

**ELECTROMAGNETIC COMPATIBILITY
TEST REPORT
TO
FCC 47 CFR Part 24
&
INDUSTRY CANADA RSS-133 Issue 5
TEST REPORT
for
Transmitter Intentional Radiator**

Report Number: E10599-1302 DO
Issue: Modified Version 2.0
Date of Issue: November 05, 2013
Number of Pages: 36

Testing laboratory..... : Quality Auditing Institute

Address..... : 16 – 211 Schoolhouse Street, Coquitlam, BC, V3K 4X9, Canada

Accreditations (ISO 17025):



Standard Council of Canada: Accredited Laboratory No. 743

International Accreditation Service Inc.: Accredited Laboratory: No. TL-239

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Contact..... : Randeep Chatha, rundeep.chatha@starsolutions.com

Industry Canada Registration : 8076A-21001001
FCC Registration: S52-2-10-01-00-1

Test specifications:

Standard..... : RSP-100 Iss 9; RSS-Gen Iss 3; RSS-102 Iss 4; RSS-133 Iss 6;
FCC Part 2; FCC Part 24.
Test Procedure : As called by the standards above and TIA/EIA-603-C
Non-standard test method..... : N/A



STARSOLUTIONS

ENABLING NETWORKS TO REACH NEW MARKETS

Trade Mark:

Manufacturer:

Model Number:

Model Description:

Star Solutions International Inc.

QD9004.0

iCell QUADPAC DO IP-RAN 1900MHz CPU AC GPS



Revision History

| Date | Report Number | Rev # | Details | Authors Initials |
|--------------|----------------|-------|--------------------------------------------------|------------------|
| Oct 15, 2013 | E10599-1302 DO | 0.0 | Draft Test Report | DJ |
| Oct 16, 2013 | E10599-1302 DO | 1.0 | Original Release Test Report | DJ |
| Nov 05, 2013 | E10599-1302 DO | 2.0 | Modified Out-Of-Band Spurious Radiated Emissions | DJ |
| | | | | |
| | | | | |

All previous versions of this Report have been superseded by the latest dated Revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.

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Section I. GENERAL TEST INFORMATION

EMC TEST SUMMARY

The following tests demonstrate testimony for the FCC & IC Marks for Transceivers / electromagnetic compatibility testing for this EUT as required by FCC Part 24 and IC RSS-133 Issue 6.

| Test / Requirement Description | Applicable FCC Rule Parts | Applicable Industry Canada Rule Parts | Results | | Pass / Fail |
|--------------------------------------------|--------------------------------------------------|---------------------------------------|--------------|---------------------|-------------|
| | | | Limit | Measured | |
| Antenna Requirements | N/A | RSS-Gen, Issue 3 | No | N/A | Pass |
| Frequency Range(s) | 2.1033(c)(5) 24.229 | RSP-100(7.2)(a) | 1930-1990MHz | 1931.25-1988.75 MHz | Pass |
| RF power output at antenna terminals | 2.1033(c)(6) 2.1033(c)(7) 2.1046 24.232 | RSP-100(7.2)(a) RSS-133 | EIRP 65 dBm | 18.4-19.4dBm | Pass |
| 99% Bandwidth | | RSS-GEN (4.4.1) RSS-133 | N/A | 1.296MHz | Pass |
| Occupied Bandwidth (26dB) | 2.1049 24.200 | | N/A | 1.640MHz | Pass |
| Spurious Emissions at antenna terminals | 2.1051 2.1057 24.238 | RSS-133 | -13 dBm | >20dB margin | Pass |
| Spurious Emissions Radiated Field Strength | 2.1053 2.1057 | RSS-133 | -13 dBm | >20dB margin | Pass |
| Frequency Stability | 2.1055 24.235 | RSS-GEN (4.7) | 1ppm | 0.3ppm | Pass |

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with CFR 47 FCC Part 24 and Industry Canada RSS-133. The manufacturer is responsible for the tested product configuration, continued product compliance with these standards listed, and for the appropriate auditing of subsequent products as required.

X

Tested By & Report Written By David Johanson,
RF/EMC Test Engineer

X

Reviewed By Amandeep Jathaul
RF/EMC Test Engineer

TEST RESULT CERTIFICATION

Applicant: Star Solutions International, Inc.
 Suite 120 – 4600 Jacombs Rd. Richmond BC, V6V 3B1, Canada

Equipment Under Test:

Part Number: 24246787GS
 Product Description: iCell QUADPAC DO IP – RAN 1900MHz CPU AC GPS
 Model Number: QD9004.0
 and
 Part Number: 24246792GS
 Product Description: iCell QUADPAC DO IP – RAN 1900MHz AC GPS
 Model Number: QD9003.0
Date of Test: Sept 23-Oct 09, 2013

EUT DESCRIPTION

| EUT | |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Functional Description | <p>The Star Solutions iCell QUADPAC DO IP-RAN 1900MHz CPU AC GPS is a EV-DO CDMA2000 PCS Base Station which is designed to operate Tx: 1930-1990MHz and RX: 1850-1910MHz.</p> <p>The QuadPAC is part of the Star Solutions All-IP CDMA2000® network.</p> <p>The All-IP CDMA2000® network is an end-to-end, all-Internet-Protocol (IP)-based, wireless communication solution. The CDMA2000® system provides the mobility and media control traditionally associated with a circuit-switched Mobile Switching Center (MSC), but in a packet-based environment.</p> <p>The All-IP CDMA2000® system is 2G- and 3G-capable, supporting cdmaOne and CDMA2000 1x and Evolution Data Optimized (EV-DO) networks. By deploying the CDMA2000® system in 2G and 3G environments, network operators gain the efficiency inherent in packet-based networks, while building a network core that is capable of supporting 3G standards.</p> <p>The iCell™ QuadPAC IP-RAN is a configurable 1RU rackmount basestation solution for CDMA2000™ DO picocell deployment requirements. The QuadPAC unit is designed to house a EVDO BTS Module, a Power Supply Module, a timing source module (either a clock (higher-performance OCXO) module or a GPS receiver module), and an optional CPU Network Module that enables CDMA network functionality such as the BSC, PDSN, and Wireless Call Manager. The QuadPAC provides single-carrier, single-sector coverage with a 32 channel-element capacity.</p> <p>The iCell QuadPAC hardware configuration consists of a base configuration with additional optional modules that can be installed depending on the deployment scenario.</p> <p>The base configuration consists of:</p> <ul style="list-style-type: none"> ■ BSS Module (BTS and integrated BSC) ■ Power Supply Module ■ GPS Module - Provides a frequency reference 1PPS signal via a GPS antenna ■ Clock Module - Provides a stand-alone frequency reference if a GPS signal |

| | |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | is not readily available ■ CPU Module - Enables CDMA network functionality such as the BSC, PDSN, and Wireless Call Manager (wCM). |
| Operational Description | EVDO CDMA Forward signal is developed in the Qualcomm CSM5000 CDMA modems in the main digital board of the BTS module. The digitizer module converts the signal to analog. This signal is up-converted to the desired channel frequency, amplified and filtered. |
| Antenna | No antenna was provided with this sample. |
| Ratings | 100-240Vac 50/60Hz 100VA (in normal operating environment) |
| Software and Firmware | The EUT was programmed and verified with a host laptop equipment during testing using Windows 7 operating system and Windows Explorer. The Star Solutions Software FCC_TOOL ver 7.0.6 was used to change the channels and power settings of the EUT. The EUT firmware tested was: The EUT firmware tested was: 1.2.8 Production Release The Software Application firmware was: 2.1.1 Production Release |
| Received Date | September 23, 2013 |
| Received By | David Johanson |
| Sample Log | QAI Product Control Log (QM 1305 - Sample Inventory) |

FACILITIES AND ACCREDITATION

| | |
|---------------------------|------------------------------------------------------------|
| Testing Laboratory: | Quality Auditing Institute |
| Address | 16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada |
| Associated Laboratory: | Quality Auditing Institute EMC lab (Remote location) |
| Address | 19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada |
| Tested & Reported by..... | David Johanson |
| Checked by..... | Amandeep Jathaul |

ENVIROMENTAL CONDITIONS:

INDOORS: Temperature: 22-28°C R.H.: 39.7 - 54.4%

OUTDOORS: Temperature: 18°C R.H.: 58%

TESTING METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4, FCC CFR 47 Part 2, FCC CFR 47 Part 24, and RSS-Gen, Issue 3 and RSS-133, Issue 6. The FCC testing was also done using the FCC KDB 971168 D01 Measurement Guidance for Certification of Licensed Digital Transmitters v02r0.

EUT TESTING CONFIGURATION

For the purpose of compliance testing, the EUT was powered using 120Vac 60Hz. The transmitter was set for continuous operation on various frequencies in modulated modes of operation as required for the test. Only the iCell QUADPAC DO IP – RAN 1900MHz CPU AC GPS (Model Number: QD9004.0) was tested, it has the extra CPU board installed, since this was considered the same as the iCell QUADPAC DO IP – RAN 1900MHz AC GPS (Model Number: QD9003.0)

WORST TEST CASE

The worst-case channel is determined as the channel with the highest output power using the narrowest Bandwidth Modulation. The highest measured output power was on Channel 600 at 1960MHz using the default QPSK modulation.

TEST SETUP

The EUT was connected to 120Vac 60Hz power source.

The RF Section Ethernet port was connected to the CPU Ethernet port 1 using a 1meter Ethernet cable with an appropriate Ferrite to reduce the digital mode emissions.

