Nemko Test Report:	4L0571RUS3
Applicant:	Andrew Corporation 108 Rand Park Drive Garner, NC 27529
Equipment Under Test: **(E.U.T.)**	TFAH 80/85/19
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, Frontline Group Manager
Date:	11/16/04
Total Number of Pages:	34

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: TFAH 80/85/19

Serial No.: 043003403

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

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

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		Complies
Frequency Stability	90.213		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.

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Section 2. General Equipment Specification

Supply Voltage Input: 115 Vac

Frequency Range: 851 to 869 MHz (Downlink only)

Tunable Bands: Full band coverage

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	D7W (QAM)	Other
☒	☒	☒	☒	☐

Output Impedance: 50 ohms

RF Power Output (rated):

Single: 2.5 Watts Analog – 631 mW iDEN
Composite: 0.5 Watt Analog – 282 mW iDEN

Operator Selection of Operating Frequency: None

Power Output Adjustment Capability: None

Frequency Translation:

F1-F1	F1-F2	N/A
☒	☐	☐

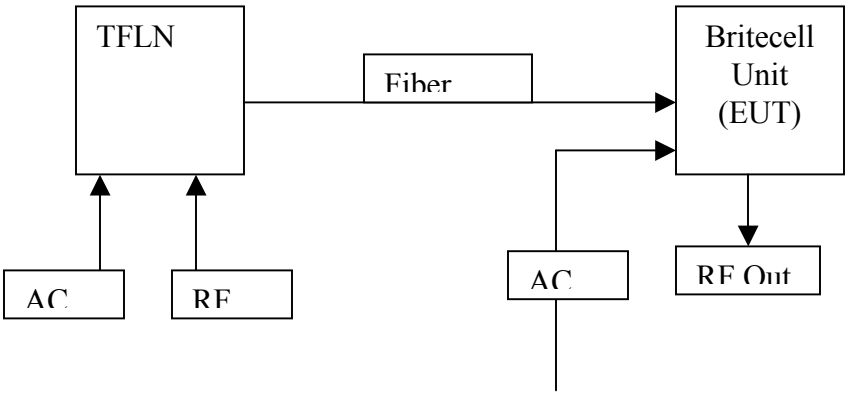
Band Selection:

Software	Duplexer Change	Fullband Coverage
☐	☐	☒

Description of Operation

TFAH 80/58/19 is a fiber based tri-band repeater operating in the 800 MHz SMR, the 800 MHz cellular and the 1900 MHz PCS bands

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 8/30/04

Test Results: Complies.

Measurement Data:

Modulation	Frequency (MHz)	Measured Power (dBm/Carrier)	Composite Power (dBm)
Analog	860	24	27
iDEN	860	21.5	24.5

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 8/30/04

Test Results: Complies.

Test Data: See attached graph(s).

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**

Page 1 of 4 — Complete: X — Preliminary:

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	PCS AMPLIFIER		
Configuration:	TX		
Sample Number:	1		
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots

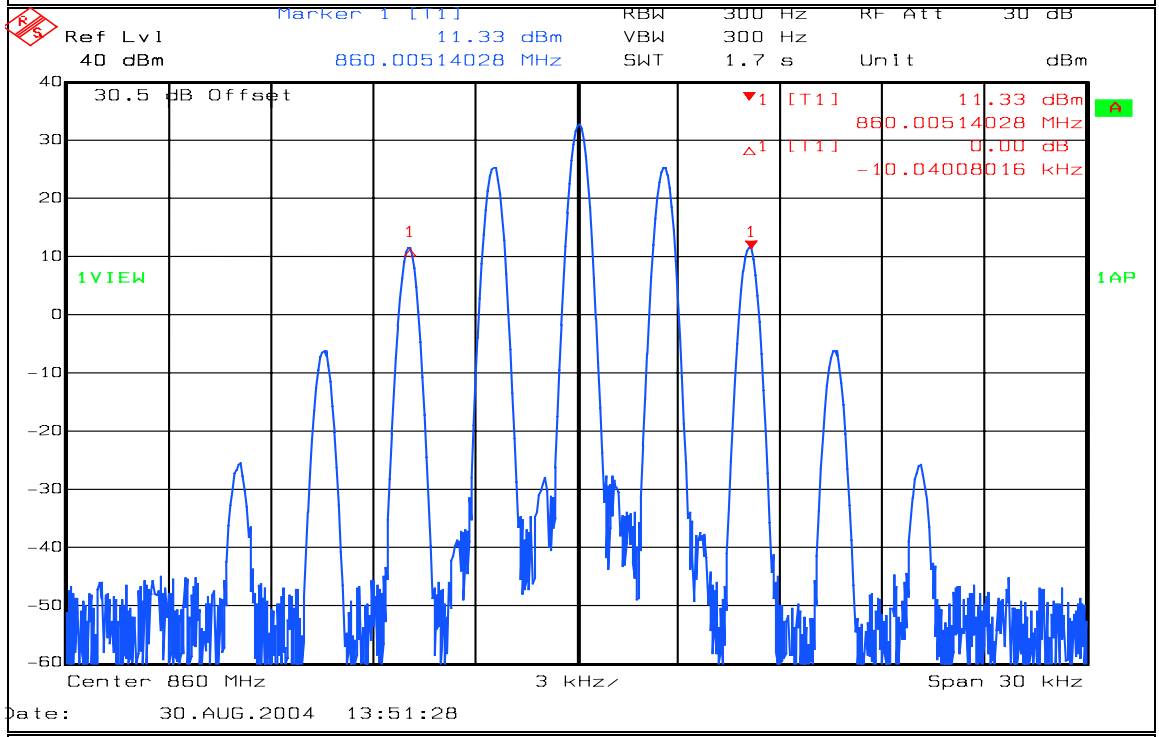
Measurement Distance: NA m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1629
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1065	Cable #4:	
Attenuator #2:	1604	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes:
ANALOG OUTPUT
MAX POWER 34 dBm
2 kHz Tone - 2.5 kHz Deviation

Test Data – Occupied Bandwidth

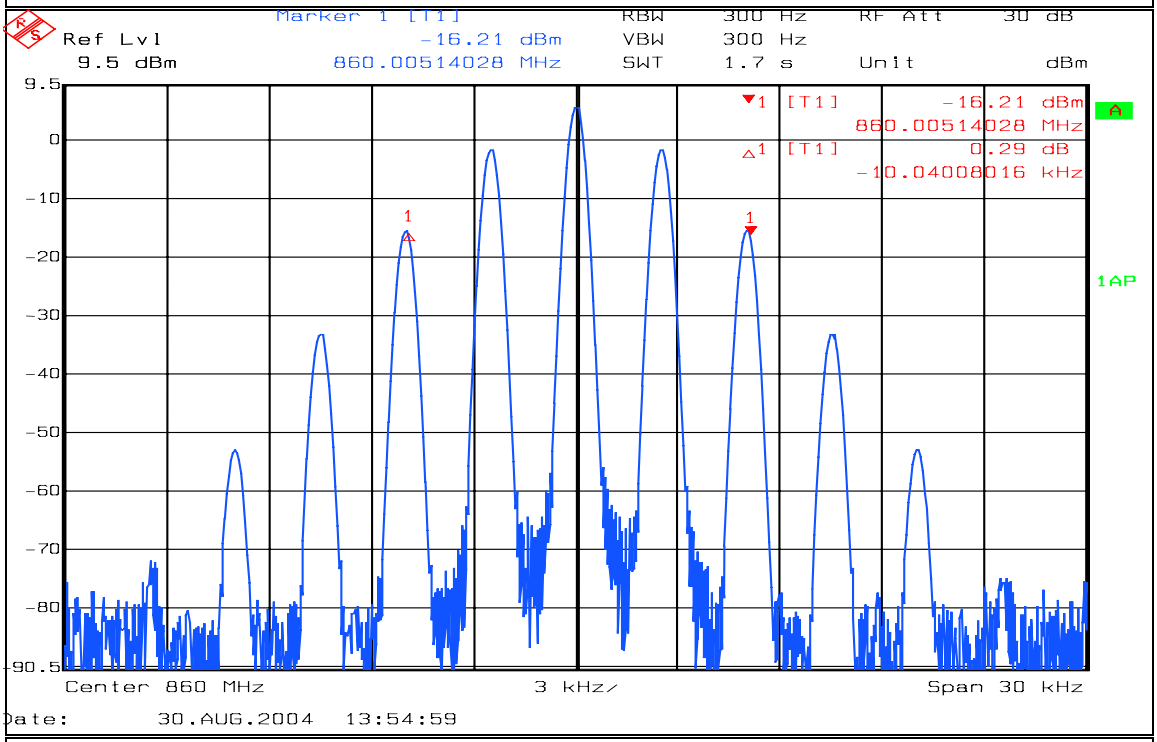
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Occupied Bandwidth**

Page 2 of 4

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	PCS AMPLIFIER		
Configuration:	TX		



Notes: ANALOG INPUT

Test Data – Occupied Bandwidth

Dallas Headquarters:
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Lewisville, TX 75057
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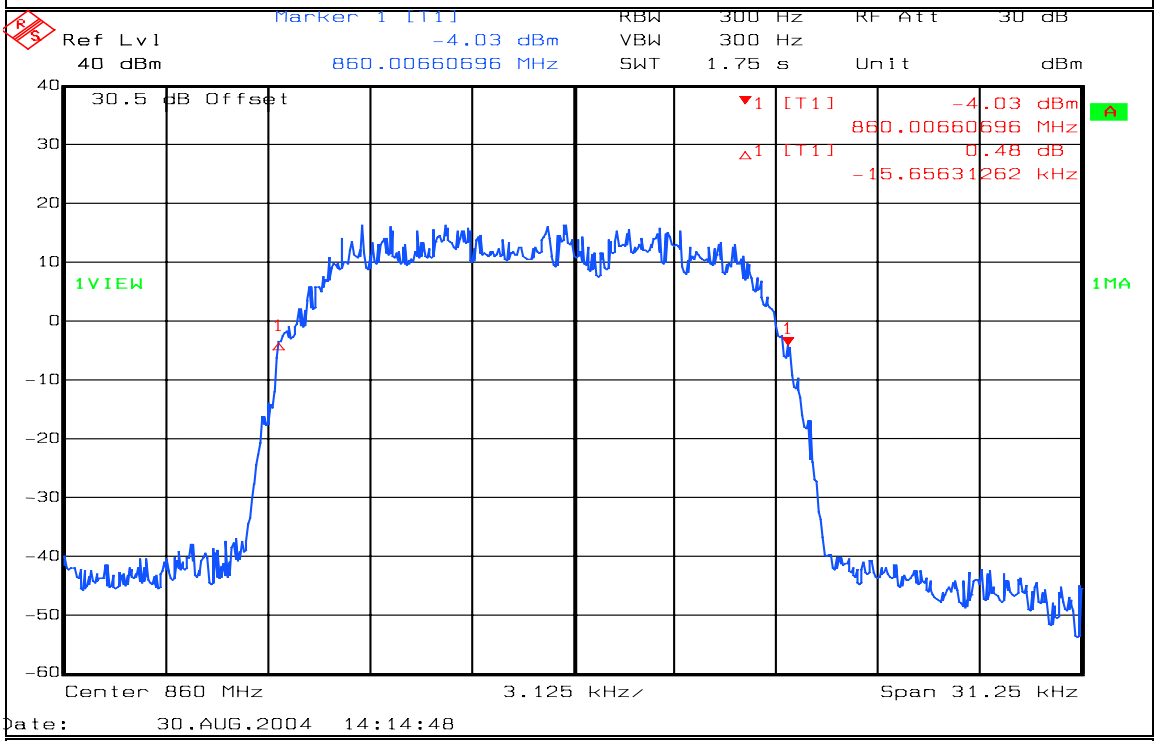
Nemko Dallas, Inc.

Data Plot — **Occupied Bandwidth**

Page 3 of 4

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	PCS AMPLIFIER		
Configuration:	TX		



Notes: **iDEN Output**
28 dBm

Test Data – Occupied Bandwidth

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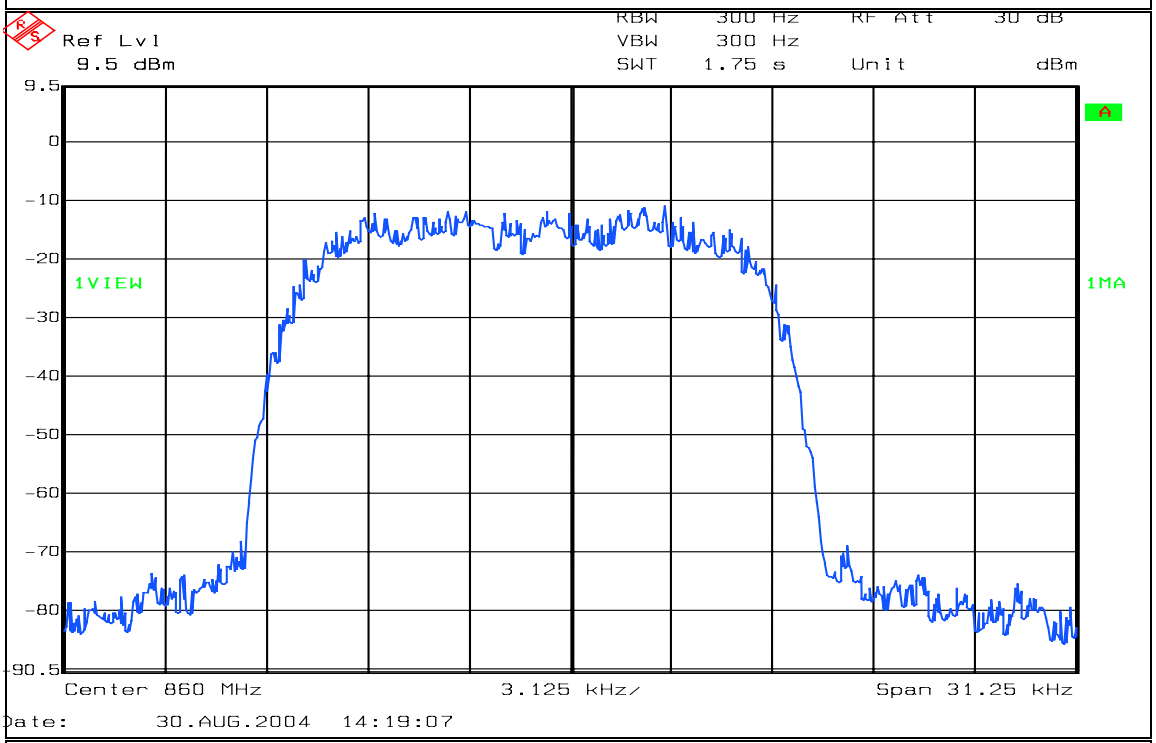
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Occupied Bandwidth**

Page 4 of 4

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	PCS AMPLIFIER		
Configuration:	TX		



Notes: iDEN Input

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 8/30/04

Test Results: Complies.

Test Data: See attached graph(s).

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.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 1 of 6 — Complete: X — Preliminary:

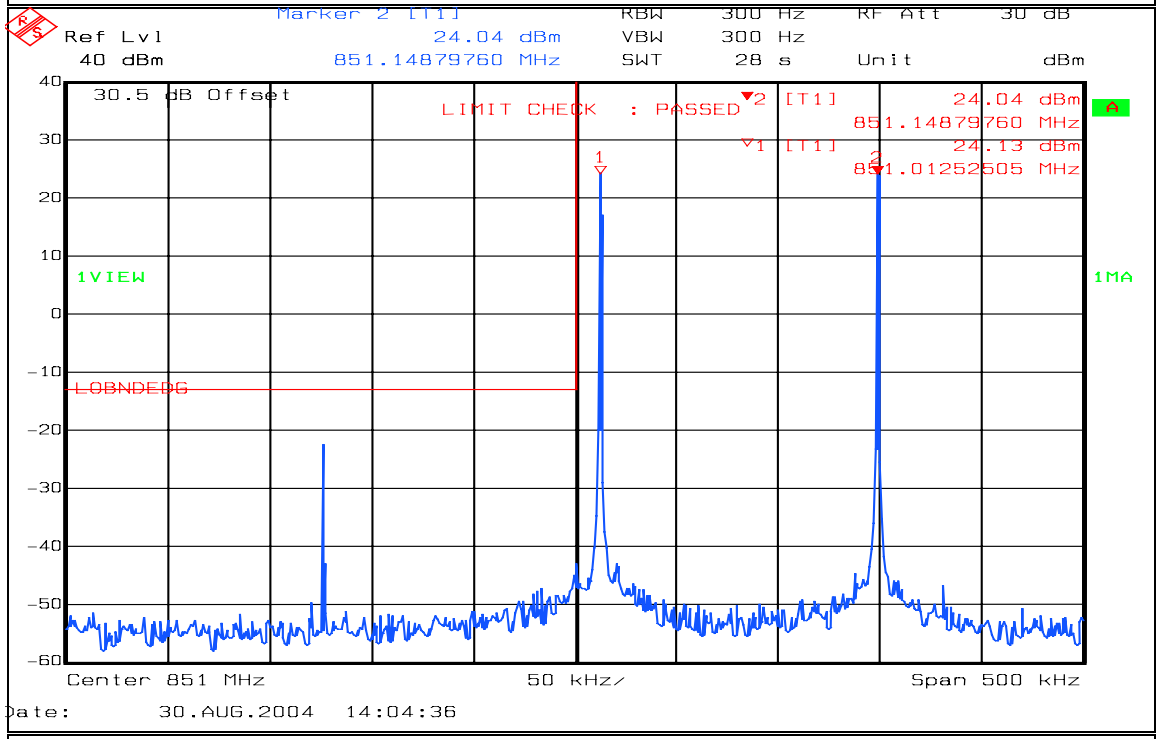
Job No.:	4L0571	Date:	8/30/2004		
Specification:	PT90	Temperature(°C):	25		
Tested By:	David Light	Relative Humidity(%)	40		
E.U.T.:	SMR Band AMPLIFIER				
Configuration:	TX				
Sample Number:	1				
Location:	Lab 1	RBW:	Refer to plots	Measurement Distance:	NA m
Detector Type:	Peak	VBW:	Refer to plots		

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1629
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1065	Cable #4:	
Attenuator #2:	1604	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes:
LOWER BAND EDGE
2 CHANNELS AT 24 dBm EACH
ANALOG

Test Data – Spurious Emissions at Antenna Terminals

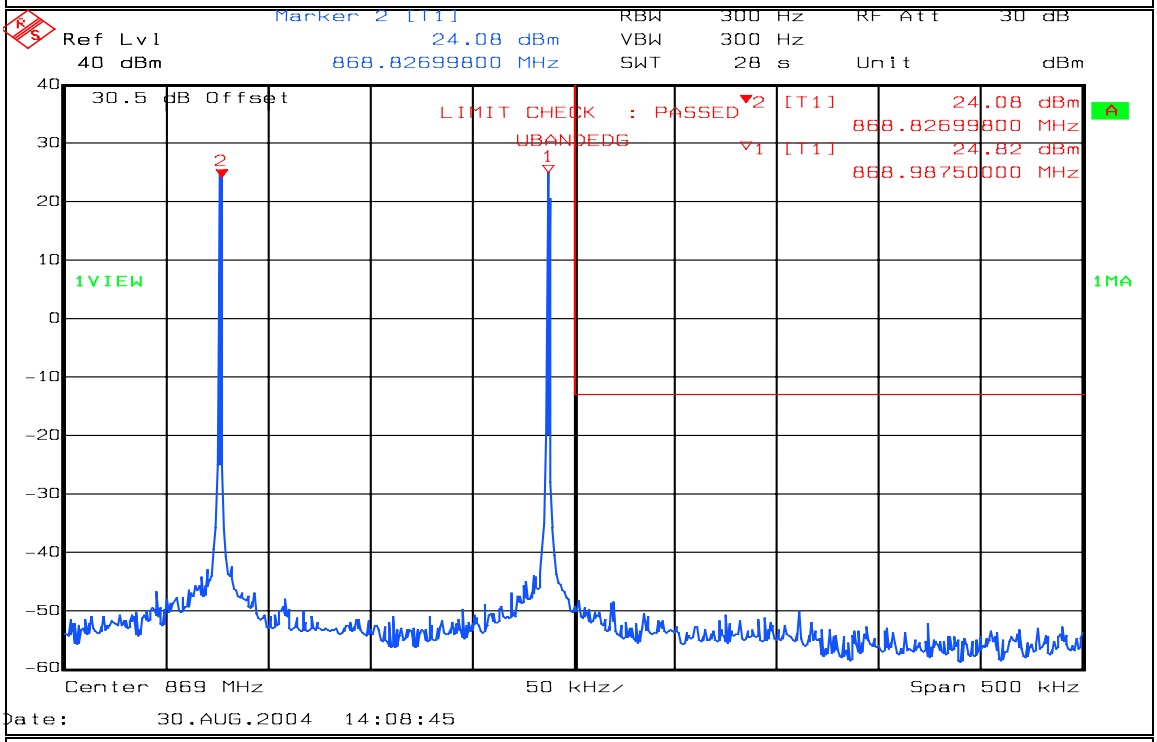
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 2 of 6

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	SMR Band AMPLIFIER		
Configuration:	TX		



Notes:
UPPER BAND EDGE - ANALOG
2 CHANNELS AT 24 dBm EACH
ANALOG

Test Data – Spurious Emissions at Antenna Terminals

Dallas Headquarters:
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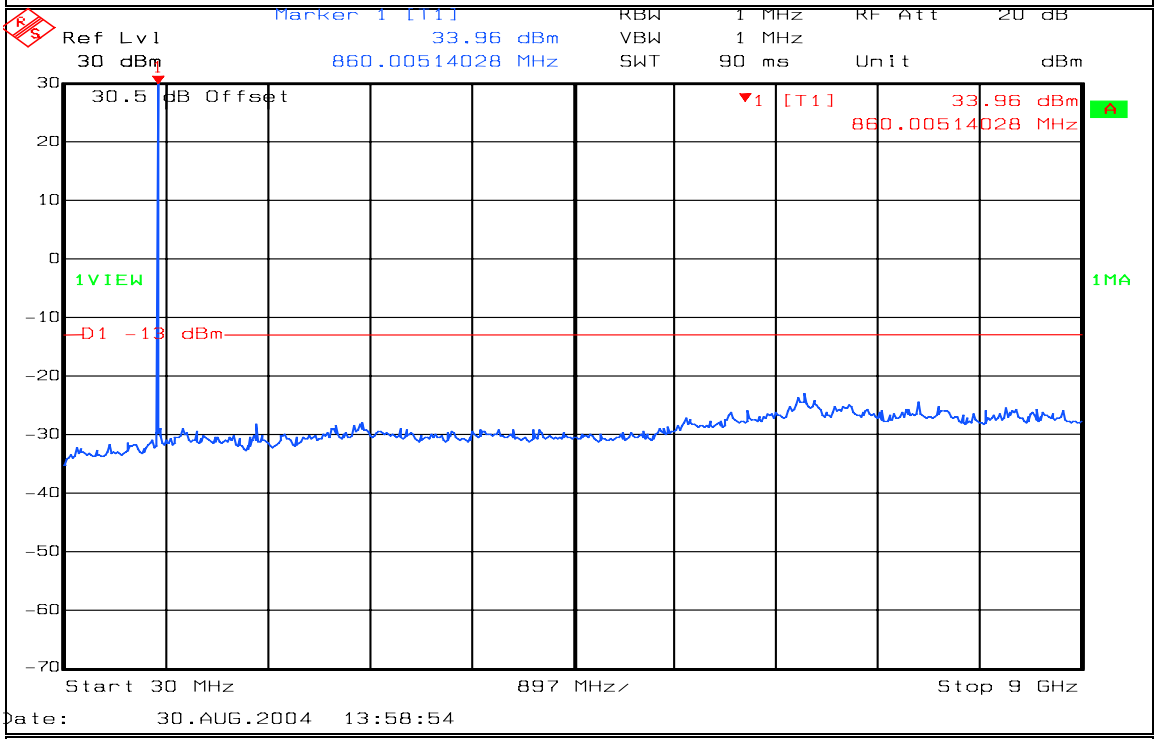
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 3 of 6

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	SMR Band AMPLIFIER		
Configuration:	TX		



Notes:
TX 860 MHz @ 34 dBm
The spectrum was searched in detail. This plot is a true indication of the emissions detected.
ANALOG

Test Data – Spurious Emissions at Antenna Terminals

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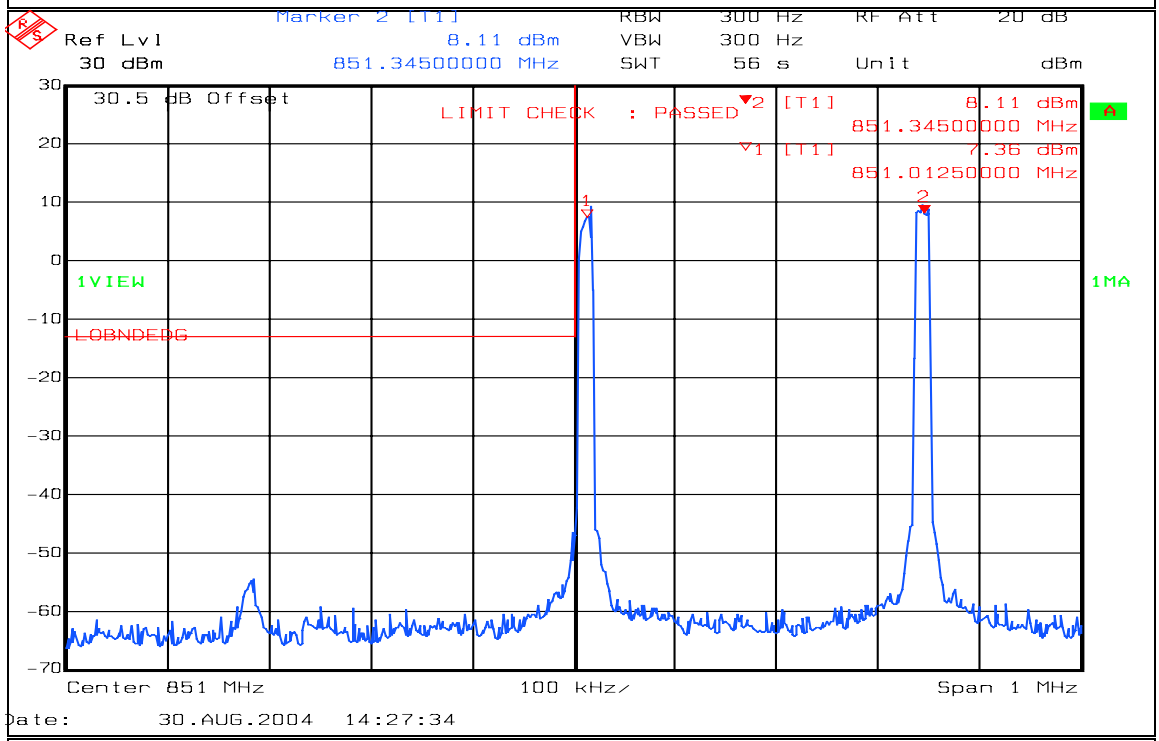
Nemko Dallas, Inc.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 4 of 6

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	SMR Band AMPLIFIER		
Configuration:	TX		



Notes: **iDEN Intermod**
21.5 dBm each

Test Data – Spurious Emissions at Antenna Terminals

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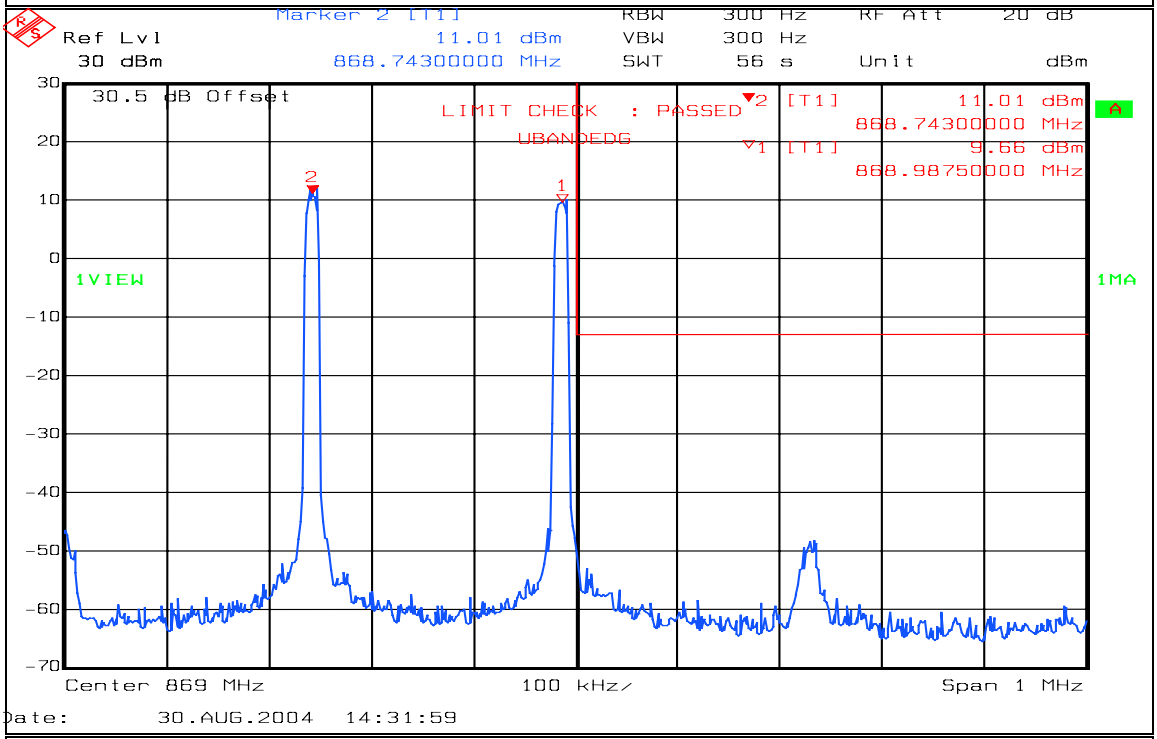
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 5 of 6

Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	SMR Band AMPLIFIER		
Configuration:	TX		



Notes: **iDEN intermod**
21.5 dBm each

Test Data – Spurious Emissions at Antenna Terminals

Dallas Headquarters:
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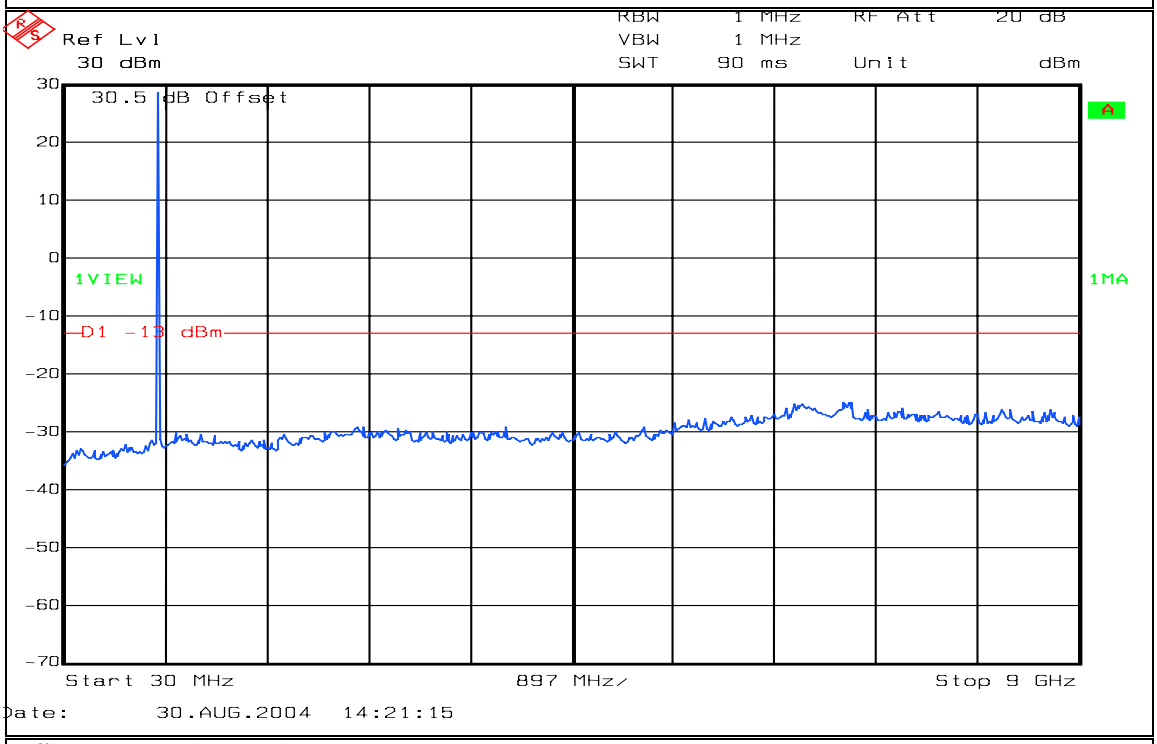
Nemko Dallas, Inc.

Data Plot — **Spurious Emissions at Antenna Terminals**

Page 6 of 6

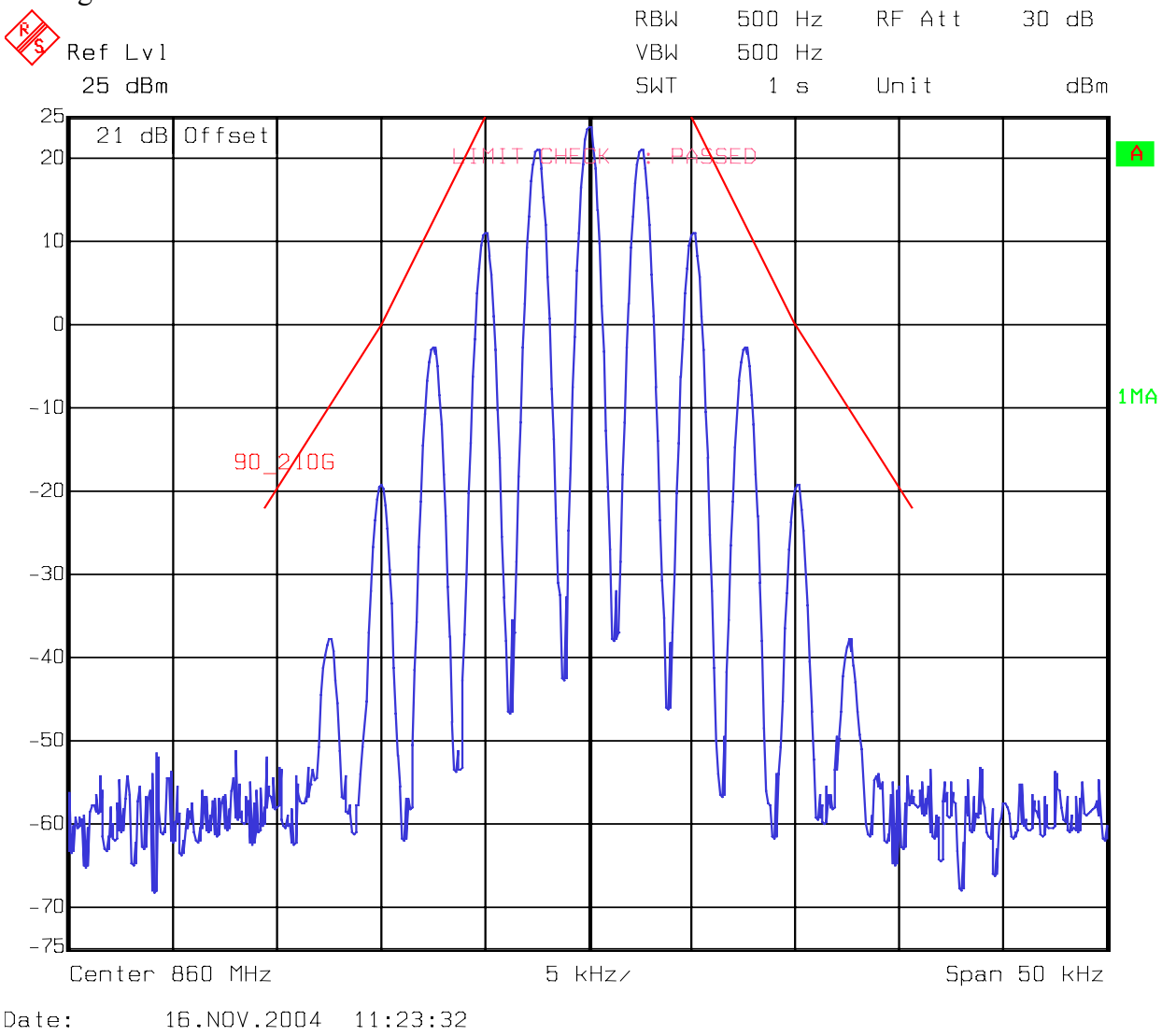
Job No.:	4L0571	Date:	8/30/2004
Specification:	PT90	Temperature(°C):	25
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	SMR Band AMPLIFIER		
Configuration:	TX		



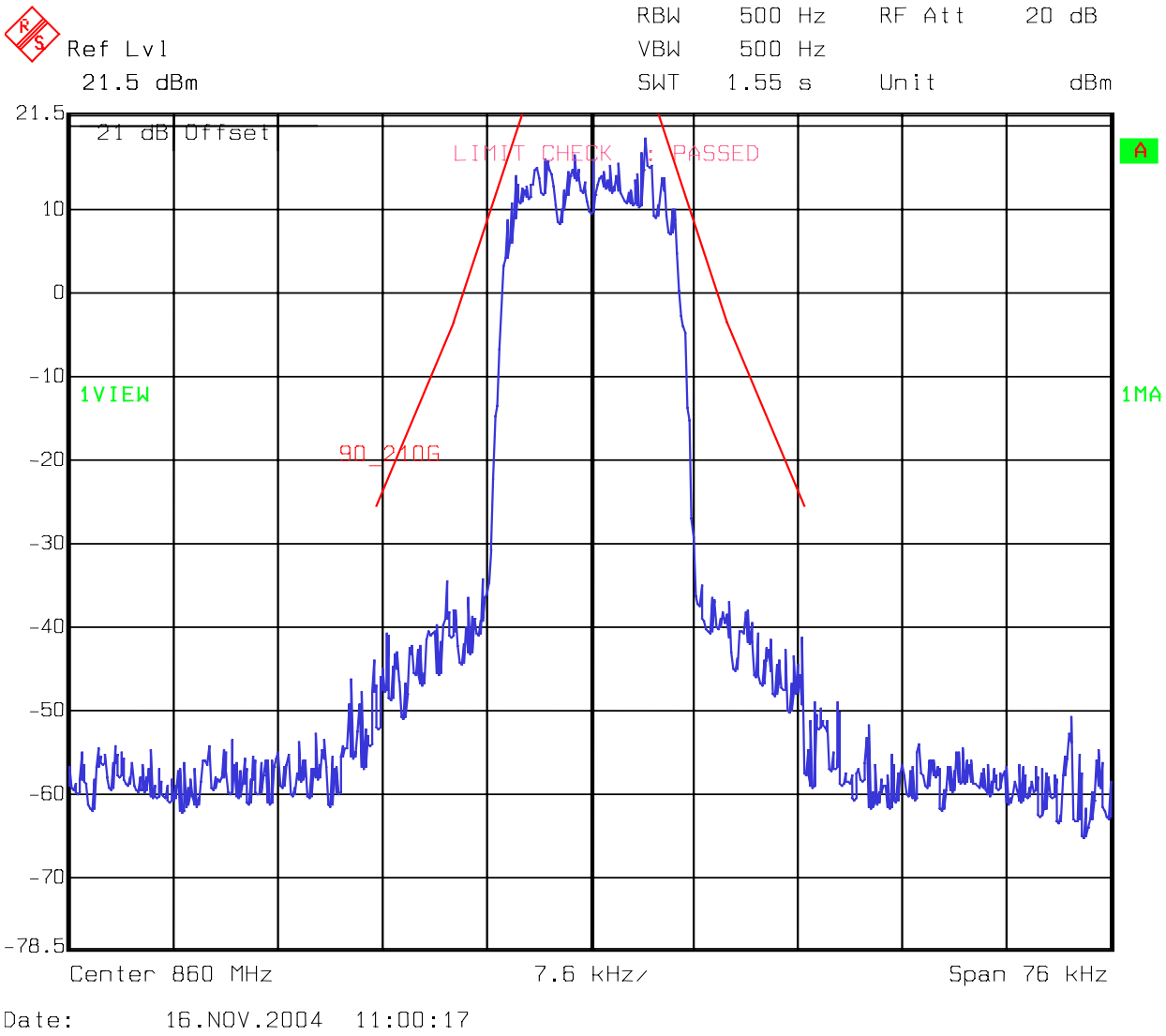
Notes: **Tx iDEN 860 MHz 28dBm**

MASK

Analog


RBW 500 Hz
RF Att 30 dB
VBW 500 Hz
SWT 1 s
Unit dBm
Ref Lvl
25 dBm
21 dB Offset
LIMIT CHECK: PASSED
90_210G
A
1MA
25
20
10
0
-10
-20
-30
-40
-50
-60
-70
-75
Center 860 MHz
5 kHz/
Span 50 kHz
Date: 16.NOV.2004 11:23:32

iDEN


Ref Lvl
21.5 dBm
RBW 500 Hz
VBW 500 Hz
SWT 1.55 s
RF Att 20 dB
Unit dBm
21 dB Offset
LIMIT CHECK: PASSED
A
1VIEW
1MA
90_210G
21.5
10
0
-10
-20
-30
-40
-50
-60
-70
-78.5
Center 860 MHz
7.6 kHz/
Span 76 kHz
Date: 16.NOV.2004 11:00:17

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Brian Boyea	DATE: 8/31/04

Test Results: Complies.

Test Data: There were no emissions detected within 20 dB of the specification of -13 dBm. The spectrum was searched to the 10^{th} harmonic of the carrier (860 MHz) with the amplifier operating at full rated power.

Equipment Used: 1304-1016-1464-1484-1485

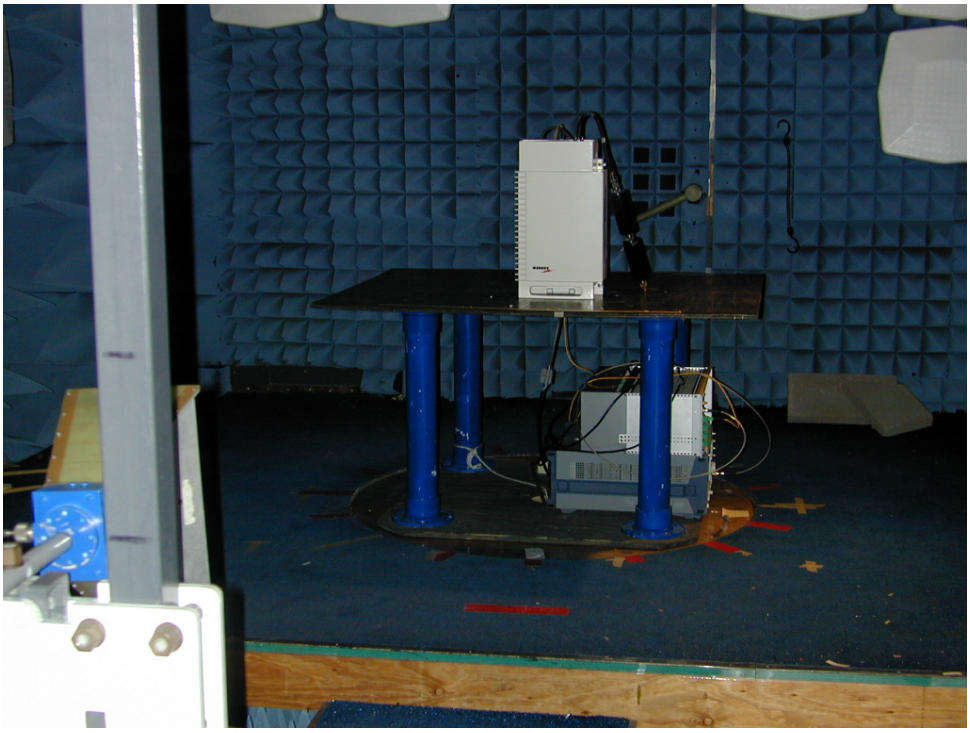
Measurement Uncertainty: +/- 1.7 dB

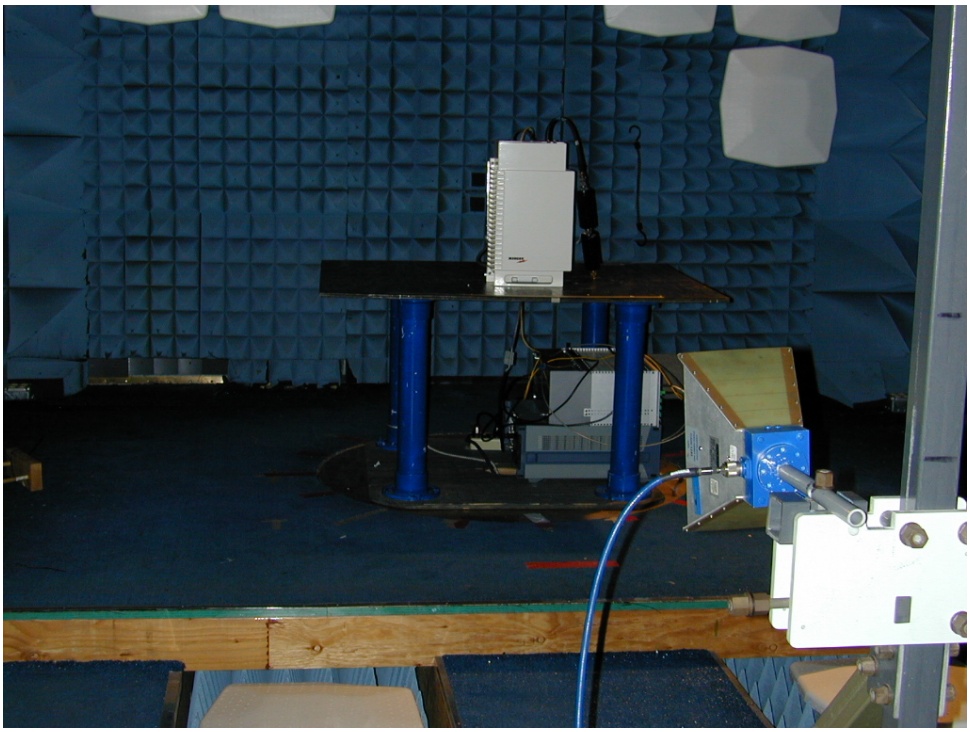
Temperature: 25 °C

Relative Humidity: 40 %

Note: See page A5 for applicable limit.

Photographs of Test Setup





Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/03	10/26/04
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	07/30/04	07/31/06
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
1065	ATTENUATOR	NARDA 776B-10	NONE	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A

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.

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.

Test Method:

The maximum field strength of the spurious emission is measured at a distance of 3 meters. The device under test is then replaced with a substitution antenna of known gain with respect to a ¼ wave dipole antenna. A calibrated signal source is used to feed the substitution antenna. The rf level to the substitution antenna is adjusted to repeat the previously measured field strength. The rf input level to the substitution antenna is the effective radiated power of the spurious emission after any correction for substitution antenna gain against a ¼ wave dipole.

The spectrum was searched up to the 10^{th} harmonic of the highest frequency generated in the device.

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

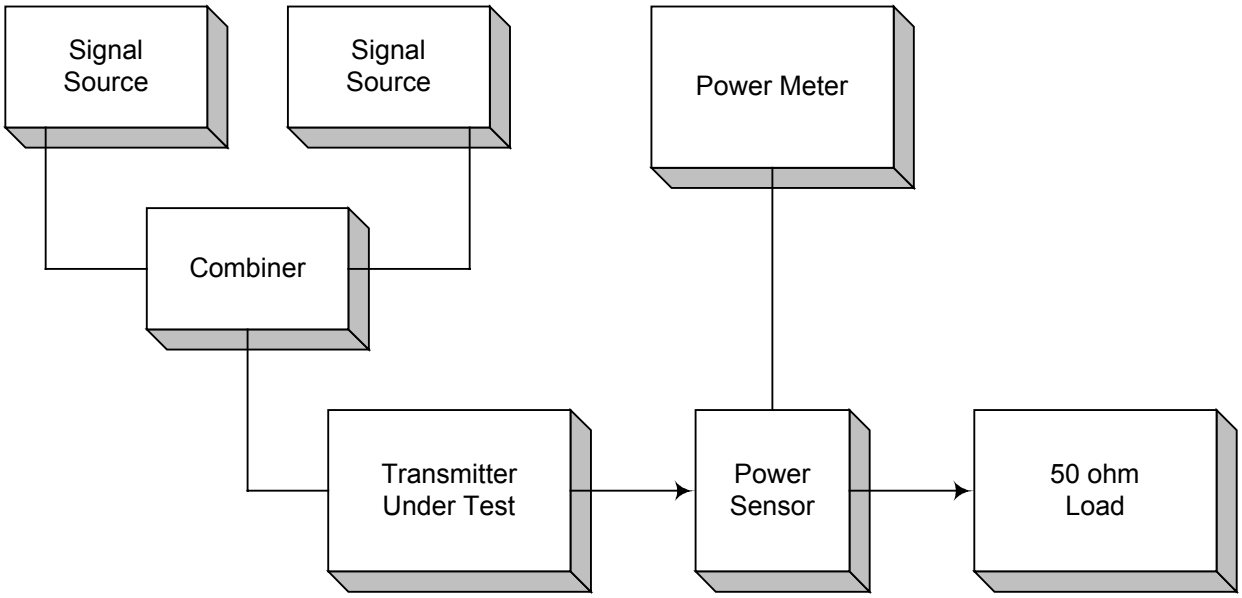
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

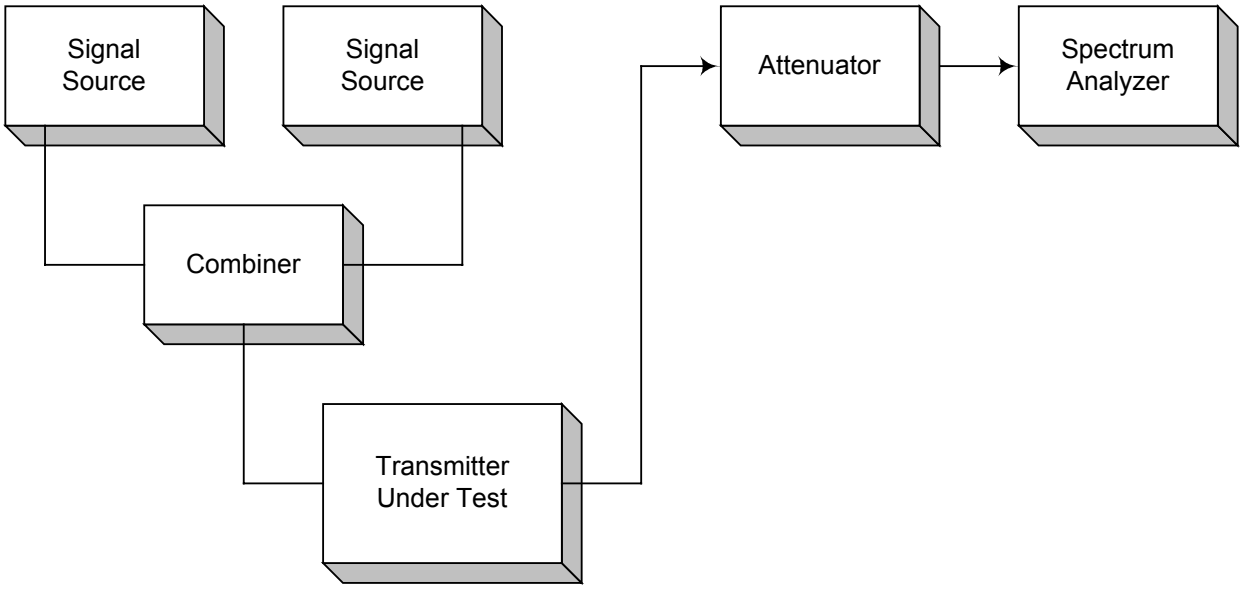
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 -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

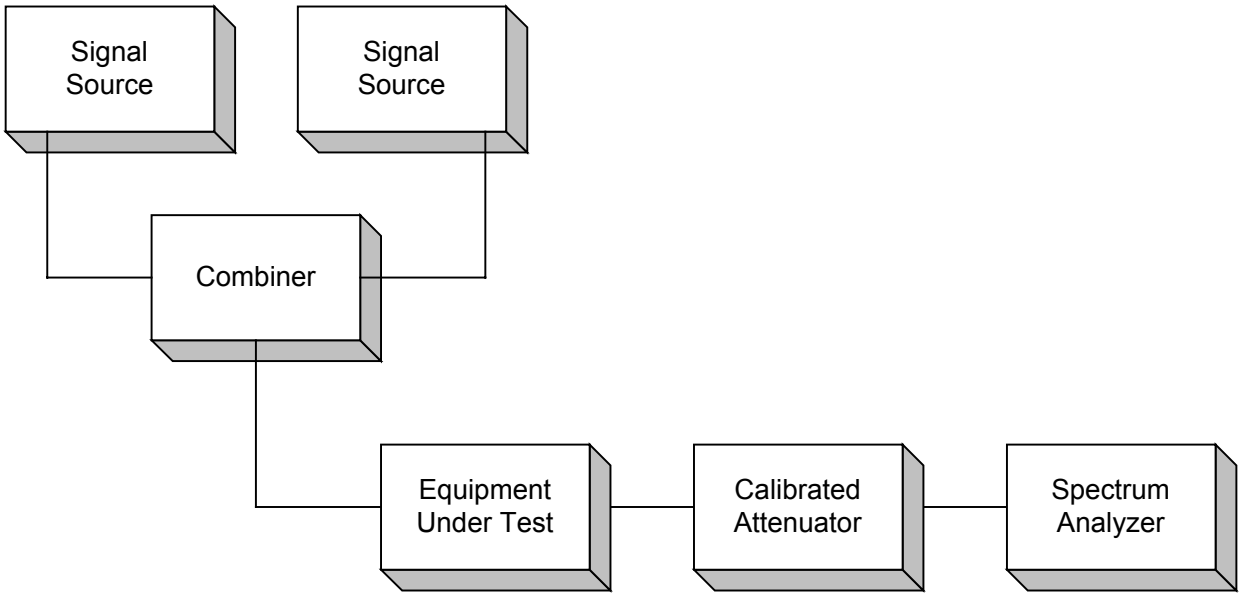
Para. No. 2.985 - R.F. Power Output



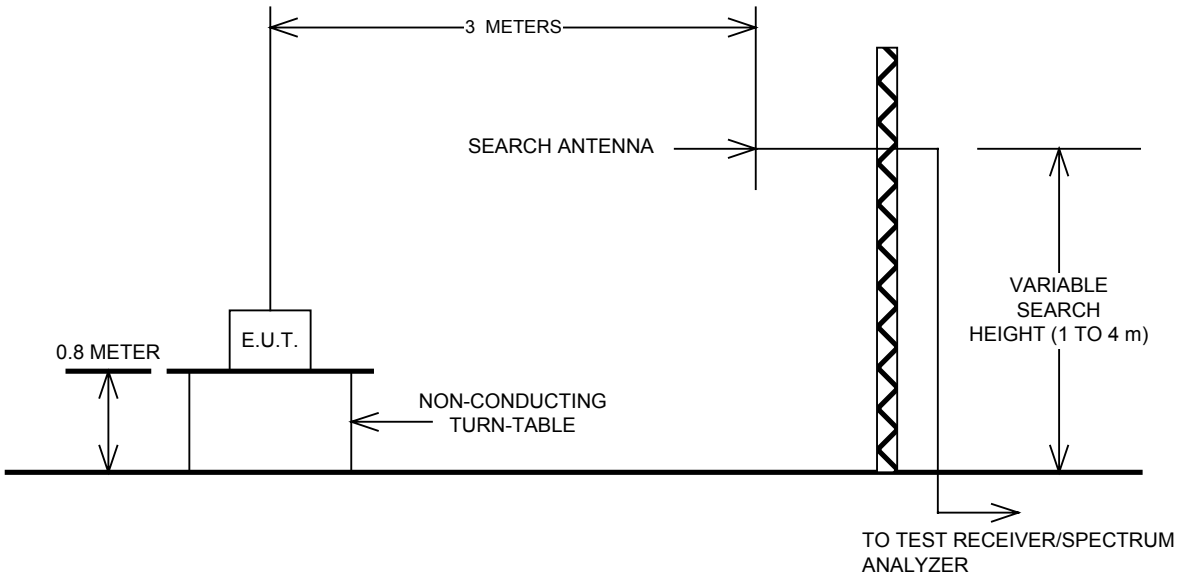
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability