Lab Code: 200167-0

# FCC PART 15.245

# TEST AND MEASUREMENT REPORT

For

## Teltron, Inc.

#202 Itplex, 16 Sinseong-Ro, Yusong-Gu,

Daejeon, South Korea

**FCC ID: XXNTMS100**
**Model: TMS100**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | Motion Sensor |

| | |
|---|---|
| **Test Engineer:** | Dennis Huang |
| **Report Number:** | R0911232-245 |
| **Report Date:** | 2009-12-02 |
| **Reviewed By:** | Boni Baniqued<br>EMC/RF Supervisor |
| **Prepared By:**<br>**(25)** | Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Avenue,<br>Sunnyvale, CA 94089, USA<br>Tel: (408) 732-9162<br>Fax: (408) 732-9164 |

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## DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R0911232-245 | Original Report | 2009-12-02 |

# 1 GENERAL INFORMATION

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

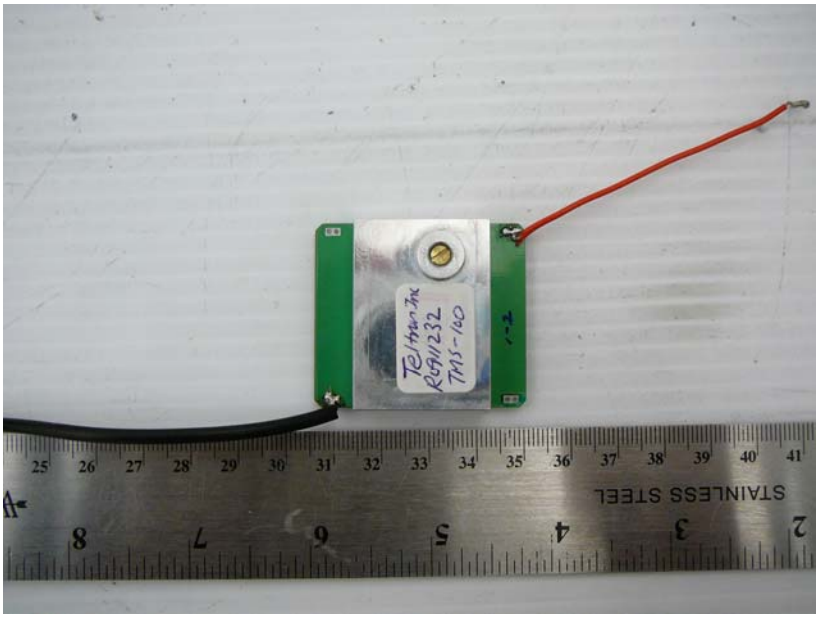
This BACL measurement and test report has been complied on behalf of *Teltron Inc.,* and their product model: *TMS100, FCC ID: XXNTMS100* or the "EUT" as referred to in this report. The EUT is an X-band Doppler motion sensor to detect motion. It consists of DR (dielectric resonator) oscillator, passive diode and patch antennas and provides most reliable solution in motion detection. It is a single frequency device; the output frequency of the motion sensor has a tolerance of 10.525 GHz ± 12.5 MHz. The device is DC powered with a typical voltage of 5 V.

## 1.2 EUT Mechanical Description

The *EUT* measures approximately 40mm **(L)** x 35mm **(W)** x 9mm **(H)**, weighing approximately 29g.

** The test data gathered are from production samples provided by the manufacturer, serial numbers: R0911232-1 assigned by BACL.*

## 1.3 EUT Photo




*Additional photos in exhibit C*

## 1.4 Objective

This type approval report is prepared on behalf of *Teltron Inc.*, in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

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

N/A

### 1.6 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

### 1.7 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are: spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

### 1.8 Test Facility

The semi-anechoic chambers used by BACL Corp., to collect radiated and conducted emissions measurement data is located in the building at it's facility in Sunnyvale, California, USA.

BACL's test sites have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp., is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

# 2 SYSTEM TEST CONFIGURATION

## 2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

## 2.2 EUT Exercise Software

N/A

## 2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

## 2.4 Equipment Modifications

No modifications were made to the EUT.

## 2.5 Local Support Equipment

| Manufacturers | Descriptions | Models | Serial Numbers |
|---|---|---|---|
| BK Precision | DC Power Supply | 1621A | D185052265 |

## 2.6 EUT Internal Configuration and Details

| Manufacturers | Descriptions | Models | Serial Numbers |
|---|---|---|---|
| Teltron Inc. | PCB Assembly | - | 1-2 |

## 2.7 Interface Ports and Cabling

| Cable Descriptions | Length (m) | From | To |
|---|---|---|---|
| Power Cable | < 1m | EUT | DC Power Supply |

# 3 SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Results |
|---|---|---|
| §15.203 | Antenna Requirement | Compliant |
| §15.207 | Conducted Emissions | N/A * |
| §15.245 (b) | Field Strength of Fundamental | Compliant |
| §15.245 (b) | Field Strength of Harmonics | Compliant |
| §15.245 (b)(3) | Radiated Emissions: Out of Band Emission | Compliant |

*Note: *Device is powered by DC or battery.*

# 4 FCC §15.203 - ANTENNA REQUIREMENT

## 4.1 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 use of a standard antenna jack or electrical connector is prohibited.

## 4.2 Antenna Connector Construction

The PCB antenna of the module was permanently attached and can not been replaced by the user.

# 5 FCC §15.207– CONDUCTED EMISSIONS

N/A

Device is DC/Battery Powered.

# 6 FCC §15.245 (b) – FIELD STRENGTH OF FUNDAMENTAL

## 6.1 Applicable standards

Per FCC §15.245 Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz.

(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency (MHz) | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (millivolts/meter) |
|---|---|---|
| 902–928 | 500 | 1.6 |
| 2435–2465 | 500 | 1.6 |
| 5785–5815 | 500 | 1.6 |
| 10500–10550 | 2500 | 25.0 |
| 24075–24175 | 2500 | 25.0 |

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209.

## 6.2 Test Setup

The radiated emissions tests were performed in the 3-meter semi-anechoic chamber test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

## 6.3 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 24 ºC |
| **Relative Humidity:** | 45 % |
| **ATM Pressure:** | 102.1kPa |

**Testing was performed by Dennis Huang on 2009-11-23.*

## 6.4 Test Equipment List and Details

| Manufacturers | Description | Model Numbers | Serial Numbers | Calibration Dates |
|---|---|---|---|---|
| HP | Pre, Amplifier (1~18 GHz) | 8449B | 3147A00400 | 2009-10-22 |
| A. R.A | Antenna, Horn, DRG (1~18 GHz) | DRG-118/A | 1132 | 2009-09-23 |
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2009-04-27 |

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

### 6.5 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

### 6.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - 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 maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

## 6.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.245 standard's radiated emissions limits for class B devices, and had the worst margin of:

**-31.57 dB @ 10525 MHz** in the **Vertical** polarization

The provisions in §15.35 for limiting peak emissions apply, Please refer to the following tables for full test results

## 6.8 Test Results

Fundamental Frequency = 10525 MHz (Measured at 3 meter)

| Freq. (MHz) | S.A. Reading (dBuV) | Azimuth (Degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H / V) | Factor (dB/m) | | | | | | |
| 10525 | 46.85 | 175 | 1 | V | 39.2 | 15 | / | 101.05 | 148 | -46.95 | Peak |
| 10525 | 44.65 | 360 | 1 | H | 39.2 | 15 | / | 98.85 | 148 | -49.15 | Peak |
| 10525 | 42.23 | 175 | 1 | V | 39.2 | 15 | / | 96.43 | 128 | -31.57 | Ave |
| 10525 | 38.87 | 360 | 1 | H | 39.2 | 15 | / | 93.07 | 128 | -34.93 | Ave |

*Note:* Measured without the Pre-Amp.*

# 7 FCC §15.245 (b) – FIELD STRENGTH OF HARMONICS & OUT OF BAND EMISSIONS

## 7.1 Applicable Standards

Per § 15.245 Operation within the bands 902–928 MHz, 2435–2465 MHz, 5785–5815 MHz, 10500–10550 MHz, and 24075–24175 MHz

(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental frequency (MHz) | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (millivolts/meter) |
|---|---|---|
| 902–928 | 500 | 1.6 |
| 2435–2465 | 500 | 1.6 |
| 5785–5815 | 500 | 1.6 |
| 10500–10550 | 2500 | 25.0 |
| 24075–24175 | 2500 | 25.0 |

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209.

Per §15.205 Restricted bands of operation

**(a)** Except as shown in 15.205 paragraphs (d), only spurious emissions are permitted in any of the frequency bands listed below:

| (MHz) | (MHz) | (MHz) | (MHz) | (MHz) | (GHz) | (GHz) |
|---|---|---|---|---|---|---|
| 0.090 – 0.110 | 8.291 – 8.294 | 16.69475 – 16.69525 | 156.7 – 156.9 | 1435 – 1626.5 | 3.332 – 3.339 | 10.6 – 12.7 |
| 0.495 – 0.505 | 8.362 – 8.366 | 25.5 – 25.67 | 162.0125 –167.17 | 1645.5 – 1646.5 | 3.3458 – 3.358 | 13.25 – 13.4 |
| 2.1735 – 2.1905 | 8.37625 – 8.38675 | 37.5 – 38.25 | 167.72 – 173.2 | 1660 – 1710 | 3.600 – 4.400 | 14.47 – 14.5 |
| 4.125 – 4.128 | 8.41425 – 8.41475 | 73 – 74.6 | 240 – 285 | 1718.8 – 1722.2 | 4.5 – 5.15 | 15.35 – 16.2 |
| 4.17725 – 4.17775 | 12.29 – 12.293 | 74.8 – 75.2 | 322 – 335.4 | 2200 – 2300 | 5.35 – 5.46 | 17.7 – 21.4 |
| 4.20725 – 4.20775 | 12.51975 – 12.52025 | 108 – 121.94 | 399.9 – 410 | 2310 – 2390 | 7.25 – 7.75 | 22.01 – 23.12 |
| 6.215 – 6.218 | 12.57675 – 12.57725 | 123 – 138 | 608 – 614 | 2483.5 – 2500 | 8.025 – 8.5 | 23.6 – 24.0 |
| 6.26775 – 6.26825 | 13.36 – 13.41 | 149.9 – 150.05 | 960 – 1240 | 2690 – 2900 | 9.0 – 9.2 | 31.2 – 31.8 |
| 6.31175 – 6.31225 | 16.42 – 16.423 | 156.52475 – 156.52525 | 1300 – 1427 | 3260 – 3267 | 9.3 – 9.5 | 36.43 – 36.5 |
| | | | | | | Above 38.6 |

**(b)** Except as provided in 15.205 paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission

limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**(c)** Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

Per FCC §15.209 Radiated emission limits, general requirements.

**(a)** Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| 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 |

*** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

**(b)** In the emission table above, the tighter limit applies at the band edges.

### 7.2 Test Setup

The radiated emissions tests were performed in the 3-meter semi-anechoic chamber test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

### 7.3 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 24 ºC |
| **Relative Humidity:** | 45 % |
| **ATM Pressure:** | 102.1 kPa |

**Testing was performed by Dennis Huang on 2009-11-23 at 3 meter 2 chamber.*

## 7.4 Test Equipment List and Details

| Manufacturers | Description | Model Number | Serial Number | Calibration Dates |
|---|---|---|---|---|
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-06-05 |
| Sunol Sciences | EMI Test Receiver | 1166.5950.03 | 100044 | 2009-04-15 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| HP | Pre, Amplifier (1~18 GHz) | 8449B | 3147A00400 | 2009-10-22 |
| A. R.A | Antenna, Horn, DRG (1~18 GHz) | DRG-118/A | 1132 | 2009-09-23 |
| Wise Wave | Antenna, Horn, (18~26.5 GHz) | ARH-4223-02 | 10555-02 | 2009-05-16 |
| Wise Wave | Pre, Amplifier (18~26.5 GHz) | ALN-22093530-01 | 12263-01 | 2009-03-11 |
| Wise Wave | Antenna, Horn, (26.5~40 GHz) | 2823-02 | 10555-01 | 2009-05-16 |
| Wise Wave | Pre, Amplifier (26.5~40 GHz) | ALN-33144130-01 | 11424-01 | 2009-03-11 |
| OML | WR-12 Harmonic Mixer with Horn Antenna (60~90 GHz) | M12HWD | E60120-1 | 2009-03-11 |
| OML | WR-12 Harmonic Mixer with Horn Antenna (90~140 GHz) | M08HWD | F60313-1 | 2009-03-11 |
| OML | Diplexer for Agilent Spectrum Analyzer | DPL26 | N/A | N/A |
| Agilent | Analyzer, Spectrum | E4440A | MY44303352 | 2009-04-27 |

* ***Statement of Traceability:*** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

## 7.5 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak and Quasi-Peak detection mode for frequencies below 1 GHz, peak and Average detection mode for frequencies above 1 GHz.

## 7.6 Corrected Amplitude & Margin Calculation

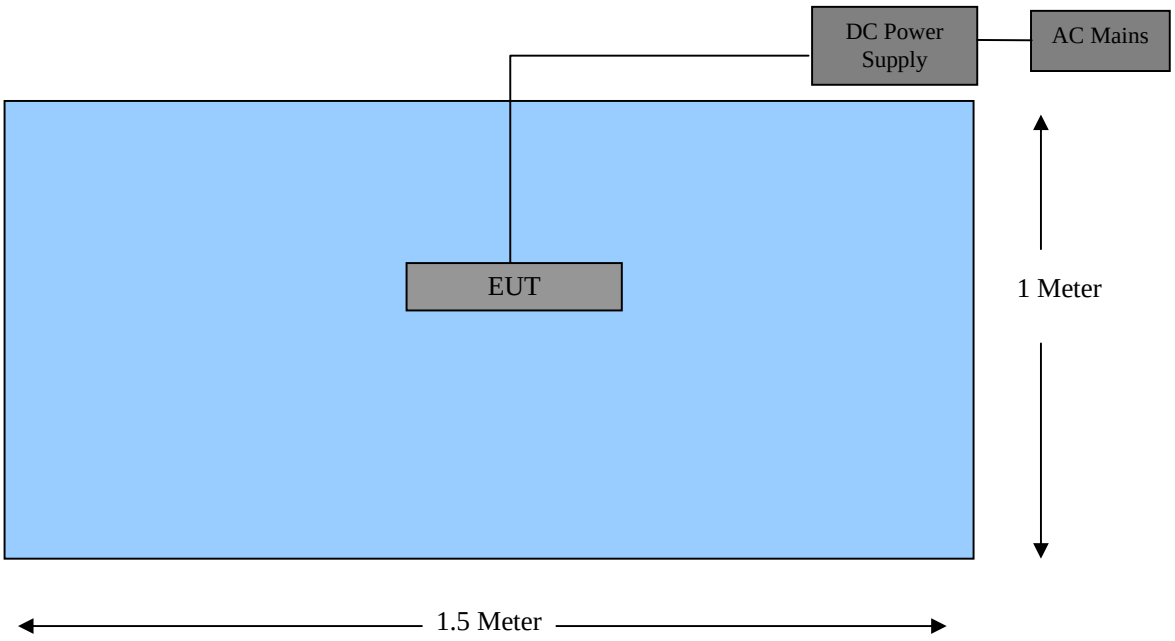
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - 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 maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

### 7.7 Test Diagram




### 7.8 Summary of Test Results

Fundamental Frequency = 10525 MHz

Worst case reading as follows measured at 3 meters:

30 MHz to 1 GHz: **-17.5 dB** at **58.46164 MHz** in the **Vertical Polarization**

1GHz – 18 GHz: Emissions are at noise floor level.

Above 18 GHz
(Measured at 1Meter): **-37.18 dB** at **21070 MHz** in the **Vertical Polarization**

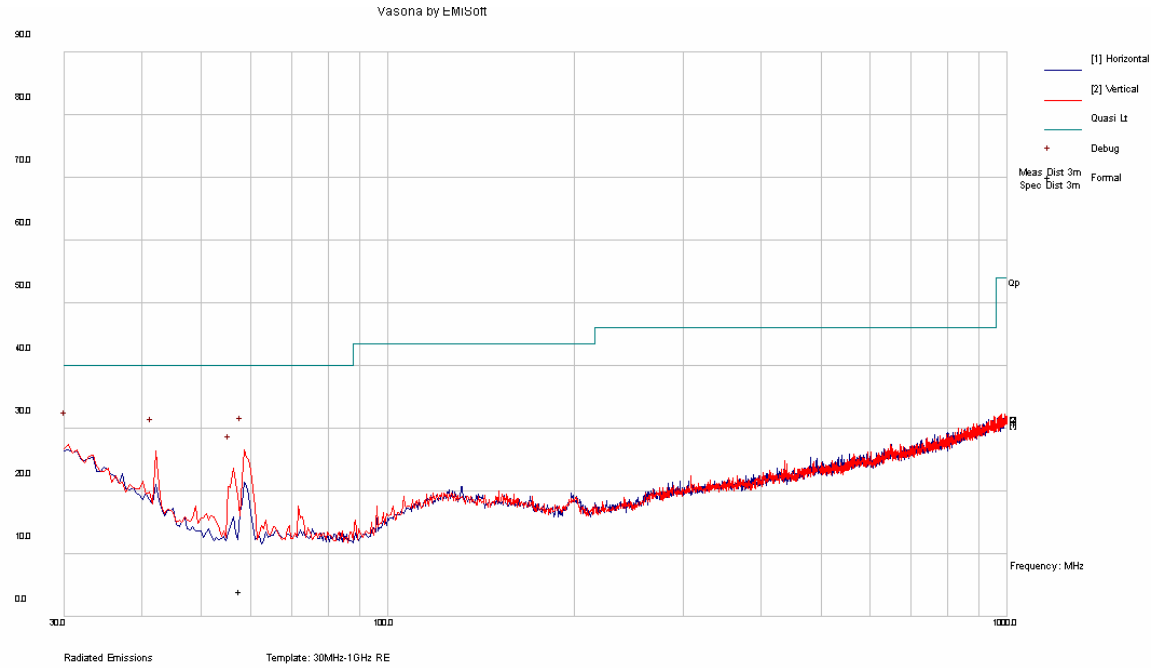
Band Edge: **-6.97 dB** at **10500 MHz** in the **Horizontal Polarization**

Please refer to the following tables for full test results

## 7.9 Test Results

### 30 MHz to 1 GHz:

(Measured at 3 meter)




## Quasi-Peak Measurements

| Frequency (MHz) | Corrected Quasi-Peak (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 58.46164 | 22.5 | 152 | V | 104 | 40 | -17.5 |

### 1 to 18 GHz:

(Measured at 3 meter)

| Frequency (MHz) | S.A. Reading (dBuV) | Detector (PK/AV) | Azimuth (Degree) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. Gain (dB) | Duty Cycle Factor (dB) | Cord. Amp. (dBuV/m) | Part 15.245 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Height (m) | Polar (H/V) | Factor (dB/m) | | | | | Limit (dBuV/m) | Margin (dB) |
| - | - | - | - | - | - | - | | - | - | - | - | -* |

* Emissions are at noise floor level

**Above 18 GHz:**

(Measured at 1 meter)

| Frequency (MHz) | S.A. Reading (dBuV) | Azimuth (Degree) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. Gain (dB) | Distance Factor (dB) | Cord. Amp. (dBuV/m) | Part 15.245 | | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Factor (dB) | | | | | Limit (dBuV/m) | Margin (dB) | |
| 21070 | 62.63 | 157 | 1.0 | V | 33.6 | 8.75 | 42.87 | -9.54 | 52.57 | 108 | -55.43 | Peak |
| 21070 | 59.93 | 205 | 1.0 | H | 33.6 | 8.75 | 42.87 | -9.54 | 49.87 | 108 | -58.13 | Peak |
| 21070 | 60.88 | 157 | 1.0 | V | 33.6 | 8.75 | 42.87 | -9.54 | 50.82 | 88 | -37.18 | Ave |
| 21070 | 58.74 | 205 | 1.0 | H | 33.6 | 8.75 | 42.87 | -9.54 | 48.68 | 88 | -39.32 | Ave |

*Other emissions are at noise floor level.

**Band Edge (10500 -10550 MHz):**

(Measured at 3 meter)

| Frequency (MHz) | S.A. Reading (dBuV) | Azimuth (Degree) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBuV/m) | 15.209 | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Factor (dB) | | | | Limit (dBuV/m) | Margin (dB) | |
| 10500 | 37 | 360 | 1.0 | V | 39.2 | 19.16 | 36.21 | 59.15 | 74 | -14.85 | Peak |
| 10500 | 37.48 | 360 | 1.0 | H | 39.2 | 19.16 | 36.21 | 59.63 | 74 | -14.37 | Peak |
| 10500 | 24.88 | 360 | 1.0 | V | 39.2 | 19.16 | 36.21 | 47.03 | 54 | -6.97 | Ave |
| 10500 | 24.85 | 360 | 1.0 | H | 39.2 | 19.16 | 36.21 | 47 | 54 | -7.0 | Ave |
| 10550 | 36.06 | 360 | 1.0 | V | 39.2 | 19.16 | 36.21 | 58.21 | 74 | -15.79 | Peak |
| 10550 | 35.78 | 360 | 1.0 | H | 39.2 | 19.16 | 36.21 | 57.93 | 74 | -16.07 | Peak |
| 10550 | 24.59 | 360 | 1.0 | V | 39.2 | 19.16 | 36.21 | 46.74 | 54 | -7.26 | Ave |
| 10550 | 24.55 | 360 | 1.0 | H | 39.2 | 19.16 | 36.21 | 46.7 | 54 | -7.3 | Ave |