

REPORT OF MEASUREMENTS

FOR

CELLULAR SPECIALTIES, INC.

BI-DIRECTIONAL AMPLIFIER

MODEL: 610pcs

FCC ID: NVRC SI610-03

CERTIFICATION APPLICATION

Applicant/Manufacturer: **Cellular Specialties
670 North Commercial Street
Manchester, NH 03101**

Equipment under Test (EUT): **The EUT is a Bidirectional Amplifier used to amplify cellular signals in the pcs band.**

Model: **610pcs**

FCC ID Number: **FCC ID: NVRCSI610-03**

Applicable Test Standard: **FCC Parts 2 & 24, Subpart E**

Device Classification: **Mobile**

EUT Frequency Range: **Uplink: 1850MHz to 1910MHz
Downlink: 1930MHz to 1990MHz**

EUT Gain: **Uplink: 45.5dB
Downlink: 46.0dB**

*Measured Power Output
at maximum input, single channel* **Uplink: +33.0dBm
Downlink: +35.7dBm**

*Power Output Rating Based
on Intermodulation Data
(For Certification Grant):* **Uplink: +24.7dBm = 300mW
Downlink: +26.0dBm = 400mW**

Modulation Types: **TDMA, CDMA, GSM**

RF Exposure + Antenna Installation: **See Attached Installation/Users Manual and MPE Evaluation**

Power Ratings Per Channel: **See Report Section 1**

Measurements Required by FCC: **See Report Section 2 (Summary of Test Program)
and the following Test Report Data Attachments:**

- RF Power Output**
- Intermodulation Characteristics**
- Occupied Bandwidth**
- Spurious Emissions at Antenna Terminals**
- Effective Radiated Power of Spurious Radiation**
- Frequency Stability**

SECTION 1

ACTUAL POWER RATINGS PER CHANNEL:

<u># Channels</u>	<u>Uplink (dBm)</u>	<u>Downlink (dBm)</u>
1	24.7	26.0
2	20.7	22.0
3	18.4	19.7
4	16.7	18.0
5	15.4	16.7
6	14.4	15.7
7	13.5	14.8
8	12.7	14.0
9	12.0	13.3
10	11.4	12.7
11	10.9	12.2
12	10.4	11.7
13	9.9	11.2
14	9.5	10.8
15	9.1	10.4
16	8.7	10.0

SECTION 2

SUMMARY OF TEST PROGRAM

POWER OUTPUT

Measurement Procedure:

The uplink and downlink of the test sample were alternately connected through external attenuators to a spectrum analyzer. Each link had an unmodulated signal sent to the input. The level of the input signal was adjusted to achieve maximum output power of the amplifier.

Testing was performed at 1 frequency within each passband (uplink and downlink). The levels of the input signals and maximized output power levels were recorded and are shown below.

UPLINK (Power Input @ max input):

Frequency (MHz)	Input (dBm)	Output (dBm)
1857.5	-12.5	33.0

DOWNLINK (Power Input @ max input):

Frequency (MHz)	Input (dBm)	Output (dBm)
1937.5	-10.3	35.7

For complete test data, see electronic Test Report Attachment, **RF Power Output Data**.

INTERMODULATION CHARACTERISTICS

Measurement Procedure:

Three CW signals were injected, in turn, to the uplink and downlink via a three way power combiner. Two signals were close together and at the low end of the passband, one signal was close to the high end of the passband. The output of each signal generator was adjusted so that the three output fundamental frequencies were equal in magnitude. At the specified input power levels all intermodulation products were at -13dBm or below. The requested power rating of the device for the certification grant is derived by summing the levels of the three input signals for each the uplink and downlink.

For complete test data, including actual X/Y plots of intermodulation signals, see electronic Test Report Attachment, **Intermodulation Characteristics Data**.

OCCUPIED BANDWIDTH

Measurement Procedure:

The test sample does not have any frequency generating circuits therefore measurements were made to compare the input signal to the output signal. The signal generator output was connected to the spectrum analyzer. A TDMA modulation signal was then applied to the carrier.

Waveforms were then noted on an X-Y plot. Next, the signal generator was connected to the EUT and the output of the EUT was connected to the spectrum analyzer. The output waveform after amplification was then compared to the emission mask requirement for TDMA signals (46dB down at plus and minus one channel spacing, 30kHz). This procedure was repeated with CDMA modulation type using the emission mask requirement for CDMA signals (46dB down at plus and minus 1 channel spacing 1.25MHz) and GSM modulation type (46dB down at plus and minus 1 channel spacing 200kHz). Testing was performed at one frequency within each passband (uplink and downlink).

For complete test data, see electronic Test Report Attachment, **Occupied Bandwidth Data**.

An explanation of the data is as follows: There are two signals superimposed on each plot, one signal is the waveform before modulation, the other is the modulated carrier. In each case the center of the grid shows a narrowband signal projecting out from the center of the modulation envelope. This signal is actually the stored unmodulated signal.

ANTENNA CONDUCTED EMISSIONS

Measurement Procedure:

The signal generator output was connected in turn to the uplink and downlink input ports of the EUT. The input power level was at the level which was ascertained during the Power Output test. A spectrum analyzer was connected to the output of the EUT. The input test frequencies used were one frequency within each passband (uplink and downlink). The level of any spurious emission was recorded. Testing was performed in the frequency range of 30MHz to 20GHz. The spurious emissions limit is -13dBm as specified in FCC Part 24, Subpart E

For complete test data, including harmonic and spurious emissions measured at antenna terminal, see electronic Test Report Attachment, **Antenna Conducted Data**.

EFFECTIVE RADIATED POWER OF SPURIOUS RADIATION

Measurement Procedure:

The test sample was placed on a 80cm high wooden test stand which was located 3 meters from the test antenna on an FCC listed test site. A signal generator was connected to the input of the amplifier. The signal generator output was set to provide the input power level necessary to achieve maximum output power of the amplifier at 1 frequency within each passband (uplink and downlink). The effective radiated power of each out of band spurious emission was measured using the substitution method specified in TIA/EIA-603. The frequency range of the test was 30MHz - 20GHz. The limit for out of band spurious emissions is -13dBm as specified in Part 24, Subpart E.

