



FCC PART 24 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

WACAL INC.

10501 Valley Blvd., Suite 1860
El Monte, CA 91731

FCC ID: P3CSIM100

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: PCS GPRS Modular
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Report No.: R0511298	
Report Date: 2006-01-06	
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TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	6
JUSTIFICATION	6
BLOCK DIAGRAM.....	6
EQUIPMENT MODIFICATIONS	6
HOST PC POWER SUPPLY AND LINE FILTERS	6
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	6
INTERFACE PORTS AND CABLING.....	6
CONFIGURATION OF TEST SYSTEM	7
TEST SETUP BLOCK DIAGRAM	7
SUMMARY OF TEST RESULTS	8
§2.1046 & §24.232 - RF POWER OUTPUT.....	9
APPLICABLE STANDARD	9
TEST PROCEDURE	9
TEST EQUIPMENT LIST AND DETAILS.....	9
ENVIRONMENTAL CONDITIONS	9
TEST RESULTS	10
§2.1049 & §24.238 - EMISSION BANDWIDTH	12
APPLICABLE STANDARDS.....	12
TEST PROCEDURE	12
TEST EQUIPMENT LIST AND DETAILS.....	12
ENVIRONMENTAL CONDITIONS	12
TEST RESULTS	12
§2.1051 & §24.238(A) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....	15
APPLICABLE STANDARDS.....	15
TEST PROCEDURE	15
TEST EQUIPMENT LIST AND DETAILS.....	15
ENVIRONMENTAL CONDITIONS	15
TEST RESULTS :	15
§2.1053 - SPURIOUS RADIATED EMISSION.....	18
APPLICABLE STANDARDS.....	18
TEST PROCEDURE	18
TEST EQUIPMENT LIST AND DETAILS.....	18
ENVIRONMENTAL CONDITIONS	19
TEST RESULT	19
§24.238 – BAND EDGE.....	20
APPLICABLE STANDARDS.....	20
TEST PROCEDURE	20
TEST EQUIPMENT LIST AND DETAILS.....	20
ENVIRONMENTAL CONDITIONS	20
TEST RESULTS	20
§2.1047 – MODULATION CHARACTERISTICS	22
APPLICABLE STANDARD	22
TEST PROCEDURE	22
TEST EQUIPMENT LIST AND DETAILS.....	22

ENVIRONMENTAL CONDITIONS	22
TEST RESULTS	22
§2.1055(A), §2.1055(D) & §24.235 - FREQUENCY STABILITY	24
APPLICABLE STANDARD	24
TEST PROCEDURE	24
TEST EQUIPMENT LIST AND DETAILS.....	24
ENVIRONMENTAL CONDITIONS	24

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The WACAL INC. product, FCC ID: P3CSIM100 or the "EUT" as referred to in this report is a PCS GPRS Modular. The EUT measures approximately 53.0 mmL x 33.0mmW x 3.0 mmH.

** The test data gathered are from production sample, serial number: S00176, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of WACAL INC. 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, spurious radiated emission, 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: ANSI 63.4-2003, and TIA/EIA-603-C

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters, except as noted below.

Test Facility

The Open Area Test site used by BACL 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 with registration number: 90464.

Test site at BACL 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-C.

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.

Host PC Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number	FCC ID
Wacal Inc	Support device	N/A	N/A	DOC

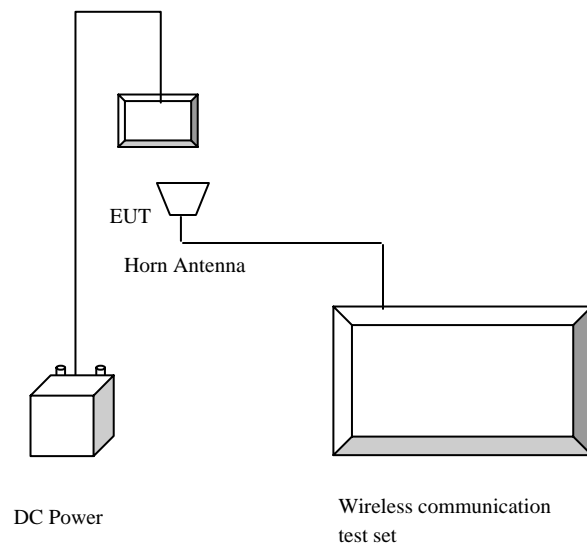
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Agilent	Wireless communication test set	8960	GB 44051221	DOC
BK Precision	DC Power supply	1740	26502000233	N/A

