Parker Chomerics

TEST SERVICES

EMC EVALUATION OF THE
MICROWAVE RADIO COMMUNICATIONS
HDX 1100C2
WITH
TRANSMITTER REMOTE CONTROL

Date: **2010 JUNE 2**
Test Report Number: **TR5629.10**

IN ACCORDANCE WITH
FCC PART 15 SUBPART B

Prepared For: **VISLINK TECHNOLOGIES**
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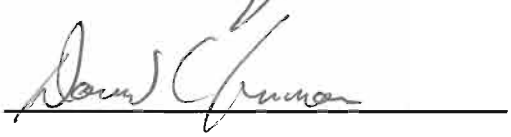
CTS Approved Signatory: 

TABLE OF CONTENTS

REVISION RECORD SHEET

Revision	Description	Date	Approval
--	Created Test Report	2010-06-02	--

The latest revision of the report is valid, all prior revisions are superseded.

LIST OF DEFINITIONS/ABBREVIATIONS

AC	Alternating Current
BB	Broadband
BW	Bandwidth
cm	Centimeter
CPU	Calibrate Prior to Use
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ER	Electric Radiation
EUT	Equipment Under Test
GHz	GigaHertz
Hz	Hertz
I-face	Interface
kHz	KiloHertz
m	Meter
MHz	MegaHertz
mm	Millimeter
mS	Millisecond
mV	MilliVolt
MR	Magnetic Radiation
NB	Narrowband
NCR	No Calibration Required
PLC	Power Line Conduction
PPS	Pulses Per Second
RF	Radio Frequency
uF	MicroFarad
uH	MicroHenry
uS	Microsecond
uV	MicroVolt
UWC	Use With Calibrated Equipment

1.0 GENERAL

1.1 Introduction

1.1.1 Purpose

The purpose of this report is to document the performance of the Microwave Radio Communications HDX 1100C2 with Transmitter Remote Control during an electromagnetic interference (EMI) test and record the test requirements and procedures used. At the request of Microwave Radio Communications, the tests were performed by Chomerics Test Services (CTS) of Woburn, Massachusetts. The assessment will determine the compliance or non-compliance with the requirements set up by the Electromagnetic Interference (EMI) Standard FCC Part 15 Subpart B.

The Radiated and Conducted Emission Standard FCC Part 15 Subpart B is designated for Information Technology Equipment (ITE).

Sal Blatti and Steve LeBlanc from Microwave Radio Communications were present during testing. Testing was performed on May 17, 2010 under purchase order number 70201234.

1.1.2 Requirements

The requirements for the sequence of tests performed on the HDX 1100C2 with Transmitter Remote Control are as follows:

FCC Part 15 Subpart B Radiated Electromagnetic Emissions

FCC Part 15 Subpart B, Class B radiated emission requirements for Information Technology Equipment (ITE).

1.2 TEST SUMMARY

The terms "Passed" or "Failed" in this section are intended to guide the reader as to whether or not the EUT met the minimum requirements that can be interpreted from the FCC Part 15 Subpart B Standard as defined in Section 1.5. The "Results" paragraph in each test section to follow and the test data sheets will outline specifically how the EUT performed during each test.

FCC Part 15 Subpart B Radiated Emissions PASSED

1.2.1 Summary of Recommendations

The Microwave Radio Communications HDX 1100C2 with Transmitter Remote Control will require no modifications in order to ensure compliance with the Electromagnetic Interference Standard FCC Part 15 Subpart B.

Please note that if any modifications and or fixes were implemented to the EUT to achieve compliance, other approaches to solving the problem may exist. In addition, any EMI/EMC shielding products listed in this report may be substituted with an equivalent.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning any product in the product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

1.2.2 Deviations, Additions, or Exclusions

The HDX 1100C2 with Transmitter Remote Control is powered by DC voltage; based on this fact, the device is not applicable to the requirements of FCC Part 15 Subpart B conducted emissions.

In addition, the HDX 1100C2 with Transmitter Remote Control was tested for radiated emissions from 9kHz to 40GHz. FCC Part 15, Subpart C section 209 limits were applied for measurements made in the frequency bands outside the Part 15, Subpart B limits.

1.3 Administrative Data

1.3.1 Test Facility

Chomerics Test Services in Woburn, Massachusetts is an American Association for Laboratory Accreditation (A2LA) accredited facility as defined on Certification Number 1980-01. The Scope of Accreditation is limited to the following tests:

Emissions

Radiated (up to 18 GHz) + Conducted	Code of Federal Regulation (CFR) 47, FCC Part 15 (Subpart B, ITE devices) using ANSI C63.4 (2001, 2003); CISPR 11; EN 55011; KN 11 (RRA Announce 2008-11, Dec. 16, 2008); CISPR 14-1; EN 55014-1; KN 14-1 (RRA Announce 2008-11, Dec. 16, 2008); CISPR 15; EN 55014-1; KN 14-1 (RRA Announce 2008-11, Dec. 16, 2008); CISPR 15; EN 55015; CNS 14115; CISPR 22; EN 55022; AS/NZS CISPR 14; AS/NZS CISPR 11; AS/NZS CISPR 22; CNS 13438;CNS 13803; CNS 13783-1; VCCI V-3; CAN/CSA CISPR 22; KN 22 (RRA Announce 2008-11, Dec. 16, 2008)
Current Harmonics	EN 61000-3-2:2006; IEC 61000-3-2:2005; AS/NZS 61000.3.2
Voltage Fluctuations + Flicker	EN 61000-3-3:2005+A3:2006; IEC 6100-3-3:2004+A1:2001+A2:2005; AS/NZS 61000.3.3
Generic Standards	EN61000-6-3:2007; IEC61000-6-3:2006; EN61000-6-4:2007;IEC61000-6-4:2006

Immunity

Electrostatic Discharge (ESD)	EN61000-4-2:1995+A1:1998+A2:2001; IEC61000-4-2:1995+A1:1998+A2:2000; IEC 61000-4-2:2001; KN 61000-4-2 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.2
Radiated Immunity	EN61000-4-3:1996+A1:2002; EN61000-4-3:2006;IEC61000-4-3:1995+A1:2002; IEC 61000-4-3:2007; KN 61000-4-3 (RRA Announce 2008-12, De. 16, 2008); AS/NZS 61000.4.3
Electrical Fast Transient/Burst	EN 61000-4-4:1995+A1:2000+A2:2001; EN 61000-4-4: 2004; EN 61000-4-4:2005+A1:2008; IEC 61000-4-4:1995+A1:2000 + A2:2001; IEC 61000-4-4:2004; IEC 61000-4-4:2007; KN 61000-4-4 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.4
Surge Immunity	EN 61000-4-5:1995+A1:2001; EN 61000-4-5:2006; IEC 61000-4-5:1995+A1:2000; IEC 61000-4-5:2005; KN 61000-4-5 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.5
Conducted Immunity	EN 61000-4-6:1996+A1:2001; IEC 61000-4-6:2007; IEC 61000-4-6:1996+A1:2000; IEC 61000-4-6: 2003+A1:2004; IEC 61000-4-6:2006; KN 61000-4-6 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.6
Power Frequency Magnetic Field Immunity	EN 61000-4-8:1993+A1:2001; IEC 61000-4-8:1993+A1:2000; IEC 61000-4-8:2001+A1:2000; KN 61000-4-8 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.8
Voltage Dips, Short Interruptions, and Line Voltage Variations	EN 61000-4-11:1994+A1:2000; IEC 61000-4-11:1994+A1:2000; EN 61000-4-11:2004; IEC 61000-4-11:2004; KN 61000-4-11 (RRA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.11

Generic Standards	EN61000-6-1:2007;IEC61000-6-1:2005;EN61000-6-2:2007;IEC61000-6-2:2005
Product Standards	IEC/EN 60601-1-2, KN 60601-1-2 (RRA Announce 2008-12, Dec. 16, 2008); EN 300 386, EN 61326-1; CISPR 24; EN 55024; KN 24 (RRA Announce 2008-12, Dec. 16, 2008); EN 50083-2; EN 55103-1; EN 55103-2; EN 61547; EN 55014-2; CISPR 14-2; KN 14-2 (RRA Announce 2008-12, Dec. 16, 2008)

Any tests in this report that are not listed above are not covered by the A2LA Accreditation.

All **test(s)** included within this report are covered under Chomerics' A2LA Scope of Accreditation.

Chomerics' Open Area Test Site B is listed by the Federal Communications Corporation (FCC) for Radiated and Conducted Emissions testing under FCC Registration number 90499.

Chomerics' Open Area Test Site B is accredited for Radiated and Conducted Emissions through Industry Canada under file number IC2959B.

