

Nemko Test Report:	4L0761RUS1REV2
Applicant:	Andrew Corporation
Equipment Under Test: (E.U.T.)	MMR8L L Repeater
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:	 Dustin Oaks, Engineer
Date:	12/30/04
Total Number of Pages:	48

Table of Contents

Section 1.	Summary of Test Results.....	3
Section 2.	General Equipment Specification.....	5
Section 3.	RF Power Output.....	8
Section 4.	Occupied Bandwidth	9
Section 5.	Spurious Emissions at Antenna Terminals.....	26
Section 6.	Field Strength of Spurious Emissions	33
Section 7.	Frequency Stability.....	37
Section 8.	Test Equipment List	38
ANNEX A - TEST METHODOLOGIES		39
ANNEX B - TEST DIAGRAMS		45

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: MMMR8L L

Serial No.: 11

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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EQUIPMENT: MMR8L L RepeaterPROJECT NO.: 4L0761R

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205		39.02	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A	N/A
Occupied Bandwidth	90.210	Plots	Plots	Complies
Spurious Emissions at Antenna Terminals	90.210	-13 dBm	Plots	Complies
Field Strength of Spurious Emissions	90.210	-13 dBm E.R.P.	E.R.P.	Complies
Frequency Stability	90.213			Complies
Transient Frequency Behavior	90.214	N/A	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.

Indoor Temperature: 20°C
 Humidity: 32%

Outdoor Temperature: 17 °C
 Humidity: 68 %

.

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input: 115V AC

Frequency Range: 851-869MHz

Tunable Bands: 851-869MHz

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	GXW (iDEN)	Other
☒	☐	☐	☒	☐

Maximum Input: +0dBm

Output Impedance: NA

RF Power Output (rated):

Single:	+40dBm
Composite:	+37dBm (2-Carrier)

Frequency Translation:

F1-F1	F1-F2	N/A
☐	☐	☒

Band Selection:

Software	Duplexer Change	Fullband Coverage
☐	☐	☒

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

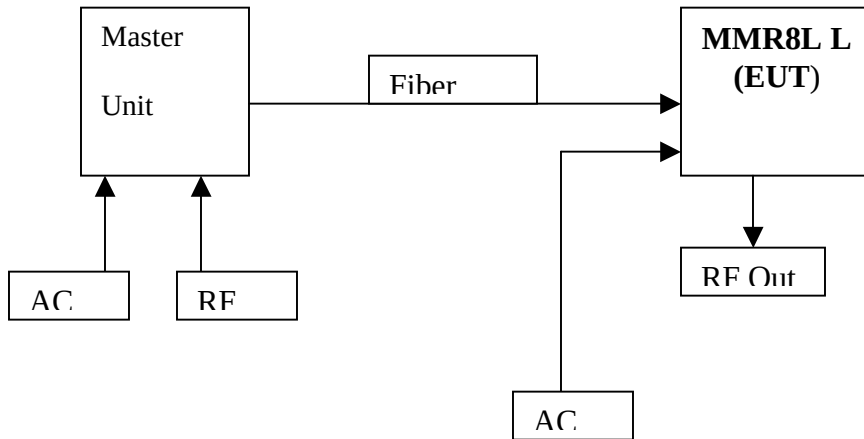
EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

Modifications Made During Testing

No Modifications made during testing

System Diagram



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Kevin Rose	DATE: 12/30/2004

Test Results: Complies**Measurement Data:**

iDEN

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)
DL851	39.94	40
DL869	39.98	40
Dual DL851	36.4	37
Dual DL869	36.6	37

Analog

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)
DL851	39.2	40
DL869	39.3	40
Dual DL851	36.4	37
Dual DL869	36.5	37

Equipment Used: 1036, 1052, 1053, 1626, 1627, 1964, 1092**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 21 °C**Relative Humidity:** 38 %

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Kevin Rose	DATE: 12/30/2004

Test Results: Complies

Test Data: See attached graph(s).

