Lab Code: 200167-0

# FCC PART 22H, 24E

# INDUSTRY CANADA RSS-132, RSS-133

# TEST AND MEASUREMENT REPORT

For

## Trimble Navigation Limited.

935 Stewart Drive,

Sunnyvale, CA 94085, USA

**FCC ID: JUP-6999600**
**IC: 1756A-6999600**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | GSM & GPRS Modem |

| | |
|---|---|
| **Test Engineer:** | Dennis Huang |
| **Report Number:** | R0909103-2224 |
| **Report Date:** | 2009-12-11 |
| **Reviewed By:** | Boni Baniqued<br>EMC/RF Supervisor |
| **Prepared By:**<br>**(84)** | Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Avenue,<br>Sunnyvale, CA 94089<br>Tel: (408) 732-9162<br>Fax: (408) 732 9164 |

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# 1 GENERAL INFORMATION

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

This test and measurement report has been compiled on behalf of *Trimble Navigation Limited* and their product *model: SNM910, Part Number: 69996-00, FCC ID: JUP-6999600, IC: 1756A-6999600* or the "EUT" as referred to in this report. The EUT is a Cellular (GSM/GPRS/EDGE) modem dongle for SPS GPS applications in the construction industry. The SNM910 is a rugged device that connects to the 26-pin connector on the SNB900, SPSx51, and SPSx81 GPS receivers, providing GSM/GPRS/EDGE connection capabilities. The SNM910 has an accessible SIM card slot that takes SIM cards from most international cellular service providers.

## 1.2 Mechanical Description

The EUT measures approximately 150mm (L) x 130 mm (W) x 100mm (H).

** The test data gathered are from typical production sample, Sample ID: KNEX16 provided by the manufacturer.*

## 1.3 EUT Photo

*Additional Photos in Exhibit C*

## 1.4 Objective

This type approval report is prepared on behalf of *Trimble Navigation Limited* in accordance with Part 2, Subpart J, Part 22 Subpart H, and Part 24 Subpart E of the Federal Communication Commissions rules, and RSS-132 Issue 2(2005-09), and RSS-133 Issue 3 (2009-02) of the Canadian Department of Industry rules.

The objective is to determine compliance with FCC Part 22H/24E and IC RSS-132/133 rules for RF output power, RF Output Power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation, receiver spurious emission, frequency stability, band edge, conducted and radiated margin. This measurement and test report only pertains to the GSM850/1900 portion of the EUT.

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

FCC ID: QIPAC75I; IC: 7830A-AC75I

## 1.6 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the FCC Part 2, Sub-part J as well as the following parts:

Part 22 Subpart H - Cellular Radiotelephone Service & Part 24 Subpart E – PCS

And IC RSS-132, RSS-133

Applicable Standards: TIA/EIA 603-C

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## 1.7 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 NIS 81, 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.

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

## 1.8 Test Facility

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 sites at BACL 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 has 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 also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: R-2463 and C-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL 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 TIA/EIA 603-C.

The final qualification test was performed with the EUT operating at normal mode.

## 2.2 EUT Exercise Software

Rohde & Schwarz CMU200 Communication test set was used to activate the EUT. A DOS ping command was used to create traffic in the Ethernet line. For the RS232 line, Winpan was used to obtain updates from the EUT/host via the serial port.

## 2.3 Special Accessories

N/A

## 2.4 Equipment Modifications

No modifications were made to the EUT

## 2.5 Remote Support Equipment

N/A

## 2.6 Local Support Equipment

| Manufacturer | Description | Model Number | Serial Number |
|---|---|---|---|
| Trimble Navigation Ltd | Host | SPS850 | 4814K55001 |
| Rohde & Schwarz | CMU200 | 1100.0008.02 | 833871/031 |
| Dell | Laptop | D620 | 35990178337 |

## 2.7 Power Supply and Line Filters

| Manufacturer | Description | Model Number | Serial Number |
|---|---|---|---|
| Ault | AC/DC Power Supply | PW174KB1802F04 | - |

