



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372

3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

January 25, 2012

Digital Receiver Technology, Inc.
20250 Century Blvd., Suite 500
Germantown, MD 20874

Dear Steve Hudson,

Enclosed is the EMC Wireless test report for MPE measurements of the Digital Receiver Technology, Inc., DRT1301C as evaluated to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 1, Subpart I, Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 2, Subpart J, and RSS-102, Issue 4, March 2010.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Digital Receiver Technology, Inc.\EMC32002-MPE Rev. 1)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc.

RF Maximum Permissible Exposure (MPE) Report For Controlled and Uncontrolled Environments

for the

Digital Receiver Technology, Inc.
DRT1301C

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 1 Subpart I & Part 2 Subpart J
&
RSS-102, Issue 4, March 2010

MET Report: EMC32002-MPE Rev. 1

January 25, 2012

Prepared For:

Digital Receiver Technology, Inc.
20250 Century Blvd., Suite 500
Germantown, MD 20874

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

RF Maximum Permissible Exposure (MPE) Report For Controlled and Uncontrolled Environments

for the

**Digital Receiver Technology, Inc.
DRT1301C**

Tested under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 1 Subpart I & Part 2 Subpart J
&
RSS-102, Issue 4, March 2010



Len Knight, Project Engineer
Electromagnetic Compatibility Lab



Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Parts 1 and 2 under normal use and maintenance.



Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	December 16, 2011	Initial Issue.
1	January 25, 2012	Revised to reflect customer corrections.

Table of Contents

I.	Executive Summary	1
	A. Purpose of Test	2
	B. MPE Measurements and Applicable Regulations	2
II.	Equipment Configuration	3
	A. Overview	4
	B. Test Site	4
	C. Description of Test Sample	4
	D. Equipment Configuration	5
	E. Support Equipment	5
	F. Ports and Cabling Information	5
	G. Antenna	5
	H. Mode of Operation	5
	I. Modifications	5
	a) Modifications to EUT	5
	b) Modifications to Test Standard	5
	J. Disposition of EUT	5
III.	MPE Limits	6
	A. Limits for Maximum Permissible Exposure (MPE)	7
	B. Calculating MPE Distance from Antenna	8
IV.	Test Equipment	16

List of Tables

Table 1. EUT Summary Table	4
Table 2. Support Equipment	5
Table 3. Ports and Cabling Information	5
Table 4. Ports and Cabling Information	5
Table 5. Test Equipment List	17

List of Figures

No table of figures entries found.

List of Photographs

Photograph 1. Test Setup	15
--------------------------------	----

List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB_μA	Decibels above one microamp
dB_μV	Decibels above one microvolt
dB_μA/m	Decibels above one microamp per meter
dB_μV/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	microhenry
μF	microfarad
μs	microseconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An MPE evaluation was performed to determine compliance of the Digital Receiver Technology, Inc. DRT1301C, with the requirements of Part 1 and 2. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the DRT1301C. Digital Receiver Technology, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the DRT1301C, has been **permanently** discontinued.

B. MPE Measurements and Applicable Regulations

This test report presents the results of Maximum Permissible Exposure (MPE)¹ measurements performed on the Digital Receiver Technology, Inc. DRT1301C, operating in the frequency ranges 851 - 869 MHz, 869 - 894 MHz, and 1930 – 1990 MHz. The tests were performed in accordance with TCB training material and the following parts of the FCC Rules and Regulations and Industry Canada Radio Standard Specification:

- IEEE Std. C95.1: 2005: “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz”
- IEEE Std. C95.3: 2002: “IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz – 300 GHz”
- FCC OET Bulletin 65, Edition 97-01: “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”
- FCC Supplement C to OET Bulletin 65, Edition 01-01: “Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emission.”
- Subpart I, Part 1 of 47 CRF FCC Rules and Regulations, Edition 10-1-06: “Procedures Implementing the National Environmental Policy Act of 1969.” Specifically, Paragraph 1.1310: “Radiofrequency Radiation Exposure Limits”
- Subpart J, Part 2 of 47 CFR FCC Rules and Regulations, Edition 10-1-06: “Equipment Authorization Procedures.” Specifically, Paragraph 2.1091: “Radiofrequency Radiation Exposure Evaluation: Mobile Devices”

¹ By definition, maximum permissible exposure (MPE) is rms or peak electric (or magnetic) field strength, or the plane-wave equivalent power densities associated with these fields to which a person may be exposed without harmful effect and with an acceptable safety factor.

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Digital Receiver Technology, Inc. to perform testing on the DRT1301C, under Digital Receiver Technology, Inc.'s purchase order number 045971.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Digital Receiver Technology, Inc., DRT1301C.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	DRT1301C			
EUT Specifications:	Primary Power: 13.8 V Vehicular Battery Voltage			
	FCC ID: XLM1301C			
	Type of Modulations:	GSM	GMSK	QPSK
	EUT Frequency Ranges:	851 – 869 MHz	869 – 894 MHz	1930 – 1990 MHz
Analysis:	The results obtained relate only to the item(s) tested.			
Environmental Test Conditions:	Temperature: 15-35° C			
	Relative Humidity: 30-60%			
	Barometric Pressure: 860-1060 mbar			
Evaluated by:	Len Knight			
Report Date(s):	January 25, 2012			

Table 1. EUT Summary Table

B. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

C. Description of Test Sample

The DRT1301C is a mobile cellular, PCS, and TDMA base station.

D. Equipment Configuration

The DRT1301C was configured with 1 RXT Digital Tuner, 1 WSP Processor, 1 LOREF Reference Generator, 1 SCP System Control, and 1 CTL Computer Control.

E. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
CF-19	Toughbook PC	Panasonic	CF-19	CF-19KDRA6M

Table 2. Support Equipment

F. Ports and Cabling Information

Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
RF In1	Receive antenna	1	5	Y	--
RF Out	Transmit antenna	1	5	Y	--
ANT/REF	Adapter to Radio	1	0.2	Y	--
LAN	LAN connection to PC	1	1	Y	--

Table 3. Ports and Cabling Information

G. Antenna

Ref. ID	Manufacture	Model	Gain
Tx Antenna	PCTEL	MLPVD 800/1900	3 dBi Cellular/4 dBi PCS

Table 4. Ports and Cabling Information

H. Mode of Operation

Operating as a mobile base station in GSM and CDMA in the Cellular and PCS bands and TDMA in the 800MHz band.

I. Modifications

- a) **Modifications to EUT**
No modifications were made to the EUT.
- b) **Modifications to Test Standard**
No modifications were made to the test standard.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Digital Receiver Technology, Inc. upon completion of testing.

III.MPE Limits

A. Limits for Maximum Permissible Exposure (MPE)

Requirements: FCC Guidelines for evaluating exposure to RF Emissions, from the FCC OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.

(A) Limits for Occupational/Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30
f = frequency in MHz		*Plane-wave equivalent power density		

Procedures: Prior to radiated testing, the radio was connected to a power meter in order to see if any channel was significantly stronger than the rest for each band. For the purposes of testing, the channel with the highest power from each band was used.

B. Calculating MPE Distance from Antenna

MPE Limit Calculation: EUT's operating frequencies @ 852.5 MHz; highest conducted power = 11.91 *dBm* therefore, **Limit for Uncontrolled Exposure: 0.568 mW/cm²**

EUT maximum antenna gain = 3 *dBi*.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (0.568 mW/cm²)
P = Power Input to antenna (15.53 mW)
G = Antenna Gain (2 numeric)

$$R = (15.53 \times 2 / 4 \times 3.14 \times 0.568)^{1/2} = 2.087 \text{ cm}$$

Calculation for 851 – 869 MHz Band

MPE Limit Calculation: EUT's operating frequencies @ 869.2 MHz; highest conducted power = 22.48 dBm therefore, **Limit for Uncontrolled Exposure: 0.579 mW/cm²**

EUT maximum antenna gain = 3 dBi.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (0.579 mW/cm²)
P = Power Input to antenna (177 mW)
G = Antenna Gain (2 numeric)

$$R = (177 * 2 / 4 * 3.14 * 0.579)^{1/2} = 6.98 \text{ cm}$$

Calculation for 869 – 894 MHz Band

MPE Limit Calculation: EUT's operating frequencies @ 1960 MHz; highest conducted power = 22.12 *dBm* therefore, **Limit for Uncontrolled Exposure: 1 mW/cm²**

EUT maximum antenna gain = 4 *dBi*.

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (1 mW/cm²)
P = Power Input to antenna (163 mW)
G = Antenna Gain (2.52 numeric)

$$R = (163 * 2.52 / 4 * 3.14 * 1.0)^{1/2} = 5.72 \text{ cm}$$

Calculation for 1930 -1990 MHz Band

Test Procedures:

1. The test setup was as described in the EUT Configuration section of this test report. The base station was on the outside of the chamber while the antenna was on the inside.
2. The antenna under test was mounted to a 30x30cm ground plane and placed on an 80cm test table.
3. The EUT was set to transmit continuously at the selected frequency and modulation at maximum RF power. The distance between the field intensity probe and the EUT's antenna was 20 cm since the calculated distance for uncontrolled environments was $R < 20$ cm.
4. Field intensity measurements were taken at different heights of the probe from the ground (0.1 to 2 meters) in 10cm increments, while rotating versus azimuth (from 0° to 360°).
5. Each maximized peak field intensity measurement was recorded.
6. Average values of power density were calculated for the imaginary whole human body (0.1–2.0 m), for the lower part of the body (0.1–0.9 m) and for the upper part of the body (1.0–2.0 m). The results of calculations are shown in the following tables.

Test Results: The EUT was compliant with this requirement.

Test Engineer: Len Knight

Test Date: 08/24/11

Part 90

General Population / Uncontrolled Environment at 20 cm			
	Raw	Corrected V/m	PD mW/cm ²
10	0.1	0.116	3.57E-06
20	0.1	0.116	3.57E-06
30	0.1	0.116	3.57E-06
40	0.1	0.116	3.57E-06
50	0.2	0.232	1.43E-05
60	0.4	0.464	5.71E-05
70	0.7	0.812	0.000175
80	1.51	1.7516	0.000814
90	2.22	2.5752	0.001759
100	1.33	1.5428	0.000631
110	0.67	0.7772	0.00016
120	0.4	0.464	5.71E-05
130	0.2	0.232	1.43E-05
140	0.1	0.116	3.57E-06
150	0.1	0.116	3.57E-06
160	0.1	0.116	3.57E-06
170	0.1	0.116	3.57E-06
180	0.1	0.116	3.57E-06
190	0.1	0.116	3.57E-06
200	0.1	0.116	3.57E-06

Uncontrolled Environment 20 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.00019
Lower Body (0.1 m to 0.9 m)	0.00031
Upper Body (1.0 m to 2.0 m)	0.00008

Part 22

General Population / Uncontrolled Environment at 20 cm			
	Raw	Corrected V/m	PD mW/cm ²
10	1.12	1.2992	0.000448
20	0.93	1.0788	0.000309
30	1.64	1.9024	0.00096
40	1.43	1.6588	0.00073
50	1.8	2.088	0.001156
60	1.67	1.9372	0.000995
70	2.15	2.494	0.00165
80	4.62	5.3592	0.007618
90	8.34	9.6744	0.024826
100	7.28	8.4448	0.018916
110	5.69	6.6004	0.011556
120	4.14	4.8024	0.006118
130	2.83	3.2828	0.002859
140	2.12	2.4592	0.001604
150	1.73	2.0068	0.001068
160	1.5	1.74	0.000803
170	0.76	0.8816	0.000206
180	0.76	0.8816	0.000206
190	0.77	0.8932	0.000212
200	0.7	0.812	0.000175

Uncontrolled Environment 20 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.00412
Lower Body (0.1 m to 0.9 m)	0.00430
Upper Body (1.0 m to 2.0 m)	0.00397

Part 24

Occupational / Controlled Environment at 20 cm			
	Raw	Corrected V/m	PD mW/cm ²
10	0.1	0.116	3.57E-06
20	0.2	0.232	1.43E-05
30	0.5	0.58	8.92E-05
40	0.69	0.8004	0.00017
50	1.07	1.2412	0.000409
60	1.5	1.74	0.000803
70	2.33	2.7028	0.001938
80	5.27	6.1132	0.009913
90	6.02	6.9832	0.012935
100	2.54	2.9464	0.002303
110	1.4	1.624	0.0007
120	1.01	1.1716	0.000364
130	0.76	0.8816	0.000206
140	0.416667	0.483333	6.2E-05
150	0.2	0.232	1.43E-05
160	0.1	0.116	3.57E-06
170	0.1	0.116	3.57E-06
180	0.1	0.116	3.57E-06
190	0.1	0.116	3.57E-06
200	0.1	0.116	3.57E-06

Uncontrolled Environment 20 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.00150
Lower Body (0.1 m to 0.9 m)	0.00292
Upper Body (1.0 m to 2.0 m)	0.00033



Photograph 1. Test Setup



IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4768	FIELD PROBE	NARDA	EP183 / OR03	SEE NOTE	
1T4148	SHIELD ROOM #2 SEMI-ANECHOIC	RANTEC	20	SEE NOTE	

Table 5. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.



End of Report