Equipment Used: 1036, 1052, 1053, 1626, 1627, 1964, 1092, 1073, 1051, 0973

Measurement Uncertainty: +/- 1.6 dB

Temperature: 19 °C

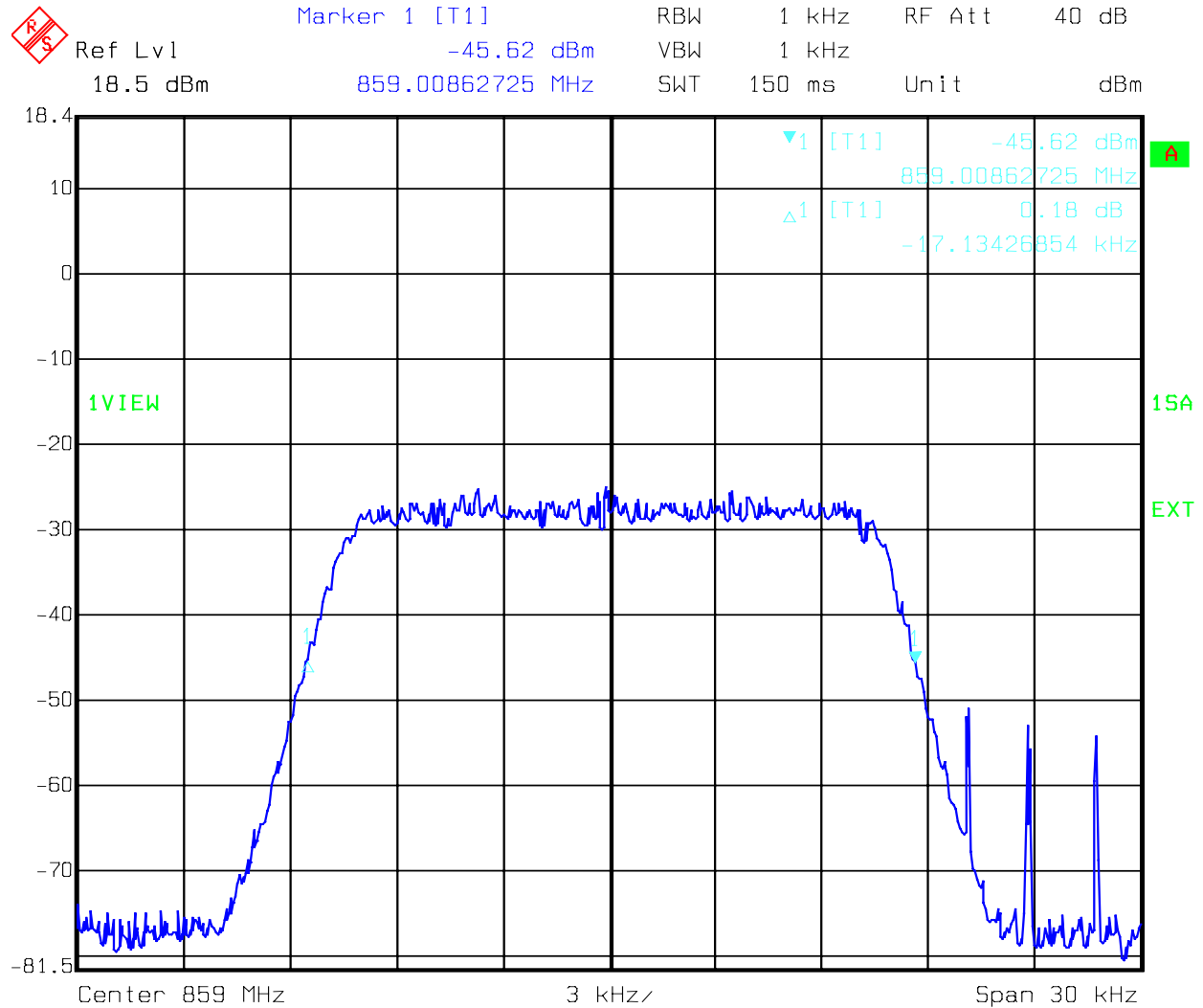
Relative Humidity: 24 %

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Band Width and Input/Output

Downlink - Input iDEN

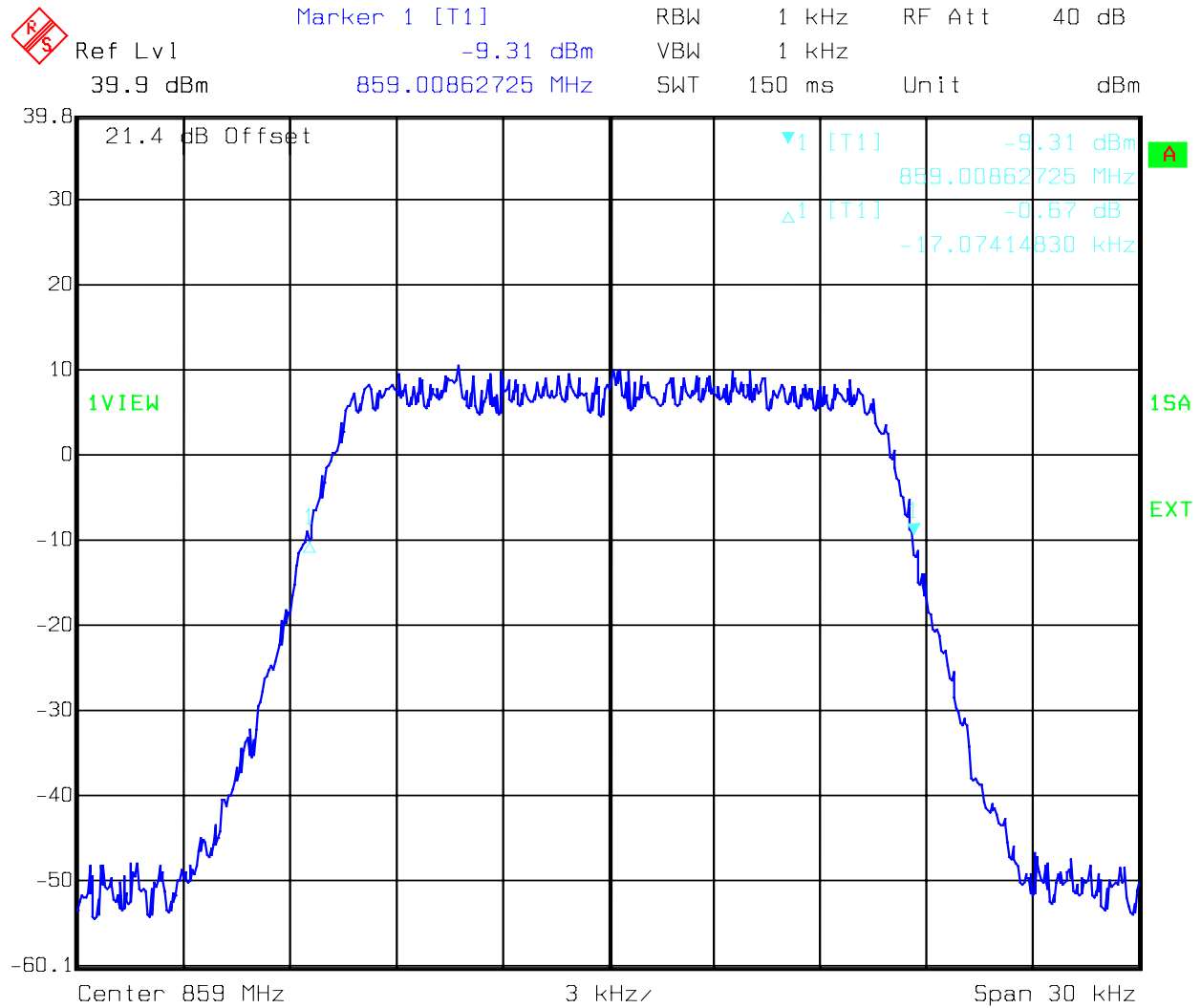


Date: 31.DEC.2004 10:29:27

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

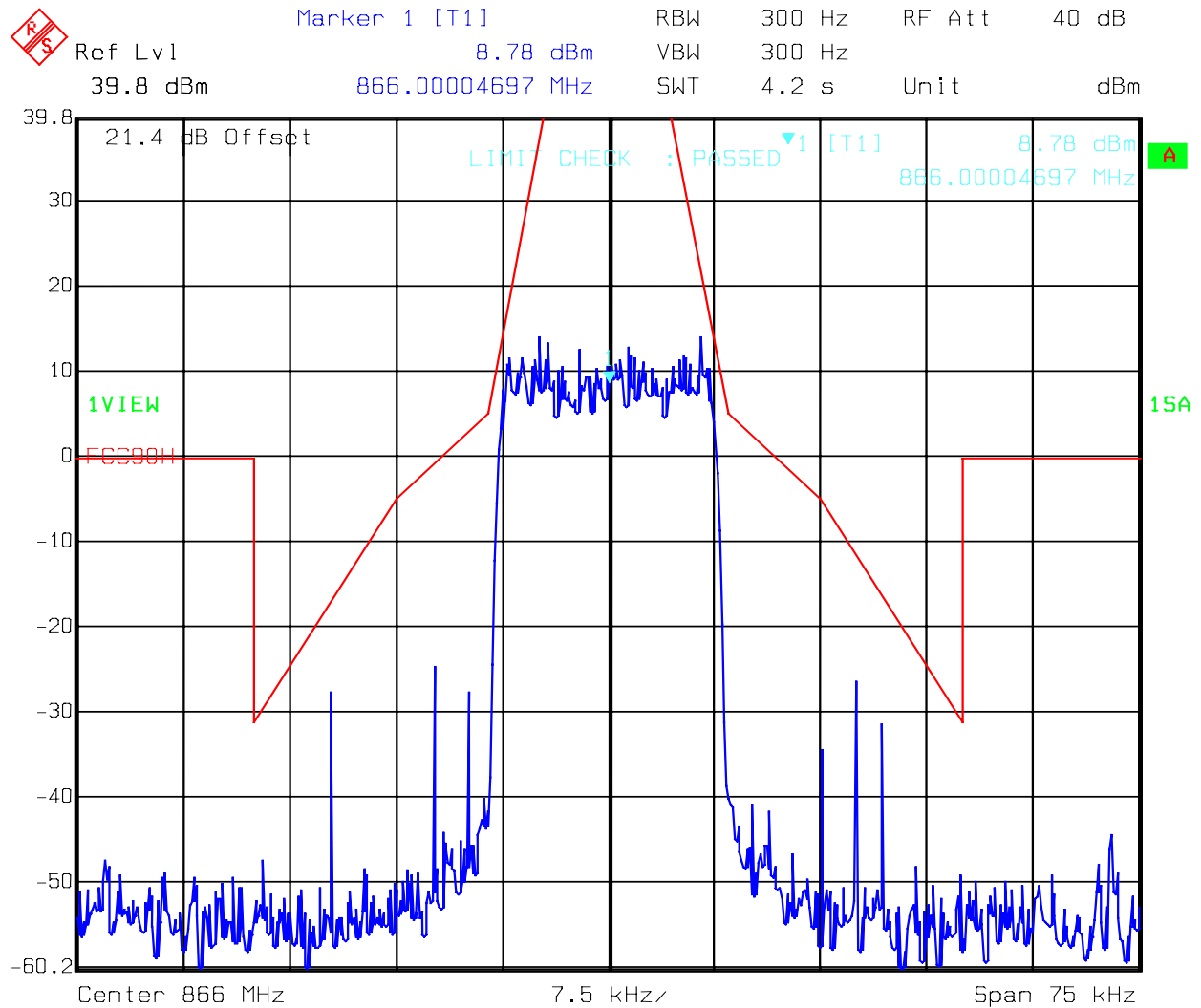
Downlink - Output iDEN



Date: 31.DEC.2004 10:21:59

EQUIPMENT: MMR8L L Repeater

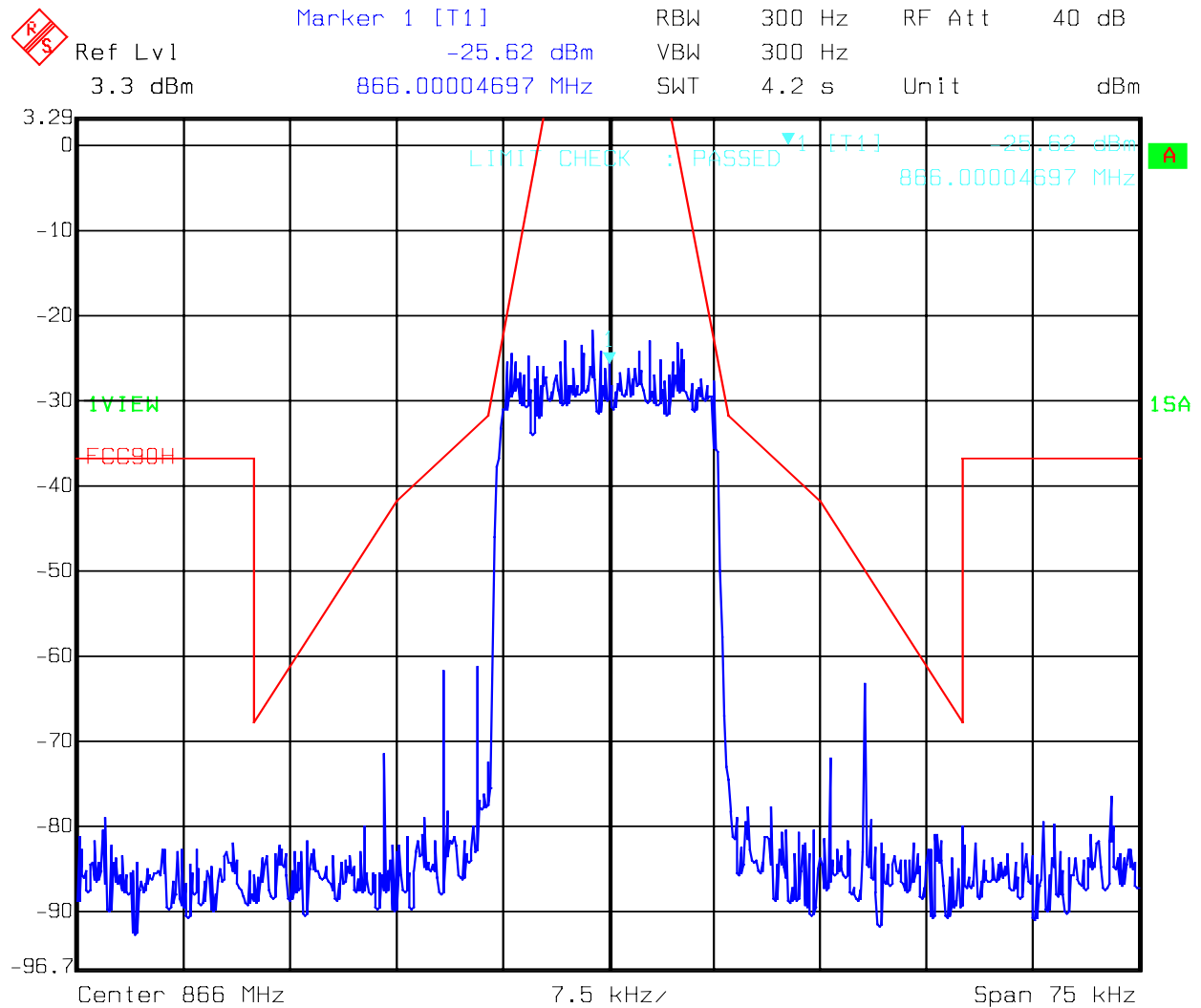
PROJECT NO.: 4L0761R



Date: 30.DEC.2004 16:28:11

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

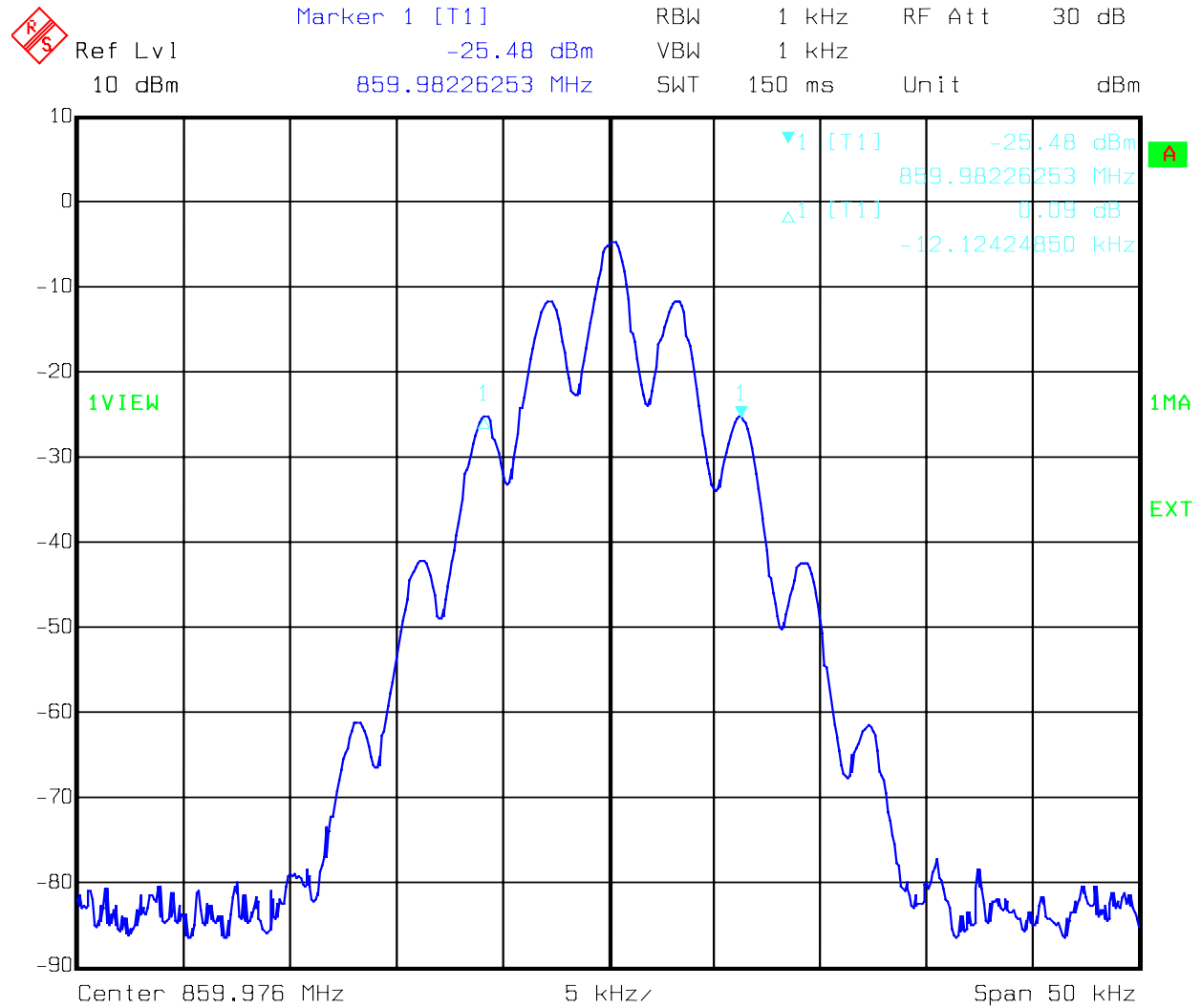


Date: 30.DEC.2004 16:38:48

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PROJECT NO.: 4L0761R

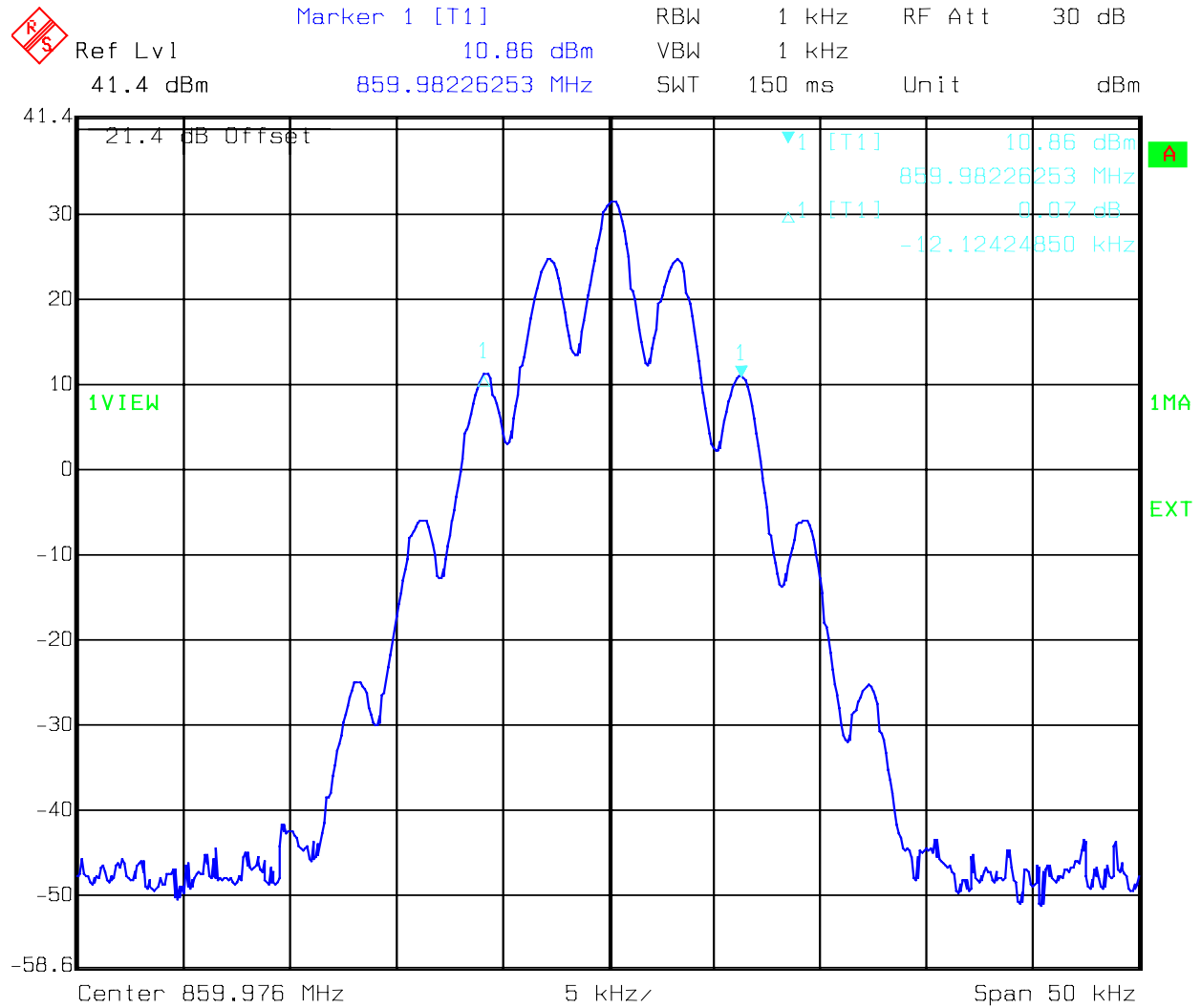
Downlink - Input Analog
2.5 kHz tone at 3 kHz deviation