For complete test data, see electronic Test Report Attachment, **Radiated Emissions Data**.

FREQUENCY STABILITY MEASUREMENTS

Measurement Procedure (Frequency vs. Voltage & Temperature):

The test sample does not have any frequency determining circuits however testing was performed at frequency versus input voltage and temperature. The test sample was placed in a temperature chamber and connected to a signal generator. The RF output of the signal generator was set to a frequency within each passband (uplink and downlink) of the test sample, and the output of the test sample was connected to a spectrum analyzer. The AC input voltage to the test sample was varied plus and minus 15% in 5% increments while the temperature was varied from -30 degrees c to +50 degrees c in 10 degree increments. The output frequency from the test sample was measured and compared to the input frequency.

For complete test data, see electronic Test Report Attachment, **Frequency Stability Data**.

SECTION 3

EQUIPMENT LISTS

Spurious Radiated Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3000	Tuned Dipole Antenna	Empire Devices	20 MHz - 200 MHz	T1	8/8/02	8/8/03
3001	Tuned Dipole Antenna	Empire Devices	200 MHz - 400 MHz	T2	8/8/02	8/8/03
3002	Tuned Dipole Antenna	Empire Devices	400 MHz - 1 GHz	T3	8/8/02	8/8/03
3130	20 dB Attenuator	Narda	DC - 18 GHz	768-20	1/25/02	1/25/03
3138	10 DB Atten. (50 ohm)	Narda	DC - 5 GHz	768-10	4/18/02	4/18/03
3258	Double Ridge Guide	EMCO	1 - 18 GHz	3115	5/6/02	5/6/03
4003	Double Ridge Guide	Tensor	1 GHz - 18 GHz	4015	1/3/02	1/3/03
4029	Open Area Test Site	Retlif	3 / 10 Meters	RNH	1/24/01	1/24/04
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	7/25/02	7/25/03
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/25/02	2/25/03
5001	Oscilator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/25/02	2/25/03
530A	AM/FM Signal Generator	Marconi Instru.	10 kHz - 1.2 GHz	2023	7/10/02	7/10/03
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	7/19/02	7/19/03

Frequency Stability

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/13/02	2/13/03
4997	Digital Thermometer	Omega	N/A		11/21/01	11/21/02
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/25/02	2/25/03
5001	Oscilator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/25/02	2/25/03
5013	Variac	Powerstat	0 - 140 VAC	116B	5/30/02	5/30/03
557	Temperature Chamber	Associated Env.	-73 C - +177 C	SK 3105	6/11/02	6/11/03

Intermodulation

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3130	20 dB Attenuator	Narda	DC - 18 GHz	768-20	1/25/02	1/25/03
3138	10 DB Atten. (50 ohm)	Narda	DC - 5 GHz	768-10	4/18/02	4/18/03
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/13/02	2/13/03
	Signal Generator	Hewlett Packard	250 KHz - 2GHz	E4431B	12/27/01	12/27/02

SECTION 3 (Continued)

EQUIPMENT LISTS

Occupied Bandwidth

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3130	20 dB Attenuator	Narda	DC - 18 GHz	768-20	1/25/02	1/25/03
3138	10 DB Atten. (50 ohm)	Narda	DC - 5 GHz	768-10	4/18/02	4/18/03
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/13/02	2/13/03
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/25/02	2/25/03
5001	Oscillator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/25/02	2/25/03
	Signal Generator	Hewlett Packard	250 KHz – 2GHz	E4431B	12/27/01	12/27/02

RF Power Out

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3130	20 dB Attenuator	Narda	DC - 18 GHz	768-20	1/25/02	1/25/03
3138	10 DB Atten. (50 ohm)	Narda	DC - 5 GHz	768-10	4/18/02	4/18/03
713	EMI Test Receiver	Rohde & Schwarz	20Hz – 26.5GHz	ESI26	7/19/02	7/19/03
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/25/02	2/25/03
5001	Oscillator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/25/02	2/25/03

Spurious Emissions at Antenna Terminals

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3130	20 dB Attenuator	Narda	DC - 18 GHz	768-20	1/25/02	1/25/03
3138	10 DB Atten. (50 ohm)	Narda	DC - 5 GHz	768-10	4/18/02	4/18/03
713	EMI Test Receiver	Rohde & Schwarz	20Hz – 26.5GHz	ESI26	7/19/02	7/19/03
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/25/02	2/25/03
5001	Oscillator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/25/02	2/25/03

RETLIF TESTING LABORATORIES

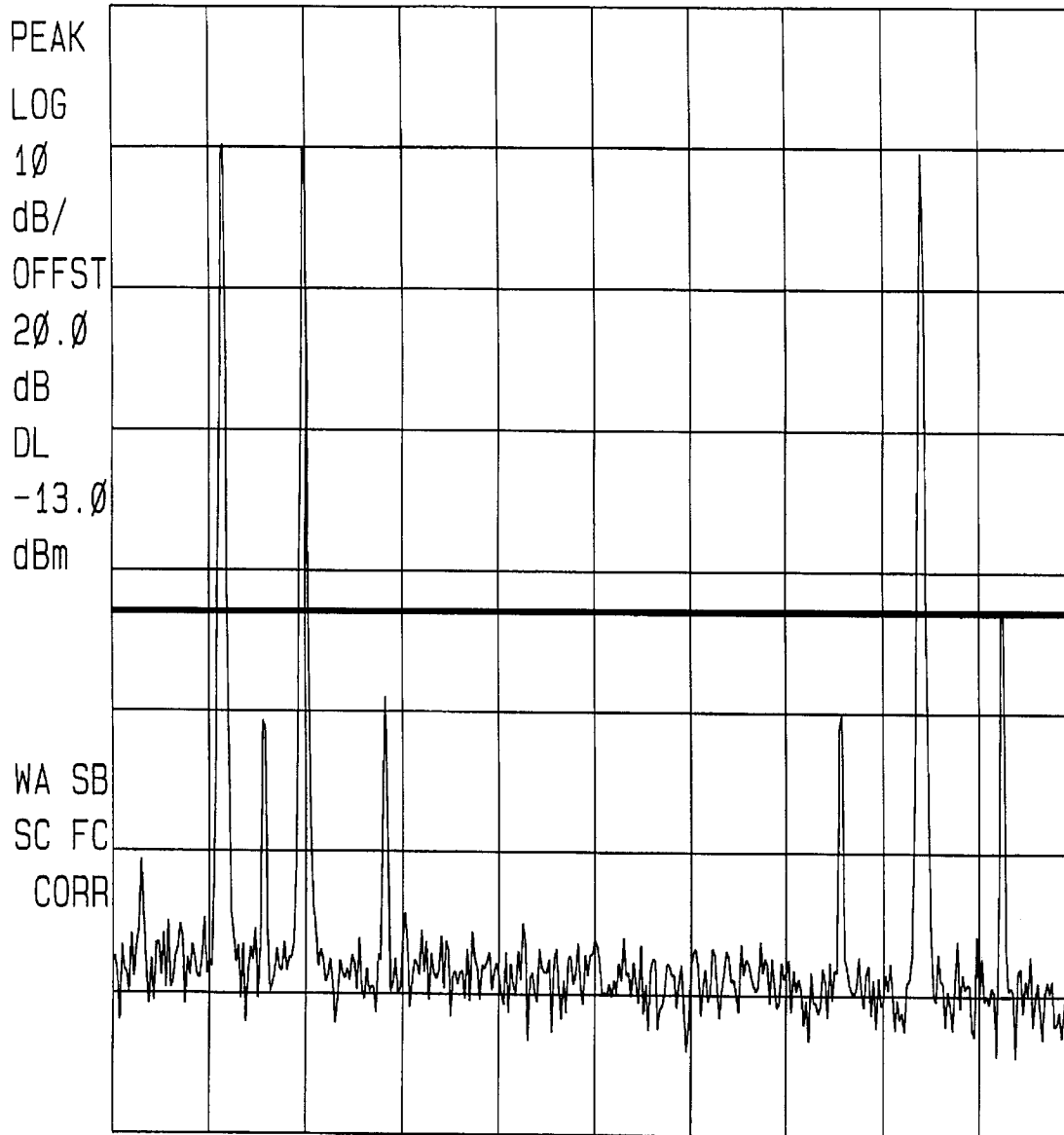
TABULAR DATA SHEET

Test Method:	RF Power Output		
Customer:	Cellular Specialties, Inc.	Job No:	R-4023N
Test Sample:	Bidirectional Amplifier		
Model No:	610 PCS	Serial No:	n/a
Test Specification:	FCC Part 2 Paragraph: 2.1046		
Operating Mode:	Amplifying input signal		
Technician:	T. Hannemann	Date:	9/5/02
Notes:	Uplink Frequency: 1857.5 MHz Downlink Frequency: 1937.5 MHz		

[illegible]

13:40:48 SEP 23, 2002

REF 30.0 dBm #AT 20 dB



START 1.85000 GHz

STOP 1.91000 GHz

#RES BW 120 kHz

VBW 300 kHz

SWP 20.0 msec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Intermodulation Characteristics, FCC Part 2, para 2.1047
Notes: Uplink Frequency Range: 1850 - 1910 MHz

