


Nemko Test Report No.: 4L0655RUS2rev1

Applicant: Enfora, Inc.

Equipment Under Test: LBH0104 Dual Band Phone

In Accordance With: FCC Part 22, Subpart H
800 MHz Cellular Subscriber Units

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, TX
75057-3136

Authorized By: 
Dustin Oaks, Engineer

Date: 29 Nov. 2004

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Section 1. Summary of Test Results

Manufacturer: Enfora, Inc.

Model No.: LBH0104

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 22, Subpart H.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input checked="" type="checkbox"/> | 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

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	2.1046	Complies
Audio Frequency Response	2.1047	NA
Audio Low Pass Filter Response	2.1047	NA
Modulation Limiting	2.1047	NA
Occupied Bandwidth	2.1049	Complies
Occupied Bandwidth (WB Data & SAT)	2.1049	NA
Occupied Bandwidth (ST)	2.1049	NA
Occupied Bandwidth (SAT)	2.1049	NA
Occupied Bandwidth (SAT)	2.1049	NA
Spurious Emissions at Antenna Terminals	2.1051	NA
Field Strength of Spurious Emissions	2.1053	Complies
Frequency Stability	2.1055	Complies

Footnotes:

The device is not analog. GSM only.
The device has an integral antenna.

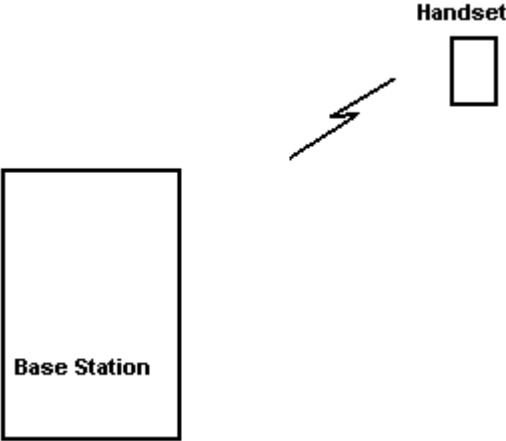
Section 2. General Equipment Specification

Frequency Range:	824.2 to 848.8 MHz
Tunable Bands:	824.2 to 849.8 MHz
Necessary Bandwidth:	300 kHz
Emission Designator:	300KGXW
Output Impedance:	50 ohms
RF Power Output (rated):	0.500 W erp
Channel Spacing:	300 kHz
Operator Selection of Frequency:	Software Controlled
Power Output Adjustment Capability:	Software Controlled

Operational Description

The phone is a dual band GSM phone operating in the 800 MHz cellular band and 1900 PCS band.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 11/10/04

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Output Power ERP (Watts)	Output Power ERP (dBm)
824.2	0.562	27.5
836.6	0.327	25.8
848.8	0.384	25.1

Note: Measurements were done radiated using the signal substitution method of measurement.

Equipment Used: 1304-1036-1484-1485

Measurement Uncertainty: +/- 1.7 dB

Temperature: 19 °C

Relative Humidity: 40 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1047
TESTED BY: David Light	DATE: 11/11/04

Test Results: Complies.

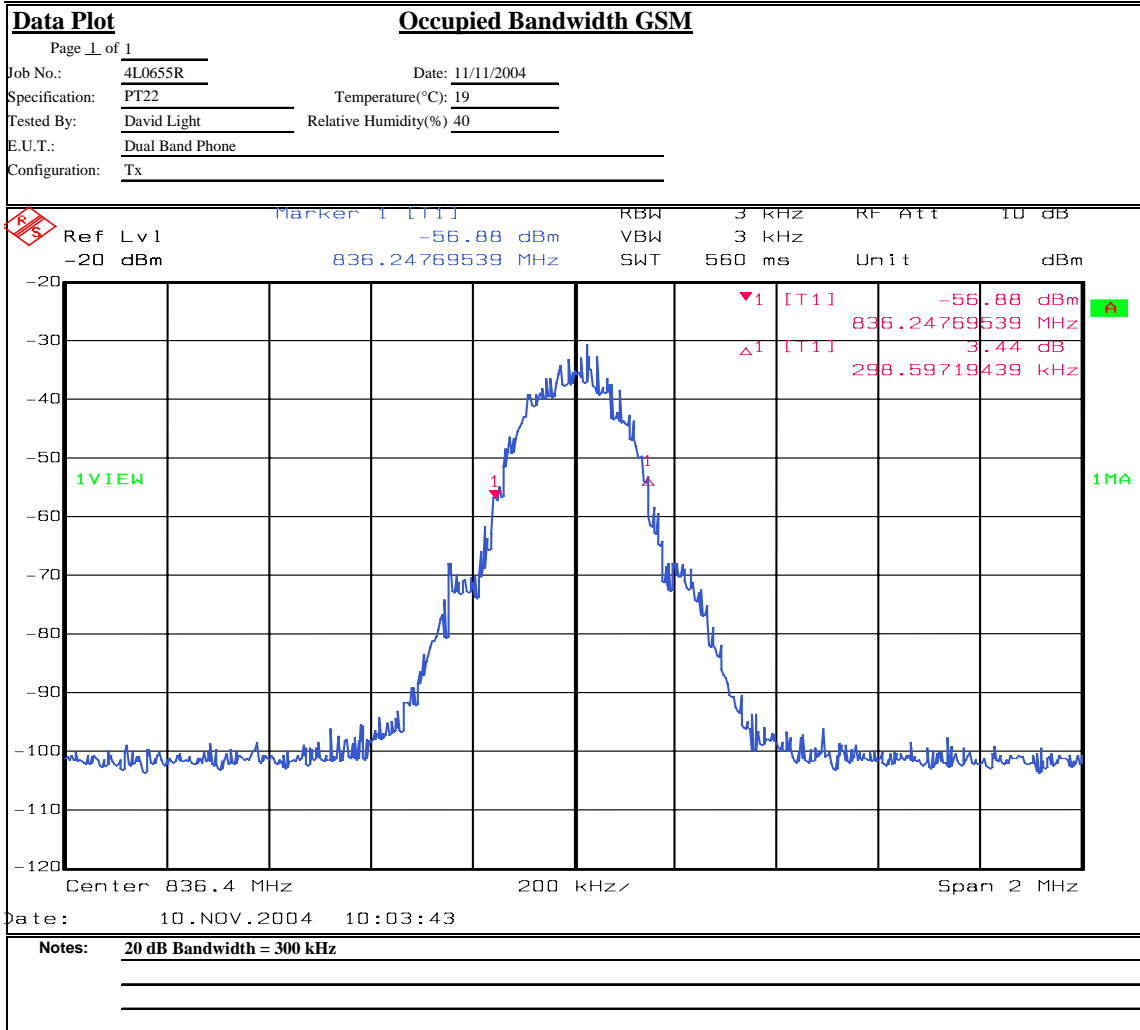
Measurement Data: See attached graph.

Test Data – Occupied Bandwidth



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Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 11/11/04

Test Results: Complies.

Measurement Data: See attached table.

EQUIPMENT: LBH0104

Test Data - Radiated Emissions



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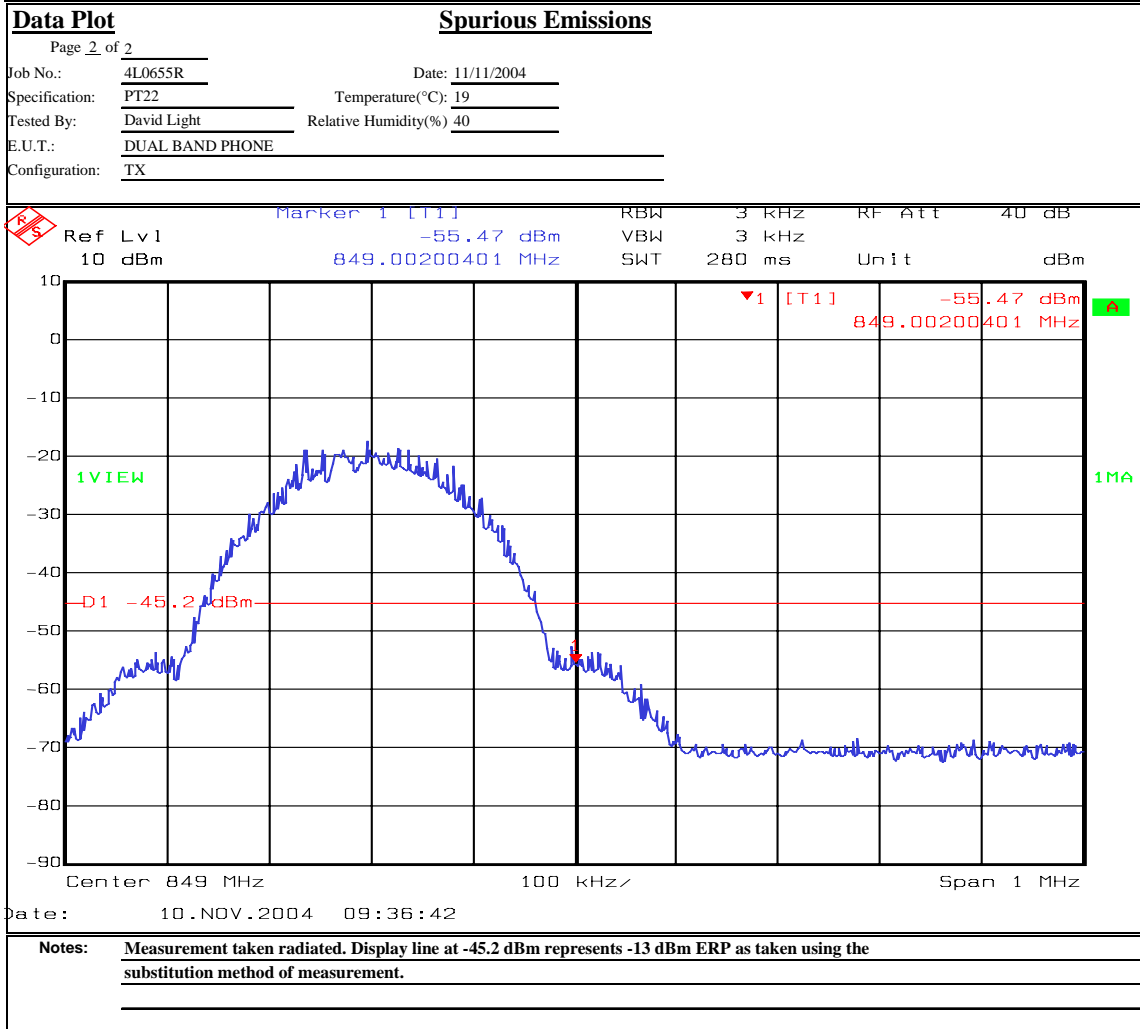
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Data Plot		Spurious Emissions		Complete _____																									
Page 1 of 2	Job No.: 4L0655R	Date: 11/11/2004	Preliminary: _____																										
Specification: PT22	Temperature(°C): 19																												
Tested By: David Light	Relative Humidity(%): 40																												
E.U.T.: DUAL BAND PHONE																													
Configuration: TX																													
Sample Number: 1																													
Location: AC 3	RBW: 300 kHz	Measurement																											
Detector Type: Peak	VBW: 300 kHz	Distance: 3 m																											
Test Equipment Used																													
Antenna: 1304	Directional Coupler: _____																												
Pre-Amp: _____	Cable #1: 1484																												
Filter: _____	Cable #2: 1485																												
Receiver: 1036	Cable #3: _____																												
Attenuator #1: _____	Cable #4: _____																												
Attenuator #2: _____	Mixer: _____																												
Additional equipment used: _____																													
Measurement Uncertainty: +/-1.7 dB																													
<table border="1"> <tr> <td>Ref Lvl</td> <td>10 dBm</td> <td>Marker 1 [T1]</td> <td>-50.87 dBm</td> <td>RBW</td> <td>3 kHz</td> <td>RF Att</td> <td>40 dB</td> </tr> <tr> <td></td> <td></td> <td></td> <td>823.99599198 MHz</td> <td>VBW</td> <td>3 kHz</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>SWT</td> <td>280 ms</td> <td>Unit</td> <td>dBm</td> </tr> </table>						Ref Lvl	10 dBm	Marker 1 [T1]	-50.87 dBm	RBW	3 kHz	RF Att	40 dB				823.99599198 MHz	VBW	3 kHz							SWT	280 ms	Unit	dBm
Ref Lvl	10 dBm	Marker 1 [T1]	-50.87 dBm	RBW	3 kHz	RF Att	40 dB																						
			823.99599198 MHz	VBW	3 kHz																								
				SWT	280 ms	Unit	dBm																						
<p>Center 824 MHz 100 kHz Span 1 MHz</p>																													
Date: 10.NOV.2004 09:26:40																													
Notes: Measurement taken radiated. Display line at -45.2 dBm represents -13 dBm ERP as taken using the substitution method of measurement.																													



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Test

Data - Radiated Emissions

EQUIPMENT: LBH0104

Test Data - Radiated Emissions



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ERP

Page 1 of 1

Job No.: 4L0655R Date: 11/10/04 Complete X
 Preliminary _____

Specification: PT22 Temperature(°C): 19
 Tested By: David Light Relative Humidity(%) 40
 E.U.T.: DUAL BAND PHONE
 Configuration: TX
 Sample No: 1
 Location: AC 3 RBW: 300 kHz Measurement
 Detector Type: Peak VBW: 300 kHz Distance: 3 m

Test Equipment Used

Antenna: 1304 Directional Coupler: _____
 Pre-Amp: 1016 Cable #1: 1484
 Filter: 1481 Cable #2: 1485
 Receiver: 1036 Cable #3: _____
 Attenuator #1: _____ Cable #4: _____
 Attenuator #2: _____ Mixer: _____
 Additional equipment used: _____
 Measurement Uncertainty: +/-1.7 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)	Pre-Amp Gain (dB)	Substitution Antenna Gain (dBD)	ERP (dBm)	ERP (mW)	Polarity	Comments
								Tx @ 836.6 MHz
1673.2	-59.0	32.7	0	6.4	-20.0	0.0101	H	Noise floor
2509.8	-31.8	34.6	32	8.0	-21.2	0.0076	H	
1673.2	-59.0	29.9	0	6.4	-22.8	0.0052	V	Noise floor
2509.8	-30.0	35.6	32	8.0	-18.5	0.0142	V	
3346.4	-44.5	37.1	32.6	8.1	-31.9	0.0006	V	

Notes: _____

The device was tested on three orthogonal axis'. Worse case data is provided.
 The device was tested from 30 MHz to the tenth harmonic of carrier.

Photographs of Test Setup



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: David Light	DATE: 11/12/04

Test Results: Complies.

Measurement Data: See attached table.

Test Data – Frequency Stability



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<u>Frequency Stability</u>	
Page <u>1</u> of <u>1</u>	
Job No.: 4L0655R	Date: 11/12/2004
Specification: PT22	Temperature(°C): <u>22</u>
Tested By: <u>David Light</u>	Relative Humidity(%) <u>40</u>
E.U.T.: <u>DUAL BAND PHONE</u>	
Configuration: <u>TX</u>	
Sample Number: <u>1</u>	
<u>Test Equipment Used</u>	
Antenna: <u>1304</u>	Directional Coupler: _____
Pre-Amp: _____	Cable #1: <u>1629</u>
Filter: _____	Cable #2: _____
Receiver: <u>1026</u>	Thermometer: <u>619</u>
Attenuator #1: _____	
Attenuator #2: _____	
Measurement Uncertainty: <u>1x10⁻¹⁷ ppm</u>	Standard Test Frequency <u>836.667607</u> MHz

Temp (°C)	Measured Frequency (MHz)	Rho	Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	836.667607		3.6	0	2091.7	0	Fully charged battery
20	836.667500		4.2	-107	2091.7	-0.1	Connected to charger
20	836.666759		3.0	-848	2091.7	-1.0	Battery cutoff
50	836.665901			-1706	2091.7	-2.0	
40	836.667312			-295	2091.7	-0.4	
30	836.668000			393	2091.7	0.5	
10	836.668800			1193	2091.7	1.4	
0	836.668870			1263	2091.7	1.5	
-10	836.668000			393	2091.7	0.5	
-20	836.667759			152	2091.7	0.2	
-30	836.668570			963	2091.7	1.2	
Notes:							

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1026	FREQUENCY COUNTER	HEWLETT PACKARD 5350B	8232A01493	01/23/04	01/22/05
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	04/22/03	04/21/04
619	THERMOMETER	FLUKE 51	4520028	09/16/04	09/16/05
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
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
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1481	Microwave Highpass Filter	K & L 3DH1-2000/T8000-0/0	4	Cal B4 Use	N/A
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	07/23/04	07/23/05
791	PREAMP, 25dB	ICC LNA25	398	11/12/04	11/12/05
1983	CABLE	KTL Site A OATS	N/A	03/11/04	03/11/05
760	Antenna biconical	Electro Metrics MFC-25	477	06/22/04	06/22/05

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output	PARA. NO.: 1.1046
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Minimum Standard:

§22.913 Effective radiated power limits. - The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Method Of Measurement:

Detachable Antenna:

The power at antenna terminals is measured using power meter.

Integral Antenna:

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: Audio Frequency Response	PARA. NO.: 2.1047
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Minimum Standard: No specific limit expressed in the FCC Rules.

From 300 to 3000 Hz the audio frequency response should not vary more than +1 to -3 dB from a true 6dB octave pre-emphasis characteristic as referred to 1000 Hz level (with the exception of a permissible 6dB per octave roll-off from 2500 to 3000 Hz).

Method Of Measurement:

Operate the transmitter with the compressor disabled, and monitor the output with a frequency deviation meter or standard test receiver without standard 750-microsecond de-emphasis, with expander disabled, and without C-message weighted filter (see 6.6.2). Apply a sine wave audio input to the transmitter external audio input port, vary the modulating frequency from 300 to 3000 Hz and observe the input levels necessary to maintain a constant ± 2.9 kHz system deviation.

NAME OF TEST: Audio Low Pass Filter Response	PARA. NO.: 2.1047
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Minimum Standard: No specific limit expressed in the FCC Rules.

For mobile stations, signals should be attenuated as a function of frequency as follows:

- i. In the frequency ranges 3.0 to 5.9 Hz and 6.1 to 15 kHz, $40 \log (f/3)$ dB.
- ii. In the frequency range 5.9 to 6.1 kHz, 35 dB
- iii. In the frequency range above 15 kHz, 28 dB.

Method Of Measurement:

Adjust the audio input frequency to 1000 Hz and adjust the input level to 20 dB greater than that required to produce ± 8 kHz deviation. Note the output level on the frequency deviation meter or standard test receiver. Using the output level as reference (0dB), vary the modulating frequency from 3000 Hz to 30,000 Hz and observe the change in output while maintaining a constant audio input level.

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.1047
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Minimum Standard: No specific requirement expressed in the FCC Rules.

The levels of the modulating signals should be set to the values specified below and should be maintained within $\pm 10\%$ of these values.

Voice: ± 12 kHz

SAT: ± 2 kHz

Wideband Data: ± 8 kHz

ST: ± 8 kHz

Method Of Measurement:

Voice: A 1 kHz audio tone is injected at levels between -45 and +20 dBVrms. The peak deviation is noted. This is repeated with a 300 Hz tone and a 3 kHz tone. A plot showing the family of curves is presented.

SAT: A SAT tone is generated by the mobile station and the peak deviation is measured.

Wideband Data: Wideband data is generated by the mobile station and the peak deviation is measured.

ST: ST data is generated by the mobile station and the peak deviation is measured.

NAME OF TEST: Occupied Bandwidth (Voice & SAT)	PARA. NO.: 2.1049
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Minimum Standard:

22.917 Emission limitations for cellular equipment. - The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

NAME OF TEST: Occupied Bandwidth (WBD & SAT)	PARA. NO.: 2.1049
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Minimum Standard:

22.917 Emission limitations for cellular equipment. - The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 2.1051

Minimum Standard:

22.917 Emission limitations for cellular equipment. - The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.1053
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Minimum Standard:

22.917 Emission limitations for cellular equipment. - The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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.

The spectrum is searched to 10 GHz.

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
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Minimum Standard: Para. No. 22.355. The transmitter carrier frequency shall remain within the tolerances given in Table C-1.

Freq. Range (MHz)	Mobile > 3 W	Mobile ≤ 3 W
821 to 896	2.5	2.5

Table C-1

Method Of Measurement:

Frequency Stability With Voltage Variation:

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation:

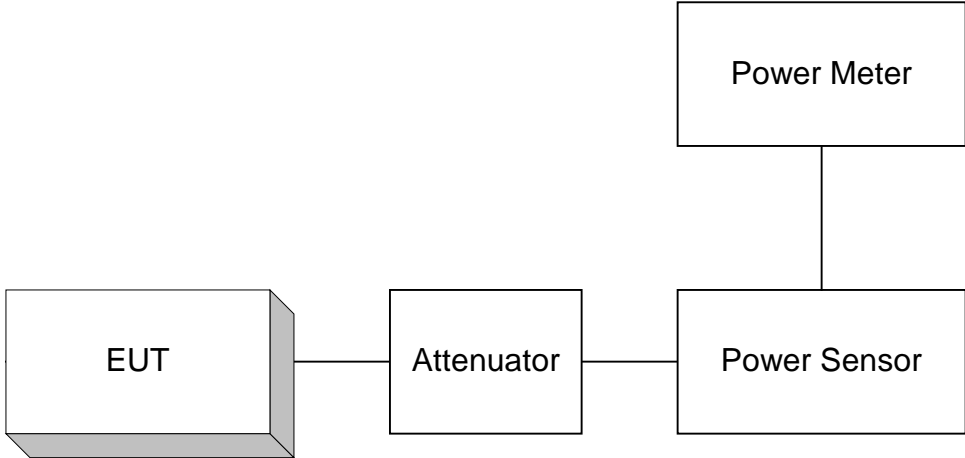
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

Devices that operate within a network and use dynamic power and frequency adjustment, the device is placed in call mode using a test set during this testing.

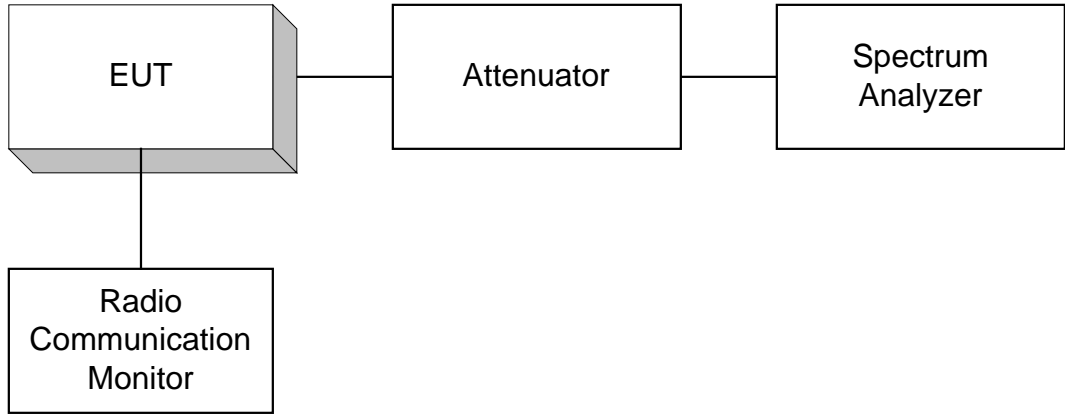
For devices that use complex digital modulation and cannot produce an unmodulated rf signal, the device is placed into call mode with a test set and the frequency error and rho parameters are recorded at each temperature and voltage variation.

ANNEX B - TEST DIAGRAMS

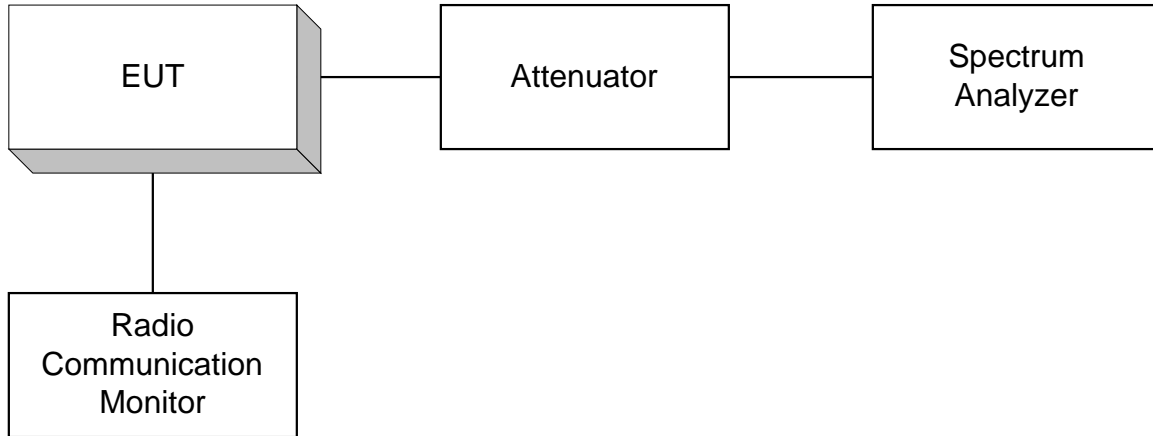
Para. No. 2.1046 - R.F. Power Output



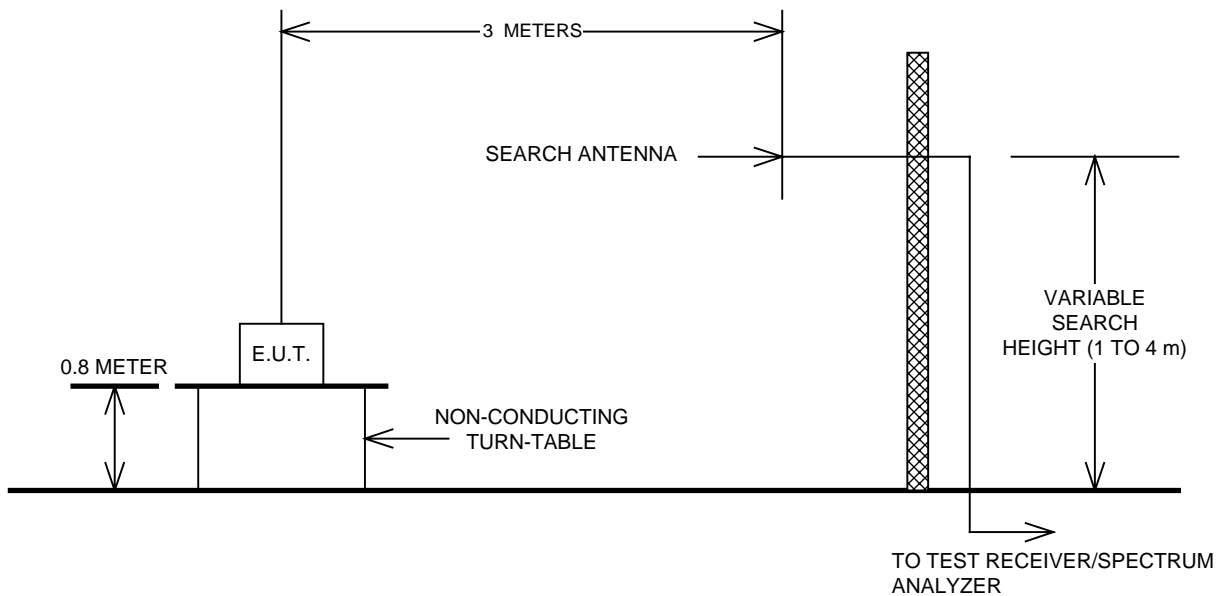
Para. No. 2.1049 - Occupied Bandwidth



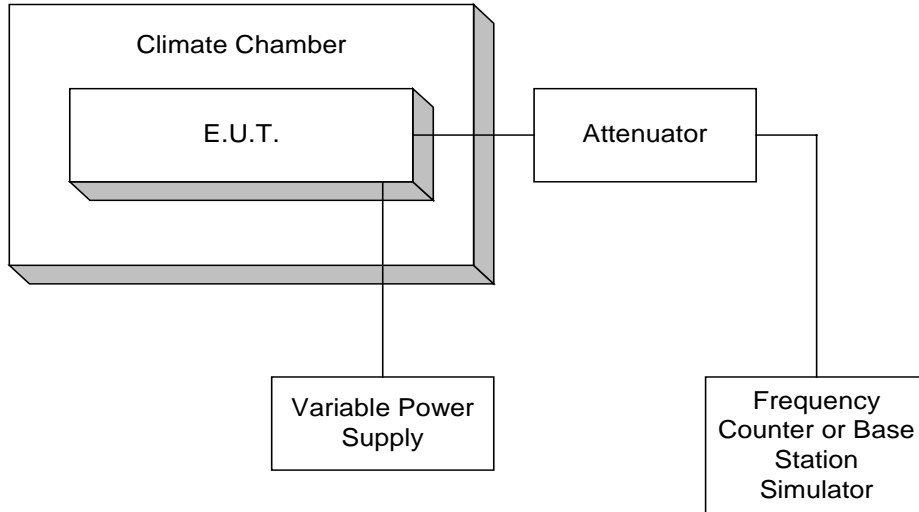
Para. No. 2.1051 Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation



Para. No. 2.1055 - Frequency Stability



Para. No. 2.1045 – Audio Frequency Response, Audio Low Pass Filter Response
And Modulation Limiting

