

Nemko Test Report No.: 3L0477RUS1Rev4

Applicant: Enfora, Inc.
661 E. 18th Street
Plano, TX 75074

Equipment Under Test: EnablerII-G Model GSM0108

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:



Tom Tidwell, Frontline Manager

Date: 5/18/04

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Section 1. Summary of Test Results

Manufacturer: Enfora, Inc.

Model No.: GSM0108

Serial No.: SN1

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.



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

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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
Spurious Emissions at Antenna Terminals	2.1051	Complies
Field Strength of Spurious Emissions	2.1053	Complies
Frequency Stability	2.1055	Complies

Footnotes:

The device is digital only.

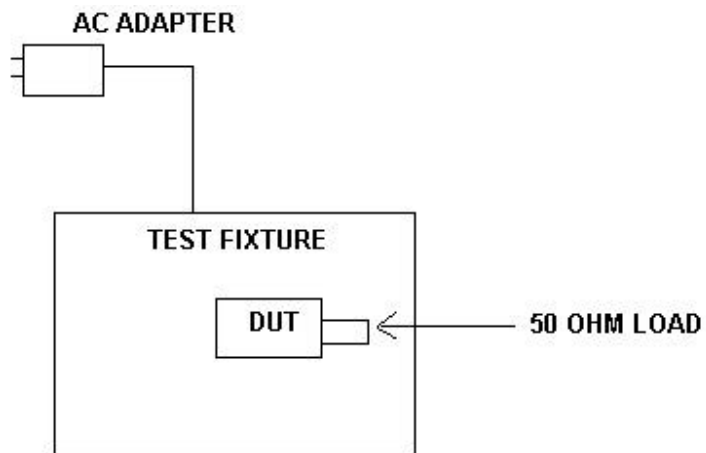
Section 2. General Equipment Specification

Frequency Range:	824.2 to 848.8 MHz
Tunable Bands:	824.2 to 848.8 MHz
Necessary Bandwidth:	270 kHz
Emission Designator:	270KG7W
Output Impedance:	50 ohms
RF Power Output (rated):	33 dBm (2 Watts) erp
Number of Channels:	124
Operator Selection of Frequency:	Software Controlled
Power Output Adjustment Capability:	Software Controlled

Operational Description

This device is a wireless GSM/GPRS wireless modem that operates in the 800 MHz cellular band and the 1900 MHz PCS band.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 12/1/03

Test Results: Complies.

Measurement Data:

Frequency (MHz)	Output Power (dBm)	Rated Power (dBm)
824.2	32.2	33
836.52	32.2	33
848.8	32.4	33

Antenna gain: 1 dB

ERP = 32.4 + 1 dB = 33.4 dBm (2 watts)

Equipment Used: 1036-1064-1065-1629

Measurement Uncertainty: +/- 1.7 dB dB

Temperature: 22 °C

Relative Humidity: 40 %



Nemko Dallas, Inc.

Dallas Headquarters:

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ERP Substitution Method

Page 1 of 1

Job No.: 3L0477

Date: 12/8/03

Complete x Preliminary

Specification: PART 22

Temperature(°C): 23

Tested By: David Light

Relative Humidity(%) 37

E.U.T.: GSM0108

Configuration: TX at full rf transmit power

Sample No:

Location: Lab 3

RBW: 1 MHz

Measurement

Detector Type: Peak

VBW: 1 MHz

Distance: 3 m**Test Equipment Used**

Antenna: 993

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 Uncertainty: +/-1.7 dB

Frequency (MHz)	Meter Reading (dBm)	Substitution Level (dBm)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
824.20	0.9	33.1			4.9	33.1			V	
836.52	1.0	33.2			4.9	33.2			V	
848.80	1.1	33.3			4.9	33.3			V	

Notes: Measurements were taken in Vertical and Horizontal Polarizations of the Receive antenna and the equipment under test was manipulated in 3 orthogonal axis in order to determine the orientation of maximum field intensity.

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth GSM	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 12/01/03

Test Results: Complies.

Measurement Data: See attached graph.

Equipment Used: 1036-1064-1065-1629

Measurement Uncertainty: 1×10^{-7} ppm

Temperature: 22 °C

Relative Humidity: 40 %

Test Plot – Occupied Bandwidth

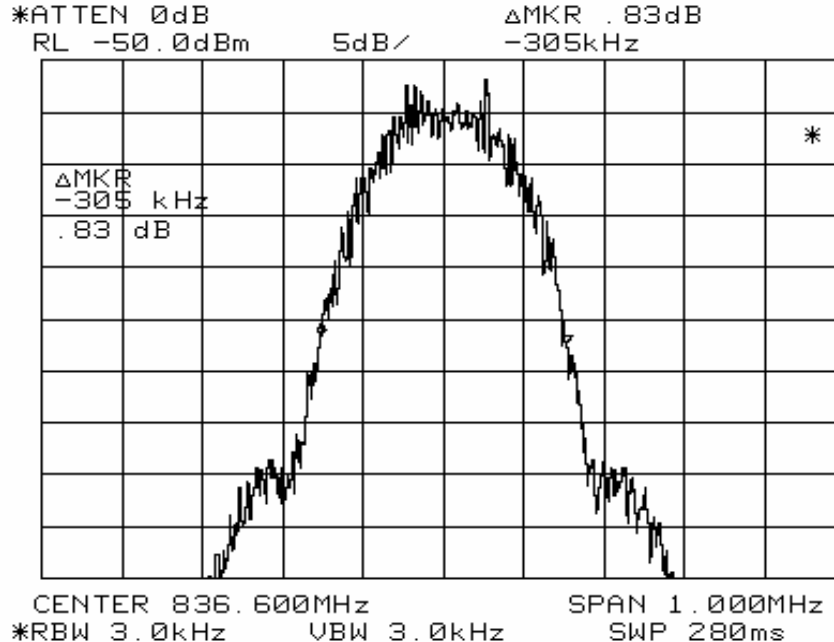


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Data Plot		Occupied Bandwidth	
Page 1 of 1			
Job No.: 3L0477	Date: 12/1/2003	Complete <u>X</u>	
Specification: PART22	Temperature(°C): 22	Preliminary: _____	
Tested By: David Light	Relative Humidity(%): 40		
E.U.T.: GSM0108			
Configuration: TX IN TEST FIXTURE			
Sample Number: 1			
Location: Lab 1	RBW: 20 kHz	Measurement	
Detector Type: Peak	VBW: 20 kHz	Distance: NA m	
Test Equipment Used			
Antenna: 993	Directional Coupler: _____		
Pre-Amp: _____	Cable #1: 1484		
Filter: _____	Cable #2: 1485		
Receiver: 1464	Cable #3: _____		
Attenuator #1: _____	Cable #4: _____		
Attenuator #2: _____	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: 1×10^{-7} ppm			



Notes:

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions At Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 12/1/03

Test Results: Complies.

Measurement Data: See attached graph.

Equipment Used: 1036-1064-1065-1629

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

Test Plots – Spurious Emissions at Antenna Terminals



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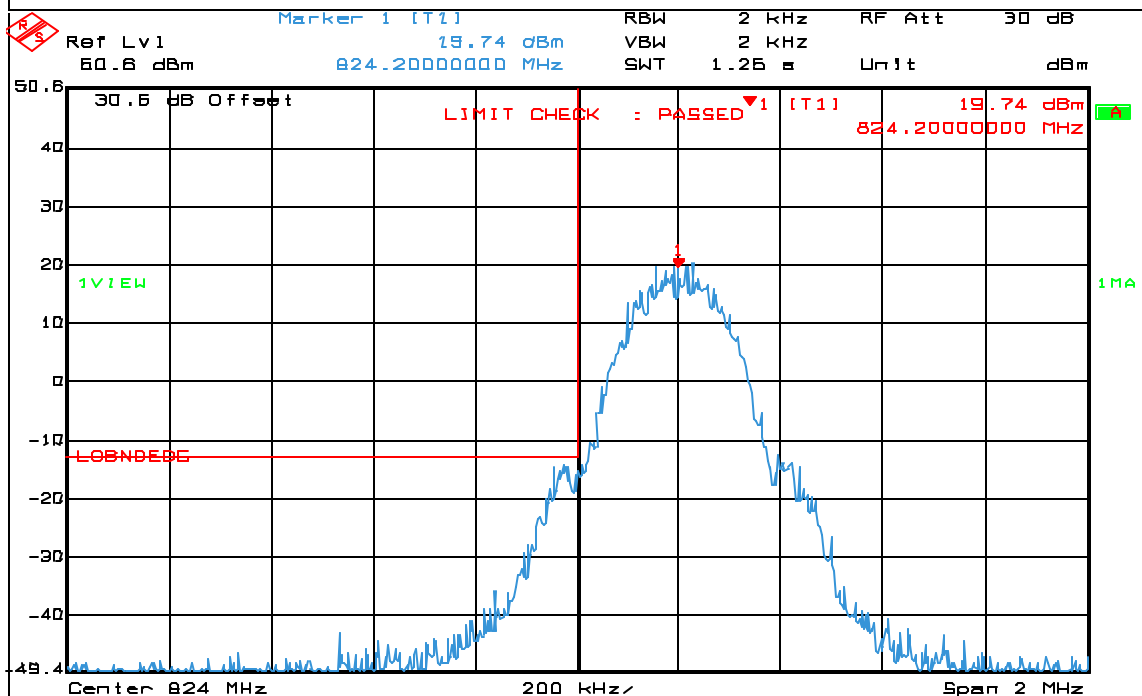
Data Plot

Spurious Emissions at Antenna Terminals

Page 1 of 3
Job No.: 3L0477 Date: 12/1/2003 Complete X
Specification: PART22 Temperature(°C): 22 Preliminary: _____
Tested By: David Light Relative Humidity(%): 40
E.U.T.: GSM0108
Configuration: TX IN TEST FIXTURE
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: 1629
Filter: _____ Cable #2: _____
Receiver: 1036 Cable #3: _____
Attenuator #1: 1064 Cable #4: _____
Attenuator #2: 1065 Mixer: _____
Additional equipment used: _____
Measurement Uncertainty: +/-1.7 dB



Date: 01 DEC 2003 14:02:08

Notes: LOWER BAND EDGE

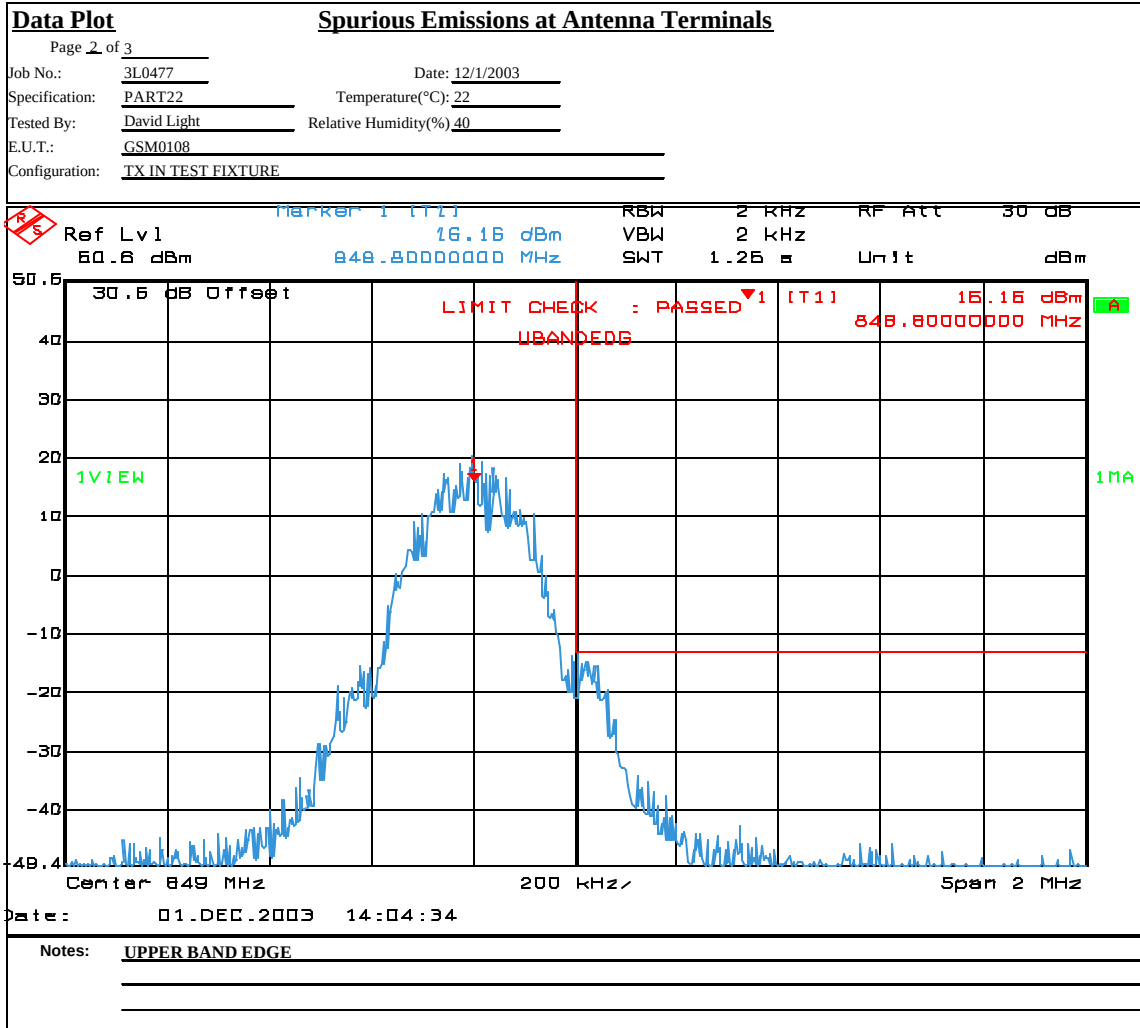
Test Plots – Spurious Emissions at Antenna Terminals



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Test Plots – Spurious Emissions at Antenna Terminals



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Data Plot

Page 3 of 3

Job No.: 3L0477

Date: 12/1/2003

Specification: PART2

Temperature(°C): 22

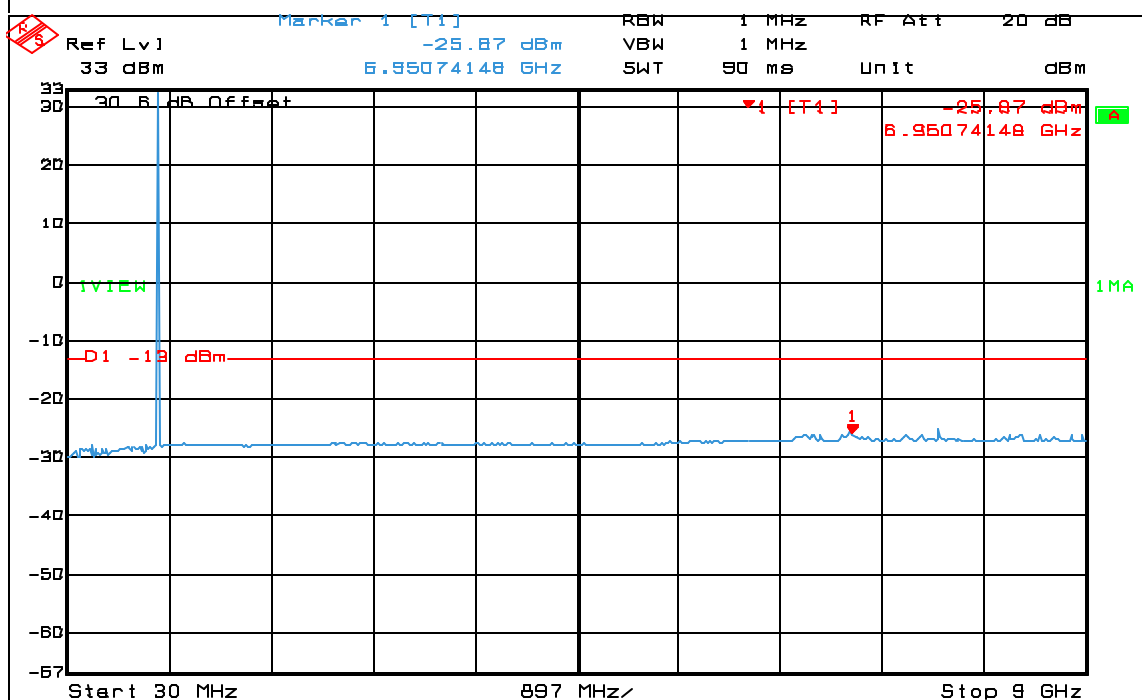
Tested By: David Light

Relative Humidity(%) 40

E.U.T.:	GSM0108
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Configuration:	TX IN TEST FIXTURE
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Spurious Emissions at Antenna Terminals



Date: 01.DEC.2003 14:08:23

Notes: MARKER INDICATES HIGHEST EMISSION LEVEL (NOISE FLOOR)

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: Dustin Oaks	DATE: 12/1/03

Test Results: Complies.

Measurement Data: See attached table.

Equipment Used: 1464-993-1016-1484-1485

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 60 %

Test Data - Radiated Emissions



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ERP Substitution Method

Page 1 of 1

Job No.:	3L0477	Date:	12/1/03
Specification:	PART 22	Temperature(°C):	<u>20</u>
Tested By:	<u>Dustin Oaks</u>	Relative Humidity(%):	<u>60</u>
E.U.T.:	<u>GSM0108</u>		
Configuration:	<u>TX IN TEST FIXTURE INTO LOAD</u>		
Sample No:	<u></u>		
Location:	<u>Lab 3</u>	RBW:	<u>1 MHz</u>
Detector Type:	<u>Peak</u>	VBW:	<u>1 MHz</u>

Complete X
Preliminary

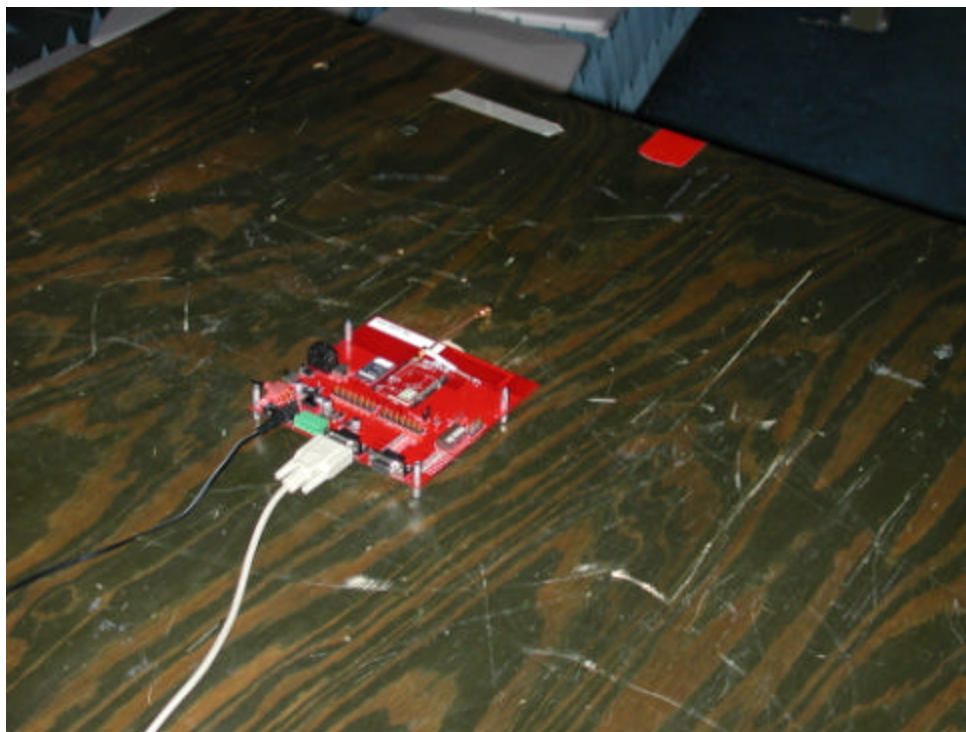
Test Equipment Used

Antenna:	993	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 Uncertainty:	+/-1.7 dB		

Frequency	Meter Reading	Substitution Level		Pre-Amp Gain	Substitution Antenna Gain	ERP	Limit	Margin	Polarity	Comments
(MHz)	(dBm)	(dBm)		(dB)	(dBd)	(dBm)	(dBm)	(dB)		
1673.35	-49.0	-48.5		32.5	7.3	-48.5	-13.0	-35.5000	h	
2509.70	-55.2	-52.6		32.9	8.0	-52.6	-13.0	-39.5700	h	
3346.38	-53.3	-49.6		32.6	8.0	-49.6	-13.0	-36.5967	h	
5019.60	-51.5	-45.9		32.7	8.2	-45.9	-13.0	-32.8667	h	
5856.26	-56.2	-50.3		31.9	9.3	-50.3	-13.0	-37.2667	h	
8366.10	-57.7	-48.1		32.9	9.1	-48.1	-13.0	-35.1000	h	
1673.30	-46.8	-48.3		32.5	7.3	-48.3	-13.0	-35.3300	v	
2509.90	-52.6	-50.0		32.9	8.0	-50.0	-13.0	-37.0000	v	
3346.50	-50.6	-43.4		32.6	8.0	-43.4	-13.0	-30.3667	v	
4183.03	-56.0	-43.7		33	8.2	-43.7	-13.0	-30.6667	v	
5019.63	-49.8	-41.2		32.7	8.2	-41.2	-13.0	-28.1967	v	
5856.23	-57.3	-49.4		31.9	9.3	-49.4	-13.0	-36.3967	v	
6692.48	-58.8	-49.1		31.57	9.4	-49.1	-13.0	-36.0667	v	
7529.43	-58.0	-49.1		32.89	9.2	-49.1	-13.0	-36.0567	v	
8366.03	-56.3	-46.4		32.9	9.1	-46.4	-13.0	-33.3967	v	
9202.63	-56.0	-48.7		34	9.6	-48.7	-13.0	-35.6667	v	

Notes: _____

Photographs of Test Setup



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: David Light	DATE: 12/2/03

Test Results: Complies.

Measurement Data: See attached table.

Standard Test Frequency: 836.657680 MHz
Standard Test Voltage: 5 Vdc

Equipment Used: 283-1064-1065-1629-1036

Measurement Uncertainty: 1×10^{-7} ppm

Temperature: 22 °C

Relative Humidity: 40 %

Test Data – Frequency Stability

Temperature	Voltage	Frequency Error (Hz)	Comments
20 °C	3.8	0	
20 °C	4.37	0	
20 °C	3.25	0	
10 °C	3.8	82	
0 °C	3.8	76	
-10 °C	3.8	76	
-20 °C	3.8	77	
-30 °C	3.8	75	
30 °C	3.8	80	
40 °C	3.8	82	
50 °C	3.8	85	

Section 8. Test Equipment List

Nemko	Description	Manufacturer Model	Serial	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & FSEK30	830844/006	12/18/01	12/19/03
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1065	ATTENUATOR	NARDA 776B-10	NONE	CBU	N/A
1629	CABLE, 6	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1464	Spectrum	Hewlett 8563E	3551A04428	02/11/03	02/11/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	8/28/03	8/28/04
993	Horn antenna	A.H. SAS-200/571	XXX	01/08/02	01/09/04
283	Environmental Chamber with controller #	ENVIROTRONIC SH27 & 2030-22844	129010083	04/22/03	04/21/04

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output**PARA. NO.: 1.1046****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
--	-------------------

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**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****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
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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: Field Strength of Spurious Radiation**PARA. NO.:** 2.1053**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

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:

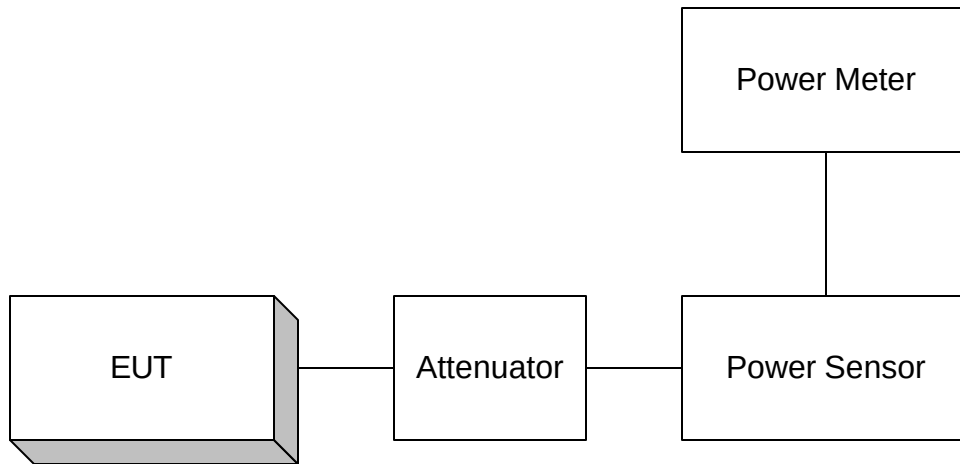
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

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.

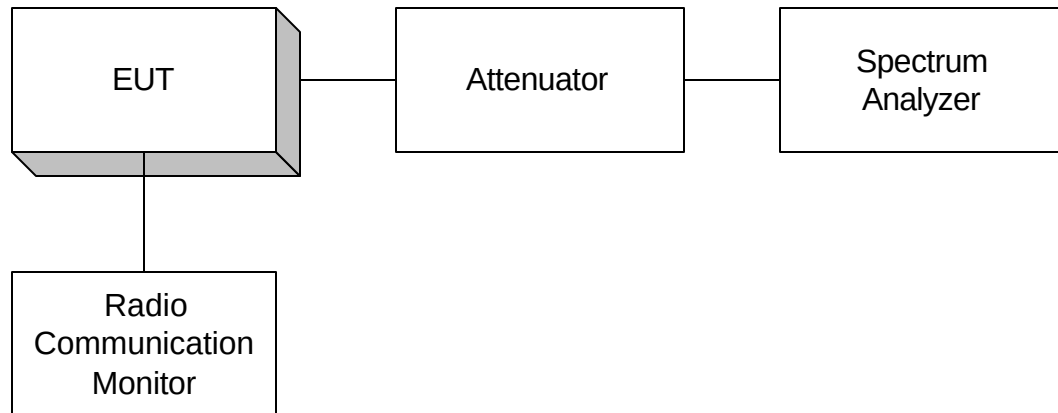
For devices that use complex digital modulation and cannot produce an unmodulated rf signal, the device is placed into call mode with a test set and the frequency error and rho parameters are recorded at each temperature and voltage variation.

ANNEX B - TEST DIAGRAMS

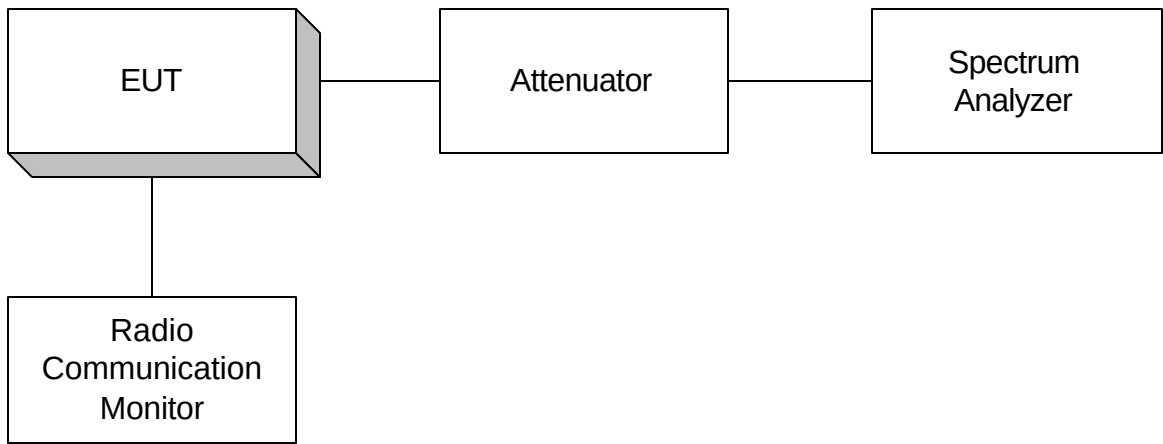
Para. No. 2.1046 - R.F. Power Output



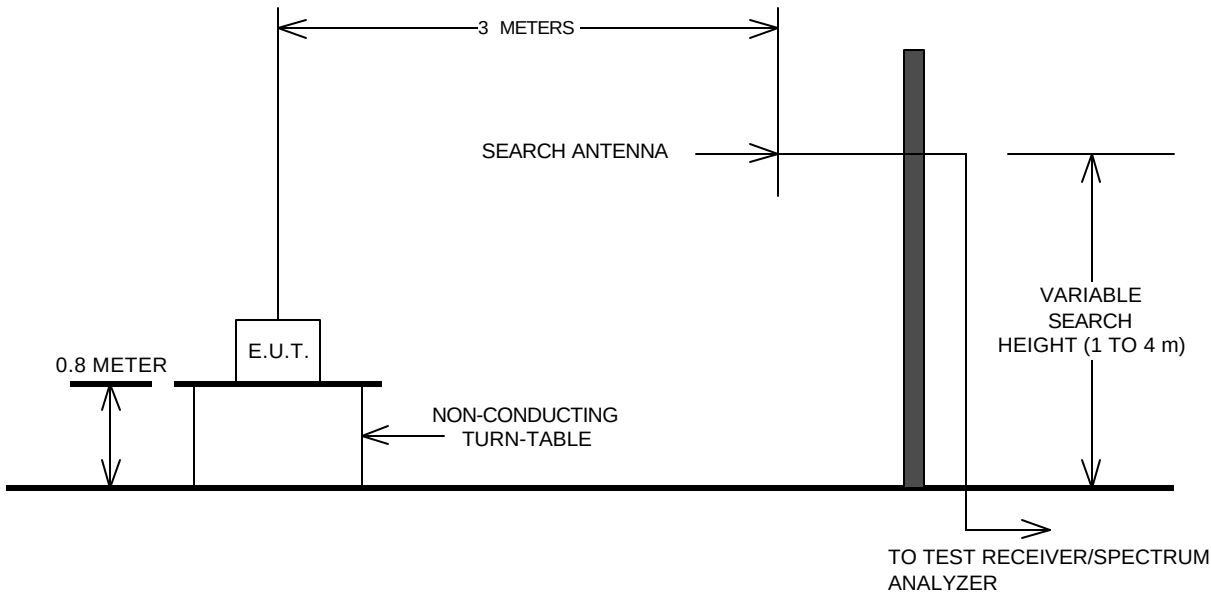
Para. No. 2.1049 - Occupied Bandwidth



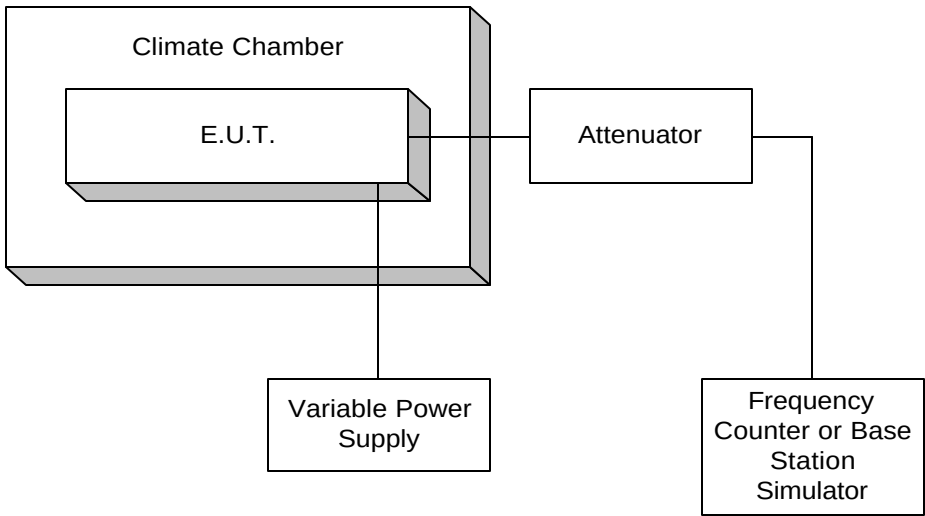
Para. No. 2.1051 Spurious Emissions at Antenna Terminals



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

