EMISSIONS TEST REPORT

Report Number: 3139325BOX-009
Project Number: 3139325

Testing performed on the

VCA100 Radio

Model: BAEVCA100-U1FCGX-LF

To

FCC Part 22 Subpart E "Public Mobile Radio – Paging and Radiotelephone Service"
FCC Part 74 Subpart H "Experimental Radio, Auxiliary, Special Broadcast And Other Program Distributional Services – Low Power Auxiliary Stations"
FCC Part 90 Subpart I
"Private Land Mobile Radio Services – General Technical Requirements"

For
BAE Systems – Homeland Security Solutions

Test Performed by:	Test Authorized by:
Intertek – ETL SEMKO	BAE Systems – Homeland Security Solutions
70 Codman Hill Road	2 Forbes Road
Boxborough, MA 01719	Lexington, MA 02420

Prepared by: _____ Date: 01/31/2008
Nicholas Abbondante

Reviewed by: _____ Date: 01/31/2008
Michael F. Murphy

1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company:	BAE Systems – Homeland Security Solutions 2 Forbes Road Lexington, MA 02420
Contact:	Mr. Ralph Lombardo
Telephone:	603-885-7172
Fax:	N/A
Email:	Ralph.lombardo@baesystems.com

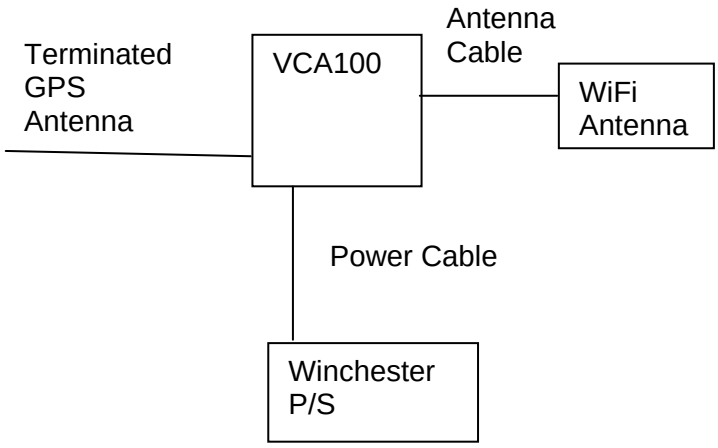
1.2 Equipment Under Test

Equipment Type:	VCA100 Radio
Model Number(s):	BAEVCA100-U1FCGX-LF
Serial number(s):	0716HNH000031
Manufacturer:	BAE Systems – Homeland Security Solutions
EUT receive date:	12/05/2007
EUT received condition:	Prototype in Good Condition
Test start date:	12/06/2007
Test end date:	01/10/2008

1.3 Test Plan Reference: Tested according to the standards listed and ANSI/TIA-603-C-2004.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
WiFi Antenna Cable	Braid	SMA	4.2	1
GPS Antenna Cable	Braid	SMA	5.5	1
Power Cable	None	Plastic/Wire	3.25	1

1.4.3. Support Equipment:

Name: Antenex WiFi Antenna 2.4-2.5 GHz
Model No.: A10245
Serial No.: N/L

Name: All-Start Winchester Portable Power Generator
Model No.: WPG103
Serial No.: N/L

1.5 Mode(s) of Operation:

During testing, the EUT was powered from a nominal 12V DC power supply. For the FCC Part 90 testing, the EUT was fully powered and was transmitting an unmodulated one second burst with one second intervals.

1.6 Floor Standing Equipment: Applicable:____ Not Applicable: X

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 22 Subpart E FCC Part 74 Subpart H FCC Part 90 Subpart I		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
FCC Part 22 Subpart E, FCC Part 74 Subpart H, FCC Part 90 Subpart I		
RF Output Power FCC §22.565(a), FCC §74.861(d)(1), FCC §90.205(d)	Power must not exceed the following: FCC Part 22: 152-153 MHz – 1400 Watts ERP, 157-159 MHz – 150 Watts ERP FCC Part 74: Licensees may not operate at higher than 1 Watt ERP. FCC Part 90: Power limitation is dependant on the device antenna's height above average terrain (HAAT) and on the required service area, and will be authorized according to the HAAT table found in FCC §90.205(d) Table 1.	Pass
Radiated Emissions FCC §22.359(a), FCC §74.861(d)(3), FCC §90.210	Spurious emissions must not exceed -13 dBm ERP.	Pass

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:

±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC Part 22, FCC Part 74, FCC Part 90

Test: RF Output Power, FCC §22.565(a), FCC §74.861(d)(1), FCC §90.205(d)

Performance Criterion: Power must not exceed the following values:
FCC Part 22: 152-153 MHz – 1400 Watts ERP, 157-159 MHz – 150 Watts ERP
FCC Part 74: Licensees may not operate at higher than 1 Watt ERP.
FCC Part 90: Power limitation is dependant on the device antenna's height above average terrain (HAAT) and on the required service area, and will be authorized according to the HAAT table found in FCC §90.205(d) Table 1.

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	21	Humidity (%):	23	Pressure (hPa):	1050
Pretest Verification Performed		Yes		Equipment under Test:		BAEVCA100-U1FCGX-LF	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		0716HNH000031	

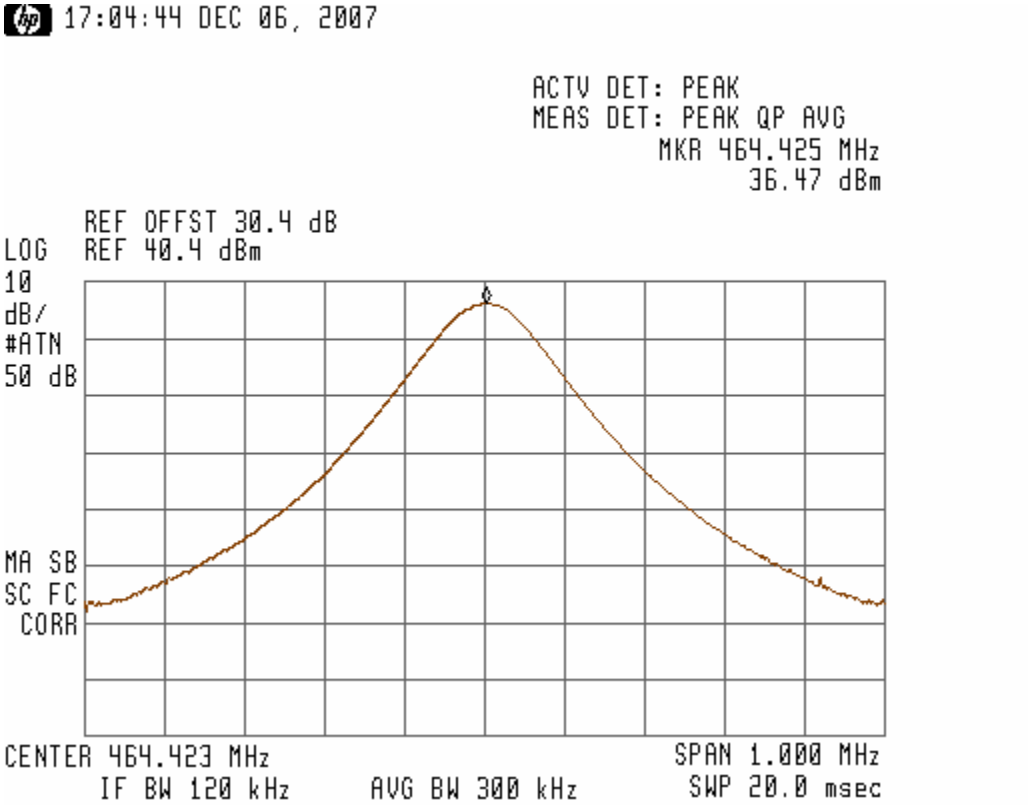
Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	Attenuator, 30dB	Weinschel Corp	47-30-34	BD4327	09/13/2008
3	40 GHz Cable	Megaphase	TM40-K1K1-197	7030801 002	05/23/2008
4	EMI Receiver with 85420E RF Filter Section	Hewlett Packard	8542E	3906A00273	02/16/2008

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:



RF Output Power, 464.425 MHz, 36.47 dBm

Test Results: Pass

Test Standard: FCC Part 22, FCC Part 74, FCC Part 90

Test: Radiated Emissions, FCC §22.359(a), FCC §74.861(d)(3), FCC §90.210

Performance Criterion: Spurious emissions must not exceed -13 dBm ERP.

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	21	Humidity (%):	35/27	Pressure (hPa):	1050
Pretest Verification Performed		Yes		Equipment under Test:		BAEVCA100-U1FCGX-LF	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		0716HNH000031	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	ANTENNA	EMCO	3142	9711-1223	02/06/2008
3	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/17/2008
4	EMI Receiver with 85420E RF Filter	Hewlett Packard	8542E	3906A00273	02/16/2008
5	ANTENNA	Compliance Design	B100	1852	09/13/2008
6	ANTENNA	Compliance Design	B200	1850	09/13/2008
7	ANTENNA	Compliance Design	B300	00674	09/13/2008
8	40 GHz Cable	Megaphase	TM40-K1K1-80	7030802 002	04/24/2008
9	HORN ANTENNA	EMCO	3115	9610-4980	06/18/2008
10	1GHz High Pass Filter	Reactel, Inc	7HS-1G/10G-S11	06-1	09/18/2008
11	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL027	12/06/2008
12	High Frequency Cable 40GHz	Megaphase	TM40 K1K1 197	CBL028	12/06/2008
13	Preamplifier, 40 GHz	Miteq	NSP-4000NFG	1260417	03/25/2008
14	HORN ANTENNA	EMCO	3115	9602-4675	09/24/2008
15	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	11/26/2008
16	Sweep Generator	Hewlett Packard	83620A	3213A01244	02/06/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Radiated Emissions, Substitution

Company: BAE Systems
Model #: VCA100-U1FCGX-LF
Serial #: 0713HNH000031
Engineer(s): Nicholas Abbondante
Project #: 3139325
Standard: FCC Part 90
Barometer: BAR2

Rx Antenna: LOG2 HORN2
Rx Cable(s): S2 10M FLR CBL027 CBL028
Rx Preamp: PRE9 Receiver: 145-092
Tx Antenna: ANT2A, B, C HORN3 ROS001
Tx Cable(s): MEG004
Tx Signal Generator: HEW62
ERP or EIRP?: ERP

Location: Site 2
Date(s): 01/08/08 01/09/08 1/10/2008
Temp/Humidity/Pressure: 21c 35%/27% 1050mB
Test Distance (m): 10 Voltage/Frequency: Fresh 12V Battery Frequency Range: 30-1000 MHz

Net = Generator Level (0.00 dBm) + (EUT reading - Generator reading) - Cable Loss + Antenna Gain (dBi or dBd)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	EUT Reading dB(uV)	Generator Reading dB(uV)	Transmit Cable Loss dB	Transmit Antenna dBi	Generator Level dBm	Net dBm	Limit dBm	Margin dB	Bandwidth
Note: Test distance 10m											
PK	H	464.425	37.6	51.5	0.5	1.4	-20.0	-35.2	-13.0	-22.2	120/300 kHz
PK	V	928.850	6.4	40.5	0.7	-0.6	-20.0	-57.5	-13.0	-44.5	120/300 kHz
PK	V	73.950	10.6	64.4	0.2	1.2	-20.0	-75.0	-13.0	-62.0	120/300 kHz
PK	V	85.050	12.6	61.5	0.2	0.5	-20.0	-70.7	-13.0	-57.7	120/300 kHz
PK	V	109.000	7.9	57.7	0.2	-2.0	-20.0	-74.1	-13.0	-61.1	120/300 kHz
PK	V	116.300	10.8	58.8	0.2	-1.1	-20.0	-71.5	-13.0	-58.5	120/300 kHz
PK	V	133.163	19.3	63.6	0.2	0.8	-20.0	-66.0	-13.0	-53.0	120/300 kHz
PK	V	139.400	17.4	63.1	0.3	1.5	-20.0	-66.6	-13.0	-53.6	120/300 kHz
PK	V	150.130	9.5	60.7	0.3	1.2	-20.0	-72.4	-13.0	-59.4	120/300 kHz
PK	V	284.500	8.7	54.0	0.4	-0.3	-20.0	-68.1	-13.0	-55.1	120/300 kHz
PK	V	306.000	10.7	49.9	0.4	-0.8	-20.0	-62.5	-13.0	-49.5	120/300 kHz
PK	V	333.000	19.3	49.3	0.4	-0.6	-20.0	-53.1	-13.0	-40.1	120/300 kHz
PK	V	350.000	14.1	50.7	0.4	-1.7	-20.0	-60.8	-13.0	-47.8	120/300 kHz
PK	V	360.500	8.7	50.3	0.4	-1.7	-20.0	-65.9	-13.0	-52.9	120/300 kHz
PK	V	399.500	13.7	45.2	0.5	0.1	-20.0	-54.0	-13.0	-41.0	120/300 kHz
PK	H	415.000	25.7	52.1	0.5	0.7	-20.0	-48.3	-13.0	-35.3	120/300 kHz
PK	V	436.500	20.4	48.9	0.5	0.6	-20.0	-50.5	-13.0	-37.5	120/300 kHz
PK	H	779.000	4.9	46.1	0.7	1.0	-20.0	-63.1	-13.0	-50.1	120/300 kHz
PK	H	790.800	6.5	45.6	0.7	1.6	-20.0	-60.3	-13.0	-47.3	120/300 kHz
Note: Test distance 3m; 1 GHz High Pass Filter REA003											
PK	V	1393.275	36.1	82.9	0.9	7.2	-20.0	-62.7	-13.0	-49.7	1/3 MHz
PK	V	1857.700	35.3	79.6	1.1	7.8	-20.0	-59.7	-13.0	-46.7	1/3 MHz
PK	H	2322.125	37.8	79.0	1.2	8.5	-20.0	-56.1	-13.0	-43.1	1/3 MHz
PK	V	2786.550	35.6	78.0	1.3	9.0	-20.0	-56.9	-13.0	-43.9	1/3 MHz
PK	V	3250.975	35.5	74.3	1.5	9.0	-20.0	-53.4	-13.0	-40.4	1/3 MHz
PK	V	3715.400	34.5	73.1	1.6	9.0	-20.0	-53.4	-13.0	-40.4	1/3 MHz
PK	V	4179.825	34.8	73.8	1.7	9.5	-20.0	-53.4	-13.0	-40.4	1/3 MHz
PK	V	4644.250	35.1	74.0	1.8	9.8	-20.0	-53.0	-13.0	-40.0	1/3 MHz
PK	V	1053.400	44.1	82.8	0.8	6.1	-20.0	-55.5	-13.0	-42.5	1/3 MHz
PK	V	1189.700	42.0	82.0	0.8	6.6	-20.0	-56.4	-13.0	-43.4	1/3 MHz
PK	V	1708.800	37.0	81.5	1.0	7.7	-20.0	-59.9	-13.0	-46.9	1/3 MHz

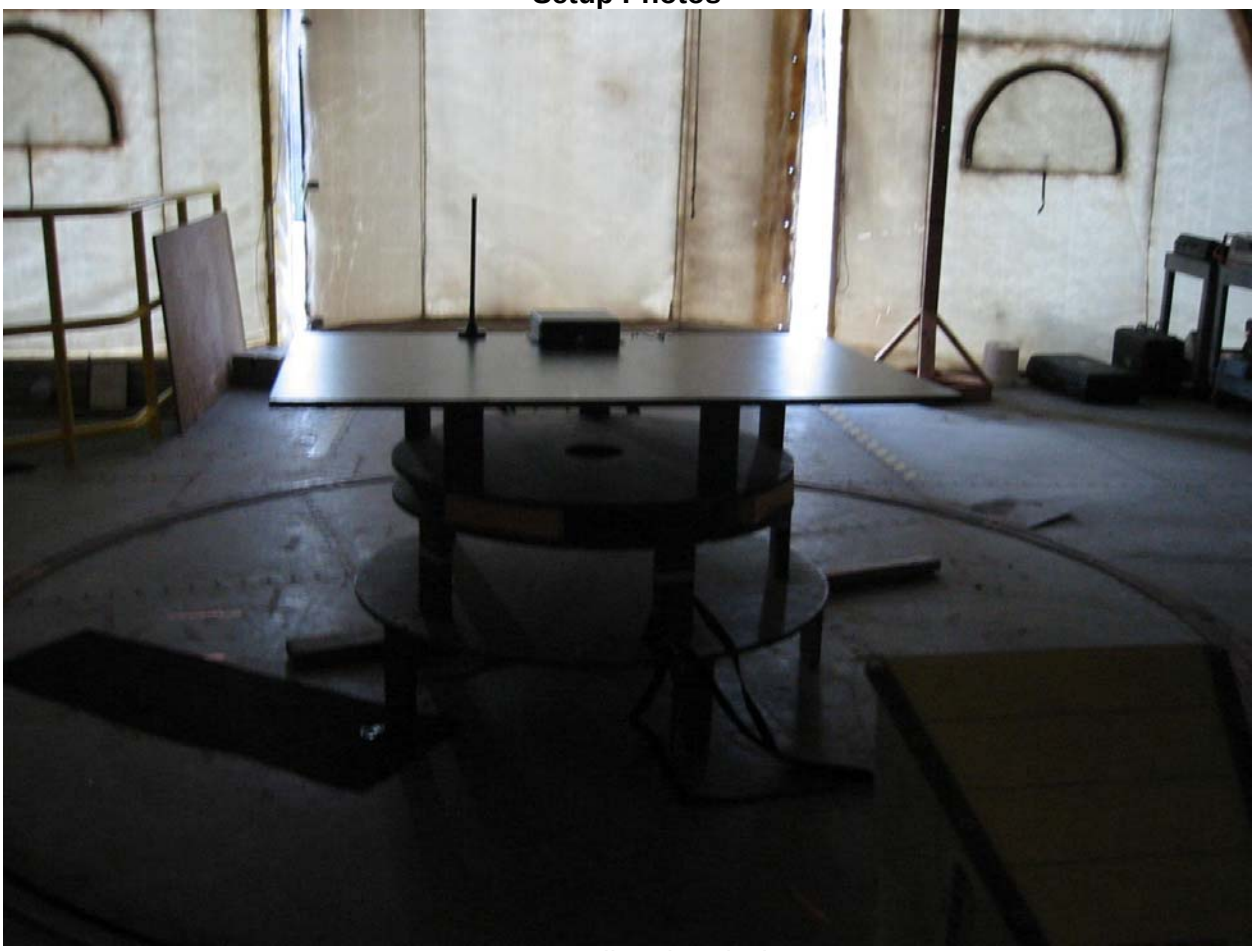
Setup Photos

30-1000 MHz Radiated Emissions

Setup Photos

30-1000 MHz Radiated Emissions

Setup Photos



1-5 GHz Radiated Emissions

Setup Photos

1-5 GHz Radiated Emissions