

KTL Test Report No.:

0L0145RUS1

Applicant:

Allen Telecom
140 Vista Centre Dr.
Forest, VA. 2451

Equipment Under Test:

MR301B

FCC ID:

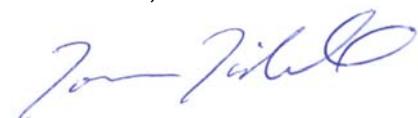
BCR-RPT-MR301B

In Accordance With:

FCC Part 24, Subpart E
Narrowband PCS Repeaters

Tested By:

KTL Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136



Authorized By:

Tom Tidwell, RF Group Manager

Date:

1 July, 2000

Total Number of Pages:

40

Table of Contents

Section 1. Summary of Test Results.....	3
Section 2. General Equipment Specification.....	5
Section 3. RF Power Output	7
Section 4. Occupied Bandwidth	8
Section 5. Spurious Emissions at Antenna Terminals.....	18
Section 6. Field Strength of Spurious.....	23
Section 7. Frequency Stability.....	29
Section 8. Test Equipment List.....	30
ANNEX A - TEST DETAILS	31
ANNEX B - TEST DIAGRAMS.....	37

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FCC PART 24, SUBPART E
NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**

Section 1. Summary of Test Results

Manufacturer: Allen Telecom

Model No.: MR301B

Serial No.: 42

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 24, Subpart E.

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

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	24.232	100W	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	Complies
Occupied Bandwidth (NADC)	24.238	Input/Output	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Complies
Frequency Stability	24.235	N/A	N/A

Footnotes:

(1) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.

Measurement uncertainty for each test configuration is expressed to 95% probability.

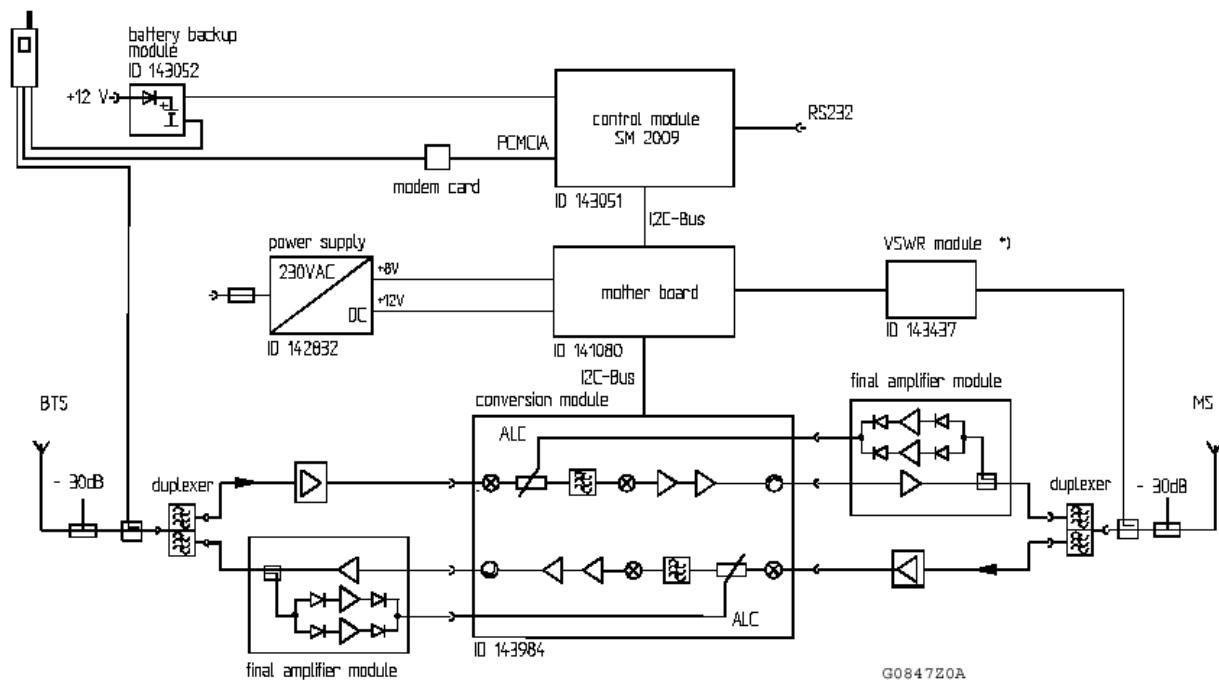
Section 2. General Equipment Specification

Supply Voltage Input:	115vac		
Up link	901-901.9 MHz		
Down link	940-941 MHz		
Type of Modulation and Designator:	2fsk <input checked="" type="checkbox"/> 8K00F1D	4fsk <input checked="" type="checkbox"/> 16K00F1D	NADC (DXW) <input type="checkbox"/>
System Gain:	85 dB		
Output Impedance:	50 ohms		
Max Input:	-42.5 dBm		
RF Output (Rated): Uplink	Per channel:	.5 W	
	Total:	2 W	
RF Output (Rated): Downlink	Per channel:	.5 W	
	Total:	2 W	
Frequency Translation:	F1-F1 <input checked="" type="checkbox"/>	F1-F2 <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Band Selection:	Software <input checked="" type="checkbox"/>	Duplexer <input type="checkbox"/>	Fullband <input type="checkbox"/>

Description of Operation

The Repeater MR301B is a band selective Repeater which bi-directionally amplifies signals between mobile stations and a base station in a GSM900 mobile telephone system. It is employed wherever bad topological conditions cause poor field strengths. It can provide highly selective amplification of the entire GSM900 band or band segments, thus enabling radio coverage in regions where satisfactory quality of communication is not available.

System Diagram



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NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies.

Measurement Data:

MODULATION	POWER OUTPUT PER CHANNEL (dBm)	COMPOSITE POWER OUTPUT (dBm)
FSK	+26.8	+31.6

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 °C

Relative Humidity: 46 %

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NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

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PROJECT NO.: **0L0145RUS1**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (fsk)	PARA. NO.: 2.1049
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies.

Test Data: See attached plot(s).

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 °C

Relative Humidity: 46 %

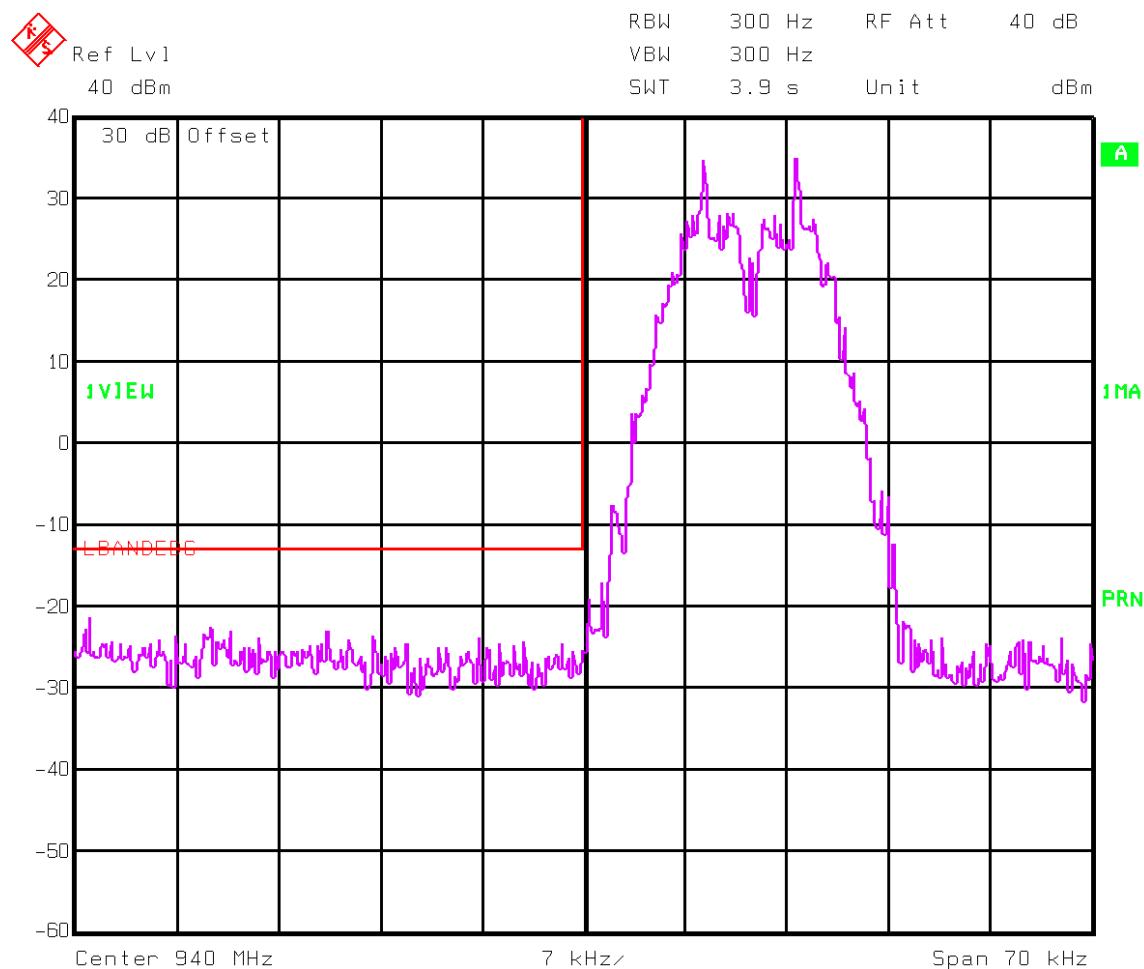
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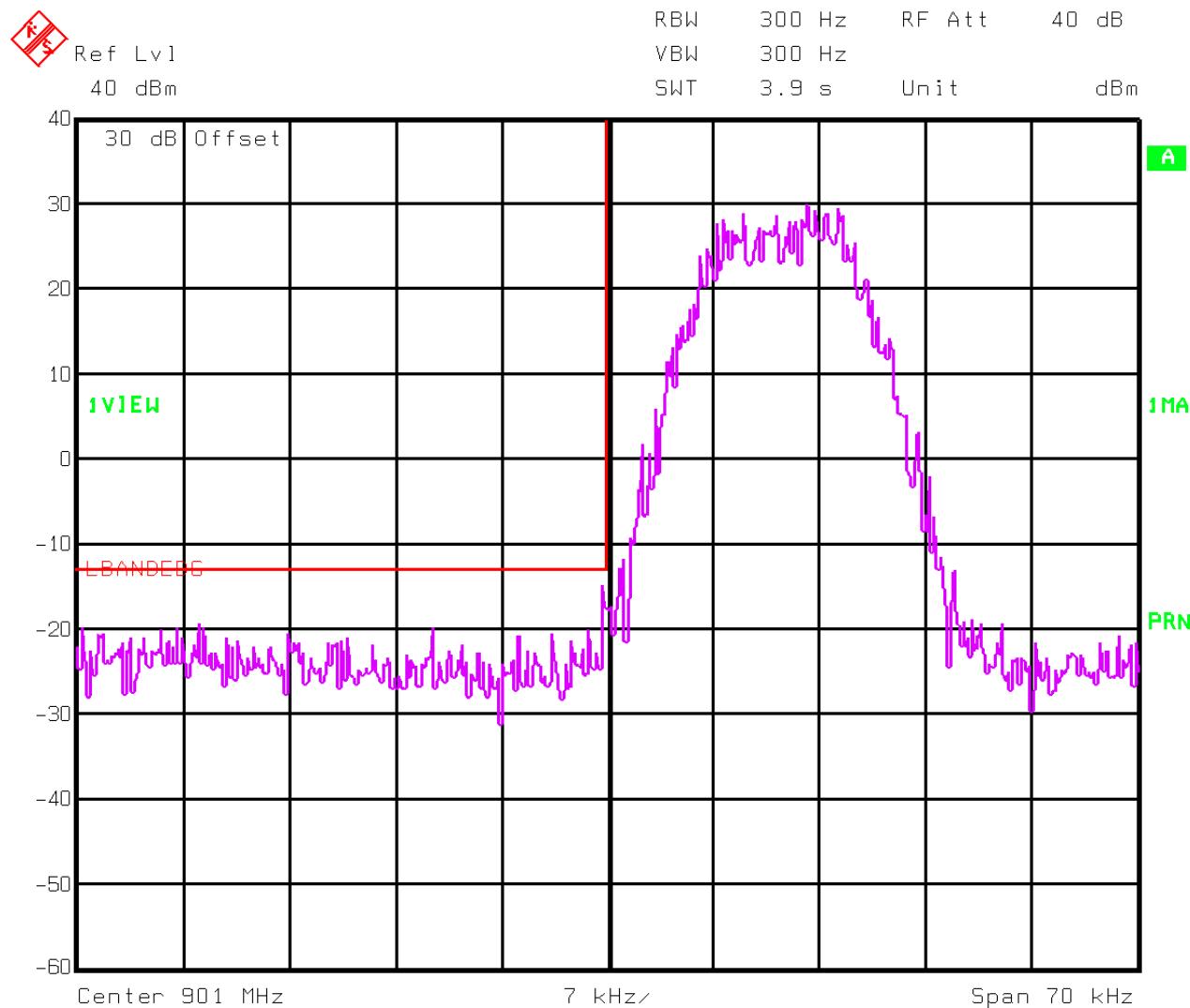
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EQUIPMENT: MR301B

FCC ID: BCR-RPT-MR301B

PROJECT NO.: **0L0145RUS1**



EQUIPMENT: **MR301B**FCC ID: **BCR-RPT-MR301B**PROJECT NO.: **0L0145RUS1**

Title: lower band edge
Comment A: lower band edge uplink 4 fsk
lbeulol4f
Date: 16.JUN.2000 8:51:45

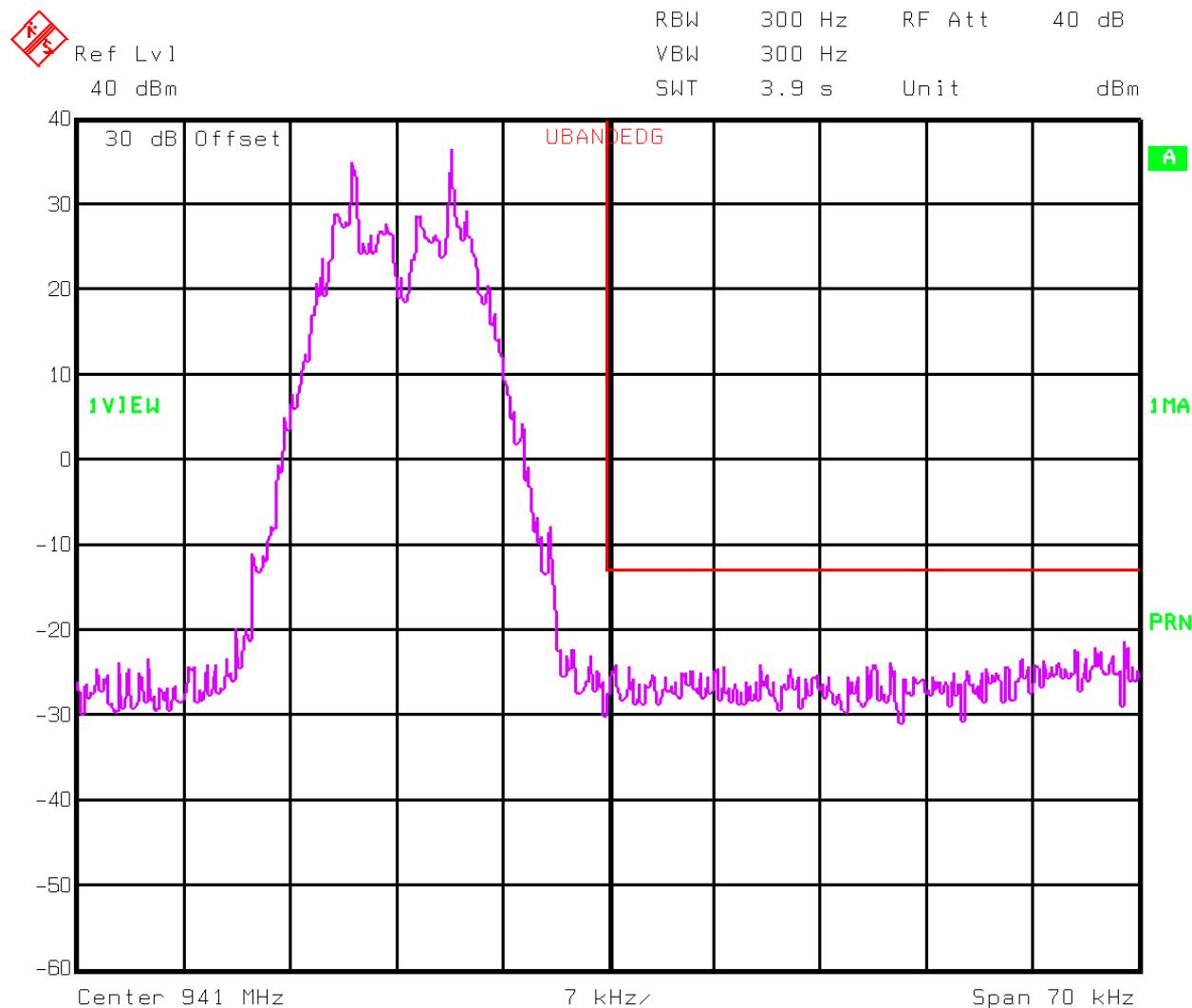
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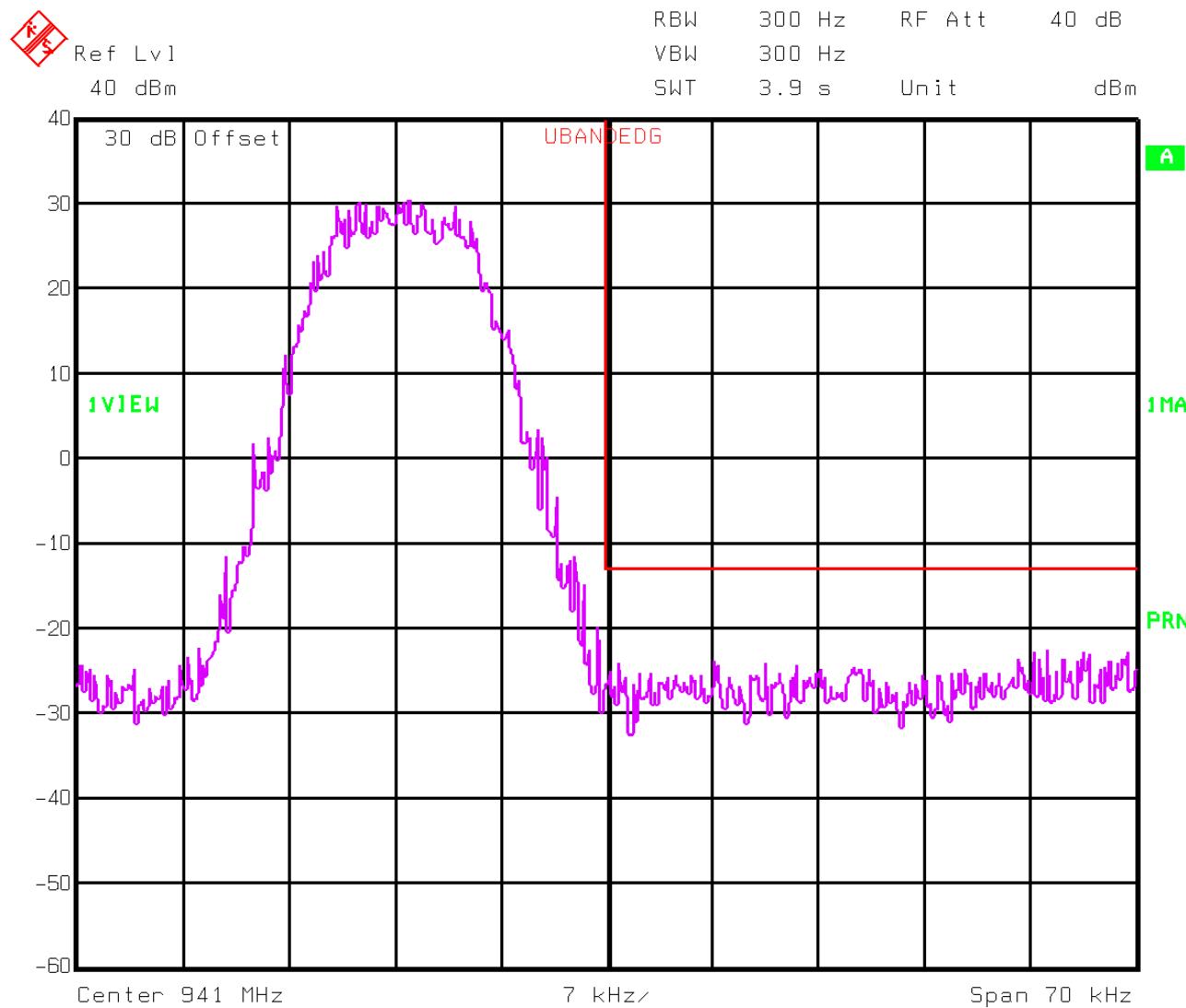
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FCC ID: BCR-RPT-MR301B

PROJECT NO.: **0L0145RUS1**



Title: upper band edge
Comment A: upper band edge downlink 2 fsk
ubedlo2f
Date: 16.JUN.2000 9:06:51

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Date: 16.JUN.2000 9:05:19

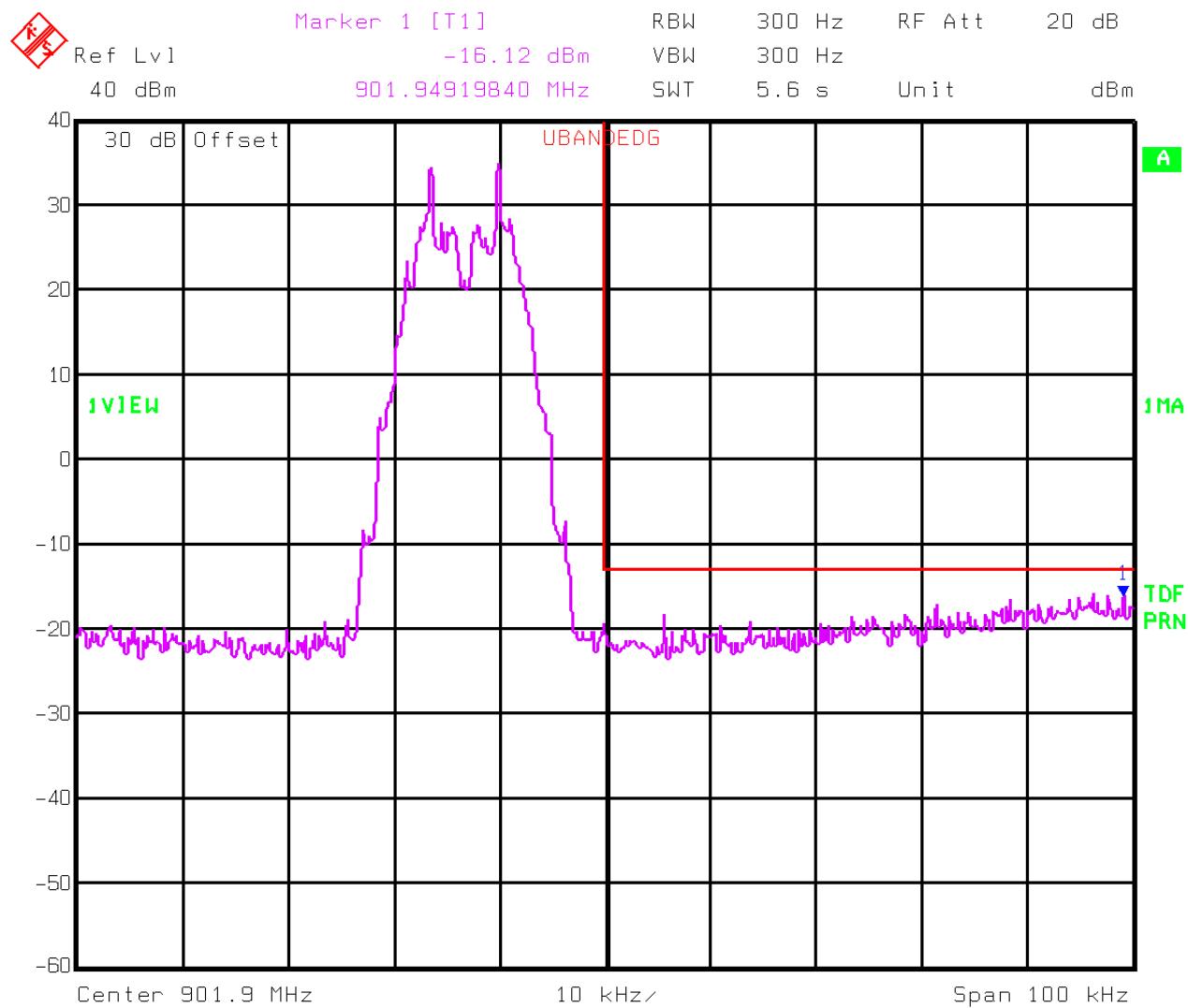
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NARROWBAND PCS REPEATERS

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FCC ID: BCR-RPT-MR301B

PROJECT NO.: **0L0145RUS1**



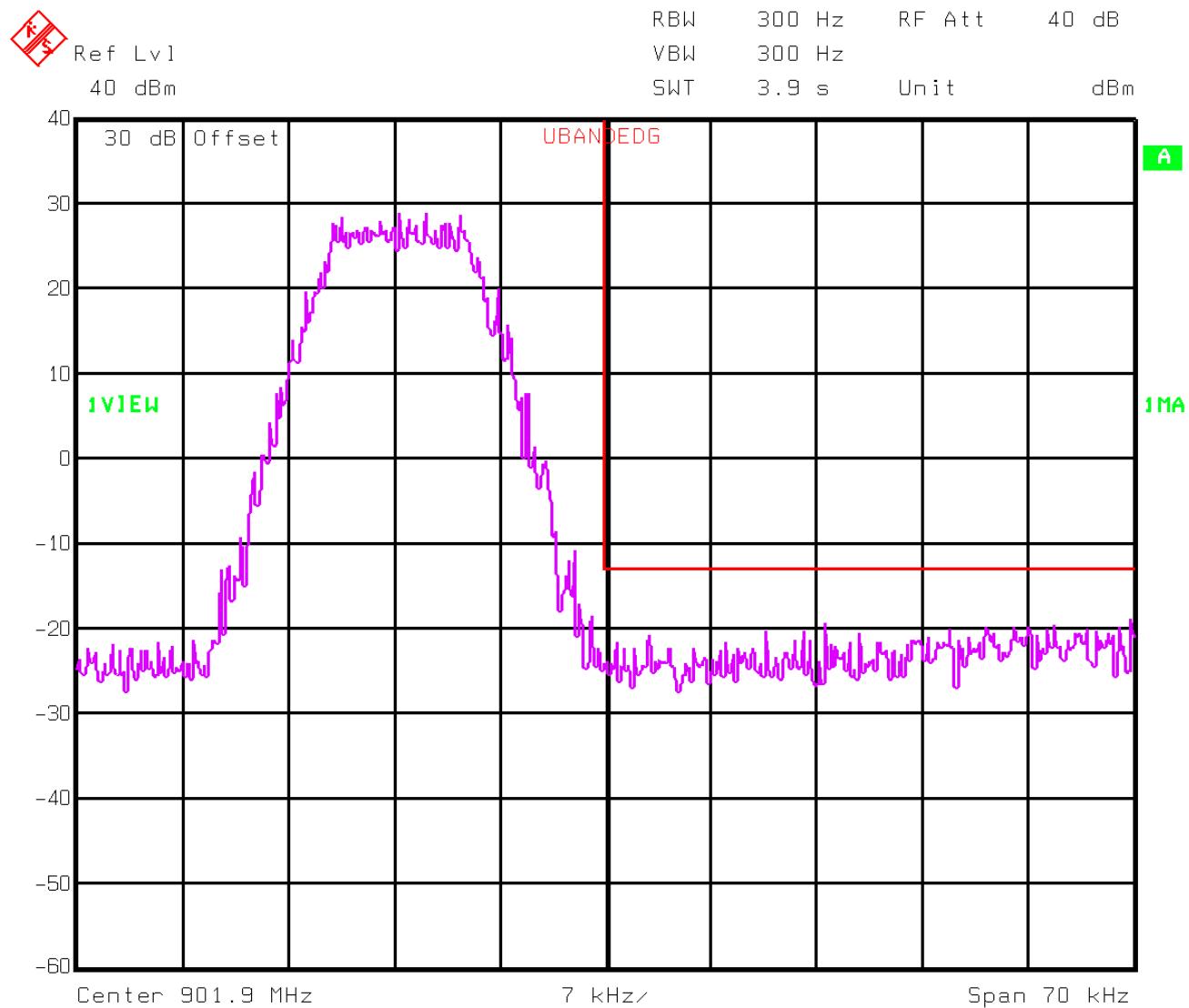
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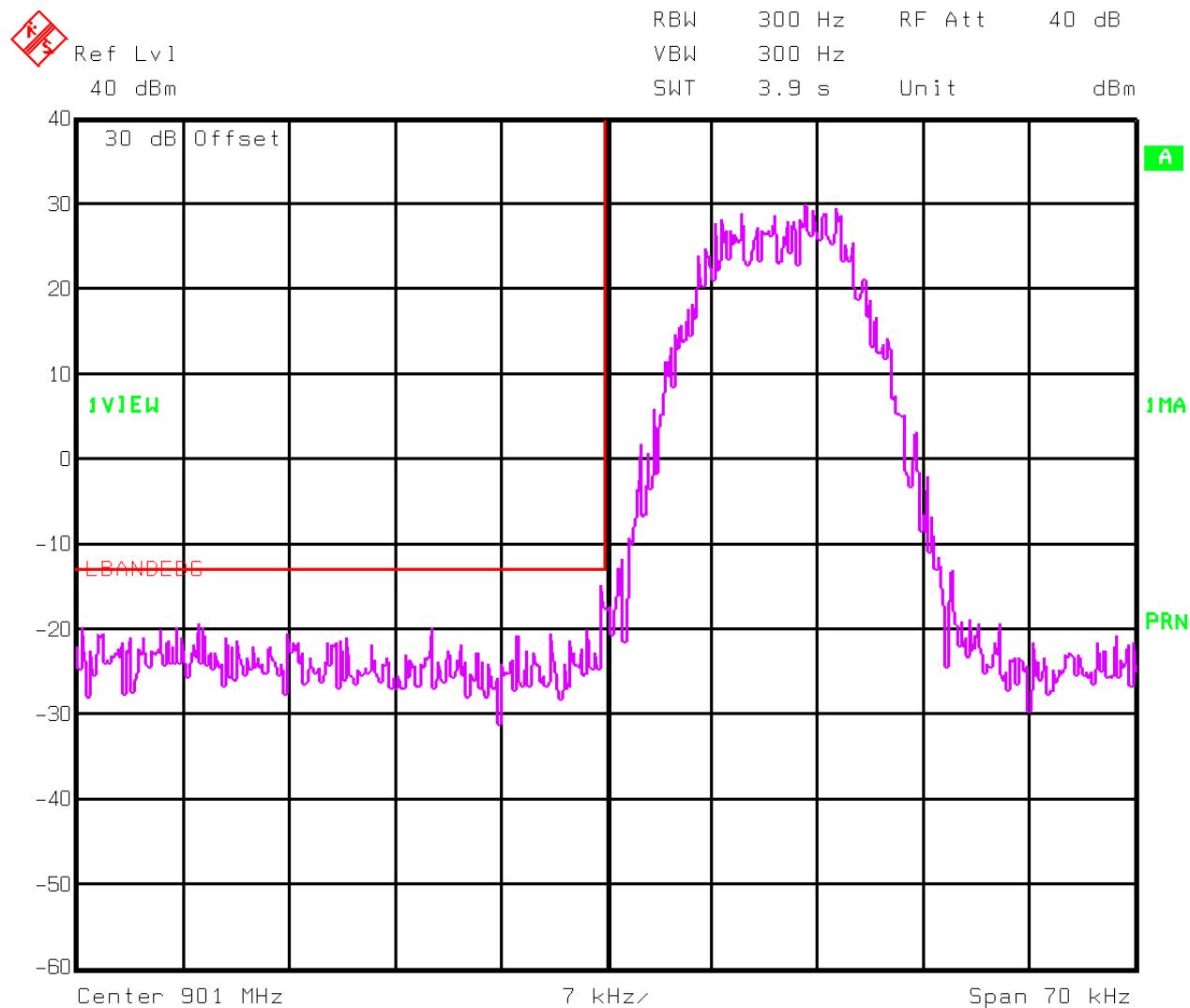
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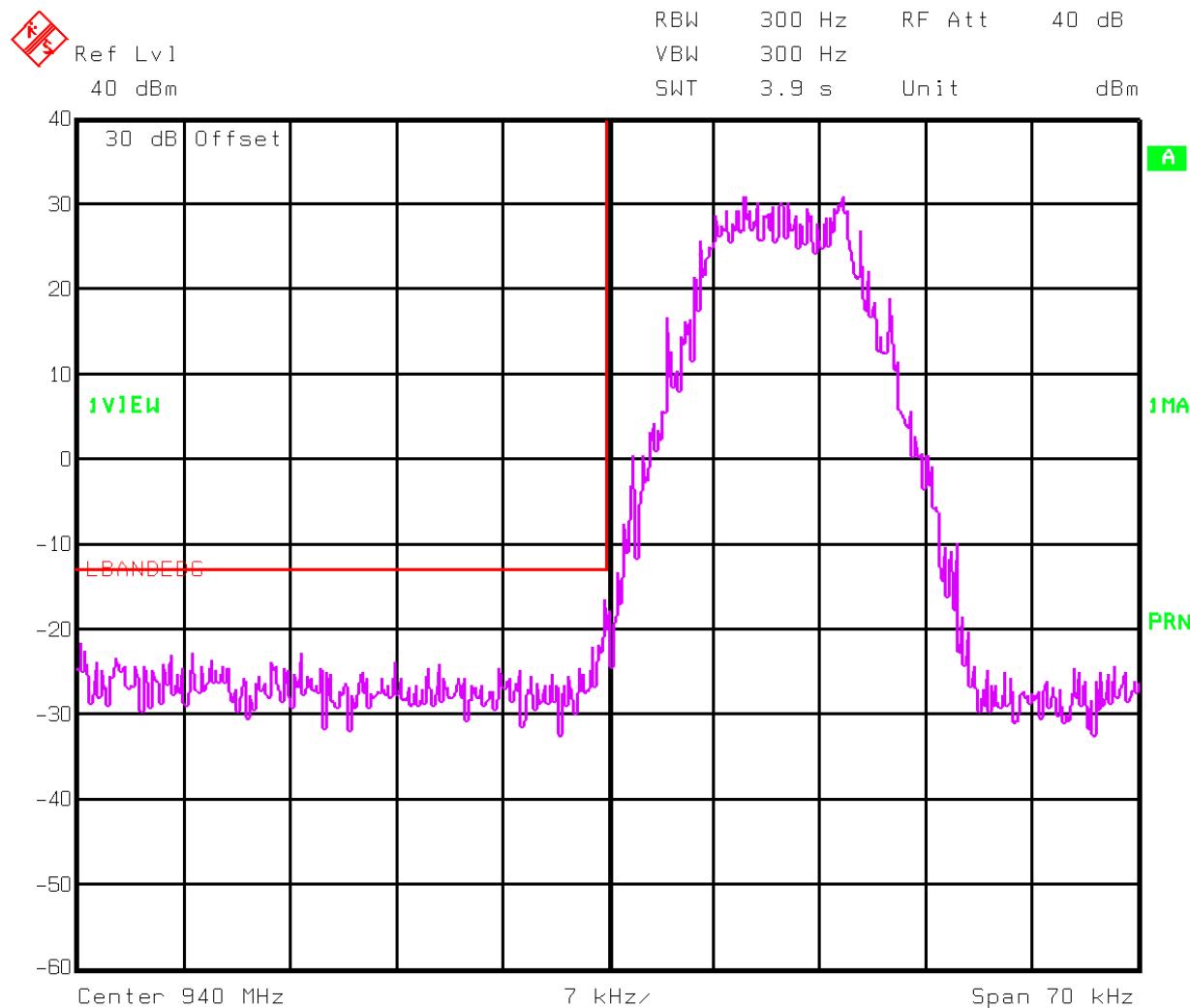
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Title: upper band edge
Comment A: upper band edge uplink 4 fsk
ubeul04f
Date: 16.JUN.2000 8:48:00

EQUIPMENT: **MR301B**FCC ID: **BCR-RPT-MR301B**PROJECT NO.: **0L0145RUS1**

Title: lower band edge
Comment A: lower band edge uplink 4 fsk
lbeulof
Date: 16.JUN.2000 8:51:45

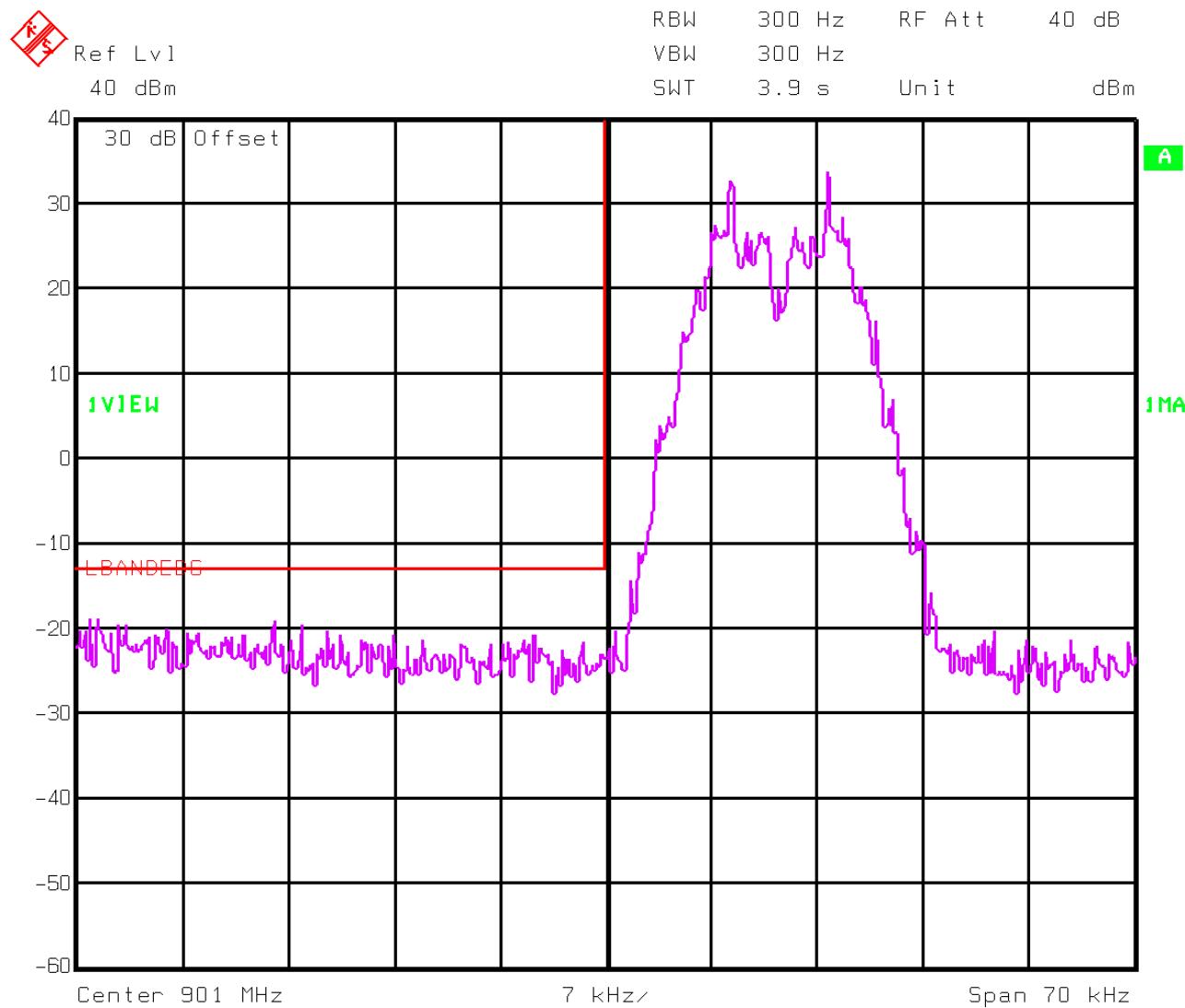
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Title: lower band edge

Comment A: lower band edge downlink 4 fsk

lbedlo4f

Date: 16.JUN.2000 9:02:55

EQUIPMENT: **MR301B**FCC ID: **BCR-RPT-MR301B**PROJECT NO.: **0L0145RUS1**

Title: lower band edge
Comment A: lower band edge uplink 2 fsk
lbeulol2f
Date: 16.JUN.2000 8:53:26

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FCC PART 24, SUBPART E

NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies.

Test Data: See attached plot(s).

Measurement Uncertainty: +/- 1.06 dB

Temperature: 21 °C

Relative Humidity: 46 %

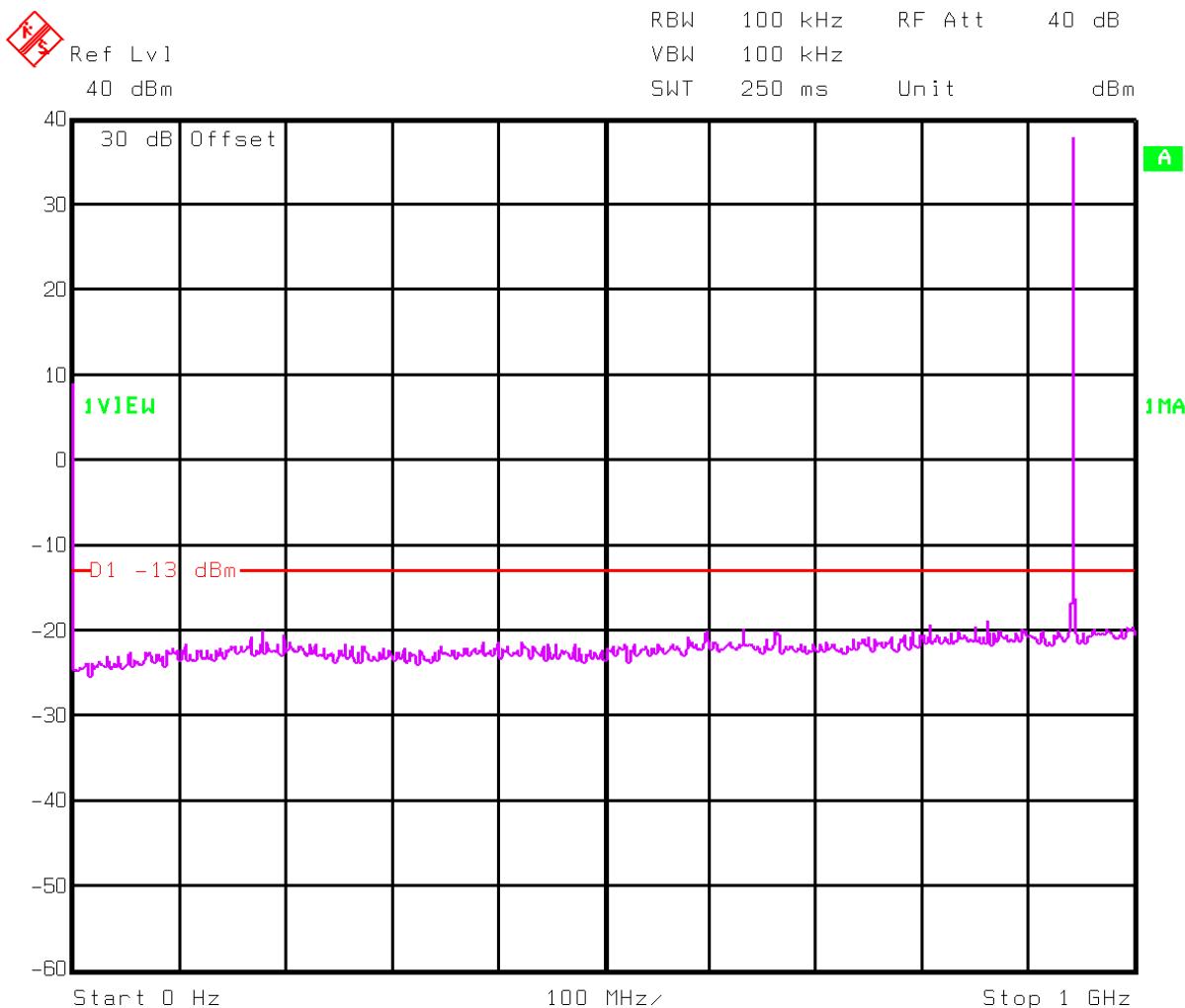
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NARROWBAND PCS REPEATERS

EQUIPMENT: MR301B

FCC ID: BCR-RPT-MR301B

PROJECT NO.: 0L0145RUS1



Title: spurious emssions
Comment A: spurious emssions 4fsk downlink
aspur241
Date: 16.JUN.2000 9:10:46

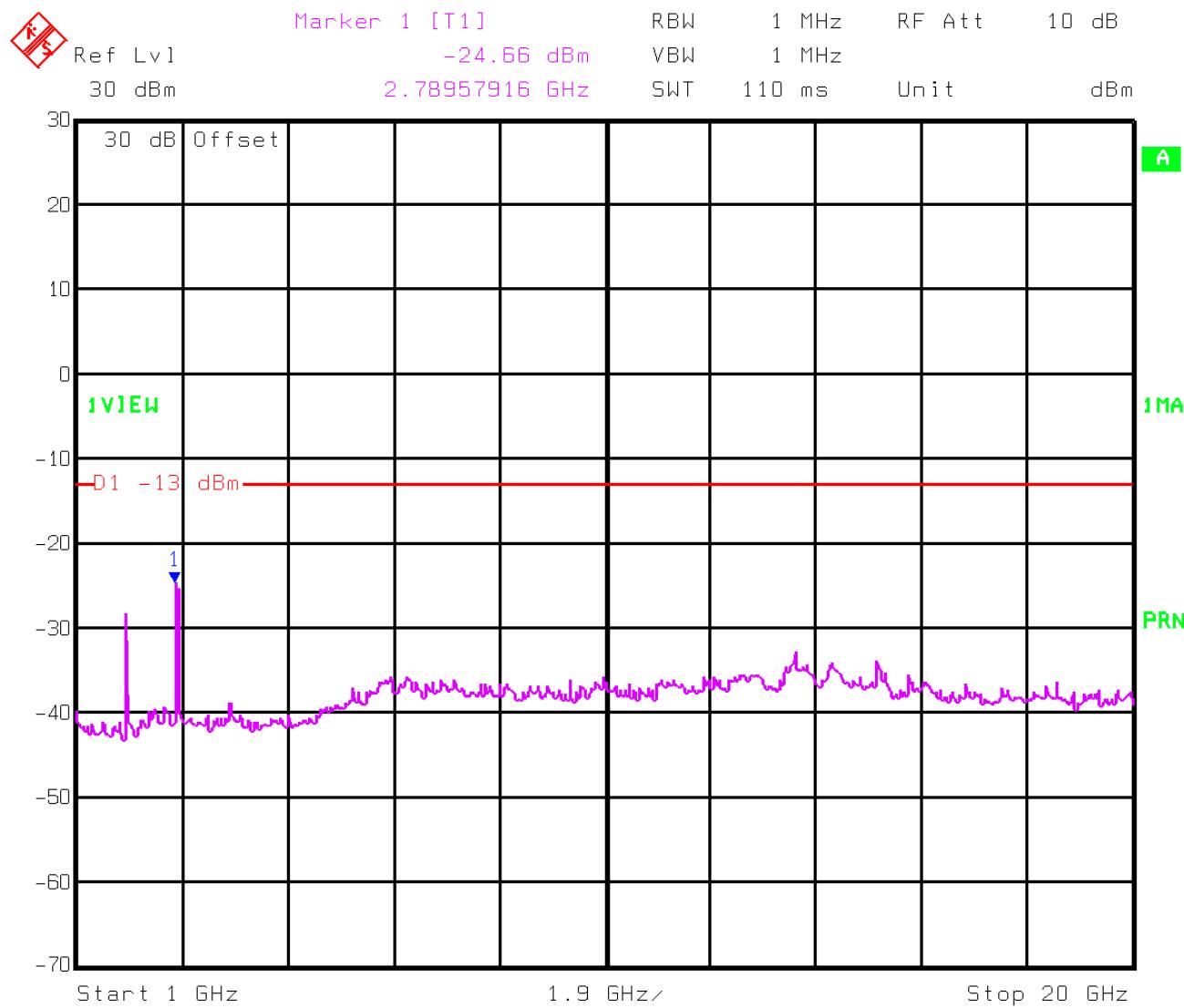
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FCC PART 24, SUBPART E
NARROWBAND PCS REPEATERS

EQUIPMENT: MR301B

FCC ID: BCR-RPT-MR301B

PROJECT NO.: **0L0145RUS1**



Title: spurious emssions
Comment A: spurious emssions 4fsk downlink
aspur242
Date: 16.JUN.2000 9:12:31

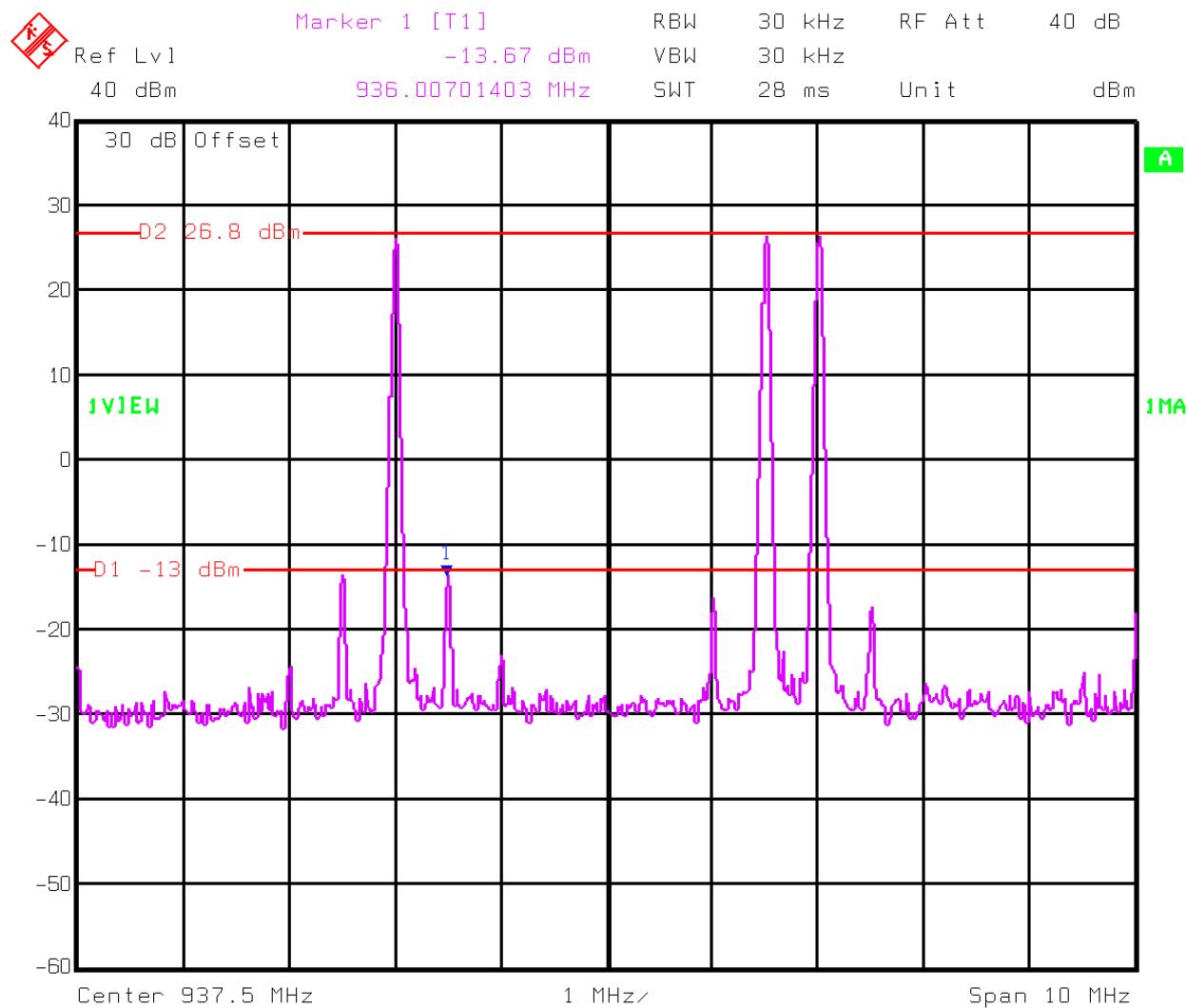
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FCC PART 24, SUBPART E
NARROWBAND PCS REPEATERS

EQUIPMENT: MR301B

FCC ID: BCR-RPT-MR301B

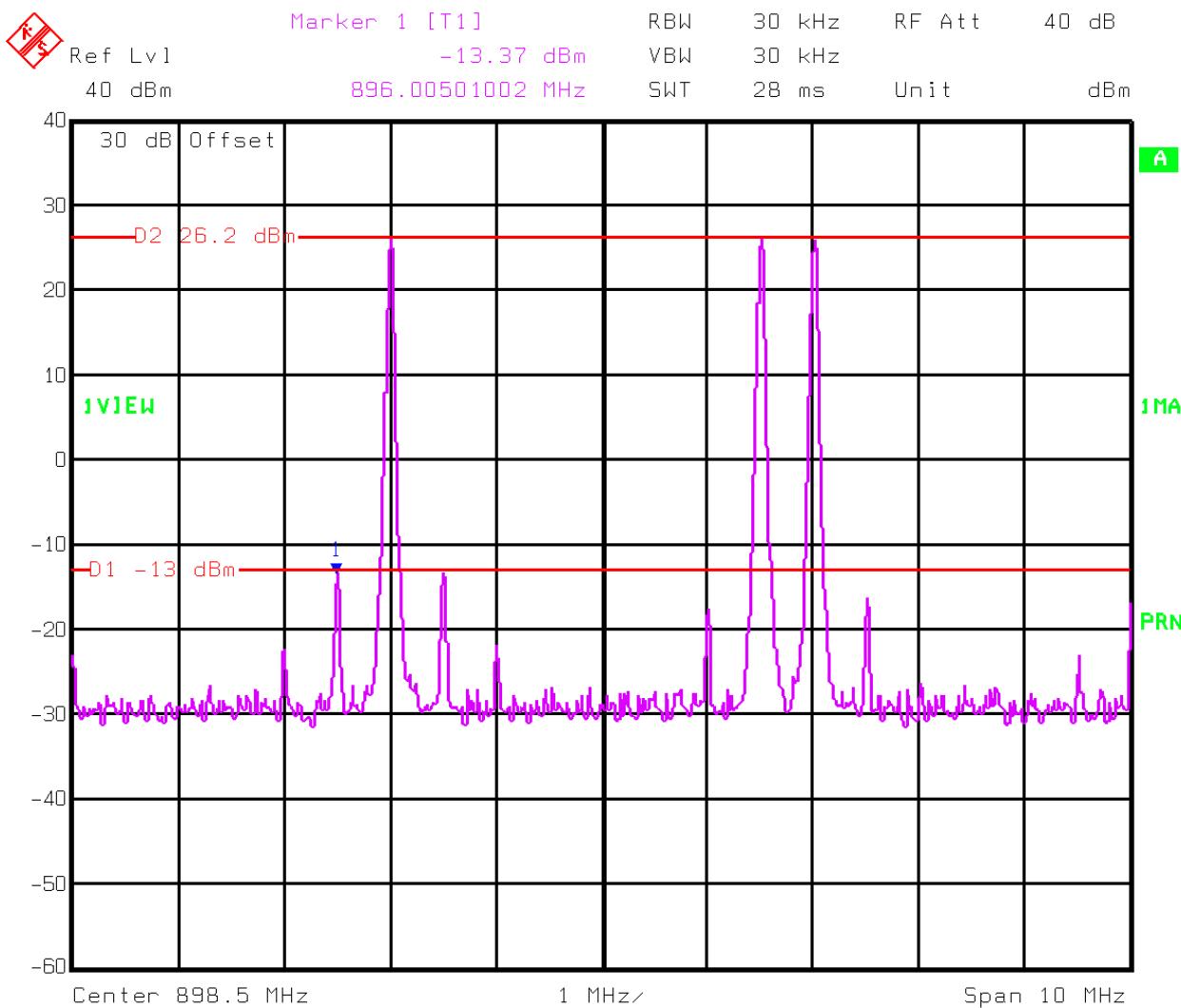
PROJECT NO.: **0L0145RUS1**



Title: intermodulation products downlink

Comment A: intermodulation products downlink
intmod1

Date: 16.JUN.2000 14:48:24

EQUIPMENT: **MR301B**FCC ID: **BCR-RPT-MR301B**PROJECT NO.: **0L0145RUS1**

Title: intermodulation products uplink

Comment A: intermodulation products uplink
intmod2

Date: 16.JUN.2000 14:54:54

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FCC PART 24, SUBPART E
NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1051
TESTED BY: Kevin Rose	DATE: 6/15/01

Test Results: Complies. There were no emissions detected within 20 dB of the specification limit.

Test Data: See attached data.

Measurement Uncertainty: +/- 3.6 dB

Temperature: 21 °C

Relative Humidity: 46 %

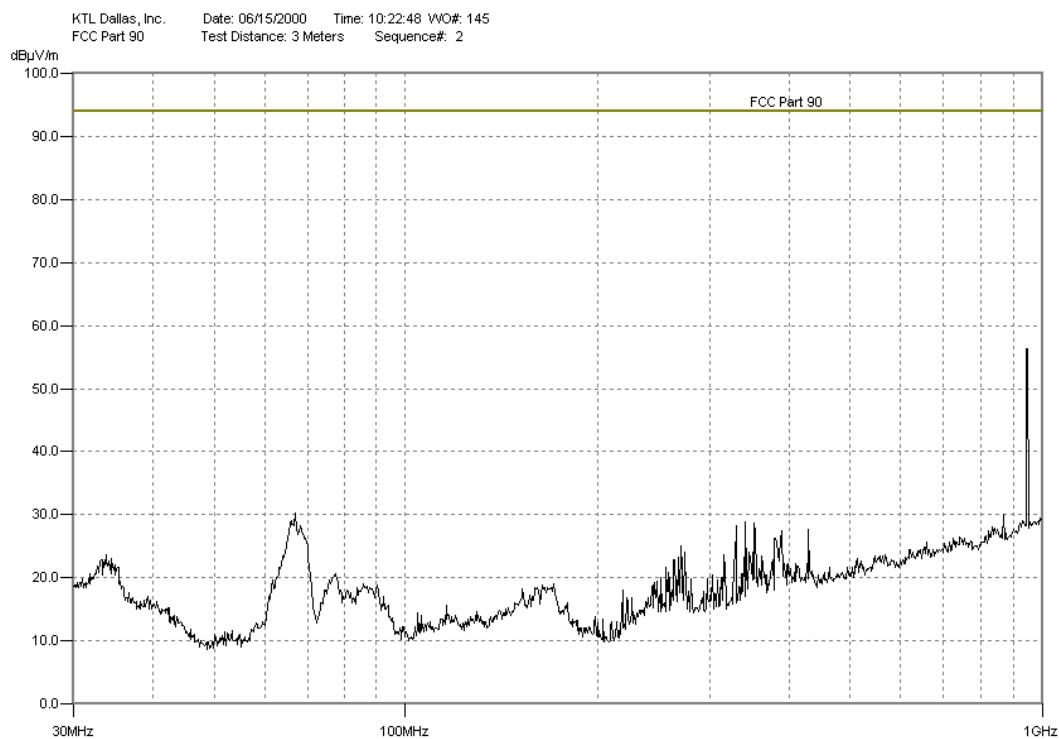
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NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**



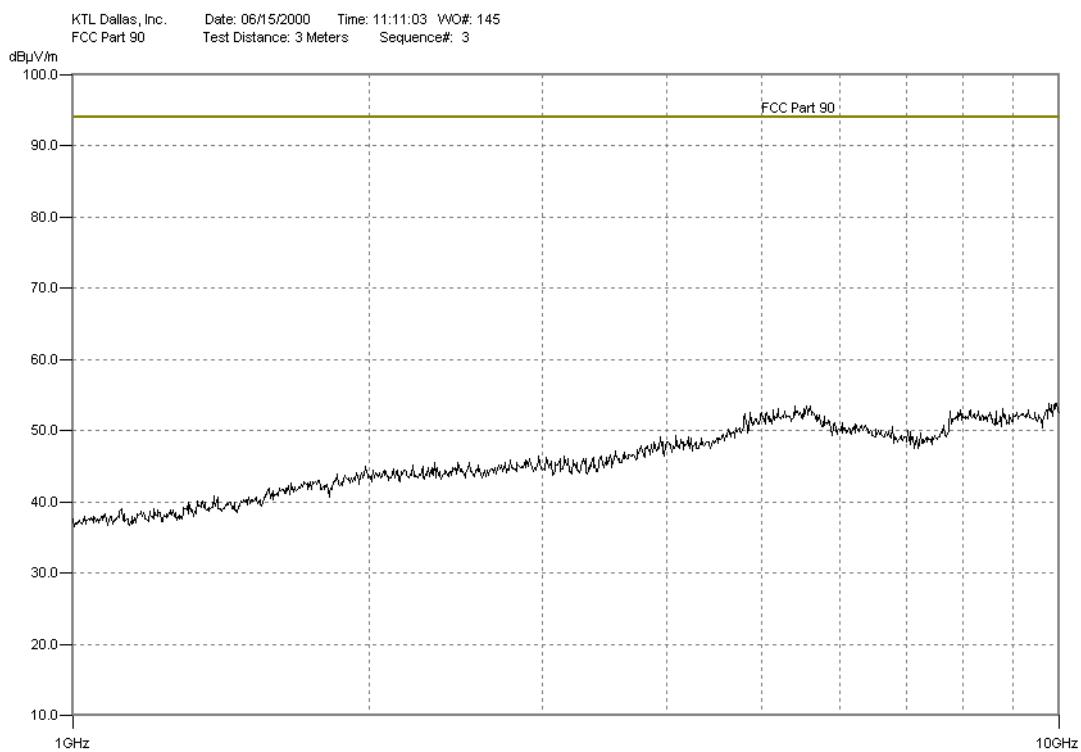
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NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**



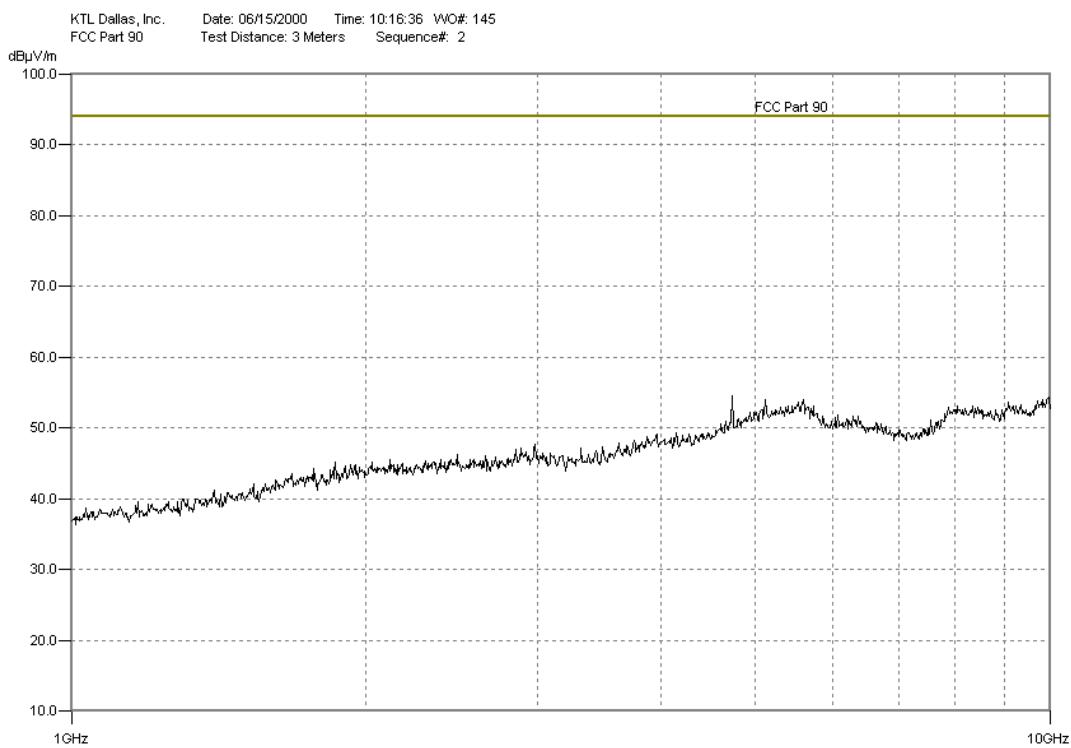
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NARROWBAND PCS REPEATERS

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FCC ID: **BCR-RPT-MR301B**

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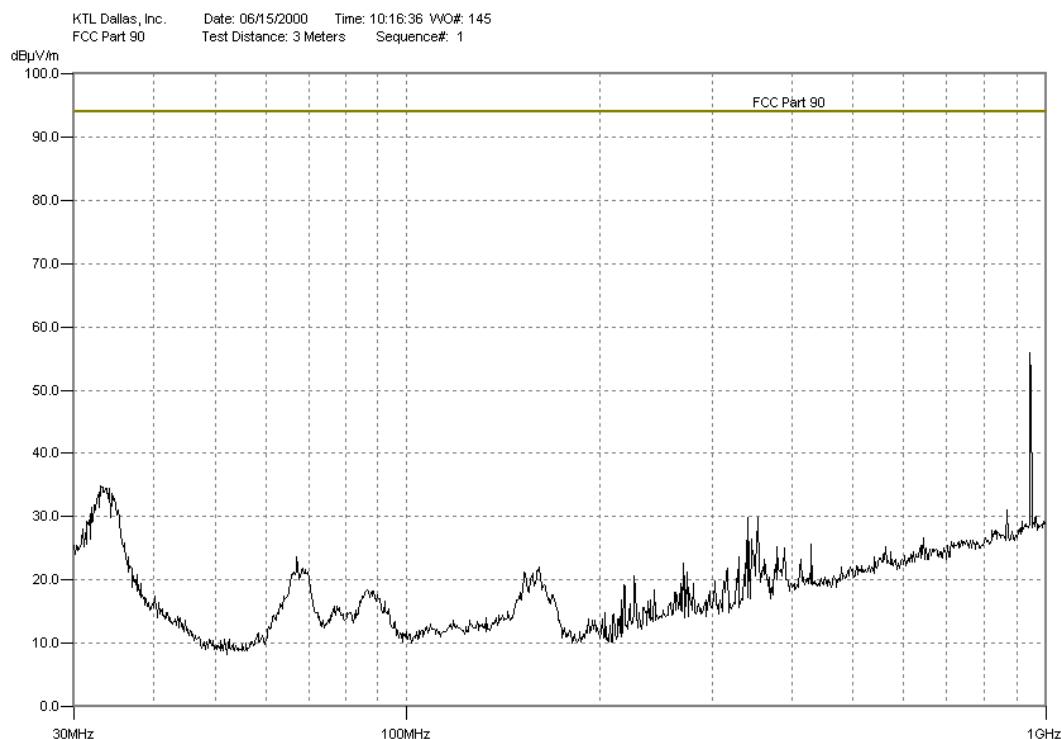
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NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

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NARROWBAND PCS REPEATERS

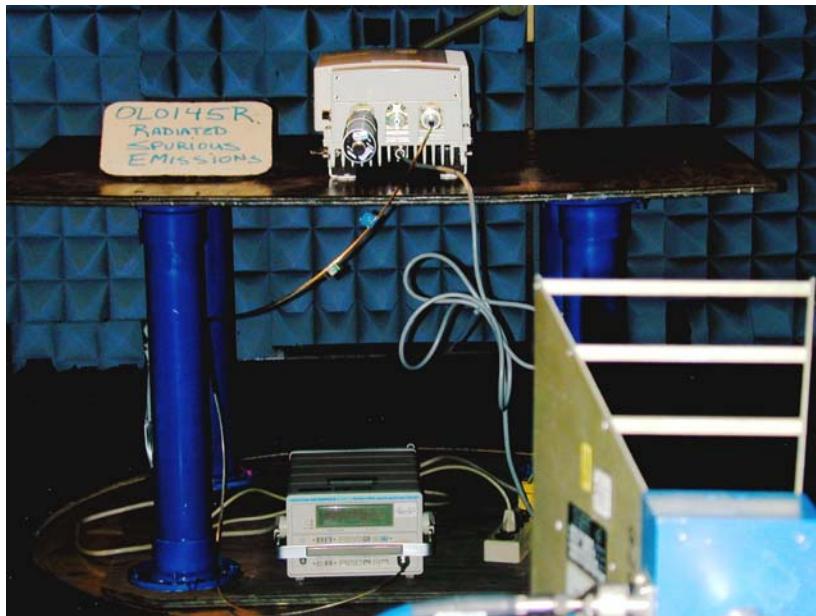
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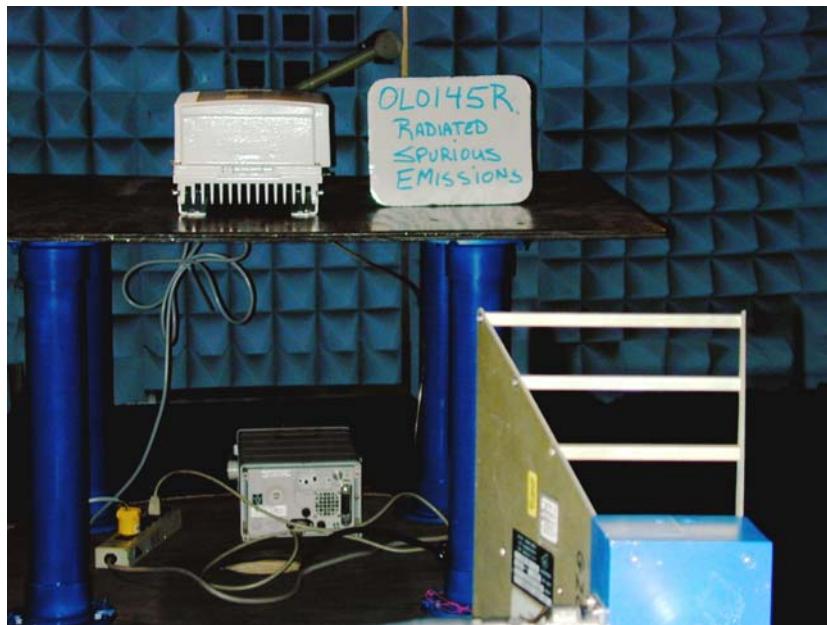
PROJECT NO.: **0L0145RUS1**

Photographs of Test Setup

REAR VIEW



FRONT VIEW



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY:	DATE:

Test Results: Complies.**Measurement Data:** See attached page.
Standard Test Frequency: MHz
Standard Test Voltage:**Equipment Used:****Measurement Uncertainty:** +/- 1.6 dB**Lab Temperature:** °C**Relative Humidity:** %**Not Applicable**

Section 8. Test Equipment List**TEST EQUIPMENT LIST**

REF. NO.	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
6	Spectrum analyzer	Hewlett Packard	8563E	3246A00540		12/10/00	C
8	Power meter	Hewlett Packard	438A	3048U03049		30/10/99	C
9	Power sensor	Hewlett Packard	8481A	1926A22749		3/12/99	C
10	Modulation domain analyzer	Hewlett Packard	53310				C
12	RF signal generator	Rohde & Schwarz	SMGU	DE 12112		31/10/99	C
17	Attenuator (10 dB)	Narda	76610				C
18	Attenuator (10 dB)	Narda	76610				C
19	Spectrum analyzer	Rohde & Schwarz	FSEK 30				K
21	30 dB attenuator						C

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FCC PART 24, SUBPART E
NARROWBAND PCS REPEATERS

EQUIPMENT: **MR301B**

FCC ID: **BCR-RPT-MR301B**

PROJECT NO.: **0L0145RUS1**

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output**PARA. NO.: 2.1046**

Minimum Standard: Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

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

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.1047**

Minimum Standard: Para. No. 24.238(b). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

Method Of Measurement:**CDMA**

Spectrum analyzer settings:

RBW: 30 kHz

VBW: \geq RBW

Span: 5 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz

VBW: \geq RBW

Span: 2 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz

VBW: \geq RBW

Span: 1 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 2.1051

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1MHz from Band Edge)
VBW: \geq RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: \geq RBW
Sweep: Auto
Video Avg: Disabled

NADC

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: \geq RBW
Sweep: Auto
Video Avg: Disabled

To demonstrate compliance at band edges the frequency of the input signal is set to the lowest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.1053
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Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Calculation Of Field Strength Limit

An example of attenuation requirement of $43 + 10 \log P$ is equivalent to -13 dBm (5×10^{-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)

$R = 3m$ (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R}$$

$$E = \frac{\sqrt{30 \times 1.64 \times 5 \times 10^{-5}}}{3} = 0.016533 \text{ V / m} = 84.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

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

$R = 3m$ (Measurement Distance)

$$E = 84.4 - 20 \log \sqrt{1.64} = 82.3 \text{ dB}\mu\text{V / m} @ 3m$$

NAME OF TEST: Frequency Stability**PARA. NO.: 2.1055**

Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref. in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

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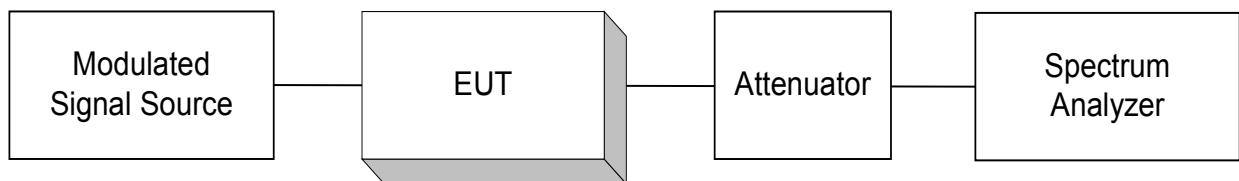
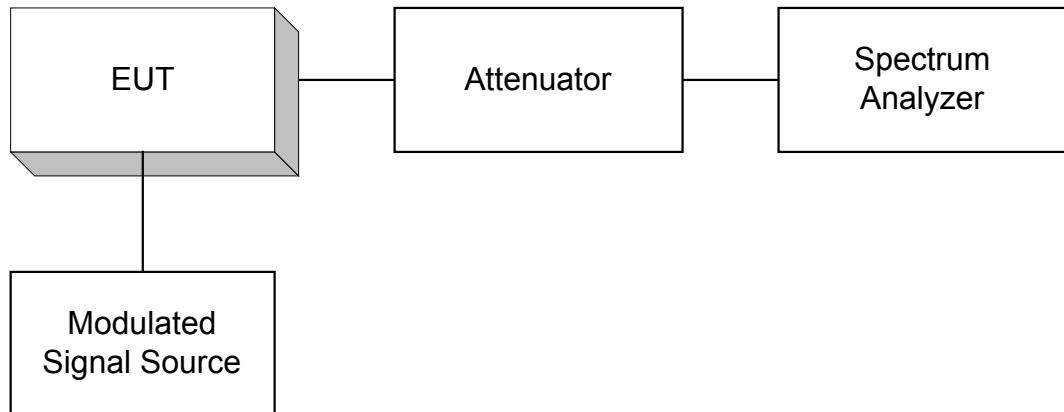
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NARROWBAND PCS REPEATERS

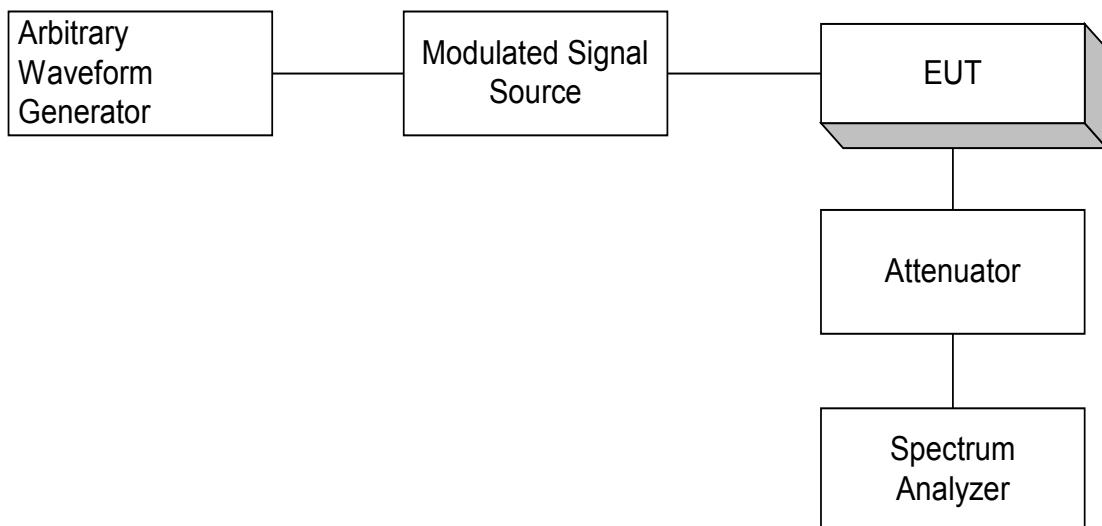
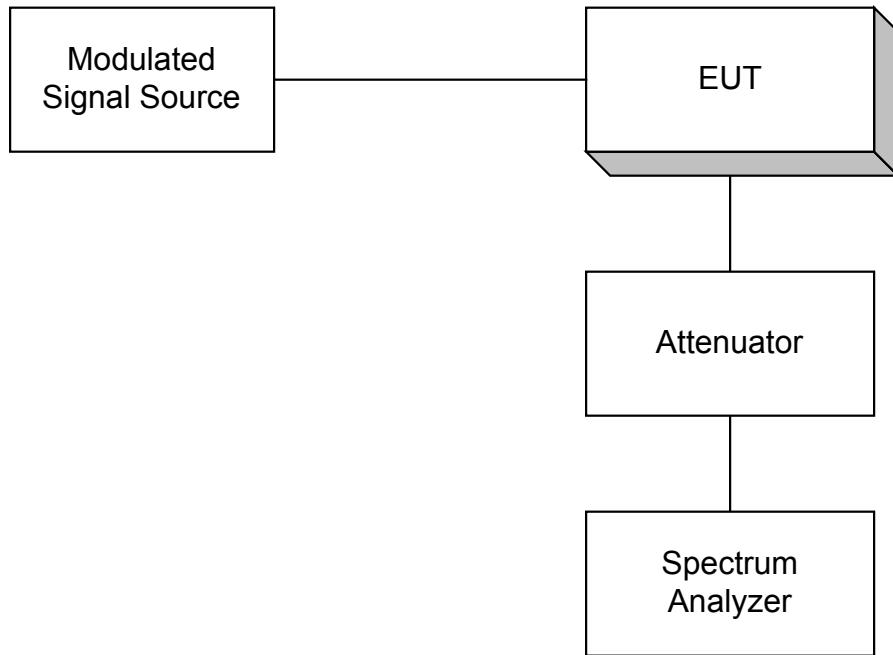
EQUIPMENT: **MR301B**

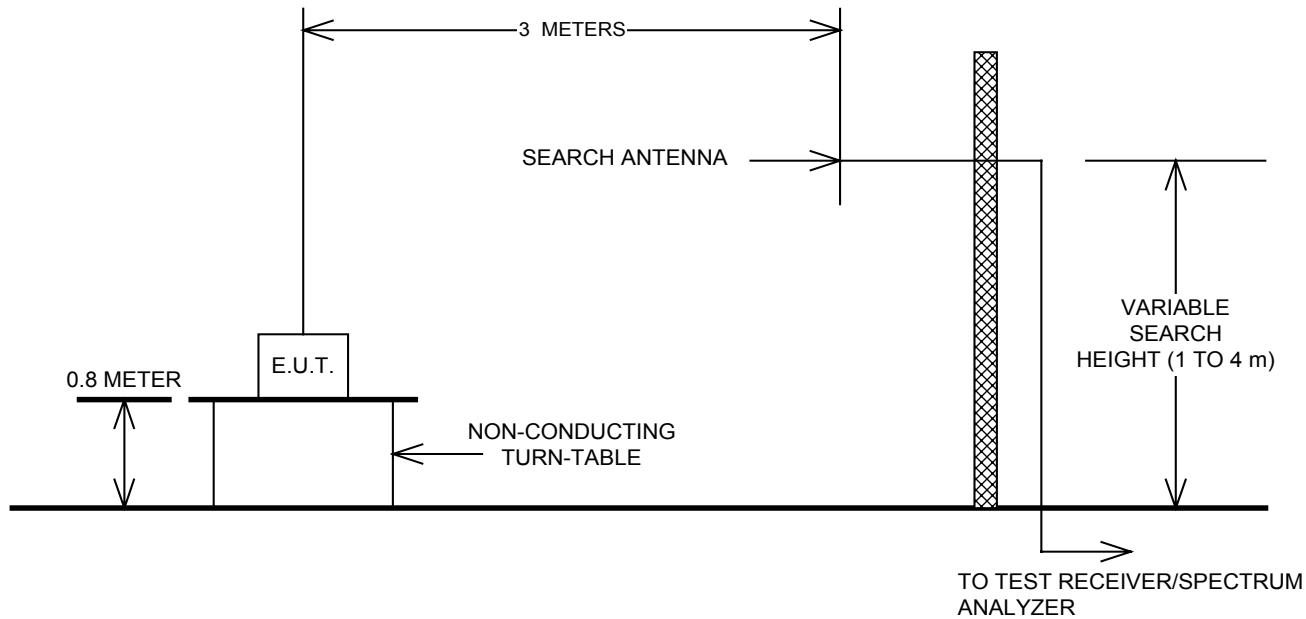
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PROJECT NO.: **0L0145RUS1**

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**