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EMC/SAFETY

POWERWAVE TECHNOLOGIES TEST REPORT

FOR THE

GSM/EDGE BOOSTER AMPLIFIER, SPA9329-35

FCC PART 24 AND PART 15 SUBPART B SECTION 15.107 CLASS A

COMPLIANCE

DATE OF ISSUE: NOVEMBER 8, 2002

PREPARED FOR:

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

P.O. No.: 60772
W.O. No.: 79687

PREPARED BY:

Mary Ellen Clayton
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: October 22-28, 2002

Report No.: FC02-100

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ADMINISTRATIVE INFORMATION

DATE OF TEST:	October 22-28, 2002
DATE OF RECEIPT:	October 22, 2002
PURPOSE OF TEST:	To demonstrate the compliance of the GSM/EDGE Booster Amplifier, SPA9329-35 with the requirements for FCC Part 24 and Part 15 Subpart B Section 15.107 Class A devices.
TEST METHOD:	ANSI C63.4 (1992) and FCC Part 24
FREQUENCY RANGE TESTED:	150 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 GSM/EDGE Booster Amplifier, SPA9329-35 was found to be fully compliant with the following standards and specifications:

United States

- FCC Part 24 and method
- FCC Part 15 Subpart B Section 15.107 Class A using:
- ANSI C63.4 (1992) method

CONDITIONS FOR COMPLIANCE

No modifications to the EUT were necessary to comply. Conducted emissions performed at 230V because that is the only voltage at which the EUT operates.

APPROVALS

QUALITY ASSURANCE:

Steve Behm, Director of Engineering Services

Joyce Walker, Quality Assurance Administrative Manager

Septimiu Apahidean, EMC/Lab Manager

TEST PERSONNEL:

Eddie Wong, EMC Engineer

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The 100 W Booster amplifier, 1930-1990 MHz.tested by CKC Laboratories was a production unit. The SPA9329-35 is a linear booster amplifier that operates in a fequency range from 1930 MHz to 1990 MHz and provides 100 watts (50 dBm) of output power with a maximum gain of 23 dB. The amplifier is modular in design, and is ideally suited for use in GSM and EDGE base stations.

EQUIPMENT UNDER TEST

GSM/ EDGE Booster Amplifier

Manuf:	Powerwave Technologies
Model:	SPA 9329-35
Serial:	07
FCC ID:	E67 pending

PERIPHERAL DEVICES

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

Power Supply

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

Amplifier

Manuf:	Mini Circuit
Model:	24L-24
Serial:	H0100896-16
FCC ID:	DoC

Power Meter

Manuf:	HP
Model:	E4418B
Serial:	US39251692
FCC ID:	DoC

Signal Generator

Manuf:	Agilent
Model:	E4433B
Serial:	US40051329
FCC ID:	DoC

Power Supply

Manuf:	HP
Model:	E3615A
Serial:	NA
FCC ID:	NA

PCS Band Pass Filter

Manuf:	Lorch Microwave
Model:	WF-51059
Serial:	AB18R
FCC ID:	DoC

TEMPERATURE AND HUMIDITY DURING TESTING

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

2.1033(c)(3) USER'S MANUAL
The necessary information is contained in a separate document.

2.1033 (c)(4) TYPE OF EMISSIONS
GXW, G7W

2.1033(c)(5) FREQUENCY RANGE
1930-1990 MHz

2.1033(c)(6) OPERATING POWER
100 Watts

2.1033(c)(7) MAXIMUM POWER RATING
100 Watts

2.1033(c)(8) DC VOLTAGES
The necessary information is contained in a separate document.

2.1033(c)(9) TUNE-UP PROCEDURE
The necessary information is contained in a separate document.

2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION
The necessary information is contained in a separate document.

2.1033(c)(11) LABEL AND PLACEMENT
The necessary information is contained in a separate document.

2.1033(c)(12) SUBMITTAL PHOTOS
The necessary information is contained in a separate document.

2.1033(c)(13) MODULATION INFORMATION
The necessary information is contained in a separate document.

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

§24.2329(a) 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.*

Setup: The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port id connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The RF signal of EDGE and GSM modulation, with the RF level adjusted to maintain 100 watts at the output of the EUT is sent to the EUT via an amplifier. The EUT amplifies the signal and the output RF signal is loaded in to the RF load and a directional coupler. The output power is measured at the RF output port of the directional coupler with a spectrum analyzer. Range of measurement: Fundamental. Instrument setting: RBW=VBW=1 MHz. RF loss (49.4 dB) of the RF load and attenuator is compensated for. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity. The amplifier will not be commercially available with transmitting antenna provided hence the EIRP measurement will be determined by the installer of the final product.

The following table demonstrates the EUT is deemed compliant in pursuant of "***In no case may the peak output power of a base station transmitter exceed 100 watts.***" of 24.2329(a) Power and antenna height limits requirement.

RF Power Output at Antenna Terminal

Frequency (MHz)	Modulation	Measured Peak Power (watts)
1930	GSM	100
1960	GSM	100
1990	GSM	100
1930	EDGE	100
1960	EDGE	100
1990	EDGE	100

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Powerwave Technologies**
Specification: **FCC 24.232(a)**
Work Order #: **79687** Date: 10/22/2002
Test Type: **Conducted Emissions** Time: 11:26:55
Equipment: **GSM/ EDGE Booster Amplifier** Sequence#: 1
Manufacturer: Powerwave Technologies Tested By: Eddie Wong
Model: SPA 9329-35 27 VDC
S/N: 07

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The Signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. The output power is monitored at the RF output port of the directional coupler. Range of measurement: Fundamental. Modulation: GSM & EDGE Limit = 100 watts peak = 157 dBuV=50 dBm. Instrument setting: RBW=1 MHz, VBW=1 MHz. 27 VDC (230Vac, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.

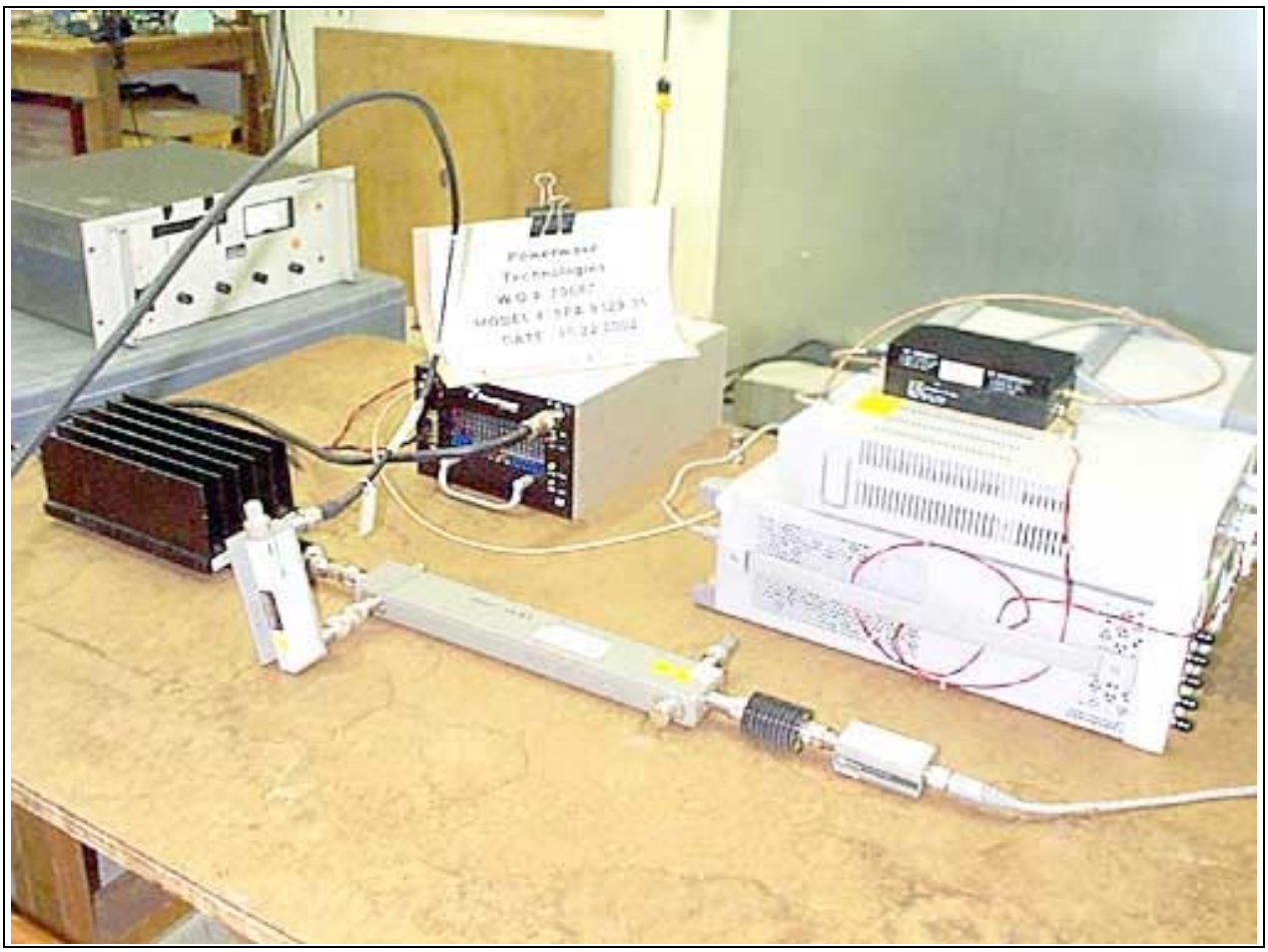
Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1929.990M	156.3	+0.7				+0.0	157.0	157.0 EDGE	+0.0	Anten
2	1959.890M	156.4	+0.6				+0.0	157.0	157.0 EDGE	+0.0	Anten
3	1990.000M	156.4	+0.6				+0.0	157.0	157.0 EDGE	+0.0	Anten
4	1990.020M	156.4	+0.6				+0.0	157.0	157.0 GSM	+0.0	Anten
5	1959.925M	156.4	+0.6				+0.0	157.0	157.0 GSM	+0.0	Anten
6	1930.004M	156.3	+0.7				+0.0	157.0	157.0 GSM	+0.0	Anten

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	01865	HP	8566B	2532A02509	092702	092703
QP Adapter	01437	HP	85650A	3303A01884	092702	092703
¼" Heliax Coaxial Cable	NA	Andrew	FSJ-50A-4	Cable#7 (6 ft)	071502	071503
3.5 GHG HPF``	2117	HP	84300-80038	364A00027	062502	062503

RF Power



RF Power

RF Power

2.1033(c)(14)/2.1047(a) - MODULATION CHARACTERISTICS - Audio Frequency Response

Not applicable to this unit.

