First InterComm™ System

VCA100

Installation Guide

** NOTE: if time permits this manual will be laid out in 8x10 format w/ spiral binder by the Media dept and made to look similar to other FISC manuals at the completion of stake holder review. Page breaks and column formatting will be different. Graphics will be cleaned up.

Intended audience is sub-contracted 2-way shops that have signed a NDA and have a SOW.

BAE SYSTEMS

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FC	# Federal Communications Commission (FCC)

Compliance - This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Further, proper installation does not guarantee that interference will not occur in a particular situation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and affected receiver.
- Connect equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an experienced radio/TV technician for help.

Radio Frequency Exposure Compliance – The First InterComm™ System generates and uses RF energy. Pursuant to FCC rules for the Maximum Permissible RF Exposure the antenna(s) specified in this manual MUST be installed so as to provide a separation distance of at least 18 inches (45 cm) from all persons. Additionally, the unit may not be used to transmit for more than 50% of the time (average duty cycle over a 30 minute period).

Users must not change the antenna types or their location at the risk of voiding the conditions of their FCC license and/or the conditions to which the product has been certified (consult your installer in these cases). Changes or modifications to the equipment may cause harmful interference unless the modifications are expressly approved in the installation manual. The authority to operate the equipment could be lost, if an unauthorized change or modification is made.

⚠️	# Electromagnetic Interference/Compatibility

Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility. It may be necessary to conduct compatibility testing to determine if any electronic equipment used in or around vehicles is sensitive to external RF energy or if any procedures need be applied to eliminate or mitigate the potential for interaction between the First InterComm™ System and other equipment or devices.

- *Facilities* – To avoid EMI or compatibility conflicts, turn off the First InterComm™ System near any facility where posted notices instruct you to do so; e.g., hospitals or health care facilities.
- *Vehicles* – To avoid possible interaction between First InterComm™ System and vehicle electronic control modules (e.g., ABS, engine, or transmission controls), the First InterComm™ System should be installed only by a professional installer.
- *Pacemakers* – Maintain a minimum separation of 12 inches between First InterComm™ System components (the VCA100 and associated antennas) and any pacemaker to avoid potential interference with pacemaker function.

WARNING	**General Precautions**

- **_DC Power_** – Ensure that power into the First InterComm™ System does not exceed 24VDC.

- **_Explosive Environments_** – Ensure the First InterComm™ System is turned off before entering a blasting area, or in areas posted "TURN OFF TWO-WAY RADIO". Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or death.

	First InterComm System Installation Checklist
☐	Plan First InterComm™ System (FICS) equipment locations on the vehicle, Section 3.
☐	Perform Vehicle Installation, Section 4.
☐	Perform DC Power Test, Section 5
☐	Fill out Table 7, "**Required User Information**". Provide copies to Customer, and BAE Systems, and retain file copy.
☐	Perform VCA100 Programming, Section 6.
☐	Perform Unit Test Plan, Section 7.
☐	Fill out "**Installation Sign Off Sheet**", Appendix E. Obtain required signatures and send to BAE Systems, retain file copy.

1.0 Introduction

The First InterComm™ System (FICS) allows first responders from different agencies at an emergency incident to readily communicate with one another, even though their radios operate on different frequencies; i.e., VHF, UHF or 800 MHz systems, both digital and analog. The FICS can accommodate any new communication technologies, including operating systems in the 700-MHz band.

Only one vehicle from each on-scene department is required to have an installed FICS unit to enable linking dissimilar radio networks. There is no requirement for special equipment, stand-alone towers, or other costly infrastructure.

An optional capability included with the FICS is Talk Group Software that allows the Incident Commander (IC), using a standard laptop computer with Wireless Fidelity (Wi-Fi) capability, to monitor system status and to control communications. FICS Talk Group Software significantly enhances the system, but is *not required* for voice interoperability; the latter is provided by the VCA100 and associated antennas alone.

The Department of Homeland Security (DHS) has designated the FICS as a Qualified Anti-Terrorism Technology under the SAFETY Act. The FICS Supports the National Incident Management System (NIMS), and is included in the Memorial Institute for the Prevention of Terrorism (MIPT) "Responders Knowledge Base" and the InterAgency Board's (IAB) "Standard Equipment List".

Finally, it is important to note that using the FICS does not require changes to Standard Operating Procedures (SOP). Rather, it provides day-to-day voice interoperability at an incident scene, and offers improved coordination of on-site first responder personnel.

This installation guide contains information for the proper installation of the FICS. We strongly recommended that the system be installed in accordance with this guide, understanding that concessions may be needed for specific vehicles. This guide assumes that the system installer is qualified, familiar with the intended vehicle, and possesses the proper tools.

2.0 First InterComm™ System Description

The FICS (Figure 1 below) consists of:

- VCA100 unit, matched to user's existing radio network frequencies
- Vehicle-mounted Wireless Fidelity (Wi-Fi) antenna
- Vehicle-mounted Land Mobile Radio (LMR) antenna, matched to user's existing radio network frequencies
- Remote On/Off switch
- FICS Talk Group Software (optional capability)

The system operates on 12VDC vehicle power through an independent cab-mounted switch. There are no speakers, microphones, or other vehicle tie-ins.

Eleven VCA100 models are available to cover the LMR bands (see Table 1 below). The LMR antenna must match the frequency band of the VCA100 model being installed. A standard, roof mounted 2.4 GHz 802.11 antenna is used for all VCA100 models.
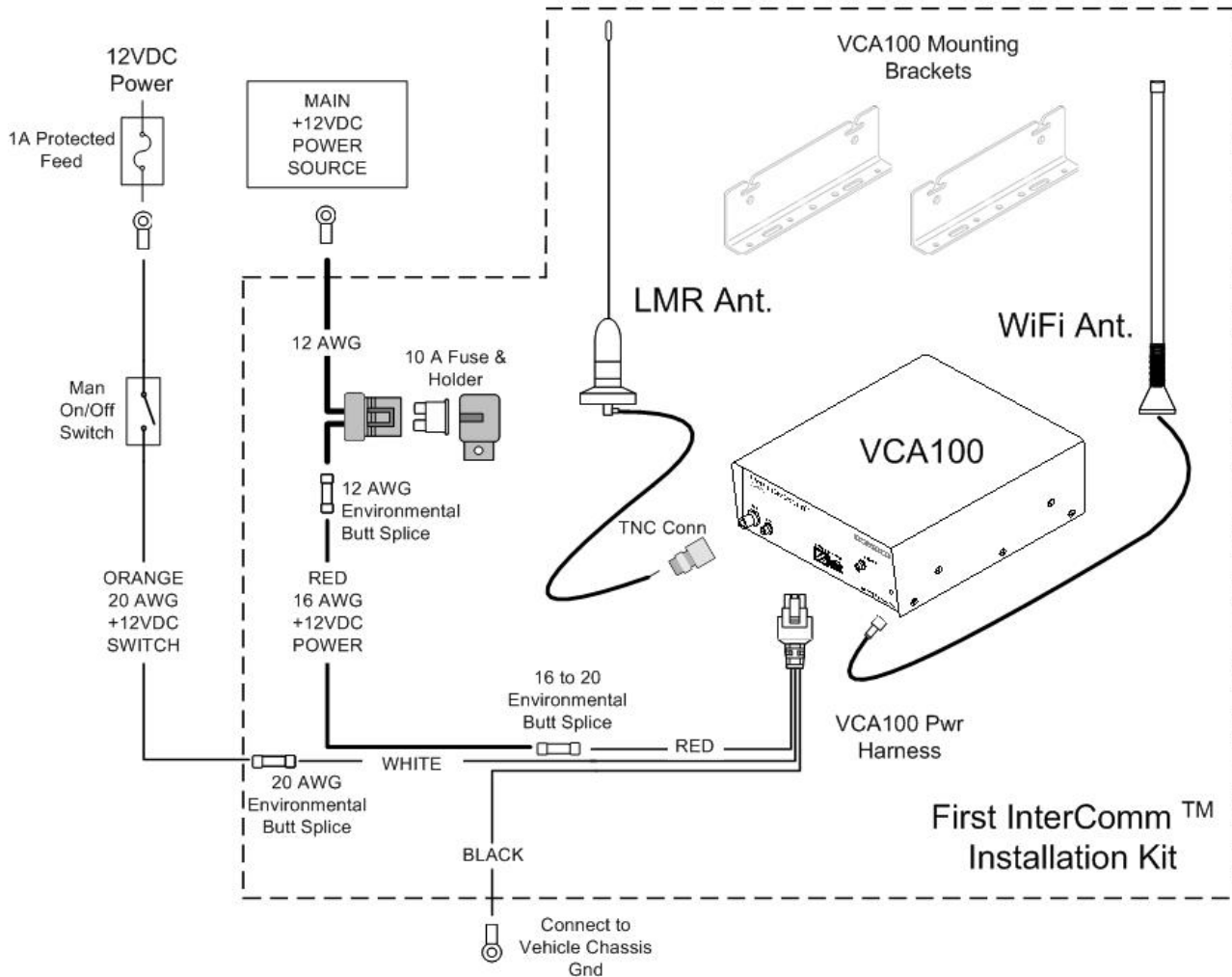
Figure 1. Typical VCA100 Vehicle Installation

Table 1. First InterComm™ System VCA100 Models

Model	Protocol	Encryption	LMR Band	Kenwood Radio Module	Frequency Range
VCA100-L1FCGX	FM	None	VHF Low Band	TK-190K	29.7 – 37 MHz
VCA100-L2FCGX	FM	None	VHF Low band	TK-190K2	35 – 50 MHz
VCA100-V1FCGX	FM	None	VHF High Band	TK-2180K	136 - 174 MHz
VCA100-V1PCGX	FM/P25	None	VHF High Band	TK-5210K	136 - 174 MHz
VCA100-V1PAGX	FM/P25	DES/AES	VHF High Band	TK-5210K	136 - 174 MHz
VCA100-V1PDGX	FM/P25	DES	VHF High Band	TK-5210K	136 - 174 MHz
VCA100-U1FCGX	FM	None	UHF	TK-3180K	450 - 520 MHz
VCA100-81FCGX	FM	None	800	TK-480SK	806 - 870 MHz
VCA100-81PCGX	FM/P25	None	800	TK-5400K	806 - 870 MHz
VCA100-81PDGX	FM/P25	DES	800	TK-5400K	806 - 870 MHz
VCA100-91FCGX	FM	None	900	TK-481SK	896 - 941 MHz

2.1   Vehicle Communications Assembly, Model VCA100

The VCA100 (Figure 2 below) is mounted in a vehicle and has no operator controls other than a remote power-on switch. Once initialized, VCA100 operations are transparent to the operator. Responders need only set their radio equipment to the pre-designated interoperability channel to monitor or speak to members of other radio networks at the site. The specific VCA100 model is selected based on the radio frequencies used by the participating department (see Appendix A).
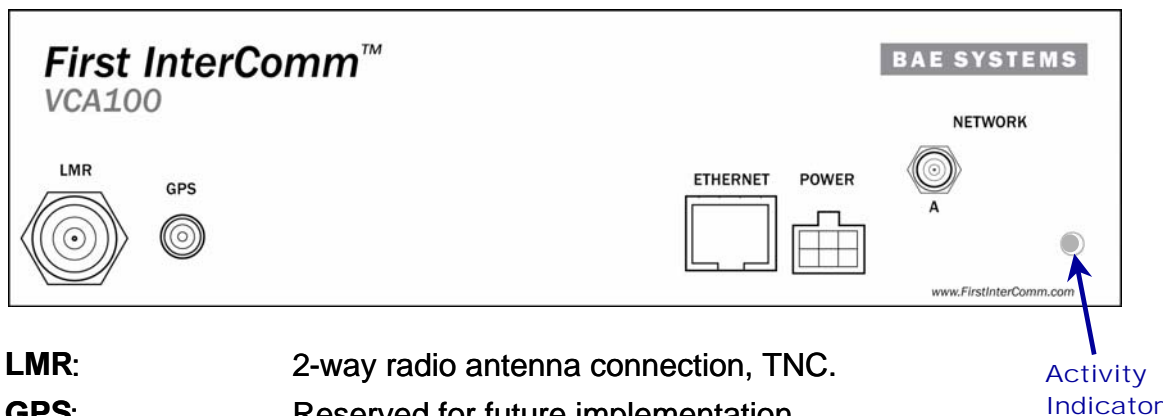
- **LMR**:   2-way radio antenna connection, TNC.
- **GPS**:   Reserved for future implementation.
- **Ethernet**   Factory use only.
- **Power**:   Nominal 13.6V DC and 1.75 A max
  On/Off control is via cab mounted switch toggle switch
- **Network**   Wireless antenna port A, reverse polarity SMA connector.

- **Activity Indicator:** Power On, Built in Test indicator light.

Figure 2. First InterComm™ System VCA100 Unit

2.2 VCA100 Power Connector

The VCA100 uses three (3) pins of a 6-pin Molex connector as shown in Figure 3.

4	5	6
Gnd	NC	NC
+12 VDC Pwr	+12 VDC Switch	NC
1	2	3

Front View of Molex Connector
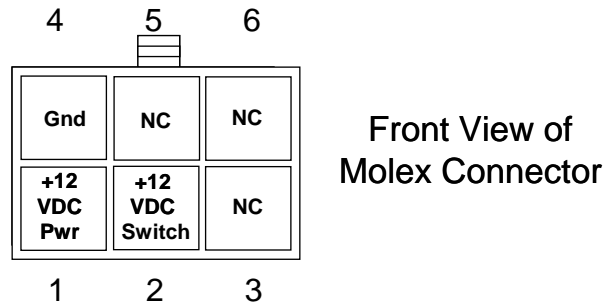
Figure 3. VCA100 Power Harness Connector – Front View

2.3 WiFi Antenna

The standard WiFi antenna for all VCA100 installations is the Comtelco Model A10245B (Figure 4), a 2.4 GHz 802.11 roof mounted antenna, with elevated feed to rise above cab obstructions and light bars. Gain is 3 dBi without ground plane, 5 dBi with ground plane. Through mount is the Comtelco Model MBZM-10R/PI with 14' micro-loss cable and factory terminated SMA connector.
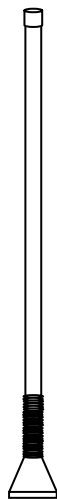
Height: 14 inches

Mount: Standard TAD/NMO

Gain: 5 dBi with ground plane

Mechanical: Built-in shock spring

Figure 4. Standard Comtelco WiFi Antenna

2.4 Land Mobile Radio Antenna

A LMR antenna must match the frequency of the specific VCA100 model being installed on the vehicle. Appendix A lists recommended LMR antennas that may be used with various VCA100 models.

3.0   Planning the Installation

3.1   Installation Kit Components

Table 2 lists the deliverable installation kit for the First InterComm™ System. Specific antennas will vary depending on the LMR frequency. The material listed is based on availability; equivalent products may be used.

Table 2. VCA 100 Vehicle Installation Kit

Description	Part Number	Vendor	Qty
Vehicle Communications Assembly Model 100 (VCA100) *includes screw, harness, and bracket below	Model number is frequency dependent	BAE Systems	1
VCA100 Mounting Bracket	BAE001131-01-LF	BAE Systems	2
VCA100 Power Harness	8422765-2	BAE Systems	1
Screws, center sunk head, #6-32 x .500 lg	na	na	4
12 VDC Power Cable, 16 AWG (red) for Specification SAEJ1128	WX16-2 (SXL 16 ga)	Waytek, Inc	20'
12 VDC Power Cable, 20 AWG (orange) for Specification SAEJ1128-GPT	WG20-3 (GPT 20 ga)	Waytek, Inc	15'
Butt Splice, 16 ga Environmentally Sealed	31980	Waytek, Inc	2
Butt Splice, Step Down, 16ga to 20 ga, environmentally sealed	38058	Waytek, Inc	1
Butt Splice, 20 ga Environmentally Sealed	30980	Waytek, Inc	2
ATO/ATC Fuse Holder with GXL wire	46047	Waytek, Inc	1
ATO/ATC Fuse, 10 A	46210	Waytek, Inc	1
LMR Antenna, through mount, with hardware	Various	Multiple	1
WiFi Antenna, elevated feed, 5dBi gain, 2.4GHz, through mount, 3/4-inch hole	A10245B	Comtelco	1
WiFi Through mount base and14' cable with reverse polarity (female) SMA connector	CEZM10-RP	Comtelco	1

Table 3 lists typical Installer-supplied parts that are vehicle specific and not supplied with the kit.

Table 3. Installer-Supplied Parts

Description	Part Number	Vendor	Quantity
SPST Switch, illuminating, 1 A (minimum)	44206 or similar	Waytek, Inc	1
Ground Wire, 18 AWG (black)	Varies	Varies	As Required
Ring Terminal, size as needed (Gnd)	Varies	Varies	2
Terminals, size as needed (switch)	Varies	Varies	3
Terminal, size as needed (main power cut in)	Varies	Varies	1
Grommet, rubber, various sizes	Varies	Varies	As Required
Cable Ties, Nylon	Varies	Varies	As Required
Cable Tie mount, 4-way	Varies	Varies	As Required
Screws, self tapping, #8-32, .500 lg	Varies	Varies	9
Washers, size and type as needed	Varies	Varies	As Required

3.2   Tools and Test Equipment

Table 4 lists details of the test equipment and software required to install the FICS VCA100. These comprise:

- A laptop computer equipped with WiFi capability, loaded with Windows® XP[1] Operating System, Service Pack 2, and BAE Systems supplied software (required to upload user-specific parameters into the VCA100). The laptop is also used to test the FICS VCA100 after installation.

- A watt meter to perform VSWR test.

- A volt/ohmmeter to perform voltage and resistance checks.

Table 4. Required Equipment and Software

Description	Part Number	Vendor	Quantity
Laptop PC with Windows XP, Service Pack 2	Varies	Varies	1
BAE Systems approved 2.4 GHz Wireless Network Card	List to be provided	List to be provided	1
BAE Systems First InterComm™ System Installers CD	TBD	BAE Systems	1
Voltage/Resistance Meter (DVM or VOM)	Varies	Varies	1
Watt Meter w/ cables, slugs, and adapters	Model 43 or equivalent	Bird or equivalent	1

Table 5 lists recommended tools for the First InterComm™ System installation. Equivalent substitutes may be used as necessary.

Table 5. Recommended Tools for First InterComm™ System Installation

Tool	Model/Specification
Screwdrivers, Phillips Head	#1 and #2 flathead
Non-insulated Crimp Tool	Thomas & Betts WT-111-M
Crimp Tool, Ratcheting Coaxial	Cambridge 24-9960P
Hole Saw, 3/4-inch with depth protection	Ripley HSK 19 or Antenex® HS34
Non-Metallic Fish Tape	Klein-Lite® 50156, 25 feet
Clutch-type Screw Gun	Makita® #6096DWE, #1 and #2 Phillips-Head bits
Pliers	Slip Jaw
Electric Drill	3/8-inch, with HSS bits
De-Burring Tool	
Socket Set	Quarter Inch
Wire Cutters	Flush-cut and large
RF Cable Termination Kit	For SMA and TNC connectors
Heat Gun	

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[1] Windows is a registered trademark of Microsoft Corporation

3.3   System Component Locations

> ### WARNING
>
> WHEN SELECTING LOCATIONS FOR FIRST INTERCOMM™ SYSTEM COMPONENTS, AVOID HIGH FREQUENCY (HF) NOISE PRODUCERS AND DO NOT RUN DC POWER FEEDS TO THE VCA100 PARALLEL TO IGNITION CIRCUITS, ELECTRONIC MODULES, OR SIMILAR ITEMS. AVOID RUNNING POWER LEADS IN PARALLEL WITH VEHICLE WIRING OVER LONG DISTANCES.

3.3.1   VCA100

The VCA100 has no operator interfaces other than an activity indicator. Also, the unit has no fan; it is convection cooled and does not require any special ventilation. However, it is not environmentally sealed and must be installed in a protected area where it will not be exposed to any fluids (THE ENGINE COMPARTMENT IS *NOT* ACCEPTABLE). The optimum location is one in which the VCA100 is out of the way, its face plate and cable connections protected as much as possible, and there are at least six inches of space around the VCA100 to allow air circulation. Additionally, attempt to provide line of sight to the activity indicator.

Plan for cable management and strain relief loops for the cables. Cable ties and mounts are needed to prevent cable movement and vibration.

3.3.2   WiFi Antenna

The WiFi antenna location has highest priority because the antenna's relatively short range has the greatest effect on system performance. Mount the antenna as high as possible on the cab roof, and as close as possible to the vehicle's centerline to provide 360-degree coverage. The antenna requires a metal ground plane to achieve its full 5dBi of gain.

We recommend keeping the antenna at least 12 inches away from any light bars or other antennas. The maximum designed distance from the VCA100 to the WiFi antenna is 14 feet, the standard cable length that comes with the antenna. Extensions are not recommended since they will significantly reduce the WiFi range. If an extension cannot be avoided substitute the antenna mount with a cable of sufficient length (no splices or adapters) and equivalent or better loss specifications at 2.4 GHz than what is supplied.

Certain vehicles do not allow locating the antenna in the center or center-rear of the roof. In this case, the next best antenna location is on the direct center of the trunk lid. Be aware, however, that this location will degrade the WiFi range. The mounting area under the antenna must be a flat, metallized ground plane.

3.3.3   Land Mobile Radio Antenna

The LMR antenna must match the frequency of the specific VCA100 model being installed on the vehicle. Many LMR antennas will require cutting to ensure proper VSWR match on the customer's frequency. Ensure that the new LMR antenna is not installed in close proximity to any existing LMR antennas.

We recommend keeping the antenna at least 12 inches away from any light bars, antennas, or other roof-mounted equipment.

3.3.4   Power and Fuse

The vehicle's main power source is connected to the VCA100 by the DC power cable (red) that passes through an inline fuse. Locate the fuse as close as possible to the power source and splice it in with weatherproof butt splices (*SUPPLIED*). Mount the fuse assembly (Figure 5) to facilitate maintenance. Splice the power line to the VCA100 power harness (*SUPPLIED*) using the step-down splice (*SUPPLIED*) to accommodate the dissimilar wire gauges.

Figure 5. In-Line Fuse

3.3.5   Manual Switch

A second, low current, power line (orange) <u>must</u> run through a cab-mounted manual toggle switch to the VCA100 power connector *SWITCH* input (pin 2). This switch is not supplied in the deliverable installation kit because User-specific vehicle installations vary; i.e., switch location is a function of User requirements and vehicle constraints. An illuminated manual switch, appropriately labeled, is recommended. Connect the switch to a 1-ampere fuse-protected vehicle power source.

4.0   Installation Procedures

4.1   VCA100 Unit

1. Record the VCA100 model number and serial number on the *INSTALLATION SIGN OFF SHEET* (see Appendix E). Tag is not viewable after mounting.

2. Carefully inspect the area selected for the VCA100 unit to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

3. Attach the two L-shaped mounting brackets (Figure 6) to the sides of the VCA100 using four #6-32 countersunk machine screws if holes are used, or thumbscrews if quick-release slots are used. Attach the wide edge of the bracket to the VCA100; attach the narrow edge to the vehicle.

4. Place the VCA100 in its final location and scribe three bracket holes into the vehicle on each side of the VCA100 for drilling. The VCA100 must be firmly mounted to the vehicle.

5. Pre-drill six holes into the vehicle to accommodate self-tapping screws. The size of the hardware used determines the size of the holes.

6. Mount the VCA100 to the vehicle with self-tapping screws.
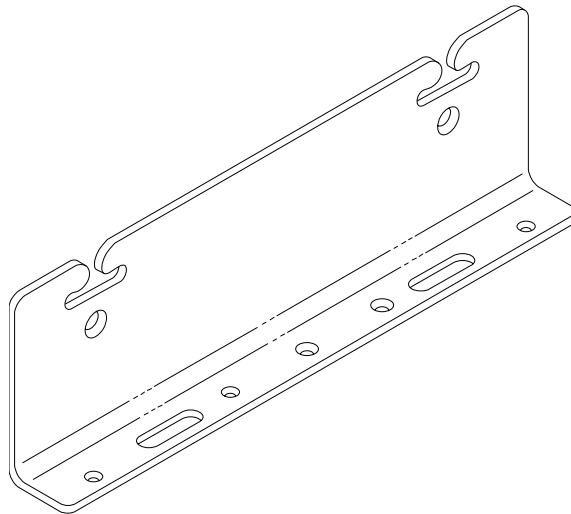
Figure 6. VCA100 Mounting Bracket

4.2   WiFi Antenna

1. Verify the center pin of the WiFi antenna cable connector is female (reverse polarity SMA). Carefully inspect the area selected for the WiFi antenna to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

2. Follow manufacturer's installation instructions for external mounting of the WiFi antenna.

3. Run the RF cable from the WiFi antenna to the VCA100. Use cable ties and mounts to protect the cable. Grommet all through holes to prevent cable chaffing.

4. Connect the WiFi RF cable in a straight path to the VCA100 *NETWORK A* SMA connector. Use cable ties and mounts to keep the cable from moving or placing stress on the SMA connector.

4.3   Land Mobile Radio Antenna

1. Carefully inspect the area selected for the LMR antenna to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

2. Follow the LMR manufacturer's installation instructions for mounting of the antenna and for trimming it to the user's frequency.

3. Run the RF cable from the LMR antenna to the VCA100. Use cable ties and mounts to protect the cable. Grommet all through holes to prevent cable chaffing.

4. At the VCA100, lay in a stress relief loop and cut the LMR RF cable to length. Terminate the cable with a TNC connector in accordance with manufacturer's instructions. Connect to the VCA100 *LMR* TNC connector.

4.4   DC Power

1. Carefully inspect the area selected for the DC power lines to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

2. Starting at the VCA100, locate a suitable chassis ground as close to the VCA100 as possible. If necessary, scrape and remove paint to reach bare metal. Drill chassis and use a self-tapping screw and star washer to create a chassis ground.

3. Locate the 20 AWG ground (black) wire of the VCA100 power harness (Pin 4). Cut and strip the outer cable jacket as required. Cut the end of the ground wire to length, terminating with a ring terminal, and secure the terminal to the chassis ground created in Step 2 (see Figure 3).

4. Lay in a stress relief loop and use cable ties and mounts to secure the power harness to the vehicle and prevent vibration or strain on the power connector.

5. Connect a suitable length of red 16 AWG wire to the VCA100 power harness main power (red) wire (Pin 1) (see Figure 3) using the 16 to 20 step-down environmental splice (*SUPPLIED*). Run the other end of the wire to the VCA100 in-line fuse. Use cable ties and mounts to protect the cable. Grommet all through holes to prevent cable chaffing.

6. Connect a suitable length of orange 20 AWG wire to the VCA100 power harness 12V Switch (white) wire (Pin 2) (see Figure 3) using the 20 AWG environmental splice (*SUPPLIED*). Run the other end of the wire to the planned location of the

VCA100 On/Off Switch. Use cable ties and mounts to protect the wire. Grommet all through holes to prevent cable chaffing.

4.5   VCA100 On/Off Switch

1. Carefully inspect the area selected for the VCA100 On/Off Switch to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

2. Drill or cut an area to hold the lighted toggle switch. Mount and label the switch.

3. If the switch is illuminated, locate a suitable chassis ground as close to the new power switch as possible. If necessary, scrape and remove paint to reach bare metal. Drill chassis and use self-tapping screw and star washer to create a chassis ground for the switch.

4. I f the switch is illuminated, connect a suitable length of black 20 AWG wire to the ground lug of the VCA100 On/Off switch using an appropriate terminal. Cut other end to length, terminate with a ring terminal, and secure the assembly to the chassis ground created in step 3 above.

5. Locate the end of the orange 20 AWG switch extension wire from the VCA100 power harness and cut it to length to mate with the VCA100 On/Off switch. Connect the wire to the _power out_ lug of the VCA100 On/Off switch using an appropriate terminal.

6. Use an appropriate terminal to connect a suitable length of orange 20 AWG wire to the _power in_ lug of the VCA100 On/Off switch. Connect the other end of the wire to a 1A fuse-protected vehicle power source with appropriate terminal. Use cable ties and mounts to protect the wire. Grommet through holes to prevent cable chaffing.

7. Reassemble any panels or consoles opened for installation of the switch.

4.6   Fuse Assembly

1. Carefully inspect the area selected for the fuse assembly to ensure that the area is free of physical or electrical obstacles that could interfere with proper installation, maintenance, or operation.

2. Drill into the vehicle at the proper location to receive the Fuse Assembly's cap and mounting tab. Remove fuse from holder and mount holder using a self-tapping screw.

3. Locate the end of the red 16 AWG extension wire from the VCA100 Power harness and cut it to length to mate with one end of the Fuse Assembly. Connect it to the Fuse Assembly using a 12AWG environmental splice (_SUPPLIED_).

4. If the Fuse Assembly lead is too short, use an environmental splice (_SUPPLIED_) connected to a suitable length of red 16AWG wire to extend the lead.

5. Connect the Fuse Assembly's other wire to the vehicle's load center or main +12VDC power source using the appropriate termination.

6. Use cable ties and mounts to protect the wire. Grommet all through holes to prevent cable chaffing. Install VCA100 Fuse.

5.0 Initial Power Test

1. Before connecting to the VCA100, use a voltmeter at the VCA100 power harness connector to check for a constant +12VDC, switched +12VDC, and ground (Figure 3 shows the VCA100 power connector).

2. Follow the steps as listed in Table 6. Correct any problems encountered before proceeding to the next step.
3. Place check mark in Verified box after successful completion of test step.

Table 6. Initial Power Tests

4 5 6 Gnd / NC / NC +12 VDC Pwr / +12 VDC Switch / NC Front View of Molex Connector 1 2 3	Required Equipment: Volt/Ohm Meter

Step	Procedure	Expected Result	Verified
1	Verify VCA100 power harness is disconnected from VCA100 and energized	VCA100 power harness disconnected and energized	
2	Probe the VCA100 power harness connector Pin 1 for a constant +12 VDC	Voltmeter reads vehicle power as approximately +12VDC	
3	Set the VCA100 power switch to ON	Power switch is ON	
4	Probe the VCA100 power harness connector pin 2 for switched +12 VDC	Voltmeter reads vehicle power as approximately +12VDC	
5	Set the VCA100 power switch to OFF	VCA100 is OFF	
6	Probe the VCA100 power harness connector pin 2 for switched +12 VDC	Voltmeter reads 0 VDC	
7	Probe VCA100 power harness connector pin 4 (ground) to chassis ground with ohmmeter	Good ground connection exists	
8	Connect VCA100 power harness to VCA100.	Items are connected.	
9	Turn on VCA100 unit and monitor Activity LED (see Figure 2) for Power On Built In Test (PBIT) Result. LED will illuminate for approx. 30 sec. during initialization, extinguishes for 10 sec., then illuminates and remains on if Power-on BIT is successful.	Power-on BIT is successful.	

6.0 Programming Procedure

The VCA100 is delivered with operating software but must be updated with user-specific parameters. Programming is done in two parts:

- BAE Systems' supplied *VCA MANAGER* Program and utilities is used to update the flash or to load new operating software.

- Installer supplied *Serial/IP COM Port Redirector* and Kenwood Radio programming software is used to update the radio module.

All programming is done wirelessly by loading the software on an Installer supplied maintenance laptop equipped with a BAE Systems approved wireless network card.

6.1 Preparation

1. Appendix B contains instructions for operating the *Serial IP* and the *VCA MANAGER* Programs. See Kenwood documentation for operation of that software.

2. Consult with the end user department and discuss incorporating the VCA100 into their standard operating procedures.

3. Collect and record the required VCA100 User information in Table 7.

4. Provide copies to Customer, BAE Systems, and retain copy for records.

Table 7. Required User Information

Item	Parameter	Format	User Data
1	Department Name	Up to 128 Characters.	
2	Vehicle ID	Up to 128 Characters.	
3	Vehicle Type	Icon on WiFi network, e.g., fire, police, ambulance.	
4	Nickname	Up to 16 Characters	
5	LMR Bandwidth	Wide (25 kHz) or Narrow (12.5 kHz)	
6	LMR Mode	Analog or Digital	
7	LMR Transmit Power	High or Low	
8	LMR Transmit Frequency	Numeric entry in MHz	
9	LMR Receive Frequency	Numeric entry in MHz	
10	LMR Transmit Private Line Code	Frequency or Alphanumeric ID [e.g. 94.8Hz (2A)]	
11	LMR Receive Private Line Code	Frequency or Alphanumeric ID [e.g. 94.8Hz (2A)]	
12	VCA100 ID	Serial number on unit	

6.2   VCA100 Update Procedure

1. Perform the update in two parts: *VCA MANAGER* program and Kenwood Radio software.

2. Follow the steps as listed in Table 8. Correct any problems encountered before proceeding to the next step.

3. Place check mark in Verified box after successful completion of test step.

Table 8. VCA100 Configuration Procedure

Required Items:
a. VCA100 Installed in vehicle
b. User Parameters (Table 7 of this document).
c. Installer's WiFi Laptop configured using BAE Systems' software CD
d. Serial IP and Kenwood Radio programming software installed on laptop

Step	Procedure	Expected Result	Verified
1	Turn on VCA100. Wait one minute for boot up to complete.	Booted	
2	Turn on the laptop and connect to First_InterComm_Network.	Connected	
3	Execute *VCA MANAGEMER* program (see Appendix B in this document) and input specific User Parameters. VCA100 will reboot after committing changes.	Updated and Rebooted	
4	Launch *Serial IP* program. (see Appendix B in this document)	Running	
5	Use *Serial IP* program to enable a virtual COM port between COM2 and the VCA100. (see Appendix B in this document)	Enabled	
6	Launch the appropriate Kenwood Radio programming software for the VCA100 and set COM port to COM2. (see Table 1, First InterComm™ System VCA100 Models)	Running, COM2	
7	Program VCA100 Radio module with specific User LMR frequencies and PL Codes.	Programmed	
8	Close Kenwood, *SERIAL IP* and *VCA MANAGER* program. Prepare to run System Functional Test of the Unit Test Plan to verify updates.	Closed	

7.0   Unit Test Plan

Follow the test procedures described in Paragraphs 7.1 and 7.2. Correct any problems found, retest, and record final results on the *INSTALLATION SIGN OFF SHEET* (Appendix E).

7.1   LMR Antenna VSWR Test

Perform an antenna VSWR test using an in-line wattmeter with appropriate frequency range and power levels, and low loss cable and connectors. The LMR output is expected to be in the range of 3 to 5 watts. Record results in Table 9.

Table 9. LMR Antenna VSWR Test Results

Required Material:			
a. VCA100 installed in vehicle with LMR Antenna and cable under test			
b. Antenna OEM's VSWR procedure (or standard industry accepted VSWR procedure)			
c. Watt meter			
Step	**Procedure**	**Requirement**	**Result**
1	Perform LMR VSWR procedure. Record result.	**<** 2:1 VSWR (10%)	

7.2   System Functional Test

1. Follow the test steps in Table 10 to verify the VCA100's key functions and its ability to operate in a network.

2. Correct any problems found, retest, and record final results on the *INSTALLATION SIGN OFF SHEET* (Appendix E).

3. Obtain required signatures and send to BAE Systems, retain file copy.

Table 10. System Functional Test Results

Required Material:			
a. VCA100 under test installed in vehicle and configured with user parameters.			
b. Known good user mobile or portable radio with the same Frequency and PL Code as the VCA100 under test.			
c. Known good second VCA100 and mobile or portable radio set to a different frequency than the VCA100 under test with a line-of-sight path more than 100 feet but less than 300 feet separation between the VCAs.			
Step	**Procedure**	**Expected Result**	**Verified**
1	Turn on VCA100 under test. Wait one minute for boot up to complete.	Boot up complete	
2	Turn on mobile or portable radio associated with the VCA100 under test. Verify the proper channel is selected.	Proper channel selected	
3	Turn on known good second VCA100. Wait one minute for boot up to complete.	Boot up complete	
4	Turn on mobile or portable radio associated with known good VCA100. Verify proper channel is selected.	Proper channel selected	

5	Verify 2-way communication through both units occurs without distortion, breakup, or dropouts. Record final result on *Installation Sign Off Sheet.*	Communication is good	

8.0 Troubleshooting

Appendix D contains detailed troubleshooting procedures for the FICS.

IMPORTANT

- If the FICS appears to interfere with incident site operations, immediately turn off every VCA unit (and FICS Talk Group Software if in use), and return to normal SOP.

- If Talk Group Software or Incident Commander Workstation (laptop) computer problems occur, the VCA100 units will remain in their last assigned Talk Groups. If the laptop or software is not functional, and communication is needed between all responders, power-cycle all VCA100s.

9.0 BAE Support Information

- Telephone Support: (603) 759-1027

- E-Mail: firstintercomm.eis@baesystems.com

- Web: http://www.firstintercomm.com

10.0 Companion Documentation

- *First InterComm™ System User Guide*, Document No. A29798.

- *First InterComm™ System Talk Group Software*, Document No. A29800.

Appendix A
Recommended LMR Antennas

Table A-1. Recommended LMR Antennas

Model	Suggested Antennas	LMR Band	Frequency Range	Protocol	Encryption
VCA100-L1FCGX	C27, C30, C34	VHF Low Band	29.7 – 37 MHz	FM	None
VCA100-L2FCGX	C34, C37, C40, C47	VHF Low band	35 – 50 MHz	FM	None
VCA100-V1FCGX	B1323	VHF High Band	136 - 174 MHz	FM	None
VCA100-V1PCGX	B1323	VHF High Band	136 - 174 MHz	FM/P25	None
VCA100-V1PAGX	B1323	VHF High Band	136 - 174 MHz	FM/P25	DES/AES
VCA100-V1PDGX	B1323	VHF High Band	136 - 174 MHz	FM/P25	DES
VCA100-U1FCGX	B4503, B4703, B4903	UHF	450 - 520 MHz	FM	None
VCA100-81FCGX	B8063	800	806 - 870 MHz	FM	None
VCA100-81PCGX	B8063	800	806 - 870 MHz	FM/P25	None
VCA100-81PDGX	B8063	800	806 - 870 MHz	FM/P25	DES
VCA100-91FCGX	B8963	900	896 - 941 MHz	FM	None

Table A-2. LMR Antenna Specifications

| Manufacturer	Part Number	Frequency (MHz)	Gain (dBi)	Wave Length	Load	Tunable	Height (inches)
Laird	C27	26.75-31	Unity	1/4	Coil Style	Yes	52.5
Laird	C30	30-35	Unity	1/4	Coil Style	Yes	52.5
Laird	C34	34-37	Unity	1/4	Coil Style	Yes	52.5
Laird	C37	37-40	Unity	1/4	Coil Style	Yes	52.5
Laird	C40	40-47	Unity	1/4	Coil Style	Yes	52.5
Laird	C47	47-50	Unity	1/4	Coil Style	Yes	52.5
Laird	B1323	132-174	3	5/8	Coil Style	Yes	57
Laird	B4503	450-470	3	5/8	Coil Style	Yes	13
Laird	B4703	470-490	3	5/8	Coil Style	Yes	12.5
Laird	B4903	490-512	3	5/8	Coil Style	Yes	12.5
Laird	B8063	806-866	3	5/8	Base	Yes	4 7/8
Laird	B8963	896-970	3	5/8	Base	-	4 7/8

Appendix B
VCA100 Software Programs and Utilities

B.1 BAE Systems VCA Manager Program

The *VCA Manager* is used to connect wirelessly to the VCA100 in order to change User parameters and upgrade software on the VCA100. The procedure is to:

1. Power up the VCA100(s) that will be updated and then power up the laptop so that a First InterComm Network is established.

2. Launch the *First InterComm VCA Manager* software using the Windows start button to navigate to **F**irst InterComm and click on the VCA Manager menu item.
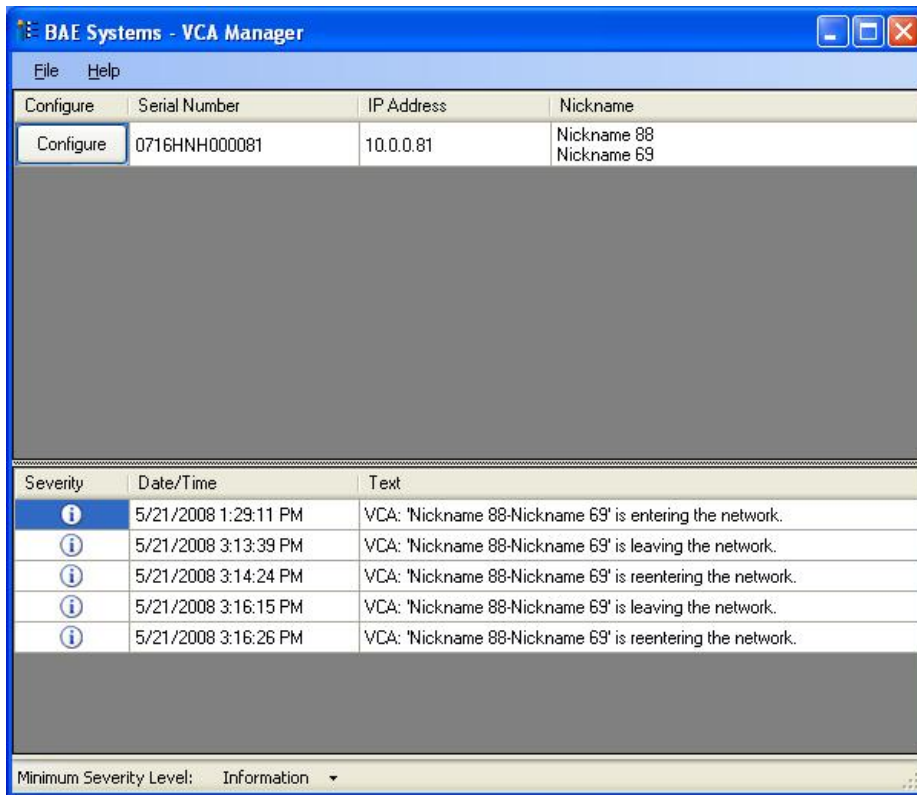
Figure B-1.1 First InterComm™ VCA Manager Window

3. VCAs in the network will will be listed in the top field of the window. Click on *Configure* next to the serial number of the VCA to be updated.

4. An Internet Explore window will open for that VCA. Click on *Configure* VCA100.
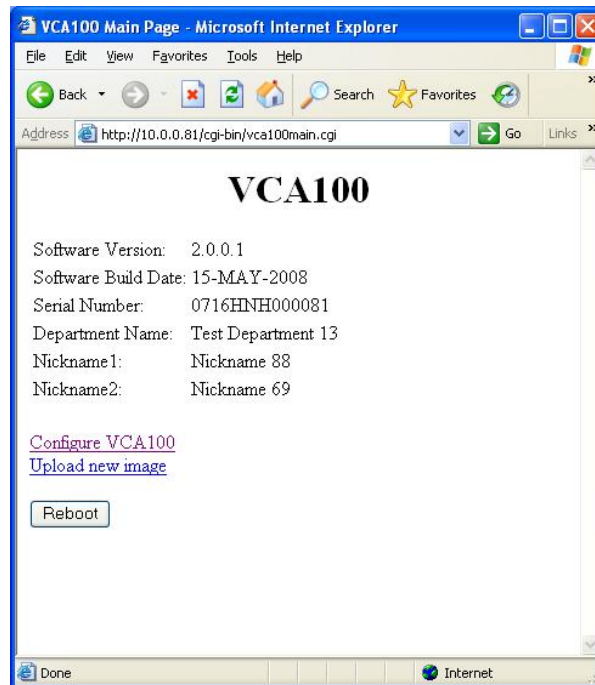
Figure B-1.2 VCA Manager Configuration Tool

5. Enter user name and password in the pop up window and click *Validate.* (See your BAE Systems representative for your user name and password.)
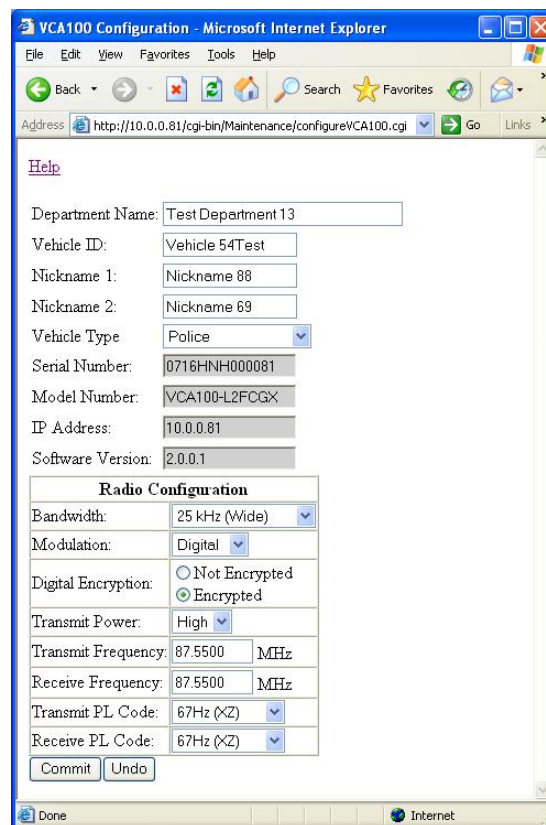

Figure B-1.3 VCA Manager Configuration Window

6. Fill in the fields with new parameter information. Click on *Commit* to update.
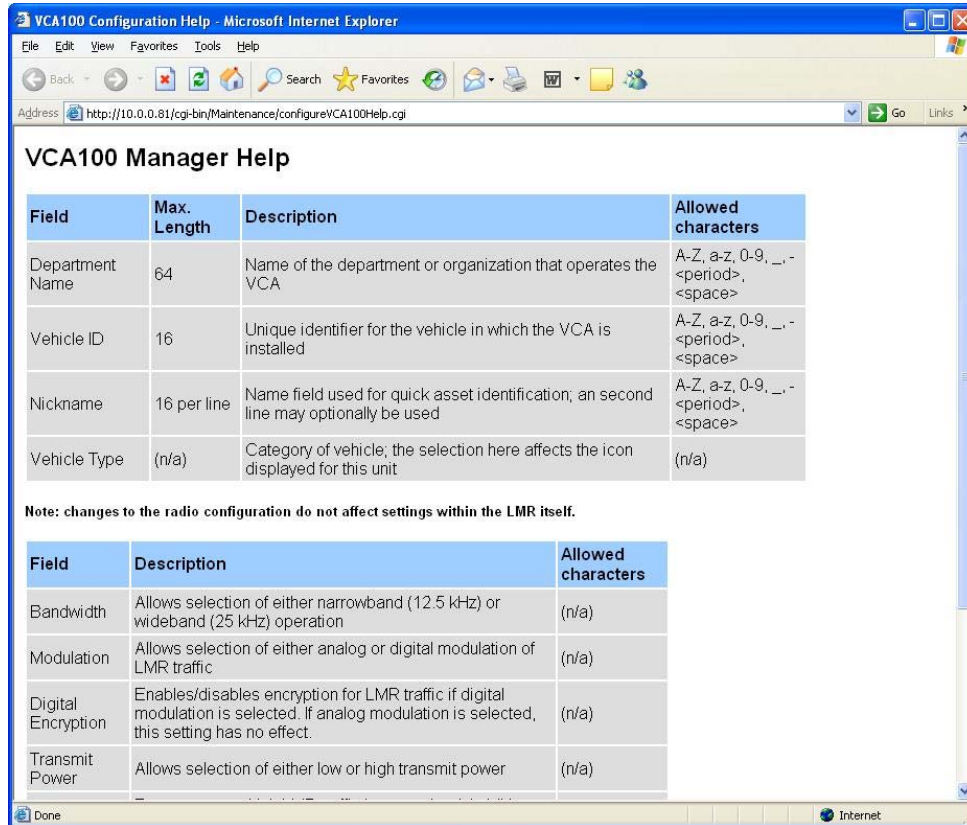

Figure B-1.4 First InterComm™ VCA Manager Help Window

7. Clicking on *Help* will open the VCA00 manger Help page, which provide detailed information about each of the data fields.

8. If the VCA100 software requires upgrading, click on *Upload* new software image at the main VCA100 Internet Explorer window (Figure B-1.2). Log in with name and password then click on *Browse* and navigate to the location of the new software file.

9. Click on the filename to enable the *Update* button. The field next to the button will display the filename.

10. Click on *Update* and monitor progress.

11. Perform the SYSTEM FUNCTIONAL TEST described in Paragraph 7.2 to verify that the newly programmed VCA100 communicates with other VCA100 units.

B.2 Serial IP Program

Serial/IP Redirector software, a utility program, creates a virtual COM port that associates an IP address with a hardware COM port. This allows RS-232 programming with Kenwood software over a wireless link to the VCA100 Radio Module. The procedure is to:

1. Start the *VCA MANAGER PROGRAM* (Paragraph B.1) to enable access to the First InterComm™ network and the VCA100 being programmed.

2. Start the Serial IP Panel (Figure B-2) using the Windows start button; i.e.,
   START → ALL PROGRAMS → SERIAL IP → CONTROL PANEL

3. Enter the target VCA100's IP address into the *IP ADDRESS BOX (10.0.0.X)*, where X is the last digits of the unit's serial number. Enter 7000 into the *Port Number* box.

4. Set the COM port to COM2 in the Serial IP Control Panel;
   SELECT PORTS... → COM2→ OK

5. Click on the *Configuration Wizard* (Figure B-3) in the *SERIAL IP CONTROL PANEL*.

6. Click *Start* in the wizard.

7. Watch the STATUS window in the *Configuration Wizard* to verify that the TELENET session progresses successfully and that all check marks are green.

8. Click on *Use Settings* in the *CONFIGURATION WIZARD* to complete the Serial IP setup and enable the virtual Com Port. (*NOTE: It is very easy to forget this step)
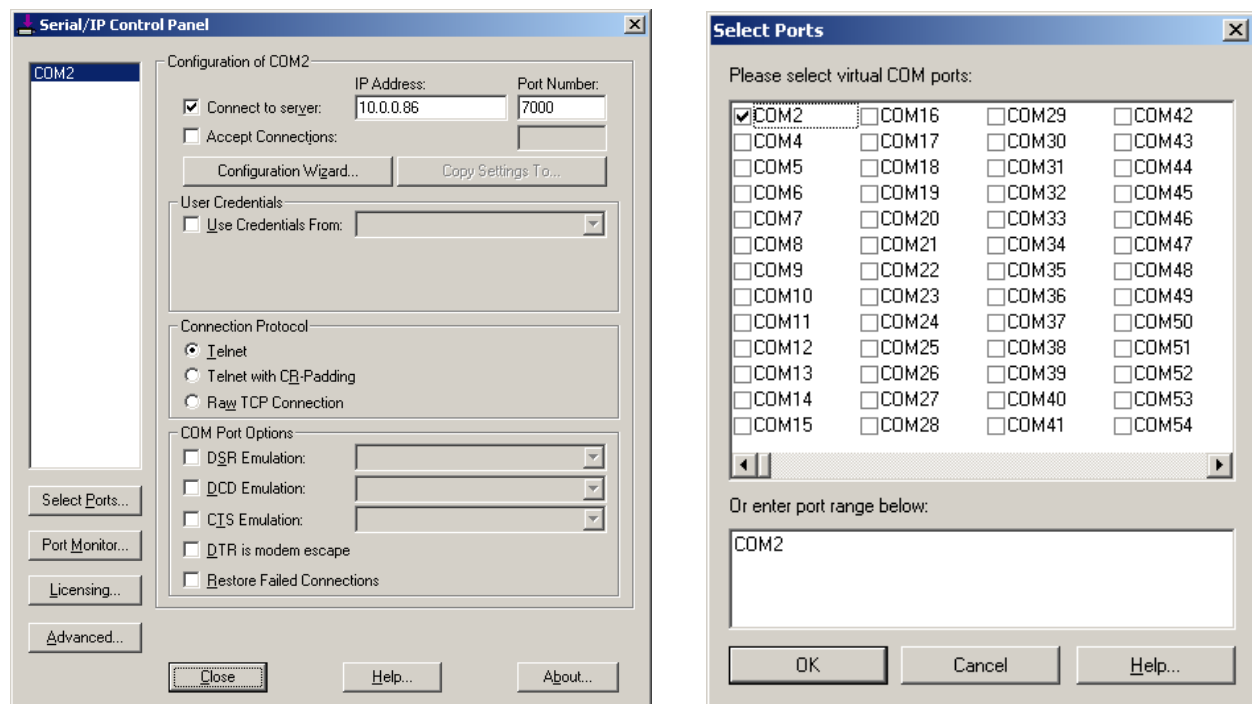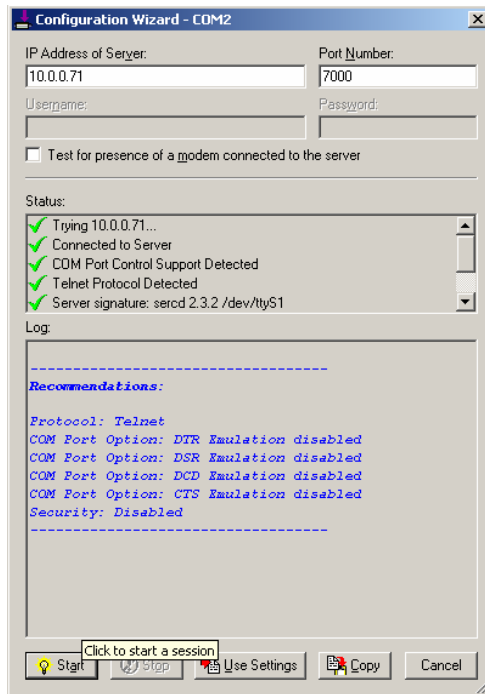
Figure B-2.1 Serial IP Control Panel and Select Port Windows

Figure B-2.2 Serial IP Program Configuration Wizard

B.3 Kenwood Radio Programming Software

Kenwood Radio Programming software is used as a utility program to configure the VCA100 Radio Module.

NOTE
IT IS REQUIRED TO PROGRAM ALL RADIOS PER THE PARAMETERS IN TABLE B-2 BELOW.

The procedure is to:

1. Start the VCA Manager Program and Serial IP program (Paragraph B.1 & B.2 above) to link the COM2 port to the VCA100 being programmed.

2. Consult Table B-1 below to find the First InterComm™ System VCA100 Model and then launch the corresponding Kenwood Radio programming software for the VCA100 being programmed.

3. Set COM port used in the Kenwood software to COM2.

4. Consult Table B-2 below, Required Kenwood Radio Parameters To Be Programmed, and program the values appropriate to the model being updated.

5. Consult Table 7, Required User Information, and program the appropriate values into the VCA100 radio module.

Model	Protocol	Encryption	Frequency Range	Kenwood Radio Module	Kenwood Radio Prgm S/W
VCA100-L1FCGX	FM	None	29.7 – 37 MHz	TK-190K	KPG-59D
VCA100-L2FCGX	FM	None	35 – 50 MHz	TK-190K2	KPG-59D
VCA100-V1FCGX	FM	None	136 - 174 MHz	TK-2180K	KPG-89D
VCA100-V1PCGX	FM/P25	None	136 - 174 MHz	TK-5210K	KPG-95D
VCA100-V1PAGX	FM/P25	DES/AES	136 - 174 MHz	TK-5210K	KPG-95D
VCA100-V1PDGX	FM/P25	DES	136 - 174 MHz	TK-5210K	KPG-95D
VCA100-U1FCGX	FM	None	450 - 520 MHz	TK-3180K	KPG-89D
VCA100-81FCGX	FM	None	806 - 870 MHz	TK-480SK	KPG-49D
VCA100-81PCGX	FM/P25	None	806 - 870 MHz	TK-5400K	KPG-78D
VCA100-81PDGX	FM/P25	DES	806 - 870 MHz	TK-5400K	KPG-78D
VCA100-91FCGX	FM	None	896 - 941 MHz	TK-481SK	KPG-49D

Table B-1 VCA100Model Characteristics

Kenwood Radio Module	Squelch Level	Timeout	Warning Tone	Minimum Volume Setting	Maximum Volume Setting
TK-190K	8	120 sec	Disable	4	n/a
TK-190K2	8	120 sec	Disable	4	n/a
TK-2180		120 sec	Disable	9	9
TK-3180		120 sec	Disable	9	9
TK-5210		120 sec	Disable	11	11
TK-5400		120 sec	Disable	13	n/a
TK-480		120 sec	Disable	3	n/a

Table B-2 Required Kenwood Radio Parameters To Be Programmed

Appendix C
Acronyms and Abbreviations

ABS	Antilock Brake System
AES	Advanced Encryption Standard
ATC	Automotive Blade-Type Fuse
ATO	Automotive Blade-Type Fuse
AWG	American Wire Gauge
COM	Communication (port)
DC	Direct current
DES	Data Encryption Standard
DHS	Department of Homeland Security
EMI	Electromagnetic Interference
EMS	Emergency Medical Service
FCC	Federal Communications Commission
FICS	First InterComm™ System
FM	Frequency Modulation
GPS	Global Positioning System
GXL	Brand name for a cross-linked polyethylene jacketed wire
HF	High Frequency
HSS	High Speed Steel
IAB	InterAgency Board
IAN	Incident Area Network
IC	Incident Commander
ID	Identification
IP	Internet Protocol
LED	Light Emitting Diode
LMR	Land Mobile Radio
MIPT	Memorial Institute for the Prevention of Terrorism
NIMS	National Incident Management System
NMO	New Motorola
OEM	Original Equipment Manufacturer
P25	Project 25 (digital encryption protocol)
RF	Radio Frequency
SAE	Society of Automotive Engineers
SMA	Subminiature A-type (connector)
SOP	Standard Operating Procedures
SPST	Single Pole, Single Throw
TBD	To Be Determined
TNC	Threaded Neill-Concelman (connector)
UHF	Ultra High Frequency
VCA	Vehicle Communications Assembly
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
WiFi	Wireless Fidelity

Appendix D
Troubleshooting Procedures

To Be Supplied

Appendix E
Installation Sign Off Sheet

I CERTIFY THAT THE FIRST INTERCOMM™ SYSTEM SUPPLIES AND INSTALLATION SERVICES HAVE BEEN FURNISHED IN ACCORDANCE WITH APPLICABLE CONTRACT REQUIREMENTS.

Site Name: _____

Site Location: _____

Vehicle VIN: _____

Vehicle Type / Model: _____

VCA100 S/N: _____

The undersigned agree that the Unit Test Plan has been satisfactorily completed, with the exception of the outstanding items identified below, which must be resolved per the list below in order for Customer to be fully satisfied.

_____

Name, Title (BAE Systems Representative) Date_____

_____

Name, Title (Customer)   **Date** _____

OUTSTANDING ISSUES

Test Para.	Issue	Resolution Plan	Resolution

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