## 2.8 Interface Ports and Cabling

| Cable Description | Length | From | To |
|---|---|---|---|
| 60789-00 (Ethernet) | 1m | EUT | Laptop PC |
| LEMO (R232) | 2m | EUT | Laptop PC |
| LEMO (DC power) | 2m | EUT | AC/DC power supply |

## 2.9 EUT Internal Configuration Details

| Manufacturer | Description | Model Number | Serial Number |
|---|---|---|---|
| Trimble Navigation Limited | PCB Assembly – Main Board | 74373A | 74373-00-A-0L |
| Trimble Navigation Limited | PCB Assembly – Connector Board | 6844-B | - |

# 3 SUMMARY OF TEST RESULTS

| FCC & RSS Rules | Description of Test | Result |
|---|---|---|
| FCC §2.1047<br>IC RSS-132 §4.2; RSS-133 §6.2 | Modulation Characteristics | N/A |
| FCC §2.1053<br>FCC §22.917 (a); §24.238 (a)<br>IC RSS-132 §4.5; RSS-133 §6.5 | Field Strength of Spurious Radiation | Compliant |
| FCC §2.1091<br>IC RSS-102 | RF Exposure | Compliant |
| FCC §2.1046<br>FCC §22.913; §24.232<br>IC RSS-132 §4.4; RSS-133 §6.4 | RF Output Power | Compliant * |
| FCC §2.1049<br>FCC §22.917; FCC §24.238<br>IC RSS-132 §4.5; RSS-133 §6.5 | Out of Band Emissions, Occupied Bandwidth | Compliant * |
| FCC §2.1051<br>FCC §22.917; FCC §24.238(a)<br>IC RSS-132 §4.5; RSS-133 §6.5 | Spurious Emissions at Antenna Terminals | Compliant * |
| FCC §2.1055<br>FCC §22.355; FCC §24.235<br>IC RSS-132 §4.3; RSS-133 §6.3 | Frequency stability vs. temperature<br>Frequency stability vs. voltage | Compliant * |
| FCC §22.917; FCC §24.238<br>IC RSS-132 §4.5; RSS-133 §6.5 | Band Edge | Compliant* |
| IC RSS-132 §4.6; RSS-133 §6.6 | Receiver Spurious Emission | Compliant |

Note* Please refer to the following report for test results:

FCC ID: QIPAC75I and IC: 7830A-AC75I

# 4 FCC §2.1047 & IC RSS-132 §4.2, RSS-133 §6.2 - MODULATION CHARACTERISTIC

## 4.1 Applicable Standard

According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

## 4.2 Result

Not applicable.

# 5 FCC §1.1307(b)(1), §2.1091 & IC RSS-102 - RF EXPOSURE

## 5.1 Applicable Standards

According to FCC §1.1307(b)(1), §2.1091 and IC RSS-102, RF exposure is calculated.

FCC:

Limits for General Population/Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Averaging Time (minutes) |
|---|---|---|---|---|
| **Limits for General Population/Uncontrolled Exposure** | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *($180/f^2$) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | / | / | f/1500 | 30 |
| 1500-100,000 | / | / | 1.0 | 30 |

Note: f = frequency in MHz
* = Plane-wave equivalent power density

IC:

RSS-102, RF Field Strength Limits for Devices Used by the General Public

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($W/m^2$) | Averaging Time (minutes) |
|---|---|---|---|---|
| **Limits for General Population/Uncontrolled Exposure** | | | | |
| 0.003-1 | 280 | 2.19 | - | 6 |
| 1-10 | 280/f | 2.19/f | - | 6 |
| 10-30 | 28 | 2.19/f | - | 6 |
| 30-300 | 28 | 0.073 | 2* | 6 |
| 300-1500 | $1.585\ f^{0.5}$ | $0.0042\ f^{0.5}$ | f/150 | 6 |
| 1500-15000 | 61.4 | 0.163 | 10 | 6 |
| 15000-150000 | 61.4 | 0.163 | 10 | $616000/f\ f^{1.2}$ |
| 150000-300000 | $0.1585\ f^{0.5}$ | $4.21x10^{-4}\ f^{0.5}$ | $6.67x10^{-5}\ f$ | $616000/f\ f^{1.2}$ |