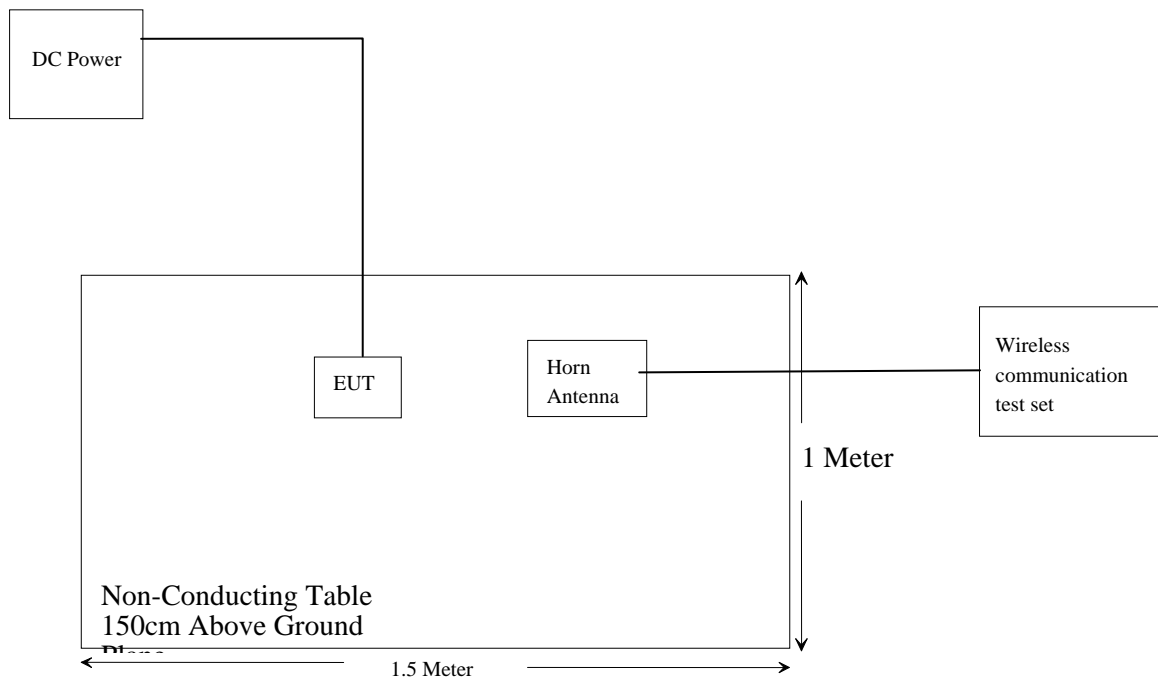
Interface Ports and Cabling

Cable Description	Length (M)	Port/From	To
Power cable	0.4	Support device	DC Power supply

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number: S00176.

FCC RULE	DESCRIPTION OF TEST	Result
§2.1046 § 24.232	RF power output	Compliant
§ 2.1049 § 24.238(b)	Emission Bandwidth	Compliant
2.1051 § 24.238(a)	Spurious emissions at antenna terminals	Compliant
2.1053	Spurious Radiated Emissions	Compliant
§24.238	Band Edge	Compliant
§ 2.1047	Modulation Characteristics	Compliant
§ 2.1055 § 24.235	Frequency stability	Compliant

§2.1046 & §24.232 - RF POWER OUTPUT

Applicable Standard

According to FCC §2.1046 and §24.232 (b), mobile stations are limited to 2 watts eirp peak power.

Test Procedure

The antenna was removed and SMA connector was connected to the transmitter output. The transmitter output was connected to a calibrated coaxial attenuator (50 Ohm), the other end of which was connected to a power meter. Transmitter output was read off the power meter in dBm. The power output at the transmitter was determined by adding the value of the attenuator to the power meter reading.

The test was performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the transmitter.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2004-11-10

