

KTL Test Report:	9L0234R
Applicant:	Allen Telecom, Inc. 140 Vista Centre Drive Forest, VA 24551
Equipment Under Test: (E.U.T.)	EAC-2000D Digital Cellular Enhancer
FCC ID:	BCR9GB2000
In Accordance With:	FCC Part 22, Subpart H Cellular Band Repeaters
Tested By:	KTL Dallas Inc. 802 N. Kealy Lewisville, TX 75057-3136
Authorized By:	Tom Tidwell, RF Group Manager
Date:	
Total Number of Pages:	60

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

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EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 1. Summary of Test Results

Manufacturer: Grayson Wireless

Model No.: EAC – 2000D

Serial No.: NONE

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 22, Subpart H.

☐

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

TESTED BY: Tom Tidwell DATE: 7/29/99 – 8/2-99

Ron Gaytan DATE: 8/4/99

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EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	22.913(a)	500W ERP	15 W/ch. Fwd. .1 W/ch. Rvs.	Complies
Occupied Bandwidth (Voice & SAT)	22.917(c)	Mask	N/A	N/A
Occupies Bandwidth (Wideband Data)	22.917(d)	Mask	Graph	Complies
Occupied Bandwidth (ST)	22.917(d)	Mask	N/A	N/A
Occupied Bandwidth (Digital)	None	Mask	Graph	Complies
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	Graph	Graph
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	Graph	Graph
Frequency Stability	22.355	1.5 ppm	N/A	N/A

Footnotes:

- (1) Since the digital controller, IF cards, and amplifier provide only digitally modulated waveforms (TDMA) and wideband overhead data, only these two waveforms were tested.
- (2) The IF cards use a common reference oscillator. Data is presented in the submission showing stability of the reference oscillator.

Test Conditions:

Indoor Temperature: 25°C
 Humidity: 23%

Outdoor Temperature: 37°C
 Humidity: 23%

.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 2. General Equipment Specification

Supply Voltage Input: 230 VAC

Frequency Range: Downlink: 869 – 894 MHz

Frequency Range: Uplink: 824 – 849 MHz

Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	NADC (DXW)	CDPD (F9W)	AMPS (F8W, F1D)
	☐	☐	☒	☐	☒

Output Impedance: 50 ohms

Max Input Power: -40 dBm

RF Output (Rated):	Downlink:	15 watts per channel / 150 watts total
	Uplink:	.1 watts per channel / 1 watt total

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

Band Selection:	Software	Duplexer Change	Fullband Coverage
	☒	☐	☐

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Description of Modifications For Class II Permissive Change

The manufacturer is offering a TDMA(IS-136) channel kit to as an installed option to the EAC-2000 Repeater (FCC ID. BCR9GB2000). This kit consists of:

- (1) TDMA IF module
- (2) 45 linear power amplifier
- (3) Upgraded control module

The EAC-2000 product is a channelized repeater, therefore a TDMA channel kit can be installed alongside of existing analogue channels. Up to 11 TDMA channel kits can be installed in a system.

Changes in the control module have been made to allow the EAC-2000 to process both analogue and TDMA signals. This modification consists of:

- (1) Additional microprocessor memory.
- (2) Addition of a setup/service connector to allow for direct communication with TDMA cards.

Power output and frequency range are not changed from the originally approved EAC-2000 product.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Modifications Made During Testing

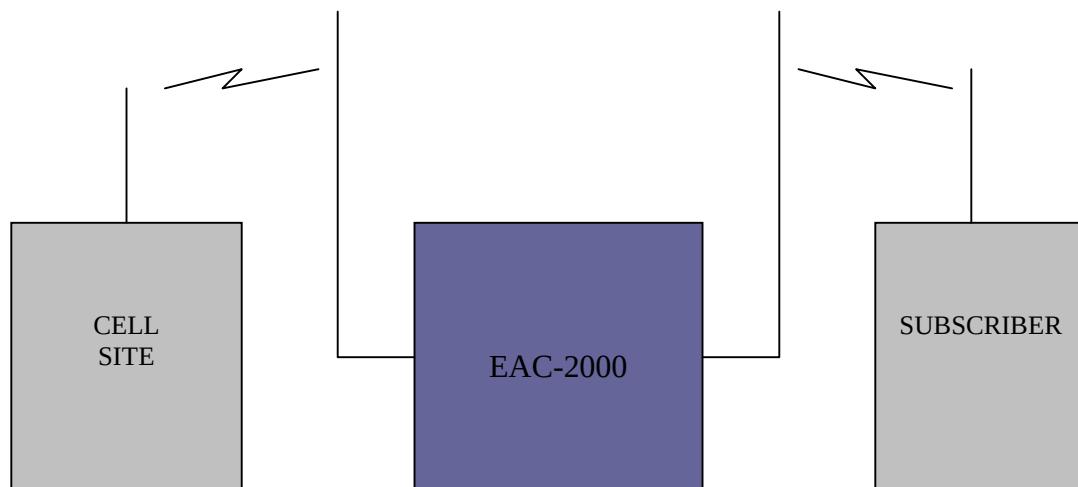
NOT APPLICABLE

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Theory of Operation

The EAC-2000D is a TDMA digital channel kit for the EAC-2000 analogue cellular coverage enhancer (FCC ID. BCR9GB2000). The kit consists of : a TDMA IF card, a TDMA Controller card, and a TDMA 45 Power Amplifier. The kit can be installed in combination with analogue channels. The EAC-2000D is used to extend coverage in areas not adequately covered by cellular base stations. The EAC 2000D is provided in either a five channel or ten channel version. The five channel version operates at 20 watts per channel for a total of 100 watts and the ten channel version operates at 15 watts per channel for a total of 150 watts.

System Diagram



EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Tom Tidwell	DATE: 7/30/99

Test Results: Complies.

Measurement Data:

	Modulation Type	Per Channel Power Output (dBm)	Composite Power Output (dBm)
Uplink	AMPS	N/A	N/A
Downlink	AMPS	N/A	N/A
Uplink	CDMA	N/A	N/A
Downlink	CDMA	N/A	N/A
Uplink	GSM	N/A	N/A
Downlink	GSM	N/A	N/A
Uplink	NADC	+20.0	+30.0
Downlink	NADC	+41.8	+51.8
Uplink	CDPD	N/A	N/A
Downlink	CDPD	N/A	N/A

NOTE: These forward link power levels are valid for channels 991 – 798 (869.040 MHz – 893.940 MHz) only. The forward link power output at channel 799 is reduced to 2 watts per channel to comply with the $43 + 10 \log (P)$ specification limit outside the assigned band. Please refer to plot 14 on page 28.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (Voice + SAT)	PARA. NO.: 2.917(c)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Test Data: See attached graph(s).

NOT APPLICABLE

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

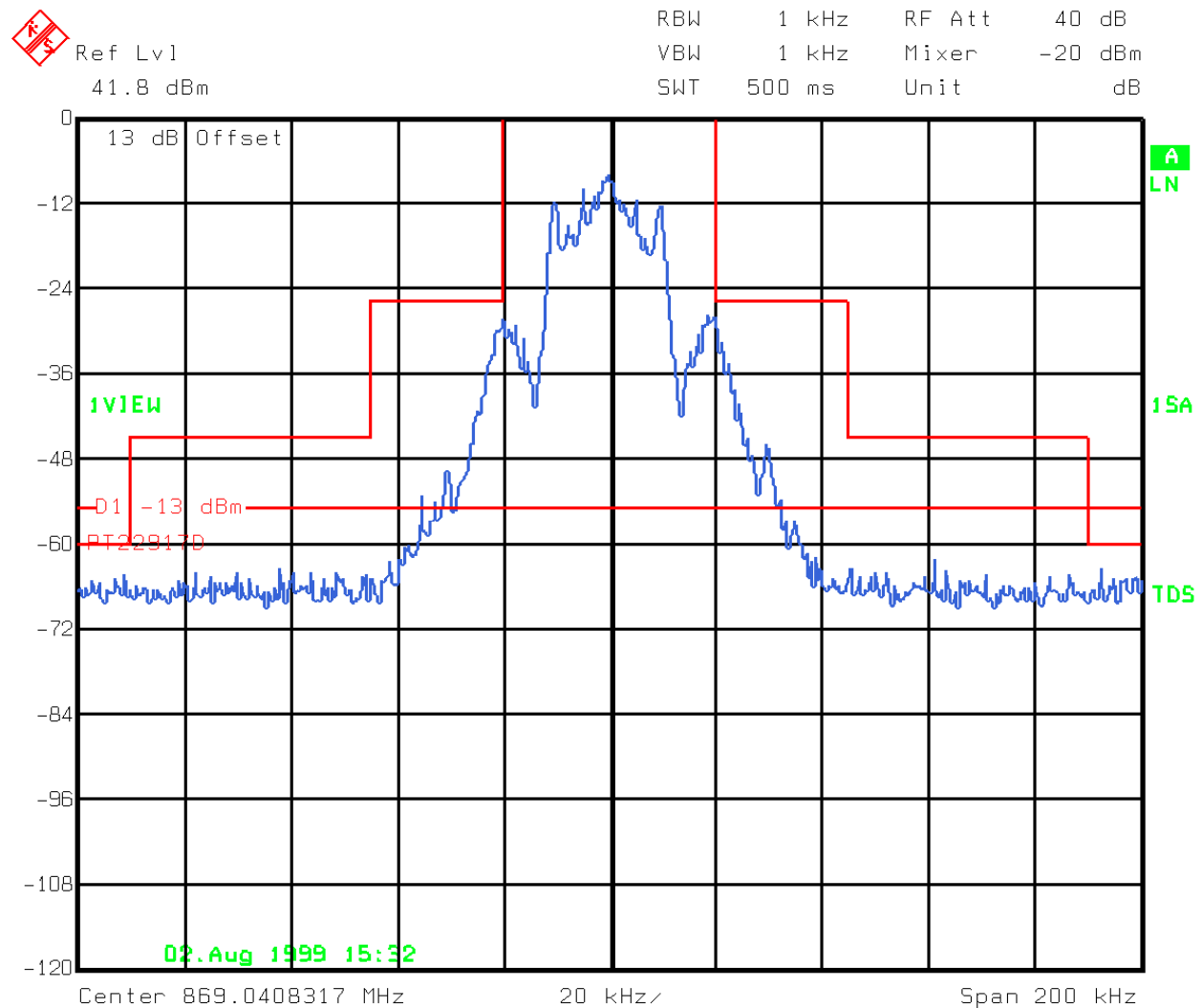
NAME OF TEST: Occupied Bandwidth (WB Data)	PARA. NO.: 2.917 (d)
TESTED BY: Tom Tidwell	DATE: 8/2/99

Test Results: Complies.

Test Data: See attached graph(s).

See following plots.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Occupied Bandwidth - Forward Channel
Comment A: Channel 991
Date: 2.AUG.1999 15:32:31

Plot 1

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Occupied Bandwidth (ST)	PARA. NO.: 2.917(d)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Test Data: See attached graph(s).

NOT APPLICABLE

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

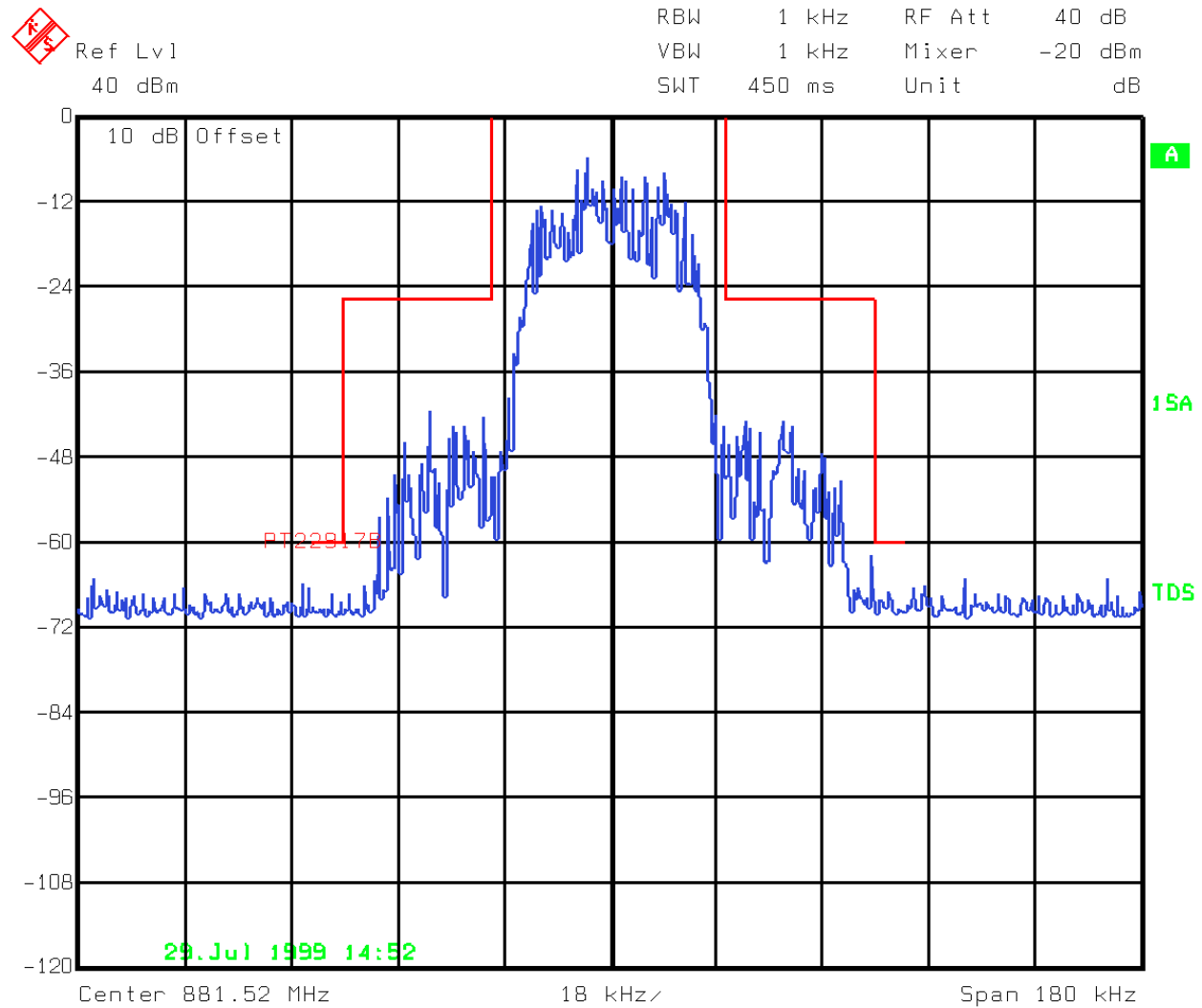
NAME OF TEST: Occupied Bandwidth (Digital Mod.)	PARA. NO.: 2.917(e)
TESTED BY: Tom Tidwell	DATE: 7/29/99

Test Results: Complies.

Test Data: See attached graph(s).

See following plots.

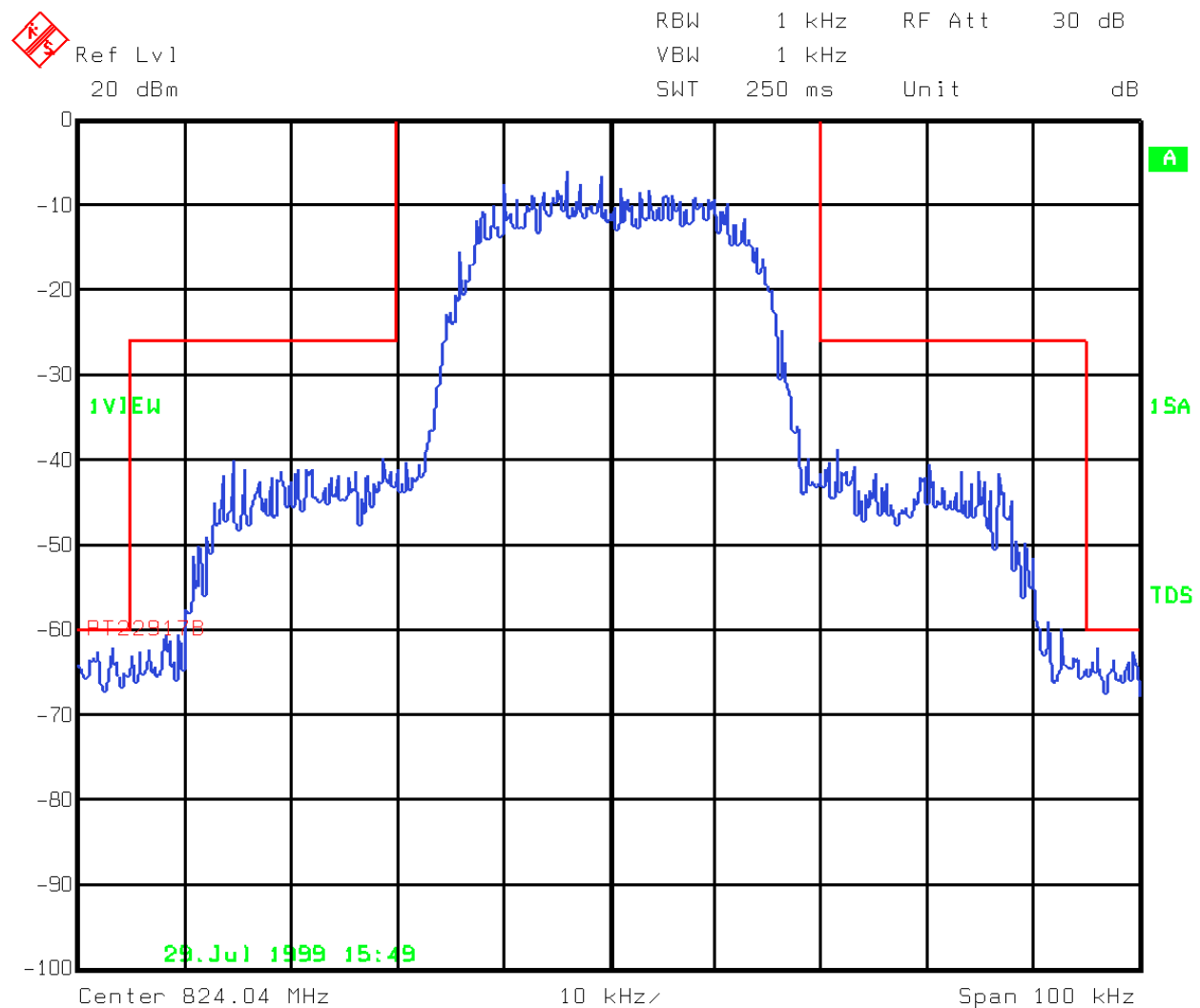
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Occupied Power Bandwidth - Forward Channel 384
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 29.JUL.1999 14:52:16

Plot 2

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Occupied Power Bandwidth - Reverse Channel 991
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 15:50:06

Plot 3

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 5. Spurious Emissions at Antenna Terminals

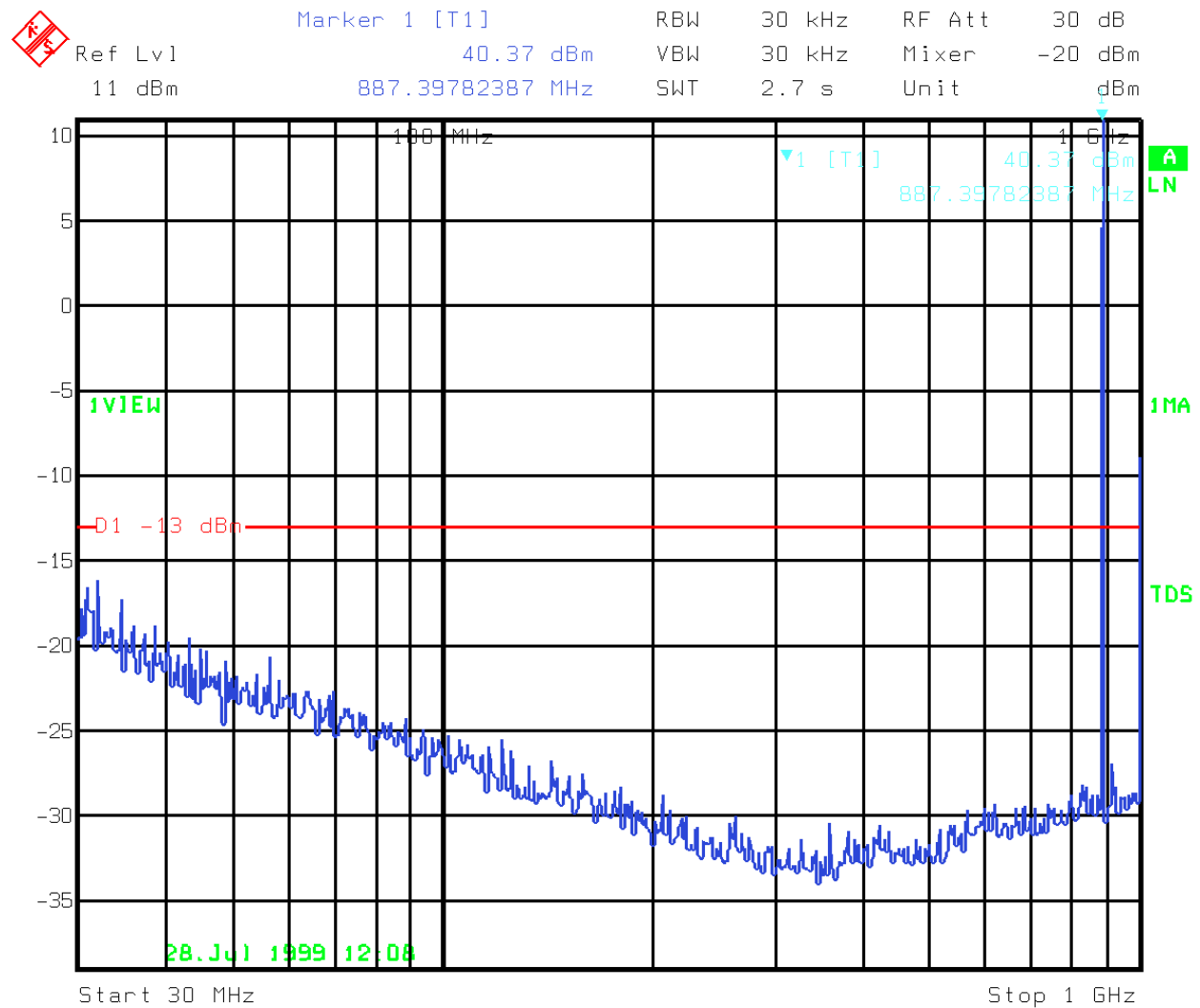
NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Tom Tidwell	DATE: 7/28/99

Test Results: Complies.

Test Data:

See following plots.

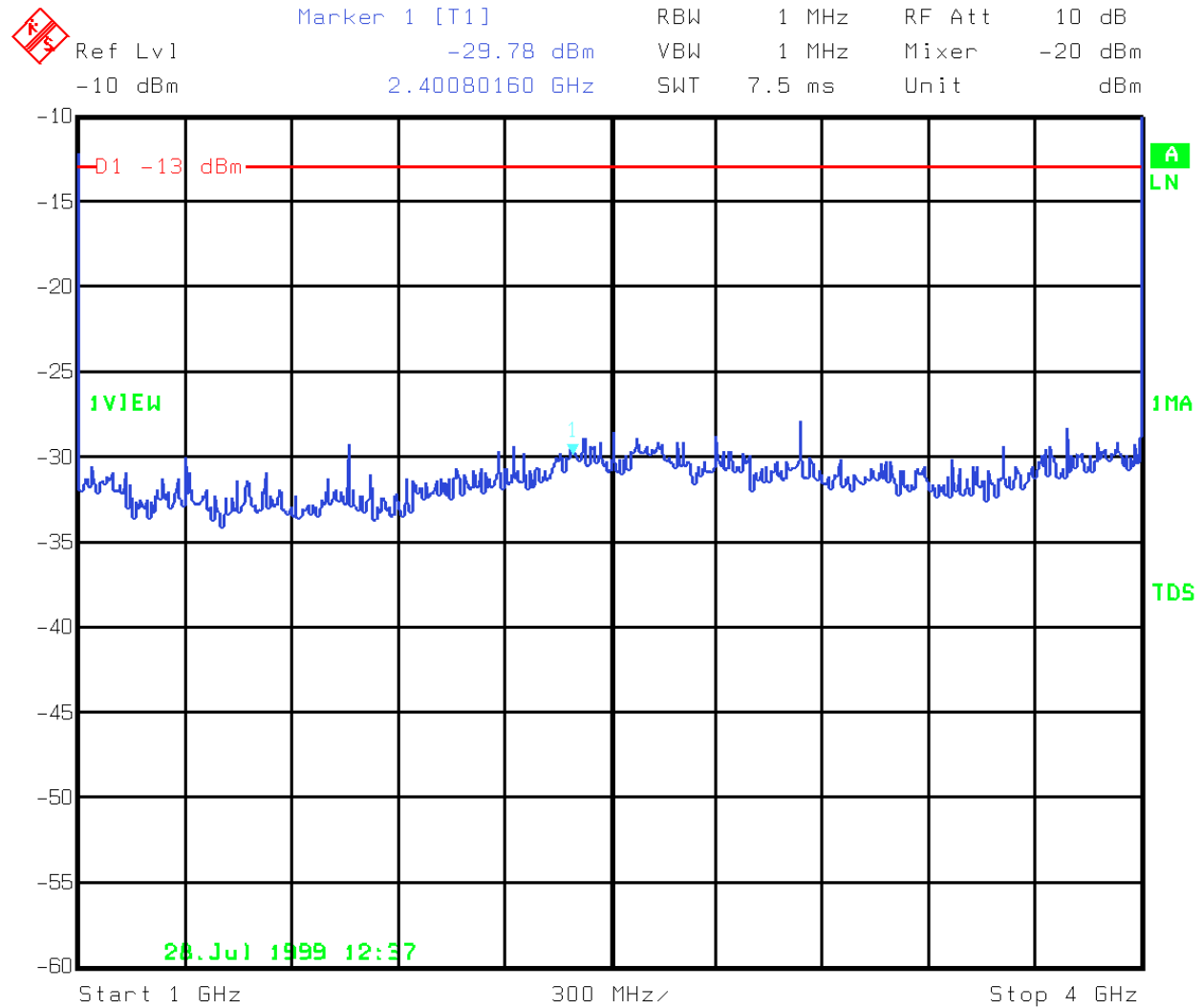
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Forward Channel 384
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 28.JUL.1999 12:08:50

Plot 4

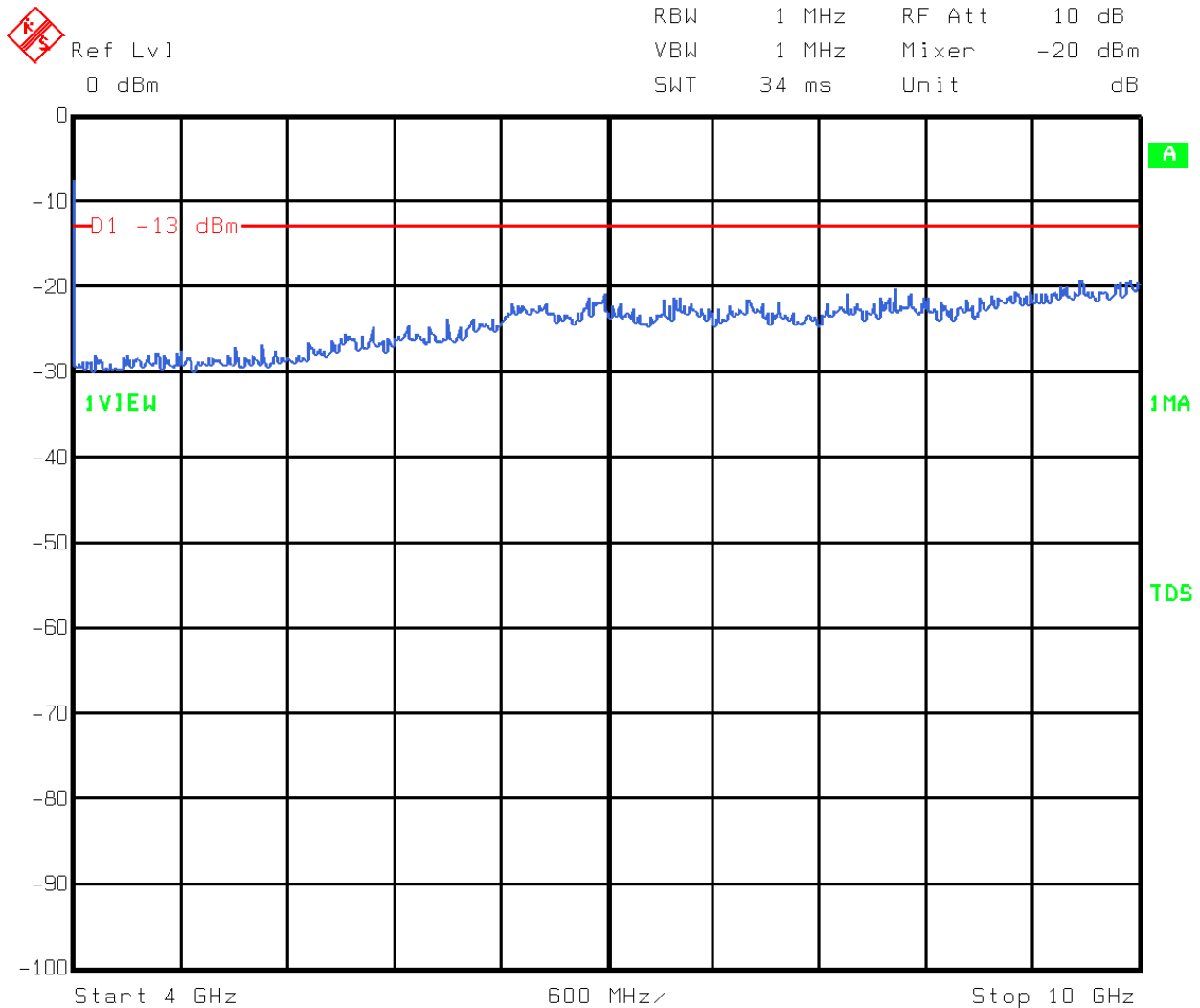
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Forward Channel 384
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 28.JUL.1999 12:37:59

Plot 5

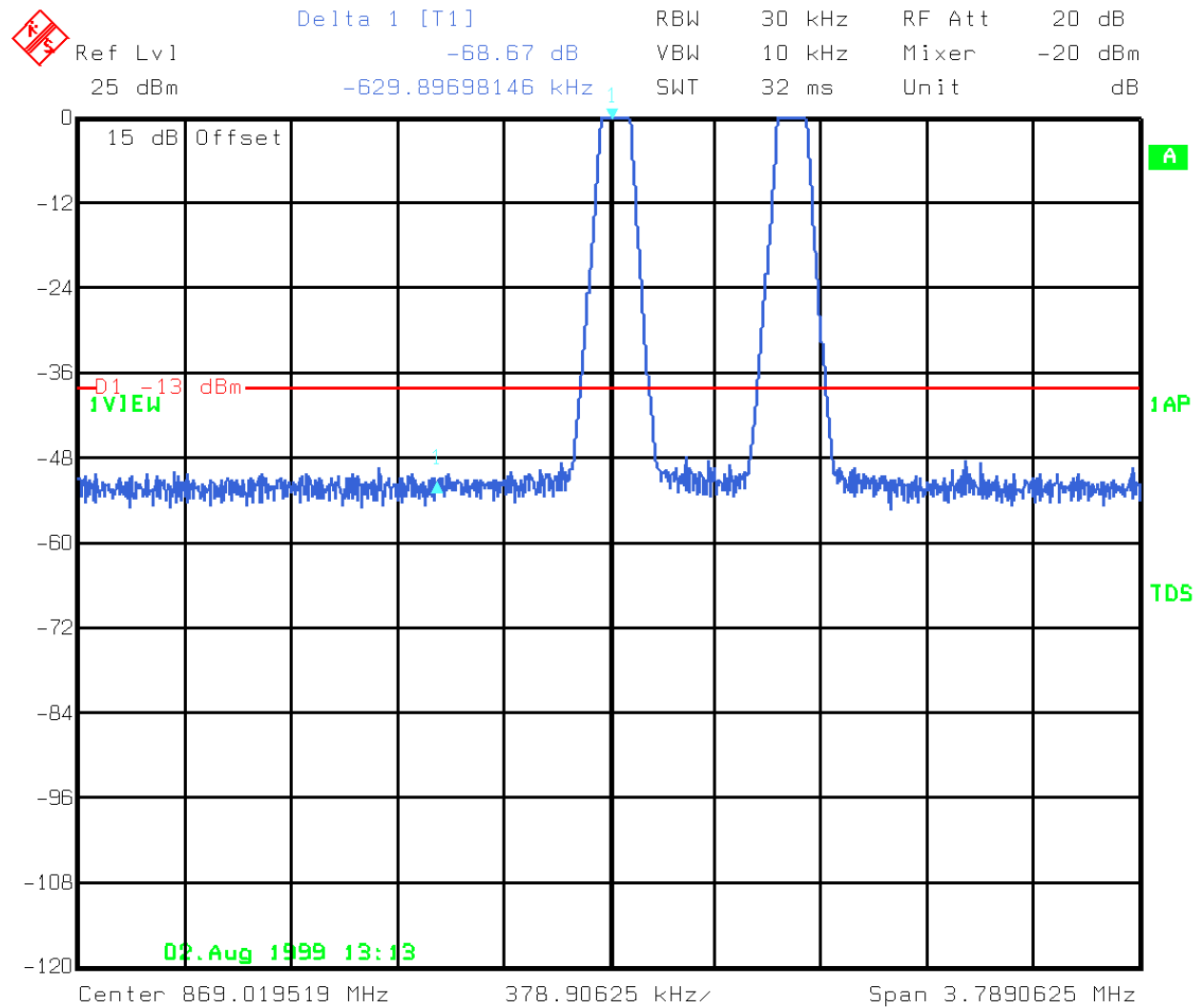
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Forward Channel
Comment A: TDMA Forward Channel 6 Slots, Pseudorandom Bit Stream
Date: 5.AUG.1999 14:09:52

Plot 6

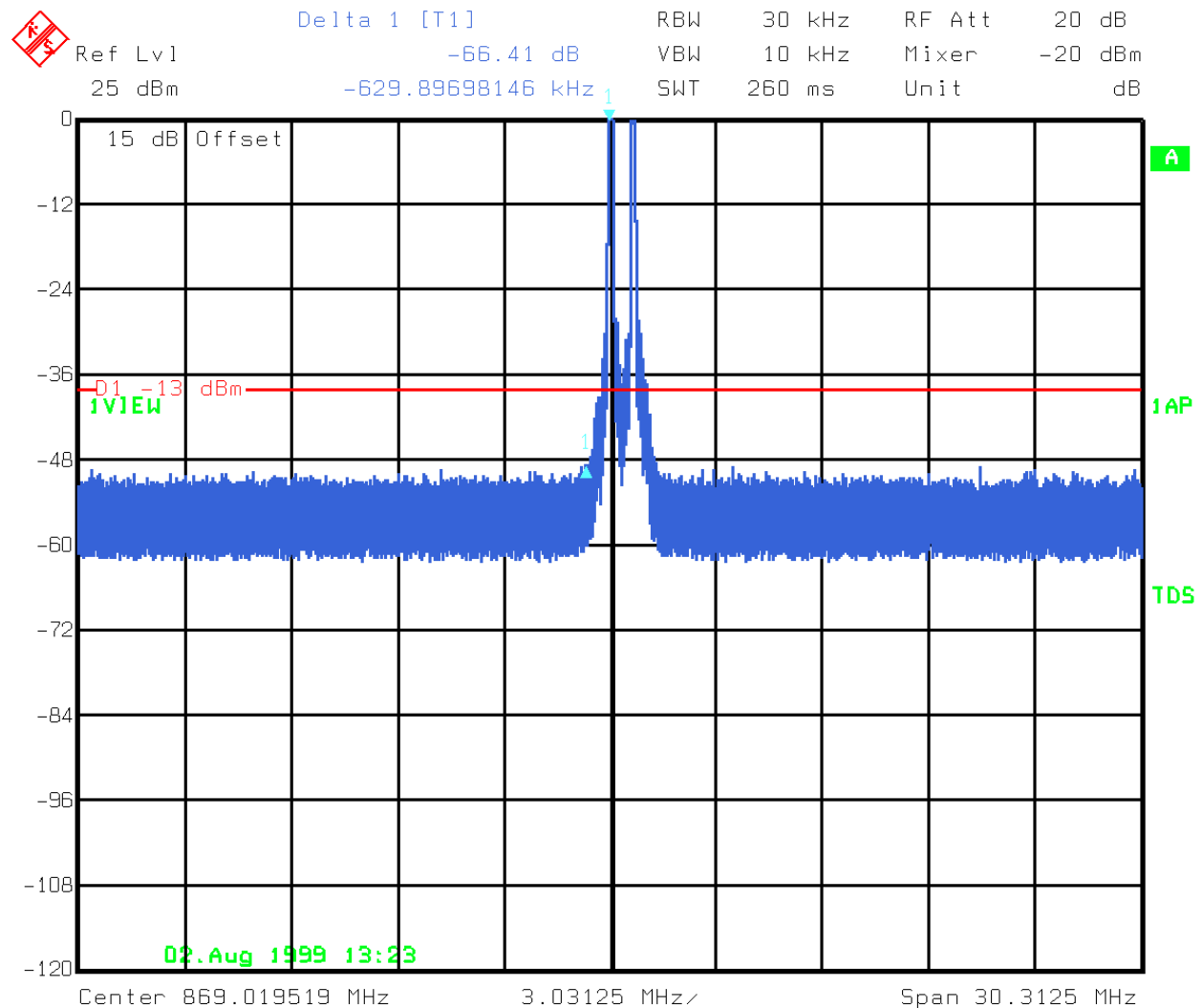
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation Spurious Emissions
Comment A: Forward Link - Channel 799 and Channel 1012
Date: 2.AUG.1999 13:13:48

Plot 7
TDMA INTERMODULATION

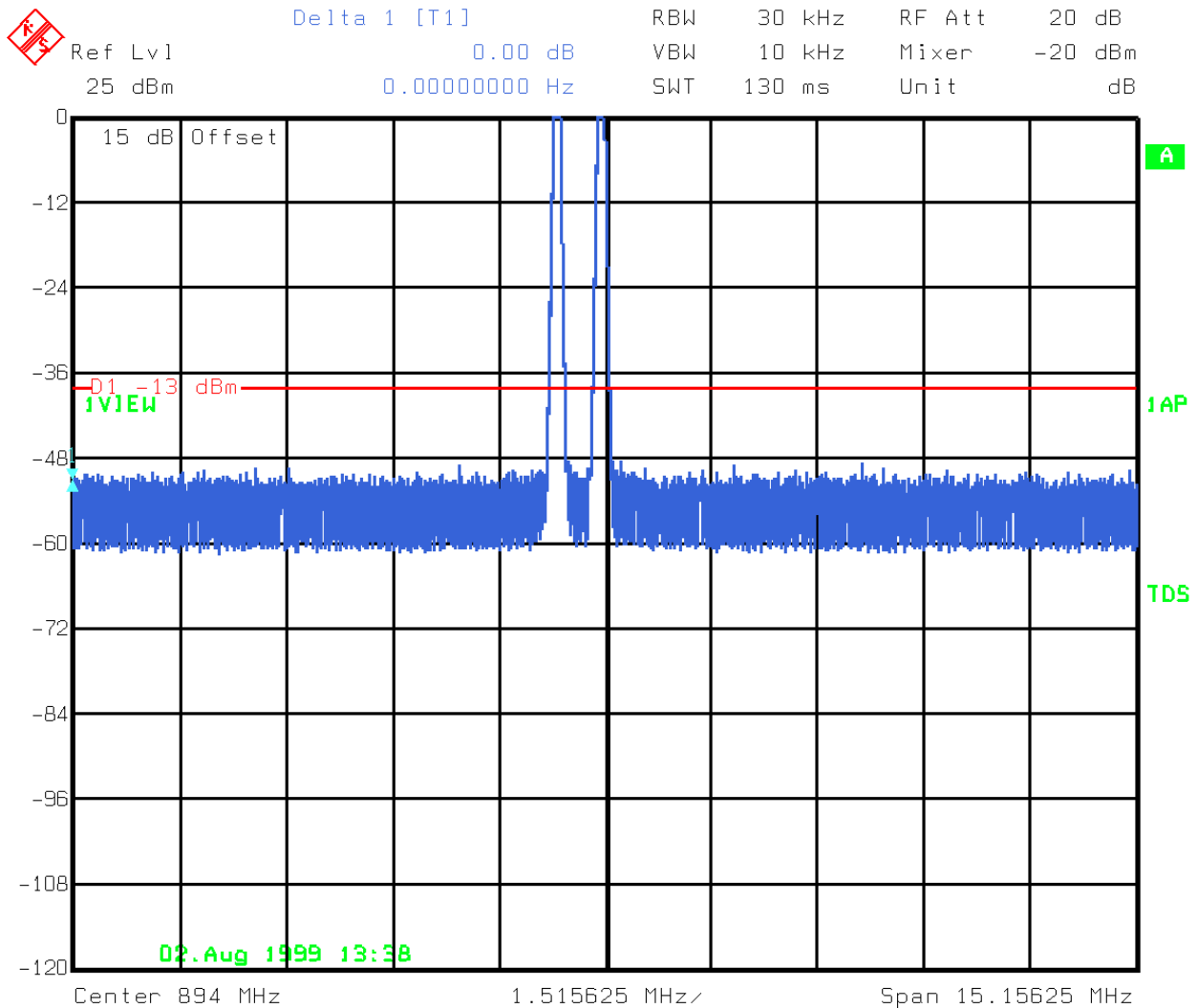
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation Spurious Emissions
Comment A: Forward Link - Channel 799 and Channel 1012
Date: 2.AUG.1999 13:23:41

Plot 8
TDMA INTERMODULATION

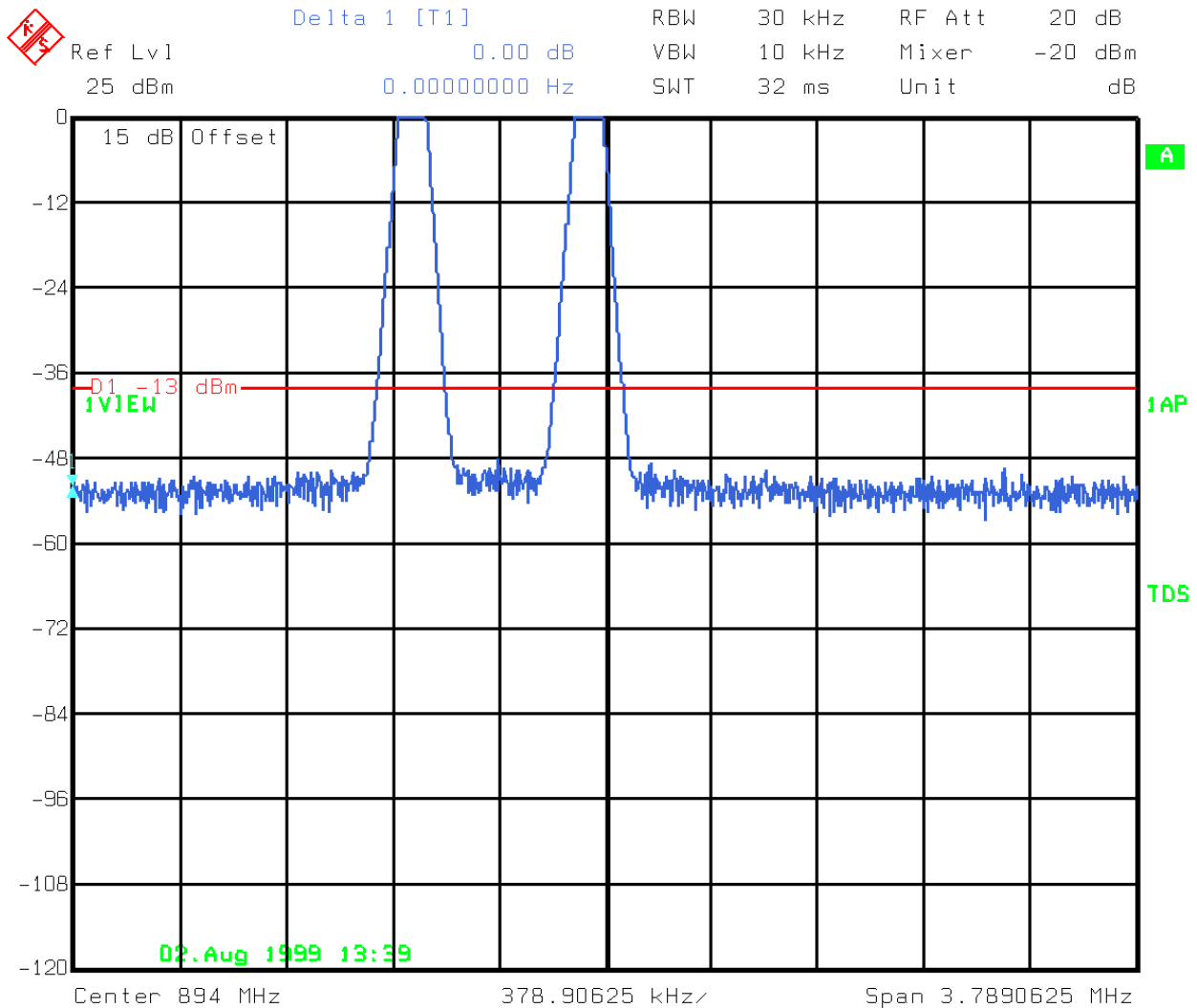
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation Spurious Emissions
Comment A: Channels 777 and 798 / 15 W per channel
Date: 2.AUG.1999 13:39:00

