KTL Test Report:	0L0145RUS2
Applicant:	Allen Telecom 140 Vista Centre Dr. Forest, VA. 2451
Equipment Under Test: **(E.U.T.)**	MR301B
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

Table of Contents

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

A	M	P

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

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%

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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**
	☒	☐	☐

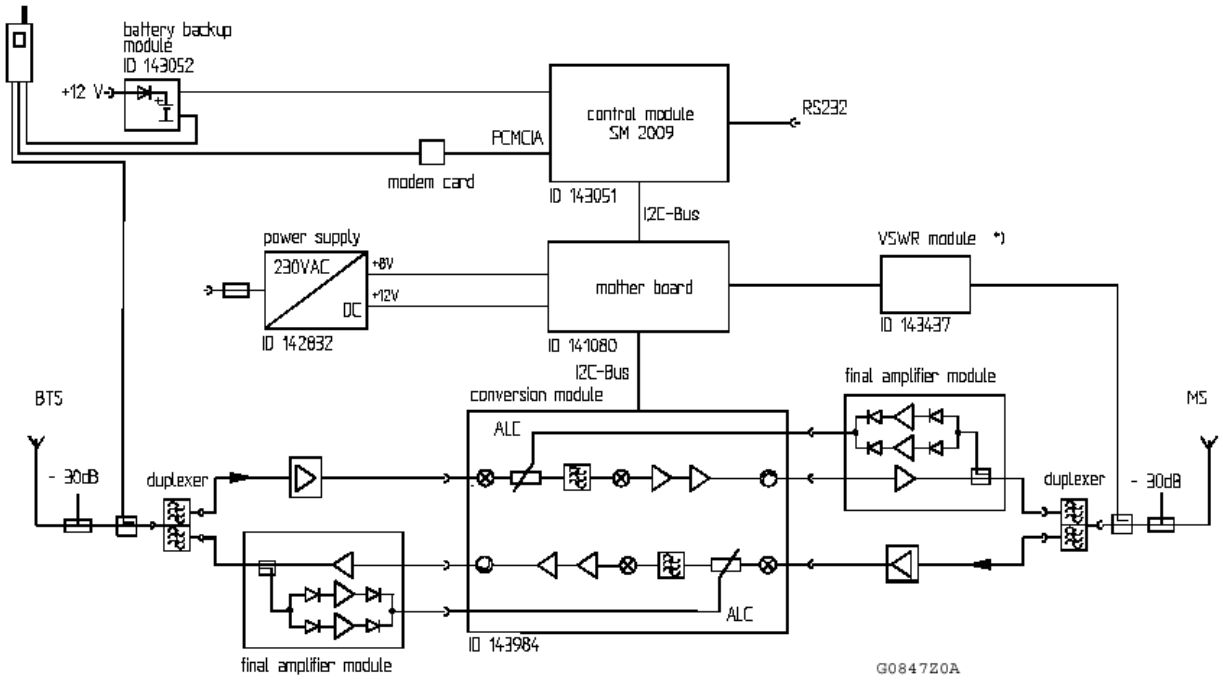
Modifications Made During Testing

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



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:

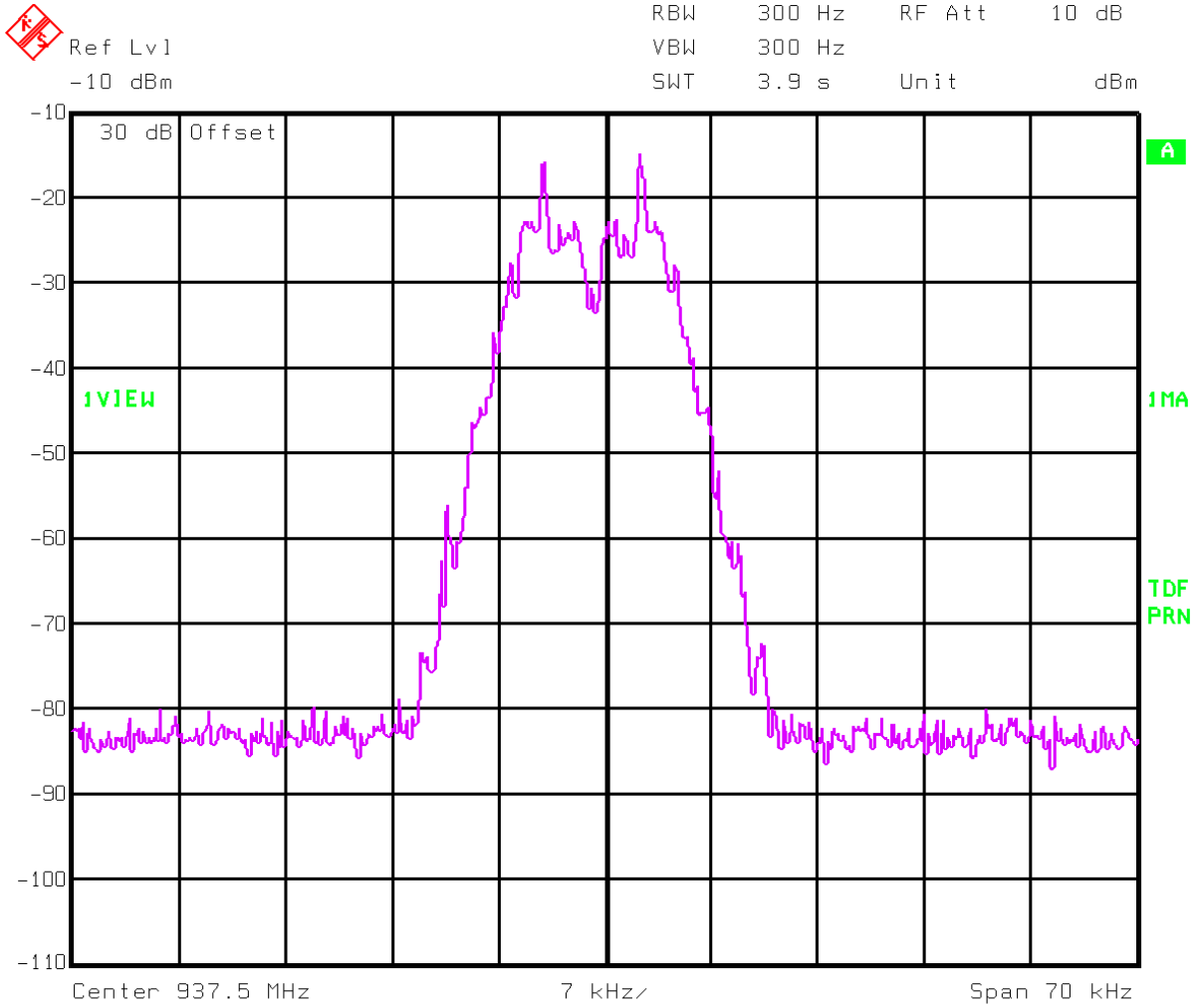
MODULATION	POWER OUTPUT PER CHANNEL (dBm)	COMPOSITE POWER OUTPUT (dBm)
FSK	+26.8	+31.6

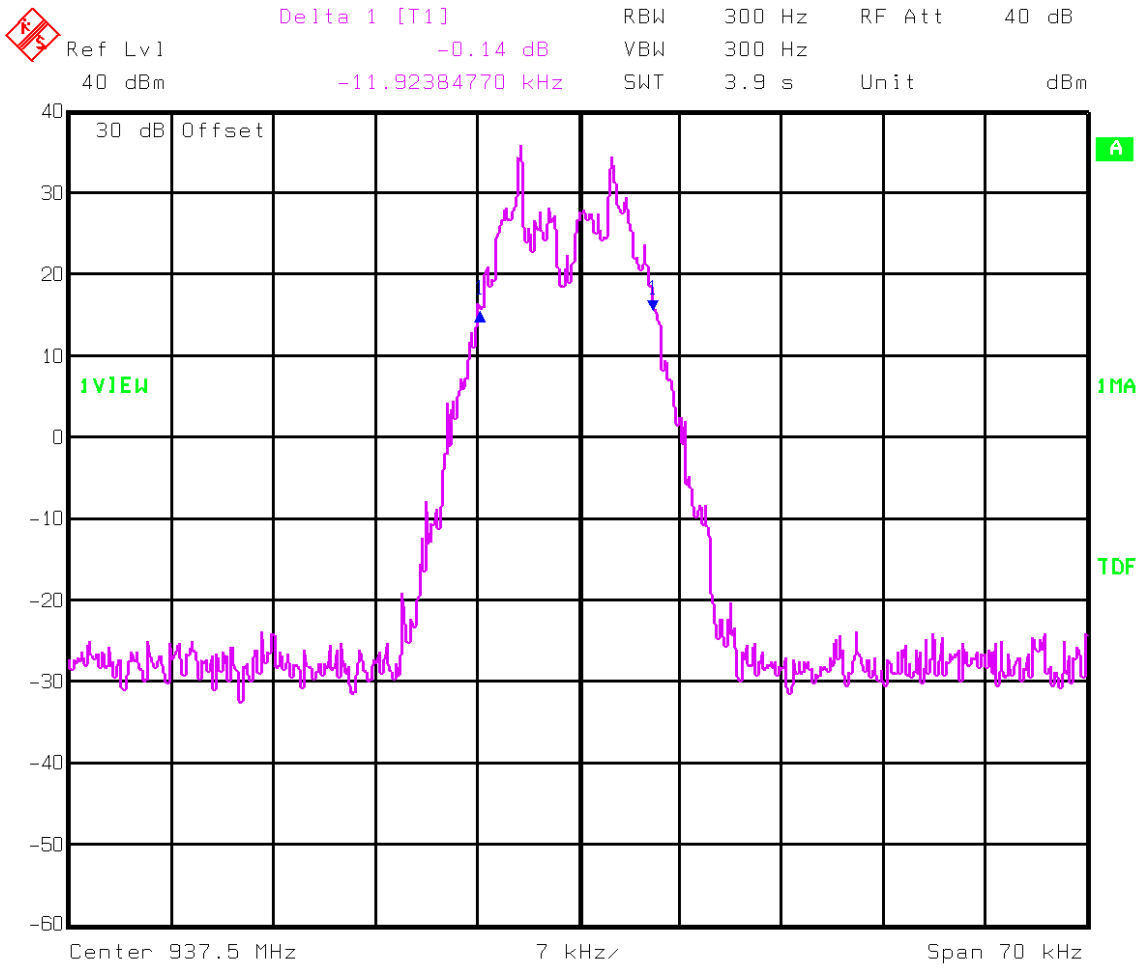
Section 4. Occupied Bandwidth

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

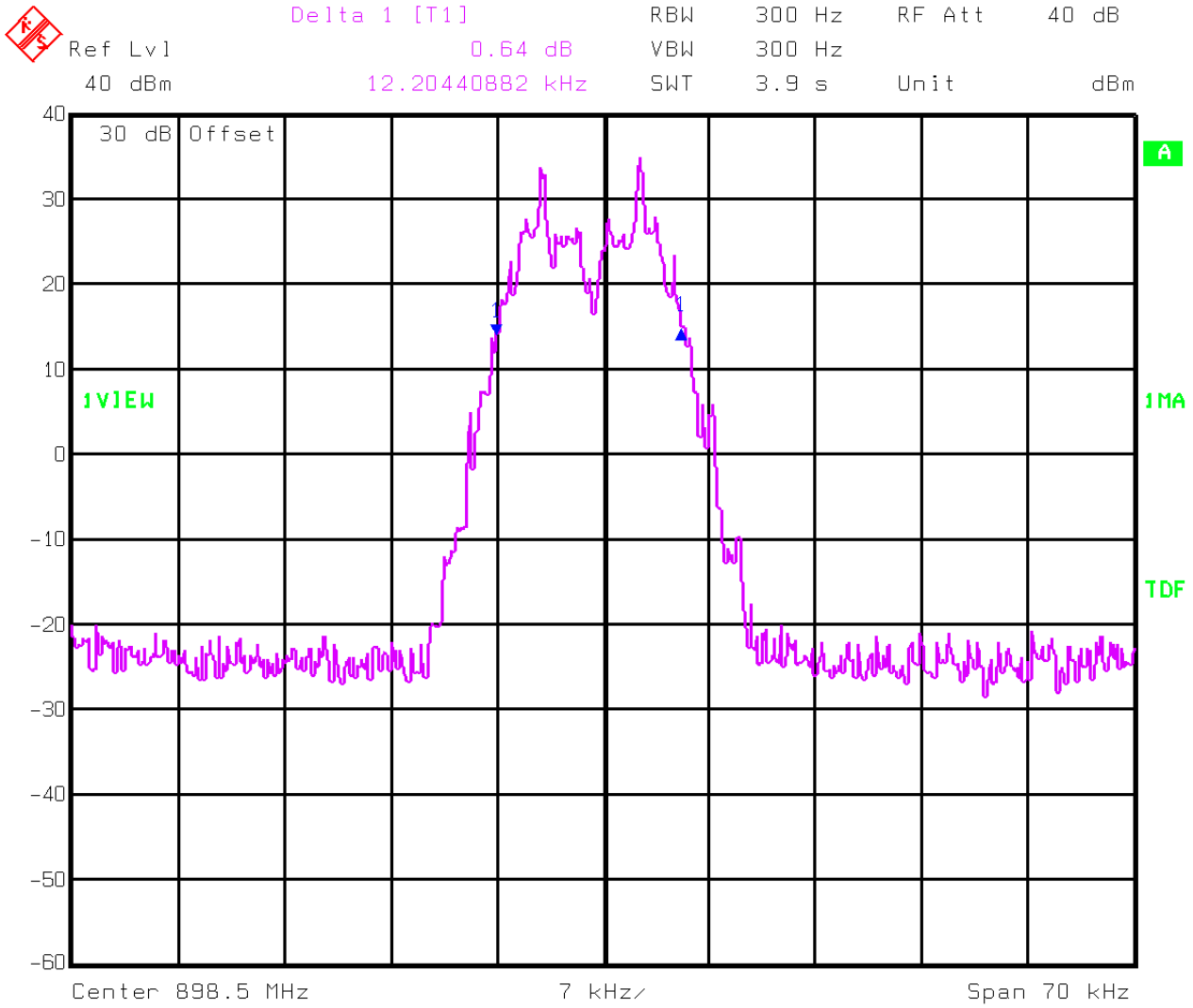
Test Results: Complies

Test Data: See attached graph(s).

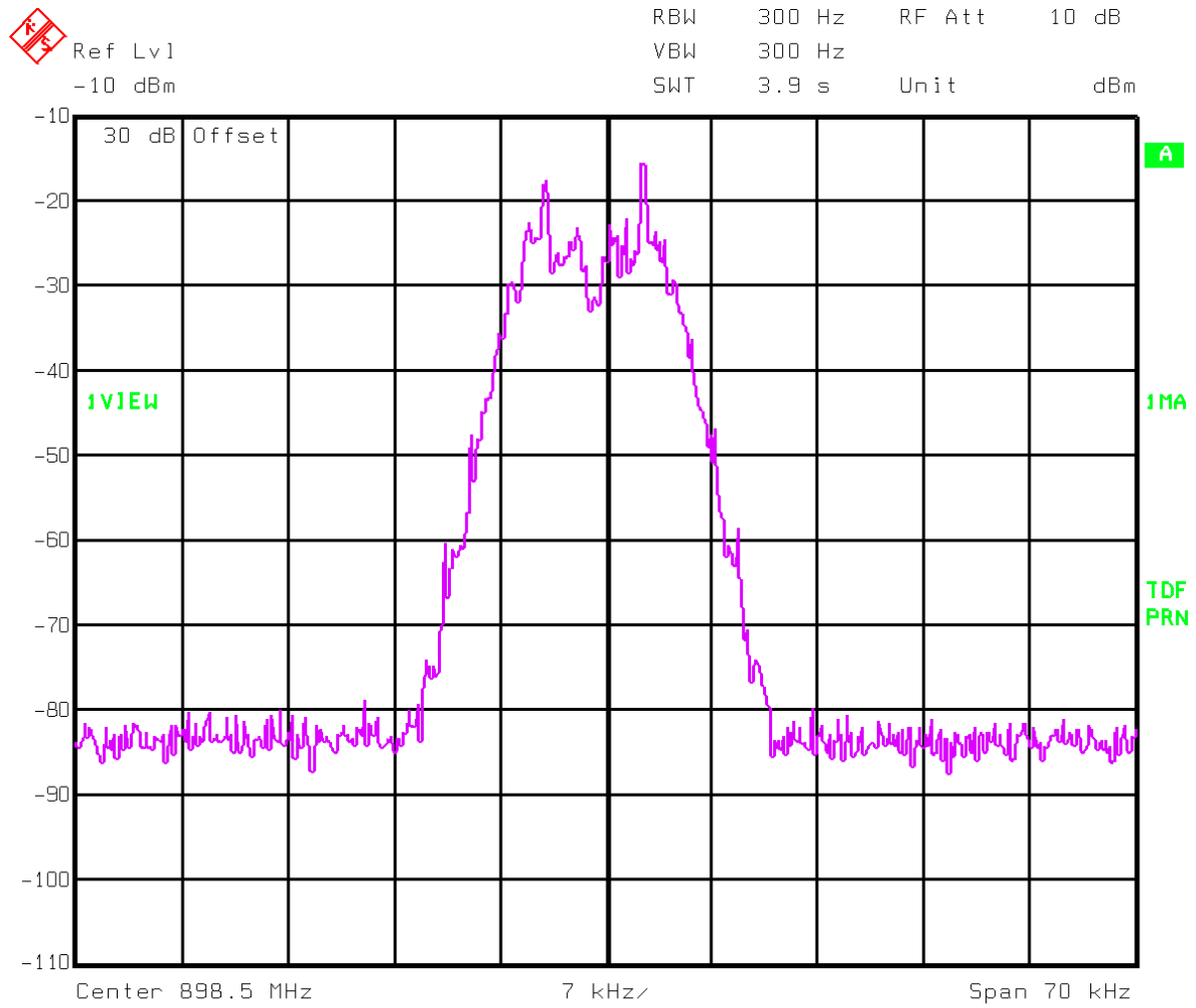

RBW 300 Hz
RF Att 10 dB
VBW 300 Hz
SWT 3.9 s
Unit dBm
Ref Lvl
-10 dBm
30 dB Offset
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1VIEW
A
1MA
TDF
PRN
Center 937.5 MHz
7 kHz/
Span 70 kHz
Title: occupied bandwidth 2 fsk input
Comment A: occupied bandwidth down link
ocb2fdli
Date: 15.JUN.2000 18:19:54



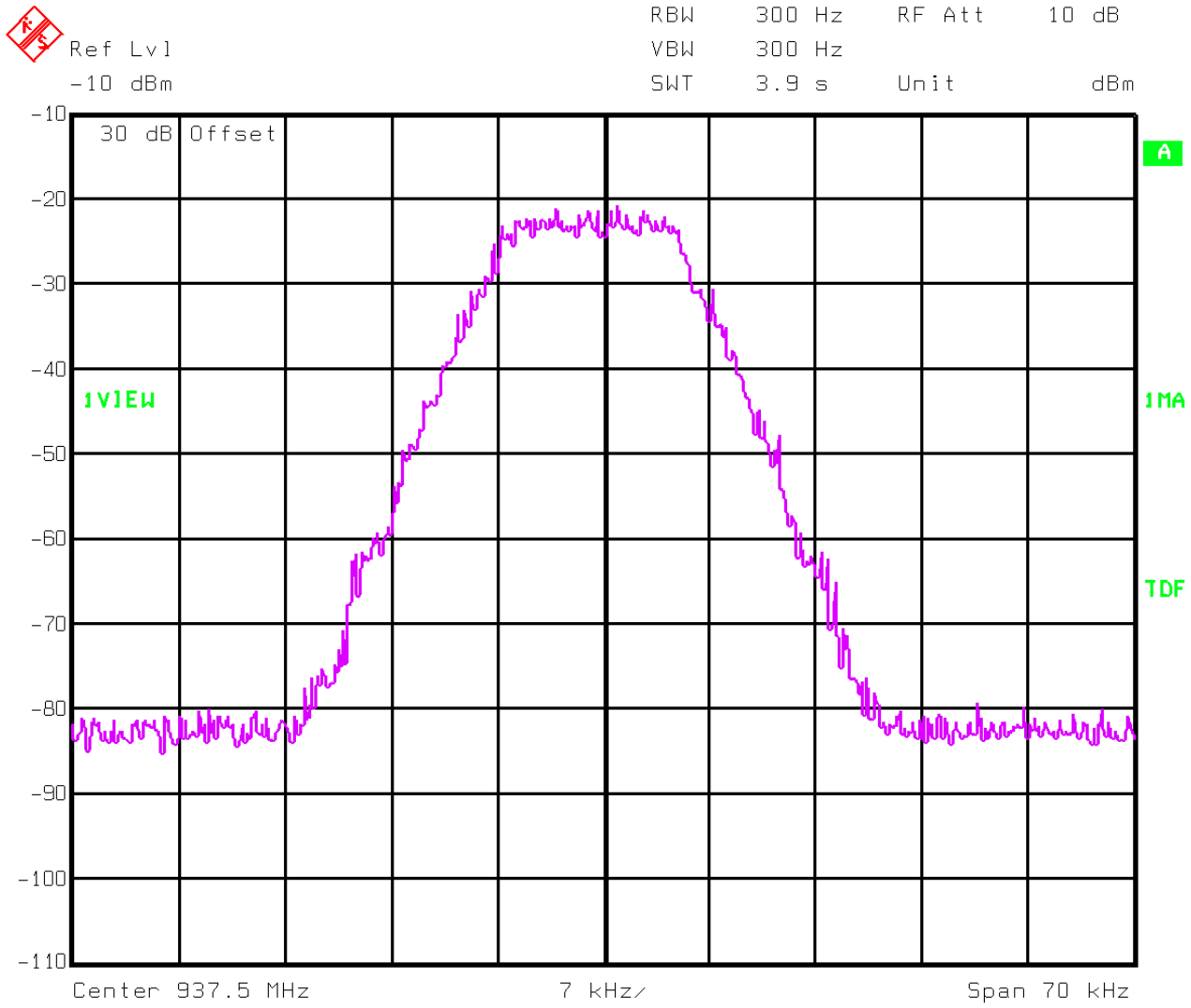
Title: occupied bandwidth 2 fsk output downlink
Comment A: occupied bandwidth downlink output 2 fsk ocb2fdlo
Date: 15.JUN.2000 18:38:24



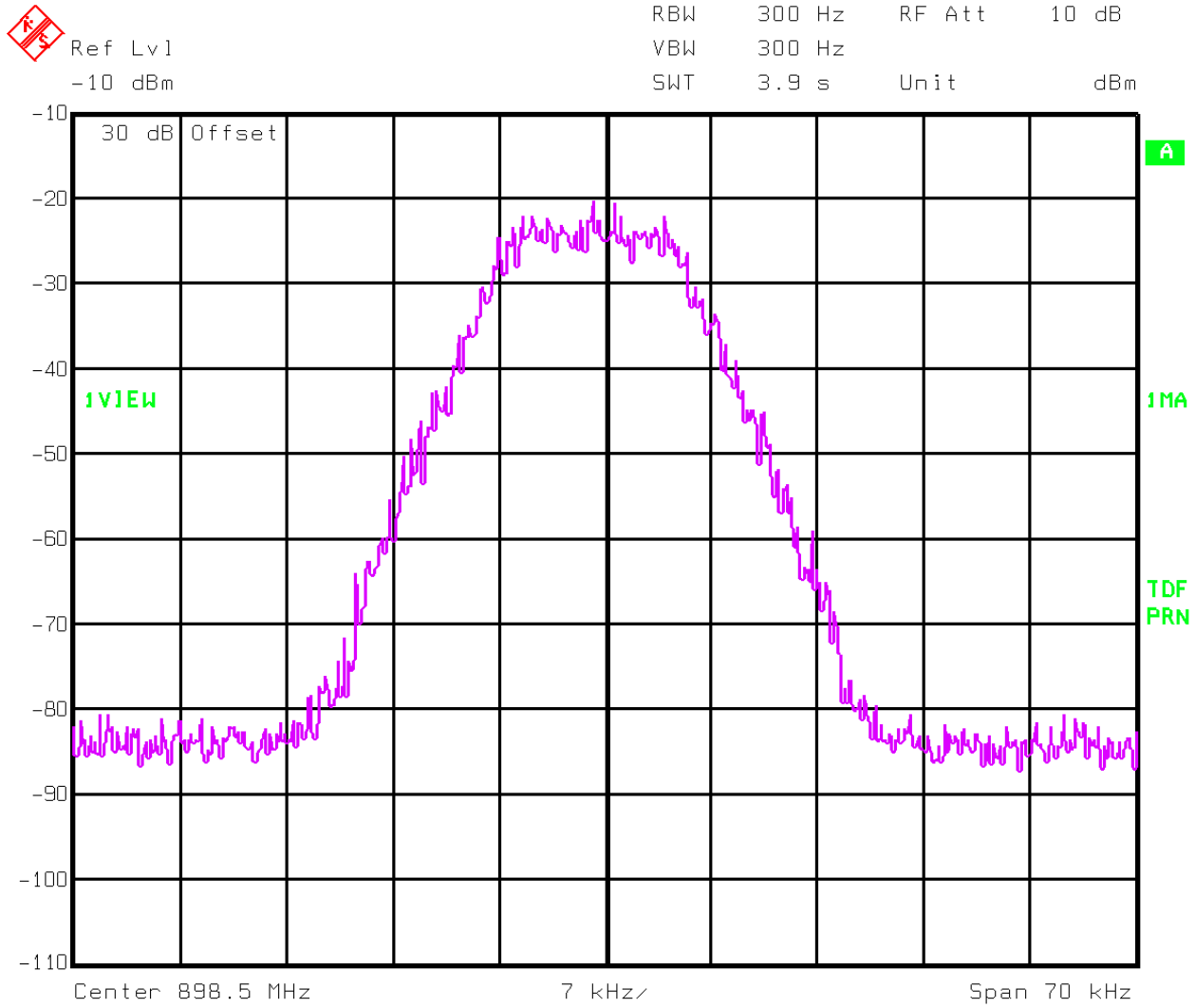
Title: occupied bandwidth 2 fsk output uplink
Comment A: occupied bandwidth uplink output 2 fsk
ocb2fulo
Date: 15.JUN.2000 18:46:06



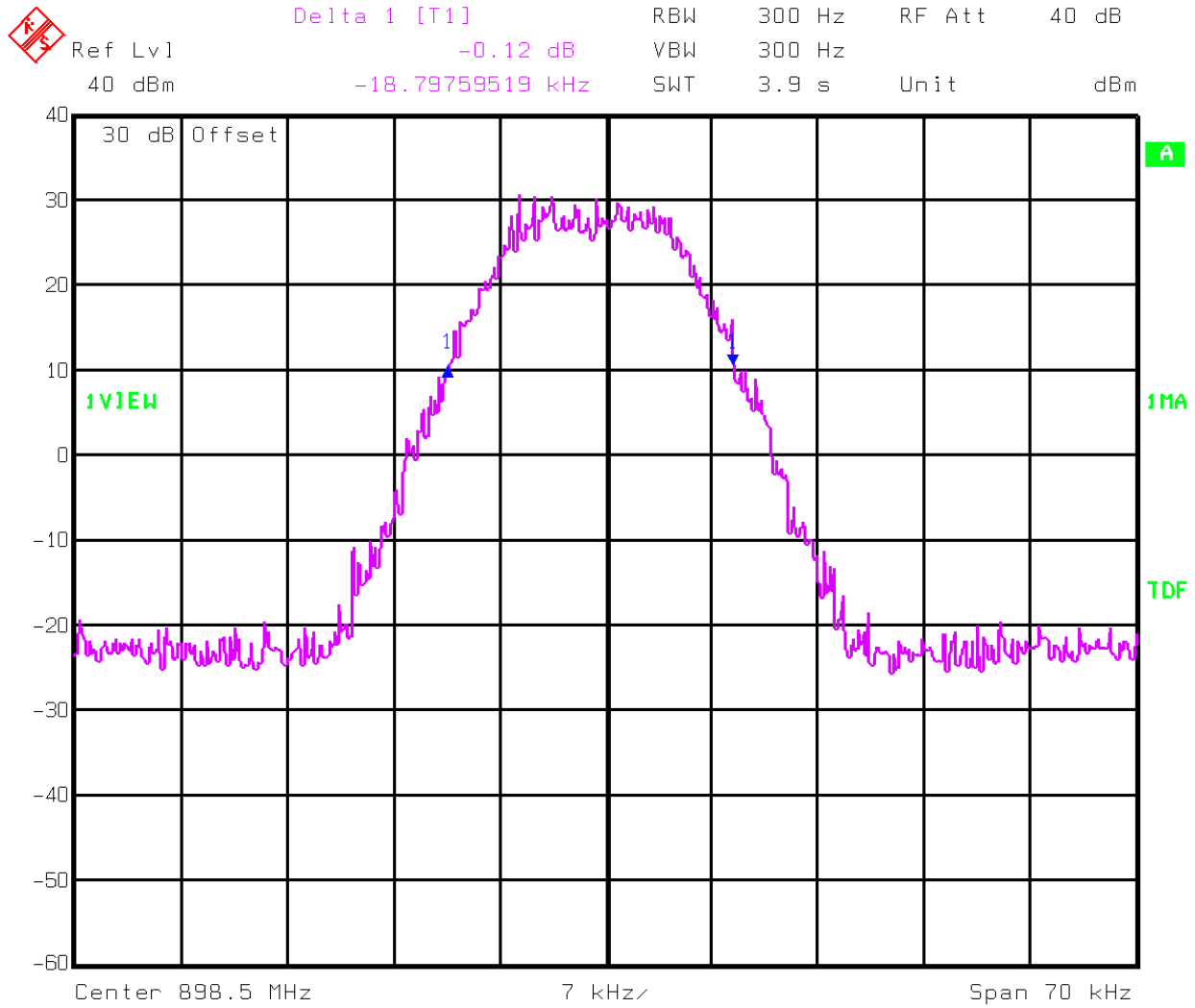
Title: occupied bandwidth 2 fsk input uplink
Comment A: occupied bandwidth uplink input 2 fsk
ocb2fuli
Date: 15.JUN.2000 18:55:22



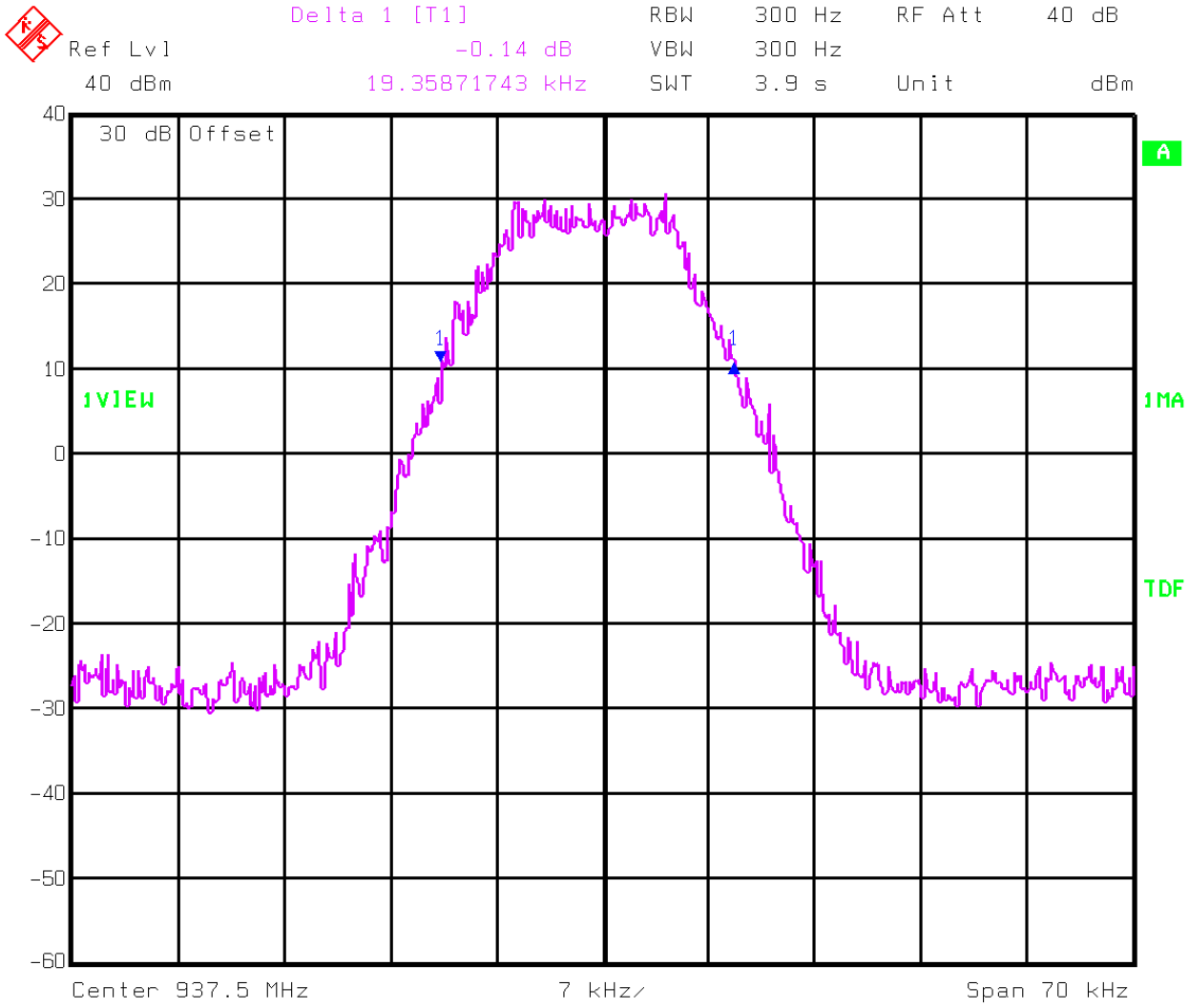
Title: occupied bandwidth 4 fsk input
Comment A: occupied bandwidth down link input 4fsk
ocb4fdli
Date: 15.JUN.2000 17:07:17



Title: occupied bandwidth 4 fsk input uplink
Comment A: occupied bandwidth uplink input 4 fsk
ocb4fuli
Date: 15.JUN.2000 18:53:36



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



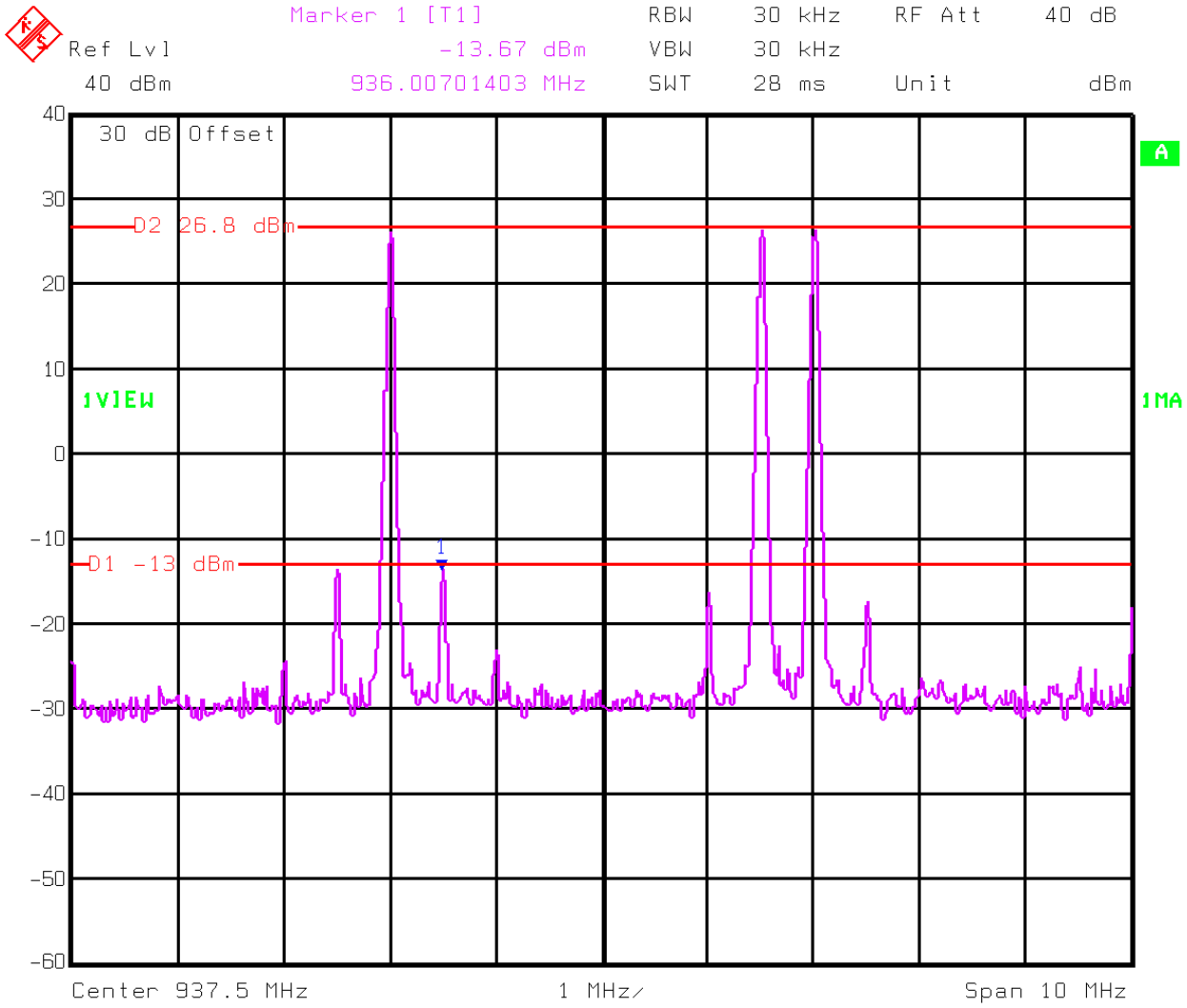
Title: occupied bandwidth 4 fsk output
Comment A: occupied bandwidth down link output 4fsk
ocb4fdlo
Date: 15.JUN.2000 17:04:03

Section 5. Spurious Emissions at Antenna Terminals

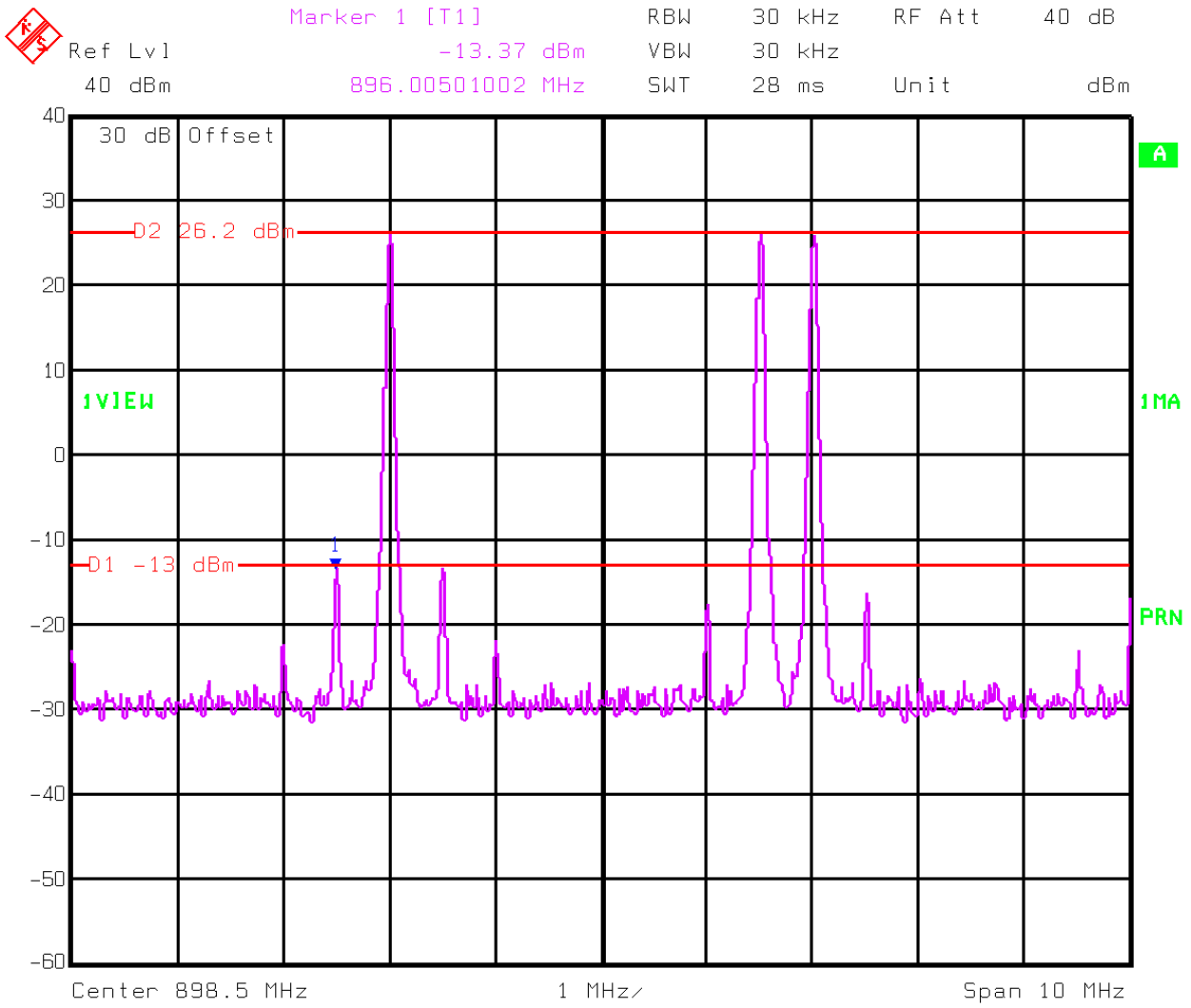
NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Kevin Rose	DATE: June 16, 2000

Test Results: Complies

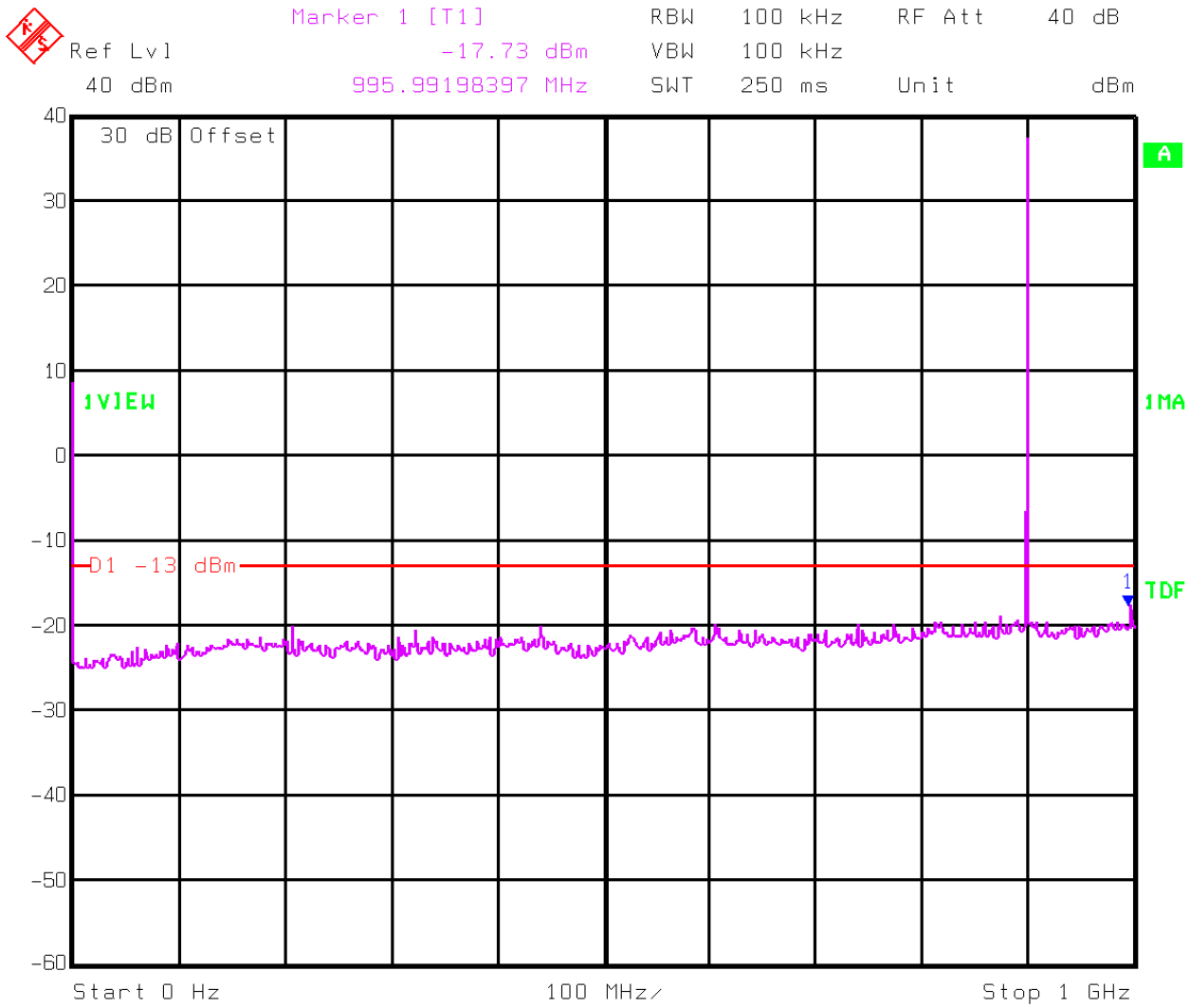
Test Data: See attached graph(s).

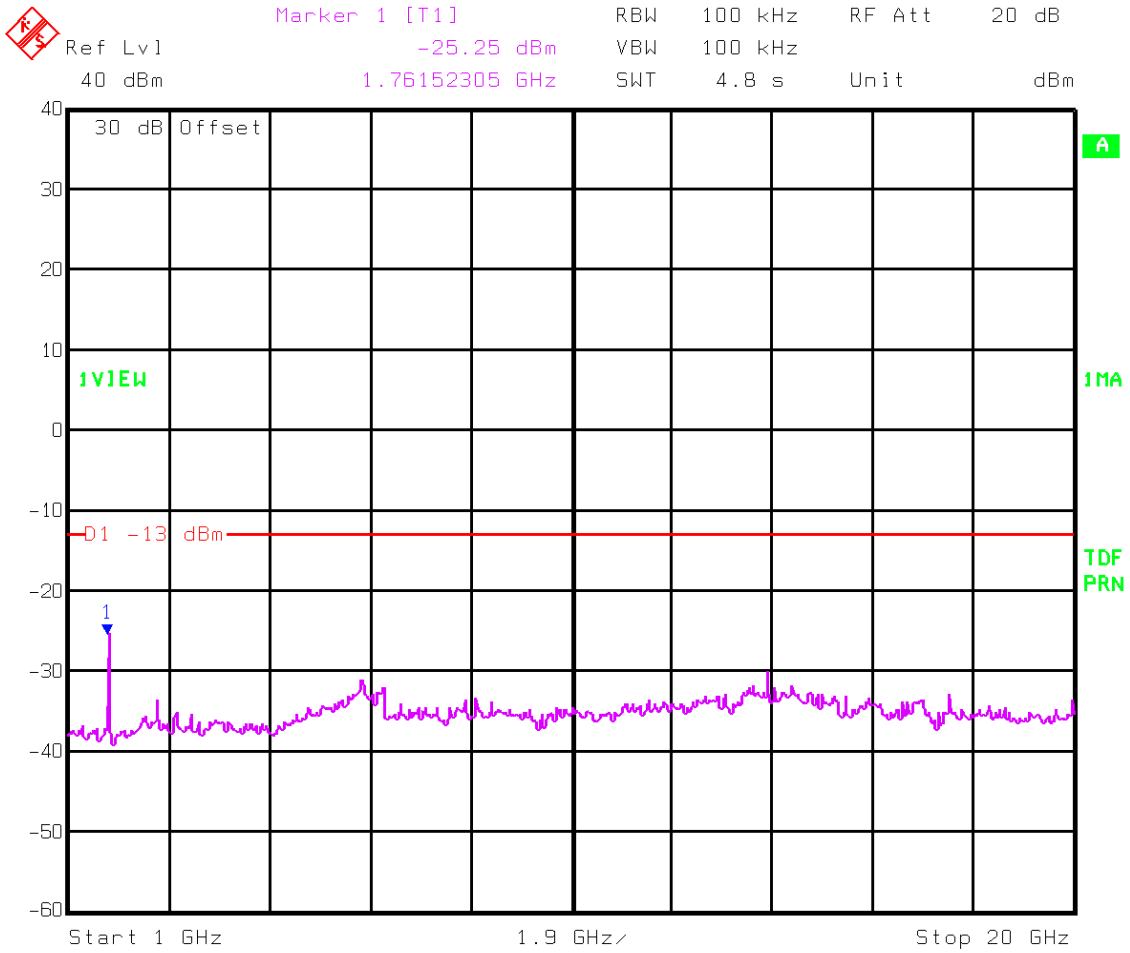


Title: intermodulation products downlink
Comment A: itermodulation products downlink
intmod1
Date: 16.JUN.2000 14:48:24



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


Marker 1 [T1]
Ref Lvl
40 dBm
-17.73 dBm
995.99198397 MHz
RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 40 dB
Unit dBm
30 dB Offset
1VIEW
D1 -13 dBm
1MA
TDF
A
Start 0 Hz
100 MHz/
Stop 1 GHz
Title: spurios emissions uplink
Comment A: spurios emissions
aspur901
Date: 15.JUN.2000 19:00:09



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

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.

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 . Complete X

Job No.: 0l0145R Date: 6/15/00 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

Detector Type: Peak 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	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

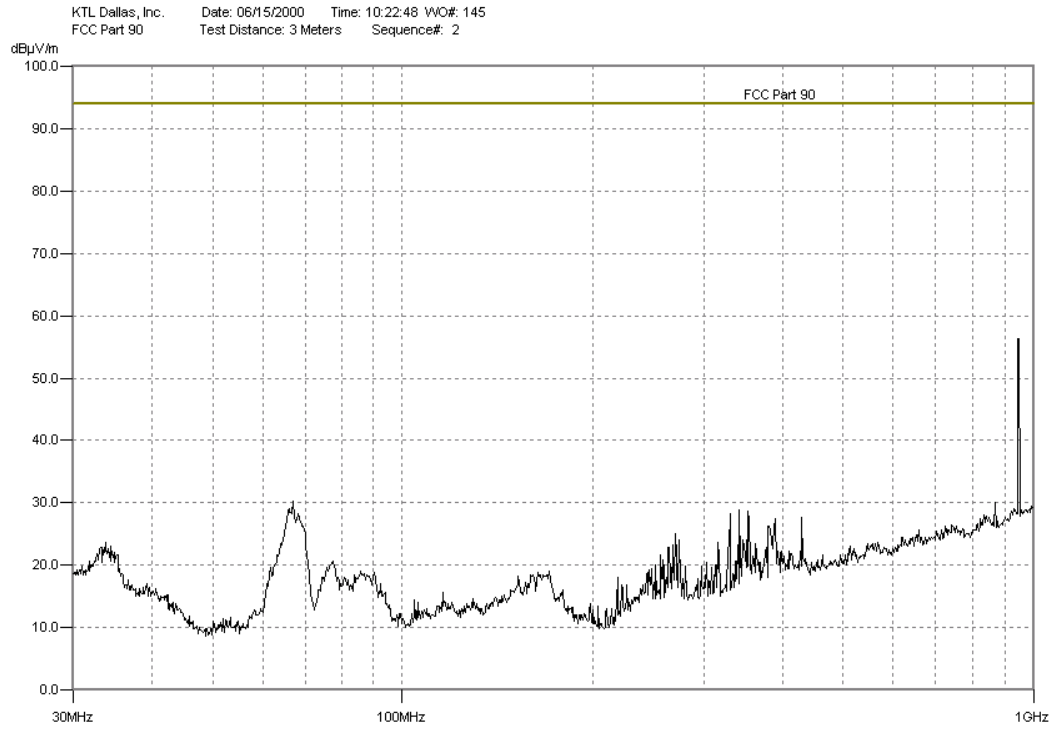
Additional equipment used: 1016 993

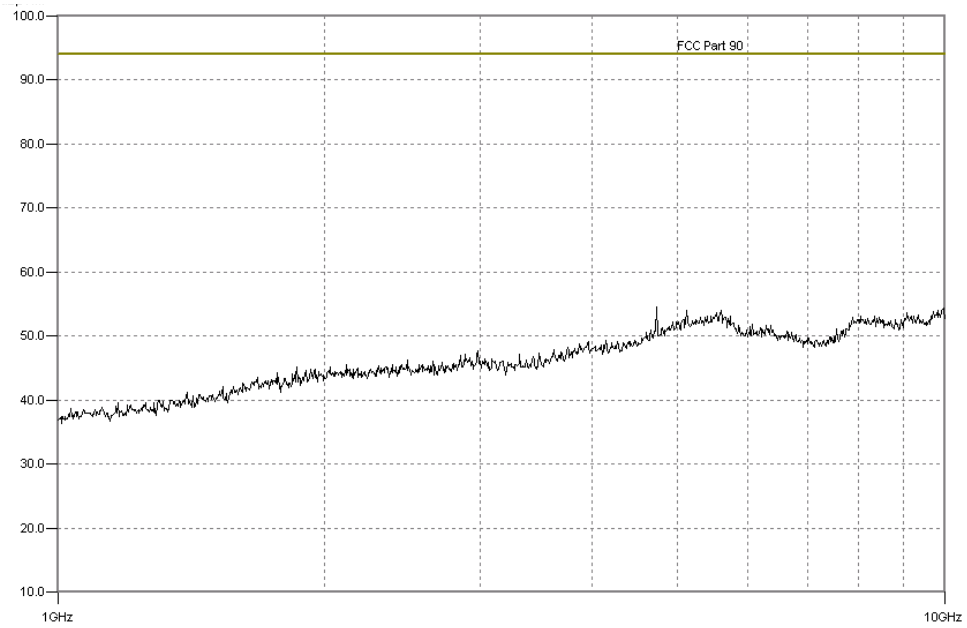
Measurement Uncertainty: +/- .7 dB

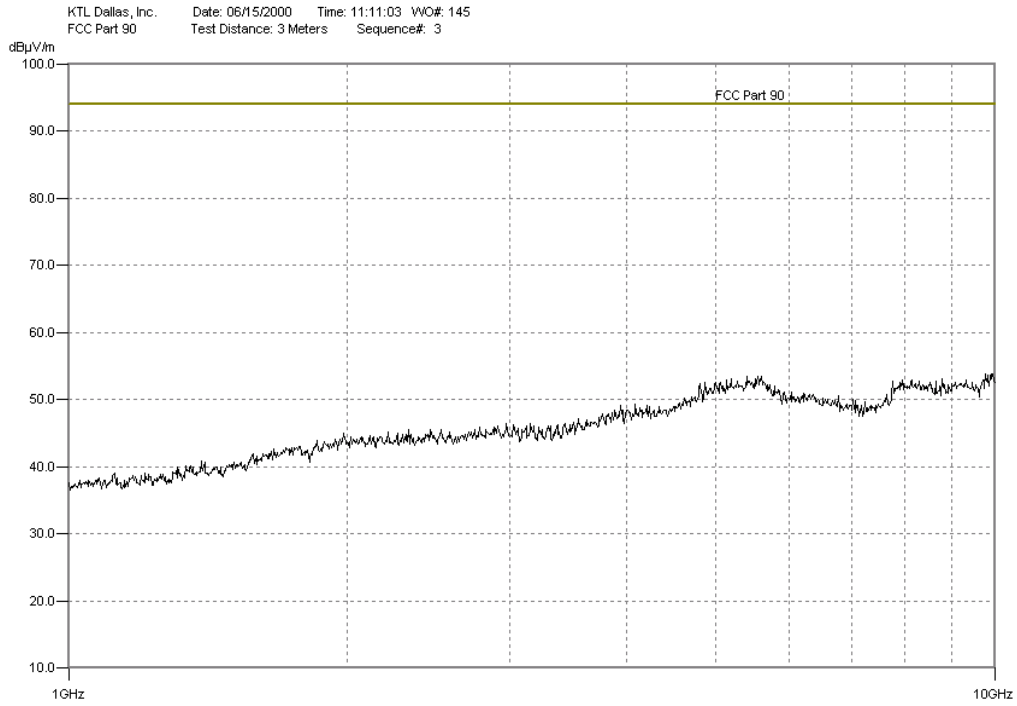
Frequency (GHz)	Meter Reading (dBm)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Conversion Factor	Corrected Reading (dBuV/m)	ERP (mW)	EIRP (dBm)	Polarity	Comments
0.9475	-53.7	24.9	2	24.2	107.0	56	0.00	-39.23	V	Fundamental
0.9475	-53.3	24.9	2	24.2	107.0	56	0.00	-38.83	H	Fundamental
1.895	-66.3	29.7	3.4	32.4	107.0	41	0.00	-53.83	V	Noise Floor
2.843	-66.3	29.7	3.4	32.4	107.0	41	0.00	-53.83	V	Noise Floor
3.79	-65.8	30.9	3.8	31.5	107.0	44	0.00	-50.83	V	Noise Floor
4.74	-59	30.9	4.2	30.4	107.0	53	0.00	-42.53	V	5th Harmonick
1.895	-66.3	29.7	3.4	32.4	107.0	41	0.00	-53.83	H	Noise Floor
2.843	-66.3	29.7	3.4	32.4	107.0	41	0.00	-53.83	H	Noise Floor
3.79	-65.8	30.9	3.8	31.5	107.0	44	0.00	-50.83	H	Noise Floor
4.74	-68.3	30.9	4.2	30.4	107.0	43	0.00	-51.83	H	Noise Floor

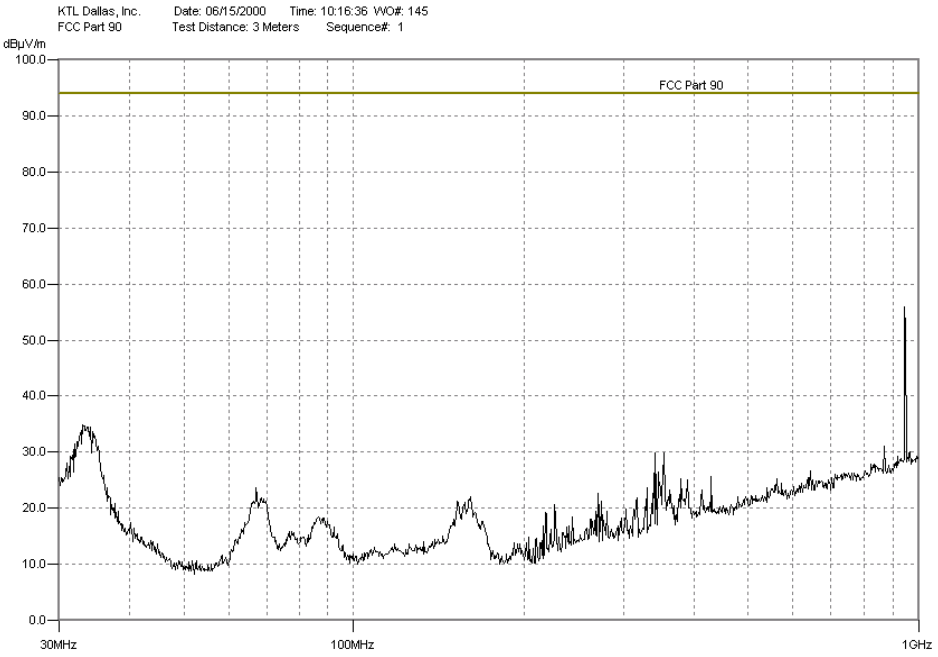
Notes: Scanned spectrum to the 10th harmonic of fundamental

Test Data - Radiated Emissions



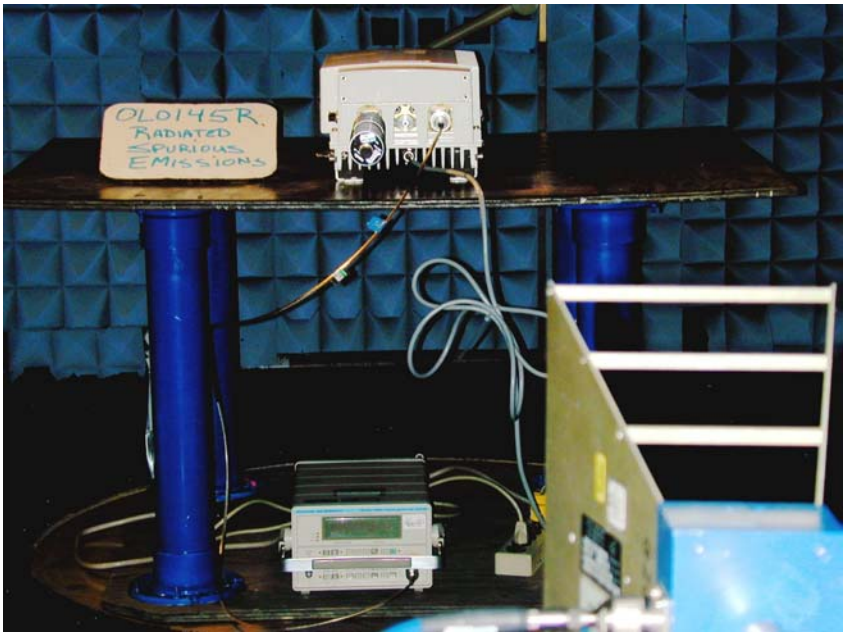



KTL Dallas, Inc. Date: 06/15/2000 Time: 11:11:03 WO#: 145
FCC Part 90 Test Distance: 3 Meters Sequence#: 3
dBµV/m
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC Part 90
1GHz
10GHz

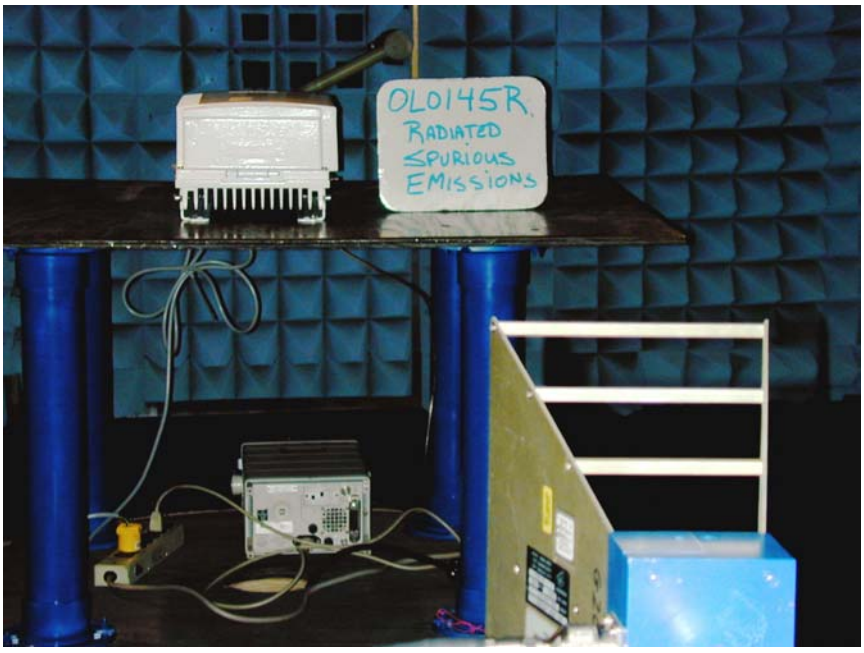

KTL Dallas, Inc. Date: 06/15/2000 Time: 10:16:36 WO#: 145
FCC Part 90 Test Distance: 3 Meters Sequence#: 1
dBµV/m
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
FCC Part 90
30MHz
100MHz
1GHz

Photographs of Test Setup

REAR VIEW



FRONT VIEW



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

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

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: $\Rightarrow$ RBW

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

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 x 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)

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

For emissions > 1 GHz:

G = 1 (Isotropic Gain)
P = 1 x 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

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

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

NAME OF TEST: Frequency Stability **PARA. NO.: 2.995**

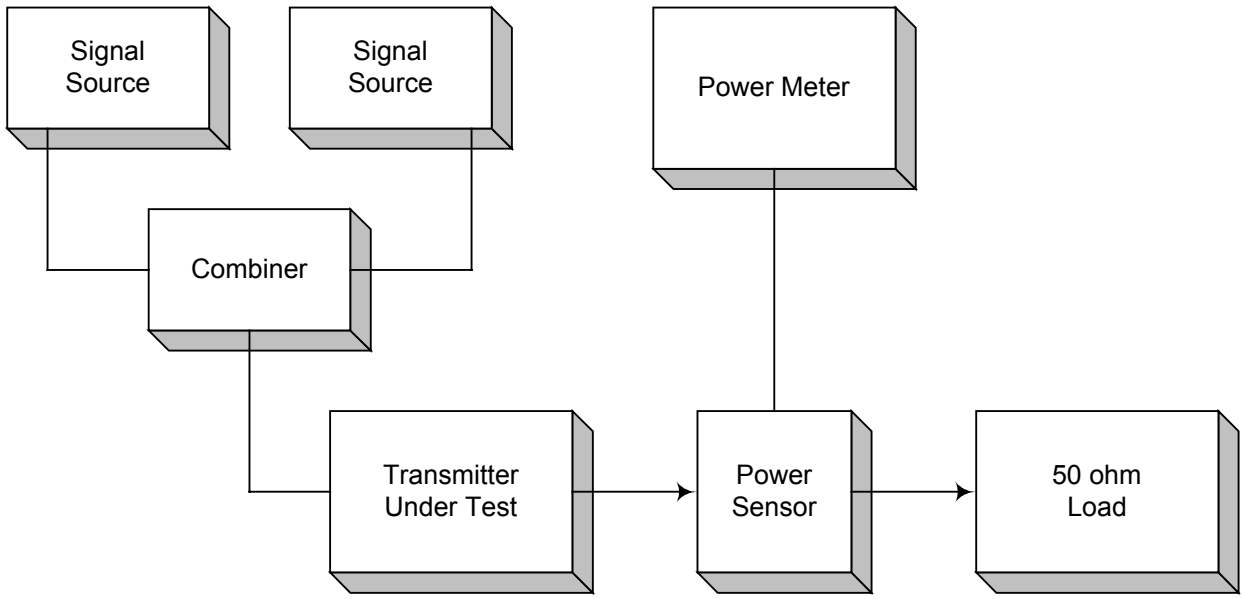
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

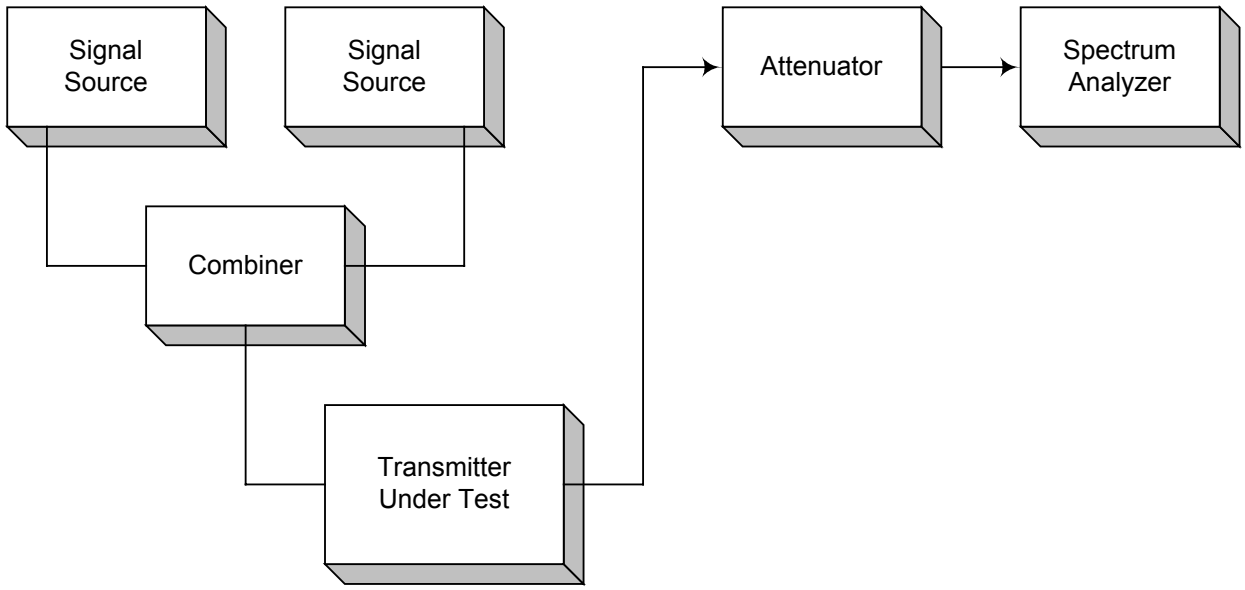
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 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	-	-	-

ANNEX B - TEST DIAGRAMS

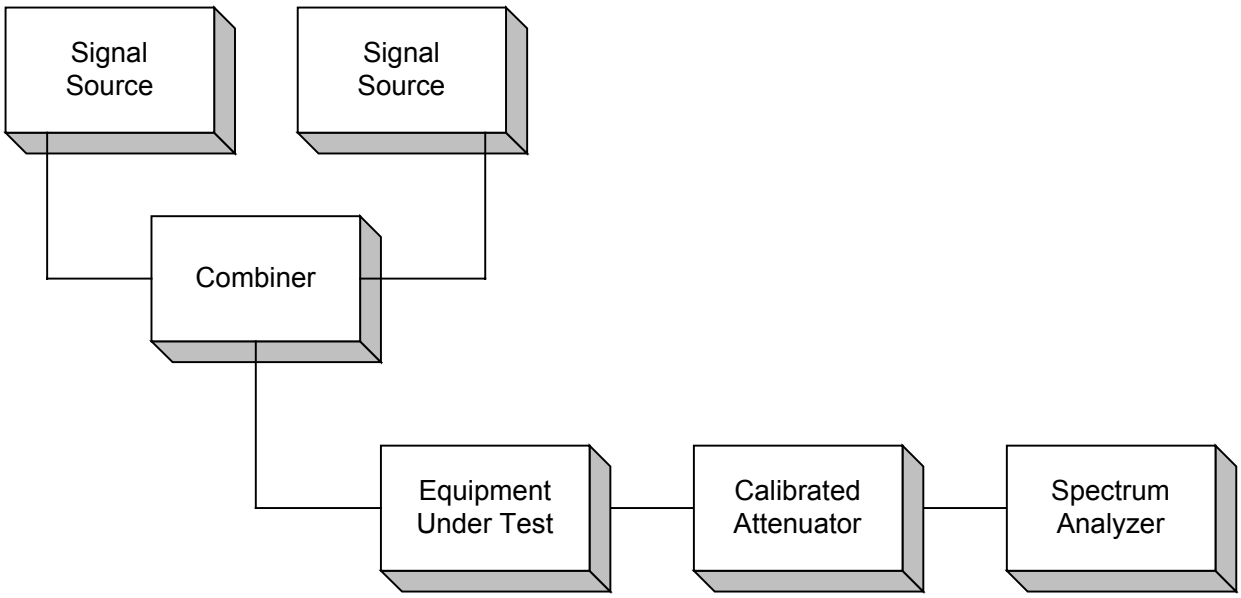
Para. No. 2.985 - R.F. Power Output



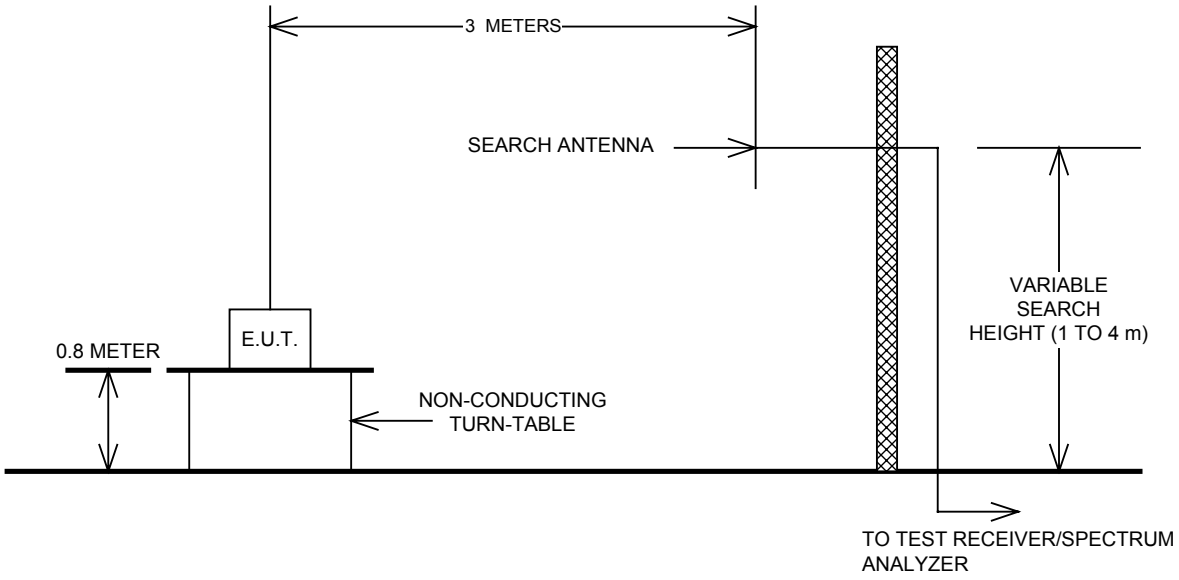
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability