# FCC PART 15 SUBPART B
# AS/NZS CISPR 22: 2009 + A1: 2010

# TEST AND MEASUREMENT REPORT

For

## TracStar Systems dba Cobham SATCOM

1551 College Park Business Center Road,

Orlando, FL 32804, USA

**FCC ID: 2ADHY-ROJ-5075G**
**Model: EXPLORER 5075GX**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | VSAT Terminal |

**Prepared By:** Jerry Wang

**Report Number:** R1408202 Rev A

**Report Date:** 2014-11-24

**Reviewed By:** Mark Derickson, EMC Supervisor

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# DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R1408202 | Original Report | 2014-10-23 |
| 1 | R1408202 Rev A | Revised Report | 2014-11-24 |

# 1 General Information

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

This test and measurement report has been compiled on behalf of *TracStar Systems dba Cobham SATCOM,* and their product model: *EXPLORER 5075GX*, FCC ID: 2ADHY-ROJ-5075G, which will henceforth be referred to as the "EUT" (Equipment under Test) in this report. The EUT is Auto-Deploy, portable VSAT terminal for operations on the Inmarsat Global Xpress Ka-band network

## 1.2 Mechanical Description of EUT

The EUT measures approximately 61cm (L) x 107cm (W) x 101 cm (H) and Wight 27.2 kg.

*The data gathered are from a production sample provided by the manufacturer, serial number: R1407111-01 (serial number assigned by BACL).*

## 1.3 Objective

This report is prepared on behalf of *TracStar Systems dba Cobham SATCOM,* in accordance with FCC Part 15B, & AS/NZS CISPR 22:2009 + A1:2010, Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurements.

The objective is to determine compliance with FCC Part 15B, & AS/NZS CISPR 22: 2009+A1: 2010, Standard Class B limits for conducted and radiated emission requirements for Information Technology Equipment.

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

No related submittals.

## 1.5 Test Methodology

All measurements contained in this report were conducted in accordance with AS/NZS CISPR 22:2009 + A1:2010, CISPR 22, & ANSI C63.4-2009, Standards for Information Technology Equipment — Radio Disturbance Characteristics — Limits and Methods of Measurement.

All tests were performed at Bay Area Compliance Laboratories Corp.

## 1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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 CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB 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 Corp.

## 1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea ( Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. 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 an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

# 2 EUT Test Configuration

## 2.1 Justification

The EUT was configured for testing in accordance with requirements of the ANSI C63.4-2009, AS/NZS CISPR 22:2009 + A1:2010, and CISPR 22 standards.

## 2.2 EUT Exercise Software

The software used was provided by TracStar and was verified by Bryan Smith to comply with the standard requirements being tested against.

The software used was EMISoft-Vasona 5.0068 for EMI testing.

## 2.3 Equipment Modifications

N/A

## 2.4 Special Equipment

N/A

## 2.5 Local Support Equipment

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Toshiba | Laptop | U405-S921 | 28117987 |

## 2.6 External I/O Cabling List and Details

| Cable Description | Part Number | Description |
|---|---|---|
| TX Cable | 105067-19IN | Cable – Transmit 50 OHM UF- 2FT. |
| RX Cable | 1306962 | Cable RX 50OHM N STRT N R/A |
| BUC Ctl Cable | 130947 | Cable, Pos Head External M&C to BUC |

## 2.7 EUT Internal Configuration Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Cobham-Tracstar | Antenna Interface Bd | 400069 Rev A | Part of 113706 Rev A |
| Cobham-Tracstar | CPU Bd | 103139 Rev A | Part of 113706 Rev A |
| Cobham-Tracstar | Motor Drive | 102050-9 Rev C | Part of 113706 Rev A |
| Cobham-Tracstar | Power Supply | 400081 Rev B | - |
| Cobham – Thrane & Thrane | CMIF | TT57-138120 Rev B | 6923280011 |
| Amphenol | Ethernet Front Panel | MRJ-5780-01 | 38-142250-A |
| Cobham-Thrane & Thrane | WiFi Antenna Module | TBD | 0832610020 |
| Cobham-Tracstar | GPS | 400065-1 Rev B | 070313 |
| Cobham-Tracstar | PIF Bd | 400071 Rev A | - |
| Cobham – NJRC | Ka Band BUC | NJT5830 | A00380A43 |
| Cobham – NJRC | Ka Band LNB | NJR2825 | A00436A43 |
| Cobham-Tracstar | ACU Board Set | 113706 ReV A | 302620176A |

## 2.8 Mode of Operation

For the purposes of this testing a test mode of operation was created using the stow command which causes moves of the GX pointing system, both Azimuth and Elevation, in a repetitive sequence. The test mode is invoked by activating a "STOW" stow command from the front panel.
For normal operative mode the "STOW" command will return the pointing head (azimuth and elevation) to a fixed position use in stowing the terminal.
For purposes of test the "DEPLOY" command mode would not be invoked. In normal operation the terminal would point to commanded satellite position, establish lock and stop in the fixed position until re-commanded, shut down or stowed.

## 2.9 Method of monitoring

For purposes of this test the "STOW" routine may be used to activate continuous movement of the azimuth and elevation arms of the system. In the event of input power failure or protective condition, the power may be automatically restored however the current command would revert to the default power up state. It would be necessary re-invoke the appropriate command (DEPLOY or STOW) as necessary to continue with testing.

# 3 Summary of Test Results

| Standards | Test Description | Result(s) |
|---|---|---|
| FCC §15.107<br>CISPR 22 §5 | Conducted Emissions | Compliant |
| FCC §15.109<br>CISPR 22 §6 | Radiated Emissions | Compliant |

# 4 FCC §15.107& AS/NZS CISPR 22 §5 – Conducted Emissions

## 4.1 Applicable Standards

As per FCC §15.107,

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Table 1 – Limits for conducted disturbance at the mains ports of Class B ITE

| Frequency range (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

*Decreases with the logarithm of the frequency

As per EN 55022 §5 & CISPR 22 §5: Conducted Limits

The equipment under test (EUT) shall meet the limits in the following table(s), as applicable, including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and quasi-peak detector receiver and measured in accordance with the methods described in Clause 9. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary. If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

Limits for Conducted Disturbance at the Mains Ports of Class B ITE

| Frequency range MHz | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| ***NOTE 1:*** *The lower limit shall apply at the transition frequency.*<br>***NOTE 2:*** *The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.* | | |

## 4.2 EUT Setup

The conducted emissions tests were performed in the 10-meter chamber, using the setup in accordance with CISPR 22: 2010, measurement procedures. The specifications used were in accordance with CISPR 22 §5 standard, Class B limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to an AC line power source.

