

FCC PART 90 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

RES LTD.

2410 Vantage Dr., Elgin, IL 60123

FCC ID: OEUB851-1A

This Report Concerns: ☒ Original Report	Equipment Type: IDEN Wireless Compensator
Test Engineer: Daniel Deng	
Report No.: R0505111	
Report Date: 2005-05-23	
Reviewed By: Richard Lee	
Prepared By:	Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

Note: The test report is specially limited to the above company and this particular sample 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.

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
TEST FACILITY	3
SYSTEM TEST CONFIGURATION.....	4
JUSTIFICATION	4
BLOCK DIAGRAM.....	4
EQUIPMENT MODIFICATIONS	4
TEST SETUP BLOCK DIAGRAM	4
SUMMARY OF TEST RESULTS	5
§2.1046, AND §90.205 - CONDUCTED OUTPUT POWER	6
PROVISION APPLICABLE.....	6
TEST PROCEDURE	6
TEST EQUIPMENT	6
ENVIRONMENTAL CONDITIONS	6
TEST RESULTS	6
§2.1049, § 90.209, § 90.210 – OCCUPIED BANDWIDTH.....	7
APPLICABLE STANDARD	7
TEST PROCEDURE	7
TEST EQUIPMENT	7
ENVIRONMENTAL CONDITIONS	8
TEST RESULTS	8
§2.1051 AND §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	15
APPLICABLE STANDARD	15
TEST PROCEDURE	15
TEST EQUIPMENT	15
ENVIRONMENTAL CONDITIONS	15
TEST RESULTS	15
§2.1053 AND §90.210 - RADIATED SPURIOUS EMISSION	19
APPLICABLE STANDARD	19
TEST PROCEDURE	19
TEST EQUIPMENT	19
ENVIRONMENTAL CONDITIONS	19
TEST RESULT	20
§2.1051 & §90.210(G) - TWO-TONE INTERMODULATION TEST.....	21
APPLICABLE STANDARDS	21
TEST PROCEDURE	21
TEST EQUIPMENT	21
TEST RESULTS	21
PLOTS OF TWO-TONE TEST RESULT.....	21

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *RES Ltd.*'s product, FCC ID: *OEUB851-1A* or the "EUT" as referred to in this report is an iDEN Wireless Compensator, which measures approximately 135mmL x 115mmW x 28mmH.

**The test data gathered are from production sample serial number 148489, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *RES Ltd.* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules for output power, occupied bandwidth, spurious emission at antenna terminal, radiated spurious emission, two-tone test and RF exposure.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003 and TIA/EIA 603A, 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 by 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 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 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 EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

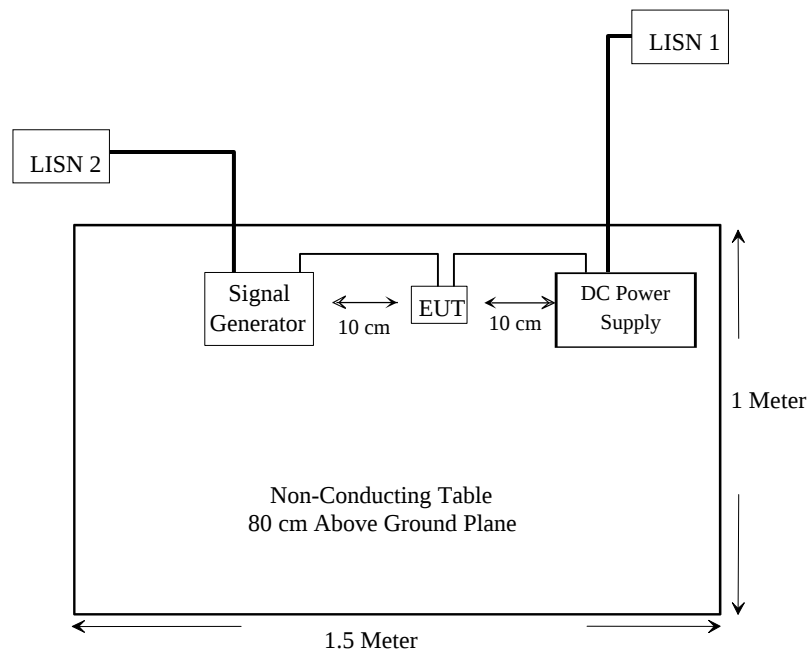
Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

RULE	DESCRIPTION OF TEST	RESULT
§ 2.1046 § 90.205	Conducted Output Power	Compliant
§ 2.1049 § 90.209 § 90.210	Occupied Bandwidth	Compliant
§ 2.1051 § 90.210	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1053 § 90.210	Radiated Spurious Emission	Compliant
§ 90.210	Two-Tone Test	Compliant
§ 1.1310 § 2.1091	RF Exposure	Compliant

§2.1046, and §90.205 - CONDUCTED OUTPUT POWER

Provision Applicable

Per FCC §2.1046 and §90.205: maximum ERP is dependent upon the station's antenna HAAT and required service area. The maximum output power of the transmitter for mobile station is 100 watts (20dBm).

Test Procedure

The RF output of the transceiver was connected to a power meter through appropriate attenuator.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Power Meter	E4419B	MY4121511	2005-04-29

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	48%
ATM Pressure:	1013 mbar

The testing was performed by Daniel Deng on 2005-05-18.

Test Results

Uplink:

CHANNEL	FREQUENCY (MHz)	POWER (dBm)	RATED POWER (dBm)
Low	806	18.54	20
Mid	815	20.50	20
High	824	17.69	20

Downlink:

CHANNEL	FREQUENCY (MHz)	POWER (dBm)	RATED POWER (dBm)
Low	851	20.41	20
Mid	860	20.27	20
High	869	20.35	20

§2.1049, § 90.209, § 90.210 – OCCUPIED BANDWIDTH

Applicable Standard

§2.1049, §90.209 and §90.210(g).

(g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but no more than 10 kHz: At least $83 \log(f_d/5)$ dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least $116 \log(f_d/6.1)$ dB, or $50 + 10 \log(P)$ dB, or 70 dB, whichever is the lesser attenuation;

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: 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 resolution bandwidth of the spectrum analyzer was set at 1 kHz and the spectrum was recorded in the frequency band ± 50 KHz from the carrier frequency.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	8564E	3943A01781	2004-10-04
Hewlett Packard	Plotter	HP7470A	2541A49659	N/A

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

Environmental Conditions

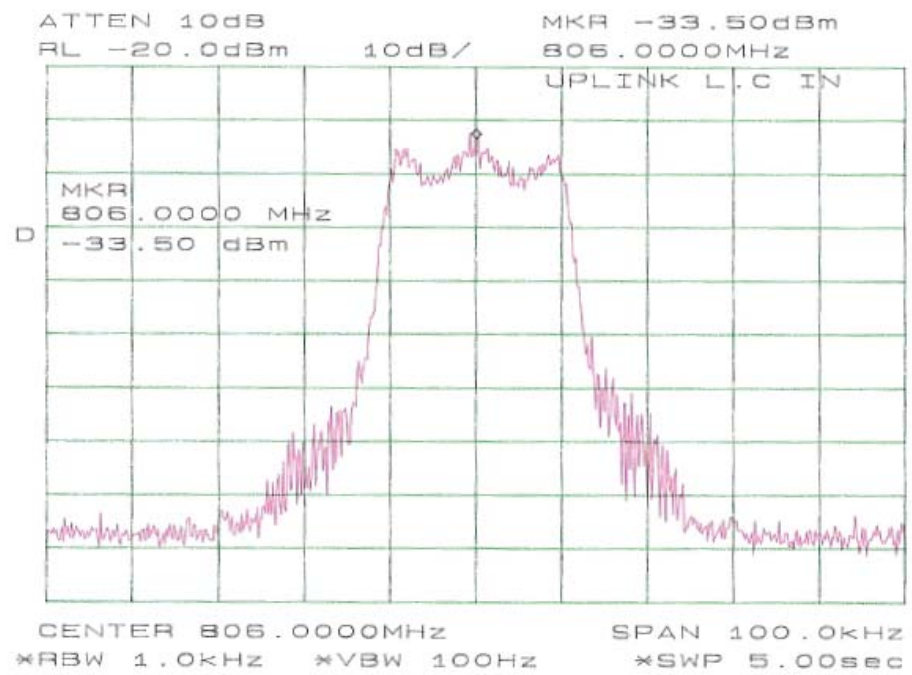
Temperature:	20° C
Relative Humidity:	48%
ATM Pressure:	1013 mbar

The testing was performed by Daniel Deng on 2005-05-18.

