

Nemko Test Report: 4L0492RUS1REV2

Applicant: Andrew Corporation

**Equipment Under Test:
(E.U.T.)** Optical 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:



Tom Tidwell, Frontline Manager

Date: 2 November, 2004

Total Number of Pages: 70

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EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

Section 1. Summary of Test Results

Manufacturer: [Andrew Corporation](#)

Model No.: [TFAN 80/90](#)

Serial No.: [042602622](#)

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: Optical Repeater**PROJECT NO.: 4L0492R**

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: 21°C
 Humidity: 51%

Outdoor Temperature: 19 °C
 Humidity: 65 %

.

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input: 115V AC

Frequency Range: 935-960MHz

851-869MHz

Tunable Bands: 935-960MHz

20 dB Passband:

Type(s) of Modulation:	F3E (Voice)	F1D	F2D	GXW (QAM)	Other
	☐	☐	☐	☒	☐

Maximum Input: +0dBm

Output Impedance: NA

RF Power Output (rated):	Single:	13dBm
	Composite:	10dBm (2-Carrier)

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

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☒

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

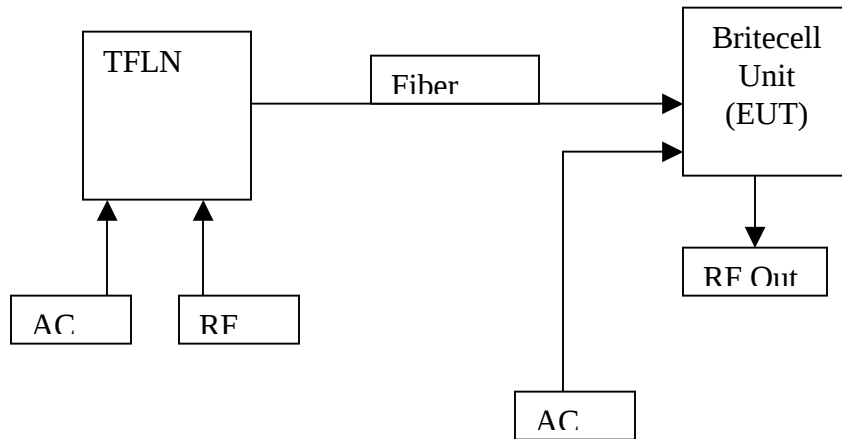
EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

Modifications Made During Testing

No Modifications made during testing

System Diagram



EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Dustin Oaks	DATE: 08/13/2004

Test Results: Complies**Measurement Data:**

900 Band

Frequency (MHz)	Measured Power (mW)	Measured Power (dBm)	Rated Power (dBm)
iDEN	33.65	15.27	15.00
ANALOG	132.13	21.21	21.00

800 Band

Frequency (MHz)	Measured Power (mW)	Measured Power (dBm)	Rated Power (dBm)
iDEN	32.51	15.12	15.00
ANALOG	127.64	21.06	21.00

Equipment Used: 1036, 1053, 1627, 1471, 1973**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 21 °C**Relative Humidity:** 51 %

EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Dustin Oaks	DATE: 08/13/2004

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

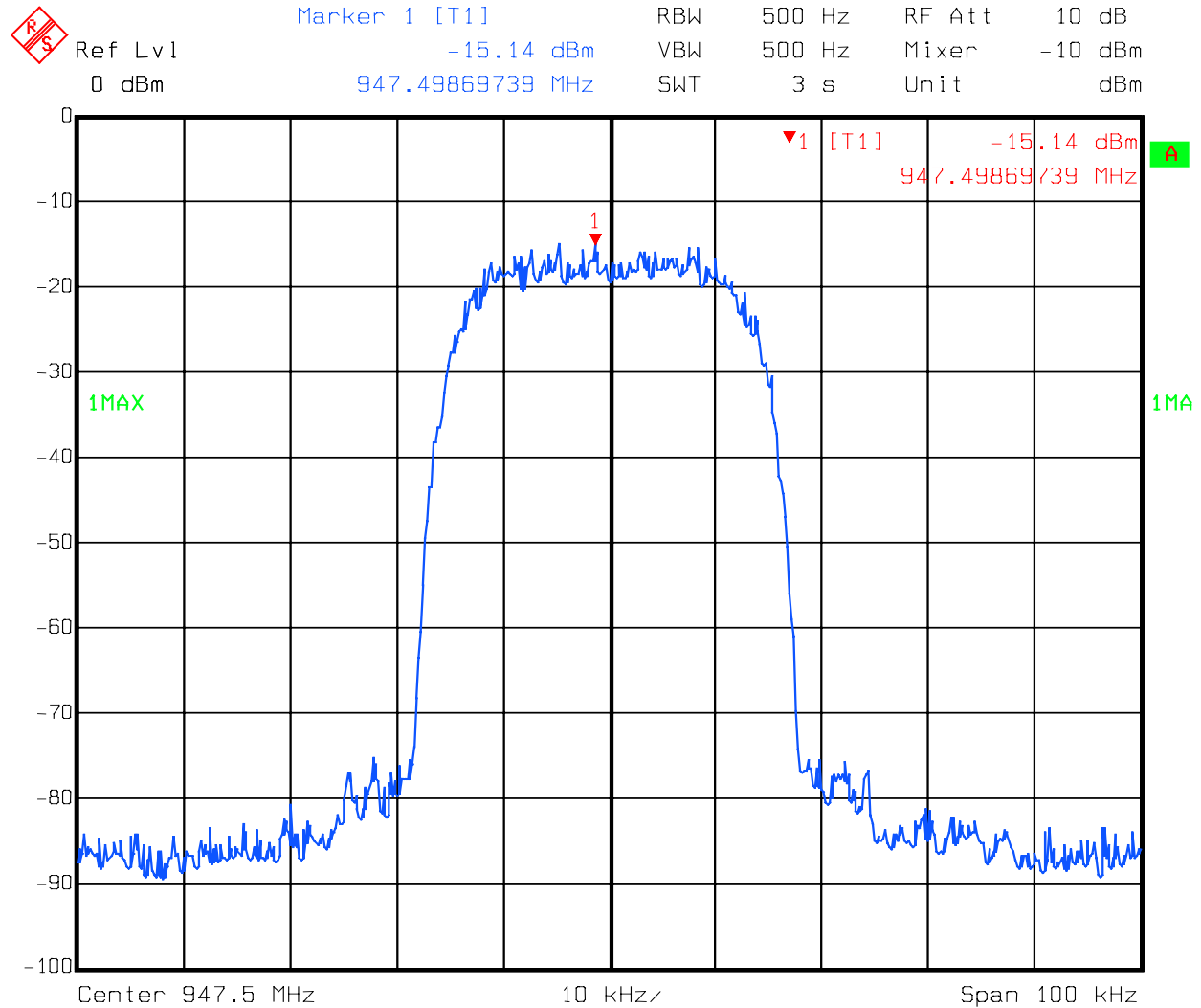
Relative Humidity: 51 %

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Band Width and Input/Output

Input iDEN (900 Band)

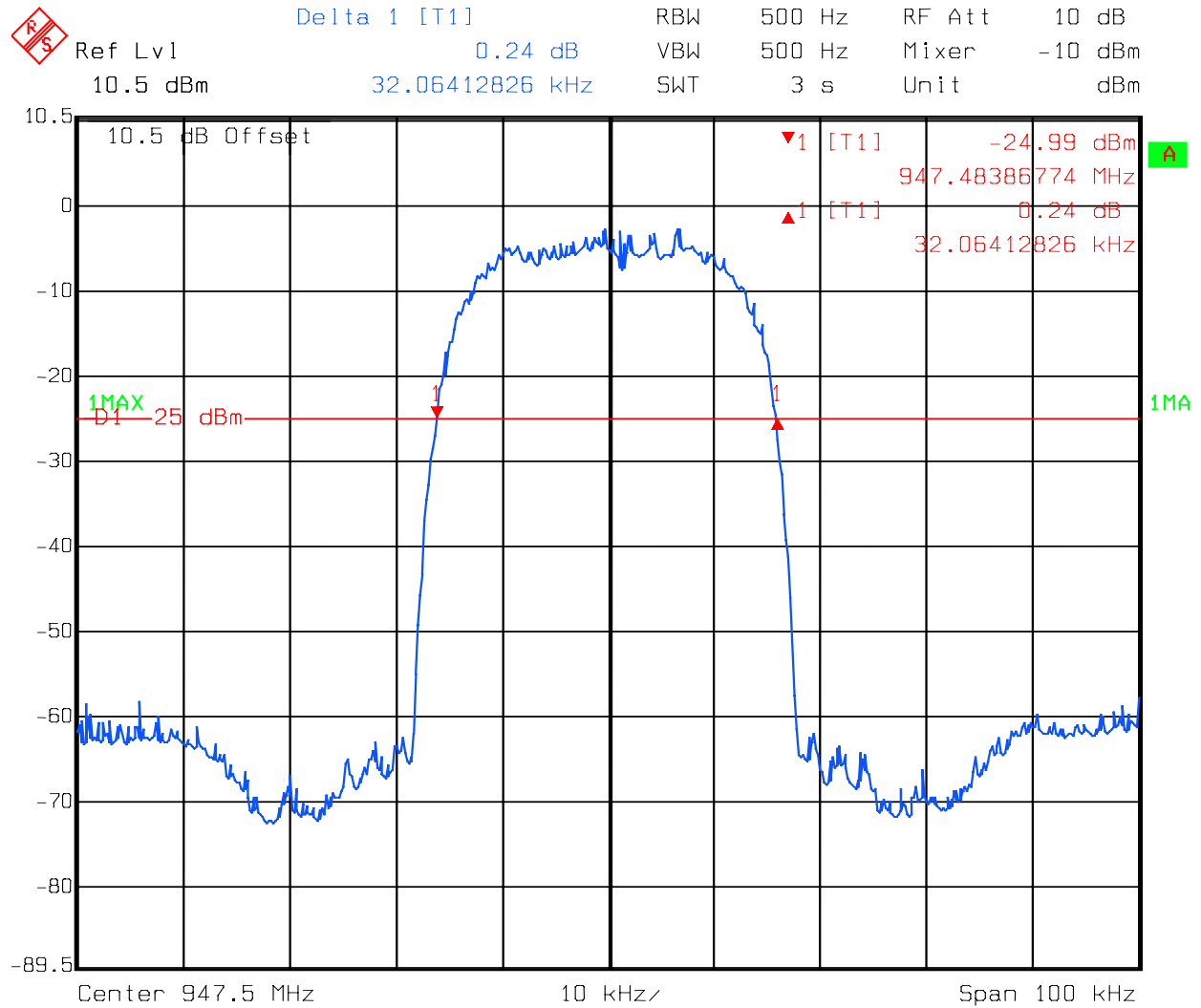


Date: 13.AUG.2004 11:15:04

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Output iDEN (900 Band)

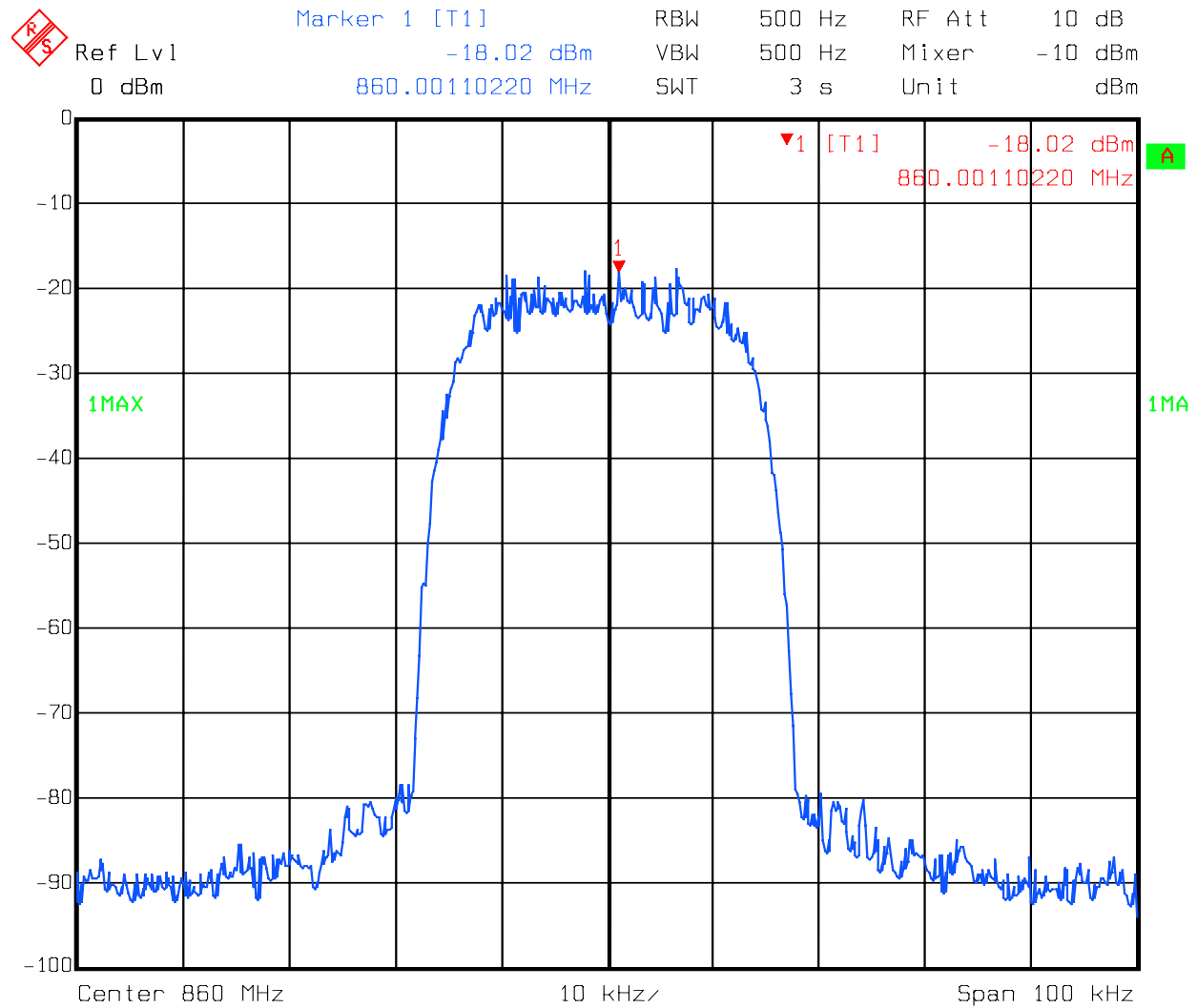


Date: 13.AUG.2004 11:13:45

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Input iDEN (800 Band)

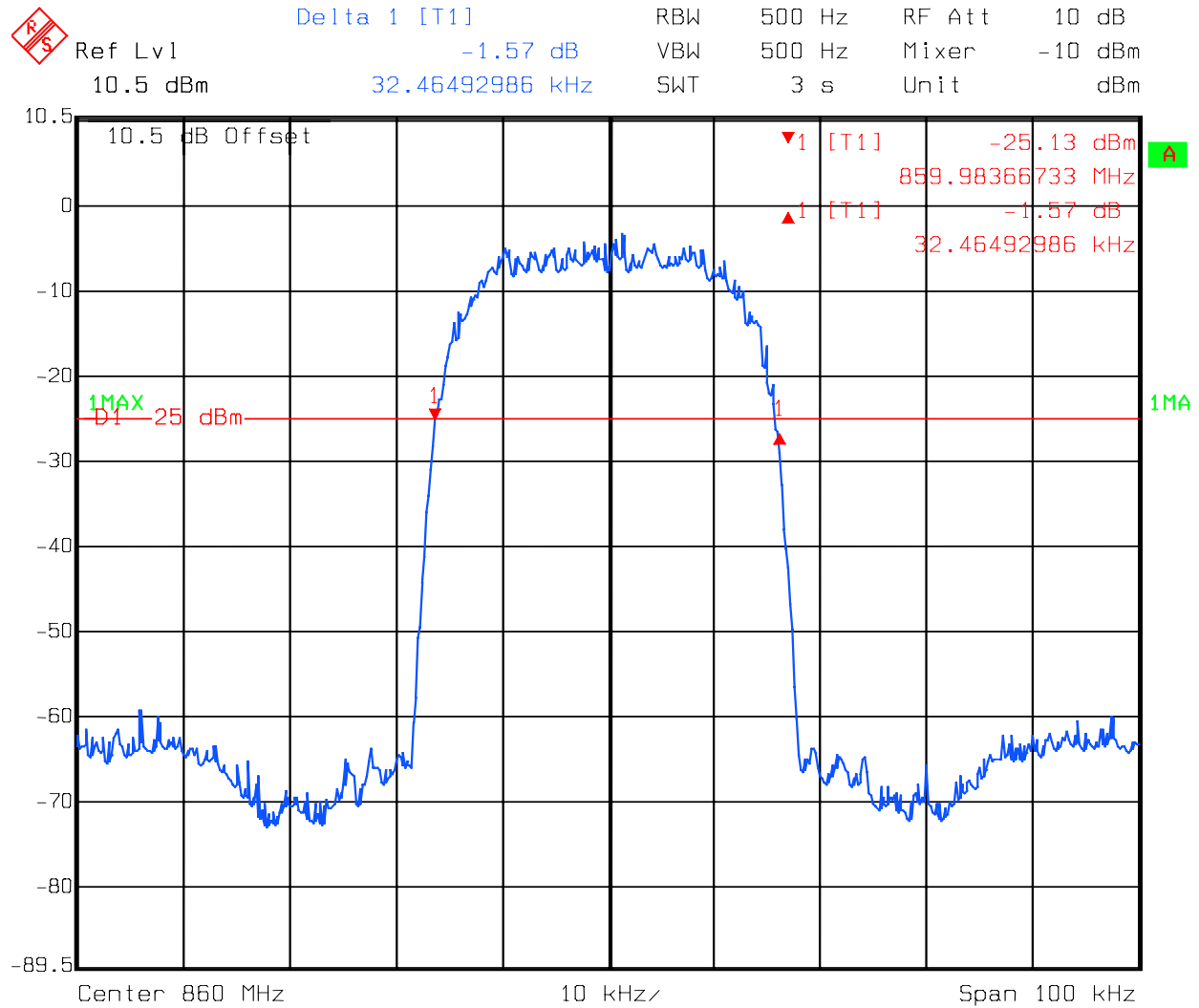


Date: 13.AUG.2004 11:19:24

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Output iDEN (800 Band)

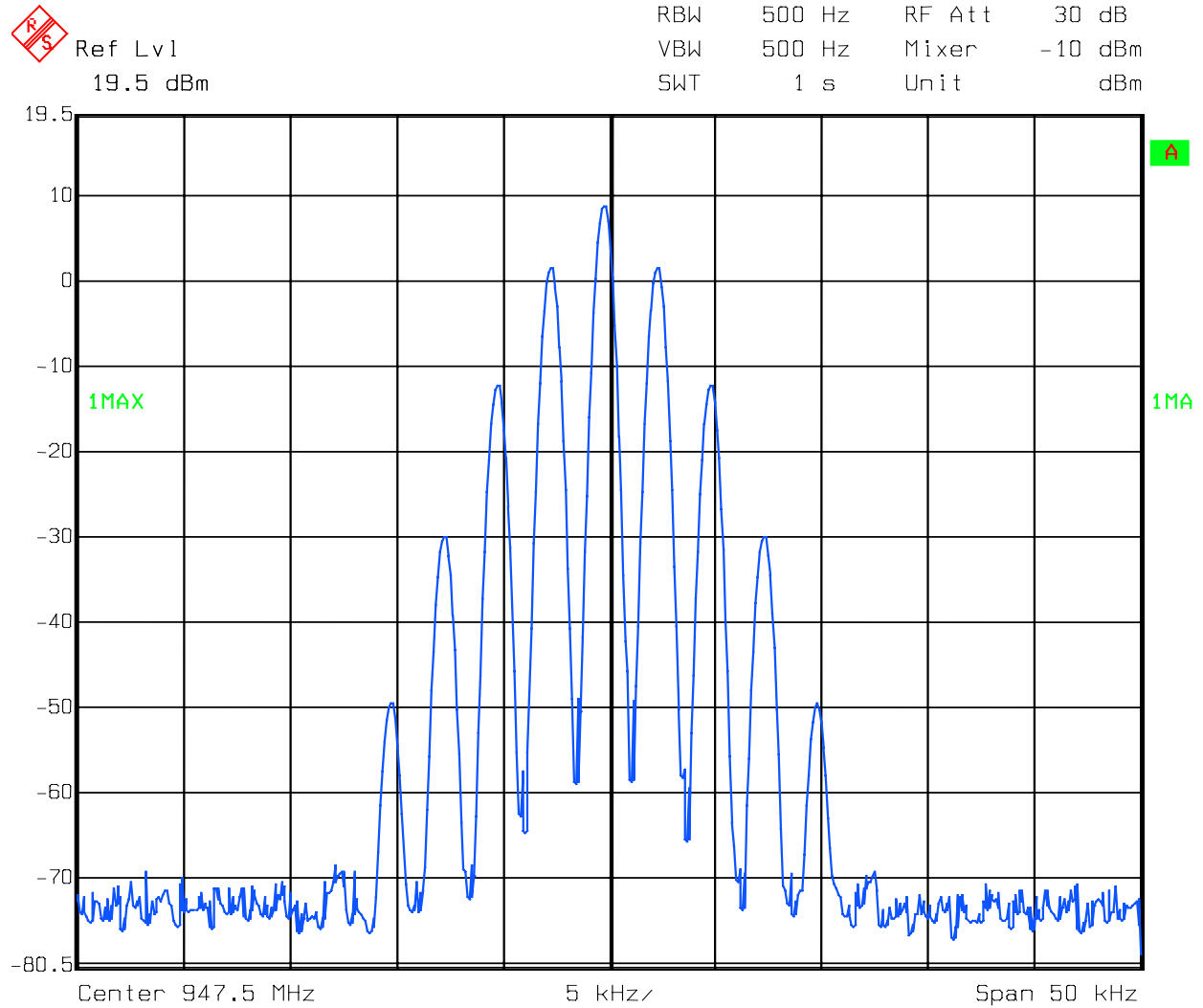


Date: 13.AUG.2004 11:18:26

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Input ANALOG (900 Band)

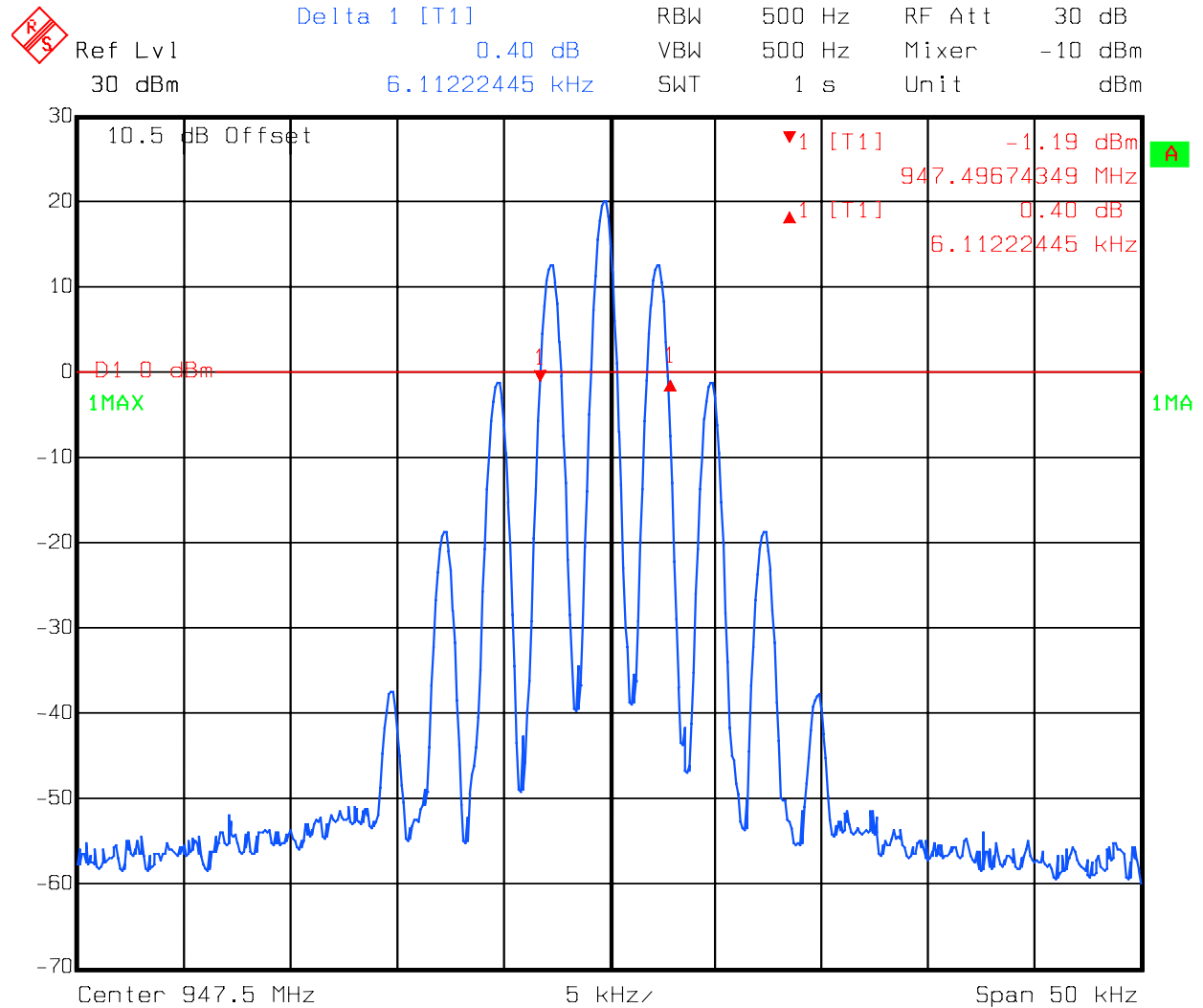


Date: 13.AUG.2004 14:57:21

Output ANALOG (900 Band)

