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
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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., DRT1183C 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.\EMC31505B-MPE Rev. 1)

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

for the

Digital Receiver Technology, Inc.
DRT1183C

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: EMC31505B-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
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Digital Receiver Technology, Inc.
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Tested under
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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, and Industry Canada standards RSS-102, Issue 4, March 2010 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

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

Table of Contents

List of Tables

List of Figures

List of Photographs

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µF	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An MPE evaluation was performed to determine compliance of the Digital Receiver Technology, Inc. DRT1183C, 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 DRT1183C. 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 DRT1183C, 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. DRT1183C, 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"
- RSS-102, Issue 4, March 2010: "Spectrum Management and Telecommunications Radio Standards Specification. Radiofrequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands.)"

[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 DRT1183C, under Digital Receiver Technology, Inc.'s purchase order number 045620.

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., DRT1183C.

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

Model(s) Tested:	DRT1183C			
EUT Specifications:	Primary Power: 13.8 V Vehicular Battery Voltage			
	FCC ID: XLM1183C			
	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: 15-35º 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 DRT9957A is an RF power amplifier used with DRT base stations operating in the cellular, PCS, and TDMA 850MHz bands.

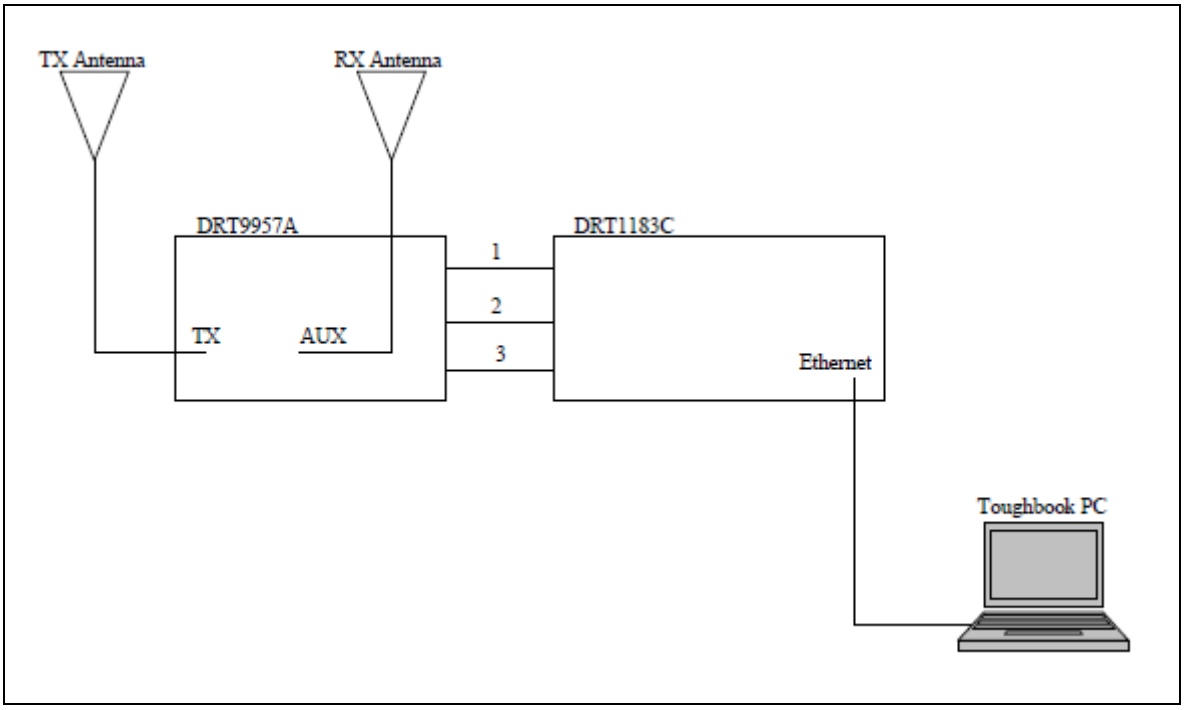


Figure 1. Block Diagram of Test Configuration

D. Equipment Configuration

Name / Description	Model Number
TacTRAM	DRT9957A

Table 2. Equipment Configuration

E. Support Equipment

Name / Description	Manufacturer	Model Number	Serial Number
Base Station	DRT	DRT1183C	--
Toughbook PC	Panasonic	CF-19	CF-19KDRAX6M

Table 3. Support Equipment

F. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded? (Y/N)	Termination Box ID & Port ID
N/A	AUX RF	Receive antenna	1	5	Y	N/A
N/A	TX	Transmit antenna	1	5	Y	N/A
1	RX E	RX signal to base station	1	2	Y	N/A
2	TX D	TX signal to amplifier	1	2	Y	N/A
3	RS-232 Control/GPIO	Control signals between base station and amplifier	1	2	Y	N/A

Table 4. Ports and Cabling Information

G. Mode of Operation

Operates as a RF power amplifier for DRT mobile base stations in GSM and CDMA in the Cellular and PCS bands, and TDMA in the 850MHz band.

