Andrew Corporation 108 Rand Park Drive Garner, NC 27529
TFAH 80/85/19
FCC Part 90, Subpart I Private Land Mobile Repeater
Nemko Dallas Inc. 802 N. Kealy Lewisville, TX 75057-3136
Tom Tidwell, Frontline Group Manager
11/16/04
34

4L0571RUS3

Nemko Test Report:

EQUIPMENT: TFAH 80/85/19

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FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

Section 1.	Summary of Test Results					
Manufacturer:	Andrew Corporation					
Model No.:	TFAH 80/85/19					
Serial No.:	043003403					
General:	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			

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE

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

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EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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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EQUIPMENT: TFAH 80/85/19

Section 2. General Equipment Specification

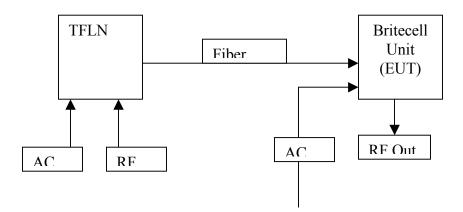
Supply Voltage Input:		115 Vac 851 to 869 MHz (Downlink only)						
Frequency Range:								
Tunable Bands:		Full band c	coverage					
Type(s) of Modulation:		F3E (Voice)	F1D	F2D	D7W (QAM)	Other		
Output Impedance:		50 ohms						
RF Power Output (rated):	Single: Composite:	2.5 Watts Analog – 631 mW iDEN 0.5 Watt Analog – 282 mW iDEN						
Operator Selection of Operating Frequency:		None						
Power Output Adjustment Capability:		None						
Frequency Translation:			F	°1-F1	F1-F2	N/A		
Band Selection:			So	ftware	Duplexer Change	Fullband Coverage		

EQUIPMENT: TFAH 80/85/19

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



FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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).

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER **Test Report No.: 4L0571RUS3**

EQUIPMENT: TFAH 80/85/19

Test Data - Occupied Bandwidth



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Data Plot				<u>Occ</u>	upied B	anc	dwidt	<u>h</u>						
Page <u>1</u> c	of <u>4</u>									Com	plete	X		
Job No.:	4L0571			Date:	8/30/2004					Prelimin	ary:			
Specification:	PT90		Temp	erature(°C):	25									
Tested By:	David L	ight		Humidity(%)	40									
E.U.T.:	PCS AN	1PLIFIER		-										
Configuration:	TX													
Sample Number	: 1													
Location:	Lab	1			RBW:	Refe	er to plots			Measure	ment			
Detector Type:	Peal						er to plots	_			ance: N	JA n	n	
								_			_	-		
Test Equipm	ent Use	d												
Antenna:				Directio	onal Coupler:									
Pre-Amp:					Cable #1:		1629	_						
Filter:		_			Cable #2:			_						
Receiver:	1036	5			Cable #3:			_						
Attenuator #1	106:				Cable #4:			_						
Attenuator #2:	1604				Mixer:			_						
Additional equip						_		_						
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-60	1,17			'II'					"7	71		"		J
Cen	ter 8	60 MHz			3	кН	Z/					Span	30 kHz	
Date:	30	J.AUG.2	004 13	:51:28										
Notes:		OG OUTPUT												
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		Tone - 2.5 kH												
1	4 KHZ	1 one - 2.5 KH	iz Deviation											

EQUIPMENT: TFAH 80/85/19

Test Data - Occupied Bandwidth

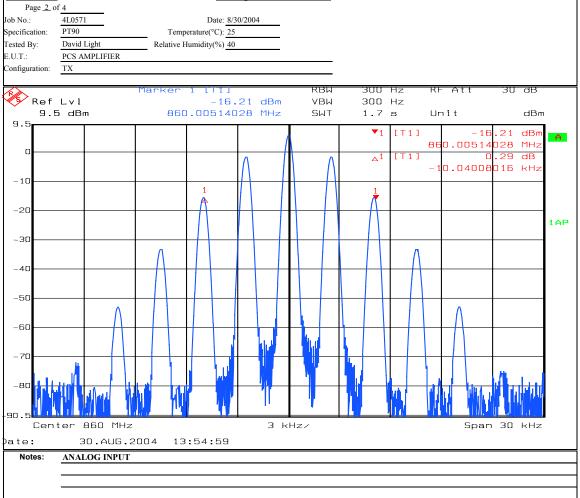


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Data Plot Occupied Bandwidth



EQUIPMENT: TFAH 80/85/19

Test Data - Occupied Bandwidth



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Nemko Dallas, Inc. Data Plot **Occupied Bandwidth** Page <u>3</u> of <u>4</u> Job No.: 4L0571 Date: 8/30/2004 Specification: PT90 Temperature(°C): 25 Tested By: David Light Relative Humidity(%) 40 PCS AMPLIFIER EUT: Configuration: TX Ref Lvl -4.03 dBm VΒW 300 Hz 40 dBm 860.00660696 MHz SWT 1.75 s Unit dBm 30.5 dB Offset .03 dBr Α 860.00660696 MHz 30 dВ 48 5.65631 262 kHz 20 Jelahaman Mayoran Mundaga 1 C **1VIEW** 1MA -10 -20 -30 -40 white many the property to -50 -60 Center 860 MHz 3.125 kHz/ Span 31.25 kHz ate: 30.AUG.2004 iDEN Output Notes: 28 dBm

EQUIPMENT: TFAH 80/85/19

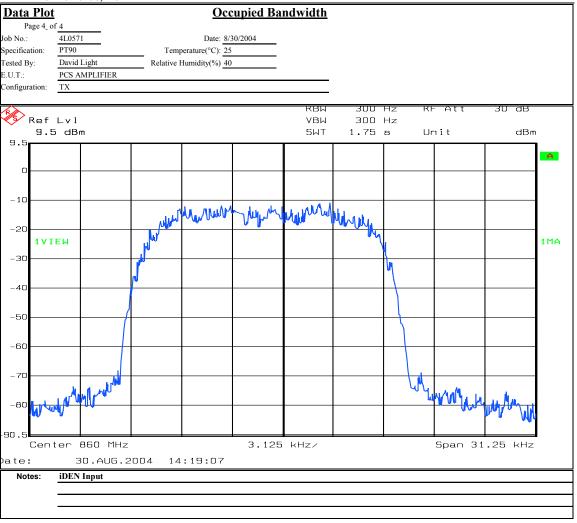
Test Data - Occupied Bandwidth



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EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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).

EQUIPMENT: TFAH 80/85/19

Test Data - Spurious Emissions at Antenna Terminals



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Complete X

Distance: NA

Measurement

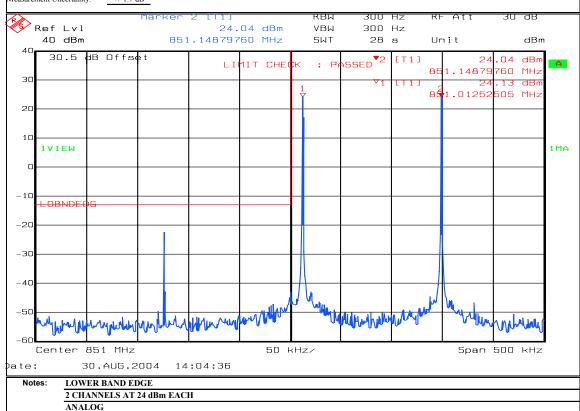
Nemko Dallas, Inc. Data Plot **Spurious Emissions at Antenna Terminals** Page <u>1</u> of <u>6</u> Job No.: 4L0571 8/30/2004 Preliminary: Specification: PT90 Temperature(°C):

Tested By: David Light Relative Humidity(%) 40 E.U.T.: SMR Band AMPLIFIER Configuration: Sample Number: Lab 1 Location: RBW: Refer to plots

Detector Type: Peak VBW: Refer to plots Test Equipment Used Antenna: Directional Coupler: Cable #1:

Pre-Amp: Filter: Cable #2 1036 Cable #3 Receiver: Attenuator #1 1065 Cable #4: Attenuator #2: Mixer Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



EQUIPMENT: TFAH 80/85/19

Test Data - Spurious Emissions at Antenna Terminals



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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 David Light Relative Humidity(%) 40 Tested By: E.U.T.: SMR Band AMPLIFIER Configuration: TX кви Ref Lvl 24.08 dBm VBW 300 Hz 40 dBm 868.82699800 MHz SWT 28 s Un i t 30.5 dB Offset .08 dBm LIMIT CHE 868.82699 800 30 868.98750000 MHz 20 10 1 V I E W 1MA - 1 C -20 -30 -40 www.hallenger. When Center 869 MHz 50 kHz/ Span 500 kHz 30.AUG.2004 14:08:45 ate: UPPER BAND EDGE - ANALOG 2 CHANNELS AT 24 dBm EACH ANALOG

EQUIPMENT: TFAH 80/85/19

Test Data - Spurious Emissions at Antenna Terminals



ANALOG

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Nemko Dallas, Inc. Data Plot **Spurious Emissions at Antenna Terminals** Page <u>3</u> of 6 Job No.: 4L0571 Date: 8/30/2004 Temperature(°C): 25 Specification: PT90 Tested By: David Light Relative Humidity(%) 40 SMR Band AMPLIFIER EUT. Configuration: TX Ref Lvl 33.96 dBm 1 MHz VBW 860.00514028 MHz 30 dBm SWT 90 ms Unit dBm 30.5 dB Offset 33 .96 dBm Α 860.00514028 MHz 20 10 1 V I E W 1MA -10-D1 -20 -30 -50 -60 897 MHz/ Stop 9 GHz Start 30 MHz 30.AUG.2004 ate: 13:58:54 Notes: TX 860 MHz @ 34 dBm The spectrum was searched in detail. This plot is a true indication of the emissions detected.

EQUIPMENT: TFAH 80/85/19

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 Temperature(°C): 25 Specification: PT90 Tested By: David Light Relative Humidity(%) 40 SMR Band AMPLIFIER EUT. Configuration: TX Ref Lvl 300 Hz 8.11 dBm VBW 30 dBm 851.34500000 MHz SWT 56 s Unit dBm 30 30.5 dB Offset 1 1 dBm LIMIT CHE : P# .34500000 MHz 851 851.01250 000 MHz 1 C **1VIEW** 1MA – 1 C OBNDE -20 -30 -40 -50 -60 Windery. Mally was horasty right pely the John will to 100 kHz/ Center 851 MHz Span 1 MHz 30.AUG.2004 14:27:34 ate: iDEN Intermod Notes: 21.5 dBm each

EQUIPMENT: TFAH 80/85/19

Test Data - Spurious Emissions at Antenna Terminals



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Nemko Dallas, Inc. Data Plot **Spurious Emissions at Antenna Terminals** Page <u>5</u> of 6 Job No.: 4L0571 Date: 8/30/2004 Temperature(°C): 25 Specification: PT90 Tested By: David Light Relative Humidity(%) 40 SMR Band AMPLIFIER EUT. Configuration: TX Ref Lvl 11.01 dBm VBW 300 Hz 868.74300000 MHz 30 dBm SWT 56 s Unit dBm 30 30.5 dB Offset . 0 1 dBn LIMIT CHE 868.74300000 MHz 868.98750 000 MHz 10 **1VIEW** 1MA -10 -20 -30 -40 -50 -60 the harmon the manual MANAMAN Center 869 MHz 100 kHz/ Span 1 MHz 30.AUG.2004 14:31:59 ate: iDEN intermod Notes: 21.5 dBm each

EQUIPMENT: TFAH 80/85/19

Test Data - Spurious Emissions at Antenna Terminals



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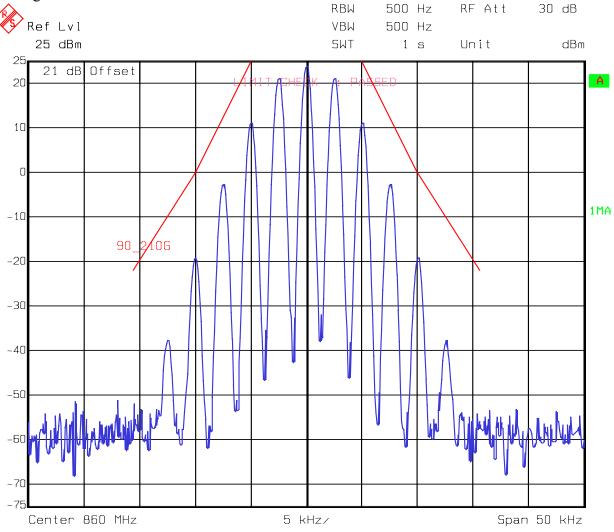
Nemko Dallas, Inc. Data Plot **Spurious Emissions at Antenna Terminals** Page <u>6</u> of <u>6</u> Job No.: 4L0571 Date: 8/30/2004 Specification: PT90 Temperature(°C): 25 Tested By: David Light Relative Humidity(%) 40 SMR Band AMPLIFIER EUT. Configuration: TX Ref Lvl 1 MHz VBW 30 dBm Unit dBm SWT 90 ms 30.5|dB Offset A 20 10 1VIEW 1MA -10 -20 -30 -40 -50 -60 897 MHz/ Stop 9 GHz Start 30 MHz 30.AUG.2004 14:21:15 Notes: Tx iDEN 860 MHz 28dBm

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

MASK

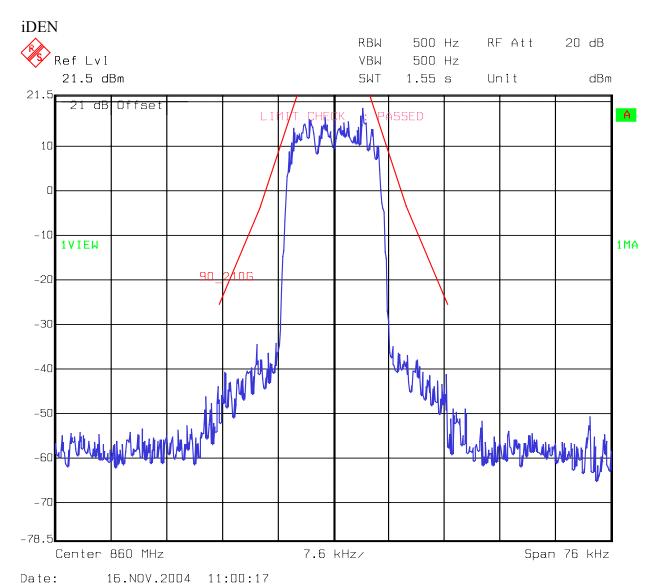
Analog



Date: 16.NOV.2004 11:23:32

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3



EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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 10th 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

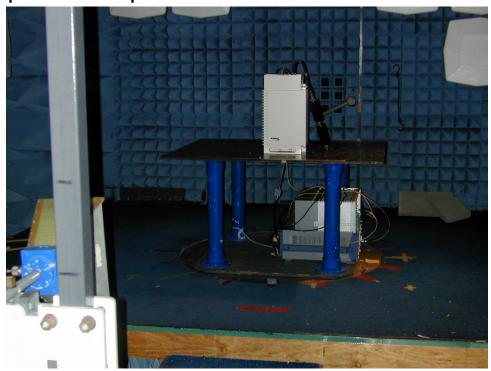
Temperature: 25 °C

Relative Humidity: 40 %

Note: See page A5 for applicable limit.

EQUIPMENT: TFAH 80/85/19

Photographs of Test Setup





EQUIPMENT: TFAH 80/85/19

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

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER Test Report No.: 4L0571RUS3

EQUIPMENT: TFAH 80/85/19

ANNEX A - TEST METHODOLOGIES

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER Test Report No.: 4L0571RUS3

EQUIPMENT: TFAH 80/85/19

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

FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER Test Report No.: 4L0571RUS3

EQUIPMENT: TFAH 80/85/19

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.

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FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER

EQUIPMENT: TFAH 80/85/19 Test Report No.: 4L0571RUS3

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	В	C
72 - 76	В	С
150 - 174	B, D or E	C, D or E
150 Paging only	В	С
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	В	Н
806 - 821/851 - 866	В	G
821 - 824/ 866 - 869	В	Н
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	В	G
Above 940	В	С
All other bands	В	С

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FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER Test Report No.: 4L0571RUS3

EQUIPMENT: TFAH 80/85/19

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 ½ 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 $10^{\rm th}$ harmonic of the highest frequency generated in the device.

EQUIPMENT: TFAH 80/85/19

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	Fixed And Base	Mobile Stations		
(MHz)	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	-	-	-	

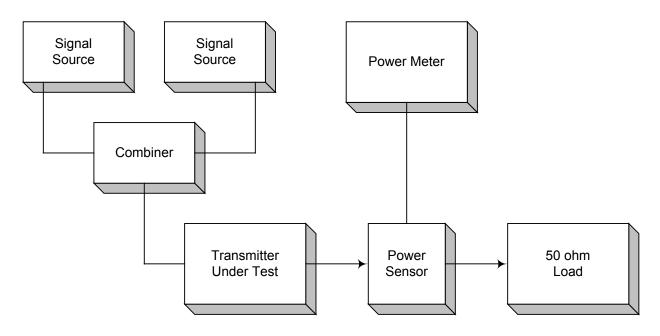
FCC PART 90, SUBPART I PRIVATE LAND MOBILE REPEATER Test Report No.: 4L0571RUS3

EQUIPMENT: TFAH 80/85/19

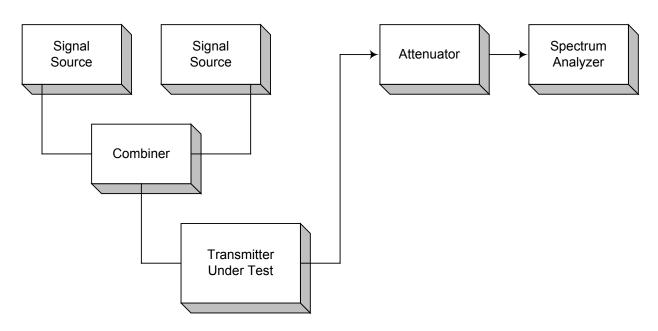
ANNEX B - TEST DIAGRAMS

EQUIPMENT: TFAH 80/85/19

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

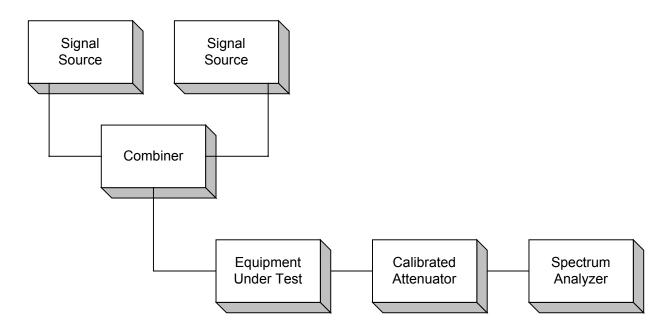


Para. No. 2.989 - Occupied Bandwidth

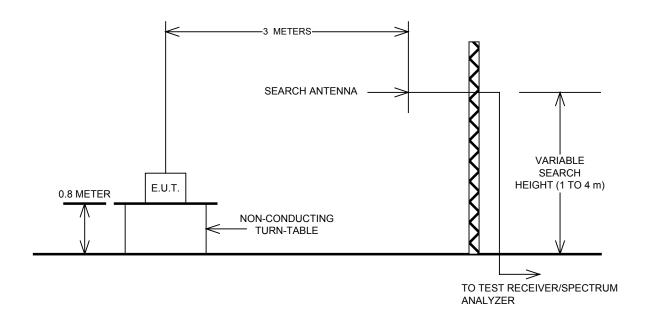


EQUIPMENT: TFAH 80/85/19

Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



EQUIPMENT: TFAH 80/85/19

Para. No. 2.995 - Frequency Stability

