

Nemko Test Report: 1L0264RUS1

Applicant: ALLEN TELECOM
140 Vista Center Drive
Forest, Virginia 24551

**Equipment Under Test:
(E.U.T.)** TRUNKING / iDEN BRITECELL FAST SYSTEM

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: 7/16/01

Total Number of Pages: 37

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Section 1. Summary of Test Results

Manufacturer: ALLEN TELECOM

Model No.: TRUNKING / iDEN BRITECELL FAST SYSTEM

Serial No.: NONE

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.

See " Summary of Test Data".



NVLAP LAB CODE: 100351-0

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MES.	RESULT
RF Power Output	90.205		18.76 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	- 20 dBm	< -20 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.
- (3) Since the E.U.T. is an F1 to F1 repeater. Frequency stability was not measured.

Section 2. General Equipment Specification**Transmitter****Supply Voltage Input:** -48 VDC**Frequency Range:** 851-869 MHz**Tunable Bands:** 851-869 MHz

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

Gain: 0 dB**Maximum Input:** + 27 dBm (1 tone CW)**Output Impedance:** 50 Ohms

RF Power Output (rated):	iDEN:	+18 dBm (063 W)
	Voice:	+19 dBm (079 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
	☐	☐	☒

Description of Modifications For Class II Permissive Change

Not Applicable

Modifications Made During Testing

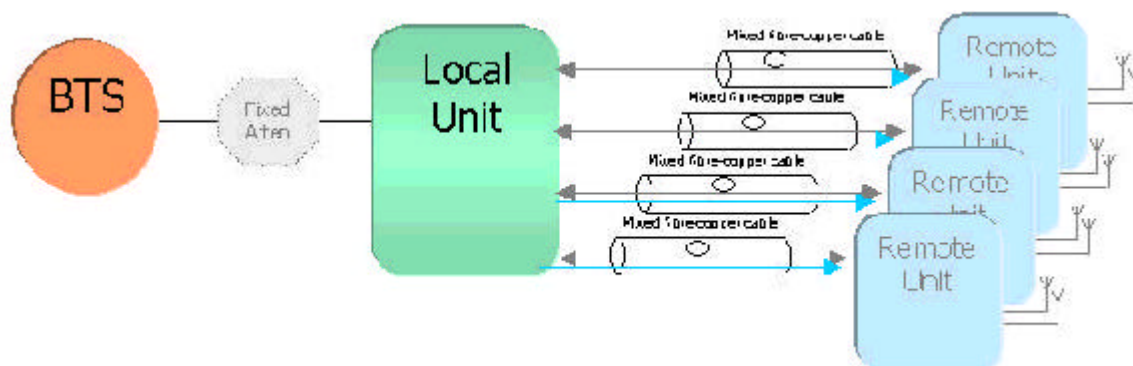
Not Applicable

Theory of Operation

BRITECELL™ FAST is a plug and play BriteCell kit, offering the most suitable solution for indoor coverage in small areas, thanks to its compactness and absolute easiness to install. The package includes up to four compact RF remote transceivers (TFAF), driven by one local distribution unit (TFLF). It is available in various frequency ranges (from 800MHz up to 2200 MHz), as a single band product. It is aimed to satisfy the requirements of 2nd and 3rd generation mobile networks for simple coverage needs.

The TFLF local unit has been properly designed into a stand-alone mechanical case, including all required ancillary and support functions. The kit includes also four standard TFAF Remote units and a compound fiber-copper cable to connect them to local unit. The installed units can be later kept also in case of system expansion to a fully modular BriteCell configuration, both single band or dual band, with a minimum setting effort. Both TFL and TFA can be optionally hosted into TKA mounting kits, allowing outdoor installation if required.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Chinda Poy	DATE: 7/9/01

Test Results: Complies.

Measurement Data:

IDEN Modulation

Frequency (MHz)	Measured Power (dBm)
860	17.89

Voice Modulation

Frequency (MHz)	Measured Power (dBm)
860	18.76

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Chinda Poy	DATE: 7/09/01

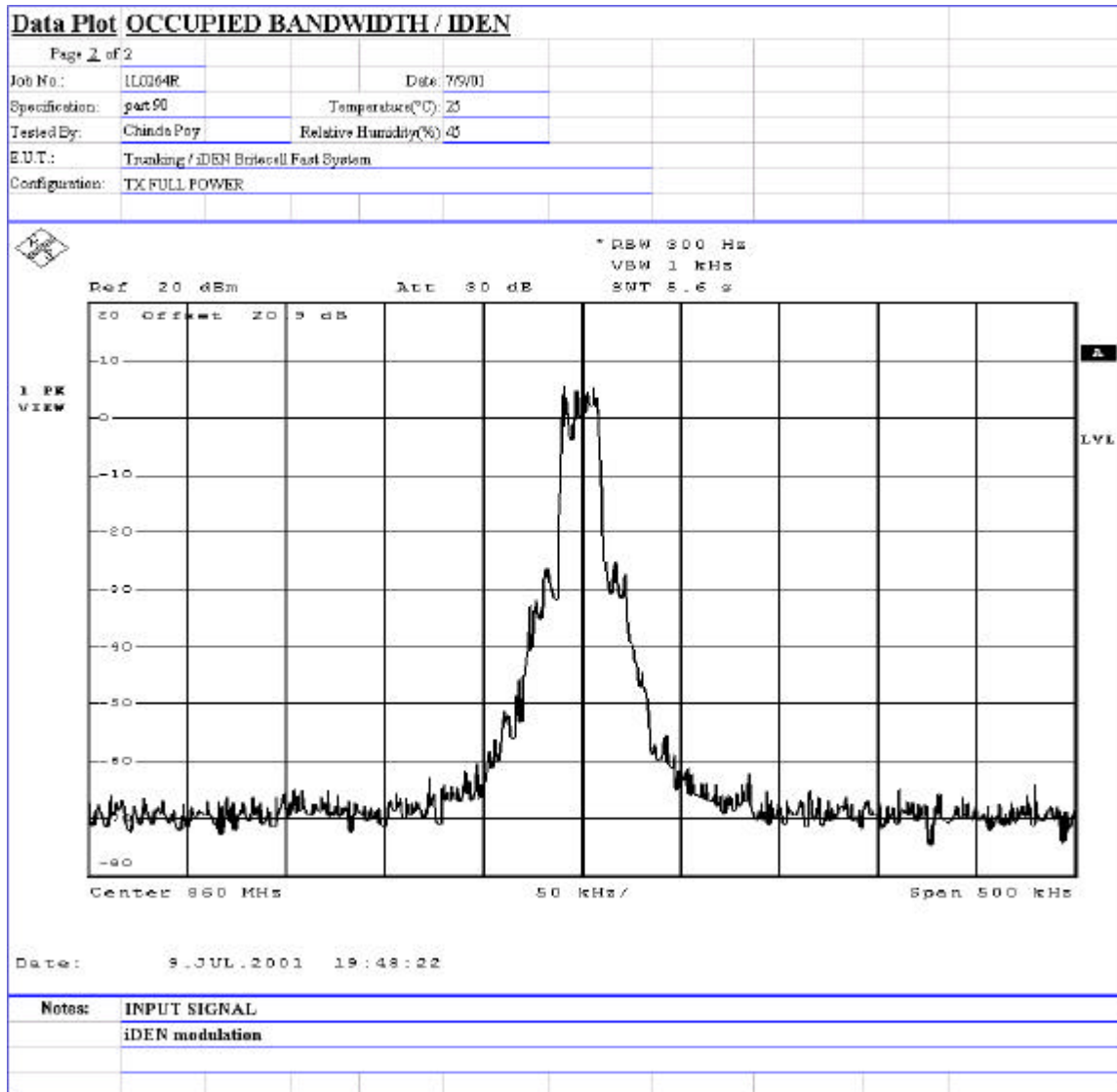
Test Results: Complies.