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

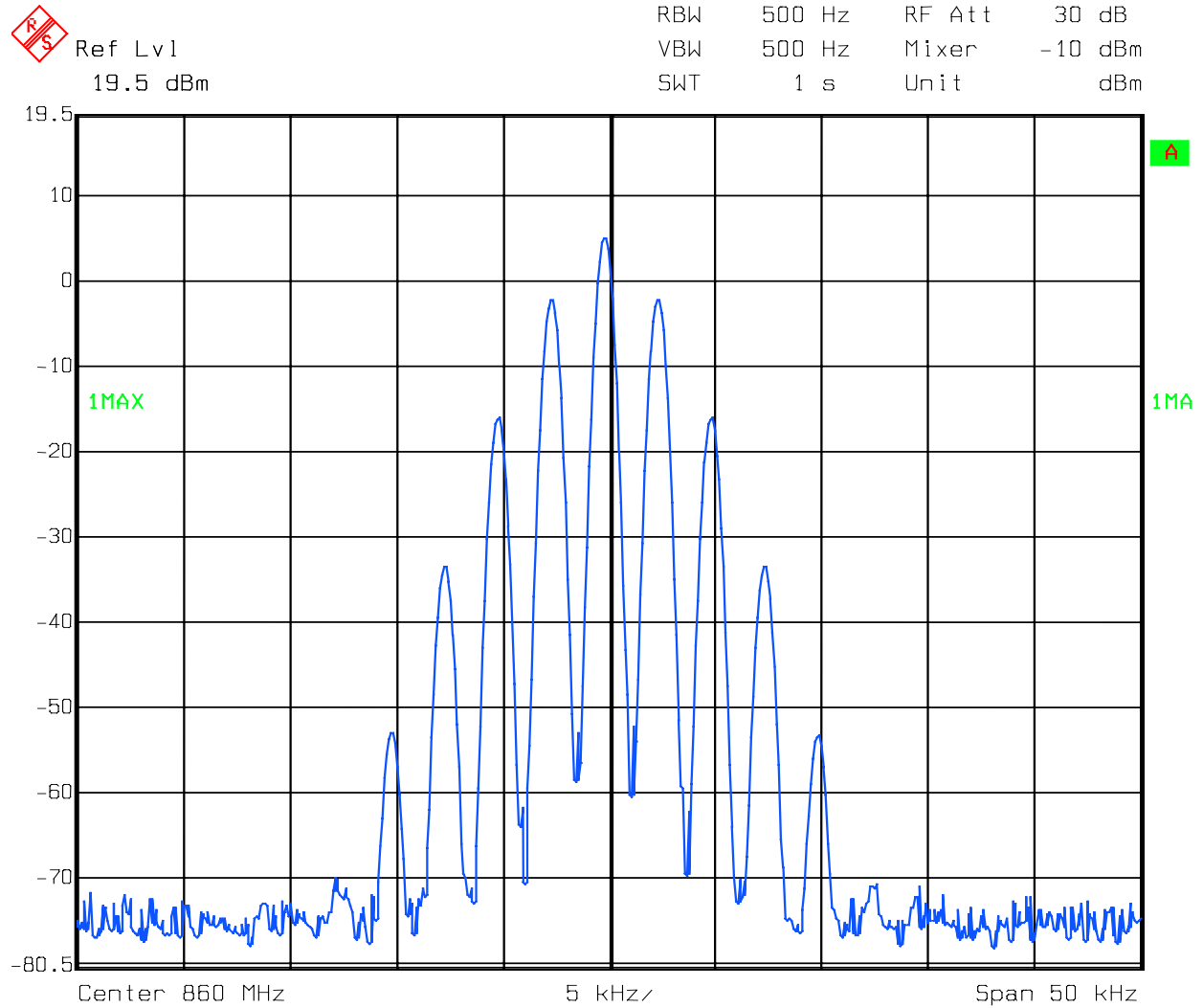


Date: 13.AUG.2004 14:56:11

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Input ANALOG (800 Band)

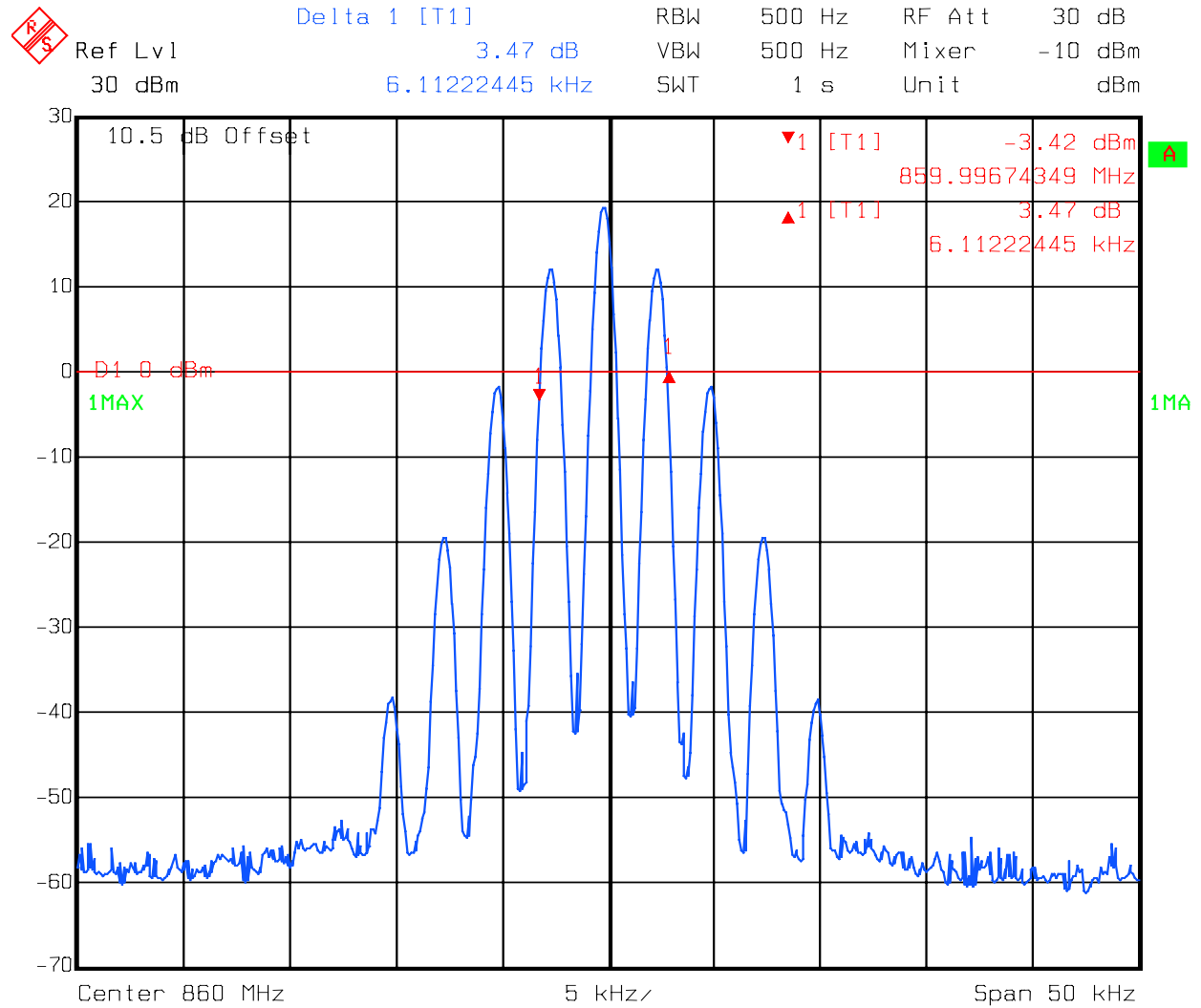


Date: 13.AUG.2004 15:02:07

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Output ANALOG (800 Band)



Date: 13.AUG.2004 15:00:51

EQUIPMENT: Optical Repeater

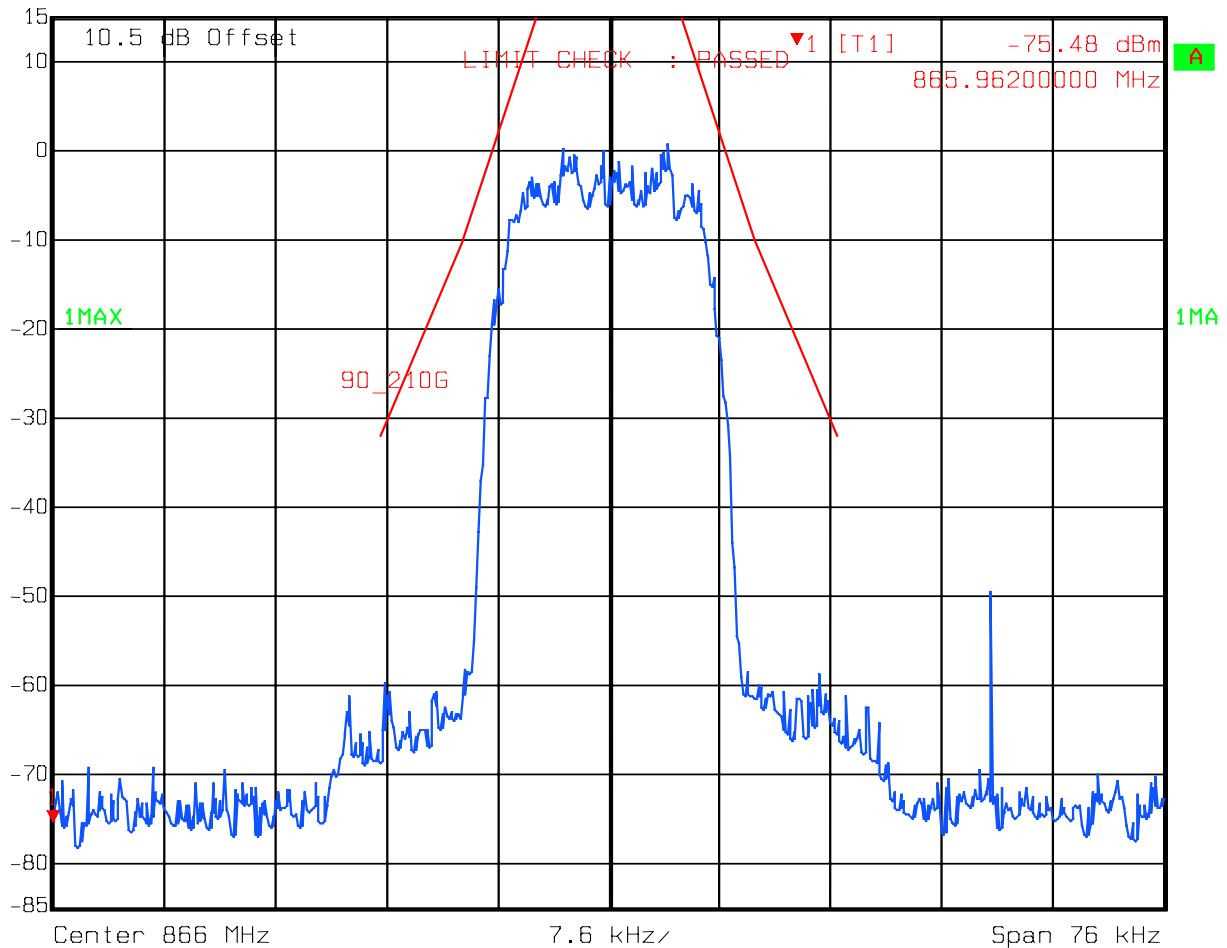
PROJECT NO.: 4L0492R

Emissions Mask

iDEN 800Band, Mask G



Ref Lvl 15 dBm
Marker 1 [T1] 865.9620000 MHz
-75.48 dBm
RBW 500 Hz
VBW 500 Hz
SWT 1.55 s
RF Att 20 dB
Mixer -10 dBm
Unit dBm

