| | |
|---|---|
| **Nemko Test Report:** | 41771RUS1 |
| **Applicant:** | Tracciare, LLC<br>156 Alta Mesa Road<br>Fort Worth, TX 76108<br>USA |
| **Equipment Under Test: (E.U.T.)** | RF460 |
| **FCC Identifier:** | X4WRF460 |
| **IC Identifier:** | 8809A-RF460 |
| **In Accordance With:** | FCC Part 90, Subpart I & Industry Canada RSS-119, Issue 9, Private Land Mobile Transmitter |
| **Tested By:** | Nemko USA Inc.<br>802 N. Kealy<br>Lewisville, TX<br>75057-3136 |

TESTED BY: _____ DATE: 09 February 2010

David Light, Senior Wireless Engineer

APPROVED BY: _____ DATE: 15 February 2010

Tom Tidwell, Telecom Direct

**Total Number of Pages: 33**

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## Section 1. Summary of Test Results

Manufacturer: Tracciare, LLC

Model No.: RF460

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 90, Subpart I and Industry Canada RSS-119.

☒ 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".

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**Summary of Test Data**

| NAME OF TEST | PARA. NO. | RESULT |
|---|---|---|
| RF Power Output | 90.205 | Complies |
| Audio Frequency Response | TIA EIA-603.3.2.6 | [1]NA |
| Audio Low-Pass Filter Response | TIA EIA-603.3.2.6 | [1]NA |
| Modulation Limiting | TIA EIA-603.3.2.6 | Complies |
| Occupied Bandwidth | 90.210 | Complies |
| Spurious Emissions at Antenna Terminals | 90.210 | Complies |
| Field Strength of Spurious Emissions | 90.210 | Complies |
| Frequency Stability | 90.213 | Complies |
| Transient Frequency Behavior | 90.214 | Complies |
| Receiver Spurious Emissions | RSS GEN | Complies |

**Footnotes:**

[1] The DUT has no audio components.

## Section 2. General Equipment Specification

| | |
|---|---|
| **Supply Voltage Input:** | 120 Vac |
| **Frequency Range:** | 450 to 470 MHz |
| **Necessary Bandwidth:** | 11.8 kHz<br>(2 x 3.5kHz) + (2 x (4800bps/2)) = 11.8 kHz |

**Type(s) of Modulation:**

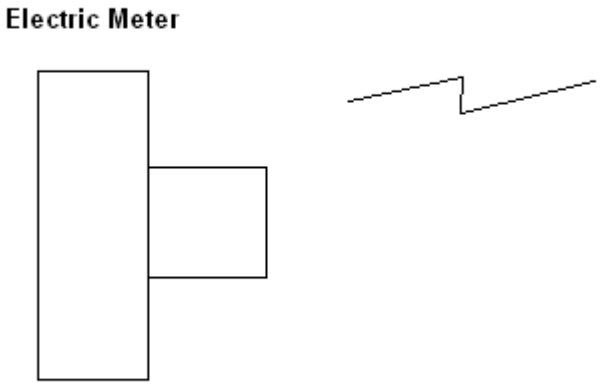
| F3E (Voice) | F1D | F2D | D7W (QAM) | Other |
|---|---|---|---|---|
| ☐ | ☒ | ☐ | ☐ | ☐ |

| | |
|---|---|
| **Emission Designator:** | 11K8F1D<br>(2 x 3.5kHz) + (2 x (4800bps/2)) = 11.8 kHz |
| **Output Impedance:** | 50 ohms |
| **RF Power Output (rated):** | 2.0 Watts |
| **Channel Spacing(s):** | 12.5 kHz |
| **Operator Selection of Operating Frequency:** | Factory set |
| **Power Output Adjustment Capability:** | None |

## System Description

The RF460 is a wireless transmitter for relaying power usage from electric power meters.

## System Diagram



## Section 3. RF Power Output

| | |
|---|---|
| NAME OF TEST: RF Power Output | PARA. NO.: 2.985 |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:**

| Frequency (MHz) | Measured Power (dBm) | Measured Power (Watts) | Rated Power (Watts) |
|---|---|---|---|
| 450.0125 | 33.00 | 2 | 2 |
| 460.0000 | 33.01 | 2 | 2 |
| 469.9875 | 33.01 | 2 | 2 |

Spectrum Analyzer Settings:

RBW: 1 MHz
VBW: 1 MHz
Detector: Max Peak

**Measurement Conditions:**

Temperature: 22 °C
Humidity: 31 %

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

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

## Section 4. Modulation Characteristics

| | |
|---|---|
| NAME OF TEST: Modulation Characteristics | PARA. NO.: 2.987 |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:** Maximum deviation for non-voice modulation 3.5 kHz.

Limit: 12 kHz

**Measurement Conditions:** Temperature: 22 °C
Humidity: 45 %

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

**Description of modulation:** FM

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

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

## Section 5. Occupied Bandwidth

| | |
|---|---|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 2.989 |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

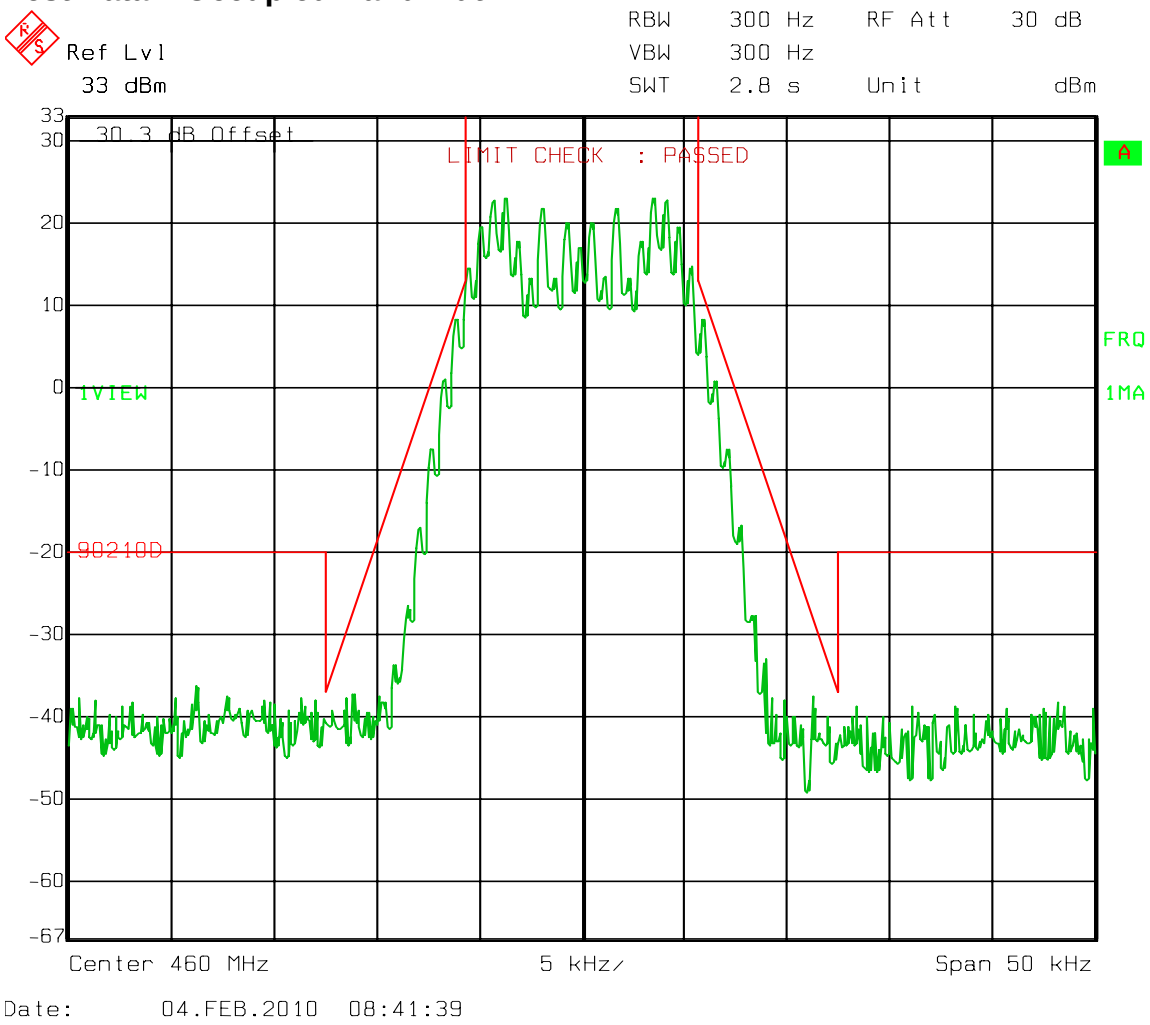
**Measurement Data:** Attached

**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

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

Note: The data presented is representative of the worst-case of low, mid, and high frequency channels (450.0125 MHz, 460.0000 MHz, and 469.0875 MHz).

## Test Data – Occupied Bandwidth



## Section 6. Spurious Emissions at Antenna Terminals

| | |
|---|---|
| NAME OF TEST: Spurious Emissions @ Antenna Terminals | PARA. NO.: 2.991 |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:** See attached data

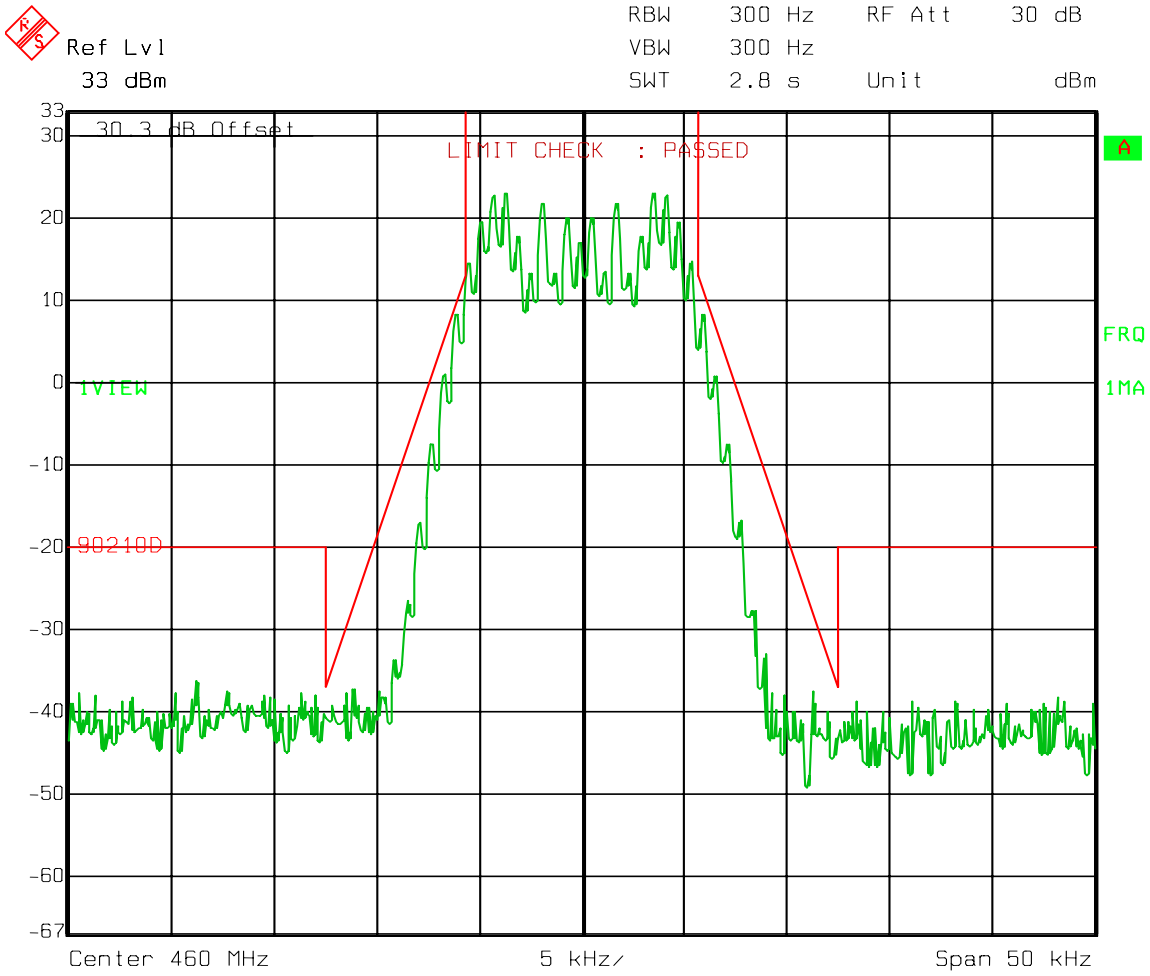
**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

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

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

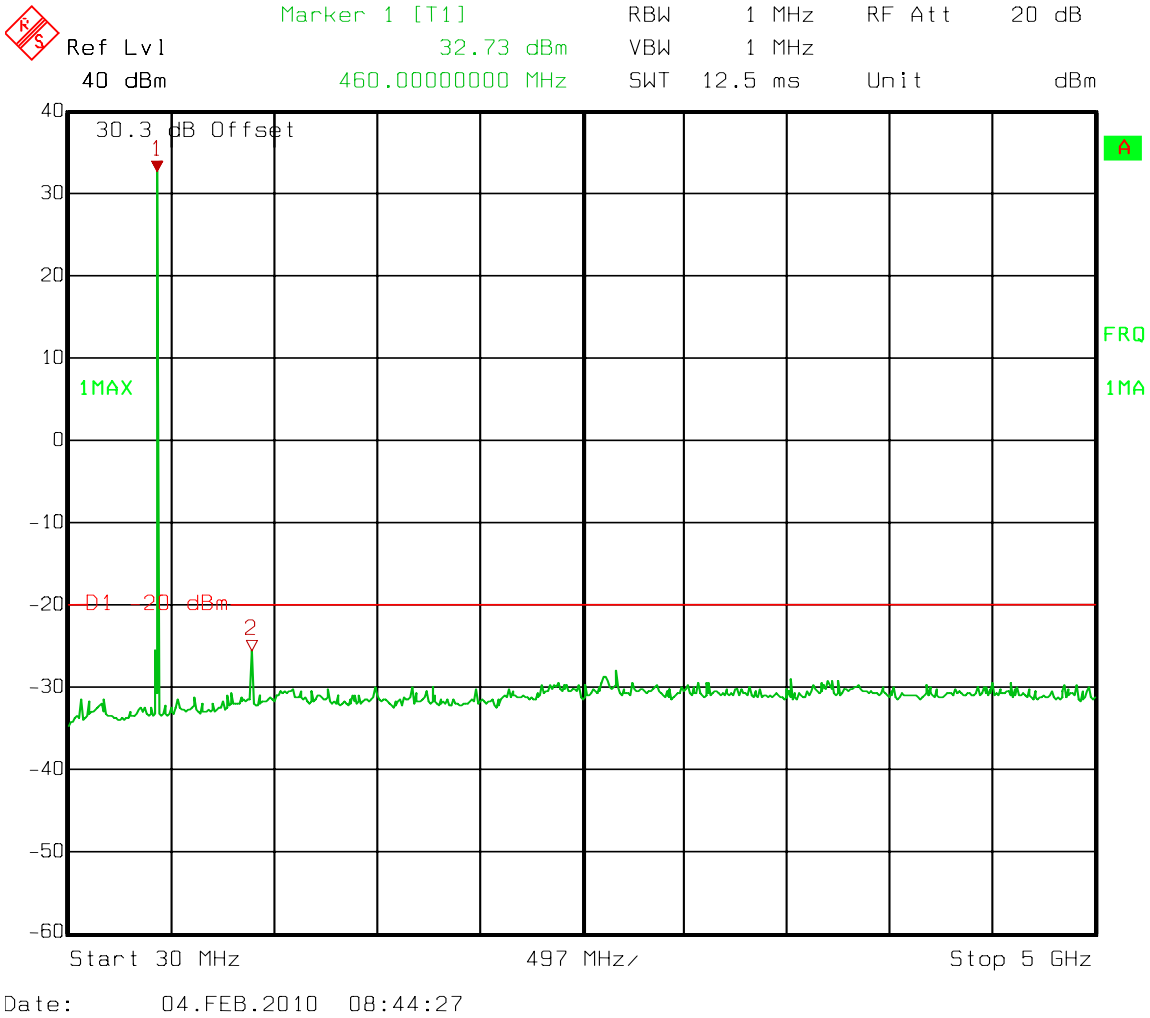
Note: The data presented is representative of the worst-case of low, mid, and high frequency channels (450.0125 MHz, 460.0000 MHz, and 469.0875 MHz).

## Test Data – Spurious Emissions at Antenna Terminals




Date: 04.FEB.2010 08:41:39

## Test Data – Spurious Emissions at Antenna Terminals




Date: 04.FEB.2010 08:44:27

## Section 7. Field Strength of Spurious Emissions

| | |
|---|---|
| NAME OF TEST: Field Strength of Spurious Emissions | PARA. NO.: 2.993 |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:** There were no emissions observed within 20 dB of the specification limit of -20 dBm.

The spectrum was searched from 30 to 5000 MHz.

| | | |
|---|---|---|
| Below 1000 MHz | RBW=VBW=100 kHz | Peak detector |
| Above 1000 MHz | RBW=VBW=1 MHz | Peak detector |

**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

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

**Test Equipment Used:** 1464-1484-1485-1016-993-1480-791

## Section 8. Frequency Stability

| | |
|---|---|
| NAME OF TEST: Frequency Stability | PARA. NO.: 2.995 |
| TESTED BY: David Light | DATE: 05 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:** See attached data

**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

**Test Equipment Used:** 1036-1082-1469-1472-283

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

## Test Data – Frequency Stability

Measurement Uncertainty: $1x10^{-17}$ppm **Reference Frequency** **460.004441** **MHz**

| Temp (°C) | Measured Frequency (MHz) | | Test Voltage | Freqeuncy Error (Hz) | Limit (+/-Hz) | Error (ppm) | Comment |
|---|---|---|---|---|---|---|---|
| 20 | 460.004441 | | 120 | 0 | 1150.0 | 0.000 | |
| 20 | 460.004441 | | 102 | 0 | 1150.0 | 0.000 | |
| 20 | 460.004441 | | 138 | 0 | 1150.0 | 0.000 | |
| | | | | | | | |
| 50 | 460.003915 | | 120 | -526 | 1150.0 | -1.143 | |
| 40 | 460.004203 | | 120 | -238 | 1150.0 | -0.517 | |
| 30 | 460.004360 | | 120 | -81 | 1150.0 | -0.176 | |
| | | | | | | | |
| 10 | 460.004378 | | 120 | -63 | 1150.0 | -0.137 | |
| 0 | 460.004437 | | 120 | -4 | 1150.0 | -0.009 | |
| -10 | 460.004451 | | 120 | 10 | 1150.0 | 0.022 | |
| -20 | 460.004331 | | 120 | -110 | 1150.0 | -0.239 | |
| -30 | 460.004300 | | 120 | -141 | 1150.0 | -0.307 | |

Notes:

Limit +/- 2.5 ppm

## Section 9. Transient Frequency Behavior

| | |
|---|---|
| NAME OF TEST: Transient Frequency Behavior | PARA. NO.: 90.214 |
| TESTED BY: David Light | DATE: 05 February 2010 |

**Measurement Results:** Complies.

**Measurement Data:** See attached data

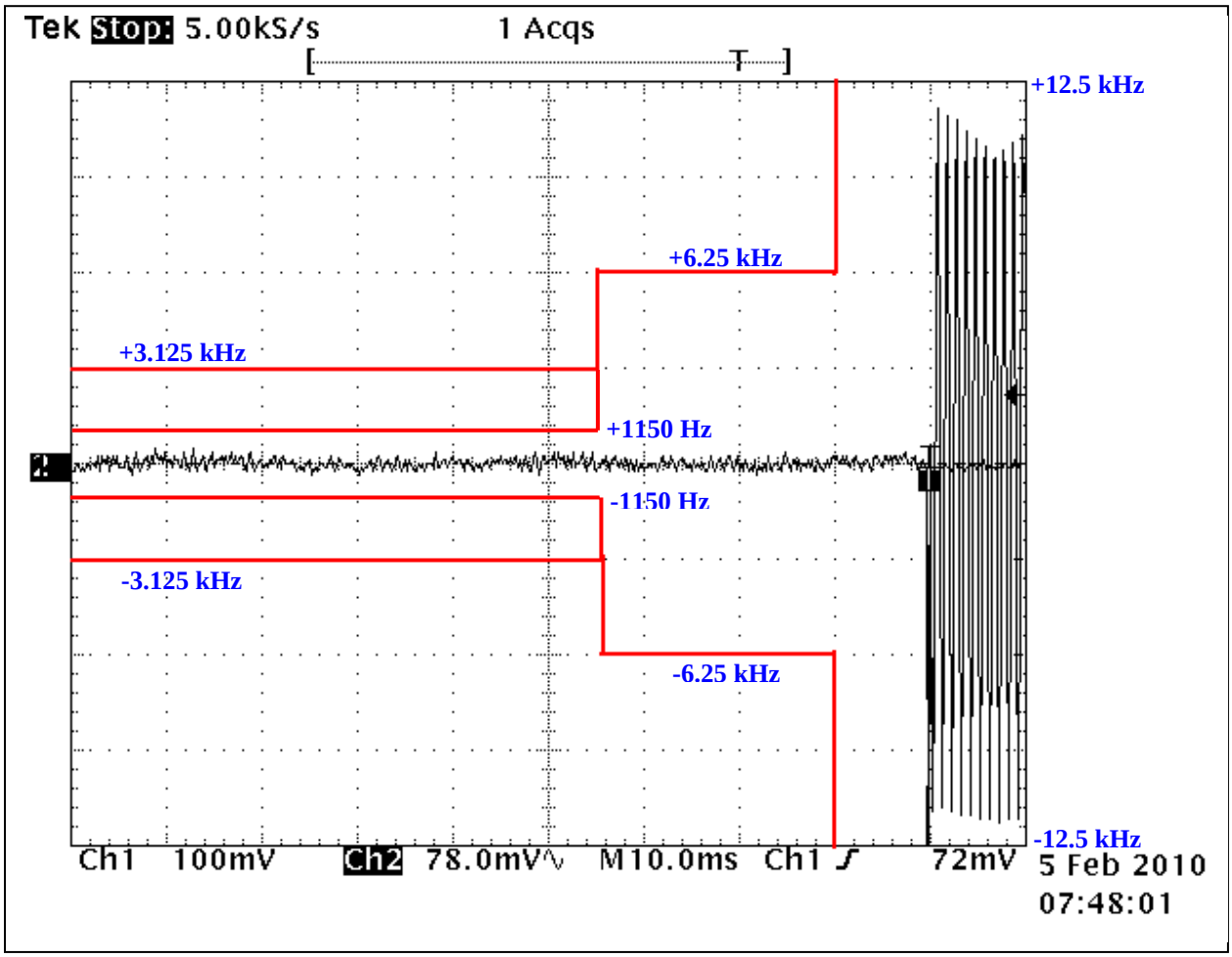
**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

**Test Equipment Used:** 1463-1082-1054-1093

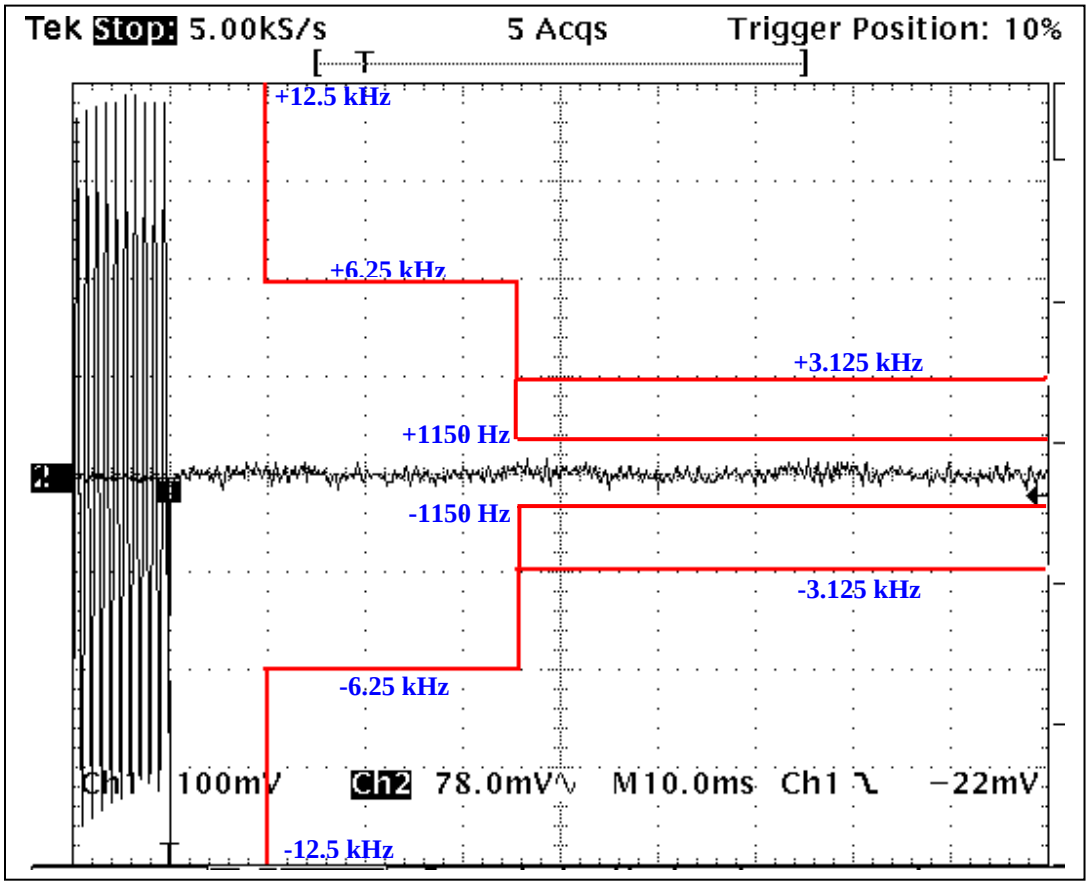
**Measurement Uncertainty:** +/- $1X10^{-7}$ ppm

**Test Data – Transient Frequency Behavior**

## RF OFF CONDITION



## RF OFF CONDITION



## Section 10. Receiver Spurious Emissions at Antenna Terminals

| | |
|---|---|
| NAME OF TEST: Receiver Spurious Emissions | PARA. NO.: RSS GEN |
| TESTED BY: David Light | DATE: 04 February 2010 |

**Measurement Results:** Complies.

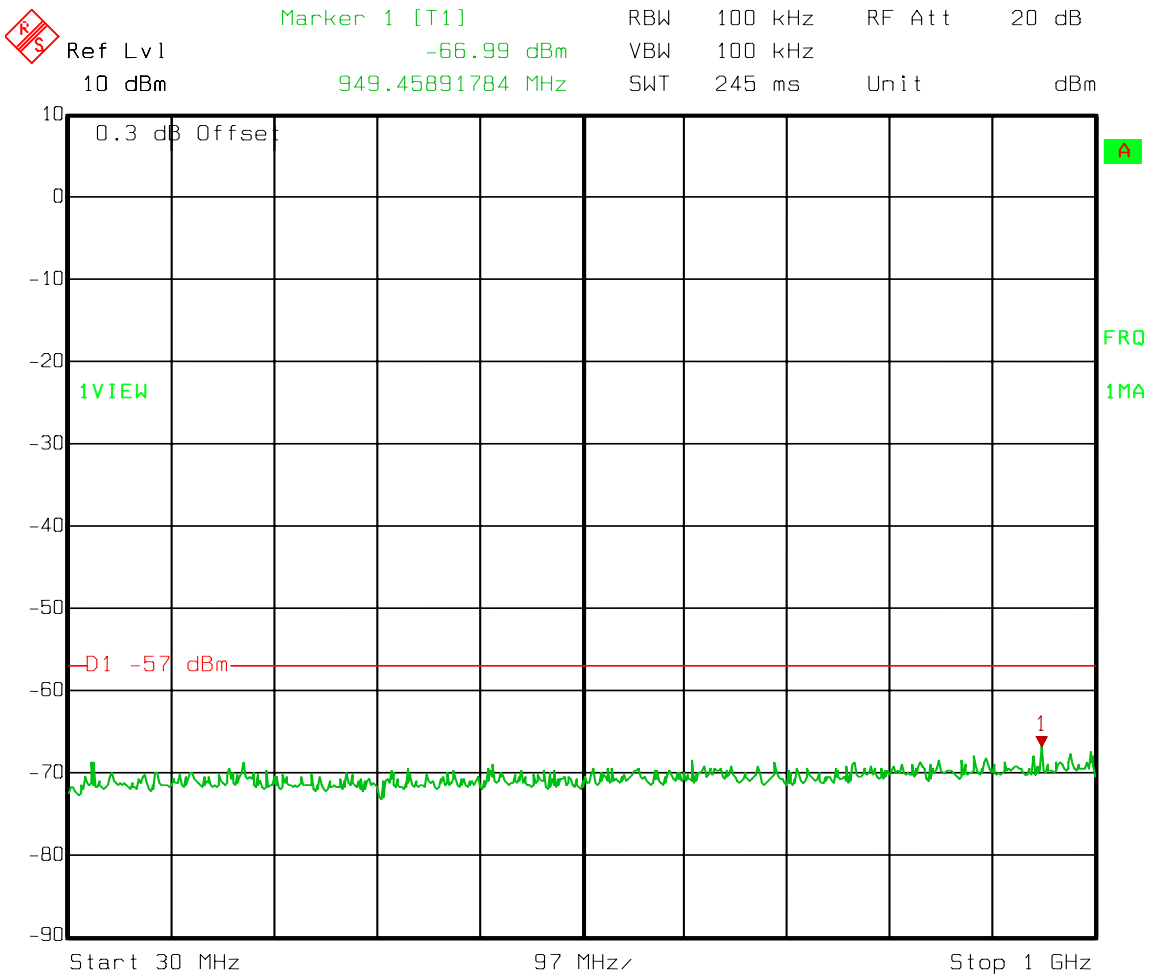
**Measurement Data:** See attached data

**Measurement Conditions:** Temperature: 22 °C
Humidity: 31 %

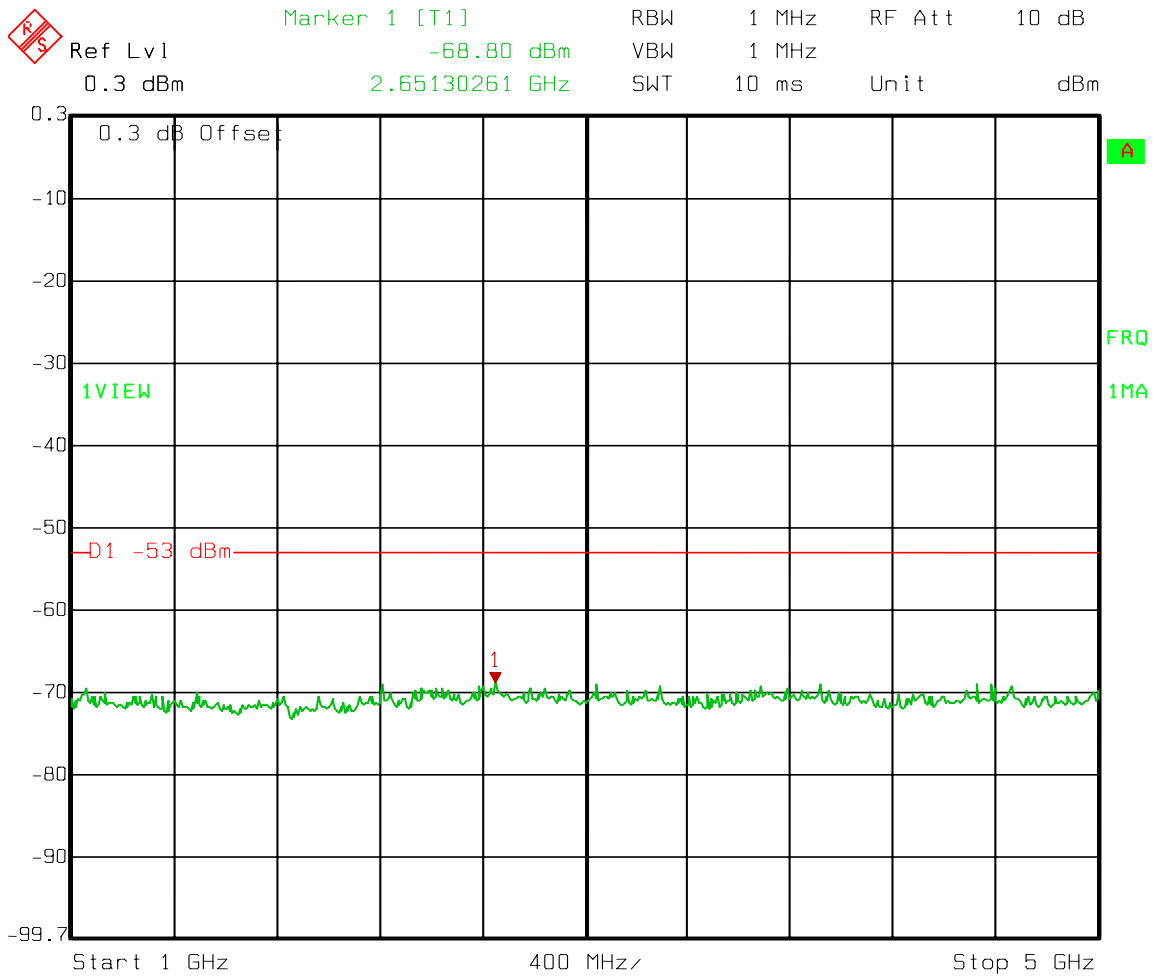
**Measurement Uncertainty:** +/- 1.7 dB

**Test Equipment Used:** 1036-1082

**Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.**




Date: 04.FEB.2010 08:48:02




Date: 04.FEB.2010 08:49:35

## Section 11. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|---|---|---|---|---|---|
| 1036 | SPECTRUM ANALYZER | ROHDE & SCHWARZ FSEK30 | 830844/006 | 01/19/09 | 01/20/11 |
| 1082 | CABLE 2m | Astrolab 32027-2-29094-72TC | N/A | CBU | N/A |
| 1469 | 10 db Attenuator DC 18 Ghz | MCL Inc. BW-S10W2 10db-2WDC | NONE | CBU | N/A |
| 1472 | 20db Attenuator DC 18 Ghz | Omni Spectra 20600-20db | NONE | CBU | N/A |
| 1464 | Spectrum analyzer | Hewlett Packard 8563E | 3551A04428 | 02/27/09 | 02/28/11 |
| 1484 | Cable | Storm PR90-010-072 | N/A | 06/23/09 | 06/23/10 |
| 1485 | Cable | Storm PR90-010-216 | N/A | 06/23/09 | 06/23/10 |
| 1016 | Pre-Amp | HEWLETT PACKARD 8449A | 2749A00159 | 06/23/09 | 06/23/10 |
| 993 | Horn antenna | A.H. Systems SAS-200/571 | XXX | 09/09/09 | 09/09/11 |
| 1480 | Bilog Antenna | Schaffner-Chase CBL6111C | 2572 | 01/18/10 | 01/18/11 |
| 791 | PREAMP, 25dB | Nemko USA, Inc. LNA25 | 398 | 05/28/09 | 05/28/10 |
| 283 | Environmental Chamber with controller # 1189006 | ENVIROTRONICS SH27 & 2030-22844 | 129010083 | 10/06/09 | 10/06/10 |
| 1463 | Color 4 Ch Digitizing Oscilloscope | Tektronix TDS684A | B010460 | 06/17/09 | 06/17/10 |
| 1054 | DUAL DIRECTIONAL COUPLER | NARDA 3020A | 34366 | CBU | N/A |
| 1093 | COMBINER | MINI-CIRCUITS ZFSC-3-4 | NONE | CBU | N/A |

# 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 a spectrum analyzer with the IF bandwidth filter set to a level greater than the 20 dB bandwidth of the measured rf waveform. Power output is measured with the maximum rated input level.

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

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

**Minimum Standard:** Para. No. 90.210, see table 1 below for applicable mask.

**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 |

**Test Method:**

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

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

| **NAME OF TEST: Field Strength of Spurious** | **PARA. NO.: 2.993** |
|---|---|

**Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.

Field strength of spurious emission testing was performed using the substitution antenna method described in EIA/TIA IS-603C.

**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 | Mobile Stations < 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 | - | - | - |

**NAME OF TEST: Transient Frequency Behavior PARA. NO.: 2.214**

**Minimum Standard:**

**Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels**

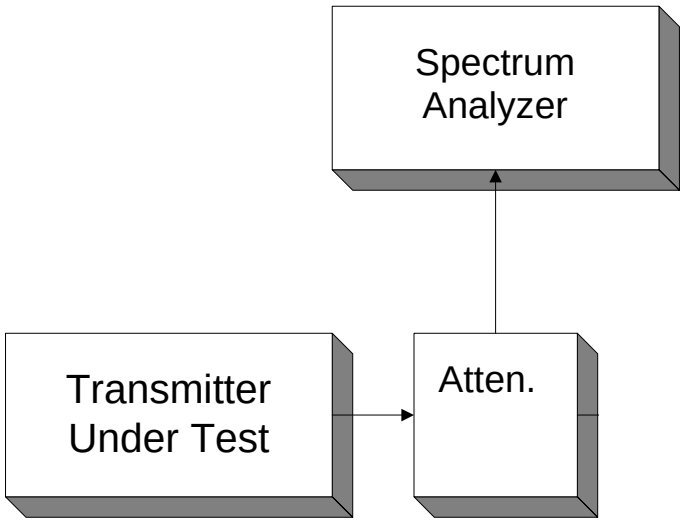
| | | Frequency ranges (MHz) All equipment | | | | | |
|---|---|---|---|---|---|---|---|
| | Maximum | Base station and portable radios | | | Mobile Radios | | |
| Time intervals [1,2] | Frequency difference[3] (kHz) | 150 - 174 (ms) | 450 - 500 (ms) | 500 - 512 (ms) | 150 - 174 (ms) | 450 - 500 (ms) | 500 - 512 (ms) |
| $t_1$[4] | ± 25 | 5.0 | 10.0 | 20.0 | 5.0 | 10.0 | 5.0 |
| $t_2$ | ± 12 | 20.0 | 25.0 | 50.0 | 20.0 | 25.0 | 20.0 |
| $t_3$[4] | ± 25 | 5.0 | 10.0 | 10.0 | 5.0 | 10.0 | 5.0 |

**Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels**

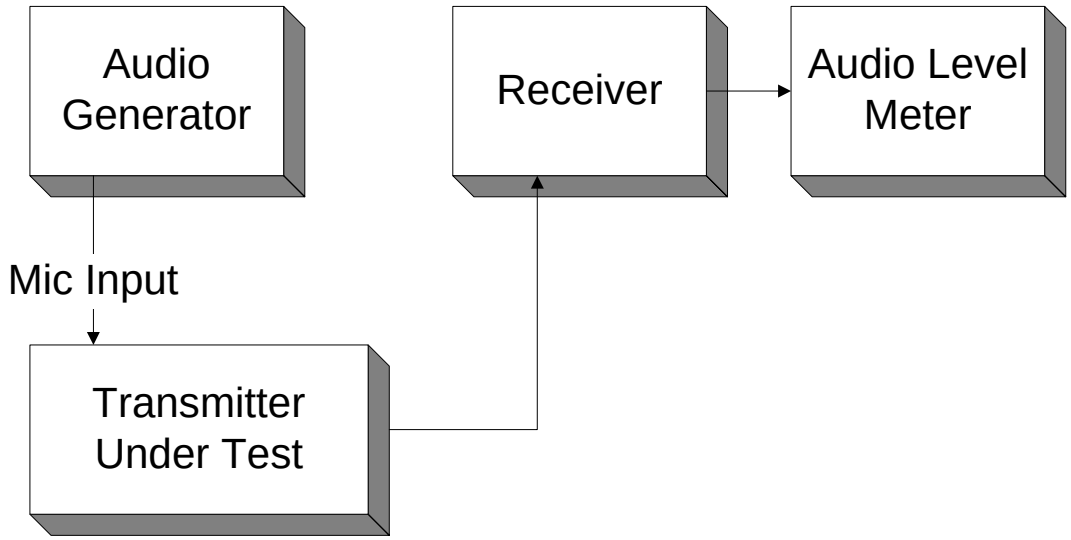
| | Maximum | Frequency ranges (MHz) All equipment | | |
|---|---|---|---|---|
| Time intervals [1,2] | Frequency difference[3] (kHz) | 150 - 174 (ms) | 450 - 500 (ms) | 500 - 512 (ms) |
| $t_1$[4] | ± 12.5 / ± 6.25 | 5.0 | 10.0 | 20.0 |
| $t_2$ | ± 6.25 / ± 3.125 | 20.0 | 25.0 | 50.0 |
| $t_3$[4] | ± 12.5 / ± 6.25 | 5.0 | 10.0 | 10.0 |

# ANNEX B - TEST DIAGRAMS

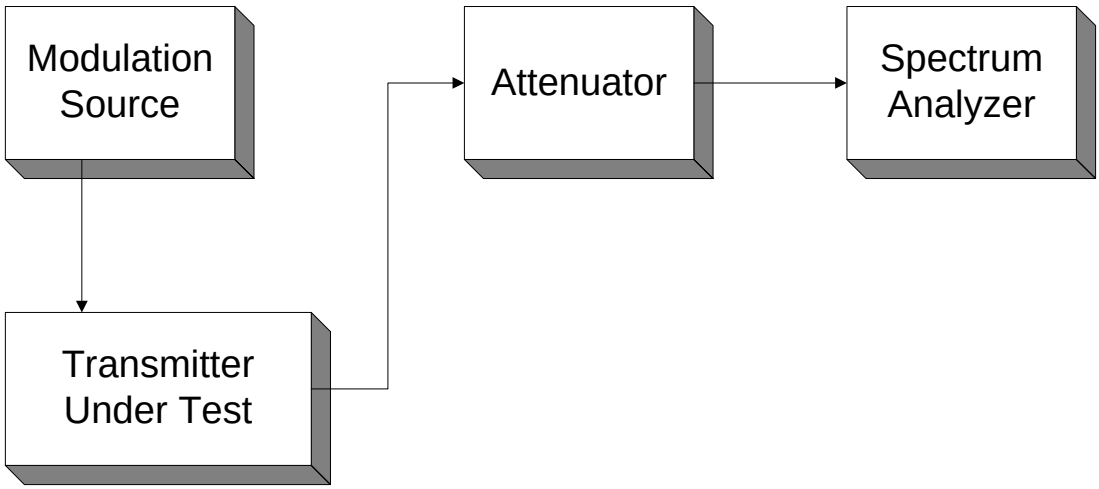
**Para. No. 2.985 - R.F. Power Output**



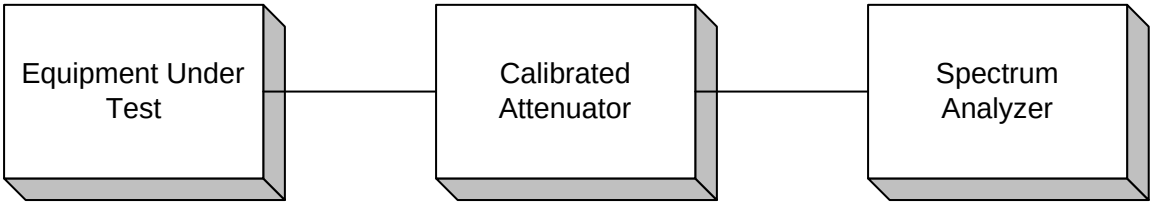
**Para. No. 2.987(b) - Modulation Limiting**



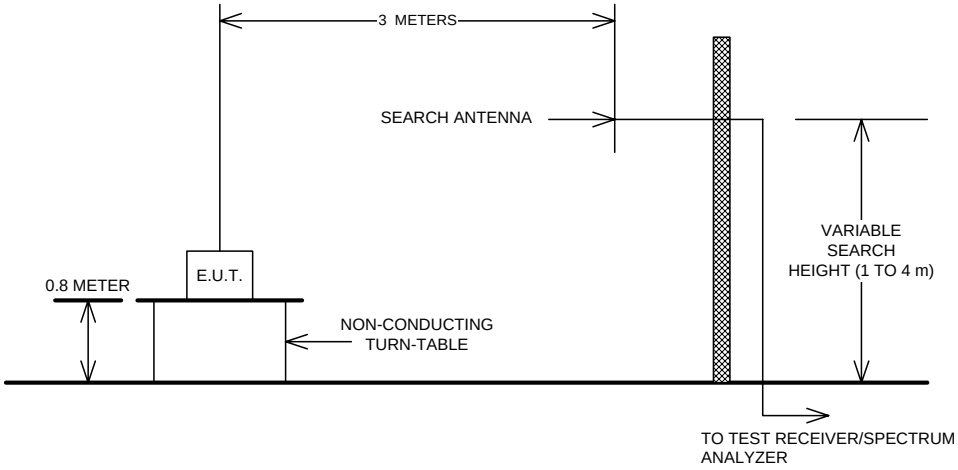

**Para. No. 2.989 - Occupied Bandwidth**



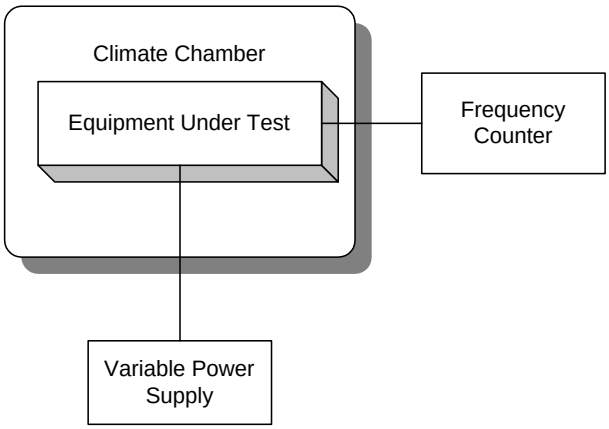
## Para. No. 2.991 - Spurious Emissions at Antenna Terminals



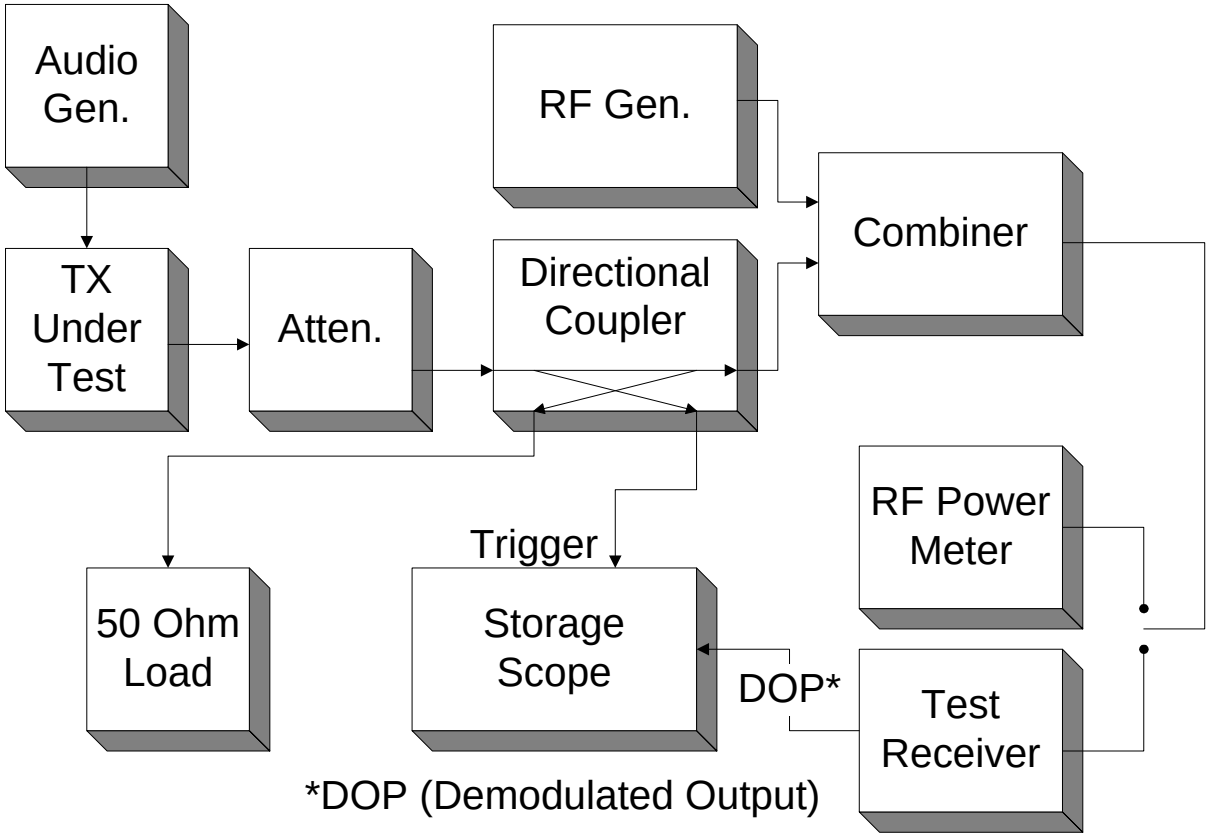

## Para. No. 2.993 - Field Strength of Spurious Radiation




## Para. No. 2.995 - Frequency Stability



**Para. No. 90.214 - Transient Frequency Behavior**




**Voice**

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters
Para. no. 2.2.19 Transient Frequency Behavior (page no. 83).

**Data**

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behavior