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Output Analog
2.5 kHz tone at 3 kHz deviation



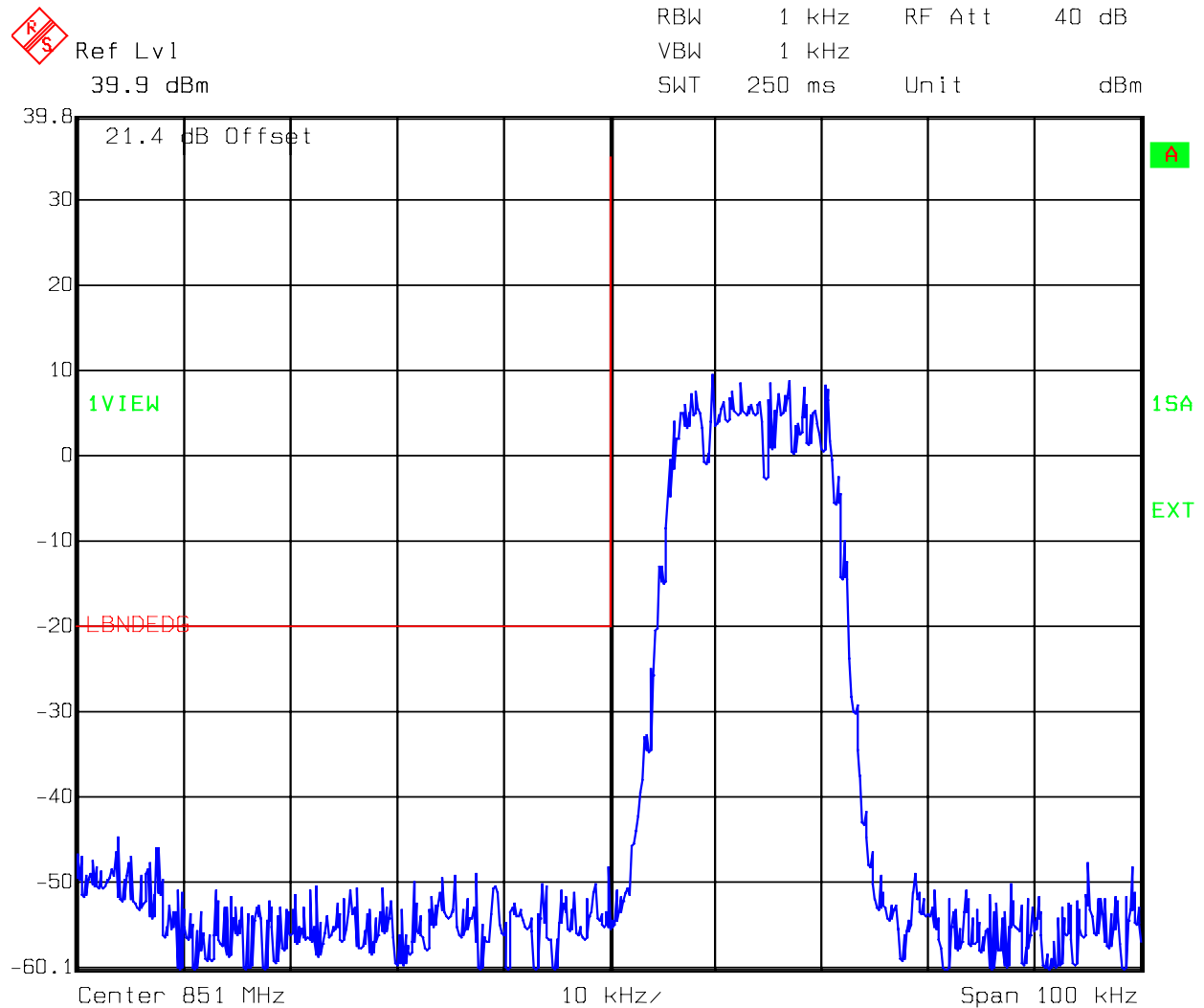
Date: 31.DEC.2004 11:39:15

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Band Edge

Downlink - Lower iDEN

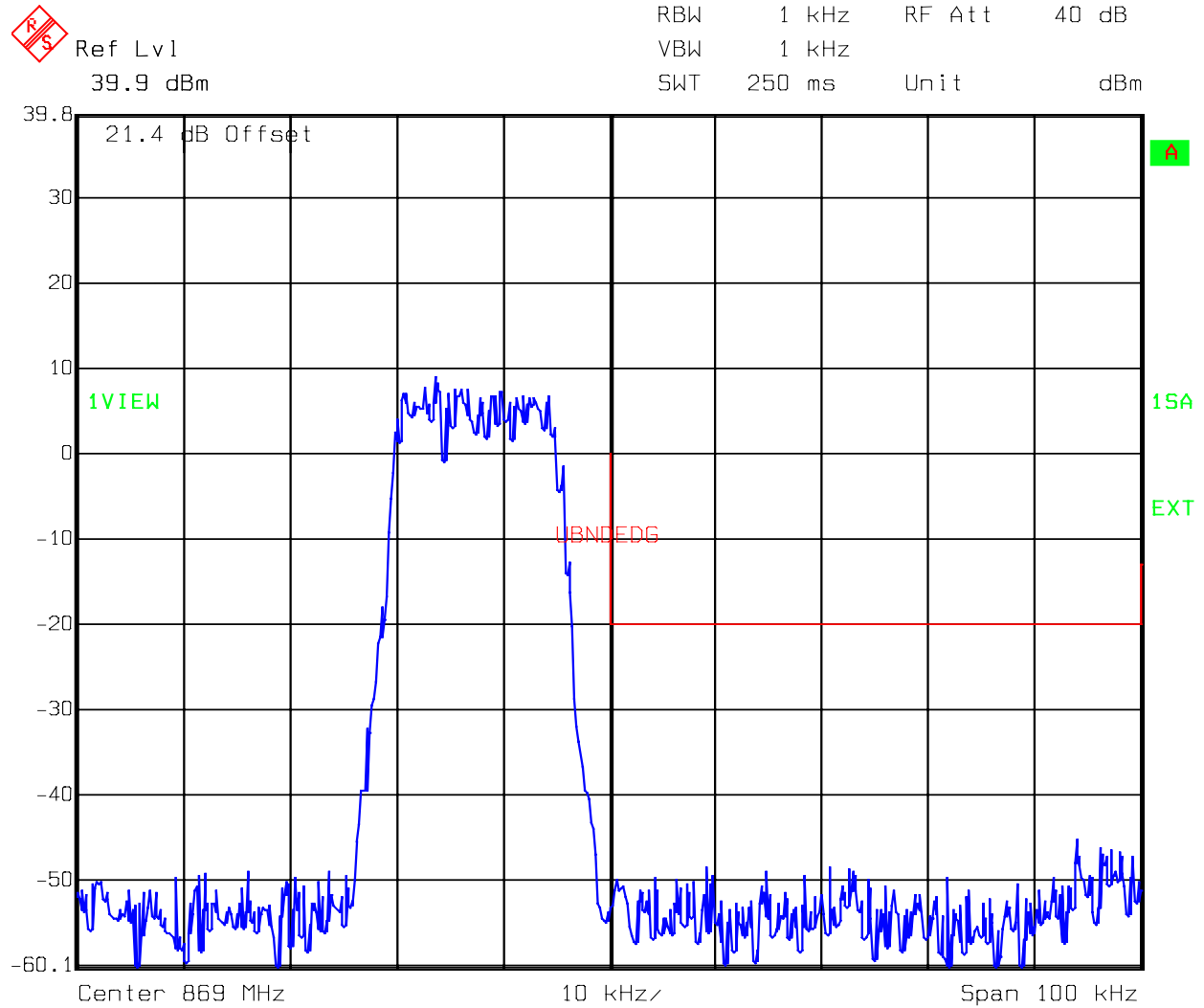


Date: 31.DEC.2004 10:03:12

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper iDEN

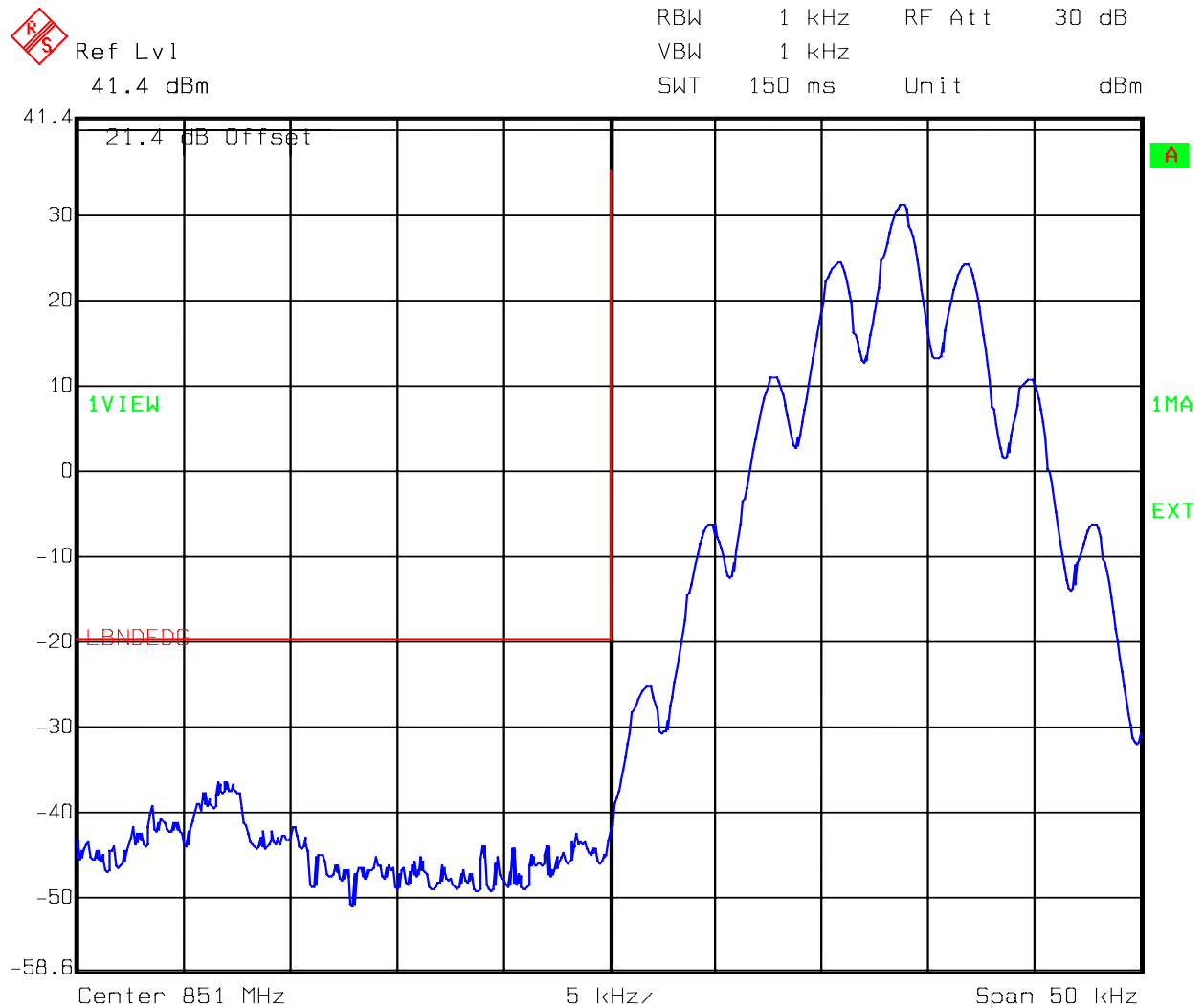


Date: 31.DEC.2004 10:00:52

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Lower Analog
851.0125 MHz,

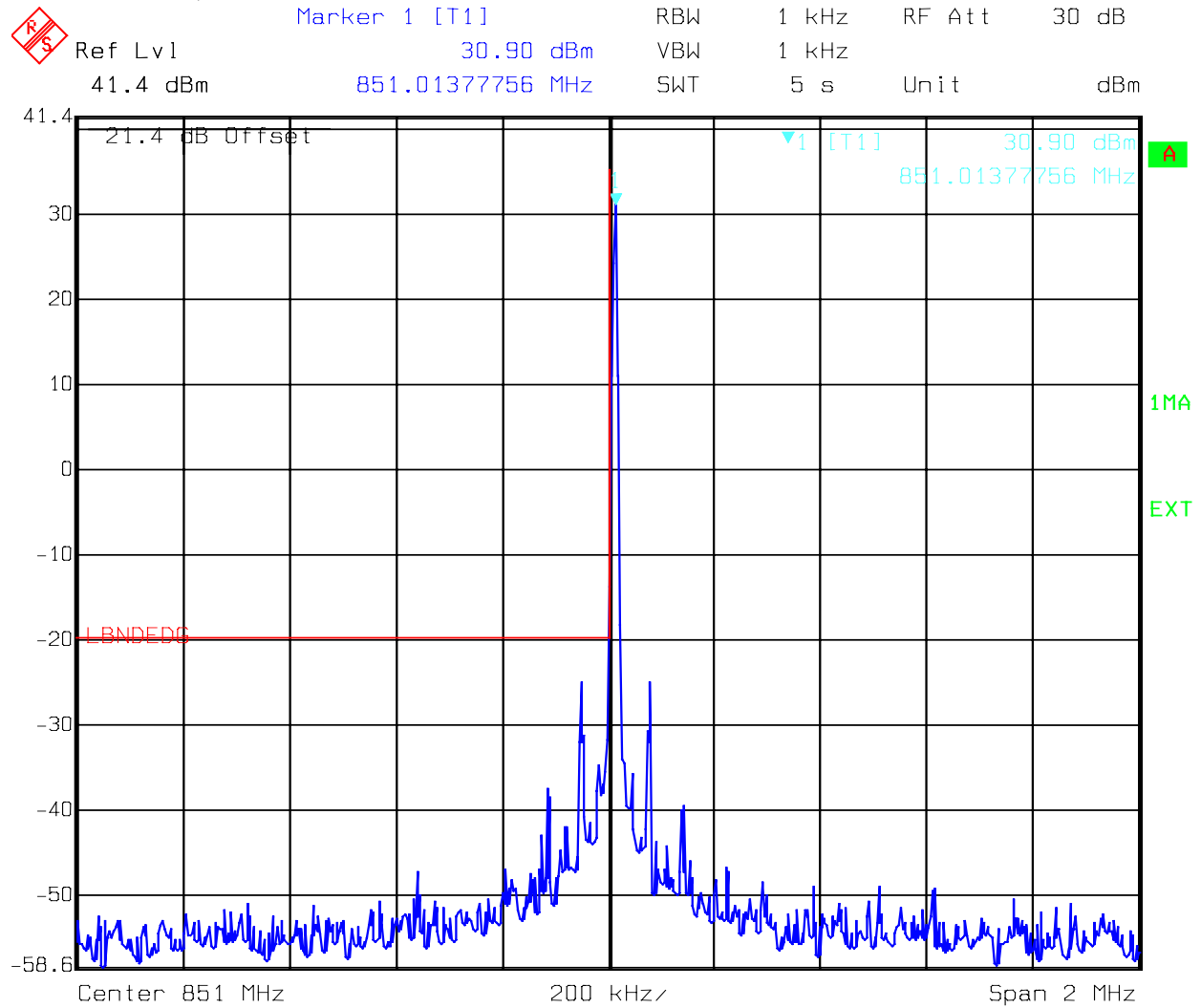


Date: 31.DEC.2004 11:35:43

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Lower Analog
851.0125 MHz,

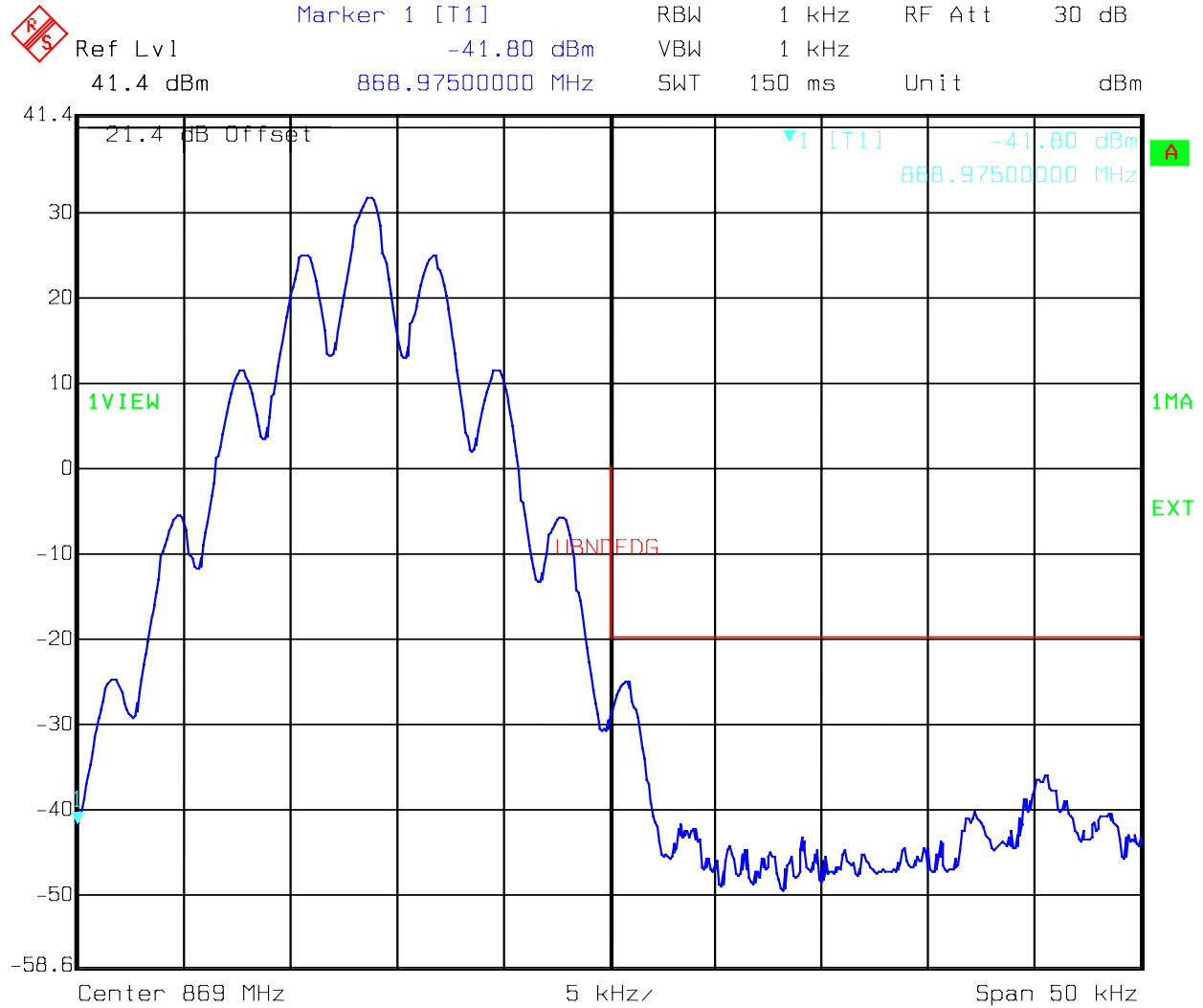


Date: 31.DEC.2004 11:36:39

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper Analog
868.9875 MHz,

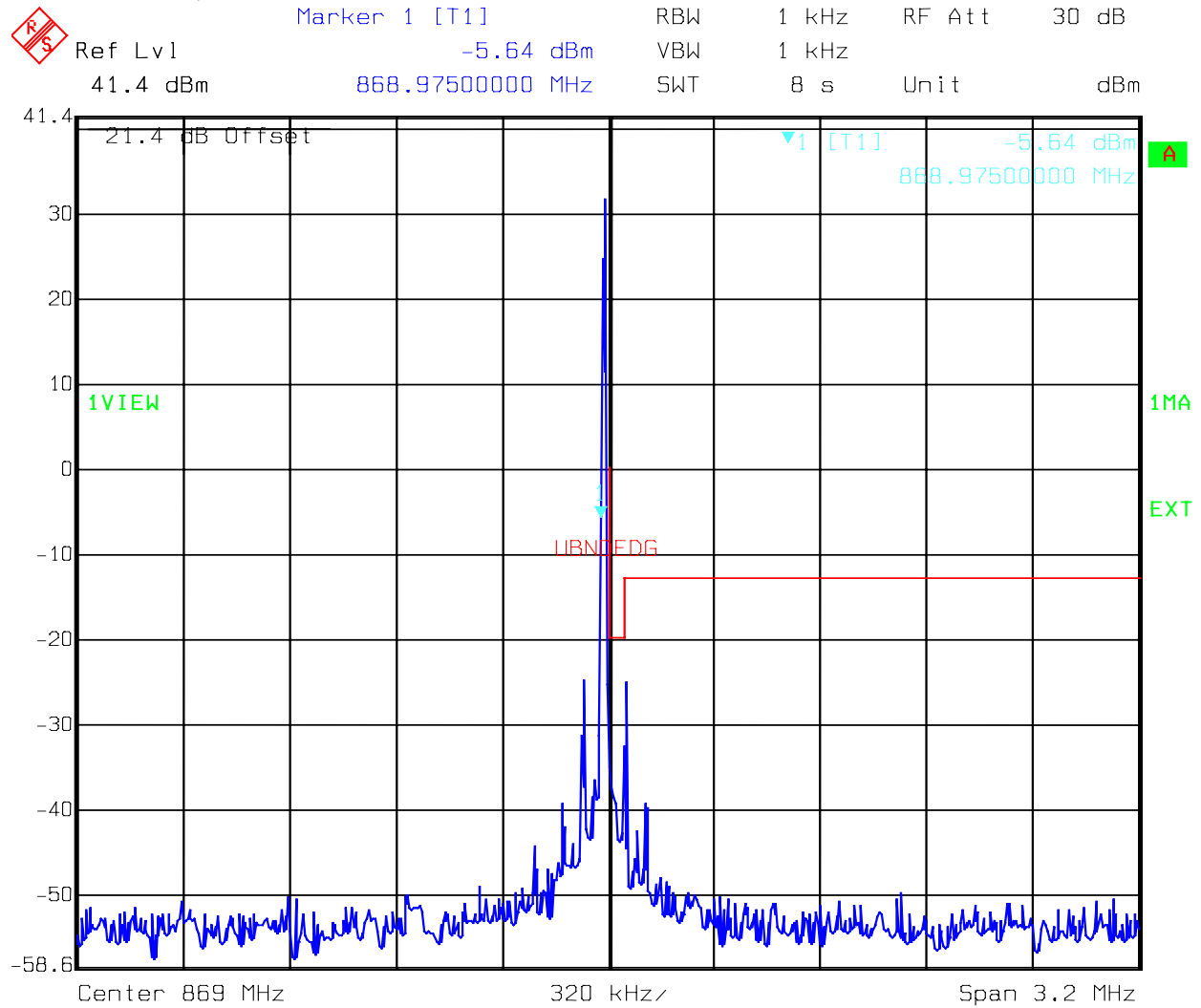


Date: 31.DEC.2004 11:33:58

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper Analog
868.9875 MHz,



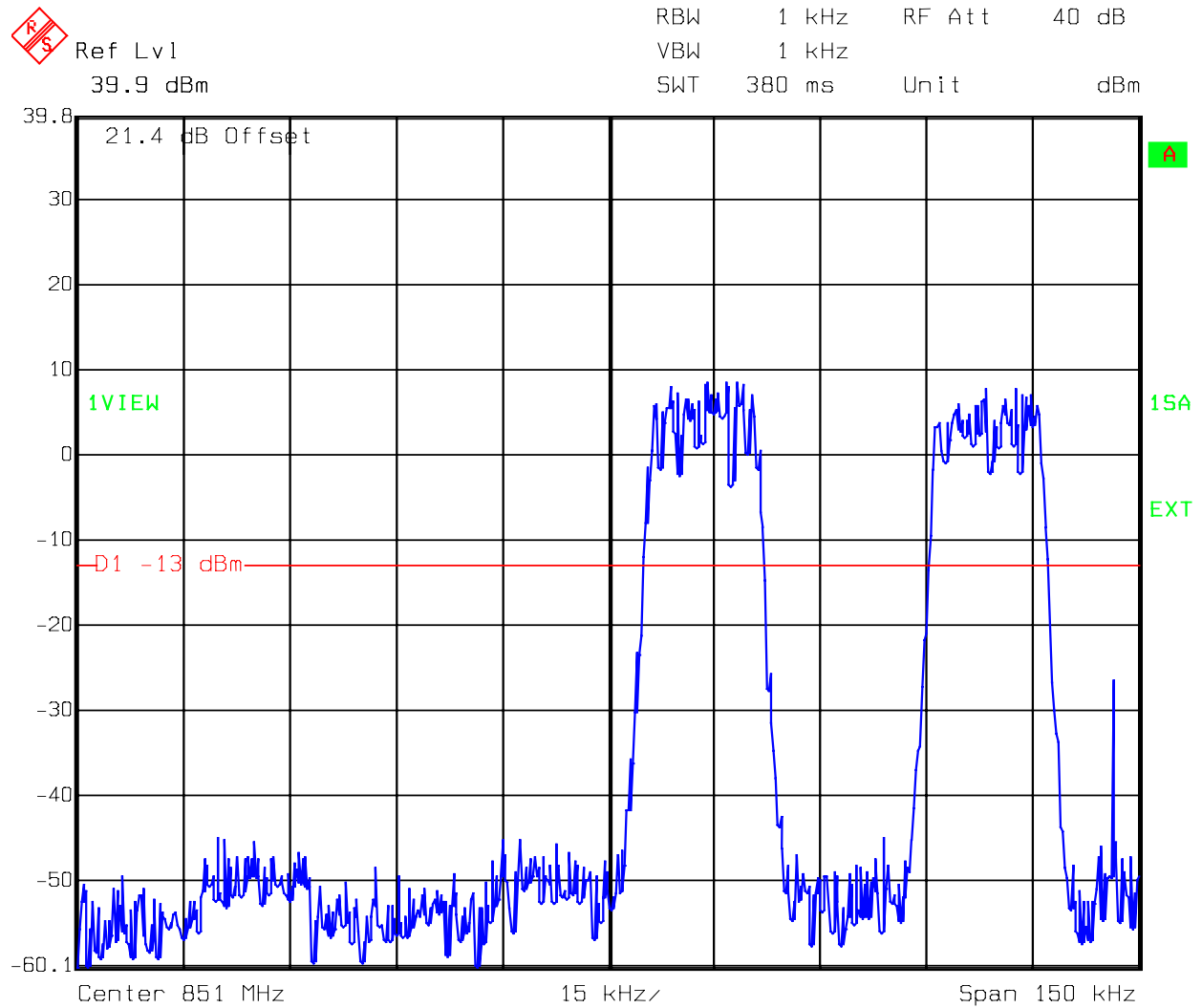
Date: 31.DEC.2004 11:32:37

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Intermodulation

Downlink - Lower iDEN

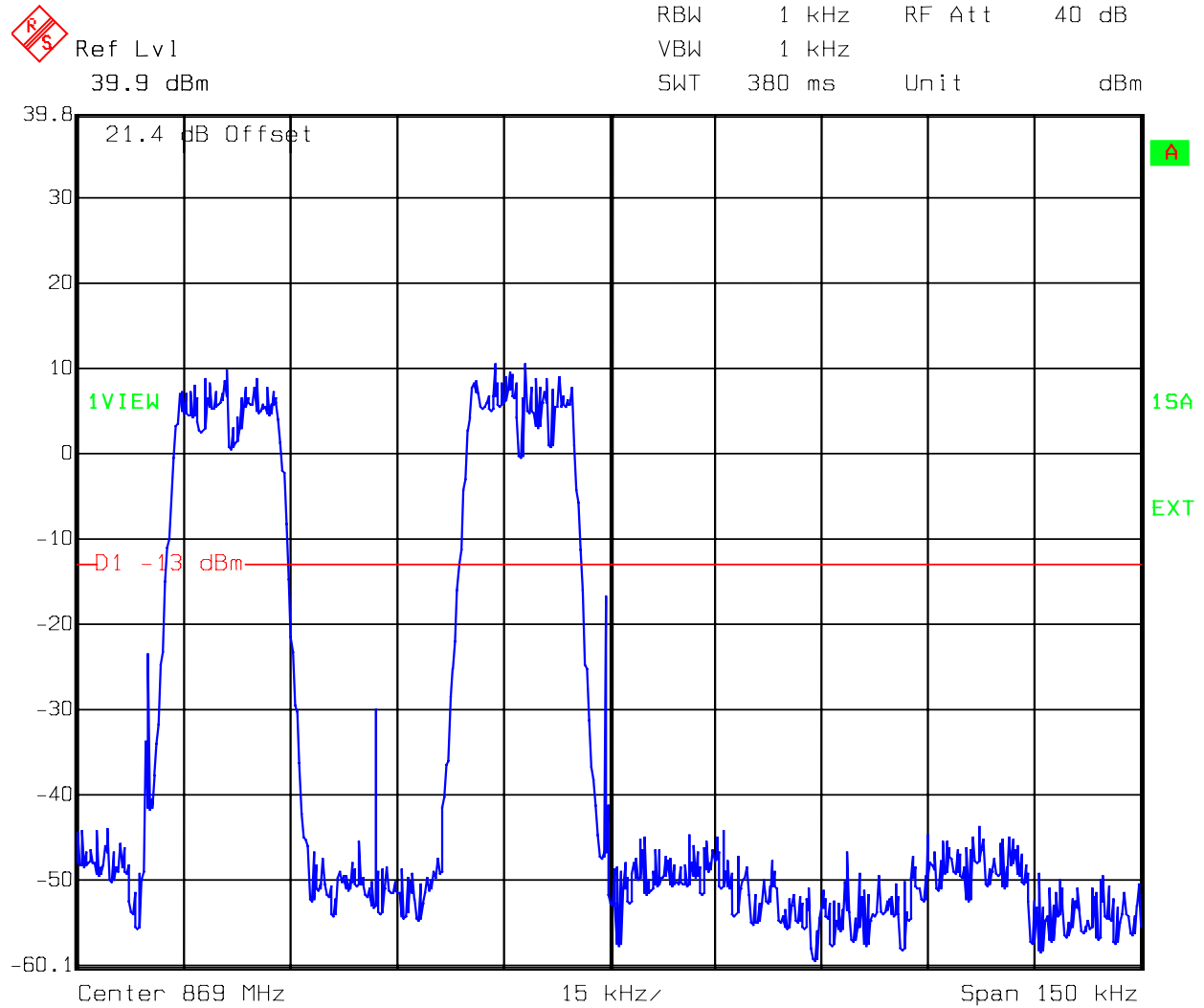


Date: 31.DEC.2004 10:10:35

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper iDEN

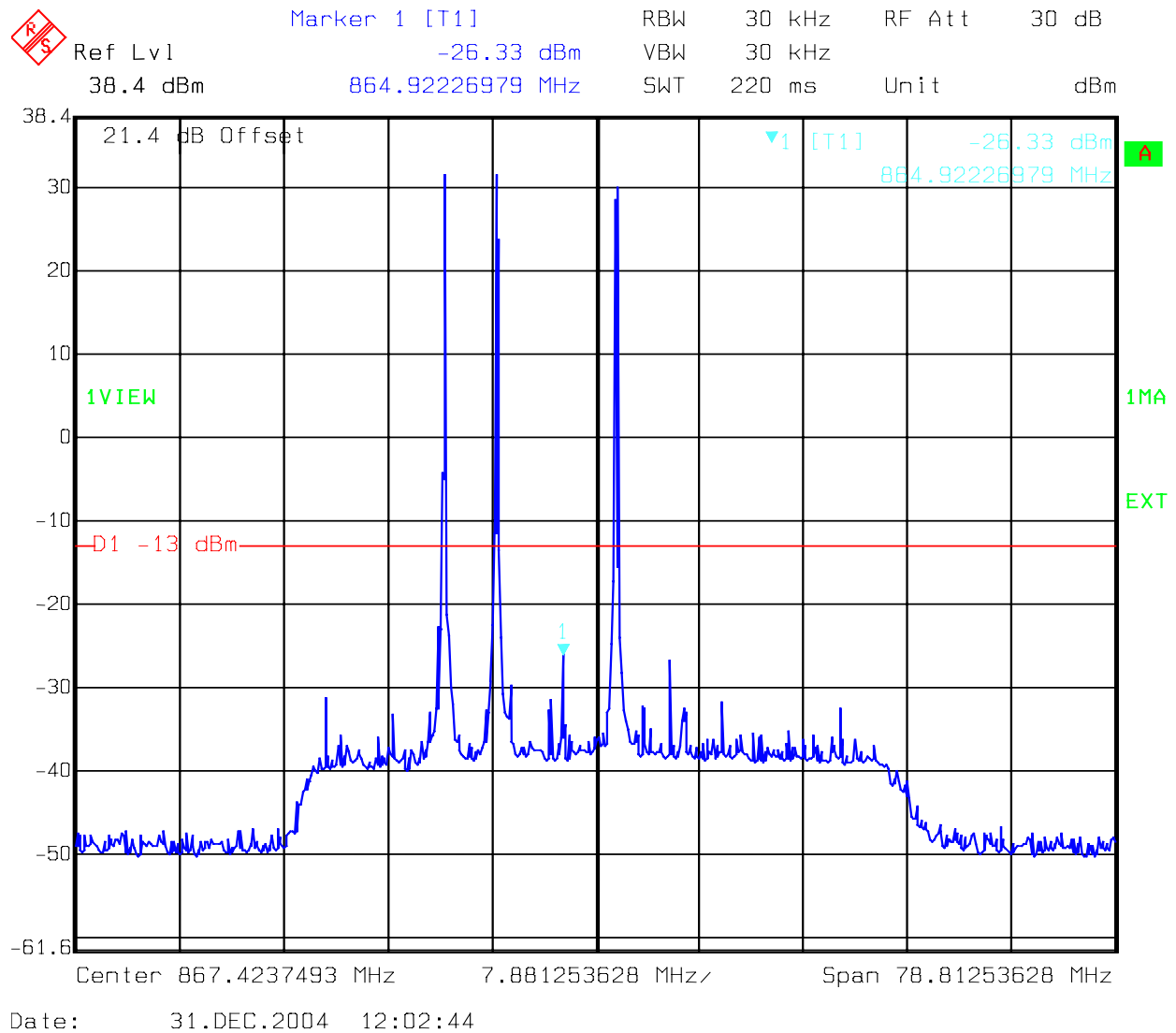


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EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

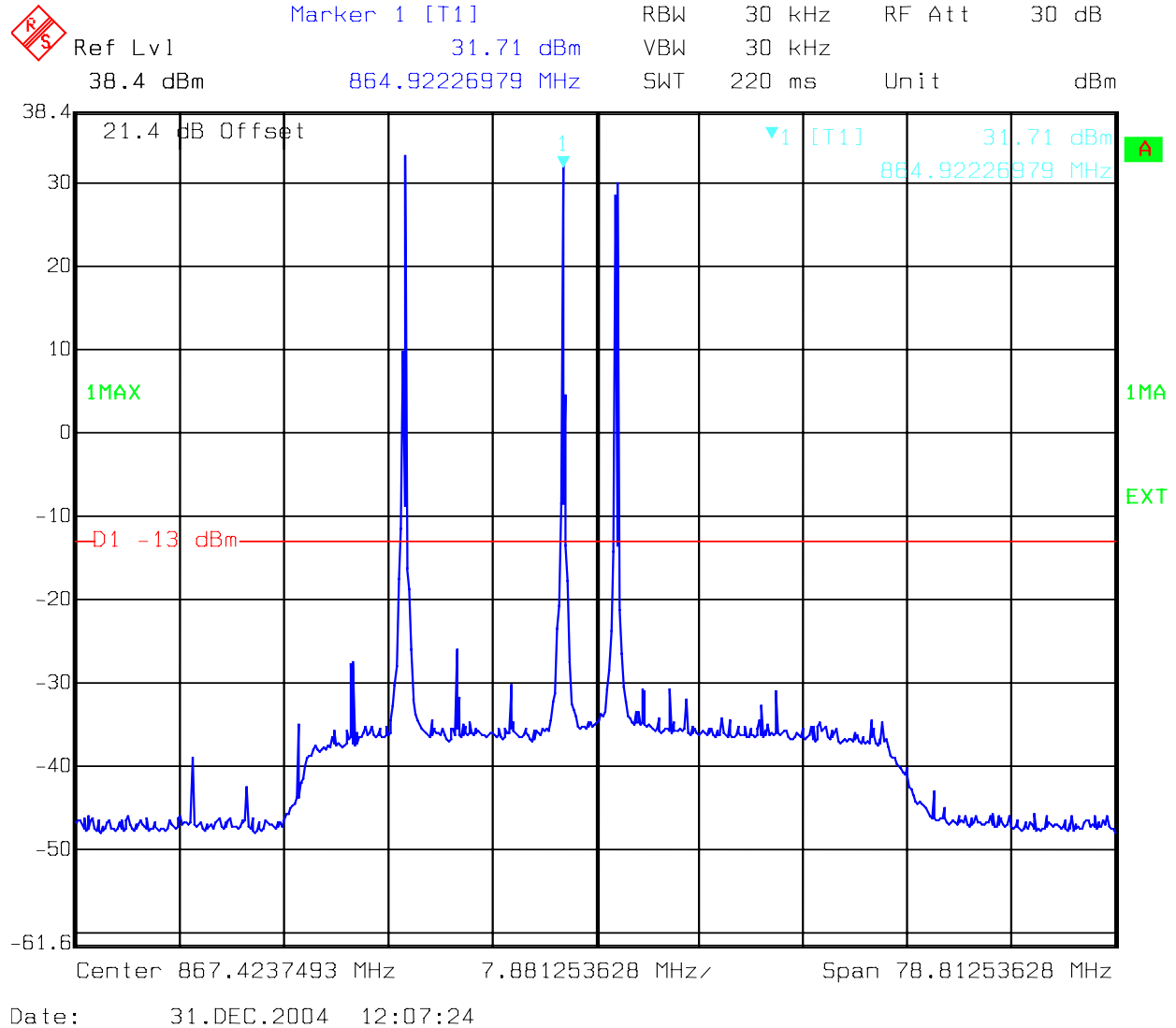
Downlink – 3 Signal Intermodulation, Analogue
22.5 dBm/carrier



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink – 3 Signal Intermodulation, Analogue
22.5 dBm/carrier



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Kevin Rose	DATE: 12/30/2004

Test Results: Complies

Test Data: See attached graph(s).

