# FCC IC Test Report

| | |
|---|---|
| **Report No.:** | FCC_IC_SL19121803-TRB-030_Co-location Rev_1.0 |
| **FCC ID:** | JUP-8311891 |
| **IC:** | 1756A-8311891 |
| **Test Model:** | CBMRX-010B (SPS855) |
| **Series Model:** | N/A |
| **Received Date:** | 02/04/2020 |
| **Test Date:** | 02/04/2020 |
| **Issued Date:** | 02/26/2020 |
| **Applicant:** | Trimble Inc. |
| **Address:** | 935 Stewart Drive, Sunnyvale, CA 94085, USA |
| **Issued By:** | Bureau Veritas Consumer Products Services, Inc. |
| **Lab Address:** | 775 Montague Expressway, Milpitas, CA 95035, USA |
| **FCC Registration / Designation Number:** | 540430 / 4842D |

TESTING CERT # 2742-01

## Table of Contents

## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| FCC_IC_SL19121803-TRB-030_Co-location | Original release | 02/05/2020 |
| FCC_IC_SL19121803-TRB-030_Co-location Rev_1.0 | Update Per Customer Review | 02/26/2020 |

## 1 Certificate of Conformity

| | |
|---|---|
| **Product:** | GNSS Receiver with integrated 900MHz FHSS radio and optional BT modem |
| **Brand:** | Trimble Inc. |
| **Test Model:** | CBMRX-010B (SPS855) |
| **Series Model:** | N/A |
| **Sample Status:** | Engineering Sample |
| **Applicant:** | Trimble Inc. |
| **Test Date:** | 02/04/2020 |
| **Standards:** | 47 CFR FCC Part 15, Subpart C (Section 15.247)<br>ANSI C63.10: 2013 |

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc. Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** _____ , **Date:** 02/26/2020

Deon Dai / Test Engineer

**Approved by :** _____ , **Date:** 02/26/2020

Chen Ge / Engineer Reviewer

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247)<br>RSS 247 Issue2, RSS Gen Issue5 | | | |
|---|---|---|---|
| FCC / IC Clause | Test Item | Result | Remarks |
| 15.207<br>RSS Gen 8.8 | AC Power Conducted Emission | N/A | N/A |
| 15.205<br>&15.209 &<br>15.247(d)<br>RSS 247 5.5C | Radiated Emissions and Band Edge Measurement | PASS | Meet the requirement of limit. |
| 15.247(a)(2)<br>RSS 247 5.2.1<br>RSS Gen 6.7 | 6dB bandwidth & 99% bandwidth | N/A | N/A |
| 15.247(b)<br>RSS 247 5.4.4 | Conducted power | N/A | N/A |
| 15.247(e)<br>RSS 247 5.2.2 | Power Spectral Density | N/A | N/A |
| 15.203 | Antenna Requirement | PASS | Antenna connector is TNC not a standard connector. (The device is professionally installed)<br>BT antenna is permanently attached |

Note: N/A: For details please see

900MHz

original report No.: R1504291-247 (FCC ID: JUP-8311891/ IC: 1756A-8311891)

BT module

FR3D0402AE (FCC ID: Z64-2564N, IC: 451I-2564N)

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Expanded Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 3.51dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 3.73dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 4.64dB |
| | 6GHz ~ 18GHz | 4.82dB |
| | 18GHz ~ 40GHz | 4.91dB |

### 2.2 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 General Description of EUT

| | |
|---|---|
| Product | GNSS Receiver with integrated 900MHz FHSS radio and optional BT modem |
| Brand | Trimble Inc. |
| Test Model | CBMRX-010B (SPS855) |
| Identification No. of EUT | N/A |
| Series Model | N/A |
| Model Difference | N/A |
| Status of EUT | Engineering Sample |
| Operating Frequency | 902.6 ~ 927.6 MHz<br>2.402 ~ 2.48 GHz |
| Number of Channel | FHSS: 50<br>BT_LE:40 |
| Antenna Type | Dipole Antenna<br>Chip Antenna |
| Antenna Connector | TNC Connector |
| Antenna Gain | 900MHz Band: 2.5 dBi<br>2.4G Band: 2 dBi |

