



ADDENDUM TO POWERWAVE TECHNOLOGIES TEST REPORT FC04-040

FOR THE

SINGLE CHANNEL 1900 MHZ AMPLIFIER MODULE, SPA9322-30C (ROYALE)

FCC PART 24E AND RSS-133

COMPLIANCE

DATE OF ISSUE: JUNE 17, 2004

PREPARED FOR:

Powerwave Technologies
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Date of test: March 29 - June 9, 2004

Report No.: FC04-040A

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ADMINISTRATIVE INFORMATION

DATE OF TEST: March 29 - June 9, 2004

DATE OF RECEIPT: March 29, 2004

PURPOSE OF TEST: To demonstrate the compliance of the Single Channel 1900 MHz Amplifier Module, SPA9322-30C (Royale) with the requirements for FCC Part 24E and RSS-133 devices.
Addendum A is to revise the test conditions on page 22.

TEST METHOD: FCC Part 24E and RSS-133

FREQUENCY RANGE TESTED: 9 kHz-20 GHz

MANUFACTURER: Powerwave Technologies
1801 E. St. Andrew Place
Santa Ana, CA 92705

REPRESENTATIVE: Jeffrey Dale

TEST LOCATION: CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92621

SUMMARY OF RESULTS

As received, the Powerwave Technologies Single Channel 1900 MHz Amplifier Module, SPA9322-30C (Royale) was found to be fully compliant with the following standards and specifications:

Canadian Standard	Canadian Section	FCC Standard	FCC Section	Test Description
RSS 133	5.5	NA	NA	Types of modulation
RSS 133	6.2	47 CFR	24.232	Power Output
RSS 133	6.3	47 CFR	24.238	Emissions Limitations
IC 3172-D		100638		Site File No.

CONDITIONS FOR COMPLIANCE

Modification: 1930-1990 MHz band pass duplexer CMD230, SN 000903 installed on the RF output port.

APPROVALS

Steve Behm, Director of Engineering Services

QUALITY ASSURANCE:



Joyce Walker, Quality Assurance Administrative Manager

TEST PERSONNEL:



Eddie Wong, EMC Engineer



Stuart Yamamoto, EMC Engineer

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The EUT tested by CKC Laboratories was a production unit

EQUIPMENT UNDER TEST

Single Channel 1900 MHz Amplifier Module

Manuf: Powerwave Technologies
Model: SPA9322-30C (Royale)
Serial: 028
FCC ID: pending

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

DC Power Supply

Manuf: Xantrex
Model: XTS 30-2X
Serial: 60397
FCC ID: NA

Signal Generator

Manuf: Agilent
Model: E4433B
Serial: US40051207
FCC ID: DoC

Signal Amplifier

Manuf: Mini Circuits
Model: ZHL-42
Serial: NA
FCC ID: DoC

Power Meter

Manuf: Agilent
Model: E4419B
Serial: GB4020760
FCC ID: NA

27 VDC Power Supply

Manuf: HP
Model: 6269B
Serial: 2436A-11867
FCC ID: NA

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

FCC 2.1033(c)(3) USER'S MANUAL

The necessary information is contained in a separate document.

FCC 2.1033 (c)(4) TYPE OF EMISSIONS

GXW (GSM/GMSK) and G7W (EDGE).

FCC 2.1033 (c)(5) FREQUENCY RANGE

1930 MHz – 1990 MHz.

FCC 2.1033 (c)(6) OPERATING POWER

30 Watts.

FCC 2.1033 (c)(7) MAXIMUM POWER RATING

100 Watts.

FCC 2.1033 (c)(8) DC VOLTAGES

The necessary information is contained in a separate document.

FCC 2.1033 (c)(9) TUNE-UP PROCEDURE

The necessary information is contained in a separate document.

FCC 2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION

The necessary information is contained in a separate document.

FCC 2.1033(c)(11) LABEL AND PLACEMENT

The necessary information is contained in a separate document.

FCC 2.1033(c)(12) SUBMITTAL PHOTOS

The necessary information is contained in a separate document.

FCC 2.1033 (c)(13) MODULATION INFORMATION

GSM and EDGE.

FCC 2.1033(c)(14)/2.1046/24.232(a) - RF POWER OUTPUT

§24.232 Power and antenna height limits.

(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. See 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power; see Table 1 of this section. **In no case may the peak output power of a base station transmitter exceed 100 watts.** The service area boundary limit and microwave protection criteria specified in §§24.236 and 24.237 apply.

Table 1: Reduced Power for Base Station Antenna Heights Over 300 Meters

HAAT in meters	Maximum E.I.R.P. (watts)
≤300	1640
≤500	1070
≤1000	490
≤1500	270
≤2000	160

The EUT is a RF amplifier. The manufacture does not provide an antenna for sale with the product, hence EIRP is not measured nor calculated. The end user of this product is to exercise proper engineering judgement to select the appropriate antenna to comply with the EIRP limitation set forth by FCC24.23a (a).

The RF power of the EUT was measured at the antenna port. The measurement satisfies the above requirement by demonstrating the measured power is below 100 watts.

Test setup: The EUT is placed on top of a fan which is on the wooden table top. The RF Input port is connected to a support signal preamplifier which is connected to a signal generator. The RF Output is connected to a RF load and a directional coupler. The RF power of the EUT is monitored at the output of the directional coupler and the RF input signal is adjusted to maintain the output power.

The RF Output power is measured at the antenna port of the EUT.

Conclusion: As indicated below, the power level does not exceed the 100 Watt peak power limit.

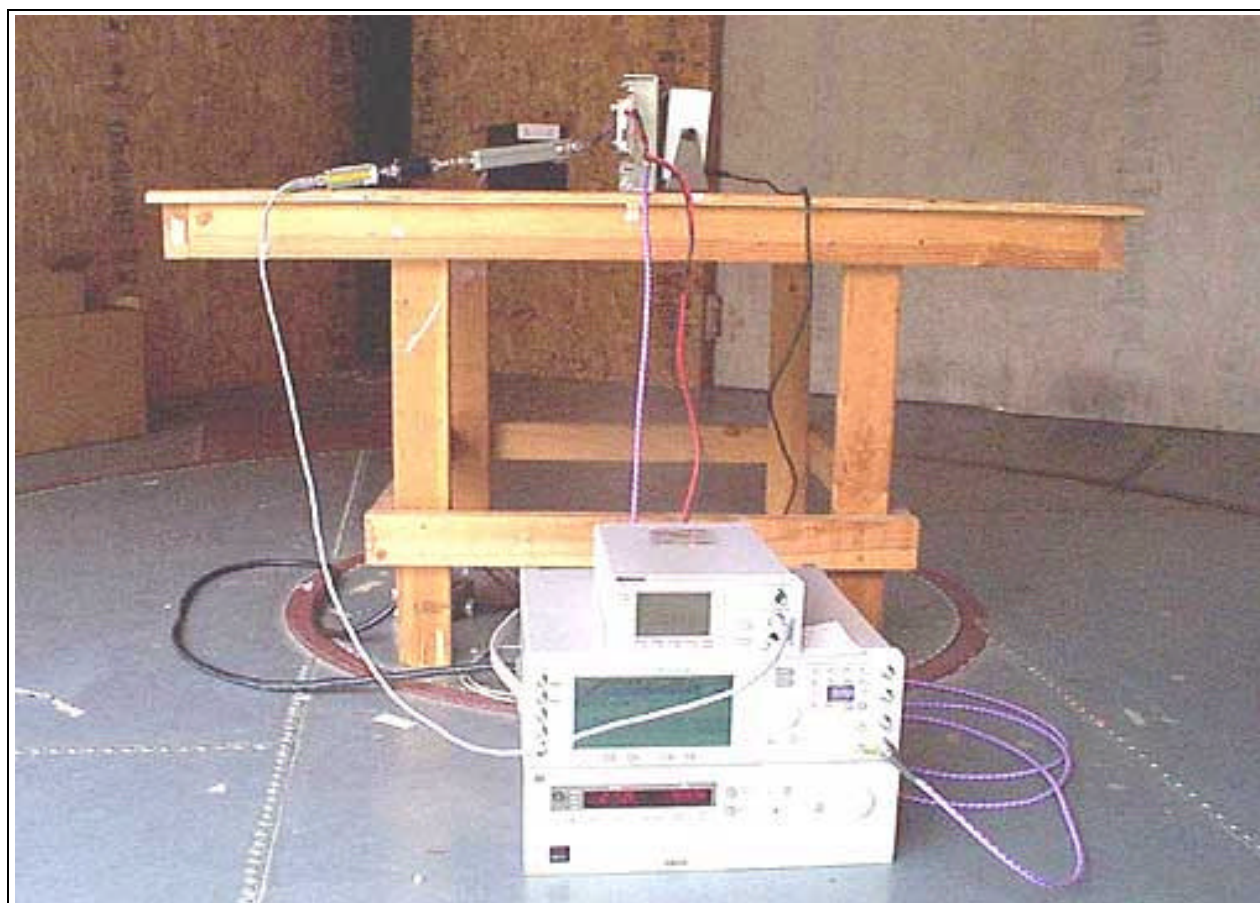
Modulation EDGE and GSM

Frequency	Measured Power
1930.2 MHz	30
1960.0 MHz	30
1989.8 MHz	30

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
RF Power meter	Cust	Agilent	E4419B	US39400740	033104	033105
Power Sensor	Cust	Agilent	8481A	US37298441	033104	033105

FCC 24.232 POWER



**FCC 2.1033(c)(14)/2.1047(a) - MODULATION CHARACTERISTICS - AUDIO
FREQUENCY RESPONSE**

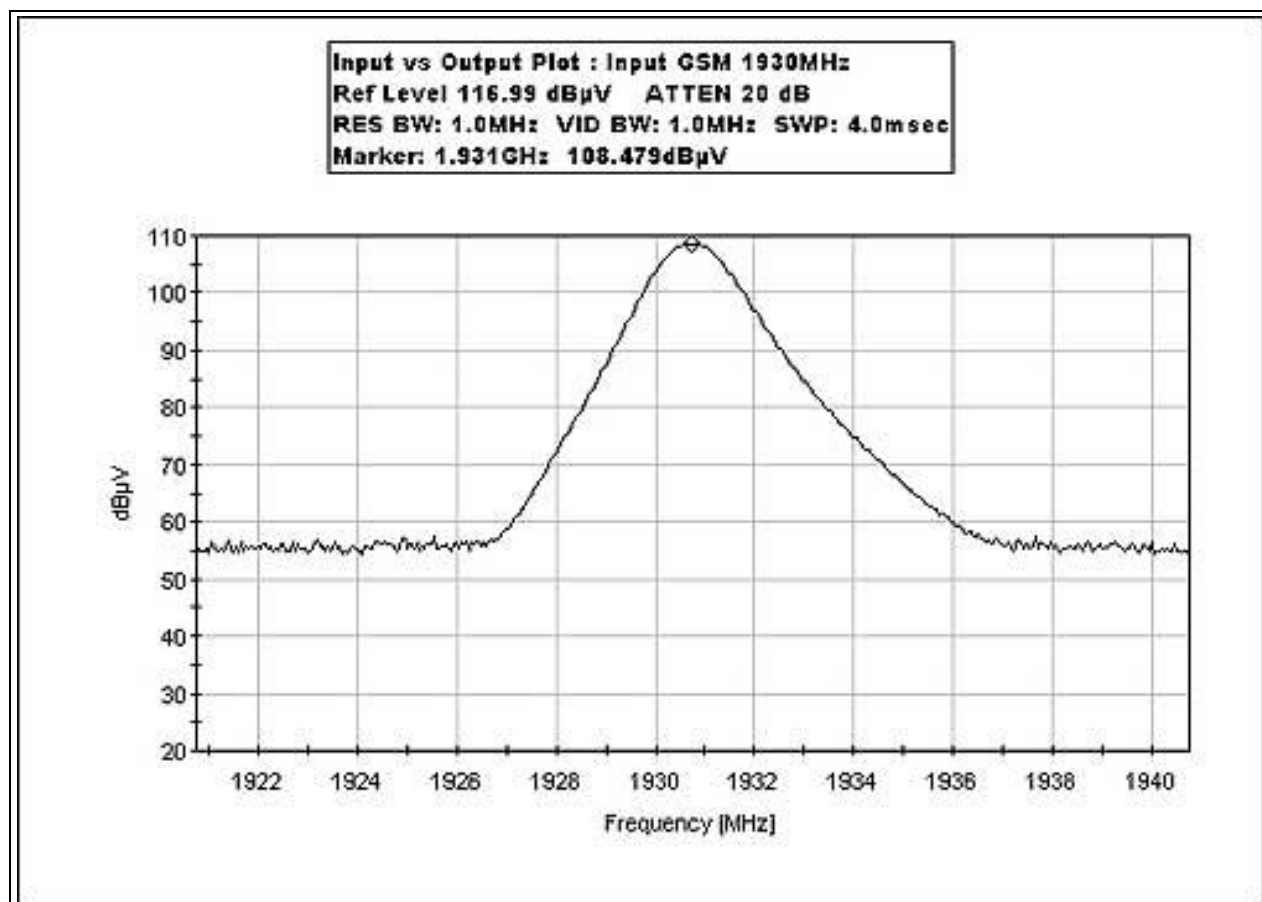
Not applicable to this unit.

**FCC 2.1033(c)(14)/2.1047(b) MODULATION CHARACTERISTICS– Modulation
Limiting Response**

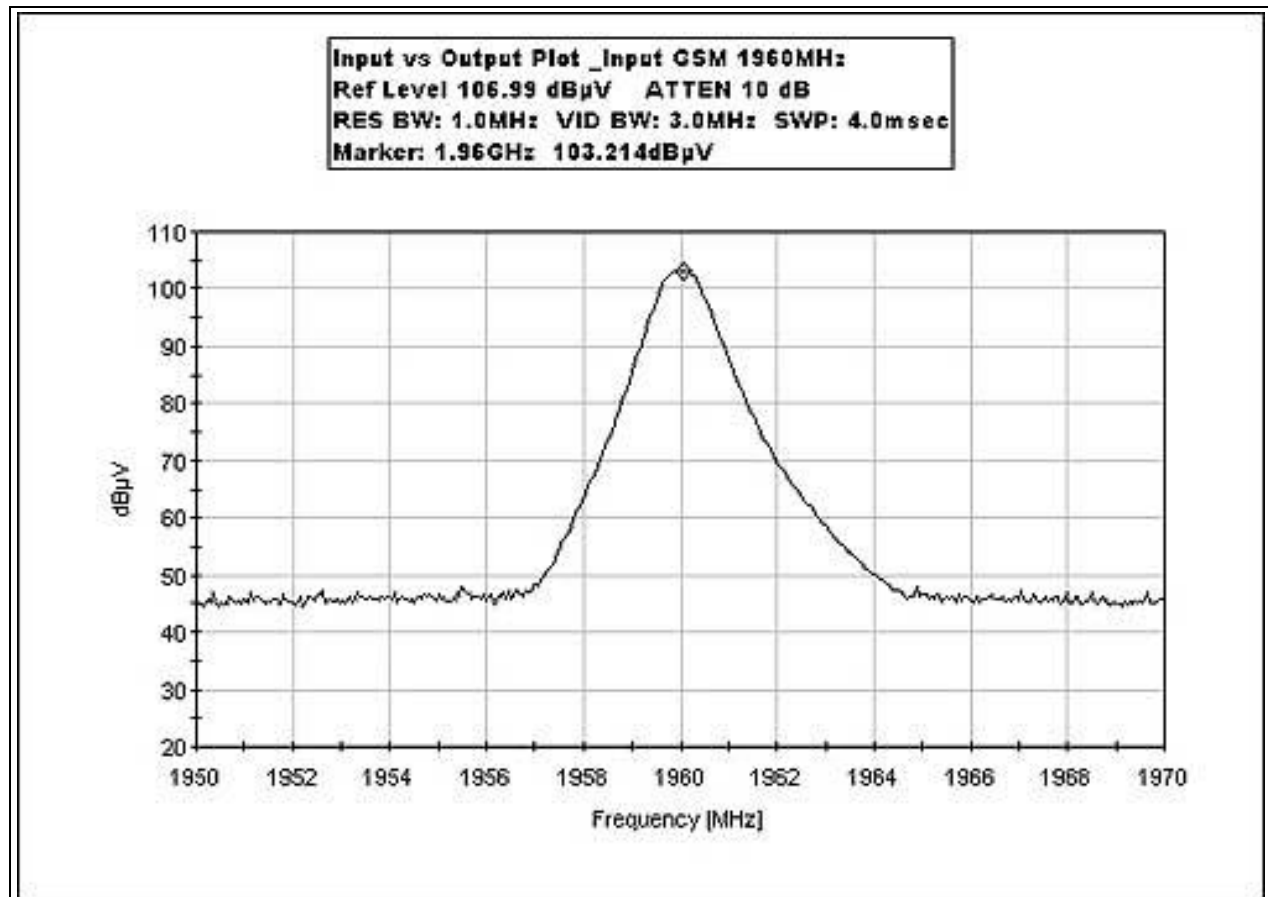
Not applicable to this unit.

