# FCC Part 15.231

# RSS-GEN ISSUE 5 February 2021 Amendment 2

# RSS-210, ISSUE 10, April 2020 Amendment

# TEST REPORT

For

## Superior Electronics Corporation.

**No.10, Lane 31, Chongde St., Sinyi District, Taipei City 110, Taiwan (R.O.C.)**

**FCC ID: K4E919T4G-1**
**IC: 23770-K919T4GNUQ1**

| **Report Type:** Original Report | **Product Type:** High Frequency Long Range Remote Transmitter |
|---|---|

**Report Producer :** Coco Lin

**Report Number :** RLK221103002RF01

**Report Date :** 2023-03-02

**Reviewed By:** Rory Cheng

**Prepared By:** Bay Area Compliance Laboratories Corp.
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# Revision History

| Revision | No. | Report Number | Issue Date | Description | Author/ Revised by |
|---|---|---|---|---|---|
| 0.0 | RLK221103002 | RLK221103002RF01 | 2023-03-02 | Original Report | Coco Lin |

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# 1 General Information

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

| | |
|---|---|
| Manufacturer | Superior Electronics Corporation. |
| | No.10, Lane 31, Chongde St., Sinyi District, Taipei City 110, Taiwan (R.O.C.) |
| Brand(Trade) Name | ENFORCER |
| Product (Equipment) / PMN | High Frequency Long Range Remote Transmitter |
| Main Model Name / HVIN | FCC : SK-919T4-GNUQ, IC : SK-919T4-GNUQ1 |
| Series Model Name/<br><br><br><br>HVIN | FCC : SK-919T4-GNQ<br>SK-919T3-GNUQ, SK-919T3-GNQ<br>SK-919T2-GNUQ, SK-919T2-GNQ<br>SK-919T1-GBUQ, SK-919T1-GBQ<br>IC : SK-919T4-GNQ1<br>SK-919T3-GNUQ1, SK-919T3-GNQ1<br>SK-919T2-GNUQ1, SK-919T2-GNQ1<br>SK-919T1-GBUQ1, SK-919T1-GBQ1 |
| Model Discrepancy | SK-919T4-GNQ/SK-919T4-GNQ1 4buttons transmitter, plastic with logo<br>SK-919T4-GNUQ/SK-919T4-GNUQ1 4buttons transmitter, plastic no logo<br>SK-919T3-GNQ/SK-919T3-GNQ1 3buttons transmitter, plastic with logo<br>SK-919T3-GNUQ/SK-919T3-GNUQ1 3buttons transmitter, plastic no logo<br>SK-919T2-GNQ/SK-919T2-GNQ1 2buttons transmitter, plastic with logo<br>SK-919T2-GNUQ/SK-919T2-GNUQ1 2buttons transmitter, plastic no logo<br>SK-919T1-GBQ/SK-919T1-GBQ1 1button transmitter, plastic with logo<br>SK-919T1-GBUQ/SK-919T1-GBUQ1 1button transmitter, plastic no logo |
| Frequency Range | 315 MHz |
| Modulation Type | ASK |
| Number of Channels | 1 Channel |
| Antenna Specification | N/A |
| Power Operation | DC 3Vdc from Battery |
| Received Date | 2022/11/14 |
| Date of Test | 2023/01/18 |

*All measurement and test data in this report was gathered from production sample serial number:

SK-919T4-GNUQ/SK-919T4-GNUQ1 sample serial number is RLK221103002-01

SK-919T4-GNQ/SK-919T4-GNQ1 sample serial number is RLK221103002-02

SK-919T3-GNUQ/SK-919T3-GNUQ1 sample serial number is RLK221103002-03

SK-919T3-GNQ/SK-919T3-GNQ1 sample serial number is RLK221103002-04

SK-919T2-GNUQ/SK-919T2-GNUQ1 sample serial number is RLK221103002-05
SK-919T2-GNQ/SK-919T2-GNQ1 sample serial number is RLK221103002-06
SK-919T1-GBUQ/SK-919T1-GBUQ1 sample serial number is RLK221103002-07
SK-919T1-GBQ/SK-919T1-GBQ1 sample serial number is RLK221103002-08
(Assigned by BACL, Linkou Laboratory).

## 1.2 Objective

This report is prepared on behalf of Superior Electronics Corporation. all the test measurements were Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commission's rules, and RSS-210, Issue 10, April 2020 Amendment of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, February 2021 Amendment 2, General Requirements for Compliance of Radio Apparatus

## 1.3 Related Submittal(s)/Grant(s)

N/A

## 1.4 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, and RSS-210, Issue 10, April 2020 Amendment of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, February 2021 Amendment 2, General Requirements for Compliance of Radio Apparatus.

## 1.5 Statement

Decision Rule: No, (The test results do not include MU judgment)


Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (Linkou Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

## 1.6 Measurement Uncertainty

| Parameter | | Uncertainty |
|---|---|---|
| Emissions Bandwidth | | +/- 0.94 MHz |
| Unwanted Emissions, conducted | | +/- 0.77 dB |
| Emissions, radiated | 30 MHz~1GHz | +/- 5.48 dB |
| | 1 GHz~18 GHz | +/- 5.53 dB |
| Temperature | | +/- 1.27 °C |
| Humidity | | +/- 3 % |

## 1.7 Environmental Conditions

| Test Site | Test Date | Temperature (℃) | Relative Humidity (%) | ATM Pressure (hPa) | Test Engineer |
|---|---|---|---|---|---|
| Radiation Spurious Emissions | 2023/1/18 | 17.7 | 60 | 1010 | Allen Cheng |
| Deactivation Test | 2023/1/18 | 17.7 | 60 | 1010 | Allen Cheng |
| Emissions Bandwidth | 2023/1/18 | 17.7 | 60 | 1010 | Allen Cheng |

## 1.8 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Linkou Laboratory) to collect test data is located on

☒ No.6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.).

Bay Area Compliance Laboratories Corp. (Linkou Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3546) and the FCC designation No.TW3546 under the Mutual Recognition Agreement (MRA) in FCC Test.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: TW3546.

# 2 System Test Configuration

## 2.1 Description of Test Configuration

Channel list:

| Channel | Frequency (MHz) |
|---|---|
| 1 | 315 |

The system was configured for testing in an engineering mode, which was provided by manufacturer.

## 2.2 Equipment Modifications

No modification was made to the EUT.