**Note:** *f* is frequency in MHz
* Power density limit is applicable at frequencies greater than 100 MHz.

## 5.2 MPE Prediction

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Cellular Band

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 33.45 |
| Maximum peak output power at antenna input terminal (mW): | 2213.09 |
| Prediction distance (cm): | 28 |
| Prediction frequency (MHz): | 824.6 |
| Antenna Gain, typical (dBi): | -0.3 |
| Maximum Antenna Gain (numeric): | 0.933 |
| Power density at predication frequency and distance ($mW/cm^2$): | 0.2097 |
| Power density at predication frequency and distance ($W/m^2$): | 2.097 |
| FCC MPE limit for uncontrolled exposure at predication frequency ($mW/cm^2$): | 0.5497 |
| IC MPE limit for uncontrolled exposure at predication frequency ($W/m^2$): | 5.4973 |

PCS Band

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 30.58 |
| Maximum peak output power at antenna input terminal (mW): | 1142.88 |
| Prediction distance (cm): | 28 |
| Prediction frequency (MHz): | 1850.2 |
| Antenna Gain, typical (dBi): | 2.2 |
| Maximum Antenna Gain (numeric): | 1.66 |
| Power density at predication frequency and distance ($mW/cm^2$): | 0.1927 |
| Power density at predication frequency and distance ($W/m^2$): | 1.927 |
| FCC MPE limit for uncontrolled exposure at predication frequency ($mW/cm^2$): | 1.0 |
| IC MPE limit for uncontrolled exposure at predication frequency ($W/m^2$): | 10.0 |

**Result**

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power densities at the distance of 28 cm are 0.2097 $mW/cm^2$ (2.097 $W/m^2$) for Cellular band and 0.1927 $mW/cm^2$ (1.927 $W/m^2$) for PCS band. Proper use this device results in exposure the government limits below has been addressed in the user manual.

# 6 FCC §2.1053, §22.917, §24.238 & IC RSS-132 §4.5, RSS-133 §6.5 - SPURIOUS RADIATED EMISSIONS

## 6.1 Applicable Standard

Requirements: CFR 47, §2.1053, §22.917 & §24.238.

Requirements: RSS-132 §4.5 & RSS-133 §6.5.

## 6.2 Test Procedure

TIA/EIA-603-C Section 2.2.12 – Unwanted Emission: Radiated Spurious

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 log (TX Power in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 $\text{Log}_{10}$ (power out in Watts)

## 6.3 Test Equipment List and Details

| Manufacturer | Description | Model Number | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2009-04-28 |
| Rohde & Schwarz | CMU200 | 1100.0008.02 | 833871/031 | 2009-06-22 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-07-28 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 2009-07-01 |
| Rohde & Schwarz | Generator, Signal | SMIQ03 | 849192/0085 | 2007-12-03* |
| Ducommun | Pre-Amplifier | ALN-09173030-01 | 988251-03R | 2009-03-04 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-03-06 |

*Based on a two year calibration cycle
**Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 6.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 21 °C ~ 25 °C |
| **Relative Humidity:** | 50 % ~ 67 % |
| **ATM Pressure:** | 101.1kPa ~ 101.6kPa |

** Testing performed by Dennis Huang on 2008-09-10, 2008-09-11, 2009-10-15.*

## 6.5 Summary of Test Results

Worst case reading as follows:

Host Orientation - Horizontal Flat on Table

| **Mode: GSM 850 MHz** | | |
|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** |
| -10.07 | 1673.20 | Horizontal |
| **Mode: GSM 1900 MHz** | | |
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** |
| -27.73 | 3760.00 | Vertical |

## 6.6 Test Results

Please refer to the following tables.

**GSM 850 MHz Band** (Host Orientation – Horizontal on Table)

Middle Channel – 836.6 MHz

| Indicated | | Azimuth (degree) | Test Antenna | | Substituted | | | | | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Amp. (dBuV) | | Height (cm) | Polarity (H/V) | Frequency (MHz) | Level (dBm) | Ant. Cord. (dB) | Cable Loss (dB) | Absolute Level (dBm) | | |
| 1673.2 | 70.93 | 233 | 121 | V | 1673.2 | -28.4 | 9.2 | 4.66 | -23.86 | -13.00 | -10.86 |
| 1673.2 | 70.82 | 278 | 113 | H | 1673.2 | -27.6 | 9.2 | 4.66 | -23.07 | -13.00 | -10.07 |

**GSM 1900 MHz Band** (Host Orientation – Horizontal on Table)

Middle Channel – 1880 MHz

| Indicated | | Azimuth (degree) | Test Antenna | | Substituted | | | | | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Amp. (dBuV) | | Height (cm) | Polarity (H/V) | Frequency (MHz) | Level (dBm) | Ant. Cord. (dB) | Cable Loss (dB) | Absolute Level (dBm) | | |
| 3760.0 | 57.02 | 229 | 110 | V | 3760.0 | -44.49 | 11.30 | 7.54 | -40.73 | -13.00 | -27.73 |
| 3760.0 | 55.41 | 188 | 158 | H | 3760.0 | -50.39 | 11.30 | 7.54 | -46.63 | -13.00 | -33.63 |

**GSM 850 MHz Band** (Host Orientation – Vertical on Table)

Middle Channel – 836.6 MHz

| Indicated | | Azimuth (degree) | Test Antenna | | Substituted | | | | | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Amp. (dBuV) | | Height (cm) | Polarity (H/V) | Frequency (MHz) | Level (dBm) | Ant. Cord. (dB) | Cable Loss (dB) | Absolute Level (dBm) | | |
| 1673.2 | 66.24 | 255 | 100 | V | 1673.2 | -33.08 | 9.20 | 4.66 | -28.55 | -13.00 | -15.55 |
| 1673.2 | 66.36 | 294 | 168 | H | 1673.2 | -32.06 | 9.20 | 4.66 | -27.53 | -13.00 | -14.53 |
| 2509.8 | 56.75 | 105 | 134 | V | 2509.8 | -43.98 | 9.40 | 6.12 | -40.71 | -13.00 | -27.71 |
| 2509.8 | 51.81 | 125 | 152 | H | 2509.8 | -50.72 | 9.40 | 6.12 | -47.45 | -13.00 | -34.45 |

**GSM 1900 MHz Band** (Host Orientation – Vertical on Table)

Middle Channel – 1880 MHz

| Indicated | | Azimuth (degree) | Test Antenna | | Substituted | | | | | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Amp. (dBuV) | | Height (cm) | Polarity (H/V) | Frequency (MHz) | Level (dBm) | Ant. Cord. (dB) | Cable Loss (dB) | Absolute Level (dBm) | | |
| 3760.0 | 53.76 | 111 | 148 | V | 3760.0 | -47.75 | 11.30 | 7.54 | -43.99 | -13.00 | -30.99 |
| 3760.0 | 54.38 | 220 | 202 | H | 3760.0 | -51.42 | 11.30 | 7.54 | -47.66 | -13.00 | -34.66 |

# 7 IC RSS-132 §4.6 & RSS-133 §6.6- Receiver Radiated Emissions

## 7.1 Applicable Standard

IC RSS-132 §4.6 and RSS-133 §6.6 Receiver spurious emissions shall comply with the limits specified in RSS-Gen §6

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of table below:

Spurious Emission Limits for Receiver

| Spurious Frequency (MHz) | Field Strength (microvolts/m) at 3 metres |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| 960-1610 | 500 |
| Above 1610 | 1000 |

(b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

## 7.2 Test Setup

The radiated emissions tests were performed in the 5-meter test chamber, using the setup in accordance with CISPR 22 Ed. 5.2 b: 2006 measurement procedures. The specifications used were in accordance with CISPR 22 §6 Standard, Class B limits for frequencies between 30 MHz and 1 GHz, and FCC Part 15 Standard, Class B limits for frequencies above 1 GHz.