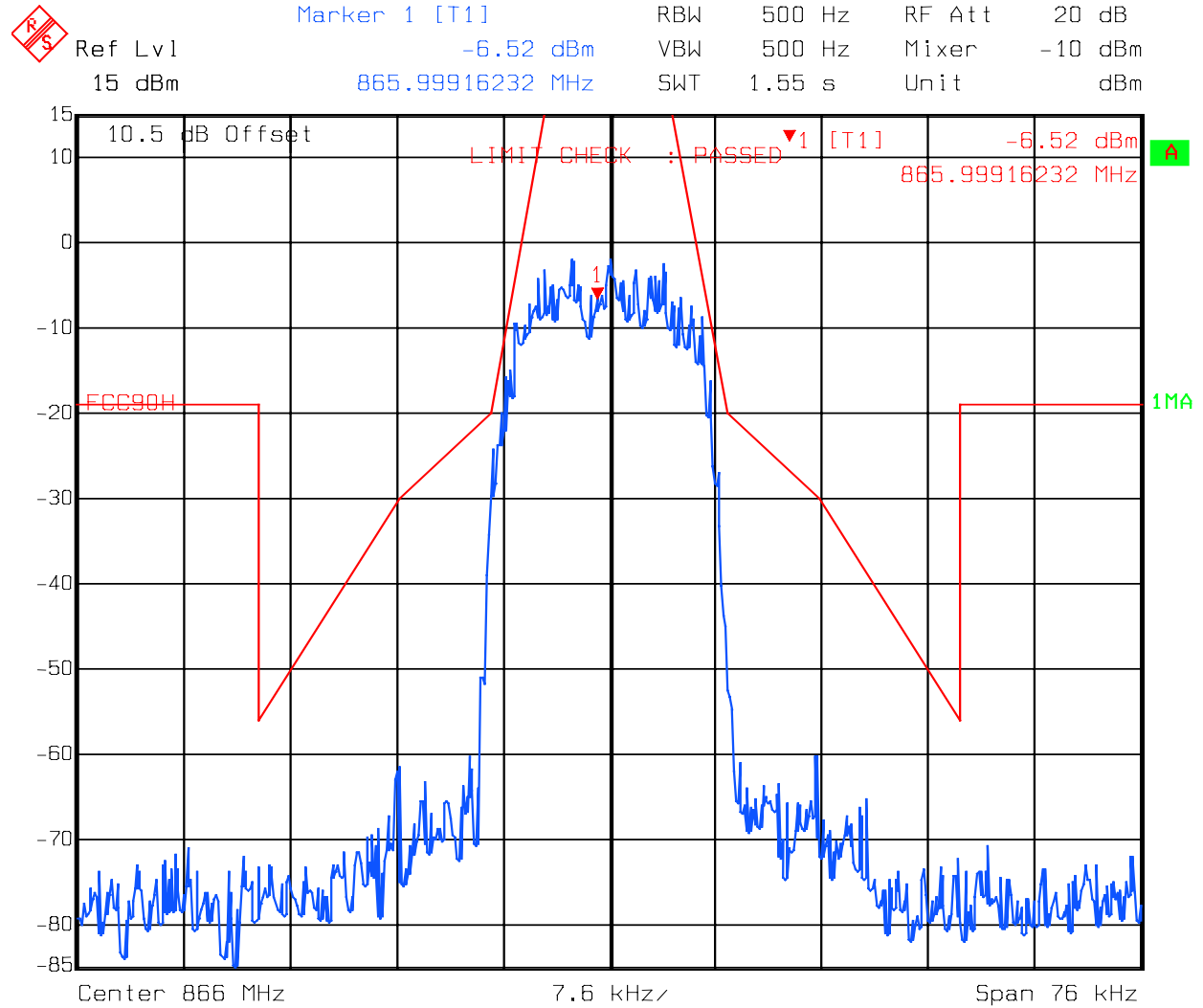


Date: 13.AUG.2004 14:21:26

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

iDEN 800Band, Mask H

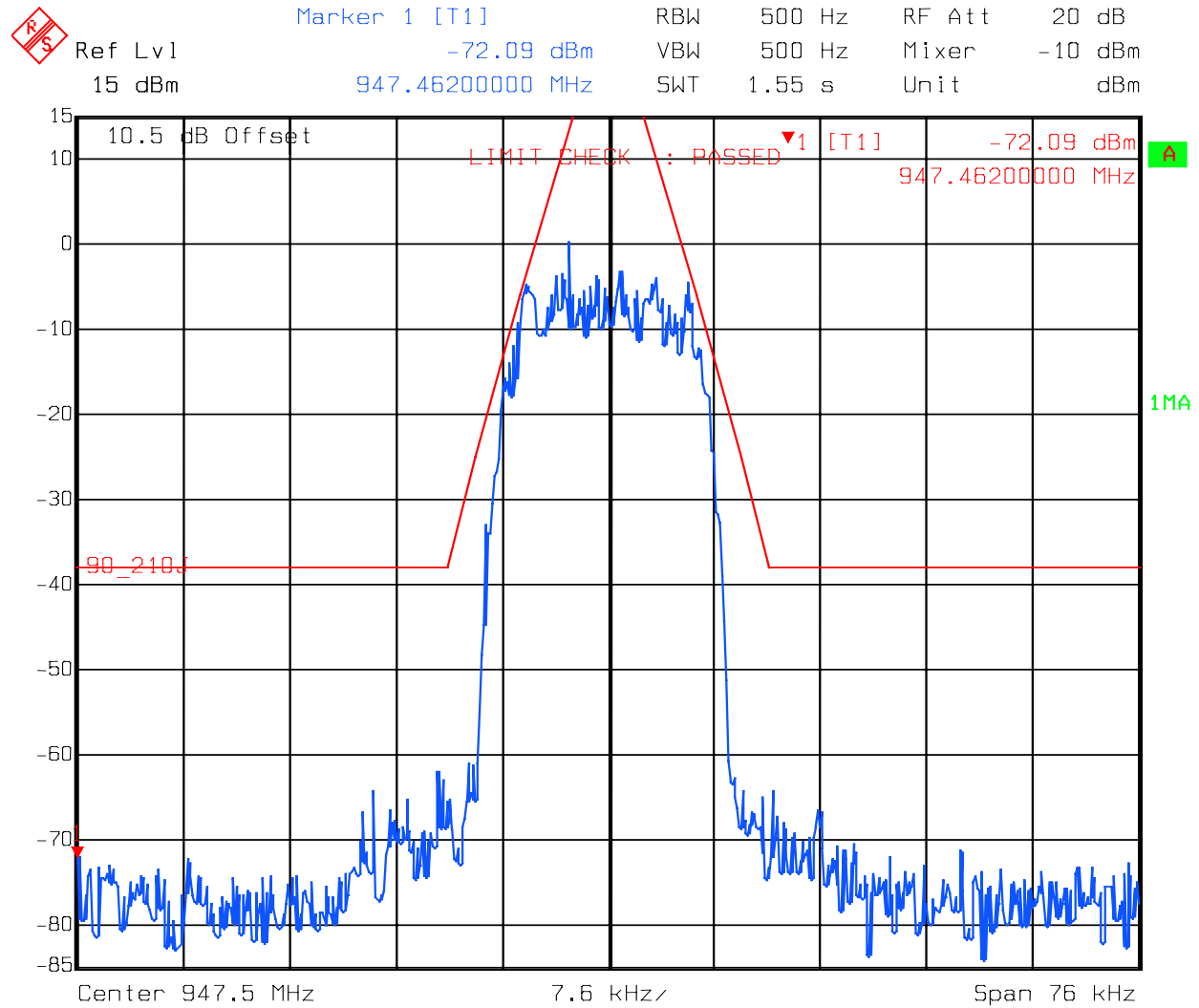


Date: 13.AUG.2004 14:41:31

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

iDEN 900Band, Mask J

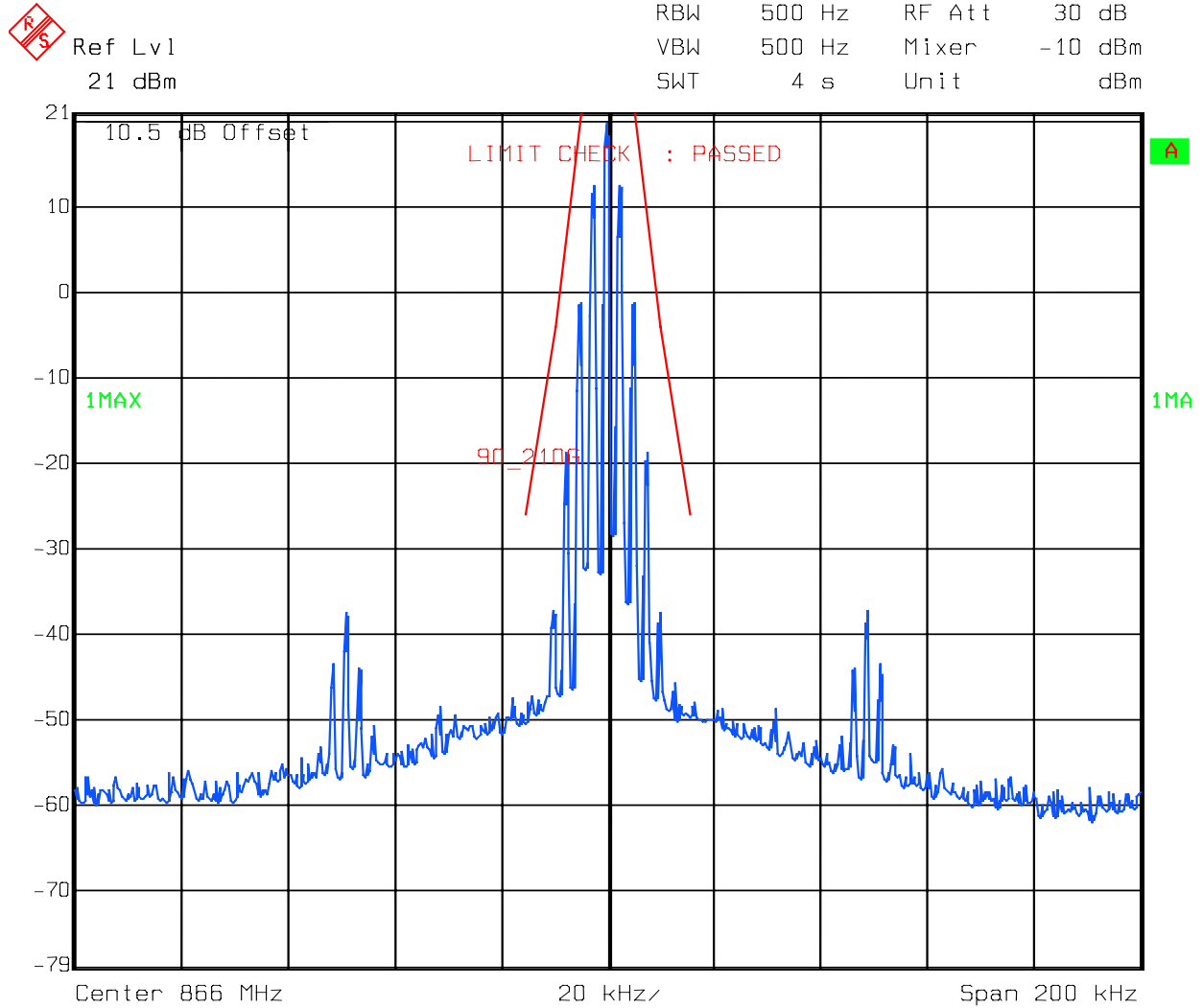


Date: 13.AUG.2004 14:47:28

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

ANALOG 800Band, Mask G



Date: 13.AUG.2004 15:08:46

EQUIPMENT: Optical Repeater

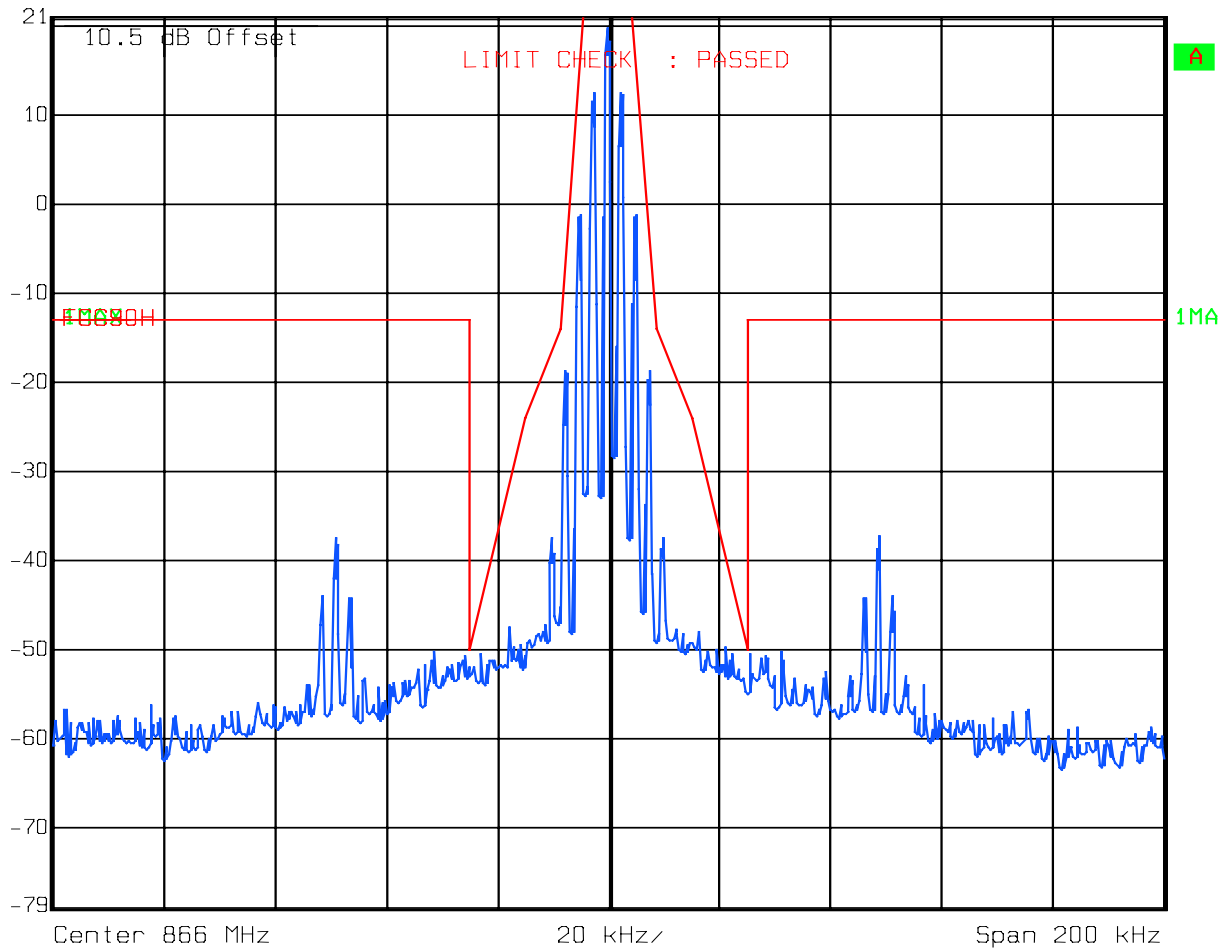
PROJECT NO.: 4L0492R

ANALOG 800Band, Mask H



Ref Lvl
21 dBm

RBW	500 Hz	RF Att	30 dB
VBW	500 Hz	Mixer	-10 dBm
SWT	4 s	Unit	dBm

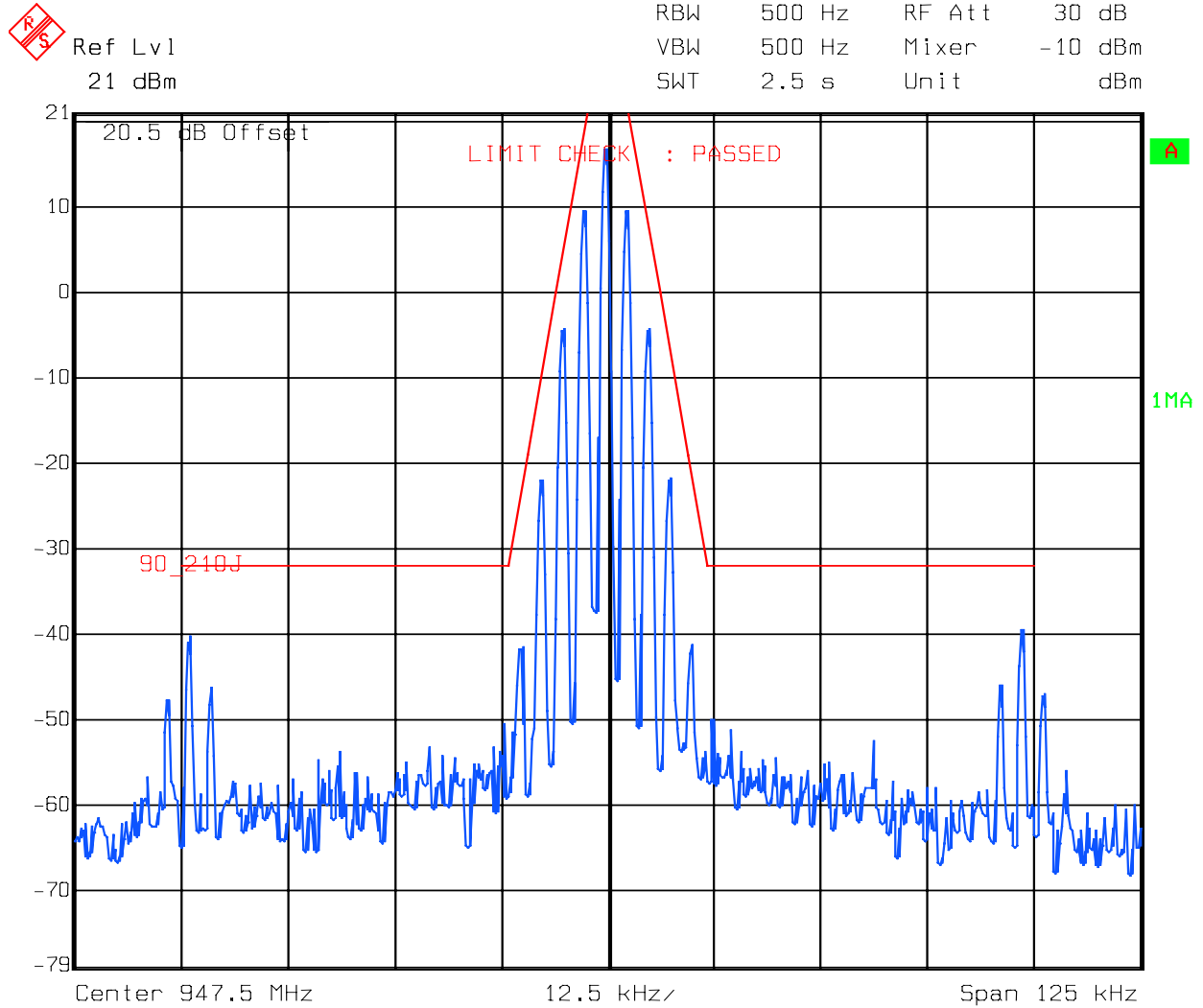


Date: 13.AUG.2004 15:08:01

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

ANALOG 900Band, Mask J



Date: 13.AUG.2004 15:13:13

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Dustin Oaks	DATE: 07/28/2004

Test Results: Complies

Test Data: See attached graph(s).

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

Measurement Uncertainty: +/- 1.6 dB

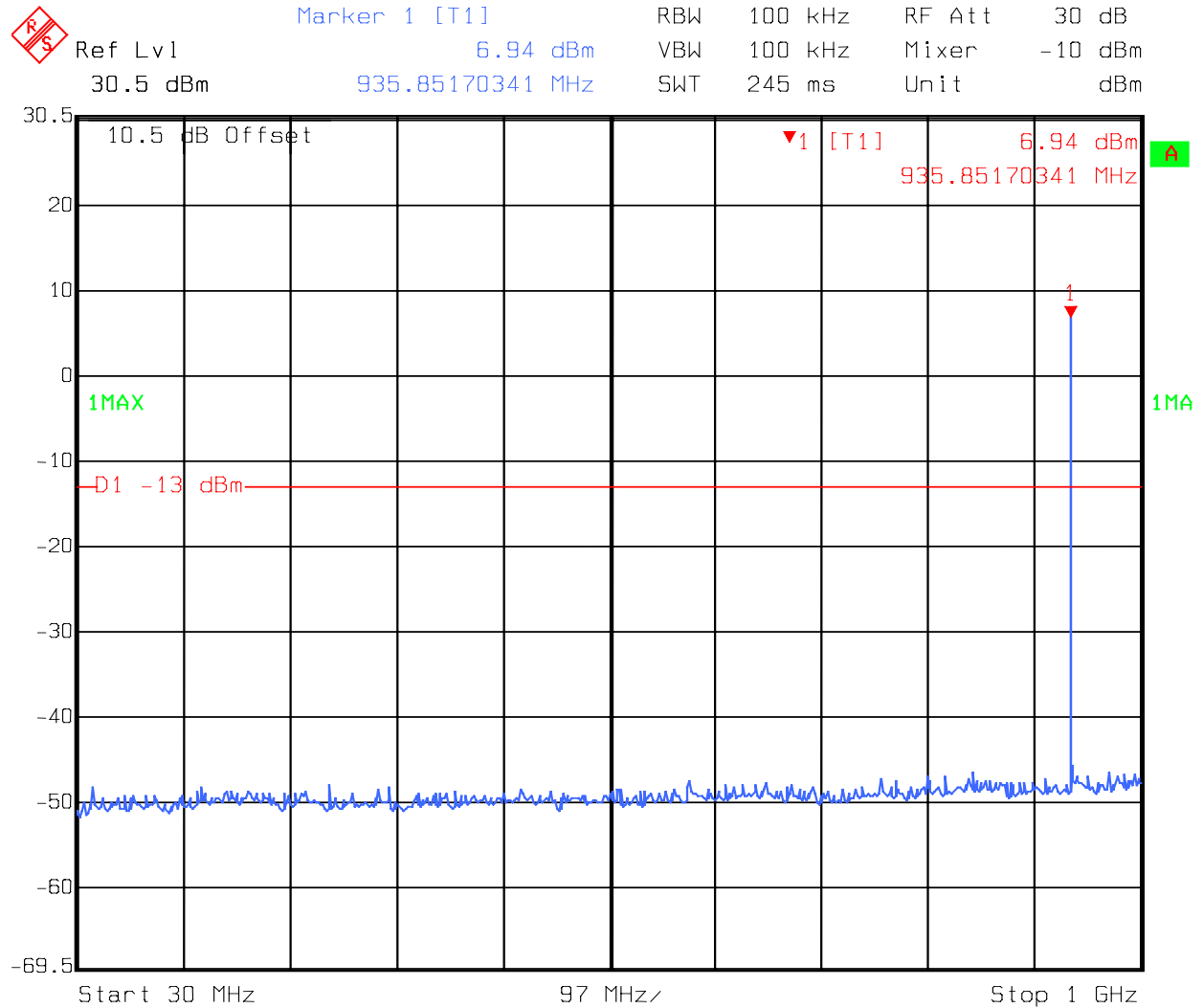
Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