## 2.3 EUT Exercise Software

No test software was used

## 2.4 Test Mode

Pre-scan

Radiated Spurious Emissions

Evaluate all modes and buttons duty cycle and Power Level.

All buttons have the same duty cycle.

Power Level worst case is the SK-919T4-GNUQ button 1

## 2.5 Support Equipment List and Details

N/A

## 2.6 External Cable List and Details

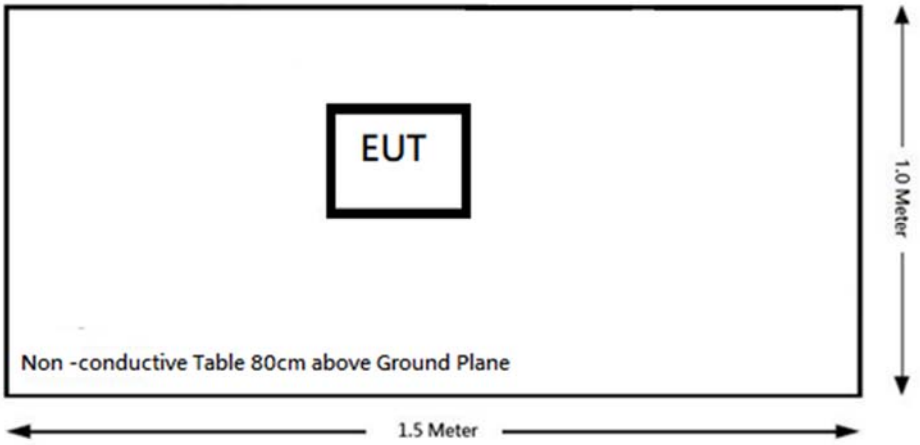
N/A

## 2.7 Block Diagram of Test Setup

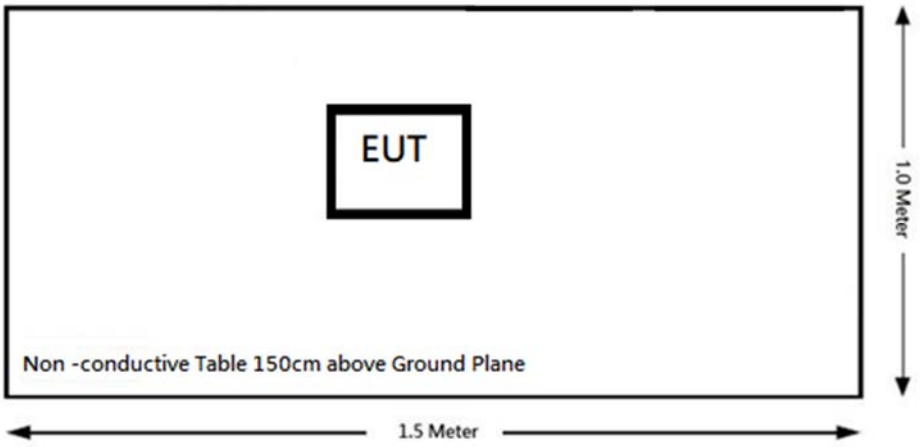
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

**Radiation:**

Below 1GHz:




Above 1GHz:



## 2.8 Pulse desensitization factor

| Radio Mode | On Time (ms) | Period (ms) | Pulse desensitization factor (dB) |
|---|---|---|---|
| 315 | 19.54 | 49.2 | -8.02 |

Note:

Pulse desensitization factor = 20log(On time/ Period)

Period of the pulse train, or 100 ms if the pulse train length is greater than 100 ms

There are two types of pulse,

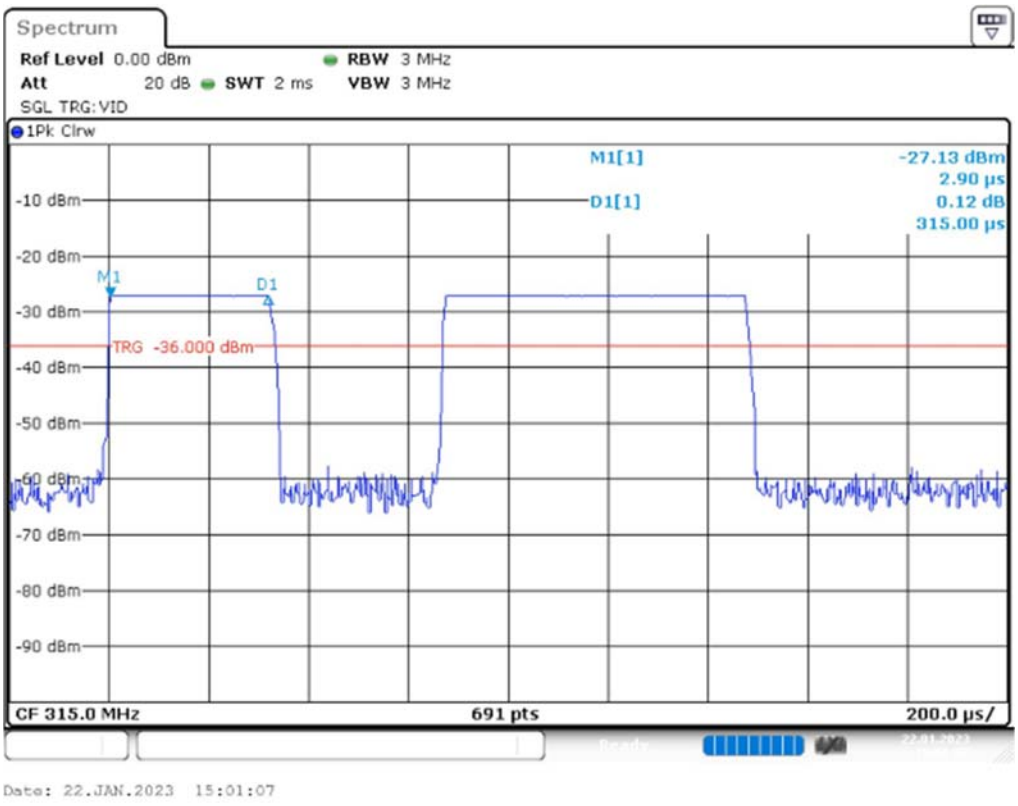
N1=19 pulse, pulse time = 315 us

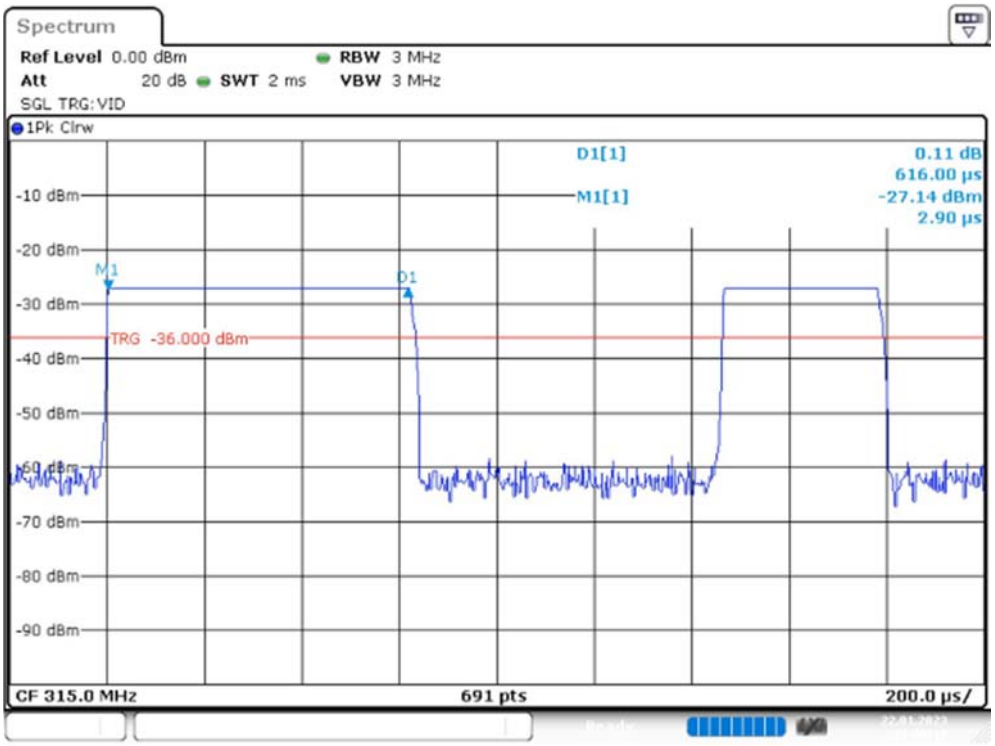
N2=22 pulse, pulse time = 616 us

N1+N2 on time = 19.54 ms

Please refer to the following plots.

**315 Mode**



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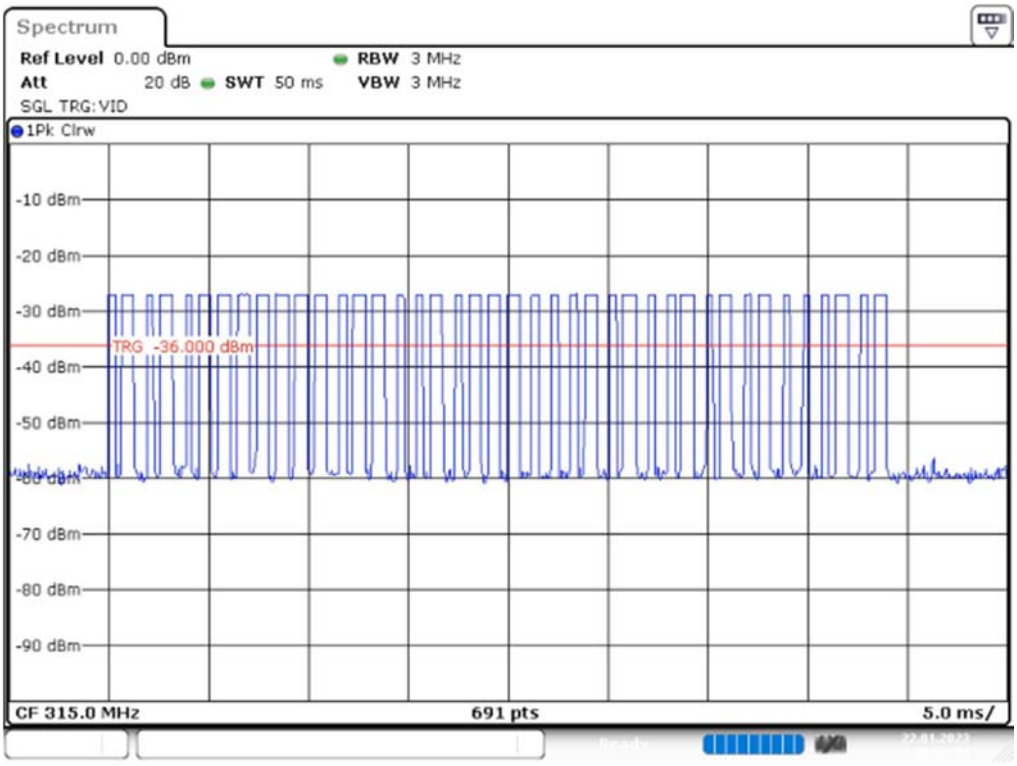
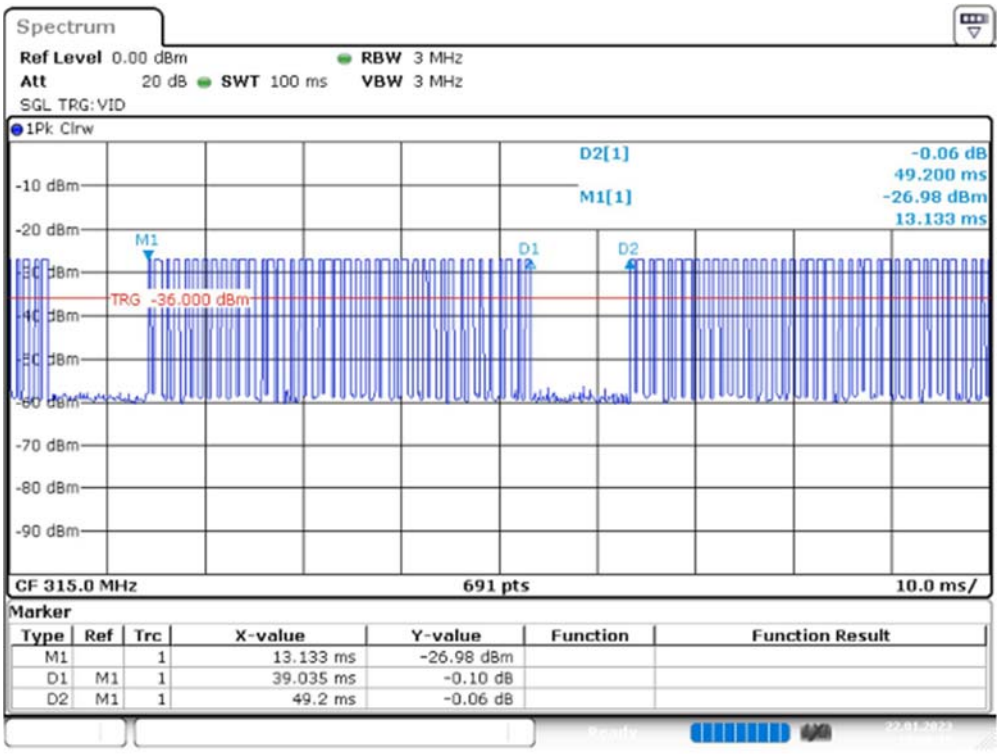



Date: 22.JAN.2023 14:57:04




Date: 22.JAN.2023 15:08:20

# 3 Summary of Test Results

| FCC Rules | Description of Test | Results |
|---|---|---|
| RSS-102 Clause 2.5.1 | Exemption Limits For Routine Evaluation-SAR Evaluation | Compliance |
| §15.203<br>RSS-GEN Clause 6.8 | Antenna Requirement | Compliance |
| §15.207(a)<br>RSS-Gen Clause 8.8 | Conducted Emissions | Not applicable |
| §15.205, §15.209, §15.231(b)<br>RSS-Gen Clause 8.10<br>RSS-210 Annex A, A.1.2 | Radiated Emissions | Compliance |
| §15.231(a)(1)<br>RSS-210 Annex A, A.1.1 | Deactivation Test | Compliance |
| §15.231(c) | 20dB Emission Bandwidth | Compliance |
| RSS-Gen Clause 6.7<br>RSS-210 Annex A, A.1.3 | 99% Occupied Bandwidth | Compliance |
| §1.1307(b)(3)(i) | RF Exposure | Compliance |

Not Applicable: the device was powered by battery.

# 4 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Radiated Room (966-A) | | | | | |
| Bilog Antenna with 6 dB Attenuator | SUNOL SCIENCES & EMCI | JB3 & N-6-06 | A111513 & AT-N0668 | 2022/4/11 | 2023/4/10 |
| Horn Antenna | ETS-Lindgren | 3115 | 109141 | 2022/7/13 | 2023/7/12 |
| Preamplifier | A.H. Systems | PAM-0118P | 470 | 2022/3/23 | 2023/3/22 |
| ESR EMI Test Receiver | Rohde & Schwarz | ESR3 | 102448 | 2022/9/29 | 2023/9/28 |
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101457 | 2022/09/13 | 2023/09/12 |
| Microflex Cable (0.9m) | UTIFLEX | W6103 | LKTE381 | 2022/6/30 | 2023/6/29 |
| Microflex Cable (2m) | EMCI | EMC106-SM-SM-2000 | 180515 | 2022/8/5 | 2023/8/4 |
| Microflex Cable (8m) | UTIFLEX | UFA210A-1-3149-300300 | MFR 64639 232490-001 | 2022/8/5 | 2023/8/4 |
| Software | AUDIX | E3 V9 | E3LK-01 | N.C.R | N.C.R |

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements*

# 5 FCC §15.203 & RSS-GEN Clause 6.8– Antenna Requirements

## 5.1 Applicable Standard

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. fo transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

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

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested. For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

## 5.2 Antenna Connected Construction

This antenna is on board PCB antenna.

**Result:** Compliant.

# 6 RSS-102 § 2.5.1 – EXEMPTION LIMITS FROM ROUTINE EVALUATION – SAR EVALUATION

## 6.1 Applicable Standard

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance

| Frequency (MHz) | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300 | 71 mW | 101 mW | 132 mW | 162 mW | 193 mW |
| 450 | 52 mW | 70 mW | 88 mW | 106 mW | 123 mW |
| 835 | 17 mW | 30 mW | 42 mW | 55 mW | 67 mW |
| 1900 | 7 mW | 10 mW | 18 mW | 34 mW | 60 mW |
| 2450 | 4 mW | 7 mW | 15 mW | 30 mW | 52 mW |
| 3500 | 2 mW | 6 mW | 16 mW | 32 mW | 55 mW |
| 5800 | 1 mW | 6 mW | 15 mW | 27 mW | 41 mW |
| **Frequency (MHz)** | **Exemption Limits (mW)** | | | | |
| | **At separation distance of 30 mm** | **At separation distance of 35 mm** | **At separation distance of 40 mm** | **At separation distance of 45 mm** | **At separation distance of ≥50 mm** |
| ≤300 | 223 mW | 254 mW | 284 mW | 315 mW | 345 mW |
| 450 | 141 mW | 159 mW | 177 mW | 195 mW | 213 mW |
| 835 | 80 mW | 92 mW | 105 mW | 117 mW | 130 mW |
| 1900 | 99 mW | 153 mW | 225 mW | 316 mW | 431 mW |
| 2450 | 83 mW | 123 mW | 173 mW | 235 mW | 309 mW |
| 3500 | 86 mW | 124 mW | 170 mW | 225 mW | 290 mW |
| 5800 | 56 mW | 71 mW | 85 mW | 97 mW | 106 mW |

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

## 6.2 Calculated Data:

According to Table 1, for the separation distance is less than or equal to 5 mm, the exemption limit for <300MHz is 71mW and the exemption limit for 450MHz is 52mW, so the exemption limit for 315MHz = 52mW + (450MHz-315MHz)*(71mW-52mW) / (450MHz-300MHz) = 69 mW

Exemption from Routine Evaluation Limit is:

Calculate the EIRP from the radiated field strength in the far field using Equation

EIRP= $E_{Meas}$ + 20log ($d_{Meas}$)−104.7

EIRP= 68.17 dBμV/m -95.2 = -27.03 dBm

EIRP Tune-up power = -27.03 dBm = 0.002 mW < 69 mW

**Result:** The device meets the exemption requirement.

# 7 FCC §15.209, §15.205 , §15.231(b) & RSS-210 Annex A.1.2, RSS-GEN Clause 8.10– Radiated Emissions

## 7.1 Applicable Standard

FCC §15.205, §15.209, §15.231 (b)

According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emission (microvolts/meter) |
|---|---|---|
| 40.66 – 40.70 | 2250 | 225 |
| 70 – 130 | 1250 | 125 |
| 130 – 174 | 1250 to 3750 ** | 125 to 375 ** |
| 174 – 260 | 3750 | 375 |
| 160 – 470 | 3750 to 12500 ** | 375 to 1250 ** |
| Above 470 | 12500 | 1250 |

**: Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

RSS-210, Annex A, A.1.2

Following are the requirements for field strength of emissions:

(a) The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in table A1, based on the average value of the measured emissions. The requirements of the “Pulsed operation” section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions.

