April 7, 1998

Federal Communications Commission
Equipment Approval Services
PO Box 358315
Pittsburgh, PA 15251-5315

Dear Sir/Madam:

Enclosed you will find a certification application for a Mini Bidirectional Amplifier, Model No. 110, FCC ID: NVRCSI110-01. Certification is requested under FCC Parts 2 & 90. This application is being filed by Retlif Testing Laboratories on behalf of Cellular Specialties, Inc.

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
Branch Manager

Enc. (as stated)

CERTIFICATION APPLICATION

Applicant/Manufacturer:	**Cellular Specialties, Inc.** **670 North Commercial Street** **Manchester, NH 03101**
Equipment under Test (EUT):	**The EUT is a Mini Bidirectional Amplifier used to amplify signals in an enclosed environment.**
FCC ID Number:	**FCC ID: NVRCSI110-01**
Applicable Test Standard:	**FCC Parts 2 & 90 SMR Operations**
Frequency Range:	**Uplink:806 MHz to 821 MHz** **Downlink: 851 MHz to 866 MHz**
Maximum Rated Input Power:	**Uplink:-11dBm** **Downlink: -8dBm**
Gain:	**Uplink:38dB** **Downlink: 17dB**
Measured Power Output Using Max. Rated Power Input:	**Uplink:27dBm** **Downlink: 17dBm**
Maximum Power Output Using Intermodulation Data (For Certification Grant):	**Uplink:300mW** **Downlink: 25mW**
RF Exposure, Antenna Installation, and Power Ratings Per Channel:	**See Report Section 1 (Environmental Impacts)**
Measurements Required by FCC:	**See Report Section 2 (Summary of Test Program) and the following Test Report Data Attachments:** **-RF Power Input** **-Intermodulation Characteristics** **-Occupied Bandwidth** **-Spurious Emissions at Antenna Terminals** **-Field Strength of Spurious Radiation** **-Frequency Stability**

SECTION 1
ENVIRONMENTAL IMPACTS

RF EXPOSURE AND ANTENNA INSTALLATION:

CAUTION Inside antennas should be positioned to observe minimum separation of 2.3 cm. (~1.0 in.) from any workstation. Personnel working in the vicinity of inside (downlink) antennas should observe the following guidelines for minimum distances between the human body and the antenna when establishing the position of new workstations.

The placement of a workstation must be in excess of 2.3 cm. (~1.0 in.) from any interior antenna. Exceeding this minimum separation will ensure that the employee does not receive RF-exposure beyond that Maximum Permissible Exposure according to section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

ACTUAL POWER RATINGS PER CHANNEL:

# Channels	Uplink (dBm)	Downlink (dBm)	# Channels	Uplink (dBm)	Downlink (dBm)
1	27.0	15.0	11	16.6	4.6
2	24.0	12.0	12	16.2	4.2
3	22.2	10.2	13	15.9	3.9
4	21.0	9.0	14	15.5	3.5
5	20.0	8.0	15	15.2	3.2
6	19.2	7.2	16	15.0	3.0
7	18.5	6.5	17	14.7	2.7
8	18.0	6.0	18	14.4	2.4
9	17.5	5.5	19	14.2	2.2
10	17.0	5.0	20	14.0	2.0

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, resulting in maximum output power.

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

Frequency (MHz)	Input (dBm)	Output (dBm)
806	-11.0	27.0
814	-11.0	27.0
821	-11.0	26.9

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

Frequency (MHz)	Input (dBm)	Output (dBm)
851	-8.0	16.7
859	-10.0	16.6
866	-8.0	16.6

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

INTERMODULATION CHARACTERISTICS

Measurement Procedure:

Three 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 pass band, one signal was close to the high end of the pass band. The output of each signal generator was adjusted so that the intermodulation products (spurs) of the output signals were at least 20dB below the fundamental frequencies and the three output fundamental frequencies were equal in magnitude.

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 modulation signal was applied to the carrier. This waveform was 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. This output waveform was then compared to the input waveform to show that there was no change in the applied signal after amplification. The above procedure was repeated using a 16kHz square wave FM modulation.

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

ANTENNA CONDUCTED EMISSIONS

Measurement Procedure:

The signal generator output was connected, in turn, to the uplink and downlink ports of the EUT. The EUT was connected to the spectrum analyzer. A swept signal, whose frequency range was the center frequency + and - 22.5MHz, was applied to the EUT with a power level which was ascertained during the Power Output test. The output waveform was noted on an X-Y plot. Per the above setup, a swept signal, whose frequency range was the center frequency + and - 225MHz was applied to the EUT with the same power level as above. The output waveform was noted on an X-Y plot.

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 an 80cm high wooden test stand which was located three meters from the test antenna on an FCC listed test site. The frequency range scanned was from 30 MHz to 9 GHz. After determining the source of highest emissions, emission levels were recorded.

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	Frequency Range	Model No.	Cal. Date	Due Date
3130	20dB Attenuator	Narda	DC - 18GHz	768-20	12/18/98	12/18/99
3139	10DB Atten. (50 ohm)	Narda	DC - 5GHz	768-10	4/9/99	4/9/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/11/99	2/11/00
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00

Intermodulation Characteristics

EN	Type	Manufacturer	Frequency Range	Model No.	Cal. Date	Due Date
3008	Signal Generator	Gigatronics	50MHz - 18GHZ	900/0.05-18	10/14/98	10/14/99
3009A	Microwave Signal Gen.	Hewlett Packard	700MHz - 2.1GHz	614a	11/9/98	11/9/99
3130	20dB Attenuator	Narda	DC - 18GHz	768-20	12/18/98	12/18/99
3139	10DB Atten. (50 ohm)	Narda	DC - 5GHz	768-10	4/9/99	4/9/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/11/99	2/11/00
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00

Occupied Bandwidth

EN	Type	Manufacturer	Frequency Range	Model No.	Cal. Date	Due Date
3130	20dB Attenuator	Narda	DC - 18GHz	768-20	12/18/98	12/18/99
3139	10DB Atten. (50 ohm)	Narda	DC - 5GHz	768-10	4/9/99	4/9/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/11/99	2/11/00
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00

Antenna Conducted

EN	Type	Manufacturer	Frequency Range	Model No.	Cal. Date	Due Date
3130	20dB Attenuator	Narda	DC - 18GHz	768-20	12/18/98	12/18/99
3139	10DB Atten. (50 ohm)	Narda	DC - 5GHz	768-10	4/9/99	4/9/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/11/99	2/11/00
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00

Radiated Emissions

EN	Type	Manufacturer	Frequency Range	Model No.	Cal. Date	Due Date
3116	Pre-Amplifier	Miteq	0.1GHz - 18GHz	AFS42-35	12/3/98	12/3/99
3118	Broadband Pre-Amp.	Electro-Metrics	10kHz - 1GHz	BPA-1000	7/16/99	7/16/00
3258	Double Ridge Guide	EMCO	1GHz - 18GHz	3115	4/7/99	4/7/00
4202	Biconilog	EMCO	26MHz - 2GHz	3142	6/16/99	6/16/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	9/18/98	9/18/99
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00

Frequency Stability

EN	Type	Manufacturer	Frequency Range	Model No.	Cal. Date	Due Date
3130	20dB Attenuator	Narda	DC - 18GHz	768-20	12/18/98	12/18/99
3139	10DB Atten. (50 ohm)	Narda	DC - 5GHz	768-10	4/9/99	4/9/00
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	2/11/99	2/11/00
530A	AM/FM Signal Gen.	Marconi Instru.	10kHz - 1.2GHz	2023	3/8/99	3/8/00