

PRELIMINARY

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First InterComm™ System User Guide



BAE SYSTEMS

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Warnings and Precautions



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 Notice – The First InterComm™ System generates and uses RF energy. Changes or modifications to the equipment may cause harmful interference unless the modifications are expressly approved in the installation or maintenance manuals. 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 designed, shielded, 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 the 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.



RF Exposure Compliance

Pursuant to FCC rules for the Maximum Permissible Exposure (RF) 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.

In addition, the unit may not be used to transmit for more than 50% of the time (average duty cycle over a 30 minute period).

WARNING

General Precautions

- **Professional Installation** – The VCA100 unit and its antennas must be installed by a qualified professional installer.
 - Users must not change the antenna types or their location as you risk voiding the conditions of your FCC license and/or the conditions to which the product has been certified (consult your installer in these cases).
- **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.

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Welcome to First InterComm™ Networking

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 the 700-MHz bandwidth.

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 of the FICS is the Incident Commander Talkgroup Control™ Software (ICTCS) 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. The ICTCS 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 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) “Responder Knowledge Base” and the InterAgency Board's (IAB) “Standardized Equipment List” (SEL).

Finally, it is important to note that using the FICS does not require changes to your 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 User Guide contains a description of the FICS, and information on how to activate the system and maximize its effectiveness.

First InterComm™ System Overview

The FICS consists of a Vehicle Communications Assembly (VCA100), a Land Mobile Radio (LMR) antenna, and a Wi-Fi antenna. The system uses standard 12 VDC vehicle power and has these features:

- No setup time required; voice interoperability is automatically available within one minute of arriving on scene;
- Responders use their existing familiar radios. Multiple radios are not required;
- Responders require no special training;
- System span is scalable from routine to large incidents with no change in SOP;
- Compliance with commercial standards for radio communications and mesh networks;

- Connectivity with civil and military communications Systems; and
- Digital technology which supports radio upgrades.

The optional Incident Commander Talkgroup Control Software (ICTCS gives the Incident Commander the option to monitor VCA100 status and control communications using a standard laptop computer with Wi-Fi capability.

NOTE

THE ICTCS ADDS SIGNIFICANT CAPABILITY TO THE SYSTEM, BUT IS NOT REQUIRED FOR VOICE INTEROPERABILITY WHICH IS PROVIDED BY THE VCA100S AND ASSOCIATED ANTENNAS.

The First InterComm™ System in Action

Turning on two or more VCA100 units establishes an *ad hoc* wireless mesh Incident Area Network (IAN). In Figure 1, the Group A first responder, whose radio operates at 453.95 MHz, is talking to a Group B first responder whose radio operates at 154.57 MHz. The process that makes this happen is as follows: When a Group A portable or mobile radio is keyed up, its voice transmission is translated into digital Voice-over-Internet Protocol (VoIP) packets that are placed onto the IAN. Every VCA100 unit registered in the network (in Figure 1, Group B) receives these digital packets, which are then translated back into voice transmissions compatible with each frequency associated with the receiving VCA100.

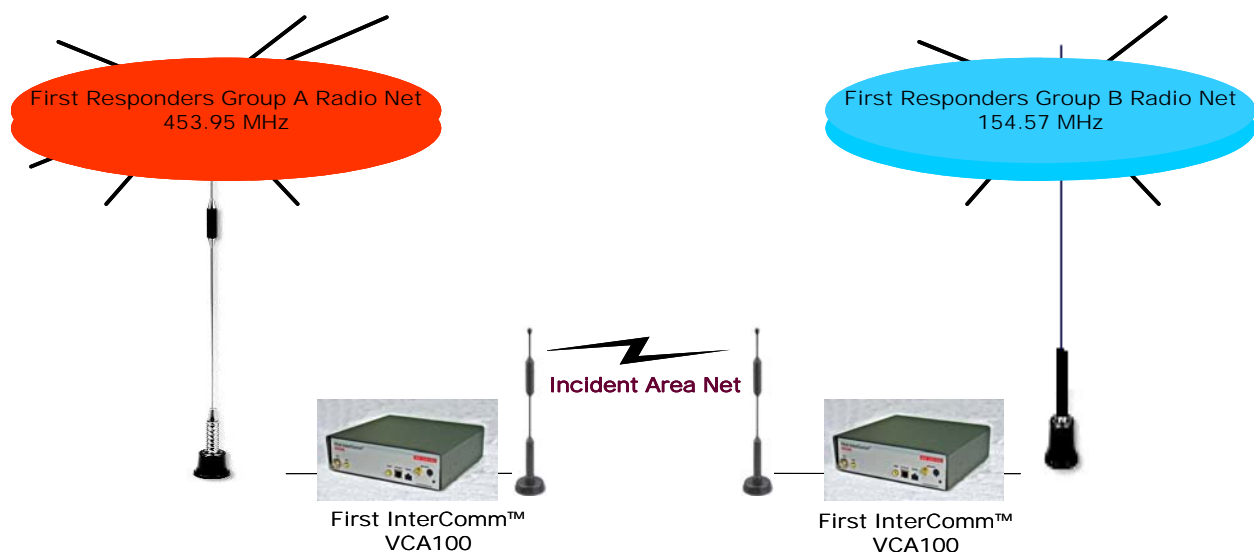


Figure 1. The FICS in Action

As other first responder departments arrive on scene and turn on their VCA100s, the units *automatically* connect to one another. When local first responders are joined by other agencies (e.g., Public Health, Disaster Recovery, Federal Agencies, and National Guard), their VCA100 units also connect to the IAN, thus establishing cross-

jurisdictional communications. This temporary IAN (Figure 2) exists as long as VCA100-equipped vehicles are present, and can expand or contract as first responders enter or leave the area.

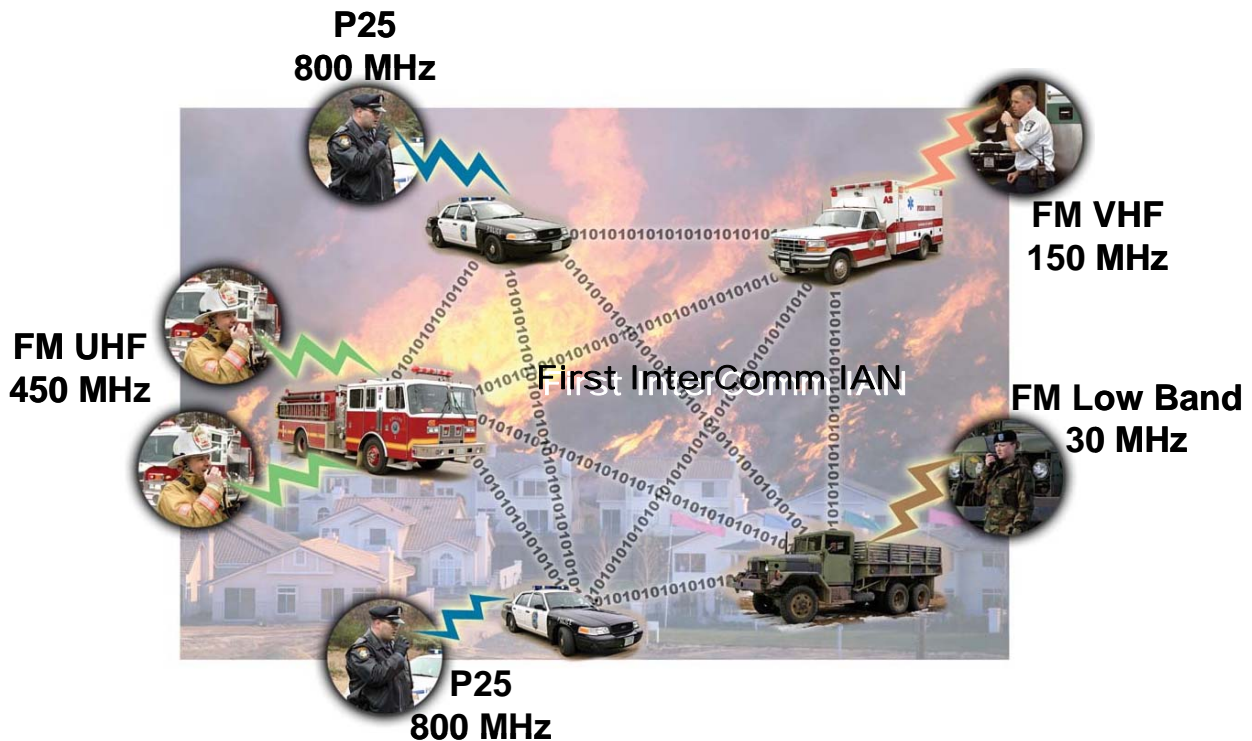


Figure 2. The Incident Area Network (IAN) Expands or Contracts as Needed

At some point, when numerous first responders are on-line, overall coordination can be beneficial. The IC has the *OPTION* to assume control of the IAN using any laptop computer operating with Windows XP and equipped with Wi-Fi and ICTCS (Figure 3). The ICTCS allows the IC to:

- Establish sectors by frequency in accordance with the DHS National Incident Management System (NIMS);
- Isolate any agency equipped with FICS units (e.g., Fire, EMS, Emergency Management, Public Works, law enforcement) as required into the appropriate Talkgroup, thereby
 - » Ensuring a single chain of command;
 - » Improving communications efficiency; and
 - » Increasing emergency responder safety.

Refer to *First InterComm™ System Incident Commander Talkgroup Control Software* (BAE Systems Document No. A29800) for details on the ICTCS.

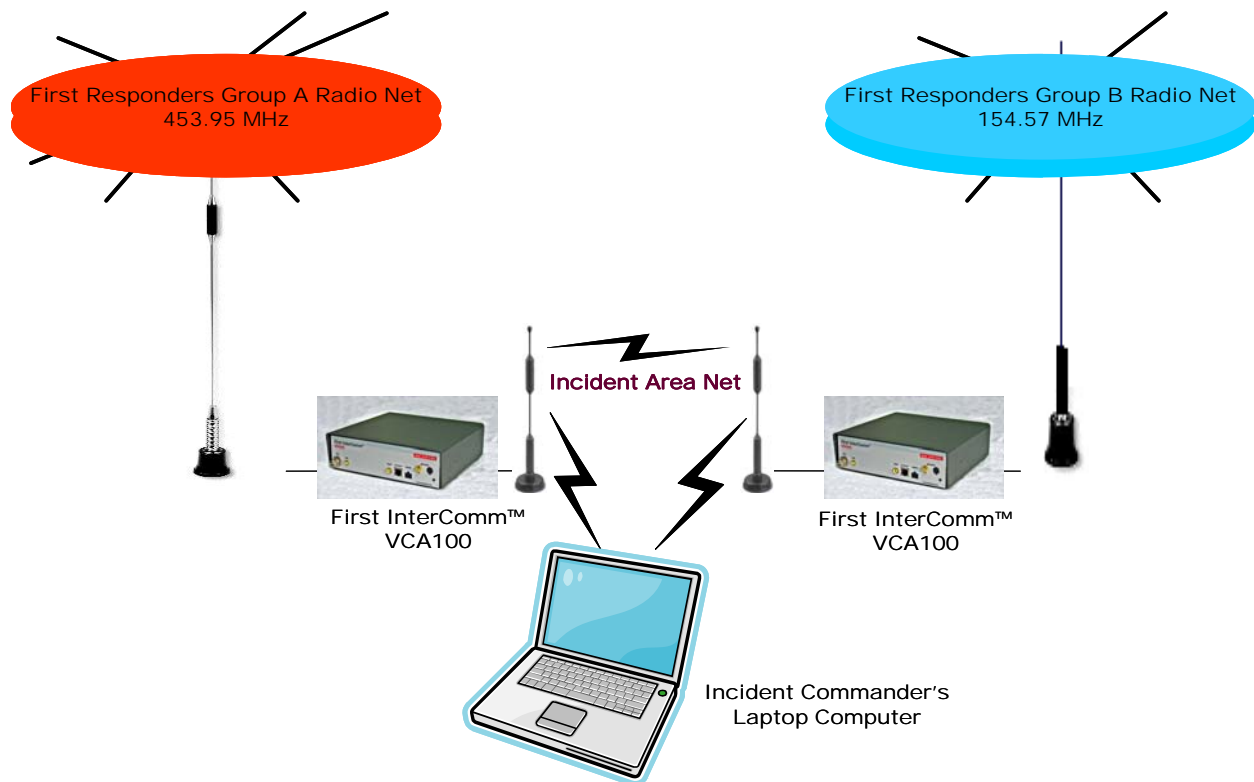


Figure 3. The FICS Enhanced by the Optional ICTCS

Operating the First InterComm™ System

Start-Up

1. Apply power to the VCA100 with the cab-mounted switch.
2. Allow approximately one minute for the unit to initialize and connect to any other VCA100s in the area.
3. Switch radio equipment to the tactical channel selected for use with the VCA100.
4. Communicate using the applicable SOP.

RECOMMENDATION

TURN ON THE VCA100 UNIT ON THE WAY TO THE SCENE

Vehicle Location

Wireless signals grow weaker as they propagate (travel away) from the transmitter. The FICS is designed to operate up to approximately one-quarter mile between VCA100s, assuming a clear, unobstructed Line of Sight (LOS). Buildings, hills, vegetation, and other obstructions will reduce range as shown in Figure 4. In addition, metallic objects such as dumpsters, vehicles, etc. may cause interference that degrades performance. If possible, position VCA100-equipped vehicles to minimize such factors.

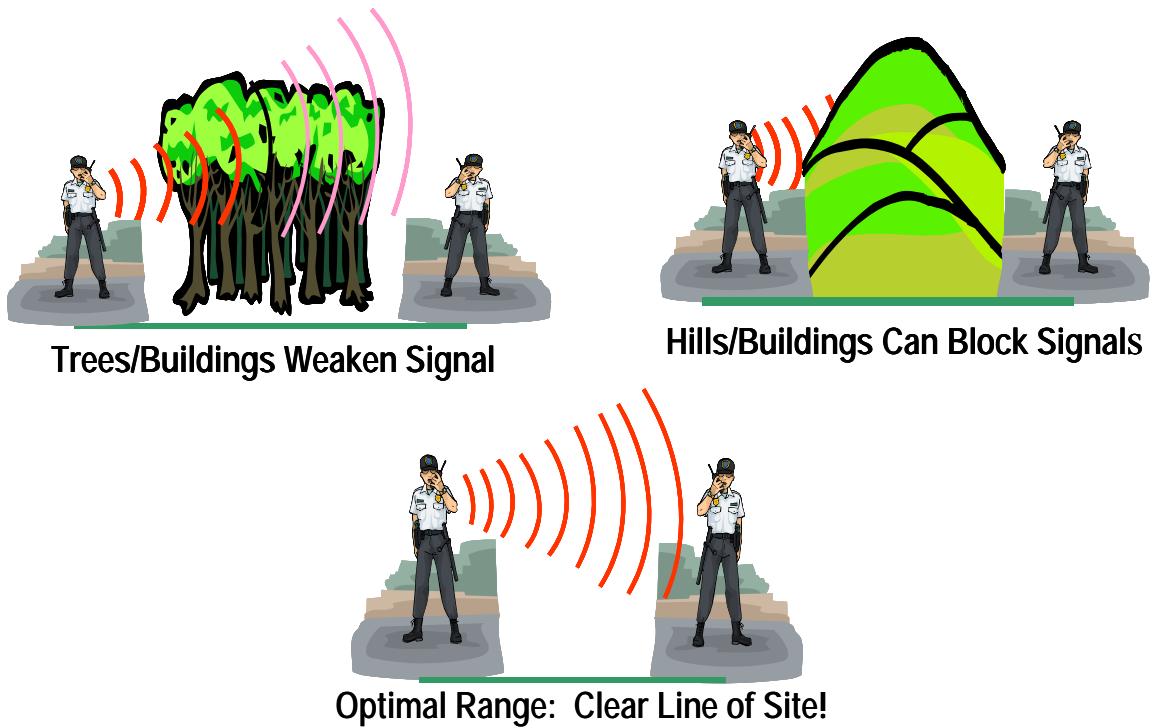


Figure 4. Area Geometry or Physical Features Can Affect Talk Range

Signal Relay (Hopping)

Figure 5 shows a generalized urban incident site where there is no LOS between vehicles A and D or vehicles B and C. Figure 6 shows a generalized ex-urban incident site where vehicles A and E have no LOS and are considerably farther apart than one-quarter mile. In both scenarios, the FICS overcomes these limitations by “hopping” voice communications; i.e., passing communications through the units that do have LOS. Thus, all units can communicate even though not all have direct LOS.

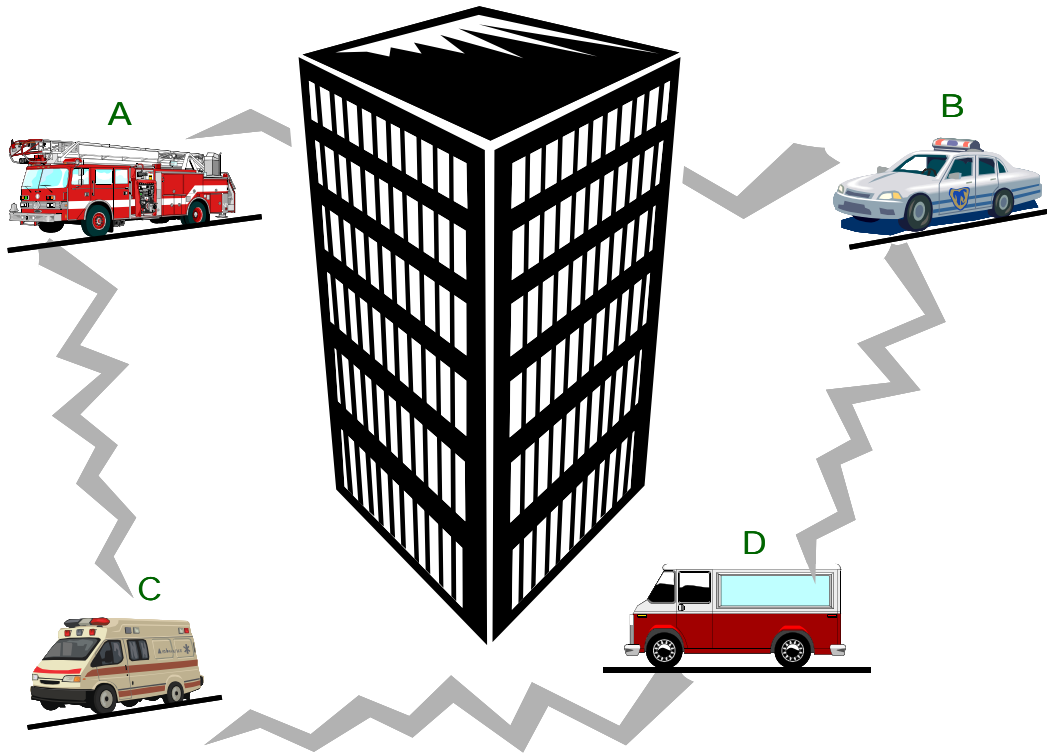


Figure 5. First InterComm Allows Communication between Vehicles without LOS

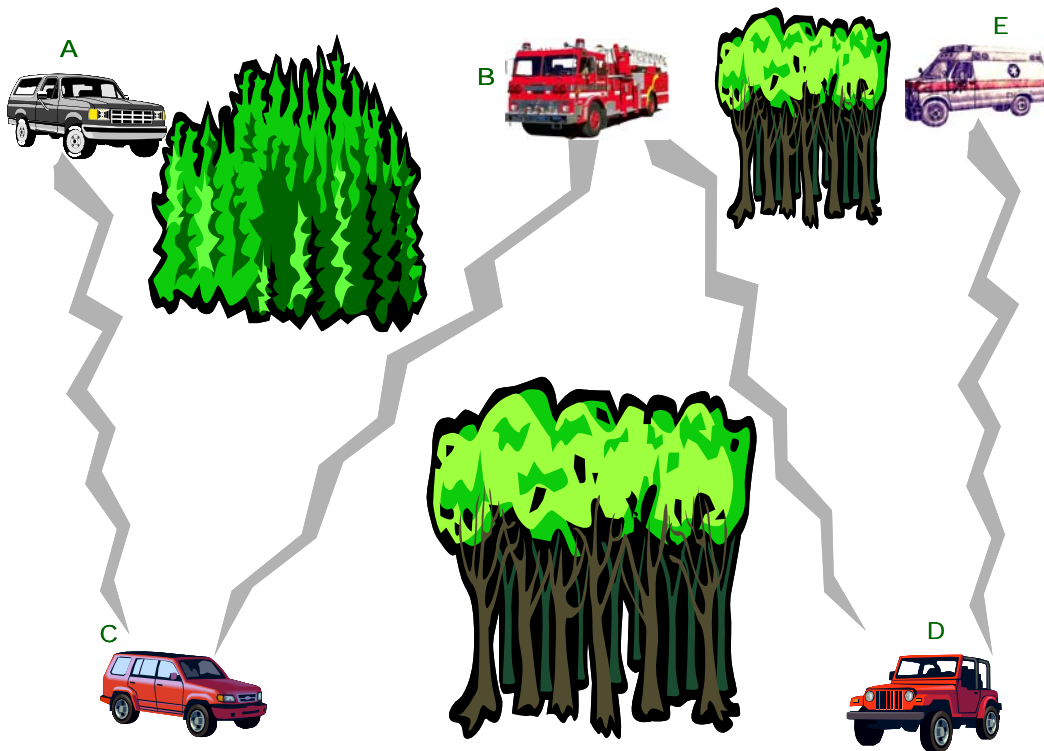


Figure 6. First InterComm™ Range is Extended by “Hopping”

Troubleshooting

IMPORTANT

- If the FICS appears to interfere with incident site operations, immediately turn off every VCA unit (and ICTCS if in use) and return to normal operating procedures.
- If ICTCS or laptop computer problems occur, the VCA100 units will remain in their assigned Talkgroups. If the laptop or ICTCS is not functional, and communication is needed between all responders, cycle power to all VCA100s. This entails turning off the power to the VCA100 and then re-powering.

Table 1. VCA100 Troubleshooting Procedures

Problem	Action	Comments
No communications via First InterComm	<ol style="list-style-type: none"> 1. Verify indicator on Power Switch is lit. If not, verify that fuse is good 2. Verify use of designated channel on all communication devices. 3. Verify at least two VCA100s are in the incident area, and power has been applied to the units at least 60 seconds. 4. Verify each VCA100 wireless antenna has clear LOS to other wireless antennas. 5. Verify distance between VCA100 wireless antennas is one-quarter mile or less. 	<ol style="list-style-type: none"> 1. If the VCA100 front panel is visible, a secondary power indication is an amber LED in the lower right corner of the Ethernet connector (Figure 7) 2. If the fuse is good, but there is no power indication, contact maintenance personnel.

