Nemko Test Report:	1L0025RUS1
Applicant:	Andrew Corporation
Equipment Under Test:	InCell Fiber Optic Distributed Antenna System Model: SMR Repeater
FCC ID:	KUWINCELLSMR
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:	February, 2001
Total Number of Pages:	34

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: Incell SMR Repeater

Serial No.:

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	M	P	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".

NVLAP®

NVLAP LAB CODE: 100426-0

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205		19.7 dBm	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A	N/A
Occupied Bandwidth	90.210	Plots	Plots	Complies
Spurious Emissions at Antenna Terminals	90.210	Plots	Plots	Complies
Field Strength of Spurious Emissions	90.210	-13 dBm	> -13 dBm	Complies
Frequency Stability	90.213	N/A	N/A	N/A
Transient Frequency Behavior	90.214	N/A	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

Transmitter

Supply Voltage Input:	CDU RAU	120 VAC via power mains 24 Vdc via CDU
Frequency Range:		851-869 MHz
Tunable Bands:		851-869 MHz

Type(s) of Modulation:

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

Gain:		15 dB
Maximum Input:		0 dBm
Output Impedance:		50 Ohms
RF Power Output (rated):	**Voice:** **iDEN:**	+14 dBm (.024 W) +20 dBm (.100 W)
Operator Selection of Operating Frequency:		Not selectable
Power Output Adjustment Capability:		Not adjustable by user

Frequency Translation:

F1-F1	F1-F2	N/A
☒	☐	☐

Band Selection:

Software	Duplexer Change	Fullband Coverage
☐	☐	☒

Modifications Made During Testing

None

System Description

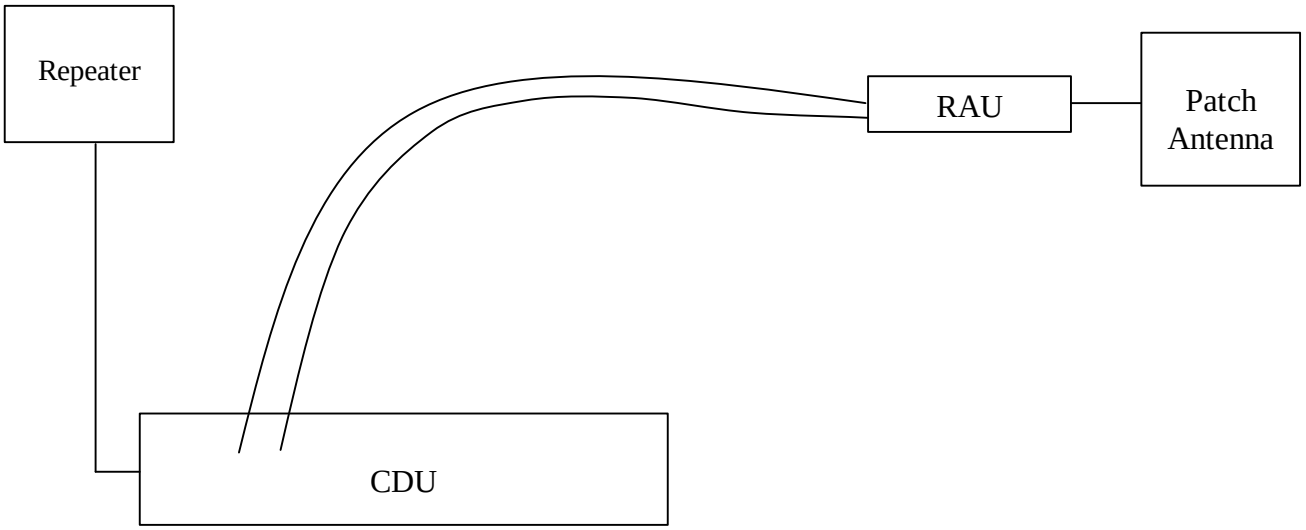
The EUT is a SMR band repeater system that uses fiber optic to distribute modulated rf signals from a base station or repeater to locations throughout a building. The system operates with a direct connection in the uplink direction.

The system is made up of two components:

1) CDU (Central Distribution Unit) - This unit is typically located in a wiring closet. Each CDU can interface to six RAU (Remote Antenna Units). The CDU collects and distributes voice and data signals through fiber cable pairs. The CDU connects to the output of a repeater unit. The Uplink direction is a directly wired connection and cannot connect directly to an antenna. The transmit signals from the repeater are converted from rf to optical and distributed via the fiber cables to a RAU.
2) RAU (Remote Antenna Unit) - This unit converts the signal received from the CDU back to rf and transmits the rf to subscriber units within its coverage range. Conversely it receives the rf signals transmitted by the subscriber units, converts the rf to an optical signal and sends it to the CDU via fiber.

The overall rf gain of the system in the downlink direction is nominally 15 dB.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE: 15 Feb 2001

Test Results: Complies.

Measurement Data:

IDEN Modulation

Frequency (MHz)	Measured Power (dBm)
852	11.0
860	13.3
868	13.8

Voice Modulation

Frequency (MHz)	Measured Power (dBm)
852	19.2
860	19.7
868	19.6

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE:15 Feb 2001

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

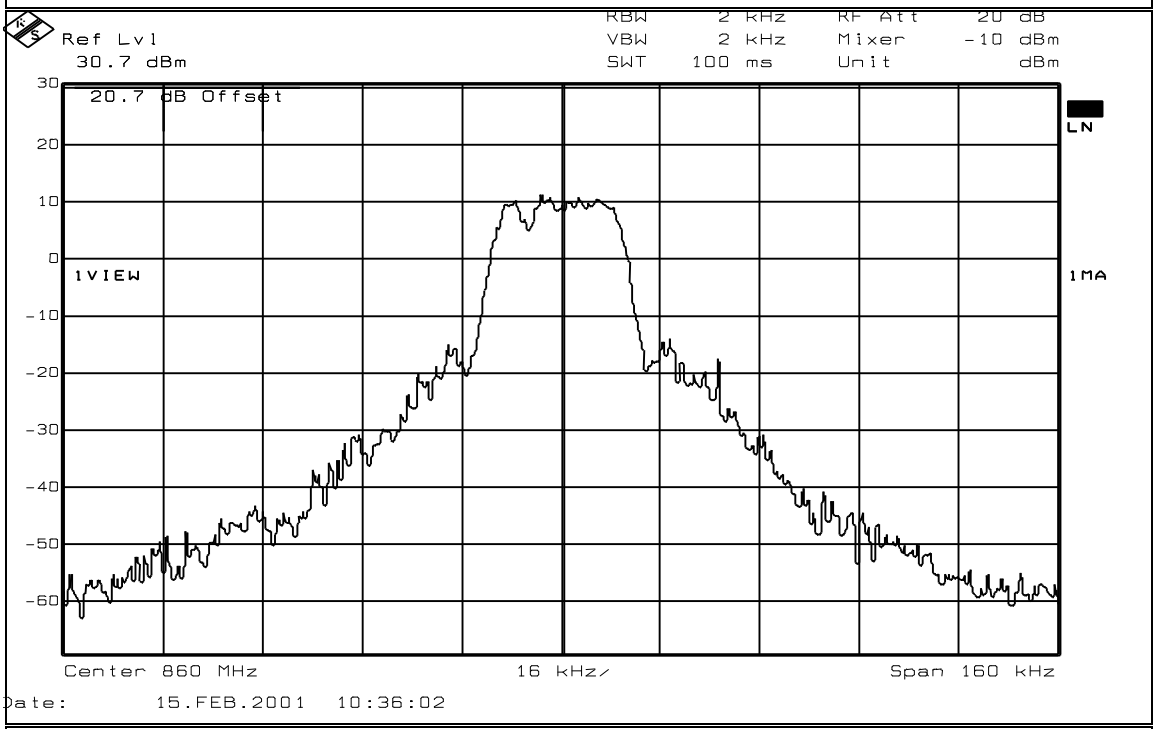
Complete X
Preliminary

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX FULL POWER		
Sample No.:	S02		
Location:	Lab 1	RBW:	REFER TO PLOTS
Detector Type:	Peak	VBW:	REFER TO PLOTS

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1082
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1475	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncert +/-3.6 dB



Notes: **OUTPUT SIGNAL - iDEN**

Test Data - Occupied Bandwidth

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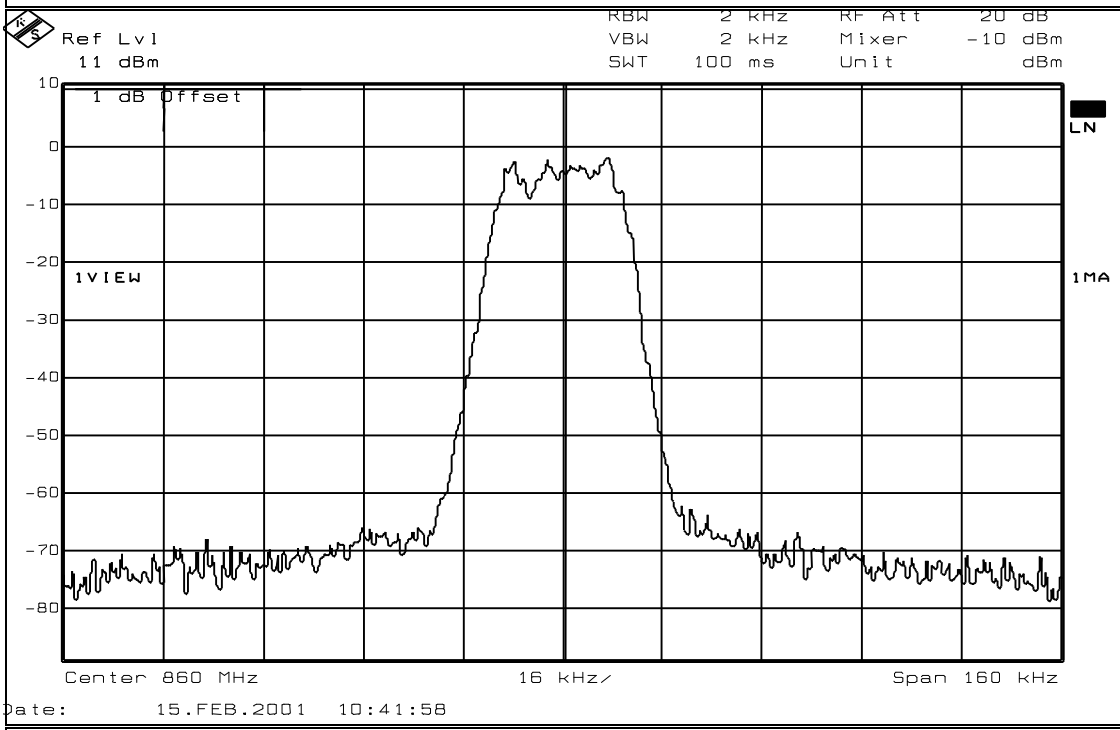
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot **Occupied Bandwidth**