Equipment Used: 1036, 1053, 1627, 1471, 1973, 1092

Measurement Uncertainty: +/- 1.6 dB

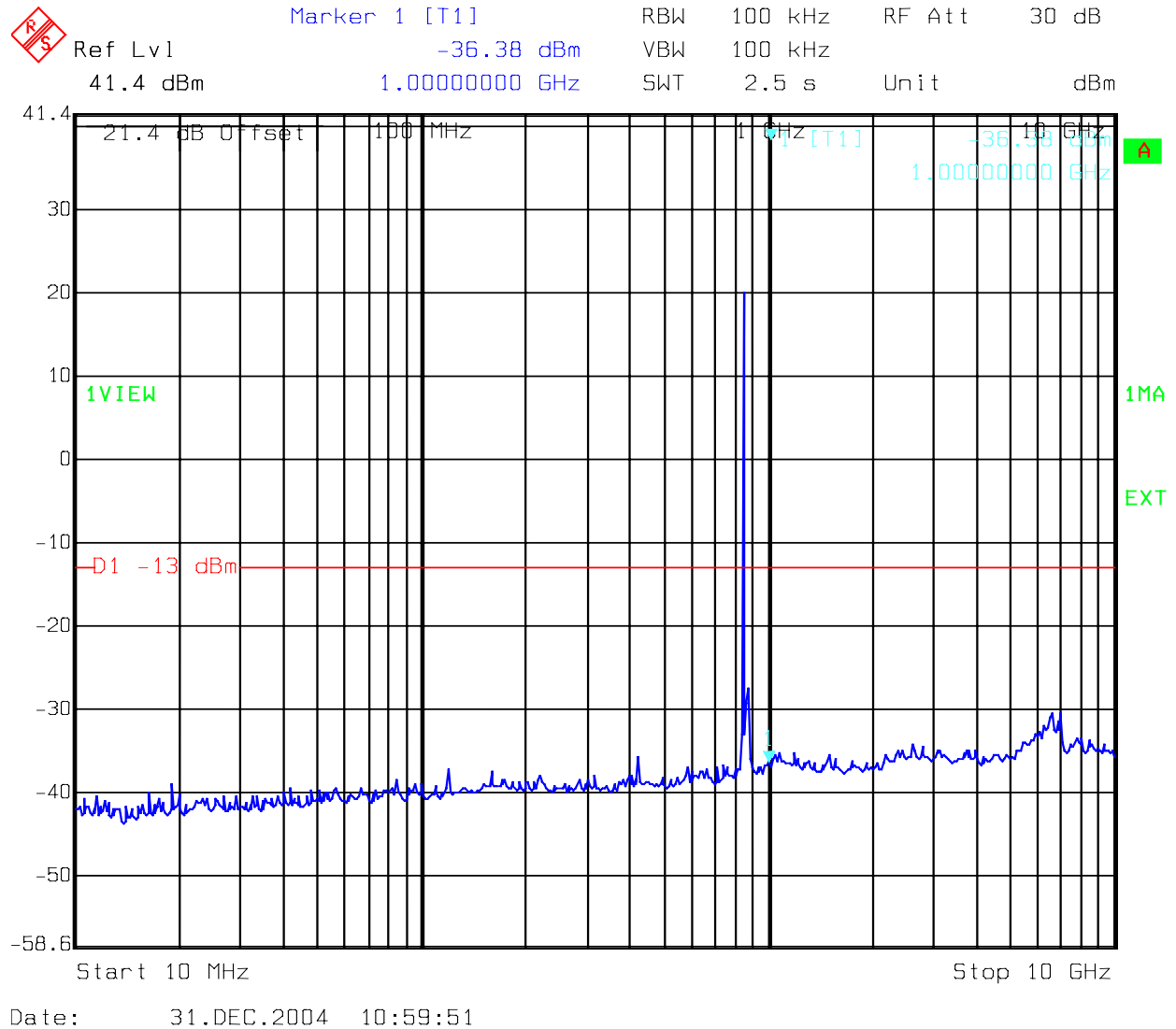
Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

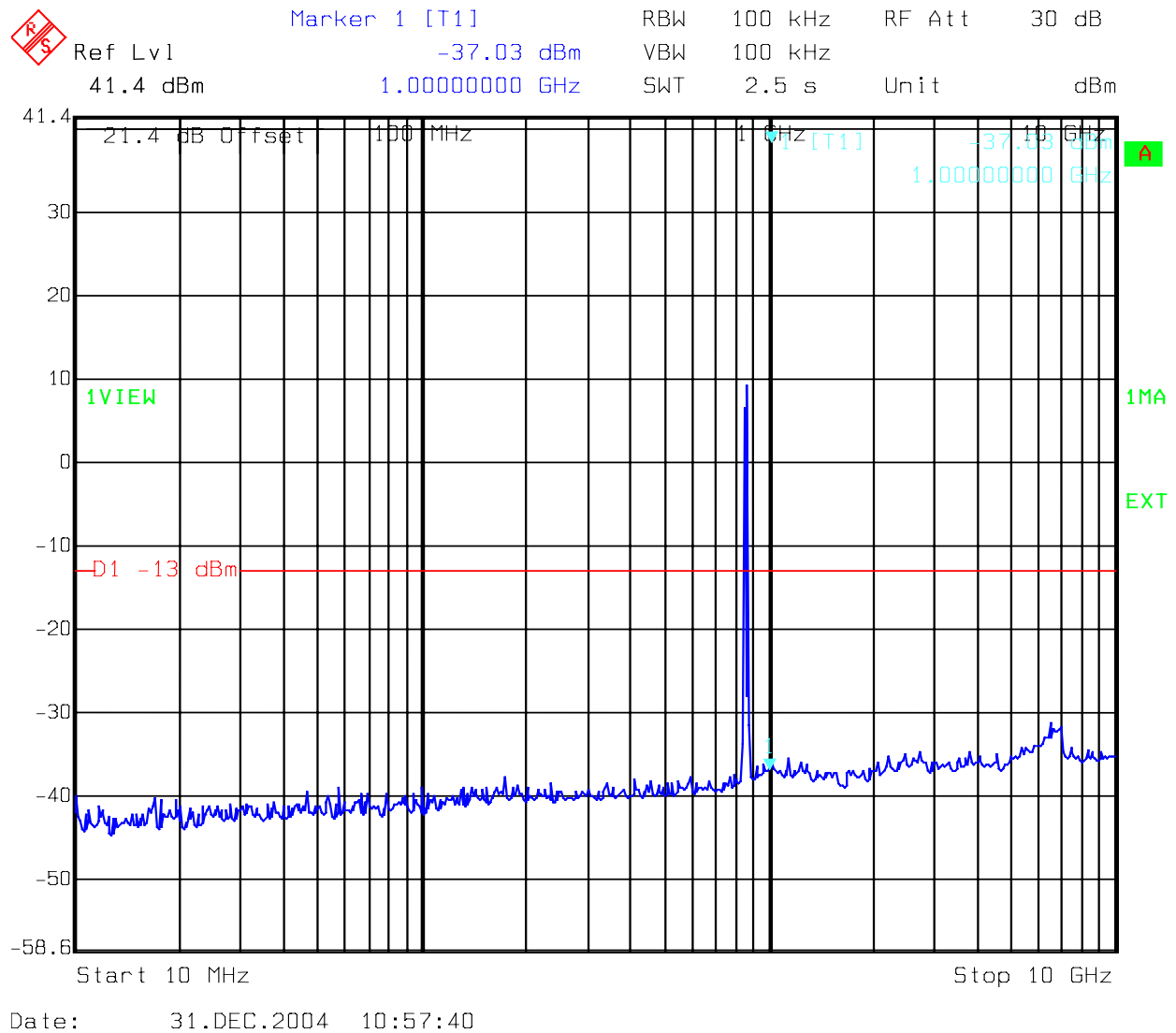
Downlink - Low Channel iDEN



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

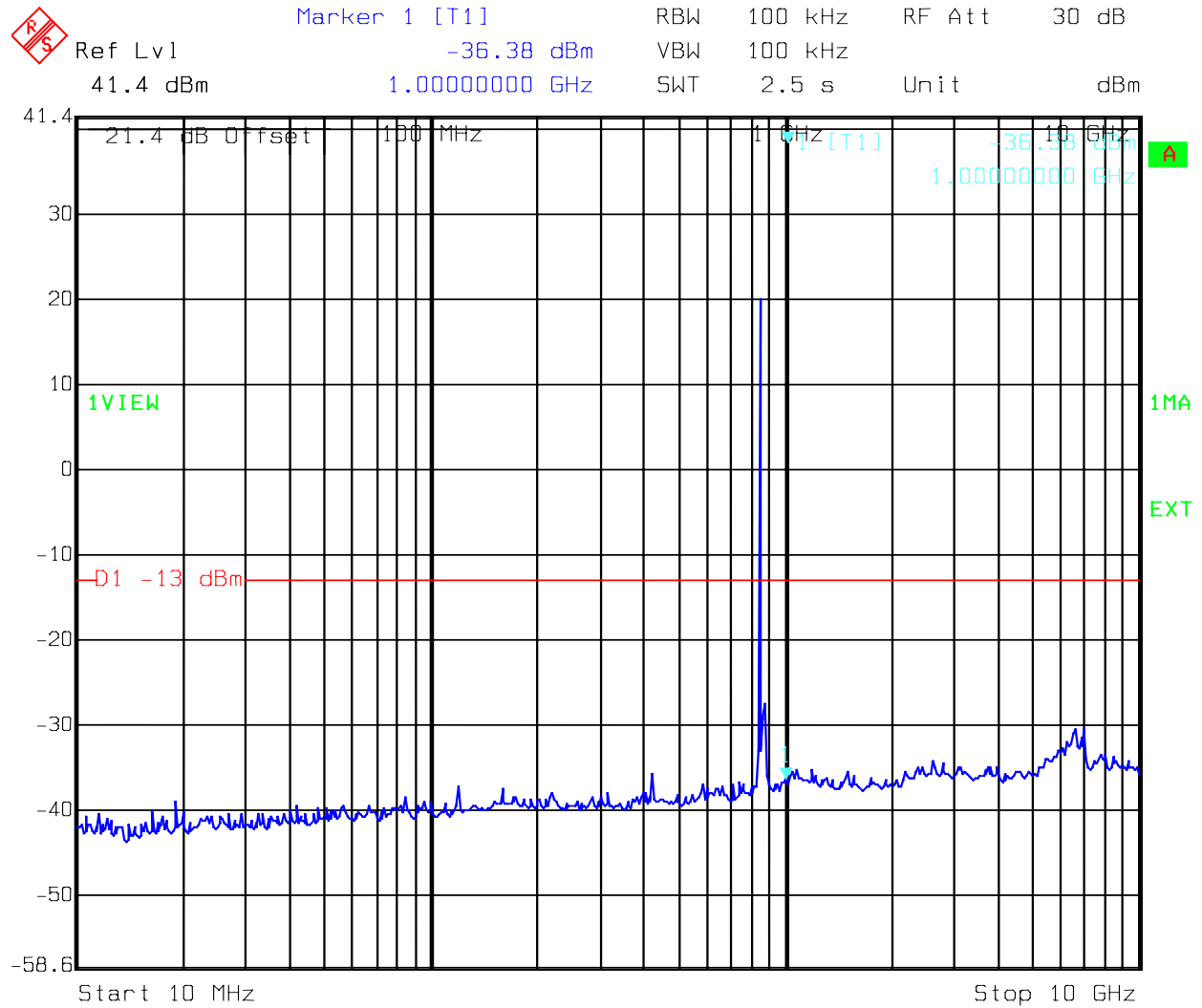
Downlink - Mid Channel iDEN



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper Channel iDEN

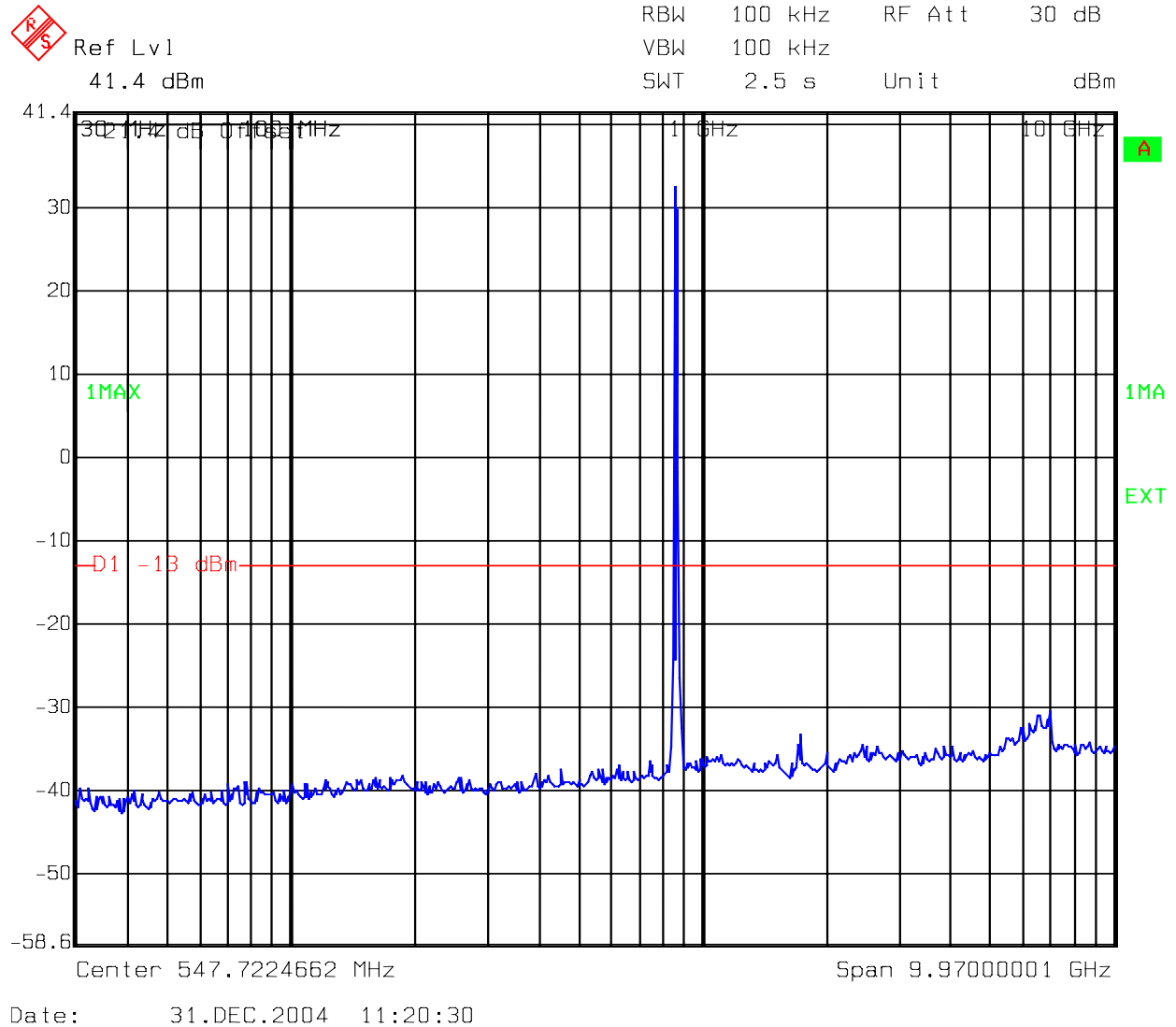


Date: 31.DEC.2004 11:01:21

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

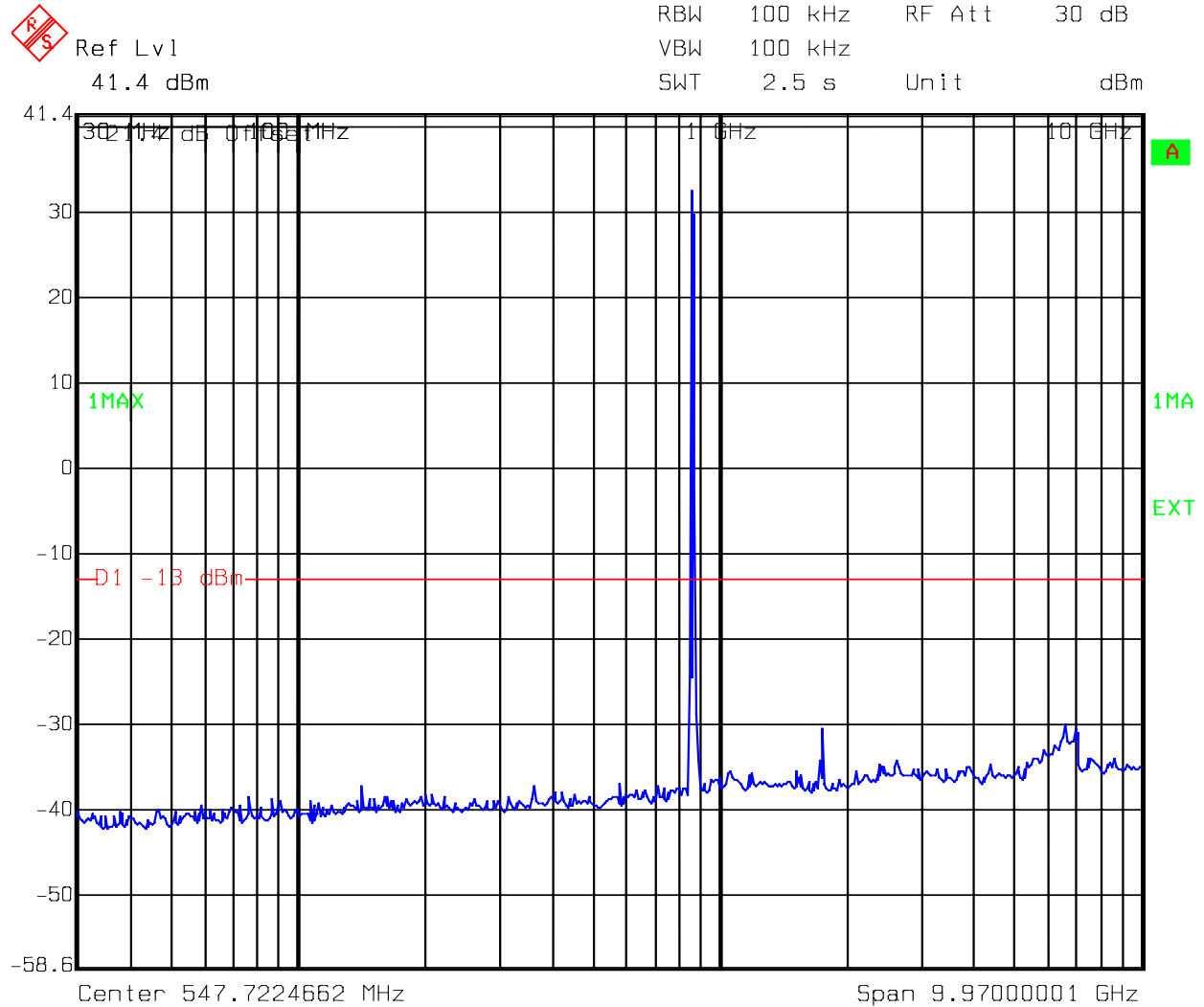
Downlink - Lower Channel Analog



EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Mid Channel Analog

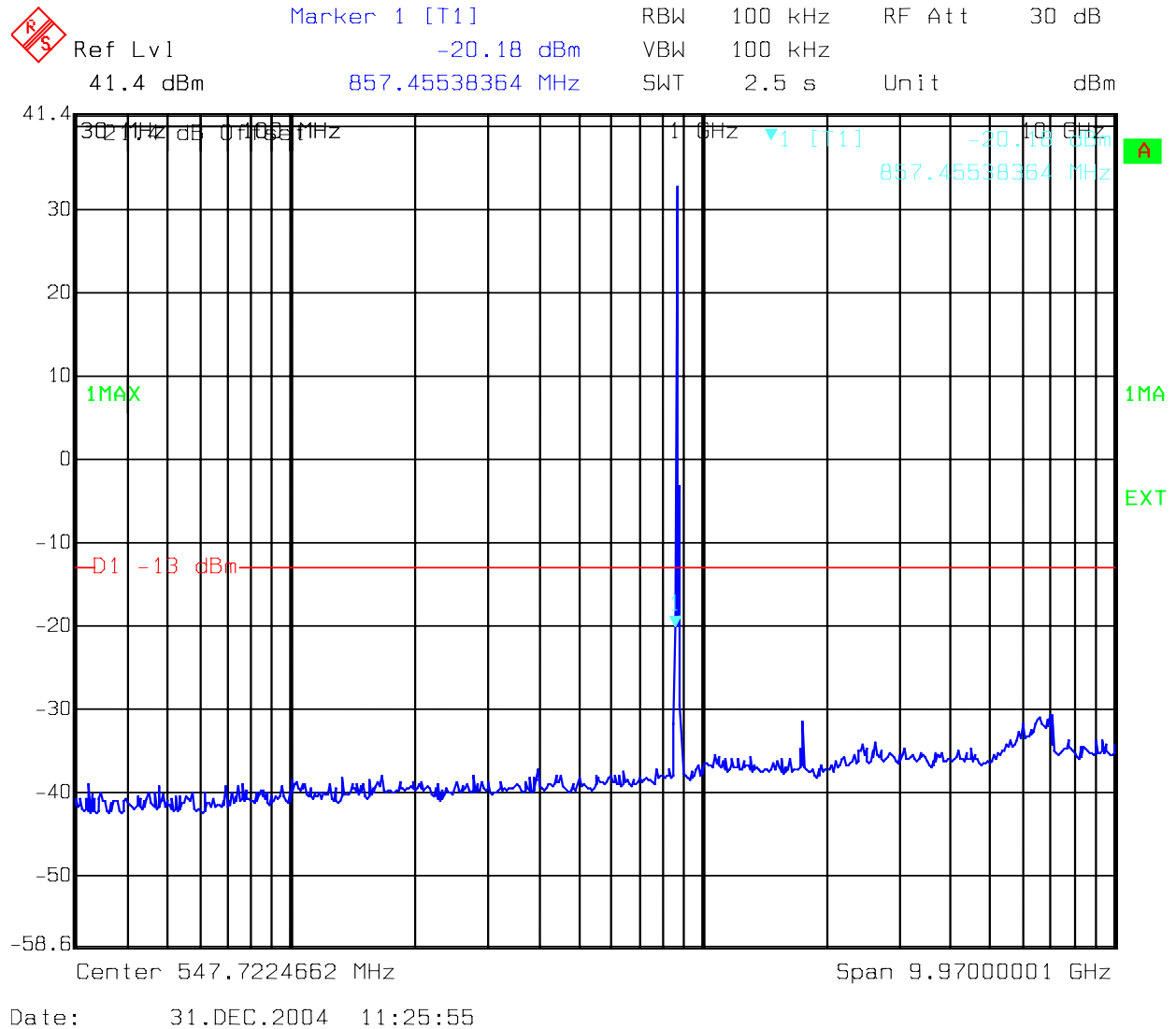


Date: 31.DEC.2004 11:22:22

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Downlink - Upper Channel Analog



EQUIPMENT: MMR8L L RepeaterPROJECT NO.: **4L0761R**

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Kevin Rose	DATE: 12/30/2004

Test Results: Complies**Test Data:** No Emissions found within 20dB of Limit. Noise floor was greater than 20dB below limit. Frequency range scanned from 30MHz to 18GHz**Note:** See page A5 for applicable limit.**Equipment Used:** [Reference data sheets](#)**Measurement Uncertainty:** +/- [3.6](#) dB**Temperature:** [21](#) °C**Relative Humidity:** [38](#) %

PROJECT NO.: 4L0761R

ERP Substitution Method

Test Equipment Used

Antenna:	1304	Directional Coupler:	
Pre-Amp:	1016	Cable #1:	1484
Filter:		Cable #2:	1485
Receiver:	795	Cable #3:	1483
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		

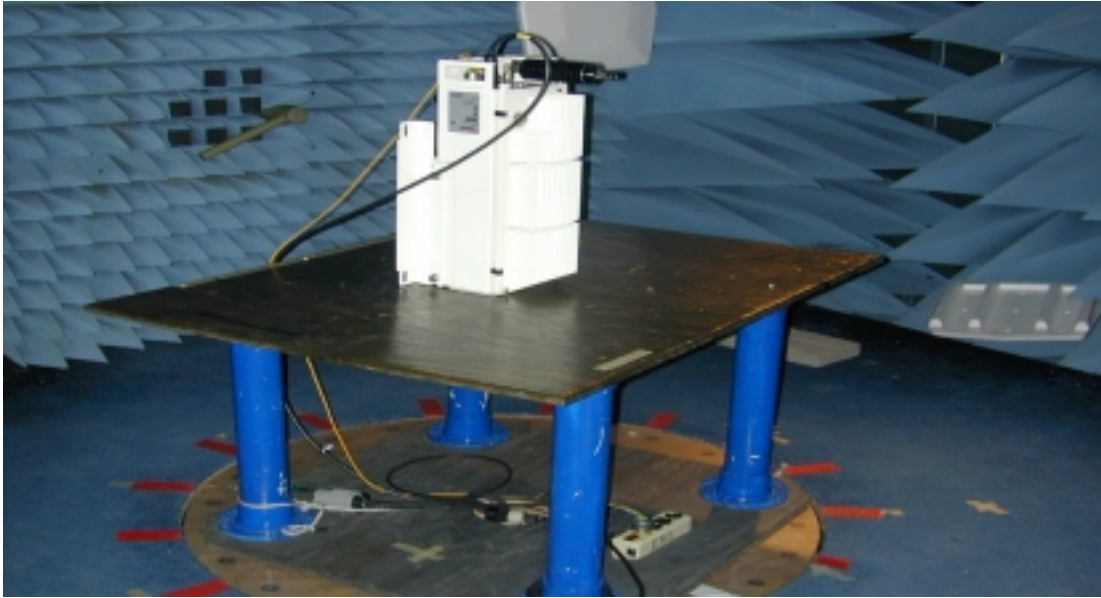
[illegible]

Notes:

PROJECT NO.: 4L0761R

Photographs of Test Setup

FRONT VIEW



REAR VIEW



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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY:	DATE:

Test Results: **Not Applicable.**

Measurement Data: See attached tables.