Chomerics' Open Area Test Site B is accredited to the Voluntary Control Council for Interference (VCCI) for Radiated and Conducted Emissions testing under file R-2454 (3 and 10 meters) and C-2689 respectively.

Chomerics test facility operates under the current revision of Chomerics Quality Assurance (QA) Manual Document Number QA002.

The QA Manual has been constructed to reflect a quality program in accordance with the requirements of the National Institute of Standards and Technology (NIST), ISO 9002, ISO Guide 25, NIST Handbook 150, EN 45001, MIL-I-45208A, MIL-STD-461D, 462D and Chomerics Quality Assurance Program (QAP).

The QA Manual outlines and describes the procedures for establishing and maintaining the quality of analysis, research, inspection, and testing within Chomerics Test Service (CTS).

This test report does not represent an endorsement by the U.S. Government.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

Measurements performed for this test are traceable to the National Institute of Standards and Technology (NIST) based on the fact that all test equipment used for the measurements were previously calibrated using standards traceable to NIST.

MEASUREMENT UNCERTAINTY

Chomerics Test Services measurement uncertainty is based on a probability of approximately 95% (2Σ); based on this fact, the manufacturer for the equipment under test can make an informative assessment with respect to conformance to an applicable standard based on the level of uncertainty of the measurement. Chomerics Test Services Measurement Uncertainty documentation is available upon request.

CISPR tests performed in Test Chamber A and Open Area Test Site B are in compliance to the measurement uncertainty limit described in CISPR 16-4-2 Section 4.1Table 1 Values for U_{CISPR}. Based on this fact, the computed values for measurement uncertainty need not be tabulated into Chomerics test and measurement data.

TEST	LOCATION	Measurement Uncertainty (dBuV)
Conducted Emissions 9kHz - 150kHz	Test Chamber A	3.61
Conducted Emissions 150kHz - 30MHz	Test Chamber A	3.23
Radiated Emissions 30MHz – 1GHz at 3 Meter/10 Meter	Open Area Test Site B	4.57
Conducted Emissions 9kHz - 150kHz	Open Area Test Site B	3.61
Conducted Emissions 150kHz - 30MHz	Open Area Test Site B	3.05

1.3.2 Sample Calculation

Radiated Emissions

The tabular data listed in the report is the highest signal detected during the scan. At a minimum six of the highest signals will be selected and maximized. The tabular data sheet shall contain the measured value "QP-Value", field level, limit, margin to the limit, antenna height, antenna polarity and turn table azimuth.

The field level is the final value that will be compared to the limit in order to determine if the EUT is in compliance. The field level will be calculated by the following for each of the signals maximized:

Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Field Level dBuV = Measured Value dBuV + Antenna Factor dB + Cable Loss dB

37dBuV = 30dBuV + 5dB + 2dB

The margin to the limit shall be calculated by subtracting the field level to the limit. The margin to the limit shall be calculated by the following for each of the signal maximized.

Margin to Limit dB = Field Level dBuV – Limit dBuV
-3dB = 37dBuV - 40dBuV

Conducted Emissions

The tabular data listed in the report is the highest signal detected during the scan. At a minimum six of the highest signals will be selected and maximized. The tabular data sheet shall contain the measured value, final level, limit, margin to the limit, LISN factor

The final value will be compared to the limit in order to determine if the EUT is in compliance. The final value will be calculated by the following for each of the maximized signals.

Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Final Value dBuV = measured value dBuV + LISN Factor dB + cable loss (dB)

52dBuV = 49dBuV + 1dB + 2dB

The margin to the limit shall be calculated by subtracting the final value to the limit. The margin to the limit shall be calculated by the following for each signal maximized.

Margin to Limit dB = Final Value dBuV – Limit dBuV
+12dB = 52dBuV - 40dBuV

1.3.3 Equipment Calibration

The calibration of Chomerics test facility equipment is controlled under the current edition of Chomerics Laboratory Test Equipment Calibration Manual Document Number QA001.

The test equipment used throughout this test sequence conforms to laboratory calibration standards, MIL-STD-45662, traceable to the National Institute of Standards and Technology (NIST). The date of the last calibration is listed in Appendix B for the applicable equipment.

All test equipment is calibrated in one year intervals.

1.3.4 Test Personnel

The test personnel performing or supervising the tests are accredited by the National Association of Radio and Telecommunications Engineers, Inc. (NARTE) as Certified Electromagnetic Compatibility Engineers (N.C.E.) and Technicians (N.C.T.).

1.4 Test Set-up

1.4.1 Test Site Matrix

The specific test locations used for the emissions testing of the Microwave Radio Communications HDX 1100C2 with Transmitter Remote Control are as follows: (Refer to Section 1.4.2 for test site descriptions).

Emissions Test	**Test Site**
FCC Part 15 Subpart B Radiated Emissions	Open Area Test Site B

1.4.2 Test Site Descriptions

The following is a list of test sites and descriptions of each. Refer to Section 1.4.1 for specific test sites used for testing.

Open Area Test Site B: Chomerics' Open Area Test Site "B" if used for this test program is located in the lower parking lot behind the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 1). Parking is permitted on one side of Test Site "B" at a discrete distance from the imaginary ellipse.

The Open Area Test Site "B" enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow both 3 and 10 meter measurements and is heated and/or air conditioned.

The structure used to support equipment under test is a 14 foot diameter motorized turntable. The sheet metal surface is flush with the ground plane. To ground the turntable, copper fingers (1" x 1.5") are mounted around the outer edge of the turntable using machine screws. The spring fingers are equally spaced and provide a uniform interface between the turntable metal surface and ground plane. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane.

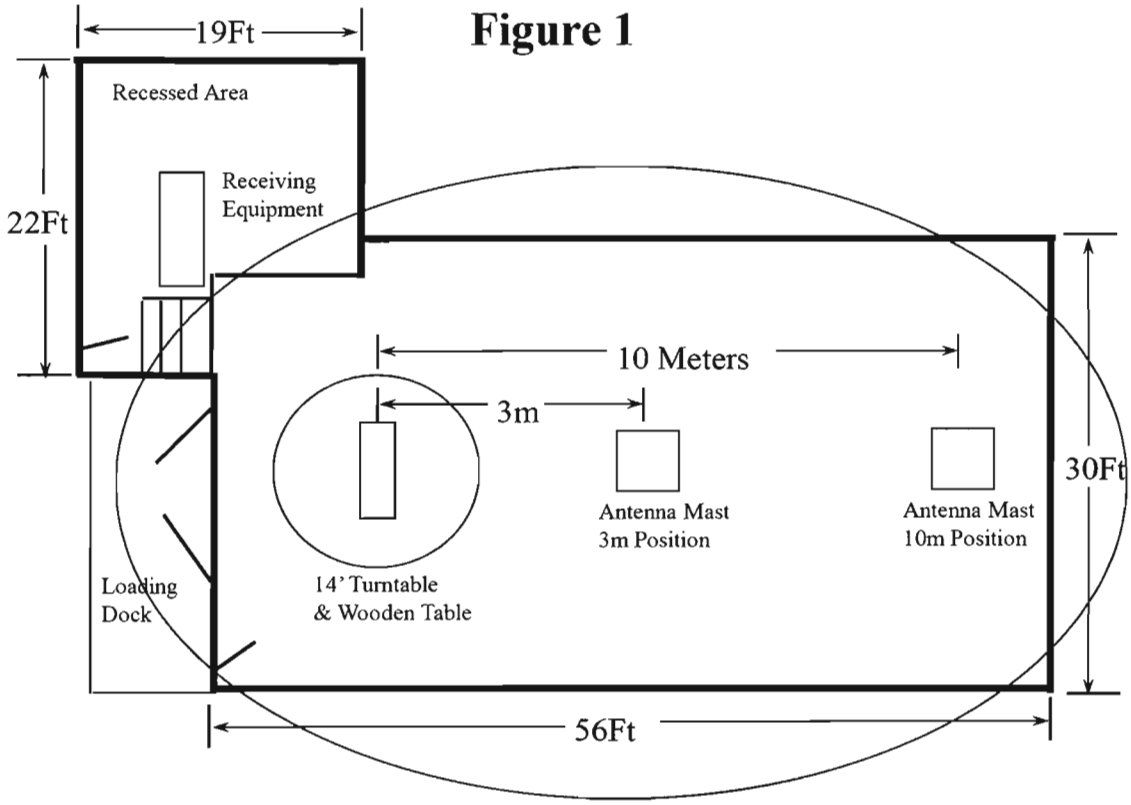
The addition at the end of the Open Area Test Site "B" is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

The available AC power within Open Area Test Site "B" is 120V 60Hz Single Phase 60Amps; 208V 60Hz Three Phase 60Amps; 208V 60Hz Single Phase 60Amps; 230V 50Hz Single Phase 50Amps.