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

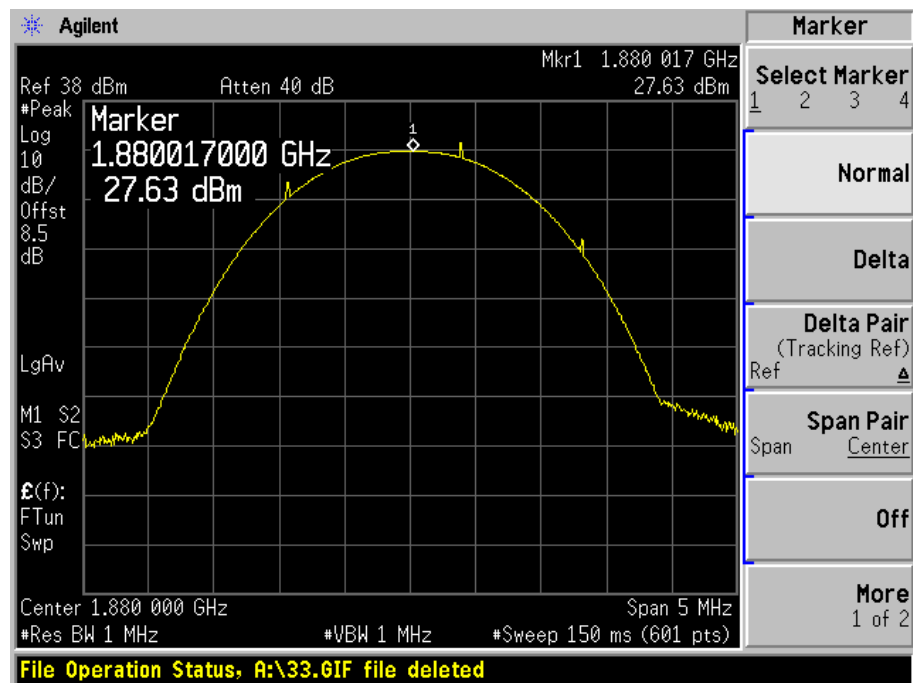
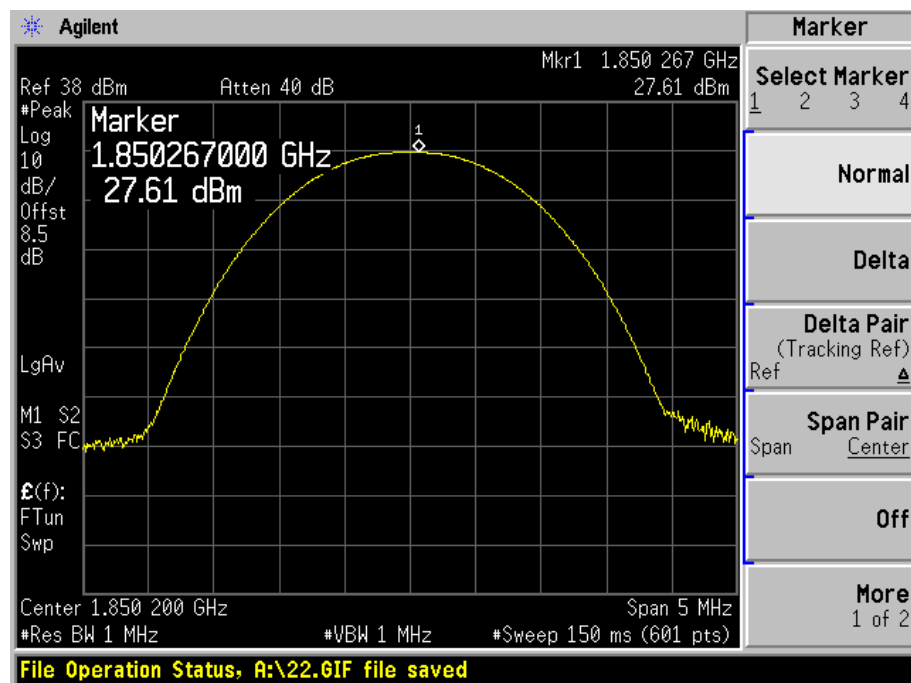
Environmental Conditions

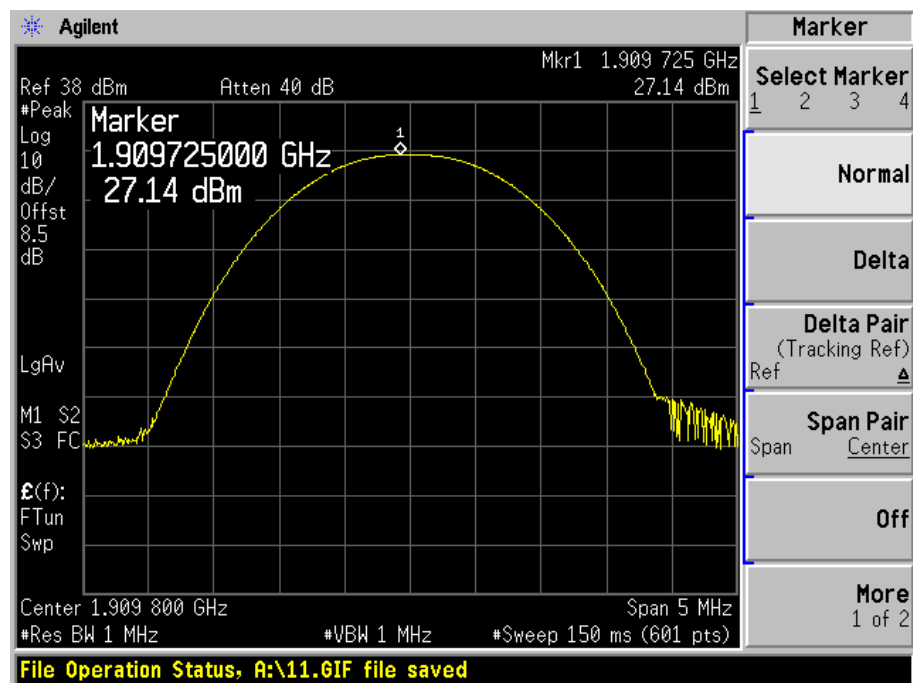
Temperature:	18° C
Relative Humidity:	65%
ATM Pressure:	1018 mbar