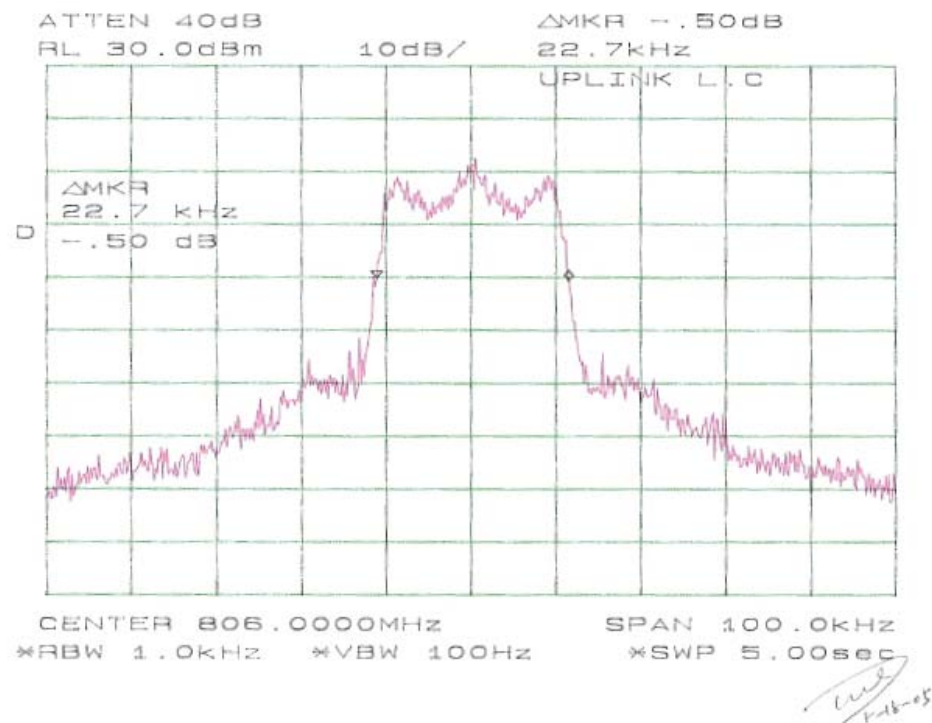
Test Results

Please refer to the hereinafter plots.

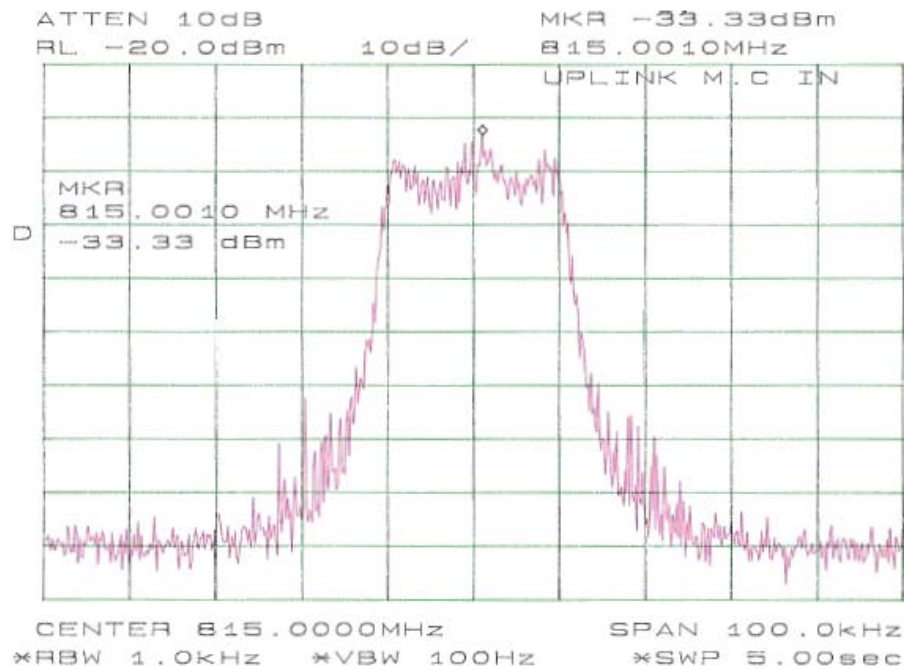
Uplink: (Input Signal, Low Channel)



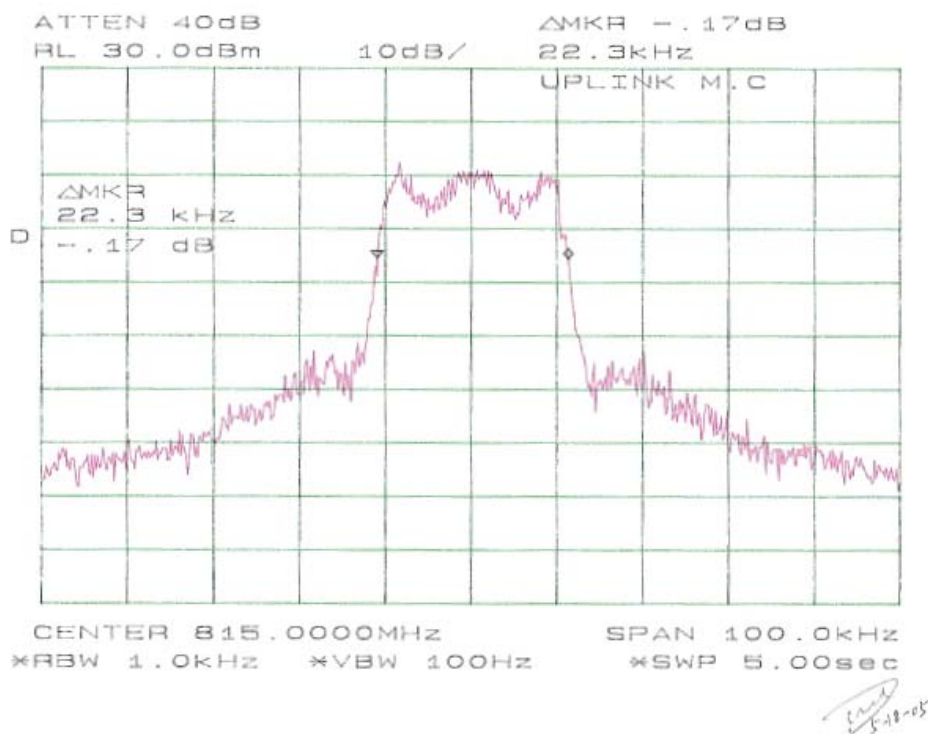
Uplink: (Output Signal, Low Channel)



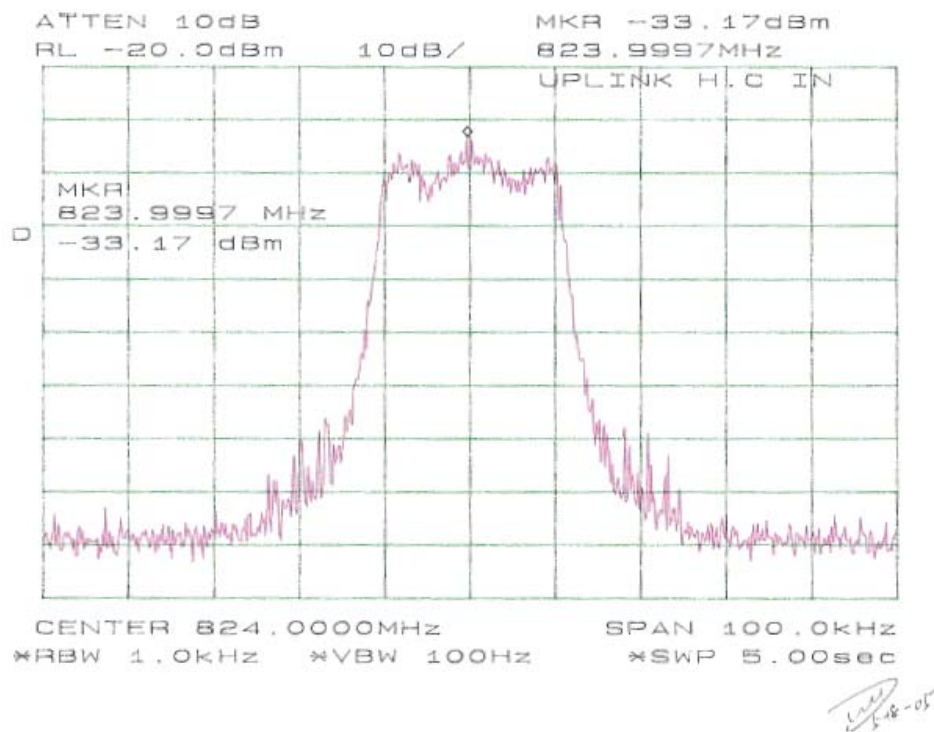
Uplink: (Input Signal, Middle Channel)



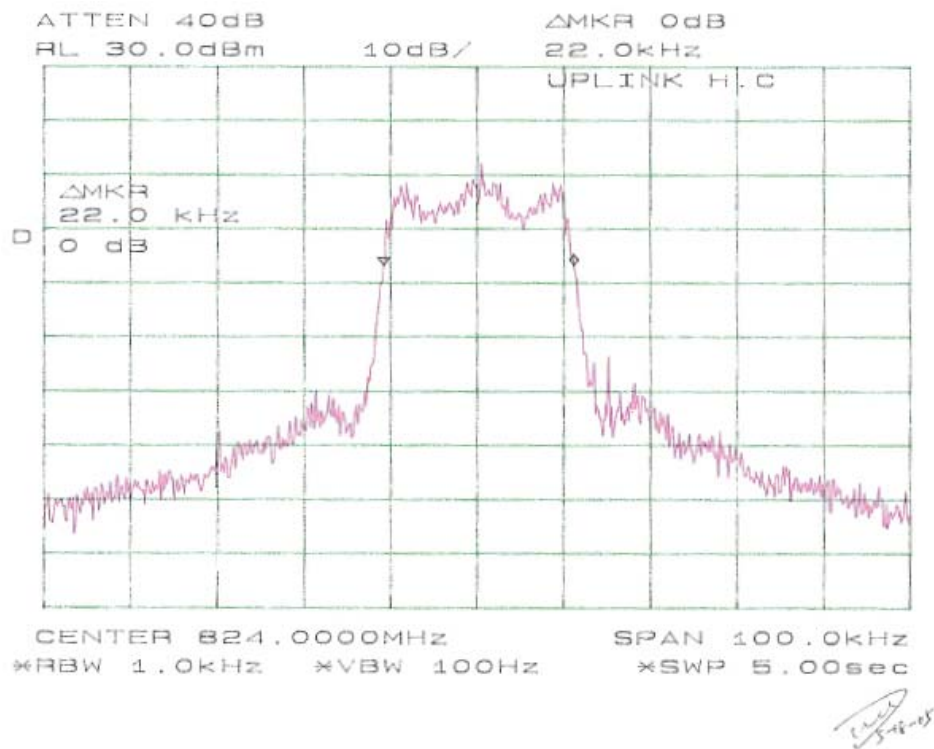
Uplink: (Output Signal, Middle Channel)



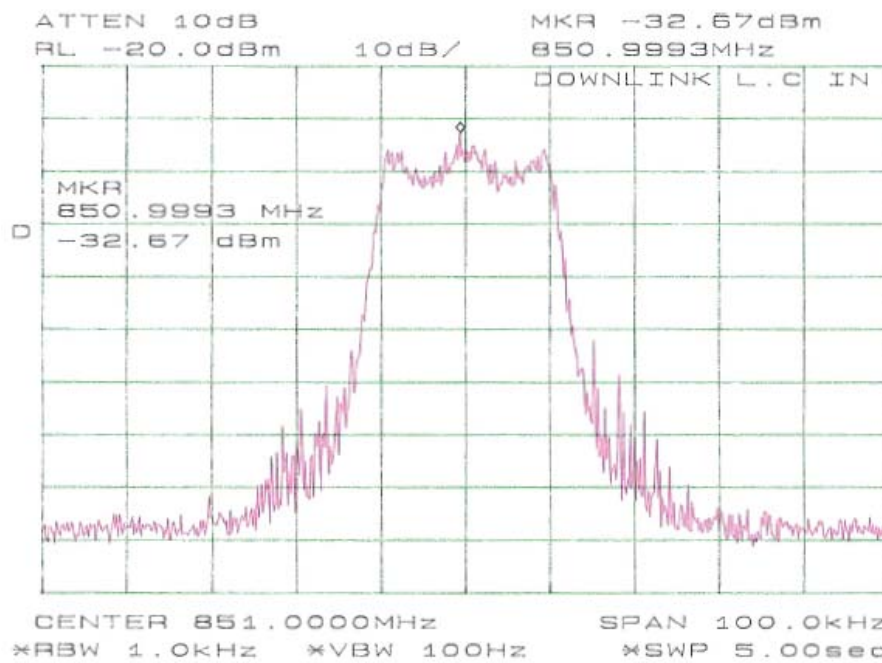
Uplink: (Input Signal, High Channel)



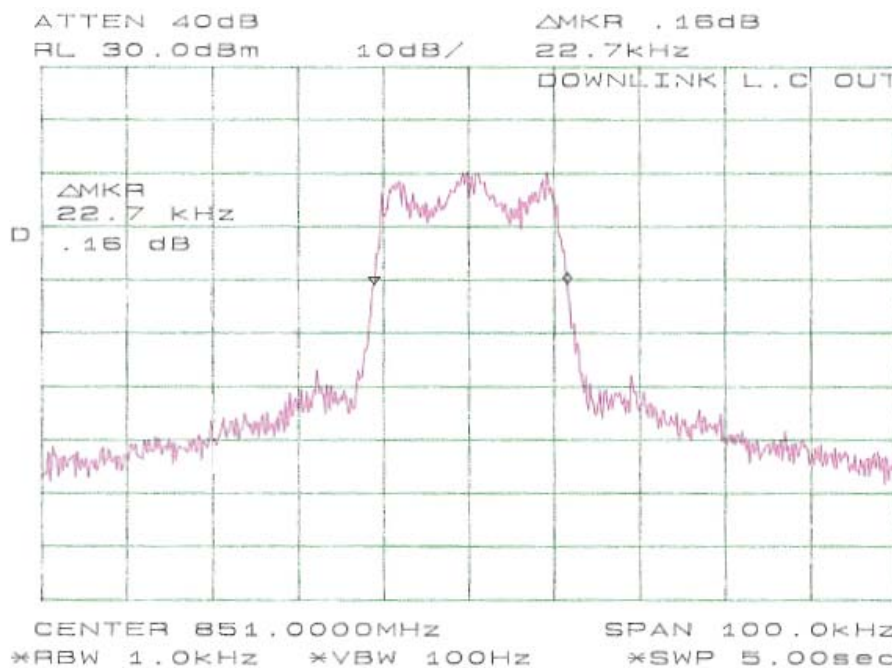
Uplink: (Output Signal, High Channel)



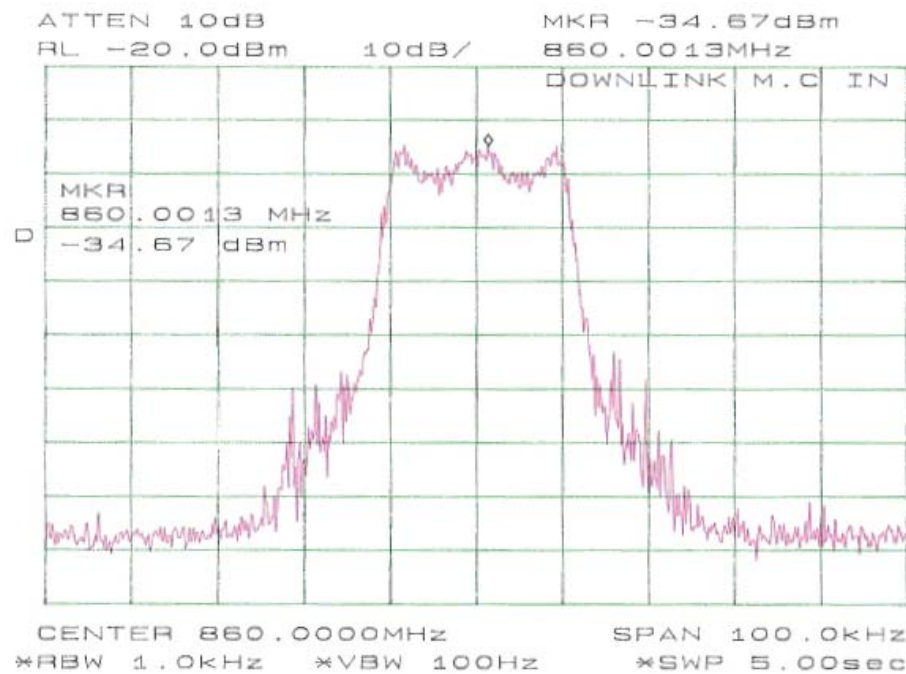
Downlink: (Input Signal, Low Channel)



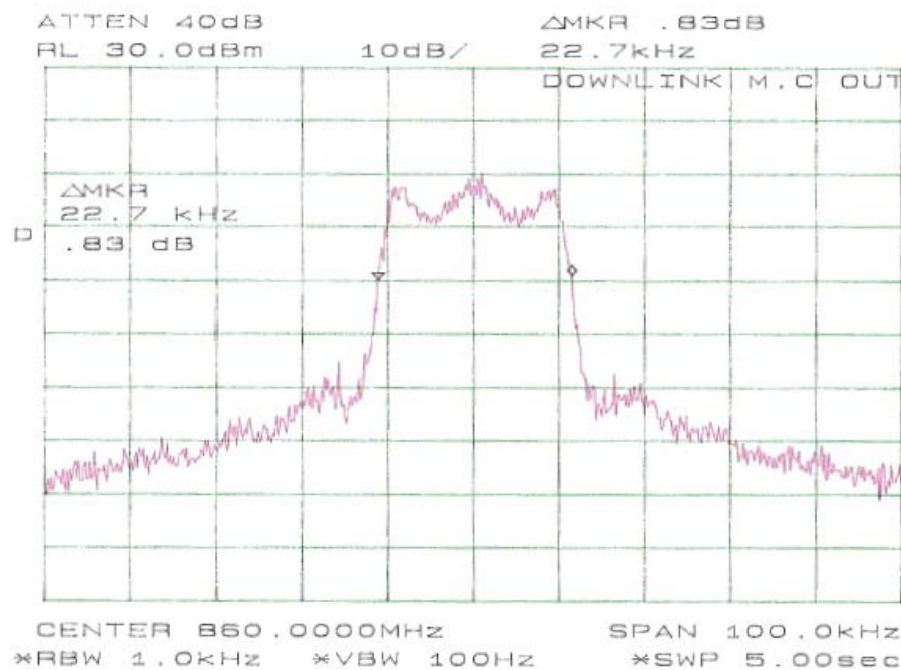
Downlink: (Output Signal, Low Channel)



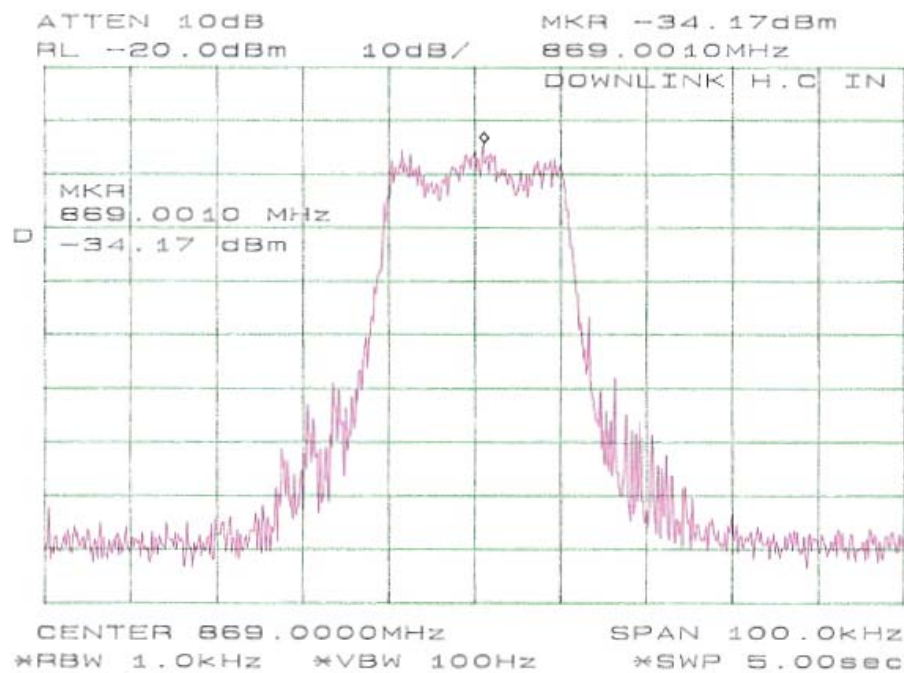
Downlink: (Input Signal, Middle Channel)



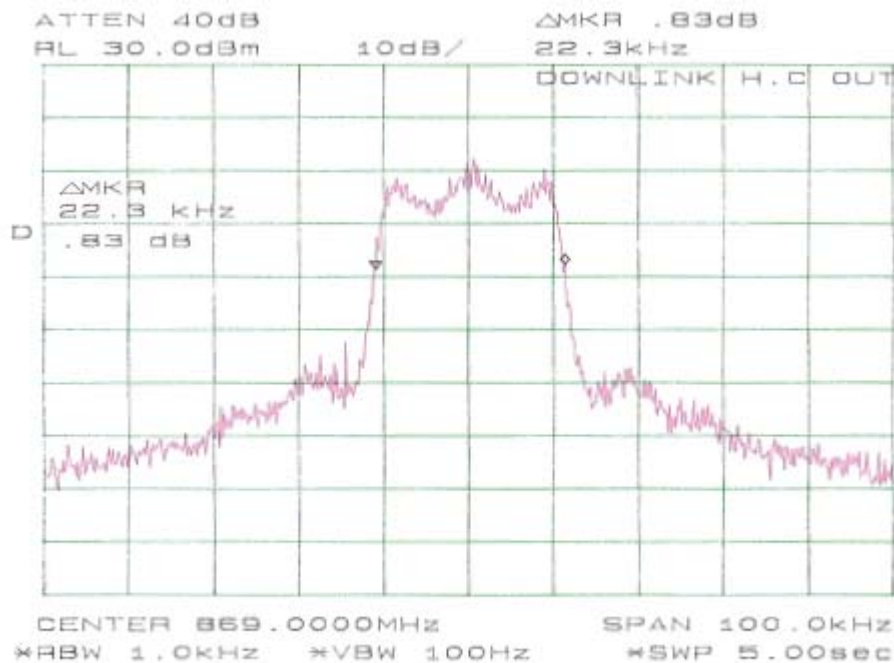
Downlink: (Output Signal, Middle Channel)



Downlink: (Input Signal, High Channel)



Downlink: (Output Signal, High Channel)



§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

§2.1051 and §90.210

On any frequency removed from the center of the assigned channel by more than 250 percent 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

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	8564E	3943A01781	2004-10-04
Hewlett Packard	Plotter	HP7470A	2541A49659	N/R

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

Environmental Conditions

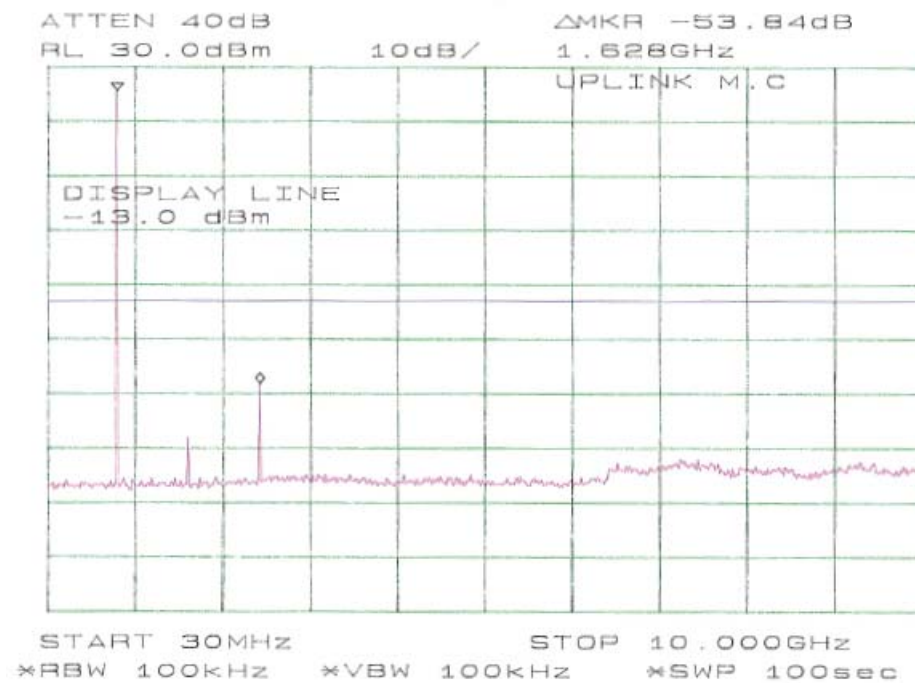
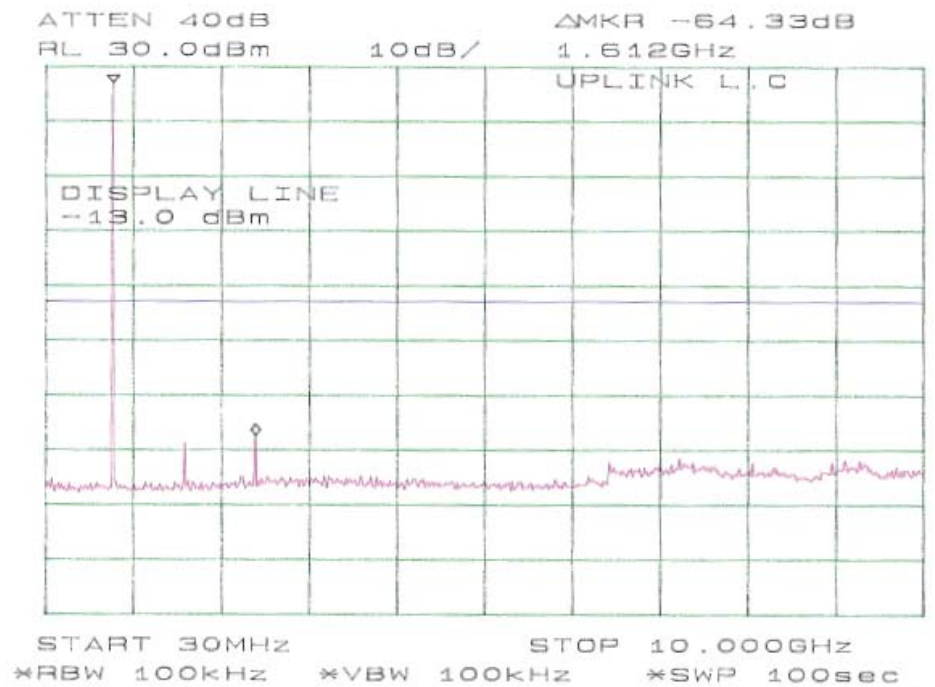
Temperature:	20° C
Relative Humidity:	48%
ATM Pressure:	1013 mbar

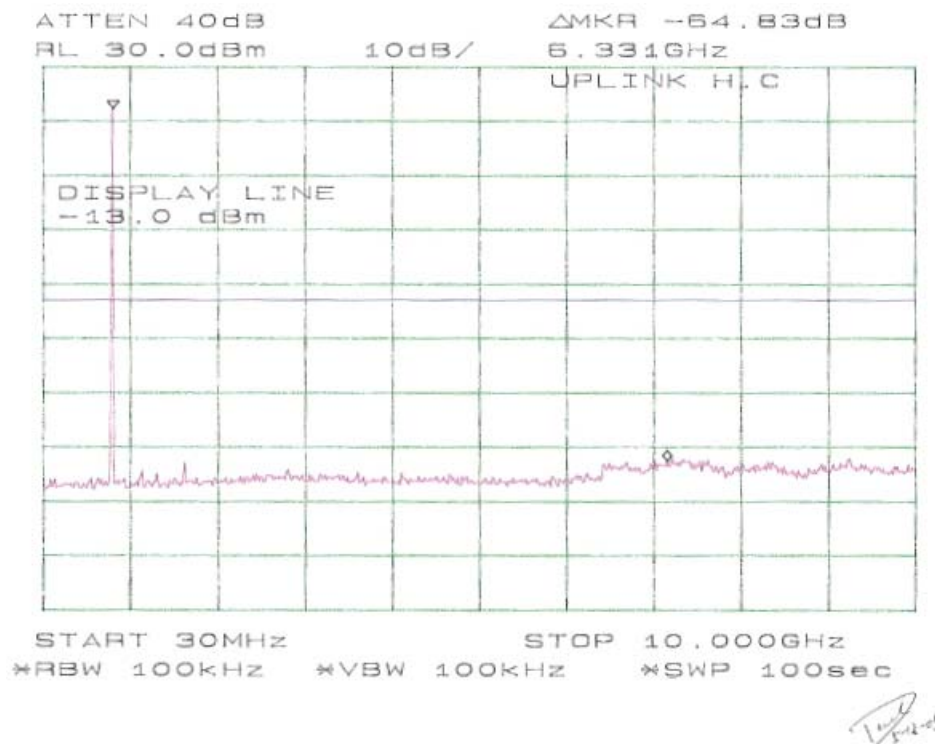
The testing was performed by Daniel Deng on 2005-05-18.

Test Results

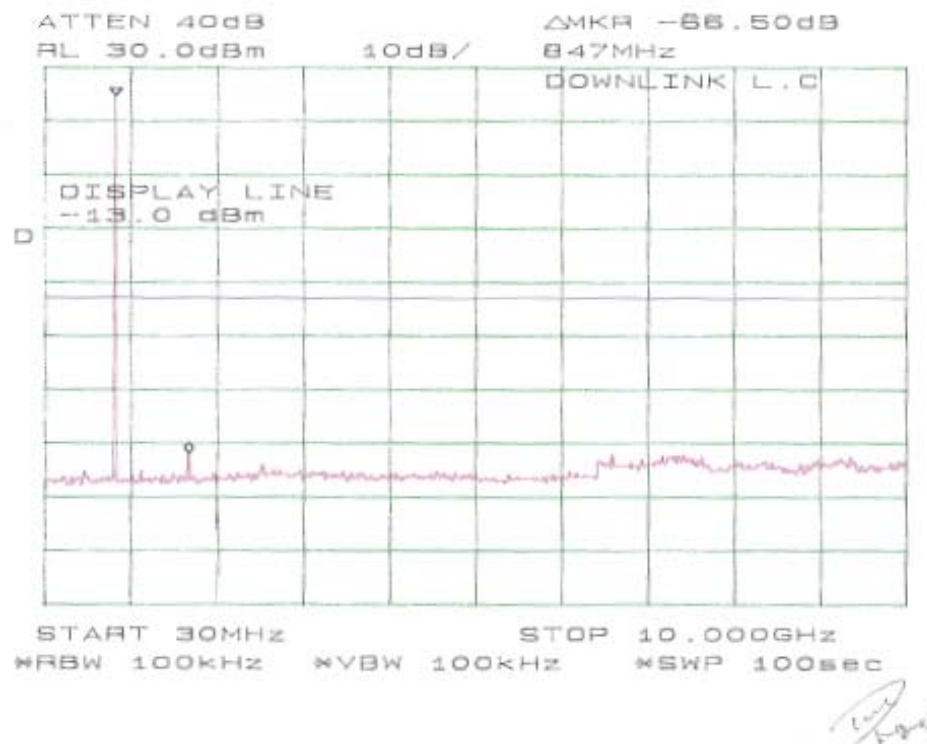
Please refer to the hereinafter plots.

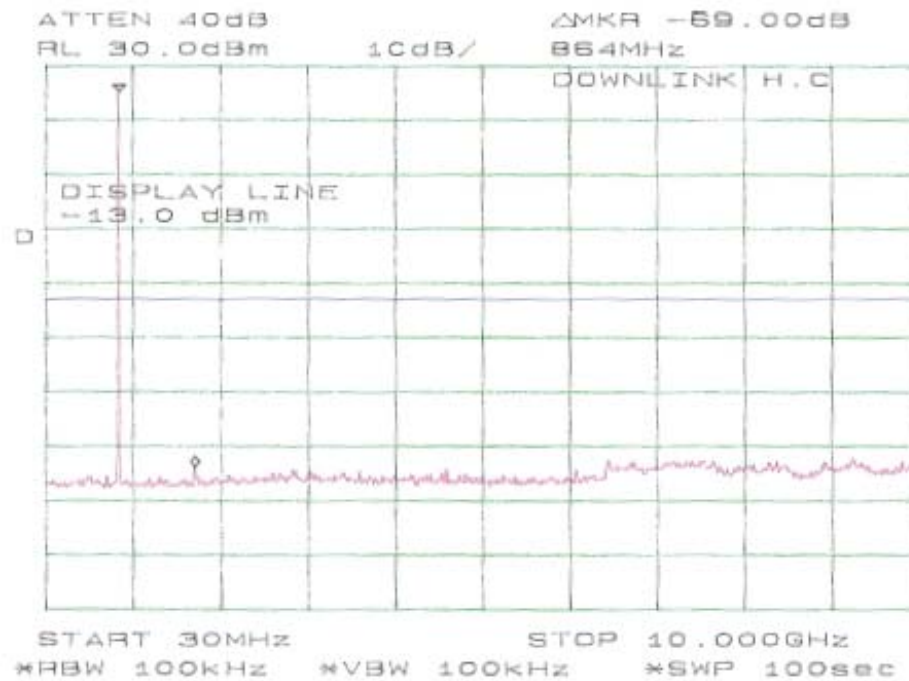
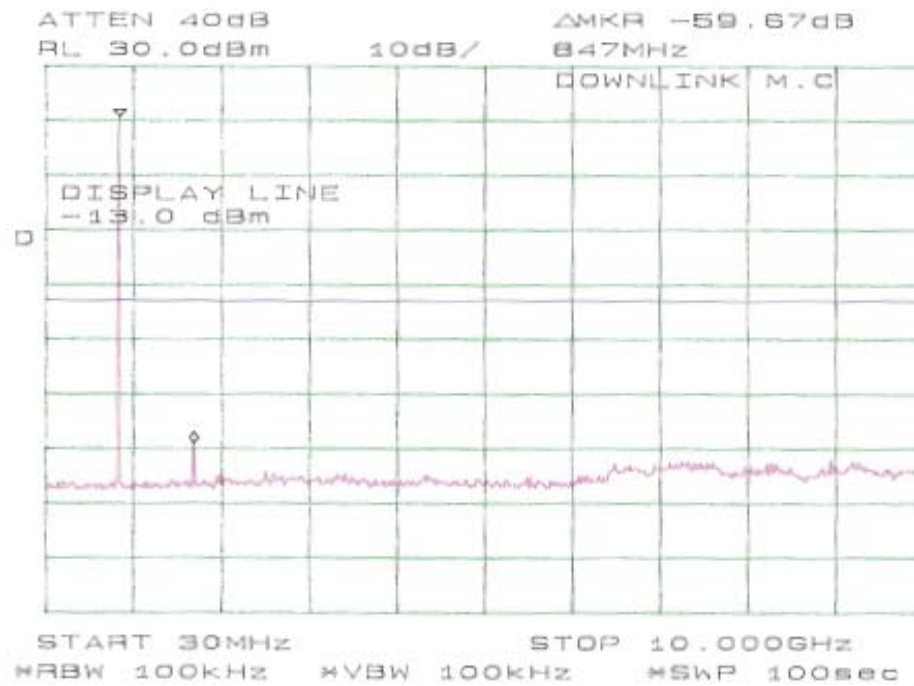
Uplink:





Downlink:





§2.1053 and §90.210 - RADIATED SPURIOUS EMISSION

Applicable Standard

§2.1053 and §90.210(g)

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 (TXpwr in Watts/0.001) – the absolute level

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
ETS	Biconical Antennas	3110B	9603-2315	2004-12-14
ETS	Log-Periodic Antenna	3148	4-1155	2004-12-14
Rohde&Schwarz	Signal Generator	SMIQ03	DE23746	2005-05-02
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10
Com-Power	Antenna, Dipole	AD-100	2222	2004-09-26
A.H. Systems	Antenna, Horn	SAS-200/571	261	2005-04-20
Sunol Sciences	Antenna	DRH-118	A052704	2004-06-02

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

Environmental Conditions

Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1015 mbar

The testing was performed by Daniel Deng on 2005-05-20.

Test Result

-14.5dB at 1630MHz, for Uplink Channel
 -18.2dB at 2580MHz, for Downlink Channel

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
Uplink Middle Channel (f = 815MHZ)											
1630	52.11	0	1.5	h	1630	-35.5	9.3	1.3	-27.5	-13	-14.5
1630	48.75	90	1.5	v	1630	-38.8	9.3	1.3	-30.8	-13	-17.8
2445	40.58	90	1.5	v	2445	-42.5	9.3	1.6	-34.8	-13	-21.8
2445	34.77	180	1.3	h	2445	-49.1	9.3	1.6	-41.4	-13	-28.4
3260	13.2	300	1.6	v	3260	-62.2	9.5	2.2	-54.9	-13	-41.9
3260	11.25	0	1.4	h	3260	-64.8	9.5	2.2	-57.5	-13	-44.5
Downlink Middle Channel (f = 860MHZ)											
2580	41.29	0	1.3	v	2580	-38.9	9.3	1.6	-31.2	-13	-18.2
1720	45.47	0	1.3	v	1720	-42.1	9.3	1.3	-34.1	-13	-21.1
1720	41.66	270	1.6	h	1720	-45.3	9.3	1.3	-37.3	-13	-24.3
2580	30.69	120	1.5	h	2580	-49.9	9.3	1.6	-42.2	-13	-29.2
3440	19.95	270	1.4	v	3440	-57.3	10.6	2.3	-49.0	-13	-36.0
3440	18.13	330	1.6	h	3440	-58.5	10.6	2.3	-50.2	-13	-37.2

Note:

- 1) No preamplifier used.
- 2) Test in three orthogonal plane.
- 3) Normal condition

§2.1051 & §90.210(g) - TWO-TONE INTERMODULATION TEST

Applicable Standards

According to §2.1051 & §90.210(g), Intermodulation products must be attenuated below the rated power of the EUT by at least $43 + 10\log(P)$, equivalent to -13 dBm.

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 30 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic. Two input signals are equal in level (and can be raised equally), were sent to the EUT.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde&Schwarz	Generator, Signal	SMIQ03	DE23746	2005-05-02
Agilent	Generator, Signal	E4438C	MY42081680	2005-03-05
Agilent	Analyzer	8564E	3943A01781	2004-10-04
HP	Plotter	HP7470A	2541A4965S	N/R

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

Test Results

Environmental Conditions

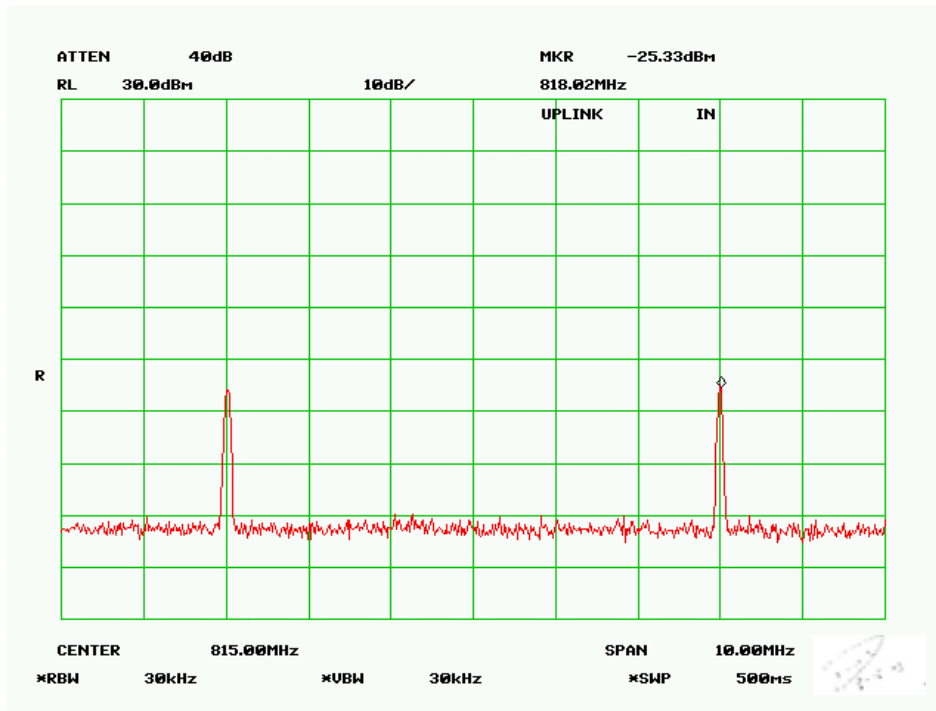
Temperature:	20° C
Relative Humidity:	48%
ATM Pressure:	1013 mbar

The testing was performed by Daniel Deng on 2005-05-18.

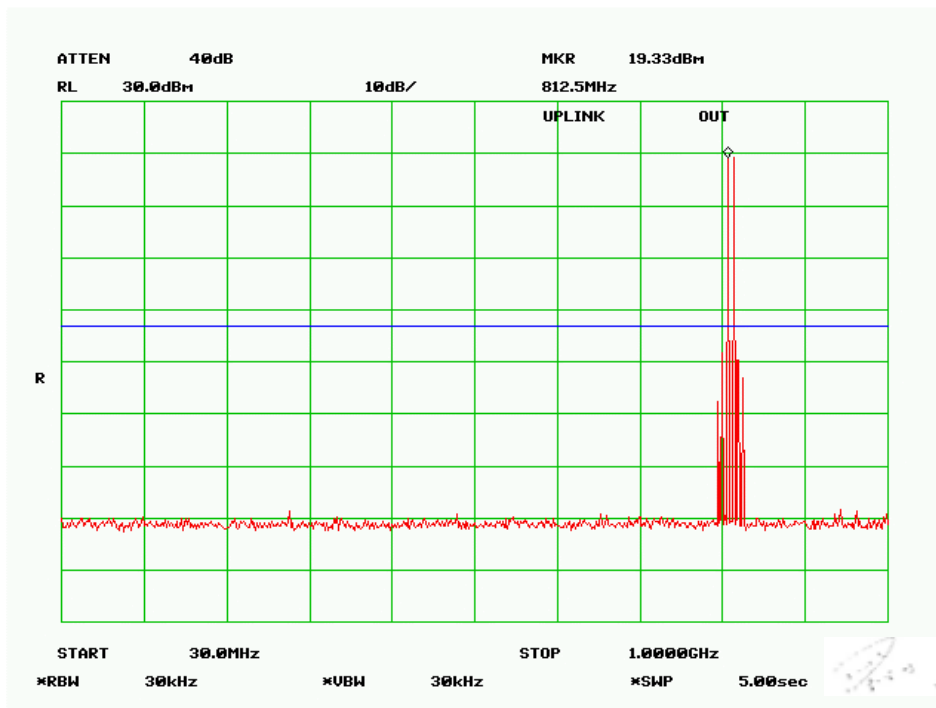
Plots of Two-Tone Test Result

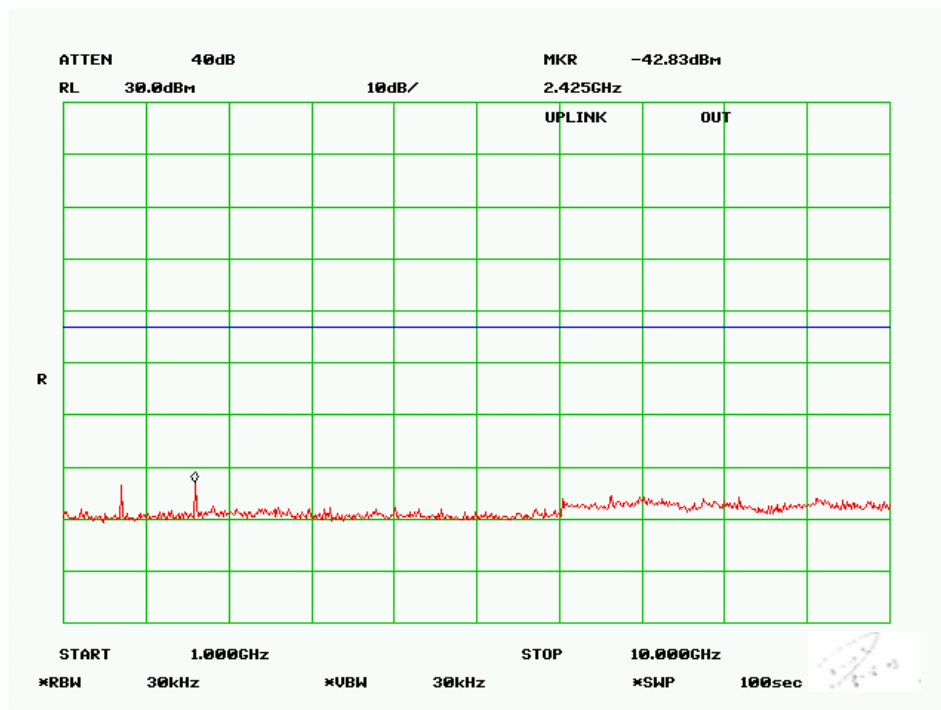
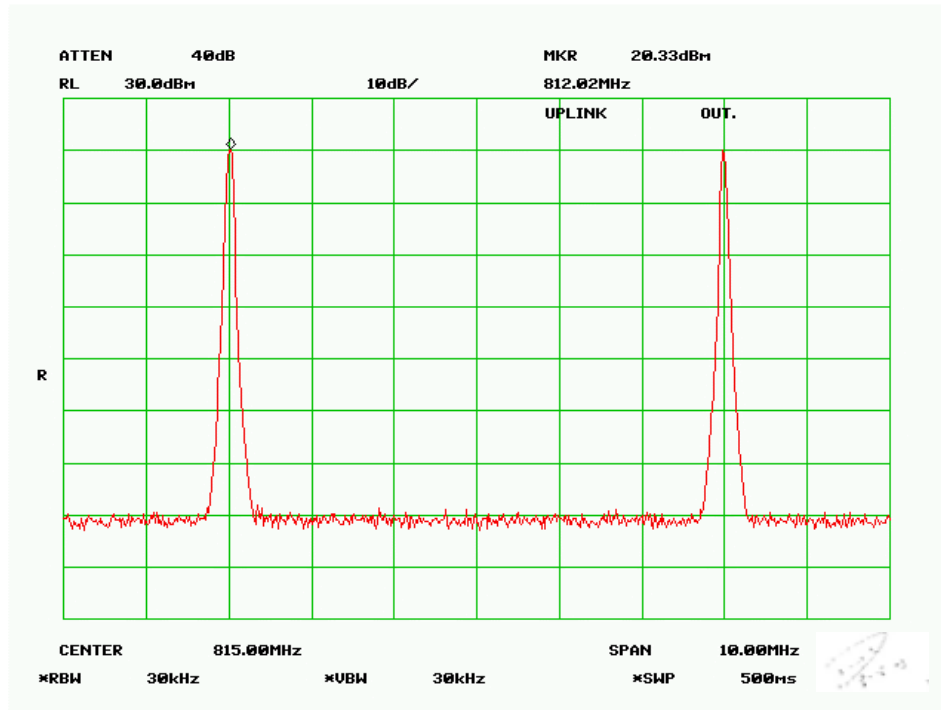
Please refer to plots hereinafter.

Uplink: (Input Signal)

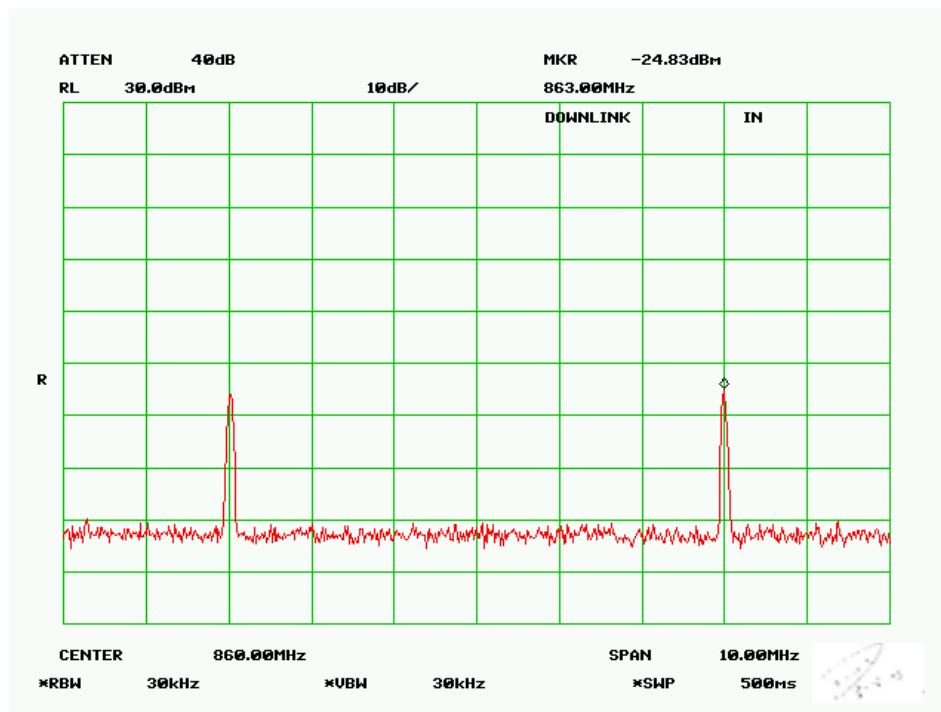


Uplink: (Output Signal)





Downlink: (Input Signal)



Downlink: (Output Signal)