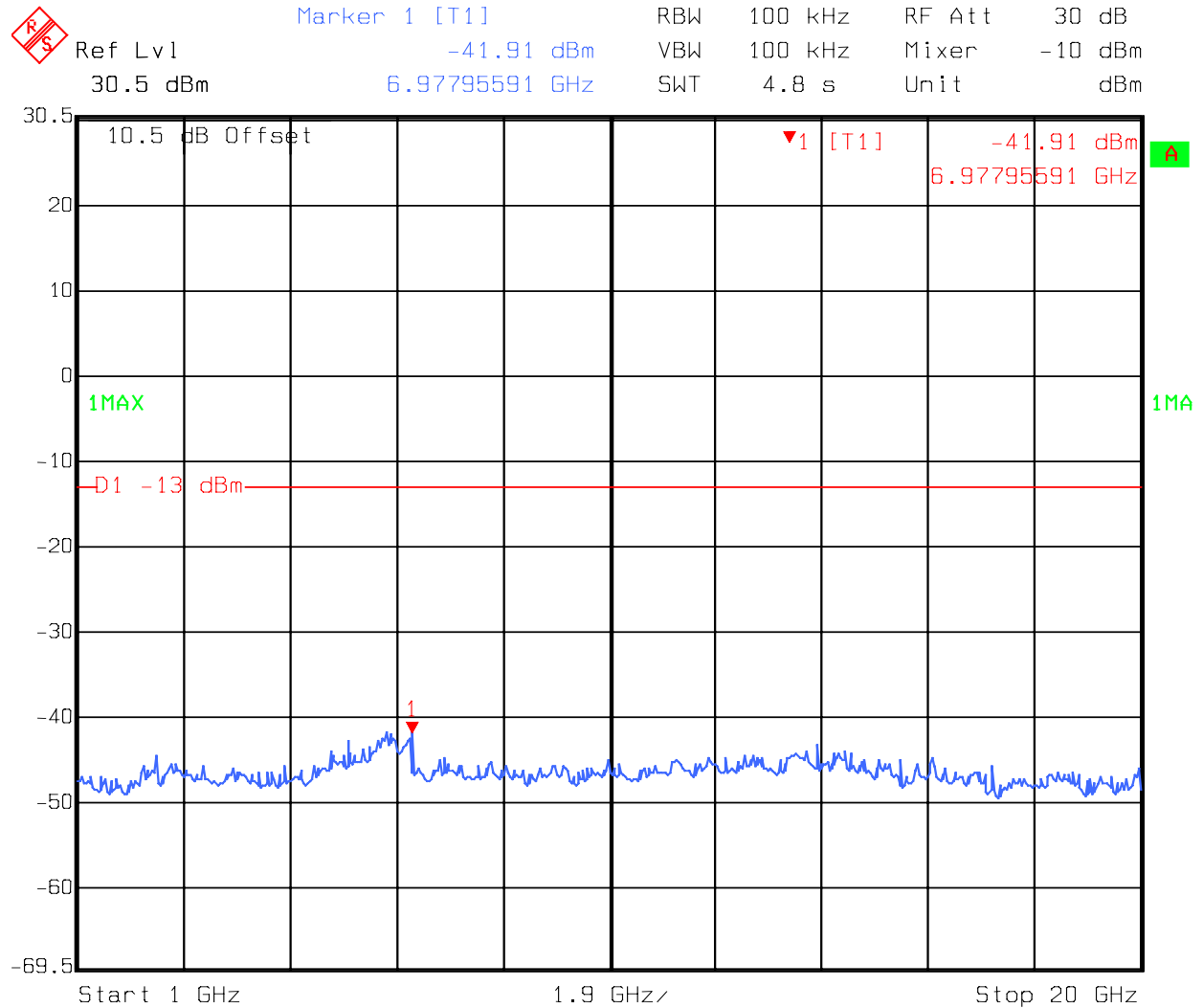
Low Channel iDEN



Date: 28.JUL.2004 19:17:18

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

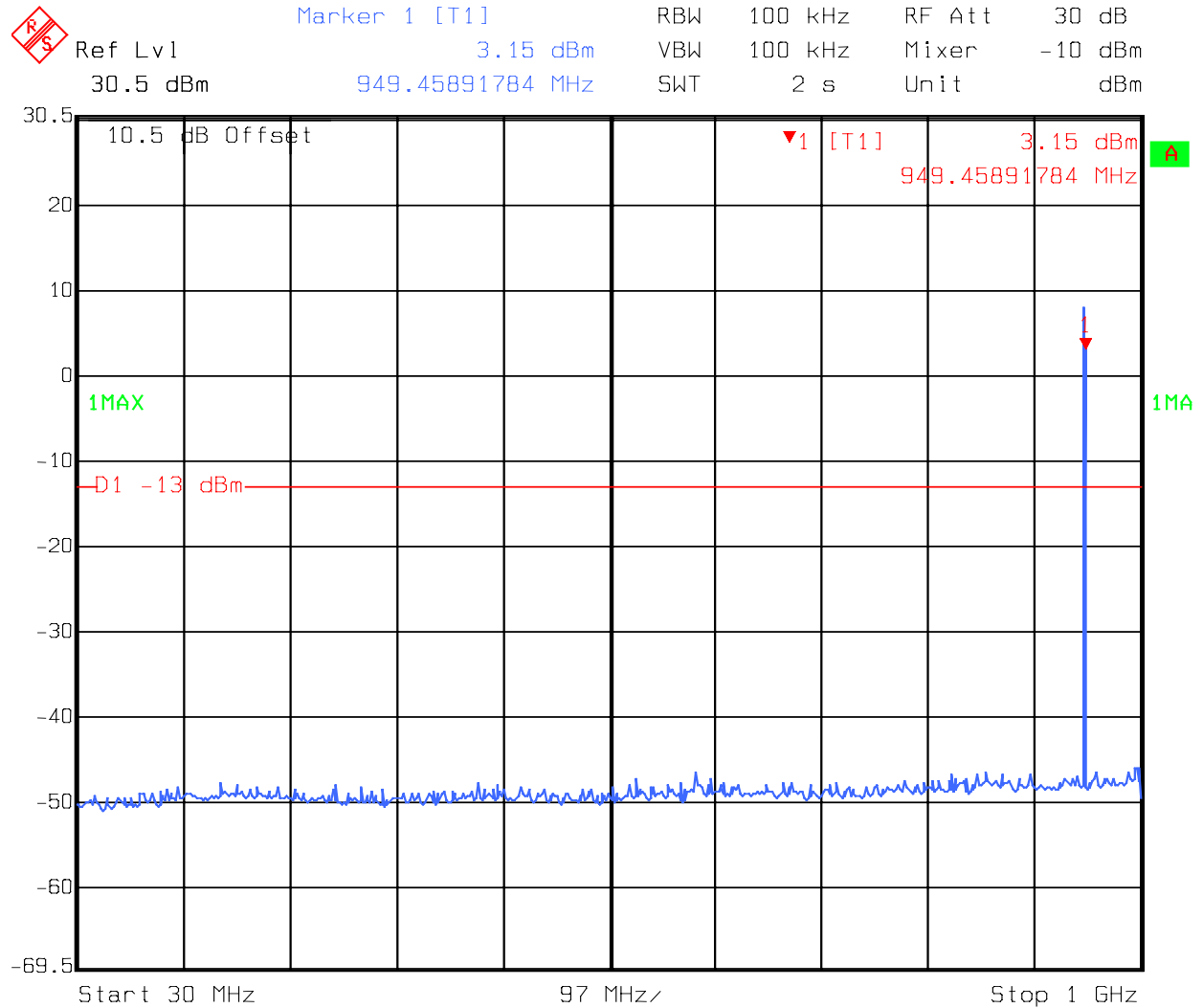


Date: 28.JUL.2004 19:17:43

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

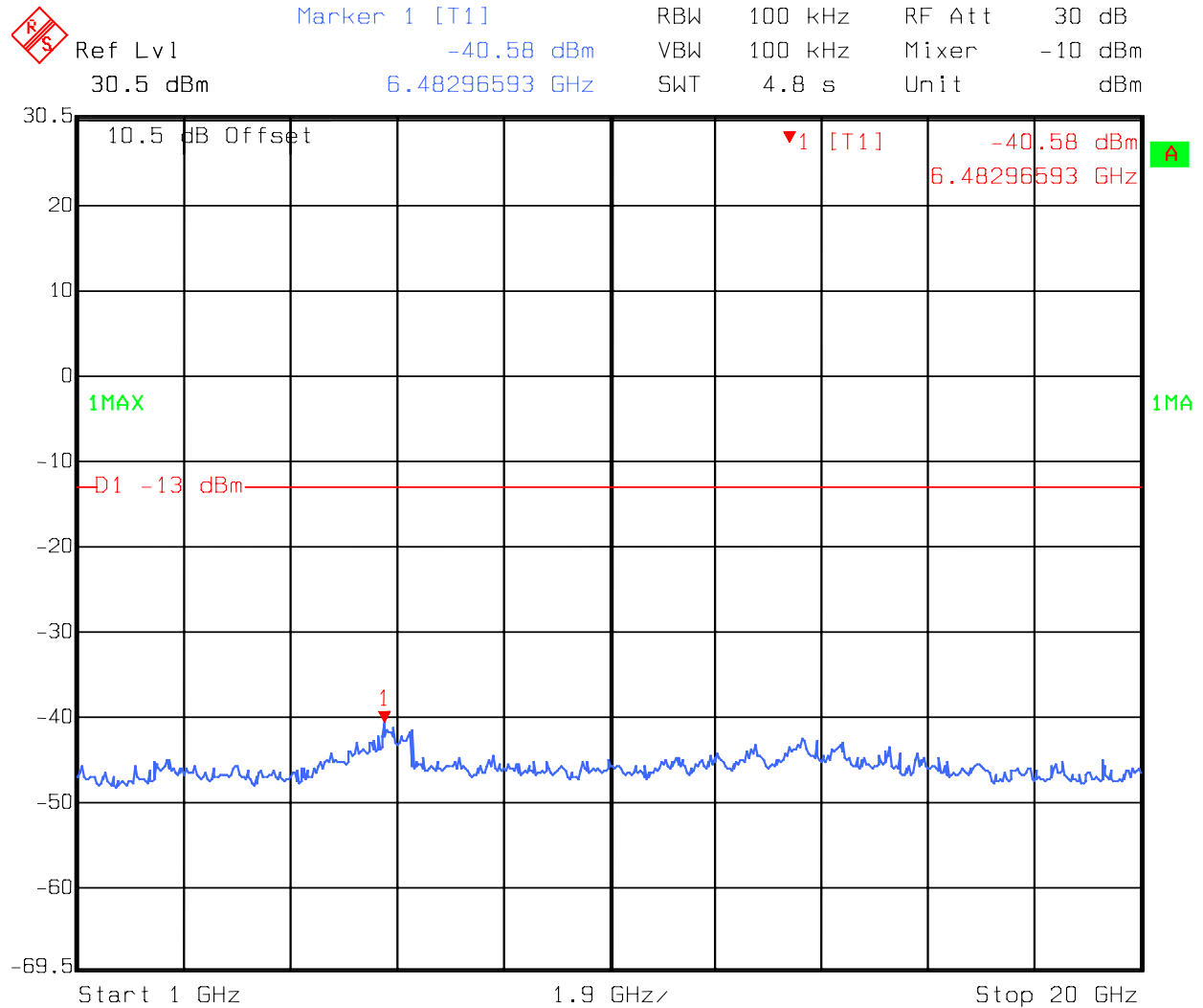
Mid Channel iDEN



Date: 28.JUL.2004 18:41:16

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

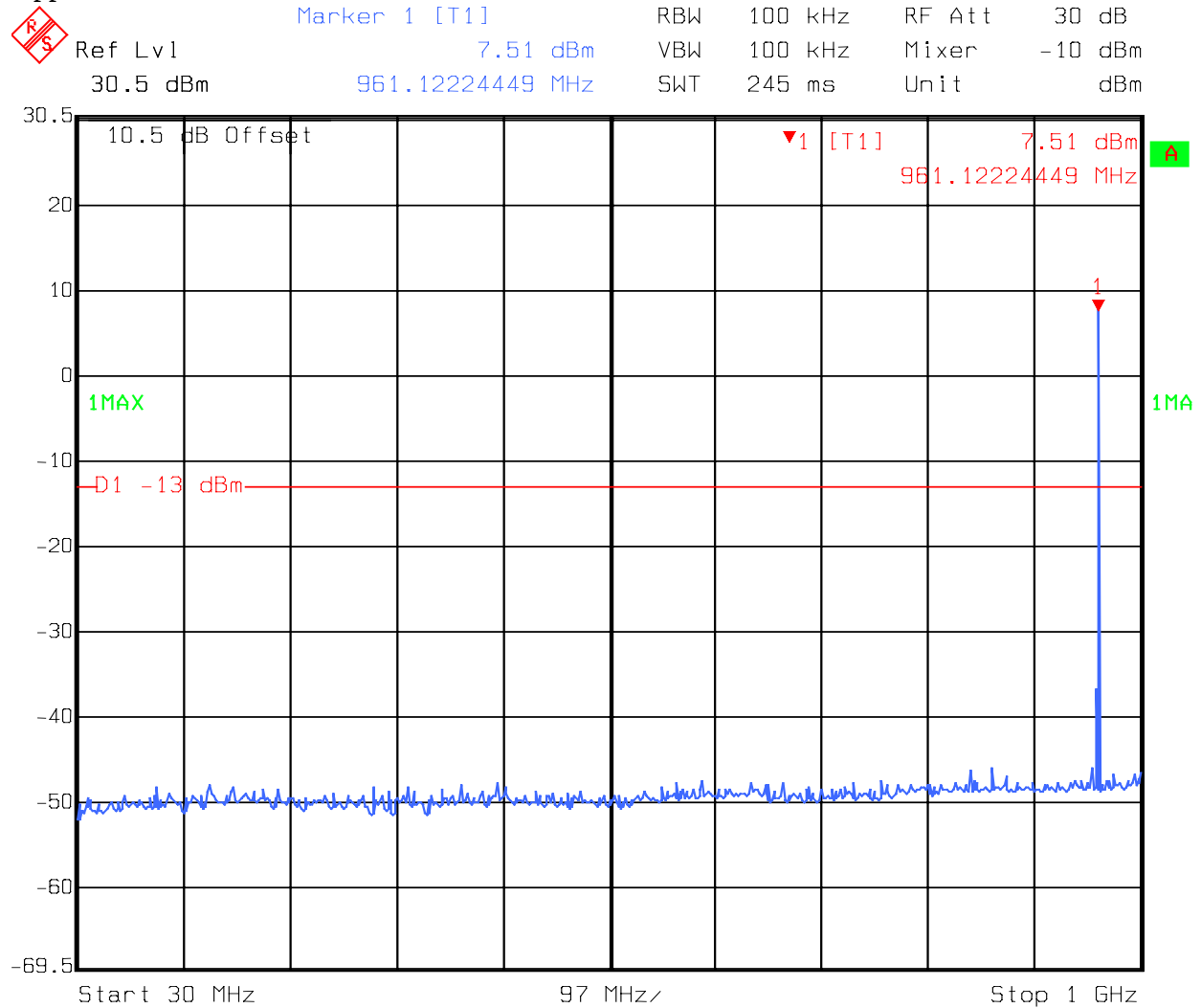


Date: 28.JUL.2004 18:42:16

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

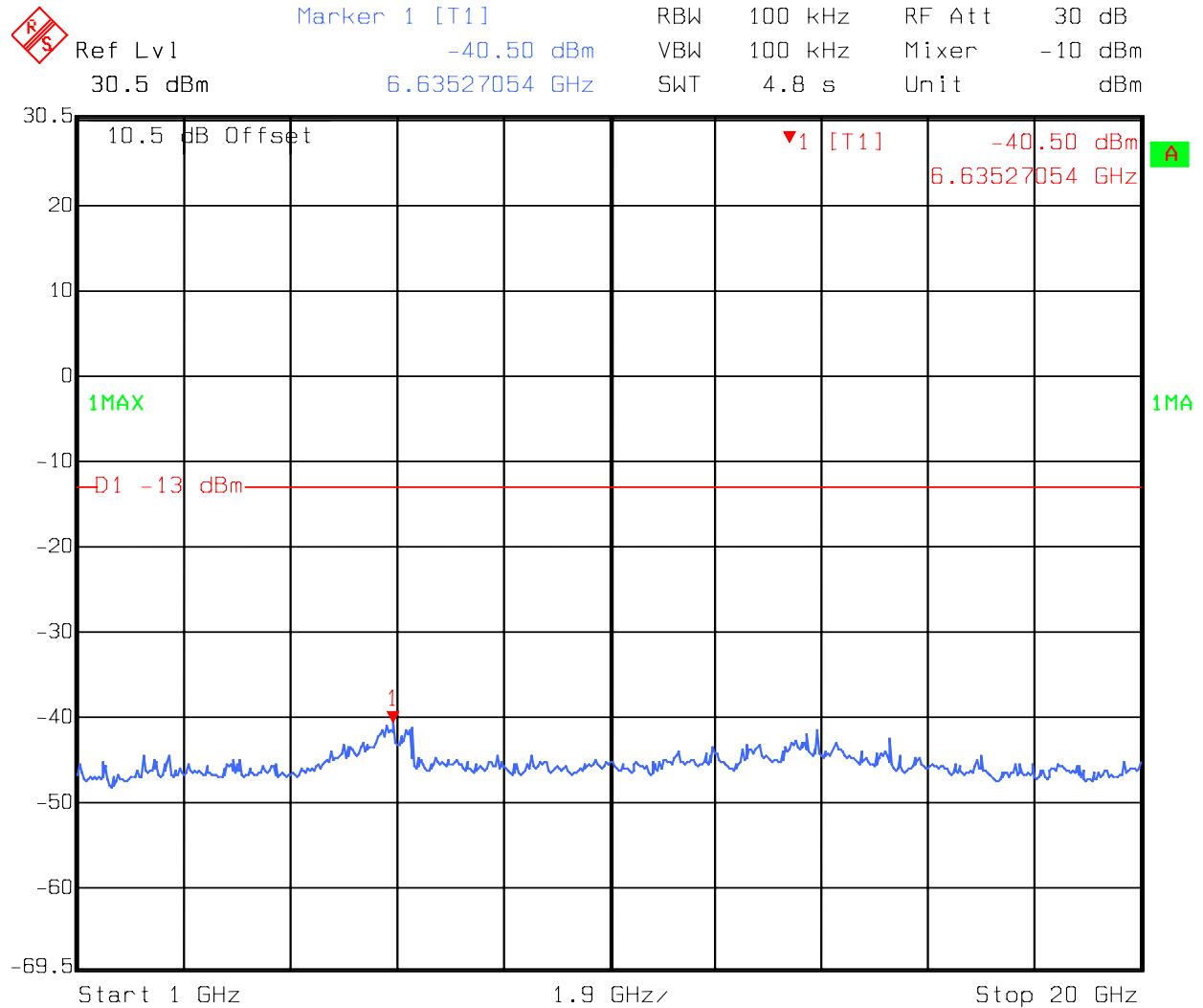
Upper Channel iDEN



Date: 28.JUL.2004 19:16:43

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

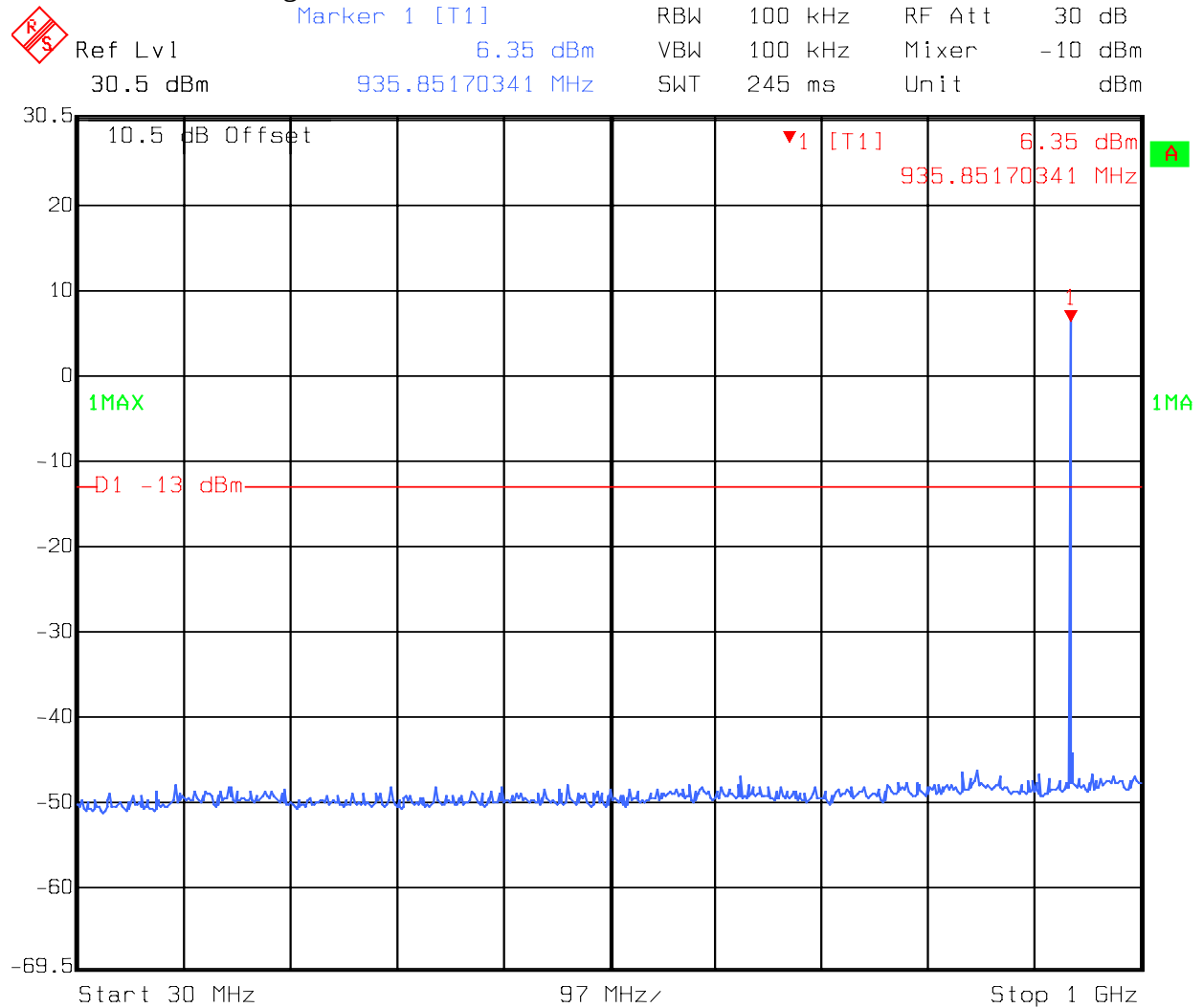


Date: 28.JUL.2004 19:16:09

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

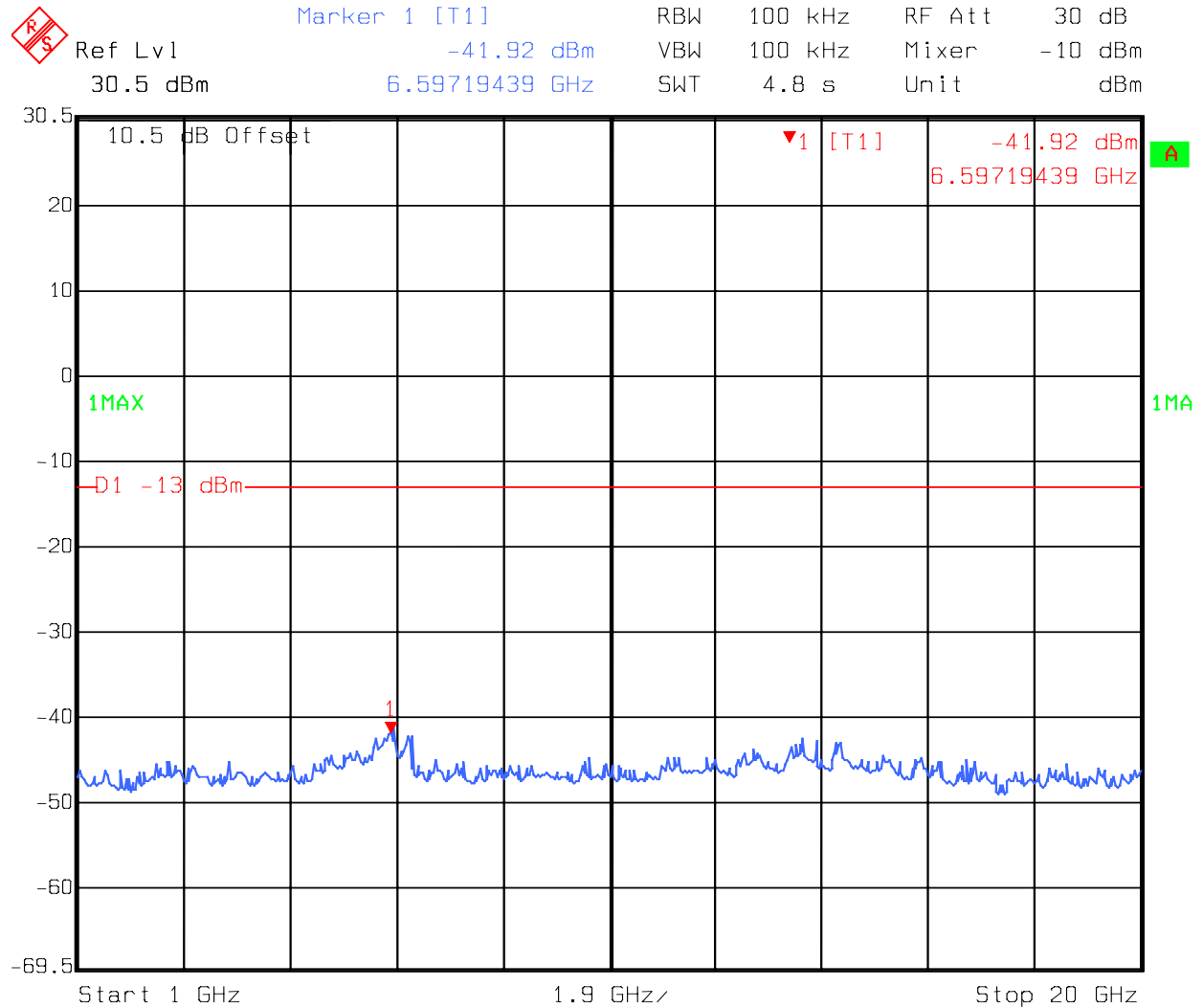
Lower Channel Analog



Date: 28.JUL.2004 19:12:18