The spacing between the peripherals was 3 cm.
The external I/O cables were draped along the test table and bundled as required.
The adaptor of EUT was connected to a 120 V, 60 Hz AC line power source.

## 7.3 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).

## 7.4 Test Equipment List and Details

| Manufacturer | Description | Model Number | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2009-04-28 |
| Rohde & Schwarz | CMU200 | 1100.0008.02 | 833871/031 | 2009-06-22 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-07-28 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 2009-07-01 |
| Rohde & Schwarz | Generator, Signal | SMIQ03 | 849192/0085 | 2007-12-03 |
| Ducommun | Pre-Amplifier | ALN-09173030-01 | 988251-03R | 2009-03-04 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-03-06 |

*Based on a two year calibration cycle
**Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 7.5 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 21 °C ~ 25 °C |
| **Relative Humidity:** | 50 % ~ 67 % |
| **ATM Pressure:** | 101.1kPa ~ 101.6kPa |

** Testing performed by Dennis Huang on 2008-09-10, 2008-09-11, 2009-10-15.*

## 7.6 Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Loss + Attenuator Factor – Amplifier Gain

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (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. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

## 7.7 Summary of Test Results

According to the recorded data, the EUT complied with CISPR 22 §6 Standard, Class B limits, and had the worst margin reading of:

| **Mode: Receiving** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| - | - | - | 30 to 10000 |

**Note: All emissions from the EUT are on the noise level or with a margin greater than 20 dB.*

# 8 FCC §2.1046, §22.913(a), §24.232 & IC RSS-132 §4.4 & RSS-133 §6.4 – RF OUTPUT POWER

## 8.1 Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (a), in no case may the peak output power of a base station transmitter exceed 2 watt.

According to RSS-132 §4.4, the transmitter output power shall not exceed the limits given in SRSP-503. The maximum ERP shall be 6.3 watts for mobile stations

According to RSS-133 §6.4 (with reference to SRSP-510), the maximum permissible output power for a mobile station is 2 watts (33 dBm).

## 8.2 Test Procedure

Conducted:

The RF output of the transmitter was connected to wireless communication test set through the sufficient attenuation.

Radiated:

TIA/EIA-603-C Section 2.2.17 – Radiated Power Output

## 8.3 Test Equipment List and Details

| Manufacturer | Description | Model Number | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Spectrum Analyzer | E4440A | MY44303352 | 2009-04-28 |
| Rohde & Schwarz | CMU200 | 1100.0008.02 | 833871/031 | 2009-06-22 |
| Sunol Sciences | Antenna | JB1 | A020106-1 | 2009-04-17 |
| A.R.A | Horn Antenna | DRG-118/A | 1132 | 2009-07-28 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 2009-07-01 |
| Rohde & Schwarz | Generator, Signal | SMIQ03 | 849192/0085 | 2008-10-14 |
| Ducommun | Pre-Amplifier | ALN-09173030-01 | 988251-03R | 2009-03-04 |
| HP | Pre-Amplifier | 8447D | 2944A06639 | 2009-03-06 |

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

## 8.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 21 °C ~ 25 °C |
| **Relative Humidity:** | 50 % ~ 67 % |
| **ATM Pressure:** | 101.1kPa ~ 101.6kPa |

** Testing performed by Dennis Huang on 2008-09-10, 2008-09-11, 2009-10-15.*

## 8.5 Summary of Test Results

**Conducted Output Power:**

Please refer to FCC ID: QIPAC75I

**Radiated Power (ERP and EIRP)**

GSM/GPRS 850 MHz Band (Host Orientation – Horizontal Flat on Table)

| Frequency (MHz) | S.A. Amp. (dBµV/m) | Table Azimuth (Degrees) | Test Antenna | | Substitution | | | | Absolute Level (dBm) | FCC & IC | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/ V) | Freq (MHz) | Level (dBm) | Antenna Gain (dB) | Cable Loss (dB) | | Limit (dBm) | Margin (dBm) |
| 824.2 | 102.00 | 340 | 1.0 | V | 824.2 | 26.42 | 0 | 0.21 | 26.21 | 38.45 | -12.24 |
| 824.2 | 105.08 | 330 | 1.0 | H | 824.2 | 28.53 | 0 | 0.21 | 28.32 | 38.45 | -10.13 |
| 836.6 | 103.13 | 335 | 1.0 | V | 836.6 | 27.57 | 0 | 0.21 | 27.36 | 38.45 | -11.09 |
| 836.6 | 104.80 | 340 | 1.0 | H | 836.6 | 28.87 | 0 | 0.21 | 28.66 | 38.45 | -9.79 |
| 848.8 | 103.34 | 350 | 1.0 | V | 848.8 | 28.25 | 0 | 0.21 | 28.04 | 38.45 | -10.41 |
| 848.8 | 103.29 | 340 | 1.0 | H | 848.8 | 27.88 | 0 | 0.21 | 27.67 | 38.45 | -10.78 |

GSM/GPRS 1900 MHz Band (Host Orientation – Horizontal Flat on Table)

| Frequency (MHz) | S.A. Amp. (dBµV/m) | Table Azimuth (Degrees) | Test Antenna | | Substitution | | | | Absolute Level (dBm) | FCC & IC | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/ V) | Freq (MHz) | Level (dBm) | Antenna Gain (dB) | Cable Loss (dB) | | Limit (dBm) | Margin (dBm) |
| 1850.2 | 93.73 | 84 | 1.28 | V | 1850.2 | 16.79 | 9.5 | 4.95 | 21.34 | 33 | -11.66 |
| 1850.2 | 93.88 | 189 | 1.61 | H | 1850.2 | 15.37 | 9.5 | 4.95 | 19.92 | 33 | -13.08 |
| 1880.0 | 93.96 | 84 | 1.74 | V | 1880.0 | 14.99 | 9.0 | 5.16 | 18.83 | 33 | -14.17 |
| 1880.0 | 92.13 | 200 | 1.63 | H | 1880.0 | 11.54 | 9.0 | 5.16 | 15.38 | 33 | -17.62 |
| 1909.8 | 93.65 | 82 | 1.66 | V | 1909.8 | 17.08 | 9.0 | 5.16 | 20.92 | 33 | -12.08 |
| 1909.8 | 91.38 | 195 | 1.60 | H | 1909.8 | 15.01 | 9.0 | 5.16 | 18.85 | 33 | -14.15 |

GSM/GPRS 850 MHz Band (Host Orientation – Vertical on Table)

| Frequency (MHz) | S.A. Amp. (dBµV/m) | Table Azimuth (Degrees) | Test Antenna | | Substitution | | | | Absolute Level (dBm) | FCC & IC | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/ V) | Freq (MHz) | Level (dBm) | Antenna Gain (dB) | Cable Loss (dB) | | Limit (dBm) | Margin (dBm) |
| 824.2 | 102.71 | 52 | 1 | V | 824.2 | 27.13 | 0 | 0.21 | 26.92 | 38.45 | -11.53 |
| 824.2 | 107.24 | 74 | 1 | H | 824.2 | 30.69 | 0 | 0.21 | 30.48 | 38.45 | -7.97 |
| 836.6 | 100.98 | 53 | 1 | V | 836.6 | 25.42 | 0 | 0.21 | 25.21 | 38.45 | -13.24 |
| 836.6 | 107.72 | 75 | 1 | H | 836.6 | 31.79 | 0 | 0.21 | 31.58 | 38.45 | -6.87 |
| 848.8 | 104.41 | 52 | 1 | V | 848.8 | 29.32 | 0 | 0.21 | 29.11 | 38.45 | -9.34 |
| 848.8 | 108.10 | 75 | 1 | H | 848.8 | 32.69 | 0 | 0.21 | 32.48 | 38.45 | -5.97 |

GSM/GPRS 1900 MHz Band (Host Orientation – Vertical on Table)

| Frequency (MHz) | S.A. Amp. (dBµV/m) | Table Azimuth (Degrees) | Test Antenna | | Substitution | | | | Absolute Level (dBm) | FCC & IC | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/ V) | Freq (MHz) | Level (dBm) | Antenna Gain (dB) | Cable Loss (dB) | | Limit (dBm) | Margin (dBm) |
| 1850.2 | 90.09 | 312 | 100 | V | 1850.2 | 13.15 | 9.5 | 4.95 | 17.70 | 33 | -15.30 |
| 1850.2 | 87.71 | 324 | 106 | H | 1850.2 | 9.20 | 9.5 | 4.95 | 13.75 | 33 | -19.25 |
| 1880.0 | 89.19 | 340 | 160 | V | 1880 | 10.22 | 9.0 | 5.16 | 14.06 | 33 | -18.94 |
| 1880.0 | 87.11 | 319 | 229 | H | 1880 | 6.52 | 9.0 | 5.16 | 10.36 | 33 | -22.64 |
| 1909.8 | 88.91 | 340 | 160 | V | 1909.8 | 12.34 | 9.0 | 5.16 | 16.18 | 33 | -16.82 |
| 1909.8 | 87.89 | 313 | 243 | H | 1909.8 | 11.52 | 9.0 | 5.16 | 15.36 | 33 | -17.64 |

# 9 FCC §2.1049, §22.917, §24.238 & IC RSS-132 §4.4, RSS-133 §6.4 - OCCUPIED BANDWIDTH

## 9.1 Applicable Standard

Requirements: CFR 47, §2.1049, §22.917 and §24.238.

Requirements: RSS-132 §4.4 & RSS-133 §6.4.

## 9.2 Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 3 kHz (Cellular /PCS) and the -26 dB bandwidth was recorded.

## 9.3 Summary of Test Results

Please refer to the following report for test results:

FCC ID: QIPAC75I and IC: 7830A-AC75I

# 10 FCC §2.1051, §22.917, §24.238(a) & IC RSS-132 §4.5, RSS-133 §6.5 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## 10.1 Applicable Standard

Requirements: CFR 47, § 2.1051. § 22.917 & §24.238(a).

Requirements: RSS-129 §8.1, RSS-132 §4.5 & RSS-133 §6.5.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

## 10.2 Test Procedure

TIA/EIA-603-C Section 2.2.13– Unwanted Emission: Conducted Spurious

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to $10^{th}$ harmonic.

## 10.3 Test Results

Please refer to the following report for test results:

FCC ID: QIPAC75I and IC: 7830A-AC75I

# 11 FCC §2.1055, §22.355, §24.235 & IC RSS-132 §4.3, RSS-133 §6.3 - FREQUENCY STABILITY

## 11.1 Applicable Standard

Requirements: CFR47 §2.1055(a), §2.1055(d) & §22.355, §24.235.

Requirements: IC RSS-132 §4.3 & RSS-133 §6.3.

## 11.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

## 11.3 Test Results

Please refer to the following report for test results:

FCC ID: QIPAC75I and IC: 7830A-AC75I

# 12 FCC §22.917, §24.238 & IC RSS-132 §4.5, RSS-133 §6.5 – BAND EDGE

## 12.1 Applicable Standard

According to § 22.917, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238, the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Requirements: RSS-132 §4.5 & RSS-133 §6.5.

## 12.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency, RBW set to 10 kHz.

## 12.3 Test Results

Please refer to the following report for test results:

FCC ID: QIPAC75I and IC: 7830A-AC75I