This Site is listed with the Federal Communications Commission (FCC) and approved by BSMI, VCCI, AUSTEL and CSA.

OPEN AREA TEST SITE B

Figure 1



Test Chamber A: Chomerics' Test Chamber "A", if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 2). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York. Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6. The main test chamber is 22 x 10 x 10 feet in size with an adjacent enclosure that is 8 x 8 x 8 feet in size. The adjacent room used for support equipment and the main test chamber are connected together and referenced to the same single point ground.

When needed for tabletop equipment, a wooden table measuring 3 x 9 feet in size is positioned within the test chamber. When used for MIL-STD-461D tests the tabletop surface is covered with a copper sheet and grounded to the test chamber wall so that the resistance is less than 2.5 milliOhms.

The power line filters supplying the power to the enclosure provide 100dB of attenuation from 10kHz to 10GHz. The adjacent room, used for support equipment, and the main test chamber have independent AC power obtained from independent AC power line filters.

The available AC power in Test Chamber "A" is 120V 60Hz Single Phase 100Amps; 120V 400Hz Three Phase 50Amps; 208V 60Hz Three Phase 100Amps; 208V 60Hz Single Phase 100Amps; 230V 50Hz Single Phase 50Amps.

Test Chamber B: Chomerics' Test Chamber "B", if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 2). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York. Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6.

The main test chamber is 22 x 10 x 10 feet in size with an adjacent enclosure that is 8 x 8 x 8 feet in size. The adjacent room used for support equipment and the main test chamber are connected together and referenced to the same single point ground.

Test Chamber "B" is lined with Rantec ferrite absorber tiles FT-100. All surfaces of the room are lined with FT-100 material. The floor is lined with removable tiles.

This absorber material allows the test chamber to meet the 0-6dB field uniformity requirements of IEC 1000-4-3 and ENV 50140.

There are two access panels between the main test chamber and the support room. The access panels are covered with absorber tiles. The absorber tiles can be removed from the access panels.

The power line filters supplying the power to the enclosures provide 100dB of attenuation from 10kHz to 10GHz. The adjacent rooms used for support equipment and the main test chamber have independent AC power obtained from independent AC power line filters.

The available AC power in Test Chamber "B" is 120V 60Hz Single Phase 30Amps; 208V 60Hz Three Phase 30Amps and 230V 50Hz Single Phase 30Amps: A wooden table 3 x 6 feet in size is used for tabletop equipment.

Test Chamber C: Chomerics' Test Chamber "C", if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 2). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York.

Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6. The main test chamber is 16 x 20 x 10 feet in size with two adjacent enclosures on either side which are 8 x 8 x 8 and 8 x 12 x 10 feet in size, respectively.

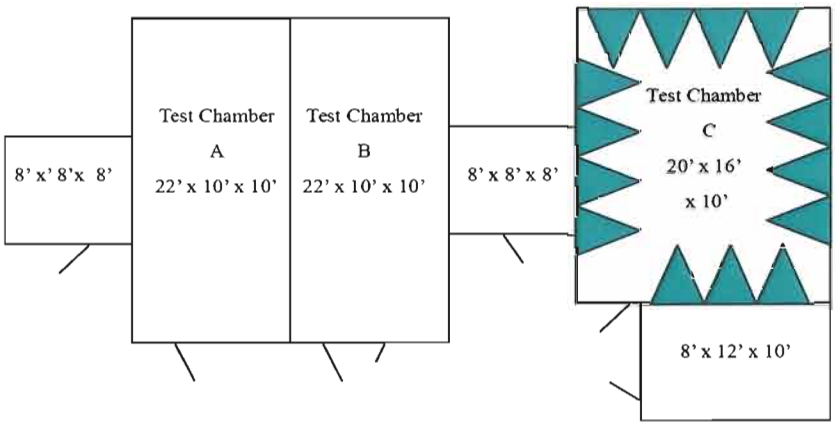
Test Chamber "C" is lined with Emerson-Cuming RF absorber material. This absorber material meets the following absorption specifications: 80MHz 6dB, 300MHz 30dB, 500MHz 35dB, 1GHz 40dB, and 3 to 24 GHz 50dB. Each of the two adjacent rooms used for support equipment and the main test chamber are connected together and referenced to the same single point ground.

When needed for tabletop equipment, a wooden table measuring 3 x 9 feet in size is positioned within the test chamber. When used for MIL-STD-461D tests, the tabletop surface is covered with a copper sheet and grounded to the test chamber wall so that the resistance is less than 2.5 milliohms. When used for radiated electromagnetic field tests, to some standards, the copper tabletop surface is removed.

The available AC power in Test Chamber "C" is 120V 60Hz AC Single Phase 60Amps; 230V 50Hz AC Single Phase 50Amps; 115V 400Hz AC Three Phase 30Amps (through access panel); 208V 60Hz AC Three Phase AC 30Amps (through access panel).

The power line filters supplying the power to the enclosures provide 100dB of attenuation from 10kHz to 10GHz. Each of the two adjacent rooms used for support equipment and the main test chamber has independent AC power obtained from independent AC power line filters.

Immunity Lab Layout
Figure 2



Key:

= Emerson-Cuming RF absorber material

EC Lab A: Chomerics EC Lab "A" is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts.

EC Lab "A" is a typical room measuring 20 x 16 feet with an aluminum sheet metal (8 x 12 feet in size) in the center of the floor for a ground plane. When needed for tabletop equipment, a wooden table (0.8 meters in height) is placed on the metal ground plane that extends at least 0.1m beyond all sides of the table. A removable 3 x 6 foot sheet of aluminum is placed on top of the wooden table when a horizontal coupling plane is required.

The appropriate connections, as needed for each test, are used to interconnect the table horizontal coupling plane, ground plane floor, test equipment, and earth ground.

The available AC power in the EC Lab "A" is 120V 60Hz AC Single Phase 60Amps; 230V 50Hz AC Single Phase 50Amps; and 208V 60Hz AC Three Phase AC 30Amps.

The EC Lab "A" is equipped with air and water services for use with equipment that requires it.

The humidity in EC Lab "A" can be automatically controlled in the range of 20% to 60%.

EC Lab B: Chomerics' EC Lab "B" is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts.

EC Lab "B" is a typical room measuring 12x14 feet with a copper sheet (6x8 feet in size) in the center of the floor for a ground plane. When needed for tabletop equipment, a wooden table (0.8 meters in height) is placed on the metal ground plane that extends at least 0.1m beyond all sides of the table. A removable 3 x 6 foot sheet of aluminum is placed on top of the wooden table when a horizontal coupling plane is required.

The appropriate connections, as needed for each test, are used to interconnect the table horizontal coupling plane, ground plane floor, test equipment, and earth ground.

The available AC power in the EC Lab "B" is 120V 60Hz AC Single Phase 60Amps, 230V 50Hz AC Single Phase 50Amps; and 208V 60Hz AC Three Phase AC 30Amps.

The humidity in EC Lab "B" can be automatically controlled in the range of 20% to 60%.

Safety Lab: The Safety Test Laboratory is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts.

The power in the test lab consists of a 208 Volt, three phase, 200 Amp distribution panel which feeds a power bus which has various types of American and European single and three phase receptacles. The largest of which is a 100 Amp three- phase service with its own disconnect switch. This distribution panel also provides power to a programmable power source capable of providing three- phase power up to 312 V Line to Neutral at up to 10 kVA total power. The output of this programmable power source also feeds a distribution panel that feeds a power bus with various types of American and European single and three phase receptacles.

The lab contains a 32 cubic foot temperature and humidity chamber that is required by most safety standards for temperature and humidity preconditioning of equipment.

1.4.3 Equipment Under Test

The Microwave Radio Communications HDX 1100C2 (S/N 8999999) with Vislink Transmitter Remote Control (S/N AA09300391) is an aircraft transmitter.

The support equipment needed to run the HDX 1100C2 with Transmitter Remote Control in the High Power +30dBm mode of operation consisted of the following:

a. Kenwood PR36-1.2A Regulated DC Power Supply
b. Vislink Model 907630-3 DC supply(S/N 0511ST0000300G)

The HDX 1100C2 with Transmitter Remote Control operates on +28VDC power supplied by Vislink Model 907630-3 DC supply. The Vislink Model 907630-3 DC supply operates on 120VAC/60Hz power supplied by Chomerics Test Services. The Vislink Transmitter Remote Control operates on +28VDC power supplied by the Kenwood PR36-1.2A Regulated DC Power Supply. The Kenwood PR36-1.2A Regulated DC Power Supply operates on 120VAC/60Hz power supplied by Chomerics Test Services.