H. 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.

I. 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 = 31.16 *dBm* therefore, **Limit for Uncontrolled Exposure: 0.568 mW/cm^2**

EUT maximum antenna gain = 3 *dBi.*

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

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

where, S = Power Density (0.568 mW/cm^2)
P = Power Input to antenna (1307 mW)
G = Antenna Gain (2 numeric)

$R = (1307*2/ 4*3.14*0.568)^{1/2} = 19.14$ cm

MPE Limit Calculation: EUT's operating frequencies @ 852.5 MHz; highest conducted power = 31.16 *dBm* therefore, **Limit for Occupational/Controlled Exposure: 2.842 mW/cm^2**

EUT maximum antenna gain = 3 *dBi.*

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

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

where, S = Power Density (2.842 mW/cm^2)
P = Power Input to antenna (1307 mW)
G = Antenna Gain (2 numeric)

$R = (1307*2/ 4*3.14*2.842)^{1/2} = 8.9$ cm

MPE Limit Calculation: EUT's operating frequencies @ 881.6 MHz; highest conducted power = 38.10 *dBm* therefore, **Limit for Uncontrolled Exposure: 0.588 mW/cm^2**

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 (0.588 mW/cm^2)
P = Power Input to antenna (6458 mW)
G = Antenna Gain (2 numeric)

$R = (6458*2/ 4*3.14*0.588)^{1/2} = 41.81$ cm

MPE Limit Calculation: EUT's operating frequencies @ 881.6 MHz; highest conducted power = 38.10 *dBm* therefore, **Limit for Occupational/Controlled Exposure: 2.939 mW/cm^2**

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 (2.939 mW/cm^2)
P = Power Input to antenna (6458 mW)
G = Antenna Gain (2 numeric)

$R = (6458*2/ 4*3.14*2.939)^{1/2} = 18.7$ cm

MPE Limit Calculation: EUT's operating frequencies @ 1989.8 MHz; highest conducted power = 37.30 *dBm* therefore, **Limit for Uncontrolled Exposure: 1 mW/cm^2**

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/cm^2)
P = Power Input to antenna (5371 mW)
G = Antenna Gain (2.52 numeric)

$R = (5371*2/ 4*3.14*1.0)^{1/2} = 32.82$ cm

MPE Limit Calculation: EUT's operating frequencies @ 1989.8 MHz; highest conducted power = 37.30 *dBm* therefore, **Limit for Occupational/Controlled Exposure: 5 mW/cm^2**

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 (5 mW/cm^2)
P = Power Input to antenna (5371 mW)
G = Antenna Gain (2.52 numeric)

$R = (5371*2/ 4*3.14*5.0)^{1/2} = 14.63$ cm

Test Procedures:

1. The test setup was as described in the EUT Configuration section of this test report. The base station and amplifier were 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 equal to the calculated distance R applicable either for controlled or uncontrolled environments.
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 19.14			
	Raw	**Corrected V/m**	**PD mW/cm2**
10	4.096	4.01408	0.004274
20	4.483	4.39334	0.00512
30	5.751	5.63598	0.008426
40	5.735	5.6203	0.008379
50	7.019	6.87862	0.012551
60	6.942	6.80316	0.012277
70	8.739	8.56422	0.019455
80	17.95	17.591	0.08208
90	26.68	26.1464	0.181335
100	27.77	27.2146	0.196455
110	21.31	20.8838	0.115685
120	17.54	17.1892	0.078374
130	14.45	14.161	0.053192
140	11.31	11.0838	0.032586
150	9.16	8.9768	0.021375
160	7.617	7.46466	0.01478
170	5.757	5.64186	0.008443
180	5.137	5.03426	0.006722
190	4.141	4.05818	0.004368
200	3.981	3.90138	0.004037