Page 2 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX FULL POWER		



Notes: **INPUT SIGNAL - iDEN**

Test Data - Occupied Bandwidth

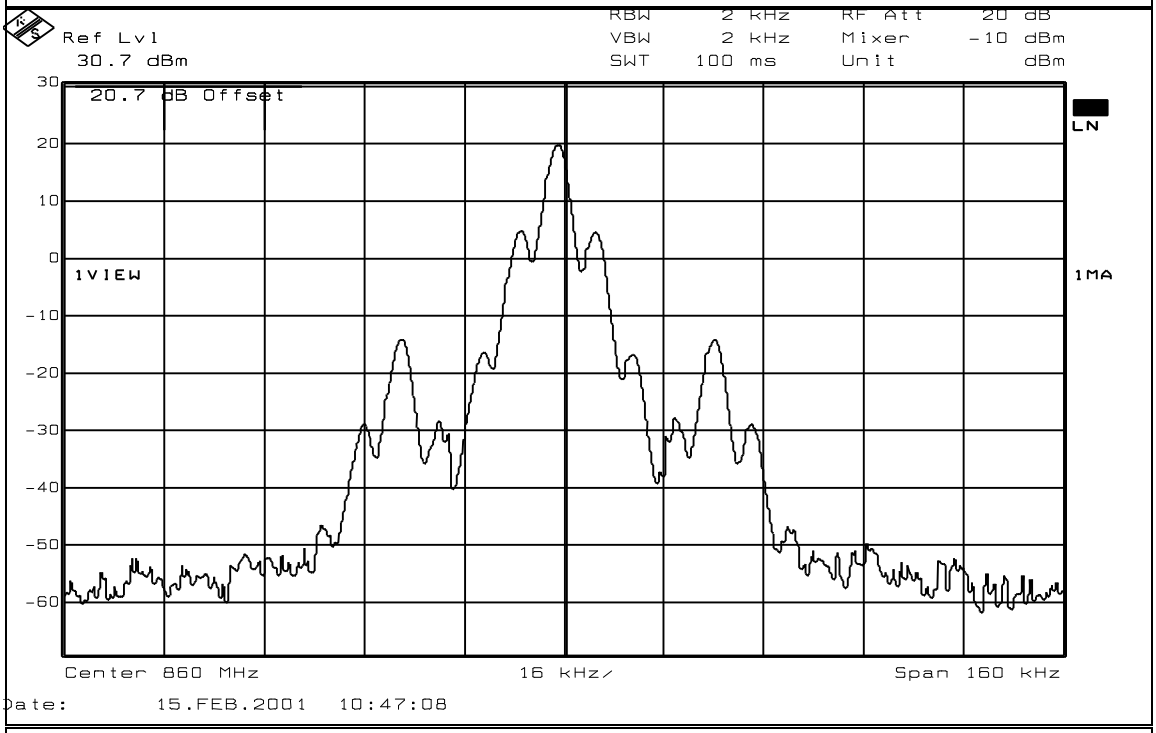
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot Occupied Bandwidth

Page 3 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX FULL POWER		



Notes: **OUTPUT SIGNAL - VOICE**

Test Data - Occupied Bandwidth

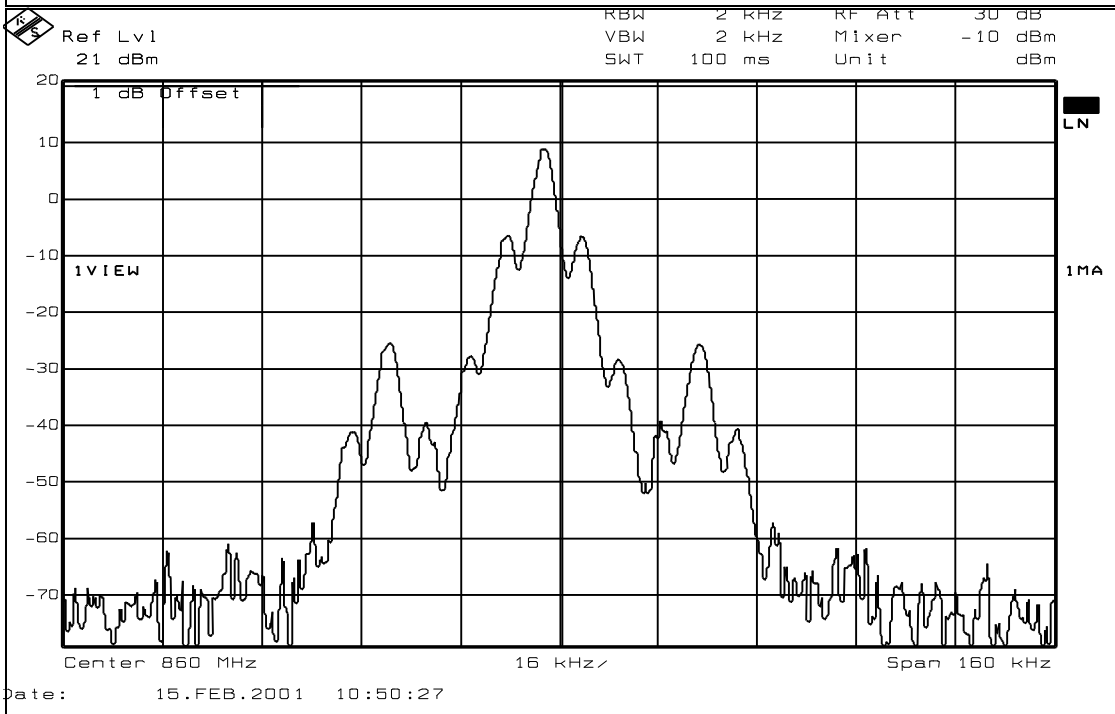
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Test Plot: Occupied Bandwidth

Page 4 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX FULL POWER		



Notes: **INPUT SIGNAL - VOICE**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE: 15 Feb 2001

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 **Intermodulation Characteristics**

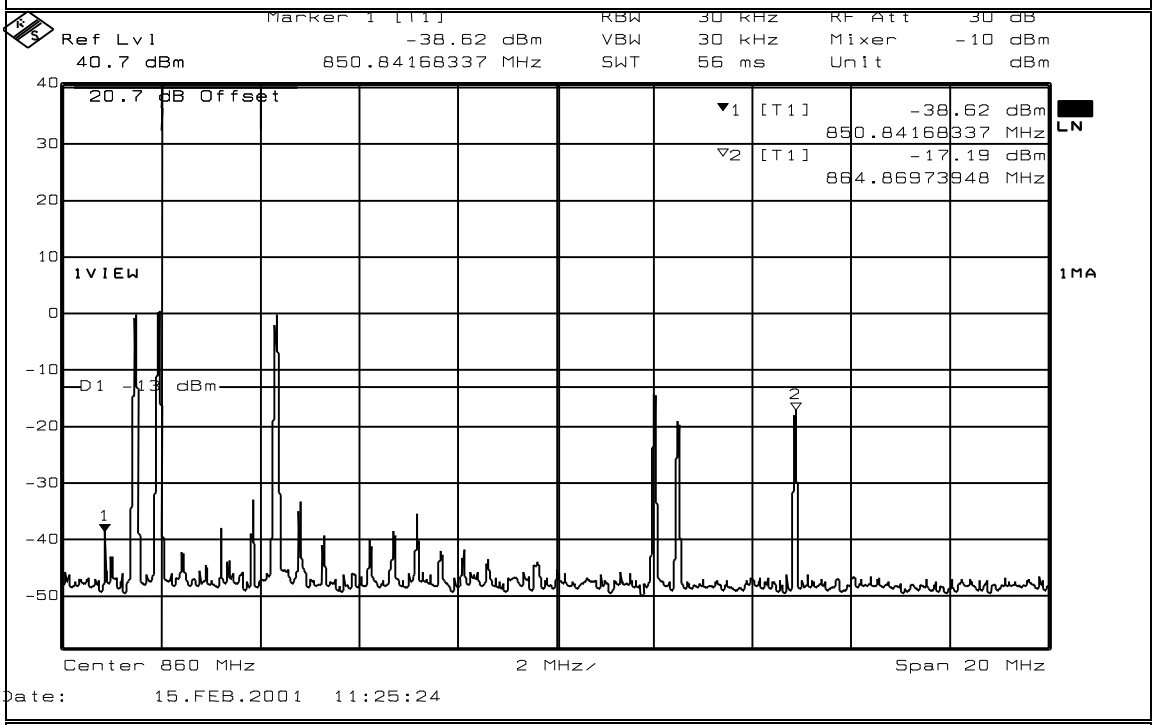
Page 1 of 2

Complete X
Preliminary

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX 3 SIGNALS FULL POWER		
Sample No.:	S02		
Location:	Lab 1	RBW:	30 kHz
Detector Type:	Peak	VBW:	30 kHz

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1082
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1475	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		



Notes:	**MARKER 1 INDICATES OUT OF BAND INTERMODULATION**
	MARKER 2 INDICATES INBAND INTERMODULATION
	iDEN Modulation

Test Data - Spurious Emissions at Antenna Terminals

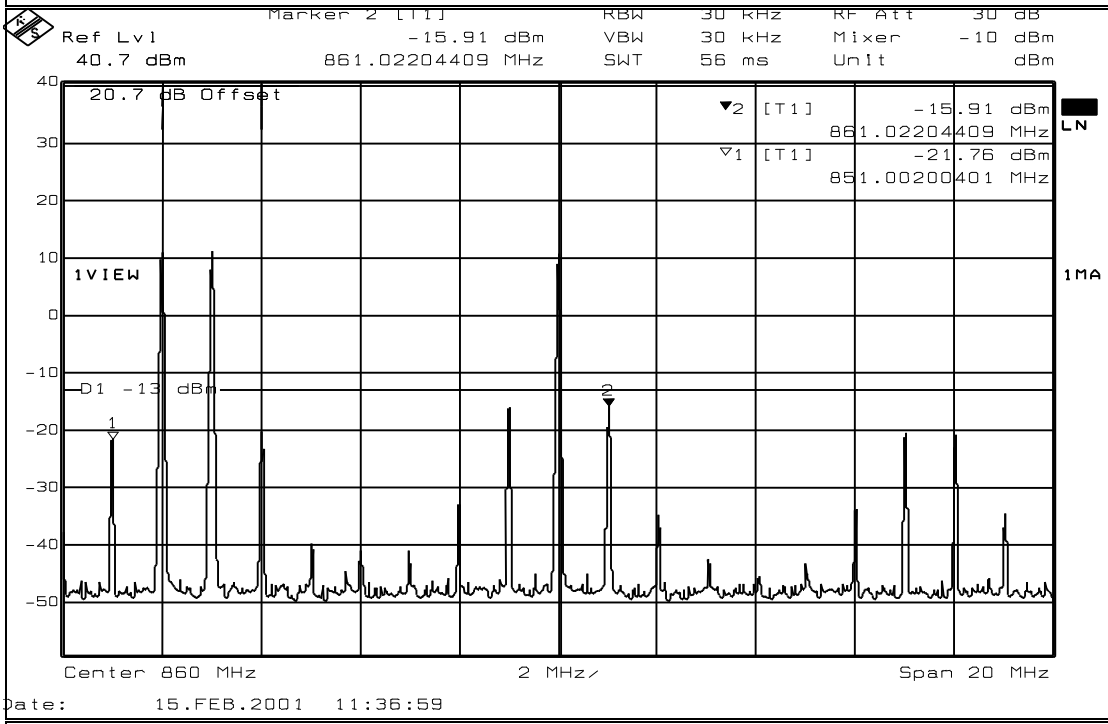
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot **Intermodulation Characteristics**

Page 2 of 2

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPEATER		
Configuration:	TX 3 SIGNALS FULL POWER		



Notes:
MARKER 1 INDICATES OUT OF BAND INTERMODULATION
MARKER 2 INDICATES INBAND INTERMODULATION
Voice Modulation

Test Data - Spurious Emissions at Antenna Terminals

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

Data Plot Antenna Port Spurious Emissions

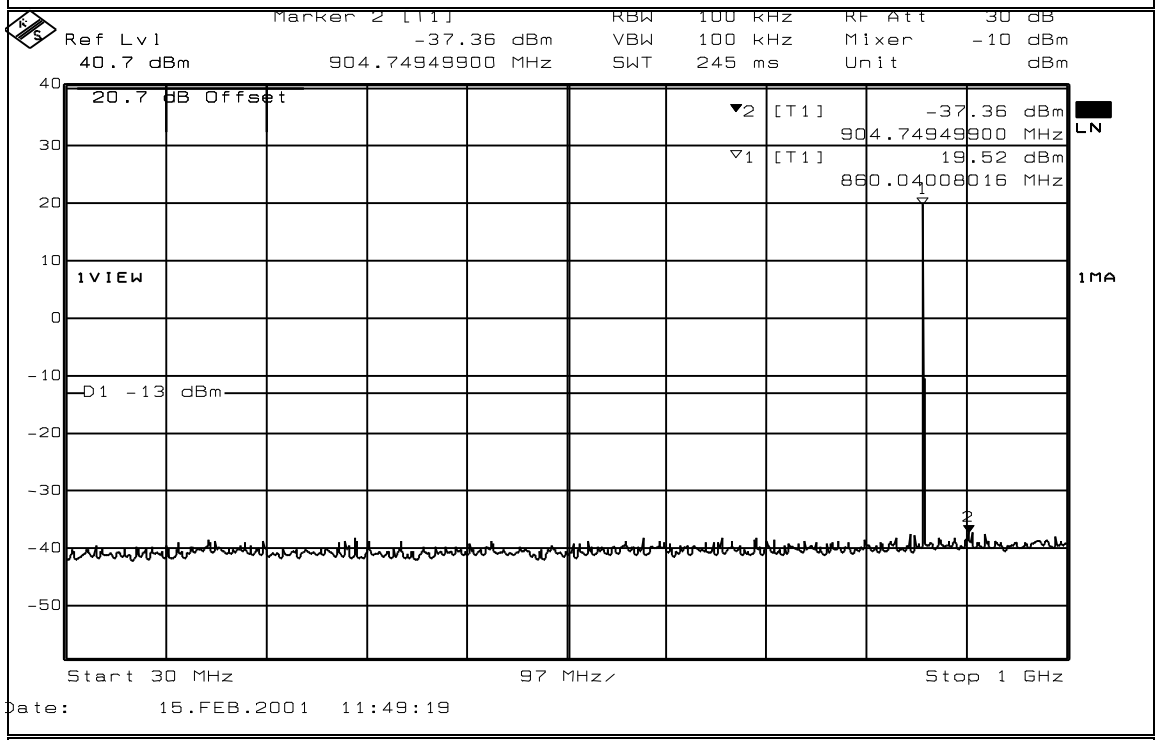
Page 1 of 4

Complete X
Preliminary

Job No.: 1L0025R Date: 02/15/01
Specification: PART 90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: INCELL SMR REPAETER
Configuration: TX FULL POWER
Sample No.: S02
Location: Lab 1 RBW: Refer to plots
Detector Type: Peak VBW: Refer to plots

Test Equipment Used

Antenna: Directional Coupler:
Pre-Amp: Cable #1: 1082
Filter: Cable #2:
Receiver: 1036 Cable #3:
Attenuator #1 1475 Cable #4:
Attenuator #2: Mixer:
Additional equipment used:
Measurement Uncertainty: +/-3.6 dB



Notes: **MARKER 1 INDICATES CARRIER**
MARKER 2 INDICATES EMISSION
Voice modulation

Test Data - Spurious Emissions at Antenna Terminals

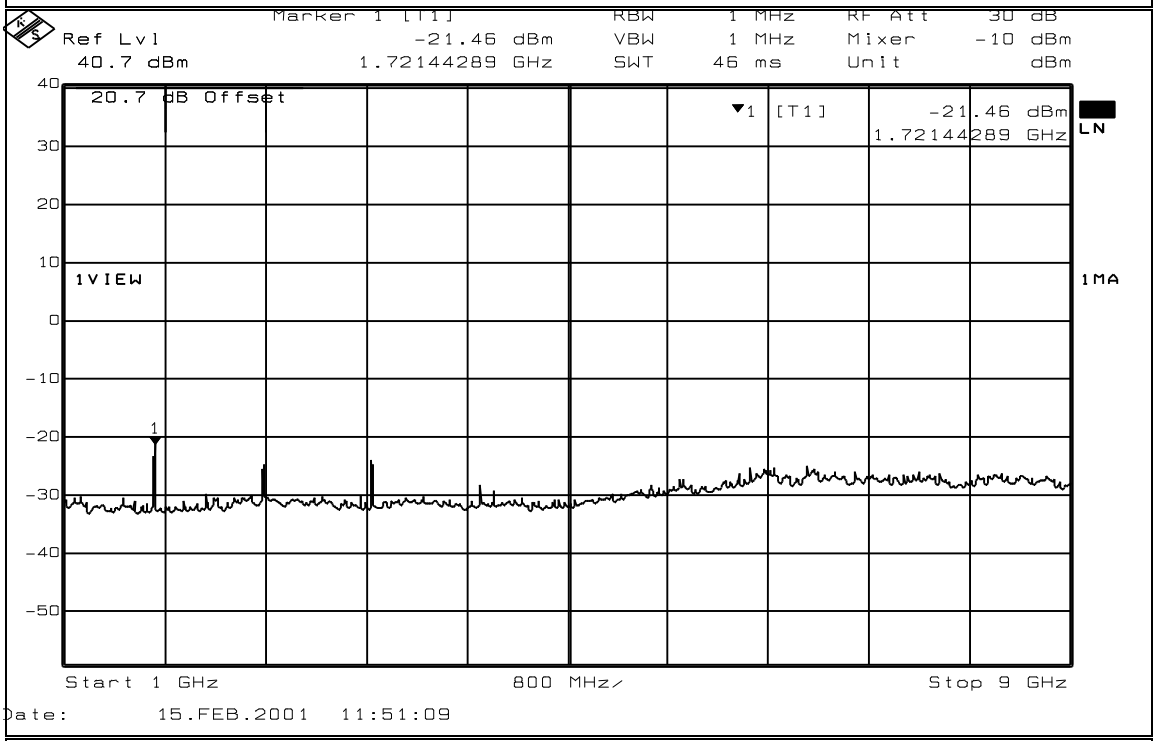
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot Antenna Port Spurious Emissions

Page 2 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPAETER		
Configuration:	TX FULL POWER		



Notes: **Voice Modulation**

Test Data - Spurious Emissions at Antenna Terminals

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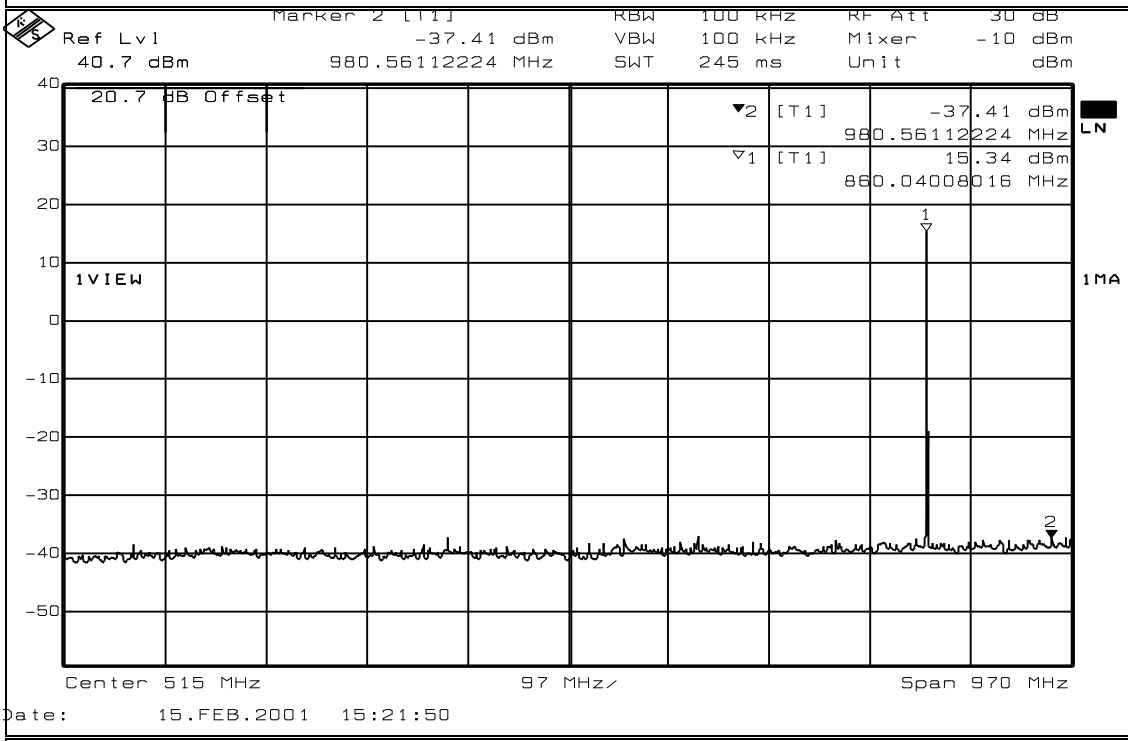
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot Antenna Port Spurious Emissions

Page 3 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPAETER		
Configuration:	TX FULL POWER		



Notes:
MARKER 1 INDICATES CARRIER
MARKER 2 INDICATES EMISSION
iDEN Modulation

Test Data - Spurious Emissions at Antenna Terminals

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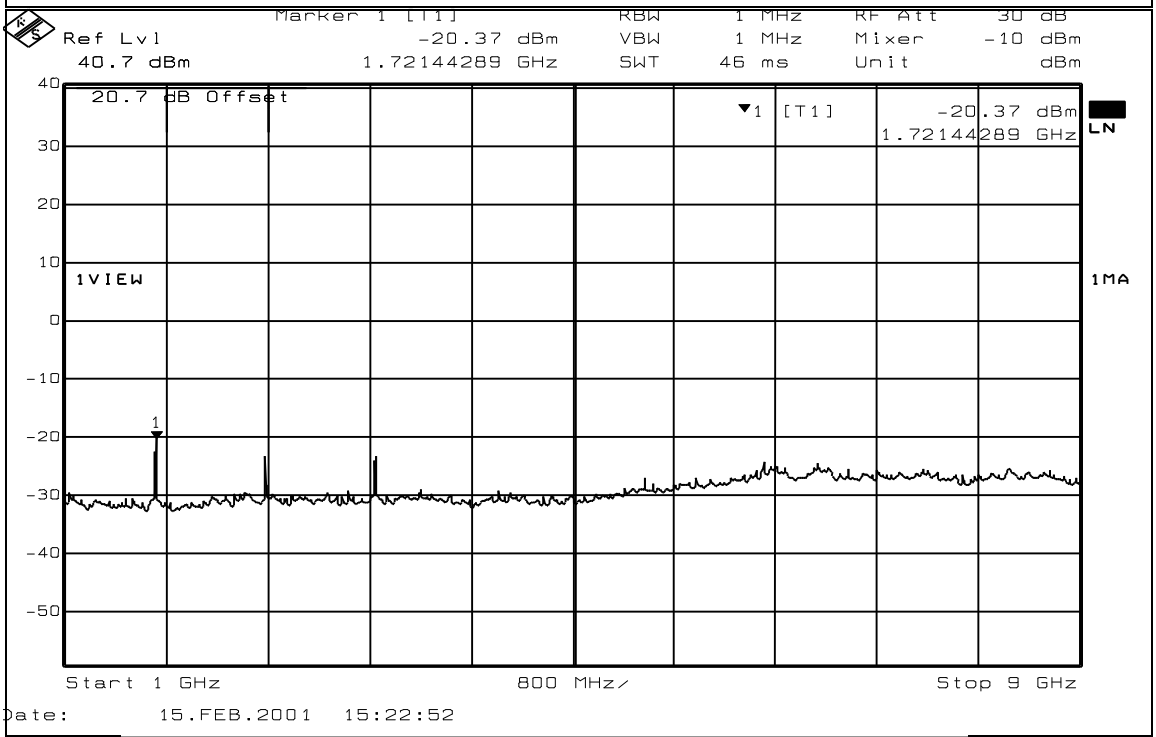
Fax: (972) 436-2667

Nemko Dallas, Inc.

Test Plot: Antenna Port Spurious Emissions

Page 4 of 4

Job No.:	1L0025R	Date:	02/15/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	INCELL SMR REPAETER		
Configuration:	TX FULL POWER		



Notes: **iDEN Modulation**

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David LightTom Tidwell & Debbie Jensen	DATE: 16 Feb 2001

Test Results: Complies.

Test Data: See attached table.

Note: See page A5 for applicable limit.

Test Data - Radiated Emissions

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

Nemko Dallas, Inc.

Field Strength of Spurious Emissions

Page 1 of 1 Complete X
Job No.: 1L0025R Date: 2/16/01 Preliminary
Specification: PART 90 Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: INCELL SMR REPEATER
Configuration: TX FULL POWER MID BAND
Sample Number: S02
Location: AC 3 RBW: 1 MHz Measurement
Detector Type: Peak VBW: 500 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 Unc +/-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	-46.7	29.9		32.9	6.4		-43.4	0.000046	V	
2580	-53.7	35.6		33.3	8.0		-43.5	0.000045	V	
3440	-54.8	37.1		33.6	8.1		-43.2	0.000048	V	
4300	-61.2	42.8		33.2	7.9		-43.7	0.000043	V	
5160	-62.5	40.6		32.8	9.1		-45.6	0.000027	V	NOISE FLOOR
6020	-63.7	37.9		32.0	9.5		-48.3	0.000015	V	NOISE FLOOR
6880	-66.0	38.3		32.8	10.1		-50.4	0.000009	V	NOISE FLOOR
7740	-65.5	40.4		33.4	9.4		-49.0	0.000012	V	NOISE FLOOR
8600	-63.7	40.3		34.4	9.9		-47.9	0.000016	V	NOISE FLOOR
1720	-47.0	32.7		32.9	6.4		-40.9	0.000082	H	
2580	-55.0	34.6		33.3	8.0		-45.7	0.000027	H	
3440	-59.3	35.8		33.6	8.1		-49.0	0.000013	H	
4300	-63.0	35.2		33.2	7.9		-53.1	0.000005	H	NOISE FLOOR
5160	-62.5	36.3		32.8	9.1		-50.0	0.000010	H	NOISE FLOOR
6020	-63.7	36.6		32.0	9.5		-49.6	0.000011	H	NOISE FLOOR
6880	-66.0	37.8		32.8	10.1		-50.8	0.000008	H	NOISE FLOOR
7740	-65.5	39.8		33.4	9.4		-49.7	0.000011	H	NOISE FLOOR
8600	-63.7	41.8		34.4	9.9		-46.3	0.000023	H	NOISE FLOOR

Notes: SCANNED TO THE TENTH HARMONIC OF CARRIER
CHECKED THE AXIS - WORST CASE LYING FLAT

Photographs of Test Setup

FRONT VIEW

REAR VIEW

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: Tom Tidwell & Debbie Jensen	DATE:

Test Results: Complies/Does Not Comply.

Measurement Data: See attached tables.

Not Applicable

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/99 2 Yr Cycle
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01 2 Yr Cycle
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	05/25/00
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/00
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/00
1475	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W3	NONE	CBU
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99 2 Yr Cycle

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: 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**

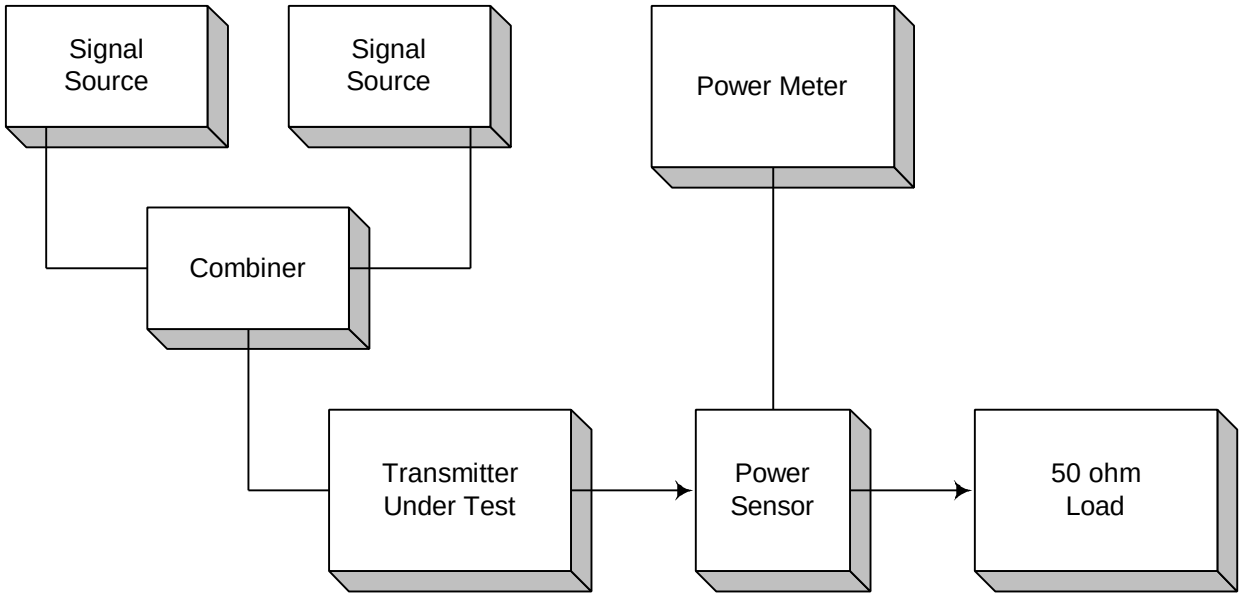
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

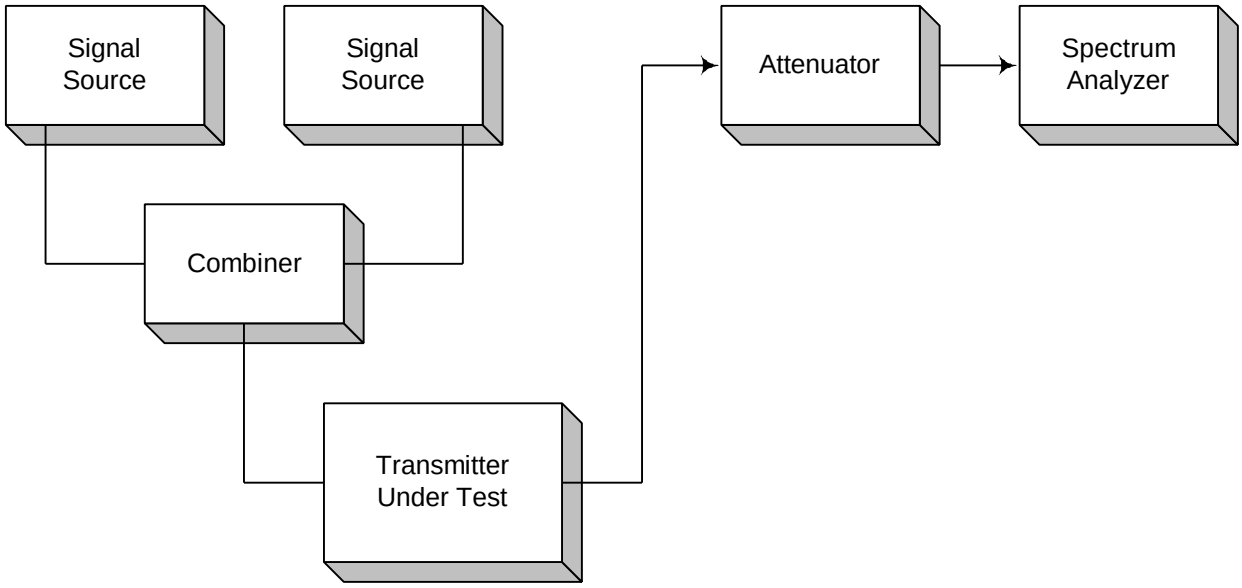
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 -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

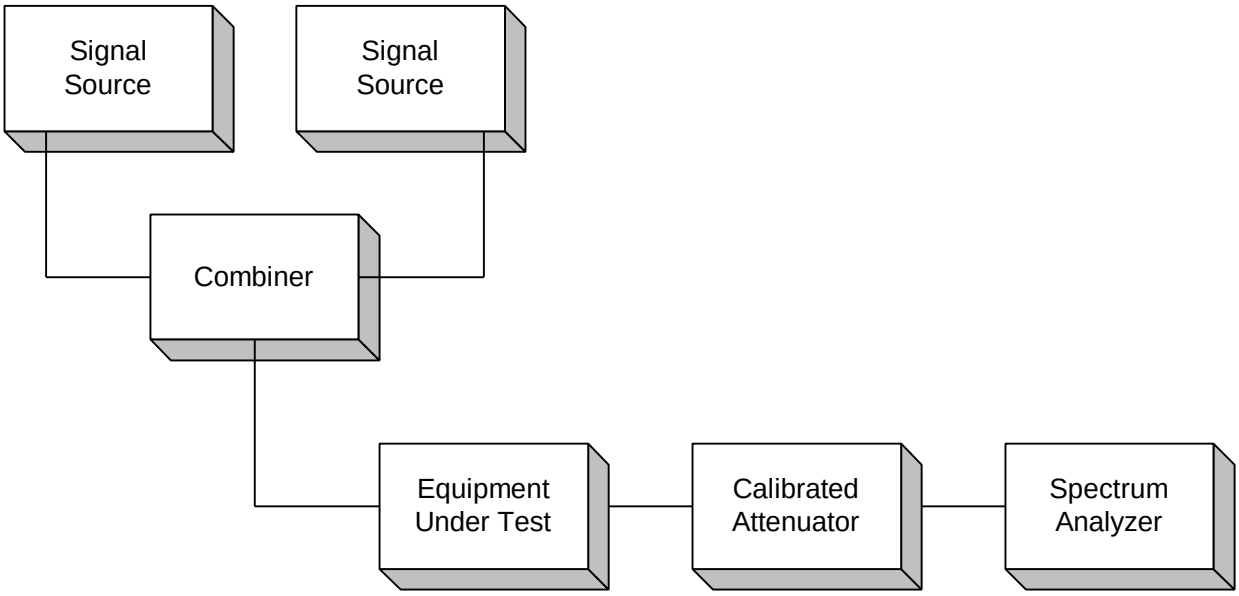
Para. No. 2.985 - R.F. Power Output



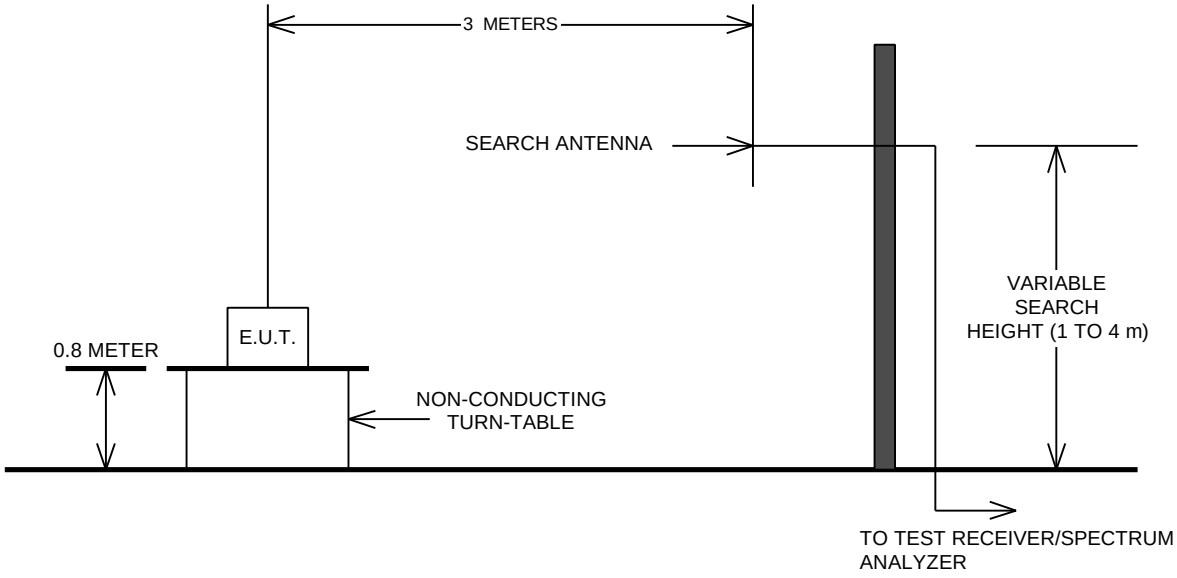
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability