Nemko Test Report:	1L0084RUS1
Applicant:	Withus Co., Ltd. 2F Miguempark B/D 150 Geumgok-dong, Bundang-gu, Seongnam-si, Kyongki-do, Republic of Korea
Equipment Under Test: (E.U.T.)	WER 824A AMPS REPEATER
In Accordance With:	**FCC Part 22, Subpart H** Cellular Band Repeaters
Tested By:	Nemko Dallas Inc. 802 N. Kealy Lewisville, TX 75057-3136
Authorized By:	 Tom Tidwell, RF Group Manager
Date:	7/6/01
Total Number of Pages:	74

Table of Contents

Section 1. Summary of Test Results

Manufacturer: AP Research

Model No.: WER 824A

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

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

Summary Of Test Data

	PARA. NO.			
RF Power Output	22.913(a)	500W ERP	< 500 W ERP	Complies
Occupied Bandwidth (Voice & SAT)	22.917(c)	Mask	Plots	Complies
Occupies Bandwidth (Wideband Data)	22.917(d)	Mask	Plots	Complies
Occupied Bandwidth (ST)	22.917(d)	Mask	Plots	Complies
Occupied Bandwidth (Digital)	None	None	Plots	Complies
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	< -13 dBm	Complies
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	< -13 dBm EIRP	Complies
Frequency Stability	22.355	1.5 ppm	N/A	N/A

Footnotes:

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

.

Section 2. General Equipment Specification

Supply Voltage Input:		100-240 VAC
Frequency Range:	**Downlink:**	869 – 894 MHz
Frequency Range:	**Uplink:**	824 – 849 MHz

CDMA (F9W)	**GSM (GXW)**	**NADC (DXW)**	**CDPD (F9W)**	**AMPS (F8W, F1D)**
☒	☐	☒	☐	☒

Output Impedance:		50 ohms	
RF Output (Rated):	**Downlink:**	Per Channel:	0.5 W
		Total:	1.0 W
	Uplink:	Per Channel:	0.5 W
		Total:	1.0 W

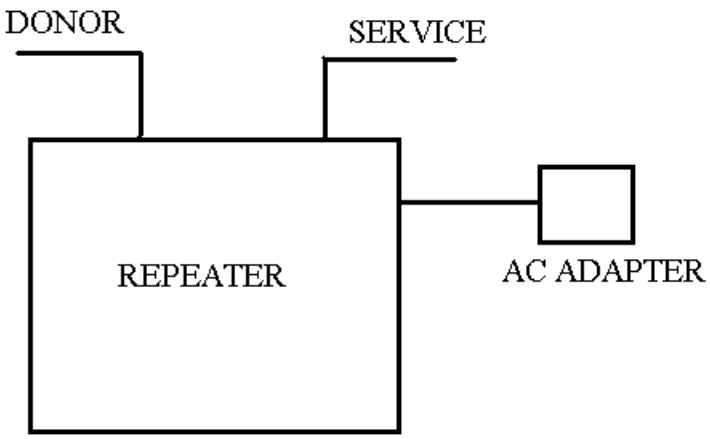
Frequency Translation:	**F1-F1**	**F1-F2**	**N/A**
	☒	☐	☐

Software	**Duplexer Change**	**Fullband Coverage**
☐	☐	☒

Description of Operation

This repeater (model: WER-824) is a compact bi-directional linear amplifier for 800 MHz AMPS band. It is ideal for extending two-way voice and data communications for null areas. This unit features 80 dB gain and output IP3 level of +45 dBm.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David LightTom Tidwell	DATE: 6/20/01

Test Results: Complies.

Test Data:

	Modulation Type	Per Channel Power Output (dBm)	Composite Power Output (dBm)
Uplink	AMPS	26	29 (2 Chs)
Downlink	AMPS	24.5	27.5 (2 Chs)
Uplink	CDMA	29	32 (2 Chs)
Downlink	CDMA	27	30 (2 Chs)
Uplink	NADC	29	32 (2 Chs)
Downlink	NADC	27	30 (2 Chs)

Note: The device was tested at 98 –132 VAC. Voltage input had no effect on power output.

Equipment Used: 1064-1065-1029-1030

Measurement Uncertainty: +/- 0.6 dB

Temperature: 22 °C

Relative Humidity: 50 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David LightTom Tidwell	DATE: 6/20/01

Test Results: Complies.

Test Data: See attached plots

Equipment Used: 1036-1064-1065-1083

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 50 %

Plots – Occupied Bandwidth CDMA

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802 N. Kealy
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Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **OCCUPIED BANDWIDTH - CDMA**

Page 1 of 2 — Complete X — Preliminary

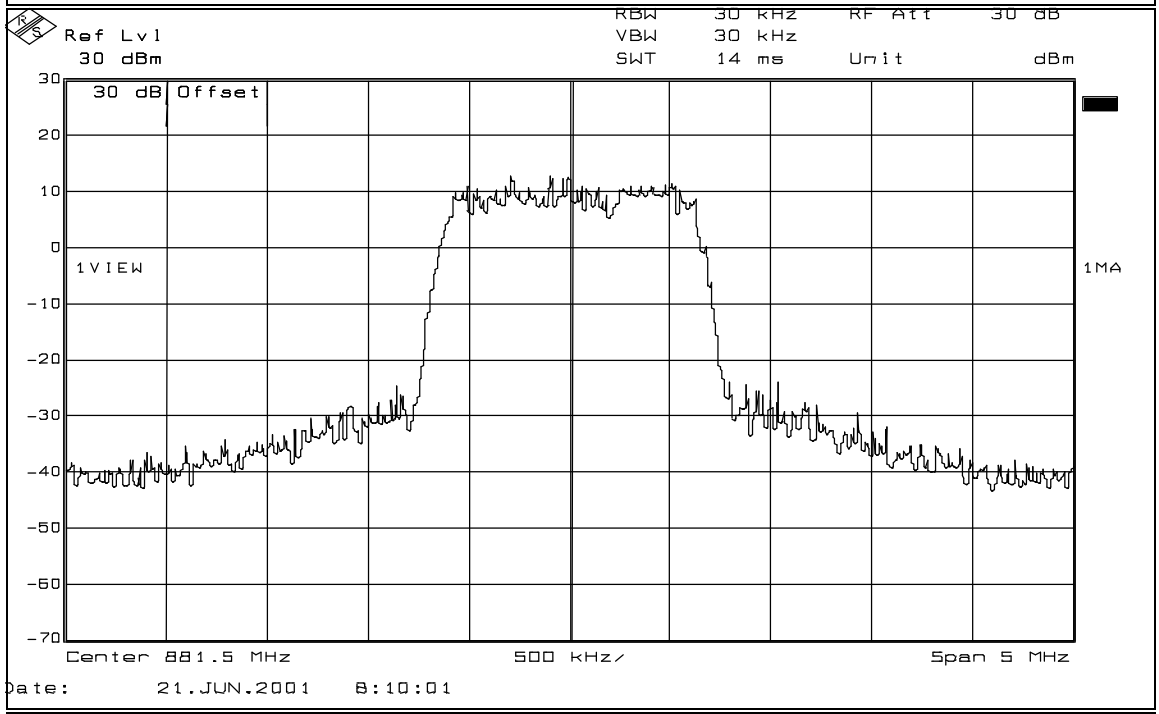
Job No.:	1L0084R	Date: 6/20/01	
Specification:	PART22	Temperature(°C): 22	
Tested By:	David Light	Relative Humidity(%) 50	
E.U.T.:	CELL BAND REPEATER		
Configuration:	TRANSMIT		
Sample Number:	1		
Location:	Lab 1	RBW: Refer to plots	Measurement Distance: N/A m
Detector Type:	Peak	VBW: Refer to plots	

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: **OUTPUT SIGNAL**
CDMA
DOWNLINK

Plots – Occupied Bandwidth CDMA

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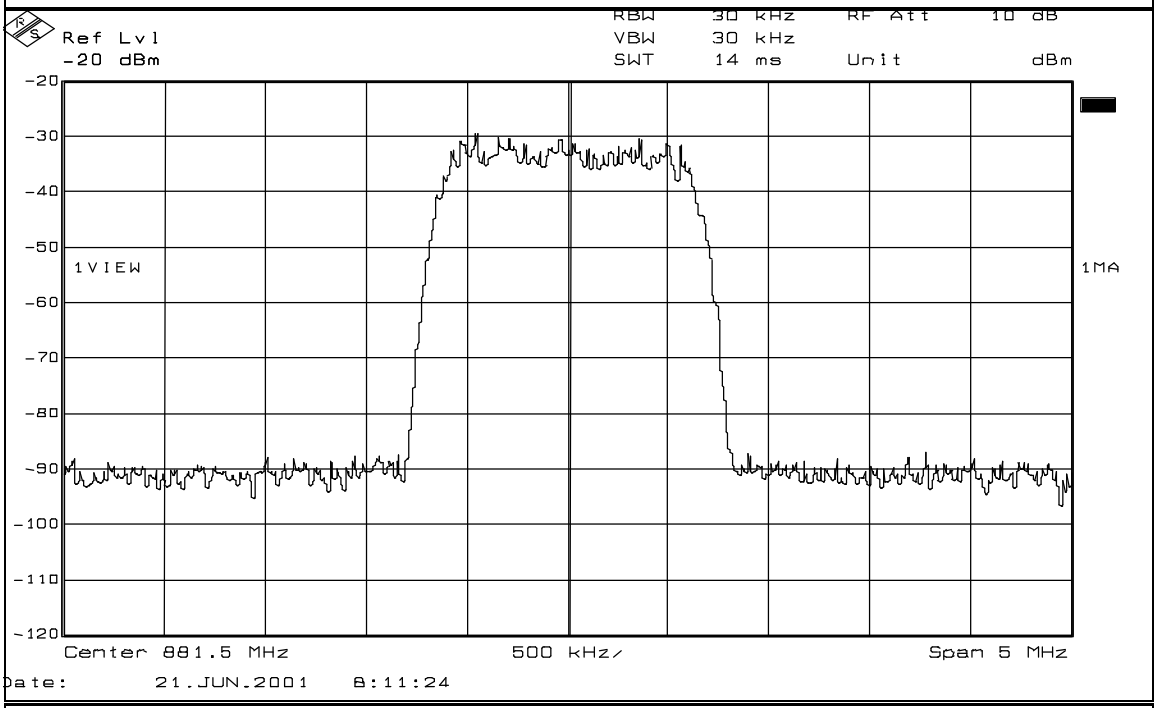
Data Plot **OCCUPIED BANDWIDTH - CDMA**

Page 2 of 2

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELL BAND REPEATER
Configuration: TRANSMIT



Notes: **INPUT SIGNAL**
CDMA
DOWNLINK

Plots – Occupied Bandwidth CDMA

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Data Plot CDMA

Page 2 of DOWNLINK

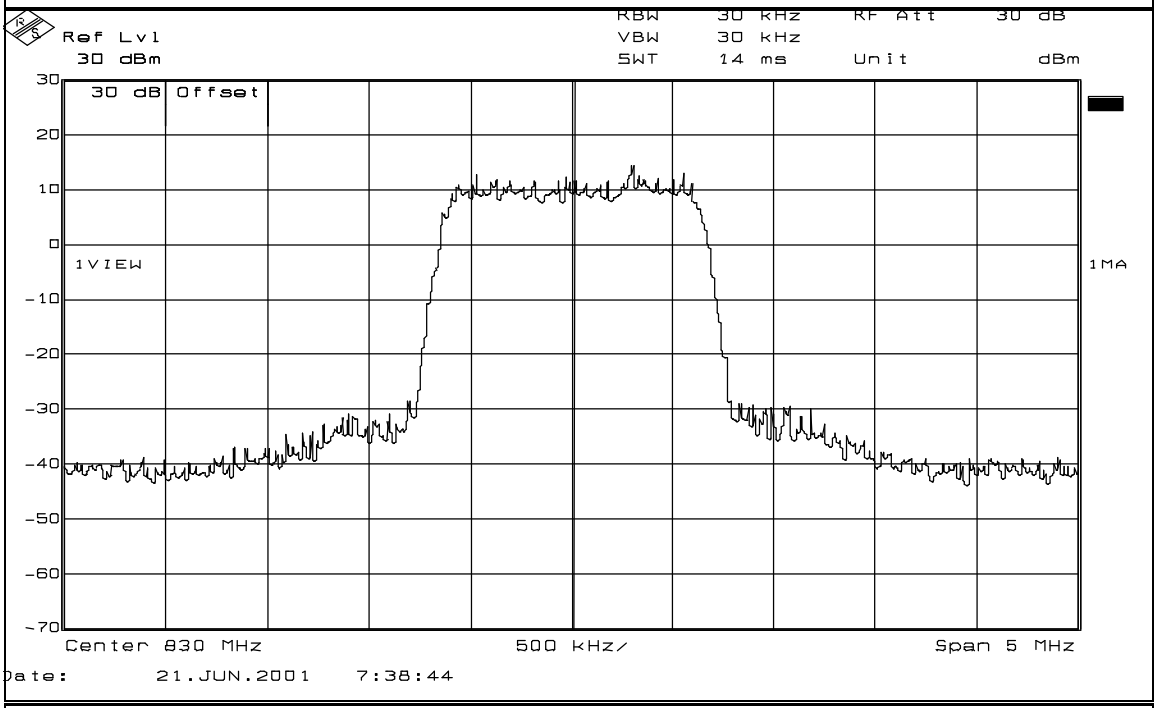
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **OUTPUT SIGNAL**
CDMA
UPLINK

Plots – Occupied Bandwidth CDMA

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Data Plot CDMA

Page 2 of DOWNLINK

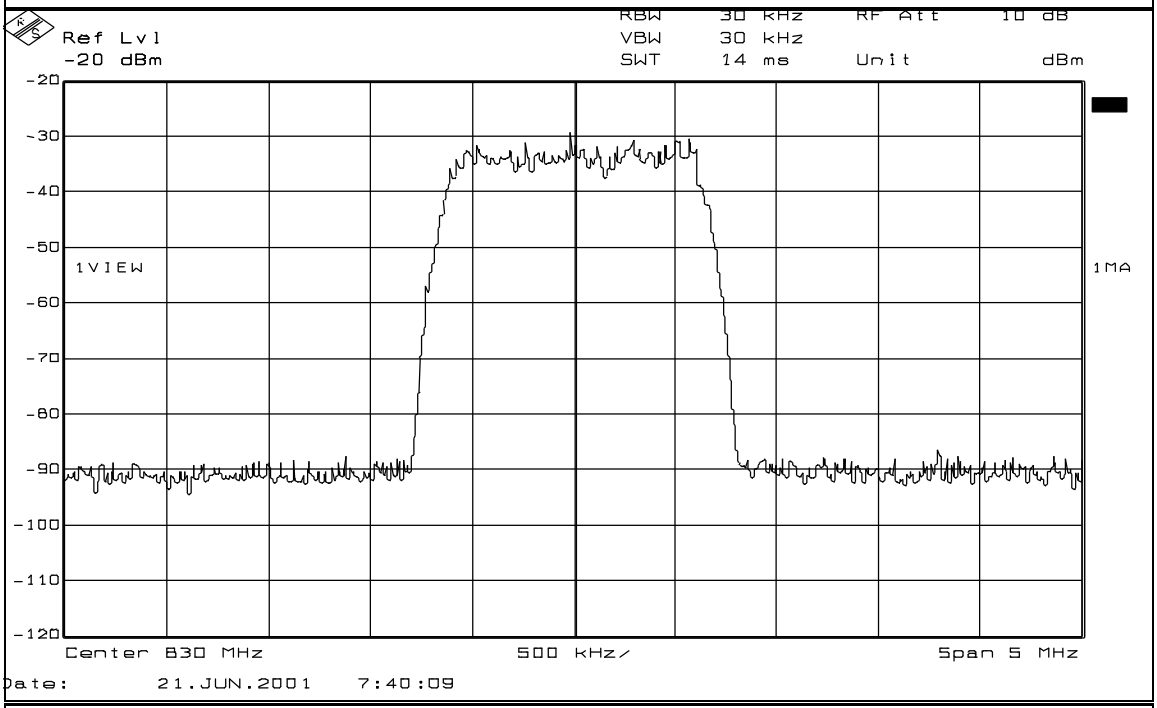
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **INPUT SIGNAL**
CDMA
UPLINK

Plot s – Occupied Bandwidth TDMA

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Data Plot — **OCCUPIED BANDWIDTH - TDMA**

Page 1 of 2 — Complete X — Preliminary

Job No.: 1L0084R — Date: 6/20/01

Specification: PART22 — Temperature(°C): 22

Tested By: David Light — Relative Humidity(%) 50

E.U.T.: CELL BAND REPEATER

Configuration: TRANSMIT

Sample Number: 1

Location: Lab 1 — RBW: Refer to plots — Measurement

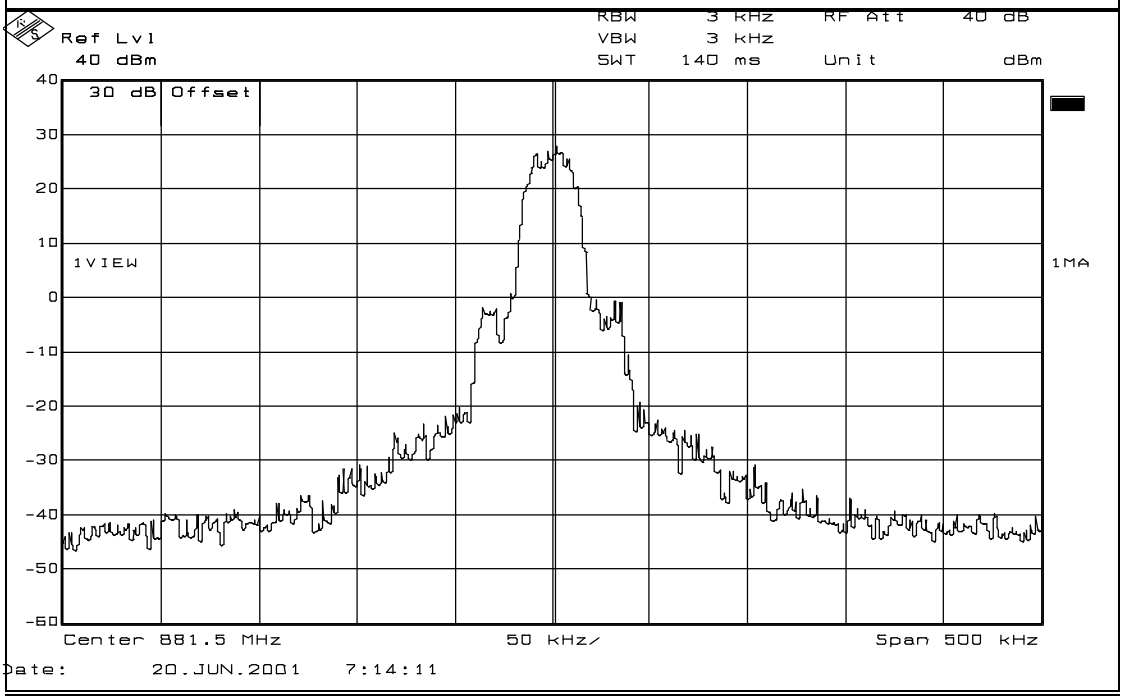
Detector Type: Peak — VBW: Refer to plots — Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: **OUTPUT SIGNAL**
TDMA

Plots – Occupied Bandwidth TDMA

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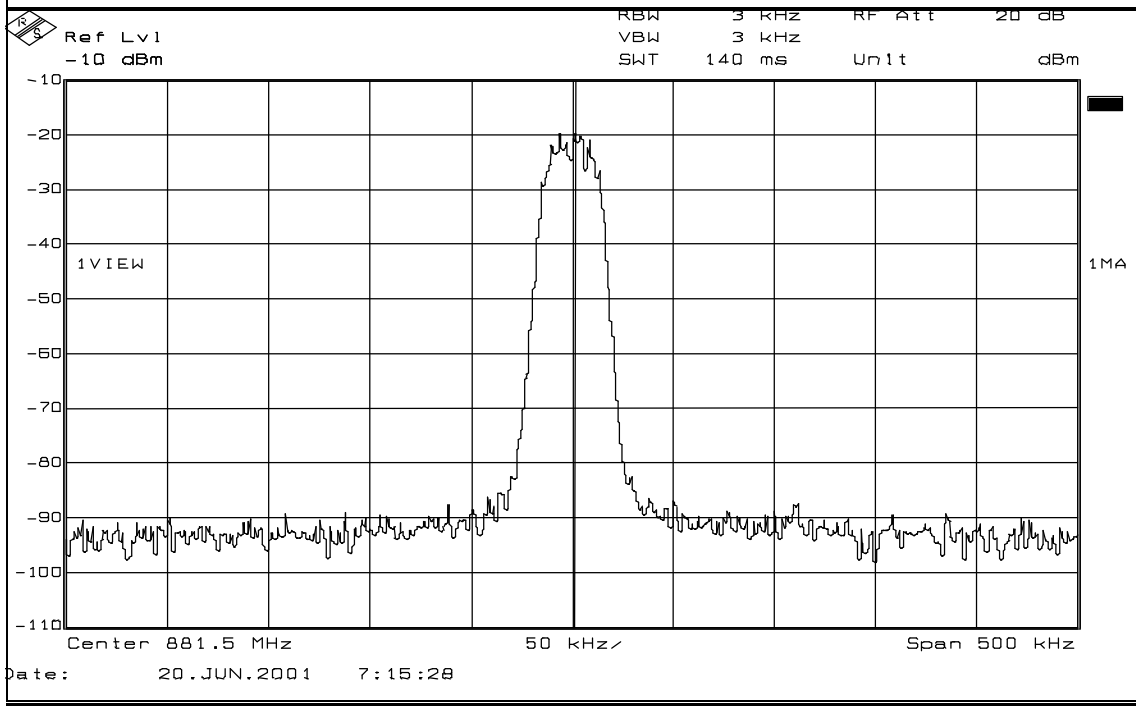
Data Plot **OCCUPIED BANDWIDTH - TDMA**

Page 2 of 2

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELL BAND REPEATER
Configuration: TRANSMIT



Notes: **INPUT SIGNAL**
TDMA

Plots – Occupied Bandwidth TDMA

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Data Plot TDMA

Page 2 of DOWNLINK

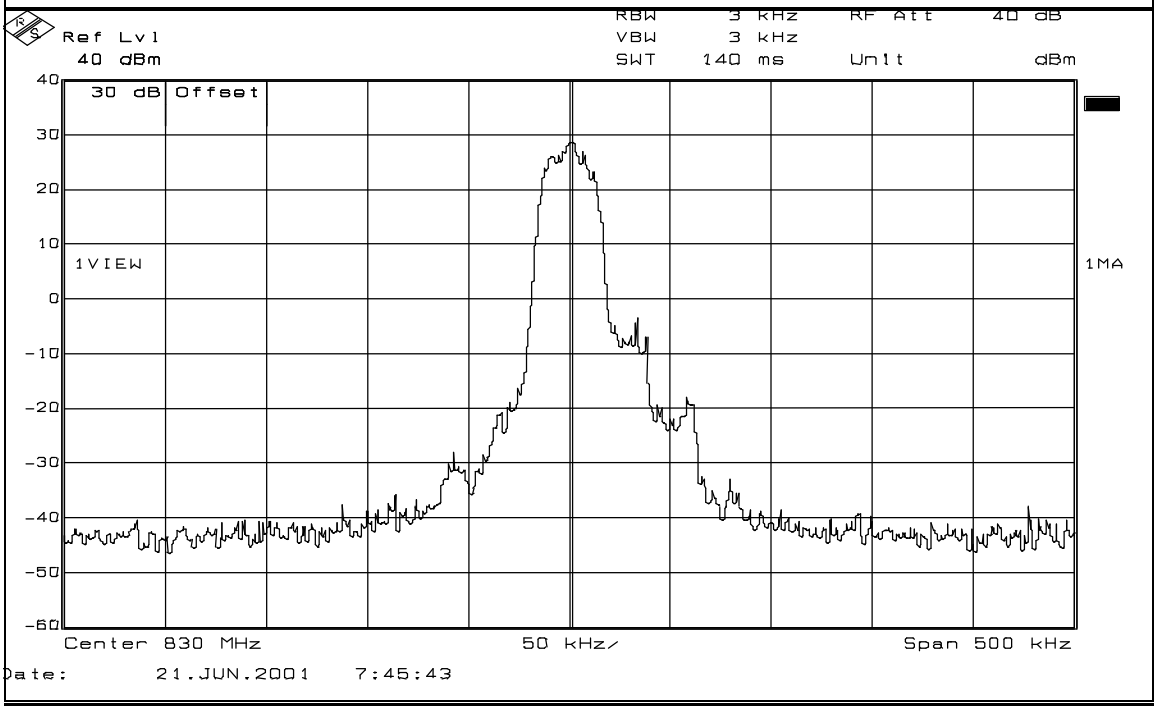
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **OUTPUT SIGNAL**
TDMA
UPLINK

Plots – Occupied Bandwidth TDMA

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Data Plot TDMA

Page 2 of DOWNLINK

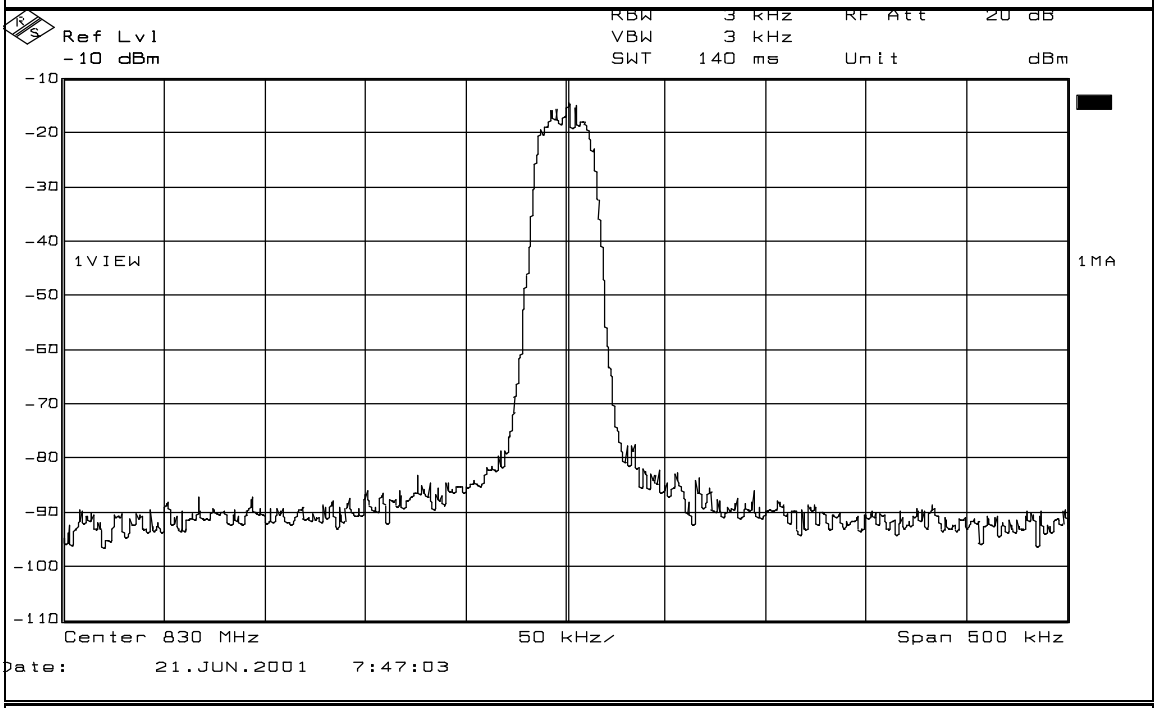
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **INPUT SIGNAL**
TDMA
UPLINK

Plots – Occupied Bandwidth Wide Band Data

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Data Plot **OCCUPIED BANDWIDTH - WIDE BAND DATA**

Page 1 of 2 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELL BAND REPEATER

Configuration: TRANSMIT

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

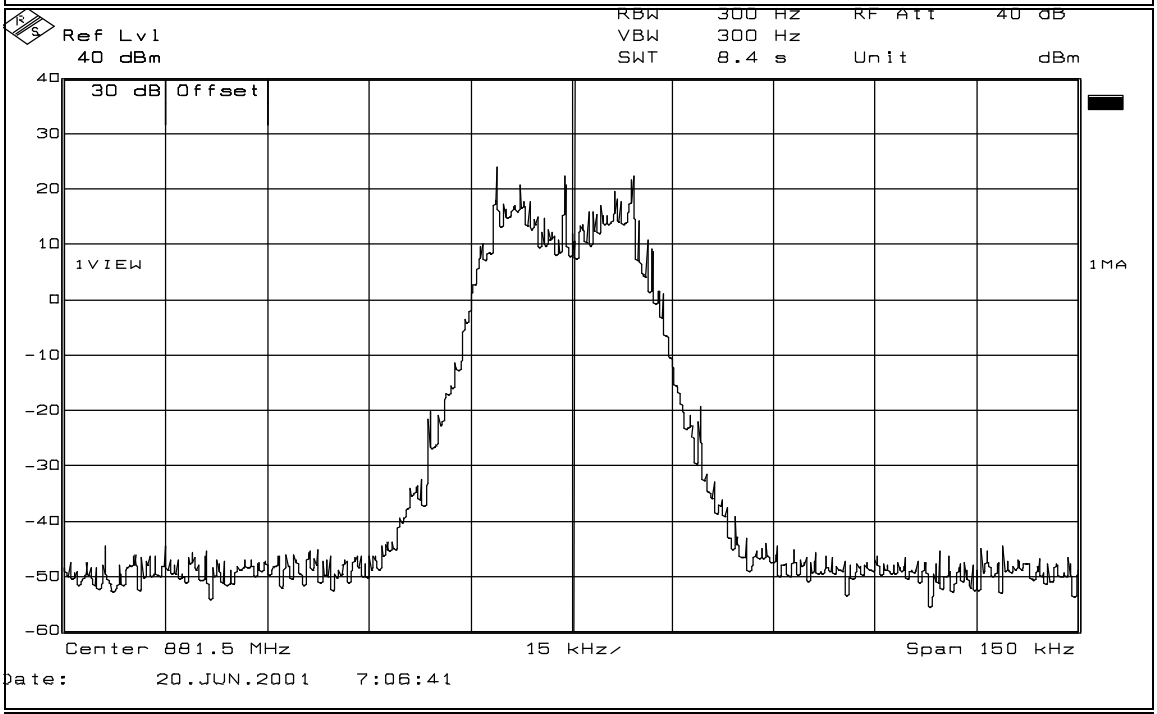
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: OUTPUT SIGNAL
WIDE BAND DATA

Plots – Occupied Bandwidth Wide Band Data

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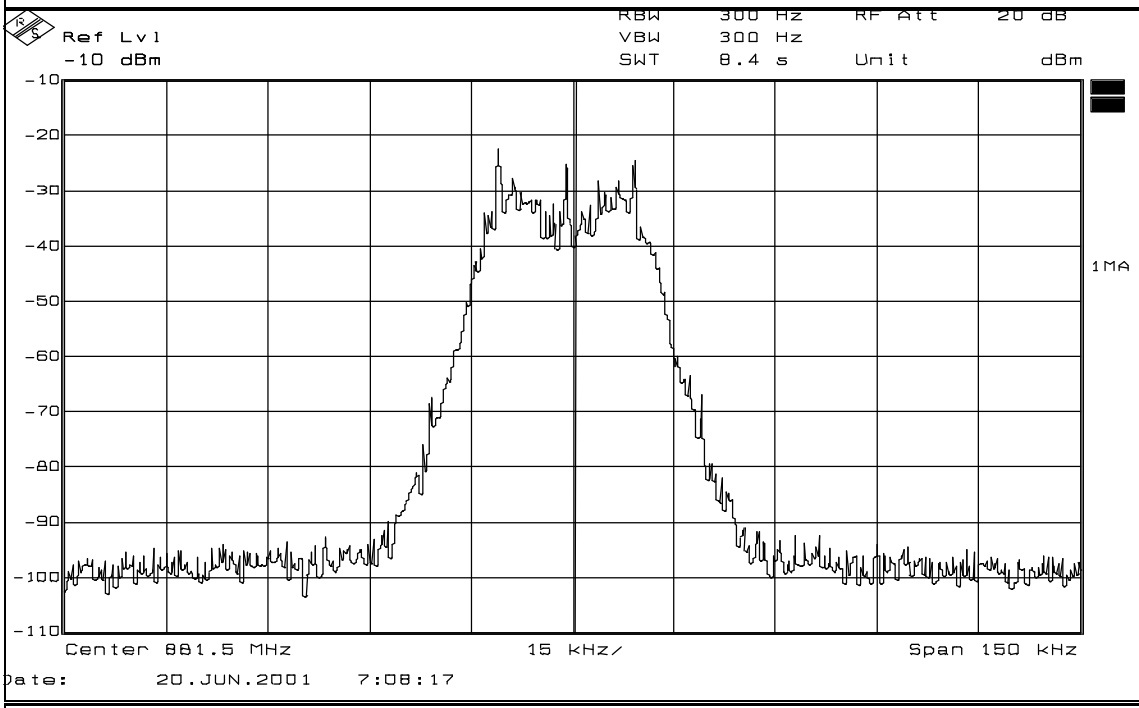
Data Plot **OCCUPIED BANDWIDTH - WIDE BAND DATA**

Page 2 of 2

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELL BAND REPEATER
Configuration: TRANSMIT



Notes: **INPUT SIGNAL**
WIDE BAND DATA

Plots – Occupied Bandwidth Wide Band Data

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Data Plot **WIDE BAND DATA**

Page 2 of DOWNLINK

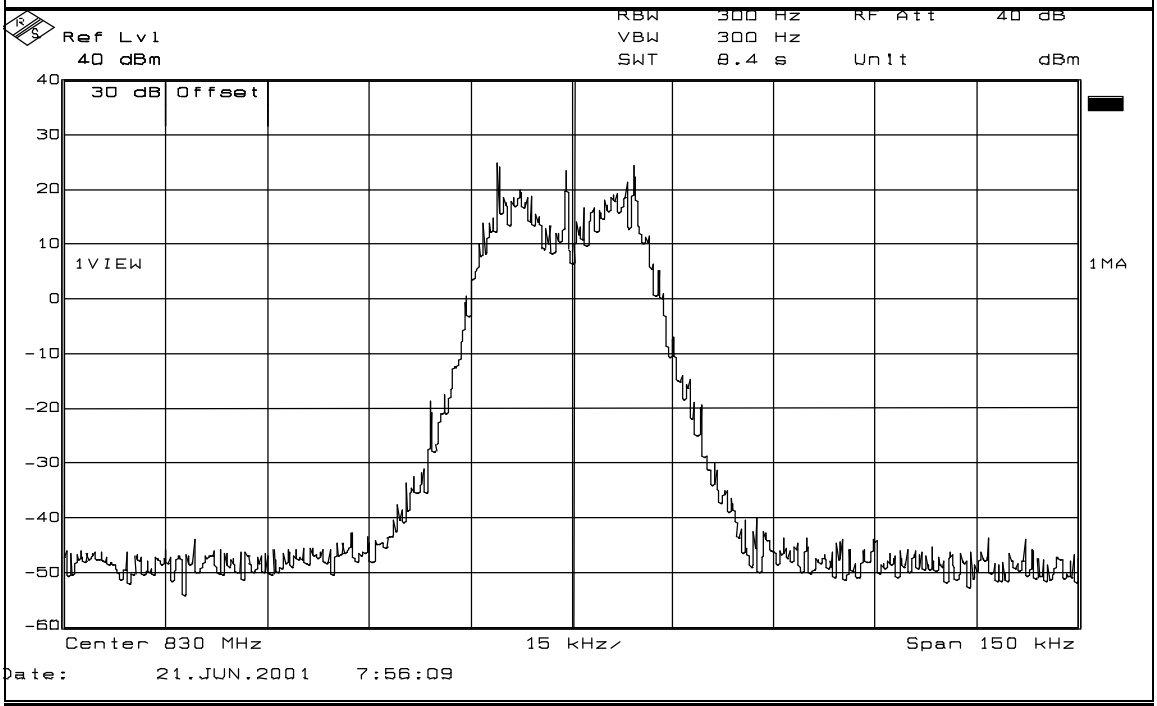
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **OUTPUT SIGNAL**
WIDE BAND DATA
UPLINK

Plots – Occupied Bandwidth Wide Band Data

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Data Plot **WIDE BAND DATA**

Page 2 of DOWNLINK

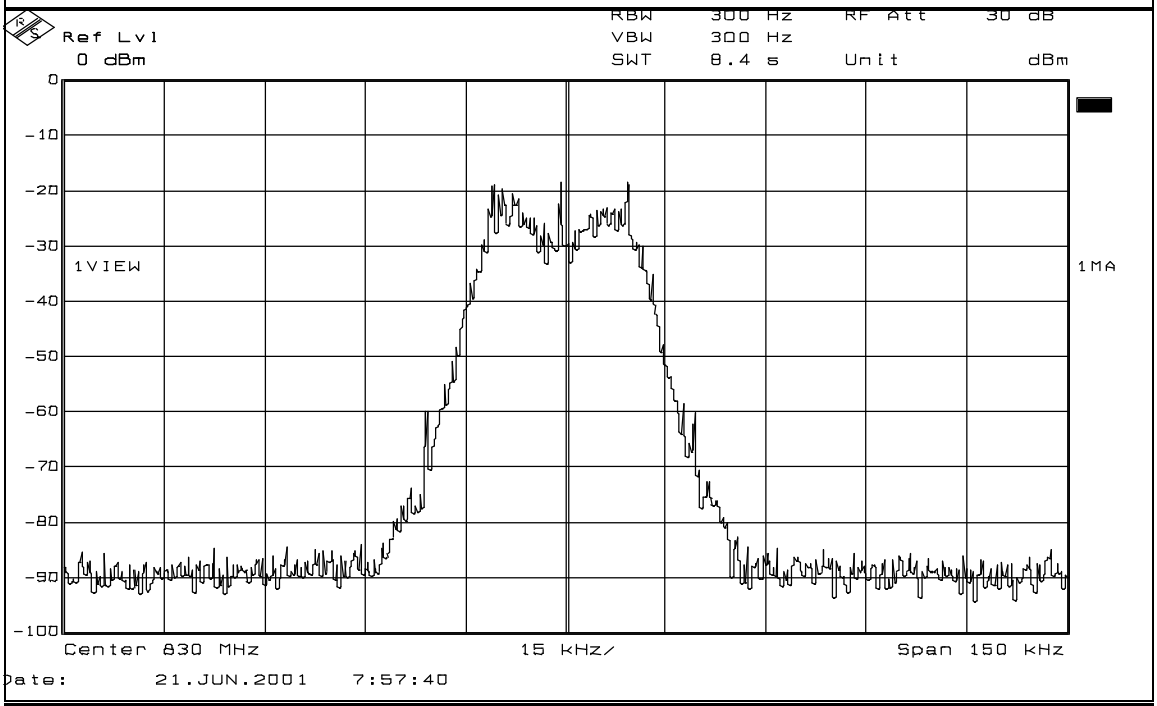
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **INPUT SIGNAL**
WIDE BAND DATA
UPLINK

Plots – Occupied Bandwidth Voice and SAT

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Data Plot **OCCUPIED BANDWIDTH - VOICE AND SAT**

Page 1 of 2 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELL BAND REPEATER

Configuration: TRANSMIT

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

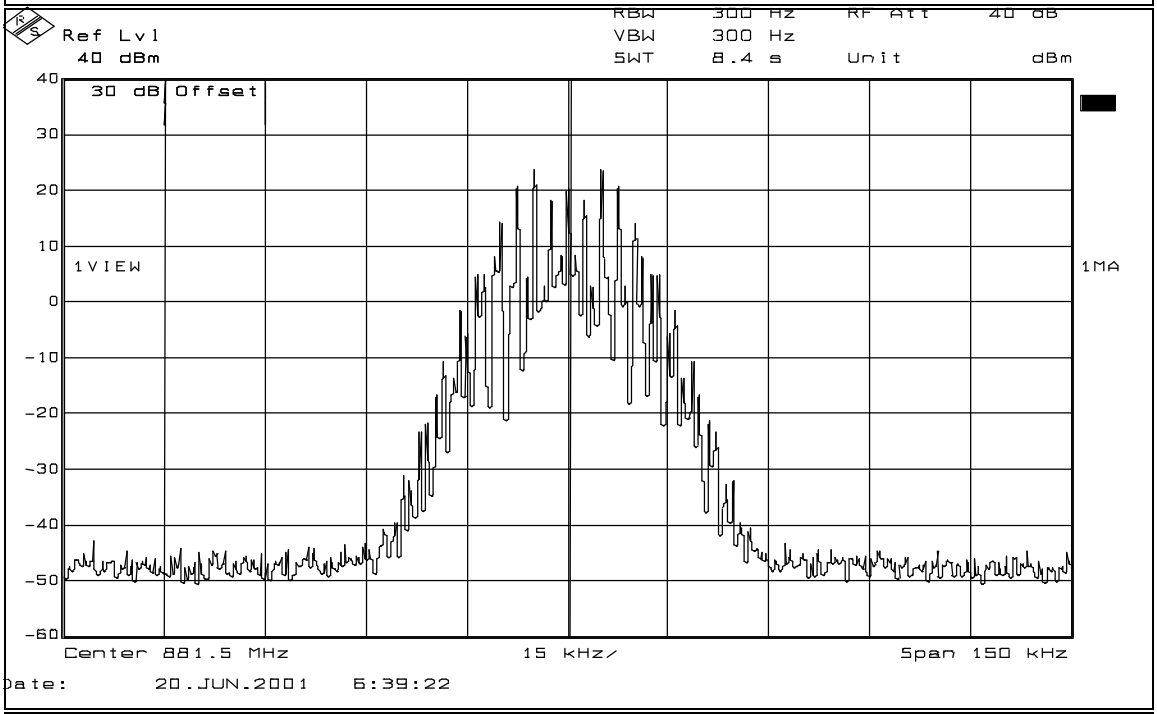
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: **OUTPUT SIGNAL**
VOICE AND SAT

Plots – Occupied Bandwidth Voice and SAT

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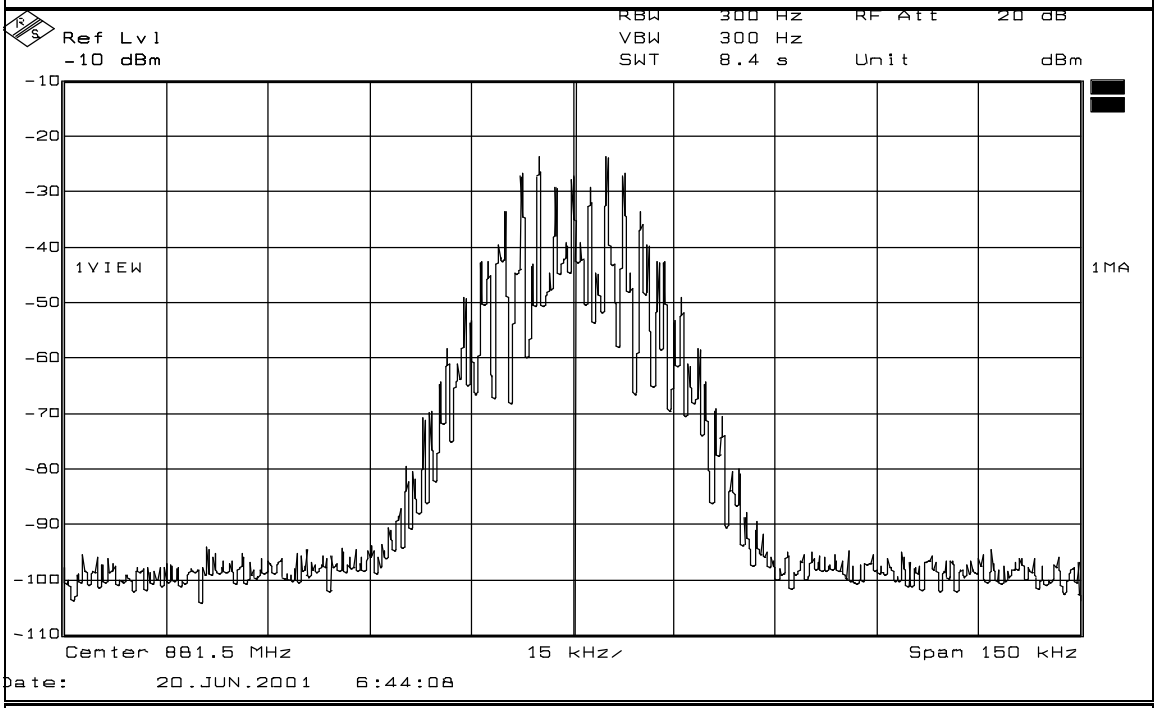
Data Plot **OCCUPIED BANDWIDTH - VOICE AND SAT**

Page 2 of 2

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELL BAND REPEATER
Configuration: TRANSMIT



Notes: **INPUT SIGNAL**
VOICE AND SAT

Plots – Occupied Bandwidth Voice and SAT

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Data Plot **VOICE AND SAT**

Page 2 of _____

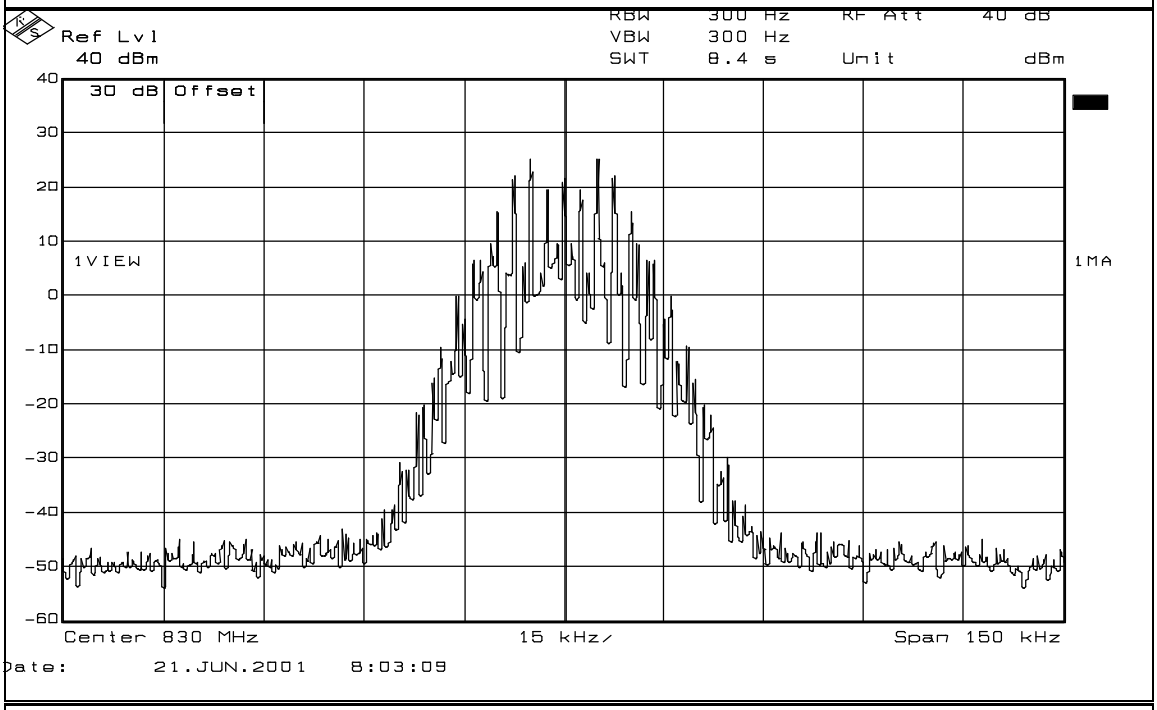
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **OUTPUT SIGNAL**
VOICE AND SAT
UPLINK

Plots – Occupied Bandwidth Voice and SAT

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Data Plot VOICE AND SAT

Page 2 of _____

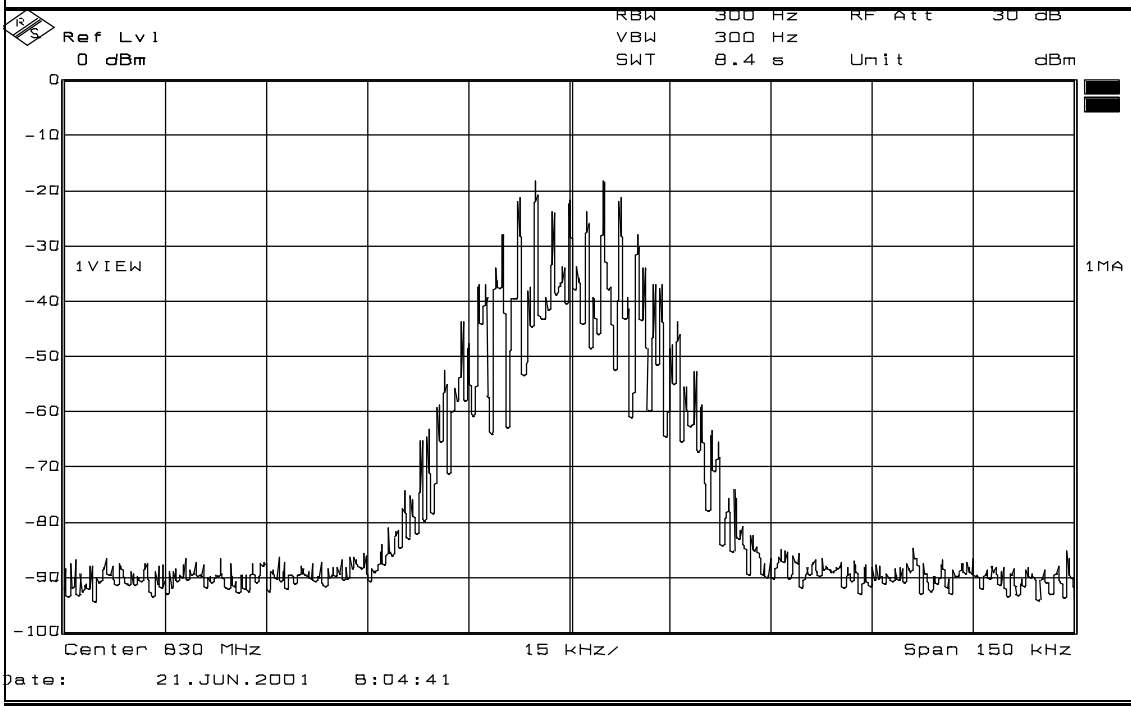
Job No.: _____ Date: _____

Specification: _____ Temperature(°C): _____

Tested By: _____ Relative Humidity(%) _____

E.U.T.: _____

Configuration: _____



Notes: **INPUT SIGNAL**
VOICE AND SAT
UPLINK

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David LightTom Tidwell	DATE: 6/20/01

Test Results: Complies.

Test Data: See attached plots

Equipment Used: 1036-1064-1064-1083

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 50 %

Plots – Spurious Emissions at Antenna Terminals

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Nemko Dallas, Inc.

Data Plot **SPURIOUS EMISSIONS - CONDUCTED**

Page 1 of 4 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELLULAR BAND REPEATER

Configuration: TRANSMIT FULL POWER

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

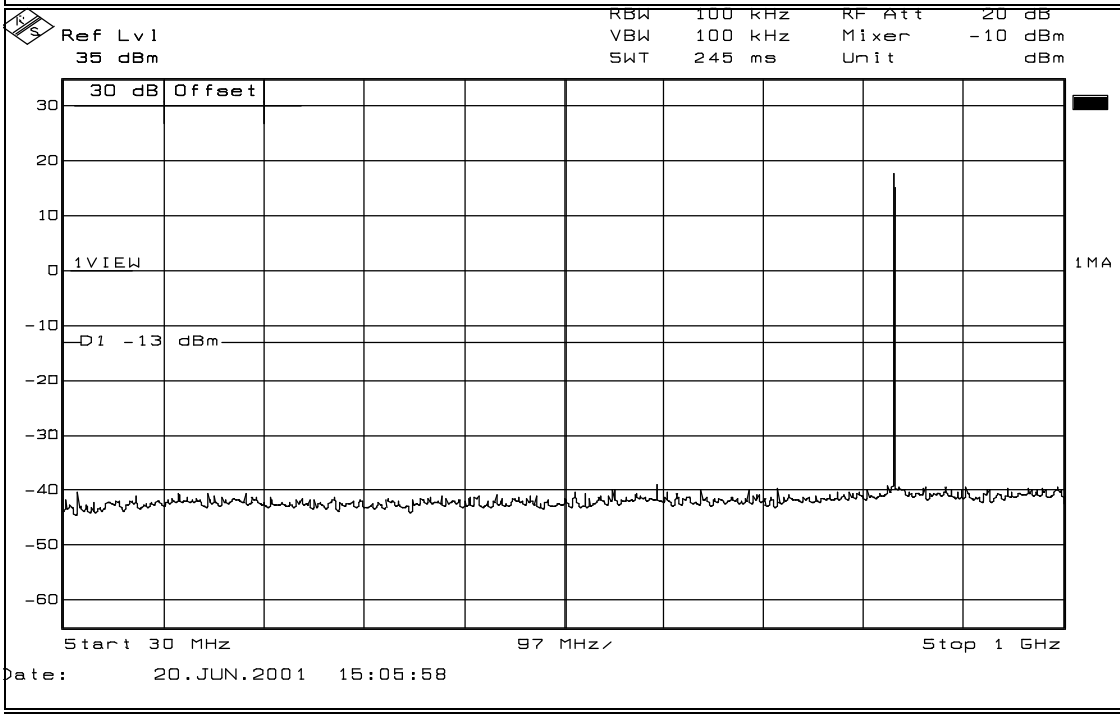
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **CDMA MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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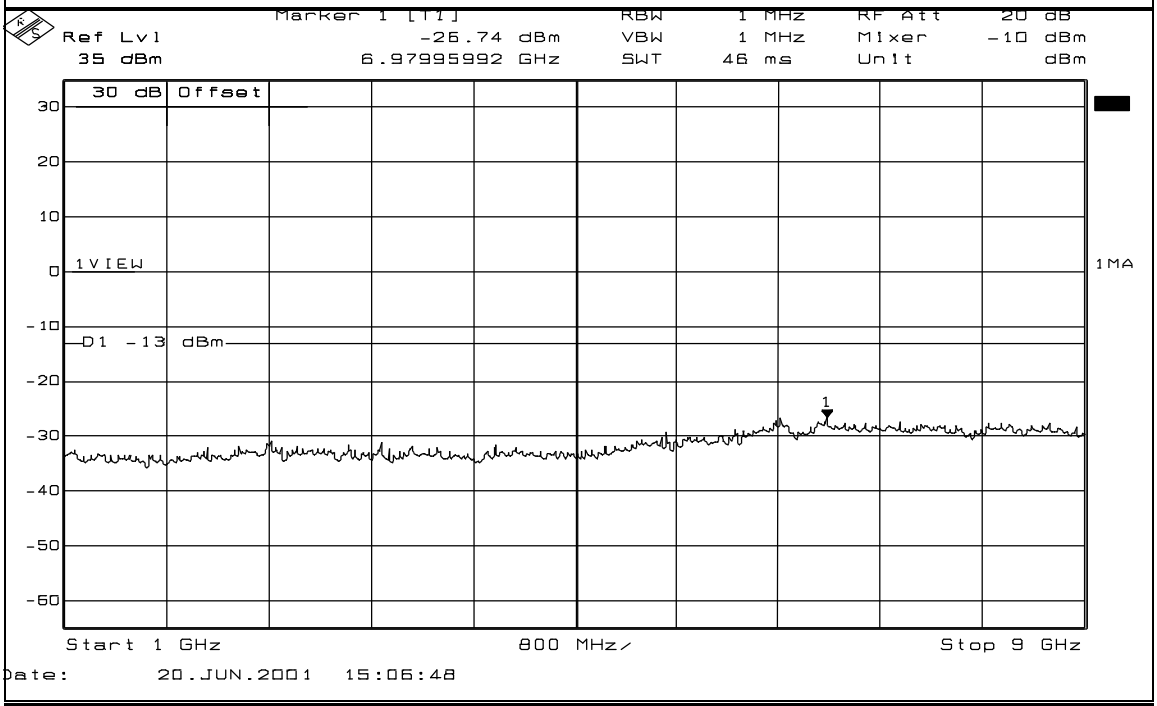
Nemko Dallas, Inc.

Data Plot **SPURIOUS EMISSIONS - CONDUCTED**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **CDMA MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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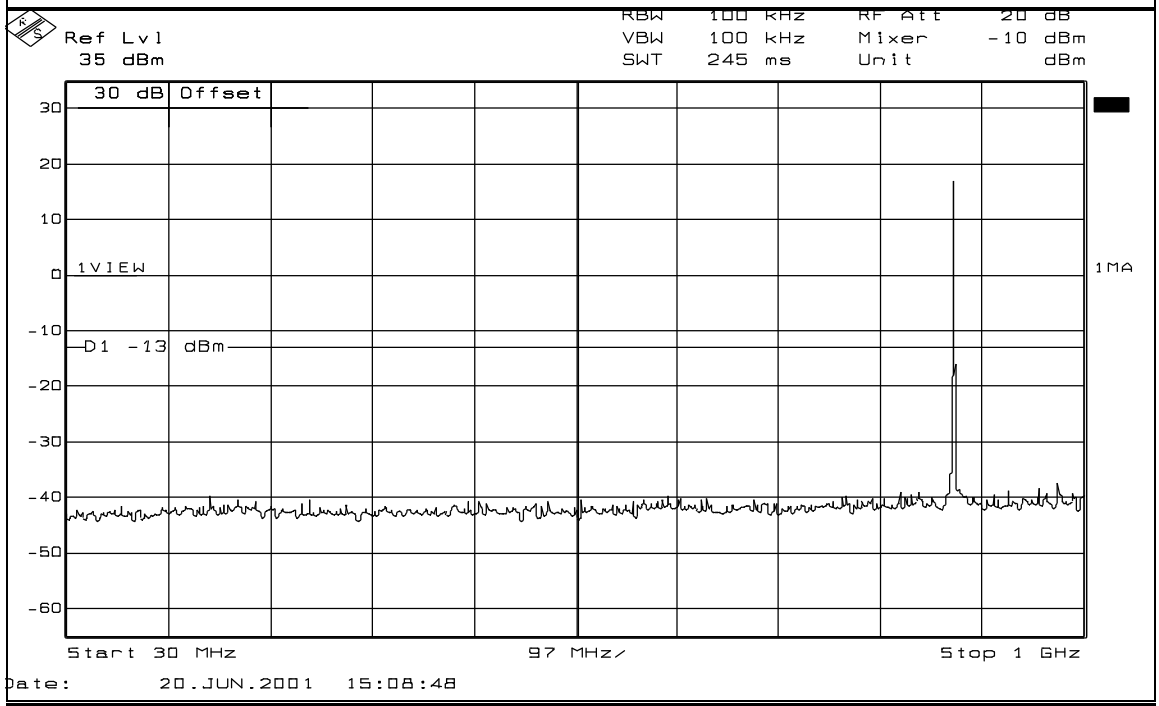
Data Plot SPURIOUS EMISSIONS - CONDUCTED

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **CDMA MODULATION**
DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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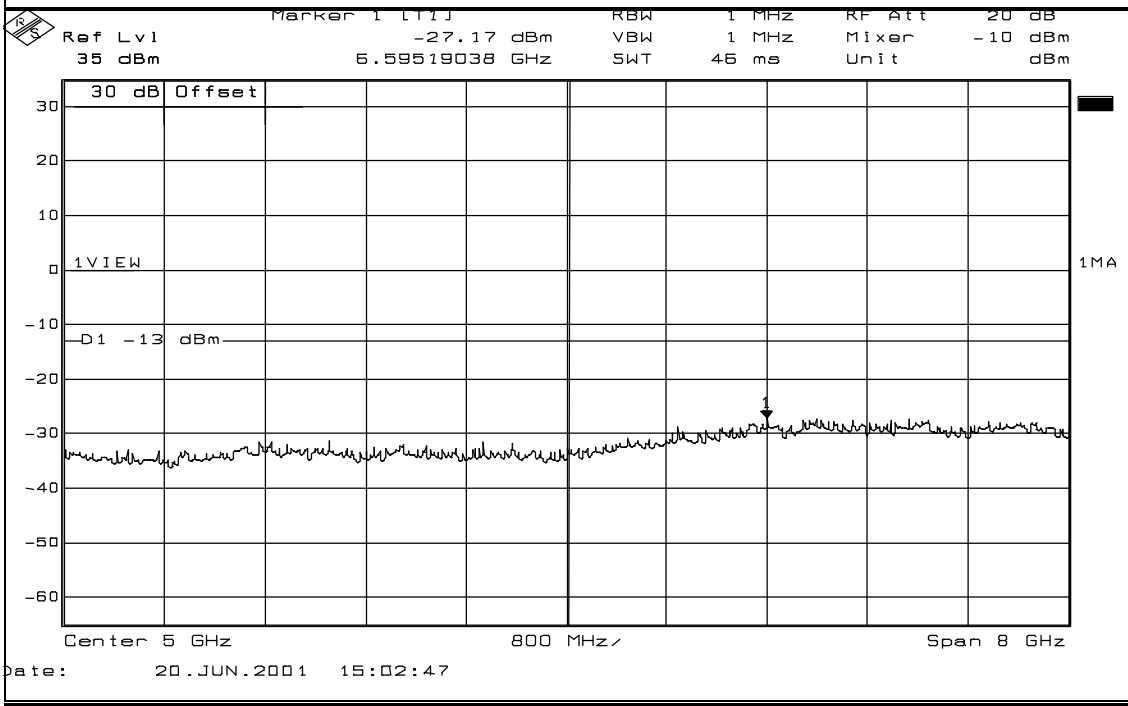
Test Plot: SPURIOUS EMISSIONS - CONDUCTED

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **CDMA MODULATION**
DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

Dallas Headquarters:
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Tel: (972) 436-9600
Fax: (972) 436-2667

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Data Plot **BANDEDGE - CDMA**

Page 1 of 4 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART 22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELLULAR BAND REPEATER

Configuration: TRANSMIT

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

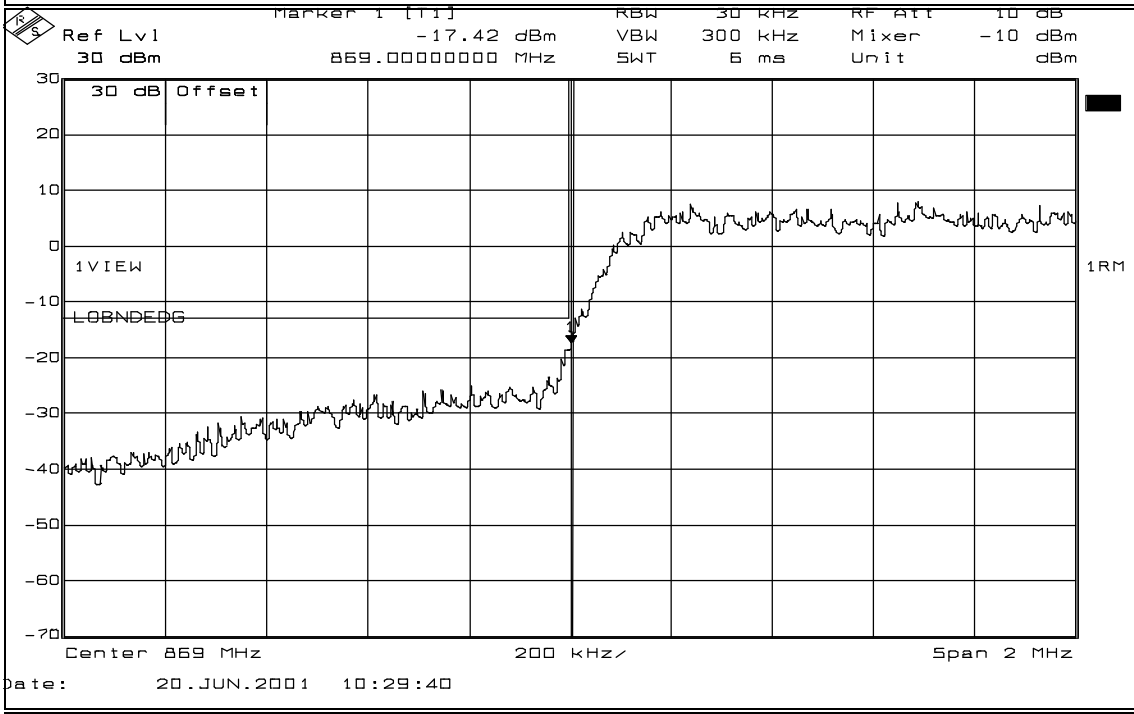
Detector Type: Rms VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes:

CDMA

LOWER BANDEDGE - DOWNLINK

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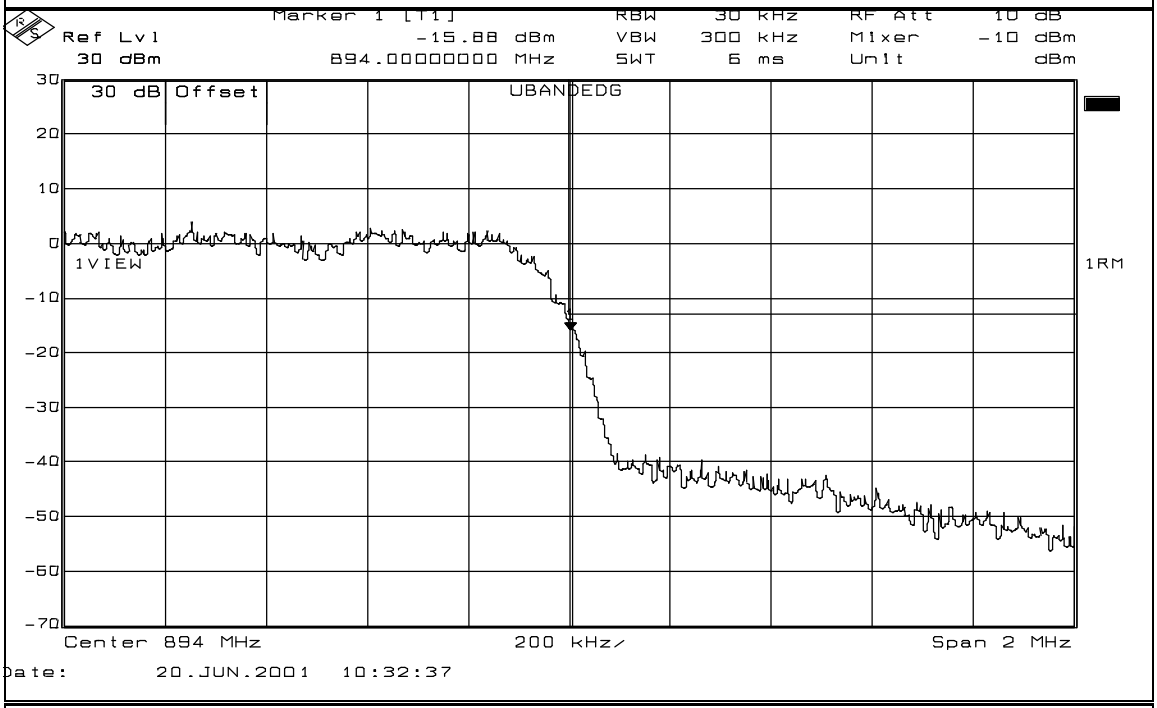
Data Plot **BANDEDGE - CDMA**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes:

CDMA
UPPER BANDEDGE - DOWNLINK

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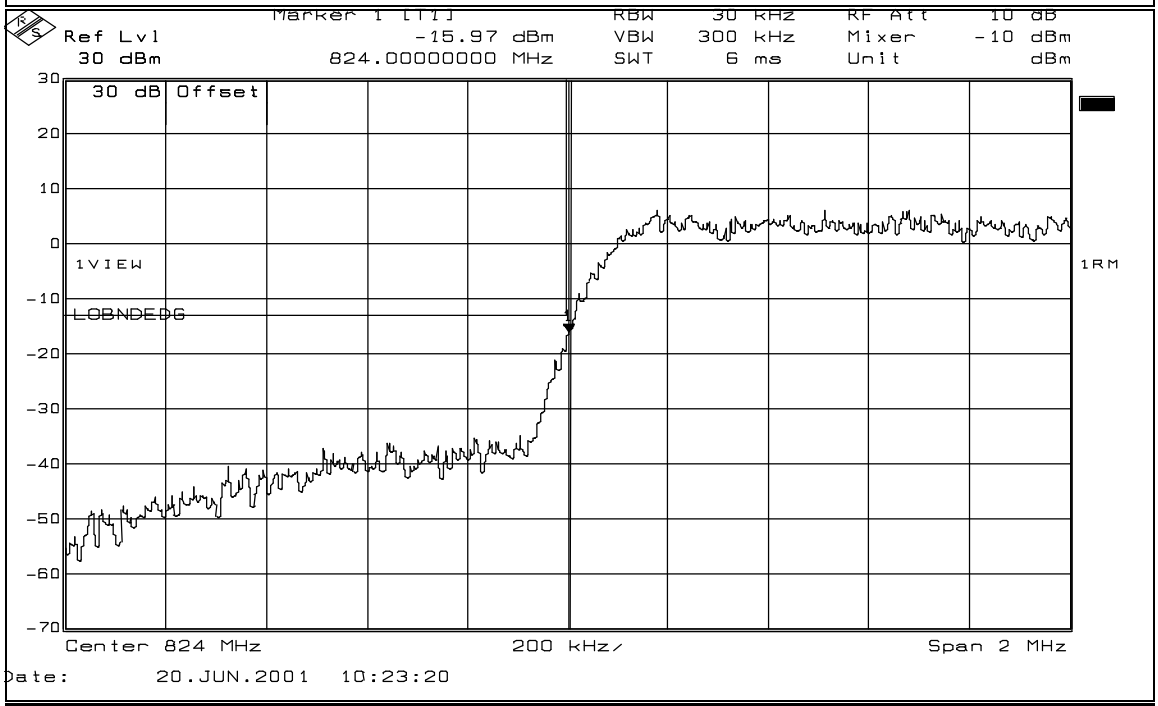
Data Plot **BANDEDGE - CDMA**

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes:

CDMA
LOWER BANDEDGE - UPLINK

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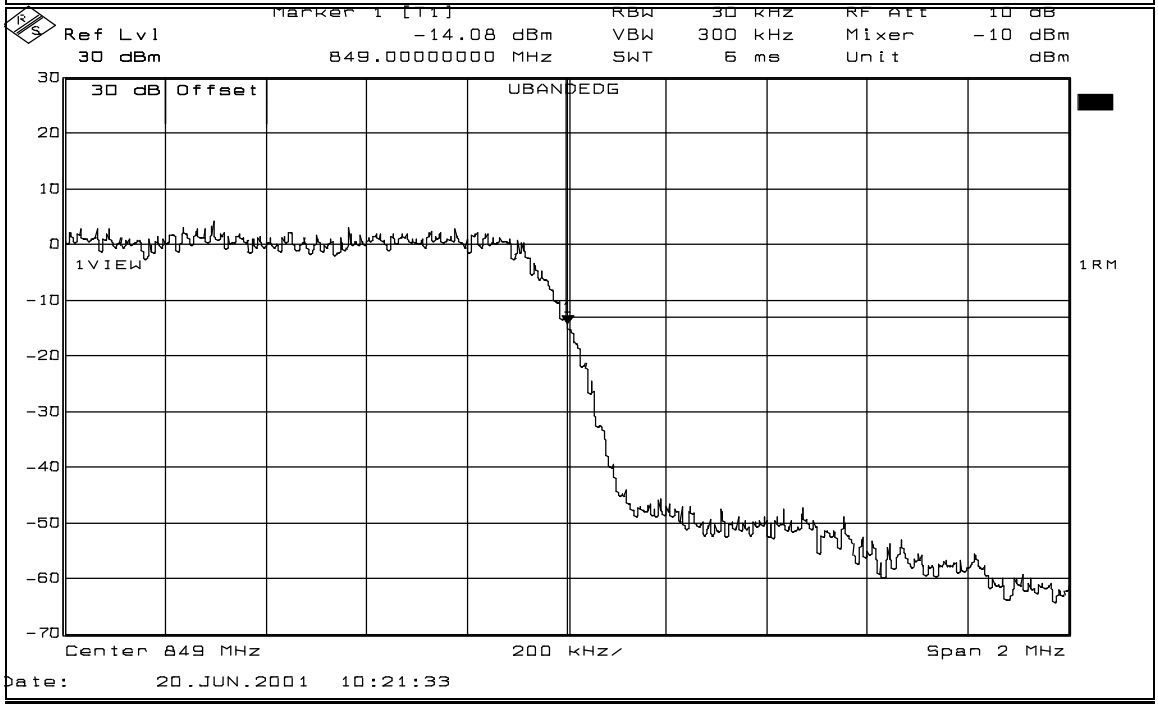
Test Plot: **BANDEDGE - CDMA**

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes:
CDMA
UPPER BANDEDGE - UPLINK

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Data Plot — **INTERMODULATION CHARACTERISTICS - CDMA**

Page 1 of 4 — Complete X — Preliminary

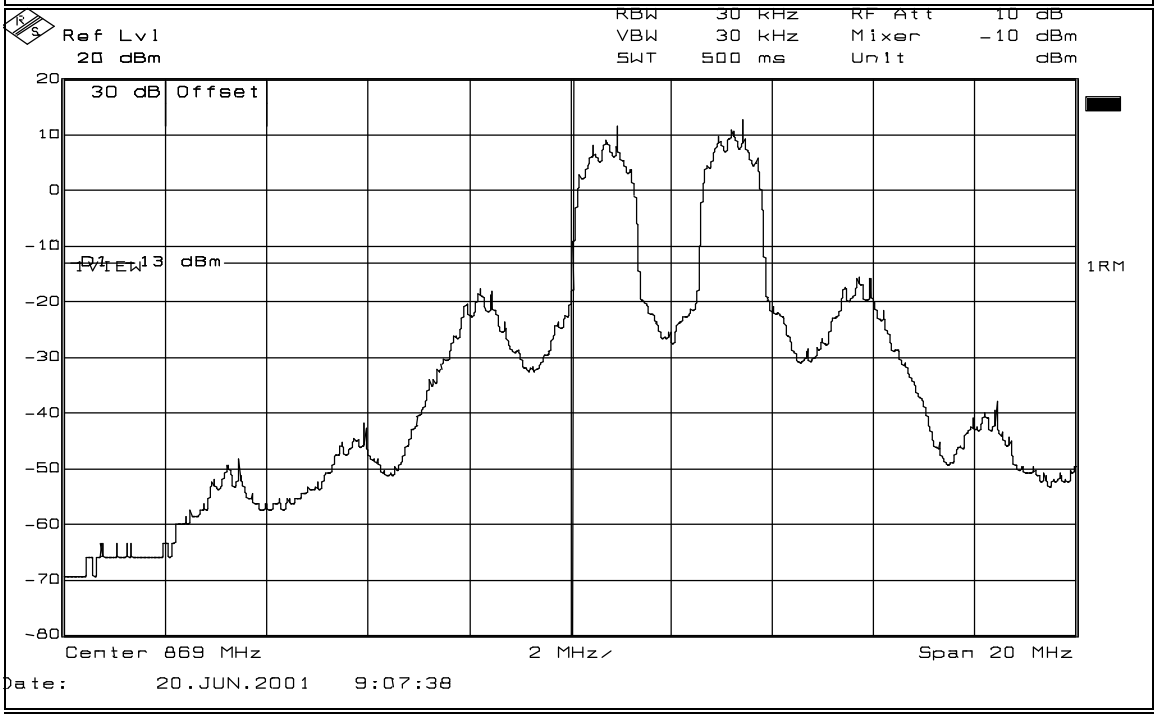
Job No.:	1L0084R	Date: 6/20/01	
Specification:	PART 22	Temperature(°C): 22	
Tested By:	David Light	Relative Humidity(%) 50	
E.U.T.:	CELLULAR BAND REPEATER		
Configuration:	TRANSMIT		
Sample Number:	1		
Location:	Lab 1	RBW: Refer to plots	Measurement
Detector Type:	Rms	VBW: Refer to plots	Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: INBAND AND OUT OF BAND INTERMODULATION
CDMA
LOWER BANDEDGE - DOWNLINK

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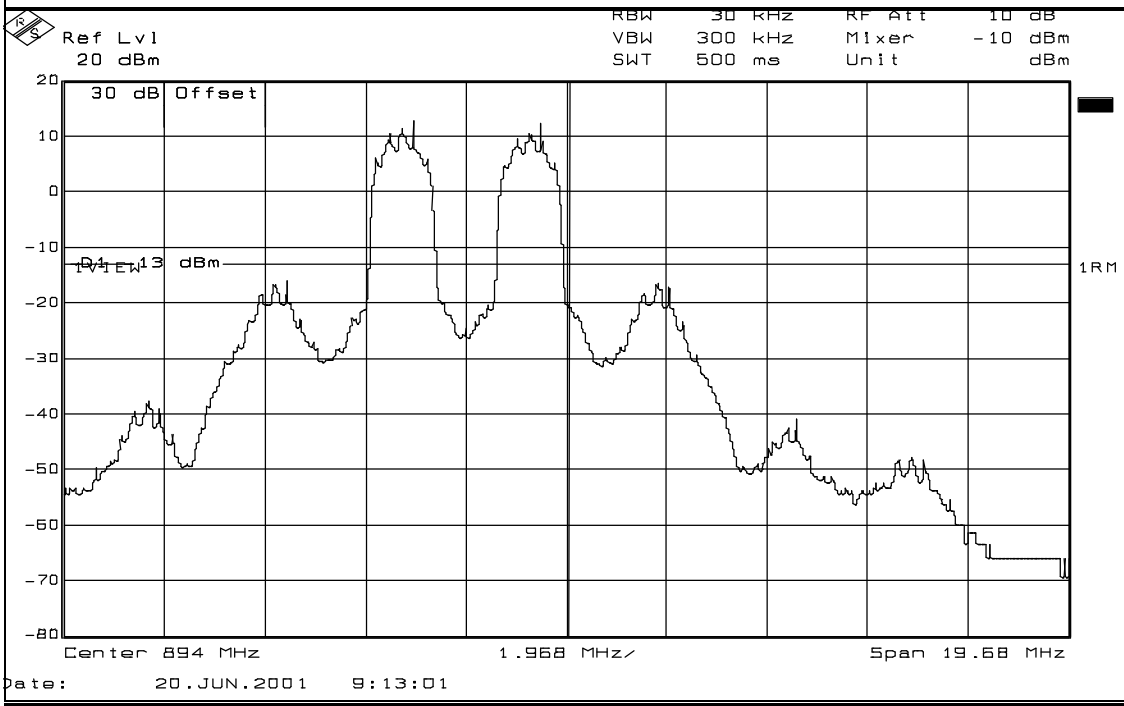
Data Plot **INTERMODULATION CHARACTERISTICS - CDMA**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
CDMA
UPPER BANDEDGE - DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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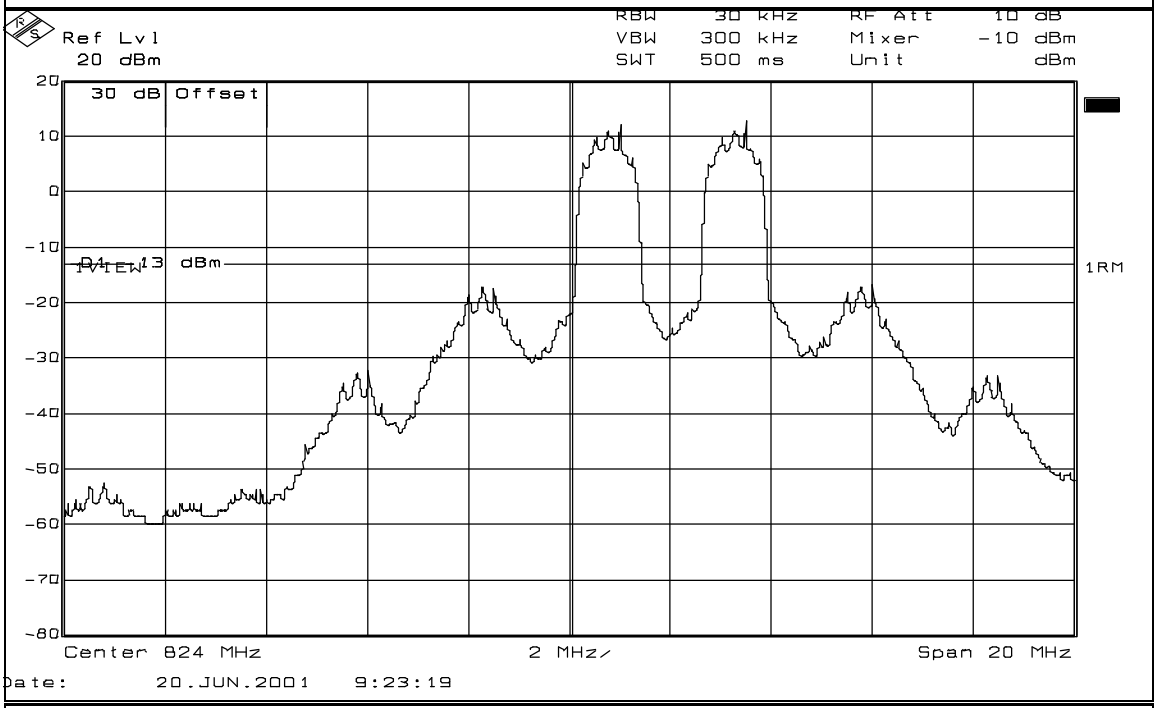
Data Plot **INTERMODULATION CHARACTERISTICS - CDMA**

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: INBAND AND OUT OF BAND INTERMODULATION
CDMA
LOWER BANDEDGE - UPLINK

Plots – Spurious Emissions at Antenna Terminals

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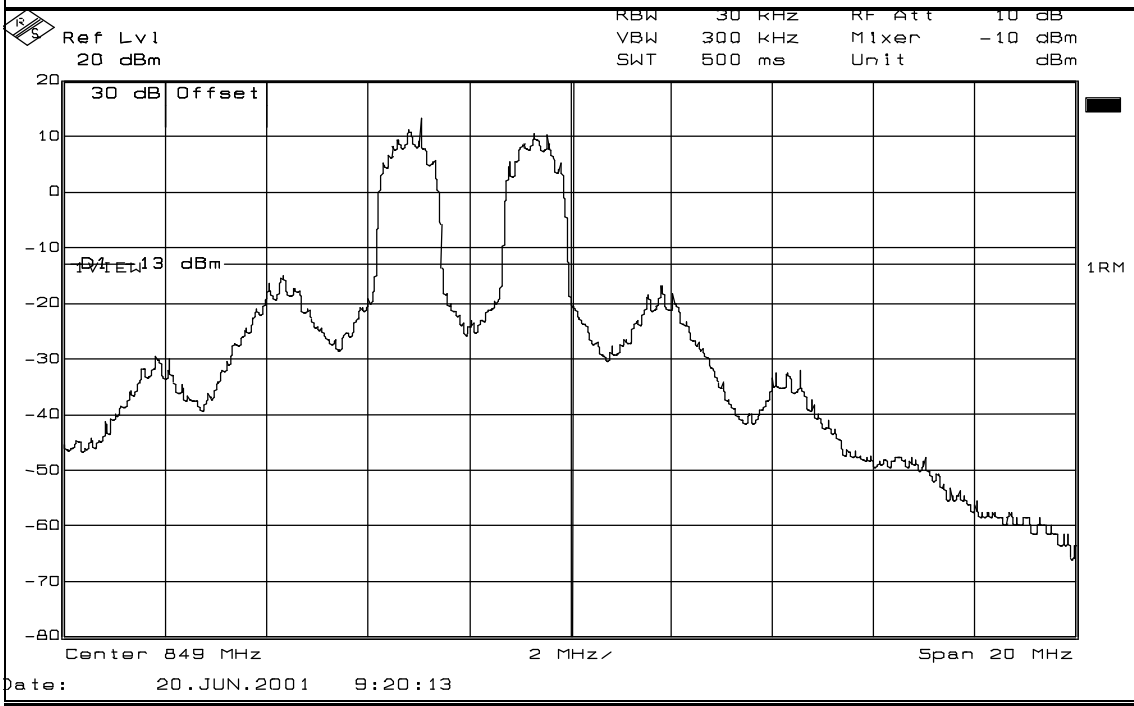
Test Plot: **INTERMODULATION CHARACTERISTICS - CDMA**

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
CDMA
UPPER BANDEDGE - UPLINK

Plots – Spurious Emissions at Antenna Terminals

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Data Plot **SPURIOUS EMISSIONS - CONDUCTED**

Page 1 of 4 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELLULAR BAND REPEATER

Configuration: TRANSMIT FULL POWER

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

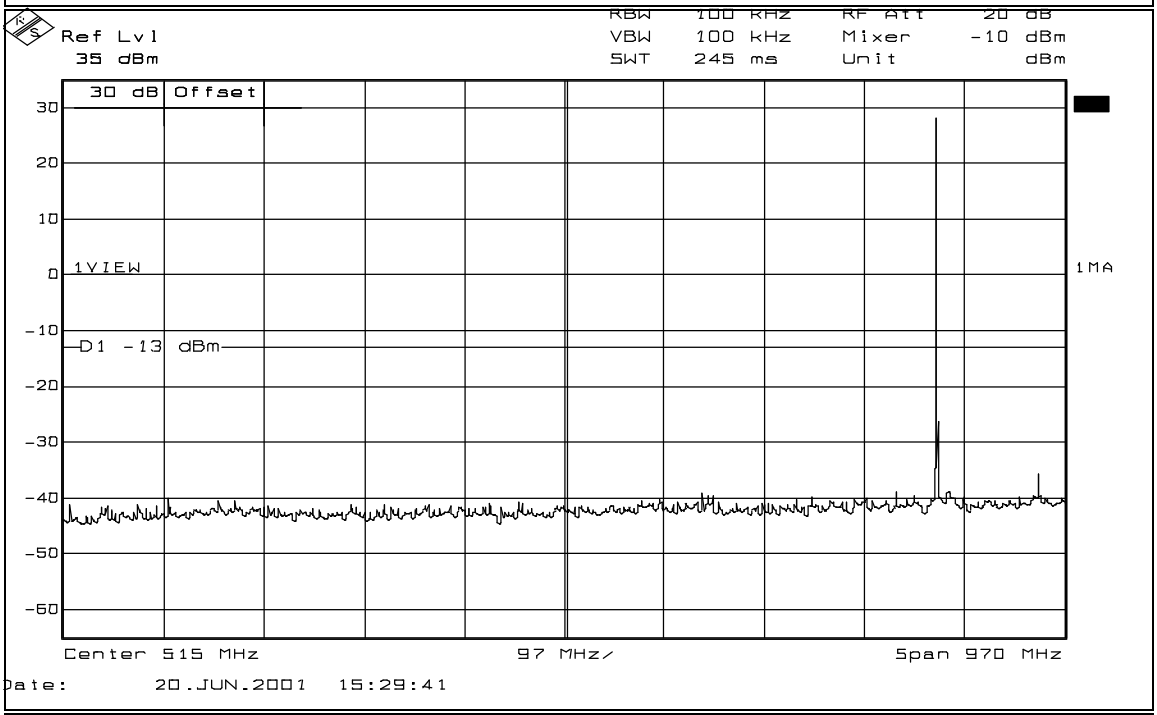
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **TDMA MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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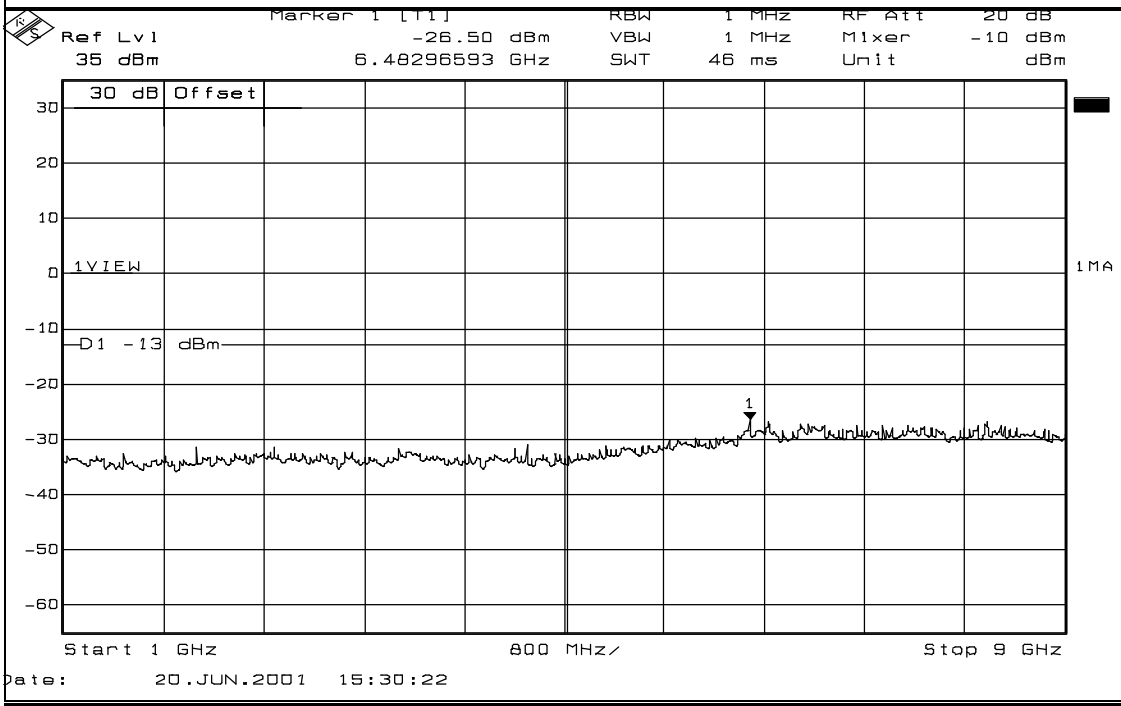
Data Plot **SPURIOUS EMISSIONS - CONDUCTED**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **TDMA MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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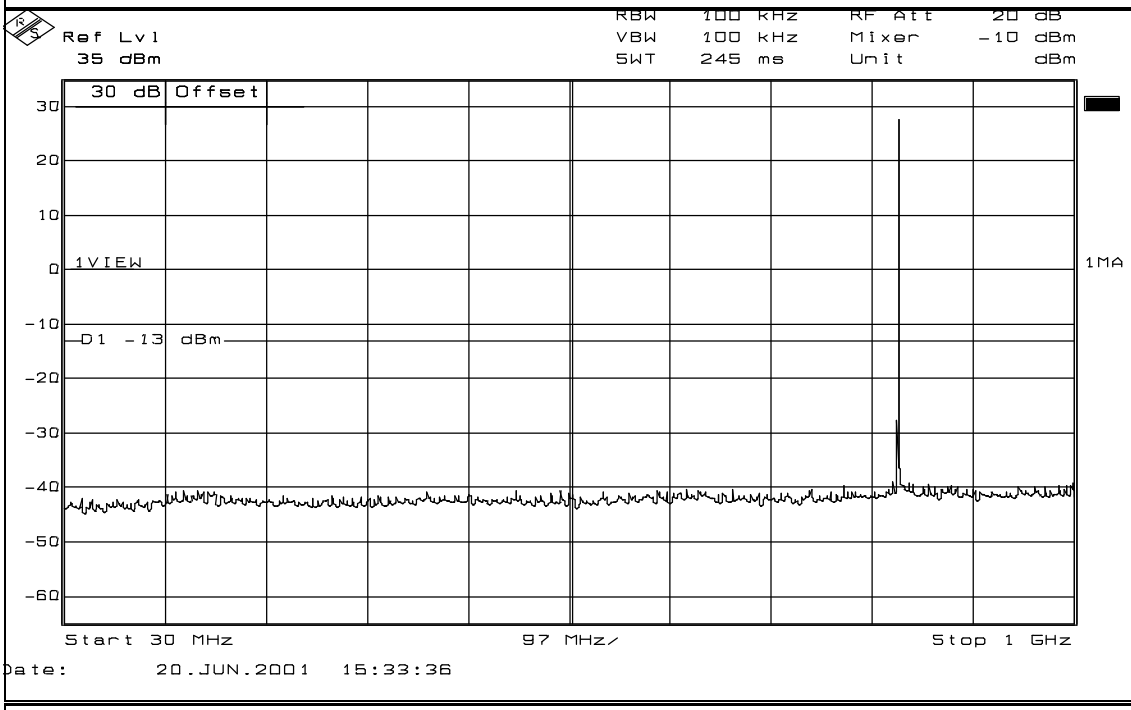
Data Plot SPURIOUS EMISSIONS - CONDUCTED

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **TDMA MODULATION**
DOWNLINK

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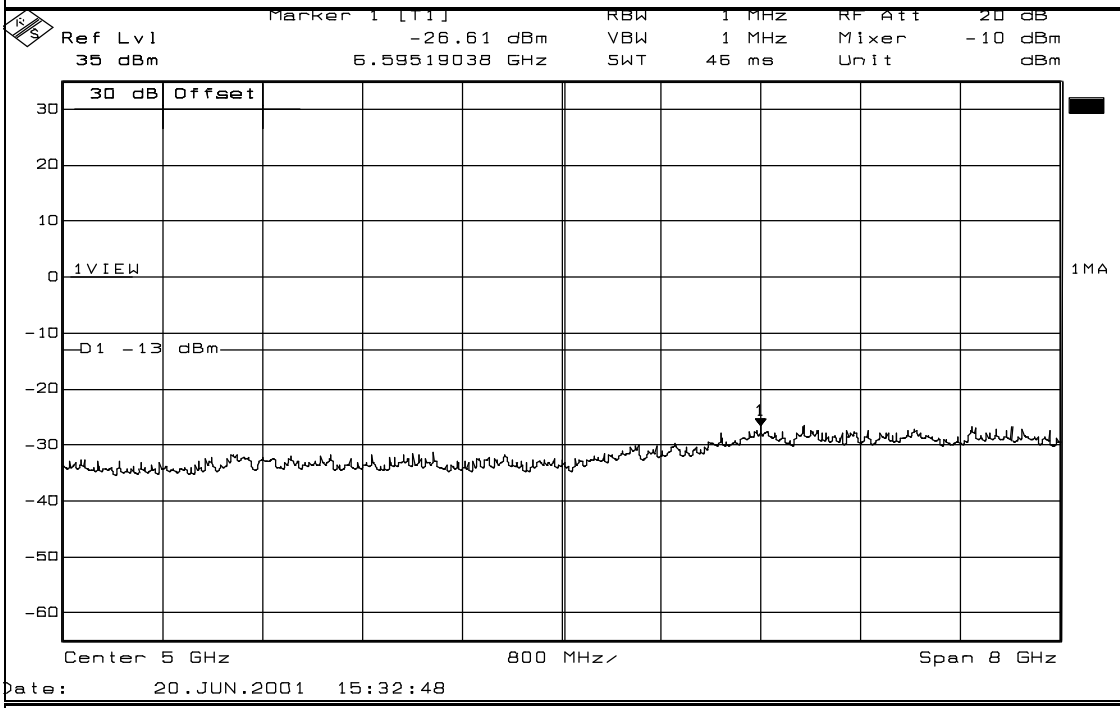
Test Plot: **SPURIOUS EMISSIONS - CONDUCTED**

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **TDMA MODULATION**
DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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Data Plot **INTERMODULATION CHARACTERISTICS - TDMA**

Page 1 of 4 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART 22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELLULAR BAND REPEATER

Configuration: TRANSMIT

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

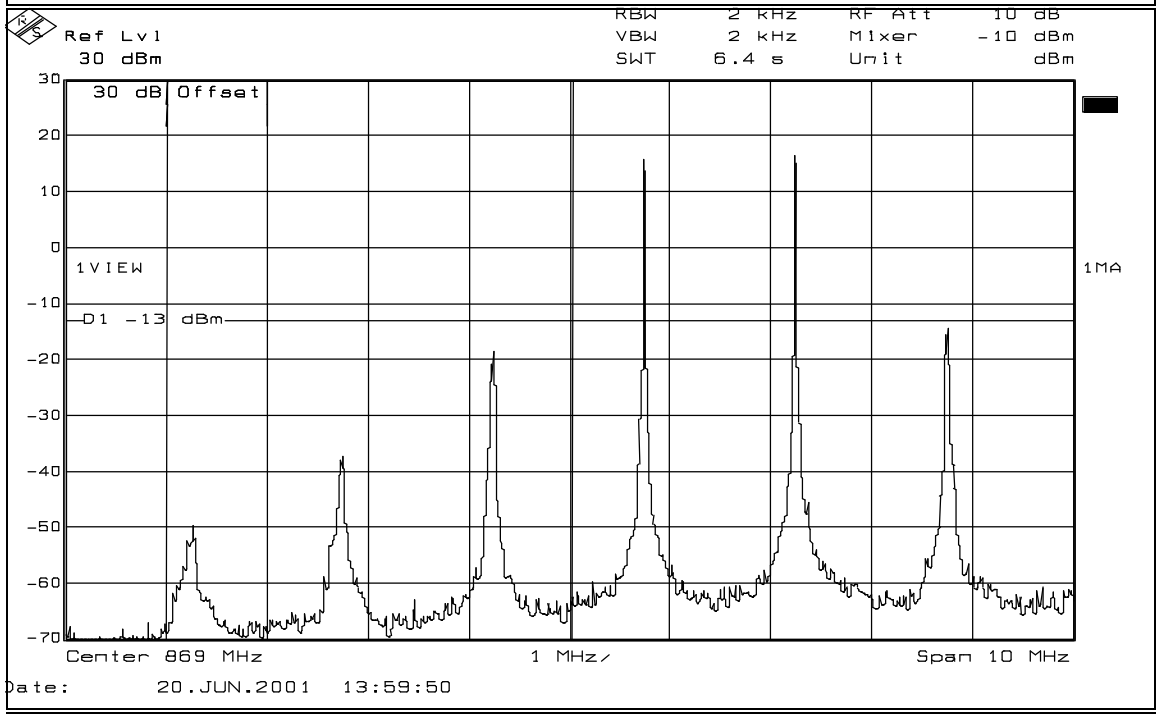
Detector Type: Rms VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
TDMA
LOWER BANDEDGE - DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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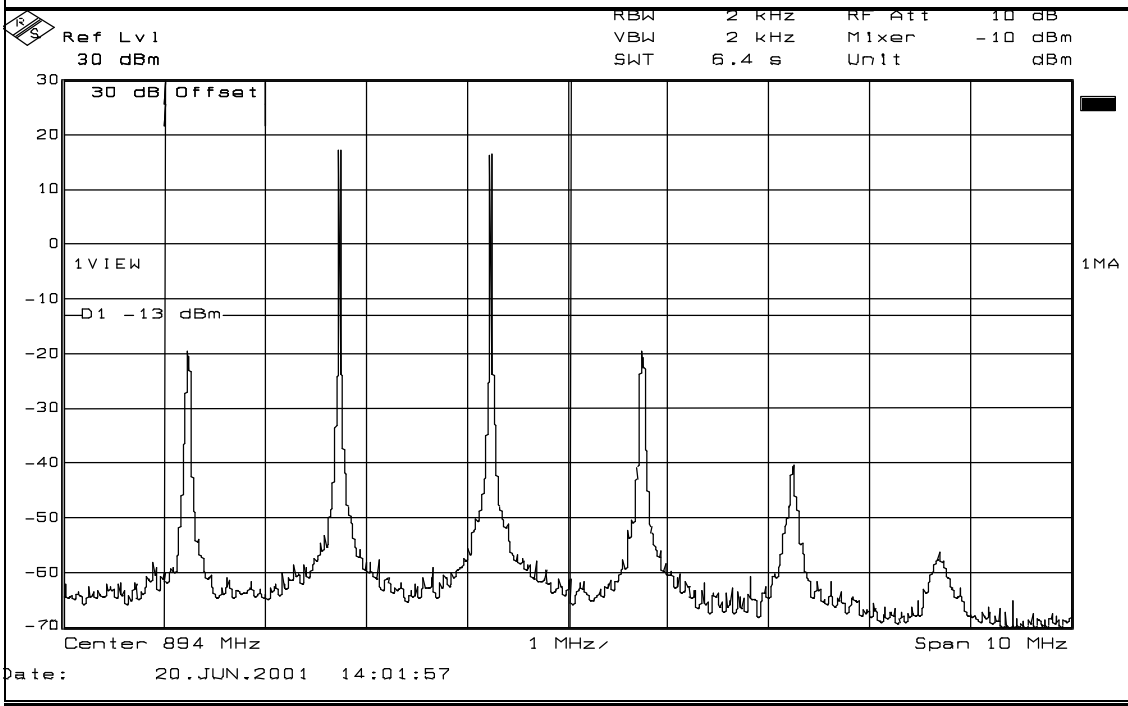
Data Plot **INTERMODULATION CHARACTERISTICS - TDMA**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
TDMA
UPPER BANDEDGE - DOWNLINK

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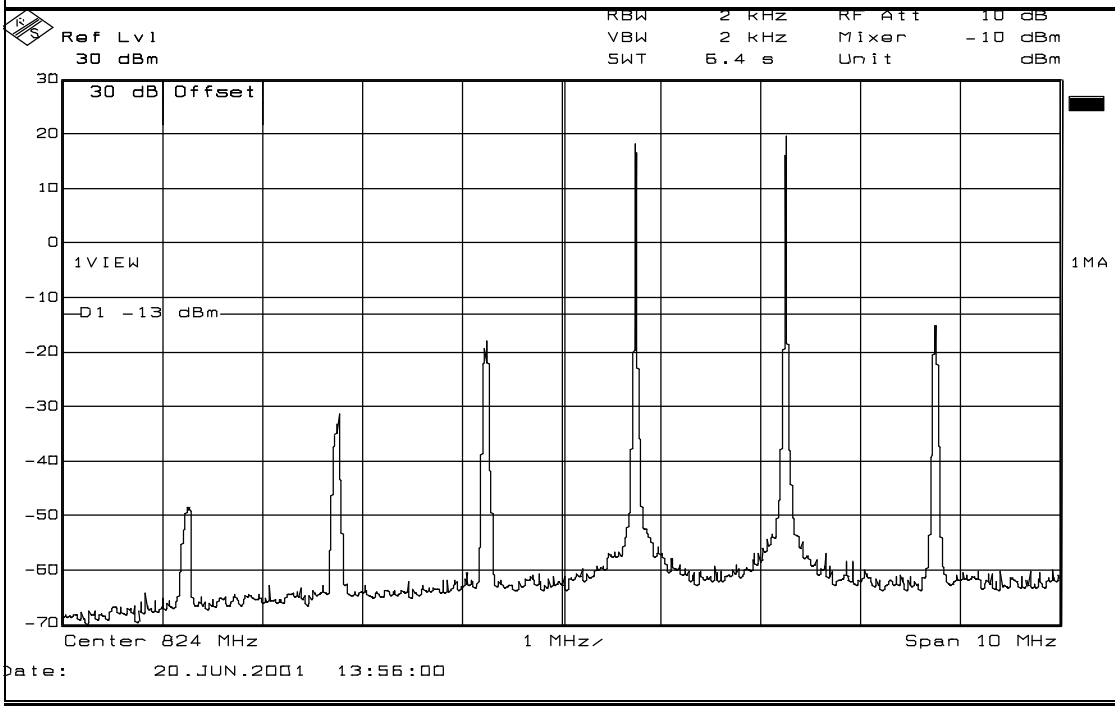
Data Plot **INTERMODULATION CHARACTERISTICS - TDMA**

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
TDMA
LOWER BANDEDGE - UPLINK

Plots – Spurious Emissions at Antenna Terminals

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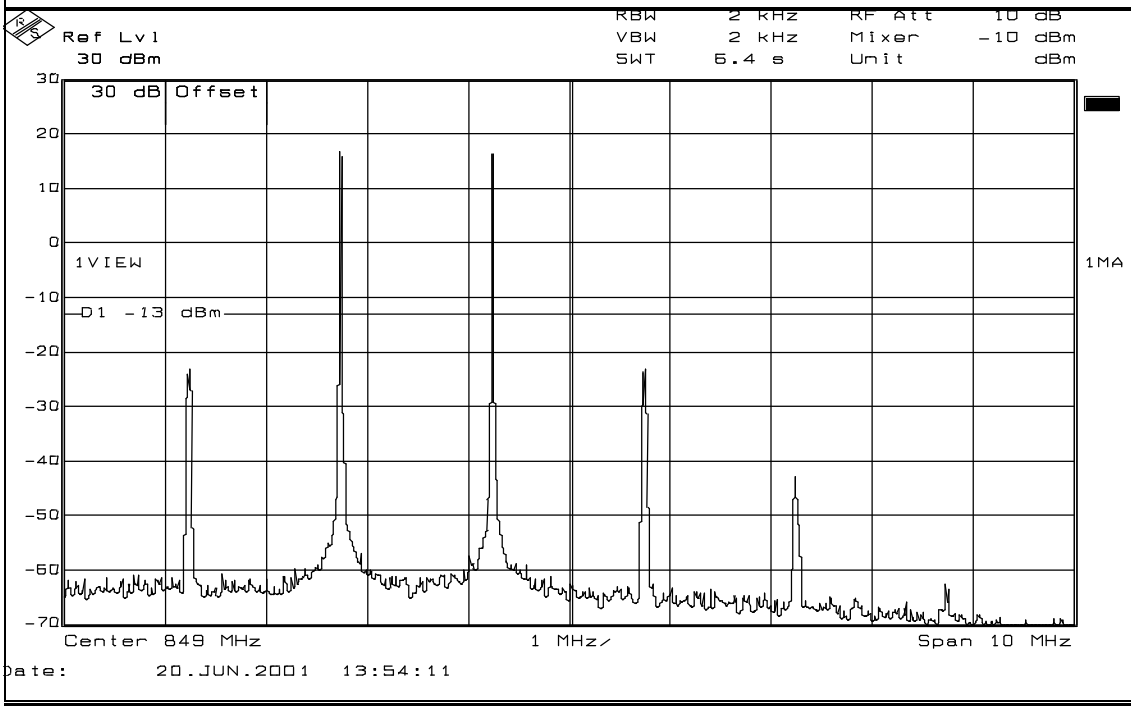
Test Plot: **INTERMODULATION CHARACTERISTICS - TDMA**

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
TDMA
UPPER BANDEDGE - UPLINK

Plots – Spurious Emissions at Antenna Terminals

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Data Plot **SPURIOUS EMISSIONS - ANALOG**

Page 1 of 6 Complete X

Job No.: 1L0084R Date: 6/20/01 Preliminary

Specification: PART22 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: CELLULAR BAND REPEATER

Configuration: TRANSMIT FULL POWER

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

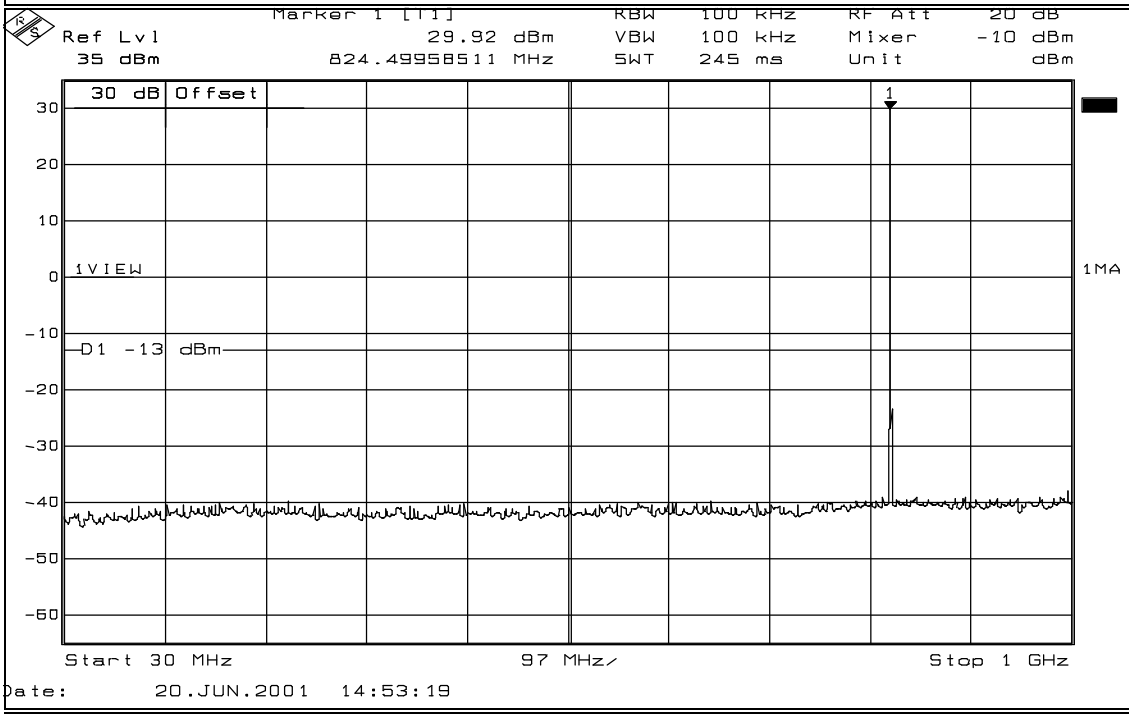
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **VOICE MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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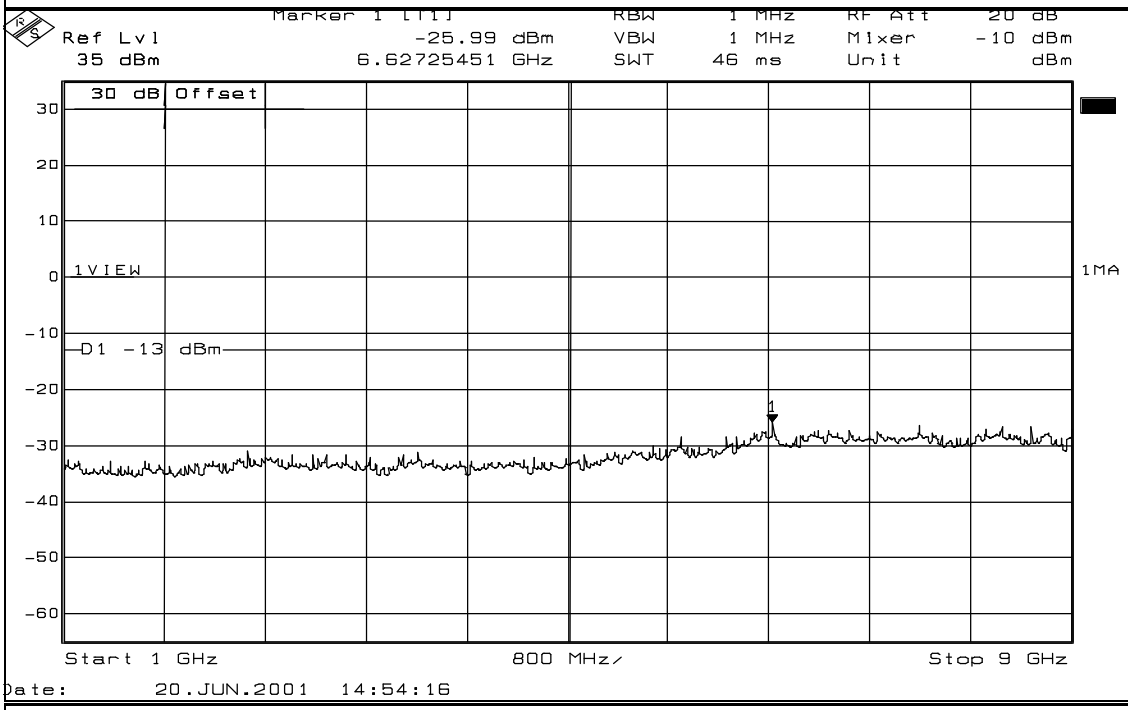
Data Plot **SPURIOUS EMISSIONS - ANALOG**

Page 2 of 6

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **VOICE MODULATION**
UPLINK

Plots – Spurious Emissions at Antenna Terminals

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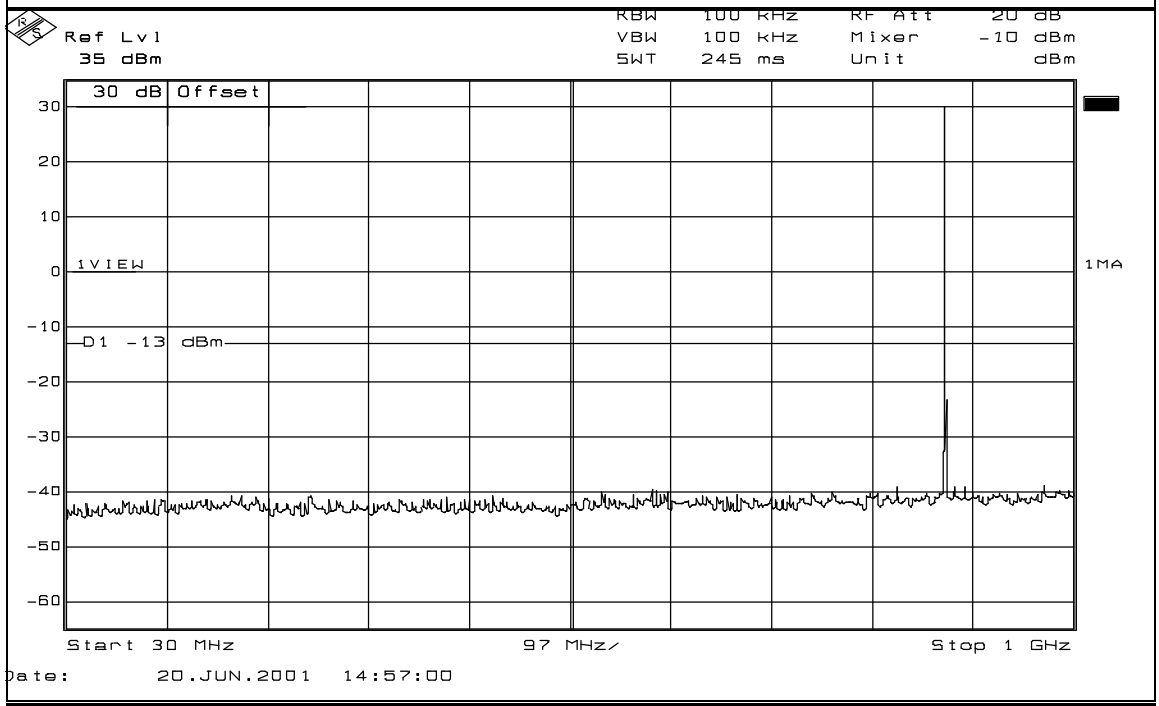
Data Plot SPURIOUS EMISSIONS - ANALOG

Page 3 of 6

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **VOICE MODULATION**
DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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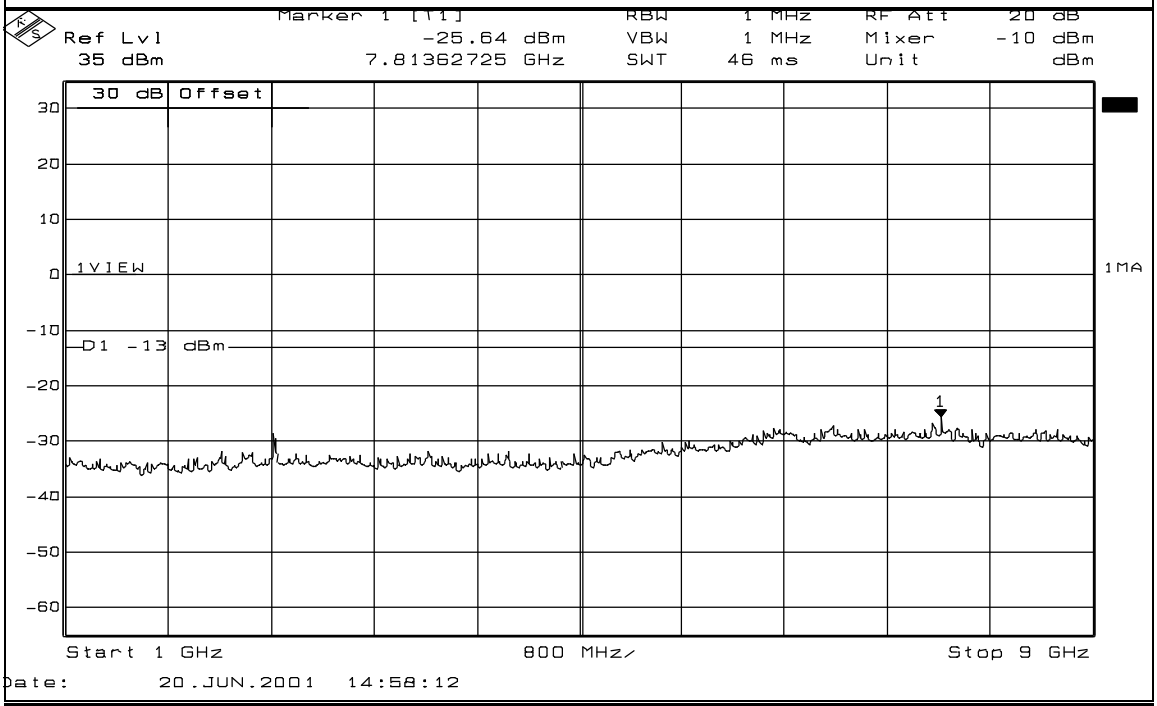
Test Plot: **SPURIOUS EMISSIONS - ANALOG**

