

# FCC PART 24 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

## XATA Corporation

151 East Cliff Rd  
Burnsville, MN 55337

**FCC ID: POCQ2438F**

|                                                                                                                                                                     |                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>This Report Concerns:</b><br><input checked="" type="checkbox"/> Original Report                                                                                 | <b>Equipment Type:</b><br>Onboard Information System |
| <b>Test Engineer:</b> Ming Jing /                                                |                                                      |
| <b>Report No.:</b> R0409142                                                                                                                                         |                                                      |
| <b>Report Date:</b> 2004-10-01                                                                                                                                      |                                                      |
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**Note:** The test report is specially limited to the above company and the product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the US Government.

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## GENERAL INFORMATION

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### Product Description for Equipment Under Test (EUT)

The XATA Corporation product, FCC ID: POCQ2438F, Model: SA-0074-01/SA-0075-01 or the "EUT" as referred to in this report is a state-of-art onboard information system that integrates onboard computer, real-time communications, global positioning and advanced fleet management software into an enterprise-wide logistics solution for America's largest fleets. The EUT measures approximately 185mm(L) x 185mm(W) x 85mm(H). The EUT operates at the frequency of 1851.25 – 1908.75 MHz, maximum output power (ERP) 30.17dBm (1.04W), frequency tolerance 2.5ppm and emission designator 1M27G1D.

*\* The test data gathered are from typical production sample, serial number: 40000833, provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of XATA Corporation in accordance with Part 2, Subpart J, and Part 24 Subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, band edge and radiated margin.

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

No Related Submittals

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 24 Subpart E - PCS

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, ANSI 63.4-1992, and TIA/EIA-603A.

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.

### Test Facility

The Open Area Test site used by BACL Corp. to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

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 has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules and Article 8 of the VCCI regulations. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACLa is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

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## SYSTEM TEST CONFIGURATION

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### Justification

The EUT was configured for testing according to TIA/EIA 603A.

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

### Block Diagram

Please refer to Exhibit D.

### Equipment Modifications

No modifications were made to the EUT.

### Local Support Equipment List and Details

| Manufacturer | Description     | Model      | Serial Number | FCC ID |
|--------------|-----------------|------------|---------------|--------|
| Condor       | DC power supply | GPFC250-12 | 023496-2001   |        |

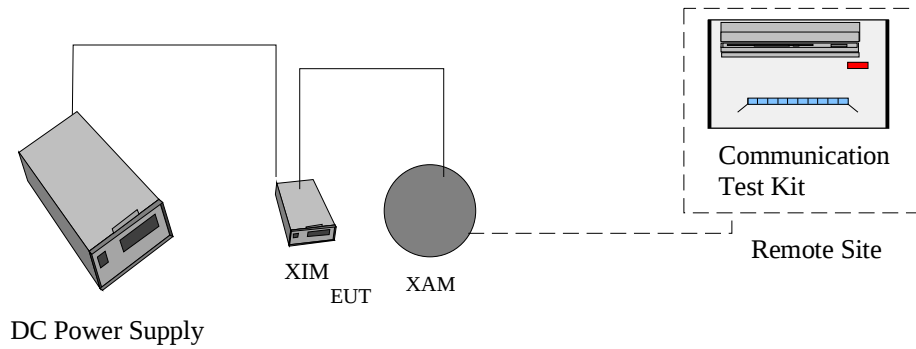
### Remote Support Equipment List and Details

| Manufacturer | Description            | Model | Serial Number | FCC ID |
|--------------|------------------------|-------|---------------|--------|
| Agilent      | Communication test set | 8960  | G134405       |        |

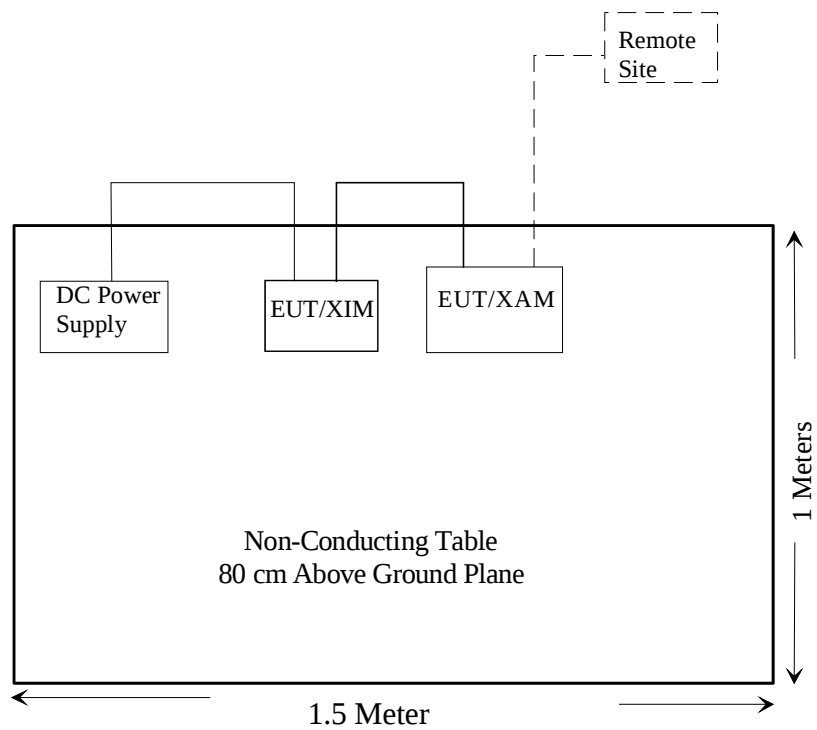
### External Cables List and Details

| Cable Description | Length (M) | From       | To         |
|-------------------|------------|------------|------------|
| Drop Cable        | 5.0        | Port / XAM | Port / XIM |

## Configuration of Test System



## Test Setup Block Diagram



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## SUMMARY OF TEST RESULTS

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Results reported relate only to the product tested

| FCC RULE                                 | DESCRIPTION OF TEST                                                    | RESULT    |
|------------------------------------------|------------------------------------------------------------------------|-----------|
| § 2.1047                                 | Modulation Characteristics                                             | Compliant |
| § 2.1053                                 | Field Strength of Spurious Radiation                                   | Compliant |
| §2.1093                                  | RF Exposure                                                            | Compliant |
| § 2.1046,<br>§ 24.232                    | RF Output Power                                                        | Compliant |
| § 2.1046,<br>§ 24.232                    | Conducted Output Power                                                 | Compliant |
| § 2.1049<br>§ 24.238                     | Out of Band Emission, Occupied Bandwidth                               | Compliant |
| § 2.1051,<br>§ 24.238(a)                 | Spurious Emissions at Antenna Terminals                                | Compliant |
| § 2.1055 (a)<br>§ 2.1055 (d)<br>§ 24.235 | Frequency stability vs. temperature<br>Frequency stability vs. voltage | Compliant |
| §24.238                                  | Band Edge                                                              | Compliant |

## §2.1047 - MODULATION CHARACTERISTIC

### Applicable Standard

Requirement: FCC § 2.1047.

### Test Procedure

UMTS digital mode is used by EUT.

### Test Equipment List and Details

| Manufacturer | Description       | Model   | Serial Number | Cal. Date    |
|--------------|-------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter           | HP7470A | 2541A49659    | Not Required |

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

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

The testing was performed by Ming Jin on 2004-09-23

### Test Results

Please refer to the hereinafter plots.



## §2.1053 - SPURIOUS RADIATED EMISSIONS

### Applicable Standard

Requirements: CFR 47, § 2.1053.

### Test Procedure

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 =  $10 \lg (\text{TXpwr in Watts}/0.001)$  – the absolute level

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

### Test Equipment List and Details

| Manufacturer | Description          | Model       | Serial Number | Cal. Date  |
|--------------|----------------------|-------------|---------------|------------|
| HP           | Spectrum Analyzer    | 8568B       | 2601A02165    | 2004-07-03 |
| HP           | Amplifier            | 8447E       | 2944A10187    | 2004-09-23 |
| HP           | Quasi-Peak Adapter   | 85650A      | 3019A05393    | 2004-06-13 |
| EMCO         | Biconical Antenna    | 3110B       | 9309-1165     | 2003-10-11 |
| EMCO         | Log Periodic Antenna | 3146        | 2101          | 2003-10-11 |
| AH System    | Horn Antenna         | SAS-200/511 | 261           | 2004-08-02 |
| HP           | Spectrum Analyzer    | HP8564E     | 3943A01781    | 2004-08-01 |

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

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

**Test Result**

Mid Channel: -34.50 dB at 3760 MHz

| EUT              |                 |                 |                 |              | Substitution     |              | Generator         |            |              | Standard     |              |
|------------------|-----------------|-----------------|-----------------|--------------|------------------|--------------|-------------------|------------|--------------|--------------|--------------|
| Indicated        |                 | Table           | Test Antenna    |              |                  |              | Antenna           | Cable      | Absolute     | FCC          | FCC          |
| Frequency<br>MHz | Ampl.<br>dBuV/m | Angle<br>Degree | Height<br>Meter | Polar<br>H/V | Frequency<br>MHz | Level<br>dBm | Gain<br>Corrected | Loss<br>dB | Level<br>dBm | Limit<br>dBm | Margin<br>dB |
| 1880             | 108.4           | 210             | 1.5             | v            | 1880             | 22.1         | 8.3               | 1.3        | 29.1         |              |              |
| 1880             | 105.2           | 290             | 1.8             | h            | 1880             | 19.7         | 8.3               | 1.3        | 26.7         |              |              |
| 3760             | 33.6            | 0               | 1.5             | v            | 3760             | -55.8        | 10.3              | 2.0        | -47.5        | -13          | -34.50       |
| 3760             | 32.9            | 45              | 2.0             | h            | 3760             | -57.1        | 10.3              | 2.0        | -48.8        | -13          | -35.80       |
| 5640             | 31.7            | 110             | 1.5             | v            | 5640             | -58.3        | 10.6              | 2.55       | -50.25       | -13          | -37.25       |
| 7520             | 31.3            | 270             | 1.6             | v            | 7520             | -58.9        | 10.6              | 2.55       | -50.85       | -13          | -37.85       |
| 5640             | 30.5            | 90              | 1.5             | h            | 5640             | -59.4        | 10.6              | 2.55       | -51.35       | -13          | -38.35       |
| 7520             | 30.1            | 310             | 1.5             | v            | 7520             | -59.7        | 10.6              | 2.55       | -51.65       | -13          | -38.65       |

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## §2.1046, & §24.232 - RF POWER OUTPUT

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### Applicable Standard

According to FCC §2.1046 and §24.232 (1), mobile/portable stations are limited to 2 watts EIRP.

### Test Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

## Test Equipment List and Details

| Manufacturer | Description          | Model       | Serial Number | Cal. Date  |
|--------------|----------------------|-------------|---------------|------------|
| HP           | Spectrum Analyzer    | 8568B       | 2601A02165    | 2004-07-03 |
| HP           | Amplifier            | 8447E       | 2944A10187    | 2003-09-23 |
| HP           | Quasi-Peak Adapter   | 85650A      | 3019A05393    | 2004-06-13 |
| EMCO         | Biconical Antenna    | 3110B       | 9309-1165     | 2003-10-11 |
| EMCO         | Log Periodic Antenna | 3146        | 2101          | 2003-10-11 |
| AH System    | Horn Antenna         | SAS-200/511 | 261           | 2004-08-02 |

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

## Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

## Test Results

| FREQUENCY<br>(MHZ) | SUBSTITUTION<br>READING<br>(dBm) | SUBSTITUTION<br>ANTENNA<br>GAIN | SUBSTITUTION<br>CABLE LOSS<br>(dB) | EIRP<br>(dBm) |
|--------------------|----------------------------------|---------------------------------|------------------------------------|---------------|
| 1880               | 22.1                             | 8.3                             | 1.3                                | 29.1          |

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

$$22.1 + 8.3 - 1.3 = 29.1$$

## §2.1046, & §24.232 – CONDUCTED OUTPUT POWER

### Applicable Standard

According to FCC §2.1046 and §24.232 (b), Mobile/Portable Station are limited to 2 Watts e.i.r.p. Peak Power.

### Test Procedure

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

### Test Equipment List and Details

| Manufacturer | Description         | Model   | Serial Number | Cal. Date    |
|--------------|---------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer   | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter             | HP7470A | 2541A49659    | Not Required |
| A.H. Systems | Horn Antenna        | SAS200  | 261           | 2004-05-31   |
| ETS          | Logperiodic Antenna | 3148    | 0004-1155     | 2003-10-11   |
| EMCO         | Biconical Antenna   | 3110B   | 9603-2315     | 2003-10-11   |

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

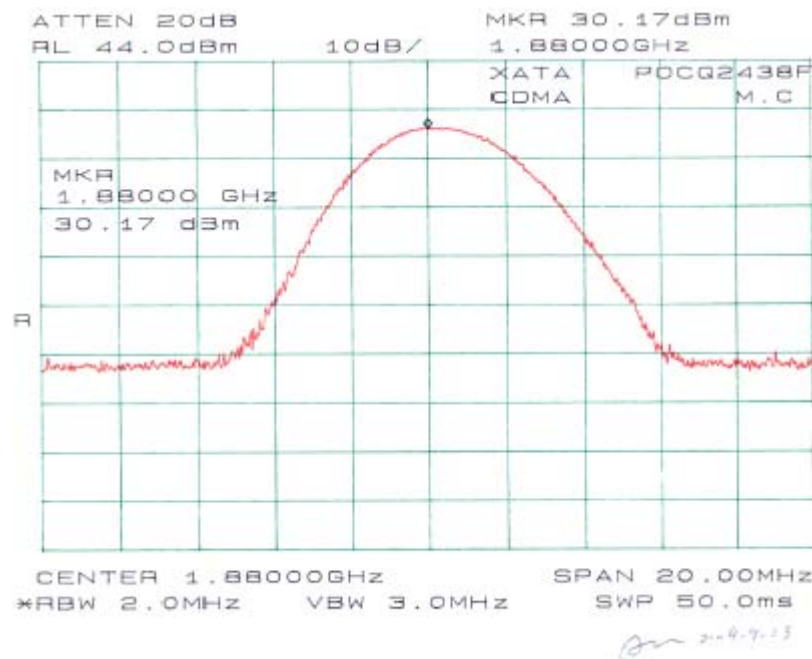
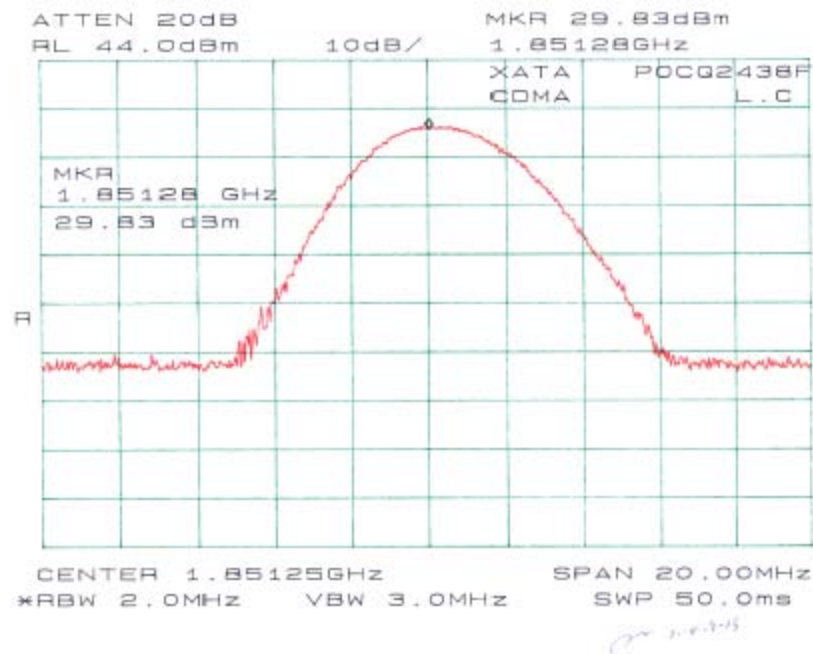
### Environmental Conditions

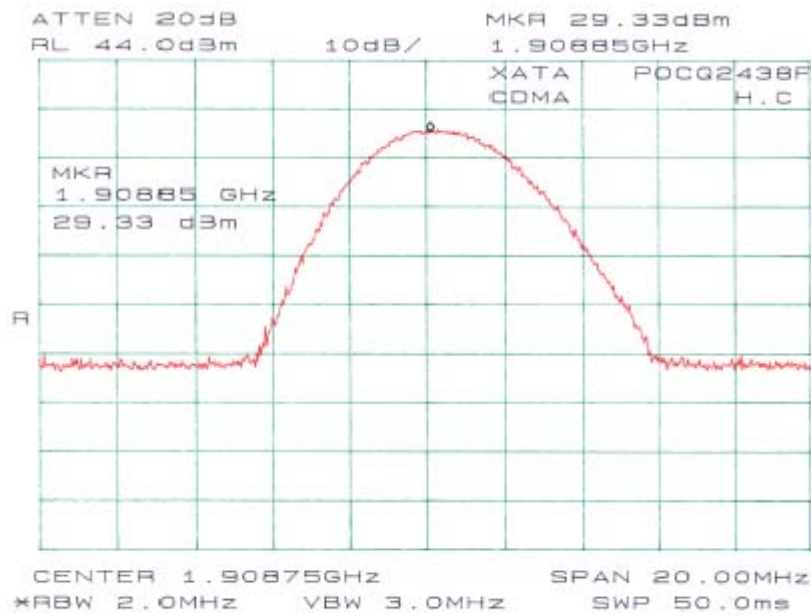
|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

### Test Results

| Channel | Frequency (MHz) | Output Power in dBm | Output Power in W | Limit in W |
|---------|-----------------|---------------------|-------------------|------------|
| LOW     | 1851.25         | 29.83               | 0.962             | 2          |
| MIDDLE  | 1880.00         | 30.17               | 1.040             | 2          |
| HIGH    | 1908.75         | 29.33               | 0.857             | 2          |





## §2.1049, & §24.238 - OCCUPIED BANDWIDTH

### Applicable Standard

Requirements: CFR 47, Section 2.1049, and Section 24.238.

### Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 30 KHz and the 26 dB bandwidth was recorded.

### Test Equipment List and Details

| Manufacturer | Description       | Model   | Serial Number | Cal. Date    |
|--------------|-------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter           | HP7470A | 2541A49659    | Not Required |

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

### Environmental Conditions

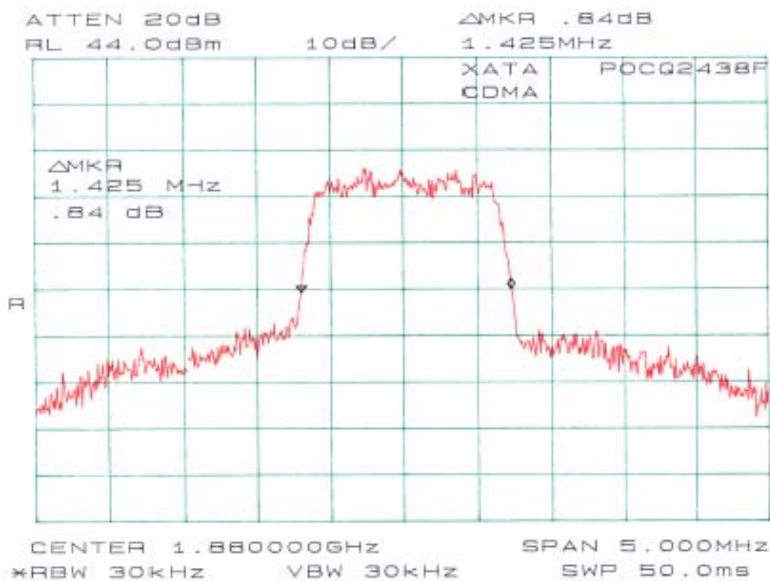
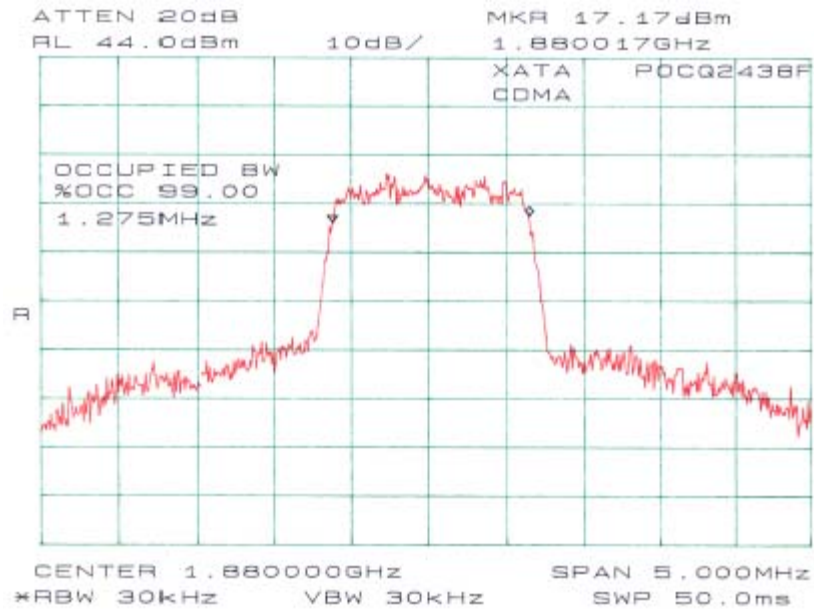
|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

### Test Results

| Channel | Frequency (Mhz) | Type               | Measurement (MHz) | Result    |
|---------|-----------------|--------------------|-------------------|-----------|
| Middle  | 1880.00         | Occupied Bandwidth | 1.275             | Compliant |
|         |                 | 26dB Bandwidth     | 1.425             | Compliant |

Please refer to the hereinafter plots.



## §2.1051, & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Applicable Standard

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

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

### Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer 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<sup>th</sup> harmonic.

### Test Equipment List and Details

| Manufacturer | Description       | Model   | Serial Number | Cal. Date    |
|--------------|-------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter           | HP7470A | 2541A49659    | Not Required |

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

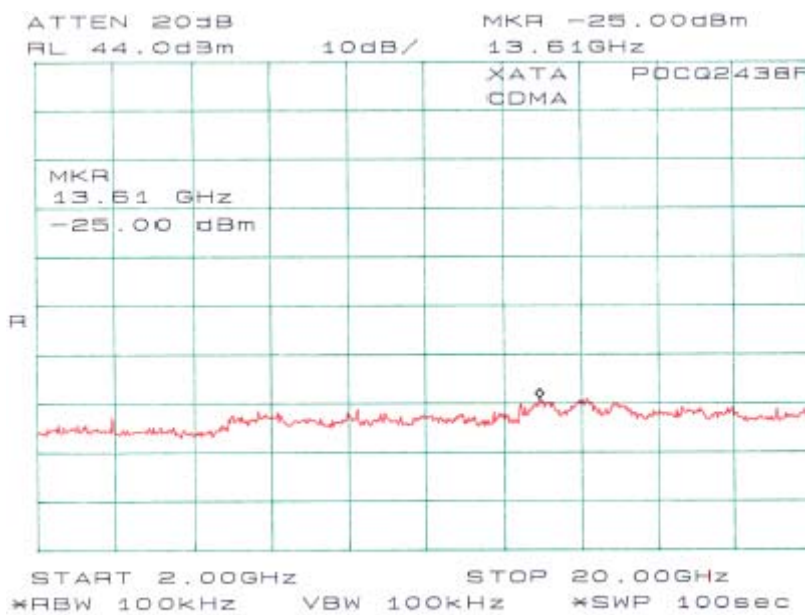
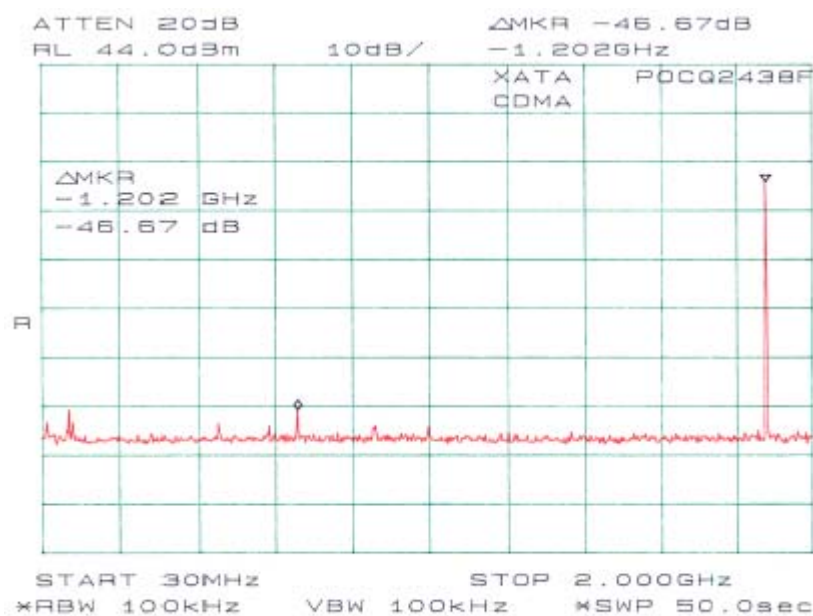
### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

### Test Results

Please refer to the hereinafter plots.



## §2.1055 (a), §2.1055 (d), & §24.235 - FREQUENCY STABILITY

### Applicable Standard

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

According to §24.235, The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### 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 a frequency counter 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 counter.

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.

### Test Equipment List and Details

| Manufacturer | Description       | Model   | Serial Number | Cal. Date    |
|--------------|-------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter           | HP7470A | 2541A49659    | Not Required |
| HP           | Temperature Oven  | 7475A   | 2541A49659    | N/R          |

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

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

**Test Results***Frequency Stability Versus Temperature*

| Reference Frequency : 1880.0000 MHz, Limit : 2.5 ppm |                       |                                     |              |
|------------------------------------------------------|-----------------------|-------------------------------------|--------------|
| Temperature<br>C                                     | Power supplied<br>Vdc | Frequency Measure with Time Elapsed |              |
|                                                      |                       | MCF<br>(MHz)                        | Error<br>ppm |
|                                                      |                       |                                     |              |
| 50                                                   | 12                    | 1880.0019                           | 1.01         |
| 40                                                   | 12                    | 1880.0013                           | 0.69         |
| 30                                                   | 12                    | 1880.0004                           | 0.22         |
| 20                                                   | 12                    | 1880                                | 0            |
| 10                                                   | 12                    | 1880                                | 0            |
| 0                                                    | 12                    | 1879.9998                           | -0.11        |
| -10                                                  | 12                    | 1879.9996                           | -0.21        |
| -20                                                  | 12                    | 1879.9995                           | -0.27        |
| -30                                                  | 12                    | 1879.9995                           | -0.27        |

| Reference Frequency : 1880.0000 MHz, Limit : 2.5 ppm |                                     |              |
|------------------------------------------------------|-------------------------------------|--------------|
| Power supplied<br>Vdc                                | Frequency Measure with Time Elapsed |              |
|                                                      | Frequency<br>(MHz)                  | Error<br>ppm |
| 13.8                                                 | 1880                                | 0            |
| 10.2                                                 | 1880.0002                           | 0.11         |

## §24.238 – BAND EDGE

### Applicable Standard

According to §24.238, the power of any emission 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.

### 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 30KHz.

### Test Equipment List and Details

| Manufacturer | Description       | Model   | Serial Number | Cal. Date    |
|--------------|-------------------|---------|---------------|--------------|
| HP           | Spectrum Analyzer | HP8564E | 3943A01781    | 2004-08-01   |
| HP           | Plotter           | HP7470A | 2541A49659    | Not Required |

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

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 26° C     |
| Relative Humidity: | 35%       |
| ATM Pressure:      | 1018 mbar |

*The testing was performed by Ming Jin on 2004-09-23*

### Test Results

Please refer to the following plots.

