

Nemko Test Report: 2L0027RUS1

Applicant: Andrew Corporation
2601 Telecom Parkway
Richardson, TX 7508

**Equipment Under Test:
(E.U.T.)** Enhanced Remote Antenna Unit (ERAU)
Part No. AEO4A-D0602-001

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: 3/22/02

Total No. of Pages: 57

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Table of Contents

SECTION 1.	SUMMARY OF TEST RESULTS	3
SECTION 2.	GENERAL EQUIPMENT SPECIFICATION	5
SECTION 3.	RF POWER OUTPUT	7
SECTION 4.	OCCUPIED BANDWIDTH	8
SECTION 5.	SPURIOUS EMISSIONS AT ANTENNA TERMINALS	19
SECTION 6.	FIELD STRENGTH OF SPURIOUS	38
SECTION 7.	TEST EQUIPMENT LIST.....	41
ANNEX A -	TEST DETAILS.....	42
ANNEX B -	TEST DIAGRAMS	51

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: Enhanced Remote Antenna Unit (ERAU)

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.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input checked="" type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input type="checkbox"/> | 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".

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EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
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 (ST)	22.917(d)	Mask	Complies
Occupied Bandwidth (Digital)	None	None	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

Footnote [The device is an F1-F1 repeater with no modulation circuitry therefore, frequency stability was not tested.](#)

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

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Section 2. General Equipment Specification

Supply Voltage Input:	40-70 Vdc				
Frequency Range:	Downlink:	869 – 894 MHz			
Frequency Range:	Uplink:	824 – 849 MHz			
Type of Modulation and Designator:	CDMA (F9W) <input checked="" type="checkbox"/>	GSM (GXW) <input type="checkbox"/>	NADC (DXW) <input checked="" type="checkbox"/>	CDPD (F9W) <input type="checkbox"/>	AMPS (F8W, F1D) <input checked="" type="checkbox"/>
Output Impedance:	50 ohms				
Max Input Power:	0 dBm				
RF Output (Rated):	Downlink:	Per Channel:	0.375	W	
		Total:	0.750	W	
	Uplink:	Per Channel:	N/A	W	
		Total:	N/A	W	
Frequency Translation:	F1-F1 <input checked="" type="checkbox"/>	F1-F2 <input type="checkbox"/>	N/A <input type="checkbox"/>		
Band Selection:	Software <input type="checkbox"/>	Duplexer Change <input type="checkbox"/>	Fullband Coverage <input checked="" type="checkbox"/>		

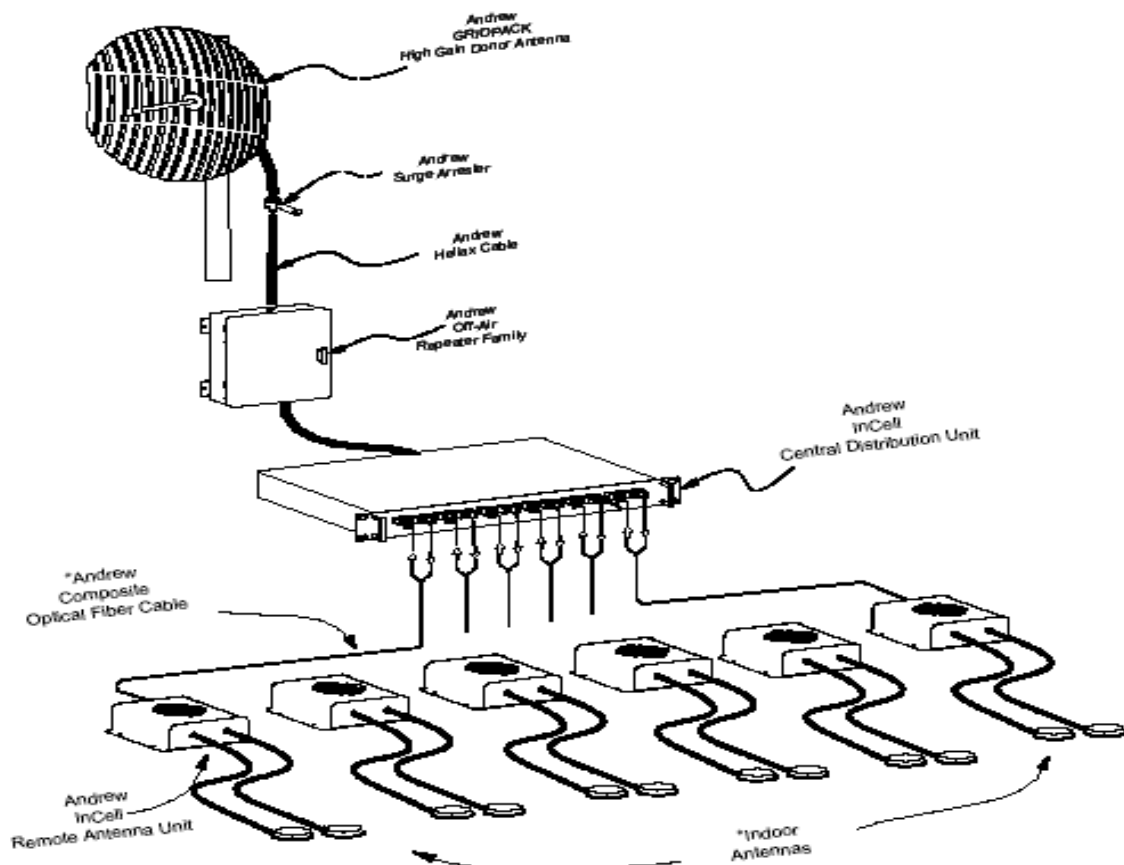
EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Description of Operation

The Andrew InCell™ Fiber Distributed Antenna System is designed to provide improved RF performance in buildings that suffer from poor wireless coverage. The InCell™ interfaces directly with a BTS or off-air antenna and distributes RF signals to indoor antennas that provide improved downlink and uplink performance. The InCell™ system uses multiple Enhanced Remote Antenna Units (ERAU) located within the building to optimize communications with handheld mobile phones and wireless office equipment. Each ERAU is connected to a central distribution unit (CDU) by two low-loss, single mode fiber optic cables that provide downlink signals to the remote antenna and uplink signals from the mobile phone or wireless office equipment.

System Diagram



EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 3/18/2002

Test Results: Complies.

Test Data:

	Modulation Type	Per Channel Power Output (2 Carriers) (dBm)	Composite Power Output (dBm)
Uplink	AMPS	N/A	
Downlink	AMPS	25.4	28.4
Uplink	CDMA	N/A	
Downlink	CDMA	25.8	28.8
Uplink	NADC	N/A	
Downlink	NADC	25.8	28.8

Equipment Used: 1036-1629-1471-1478

Measurement Uncertainty: +/- 1.6 dB

Temperature: 22 °C

Relative Humidity: 60 %

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 3/18/2002

Test Results: [Complies.](#)

Test Data: [See attached plots](#)

Measurement Uncertainty: +/- 1.6 dB

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

PROJECT NO.: 2L0027RUS1

Test Data – Occupied Bandwidth



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Fax: (972) 436-2667

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<u>Data Plot</u>		<u>OCCUPIED BANDWIDTH</u>		Complete <u> X </u>																		
Page <u>1</u> of <u>6</u>		Date: <u>3/18/2002</u>		Preliminary: <u> </u>																		
Job No.: <u>2L0027R</u>		Temperature(°C): <u>20</u>																				
Specification: <u>PT 22</u>		Relative Humidity(%): <u>60</u>																				
Tested By: <u>David Light</u>																						
E.U.T.: <u>DUAL BAND REPEATER</u>																						
Configuration: <u>TX FULL POWER IN MID BAND</u>																						
Sample Number: <u>1</u>																						
Location: <u>Lab 1</u>	RBW: <u>Refer to plots</u>	Measurement																				
Detector Type: <u>Peak</u>	VBW: <u>Refer to plots</u>	Distance: <u>N/A</u> m																				
<u>Test Equipment Used</u>																						
Antenna: <u> </u>	Directional Coupler: <u> </u>																					
Pre-Amp: <u> </u>	Cable #1: <u>1628</u>																					
Filter: <u> </u>	Cable #2: <u>1629</u>																					
Receiver: <u>1036</u>	Cable #3: <u>1627</u>																					
Attenuator #1: <u>1478</u>	Cable #4: <u> </u>																					
Attenuator #2: <u>1471</u>	Mixer: <u> </u>																					
Additional equipment used: <u>1052 1051 1092 1053</u>																						
Measurement Uncertainty: <u>+/-1.7 dB</u>																						
<table border="0" style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 20px;"></td> <td style="width: 100px;">Ref Lvl</td> <td style="width: 100px;">RBW</td> <td style="width: 100px;">300 Hz</td> <td style="width: 100px;">RF Att</td> <td style="width: 100px;">30 dB</td> </tr> <tr> <td></td> <td>40 dBm</td> <td>VBW</td> <td>300 Hz</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>SWT</td> <td>11.5 s</td> <td>Unit</td> <td>dBm</td> </tr> </table>						Ref Lvl	RBW	300 Hz	RF Att	30 dB		40 dBm	VBW	300 Hz					SWT	11.5 s	Unit	dBm
	Ref Lvl	RBW	300 Hz	RF Att	30 dB																	
	40 dBm	VBW	300 Hz																			
		SWT	11.5 s	Unit	dBm																	
<p style="text-align: center;">Center 881.52 MHz 20 kHz/ Span 200 kHz</p>																						
Date: 18.MAR.2002 11:31:33																						
Notes: <u>TDMA OUTPUT</u>																						

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

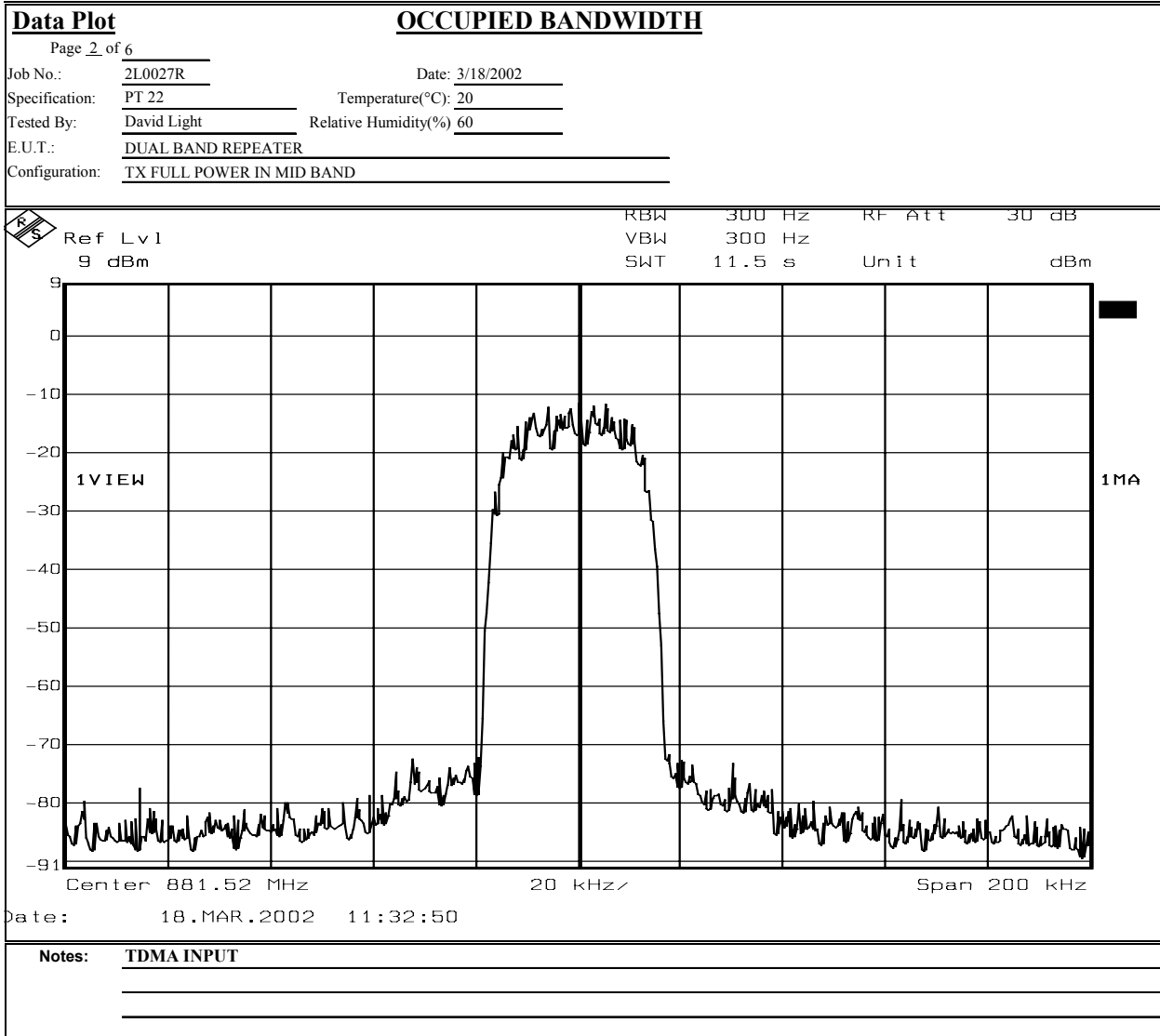
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Test Data – Occupied Bandwidth



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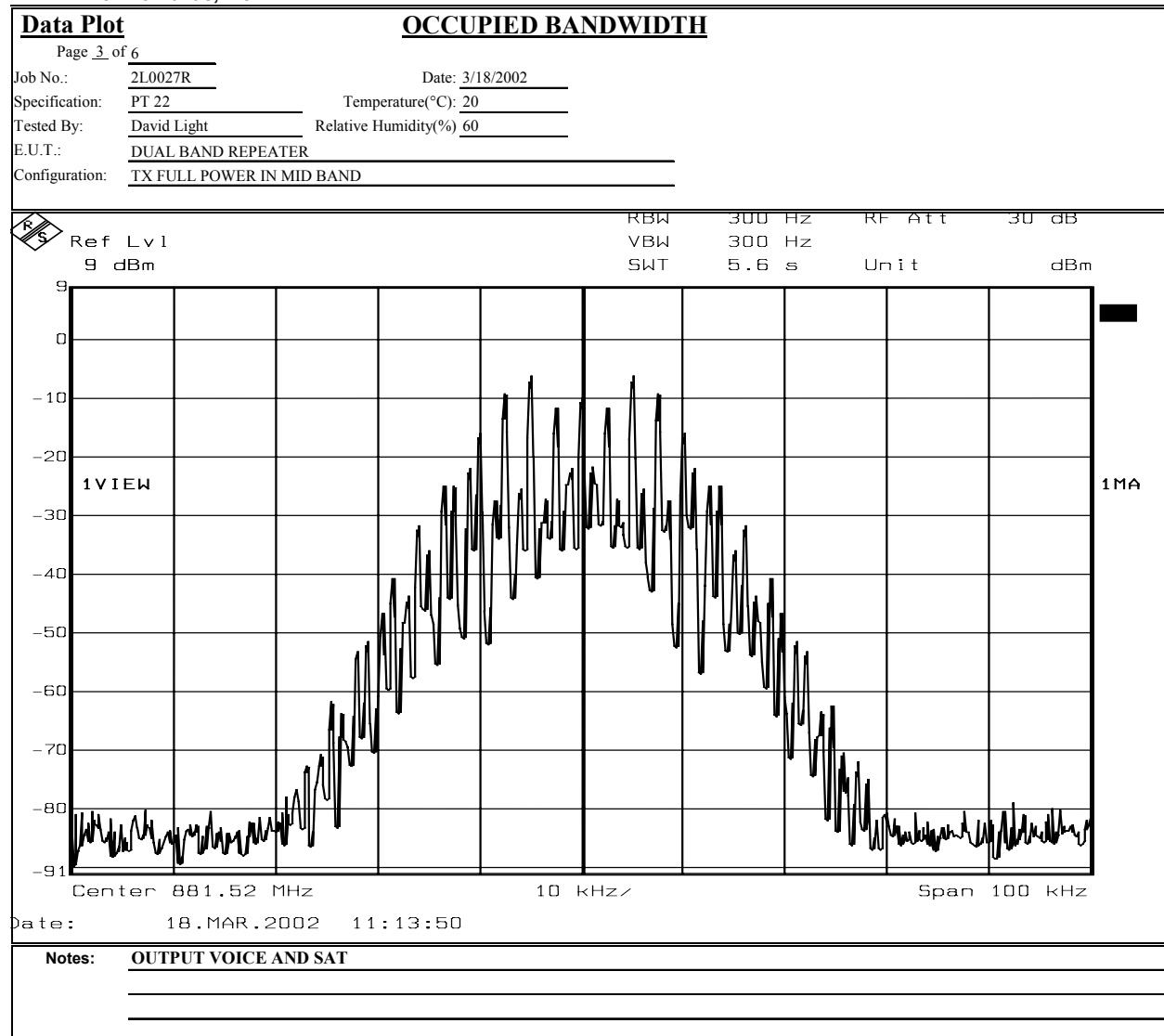
Test Data – Occupied Bandwidth



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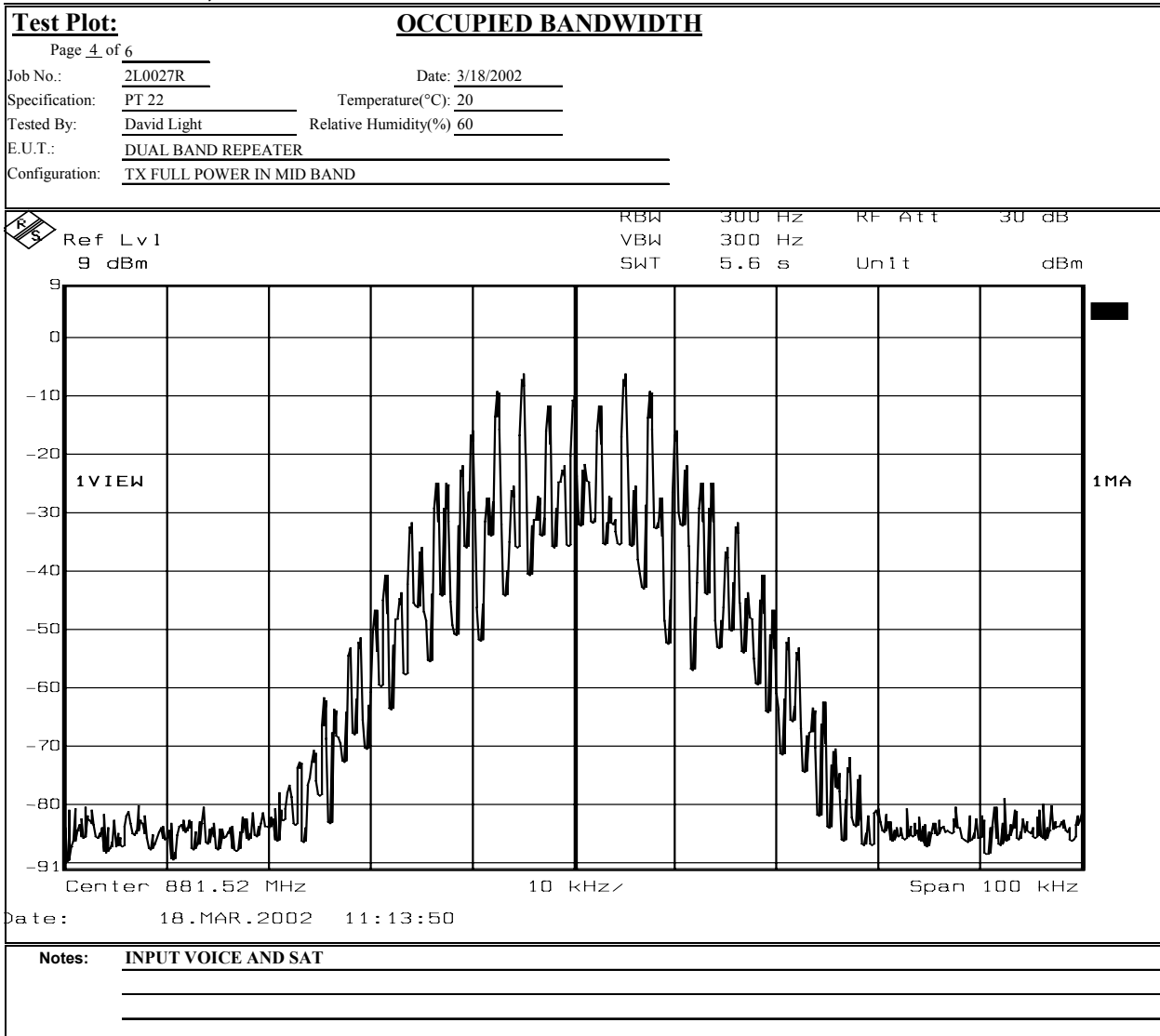
PROJECT NO.: 2L0027RUS1

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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

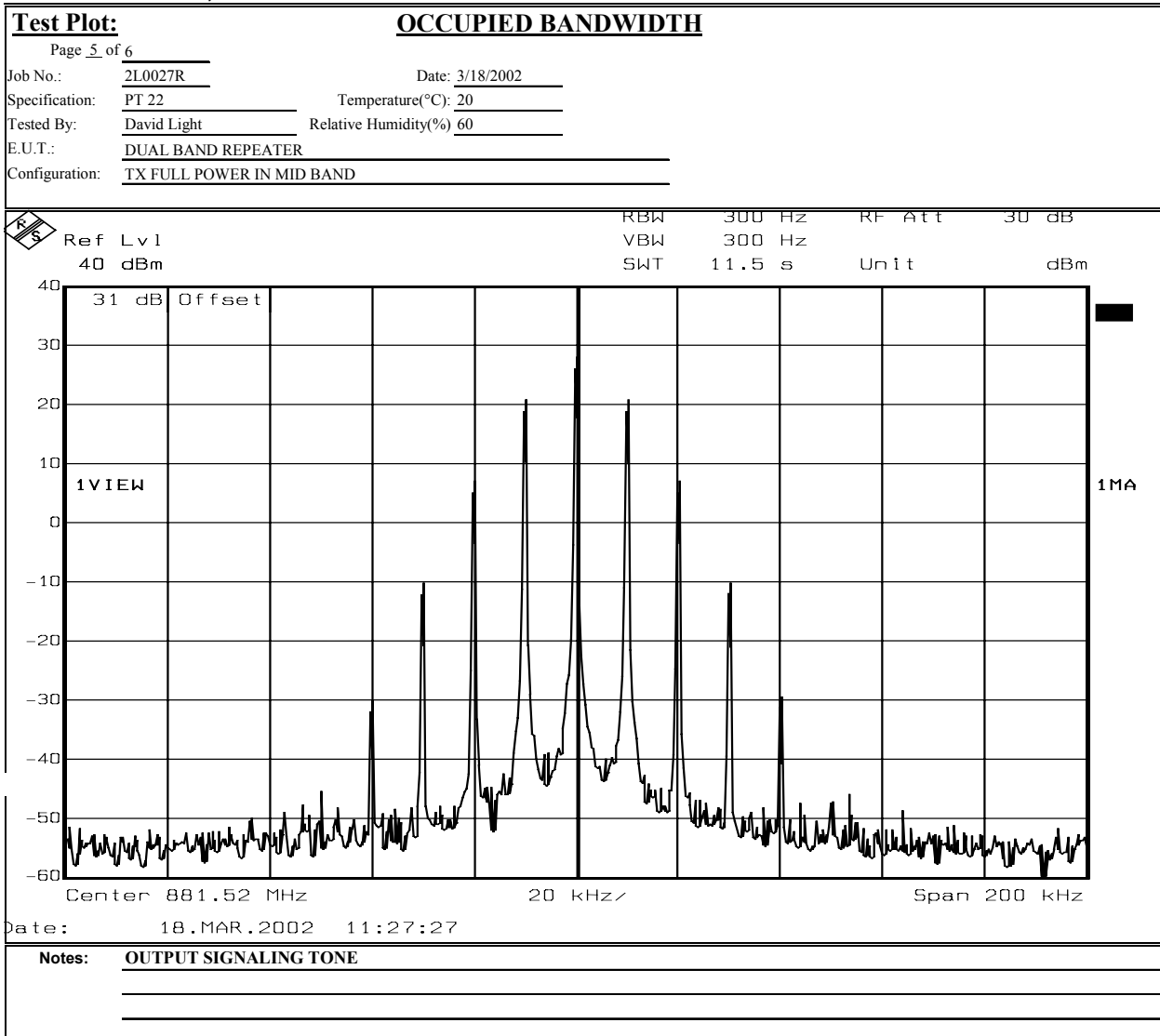
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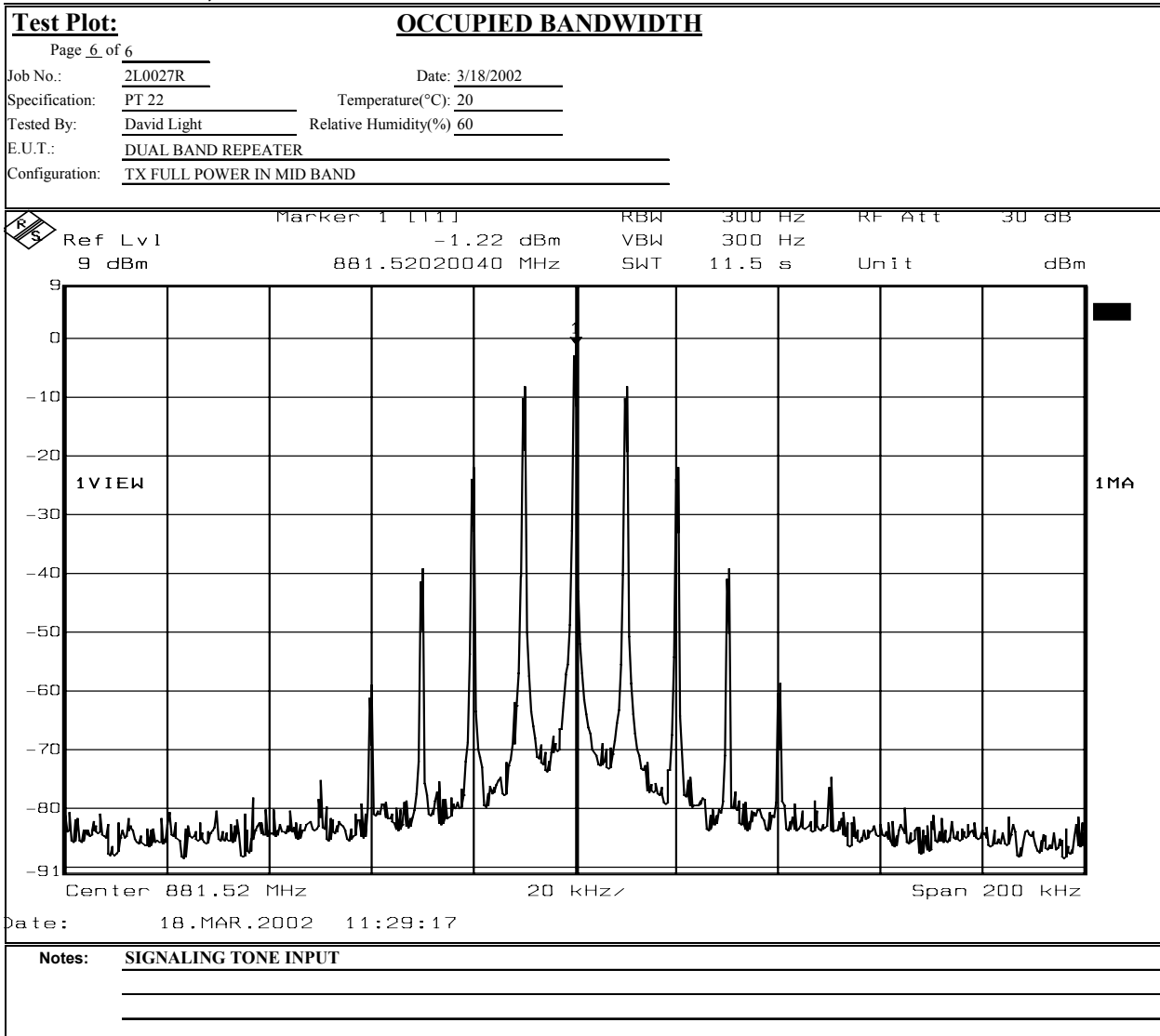
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<u>Data Plot</u>		<u>OCCUPIED BANDWIDTH</u>		Complete <u> X </u>															
Page <u>1</u> of <u>4</u>		Date: <u>3/18/2002</u>		Preliminary: <u> </u>															
Job No.: <u>2L0027R</u>		Temperature(°C): <u>22</u>																	
Specification: <u>PT 22</u>		Relative Humidity(%): <u>60</u>																	
Tested By: <u>David Light</u>																			
E.U.T.: <u>DUAL BAND REPEATER</u>																			
Configuration: <u>TX FULL POWER AT MID BAND</u>																			
Sample Number: <u>1</u>		RBW: <u>Refer to plots</u>		Measurement Distance: <u>N/A</u> m															
Location: <u>Lab 1</u>		VBW: <u>Refer to plots</u>																	
Detector Type: <u>Peak</u>																			
<u>Test Equipment Used</u>																			
Antenna: <u> </u>		Directional Coupler: <u> </u>																	
Pre-Amp: <u> </u>		Cable #1: <u>1627</u>																	
Filter: <u> </u>		Cable #2: <u>1628</u>																	
Receiver: <u>1036</u>		Cable #3: <u>1629</u>																	
Attenuator #1: <u>1478</u>		Cable #4: <u> </u>																	
Attenuator #2: <u>1471</u>		Mixer: <u> </u>																	
Additional equipment used:	<u>1052</u>	<u>1051</u>	<u>1092</u>	<u>1053</u>															
Measurement Uncertainty:	<u>+/-1.7 dB</u>																		
<table style="width:100%; border: none;"> <tr> <td style="border: none;">Ref Lvl</td> <td style="border: none;">RBW</td> <td style="border: none;">30 kHz</td> <td style="border: none;">RF Att</td> <td style="border: none;">20 dB</td> </tr> <tr> <td style="border: none;">40 dBm</td> <td style="border: none;">VBW</td> <td style="border: none;">30 kHz</td> <td style="border: none;">Mixer</td> <td style="border: none;">-10 dBm</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">SWT</td> <td style="border: none;">14 ms</td> <td style="border: none;">Unit</td> <td style="border: none;">dBm</td> </tr> </table>					Ref Lvl	RBW	30 kHz	RF Att	20 dB	40 dBm	VBW	30 kHz	Mixer	-10 dBm		SWT	14 ms	Unit	dBm
Ref Lvl	RBW	30 kHz	RF Att	20 dB															
40 dBm	VBW	30 kHz	Mixer	-10 dBm															
	SWT	14 ms	Unit	dBm															
Date: <u>18.MAR.2002 11:36:48</u>																			
Notes: <u>CDMA OUTPUT</u>																			

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

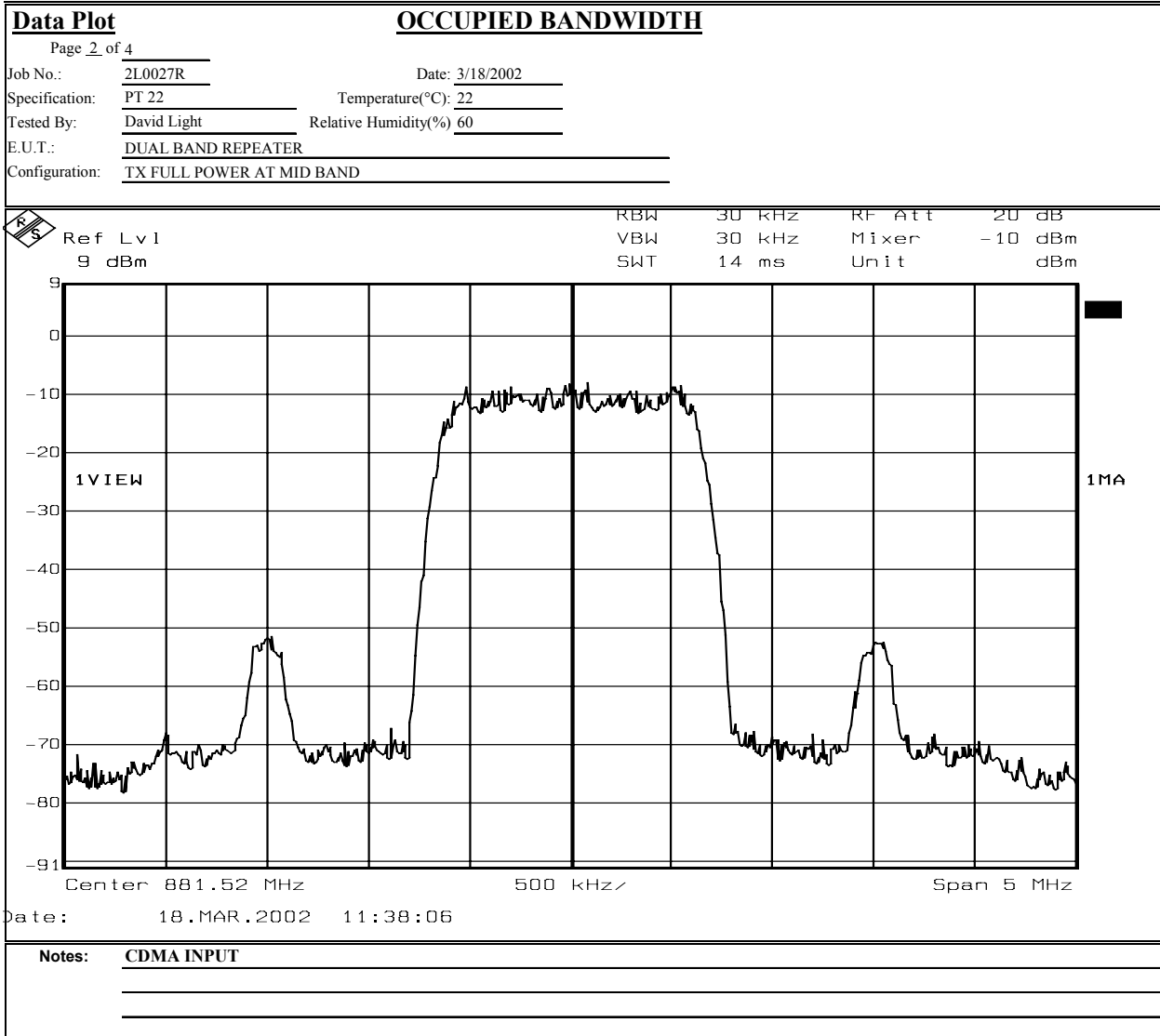
PROJECT NO.: 2L0027RUS1

Test Data – Occupied Bandwidth



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

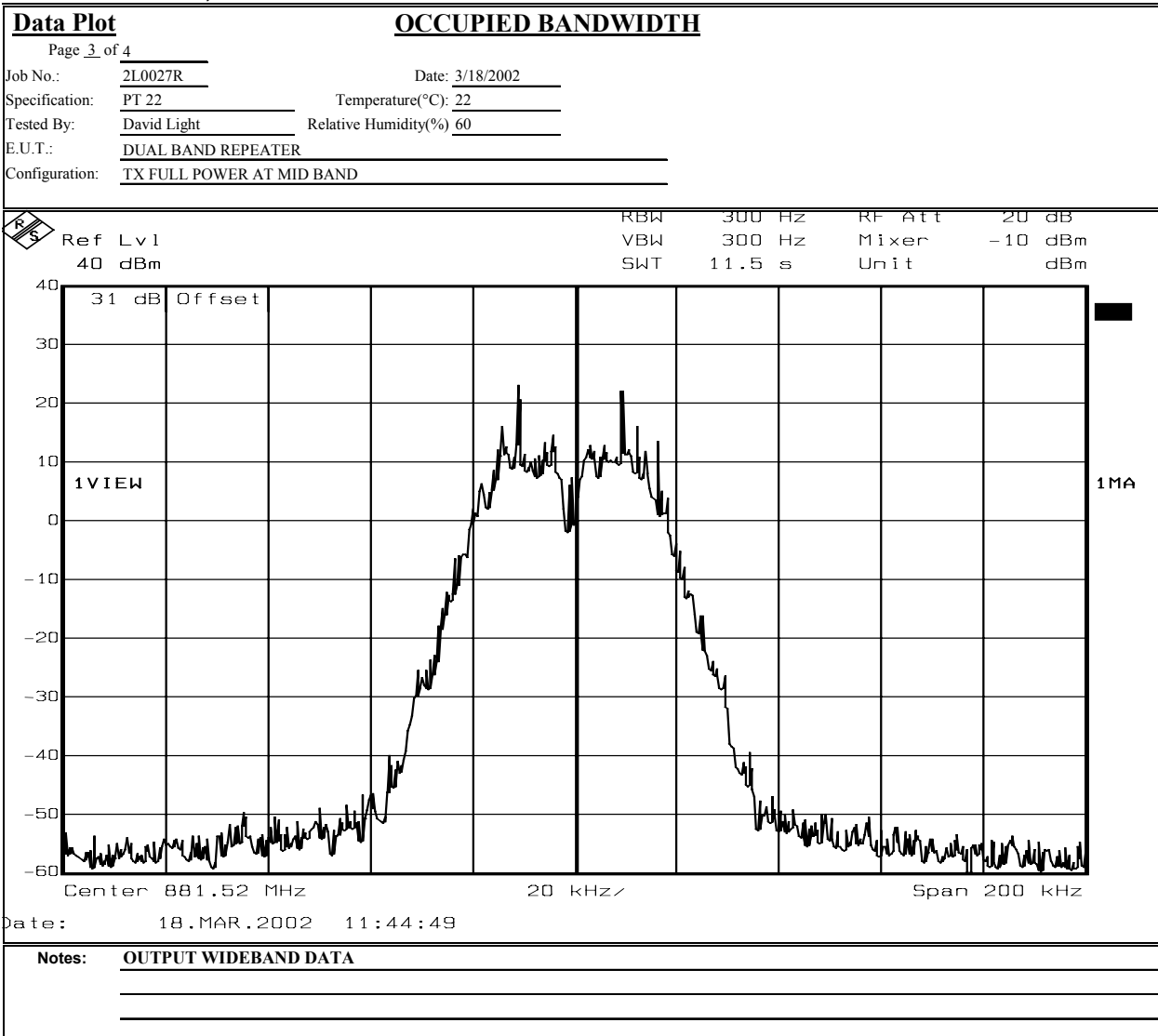
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Test Data – Occupied Bandwidth



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EQUIPMENT: Enhanced Remote Antenna Unit
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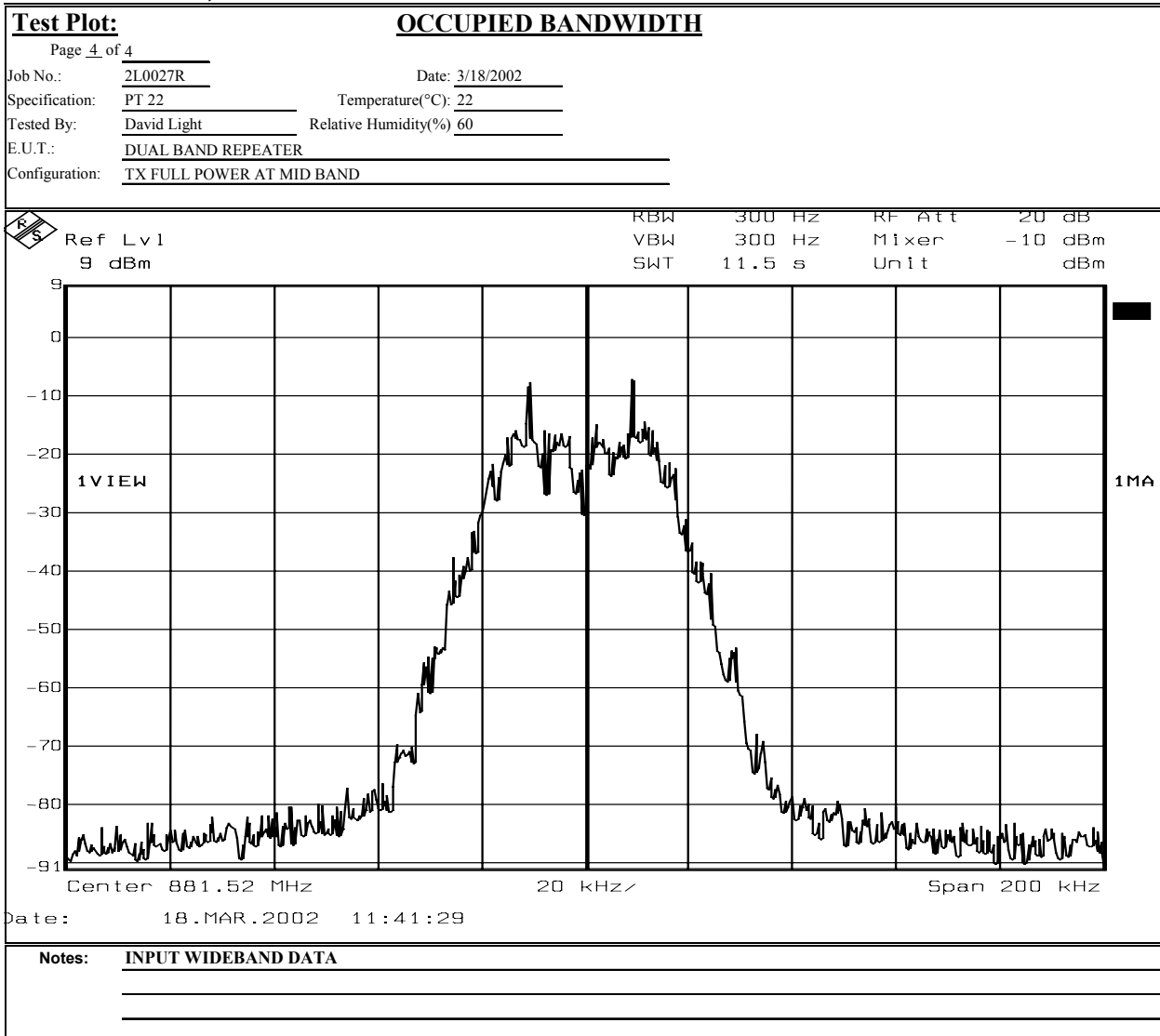
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EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

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Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 3/18/2002

Test Results: [Complies.](#)

Test Data: [See attached plots](#)

Measurement Uncertainty: +/- 1.6 dB

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Page 1 of 2 Complete X

Job No.: 2L0027R Date: 3/18/2002
 Specification: PT 22 Temperature(°C): 22
 Tested By: David Light Relative Humidity(%): 60
 E.U.T.: DUAL BAND REPEATER
 Configuration: TX AT MID BAND
 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: <u>1627</u>
Filter: _____	Cable #2: <u>1628</u>
Receiver: <u>1036</u>	Cable #3: <u>1629</u>
Attenuator #1: <u>1478</u>	Cable #4: _____
Attenuator #2: <u>1471</u>	Mixer: _____

Additional equipment used: 1052 1051 1092 1053
 Measurement Uncertainty: +/-1.7 dB

Ref Lvl	30 dBm	Marker 1 [11]	28.32 dBm	RBW	100 kHz	RF Att	10 dB
			869.75951904 MHz	VBW	100 kHz	Mixer	-10 dBm
				SWT	245 ms	Unit	dBm

31 dB Offset

1 VIEW

D1 -13 dBm

1MA
EXT

Start 30 MHz 97 MHz/ Stop 1 GHz

Date: 18.MAR.2002 16:11:11

Notes: _____

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

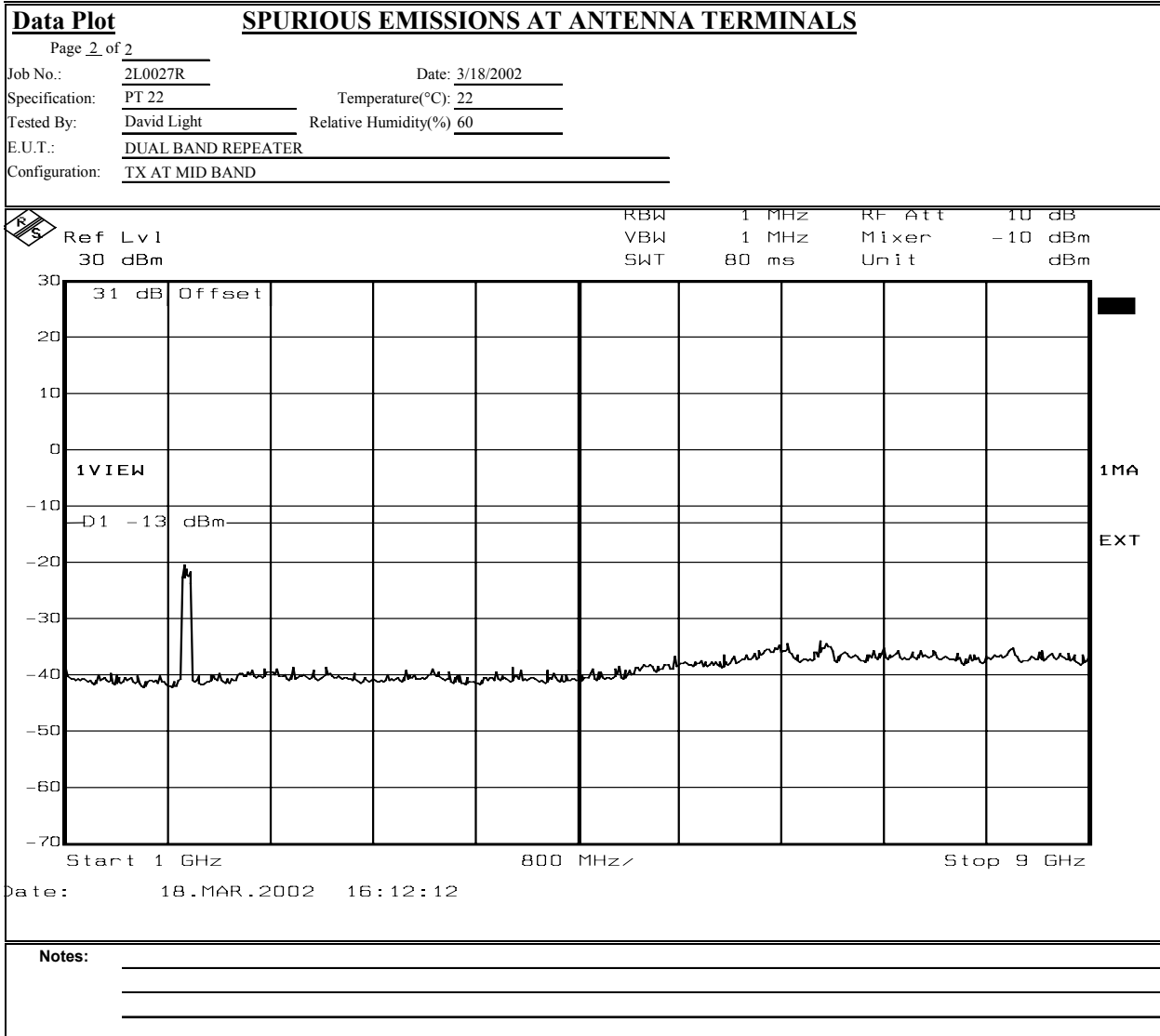
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

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<u>Data Plot</u>		<u>UPPER BANDEDGES</u>		Complete <u> X </u>																						
Page <u>1</u> of <u>5</u>		Date: <u>3/18/2002</u>		Preliminary: <u> </u>																						
Job No.: 2L0027R		Temperature(°C): <u>22</u>																								
Specification: PT22		Relative Humidity(%): <u>60</u>																								
Tested By: <u>David Light</u>																										
E.U.T.: <u>DUAL BAND REPEATER</u>																										
Configuration: <u>TX AT HIGHEST CHANNEL IN BAND</u>																										
Sample Number: <u>1</u>																										
Location: <u>Lab 1</u>		RBW: <u>Refer to plots</u>		Measurement																						
Detector Type: <u>Refer to plot</u>		VBW: <u>Refer to plots</u>		Distance: <u>N/A</u> m																						
<u>Test Equipment Used</u>																										
Antenna: <u> </u>		Directional Coupler: <u> </u>																								
Pre-Amp: <u> </u>		Cable #1: <u>1627</u>																								
Filter: <u> </u>		Cable #2: <u>1628</u>																								
Receiver: <u>1036</u>		Cable #3: <u>1629</u>																								
Attenuator #1: <u>1478</u>		Cable #4: <u> </u>																								
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Additional equipment used: <u>1052 1051 1092 1053</u>																										
Measurement Uncertainty: <u>+/-1.7 dB</u>																										
<table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <tr> <td>Ref</td> <td>Lvl</td> <td>Marker 1 [11]</td> <td>RBW</td> <td>300 Hz</td> <td>RF Att</td> <td>10 dB</td> </tr> <tr> <td>30 dBm</td> <td></td> <td>6.69 dBm</td> <td>VBW</td> <td>300 Hz</td> <td>Mixer</td> <td>-10 dBm</td> </tr> <tr> <td></td> <td></td> <td>893.97000000 MHz</td> <td>SWT</td> <td>11.5 s</td> <td>Unit</td> <td>dBm</td> </tr> </table>						Ref	Lvl	Marker 1 [11]	RBW	300 Hz	RF Att	10 dB	30 dBm		6.69 dBm	VBW	300 Hz	Mixer	-10 dBm			893.97000000 MHz	SWT	11.5 s	Unit	dBm
Ref	Lvl	Marker 1 [11]	RBW	300 Hz	RF Att	10 dB																				
30 dBm		6.69 dBm	VBW	300 Hz	Mixer	-10 dBm																				
		893.97000000 MHz	SWT	11.5 s	Unit	dBm																				
<p>Center 894 MHz 20 kHz/ Span 200 kHz</p>																										
Date: 18.MAR.2002 14:15:09																										
Notes: <u>WIDEBAND DATA</u>																										

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

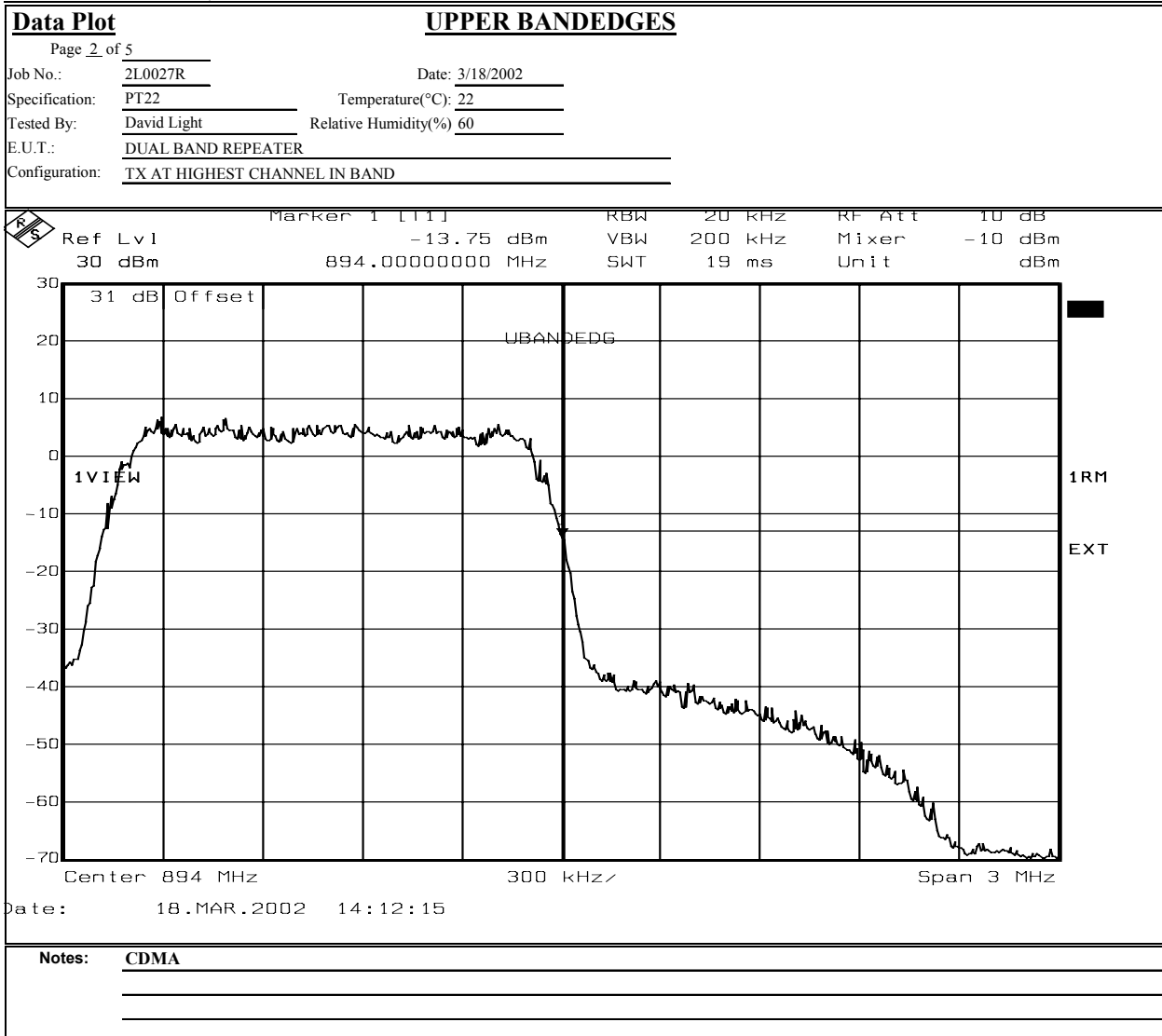
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Test Data – Spurious Emissions at Antenna Terminals



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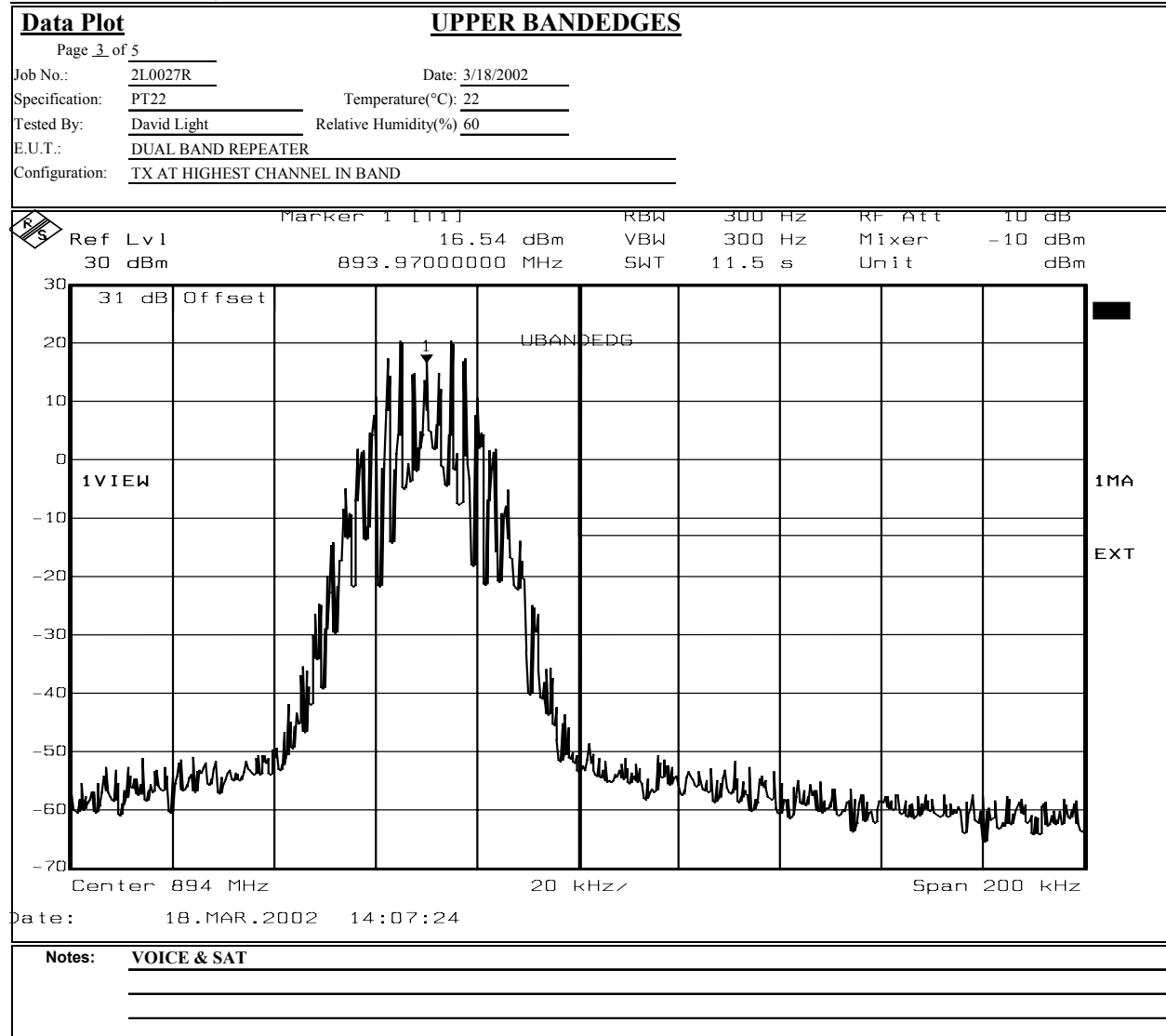
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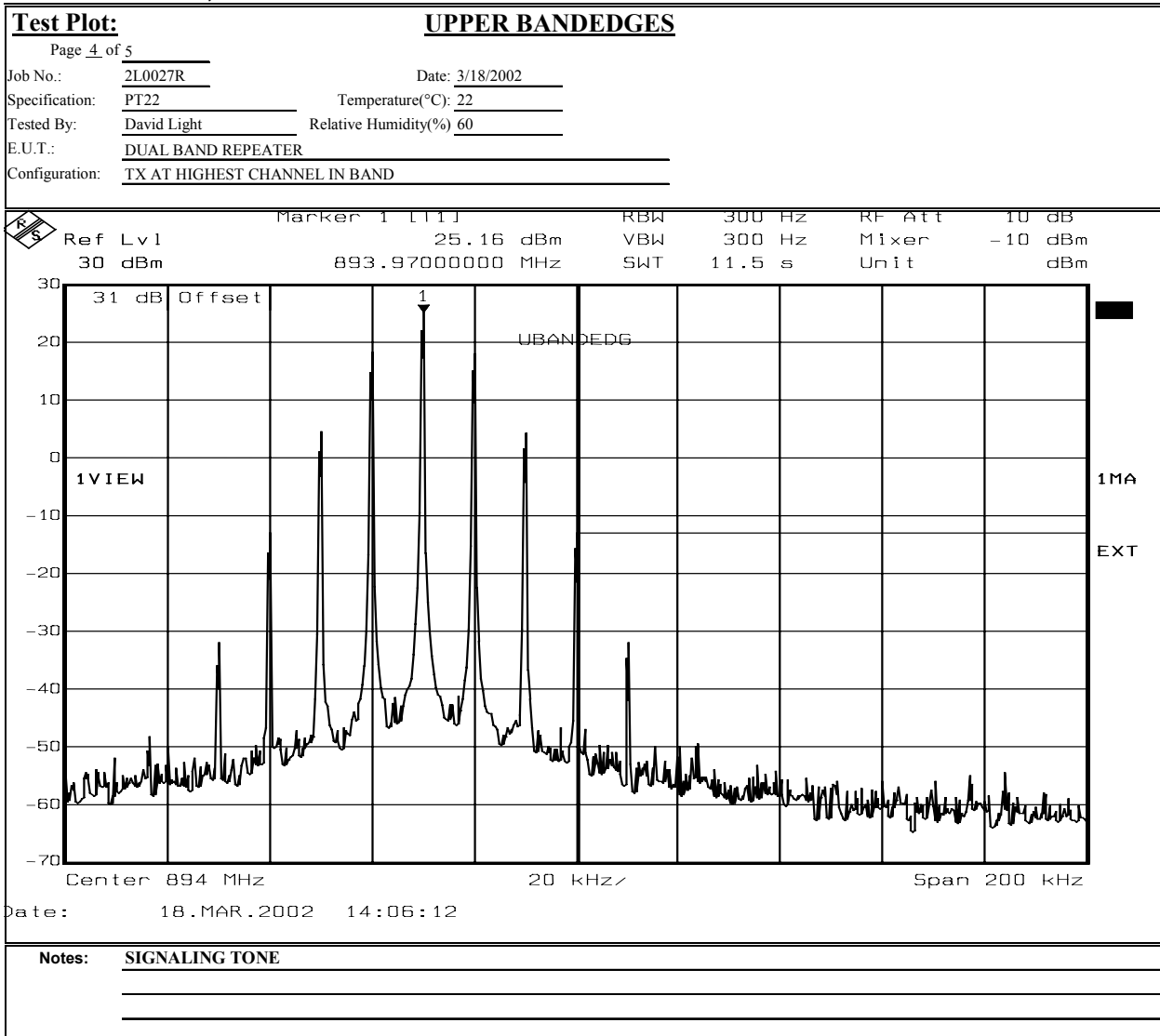
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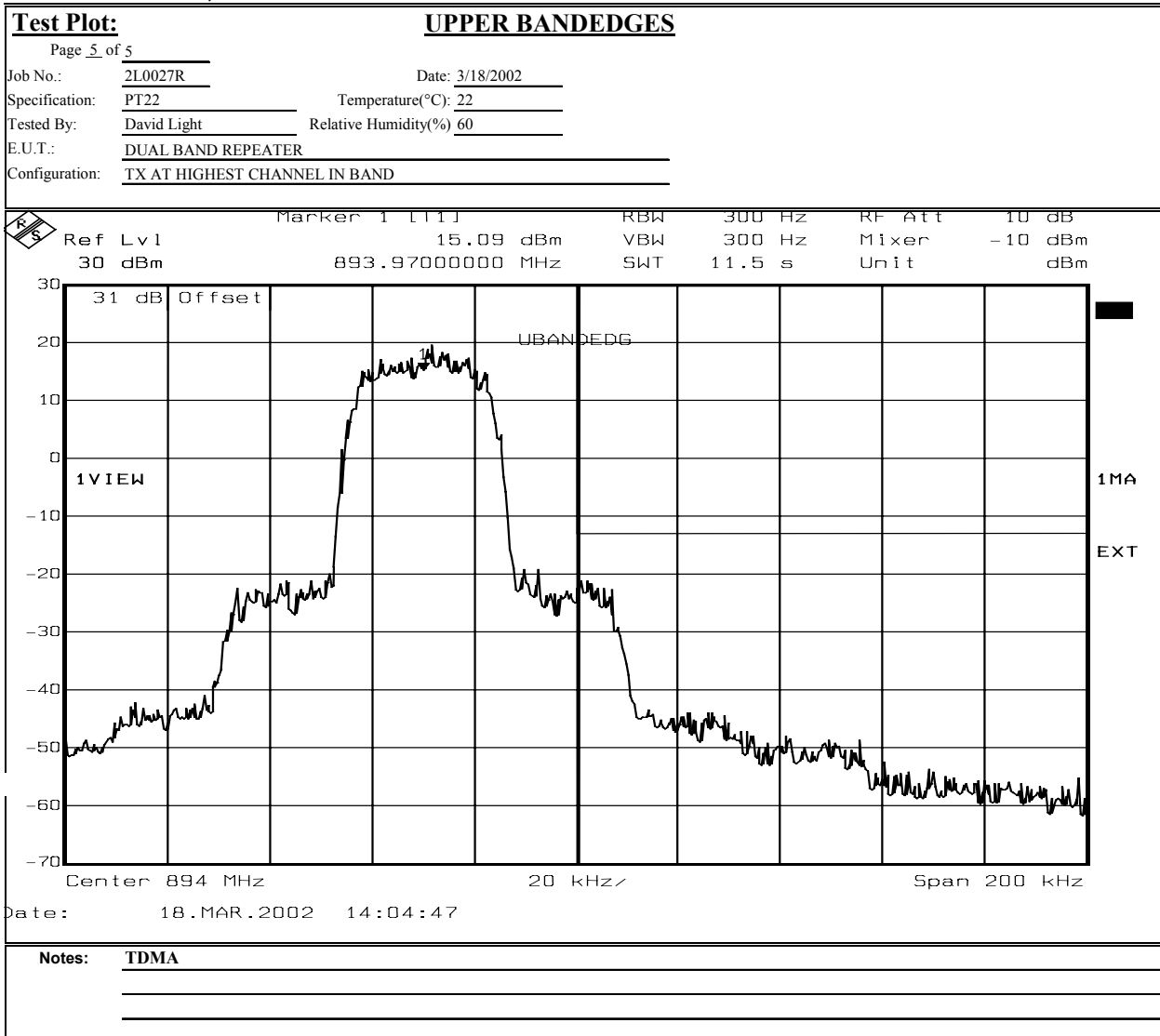
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Fax: (972) 436-2667

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<u>Data Plot</u>		<u>LOWER BANDEDGES</u>		Complete <u> X </u>																			
Page <u>1</u> of <u>5</u>				Preliminary: <u> </u>																			
Job No.:	<u>2L0027R</u>	Date:	<u>3/18/2002</u>																				
Specification:	<u>PT22</u>	Temperature(°C):	<u>22</u>																				
Tested By:	<u>David Light</u>	Relative Humidity(%):	<u>60</u>																				
E.U.T.:	<u>DUAL BAND REPEATER</u>																						
Configuration:	<u>TX AT LOWEST CHANNEL IN BAND</u>																						
Sample Number:	<u>1</u>																						
Location:	<u>Lab 1</u>	RBW:	<u>Refer to plots</u>	Measurement																			
Detector Type:	<u>Refer to plot</u>	VBW:	<u>Refer to plots</u>	Distance:	<u> </u> m																		
Test Equipment Used																							
Antenna:	<u> </u>	Directional Coupler:	<u> </u>																				
Pre-Amp:	<u> </u>	Cable #1:	<u>1627</u>																				
Filter:	<u> </u>	Cable #2:	<u>1628</u>																				
Receiver:	<u>1036</u>	Cable #3:	<u>1629</u>																				
Attenuator #1:	<u>1478</u>	Cable #4:	<u> </u>																				
Attenuator #2:	<u>1471</u>	Mixer:	<u> </u>																				
Additional equipment used:	<u>1052</u> <u>1051</u> <u>1092</u> <u>1053</u>																						
Measurement Uncertainty:	<u>+/-1.7 dB</u>																						
<table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <tr> <td style="width:15%;"></td> <td style="width:35%;">Marker 1 [11]</td> <td style="width:15%;">RBW</td> <td style="width:15%;">300 Hz</td> <td style="width:15%;">RF Att</td> <td style="width:15%;">20 dB</td> </tr> <tr> <td>Ref Lvl</td> <td>2.96 dBm</td> <td>VBW</td> <td>300 Hz</td> <td>Mixer</td> <td>-10 dBm</td> </tr> <tr> <td>40 dBm</td> <td>869.04000000 MHz</td> <td>SWT</td> <td>11.5 s</td> <td>Unit</td> <td>dBm</td> </tr> </table>							Marker 1 [11]	RBW	300 Hz	RF Att	20 dB	Ref Lvl	2.96 dBm	VBW	300 Hz	Mixer	-10 dBm	40 dBm	869.04000000 MHz	SWT	11.5 s	Unit	dBm
	Marker 1 [11]	RBW	300 Hz	RF Att	20 dB																		
Ref Lvl	2.96 dBm	VBW	300 Hz	Mixer	-10 dBm																		
40 dBm	869.04000000 MHz	SWT	11.5 s	Unit	dBm																		
Date: <u>18.MAR.2002</u> <u>11:51:08</u>																							
Notes: <u>WIDEBAND DATA</u>																							

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

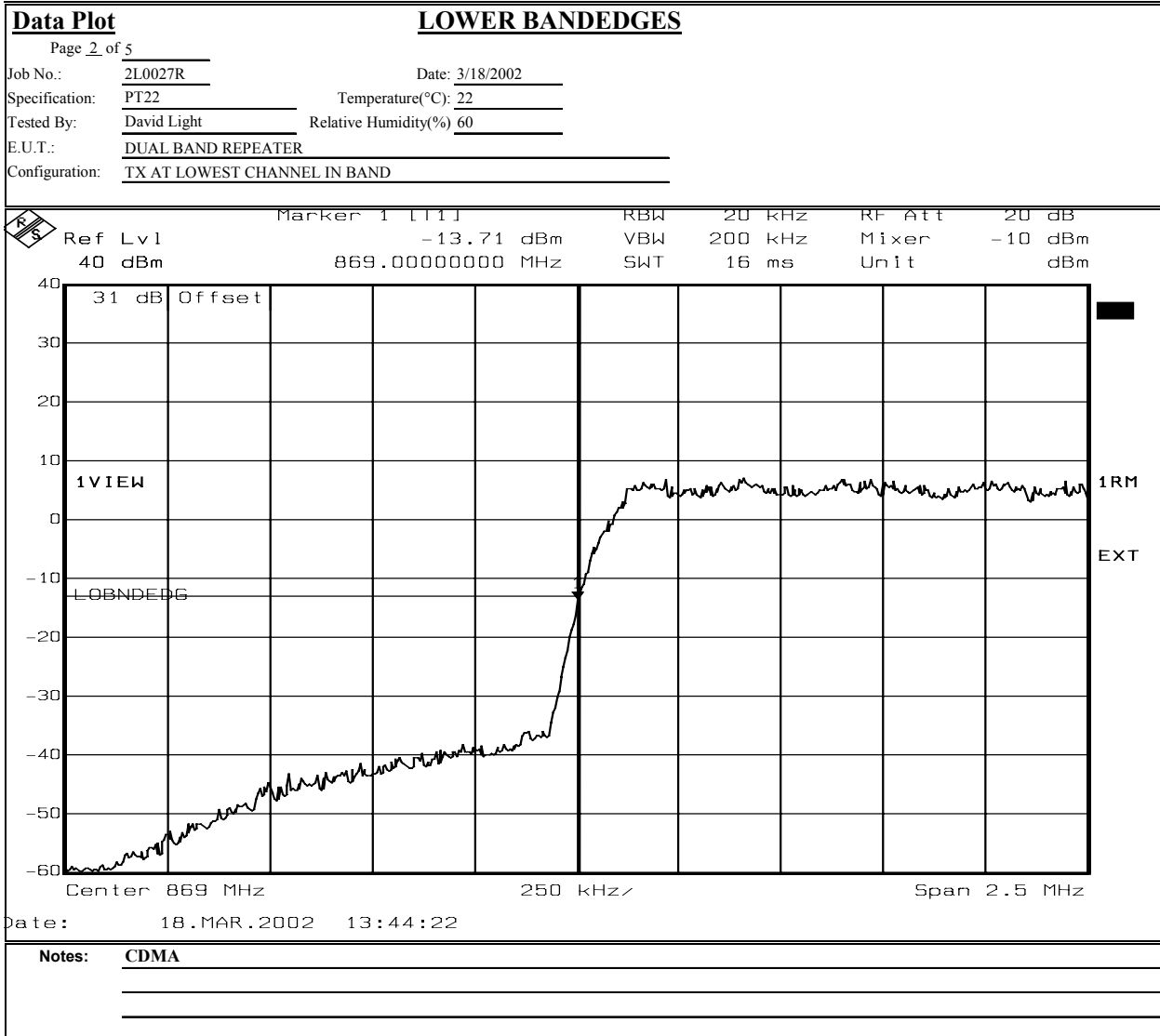
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

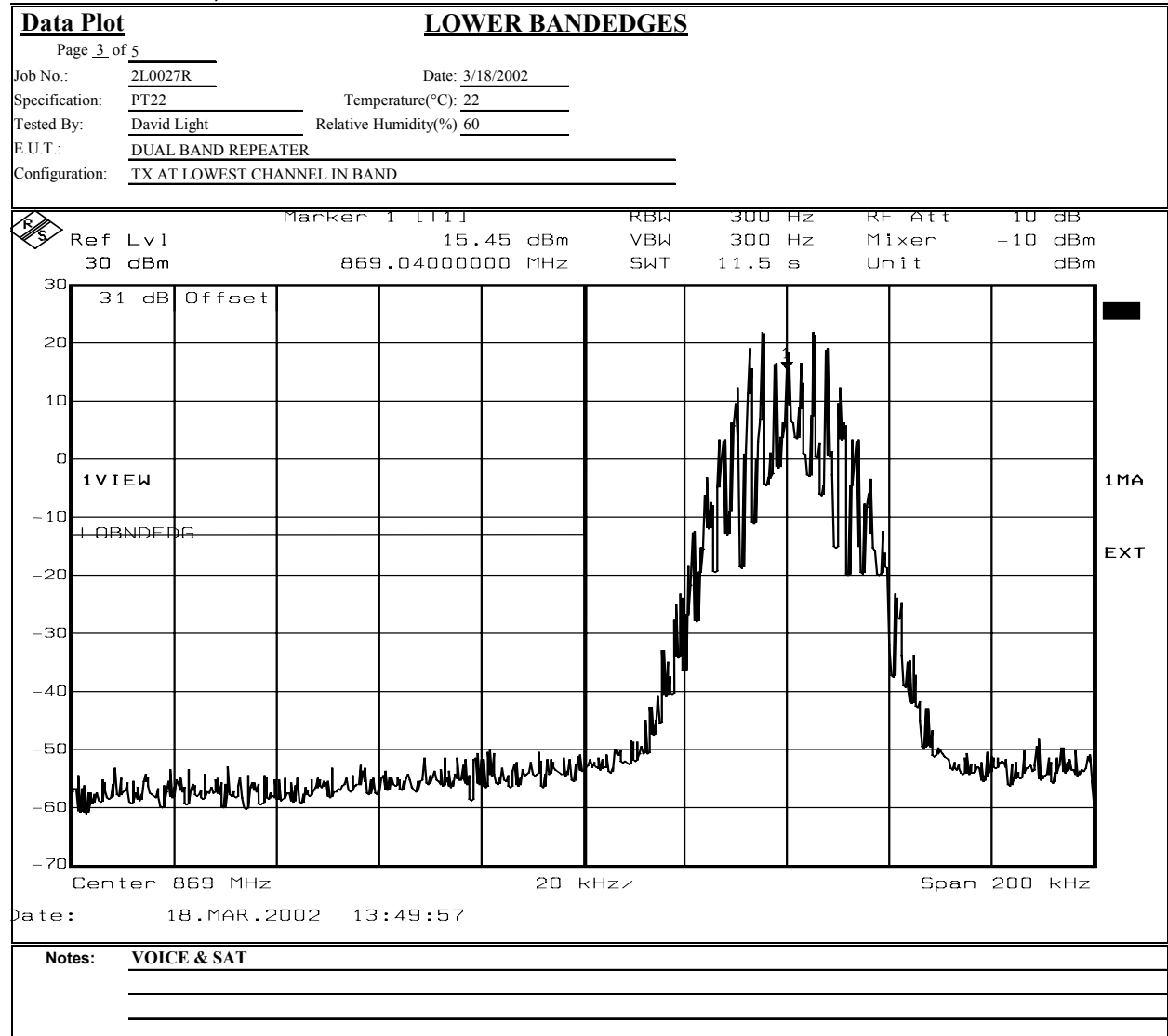
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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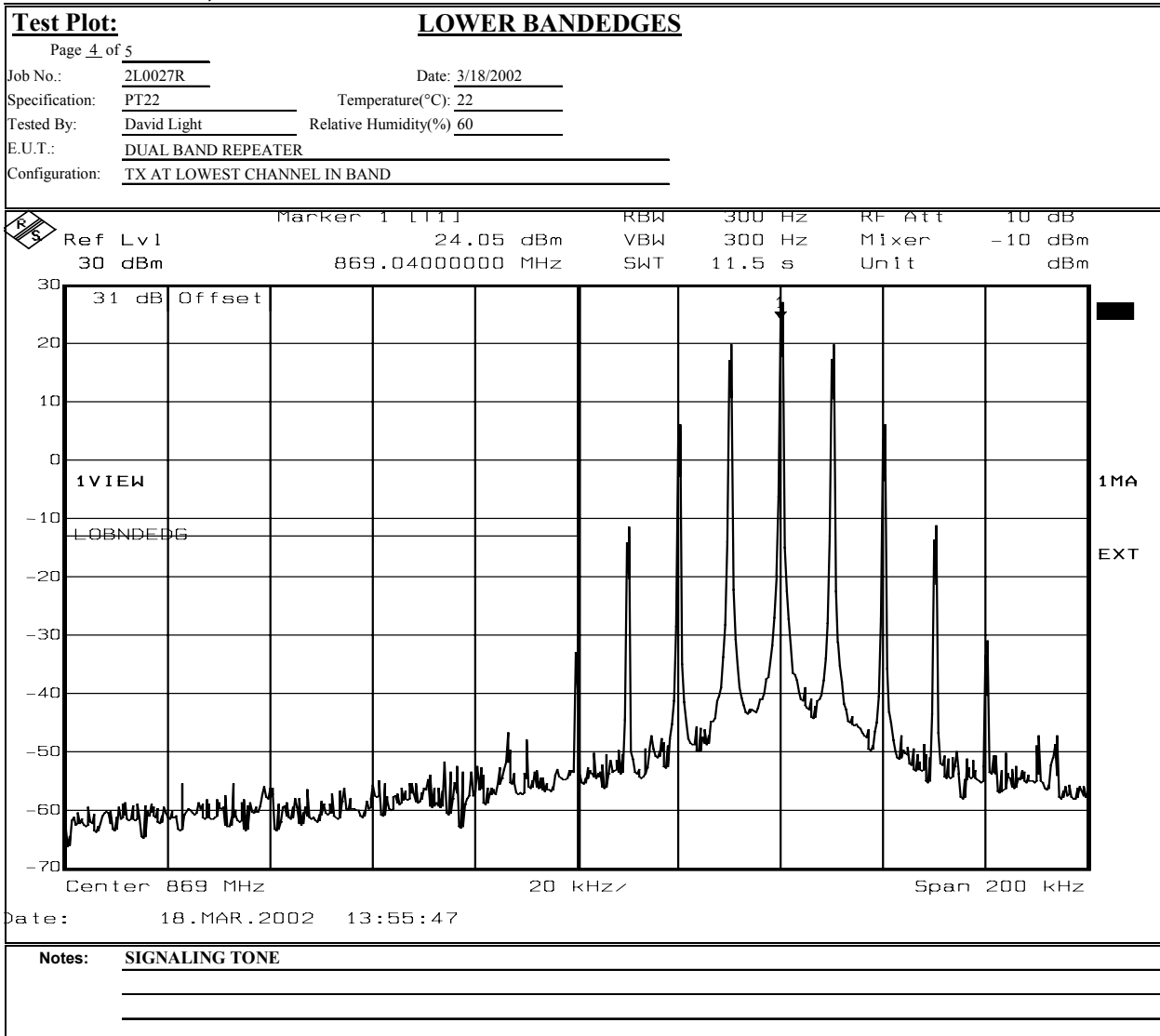
PROJECT NO.: 2L0027RUS1

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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

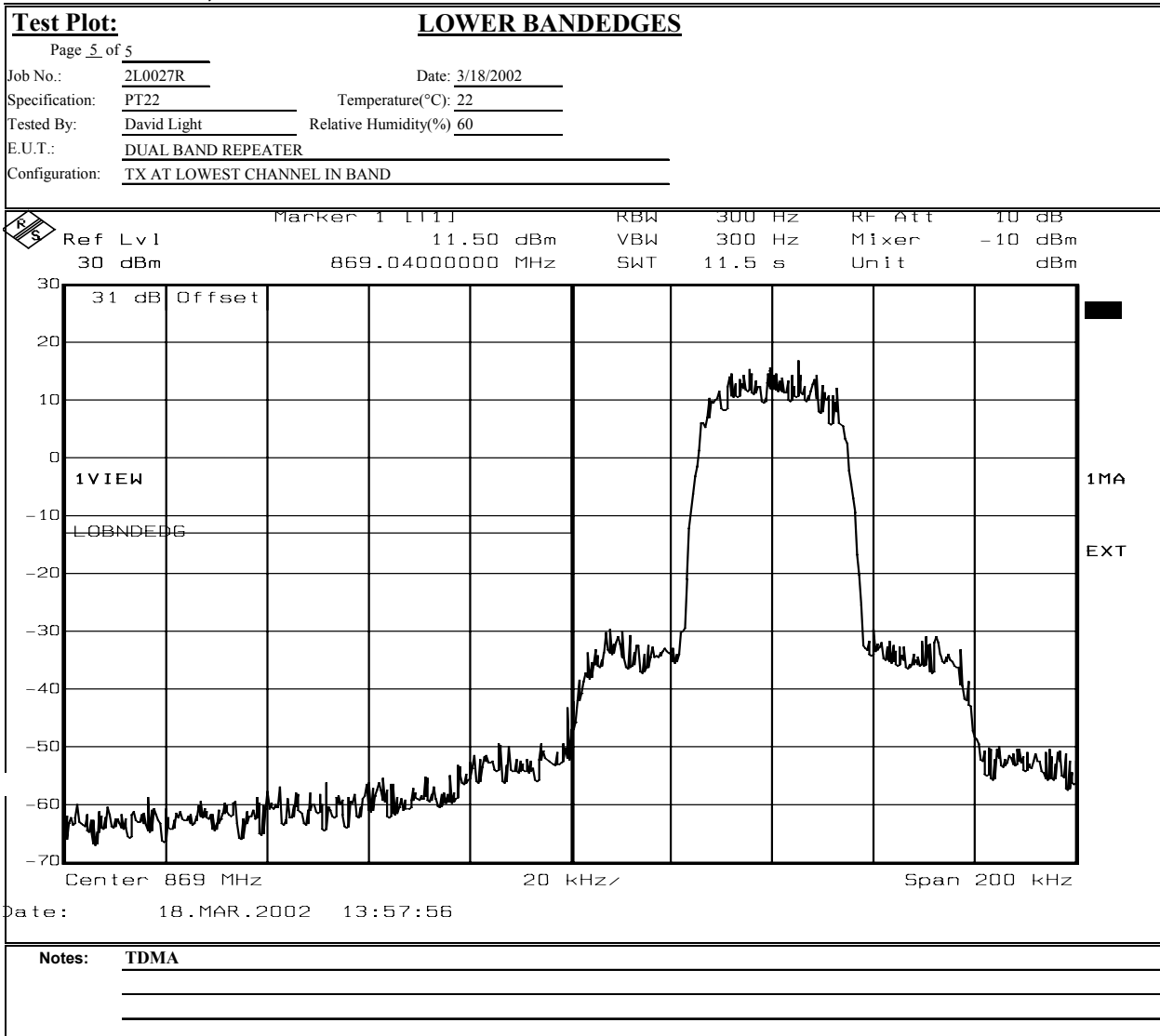
PROJECT NO.: 2L0027RUS1

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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		<u>INTERMODULATION CHARACTERISTICS</u>																								
Page 1 of 6				Complete	X																					
Job No.:	2L0027R	Date:	3/18/2002		Preliminary:																					
Specification:	PT22	Temperature(°C):	22																							
Tested By:	David Light	Relative Humidity(%):	60																							
E.U.T.:	DUAL BAND REPEATER																									
Configuration:	TX 2 CARRIERS AT BANDEDGES																									
Sample Number:	1																									
Location:	Lab 1	RBW:	Refer to plots		Measurement																					
Detector Type:	Refer to plot	VBW:	Refer to plots		Distance: N/A m																					
Test Equipment Used																										
Antenna:		Directional Coupler:																								
Pre-Amp:		Cable #1:	1627																							
Filter:		Cable #2:	1628																							
Receiver:	1036	Cable #3:	1629																							
Attenuator #1:	1478	Cable #4:																								
Attenuator #2:	1471	Mixer:																								
Additional equipment used:	1052 1051 1092 1053																									
Measurement Uncertainty:	+/-1.7 dB																									
<table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <tr> <td>Ref</td> <td>Lvl</td> <td>Marker 2 [T1]</td> <td>RBW</td> <td>20 kHz</td> <td>RF Att</td> <td>10 dB</td> </tr> <tr> <td>30 dBm</td> <td></td> <td>-18.75 dBm</td> <td>VBW</td> <td>300 kHz</td> <td>Mixer</td> <td>-10 dBm</td> </tr> <tr> <td></td> <td></td> <td>894.82164329 MHz</td> <td>SWT</td> <td>125 ms</td> <td>Unit</td> <td>dBm</td> </tr> </table>						Ref	Lvl	Marker 2 [T1]	RBW	20 kHz	RF Att	10 dB	30 dBm		-18.75 dBm	VBW	300 kHz	Mixer	-10 dBm			894.82164329 MHz	SWT	125 ms	Unit	dBm
Ref	Lvl	Marker 2 [T1]	RBW	20 kHz	RF Att	10 dB																				
30 dBm		-18.75 dBm	VBW	300 kHz	Mixer	-10 dBm																				
		894.82164329 MHz	SWT	125 ms	Unit	dBm																				
Date: 18.MAR.2002 15:30:09 Center 894 MHz 2 MHz/ Span 20 MHz																										
Notes: <u>CDMA - UPPER BANDEDGE</u> <u>2 CARRIERS</u>																										

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

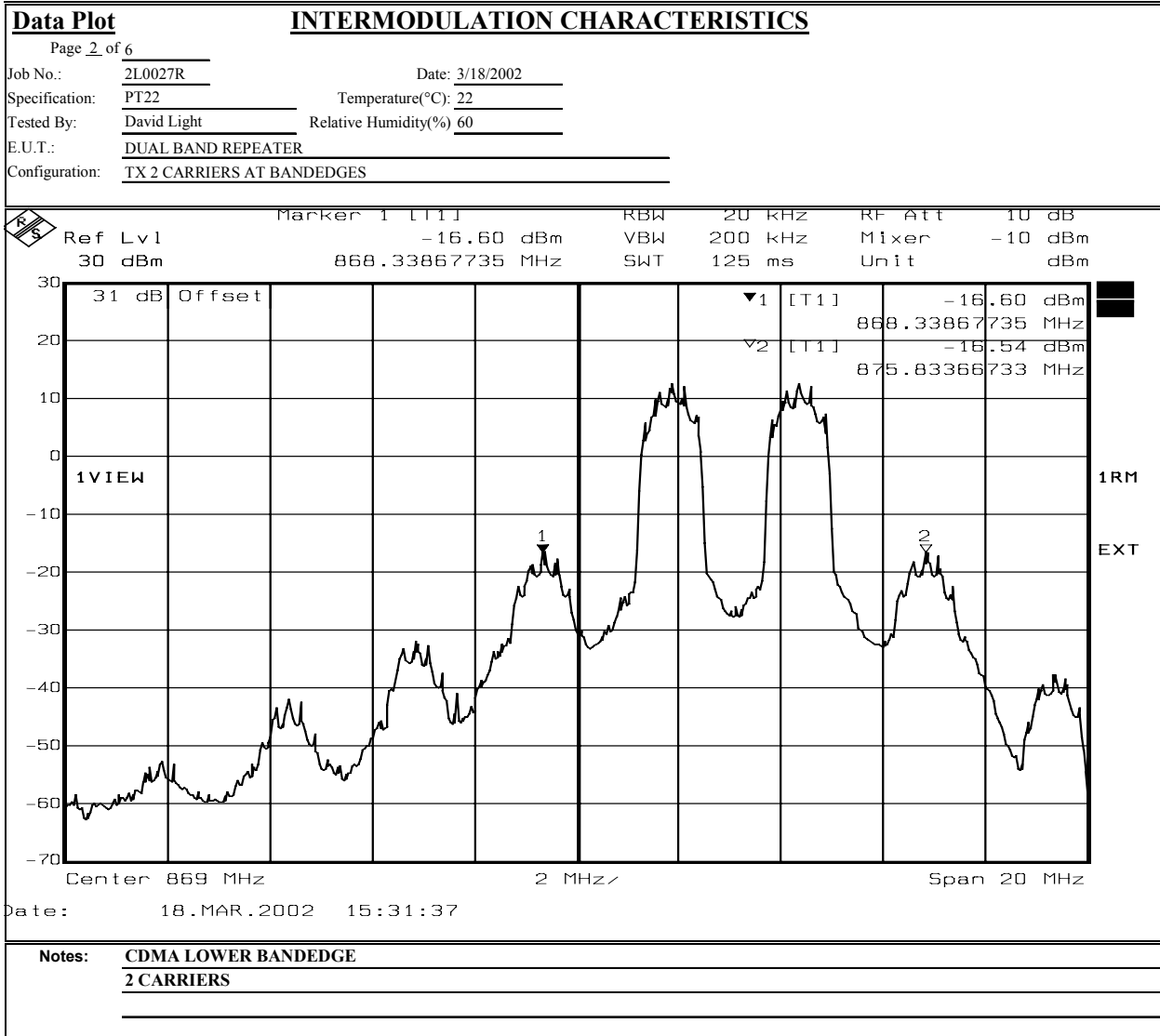
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

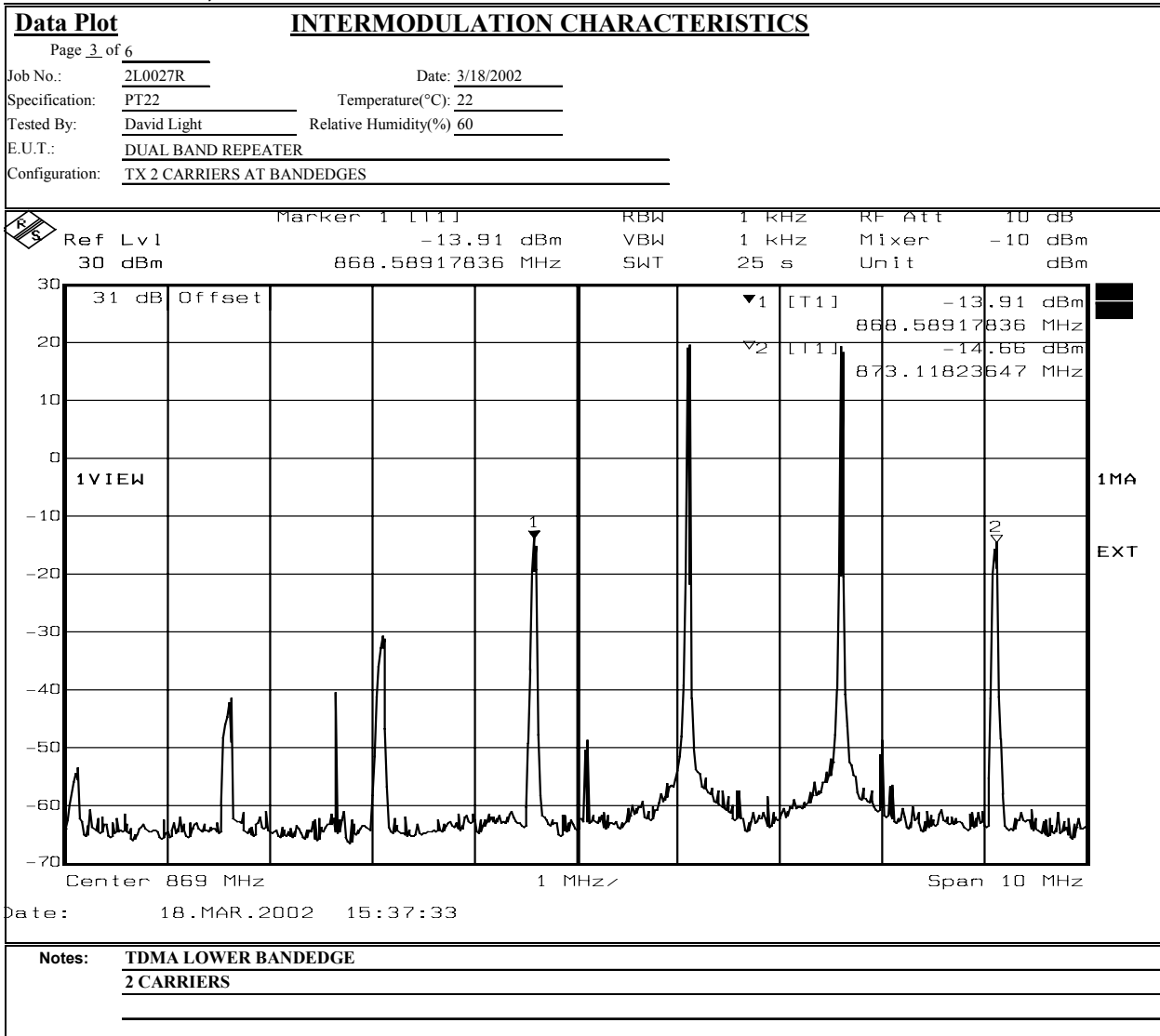
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

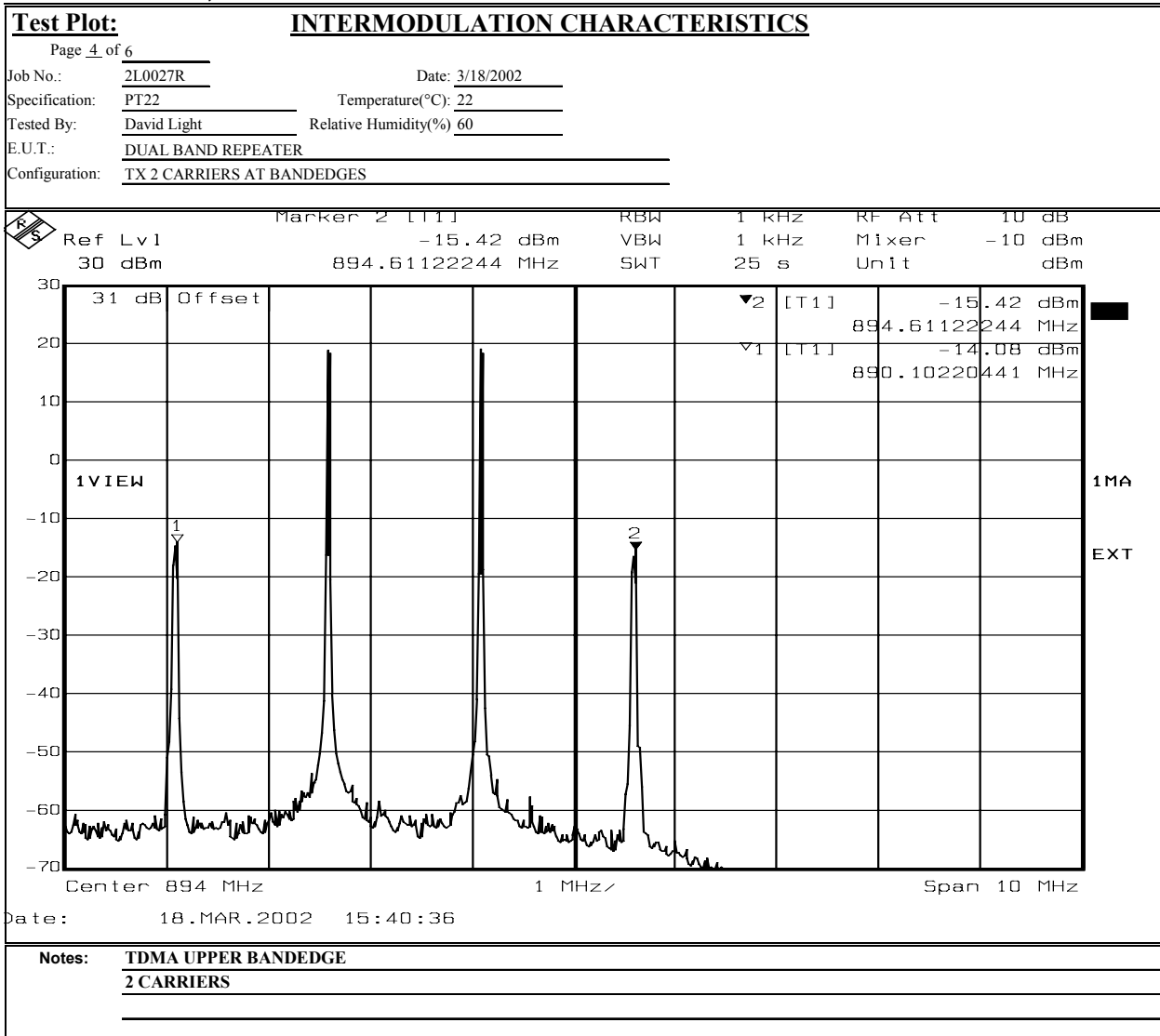
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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Fax: (972) 436-2667

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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

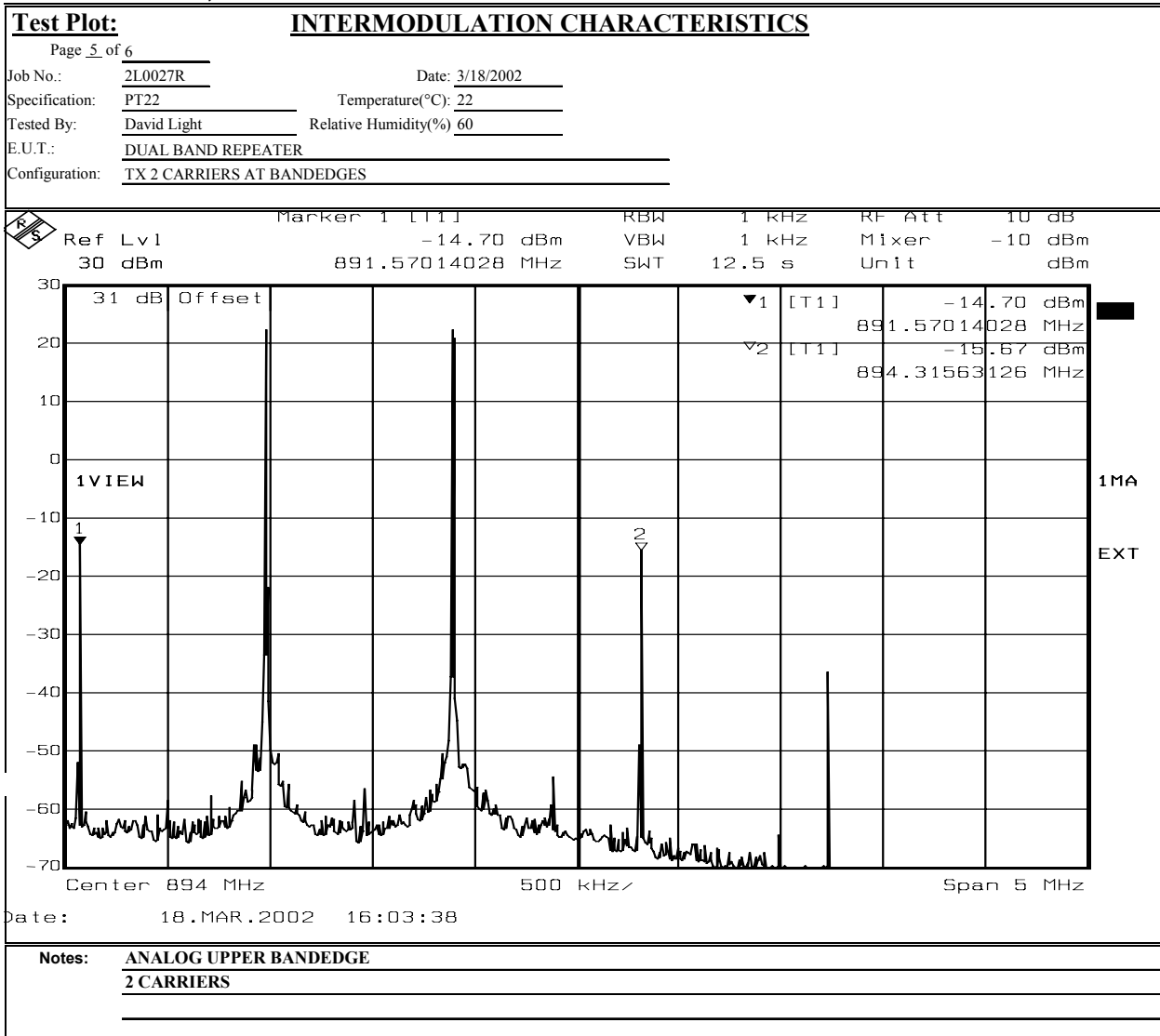
PROJECT NO.: 2L0027RUS1

Test Data – Spurious Emissions at Antenna Terminals



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EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

PROJECT NO.: 2L0027RUS1

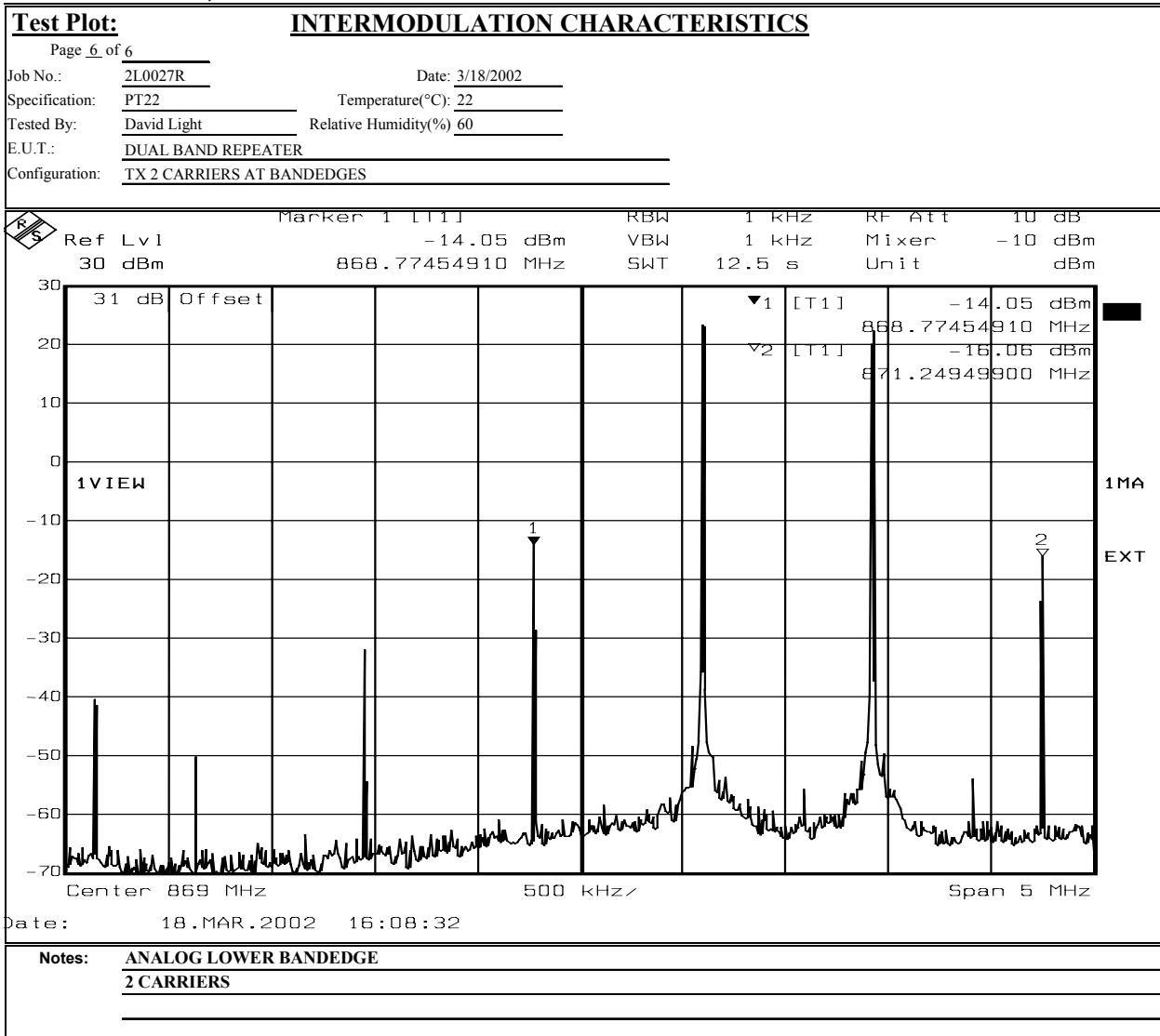
Test Data – Spurious Emissions at Antenna Terminals

C



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EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 3/19/2002

Test Results: [Complies.](#)

Test Data: [See attached table.](#)

Measurement Uncertainty: +/- 3.6 dB

EQUIPMENT: Enhanced Remote Antenna Unit (ERAU)

PROJECT NO.: 2L0027RUS1

Test Data - Field Strength of Spurious Emissions



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

<u>Field Strength of Spurious Emissions</u>										
Page <u>1</u> of <u>1</u>							Complete <u>X</u>			
Job No.:	2L0027R		Date:		3/19/2002		Preliminary _____			
Specification:	PT22		Temperature(°C):		20					
Tested By:	<u>David Light</u>		Relative Humidity(%):		60					
E.U.T.:	<u>DUAL BAND REPEATER</u>									
Configuration:	<u>TX @ 880 MHz</u>									
Sample No.:	<u>1</u>									
Location:	<u>AC 3</u>				RBW:	<u>1 MHz</u>		Measurement		
Detector Type:	<u>Peak</u>				VBW:	<u>1 MHz</u>		Distance: <u>3 m</u>		
Test Equipment Used										
Antenna:	<u>1304</u>		Directional Coupler:		_____					
Pre-Amp:	<u>1016</u>		Cable #1:		<u>1484</u>					
Filter:	_____		Cable #2:		<u>1485</u>					
Receiver:	<u>1464</u>		Cable #3:		_____					
Attenuator #1:	_____		Cable #4:		_____					
Attenuator #2:	_____		Mixer:		_____					
Additional equipment used:	_____									
Measurement Uncertainty:	<u>+/-3.6 dB</u>									
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)		ERP (dBm)	ERP (mW)	Polarity	Comments
1760	-47.3	31.0		33.3	7.3		-42.4	0.0001	V	
2640	-56.0	35.5		33.8	8.0		-46.4	0.0000	V	
3520	-62.0	43.3		33.6	8.6		-43.7	0.0000	V	Noise floor
4400	-62.0	45.3		33.5	8.2		-42.0	0.0001	V	
8800	-65.0	44.8		34.3	9.4		-45.1	0.0000	V	Noise floor
1760	-54.0	33.0		33.3	7.3		-47.1	0.0000	H	
2640	-58.6	35.5		33.8	8.0		-49.0	0.0000	H	
3520	-62.0	35.5		33.6	8.6		-51.6	0.0000	H	Noise floor
4400	-64.0	34.8		33.5	8.2		-54.5	0.0000	H	Noise floor
8800	-65.0	42.2		34.3	9.4		-47.8	0.0000	H	Noise floor
Notes: Scanned spectrum to the tenth harmonic										

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Test Setup – Field strength of Spurious Emissions
Front



Rear



EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01
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
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01
1052	I/Q MODULATION GENERATOR	Rhode & Schwarz AMIQ	DE30619	09/25/00
1051	Radio Communication Analyzer	Rhode & Schwarz CMTA-54	835875/002	CBU
1478	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W6	NONE	CBU
1471	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	CBU
1627	CABLE, 5 ft	MEGAPHASE 10312 1GVT4	N/A	CBU
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU
1092	COMBINER	MINI-CIRCUITS ZA3PD-1.5	NONE	CBU
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	08/09/01

Nemko Dallas

FCC PART 22, SUBPART H
CELLULAR BAND REPEATERS

EQUIPMENT: [Enhanced Remote Antenna Unit
\(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

ANNEX A - TEST DETAILS

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

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

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

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: \geq 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.

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

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: \geq 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

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

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: \geq 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

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

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: \geq RBW

Span: As required

Sweep: Auto

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

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: \geq RBW

Start Frequency: 0 MHz

Stop Frequency: 10 GHz

Sweep: Auto

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

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.

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.

The spectrum is searched to the 10th harmonic.

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

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.

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FCC PART 22, SUBPART H
CELLULAR BAND REPEATERS

EQUIPMENT: [Enhanced Remote Antenna Unit
\(ERAU\)](#)

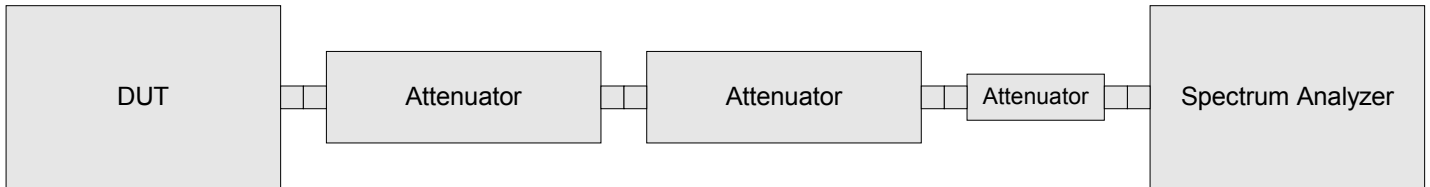
PROJECT NO.: 2L0027RUS1

ANNEX B - TEST DIAGRAMS

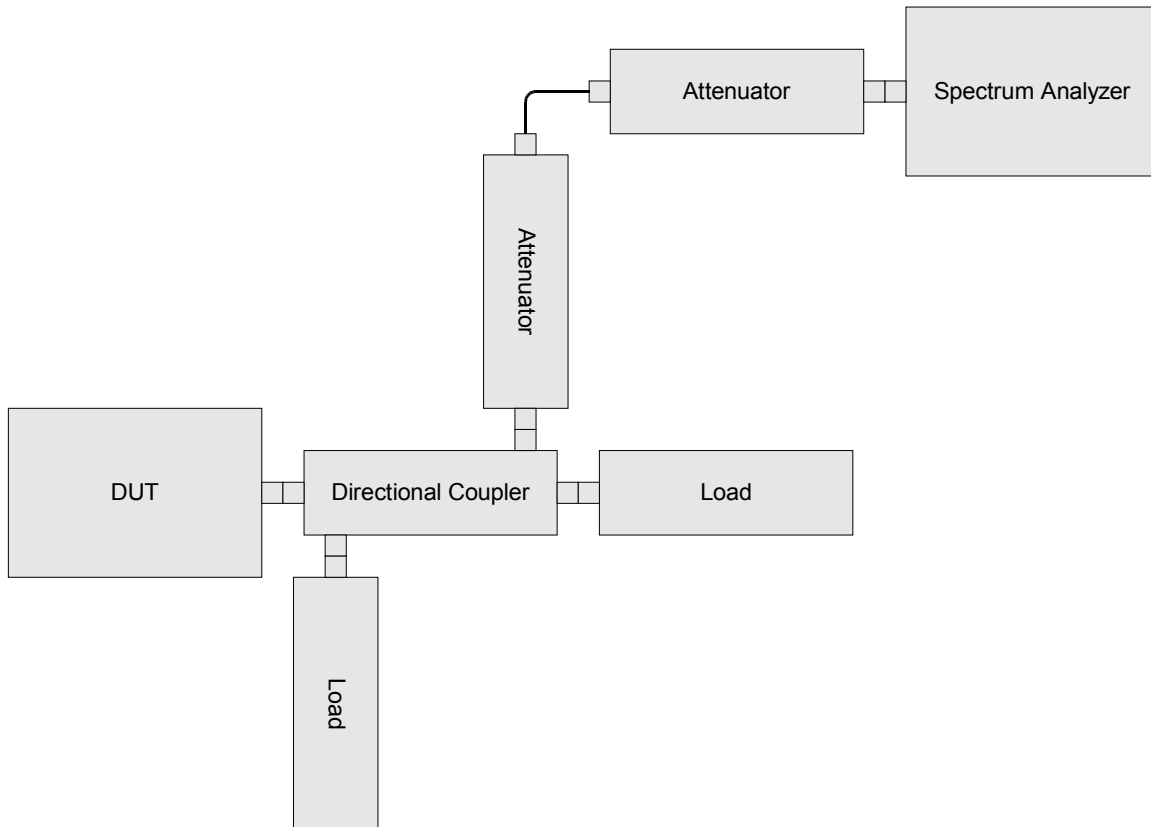
EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

PROJECT NO.: 2L0027RUS1

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



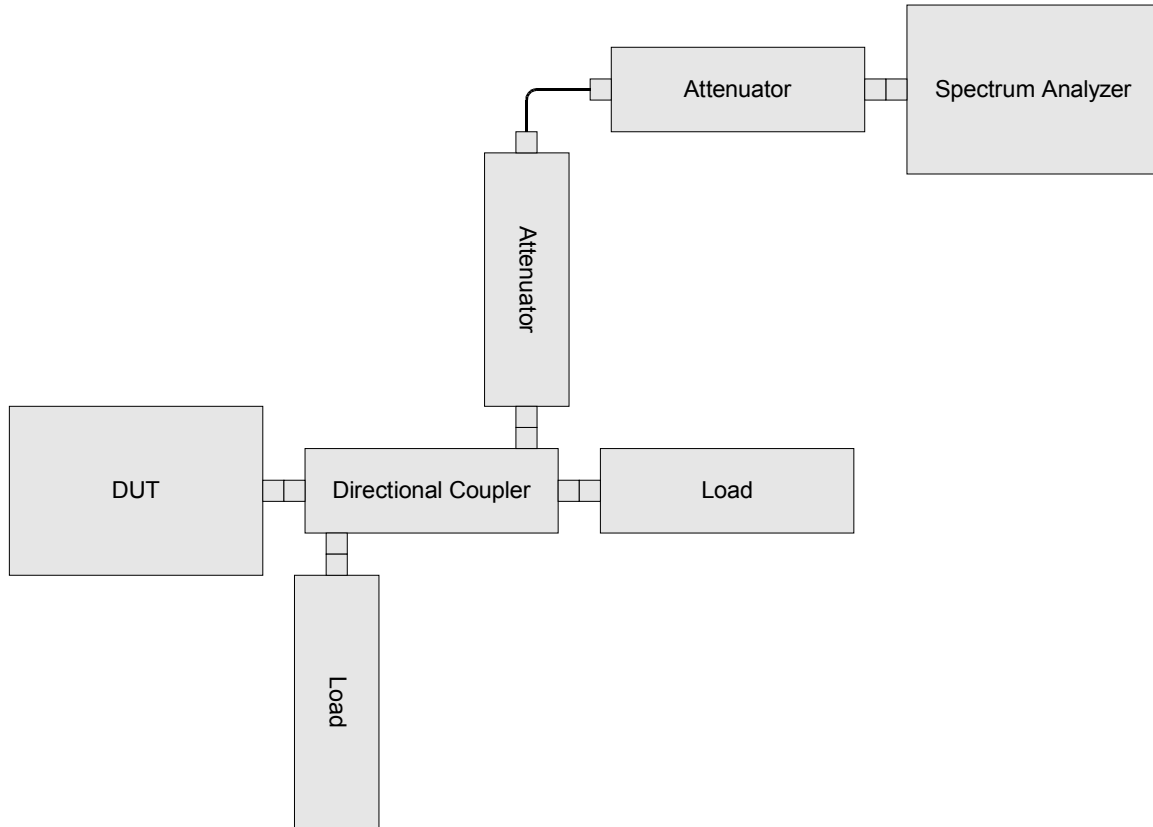
Para. No. 2.1049 - Occupied Bandwidth



EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

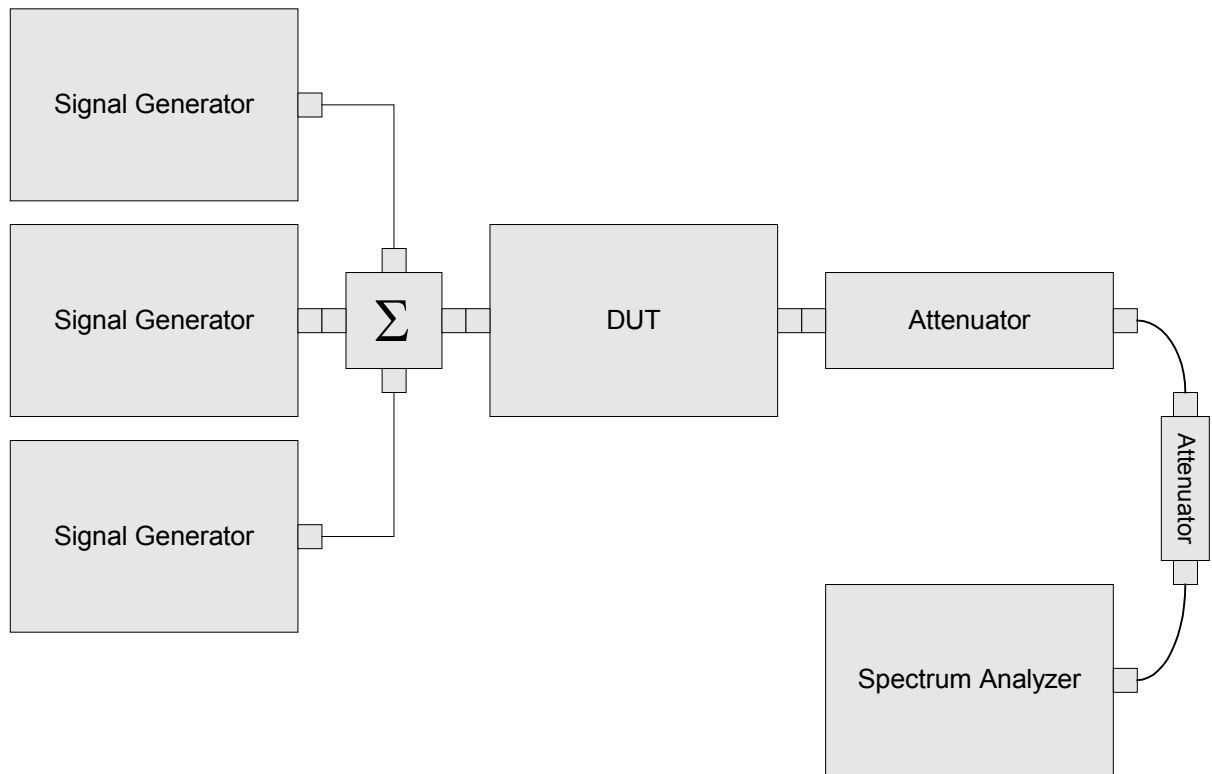
PROJECT NO.: 2L0027RUS1

Para. No. 2.1051 Spurious Emissions at Antenna Terminals



EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

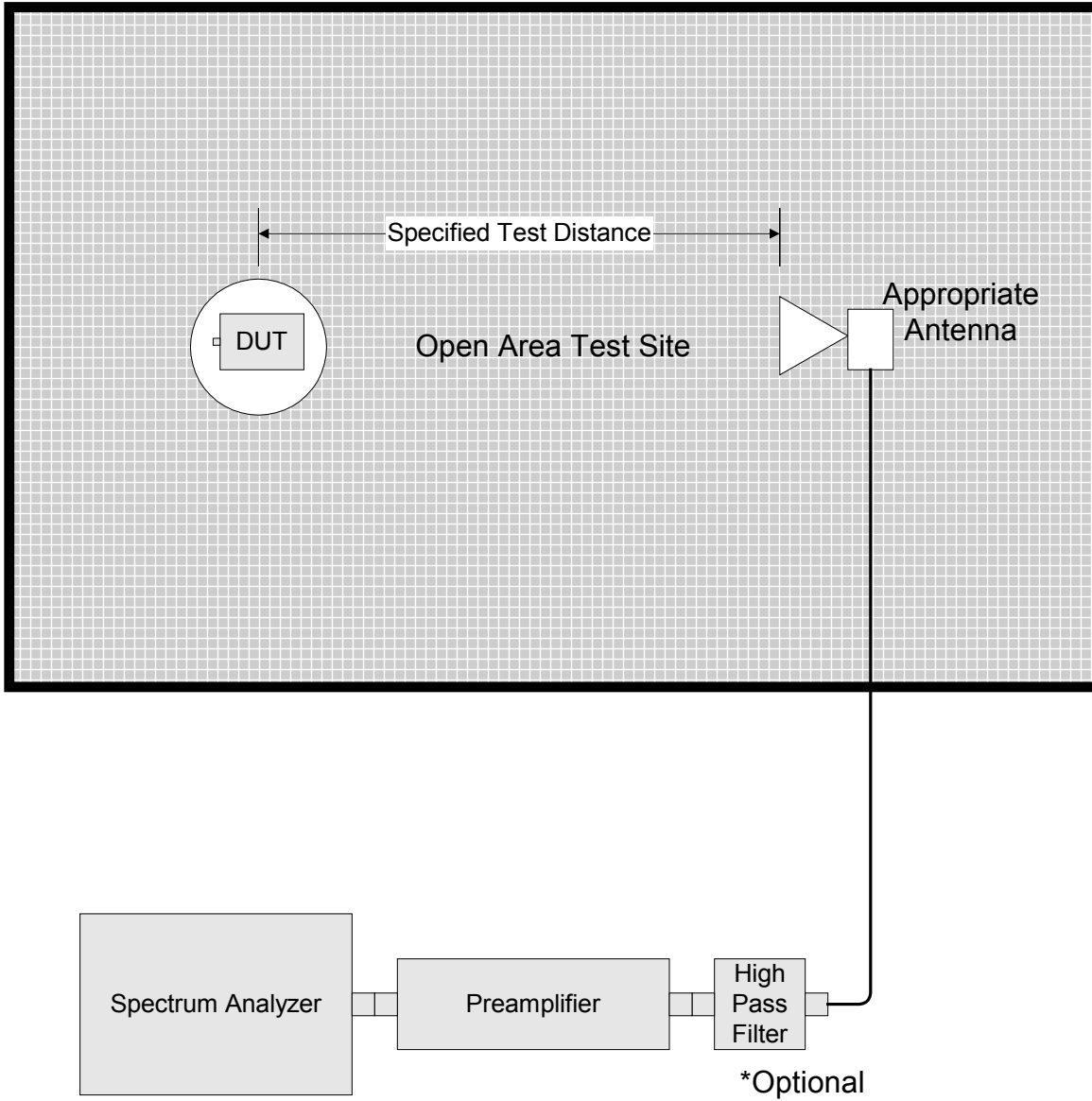
PROJECT NO.: 2L0027RUS1



EQUIPMENT: [Enhanced Remote Antenna Unit \(ERAU\)](#)

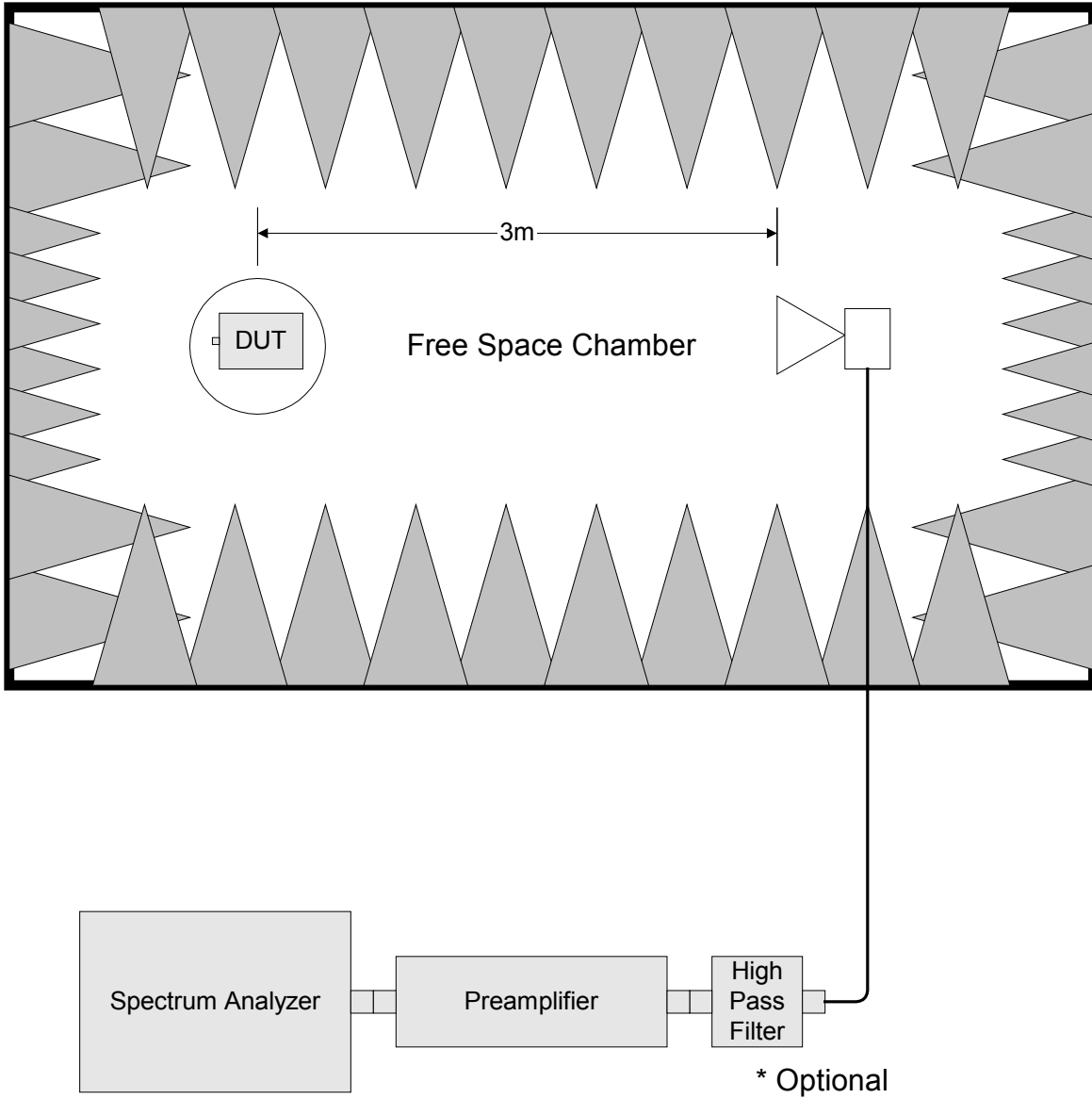
PROJECT NO.: 2L0027RUS1

Para. No. 2.1053 - Field Strength of Spurious Radiation



EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1



EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS1

Para. No. 2.1055 - Frequency Stability