Page 4 of 6

Job No.: 1L0084R Date: 6/20/01
Specification: PART22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER



Notes: **VOICE MODULATION**
DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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Data Plot — **INTERMODULATION CHARACTERISTICS - AMPS**

Page 1 of 4 — Complete X — Preliminary

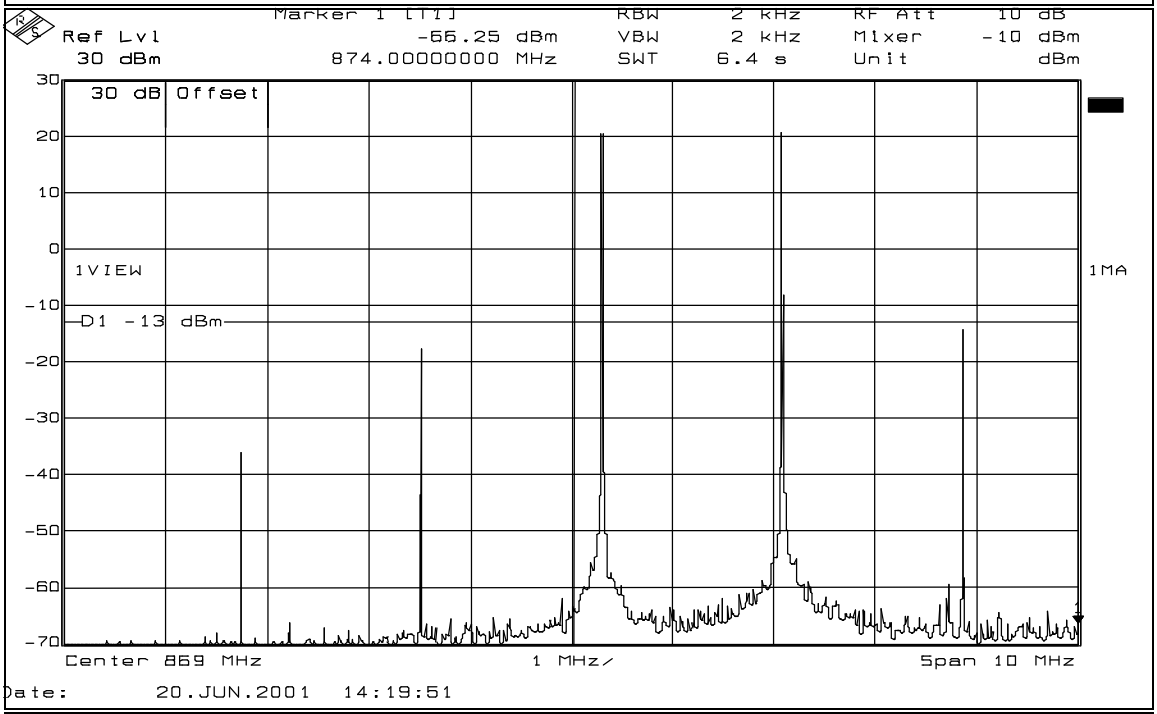
Job No.:	1L0084R	Date: 6/20/01			
Specification:	PART 22	Temperature(°C): 22			
Tested By:	David Light	Relative Humidity(%) 50			
E.U.T.:	CELLULAR BAND REPEATER				
Configuration:	TRANSMIT				
Sample Number:	1				
Location:	Lab 1	RBW: Refer to plots		Measurement	
Detector Type:	Rms	VBW: Refer to plots		Distance: N/A	m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:	1065	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
AMPS
LOWER BANDEDGE - DOWNLINK

Plots – Spurious Emissions at Antenna Terminals

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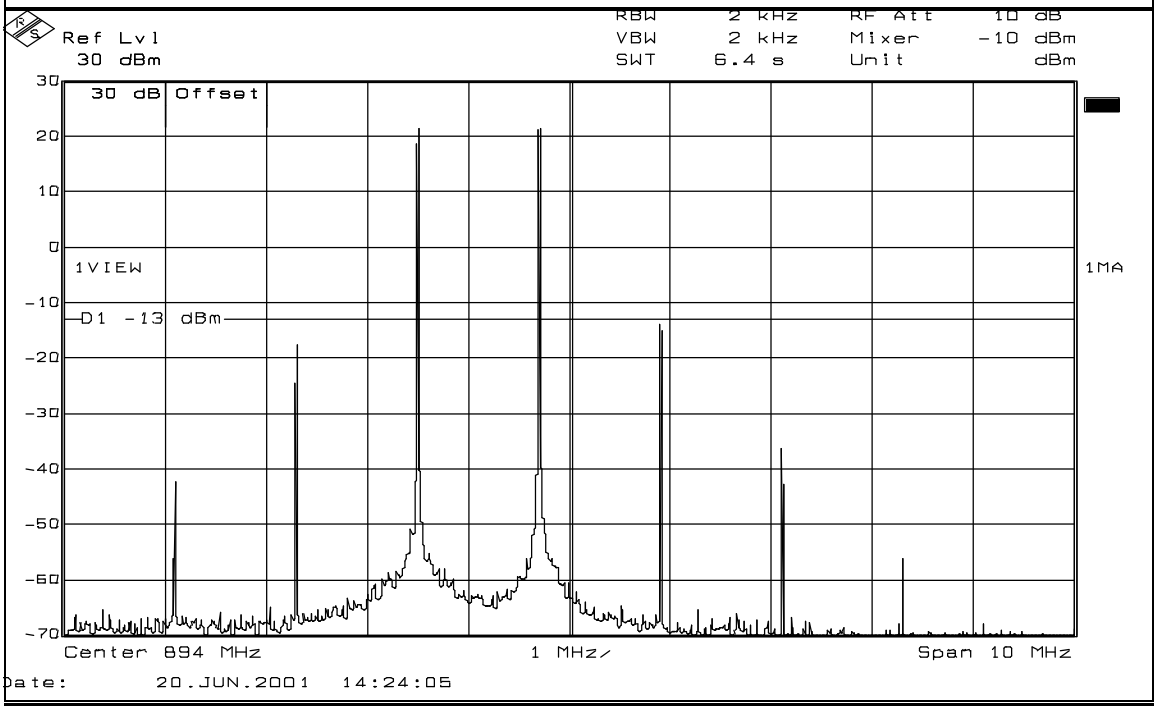
Data Plot **INTERMODULATION CHARACTERISTICS - AMPS**

Page 2 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
AMPS
UPPER BANDEDGE - DOWNLINK

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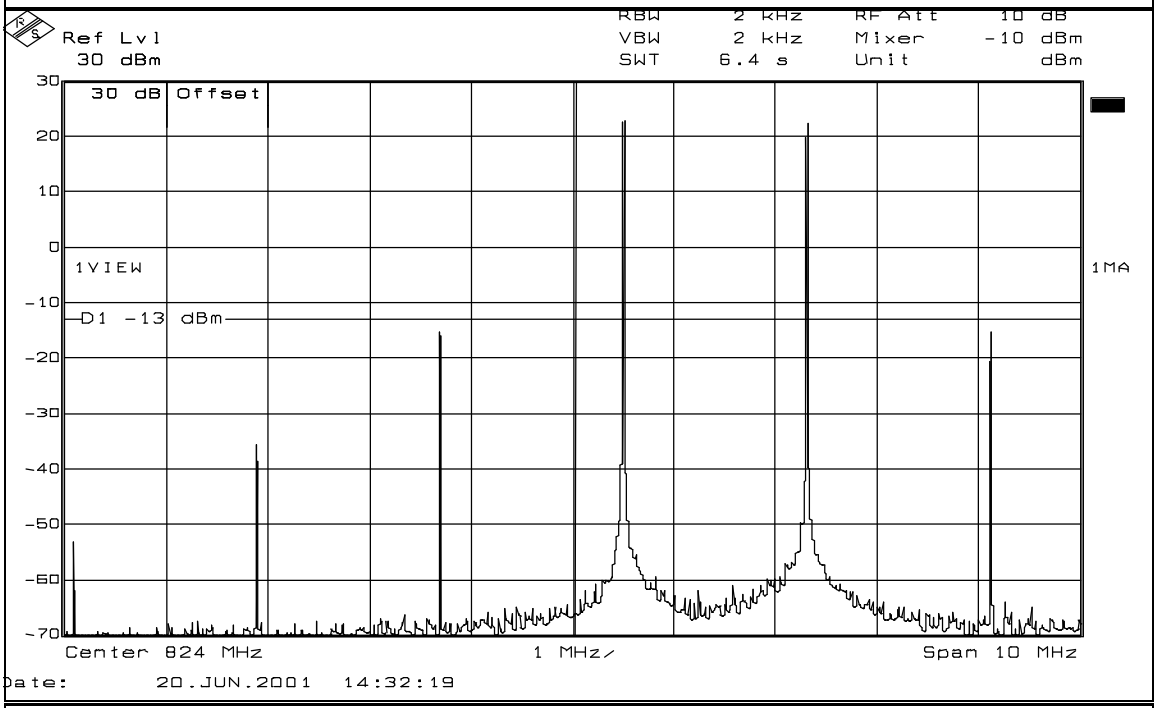
Nemko Dallas, Inc.

Data Plot **INTERMODULATION CHARACTERISTICS - AMPS**

Page 3 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
AMPS
LOWER BANDEDGE - UPLINK

Plots – Spurious Emissions at Antenna Terminals

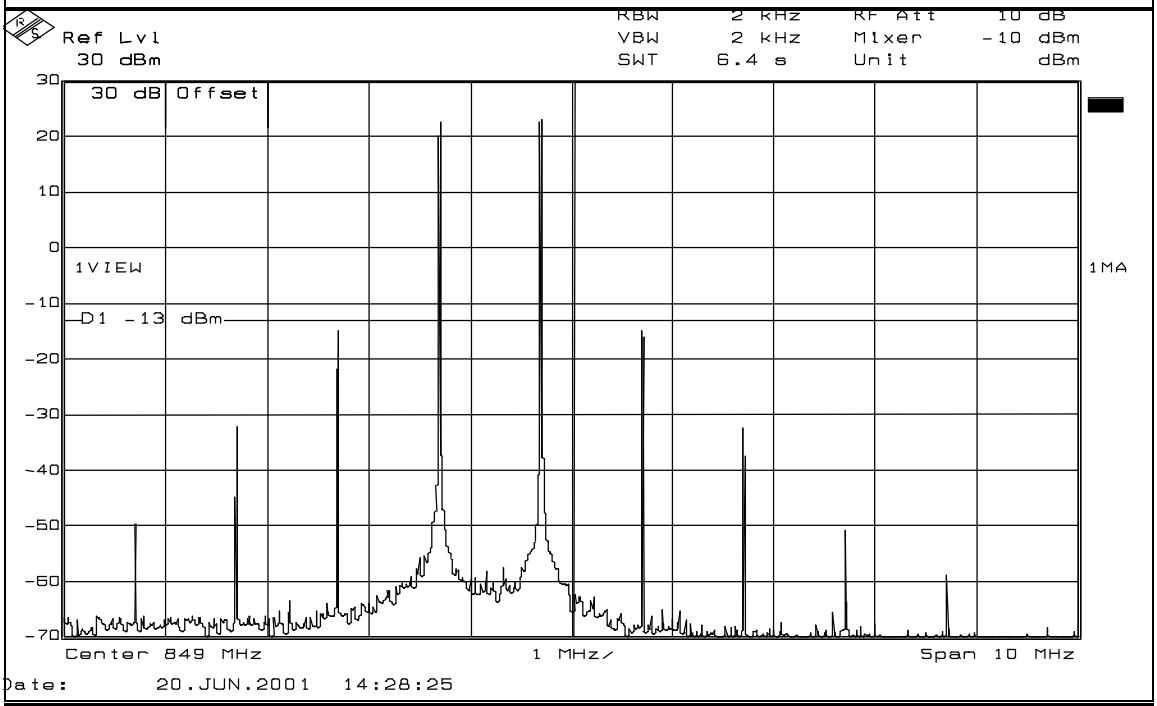
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Test Plot: **INTERMODULATION CHARACTERISTICS - AMPS**

Page 4 of 4

Job No.: 1L0084R Date: 6/20/01
Specification: PART 22 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT



Notes: **INBAND AND OUT OF BAND INTERMODULATION**
AMPS
UPPER BANDEDGE - UPLINK

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David LightTom Tidwell	DATE:6/20/01

Test Results: Complies.

Test Data: See attached table.

Equipment Used: 1464-1484-1485-993-1016

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 50 %

Test Data – Field Strength of Spurious Emissions

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Field Strength of Spurious Emissions

Page 1 of 1

Complete X
Preliminary

Job No.: 1L0084R
Specification: PART 22
Tested By: David Light
E.U.T.: CELLULAR BAND REPEATER
Configuration: TRANSMIT FULL POWER
Sample No: 1
Location: AC 3
Detector Type: Peak

Date: 6/20/01
Temperature(°C): 22
Relative Humidity(%) 50
RBW: 1 MHz
VBW: 1 MHz
Measurement Distance: 3 m

Test Equipment Used

Antenna:
Pre-Amp: 1016
Filter:
Receiver: 1464
Attenuator #1
Attenuator #2:
Additional equipment used:
Measurement Uncertainty: +/-1.76 dB

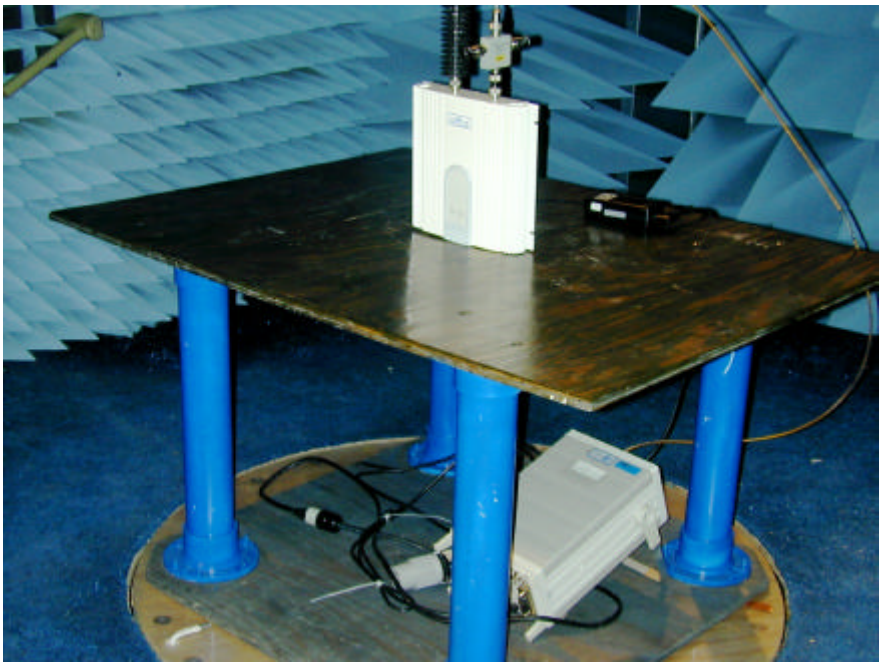
Directional Coupler:
Cable #1: 1484
Cable #2: 1485
Cable #3:
Cable #4:
Mixer:

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)		ERP (dBm)	ERP (mW)	Polarity	Comments
										Downlink (875 MHz)
1750	-61.3	29.9		31.7	6.4		-56.8	0.000002	V	
2625	-69.3	35.6		32.5	8.0		-58.3	0.000001	V	
3500	-70.0	40.4		32	8.0		-53.6	0.000004	V	Noise floor
4375	-71.5	42.8		31.4	7.9		-52.2	0.000006	V	Noise floor
1750	-66.5	32.7		31.7	6.4		-59.2	0.000001	H	
2625	-69.7	34.6		32.5	8.0		-59.6	0.000001	H	Noise floor
3500	-70.0	34.3		32	8.0		-59.7	0.000001	H	Noise floor
4375	-71.5	35.2		31.4	7.9		-59.8	0.000001	H	Noise floor
										Uplink (830 MHz)
1660	-70.2	32.7		31.5	6.4		-62.7	0.000001	H	Noise floor
2490	-69.8	36.7		32.2	6.9		-58.5	0.000001	H	Noise floor
3320	-70.3	35.8		32.4	8.1		-58.8	0.000001	H	Noise floor
4150	-72.0	35.2		31.4	7.9		-60.3	0.000001	H	Noise floor
1660	-70.2	29.9		31.5	6.4		-65.5	0.000000	V	Noise floor
2490	-69.8	34.1		32.2	6.9		-61.1	0.000001	V	Noise floor
3320	-70.3	37.1		32.4	8.1		-57.5	0.000002	V	Noise floor
4150	-72.0	42.8		31.4	7.9		-52.7	0.000005	V	Noise floor

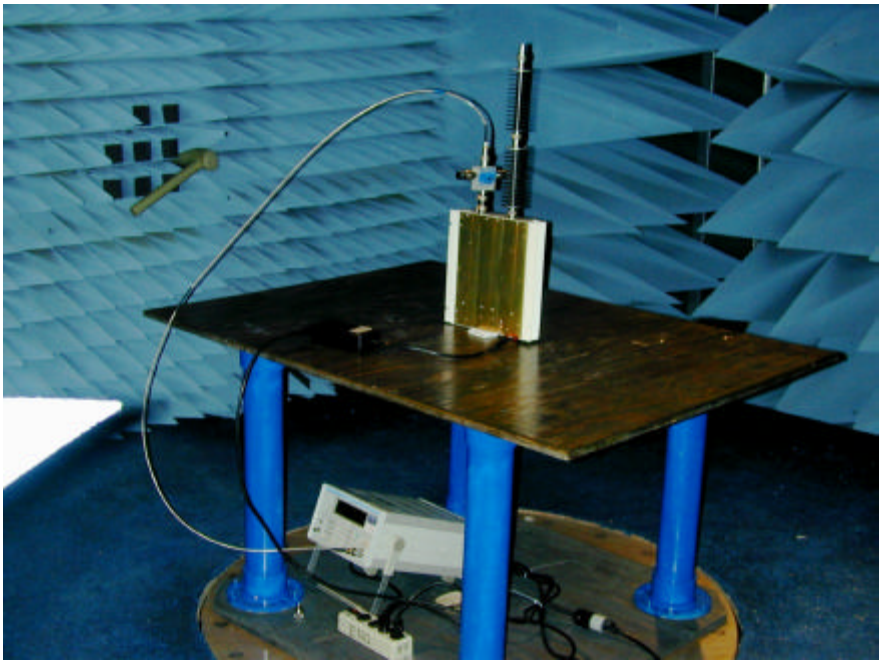
Notes: SCANNED SPECTRUM TO THE TENTH HARMONIC OF CARRIER FREQUENCY

Photos – Test Setup

Front



Rear



Section 7. Frequency Stability

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

Test Results: Complies.

Test Data: See attached table.

Standard Test Frequency MHz

Standard Test Voltage

Equipment

Not Applicable

Measurement Uncertainty: +/- 1 x 10^{-7} ppm

Temperature: °C

Relative Humidity: %

Section 8. Test Equipment List

ASSET	Description	Manufacturer Model Number	Serial Number	Cal. Date	Cal. Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/02/02
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99	07/16/01
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01	05/30/02
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00	05/25/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01	06/01/02
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1065	ATTENUATOR	NARDA 776B-10	NONE	CBU	N/A
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	06/01/01	06/01/02
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/99	06/14/01
1029	PEAK POWER METER	HP 8900D	3303U0012	03/12/01	03/12/02
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	03/12/01	03/12/02

ANNEX A - TEST DETAILS

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

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 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:

$$P = \frac{E^2R^2}{30G} = \frac{E^2 3^2}{30G}$$

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 (Voice & SAT) PARA. NO.: 2.1049

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: ≥ RBW
Span: 100 kHz
Sweep: Auto

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.

NAME OF TEST: Occupied Bandwidth (WB Data)	**PARA. NO.: 2.1049**

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: ≥ RBW
Span: 200 kHz
Sweep: Auto

Input Signal Characteristics:
RF level: Maximum recommended by manufacturer
AF1 frequency: 10 kHz, random bit sequence
AF1 level: sufficient to produce 8 kHz deviation

NAME OF TEST: Occupied Bandwidth (ST)	**PARA. NO.: 2.1049**

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: ≥ RBW
Span: 200 kHz
Sweep: Auto

Input Signal Characteristics:
RF level: Maximum recommended by manufacturer
AF1 frequency: 10 kHz tone
AF1 level: sufficient to produce 8 kHz deviation

NAME OF TEST: Occupied Bandwidth (Digital Modulation)	**PARA. NO.: 2.1049**

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: ≥ RBW
Span: As required
Sweep: Auto

Input Signal Characteristics:
RF level: Maximum recommended by manufacturer

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

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: ≥ RBW
Start Frequency: 0 MHz
Stop Frequency: 10 GHz
Sweep: Auto

NAME OF TEST: Field Strength of Spurious Radiation	**PARA. NO.: 2.1053**

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

$$E = 84.4 - 20Log\sqrt{1.64} = 82.3 dBmV/m@3m$$

The spectrum is searched to 10 GHz.

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

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

Table C-1

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

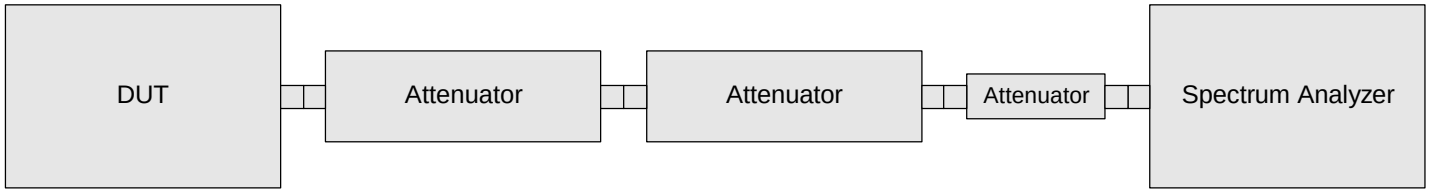
Method Of Measurement:

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.

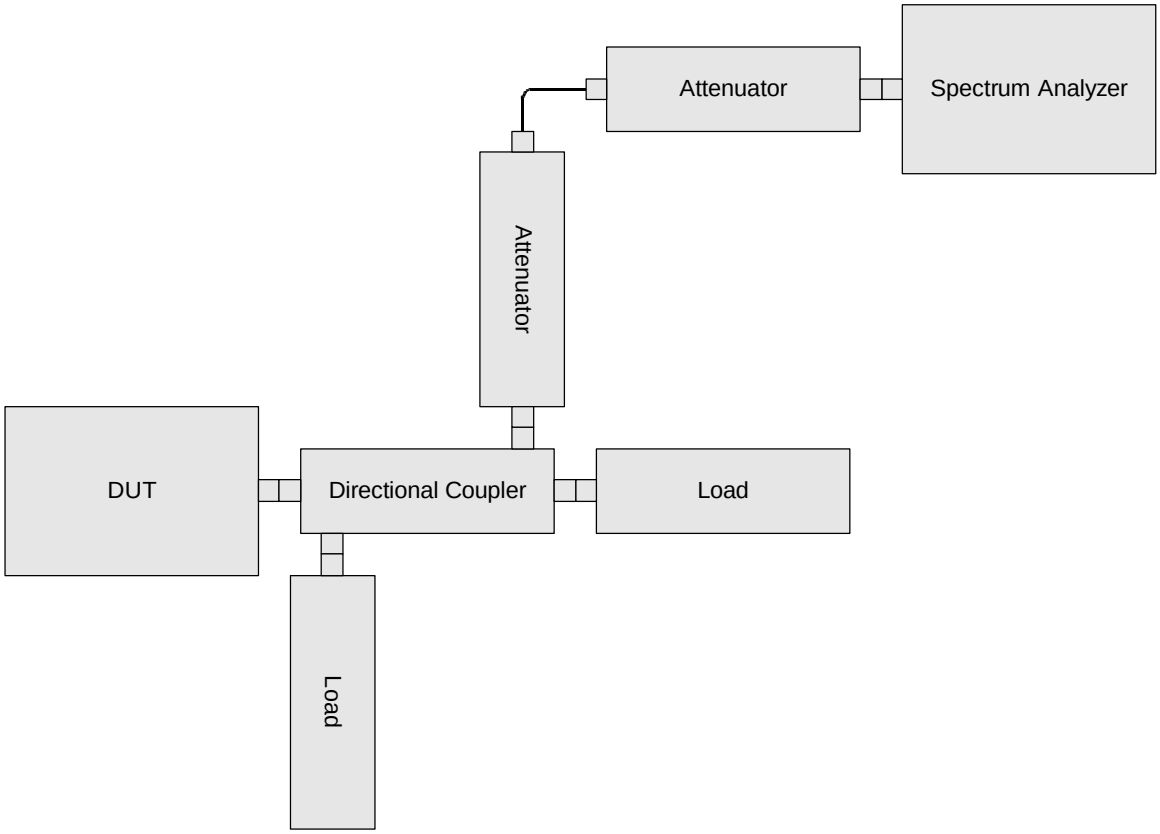
Frequency Stability With Temperature Variation:
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30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

ANNEX B - TEST DIAGRAMS

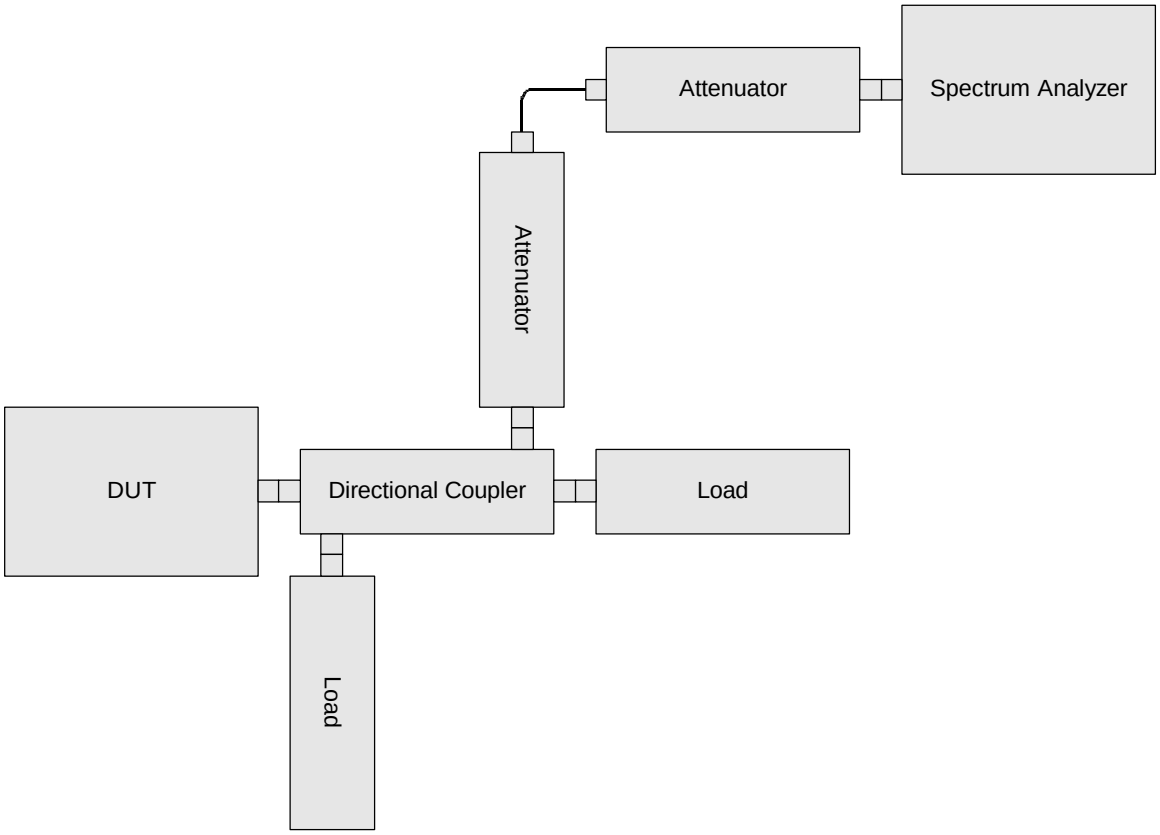
Para. No. 2.1046 - R.F. Power Output

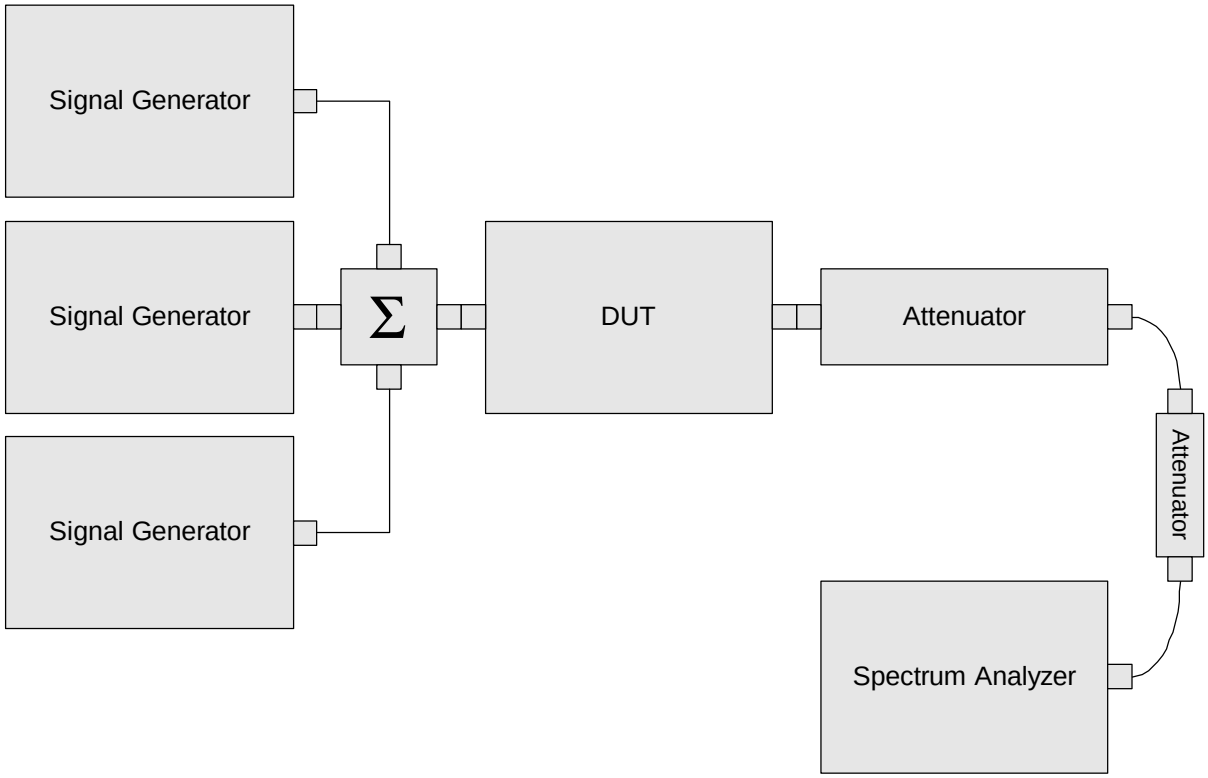


Para. No. 2.1049 - Occupied Bandwidth

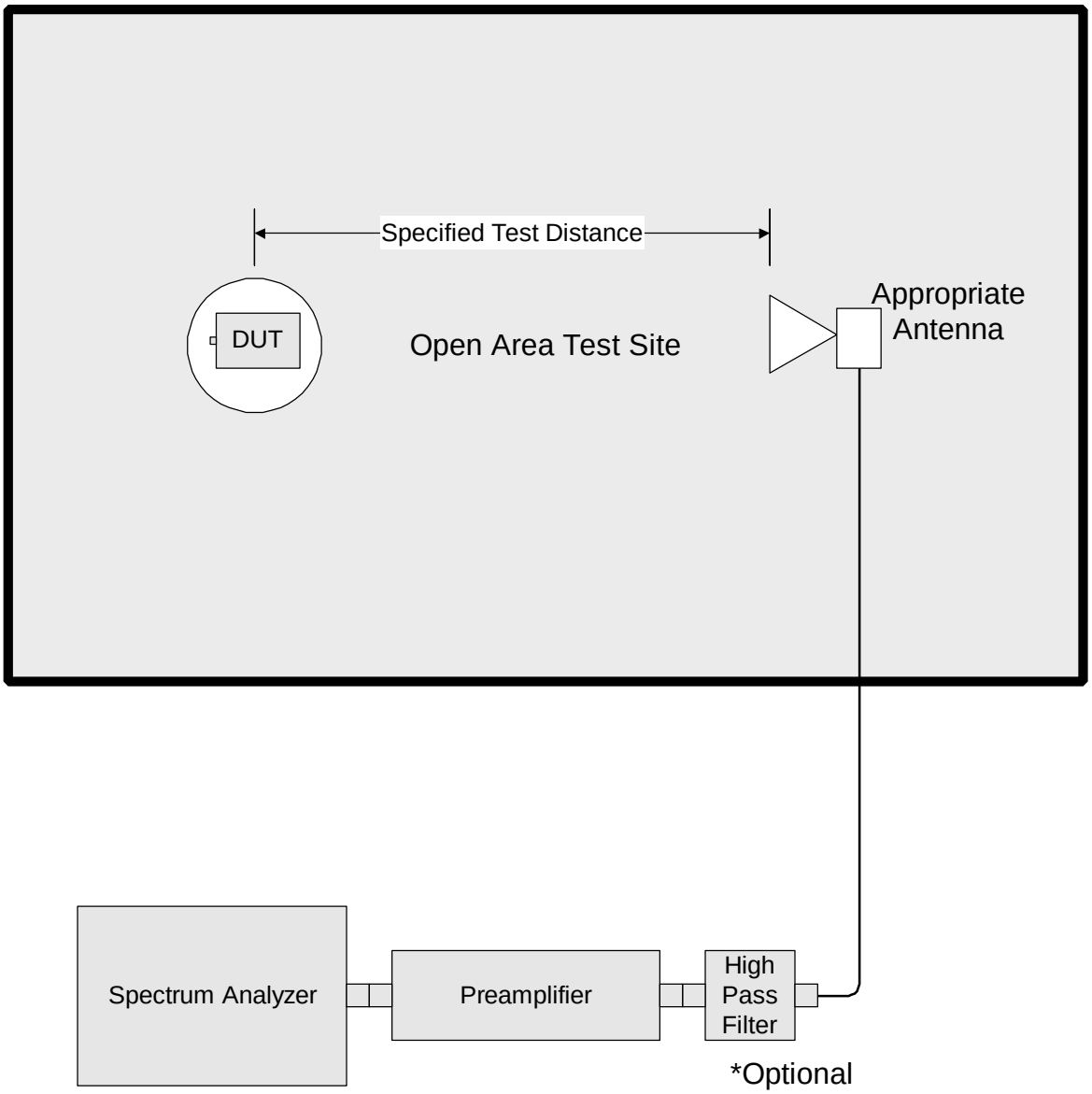


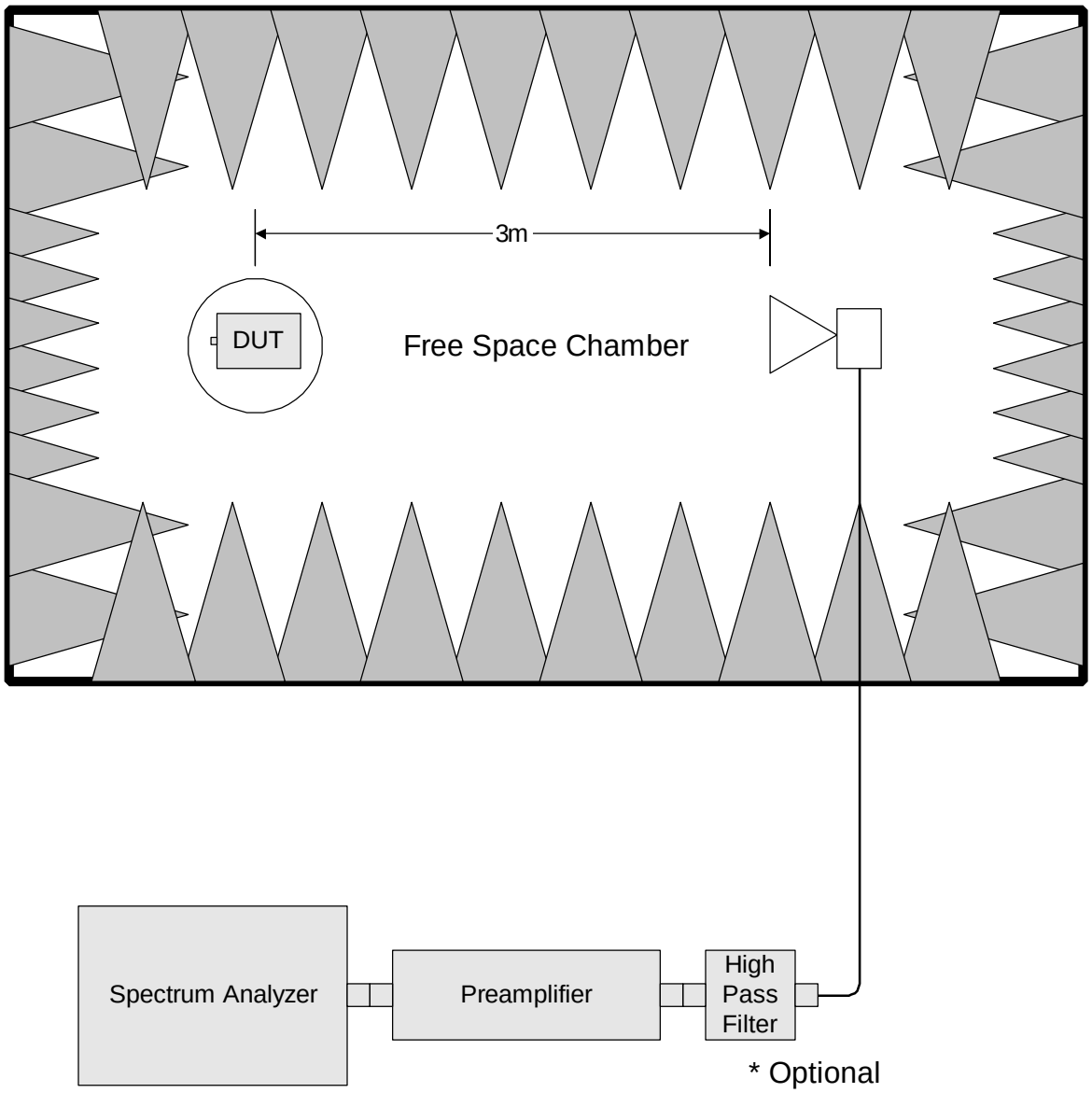
Para. No. 2.1051 Spurious Emissions at Antenna Terminals




Signal Generator
Signal Generator
Signal Generator
Σ
DUT
Attenuator
Attenuator
Spectrum Analyzer

Para. No. 2.1053 - Field Strength of Spurious Radiation




3m
DUT
Free Space Chamber
Spectrum Analyzer
Preamplifier
High Pass Filter
* Optional

Para. No. 2.1055 - Frequency Stability