REPORT OF MEASUREMENTS

FOR

CELLULAR SPECIALTIES, INC.

BI-DIRECTIONAL AMPLIFIER

MODEL: 150pcs

FCC ID: NVRBA15X-01

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:	**150pcs**
FCC ID Number:	**FCC ID: NVRBA15X-01**
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: 48dB** **Downlink: 48dB**
Measured Power Output at maximum input, single channel	**Uplink: +31.07dBm** **Downlink: +30.63dBm**
Power Output Rating Based on Intermodulation Data (For Certification Grant):	**Uplink: +21.0dBm = 125mW** **Downlink: +19.0dBm = 80mW**
Modulation Types:	**TDMA, CDMA, GSM**
RF Exposure + Antenna Installation:	**See Attached Installation/Users Manual and MPE Evaluation**
Power Ratings Per Channel:	**See Attached Data**
Measurements Required by FCC:	**See Report Section 1 (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

SUMMARY OF TEST PROGRAM

RF 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 1frequency 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)
1880	-17.36	31.07

DOWNLINK (Power Input @ max input):

Frequency (MHz)	Input (dBm)	Output (dBm)
1960	-17.85	30.63

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

INTERMODULATION CHARACTERISTICS (TWO TONE)

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, CDMA and GSM Modulations. The requested power 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

Measurement Procedure:

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). 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. 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 2

EQUIPMENT LISTS

RF Power Output

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3128	20 dB Attenuator	Lucas Weinscher	DC - 18 GHz	2	1/8/03	1/8/04
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/14/03	2/14/04
5001	Oscillator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/14/03	2/14/04

Spurious Emissions at the Antenna Terminals

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3128	20 dB Attenuator	Lucas Weinscher	DC - 18 GHz	2	1/8/03	1/8/04
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04
5001	Sweep Oscillator	Hewlett Packard	.01 - 20.4 GHz	8350B	2/14/03	2/14/04
5001	Oscillator Plug-In	Hewlett Packard	.01 - 20 GHz	83592A	2/14/03	2/14/04

Occupied Bandwidth

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3128	20 dB Attenuator	Lucas Weinscher	DC - 18 GHz	2	1/8/03	1/8/04
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04
	Signal Generator	Hewlett Packard	250 kHz – 2 GHz	E4431B	12/27/01	12/27/03

Two Tone

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3128	20 dB Attenuator	Lucas Weinscher	DC - 18 GHz	2	1/8/03	1/8/04
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04
	Signal Generator	Hewlett Packard	250 kHz – 2 GHz	E4431B	12/27/01	12/27/03

EQUIPMENT LISTS

Spurious Radiated Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3258	Double Ridge Guide	EMCO	1 - 18 GHz	3115	5/14/03	5/14/04
3430	Horn Antenna	MCS Corporation	18 GHz - 26.5 GHz	K-5039	1/3/03	1/3/04
4029	Test Site Attenuation	Retlif	3 / 10 Meters	RNH	8/8/02	8/8/03
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	7/25/02	7/25/03
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04

Frequency Stability

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3128	20 dB Attenuator	Lucas Weinscher	DC - 18 GHz	2	1/8/03	1/8/04
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	3/18/03	3/18/04
4997	Digital Thermometer	Omega	N/A		12/19/02	12/19/03
5013	Variac	Powerstat	0 - 140 VAC	116B	5/30/02	5/30/03
520N	Digital Multimeter	Wavetek	N/A	25XT	11/26/02	6/26/03
557	Temperature Chamber	Associated Env.	-73 C - +177 C	SK 3105	6/11/02	6/11/03