RETLIF TESTING LABORATORIES

REPORT OF MEASUREMENTS

FOR

CELLULAR SPECIALTIES, INC.

BI-DIRECTIONAL AMPLIFIER

MODEL: 610smr-900

FCC ID: NVRCSI610-04

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 Special Mobile Radio (SMR) Band.**
Model:	**610smr-900**
FCC ID Number:	**FCC ID: NVRCSI610-04**
Applicable Test Standard:	**FCC Parts 2 & 90 SMR Operations and 90.219 Use of Signal Boosters**
Device Classification:	**Mobile**
EUT Frequency Range:	**Uplink: 896 MHz to 901MHz** **Downlink: 935MHz to 940MHz**
Modulation Type:	**TDMA**
Measured Power Output - Based on Two-Tone Intermodulation Data (For Certification Grant):	**Uplink: .647W** **Downlink: 1.05W**
RF Exposure + Antenna Installation:	**See Attached Installation/Users Manual and MPE Evaluation**
Power Ratings Per Channel:	**See Attached Power Rating/Channel Data**
Measurements Required by FCC:	**See Report Section 1 (Summary of Test Program) and the following Test Report Data Attachments:** **-RF Power Output (See Two Tone Data)** **-Intermodulation Characteristics (Two-Tone)** **-Occupied Bandwidth** **-Spurious Emissions at Antenna Terminals** **-Effective Radiated Power of Spurious Radiation** **-Frequency Stability**

SECTION 1
SUMMARY OF TEST PROGRAM

INTERMODULATION CHARACTERISTICS (TWO TONE)/RF POWER OUTPUT

Measurement Procedure:

Two modulated signals were injected, in turn, to the uplink and downlink via a two way power combiner. The two signals were close together and at the low end of the passband. The output of each signal generator was adjusted so that the two output fundamental frequencies were equal in magnitude. At the specified input power levels all intermodulation products were at -13dBm or below. This procedure was repeated with the two signals close together at the upper end of the passband. Testing was performed using TDMA Modulation. The RF Power Output Rating of the device for the certification grant is derived by summing the levels of the two 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

The test sample does not have any frequency generating circuits therefore measurements were made to compare the modulated input signal to the modulated output signal after amplification. The signal generator output was connected to the spectrum analyzer. A TDMA modulated 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). 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.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

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 9.5GHz. The spurious emissions limit is -13dBm as specified in FCC Part 90.

For complete test data, including harmonic and spurious emissions measured at antenna terminal, see electronic Test Report Attachment, **Spurious Emissions At Antenna Terminals 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 - 9.5GHz. The limit for out of band spurious emissions is -13dBm as specified in Part 90.

For complete test data, see electronic Test Report Attachment, **Spurious Radiated Emissions (ERP) Data**.

FREQUENCY STABILITY MEASUREMENTS

Measurement Procedure (Frequency vs. Voltage):

As the test sample does not have any frequency determining circuits only frequency versus input voltage measurements were performed 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 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 2
EQUIPMENT LISTS

Frequency Stability

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	10/15/2003	10/15/2004
4935A	6.0 dB Attenuator	JFW Inc.	DC - 2 GHz	50FH-006-50N	01/08/2003	01/08/2004
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	11/05/2002	11/05/2003
5013	Variac	Powerstat	0 - 140 VAC	116B	06/04/2003	06/04/2004
5016	Attenuator	Narda	DC - 18 GHz	776B-30	11/06/2002	11/06/2003
520N	Digital Multimeter	Wavetek	N/A	25XT	05/26/2003	11/26/2003

Occupied Bandwidth

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4935A	6.0 dB Attenuator	JFW Inc.	DC - 2 GHz	50FH-006-50N	01/08/2003	01/08/2004
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5016	Attenuator	Narda	DC - 18 GHz	776B-30	11/06/2002	11/06/2003

Spurious Emissions at Antenna Port

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	10/15/2003	10/15/2004
5016	Attenuator	Narda	DC - 18 GHz	776B-30	11/06/2002	11/06/2003
530A	AM/FM Signal Generator	Marconi Instru.	10 kHz - 1.2 GHz	2023	04/18/2003	04/18/2005

Spurious Radiated Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4029B	Test Site Attenuation	Retlif	3 / 10 Meters	RNH	07/30/2003	07/30/2004
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	08/29/2003	08/29/2004
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	10/15/2003	10/15/2004
4984A	High Gain Horn	Microlab/FXR	1.0 - 1.7 GHz	L638A	01/03/2003	01/03/2004
4984B	High Gain Horn	Microlab/FXR	1.7 - 2.6 GHz	R638A	01/03/2003	01/03/2004
4984C	High Gain Horn	Microlab/FXR	2.6 - 3.95 GHz	S638A	01/03/2003	01/03/2004
4984D	High Gain Horn	Microlab/FXR	3.95 - 5.85 GHz	H638A	01/03/2003	01/03/2004
4984E	High Gain Horn	Microlab/FXR	5.8 - 8.2 GHz	C638A	01/03/2003	01/03/2004
4984F	High Gain Horn	Microlab/FXR	8.2 - 12.4 GHz	X638A	01/03/2003	01/03/2004

Intermodulation (Two Tone)

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	10/15/2003	10/15/2004
5001A	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	02/14/2003	02/14/2004
5001B	Oscilator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	02/14/2003	02/14/2004
5016	Attenuator	Narda	DC - 18 GHz	776B-30	11/06/2002	11/06/2003
530A	AM/FM Signal Generator	Marconi Instru.	10 kHz - 1.2 GHz	2023	04/18/2003	04/18/2005