



**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:**

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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*

<i>HAAT in meters</i>	<i>Maximum E.I.R.P. (watts)</i>
<i>6300</i>	<i>1640</i>
<i>6500</i>	<i>1070</i>
<i>61000</i>	<i>490</i>
<i>61500</i>	<i>270</i>
<i>62000</i>	<i>160</i>

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.

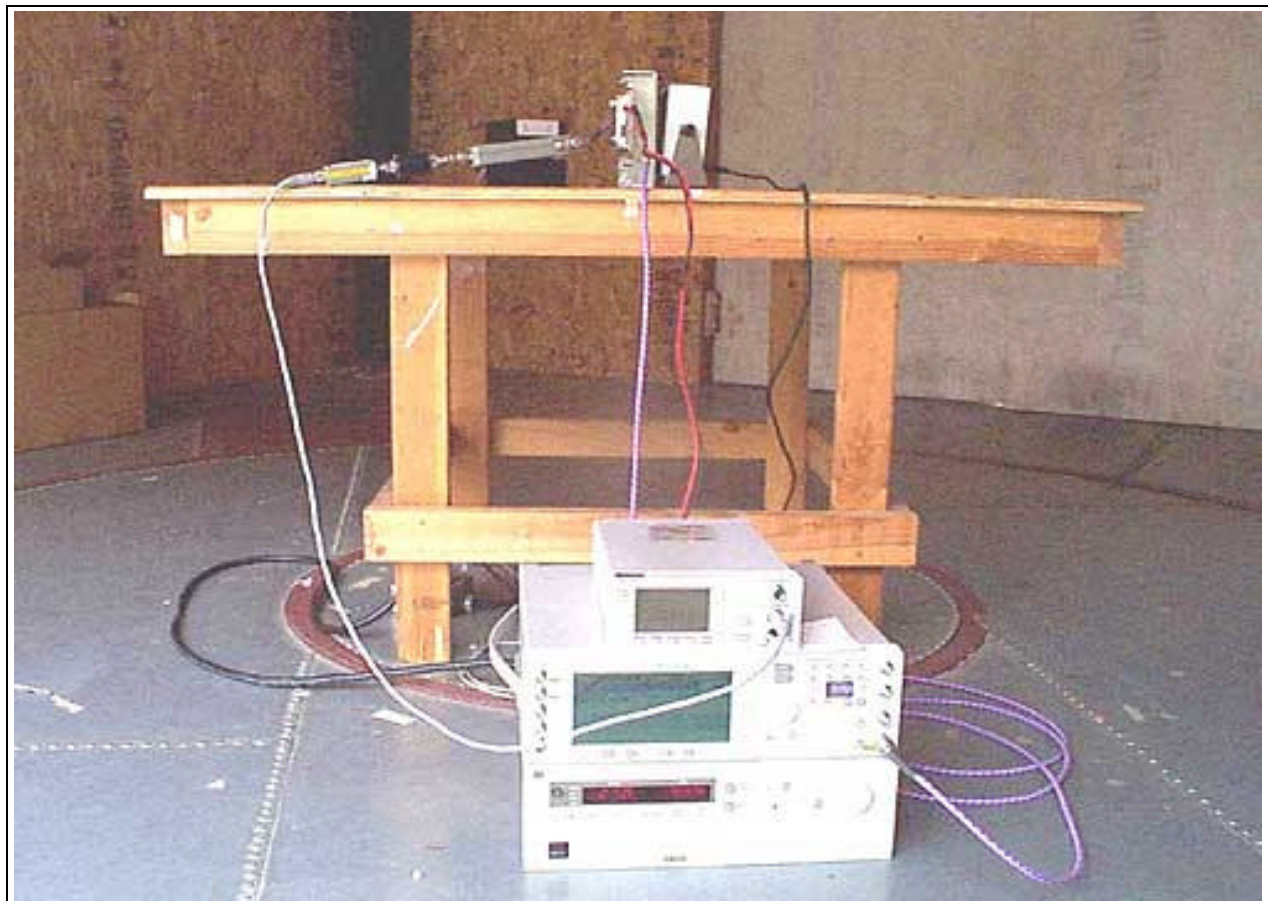
Modulation EDGE and GSM

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**

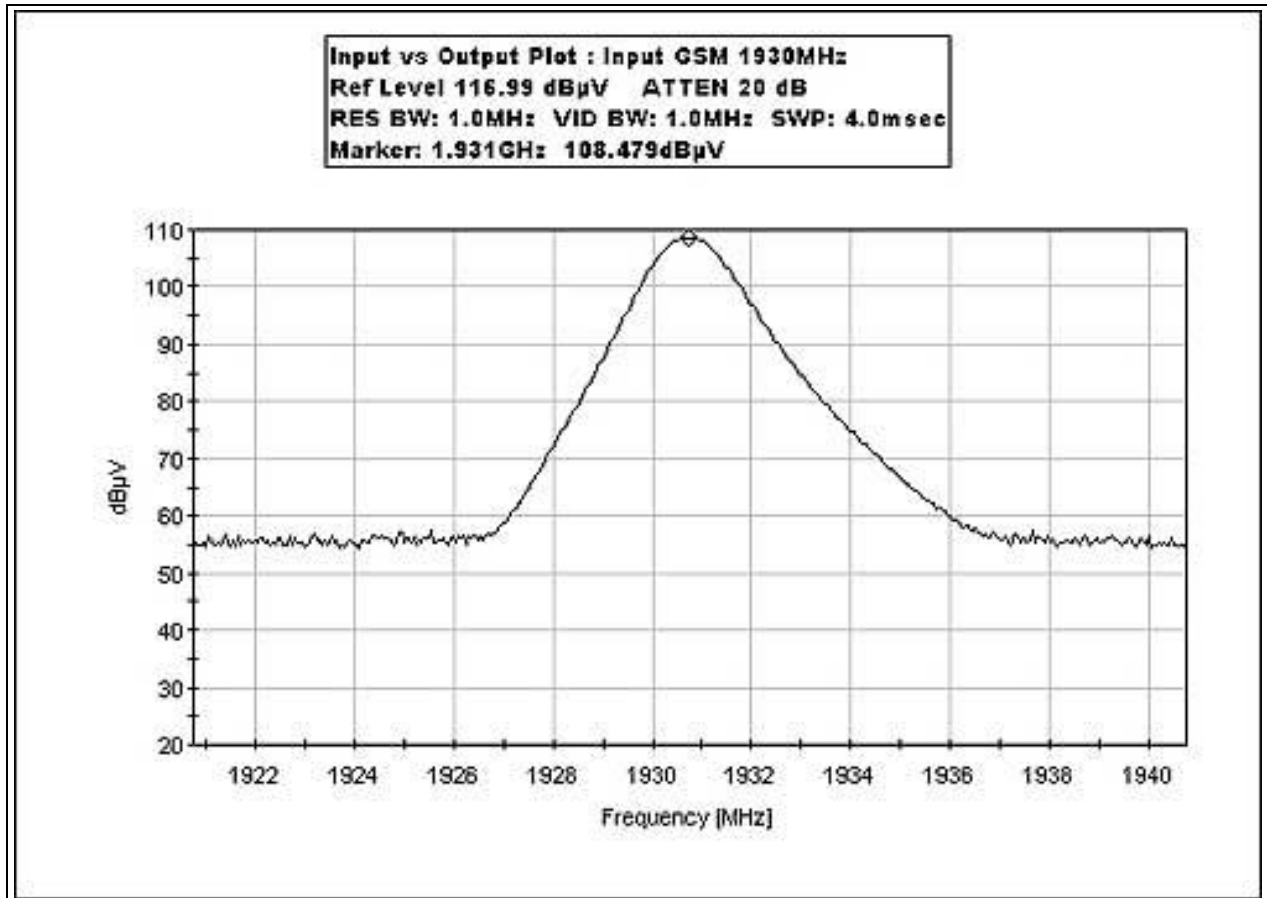
Not applicable to this unit.

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

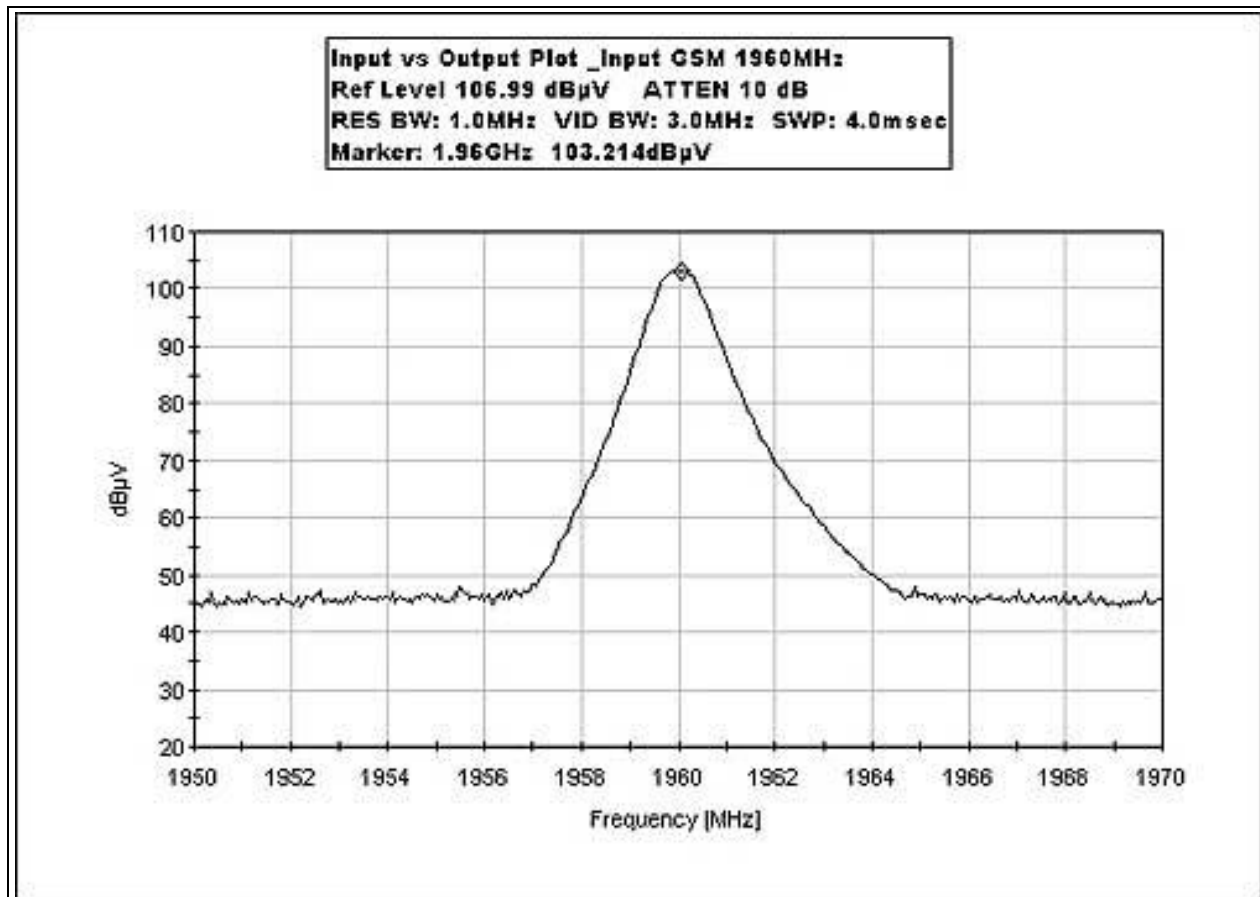
Not applicable to this unit.

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

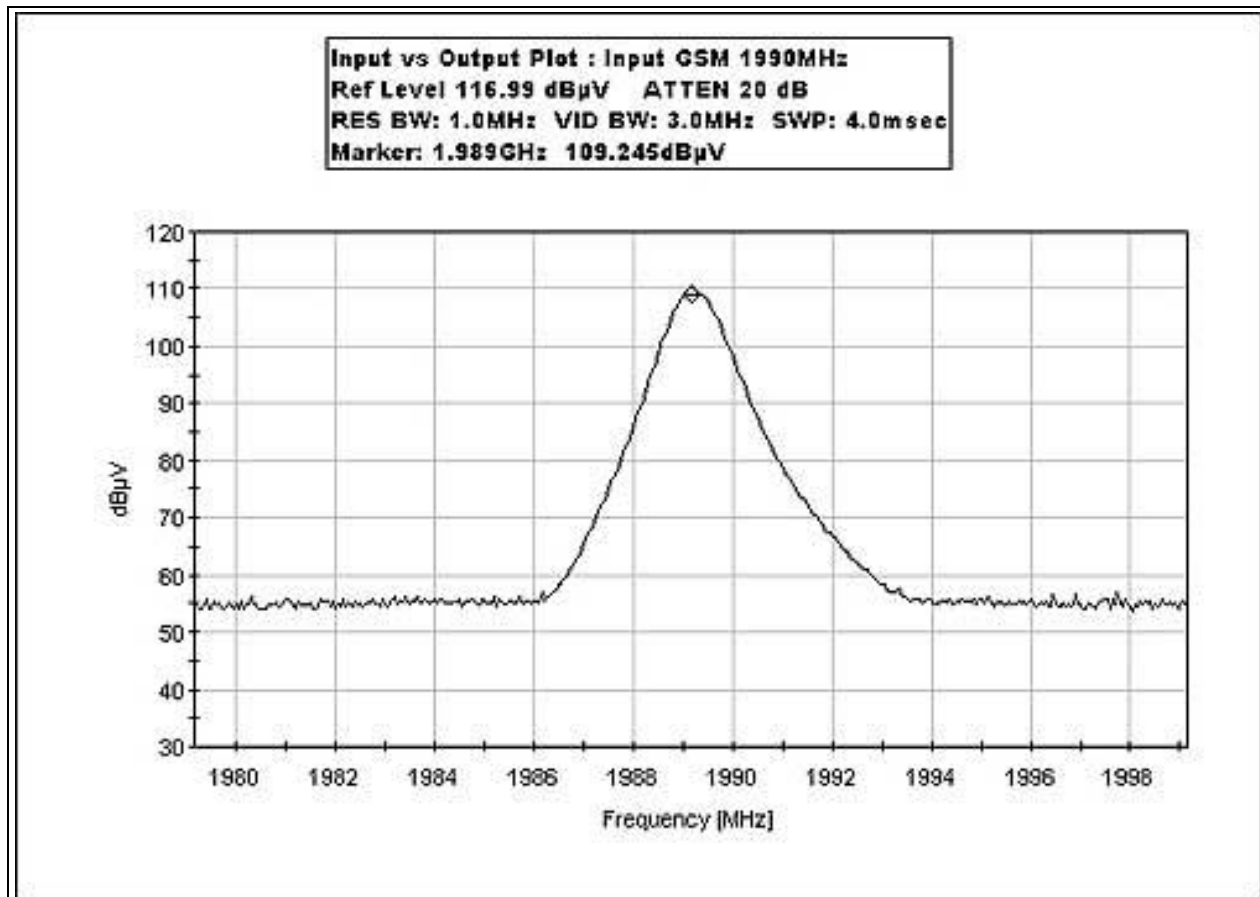
INPUT PLOT GSM 1930 MHz



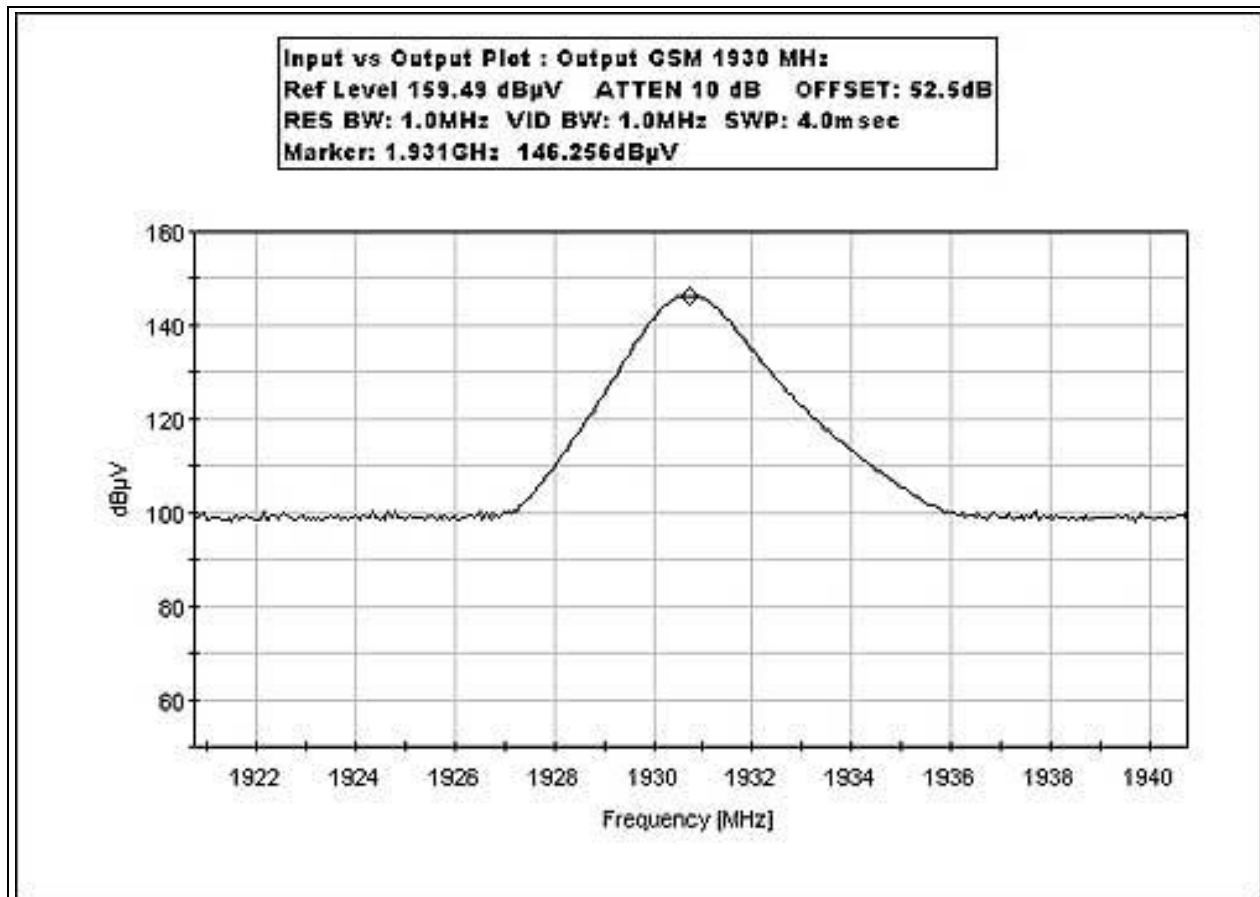
**FCC 2.1049(i) INPUT PLOT GSM 1960 MHz**



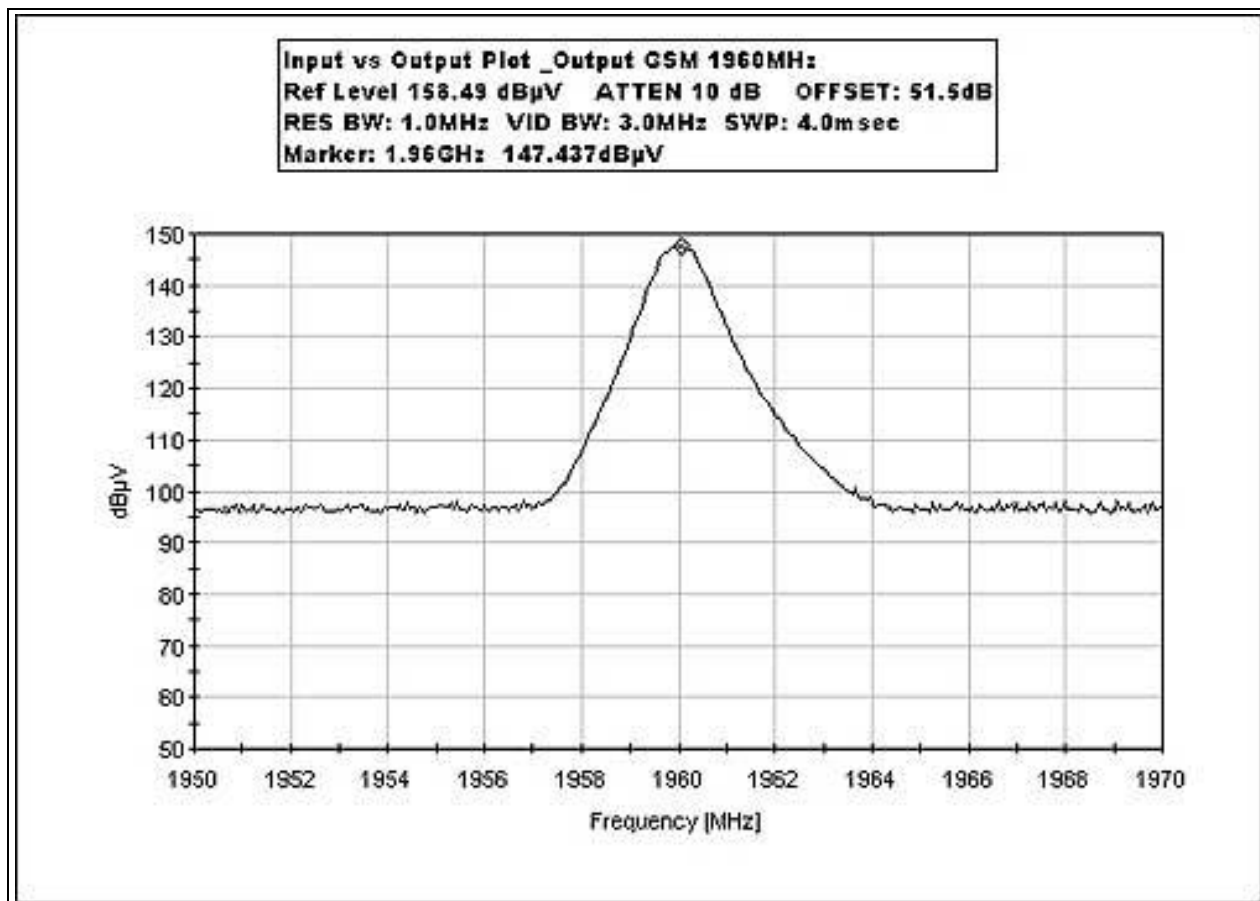
**FCC 2.1049(i) INPUT PLOT GSM 1990 MHz**



