

Nemko Test Report: 2L0027RUS3

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 90, Subpart I**
Private Land Mobile Repeater

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Authorized By:



Tom Tidwell, Wireless Group Manager

Date: 3/22/02

Total Number of Pages: 38

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EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

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 90, Subpart I.

New Submission

Production Unit

Class II Permissive Change

Pre-Production Unit

A	<	P
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Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	90.205		Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A
Occupied Bandwidth	90.210	Plots	Complies
Spurious Emissions at Antenna Terminals	90.210	Plots	Complies
Field Strength of Spurious Emissions	90.210	-13 dBm	Complies
Frequency Stability	90.213	N/A	N/A
Transient Frequency Behavior	90.214	N/A	N/A

Footnotes For N/A's:

- (1) Since the E.U.T. does not contain modulation circuitry modulation testing was not performed.
- (2) Since the E.U.T. is not a keyed carrier system, Transient Frequency Behavior was not performed.

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input: 40-70 Vdc
Frequency Range: 851 to 869 MHz
Tunable Bands: Full band coverage

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	D7W (QAM)	Other
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Maximum Input: 0 dBm

Output Impedance: 50 ohms

RF Power Output (rated): **Single:** 28.8 dBm (750 mW)
Composite: 28.8 dBm (750 mW)

Operator Selection of Operating Frequency: Full band coverage

Power Output Adjustment Capability: None

Frequency Translation:

F1-F1	F1-F2	N/A
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Band Selection:

Software	Duplexer Change	Fullband Coverage
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS3

Description of Modifications For Class II Permissive Change

Not Applicable

Modifications Made During Testing

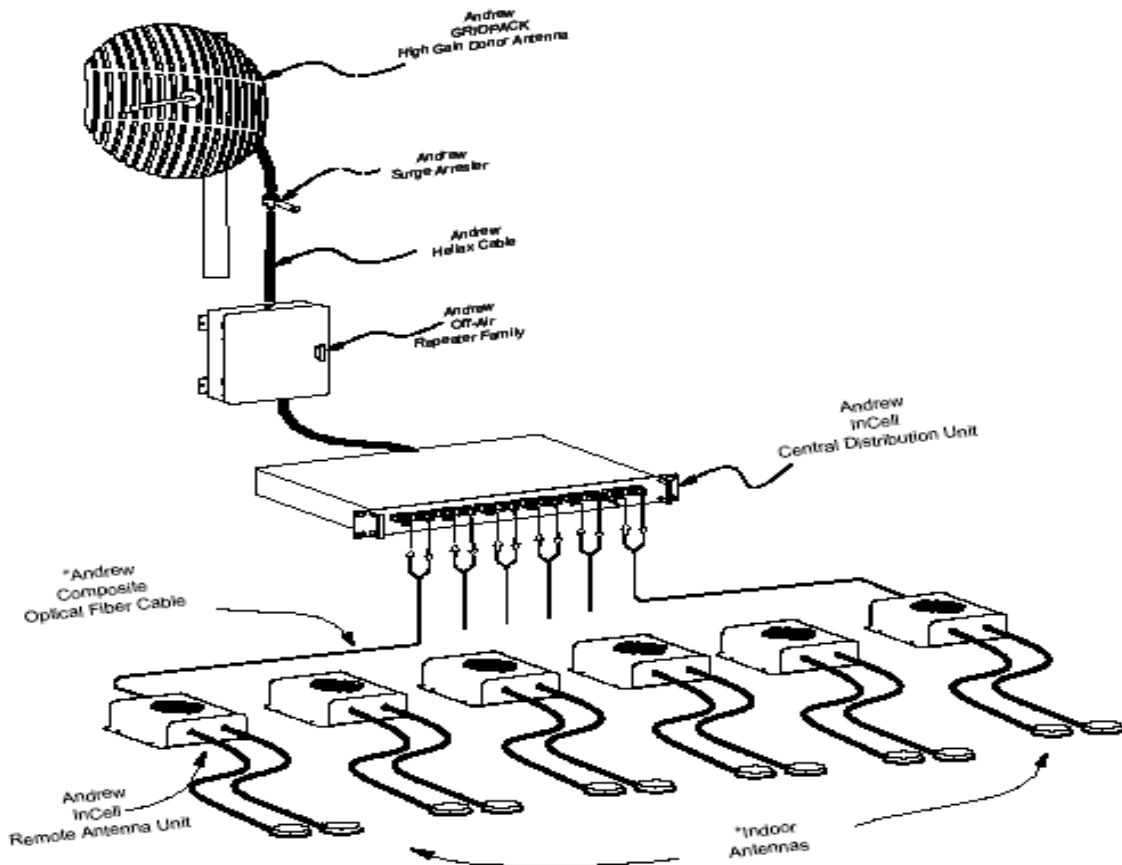
Not Applicable

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

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



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE:3/19/2002

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
851.0125	28.8	28.8	1
860.9875	28.9	28.8	1
868.9875	28.7	28.8	1

Test Equipment: 1036-1471-1478-1629

Test Conditions:
Temperature: 22° C

Humidity: 60% RH

Measurement Uncertainty: +/- 1.7 dB

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Enhanced Remote Antenna Unit
(ERAU)**

PROJECT NO.: **2L0027RUS3**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 3/19/2002

Test Results: Complies.

Test Data: See attached graph(s).

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

Test Data – Occupied Bandwidth



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Data Plot	<u>OCUPIED BANDWIDTH</u>			
Page 1 of 4	Complete <u> X </u>			
Job No.: 2L0027R	Date: <u> 3/19/2002 </u>	Preliminary: <u> </u>		
Specification: PT 90	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 FULL POWER </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		
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> 1051 1052 1053 1092 </u>				
Measurement Uncertainty: <u> +/-1.7 dB </u>				
<table style="width:100%; border: none;"> <tr> <td style="border: none;"> </td> <td style="border: none; vertical-align: top;"> RBW 300 Hz VBW 300 Hz SWT 11.5 s RF Att 20 dB Unit dBm </td> </tr> </table>				RBW 300 Hz VBW 300 Hz SWT 11.5 s RF Att 20 dB Unit dBm
	RBW 300 Hz VBW 300 Hz SWT 11.5 s RF Att 20 dB Unit dBm			
<p>Ref Lvl 21 dBm</p> <p>Center 860.9875 MHz 20 kHz</p> <p>Span 200 kHz</p> <p>Date: 19.MAR.2002 09:12:31</p>				
<p>Notes: <u> Output signal iDEN </u></p> <p>_____</p> <p>_____</p>				

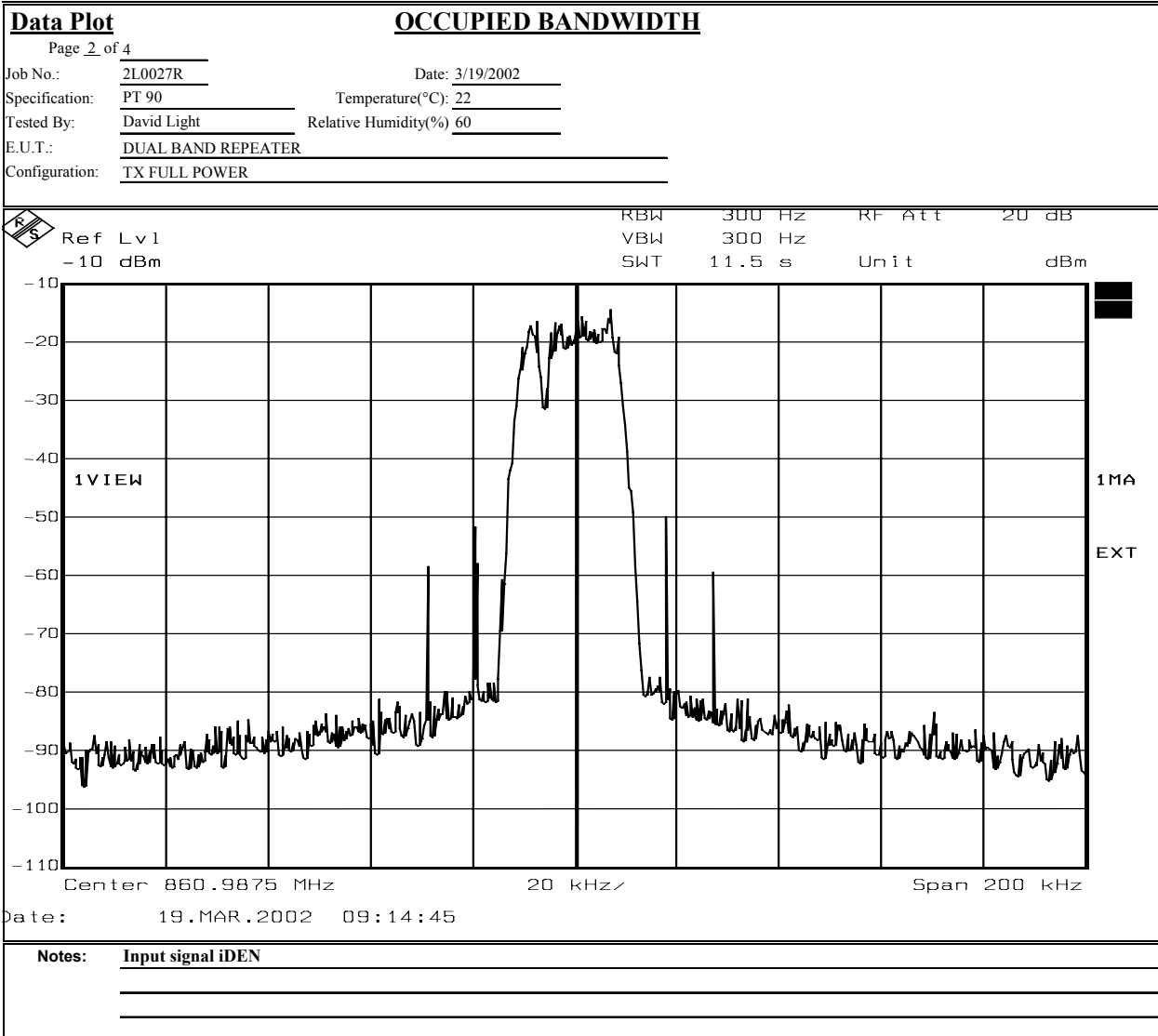
EQUIPMENT: Enhanced Remote Antenna Unit
 (ERAU)

Test Data – Occupied Bandwidth



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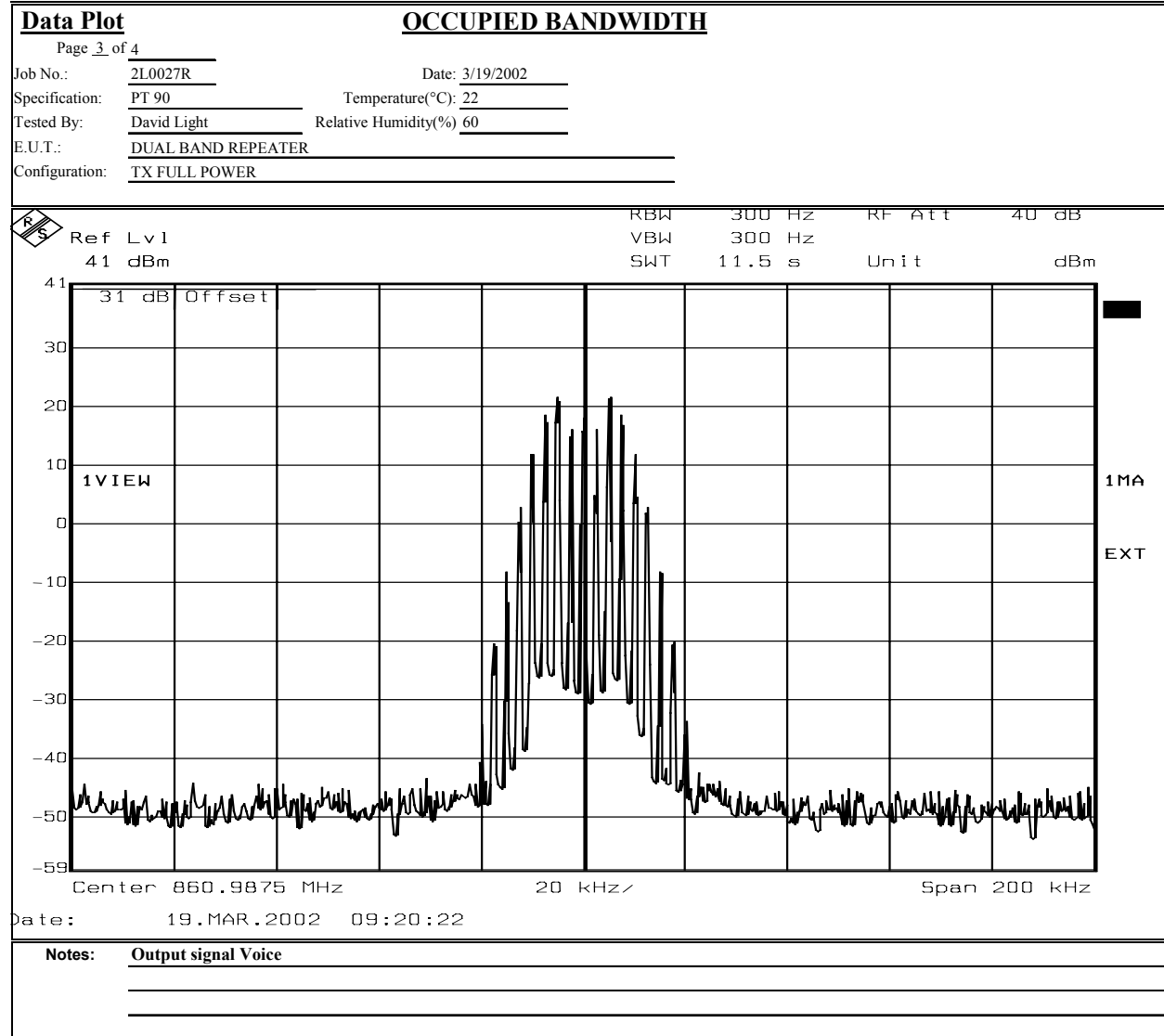
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Test Data – Occupied Bandwidth



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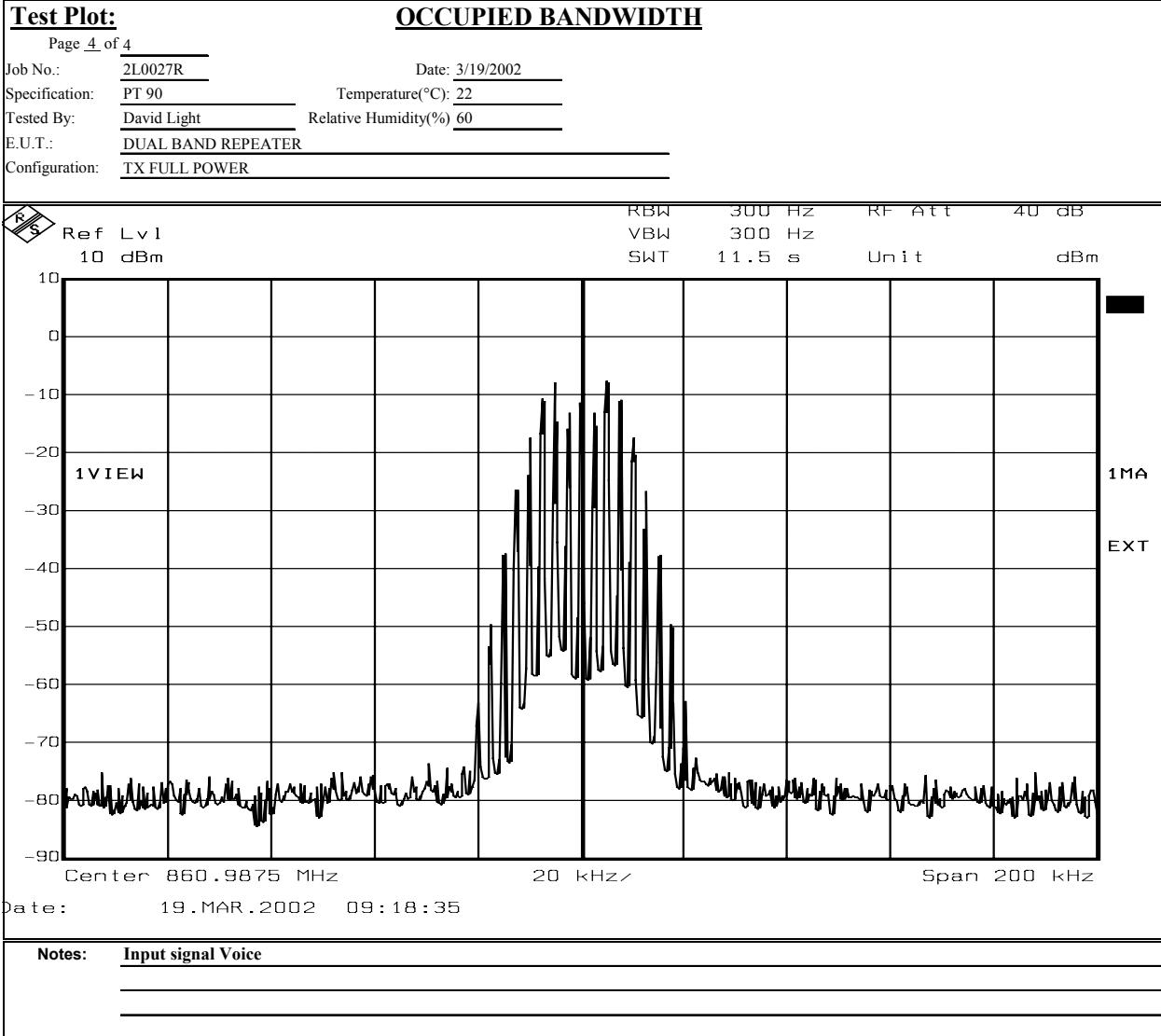
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Test Data – Occupied Bandwidth



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Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 3/19/2002

Test Results: Complies.

Test Data: See attached graph(s).

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FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Enhanced Remote Antenna Unit
(ERAU)**

PROJECT NO.: **2L0027RUS3**

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		ANTENNA PORT SPURIOUS EMISSIONS																								
Page 1 of 4		Complete <u>X</u>		Preliminary: _____																						
Job No.:	2L0027R	Date:	3/19/2002																							
Specification:	PT 90	Temperature(°C):	22																							
Tested By:	David Light	Relative Humidity(%)	50																							
E.U.T.:	DUAL BAND REPEATER																									
Configuration:	TX 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:	1627																							
Filter:	_____	Cable #2:	1628																							
Receiver:	1036	Cable #3:	1629																							
Attenuator #1:	1478	Cable #4:	_____																							
Attenuator #2:	1471	Mixer:	_____																							
Additional equipment used:	1051 1052 1053 1092																									
Measurement Uncertainty:	+/-1.7 dB																									
<table border="1"> <tr> <td>Ref</td> <td>Lvl</td> <td>29.49 dBm</td> <td>RBW</td> <td>100 kHz</td> <td>RF Att</td> <td>30 dB</td> </tr> <tr> <td>40 dBm</td> <td></td> <td>860.04008016 MHz</td> <td>VBW</td> <td>100 kHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>SWT</td> <td>245 ms</td> <td>Unit</td> <td>dBm</td> </tr> </table>						Ref	Lvl	29.49 dBm	RBW	100 kHz	RF Att	30 dB	40 dBm		860.04008016 MHz	VBW	100 kHz						SWT	245 ms	Unit	dBm
Ref	Lvl	29.49 dBm	RBW	100 kHz	RF Att	30 dB																				
40 dBm		860.04008016 MHz	VBW	100 kHz																						
			SWT	245 ms	Unit	dBm																				
Date: 19.MAR.2002 12:28:35																										
Notes: iDEN																										

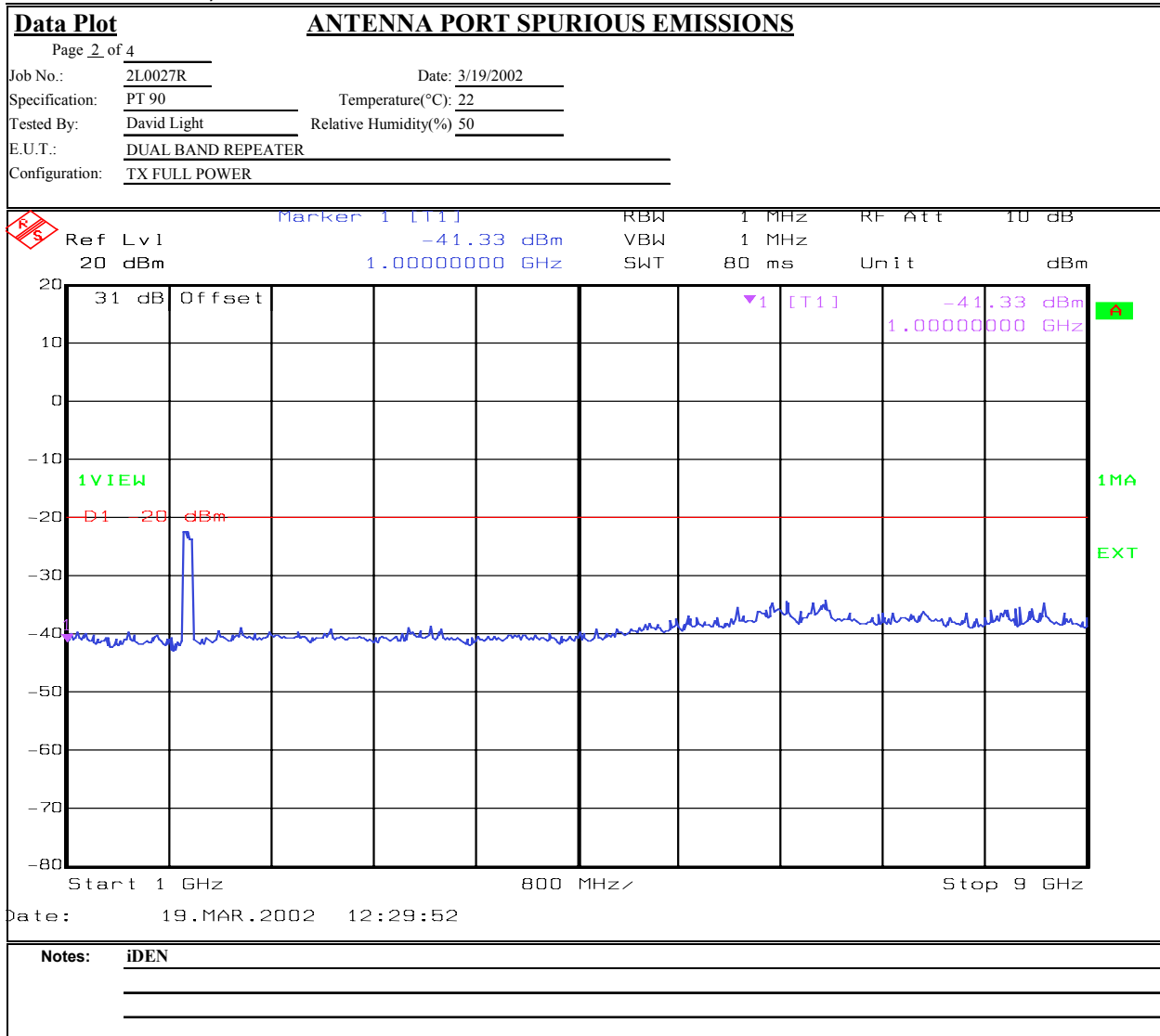
EQUIPMENT: Enhanced Remote Antenna Unit
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Test Data – Spurious Emissions at Antenna Terminals



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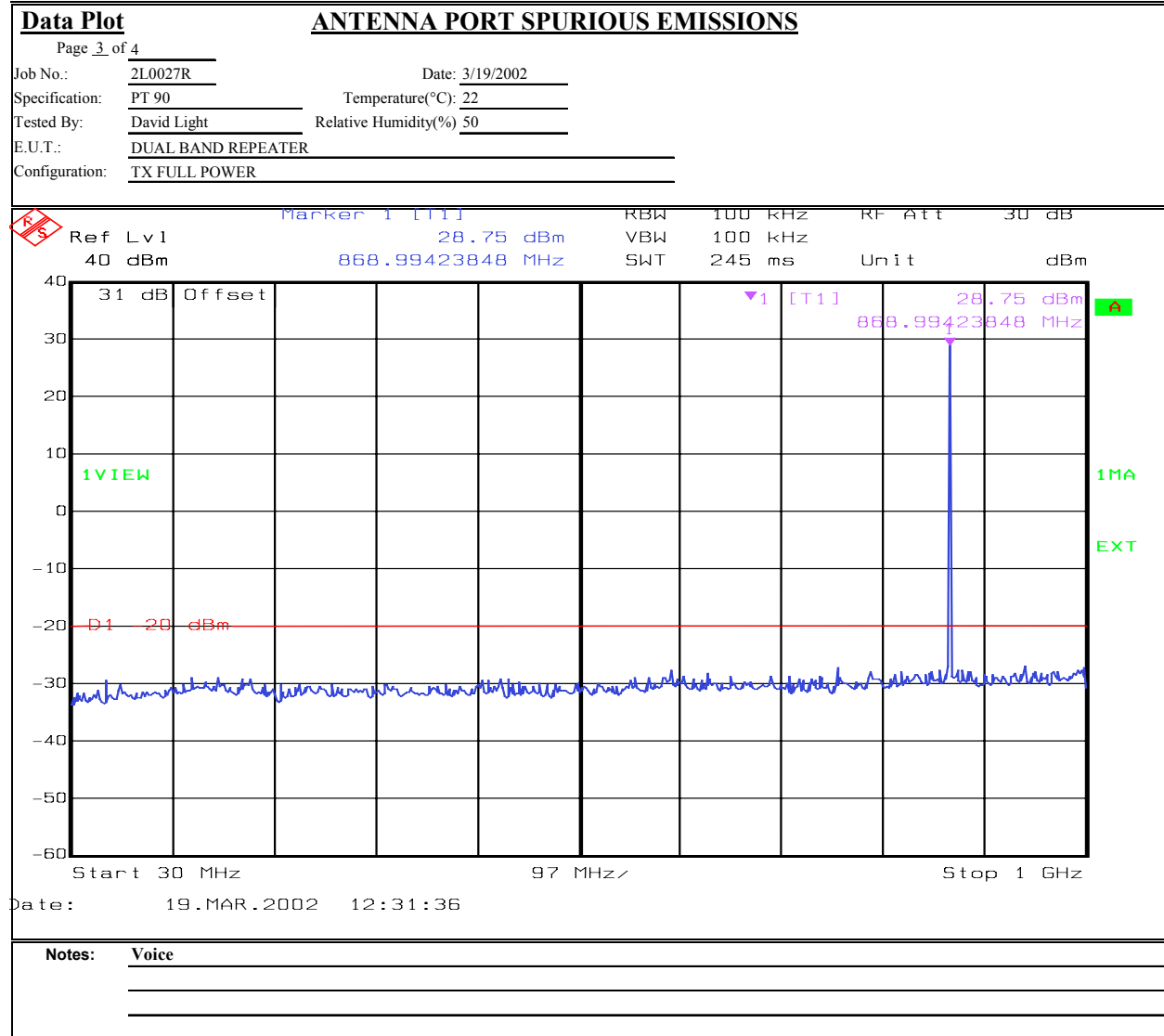


Test Data – Spurious Emissions at Antenna Terminals



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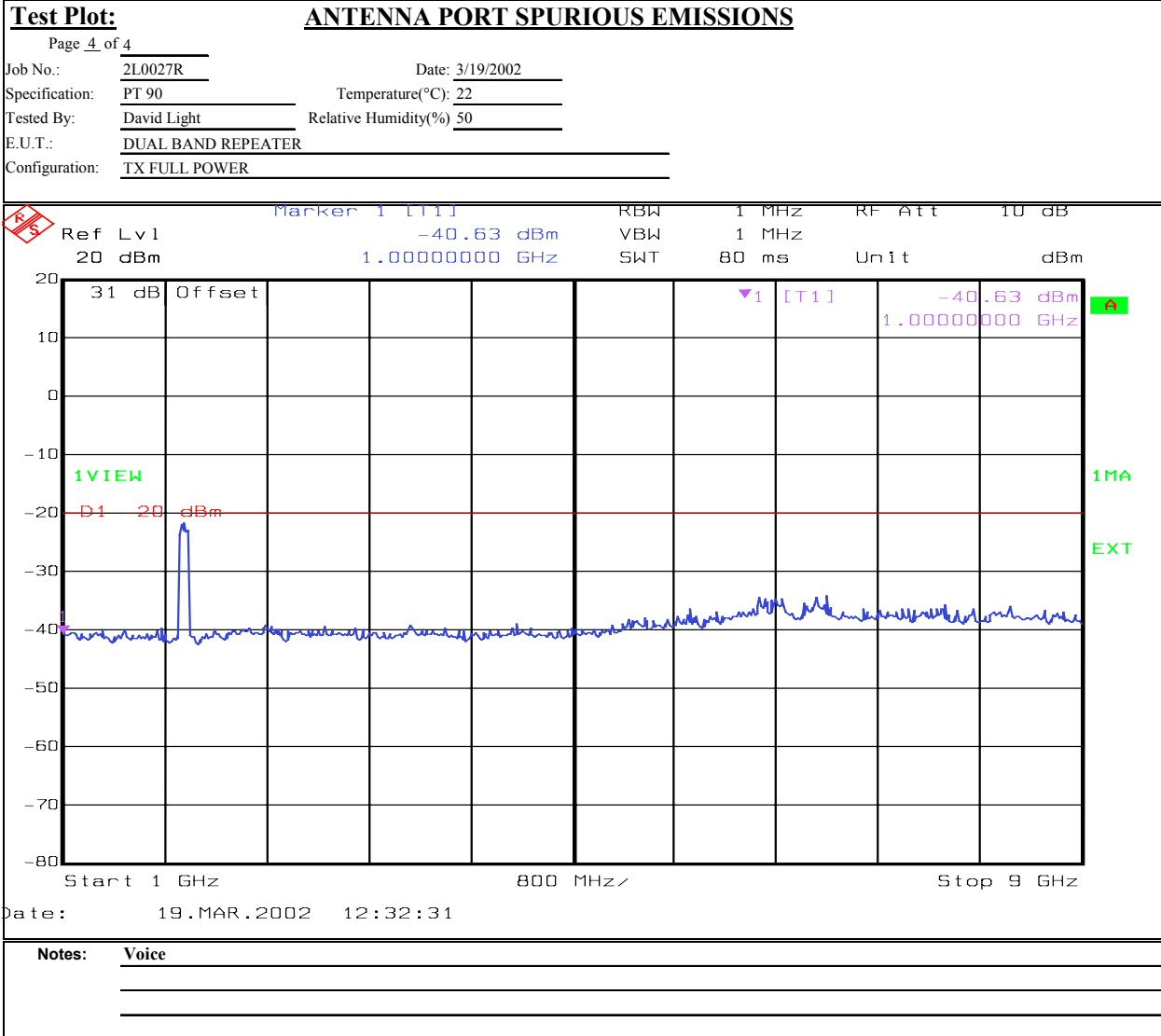
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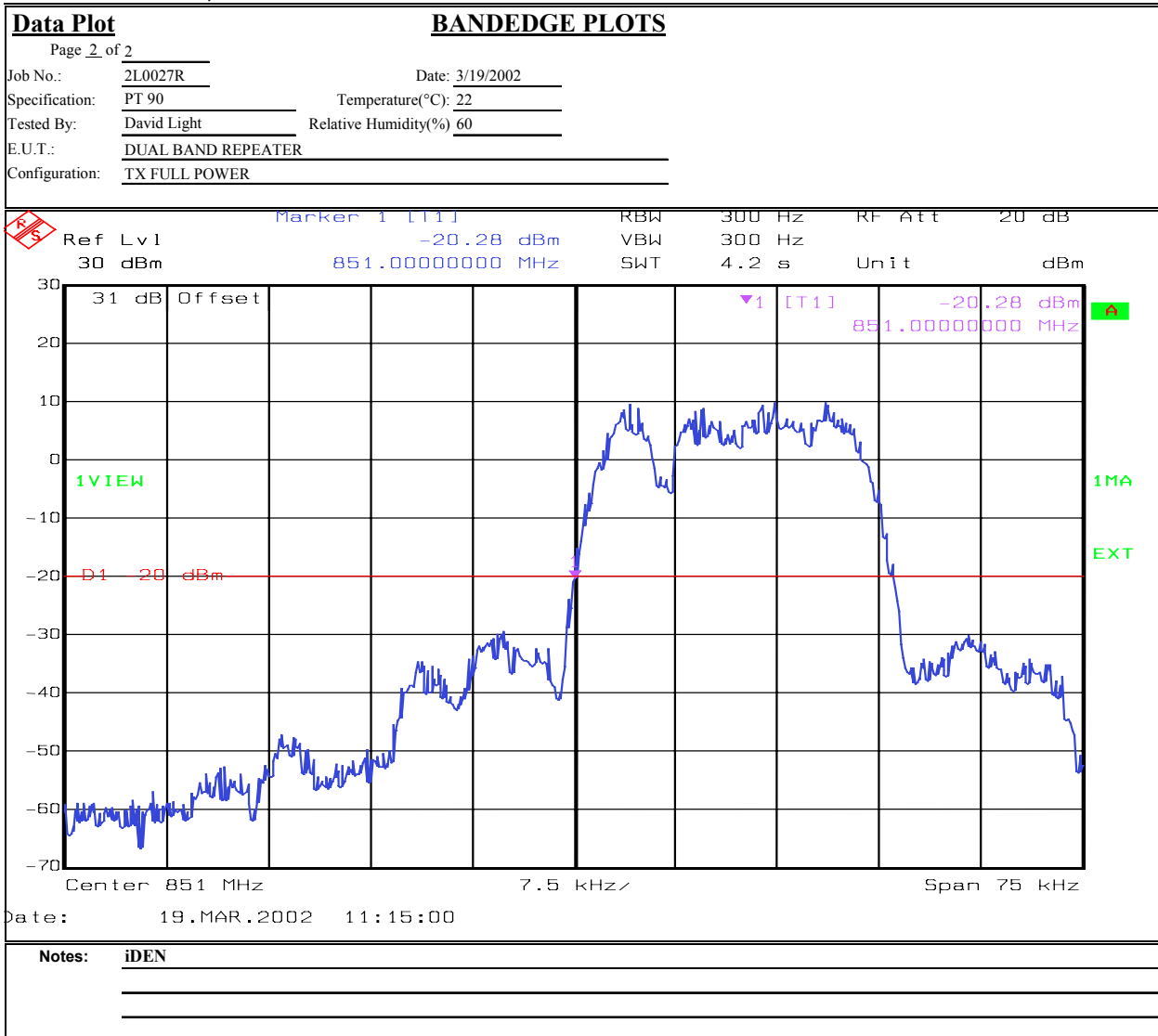
Data Plot		<u>BANDEDGE PLOTS</u>			
Page 1 of 2				Complete	<u>X</u>
Job No.:	2L0027R	Date:	3/19/2002	Preliminary:	
Specification:	PT 90	Temperature(°C):	22		
Tested By:	David Light	Relative Humidity(%)	60		
E.U.T.:	DUAL BAND REPEATER				
Configuration:	TX FULL POWER				
Sample Number:	1				
Location:	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:	1627		
Filter:		Cable #2:	1628		
Receiver:	1036	Cable #3:	1629		
Attenuator #1:	1478	Cable #4:			
Attenuator #2:	1471	Mixer:			
Additional equipment used:	1051 1052 1053 1092				
Measurement Uncertainty:	+/-1.7 dB				
<div style="display: flex; justify-content: space-between; font-size: small;"> Ref Lvl 30 dBm Marker 1 [T1] -29.91 dBm RBW 300 Hz RF Att 20 dB </div> <div style="display: flex; justify-content: space-between; font-size: small;"> 31 dB Offset 869.0000000 MHz VBW 300 Hz Unit dBm </div> <div style="display: flex; justify-content: space-between; font-size: small;"> D1 20 dBm SWT 4.2 s </div>					
Center 869 MHz 7.5 kHz/ Span 75 kHz					
Date: 19.MAR.2002 11:16:11					
Notes: iDEN					

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		INTERMODULATION CHARACTERISTICS																								
Page 1 of 4		Complete	X																							
Job No.: 2L0027R	Date: 3/19/2002	Preliminary:																								
Specification: PT 90	Temperature(°C): 22																									
Tested By: David Light	Relative Humidity(%): 60																									
E.U.T.: DUAL BAND REPEATER																										
Configuration: TX 2 CARRIERS																										
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: 1627																									
Filter:	Cable #2: 1628																									
Receiver: 1036	Cable #3: 1629																									
Attenuator #1: 1478	Cable #4:																									
Attenuator #2: 1471	Mixer:																									
Additional equipment used: 1051 1052 1053 1092																										
Measurement Uncertainty: +/-1.7 dB																										
<table border="1"> <thead> <tr> <th>Ref</th> <th>Lvl</th> <th>Marker 1 [T1]</th> <th>RBW</th> <th>1 kHz</th> <th>RF Att</th> <th>40 dB</th> </tr> </thead> <tbody> <tr> <td>41</td> <td>dBm</td> <td>-29.14 dBm</td> <td>VBW</td> <td>1 kHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>850.15831663 MHz</td> <td>SWT</td> <td>20 s</td> <td>Unit</td> <td>dBm</td> </tr> </tbody> </table>						Ref	Lvl	Marker 1 [T1]	RBW	1 kHz	RF Att	40 dB	41	dBm	-29.14 dBm	VBW	1 kHz					850.15831663 MHz	SWT	20 s	Unit	dBm
Ref	Lvl	Marker 1 [T1]	RBW	1 kHz	RF Att	40 dB																				
41	dBm	-29.14 dBm	VBW	1 kHz																						
		850.15831663 MHz	SWT	20 s	Unit	dBm																				
<p>Center 851 MHz 800 kHz Span 8 MHz</p>																										
Date: 19.MAR.2002 09:30:57																										
<p>Notes: Lower bandedge intermod - iDEN Marker 1 indicates highest out of band emission, Marker 2 indicates highest inband emission</p>																										

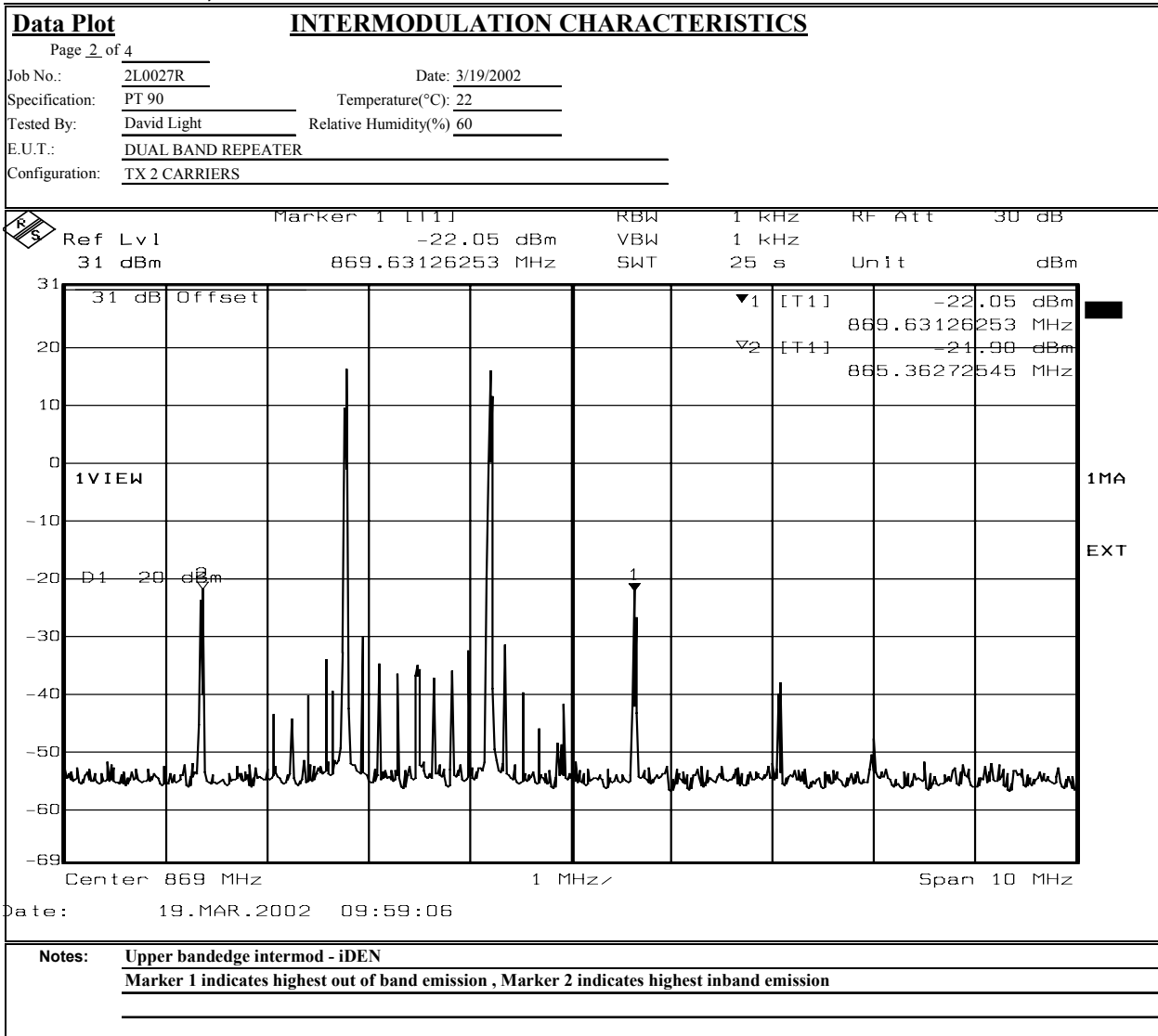
EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

Test Data – Spurious Emissions at Antenna Terminals



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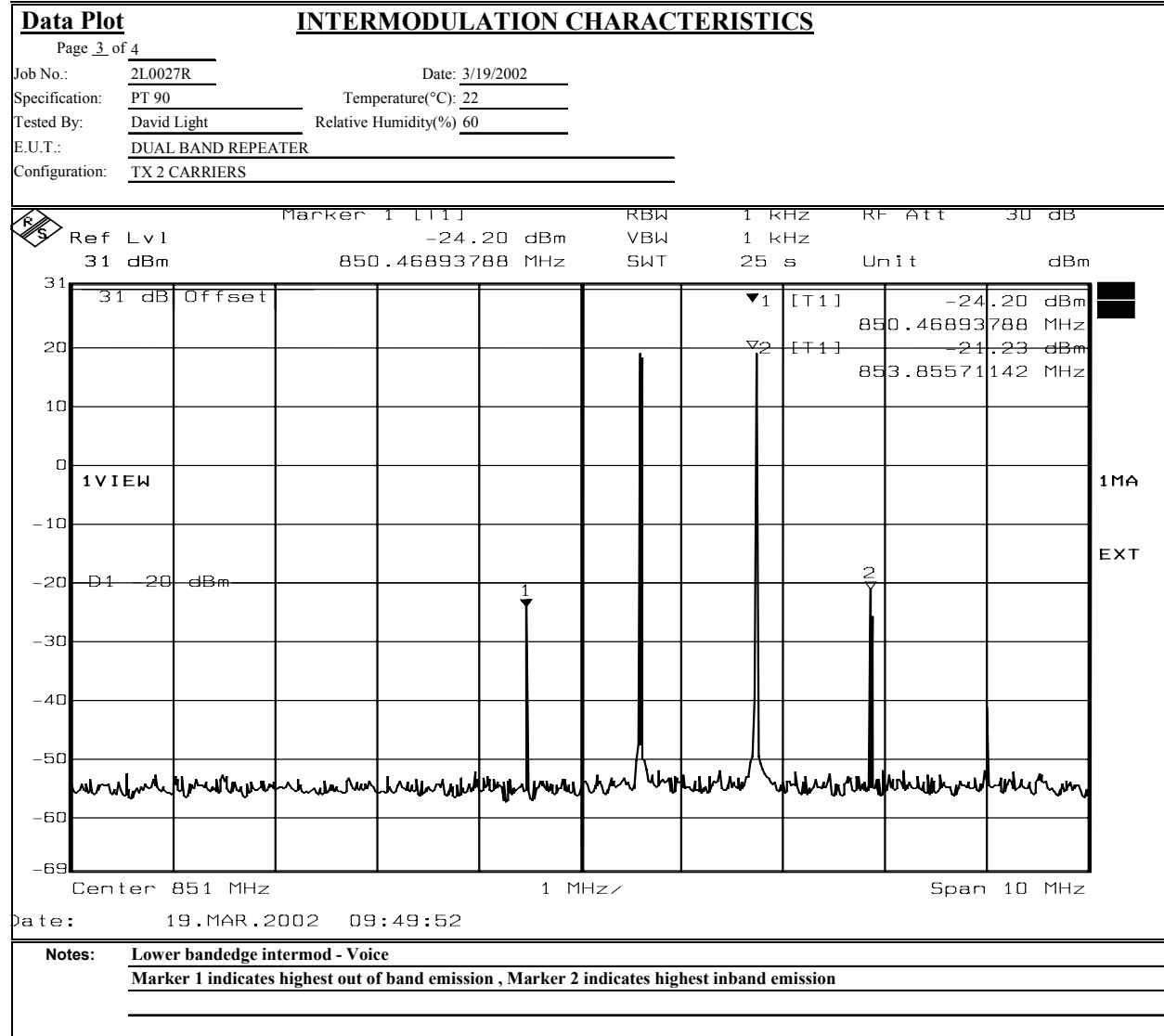
Test Data – Spurious Emissions at Antenna Terminals



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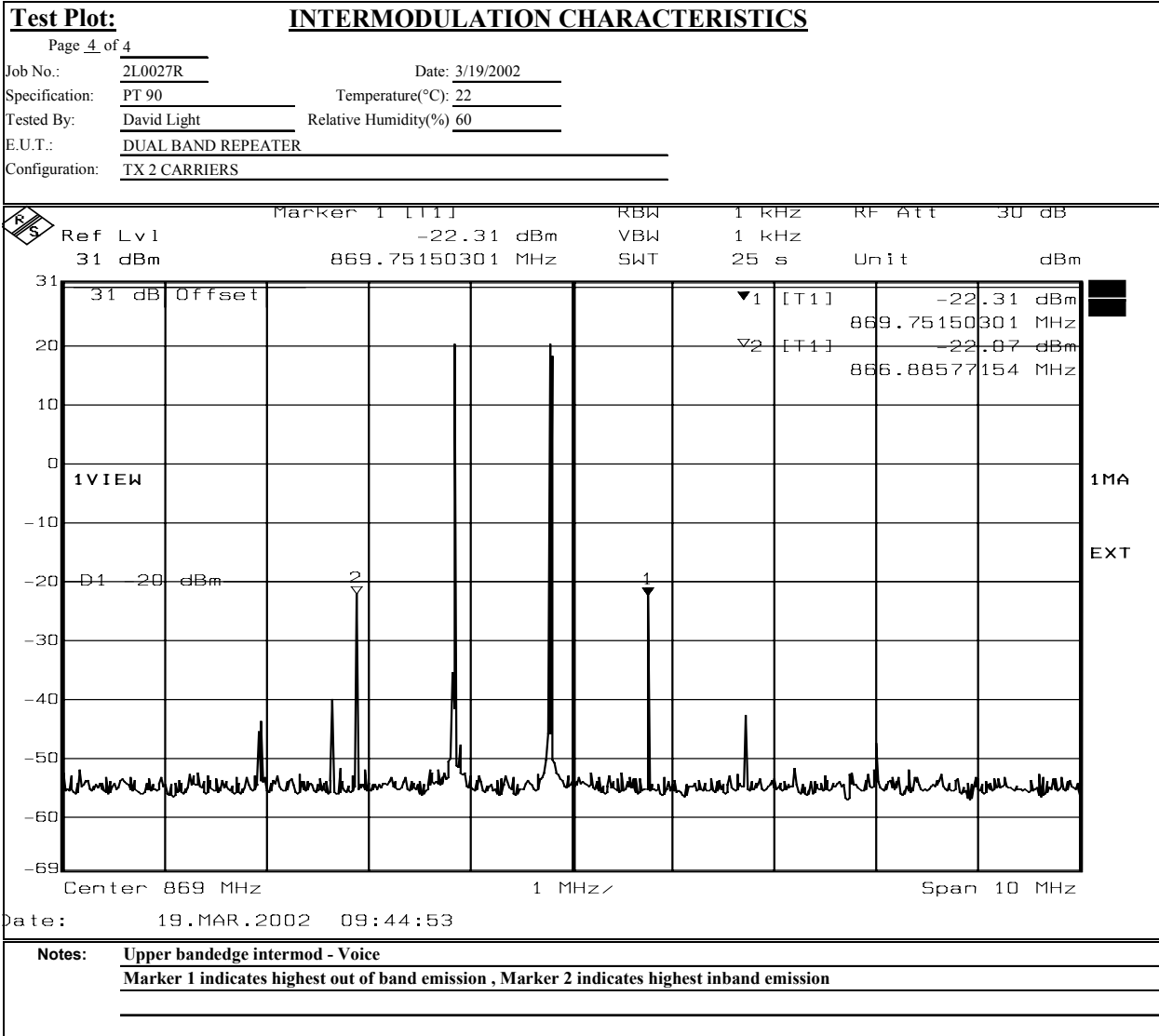
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Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE:3/19/2002

Test Results: Complies.

Test Data: See attached table.

Note: See page A5 for applicable limit.

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

Test Data – Field Strength of Spurious Emissions



Nemko Dallas, Inc.

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Field Strength of Spurious Emissions									
Page 1 of 1						Complete <u> x </u>			
Job No.:		Date: 3/19/2002				Preliminary _____			
Specification:		Temperature(°C): 20							
Tested By: David Light		Relative Humidity(%) 60							
E.U.T.: DUAL BAND REPEATER									
Configuration: TX @ 860 MHz									
Sample No: 1									
Location: AC 3				RBW: 1 MHz		Measurement			
Detector Type: Peak				VBW: 1 MHz		Distance: 3 m			
Test Equipment Used									
Antenna: 1304				Directional Coupler: _____					
Pre-Amp: 1016				Cable #1: 1484					
Filter: _____				Cable #2: 1485					
Receiver: 1464				Cable #3: _____					
Attenuator #1 _____				Cable #4: _____					
Attenuator #2 _____				Mixer: _____					
Additional equipment used: _____									
Measurement Uncertainty: +/-3.6 dB									
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	ERP (mW)	Polarity	Comments
1720	-49.2	33.0		33.3	7.3	-42.3	0.0001	H	
2580	-53.8	35.5		33.8	8.0	-44.2	0.0000	H	
3440	-62.5	36.3		33.6	8.0	-51.8	0.0000	H	Noise floor
4300	-63.0	34.8		33.5	8.2	-53.5	0.0000	H	Noise floor
8600	-66.7	42.2		34.3	9.4	-49.5	0.0000	H	Noise floor
1720	-43.5	31.0		33.3	7.3	-38.6	0.0001	V	
2580	-51.5	35.5		33.8	8.0	-41.9	0.0001	V	
3440	-62.5	39.8		33.6	8.0	-48.3	0.0000	V	Noise floor
4300	-61.8	45.3		33.5	8.2	-41.8	0.0001	V	
8600	-66.7	44.8		34.3	9.4	-46.8	0.0000	V	Noise floor
Notes: Scanned spectrum to the tenth harmonic									

Photographs of Test Setup

FRONT VIEW



REAR VIEW



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 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Enhanced Remote Antenna Unit
(ERAU)**

PROJECT NO.: **2L0027RUS3**

ANNEX A - TEST METHODOLOGIES

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
--------------------------------------	-------------------------

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

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

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

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

Nemko Dallas

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Enhanced Remote Antenna Unit
(ERAU)**

PROJECT NO.: **2L0027RUS3**

NAME OF TEST: Spurious Emissions at Antenna Terminals
--

PARA. NO.: 2.991

Test Method:
range.

RBW: 1% of emission bandwidth in the 0 - 1 GHz

1 MHz at frequencies above 1 GHz.

VBW: \Rightarrow RBW

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

Nemko Dallas

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

PROJECT NO.: 2L0027RUS3

NAME OF TEST: Occupied Bandwidth **PARA. NO.: 2.989**

Minimum Standard: Para. No. 90.210, see table 1 below for applicable mask.

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.993
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Minimum Standard: Para. No. 90.210, see table 1 for applicable mask.

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 up to the 10th harmonic.

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
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Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain

within the assigned frequency below in ppm.

Table 2

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

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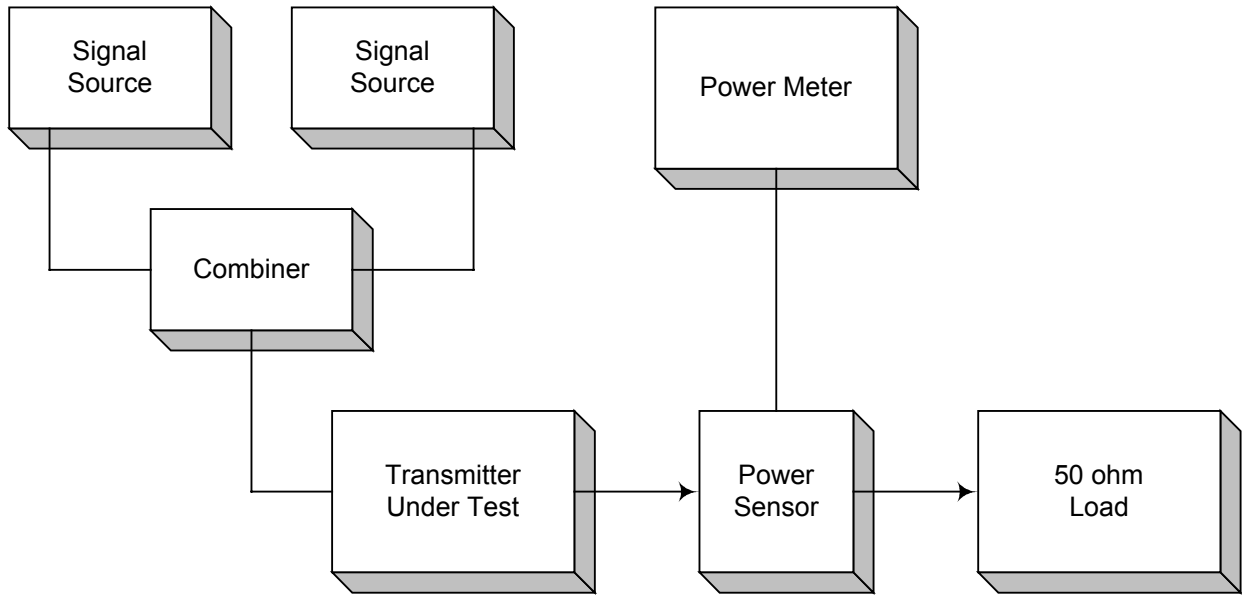
FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **Enhanced Remote Antenna Unit
(ERAU)**

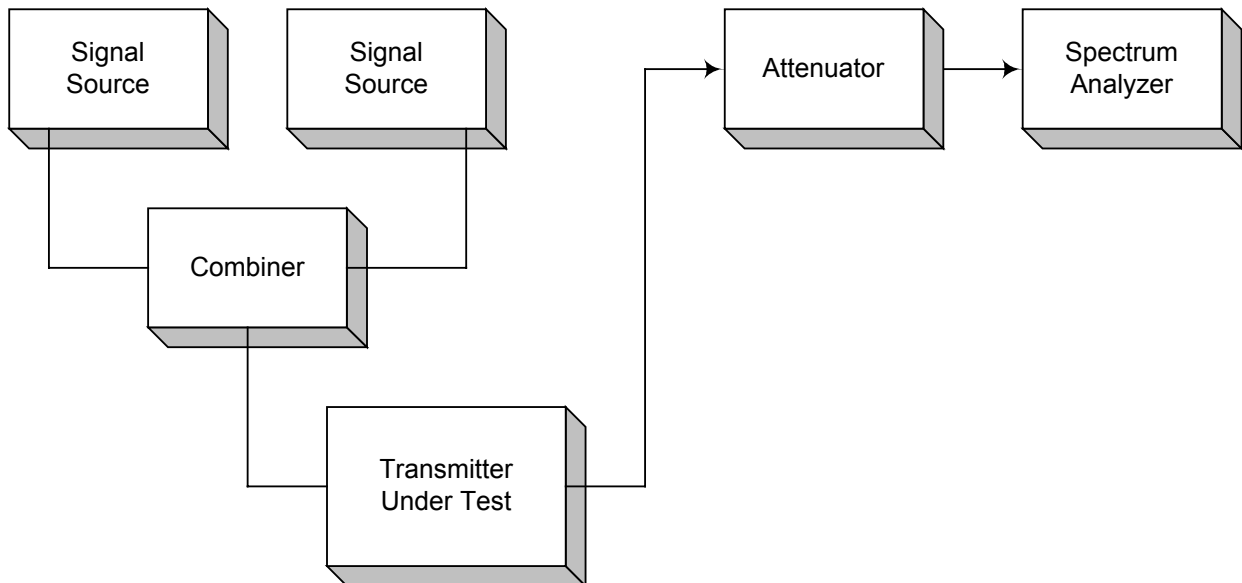
PROJECT NO.: **2L0027RUS3**

ANNEX B - TEST DIAGRAMS

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

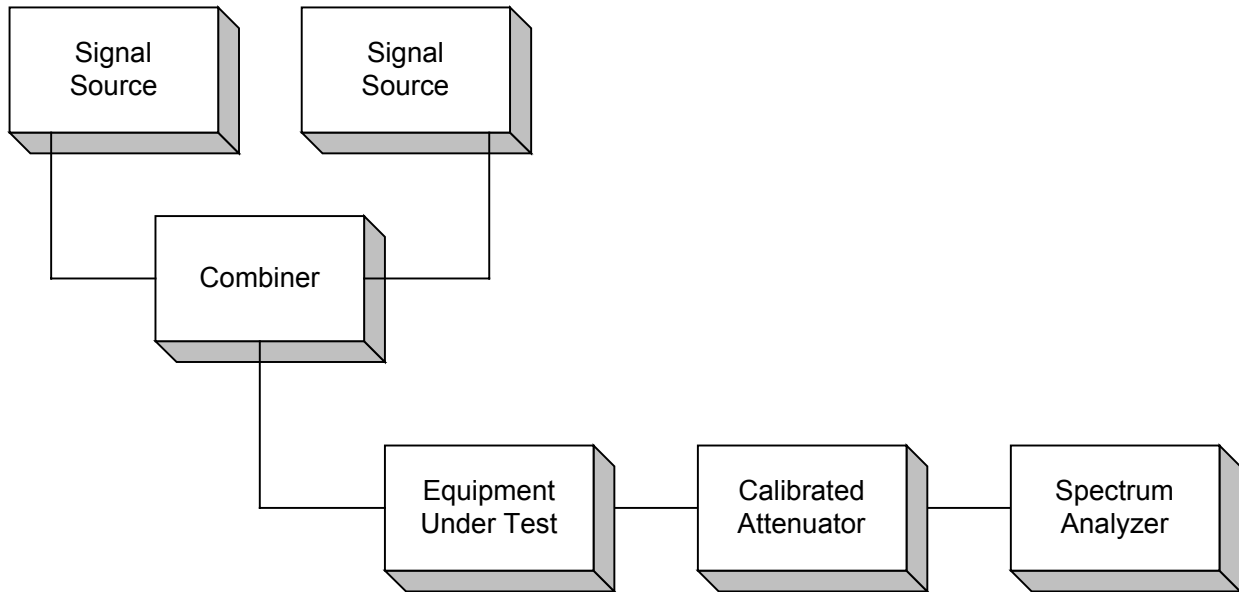


Para. No. 2.989 - Occupied Bandwidth

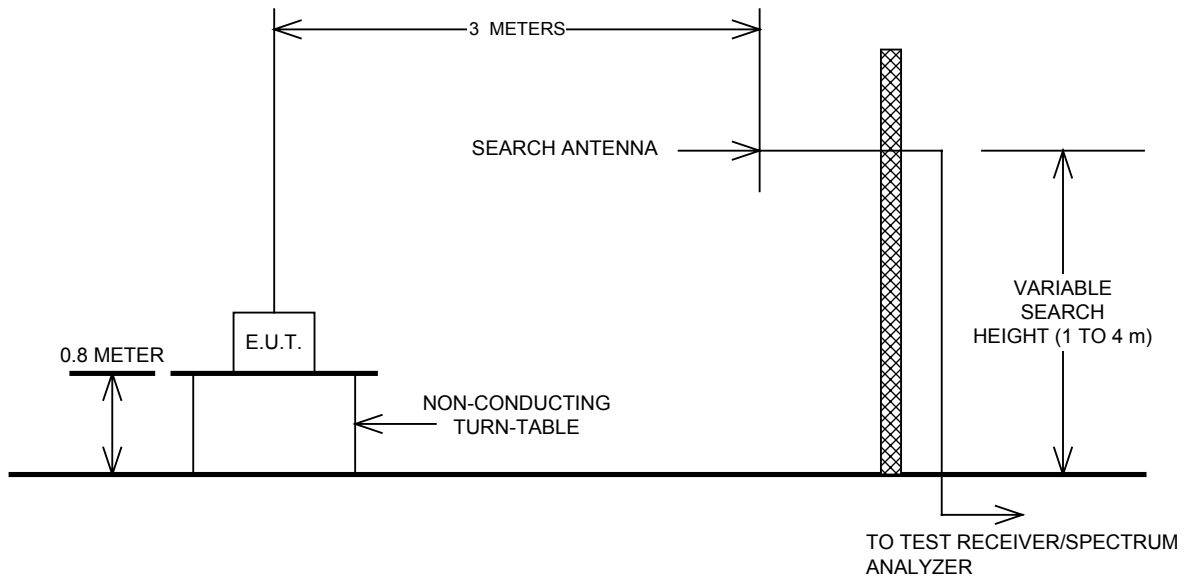


EQUIPMENT: Enhanced Remote Antenna Unit
(ERAU)

Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