* *The testing was performed by Daniel Deng on 2005-12-27.*

Channel	Frequency (MHZ)	Conducted Power (dBm)	EIRP (dBm)
Low CH	1850.2	27.61	27.61
Mid CH	1880	27.63	27.63
High Ch	1909.8	27.14	27.14

Note : The antenna gain = 0 dBi , Please refer to the plots :

Test Results



§2.1049 & §24.238 - EMISSION BANDWIDTH

Applicable Standards

According to FCC §2.1049 and §24.238 (b), the emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

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 spectrum was recorded.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

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

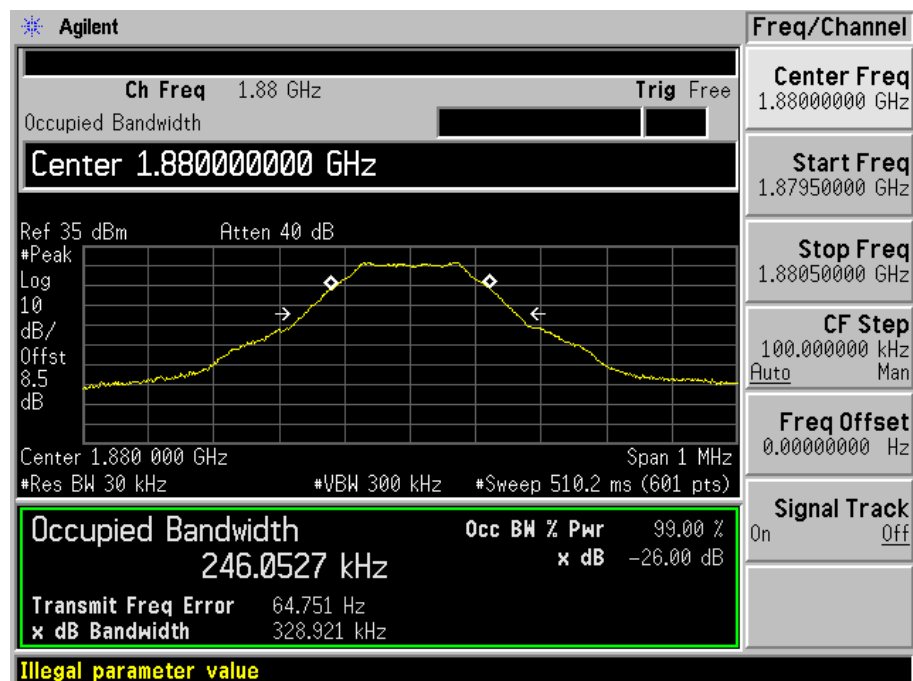
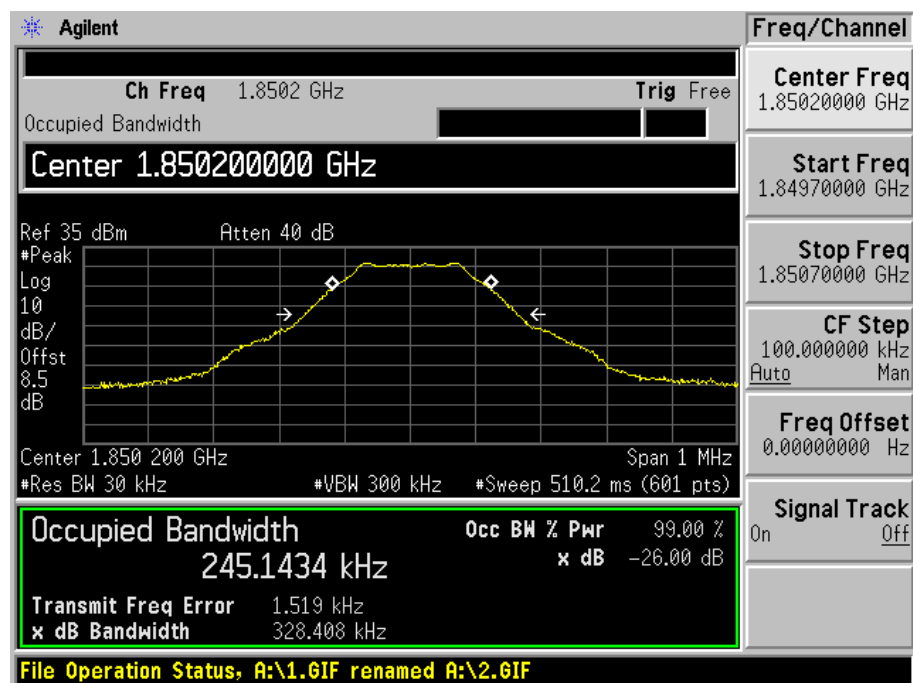
Environmental Conditions