Date: 9/23/02

Tech: T. Firkowski

Sheet 1 of 2

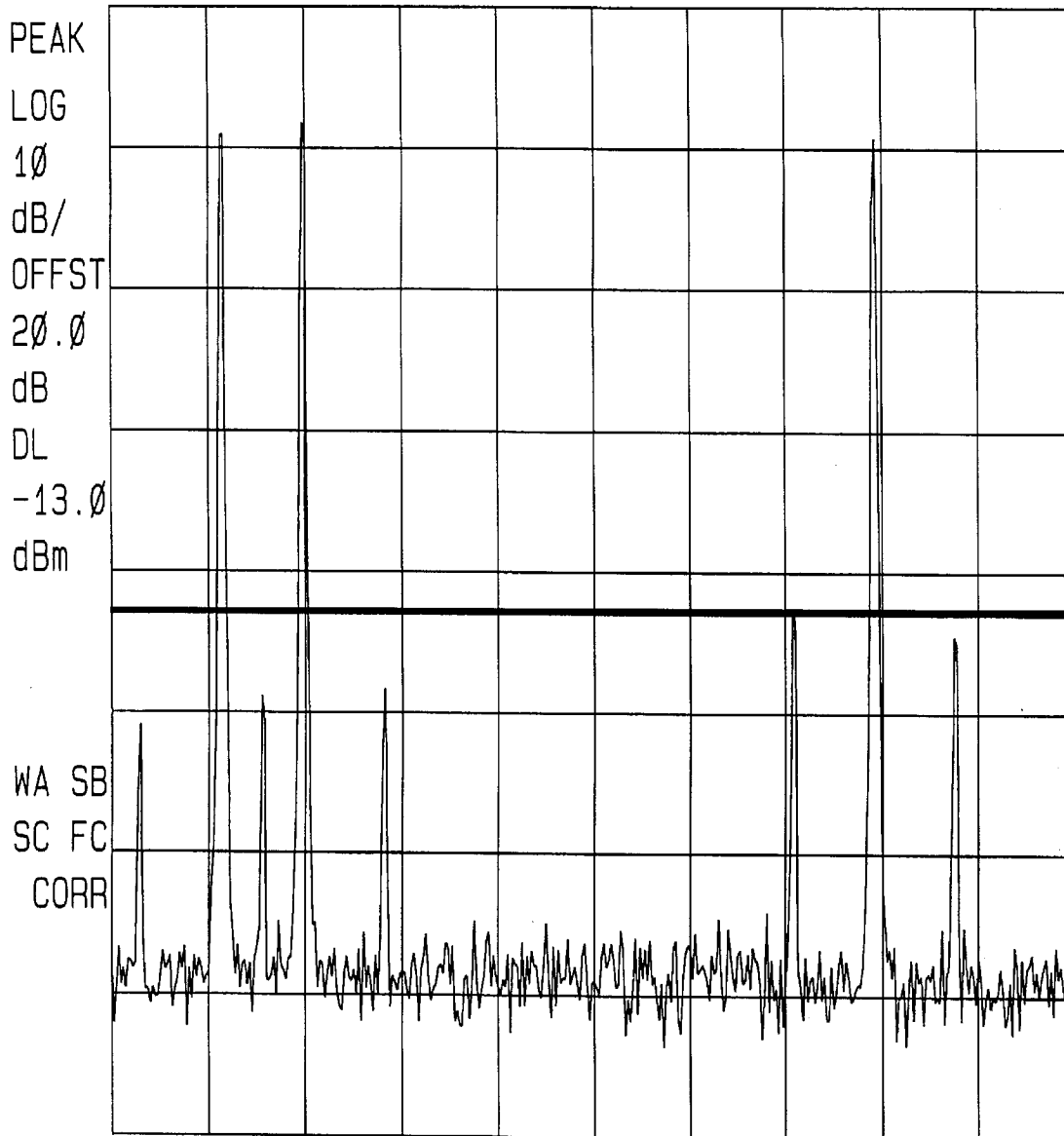


Retlif Testing Laboratories

Report No R-4023N

13: 45: 07 SEP 23, 2002

REF 30.0 dBm #AT 20 dB



START 1.93000 GHz

STOP 1.99000 GHz

#RES BW 120 kHz

VBW 300 kHz

SWP 20.0 msec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Intermodulation Characteristics, FCC Part 2, para 2.1047
Notes: Downlink Frequency Range: 1930 - 1990 MHz

Date: 9/23/02

Tech: T. Firkowski

Sheet 2 of 2

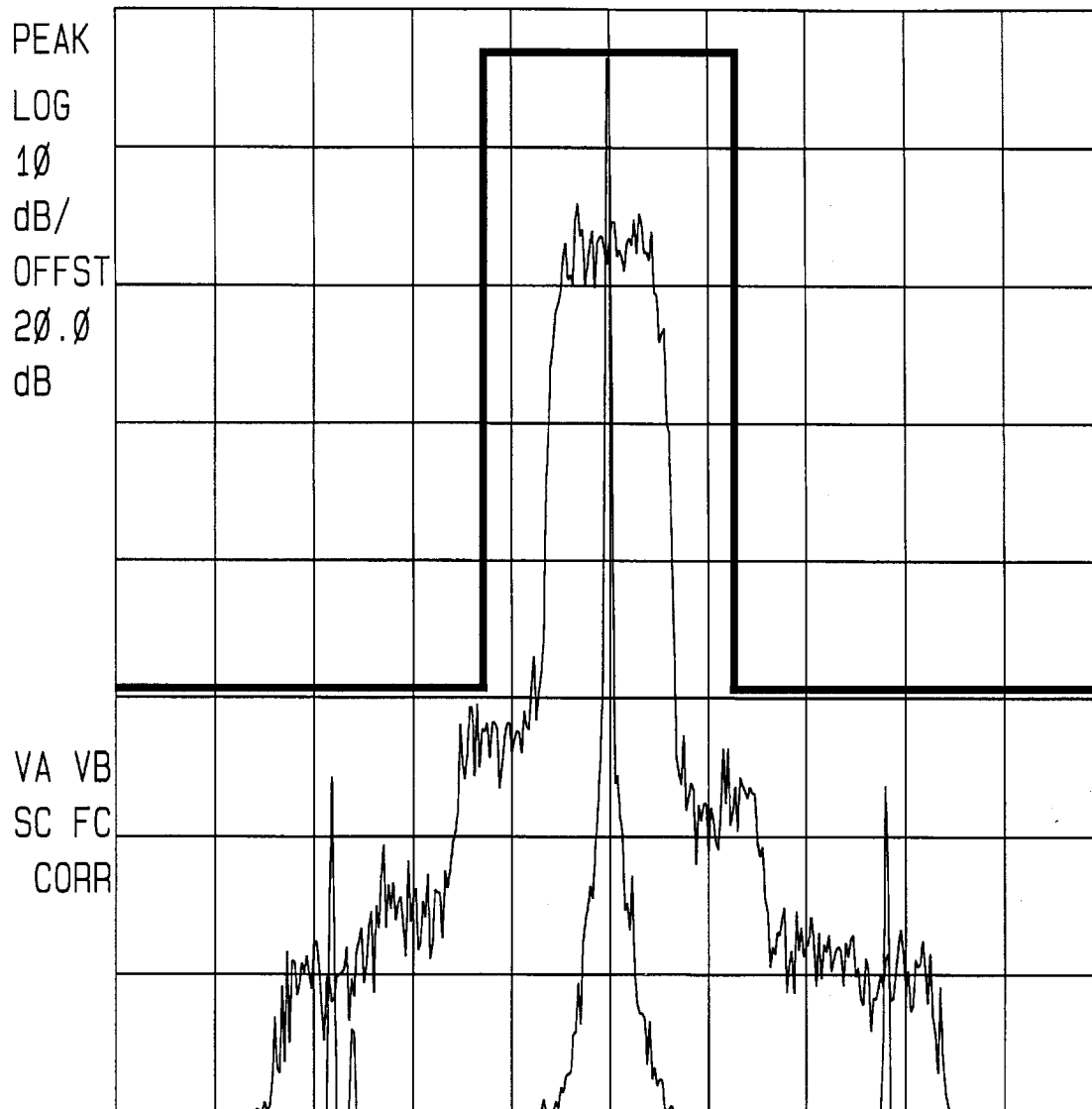


Retlif Testing Laboratories

Report No R-4023N

14:05:48 SEP 23, 2002
hp

REF 35.0 dBm #AT 30 dB



CENTER 1.8800000 GHz

SPAN 250.0 kHz

#RES BW 300 Hz

VBW 1 kHz

SWP 8.33 sec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Occupied Bandwidth, FCC Part 2, para 2.1049
Notes: Uplink Frequency 1880 MHz
Modulation: TDMA

Date: 9/23/02

Tech: T. Firkowski

Sheet 1 of 6

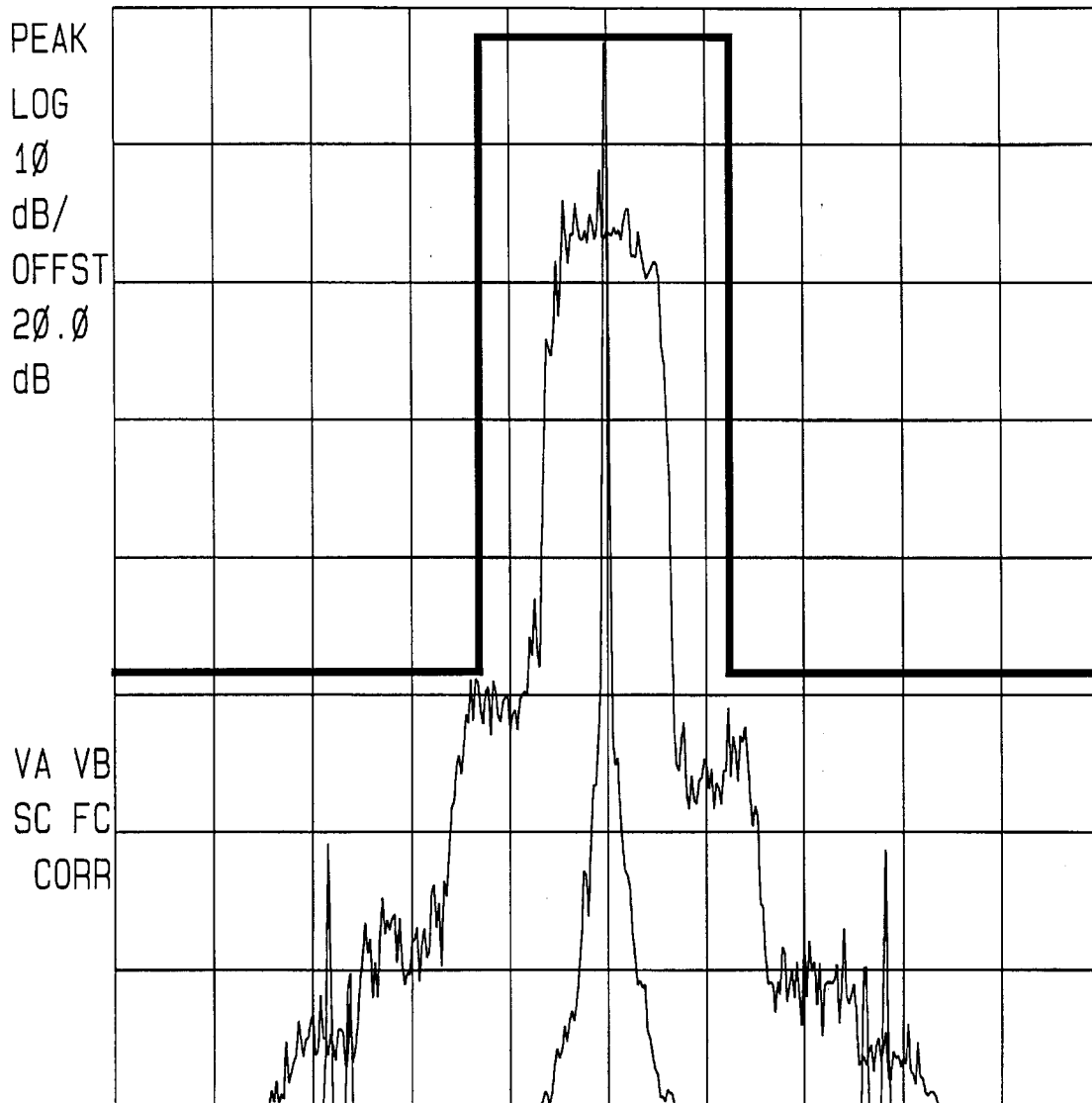


Retlif Testing Laboratories

Report No. R-4023N

14:00:02 SEP 23, 2002

REF 35.0 dBm #AT 30 dB



CENTER 1.9600000 GHz

SPAN 250.0 kHz

#RES BW 300 Hz

VBW 1 kHz

SWP 8.33 sec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Occupied Bandwidth, FCC Part 2, para 2.1049
Notes: Downlink Frequency 1960 MHz
Modulation: TDMA

Date: 9/23/02

Tech: T. Firkowski

Sheet 2 of 6



Retlif Testing Laboratories

Report No. R-4023N

14: 15: 51 SEP 23, 2002

hp

REF 35.0 dBm

#AT 30 dB

PEAK

LOG

10

dB/

OFFST

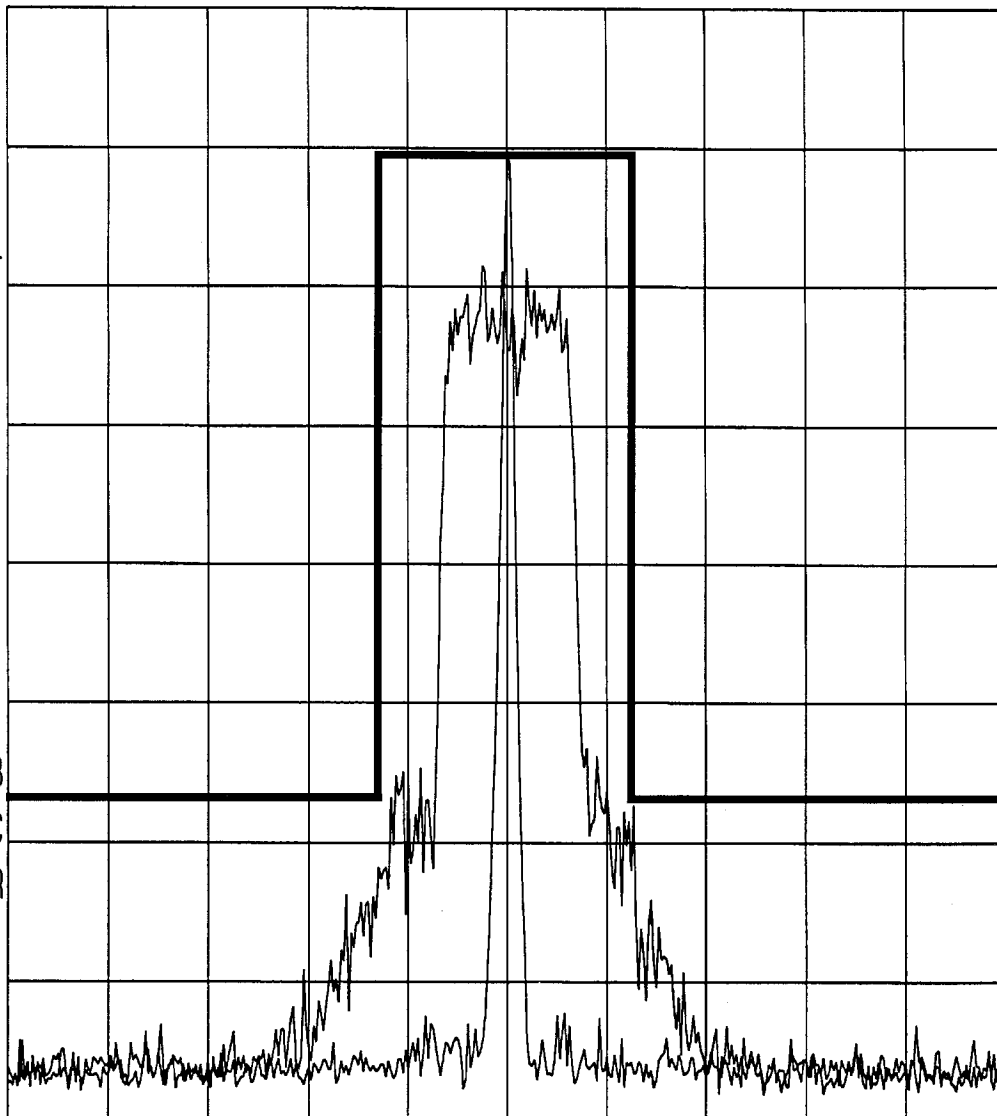
20.0

dB

VA VB

SC FC

CORR



CENTER 1.88000 GHz

SPAN 10.00 MHz

#RES BW 30 kHz

VBW 100 kHz

SWP 33.3 msec

Customer:
Test Sample:
Model No:
Test Method:
Notes:

Cellular Specialties, Inc.
Bidirectional Amplifier
610 P
Occupied Bandwidth, FCC Part 2, para 2.1049
Uplink Frequency 1880 MHz
Modulation: CDMA

Date: 9/23/02

Tech: T. Firkowski

Sheet 3 of 6

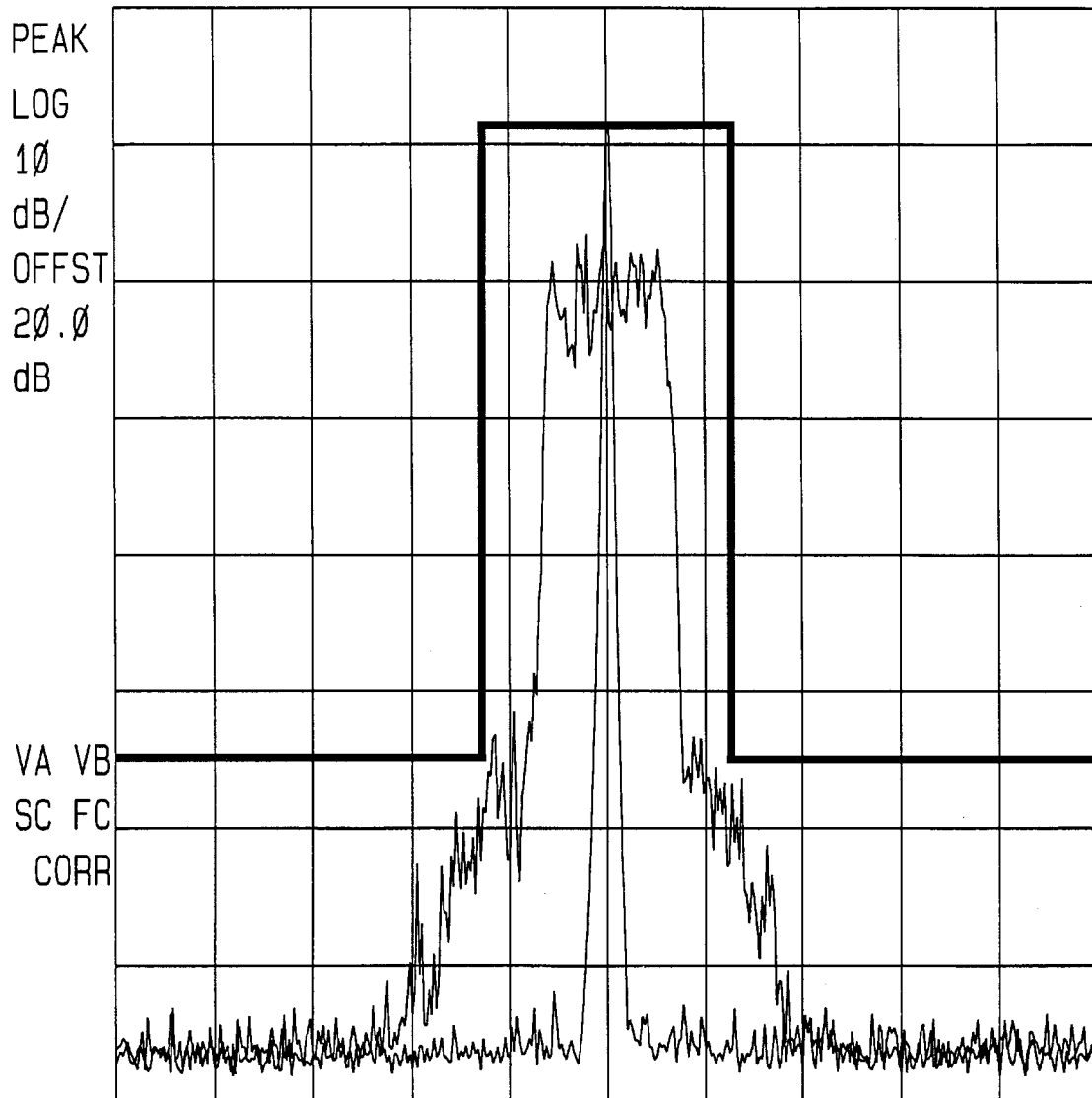


Retlif Testing Laboratories

Report No. R-4023N

14:20:43 SEP 23, 2002
hp

REF 35.0 dBm #AT 30 dB



CENTER 1.96000 GHz

SPAN 10.00 MHz

#RES BW 30 kHz

VBW 100 kHz

SWP 33.3 msec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Occupied Bandwidth, FCC Part 2, para 2.1049
Notes: Downlink Frequency 1960 MHz
Modulation: CDMA

Date: 9/23/02

Tech: T. Firkowski

Sheet 4 of 6

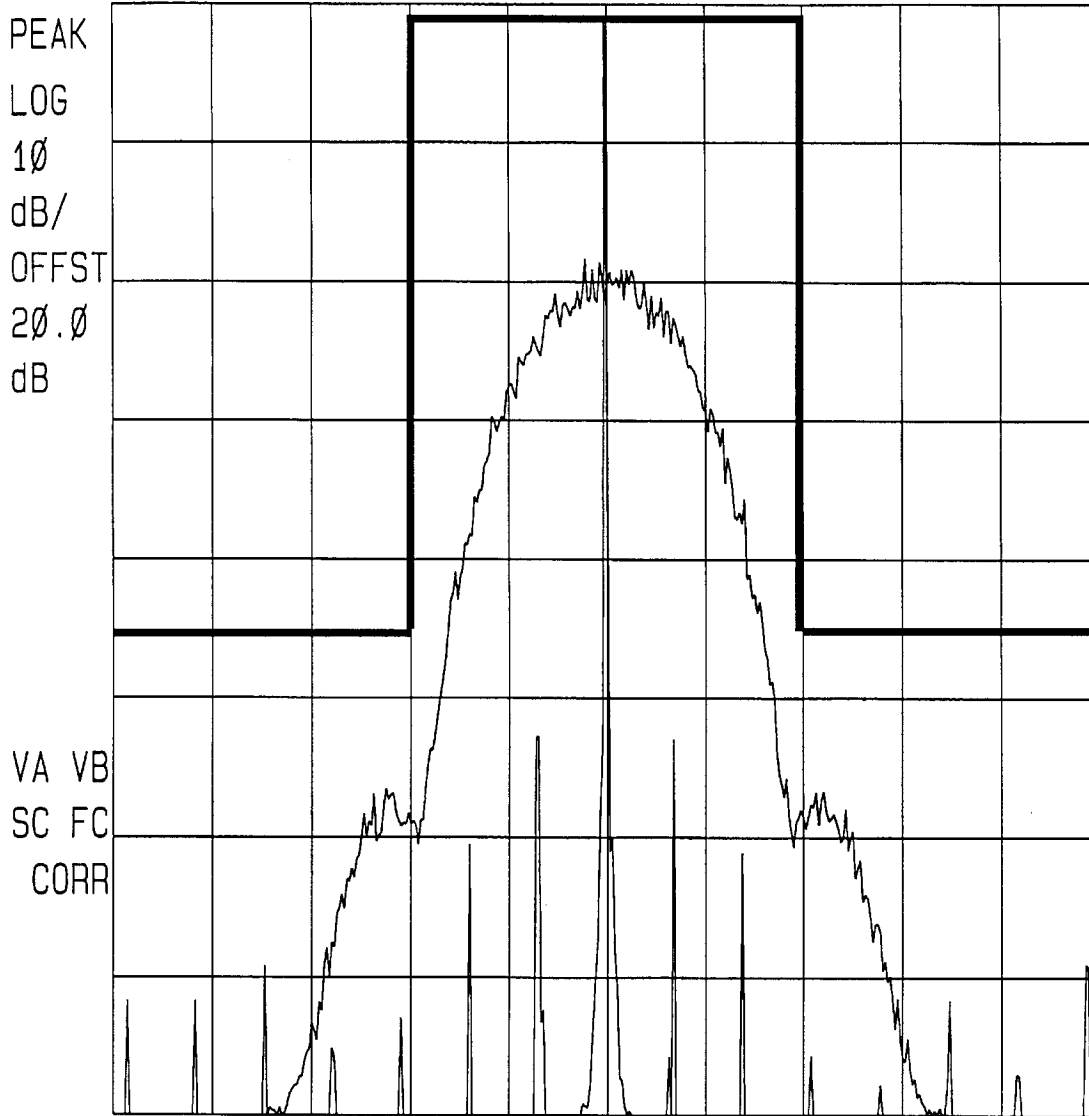


Retlif Testing Laboratories

Report No. R-4023N

14: 43: 56 SEP 23, 2002
hp

REF 35.0 dBm #AT 30 dB



CENTER 1.880000 GHz

SPAN 1.000 MHz

#RES BW 300 Hz

VBW 1 kHz

SWP 33.3 sec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Occupied Bandwidth, FCC Part 2, para 2.1049
Notes: Uplink Frequency 1880 MHz
Modulation: GSM