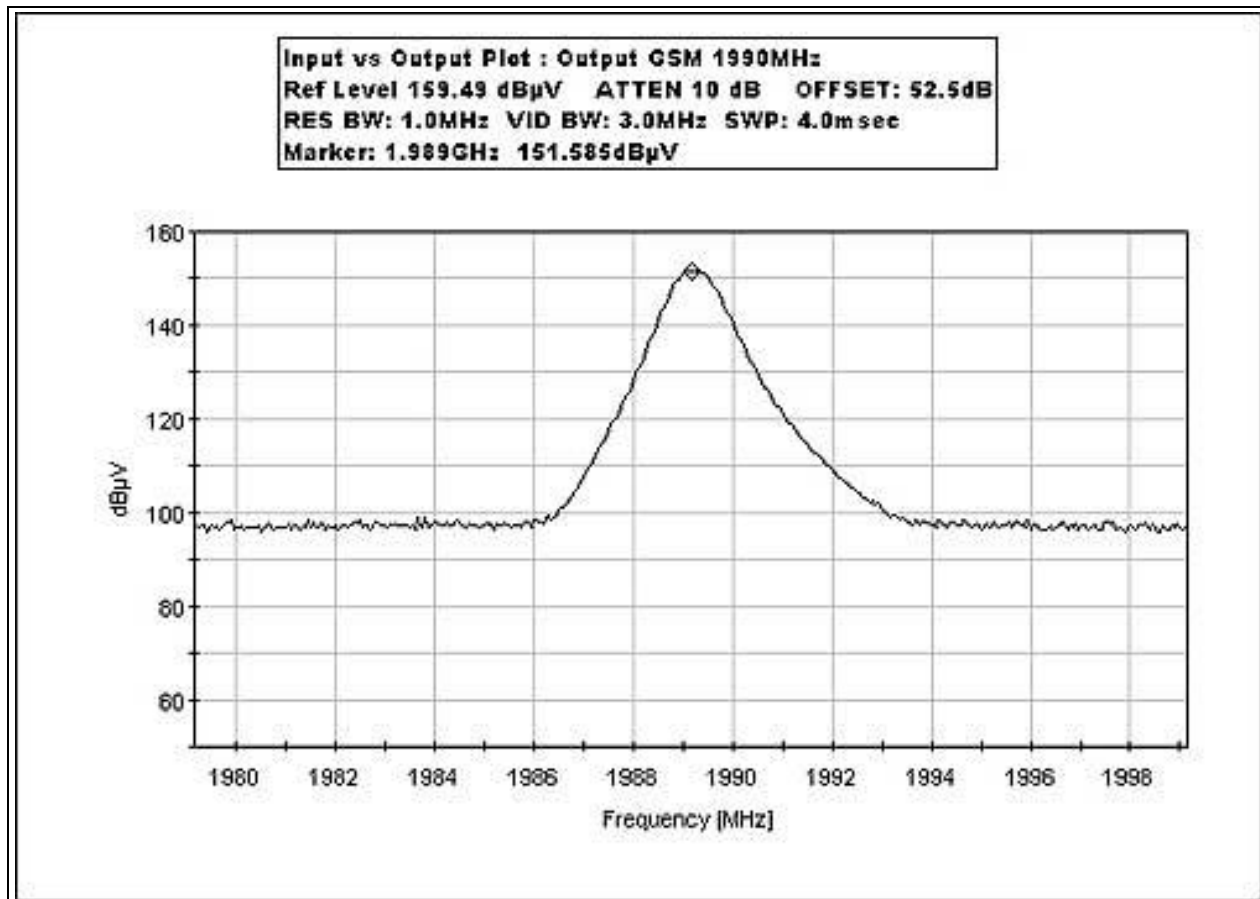
FCC 2.1049(i) OUTPUT PLOT GSM 1930 MHz



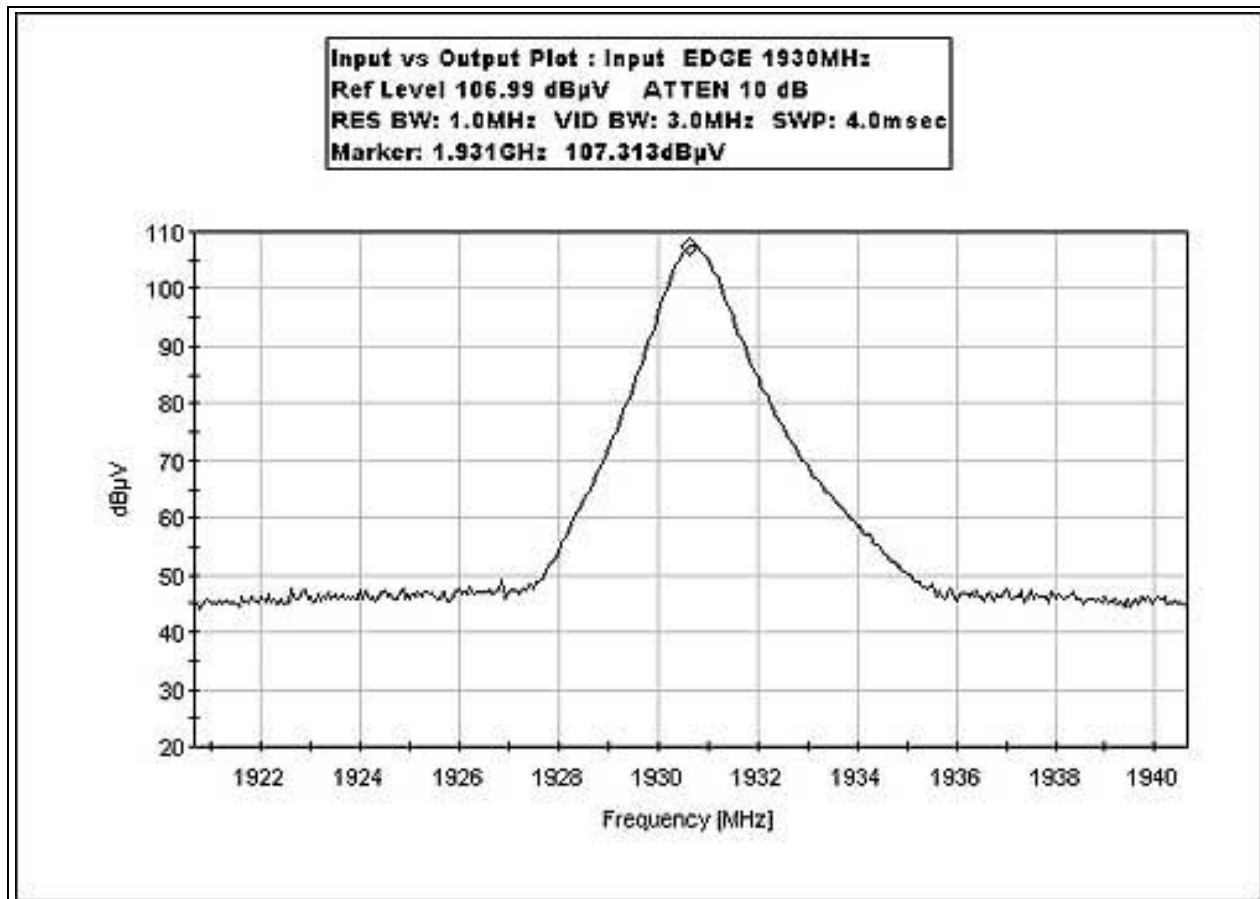
**FCC 2.1049(i) OUTPUT PLOT GSM 1960 MHz**



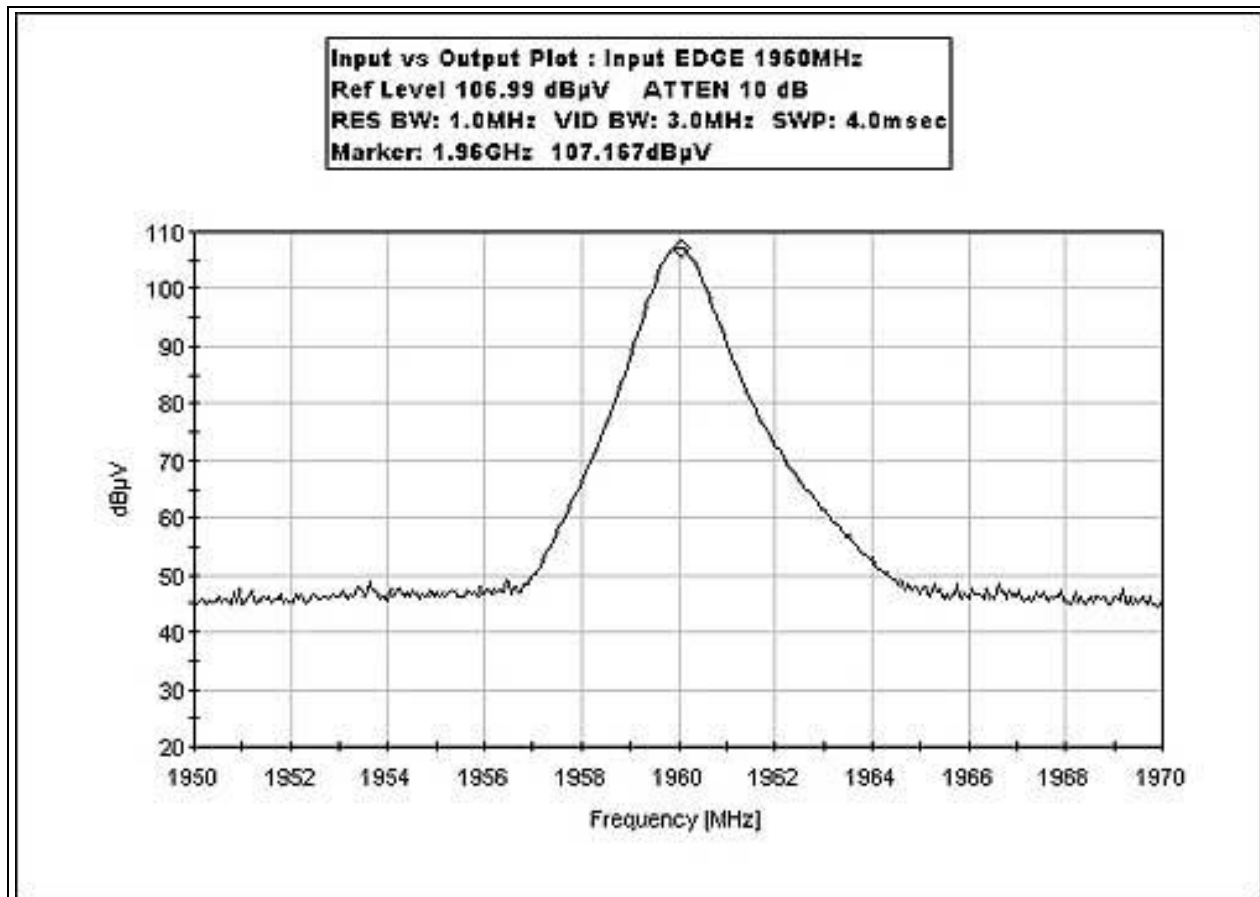
FCC 2.1049(i) OUTPUT PLOT GSM 1990 MHz



FCC 2.1049(i) INPUT PLOT EDGE 1930 MHz

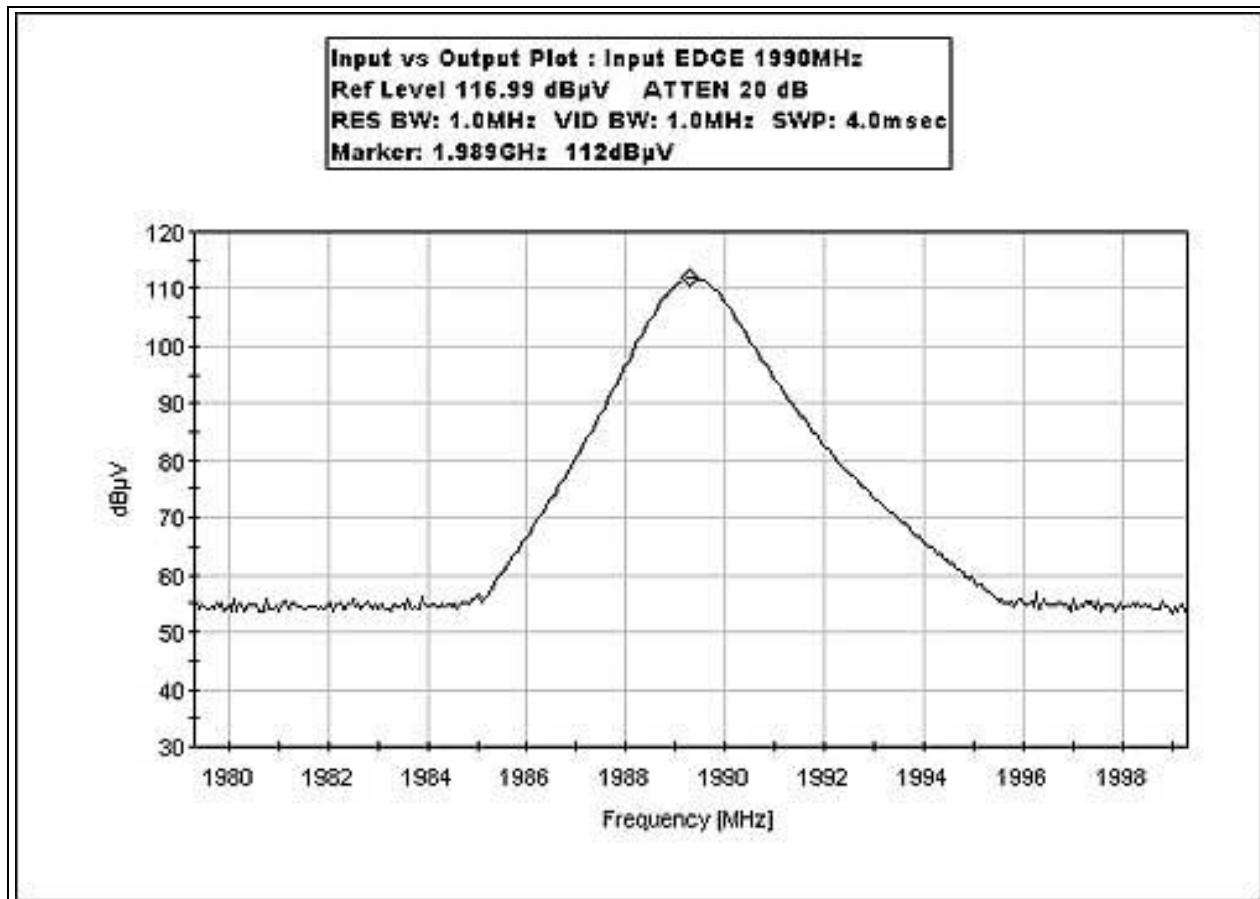


FCC 2.1049(i) INPUT PLOT EDGE 1960 MHz

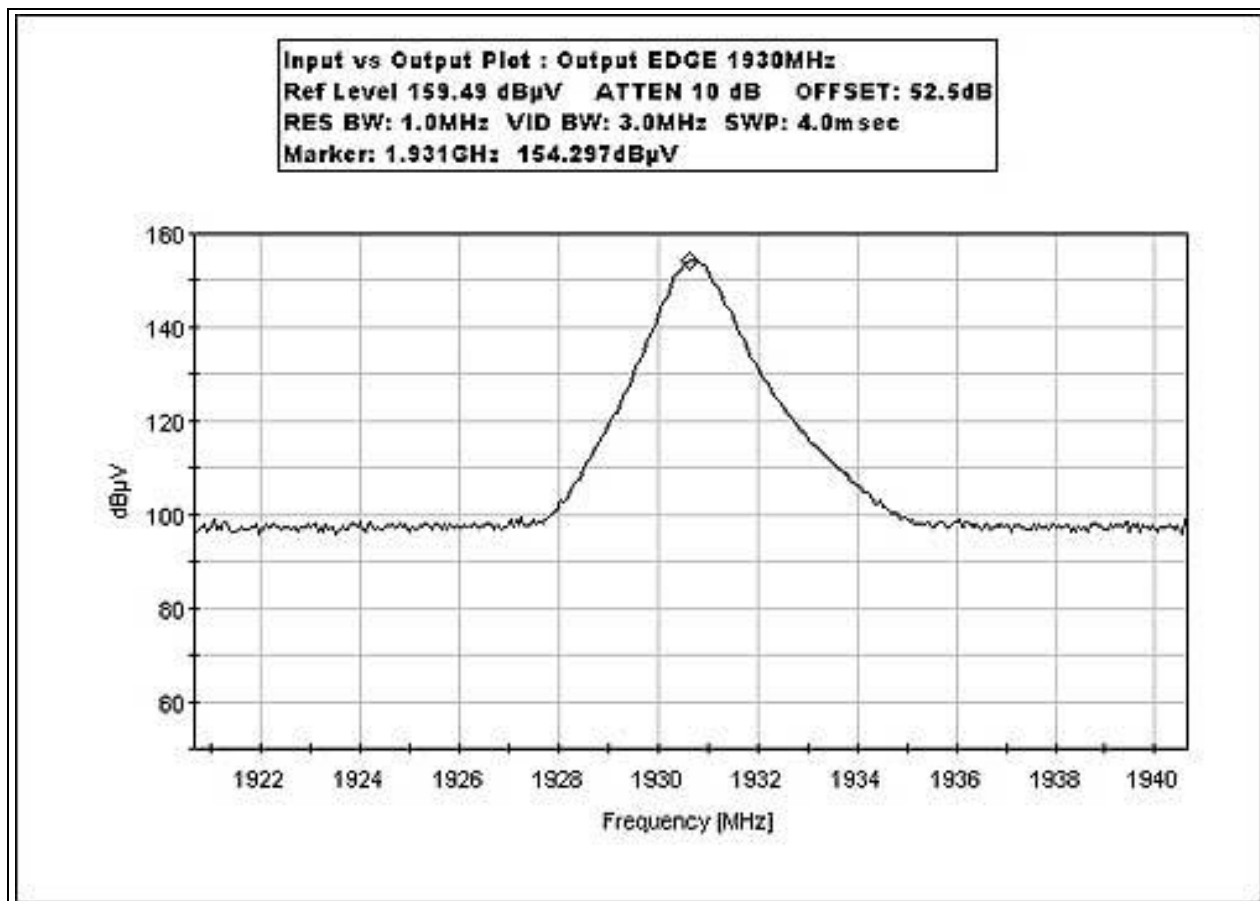




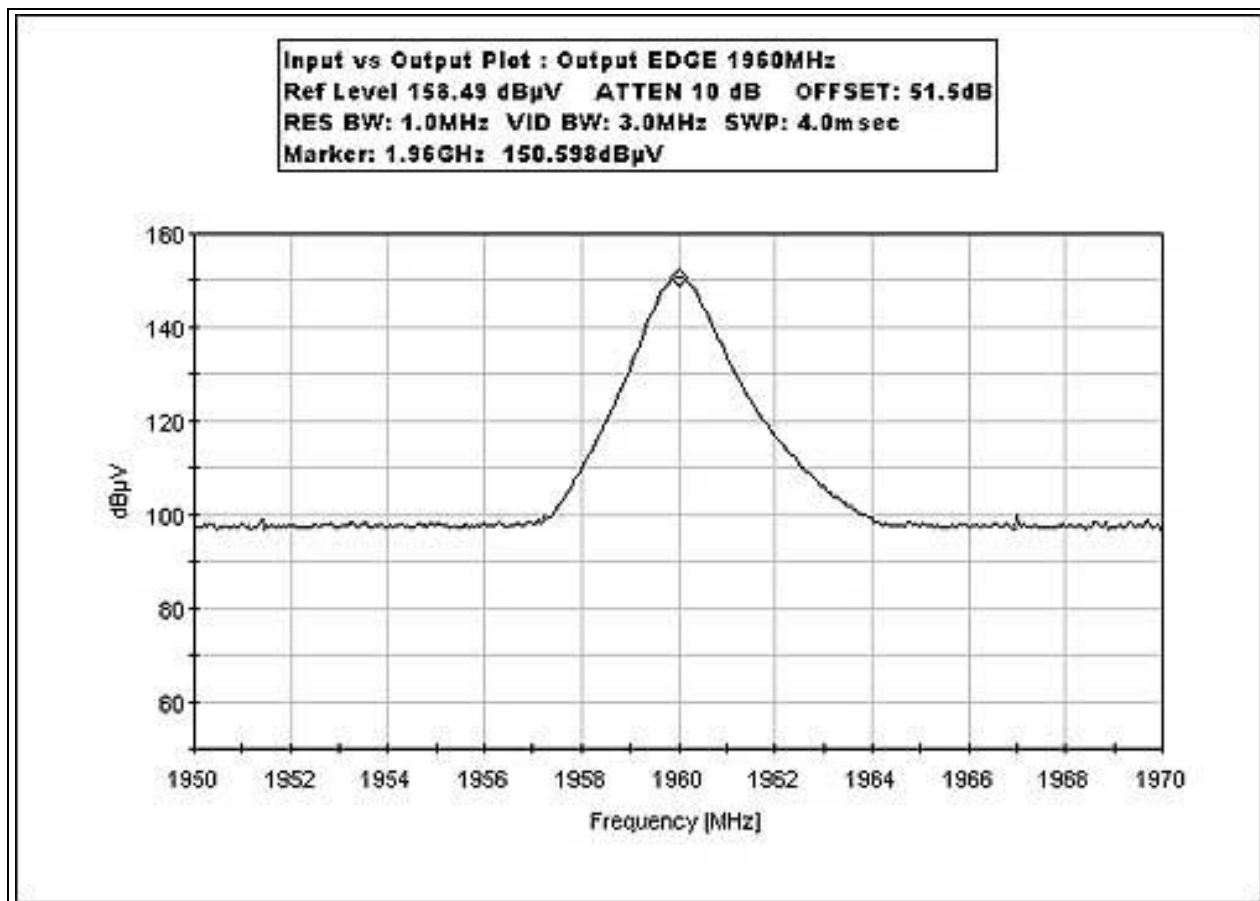
FCC 2.1049(i) INPUT PLOT EDGE 1990 MHz



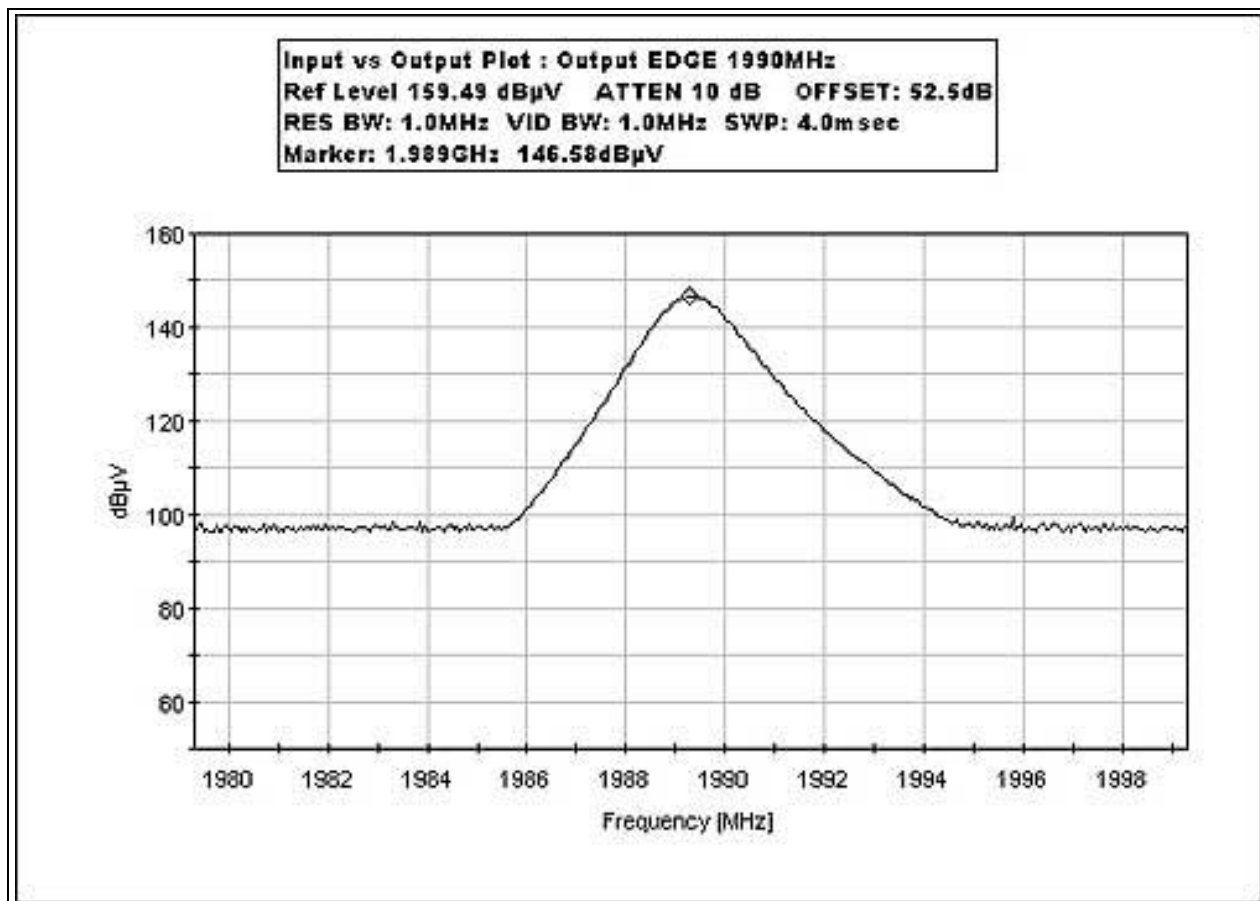
FCC 2.1049(i) OUTPUT PLOT EDGE 1930 MHz



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**

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

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

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

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

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



**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.**

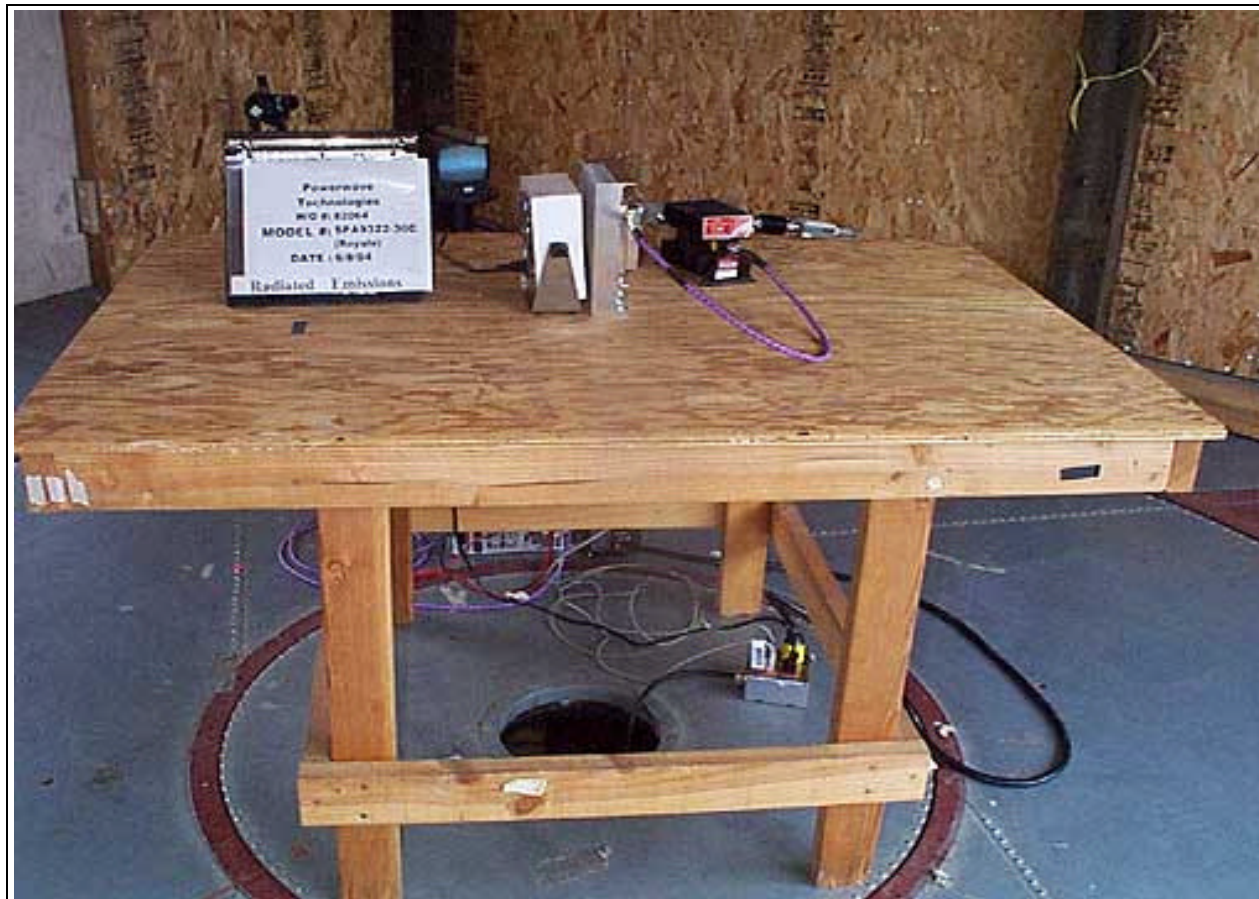
Operating Frequency: 1930 MHz - 1990 MHz  
 Channels: Low, Mid & High  
 Highest Measured Output Power: 44.77 EIRP(dBm)= 30 EIRP(Watts)  
 Distance: 3 meters  
 Limit:  $43+10\text{Log}(P)$  57.77 dBc

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



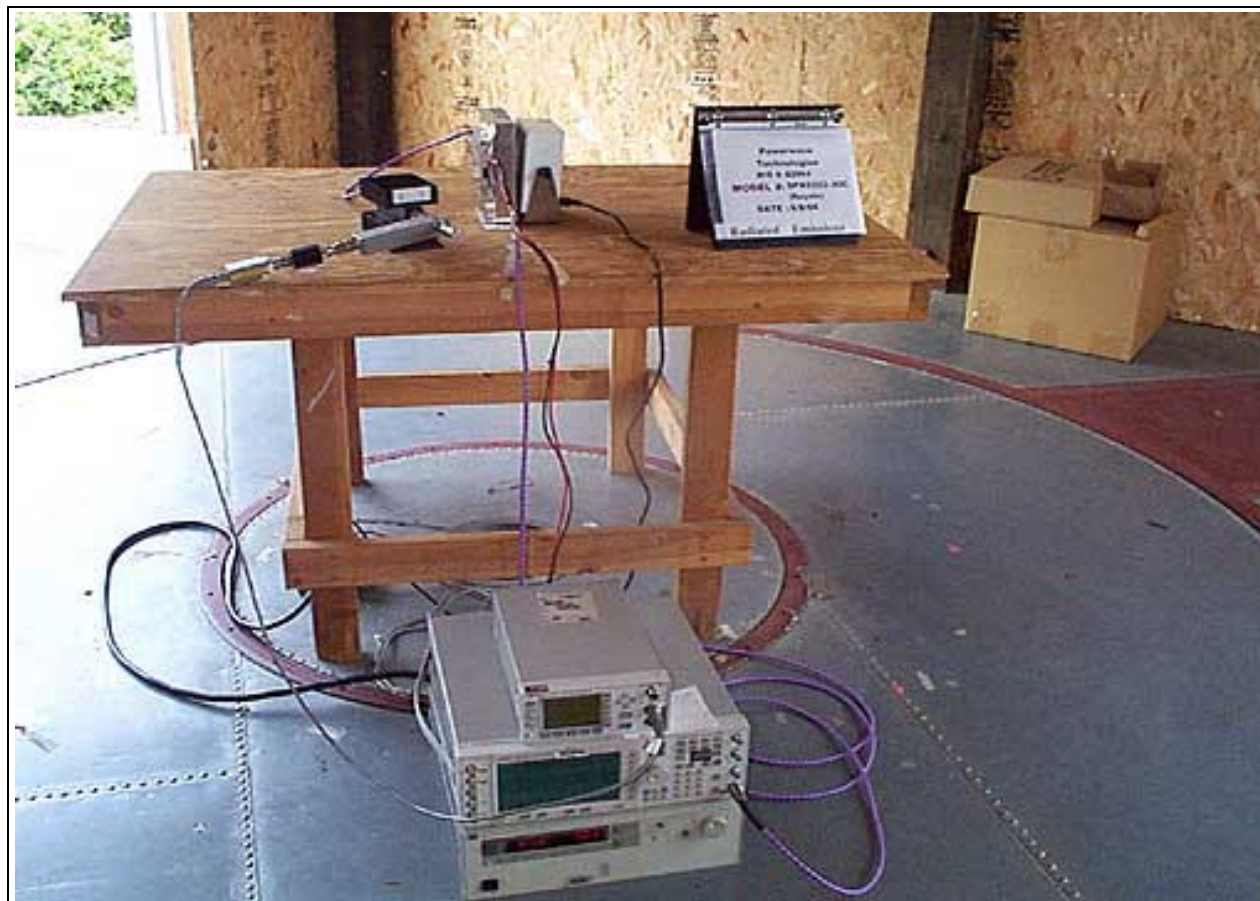
Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,920.02	-23.2	Horiz	67.97
5,880.02	-24.8	Vert	69.57
13,720.03	-30.4	Vert	75.17
13,720.00	-31.7	Horiz	76.47
7,840.03	-32.3	Vert	77.07
7,839.92	-32.5	Horiz	77.27
11,760.02	-35.7	Vert	80.47
11,760.00	-36.3	Horiz	81.07
9,799.91	-37.7	Horiz	82.47
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

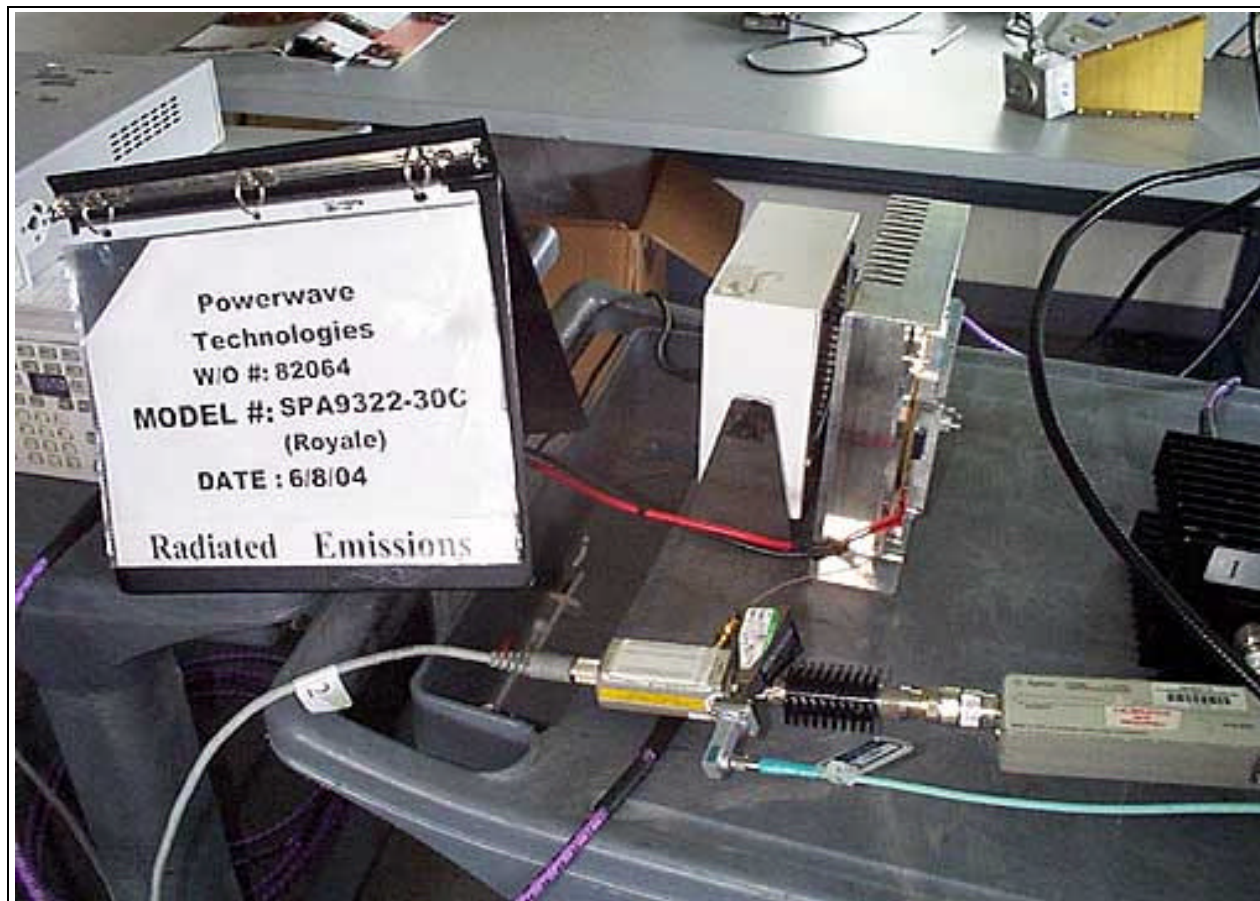
**PHOTOGRAPH SHOWING RADIATED EMISSIONS**



Radiated Emissions - Back View



**PHOTOGRAPH SHOWING RADIATED EMISSIONS**



Radiated Emissions - Horn Antenna

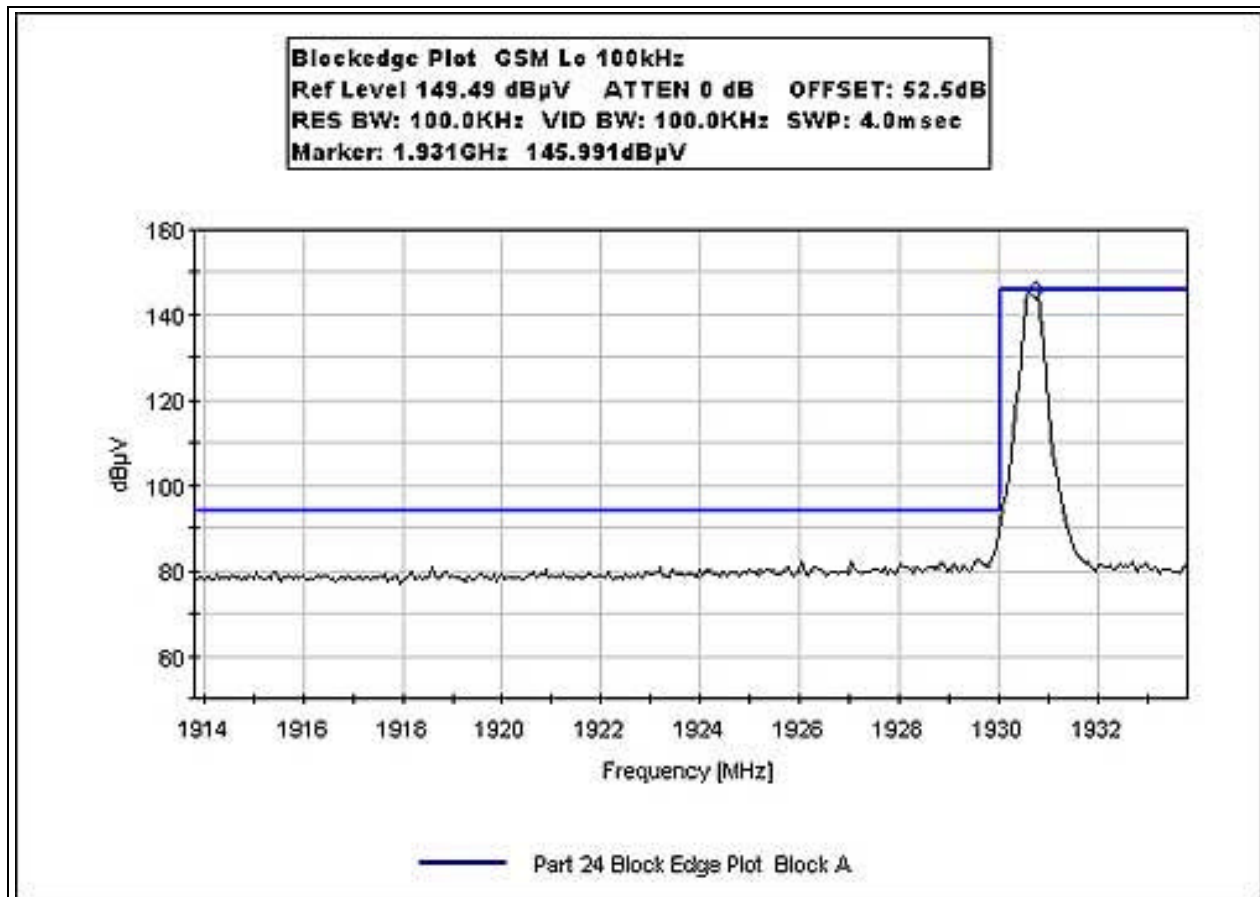
**Test Equipment 3/29/04**

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

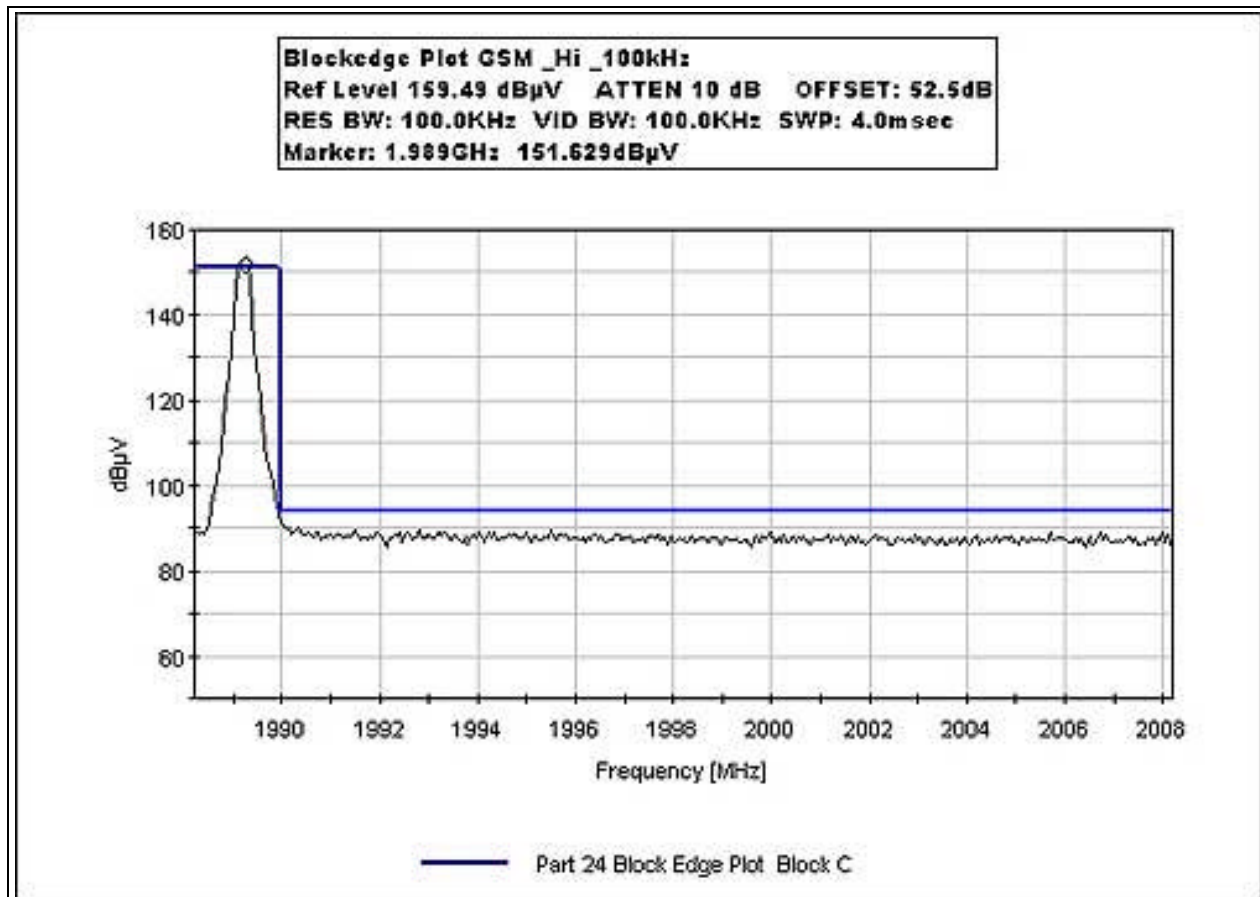
**Test Equipment 6/8/04**

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

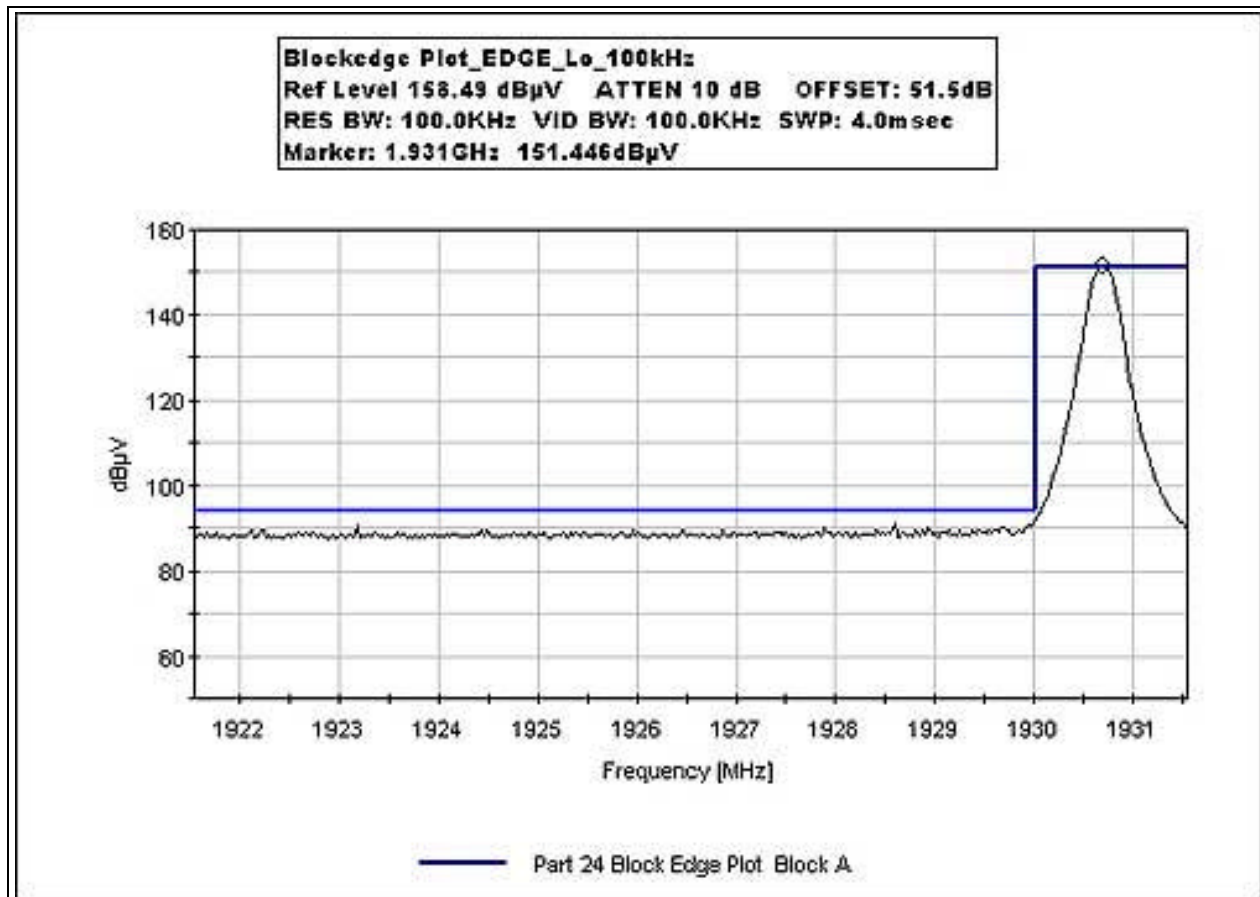
### BLOCKEDGE PLOT GSM LOW



### BLOCKEDGE PLOT GSM HIGH

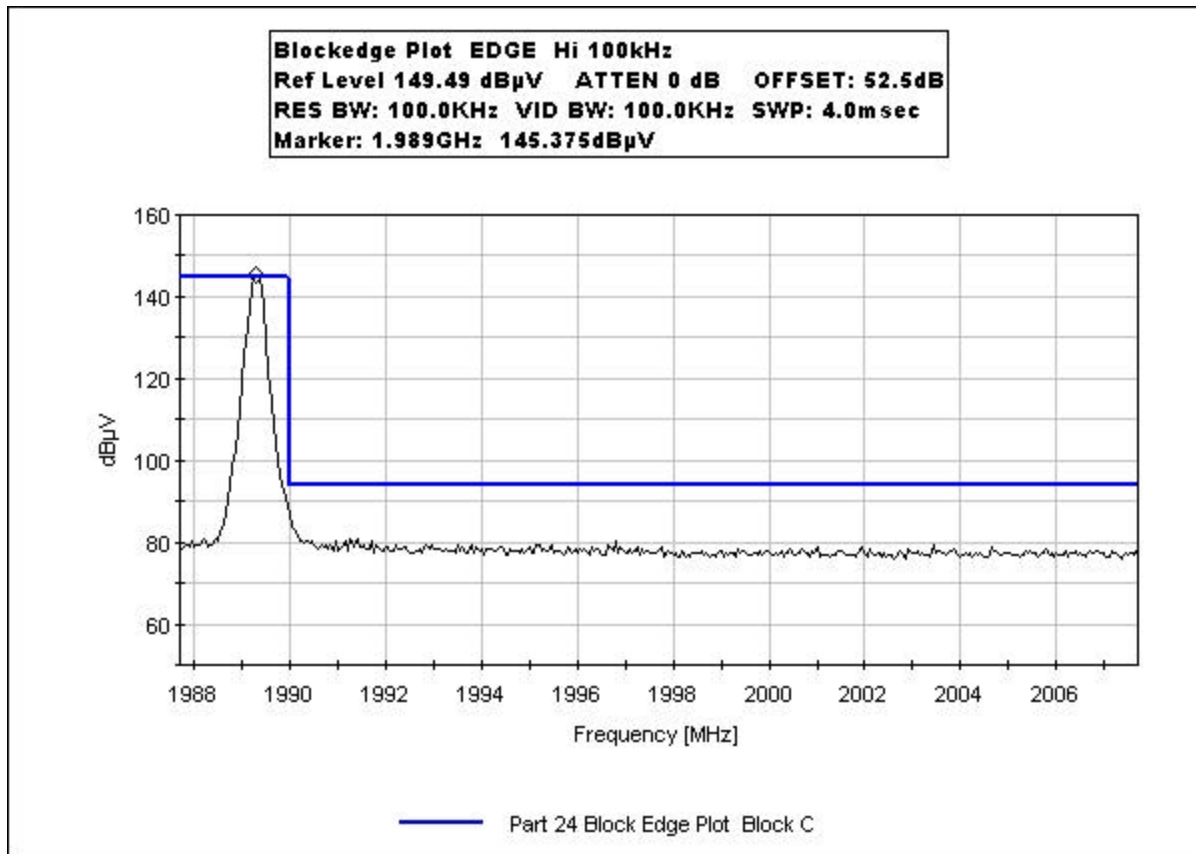


### BLOCKEDGE PLOT EDGE LOW





### BLOCKEDGE PLOT EDGE HIGH



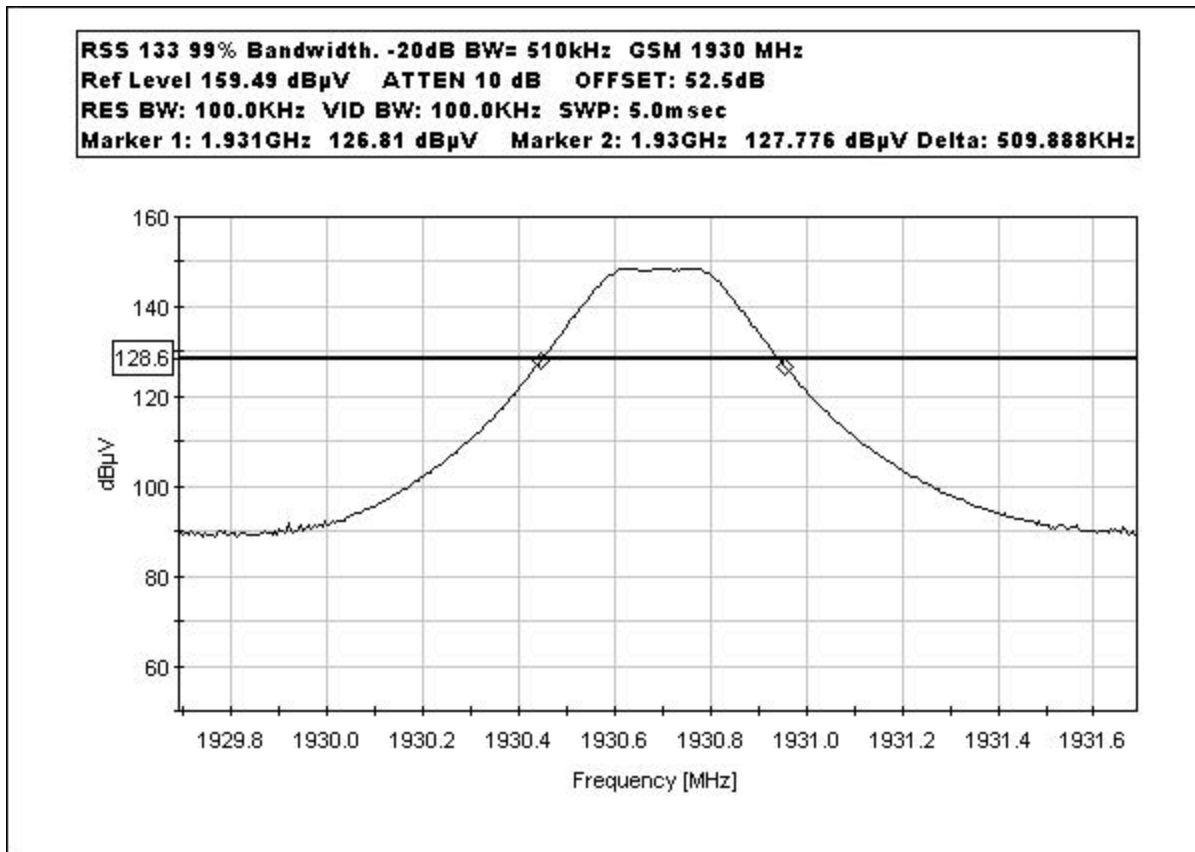
**Test Equipment**

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

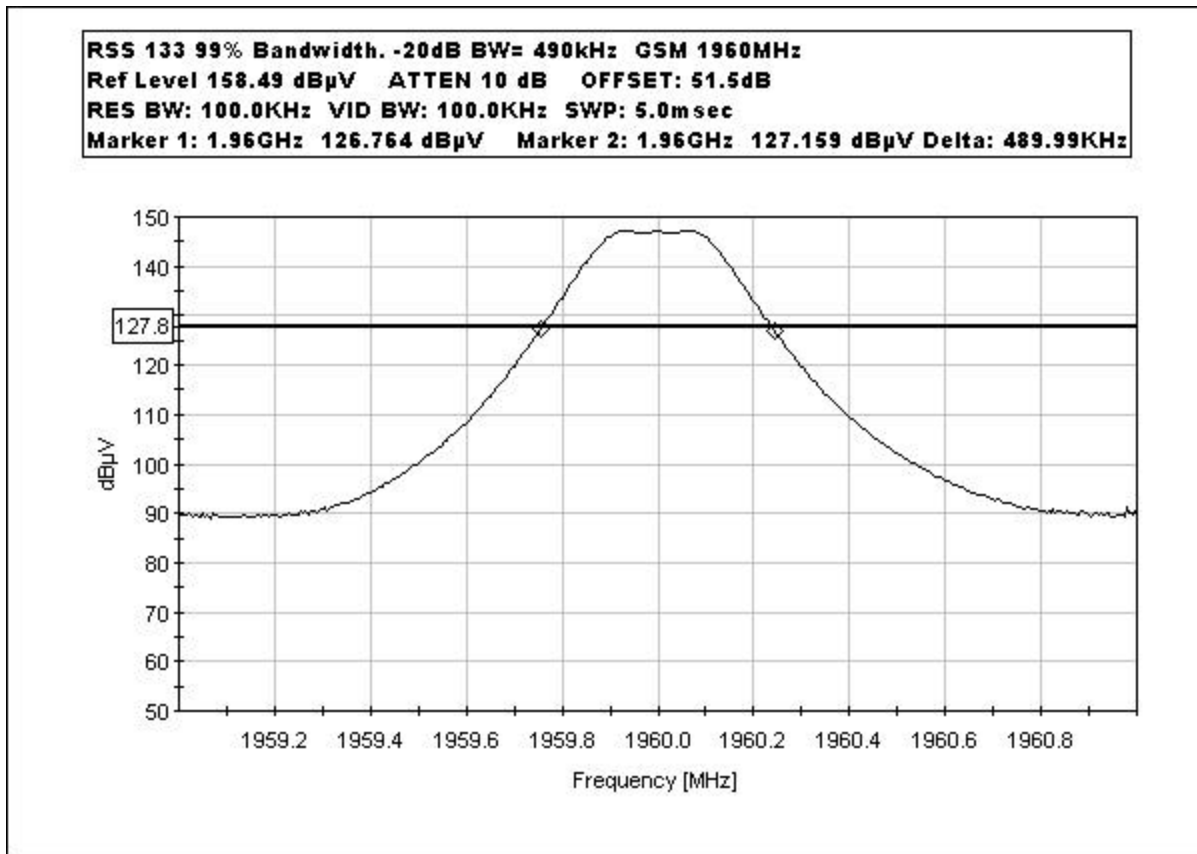
**PHOTOGRAPH SHOWING DIRECT CONNECT TEST SETUP**



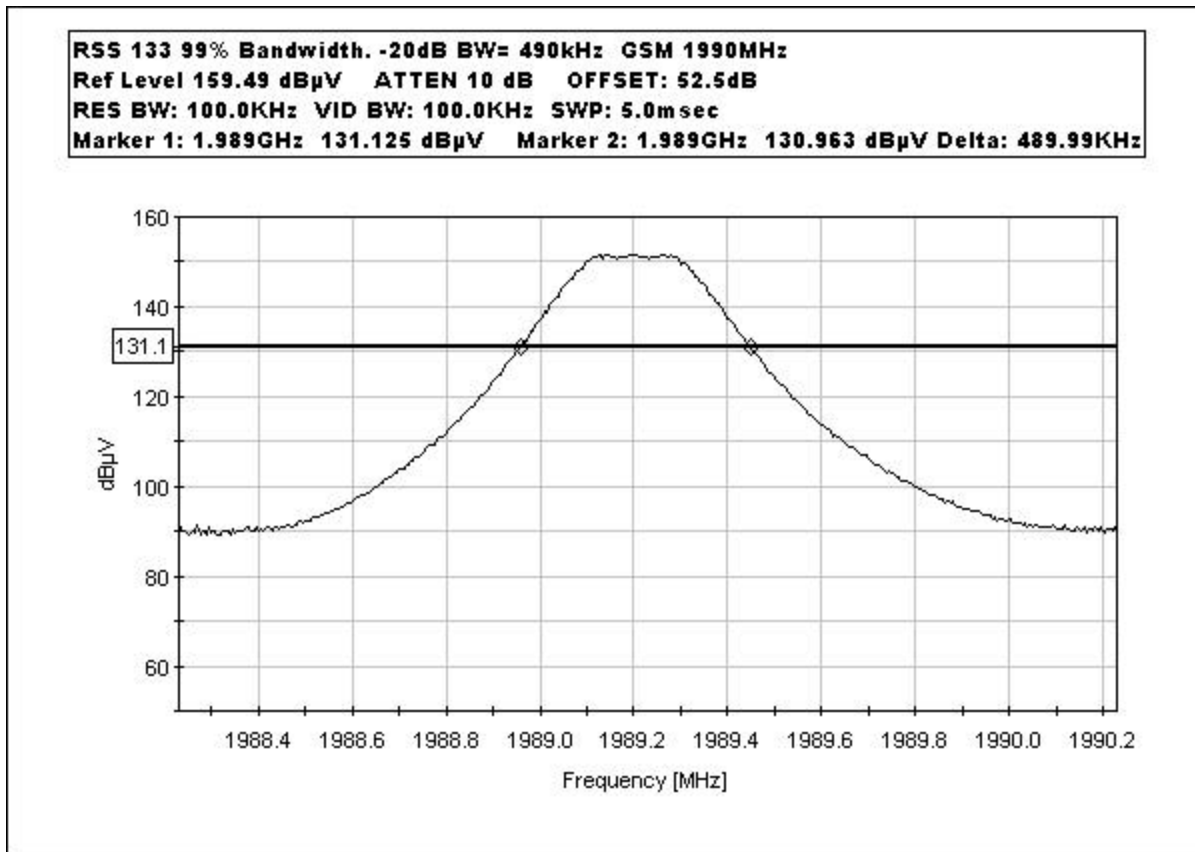
### RSS-133 99% BANDWIDTH GSM 1930 MHz



### RSS-133 99% BANDWIDTH GSM 1960 MHz

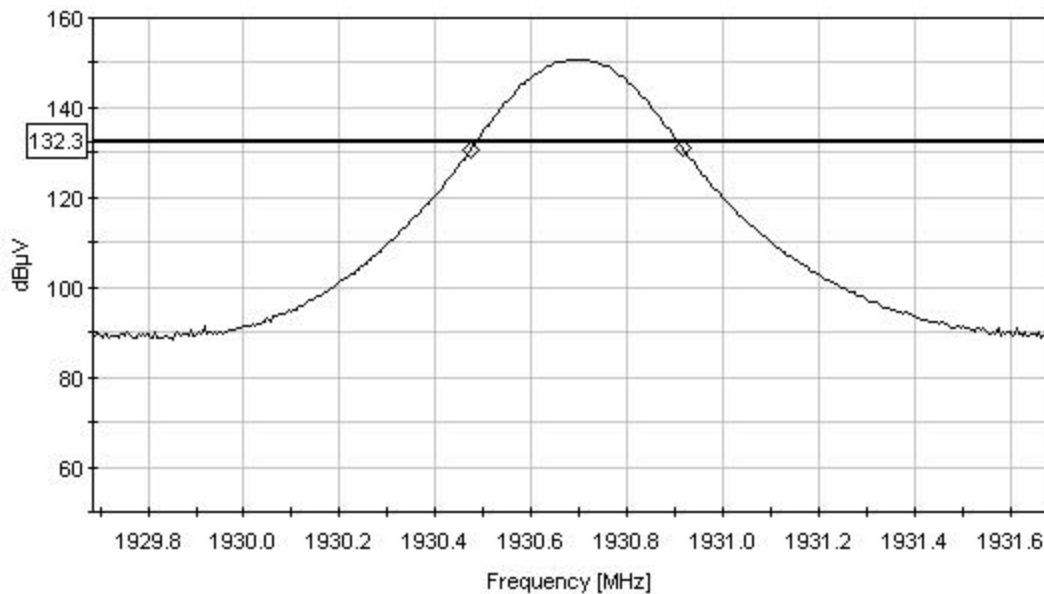


### RSS-133 99% BANDWIDTH GSM 1990 MHz

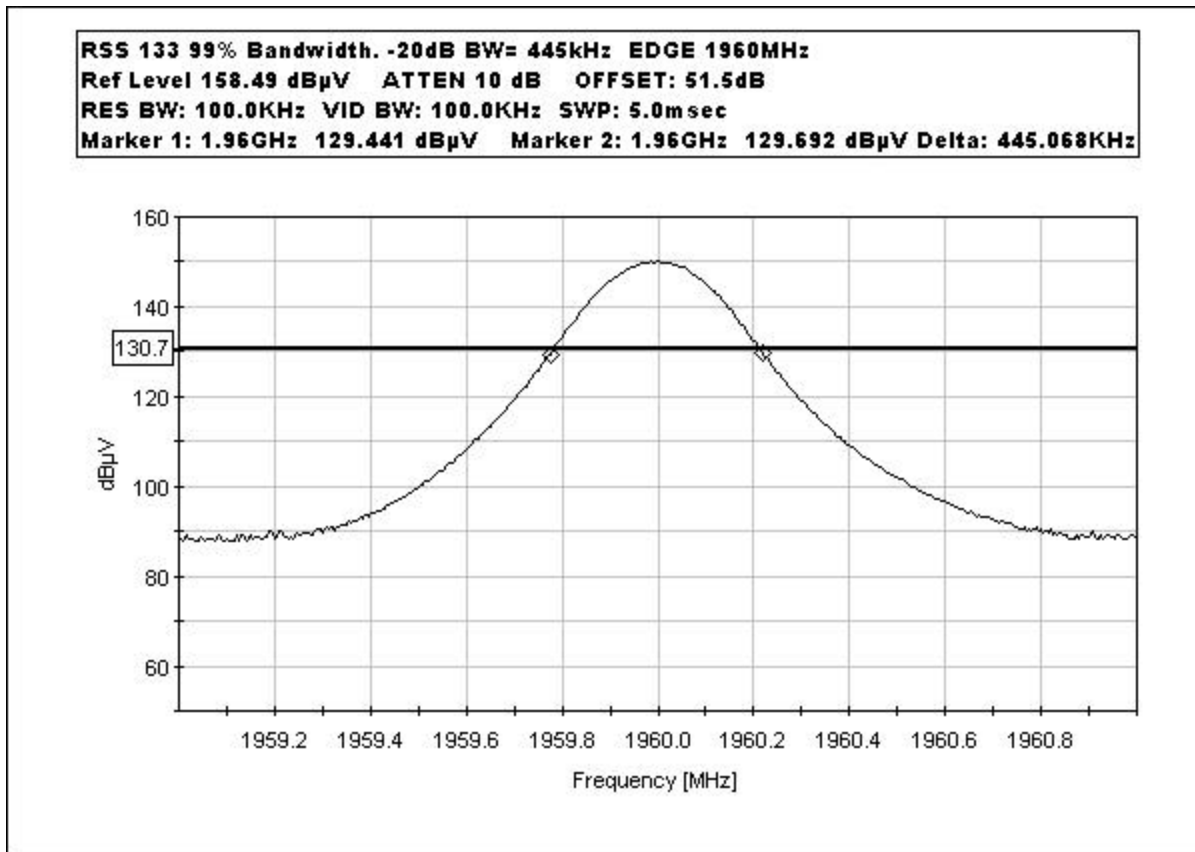


### RSS-133 99% BANDWIDTH EDGE 1930 MHz

**RSS 133 99% Bandwidth. -20dB BW= 440kHz EDGE 1930MHz**  
**Ref Level 159.49 dB $\mu$ 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 $\mu$ V Marker 2: 1.931GHz 131.157 dB $\mu$ V Delta: 439.941KHz**

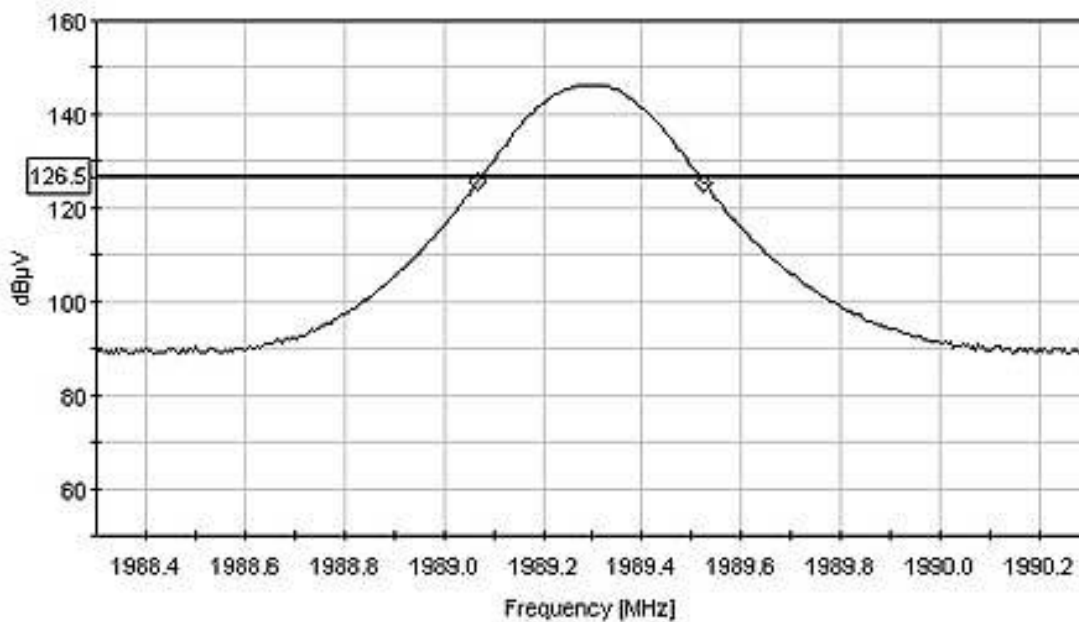


### RSS-133 99% BANDWIDTH EDGE 1960 MHz



**RSS-133 99% BANDWIDTH EDGE 1990 MHz**

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

