



**Nemko Test Report:** 1906RUS5

**Applicant:** Fiber-Span  
111 Corporate Blvd, S.  
Plainfield, NJ 07080  
USA

**Equipment Under Test:  
(E.U.T.)** FS31X-40-1.0-2-RM

**In Accordance With:** **CFR 47 Part 90, Subpart I**  
Private Land Mobile Repeater

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

**TESTED BY:**

David Light, senior Wireless Engineer

**DATE:** 10 January 2007

**APPROVED BY:**

Kevin Rose, Wireless Engineer

**DATE:** 12 January 2007

**Number of Pages: 26**

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EQUIPMENT: **FS31X-40-1.0-2-RM**

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## Section 1. Summary of Test Results

Manufacturer: **Fiber-Span**  
Model No.: **FS31X-40-1.0-2-RM**  
Serial No.: **A1937-1-1**

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 CFR Part 90, Subpart I.

|                                     |                            |                                     |                     |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission             | <input checked="" type="checkbox"/> | Production Unit     |
| <input type="checkbox"/>            | Class II Permissive Change | <input type="checkbox"/>            | 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".



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**Summary Of Test Data**

| NAME OF TEST                               | PARA. NO. | SPEC.        | RESULT   |
|--|-----------|--------------|----------|
| RF Power Output                            | 90.205    | 12 Watts     | Complies |
| Occupied Bandwidth                         | 90.210    | Input/Output | Complies |
| Spurious Emissions at Antenna<br>Terminals | 90.210    | Plots        | Complies |
| Field Strength of Spurious<br>Emissions    | 90.210    | Mask         | Complies |
| Frequency Stability                        | 90.213    | NA           | NA       |

**Footnotes For N/A's:**

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
- (2) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.

**Section 2. General Equipment Specification****Transmitter**

Supply Voltage Input: 120 Vac

Frequency Range: 406.1-512.0 MHz

Type(s) of Modulation:

F3E  
(Voice)  
☒F1D  
☐D7W  
(QAM)  
☐Other  
☐

Output Impedance: 50 ohms

RF Power Output:  $\frac{2}{33}$  W  
dBmOperator Selection of Operating  
Frequency: NonePower Output Adjustment  
Capability: Software

Frequency Translation:

F1-F1  
☒F1-F2  
☐N/A  
☐

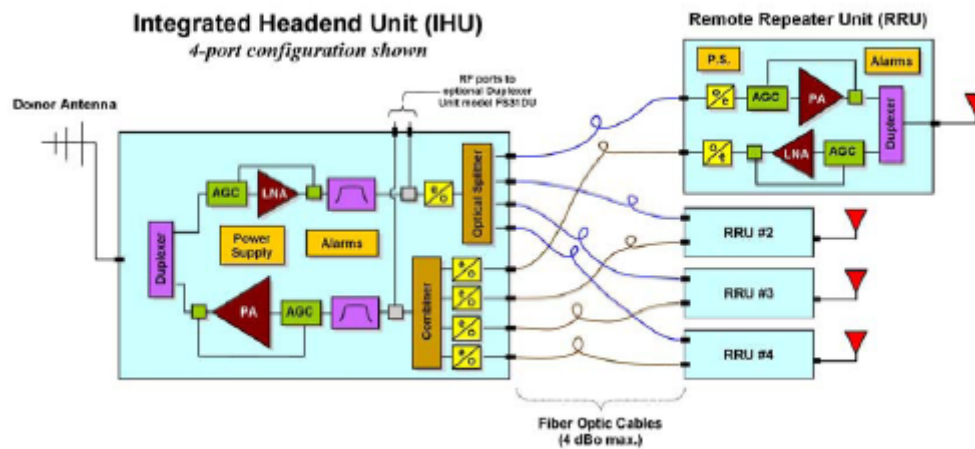
Band Selection:

Software  
☐Duplexer  
Change  
☐Full  
Band  
Coverage  
☒

## Description of EUT

Fiber optic bi-directional amplifier operating in the 400 MHz private land mobile band.

## System Diagram



EQUIPMENT: **FS31X-40-1.0-2-RM**

### Section 3. RF Power Output

|                               |                       |
|-------------------------------|-----------------------|
| NAME OF TEST: RF Power Output | PARA. NO.: 2.1046     |
| TESTED BY: David Light        | DATE: 08 January 2007 |

**Test Results:** Complies.

**Measurement Data:**

| Modulation | Output per Channel (dBm) | Composite Power (dBm) | Composite Power (W) |
|------------|--------------------------|-----------------------|---------------------|
| Analog     | 30                       | 33                    | 2                   |
| Analog     | 30                       | 33                    | 2                   |

**Equipment Used:** 1036-1469-1604-1064-1082-2071-2072

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

**Temperature:** 23 °C

**Relative Humidity:** 36 %

EQUIPMENT: **FS31X-40-1.0-2-RM**

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#### Section 4. Occupied Bandwidth

|                                  |                        |
|----------------------------------|------------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 2. 1049     |
| TESTED BY: David Light           | DATE: 28 December 2006 |

**Test Results:** Complies.

**Test Data:** See attached plot(s).

**Equipment Used:** 1036-1469-1604-1064-1082

**Measurement Uncertainty:** 1X10<sup>-7</sup> ppm

**Temperature:** 23 °C

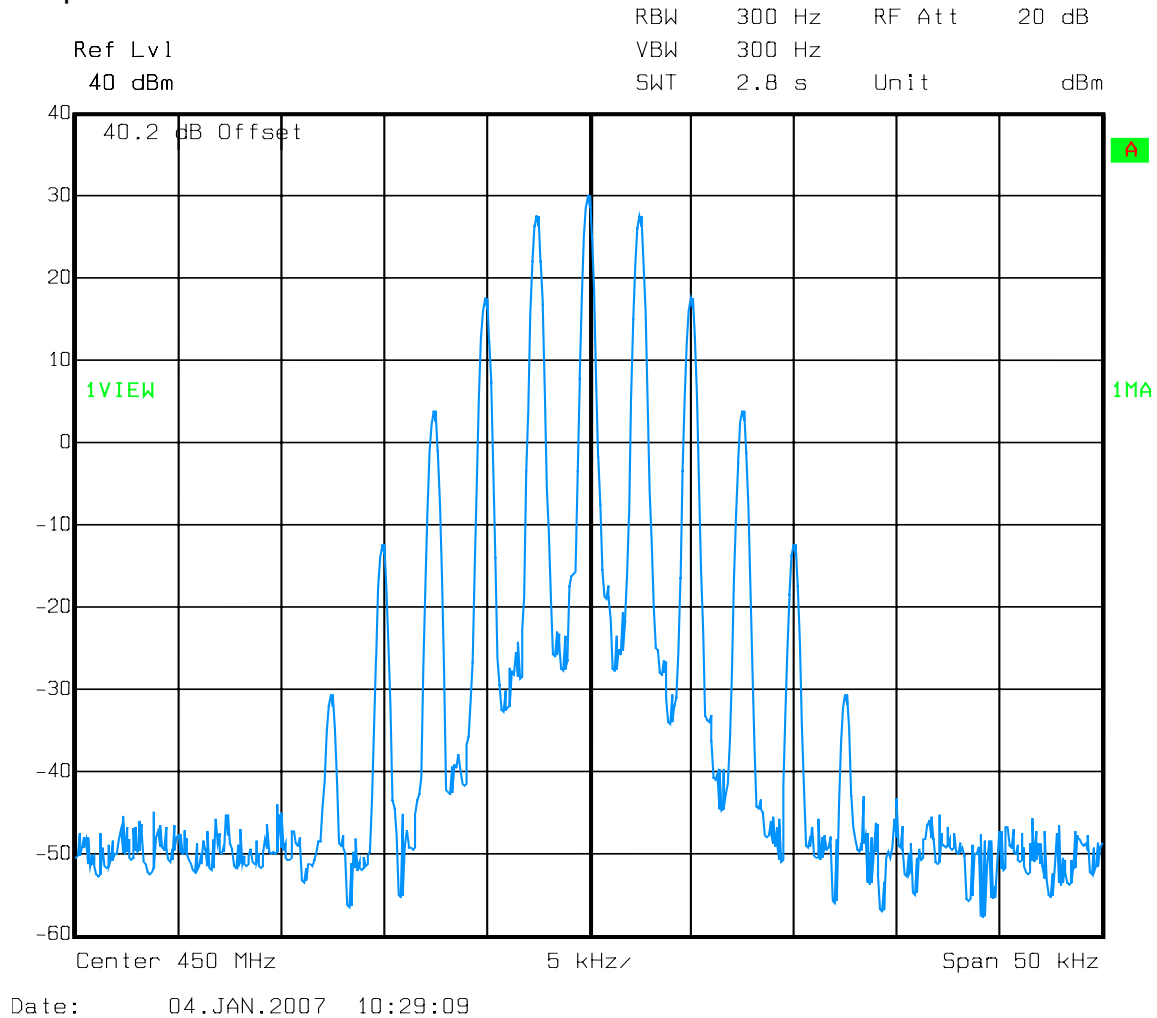
**Relative Humidity:** 40 %



EQUIPMENT: **FS31X-40-1.0-2-RM**

# Test Data – Occupied Bandwidth

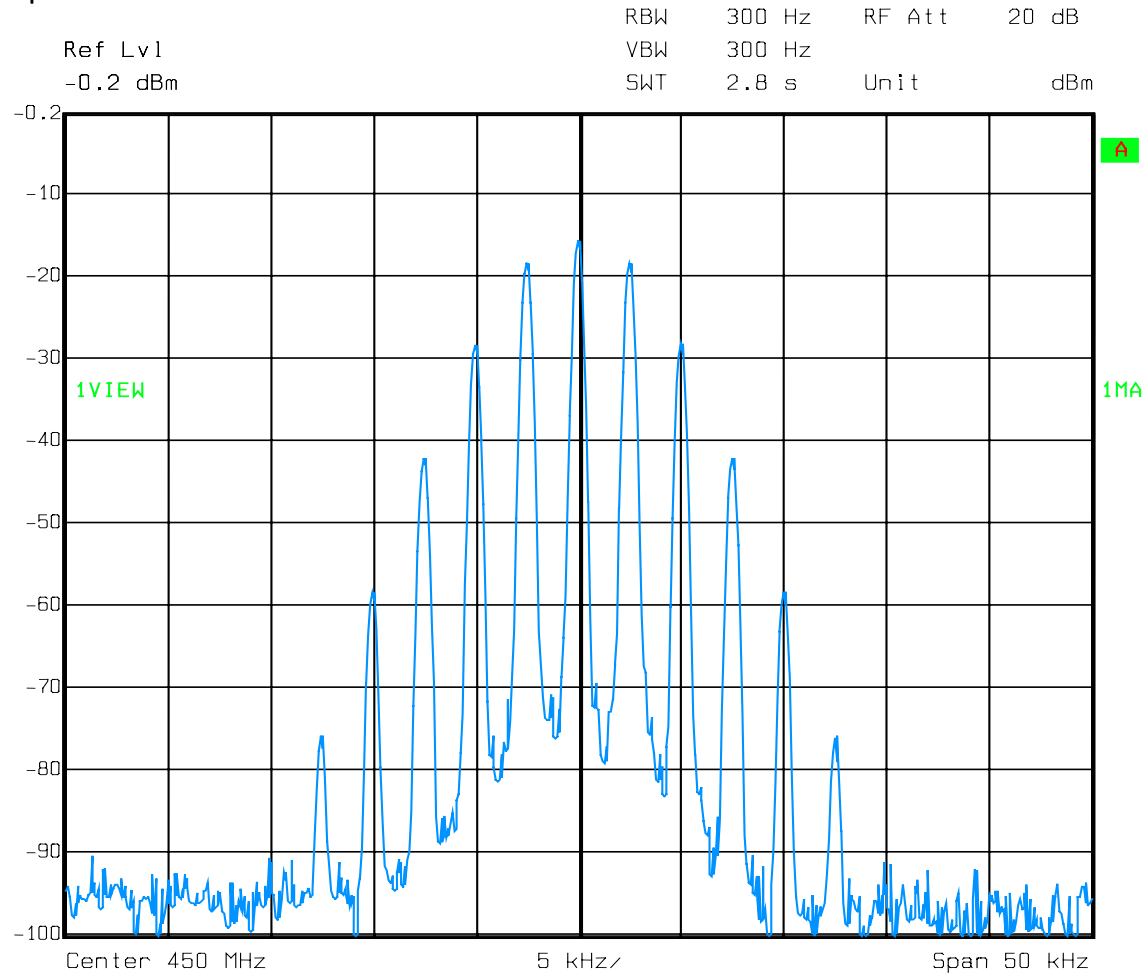
## Output



EQUIPMENT: **FS31X-40-1.0-2-RM**

# Test Data – Occupied Bandwidth

Input



Date: 04.JAN.2007 10:30:09

## Section 5. Spurious Emissions at Antenna Terminals

|  |                     |
|--|---------------------|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 2.1051   |
| TESTED BY: David Light                               | DATE: 03 January 07 |

**Test Results:** Complies.

**Test Data:** See attached plot(s).

**Equipment Used:** 1036-1469-1604-1064-1082

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

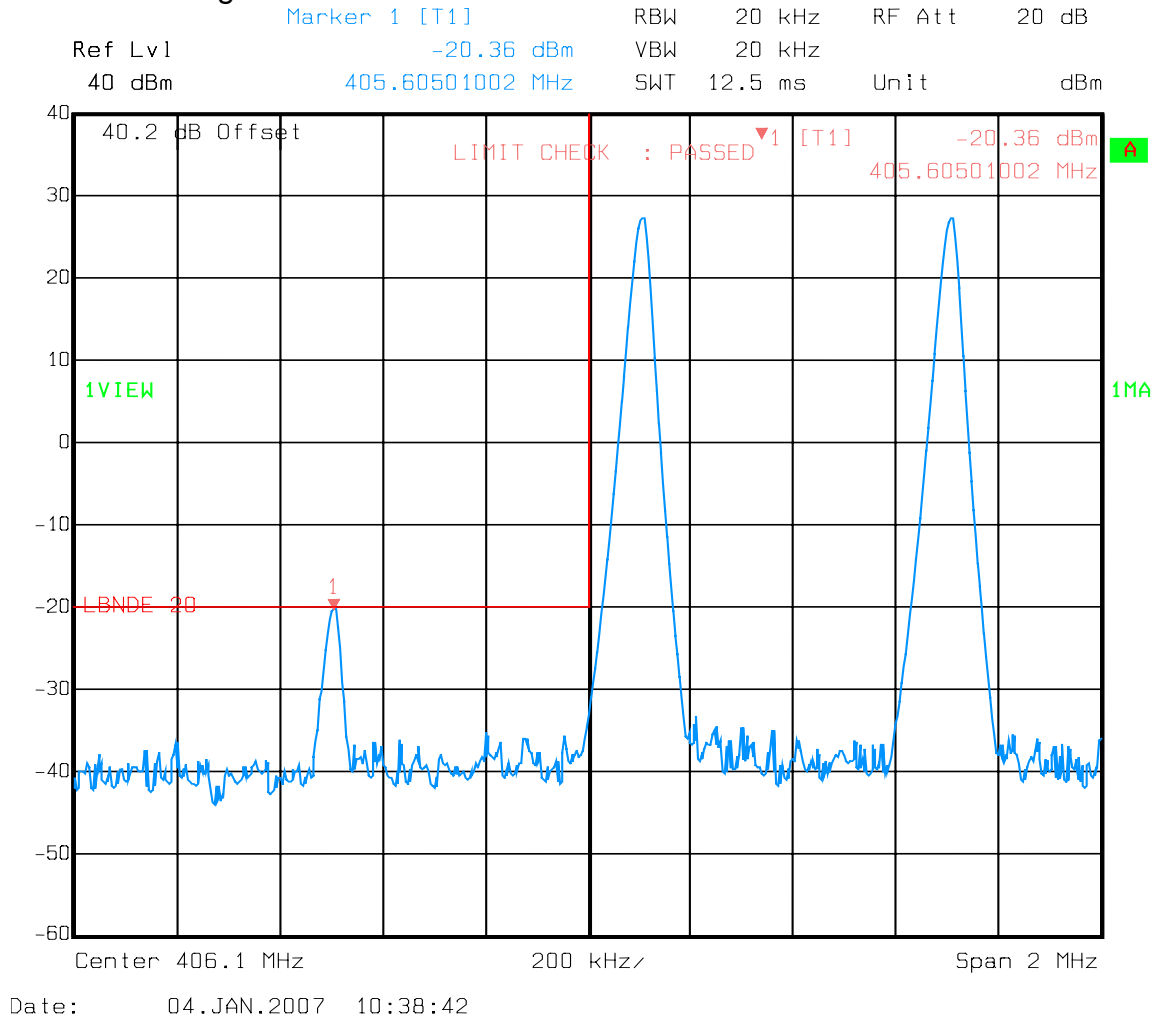
**Temperature:** 22 °C

**Relative Humidity:** 30 %

EQUIPMENT: **FS31X-40-1.0-2-RM**

# Test Data – Spurious Emissions at Antenna Terminals

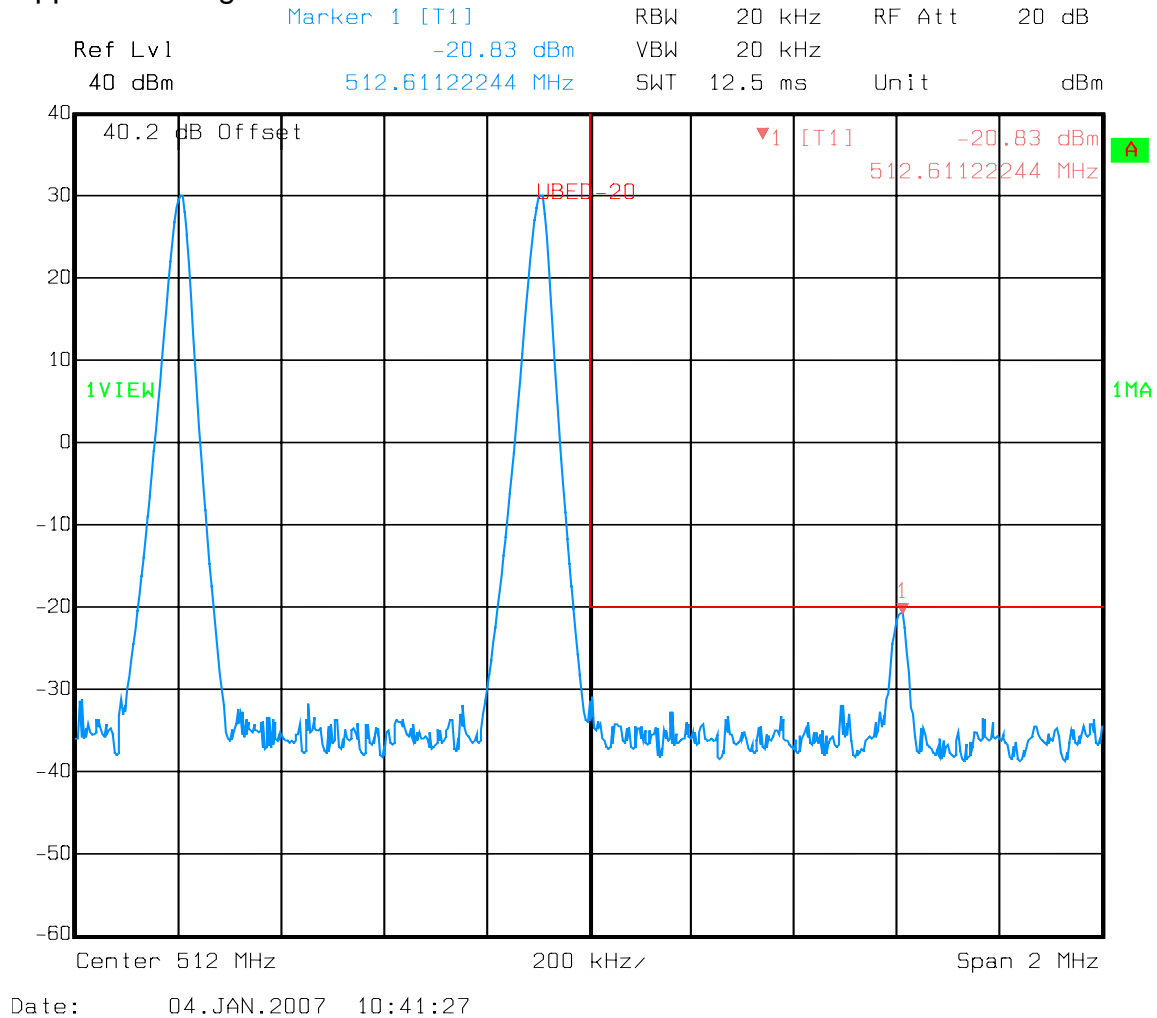
## Lower Bandedge Intermodulation



EQUIPMENT: **FS31X-40-1.0-2-RM**

# Test Data – Spurious Emissions at Antenna Terminals

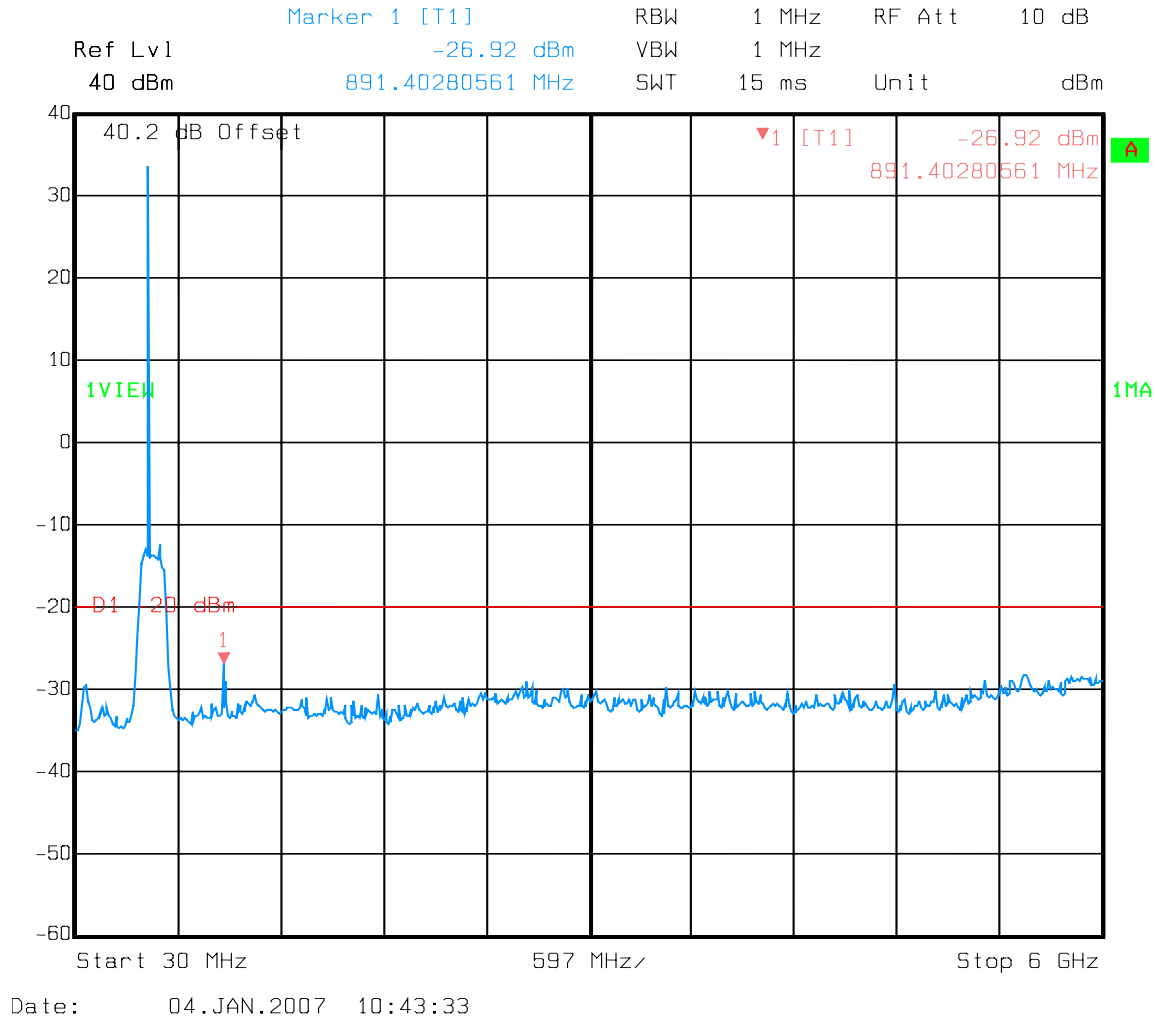
## Upper Bandedge Intermodulation



EQUIPMENT: **FS31X-40-1.0-2-RM**

# Test Data – Spurious Emissions at Antenna Terminals

Carrier notched



## Section 6. Field Strength of Spurious Emissions

|  |                     |
|--|---------------------|
| NAME OF TEST: Field Strength of Spurious Emissions | PARA. NO.: 2.1053   |
| TESTED BY: David Light                             | DATE: 03 January 07 |

**Test Results:** Complies.

**Test Data:** The spectrum was searched from 30 MHz to the tenth harmonic of the carrier. There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

RBW=VBW=100 kHz below 1000 MHz  
RBW=VBW=1 MHz above 1000 MHz

**Equipment Used:** 759-1195-791-1464-993-1016-1484-1485

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

**Temperature:** 23 °C

**Relative Humidity:** 35 %

**Note:** See page A5 for applicable limit.

**EQUIPMENT: FS31X-40-1.0-2-RM****Section 7. Test Equipment List**

| Nemko ID | Description                | Manufacturer<br>Model Number   | Serial Number | Calibration<br>Date | Calibration<br>Due |
|----------|----------------------------|--------------------------------|---------------|---------------------|--------------------|
| 1036     | SPECTRUM ANALYZER          | ROHDE & SCHWARZ<br>FSEK30      | 830844/006    | 05/26/06            | 05/26/08           |
| 1082     | CABLE 2m                   | Astrolab<br>32027-2-29094-72TC | N/A           | CBU                 | N/A                |
| 1469     | 10 db Attenuator DC 18 Ghz | MCL Inc.<br>BW-S10W2 10db-2WDC | NONE          | CBU                 | N/A                |
| 1604     | ATTENUATOR                 | NARDA<br>776B-20               | NONE          | N/A                 | N/A                |
| 1064     | ATTENUATOR                 | NARDA<br>776B-20               | NONE          | CBU                 | N/A                |
| 2071     | Power Sensor               | Agilent<br>E9304A              | MY41495174    | 11/14/06            | 11/14/07           |
| 2072     | Power Meter                | HP<br>E4418B                   | GB39401848    | 11/13/06            | 11/13/07           |
| 759      | ANTENNA, LOG PERIODIC      | A.H. SYSTEMS<br>SAS-200/510    | 556           | 02/13/06            | 02/13/07           |
| 1195     | ANTENNA,BICONICAL          | A.H. SYSTEMS<br>SAS-200/542    | 235           | 02/10/06            | 02/10/07           |
| 791      | PREAMP, 25dB               | Nemko USA, Inc.<br>LNA25       | 398           | 04/20/06            | 04/20/07           |
| 1016     | Pre-Amp                    | HEWLETT PACKARD<br>8449A       | 2749A00159    | 04/20/06            | 04/20/07           |
| 993      | Horn antenna               | A.H. Systems<br>SAS-200/571    | XXX           | 08/01/05            | 08/02/07           |
| 1464     | Spectrum analyzer          | Hewlett Packard<br>8563E       | 3551A04428    | 01/14/05            | 01/15/07           |
| 1484     | Cable                      | Storm<br>PR90-010-072          | N/A           | 10/02/06            | 10/02/07           |
| 1485     | Cable                      | Storm<br>PR90-010-216          | N/A           | 10/02/06            | 10/02/07           |
| 1659     | Spectrum Analyzer          | Rhode & Schwarz<br>FSP         | 973353        | 01/10/06            | 01/10/07           |



## **ANNEX A - TEST METHODOLOGIES**

**NAME OF TEST: RF Power Output**

**PARA. NO.: 2.1046**

**Minimum Standard:** Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

**Method Of Measurement:**

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

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

**NAME OF TEST: Spurious Emissions at Antenna  
Terminals****PARA. NO.: 2.1051****Minimum Standard:** 90.210, Table 1**Table 1**

| Frequency Band (MHz) | Mask for equipment with Low Pass Filter | Mask for equipment without Low Pass Filter |
|----------------------|---|--|
| Below 25             | A or B                                  | A or C                                     |
| 25 - 50              | B                                       | C  |
| 72 - 76              | B                                       | C  |
| 150 - 174            | B, D or E                               | C, D or E                                  |
| 150 Paging only      | B                                       | C  |
| 220 - 222            | F                                       | F  |
| 421 - 512            | B, D or E                               | C, D or E                                  |
| 450 paging only      | B                                       | H  |
| 806 - 821/ 851 - 866 | B                                       | G  |
| 821 - 824/ 866 - 869 | B                                       | H  |
| 896 - 901/ 935 - 940 | I                                       | J  |
| 902 - 928            | K                                       | K  |
| 929 - 930            | B                                       | G  |
| Above 940            | B                                       | C  |
| All other bands      | B                                       | C  |

| MASK        | Spurious Limit | FS Limit Below 1 GHz | FS Limit Above 1 GHz |
|-------------|----------------|----------------------|----------------------|
| A,B,C,G,H,I | -13dBm         | 84.4 dB $\mu$ V/m@3m | 82.2 dB $\mu$ V/m@3m |
| D,J         | -20dBm         | 77.4 dB $\mu$ V/m@3m | 75.2 dB $\mu$ V/m@3m |
| E,F,K       | -25dBm         | 72.4 dB $\mu$ V/m@3m | 70.2 dB $\mu$ V/m@3m |

**Test Method:** RBW: 1% of emission bandwidth in the 0 - 1 GHz range.  
1 MHz at frequencies above 1 GHz.  
VBW:  $\Rightarrow$  RBW

The spectrum is searched up to 10 times the fundamental frequency.

|   |                          |
|---|--------------------------|
| <b>NAME OF TEST: Occupied Bandwidth</b> | <b>PARA. NO.: 2.1049</b> |
|---|--------------------------|

**Minimum Standard:** Not defined. Input/Output

**Method Of Measurement:**

Analog

Spectrum analyzer settings:

RBW=VBW=300 Hz

Span: 100 kHz

Sweep: Auto

iDEN

RBW=VBW= 300 Hz

Span: 100 kHz

Sweep: Auto

**NAME OF TEST: Field Strength of Spurious****PARA. NO.: 2.1051****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Method Of Measurement:** TIA/EIA-603-1992

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

| <b>MASK</b> | <b>Spurious Limit</b> | <b>FS Limit Below 1 GHz</b> | <b>FS Limit Above 1 GHz</b> |
|-------------|-----------------------|-----------------------------|-----------------------------|
| A,B,C,G,H,I | -13dBm                | 84.4 dB $\mu$ V/m@3m        | 82.2 dB $\mu$ V/m@3m        |
| D,J         | -20dBm                | 77.4 dB $\mu$ V/m@3m        | 75.2 dB $\mu$ V/m@3m        |
| E,F,K       | -25dBm                | 72.4 dB $\mu$ V/m@3m        | 70.2 dB $\mu$ V/m@3m        |

**NAME OF TEST: Frequency Stability****PARA. NO.: 2.1055**

**Minimum Standard:** Para. No. 990.213. The transmitter carrier frequency shall remain

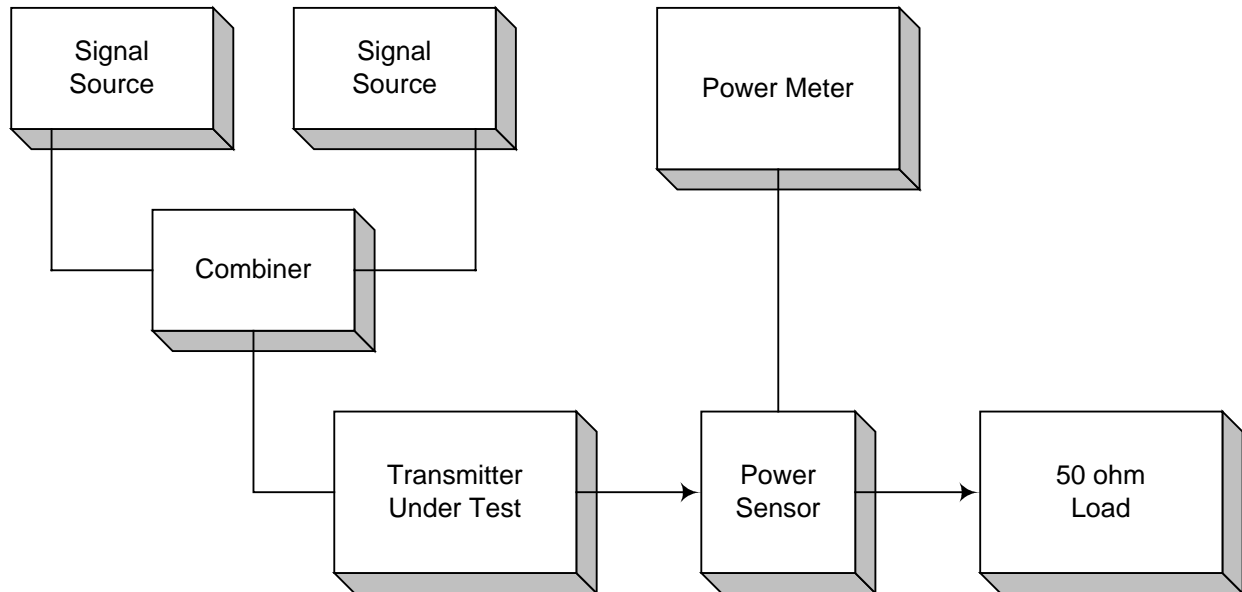
within the assigned frequency below in ppm.

**Table 2**

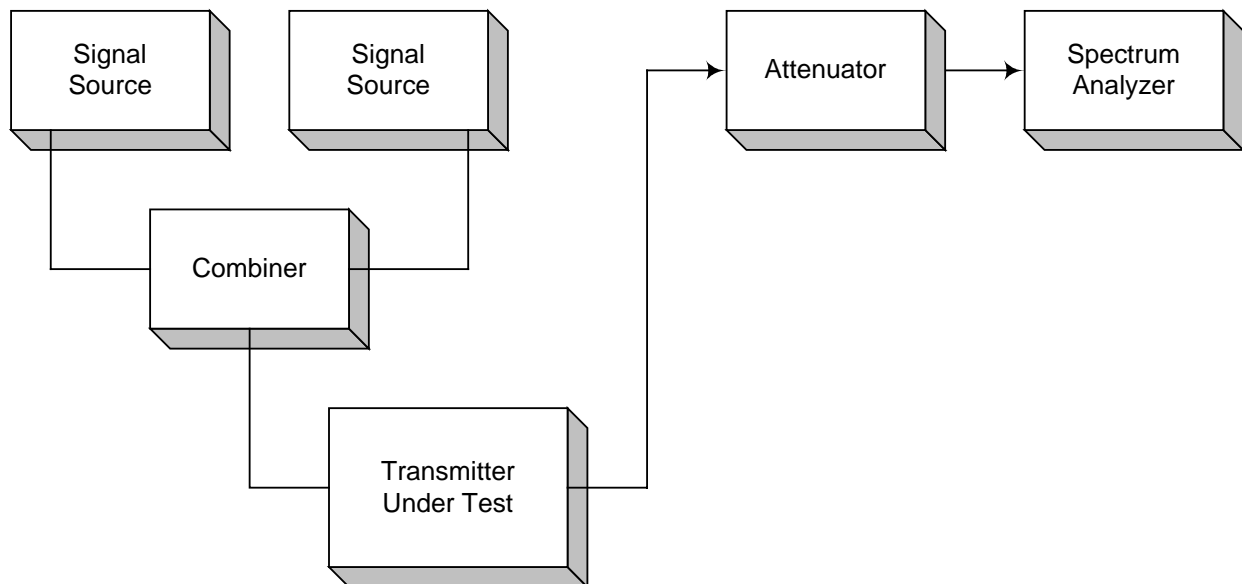
| Frequency Band<br>(MHz) | Fixed And Base<br>Stations | Mobile Stations   |                   |
|-------------------------|----------------------------|-------------------|-------------------|
|                         |                            | > 2 Watts o/p pwr | < 2 Watts o/p pwr |
| Below 25                | 100                        | 100               | 200               |
| 25 - 50                 | 20                         | 20                | 50                |
| 72 - 76                 | 5                          | -                 | 50                |
| 150 - 174               | 5                          | 5                 | 5                 |
| 220 - 222               | 0.1                        | 1.5               | 1.5               |
| 421 - 512               | 2.5                        | 5                 | 5                 |
| 806 - 821               | 1.5                        | 2.5               | 2.5               |
| 821 - 824               | 1.0                        | 1.5               | 15                |
| 851 - 866               | 1.5                        | 2.5               | 2.5               |
| 866 - 869               | 1.0                        | 1.5               | 1.5               |
| 869 - 901               | 0.1                        | 1.5               | 1.5               |
| 902 - 928               | 2.5                        | 2.5               | 2.5               |
| 929 - 930               | 1.5                        | -                 | -                 |
| 935 - 940               | 0.1                        | 1.5               | 1.5               |
| 1427 - 1435             | 300                        | 300               | 300               |
| Above 2450              | -                          | -                 | -                 |

## **ANNEX B - TEST DIAGRAMS**

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

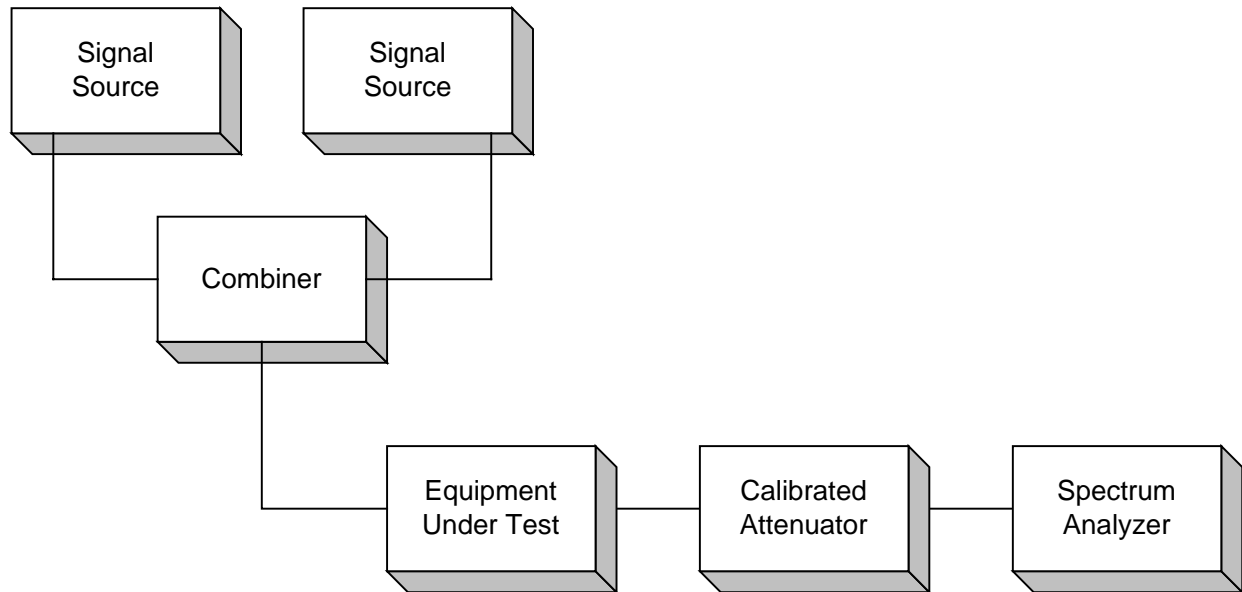


**Para. No. 2.1049 - Occupied Bandwidth**

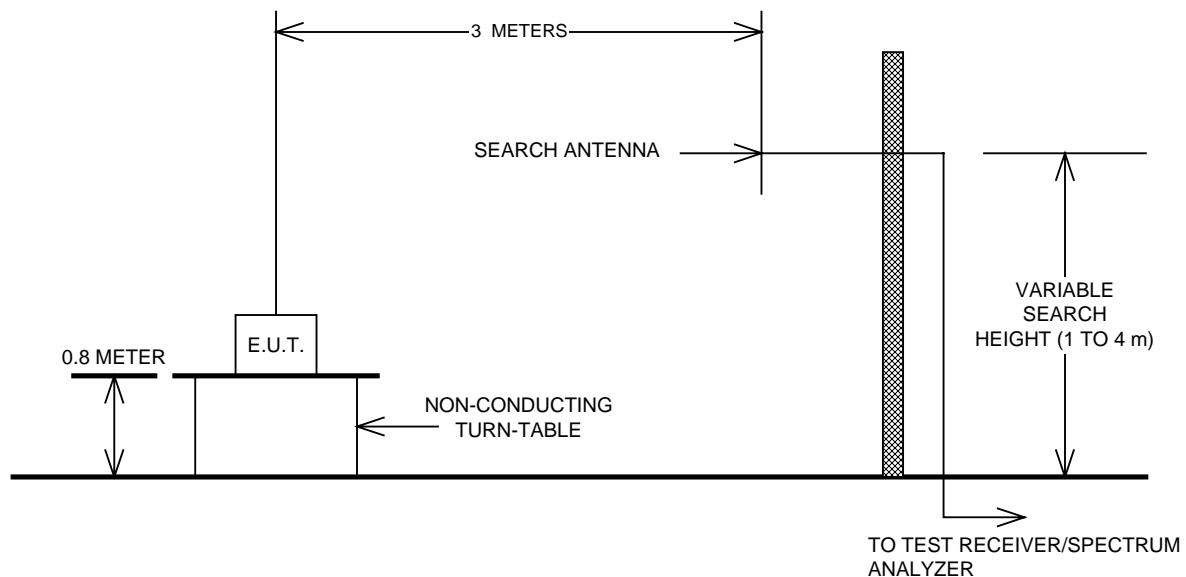




**Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**



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



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