Test Data: See attached graph(s).

Test Data – Occupied Bandwidth / iDen

Data Plot OCCUPIED BANDWIDTH / IDEN	
Page 1 of 2	
Job No.: 110264R	Date: 7/6/01
Specification: part 90	Temperature(°C): 23
Tested By: Chndr Poy	Relative Humidity(%): 45
E.U.T.: Trunking / iDEN Britecell Fast System	
Configuration: TX FULL POWER	
Sample Number:	
Location: Lab 1	RBW: Refer to plots
Detector Type: Peak	VIEW: Refer to plots
Test Equipment Used	
Antenna:	Directional Coupler:
Pre-Amp:	Cable #1: 1093
Filter:	Cable #2:
Receiver: 1036	Cable #3:
Attenuator #1: 1474	Cable #4:
Attenuator #2:	Mixer:
Additional equipment used:	
Measurement Uncertainty: +/- 0.6 dB	
Ref 20 dBm Att 30 dB * RBW 300 Hz VIEW 1 kHz SWT 5.6 x Offset 20.9 dB Center 950 MHz 50 kHz/ Span 500 kHz	
Date: 9 JUL 2001 19:44:58	
Notes:	OUTPUT SIGNAL
	iDEN modulation

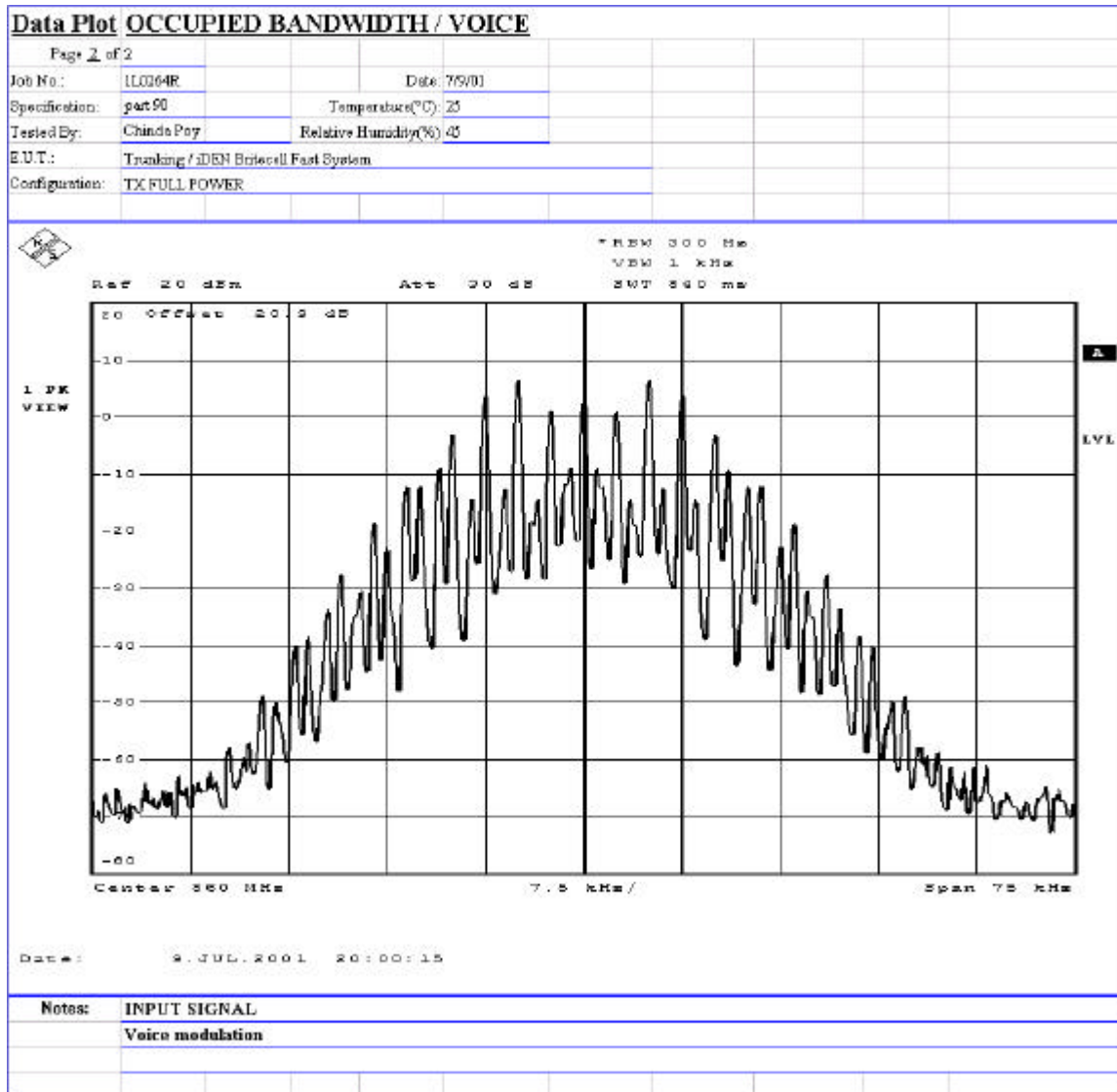
Test Data – Occupied Bandwidth / iDen



Test Data – Occupied Bandwidth / Voice

Data Plot		OCCUPIED BANDWIDTH / VOICE	
Page 1 of 2			
Job No.:	110264R	Date:	7/6/01
Specification:	part 90	Temperature(°C):	23
Tested By:	Chnds.Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
Sample Number:			
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VIEW:	Refer to plots
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1093
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1474	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		
Ref 20 dBm Acc 20 dB RBW 300 Hz VBW 1 kHz SMT 840 ms Center 5.60 MHz 7.5 kHz Span 7.5 kHz Date: 9 JUL 2001 19:58:14			
Notes:	OUTPUT SIGNAL		
	Voice modulation		

Test Data – Occupied Bandwidth / Voice



Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Chinda Poy	DATE: 7/09/01

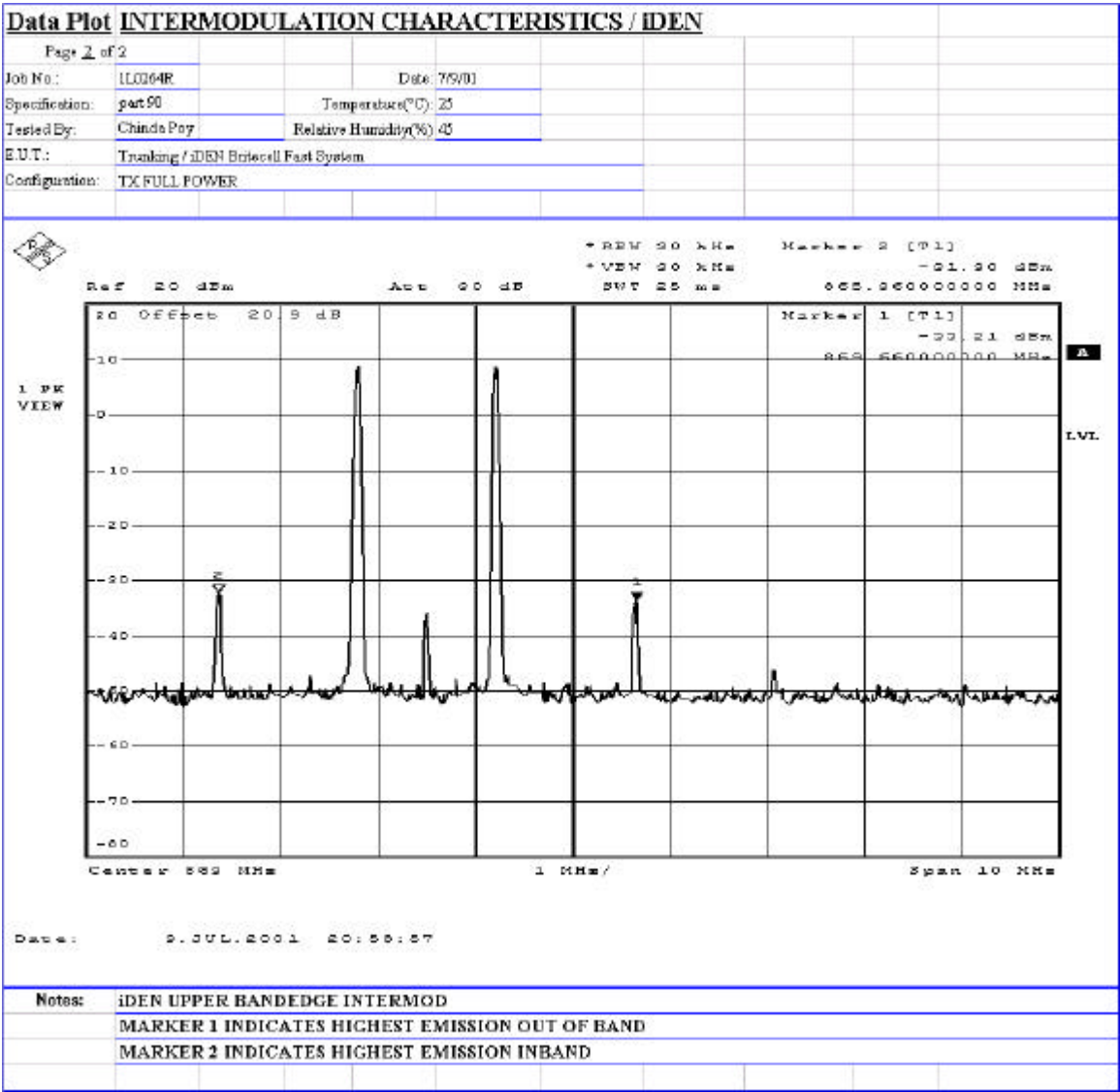
Test Results: Complies.

Test Data: See attached graph(s).

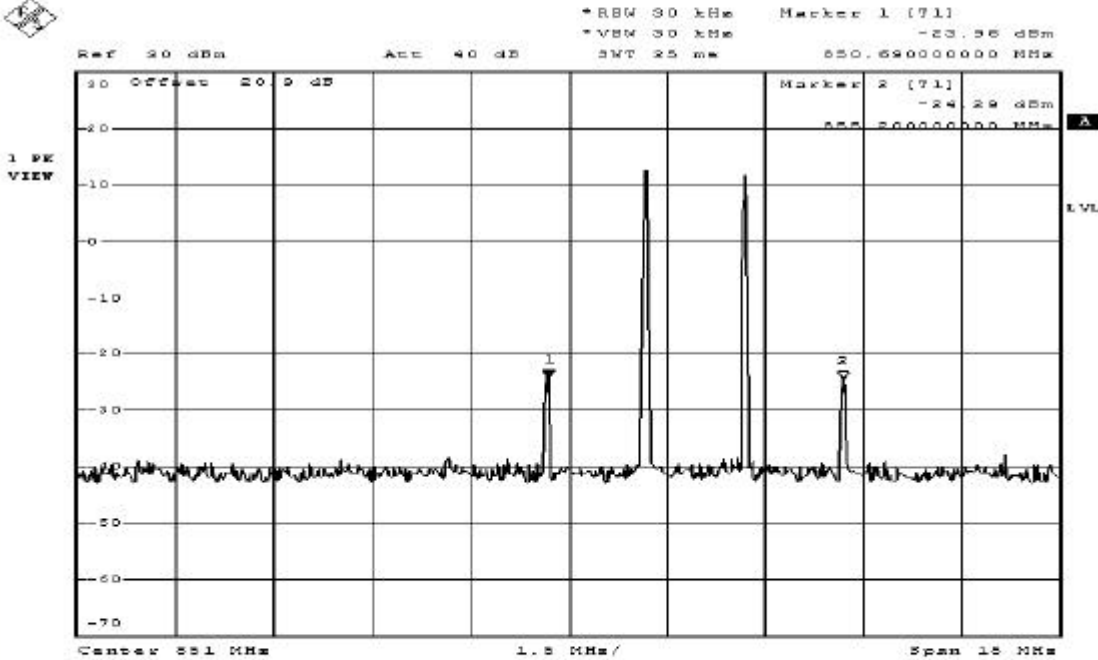
Test Data – Spurious Emission

Data Plot INTERMODULATION CHARACTERISTICS / iDEN			
Page 1 of 2		Complete	X
Job No.:	110264R	Date:	7/6/01
Specification:	part 90	Temperature(°C):	23
Tested By:	Chnds.Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
Sample Number:			
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VIEW:	Refer to plots
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1093
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1474	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		
Date: 9 JUL 2001 21:02:08 Notes: iDEN LOWER BANDEDGE INTERMOD MARKER 1 INDICATES HIGHEST EMISSION OUT OF BAND MARKER 2 INDICATES HIGHEST EMISSION INBAND			

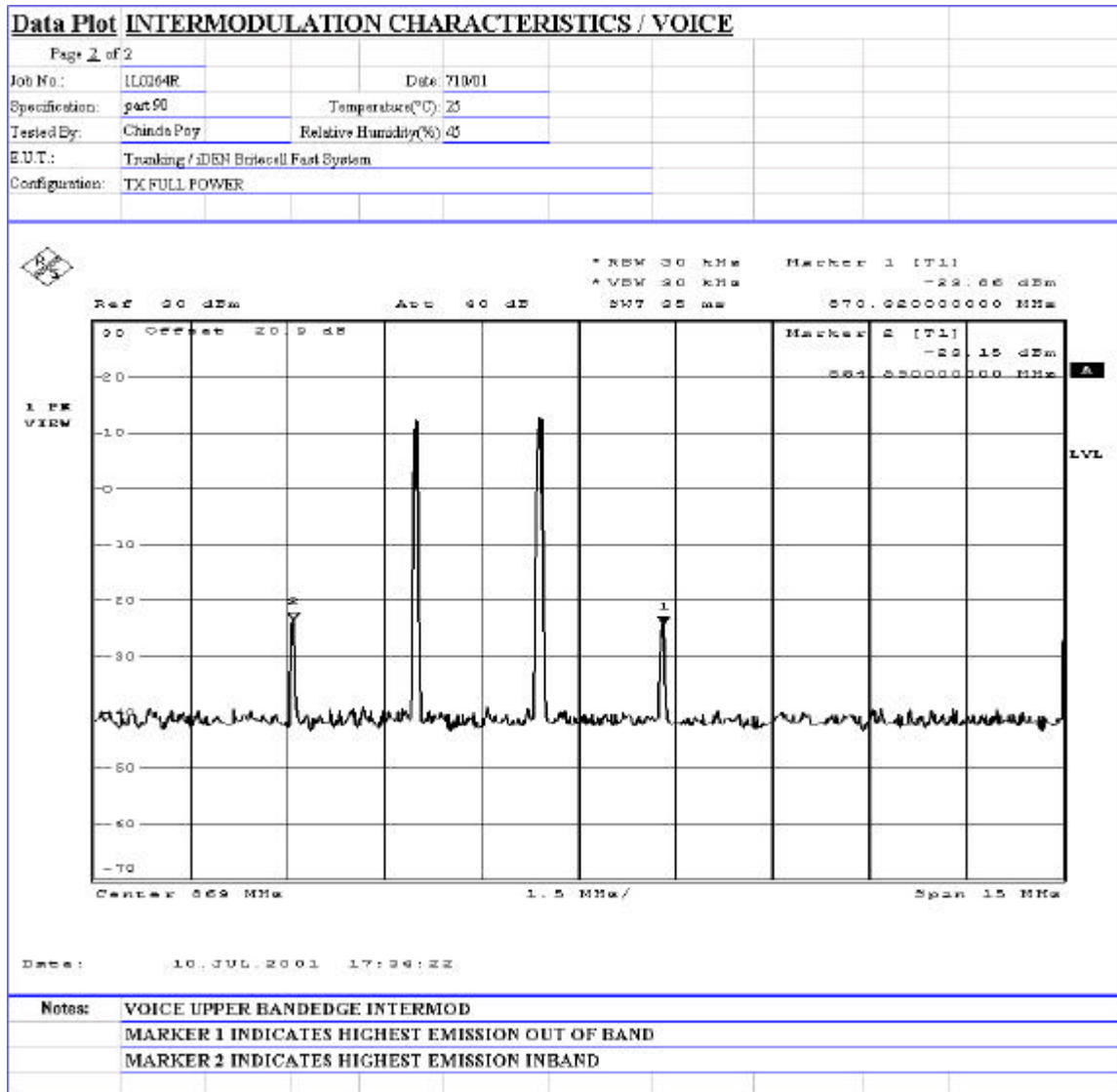
Test Data – Spurious Emission



Test Data – Spurious Emission

Data Plot INTERMODULATION CHARACTERISTICS / VOICE			
Page 1 of 2		Complete	X
Job No.:	1L0264R	Date:	7/10/01
Specification:	part 90	Temperature(°C):	25
Tested By:	Chndr Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
Sample Number:			
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VIEW:	Refer to plots
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1093
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1474	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		
 Ref 20 dBm Acc 40 dB RBW 30 kHz Marker 1 [711] -23.96 dBm VSW 30 kHz SWT 25 ms 550.650000000 MHz Marker 2 [711] -24.29 dBm 555.500000000 MHz 1 PEAK VIEW Center 551 MHz 1.5 MHz / Span 15 MHz Date: 10 JUL 2001 17:20:24			
Notes:	VOICE LOWER BANDEDGE INTERMOD		
	MARKER 1 INDICATES HIGHEST EMISSION OUT OF BAND		
	MARKER 2 INDICATES HIGHEST EMISSION INBAND		

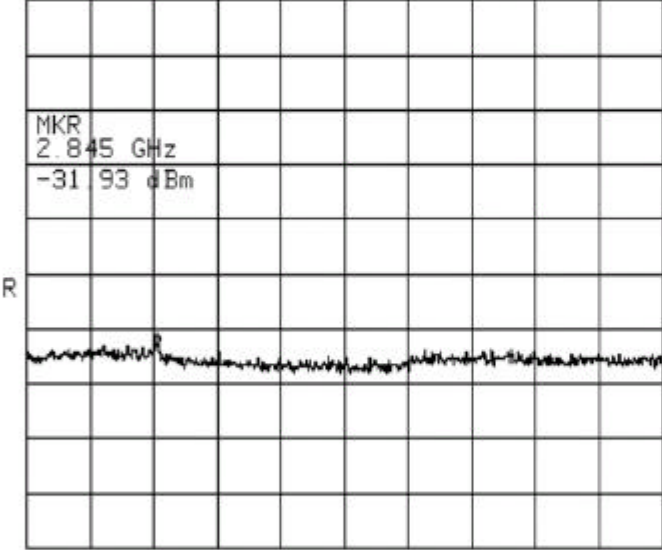
Test Data – Spurious Emission



Test Data – Spurious Emission

Data Plot		ANTENNA PORT SPURIOUS EMISSIONS / iDEN.	
Page 1 of 2			
Job No.:	1L0264R	Date:	7/10/01
Specification:	part 90	Temperature(°C):	23
Tested By:	Chnds.Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
Sample Number:			
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1093
Filter:		Cable #2:	
Receiver:	146+	Cable #3:	
Attenuator #1:	147+	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		
ATTEN 20dB MKR 8.23dBm RL 30.9dBm 10dB/ 859.4MHz START 30.0MHz STOP 1.0000GHz *RBW 100kHz VBW 100kHz SWP 250ms			
Notes:	Marker indicates carrier		
	iDEN modulation		

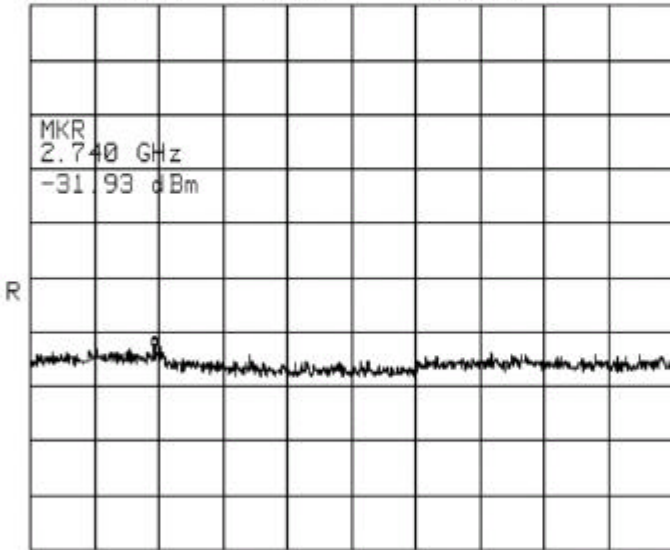
Test Data – Spurious Emission

Data Plot		ANTENNA PORT SPURIOUS EMISSIONS / iDEN.	
Page 2 of 2			
Job No.:	1L0264R	Date:	7/10/01
Specification:	part 90	Temperature(°C):	25
Tested By:	Chanda Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
ATTEN 20dB MKR -31.93dBm RL 30.9dBm 10dB/ 2.845GHz  START 1.000GHz STOP 10.000GHz *RBW 1.0MHz VBW 1.0MHz SWP 180ms			
Notes:	Marker indicates highest emission		
	iDEN modulation		

Test Data – Spurious Emission

Data Plot		ANTENNA PORT SPURIOUS EMISSIONS / VOICE	
Page 1 of 2			
Job No.:	1L0264R	Date:	7/10/01
Specification:	part 90	Temperature(°C):	23
Tested By:	Chnds.Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
Sample Number:			
Location:	Lab 1	RBW:	Refer to plots
Detector Type:	Peak	VBW:	Refer to plots
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1093
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1:	1474	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-3.6 dB		
Notes:	Marker indicates carrier		
	Voice modulation		

Test Data – Spurious Emission

Data Plot		ANTENNA PORT SPURIOUS EMISSIONS / VOICE	
Page 2 of 2			
Job No.:	1L0264R	Date:	7/10/01
Specification:	part 90	Temperature(°C):	25
Tested By:	Chanda Poy	Relative Humidity(%):	45
E.U.T.:	Trunking / iDEN Britecell Fast System		
Configuration:	TX FULL POWER		
ATTEN 20dB MKR -31.93dBm RL 30.9dBm 10dB/ 2.740GHz  START 1.000GHz STOP 10.000GHz *RBW 1.0MHz VBW 1.0MHz SWP 100ms			
Notes:	Marker indicates highest emission		
	Voice modulation		

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Chinda Poy	DATE: 7/10/01

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 2

Job No.: 1L0264R

Date: 7/10/01

Complete X

Preliminary

Specification: part 90

Temperature(°C): 25

Tested By: Chinda Poy

Relative Humidity(%) 45

E.U.T.: TRUNKING / iDEN Britecell Fast System

Configuration: TX FULL POWER

Sample Number:

Location: AC 3

RBW: 1 MHz

Measurement

Detector Type:	Peak
----------------	------

VBW: 1 MHz

Distance 3 m

Test Equipment Used

Antenna: 993

Directional Coupler: #N/A

Pre-Amp:	1016
----------	------

Cable #1:	1046
-----------	------

Filter:	#N/A
---------	------

Cable #2: #N/A

Receiver:	1036
-----------	------

Cable #3: #N/A

Attenuator #1 #N/A

Cable #4: #N/A

Attenuator #2: #N/A

Mixer: #N/A

Additional

equipment used:

Measurement

Uncertainty: +/- .7 dB

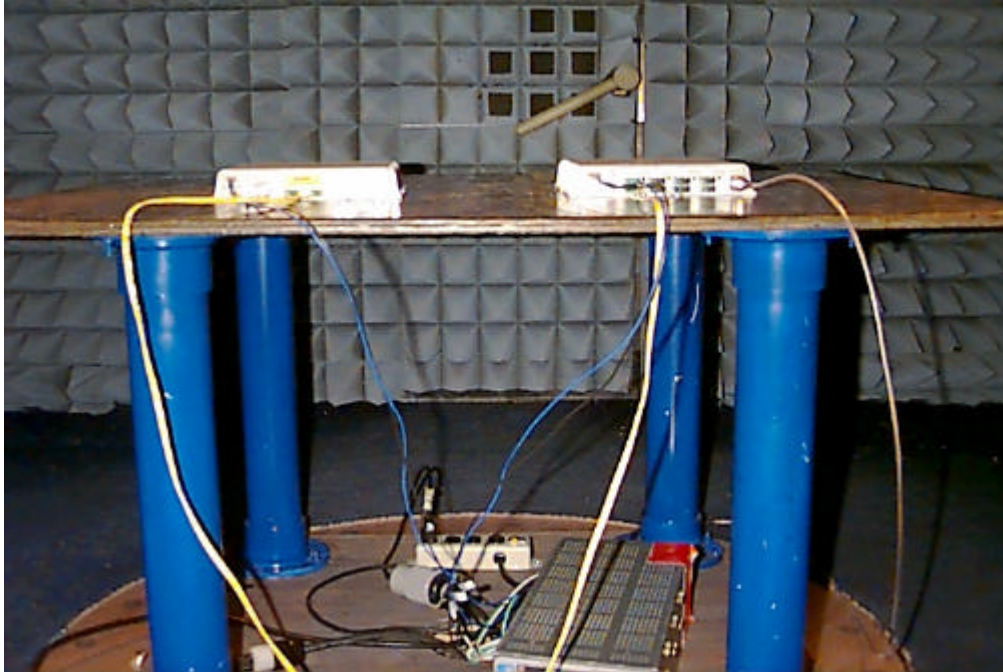
[illegible]

Notes:

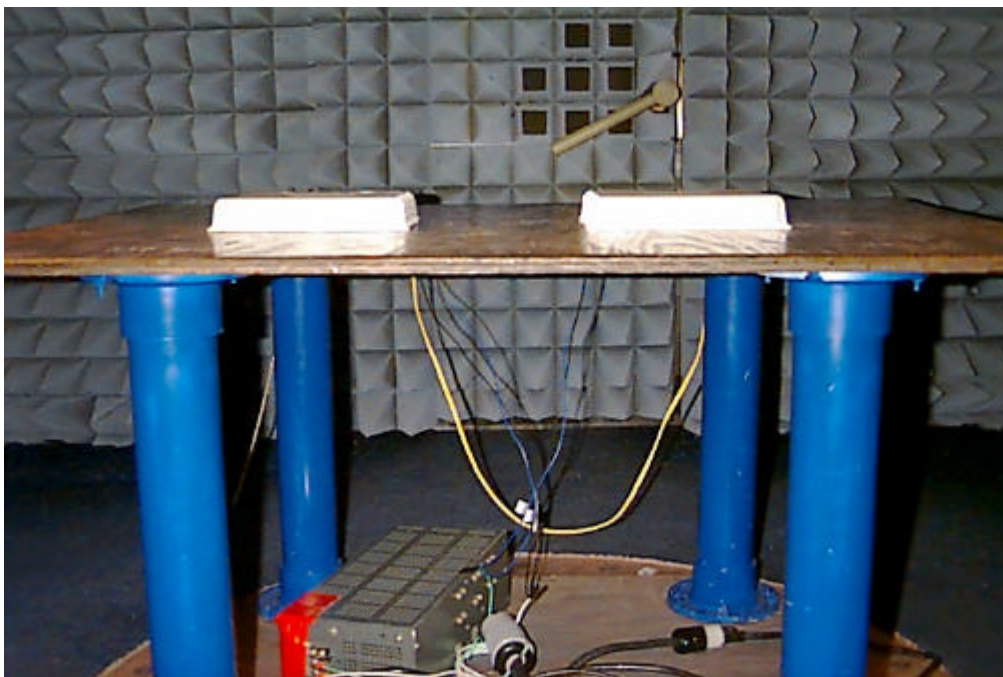
860 MHz / SCANNED TO THE 10TH HARMONIC

Photographs of Test Setup

FRONT VIEW



REAR VIEW



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability

PARA. NO.: 2.995

TESTED BY:

DATE:

Test Results:

Measurement Error:

Complies with FCC Part 90.101

See applicable S. 90.101

Not Applicable

Section 8. Test Equipment List

ASSET	Description	Manufacturer Model Number	Serial Number	Cal. Date	Cal. Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/99	06/14/01
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/02/02
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01	05/30/02
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99	07/16/01
1474	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W2	NONE	CBU	N/A
1043	Flexible cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	01/29/01	01/29/02
1046	Flex cable 1m	Astrolab Inc. 32022-2-29094K-1M	N/A	01/29/01	01/29/02
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00	05/25/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01	06/01/02

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.**Calculation of Field Strength Limit**

An example of attenuation requirement of $50 + 10 \log P$ is equivalent to -20 dBm (1×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions ≤ 1 GHz:

G = 1.64 (Dipole Gain)

P = 10^{-5} Watts (Maximum spurious output power)

R = 3m (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V / m} = 77.4 \text{ dBmV / m}$$

For emissions > 1 GHz:

G = 1 (Isotropic Gain)

P = 1×10^{-5} Watts (Maximum spurious output power)

R = 3m (Measurement Distance)

$$E = 77.4 - 20 \log \sqrt{1.64} = 75.2 \text{ dBmV / m@3m}$$

MASK	Spurious Limit	FS Limit Below 1 GHz	FS Limit Above 1 GHz
A,B,C,G,H,I	-13dBm	84.4 dBμV/m@3m	82.2 dBμV/m@3m
D,J	-20dBm	77.4 dBμV/m@3m	75.2 dBμV/m@3m
E,F,K	-25dBm	72.4 dBμV/m@3m	70.2 dBμV/m@3m

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

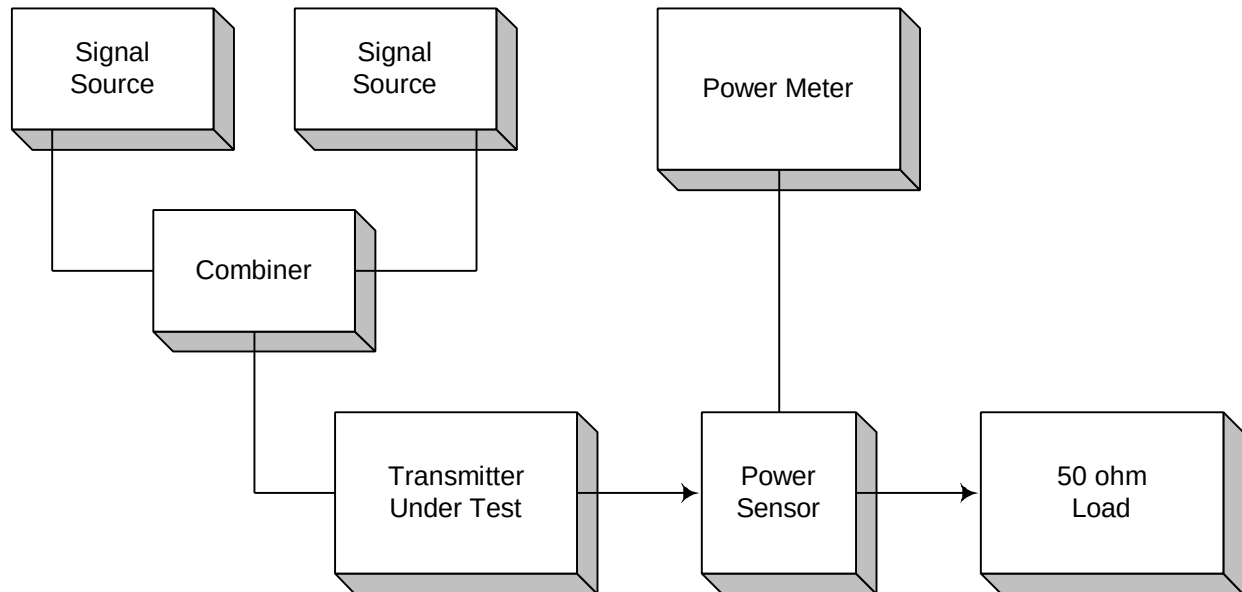
Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Table 2

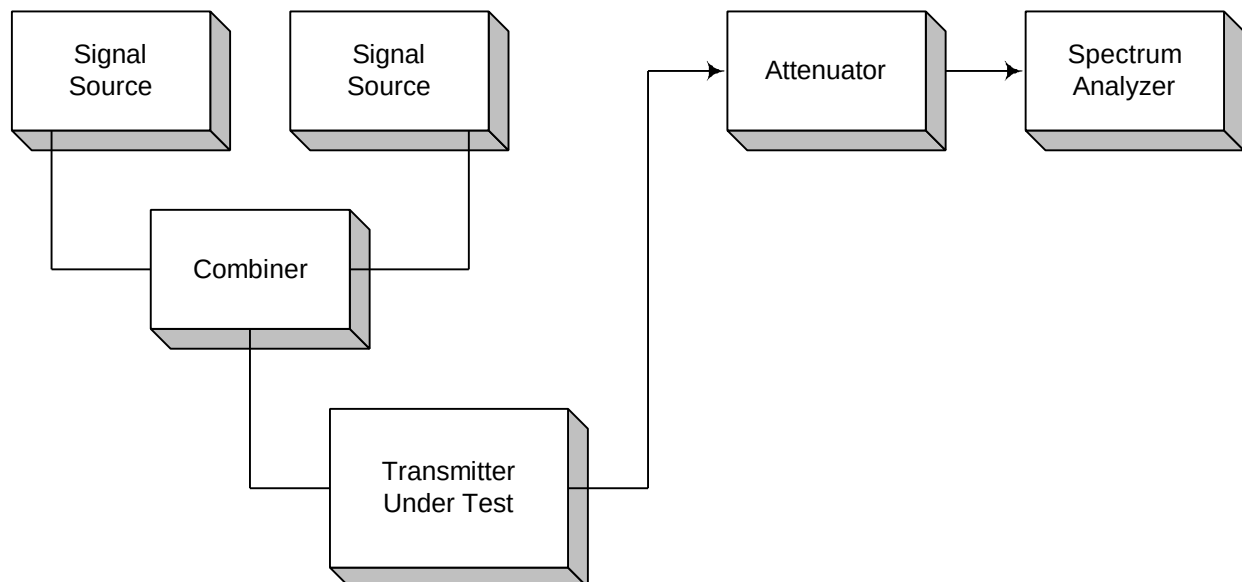
Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 -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

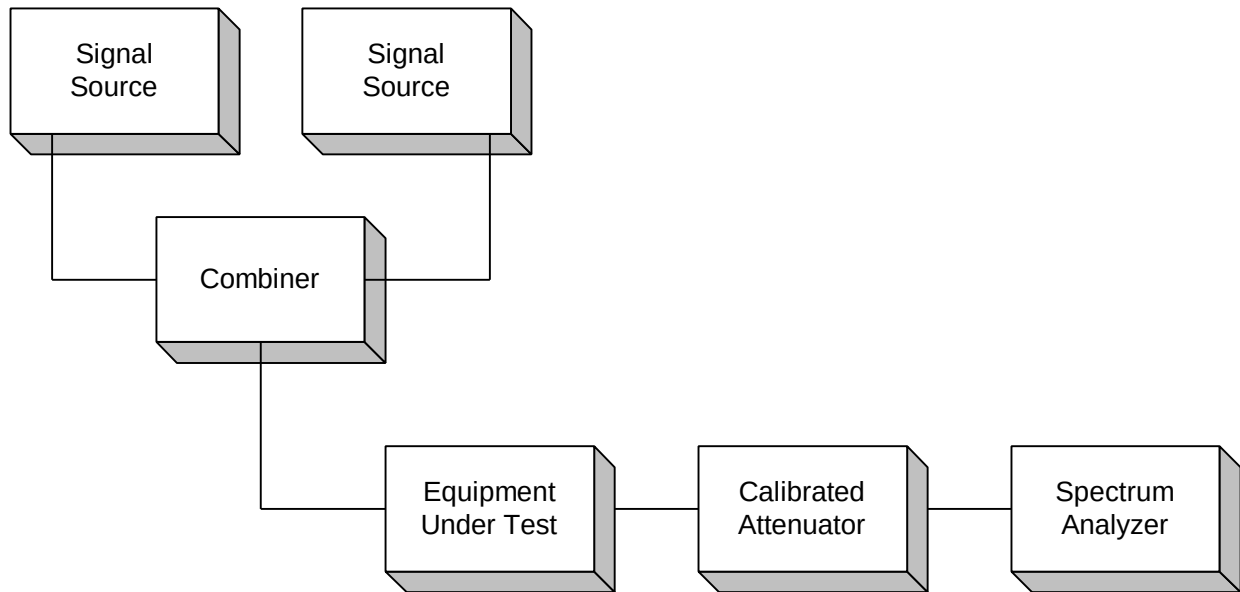
Para. No. 2.985 - R.F. Power Output



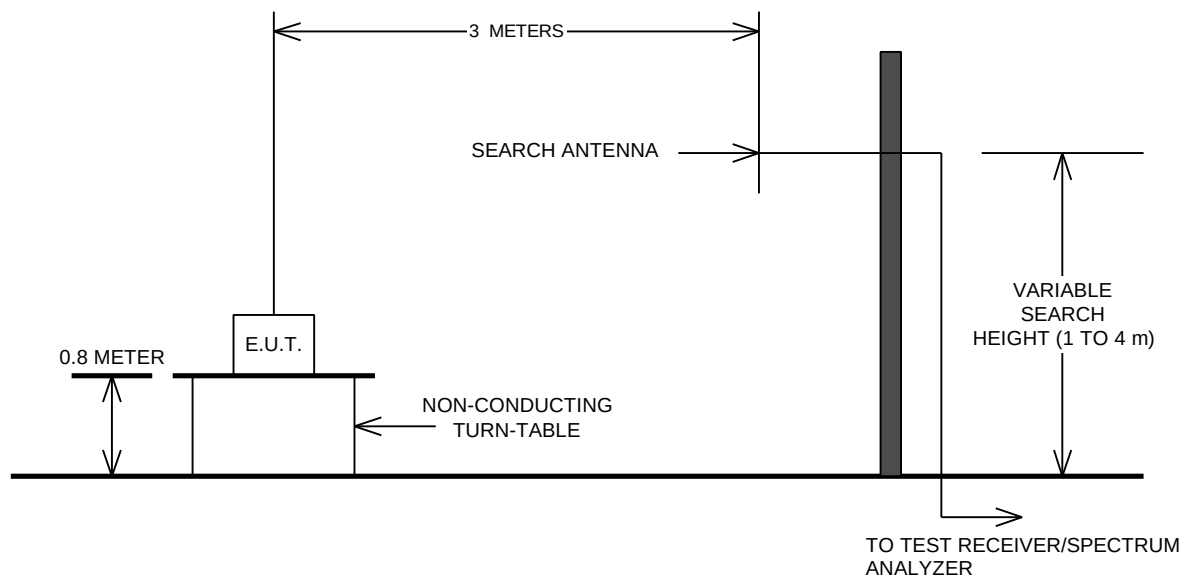
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 - Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