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

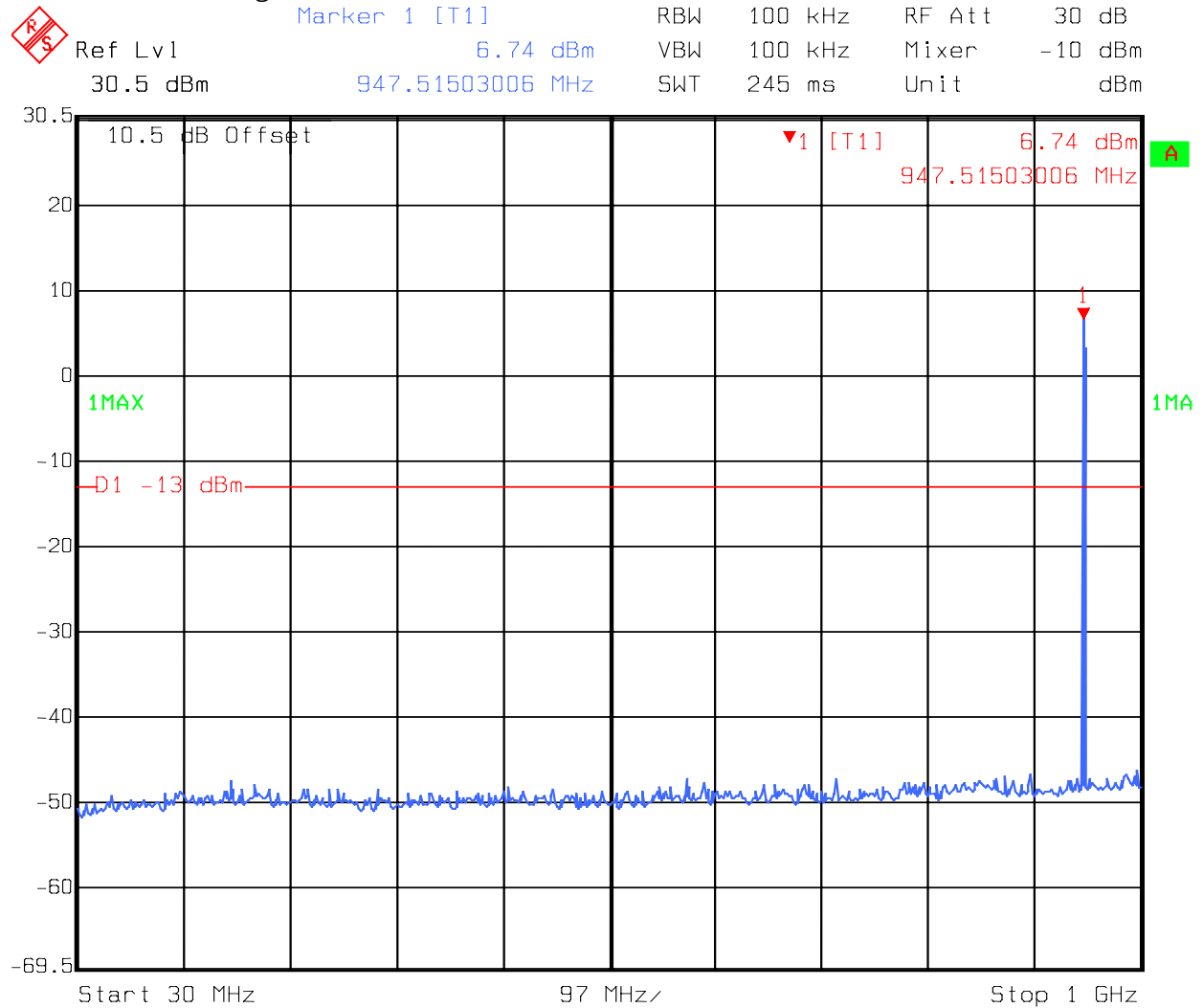


Date: 28.JUL.2004 19:12:48

EQUIPMENT: Optical Repeater

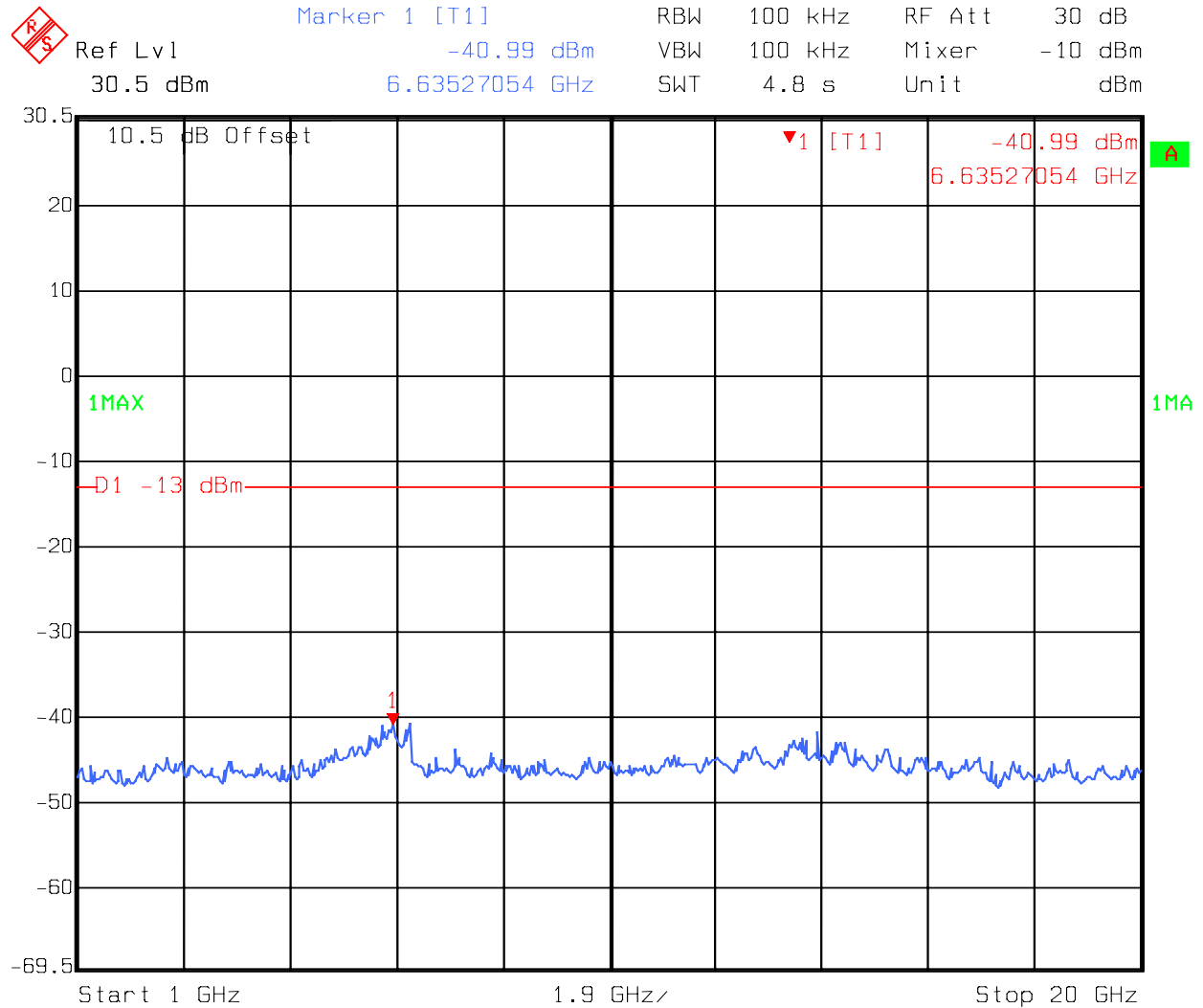
PROJECT NO.: 4L0492R

Mid Channel Analog



EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

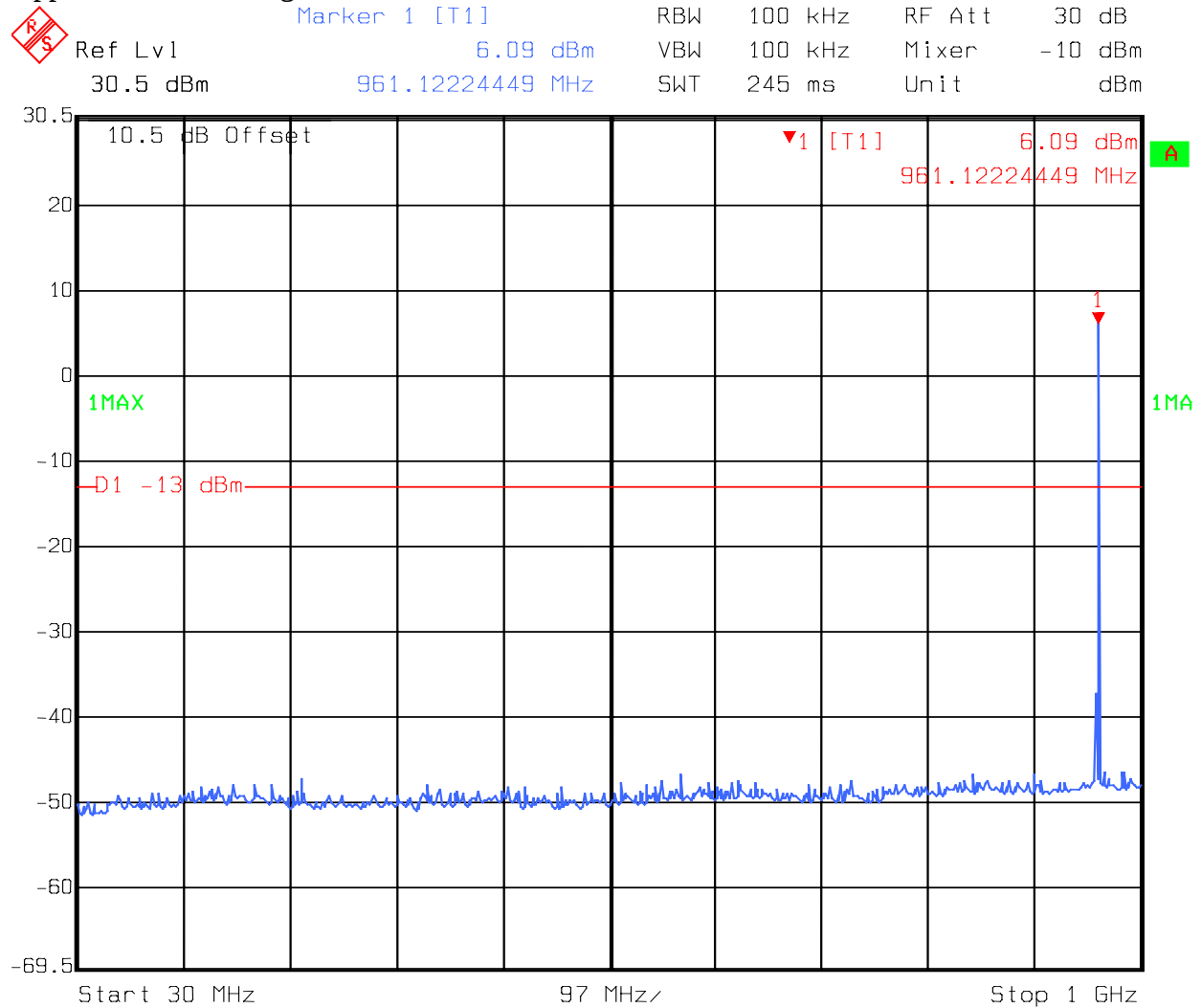


Date: 28.JUL.2004 19:13:24

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

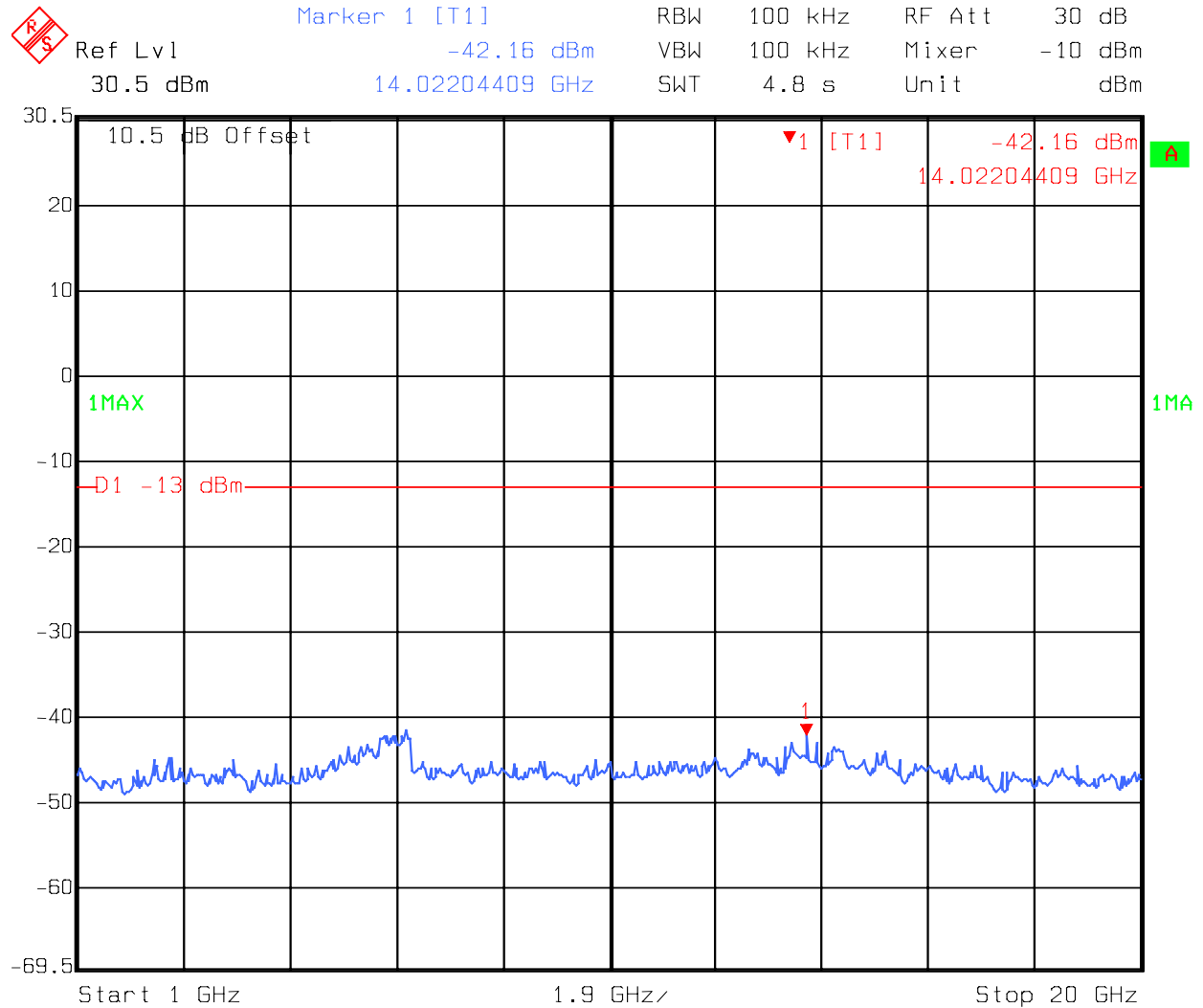
Upper Channel Analog



Date: 28.JUL.2004 19:14:39

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R



Date: 28.JUL.2004 19:15:06

EQUIPMENT: Optical Repeater

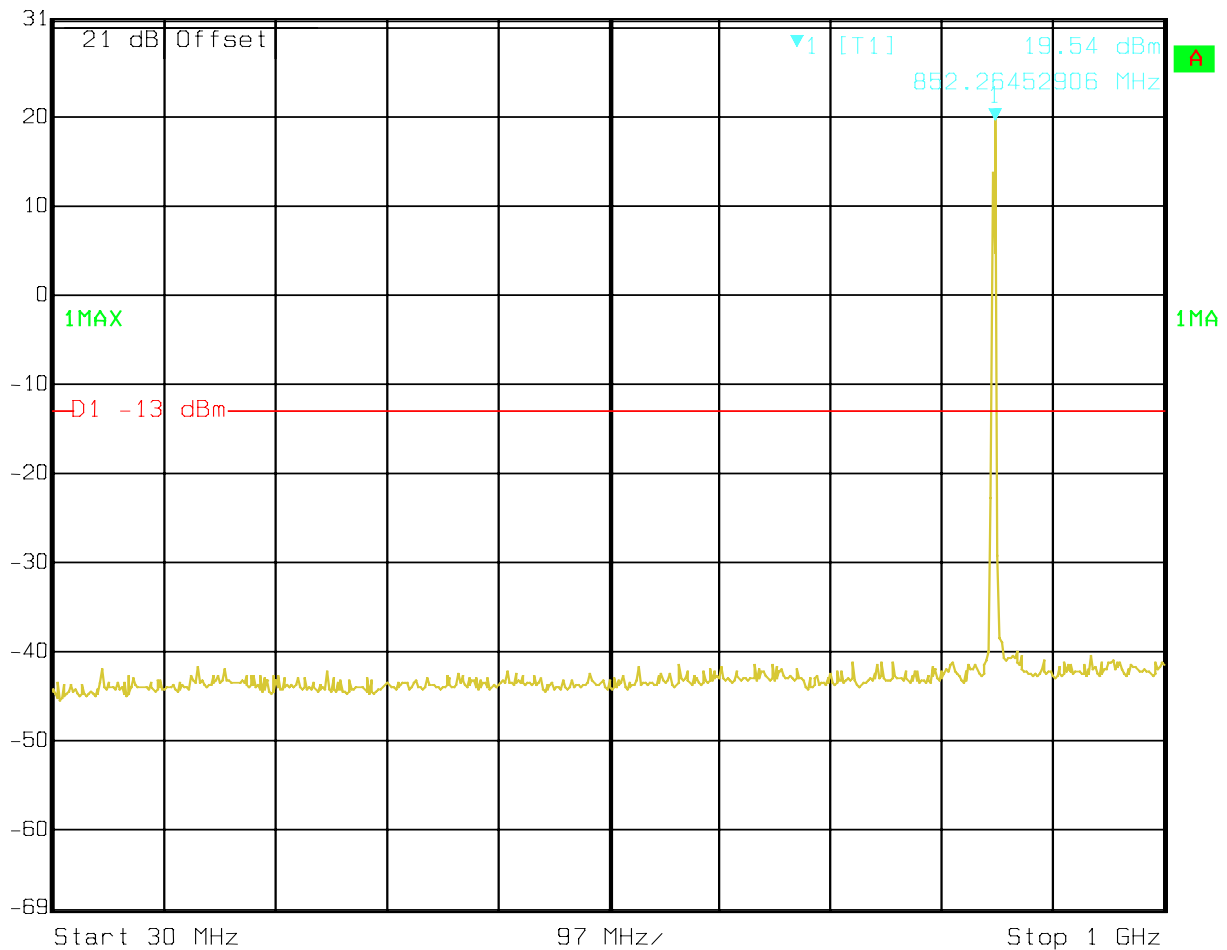
PROJECT NO.: 4L0492R

800MHz Band Conducted Emissions

800MHz Band Analog Modulation

Low Channel

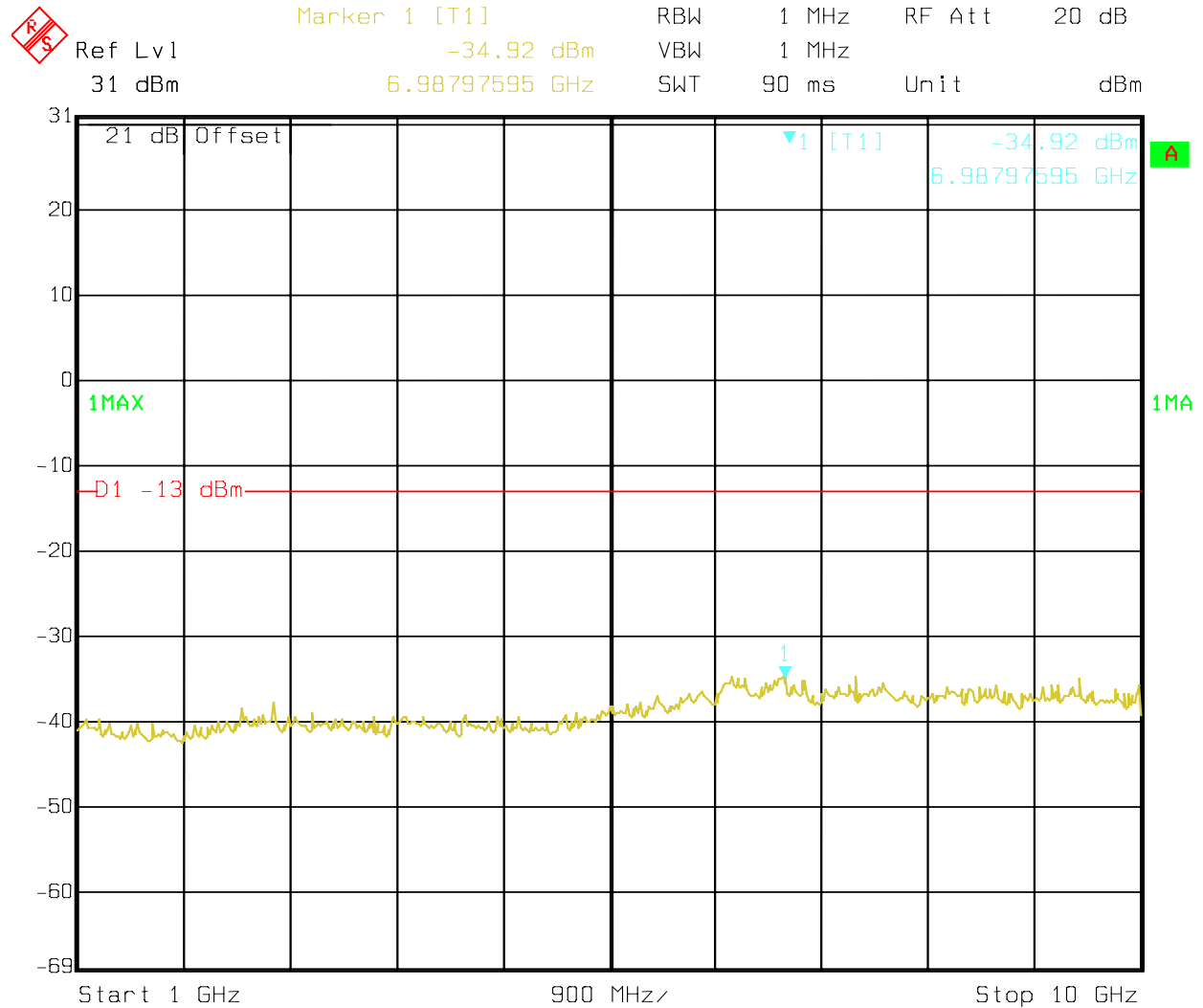
 Ref Lvl 31 dBm Marker 1 [T1] 19.54 dBm 852.26452906 MHz RBW 1 MHz RF Att 20 dB VBW 1 MHz Unit dBm SWT 5 ms



Date: 01.NOV.2004 17:53:11

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

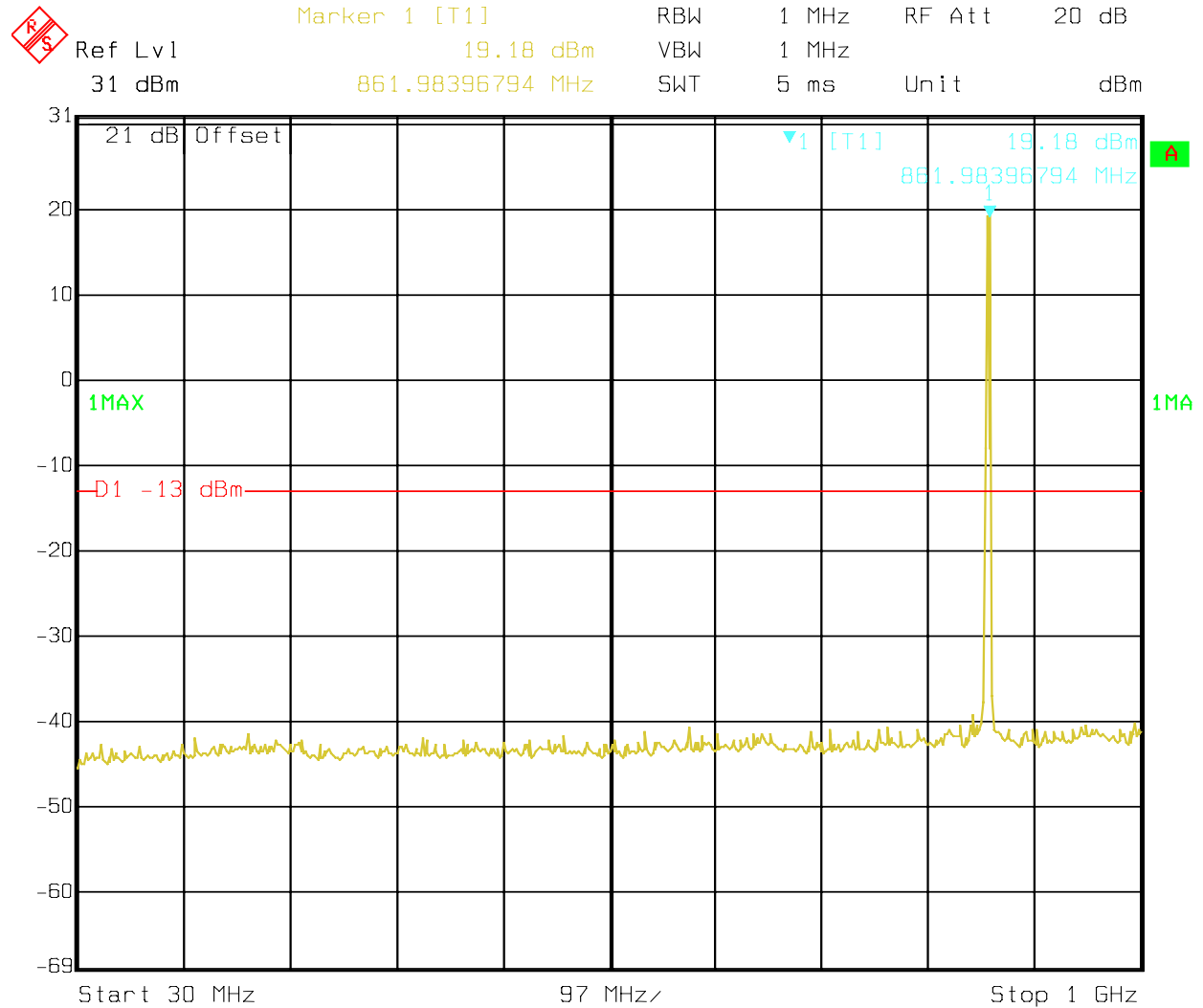


Date: 01.NOV.2004 17:53:36

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

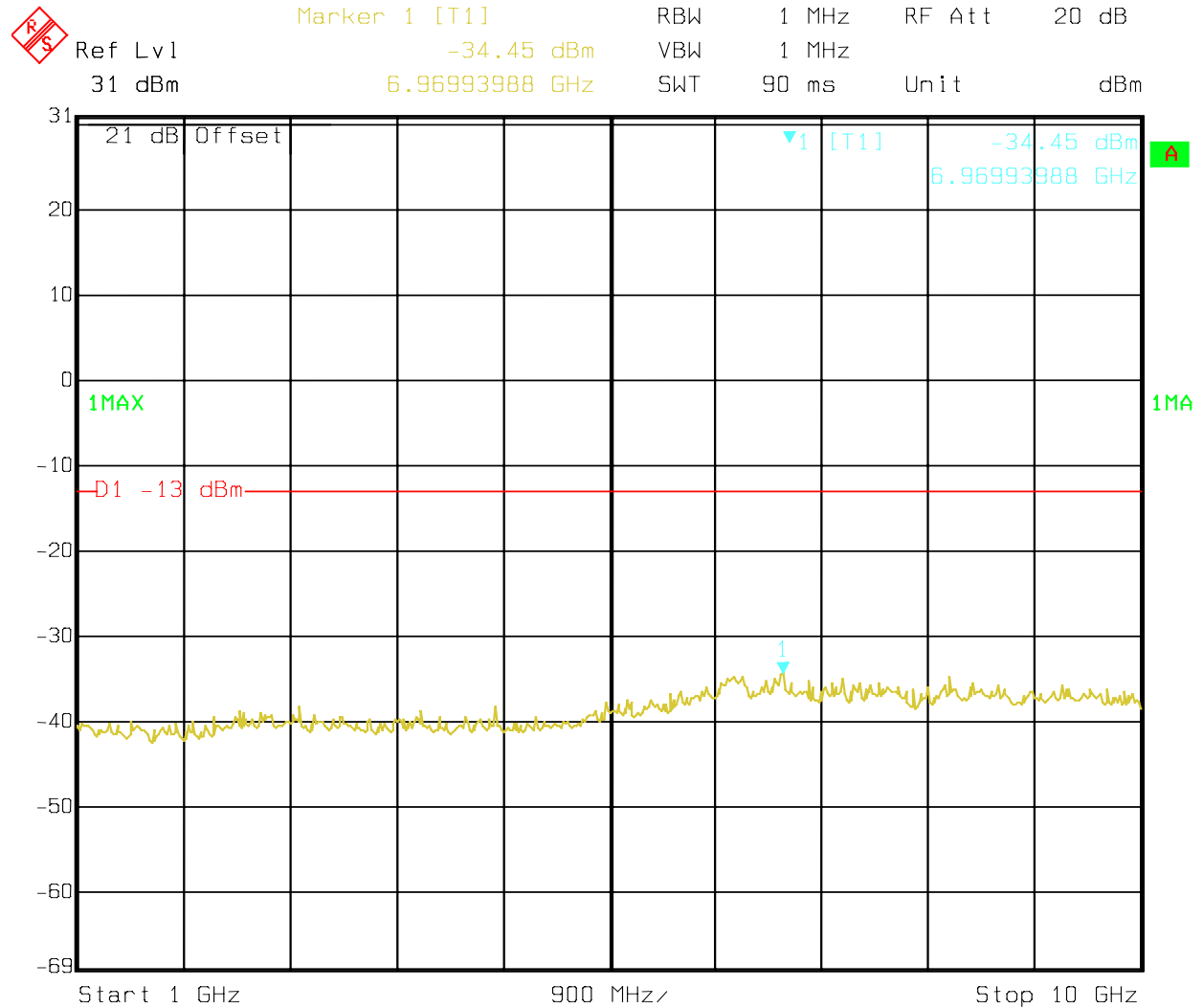
Mid Channel



Date: 02.NOV.2004 09:43:43

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

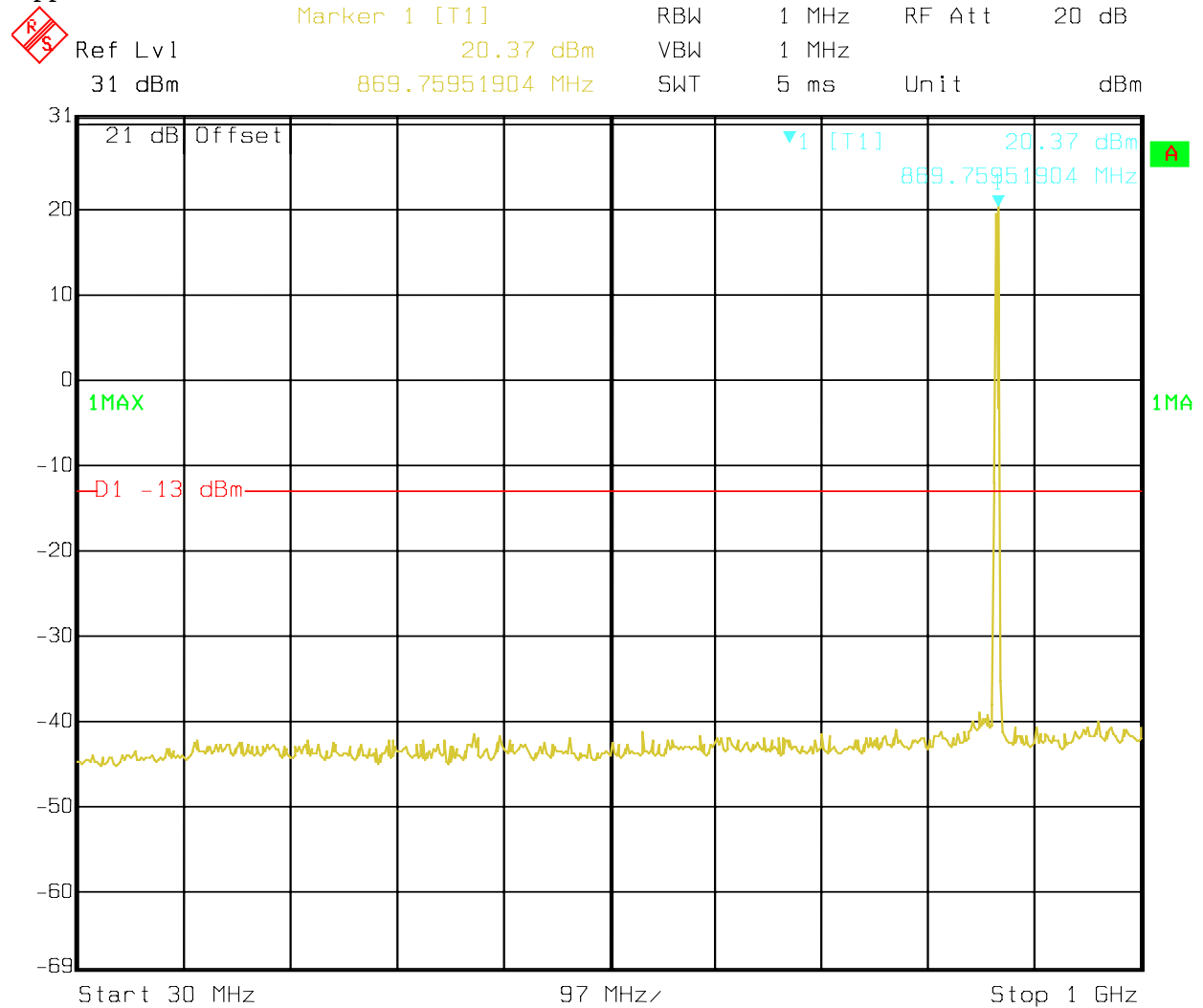


Date: 01.NOV.2004 17:48:10

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

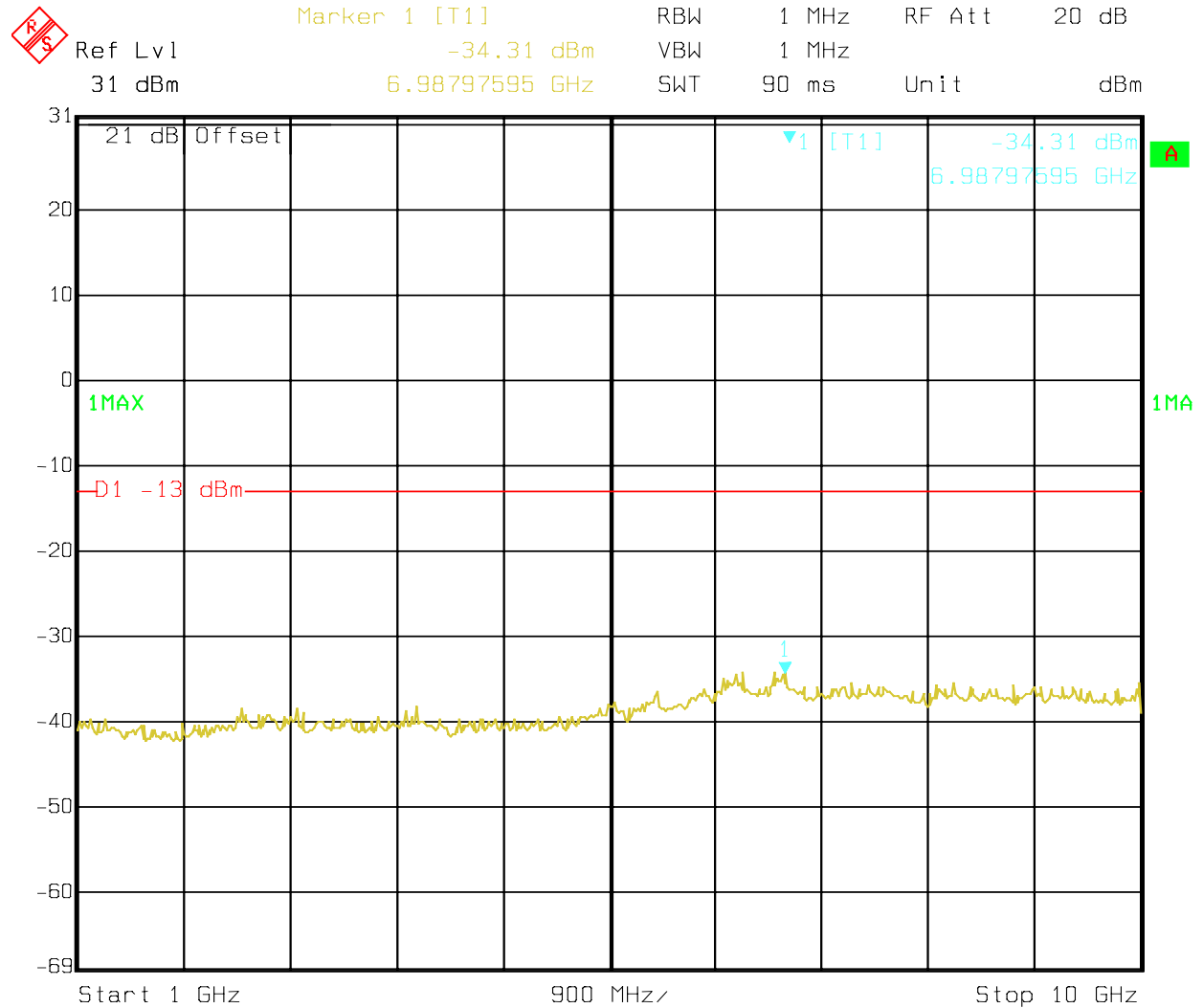
Upper Channel



Date: 01.NOV.2004 17:54:49

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R



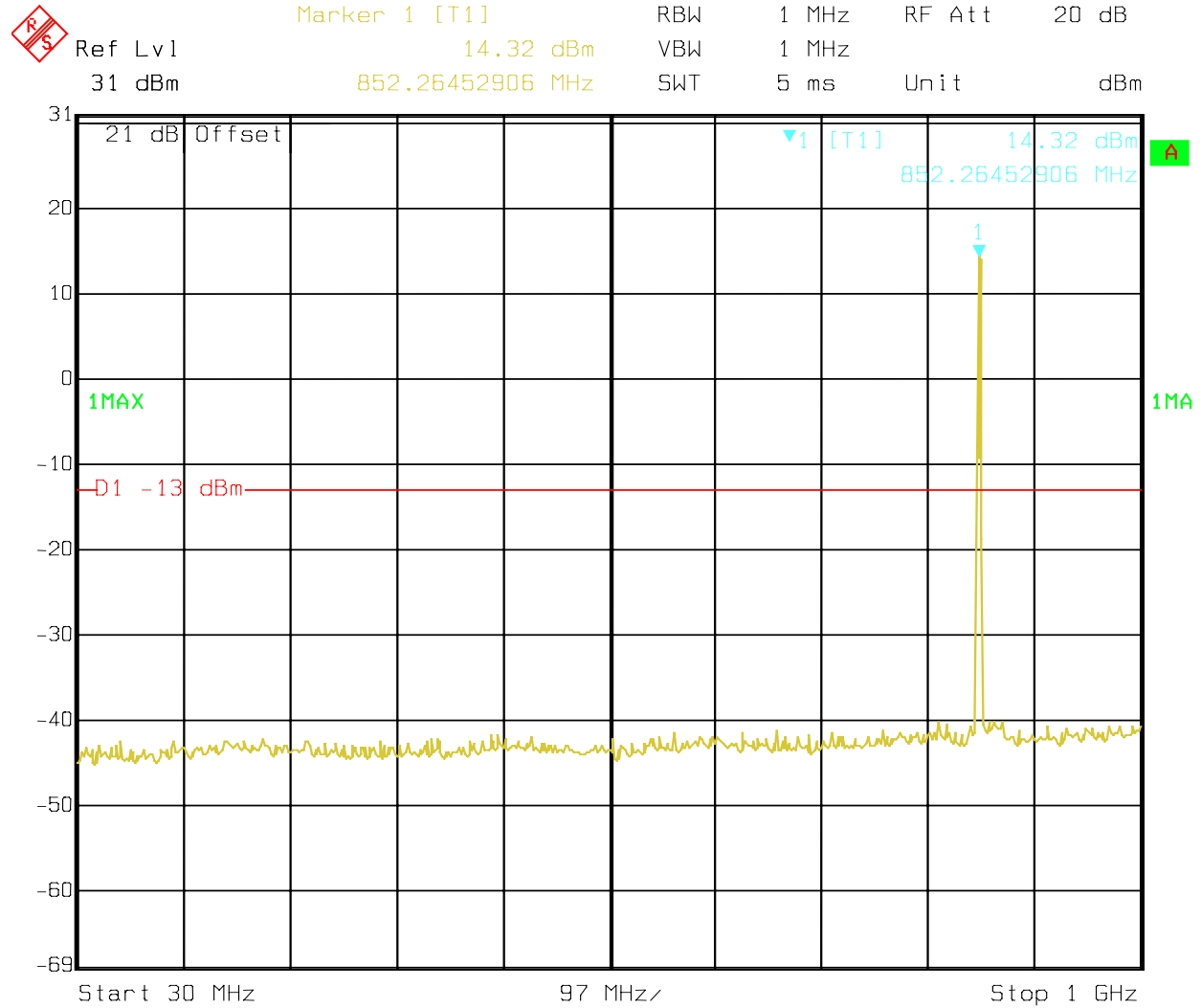
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EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

800MHz Band iDEN Modulation

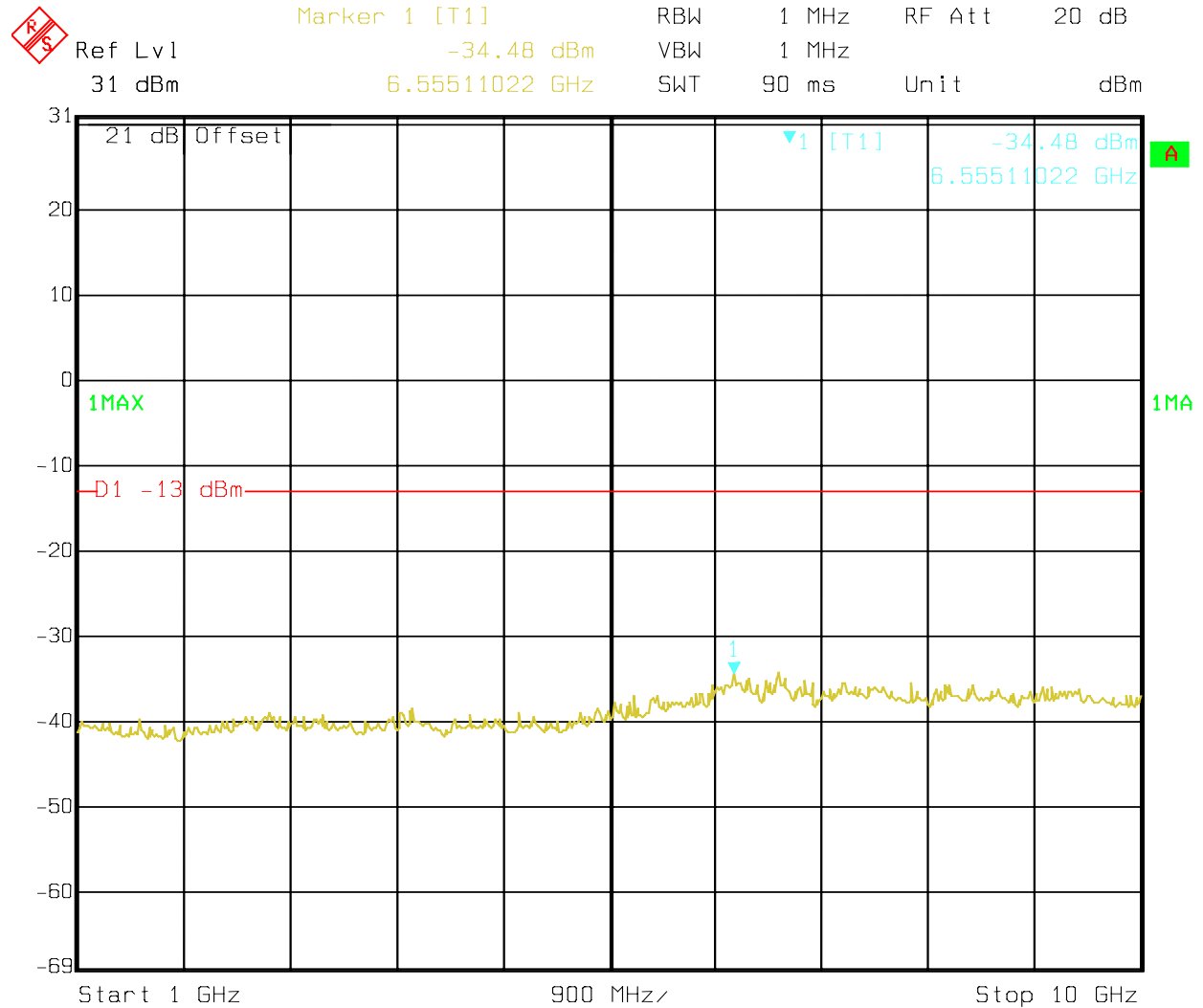
Lower Channel



Date: 02.NOV.2004 09:40:34

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

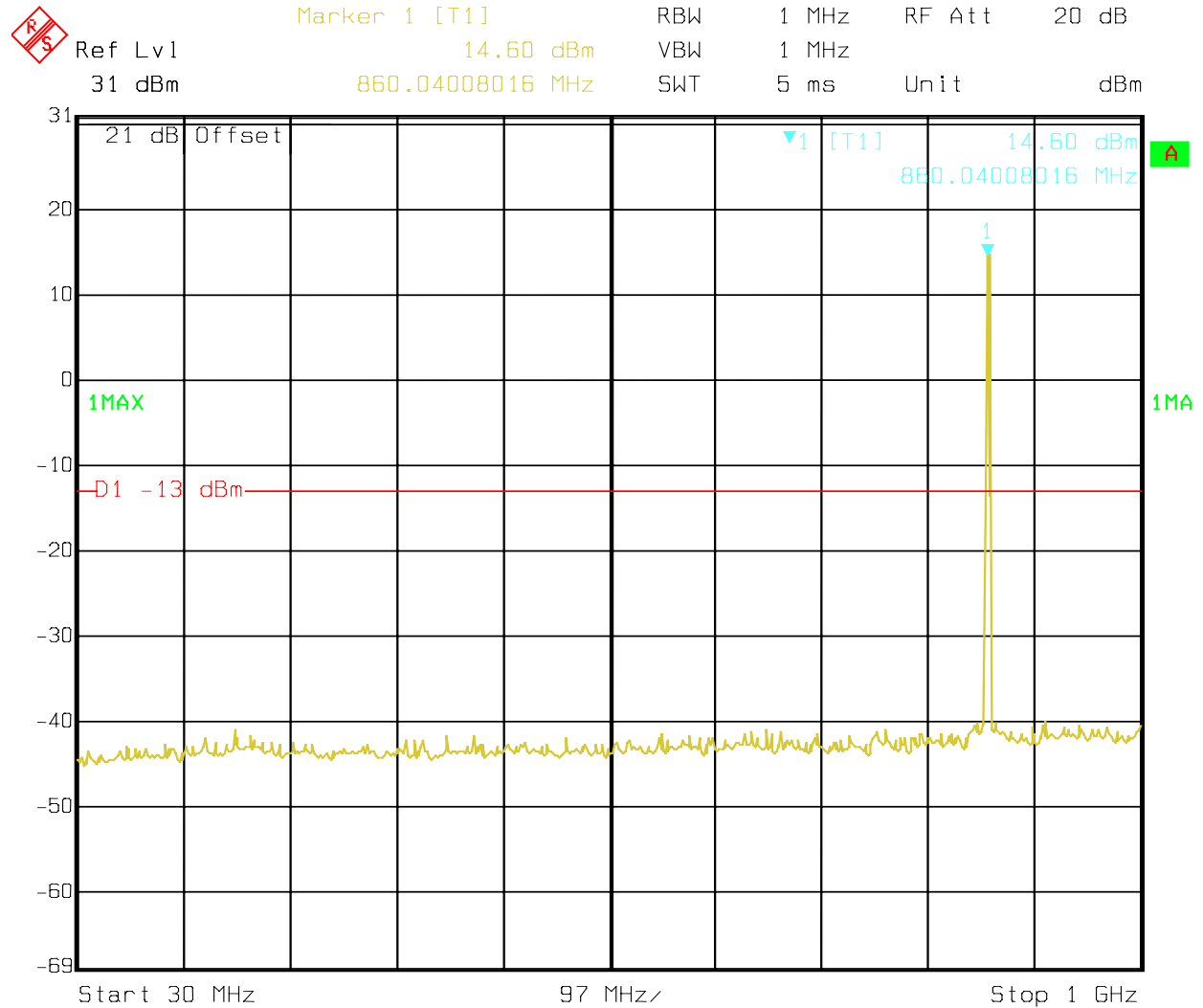


Date: 02.NOV.2004 09:41:06

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

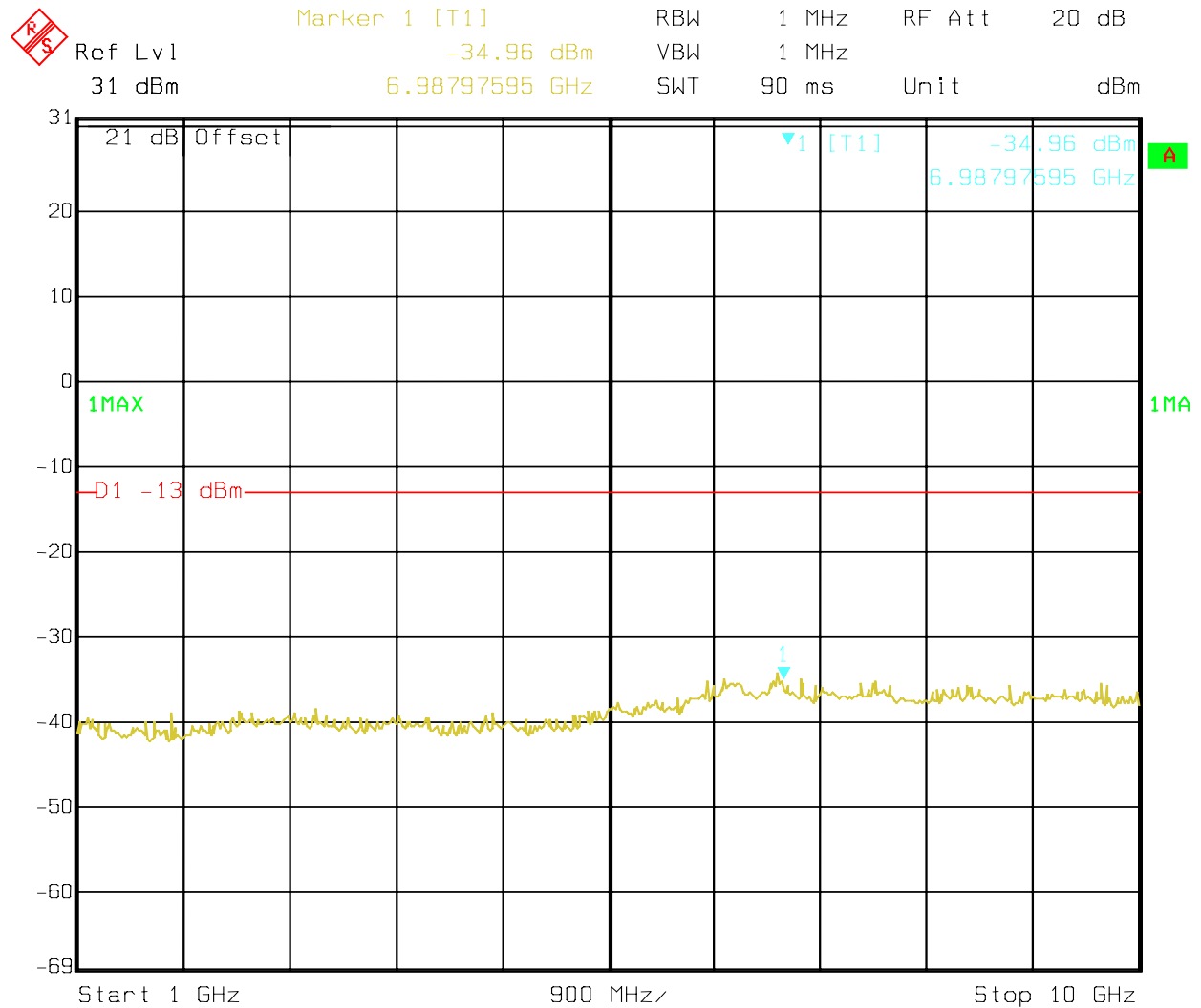
Mid Channel



Date: 02.NOV.2004 09:41:50

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

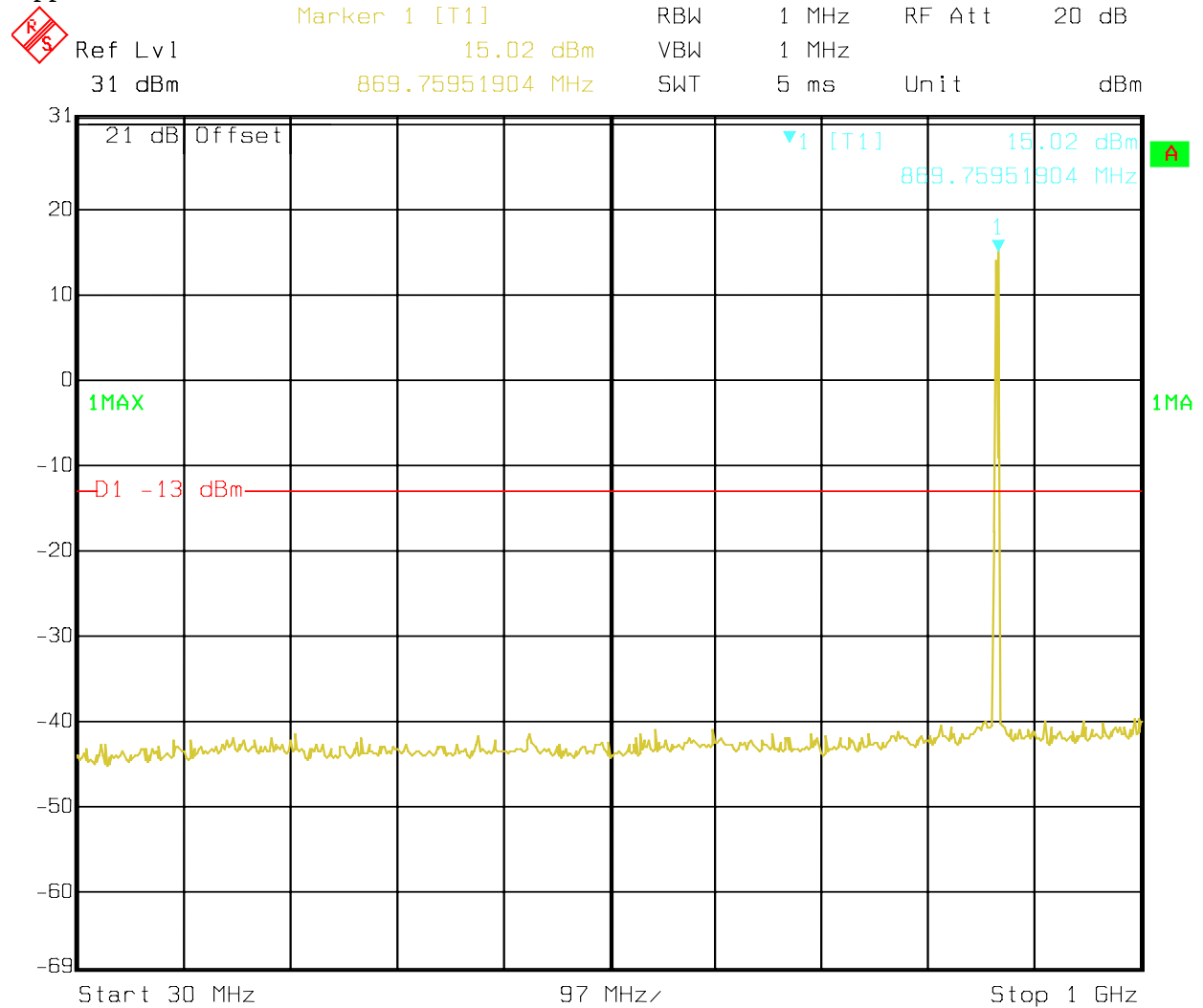


Date: 02.NOV.2004 09:42:18

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

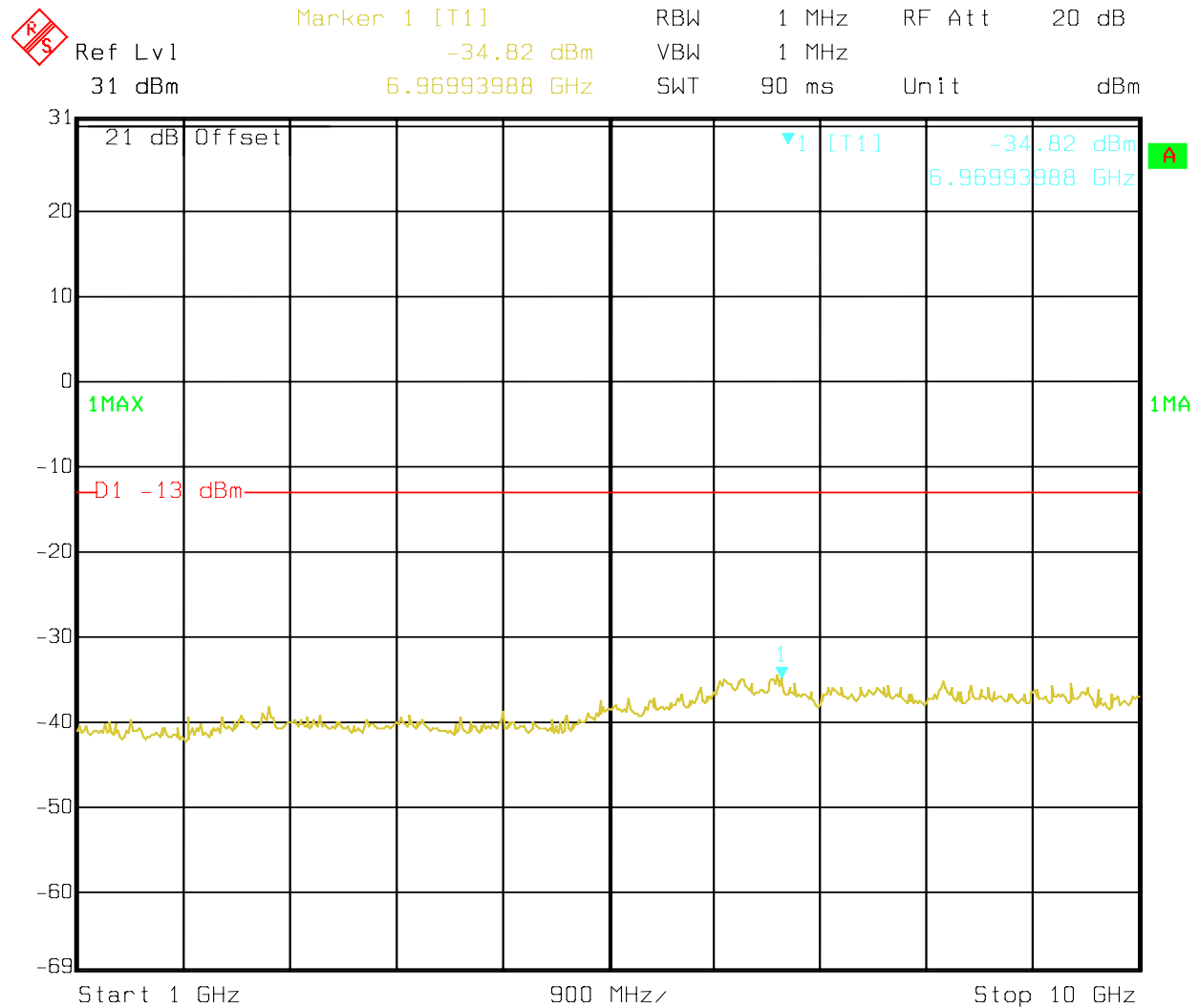
Upper Channel



Date: 02.NOV.2004 09:31:43

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R



Date: 02.NOV.2004 09:32:19

EQUIPMENT: Optical Repeater

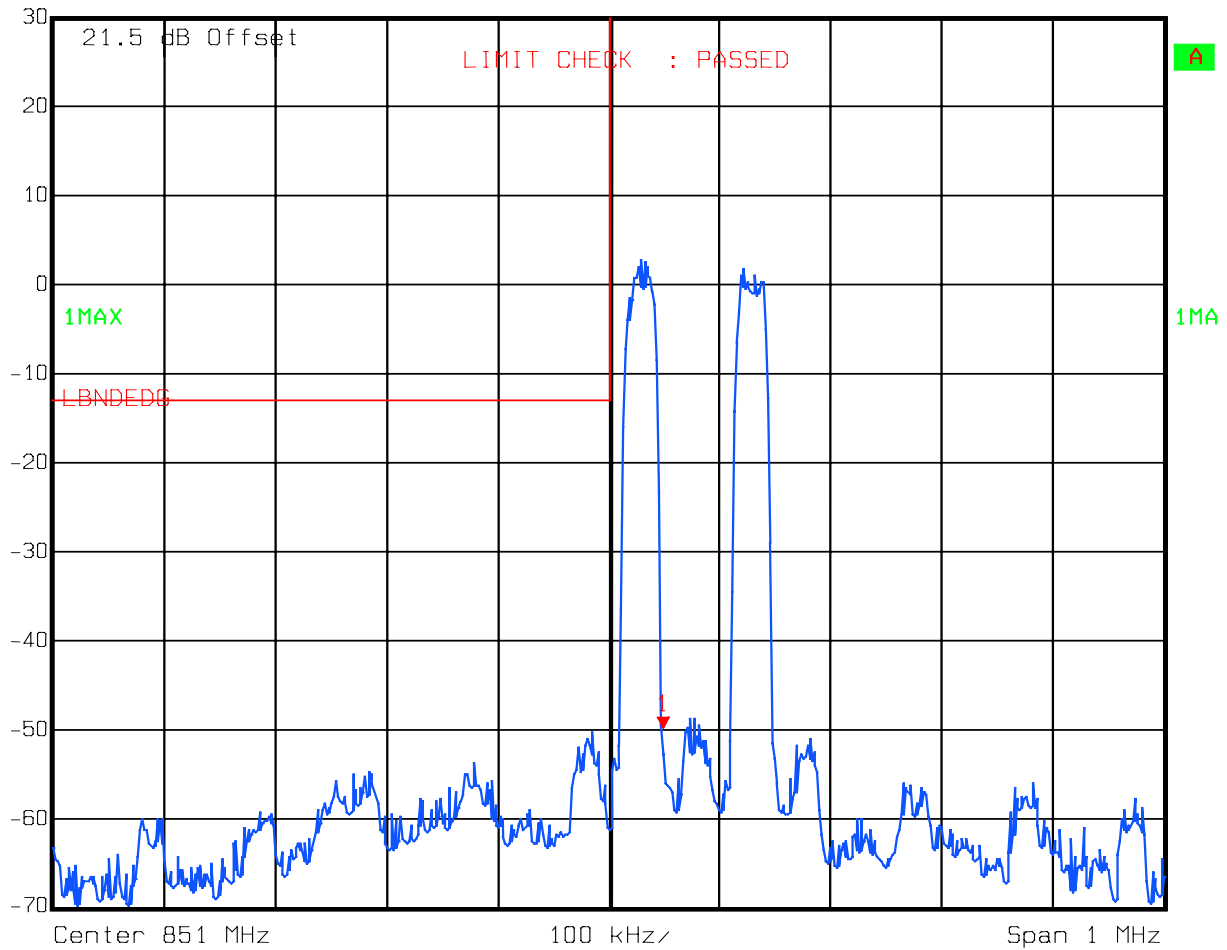
PROJECT NO.: 4L0492R

Intermodulation

Lower edge iDEN (800 Band)



Ref Lvl 30 dBm
Marker 1 [T1] -49.76 dBm
851.05000000 MHz
RBW 1 kHz
VBW 1 kHz
SWT 2.5 s
RF Att 20 dB
Unit dBm

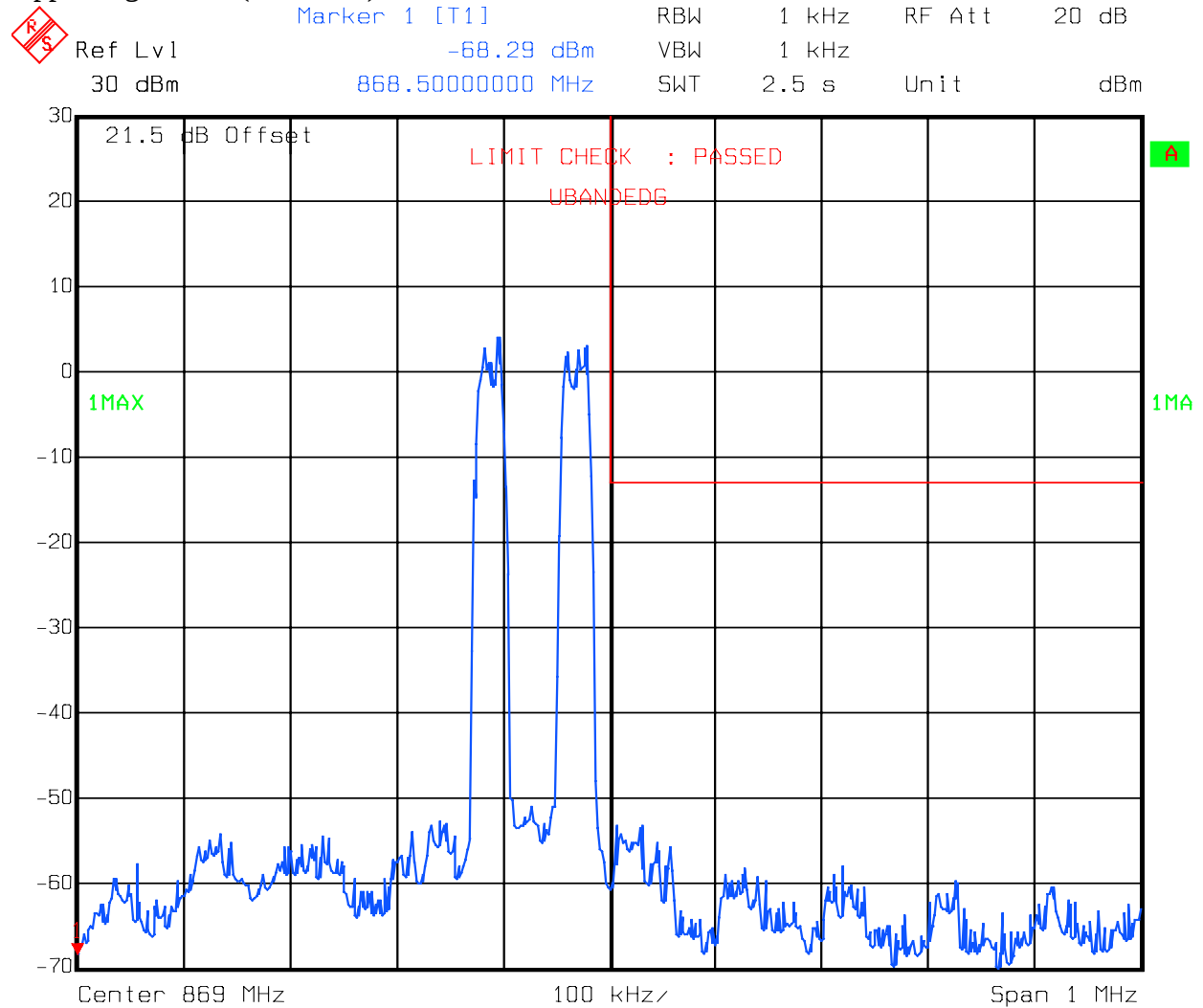


Date: 05.OCT.2004 13:40:23

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Upper edge iDEN (800 Band)

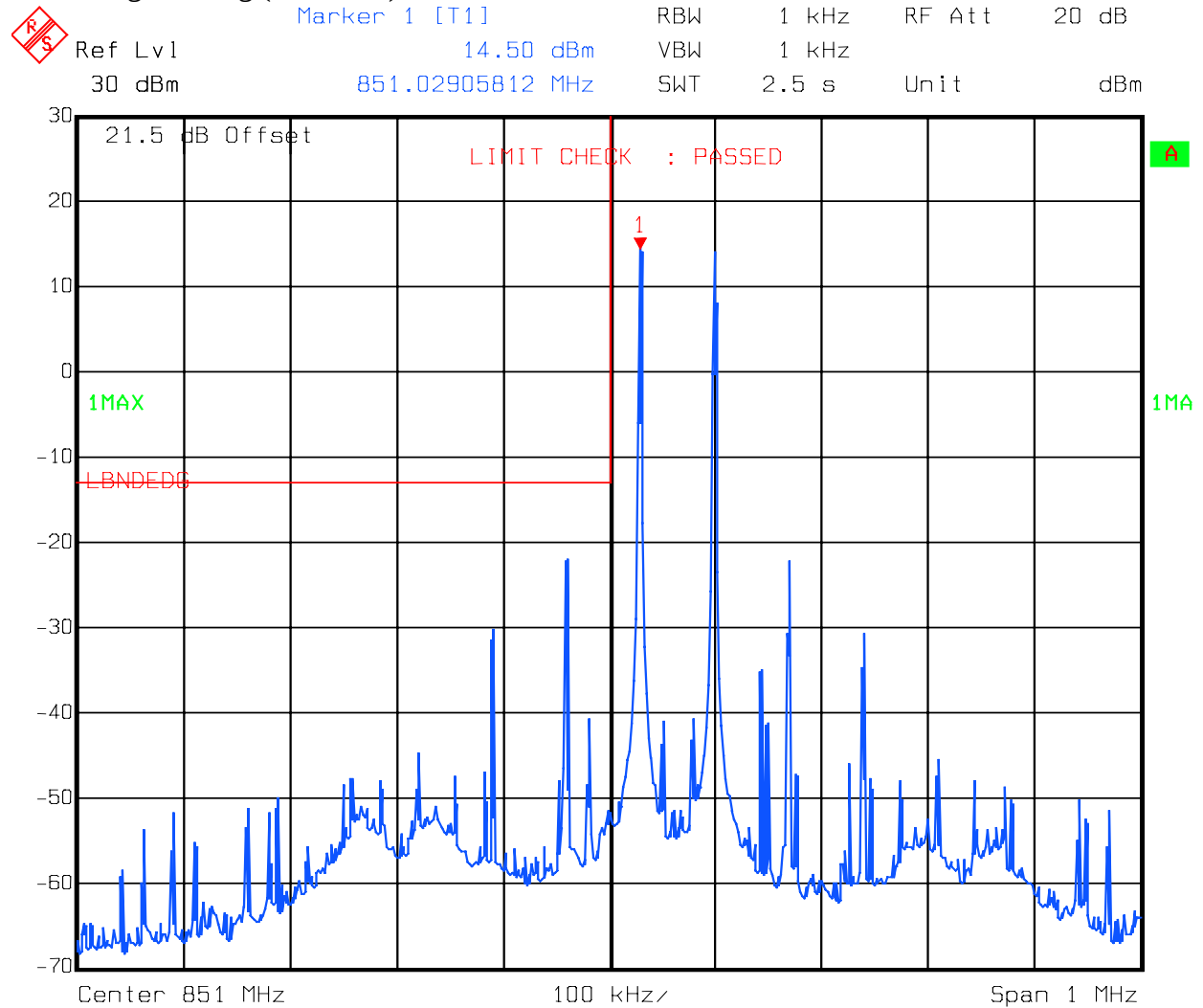


Date: 05.OCT.2004 13:44:59

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Lower edge Analog (800 Band)

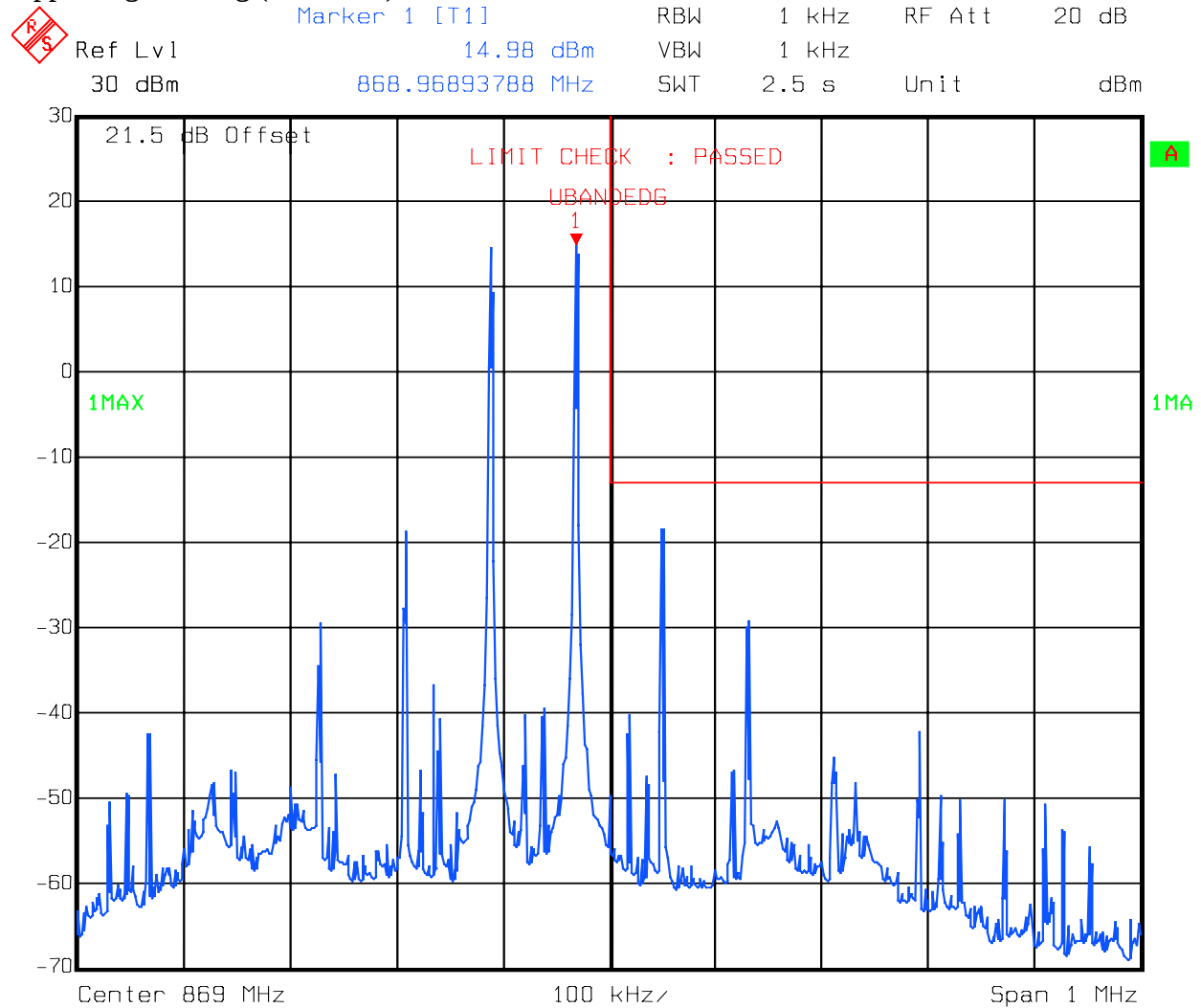


Date: 05.OCT.2004 13:50:05

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Upper edge Analog (800 Band)

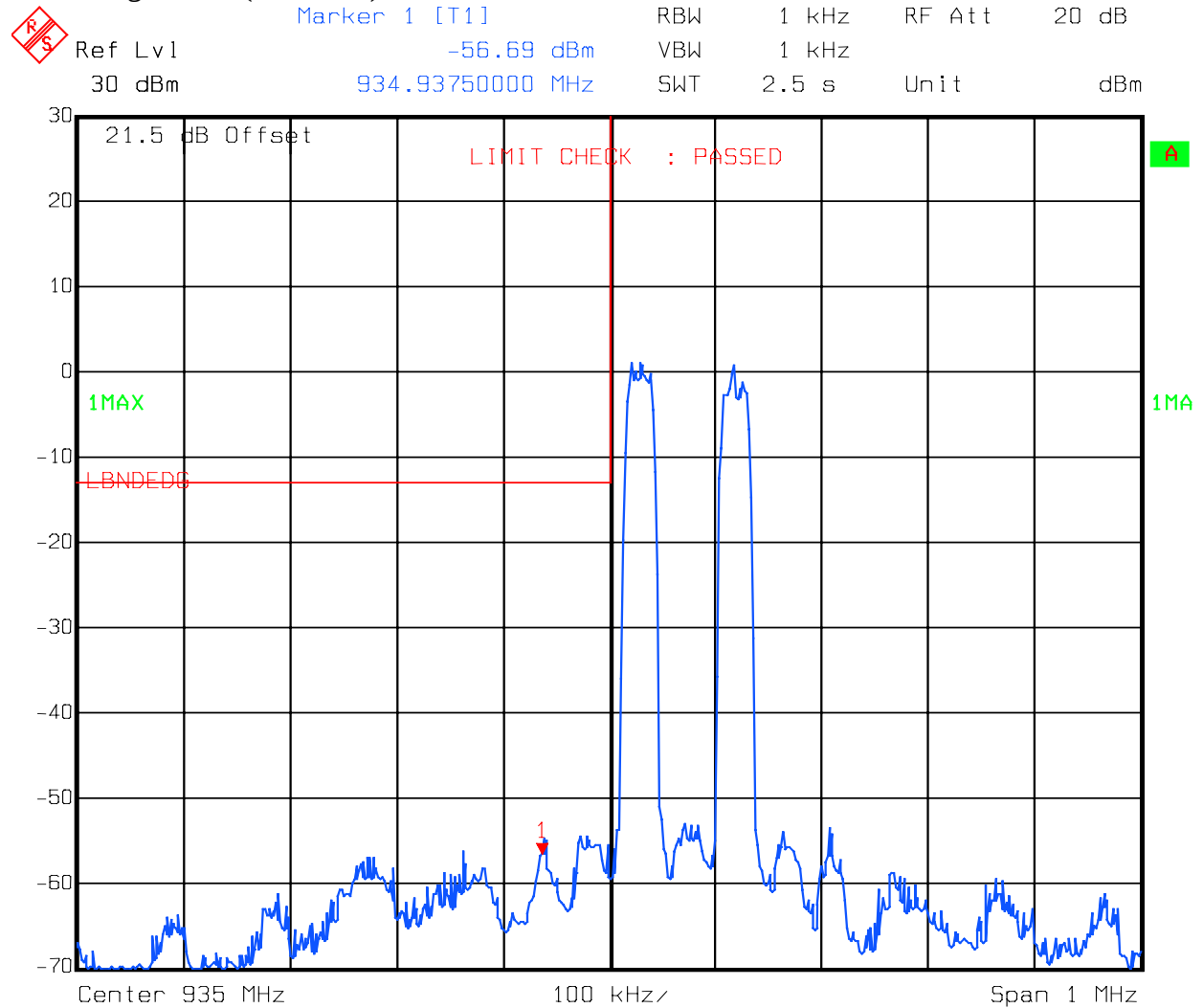


Date: 05.OCT.2004 13:47:57

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Lower edge iDEN (900 Band)

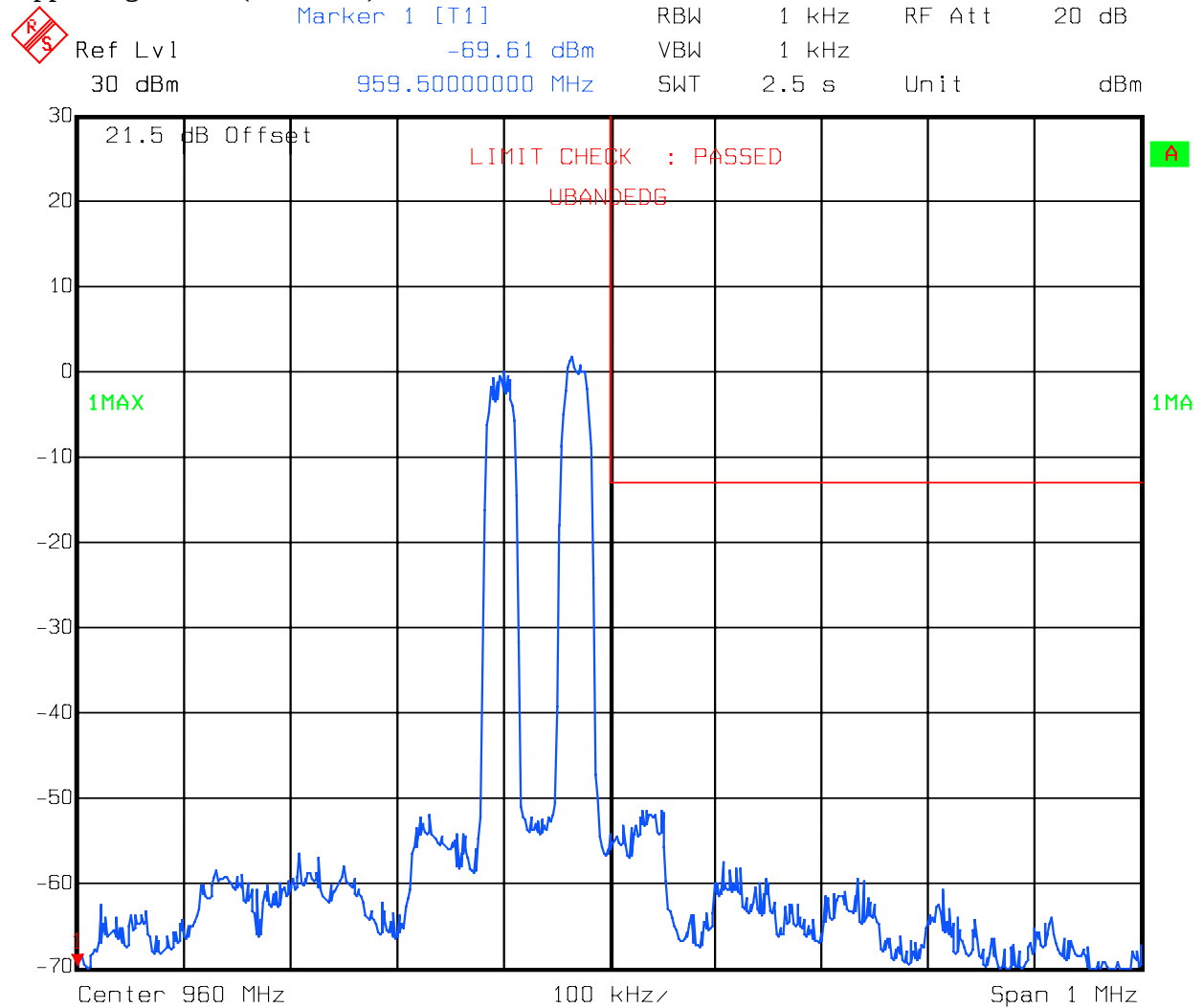


Date: 05.OCT.2004 13:53:21

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Upper edge iDEN (900 Band)

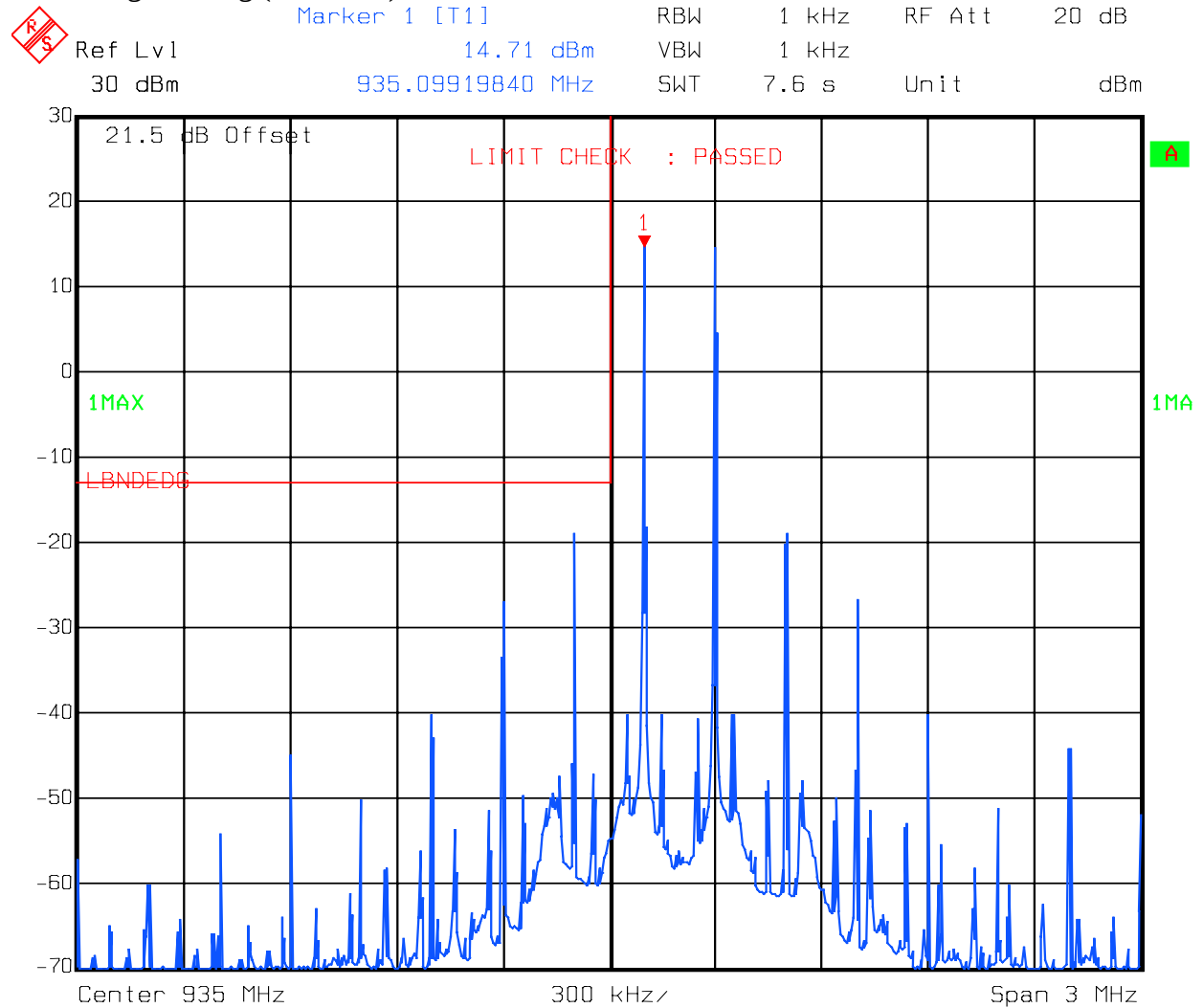


Date: 05.OCT.2004 13:54:46

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Lower edge Analog (900 Band)

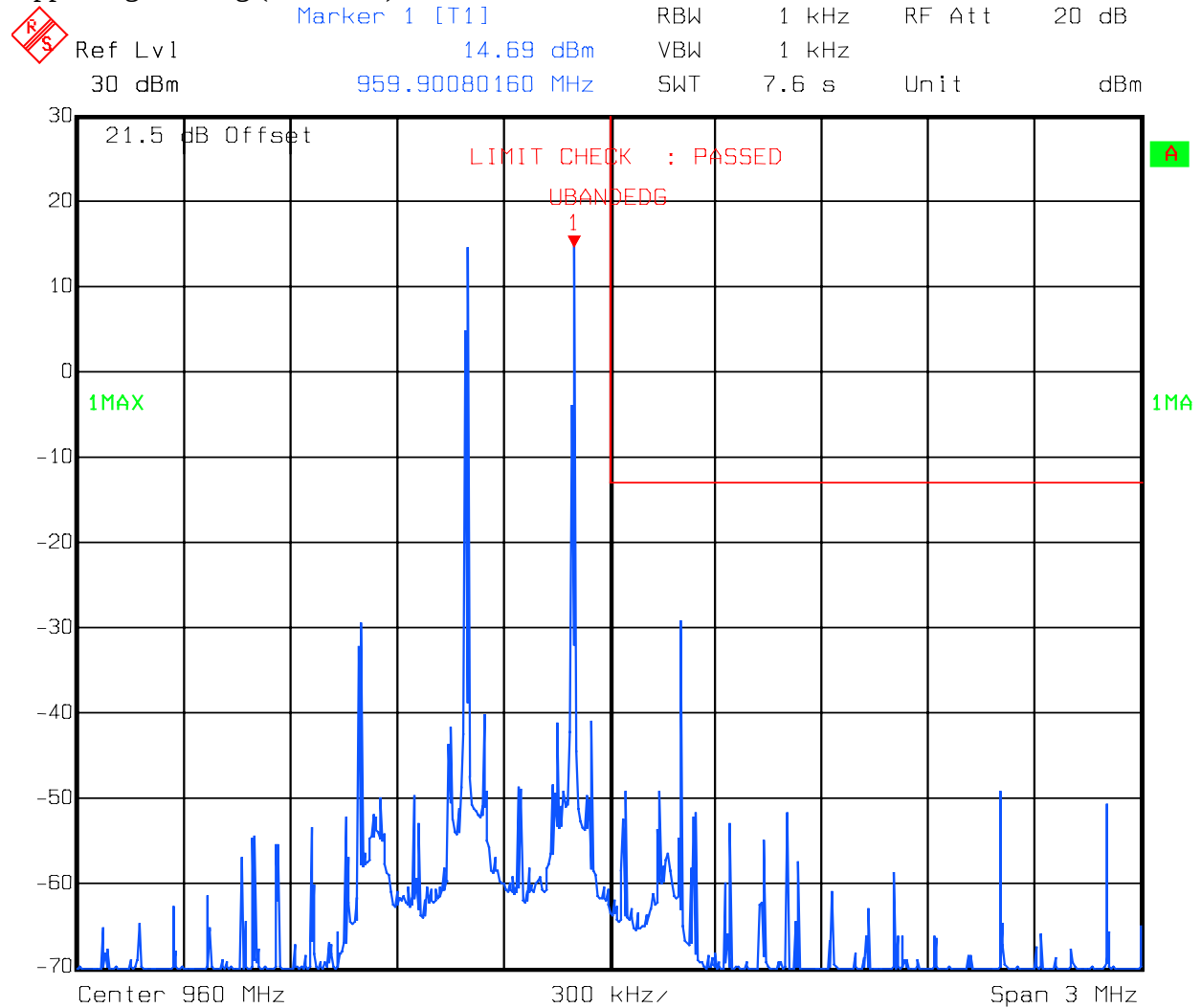


Date: 05.OCT.2004 11:01:30

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

Upper edge Analog (900 Band)



Date: 05.OCT.2004 11:04:54

EQUIPMENT: **Optical Repeater**PROJECT NO.: **4L0492R**

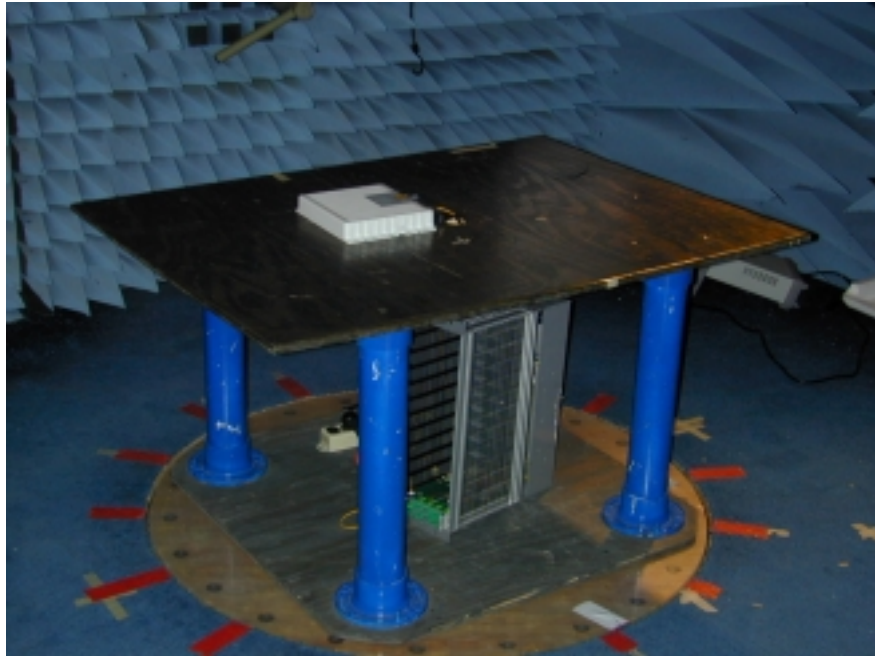
Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY:	DATE:

Test Results: Complies**Test Data:** No Emissions found within 20dB of Limit. Noise from was greater than 20dB below limit. Frequency range scanned from 30MHz to 20GHz**Note:** See page A5 for applicable limit.**Equipment Used:****Measurement Uncertainty:** +/- 3.6 dB**Temperature:** 21 °C**Relative Humidity:** 51 %

Photographs of Test Setup

FRONT VIEW



REAR VIEW



Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

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: Optical Repeater

PROJECT NO.: 4L0492R

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	03/22/04	03/23/06
1471	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1627	CABLE, 5 ft	MEGAPHASE 10312 1GVT4	N/A	CBU	N/A
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/30/04	07/30/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/30/04	07/30/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/03	10/26/04
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

ANNEX A - TEST METHODOLOGIES

Nemko USA

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Optical Repeater**

PROJECT NO.: **4L0492R**

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.

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

PROJECT NO.: 4L0492R

PARA. NO.: 2.991

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

$$\text{VBW} = \text{RBW}$$

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

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

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

EQUIPMENT: **Optical Repeater**PROJECT NO.: **4L0492R**

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

Test Method: The substitution antenna method was used to measure erp of spurious emissions. This method is described in EIA/TIA 603. The field strength of the emission is measured and recorded. The EUT is then replaced with a substitution antenna of known gain against a dipole. The substitution antenna is fed with a calibrated signal which is adjusted until the previously recorded value is repeated. The erp of the spurious signal is the level required to repeat the previously measured level. If the substitution antenna gain is calibrated and expressed as dBi (referenced to an isotropic radiator instead of a dipole), the result is adjusted by 2.15 dB so that the result is erp not eirp.

EQUIPMENT: Optical Repeater

PROJECT NO.: 4L0492R

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	-	-	-

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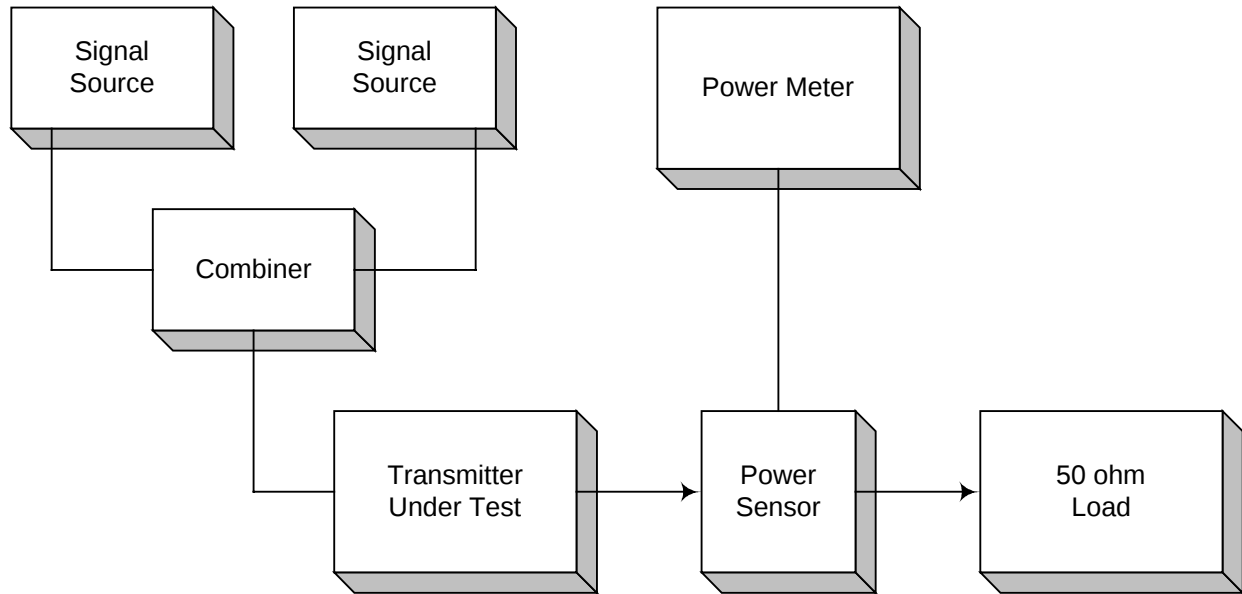
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Optical Repeater**

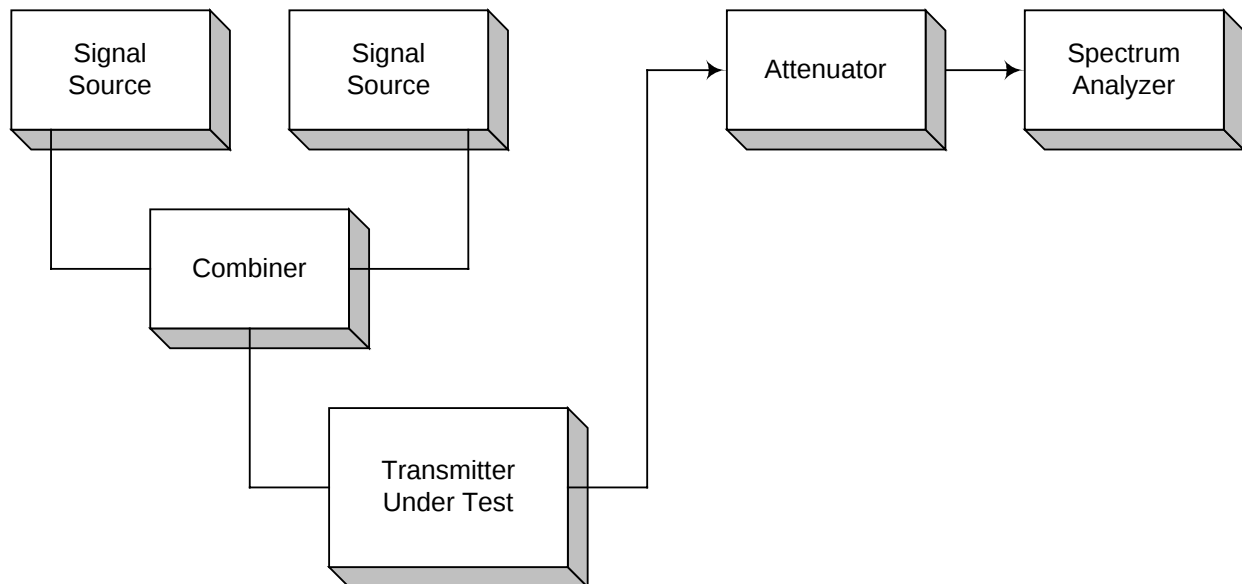
PROJECT NO.: **4L0492R**

ANNEX B - TEST DIAGRAMS

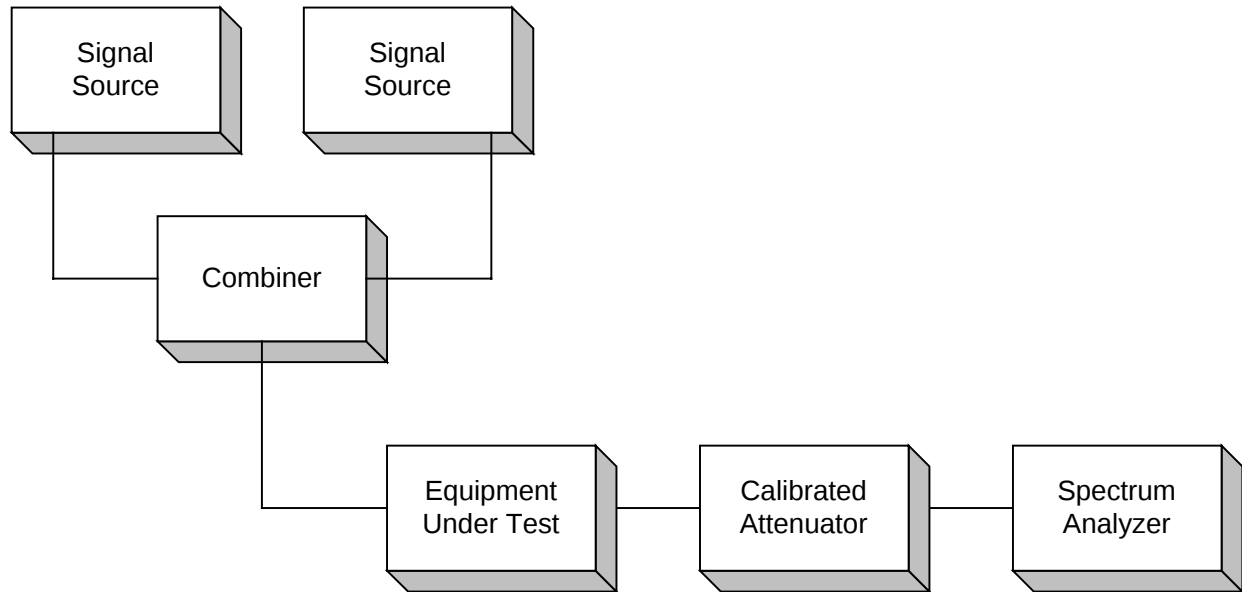
Para. No. 2.985 - R.F. Power Output



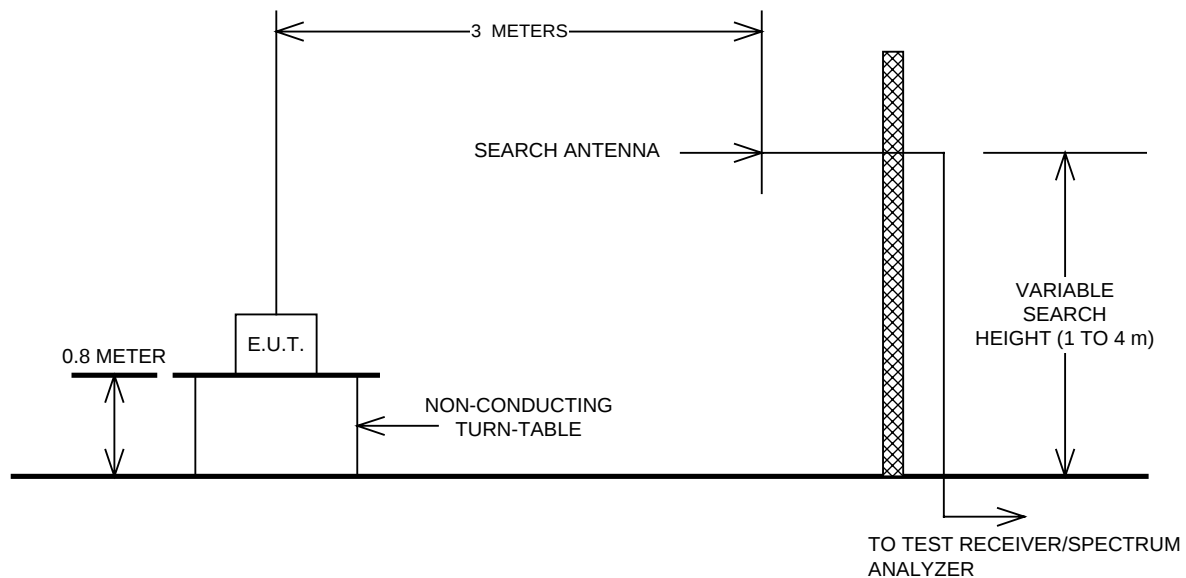
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

