| | |
|---|---|
| **Nemko Test Report:** | 10215925RUS1 |
| **Applicant:** | Fiber-Span<br>3434 Rte. 22W<br>Suite 140<br>Branchburg, NJ 08876 |
| **Equipment Under Test:**<br>**(E.U.T.)** | FS31R-15C<br>FCC ID.: Q4VFS31-15C |
| **In Accordance With:** | **CFR 47 Part 90, Subpart I**<br>Private Land Mobile Repeater |
| **Tested By:** | Nemko USA Inc.<br>802 N. Kealy<br>Lewisville, TX 75057-3136 |

**TESTED BY:** _____ **DATE:** **03 April 2012**

David Light, Senior Wireless Engineer

**APPROVED BY:** _____ **DATE:** **05 April 2012**

Mike Cantwell

**Number of Pages: 26**

# Table of Contents

## Section 1. Summary of Test Results

Manufacturer: Fiber-Span

Model No.: FS31R-15C

Serial No.: A2811-1-1

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.

☒ 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

**Summary Of Test Data**

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

**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.

Changes to report Rev1: FCC ID. added to cover.

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## Section 2. General Equipment Specification

**Transmitter**

**Supply Voltage Input:** 110 Vac

**Frequency Range:** 169-175 MHz

**Type(s) of Modulation:**

| F3E (Voice) | F1D | F2D | D7W (QAM) | Other |
|---|---|---|---|---|
| ☒ | ☒ | ☒ | ☐ | ☐ |

**Gain:** 45 dB

**Output Impedance:** 50 ohms

**RF Power Output (rated):** 4.0 W
36.0 dBm

**Channel Spacing(s):** 12.5 kHz

**Operator Selection of Operating Frequency:** Full band coverage

**Power Output Adjustment Capability:** None

**Frequency Translation:**

| F1-F1 | F1-F2 | N/A |
|---|---|---|
| ☒ | ☐ | ☐ |

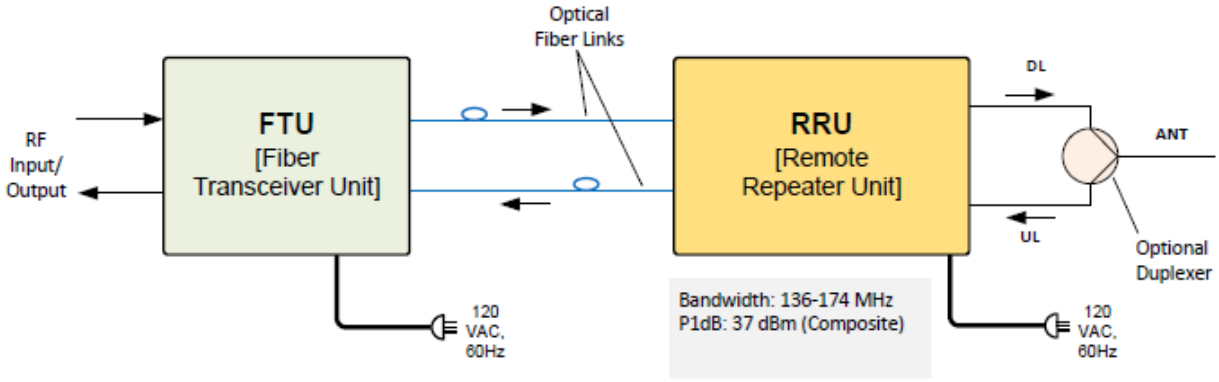
**Band Selection:**

| Software | Duplexer Change | Fullband Coverage |
|---|---|---|
| ☐ | ☐ | ☒ |

## Description of EUT

The VHF fiber optic remote repeater unit is a bi-directional RF amplifier (also called booster) is utilized for receiving downlink optical input signals from a single mode fiber medium which in turn converts back to its original RF signals, that filters, tuned for best selectivity in the specifiedbandwidth while rejecting outside of the bandwidth.

## System Diagram



## Section 3. RF Power Output

| | |
|---|---|
| NAME OF TEST: RF Power Output | PARA. NO.: 2.985 |
| TESTED BY: David LightTom Tidwell & Debbie Jensen | DATE: 03 April 2012 |

**Test Results:** Complies.

**Measurement Data:**

| Direction | Modulation | Output per Channel (dBm) | Composite Power (dBm) | Composite Power (W) |
|---|---|---|---|---|
| Uplink | Analog | NA | NA | NA |
| Downlink | Analog | +33 | +36 | 4.0 |

**Equipment Used:** 1036-1082-1472-1469

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

**Temperature:** 22 °C

**Relative Humidity:** 49 %

## Section 4. Occupied Bandwidth

| | |
|---|---|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 2.989 |
| TESTED BY: David LightTom Tidwell & Debbie Jensen | DATE: 03 April 2012 |

**Test Results:** Complies.

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

**Equipment Used:** 1036-1082-1472-1469

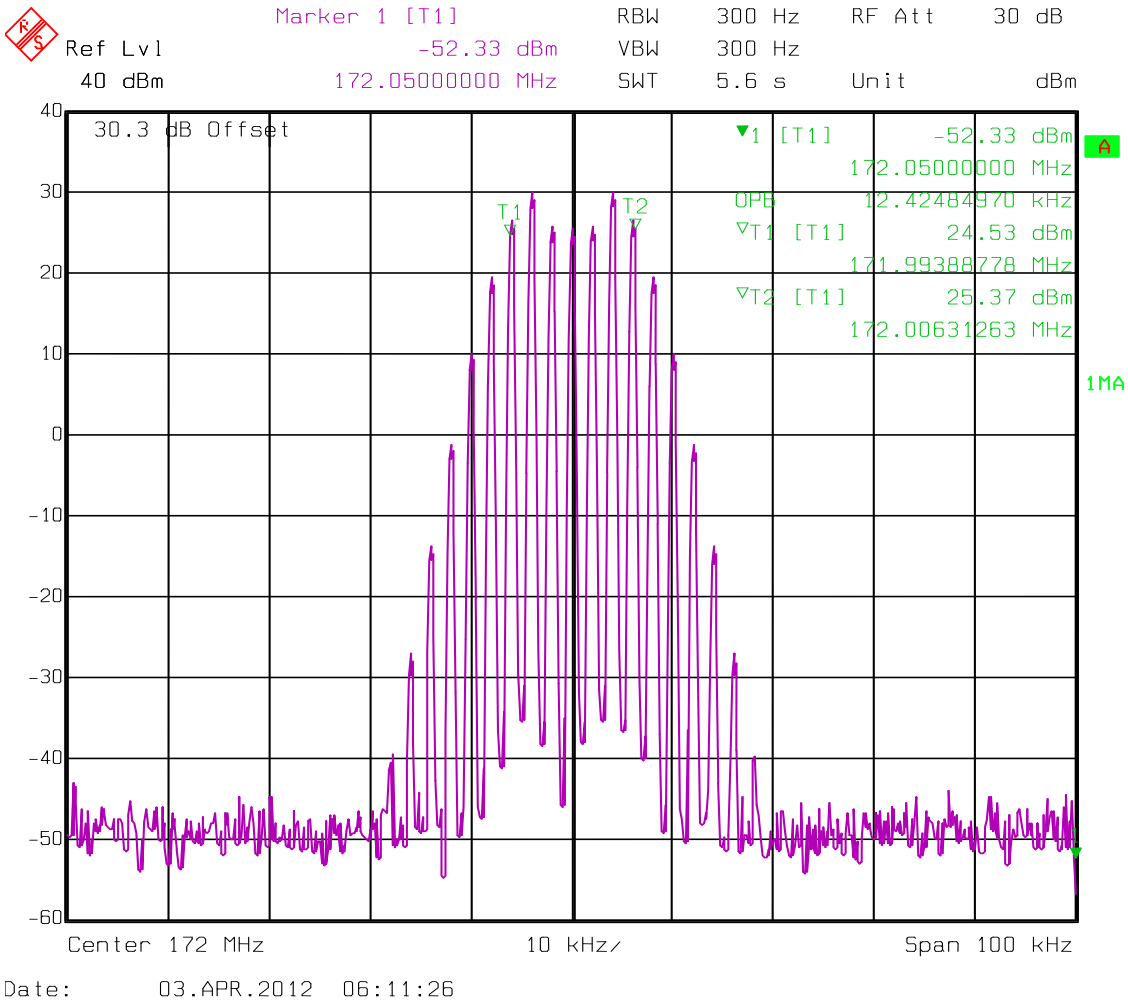
**Measurement Uncertainty:** $1X10^{-7}$ ppm

**Temperature:** 22 °C

**Relative Humidity:** 49 %

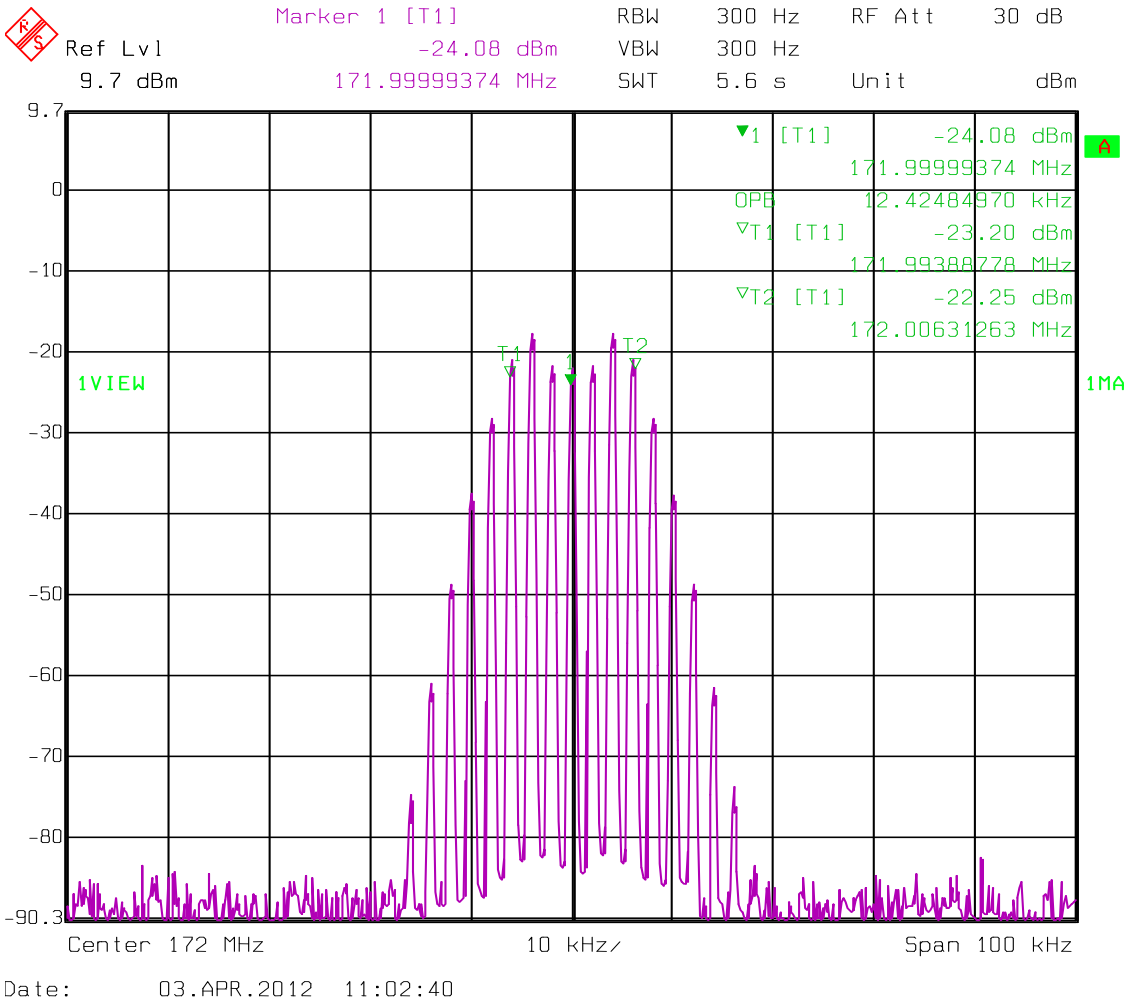
## Test Data – Occupied Bandwidth

Analog - Output



## Test Data – Occupied Bandwidth

Analog - Input



## Section 5. Spurious Emissions at Antenna Terminals

| | |
|---|---|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 2.991 |
| TESTED BY: David LightTom Tidwell & Debbie Jensen | DATE: 03 April 2012 |

**Test Results:** Complies.

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

**Equipment Used:** 1036-1082-1472-1469

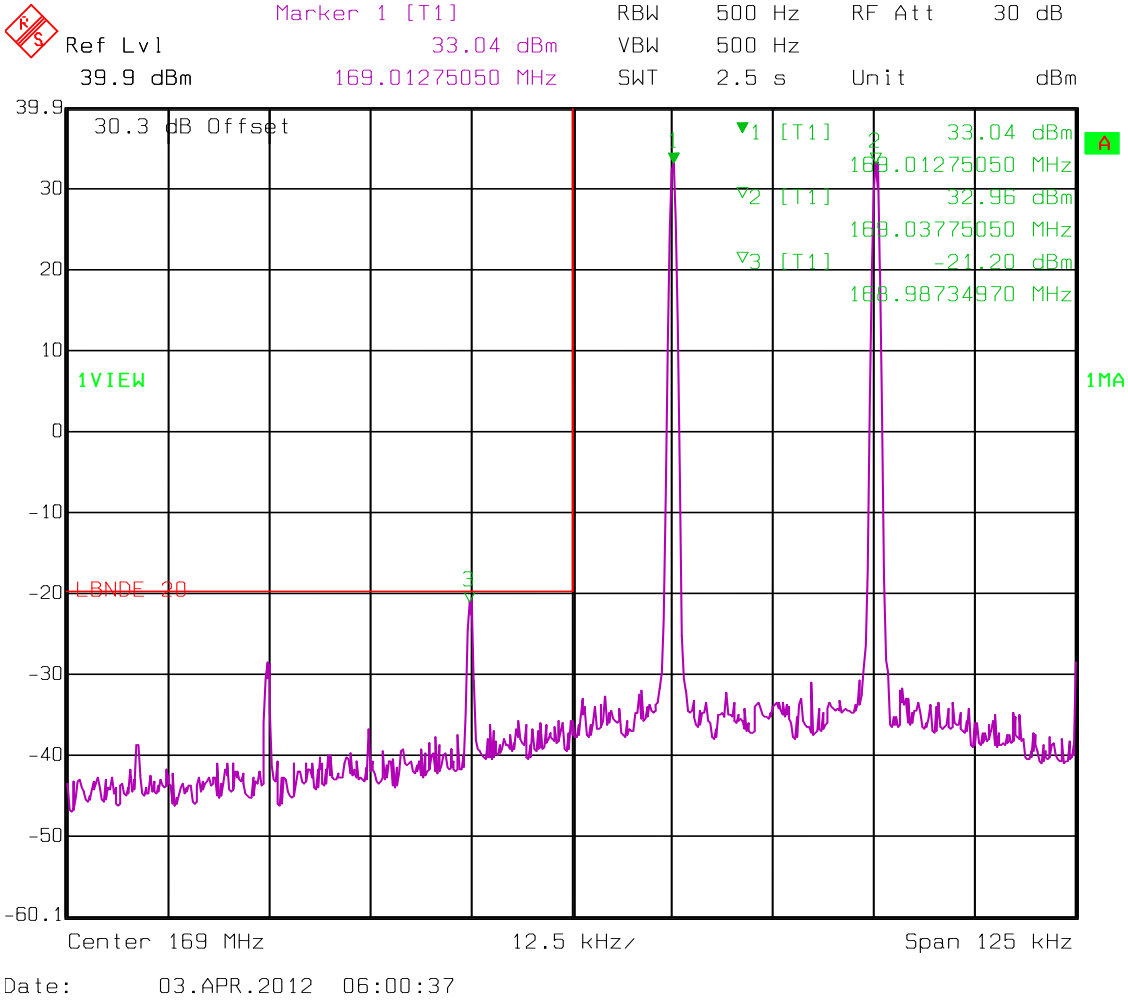
**Measurement Uncertainty:** +/- 1.7 dB

**Temperature:** 22 °C

**Relative Humidity:** 49 %

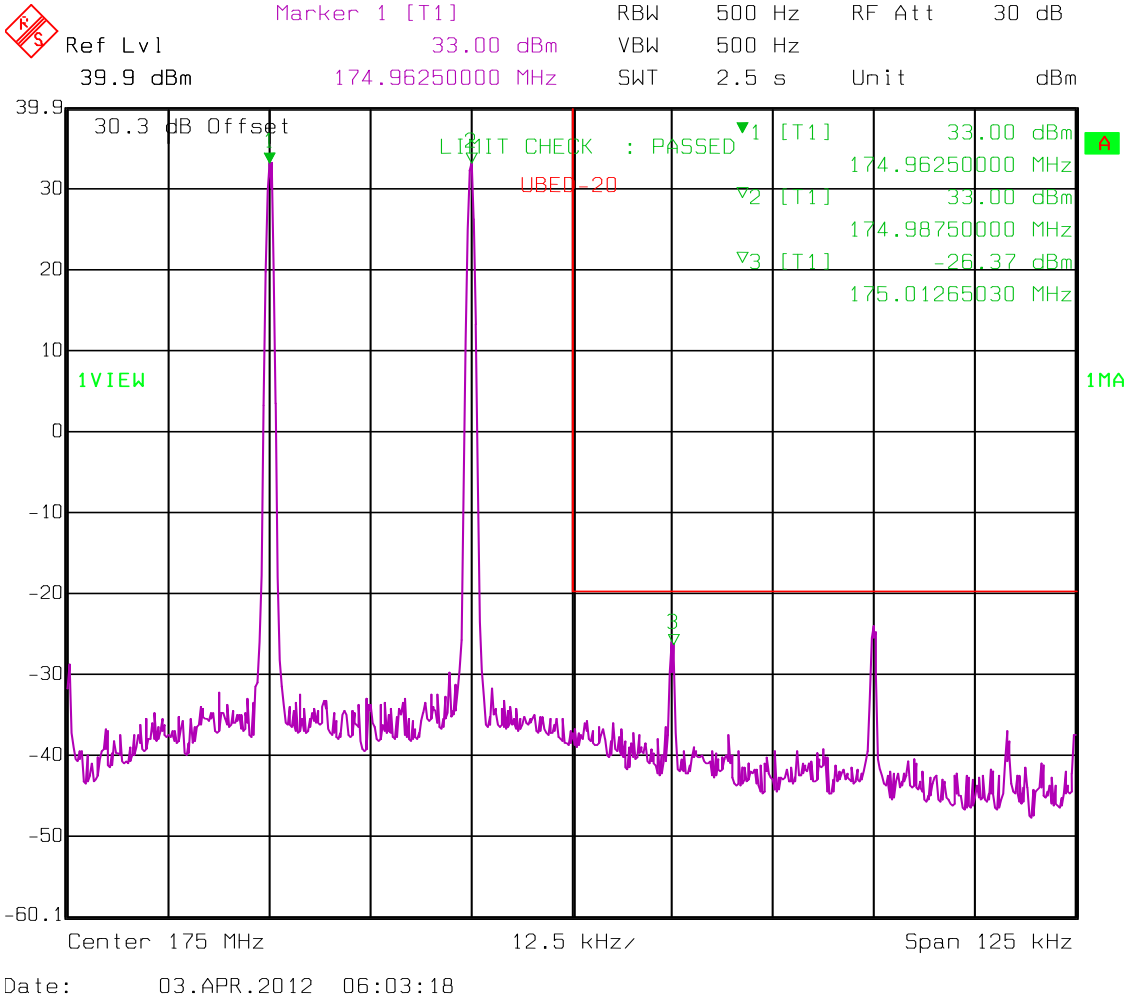
## Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation
Analog
Downlink



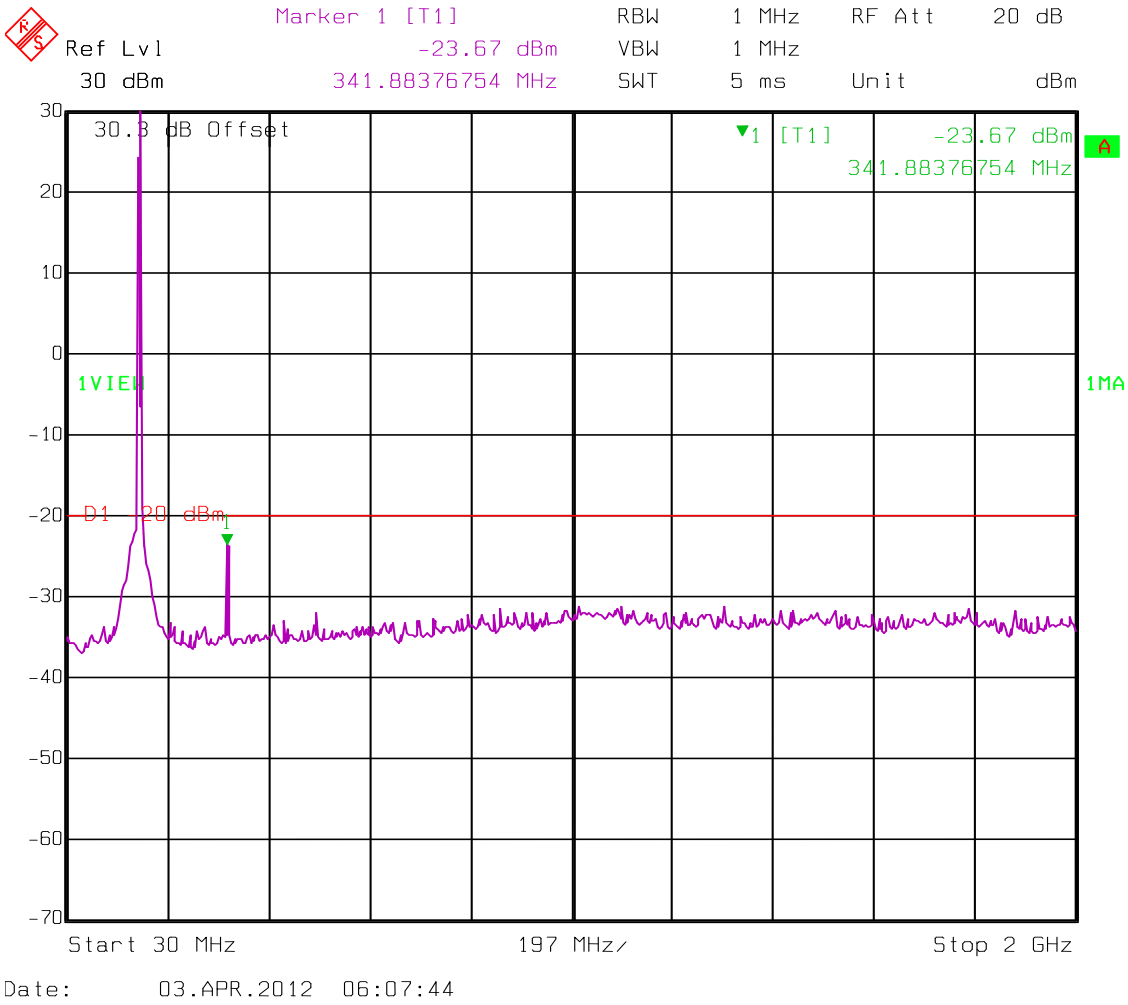
## Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation
Analog
Downlink



## Test Data – Spurious Emissions at Antenna Terminals

Spurs – Analog - Downlink



## Section 6. Field Strength of Spurious Emissions

| | |
|---|---|
| NAME OF TEST: Field Strength of Spurious Emissions | PARA. NO.: 2.993 |
| TESTED BY: David LightTom Tidwell & Debbie Jensen | DATE: 03 April 2012 |

**Test Results:** Complies.

**Test Data:** There were no emissions detected within 20 dB of the specification limit of 50 + 10 log (P) dB (*Mask 90.210(d)*) therefore none are reported. The spectrum was searched from 30 MHz to 2 GHz.

RBW/VBW = 1 MHz

**Equipment Used:** 1464-1783-1025-1480-1016-993

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

**Temperature:** 22 °C

**Relative Humidity:** 49 %

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

## Section 7. Test Equipment List

| Asset Tag | Description | Manufacturer | Model | Serial # | Last Cal | Next Cal |
|---|---|---|---|---|---|---|
| 993 | Antenna, Horn | A.H. Systems | SAS-200/571 | 162 | 22-Sep-2011 | 22-Sep-2013 |
| 1016 | Preamplifier | Hewlett Packard | 8449A | 2749A00159 | 20-Jul-2011 | 20-Jul-2012 |
| 1025 | Preamplifier, 25dB | Nemko USA, Inc. | LNA25 | 399 | 27-Feb-2012 | 27-Feb-2013 |
| 1036 | Spectrum Analyzer | Rohde & Schwartz | FSEK30 | 830844/006 | 23-Dec-2011 | 23-Dec-2013 |
| 1082 | Cable, 2m | Astrolab | 32027-2-29094-72TC | | N/R | |
| 1464 | Spectrum Analyzer | Hewlett Packard | 8563E | 3551A04428 | 16-May-2011 | 16-May-2013 |
| 1469 | Attenuator | MCL Inc. | BW-S10W2 | | N/R | |
| 1472 | Attenuator, | Omni Spectra | 20600-20db | | N/R | |
| 1480 | Antenna, Bilog | Schaffner-Chase | CBL6111C | 2572 | 07-Feb-2012 | 07-Feb-2013 |
| 1783 | Cable Assy, | Nemko | Chamber | | 26-Sep-2011 | 26-Sep-2012 |

# ANNEX A - TEST METHODOLOGIES

| **NAME OF TEST: RF Power Output** | **PARA. NO.: 2.985** |
|---|---|

**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.: 2.991**

**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 dBμV/m@3m | 82.2 dBμV/m@3m |
| D,J | -20dBm | 77.4 dBμV/m@3m | 75.2 dBμV/m@3m |
| E,F,K | -25dBm | 72.4 dBμV/m@3m | 70.2 dBμV/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.

**NAME OF TEST: Occupied Bandwidth** **PARA. NO.: 2.989**

**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.: 2.993**

**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.

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

**NAME OF TEST: Frequency Stability** **PARA. NO.: 2.995**

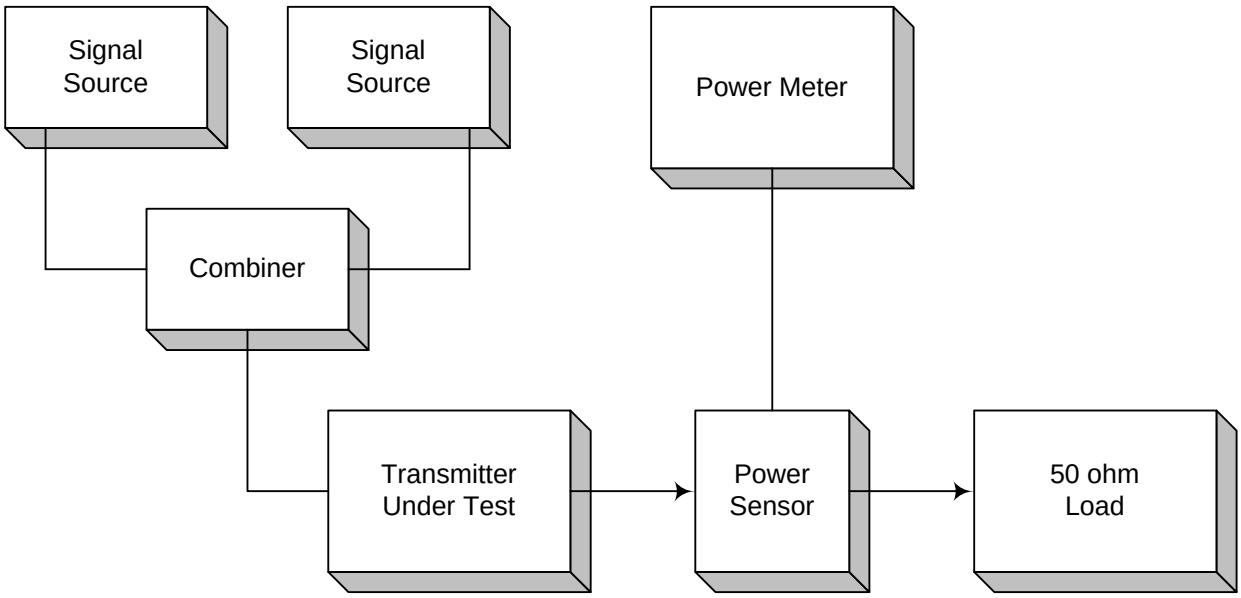
**Minimum Standard:** Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

**Table 2**

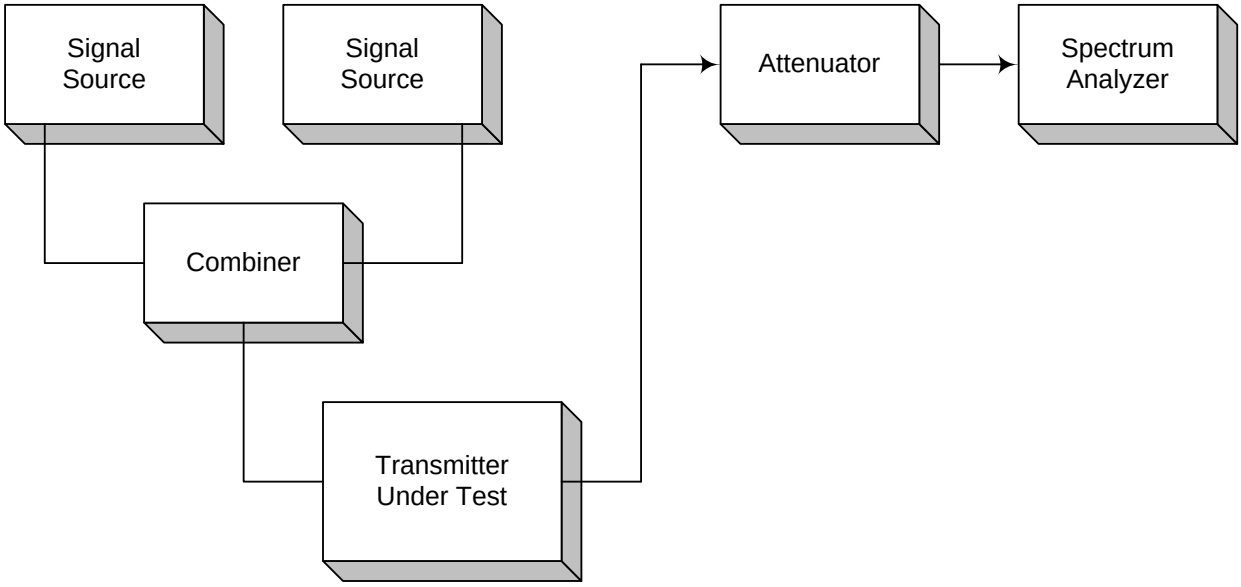
| Frequency Band (MHz) | Fixed And Base Stations | Mobile Stations | |
|---|---|---|---|
| | | > 2 Watts o/p pwr | < 2 Watts o/p pwr |
| Below 25 | 100 | 100 | 200 |
| 25 - 50 | 20 | 20 | 50 |
| 72 - 76 | 5 | - | 50 |
| 150 - 174 | 5 | 5 | 5 |
| 220 - 222 | 0.1 | 1.5 | 1.5 |
| 421 - 512 | 2.5 | 5 | 5 |
| 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

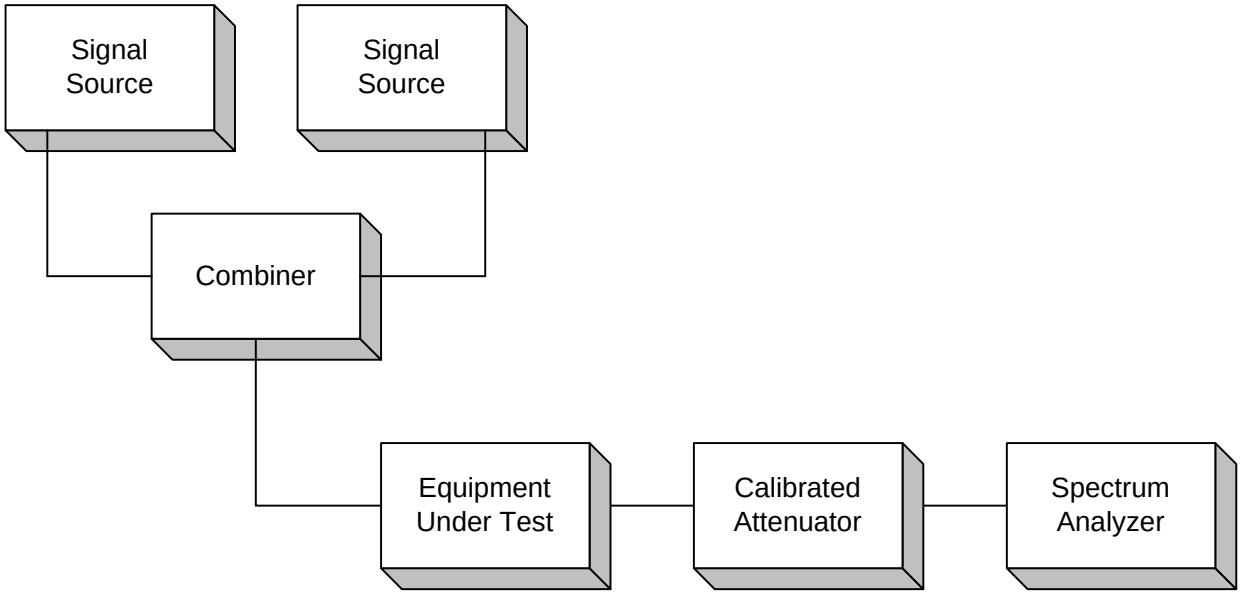
**Para. No. 2.985 - R.F. Power Output**



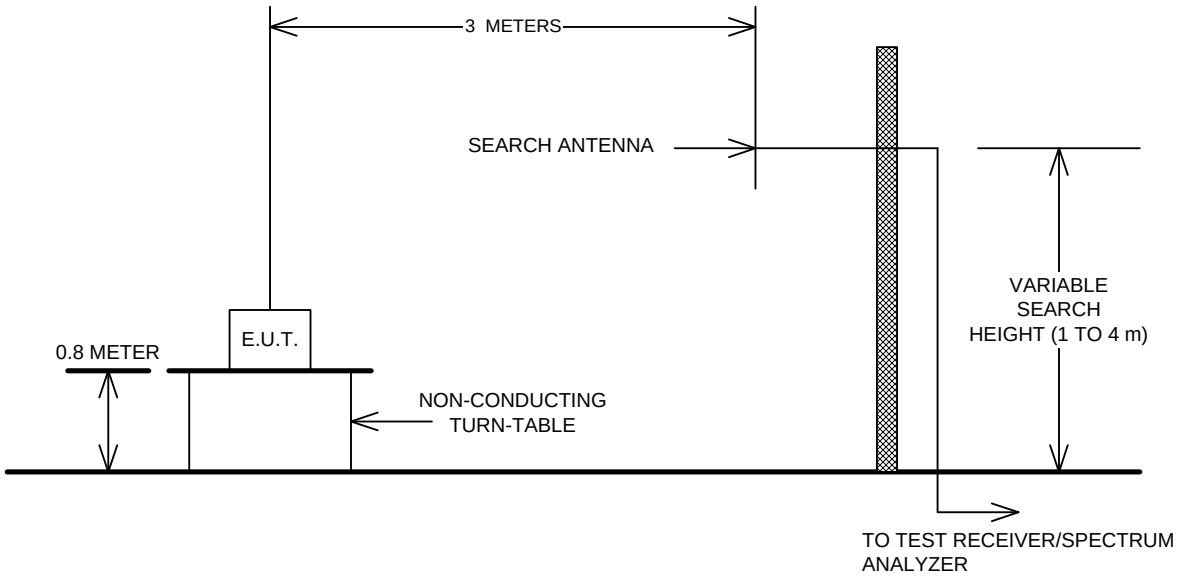

**Para. No. 2.989 - Occupied Bandwidth**



**Para. No. 2.991 - Spurious Emissions at Antenna Terminals**




**Para. No. 2.993 - Field Strength of Spurious Radiation**



**Para. No. 2.995 - Frequency Stability**