**Retlif Testing Laboratories**

*101 New Boston Road, Goffstown, NH 03045*
*603-497-4600 - Fax: 603-497-5281*

CORPORATE OFFICE
795 Marconi Avenue
Ronkonkoma, NY 11779
631-737-1500 Fax 631-737-1497
(A NY Corporation)

WASHINGTON
REGULATORY OFFICE
703-533-1614 Fax 703-533-1612

# REPORT OF MEASUREMENTS

# FOR

# CELLULAR SPECIALTIES, INC.

# BI-DIRECTIONAL AMPLIFIER

## MODEL: 510smr900

## FCC ID: NVRCSI510-04

# CERTIFICATION APPLICATION

| | | |
|---|---|---|
| *Applicant/Manufacturer:* | **Cellular Specialties<br>670 North Commercial Street<br>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:* | **510smr900** | |
| *FCC ID Number:* | **FCC ID: NVRCSI510-04** | |
| *Applicable Test Standard:* | **FCC Parts 2 & 90 SMR Operations<br>and 90.219 Use of Signal Boosters** | |
| *Device Classification:* | **Mobile** | |
| *EUT Frequency Range:* | **Uplink:<br>Downlink:** | **896 MHz to 901MHz<br>935MHz to 940MHz** |
| *EUT Gain:* | **Uplink:<br>Downlink:** | **58.8dB<br>57dB** |
| *Measured Power Output<br>at maximum input, single channel* | **Uplink:<br>Downlink:** | **+26.8dBm = 479mW<br>+28dBm = 631mW** |
| *Power Output Rating Based<br>on Intermodulation Data<br>(For Certification Grant):* | **Uplink:<br>Downlink:** | **458mW<br>458mW** |
| *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)<br>and the following Test Report Data Attachments:<br><br>-RF Power Output<br>-Intermodulation Characteristics<br>-Occupied Bandwidth<br>-Spurious Emissions at Antenna Terminals<br>-Effective Radiated Power of Spurious Radiation<br>-Frequency Stability** | |

## SECTION 1

ACTUAL POWER RATINGS PER CHANNEL:

| # Channels | Uplink (dBm) | Downlink (dBm) |
|---|---|---|
| 1 | 28.0 | 28.0 |
| 2 | 24.0 | 24.0 |
| 3 | 21.7 | 21.7 |
| 4 | 20.0 | 20.0 |
| 5 | 18.7 | 18.7 |
| 6 | 17.7 | 17.7 |
| 7 | 16.8 | 16.8 |
| 8 | 16.0 | 16.0 |
| 9 | 15.3 | 15.3 |
| 10 | 14.7 | 14.7 |
| 11 | 14.2 | 14.2 |
| 12 | 13.7 | 13.7 |
| 13 | 13.2 | 13.2 |
| 14 | 12.8 | 12.8 |
| 15 | 12.4 | 12.4 |
| 16 | 12.0 | 12.0 |
| 17 | 11.6 | 11.6 |
| 18 | 11.3 | 11.3 |
| 19 | 11.0 | 11.0 |
| 20 | 10.7 | 10.7 |

## 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 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) |
|---|---|---|
| 898.5 | -32 | 26.8 |

DOWNLINK (Power Input @ max input):

| Frequency (MHz) | Input (dBm) | Output (dBm) |
|---|---|---|
| 937.5 | -29 | 28.0 |

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 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 with a power level which was ascertained during the Power Output test. A 16kHz square wave FM 1kHz modulated signal (simulated TDMA) 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.

## 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 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, **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 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 1 frequency within each passband (uplink and downlink). The effective radiated power of each out of band spurious emissions was measured using the substitution method specified in TIA/EIA-603. Field strength measurements of each out of band emission were taken and recorded. 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, **Radiated Emissions Data**.

## FREQUENCY STABILITY MEASUREMENTS

Measurement Procedure (Frequency vs. Voltage):

As the test sample does not have any frequency determining circuits testing was performed 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 3
## EQUIPMENT LISTS

### 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 |
| 4963 | Attenuator | Hewlett Packard | DC - 18 GHz | 8491A | 10/15/01 | 10/15/02 |
| 4995 | Signal Generator | Marconi Instru. | 10 kHz - 1 GHz | 2022 | 10/24/01 | 10/24/02 |
| 5013 | Variac | Powerstat | n/a | 116B | 5/30/02 | 5/30/03 |
| 520N | Digital Multimeter | Wavetek | N/A | 25XT | 2/28/02 | 8/28/03 |

### Intermodulation Characteristics

| EN | Type | Manufacturer | Description | Model No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| 4961 | Attenuator | Narda | DC - 18 GHz | 757C-30dB | 11/7/01 | 11/7/02 |
| 4995 | Signal Generator | Marconi Instru. | 10 kHz - 1 GHz | 2022 | 10/24/01 | 10/24/02 |
| 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 |
| 530A | AM/FM Signal Generator | Marconi Instru. | 10 kHz - 1.2 GHz | 2023 | 7/9/01 | 7/9/02 |
| 713 | EMI Test Receiver | Rohde & Schwarz | 20 Hz - 26.5 GHz | ESI26 | 7/9/01 | 7/9/02 |

### Occupied Bandwidth

| EN | Type | Manufacturer | Description | Model No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| 4961 | Attenuator | Narda | DC - 18 GHz | 757C-30dB | 11/7/01 | 11/7/02 |
| 530A | AM/FM Signal Generator | Marconi Instru. | 10 kHz - 1.2 GHz | 2023 | 7/9/01 | 7/9/02 |
| 713 | EMI Test Receiver | Rohde & Schwarz | 20 Hz - 26.5 GHz | ESI26 | 7/9/01 | 7/9/02 |

### RF Power Output

| EN | Type | Manufacturer | Description | Model No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| 4895 | Spectrum Analyzer | Hewlett Packard | 9kHz - 22GHz | 8593EM | 2/13/02 | 2/13/03 |
| 4963 | Attenuator | Hewlett Packard | DC - 18 GHz | 8491A | 10/15/01 | 10/15/02 |
| 4995 | Signal Generator | Marconi Instru. | 10 kHz - 1 GHz | 2022 | 10/24/01 | 10/24/02 |

### Spurious Emissions at Antenna Terminals

| EN | Type | Manufacturer | Description | Model No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| 4895 | Spectrum Analyzer | Hewlett Packard | 9kHz - 22GHz | 8593EM | 2/13/02 | 2/13/03 |
| 4963 | Attenuator | Hewlett Packard | DC - 18 GHz | 8491A | 10/15/01 | 10/15/02 |
| 4995 | Signal Generator | Marconi Instru. | 10 kHz - 1 GHz | 2022 | 10/24/01 | 10/24/02 |

## Spurious Radiated Emissions

| EN | Type | Manufacturer | Description | Model No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| 3000 | Tuned Dipole Antenna | Empire Devices | 20 MHz - 200 MHz | T1 | 8/8/00 | 8/8/03 |
| 3008 | Signal Generator | Gigatronics | 50 MHz - 18 GHz | 900/0.05-18 | 11/20/01 | 11/20/02 |
| 3116 | Pre-Amplifier | Miteq | 0.1 GHz - 18 GHz | AFS42-35 | 4/22/02 | 4/22/03 |
| 3117 | Power Supply | B&K Precision | 0-30 Vdc, 3.0 A | 1630 | 2/25/02 | 2/25/03 |
| 3119 | Pre-Amplifier | Retlif | 10 kHz - 1 GHz | RET-PA-SW | 7/3/01 | 7/3/02 |
| 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 | Test Site Attenuation | Retlif | 3 / 10 Meters | RNH | 8/3/01 | 8/3/02 |
| 4202 | Biconilog | EMCO | 26 MHz - 2 GHz | 3142 | 7/16/01 | 7/16/02 |
| 4921 | Graphics Plotter | Hewlett Packard | N/A | 7550A | 8/29/01 | 8/29/02 |
| 4985 | Transient Generator | Elgar | 60/400 Hz | TG-704A-1D | 2/28/02 | 2/28/03 |
| 4995 | Signal Generator | Marconi Instru. | 10 kHz - 1 GHz | 2022 | 10/24/01 | 10/24/02 |

# RETLIF TESTING LABORATORIES

## TABULAR DATA SHEET

| | | | |
|---|---|---|---|
| Test Method: | RF Power Output | | |
| Customer: | Cellular Specialties, Inc. | Job No: | R-3974N |
| Test Sample: | Bidirectional Amplifier | | |
| Model No: | 510 SMR900 | Serial No: | n/a |
| Test Specification: | FCC Part 2 Paragraph: 2.1046 | | |
| Operating Mode: | Amplifying input signal | | |
| Technician: | T. Firkowski | Date: | 5/30/02 |
| Notes: | Uplink Frequency: 898.5 MHz<br>Downlink Frequency: 937.5 MHz | | |

| Test Frequency | Power In @ EUT Max input | Power Output | Gain | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | dBm | dBm | dB | | | | | | | |
| (Uplink) | | | | | | | | | | |
| | | | | | | | | | | |
| 898.5000 | -32.00 | 26.80 | 58.80 | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| (Downlink) | | | | | | | | | | |
| | | | | | | | | | | |
| 937.5000 | -29.00 | 28.00 | 57.00 | | | | | | | |

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

| | | | |
|---|---|---|---|
| **Test Method:** | **Spurious Emissions at the Antenna Terminals 30 MHz to 9.5 GHz** | | |
| **Customer:** | Cellular Specialties, Inc. | **Job No:** | R-3974N |
| **Test Sample:** | Bidirectional Amplifier | | |
| **Model No:** | 510 SMR900 | **Serial No:** | n/a |
| **Test Specification:** | FCC Part 2<br>Paragraph: 2.1051 | | |
| **Operating Mode:** | Amplifying input signal | | |
| **Technician:** | T. Firkowski | **Date:** | 5/30/02 |
| **Notes:** | Uplink Frequency 898.5 MHz<br>Downlink Frequency 937.5 MHz | | |

| Uplink Input Signal | Test Frequency | Harmonic Frequencies | Reading | Limit | Downlink Input Signal | Test Frequency | Harmonic Frequencies | Reading | Limit | |
|---|---|---|---|---|---|---|---|---|---|---|
| dBm | MHz | MHz | dBm | dBm | dBm | MHz | MHz | dBm | dBm | |
| -32.00 | 898.50 | 898.50 | 26.00 | | -29.00 | 937.50 | 937.50 | 28.00 | | |
| I | I | 1797.00 | -36.83 | -13.0 | I | I | 1875.00 | -35.78 | -13.0 | |
| I | I | 2695.50 | -19.25 | I | I | I | 2812.50 | -19.94 | I | |
| I | I | 3594.00 | <-55 | I | I | I | 3750.00 | <-55 | I | |
| I | I | 4492.50 | <-55 | I | I | I | 4687.50 | <-55 | I | |
| I | I | 5391.00 | <-55 | I | I | I | 5625.00 | <-55 | I | |
| I | I | 6289.50 | <-49 | I | I | I | 6562.50 | <-49 | I | |
| I | I | 7188.00 | <-49 | I | I | I | 7500.00 | <-49 | I | |
| I | I | 8086.50 | <-48 | I | I | I | 8437.50 | <-48 | I | |
| -32.00 | 898.50 | 8985.00 | <-48 | -13.0 | -29.00 | 937.50 | 9375.00 | <-48 | -13.0 | |

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

| | | | |
|---|---|---|---|
| **Test Method:** | Spurious Radiated Emissions (ERP) 30 MHz to 9.5 GHz | | |
| **Customer:** | Cellular Specialties, Inc. | **Job No:** | R-3974N |
| **Test Sample:** | Bidirectional Amplifier | | |
| **Model No:** | 510 SMR900 | **Serial No:** | n/a |
| **Test Specification:** | FCC Part 2.1053/90.209 Paragraph: n/a | | |
| **Operating Mode:** | Amplifying input signal | | |
| **Technician:** | T. Firkowski | **Date:** | 5/29/02 |
| **Notes:** | Uplink Frequency Range: 896 - 901 MHz Tested at 898.5 MHz<br>Peak Detector | | |

| Test Frequency | Antenna Position | Turntable Position | Reference Reading | Signal Gen Level | Reference Ant Gain | | | | Corrected Reading | Spurious Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | (H/V) - Height | Degrees | dBuV | dBm | dBI | | | | dBm | dBm |
| 30.00 | - | - | - | - | - | | | | - | -13.00 |
| I | - | - | - | - | - | | | | - | I |
| 48.66 | V-1m | 180.0 | 56.79 | -48.95 | 1.64 | | | | -47.31 | I |
| 75.76 | V-1m | 180.0 | 56.36 | -51.27 | 1.64 | | | | -49.63 | I |
| 1797.00 | V-1m | 180.0 | 51.34 | -59.04 | 7.98 | | | | -51.06 | I |
| 2695.50 | V-1m | 180.0 | 57.87 | -50.73 | 8.74 | | | | -41.99 | I |
| 3594.00 | H-1m | 180.0 | 52.93 | -49.27 | 8.82 | | | | -40.44 | I |
| 4492.50 | H-1m | 180.0 | 57.74 | -48.82 | 10.17 | | | | -38.65 | I |
| 5391.00 | V-1m | 180.0 | 52.13 | -47.89 | 9.58 | | | | -38.31 | I |
| 6289.50 | V-1m | 180.0 | 44.71 | -59.55 | 10.63 | | | | -48.92 | I |
| I | - | - | - | - | - | | | | - | I |
| 9500.00 | - | - | - | - | - | | | | - | -13.00 |

EUT emissions observed throughout the given frequency spectrum were recorded & evaluated, Emission levels closest to the limit are listed on this data sheet.

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

| | | | |
|---|---|---|---|
| **Test Method:** | Spurious Radiated Emissions (ERP) 30 MHz to 9.5 GHz | | |
| **Customer:** | Cellular Specialties, Inc. | **Job No:** | R-3974N |
| **Test Sample:** | Bidirectional Amplifier | | |
| **Model No:** | 510 SMR900 | **Serial No:** | n/a |
| **Test Specification:** | FCC Part 2.1053/90.209 Paragraph: n/a | | |
| **Operating Mode:** | Amplifying input signal | | |
| **Technician:** | T. Firkowski | **Date:** | 5/29/02 |
| **Notes:** | Downlink Frequency Range: 935 - 940 MHz Tested at 937.5 MHz Peak Detector | | |

| Test Frequency | Antenna Position | Turntable Position | Reference Reading | Signal Gen Level | Reference Ant Gain | | | | Corrected Reading | Spurious Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | (H/V) - Height | Degrees | dBuV | dBm | dBI | | | | dBm | dBm |
| 30.00 | - | - | - | - | - | | | | - | -13.00 |
| I | - | - | - | - | - | | | | - | I |
| 48.66 | V-1m | 180.0 | 56.77 | -48.94 | 1.64 | | | | -47.30 | I |
| 75.76 | V-1m | 180.0 | 56.35 | -51.26 | 1.64 | | | | -49.62 | I |
| 1875.00 | V-1m | 180.0 | 53.45 | -55.89 | 7.95 | | | | -47.94 | I |
| 2812.50 | V-1m | 180.0 | 63.49 | -45.12 | 8.76 | | | | -36.36 | I |
| 3750.00 | H-1m | 180.0 | 53.05 | -49.37 | 8.70 | | | | -40.67 | I |
| 4687.50 | V-1m | 180.0 | 57.68 | -48.94 | 9.94 | | | | -39.01 | I |
| 5625.00 | V-1m | 180.0 | 49.64 | -51.91 | 9.80 | | | | -42.11 | I |
| I | - | - | - | - | - | | | | - | I |
| 9500.00 | - | - | - | - | - | | | | - | -13.00 |

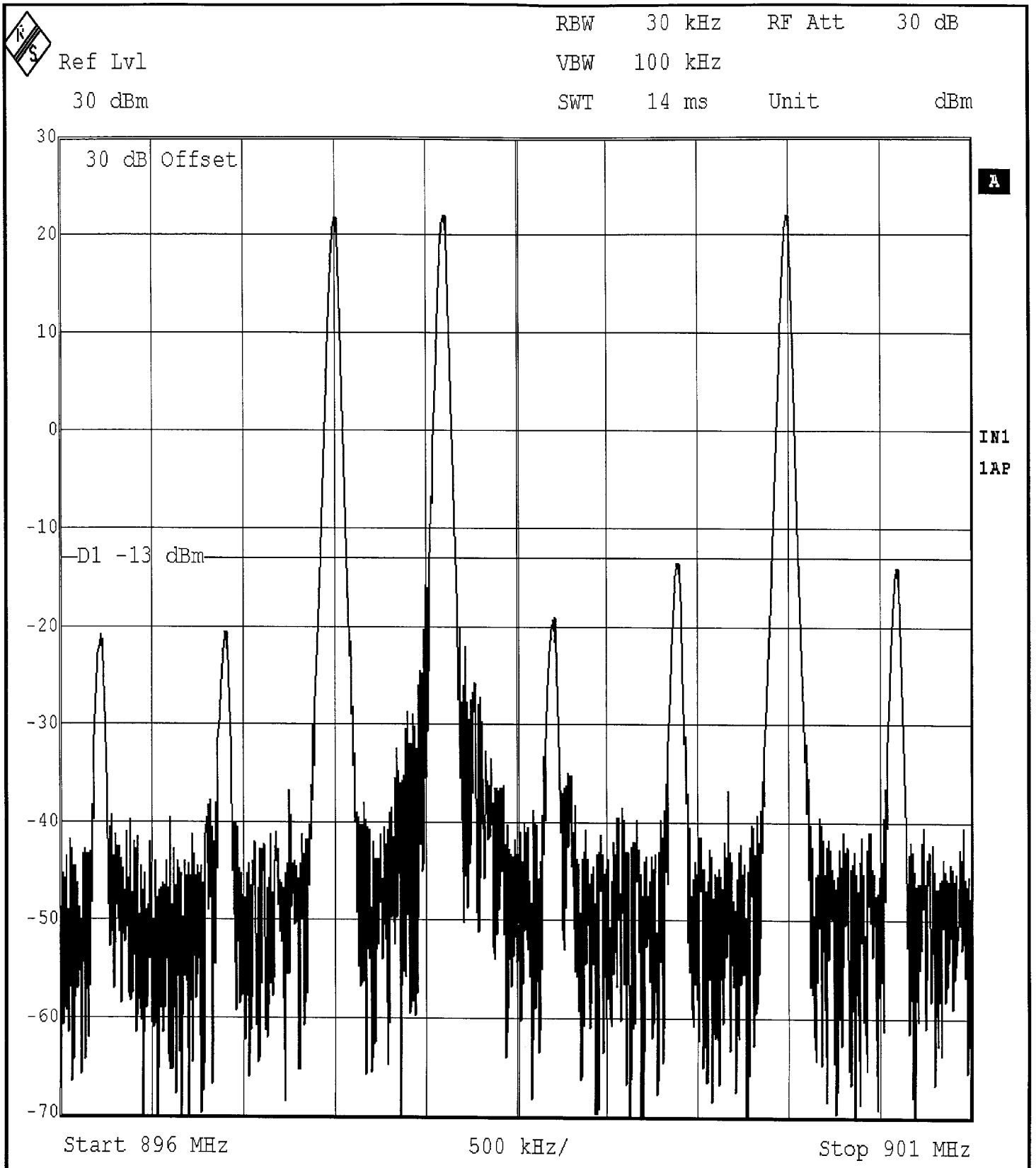
EUT emissions observed throughout the given frequency spectrum were recorded & evaluated, Emission levels closest to the limit are listed on this data sheet.

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

| | | | |
|---|---|---|---|
| **Test Method:** | **Frequency Stability** | | |
| **Customer:** | Cellular Specialties, Inc. | **Job No:** | R-3974N |
| **Test Sample:** | Bidirectional Amplifier | | |
| **Model No:** | 510 SMR900 | **Serial No:** | n/a |
| **Test Specification:** | FCC Part 2<br>Paragraph: 2.1055 | | |
| **Operating Mode:** | Amplifying input signal | | |
| **Technician:** | T. Firkowski | **Date:** | 5/30/02 |
| **Notes:** | Uplink Frequency 898.5 MHz Nominal Voltage = 115 VAC<br>Downlink Frequency 937.5 MHz | | |

| Test Frequency | Input Power | Output Power | | Frequency @ 97.75 VAC | Frequency @ 103.50 VAC | Frequency @ 109.25 VAC | Frequency @ 115 VAC | Frequency @ 120.75 VAC | Frequency @ 126.50 VAC | Frequency @ 132.25 VAC |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | dBm | dBm | | MHz | MHz | MHz | MHz | MHz | MHz | MHz |
| (Uplink) | | | | | | | | | | |
| | | | | | | | | | | |
| 898.50 | -32.00 | 26.00 | | 898.50 | 898.50 | 898.50 | 898.50 | 898.50 | 898.50 | 898.50 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| (Downlink) | | | | | | | | | | |
| | | | | | | | | | | |
| 937.50 | -29.00 | 28.00 | | 937.50 | 937.50 | 937.50 | 937.50 | 937.50 | 937.50 | 937.50 |

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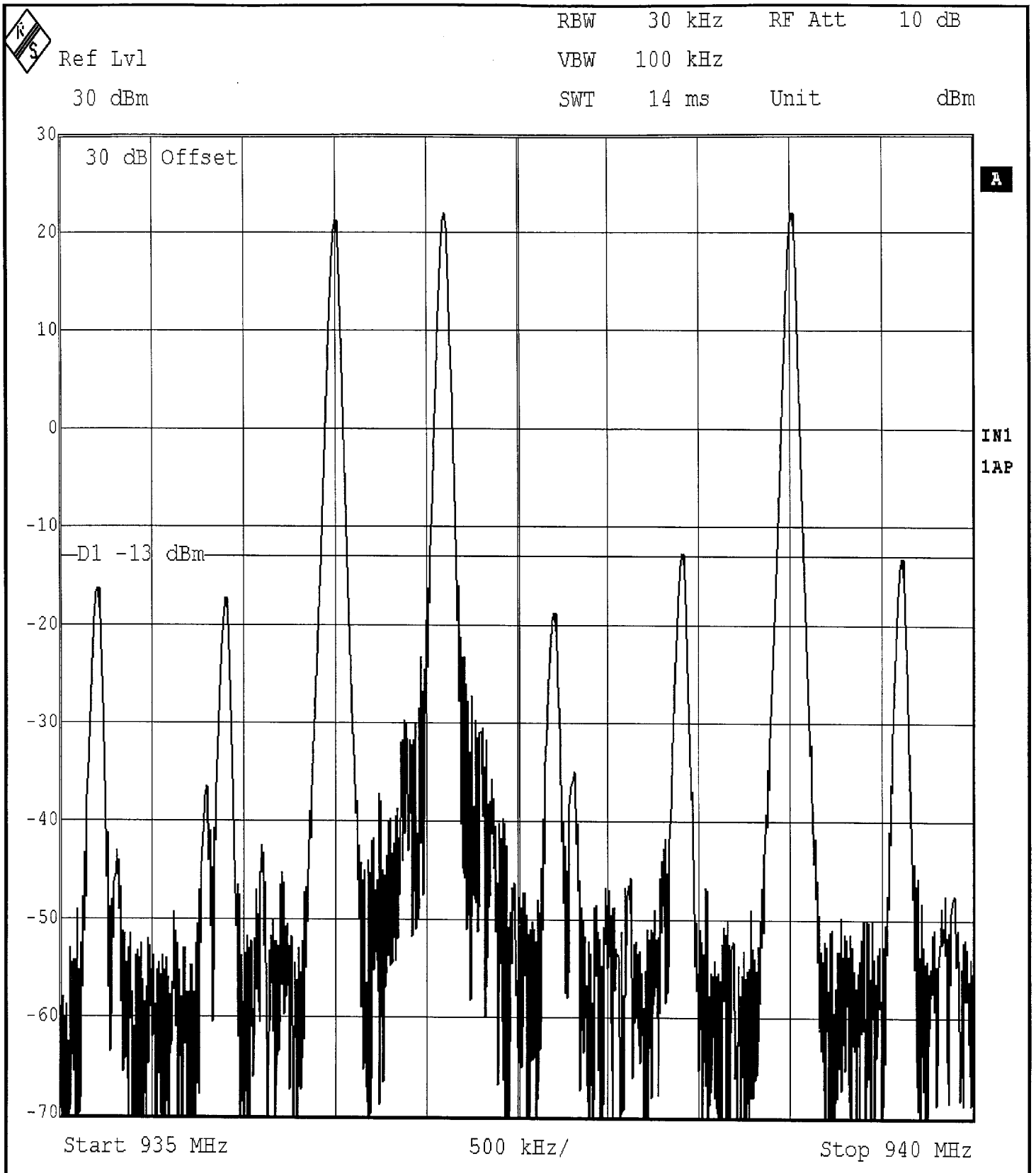
| | |
|---|---|
| Customer: | Cellular Specialties, Inc. |
| Test Sample: | Bidirectional Amplifier |
| Model No: | 510 SMR900 |
| Test Method: | Intermodulation Characteristics, FCC Part 2, para 2.1047 |
| Notes: | Uplink Frequency Band: 896 - 901 MHz |

Date: 6/20/02 Tech: T. Firkowski Sheet 1 of 2

**Retlif Testing Laboratories**

Report No R-3974N

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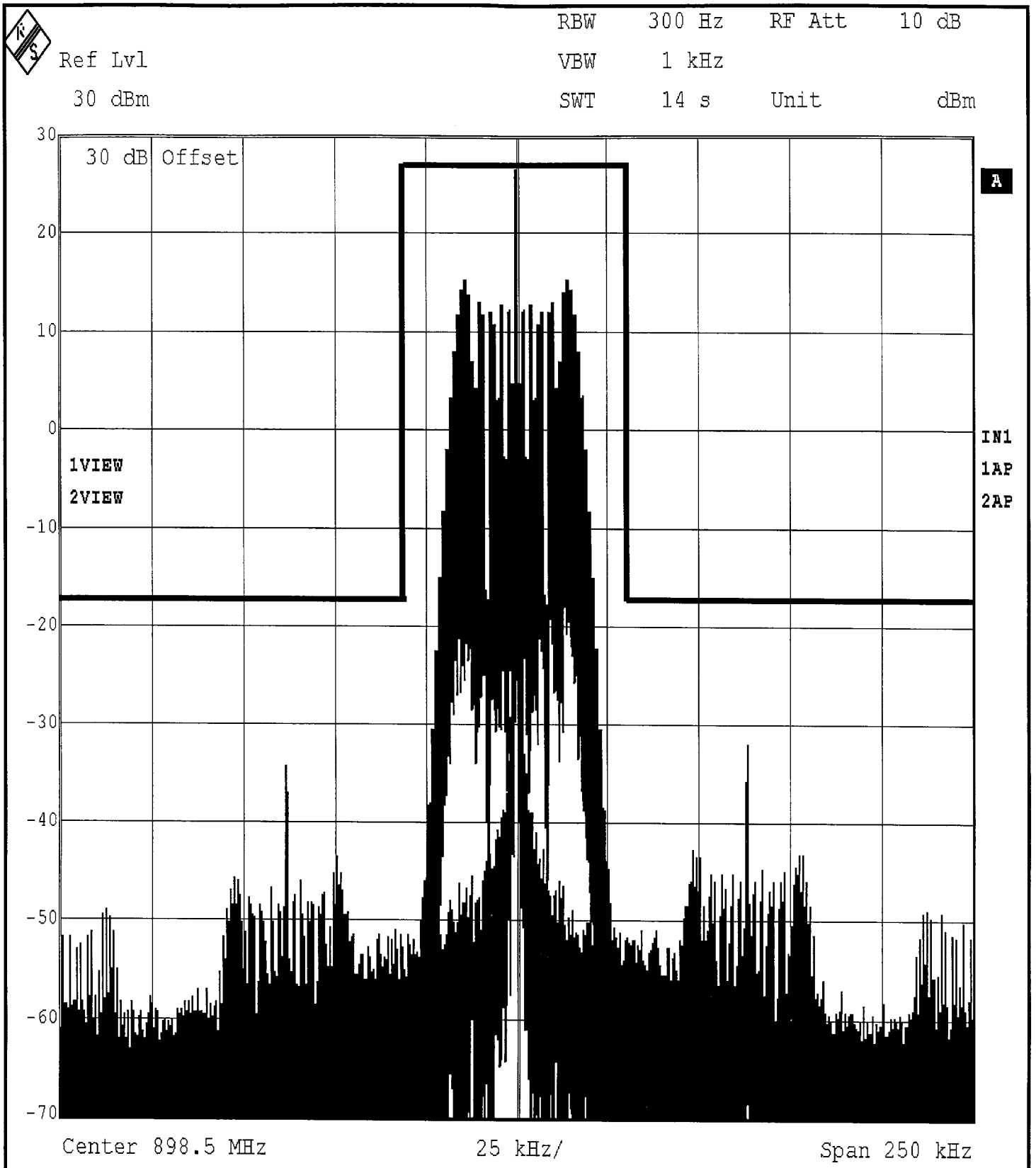
| | |
|---|---|
| Customer: | Cellular Specialties, Inc. |
| Test Sample: | Bidirectional Amplifier |
| Model No: | 510 SMR900 |
| Test Method: | Intermodulation Characteristics, FCC Part 2, para 2.1047 |
| Notes: | Downlink Frequency Band: 935 - 940 MHz |

Date: 6/20/02 Tech: T. Firkowski Sheet 2 of 2

**Retlif Testing Laboratories**

Report No R-3974N

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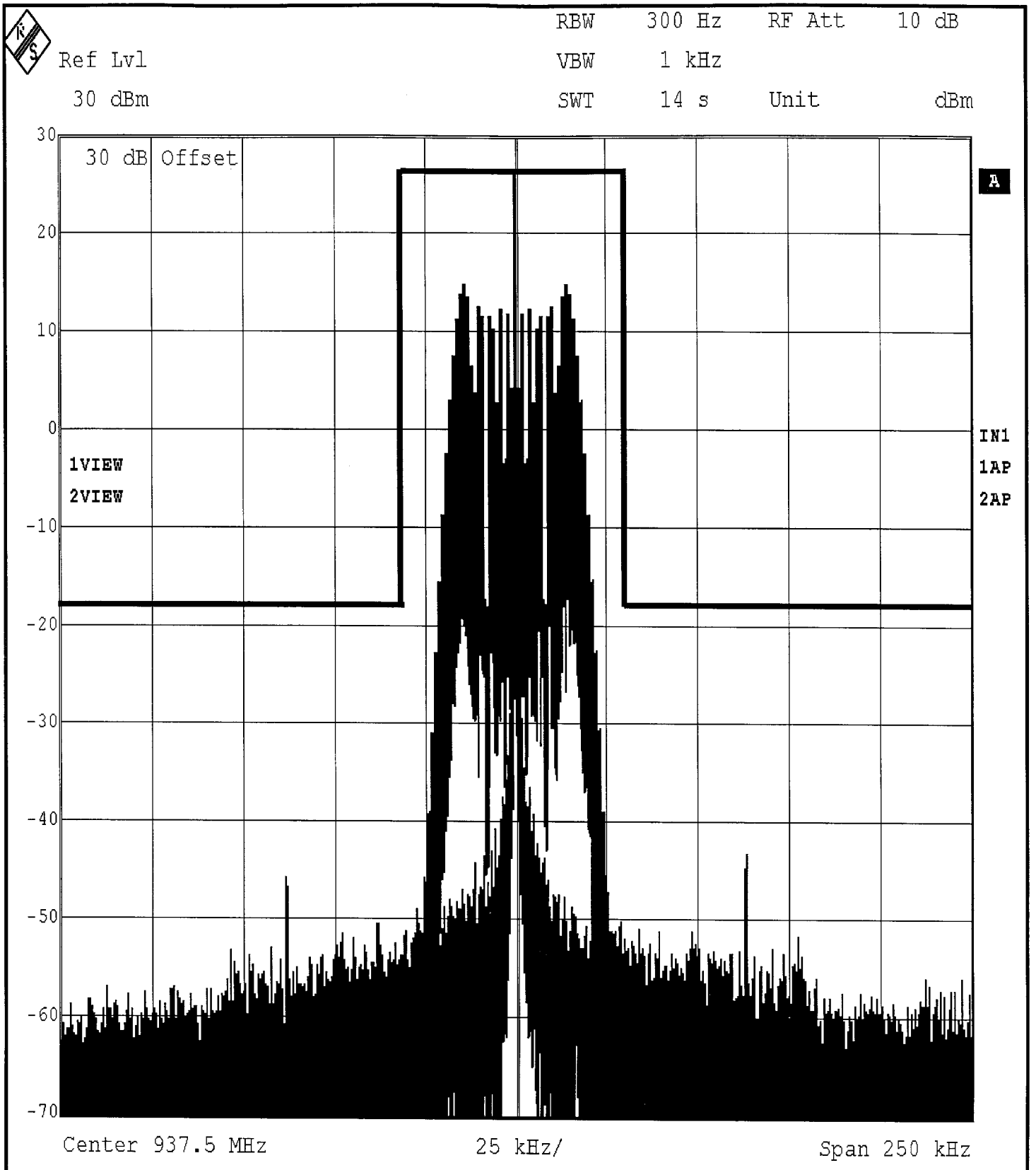
| | |
|---|---|
| Customer: | Cellular Specialties, Inc. |
| Test Sample: | Bidirectional Amplifier |
| Model No: | 510 SMR900 |
| Test Method: | Occupied Bandwidth, FCC Part 2, para 2.1049 |
| Notes: | Uplink Frequency 898.5 MHz |
| | Modulation: TDMA |

Date: 6/20/02 Tech: T. Firkowski Sheet 1 of 2

**Retlif Testing Laboratories**

Report No R-3974N

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| | |
|---|---|
| Customer: | Cellular Specialties, Inc. |
| Test Sample: | Bidirectional Amplifier |
| Model No: | 510 SMR900 |
| Test Method: | Occupied Bandwidth, FCC Part 2, para 2.1049 |
| Notes: | Downlink Frequency 937.5 MHz<br>Modulation: TDMA |

Date: 6/20/02 Tech: T. Firkowski Sheet 2 of 2

**Retlif Testing Laboratories**

Report No R-3974N