Nemko Test Report:	2L0551RUS2
Applicant:	Aerial Facilities Limited
Equipment Under Test: (E.U.T.)	UHF2
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:	12/11/02
Total Number of Pages:	28

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Aerial Facilities Limited

Model No.: UHF2

Serial No.: 13401 G

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.	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.

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Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:		115 Vac
Frequency Range:		486.0625, 486.2875, 486.3125, and 486.5625 MHz
Tunable Bands:		Single fixed channels
Type(s) of Modulation:		**F3E (Voice)** ☒ **F1D** ☐ **F2D** ☐ **D7W (QAM)** ☐ **Other** ☐
Gain:		35 dB min.
Maximum Input:		-19 dBm
Output Impedance:		50 ohms
RF Power Output (rated):	**Single Channel:**	20 dBm (100 mW)
	Composite:	26 dBm (400 mW)
Channel Spacing(s):		25 kHz
Operator Selection of Operating Frequency:		Fixed
Power Output Adjustment Capability:		Manual (Attenuators)
Frequency Translation:		**F1-F1** ☒ **F1-F2** ☐ **N/A** ☐
Band Selection:		**Software** ☐ **Duplexer Change** ☒ **Fullband Coverage** ☐

Theory of Operation

The AFL Off air Amplifiers for the Pasadena Blue line project are 2 way on-band RF amplifiers. Their application is as an interface between the donor radio sites and the Fibre optic receivers and transmitters which will extend coverage to the locations via the fibre optic link. There are two units one designated for the 'UHF1' frequencies the other for the 'UHF2' frequencies.

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE:12/11/2002

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Measured Power (dBm)
486.0625	20
486.2875	20
486.3125	20
486.5625	20

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 12/11/2002

Test Results: Complies.

Test Data: See attached graph(s).

Test Data – Occupied Bandwidth (Input/Output)

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 2

Complete X
Preliminary:

Job No.:	2L0551R	Date:	12/11/2002
Specification:	PART 90	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	45
E.U.T.:	UHF2		
Configuration:	TX FULL POWER		
Sample Number:	1		
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots

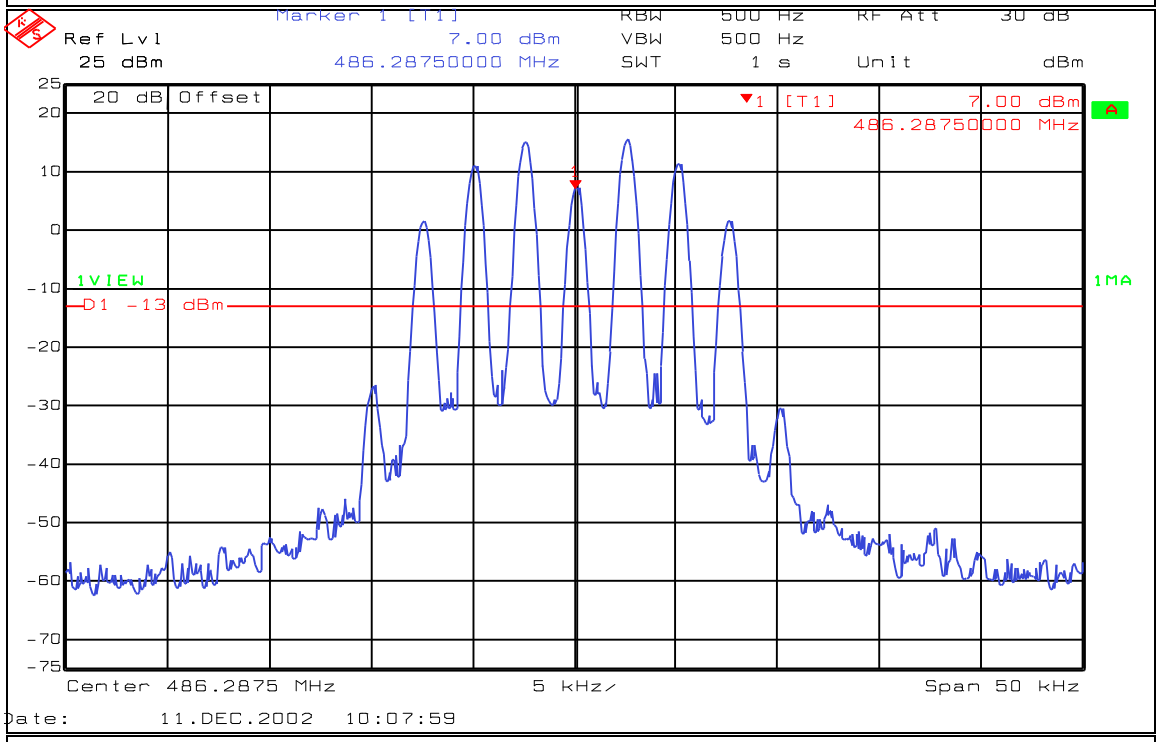
Measurement Distance: NA m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1083
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **OUTPUT SIGNAL 486.2875 MHz**
2.5 kHz TONE / 5 kHz DEVIATION

