TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Partial Test of: Enfora L.P.
GSM2228 MiniMT With Personal Hands Free

To: FCC Part 22: 2006 (Subpart H) and
FCC Part 24: 2006 (Subpart E)

Test Report Serial No:
RFI/RPTE2/RP72182JD09A

Supersedes Test Report Serial No:
RFI/RPTE1/RP72182JD09A

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager: **pp.** 	
Tested By: Ian Watch 	**Checked By: Michael Derby** 
Report Copy No: PDF01	
Issue Date: 14 March 2007	**Test Dates: 08 March 2007**

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields.

This report may be copied in full. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

This page has been left intentionally blank.

Test of: **Enfora L.P.**
GSM2228 MiniMT With Personal Hands Free
To: **FCC Part 22: 2006 (Subpart H) and FCC Part 24: 2006 (Subpart E)**

Table of Contents

1. Client Information

Company Name:	Enfora L.P.
Address:	661 E 18th Street Plano TX 75074 USA
Contact Name:	Mr R Holden

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Description of EUT

The equipment under test is a Quad-Band GSM2228 MiniMT Mobile Tracking Device with personal hands free kit. The EUT was tested at GSM850, GPRS850, PCS1900 and GPRS1900.

2.2. Identification of Equipment Under Test (EUT)

Description:	Mobile Tracking Device
Brand Name:	Enfora
Model Name or Number:	GSM2228 MiniMT
Serial Number:	2228100790200
IMEI Number:	011070000067926
Hardware Version Number:	A
Software Version Number:	0.1.0
Hardware Revision of GSM Module:	C
Software Revision of GSM Module:	0.7.6
FCC ID Number:	MIVGSM2228
Country of Manufacture:	USA
Date of Receipt:	08 March 2007

2.3. Modifications Incorporated in the EUT

During the course of testing the EUT was not modified.

2.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Personal Hands Free Kit (PHF)
Brand Name:	None Stated on device (unbranded)
Model Name or Number:	None Provided by customer
Serial Number:	None Provided by customer
Cable Length and Type:	Length: 1.5m, Type: 2 core audio cable
Country of Manufacture:	None Stated on device
Connected to Port	2.5mm female audio jack

2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Radio communication Analyser
Brand Name:	Anritsu
Model Name or Number:	MT8820A
Serial Number:	6K00000647
Cable Length and Type:	1.5m, Utiflex
Connected to Port:	RF (Input / Output) Air Link

Description:	AC Charger
Brand Name:	Zip-Linq
Model Name or Number:	LD3007
Serial Number:	None stated
Cable Length and Type:	1.8m, USB to Mini USB
Connected to Port:	DC Input

2.6. Additional Information Related to Testing

Power Supply Requirement:	Nominal 115 V, 60 Hz AC Mains supply (used as battery charger) Internal battery supply of 3.7V, 1300 mAH
Intended Operating Environment:	Residential, Commercial, Within GSM coverage
Equipment Category:	GSM 850/GSM 1900
Type of Unit:	Portable (Standalone battery powered device)
Interface Ports:	USB / Charger Port

FCC Part 22

Transmit Frequency Range:	869.0 to 894.0 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	869.2
	Middle	189	881.4
	Top	251	893.8
Receive Frequency Range:	824.0 to 849.0 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	824.2
	Middle	189	836.4
	Top	251	848.8
Maximum Power Output (ERP):	28.8 dBm (measured)		

FCC Part 24

Transmit Frequency Range:	1930.0 to 1990.0 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1930.2
	Middle	660	1959.8
	Top	810	1989.8
Receive Frequency Range:	1850.0 to 1910.0 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1909.8
Maximum Power Output (EIRP):	24.0 dBm (measured)		

3. Test Specification, Methods and Procedures

Reference:	FCC Part 22: 2006 Subpart H (Cellular Radiotelephone Service)
Title:	Code of Federal Regulations, Part 22 (47CFR22) Personal Communication Services.

Reference:	FCC Part 24: 2006 Subpart E (Broadband PCS)
Title:	Code of Federal Regulations, Part 24 (47CFR24) Personal Communication Services.

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003
Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)
Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)
Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)
Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)
Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

3.2. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures Section above. Appendix 1 contains a list of the test equipment used.

4. Deviations from the Test Specification

At the request of the client, only Transmitter Effective Radiated Power (ERP) and Transmitter Equivalent Isotropic Radiated Power (EIRP) measurements were performed.

5. Operation of the EUT during Testing

5.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated.

GSM 850 MHz and PCS 1900 MHz co-allocated modes.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration unless otherwise stated:

Tested connected to an AC/DC supply with battery.

Following investigations, the final power measurements were made without the personal hands free kit connected.

6. Summary of Test Results

FCC Part 22

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Transmitter Effective Radiated Power (ERP)	Section 22.913(a)	Antenna	Complied

FCC Part 24

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Transmitter Effective Isotropic Radiated Power (EIRP)	Section 24.232	Antenna	Complied

6.1. Location of Tests

All the measurements described in this report were performed at the premises of
RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ

FCC Site Registration Number: 90895

IC Site Registration Number: 3485

7. Measurements, Examinations and Derived Results

7.1. General Comments

This Section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 8 for details of measurement uncertainties.

7.2. Test Results – FCC Part 22 (Subpart H)

7.2.1. Transmitter Effective Radiated Power (ERP): Section 22.913(a)

The EUT was configured for effective radiated power, as described in Section 9 of this report.

Tests were performed to identify the maximum effective radiated power (ERP).

Results:

Channel	Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	824.2	28.8	38.4	9.6	Complied
Middle	836.4	26.7	38.4	11.7	Complied
Top	848.8	28.8	38.4	9.6	Complied

Note: Worst case levels without the hands free kit connected, are shown above.

7.2.2. Test Results – FCC Part 24 (Subpart E)

7.2.3. Transmitter Effective Isotropic Radiated Power (EIRP): Section 24.232

The EUT was configured for effective isotropic radiated power, as described in Section 9 of this report.

Tests were performed to identify the maximum effective isotropic radiated power (EIRP).

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity	Maximum Transmitter EIRP (dBm)	Limit EIRP (dBm)	Margin (dB)	Result
Bottom	1850.2	Vertical	23.3	33.0	9.7	Complied
Middle	1879.8	Vertical	23.1	33.0	9.9	Complied
Top	1909.8	Vertical	24.0	33.0	9.0	Complied

Note: Worst case levels without the hands free kit connected, are shown above.

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Equivalent Isotropic Radiated Power (EIRP) and Effective Radiated Power (ERP)	Not applicable	95%	±2.54 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

9. Measurement Methods

9.1. Effective Radiated Power (ERP) – FCC Part 22

ERP measurements were performed in accordance with the standard, against appropriate limits.

The ERP was measured with the EUT arranged on a non-conducting turntable on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4. The transmitter was fitted with an integral antenna; as such all radiated tests were performed with the unit operating into the integral antenna.

The level of the ERP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For ERP measurements a dipole antenna was used. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The ERP was calculated as:-

ERP = Signal Generator Level - Cable Loss + Antenna Gain

Effective Radiated Power (ERP) (Continued)

Circumstances where the signal generator could not produce the desired power, substitutions were performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The ERP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated ERP to obtain the substituted EUT ERP.

Delta (dB) = EUT – SG

Where:

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual ERP is calculated as:

ERP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT ERP is calculated as:

ERP EUT = ERP SG + Delta.

The test equipment settings for ERP measurements were as follows:

Receiver Function	Setting
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	≥ Emission Bandwidth
Amplitude Range:	100 dB
Sweep Time:	Coupled

9.2. Effective Isotropic Radiated Power (EIRP) – FCC Part 24

EIRP measurements were performed in accordance with the standard, against appropriate limits.

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4. The transmitter was fitted with an integral antenna; therefore all radiated tests were performed with the unit operating into the integral antenna.

The level of the EIRP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

All measurements were performed using broadband Horn antennas.

Effective Isotropic Radiated Power (EIRP) (Continued)

Circumstances where the signal generator could not produce the desired power, substitutions were performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

Delta (dB) = EUT – SG

Where:

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

EIRP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT EIRP is calculated as:

EIRP EUT = EIRP SG + Delta.

The test equipment settings for EIRP measurements were as follows:

Receiver Function	Setting
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	1 MHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval
A027	1-2 GHz Horn Antenna	Eaton	9188-2	301	8 June 06	36
A059	3146 Log Periodic Antenna	EMCO	3146	8902-2378	9 May 06	12
A1817	1-18GHz Horn Antenna	EMCO	3115	00075694	3 Nov 06	12
C1065	20m cable	Rosenberger	UFA210-1-7872	0985	6 Oct 06	12
C1167	3m N-Type Cable	Rosenberger Micro-Coax	FA210A103 0007070	43190-01	Cal before use	-
M1140	Radio Communications Analyser	Anritsu	MT8820A	6K0000647	Not calibrated	-
M1242	Spectrum Analyser	Rohde & Schwarz, Inc.	FSEM30	845986_022	8 Sept 2006	12
M1264	Thermo Hygrometer	RS	212-124	0	18 Feb 06	12
S202	Test Site 2	RFI	2	S202-15011990	17 Nov 2006	12

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.