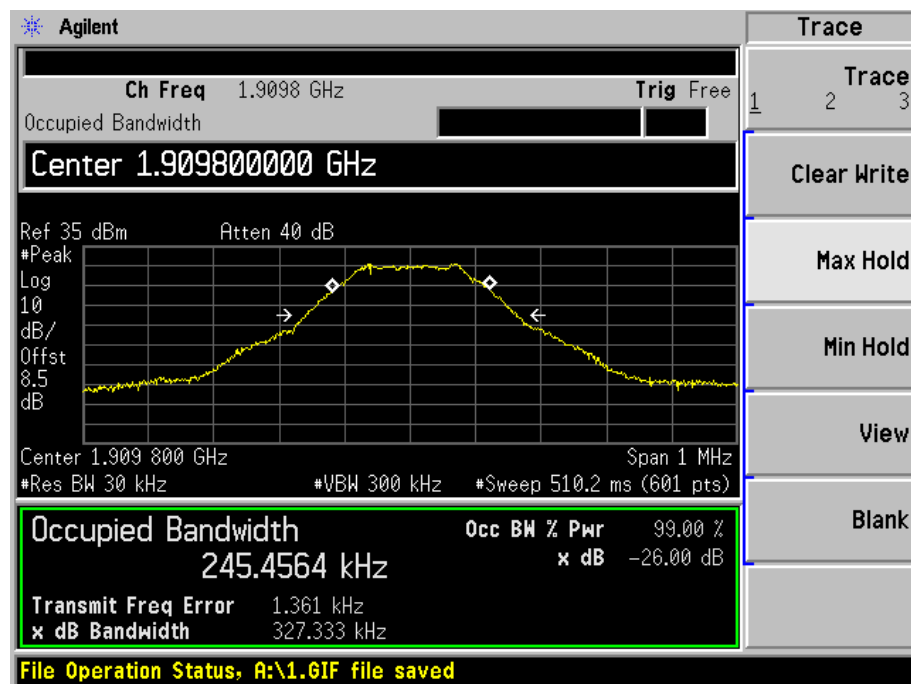
Temperature:	18° C
Relative Humidity:	65%
ATM Pressure:	1018mbar

* The testing was performed by Daniel Deng on 2005-12-27.

Test Results

Channel	Channel frequency (MHz)	99% Power Bandwidth (MHz)	26 dB Bandwidth (MHz)
Low	1850.2	0.245	0.328
Middle	1880	0.246	0.329
High	1909.8	0.245	0.327





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

Applicable Standards

According to FCC §2.1049 and §24.238, on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

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 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

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

Environmental Conditions

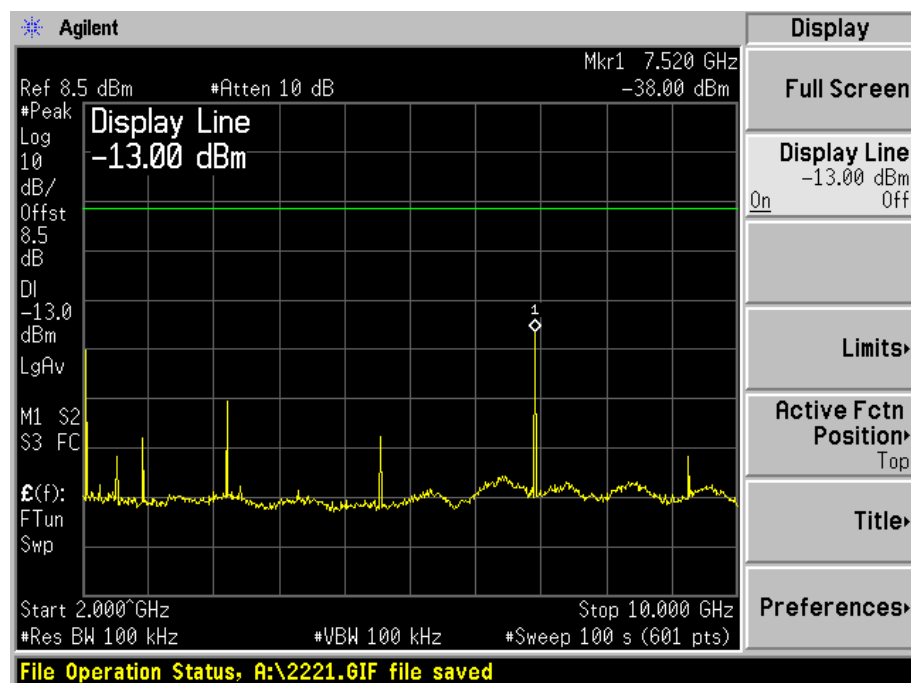
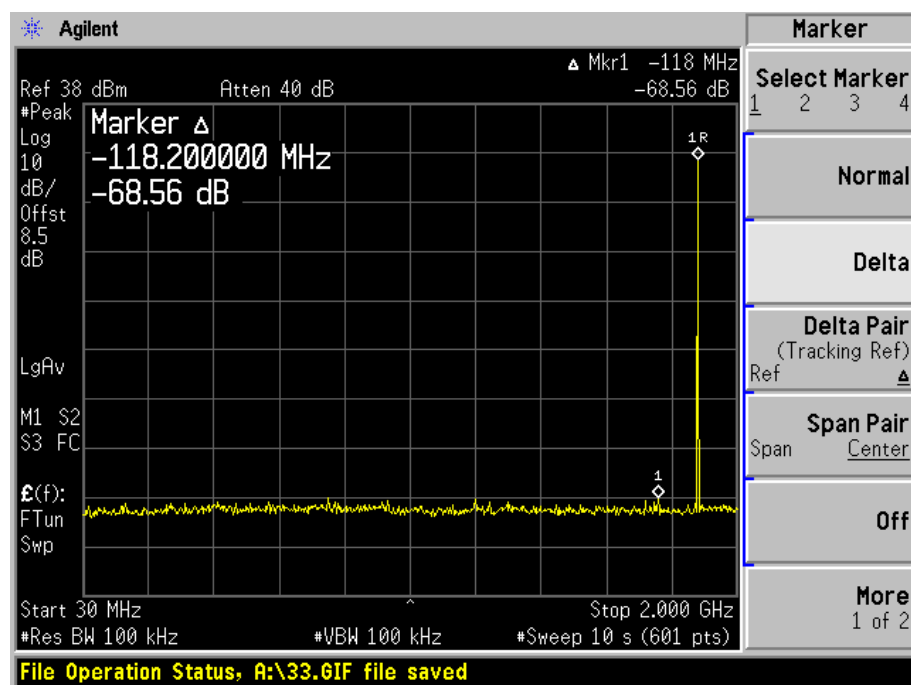
Temperature:	18° C
Relative Humidity:	68%
ATM Pressure:	1018mbar

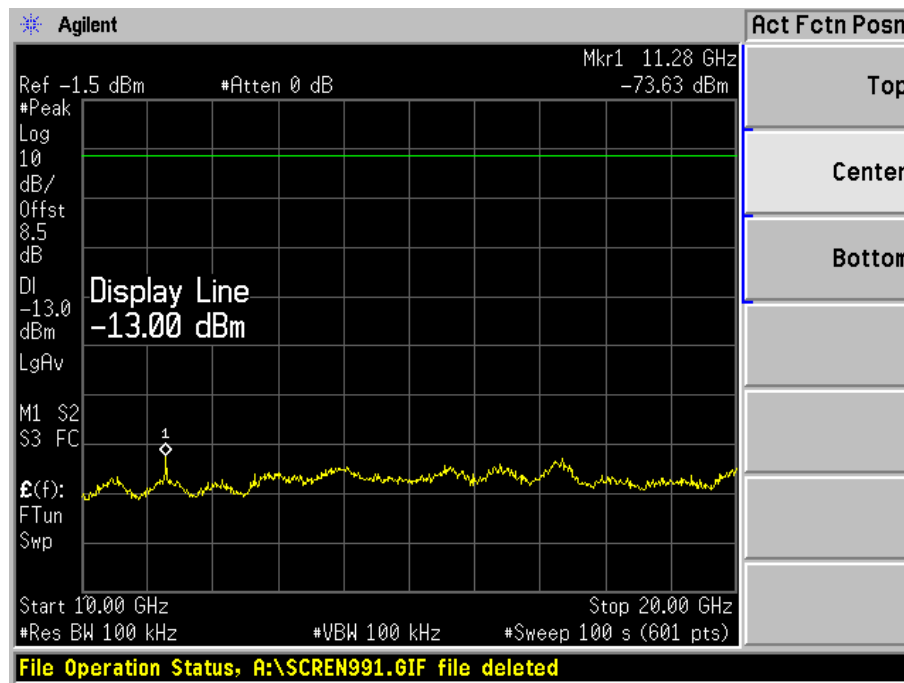
* *The testing was performed by Daniel Deng on 2005-12-27.*

Test Results :

Pass , Please refer to the hereinafter plots.

Spurious emissions at antenna port (Mid Channel)





§2.1053 - SPURIOUS RADIATED EMISSION

Applicable Standards

Requirements: CFR 47, § 2.1053, and § 24.238 (a).

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
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
ETS	Antenna, Log-Periodic	3148	4-1155	2005-12-14
ETS	Antenna, Biconical	3110B	9603-2315	2005-12-14
HP	Amplifier, Pre	8447D	2944A10198	2005-8-17
HP	Amplifier, Pre, Microwave	8449B	3147A00400	2005-8-10
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2005-5-2
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2005-4-20
HP	Generator, Signal	83650B	3614A00276	2005-5-10
A.R.A.	Antenna, Horn	DRG-118/A	1132	2005-8-17
Wainwright	Filter, Band Reject	WRCG823/850-813/860-40/8SS	2	2005-8-11
Wainwright	Filter, Band Reject	WRCG1850/1910-1835/1925-40/8SS	5	2005-8-11

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

Environmental Conditions

Temperature:	19° C
Relative Humidity:	69%
ATM Pressure:	1021mbar

* The testing was performed by Daniel Deng on 2005-12-28.