Alternatively, compliance with the limits in table A1 may be demonstrated using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

(b) Unwanted emissions shall be 10 times below the fundamental emissions field strength limits in table A1 or comply with the limits specified in RSS-Gen, whichever is less stringent.

Table A1 — Permissible field strength limits for momentarily operated devices

| Fundamental frequency (MHz), excluding restricted frequency bands specified in RSS-Gen | Field strength of the fundamental emissions (μV/m at 3 m) |
|---|---|
| 70-130 | 1,250 |
| 130-174 | 1,250 to 3,750* |
| 174-260** | 3,750 |
| 260-470** | 3,750 to 12,500* |
| Above 470 | 12,500 |

* Linear interpolation with frequency, f, in MHz:

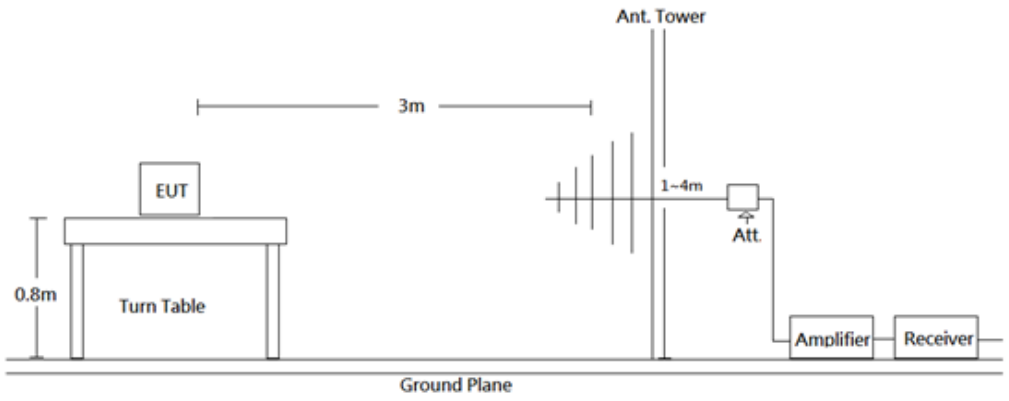
For 130-174 MHz: Field Strength (μV/m) = (56.82 x f)-6136

For 260-470 MHz: Field Strength (μV/m) = (41.67 x f)-7083

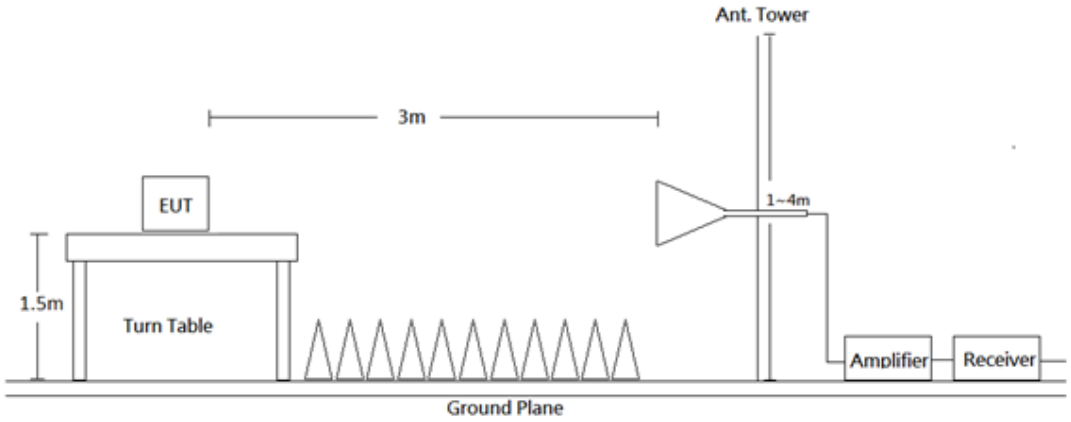
** Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

## 7.2 EUT Setup

Below 1 GHz:




Above 1 GHz:




Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209, FCC 15.231 and RSS-GEN, RSS-210 limits.

## 7.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 5 GHz. During the radiated emission test, the test receiver was set with the following configurations:

| Frequency Range | RBW | VBW | Detector |
|---|---|---|---|
| 30-1000 MHz | 120 kHz | 300k | QP |
| Above 1 GHz | 1 MHz | 3 MHz | PK |

## 7.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

## 7.5 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss – Amplifier Gain

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

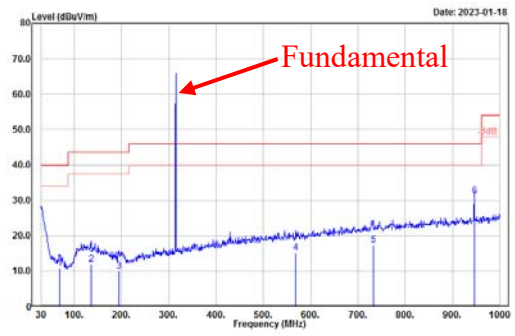
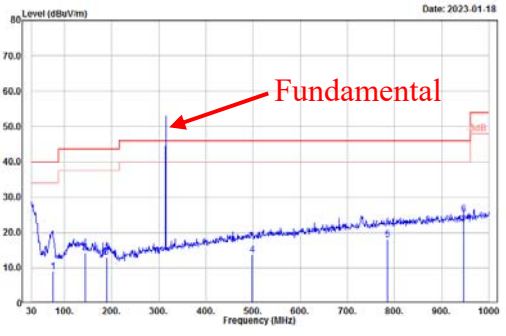
Over Limit = Level – Limit Line