Uncontrolled Environment 19.14 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.04
Lower Body (0.1 m to 0.9 m)	0.04
Upper Body (1.0 m to 2.0 m)	0.05

Part 22

General Population / Uncontrolled Environment at 41.8			
	Raw	**Corrected V/m**	**PD mW/cm2**
10	9.242	9.05716	0.021759
20	7.616	7.46368	0.014776
30	8.372	8.20456	0.017855
40	6.858	6.72084	0.011981
50	7.279	7.13342	0.013498
60	8.414	8.24572	0.018035
70	10.95	10.731	0.030545
80	16.59	16.2582	0.070114
90	25.42	24.9116	0.164612
100	31.72	31.0856	0.256317
110	32.76	32.1048	0.2734
120	30.38	29.7724	0.235118
130	27.38	26.8324	0.190976
140	25.27	24.7646	0.162675
150	22.08	21.6384	0.124196
160	20.08	19.6784	0.102716
170	16.55	16.219	0.069776
180	14.29	14.0042	0.052021
190	12.39	12.1422	0.039107
200	12.05	11.809	0.03699

Uncontrolled Environment 41.8 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.10
Lower Body (0.1 m to 0.9 m)	0.04
Upper Body (1.0 m to 2.0 m)	0.14

Part 22

Occupational / Controlled Environment at 18.7			
	Raw	**Corrected V/m**	**PD mW/cm2**
10	9.405	9.2169	0.022533
20	8.599	8.42702	0.018837
30	10.66	10.4468	0.028948
40	10.53	10.3194	0.028247
50	13.7	13.426	0.047814
60	14.21	13.9258	0.05144
70	21.32	20.8936	0.115794
80	40.98	40.1604	0.427814
90	59.51	58.3198	0.902175
100	57.31	56.1638	0.836704
110	42.77	41.9146	0.466004
120	34.81	34.1138	0.308687
130	24.61	24.1178	0.154289
140	19.61	19.2178	0.097964
150	16.85	16.513	0.072329
160	13.98	13.7004	0.049788
170	11.21	10.9858	0.032013
180	9.102	8.91996	0.021105
190	7.873	7.71554	0.01579
200	7.243	7.09814	0.013364

Controlled Environment 18.7 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.19
Lower Body (0.1 m to 0.9 m)	0.18
Upper Body (1.0 m to 2.0 m)	0.19

Part 24

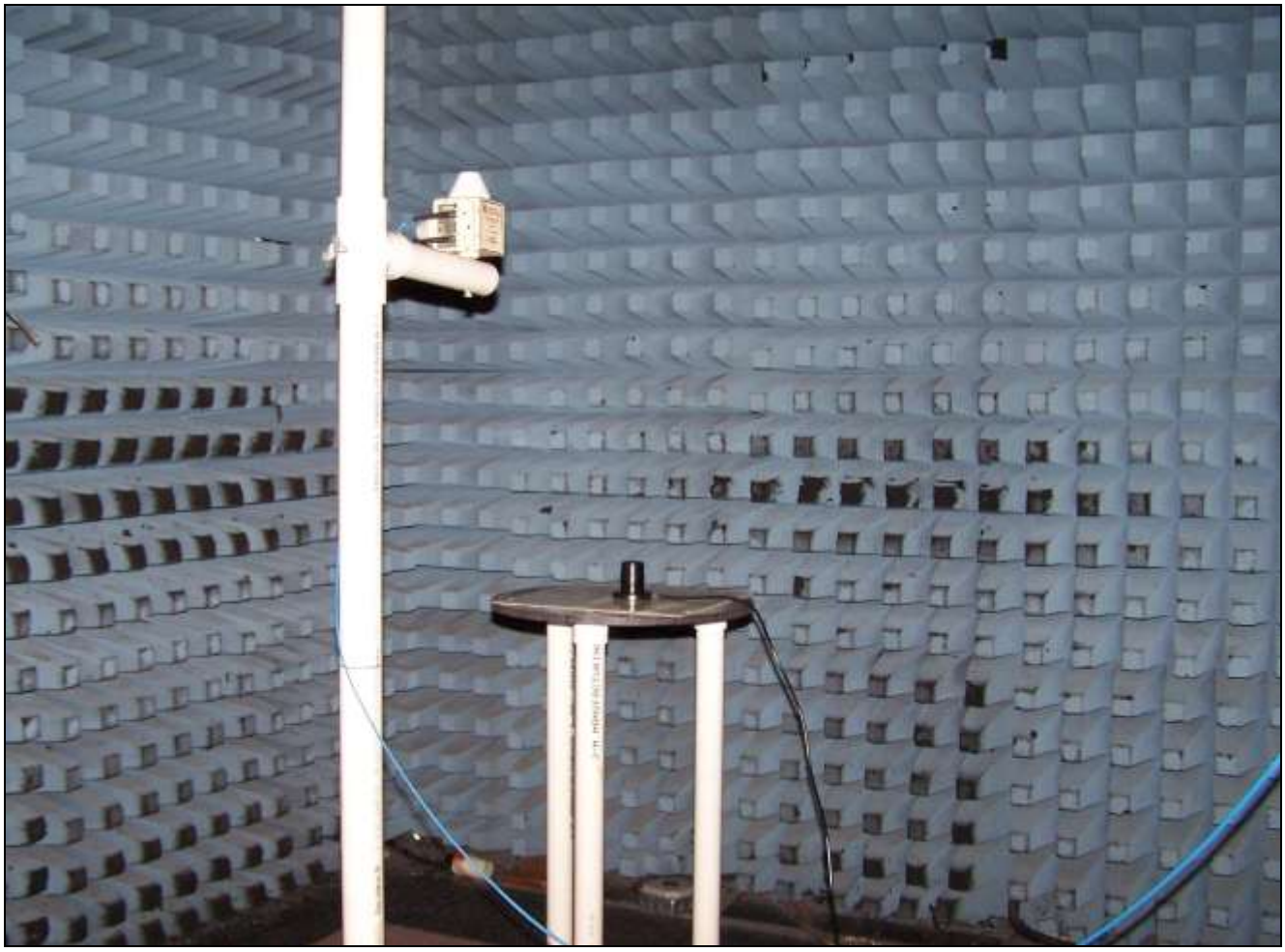
Occupational / Controlled Environment at 32.82			
	Raw	**Corrected V/m**	**PD mW/cm2**
10	5.25	6.09	0.009838
20	5.41	6.2756	0.010446
30	7.52	8.7232	0.020184
40	8.38	9.7208	0.025065
50	10.24	11.8784	0.037426
60	12.01	13.9316	0.051483
70	16.06	18.6296	0.092059
80	18.08	20.9728	0.116673
90	24.65	28.594	0.216874
100	23.44	27.1904	0.196106
110	17.68	20.5088	0.111568
120	13.59	15.7644	0.065919
130	10.75	12.47	0.041247
140	6.86	7.9576	0.016797
150	6.3	7.308	0.014166
160	2.77	3.2132	0.002739
170	2.63	3.0508	0.002469
180	2.96	3.4336	0.003127
190	4.43	5.1388	0.007005
200	2.37	2.7492	0.002005

Uncontrolled Environment 32.82 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.05
Lower Body (0.1 m to 0.9 m)	0.06
Upper Body (1.0 m to 2.0 m)	0.04

Part 24

Occupational / Controlled Environment at 14.63			
	Raw	**Corrected V/m**	**PD mW/cm2**
10	5.68	6.5888	0.011515
20	5.59	6.4844	0.011153
30	6.66	7.7256	0.015832
40	8.82	10.2312	0.027766
50	8.8	10.208	0.02764
60	12.77	14.8132	0.058204
70	15.56	18.0496	0.086416
80	36.36	42.1776	0.47187
90	43.97	51.0052	0.690061
100	25.18	29.2088	0.226301
110	16.44	19.0704	0.096467
120	7.77	9.0132	0.021548
130	6.63	7.6908	0.015689
140	4.95	5.742	0.008746
150	5.6	6.496	0.011193
160	3.75	4.35	0.005019
170	2.56	2.9696	0.002339
180	2.81	3.2596	0.002818
190	2.38	2.7608	0.002022
200	2.42	2.8072	0.00209

Controlled Environment 14.63 cm	3 dBi BMLPVDB800/1900S
Part of the Body/Averaging Points	Averaged Power Density
Whole Body (0.1 m to 2.0 m)	0.09
Lower Body (0.1 m to 0.9 m)	0.16
Upper Body (1.0 m to 2.0 m)	0.04



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		12/30/3799
1T4148	SHIELD ROOM #2 SEMI-ANECHOIC	RANTEC	20	SEE NOTE	
1T4550	ISOTROPIC ELECTRIC FIELD PROBE	HOLADAY	HI-4422	07/29/2010	07/29/2011

Table 5. Test Equipment List

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

End of Report