Test Result

-26.8 dB at 7520.65MHz

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Correction	Loss dB	Level dBm	dBm	dB
7520.65	54.85	0	1.5	v	7520.65	-47.1	11.1	3.8	-39.8	-13	-26.8
3760.55	43.5	30	1.6	v	3760.55	-53.1	10.7	2.3	-44.7	-13	-31.7
7520.65	49.65	0	1.6	h	7520.65	-52.4	11.1	3.8	-45.1	-13	-32.1
3760.55	39.8	330	1.5	h	3760.55	-57.6	10.7	2.3	-49.2	-13	-36.2
5640.5	35.2	30	1.6	v	5640.5	-59.8	11.2	3.1	-51.7	-13	-38.7
5640.5	32.3	0	1.6	h	5640.5	-62.5	11.2	3.1	-54.4	-13	-41.4
2775.68	33.6	30	1.6	v	2775.68	-63.5	10.5	1.6	-54.6	-13	-41.6
2775.68	32.2	0	1.6	h	2775.68	-64.7	10.5	1.6	-55.8	-13	-42.8

§24.238 – BAND EDGE

Applicable Standards

According to FCC §2.1049 and §24.238, when measuring the emission limits, carrier frequency shall be adjusted as close to the frequency block edges, both upper and lower.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. Adjust the carrier frequency as close to the frequency block edges both upper and lower. Sufficient scans were taken to show any out of band-edge emission.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

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

Environmental Conditions

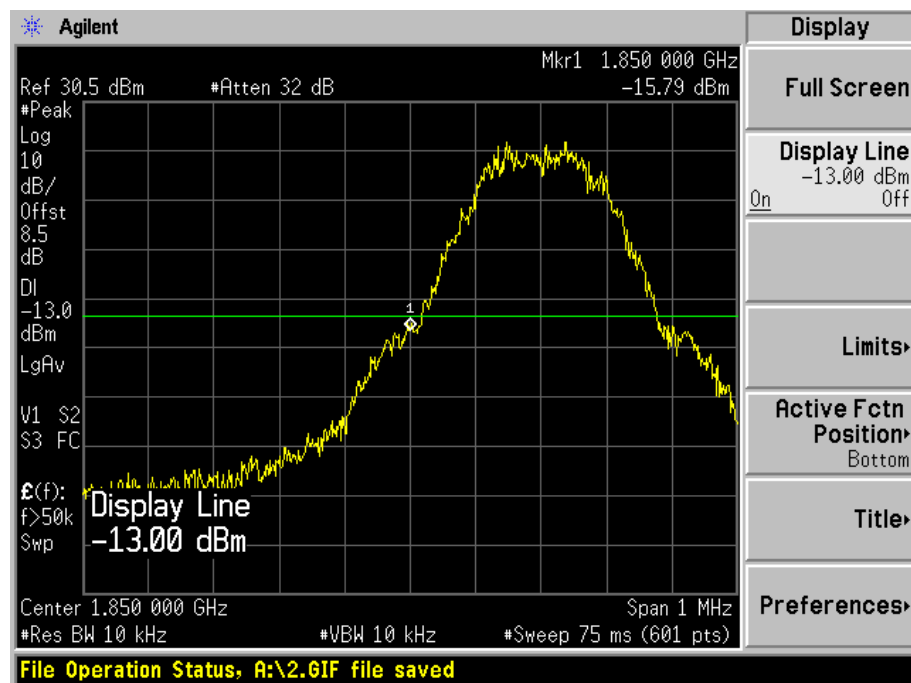
Temperature:	18° C
Relative Humidity:	65%
ATM Pressure:	1018 mbar