Plot 9
TDMA INTERMODULATION

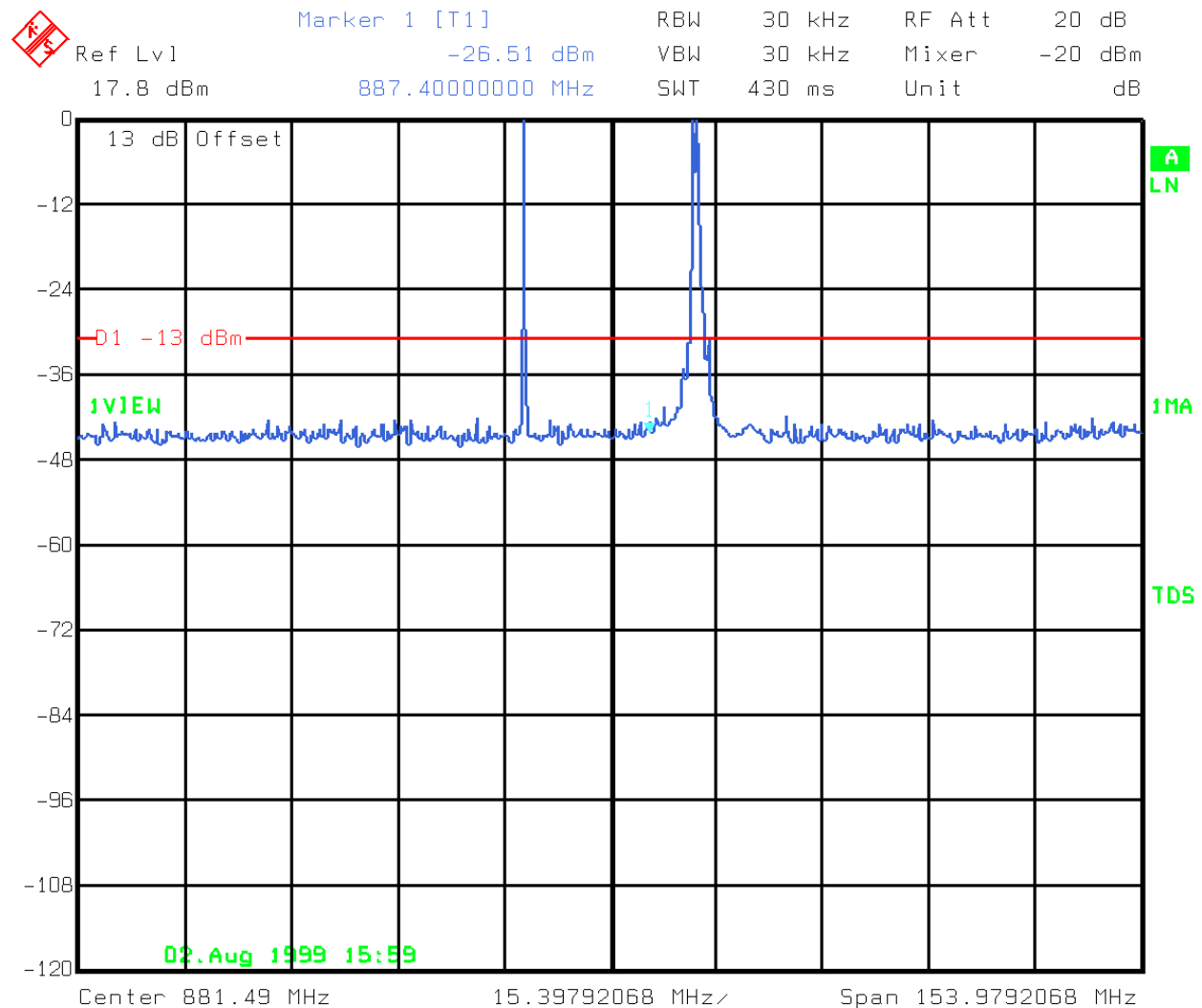
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation Spurious Emissions
Comment A: Channels 777 and 798 / 15 W per channel
Date: 2.AUG.1999 13:39:33

Plot 10
TDMA INTERMODULATION

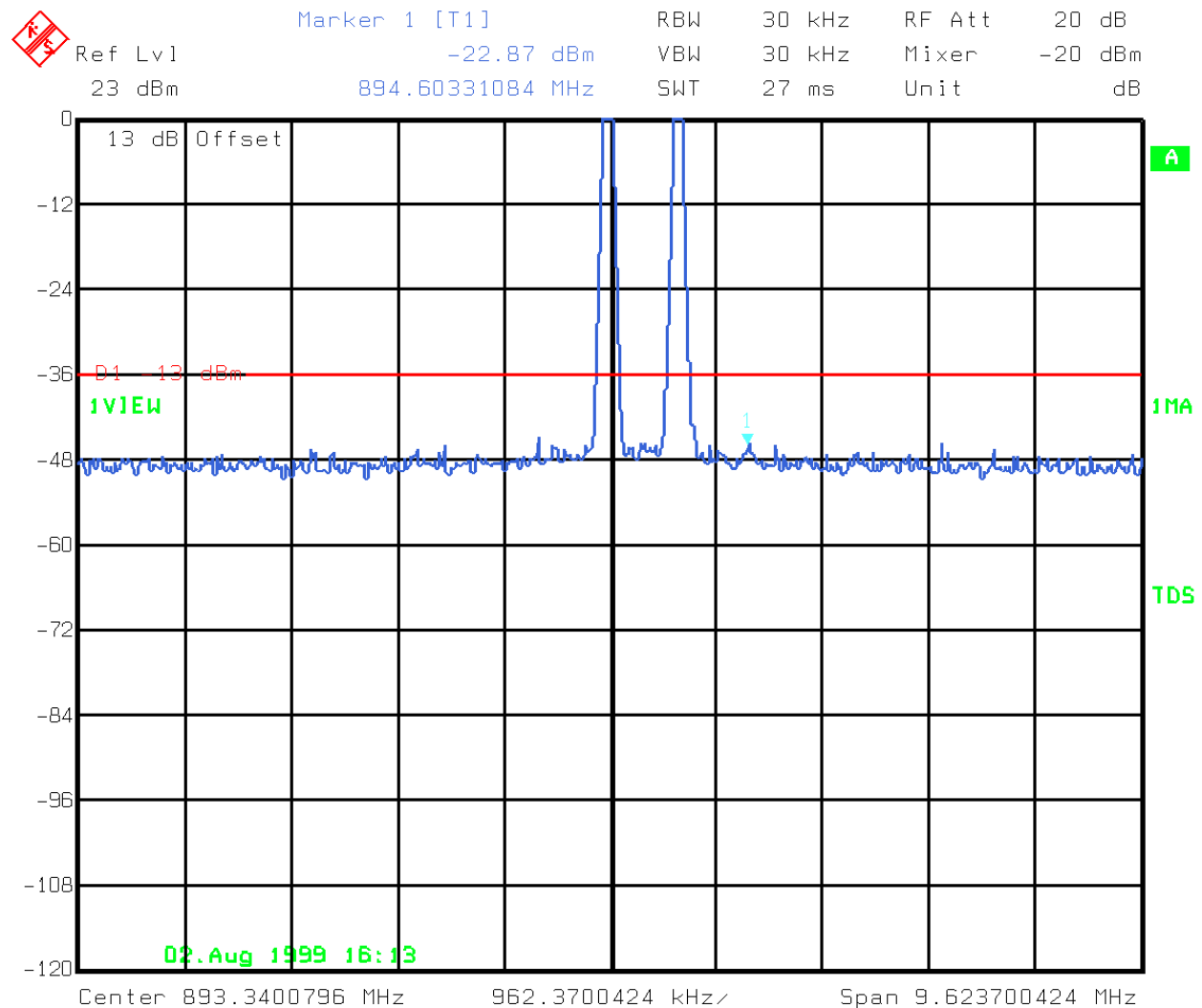
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation - Forward Channels 991, 777, & 798
Comment A: CW Carriers
Date: 2.AUG.1999 15:59:43

Plot 11
CW INTERMODULATION

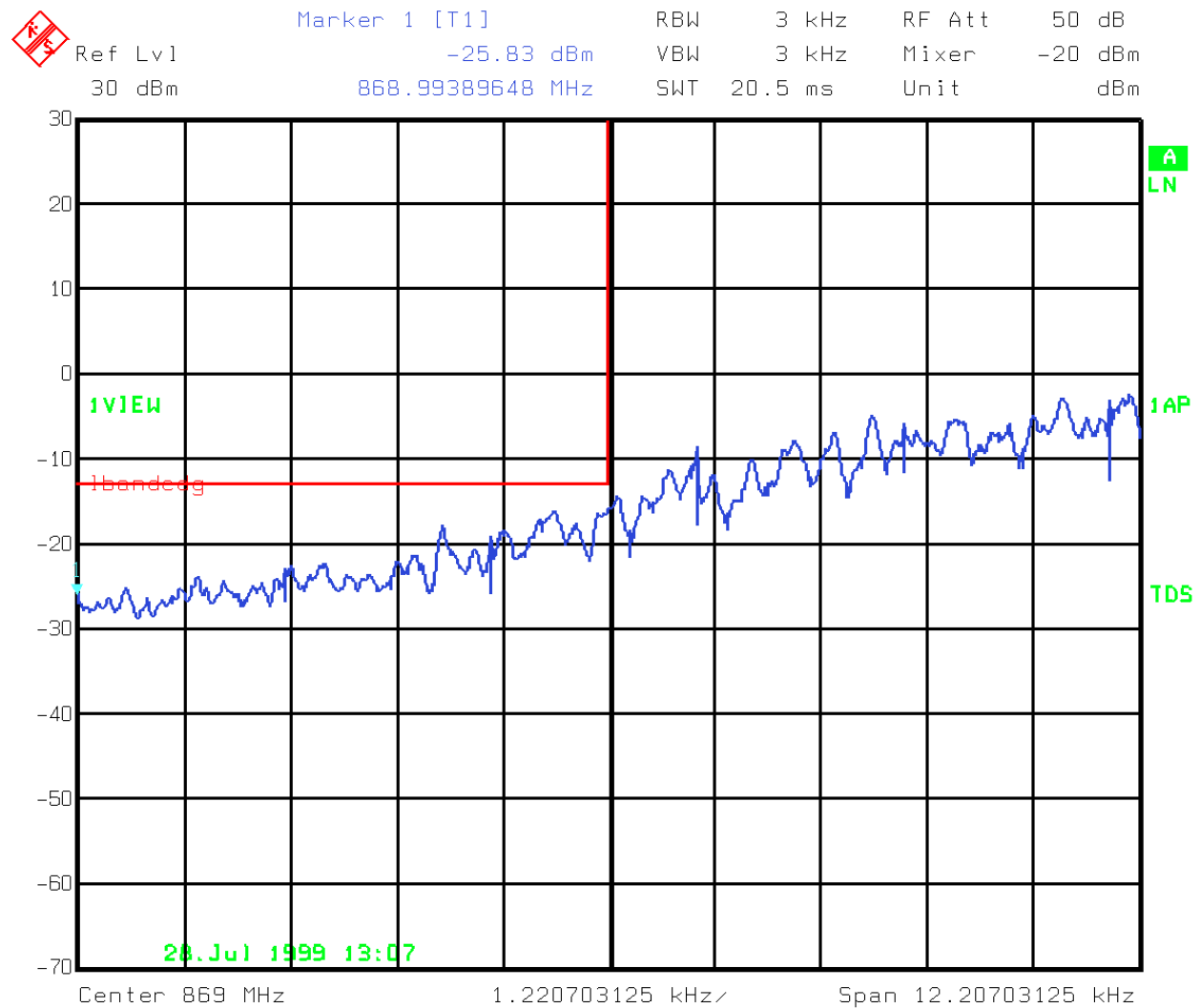
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Intermodulation - Forward Channels 991, 777, & 798
Comment A: CW Carriers
Date: 2.AUG.1999 16:13:23

Plot 12
CW INTERMODULATION

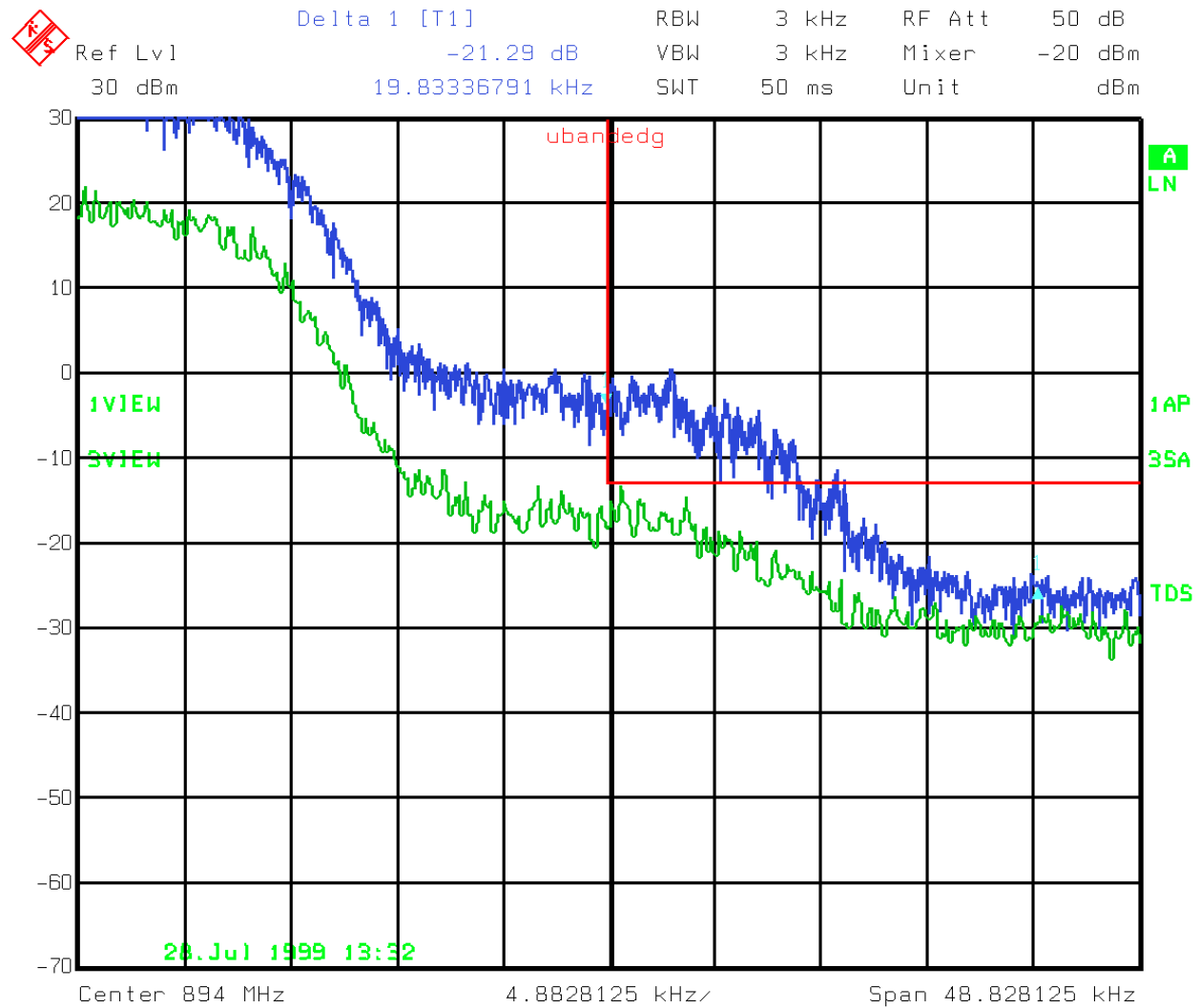
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Forward Channel 991
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 28.JUL.1999 13:08:01

Plot 13

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

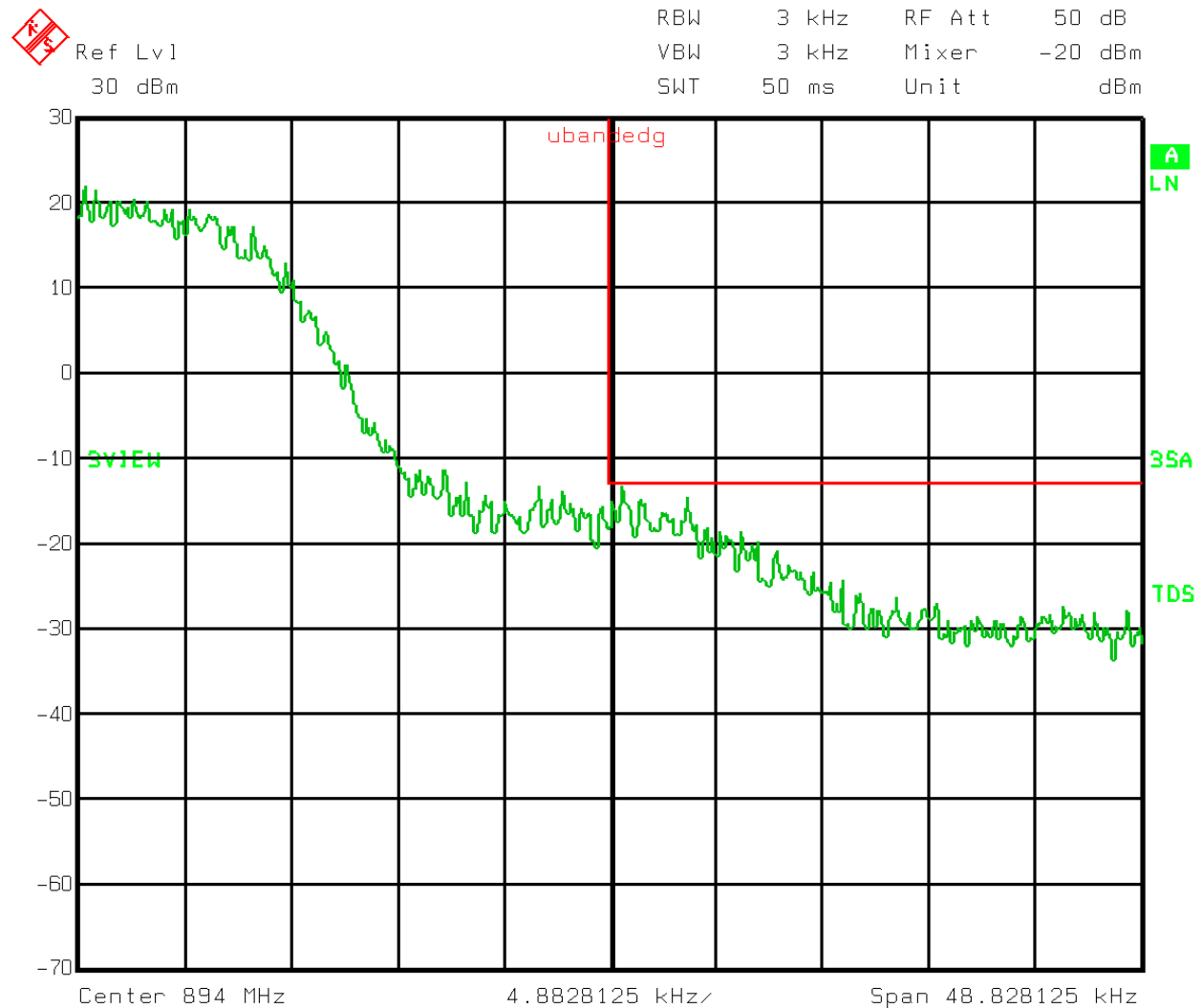


Title: Spurious Emissions - Forward Channel 799
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 28.JUL.1999 13:32:30

Plot 14

Plot showing 15 W (blue trace) and 2 W (green trace) results at channel 799

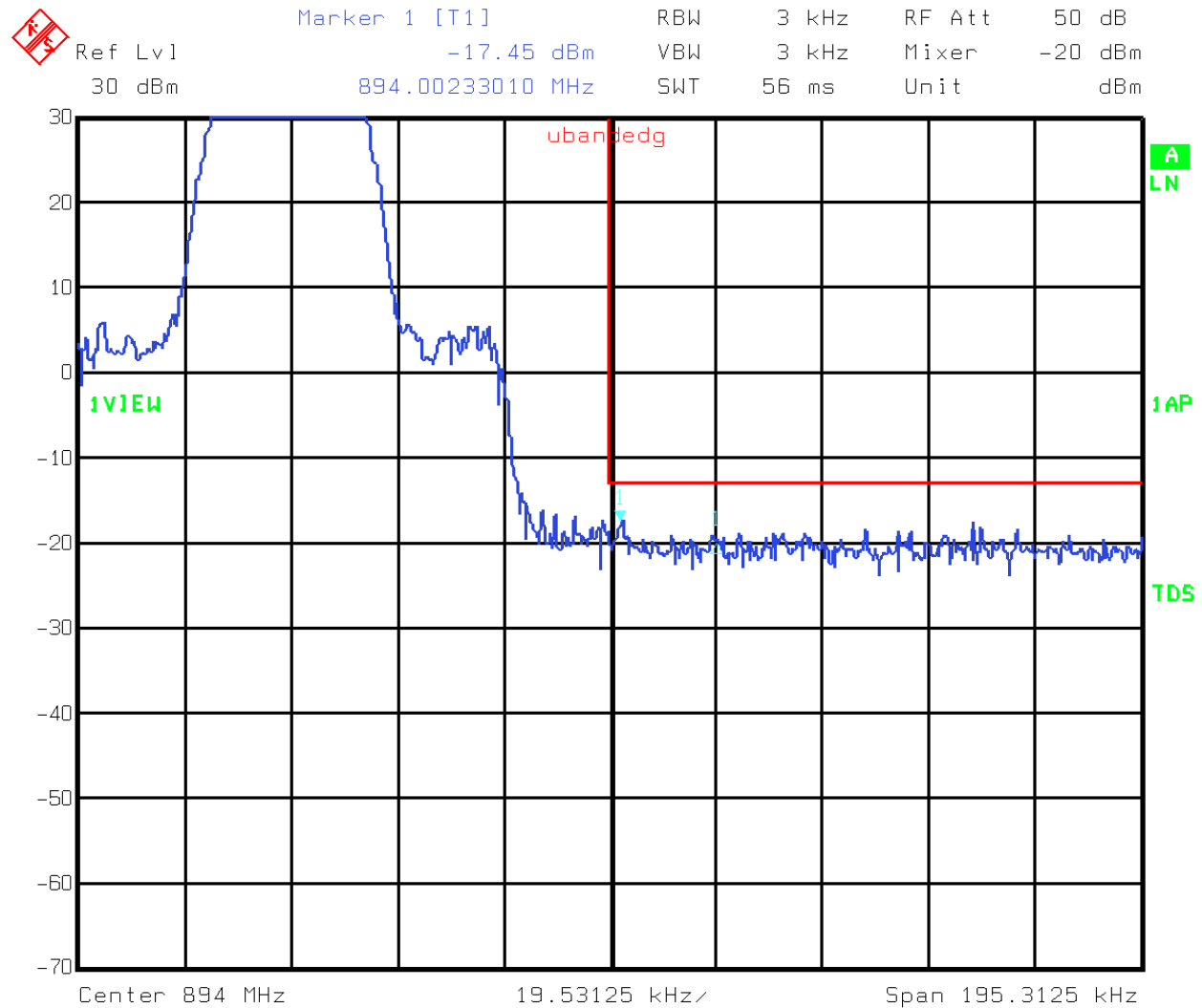
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Forward Channel 799
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 29.JUL.1999 11:21:17

Plot 15

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



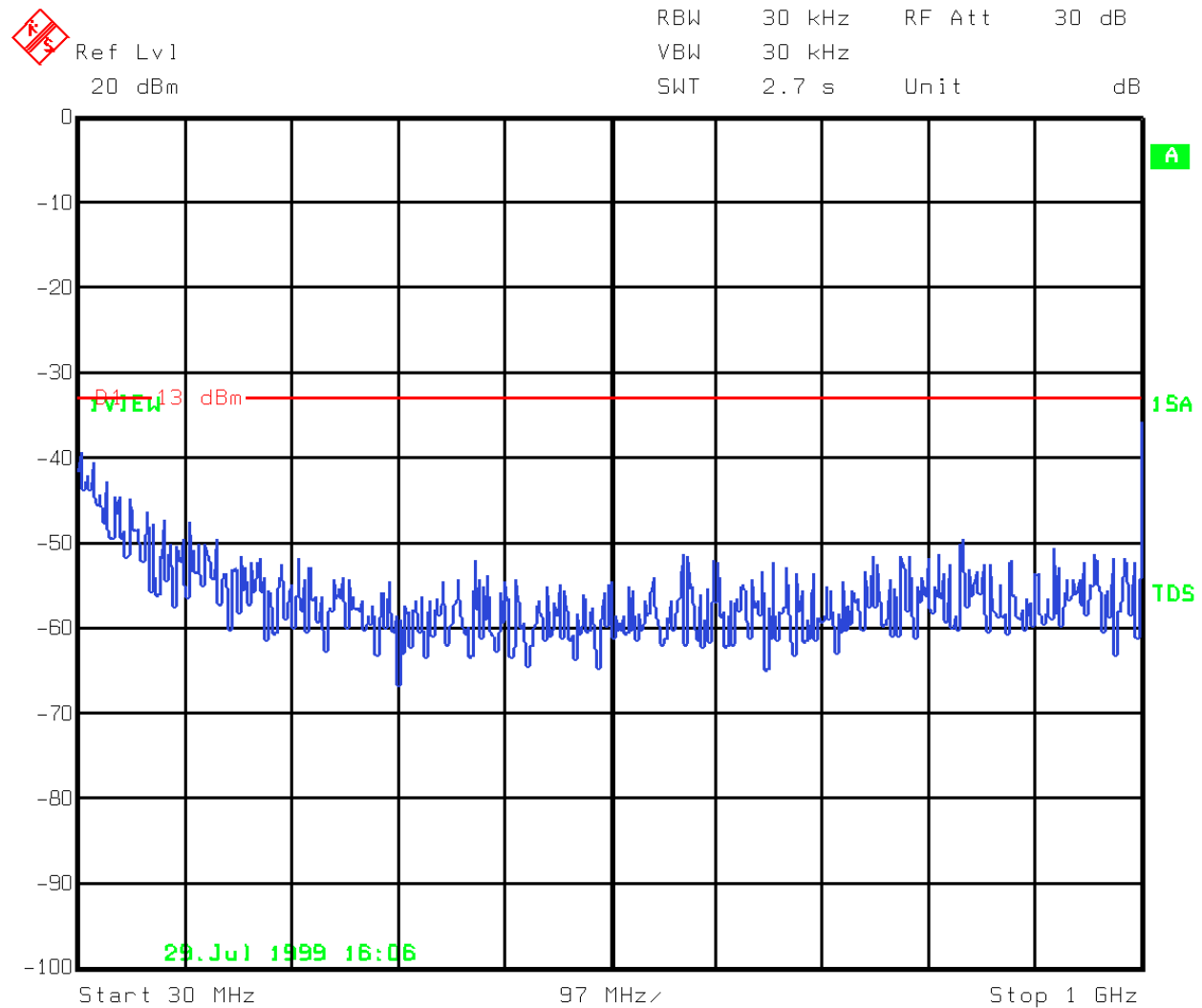
Title: Spurious Emissions - Forward Channel 798
Comment A: TDMA 6 time slots pseudorandom traffic
Date: 29.JUL.1999 11:30:23

Plot 16

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

REVERSE PATH RESULTS

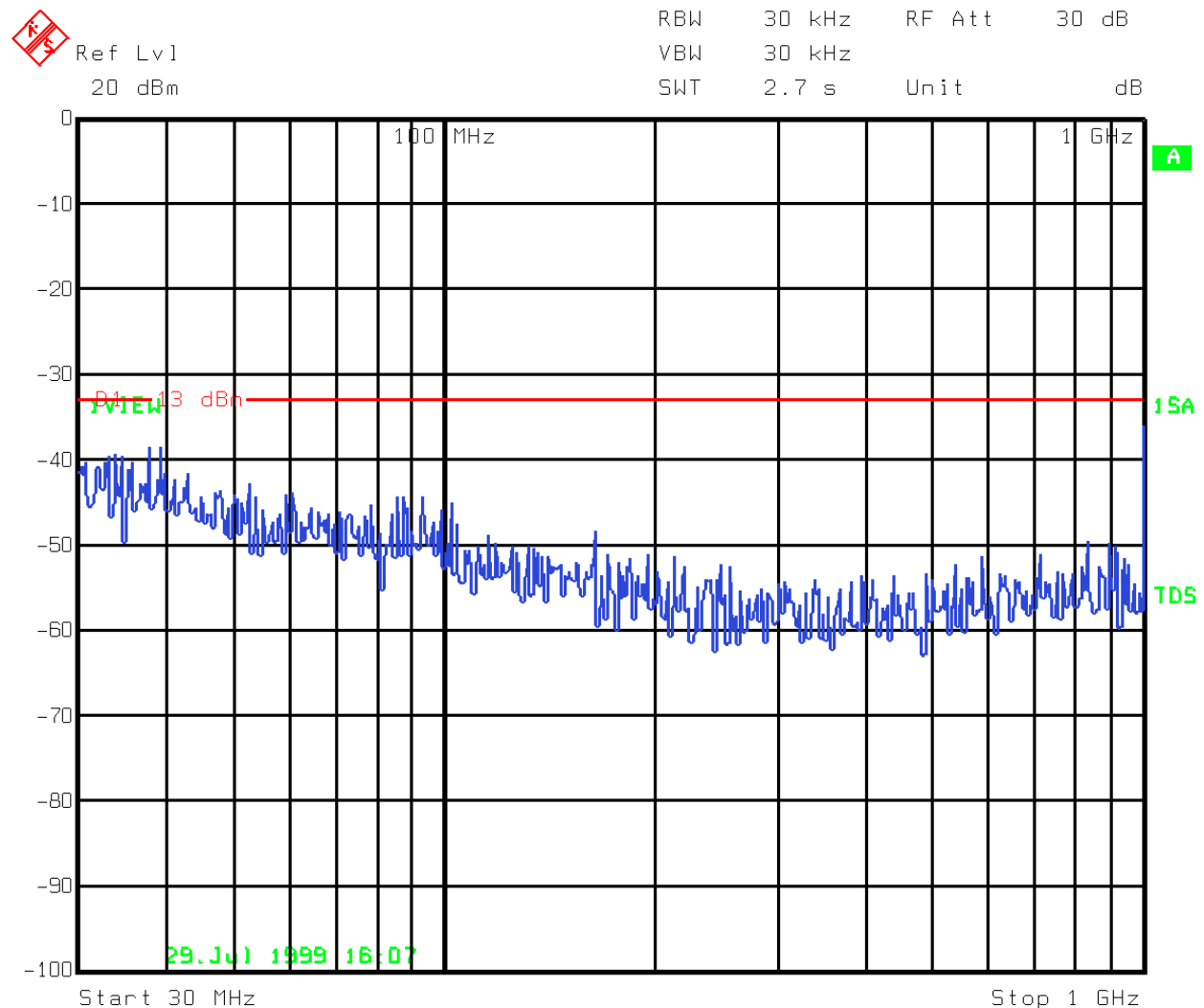
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Reverse Channel 384
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 16:07:02

Plot 17

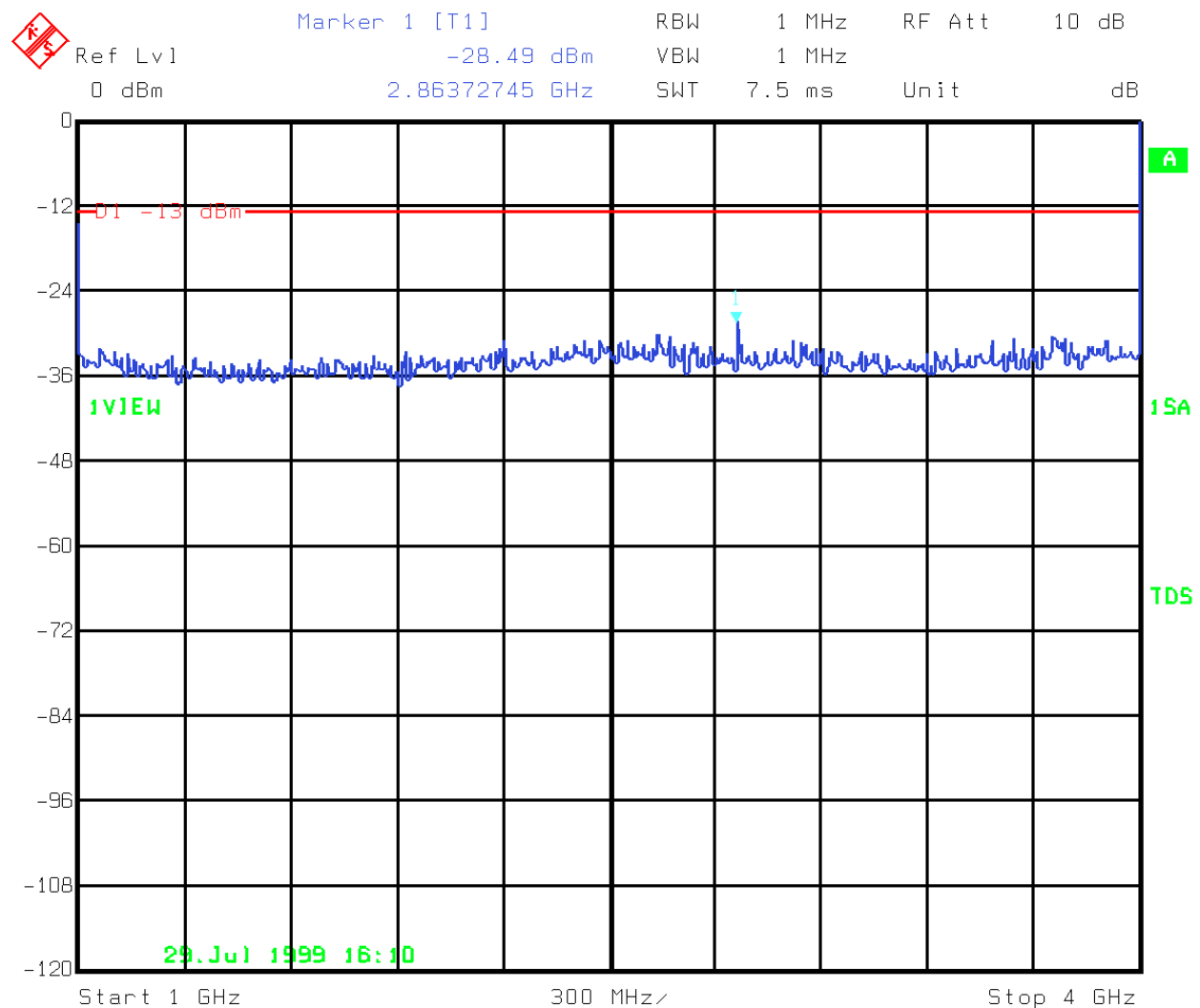
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Reverse Channel 384
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 16:08:02

Plot 18

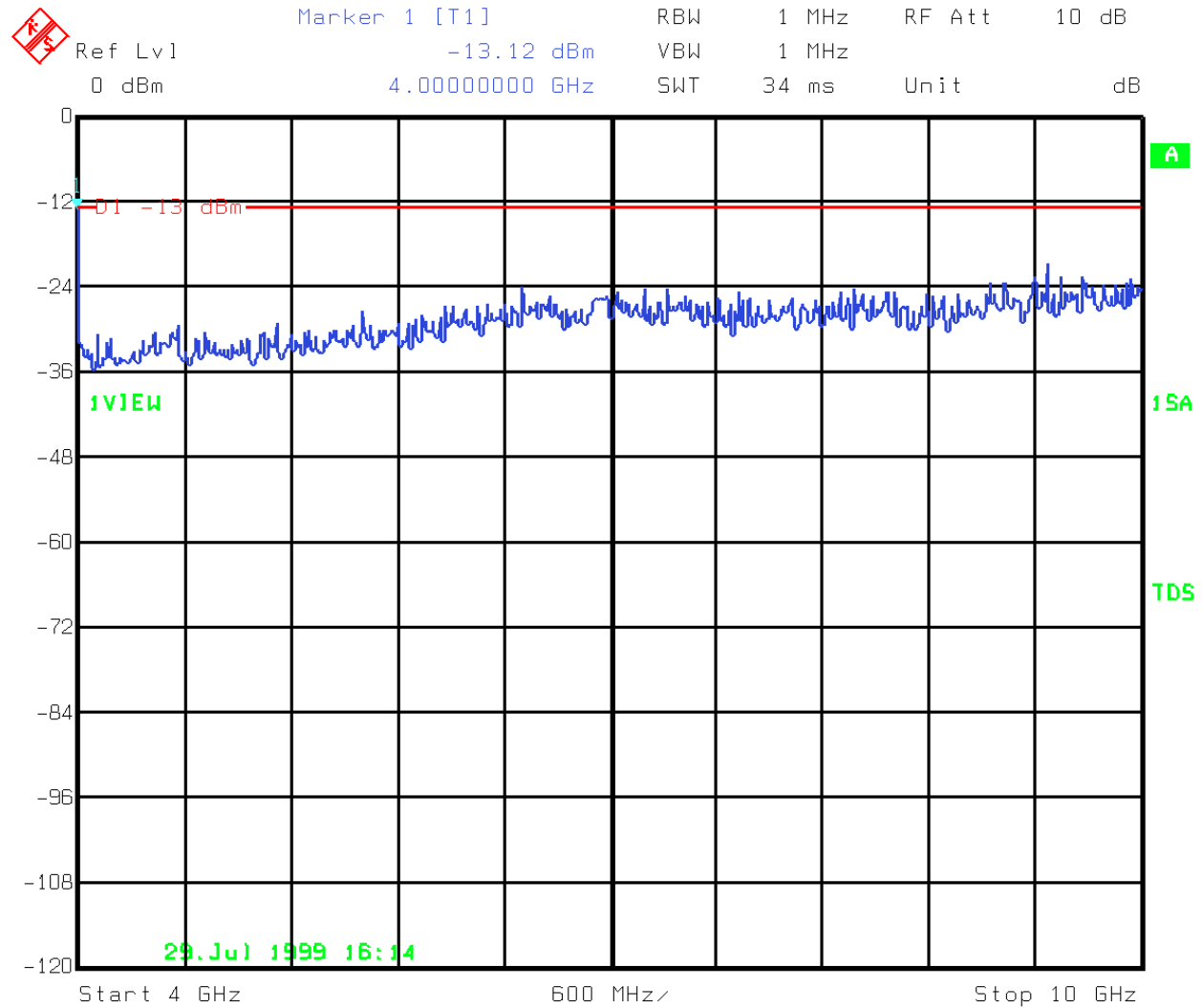
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Reverse Channel 384
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 16:11:13

Plot 19

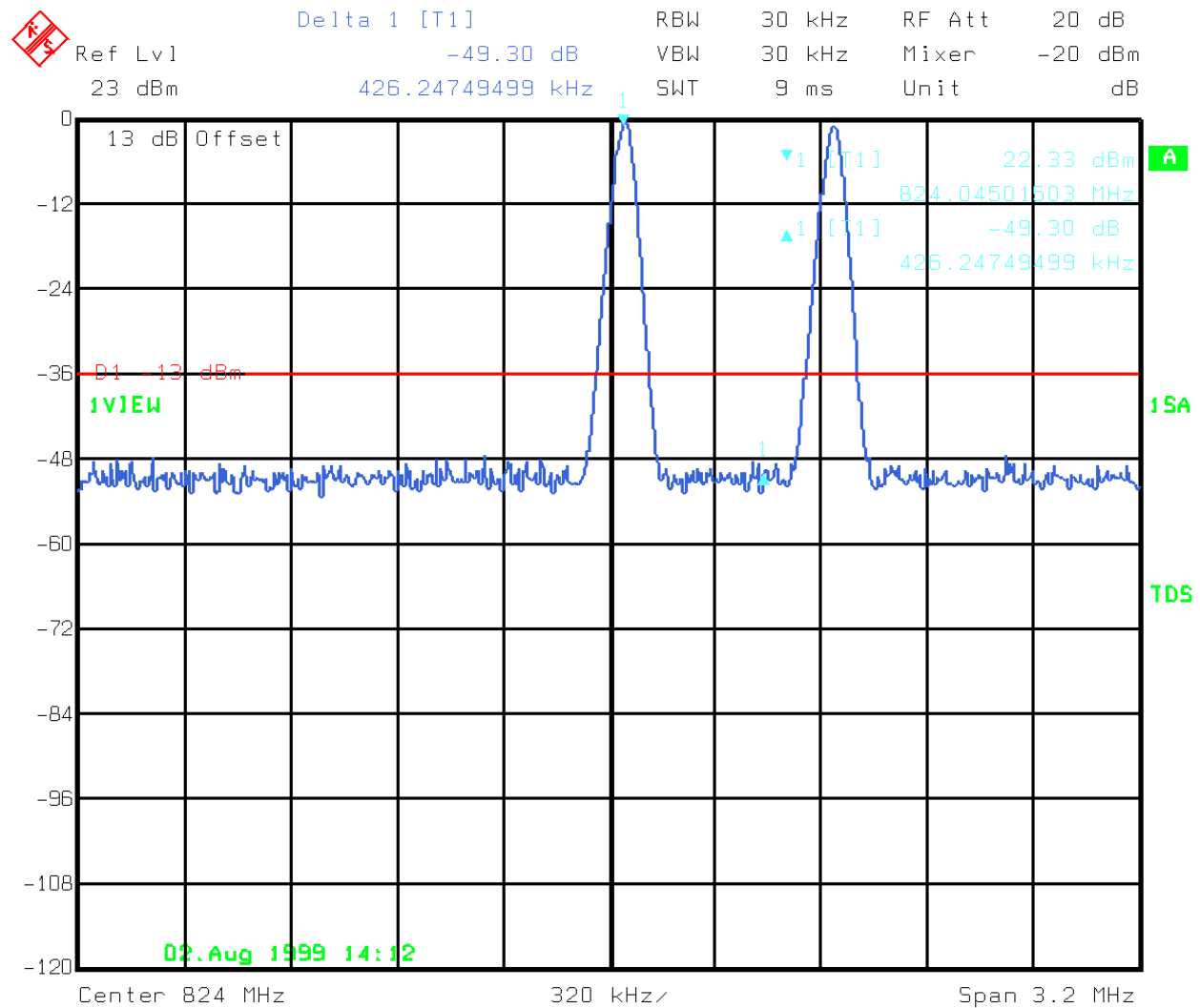
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Spurious Emissions - Reverse Channel 384
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 16:14:24

Plot 20

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

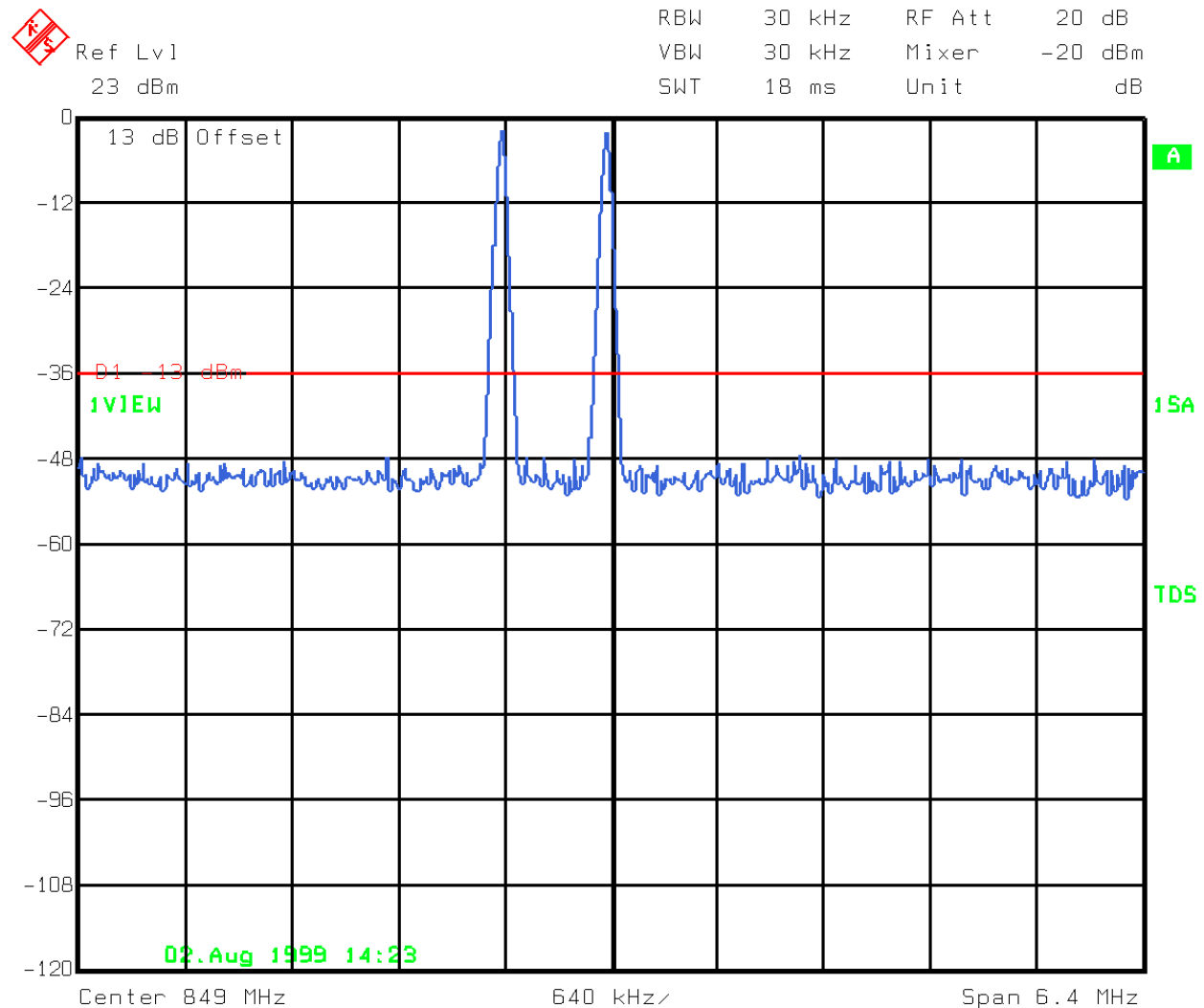


Title: Intermodulation Spurious Emissions - Reverse Direction
Comment A: Channels 999 and 1012 / .1 W per channel
Date: 2.AUG.1999 14:12:31

Plot 21

TDMA INTERMODULATION

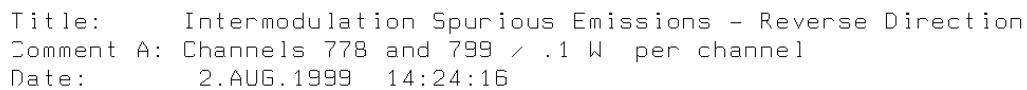
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



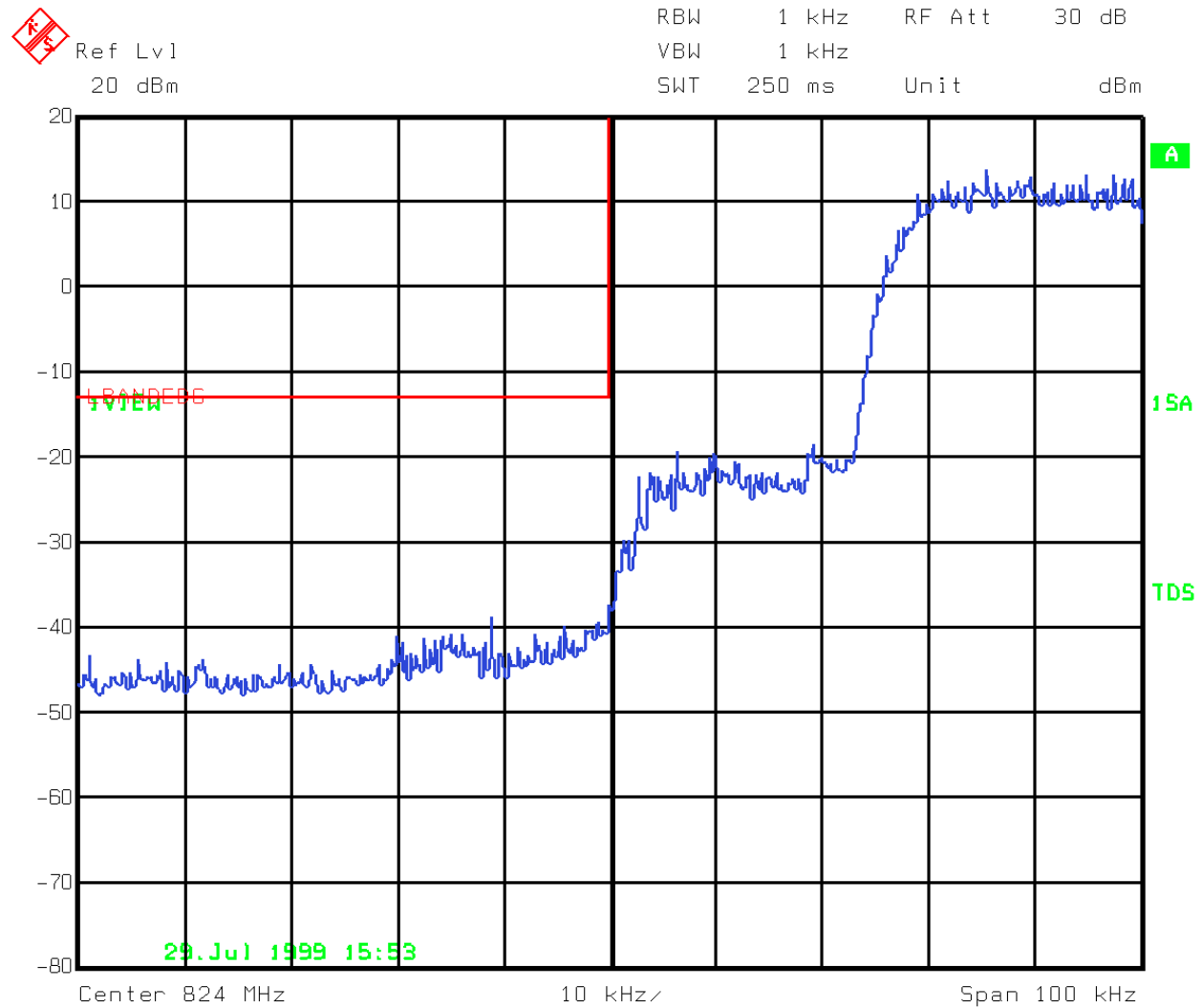
Title: Intermodulation Spurious Emissions - Reverse Direction
Comment A: Channels 778 and 799 / .1 W per channel
Date: 2.AUG.1999 14:23:39

Plot 22
TDMA INTERMODULATION

FCC ID: BCR9GB2000



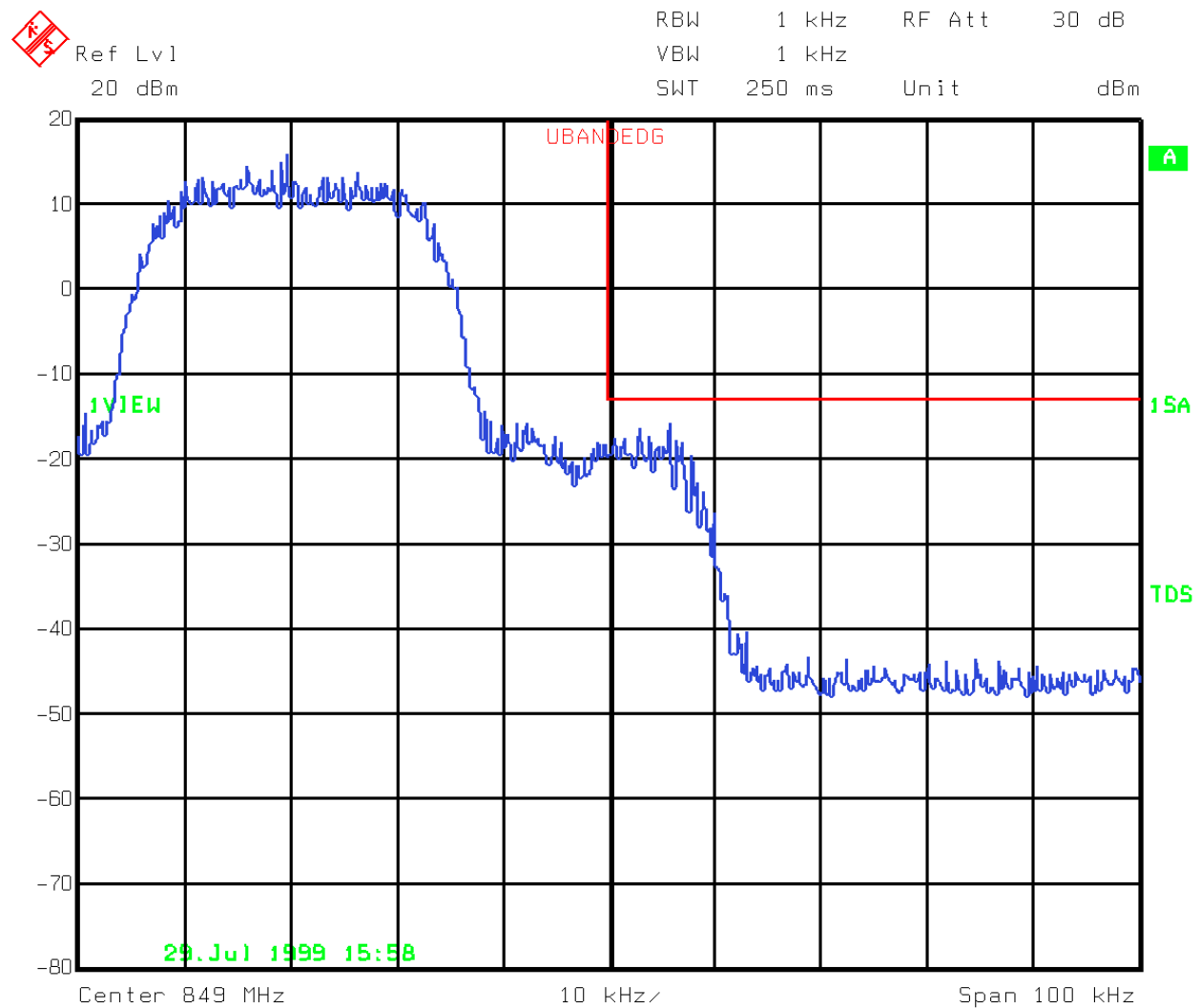
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Lower Band Edge Spurious - Reverse Channel 991
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 15:54:03

Plot 24

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000



Title: Upper Band Edge Spurious - Reverse Channel 799
Comment A: TDMA Reverse Channel pseudorandom traffic
Date: 29.JUL.1999 15:58:15

Plot 25

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.917(e)
TESTED BY: Ron Gaytan	DATE: 8/4/99

Test Results: Complies.
The maximum field strength is 61.3 dBμV/m @ 1738 @ 3m.

Test Data:

See following tables.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Test Data - Radiated Emissions



KTL Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Microwave Radiated Emissions Data

Complete ☐ Preliminary ☐ Page 1 of 2Client: Allen Telecom Test #: 1 W.O.#: 9L0234REUT: EAC-2000D Coverage Enhancer S/N: NONE Photo ID: 9L0234R MW-1Technician: Tom Tidwell Specification: CFR 47, Part 22 Lab: 1 Date: 8/4/99Equipment Used: 435, CF31, 741, G2200Configuration: Transmitting at 15 W into 50 ohm loadBandwidth: 1 MHz Video Bandwidth: 1 MHz Antenna Distance 3 m Detector: PeakClimatic Conditions: EUT Power: 115 V.A.C. ☒ 60 Hz Peak
Temperature: C 208 V.A.C. 50 Hz ☒ Average
Relative Humidity: % X 230 V.A.C.
Atmospheric Pressure: mbar Other X 1 Phase 3 Phase

Freq. (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	RF Gain (dB)	Corrected Reading (dBuV/m)	Spec. Limit (dBuV/m)	Pol.	Comments:
1.738	46.9	27.6	2.7	22.3	54.9	82.3	V	KTL# 453
2.606	38	29.3	3.4	23.0	47.7	82.3	V	
3.475	37.4	30.5	4.0	22.3	49.6	82.3	V	
4.345	42	32.1	4.3	24.0	54.4	82.3	V	Refer to Average Det.
4.345	38.4	32.1	4.3	24.0	50.8	82.3	V	Average Detector
5.213	39.5	33.6	4.9	24.1	53.9	82.3	V	Refer to Average Det.
5.213	33.4	33.6	4.9	24.1	47.8	82.3	V	Average Detector
								KTL # G2200
6.082	46.5	33.9	5.1	31.6	53.9	82.3	V	Refer to Average Det.
6.082	39.5	33.9	5.1	31.6	46.9	82.3	V	Average Detector
6.951	46.9	35.2	5.6	33.2	54.5	82.3	V	Refer to Average Det.
6.951	39.9	35.2	5.6	33.2	47.5	82.3	V	Average Detector
7.82	37.7	36.8	6.0	32.9	47.6	82.3	V	Aver. Det. , Noise Floor
8.689	38.0	37.0	6.3	33	48.3	82.3	V	Aver. Det. , Noise Floor
								KTL# 453
1.738	53.3	27.6	2.7	22.3	61.3	82.3	H	Refer to Average Det.
1.738	53.2	27.6	2.7	22.3	61.2	82.3	H	Average Detector
2.606	38.7	29.3	3.4	23.0	48.4	82.3	H	
3.475	39.8	30.5	4.0	22.3	52	82.3	H	
4.345	40.7	32.1	4.3	24.0	53.1	82.3	H	

DATACOMMON\FORMS\TESTDATASHEETS\MICRORE REV 030597

Test Data - Radiated Emissions – Downlink



KTL Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Microwave Radiated Emissions Data

Continuation Page

Complete X Preliminary

Page 2 of 2

Client: Allen Telecom

Test #: MW-1

W.O.#: 9L0234R

EUT: EAC-2000D Coverage Enhancer

S/N: NONE

Photo ID: 9L0234R MW-1

Technician: Tom Tidwell

Specification: CFR 47, Part 22

Lab: ANC1

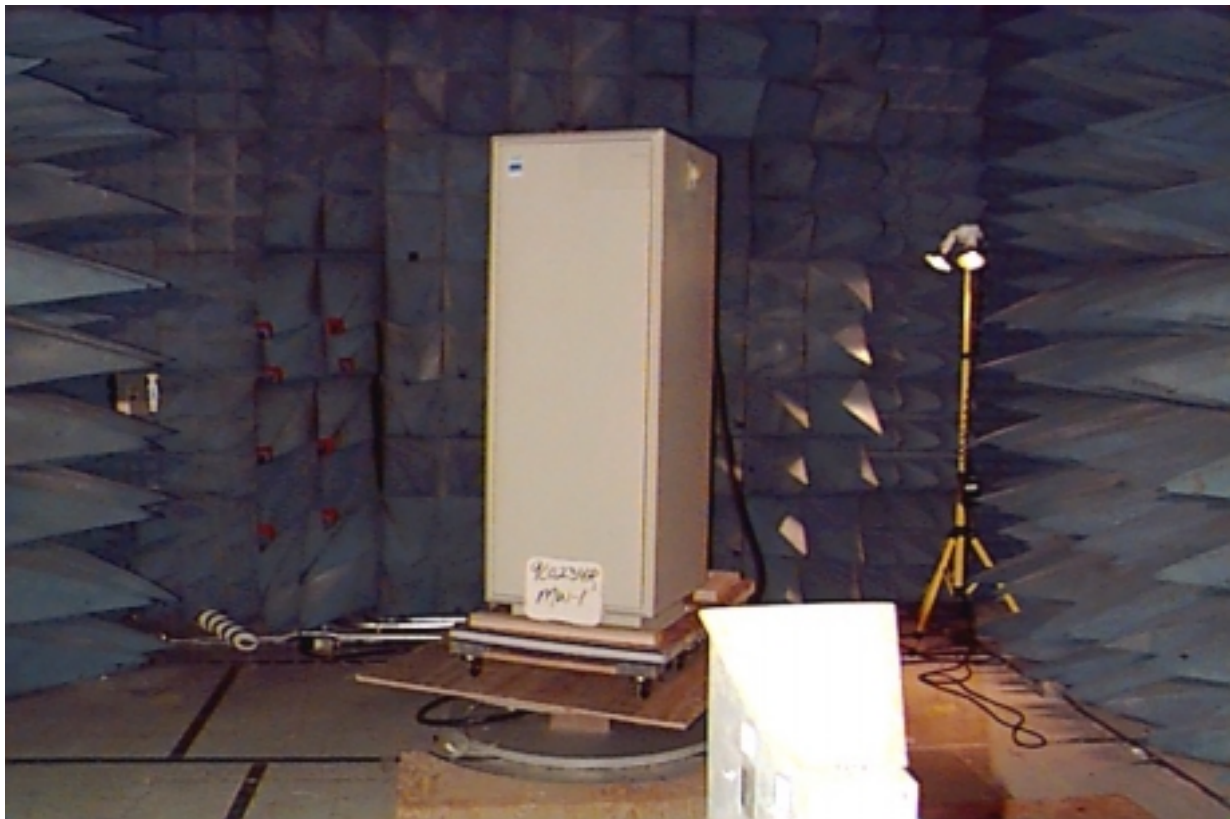
Date: 8/06/99

[illegible]

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Photographs of Test Setup

PHOTOGRAPH MW-1A



EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

PHOTOGRAPH MW-1B



EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 22.355
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Measurement Data: Standard Test Frequency: _____ MHz
 Standard Test Voltage: _____ V_{eff}

NOT APPLICABLE

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

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

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL/ ASSET NO.	LAST CAL.
1 Year	Spectrum Analyzer	Rohde & Schwarz	FSEK 30	G2632	6/14/99
1 Year	Spectrum Analyzer	Hewlett Packard	8566B	G2626	4/21/99
1 Year	Spectrum Analyzer Display	Hewlett Packard	8566B	G2626	4/21/99
1 Year	Quasi-peak adapter	Hewlett-Packard	85650A	G2614	4/21/99
1 Year	Attenuator	Narda	4779-10	039	8/1/99
1 Year	Attenuator	Narda	776B-10	G1018	10/26/98
1 Year	Attenuator	Narda	776B-20	G1017B	8/14/98
1 Year	50 Ohm Load	Bird	8141	G1360	10/26/98
1 Year	Power Meter	Wavetek	8531	G3893	6/17/99
1 Year	Power Sensor	Wavetek	85310	G3894	6/17/99
1 Year	Receiver	Electro-Metrics	EMC50	677	8/26/98
2 Year	Horn Antenna	EMCO	3115	741	6/29/99
1 Year	Log Periodic Antenna	EMCO	3146	G2018	1/21/99
1 Year	Biconical Antenna	A. H. Systems	SAS-20-20	G2020	1/21/99
1 Year	Directional Coupler	Narda	3020A	S/N. 34366	5/19/99
1 Year	Directional Coupler	Narda	3022	S/N. 73393	5/19/99
1 Year	Directional Coupler (2 – 18 GHz)	Hewlett Packard	11692D	S/N. 1212A03366	5/7/99
1 Year	Low Noise Amplifier	ICC	NONE	453	6/22/99
1 Year	Low Noise Amplifier	Hewlett Packard	8449A	G2200	6/11/99
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	S/N.22082	5/3/99
1 Year	I/Q Modulation Generator	Rohde & Schwarz	AMIQ	S/N.830848/005	5/26/99
1 Year	Preselector	Hewlett Packard	85685A	G2630	10/22/98

NA: Not Applicable
NCR: No Cal Required
COU: CAL On Use

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FCC PART 22, SUBPART H
CELLULAR BAND REPEATERS
PROJECT NO.: 9L0234R
ANNEX A

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

ANNEX A
TEST METHODOLOGIES

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
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Minimum Standard: Para. No. 22.913(a). The maximum effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 watts.

Method Of Measurement:

Detachable Antenna:

The peak power at antenna terminals is measured using a 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

EQUIPMENT: EAC-2000 Cellular Repeater
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NAME OF TEST: Occupied Bandwidth (Voice & SAT)	PARA. NO.: 2.989
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Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

- (i) On any frequency removed from the carrier frequency by more than 12 kHz but not more than 20 kHz:

at least $117 \log (f_d/12)$

- (ii) On any frequency removed from the carrier frequency by more than 20 kHz, up to the first multiple of the carrier frequency:

at least $100 \log (f_d/11)$ dB or $43 + 10 \log (P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz
VBW: $\geq$ RBW
Span: 100 kHz
Sweep: Auto
Mask: CELLF3E

Input Signal Characteristics (F3E/F3D):

RF level: Maximum recommended by manufacturer
AF1 frequency: 6 kHz
AF1 level: sufficient to produce 2 kHz deviation
AF2 frequency: 2.5 kHz
AF2 level: sufficient to produce 12 kHz deviation.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Occupied Bandwidth (WB Data)	PARA. NO.: 2.989
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Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

- (1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz:

at least 26 dB

- (2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz:

at least 45 dB

- (3) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple of the carrier frequency:

at least 60 dB or $43 + 10 \log (P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 200 kHz

Sweep: Auto

Mask: CELLF1D

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

AF1 frequency: 10 kHz, random bit sequence

AF1 level: sufficient to produce 8 kHz deviation

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Occupied Bandwidth (ST)	PARA. NO.: 2.989
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Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

- (1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz:

at least 26 dB

- (2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz:

at least 45 dB

- (3) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple of the carrier frequency:

at least 60 dB or $43 + 10 \log (P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 200 kHz

Sweep: Auto

Mask: CELLF1D

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

AF1 frequency: 10 kHz tone

AF1 level: sufficient to produce 8 kHz deviation

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Occupied Bandwidth (Digital Modulation) PARA. NO.: 2.989
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Minimum Standard: Not defined by FCC. Input vs. Output.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: CDMA (30 kHz), GSM (30 kHz), NADC (1 kHz) and CDPD (1 kHz)

VBW: $\geq$ RBW

Span: As required

Sweep: Auto

Mask:

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.991
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Minimum Standard: Para. No. 22.917(e). The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice or more than twice the fundamental emission by at least $43 + 10 \log P$. This is equivalent to -13 dBm absolute power.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 30 kHz (AMPS). As required for digital modulations.

VBW: $\geq$ RBW

Start Frequency: 30 MHz

Stop Frequency: 10 GHz

Sweep: Auto

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.993
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Minimum Standard:

Para. No. 22.917(e). The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice or more than twice the fundamental emission by at least $43 + 10 \log P$. This is equivalent to -13 dBm absolute power.

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)

$R = 3\text{m}$ (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)

$R = 3\text{m}$ (Measurement Distance)

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

The spectrum is searched to 10 GHz.

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

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

Minimum Standard: Para. No. 22.355. The transmitter carrier frequency shall remain within the tolerances given in Table C-1.

Freq. Range (MHz)	Base, fixed	Mobile > 3 W	Mobile $\leq$ 3 W
821 to 896	1.5	2.5	2.5

Table C-1

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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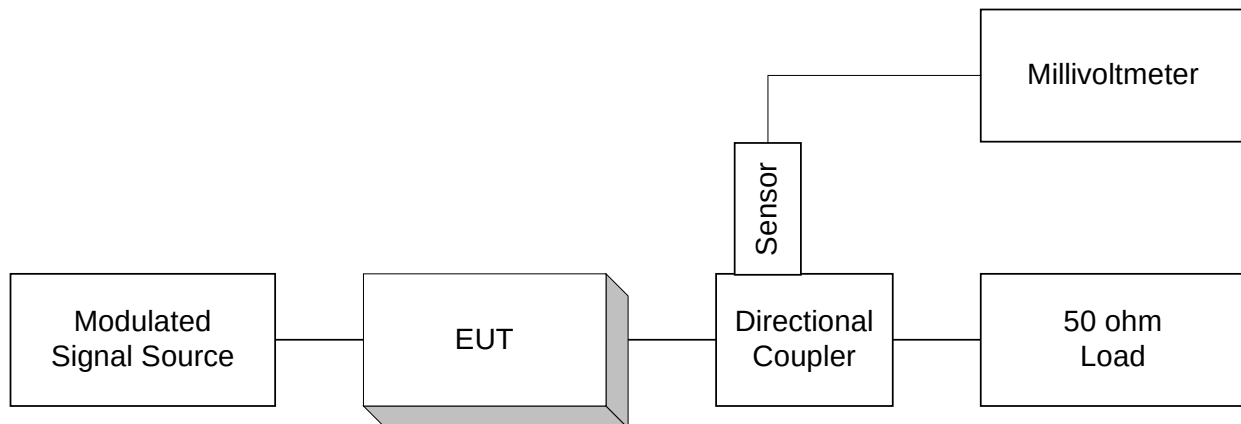
FCC PART 22, SUBPART H
CELLULAR BAND REPEATERS
PROJECT NO.: 9L0234R
ANNEX B

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

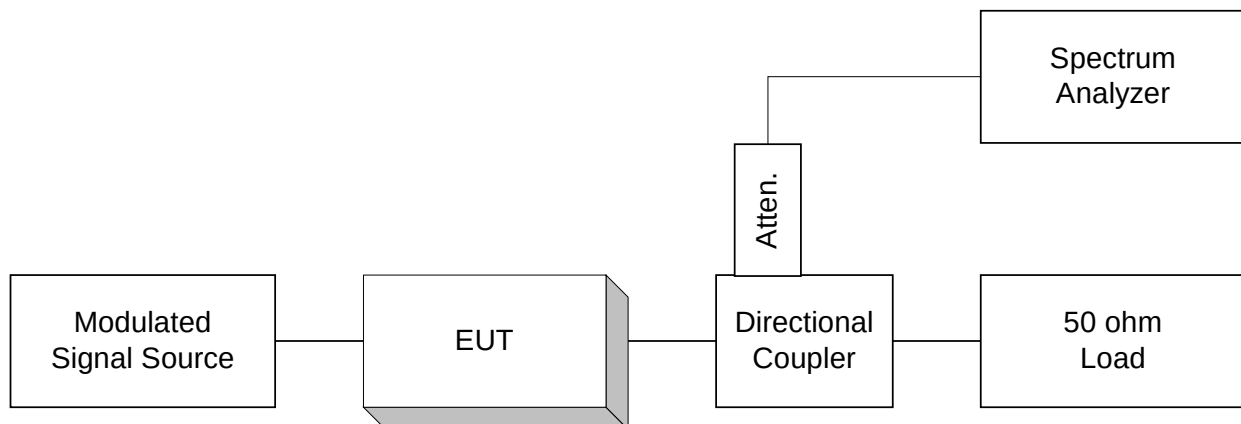
ANNEX B
TEST DIAGRAMS

EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

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

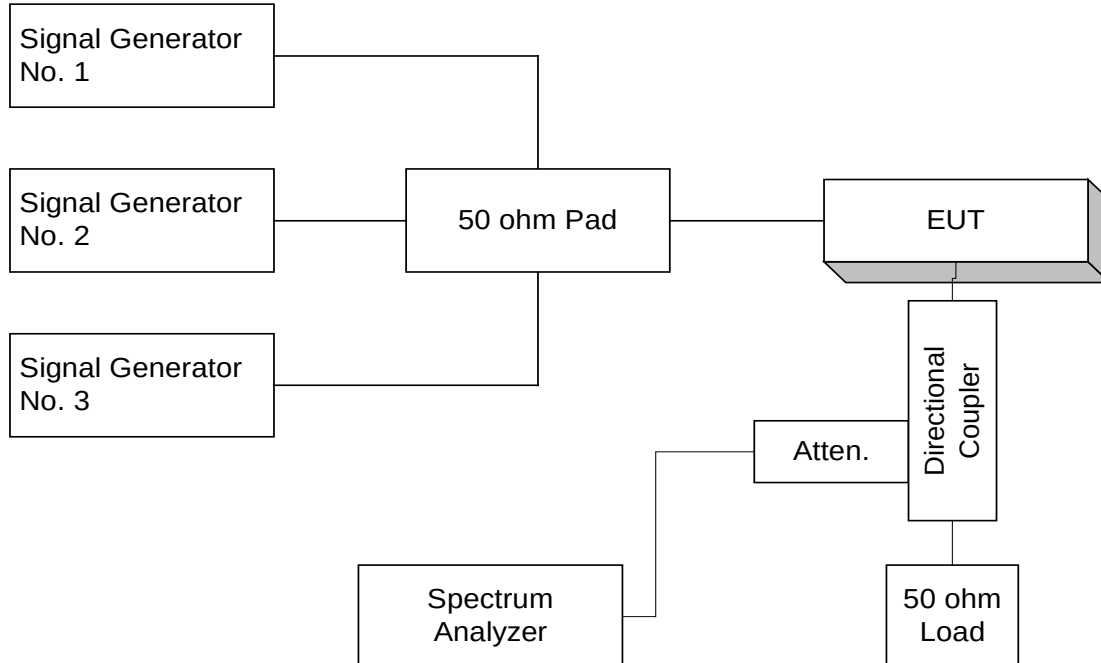
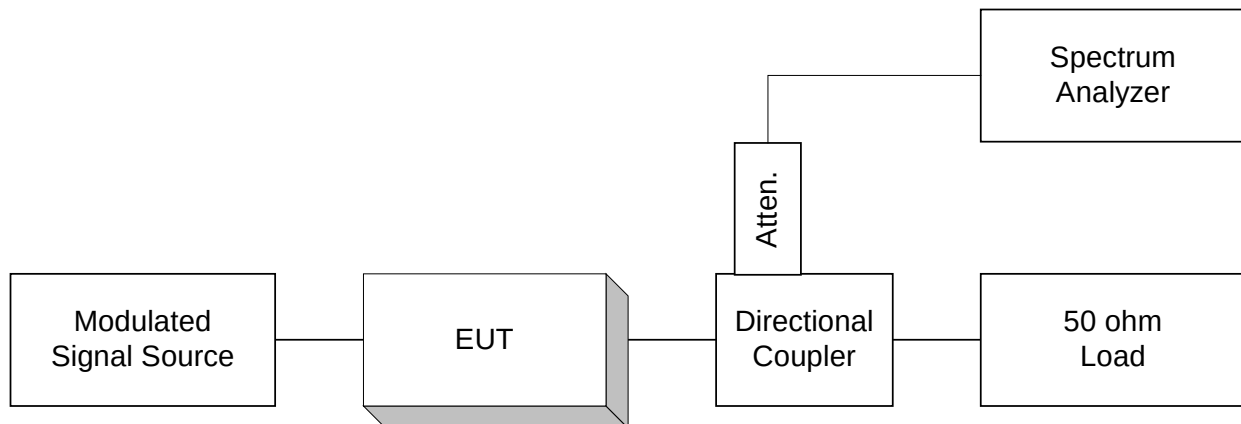


Para. No. 2.989 - Occupied Bandwidth



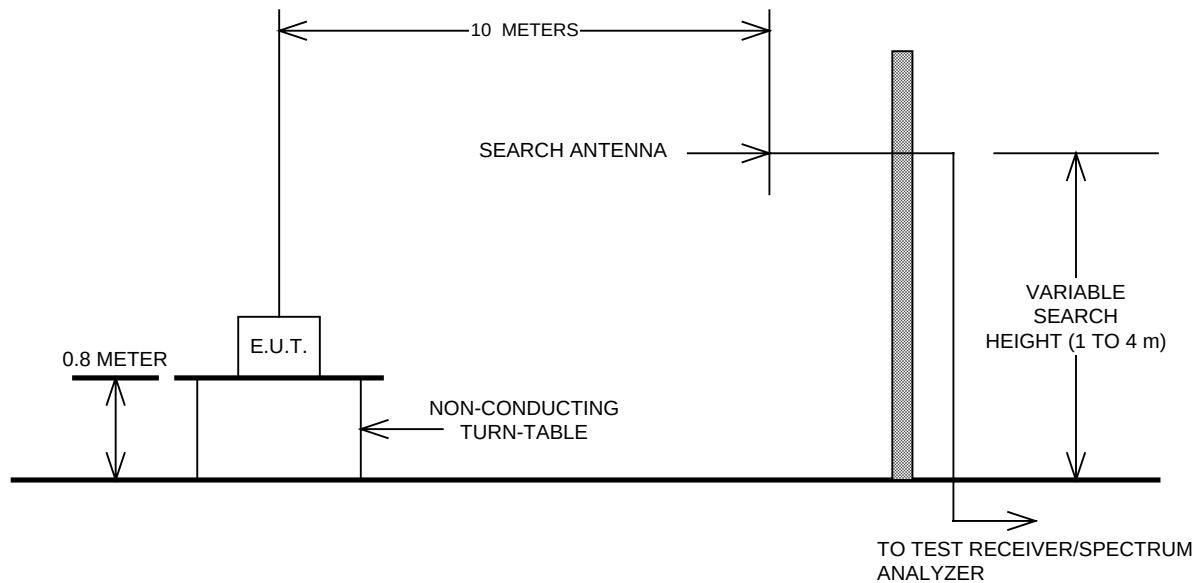
EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Para. No. 2.991 Spurious Emissions at Antenna Terminals



EQUIPMENT: EAC-2000 Cellular Repeater
FCC ID: BCR9GB2000

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