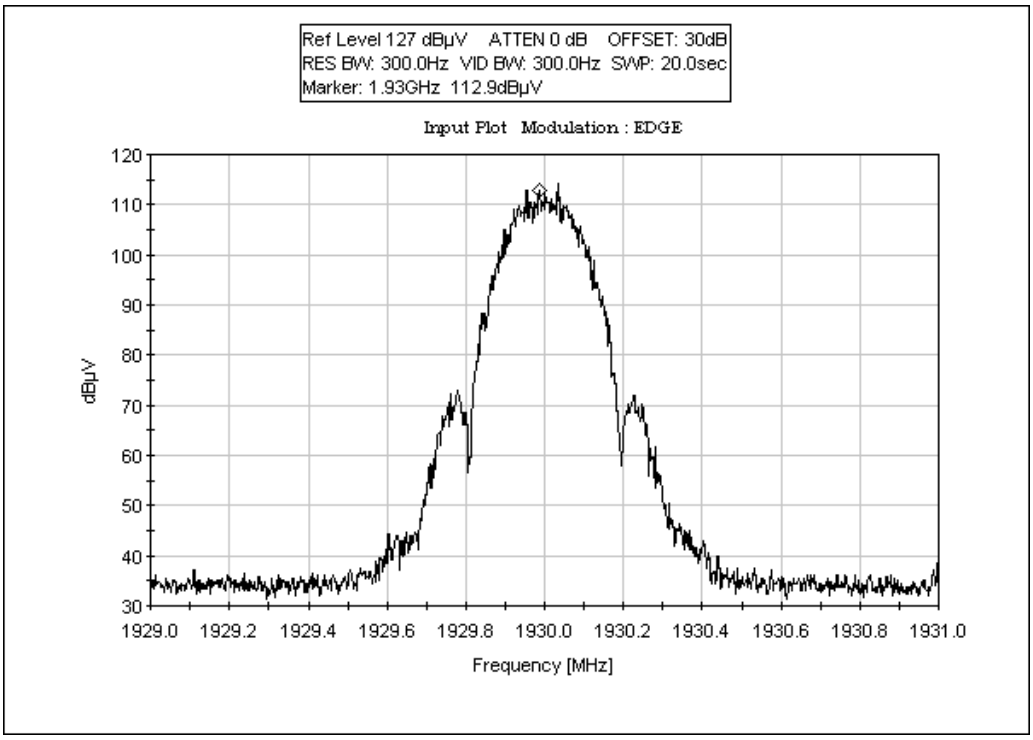
2.1033(c)(14)/2.1047(b) MODULATION CHARACTERISTICS – Modulation Limiting Response

Not applicable to this unit.

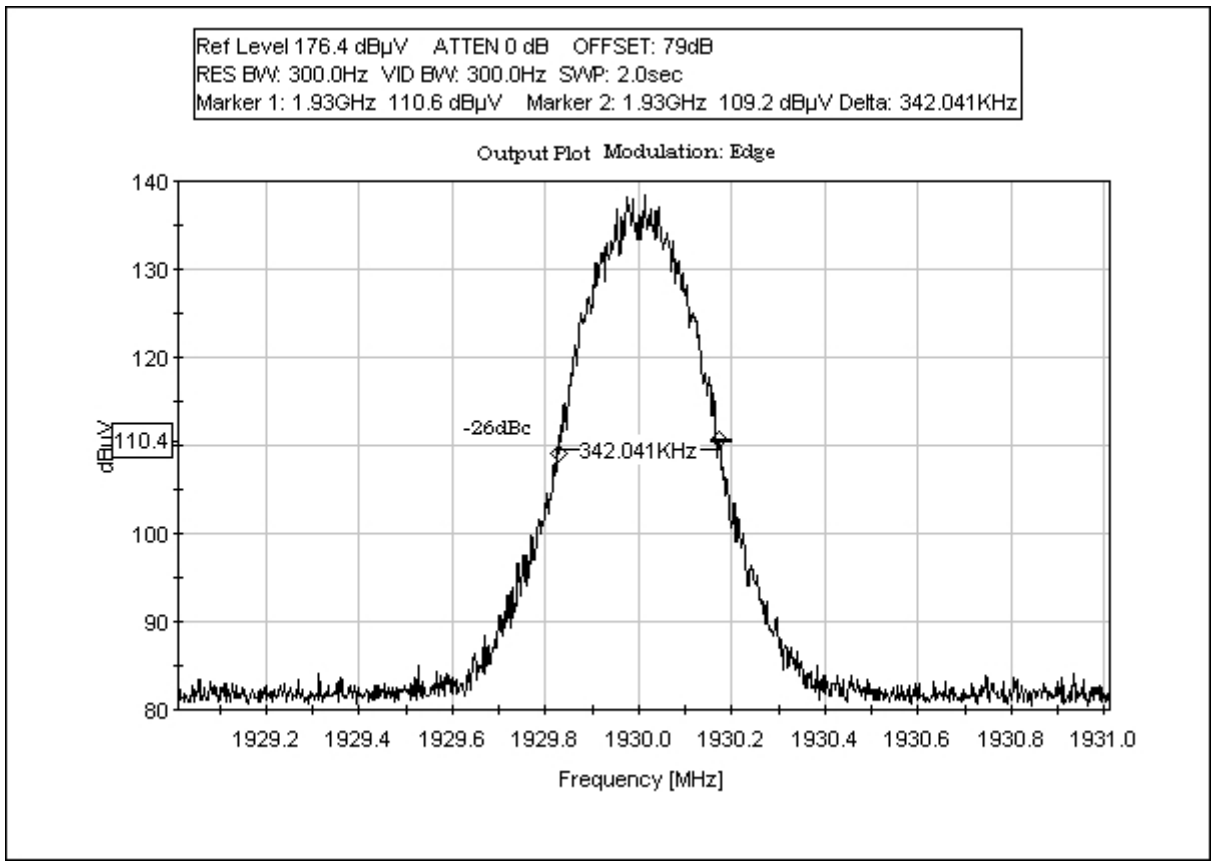
2.1033(c)(14)/2.1049(i)- OCCUPIED BANDWIDTH

Test Conditions: The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via a amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. The output power is monitored at the RF output port of the directional coupler. Range of measurement: Fundamental. Conducted power measurement measured with a Spectrum Analyzer at RF output port of the directional coupler. RF loss of 49.4 dB is compensated for. The input signal was measured at the output end of the signal generator.

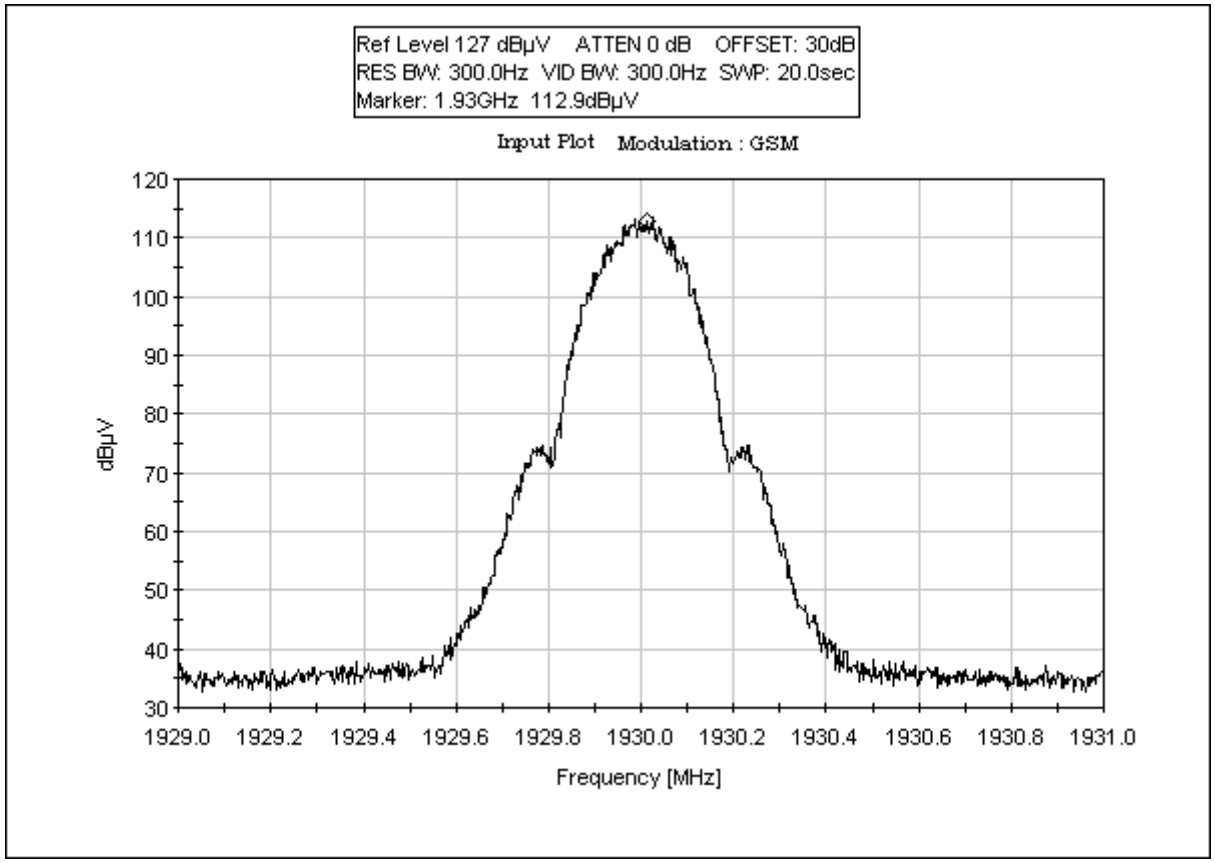
OCCUPIED BANDWIDTH 1930 MHz EDGE INPUT PLOT



