

# FCC PART 22 TYPE APPROVAL



## EMI MEASUREMENT AND TEST REPORT

For

### **Boston Amplifier, Inc**

2110 Artesia Blvd Suite B202  
Redondo Beach, CA 90278

**FCC ID: T5C-81906-BDA-SBX**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> Booster / Bi-Directional Amplifier
<b>Test Engineer:</b> Taylor Tsai / 	
<b>Report No.:</b> R0602064.doc	
<b>Report Date:</b> 2006-03-09	
<b>Reviewed By:</b> Snell Leong / 	
<b>Prepared By:</b> Bay Area Compliance Laboratory Corporation (BACL) 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**

---

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S) .....	4
TEST METHODOLOGY .....	4
TEST FACILITY .....	5
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>6</b>
JUSTIFICATION .....	6
BLOCK DIAGRAM.....	6
EQUIPMENT MODIFICATIONS .....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
INTERFACE PORTS AND CABLING.....	6
TEST SETUP BLOCK DIAGRAM .....	7
<b>SUMMARY OF TEST RESULTS .....</b>	<b>8</b>
<b>§ 2.1051 - TWO-TONE TEST .....</b>	<b>9</b>
APPLICABLE STANDARDS.....	9
TEST PROCEDURE .....	9
TEST EQUIPMENT LIST AND DETAILS.....	9
ENVIRONMENTAL CONDITIONS .....	9
PLOTS OF TWO-TONE TEST RESULT.....	9
<b>§2.1053 – SPURIOUS RADIATED EMISSIONS.....</b>	<b>14</b>
APPLICABLE STANDARD .....	14
TEST PROCEDURE .....	14
TEST EQUIPMENT LIST AND DETAILS.....	14
ENVIRONMENTAL CONDITIONS .....	15
TEST RESULT .....	15
<b>§2.1046, §22.913(A) – RF OUTPUT POWER.....</b>	<b>16</b>
APPLICABLE STANDARD .....	16
TEST PROCEDURE .....	16
TEST EQUIPMENT LIST AND DETAILS.....	16
ENVIRONMENTAL CONDITIONS .....	16
TEST RESULTS .....	16
<b>§2.1049, §22.917(B) - OCCUPIED BANDWIDTH .....</b>	<b>17</b>
APPLICABLE STANDARD .....	17
TEST PROCEDURE .....	17
TEST EQUIPMENT LIST AND DETAILS.....	17
ENVIRONMENTAL CONDITIONS .....	17
TEST RESULTS .....	17
<b>§2.1051, §22.917 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS.....</b>	<b>22</b>
APPLICABLE STANDARD .....	22
TEST PROCEDURE .....	22
TEST EQUIPMENT LIST AND DETAILS.....	22
ENVIRONMENTAL CONDITIONS .....	22
TEST RESULTS .....	22
<b>§22.917 – BAND EDGE.....</b>	<b>27</b>
APPLICABLE STANDARD .....	27
TEST PROCEDURE .....	27
TEST EQUIPMENT LIST AND DETAILS.....	27
ENVIRONMENTAL CONDITIONS .....	27

---

TEST RESULTS .....	27
--------------------	----

---

## GENERAL INFORMATION

---

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

The *Boston Amplifier, Inc.*'s product, FCC ID: *T5C-81906-BDA-SBX* or the "EUT" as referred to in this report is a Booster / Bi-Directional Amplifier, which measures approximately 121.29mm L x 93.98mm W x 25.40mm H.

*\* The test data gathered are from typical production sample, serial number: B819-2000206 provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of *Boston Amplifier, Inc* 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 output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, and conducted 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 22 Subpart H - Public Mobile Services

Applicable Standards: TIA EIA 603-C, ANSI 63.4-2003, 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 Test site used by BACL to collect radiated and conducted emission measurement data is located in the chamber of the building at 1274 Anvilwood Ave., Sunnyvale, California 94089, 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 registration number: 90464 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

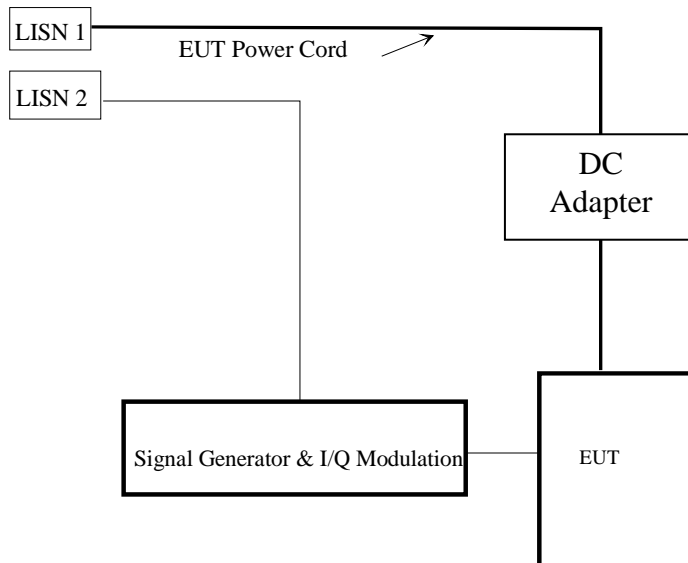
No modifications were made to the EUT.

### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Rohde & Schwarz	Signal Generator	SMIQ 03	DE23746	N/A
Rohde & Schwarz	I/O Modulation Generator	AMIQ	DE30565	N/A

### Interface Ports and Cabling

Cable Description	Length (M)	From	To
RF Cable	1.5	EUT Uplink or Downlink port	Signal generator
Power cable	6	EUT Power port	DC Power Adapter
RF Cable	1.5 x 2	SMIQ 03	AMIQ

**Test Setup Block Diagram**

---

## SUMMARY OF TEST RESULTS

---

Results reported relate only to the product tested.

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1047	Modulation Characteristics	N/A
§ 2.1051	Two-Tone Test	Compliant
§ 2.1053	Field Strength of Spurious Radiation	Compliant
§ 2.1091	RF Exposure	Compliant
§ 2.1046, § 22.913 (a)	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	N/A
§ 22.917	Band Edge	Compliant



## § 2.1051 - TWO-TONE TEST

### Applicable Standards

According to IS-138A (3.4.4), Inter modulation 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 1 MHz. Sufficient scans were taken to show any out of band emissions up to  $10^{\text{th}}$  harmonic. Two input signals are equal in level (and can be raised equally), were send to the EUT.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde &Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006
Rohde &Schwarz	I/Q Modulation	AMIQ-K11	831038/0023	5/3/2005

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

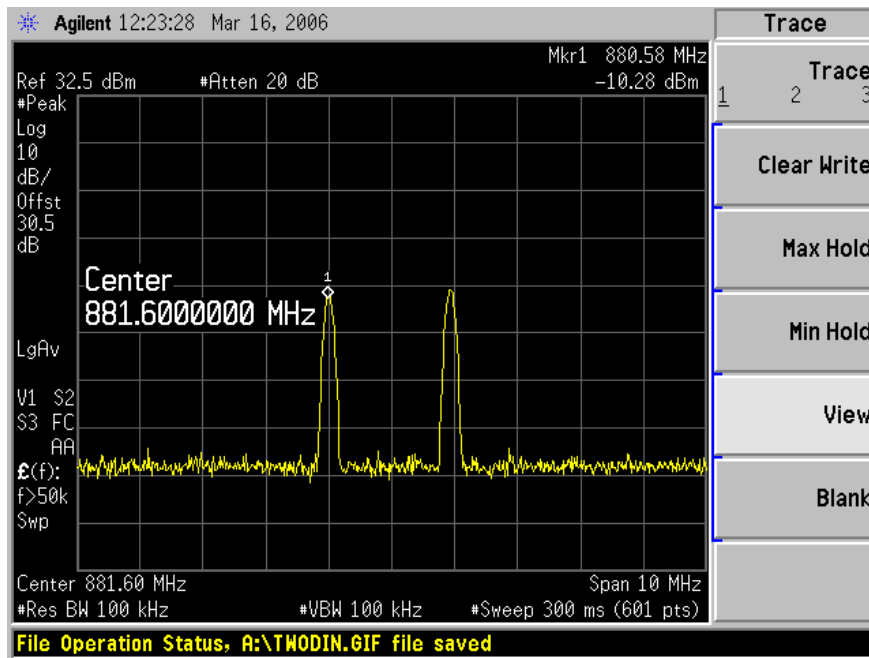
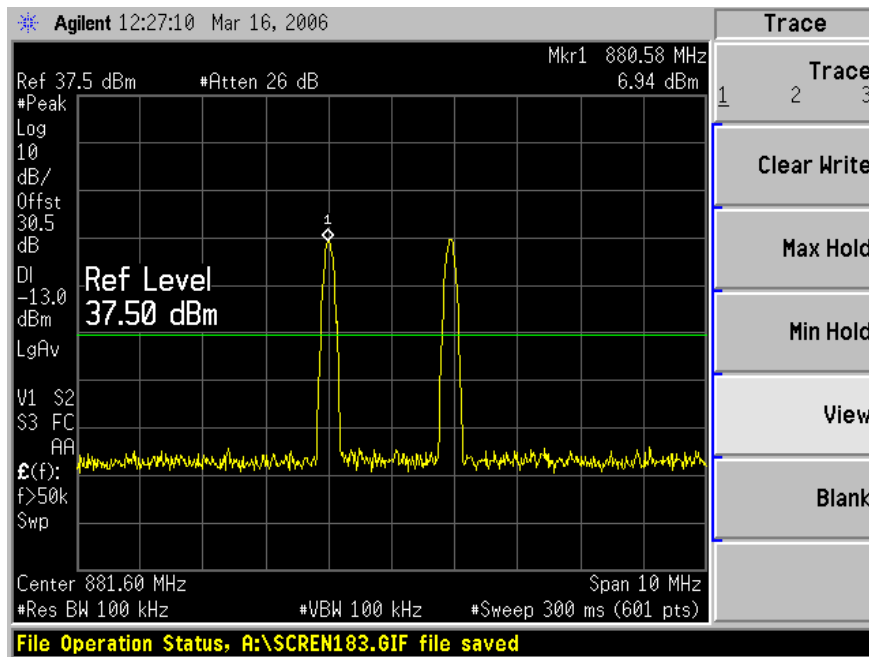
### Environmental Conditions