There are four I/O connections. They are as follows:

Quantity	Name/Type	Length (m)	Shielded?	Ferrite?	Termination
2	DC Power	2.0	No	No	EUT Power → Supply
1	I/O/Control Bundle	1.0	No	No	Remote → HDX
1	I/O/Control Bundle	2.0	No	No	Not terminated from HDX

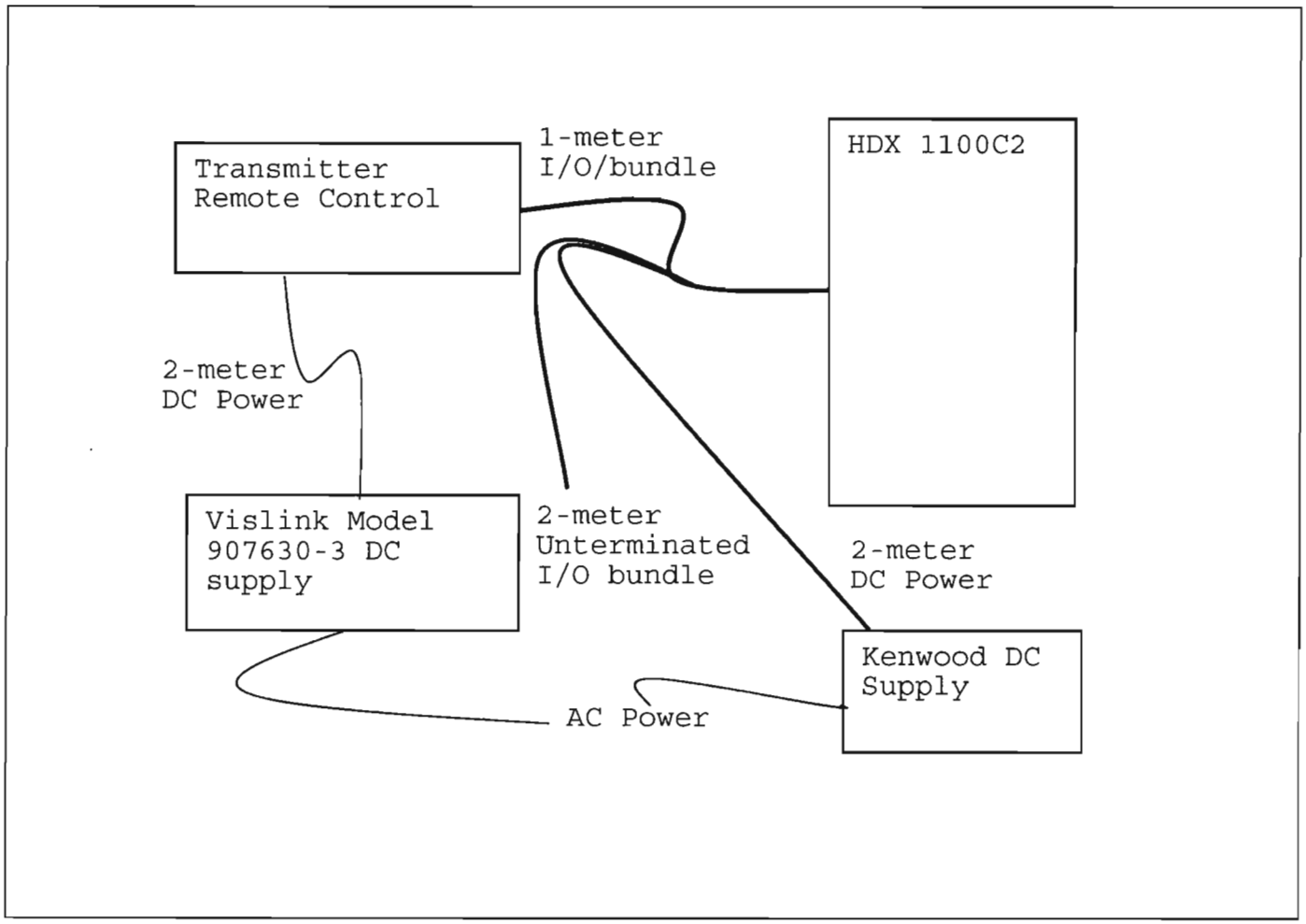
The High Power +30dBm mode of operation was used for emissions tests. The antenna port was terminated with a Narda 20 Watt 50Ω load. The HDX 1100C2 with Transmitter Remote Control was monitored during the test by Nick Orphanos of Chomerics Test Services.

The equipment under test was setup as illustrated on CTS-Form-014.

1.4.4 Block Diagram

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL

DATE: 2010-05-17
TESTED BY: NICK ORPHANOS



System Configuration Block Diagram – Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside the testing field.

FORM CTS-014

1.5 Pass/Fail Criteria

For the FCC Part 15 Subpart B tests performed in Open Area Test Site B, the emission levels shall not exceed the Class B limits in the frequency range of 30MHz and 25MHz for the radiated test.

2.0 EMISSIONS TESTS PERFORMED

2.1 FCC Part 15 Subpart B Radiated Electromagnetic Emissions

2.1.1 Equipment Used

Test Equipment		Asset #	Serial #
X	Rohde and Schwarz ESCI7	902	100747
X	Agilent E4440A Spectrum Analyzer	704	US41421236
X	Chomerics 1 GHz to 18 GHz L.N.A. System	800	1065365
X	EMCO 3115 Double Ridged Guide	374	2174
X	EMCO 6512 Loop Antenna	787	00051667
X	ETS 3142c Biconolog Antenna	769	00046673
X	Hewlett Packard 8447D Pre Amp	12	2944A06414

(See Appendix B for Equipment Calibration)

2.1.2 Test Conditions

Radiated emissions testing 30MHz through 1GHz was performed with the EUT set up on a wooden table above the turntable at a distance of 10 meters from the Biconolog antenna within Open Area Test Site B.

Radiated emissions testing 9kHz through 30MHz was performed with the EUT set up on a wooden table above the turntable at a distance of 3 meters from the Loop Antenna within Open Area Test Site B.

Radiated emissions testing 1GHz through 25GHz was performed with the EUT set up on a wooden table above the turntable at a distance of 3 meters from the Horn antennas within Open Area Test Site B.

The Microwave Radio Communications HDX 1100C2 with Transmitter Remote Control was configured to operate in the High Power +30dBm mode of operation to maximize the emissions. The HDX 1100C2 with Transmitter Remote Control was set up and powered by +28VDC for radiated emission tests. The worst case signals detected were recorded.

2.1.3 Test Method

The test method of FCC Part 15 Subpart B was followed for Class B equipment. For the radiated emission measurements, a manual scan was performed from 150kHz to 40GHz. During this scan, the antenna, turntable and the EUT's cable positions were manipulated to maximize the emission levels in a given frequency band displayed on the spectrum analyzer.

2.1.4 Results

The Microwave Radio Communications HDX 1100C2 with Transmitter Remote Control with the meets the requirements for radiated emissions as required by FCC Part 15 Subpart B, Class B equipment.

The worst case signal detected is 1.5 dB below the limit at 768.0MHz frequency.

2.1.5 Test Data

RADIATED E FIELD EMISSION MEASUREMENTS

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM
BANDWIDTH: [X] 100 KHZ (PEAK)/120 KHZ (QP)
BANDWIDTH: [X] 10KHZ (PEAK)/9KHZ (QP)
OTHER (SPECIFY)

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: ANTENNAS
TEST SPEC: FCC PART 15 SUBPART B
PROCEDURE: ANSI C63.4

FREQUENCY MHz	PEAK MEASURED LEVEL dBuV	QUASI-PEAK MEASURED LEVEL dBuV	ANTENNA HEIGHT (METERS)	TURNTABLE AZIMUTH (DEGREES)	ANTENNA H/V	ANTENNA FAC/CABLE LOSS dB	FIELD LEVEL dBuV/m ✧	LIMIT dBuV/m (QP)
0.223	2.5	--	1.0	180	--	60.3	**62.8**	**112.7***
159.997	12.0	--	1.23	270	V	12.0	**24.0**	**33.0**
166.8	--	12.5	1.23	45	V	11.8	**24.3**	**33.0**
233.516	18.0	--	1.24	0	V	14.8	**32.8**	**35.5**
255.997	8.5	--	3.18	45	H	15.7	**24.2**	**35.5**
300.2	--	15.0	1.24	0	V	16.0	**31.0**	**35.5**
324.0	--	15.5	1.25	0	V	17.9	**33.4**	**35.5**
366.9	--	12.5	1.24	45	V	20.4	**32.7**	**35.5**
768.0	--	5.0	1.40	90	H	28.8	**34.0**	**35.5**

✧All signals greater than 3dB from the limit are calculate to the nearest whole number.

NOTES: Applicable FCC Part 15 Subpart B limits for the device under test were from 30MHz through 25GHz.

***FCC Part 15 Subpart C Section 15.209 limits were applied outside the Subpart B range.**

FORM CTS-DS-001R

Test Data

RADIATED E FIELD EMISSION MEASUREMENTS

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM
BANDWIDTH: [X] 1MHZ (AVG)
OTHER (SPECIFY)

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: ANTENNAS
TEST SPEC: FCC PART 15 SUBPART B
PROCEDURE: ANSI C63.4

FREQUENCY GHz	AVG MEASURED LEVEL dBuV	ANTENNA HEIGHT (METERS)	TURNTABLE AZIMUTH (DEGREES)	ANTENNA H/V	ANTENNA FAC/AMPLIFIER GAIN Loss dB	FIELD LEVEL dBuV/m ✧	LIMIT dBuV/m (AVG)
1.2009	36.5	1.28	0	H	-11.6	**24.9**	**54**
1.408	39.2	1.00	180	V	-11.3	**27.9**	**54**
2.485	55.8	1.10	225	H	-5.7	**50.1**	**54**
9.942	33.7	1.10	0	V	11.6	**45.3**	**54**

✧All signals greater than 3dB from the limit are calculate to the nearest whole number.

NOTES:

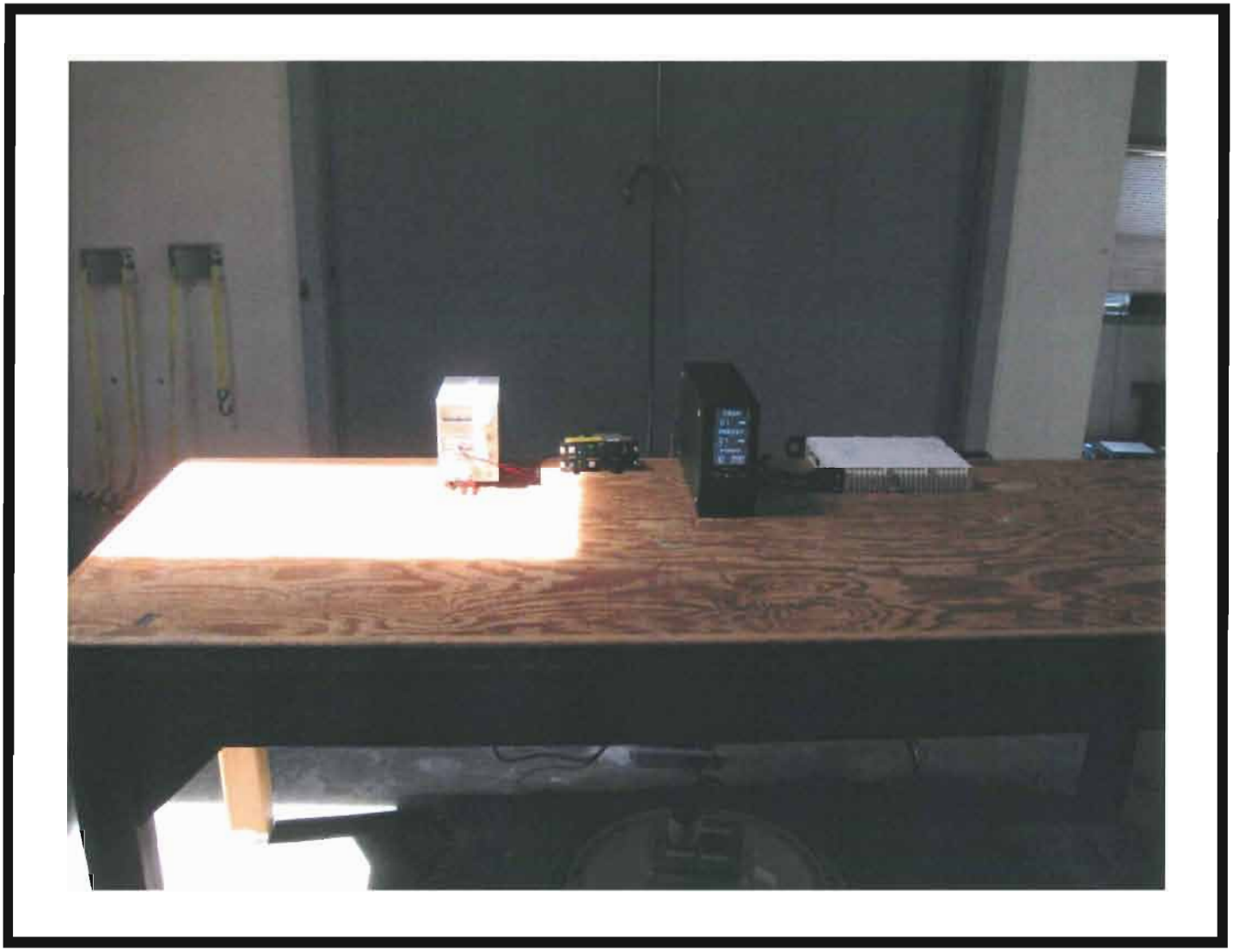
FORM CTS-DS-001R

2.1.6 Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B



Photograph Description: Radiated set-up

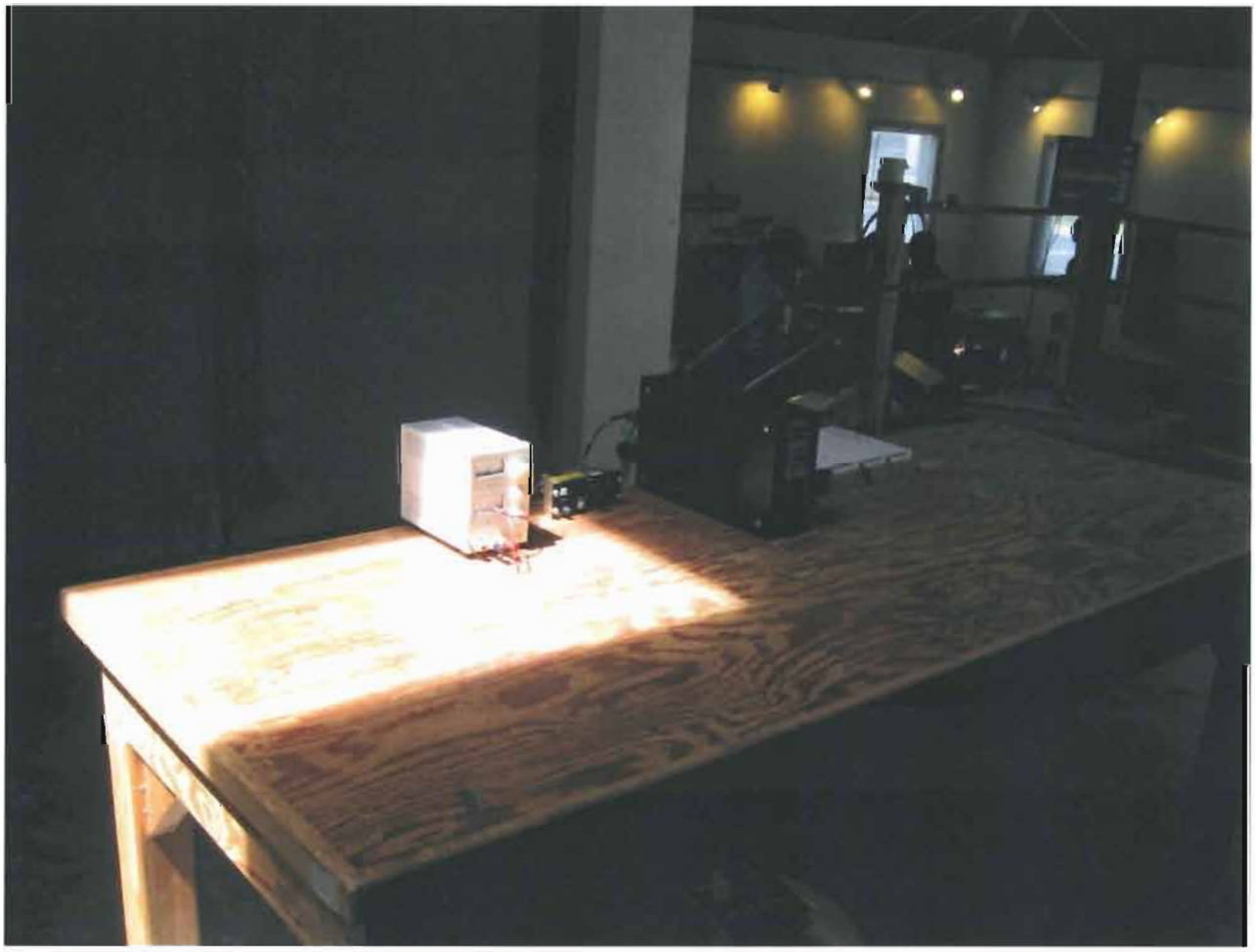
FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B



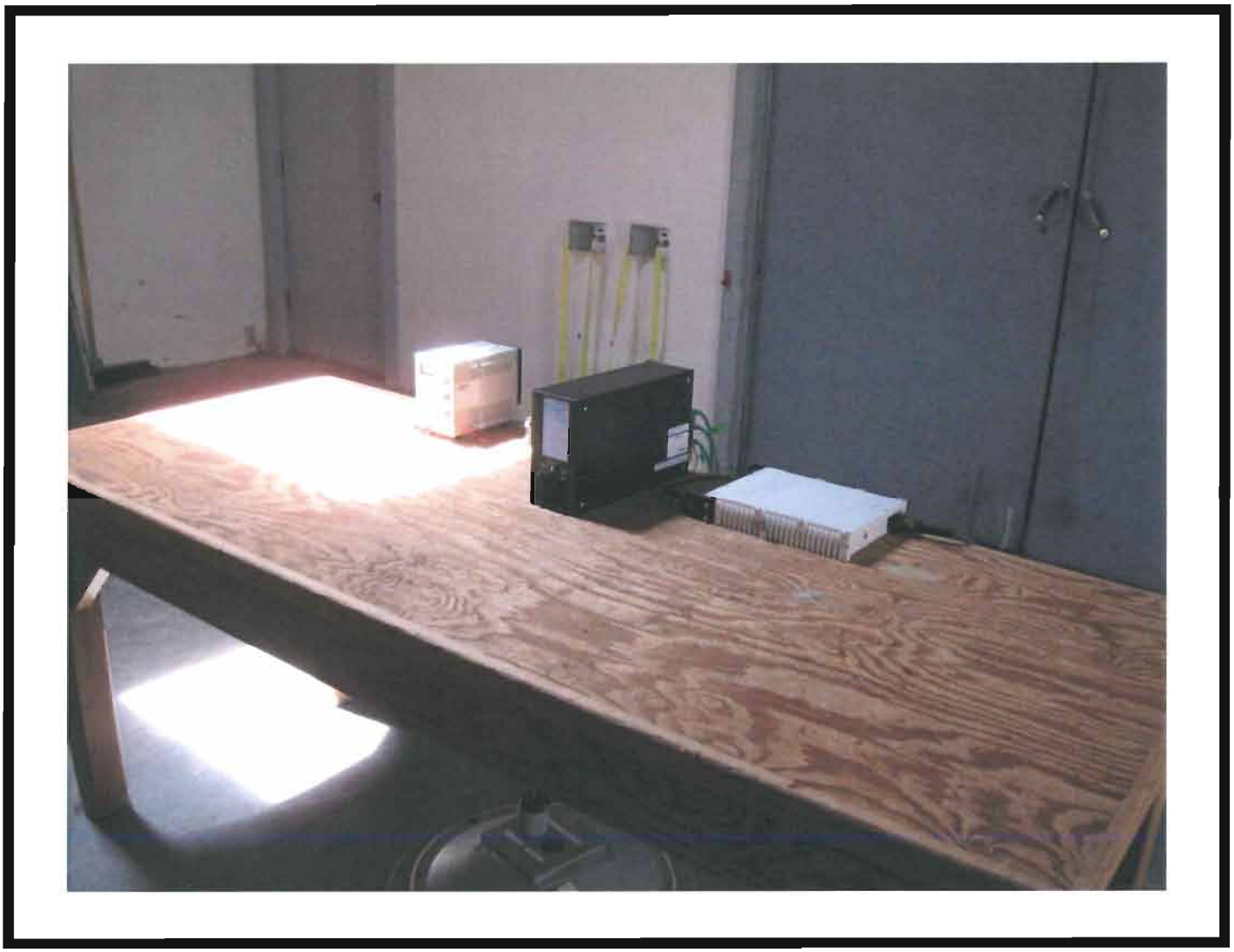
Photograph Description: Radiated set-up

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1
COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B



Photograph Description: Radiated set-up

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1
COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B

Photograph Description: Radiated set-up

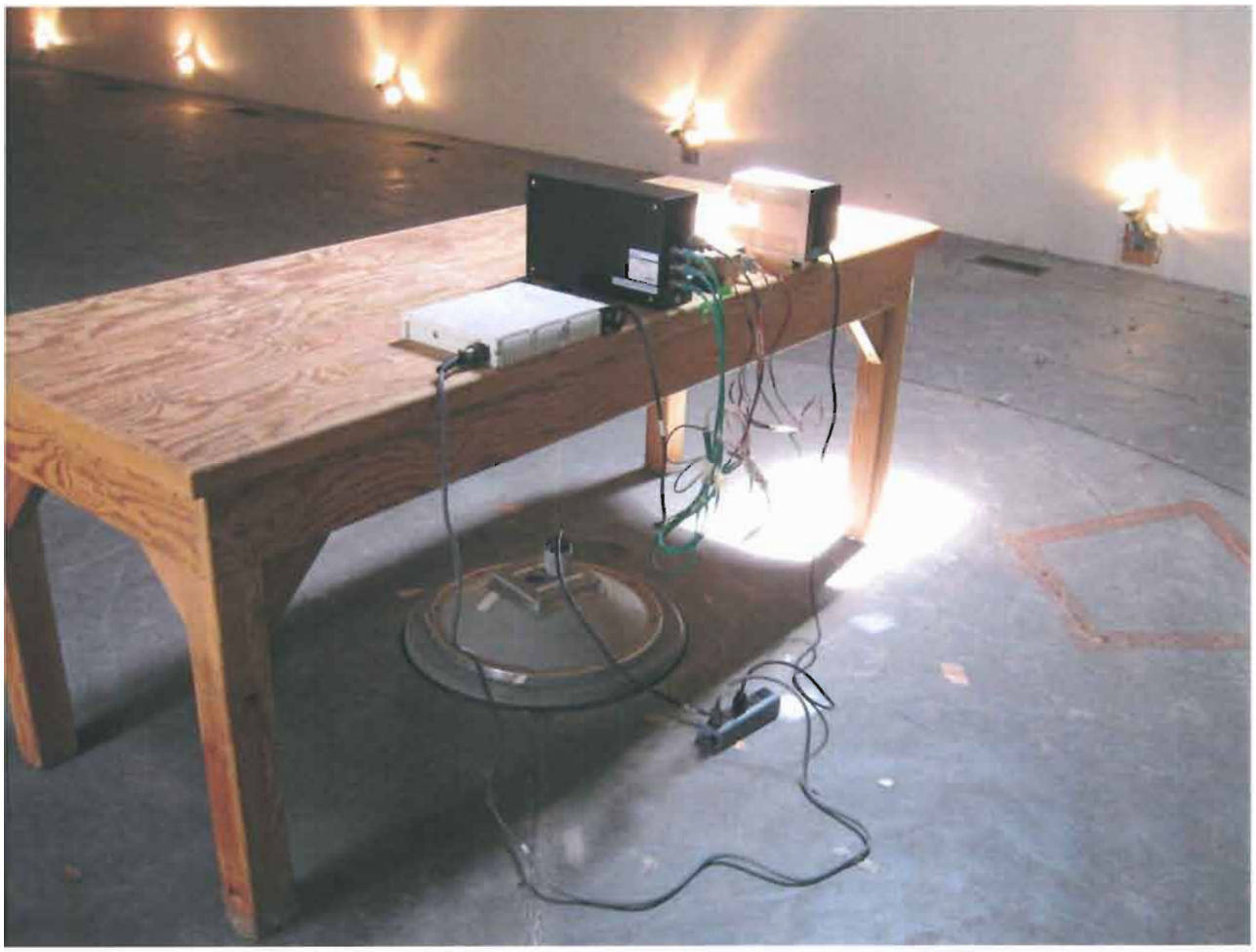
FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B



Photograph Description: Radiated set-up

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: BICONOLOG ANTENNA
TEST SPEC: FCC PART 15 SUBPART B

Photograph Description: Radiated set-up

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: LOOP ANTENNA
TEST SPEC: FCC PART 15 SUBPART B

Photograph Description: Radiated set-up

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL
TESTED BY: NICK ORPHANOS
OPERATING MODE: HIGH POWER +30DBM

DATE: 2010-05-17
TEST NUMBER: 1

COUPLING DEVICE: RIDGE GUIDE ANTENNA
TEST SPEC: FCC PART 15 SUBPART B

Photograph Description: Radiated set-up

FORM CTS-PHOTO

APPENDIX A

TEST LOG
AND
LABORATORY ENVIRONMENTS

TEST LOG

CUSTOMER: MICROWAVE RADIO COMMUNICATIONS **PROGRAM: EMISSIONS**
EQUIPMENT: HDX 1100C2 WITH TRANSMITTER REMOTE CONTROL **TESTED BY: NICK ORPHANOS**

	Date	Comments
Pre-Test Checklist	2010-05-17	Test Plan/Procedure: ANSI c63.4 Test Specification: FCC Part 15 Subpart B Chomerics Procedure: CHO TPEC T2 EUT Power Requirement Verified: +28 DC Voltage EUT Functional Operational Check: [X] Pass [ ] Fail Environmental: Bonding/Grounding: N/A Safety Issues: N/A

In-Process Test Checklist	Date	Test #	Test Type	Test Equipment Calibrated	Test Performed Properly – Data Accepted	EUT Set-up Check/ Operational Check	EUT Pass/ Fail
	2010-05-17	1	RE	Yes	Yes	Yes	Pass

Post Test Checklist	Date: 2010-05-17	EUT Functional Operation Check: [X] Pass [ ] Fail	Test Engineer/Tech Approved Signatory

FORM CTS-010

LABORATORY ENVIRONMENTS

Date	Test Site	Ambient Temperature (°C)	Relative Humidity (%)	Atmospheric Pressure (mBar)
2010-05-17	Open Area Test Site B	22	32	1026

APPENDIX B

EQUIPMENT CALIBRATION

Test Equipment	Asset #	Serial #	Last Cal Date
Agilent E4401B Spectrum Analyzer	725	MY41440273	2009/08
Agilent E4401B Spectrum Analyzer	726	MY41440274	2009/09
Agilent E4440A Spectrum Analyzer	704	US41421236	2010/02
AR Amplifier 250T1G3	784	313235	NCR
AR Amplifier 100W1000B	768	311120	NCR
AR FM2000 Isolated Field Monitor	39	13009	2009/05
AR FP2000 Isolated Field Probe	40	12914	2009/05
AR Leveling Preamplifier 888	491	15606	NCR
AR FP2080 Probe (80 MHz to 40 GHz)	767	309531	2009/05
Boonton 4232A RF Power Meter	777	148602	2009/09
Boonton 51011 EMC RF Power Sensor	778	33863	2009/09
Boonton 51011 EMC RF Power Sensor	779	33862	2009/09
Chomerics 1 GHz to 18 GHz L.N.A. System.	800	1065365	NCR
Chomerics 100 Ohm Resistor	N/A	N/A	NCR
Dell Flat panel monitor	NA	NA	NCR
Dell Desktop Computer	N/A	N/A	NCR
Eaton Bulk Current Injection Probe 95242-1	215	290	UWC
Eaton Bulk Current Probe 91550-1	218	2759	2010/04
Eaton Bulk Current Probe 954111-1	217	1393	2010/04
Eaton B.C. I. Probe Calibrator 95241-1	219	0179680-04	UWC
Elgar SW 5250M	870	0841A00418	UWC
Elgar SW 5250S	871	0841A00419	UWC
Elgar SW PDU	868	0839A0329	UWC
EMCO Log Periodic Antenna 3146	80	3381	2010/01
EMCO 3109 Biconical Antenna	116	2415	2010/04
EMCO 3120 Tuned Dipole Antenna B1	474	21	2010/01
EMCO 3121 Tuned Dipole Antenna B2	475	177	2010/01
EMCO 3121 Tuned Dipole Antenna B3	476	698	2010/01
EMCO 3115 Microwave Horn Antenna	376	2796	2010/01
EMCO 7405 RF Probe Kit	3	9006-1648	NCR
EMCO 3810/2NM LISN	601	9612-1740	2010/01

EMCO 3825/2R LISN	890	1031	2009/07
EMCO Voltage Probe 3701	499	9604-1130	2009/05
EMCO 3143 Biconolog	505	1266	NCR
EMCO 3115 Double Ridged Guide	374	2174	2010/02
EMCO Loop Antenna 6512	787	00051667	2009/11
ETS 3142c Biconolog Antenna (Site B)	769	00046673	2009/12
ETS Lindgren T.I.L.E. 4! Software Version 4.0.A.9	N/A	N/A	NCR
FCC 150-50 Ohm Adapters	361	4	UWC
FCC 801-M2-25	364	1	UWC
FCC 801-M3-25A Power Line Coupling/Decoupling Network	622	99125	NCR
FCC 801-150-50 CDN	583	9975	UWC
FCC 50-150 Ohm Adapter	486	276	UWC
FCC 50-150 Ohm Adapter	487	277	UWC
FCC 801-T4 Coupling Network	485	45	UWC
FCC 801-T2 Coupling Network	484	50	UWC
FCC 801-AF2 Coupling Network	483	35	UWC
FCC 801-150-50-BCI Adapter	702	343	UWC
FCC 801-150-50-BCI Adapter	775	449	UWC
FCC 801-150-50-BCI Adapter	776	450	UWC
Haefely Psurge 4010 Generator	671	583334-86	2009/10
Haefely Psurge 4010 Generator	736	151542	2009/05
Haefely PHV 41.1 PEFT.1 Generator	489	082-106-18	2009/12
Haefely PHV 41.2 PEFT.1 Generator	355	082-106-01	2009/06
Haefely FP16/3-1 Coupling Filter	356	082-208-02	UWC
Haefely IP4 Coupling Clamp	481	N/A	NCR
Haefely Metallic Surge Pistol	643	N/A	UWC
Haefely Fp20/3-3 Coupling Filter	358	082-170-06	UWC
Hewlett Packard 8447D Pre Amp	887	2443A04253	2009/06
Hewlett Packard 8447D Pre Amp	12	2944A06414	2010/01
Hewlett Packard 8447F Pre Amp	633	2805A3022	2010/01
HP8566B Spectrum Analyzer	47	2637A04064	2009/07
HP85685A Preselector	48	2648A00483	2009/07

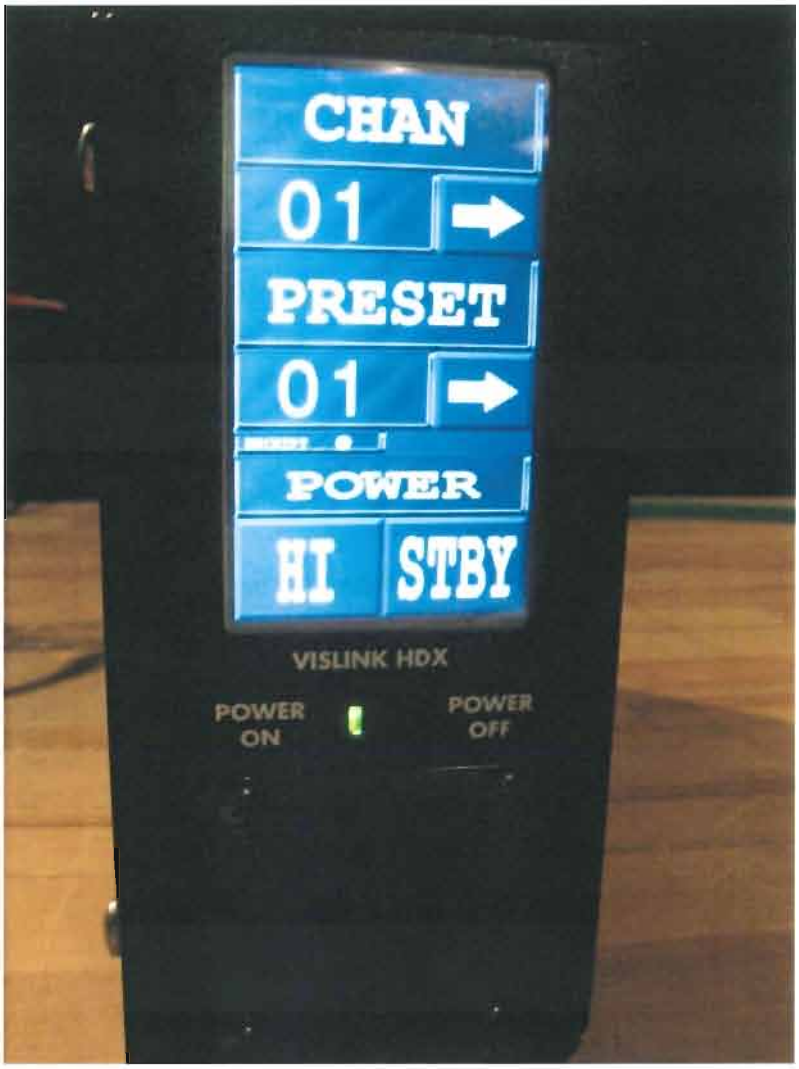
HP Display Unit	46	2648A14289	2009/07
HP85650A Quasi Peak Adaptor	751	3033A1482	2009/07
HP Power Meter 437B	203	2949A02617	2010/04
HP 651B Signal Generator	57	1230A10422	2009/10
HP 3325A Signal Generator	617	2512A23039	2009/11
HP 3326A Signal Generator	37	2519A00753	2009/10
HP 83620B Signal Generator	624	3844A00963	2009/11
HP 83620B Signal Generator	625	3844A00955	2009/12
HP 83640A Signal Generator	38	3009A00188	2009/05
Hughes 1277H09F000 Amplifier	N/A	082	NCR
Keytek MZ-15 ESD Simulator	336	8801209	2009/12
Keytek VCP-1 Vertical Coupling Plane	368	9209332	NCR
Keytek CTC-3 Coax Monitor	440	N/A	NCR
LogiMetrics A300/L (1-2 GHz)	135	3091	NCR
LogiMetrics A300/S (2-4 GHz)	92	3092	NCR
Narda 768-20 Attenuator	796	NA	2010/01
Narda 3020A Directional Coupler	214	34514	2009/07
Narda 3022 Directional Coupler	212	73360	2010/04
Narda 3022 Directional Coupler	814	81864	2009/10
Polarad MDS21 Absorbing Clamp	435	301404/003	2009/12
Polarad ESH2-25 Artificial Mains Network	23	890484/016	2010/01
Quantum Change/EMC Systems, LLC T.I.L.E. Software Version 3.4.K.13	N/A	N/A	NCR
RF Power Labs Pre Amp	562	N/A	NCR
Rohde and Schwarz ESV Test Receiver	15	875931049	2009/09
Rohde and Schwarz ESH-2 Test Receiver	16	8799631020	2009/09
Rohde and Schwarz ESH-2 Test Receiver	488	879575/006	2010/04
Rohde and Schwarz ESIB40	803	100293	2009/06
Rohde and Schwarz Signal Generator SMH	881	883 802/013	2009/12
Schaffner NSG 438 PN 400-348 ESD Simulator	755	385	2010/03
Schaffner INA 4380 150pF/330Ohm Network	756	403-550-0447	2010/03
Schaffner INA 4381 150pF/2K Network	758	403-564-0413	2010/03
Schaffner INA 4382 330pF/2K Network	761	403-565-0402	2010/03

Schaffner INA 4480 Magnetic Loop	763	403-615-0413	2010/03
Schaffner INA 4551 150pF/500Ohm Network	757	403-591-0503	2010/03
Schaffner INA 4553 330pF/330Ohm Network	759	403-588-0447	2010/03
Schaffner INA 4554 150pF/150Ohm Network	760	403-588-0427	2010/03
Sharp Closed Circuit Video Monitor	N/A	N/A	NCR
Solar High Pass Filter 7930-5.0	781	NA	NCR
Solar Current Probe 6741-1	468	901610	2010/04
Solar 50 Ohm/50uH L.I.S.N.	381	852334	2010/01
Solar 50 Ohm/50uH L.I.S.N.	382	860622	2010/02
Solar 50 Ohm/50uH L.I.S.N.	19	894304	2010/02
Solar 50 Ohm/50uH L.I.S.N.	20	894305	2010/02
Solar 50 Ohm/50uH L.I.S.N.	21	894307	2010/01
Solar 50 Ohm/50uH L.I.S.N.	22	8923108	2010/01
Solar 9144-1N Current Injection Probe	857	078003	UWC
Staco 3PN 1520B Variac	635	N/A	NCR
Tegram Bulk Current Injection Probe 95252-1	490	12180	UWC
Tegram B. C. I. Probe Calibrator 95251-1	507	12326	UWC
Tektronix 494 AP Spectrum Analyzer	543	B010201	2009/09
Tektronix 7104 Oscilloscope	60	B064064	2009/12
Tektronix 7A29 Vertical Amplifier	153	B040385	2009/12
Tektronix 7B92A Time Base	150	B094245	2009/12
Tektronix TB92A Time Base	196	B096042	2010/03
Tektronix TDS 380 Oscilloscope	516	B012231	2009/10
Voltech PM3000A Power Analyzer	508	0882	2009/10
Voltech PM6000A Power Analyzer	861	100006700235	2010/03
Voltech IEC 555 STD Impedance Network	50	685	2009/10
Werlatone Dual Directional Coupler	731	14303	2009/11
Werlatone C6277-10 Directional Coupler	780	20250	2009/09

APPENDIX C

ADDITIONAL PHOTOGRAPHIC DOCUMENTATION

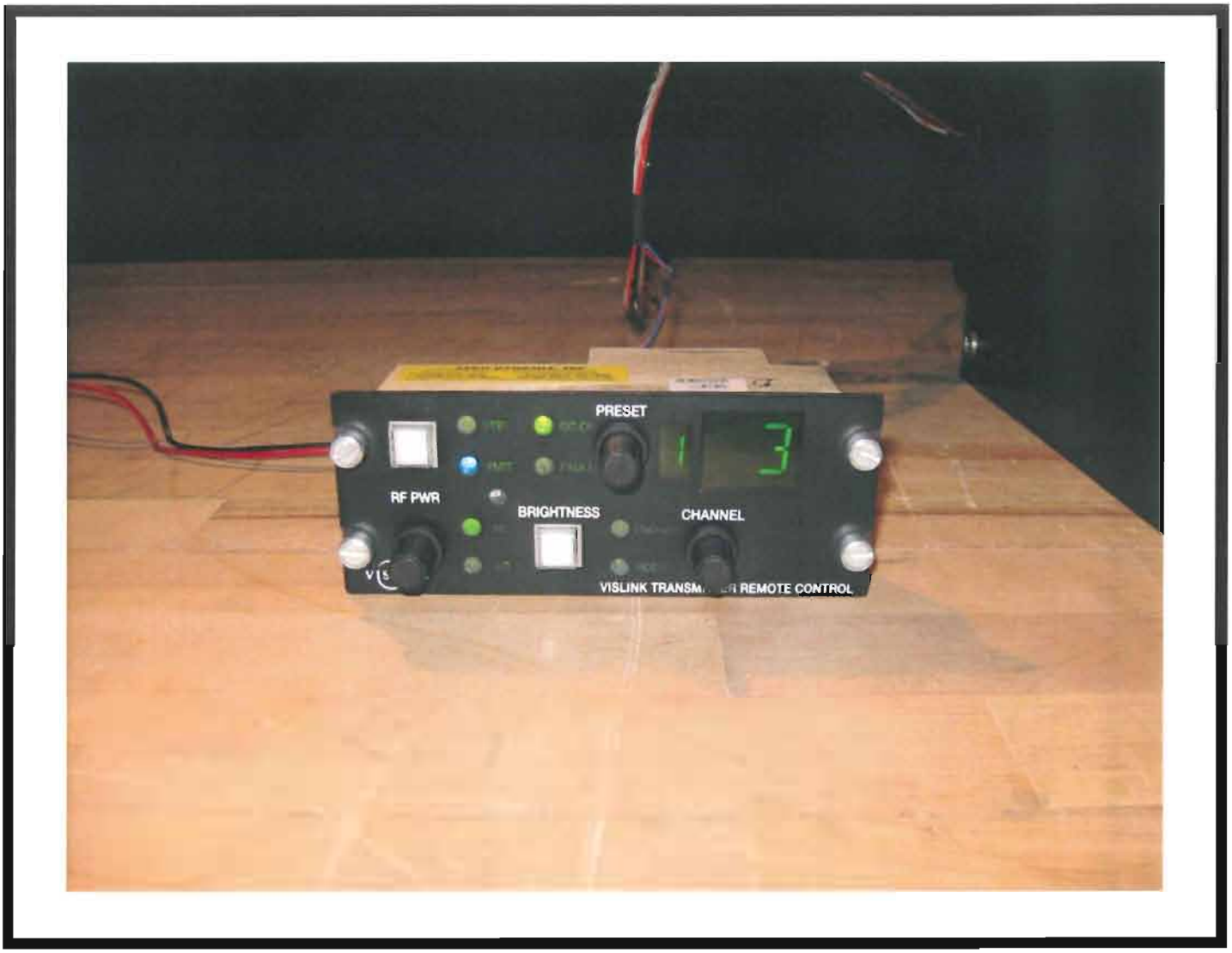
Photographic Documentation



Photograph Description: HDX 1100C2 in operating mode

FORM CTS-PHOTO

Photographic Documentation



Photograph Description: Transmitter Remote Control in operating mode

FORM CTS-PHOTO

Photographic Documentation

Photograph Description: HDX 1100C2 Product Label

FORM CTS-PHOTO

Photographic Documentation

Photograph Description: Transmitter Remote Control Product Label

FORM CTS-PHOTO