## 7.6 Test Results

*Test Mode: Transmitting*

*(Pre-scan with three orthogonal axis, and worse case as Z axis.)*

30MHz-1GHz

| Horizontal | Vertical |
|---|---|
|  |  |

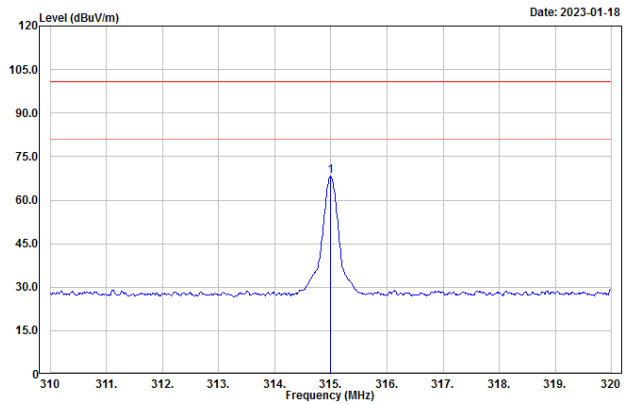
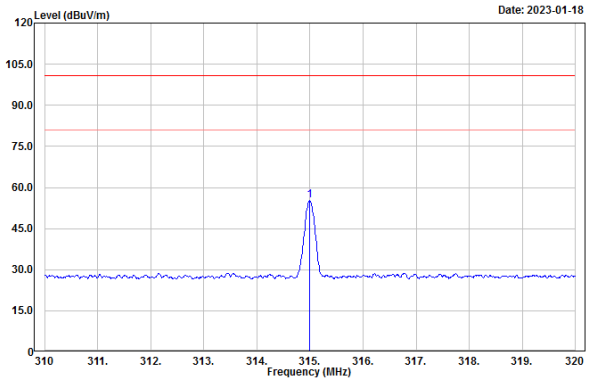


| | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | 68.800 | 10.93 | 40.00 | -29.07 | 34.23 | -23.30 | QP |
| 2 | 135.730 | 11.90 | 43.50 | -31.60 | 30.96 | -19.06 | QP |
| 3 | 194.900 | 10.07 | 43.50 | -33.43 | 30.30 | -20.23 | QP |
| 4 | 568.350 | 15.08 | 46.00 | -30.92 | 29.17 | -14.09 | QP |
| 5 | 732.280 | 17.31 | 46.00 | -28.69 | 28.83 | -11.52 | QP |
| 6 | 945.680 | 31.23 | 46.00 | -14.77 | 40.41 | -9.18 | QP |

| | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | 75.590 | 8.80 | 40.00 | -31.20 | 32.60 | -23.80 | QP |
| 2 | 143.490 | 14.38 | 43.50 | -29.12 | 33.87 | -19.49 | QP |
| 3 | 189.080 | 12.93 | 43.50 | -30.57 | 34.02 | -21.09 | QP |
| 4 | 498.510 | 13.56 | 46.00 | -32.44 | 28.71 | -15.15 | QP |
| 5 | 784.660 | 17.95 | 46.00 | -28.05 | 28.74 | -10.79 | QP |
| 6 | 945.680 | 25.18 | 46.00 | -20.82 | 34.36 | -9.18 | QP |

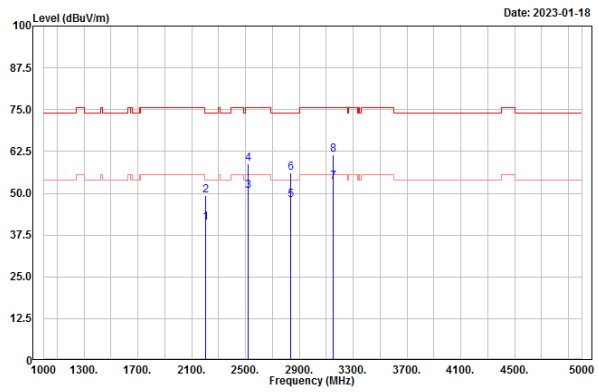
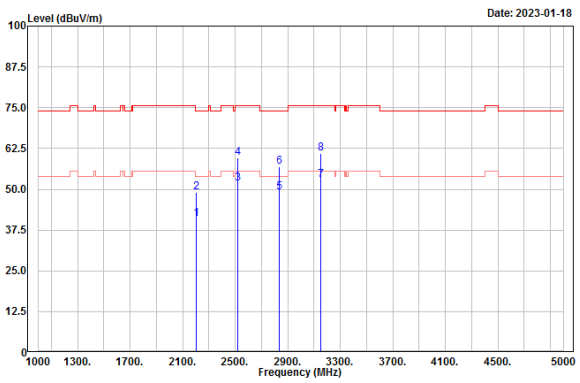
Level = Read Level + Factor
Over Limit = Level – Limit Line
Factor = Antenna Factor + Cable Loss – Amplifier Gain

Fundamental:

| Horizontal | Vertical |
|---|---|
|  |  |



1GHz-5GHz:

| Horizontal | Vertical |
|---|---|
|  |  |

## Horizontal

| | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | 315.000 | 68.17 | 95.62 | -27.45 | 87.66 | -19.49 | Peak |

| | | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | ! | 2205.000 | 41.18 | 54.00 | -12.82 | 51.04 | -9.86 | Average |
| 2 | | 2205.000 | 49.20 | 74.00 | -24.80 | 59.06 | -9.86 | Peak |
| 3 | ! | 2520.000 | 50.77 | 55.62 | -4.85 | 59.56 | -8.79 | Average |
| 4 | ! | 2520.000 | 58.79 | 75.62 | -16.83 | 67.58 | -8.79 | Peak |
| 5 | ! | 2835.000 | 48.04 | 54.00 | -5.96 | 55.81 | -7.77 | Average |
| 6 | ! | 2835.000 | 56.06 | 74.00 | -17.94 | 63.83 | -7.77 | Peak |
| 7 | ! | 3150.000 | 53.38 | 55.62 | -2.24 | 59.72 | -6.34 | Average |
| 8 | ! | 3150.000 | 61.40 | 75.62 | -14.22 | 67.74 | -6.34 | Peak |

## Vertical

| | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | 315.000 | 55.20 | 95.62 | -40.42 | 74.69 | -19.49 | Peak |

| | | Freq | Level | Limit Line | Over Limit | Read Level | Factor | Remark |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV/m | dBuV/m | dB | dBuV | dB/m | |
| 1 | ! | 2205.000 | 40.94 | 54.00 | -13.06 | 50.80 | -9.86 | Average |
| 2 | | 2205.000 | 48.96 | 74.00 | -25.04 | 58.82 | -9.86 | Peak |
| 3 | ! | 2520.000 | 51.65 | 55.62 | -3.97 | 60.44 | -8.79 | Average |
| 4 | ! | 2520.000 | 59.67 | 75.62 | -15.95 | 68.46 | -8.79 | Peak |
| 5 | ! | 2835.000 | 48.98 | 54.00 | -5.02 | 56.75 | -7.77 | Average |
| 6 | ! | 2835.000 | 57.00 | 74.00 | -17.00 | 64.77 | -7.77 | Peak |
| 7 | ! | 3150.000 | 52.94 | 55.62 | -2.68 | 59.28 | -6.34 | Average |
| 8 | ! | 3150.000 | 60.96 | 75.62 | -14.66 | 67.30 | -6.34 | Peak |

Level = Read Level + Factor
Over Limit = Level – Limit Line
Factor = Antenna Factor + Cable Loss – Amplifier Gain
Average = Peak + Pulse desensitization factor

# 8 FCC §15.231(a)(1) & RSS-210 Annex A, A1.1(a)–Deactivation Testing

## 8.1 Applicable Standard

Per FCC §15.231(a) (1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

RSS-210, Annex A, A.1.1(a)

A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released

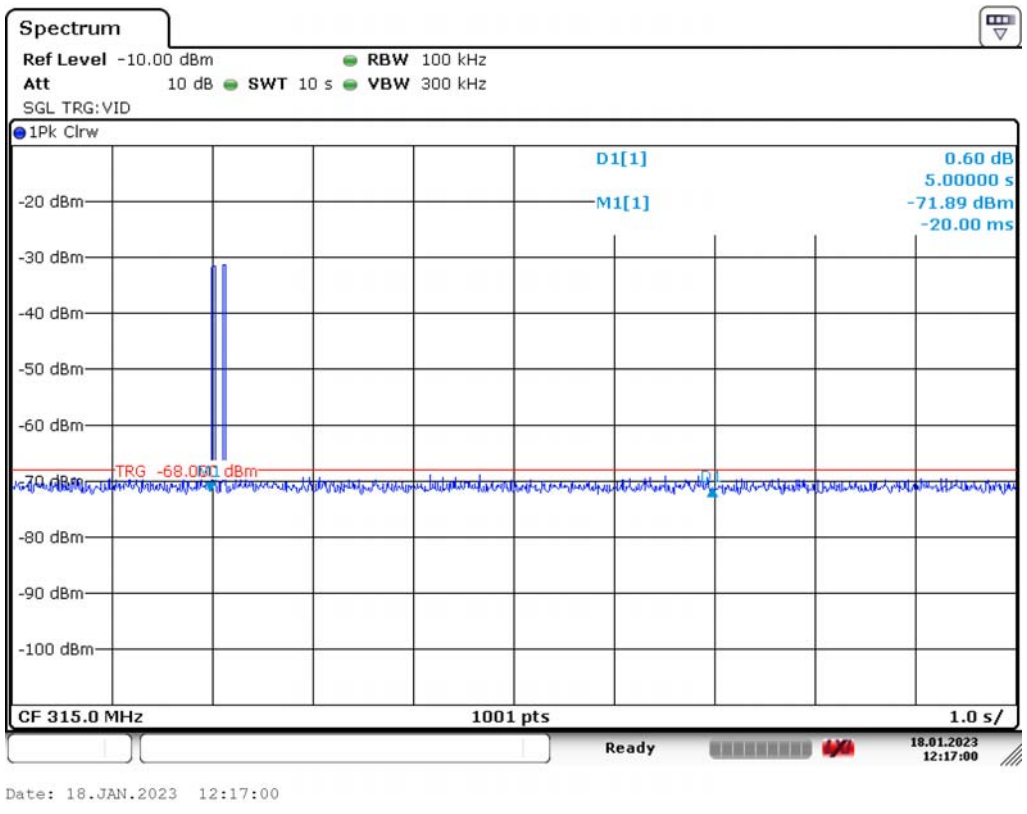
## 8.2 Test Procedure

1. With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100k VBW=300k Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

## 8.3 Test Results

*Test mode: Transmitting*

**5S**



# 9 FCC §15.231(c) – 20 dB Emission Bandwidth Testing

## 9.1 Applicable Standard

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

## 9.2 Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

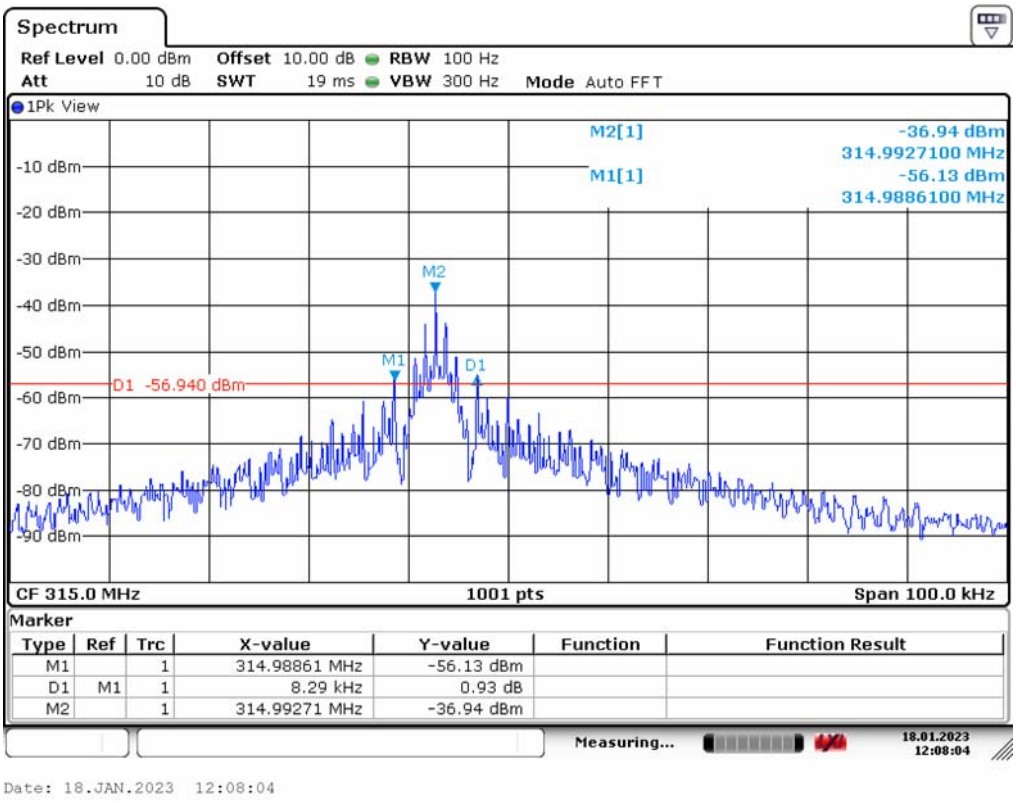
## 9.3 Test Results

| Frequency (MHz) | 20 dB Emission Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 315 | 8.29 | 787.5 | Compliance |

**Note:** Limit = 0.25% * Center Frequency = 0.25% * 315 MHz = 787.5 kHz

*Test mode: Transmitting*

**20 dB Emission Bandwidth**



# 10 RSS-210 Annex A, A.1.3, RSS-GEN Clause 6.7– 99% Occupied Bandwidth

## 10.1 Applicable Standard

According to RSS-210 Annex A A.1.3:

The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.

According to RSS-Gen Clause 6.7:

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

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

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span. The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold,

may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

## 10.2 Test Procedure

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

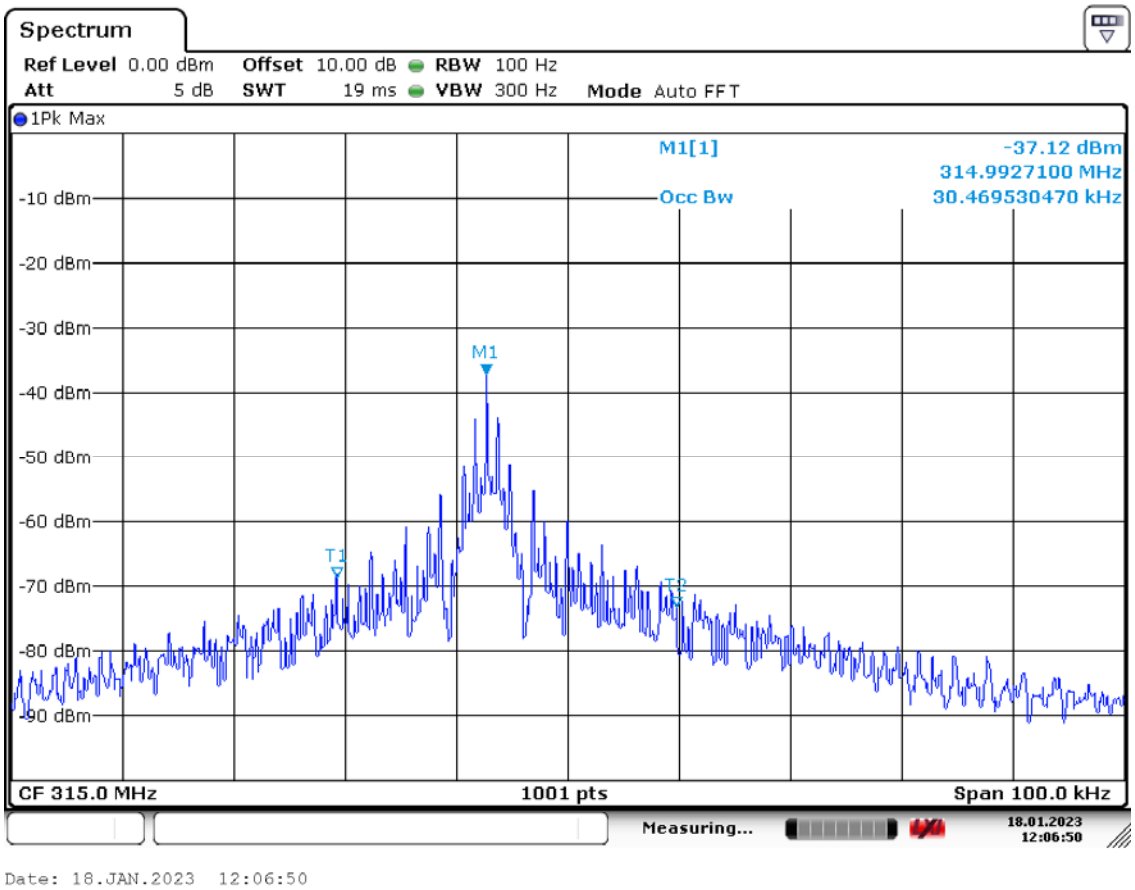
## 10.3 Test Results

| Frequency (MHz) | 99% Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 315 | 30.47 | 787.5 | Compliance |

**Note:** Limit = 0.25% * Center Frequency = 0.25% * 315 MHz = 787.5 kHz

*Test mode: Transmitting*

**99% Emission Bandwidth**



# 11 FCC §1.1307(b)(3)(i)–RF Exposure

## 11.1 Applicable Standard

According to subpart §1.1307(b)(3)(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

For single RF sources (*i.e.,* any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);
(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). *Pth* is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^x & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where $\lambda$ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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

Expand Table

| 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 | 19.2$R^2$. |

The sequence to apply for single portable RF sources includes the following steps:

1) determination of 1 mW blanket exemption under § 1.1307(b)(3)(i)(A)

2) determination of exemption under the MPE-based § 1.1307(b)(3)(i)(C) if 1) is not met

3) determination of exemption under the SAR-based § 1.1307(b)(3)(i)(B) if both 1) and 2) are not met

## 11.2 Calculated Data:

Calculate the ERP from the radiated field strength in the far field using Equation

EIRP= $E_{Meas}$ + 20log ($d_{Meas}$)−104.7

EIRP= 68.17 dBμV/m -95.2 = -27.03 dBm

ERP= -27.03 – 2.15 = -29.18 dBm

Project info

| Band | Freq (MHz) | Distances (mm) | ERP (dBm) | ERP (mW) |
|---|---|---|---|---|
| SRD | 315 | 5 | -29.18 | 0.001 |

§ 1.1307(b)(3)(i)(A)

The available maximum time-averaged power is no more than 1 mW

| Band | Freq (MHz) | Result Option A |
|---|---|---|
| SRD | 315 | exempt |

§ 1.1307(b)(3)(i)(A) method is applicable.

**Result:** The device meets the exemption requirement.

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