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

### 3.2 Description of Test Modes

50 channels are provided for 902.6 ~ 927.6 MHz

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 1 | 902.6 | - | - |
| - | - | - | - |
| - | - | - | - |
| - | - | - | - |
| - | - | 50 | 927.6 |
| 25 | 915.4 | | |

40 channels are for BLE:

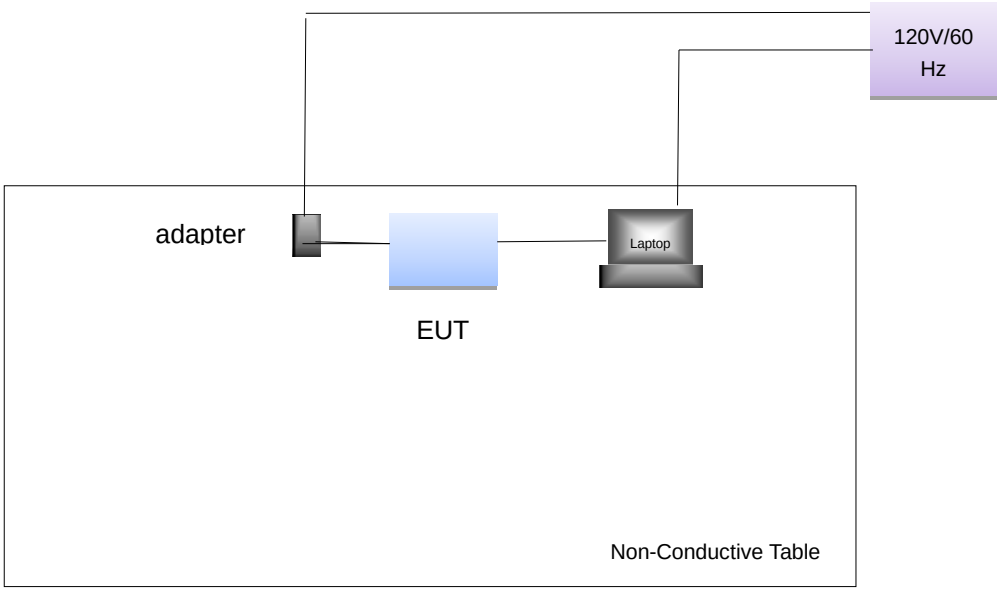
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |

### 3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product | Brand | Model No. | Serial No. | Remarks |
|---|---|---|---|---|---|
| A. | Laptop | Lenovo | E430 | N/A | Provide by customer |
| B. | Zephyr3 Rover GNSS antenna | Trimble | 105000-10 | 1312118144 | Provide by customer |
| C. | 900MHz Antenna | Laird Tech | MAF94384 /Gain: 2.5dB | N/A | Provide by customer |
| D. | RJ45 Ethernet Cable | N/A | N/A | N/A | Provide by customer |
| E. | DB26-DB9 Ethernet and Power Adapter | ENHANCE, INC | TNL-57168 | N/A | Provide by customer |
| F. | DB9-DB9 Null Modem cable | Cable Connection | 59043 | N/A | Provide by customer |
| G. | DB9(F) Y to OS/&PM to power jack cable | SINBON ELECTRONICS | 59044 | N/A | Provide by customer |
| H. | AC-DC Adapter | Adaptech Tech Inc. | ATS065T-A190_65W (TPN107000) | N/A | Provide by customer |

#### 3.3.1 Configuration of System under Test



GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**47 CFR FCC Part 15, Subpart C (Section 15.247)**
**RSS 247 Issue 2, February 2017**
**RSS Gen Issue 5, March 2019**
**ANSI C63.10-2013**

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB (power peak measurement) or 30dB (power Ave.measurement) below the highest level of the desired power:

| Frequencies (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 |

**NOTE**:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|---|---|---|---|---|
| 50GHz Spectrum Analyzer | N9030B (PXA) | MY57140597 | 06/05/2019 | 06/05/2020 |
| Biconilog Antenna Sunol | JB1 | A030702 | 03/09/2018 | 03/09/2020 |
| Pre-Amplifier RF Bay, Inc. | LPA-6-30 | 11170601 | 04/27/2019 | 04/27/2020 |
| Horn Antenna ETS-Lindgren | 3117 | 218554 | 11/06/2019 | 11/06/2020 |
| Pre-Amplifier RF-Lambda | RAMP00M50GA | 17032300048 | 06/18/2019 | 06/18/2020 |
| Micro-Tronics | 800-1000MHz Notch filter | BRM50706 | 10/23/2019 | 10/23/2020 |

4.1.3 Test Procedures

**For Radiated emission below 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case 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 Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

**For Radiated emission above 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. 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 height of antenna 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

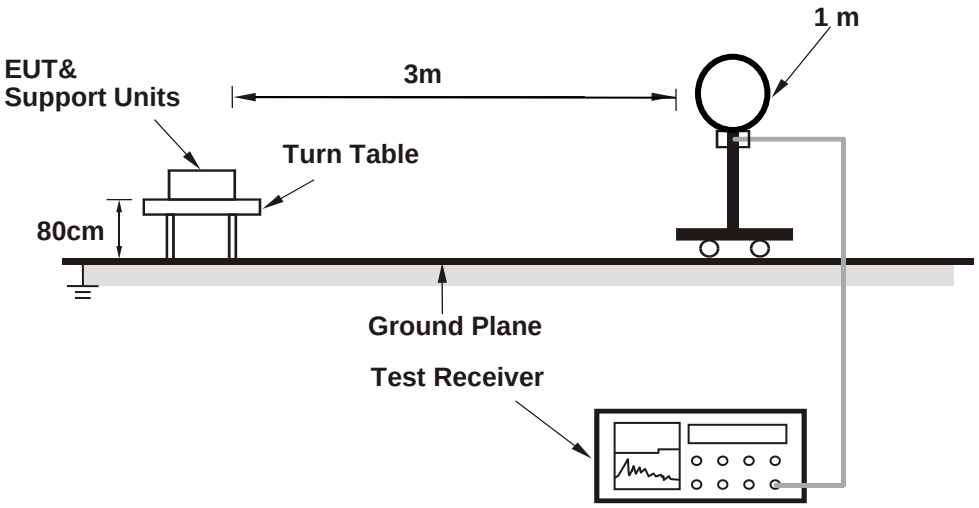
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

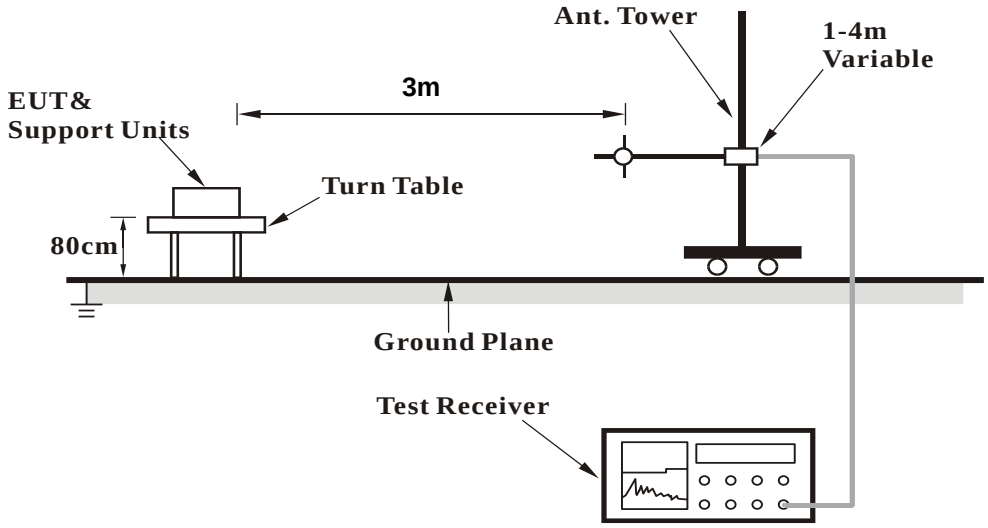
No deviation.

4.1.5 Test Setup

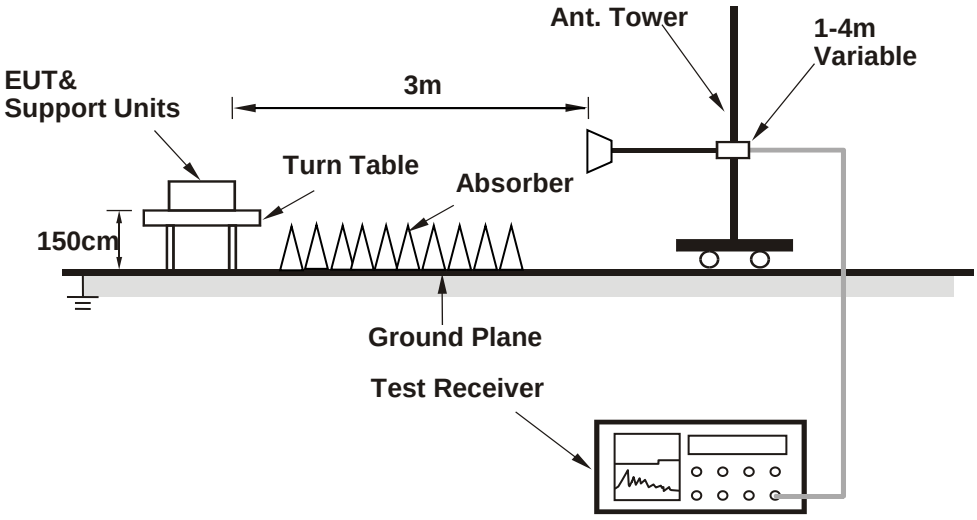
**For Radiated emission below 30MHz**




**For Radiated emission 30MHz to 1GHz**



**For Radiated emission above 1GHz**




For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared notebooks to act as communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a USB cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The necessary accessories enable the system in full functions.

4.1.7 Test Results

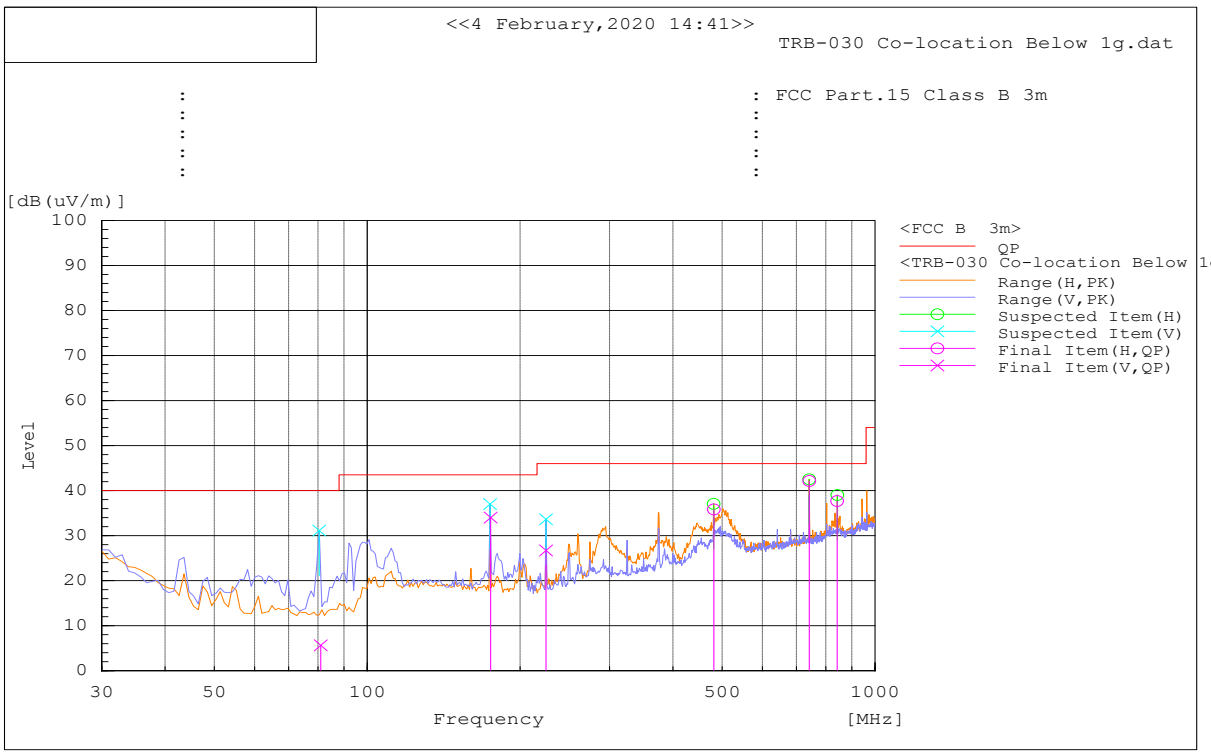
**BELOW 1GHz WORST-CASE DATA:**

| | | | |
|---|---|---|---|
| **CHANNEL** | 900MHz/BLE transmit simultaneous mode | **DETECTOR FUNCTION** | Quasi Peak |
| **FREQUENCY RANGE** | 30MHz – 1GHz | | |

| Antenna Polarity & Test Distance: Vertical and Horizontal at 3m | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Polarization (H/V) | Reading QP [dB(uV)] | Factor [dB/m] | Level QP [dB(uV/m)] | Limit\QP dB(uV/m) | Margin QP [dB] | Height (cm) | Angle (Deg) | Pass/Fail |
| 1 | 81.009 | V | -7.2 | 12.9 | 5.7 | 40 | 34.3 | 131 | 356 | Pass |
| 2 | 174.992 | V | 15.8 | 18.2 | 34 | 43.5 | 9.5 | 141 | 149 | Pass |
| 3 | 224.988 | V | 9.4 | 17.3 | 26.7 | 46 | 19.3 | 99.9 | 76.7 | Pass |
| 4 | 481.48 | H | 10.9 | 24.9 | 35.8 | 46 | 10.2 | 195 | 306 | Pass |
| 5 | 742.119 | H | 13.8 | 28.3 | 42.1 | 46 | 3.9 | 112 | 177 | Pass |
| 6 | 842.243 | H | 8 | 29.7 | 37.7 | 46 | 8.3 | 99.8 | 170 | Pass |

**REMARKS:**

1. Level (dBuV) = Reading (dBuV) + Factor (dB/m)).
2. Factor (dB (1/m)) = Antenna Factor (AF) (dB/m)) + Cable Loss (dB)
3. Margin = Limit value (dBuV/m) - Level (dBuV/m)



## Above 1GHz Test Data:

**Above 1GHz-26.5GHz – Co-location**

| ANTENNA POLARITY & test distance: HORIZONTAL& Vertical at 3 m | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency [MHz] | Pol | Reading AV [dB(uV)] | Factor [dB/m] | Measurement Type | Level [dB(uV/m)] | Limit [dB(uV/m)] | Margin [dB] | Height [cm] | Angle [deg] |
| 1798.108 | H | 44.5 | -10.9 | Average | 33.6 | 54 | 20.4 | 290.1 | 290.4 |
| 2700.988 | H | 42.1 | -9 | Average | 33.1 | 54 | 20.9 | 217.7 | 169.6 |
| 4504.097 | V | 39.9 | -4 | Average | 35.9 | 54 | 18.1 | 191.3 | 42.9 |
| 1798.108 | H | 53.9 | -10.9 | Peak | 43 | 74 | 31 | 290.1 | 290.4 |
| 2700.988 | H | 51.1 | -9 | Peak | 42.1 | 74 | 31.9 | 217.7 | 169.6 |
| 4504.097 | V | 49.3 | -4 | Peak | 45.3 | 74 | 28.7 | 191.3 | 42.9 |

## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

**Appendix – Information on the Testing Laboratories**

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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