Test Data – Occupied Bandwidth (Input/Output)

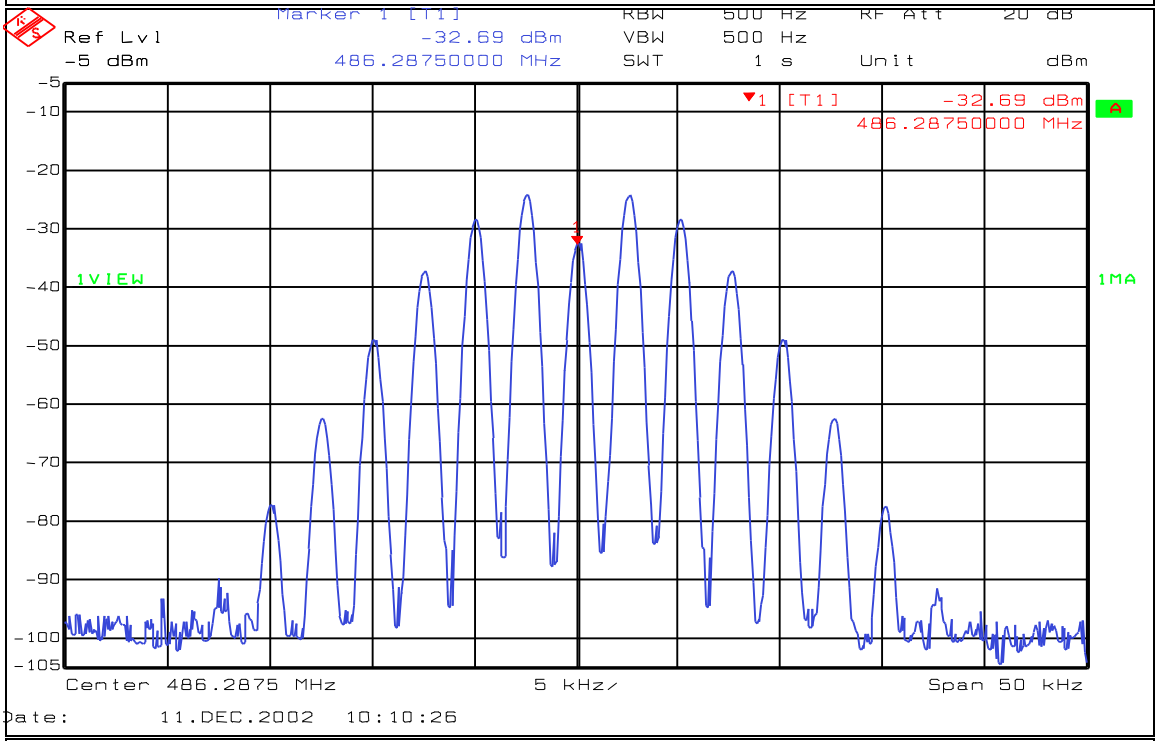
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — **Occupied Bandwidth**

Page 2 of 2

Job No.:	2L0551R	Date:	12/11/2002
Specification:	PART 90	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	45
E.U.T.:	UHF2		
Configuration:	TX FULL POWER		



Notes: **INPUT SIGNAL**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE:12/11/2002

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

Job No.: 2L0551R Date: 12/11/2002 Preliminary:

Specification: PART 90 Temperature(°C): 20

Tested By: David Light Relative Humidity(%) 45

E.U.T.: UHF2

Configuration: TX 3 CHANNELS 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:

