Nemko Test Report:	1L0616RUS1
Applicant:	Remec/Waycom 3238 Southern Drive, Suite 303 Garland, TX 75043
Equipment Under Test: (E.U.T.)	EPUMA EDGE 850
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:	Jo- Till
	Tom Tidwell, Wireless Group Manager
Date:	11/14/01
Total Number of Pages:	55

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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Nemko Dallas

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 1. Summary of Test Results

Manufacturer: Remec/Waycom

Model No.: EPUMA EDGE 850

Sample No.: S01

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

NVLAP LAB CODE: 100426-0

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EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Summary Of Test Data

RF Power Output	22.913(a)	500W ERP	Complies	
Occupied Bandwidth (Voice & SAT)	22.917(c)	Mask	Complies	
Occupies Bandwidth (Wideband Data)	22.917(d)	Mask	Complies	
Occupied Bandwidth (Digital)	22.917(d)	Mask	Complies	
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	Complies	
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	Complies	
Frequency Stability	22.355	1.5 ppm	N/A	

Footnotes: The device is an F1-F1 repeater, therefore this parameter was not tested. There is no frequency translation performed within the device.

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

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 2. General Equipment Specification

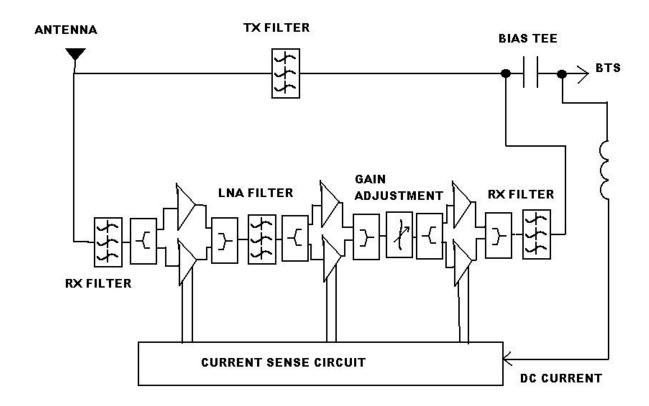
Supply Voltage Input:	+12 Vdc		
Frequency Range: Downlink:	869 – 894 MHz		
Frequency Range: Uplink:	824 – 849 MHz Note-This repeater has only.	active comp	onents for uplink
	CDMA GSM (F9W) (GXW)		CDPD AMPS (F9W) (F8W, F1D)
Output Impedance:	50 ohms		
Frequency Translation:	F1-F1	F1-F2	N/A
	Software	Duplexer Change	Fullband Coverage

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Description of Operation

The device is a repeater operating in the uplink spectrum of the AMPS band.

System Diagram



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FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 3. RF Power Output

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

TESTED BY: David Light DATE: 11/8/2001

Test Results: Complies.

Test Data:

	Modulation	Per Channel Power Output	Composite Power Output
	Type	(dBm)	(dBm)
Uplink	AMPS	22.3 (Single channel)	21.0 (Two Channels@18.0 dBm ea.)
Downlink	AMPS	N/A	N/A
Uplink	CDMA	20.1 (Single channel)	21.7 (Two Channels@18.7 dBm ea.)
Downlink	CDMA	N/A	N/A
Uplink	NADC	21.2 (Single channel)	19.2 (Two Channels@16.2 dBm ea.)
Downlink	NADC	N/A	N/A

Power output was tested at +/- 10% of nominal with no change in output.

Measurement Uncertainty: +/- 0.6 dB

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FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth PARA. NO.: 2.1049

TESTED BY: David Light DATE: 11/8/2001

Test Results: Complies.

Test Data: See attached plots

Measurement Uncertainty: +/- 1.7 dB

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data - Occupied Bandwidth



Dallas Headquarters:

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

Nemko Dallas, Inc. Data Plot Occupied Bandwidth - Voice & SAT Page $\underline{1}$ of $\underline{4}$ Complete Job No.: 1L0616R 11/8/2001 Preliminary: PT 22 22 Specification: Temperature(°C): Tested By: David Light Relative Humidity(%) E.U.T.: REPEATER Configuration: TYPICAL Sample Number: Location: Lab 1 RBW: Refer to plots Detector Type: Peak VBW: Refer to plots Test Equipment Used Directional Coupler: Cable #1: Pre-Amp: Cable #2: Filter: Receiver: Cable #3: Attenuator #1 1604 Cable #4: Attenuator #2: Mixer: Additional equipment used: Measurement Uncertainty: +/-1.7 dB Ref Lvl 300 Hz -10 dBm VBW Mixer 30 dBm SWT 5.6 s Unit dBm 30 dB Offset 20 10 1 V I E W 1 MA - 1C -20 TDF -30 -40 -50 Center 840 MHz 10 kHz/ Span 100 kHz 8.NOV.2001 11:01:21 ate: OUTPUT Notes: UPLINK

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Occupied Bandwidth



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	iko Dallas, Inc.				T 7.	0. (1.470				
Data Plot		<u>O</u>	ccupied B	andwidth	ı - Voice	& SAT				
pecification: ested By: U.T.:	4 IL0616R PT 22 David Light REPEATER TYPICAL		Date: 11. erature(°C): 22 fumidity(%) 45							
Ref O d					RBW VBW SWT	300 300 5.6	Hz M	- Att ixer nit	1U dB -10 dBm dBm	
-10 -20 -30 1 V I 6 -40 -50 -60 -70 -80 -90								44444		1MA
100 Cent	er 840 MHz 8.NOV.2	001 11	:02:48	10 +	≺Hz/			Span	100 kHz	
	INPUT UPLINK									

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Occupied Bandwidth



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Nemko Dallas, Inc. Occupied Bandwidth - Digital Data Plot Page 1 of 4 Complete Job No.: 1L0616R Date: 11/8/2001 Preliminary: Specification: PT 22 Temperature(°C): David Light Tested By: Relative Humidity(%) E.U.T.: REPEATER Configuration: TYPICAL Sample Number: RBW: Refer to plots Location: Lab 1 Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: Cable #1: Pre-Amp: Filter: Cable #2: Receiver: 1036 Cable #3: Attenuator #1 Cable #4: Attenuator #2: Mixer: Additional equipment used: Measurement Uncertainty: +/-1.7 dB Ref Lvl VBW 1 kHz -10 dBm Mixer 30 dBm SWT 1.25 s Unit dBm 19.9 dB Offset 20 10 1 V I E W EXT -20 -30 -40 -50 Mynduland Hayanay 50 kHz/ Span 500 kHz Center 840 MHz 8.NOV.2001 11:08:27 Notes: OUTPUT UPLINK 2FSK

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Occupied Bandwidth



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ta Plot	Occupied Bandw	idth - Dig	ital				
Page <u>2</u> of 4							
No.: 1L0616R	Date: 11/8/2001						
ification: PT 22	Temperature(°C): 22						
ed By: David Light	Relative Humidity(%) 45						
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UPLINK							
2FSK							

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data - Occupied Bandwidth



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Nemko Dallas, Inc. Data Plot Occupied Bandwidth - NADC Page <u>1</u> of <u>4</u> Complete X Job No.: 1L0616R Date: 11/8/2001 Preliminary: 22 Specification: PT 22 Temperature(°C): Tested By: David Light Relative Humidity(%) 45 E.U.T.: REPEATER Configuration: TYPICAL Sample Number: Location: Lab 1 RBW: Refer to plots Detector Type: Peak VBW: Refer to plots Test Equipment Used Directional Coupler: Antenna: Pre-Amp: Cable #1: Filter: Cable #2: Receiver: 1036 Cable #3: Cable #4: Attenuator #1 Attenuator #2: Mixer: Additional equipment used: +/-1.7 dB Measurement Uncertainty: Ref Lvl VBW 300 Hz 20 dBm SWT 11.5 s Unit dBm 19.9 dB Offset 1 V I E W 1 MA -20 -30 Thy Control of California of S TDF _4 -50 -60 -80 Center 840 MHz 20 kHz/ Span 200 kHz ate: 8.NOV.2001 10:44:21 OUTPUT Notes: UPLINK

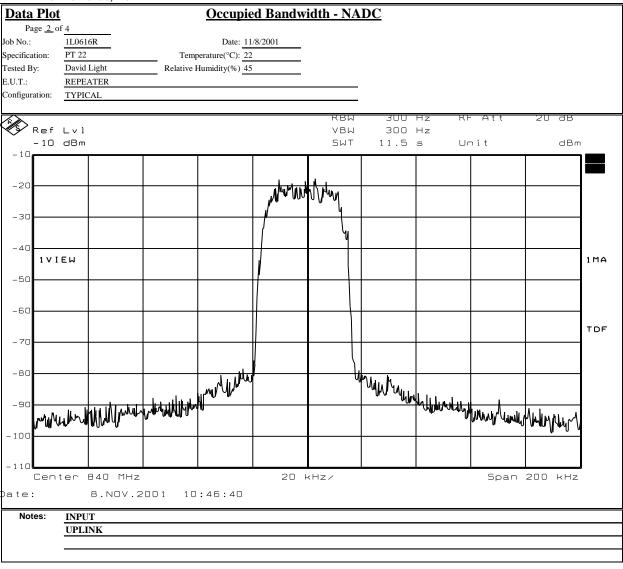
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Occupied Bandwidth



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Test Data – Occupied Bandwidth



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Nemko Dallas, Inc. Occupied Bandwidth - CDMA **Data Plot** Page <u>1</u> of <u>4</u> Complete Job No.: 1L0616R Date: ___11/8/2001 Preliminary: Specification: PT 22 Temperature(°C): 22 Tested By: David Light Relative Humidity(%) EHT REPEATER Configuration: TYPICAL Sample Number: 1 Lab 1 RBW: Refer to plots Location: Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: 1626 Pre-Amp: Cable #1: Filter: Cable #3: Receiver: 1036 Attenuator #1 Cable #4: Attenuator #2: Mixer: Additional equipment used: Measurement Uncertainty: +/-1.7 dB Ref Lvl 30 kHz -10 dBm Mixer 20 dBm SWT 28 ms Unit dBm 20 dB Offset www - 1 C and the state of t 1 V I E W 1 MA -20 -30 TDF The degree of the second -40 -50 -60 -70 1 MHz/ Center 840 MHz Span 10 MHz 8.NOV.2001 10:54:11 ate: Notes: OUTPUT UPLINK

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Occupied Bandwidth



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ata Plot				Occupio	ed Ba	ındwid	lth - (${f CD}$	MA				
Page 2 of	4												
No.:	1L0616R	_		Date: 1	1/8/2001	l							
cification:	PT 22	_	Tem	perature(°C): 22	2								
ted By:	David Light		Relative	Humidity(%) 4:	5								
T.T.:	REPEATER	t .	-										
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Nemko Dallas

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals PARA. NO.: 2.1051

TESTED BY: David Light DATE: 11/8/2001

Test Results: Complies.

Test Data: See attached plots

Measurement Uncertainty: +/- 1.6 dB

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Nemko Dallas, Inc. Data Plot Spurious Emissions at Antenna Terminals - Voice Page <u>1</u> of <u>4</u> Job No.: Date: 11/8/2001 Preliminary: 1L0616R Specification: PT 22 Temperature(°C): 22 Tested By: Relative Humidity(%) David Light EUT. REPEATER Configuration: TYPICAL Sample Number: 1 Lab 1 RBW: Refer to plots VBW: Refer to plots Detector Type: Peak Test Equipment Used Antenna: Directional Coupler: Pre-Amp: Cable #1: Filter: Cable #3: 1036 Receiver: Attenuator #1 1604 Cable #4: Attenuator #2: Mixer: Additional equipment used: Measurement Uncertainty: +/-1.7 dB Ref Lvl 100 kHz 22.88 dBm VBW 836.71342685 MHz 30 dBm SWT 245 ms Unit dBm 19.9 dB Offset 10 1 V I E W 1 MA -D1 -13 EXT -20 -30 - who we have been a second to the second the second than the second the seco -40 -50 -60 Start 30 MHz 97 MHz/ Stop 1 GHz 8.NOV.2001 12:47:27 ate: Notes: Uplink Marker indicates carrier

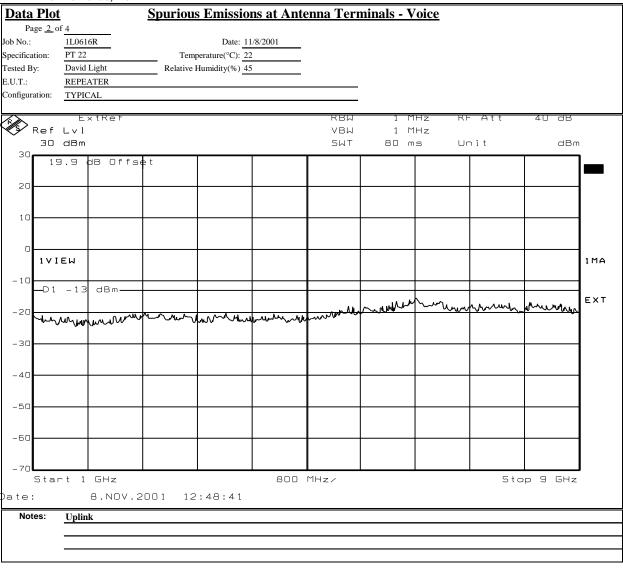
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Test Data – Spurious Emissions at Antenna Terminals

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Nemko Dallas, Inc. Data Plot **Intermodulation Characteristics - Voice** Page <u>1</u> of <u>4</u> Complete X Job No.: 1L0616R Date: 11/8/2001 Preliminary: Specification: PT 22 Temperature(°C): 22 Tested By: David Light Relative Humidity(%) EUT: REPEATER Configuration: TYPICAL Sample Number: 1 Lab 1 RBW: Refer to plots Location: Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: 1626 Pre-Amp: Cable #1: Filter: Cable #3: Receiver: 1036 Attenuator #1 Cable #4: Attenuator #2: Mixer: Additional equipment used: +/-1.7 dB Measurement Uncertainty: Ref Lvl 30 kHz 30 dBm SWT 17 ms Unit dBm 30 19.9 dB Offset 20 10 1 V I E W 1 MA -D1 -13 EXT -20 -30 \John Markett $\frac{1}{2}$ layolahawaayd Waadalaka harapen per -50 -60 Center 824 MHz 600 kHz/ Span 6 MHz 8.NOV.2001 12:38:58 ate: Notes: Lower bandedge - Uplink

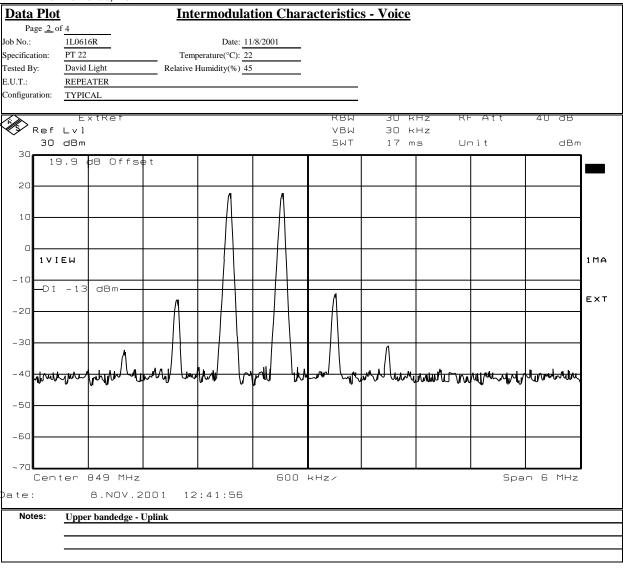
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		S	purious	Emission	s at Ante	nna Term	ninals - Tl	<u>DMA</u>			
Page <u>1</u> o	f <u>4</u>							Complete	e X		
Job No.:	1L0616R			Date:	11/8/2001			Preliminary			
Specification:	PT 22		Temp	erature(°C):	22						
Tested By:	David Light		Relative H	lumidity(%)	45						
E.U.T.:	REPEATER	₹	_								
Configuration:	TYPICAL										
Sample Number:	1										
Location:	Lab 1				RBW: I	Refer to plots					
Detector Type:	Peak	_				Refer to plots					
Test Equipm	ont Hand										
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Pre-Amp:		_		Directi	_	1626					
Filter:		_			Cable #1: _	1020					
Receiver:	1036	_			Cable #3:						
Attenuator #1	1604	_			Cable #4:						
Attenuator #2:	1004	_			_						
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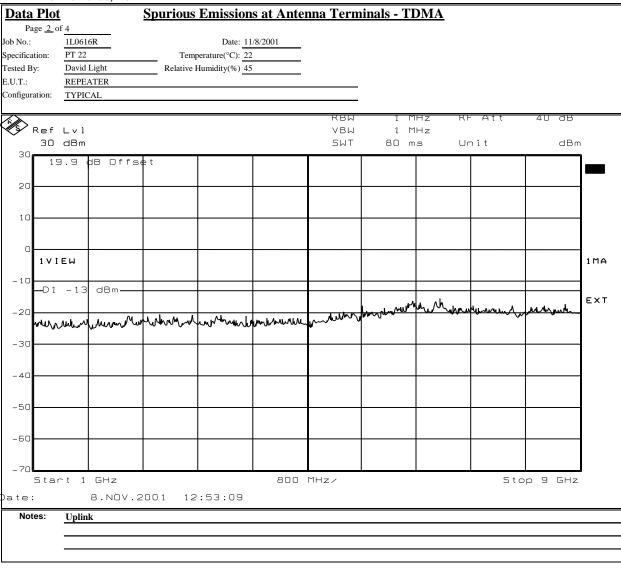
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Test Data – Spurious Emissions at Antenna Terminals



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Page of 4	Data Plot			Inter	modulat	ion Char	acteristic	s - TDM	<u>A</u>			
President Pres	Page 1	of <u>4</u>		'					 '	nplete X		
President Pres	Job No.:				Date:	11/8/2001					-	
Search S	Specification:	PT 22		Tempe	erature(°C):	22					-	
REPEATER TYPECAL	Tested By:	David Ligh	ıt			45						
Configuration TYPICAL	E.U.T.:				_							
RBW: Refer to plots Lab RBW: Refer to plots	Configuration:							-				
Peak VBW: Refer to plots	Sample Number							_				
Directional Coupler:	Location:	Lab 1				RBW:	Refer to plots	_				
Directional Coupler Cable #1: 1626 Cable #2: Cable #3: Cable #4:	Detector Type:	Peak	_			VBW:	Refer to plots	-				
Cable #1: 1626 Cable #2: Cable #3: Cable #4: Cable #4:	Test Equipn	nent Used										
Cable #2: Cable #3:	Antenna:		_		Directi	onal Coupler:		_				
Cable #3:	Pre-Amp:		<u> </u>			Cable #1:	1626	_				
1604 Cable #4:	Filter:		<u></u>			Cable #2:		_				
Mixer:	Receiver:	1036	<u> </u>			Cable #3:		_				
Additional equipment used:	Attenuator #1	1604	<u> </u>			Cable #4:		_				
### Action Action	Attenuator #2:		_			Mixer:		_				
ExtRef	Additional equip	oment used:				_		_				
Ref Lvl 30 dBm SHZ 28 ms Unit dBm 19.9 dB Offset 20 10 10 10 10 10 11 10 10 10 10 10 10 10	Measurement U	ncertainty:	+/-1.7 dB									
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-40 -40 -40 -40 -40 -40 -40 -40 -40 -40												
-50 -60 -70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43	-30								++-		-	
-50 -60 -70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43				۸ ا								
-50 -60 -70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43	مبطاء	بداله بد	بمجاهمته فيحد	باندا/بدهر	سياسا	سامال	السلالم	المستسيال	سا / الس	والملمس أمر		
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-60 -70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43												
-70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43	-50			+					1		+	
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-70 Center 824 MHz 1 MHz/ Span 10 MHz ate: 8.NOV.2001 12:31:43	-60											
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ate: 8.NOV.2001 12:31:43		ter 82	4 MHz	-		1 1	IHz/	•	•	Snar	10 MHz	
							/			2591		
Notes: Lower bandedge - Uplink	ate:	8.	NUV.200	1 12:	:31:43							
Lone bandedge - Opinis	Notes:	Lowerbo	ndedge - Unit	nk								
	110100.	LOWEI DA	nacage - Opin	ans.								
		-										

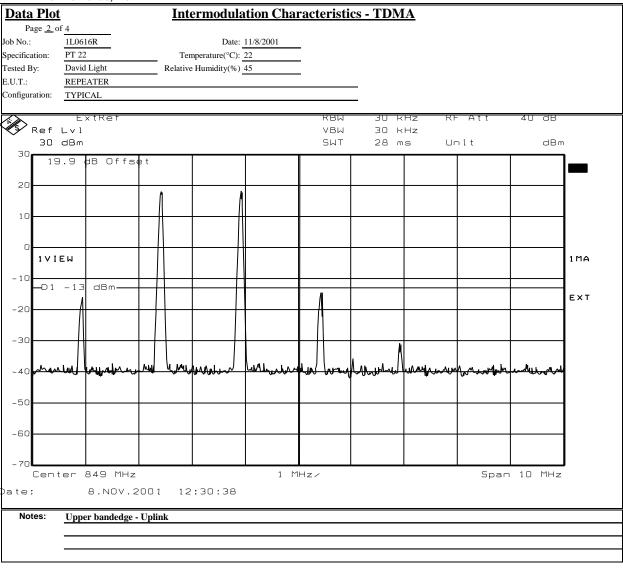
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



Dallas Headquarters:

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



EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

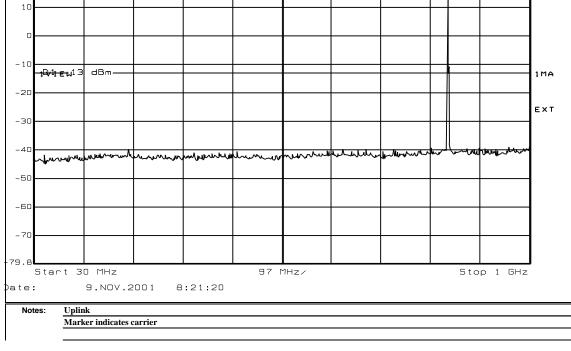
Test Data - Spurious Emissions at Antenna Terminals



Dallas Headquarters:

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

Nemko Dallas, Inc. **Spurious Emissions at Antenna Terminals - CDMA** Data Plot Page $\underline{1}$ of $\underline{4}$ Complete X Preliminary: Job No.: 1L0616R Date: 11/8/2001 Temperature(°C): 22 Specification: PT 22 Relative Humidity(%) 45 Tested By: David Light E.U.T.: REPEATER Configuration: TYPICAL Sample Number: Location: Lab 1 RBW: Refer to plots Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: Pre-Amp: Cable #1: Filter: Cable #2: Receiver: 1036 Cable #3: Attenuator #1 Cable #4: Attenuator #2: Mixer: Additional equipment used: +/-1.7 dB Measurement Uncertainty: 1 U U Ref Lvl 15.86 dBm VBW 100 kHz Mixer -10 dBm 20.2 dBm 840.60120240 MHz SWT 245 ms Unit dBm 20.1 dB Offset 10



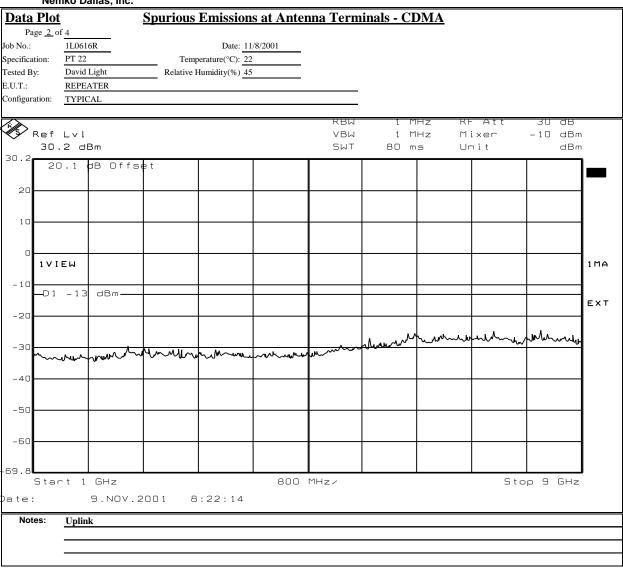
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



Dallas Headquarters:

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-70

ate:

Notes:

Center 824 MHz

8.NOV.2001

Lower bandedge - Uplink

12:23:24

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals

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

Nemko Dallas, Inc. Data Plot **Intermodulation Characteristics - CDMA** Page <u>1</u> of <u>4</u> Complete X Job No.: 1L0616R Date: 11/8/2001 Preliminary: Specification: PT 22 Temperature(°C): 22 Tested By: David Light Relative Humidity(%) EHT REPEATER Configuration: TYPICAL Sample Number: 1 Lab 1 RBW: Refer to plots Location: Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: 1626 Pre-Amp: Cable #1: Filter: Cable #2: Cable #3: Receiver: 1036 Attenuator #1 Cable #4: Attenuator #2: Mixer: Additional equipment used: +/-1.7 dB Measurement Uncertainty: Ref Lvl 30 kHz 30 dBm SWT 56 ms dBm Unit 30 19.9 dB Offset 20 10 1 V I E W 1 MA -D1 -13 dBm EXT -20 -30 -40 -50 -60

2 MHz/

Span 20 MHz

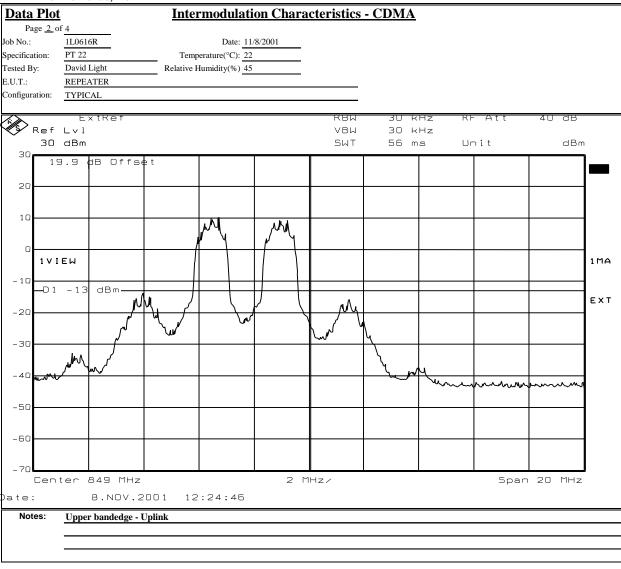
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals

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Nemko Dallas, Inc.

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

Fax: (972) 436-2667

Dallas Headquarters:

Data Plot			Band Edges	- CDMA					
Page 1 of	f <u>4</u>					Complete	e X		
Job No.:	1L0616R	Ι	Date: 11/8/2001			Complete Preliminary		-	
Specification:	PT 22	Temperature	e(°C): 22					=	
Tested By:	David Light	Relative Humidit	xy(%) 45						
E.U.T.:	REPEATER								
Configuration:	TYPICAL								
Sample Number:	1								
Location:	Lab 1		RBW:	Refer to plots					
Detector Type:	Peak		VBW:	Refer to plots					
Test Equipme	ent Used								
Antenna:			Directional Coupler:						
Pre-Amp:			Cable #1:	1626					
Filter:			Cable #2:						
Receiver:	1036		Cable #3:						
Attenuator #1	1604		Cable #4:						
Attenuator #2:			Mixer:						
Additional equip	ment used:								
Measurement Un	certainty: +/-1.7	dB							
		Marker 1 L	T	RBM	30	KHZ RF	Att	2U dB	
Ref	∟∨ l		-13.86 dBm	VBW	30		xer	-10 dBm	1
20	dBm	824.00	000000 MHz	SWT	7		nit	dBm	
20	0 40 055-	Ι. Ι		_				1	1
15	.9 dB Offs	e t							
10									
				I .				1	
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-40	maran W	Manual							1
J	•								
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-50									1
-60				<u> </u>				ļ	1
-70									1
-80									J
Cent	er 824 MHz		250	kHz/			Span	2.5 MHz	
Date:	8.NOV.2	2001 11:28	: 42						
Notes:	Lower bandedge -	Uplink							
	Channel 1013								
1									

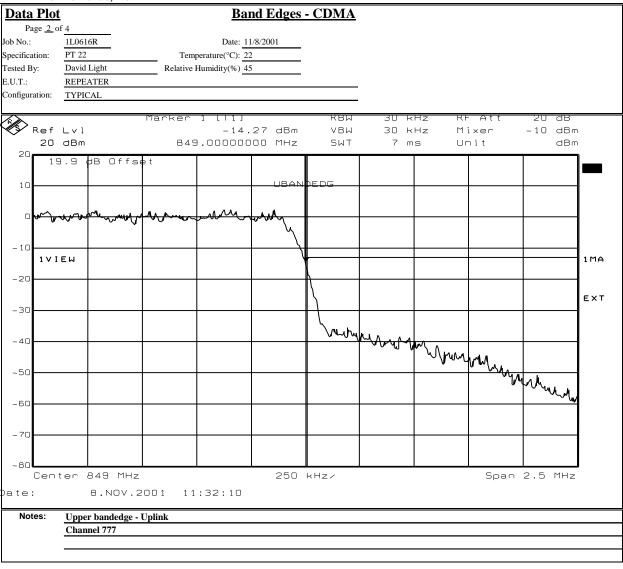
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Spurious Emissions at Antenna Terminals



Dallas Headquarters:

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Nemko Dallas

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 6. Field Strength of Spurious

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

TESTED BY: David Light DATE: 11/8/2001

Test Results: Complies.

Test Data: See attached table.

Measurement Uncertainty: +/- 3.6 dB

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Data – Field Strength of Spurious

				Field S	trength of S	purious l	Emissions			
Page 1 of	f <u>1</u>							Complete	X	_
Job No.:	1L0616R	1L0616R Date: 11/8/2001						Preliminary		_
Specification:	PT 22			perature(°C):						
Tested By:	Tom Tidwel		Relative	Humidity(%)	45					
E.U.T.:		D REPEATER					_			
Configuration:	TYPICAL						-			
Sample No:	1									
Location:	AC 3				RBW:	500 kHz	-	Measurement	2	
Detector Type:	Peak				VBW:	1 MHz	-	Distance:		m
Test Equipme	ent Used									
Antenna:	993			D	irectional Coupler:		_			
Pre-Amp:					Cable #1:	1483	_			
Filter:					Cable #2:	1485	_			
Receiver:	1464				Cable #3:		_			
Attenuator #1					Cable #4:		_			
Attenuator #2:					Mixer:		_			
Measurement Un	certainty:	+/-3.6 dB								
Frequency	Meter	Correction		Pre-Amp	Substitution		ERP	ERP	Polarity	Comments
	Reading	Factor		Gain	Antenna Gain					
(MHz)	(dBm)	(dB)		(dB)	(dBd)		(dBm)	(mW)		
1693.0	-73.5	32.7		33.3	6.4		-67.8	0.00000	Н	Noise floor
2539.5	-73.0	34.6		33.8	8.0		-64.2	0.00000	Н	Noise floor
3386.0	-73.0	35.8		33.6	8.1		-62.7	0.00000	Н	Noise floor
4232.5	-61.0	35.2		33.5	7.9		-51.4	0.00001	Н	
5079.0	-65.0	36.3		33.5	9.1		-53.2	0.00000	Н	
5925.5	-66.0	36.0		32.7	9.1		-53.6	0.00000	Н	
6772.0	-75.5	37.8		32.8	10.1		-60.3	0.00000	Н	Noise floor
7618.5	-78.0	39.8		33.0	9.4		-61.8	0.00000	H	Noise floor
8465.0	-77.0	42.2		34.3	9.7		-59.4	0.00000	Н	Noise floor
4000.0	72.5	20.0		22.2	6.4		70.6	0.00000	V	Noise floor
1693.0	-73.5 -73.0	29.9 35.6		33.3 33.8	6.4 8.0		-70.6 -63.3	0.00000	V	Noise floor
2539.5 3386.0	-63.0	37.1		33.6	8.1		-63.3	0.00000 0.00001	V	Noise moor
4232.5	-60.0	42.8		33.5	7.9		-42.8	0.00001	V	
5079.0	-75.0	40.6		33.5	9.1		-58.8	0.00000	V	Noise floor
5925.5	-75.0	38.5		32.7	9.1		-60.1	0.00000	V	Noise floor
6772.0	-75.5	38.3		32.8	10.1		-59.9	0.00000	V	Noise floor
7618.5	-78.0	40.4		33.0	9.4		-61.1	0.00000	V	Noise floor
8465.0	-77.0	41.6		34.3	9.7		-60.0	0.00000	V	Noise floor
0.00.0	, , , . 0	0		55	×.,		30.0	0.0000		
Notes	Scanned sı	pectrum to ten	th harmor	nic of carrie	r (846.5 MHz)					1
										-

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Test Setup Photographs – Field Strength of Spurious





Nemko Dallas

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 7. Frequency Stability

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

TESTED BY: DATE:

Test Results: Complies.

Test Data:

Standard Test V 103 C 3 D WHz

Equipment Used:

Measurement Uncertainty: $\pm -1 \times 10^{-7}$ ppm

Temperature: °C

Relative %

Humidity:

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	09/17/01
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01
1604	ATTENUATOR	NARDA 776B-20	NONE	09/13/01
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/01
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

ANNEX A - TEST DETAILS

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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:

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

where,

P = the equivalent isotropic radiated power in watts

E =the maximum measured field strength in V/m

R =the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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.

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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 x 10^{-5} Watts) at the antenna terminal.

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

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:

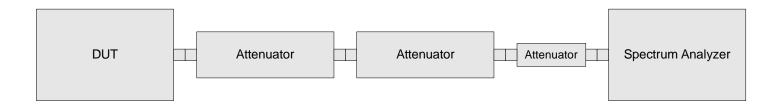
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

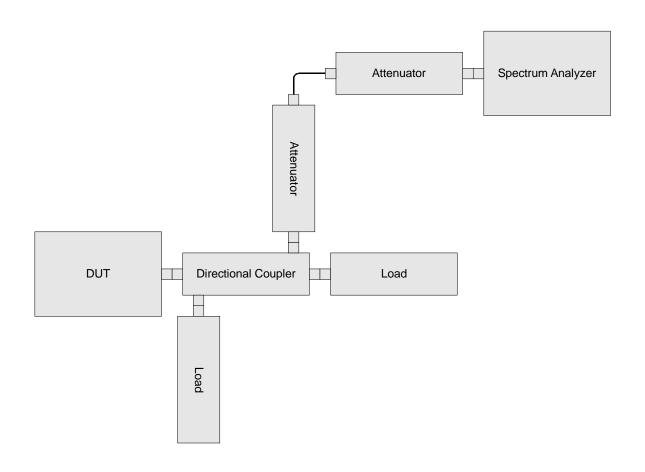
EQUIPMENT: EPUMA EDGE 850 PROJECT NO.: 1L0616RUS1

ANNEX B - TEST DIAGRAMS

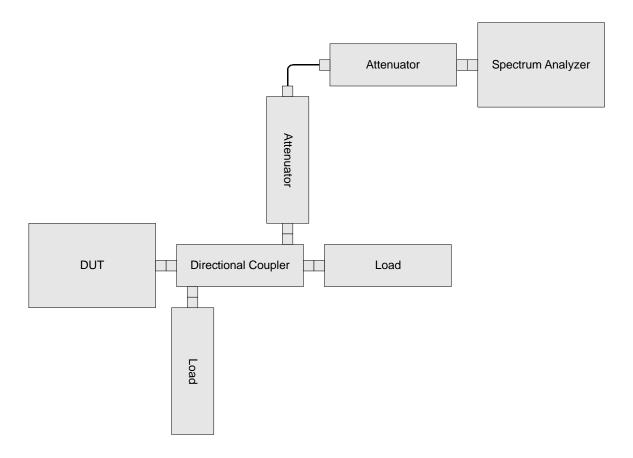
Para. No. 2.1046 - R.F. Power Output



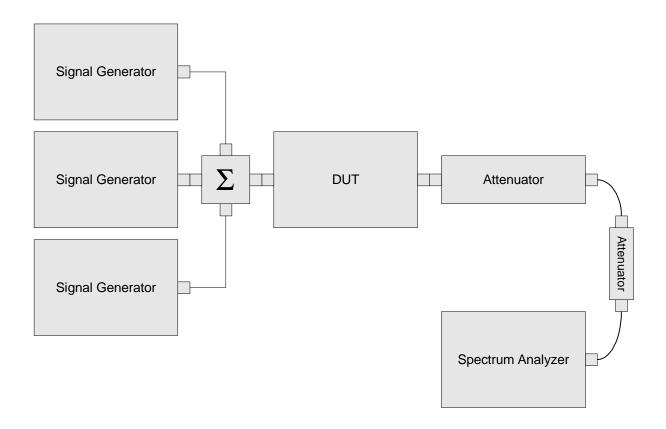
Para. No. 2.1049 - Occupied Bandwidth



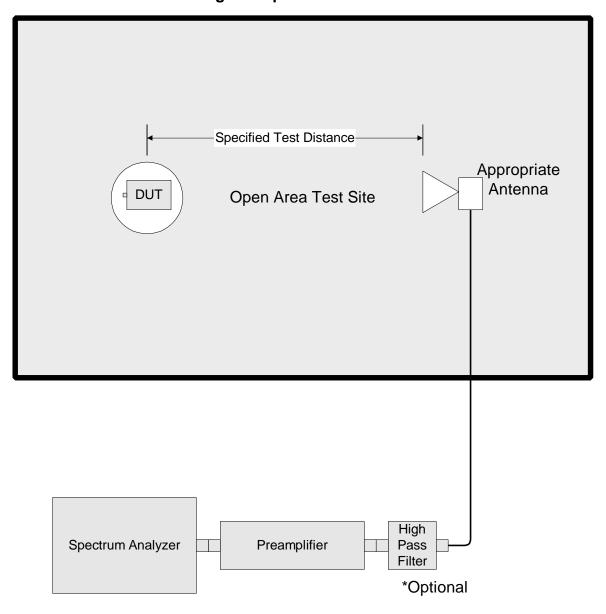
Para. No. 2.1051 Spurious Emissions at Antenna Terminals

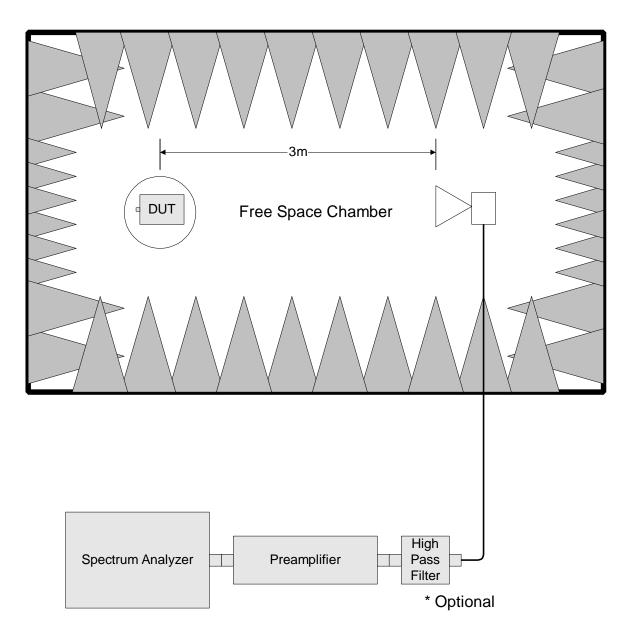


FCC PART 22, SUBPART H CELLULAR BAND REPEATERS



Para. No. 2.1053 - Field Strength of Spurious Radiation





Para. No. 2.1055 - Frequency Stability