Date: 9/23/02

Tech: T. Firkowski

Sheet 5 of 6

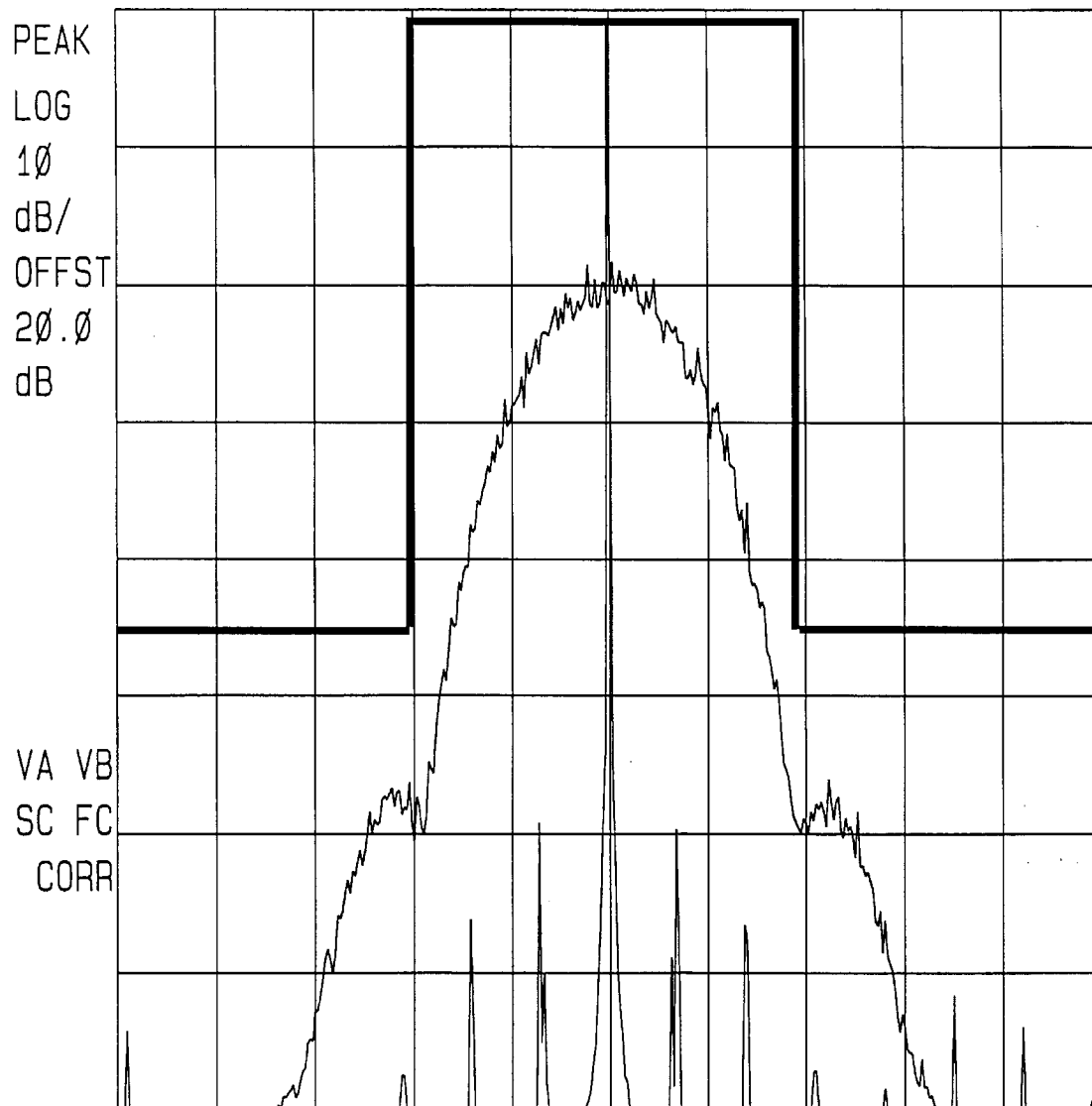


Retlif Testing Laboratories

Report No. R-4023N

14: 35: 10 SEP 23, 2002
hp

REF 35.0 dBm #AT 30 dB



CENTER 1.960000 GHz

SPAN 1.000 MHz

#RES BW 300 Hz

VBW 1 kHz

SWP 33.3 sec

Customer: Cellular Specialties, Inc.
Test Sample: Bidirectional Amplifier
Model No: 610 P
Test Method: Occupied Bandwidth, FCC Part 2, para 2.1049
Notes: Downlink Frequency 1960 MHz
Modulation: GSM

Date: 9/23/02

Tech: T. Firkowski

Sheet 6 of 6



Retlif Testing Laboratories

Report No. R-4023N

Test Method:	Spurious Emissions at the Antenna Terminals 30 MHz to 20.0 GHz		
Customer:	Cellular Specialties, Inc.	Job No:	R-4023N
Test Sample:	Bidirectional Amplifier		
Model No:	610 PCS	Serial No:	n/a
Test Specification:	FCC Part 2 Paragraph: 2.1051		
Operating Mode:	Amplifying input signal		
Technician:	T. Firkowski	Date:	9/30/02
Notes:	Uplink Frequency 1857.5 MHz Downlink Frequency 1937.5 MHz		

[illegible]

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Spurious Radiated Emissions (ERP) 30 MHz to 20.0 GHz		
Customer:	Cellular Specialties, Inc.	Job No:	R-4023N
Test Sample:	Bidirectional Amplifier		
Model No:	610 PCS	Serial No:	n/a
Test Specification:	FCC Part 2.1053\Part 24 Paragraph: n/a		
Operating Mode:	Amplifying input signal		
Technician:	T. Hannemann	Date:	9/19/02
Notes:	Uplink Frequency Range: 1850 - 1910 MHz Peak Detector Tested at 1857.5 MHz		

[illegible]

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Spurious Radiated Emissions (ERP) 30 MHz to 20.0 GHz		
Customer:	Cellular Specialties, Inc.	Job No:	R-4023N
Test Sample:	Bidirectional Amplifier		
Model No:	610 PCS	Serial No:	n/a
Test Specification:	FCC Part 2.1053\Part 24 Paragraph: n/a		
Operating Mode:	Amplifying input signal		
Technician:	T. Hannemann	Date:	9/19/02
Notes:	Downlink Frequency Range: 1930 - 1990 MHz Tested at 1937.5 MHz Peak Detector		

[illegible]

EMISSIONS DATA SHEET

Frequency Stability

Cellular Specialties, Inc.

R-4023N

Bidirectional Amplifier

610 P

Serial No:

n/a

FCC Part 2

Paragraph: 2.1055

Amplifying input signal

T. Hannemann

Date:

9/4/02

Uplink Frequency 1857.5 MHz

Nominal Voltage = 115 VAC

Downlink Frequency 1937.5 MHz

[illegible]