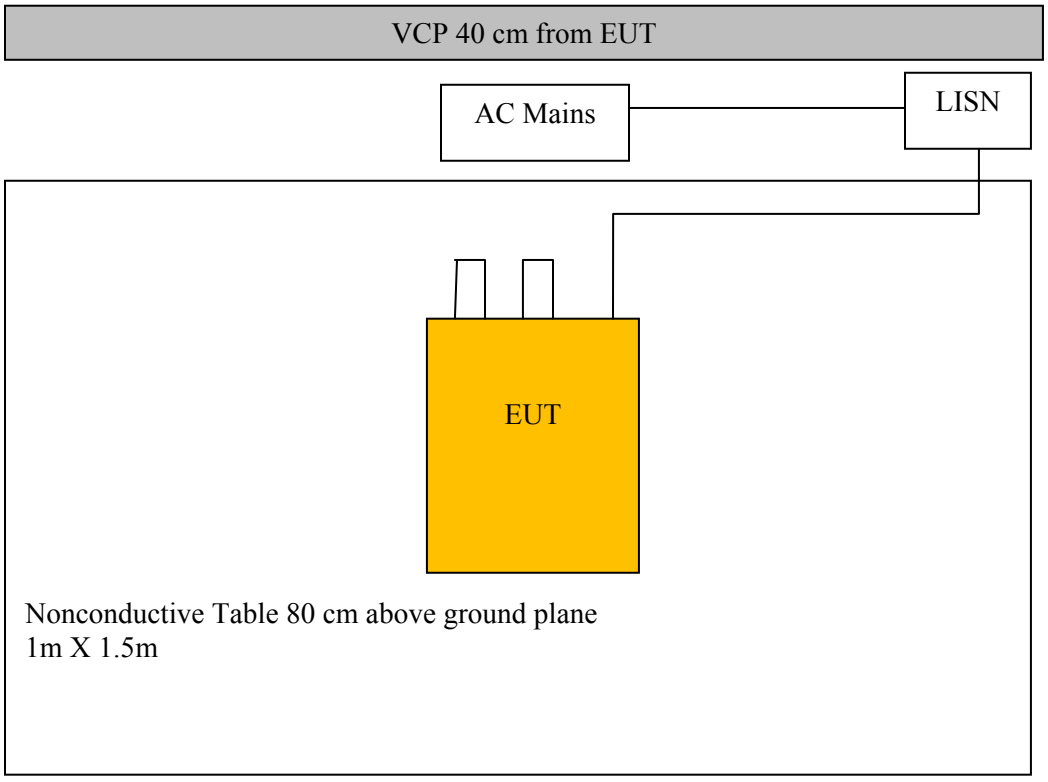
## 4.3 Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the LISN-1.

Maximization procedure was performed on the six (6) highest emission readings from the EUT.

## 4.4 Test Setup Block Diagram

**AC Line**



## 4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL) plus the High Pass Filter/Attenuator value (HA) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + HA – Ga

For example, a corrected amplitude (CA) of 36 dBuV = Indicated Amplitude reading (Ai) of 50.0 dBuV + Cable Loss (CL) 1.0 dB + High Pass Filter/Attenuator (IA) 5 dB - Amplifier Gain (Ga) 20 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin (dB) = Corrected Amplitude (dBuV) - Class B Limit (dBuV)

## 4.6 Test Equipment List and Details

| Manufacturer | Description | Model Number | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Rohde & Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100044 | 2014-07-17 | 1 year |
| Solar Electronics | LISN, EMC | 9252-50-R-24-N | 511205 | 2014-06-25 | 1 year |
| Rohde & Schwarz | Impulse Limiter | ESH3-Z2 | 101963 | 2014-07-03 | 1 year |

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 4.7 Test Environmental Conditions

| | |
|---|---|
| **Temperature** | 24.12 º C |
| **Relative Humidity** | 38.31 % |
| **ATM Pressure** | 102.15 kPa |

*The testing was performed by Jerry Wang on 2014-09-29 in 10 m chamber 1.*

## 4.8 Summary of Test Results

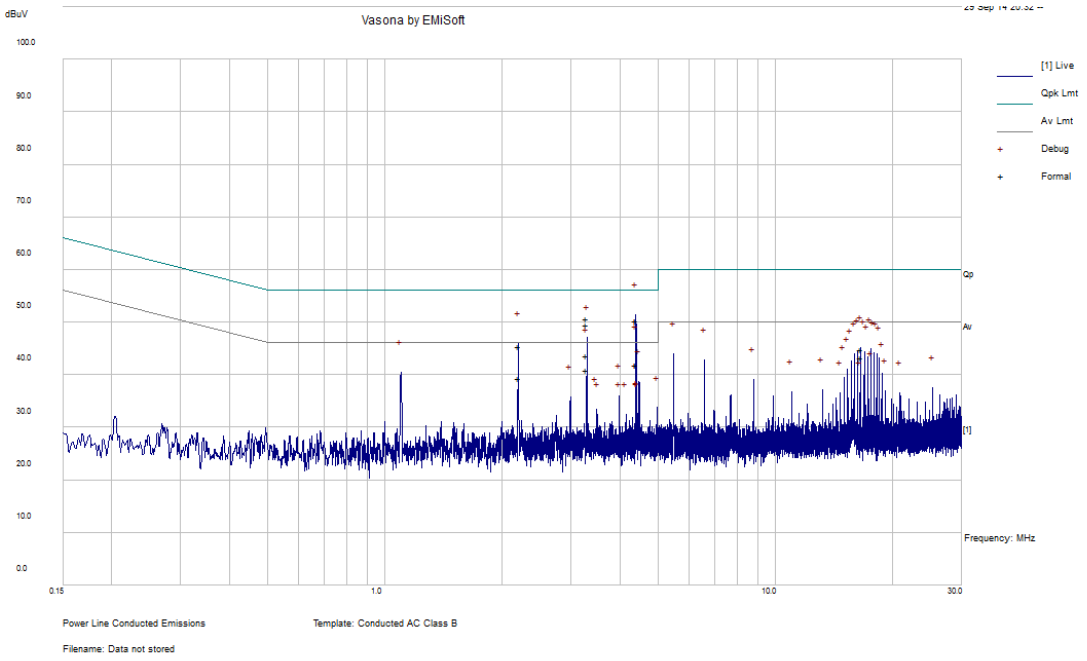
According to the recorded data, the EUT complied with FCC §15.107, and CISPR 22 §5 Standard, Class B limits, and had the worst margin reading of:

| **Connection: 120 V/60 Hz AC** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Conductor Mode (Line/Neutral)** | **Range (MHz)** |
| -2.36 | 3.29458 | Neutral | 0.15 MHz to 30 MHz |

| **Connection: 230 V/50 Hz AC** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Conductor Mode (Line/Neutral)** | **Range (MHz)** |
| -2.44 | 3.294526 | Neutral | 0.15 MHz to 30 MHz |