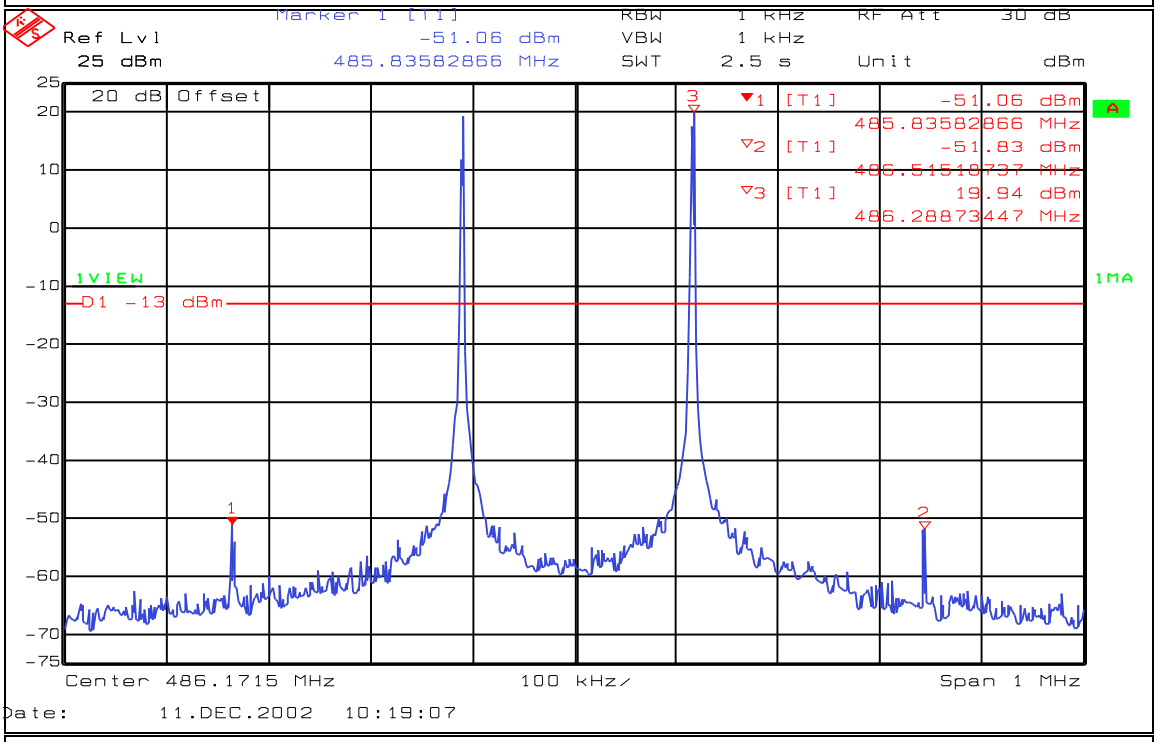
Receiver: 1036 Cable #3:

Attenuator #1 1064 Cable #4:

Attenuator #2: Mixer:

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **MARKERS 1 AND 2 INDICATE INTERMOD LEVELS**
MARKER 3 INDICATES CARRIER LEVEL
INPUT SIGNALS 486.2875 MHz and 486.0625 MHz

Test Data – Spurious Emissions at Antenna Terminals

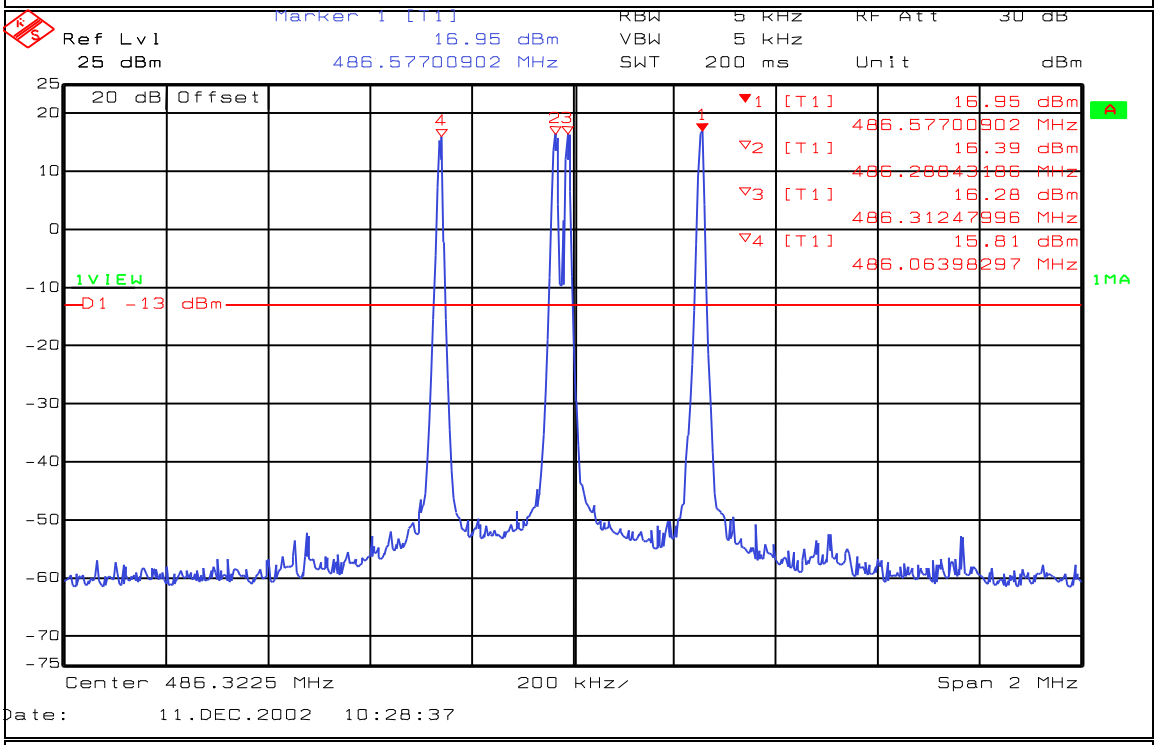
Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot **Intermodulation Characteristics**

Page 2 of 2

Job No.: 2L0551R Date: 12/11/2002
Specification: PART 90 Temperature(°C): 20
Tested By: David Light Relative Humidity(%) 45
E.U.T.: UHF2
Configuration: TX 3 CHANNELS FULL POWER



Notes: **Markers indicate 4 carriers**

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 1 Complete X

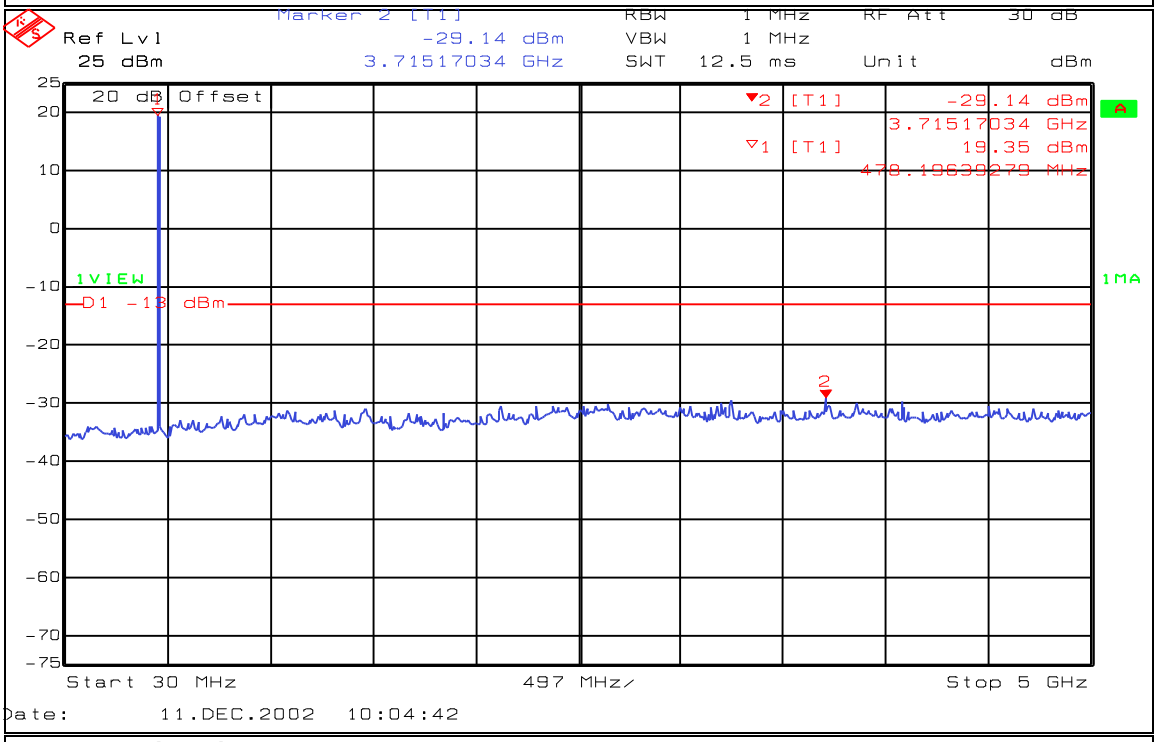
Job No.:	2L0551R	Date:	12/11/2002	Preliminary:	
Specification:	PART 90	Temperature(°C):	20		
Tested By:	David Light	Relative Humidity(%)	45		
E.U.T.:	UHF2				
Configuration:	TX FULL POWER				
Sample Number:	1				
Location:	Lab 1	RBW:	Refer to plots	Measurement	
Detector Type:	Peak	VBW:	Refer to plots	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:		Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **Marker 1 indicates carrier**
Marker 2 indicates highest emission (Noise floor)

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE:12/11/2002

Test Results: Complies.

Test Data: See attached table.

There were no emissions detected above the ambient threshold of sensitivity. The ambient threshold of sensitivity is sufficient to measure emissions within 20 dB of the specification limit.

Test Data - Radiated Emissions

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

Nemko Dallas, Inc.

ERP Substitution Method

Page 1 of 1 — Complete X — Preliminary

Job No.: 2L0551R — Date: 12/11/2002

Specification: PART 90 — Temperature(°C): 20

Tested By: David Light — Relative Humidity(%) 50

E.U.T.: UHF2 REPEATER

Configuration: TX FULL POWER INTO LOAD

Sample No: 1

Location: AC 3 — RBW: 30 kHz — Measurement Distance: 3 m

Detector Type: Peak — VBW: 30 kHz

Test Equipment Used

Antenna: 1304 — Directional Coupler:

Pre-Amp: 791 — Cable #1: 1484

Filter: — Cable #2: 1485

Receiver: 1464 — Cable #3:

Attenuator #1 — Cable #4:

Attenuator #2: — Mixer:

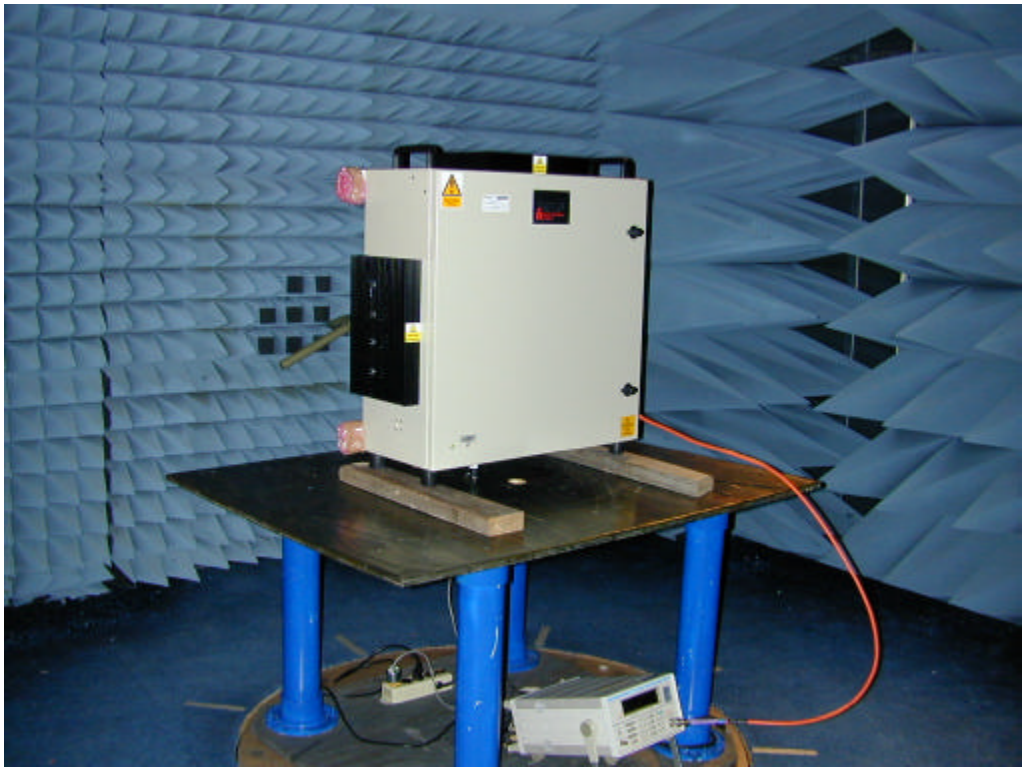
Additional equipment used: 1016

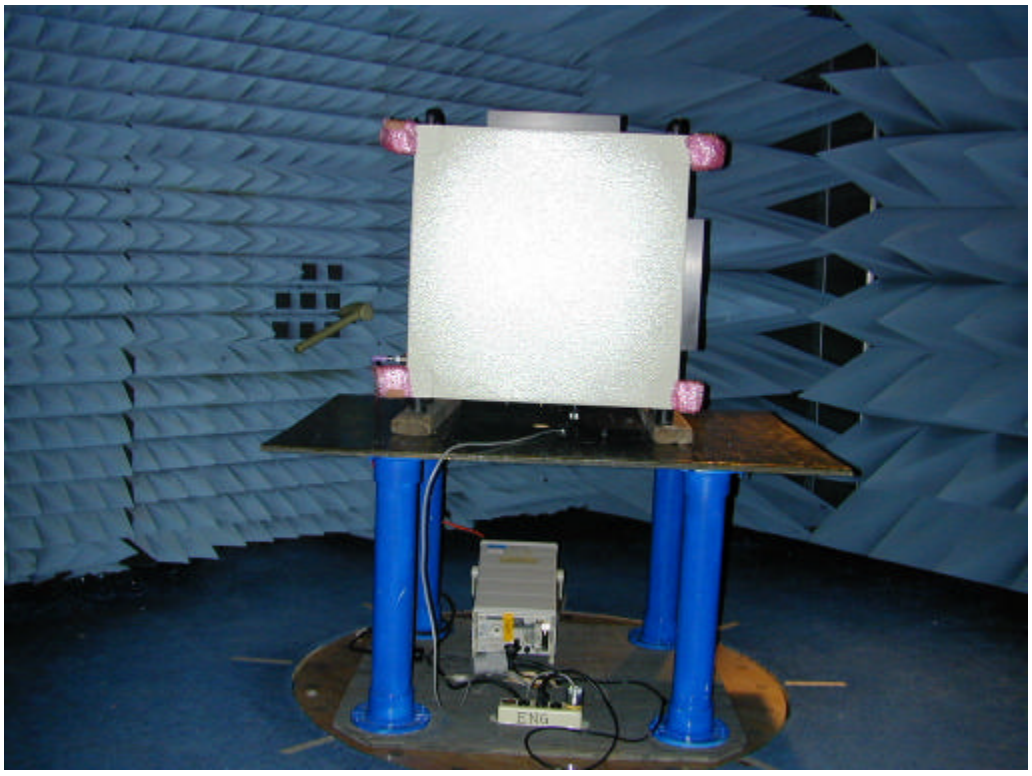
Measurement Uncertainty: +/-1.7 dB

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 @ 486.0625 MHz
972.1250	-74.0	29.3		24.1	5.0	-13	-63.8	0.0000	V	Noise floor
1458.1875	-72.0	31.5		32.4	4.9	-13	-68.1	0.0000	V	Noise floor
1944.2500	-72.0	31.0		32.9	7.3	-13	-66.7	0.0000	V	Noise floor
2430.3125	-72.0	34.2		33.0	6.8	-13	-64.1	0.0000	V	Noise floor
2916.3750	-71.0	35.5		32.7	8.0	-13	-60.3	0.0000	V	Noise floor
