

FCC PART 24 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

UTStarcom Telecom Co., Ltd

Yile Industrial Park 129 Wen Yi Road, Hangzhou City, Zhejiang Province, P. R. China

FCC ID: O6YUTS-ACS-40

2004-2-26

This Report Concerns: ☒ Original Report	Equipment Type: Wireless Local Loop
Test Engineer: Jandy Su	
Report No.: RSZ03122901	
Test Date: 2004-02-07	
Reviewed By: Ling Zhang	
Prepared By: Bay Area Compliance Lab Corp. ShenZhen Suite C, 41-D Electronics Science & Technology Building, No. 2070 Shennanzhong Rd ShenZhen, Guandong 518031, P.R. China Tel: (755) 83296449 Fax: (755) 83273756	

Note: This test report is specially limited to the above client 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 endorsement by NVLAP or any agency of the U.S. Government.

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	5
SYSTEM TEST CONFIGURATION.....	6
JUSTIFICATION	6
BLOCK DIAGRAM.....	6
EQUIPMENT MODIFICATIONS	6
TEST SETUP BLOCK DIAGRAM	6
SUMMARY OF TEST RESULTS	7
§2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION	8
APPLICABLE STANDARD	8
TEST PROCEDURE	8
TEST EQUIPMENT LIST AND DETAILS.....	8
ENVIRONMENTAL CONDITIONS	8
TEST RESULT	9
§2.1046 & §24.232 - RF POWER OUTPUT.....	12
APPLICABLE STANDARD	12
TEST PROCEDURE	12
TEST EQUIPMENT LIST AND DETAILS.....	13
ENVIRONMENTAL CONDITIONS	13
TEST RESULTS	13
§2.1046, §22.913(A), & §24.232 – CONDUCTED OUTPUT POWER	15
APPLICABLE STANDARD	15
TEST PROCEDURE	15
TEST EQUIPMENT LIST AND DETAILS.....	15
ENVIRONMENTAL CONDITIONS	15
TEST RESULTS	15
§2.1049 & §24.238 - OCCUPIED BANDWIDTH.....	16
APPLICABLE STANDARD	16
TEST PROCEDURE	16
TEST EQUIPMENT LIST AND DETAILS.....	16
ENVIRONMENTAL CONDITIONS	16
TEST RESULTS	16
§2.1051 & §24.238(A) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....	20
APPLICABLE STANDARD	20
TEST PROCEDURE	20
TEST EQUIPMENT LIST AND DETAILS.....	20
ENVIRONMENTAL CONDITIONS	20
TEST RESULTS	20
§2.1055 (A), §2.1055 (D) & §24.235 - FREQUENCY STABILITY	26
APPLICABLE STANDARD	26
TEST PROCEDURE	26
TEST EQUIPMENT LIST AND DETAILS.....	26
ENVIRONMENTAL CONDITIONS	26
TEST RESULTS	27
§24.238 – BAND EDGE.....	29
APPLICABLE STANDARD	29

TEST PROCEDURE	29
TEST EQUIPMENT LIST AND DETAILS	29
ENVIRONMENTAL CONDITIONS	29
TEST RESULTS	29
§15.109 - RADIATED EMISSIONS.....	31
MEASUREMENT UNCERTAINTY	31
EUT SETUP.....	31
SPECTRUM ANALYZER SETUP	31
TEST EQUIPMENT LIST AND DETAILS	32
TEST PROCEDURE	32
CORRECTED AMPLITUDE & MARGIN CALCULATION	32
RADIATED EMISSIONS TEST DATA.....	33
TEST RESULT	34

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *UTStarcom Telecom Co., Ltd's* product, model: *ACS40* or the "EUT" as referred to in this report is a Wireless Local Loop, which measures approximately 26.0cm L x 21.0cm W x 8.0cm H, rated input voltage: DC 72V.

Cable:

Cable Description	Length (M)	From/Port	To
Short Antenna	0.15	Antenna	EUT
Middle Antenna	0.30	Antenna	EUT
Long Antenna	0.50	Antenna	EUT

** The test data gathered are from typical production sample, serial number: 120169, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *UTStarcom Telecom Co., Ltd* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 24 Subpart E of the Federal Communication Commissions rules.

It is also prepared in accordance with Part 2, Subpart J, Part 15, Subparts A and B, and Part 24 Subpart E of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for output power, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, 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 15 Subpart B – Unintentional Radiators

Part 24 Subpart E - PCS

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, ANSI 63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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 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 C63.4-2001.

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 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.

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.

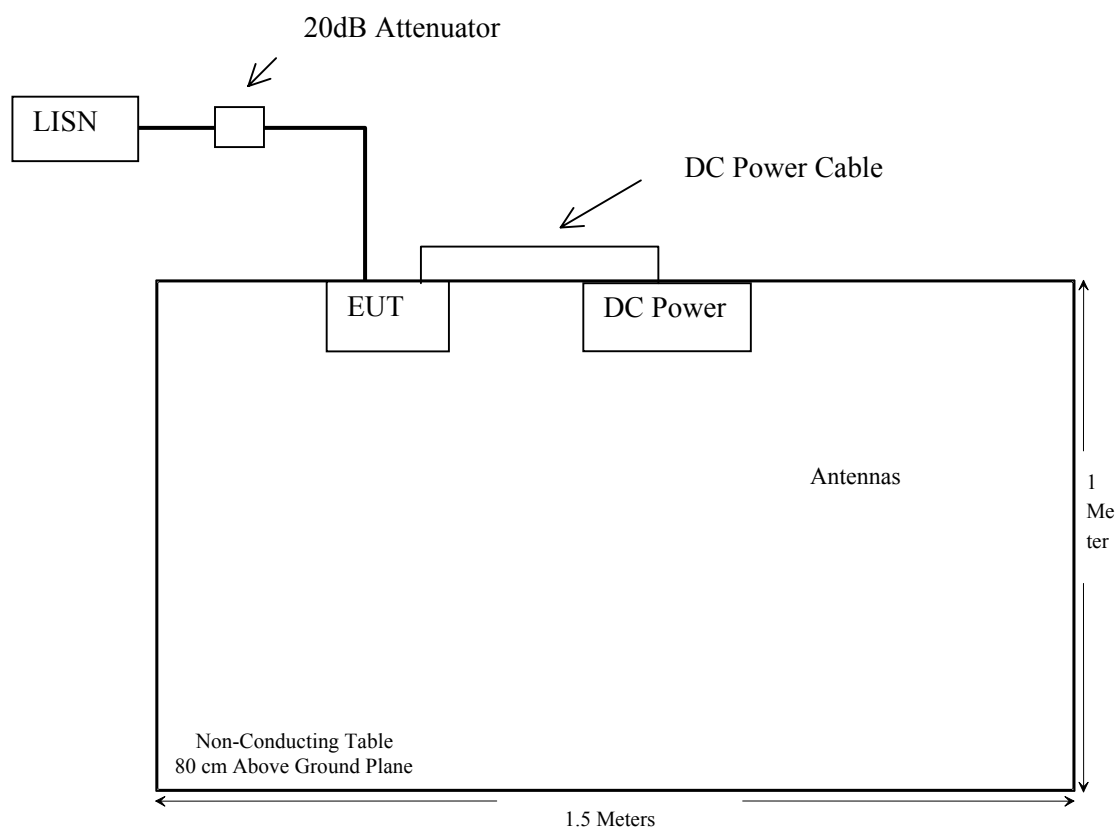
Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1053	Field Strength of Spurious Radiation	Pass
§ 2.1046, § 24.232	RF Output Power	Pass
§ 2.1049 § 24.238	Occupied Bandwidth	Pass
§ 2.1051, § 24.238(a)	Spurious Emissions at Antenna Terminals	Pass
§ 2.1055 (a) § 2.1055 (d) § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Pass
§24.238	Band Edge	Pass

§2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
ETS	Log Periodic Antenna	3146	9603-4421	2003-8-5	2004-8-4
ETS	Biconical Antenna	3110B	3360	2003-8-5	2004-8-4
FLUKE	True RMS Multimeter	187	78540402	2003-3-24	2004-3-23
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2003-11-5	2003-11-4
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	2003-9-30	2003-9-29
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	2003-8-1	2004-7-31

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Result

Sort antenna Mode

Low Frequency: -28.95 dB at 7520.36 MHz

Middle Frequency: -21.39 dB at 5685.45 MHz

High Frequency: -21.39 dB at 5728.27 MHz

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	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1880.11	96.82	0	1.0	V	1880.11	23.27	V	6.0	0.6	29.87		
1880.11	93.64	60	1.0	H	1880.11	22.49	H	6.0	0.6	29.09		
7520.36	40.22	120	1.4	V	7520.36	-53.35	V	10.2	1.2	-41.95	-13	-28.95
7520.36	39.24	180	1.4	H	7520.36	-51.25	H	10.2	1.2	-39.85	-13	-26.85
3760.24	44.26	90	1.2	V	3760.24	-47.58	V	8.4	0.8	-38.38	-13	-25.38
3760.24	44.37	180	1.2	H	3760.24	-47.36	H	8.4	0.8	-38.16	-13	-25.16
5640.30	39.98	90	1.0	H	5640.30	-48.16	H	9.8	1.0	-37.36	-13	-24.36
5640.30	40.21	0	1.0	V	5640.30	-45.19	V	9.8	1.0	-34.39	-13	-21.39
Middle channel												
1895.15	95.28	0	1.0	V	1895.15	23.41	V	6.0	0.6	30.01		
1895.15	94.36	60	1.0	H	1895.15	22.13	H	6.0	0.6	28.73		
5685.45	41.22	0	1.0	V	5685.45	-45.19	V	9.8	1.0	-34.39	-13	-21.39
3790.30	43.68	90	1.2	V	3790.30	-45.48	V	8.4	0.8	-36.28	-13	-23.28
5685.45	39.68	90	1.0	H	5685.45	-47.48	H	9.8	1.0	-36.68	-13	-23.68
3790.30	44.32	180	1.2	H	3790.30	-46.33	H	8.4	0.8	-37.13	-13	-24.13
7580.60	39.55	180	1.4	H	7580.60	-51.67	H	10.2	1.2	-40.27	-13	-27.27
7580.60	40.54	120	1.4	V	7580.60	-52.52	V	10.2	1.2	-41.12	-13	-28.12
High channel												
1909.43	98.2	0	1.0	V	1909.43	21.82	V	6.0	0.6	28.42		
1909.43	92.0	60	1.0	H	1909.43	20.38	H	6.0	0.6	26.98		
5728.27	41.82	0	1.0	V	5728.27	-45.19	V	9.8	1.0	-34.39	-13	-21.39
5728.27	41.46	90	1.0	H	5728.27	-46.27	H	9.8	1.0	-35.47	-13	-22.47
3818.86	44.7	90	1.2	V	3818.86	-48.03	V	8.4	0.8	-38.83	-13	-25.83
3818.86	44.1	180	1.2	H	3818.86	-48.24	H	8.4	0.8	-39.04	-13	-26.04
7637.70	40.48	120	1.4	V	7637.70	-51.28	V	10.2	1.2	-39.88	-13	-26.88
7637.70	39.86	180	1.4	H	7637.70	-52.34	H	10.2	1.2	-40.94	-13	-27.94

Middle antenna Mode

Low Frequency: -21.3 dB at 5640.31 MHz

Middle Frequency: -21.4 dB at 5685.44 MHz

High Frequency: -22.3 dB at 5728.24 MHz

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	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1880.12	97.54	0	1.0	V	1880.12	24.23	V	6.0	0.6	30.8		
1880.12	92.97	60	1.0	H	1880.12	23.47	H	6.0	0.6	30.1		
5640.31	40.35	0	1.0	V	5640.31	-45.12	V	9.8	1.0	-34.3	-13	-21.3
5640.31	39.61	90	1.0	H	5640.31	-47.47	H	9.8	1.0	-36.7	-13	-23.7
3760.23	45.35	90	1.2	V	3760.23	-46.58	V	8.4	0.8	-37.4	-13	-24.4
3760.23	44.32	180	1.2	H	3760.23	-47.31	H	8.4	0.8	-38.1	-13	-25.1
7520.34	41.73	180	1.4	H	7520.34	-51.64	H	10.2	1.2	-40.2	-13	-27.2
7520.34	42.25	120	1.4	V	7520.34	-52.78	V	10.2	1.2	-41.4	-13	-28.4
Middle channel												
1895.17	96.31	0	1.0	V	1895.17	23.48	V	6.0	0.6	30.1		
1895.17	94.32	60	1.0	H	1895.17	23.22	H	6.0	0.6	29.8		
5685.44	40.25	0	1.0	V	5685.44	-45.16	V	9.8	1.0	-34.4	-13	-21.4
5685.44	39.64	90	1.0	H	5685.44	-45.39	H	9.8	1.0	-34.6	-13	-21.6
3790.29	44.58	90	1.2	V	3790.29	-44.28	V	8.4	0.8	-35.1	-13	-22.1
3790.29	44.12	180	1.2	H	3790.29	-46.57	H	8.4	0.8	-37.4	-13	-24.4
7580.63	41.27	120	1.4	V	7580.63	-52.74	V	10.2	1.2	-41.3	-13	-28.3
7580.63	39.51	180	1.4	H	7580.63	-52.77	H	10.2	1.2	-41.4	-13	-28.4
High channel												
1909.40	99.21	0	1.0	V	1909.40	22.54	V	6.0	0.6	29.1		
1909.40	96.31	60	1.0	H	1909.40	21.36	H	6.0	0.6	28.0		
5728.24	41.44	90	1.0	H	5728.24	-46.14	H	9.8	1.0	-35.3	-13	-22.3
5728.24	41.35	0	1.0	V	5728.24	-46.58	V	9.8	1.0	-35.8	-13	-22.8
3818.88	44.18	180	1.2	H	3818.88	-48.13	H	8.4	0.8	-38.9	-13	-25.9
7637.72	40.21	120	1.4	V	7637.72	-50.37	V	10.2	1.2	-39.0	-13	-26.0
3818.88	45.04	90	1.2	V	3818.88	-48.74	V	8.4	0.8	-39.5	-13	-26.5
7637.72	38.69	180	1.4	H	7637.72	-52.14	H	10.2	1.2	-40.7	-13	-27.7

Long antenna Mode

Low Frequency: -21.8 dB at 5640.37 MHz

Middle Frequency: -21.1 dB at 5685.40 MHz

High Frequency: -18.1 dB at 3818.87 MHz

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	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1880.14	97.55	0	1.0	V	1880.14	24.88	V	6.0	0.6	31.5		
1880.14	93.42	60	1.0	H	1880.14	22.35	H	6.0	0.6	29.0		
5640.37	40.14	0	1.0	V	5640.37	-45.56	V	9.8	1.0	-34.8	-13	-21.8
3760.26	45.38	90	1.2	V	3760.26	-45.19	V	8.4	0.8	-36.0	-13	-23.0
5640.37	38.63	90	1.0	H	5640.37	-47.24	H	9.8	1.0	-36.4	-13	-23.4
3760.26	44.72	180	1.2	H	3760.26	-46.24	H	8.4	0.8	-37.0	-13	-24.0
7520.40	42.22	120	1.4	V	7520.40	-51.02	V	10.2	1.2	-39.6	-13	-26.6
7520.40	41.64	180	1.4	H	7520.40	-52.07	H	10.2	1.2	-40.7	-13	-27.7
Middle channel												
1895.15	96.31	0	1.0	V	1895.15	24.33	V	6.0	0.6	30.9		
1895.15	94.32	60	1.0	H	1895.15	21.82	H	6.0	0.6	28.4		
5685.40	39.64	90	1.0	H	5685.40	-44.85	H	9.8	1.0	-34.1	-13	-21.1
3790.28	44.58	90	1.2	V	3790.28	-43.63	V	8.4	0.8	-34.4	-13	-21.4
3790.28	44.12	180	1.2	H	3790.28	-44.19	H	8.4	0.8	-35.0	-13	-22.0
5685.40	40.25	0	1.0	V	5685.40	-46.25	V	9.8	1.0	-35.5	-13	-22.5
7580.64	41.27	120	1.4	V	7580.64	-52.73	V	10.2	1.2	-41.3	-13	-28.3
7580.64	39.51	180	1.4	H	7580.64	-52.71	H	10.2	1.2	-41.3	-13	-28.3
High channel												
1909.45	98.2	0	1.0	V	1909.45	22.46	V	6.0	0.6	31.8		
1909.45	92.0	60	1.0	H	1909.45	21.39	H	6.0	0.6	31.3		
3818.87	44.7	90	1.2	V	3818.87	-47.44	V	8.4	0.8	-31.1	-13	-18.1
5728.28	41.82	0	1.0	V	5728.28	-45.73	V	9.8	1.0	-33.0	-13	-20.0
3818.87	44.1	180	1.2	H	3818.87	-48.38	H	8.4	0.8	-33.4	-13	-20.4
5728.28	41.46	90	1.0	H	5728.28	-45.43	H	9.8	1.0	-33.8	-13	-20.8
7637.72	39.86	180	1.4	H	7637.72	-51.64	H	10.2	1.2	-39.0	-13	-26.0
7637.72	40.48	120	1.4	V	7637.72	-50.28	V	10.2	1.2	-41.8	-13	-28.8

§2.1046 & §24.232 - RF POWER OUTPUT

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	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results

Sort antenna Mode

Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dB	Level dBm
1880.11	23.27	V	6.0	0.6	29.87
1880.11	22.49	H	6.0	0.6	29.09
1895.15	23.41	V	6.0	0.6	30.01
1895.15	22.13	H	6.0	0.6	28.73
1909.43	21.82	V	6.0	0.6	28.42
1909.43	20.38	H	6.0	0.6	26.98

Middle antenna Mode

Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dB	Level dBm
1880.12	24.23	V	6.0	0.6	30.8
1880.12	23.47	H	6.0	0.6	30.1
1895.17	23.48	V	6.0	0.6	30.1
1895.17	23.22	H	6.0	0.6	29.8
1909.40	22.54	V	6.0	0.6	29.1
1909.40	21.36	H	6.0	0.6	28.0

Long antenna Mode

Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dB	Level dBm
1880.14	24.88	V	6.0	0.6	31.5
1880.14	22.35	H	6.0	0.6	29.0
1895.15	24.33	V	6.0	0.6	30.9
1895.15	21.82	H	6.0	0.6	28.4
1909.45	22.46	V	6.0	0.6	31.8
1909.45	21.39	H	6.0	0.6	31.3

§2.1046 & §24.232 – CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §2.1046 and §24.232 (a), in no case may the peak output power of a base station transmitter exceed 100 watt.

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	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results

Channel	Frequency (MHz)	Spectrum Analyzer level (dBm)	Spectrum Analyzer level (mW)
Channel 1 low	1880.15	22.43	174.98
Channel 2 mid.1	1895.15	23.60	229.09
Channel 2 mid.2	1909.85	23.01	199.99

§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 100 KHz and the 26 dB bandwidth was recorded.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4

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

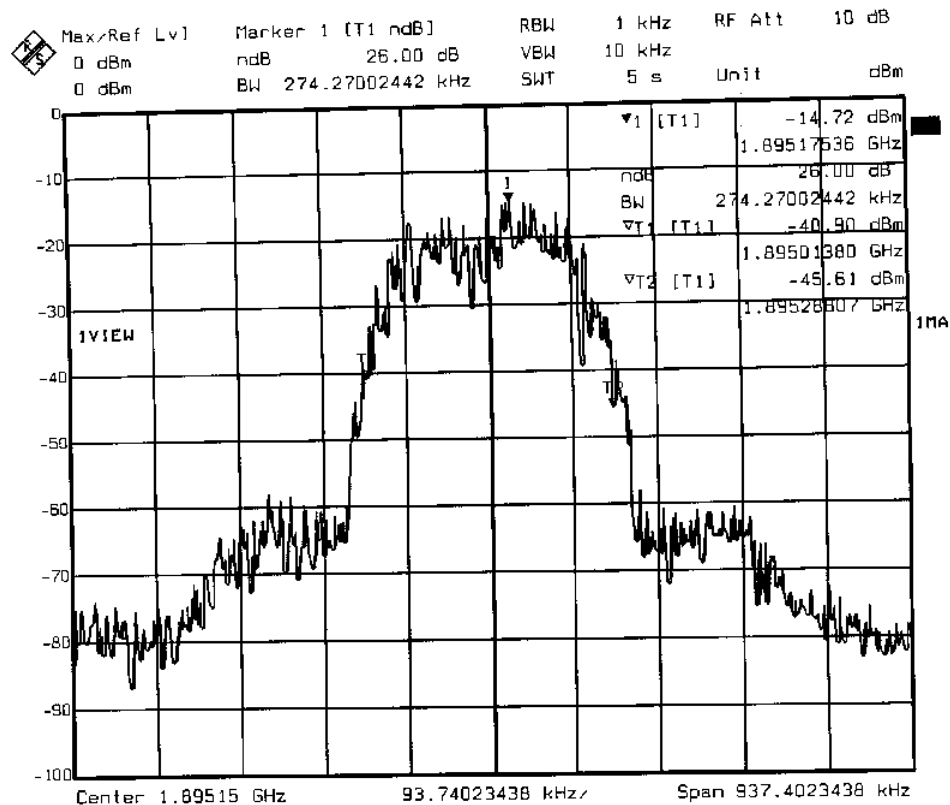
Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results

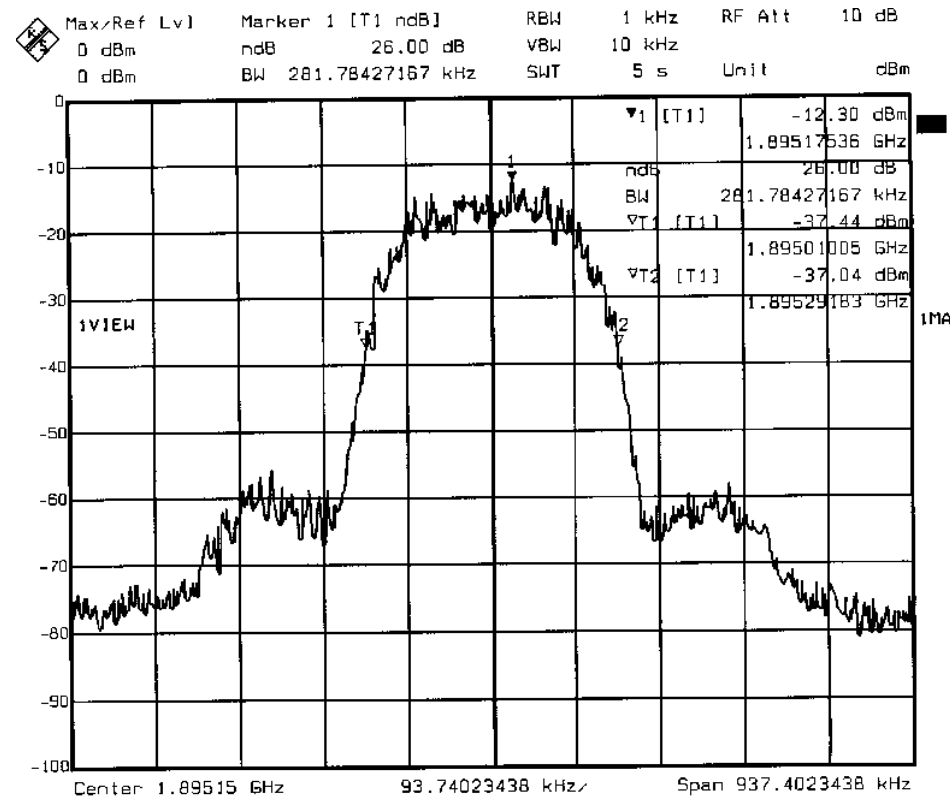
Please refer to the following plots.

Bandwidth of 1895.15MHz



Date: 27.DEC.2003 11:02:23

Jandy 2003.12.27

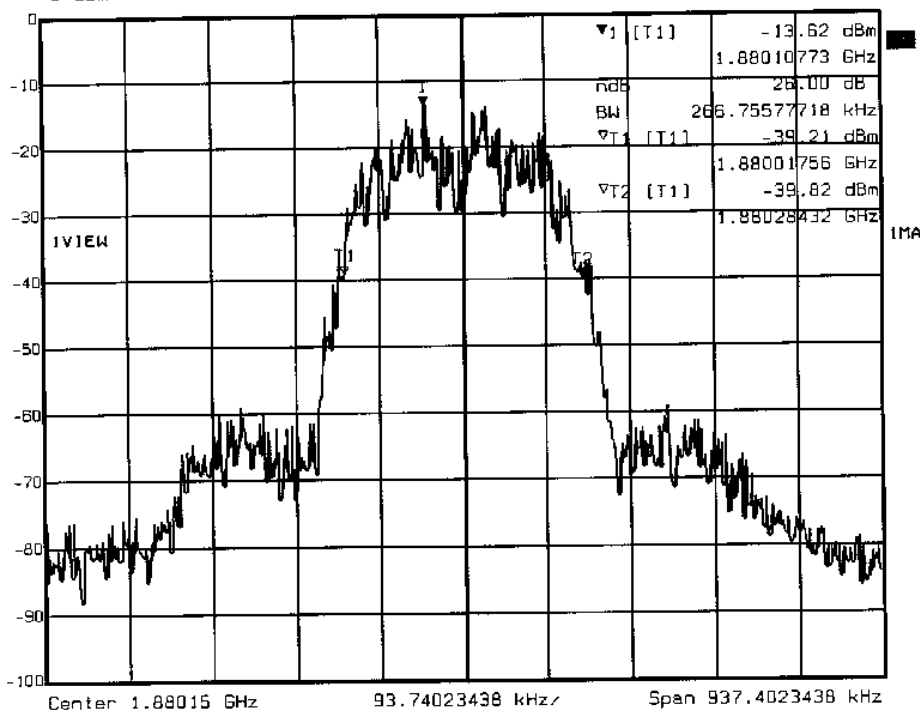


Date: 27.DEC.2003 11:03:28

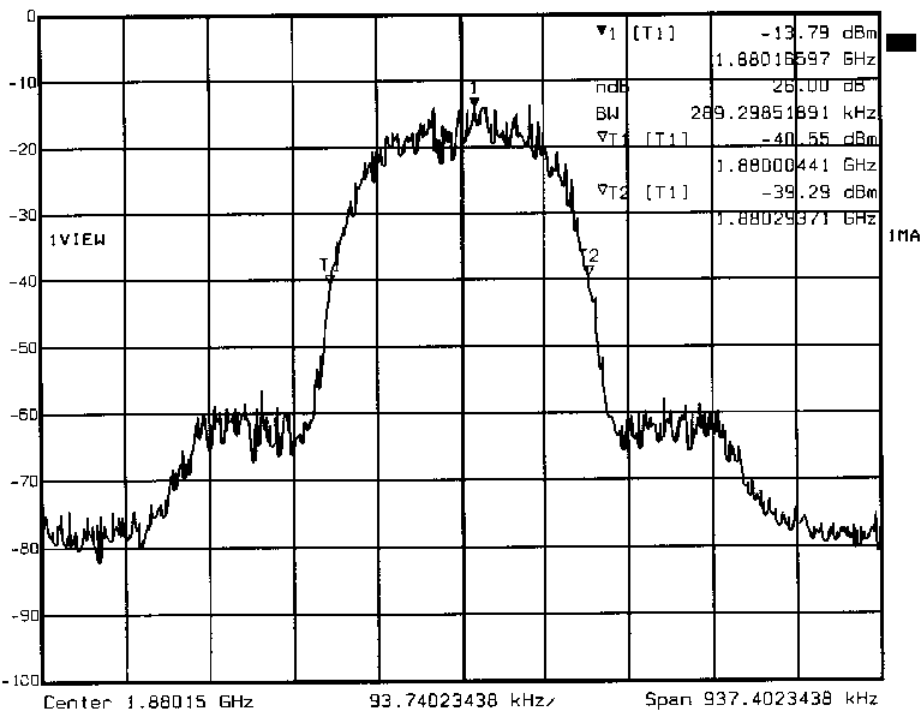
Jandy 2003.12.27

Bandwidth of 1880.15MHz

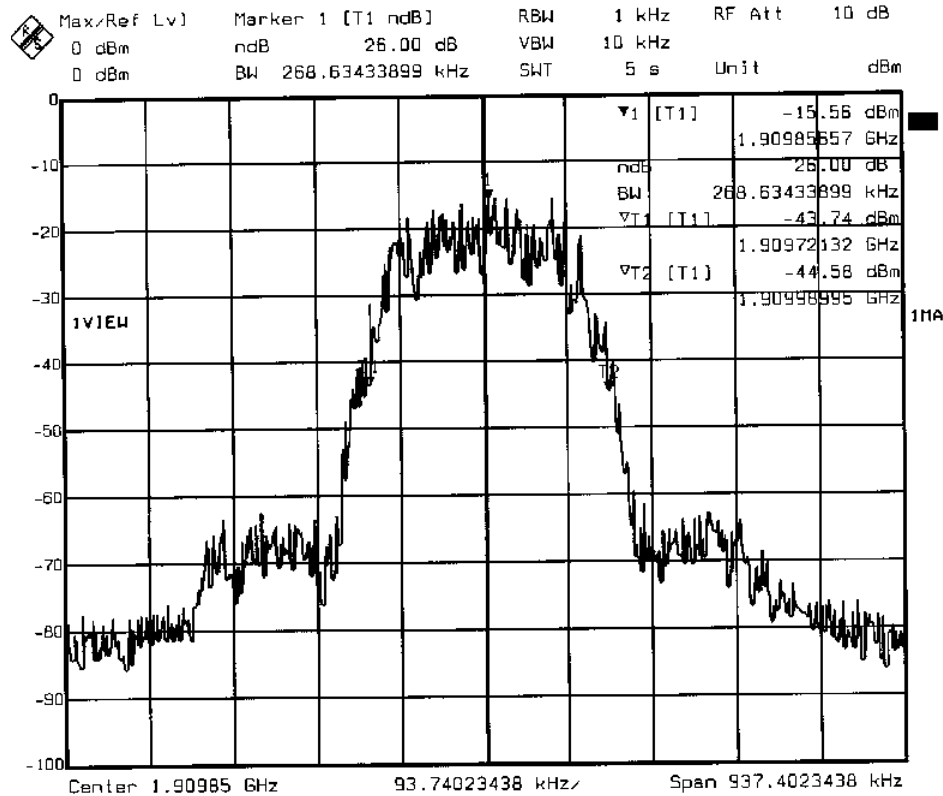
Max/Ref Lvl Marker 1 [T1 ndB] RBW 1 kHz RF Att 10 dB
0 dBm ndB 26.00 dB VBW 10 kHz
0 dBm BW 266.75577718 kHz SWT 5 s Unit dBm



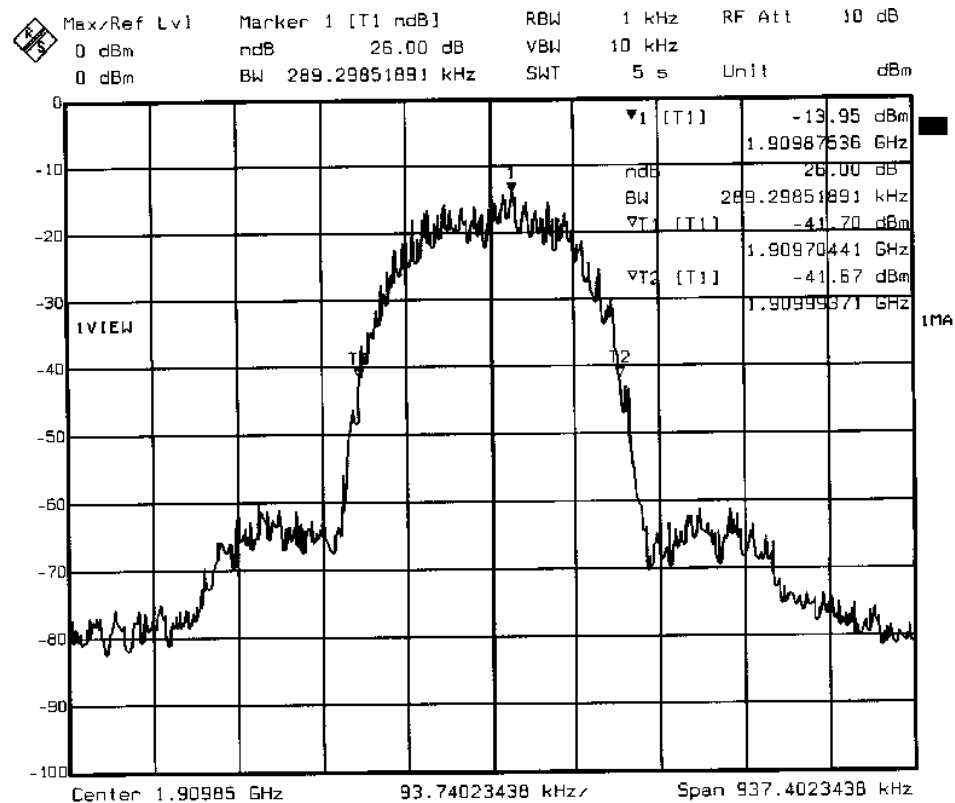
Max/Ref Lvl Marker 1 [T1 ndB] RBW 1 kHz RF Att 10 dB
0 dBm ndB 26.00 dB VBW 10 kHz
0 dBm BW 289.29851891 kHz SWT 5 s Unit dBm



Bandwidth of 1909.85MHz



Date: 27.DEC.2003 11:12:41

James 2003.12.23

Date: 27.DEC.2003 11:10:11

James 2003.12.23

§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 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4

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

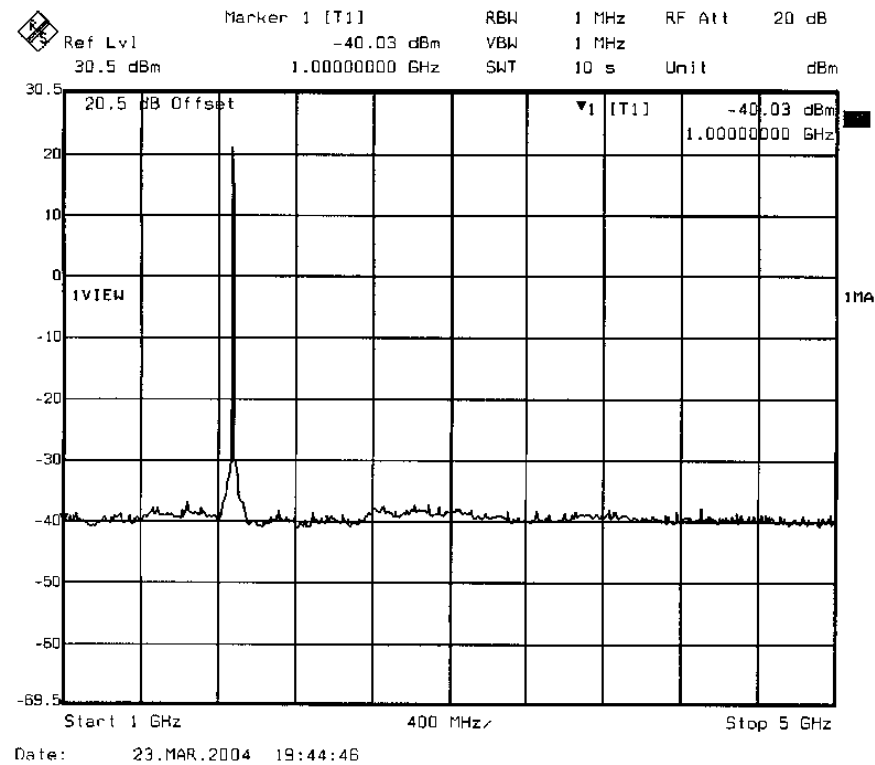
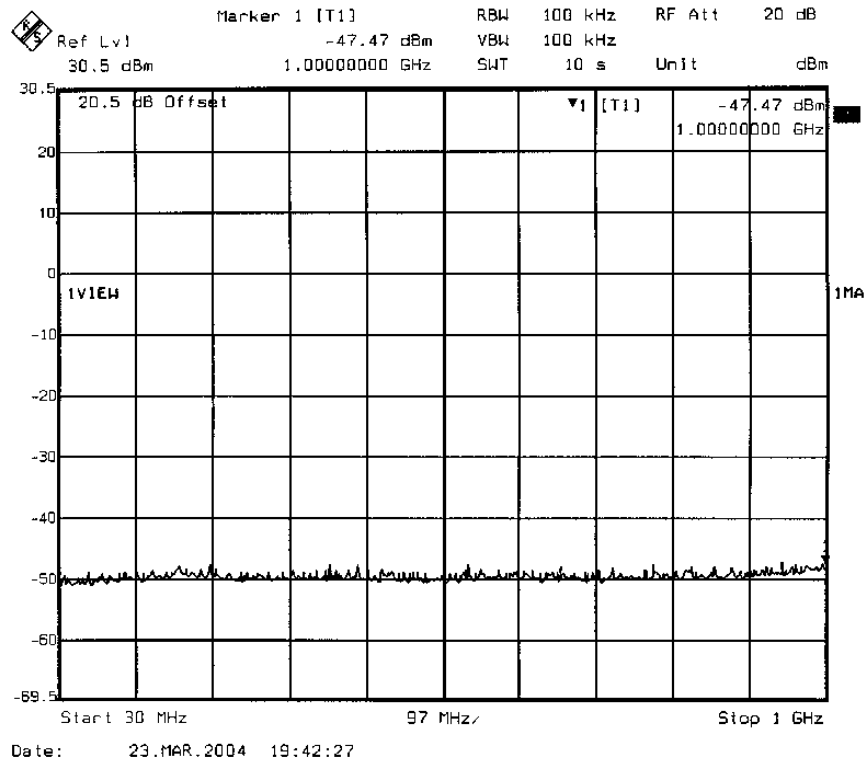
Environmental Conditions

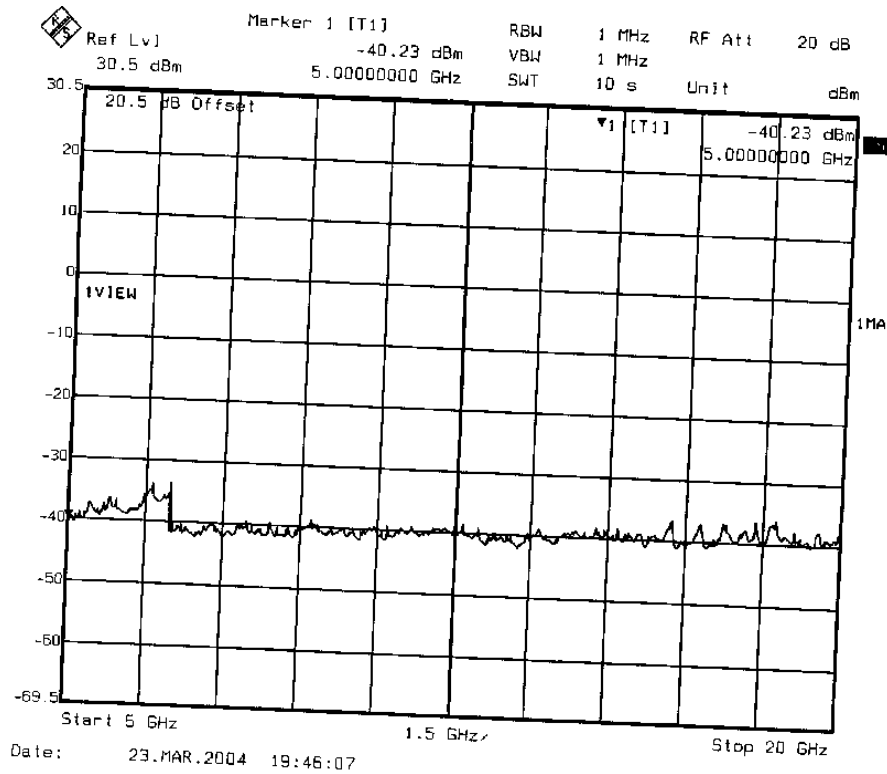
Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results

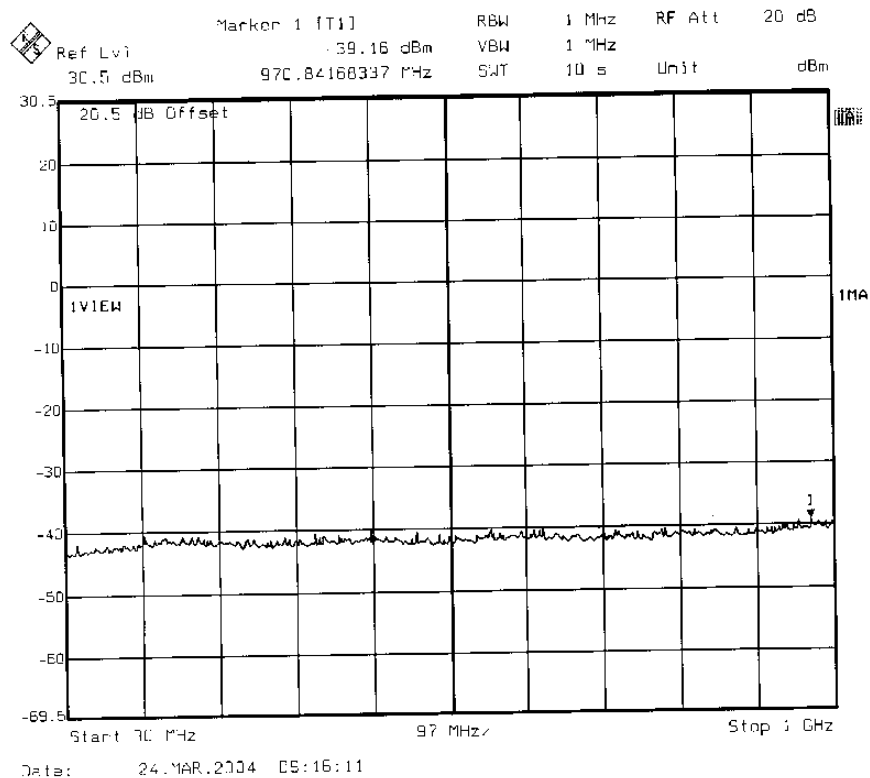
Modulation type	Channel	Measured
$\pi/4$ QPSK	Channel 1 low	<-13dBm
$\pi/4$ QPSK	Channel 2 middle1	<-13dBm
$\pi/4$ QPSK	Channel 3 middle2	<-13dBm

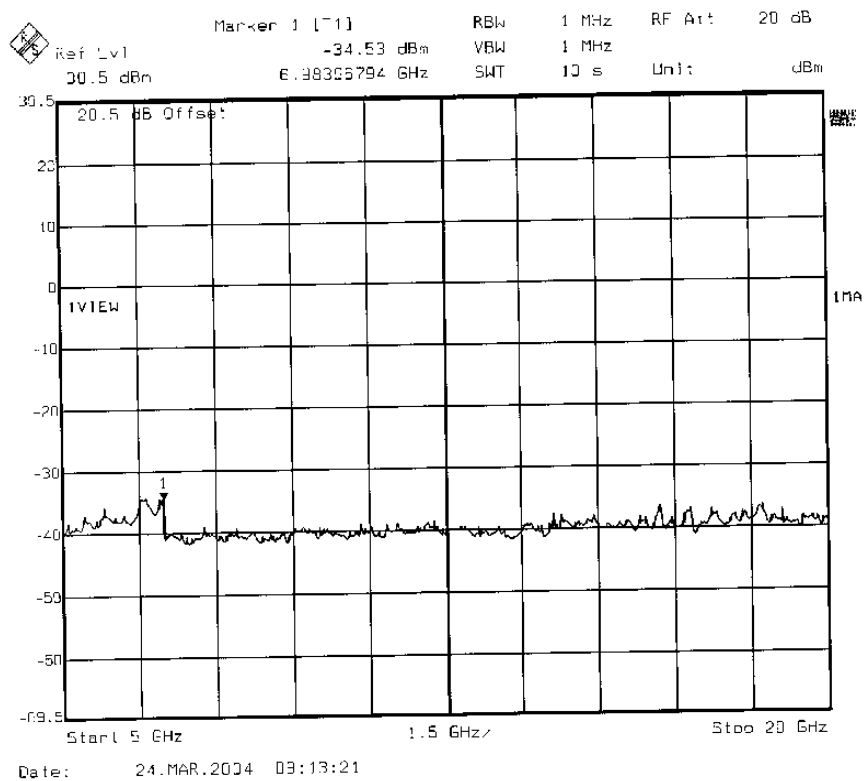
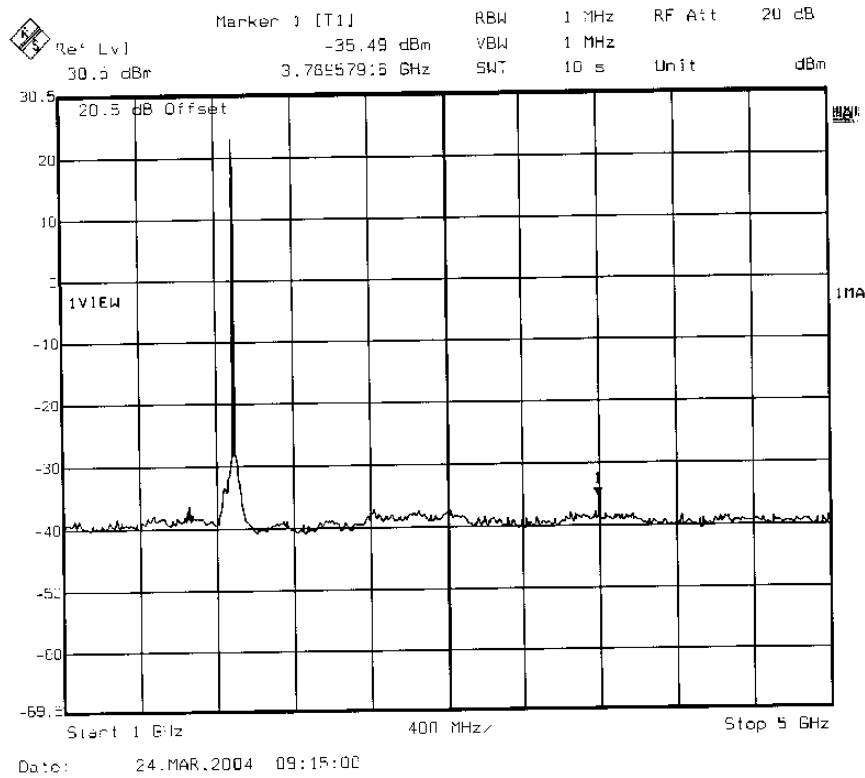
Low Channel:



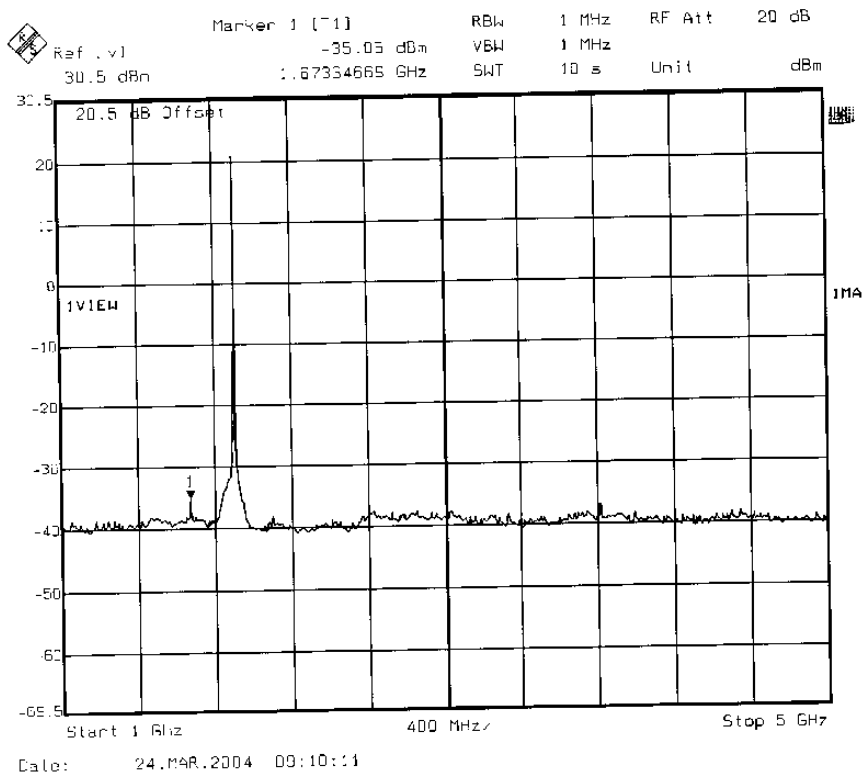
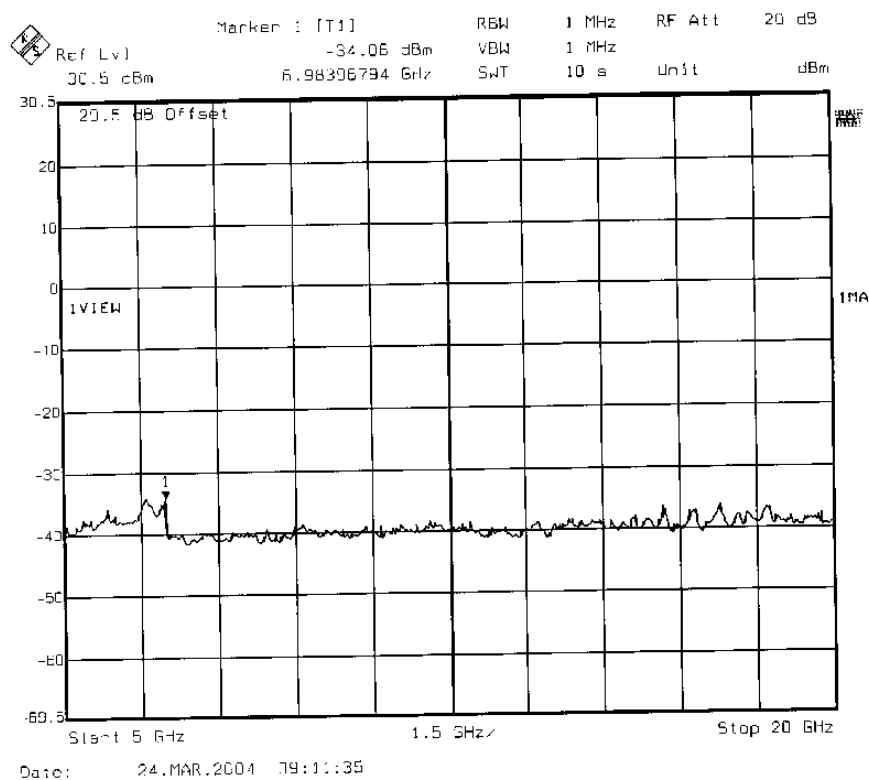


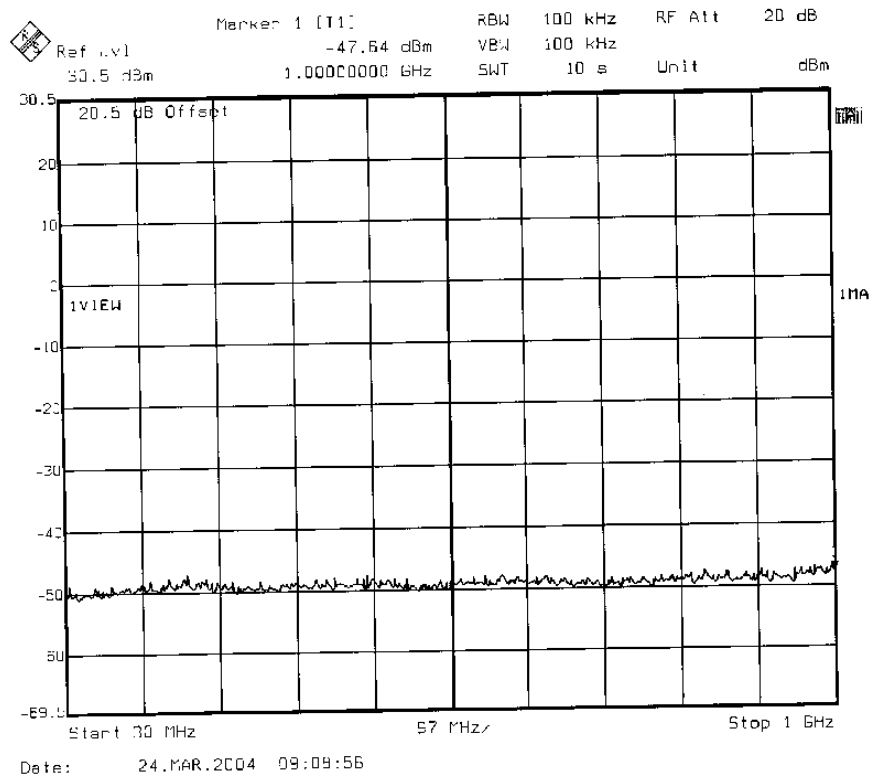
Middle Channel:





High Channel:





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

Applicable Standard

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

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	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
WUHUAN	Temperature & Humidity Chamber	HTP205	200254	2003-12-27	2004-12-26

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results**Frequency stability vs. temperature**

Channel: 1880.15MHz

Temperature	Fre. Measured (MHz)	ppm
-30° C	1880.15070	0.37
-20° C	1880.15043	0.23
-10° C	1880.15067	0.36
0° C	1880.14937	-0.34
10° C	1880.14946	-0.34
20° C	1880.15072	0.38
30° C	1880.14812	-1.00
40° C	1880.14889	-0.59
50° C	1880.15025	0.13

Channel: 1895.15MHz

Temperature	Fre. Measured (MHz)	ppm
-30° C	1895.14825	-0.92
-20° C	1895.14963	-0.20
-10° C	1895.14946	-0.28
0° C	1895.14825	-0.92
10° C	1895.15017	0.90
20° C	1895.15026	0.14
30° C	1895.15043	0.23
40° C	1895.14872	-0.68
50° C	1895.14847	-0.81

Channel: 1909.85MHz

Temperature	Fre. Measured (MHz)	ppm
-30° C	1909.84758	-1.30
-20° C	1909.85035	0.18
-10° C	1909.85027	0.14
0° C	1909.85061	0.32
10° C	1909.84897	-0.54
20° C	1909.84937	-0.33
30° C	1909.84758	-1.30
40° C	1909.84920	-0.42
50° C	1909.85038	0.20

Frequency stability vs. Input voltage:

Channel: 1880.15MHz

Input Voltage	Fre. Measured (MHz)	ppm
85%	1880.15042	0.23
115%	1880.14812	-1.00

Channel: 1895.15MHz

Input Voltage	Fre. Measured (MHz)	ppm
85%	1895.14947	-0.28
115%	1895.15026	0.14

Channel: 1909.85MHz

Input Voltage	Fre. Measured (MHz)	ppm
85%	1909.85026	0.14
115%	1909.85037	0.20

§24.238 – BAND EDGE

Applicable Standard

Requirement: §24.238.

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	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4

