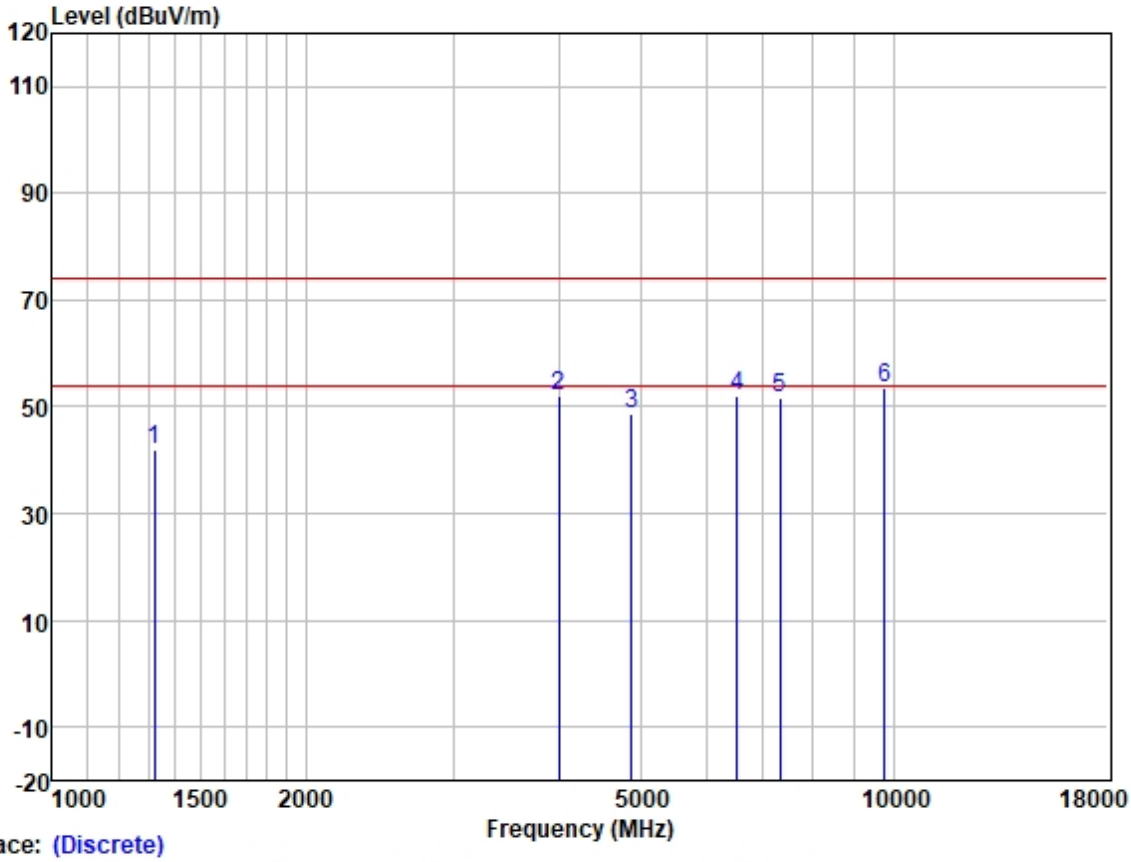
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:middle




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1323.614 | 52.46 | 25.26 | 2.60 | 38.29 | 42.03 | 74.00 | -31.97 | HORIZONTAL | Peak |
| 2 | 4004.339 | 54.61 | 29.80 | 4.60 | 36.80 | 52.21 | 74.00 | -21.79 | HORIZONTAL | Peak |
| 3 | 4880.000 | 48.50 | 31.54 | 5.50 | 36.84 | 48.70 | 74.00 | -25.30 | HORIZONTAL | Peak |
| 4 | 6526.373 | 49.27 | 34.03 | 5.84 | 37.02 | 52.12 | 74.00 | -21.88 | HORIZONTAL | Peak |
| 5 | 7320.000 | 47.15 | 36.00 | 6.13 | 37.43 | 51.85 | 74.00 | -22.15 | HORIZONTAL | Peak |
| 6 | 9760.000 | 45.45 | 38.50 | 7.02 | 37.41 | 53.56 | 74.00 | -20.44 | HORIZONTAL | Peak |

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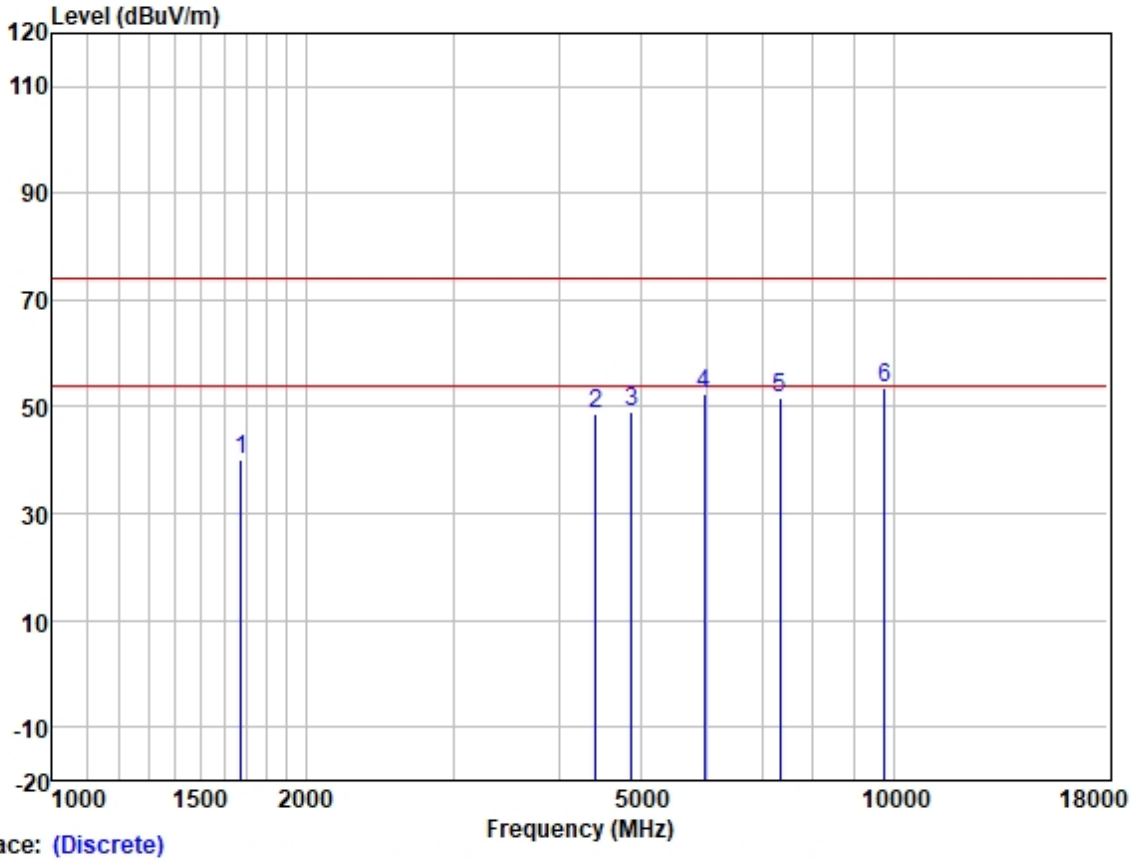
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; ; Channel:middle




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1677.621 | 49.68 | 25.68 | 2.80 | 37.91 | 40.25 | 74.00 | -33.75 | VERTICAL | Peak |
| 2 | 4430.628 | 49.91 | 30.72 | 4.78 | 36.81 | 48.60 | 74.00 | -25.40 | VERTICAL | Peak |
| 3 | 4880.000 | 48.94 | 31.54 | 5.50 | 36.84 | 49.14 | 74.00 | -24.86 | VERTICAL | Peak |
| 4 | 5949.811 | 50.78 | 32.36 | 6.05 | 36.90 | 52.29 | 74.00 | -21.71 | VERTICAL | Peak |
| 5 | 7320.000 | 47.11 | 36.00 | 6.13 | 37.43 | 51.81 | 74.00 | -22.19 | VERTICAL | Peak |
| 6 | 9760.000 | 45.42 | 38.50 | 7.02 | 37.41 | 53.53 | 74.00 | -20.47 | VERTICAL | Peak |

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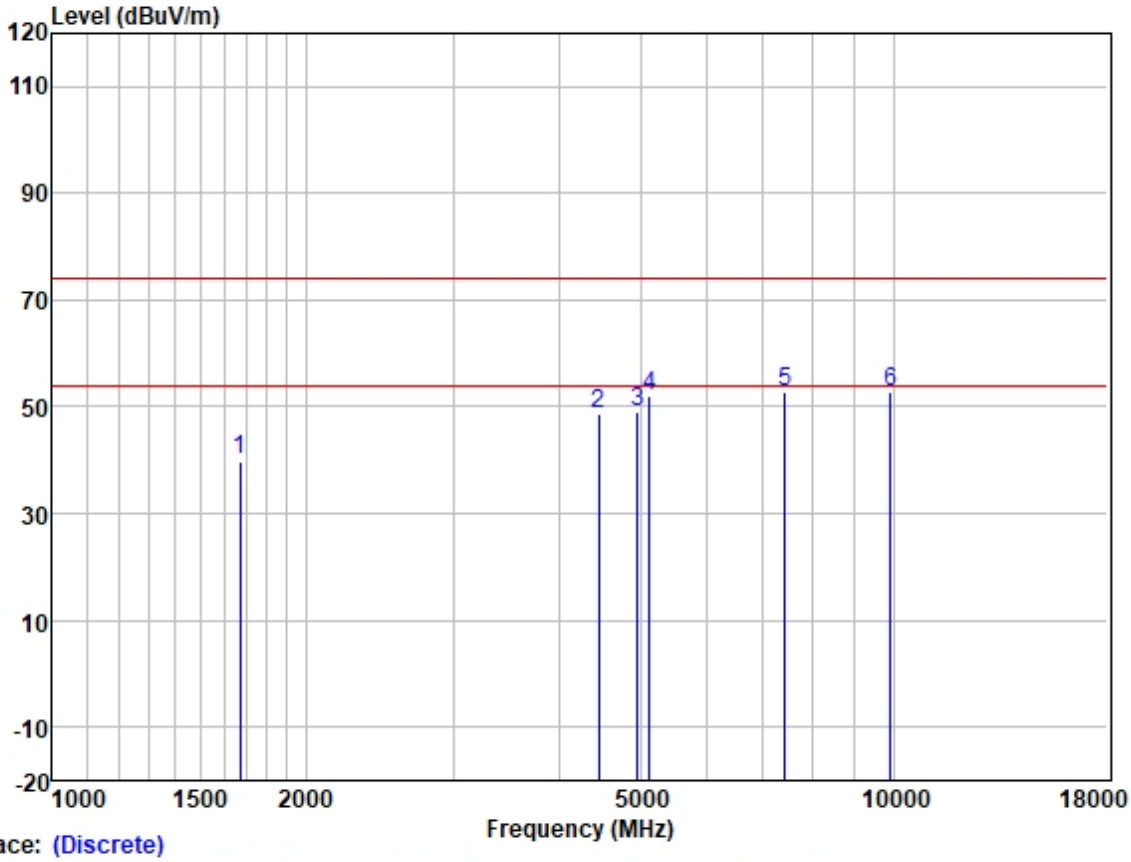
Test Mode: 02; Polarity: Horizontal; Modulation:GFSK; ; Channel:High




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1672.779 | 49.36 | 25.67 | 2.80 | 37.91 | 39.92 | 74.00 | -34.08 | HORIZONTAL | Peak |
| 2 | 4456.315 | 49.80 | 30.75 | 4.88 | 36.81 | 48.62 | 74.00 | -25.38 | HORIZONTAL | Peak |
| 3 | 4960.000 | 48.43 | 31.65 | 5.65 | 36.84 | 48.89 | 74.00 | -25.11 | HORIZONTAL | Peak |
| 4 | 5134.335 | 51.41 | 31.72 | 5.63 | 36.86 | 51.90 | 74.00 | -22.10 | HORIZONTAL | Peak |
| 5 | 7440.000 | 47.93 | 36.27 | 6.22 | 37.47 | 52.95 | 74.00 | -21.05 | HORIZONTAL | Peak |
| 6 | 9920.000 | 44.56 | 38.65 | 6.96 | 37.40 | 52.77 | 74.00 | -21.23 | HORIZONTAL | Peak |

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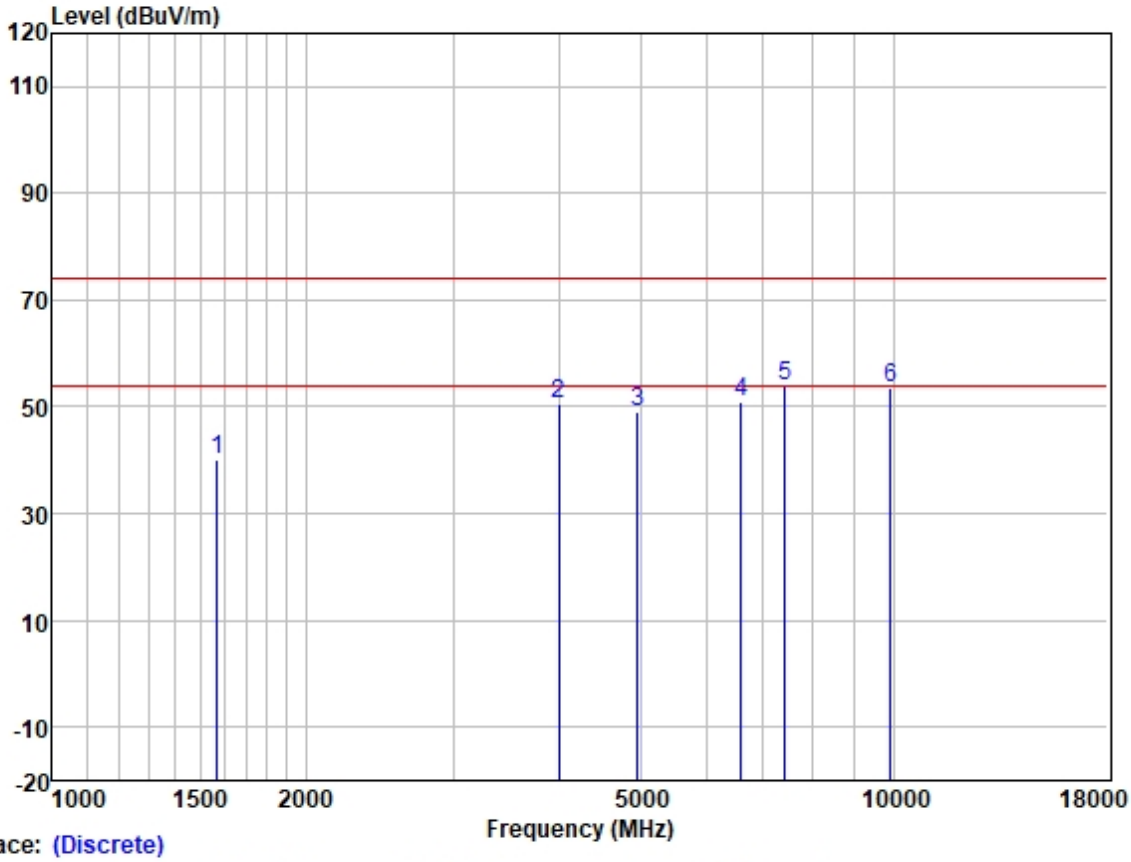
Test Mode: 02; Polarity: Vertical; Modulation:GFSK; ; Channel:High




race: (Discrete)

| | Freq | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dB | dB | dBuV/m | dBuV/m | dB | | |
| 1 | 1569.721 | 49.63 | 25.55 | 2.80 | 38.00 | 39.98 | 74.00 | -34.02 | VERTICAL | Peak |
| 2 | 4004.339 | 53.00 | 29.80 | 4.60 | 36.80 | 50.60 | 74.00 | -23.40 | VERTICAL | Peak |
| 3 | 4960.000 | 48.58 | 31.65 | 5.65 | 36.84 | 49.04 | 74.00 | -24.96 | VERTICAL | Peak |
| 4 | 6583.209 | 48.11 | 34.13 | 5.84 | 37.03 | 51.05 | 74.00 | -22.95 | VERTICAL | Peak |
| 5 | 7440.000 | 48.75 | 36.27 | 6.22 | 37.47 | 53.77 | 74.00 | -20.23 | VERTICAL | Peak |
| 6 | 9920.000 | 45.18 | 38.65 | 6.96 | 37.40 | 53.39 | 74.00 | -20.61 | VERTICAL | Peak |

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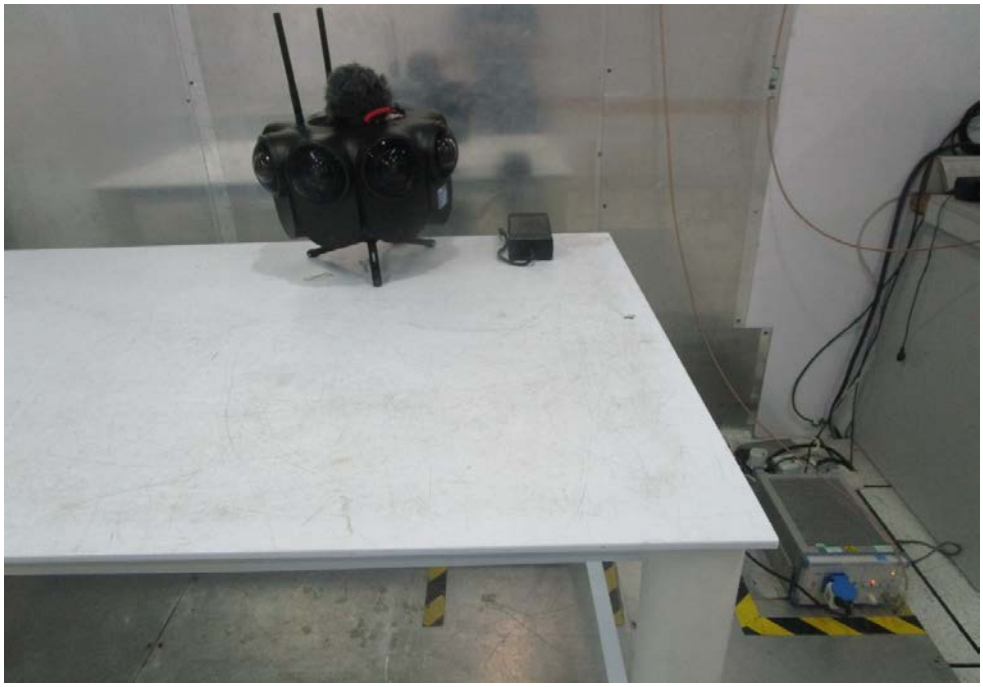
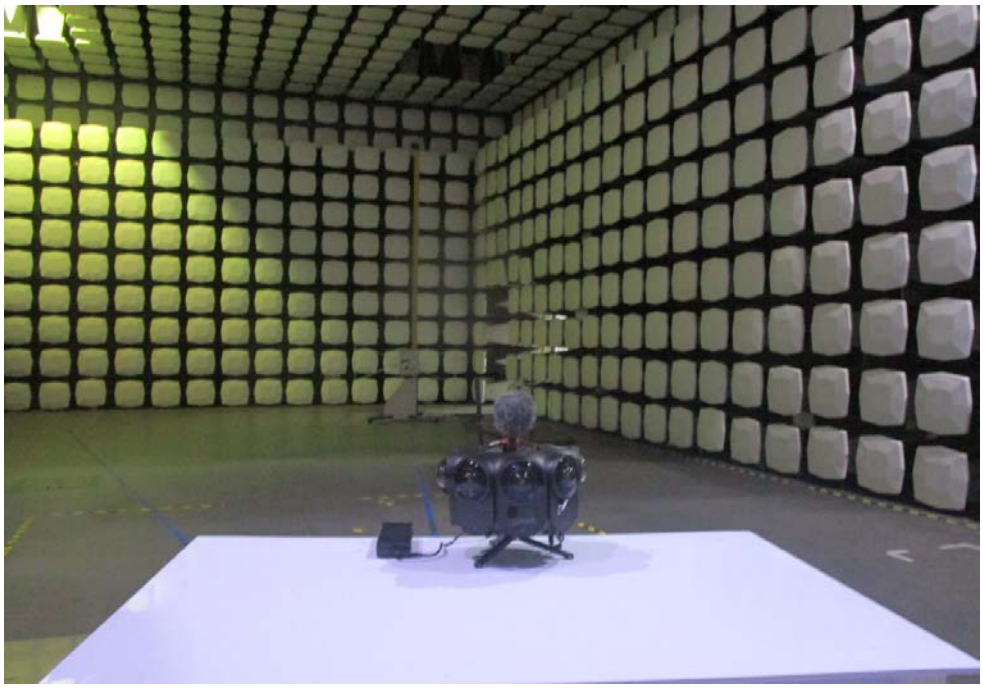
# 8 Test Setup Photo

**Conducted Emissions at AC Power Line (150kHz-30MHz)**



**Radiated Spurious Emissions (Below 1GHz)**



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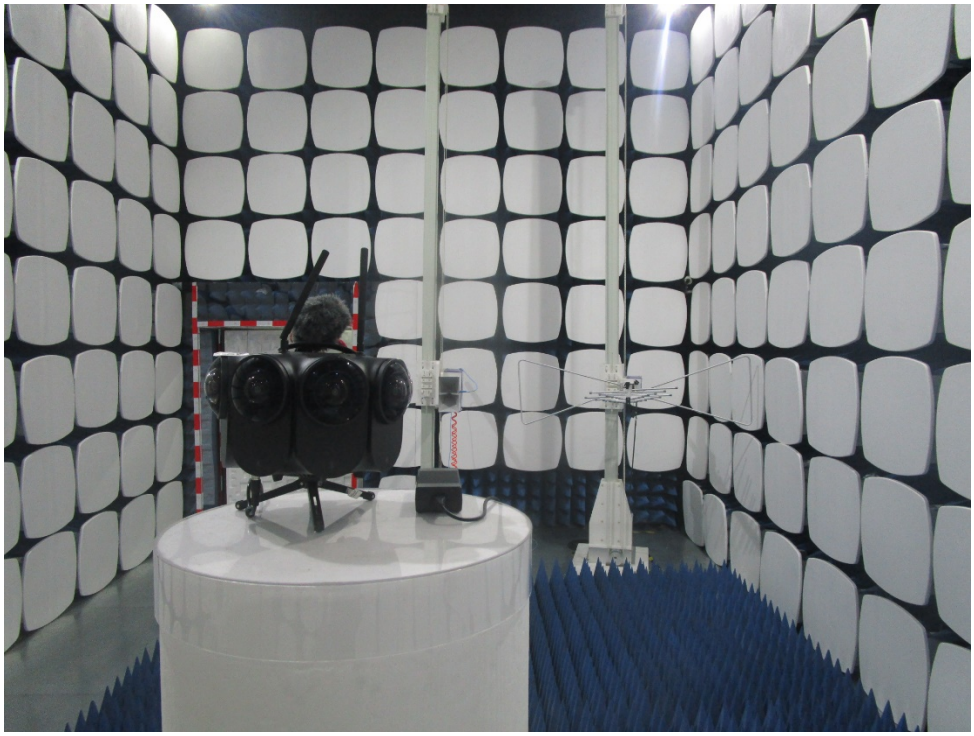
**Radiated Spurious Emissions (Above 1GHz)**



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# 9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for GZCR2110021203AT

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# 10 Appendix

1. Duty Cycle

1.1 Ant1

1.1.1 Test Result

| Ant1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mode | TX Type | Frequency (MHz) | T_on (ms) | Period (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | Max. DC Variation (%) |
| 1M | SISO | 2402 | 0.378 | 0.625 | 60.48 | 2.18 | 0.00 |
| | | 2440 | 0.378 | 0.625 | 60.48 | 2.18 | 0.00 |
| | | 2480 | 0.378 | 0.625 | 60.48 | 2.18 | 0.02 |

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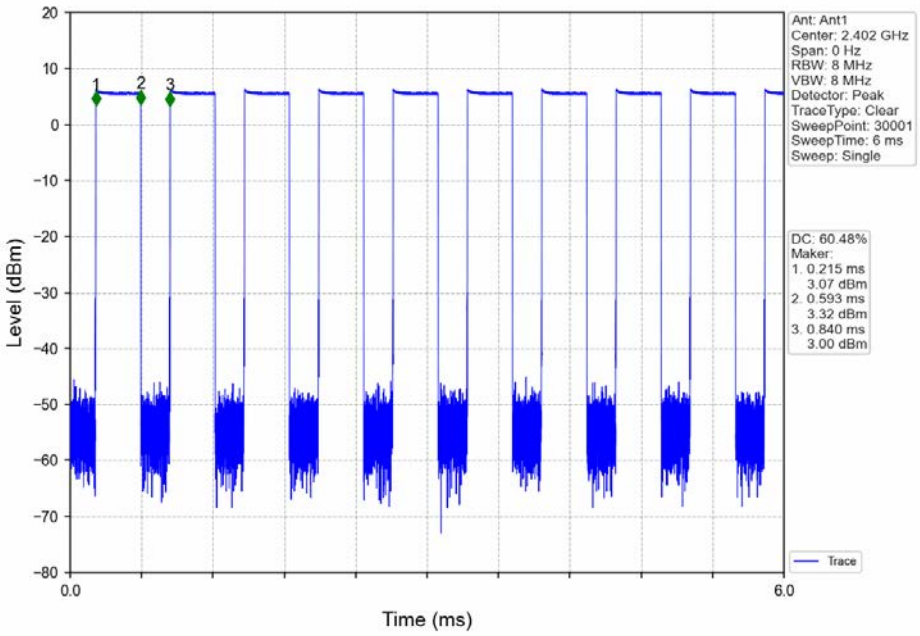
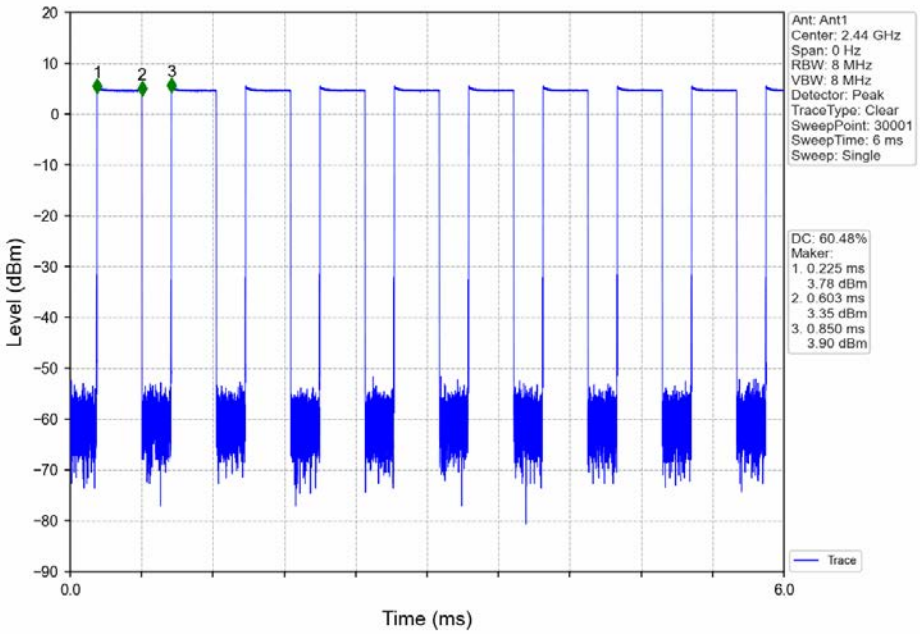
1.1.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV




1M_MCH_2440MHz_DataRate=_Ant1_NTNV

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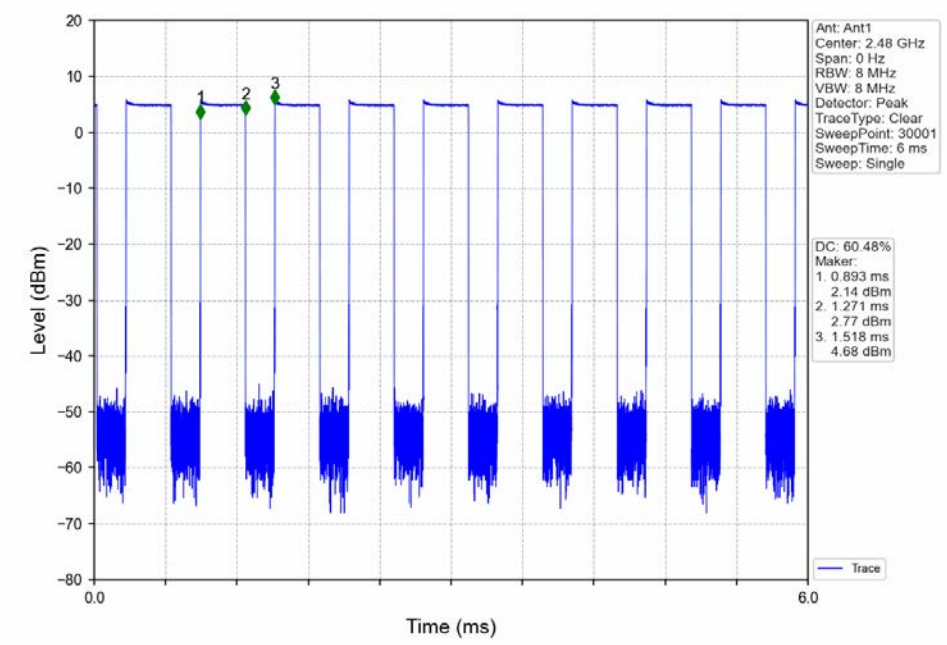
1M_HCH_2480MHz_DataRate=_Ant1_NTNV

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2. Bandwidth

2.1 OBW

2.1.1 Test Result

| Mode | TX Type | Frequency (MHz) | Ant | 99% Occupied Bandwidth (MHz) | Verdict |
|---|---|---|---|---|---|
| | | | | Result | |
| 1M | SISO | 2402 | 1 | 1.054 | Pass |
| | | 2440 | 1 | 1.057 | Pass |
| | | 2480 | 1 | 1.053 | Pass |

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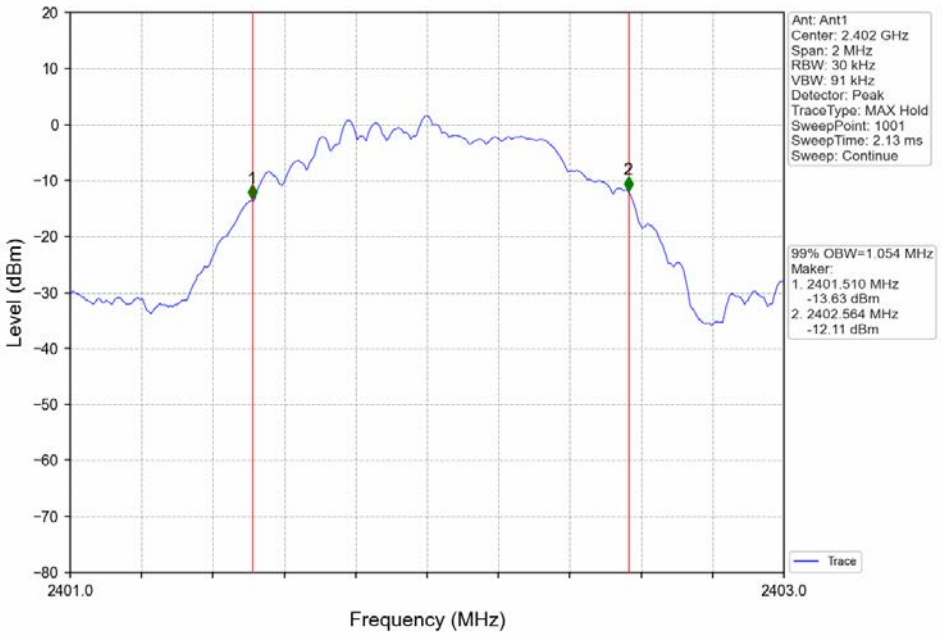
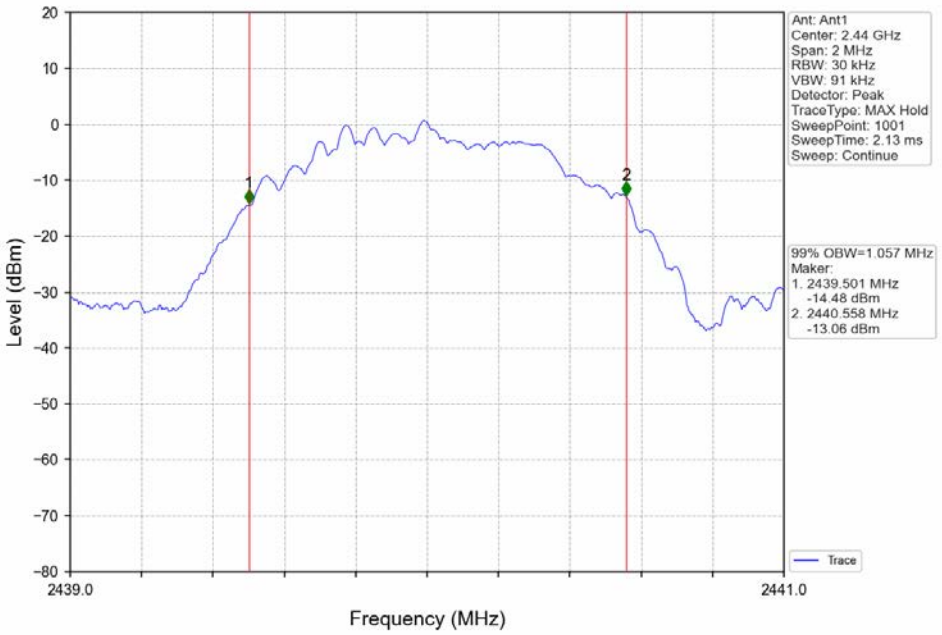
2.1.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV




1M_MCH_2440MHz_DataRate=_Ant1_NTNV

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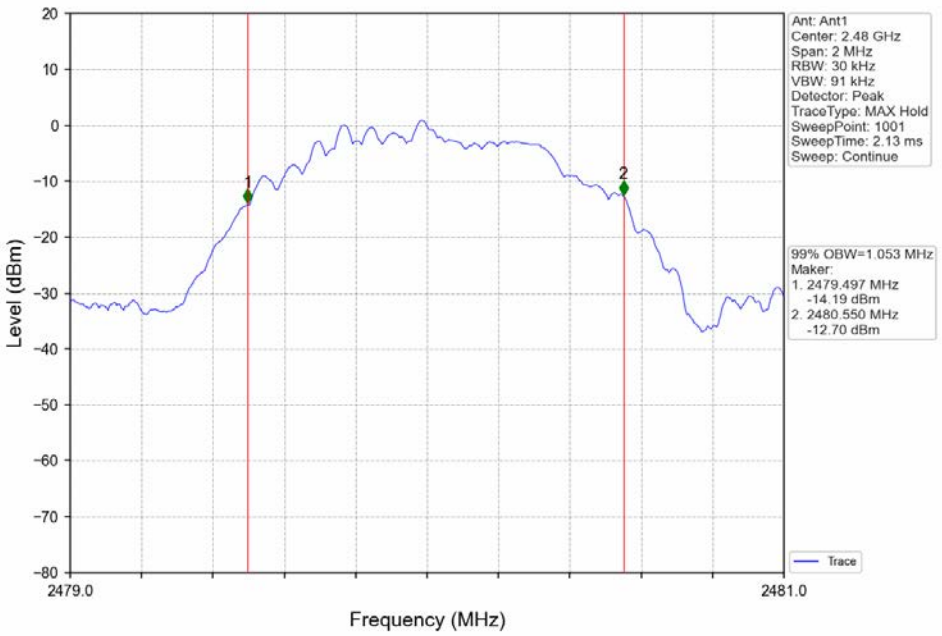
1M_HCH_2480MHz_DataRate=_Ant1_NTNV

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2.2 6dB BW

2.2.1 Test Result

| Mode | TX Type | Frequency (MHz) | Ant | 6dB Bandwidth (MHz) | | Verdict |
|---|---|---|---|---|---|---|
| | | | | Result | Limit | |
| 1M | SISO | 2402 | 1 | 0.687 | >=0.5 | Pass |
| | | 2440 | 1 | 0.684 | >=0.5 | Pass |
| | | 2480 | 1 | 0.682 | >=0.5 | Pass |

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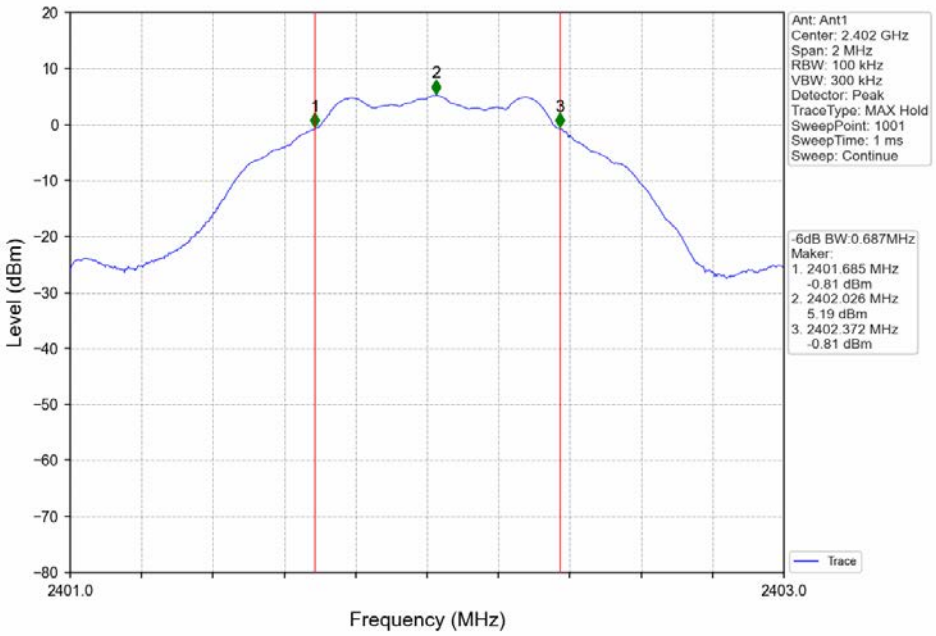
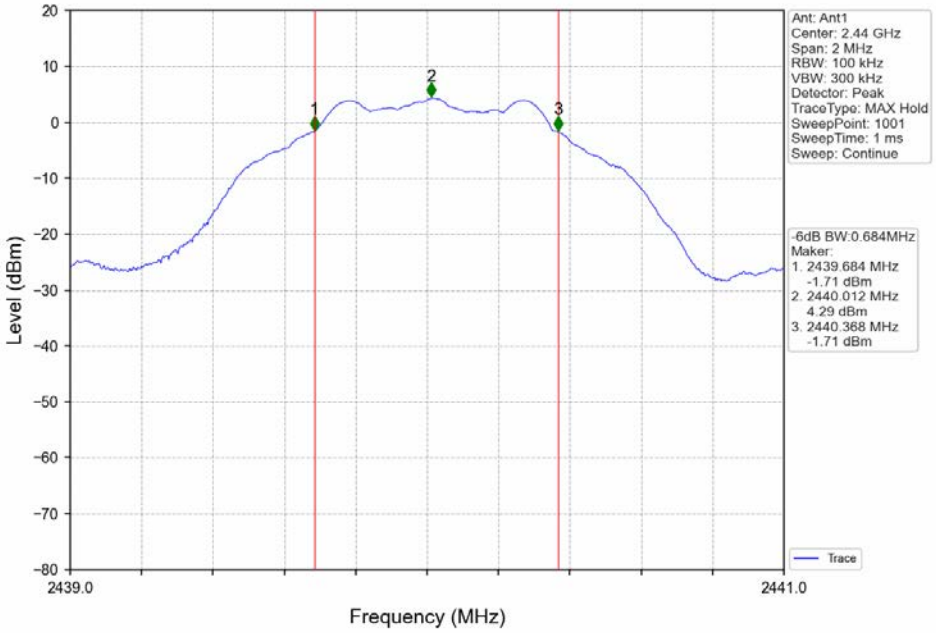
2.2.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV




1M_MCH_2440MHz_DataRate=_Ant1_NTNV

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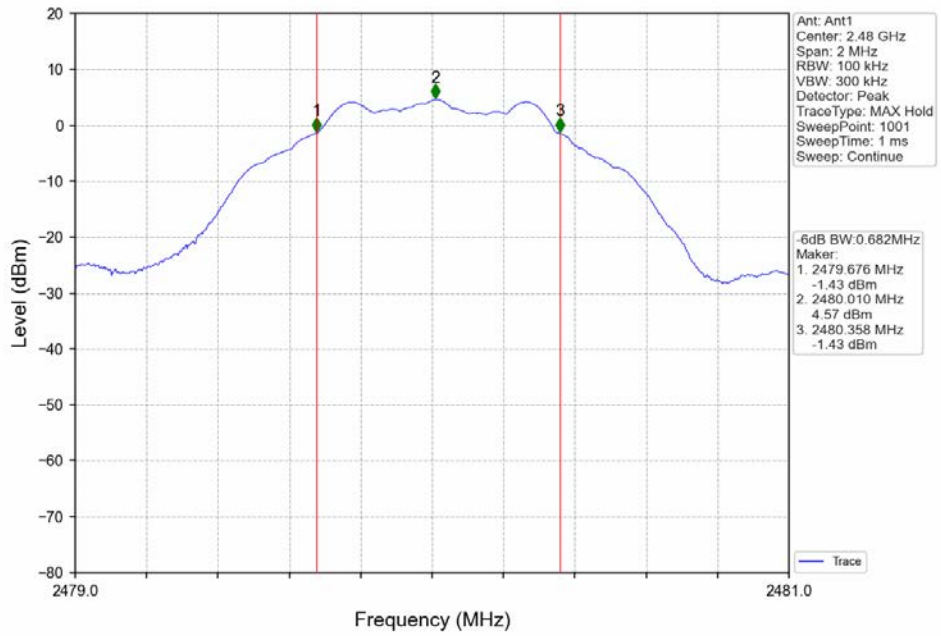
1M_HCH_2480MHz_DataRate=_Ant1_NTNV

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3. Maximum Conducted Output Power

3.1 Power

3.1.1 Test Result

| Mode | TX Type | Frequency (MHz) | Maximum Peak Conducted Output Power (dBm) | | Verdict |
|---|---|---|---|---|---|
| | | | Ant1 | Limit | |
| 1M | SISO | 2402 | 6.19 | <=30 | Pass |
| | | 2440 | 5.31 | <=30 | Pass |
| | | 2480 | 5.57 | <=30 | Pass |

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4. Maximum Power Spectral Density

4.1 PSD

4.1.1 Test Result

| Mode | TX Type | Frequency (MHz) | Maximum PSD (dBm/3kHz) | | Verdict |
|---|---|---|---|---|---|
| | | | Ant1 | Limit | |
| 1M | SISO | 2402 | -9.51 | <=8 | Pass |
| | | 2440 | -10.45 | <=8 | Pass |
| | | 2480 | -10.11 | <=8 | Pass |

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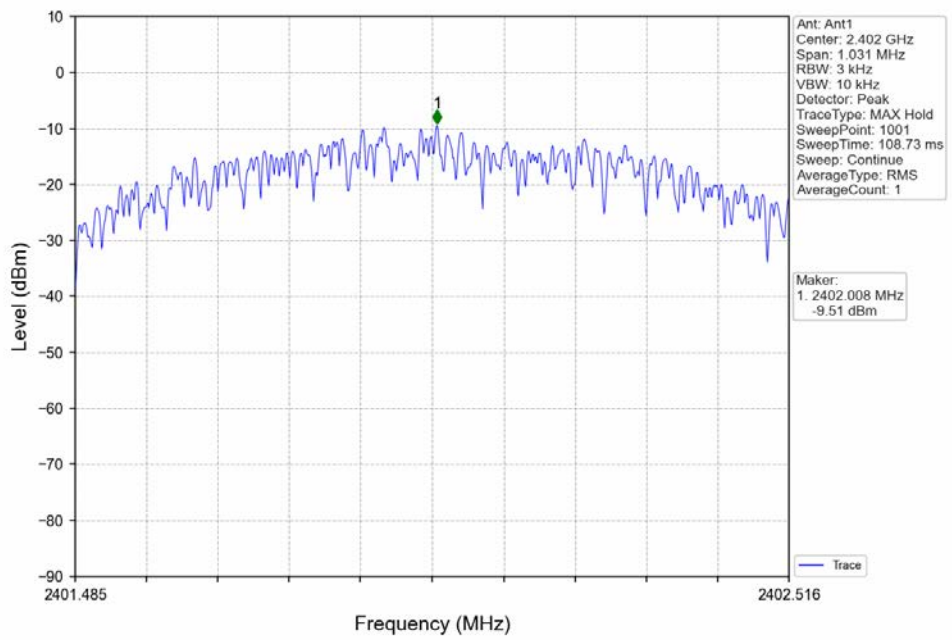
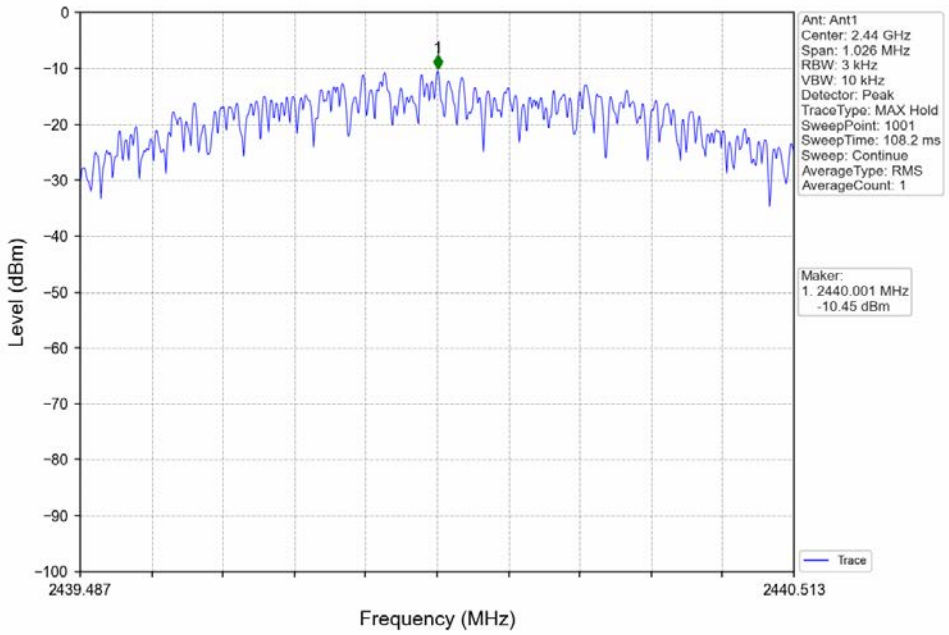
4.1.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV




1M_MCH_2440MHz_DataRate=_Ant1_NTNV

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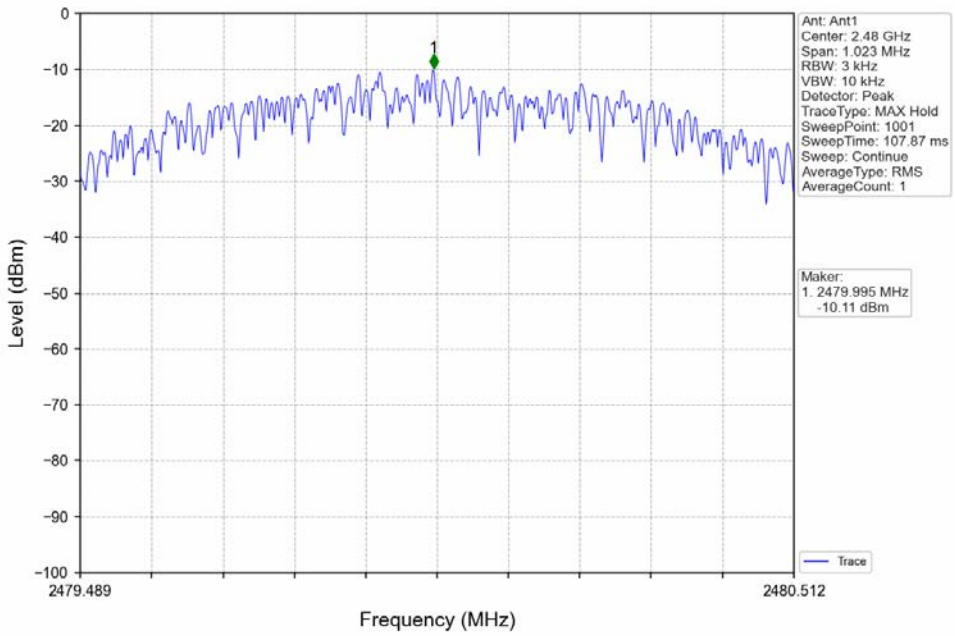
1M_HCH_2480MHz_DataRate=_Ant1_NTNV

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5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Ref

5.1.1 Test Result

| Mode | TX Type | Frequency (MHz) | Ant | Level of Reference (dBm) |
|---|---|---|---|---|
| 1M | SISO | 2402 | 1 | 5.23 |
| | | 2440 | 1 | 4.33 |
| | | 2480 | 1 | 4.58 |
| Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level. | | | | |

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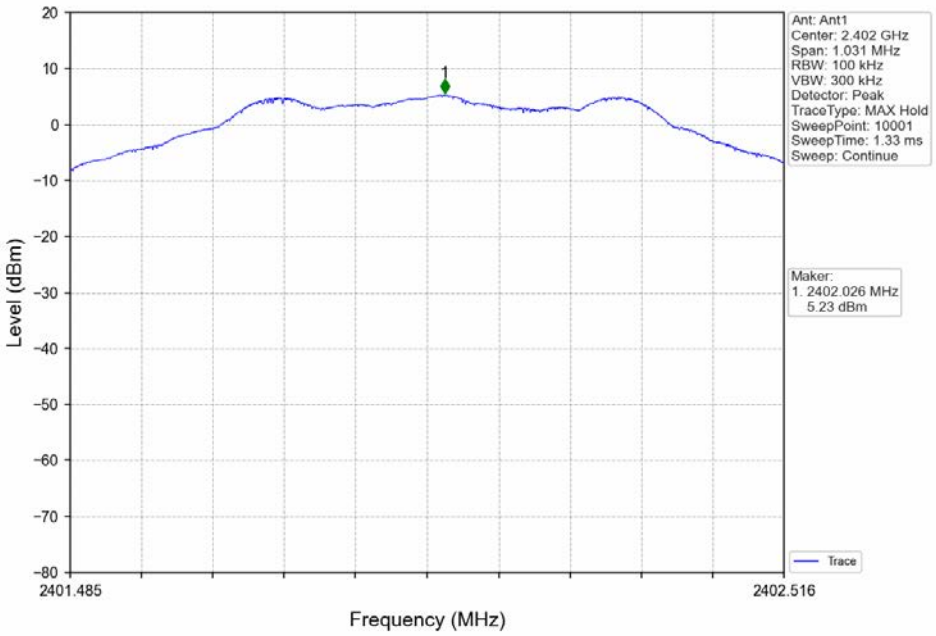
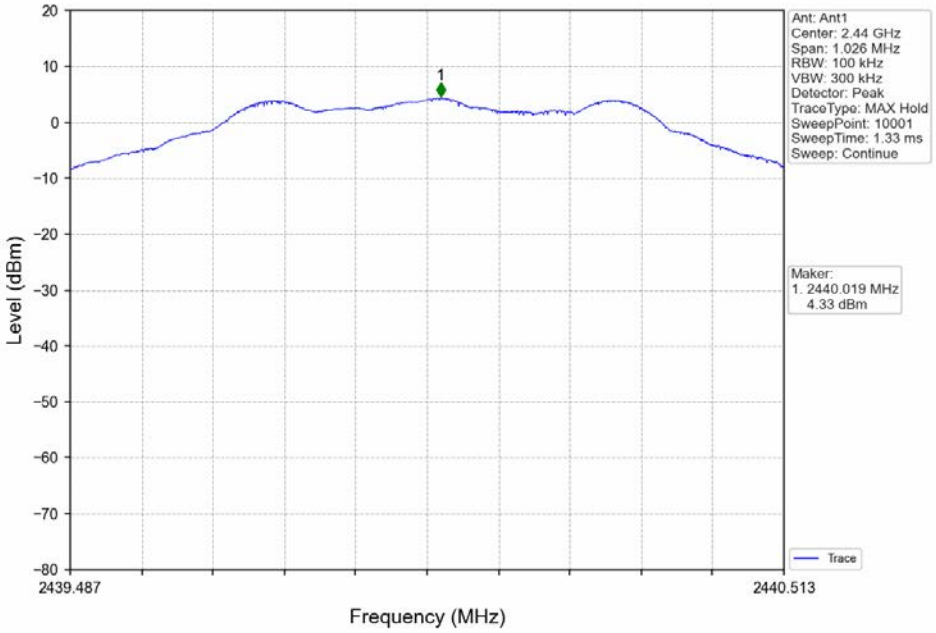
5.1.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV




1M_MCH_2440MHz_DataRate=_Ant1_NTNV

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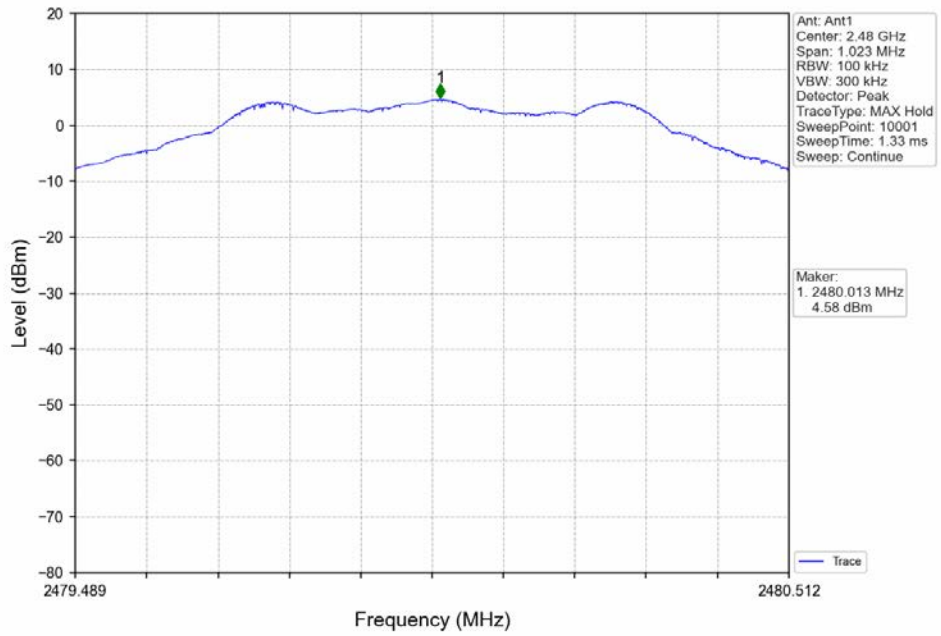
1M_HCH_2480MHz_DataRate=_Ant1_NTNV

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5.2 CSE

5.2.1 Test Result

| Mode | TX Type | Frequency (MHz) | Ant | Level of Reference (dBm) | Limit (dBm) | Verdict |
|---|---|---|---|---|---|---|
| 1M | SISO | 2402 | 1 | 5.23 | -14.77 | Pass |
| | | 2440 | 1 | 5.23 | -14.77 | Pass |
| | | 2480 | 1 | 5.23 | -14.77 | Pass |
| Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level. | | | | | | |

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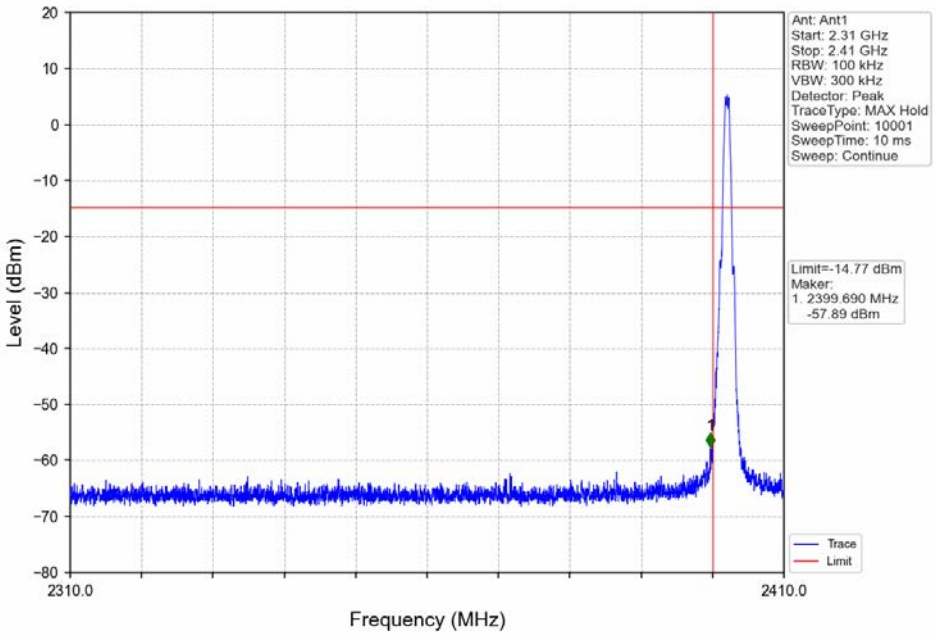
5.2.2 Test Graph

1M_LCH_2402MHz_DataRate=_Ant1_NTNV

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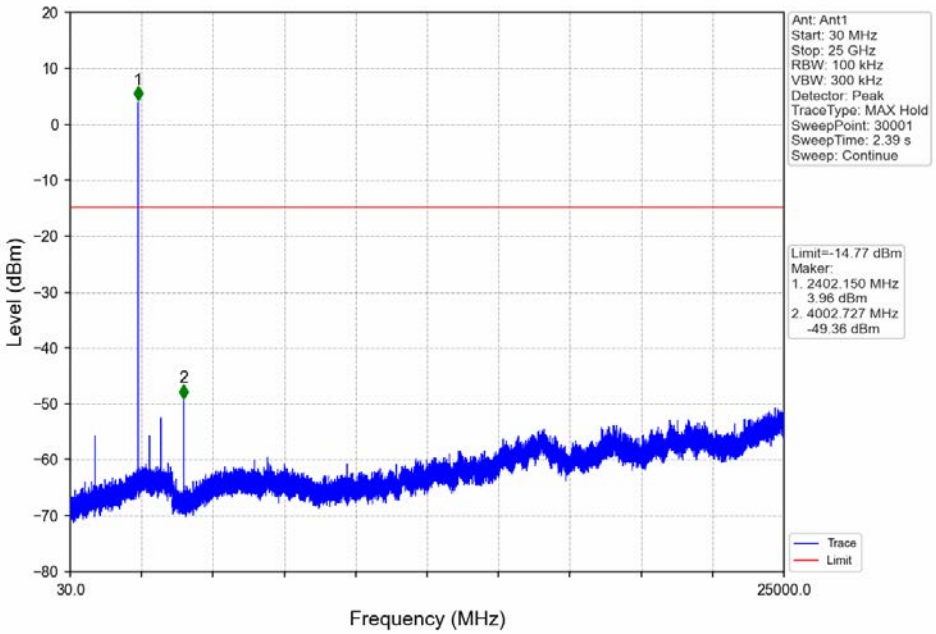


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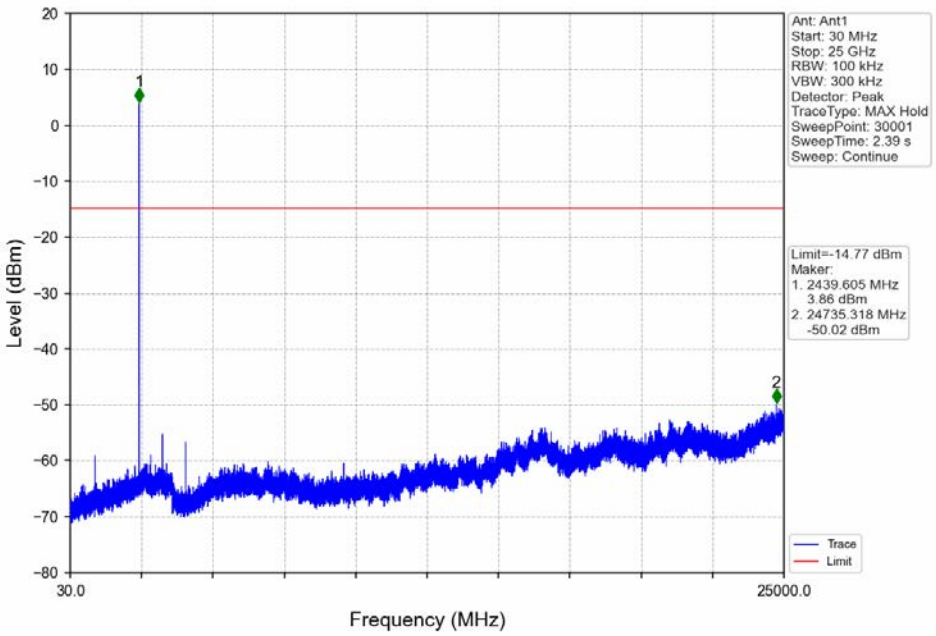


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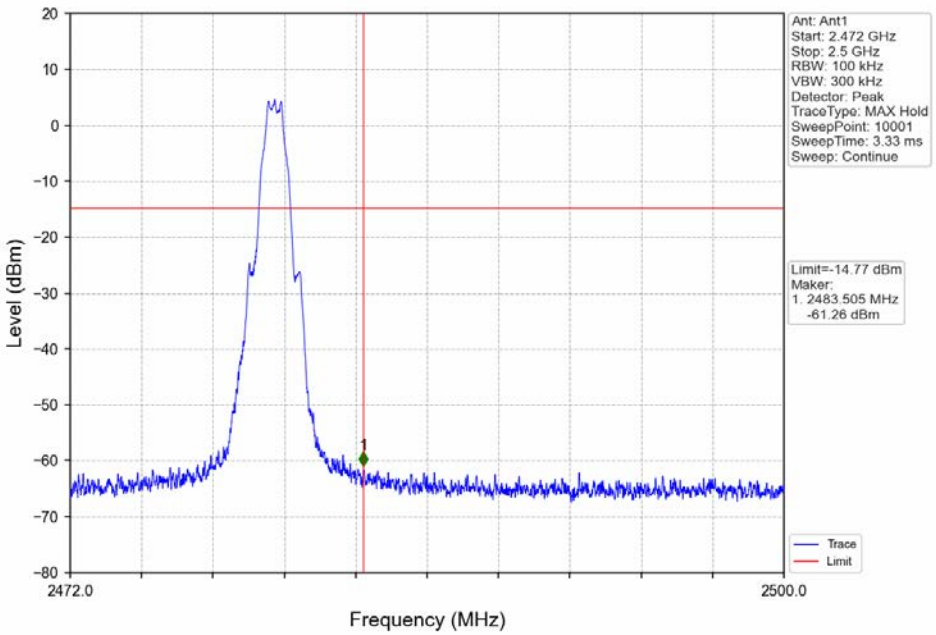


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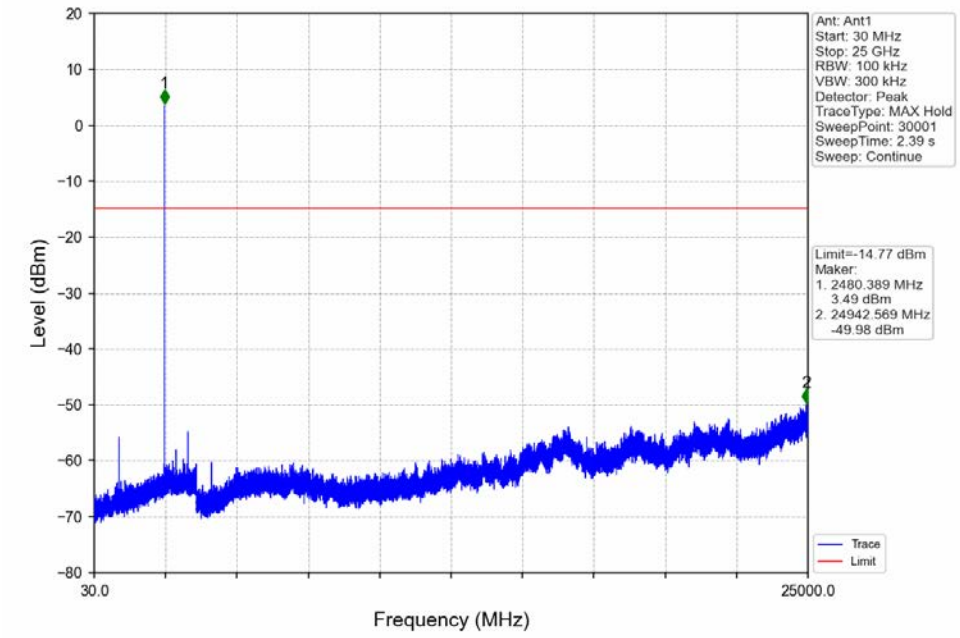


- End of the Report -

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