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSEK30	830844/006	3/29/2006
1052	I/Q MODULATION GENERATOR	Rhode & Schwarz	AMIQ	DE30619	CBU
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMIQ 03	DE22081	CBU
1626	CABLE, 5 ft	MEGAPHASE	10311 1GVT4	N/A	CBU
1627	CABLE, 5 ft	MEGAPHASE	10312 1GVT4	N/A	CBU
1092	COMBINER	MINI-CIRCUITS	ZA3PD-1.5	NONE	CBU
1051	Radio Communication Analyzer	Rhode & Schwarz	CMTA-54	CBU	CBU
1471	10 db Attenuator DC 18 Ghz	MCL Inc.	BW-S10W2 10db-2WDC	CBU	CBU
1304	HORN ANTENNA	ELECTRO METRICS	RGA-60	9/22/03	9/22/05
1016	Pre-Amp	HEWLETT PACKARD	8449A	11/12/04	11/12/05
1483	Cable 4m	Storm	PR90-010-144	08/26/04	08/26/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

ANNEX A - TEST METHODOLOGIES

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

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.

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
--	-------------------------

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

VBW=RBW

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

EQUIPMENT: MMR8L L RepeaterPROJECT NO.: 4L0761R

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

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: **4L0761R**

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

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

Test Method: The substitution antenna method as described in EIA/TIA 603 was used. The field strength of the emission is measured and recorded. The EUT is then replaced with an antenna of known gain. A calibrated signal is fed to the substitution antenna and adjusted to obtain the previously recorded field strength level. The erp is the signal fed to the substitution antenna.

EQUIPMENT: MMR8L L Repeater

PROJECT NO.: 4L0761R

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

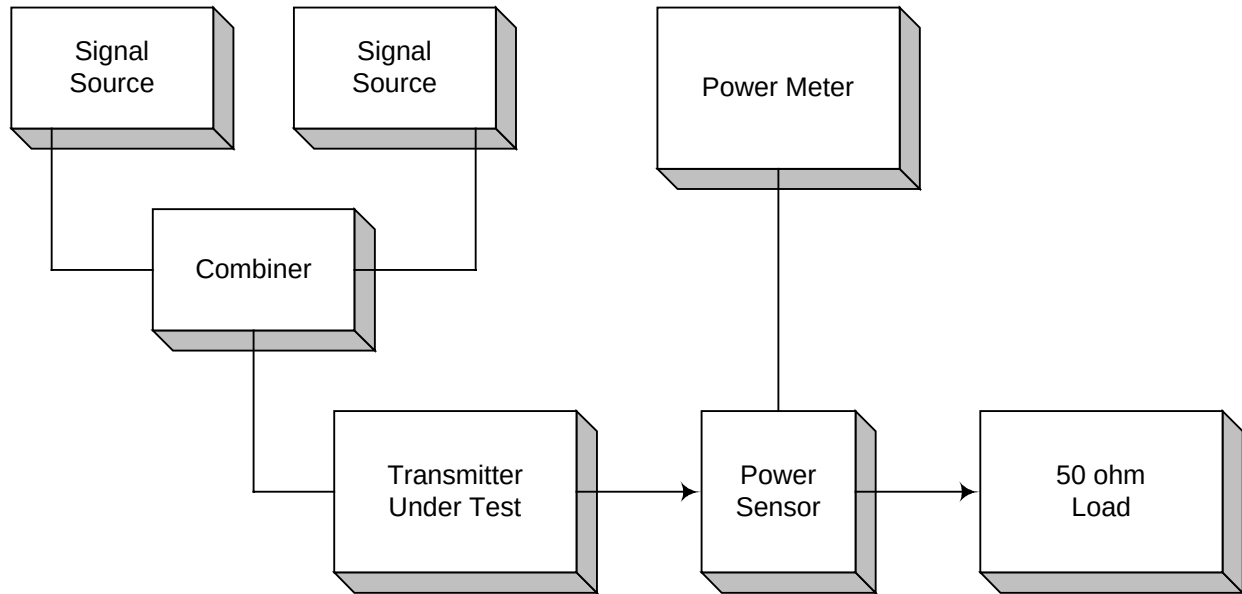
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: MMR8L L Repeater

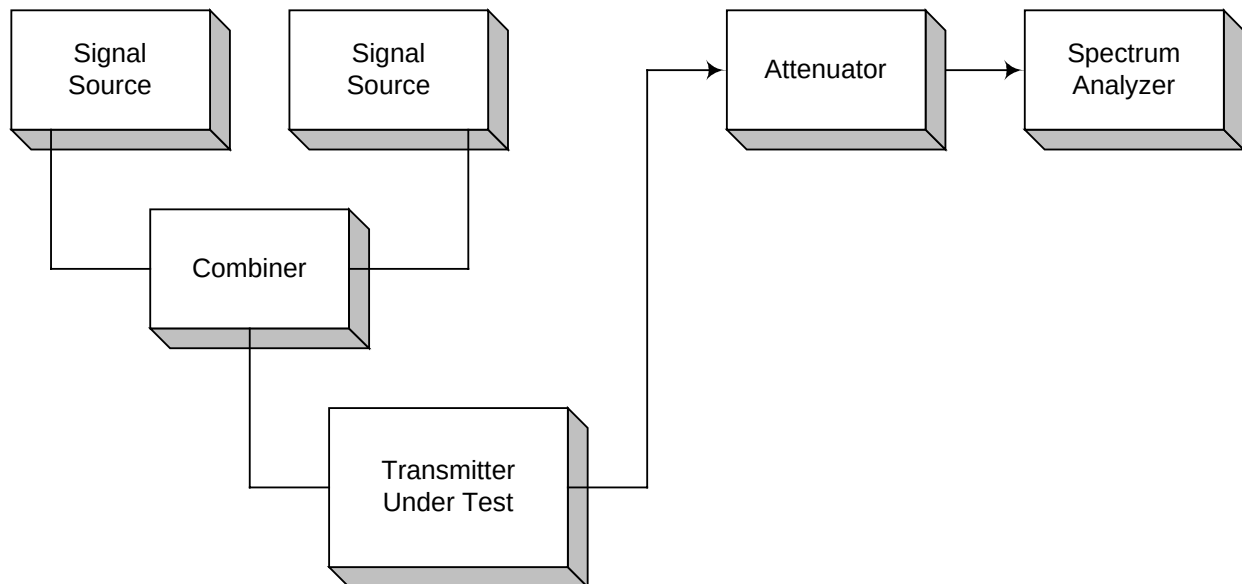
PROJECT NO.: **4L0761R**

ANNEX B - TEST DIAGRAMS

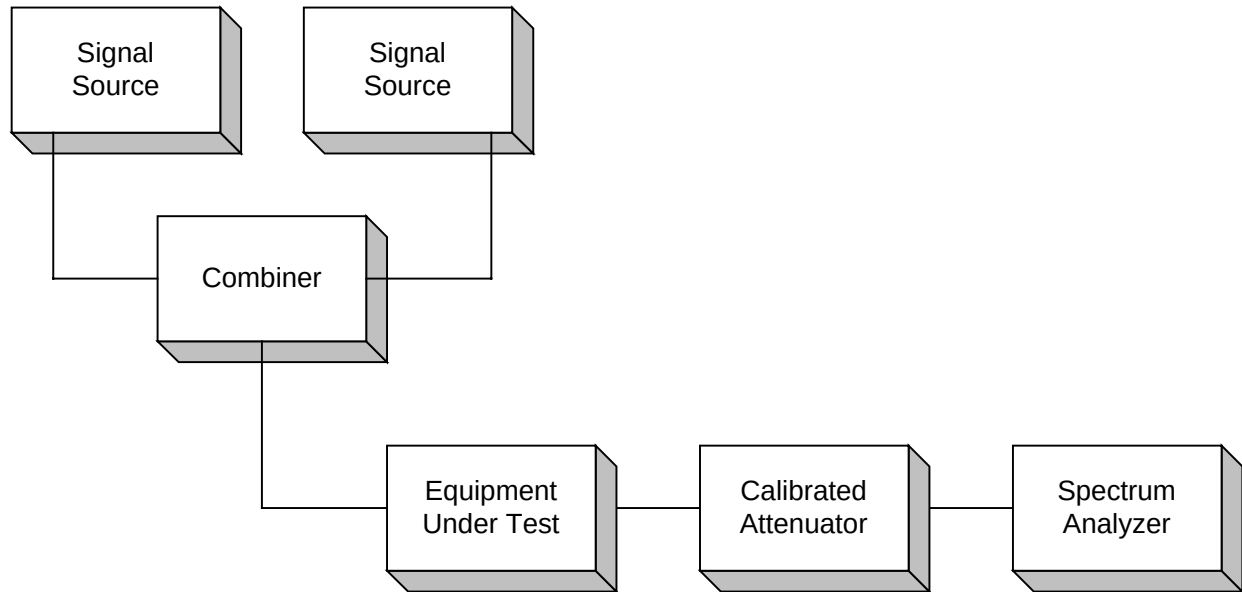
Para. No. 2.985 - R.F. Power Output



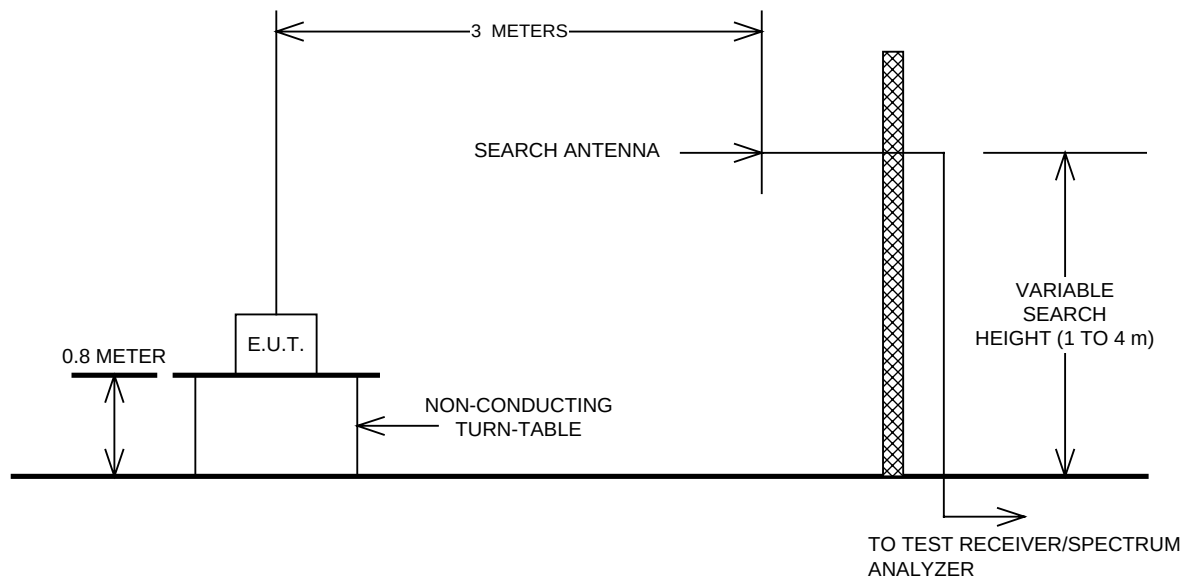
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