FCC 2.1033(c)(14)/2.1049(i)- OCCUPIED BANDWIDTH

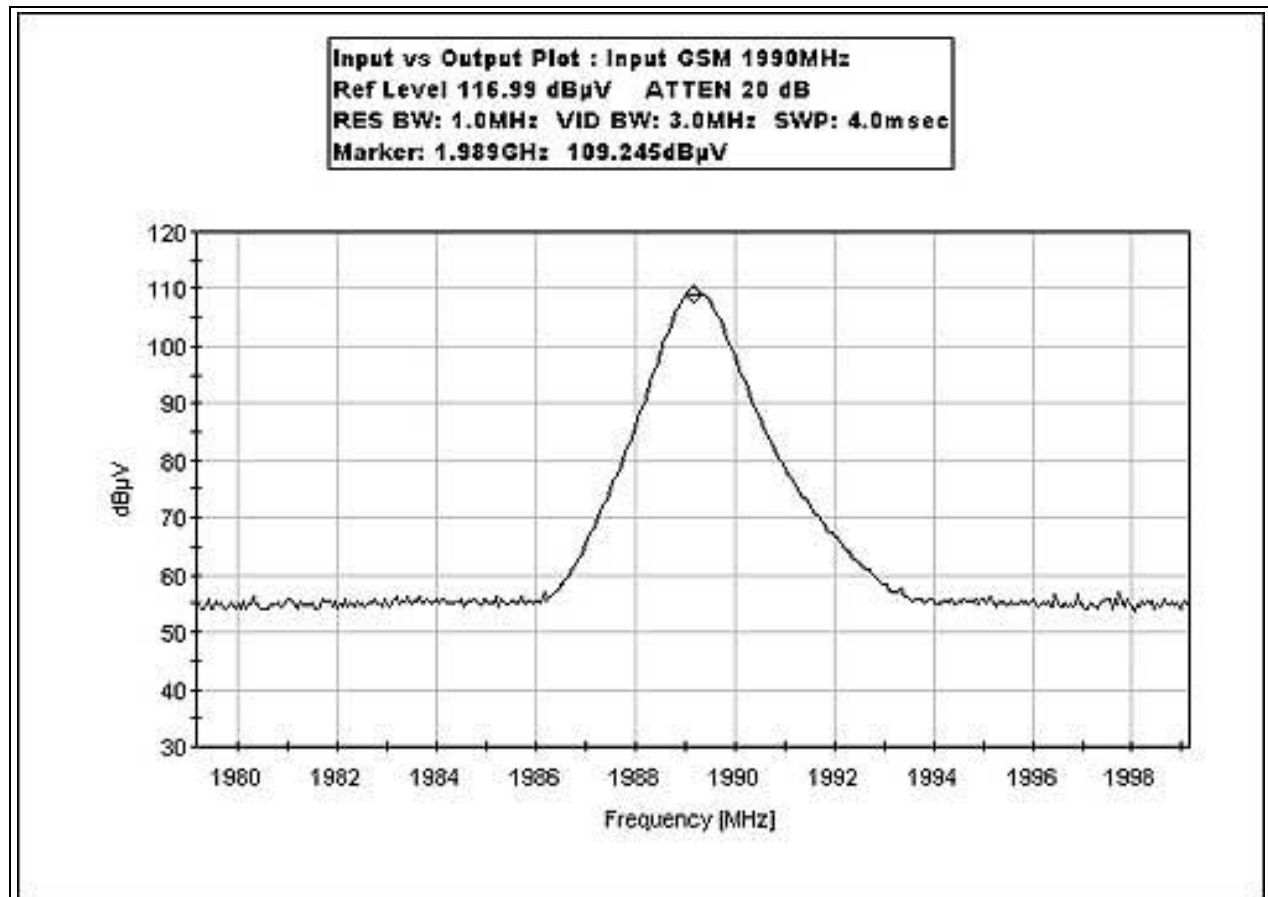
INPUT PLOT GSM 1930 MHz



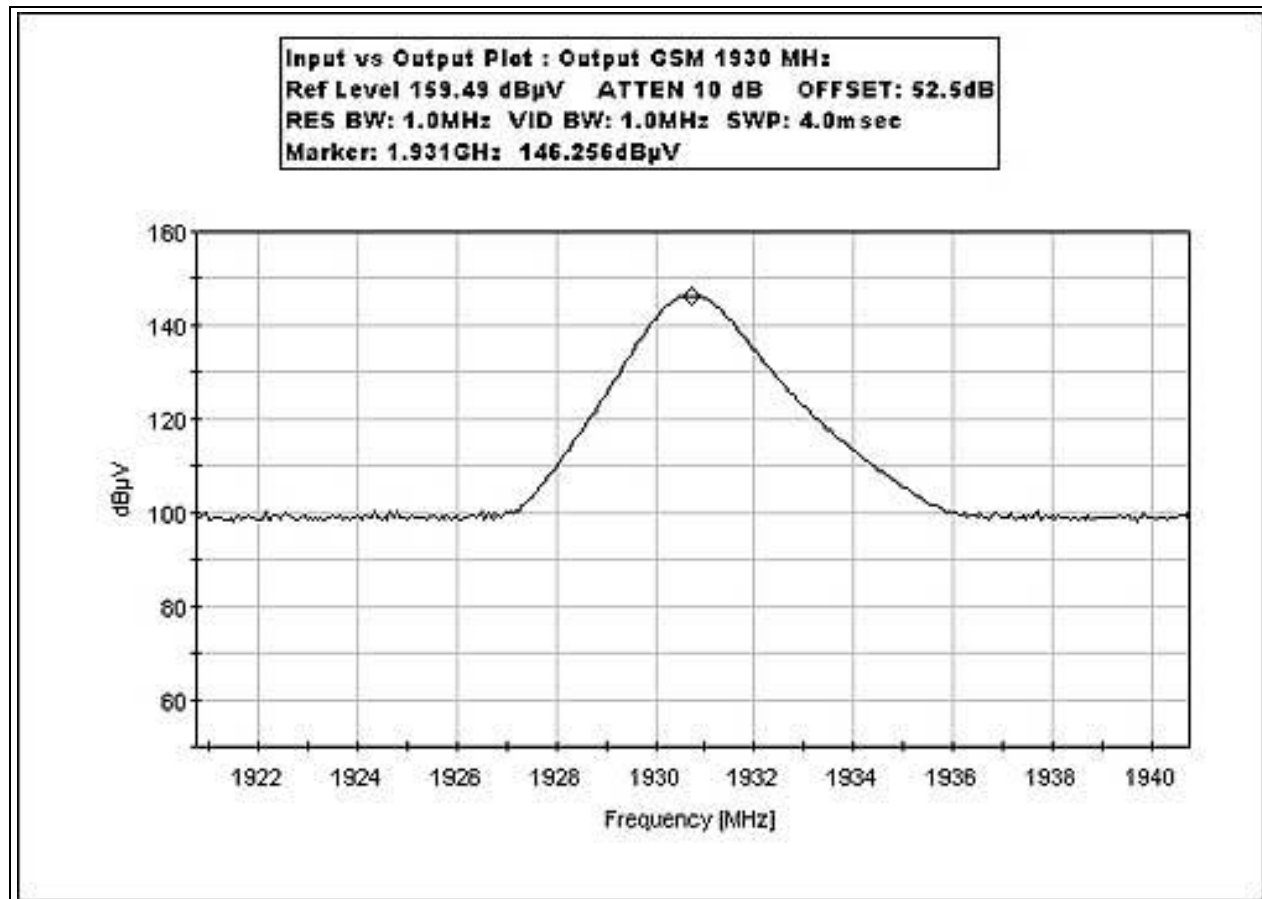
FCC 2.1049(i) INPUT PLOT GSM 1960 MHz



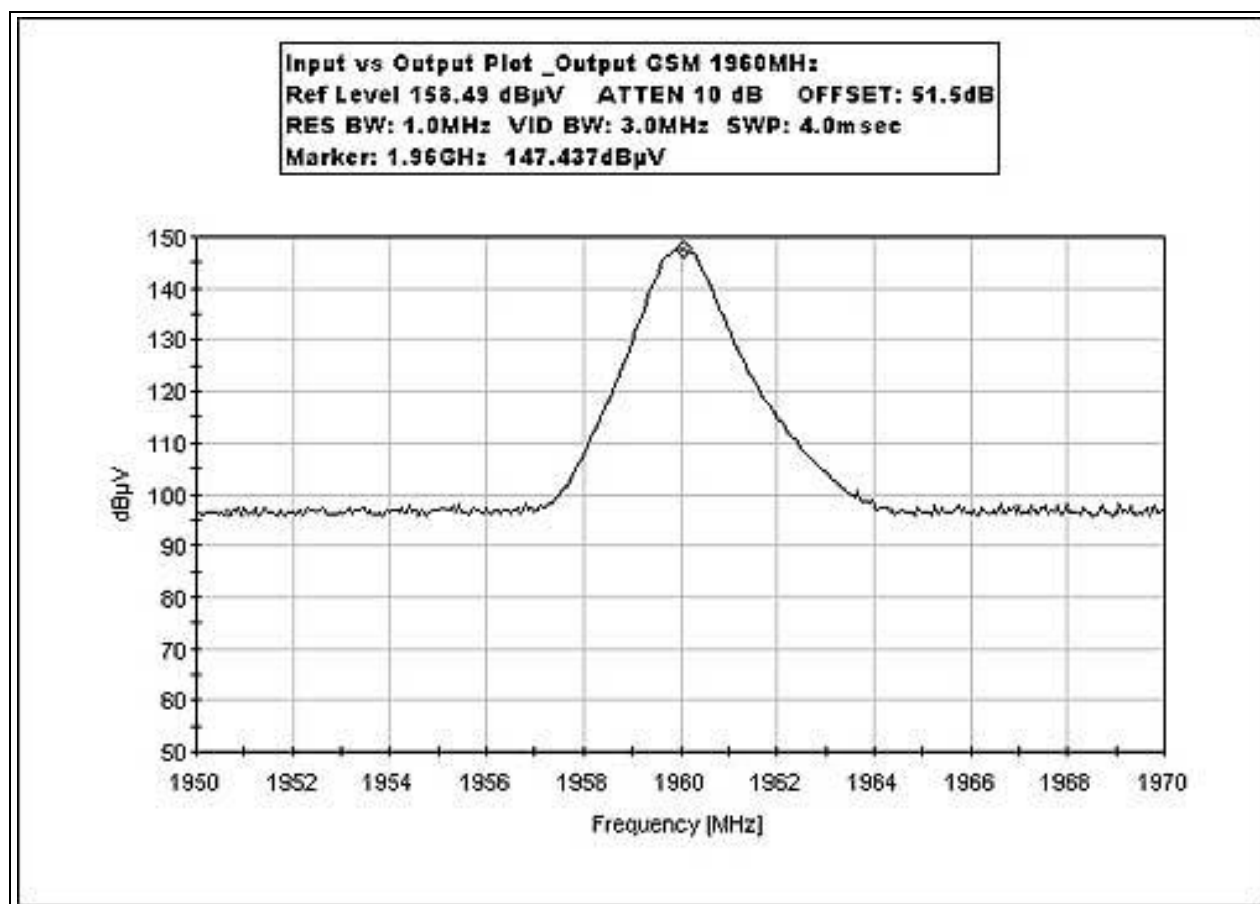
FCC 2.1049(i) INPUT PLOT GSM 1990 MHz



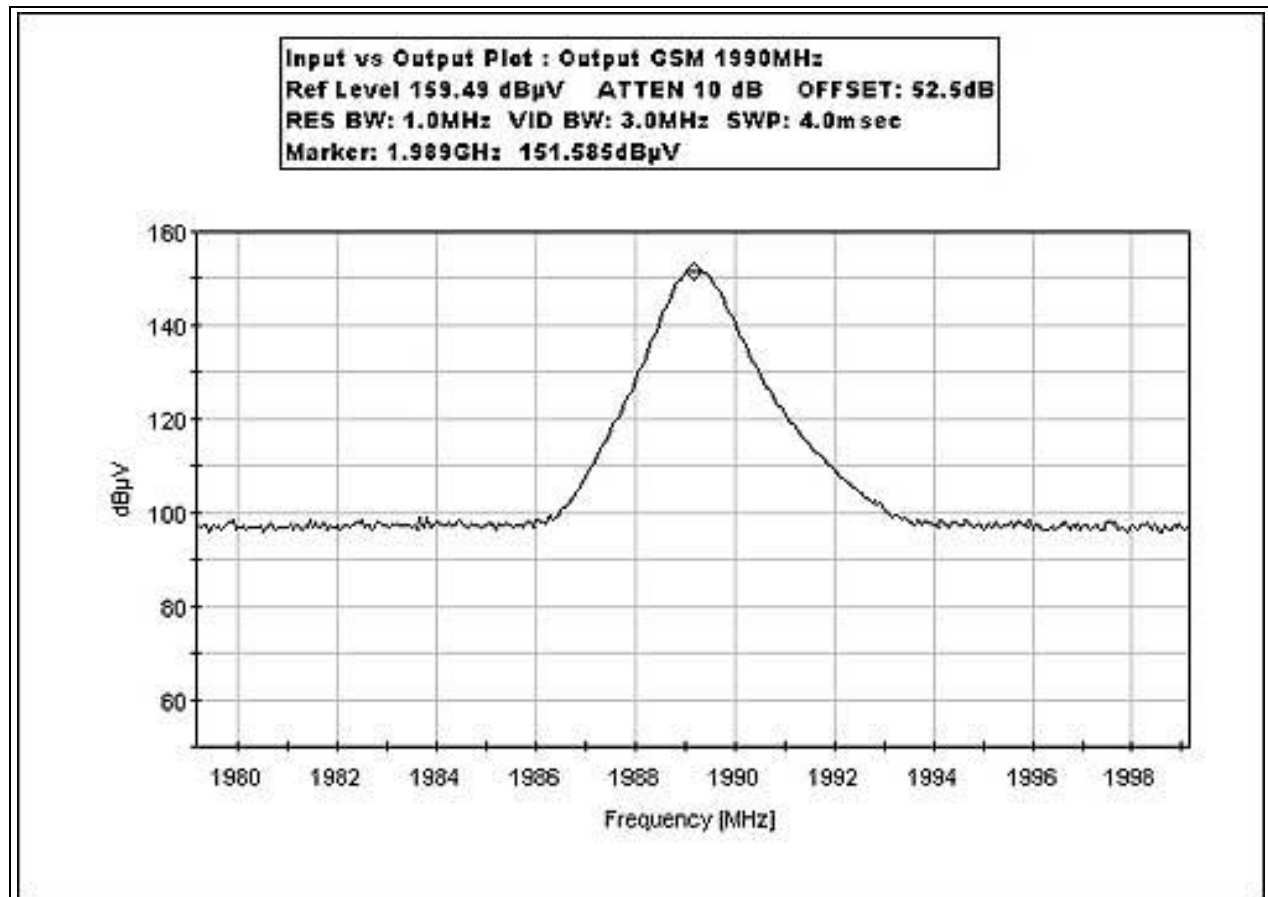
FCC 2.1049(i) OUTPUT PLOT GSM 1930 MHz



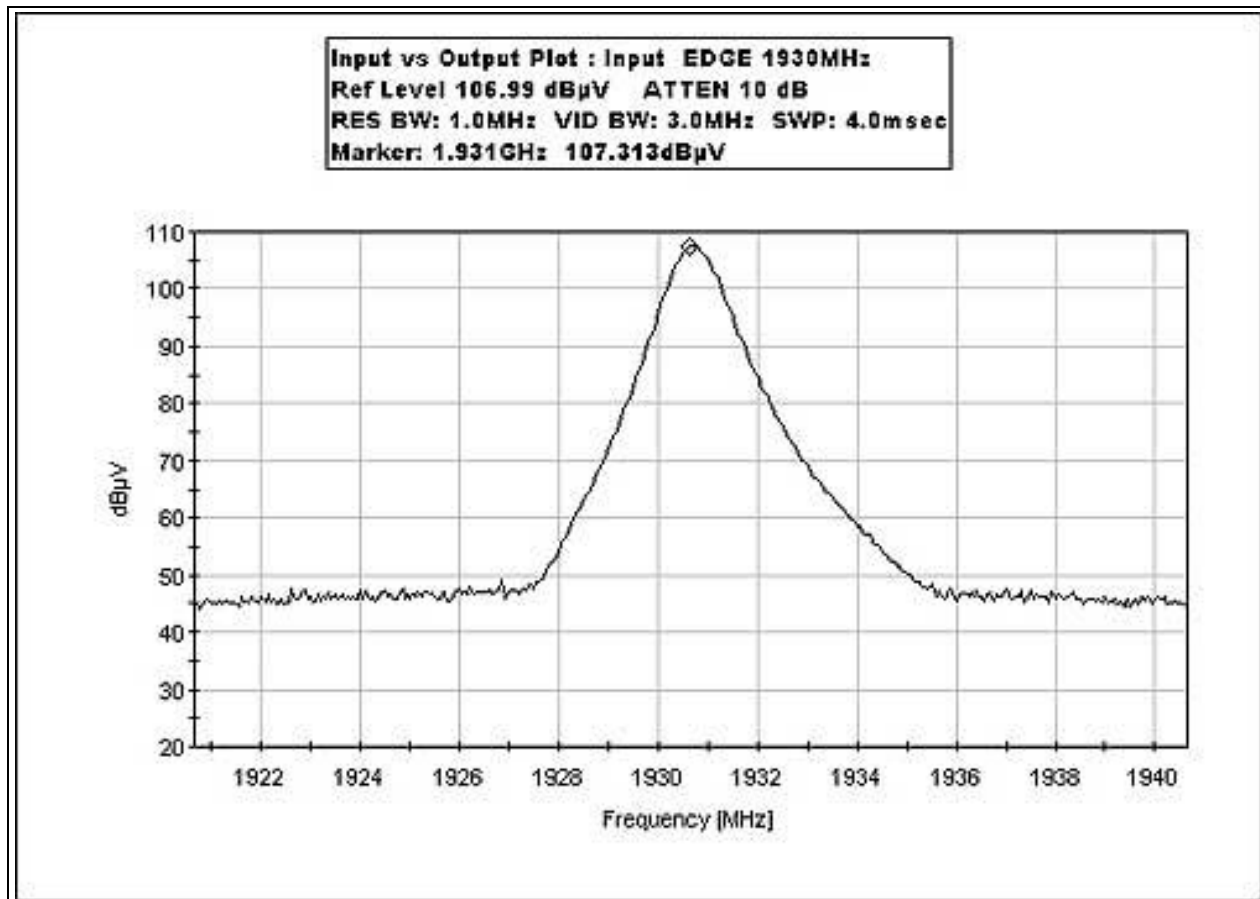
FCC 2.1049(i) OUTPUT PLOT GSM 1960 MHz



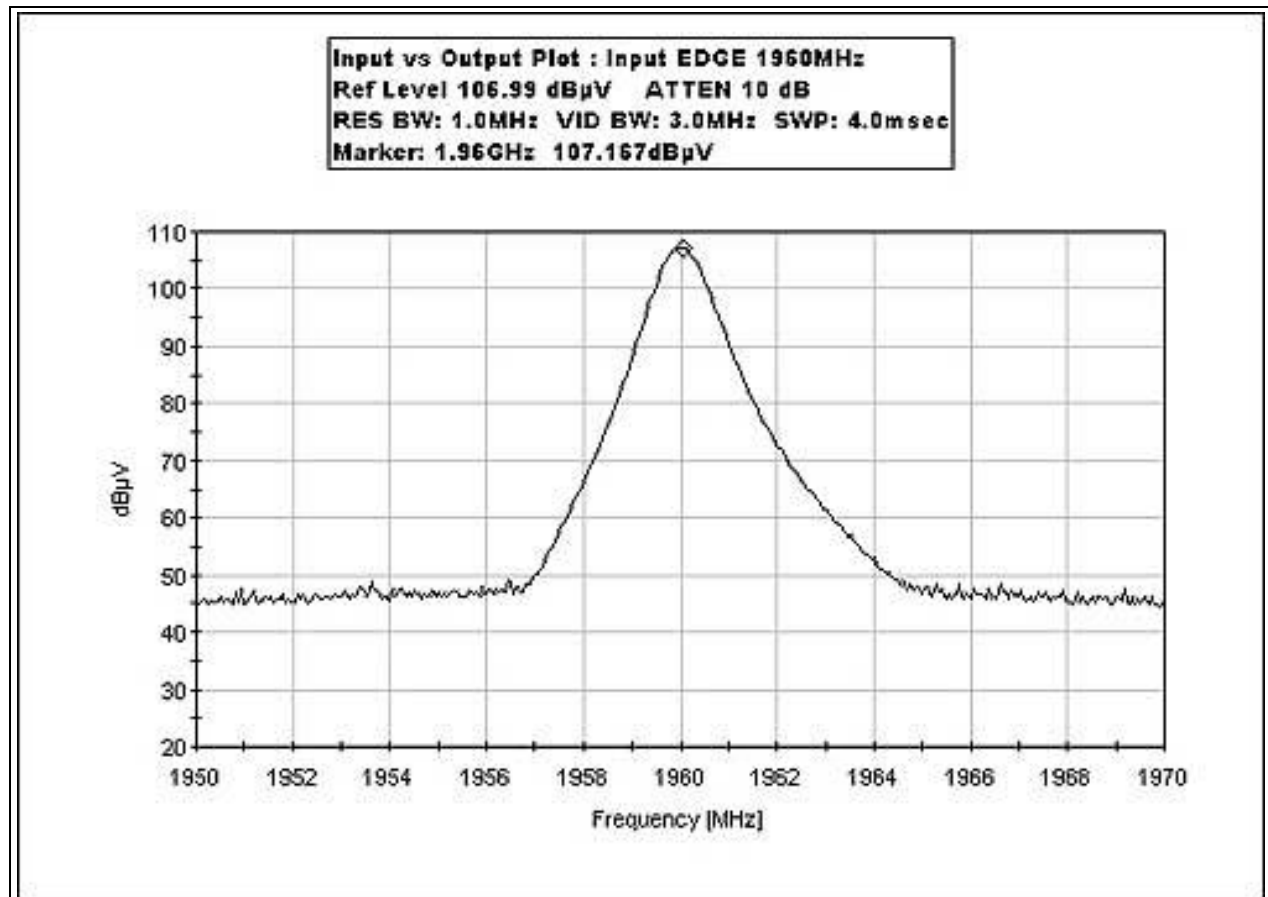
FCC 2.1049(i) OUTPUT PLOT GSM 1990 MHz



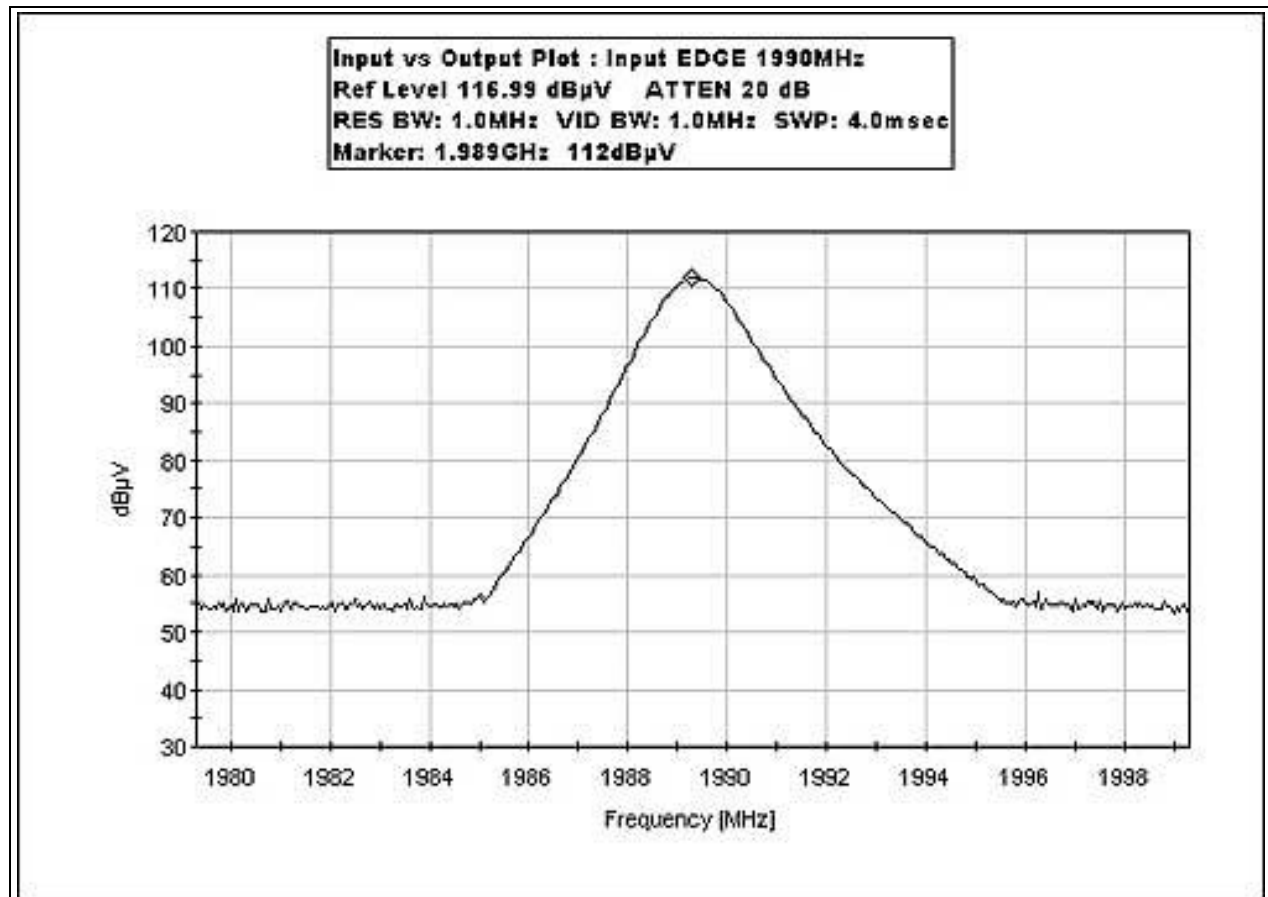
FCC 2.1049(i) INPUT PLOT EDGE 1930 MHz



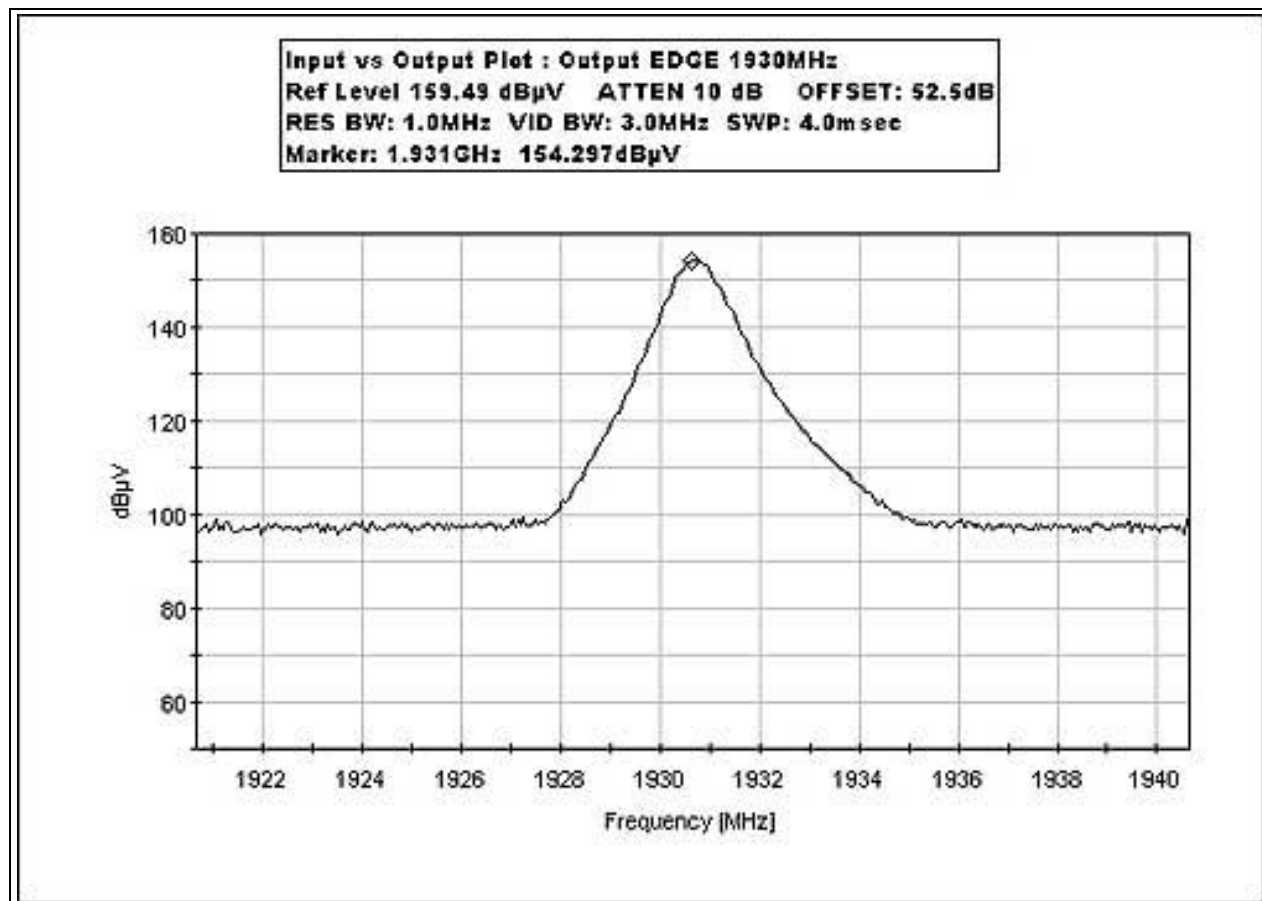
FCC 2.1049(i) INPUT PLOT EDGE 1960 MHz



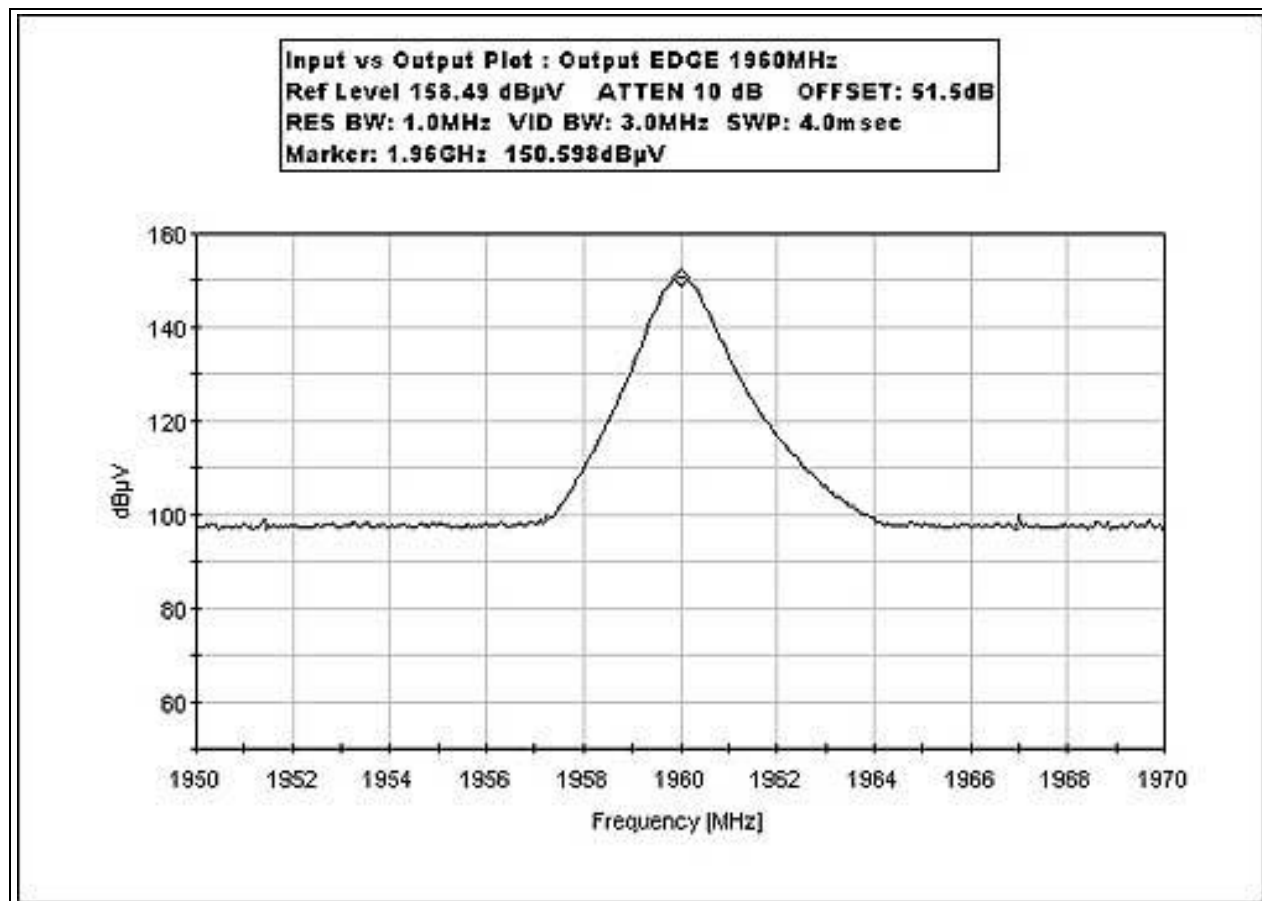
FCC 2.1049(i) INPUT PLOT EDGE 1990 MHz



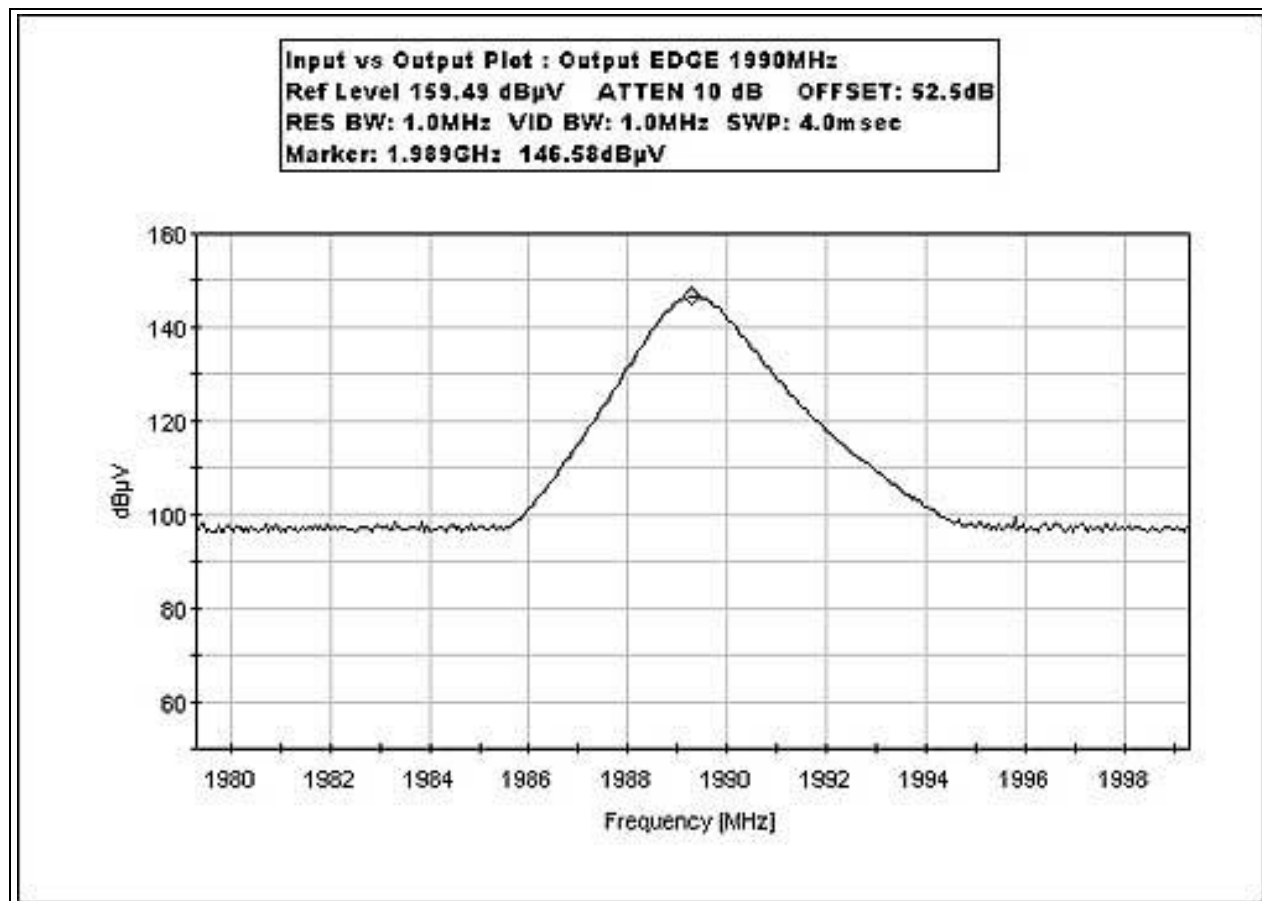
FCC 2.1049(i) OUTPUT PLOT EDGE 1930 MHz



FCC 2.1049(i) OUTPUT PLOT EDGE 1960 MHz



FCC 2.1049(i) OUTPUT PLOT EDGE 1990 MHz



Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
2.4 GHz HPF	01440	K&L	91H31-3000	001	022003	022005

PHOTOGRAPH SHOWING DIRECT CONNECT TEST SETUP



FCC 2.1033(c)(14)/2.1051/24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Conditions: The EUT is placed on the wooden table top. The RF Input port is connected to a support signal generator. The RF Output is connected to an RF load and a directional coupler. The RF power of the EUT is monitored at the output of the directional coupler and the RF input signal is adjusted to maintain the output power. Measurement made at Antenna port. Frequency: 1930.2 MHz, 1960 MHz, 1998.8 MHz. RF Output Power : 30Watts. Modulation: EDGE GSM. Frequency range of measurement = 9 kHz- 20 GHz. Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz- 30 MHz RBW=9 kHz, VBW=9 kHz; 30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 20000 MHz RBW=1 MHz, VBW=1 MHz. 27VDC (From support Power supply: 110VAC, 60 Hz), 32°C, 50%, 100kPa. Modification: 1930-1990MHz band pass duplexer CMD230, SN 000903 Installed on the RF Output port. **No signals were found.**

Limit line for Spurious Conducted Emission

$$\text{Required Attenuation} = 43 + 10 \log P \text{ dB}$$

$$\text{Limit line (dBuV)} = V_{\text{dBuV}} - \text{Attenuation}$$

$$\begin{aligned} V_{\text{dBuV}} &= 20 \log \frac{V}{1 \times 10^{-6}} \\ &= 20 (\log V - \log 1 \times 10^{-6}) \\ &= 20 \log V - 20 \log 1 \times 10^{-6} \\ &= 20 \log V - 20(-6) \\ &= 20 \log V + 120 \end{aligned}$$

$$\begin{aligned} \text{Attenuation} &= 43 + 10 \log P \\ &= 43 + 10 \log \frac{V^2}{R} \\ &= 43 + 10 (\log V^2 - \log R) \\ &= 43 + 10 (2 \log V - \log R) \\ &= 43 + 20 \log V - 10 \log R \end{aligned}$$

$$\begin{aligned} \text{Limit line} &= V_{\text{dBuV}} - \text{Attenuation} \\ &= 20 \log V + 120 - (43 + 20 \log V - 10 \log R) \\ &= 20 \log V + 120 - 43 - 20 \log V + 10 \log R \\ &= 20 \log V + 120 - 43 - 20 \log V + 10 \log R \\ &= 120 - 43 + 10 \log 50 \quad \text{Note : } R = 50 \Omega \\ &= 120 - 43 + 16.897 \\ &= 94 \text{ dBuV at any power level} \end{aligned}$$

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
2.4 GHz HPF	01440	K&L	91H31-3000	001	022003	022005

PHOTOGRAPH SHOWING DIRECT CONNECT TEST SETUP



FCC 2.1033(c)(14)/2.1053/24.238(a) - FIELD STRENGTH OF SPURIOUS RADIATION

Test Conditions: The EUT is placed on top of a fan which is on the wooden tabletop. The RF input port is connected to a support signal preamplifier which is connected to a signal generator. The RF output is connected to a RF load and a directional coupler. The RF power of the EUT is monitored at the output of the directional coupler and the RF input signal is adjusted to maintain the output power. Mode during this test: Transmit at 1930.2 MHz, 1960 MHz and 1989.8 MHz, 30Watts. Modulation type: EDGE and GSM. Frequency range of measurement = 9 kHz - 20 GHz. Frequency 9 kHz - 150 kHz RBW=200 Hz, VBW=200 Hz; 150 kHz - 30 MHz RBW=9 kHz, VBW=9 kHz; 30 MHz - 1000 MHz RBW=120 kHz, VBW=120 kHz; 1000 MHz - 20000 MHz RBW=1 MHz, VBW=1 MHz. 27VDC (From support power supply: 110VAC, 60 Hz), 32°C, 50% relative humidity, 100kPa. **No readings were found below 1 GHz.**

Operating Frequency: 1930 MHz - 1990 MHz

Channels: Low, Mid & High

Highest Measured Output Power: 44.77 EIRP(dBm)= 30 EIRP(Watts)

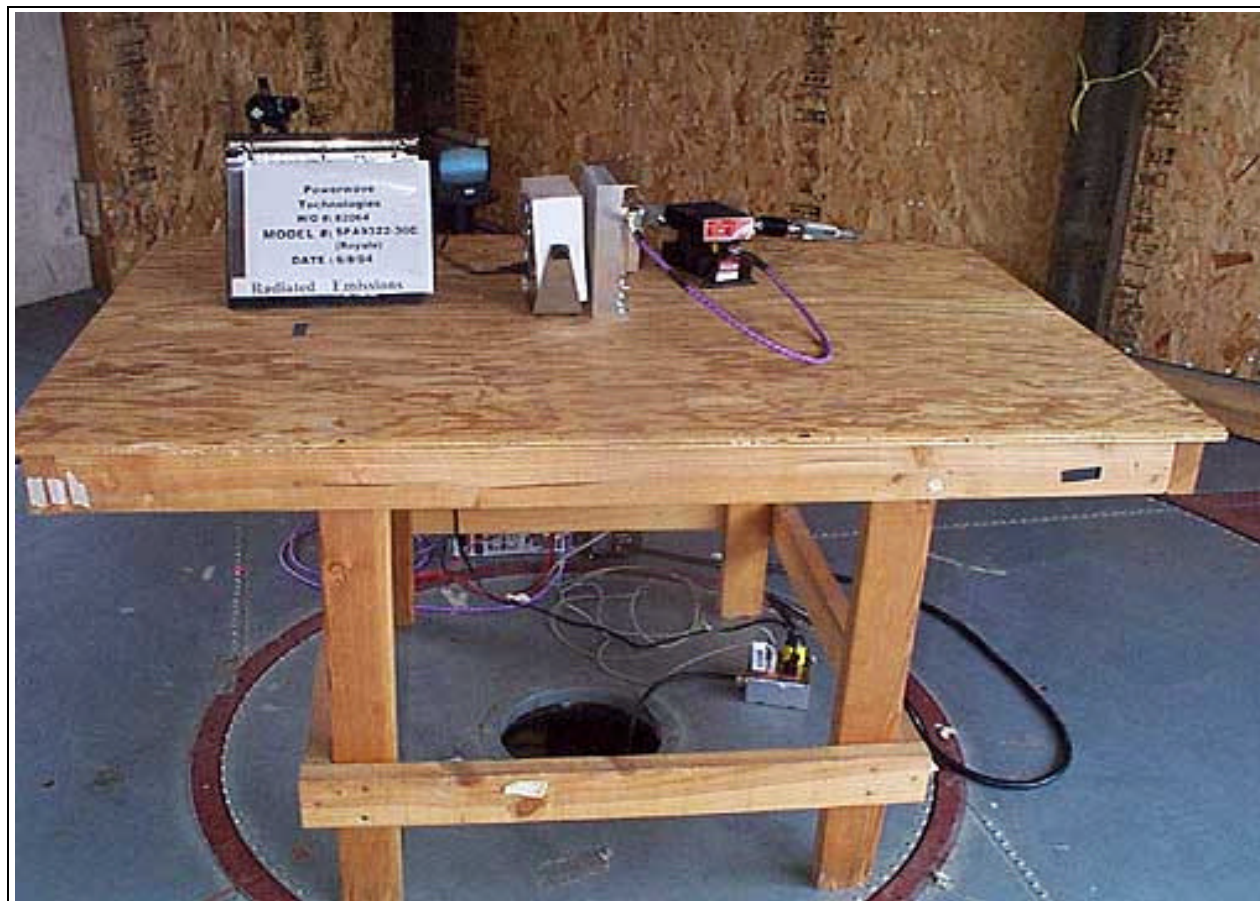
Distance: 3 meters

Limit: $43+10\log(P)$ 57.77 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
5,790.63	-19.7	Horiz	64.47
3,860.42	-21.2	Vert	65.97
17,371.82	-21.3	Horiz	66.07
17,371.83	-21.8	Vert	66.57
3,860.42	-23.6	Horiz	68.37
5,790.66	-26.2	Vert	70.97
15,441.62	-27.3	Horiz	72.07
15,441.63	-27.8	Vert	72.57
13,511.43	-31.8	Vert	76.57
13,511.42	-32.3	Horiz	77.07
7,720.83	-33.8	Vert	78.57
11,581.23	-37	Vert	81.77
7,720.88	-37.9	Horiz	82.67
11,581.22	-38.4	Horiz	83.17
9,651.03	-38.8	Vert	83.57
9,651.02	-39.2	Horiz	83.97
5,880.07	-19.3	Horiz	64.07
3,920.00	-22.4	Vert	67.17

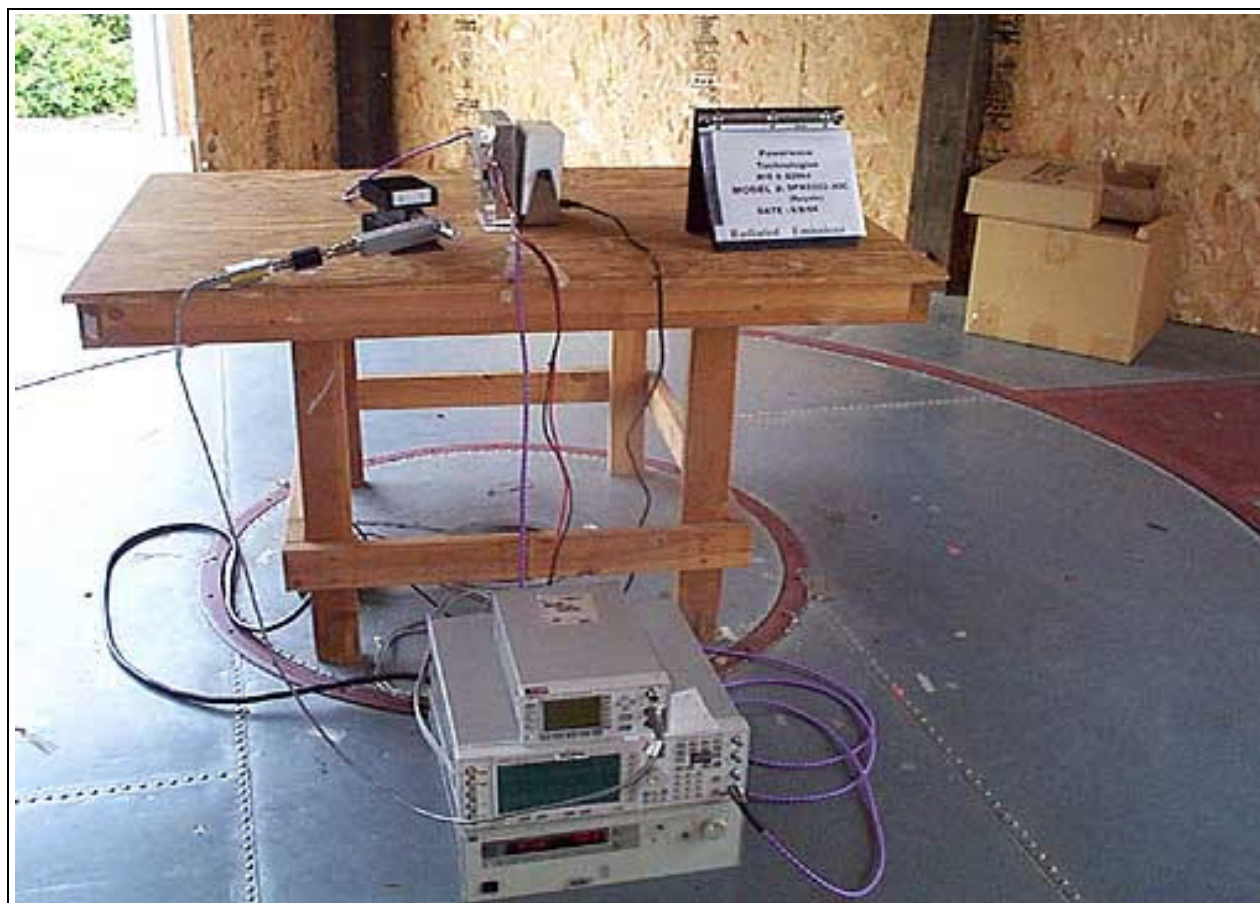
Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,920.02	-23.2	Horiz	67.97
5,880.02	-24.8	Vert	69.57
13,720.03	-30.4	Vert	75.17
13,720.00	-31.7	Horiz	76.47
7,840.03	-32.3	Vert	77.07
7,839.92	-32.5	Horiz	77.27
11,760.02	-35.7	Vert	80.47
11,760.00	-36.3	Horiz	81.07
9,799.91	-37.7	Horiz	82.47
9,800.03	-38.2	Vert	82.97
5,969.36	-17.9	Horiz	62.67
3,979.61	-21.1	Vert	65.87
3,979.61	-22.8	Horiz	67.57
5,969.38	-25.6	Vert	70.37
13,928.67	-30.5	Horiz	75.27
13,928.64	-31.5	Vert	76.27
11,938.87	-35.4	Horiz	80.17
11,938.84	-36	Vert	80.77
9,949.07	-36	Horiz	80.77
7,959.09	-36.6	Vert	81.37
7,959.50	-37.1	Horiz	81.87
9,949.05	-37.7	Vert	82.47
5,969.25	-24.7	Horiz	69.47
3,979.77	-27	Horiz	71.77
3,979.62	-27.7	Vert	72.47
5,969.38	-32.8	Vert	77.57
9,949.18	-37.3	Vert	82.07
9,949.02	-37.6	Horiz	82.37
7,959.90	-38.3	Vert	83.07
5,879.85	-24.8	Horiz	69.57
3,919.83	-25.8	Vert	70.57
3,920.15	-26.7	Horiz	71.47
5,880.22	-31.7	Vert	76.47
7,840.08	-35.9	Vert	80.67
9,800.03	-36.3	Vert	81.07
7,840.33	-37.1	Horiz	81.87
9,800.02	-38.5	Horiz	83.27
3,860.45	-23.7	Vert	68.47
5,790.75	-26.4	Horiz	71.17
3,860.55	-26.5	Horiz	71.27
5,790.86	-30.5	Vert	75.27
7,721.07	-37.7	Vert	82.47
9,651.08	-38.9	Vert	83.67
9,651.05	-39	Horiz	83.77
7,721.19	-39.1	Horiz	83.87

PHOTOGRAPH SHOWING RADIATED EMISSIONS



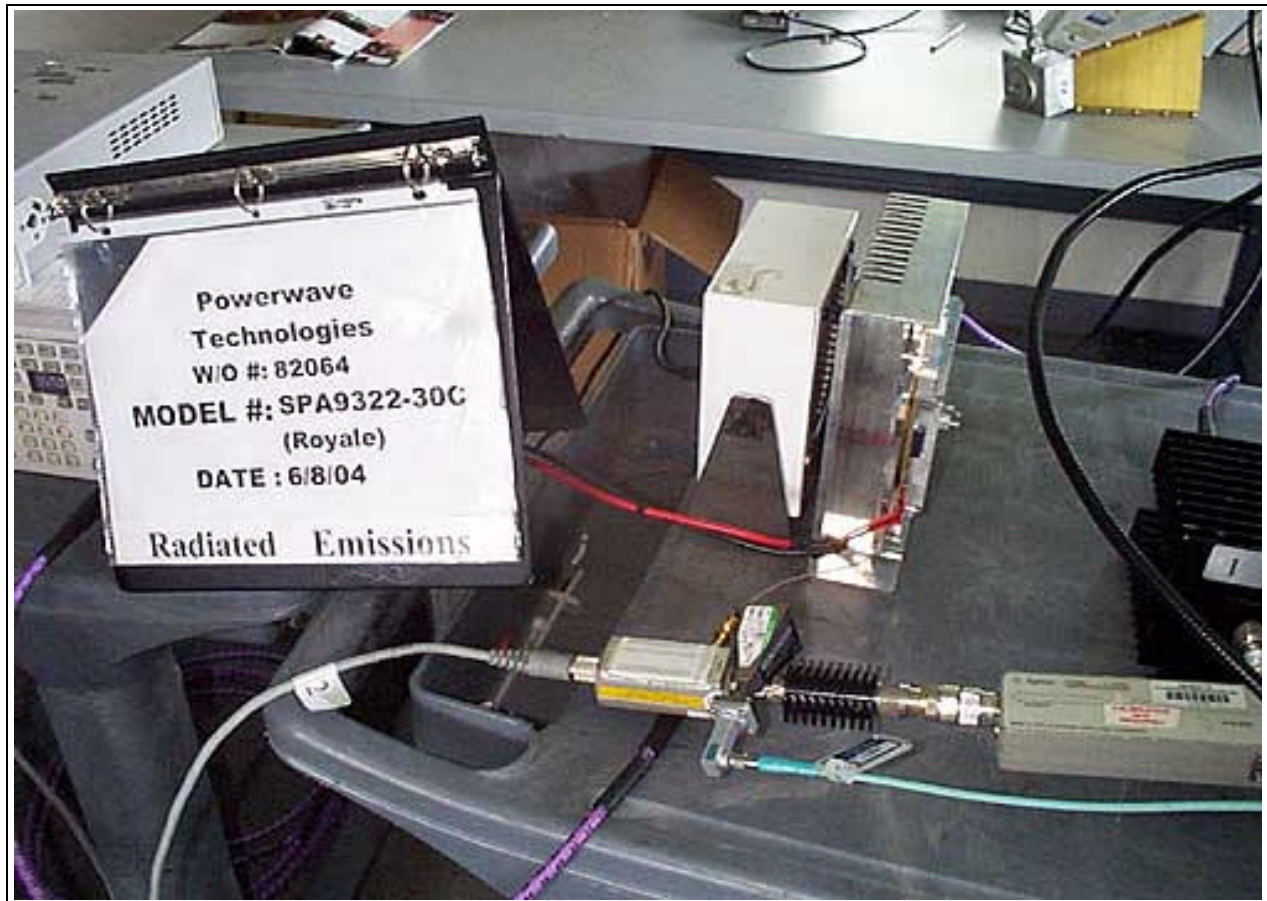
Radiated Emissions - Front View

PHOTOGRAPH SHOWING RADIATED EMISSIONS



Radiated Emissions - Back View

PHOTOGRAPH SHOWING RADIATED EMISSIONS



Radiated Emissions - Horn Antenna

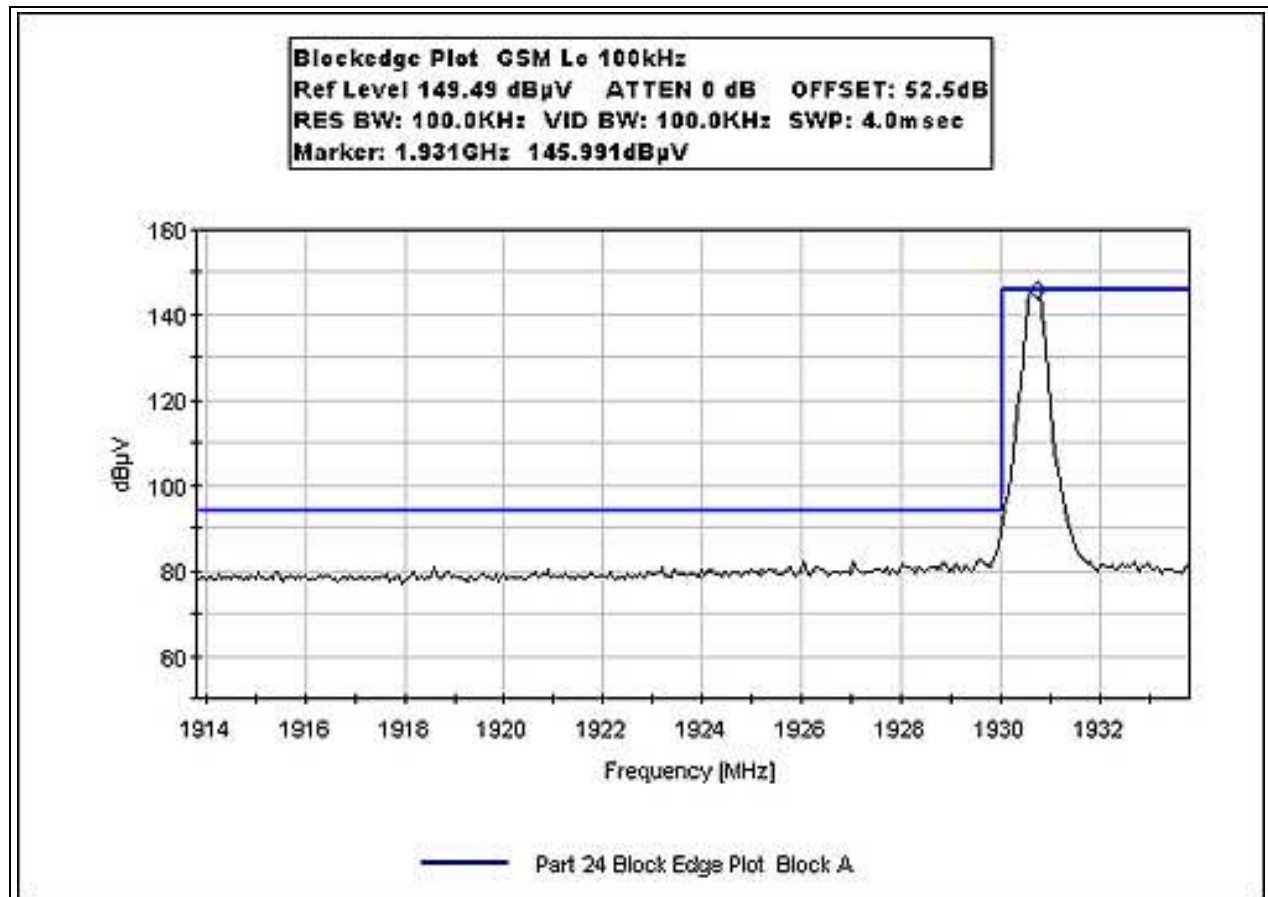
Test Equipment 3/29/04

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
Biconilog Antenna	01995	Chase	CBL6111C	2451	040804	040806
Log Periodic Antenna	300	AH	SAS 00/516	331	092302	092304
Horn Antenna	0849	EMCO	3115	6246	091002	091004
Microwave Pre-amp	00786	HP	83017A	3123A00281	091102	091104
¼" Helix Coaxial Cable	NA	Andrew	FSJ-50A-4	Cable#7 (6 ft)	073103	073104
24" SMA Cable	2604	Argosy	UFA147A	0-0360-200200	012304	012305
3.5 GHz HPF	02117	HP	84300-80038	3643A00027	060603	060605

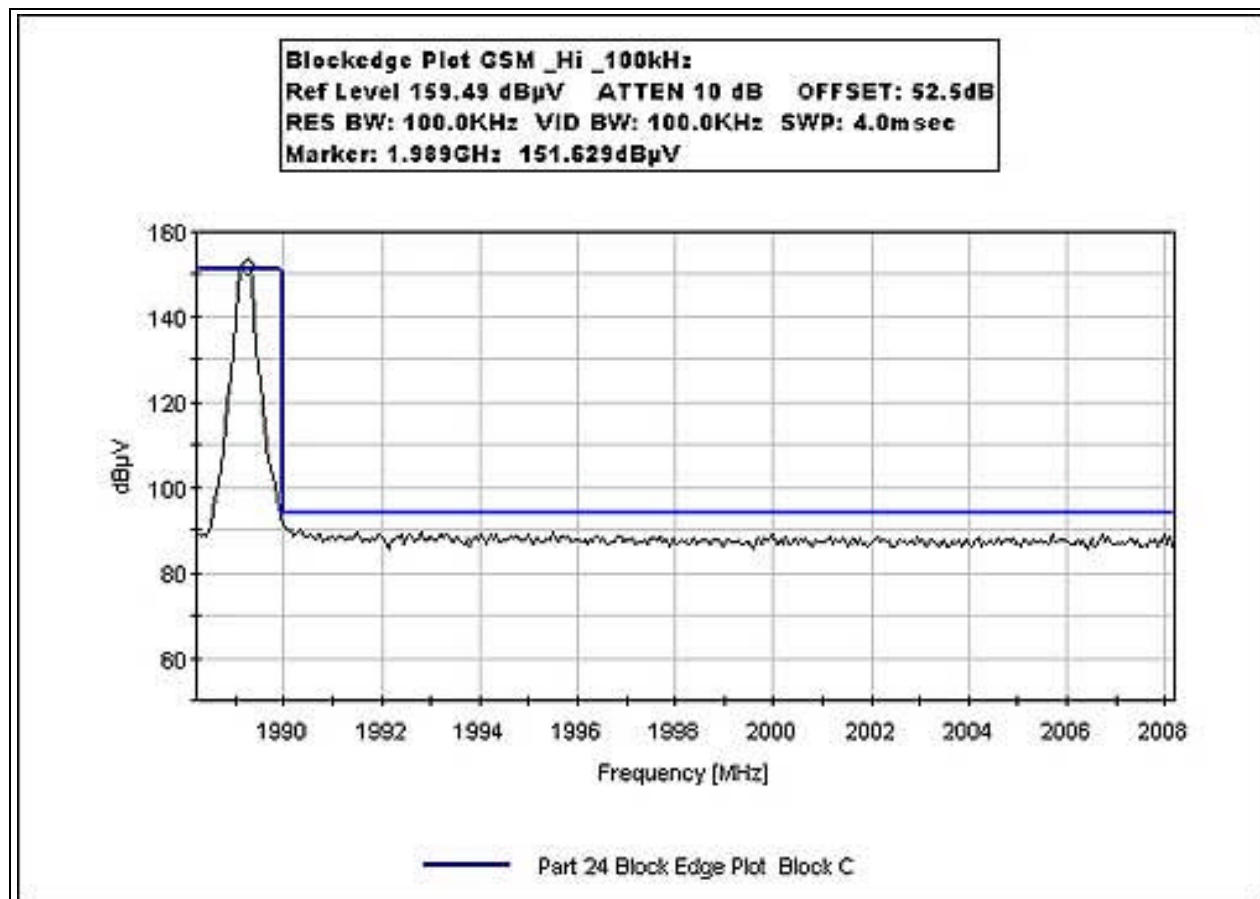
Test Equipment 6/8/04

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer RF Section	00312	HP	8568A	2049A01287	073102	073104
Spectrum Analyzer Display Section	00312	HP	85662A	2106A02109	073102	073104
Quasi Peak Adapter	02325	HP	85650A	2521A00932	073102	073104
9kHz-30Mhz						
Magnetic Loop Antenna	00314	Emco	6502	2014	072302	072304
30 MHz- 1000MHz						
Bicon Antenna	306	AH	SAS200/540	220	092302	092304
Log Periodic Antenna	300	AH	SAS 00/516	331	092302	092304
Antenna cable (10 meter site D)	NA	Andrew	LDF1-50	Cable#17	100203	100204
Antenna cable from bulkhead to antenna	N/A	Pasternack	RG-214/U	Cable #33	032904	032905
Preamp to SA Cable (3 feet)	NA	Pasternack	E100316-I	Cable #22	100603	100604
Pre-amp	00010	HP	8447D	2727A05392	071602	071604
1000-18000MHz						
Antenna cable (Helix)	NA	Andrew	LDF1-50	Cable#19	101303	101304
Horn Antenna	01646	EMCO	3115	9603-4683	042503	042505
Microwave Pre-amp	00787	HP	83017A	3123A00282	042303	042305
Coaxial Cable	P1510	W.L. Gore	3825510-75	244910	0121203	012104
2.4 GHz HPF	01440	K&L	91H31-3000	001	022003	022005
Antenna cable (10 meter site D)	NA	Andrew	LDF1-50	Cable#17	100203	100204
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
18000-20000MHz						
18-26.5 GHz Horn Antenna	02112	HP	84125-8008	3643A00027	070103	070105

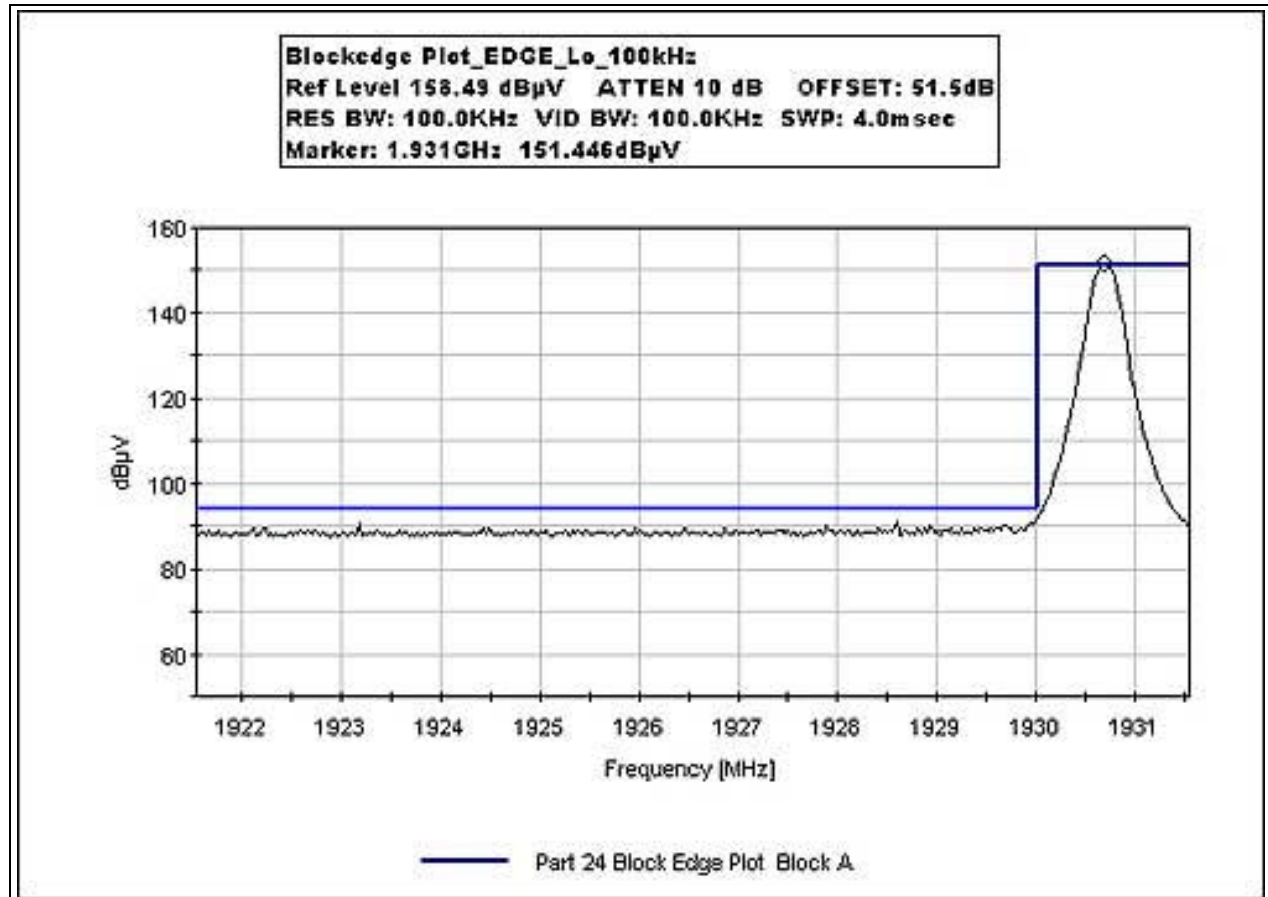
BLOCKEDGE PLOT GSM LOW



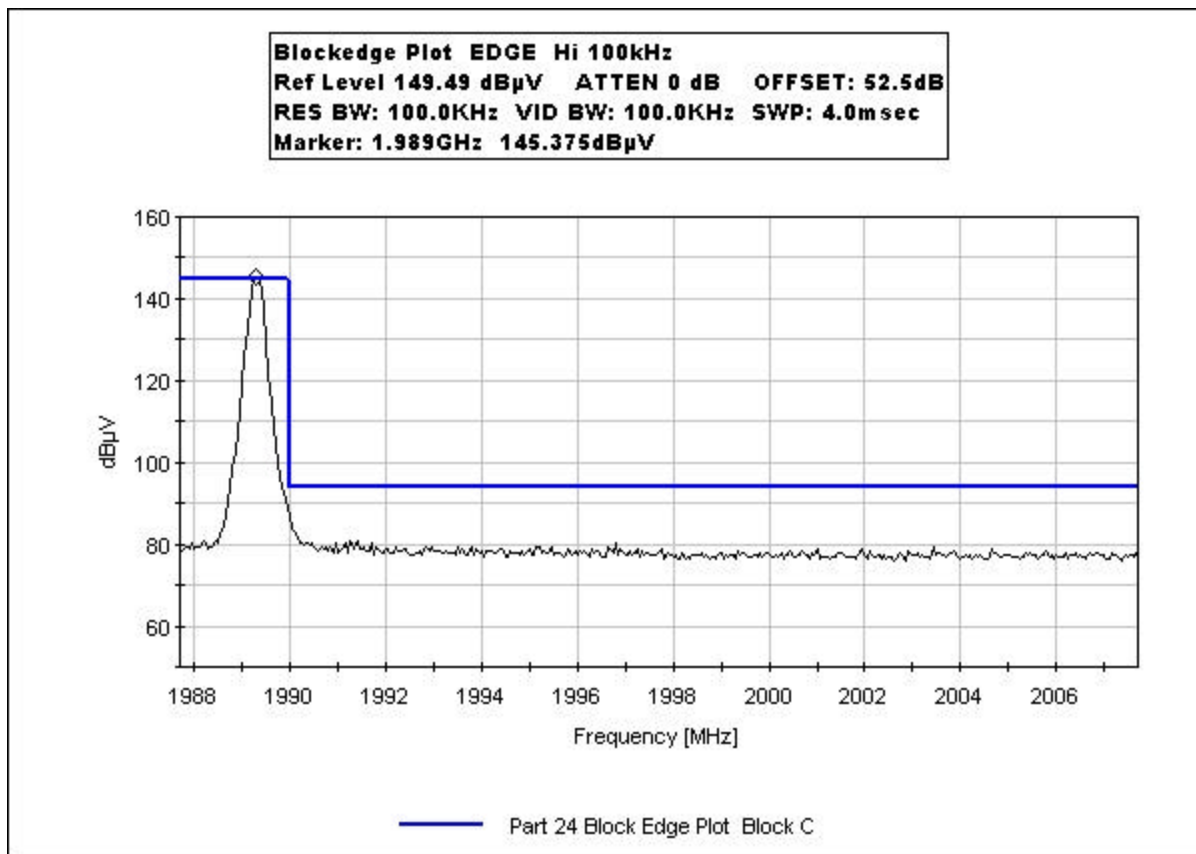
BLOCKEDGE PLOT GSM HIGH



BLOCKEDGE PLOT EDGE LOW



BLOCKEDGE PLOT EDGE HIGH



Test Equipment

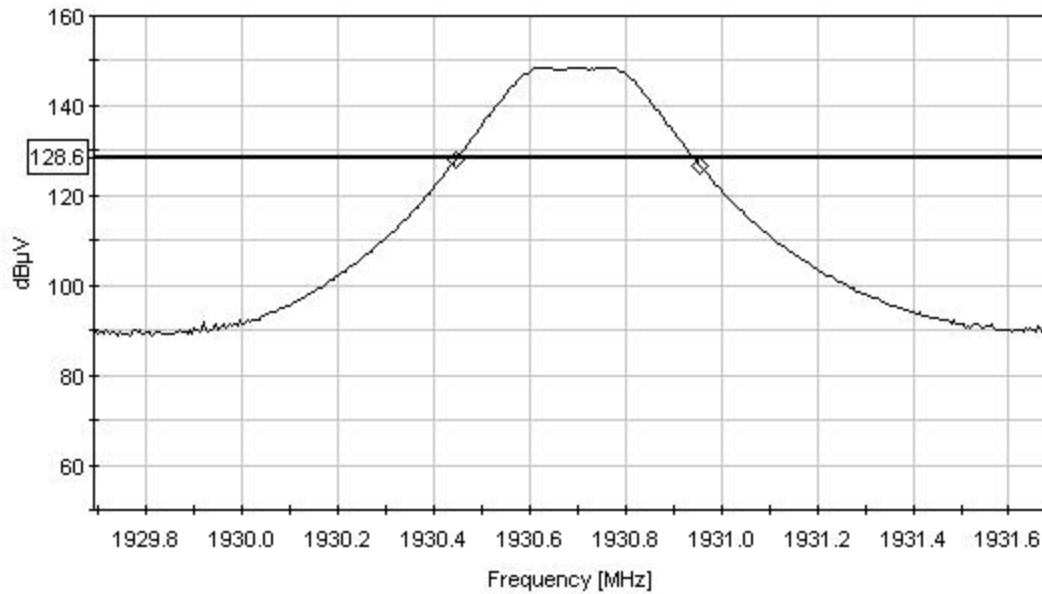
Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
2.4 GHz HPF	01440	K&L	91H31-3000	001	022003	022005

PHOTOGRAPH SHOWING DIRECT CONNECT TEST SETUP



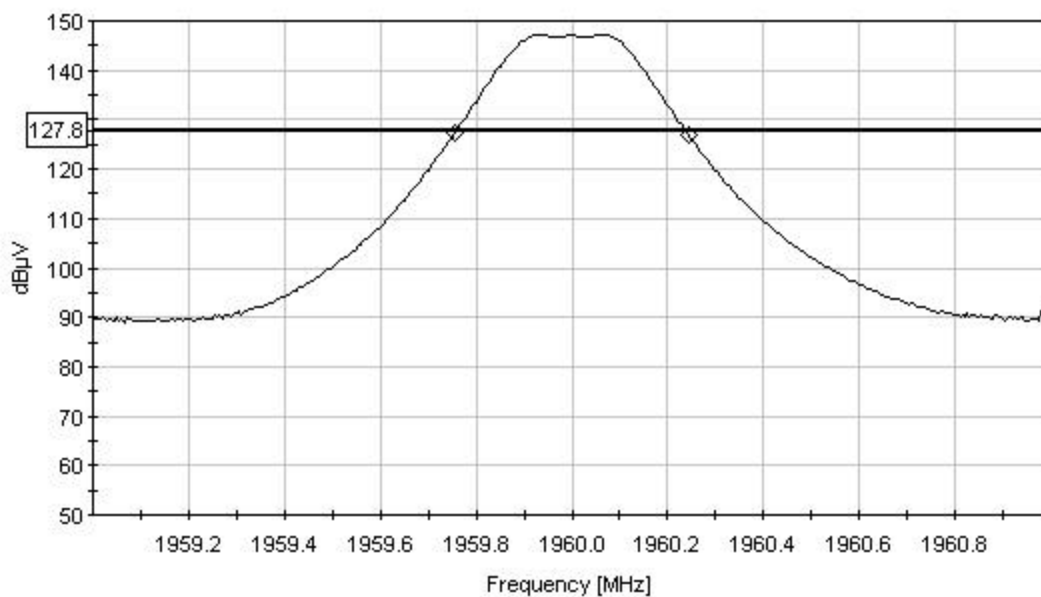
RSS-133 99% BANDWIDTH GSM 1930 MHz

RSS 133 99% Bandwidth. -20dB BW= 510kHz GSM 1930 MHz
Ref Level 159.49 dBμV ATTEN 10 dB OFFSET: 52.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.931GHz 126.81 dBμV Marker 2: 1.93GHz 127.776 dBμV Delta: 509.888KHz



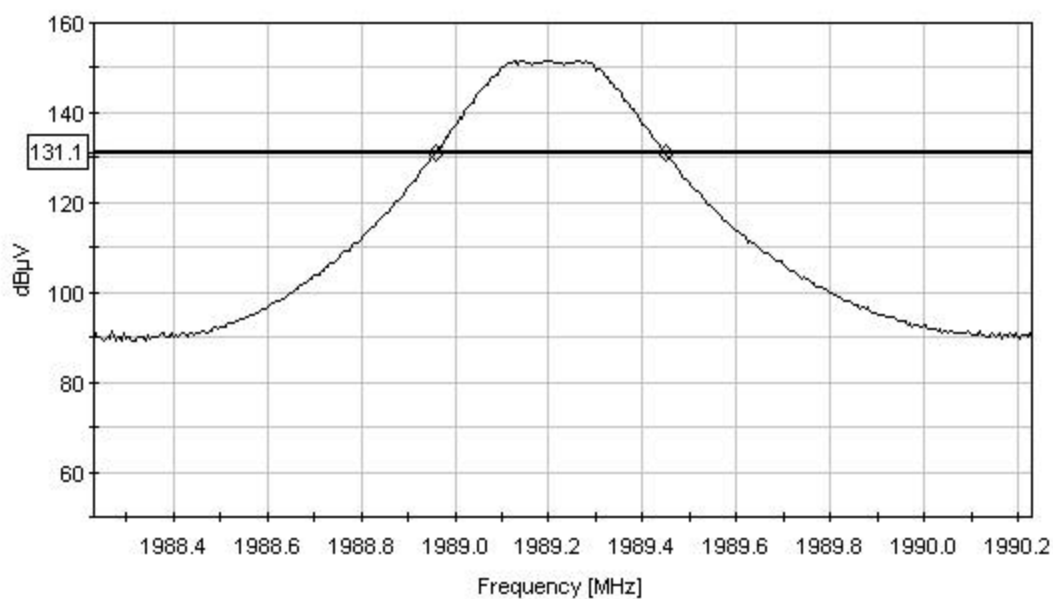
RSS-133 99% BANDWIDTH GSM 1960 MHz

RSS 133 99% Bandwidth. -20dB BW= 490kHz GSM 1960MHz
Ref Level 158.49 dBμV ATTEN 10 dB OFFSET: 51.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.96GHz 126.764 dBμV Marker 2: 1.96GHz 127.159 dBμV Delta: 489.99KHz



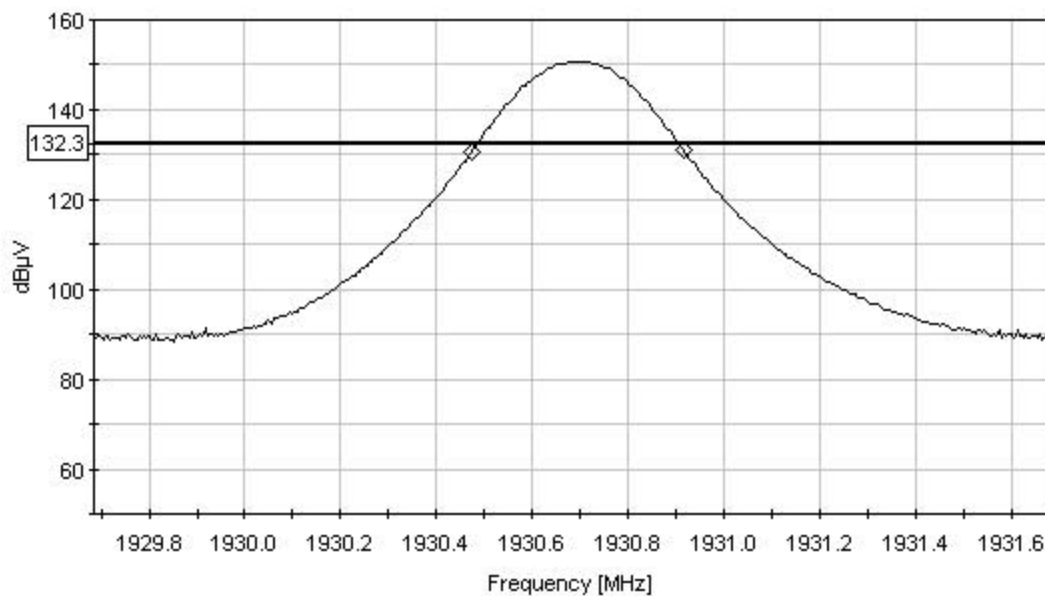
RSS-133 99% BANDWIDTH GSM 1990 MHz

RSS 133 99% Bandwidth. -20dB BW= 490kHz GSM 1990MHz
Ref Level 159.49 dBμV ATTEN 10 dB OFFSET: 52.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.989GHz 131.125 dBμV Marker 2: 1.989GHz 130.963 dBμV Delta: 489.99KHz



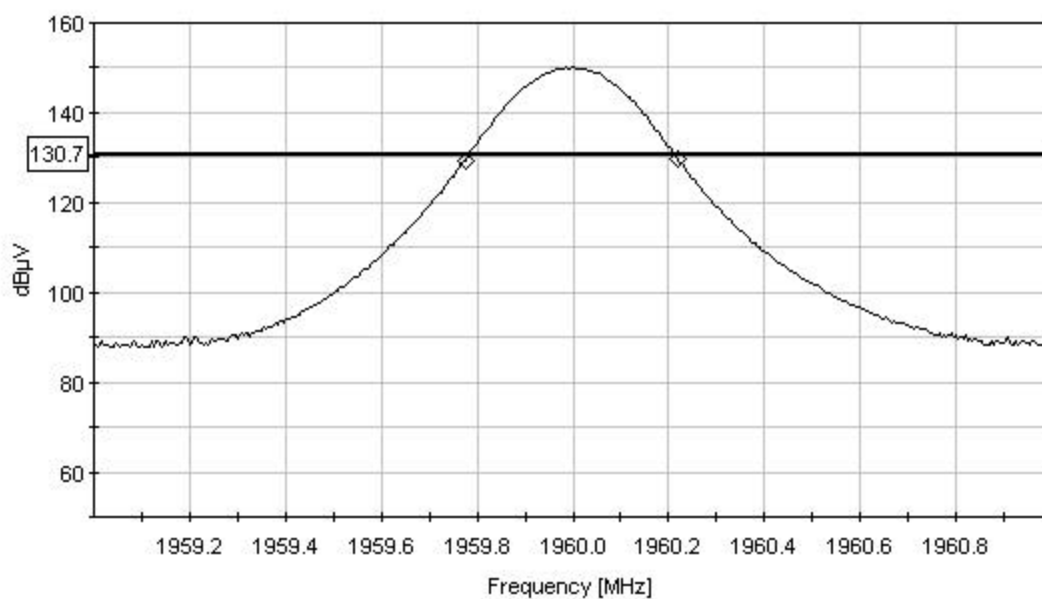
RSS-133 99% BANDWIDTH EDGE 1930 MHz

RSS 133 99% Bandwidth. -20dB BW= 440kHz EDGE 1930MHz
Ref Level 159.49 dB μ V ATTEN 10 dB OFFSET: 52.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.93GHz 130.807 dB μ V Marker 2: 1.931GHz 131.157 dB μ V Delta: 439.941KHz



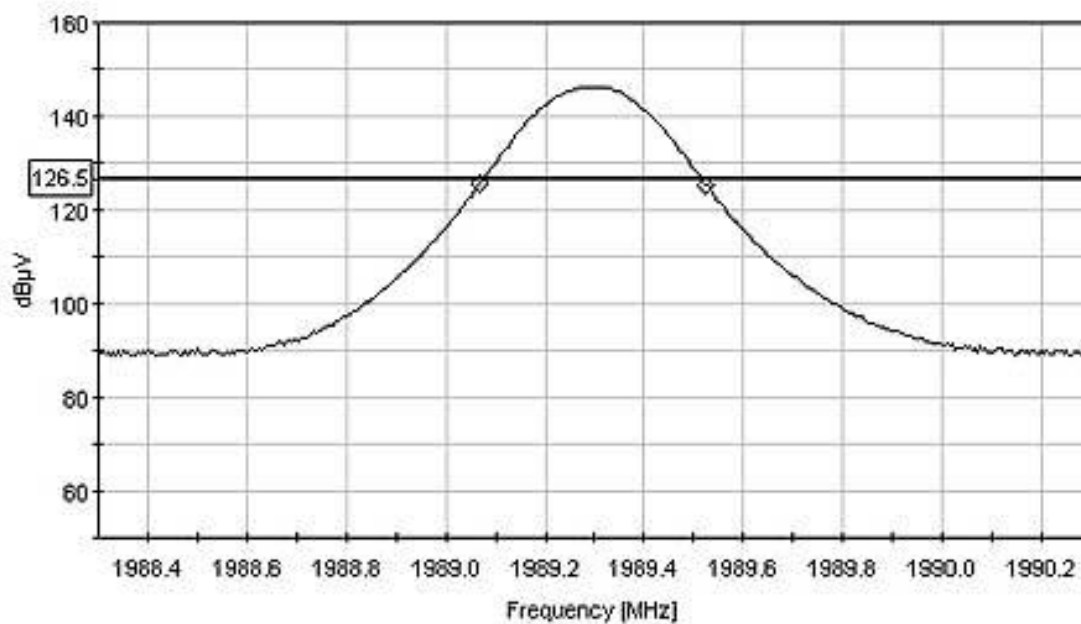
RSS-133 99% BANDWIDTH EDGE 1960 MHz

RSS 133 99% Bandwidth. -20dB BW= 445kHz EDGE 1960MHz
Ref Level 158.49 dBμV ATTEN 10 dB OFFSET: 51.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.96GHz 129.441 dBμV Marker 2: 1.96GHz 129.692 dBμV Delta: 445.068KHz



RSS-133 99% BANDWIDTH EDGE 1990 MHz

RSS 133 99% Bandwidth. -20dB BW= 455MHz EDGE 1990MHz
Ref Level 159.49 dBμV ATTEN 10 dB OFFSET: 52.5dB
RES BW: 100.0KHz VID BW: 100.0KHz SWP: 5.0msec
Marker 1: 1.989GHz 125.688 dBμV Marker 2: 1.99GHz 125.253 dBμV Delta: 455.078KHz



Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	02467	Agilent	E7405A	US40240225	033103	033105
2.4 GHz HPF	01440	K&L	91H31-3000	001	022003	022005

PHOTOGRAPH SHOWING DIRECT CONNECT TEST SETUP

