February 27, 2001

Elite Electronic Engineering, Inc.
1516 Center Circle
Downers Grove, IL 60515

Attn: Richard King

Dear Richard:

Enclosed you will find a certification application for a Bidirectional Amplifier, Model No. 510, FCC ID: NVRCSI510-02. Certification is requested under FCC Parts 2 & 22. This application is being filed by Retlif Testing Laboratories on behalf of Cellular Specialties The applicable filing fee and certification agreement have been mailed to your attention.

I trust that you will find this application to be complete; however, should you have any questions or require any additional information, please feel free to contact us.

Very truly yours,

RETLIF TESTING LABORATORIES

Scott Wentworth
Manager
Enc. (as stated)

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.**
Model:	**510**
FCC ID Number:	**FCC ID: NVRCSI510-02**
Applicable Test Standard:	**FCC Parts 2 & 22 Subpart H**
Device Classification:	**Mobile**
EUT Frequency Range:	**Uplink: 824 MHz to 849 MHz** **Downlink: 869 MHz to 894 MHz**
EUT Gain:	**Uplink: 58dB** **Downlink: 58dB**
Measured Power Output @ 1dB Compression Point:	**Uplink: +27.4dBm** **Downlink: +27.9dBm**
Protocols used with this device:	**TDMA**
Power Output Rating Based on Intermodulation Data (For Certification Grant):	**Uplink: 468mW** **Downlink: 372mW**
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** **-Field Strength of Spurious Radiation** **-Frequency Stability**

SECTION 1

ACTUAL POWER RATINGS PER CHANNEL:

# Channels	Uplink (dBm)	Downlink (dBm)
1	26.0	26.0
2	22.0	22.0
3	19.7	19.7
4	18.0	18.0
5	16.7	16.7
6	15.7	15.7
7	14.8	14.8
8	14.0	14.0
9	13.3	13.3
10	12.7	12.7
11	12.2	12.2
12	11.7	11.7
13	11.2	11.2
14	10.8	10.8
15	10.4	10.4
16	10.0	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 3 frequencies (low, mid and high) 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 @ 1dB Gain Compression Point):

Frequency (MHz)	Input (dBm)	Output (dBm)
824.0	-29.0	27.4
836.0	-30.0	27.2
849.0	-31.0	25.7

DOWNLINK (Power Input @ 1dB Gain Compression Point):

Frequency (MHz)	Input (dBm)	Output (dBm)
869.0	-31.0	26.1
881.0	-30.0	27.9
894.0	-29.0	26.7

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 input power levels used 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 signal generator output was connected to the spectrum analyzer with a power level which was ascertained during the Power Output test. A 16kHz sine wave FM 1kHz 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. These output waveforms, CW and modulated, were then compared to the input waveforms to show that there was no change in the shape of the applied signal after amplification. The above procedure was repeated using a 16kHz square wave FM 1kHz modulation. Testing was performed at three frequencies (low, mid and high) 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.

The two plots on the left of each page are the input signals to the amplifier. On the right are plots of the signals taken at the output of the amplifier.

The two top plots (left and right) utilize sine wave modulation. The two bottom plots (left and right) utilize square wave modulation as described above.

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 were (low, mid and high) within each passband (uplink and downlink). The level of any spurious emission was recorded. Testing was performed in the frequency range of 30MHz to 9GHz. The spurious emissions limit is -13dBm as specified in FCC Part 22, Subpart H.

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

FIELD STRENGTH 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 uplink 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 3 signals within the passband (low, mid and high). Field strength measurements of each out of band emission were taken and recorded. This procedure was repeated for the downlink input of the amplifier. FCC Part 2, Subpart H specifies that out of band emissions must be attenuated by 43 + 10log P. The calculated field strength limit at 3 meters for out of band emissions is 84.4dBuV/M. The frequency range of the test was 30MHz - 9GHz.

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

FREQUENCY STABILITY MEASUREMENTS

Measurement Procedure (Frequency vs. Voltage):

The RF output of the signal generator was connected to the input (uplink and downlink) of the test sample, and the output was connected to a spectrum analyzer. The input signal level was varied. Measurements were taken with the EUT supplied with signals at levels -15, -30, and -60 dB from the maximum input power.

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

SECTION 3
EQUIPMENT LISTS

RF Power Output

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	01/31/2001	01/31/2002
4961	Attenuator	Narda	DC - 18 GHz	757C-30dB	10/02/2000	10/02/2001
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	06/27/2000	06/27/2001

Intermodulation Characteristics

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3008	Signal Generator	Gigatronics	50 MHz - 18 GHz	900/0.05-18	10/11/2000	10/11/2001
3233	Graphics Plotter	Hewlett Packard	N/A	7470A	04/11/2000	04/11/2001
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	01/31/2001	01/31/2002
4961	Attenuator	Narda	DC - 18 GHz	757C-30dB	10/02/2000	10/02/2001
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	06/27/2000	06/27/2001
530A	AM/FM Signal Generator	Marconi Instru.	10 kHz - 1.2 GHz	2023	07/05/2000	07/05/2001

Occupied Bandwidth

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	01/31/2001	01/31/2002
4961	Attenuator	Narda	DC - 18 GHz	757C-30dB	10/02/2000	10/02/2001
530A	AM/FM Signal Generator	Marconi Instru.	10 kHz - 1.2 GHz	2023	07/05/2000	07/05/2001

Spurious Emissions at the Antenna Terminals

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	1/31/01	1/31/02
4961	Attenuator	Narda	DC - 18 GHz	757C-30dB	10/2/00	10/2/01
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	6/27/00	6/27/01

Spurious Radiated Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3116	Pre-Amplifier	Miteq	0.1 GHz - 18 GHz	AFS42-35	11/07/2000	11/07/2001
3117	Power Supply	B&K Precision	0-30 Vdc, 3.0 A	1630	02/23/2000	02/23/2001
3258	Double Ridge Guide	EMCO	1 - 18 GHz	3115	04/06/2000	04/06/2001
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	07/10/2000	07/10/2001
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	01/31/2001	01/31/2002
4972	Coaxial Termination	Philco	DC - 1 GHz	1608-150	11/02/2000	11/02/2001
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	06/27/2000	06/27/2001

SECTION 3 (Continued)
EQUIPMENT LISTS

Frequency Stability

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	1/31/01	1/31/02
4961	Attenuator	Narda	DC - 18 GHz	757C-30dB	10/2/00	10/2/01
4995	Signal Generator	Marconi Instru.	10 kHz - 1 GHz	2022	6/27/00	6/27/01