

KTL Test Report: 0L0145RUS2

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

Equipment Under Test: MR301B
(E.U.T.)

FCC ID: BCR-RPT-MR301B

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

Tested By: KTL Dallas Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Authorized By:



Tom Tidwell, Wireless Group Manager

Date: 1 July, 2000

Total Number of Pages: 39

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EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2

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 90, Subpart I.



New Submission



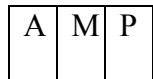
Production Unit



Class II Permissive Change



Pre-Production Unit



Equipment Code

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: 100351-0**

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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	N/A ₁
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A ₁
Modulation Limiting	TIA EIA-603.3.2.6	N/A ₁
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	N/A ₂
Transient Frequency Behavior	90.214	N/A ₃

Footnotes For N/A's:

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
- (2) This equipment does not contain frequency determining circuitry and operates in F1 - F1 mode only.
- (3) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.

Indoor Temperature: 21°C
 Humidity: 46%

Outdoor Temperature: 23°C
 Humidity: 61%

EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2

Section 2. General Equipment Specification**Transmitter**

Supply Voltage Input: 115 vac

Frequency Range: Downlink : 935 MHz – 940 MHz

Tunable Bands: Uplink 896 MHz – 901 MHz

Type(s) of Modulation:	F3E (Voice)	2FSK	4FSK	D7W (QAM)	Other
	☐	☒	☒	☐	☐

Emission designator 8K00F1D 16K00F1D

Output Impedance: 50 ohms

RF Power Output (rated): 1.5 W

Power Output Adjustment Capability: Not adjustable

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

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☒	☐	☐

KTL Dallas

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

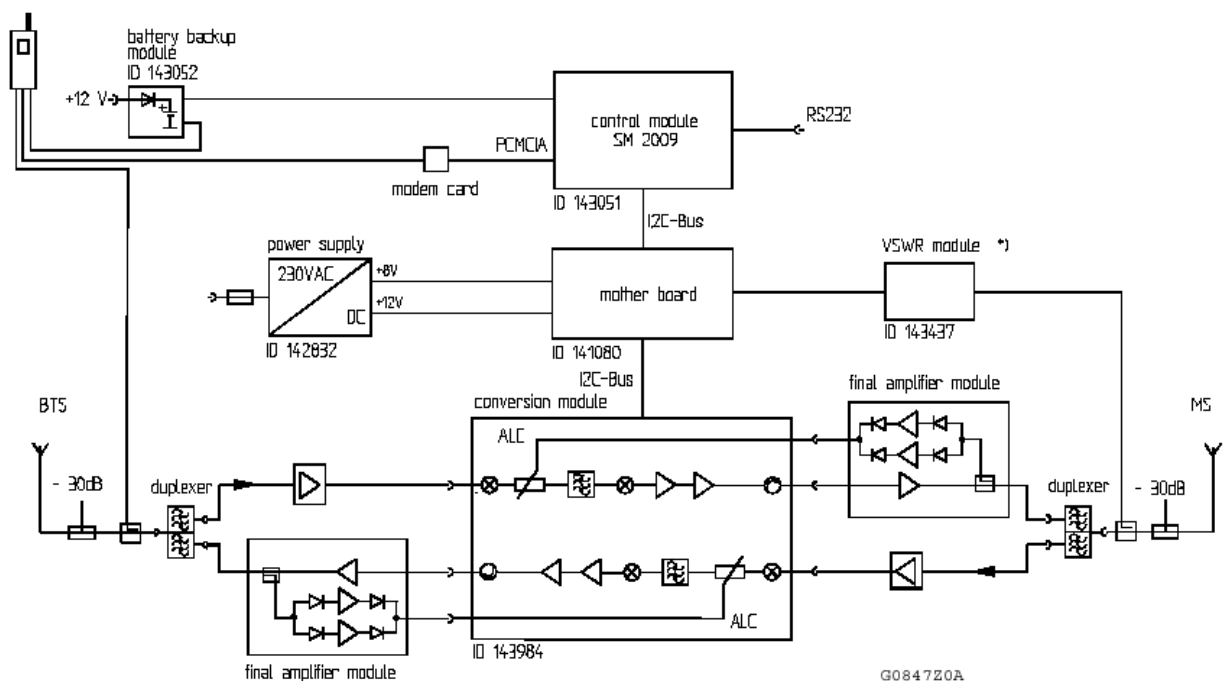
Modifications Made During Testing

No modification were made during the test.

Theory 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



EQUIPMENT: **MR301B**PROJECT NO.: **0L0145RUS2**

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
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

EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

Section 4. Occupied Bandwidth

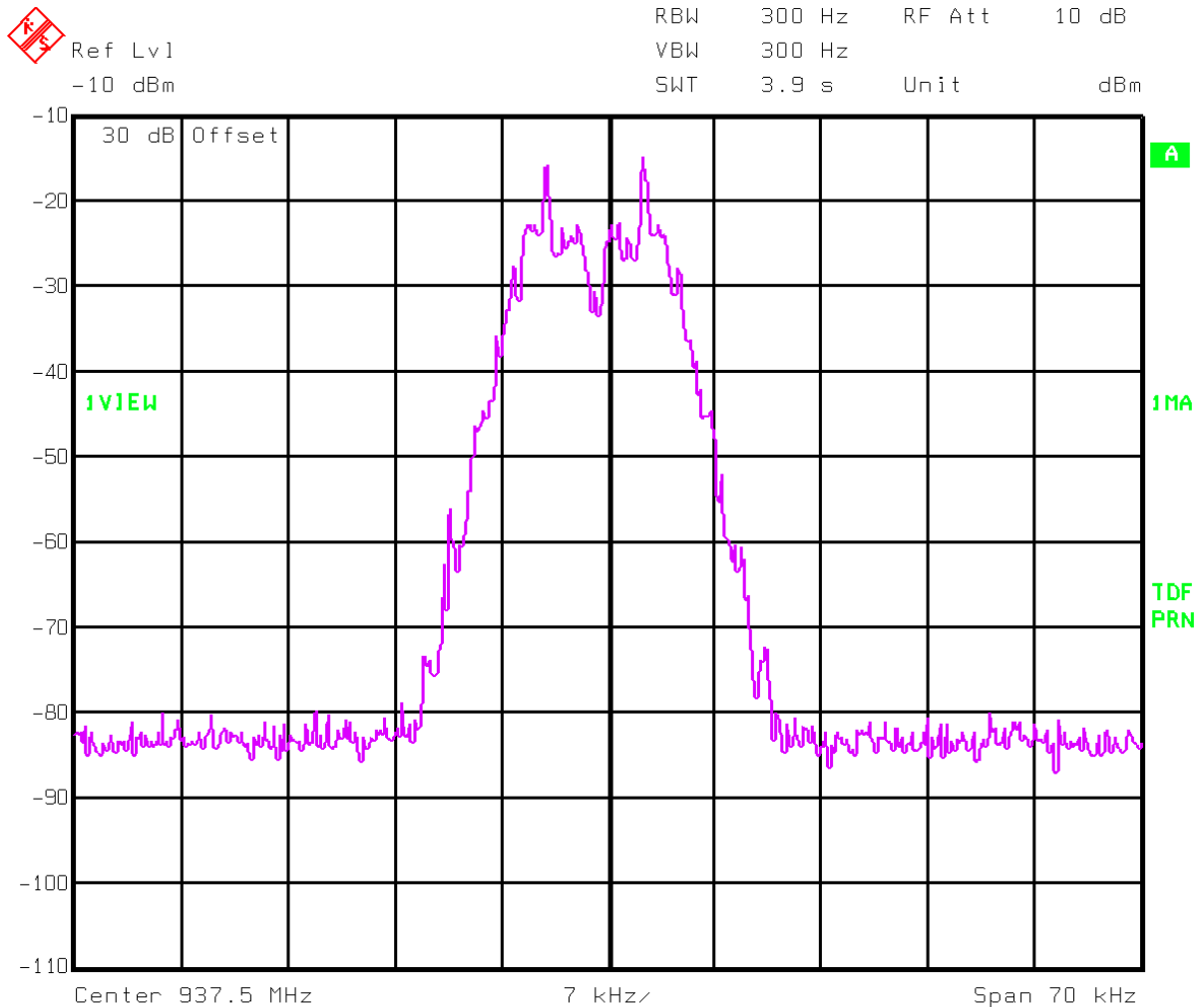
NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies

Test Data: See attached graph(s).

EQUIPMENT: MR301B

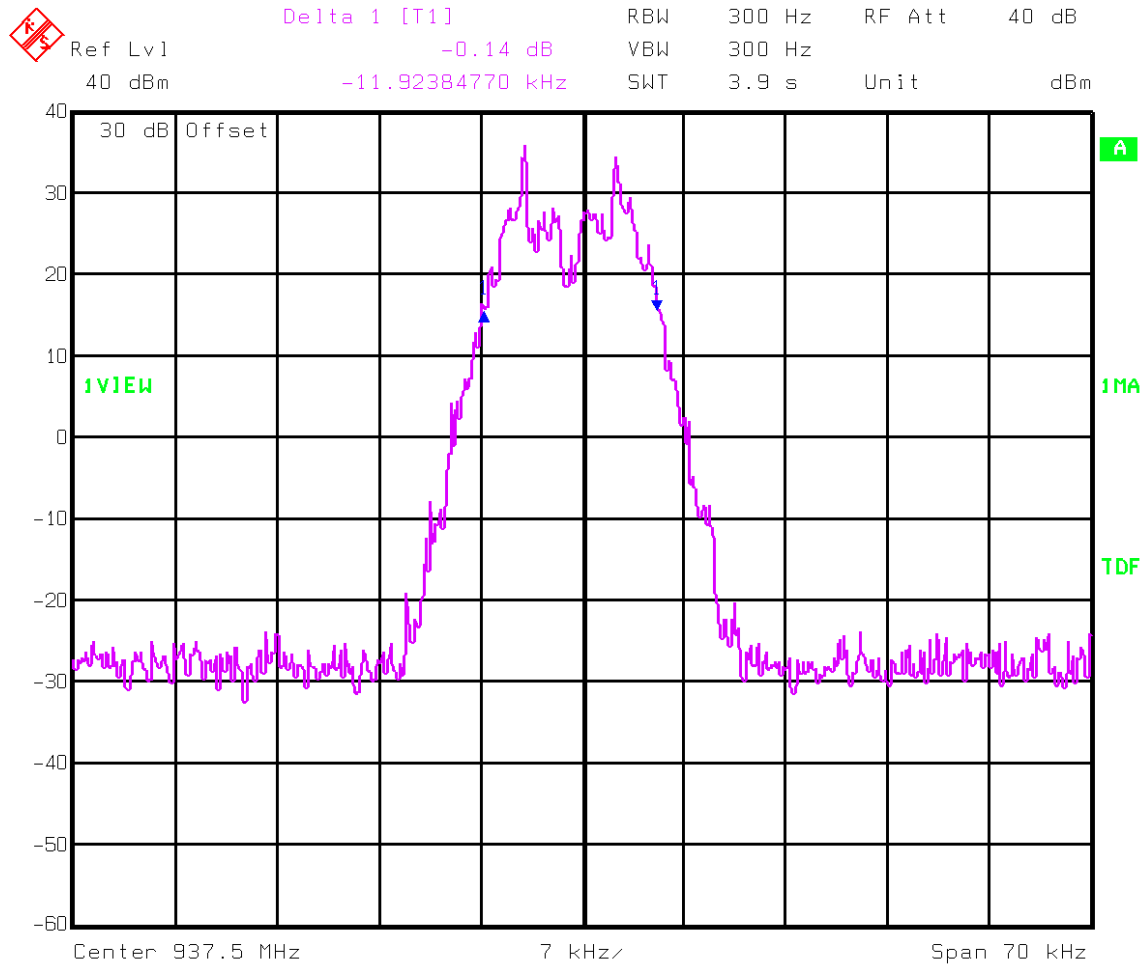
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 2 fsk input
Comment A: occupied bandwidth down link
ocb2fdli
Date: 15.JUN.2000 18:19:54

EQUIPMENT: MR301B

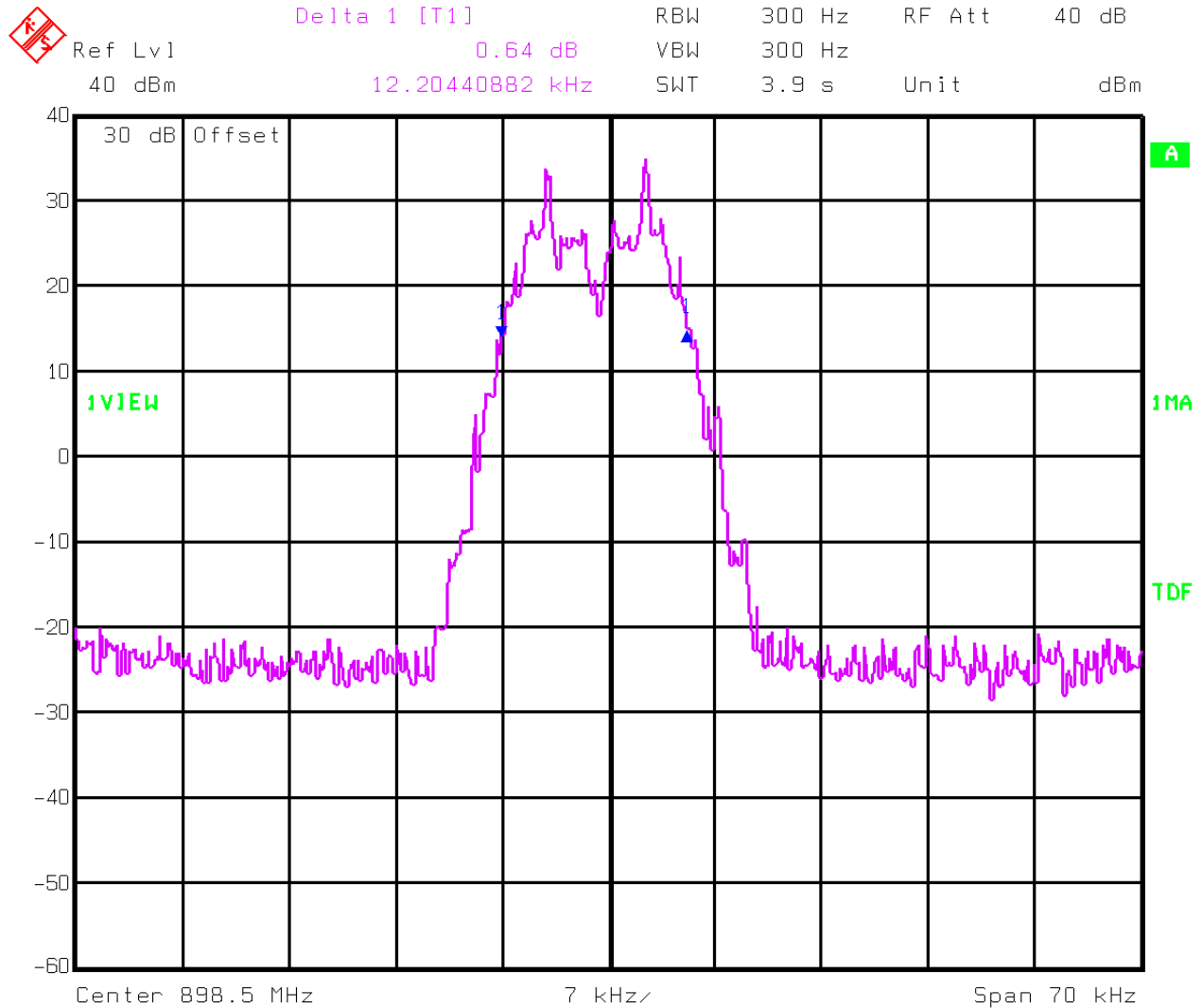
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 2 fsk output downlink
 Comment A: occupied bandwidth downlink output 2 fsk
 ocb2fd1o
 Date: 15.JUN.2000 18:38:24

EQUIPMENT: MR301B

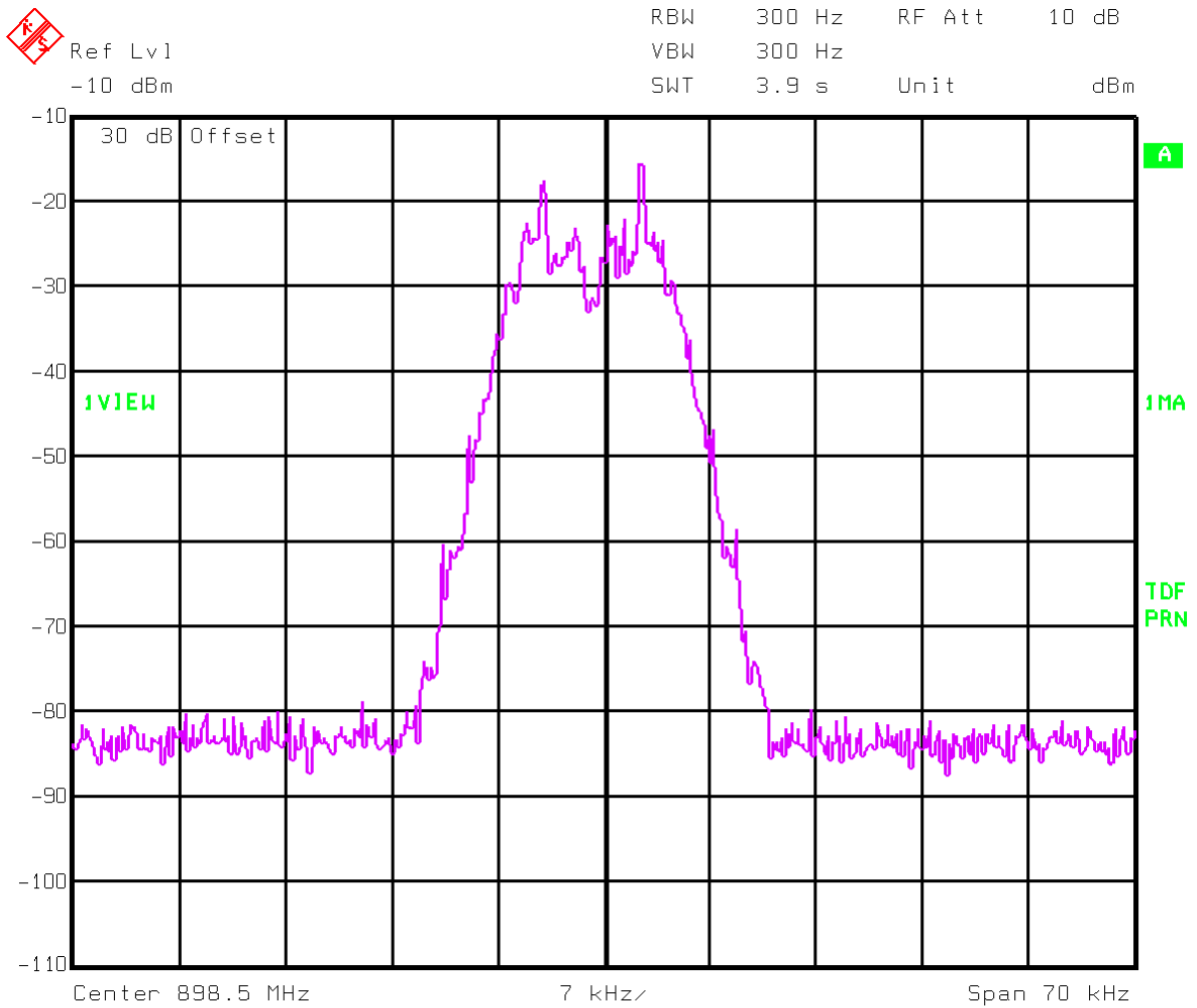
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 2 fsk output uplink
Comment A: occupied bandwidth uplink output 2 fsk
ocb2fulo
Date: 15.JUN.2000 18:46:06

EQUIPMENT: MR301B

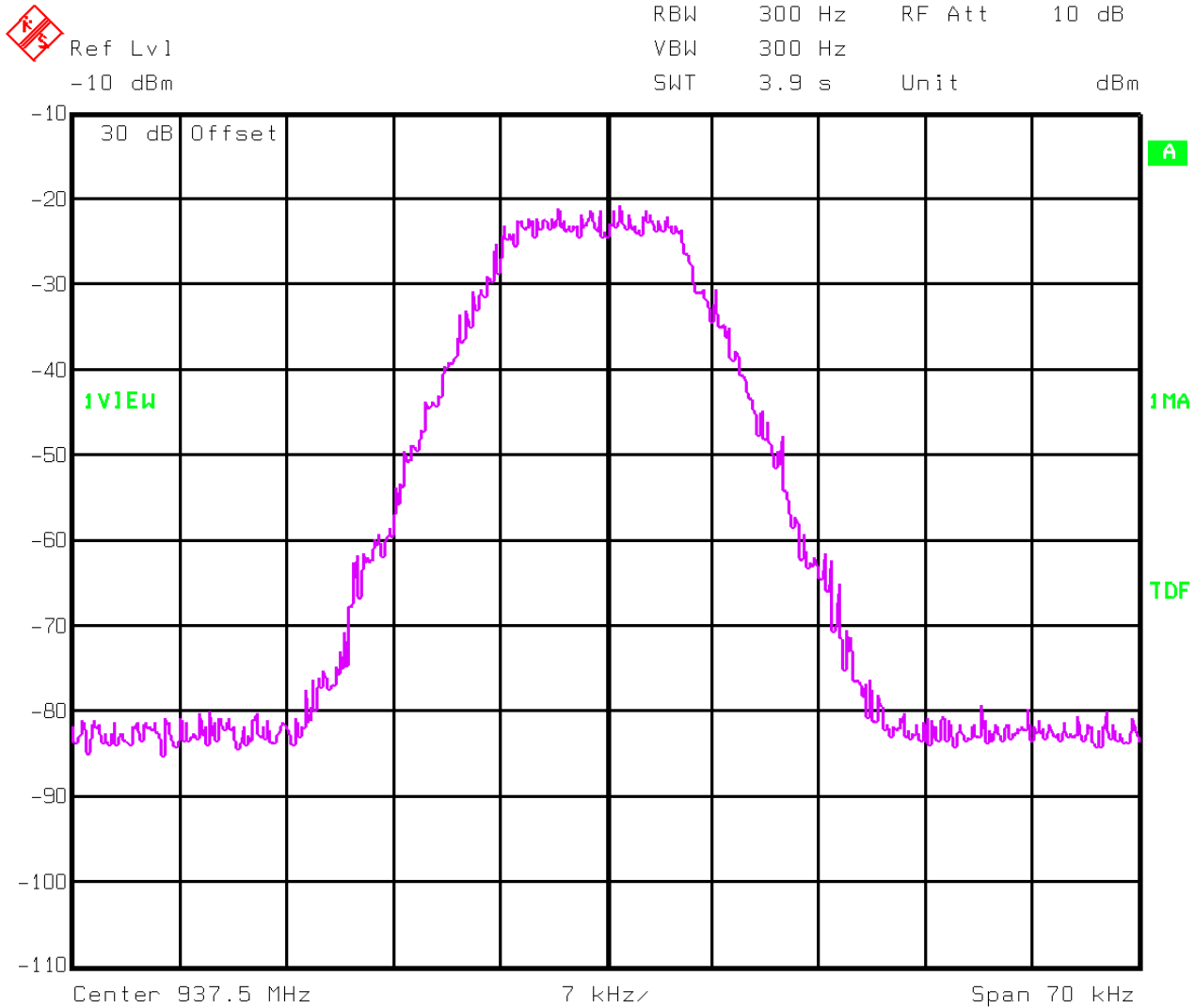
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 2 fsk input uplink
Comment A: occupied bandwidth uplink input 2 fsk
ocb2fuli
Date: 15.JUN.2000 18:55:22

EQUIPMENT: MR301B

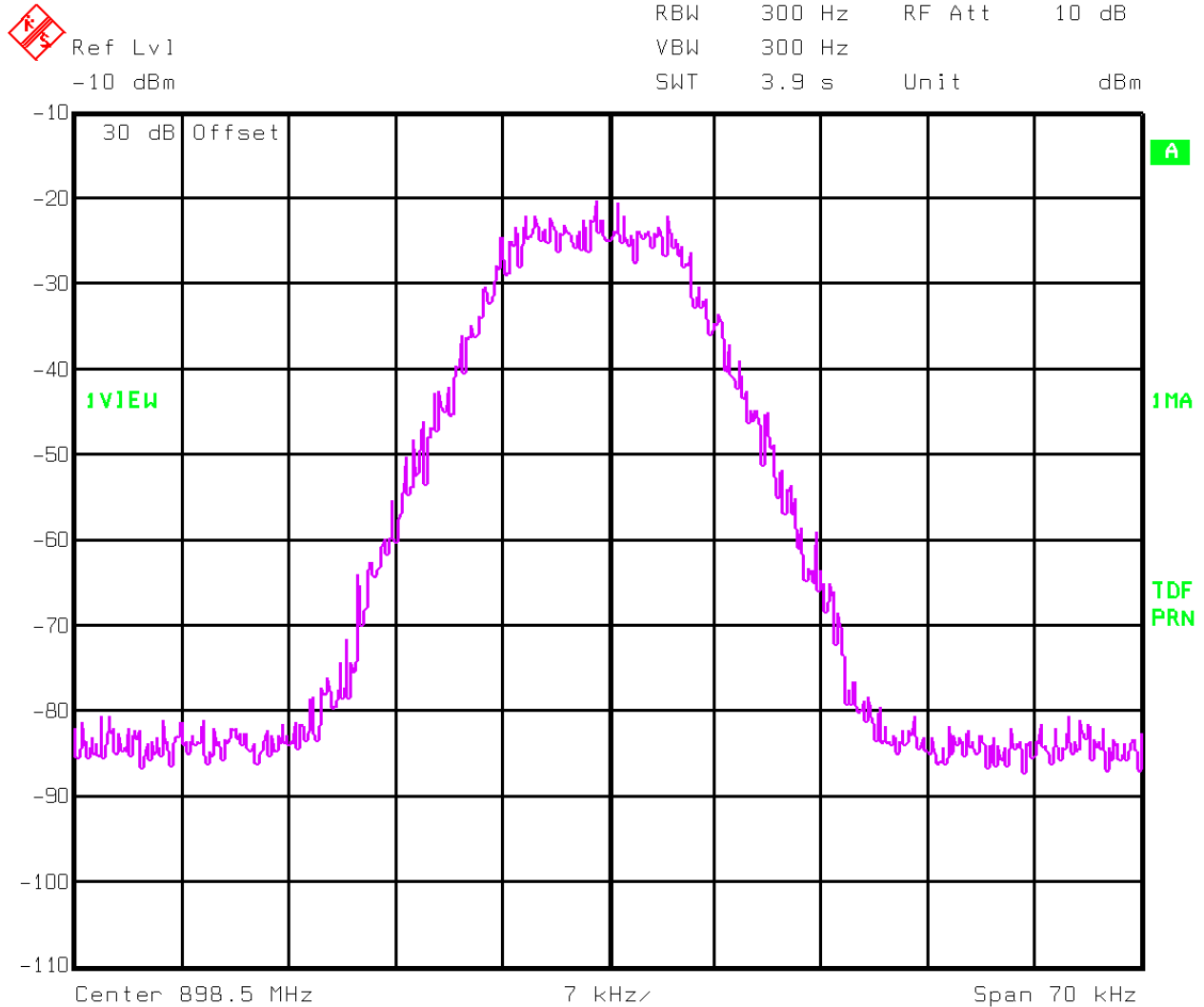
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 4 fsk input
Comment A: occupied bandwidth down link input 4fsk
ocb4fdli
Date: 15.JUN.2000 17:07:17

EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2



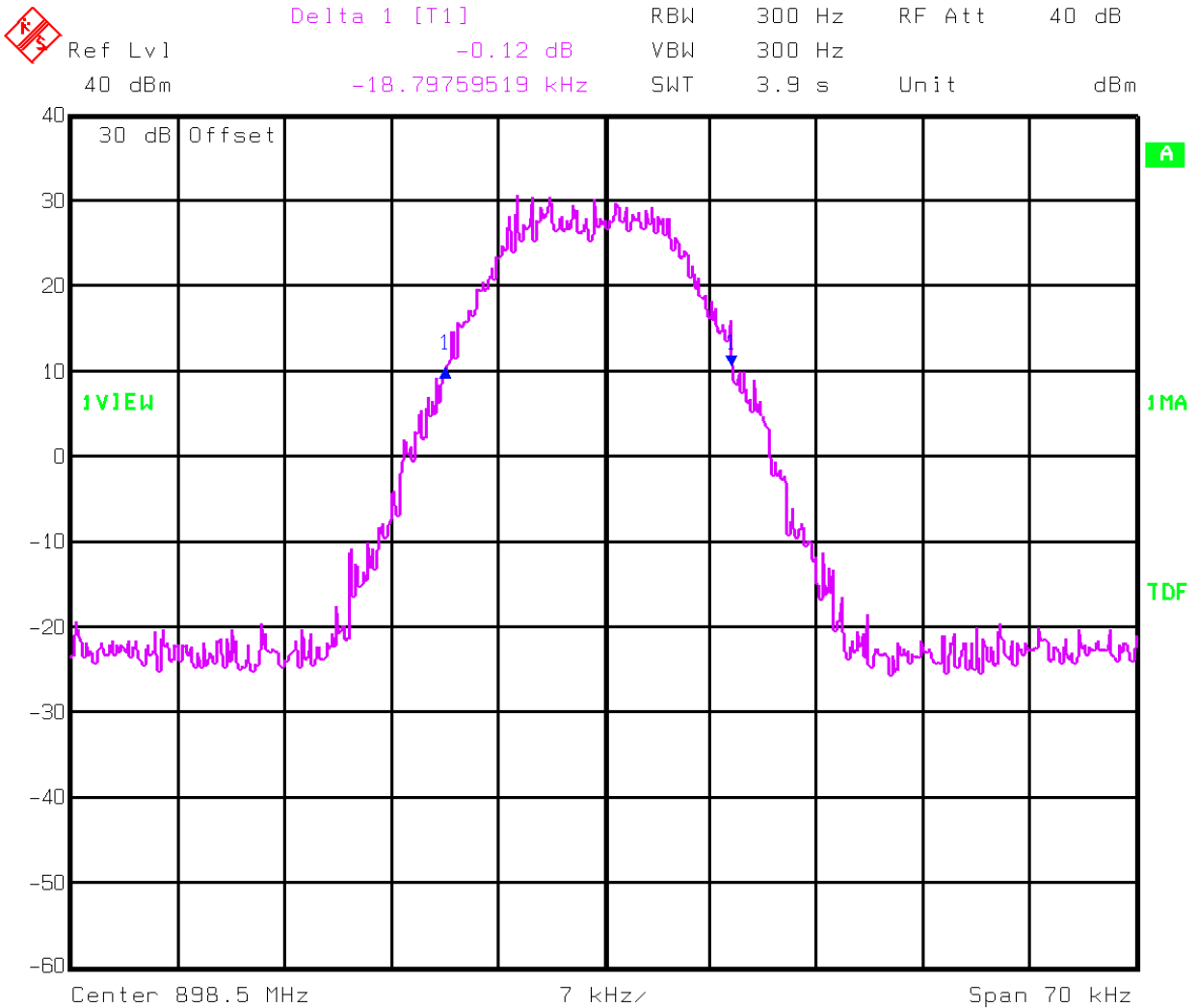
Title: occupied bandwidth 4 fsk input uplink

Comment A: occupied bandwidth uplink input 4 fsk
ocb4fuli

Date: 15.JUN.2000 18:53:36

EQUIPMENT: MR301B

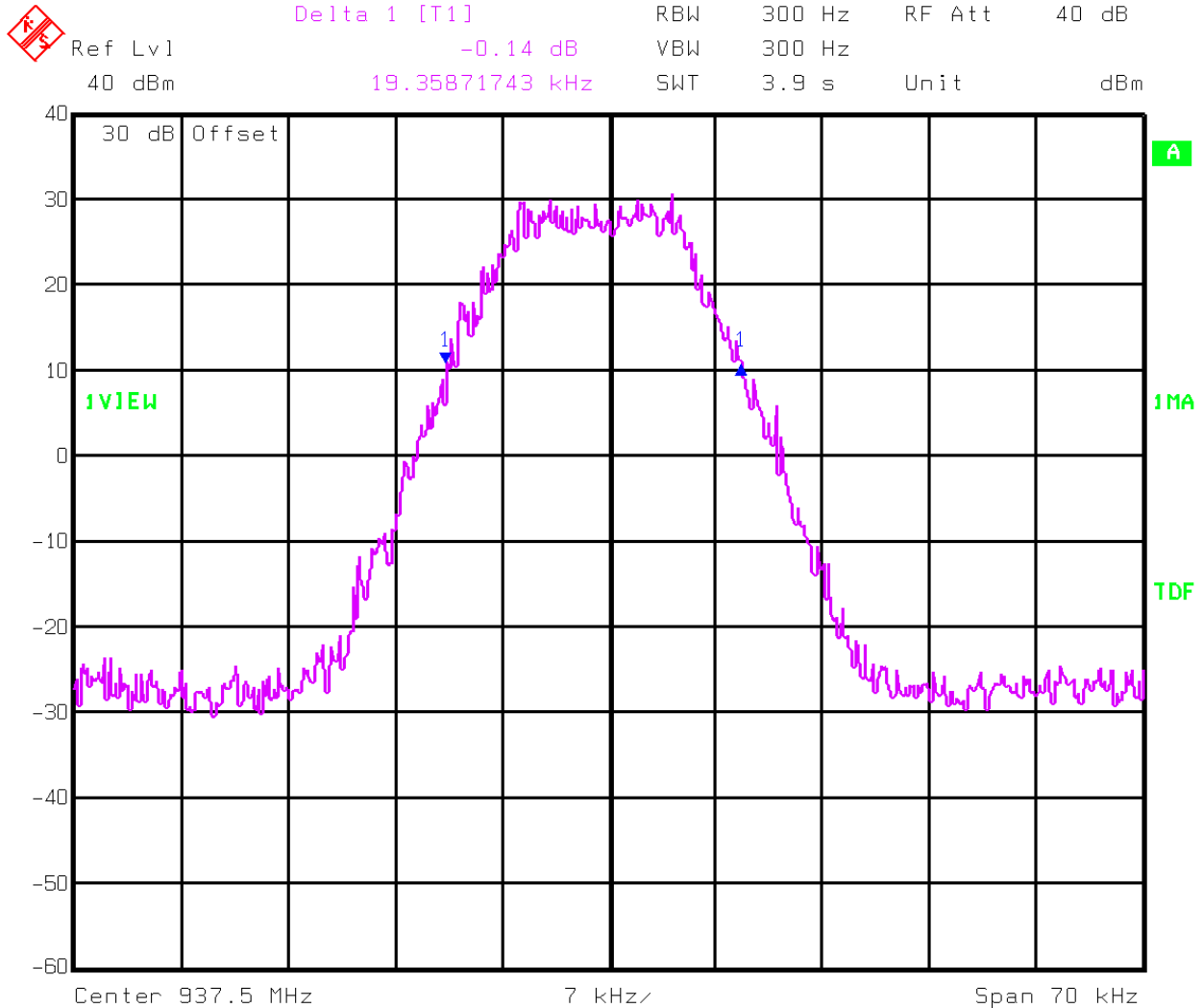
PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 4 fsk output uplink
 Comment A: occupied bandwidth uplink output 4 fsk
 ocb4fulo
 Date: 15.JUN.2000 18:50:15

EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2



Title: occupied bandwidth 4 fsk output
Comment A: occupied bandwidth down link output 4fsk
ocb4fdlo
Date: 15.JUN.2000 17:04:03

EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

Section 5. Spurious Emissions at Antenna Terminals

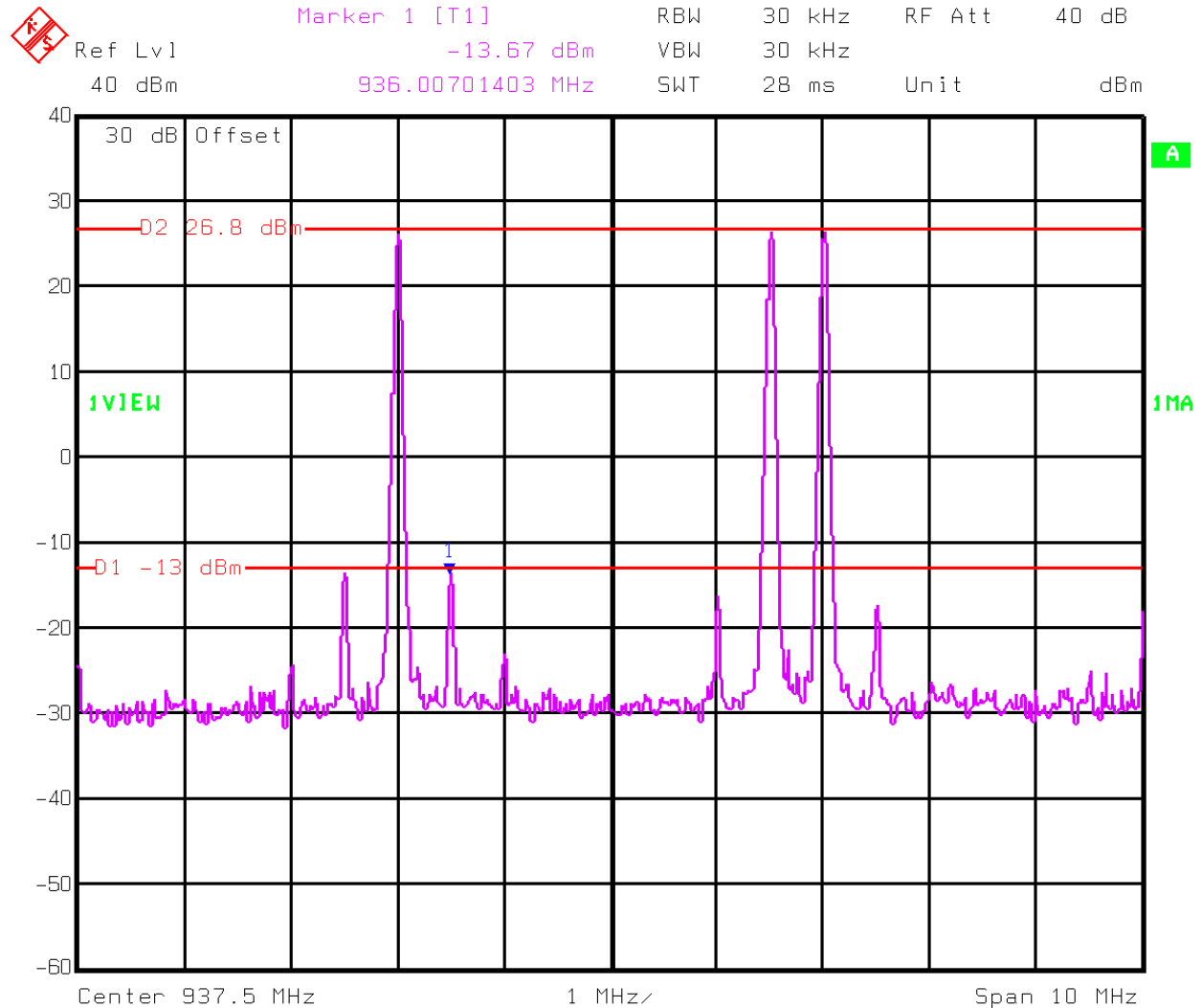
NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies

Test Data: See attached graph(s).

EQUIPMENT: MR301B

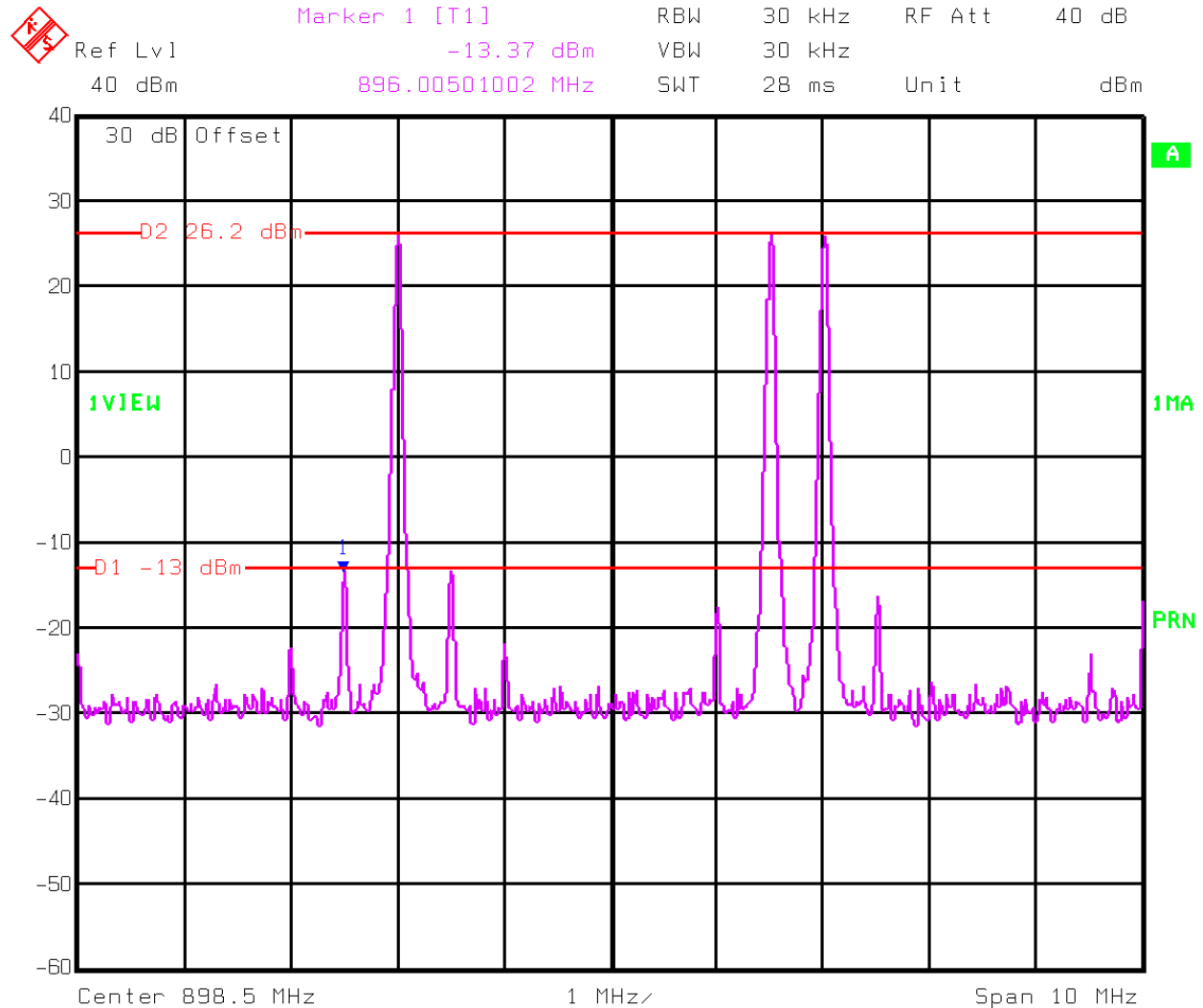
PROJECT NO.: 0L0145RUS2



Title: intermodulation products downlink
Comment A: intermodulation products downlink
intmod1
Date: 16.JUN.2000 14:48:24

EQUIPMENT: MR301B

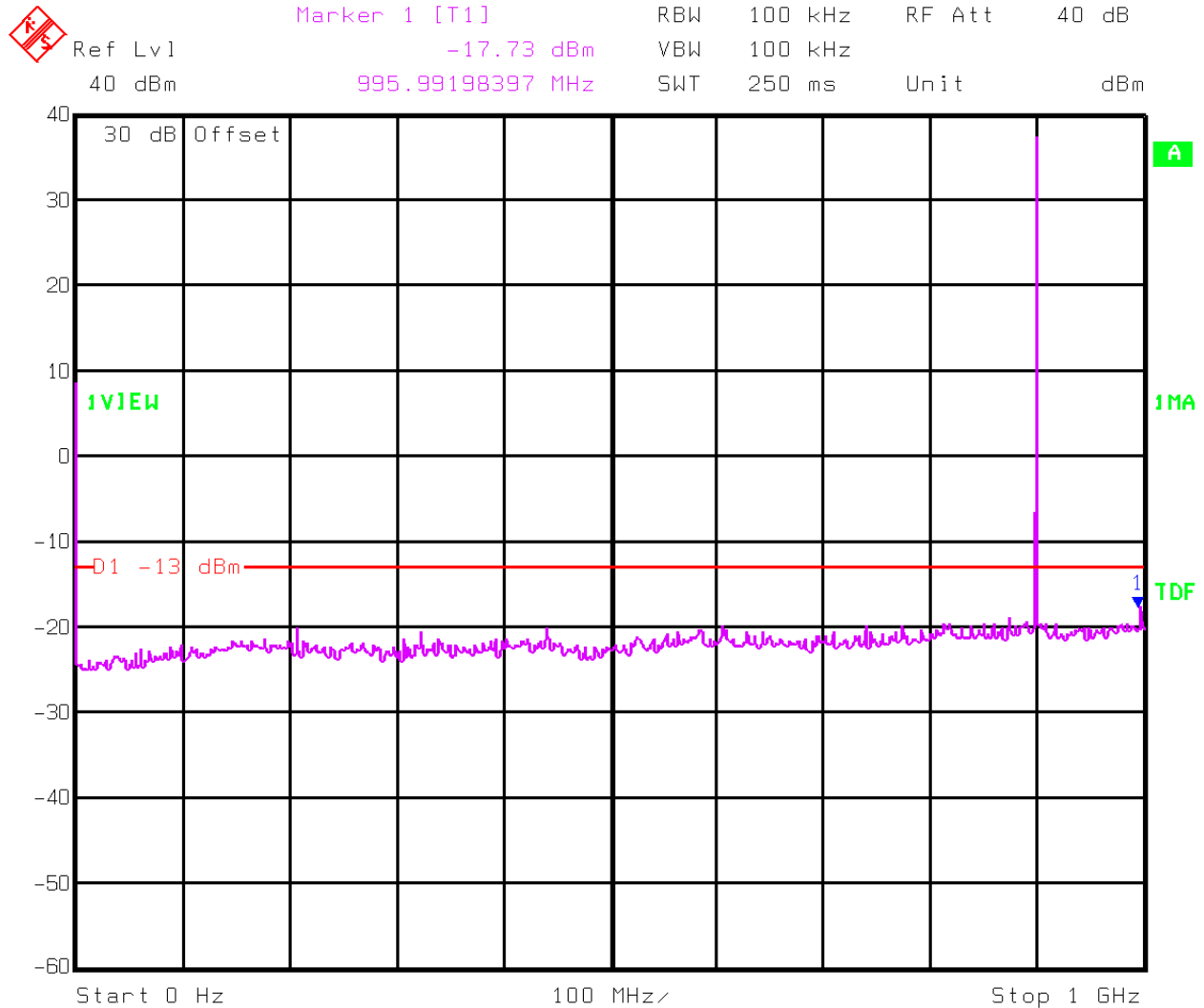
PROJECT NO.: 0L0145RUS2



Title: intermodulation products uplink
Comment A: intermodulation products uplink
intmod2
Date: 16.JUN.2000 14:54:54

EQUIPMENT: MR301B

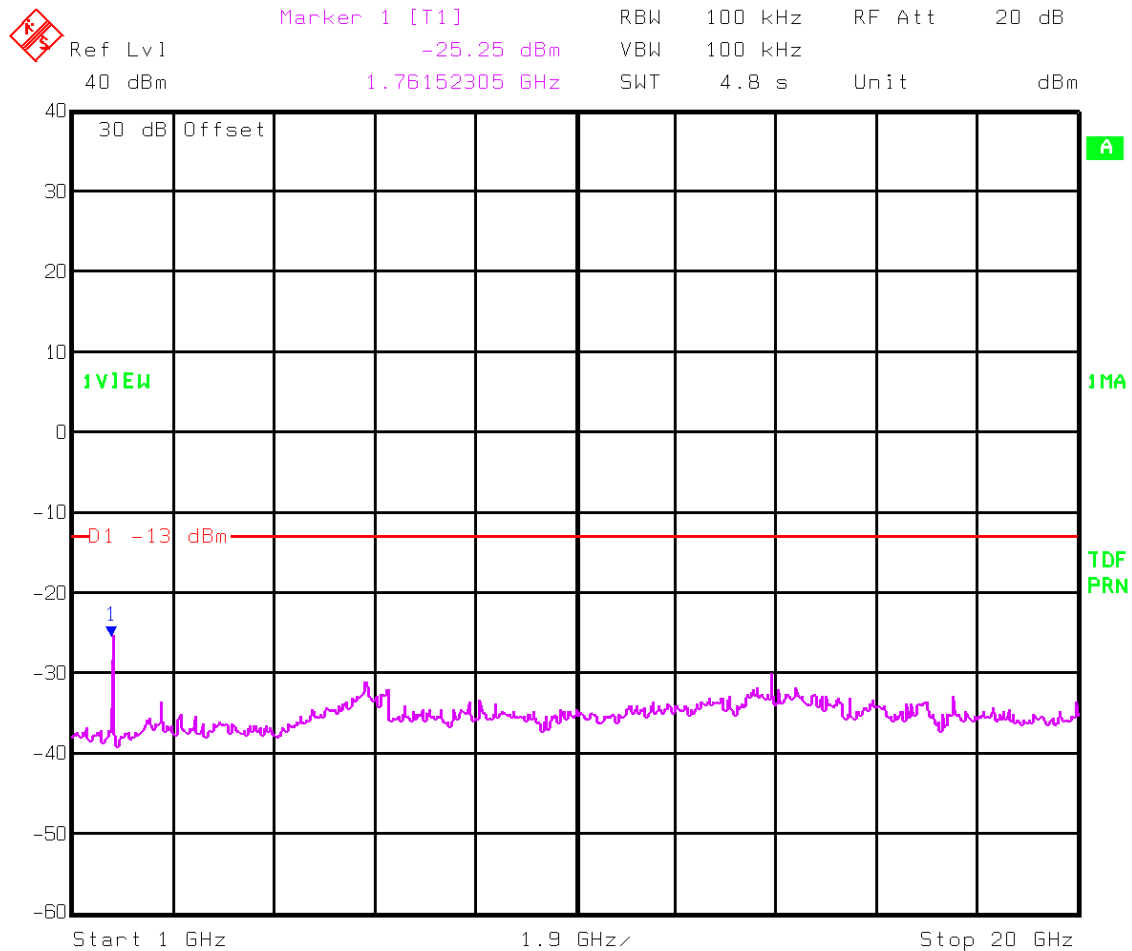
PROJECT NO.: 0L0145RUS2



Title: spurious emissions uplink
Comment A: spurious emissions
aspur901
Date: 15.JUN.2000 19:00:09

EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2



Title: spurious emissions uplink
Comment A: spurious emissions
aspur902
Date: 15.JUN.2000 19:02:00

EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Kevin Rose	DATE: 6/15/01

Test Results: Complies.

Test Data: See attached table.

Note: See page A5 for applicable limit.

EQUIPMENT: MR301B

PROJECT NO.: 0L0145RUS2

**KTL Dallas, Inc.**

Dallas Headquarters:

802 N. Kealy

Lewisville, TX 75057

Tel: (972) 436-9600

Fax: (972) 436-2667

Radiated Emissions

Page 1 of 1.

Job No.: 010145R

Date: 6/15/00

Complete X

Preliminary

Specification: CFR 47, Part 90

Temperature(°C): 24

Tested By: David Light

Relative Humidity(%) 65

E.U.T.: MR301B

Configuration: Transmitting into dummy load @ 947.5 MHz

Sample Number:

Location: AC 3

RBW: 100 kHz Below 1 GHz 1 MHz Above 1 GHz

Location:	AC 5
Detector Type:	Peak

RBW:	100 kHz	Below 1 GHz	1 MHz	Above 1 GHz
VBW:	100 kHz	Below 1 GHz	1 MHz	Above 1 GHz

Measurement Distance: 3 m

Test Equipment Used

Antenna: 1480

Directional Coupler: #N/A

Pre-Amp:	791
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Cable #1:	1484
-----------	------

Filter:	#N/A
---------	------

Cable #2: 1485

Receiver: 1464

Cable #3: #N/A

Attenuator #1	#N/A
---------------	------

Cable #4: #N/A

Attenuator #2: #N/A

Mixer: #N/A

Additional		
equipment used:	1016	993

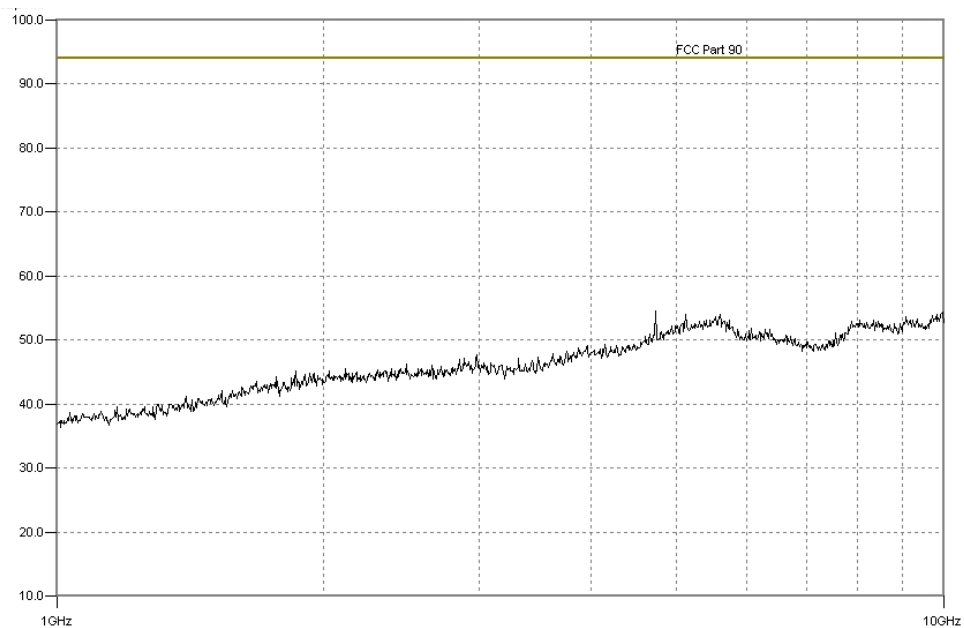
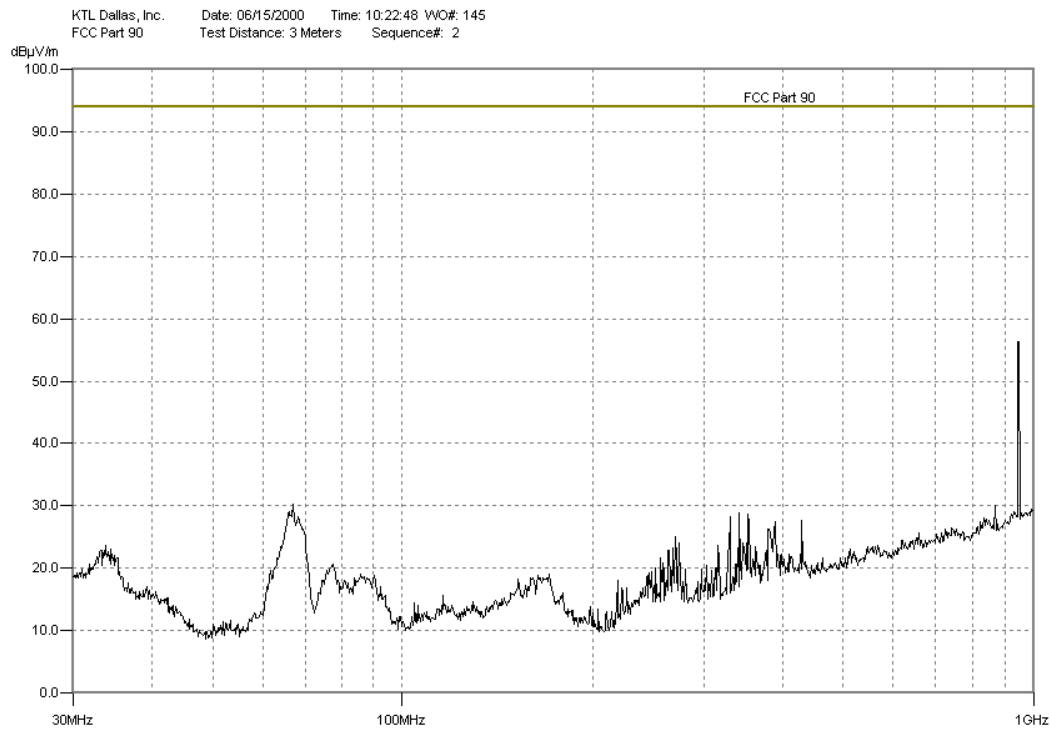
Measurement	1976
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Uncertainty: $\pm .7$ dB

[illegible]

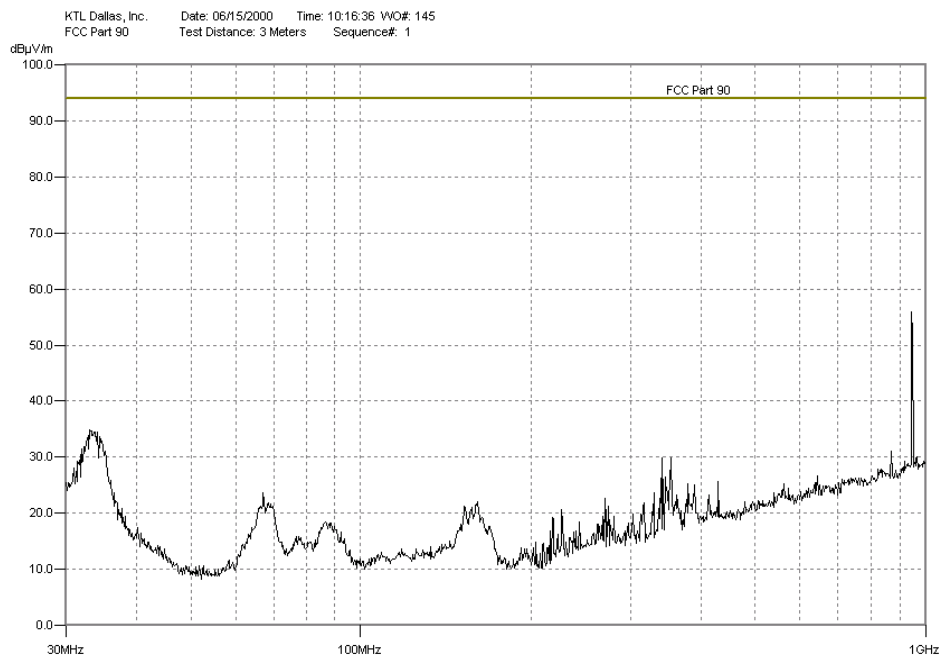
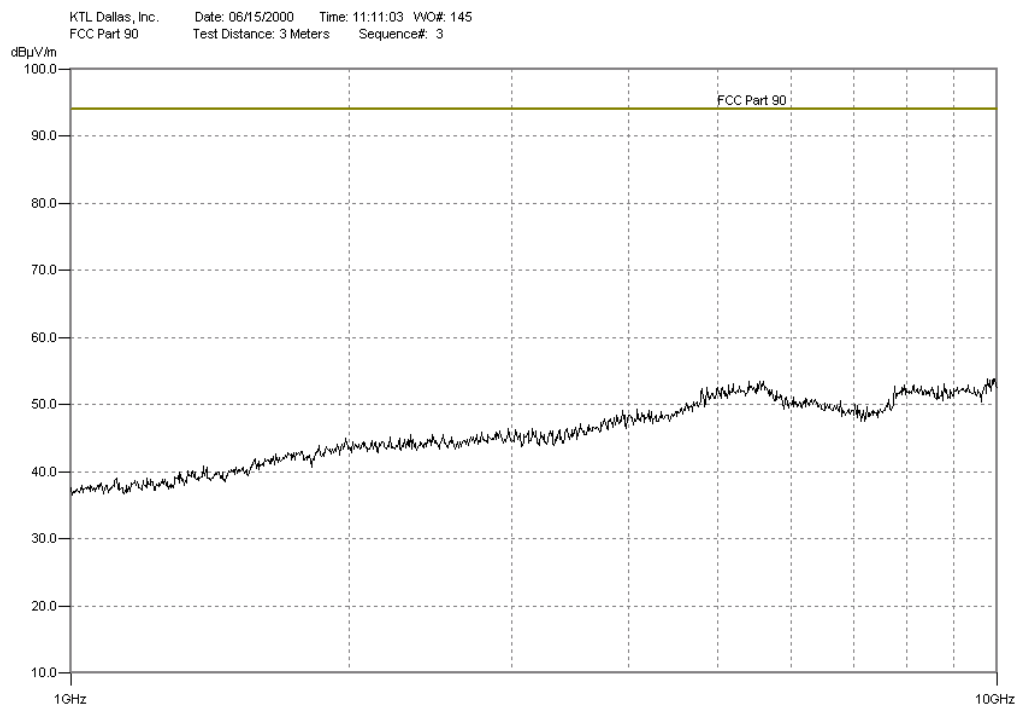
Notes: Scanned spectrum to the 10th harmonic of fundamental

Test Data - Radiated Emissions



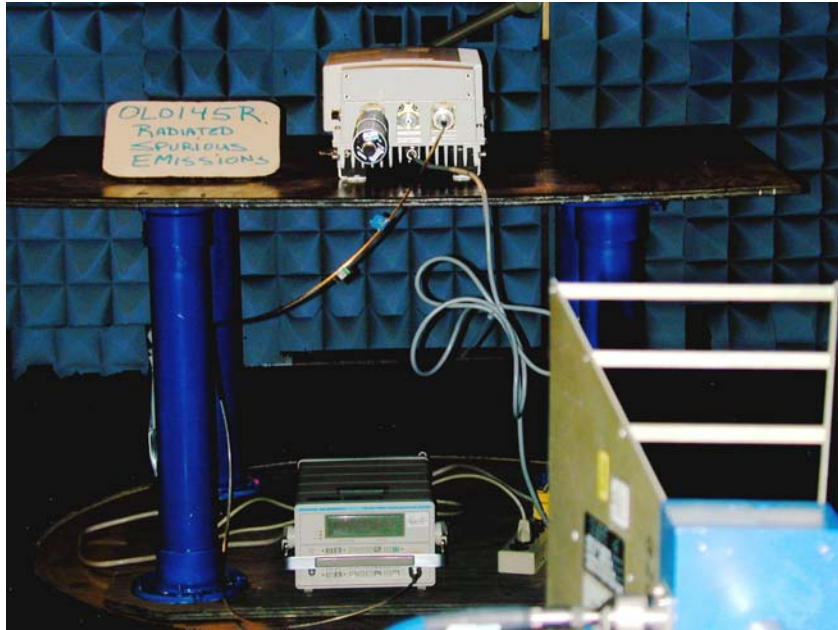
EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

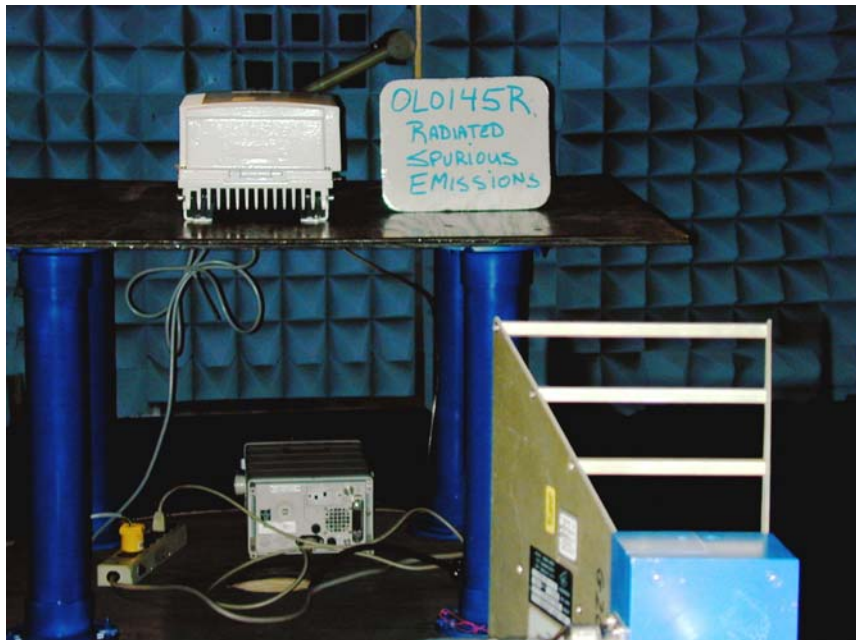


Photographs of Test Setup

REAR VIEW



FRONT VIEW



EQUIPMENT: **MR301B**

PROJECT NO.: **0L0145RUS2**

Section 7. Frequency Stability

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

Test Results: Complies/Does Not Comply.

Measurement Data: See attached tables.

Not Applicable

EQUIPMENT: **MR301B**PROJECT NO.: **0L0145RUS2**

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

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.: 0L0145RUS2

PARA. NO.: 2.991

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

VBW: $\Rightarrow$ RBW

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

EQUIPMENT: **MR301B**PROJECT NO.: **0L0145RUS2**

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

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 = 3m (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 = 1×10^{-5} Watts (Maximum spurious output power)

R = 3m (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

EQUIPMENT: **MR301B**PROJECT NO.: **0L0145RUS2**

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	-	-	-

KTL Dallas

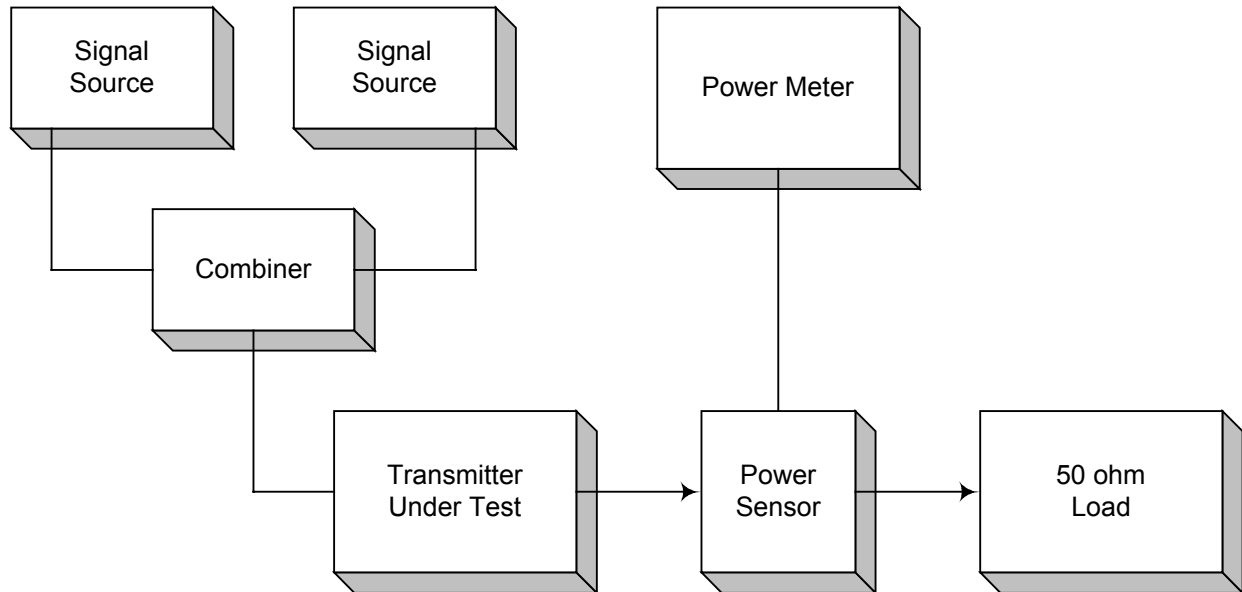
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **MR301B**

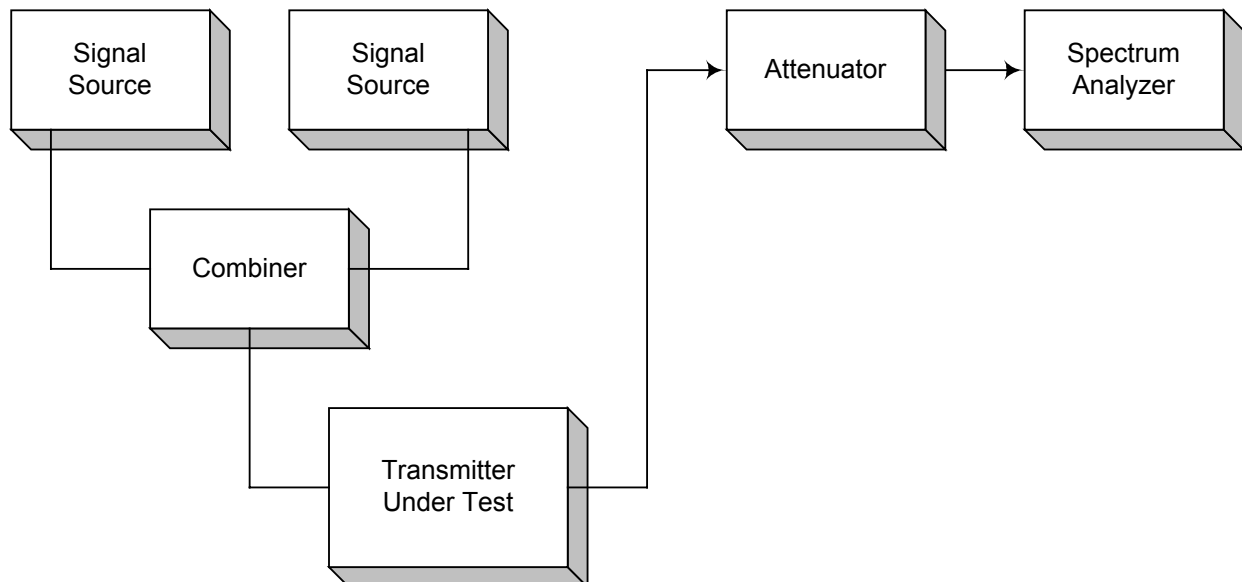
PROJECT NO.: **0L0145RUS2**

ANNEX B - TEST DIAGRAMS

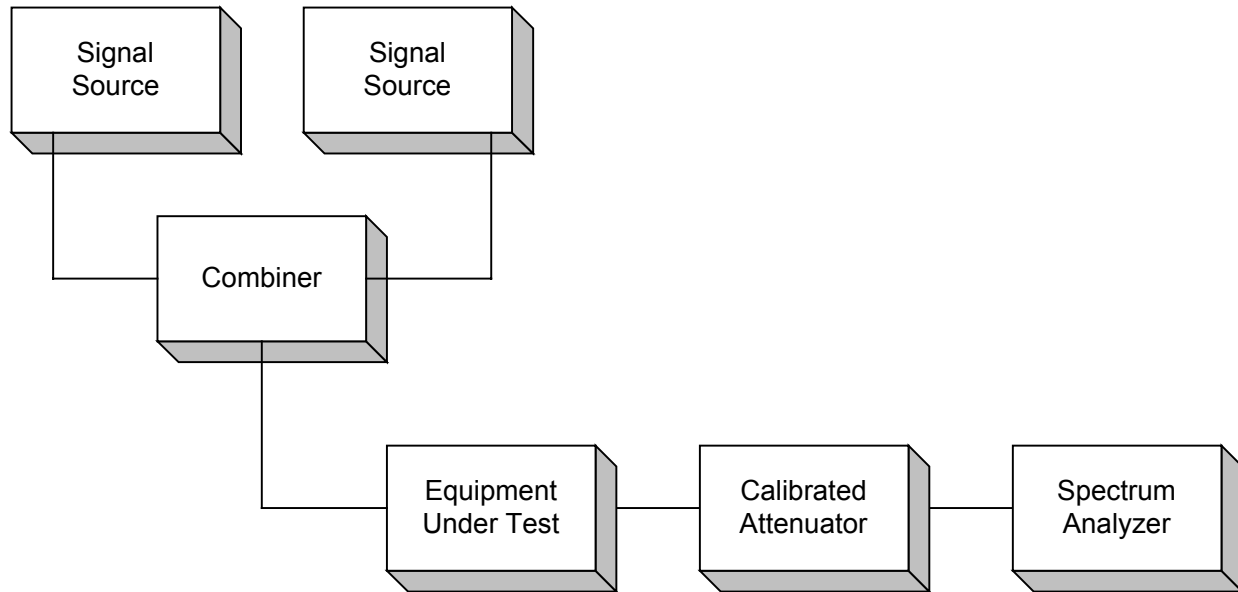
Para. No. 2.985 - R.F. Power Output



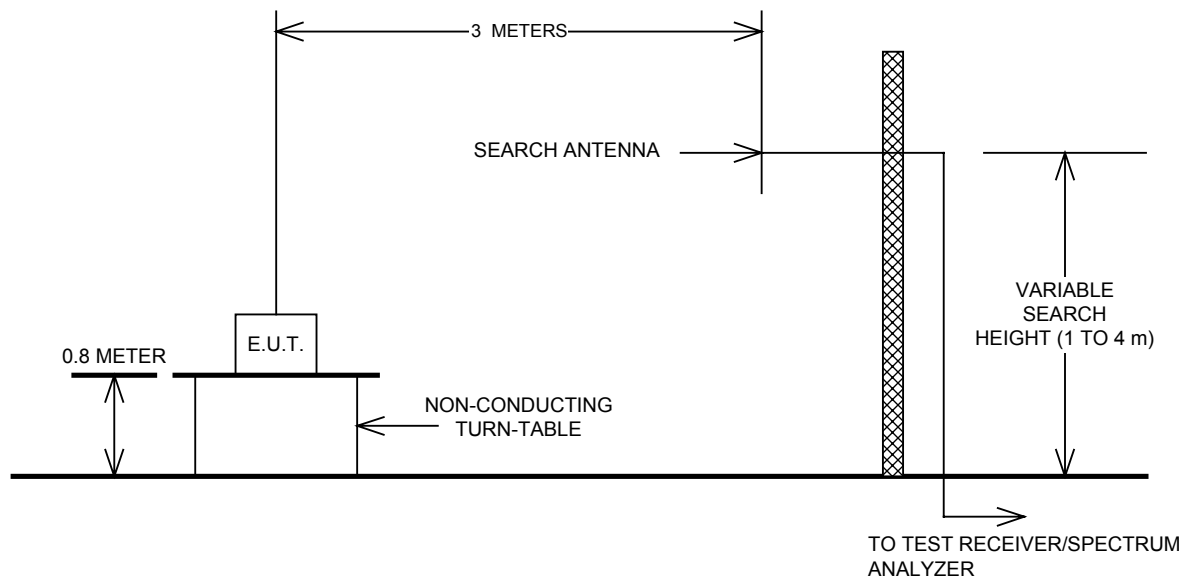
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