3402.4375	-73.0	39.8		32.6	8.0	-13	-57.8	0.0000	V	Noise floor
3888.5000	-73.0	43.3		33.0	8.6	-13	-54.1	0.0000	V	Noise floor
4374.5625	-73.0	45.3		33.2	8.2	-13	-52.7	0.0000	V	Noise floor
4860.6250	-73.0	44.0		33.1	8.7	-13	-53.5	0.0000	V	Noise floor
972.1250	-74.0	31.0		24.1	5.0	-13	-62.1	0.0000	H	Noise floor
1458.1875	-72.0	30.7		32.4	4.9	-13	-68.9	0.0000	H	Noise floor
1944.2500	-72.0	33.0		32.9	7.3	-13	-64.7	0.0000	H	Noise floor
2430.3125	-72.0	37.0		33.0	6.8	-13	-61.3	0.0000	H	Noise floor
2916.3750	-71.0	35.5		32.7	8.0	-13	-60.3	0.0000	H	Noise floor
3402.4375	-73.0	36.3		32.6	8.0	-13	-61.3	0.0000	H	Noise floor
3888.5000	-73.0	35.5		33.0	8.6	-13	-62.0	0.0000	H	Noise floor
4374.5625	-73.0	34.8		33.2	8.2	-13	-63.2	0.0000	H	Noise floor
4860.6250	-73.0	35.5		33.1	8.7	-13	-62.0	0.0000	H	Noise floor

Notes: **No emission were detected above the noise floor which was at least 20 dB below the spec limit.**

Photographs of Test Setup





Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/03/03
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01	07/31/03
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	07/15/02	07/15/03
791	PREAMP, 25dB	ICC LNA25	398	09/30/02	09/30/03
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
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
1064	ATTENUATOR	NARDA 776B-20	NONE	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: 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**

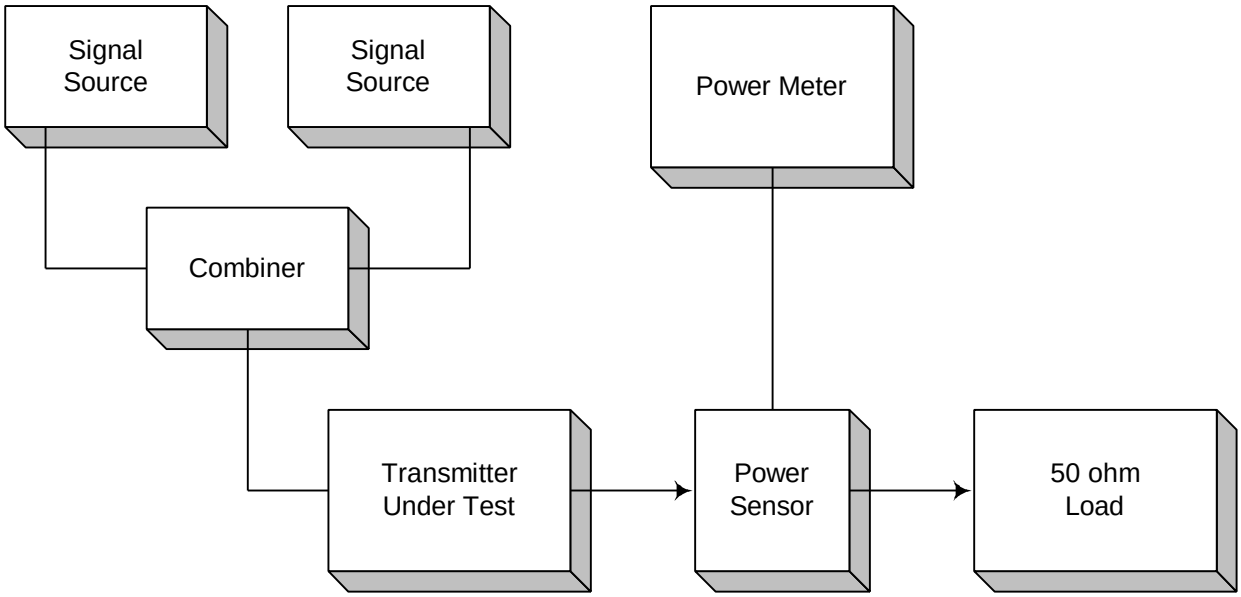
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

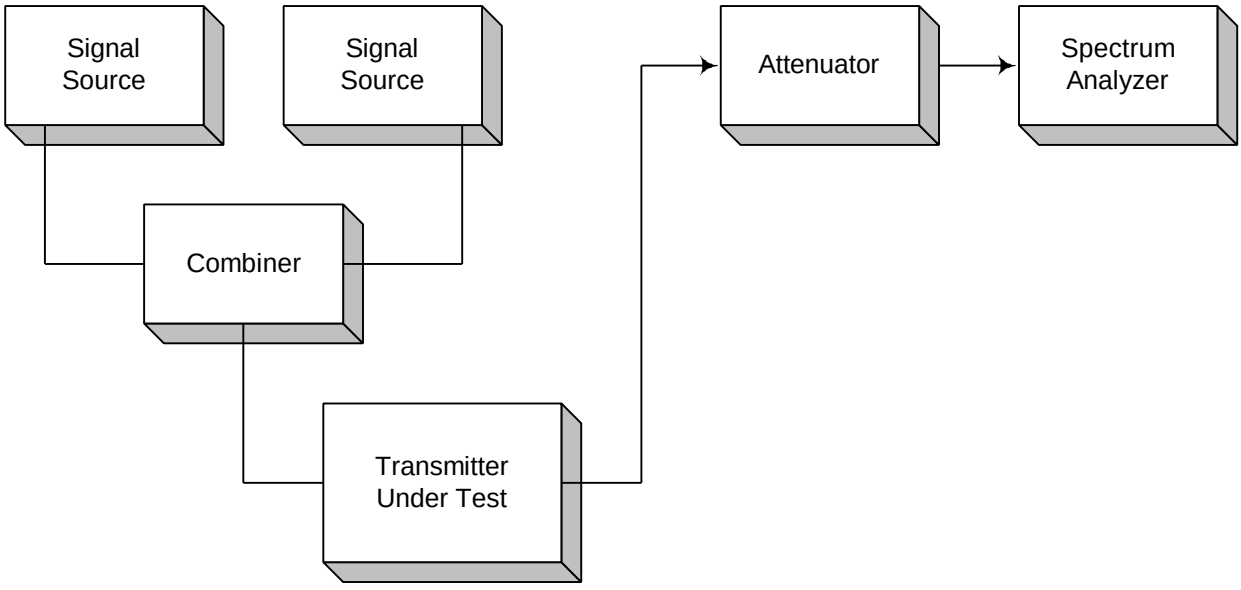
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 -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

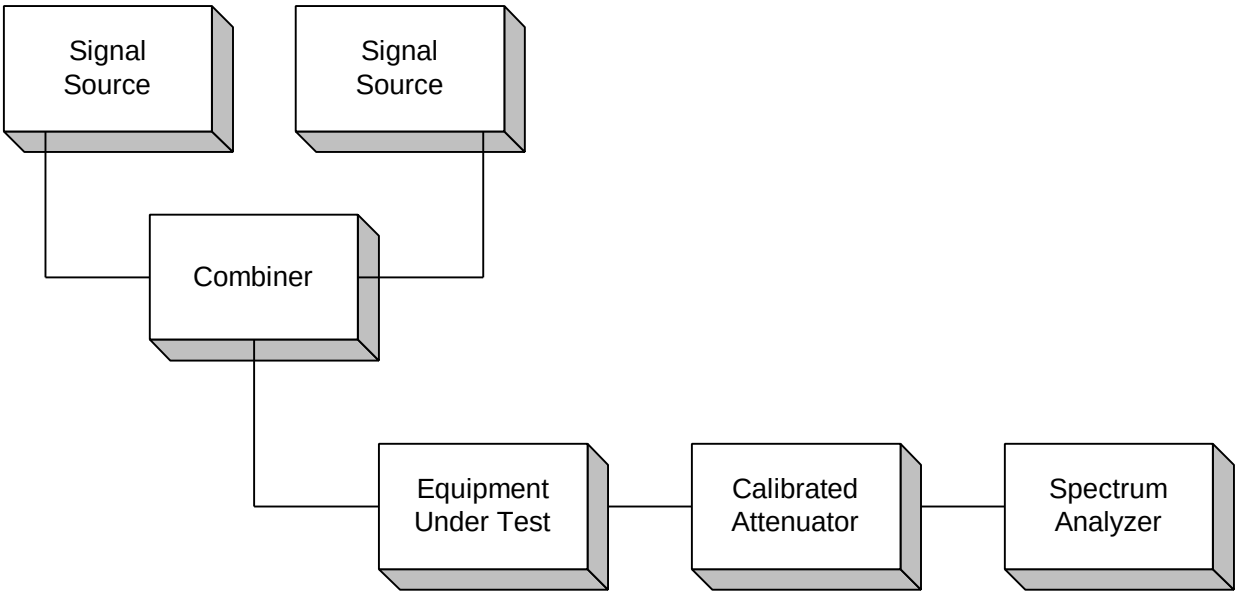
Para. No. 2.985 - R.F. Power Output



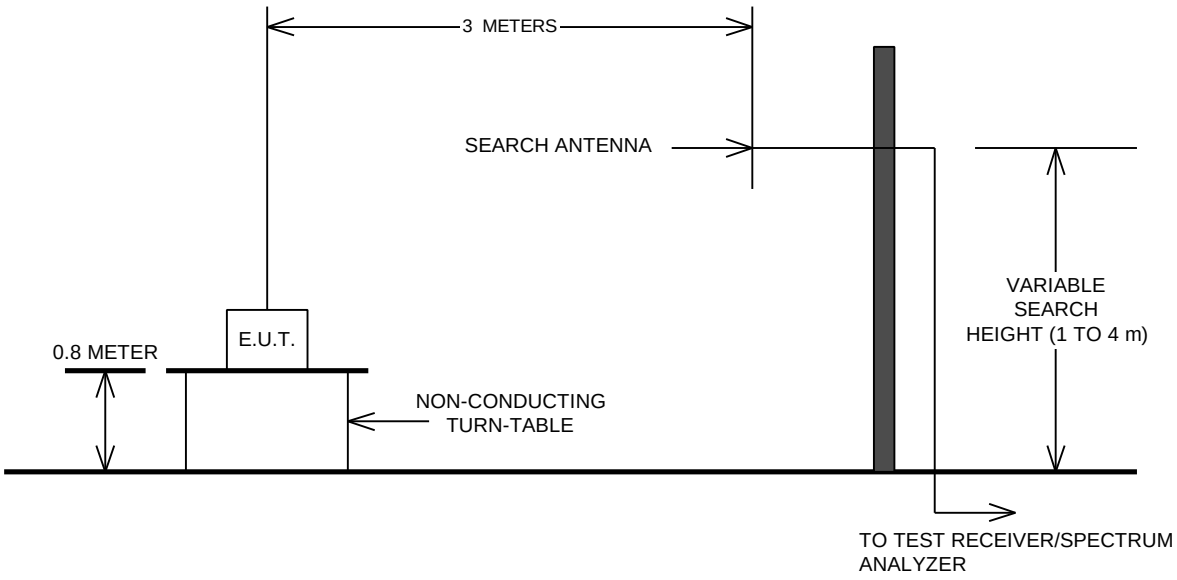
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability