



**Nemko Test Report:** 6L0013RUS1

**Applicant:** Andrew Corporation

**Equipment Under Test:** MR903D  
(E.U.T.)

**In Accordance With:** **FCC Part 24, Subpart D**  
Narrowband PCS Repeater

**Tested By:** Nemko USA Inc.  
802 N. Kealy  
Lewisville, TX  
75057-3136

**Authorized By:**

A handwritten signature in black ink, appearing to read 'David Light', is positioned above the printed name.

David Light, Senior Wireless Engineer

**Date:** 09 February 2006

*EQUIPMENT:* MR903D

**Table of Contents**

|                                   |                                               |    |
|-----------------------------------|-----------------------------------------------|----|
| Section 1.                        | Summary of Test Results .....                 | 3  |
| Section 2.                        | General Equipment Specification .....         | 5  |
| Section 3.                        | RF Power Output .....                         | 7  |
| Section 4.                        | Occupied Bandwidth.....                       | 8  |
| Section 5.                        | Spurious Emissions at Antenna Terminals ..... | 15 |
| Section 6.                        | Field Strength of Spurious .....              | 22 |
| Section 7.                        | Test Equipment List.....                      | 24 |
| ANNEX A - TEST METHODOLOGIES..... |                                               | 25 |
| ANNEX B - TEST DIAGRAMS.....      |                                               | 31 |

*EQUIPMENT:* MR903D**Section 1. Summary of Test Results**

Manufacturer: Andrew Corporation

Model No.: MR903D

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 24, Subpart D.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".

**NVLAP LAB CODE: 100426-0**

Nemko USA Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report applies only to the items tested.

*EQUIPMENT:* MR903D**Summary Of Test Data**

| NAME OF TEST                               | PARA.<br>NO. | SPEC.               | RESULT   |
|--------------------------------------------|--------------|---------------------|----------|
| RF Power Output                            | 24.132(a)    | $\leq$ Rated        | Complies |
| Occupied Bandwidth                         | 24.133       | $\leq$ Rated        | Complies |
| Spurious Emissions at Antenna<br>Terminals | 24.133       | -13 dBm             | Complies |
| Field Strength of Spurious<br>Emissions    | 24.133       | -13 dBm<br>E.I.R.P. | Complies |
| Frequency Stability                        | 24.135       | $\pm 1$ ppm         | N/A      |

**Footnotes:**

The device has no modulation circuitry; therefore this test was not performed.

The device was tested at the maximum input level for all tests

*EQUIPMENT:* MR903D**Section 2. General Equipment Specification****Supply Voltage Input:** 120 Vac**Frequency Range:** **Uplink:** 901-902 MHz**Frequency Range:** **Downlink:** 940-941 MHz**Type of Modulation:** **Analog**  
**Designator:** **(F8W/F1D)**  
☒**Output Impedance:** 50 ohms**Gain:** 60 dB**RF Output (Rated):**

| Output Power per Carrier, dBm |    |    |    |   |
|-------------------------------|----|----|----|---|
| Technology                    | 1  | 2  | 4  | 8 |
| Analog                        | 18 | 15 | 12 | 9 |

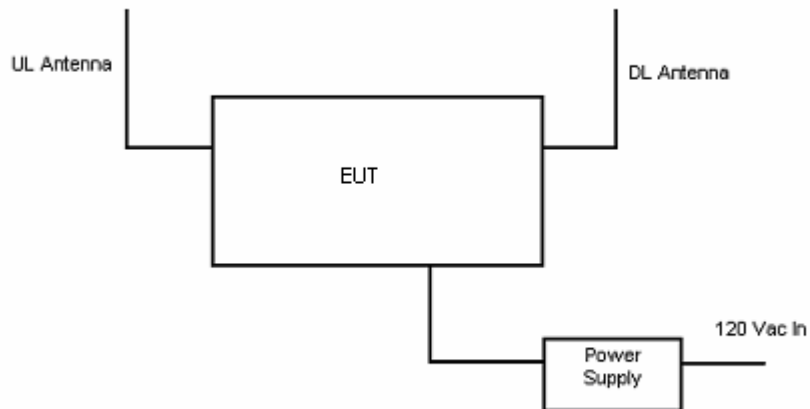
**Frequency Translation:** **F1-F1** **F1-F2** **N/A**  
☒ ☐ ☐**Band Selection:** **Software** **Selector Switch** **Fullband Coverage**  
☐ ☐ ☒

*EQUIPMENT:* MR903D

### Description of EUT

The MR903D band selective mini repeater is a bi-directional amplifier used to enhance signals between a mobile and base station in a wireless network.

### System Diagram



*EQUIPMENT:* MR903D**Section 3. RF Power Output**

|                               |                           |
|-------------------------------|---------------------------|
| NAME OF TEST: RF Power Output | PARA. NO.: 24.132         |
| TESTED BY: Kevin Rose         | DATE: 17-31 JANUARY 2006: |

**Test Results:** Complies.**Measurement Data:**

Test Equipment used: 1036-1470-1478-1629-1659

| Modulation           | Frequency (MHz) | Measured Power (dBm) | Rated Power (dBm) | Measured/Rated (dB) |
|----------------------|-----------------|----------------------|-------------------|---------------------|
| Analog uplink low    | 901.05          | 18.08                | 18                | .08                 |
| Analog uplink mid    | 901.5           | 18.05                | 18                | .05                 |
| Analog uplink high   | 902.95          | 18.17                | 18                | .17                 |
| Analog downlink low  | 940.05          | 18.11                | 18                | .11                 |
| Analog downlink mid  | 940.5           | 18.09                | 18                | .09                 |
| Analog downlink high | 942.95          | 18.13                | 18                | .13                 |

Measurement uncertainty: +/- 0.7 dB

**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

*EQUIPMENT:* MR903D

## **Section 4. Occupied Bandwidth**

|                                  |                           |
|----------------------------------|---------------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 24.131         |
| TESTED BY: Kevin Rose            | DATE: 17-31 JANUARY 2006: |

**Test Results:** Complies.

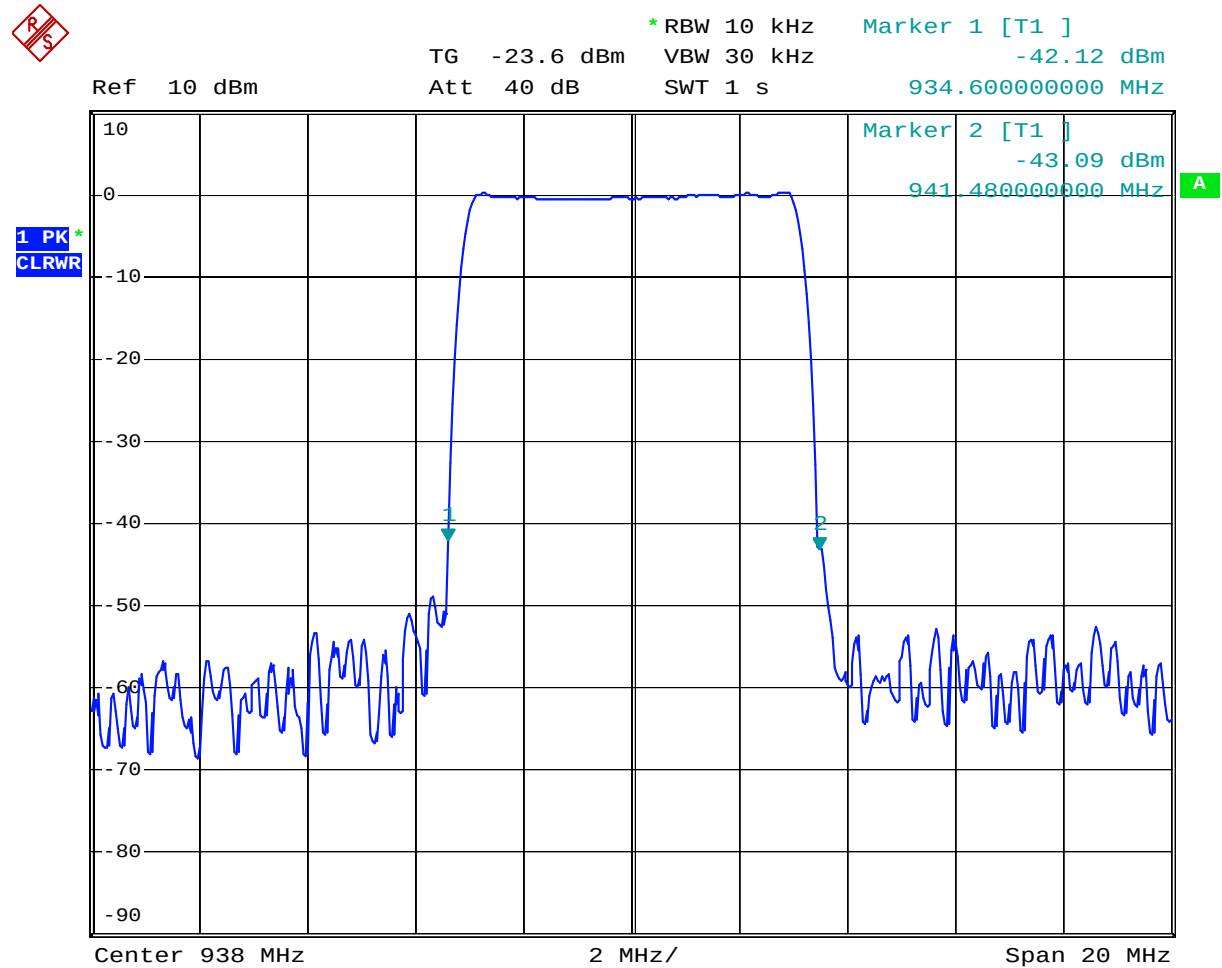
**Test Data:** See attached plots.

Measurement Uncertainty: +/- 1.7 dB

Test Equipment used: 1036-1470-1478-1629-1659



# Filter Response Downlink

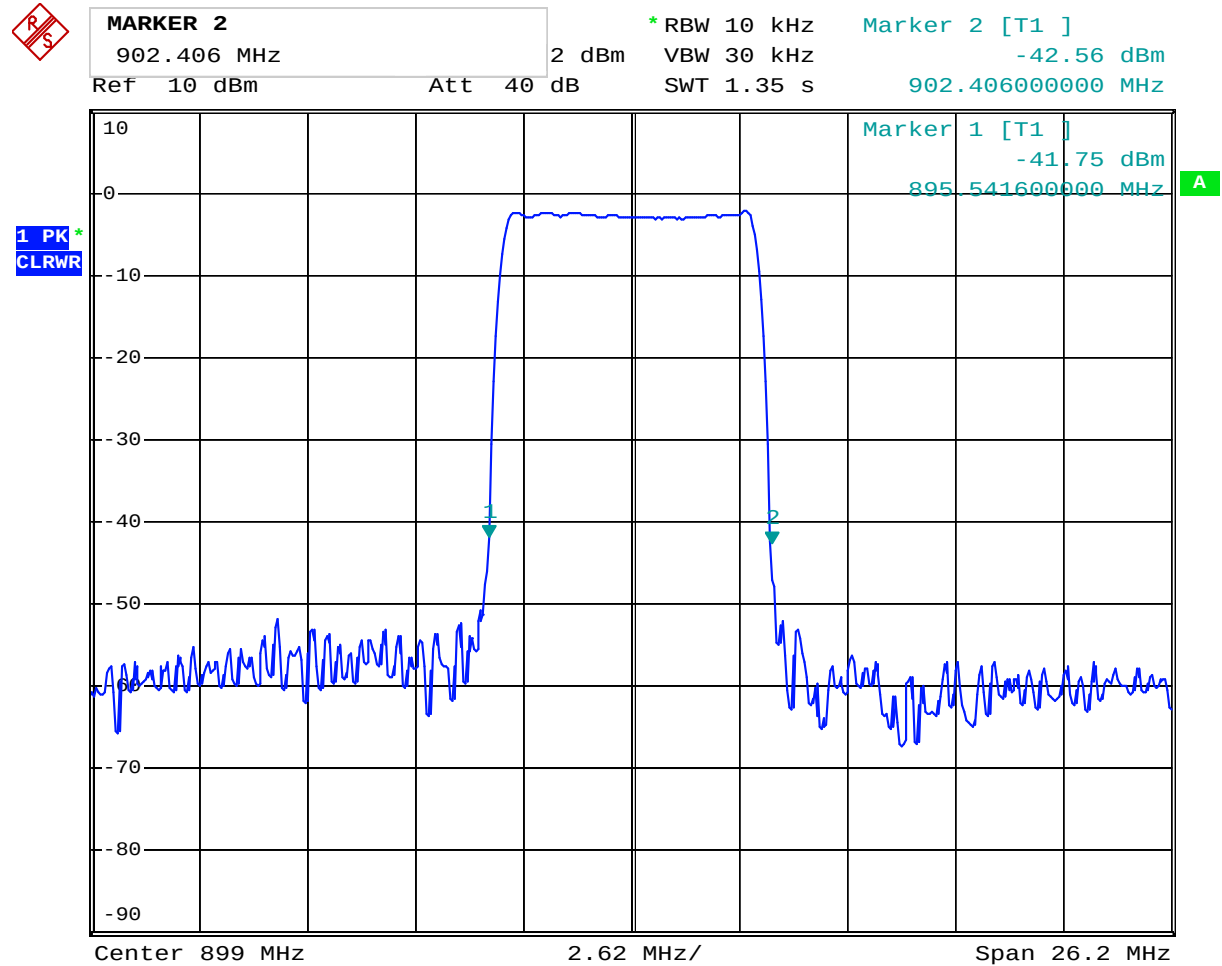


Date: 3.APR.2006 05:11:46

EQUIPMENT: MR903D

PROJECT NO.: **6L0013RUS1**

# Filter Response Uplink



Date: 3.APR.2006 05:05:28

EQUIPMENT: MR903D

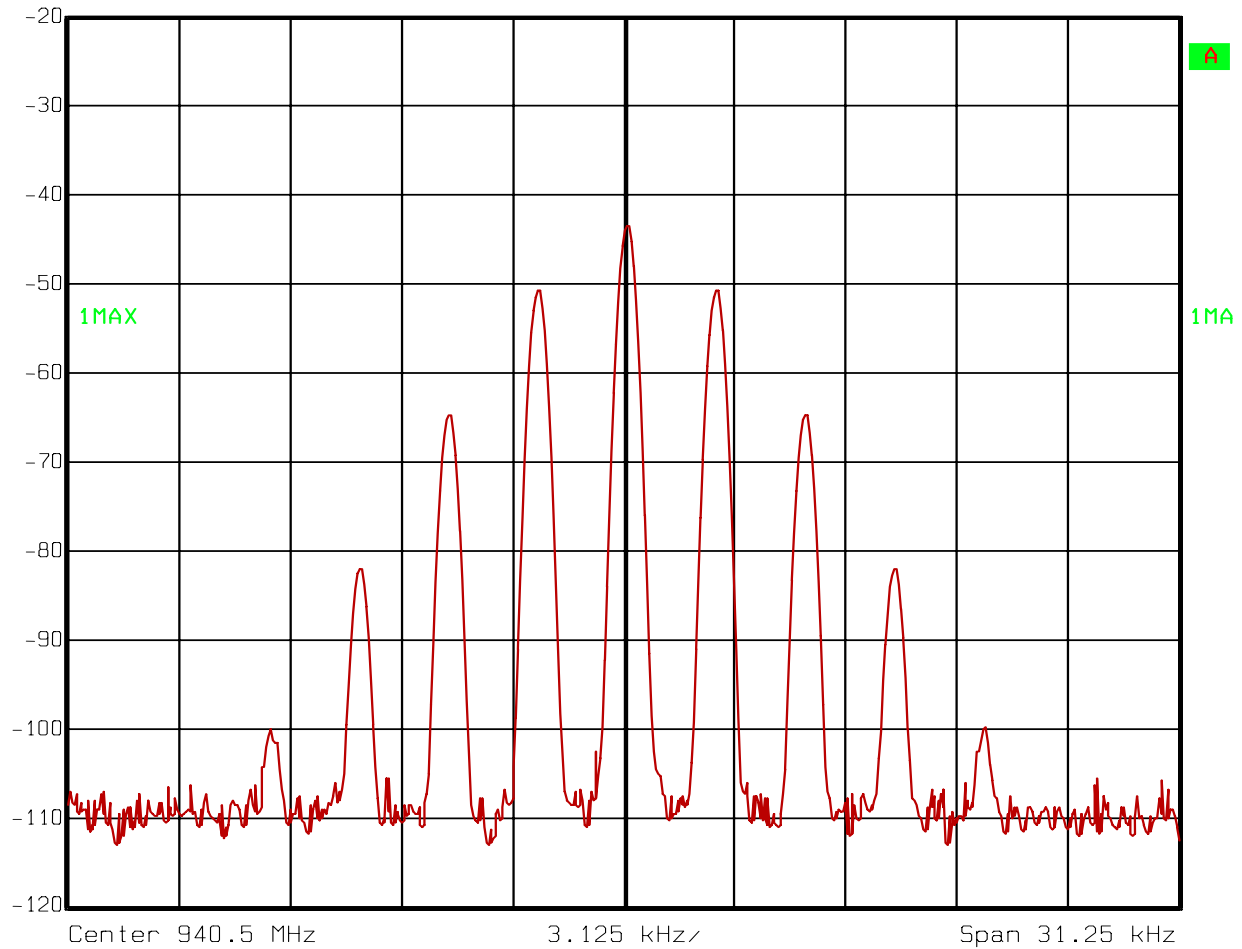
PROJECT NO.: 6L0013RUS1

DOWNLINK MID CHANNEL OBW INPUT



Ref Lvl  
-20 dBm

RBW 300 Hz RF Att 10 dB  
VBW 300 Hz  
SWT 1.75 s Unit dBm

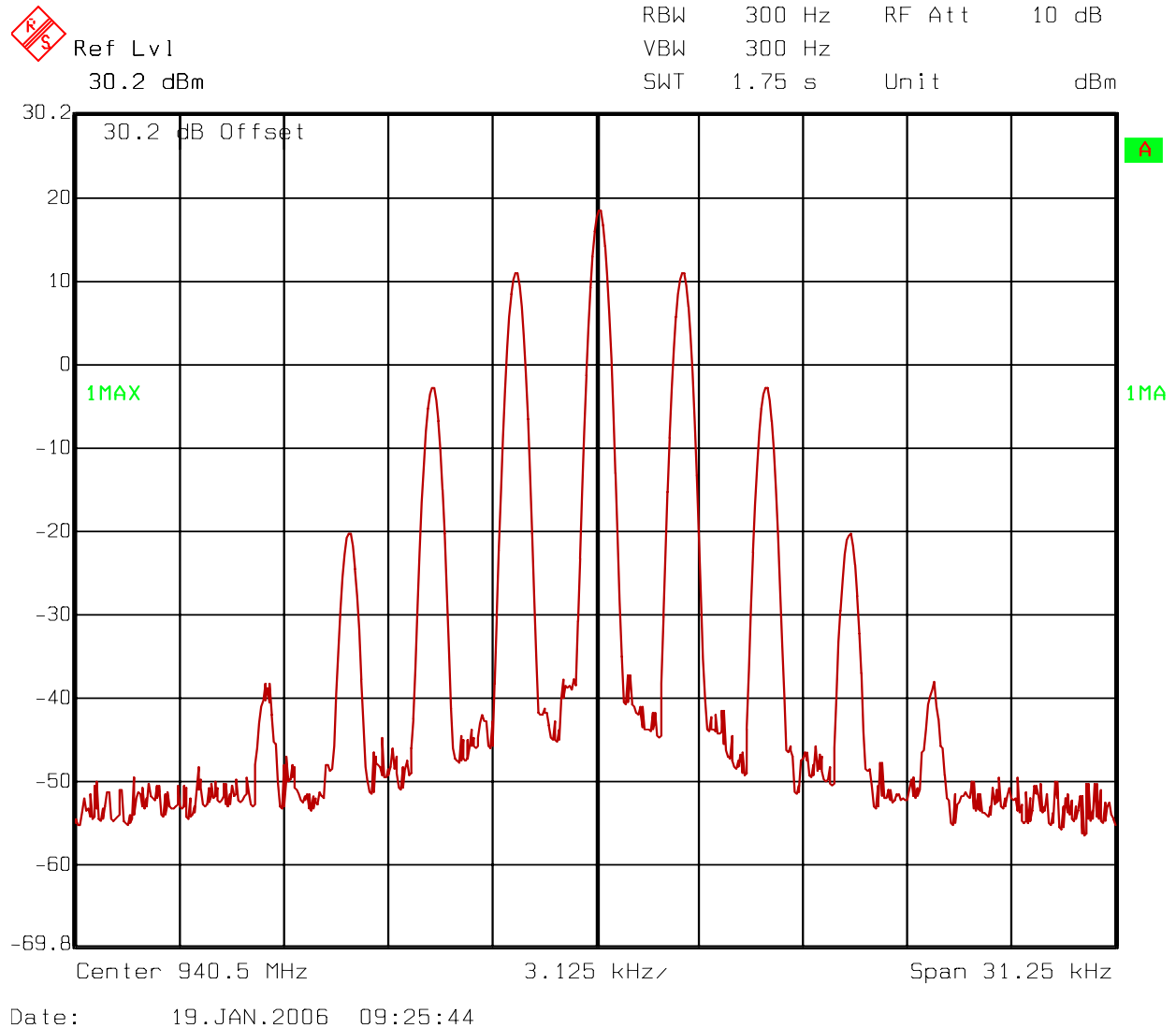


Date: 19.JAN.2006 09:30:26

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

DOWNLINK MID CHANNEL OBW OUTPUT



EQUIPMENT: MR903D

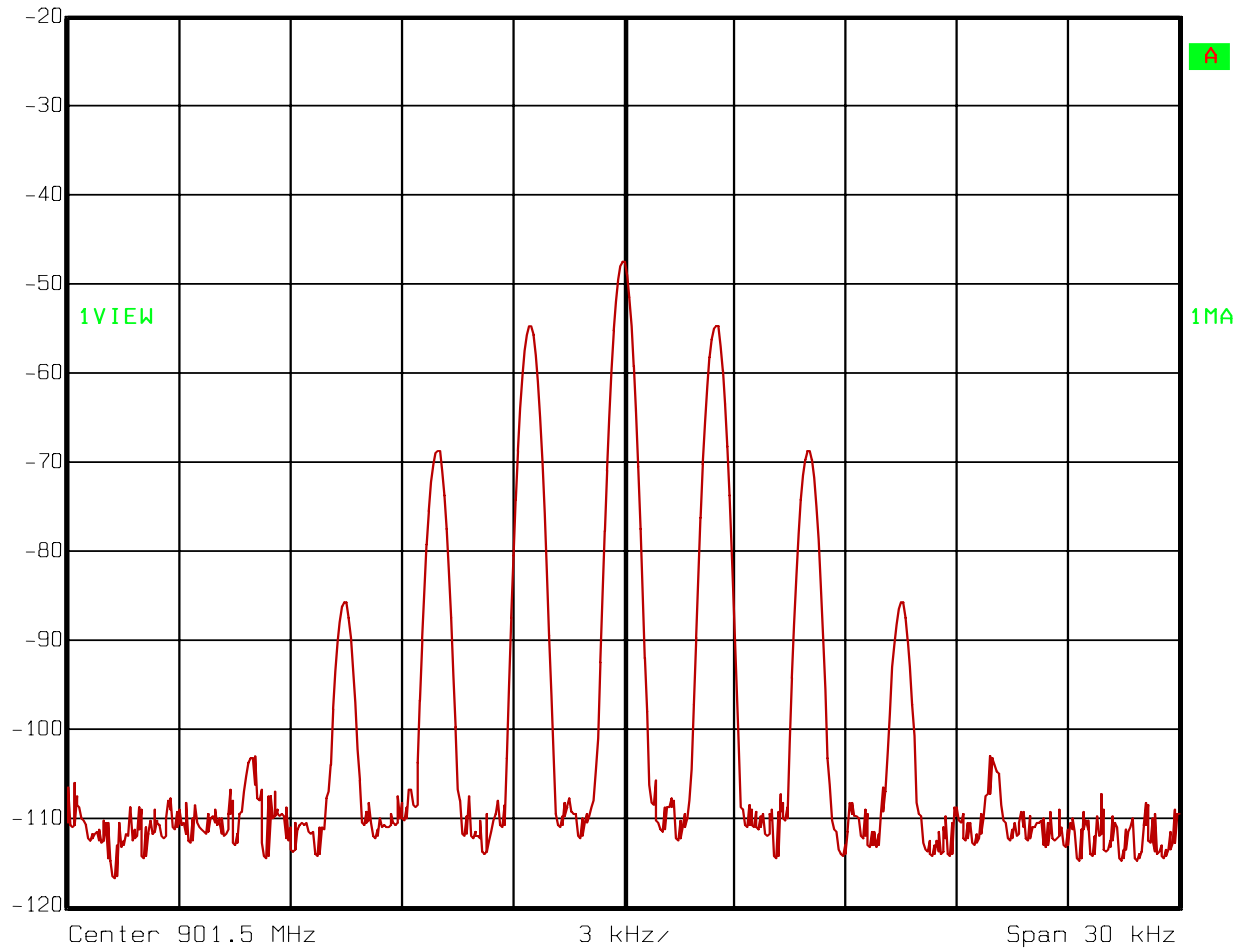
PROJECT NO.: 6L0013RUS1

UPLINK MID CHANNEL OBW INPUT



Ref Lvl  
-20 dBm

|     |        |        |       |
|-----|--------|--------|-------|
| RBW | 300 Hz | RF Att | 10 dB |
| VBW | 300 Hz |        |       |
| SWT | 1.7 s  | Unit   | dBm   |

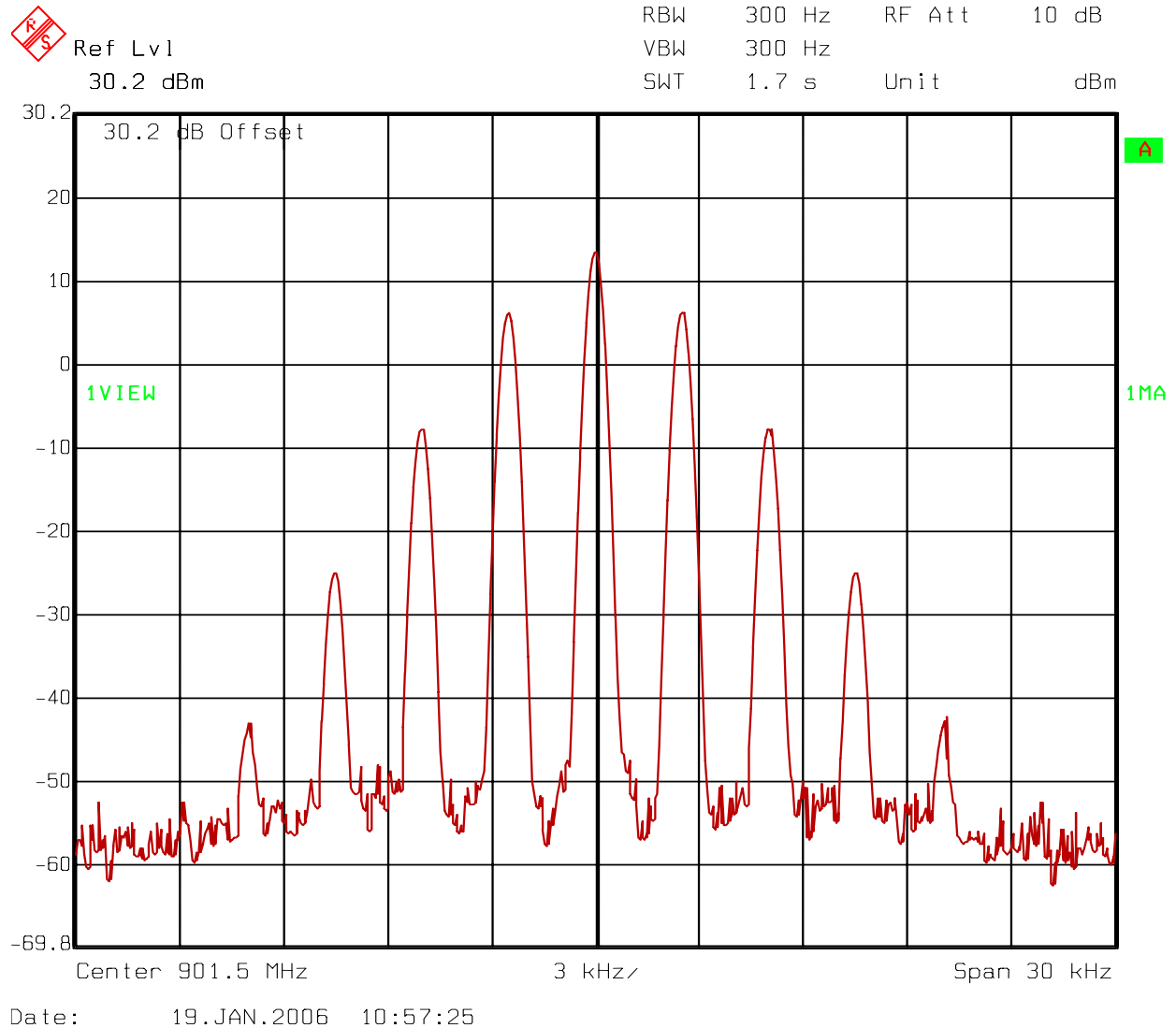


Date: 19.JAN.2006 11:00:37

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

UPLINK MID CHANNEL OBW OUTPUT



**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

*EQUIPMENT:* MR903D

## **Section 5. Spurious Emissions at Antenna Terminals**

|                                                      |                           |
|------------------------------------------------------|---------------------------|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 24.133         |
| TESTED BY: Kevin Rose                                | DATE: 17-31 JANUARY 2006: |

**Test Results:** Complies.

**Test Data:** See attached plots

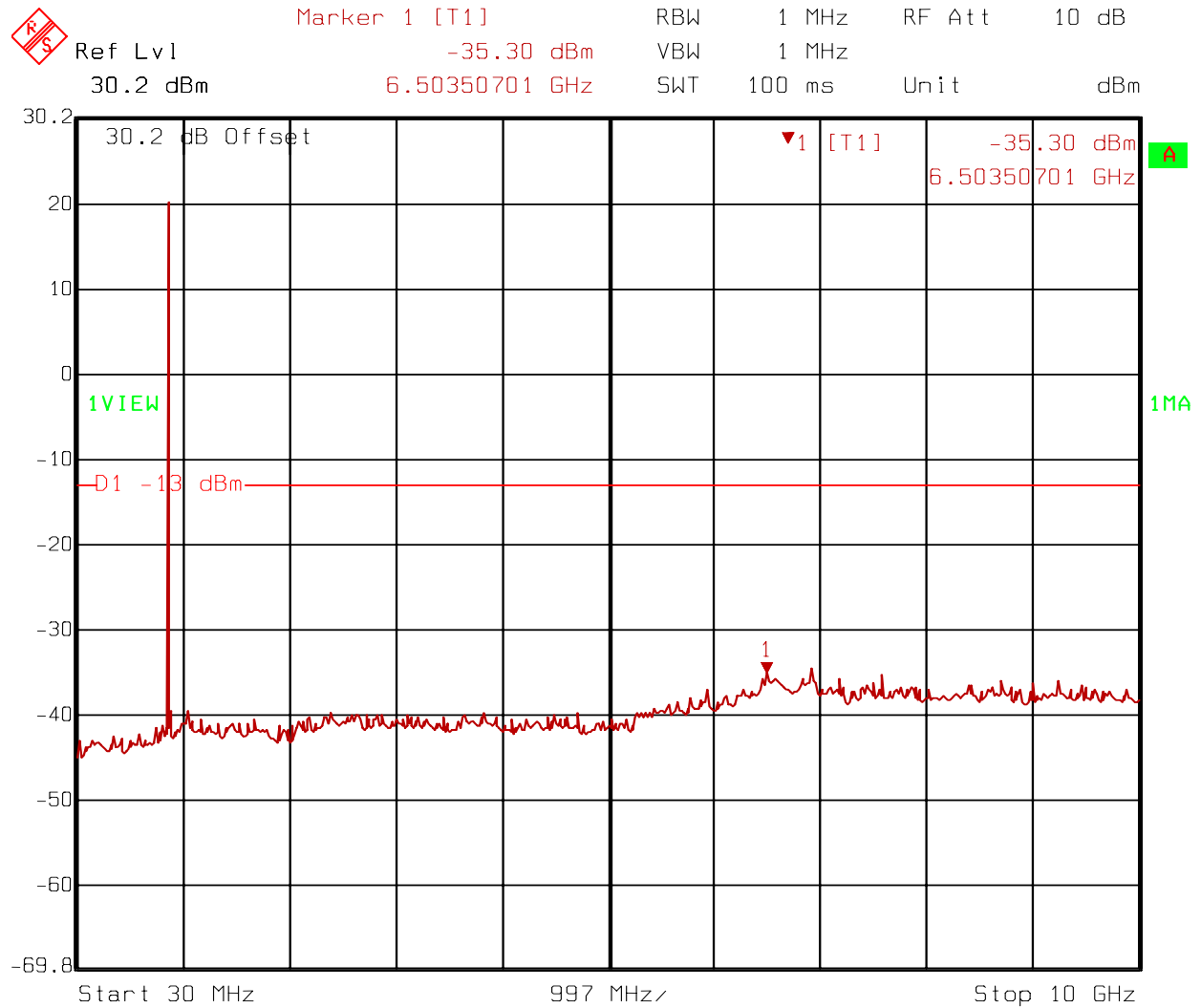
**Measurement Uncertainty:** +/- 1.7 dB

Test Equipment used: 1036-1470-1478-1629-1659

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

UPLINK MID CHANNEL SPUR



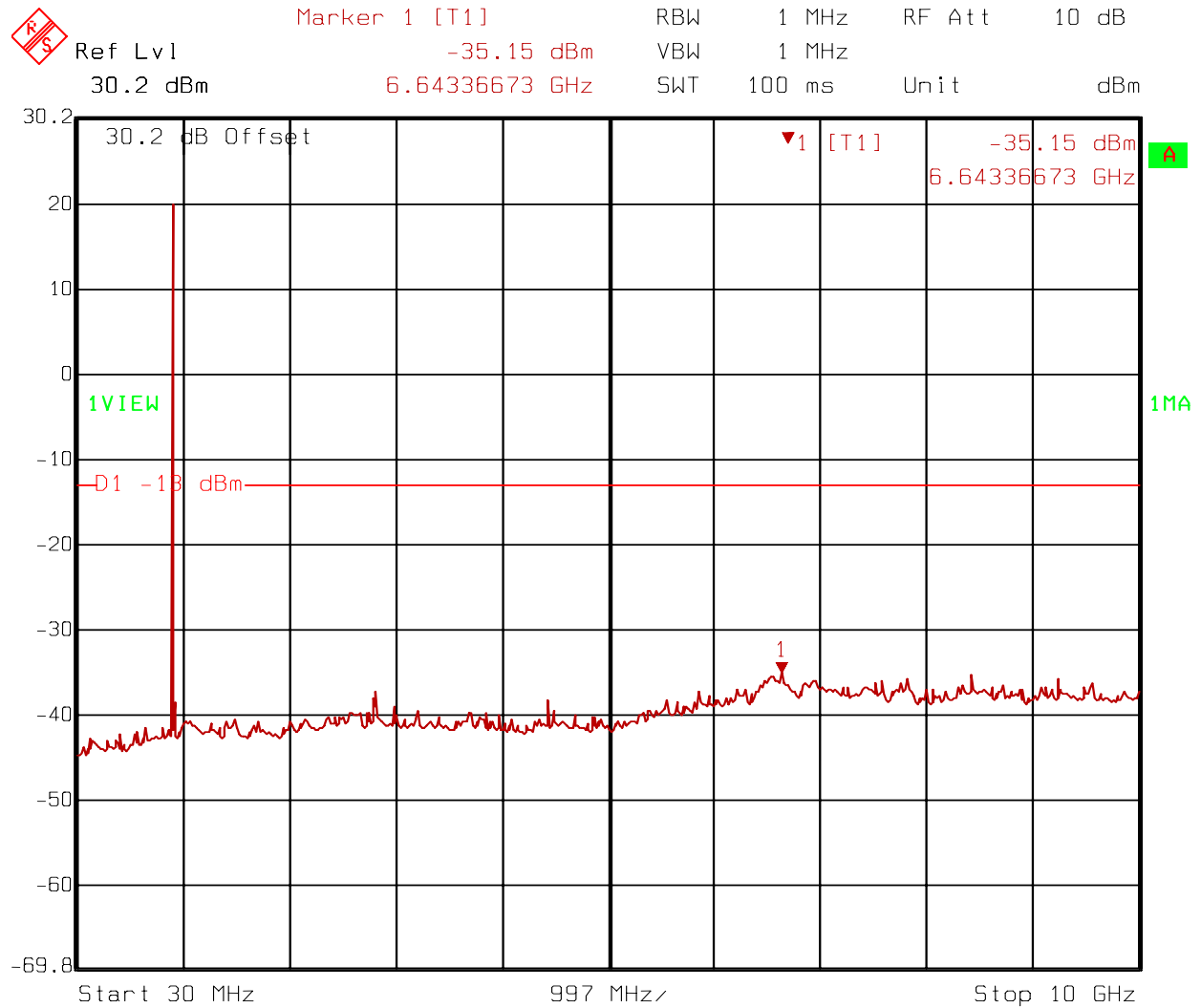
Date: 19.JAN.2006 11:06:55



EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

DOWNLINK MID CHANNEL SPUR

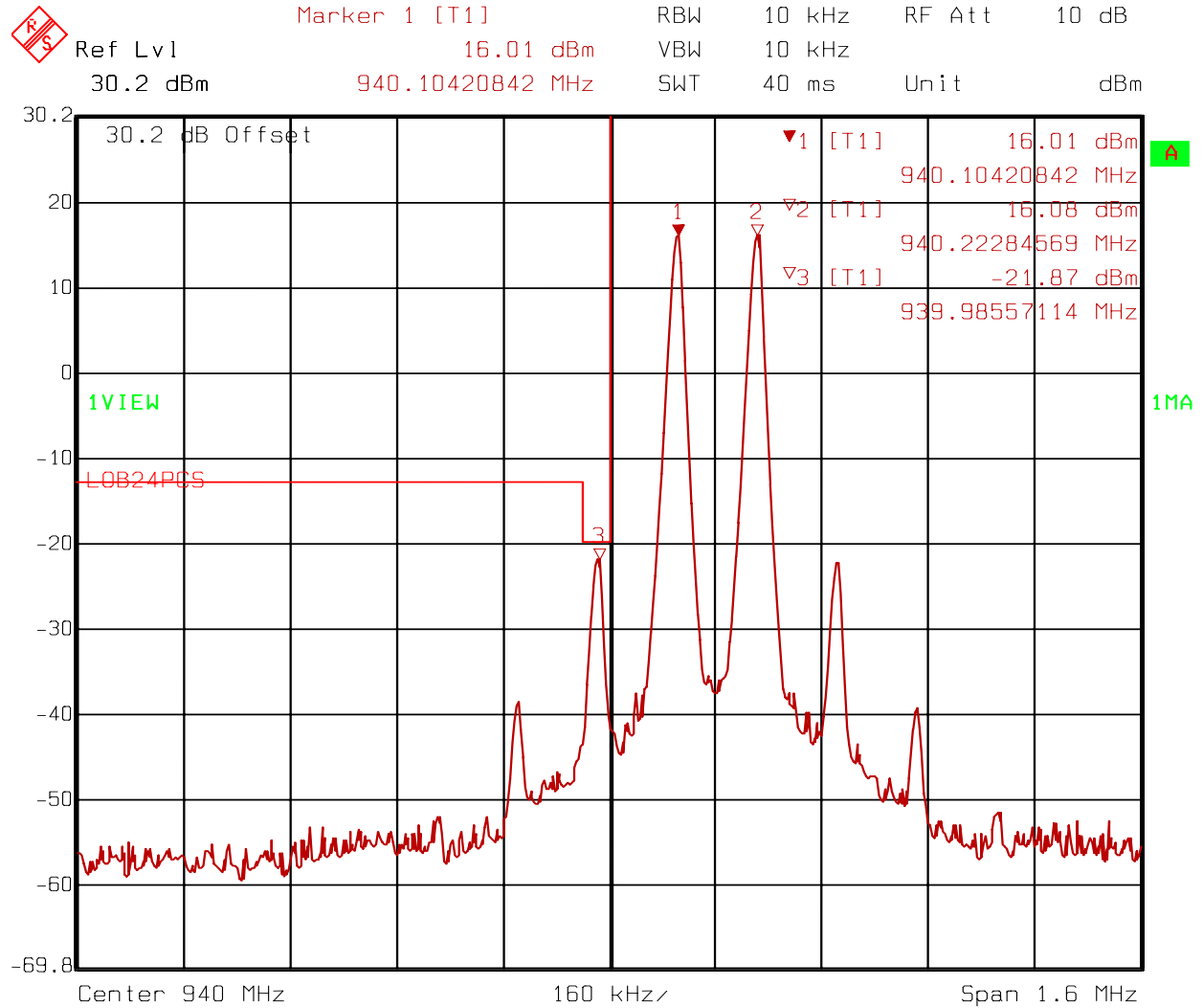


Date: 19.JAN.2006 09:22:02

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

DOWNLINK -20 LIMIT LOWER EDGE INTERMOD

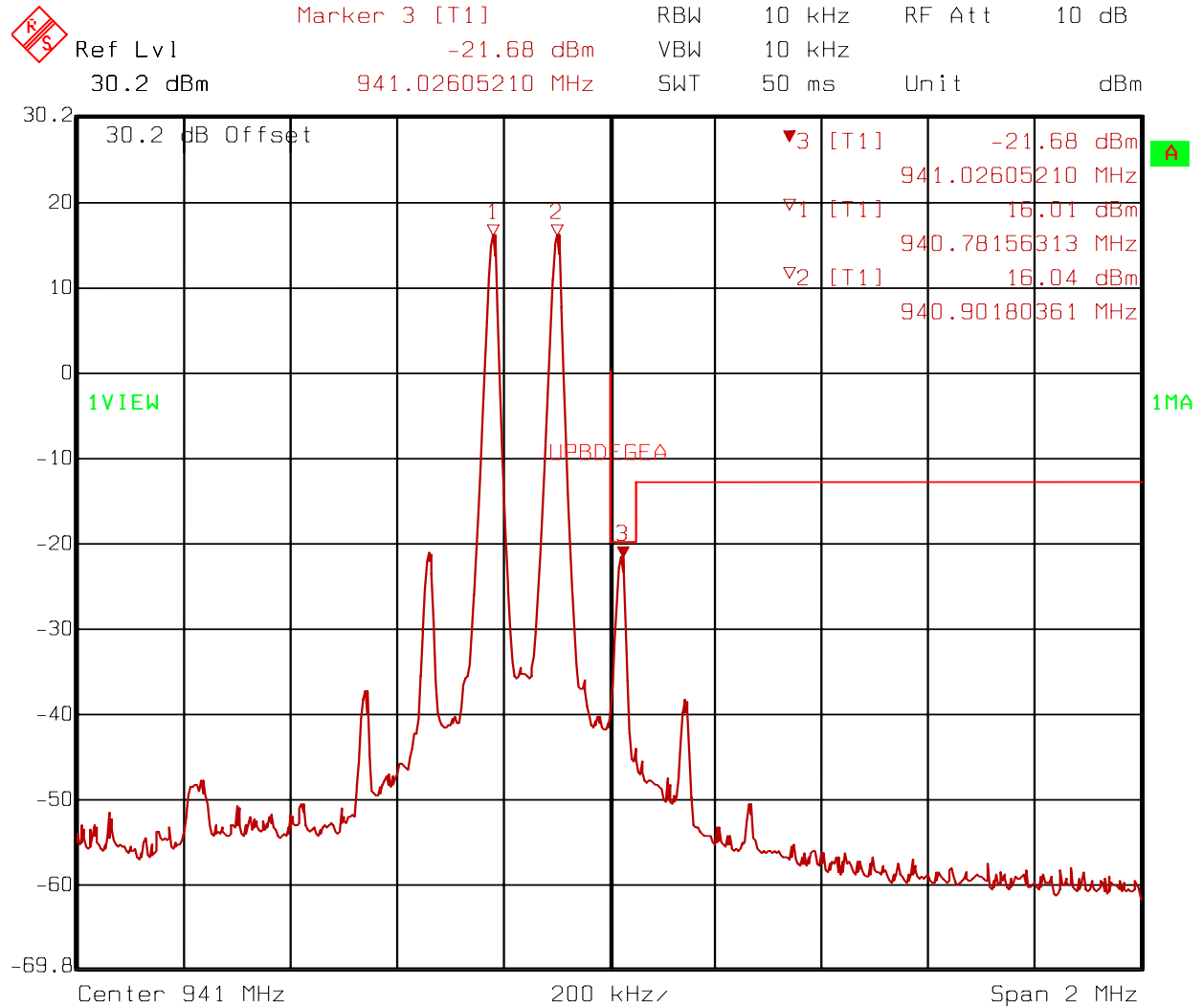


Date: 19.JAN.2006 10:47:19

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

DOWNLINK -20 LIMIT UPPER EDGE INTERMOD



Date: 19.JAN.2006 10:16:12

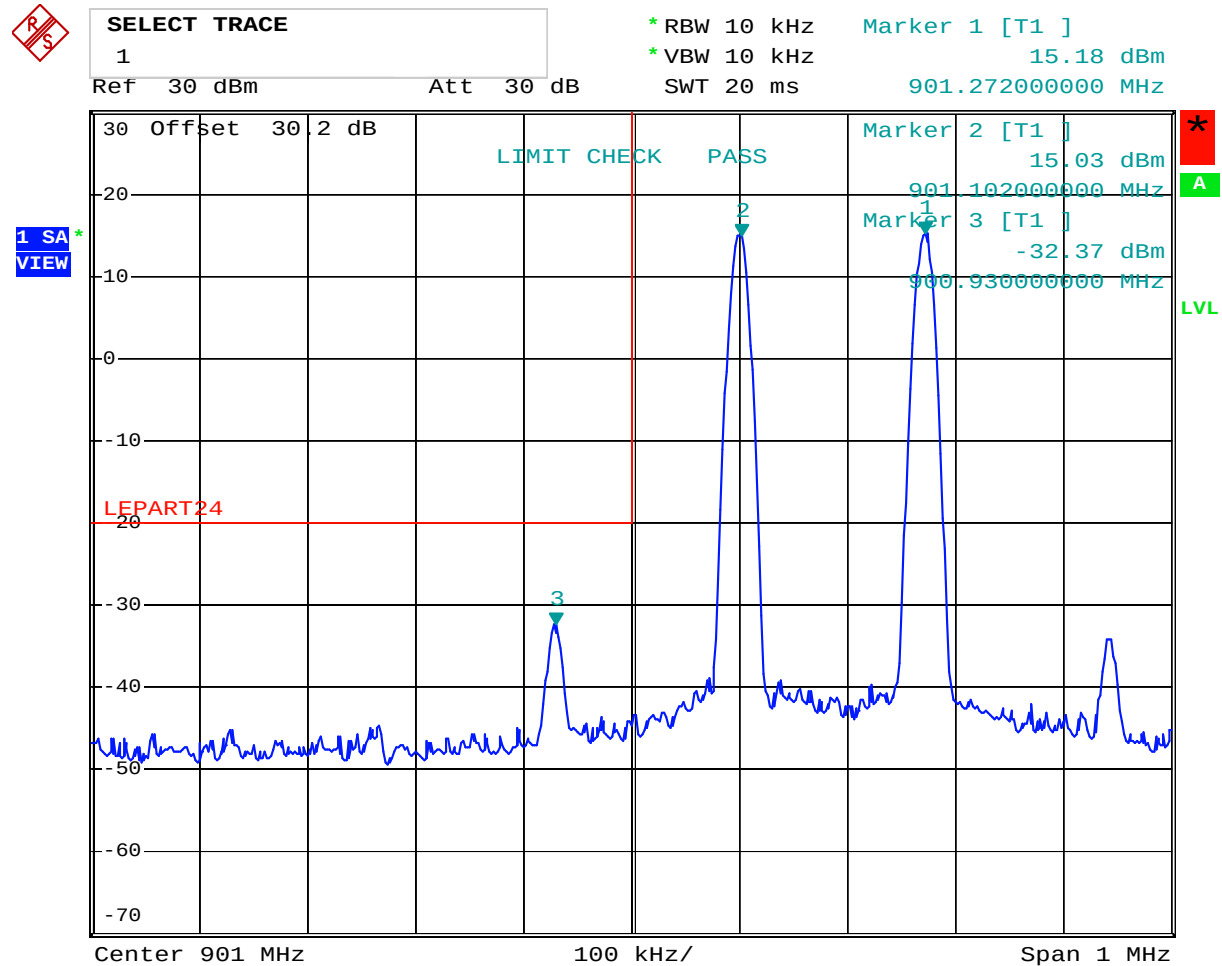
Nemko USA

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

UL LOW EDGE INTERMOD

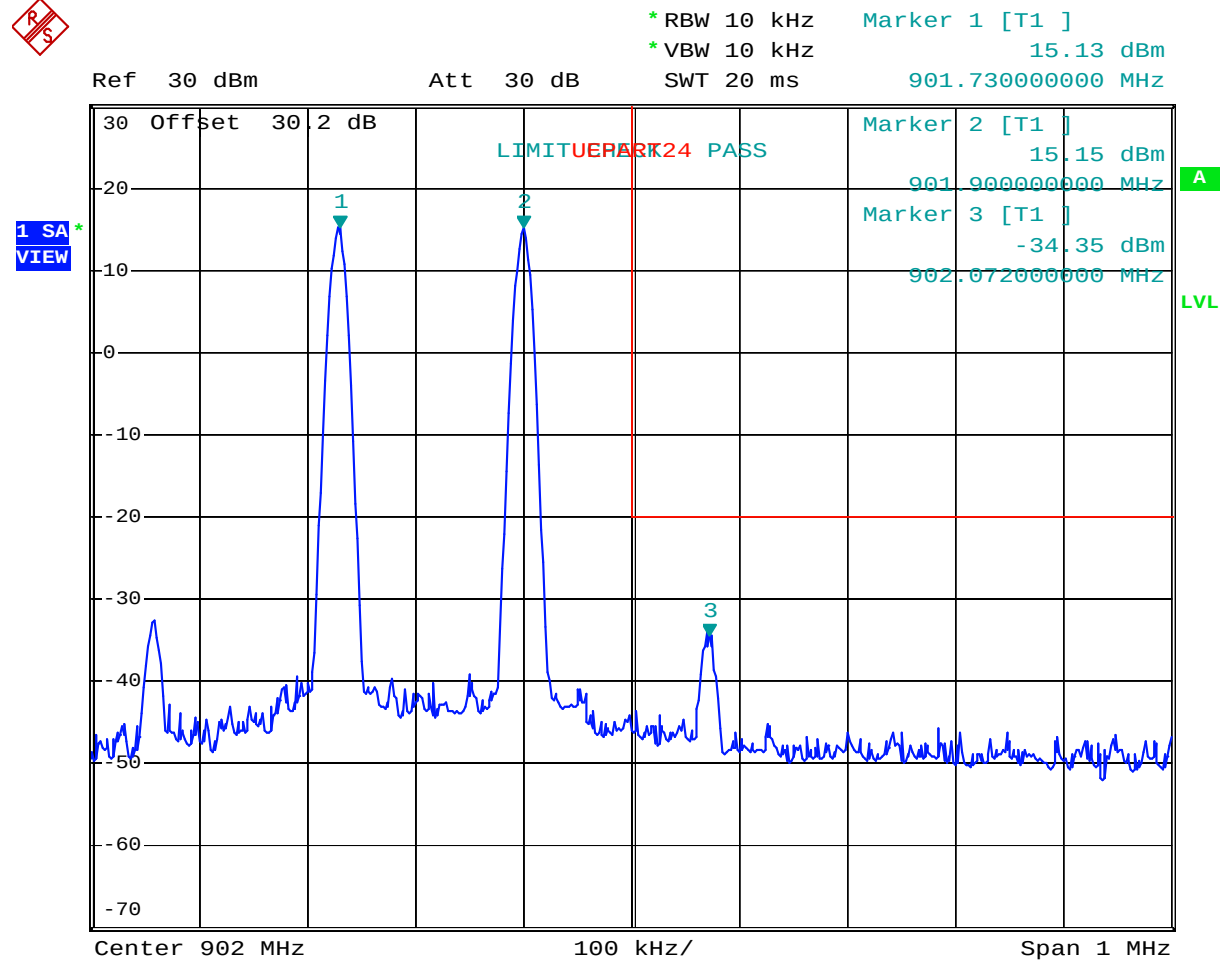


Date: 10.DEC.2005 11:28:12

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

Uplink high EDGE INTERMOD



Date: 10.DEC.2005 11:40:59

**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

*EQUIPMENT:* MR903D

## **Section 6. Field Strength of Spurious**

|                                          |                           |
|------------------------------------------|---------------------------|
| NAME OF TEST: Field Strength of Spurious | PARA. NO.: 24.133         |
| TESTED BY: Kevin Rose                    | DATE: 17-31 JANUARY 2006: |

**Test Results:** Complies.

**Test Data:** See attached table.

Measurement Uncertainty: +/- 1.7 dB

**Note: Spectrum was search from 30MHz to 10GHz no emissions were detected within 20db of the limit.**

Test Equipment used: 1464-791-1484-1485-1481-760-759-993

**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

*EQUIPMENT:* MR903D

Photographs of Test Setup  
FRONT VIEW



EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS1

**Section 7. Test Equipment List**

| Nemko ID | Description                | Manufacturer        | Serial Number | Calibration Date | Calibration Due |
|----------|----------------------------|---------------------|---------------|------------------|-----------------|
|          |                            | Model Number        |               |                  |                 |
| 1036     | SPECTRUM ANALYZER          | ROHDE & SCHWARZ     | 830844/006    | 03/22/04         | 03/23/06        |
|          |                            | FSEK30              |               |                  |                 |
| 1464     | Spectrum analyzer          | Hewlett Packard     | 3551A04428    | 01/15/07         | 01/15/07        |
|          |                            | 8563E               |               |                  |                 |
| 1470     | 10 db Attenuator DC 18 Ghz | MCL Inc.            | NONE          | CBU              | N/A             |
|          |                            | BW-S10W2 10db-2WDC  |               |                  |                 |
| 1478     | 20db Attenuator DC 18 Ghz  | MCL Inc.            | NONE          | CBU              | N/A             |
|          |                            | BW-S20W6            |               |                  |                 |
| 1629     | CABLE, 6 ft                | MEGAPHASE           | N/A           | CBU              | N/A             |
|          |                            | 10311 1GVT4         |               |                  |                 |
| 791      | PREAMP, 25dB               | ICC                 | 398           | 11/12/05         | 11/12/06        |
|          |                            | LNA25               |               |                  |                 |
| 760      | Antenna biconical          | Electro Metrics     | 477           | 08/04/05         | 08/04/06        |
|          |                            | MFC-25              |               |                  |                 |
| 759      | ANTENNA, LOG PERIODIC      | A.H. SYSTEMS        | 556           | 08/04/05         | 08/04/06        |
|          |                            | SAS-200/510         |               |                  |                 |
| 1481     | Microwave Highpass Filter  | K & L               | 4             | Cal B4 Use       | N/A             |
|          |                            | 3DH1-2000/T8000-0/0 |               |                  |                 |
| 1464     | Spectrum analyzer          | Hewlett Packard     | 3551A04428    | 01/14/05         | 01/15/07        |
|          |                            | 8563E               |               |                  |                 |
| 1659     | Spectrum Analyzer          | Rhode & Schwarz     | 973353        | 01/09/06         | 01/09/07        |
|          |                            | FSP                 |               |                  |                 |
| 1629     | CABLE, 6 ft                | MEGAPHASE           | N/A           | N/A              | 08/26/06        |
|          |                            | 10311 1GVT4         |               |                  |                 |
| 1471     | 10 db Attenuator DC 18 Ghz | MCL Inc.            | NONE          | CBU              | N/A             |
|          |                            | BW-S10W2 10db-2WDC  |               |                  |                 |
| 993      | Horn antenna               | A.H. Systems        | XXX           | 08/02/05         | 08/02/07        |
|          |                            | SAS-200/571         |               |                  |                 |
| 1484     | Cable 2.0-18.0 Ghz         | Storm               | N/A           | 09/28/05         | 09/28/06        |
|          |                            | PR90-010-072        |               |                  |                 |
| 1485     | Cable 2.0-18.0 Ghz         | Storm               | N/A           | 09/28/05         | 09/28/06        |
|          |                            | PR90-010-216        |               |                  |                 |



**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

*EQUIPMENT:* MR903D

## **ANNEX A - TEST METHODOLOGIES**

EQUIPMENT: MR903D

|                                      |                         |
|--------------------------------------|-------------------------|
| <b>NAME OF TEST: RF Power Output</b> | <b>PARA. NO.: 2.985</b> |
|--------------------------------------|-------------------------|

- Minimum Standard:** Para. No.24.132.
- (a) Stations transmitting in the 901-902 MHz band are limited to 7 watts e.r.p.
  - (b) Mobile stations transmitting in the 930-931 MHz and 940-941 MHz bands are limited to 7 watts e.r.p.
  - (c) Base stations transmitting in the 930-931 MHz and 940-941 MHz bands are limited to 3500 watts e.r.p. per authorized channel and are unlimited in antenna height except as provided in paragraph (d) of this section.

**Method Of Measurement:** CDMA Per ANSI/J-STD-008  
TDMA Per ANSI/J-STD-010  
PCS 1900 Per ANSI/J-STD-007

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter or a spectrum analyzer.

Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation  $GP/4\pi R^2 = E^2/120\pi$  and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

**EQUIPMENT:** MR903D

|                                         |                         |
|-----------------------------------------|-------------------------|
| <b>NAME OF TEST: Occupied Bandwidth</b> | <b>PARA. NO.: 2.989</b> |
|-----------------------------------------|-------------------------|

**Minimum Standard:** Para. No. 24.133. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

**Method Of Measurement:**

(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with §24.132(f), in accordance with the following schedule:

(1) For transmitters authorized a bandwidth greater than 10 kHz:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of up to and including 40 kHz: at least  $116 \times \text{Log}_{10} ((f_d + 10)/6.1)$  decibels or 50 plus  $10 \text{Log}_{10} (P)$  decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 40 kHz: at least  $43 + 10 \text{Log}_{10} (P)$  decibels or 80 decibels, whichever is the lesser attenuation.

(2) For transmitters authorized a bandwidth of 10 kHz:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of up to and including 20 kHz: at least  $116 \times \text{Log}_{10} ((f_d + 5)/3.05)$  decibels or  $50 + 10 \times \text{Log}_{10} (P)$  decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 20 kHz: at least  $43 + 10 \text{Log}_{10} (P)$  decibels or 80 decibels, whichever is the lesser attenuation.

(b) The measurements of emission power can be expressed in peak or average values provided they are expressed in the same parameters as the transmitter power.

(c) When an emission outside of the authorized bandwidth causes harmful Interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

(d) A minimum spectrum analyzer resolution bandwidth of 300 Hz shall be used when showing compliance with paragraphs (a)(1)(i) & (ii) and (a)(2)(i) & (ii).

*EQUIPMENT:* MR903D

|                                                             |                         |
|-------------------------------------------------------------|-------------------------|
| <b>NAME OF TEST: Spurious Emission at Antenna Terminals</b> | <b>PARA. NO.: 2.991</b> |
|-------------------------------------------------------------|-------------------------|

**Minimum Standard:** Para. No.24.133. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least  $43 + 10 \log (P)$  dB.

**Method Of Measurement:**

Spectrum analyzer settings:

|                       |                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------|
| 30 Mhz to 1000 MHz:   | RBW $\geq$ 100 kHz<br>VBW $\geq$ RBW<br>Sweptime – Auto<br>Video Averaging – Off<br>Detector type - Peak |
| Greater than 1000 MHz | RBW $\geq$ 1 MHz<br>VBW $\geq$ RBW<br>Sweptime – Auto<br>Video Averaging – Off<br>Detector type - Peak   |

EQUIPMENT: MR903D

|                                                           |                         |
|-----------------------------------------------------------|-------------------------|
| <b>NAME OF TEST: Field Strength of Spurious Radiation</b> | <b>PARA. NO.: 2.993</b> |
|-----------------------------------------------------------|-------------------------|

**Minimum Standard:** Para. No.24.133. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least  $43 + 10 \log (P)$  dB.

### Calculation Of Field Strength Limit

An example of attenuation requirement of  $43 + 10 \log P$  is equivalent to -13 dBm ( $5 \times 10^{-5}$  Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions  $\leq 1$  GHz:

$G = 1.64$  (Dipole Gain)

$P = 10^{-5}$  Watts (Maximum spurious output power)

$R = 3\text{m}$  (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R}$$

$$E = \frac{\sqrt{30 \times 1.64 \times 5 \times 10^{-5}}}{3} = 0.016533 \text{ V / m} = 84.4 \text{ dB}\mu\text{V / m}$$

For emissions  $> 1$  GHz:

$G = 1$  (Isotropic Gain)

$P = 1 \times 10^{-5}$  Watts (Maximum spurious output power)

$R = 3\text{m}$  (Measurement Distance)

$$E = 84.4 - 20 \log \sqrt{1.64} = 82.3 \text{ dB}\mu\text{V / m@3m}$$

**Test Method:** TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

*EQUIPMENT:* MR903D

|                                          |                         |
|------------------------------------------|-------------------------|
| <b>NAME OF TEST: Frequency Stability</b> | <b>PARA. NO.: 2.995</b> |
|------------------------------------------|-------------------------|

**Minimum Standard:** Para. No. 24.135. The frequency stability shall be  $\pm 1\%$

**Method Of Measurement:** CDMA Per ANSI/J-STD-008  
TDMA Per ANSI/J-STD-007  
NADC Per IS-136

#### Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

#### Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

#### Digitally Modulated Signals

Equipment that produces a digitally modulated carrier is tested using a vector modulation analyzer. Frequency accuracy and rho are measured over the specified environmental extremes.

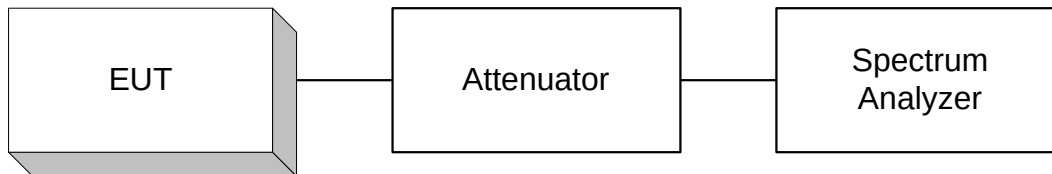
**Nemko USA**

FCC PART 24, SUBPART D  
NARROWBAND PCS SUBSCRIBER STATION  
PROJECT NO.: **6L0013RUS1**

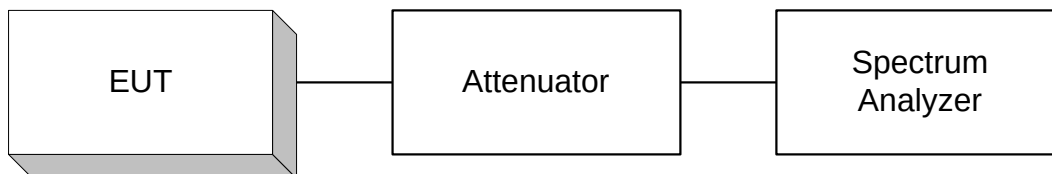
*EQUIPMENT:* MR903D

## **ANNEX B - TEST DIAGRAMS**

**Para. No. 2.1046 - R.F. Power Output**

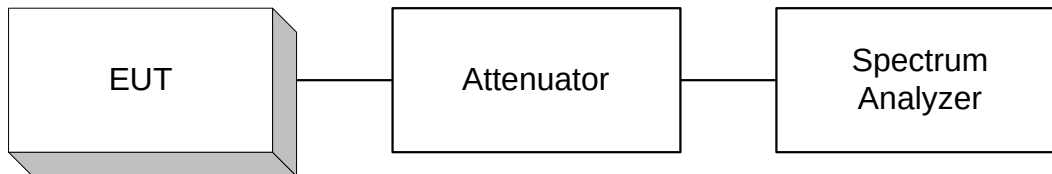


**Para. No. 2.1049 - Occupied Bandwidth**

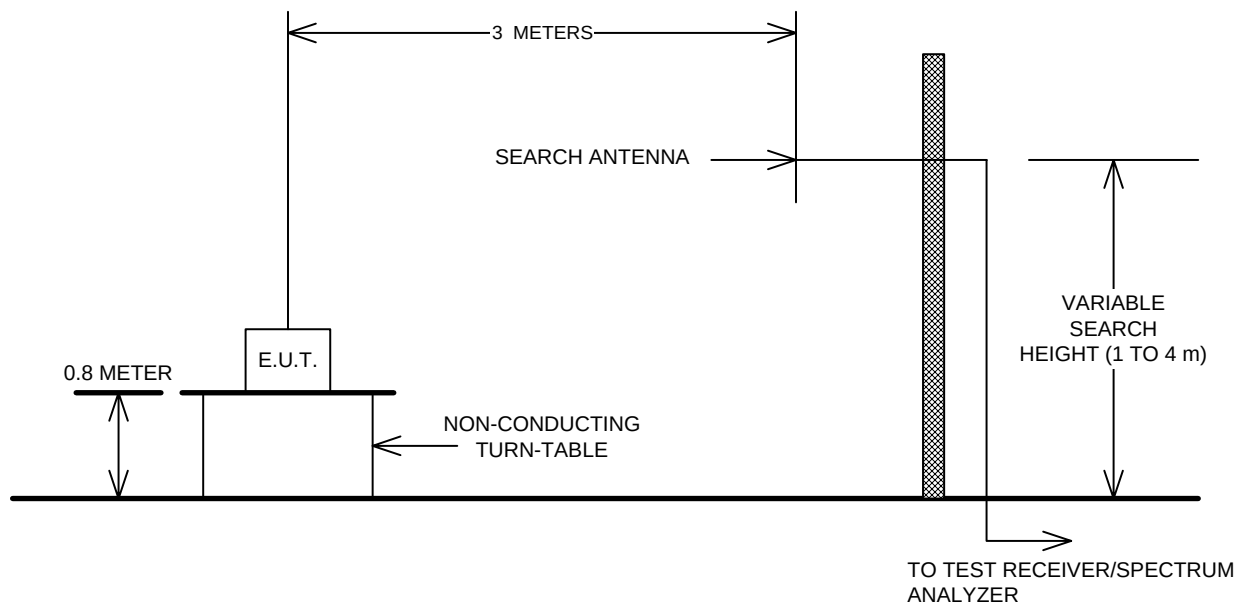




**Para. No. 2.1051 Spurious Emissions at Antenna Terminals**



**Para. No. 2.1053 - Field Strength of Spurious Radiation**



**Para. No. 2.1055 - Frequency Stability**