## 4.9 Conducted Emissions Test Plots and Data

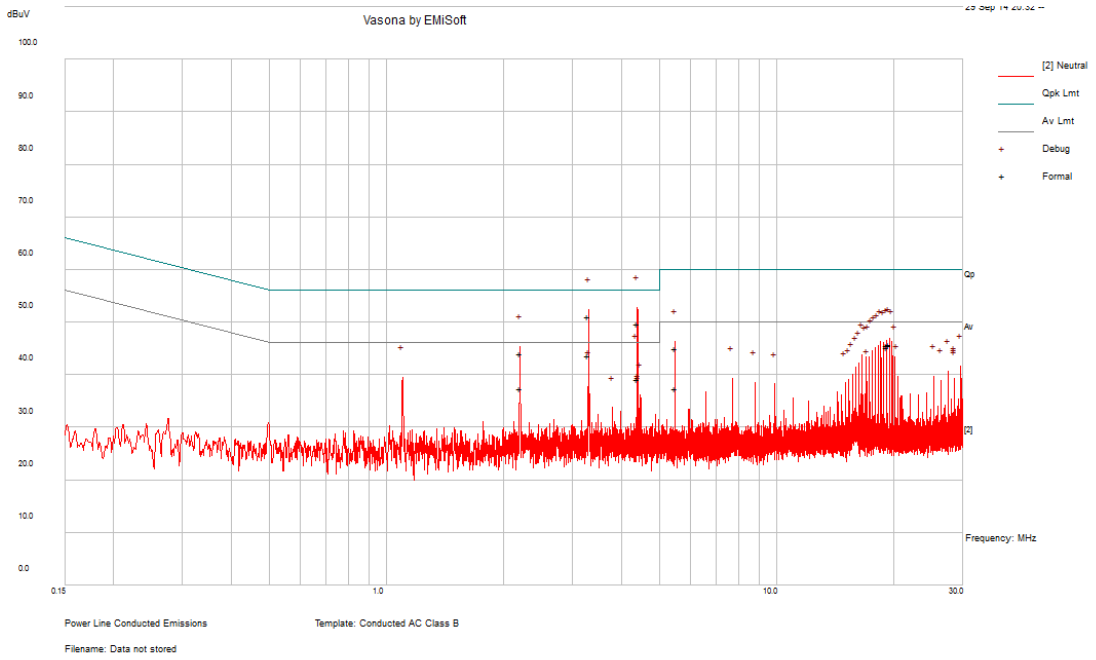
**120V, 60 Hz – Line**




| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.294497 | 50.75 | Line | 56 | -5.25 | QP |
| 4.394543 | 50.32 | Line | 56 | -5.68 | QP |
| 4.394435 | 50.27 | Line | 56 | -5.73 | QP |
| 3.291841 | 49.56 | Line | 56 | -6.44 | QP |
| 2.197337 | 45.35 | Line | 56 | -10.65 | QP |
| 16.564389 | 44.81 | Line | 60 | -15.19 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.294497 | 43.6 | Line | 46 | -2.40 | Ave. |
| 4.394543 | 41.96 | Line | 46 | -4.04 | Ave. |
| 4.394435 | 41.95 | Line | 46 | -4.05 | Ave. |
| 3.291841 | 40.88 | Line | 46 | -5.12 | Ave. |
| 2.197337 | 39.34 | Line | 46 | -6.66 | Ave. |
| 16.564389 | 43.29 | Line | 50 | -6.71 | Ave. |

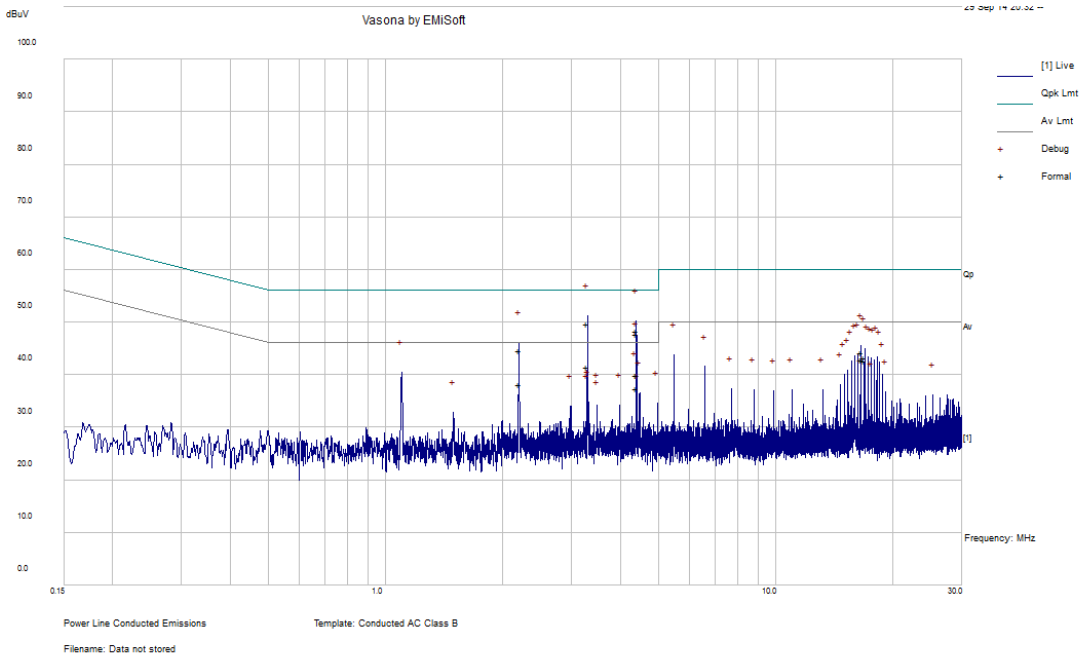
## 120 V, 60 Hz – Neutral




| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.29458 | 51.13 | Neutral | 56 | -4.87 | QP |
| 4.390094 | 49.68 | Neutral | 56 | -6.32 | QP |
| 2.198198 | 43.96 | Neutral | 56 | -12.04 | QP |
| 19.43525 | 45.67 | Neutral | 60 | -14.33 | QP |
| 19.116611 | 45.25 | Neutral | 60 | -14.75 | QP |
| 5.492558 | 45.08 | Neutral | 60 | -14.92 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.29458 | 43.64 | Neutral | 46 | -2.36 | Ave. |
| 19.43525 | 45.81 | Neutral | 50 | -4.19 | Ave. |
| 19.116611 | 45.51 | Neutral | 50 | -4.49 | Ave. |
| 4.390094 | 39.17 | Neutral | 46 | -6.83 | Ave. |
| 2.198198 | 37.36 | Neutral | 46 | -8.64 | Ave. |
| 5.492558 | 37.44 | Neutral | 50 | -12.56 | Ave. |

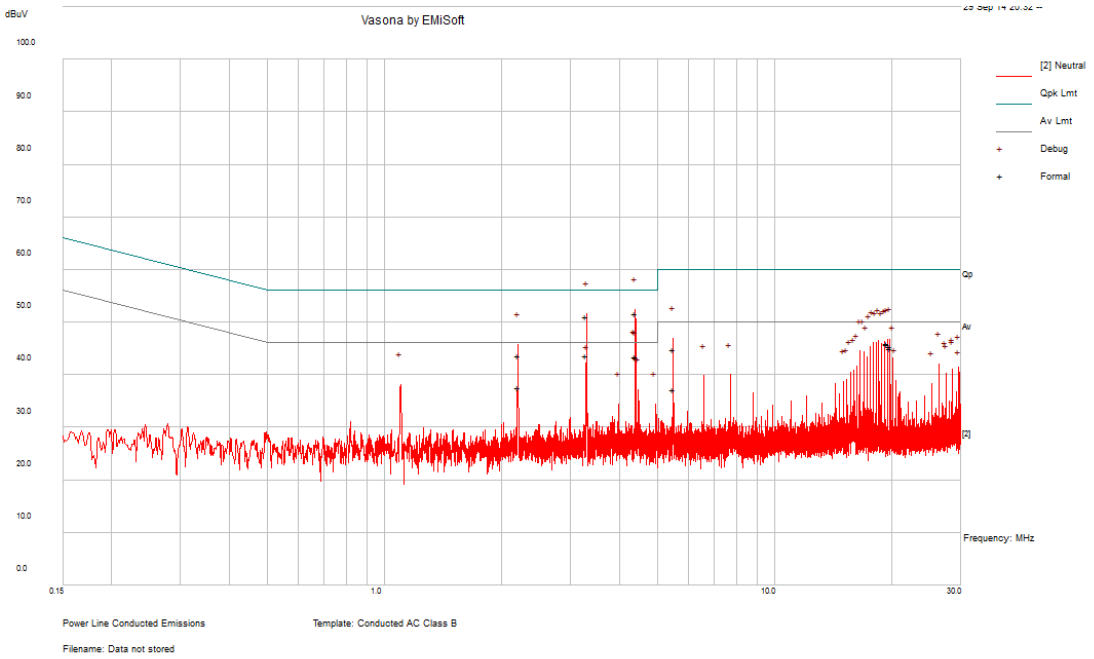
## 230V, 50 Hz – Line




| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.29282 | 49.75 | Line | 56 | -6.25 | QP |
| 4.393103 | 48.4 | Line | 56 | -7.60 | QP |
| 4.39037 | 47.74 | Line | 56 | -8.26 | QP |
| 2.198295 | 44.62 | Line | 56 | -11.38 | QP |
| 16.563258 | 44.27 | Line | 60 | -15.73 | QP |
| 16.882977 | 43.26 | Line | 60 | -16.74 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.29282 | 41.5 | Line | 46 | -4.50 | Ave. |
| 4.393103 | 39.93 | Line | 46 | -6.07 | Ave. |
| 16.563258 | 42.93 | Line | 50 | -7.07 | Ave. |
| 16.882977 | 42.68 | Line | 50 | -7.32 | Ave. |
| 2.198295 | 38.22 | Line | 46 | -7.78 | Ave. |
| 4.39037 | 37.33 | Line | 46 | -8.67 | Ave. |

## 230V, 50 Hz – Neutral




| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 4.395245 | 51.7 | Neutral | 56 | -4.30 | QP |
| 3.294526 | 51.07 | Neutral | 56 | -4.93 | QP |
| 2.196689 | 43.73 | Neutral | 56 | -12.27 | QP |
| 19.433258 | 45.7 | Neutral | 60 | -14.30 | QP |
| 19.752863 | 45.11 | Neutral | 60 | -14.89 | QP |
| 5.491994 | 44.86 | Neutral | 60 | -15.14 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (PK/QP/Ave) |
|---|---|---|---|---|---|
| 3.294526 | 43.56 | Neutral | 46 | -2.44 | Ave. |
| 4.395245 | 43.39 | Neutral | 46 | -2.61 | Ave. |
| 19.433258 | 45.91 | Neutral | 50 | -4.09 | Ave. |
| 19.752863 | 45.31 | Neutral | 50 | -4.69 | Ave. |
| 2.196689 | 37.64 | Neutral | 46 | -8.36 | Ave. |
| 5.491994 | 37.19 | Neutral | 50 | -12.81 | Ave. |

# 5 FCC §15.109 & AS/NZS CISPR 22 §6 – Radiated Emissions

## 5.1 Applicable Standards

**As per FCC §15.109: Radiated Emission Limits**

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency of Emission (MHz) | Field Strength (microvolts/meter) |
|---|---|
| 30 to 88 | 100 |
| 88 to 216 | 150 |
| 216 to 960 | 200 |
| Above 960 | 500 |

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22: "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement."

*NOTE 1: The CISPR 22 §6 Standard, Class B limits are applied to the test data hereinafter.*

**As per EN 55022 §6 and CISPR §6: Radiated Emission Limits**

The EUT shall meet the limits of the table below when measured at the measuring distance *R* in accordance with the methods described in Clause 10. If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the highest reading shall be recorded, with the exception of any brief isolated high reading, which should be ignored.

Limits for radiated disturbance of class B ITE at a measuring distance of 10 m

| Frequency range (MHz) | Quasi-peak limits (dBµV/m) |
|---|---|
| 30 to 230 | 30 |
| 230 to 1000 | 37 |
| *NOTE 1: The lower limit shall apply at the transition frequency.*<br>*NOTE 2: Additional provisions may be required for cases where interference occurs.* | |

**As per EN 55022 §6 and CISPR §6: Limits above 1 GHz**

The EUT shall meet the limits of the table below when measured in accordance with the method described in Clause 10 and the conditional testing procedure described below.

Limits for radiated disturbance of Class B ITE at a measurement distance of 3 m

| Frequency Range (GHz) | Average Limit dB(µV/m) | Peak Limit dB(µV/m) |
|---|---|---|
| 1 to 3 | 50 | 70 |
| 3 to 6 | 54 | 74 |
| *NOTE 1: The lower limit shall apply at the transition frequency.*<br>*NOTE 2: Additional provisions may be required for cases where interference occurs.* | | |

## 5.2 EUT Setup

The radiated emissions tests were performed in the10-meter test chamber, using the setup in accordance with CISPR 22 measurement procedures. The specifications used were in accordance with CISPR 22 §6 standard, Class B limits for measurements up to 1 GHz and FCC Part 15 Rules, Class B limits for frequencies above 1 GHz.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

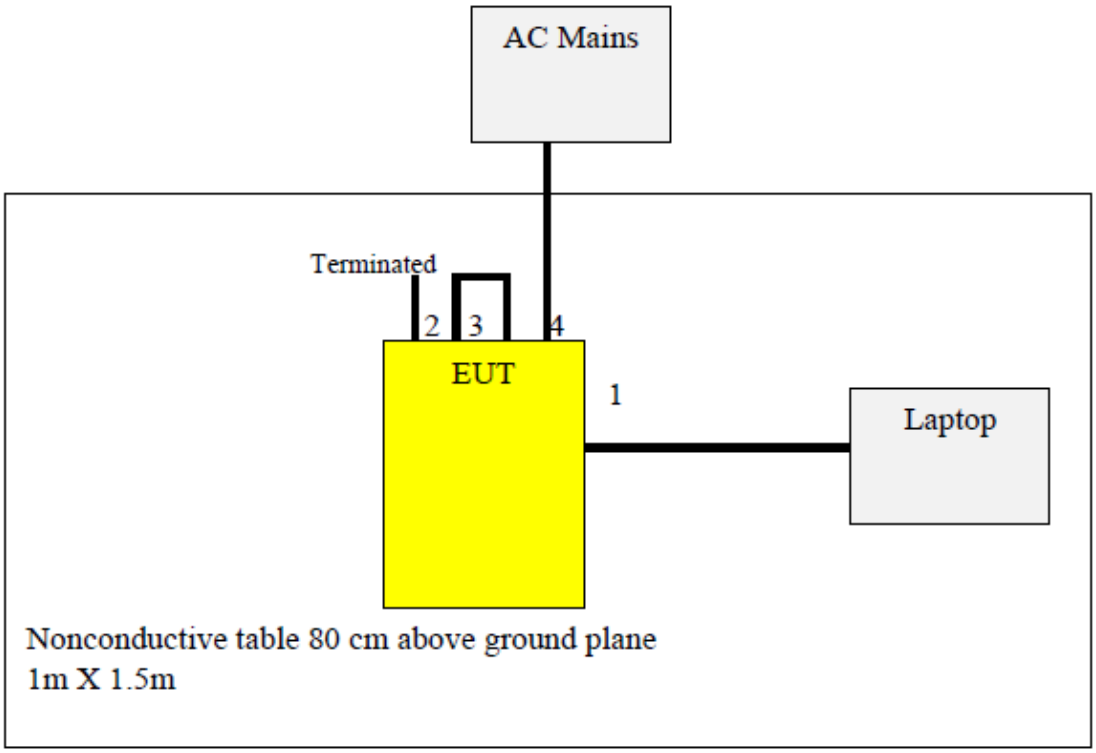
The EUT was connected to an AC line power source.

## 5.3 Test Procedure

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

All data was recorded in the peak detection mode. Quasi-peak readings were performed only when an emission was found to be marginal (within -4 dB of specification limits).

## 5.4 Test Setup Block Diagram




| | | |
|---|---|---|
| 1 – Ethernet Cable<br>2 – Ethernet Cable | 3 – Ethernet Cable Looped Back<br>4 – AC Power Cable | KEY |

## 5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to the indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, the Corrected Amplitude (CA) of 40.3 dBuV/m = indicated Amplitude reading (Ai) 32.5 dBuV + Antenna Factor (AF) 23.5dB + Cable Loss (CL) 3.7 dB + Attenuator (Atten) 10 dB - Amplifier Gain (Ga) 29.4 dB

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin (dB) = Corrected Amplitude (dBuV/m) - Class B Limit (dBuV/m)

## 5.6 Test Equipment List and Details

| Manufacturer | Description | Model Number | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Sunol Sciences | Antenna, Biconi-Log | JB1 | A020106-1 | 2014-06-25 | 1 year |
| Agilent | Amplifier, Pre | 8447D | 2944A10187 | 2014-03-20 | 1 year |
| Rohde & Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100044 | 2014-07-17 | 1 year |
| Sunol Sciences | Controller, System | SC104V | 113005-1 | Cal. Not required | N/A |
| HP | Amplifier, Pre | 8449B | 3147A00400 | 2014-03-10 | 1 year |
| A. H. Systems | Antenna, Horn | SAS-200/571 | 261 | 2014-01-30 | 1 year |
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2013-10-22 | 1 year |
| Wisewave | Antenna, Horn | ARH-4223-02 | 10555-01 | 2012-08-09 | 3 years |
| Wisewave | Antenna, Horn | ARH-2823-02 | 10555-01 | 2012-08-09 | 3 years |
| Wisewave | Amplifier, Low Noise | ALN-33144030-01 | 11424-01 | 2013-03-30 | 2 years |

***Statement of Traceability:*** **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 5.7 Test Environmental Conditions

**30-1000 MHz:**

| | |
|---|---|
| **Temperature** | 24.12 ºC |
| **Relative Humidity** | 38.31 % |
| **ATM Pressure** | 102.15 kPa |

*The testing was performed by Jerry Wang on 2014-09-29 in 10 m chamber 1.*

**1-40GHz:**

| | |
|---|---|
| **Temperature** | 25 ° C |
| **Relative Humidity** | 41 % |
| **ATM Pressure** | 101.42 kPa |

*The testing was performed by Bryan Smith on 2014-09-16 in 10 m chamber 1.*

## 5.8 Summary of Test Results

According to the data in the following table, the EUT complied with FCC 15.109, ICES-003 §6.2 and CISPR 22 Standard, Class B limits, and had the worst margin reading of:

**CISPR 22 & FCC 15B, 30 MHz to 1 GHz:**

| Frequency Range: 30 to 1000 MHz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| -1.45 | 136.0675 | Vertical | 30 to 1000 MHz |

**FCC 15B, 1-18 GHz**

| Frequency Range: 1 to 18 GHz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| -4.50 | 17279.41 | Horizontal | 1000 to 18000 MHz |

**FCC 15B, 18-26.5 GHz**

| Frequency Range: 18 to 26.5 GHz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (GHz)** |
| -8.22 | 24912.65 | Horizontal | 18 to 26.5 GHz |

**FCC 15B, 26.5-40 GHz**

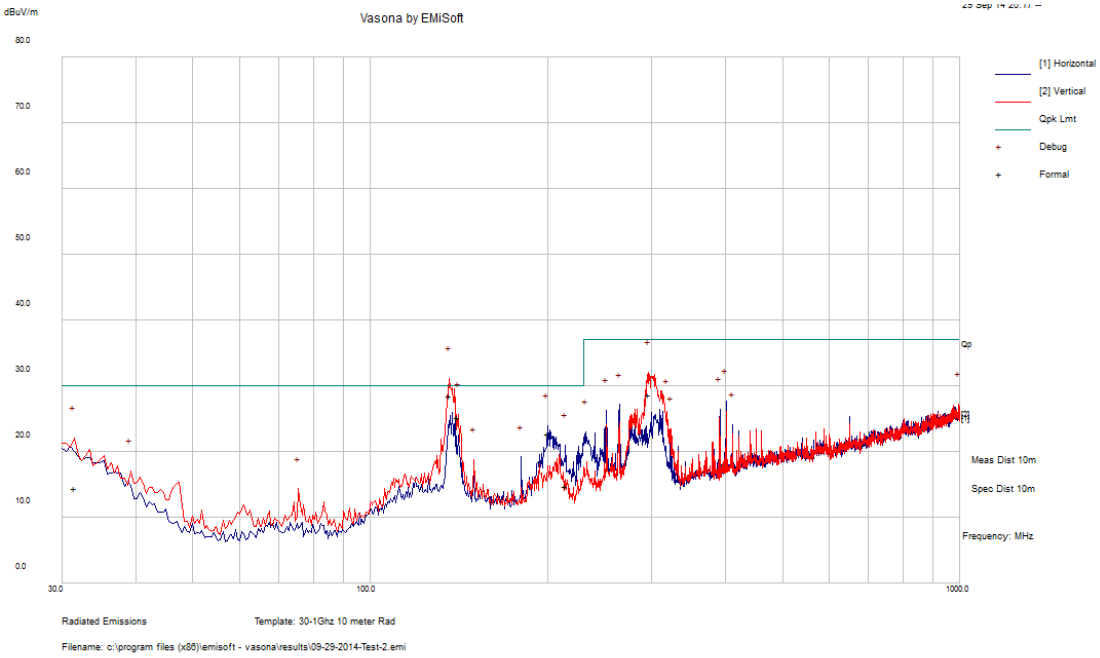
| Frequency Range: 26.5 to 40 GHz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (GHz)** |
| -5.24 | 39399.21 | Horizontal | 26.5 to 40 GHz |

**CISPR 22, above 1 GHz:**

| Frequency Range: 1 to 6 GHz | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| -17.60 | 1000 | Horizontal | 1000 to 6000 MHz |

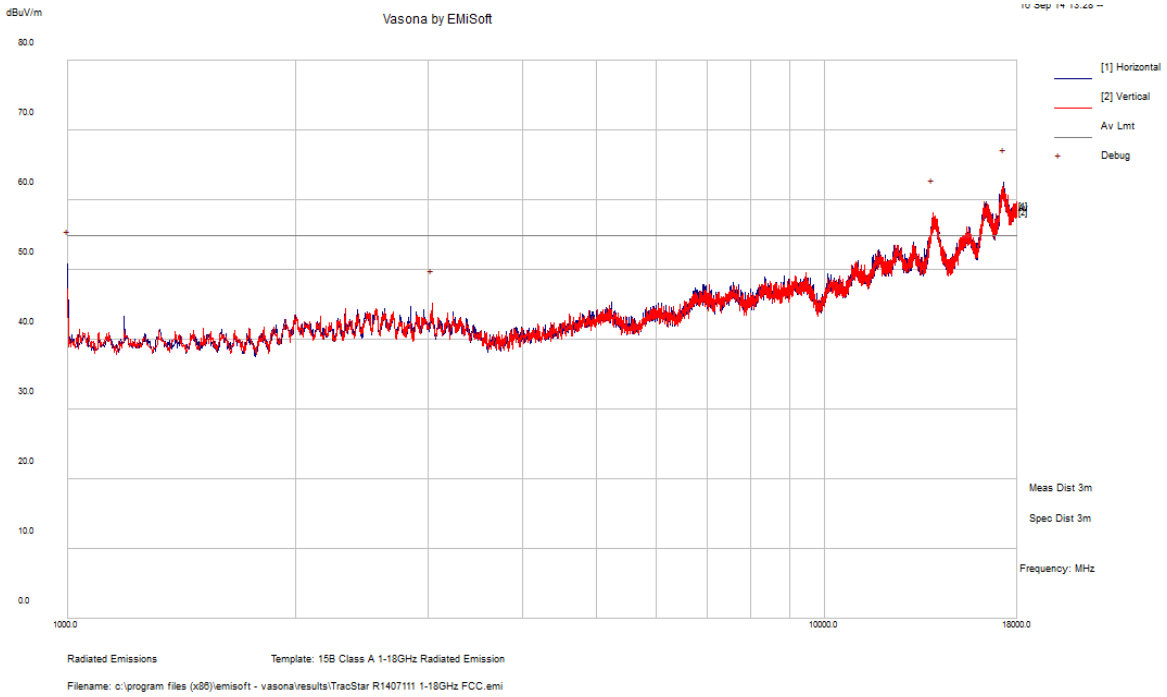
## 5.9 Radiated Emissions Test Plot and Data

