

EMISSIONS TEST REPORT

Report Number: 3136180BOX-007

Project Number: 3136180

Testing performed on the

VCA100 Radio

Model: BAEVCA100-L2FCGX-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:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
BAE Systems – Homeland Security Solutions
2 Forbes Road
Lexington, MA 02420

Prepared by:



Nicholas Abbondante

Date: 01/31/2008

Reviewed by:



Michael F. Murphy

Date: 01/31/2008

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. This report must not be used to claim product endorsement by A2LA, NIST nor any other agency of the U.S. Government.

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

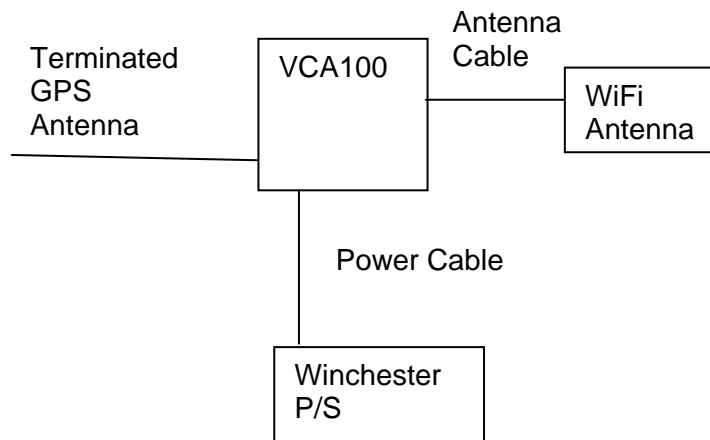
1.2 Equipment Under Test

Equipment Type: VCA100 Radio
Model Number(s): BAEVCA100-L2FCGX-LF
Serial number(s): 0716HNH000032
Manufacturer: BAE Systems – Homeland Security Solutions
EUT receive date: 01/02/2008
EUT received condition: Prototype in Good Condition
Test start date: 01/03/2008
Test end date: 01/16/2008

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 dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- 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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$\begin{aligned} RA &= 52.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ FS &= 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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

$$NF = RF + LF + CF + AF$$

Where

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$\begin{aligned} NF &= RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V} \\ UF &= 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m} \end{aligned}$$

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):	19	Humidity (%):	23	Pressure (hPa):	1050
Pretest Verification Performed	Yes		Equipment under Test:	BAEVCA100-L2FCGX-LF		
Test Engineer(s):	Nicholas Abbondante		EUT Serial Number:	0716HNNH000032		

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

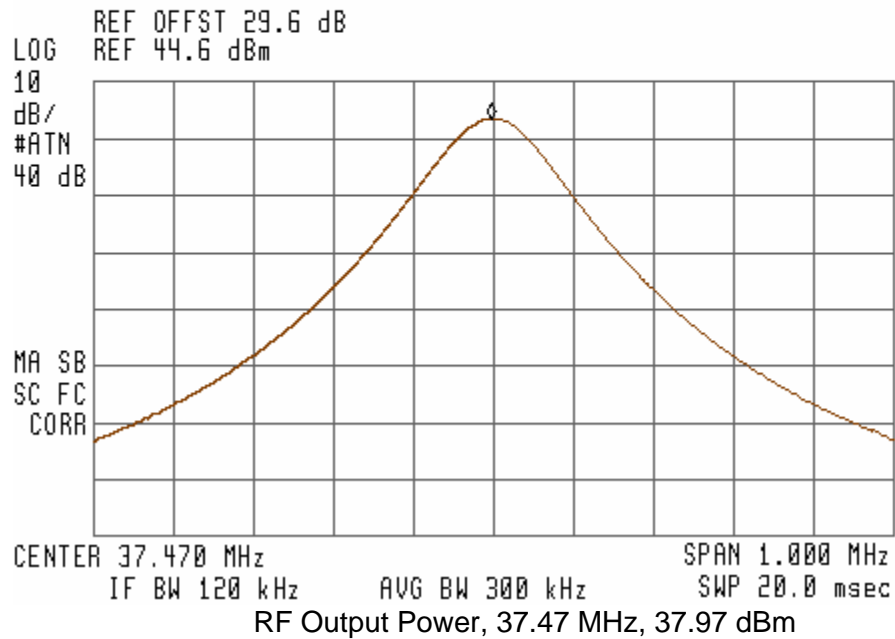
Software Utilized:

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

Test Details:

14:17:06 JAN 03, 2008

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 37.468 MHz
37.97 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):	22	Humidity (%):	23	Pressure (hPa):	1050
Pretest Verification Performed	Yes		Equipment under Test:	BAEVCA100-L2FCGX-LF		
Test Engineer(s):	Nicholas Abbondante		EUT Serial Number:	0716HNNH000032		

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	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-L2FCGX-LF
 Serial #: 0713HNH000032
 Engineer(s): Nicholas Abbondante
 Project #: 3136180
 Standard: FCC Part 90
 Barometer: BAR2 Temp/Humidity/Pressure: 22c 23% 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

Rx Antenna: LOG2
 Rx Cable(s): S2 10M FLR
 Rx Preamp: None Receiver: 145-092
 Tx Antenna: ANT2A, B, C
 Tx Cable(s): MEG004
 Tx Signal Generator: HEW62
 ERP or EIRP?: EIRP

Location: Site 2 Date(s): 01/16/08

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	V	37.470	29.7	47.0	0.1	-7.8	-20.0	-45.2	-13.0	-32.2	120/300 kHz
PK	V	74.983	12.2	64.3	0.2	1.4	-20.0	-70.8	-13.0	-57.8	120/300 kHz
PK	V	112.420	14.4	57.8	0.2	-1.7	-20.0	-65.3	-13.0	-52.3	120/300 kHz
PK	V	149.880	7.1	60.6	0.3	1.2	-20.0	-72.6	-13.0	-59.6	120/300 kHz
PK	H	187.360	4.8	59.3	0.3	0.8	-20.0	-74.0	-13.0	-61.0	120/300 kHz
PK	V	224.820	7.9	56.1	0.3	0.4	-20.0	-68.1	-13.0	-55.1	120/300 kHz
PK	V	262.000	12.8	50.8	0.4	-1.2	-20.0	-59.6	-13.0	-46.6	120/300 kHz
PK	H	299.500	18.3	53.9	0.4	-0.5	-20.0	-56.4	-13.0	-43.4	120/300 kHz
PK	V	337.500	24.6	46.6	0.4	-0.6	-20.0	-43.0	-13.0	-30.0	120/300 kHz
PK	V	375.000	8.9	48.1	0.4	-0.5	-20.0	-60.1	-13.0	-47.1	120/300 kHz
PK	H	412.500	17.6	52.3	0.5	0.6	-20.0	-54.5	-13.0	-41.5	120/300 kHz
PK	H	449.500	15.3	51.7	0.5	1.4	-20.0	-55.4	-13.0	-42.4	120/300 kHz
PK	V	487.110	5.0	45.0	0.5	1.4	-20.0	-59.2	-13.0	-46.2	120/300 kHz
PK	V	50.250	16.6	54.1	0.2	-6.6	-20.0	-64.2	-13.0	-51.2	120/300 kHz
PK	V	62.250	19.1	59.0	0.2	-2.9	-20.0	-63.1	-13.0	-50.1	120/300 kHz
PK	V	86.700	12.5	60.8	0.2	-0.3	-20.0	-68.8	-13.0	-55.8	120/300 kHz
PK	V	108.800	10.7	56.4	0.2	-2.0	-20.0	-67.9	-13.0	-54.9	120/300 kHz
PK	V	119.760	10.7	60.2	0.2	-0.6	-20.0	-70.3	-13.0	-57.3	120/300 kHz
PK	V	132.000	13.9	63.6	0.2	0.8	-20.0	-69.1	-13.0	-56.1	120/300 kHz
PK	V	146.200	12.7	61.3	0.3	1.6	-20.0	-67.3	-13.0	-54.3	120/300 kHz
PK	V	151.000	18.0	60.1	0.3	1.2	-20.0	-61.2	-13.0	-48.2	120/300 kHz
PK	V	233.250	19.1	54.9	0.3	0.4	-20.0	-55.8	-13.0	-42.8	120/300 kHz
PK	H	266.000	19.6	53.4	0.4	-0.6	-20.0	-54.8	-13.0	-41.8	120/300 kHz
PK	V	284.000	16.0	52.2	0.4	-0.4	-20.0	-56.9	-13.0	-43.9	120/300 kHz
PK	V	311.500	24.0	48.0	0.4	-1.1	-20.0	-45.5	-13.0	-32.5	120/300 kHz
PK	V	333.500	21.0	46.4	0.4	-0.8	-20.0	-46.7	-13.0	-33.7	120/300 kHz
PK	V	366.500	14.0	49.5	0.4	-1.4	-20.0	-57.3	-13.0	-44.3	120/300 kHz
PK	V	371.000	18.3	48.9	0.4	-0.9	-20.0	-52.0	-13.0	-39.0	120/300 kHz
PK	V	392.500	16.9	47.5	0.5	0.9	-20.0	-50.2	-13.0	-37.2	120/300 kHz
PK	H	421.500	25.1	52.4	0.5	0.4	-20.0	-47.4	-13.0	-34.4	120/300 kHz
PK	H	436.500	16.7	51.1	0.5	0.5	-20.0	-54.3	-13.0	-41.3	120/300 kHz
PK	H	457.800	11.3	51.1	0.5	1.6	-20.0	-58.7	-13.0	-45.7	120/300 kHz
PK	V	519.500	15.5	45.9	0.5	2.0	-20.0	-48.9	-13.0	-35.9	120/300 kHz
PK	H	753.500	14.6	44.7	0.7	1.5	-20.0	-49.2	-13.0	-36.2	120/300 kHz
PK	H	777.300	14.5	45.1	0.7	1.1	-20.0	-50.2	-13.0	-37.2	120/300 kHz
PK	H	793.000	12.3	44.5	0.7	1.8	-20.0	-51.1	-13.0	-38.1	120/300 kHz
PK	H	807.000	14.0	44.7	0.7	2.5	-20.0	-49.0	-13.0	-36.0	120/300 kHz

Setup Photos



30-1000 MHz Radiated Emissions

Setup Photos



30-1000 MHz Radiated Emissions