

Nemko Test Report: 2L0586RUS1

Applicant: Coverage Solutions Corporation

**Equipment Under Test:
(E.U.T.)** BDA-SMR-1/1W-80-A

In Accordance With: **FCC Part 90, Subpart I**
Private Land Mobile Repeater

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

A handwritten signature in blue ink, appearing to read "Tom Tidwell", is positioned above the "Authorized By" field.

Authorized By:

Tom Tidwell, Wireless Group Manager

Date: 12/17/02

Total Number of Pages: 57

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EQUIPMENT: BDA-SMR-1/1W-80-A

Section 1. Summary of Test Results

Manufacturer: Coverage Solutions Corp.

Model No.: BDA-SMR-1/1W-80-A

Serial No.: 02101047

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



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. [None](#)

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A
Occupied Bandwidth	90.210	Complies
Spurious Emissions at Antenna Terminals	90.210	Complies
Field Strength of Spurious Emissions	90.210	Complies
Frequency Stability	90.213	N/A
Transient Frequency Behavior	90.214	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: 115 Vac

Frequency Range:	Uplink	806-821 MHz
	Downlink	851-866 MHz

Type(s) of Modulation:	F3E (Voice)	F1D	F2D (FSK)	D7W (QAM)	Other
	☐	☐	☒	☒	☐

Gain: 80 dB

Output Impedance: 50 ohms

RF Power Output (rated):	Single:	2 watts
	Composite:	2 watts

Channel Spacing(s): Full band coverage

Operator Selection of Operating Frequency: Full band coverage

Power Output Adjustment Capability: Manual

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

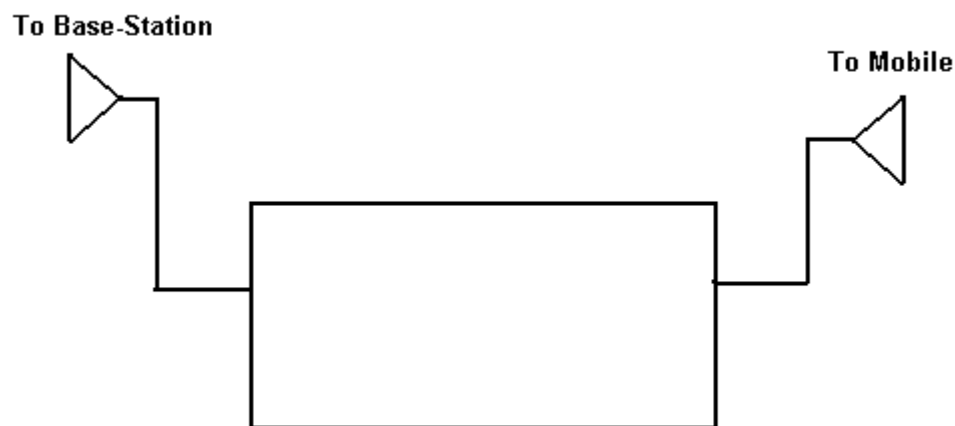
Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☐

Theory of Operation

The BDA downlink path receives RF signals from the base station and amplifies and transmits them to the subscriber. The BDA uplink path receives RF signals from the subscriber and amplifies and transmits them to the base station.

A selectable Automatic Level Control (ALC) allows for output power limiting. A variable step attenuator gives 0-30 dB of attenuation in 2 dB steps.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 12/12/2002

Test Results: Complies.**Measurement Data:**

Frequency (MHz)	Measured Power (dBm)	Measured Power (Watts)
813.5	32	1.6
858.5	32	1.6

Test Equipment Used: 1036-1064-1064-1083

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY:	DATE:

Test Results: Complies.

Test Data: See attached graph(s).

Test Data – Occupied Bandwidth



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Data

Page 1 of 6

Job No.: 2L0586R

Date: 12/12/2002

Complete

Preliminary:

Specification: PART90

Temperature(°C): 22

Tested By: David Light

Relative Humidity(%) 40

E.U.T.: 80 dB gain SMR repeater

Configuration: TX FULL POWER

Sample Number: 1

Location: Lab 1

RBW: Refer to plots

Measurement

Detector Type: Peak

VBW: Refer to plots

Distance: NA m

Test Equipment Used

Antenna:

Directional Coupler:

Pre-Amp:

Cable #1: 1083

Filter:

Cable #2:

Receiver: 1036

Cable #3:

Attenuator #1: 1064

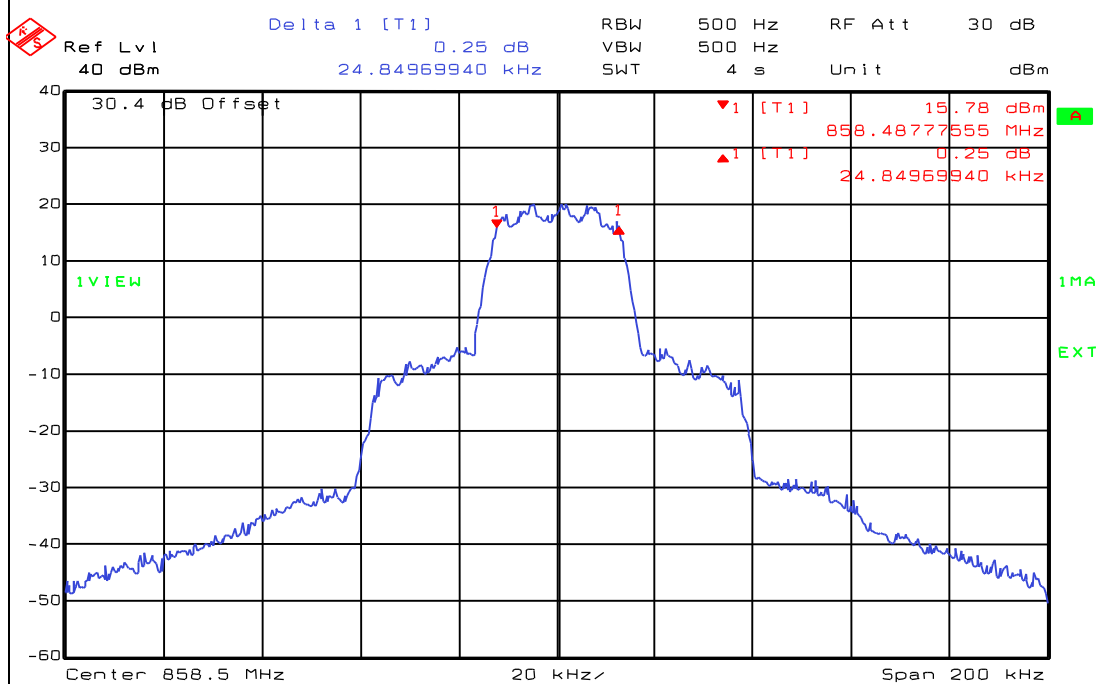
Cable #4:

Attenuator #2: 1065

Mixer:

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Date: 12.DEC.2002 14:06:01

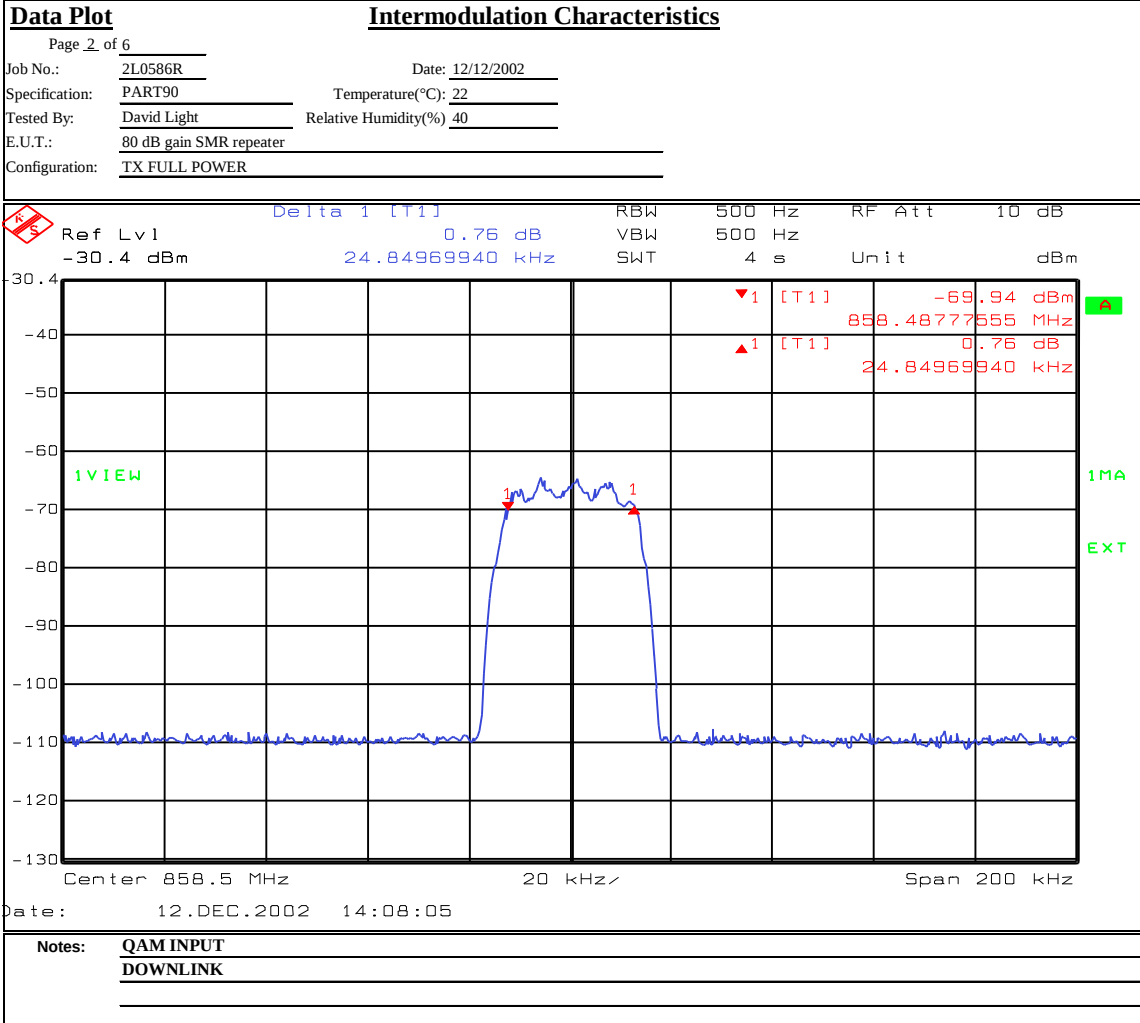
Notes: QAM OUTPUT
DOWNLINK

Test Data – Occupied Bandwidth



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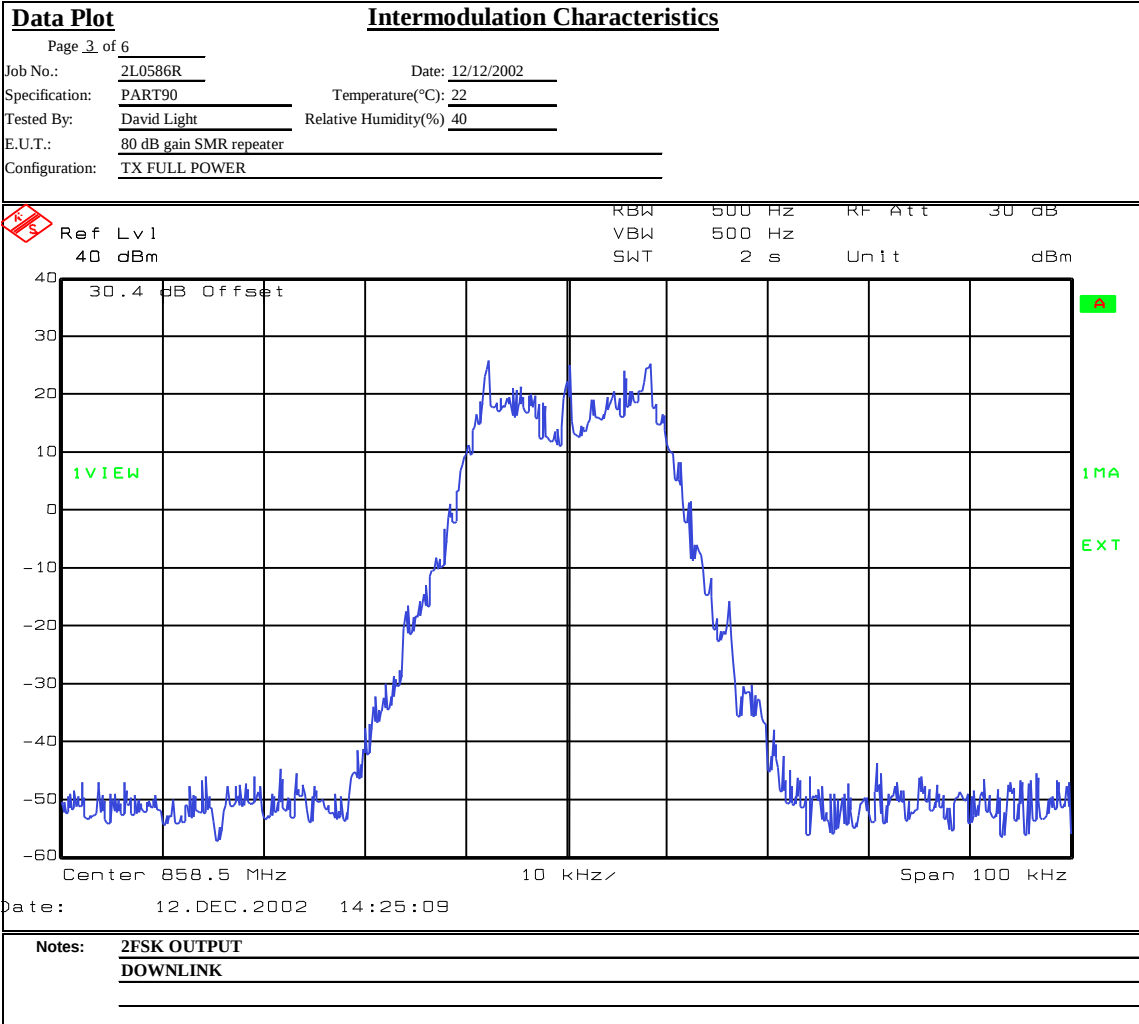
Test Data – Occupied Bandwidth



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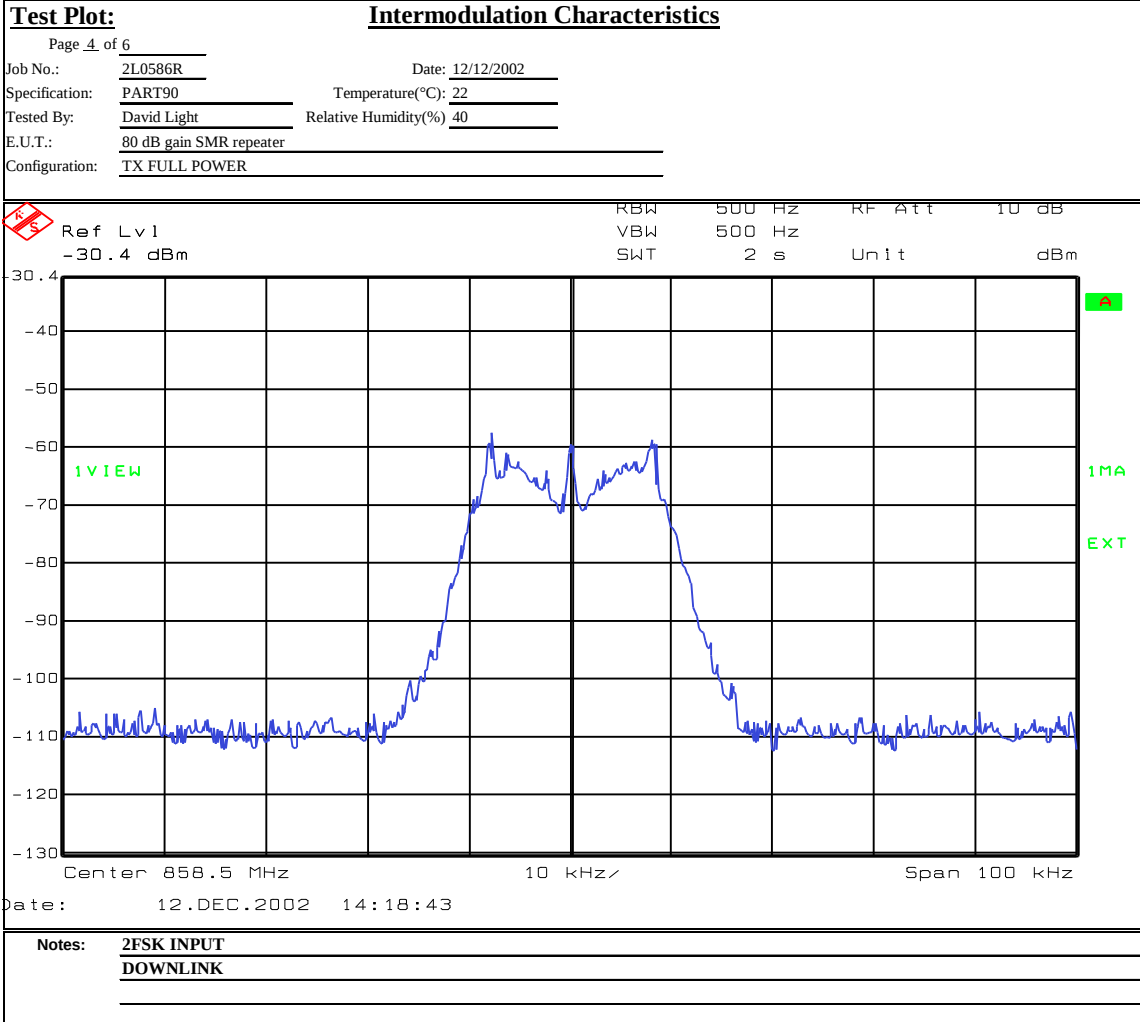


Test Data – Occupied Bandwidth



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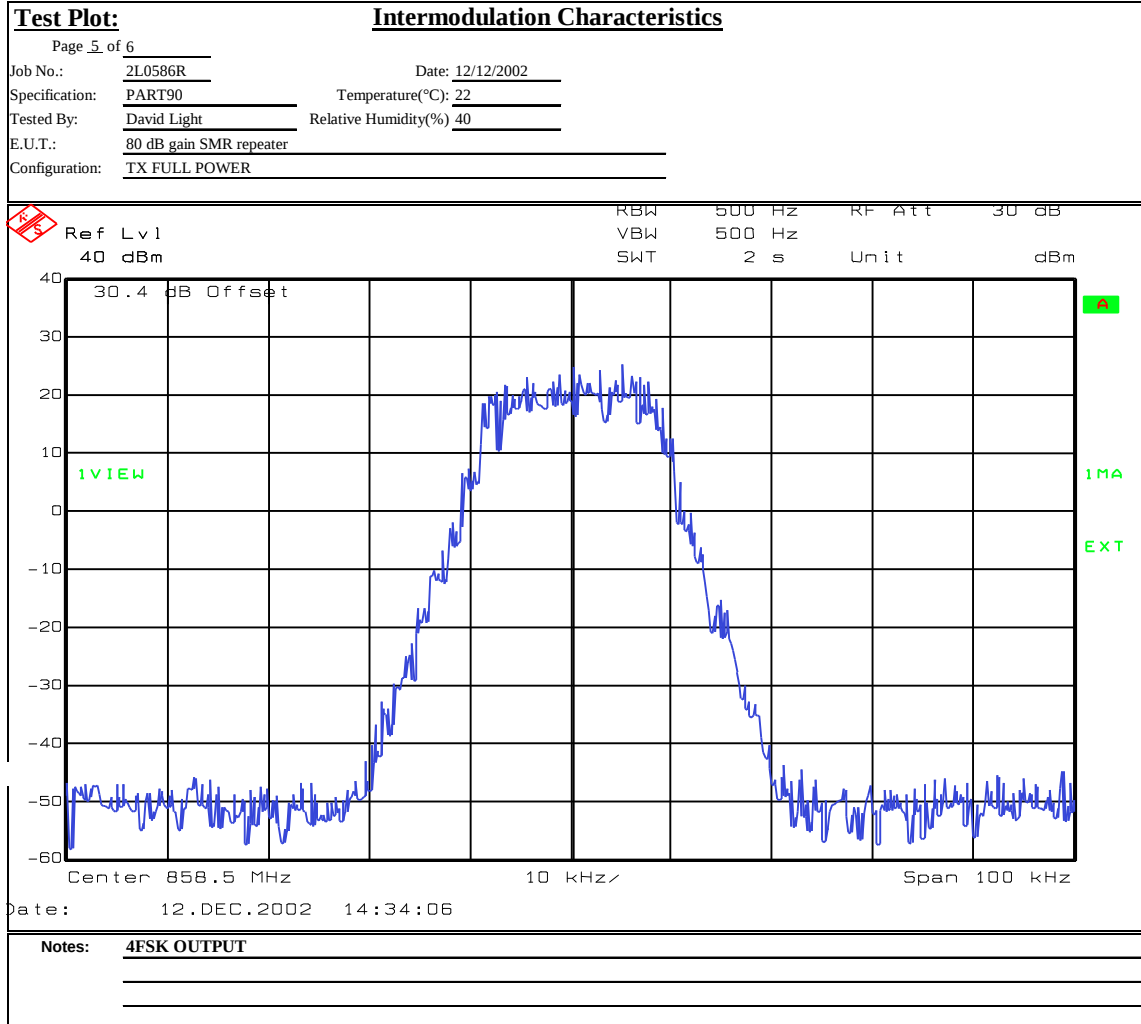


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Test Data – Occupied Bandwidth



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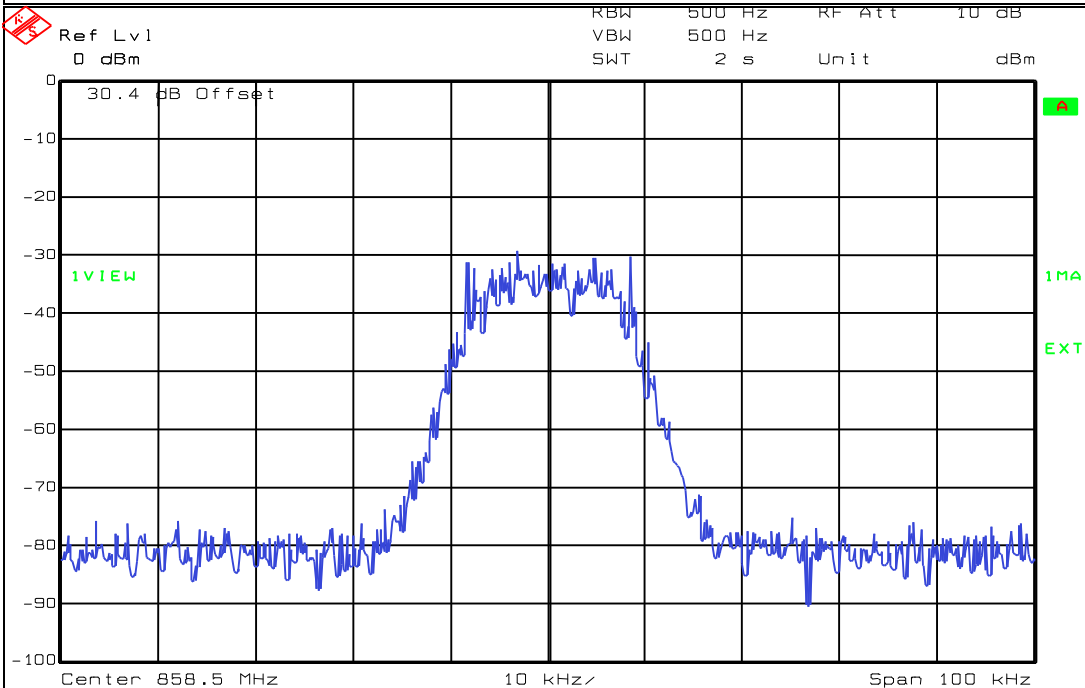
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Test Plot:

Intermodulation Characteristics

Page 6 of 6
Job No.: 2L0586R Date: 12/12/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER



Date: 12.DEC.2002 14:35:08

Notes: 4FSK INPUT
DOWNLINK

Test Data – Occupied Bandwidth



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Data Plot

Intermodulation Characteristics

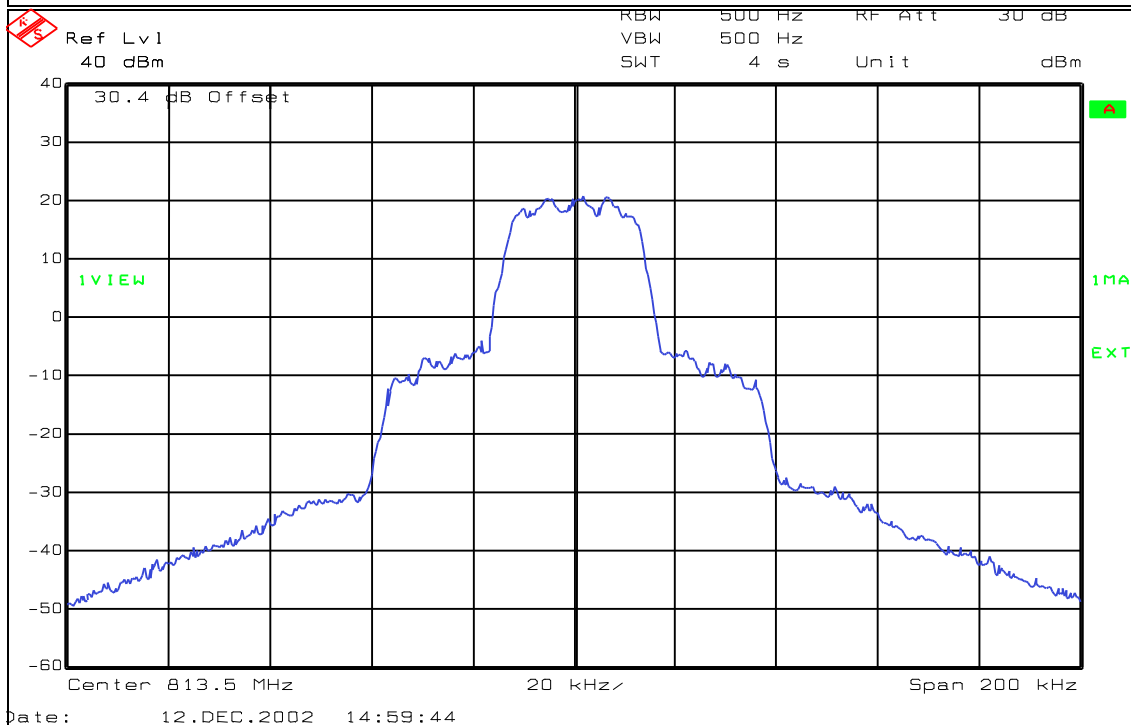
Page 1 of 6

Job No.: 2L0586R Date: 12/12/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete _____
Preliminary: _____Measurement
Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB

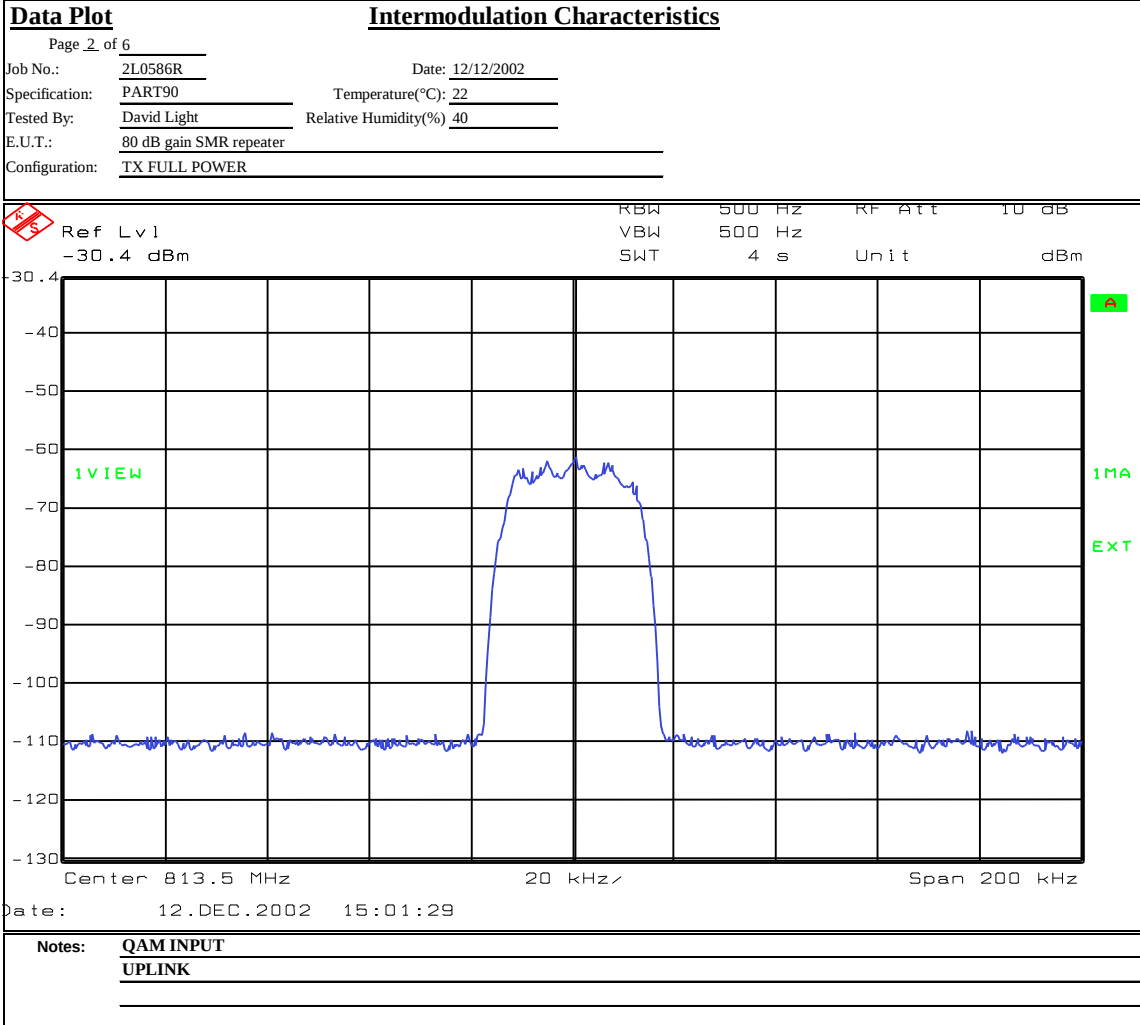
Notes: QAM OUTPUT
UPLINK

Test Data – Occupied Bandwidth



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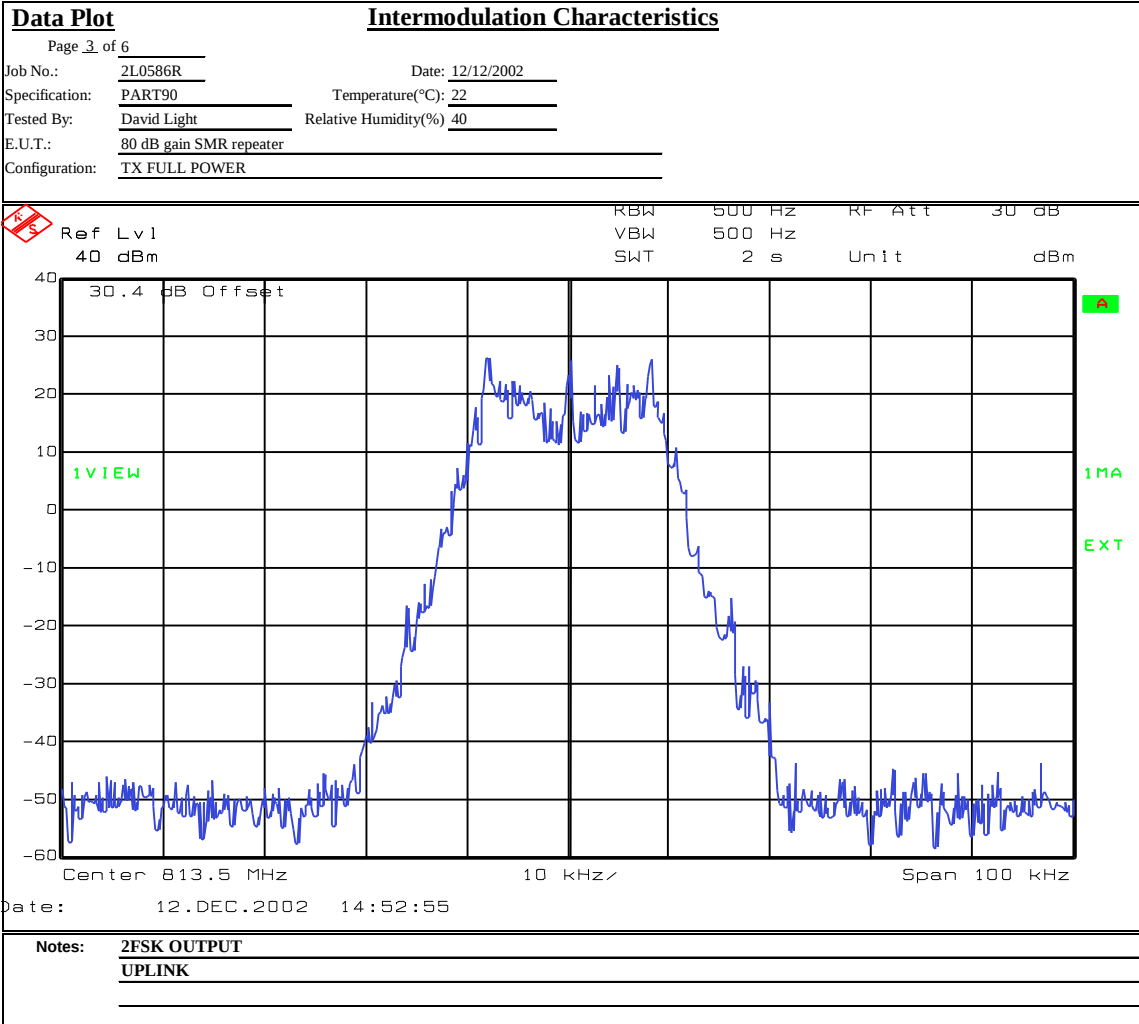
Test Data – Occupied Bandwidth



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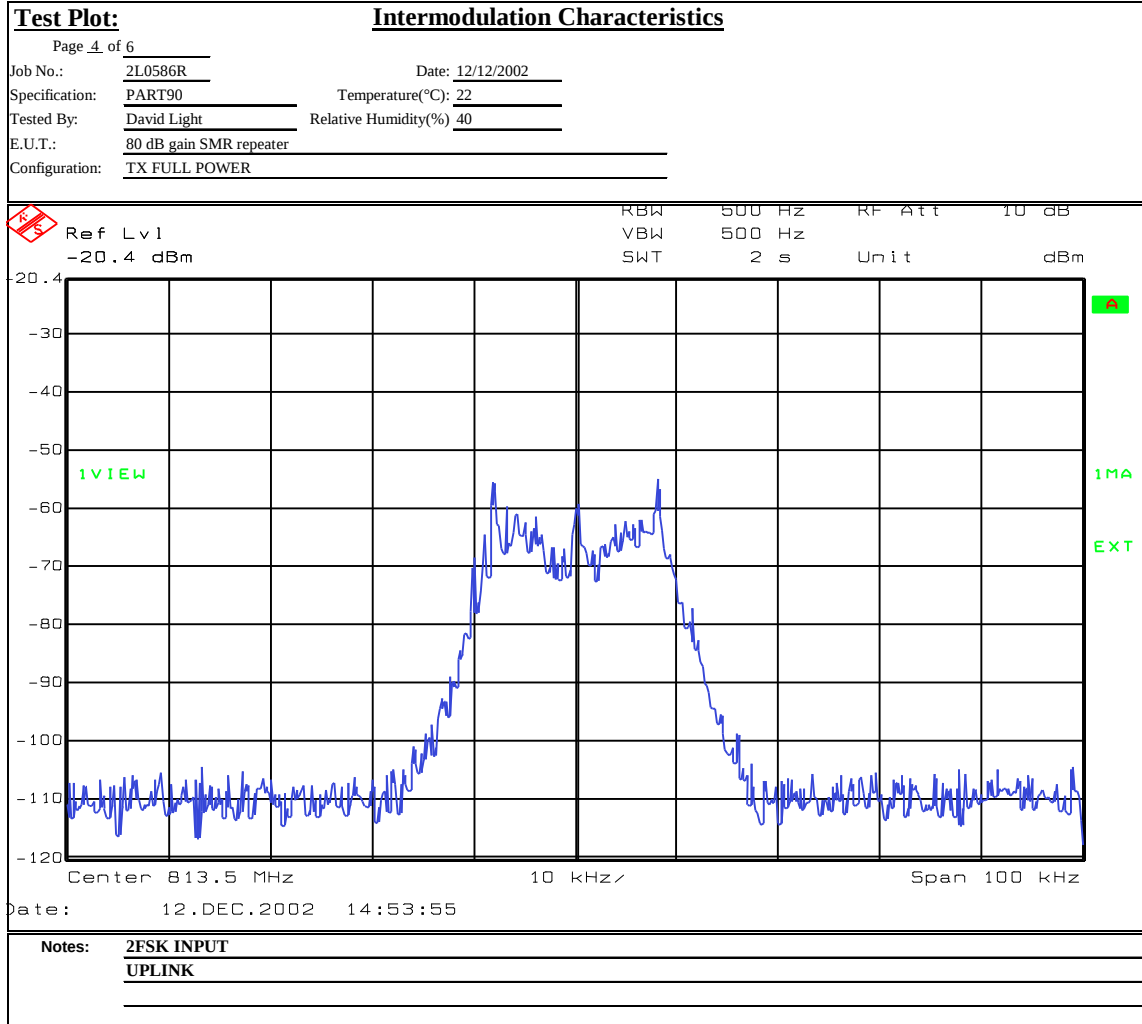


Test Data – Occupied Bandwidth



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Test Data – Occupied Bandwidth



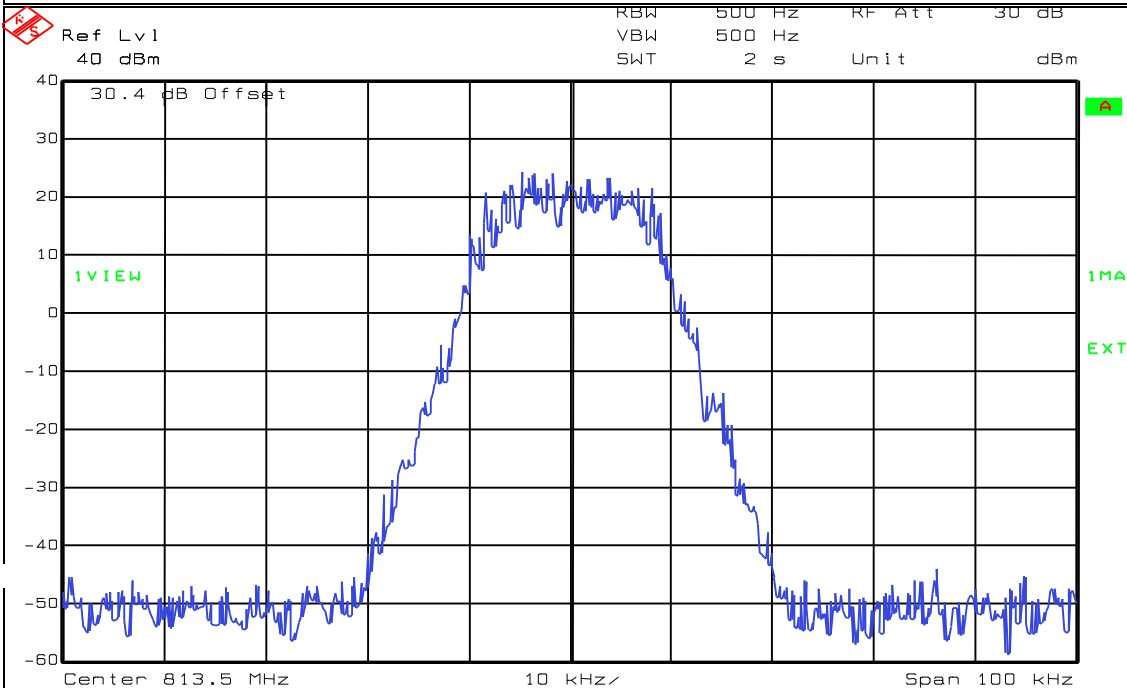
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Test Plot:

Intermodulation Characteristics

Page 5 of 6
Job No.: 2L0586R Date: 12/12/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER



Date: 12.DEC.2002 14:44:11

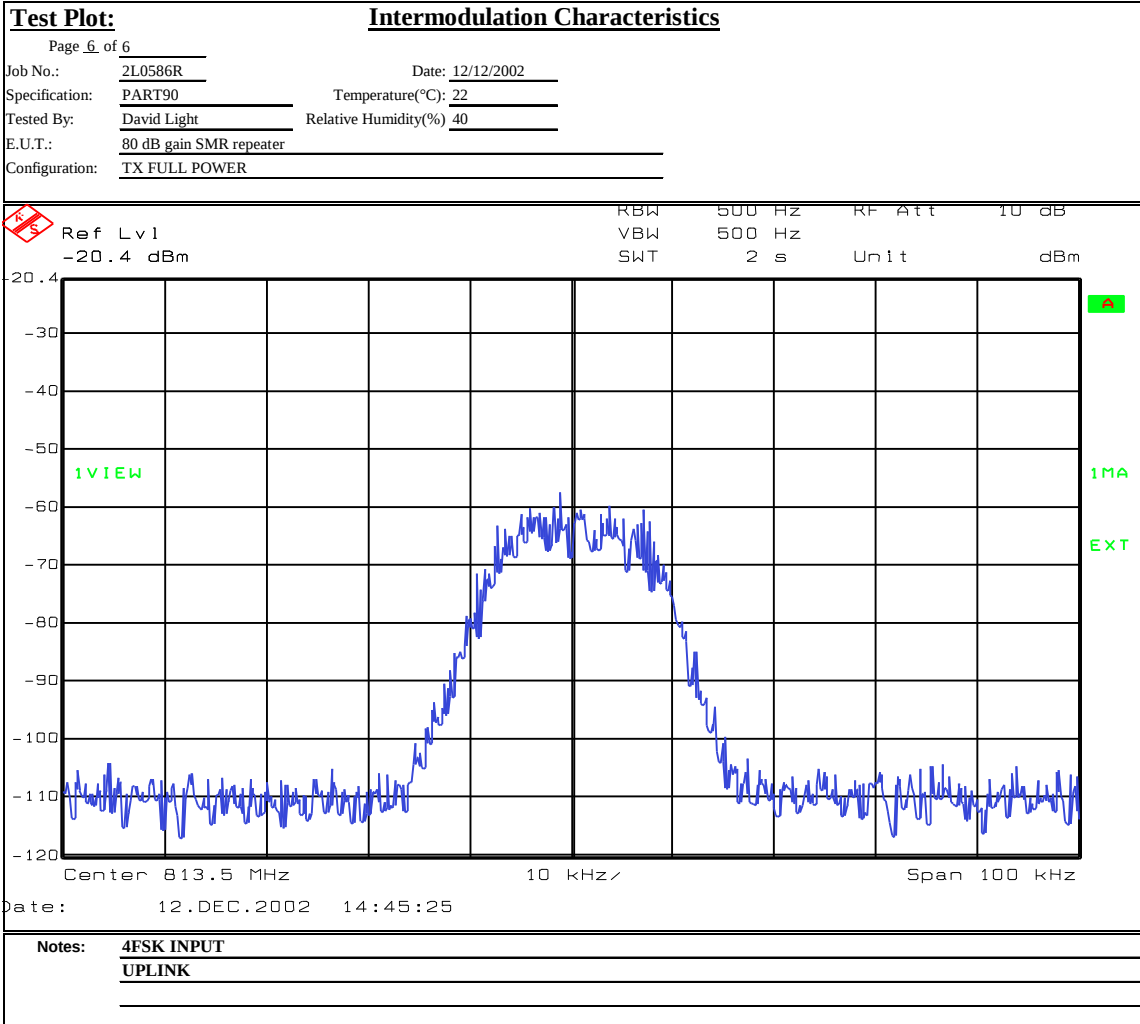
Notes: 4FSK OUTPUT
UPLINK

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: 12/13/2002

Test Results: Complies.

Test Data: See attached graph(s).

Test Data – Spurious Emissions at Antenna Terminals



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Data Plot

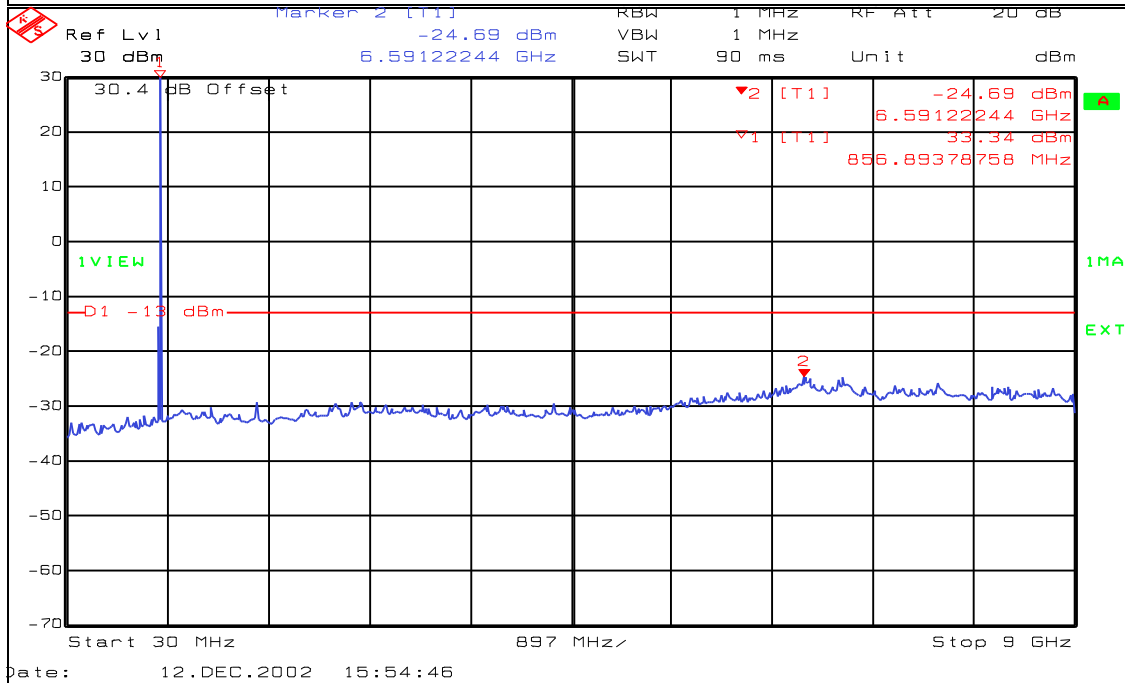
Spurious Emissions at Antenna Terminals

Page 1 of 6

Job No.: 2L0586R Date: 12/12/2002 Complete ☒ X
Specification: PART90 Temperature(°C): 22 Preliminary: ☐
Tested By: David Light Relative Humidity(%): 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots Measurement
Detector Type: Peak VBW: Refer to plots Distance: NA m

Test Equipment Used

Antenna: Directional Coupler:
Pre-Amp: Cable #1: 1083
Filter: Cable #2:
Receiver: 1036 Cable #3:
Attenuator #1: 1064 Cable #4:
Attenuator #2: 1065 Mixer:
Additional equipment used:
Measurement Uncertainty: +/-1.7 dB



Notes: QAM

DOWNLINK

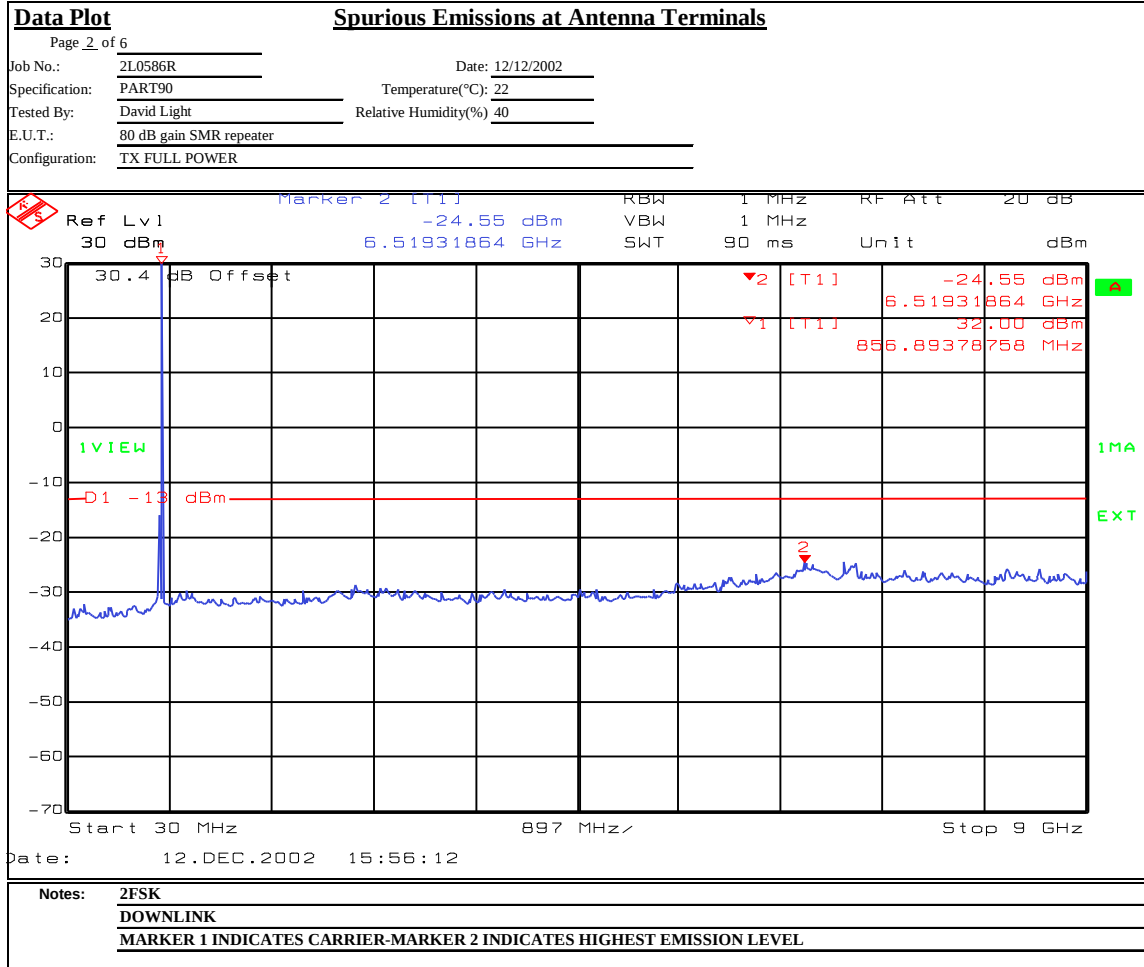
MARKER 1 INDICATES CARRIER-MARKER 2 INDICATES HIGHEST EMISSION LEVEL

Test Data – Spurious Emissions at Antenna Terminals



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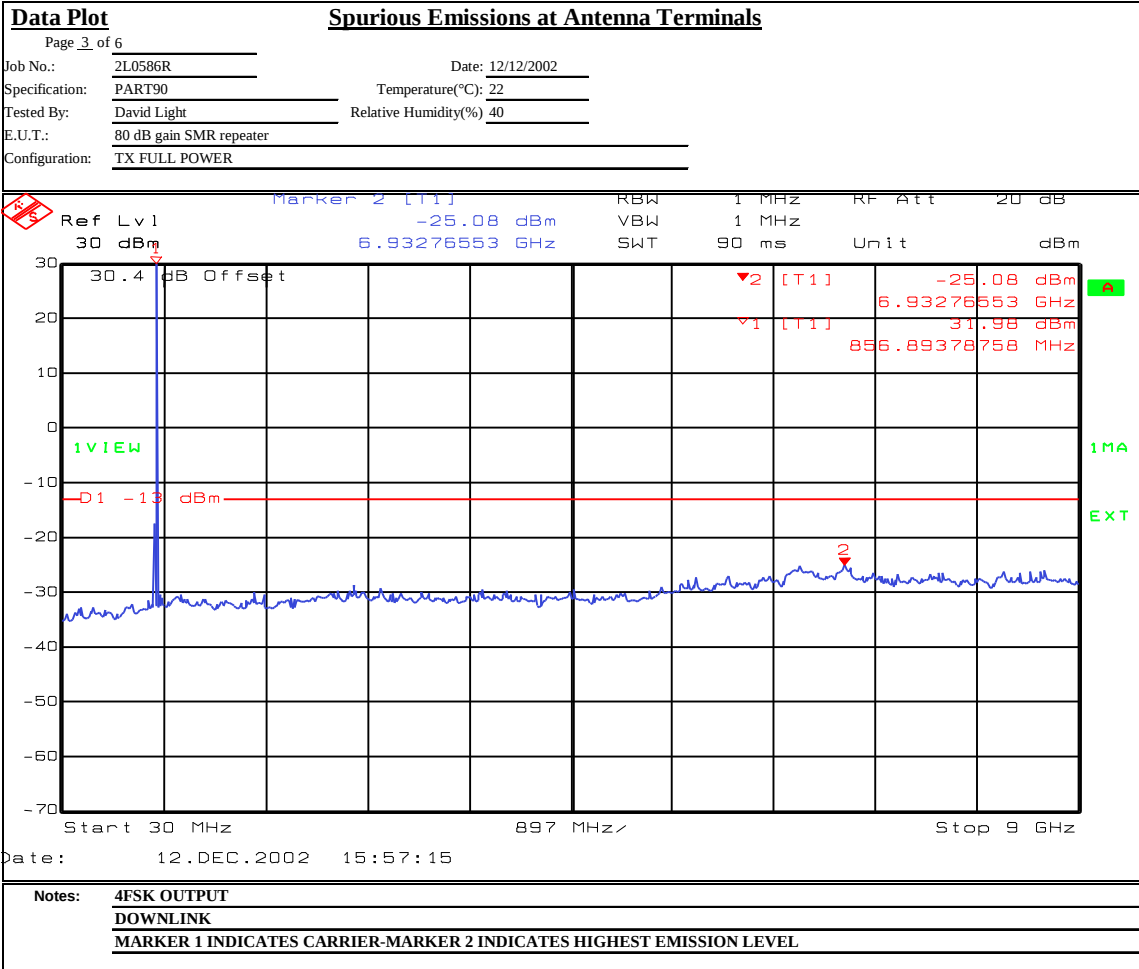


Test Data – Spurious Emissions at Antenna Terminals



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Data Plot

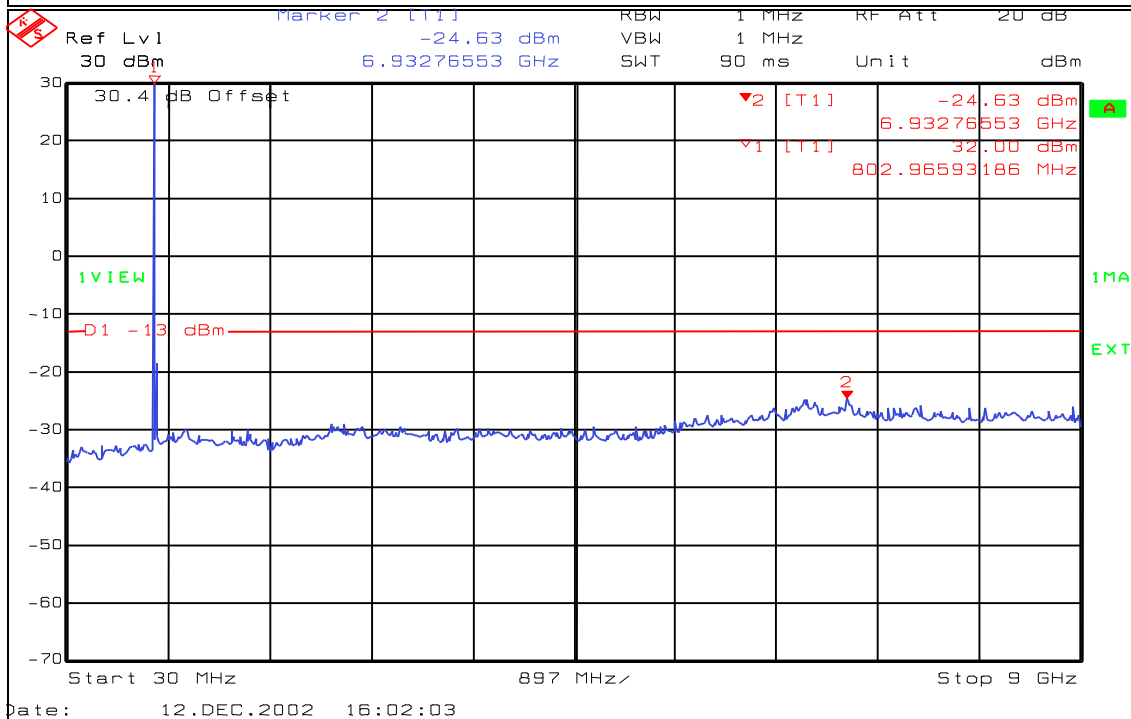
Spurious Emissions at Antenna Terminals

Page 1 of 6

Job No.: 2L0586R Date: 12/12/2002 Complete X
Specification: PART90 Temperature(°C): 22 Preliminary: _____
Tested By: David Light Relative Humidity(%) 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots Measurement
Detector Type: Peak VBW: Refer to plots Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB



Notes:

QAM

UPLINK

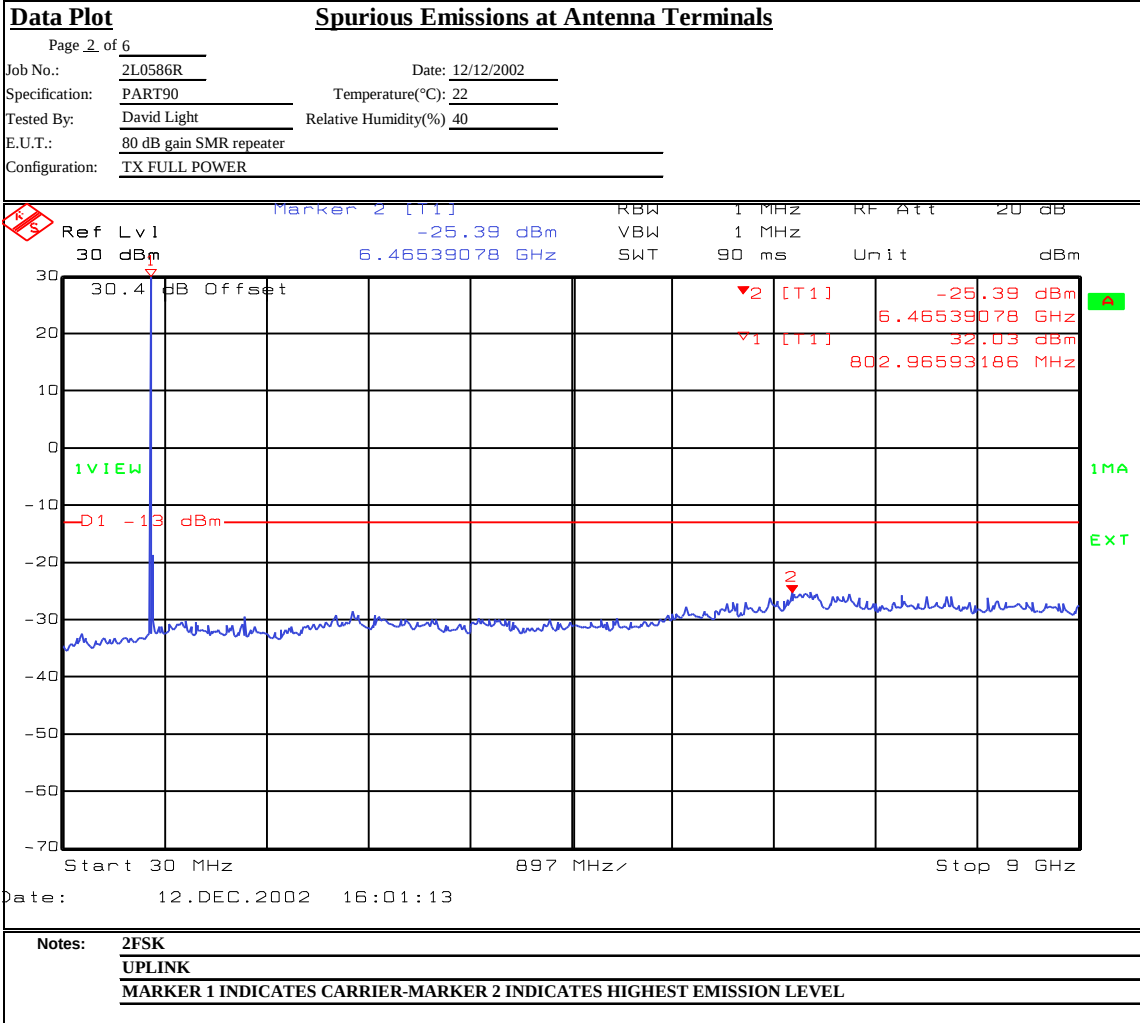
MARKER 1 INDICATES CARRIER-MARKER 2 INDICATES HIGHEST EMISSION LEVEL

Test Data – Spurious Emissions at Antenna Terminals



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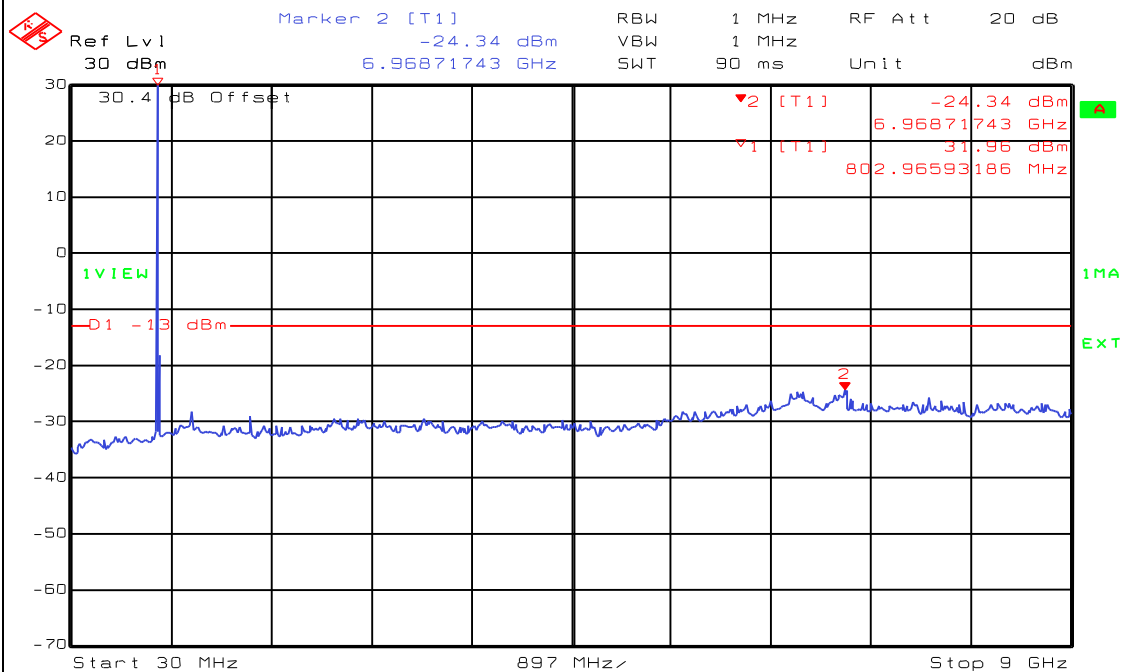
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Data Plot

Page 3 of 6

Spurious Emissions at Antenna Terminals

Job No.: 2L0586R Date: 12/12/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER



Date: 12.DEC.2002 16:00:22

Notes: 4FSK OUTPUT

UPLINK

MARKER 1 INDICATES CARRIER-MARKER 2 INDICATES HIGHEST EMISSION LEVEL

Test Data – Spurious Emissions at Antenna Terminals



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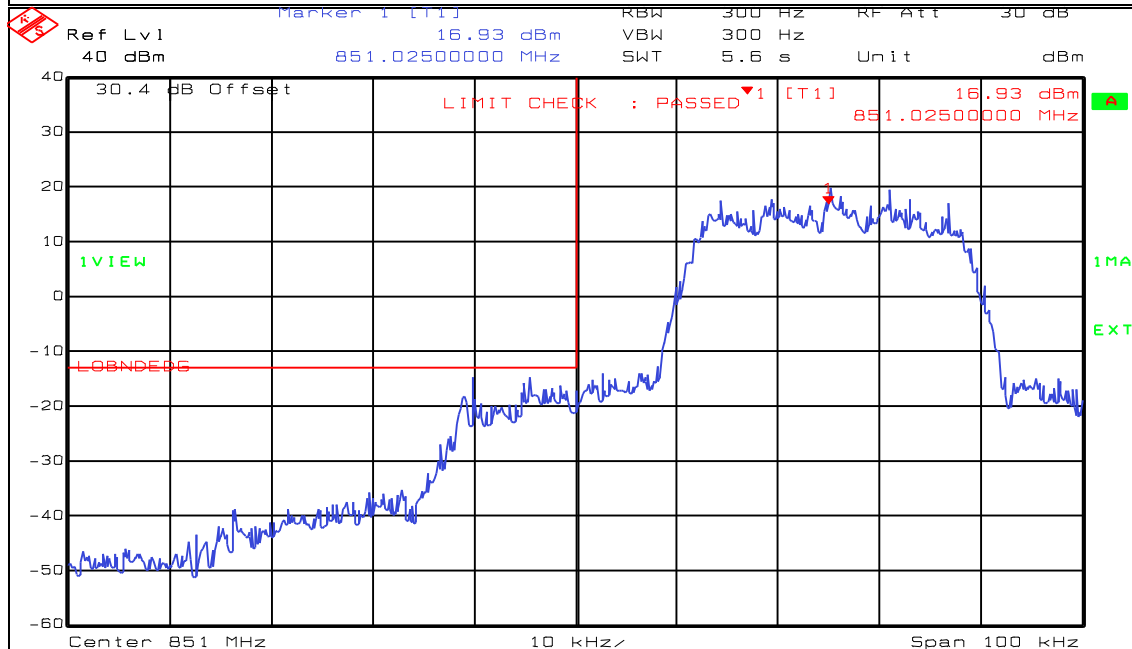
Bandedges

Job No.: 2L0586R Date: 12/13/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%): 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete ☒ X
Preliminary: ☐Measurement
Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB



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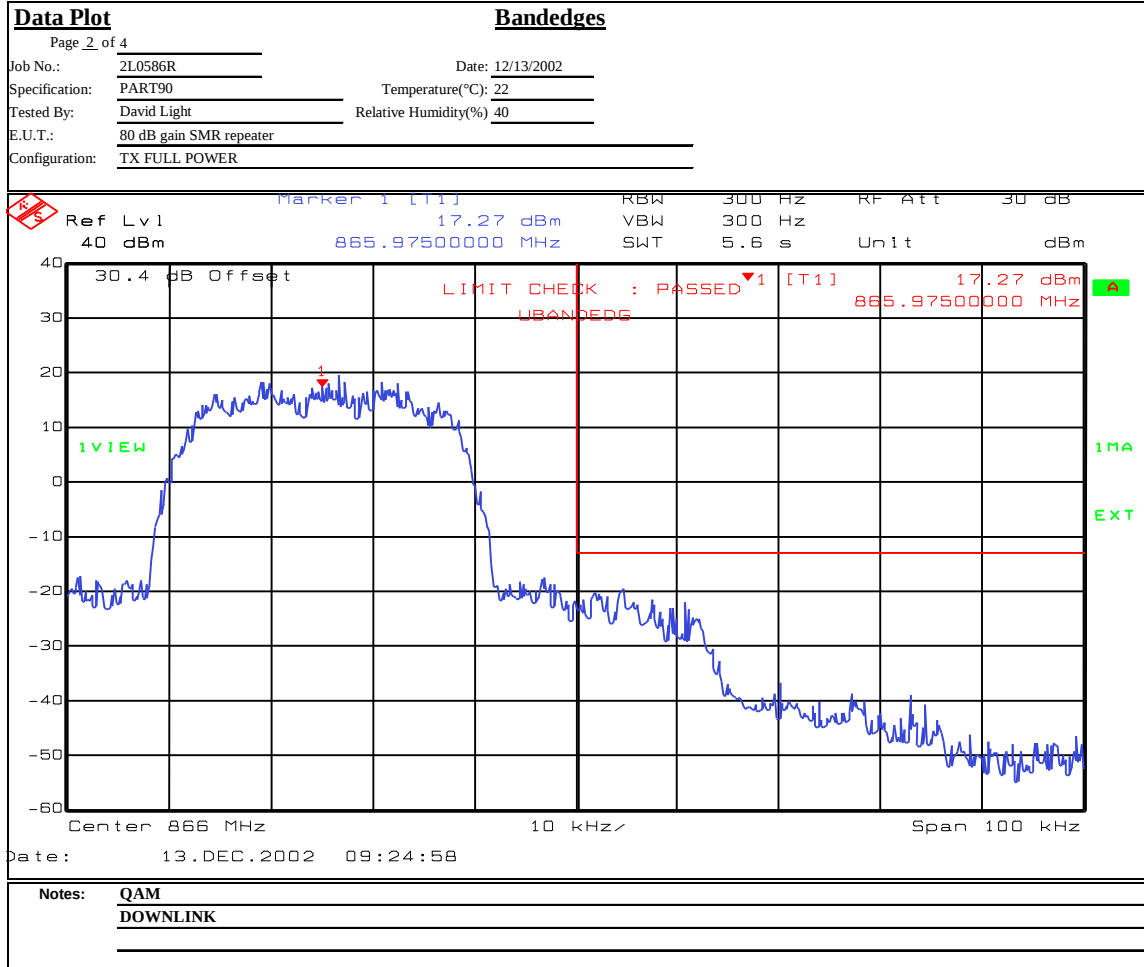
Notes: QAM
DOWNLINK

Test Data – Spurious Emissions at Antenna Terminals



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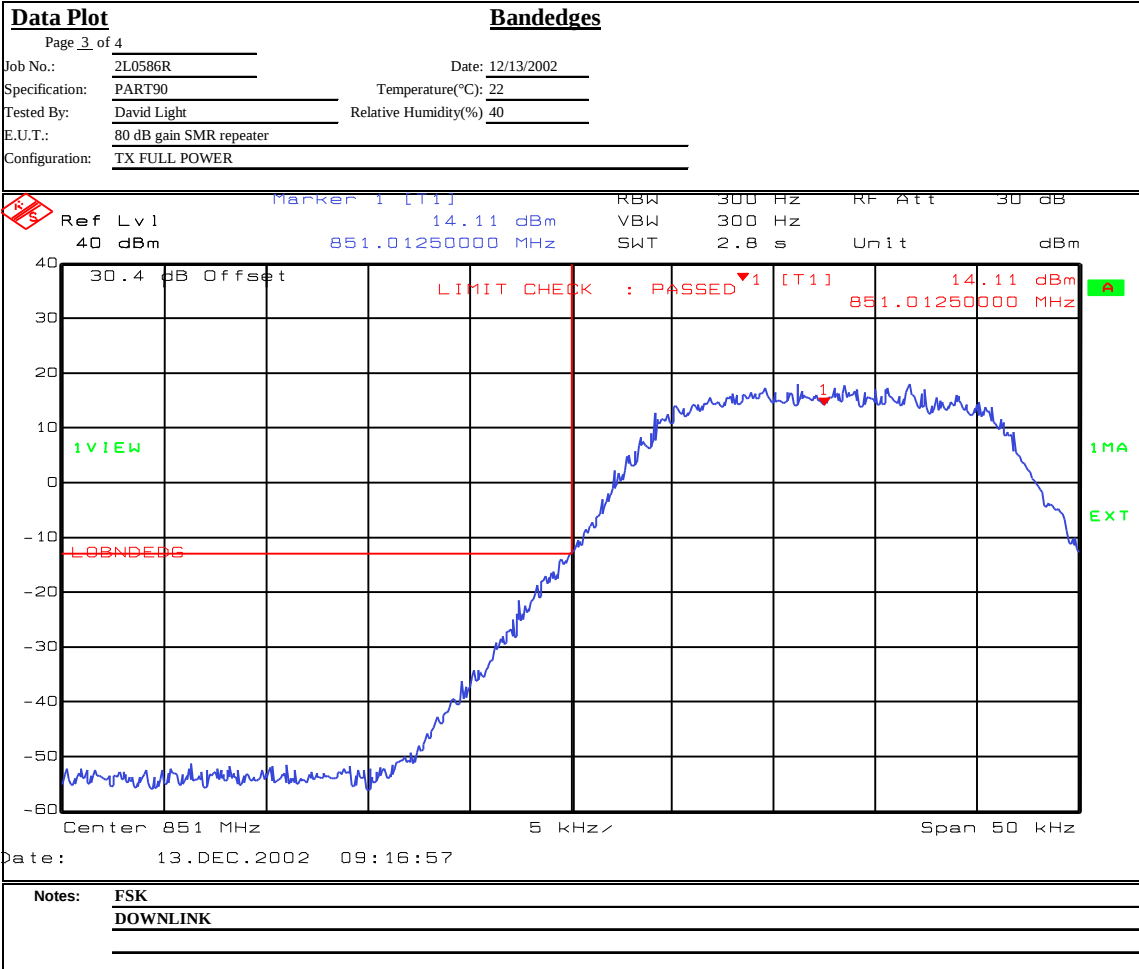


Test Data – Spurious Emissions at Antenna Terminals



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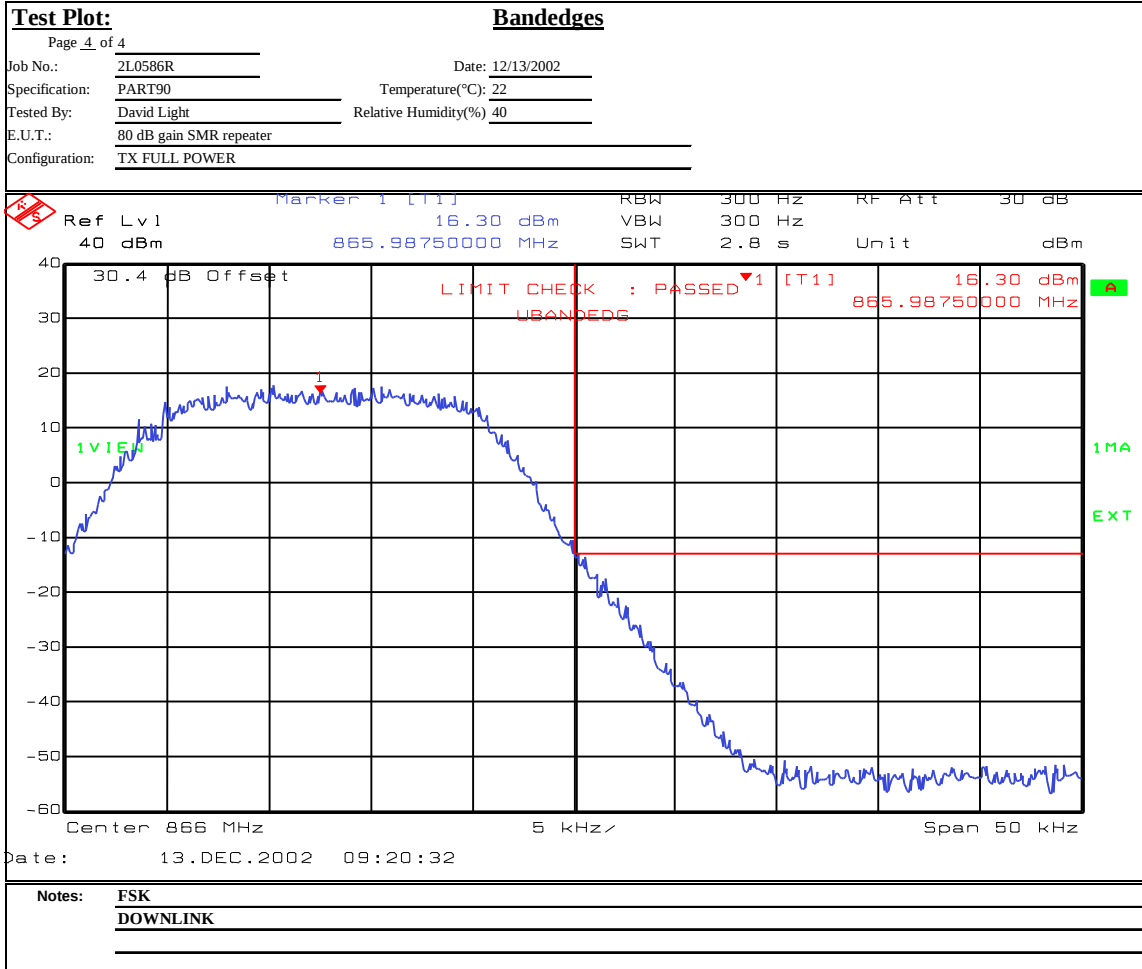
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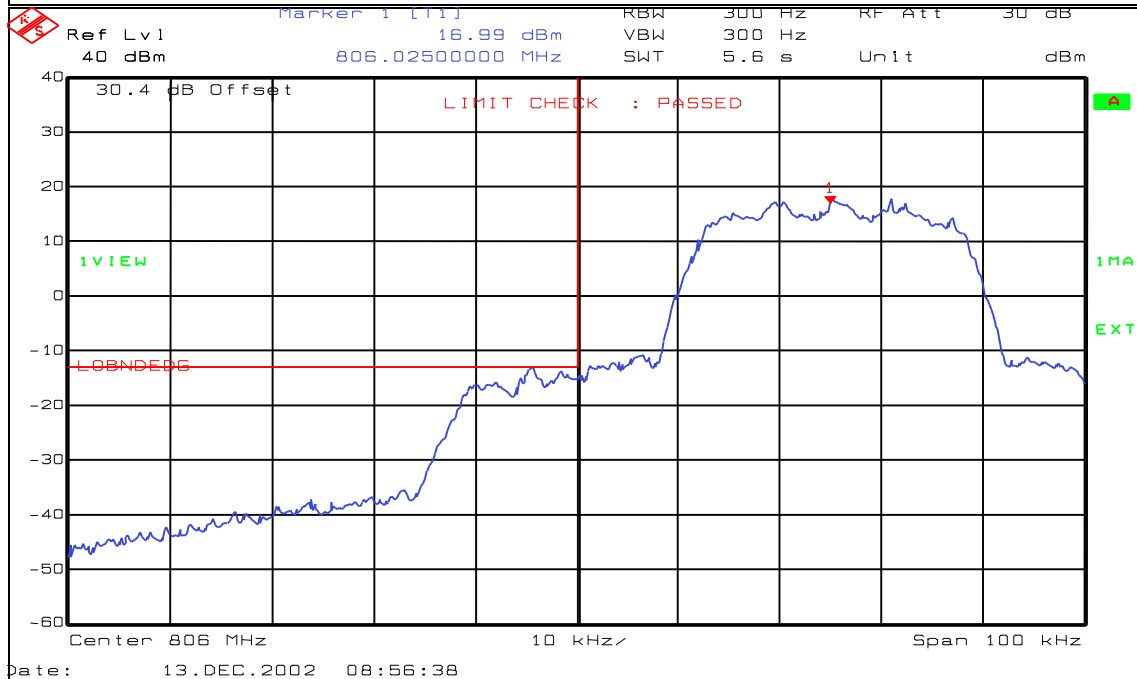
Bandedges

Job No.: 2L0586R Date: 12/13/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%): 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete ☒ X
Preliminary: ☐Measurement
Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB

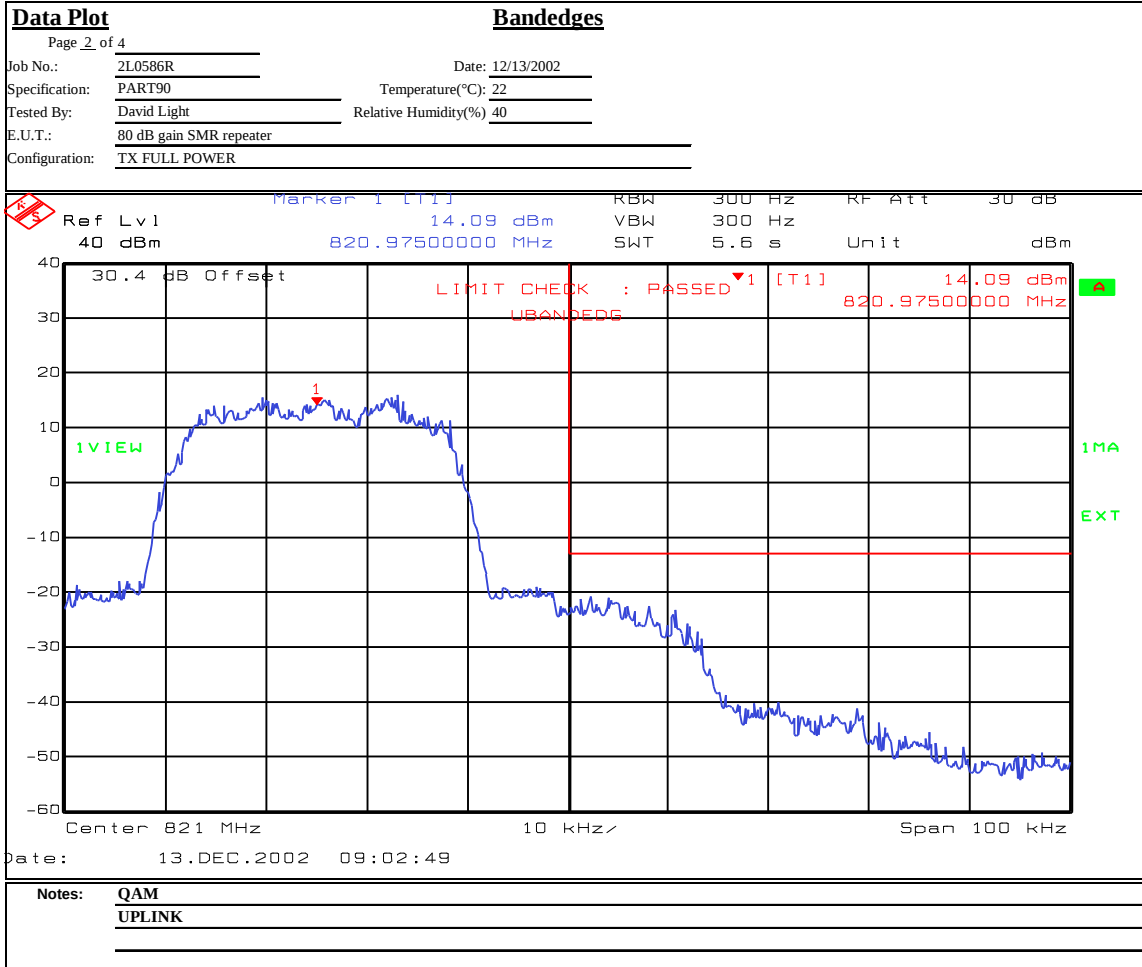
Notes: QAM
UPLINK

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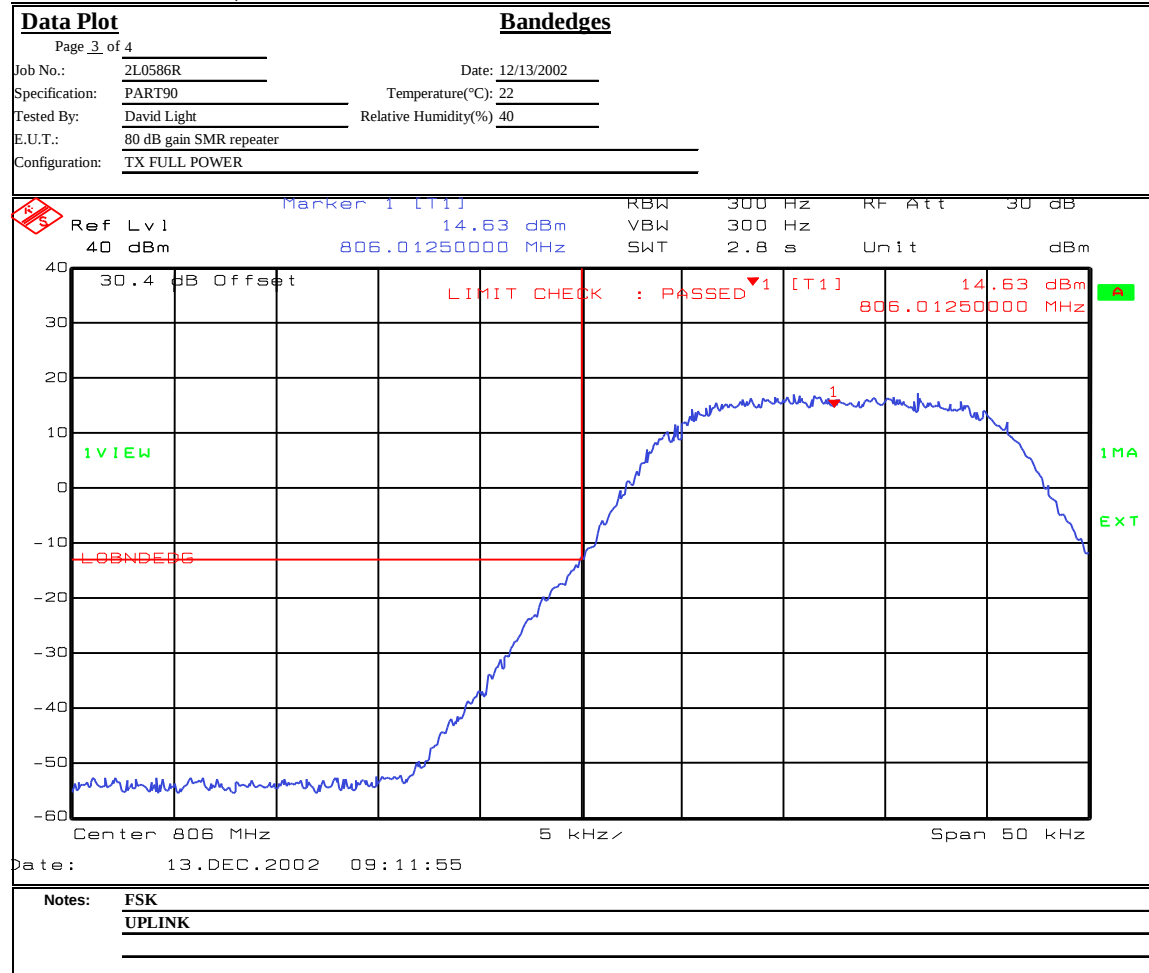
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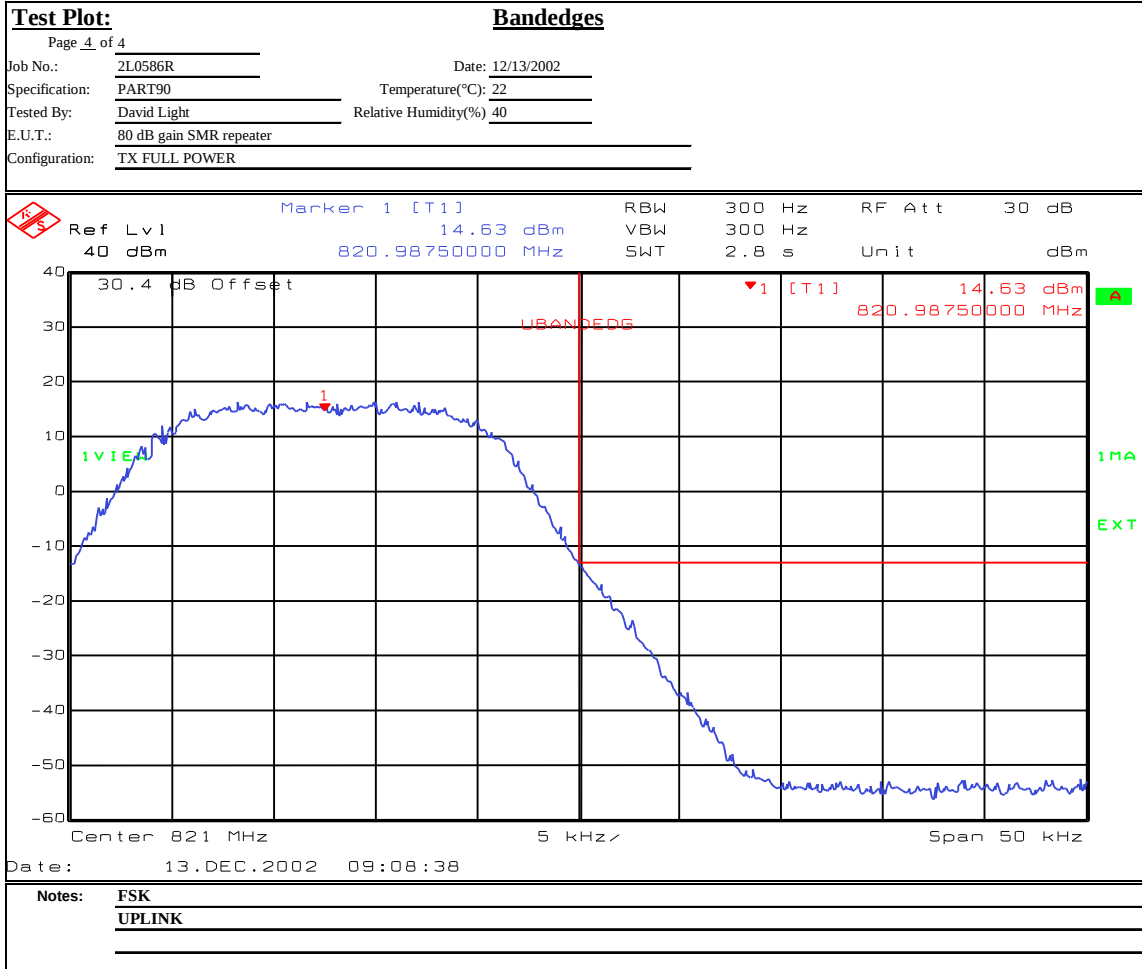


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Data Plot

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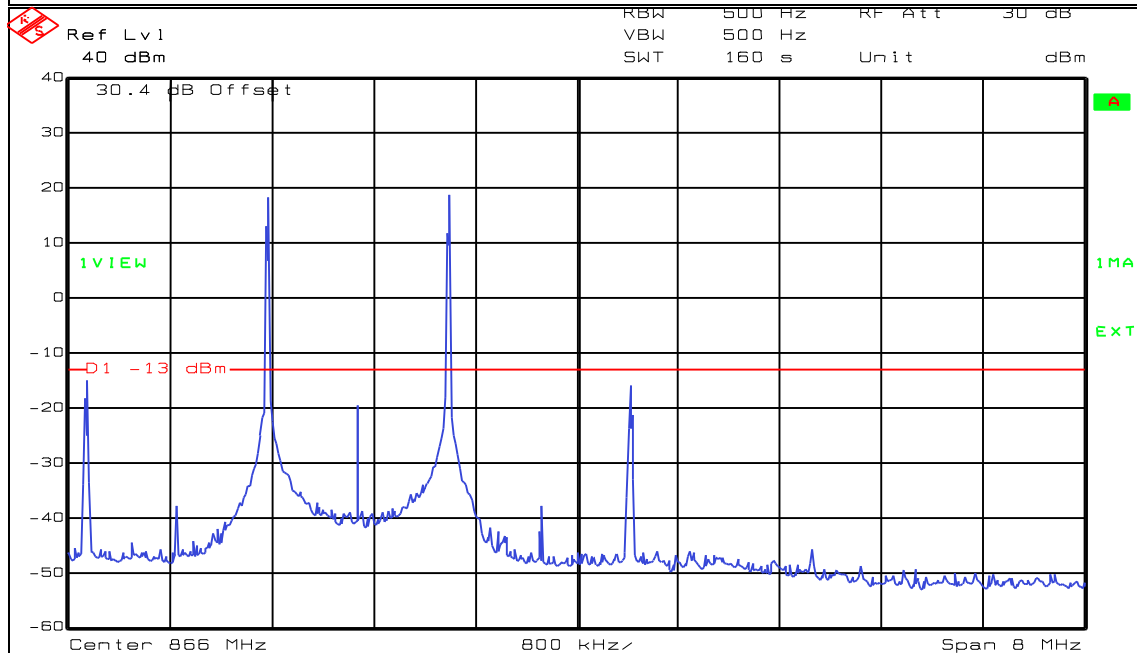
Intermodulation Characteristics

Job No.: 2L0586R Date: 12/13/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%): 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete ☒ X
Preliminary: ☐Measurement
Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB



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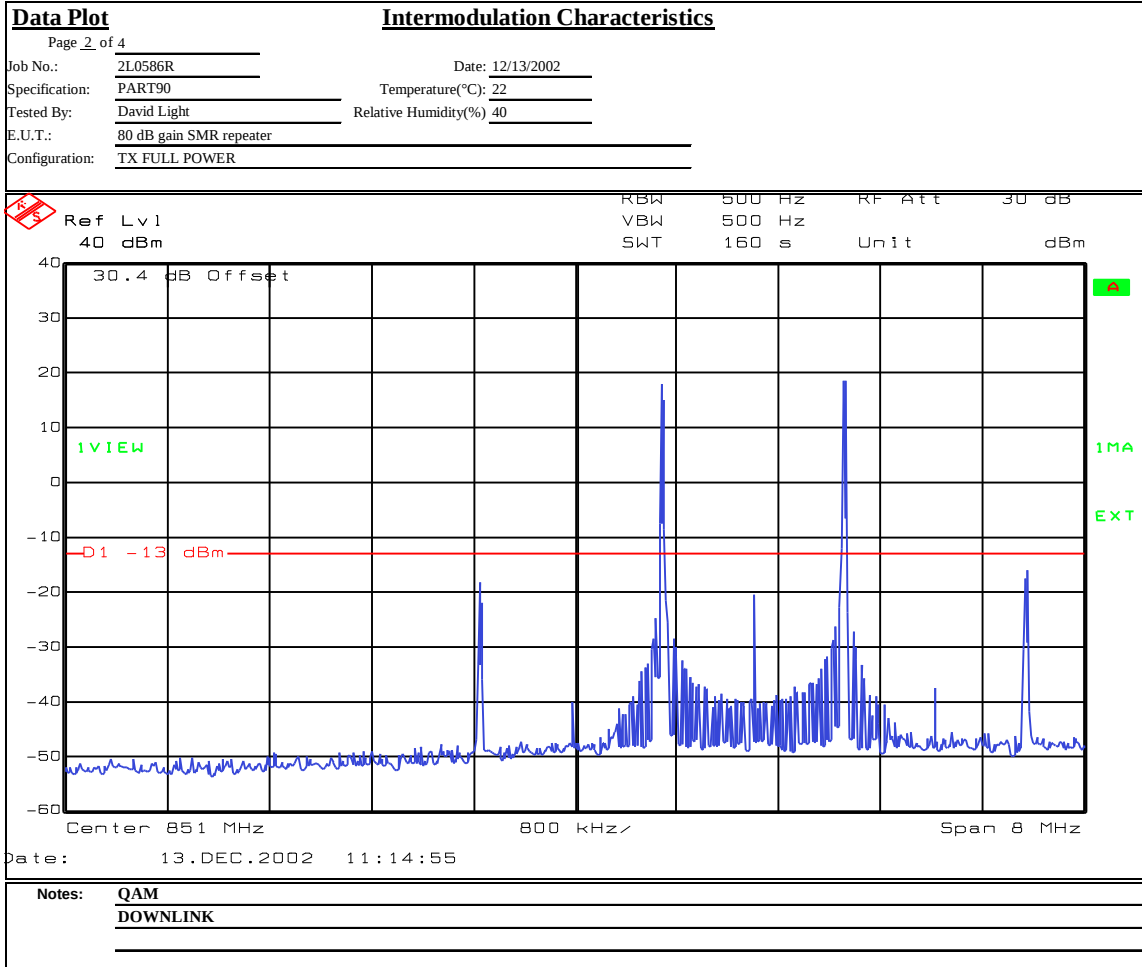
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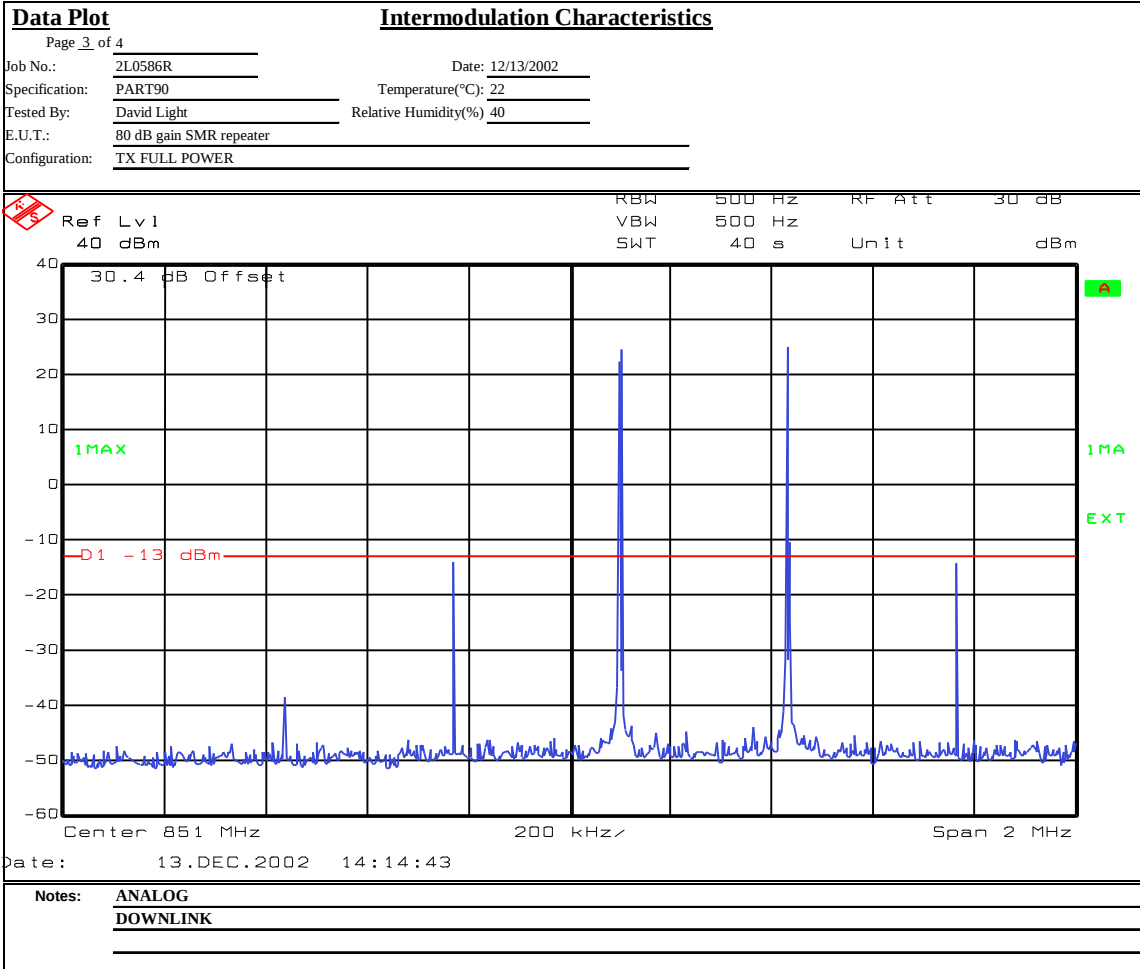
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Tel: (972) 436-9600
Fax: (972) 436-2667

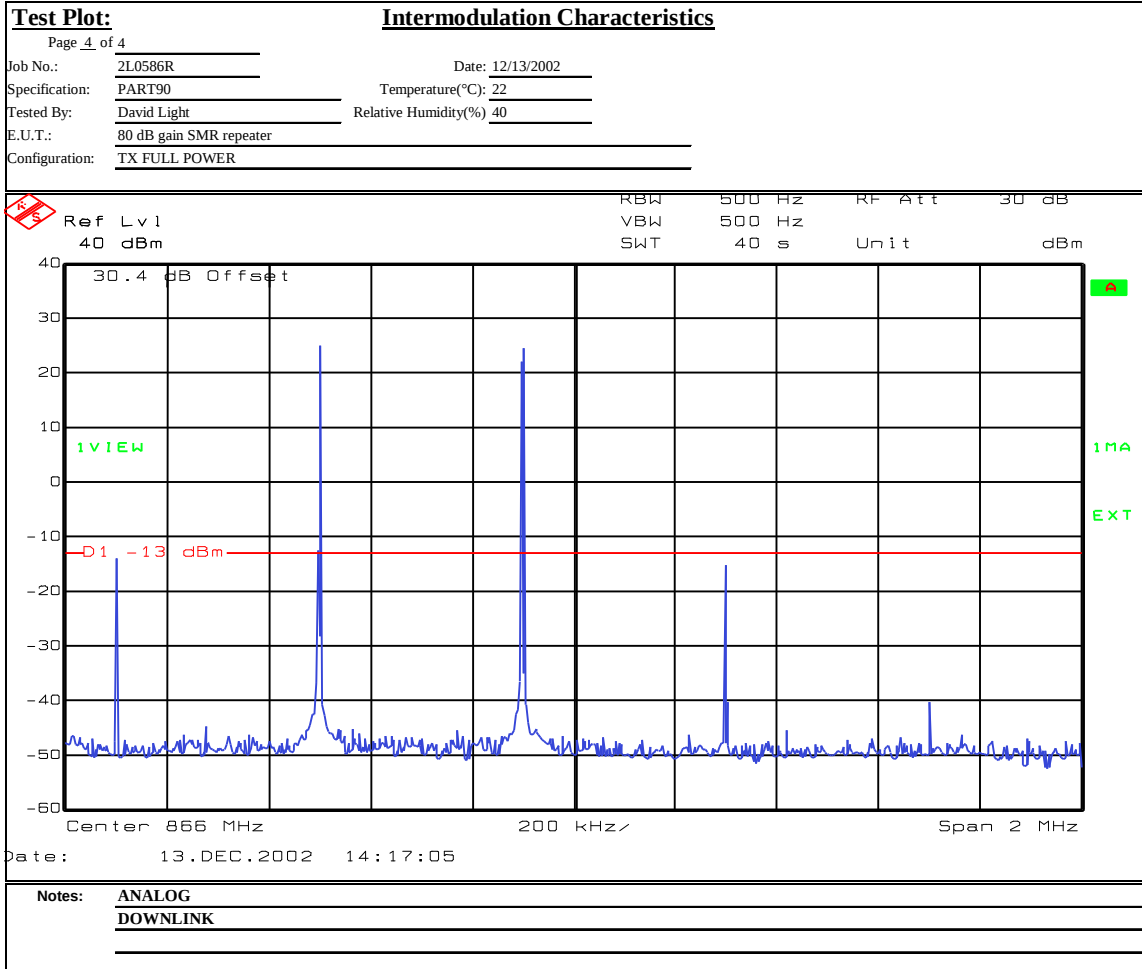


Test Data – Spurious Emissions at Antenna Terminals



Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
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Nemko Dallas, Inc.



Test Data – Spurious Emissions at Antenna Terminals



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Data Plot

Page 1 of 4

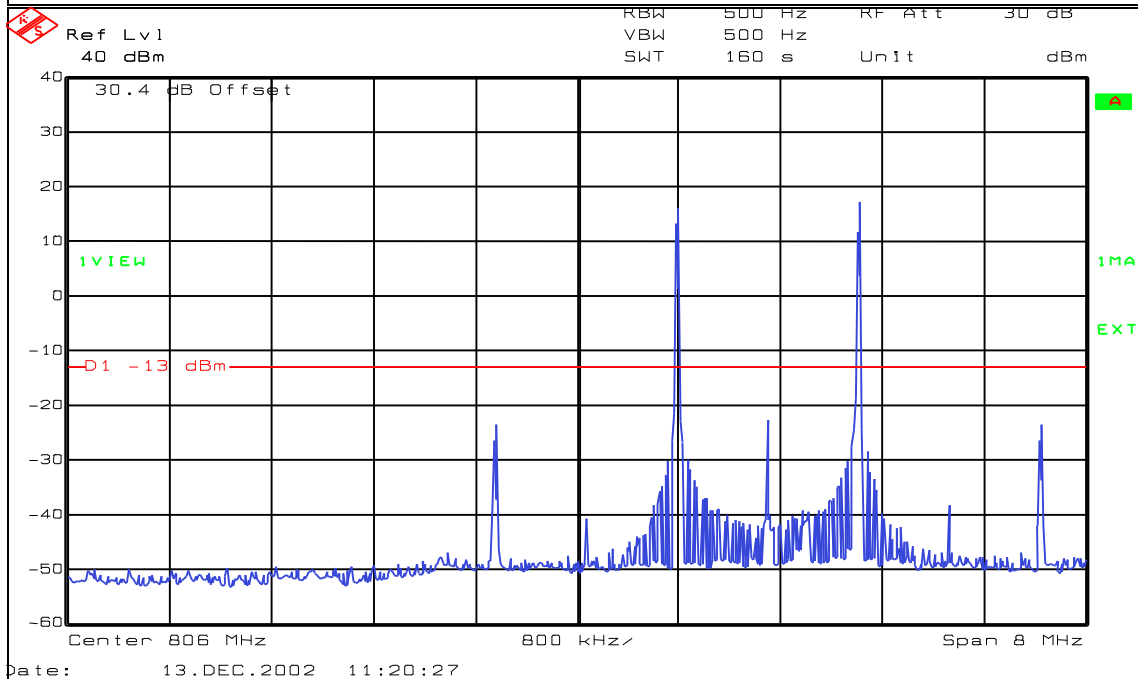
Intermodulation Characteristics

Job No.: 2L0586R Date: 12/13/2002
Specification: PART90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%): 40
E.U.T.: 80 dB gain SMR repeater
Configuration: TX FULL POWER
Sample Number: 1
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Complete ☒ X
Preliminary: ☐Measurement
Distance: NA m

Test Equipment Used

Antenna: _____ Directional Coupler: _____
Pre-Amp: _____ Cable #1: 1083
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB

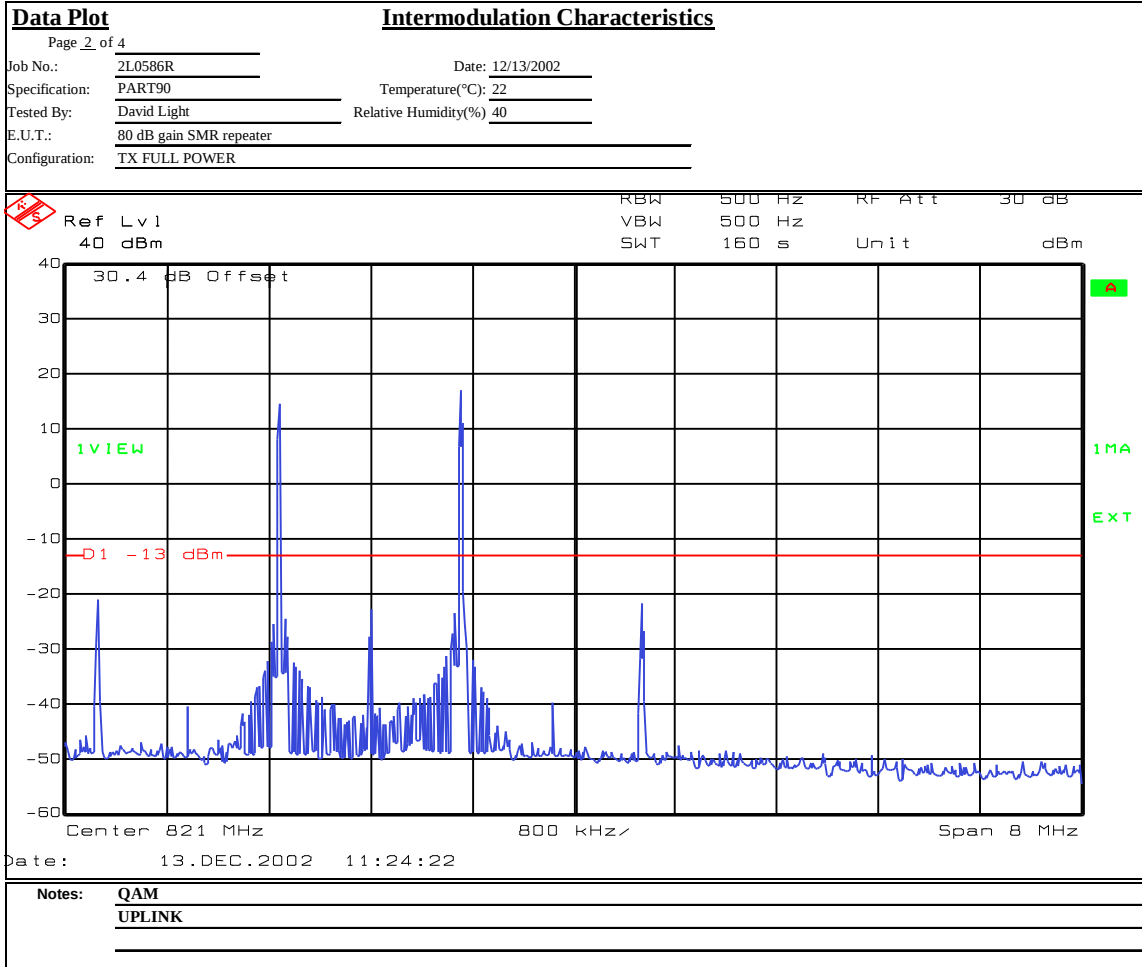
Notes: QAM
UPLINK

Test Data – Spurious Emissions at Antenna Terminals



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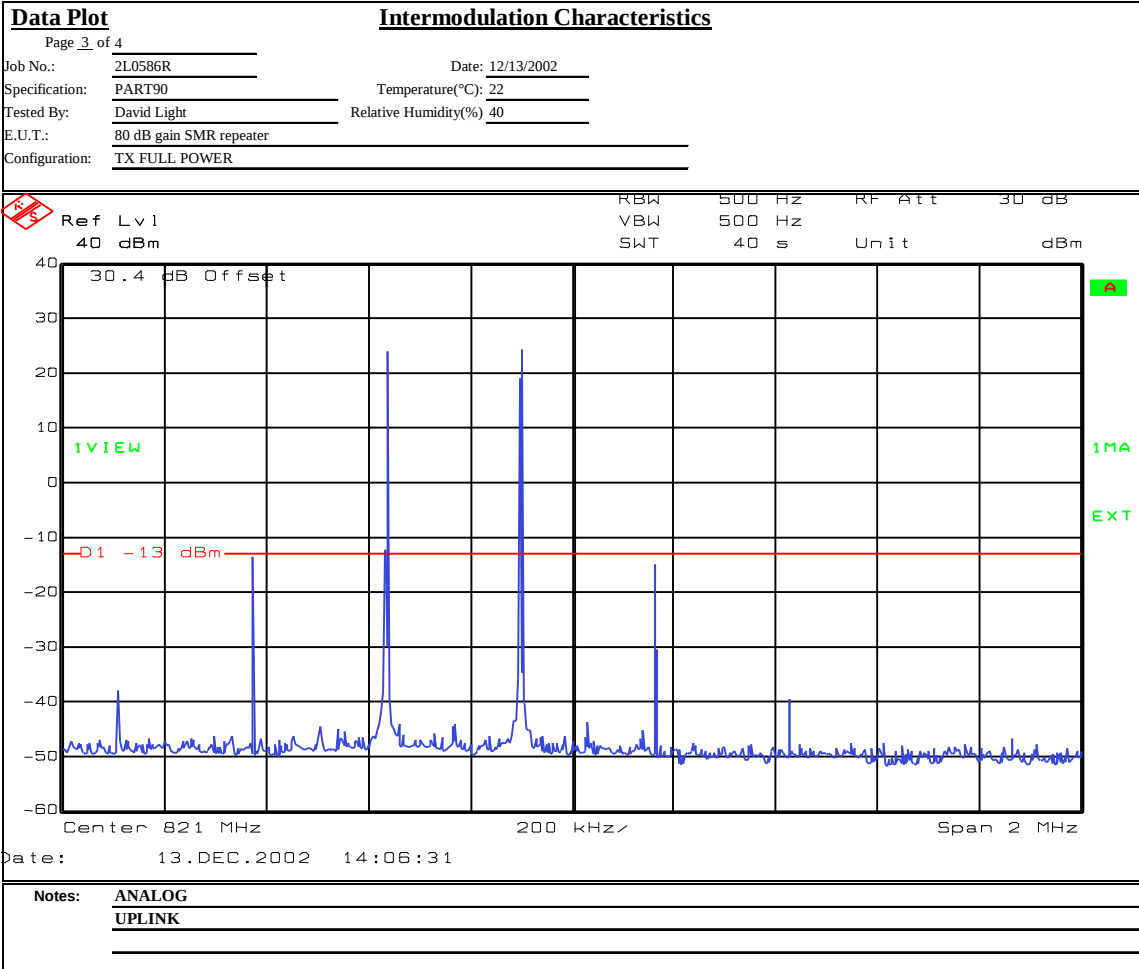
Test Data – Spurious Emissions at Antenna Terminals



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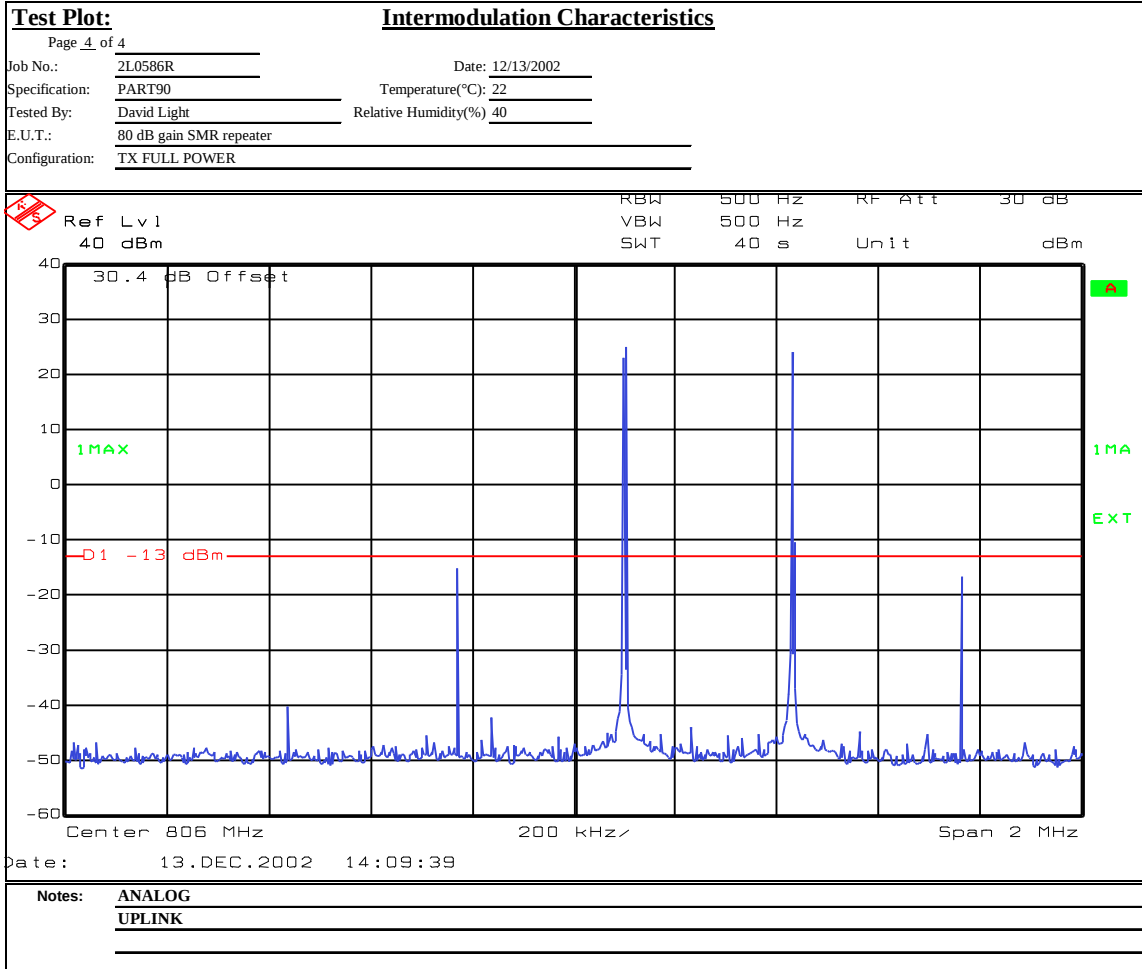


Test Data – Spurious Emissions at Antenna Terminals



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Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 12/13/2002

Test Results: Complies.

Test Data: See attached table.

Note: See page A5 for applicable limit.

EQUIPMENT: BDA-SMR-1/1W-80-A

Test Data - Radiated Emissions



Nemko Dallas, Inc.

Dallas Headquarters:

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

ERP Substitution Method

Page 1 of 1

Job No.: 2L0586R Date: 12/13/02 Complete X
Preliminary _____

Specification: PART90 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 40

E.U.T.: 80 dB gain SMR repeater

Configuration: Tx full power into load

Sample No: 1

Location: AC 3 RBW: 100 kHz Measurement _____

Detector Type: Peak VBW: 30 kHz Distance: 3 m

Test Equipment Used

Antenna: _____ 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: +/-1.7 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	Limit (dBm)	ERP (dBm)	ERP (mW)	Polarity	Comments
Tx @ 858.5										
1717.0	-67.3	31.0		32.9	7.3	-13	-62.0	0.0000	V	Downlink
2575.5	-63.6	35.5		33	8.0	-13	-53.2	0.0000	V	
3434.0	-68.2	39.8		32.6	8.0	-13	-53.0	0.0000	V	
4292.5	-70.0	45.3		33.2	8.2	-13	-49.7	0.0000	V	
8585.0	-73.0	44.8		33.5	9.4	-13	-52.3	0.0000	V	
1717.0	-70.8	33.0		32.9	7.3	-13	-63.5	0.0000	H	
2575.5	-69.8	35.5		33	8.0	-13	-59.4	0.0000	H	
3434.0	-69.5	36.3		32.6	8.0	-13	-57.8	0.0000	H	
4292.5	-70.0	34.8		33.2	8.2	-13	-60.2	0.0000	H	
8585.0	-73.0	42.2		33.5	9.4	-13	-55.0	0.0000	H	
Tx @ 813.5										
1627.0	-68.0	33.0		32.9	7.3	-13	-60.7	0.0000	H	Uplink
2440.5	-67.3	37.0		33	6.8	-13	-56.6	0.0000	H	
3254.0	-66.7	36.3		32.6	8.0	-13	-55.0	0.0000	H	
4067.5	-72.0	34.8		33.2	8.2	-13	-62.2	0.0000	H	
8135.0	-75.0	42.5		33.5	9.1	-13	-56.9	0.0000	H	
1627.0	-67.5	31.0		32.9	7.3	-13	-62.2	0.0000	V	
2440.5	-61.7	34.2		33	6.8	-13	-53.8	0.0000	V	
3254.0	-68.3	39.8		32.6	8.0	-13	-53.1	0.0000	V	
4067.5	-72.0	45.3		33.2	8.2	-13	-51.7	0.0000	V	
8135.0	-75.0	42.8		33.5	9.1	-13	-56.6	0.0000	V	

Notes: Scanned to the 10th harmonic of carrier

Nemko Dallas

FCC PART 90, SUBPART I
PRIVATE LAND MOBILE REPEATER

EQUIPMENT: **BDA-SMR-1/1W-80-A**

PROJECT NO.: **2L0586RUS1**

Photographs of Test Setup

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1605	LIMITER	FISCHER FCC-45013-1.2	184	01/17/02	01/17/03
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/03/03
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/15/02	07/15/03
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/15/02	07/15/03
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	07/15/02	07/15/03
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01	07/31/03

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

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
--	-------------------------

Test Method: RBW: 1% of emission bandwidth in the 0 - 1 GHz range.
1 MHz at frequencies above 1 GHz.

VBW: $\Rightarrow$ RBW

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

EQUIPMENT: BDA-SMR-1/1W-80-A**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
---	-------------------------

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

Calculation of Field Strength Limit

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.

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

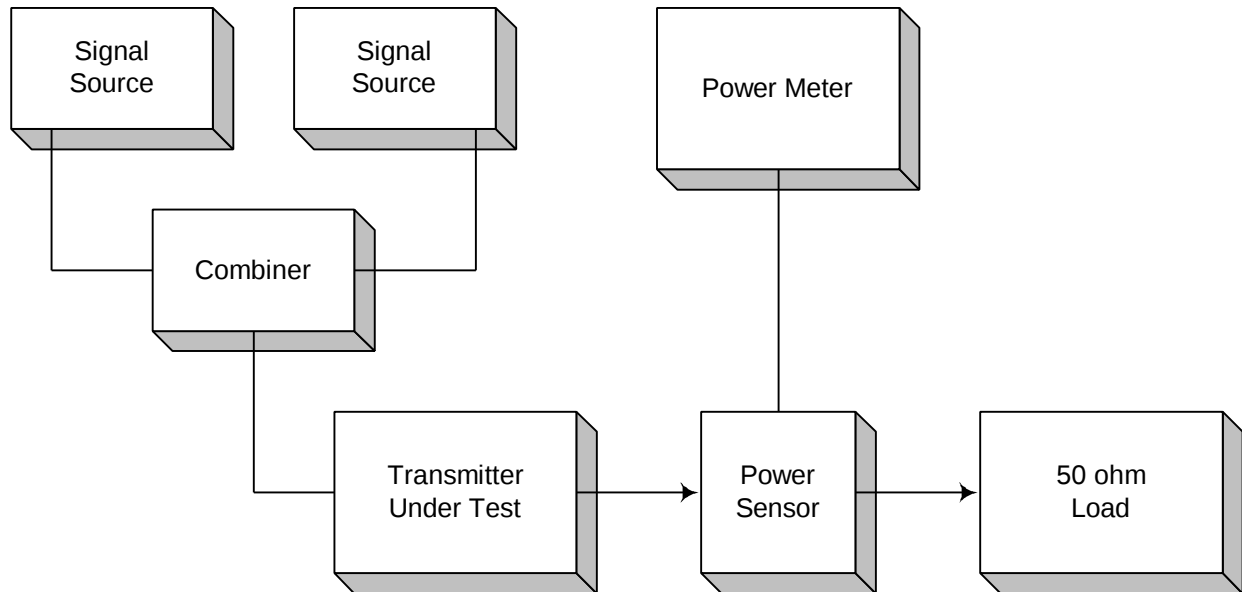
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

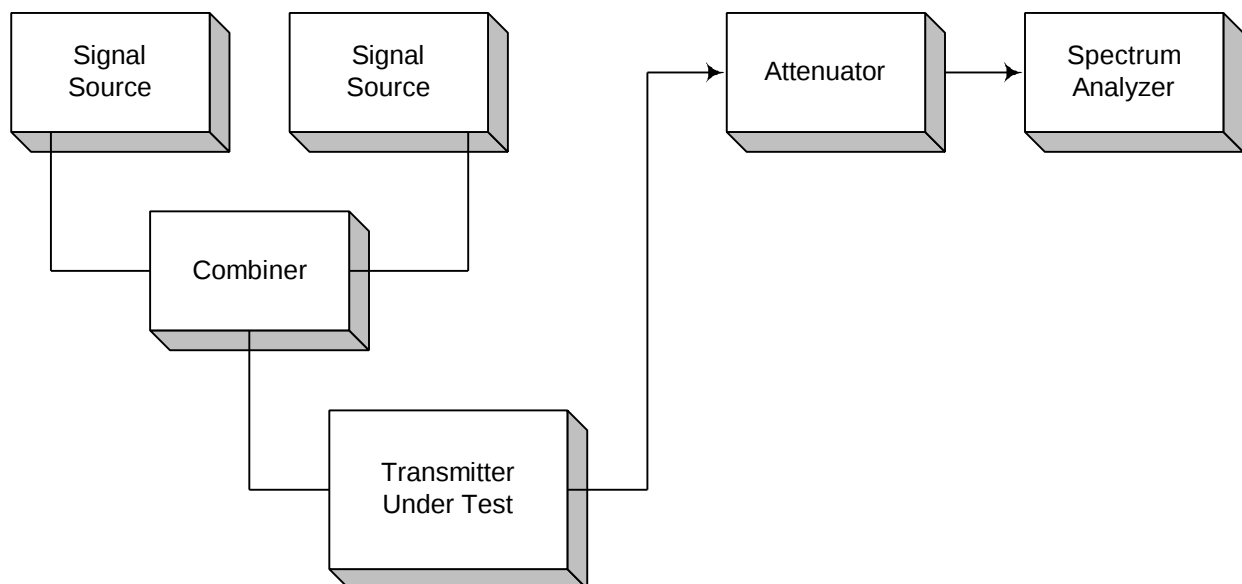
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 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	-	-	-

ANNEX B - TEST DIAGRAMS

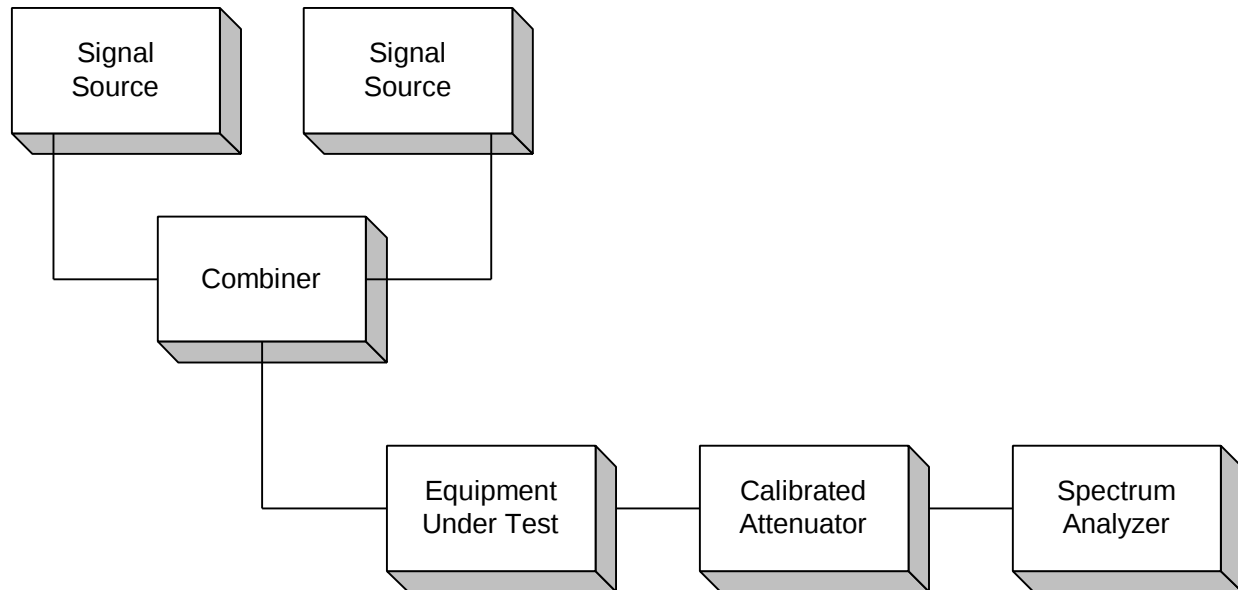
Para. No. 2.985 - R.F. Power Output



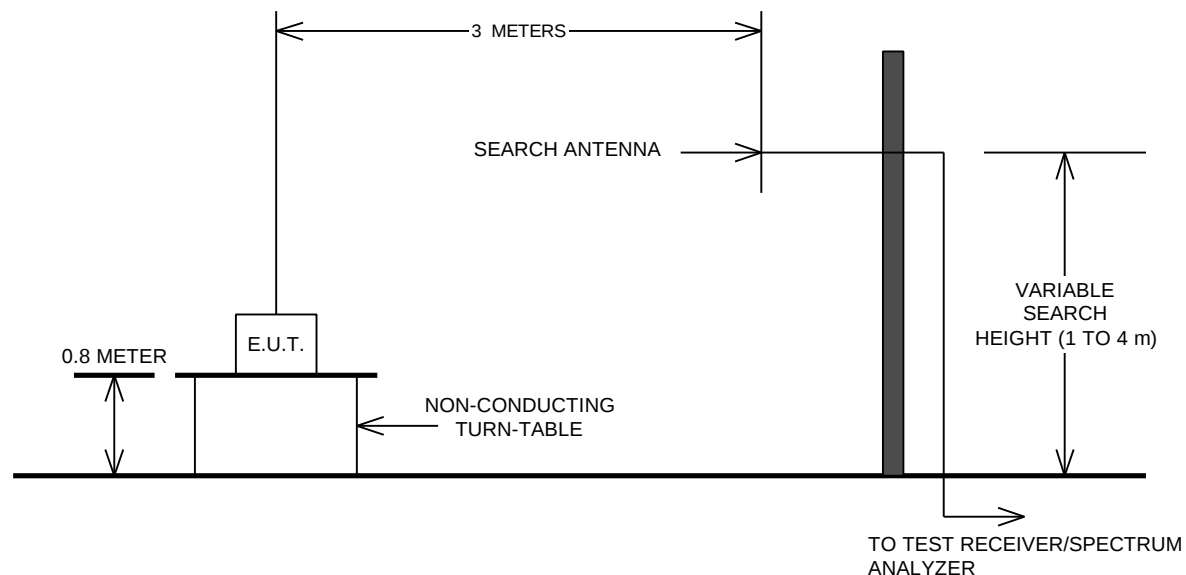
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