The CPU Ethernet port 2 was connected directly into a Laptop Ethernet port for programming and monitoring of the EUT.

The RF Input port was connected to a 1 meter cable that was terminated with a 50Ohm load.

The RF Output was connected to an EMI Receiver and Spectrum Analyzer or an RF Power Meter through the appropriate cables, attenuators and filters as required to make the RF Conducted measurements.

The RF Output was terminated into a 50Ohm to make the Radiated Spurious Emissions measurements.

The RF GPS port was connected to a 100meter cable and a GPS antenna that was located outside to receive the GPS data from the satellites.

The GPS module was used for all RF and Spurious emissions measurements.

The Clock module was used for Digital mode emissions measurements.

ANTENNA DESCRIPTION

No Antenna was included with this test. The Antenna(s) used for this transmitter must be fixed-mounted on permanent outdoor structures. RF exposure compliance is addressed at the time of licensing, as required by the responsible agencies, including antenna co-location requirements.

GENERAL TEST PROCEDURES

RF Conducted Emissions

The EUT is placed on a test bench connected directly to an EMI Receiver and Spectrum Analyzer. Conducted emissions are measured in the frequency range 10kHz to 25GHz using CISPR Peak, Quasi-Peak and Average detectors.

AC Mains Conducted Emissions

The EUT is placed on the turntable 0.8m above a ground plane. Conducted emissions are measured in the frequency range 0.15 – 30MHz using CISPR quasi-peak and average detector.

Radiated Emissions

The EUT is placed on the turntable 0.8m above a ground plane 3m away from a receiving antenna. Height of receiving antenna varied from 1m to 4m, its polarity changes from vertical to horizontal. Turntable rotates 360 degrees. Motion of turntable and receiving antenna allows determining position of maximum emission level. Quasi-peak detector applies for measurements of emissions with frequency range of 30 to 1000MHz. and average/peak detector otherwise.

Radiated Emissions for Out-Of-Band Spurious Emissions

The EUT output was terminated into a 50Ohm load and the Spurious emissions were measured using the Radiated Emissions procedure. The emission level was then re-measured using the Substitution method procedure as outlined in ANSI TIA/EIA-603 section 2.2.12 .

MEASUREMENT UNCERTAINTY

| | |
|------------------------------------|----------------------------|
| Radio Frequency | : $\pm 1,5 \times 10^{-5}$ |
| Total RF power, conducted..... | : ± 1 dB |
| RF power density, conducted..... | : ± 2.75 dB |
| Spurious emissions, conducted..... | : ± 3 dB |
| All emissions, radiated..... | : ± 3.5 dB |
| Temperature..... | : $\pm 1^\circ\text{C}$ |
| Humidity..... | : ± 5 % |
| DC and low frequency voltages..... | : ± 3 % |

TESTING EQUIPMENT

Test Equipment List

| Manufacturer | Model | Description | Serial No. | Last Cal | Cal Due Date |
|-------------------------|--------------------|-------------------------------------------------|------------|--------------|--------------|
| ETS Lindgren | 2165 | Turntable | 00043677 | N/A | N/A |
| ETS Lindgren | 2125 | Mast | 00077487 | N/A | N/A |
| Sunol Sciences | JB3 | Biconilog Antenna 30MHz-3GHz | A120004 | 28-Oct-2013 | 28-Oct-2015 |
| COM-POWER | AHA-118 | Dual Ridge Horn Antenna | 711040 | 11-Mar-2011 | 11-Mar-2014 |
| Sunol Sciences | DRH-118 | Dual Ridge Horn Antenna | A052804 | 12-Apr-2012 | 12-Apr-2015 |
| Rohde & Schwarz | ESU40 | EMI Receiver | 100011 | 26-June-2012 | 26-Jun-2015 |
| Boonton | 4200-S/17 | RF Microwatt Power Meter | 430519BG | 13-Mar-2013 | 13-Mar-2016 |
| Boonton | 51033-6E | Average Power Sensor | 15779 | 18-Mar-2013 | 18-Mar-2016 |
| COM-POWER | LI-115 | LISN | 241036 | 9-Mar-2011 | 9-Mar-2014 |
| ETS Lindgren | S201 | 3 meter Semi-Anechoic Chamber | 1030 | N/A | N/A |
| MadgeTech | PRHTemp2 00 | Temperature, Humidity & Pressure Recorder | N53053 | 26-July-2012 | 26-July-2015 |
| Cincinnati Sub- Zero | ZH-16-2-2- H/16 | Temperature and Humidity Chamber | Z0013305 | N/A | N/A |

Measurement Software List

| Manufacturer | Model | Version | Description |
|-----------------|--------|---------|-------------------------------------|
| Rhode & Schwarz | EMC 32 | 6.20.0 | Emissions Pre-scan Test Software |

Auxiliary Equipment List

| | |
|--------------|----------------------|
| Description | Laptop |
| Manufacturer | Dell |
| Model No. | PP18L Windows Vista |
| Description | GPS Antenna |
| Manufacturer | Trimble |
| Model No. | 57860-20 |
| Description | 250w 40dB Attenuator |
| Manufacturer | SMELECTRONICS |
| Model No. | SA3N250-40S |

Cables

| Description | Length | Connector A | Connector B | Shielded | Ferrites |
|---------------------|--------|-------------|-------------|----------|----------|
| RF Section Ethernet | 1m | RJ45 | RJ45 | No | Yes |
| CPU Ethernet | 1m | RJ45 | RJ45 | No | No |
| RF Output | 1m | SMA MALE | SMA MALE | Yes | No |
| RF Input | 1m | SMA MALE | SMA MALE | Yes | No |
| GPS Port | 100m | SMA MALE | TNC MALE | Yes | No |

Section II. EUT TEST RESULTS

Part 1 - RF Output Power , 99% OBW and 26dB BW

DATE(s): October 4, 2013

TEST STANDARD: FCC Part 24 and IC RSS-133

TEST VOLTAGE: 120Vac 60Hz

MINIMUM STANDARD: 3.16kW (65 dBm)

TEST SETUP: The antenna port of EUT was directly connected to an RF Power Meter or a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

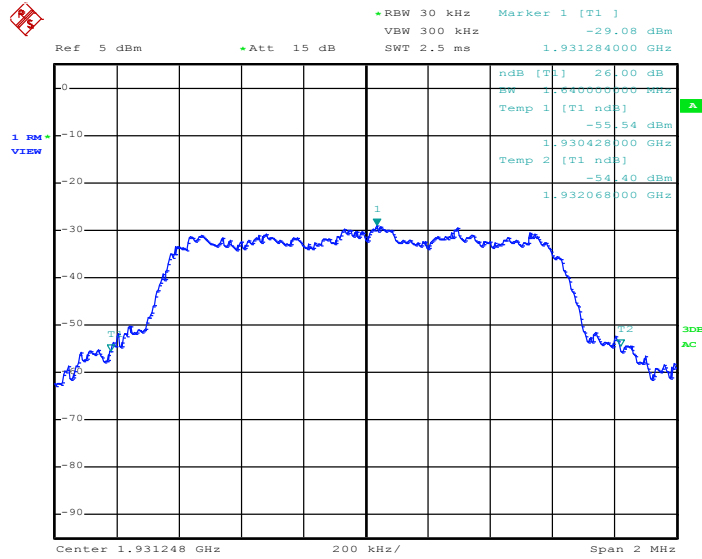
| Channel | modulation | Frequency (MHz) | RF Output Setting (dBm) | Measured (dBm) | Corrections (dB) | Measured Output Power (dBm) | 99% OBW (MHz) | 26dB BW (MHz) |
|---------|---------------|-----------------|-------------------------|----------------|------------------|-----------------------------|---------------|---------------|
| 25 | DAC9 QPSK | 1931.25 | 19 | -23.70 | 42.5 | 18.80 | 1.292 | 1.640 |
| 600 | DAC9 QPSK | 1960.00 | 19 | -23.00 | 42.5 | 19.50 | 1.288 | 1.524 |
| 1175 | DAC9 QPSK | 1988.75 | 19 | -24.10 | 42.6 | 18.50 | 1.288 | 1.512 |
| 25 | DAC11 8PSK | 1931.25 | 19 | -23.70 | 42.5 | 18.80 | 1.296 | 1.652 |
| 600 | DAC11 8PSK | 1960.00 | 19 | -23.10 | 42.5 | 19.40 | 1.292 | 1.512 |
| 1175 | DAC11 8PSK | 1988.75 | 19 | -24.10 | 42.6 | 18.50 | 1.292 | 1.612 |
| 25 | DAC12 8PSK | 1931.25 | 19 | -23.70 | 42.5 | 18.80 | 1.296 | 1.620 |
| 600 | DAC12 8PSK | 1960.00 | 19 | -23.10 | 42.5 | 19.40 | 1.292 | 1.624 |
| 1175 | DAC12 8PSK | 1988.75 | 19 | -24.10 | 42.6 | 18.50 | 1.292 | 1.632 |
| 25 | DAC 14 16-QAM | 1931.25 | 19 | -23.70 | 42.5 | 18.80 | 1.284 | 1.544 |
| 600 | DAC 14 16-QAM | 1960.00 | 19 | -23.10 | 42.5 | 19.40 | 1.292 | 1.636 |
| 1175 | DAC 14 16-QAM | 1988.75 | 19 | -24.20 | 42.6 | 18.40 | 1.292 | 1.520 |

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

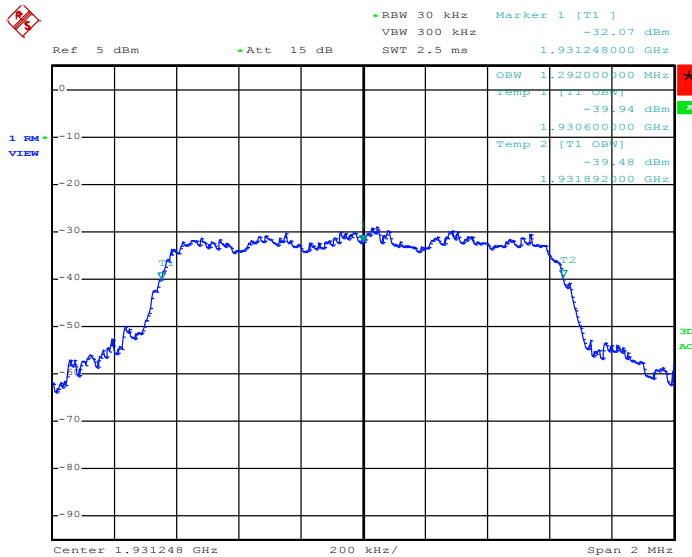
Sample Test Plots

Channel 25 DAC9-QPSK 26dB Occupied Bandwidth



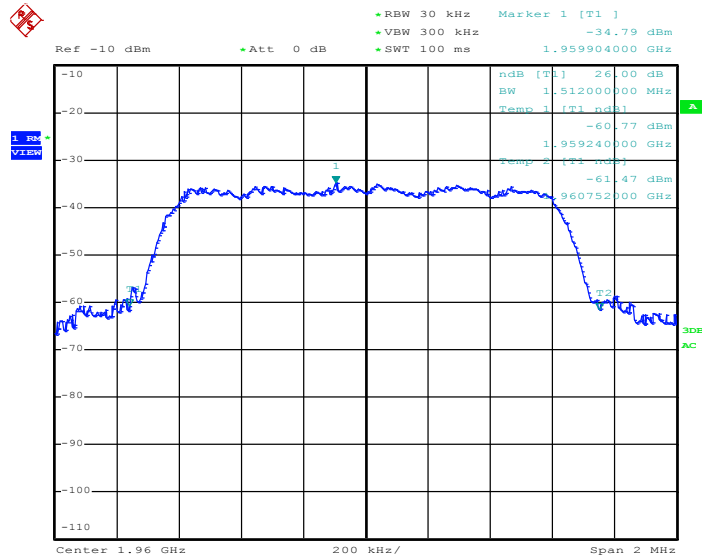
Date: 26.SEP.2013 20:17:19

Channel 25 DAC9-QPSK 99% Occupied Bandwidth



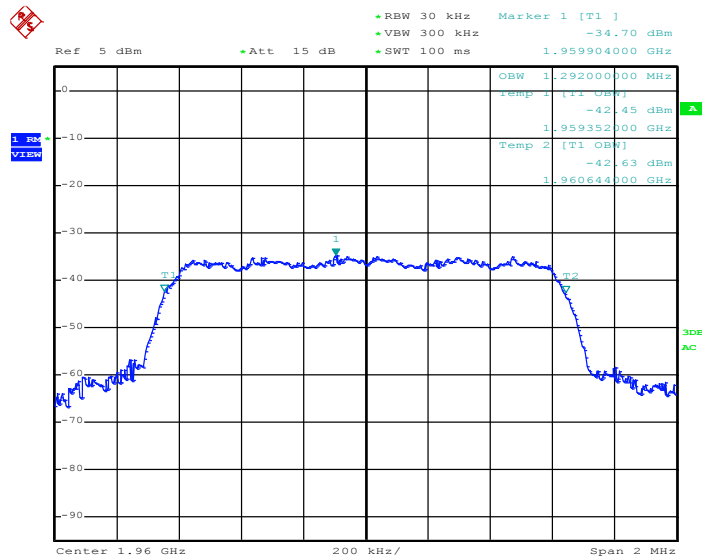
Date: 26.SEP.2013 20:13:27

Channel 600 DAC11-8PSK 26dB Occupied Bandwidth



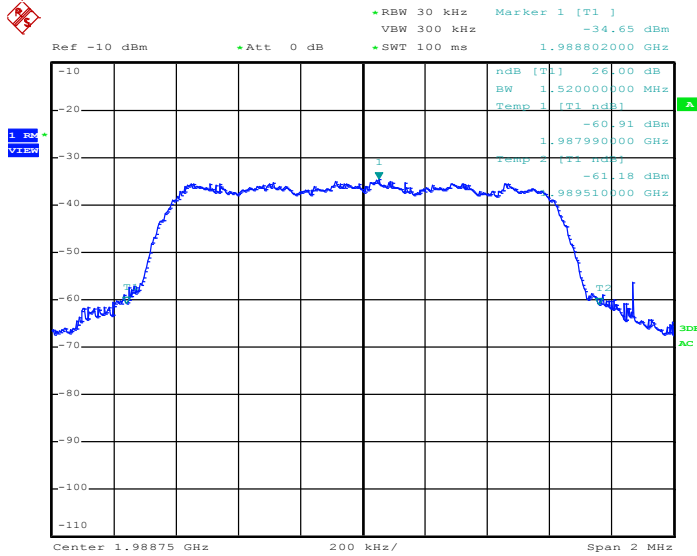
Date: 26.SEP.2013 21:32:53

Channel 600 DAC11-8PSK 99% Occupied Bandwidth



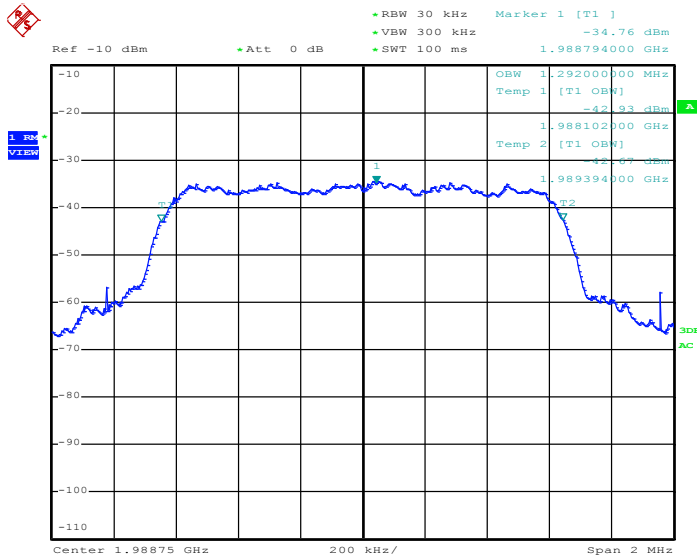
Date: 26.SEP.2013 21:29:32

Channel 1175 DAC14-16QAM 26dB Occupied Bandwidth



Date: 26.SEP.2013 22:37:14

Channel 1175 DAC14-16QAM 99% Occupied Bandwidth



Date: 26.SEP.2013 22:32:29

Part 2 - Peak-to-Average ratio

DATE(s): September 27, 2013
 TEST STANDARD: FCC Part 24 and IC RSS-133
 TEST VOLTAGE: 120Vac 60Hz
 MINIMUM STANDARD: 13dB
 TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.
 MEASUREMENT METHOD: As called by the standards above.

Average measurement Settings:
 RBW=30kHz; VBW=100kHz; Detector: RMS Average; sweep points: 2001;
 Max hold 1 minute
 Peak measurement Settings:
 RBW=3MHz; VBW=10MHz; Detector: Max Peak; sweep points: 2001;
 Max hold 1 minute

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA:

| Channel | modulation | Frequency (MHz) | PAR Peak pwr (dBm) | PAR Avg pwr (dBm) | PAR | Limit (dB) | Margin (dB) |
|---------|---------------|-----------------|--------------------|-------------------|-------|------------|-------------|
| 25 | DAC9 QPSK | 1931.25 | -17.57 | -28.18 | 10.61 | 13 | 2.39 |
| 600 | DAC9 QPSK | 1960.00 | -16.42 | -26.44 | 10.02 | 13 | 2.98 |
| 1175 | DAC9 QPSK | 1988.75 | -17.48 | -28.48 | 11.00 | 13 | 2.00 |
| 25 | DAC11 8PSK | 1931.25 | -17.45 | -28.10 | 10.65 | 13 | 2.35 |
| 600 | DAC11 8PSK | 1960.00 | -17.45 | -27.09 | 9.64 | 13 | 3.36 |
| 1175 | DAC11 8PSK | 1988.75 | -17.08 | -28.06 | 10.98 | 13 | 2.02 |
| 25 | DAC12 8PSK | 1931.25 | -16.90 | -27.81 | 10.91 | 13 | 2.09 |
| 600 | DAC12 8PSK | 1960.00 | -16.36 | -27.13 | 10.77 | 13 | 2.23 |
| 1175 | DAC12 8PSK | 1988.75 | -17.87 | -28.53 | 10.66 | 13 | 2.34 |
| 25 | DAC 14 16-QAM | 1931.25 | -17.45 | -27.30 | 9.85 | 13 | 3.15 |
| 600 | DAC 14 16-QAM | 1960.00 | -17.48 | -26.39 | 8.91 | 13 | 4.09 |
| 1175 | DAC 14 16-QAM | 1988.75 | -17.14 | -27.47 | 10.33 | 13 | 2.67 |

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

Part 3 - Unwanted Emissions Band and Block Edge

DATE(s): October 8-9, 2013

TEST STANDARD: FCC Part 24 and IC RSS-133

TEST VOLTAGE: 120Vac 60Hz

MINIMUM STANDARD: -13dBm

TEST SETUP: The antenna port of EUT was directly connected to a spectrum analyzer.

MEASUREMENT METHOD: As called by the standards above.

Blockedge measurement
Average measurement Settings:
RBW=30kHz; VBW=100kHz; Detector: RMS Average;
Max hold 1 minute ; Span: 2MHz

1MHz after blockedge using 1%RBW and 1MHz Power Integration method
RBW=30kHz; VBW=1MHz; Detector: peak
Max hold 1 minute ; Span: 1MHz

DEVICE DESCRIPTIONS: As described in the above EUT description and set up section.

EMISSIONS DATA: Block Edge

| | Modulation | Channel Frequency | Block Edge Frequency | Measured | Corrections | Measured | Limit | margin |
|-----------|------------|-------------------|----------------------|----------|-------------|----------|---------|--------|
| 25 (A) | DAC9 QPSK | 1931.25 | 1930 | -79.69 | 42.5 | -37.2 | -13.000 | 24.190 |
| 275 (A) | DAC9 QPSK | 1943.75 | 1945 | -76.81 | 42.5 | -34.3 | -13.000 | 21.310 |
| 325 (D) | DAC9 QPSK | 1946.25 | 1945 | -75.71 | 42.5 | -33.2 | -13.000 | 20.210 |
| 375 (D) | DAC9 QPSK | 1948.75 | 1950 | -79.48 | 42.5 | -37.0 | -13.000 | 23.980 |
| 425 (B) | DAC9 QPSK | 1951.25 | 1950 | -82.90 | 42.5 | -40.4 | -13.000 | 27.400 |
| 675 (B) | DAC9 QPSK | 1963.75 | 1965 | -80.10 | 42.5 | -37.6 | -13.000 | 24.600 |
| 725 (E) | DAC9 QPSK | 1966.25 | 1965 | -76.64 | 42.5 | -34.1 | -13.000 | 21.140 |
| 775 (E) | DAC9 QPSK | 1968.75 | 1970 | -76.21 | 42.5 | -33.7 | -13.000 | 20.710 |
| 825 (F) | DAC9 QPSK | 1971.25 | 1970 | -74.13 | 42.5 | -31.6 | -13.000 | 18.630 |
| 875 (F) | DAC9 QPSK | 1973.75 | 1975 | -76.67 | 42.6 | -34.1 | -13.000 | 21.070 |
| 925 (C) | DAC9 QPSK | 1976.25 | 1975 | -75.61 | 42.6 | -33.0 | -13.000 | 20.010 |
| 1175 (C) | DAC9 QPSK | 1988.75 | 1990 | -79.54 | 42.6 | -36.9 | -13.000 | 23.940 |

| | | | | | | | | |
|---------|------------|---------|------|--------|------|-------|---------|--------|
| 25 (A) | DAC11 8PSK | 1931.25 | 1930 | -79.46 | 42.5 | -37.0 | -13.000 | 23.960 |
| 275 (A) | DAC11 8PSK | 1943.75 | 1945 | -76.05 | 42.5 | -33.6 | -13.000 | 20.550 |
| 325 (D) | DAC11 8PSK | 1946.25 | 1945 | -75.31 | 42.5 | -32.8 | -13.000 | 19.810 |

| | | | | | | | | |
|----------|------------|---------|------|--------|------|-------|---------|--------|
| 375 (D) | DAC11 8PSK | 1948.75 | 1950 | -78.82 | 42.5 | -36.3 | -13.000 | 23.320 |
| 425 (B) | DAC11 8PSK | 1951.25 | 1950 | -81.67 | 42.5 | -39.2 | -13.000 | 26.170 |
| 675 (B) | DAC11 8PSK | 1963.75 | 1965 | -80.28 | 42.5 | -37.8 | -13.000 | 24.780 |
| 725 (E) | DAC11 8PSK | 1966.25 | 1965 | -76.92 | 42.5 | -34.4 | -13.000 | 21.420 |
| 775 (E) | DAC11 8PSK | 1968.75 | 1970 | -75.80 | 42.5 | -33.3 | -13.000 | 20.300 |
| 825 (F) | DAC11 8PSK | 1971.25 | 1970 | -74.78 | 42.5 | -32.3 | -13.000 | 19.280 |
| 875 (F) | DAC11 8PSK | 1973.75 | 1975 | -76.21 | 42.6 | -33.6 | -13.000 | 20.610 |
| 925 (C) | DAC11 8PSK | 1976.25 | 1975 | -74.60 | 42.6 | -32.0 | -13.000 | 19.000 |
| 1175 (C) | DAC11 8PSK | 1988.75 | 1990 | -79.81 | 42.6 | -37.2 | -13.000 | 24.210 |

| | | | | | | | | |
|----------|------------|---------|------|--------|------|-------|---------|--------|
| 25 (A) | DAC12 8PSK | 1931.25 | 1930 | -80.27 | 42.5 | -37.8 | -13.000 | 24.770 |
| 275 (A) | DAC12 8PSK | 1943.75 | 1945 | -76.56 | 42.5 | -34.1 | -13.000 | 21.060 |
| 325 (D) | DAC12 8PSK | 1946.25 | 1945 | -75.72 | 42.5 | -33.2 | -13.000 | 20.220 |
| 375 (D) | DAC12 8PSK | 1948.75 | 1950 | -78.73 | 42.5 | -36.2 | -13.000 | 23.230 |
| 425 (B) | DAC12 8PSK | 1951.25 | 1950 | -80.97 | 42.5 | -38.5 | -13.000 | 25.470 |
| 675 (B) | DAC12 8PSK | 1963.75 | 1965 | -78.53 | 42.5 | -36.0 | -13.000 | 23.030 |
| 725 (E) | DAC12 8PSK | 1966.25 | 1965 | -76.91 | 42.5 | -34.4 | -13.000 | 21.410 |
| 775 (E) | DAC12 8PSK | 1968.75 | 1970 | -75.89 | 42.5 | -33.4 | -13.000 | 20.390 |
| 825 (F) | DAC12 8PSK | 1971.25 | 1970 | -74.64 | 42.5 | -32.1 | -13.000 | 19.140 |
| 875 (F) | DAC12 8PSK | 1973.75 | 1975 | -76.19 | 42.6 | -33.6 | -13.000 | 20.590 |
| 925 (C) | DAC12 8PSK | 1976.25 | 1975 | -74.27 | 42.6 | -31.7 | -13.000 | 18.670 |
| 1175 (C) | DAC12 8PSK | 1988.75 | 1990 | -79.47 | 42.6 | -36.9 | -13.000 | 23.870 |

| | | | | | | | | |
|----------|---------------|---------|------|--------|------|-------|---------|--------|
| 25 (A) | DAC 14 16-QAM | 1931.25 | 1930 | -79.33 | 42.5 | -36.8 | -13.000 | 23.830 |
| 275 (A) | DAC 14 16-QAM | 1943.75 | 1945 | -77.10 | 42.5 | -34.6 | -13.000 | 21.600 |
| 325 (D) | DAC 14 16-QAM | 1946.25 | 1945 | -75.10 | 42.5 | -32.6 | -13.000 | 19.600 |
| 375 (D) | DAC 14 16-QAM | 1948.75 | 1950 | -78.40 | 42.5 | -35.9 | -13.000 | 22.900 |
| 425 (B) | DAC 14 16-QAM | 1951.25 | 1950 | -81.77 | 42.5 | -39.3 | -13.000 | 26.270 |
| 675 (B) | DAC 14 16-QAM | 1963.75 | 1965 | -78.42 | 42.5 | -35.9 | -13.000 | 22.920 |
| 725 (E) | DAC 14 16-QAM | 1966.25 | 1965 | -77.02 | 42.5 | -34.5 | -13.000 | 21.520 |
| 775 (E) | DAC 14 16-QAM | 1968.75 | 1970 | -76.59 | 42.5 | -34.1 | -13.000 | 21.090 |
| 825 (F) | DAC 14 16-QAM | 1971.25 | 1970 | -74.40 | 42.5 | -31.9 | -13.000 | 18.900 |
| 875 (F) | DAC 14 16-QAM | 1973.75 | 1975 | -77.49 | 42.6 | -34.9 | -13.000 | 21.890 |
| 925 (C) | DAC 14 16-QAM | 1976.25 | 1975 | -74.41 | 42.6 | -31.8 | -13.000 | 18.810 |
| 1175 (C) | DAC 14 16-QAM | 1988.75 | 1990 | -79.72 | 42.6 | -37.1 | -13.000 | 24.120 |

First 1MHz band after Blockedge

| | Modulation | Channel Frequency | Block Edge Frequency | Measured | Corrections | Measured | Limit | margin |
|-----------|------------|-------------------|----------------------|----------|-------------|----------|---------|--------|
| 25 (A) | DAC9 QPSK | 1931.25 | 1930 | -77.5 | 42.5 | -35.0 | -13.000 | 22.0 |
| 275 (A) | DAC9 QPSK | 1943.75 | 1945 | -73.9 | 42.5 | -31.9 | -13.000 | 18.9 |
| 325 (D) | DAC9 QPSK | 1946.25 | 1945 | -72.6 | 42.5 | -30.1 | -13.000 | 17.1 |
| 375 (D) | DAC9 QPSK | 1948.75 | 1950 | -76.5 | 42.5 | -34.0 | -13.000 | 21.0 |
| 425 (B) | DAC9 QPSK | 1951.25 | 1950 | -77.6 | 42.5 | -35.1 | -13.000 | 22.1 |
| 675 (B) | DAC9 QPSK | 1963.75 | 1965 | -78.1 | 42.5 | -35.6 | -13.000 | 22.6 |
| 725 (E) | DAC9 QPSK | 1966.25 | 1965 | -75.1 | 42.5 | -32.6 | -13.000 | 19.6 |
| 775 (E) | DAC9 QPSK | 1968.75 | 1970 | -73.5 | 42.5 | -31.0 | -13.000 | 18.0 |
| 825 (F) | DAC9 QPSK | 1971.25 | 1970 | -72.7 | 42.5 | -30.2 | -13.000 | 17.2 |
| 875 (F) | DAC9 QPSK | 1973.75 | 1975 | -74.3 | 42.6 | -31.7 | -13.000 | 18.7 |
| 925 (C) | DAC9 QPSK | 1976.25 | 1975 | -74.1 | 42.6 | -31.5 | -13.000 | 18.5 |
| 1175 (C) | DAC9 QPSK | 1988.75 | 1990 | -77.6 | 42.6 | -35 | -13.000 | 22.0 |

| | | | | | | | | |
|-----------|------------|---------|------|-------|------|-------|---------|------|
| 25 (A) | DAC11 8PSK | 1931.25 | 1930 | -77.2 | 42.5 | -34.7 | -13.000 | 21.7 |
| 275 (A) | DAC11 8PSK | 1943.75 | 1945 | -74.3 | 42.5 | -31.8 | -13.000 | 18.8 |
| 325 (D) | DAC11 8PSK | 1946.25 | 1945 | -72.9 | 42.5 | -30.4 | -13.000 | 17.4 |
| 375 (D) | DAC11 8PSK | 1948.75 | 1950 | -75.9 | 42.5 | -33.4 | -13.000 | 20.4 |
| 425 (B) | DAC11 8PSK | 1951.25 | 1950 | -79.6 | 42.5 | -37.1 | -13.000 | 24.1 |
| 675 (B) | DAC11 8PSK | 1963.75 | 1965 | -78.9 | 42.5 | -36.4 | -13.000 | 23.4 |
| 725 (E) | DAC11 8PSK | 1966.25 | 1965 | -74.3 | 42.5 | -31.8 | -13.000 | 18.8 |
| 775 (E) | DAC11 8PSK | 1968.75 | 1970 | -73.6 | 42.5 | -31.1 | -13.000 | 18.1 |
| 825 (F) | DAC11 8PSK | 1971.25 | 1970 | -72.5 | 42.5 | -30.0 | -13.000 | 17.0 |
| 875 (F) | DAC11 8PSK | 1973.75 | 1975 | -74.8 | 42.6 | -32.2 | -13.000 | 19.2 |
| 925 (C) | DAC11 8PSK | 1976.25 | 1975 | -73.1 | 42.6 | -30.5 | -13.000 | 17.5 |
| 1175 (C) | DAC11 8PSK | 1988.75 | 1990 | -77.6 | 42.6 | -35.0 | -13.000 | 22.0 |

| | | | | | | | | |
|----------|------------|---------|------|-------|------|-------|---------|------|
| 25 (A) | DAC12 8PSK | 1931.25 | 1930 | -78.3 | 42.5 | -35.8 | -13.000 | 22.8 |
| 275 (A) | DAC12 8PSK | 1943.75 | 1945 | -74.2 | 42.5 | -31.7 | -13.000 | 18.7 |
| 325 (D) | DAC12 8PSK | 1946.25 | 1945 | -73.5 | 42.5 | -31.0 | -13.000 | 18.0 |
| 375 (D) | DAC12 8PSK | 1948.75 | 1950 | -76.9 | 42.5 | -34.9 | -13.000 | 21.9 |
| 425 (B) | DAC12 8PSK | 1951.25 | 1950 | -78.3 | 42.5 | -35.8 | -13.000 | 22.8 |
| 675 (B) | DAC12 8PSK | 1963.75 | 1965 | -76.4 | 42.5 | -33.9 | -13.000 | 20.9 |
| 725 (E) | DAC12 8PSK | 1966.25 | 1965 | -74.1 | 42.5 | -31.6 | -13.000 | 18.6 |
| 775 (E) | DAC12 8PSK | 1968.75 | 1970 | -72.9 | 42.5 | -30.4 | -13.000 | 17.4 |

| | | | | | | | | |
|----------|------------|---------|------|-------|------|-------|---------|-------|
| 825 (F) | DAC12 8PSK | 1971.25 | 1970 | -73.1 | 42.5 | -30.6 | -13.000 | 17.6 |
| 875 (F) | DAC12 8PSK | 1973.75 | 1975 | -73.8 | 42.6 | -31.2 | -13.000 | 18.2 |
| 925 (C) | DAC12 8PSK | 1976.25 | 1975 | -72.5 | 42.6 | -29.9 | -13.000 | 16.9 |
| 1175 (C) | DAC12 8PSK | 1988.75 | 1990 | -77.6 | 42.6 | -35.0 | -13.000 | -22.0 |

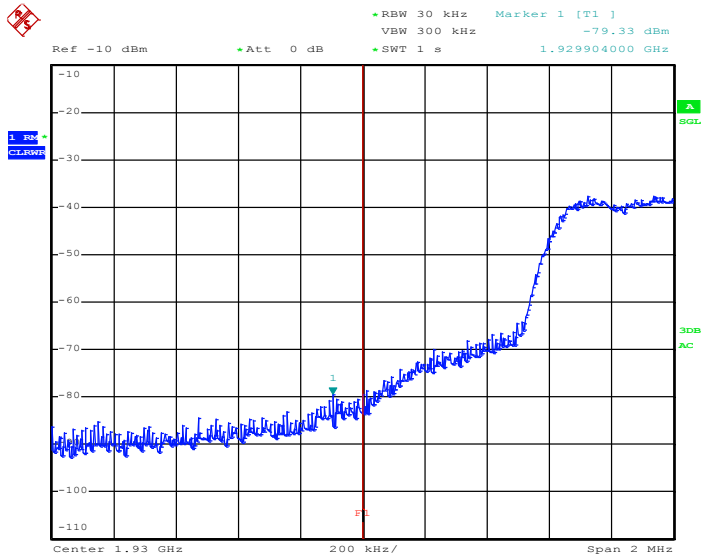
| | | | | | | | | |
|----------|---------------|---------|------|-------|------|-------|---------|------|
| 25 (A) | DAC 14 16-QAM | 1931.25 | 1930 | -76.8 | 42.5 | -34.3 | -13.000 | 21.3 |
| 275 (A) | DAC 14 16-QAM | 1943.75 | 1945 | -75.4 | 42.5 | -32.9 | -13.000 | 19.9 |
| 325 (D) | DAC 14 16-QAM | 1946.25 | 1945 | -72.6 | 42.5 | -30.1 | -13.000 | 17.1 |
| 375 (D) | DAC 14 16-QAM | 1948.75 | 1950 | -76.5 | 42.5 | -34.0 | -13.000 | 21.0 |
| 425 (B) | DAC 14 16-QAM | 1951.25 | 1950 | -78.9 | 42.5 | -36.4 | -13.000 | 23.4 |
| 675 (B) | DAC 14 16-QAM | 1963.75 | 1965 | -77.1 | 42.5 | -34.6 | -13.000 | 21.6 |
| 725 (E) | DAC 14 16-QAM | 1966.25 | 1965 | -74.8 | 42.5 | -32.3 | -13.000 | 19.3 |
| 775 (E) | DAC 14 16-QAM | 1968.75 | 1970 | -73.6 | 42.5 | -31.1 | -13.000 | 18.1 |
| 825 (F) | DAC 14 16-QAM | 1971.25 | 1970 | -72.9 | 42.5 | -30.4 | -13.000 | 17.4 |
| 875 (F) | DAC 14 16-QAM | 1973.75 | 1975 | -74.5 | 42.6 | -31.9 | -13.000 | 18.9 |
| 925 (C) | DAC 14 16-QAM | 1976.25 | 1975 | -72.9 | 42.6 | -30.3 | -13.000 | 17.3 |
| 1175 (C) | DAC 14 16-QAM | 1988.75 | 1990 | -76.5 | 42.6 | -33.9 | -13.000 | 20.9 |

OBSERVATIONS: The EUT performed as expected.

PERFORMANCE: Complies.

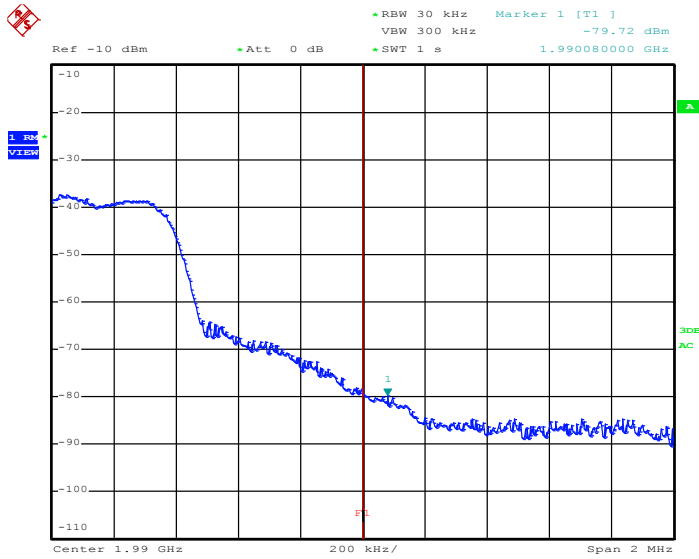
Sample Test Plots

Channel 25 DAC14-16QAM Block Edge



Date: 9.OCT.2013 09:47:02

Channel 1175DAC14-16QAM Block Edge



Date: 9.OCT.2013 14:09:46

Part 4 - Out Of Band Spurious Emissions Conducted

DATE: October 05, 2013

TEST STANDARD: FCC Part 24 and IC RSS-133

TEST VOLTAGE: 120Vac 60Hz

TEST CONDITIONS: Indoor – 3meter Semi Anechoic Chamber

MINIMUM STANDARD: -13dBm

TEST SETUP: The Transmitter Output was connected directly to the Spectrum Analyzer through appropriate attenuators and filters using a 1 meter cable. The transmitter was set for continuous transmission. The lowest, middle and highest channels were measured for all emissions 10kHz to 20 GHz.