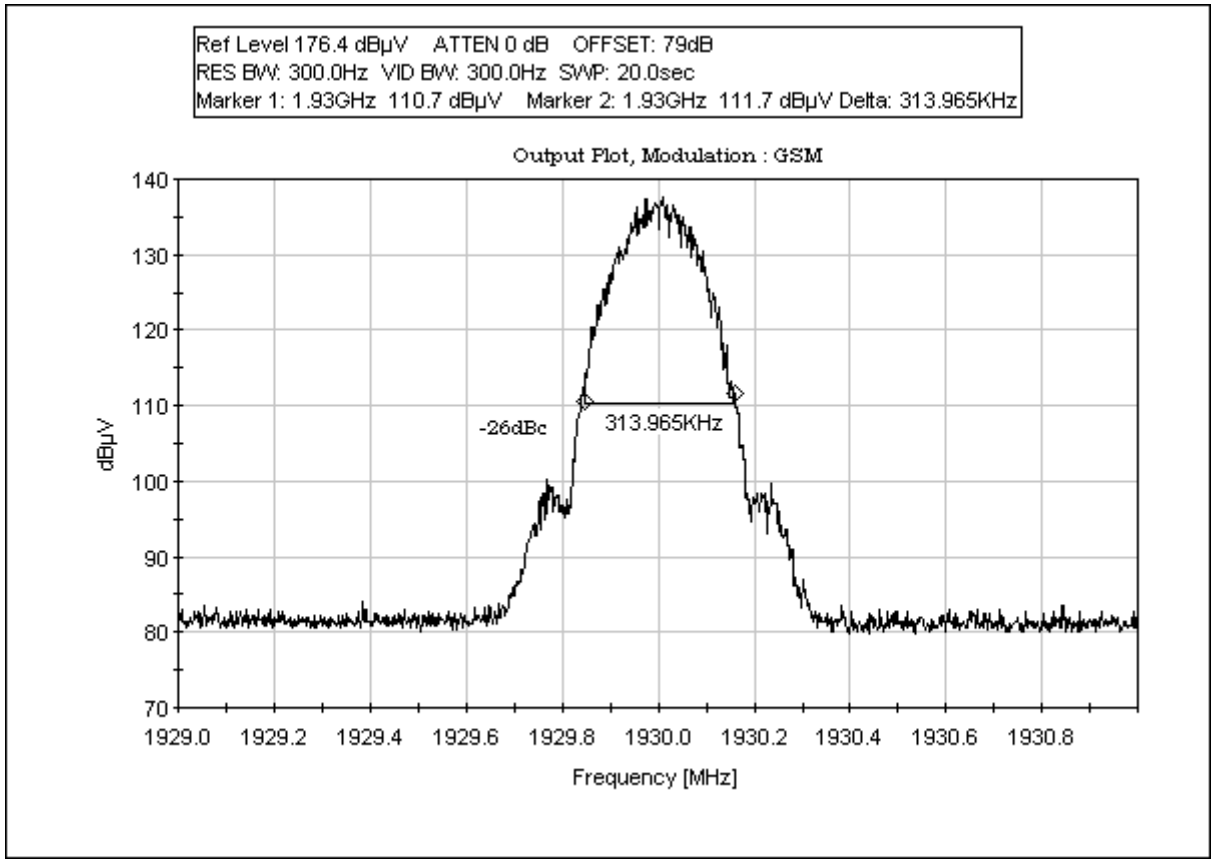
OCCUPIED BANDWIDTH 1930 MHz EDGE OUTPUT PLOT



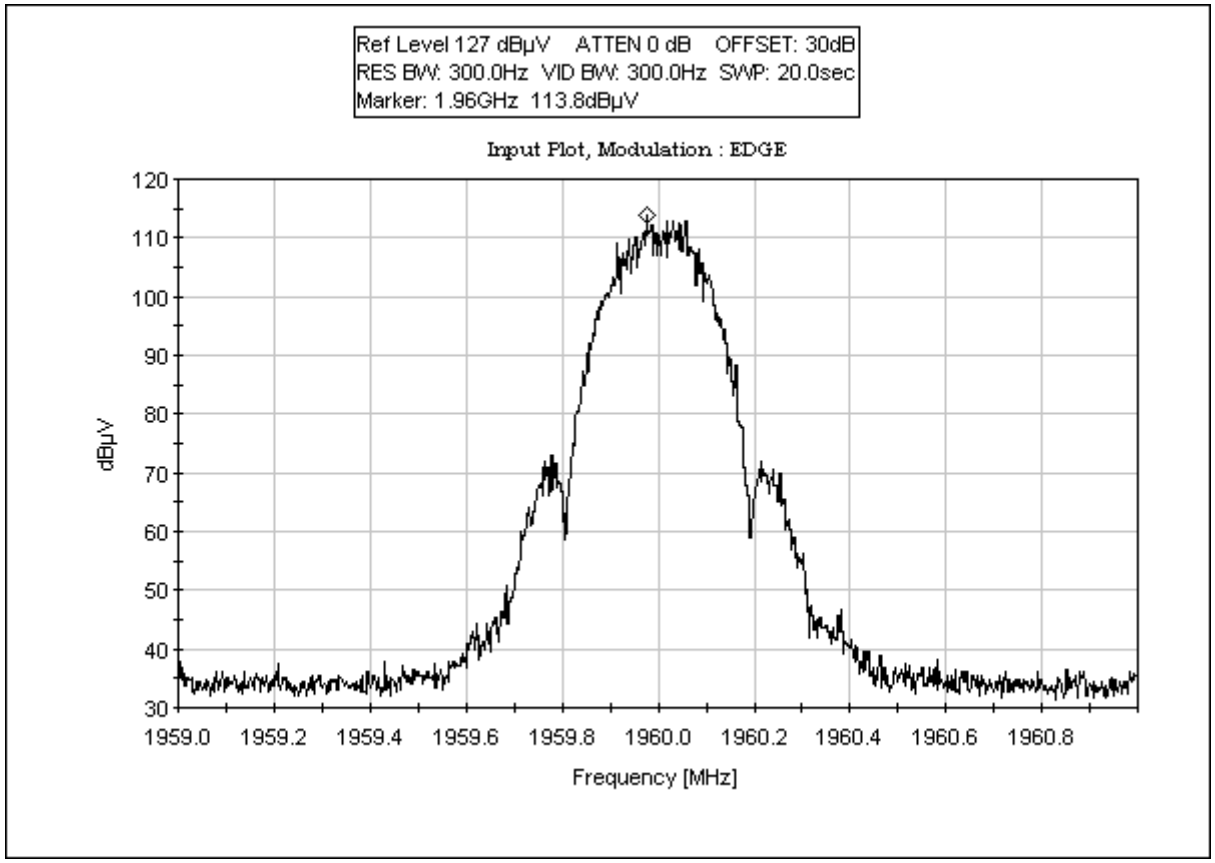
OCCUPIED BANDWIDTH 1930 MHz GSM INPUT PLOT



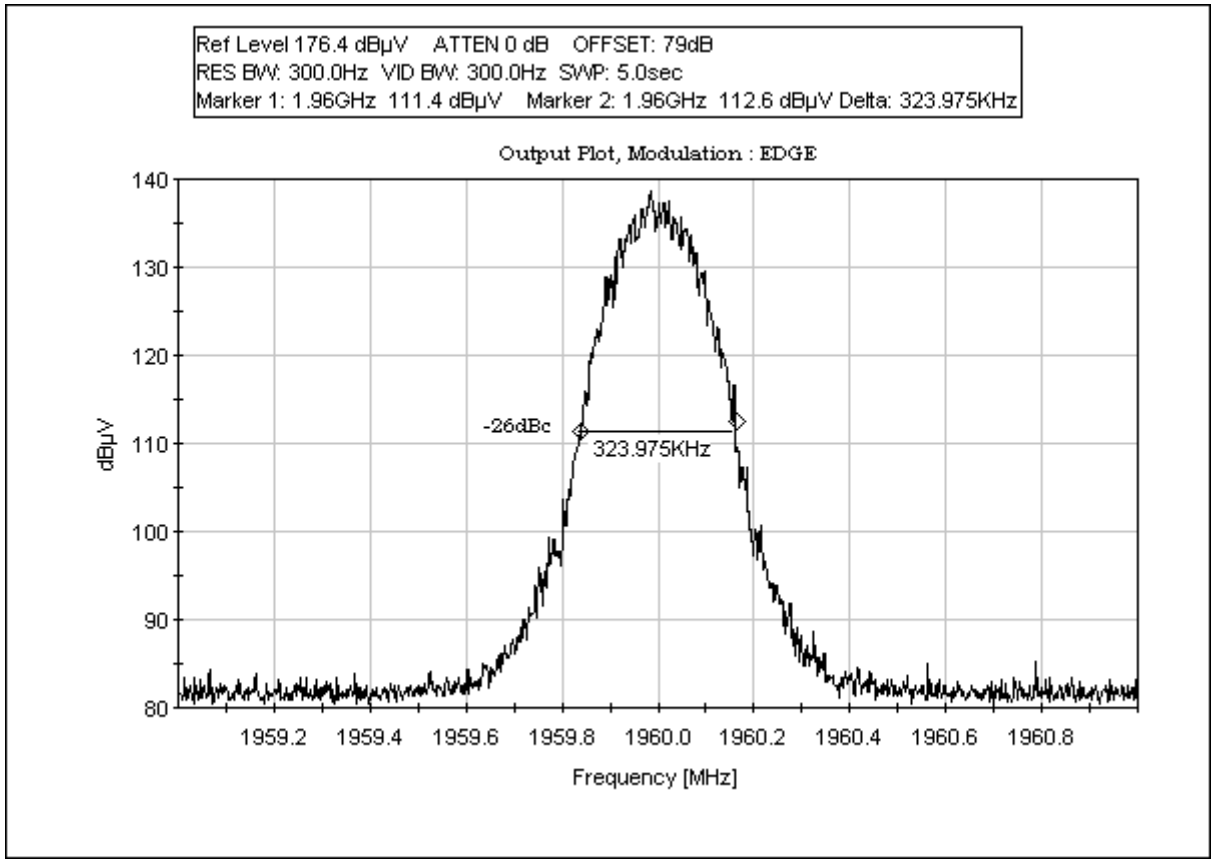
OCCUPIED BANDWIDTH 1930 MHz GSM OUTPUT PLOT



OCCUPIED BANDWIDTH 1960 MHz EDGE INPUT PLOT



OCCUPIED BANDWIDTH 1960 MHz EDGE OUTPUT PLOT



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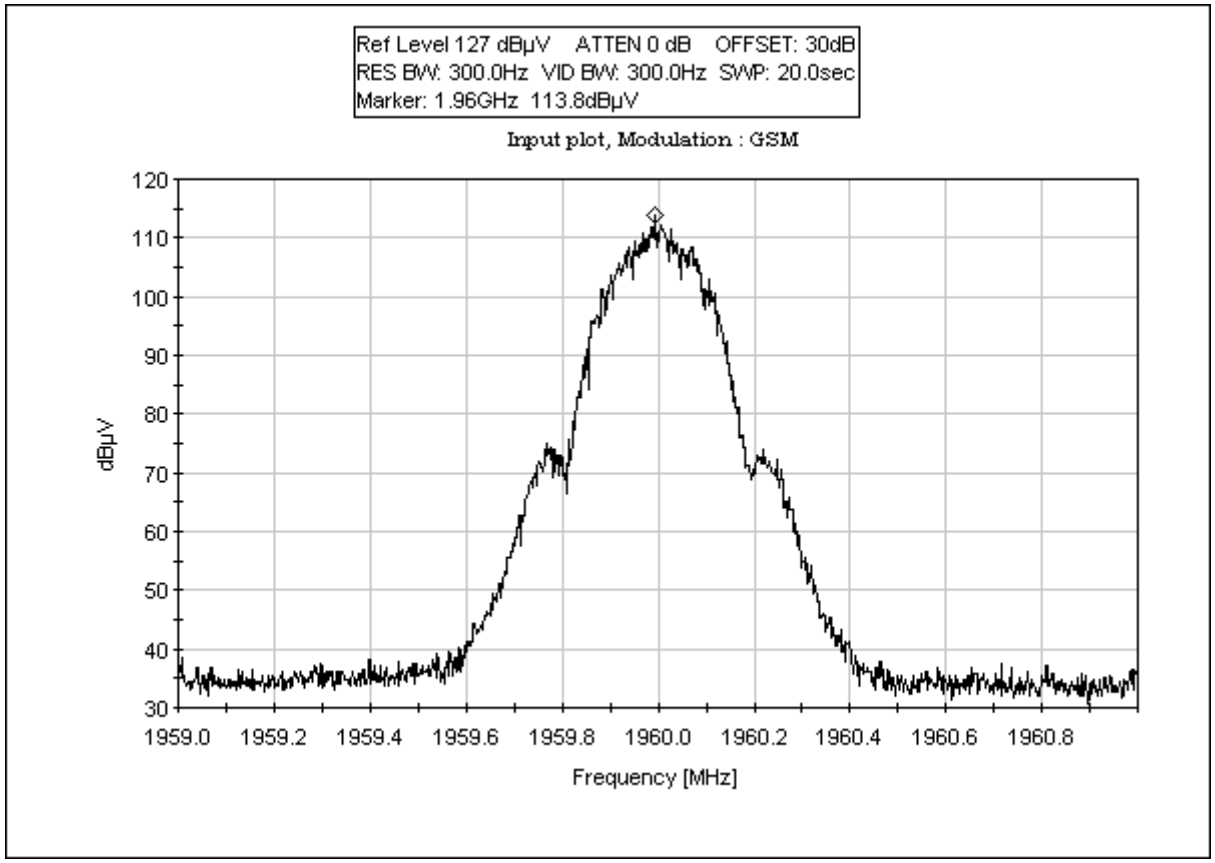
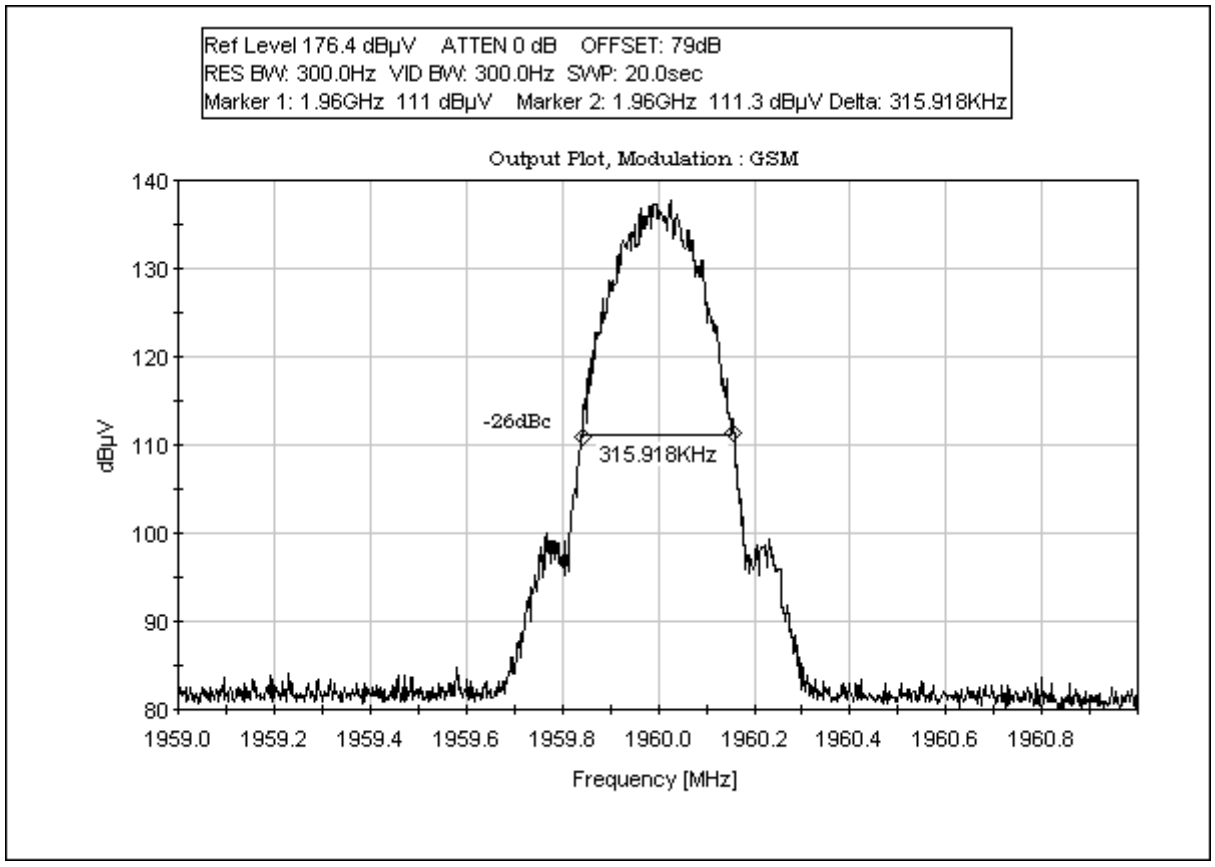
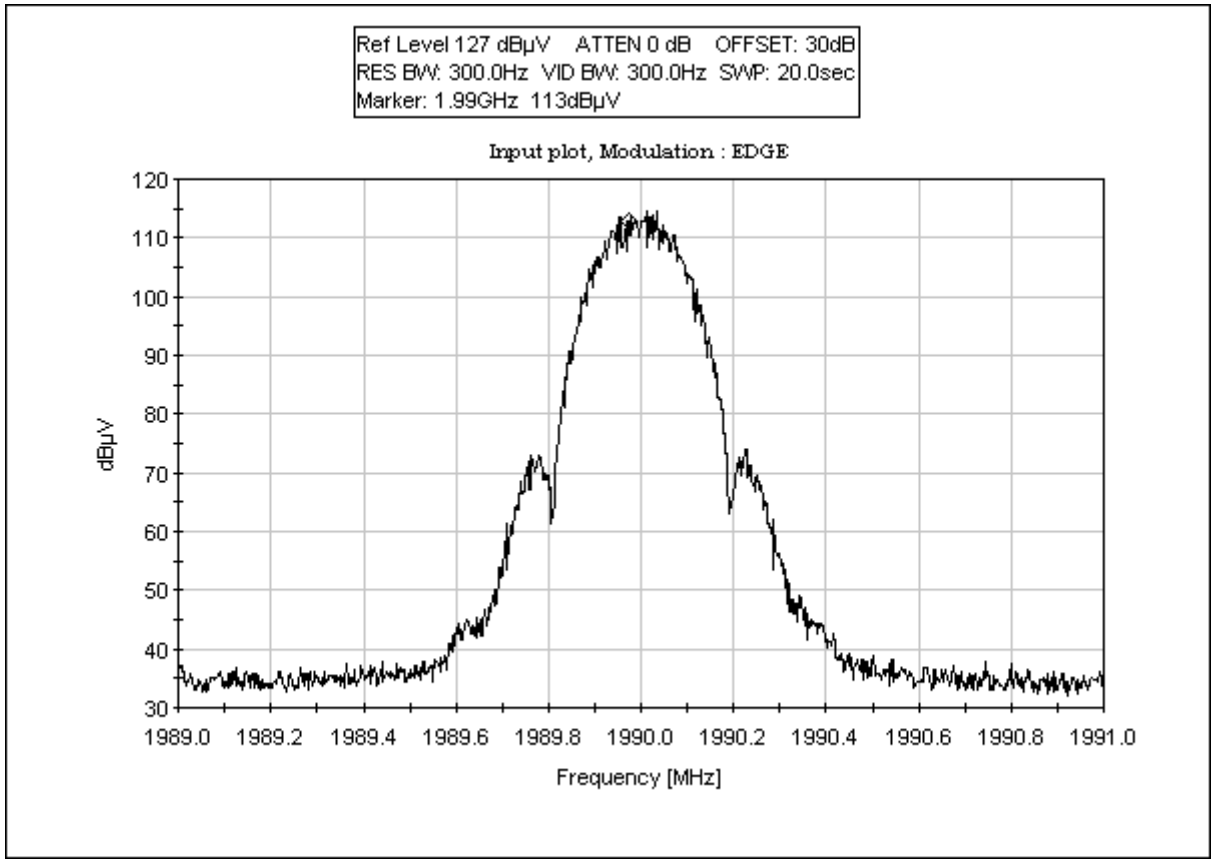


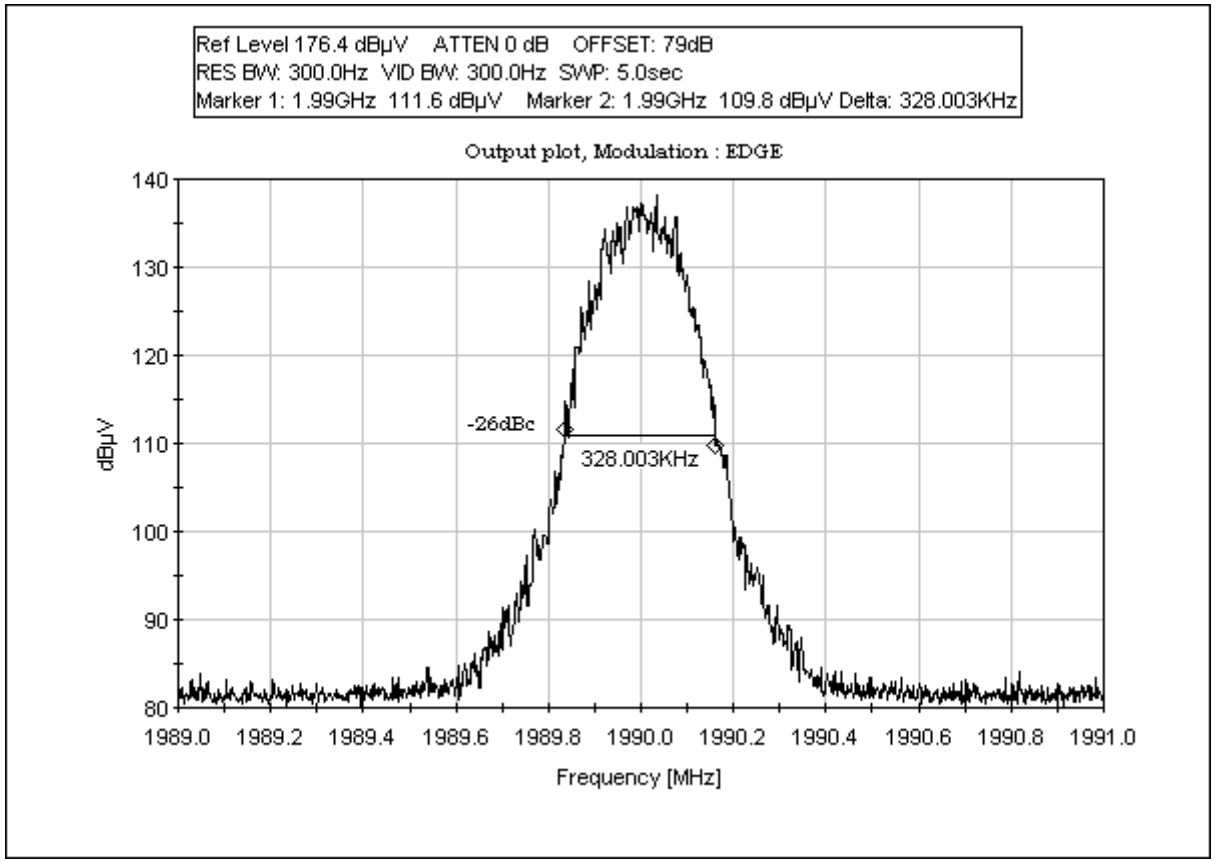
OCCUPIED BANDWIDTH 1960 MHz GSM OUTPUT PLOT



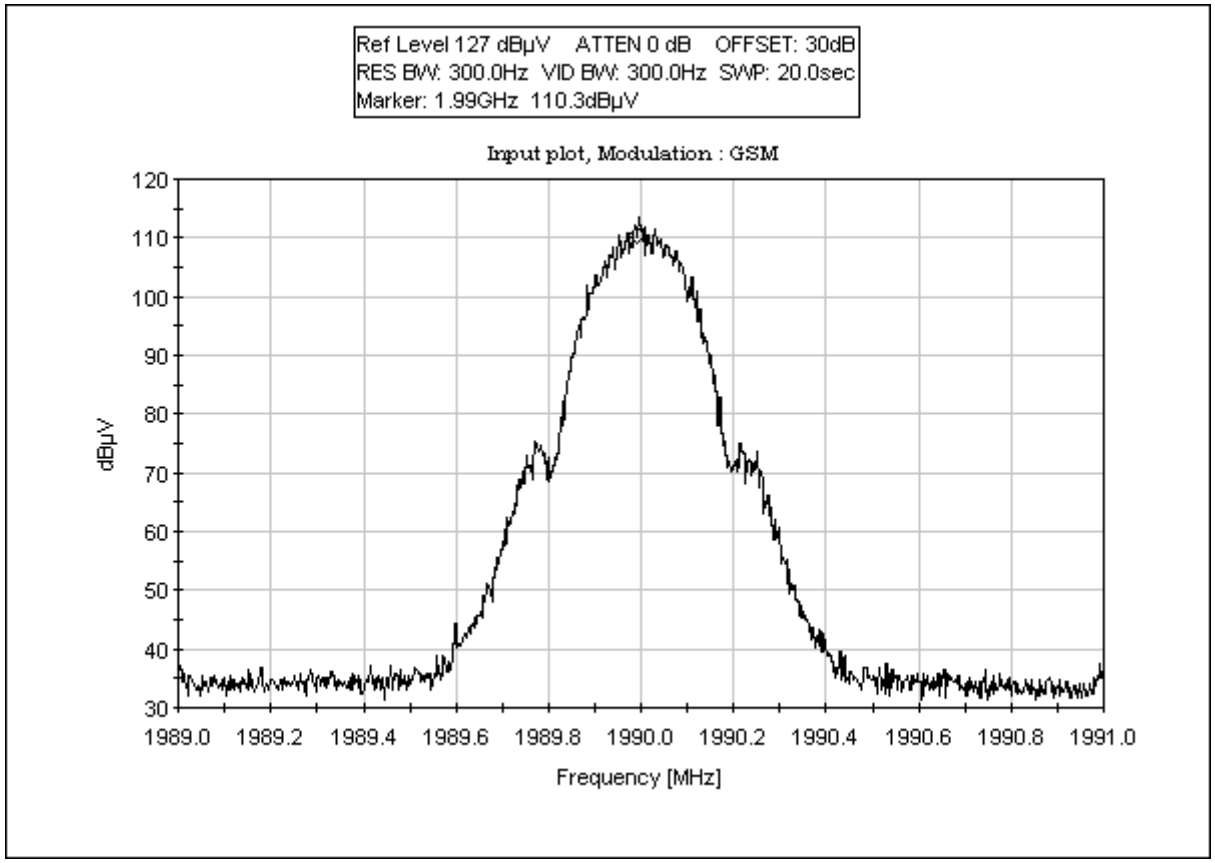
OCCUPIED BANDWIDTH 1990 MHz EDGE INPUT PLOT



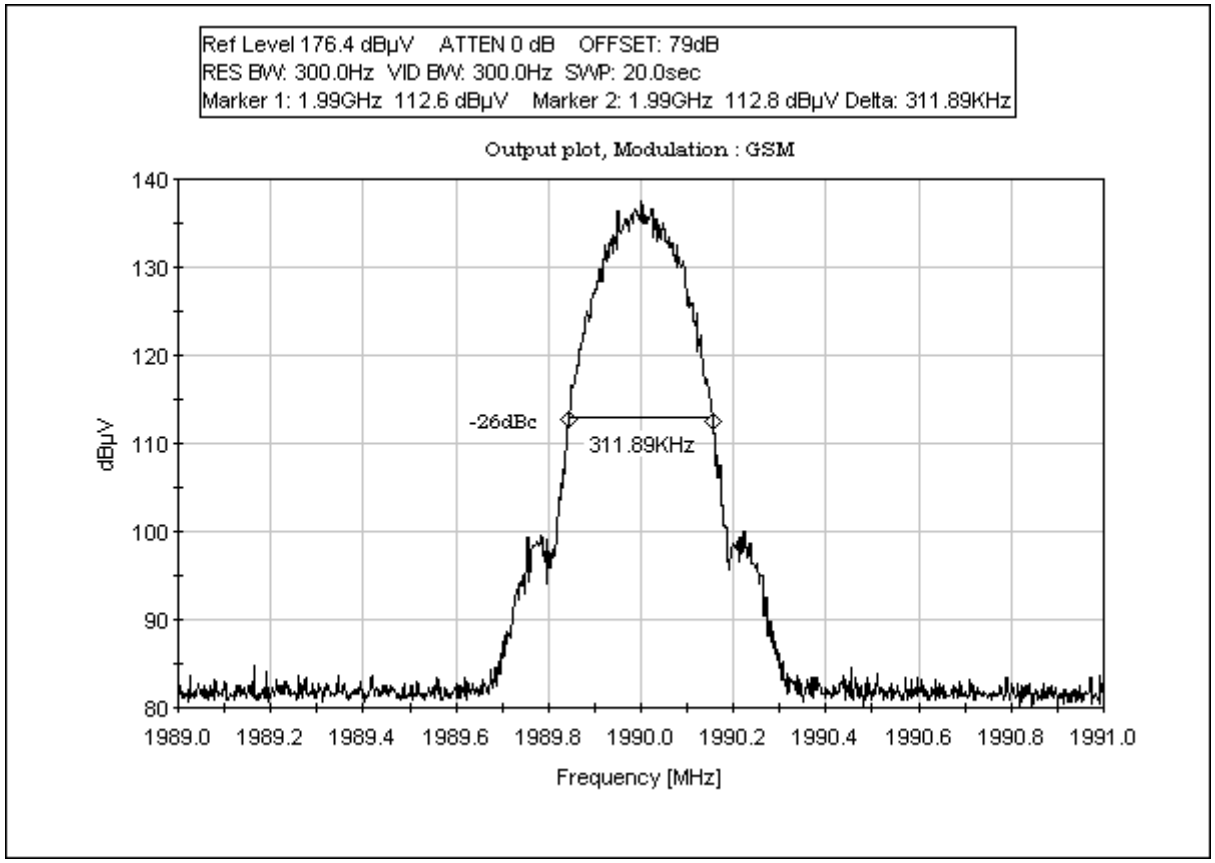
OCCUPIED BANDWIDTH 1990 MHz EDGE OUTPUT PLOT



OCCUPIED BANDWIDTH 1990 MHz GSM INPUT PLOT



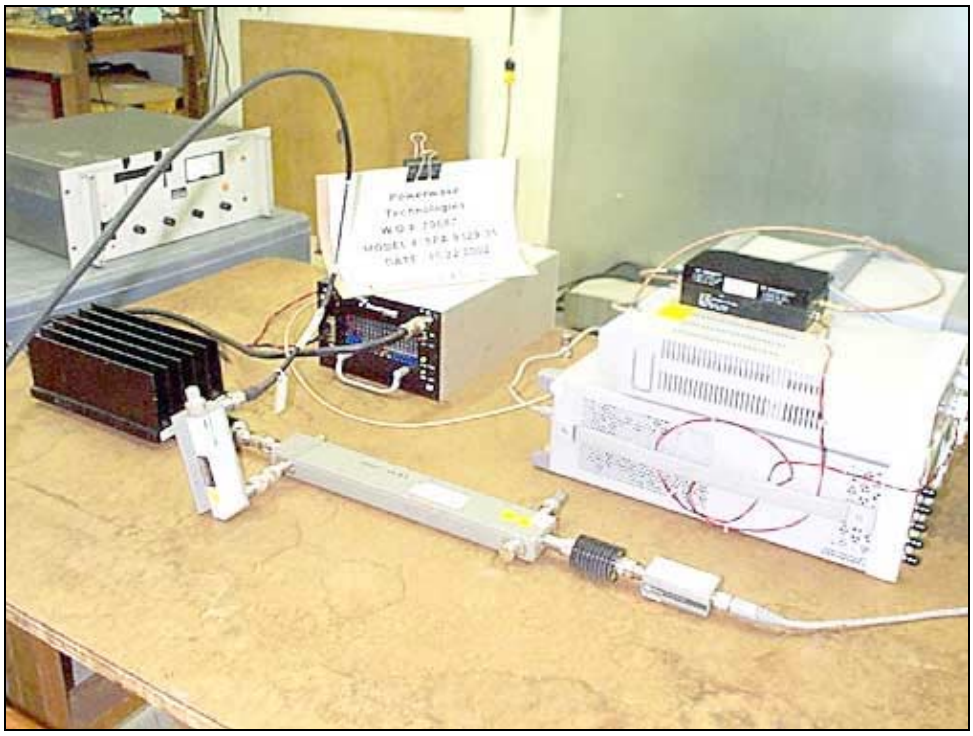
OCCUPIED BANDWIDTH 1990 MHz GSM OUTPUT PLOT



Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	01865	HP	8566B	2532A02509	092702	092703
QP Adapter	01437	HP	85650A	3303A01884	092702	092703
¼" Heliax Coaxial Cable	NA	Andrew	FSJ-50A-4	Cable#7 (6 ft)	071502	071503
3.5 GHG HPF	2117	HP	84300-80038	364A00027	062502	062503

Occupied Bandwidth



Occupied Bandwidth

Occupied Bandwidth

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

Limit line for Spurious Conducted Emission

Required Attenuation = 43+10 Log P dB

Limit line (dBuV) = V_{dBuv} - Attenuation

$V_{dBuV} = 20 \text{ Log } \frac{V}{1 \text{ x } 10^{-6}}$

$= 20\left(\text{Log } V - \text{Log } 1 \text{ x } 10^{-6}\right)$

$= 20 \text{ Log } V - 20 \text{ Log} 1 \text{ x } 10^{-6}$

$= 20 \text{ Log } V - 20(-6)$

$= 20 \text{ Log } V + 120$

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

$= 43 + 10 \text{ Log } \frac{V^2}{R}$

$= 43 + 10\left(\text{Log } V^2 - \text{Log } R\right)$

$= 43 + 10\left(2 \text{ Log } V - \text{Log } R\right)$

$= 43 + 20 \text{ Log } V - 10 \text{ Log } R$

Limit line = V_{dBuv} - Attenuation

= 20 Log V + 120 – (43 + 20 Log V – 10Log R)

= 20 Log V + 120 – 43 – 20 Log V + 10Log R

= 20 Log V + 120 – 43 – 20 Log V + 10Log R

= 120 – 43 + 10 Log 50 Note : R = 50 Ω

= 120 –43 + 16.897

= 94 dBuV at any power level

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:25:13
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	2
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1930 MHz. Modulation: EDGE. Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 94 dBuV at antenna terminal. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.	T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	3859.710M	79.0	+1.0	+1.6			+0.0	81.6	94.0	-12.4	Anten
2	5790.003M	79.2	+1.2	+0.2			+0.0	80.6	94.0	-13.4	Anten

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:49:19
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	6
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF land directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1930 MHz. Modulation: GSM. Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 94 dBuV at antenna terminal. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.	T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	3860.000M	78.0	+1.0	+1.6			+0.0	80.6	94.0	-13.4	Anten
2	5790.000M	77.0	+1.2	+0.2			+0.0	78.4	94.0	-15.6	Anten

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:29:39
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	3
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded into the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1960 MHz. Modulation: EDGE Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 94 dBuV at antenna terminal. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.	T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	5880.002M	84.9	+1.3	+0.3			+0.0	86.5	94.0	-7.5	Anten
2	3920.011M	78.0	+1.0	+1.4			+0.0	80.4	94.0	-13.6	Anten

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:39:08
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	5
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1960 MHz. Modulation: GSM. Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 94 dBuV at antenna terminal. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.	T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	5880.000M	84.1	+1.3	+0.3			+0.0	85.7	94.0	-8.3	Anten
2	3920.000M	78.2	+1.0	+1.4			+0.0	80.6	94.0	-13.4	Anten

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:32:48
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	4
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The Signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1990 MHz. Modulation: EDGE Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz- 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 94 dBuV at antenna terminal. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7.	T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	5969.990M	86.3	+1.3	+0.3			+0.0	87.9	94.0	-6.1	Anten
2	3979.995M	78.3	+1.0	+0.7			+0.0	80.0	94.0	-14.0	Anten

Test Location:	CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112		
Customer:	**Powerwave Technologies**		
Specification:	**FCC 24.238(a) Spurious Emission at antenna terminal**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	09:35:34
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	4
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		27 VDC
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1990 MHz. Modulation: GSM. Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Transducer Legend:

T1=Brea Cable: 6' 1/4" Heliax - Brea # 7. T2=3.5 GHz High-Pass

Measurement Data: Reading listed by margin. Test Lead: Antenna Terminal

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	5970.076M	86.1	+1.3	+0.3			+0.0	87.7	94.0	-6.3	Anten
2	3979.980M	77.2	+1.0	+0.7			+0.0	78.9	94.0	-15.1	Anten

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	01865	HP	8566B	2532A02509	092702	092703
QP Adapter	01437	HP	85650A	3303A01884	092702	092703
¼" Heliax Coaxial Cable	NA	Andrew	FSJ-50A-4	Cable#7 (6 ft)	071502	071503
3.5 GHG HPF	2117	HP	84300-80038	364A00027	062502	062503

Direct Connect

Direct Connect

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

Test Conditions: The EUT is placed on the test bench. The RF input port is connected to an amplifier. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. The signal generator sends RF signal to the EUT via an amplifier. The EUT amplifies the signal and the RF signal is loaded in to the RF load and a directional coupler. A PCS band pass filter is placed between the load and the directional coupler. The spurious emission is monitored at the RF output port of the directional coupler with a spectrum analyzer. Tx Freq: 1930 MHz, 1960 MHz and 1990 MHz, Modulation: GSM. Frequency range of measurement = 30 MHz - 20 GHz. Frequency 30 MHz - 1000 MHz, RBW 120 kHz, VBW 120 kHz; 1000 MHz - 20,000 MHz, RBW 1 MHz, VBW 1 MHz. Required attenuation = -43+10 Log P dB = -43 + 10 Log 100 = 82.3 dBuV at 3 meter. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity.

