

FCC PART 22 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

Maxon Electronics Australia Pty. Ltd.

36A Gibson Ave, Padstow
New South Wales 2212, Australia

FCC ID: Q2FMM-5500PRO

This Report Concerns: ☒ Original Report	Equipment Type: Wireless CDMA 1XEVD0 Ethernet Modem
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Report No.: R0506231	
Report Date: 2005-08-10	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Maxon Electronics Australia Pty. Ltd* 's product, FCC ID: Q2FMM-5500PRO or the "EUT" as referred to in this report is a CDMA USB modem, which measures approximately 129mm L x 93mm W x 27mm H. The EUT has a reverse SMA antenna with antenna gain 0 dBi, model: HW-860-RSMA.

The EUT operates at the frequency of 824.64~848.37MHz, Maximum output power of 24.53 dBm (0.283W), frequency tolerance 2.5ppm and emission designator 1M26G1D.

** The test data gathered are from typical production sample, serial number: 3B0000AF provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Maxon Electronics Australia Pty. Ltd* in accordance with Part 2, Subpart J, Part 22 Subpart H of the Federal Communication Commissions rules.

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

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 22 Subpart H - Public Mobile Services

Applicable Standards: TIA EIA 98-E, TIA603-C, and ANSI 63.4-2003.

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 Bay Area Compliance Laboratory Corporation 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 Bay Area Compliance Laboratory Corporation 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 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 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, 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>

SYSTEM TEST CONFIGURATION

Justification

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

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.

Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
KTL	Power Adapter	PA-120150S	031-855-2258	DOC

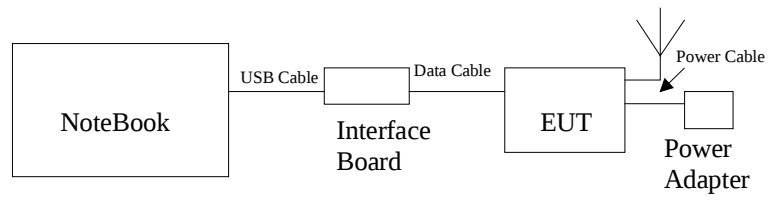
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Dell	Notebook	PR04S	SY250 A00	DOC

Interface Ports and Cabling

Cable Description	Length (M)	From	To
Data Cable	0.2	EUT	Interface Board
Power Cable	2.0	Adapter	EUT
USB Cable	1.0	Notebook	Interface Board

Configuration of Test System



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number: *3B0000AF*

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1047	Modulation Characteristics	Compliant
§ 2.1053	Field Strength of Spurious Radiation	Compliant
§2.1091	RF Exposure	Compliant
§ 2.1046, § 22.912 (d)	RF Output Power	Compliant
§ 2.1046, § 22.913 (a)	Conducted Output Power	Compliant
§ 2.1049 § 22.917 § 22.905	Out of Band Emission, Occupied Bandwidth	Compliant
§ 2.1051, § 22.917	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1055 (a) § 2.1055 (d) § 22.355	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 22.917	Band Edge	Compliant

§2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

Requirement: FCC § 2.1047.

Test Procedure

CDMA digital mode generated by software is used by EUT. Connect EUT to Simulator and spectrum analyzer, check the waveform.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10

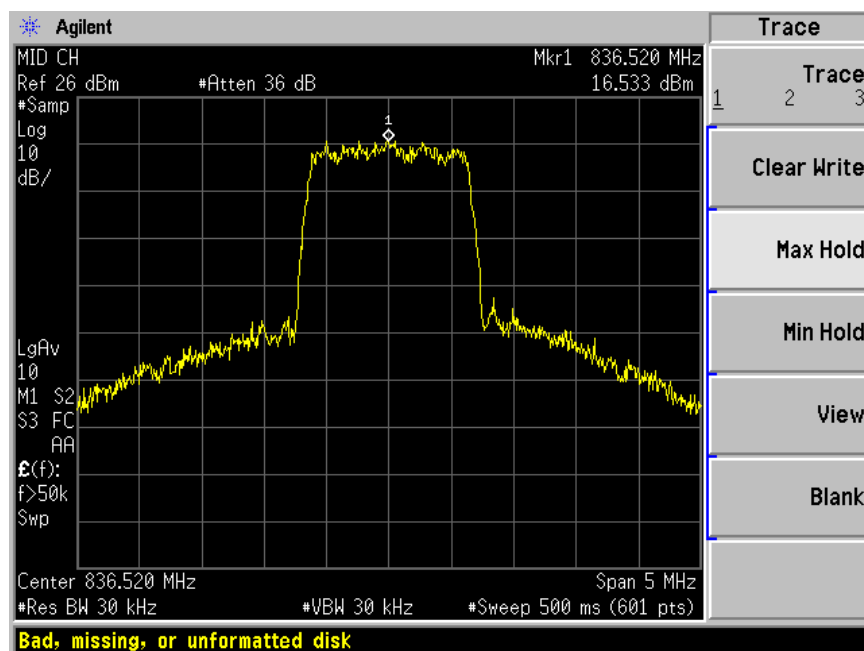
* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

The testing was performed by Daniel Deng on 2005-08-03.

Test Results



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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2004-11-10
ETS	Antenna, logperiodic	3148	4-1155	2004-12-14
ETS	Antenna, Biconical	3110B	9603-2315	2004-12-14
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2005-05-02
A.R.A	Antenna, Horn	DRG-118-A	1132	2003-09-30 **
A.R.A.	Antenna, Horn, DRG	SAS-200/571	261	2005-04-20
HP	Amplifier, Pre	8447D	2944A10198	2004-08-20
Agilent	Amplifier, Pre, Microwave	8449B	3008A01978	2004-10-05
HP	Generator, Signal	83650B	3614A00276	2005-05-10

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

** The device has a two-year calibration cycle.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	46%
ATM Pressure:	1021 mbar

The testing was performed by Daniel Deng on 2005-08-04.

Test Result

The worse case reading is

-18.2 dB at 1673.09 MHz in Vertical Polarization

EUT					Generator					Standard	
Indicated		Table	Test Antenna		Substitution		Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Corrected	Loss dB	Level dBm	Limit dBm	Margin dB
Mid Channel											
1673.09	71.5	30	2.5	V	1673.09	-39.2	9.3	1.3	-31.2	-13	-18.2
3346.08	62.5	60	1.5	V	3346.08	-39.5	10	1.9	-31.4	-13	-18.4
1673.09	71.2	0	1.3	H	1673.09	-39.6	9.3	1.3	-31.6	-13	-18.6
3346.08	61.2	0	1.6	H	3346.08	-40.9	10	1.9	-32.8	-13	-19.8
2509.56	63	90	1.5	V	2509.56	-41.3	9.3	1.6	-33.6	-13	-20.6
2509.56	62.3	0	1.5	H	2509.56	-42.2	9.3	1.6	-34.5	-13	-21.5
4183.37	50.8	0	1.6	H	4183.37	-45.3	11.1	2.3	-36.5	-13	-23.5
4183.37	47.3	60	1.5	V	4183.37	-48.9	11.1	2.3	-40.1	-13	-27.1
1632.27	42.17	270	1.3	V	1632.27	-64.1	9.3	1.3	-56.1	-13	-43.1
1536	40.2	150	1.5	H	1536	-68.2	9	1.3	-60.5	-13	-47.5
1632.27	37.2	330	1.6	H	1632.27	-68.8	9.3	1.3	-60.8	-13	-47.8
1536	39.67	180	1.4	V	1536	-68.8	9	1.3	-61.1	-13	-48.1

§1.1307(b)(1) & §2.1091 - RF EXPOSURE

According to §1.1310 and §2.1091 RF exposure is calculated.

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 (minute)
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

f = frequency in MHz

* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

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

Maximum peak output power at antenna input terminal: 24.53 (dBm)

Maximum peak output power at antenna input terminal: 283.79 (mW)

Prediction distance: 20 (cm)

Predication frequency: 800 (MHz)

Antenna Gain (typical): 0 (dBi)

antenna gain: 1.0 (numeric)

Power density at predication frequency at 20 cm: 0.056(mW/cm²)

MPE limit for uncontrolled exposure at prediction frequency: 0.53 (mW/cm²)

Test Result

The EUT is a mobile device. The power density level at 20 cm is 0.056 mW/cm², which is below the uncontrolled exposure limit of 0.53 mW/cm² at 800 MHz.

§2.1046, §22.913(a) - RF POWER OUTPUT

Applicable Standard

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

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
Agilent	Analyzer, Spectrum	E4446A	US44300386	2004-11-10
ETS	Antenna, logperiodic	3148	4-1155	2004-12-14
ETS	Antenna, Biconical	3110B	9603-2315	2004-12-14
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2005-05-02
A.R.A	Antenna, Horn	DRG-118-A	1132	2003-09-30 **
A.R.A.	Antenna, Horn, DRG	SAS-200/571	261	2005-04-20
HP	Amplifier, Pre	8447D	2944A10198	2004-08-20
Agilent	Amplifier, Pre, Microwave	8449B	3008A01978	2004-10-05
HP	Generator, Signal	83650B	3614A00276	2005-05-10

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

** The device has a two-year calibration cycle.

Environmental Conditions

Temperature:	24° C
Relative Humidity:	46%
ATM Pressure:	1021 mbar

The testing was performed by Daniel Deng on 2005-08-04.

Test Results

Frequency		Antenna	Cable	Absolute
Mhz	Measured Power (dBm)	Gain	Loss	Level
		Correction	dB	dBm
824.63	19.8	5.2	0.7	24.30
836.52	20.2	5.2	0.7	24.70
848.31	20.0	5.2	0.7	24.50

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

$$19.8 + 5.2 - 0.7 = 24.3$$

§2.1046, §22.913(a) – CONDUCTED OUTPUT POWER

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.

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10

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

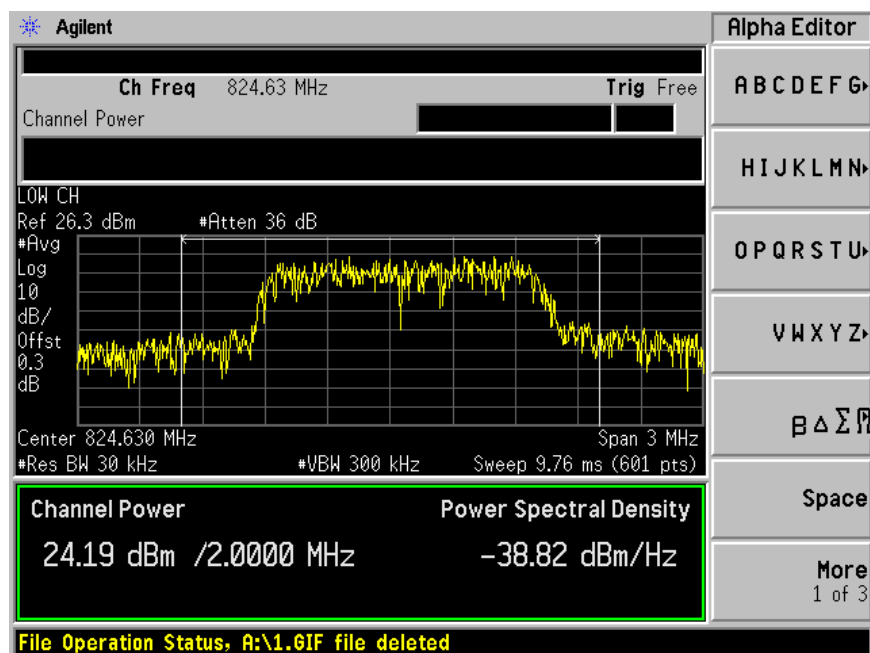
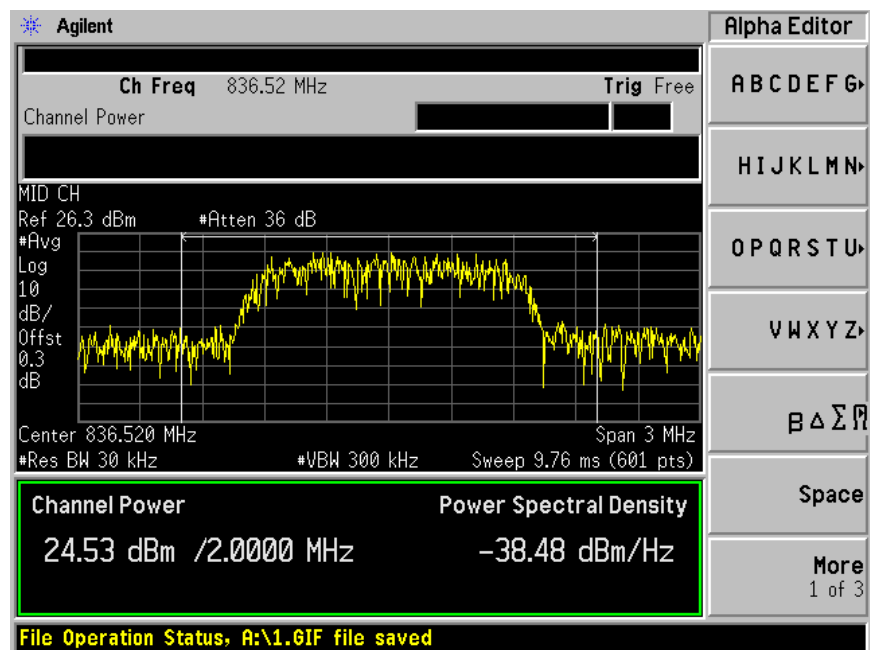
Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

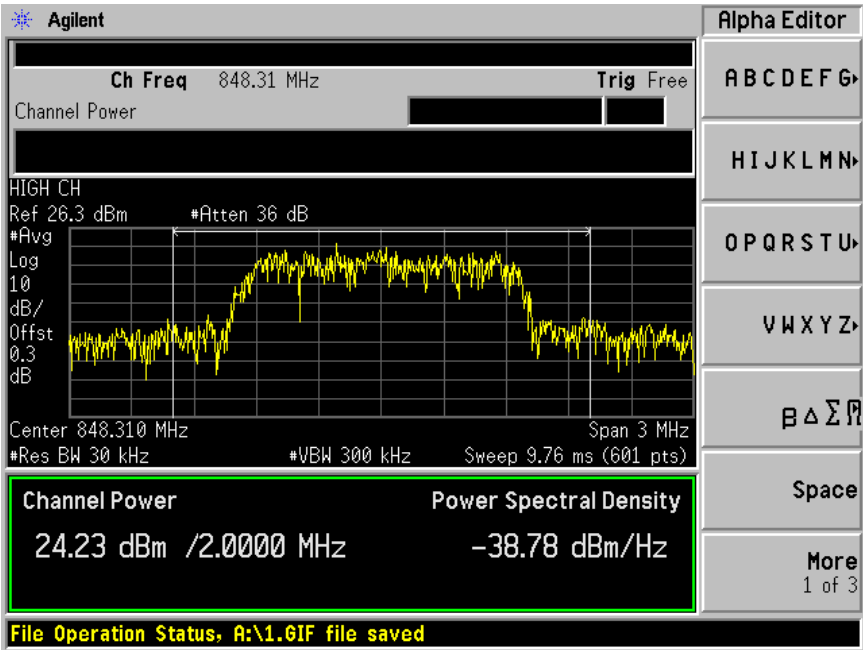
The testing was performed by Daniel Deng on 2005-08-03.

Test Results

Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit in W
LOW	824.63	24.19	0.262	7
MIDDLE	836.52	24.53	0.283	7
HIGH	848.31	24.23	0.264	7

Low Channel*Middle Channel*

High Channel



§2.1049, §22.917(d) - OCCUPIED BANDWIDTH

Applicable Standard

Requirements: CFR 47, Section 2.1049 and 22.917(d).

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 30 KHz and the 26 dB bandwidth was recorded.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10

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

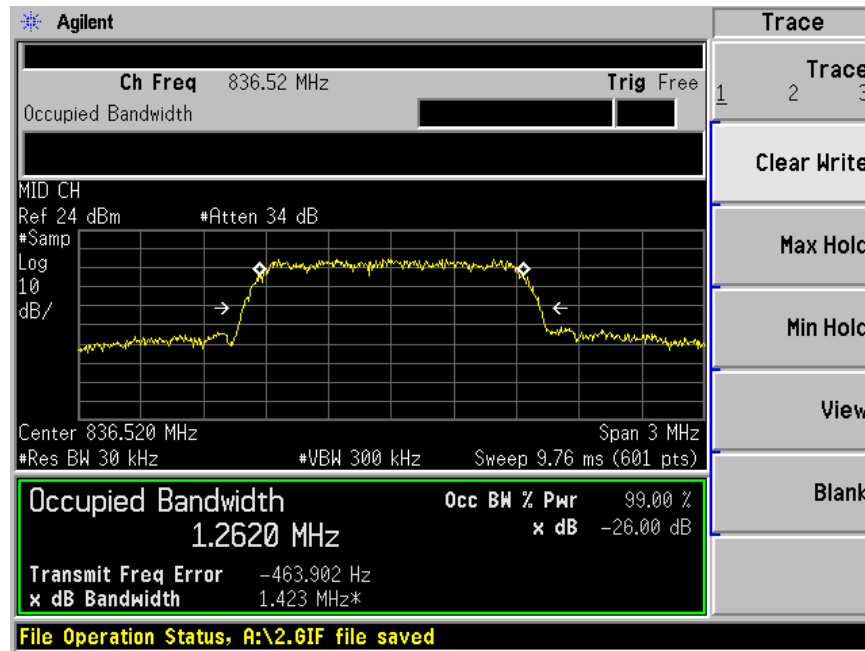
Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

The testing was performed by Daniel Deng on 2005-08-03.

Test Results

Please refer to the following plots.



§2.1051, §22.917 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

Requirements: CFR 47, § 2.1051, § 22.917.

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 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 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10

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

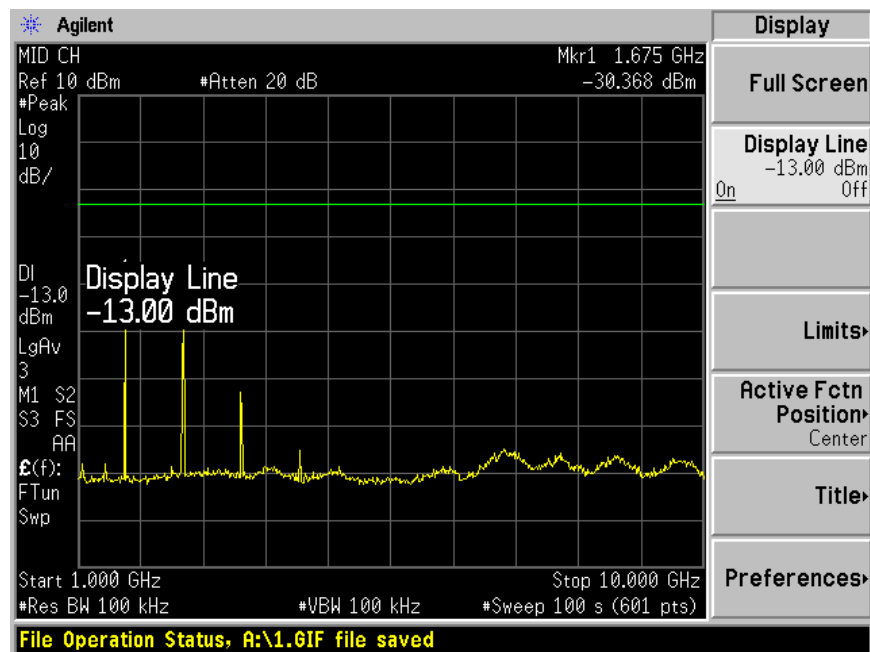
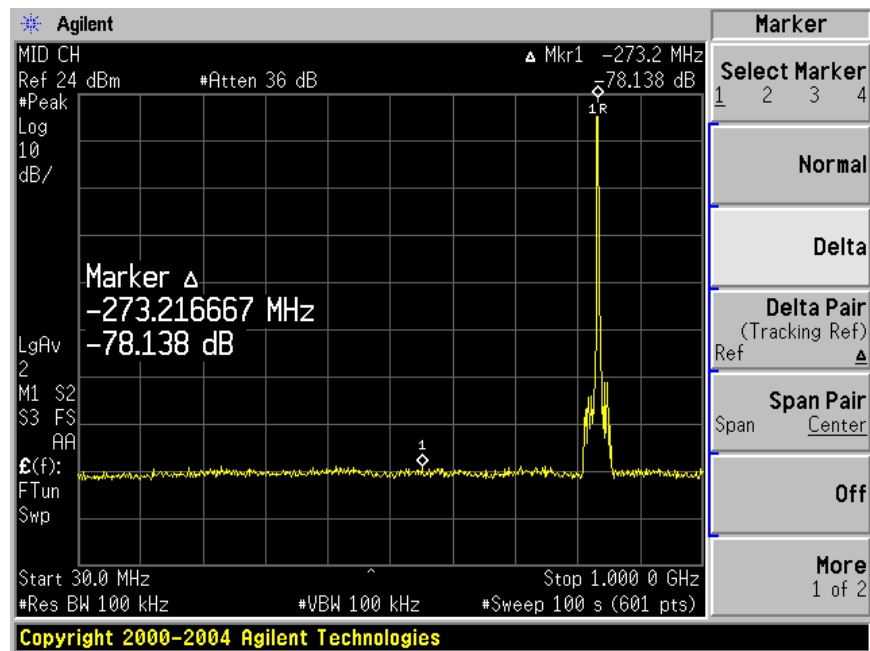
Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

The testing was performed by Daniel Deng on 2005-08-03.

Test Results

Please refer to the hereinafter plots.



§2.1055 (a), §2.1055 (d), §22.355 - FREQUENCY STABILITY

Applicable Standard

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

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1_Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Mobile Base, fixed	[SU][le]/ (ppm)	Mobile SU]3 watts [le]3 watts (ppm)
25 to 50.....	20.0	20.0	50.0
50 to 450.....	5.0	5.0	50.0
450 to 512.....	2.5	5.0	5.0
821 to 896.....	1.5	2.5	2.5
928 to 929.....	5.0	n/a	n/a
929 to 960.....	1.5	n/a	n/a
2110 to 2220.....	10.0	n/a	n/a

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 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Due Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2004-05-04
Tenney	Oven, Temperature	VersaTenn	12.222-193	2005-06-27
Agilent	Analyzer, Spectrum	E4446A	US44300386	2004-11-10

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

The testing was performed by Daniel Deng on 2005-08-03.

Test Results*Frequency Error Versus Temperature*

Condition		Ref Freq	Measured Freq	Frequency	Limit	Result
Voltage (v)	Temperature (C)	MHz	MHz	Error (PPM)	PPM	
120.00	-30.00	836.52	836.5201685	0.20	2.5	Pass
120.00	-20.00	836.52	836.5201565	0.19	2.5	
120.00	-10.00	836.52	836.5201135	0.14	2.5	
120.00	0.00	836.52	836.5201125	0.13	2.5	
120.00	10.00	836.52	836.520112	0.13	2.5	
120.00	20.00	836.52	836.5201285	0.15	2.5	
120.00	30.00	836.52	836.5201135	0.14	2.5	
120.00	40.00	836.52	836.5201265	0.15	2.5	
120.00	50.00	836.52	836.5201365	0.16	2.5	

Frequency Error Versus Voltage

Condition		Ref Freq	Measured Freq	Frequency	Limit	Result
Voltage (v)	Temperature (C)	MHz	MHz	Error(PPM)	PPM	
102.00	20.00	836.52	836.5201265	0.15	2.5	Pass
138.00	20.00	836.52	836.5201215	0.15	2.5	

§22.917 – BAND EDGE

Applicable Standard

According to § 22.917, 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
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	43%
ATM Pressure:	1018 mbar

The testing was performed by Daniel Deng on 2005-08-03.

Test Results

Please refer to the following plots.

