

Nemko Test Report: 6L0013RUS2

Applicant: Andrew Corporation

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

FCC ID:

In Accordance With: **FCC Part 90, Subpart I**
Private Land Mobile 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

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EQUIPMENT: MR903D**PROJECT NO.: 6L0013RUS2**

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 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”.

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	90.205	≤ 5 Watts	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A
Occupied Bandwidth	90.210	Input/Output	
Spurious Emissions at Antenna Terminals	90.210	Plots	
Field Strength of Spurious Emissions	90.210		
Frequency Stability	90.213		
Transient Frequency Behavior	90.214	N/A	N/A

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.

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

.

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input: 120 Vac

Frequency Range: Uplink: 896.04 to 900.97 MHz

Frequency Range: Downlink: 935.04 to 939.97 MHz

Type of Modulation: Analog iDEN
Designator: (F8W/F1D) (GXW)

☒ ☒

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
iDEN	16	13	10	7

Frequency Translation: F1-F1 F1-F2 N/A

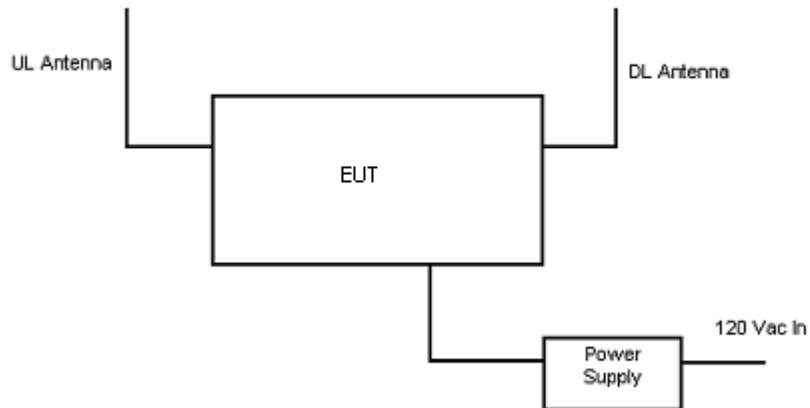
☒ ☐ ☐

Band Selection: Software Selector Switch Fullband Coverage

☐ ☐ ☒

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

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 90.205
TESTED BY: Kevin Rose	DATE: 17-31 JANUARY 2006:

Test Results: Complies**Measurement Data:****Test Equipment used:** 1036-1470-1478-1629-1659

Technology	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
iDEN uplink low	896.0125	16.1	16	.1
iDEN uplink mid	899	16.08	16	.08
iDEN uplink high	900.9875	16.17	16	.17
iDEN downlink low	935.0125	16.21	16	.21
iDEN downlink mid	937	16.13	16	.13
iDEN downlink high	939.9875	16.17	16	.17
Analog uplink low	896.0125	18.17	18	.17
Analog uplink mid	899	18.11	18	.11
Analog uplink high	900.9875	18.05	18	.05
Analog downlink low	935.0125	18.21	18	.21
Analog downlink mid	937	18.17	18	.17
Analog downlink high	939.9875	18.01	18	.01

Test Conditions: 22°C
40% RH

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 90.210
TESTED BY: KEVIN ROSE:	DATE: 17-31 JANUARY 2006:

Test Results: Complies

Test Data: See attached graph(s).

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

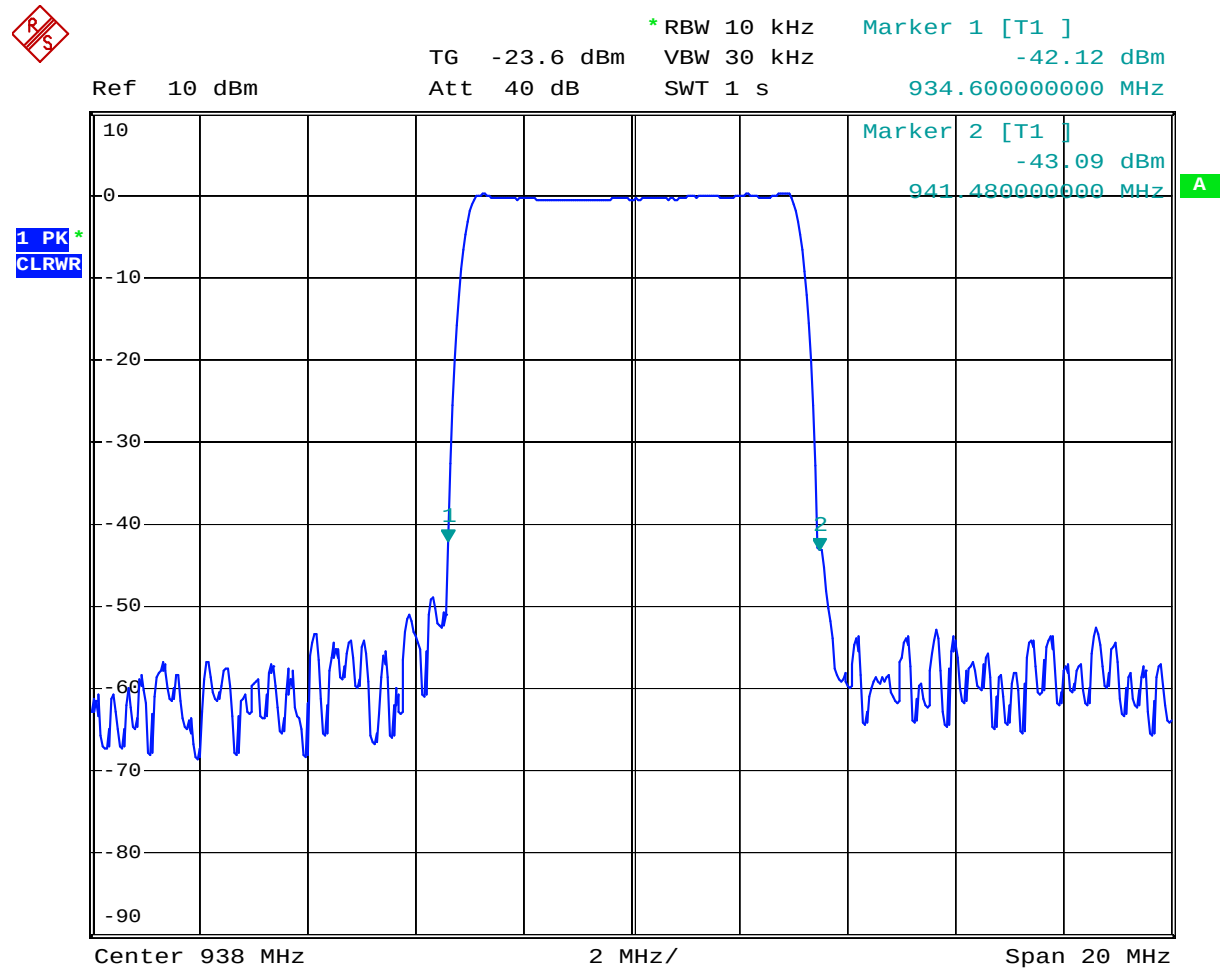
Test Conditions: 22°C

40% RH

EQUIPMENT: MR903D

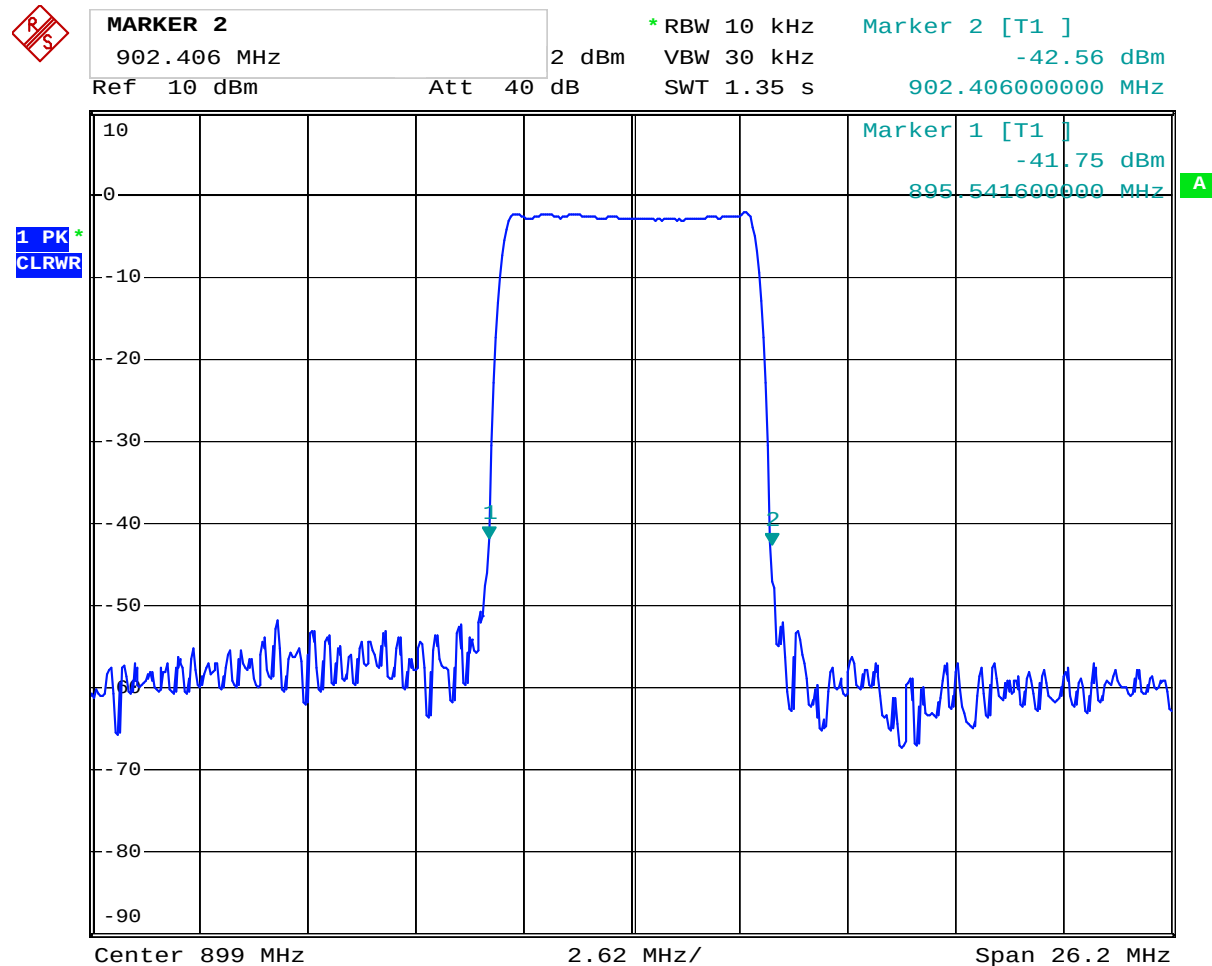
PROJECT NO.: 6L0013RUS2

Filter Response Downlink



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

Filter Response Uplink

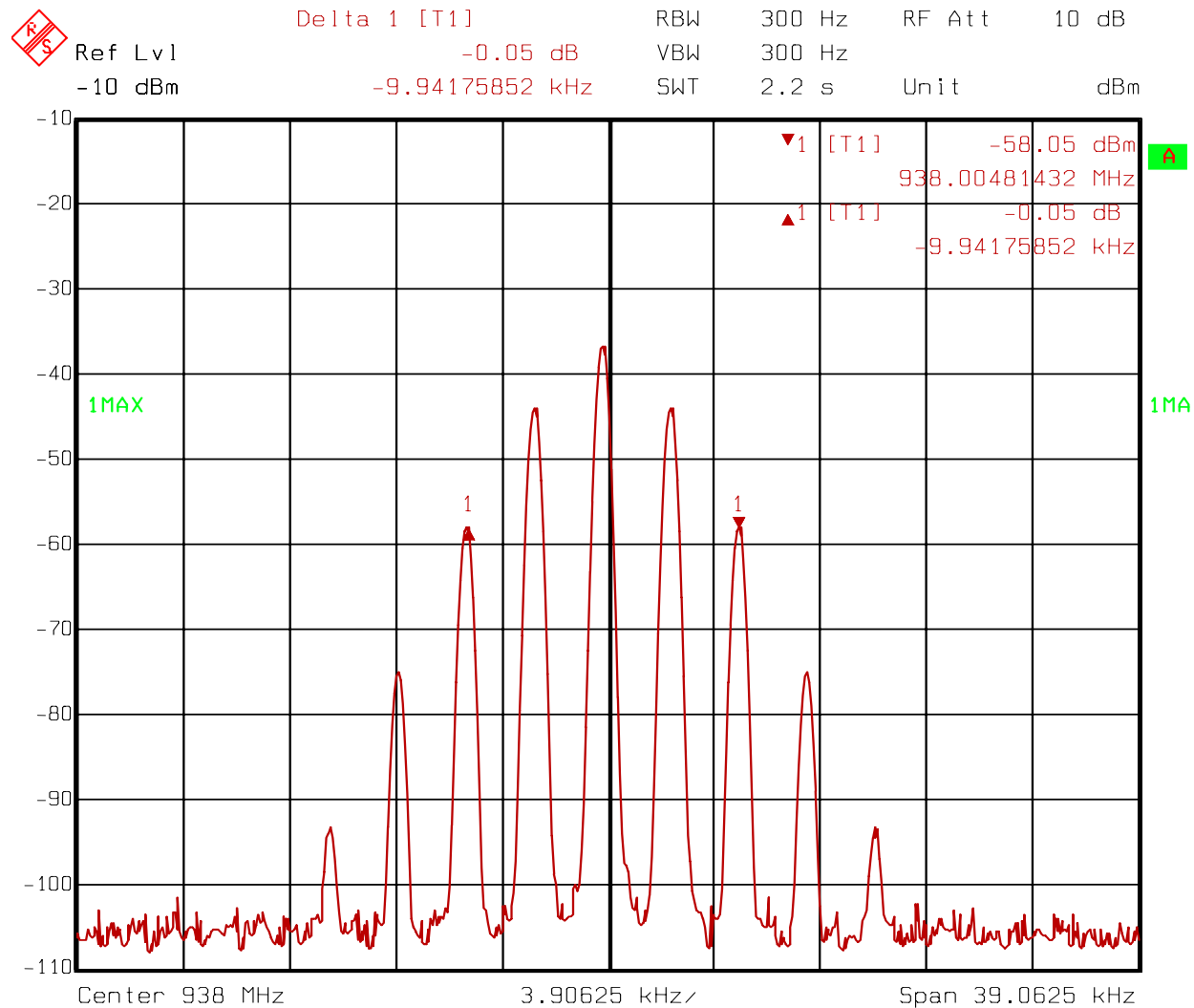


Date: 3.APR.2006 05:05:28

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK FM MID CHANNEL INPUT



Date: 18.JAN.2006 15:00:22

EQUIPMENT: MR903D

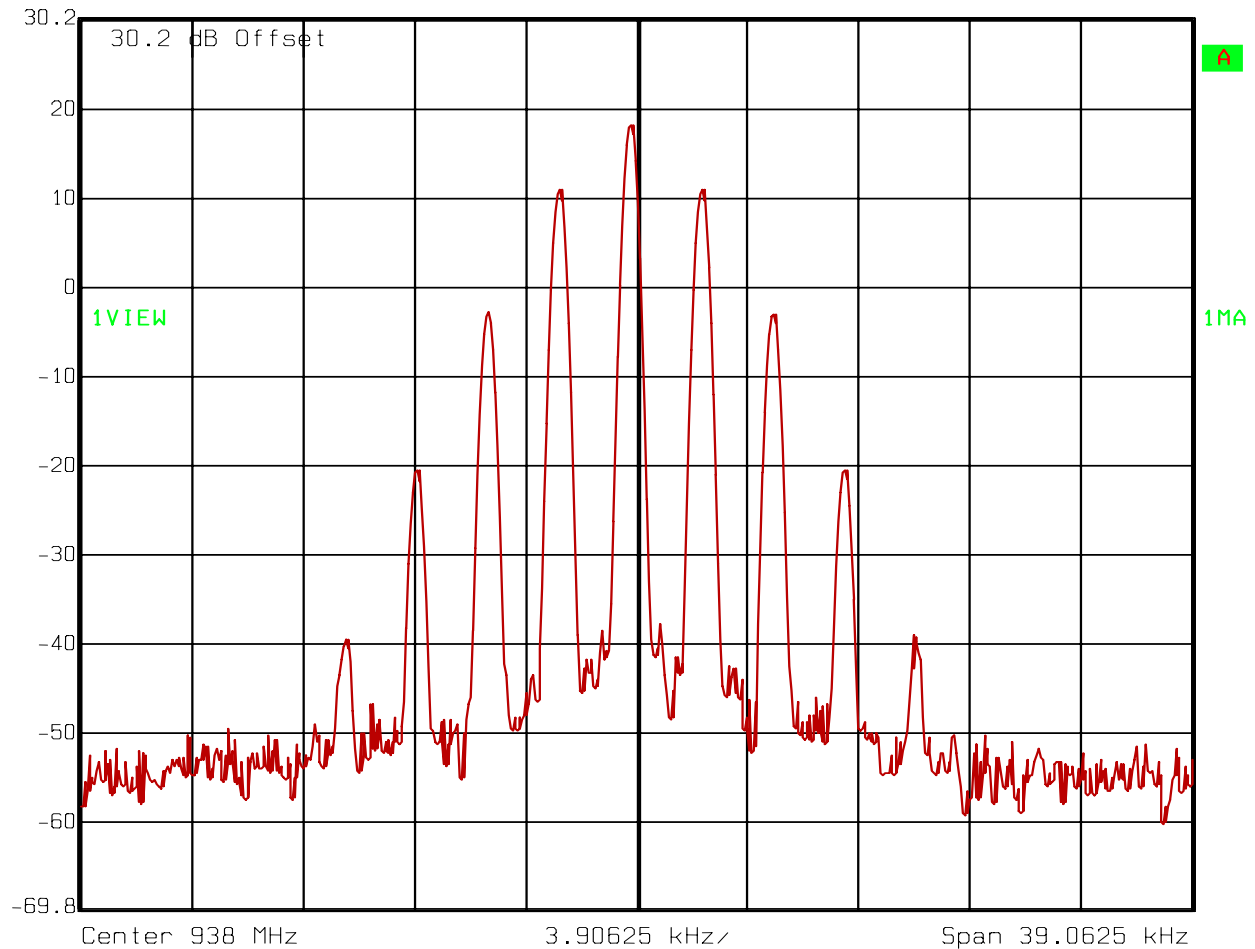
PROJECT NO.: 6L0013RUS2

DOWNLINK FM MID CHANNEL OUTPUT



Ref Lvl
30.2 dBm

RBW 300 Hz RF Att 10 dB
VBW 300 Hz
SWT 2.2 s Unit dBm



Date: 18.JAN.2006 15:04:12

EQUIPMENT: MR903D

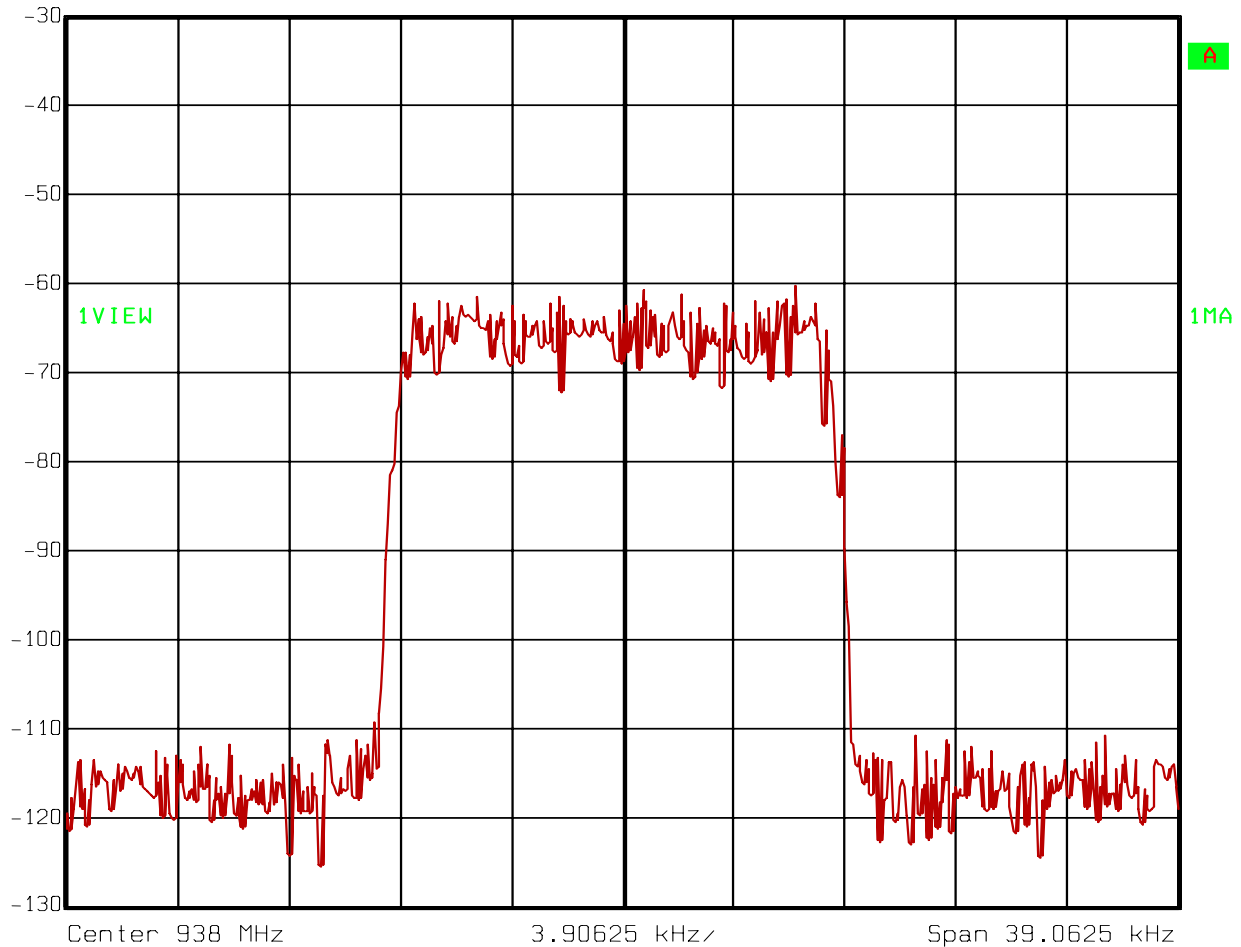
PROJECT NO.: 6L0013RUS2

DOWNLINK iDEN MID CHANNEL INPUT



Ref Lvl
-30 dBm

RBW	300 Hz	RF Att	10 dB
VBW	300 Hz		
SWT	2.2 s	Unit	dBm

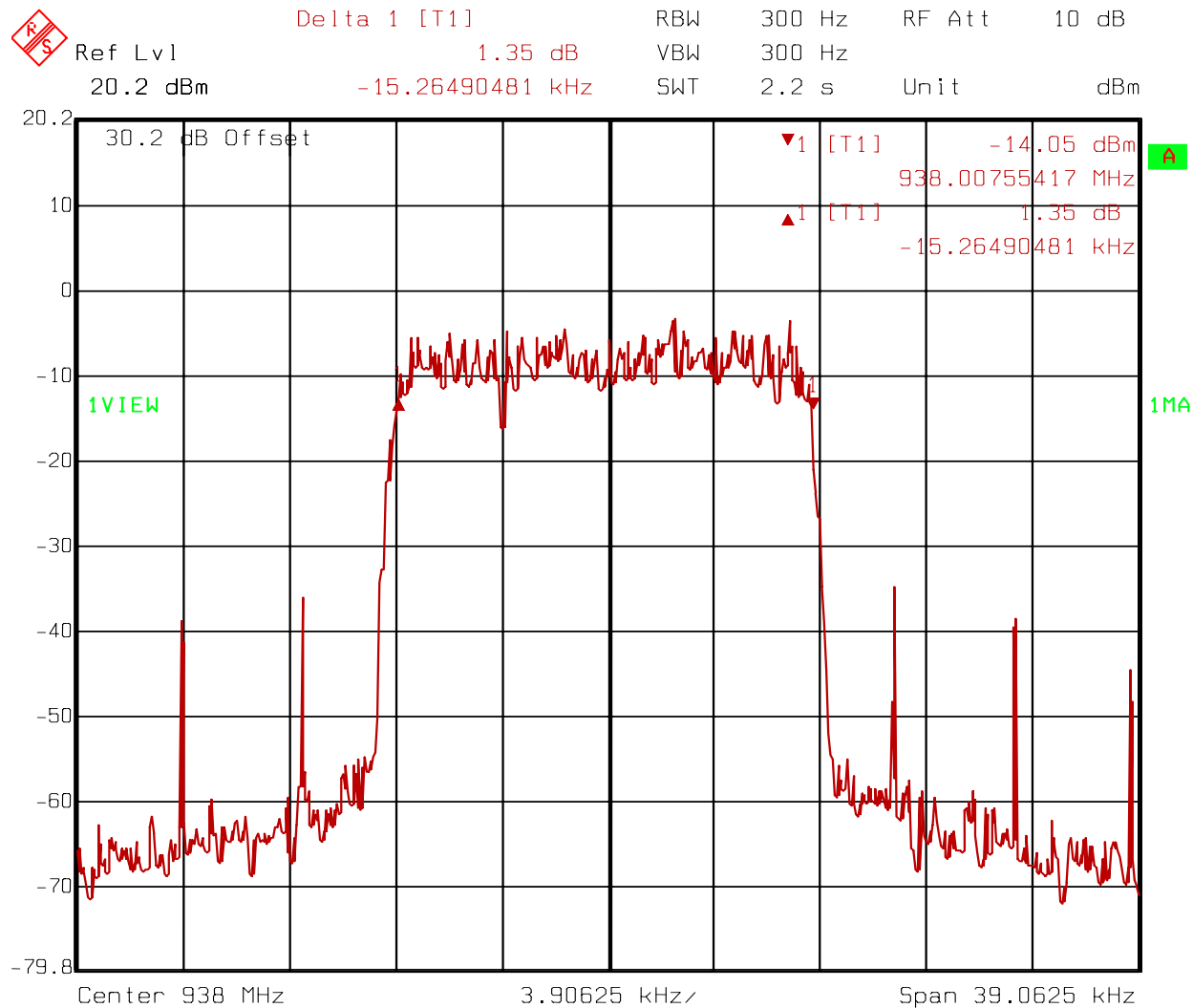


Date: 18.JAN.2006 15:16:21

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

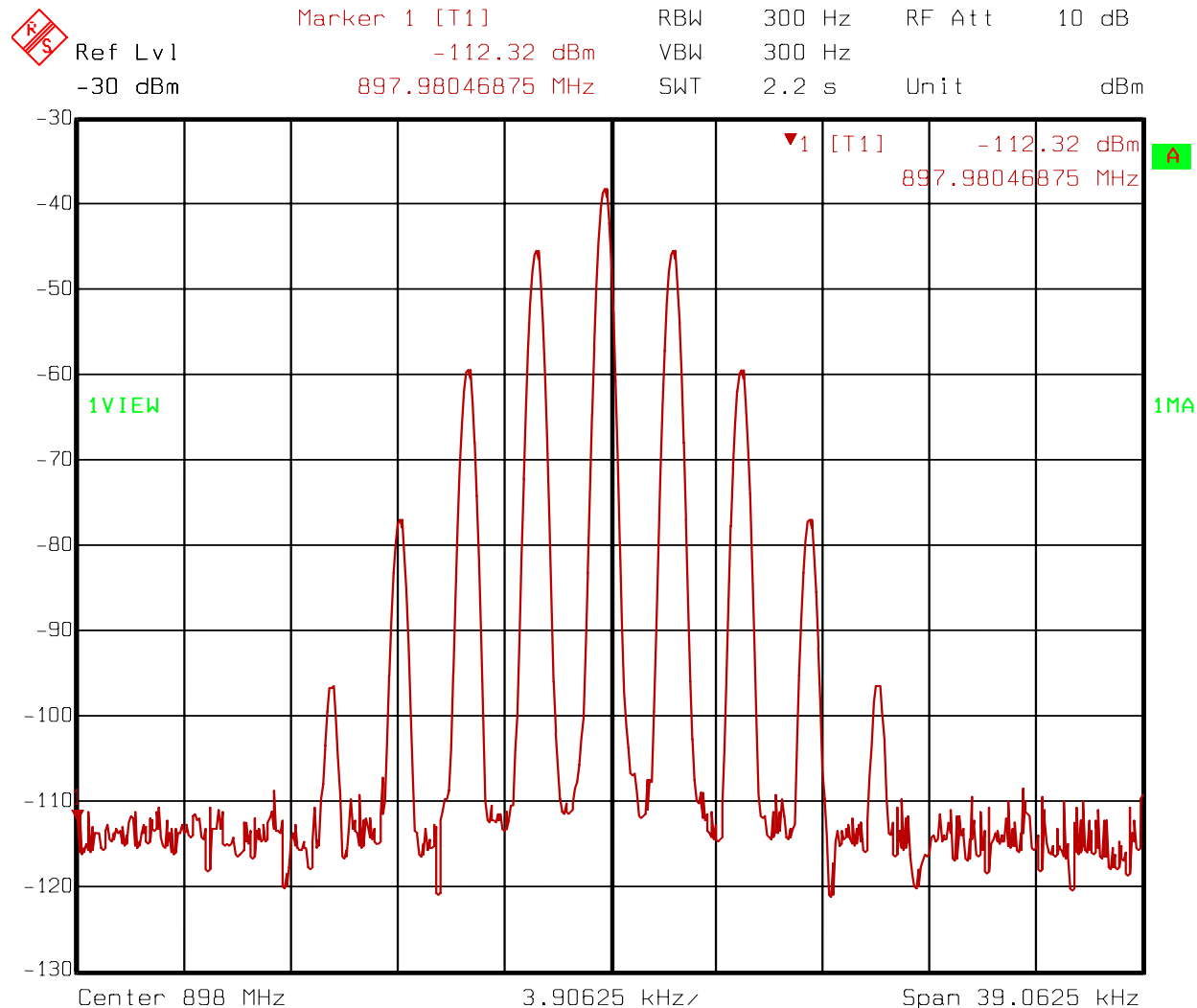
DOWNLINK IDEN MID CHANNEL OUTPUT



EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK FM MID CHANNEL INPUT

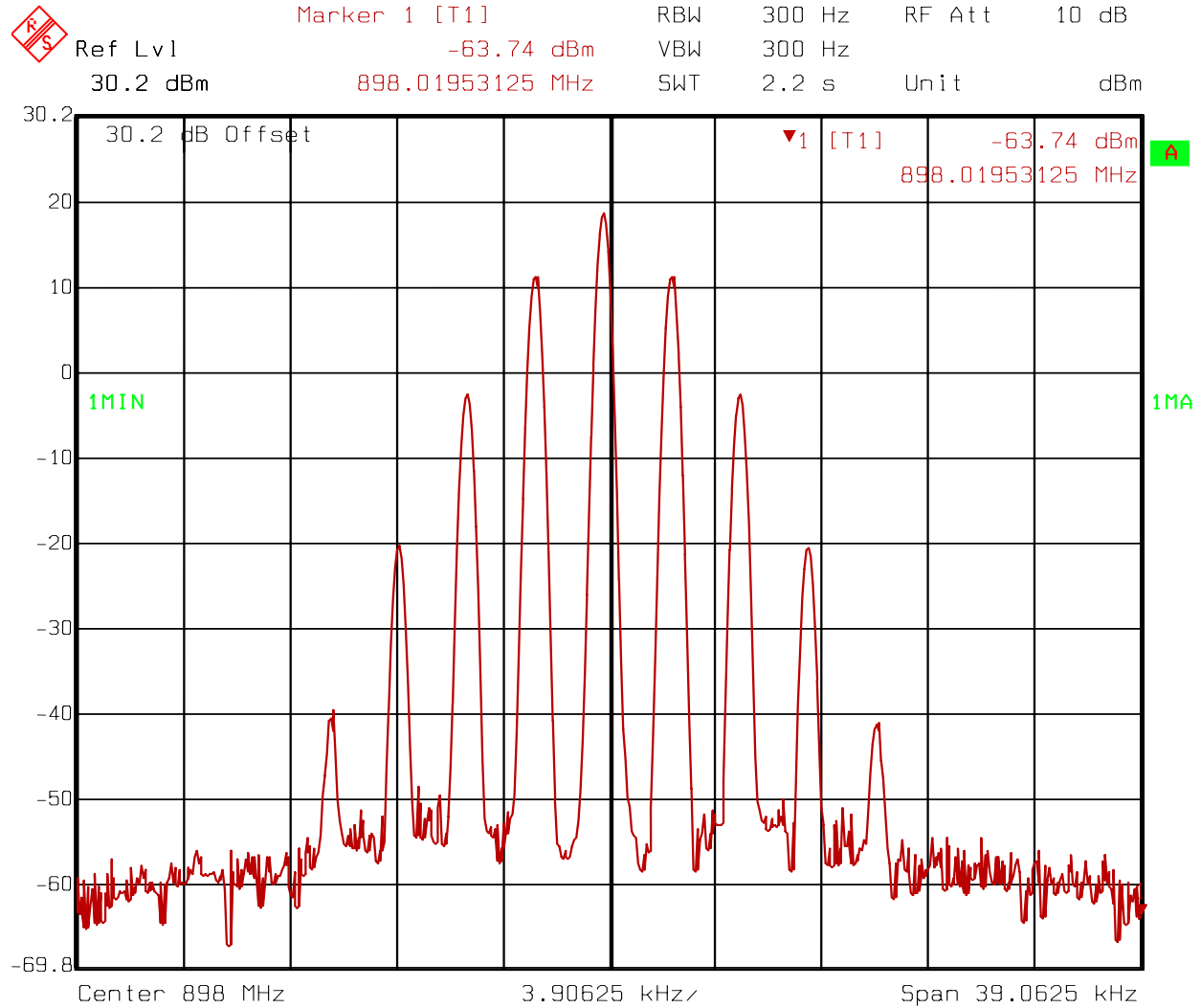


Date: 18.JAN.2006 15:37:23

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK FM MID CHANNEL OUTPUT



Date: 18.JAN.2006 15:40:50

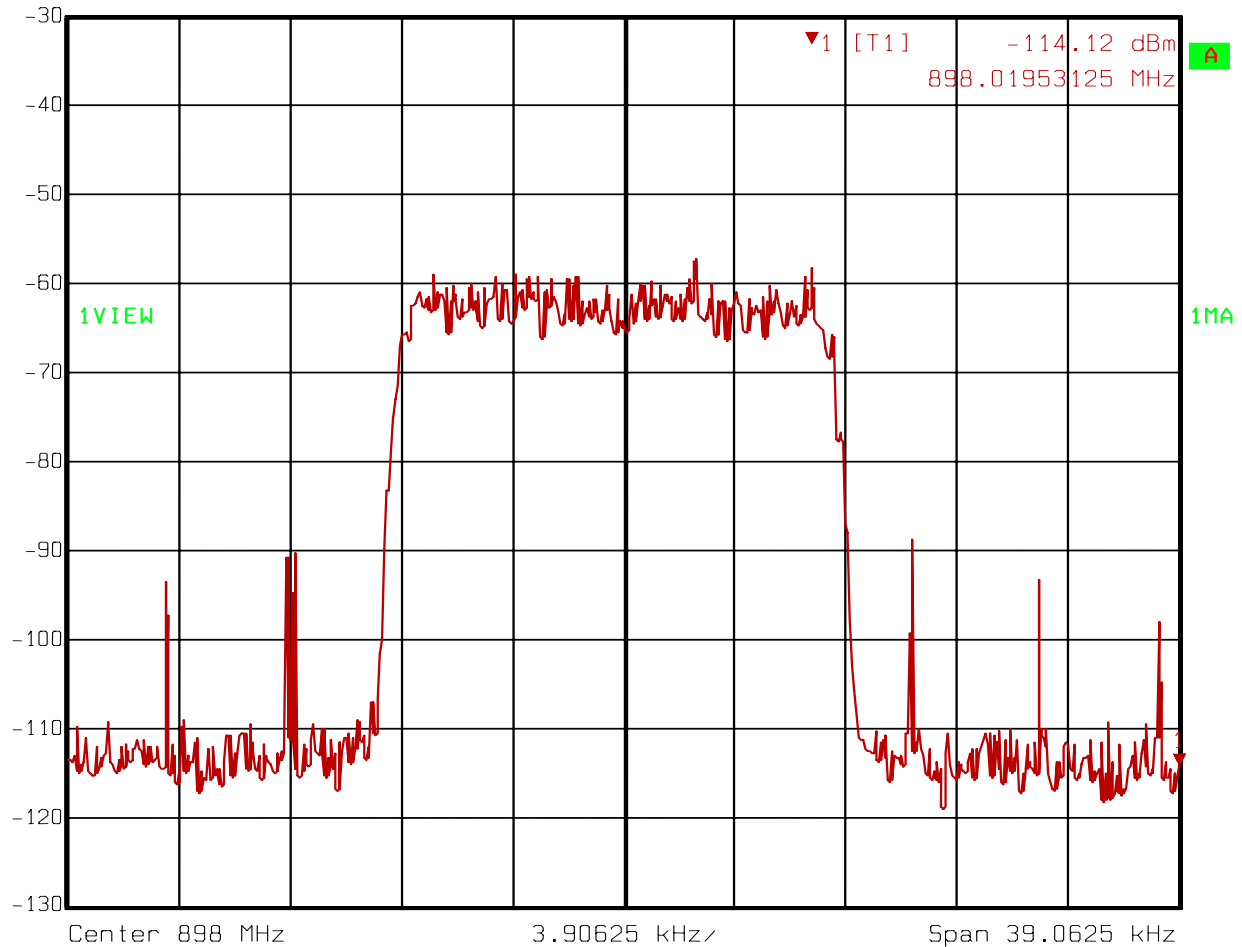
EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK IDEN MID CHANNEL INPUT



Ref Lvl -30 dBm
Marker 1 [T1] -114.12 dBm
898.01953125 MHz
RBW 300 Hz
VBW 300 Hz
SWT 2.2 s
RF Att 10 dB
Unit dBm

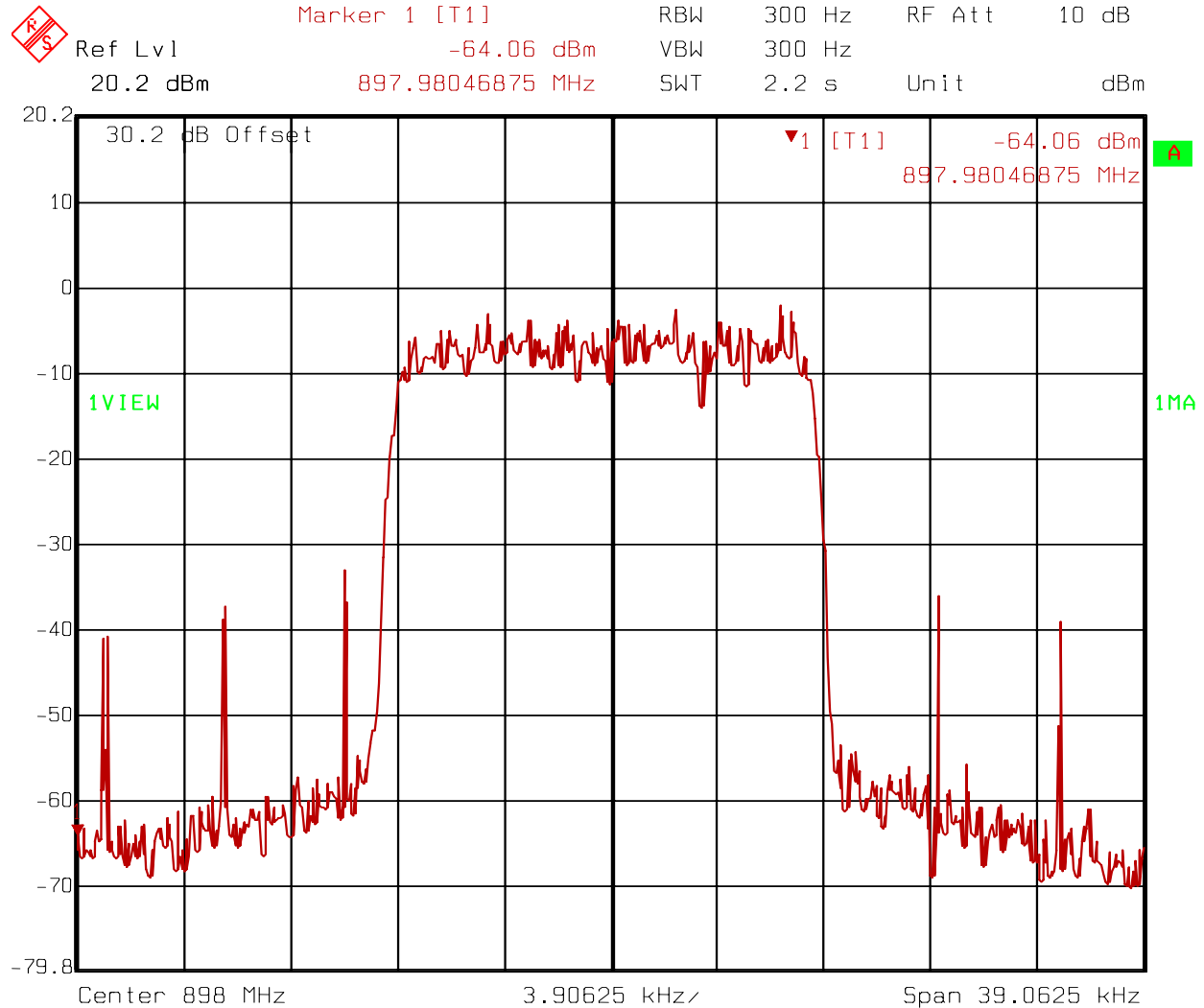


Date: 18.JAN.2006 15:23:53

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK IDEN MID CHANNEL OUTPUT



Date: 18.JAN.2006 15:43:46

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna
Terminals

PARA. NO.: 90.210

TESTED BY: KEVIN ROSE:

DATE: 17-31 JANUARY 2006:

Test Results: Complies

Test Data: See attached graph(s).

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

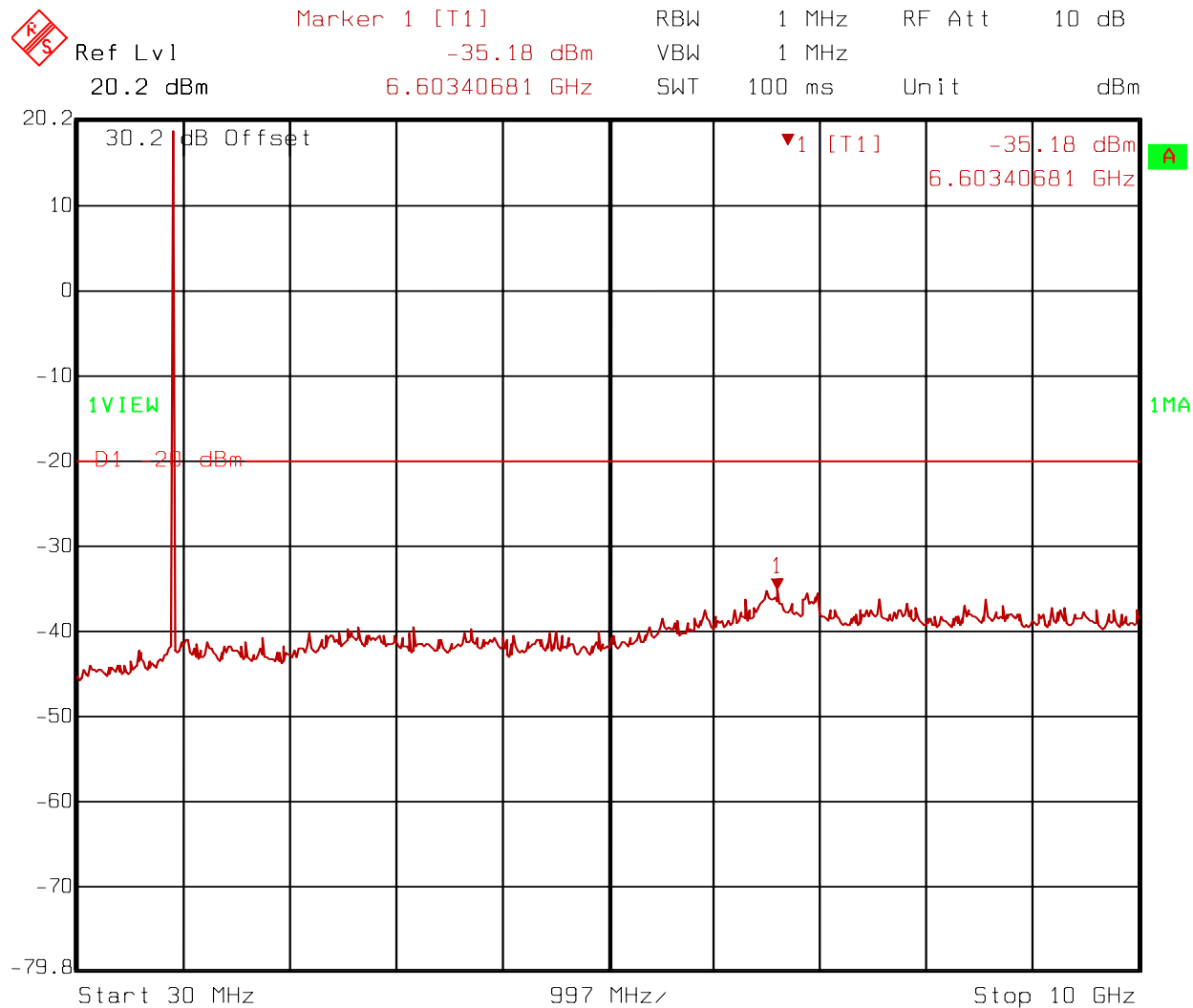
Test Conditions: 22°C

40% RH

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK FM MID CHANNEL SPUR

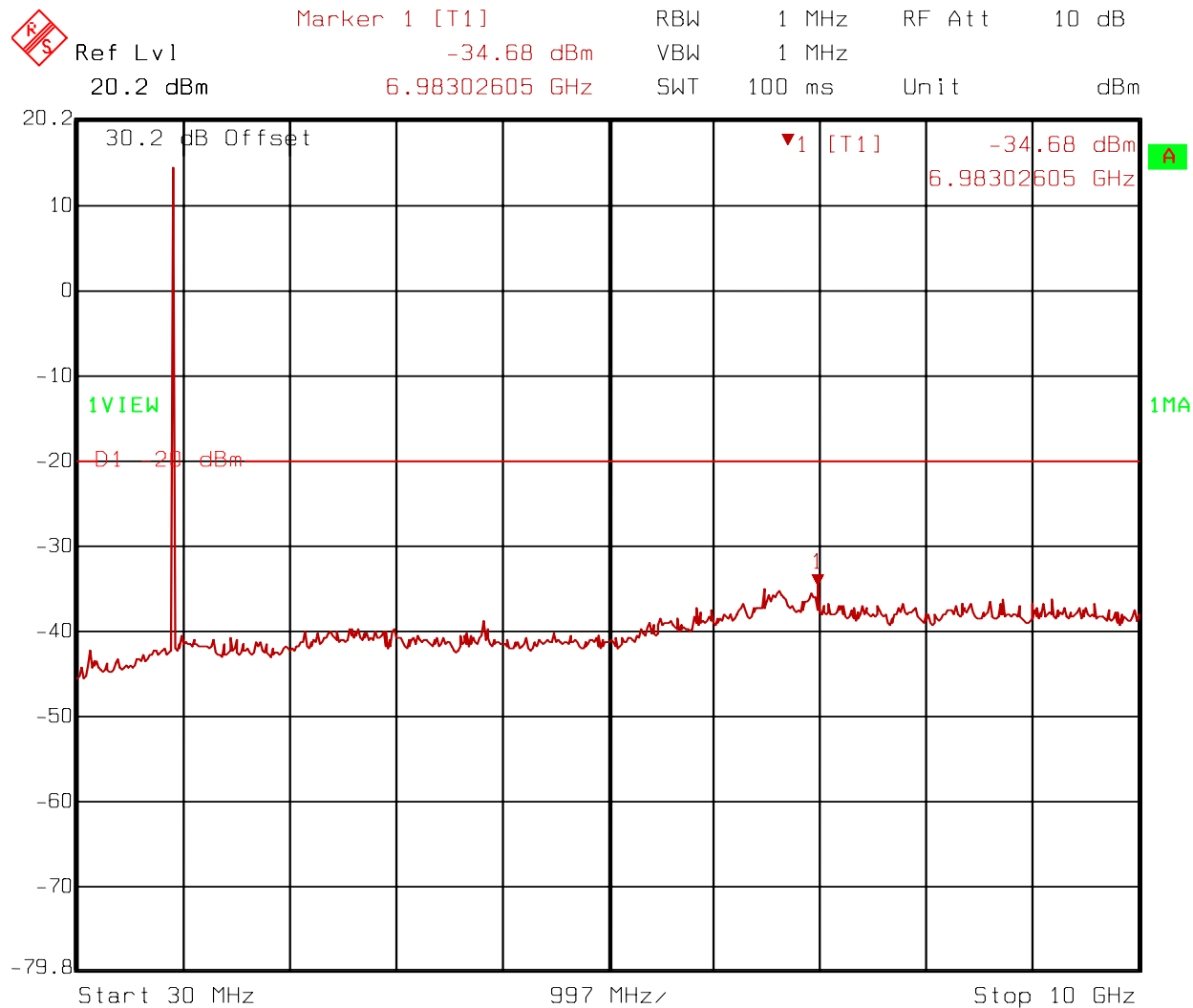


Date: 18.JAN.2006 16:15:05

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK IDEN MID CHANNEL SPUR

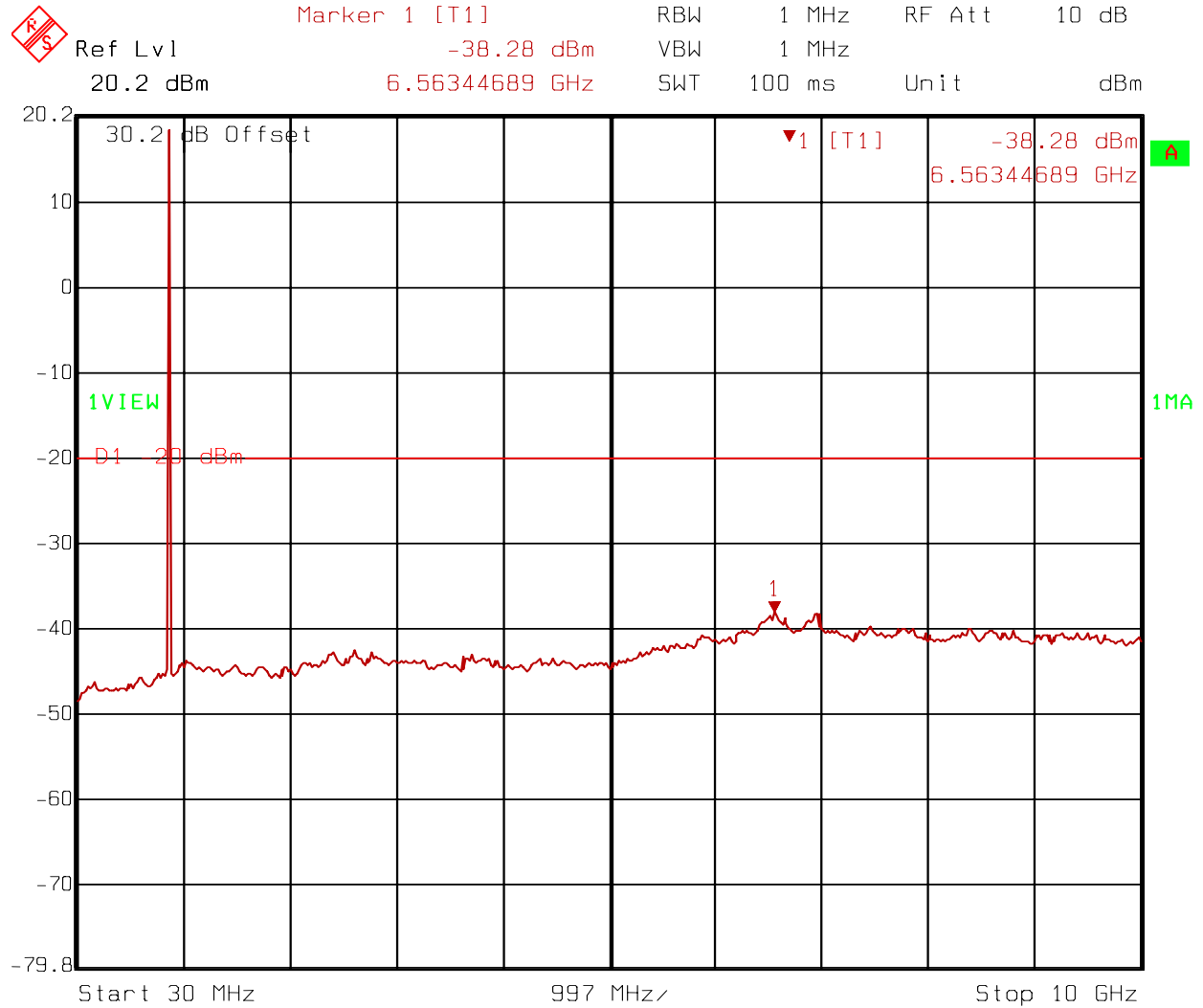


Date: 18.JAN.2006 16:17:42

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK FM MID CHANNEL SPUR

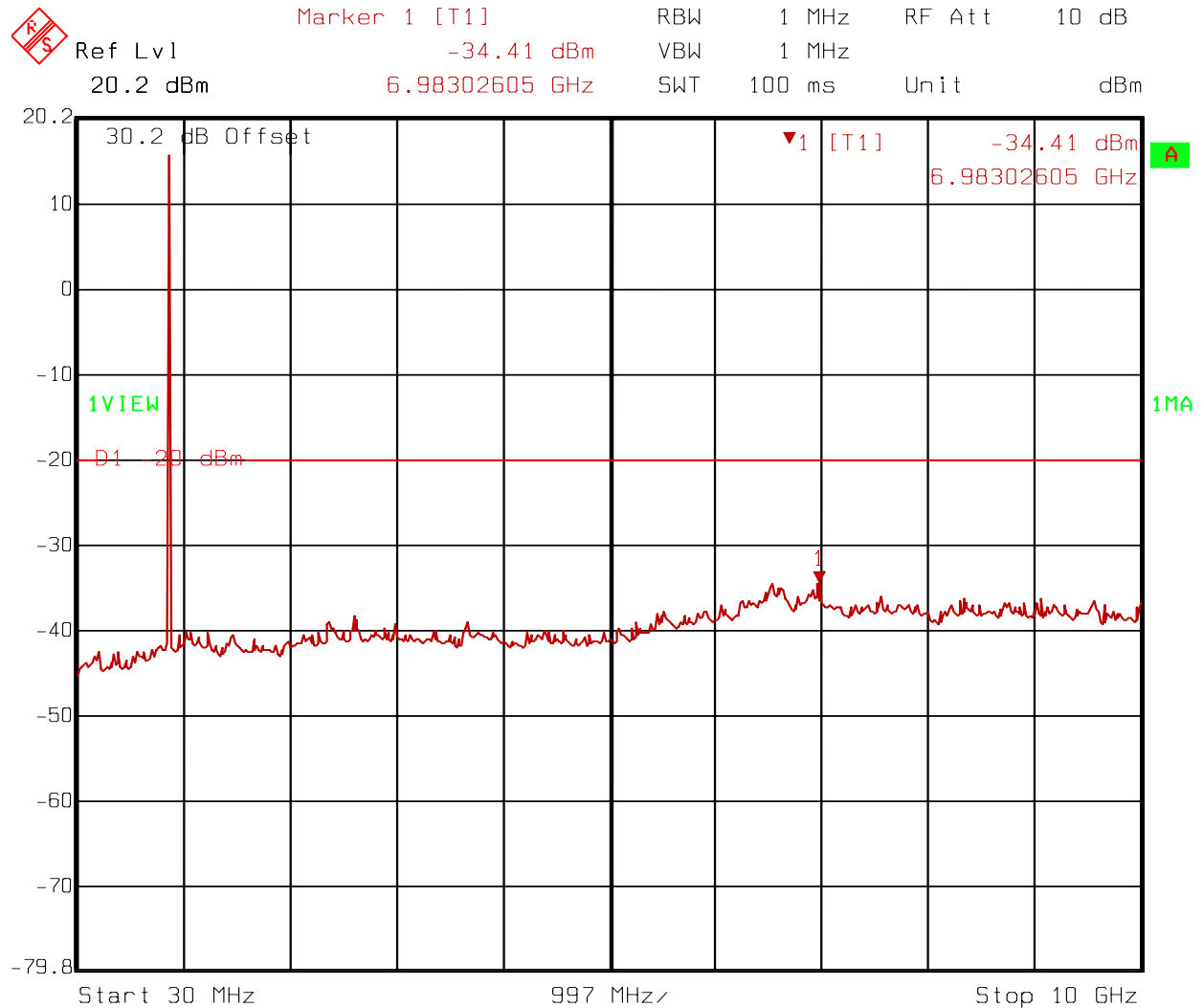


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EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK IDEN MID CHANNEL SPUR

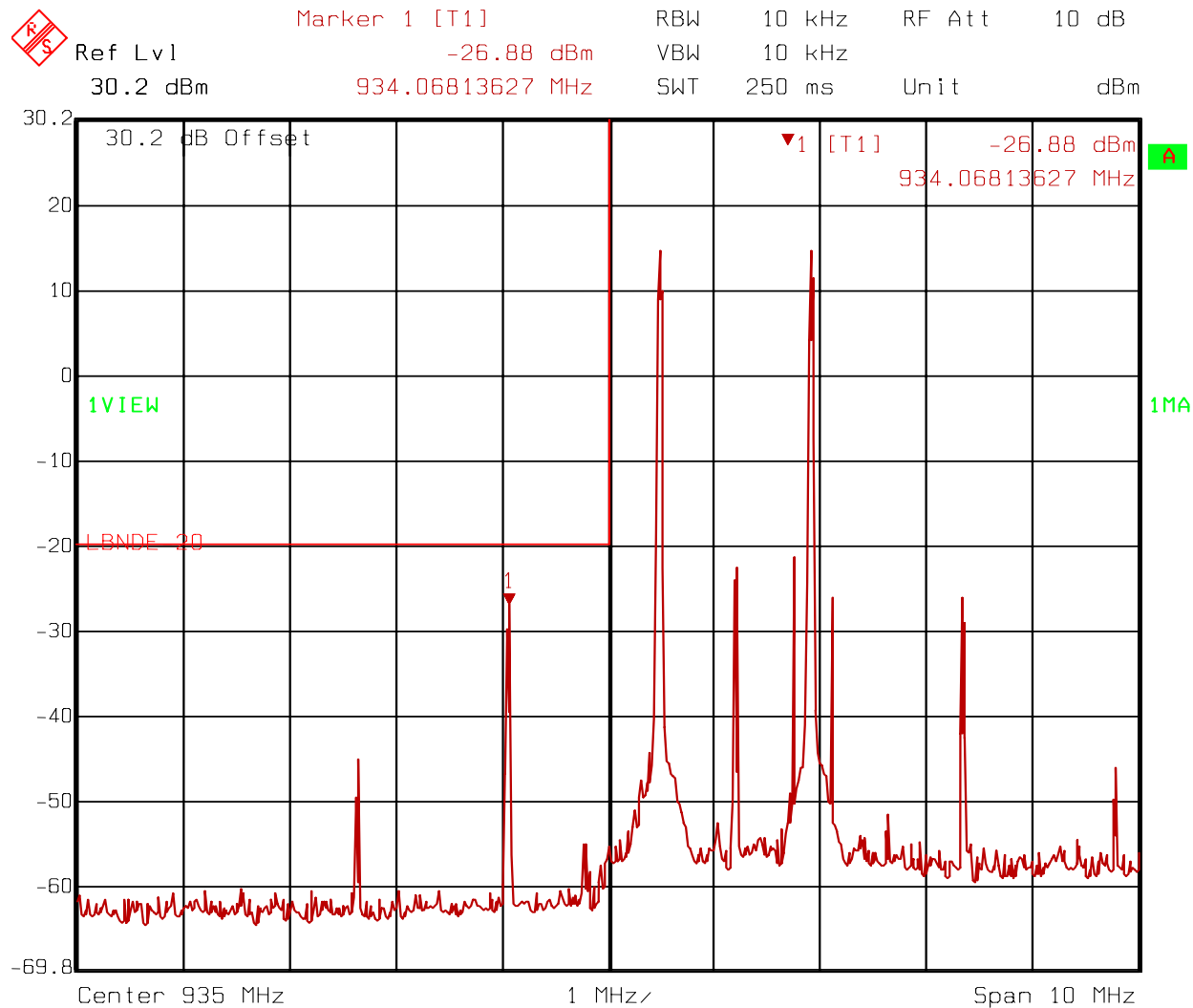


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EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK LOW BANDEDGE iDEN

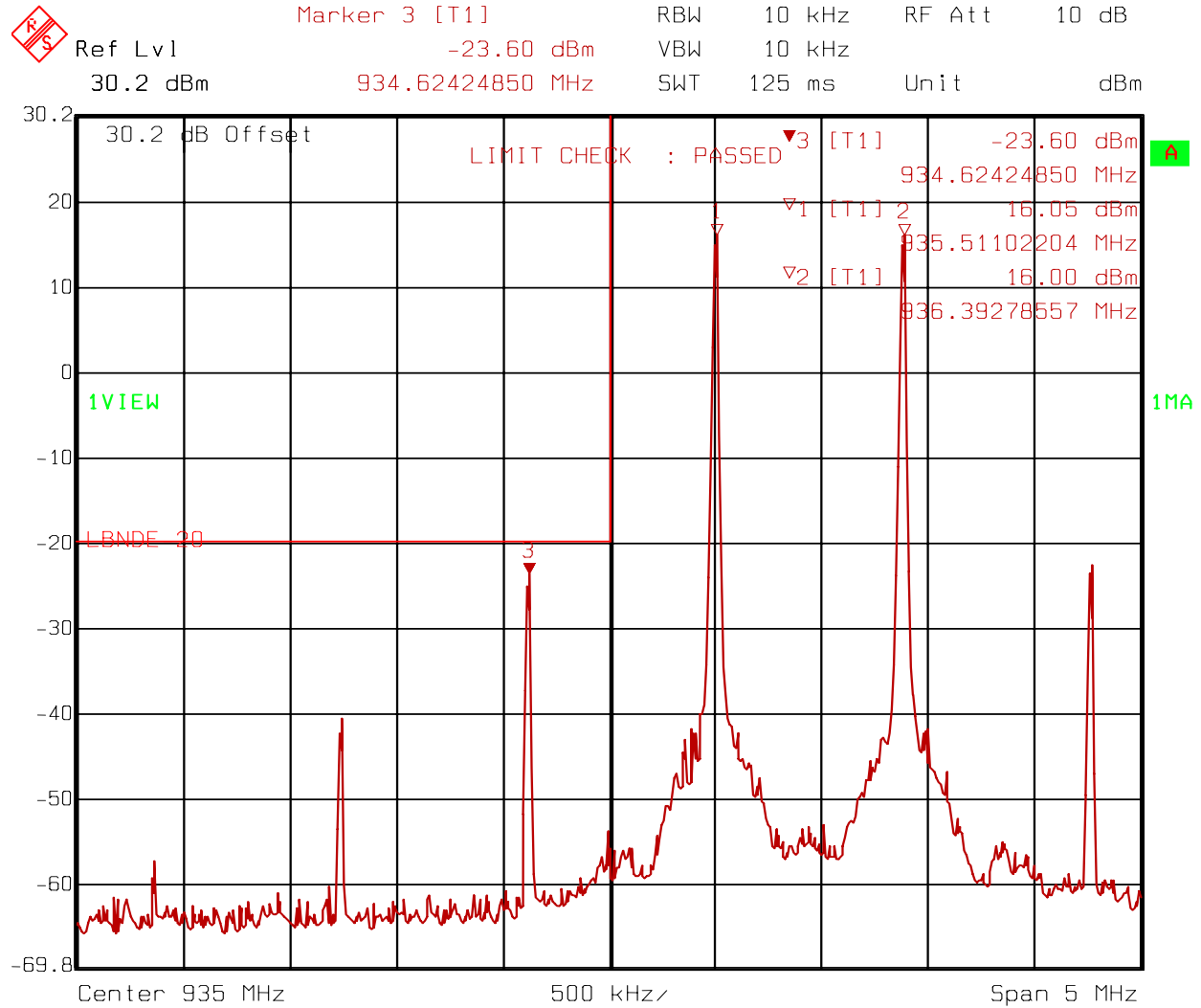


Date: 18.JAN.2006 11:27:39

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK LOW BANDEDGE FM

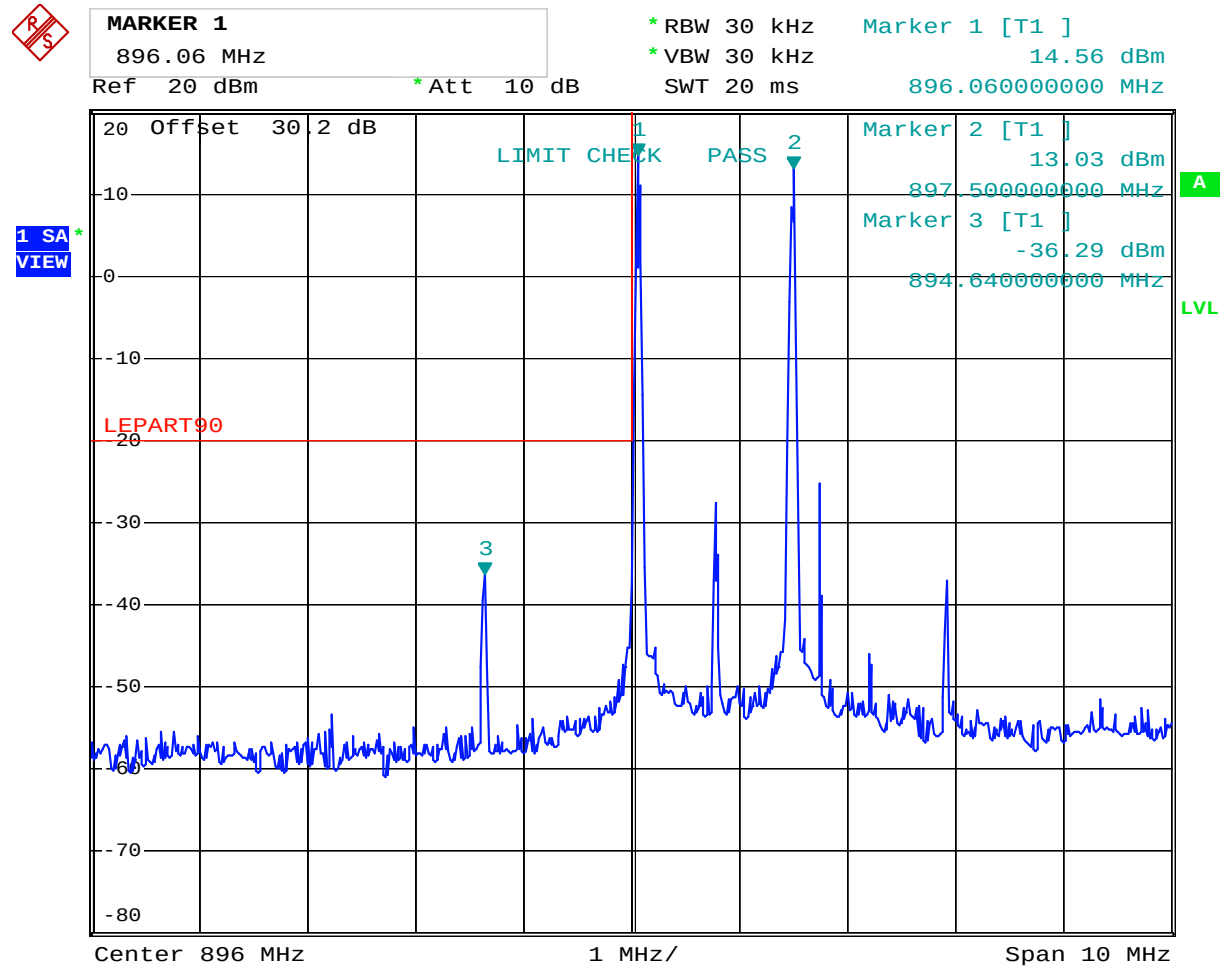


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EQUIPMENT: MR903D

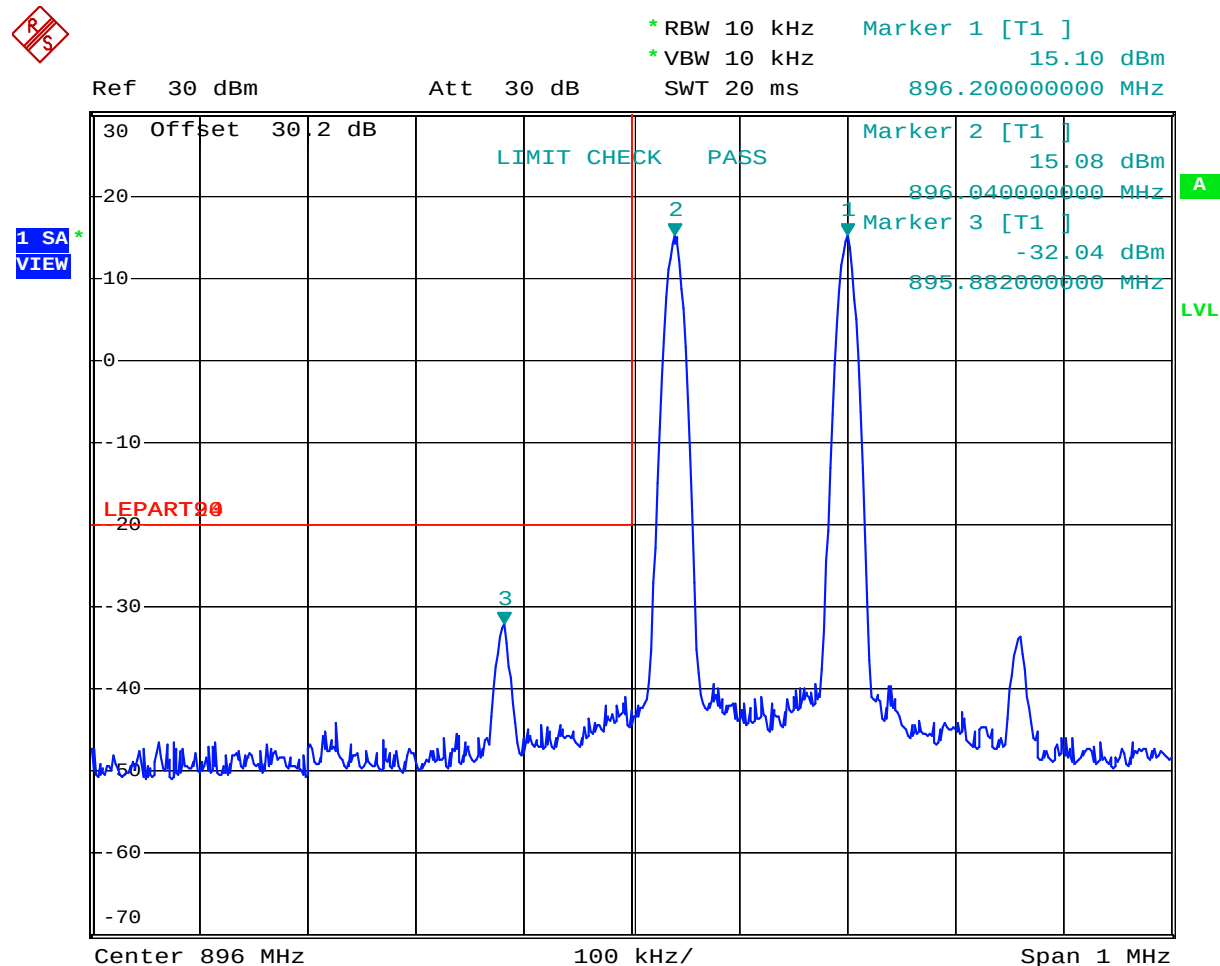
PROJECT NO.: 6L0013RUS2

UPLINK iDEN LOW BANDEDGE



Date: 10.DEC.2005 12:59:48

UPLINK LOW BANDEDGE FM

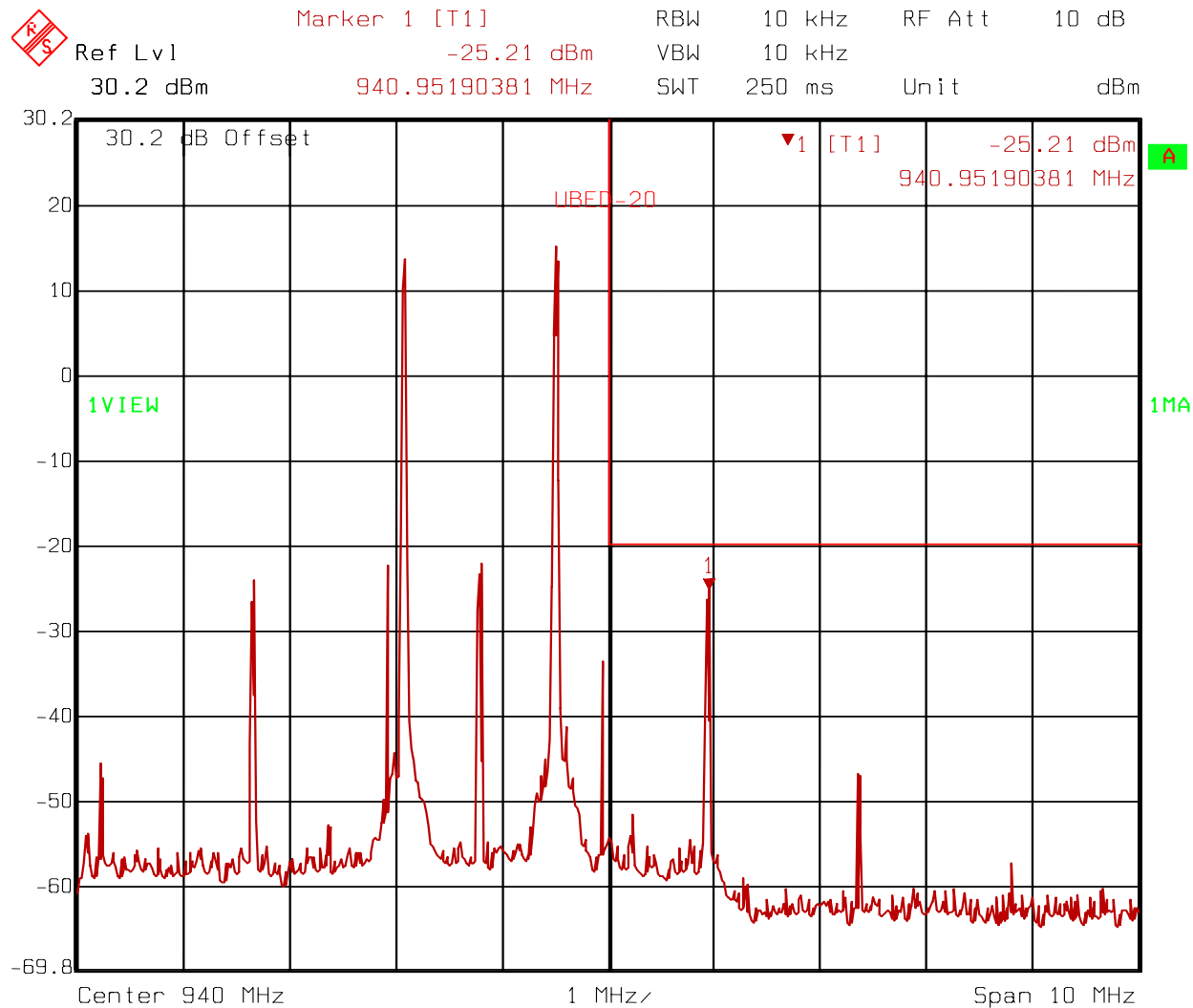


Date: 10.DEC.2005 11:32:38

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK UPPER BANDEDGE iDEN

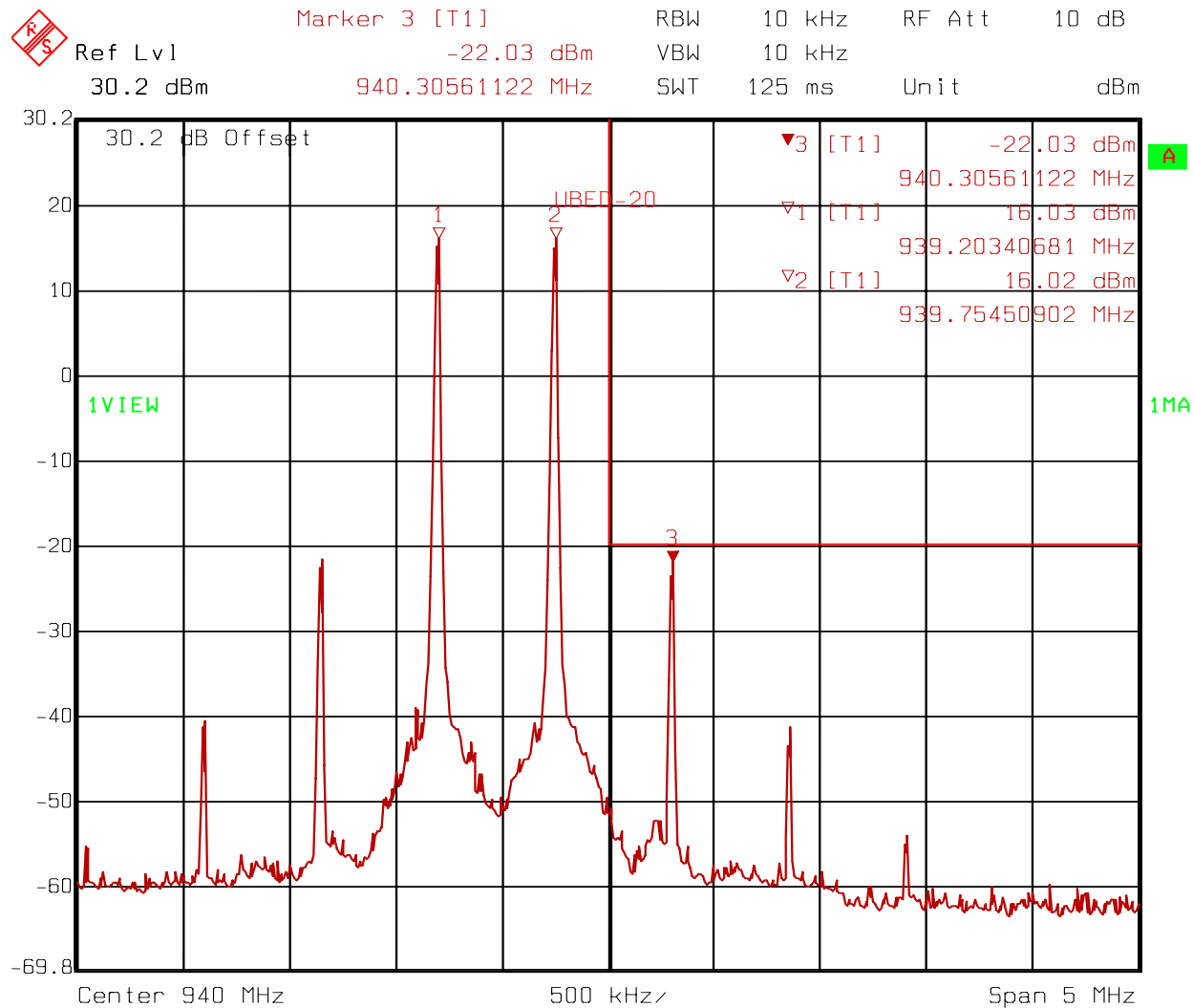


Date: 18.JAN.2006 11:30:05

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

DOWNLINK UPPER BANDEDGE FM

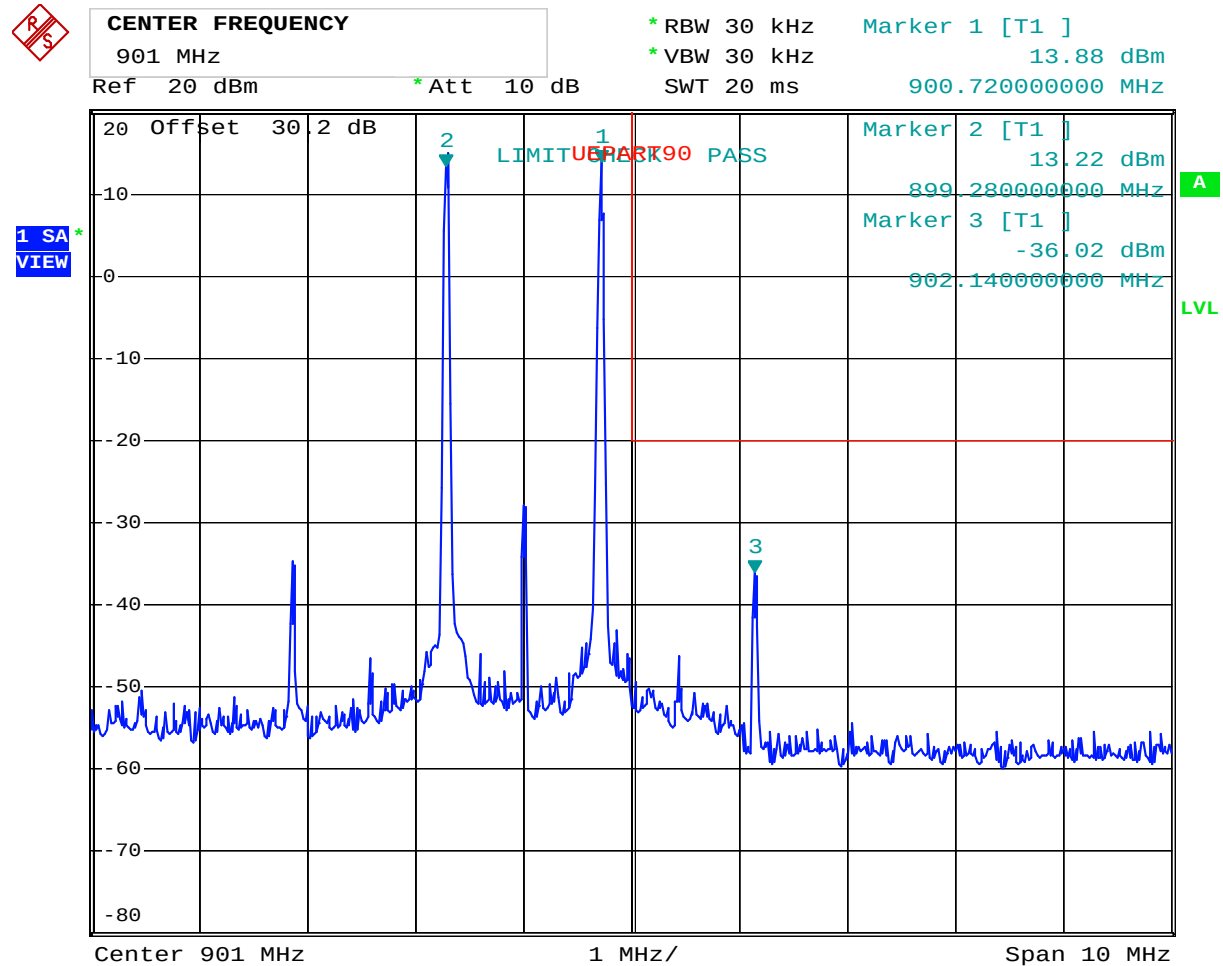


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EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK UPPER BANDEDGE iDEN

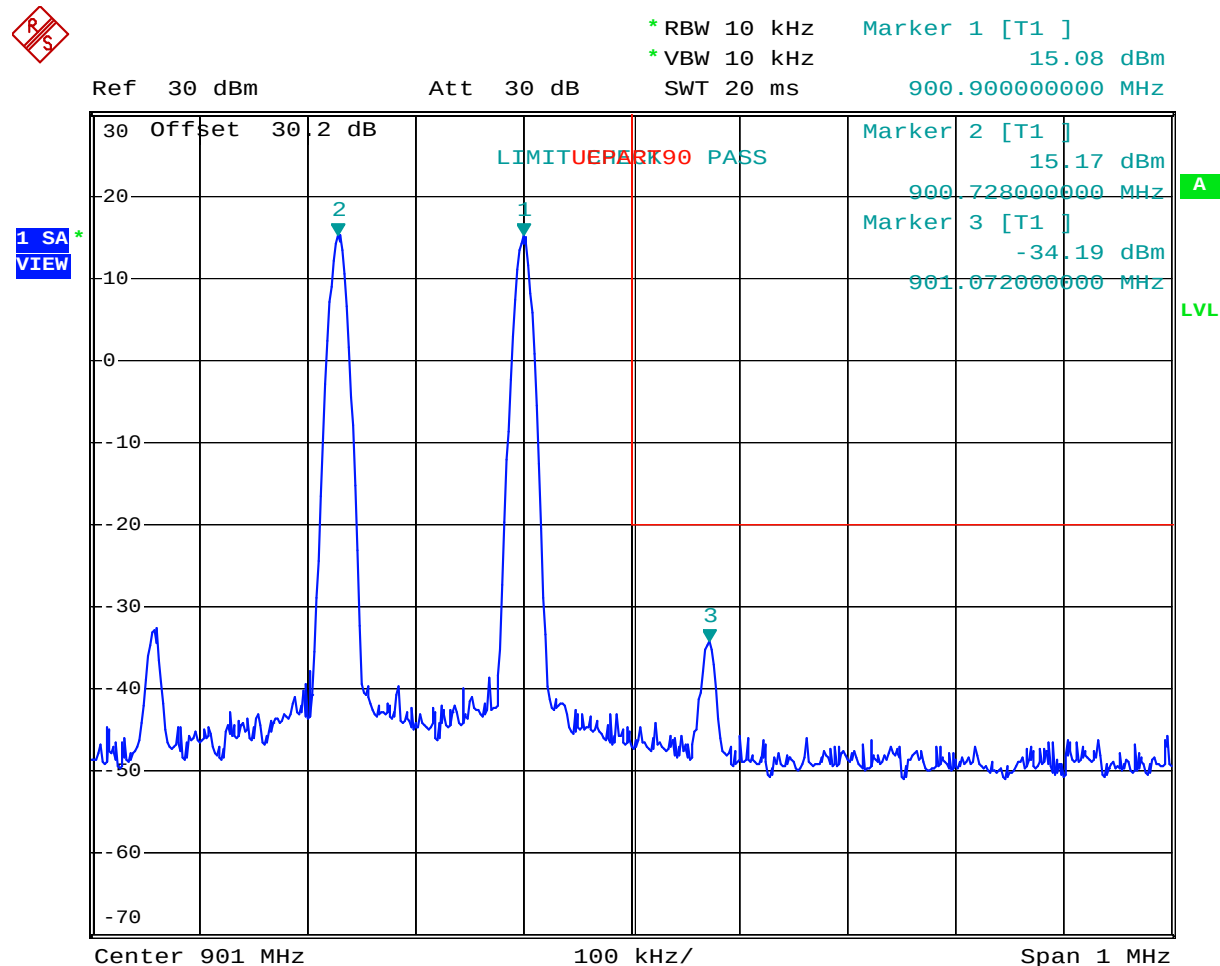


Date: 10.DEC.2005 12:56:02

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

UPLINK UPPER BANDEDGE FM



Date: 10.DEC.2005 11:38:30

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions PARA. NO.: 90.210

TESTED BY: KEVIN ROSE:

DATE: 17-31 JANUARY 2006:

Test Results: Complies.

Test Data: See notes.

Note: See page A5 for applicable limit.

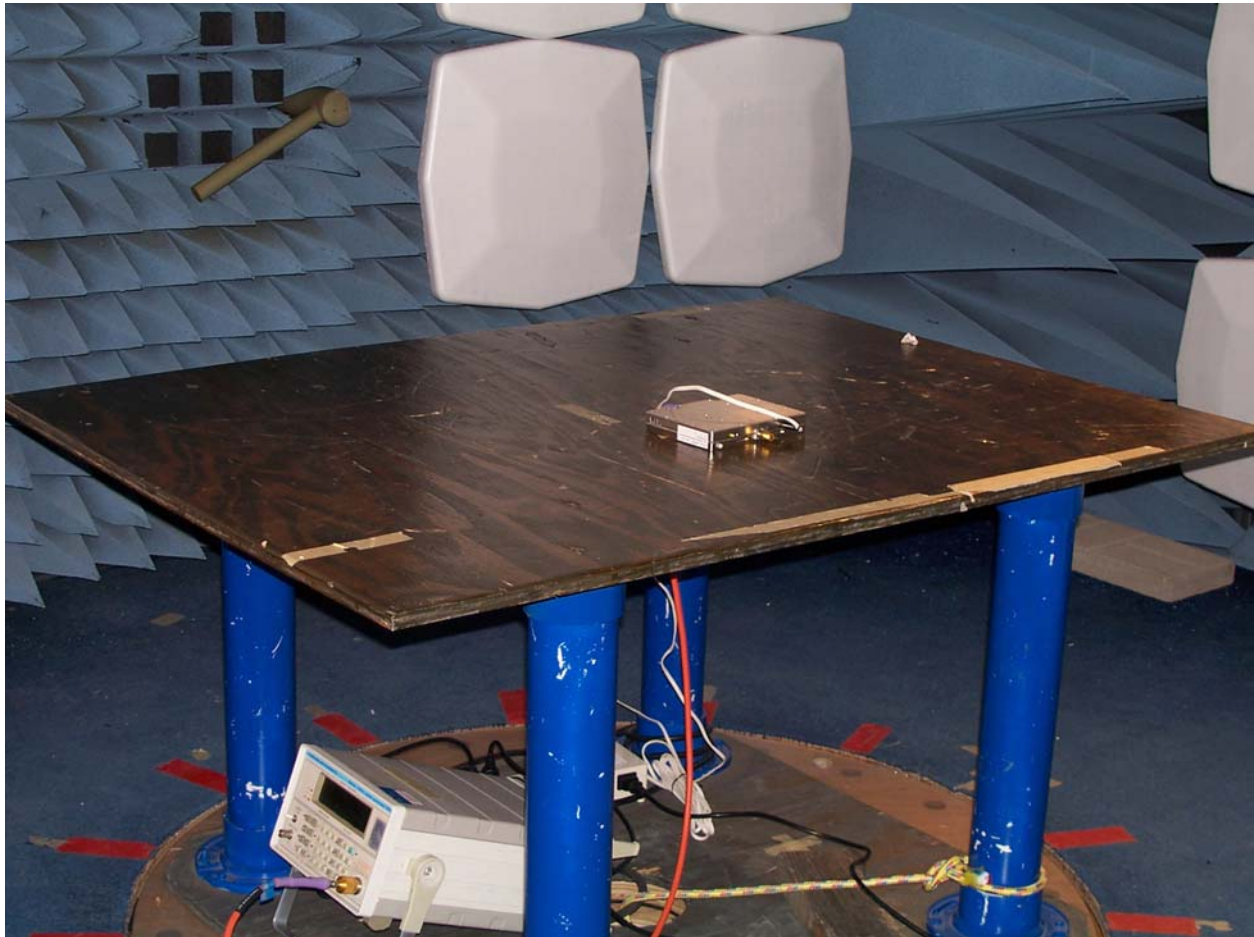
Note: Spectrum was search from 30MHz to 10GHz no emissions were detected within 20db of the limit.

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

Test Conditions: 22°C

40% RH

Photographs of Test Setup



EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

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 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR903D**

PROJECT NO.: **6L0013RUS2**

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:

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

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

PROJECT NO.: 6L0013RUS2

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

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

EQUIPMENT: MR903D

PROJECT NO.: 6L0013RUS2

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

NAME OF TEST: Field Strength of Spurious**PARA. NO.: 2.993****Minimum Standard:** Para. No. 90.210, see table 1 for applicable mask.**Calculation of Field Strength Limit**

An example of attenuation requirement of $50 + 10 \log P$ is equivalent to -20 dBm (1×10^{-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 ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

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

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

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V / m} = 77.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

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

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

$$E = 77.4 - 20 \log \sqrt{1.64} = 75.2 \text{ dB}\mu\text{V / m@3m}$$

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

PROJECT NO.: 6L0013RUS2

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	-	-	-

Nemko USA

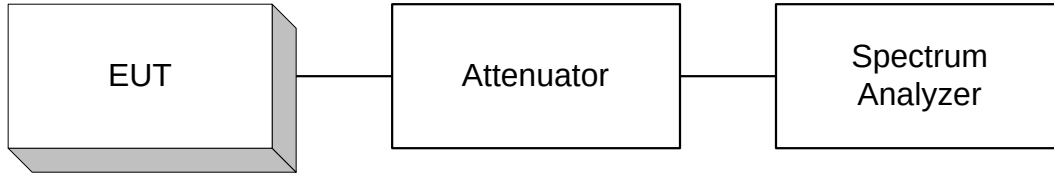
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR903D**

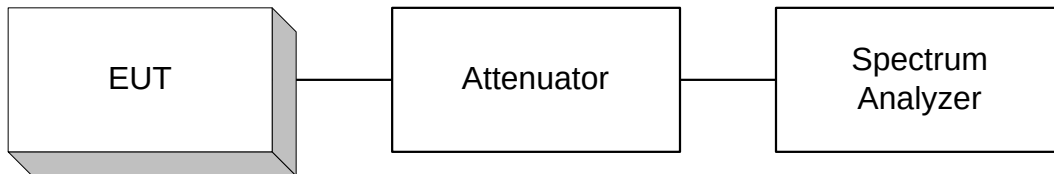
PROJECT NO.: **6L0013RUS2**

ANNEX B - TEST DIAGRAMS

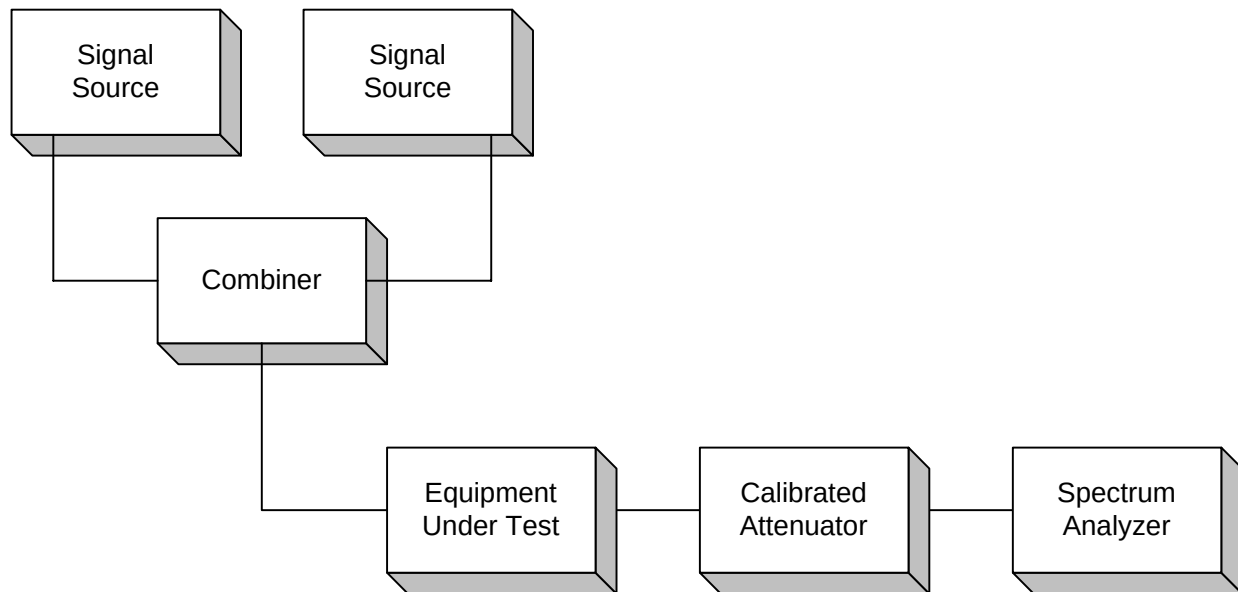
Para. No. 2.1046 - R.F. Power Output



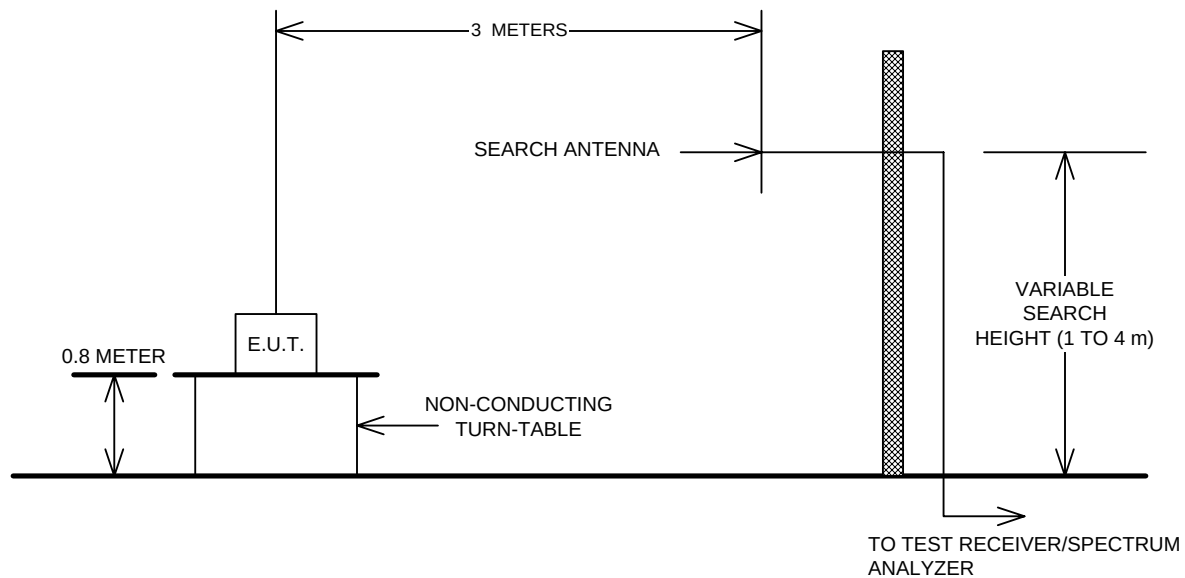
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation



Para. No. 2.1055 - Frequency Stability