Operating Frequency: 1930 MHz
Channels: Low
Highest Measured Output Power: 50.00 ERP(dBm)= 100 ERP(Watts)
Distance: 3 meters
Limit: 43+10Log(P) 63.00 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,859.80	-28.2	Horiz	78.20
3,859.92	-28.40	Vert	78.40
5,790.00	-40.10	Horiz	90.10
5,790.35	-42.30	Vert	92.30
261.15	-60.40	Horiz	110.40
616.68	-63.30	Horiz	113.30
983.40	-64.10	Horiz	114.10
283.37	-65.70	Vert	115.70
283.36	-66.70	Horiz	116.70
309.18	-72.60	Horiz	122.60
309.18	-73.70	Horiz	123.70

Operating Frequency: 1960 MHz
Channels: Middle
Highest Measured Output Power: 50.00 ERP(dBm)= 100 ERP(Watts)
Distance: 3 meters
Limit: 43+10Log(P) 63.00 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,919.98	-30.1	Horiz	80.10
3,919.96	-32.10	Vert	82.10
5,879.93	-36.50	Horiz	86.50
5,879.75	-44.70	Vert	94.70
916.76	-62.50	Horiz	112.50
822.27	-64.80	Horiz	114.80
261.23	-65.00	Horiz	115.00

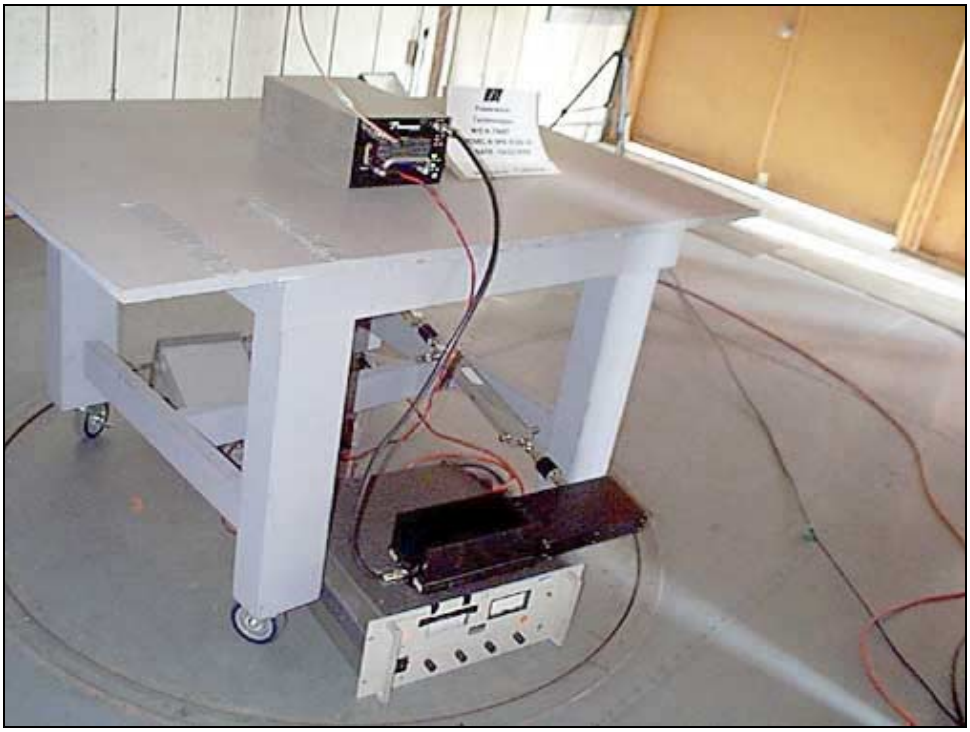
Operating Frequency: 1990 MHz
Channels: High
Highest Measured Output Power: 50.00 ERP(dBm)= 100 ERP(Watts)
Distance: 3 meters
Limit: 43+10Log(P) 63.00 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
3,979.82	-31.6	Horiz	81.60
3,980.02	-35.30	Vert	85.30
5,969.92	-39.50	Horiz	89.50
5,969.83	-41.10	Vert	91.10
683.37	-63.40	Vert	113.40
261.18	-64.00	Vert	114.00
616.69	-64.60	Horiz	114.60

Test Equipment

Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	01865	HP	8566B	2532A02509	092702	092703
QP Adapter	01437	HP	85650A	3303A01884	092702	092703
30-100MHz						
Bicon Antenna	306	AH	SAS200/540	220	092302	092303
Log Periodic Antenna	300	AH	SAS 00/516	331	092302	092303
Pre-amp	00309	HP	8447D	1937A02548	082302	082303
Antenna cable	NA	NA	RG214	Cable#15	122001	122002
Pre-amp to SA cable	NA	Harbour	RG223/U	Cable#10	070802	070803
1000-1800 MHz						
Horn Antenna	0849	EMCO	3115	6246	091002	091003
Microwave Pre-amp	00786	HP	83017A	3123A00281	091102	091103
¼" Heliax Coaxial Cable	NA	Andrew	FSJ-50A-4	Cable#7 (6 ft)	071502	071503
Antenna cable (from bulkhead to antenna, high frequency hardline) (25ft)	NA	Andrew	FSJ1-50A	Cable#13	071502	071503
3.5 GHG HPF``	2117	HP	84300-80038	364A00027	062502	062503
12' SMA Cable	01337	W.L.Gore	NA	244922	121801	121802
1800-2000MHz						
Microwave Pre-amp	00786	HP	83017A	3123A00281	091102	091103
12' SMA Cable	01337	W.L.Gore	NA	244922	121801	121802
18-26 GHz Horn	2112	HP	RA42-K-F-4B-C	961178-006.	062802	062803

OATS



OATS

2.1033(c)(14)/2.1055 - FREQUENCY STABILITY

Not applicable to this unit.

2.1091 - MPE CALCULATIONS

Calculations prepared for:

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

Calculations prepared by:

Eddie Wong
110 N. Olinda Place
Brea, CA 9283

Model Number: SPA9329-35
FCC Identification: NA

Fundamental Operating Frequency: 1930-1990 MHz

Maximum Rated Output Power: 100.00 Watts
Measured Output Power: 100.00 Watts

MPE Limit in accordance with 1.1310(b): Limits for general population/uncontrolled exposure

MPE Limit for 1930-1990 MHz = 1 mW/cm^2 (10 W/m^2)

Power Output (Watts)	Power Density Limit (mW/cm^2)	Minimum Distance (Meters)
$\text{Power Density}\ (W/m^2) = \frac{30 \times P_t \times G}{d^2 \times Z_0}$		
100	**1**	**0.89**

P_t = Power Delivered to the Antenna
G = Antenna Gain
d = Distance in meters
Zo = Impedance of Free Space

The typical antennas to be used with the EUT are structure mount antennas which under normal operation has an antenna height of at least 5 meters. As can be seen from the MPE result, this device passes the limit specified in 1.1310 at a distance of 0.89 meter.

Calculation:

$$d = \sqrt{\frac{30 \times 100 \times 1}{10 \times 377}}$$

= 0.89 meter.

15.107 – AC CONDUCTED EMISSIONS

Bandwidth **settings used**

ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz

Test Location: CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **Powerwave Technologies**
Specification: **FCC 15.107 Class A COND QP**
Work Order #: **79687** Date: 10/23/2002
Test Type: **Conducted Emissions** Time: 16:36:21
Equipment: **GSM/ EDGE Booster Amplifier** Sequence#: 21
Manufacturer: Powerwave Technologies Tested By: Eddie Wong
Model: SPA 9329-35 230V 60Hz
S/N: 07

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

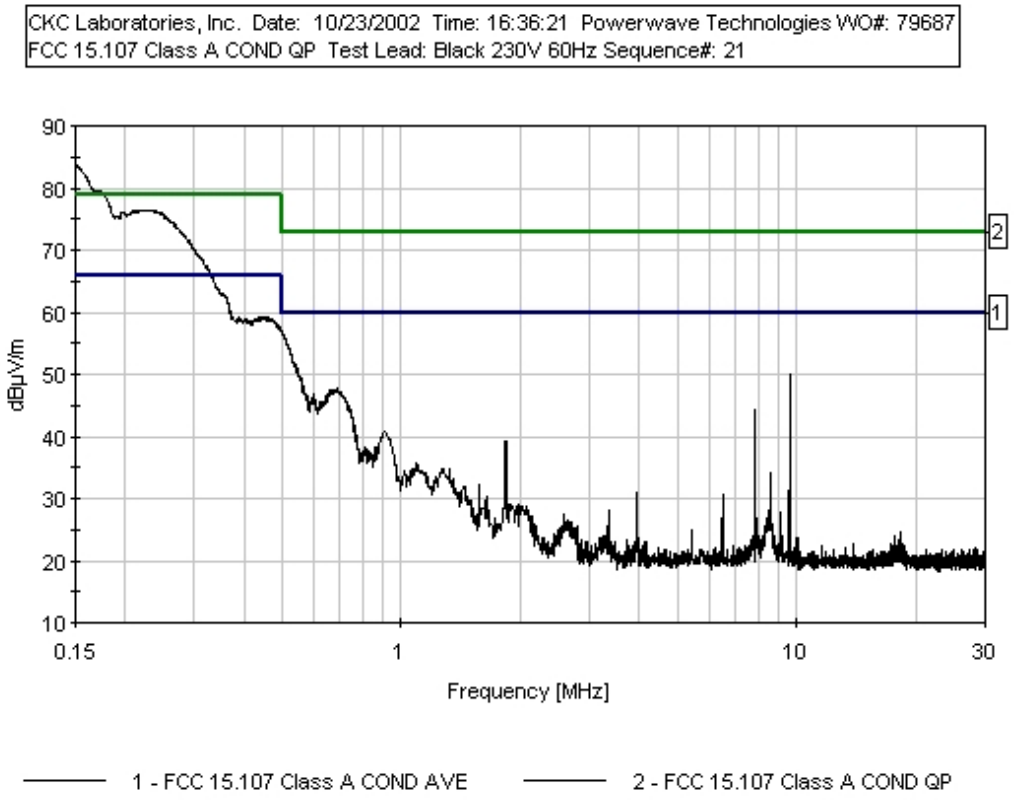
The EUT is placed on the test bench. The RF input port is connected to a section of shielded cable. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. EUT is in standby mode. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity. Frequency range tested: 150 kHz – 30 MHz.

Transducer Legend:

Measurement Data: Reading listed by margin. Test Lead: Black

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	150.000k QP	78.5					+0.0	78.5	79.0	-0.5	Black
^	150.000k	83.6					+0.0	83.6	66.0	+17.6	Black

3	9.606M	49.9	+0.0	49.9	60.0	-10.1	Black
4	686.674k	47.8	+0.0	47.8	60.0	-12.2	Black
5	150.000k Ave	50.8	+0.0	50.8	66.0	-15.2	Black
6	7.859M	44.4	+0.0	44.4	60.0	-15.6	Black
7	906.771k	40.7	+0.0	40.7	60.0	-19.3	Black
8	1.834M	39.3	+0.0	39.3	60.0	-20.7	Black
9	8.579M	34.0	+0.0	34.0	60.0	-26.0	Black
10	1.574M	32.1	+0.0	32.1	60.0	-27.9	Black
11	1.443M	31.9	+0.0	31.9	60.0	-28.1	Black
12	3.948M	30.9	+0.0	30.9	60.0	-29.1	Black
13	6.498M	30.6	+0.0	30.6	60.0	-29.4	Black
14	3.344M	28.2	+0.0	28.2	60.0	-31.8	Black
15	9.129M	27.8	+0.0	27.8	60.0	-32.2	Black
16	2.587M	27.4	+0.0	27.4	60.0	-32.6	Black
17	2.799M	25.5	+0.0	25.5	60.0	-34.5	Black


CKC Laboratories, Inc. Date: 10/23/2002 Time: 16:36:21 Powerwave Technologies WO#: 79687
FCC 15.107 Class A COND QP Test Lead: Black 230V 60Hz Sequence#: 21
90
80
70
60
50
40
30
20
10
dBµV/m
0.15
1
10
30
Frequency [MHz]
2
1
1 - FCC 15.107 Class A COND AVE
2 - FCC 15.107 Class A COND QP

Test Location:	CKC Laboratories, Inc. •110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112		
Customer:	**Powerwave Technologies**		
Specification:	**FCC 15.107 Class A COND QP**		
Work Order #:	**79687**	Date:	10/23/2002
Test Type:	**Conducted Emissions**	Time:	16:40:39
Equipment:	**GSM/ EDGE Booster Amplifier**	Sequence#:	22
Manufacturer:	Powerwave Technologies	Tested By:	Eddie Wong
Model:	SPA 9329-35		230V 60Hz
S/N:	07		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
GSM/ EDGE Booster Amplifier*	Powerwave Technologies	SPA 9329-35	07

Support Devices:

Function	Manufacturer	Model #	S/N
Power Supply	HP	6269B	2436A-11867
Signal Generator	Agilent	E4433B	US40051329
Amplifier	Mini Circuit	24L-24	H0100896-16
Power supply	HP	E3615A	NA
Power Meter	HP	E4418B	US39251692
PCS Band Pass Filter	Lorch Microwave	WF-51059	AB18R

Test Conditions / Notes:

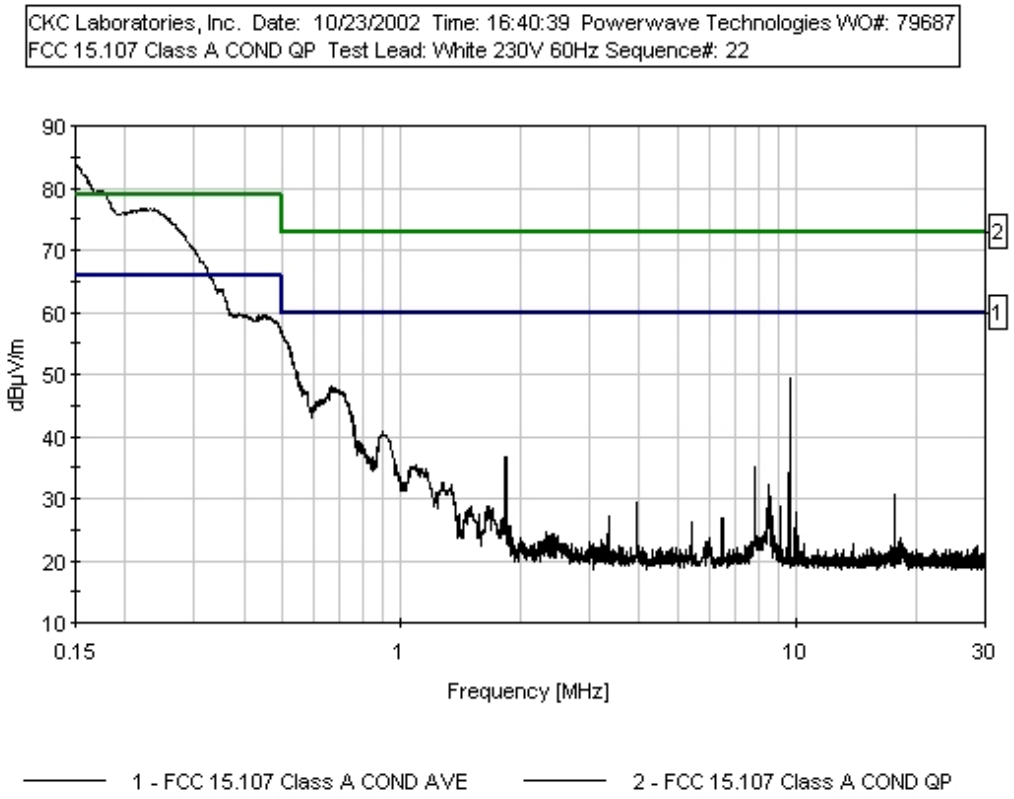
The EUT is placed on the test bench. The RF input port is connected to a section of shielded cable. The RF output port is connected to a RF load and directional coupler. The EUT receives 27 VDC from a support power supply. EUT is in standby mode. 27 VDC (230 VAC, 60 Hz), 19°C, 61% relative humidity. Frequency range tested: 150 kHz – 30 MHz.

Transducer Legend:

Measurement Data: Reading listed by margin. Test Lead: White

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	150.000k QP	78.6					+0.0	78.6	79.0	-0.4	White
^	150.000k	83.8					+0.0	83.8	66.0	+17.8	White
3	9.597M	49.4					+0.0	49.4	60.0	-10.6	White
4	664.858k	48.2					+0.0	48.2	60.0	-11.8	White
5	150.000k Ave	50.6					+0.0	50.6	66.0	-15.4	White
6	898.265k	40.8					+0.0	40.8	60.0	-19.2	White
7	1.834M	36.6					+0.0	36.6	60.0	-23.4	White
8	1.090M	35.4					+0.0	35.4	60.0	-24.6	White
9	7.859M	35.2					+0.0	35.2	60.0	-24.8	White

10	8.462M	32.1	+0.0	32.1	60.0	-27.9	White
11	17.769M	30.5	+0.0	30.5	60.0	-29.5	White
12	8.579M	30.4	+0.0	30.4	60.0	-29.6	White
13	3.948M	29.4	+0.0	29.4	60.0	-30.6	White
14	1.502M	28.7	+0.0	28.7	60.0	-31.3	White
15	9.120M	28.6	+0.0	28.6	60.0	-31.4	White
16	10.012M	27.8	+0.0	27.8	60.0	-32.2	White
17	1.396M	27.6	+0.0	27.6	60.0	-32.4	White



Equipment	Asset #	Manufacturer	Model #	Serial #	Cal Date	Cal Due
Spectrum Analyzer	01865	HP	8566B	2532A02509	092702	092703
QP Adapter	01437	HP	85650A	3303A01884	092702	092703
LISN	02128	EMCO	3816/2NM	9809-1090	032002	032003
LISN	00847	EMCO	3816/2NM	1104	100902	100903

PHOTOGRAPH SHOWING MAINS CONDUCTED EMISSIONS

PHOTOGRAPH SHOWING MAINS CONDUCTED EMISSIONS