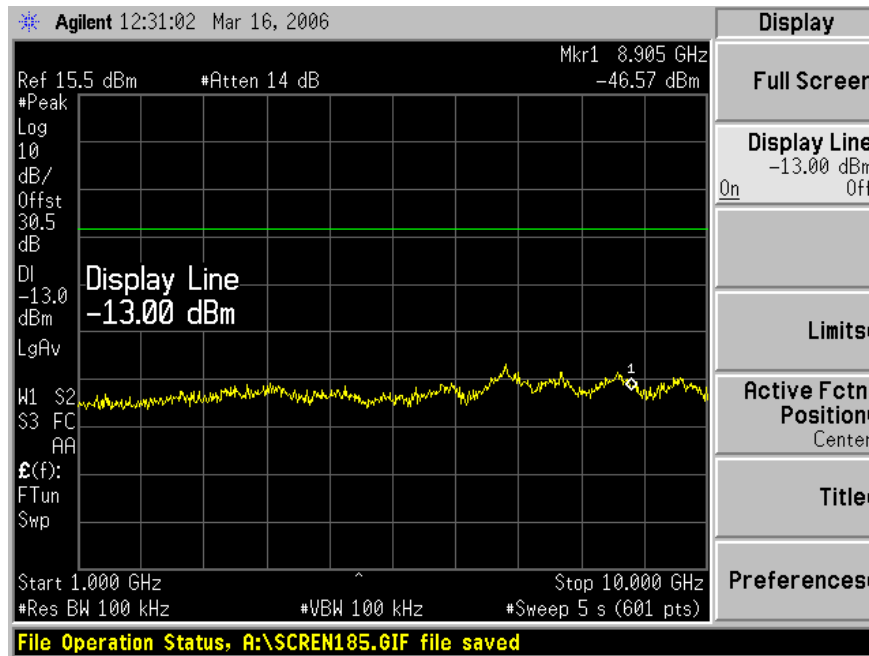
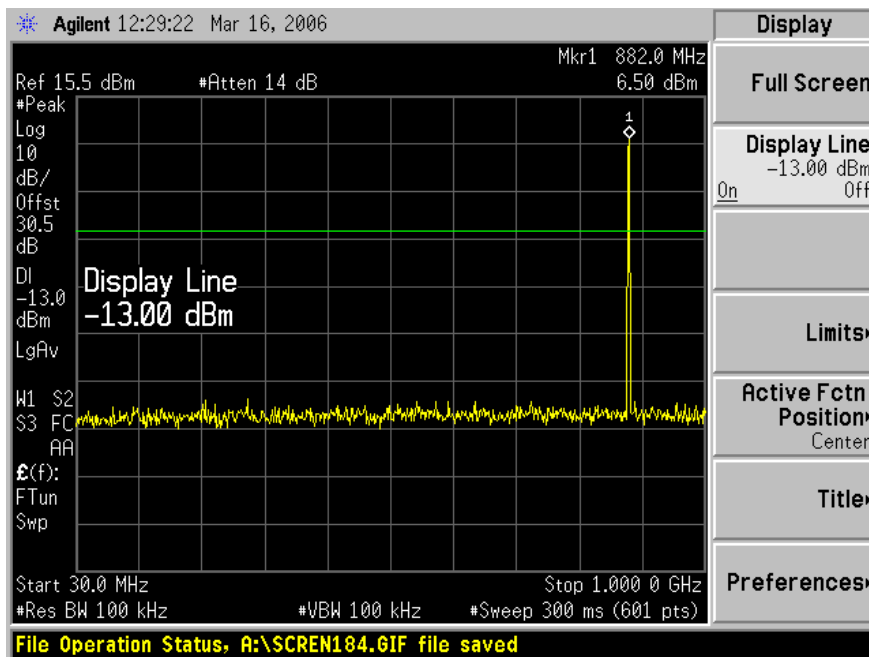
Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021 mbar

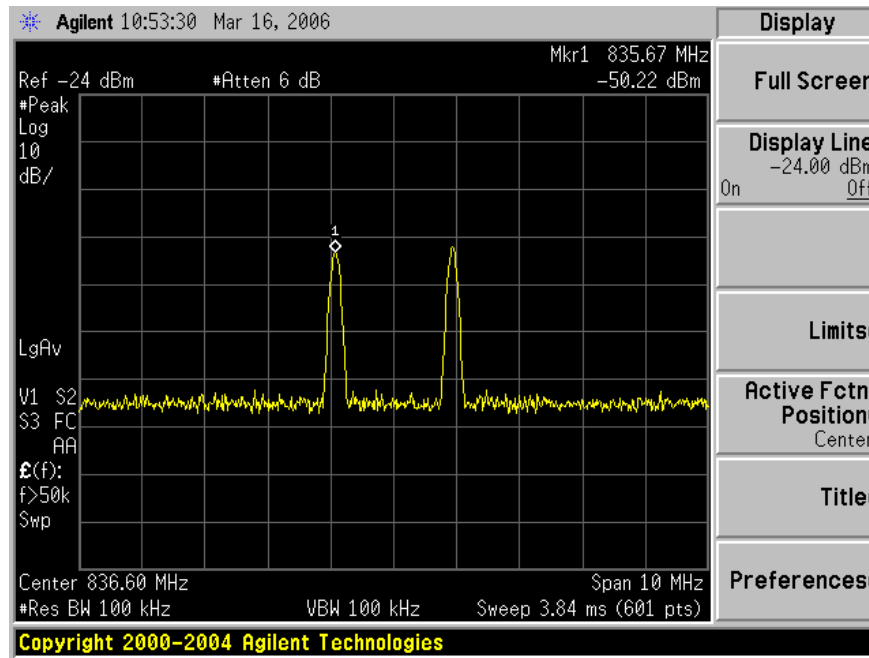
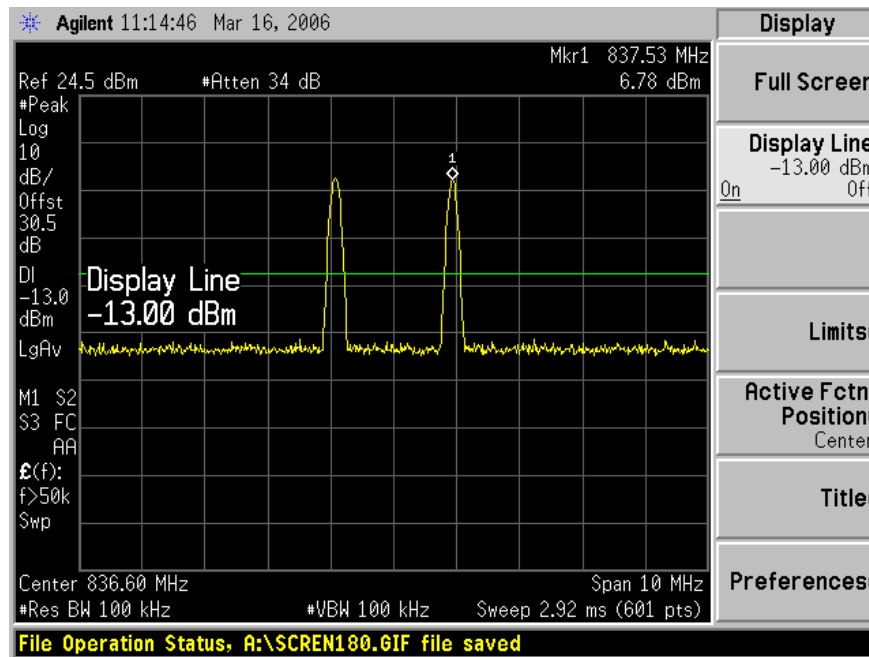
*The testing was performed by Taylor Tsai on 2006-03-06.*

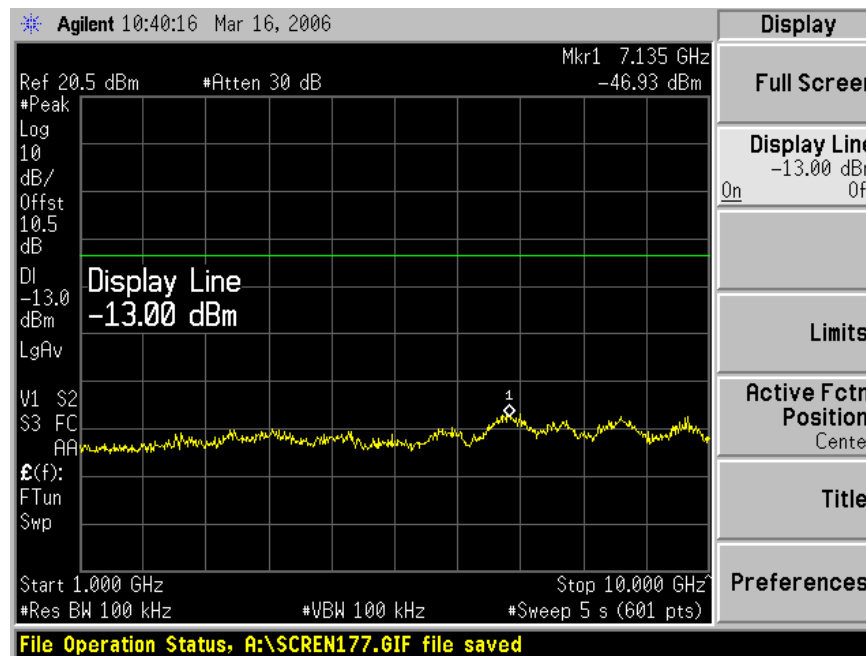
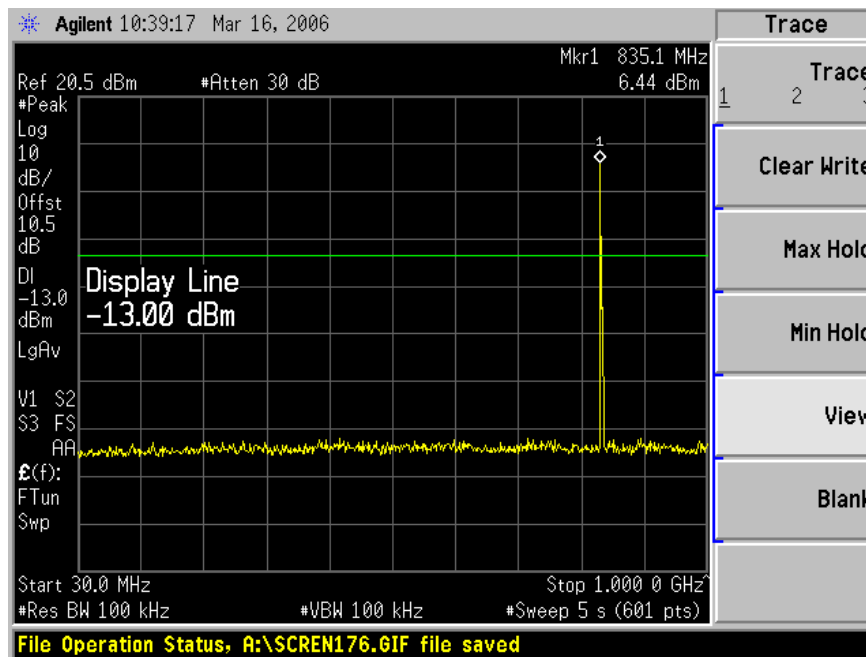
### Plots of Two-Tone Test Result

Please refer to plots hereinafter.

*Downlink IN**Downlink OUT*



*Uplink IN**Uplink OUT*



## §2.1053 – SPURIOUS RADIATED EMISSIONS

### Applicable Standard

Requirements: CFR 47, § 2.1053.

### Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

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

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

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde &Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006
A.H. system	Antenna, Horn, DRG	SAS-200/571	261	4/20/2005
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	8/17/2005
Agilent	Amplifier, Pre	8449B	3008A01978	8/10/2005
ETS	Antenna, Log-Periodic	3148	4-1155	12/14/2005
ETS	Antenna, Biconical	3110B	9603-2315	12/14/2005
HP	Generator, Signal	83650B	3614A00400	5/10/2005

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

## Environmental Conditions

Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021mbar

*The testing was performed by Taylor Tsai on 2006-03-06.*

## Test Result

The worse case readings are

- 13.90 dB at 4265.05 MHz in Vertical Polarization, uplink
- 16.60 dB at 2126.32 MHz in Vertical Polarization, downlink

Uplink Transmission in Middle Channel (836.6 MHz) scan from 30MHz - 10 GHz

Indicated Reading		Table	Antenna		Substitution		Antenna	Cable	Absolute	Limit	Margin
Freq. (MHz)	Ampl. (dBuV/m)	Degree	m	H/V	Freq. (MHz)	Level (dBm)	Gain	Loss	Level (dBm)	dBm	
4265.05	47.40	57.00	2.20	V	4265.05	-34.60	9.30	1.6	-26.90	-13	-13.90
2132.15	52.00	93.00	1.20	V	2132.15	-38.50	9.30	1.6	-30.80	-13	-17.80
4265.05	44.00	302.00	1.80	H	4265.05	-39.00	9.30	1.6	-31.30	-13	-18.30
2132.15	49.70	43.00	1.60	H	2132.15	-40.00	9.30	1.6	-32.30	-13	-19.30

Downlink Transmission in Middle Channel (881.6 MHz) scan from 30MHz - 10 GHz

Indicated Reading		Table	Antenna		Substitution		Antenna	Cable	Absolute	Limit	Margin
Freq. (MHz)	Ampl. (dBuV/m)	Degree	m	H/V	Freq. (MHz)	Level (dBm)	Gain	Loss	Level (dBm)	dBm	
2126.32	46.67	0.00	2.48	V	2126.32	-37.30	9.30	1.6	-29.60	-13	-16.60
2126.32	43.67	341.00	2.10	H	2126.32	-38.40	9.30	1.6	-30.70	-13	-17.70
4271.20	43.50	30.00	2.63	V	4271.20	-39.60	9.30	1.6	-31.90	-13	-18.90
4271.20	37.33	315.00	2.70	H	4271.20	-41.20	9.30	1.6	-33.50	-13	-20.50

## §2.1046, §22.913(a) – RF 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 input of the spectrum analyzer through sufficient attenuation.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

### Environmental Conditions

Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021mbar

*The testing was performed by Taylor Tsai on 2006-03-06.*

### Test Results

MODE		Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
CDMA	Uplink	Middle	836.52	25.40	0.347	7.00
	Downlink	Middle	881.52	9.40	0.008	7.00
GSM	Uplink	Middle	836.60	21.00	0.126	7.00
	Downlink	Middle	881.60	6.00	0.004	7.00
TDMA	Uplink	Middle	836.50	22.83	0.192	7.00
	Downlink	Middle	881.52	5.50	0.004	7.00
AMP (FM)	Uplink	Middle	836.52	22.83	0.192	7.00
	Downlink	Middle	881.52	6.17	0.004	7.00



**§2.1049, §22.917(b) - OCCUPIED BANDWIDTH****Applicable Standard**

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

**Test Procedure**

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

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

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde &Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

**Environmental Conditions**

Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021mbar

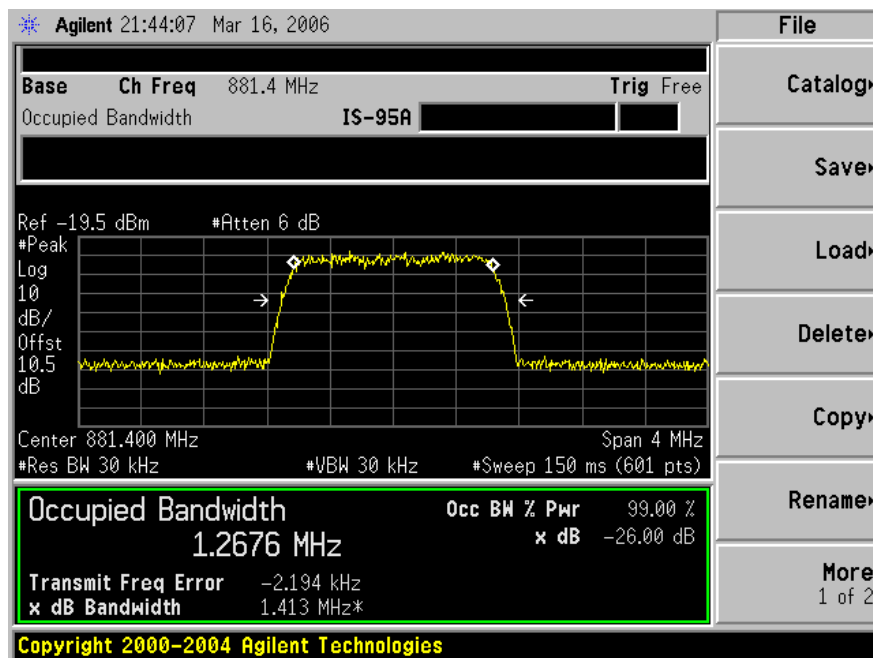
*The testing was performed by Taylor Tsai on 2006-03-06.*

**Test Results**

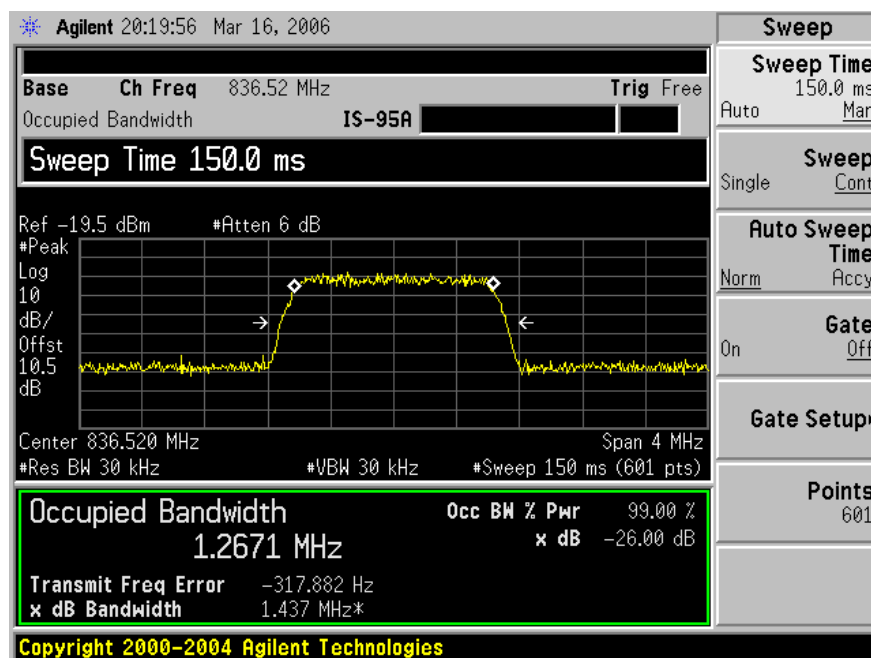
MODE		Channel	Frequency (MHz)	Emission Bandwidth in KHz
CDMA	Uplink	Middle	836.52	1267.1
	Downlink	Middle	881.40	1267.6
GSM	Uplink	Middle	836.60	250.21
	Downlink	Middle	881.60	252.01
TDMA	Uplink	Middle	836.50	29.53
	Downlink	Middle	881.50	29.17
AMPS (FM)	Uplink	Middle	836.50	28.36
	Downlink	Middle	881.50	28.47

Please refer to the following plots.

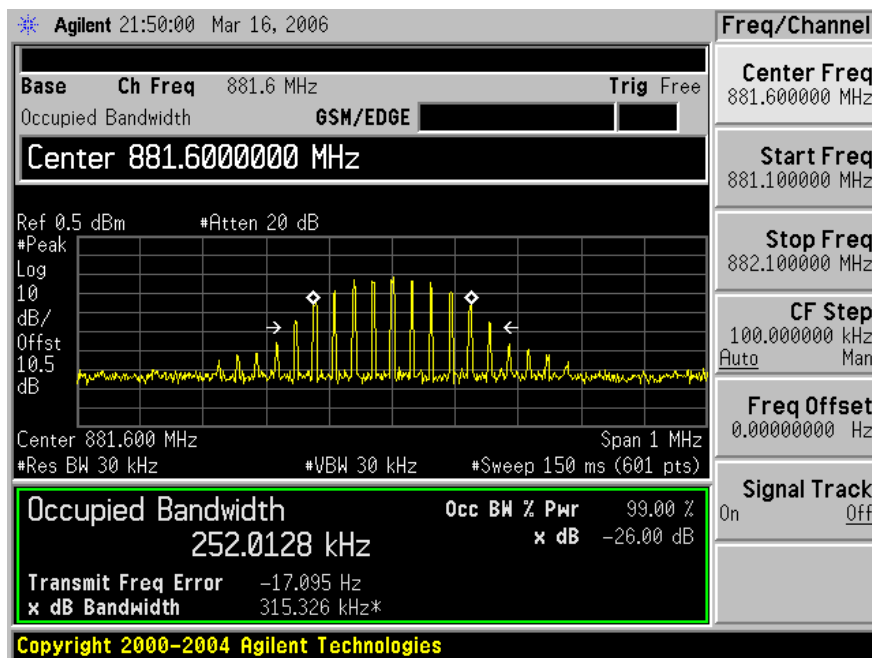
## CDMA Downlink



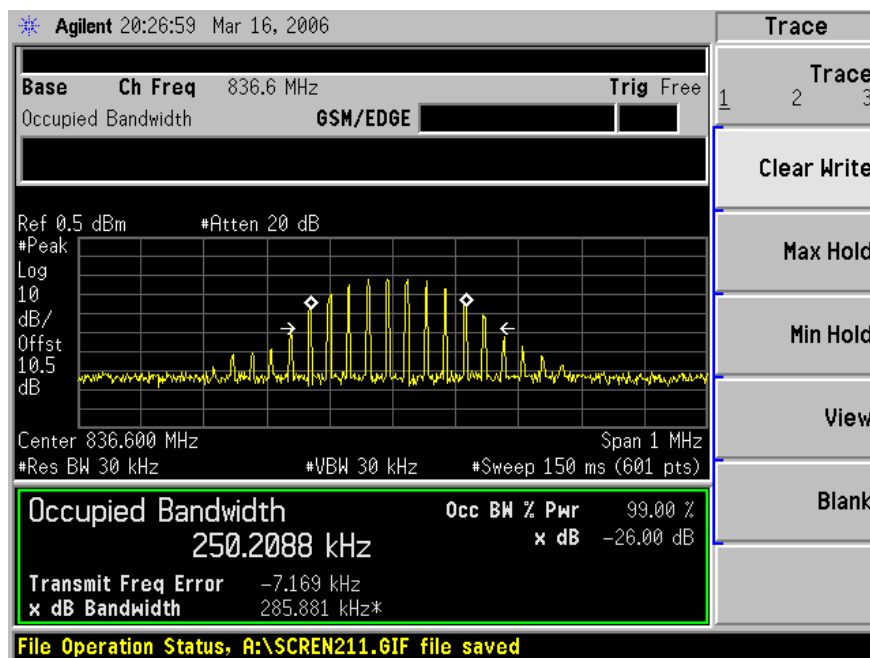
## CDMA Uplink



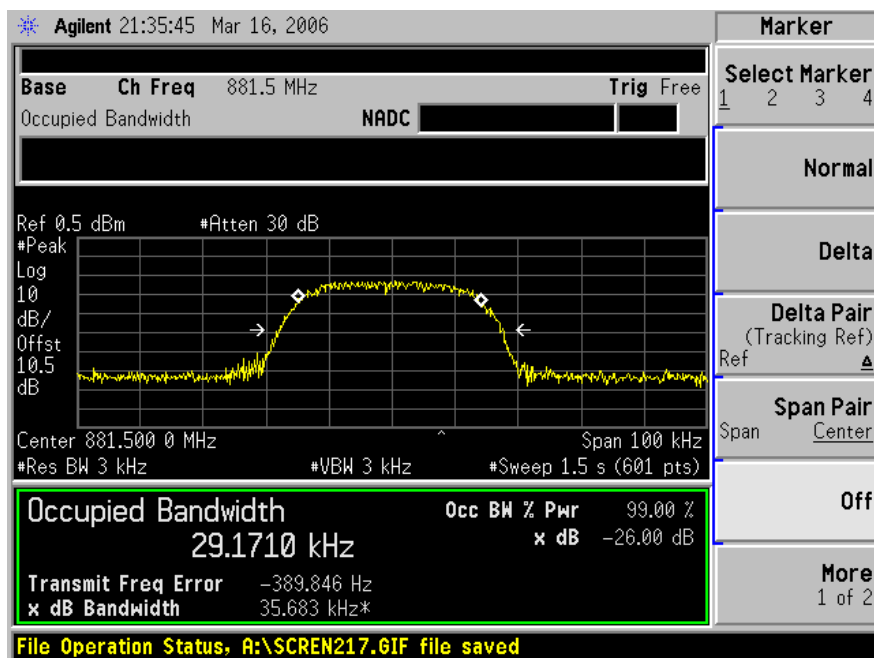
## GSM Downlink



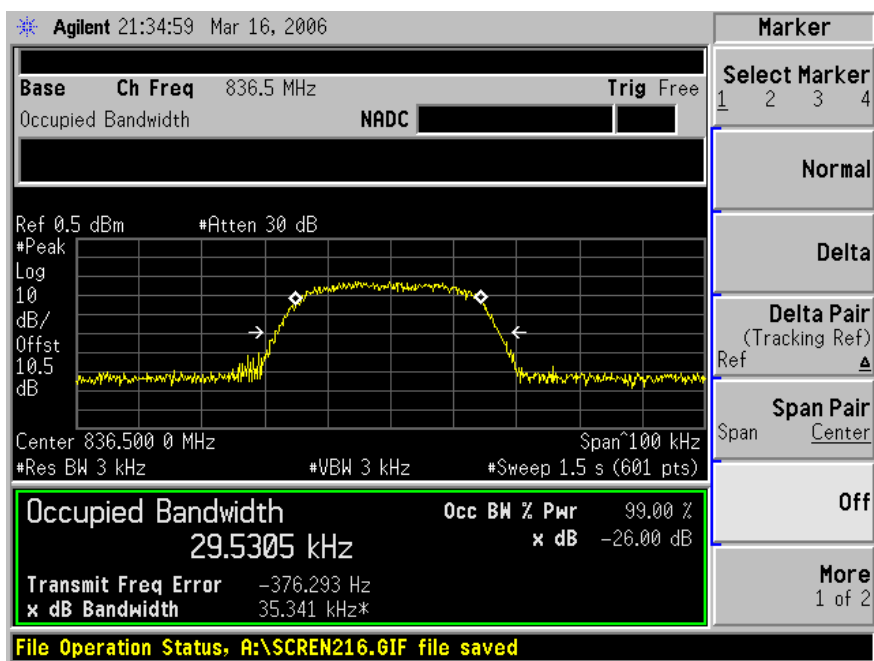
## GSM Uplink



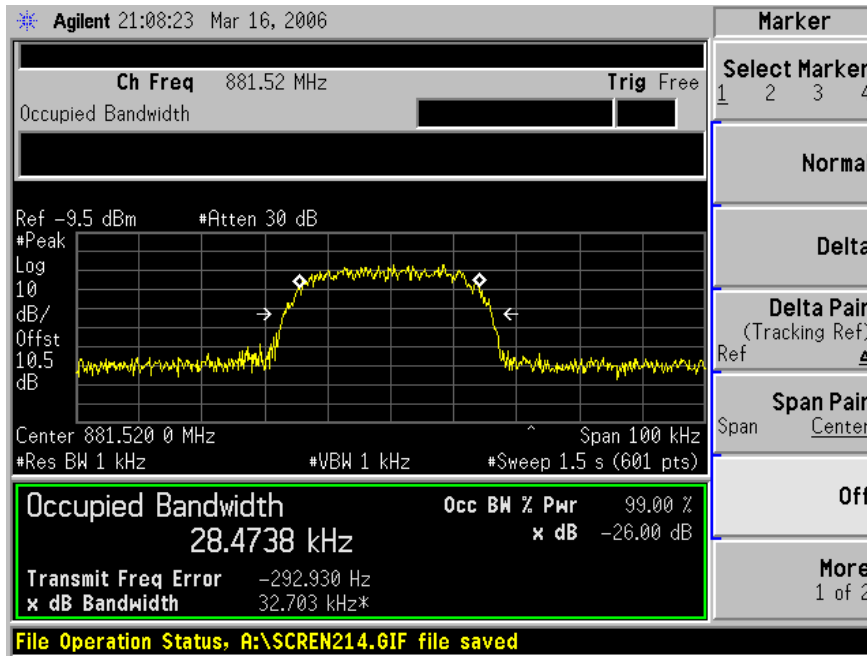
## TDMA Downlink



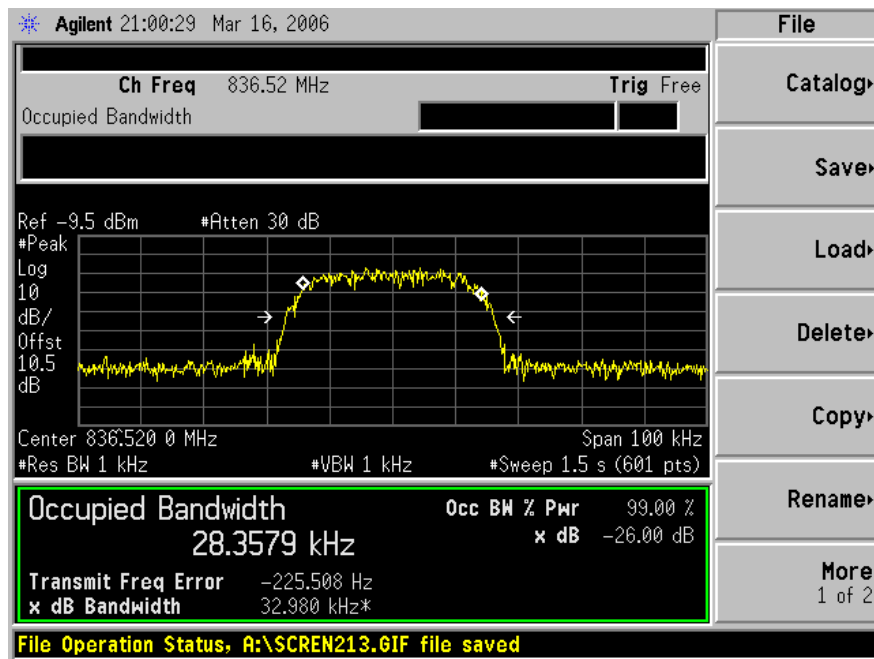
## TDMA Uplink



## AMPS Downlink



## AMP Uplink



---

**§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 through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

**Environmental Conditions**

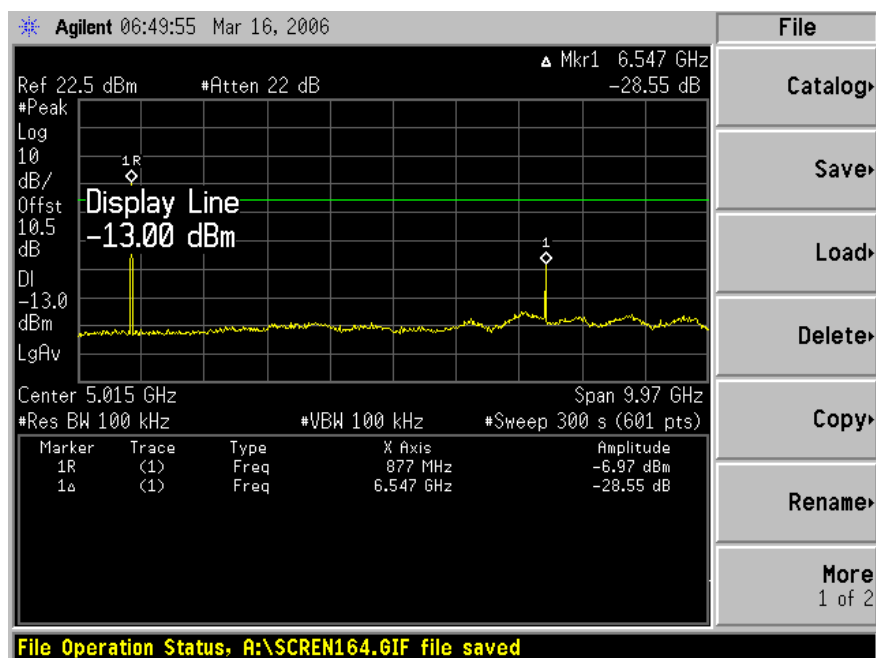
Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021mbar

*The testing was performed by Taylor Tsai on 2006-03-06.*

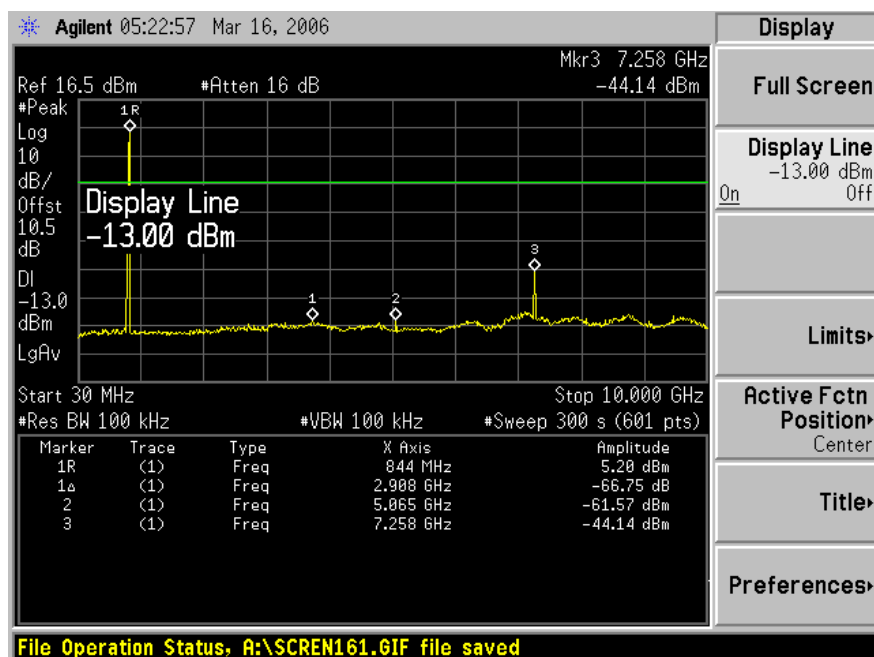
**Test Results**

Please refer to the hereinafter plots.

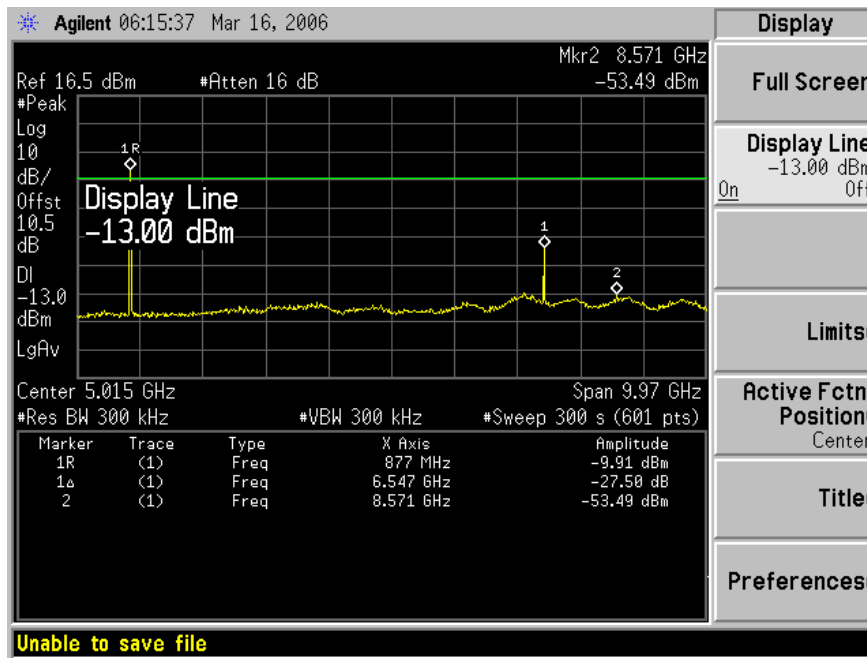
## AMPS Downlink



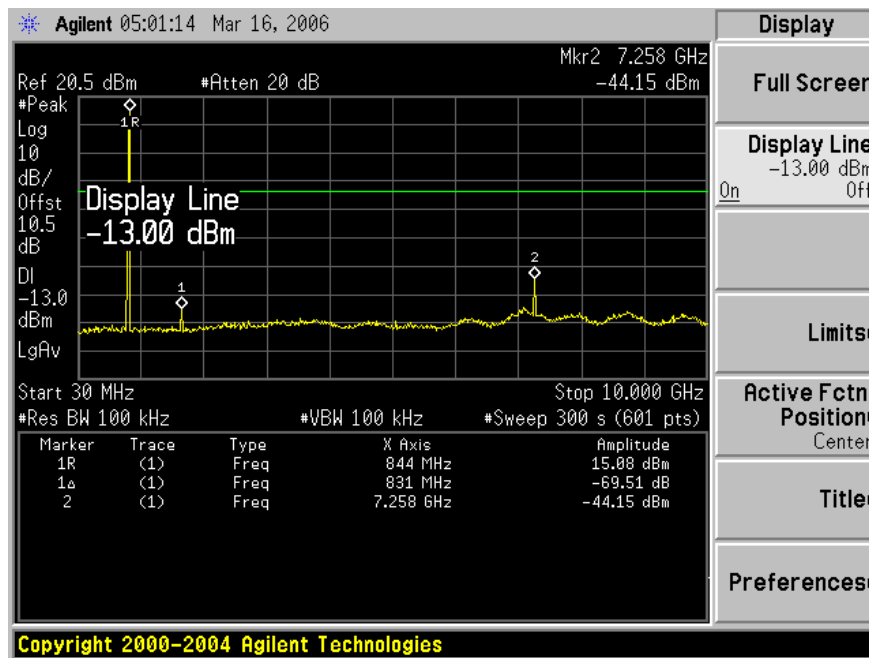
## AMPS Uplink



## CDMA Downlink

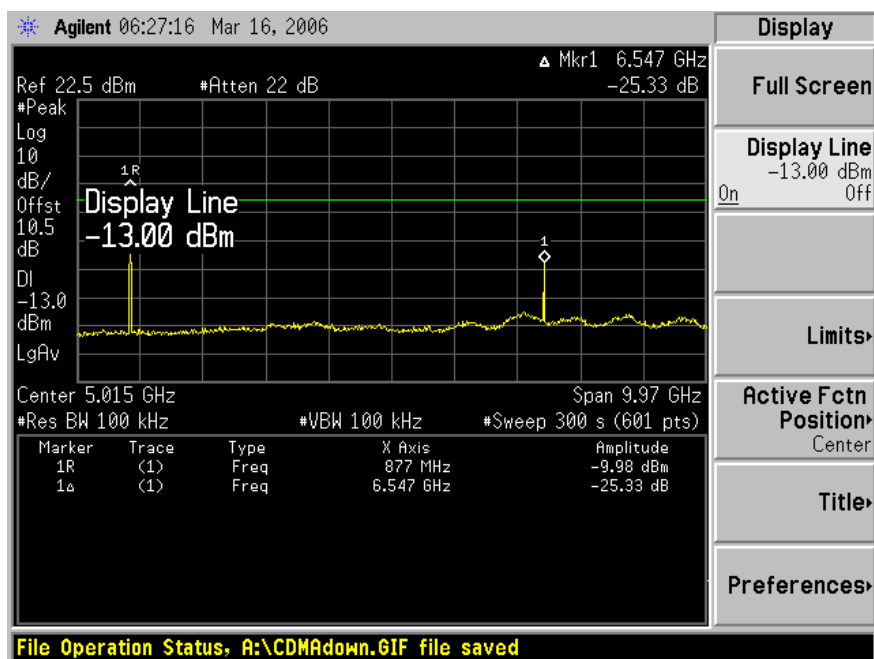


## CDMA Uplink

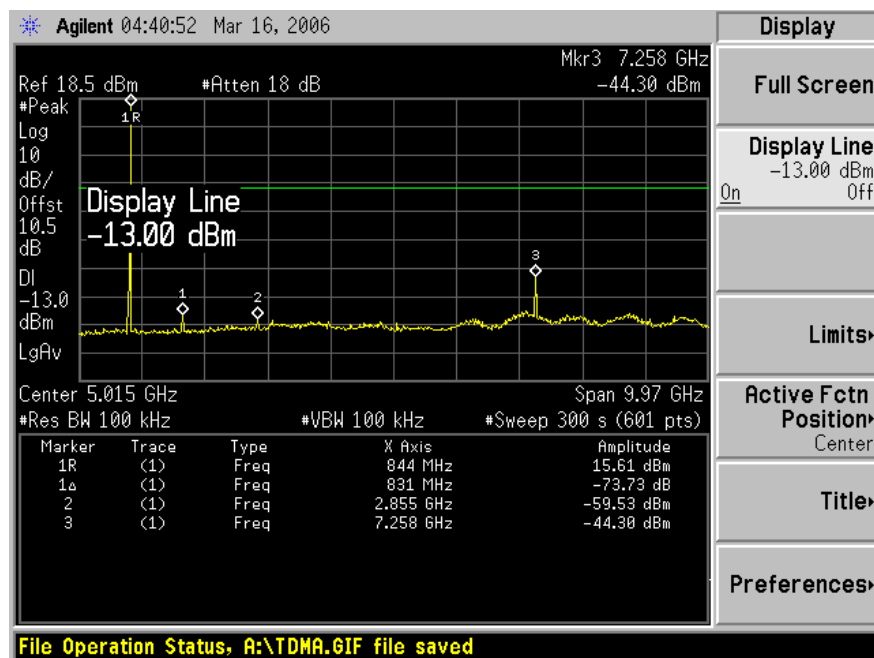




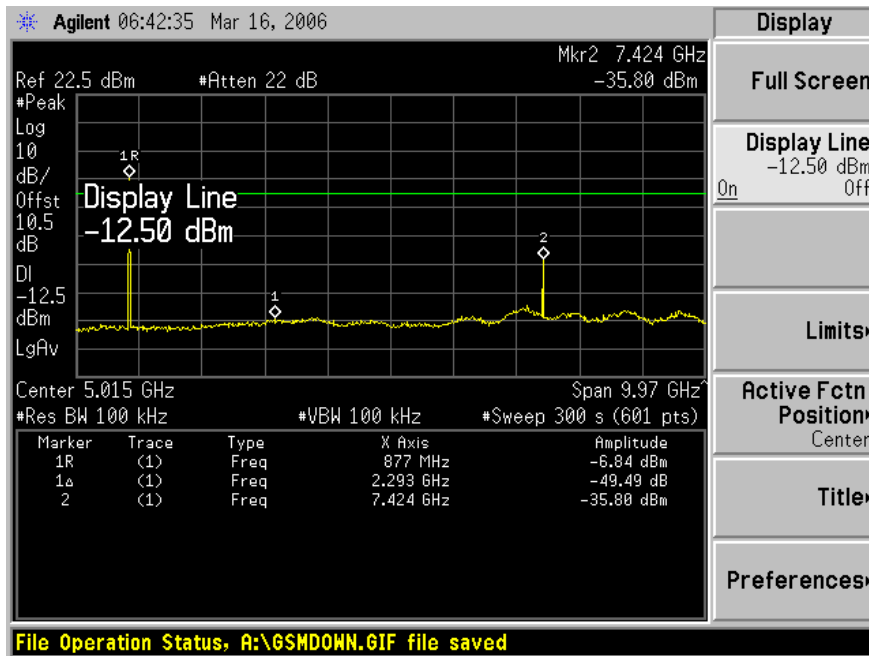
## GSM Downlink



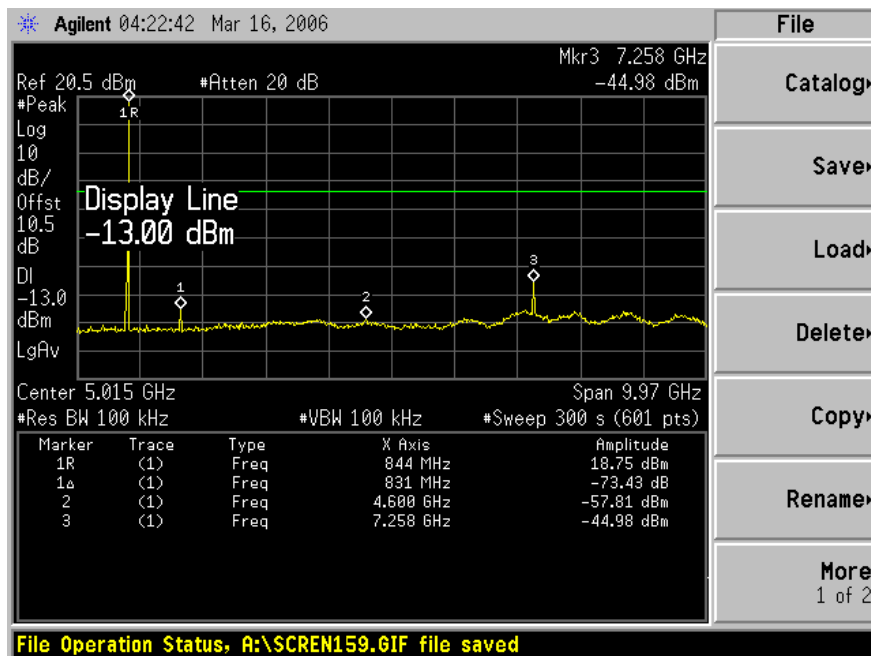
## GSM Uplink



## TDMA Downlink



## TDMA Uplink



## §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
Rohde &Schwarz	Generator, Signal	SMIQ03	849192/0085	5/2/2005
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

### Environmental Conditions

Temperature:	24° C
Relative Humidity:	42%
ATM Pressure:	1021mbar

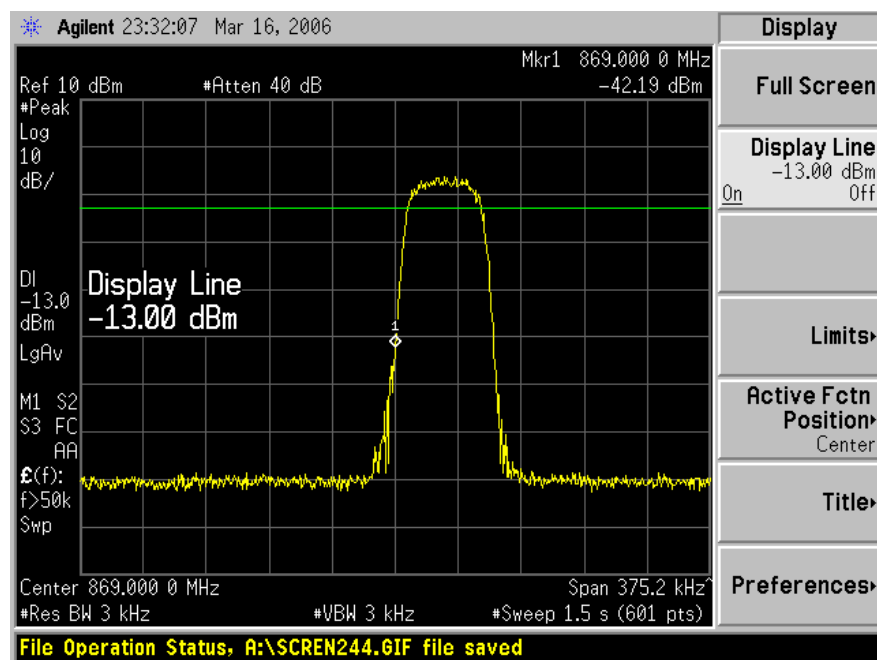
*The testing was performed by Taylor Tsai on 2006-03-06.*

### Test Results

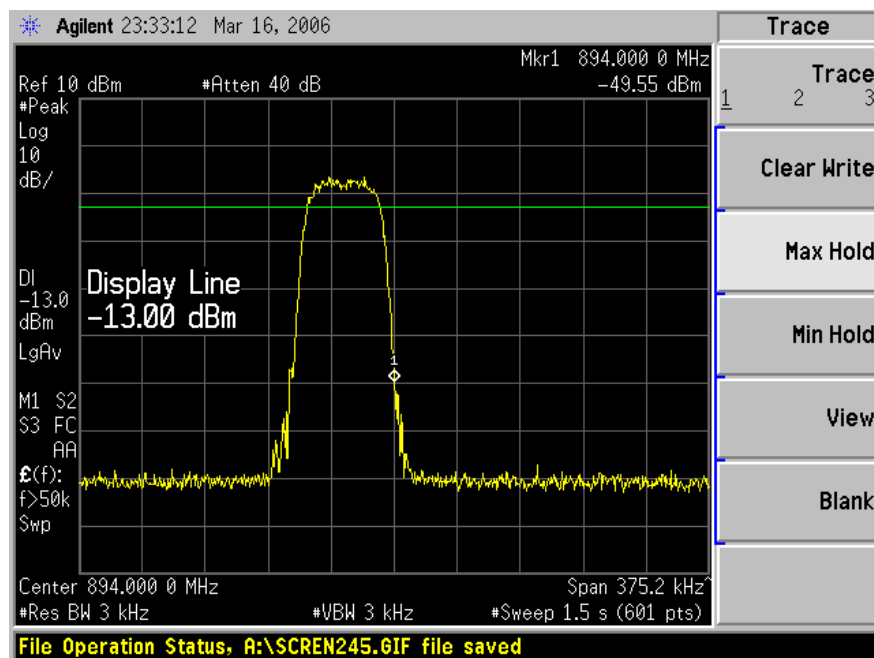
Please refer to the following plots.

## AMPS Downlink

## Low channel

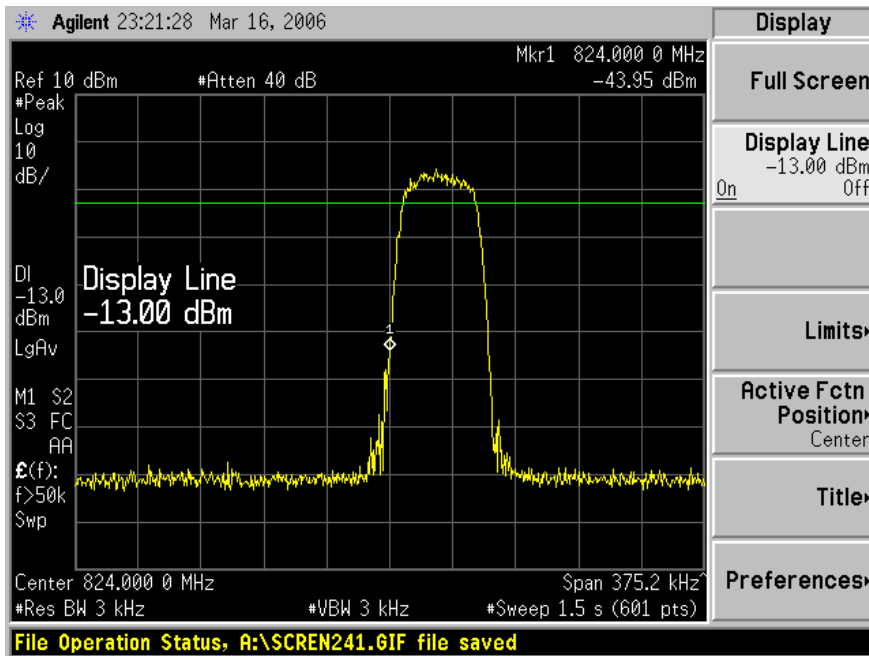


## High channel

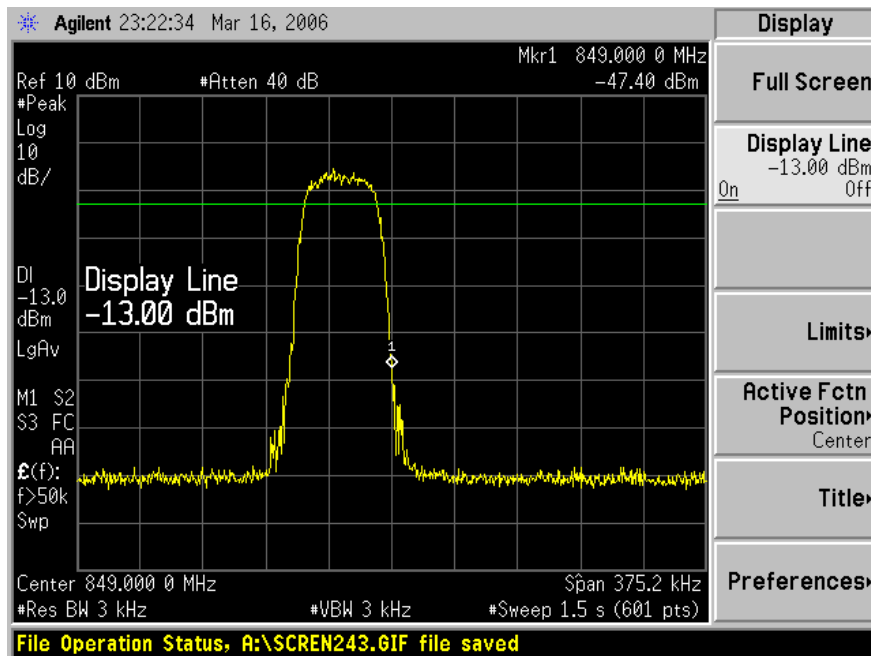


## AMPS Uplink

## Low channel

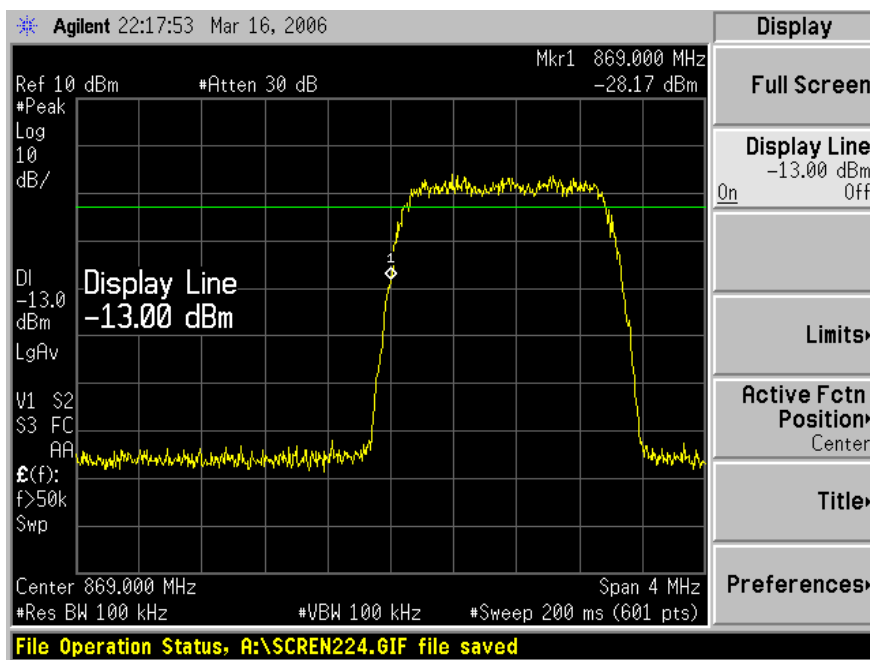


## High Channel

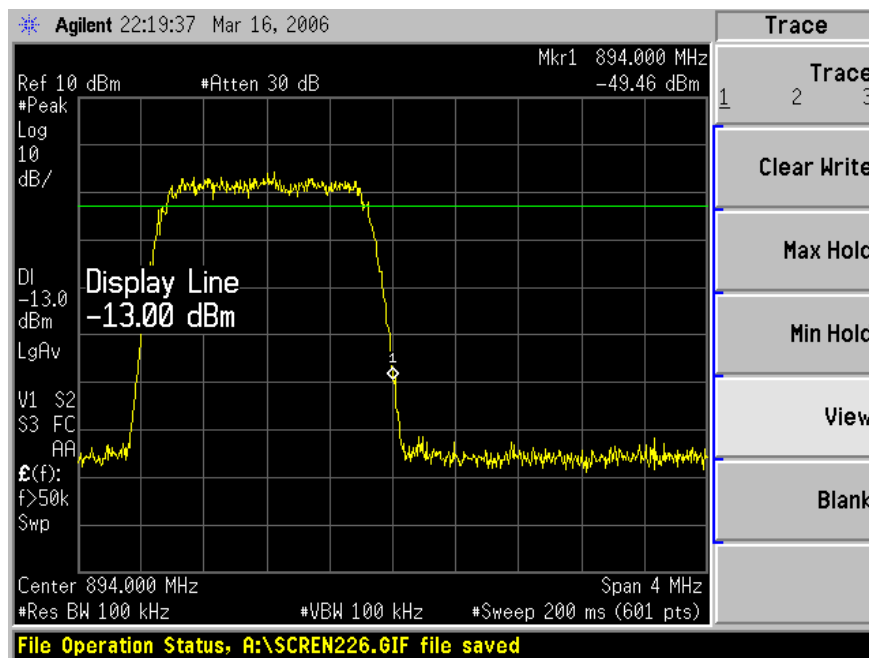


## CDMA Downlink

## Low Channel

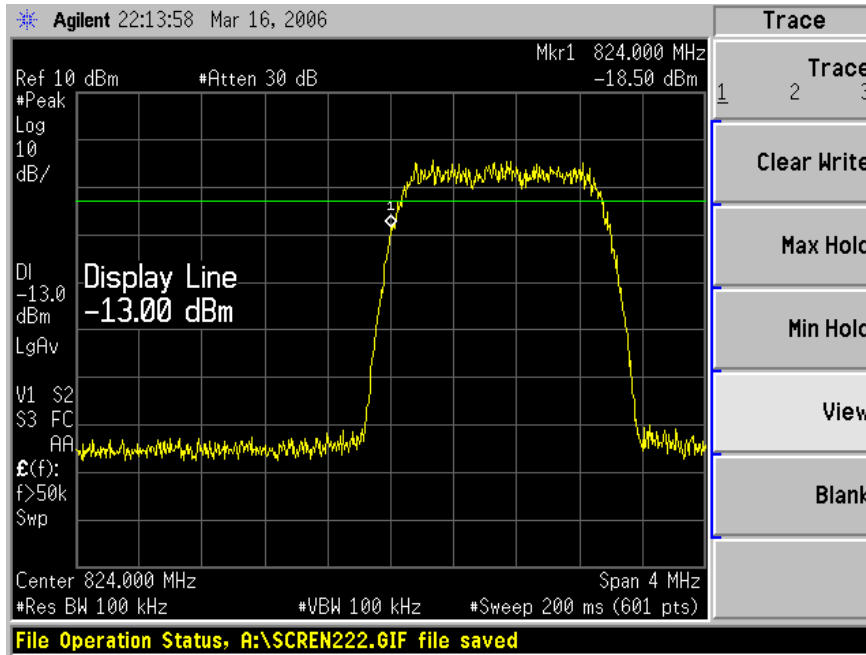


## High Channel

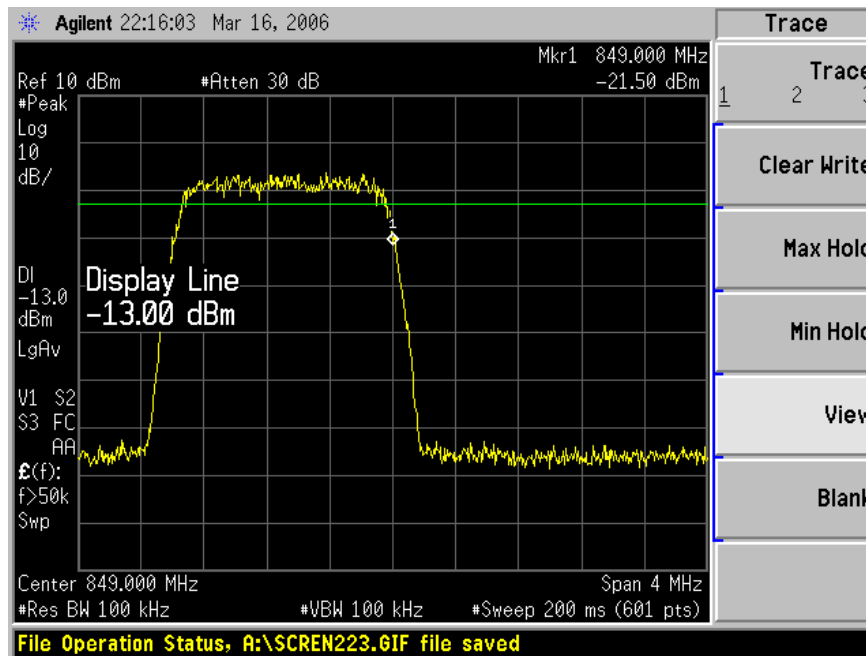


## CDMA Uplink

## Low Channel

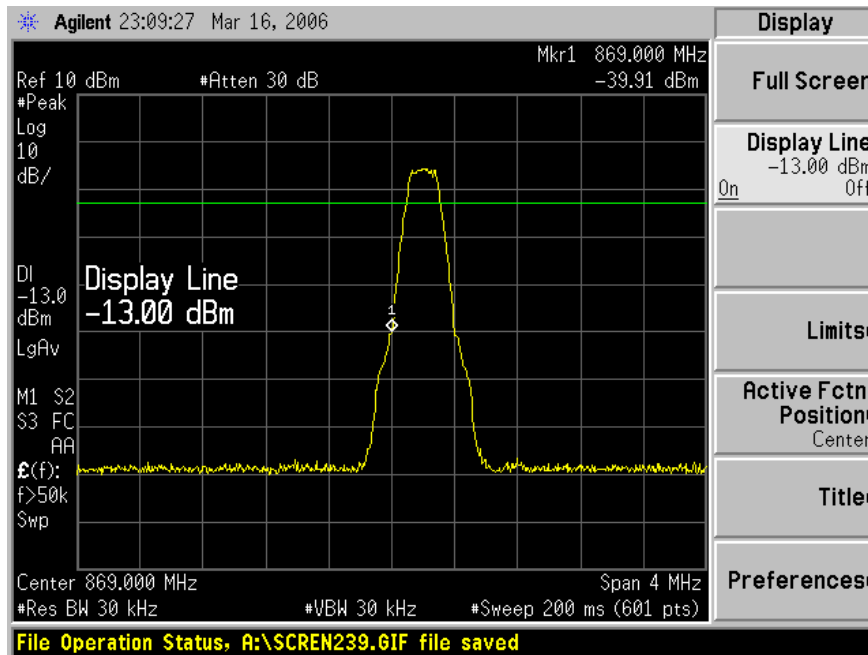


## High Channel

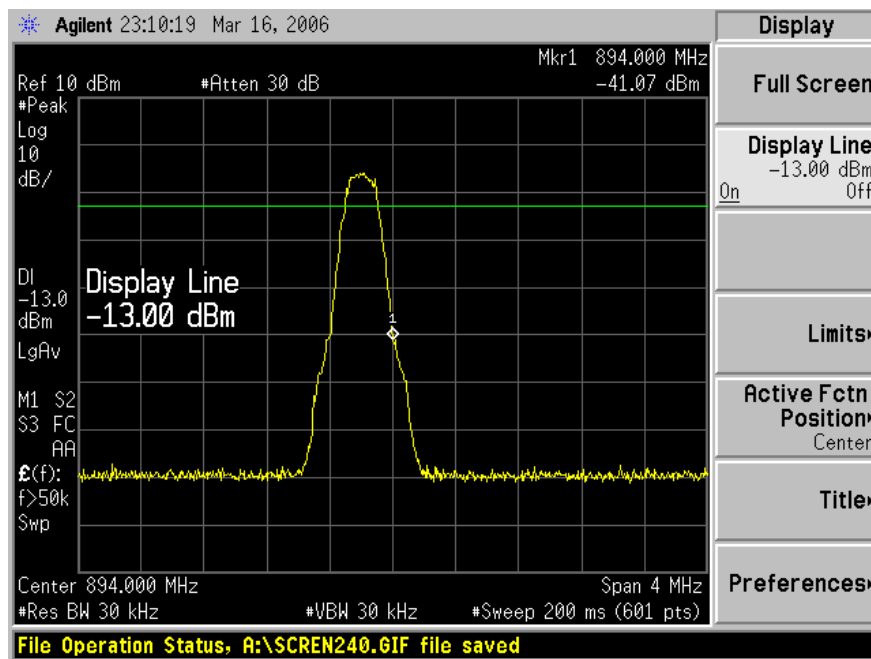


## GSM Downlink

## Low channel



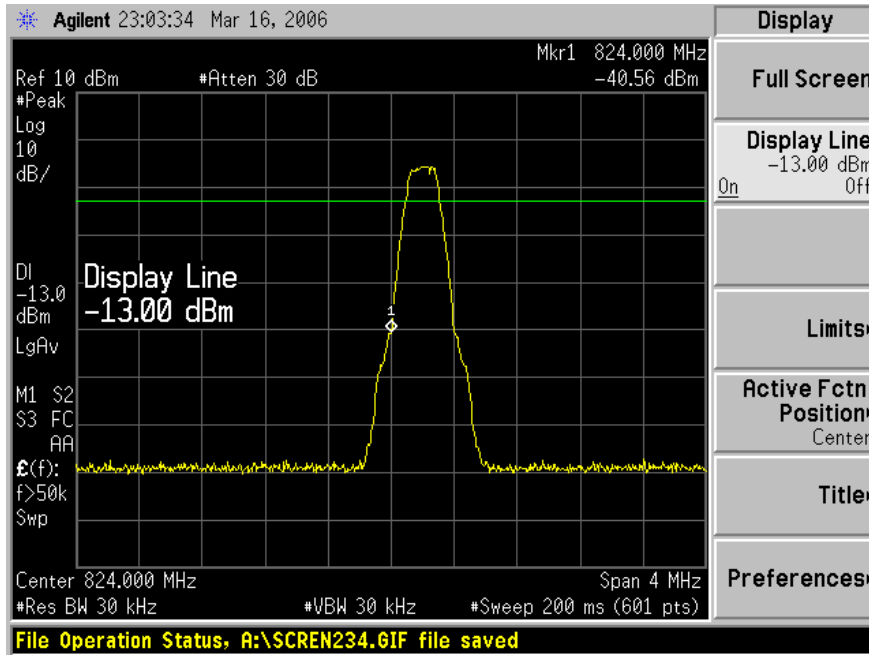
## High Channel



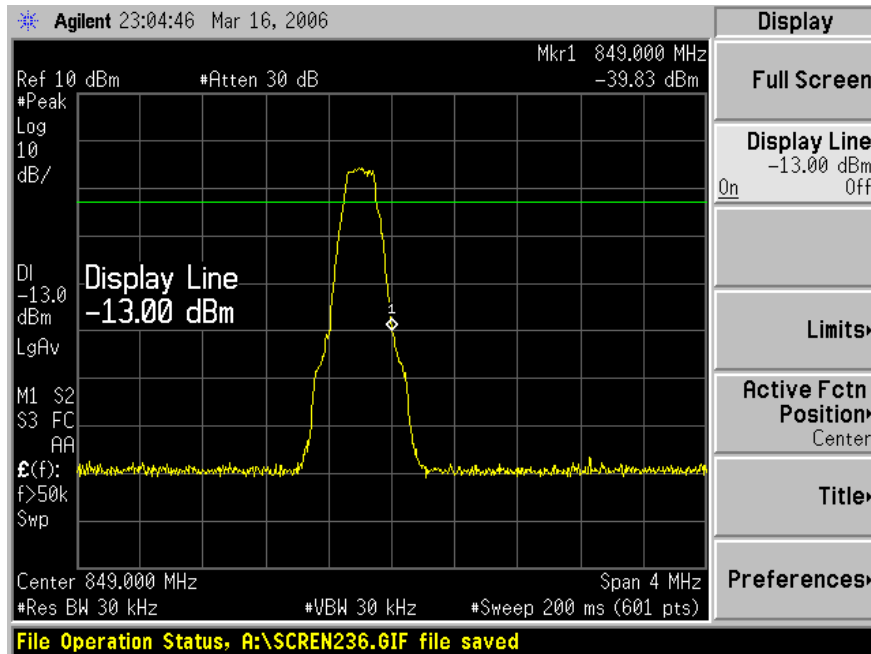


## GSM Uplink

## Low channel

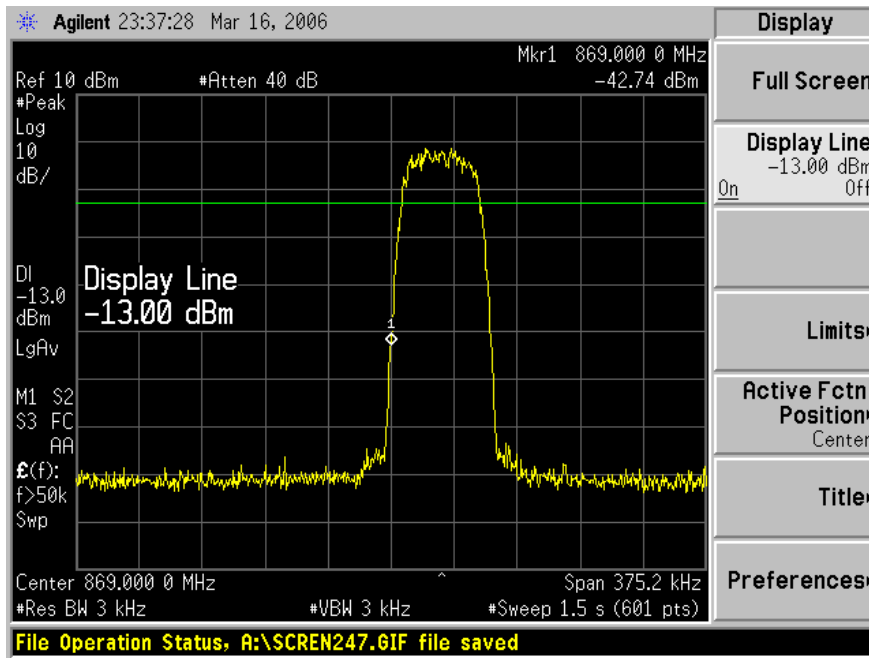


## High channel

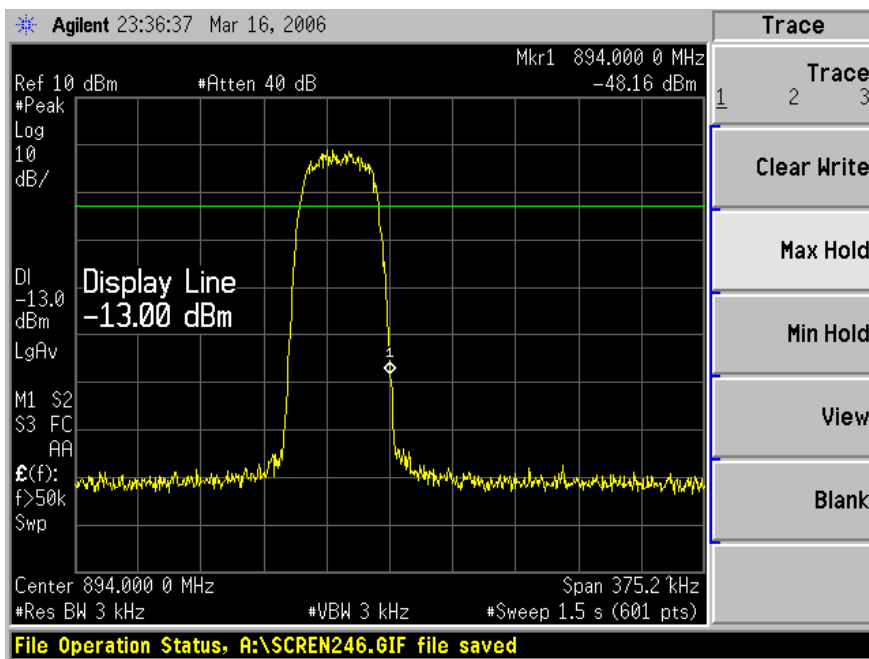


## TDMA Downlink

## Low channel

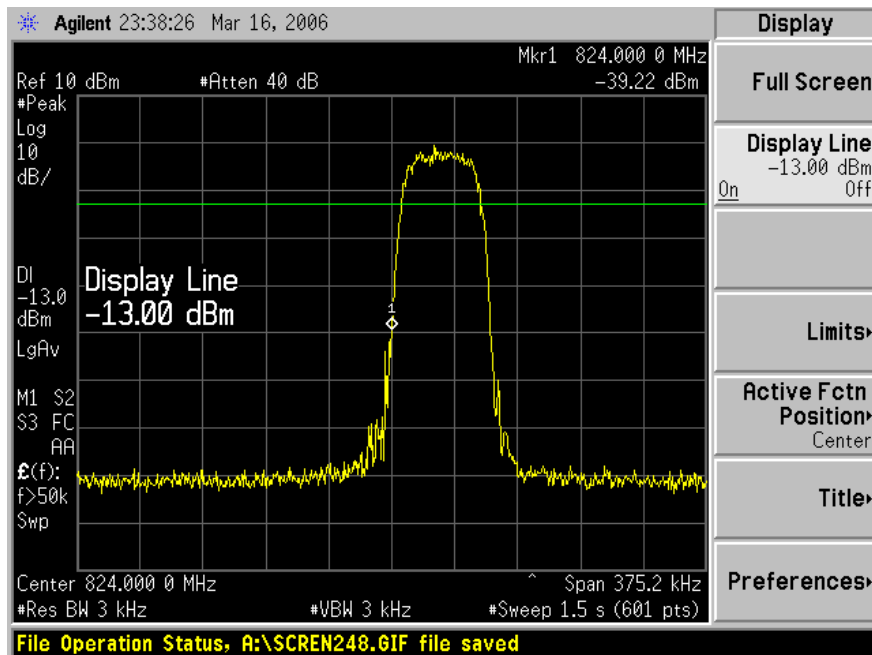


## High channel



## TDMA Uplink

## Low channel



## High channel

