# FCC PART 15.249

# RSS-GEN, ISSUE 5 MARCH 2019 AMENDMENT 1
# RSS-210, ISSUE 10, DECEMBER 2019

# TEST REPORT

For

# SZ DJI TECHNOLOGY CO., LTD

14th floor, West Wing, Skyworth Semiconductor Design Building NO.18
Gaoxin South 4th Ave, Nanshan District, Shenzhen, Guangdong, China

**FCC ID:SS3-RD242008**
**IC:11805A-RD242008**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | Omnidirectional Digital Radar |

| | |
|---|---|
| **Report Number:** | RDG200817004-00B |
| **Report Date:** | 2020-09-27 |
| **Reviewed By:** | Ivan Cao<br>Assistant Manager |
| **Test Laboratory:** | Bay Area Compliance Laboratories Corp. (Dongguan)<br>No.69 Pulongcun, Puxinhu Industry Area,<br>Tangxia, Dongguan, Guangdong, China<br>Tel: +86-769-86858888<br>Fax: +86-769-86858891<br>www.baclcorp.com.cn |

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# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

| | |
|---|---|
| **Manufacturer:** | SZ DJI TECHNOLOGY CO., LTD |
| **Manufacturer address:** | 14th floor, West Wing, Skyworth Semiconductor Design Building NO.18 Gaoxin South 4th Ave, Nanshan District, Shenzhen, Guangdong, China |
| **EUT Name:** | Omnidirectional Digital Radar |
| **Test Model:** | RD2428R |
| **Operation Frequency:** | 24150MHz |
| **Modulation Type:** | FMCW |
| **Rated Input Voltage:** | DC 12V from system |
| **Serial Number:** | RDG200817004-RF-S2 |
| **EUT Received Date:** | 2020.08.25 |
| **EUT Received Status:** | Good |

## Objective

This type approval report is prepared on behalf of ***SZ DJI TECHNOLOGY CO., LTD*** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-210, Issue 10, December 2019 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules and RSS-Gen Issue 5, March 2019, Amendment 1, General Requirements for Compliance of Radio Apparatus.

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

Part of System with FCC ID:SS3-RM5001808,IC:11805A-RM5001808

## 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 the RSS-210, Issue 10, December 2019. Applicable Standard: Licence-Exempt Radio Apparatus: Category I Equipment. And RSS-Gen Issue 5, March 2019, Amendment 1,, General Requirements for Compliance of Radio Apparatus.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

## Measurement Uncertainty

| Parameter | Measurement Uncertainty |
|---|---|
| Occupied Channel Bandwidth | ±5 % |
| Unwanted Emissions, radiated | 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical<br>200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical<br>1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB |
| Temperature | ±1℃ |
| Humidity | ±5% |
| DC and low frequency voltages | ±0.4% |
| Duty Cycle | 1% |
| AC Power Lines Conducted Emission | 3.12 dB (150 kHz to 30 MHz) |

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

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

## Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "Δ". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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# SYSTEM TEST CONFIGURATION

## Justification

The EUT was configured in swept mode for testing which was provided by the manufacturer.

The device have two antenna panel, one Omnidirectional antenna and one Directional antenna

## EUT Exercise Software

No software was used in test.

## Equipment Modifications

No modifications were made to the EUT.

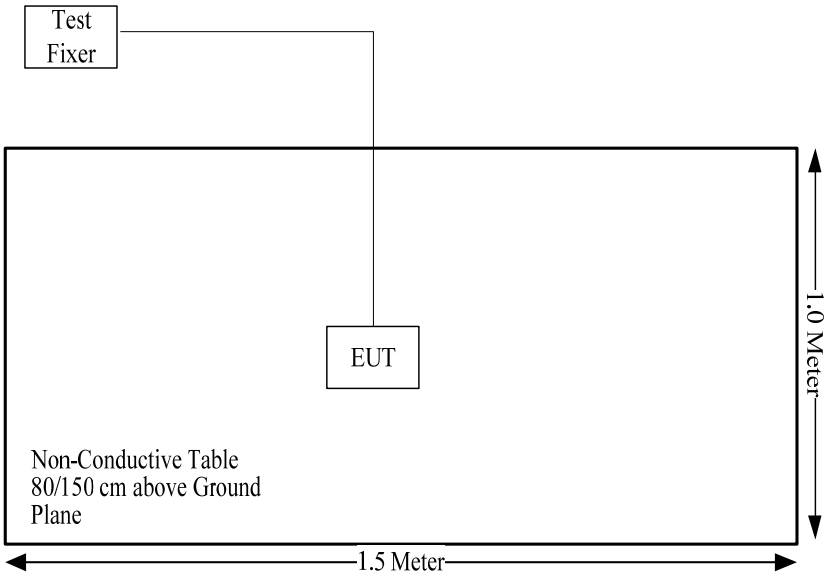
## Local Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| DJI | Test Fixer | Un-known | RDG200817004-RF-S8 |

## Support Cable List and Details

| Cable Description | Shielding Type | Ferrite Core | Length (m) | From Port | To |
|---|---|---|---|---|---|
| Signal Cable | Yes | No | 3 | Test Fixer | EUT |

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|---|---|---|
| §15.203 | Antenna Requirement | Compliance |
| §15.207(a) | Conduction Emissions | Not Applicable |
| 15.205, §15.209, §15.249 | Radiated Emissions | Compliance |
| §15.215 (c) | 20 dB Bandwidth | Compliance |

Not Applicable: The EUT was powered by DC 12V system.

# FCC§15.203， RSS-GEN CLAUSE 6.8 - ANTENNA REQUIREMENT

## Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

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

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. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).
When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.
For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:
This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

## Antenna Connector Construction

The EUT has 2 internal antenna arrangement, and the antenna gain is 17 dBi for Directional antenna, 14dBi for Omnidirectional antenna, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliant.

# FCC§15.205, §15.209&§15.249，RSS-210 ANNEX B.10,RSS -GEN CLAUSE 8.10- RADIATED EMISSIONS

## Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|---|---|---|
| 902–928 MHz | 50 | 500 |
| 2400–2483.5 MHz | 50 | 500 |
| 5725–5875 MHz | 50 | 500 |
| 24.0–24.25 GHz | 250 | 2500 |

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

As per RSS-210 Annex B.10

Devices shall comply with the following requirements:

(a) The field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits in table B2.

**Table B2 — Field strength limits at various frequencies**

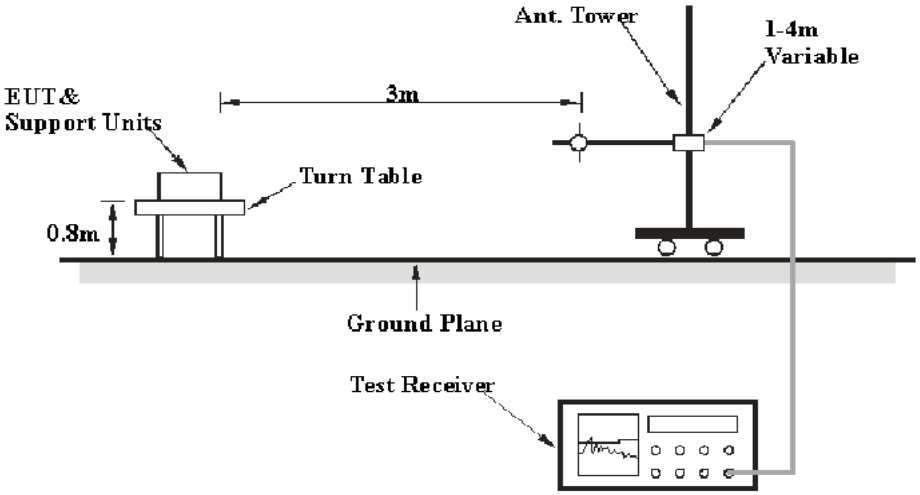
| Frequency bands (MHz) | Field strength (mV/m) | |
|---|---|---|
| | Fundamental emissions | Harmonic emissions |
| 902-928 | 50 | 0.5 |
| 2400-2483.5 | 50 | 0.5 |
| 5725-5875 | 50 | 0.5 |
| 24000-24250 | 250 | 2.5 |

The field strength shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

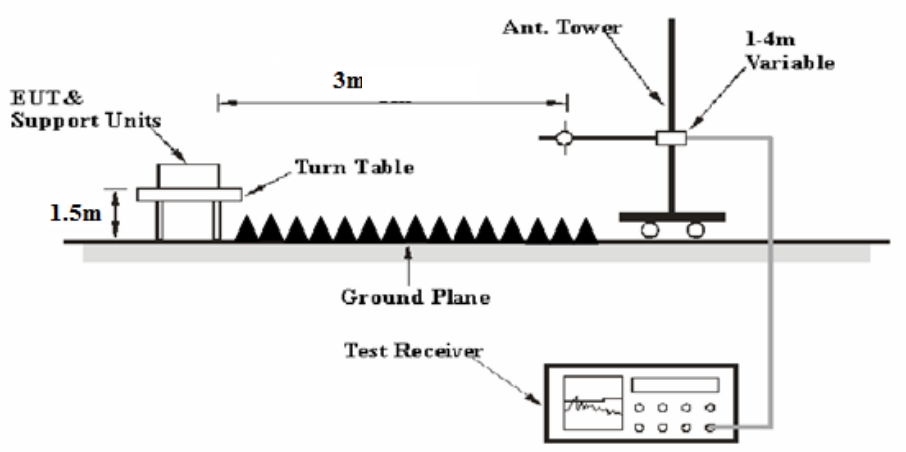
(b) Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

## EUT Setup

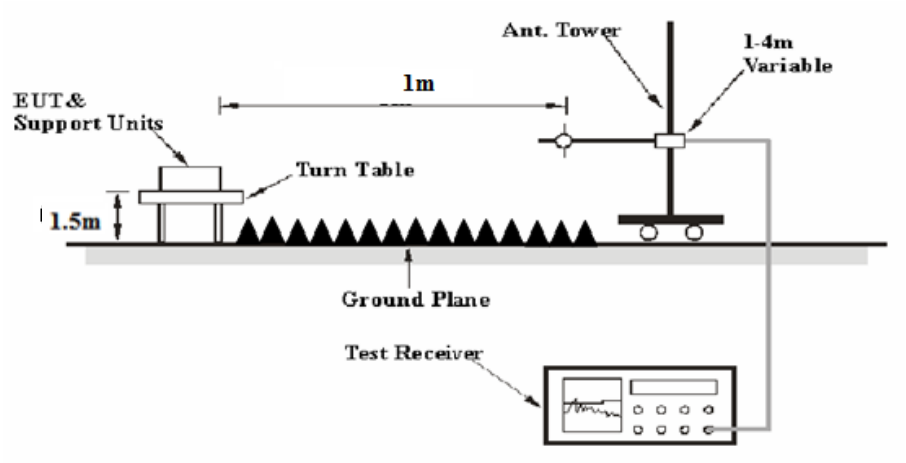
Below 1 GHz:




1-26.5 GHz:



**26.5-100 GHz:**




The radiated emission tests were performed in the 3 meters Chamber A, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

According to C63.10, the 26.5- 100GHz test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1m]) dB
Extrapolation result = Corrected Amplitude (dBμV/m) - distance extrapolation factor (9.54dB)

For above 40GHz, external harmonic mixers are utilized. The antenna is scanned around the entire perimeter surface of the EUT, in both horizontal and vertical polarizations, at the distance of 1m from the EUT for 40-100GHz. The Mixers and it`s RF cables is compose a system for calibration, the conversion factor was added into the test Spectrum Analyzer in testing.

## Test Equipment Setup

The system was investigated from 30 MHz to 100 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

| Frequency Range | RBW | Video B/W | IF B/W | Measurement |
|---|---|---|---|---|
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz | 120 kHz | QP |
| Above 1 GHz | 1MHz | 3 MHz | / | PK |
| | 1MHz | 10 Hz | / | AV |

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

## Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude 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:

Corrected Amplitude = Meter Reading + 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 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit –Corrected Amplitude

Or

Margin = Limit –Extrapolation result

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Sunol Sciences | Antenna | JB3 | A060611-1 | 2017-11-10 | 2020-11-10 |
| R&S | EMI Test Receiver | ESR3 | 102453 | 2020-09-12 | 2021-09-12 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0075-01 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-0400-01 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-NJNJ-50 | C-1400-01 | 2020-05-06 | 2021-05-06 |
| HP | Amplifier | 8447D | 2727A05902 | 2020-09-05 | 2021-09-05 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| ETS-Lindgren | Horn Antenna | 3115 | 000 527 35 | 2018-10-12 | 2021-10-12 |
| Ducommun Technolagies | Horn Antenna | ARH-4223-02 | 1007726-01 1304 | 2017-12-06 | 2020-12-05 |
| Ducommun Technolagies | Horn Antenna | ARH-2823-02 | 1007726-01 1302 | 2017-12-06 | 2020-12-05 |
| R&S | Spectrum Analyzer | FSP 38 | 100478 | 2020-07-07 | 2021-07-07 |
| Agilent | Spectrum Analyzer | E4440A | SG43360054 | 2020-07-07 | 2021-07-07 |
| Unknown | Coaxial Cable | C-SJSJ-50 | C-0800-01 | 2020-09-05 | 2021-09-05 |
| Unknown | Coaxial Cable | C-2.4J2.4J-50 | C-0700-02 | 2020-06-27 | 2021-06-27 |
| Mini-Circuit | Amplifier | ZVA-213-S+ | 54201245 | 2020-09-05 | 2021-09-05 |
| Quinstar | Amplifier | QLW-18405536-JO | 15964001001 | 2020-06-27 | 2021-06-27 |
| Farad | Test Software | EZ-EMC | V1.1.4.2 | N/A | N/A |
| R&S | Spectrum Analyzer | 8564E | 3943A01781 | 2019-01-06 | 2020-01-06 |
| MICRO-COAX | Coaxial Cable | UFA147-1-2362-100100 | 64639 231029-001 | 2020-02-24 | 2021-02-24 |
| OML | Harmonic Mixer | WR19/M19HWD | U60313-1 | 2019-10-14 | 2022-10-14 |
| OML | Horn Antenna | M19RH | 11648-01 | 2019-10-14 | 2022-10-14 |
| OML | Harmonic Mixer | WR12/M12HWD | E60120-1 | 2019-10-14 | 2022-10-14 |
| OML | Horn Antenna | M12RH | E60120-2 | 2019-10-14 | 2022-10-14 |
| OML | Harmonic Mixer | WR08/M08HWD | F60313-1 | 2019-10-14 | 2022-10-14 |
| OML | Horn Antenna | M08RH | F60313-2 | 2019-10-14 | 2022-10-14 |

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

## Test Data

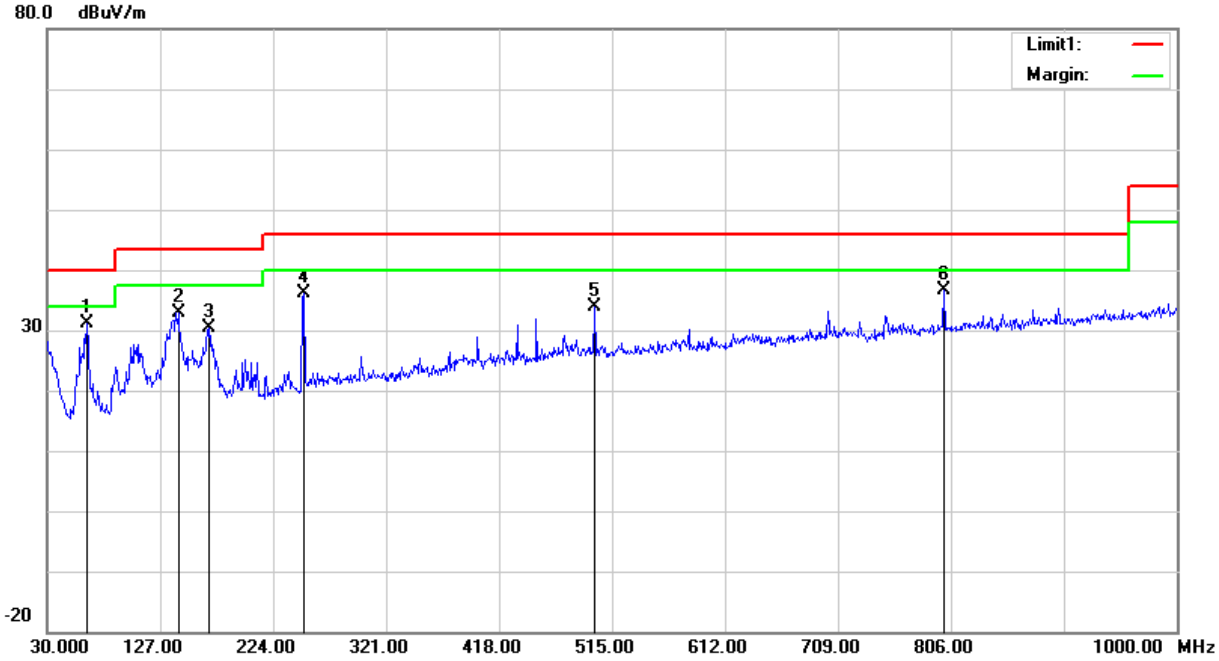
### Environmental Conditions

| Test Items | Radiation Below 1GHz | Radiation Above 1GHz |
|---|---|---|
| **Temperature:** | 27 °C | 28~29°C |
| **Relative Humidity:** | 35% | 38~40 % |
| **ATM Pressure:** | 100.7 kPa | 100.6~100.8 kPa |
| **Tester:** | Hanson Li | Felix Wang |
| **Test Date:** | 2020-09-11 | 2020-09-24~2020-09-25 |

*Test Mode: Transmitting*

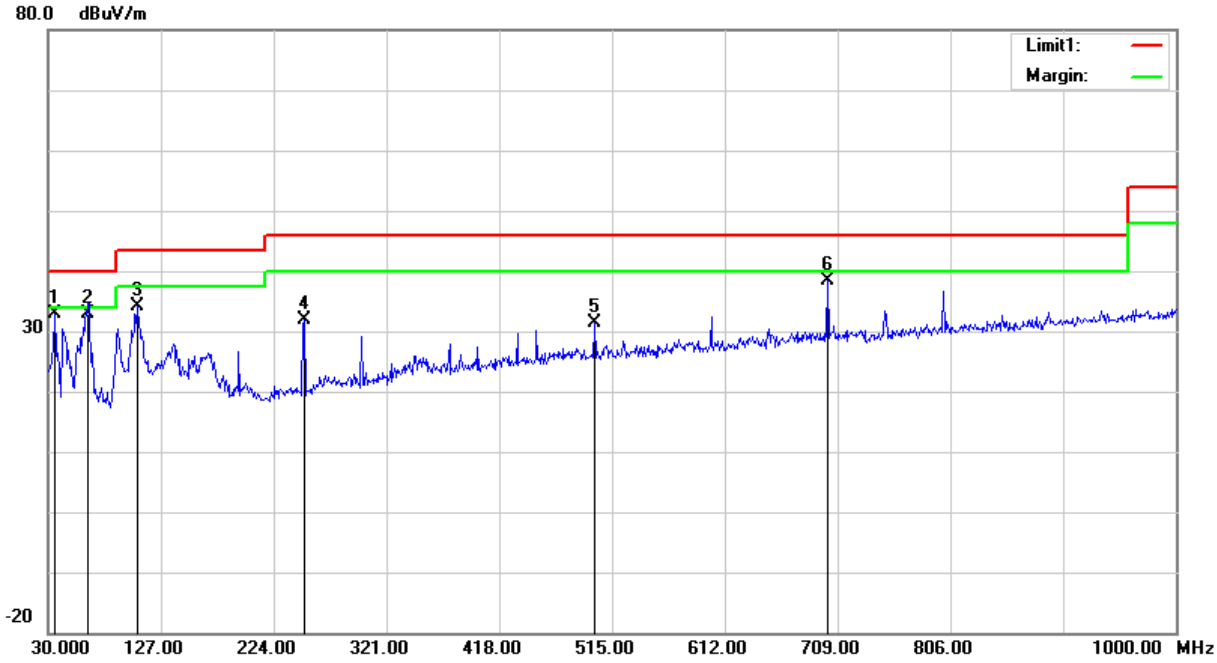
**1) 30MHz-1GHz(Omnidirectional Antenna transmitting was the worst):**

**Horizontal:**




| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 63.9500 | 43.06 | peak | -11.87 | 31.19 | 40.00 | 8.81 |
| 142.5200 | 38.87 | peak | -6.06 | 32.81 | 43.50 | 10.69 |
| 168.7100 | 36.99 | peak | -6.68 | 30.31 | 43.50 | 13.19 |
| 250.1900 | 42.15 | peak | -5.99 | 36.16 | 46.00 | 9.84 |
| 500.4500 | 34.32 | peak | -0.39 | 33.93 | 46.00 | 12.07 |
| 800.1800 | 32.87 | peak | 3.71 | 36.58 | 46.00 | 9.42 |

**Vertical:**




| Frequency (MHz) | Receiver Reading (dBuV) | Detector | Correction Factor (dB/m) | Cord. Amp. (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 35.8200 | 35.57 | peak | -2.79 | 32.78 | 40.00 | 7.22 |
| 63.9500 | 44.83 | QP | -11.87 | 32.96 | 40.00 | 7.04 |
| 106.6300 | 41.51 | peak | -7.27 | 34.24 | 43.50 | 9.26 |
| 250.1900 | 37.80 | peak | -5.99 | 31.81 | 46.00 | 14.19 |
| 500.4500 | 31.81 | peak | -0.39 | 31.42 | 46.00 | 14.58 |
| 700.2700 | 35.84 | peak | 2.59 | 38.43 | 46.00 | 7.57 |

**2) 1GHz-40GHz**
**Omnidirectional antenna:**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB/m) | | | | | |
| 5241.50 | 46.92 | PK | H | 33.69 | 3.52 | 25.57 | 58.56 | 74.00 | 15.44 |
| 5233.00 | 43.18 | PK | V | 33.67 | 3.54 | 25.59 | 54.80 | 74.00 | 19.20 |
| 1603.50 | 41.94 | PK | H | 25.63 | 1.67 | 25.85 | 43.39 | 74.00 | 30.61 |
| 1603.50 | 29.54 | AV | H | 25.63 | 1.67 | 25.85 | 30.99 | 54.00 | 23.01 |
| 1603.50 | 41.22 | PK | V | 25.63 | 1.67 | 25.85 | 42.67 | 74.00 | 31.33 |
| 1603.50 | 30.07 | AV | V | 25.63 | 1.67 | 25.85 | 31.52 | 54.00 | 22.48 |
| 12033.00 | 37.90 | PK | H | 38.97 | 6.77 | 25.17 | 58.47 | 74.00 | 15.53 |
| 12033.00 | 25.34 | AV | H | 38.97 | 6.77 | 25.17 | 45.91 | 54.00 | 8.09 |
| 12033.00 | 39.12 | PK | V | 38.97 | 6.77 | 25.17 | 59.69 | 74.00 | 14.31 |
| 12033.00 | 25.36 | AV | V | 38.97 | 6.77 | 25.17 | 45.93 | 54.00 | 8.07 |
| 24150.00* | 75.08 | PK | H | 35.50 | 10.96 | 37.12 | 84.42 | 127.96 | 43.54 |
| 24150.00 * | 48.19 | AV | H | 35.50 | 10.96 | 37.12 | 57.53 | 107.96 | 50.43 |
| 24150.00 * | 94.23 | PK | V | 35.50 | 10.96 | 37.12 | 103.57 | 127.96 | 24.39 |
| 24150.00 * | 64.48 | AV | V | 35.50 | 10.96 | 37.12 | 73.82 | 107.96 | 34.14 |
| 24000.00 | 50.97 | PK | V | 35.50 | 10.87 | 37.40 | 59.94 | 74.00 | 14.06 |
| 24000.00 | 38.40 | AV | V | 35.50 | 10.87 | 37.40 | 47.37 | 54.00 | 6.63 |
| 24250.00 | 51.89 | PK | V | 35.50 | 11.02 | 36.94 | 61.47 | 74.00 | 12.53 |
| 24250.00 | 39.64 | AV | V | 35.50 | 11.02 | 36.94 | 49.22 | 54.00 | 4.78 |

***: Fundamental.***

**40GHz-100GHz**

| Frequency (GHz) | Receiver | | Rx Antenna | | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB(1/m)) | | | | |
| 48.3 | 32.29 | PK | H | 40.08 | 72.37 | 62.83 | 87.96 | 25.13 |
| 48.3 | 19.65 | AV | H | 40.08 | 59.73 | 50.19 | 67.96 | 17.77 |
| 72.45 | 29.58 | PK | V | 43.85 | 73.43 | 63.89 | 87.96 | 24.07 |
| 72.45 | 17.17 | AV | V | 43.85 | 61.02 | 51.48 | 67.96 | 16.48 |

**Directional antenna:**

| Frequency (MHz) | Receiver | | Rx Antenna | | Cable loss (dB) | Amplifier Gain (dB) | Corrected Amplitude (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB/m) | | | | | |
| 5241.50 | 47.53 | PK | H | 33.69 | 3.52 | 25.57 | 59.17 | 74.00 | 14.83 |
| 5233.00 | 46.42 | PK | V | 33.67 | 3.54 | 25.59 | 58.04 | 74.00 | 15.96 |
| 1603.50 | 43.65 | PK | H | 25.63 | 1.67 | 25.85 | 45.10 | 74.00 | 28.90 |
| 1603.50 | 31.25 | AV | H | 25.63 | 1.67 | 25.85 | 32.70 | 54.00 | 21.30 |
| 1603.50 | 41.11 | PK | V | 25.63 | 1.67 | 25.85 | 42.56 | 74.00 | 31.44 |
| 1603.50 | 29.03 | AV | V | 25.63 | 1.67 | 25.85 | 30.48 | 54.00 | 23.52 |
| 12033.00 | 37.32 | PK | H | 38.97 | 6.77 | 25.17 | 57.89 | 74.00 | 16.11 |
| 12033.00 | 25.17 | AV | H | 38.97 | 6.77 | 25.17 | 45.74 | 54.00 | 8.26 |
| 12033.00 | 37.65 | PK | V | 38.97 | 6.77 | 25.17 | 58.22 | 74.00 | 15.78 |
| 12033.00 | 26.33 | AV | V | 38.97 | 6.77 | 25.17 | 46.90 | 54.00 | 7.10 |
| 24150.00* | 88.59 | PK | H | 35.50 | 10.96 | 37.12 | 97.93 | 127.96 | 30.03 |
| 24150.00* | 48.22 | AV | H | 35.50 | 10.96 | 37.12 | 57.56 | 107.96 | 50.40 |
| 24150.00* | 94.16 | PK | V | 35.50 | 10.96 | 37.12 | 103.50 | 127.96 | 24.46 |
| 24150.00* | 53.21 | AV | V | 35.50 | 10.96 | 37.12 | 62.55 | 107.96 | 45.41 |
| 24000.00 | 51.04 | PK | V | 35.50 | 10.87 | 37.40 | 60.01 | 74.00 | 13.99 |
| 24000.00 | 38.16 | AV | V | 35.50 | 10.87 | 37.40 | 47.13 | 54.00 | 6.87 |
| 24250.00 | 51.07 | PK | V | 35.50 | 11.02 | 36.94 | 60.65 | 74.00 | 13.35 |
| 24250.00 | 38.34 | AV | V | 35.50 | 11.02 | 36.94 | 47.92 | 54.00 | 6.08 |

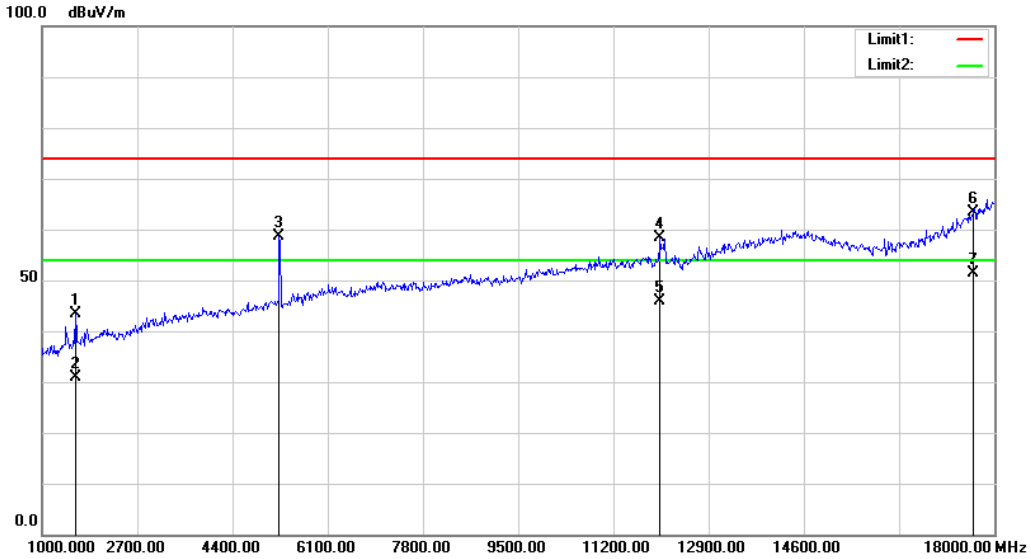
***: Fundamental.***

**40GHz-100GHz**

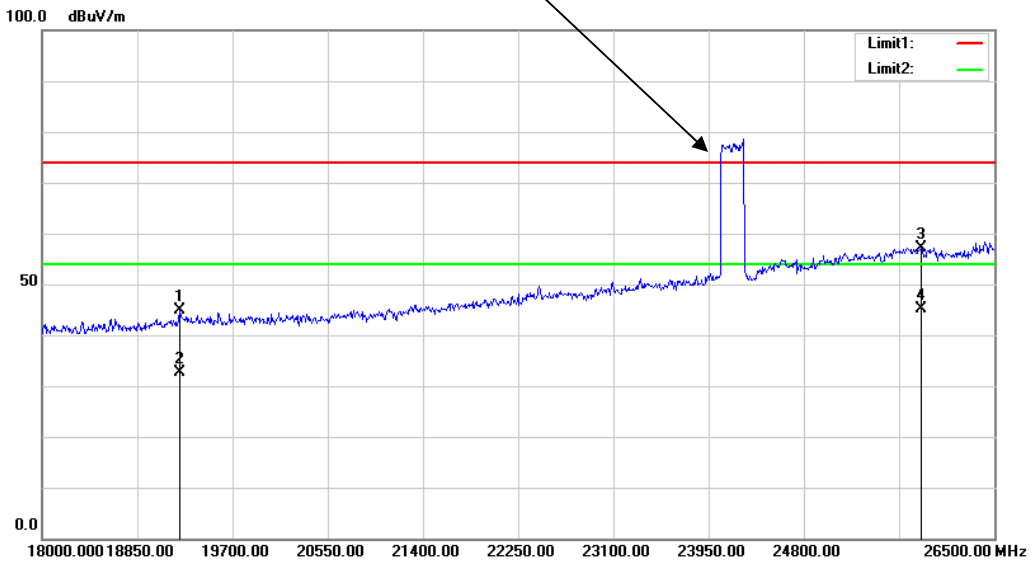
| Frequency (GHz) | Receiver | | Rx Antenna | | Corrected Amplitude (dBμV/m) | Extrapolation result (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| | Reading (dBμV) | Detector | Polar (H/V) | Factor (dB(1/m)) | | | | |
| 48.3 | 32.36 | PK | H | 40.08 | 72.44 | 62.9 | 87.96 | 25.06 |
| 48.3 | 19.58 | AV | H | 40.08 | 59.66 | 50.12 | 67.96 | 17.84 |
| 72.45 | 29.47 | PK | V | 43.85 | 73.32 | 63.78 | 87.96 | 24.18 |
| 72.45 | 17.12 | AV | V | 43.85 | 60.97 | 51.43 | 67.96 | 16.53 |

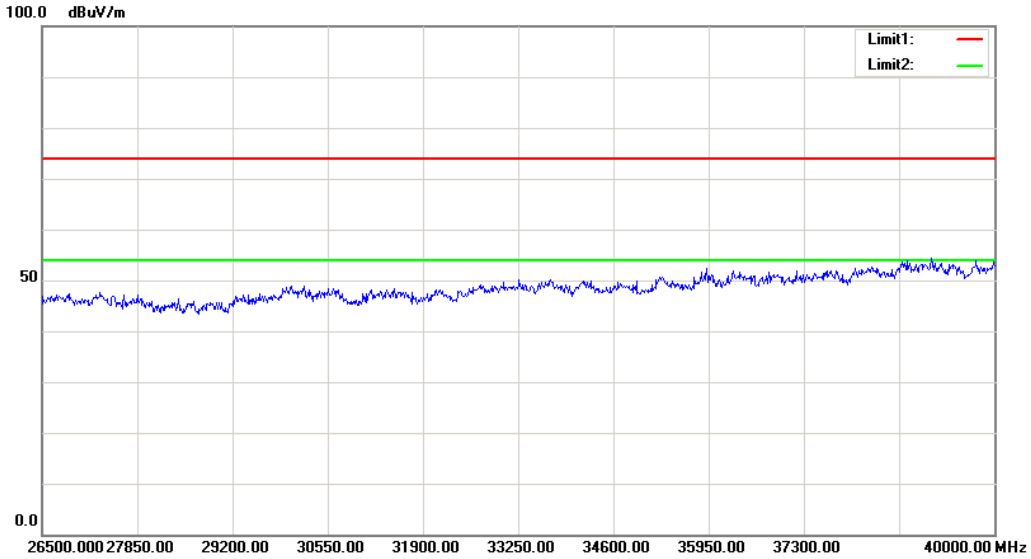
***Test Plots for above 1GHz(Worst is* Omnidirectional antenna*)***

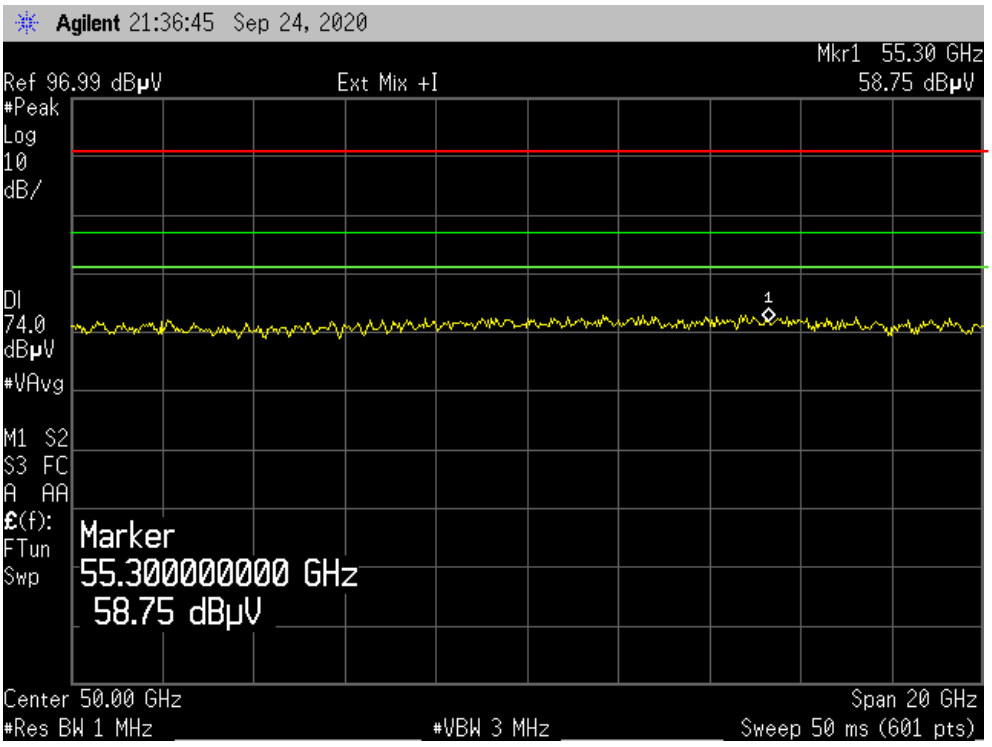
***Horizontal***

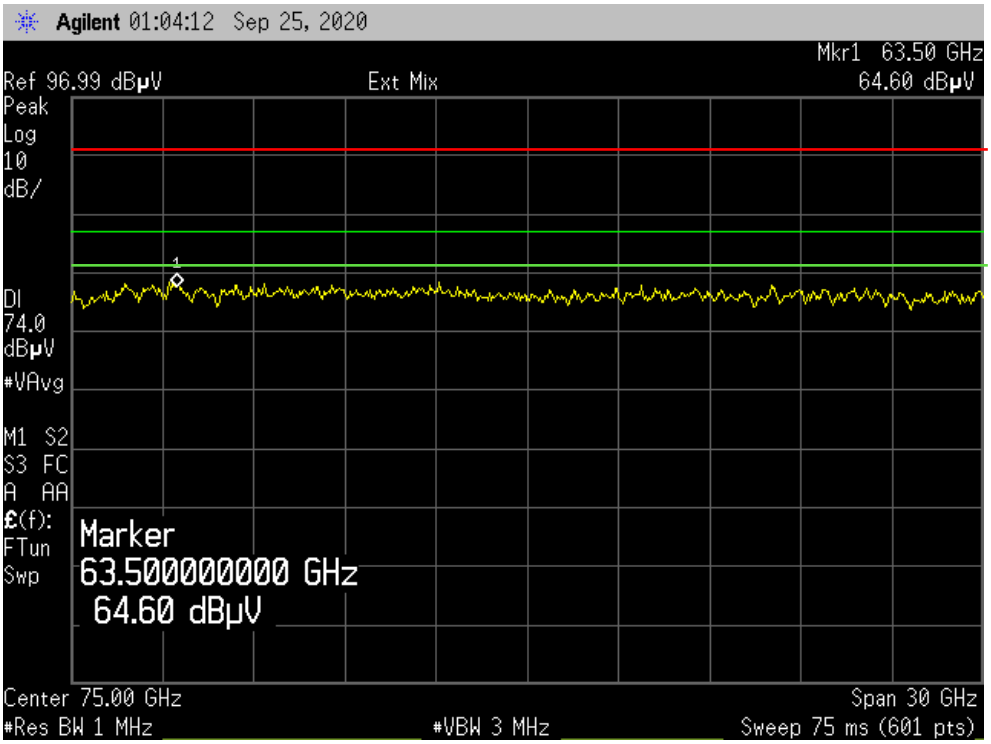


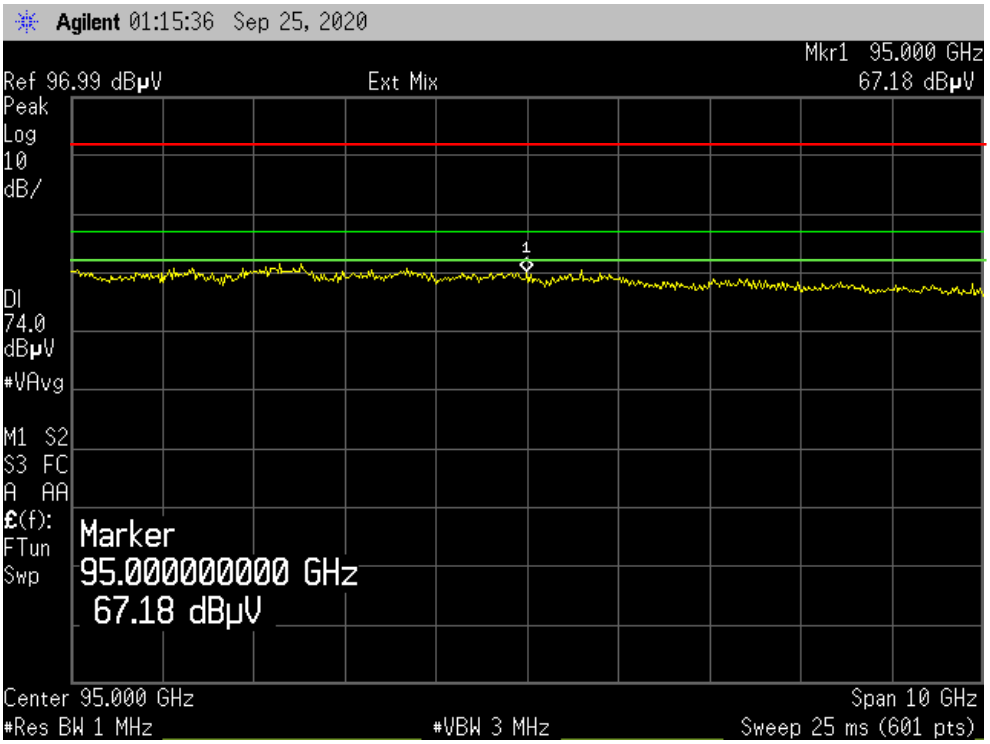

***Fundamental***



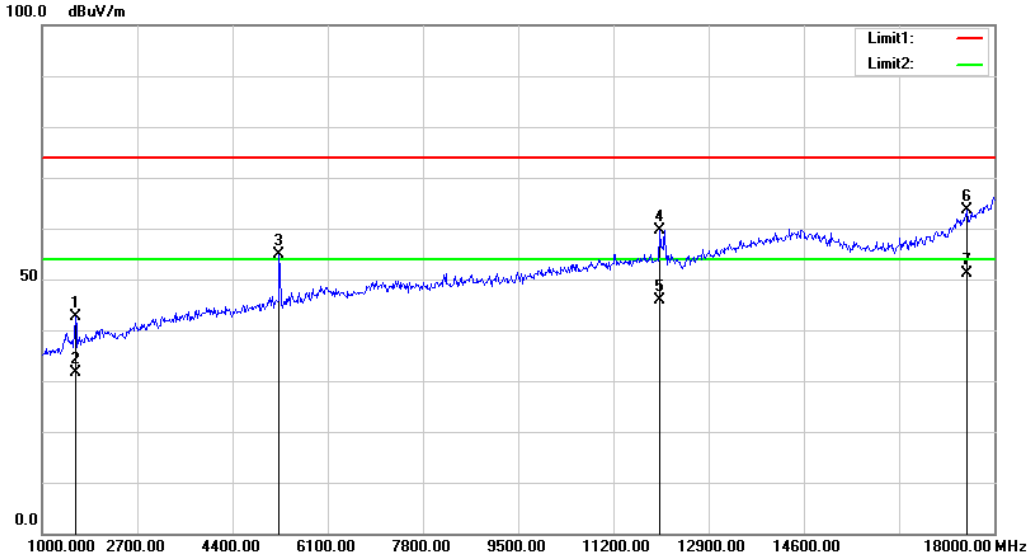

100.0 dBuV/m
Limit1:
Limit2:
50
0.0
26500.000 27850.00 29200.00 30550.00 31900.00 33250.00 34600.00 35950.00 37300.00 40000.00 MHz


Agilent 21:36:45 Sep 24, 2020
Mkr1 55.30 GHz
Ref 96.99 dBµV
Ext Mix +I
58.75 dBµV
#Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
55.300000000 GHz
58.75 dBµV
Center 50.00 GHz
Span 20 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 50 ms (601 pts)

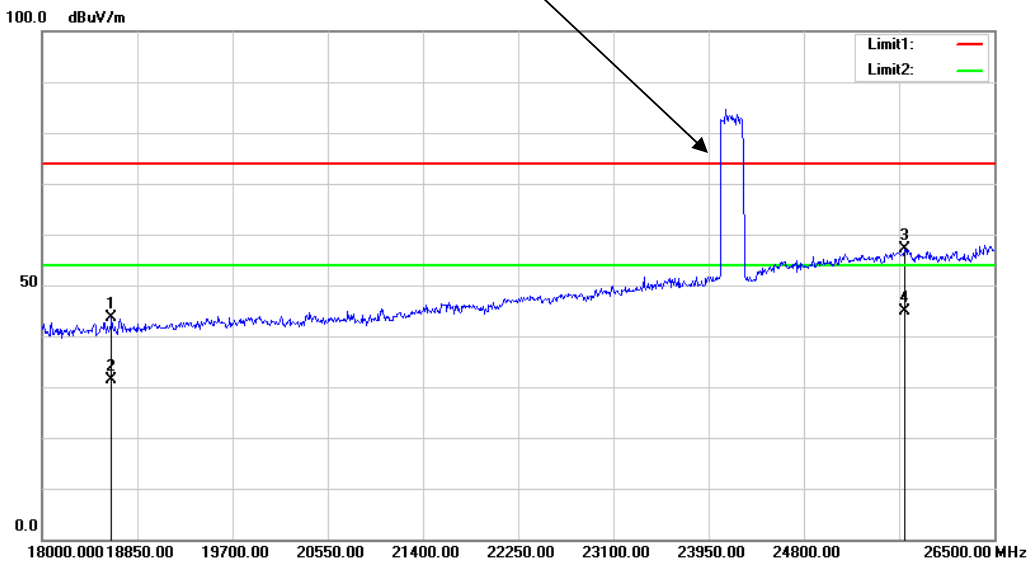

Agilent 01:04:12 Sep 25, 2020
Mkr1 63.50 GHz
Ref 96.99 dBµV
Ext Mix
64.60 dBµV
Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
63.500000000 GHz
64.60 dBµV
Center 75.00 GHz
Span 30 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 75 ms (601 pts)

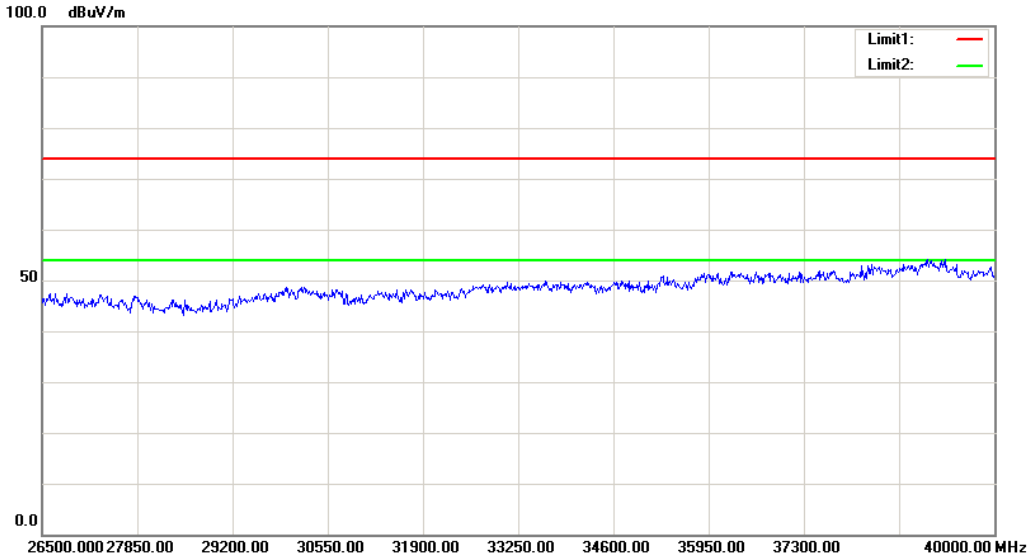

Agilent 01:15:36 Sep 25, 2020
Mkr1 95.000 GHz
Ref 96.99 dBµV
Ext Mix
67.18 dBµV
Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
95.000000000 GHz
67.18 dBµV
Center 95.000 GHz
Span 10 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 25 ms (601 pts)

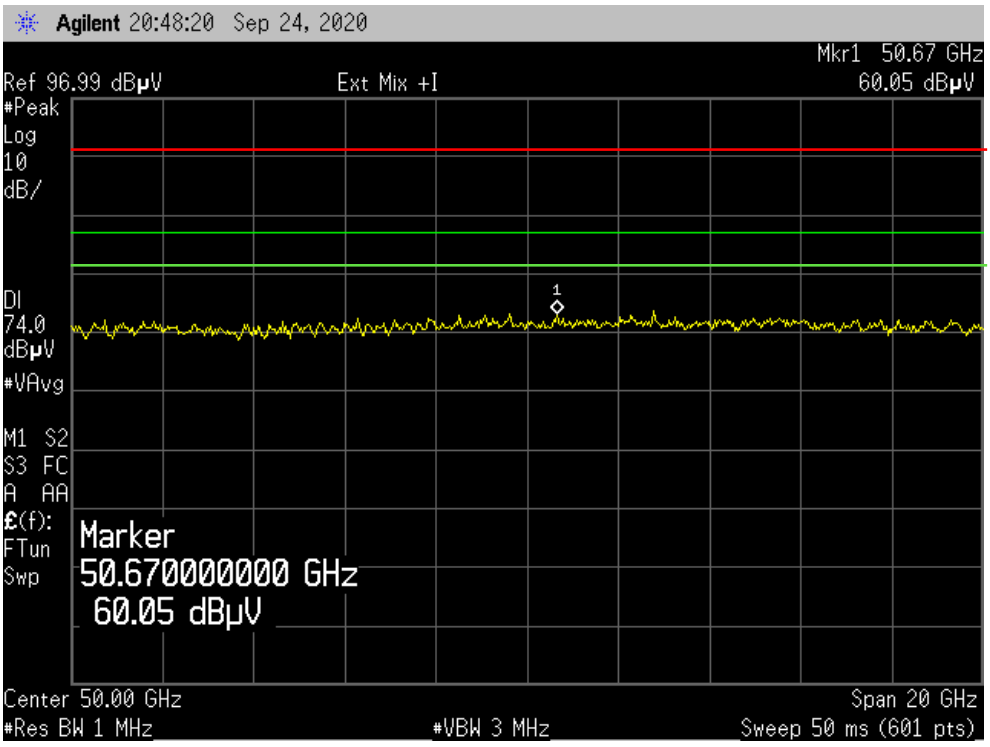
***Vertical***

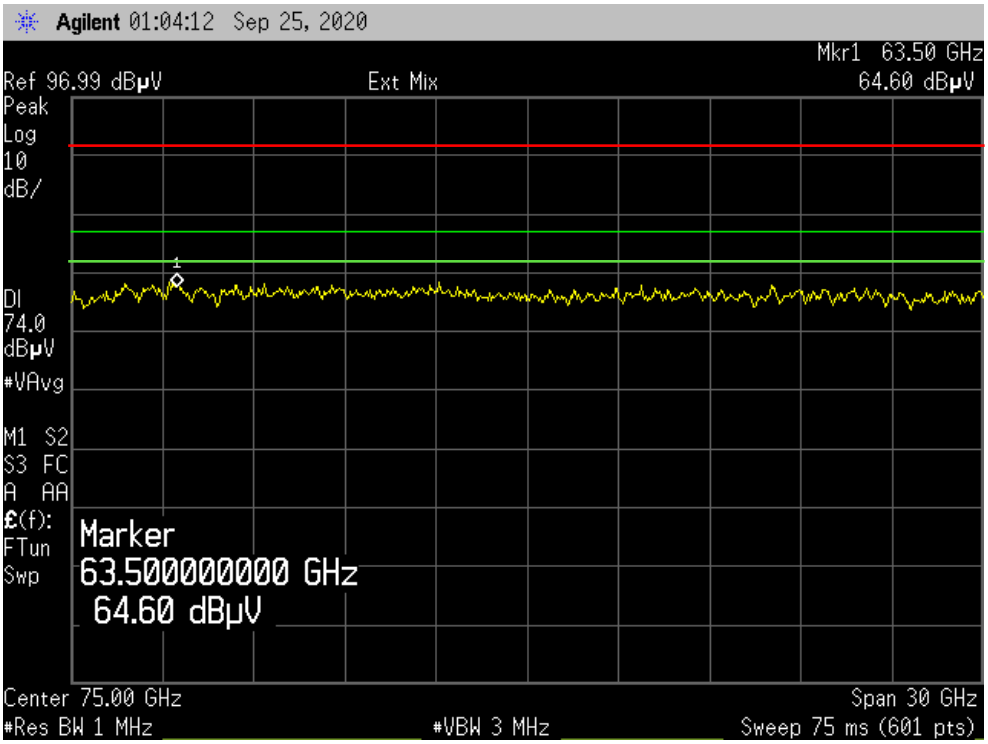


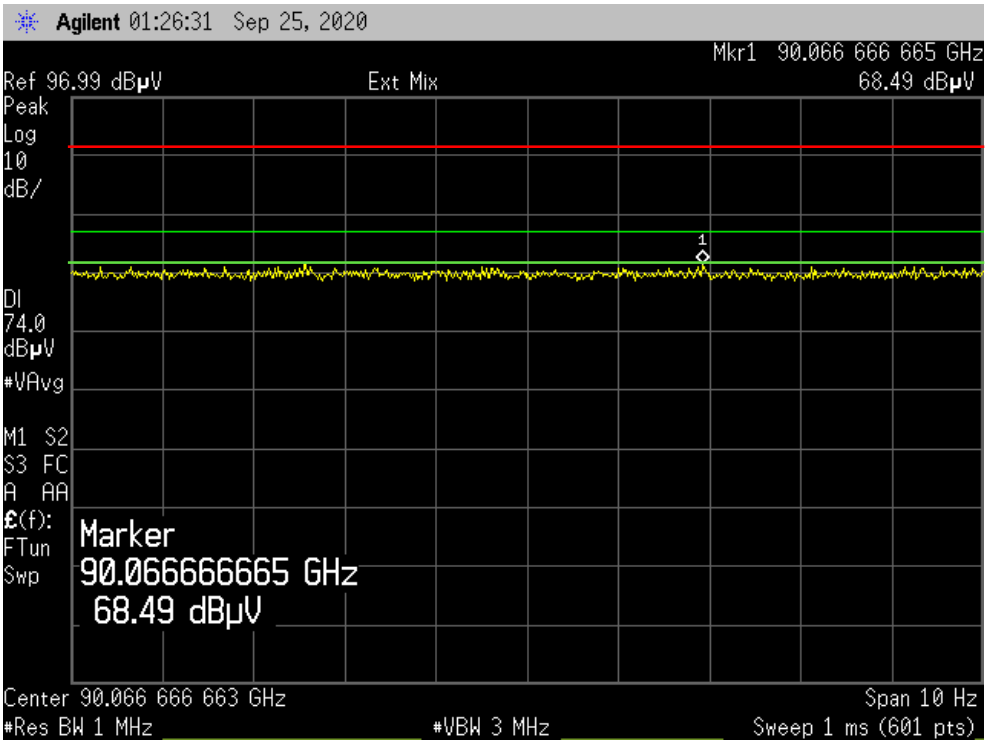

***Fundamental***




100.0 dBuV/m
Limit1:
Limit2:
50
0.0
26500.000 27850.00 29200.00 30550.00 31900.00 33250.00 34600.00 35950.00 37300.00 40000.00 MHz


Agilent 20:48:20 Sep 24, 2020
Mkr1 50.67 GHz
Ref 96.99 dBµV
Ext Mix +I
60.05 dBµV
#Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
50.670000000 GHz
60.05 dBµV
Center 50.00 GHz
Span 20 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 50 ms (601 pts)


Agilent 01:04:12 Sep 25, 2020
Mkr1 63.50 GHz
Ref 96.99 dBµV
Ext Mix
64.60 dBµV
Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
63.500000000 GHz
64.60 dBµV
Center 75.00 GHz
Span 30 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 75 ms (601 pts)


Agilent 01:26:31 Sep 25, 2020
Mkr1 90.066 666 665 GHz
Ref 96.99 dBµV
Ext Mix
68.49 dBµV
Peak
Log
10
dB/
Dl
74.0
dBµV
#VAvg
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Marker
90.066666665 GHz
68.49 dBµV
Center 90.066 666 663 GHz
Span 10 Hz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 1 ms (601 pts)

# FCC §15.215(c), RSS-GEN CLAUSE 6.7 – 20 dB BANDWIDTH TESTING&99% OCCUPIED BANDWIDTH

## Applicable Standard

According to FCC §15.215(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

According to RSS-Gen §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 in-band 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.

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)

## Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.
4. Use 99% Occupied bandwidth function test the 99% Occupied bandwidth

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| R&S | Spectrum Analyzer | FSV40 | 101474 | 2020-01-09 | 2021-01-09 |
| Ducommun Technolagies | Horn Antenna | ARH-4223-02 | 1007726-01 1304 | 2017-12-06 | 2020-12-05 |
| MICRO-COAX | Coaxial Cable | UFA147-1-2362-100100 | 64639 231029-001 | 2020-02-24 | 2021-02-24 |

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

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26.8 °C |
| **Relative Humidity:** | 54 % |
| **ATM Pressure:** | 100.6kPa |
| **Tester:** | Felix Wang |
| **Test Date:** | 2020-09-09 |

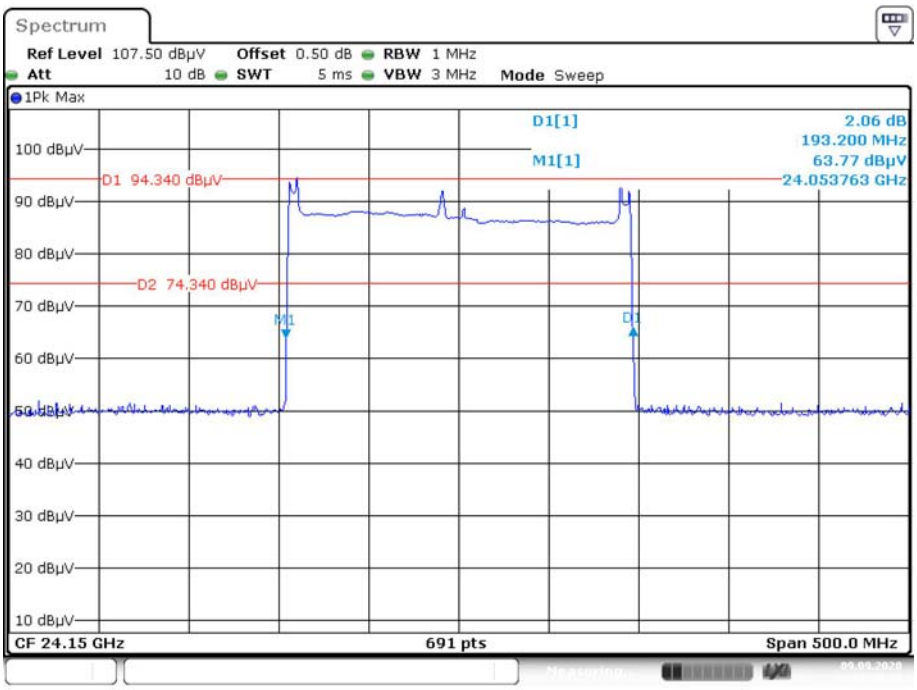
**Test Result:** Compliant.

Please refer to following tables and plots

*Test Mode: Transmitting*

| Model | Frequency (MHz) | 20 dB Bandwidth (MHz) |
|---|---|---|
| Omnidirectional antenna | 24125 | 193.2 |
| Directional antenna | 24125 | 193.198 |

Omnidirectional antenna

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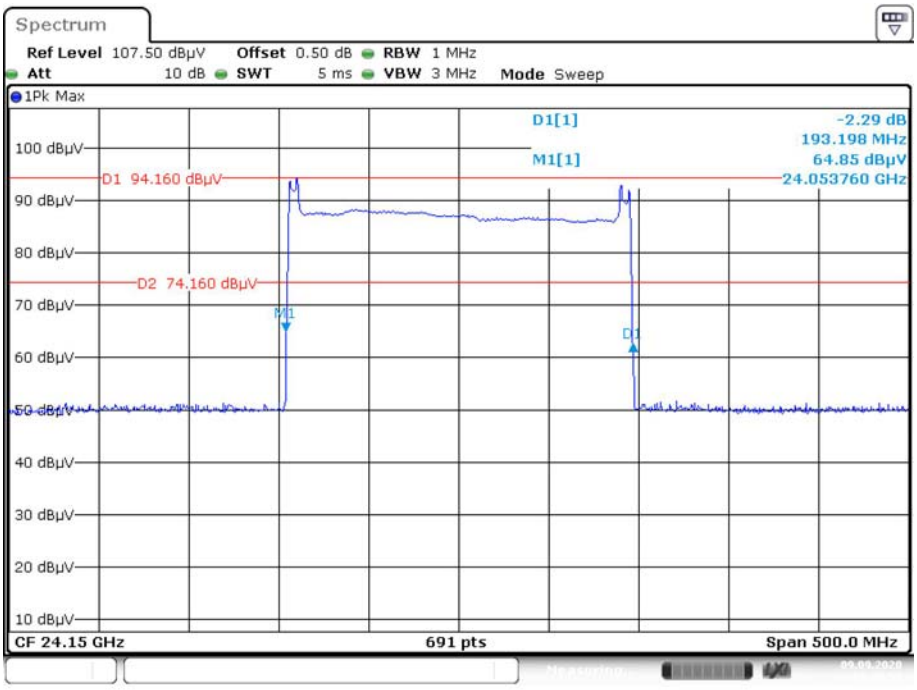
Directional antenna




Date: 9.SEP.2020 14:25:58

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