Conversion Formulas used: For the frequency measurement:
 $E(\text{dBm}) = \text{Meas}(\text{dBuV}) + \text{Cable Loss}(\text{dB}) + \text{Antennuator/Filter Loss}(\text{dB}) - 107$

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver using the appropriate attenuators and filters to optimize the reading. The settings used were:
 200Hz RBW average detector for the frequency range 9kHz-150kHz
 9kHz RBW average detector for the Frequency range 150kHz to 30MHz
 120kHz RBW quasi-peak detector for the frequency range 30MHz to 1GHz
 1MHz RBW Average detector for the frequency range 1GHz to 20GHz

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA: No transmitter Conducted Spurious Emissions were detected 9kHz to 1GHz. No data or plots are recorded 9kHz to 1GHz.
 Plots were taken using a standard set of Attenuators and filters. Then the identified frequencies were manually re-measured using the appropriate attenuators and filters to optimize the reading.

Out Of Band Spurious Emissions Conducted – Low Channel 25 – 1931.25MHz

| Frequency (MHz) | Final (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------|-------------|-------------|
| 3862.17950 | -24.2 | -13.0 | 11.2 |
| 5780.4487 | -34.7 | -13.0 | 21.7 |
| 7729.1667 | -39.1 | -13.0 | 26.1 |

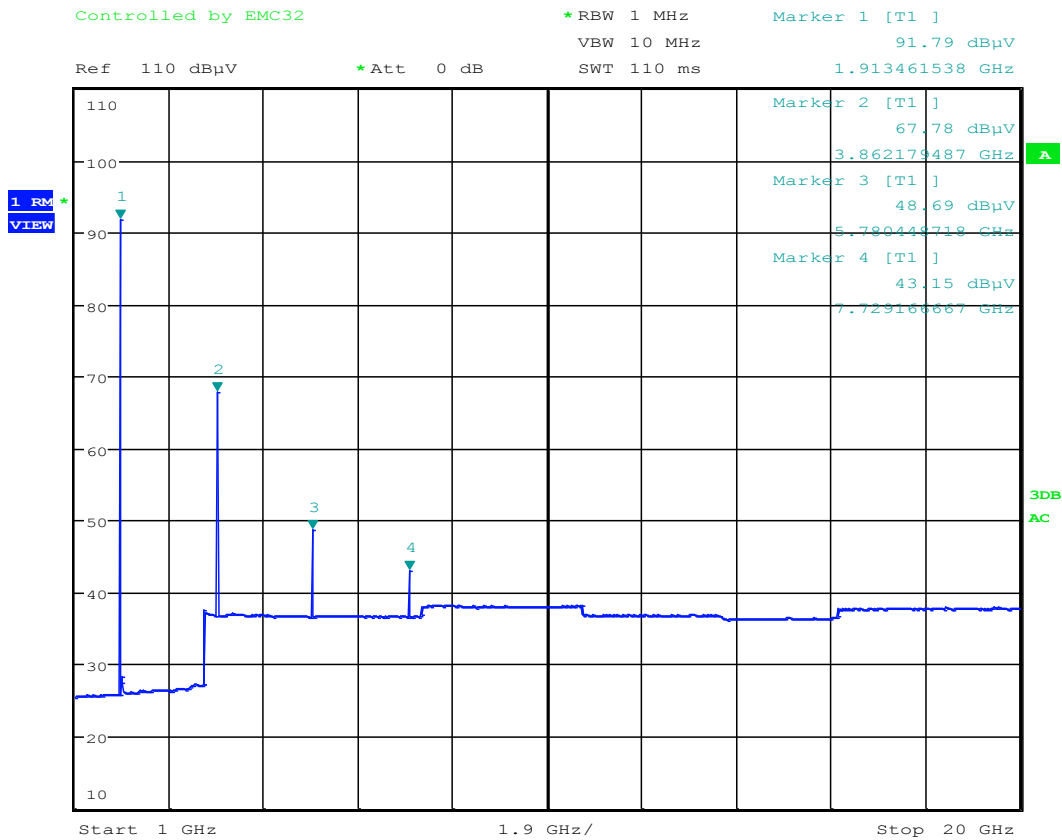
Out Of Band Spurious Emissions Radiated – Middle Channel 600 – 1960.00MHz

| Frequency (MHz) | Final (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------|-------------|-------------|
| 3923.3077 | -30.9 | -13.0 | 17.9 |
| 5871.7949 | -41.3 | -13.0 | 28.3 |
| 7850.9615 | -45.2 | -13.0 | 32.2 |

Out Of Band Spurious Emissions Radiated – High Channel 1175 – 1988.75MHz

| Frequency (MHz) | Final (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------|-------------|-------------|
| 3953.5256 | -28.4 | -13.0 | 15.4 |
| 5963.1410 | -41.3 | -13.0 | 28.3 |
| 7942.3077 | -44.6 | -13.0 | 31.6 |

Conducted emission 1GHz – 20GHz – Low Channel 25

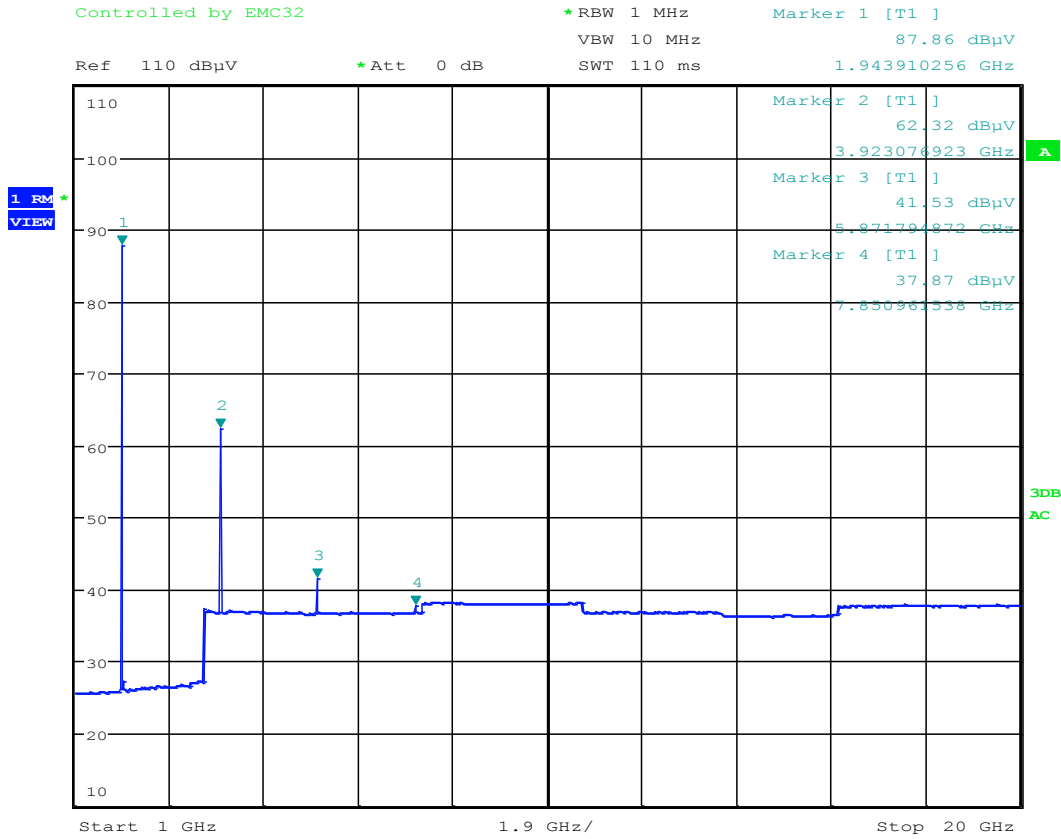


TTTTTT

Date: 5.OCT.2013 03:34:18

Reference use only

Conducted emission 1GHz – 20GHz – Middle Channel 600



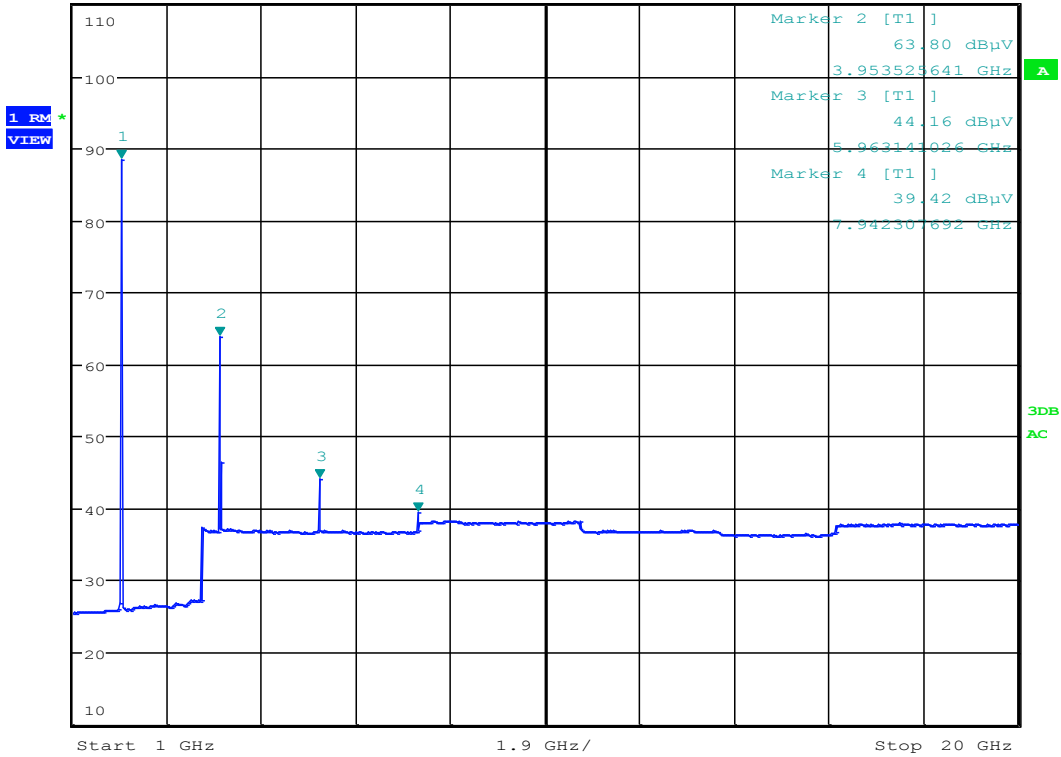
TTTTTT

Date: 5.OCT.2013 03:18:42

Reference use only

Conducted emission 1GHz – 20GHz – High Channel 1175

Controlled by EMC32 *RBW 1 MHz Marker 1 [T1]
 Ref 110 dBµV *Att 0 dB VBW 10 MHz 88.45 dBµV
 SWT 110 ms 1.974358974 GHz



TTTTTT

Date: 5.OCT.2013 03:44:28

Reference use only

Part 5 - Out Of Band Spurious Emissions Radiated

DATE: November 01, 2013

TEST STANDARD: FCC Part 24 and IC RSS-133

TEST VOLTAGE: 120Vac 60Hz

TEST CONDITIONS: Indoor – 3meter Semi Anechoic Chamber

MINIMUM STANDARD: -13dBm EIRP

Conversion Formulas used: For the frequency measurement:
 $E(\text{dBuV/m}) = \text{Measurement (dBuV)} + \text{Cable Loss(dB)} + \text{Antenna Factor (dB/m)}$
 $\text{EIRP(dBm)} = E(\text{dBuV}) + 20\text{Log(D)} - 104.8$
 $\text{ERP} = \text{EIRP} - 2.15$

TEST SETUP: The EUT was tested in our 3 m SAC and was positioned on the center of the turntable and powered up. The Transmitter Output was connected to a 50Ohm Load using a 1 meter cable. The transmitter was set for continuous transmission. The lowest, middle and highest channels were measured for all radiated emissions 10kHz to 18 GHz. The EUT was placed flat on the table top as indicated in the test photos.

MEASUREMENT METHOD: Measurements were made using spectrum analyser and receiver using the appropriate antennas, amplifiers, attenuators and filters. The settings used were:

200Hz RBW Peak detector for the frequency range 9kHz-150kHz
9kHz RBW Peak detector for the Frequency range 150kHz to 30MHz
10kHz RBW Peak detector for the frequency range 30MHz to 1GHz
1MHz RBW Peak detector for the frequency range 1GHz to 18GHz

The emissions were then re-measured using the Substitution method Procedure as described in ANSI TIA/EIA-603 Section 2.2.12

DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

EMISSIONS DATA: No transmitter Radiated Spurious Emissions were detected 9kHz to 1GHz. No data or plots are recorded 9kHz to 30MHz. The 30MHz to 1GHz plot and data are only from the Digital Circuitry and are included for reference only.

Out Of Band Spurious Emissions Radiated – Low Channel 25

| Frequency (MHz) | Peak EIRP Final measurement (dBm) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Limit (dBm) | Margin (dB) |
|-----------------|-----------------------------------|---------------------|----------|--------------------------|------------|-------------|-------------|
| 3862.5000 | -48.0 | 118.5 | V | 346.9 | -8.7 | -13 | 35.0 |
| 5793.7500 | -71.3 (nflr) | 100.0 | V | 0.0 | -2.9 | -13 | 58.3 |

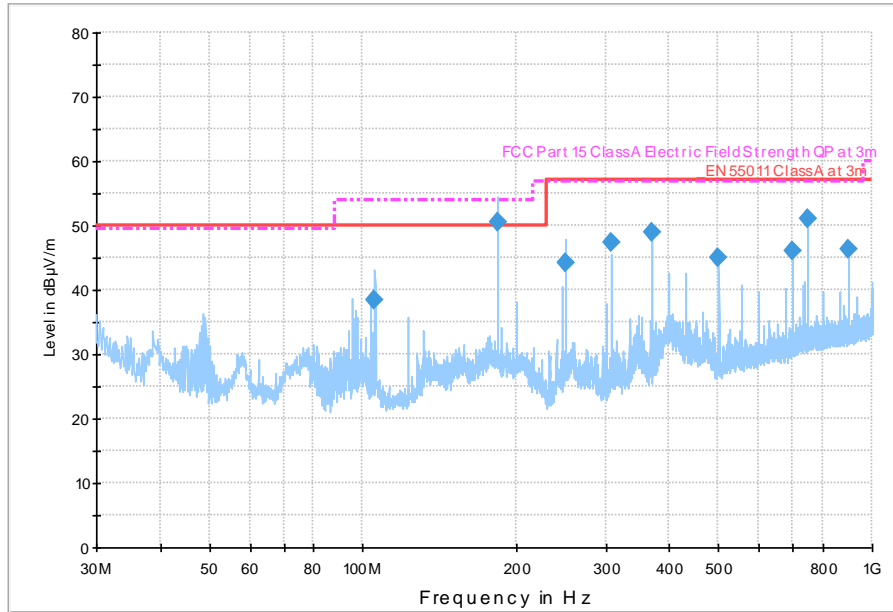
Out Of Band Spurious Emissions Radiated – Middle Channel 600

| Frequency (MHz) | Peak EIRP Final measurement (dBm) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Limit (dBm) | Margin (dB) |
|-----------------|-----------------------------------|---------------------|----------|--------------------------|------------|-------------|-------------|
| 3920.0000 | -48.4 | 117.3 | V | 347.7 | -8.7 | -13 | 35.4 |
| 5880.0000 | -71.8 (nflr) | 100.0 | V | 0.0 | -2.9 | -13 | 58.8 |

Out Of Band Spurious Emissions Radiated – High Channel 1175

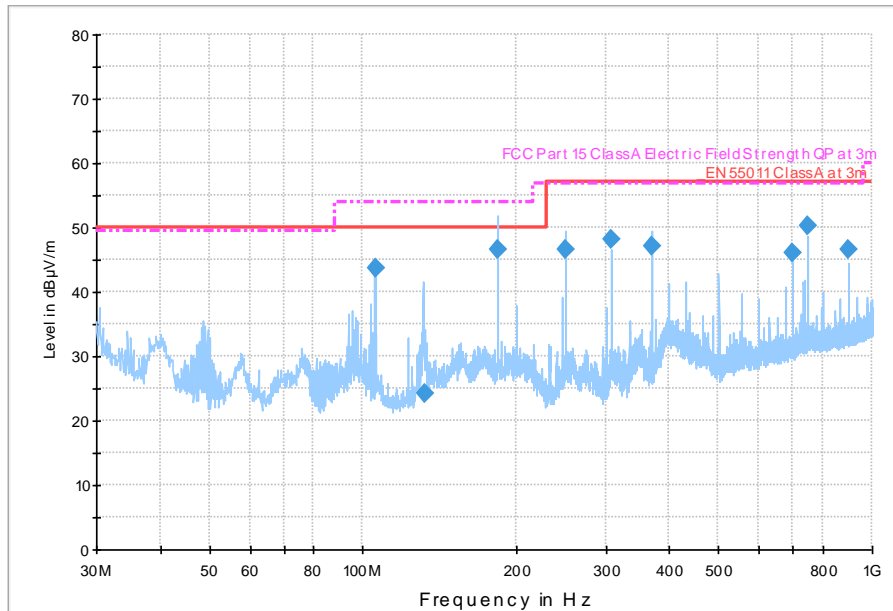
| Frequency (MHz) | RMS Average Raw measurement (dBµV/m) | Antenna height (cm) | Polarity | Turntable position (deg) | Corr. (dB) | Limit (dBm) | Margin (dB) |
|-----------------|--------------------------------------|---------------------|----------|--------------------------|------------|-------------|-------------|
| 3977.5000 | -41.3 | 116.0 | V | 0.0 | -8.7 | -13 | 38.3 |
| 5966.2500 | -72.5(nflr) | 110.8 | V | 0.0 | -2.9 | -13 | 59.5 |

Radiated emission 30MHz – 1 GHz Transmitter Off



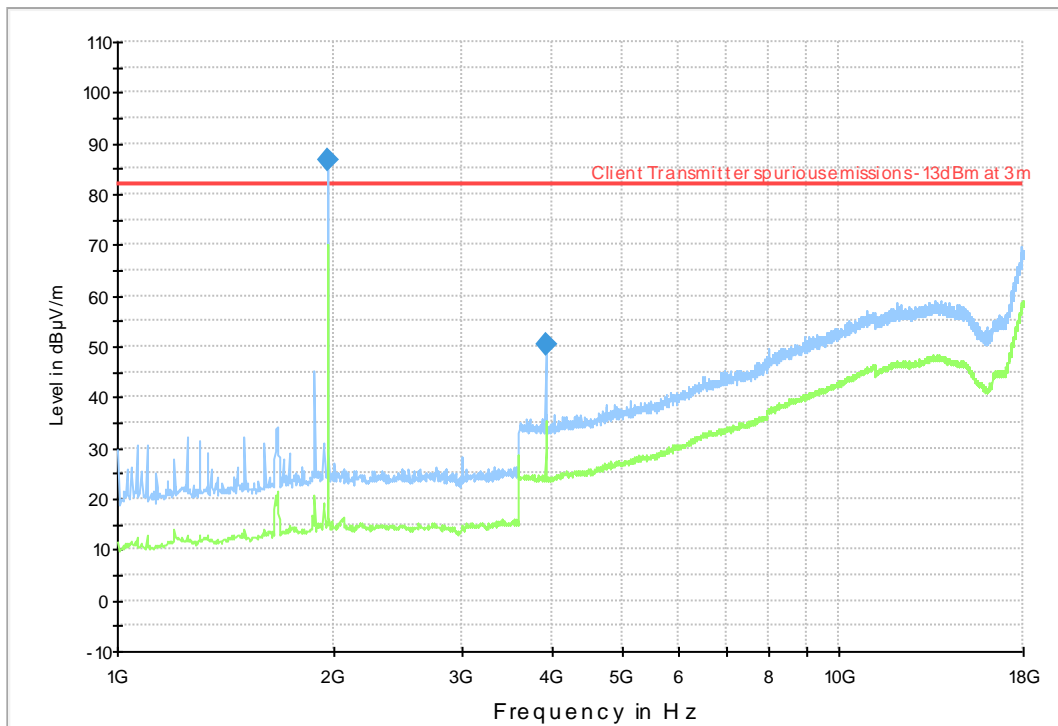
Reference plot only

Transmitter On – Channel 25



Reference plot only

Radiated emission 1 to 18GHz Transmitter On – Channel 600



Reference plot only

Part 6 - Frequency Stability

DATE: October 03, 2013

TEST STANDARD: FCC Part 24 and IC RSS-133

TEST VOLTAGE: 120Vac 60Hz +/-15%

TEST CONDITIONS: Temperature Controlled Chamber -30 to +50°Celsius

MINIMUM STANDARD: +/- 1ppm

TEST SETUP: The EUT was tested in our Temperature Chamber and was positioned on the center of the turntable and powered up. The Transmitter Output was connected to a Spectrum Analyzer using appropriate attenuators.

MEASUREMENT METHOD: The transmitter was not able to be set for CW Signals so the readings were taken with modulated signals using the ndB down method using 30kHz RBW.. Only the middle channel was measured. The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements.

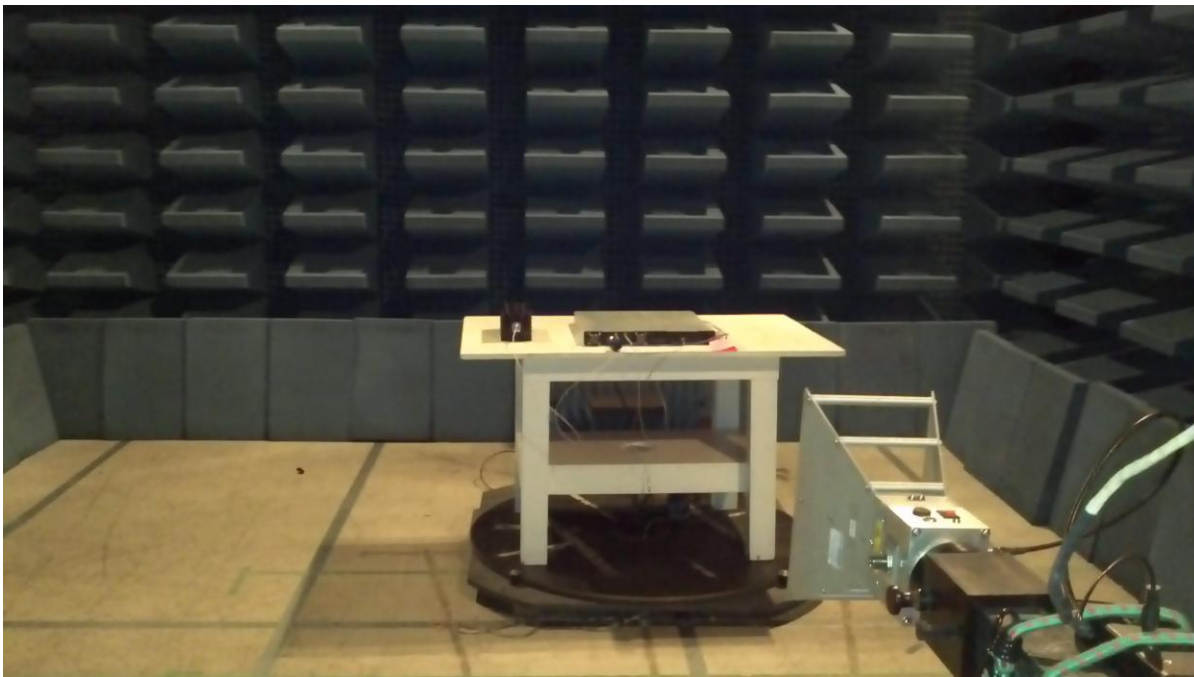
DEVICE DESCRIPTIONS: As described in the above EUT description and setup section.

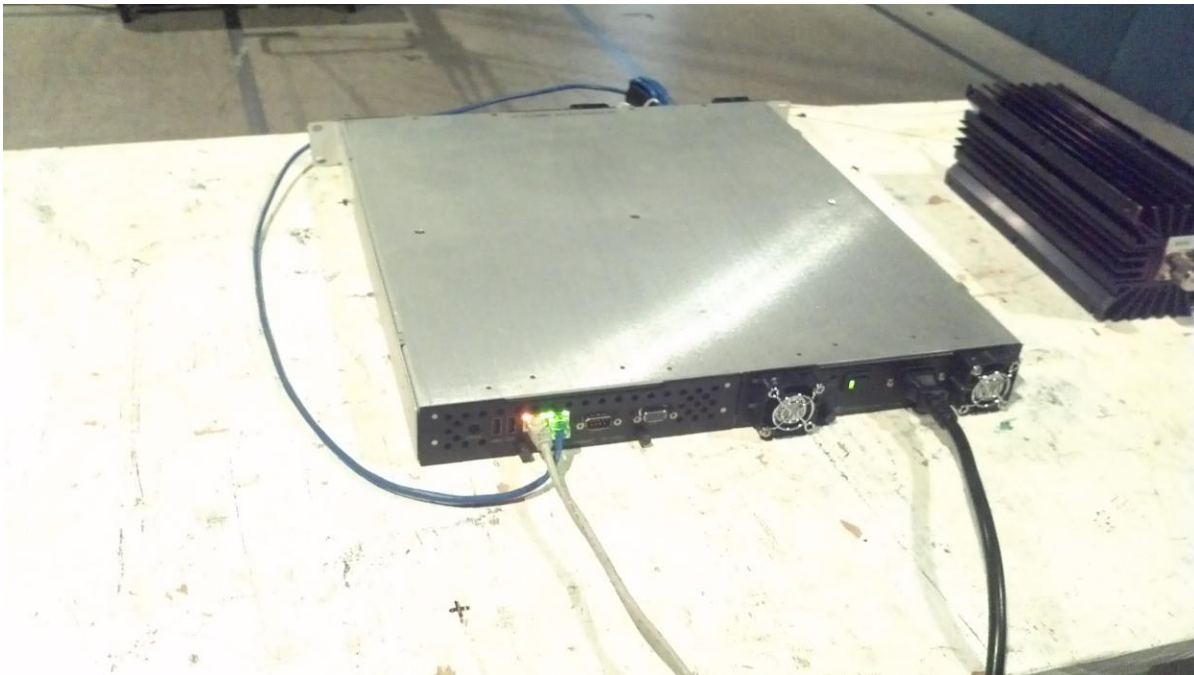
DATA:

| Temp (C) | Frequency Measured at 120Vac 60Hz (MHz) | Drift (Hz) | Drift (ppm) |
|----------|-----------------------------------------|-------------|-------------|
| -30 | 1959.999320 | -680 | 0.3 |
| -20 | 1959.999825 | -175 | 0.1 |
| -10 | 1959.999823 | -177 | 0.1 |
| 0 | 1960.000000 | 0 | 0.0 |
| 10 | 1960.000000 | 0 | 0.0 |
| 20 | 1960.000000 | 0 | 0.0 |
| 30 | 1960.000000 | 0 | 0.0 |
| 40 | 1960.000013 | 13 | 0.0 |
| 50 | 1959.999515 | -485 | 0.2 |

| Voltage (AC) | Frequency Measured at 20 Deg. Celsius (MHz) | Drift (Hz) | Drift (ppm) |
|--------------|---------------------------------------------|-------------|-------------|
| 102 | 1959.999935 | -65 | 0.0 |
| 138 | 1959.999823 | -177 | 0.1 |

Appendix A: EUT photos during the testing







End of report

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last page of this test report