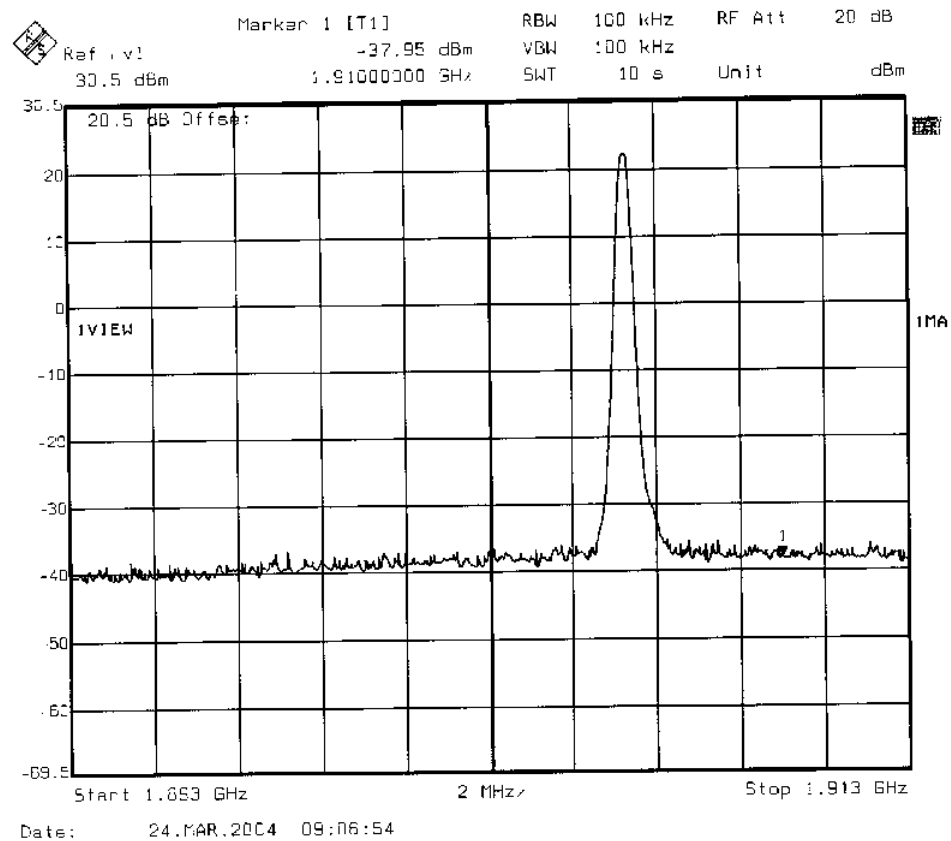
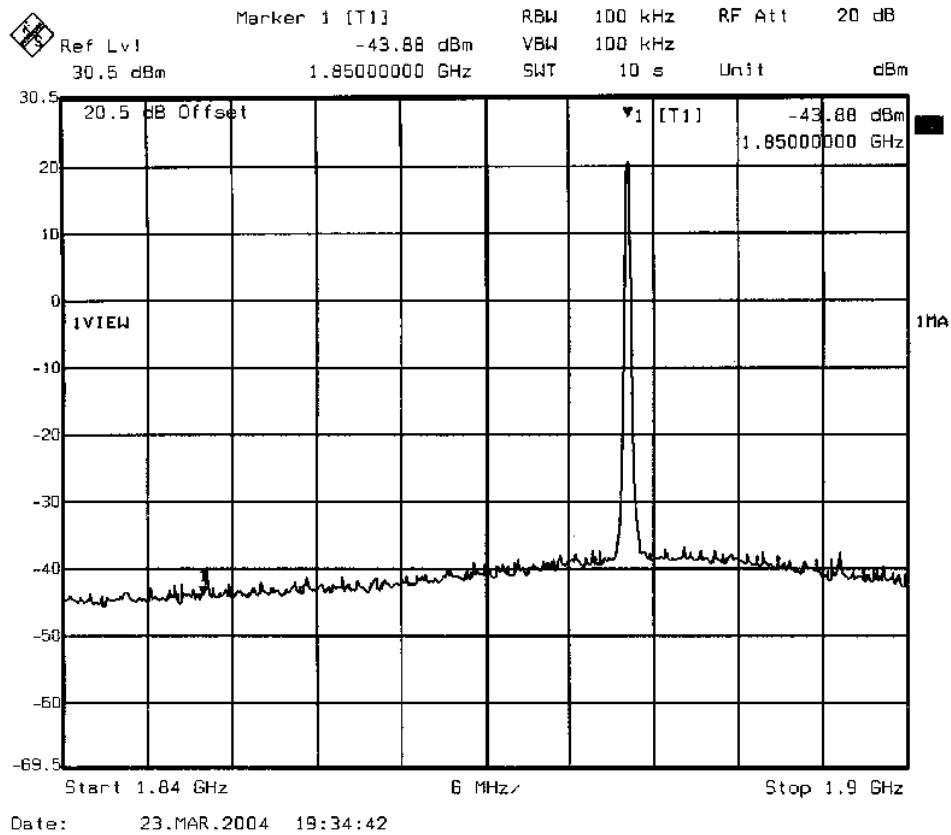
* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100 mbar

Test Results

Please refer to the following plots.



§15.109 - RADIATED EMISSIONS

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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

EUT Setup

The radiated emission tests were performed in the open area 10-meter test site, using the setup in accordance with ANSI C63.4-2001. The specification used in this report was the FCC15 Class B limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

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

Spectrum Analyzer Setup

The system was tested to 1000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
ETS	Log Periodic Antenna	3146	9603-4421	2003-8-5	2004-8-4
ETS	Biconical Antenna	3110B	3360	2003-8-5	2004-8-4

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

Test Procedure

For the radiated emissions test, the power cord of the EUT was connected to the AC floor outlet.

Maximizing procedure was performed on the six (6) highest emissions in the described configurations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB μ V of specification limits), and are distinguished with a "Qp" in the data table.

Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

Radiated Emissions Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1100mbar

Short Antenna Mode

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 CLASS B	
Freq. MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
96.01	51.79	180	1.2	h	10.4	0.9	25	38.1	43.5	-5.4
96.01	51.47	45	1	v	10.4	0.9	25	37.8	43.5	-5.7
480.01	44.58	90	1.2	h	17.9	1.9	25	39.4	46	-6.6
215.47	50.14	60	1.2	v	10.1	1.2	25	36.4	43.5	-7.1
215.73	49.98	270	1	h	10.1	1.2	25	36.3	43.5	-7.2
479.98	45.43	180	1.2	v	16.4	1.8	25	38.6	46	-7.4
108.24	47.33	45	1	h	11.4	1.2	25	34.9	43.5	-8.6
144.31	45.21	180	1.2	h	13.2	0.8	25	34.2	43.5	-9.3
108.31	46.25	180	1.2	v	11.4	1.2	25	33.9	43.5	-9.7
144.01	44.67	45	1	v	13.2	0.8	25	33.7	43.5	-9.8
240	48.2	45	1	v	11.3	1.0	25	35.5	46	-10.5
240	47.83	45	1.2	h	11.3	1.0	25	35.1	46	-10.9

Middle Antenna Mode

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 CLASS B	
Freq. MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
96.01	52.73	45	1.0	v	10.4	0.9	25	39.0	43.5	-4.5
480	46.35	180	1.2	v	17.9	1.9	25	41.2	46	-4.8
96	51.25	180	1.2	h	10.4	0.9	25	37.6	43.5	-6.0
108.33	48.37	45	1.0	h	11.4	1.2	25	36.0	43.5	-7.5
144.32	46.11	180	1.2	h	13.2	0.8	25	35.1	43.5	-8.4
216.01	51.12	60	1.0	v	10.1	1.2	25	37.4	46	-8.6
108.31	47.24	180	1.2	v	11.4	1.2	25	34.8	43.5	-8.7
480.01	42.36	90	1.2	h	17.9	1.9	25	37.2	46	-8.8
144.1	45.33	45	1.0	v	13.2	0.8	25	34.3	43.5	-9.2
240	48.24	45	1.2	h	11.3	1.0	25	35.5	46	-10.5
216.02	48.57	270	1.0	h	10.1	1.2	25	34.9	46	-11.1
240.02	47.28	45	1.2	v	11.3	1.0	25	34.6	46	-11.4

Long Antenna Mode

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 CLASS B	
Freq. MHz	Ampl. dB μ V/m	Angle Degree	Height Meter	Polar H/ V	Antenna dB μ V/m	Cable dB	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
96	53.24	45	1.0	v	10.4	0.9	25	39.5	43.5	-4.0
96.01	51.89	180	1.2	h	10.4	0.9	25	38.2	43.5	-5.3
479.98	47.26	180	1.2	v	16.4	1.8	25	40.5	46	-5.5
108.32	49.35	45	1.0	h	11.4	1.2	25	37.0	43.5	-6.6
480.01	44.53	90	1.2	h	17.9	1.9	25	39.3	46	-6.7
144.13	47.51	180	1.2	h	13.2	0.8	25	36.5	43.5	-7.0
216.02	52.17	60	1.0	v	10.1	1.2	25	38.5	46	-7.5
108.31	48.25	180	1.2	v	11.4	1.2	25	35.9	43.5	-7.7
144.14	46.47	45	1.0	v	13.2	0.8	25	35.5	43.5	-8.0
240	48.69	45	1.2	h	11.3	1.0	25	36.0	46	-10.0
240	48.21	45	1.2	v	11.3	1.0	25	35.5	46	-10.5
216.01	48.25	270	1.0	h	10.1	1.2	25	34.6	46	-11.5

Test Result

PASS