* *The testing was performed by Daniel Deng on 2005-12-27.*

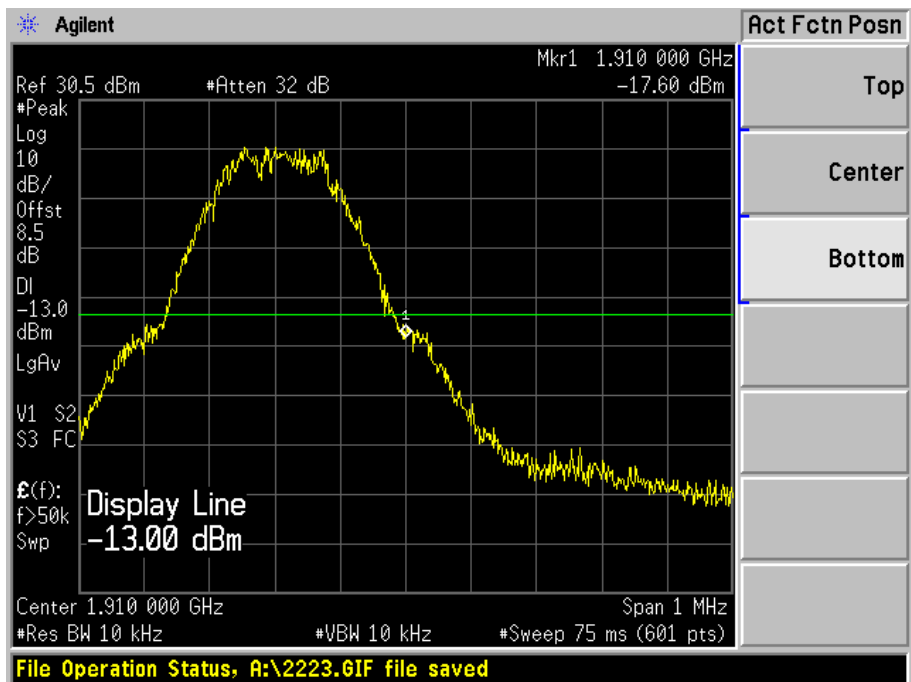
Test Results

Please refer to plots hereinafter.

Lowest Channel :



Highest Channel :



§2.1047 – Modulation Characteristics

Applicable Standard

Requirement: §2.1047.

Test Procedure

GPRS digital mode is used by EUT.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10

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

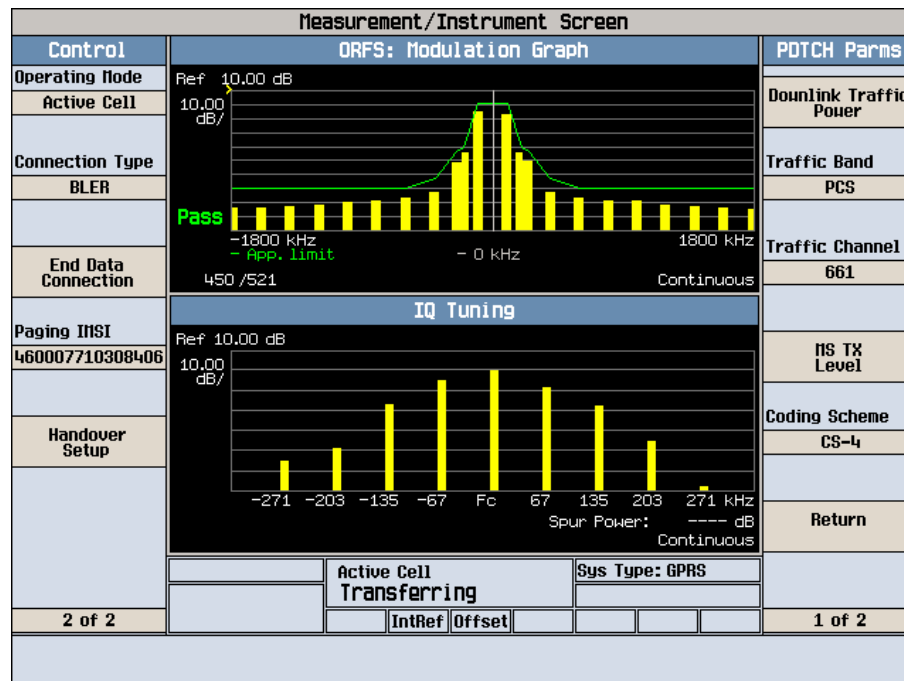
Environmental Conditions

Temperature:	18° C
Relative Humidity:	65%
ATM Pressure:	1018 mbar

* *The testing was performed by Daniel Deng on 2005-12-27.*

Test Results

Please refer to plots hereinafter.



§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 f Spectrum Analyzer 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 Spectrum Analyzer.

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Communications	E5515C	GB44051221	2005-8-8
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
Tenney	Oven, Temperature	VersaTenn	12.222-193	2005-6-4

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

Environmental Conditions

Temperature:	18° C
Relative Humidity:	65%
ATM Pressure:	1018 mbar

* *The testing was performed by Daniel Deng on 2005-12-27.*

Frequency Stability Versus Temperature

Reference Frequency: 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency error (HZ)	PPM Error
50	12	33.5	0.018
40	12	30.5	0.016
30	12	25.9	0.014
20	12	23.5	0.013
10	12	20.6	0.011
0	12	22.5	0.012
-10	12	21.6	0.011
-20	12	26.6	0.014
-30	12	35.2	0.019

Frequency Stability Versus Voltage

Reference Frequency: 1880 MHz, Limit: 2.5ppm			
Power Supplied (VDC)	Environment Temperature (°C)	Frequency error (HZ)	PPM Error
10.8	20	25.5	0.014