### 1) 30 MHz to 1 GHz measured at 10m Distance



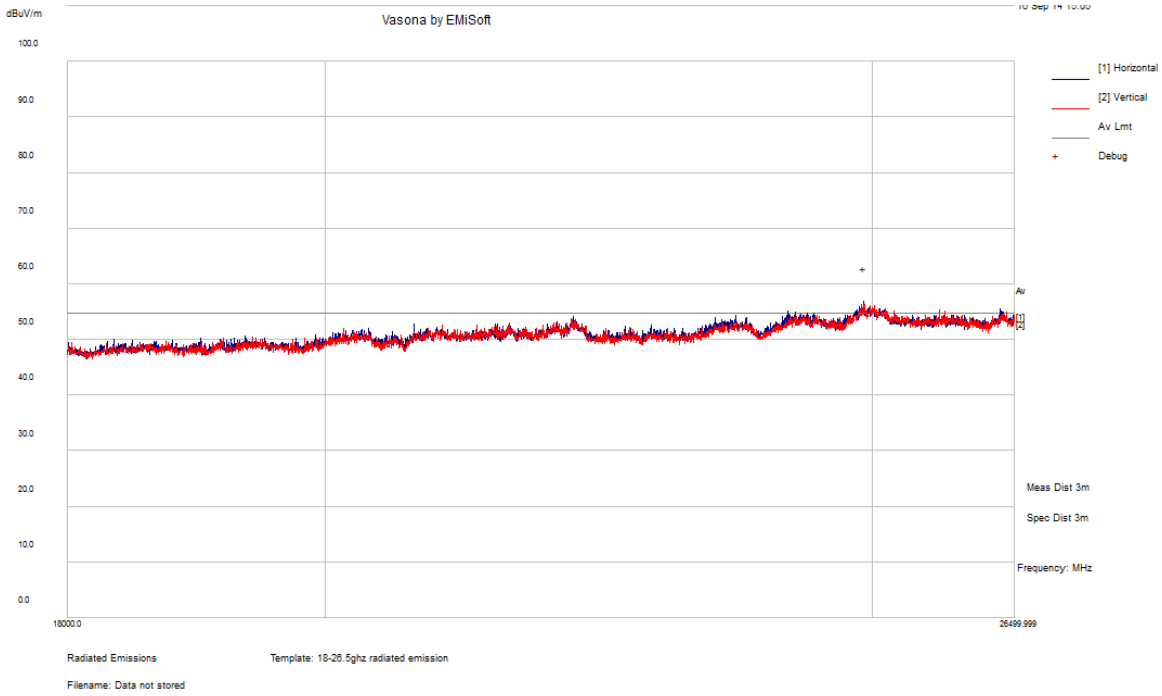

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Detector (PK/QP/Ave.) |
|---|---|---|---|---|---|---|---|
| 136.0675 | 28.55 | 100 | V | 361 | 30 | -1.45 | QP |
| 140.9455 | 25.26 | 148 | V | 14 | 30 | -4.74 | QP |
| 199.9878 | 22.72 | 397 | H | 298 | 30 | -7.28 | QP |
| 296.9525 | 28.63 | 204 | V | 231 | 37 | -8.37 | QP |
| 214.0758 | 14.67 | 365 | H | 302 | 30 | -15.33 | QP |
| 31.4945 | 14.37 | 369 | V | 147 | 30 | -15.63 | QP |

## 2) FCC Part 15B, 1 to 18 GHz measured at 3m Distance



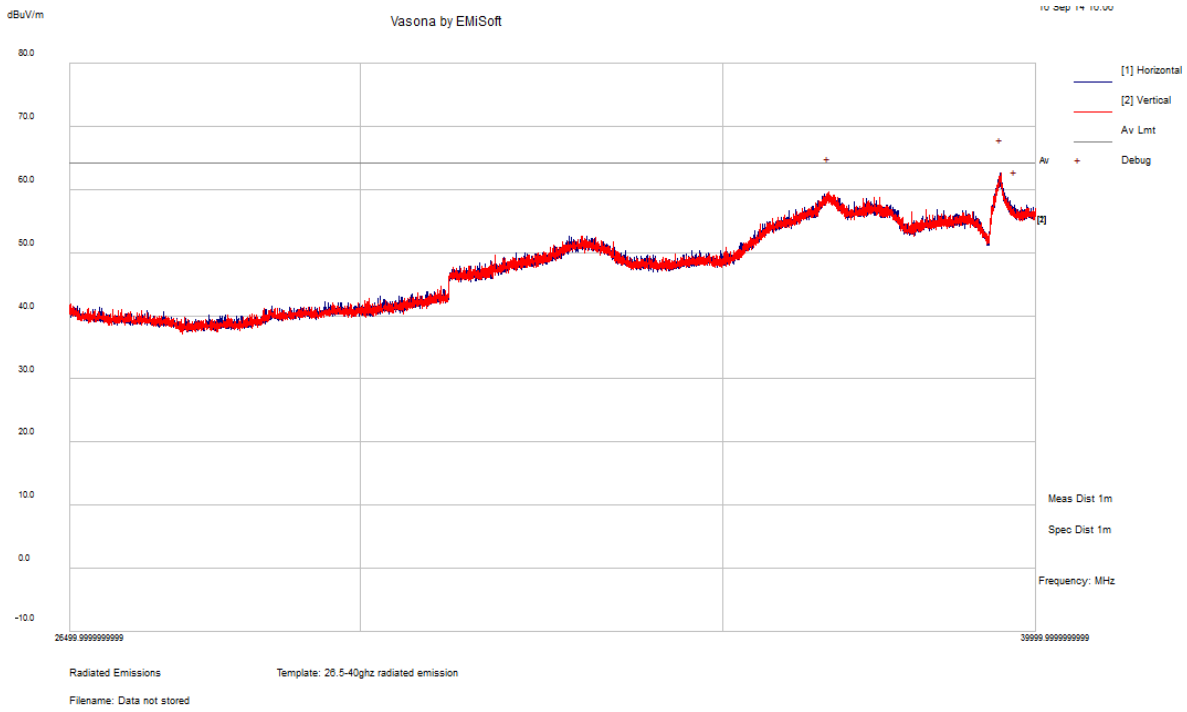

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Detector (PK/QP/Ave.) |
|---|---|---|---|---|---|---|---|
| 17280.16 | 62.51 | 100 | H | 0 | 74 | -11.49 | PK |
| 13920 | 58.15 | 200 | V | 0 | 74 | -15.85 | PK |
| 1000 | 50.86 | 100 | H | 0 | 74 | -23.14 | PK |
| 3032.031 | 45.23 | 200 | V | 0 | 74 | -28.77 | PK |
| 17279.41 | 49.5 | 112 | H | 25 | 54 | -4.50 | Ave. |
| 13921.54 | 46.04 | 125 | V | 169 | 54 | -7.97 | Ave. |
| 1000 | 34.79 | 100 | H | 87 | 54 | -19.21 | Ave. |
| 3032.644 | 31.39 | 203 | V | 231 | 54 | -22.61 | Ave. |

### 3) FCC Part 15B, 18 to 26.5 GHz measured at 3m Distance



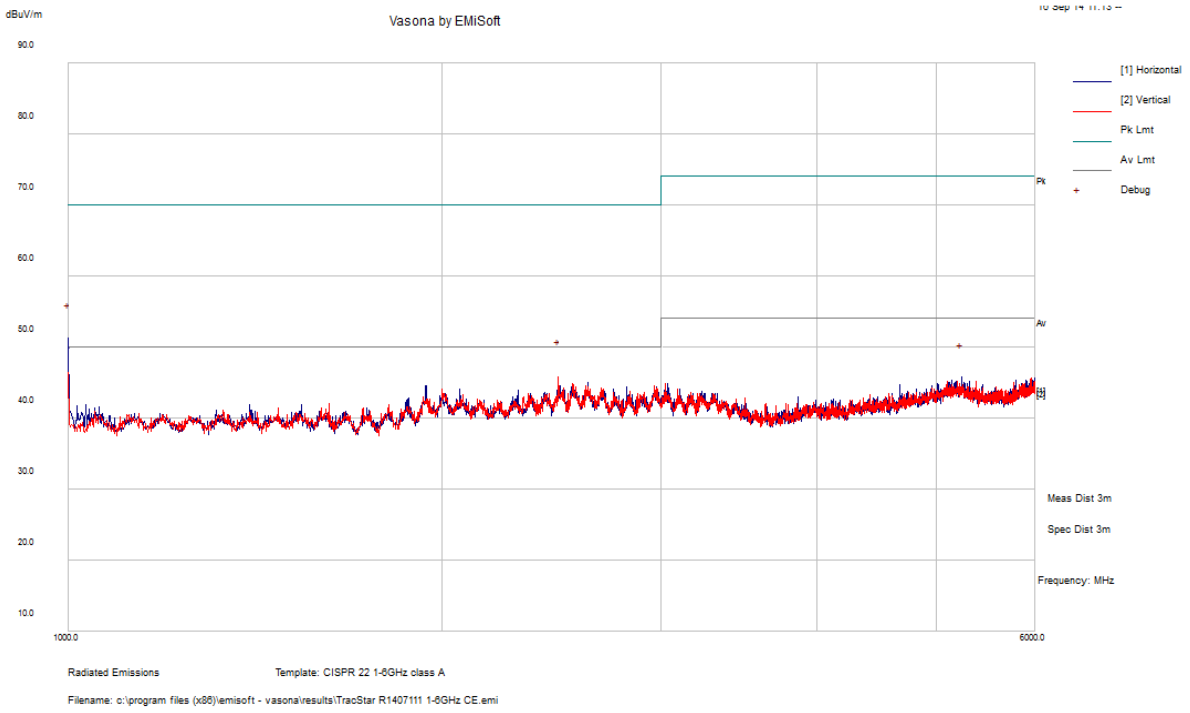

| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Detector (PK/QP/Ave.) |
|---|---|---|---|---|---|---|---|
| 24914.22 | 56.83 | 200 | H | 0 | 74 | -17.17 | PK |
| 24912.65 | 45.78 | 191 | H | 289 | 54 | -8.22 | Ave. |

## 4) FCC Part 15B, 26.5 to 40 GHz measured at 1m Distance




| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Detector (PK/QP/Ave.) |
|---|---|---|---|---|---|---|---|
| 39400.94 | 72.63 | 100 | H | 0 | 84 | -11.37 | PK |
| 36618.67 | 69.71 | 200 | V | 0 | 84 | -14.29 | PK |
| 39641.41 | 67.55 | 200 | H | 0 | 84 | -16.45 | PK |
| 39399.21 | 58.76 | 114 | H | 230 | 64 | -5.24 | Ave. |
| 36620.41 | 56.3 | 158 | V | 291 | 64 | -7.70 | Ave. |
| 39640.27 | 54.04 | 106 | H | 233 | 64 | -9.96 | Ave. |

### 5) CISPR 22, above 1 GHz measured at 3m Distance




| Frequency (MHz) | Corrected Amplitude (dBµV/m) | Antenna Height (cm) | Antenna Polarity (H/V) | Turntable Azimuth (degrees) | Limit (dBµV/m) | Margin (dB) | Detector (PK/QP/Ave.) |
|---|---|---|---|---|---|---|---|
| 2481.56 | 42.83 | 124 | V | 318 | 70 | -27.17 | PK |
| 5234.31 | 43.21 | 174 | H | 58 | 74 | -30.79 | PK |
| 1000 | 36.17 | 100 | H | 144 | 70 | -33.83 | PK |
| 1000 | 32.4 | 100 | H | 144 | 50 | -17.60 | Ave. |
| 2481.56 | 31.74 | 124 | V | 318 | 50 | -18.26 | Ave. |
| 5234.31 | 32.17 | 174 | H | 58 | 54 | -21.83 | Ave. |