First InterComm™ System Component Descriptions

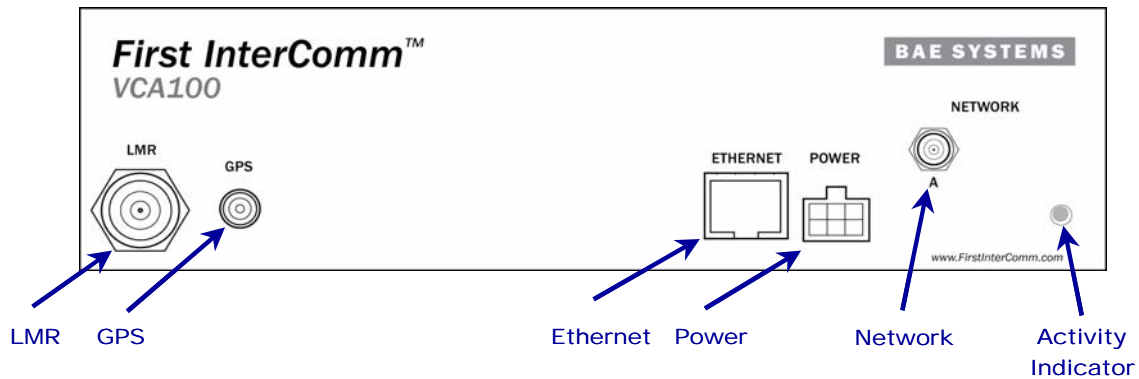
The First InterComm™ system consists of:

- VCA100 unit, matched to user’s existing radio network frequencies
- Vehicle-mounted Wireless Fidelity (Wi-Fi) antenna
- Land Mobile Radio (LMR) antenna, matched to user’s existing radio network frequencies
- Remote On/Off switch
- Incident Commander Talkgroup Control Software (optional capability)

The VCA100 Unit

The VCA100 (Figure 7) 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 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:** The VCA100 is permanently mounted in a First Responder vehicle. On/off is a cabmounted toggle switch.
- **Network:** Wireless antenna port A, reverse polarity SMA connector.
- **Activity Indicator:** Indicator light that is on during boot up.

Figure 7. VCA100 Front Panel Connectors

Mobile Radio Antennas

This vehicle-mounted antenna matches the frequency range of its associated VCA100 unit and must be compatible with the user's existing radio network.

Wi-Fi Antenna

This vehicle-mounted antenna covers the 2400 MHz to 2500 MHz frequency range and is compatible with the VCA100.

BAE Support Information

- Telephone Support: (603) 759-1027
- E-Mail: firstintercomm.eis@baesystems.com
- Web: <http://www.Firstintercomm.com>

Companion Documentation

- *First InterComm™ System Installation Guide*, Document No. A29799, October 2007.
- *First InterComm™ System Incident Commander Talkgroup Control Software*, Document No. A29800, October 2007.

Appendix A VCA100 Specifications

General

Dimensions	3 inches H, 7 inches W, 9 inches D
Weight	6 pounds
Input Voltage	+13.6 Volts DC (nominal)
Input Current	1.75 A maximum (at 13.6 v)
Input Power Connector	6-pin Molex
Frequency	Varies with model
Transmit Power	6 Watts Max, varies with model
Connectors	
<ul style="list-style-type: none"> • Network • LMR • GPS • Ethernet 	RP-SMA (SMA with male pin) TNC with receptacle contact SMA with receptacle contact (THIS OPTION NOT CURRENTLY IMPLEMENTED) RJ-45 (factory use only)
Environmental	
<ul style="list-style-type: none"> • Cooling • Temperature • Humidity • Vibration • Shock 	Ambient Air, No Fan -20°C to +60°C (operating) Up to 90% MIL-STD-810F, Method 514.5, Procedure I MIL-STD-810F, Method 516.5, Procedure I

VCA100 Configurations

Model	Protocol	Encryption	Band	Frequency Range
VCA100-L1FCGX	FM	None	Low Band	29.7 – 37 MHz
VCA100-L2FCGX	FM	None	Low band	35 – 50 MHz
VCA100-V1FCGX	FM	None	VHF	136 - 174 MHz
VCA100-V1PCGX	FM/P25	None	VHF	136 - 174 MHz
VCA100-V1PAGX	FM/P25	DES/AES	VHF	136 - 174 MHz
VCA100-V1PDGX	FM/P25	DES	VHF	136 - 174 MHz
VCA100-U1FCGX	FM	None	UHF	450 - 520 MHz
VCA100-81FCGX	FM	None	800	806 - 870 MHz
VCA100-81PCGX	FM/P25	None	800	806 - 870 MHz
VCA100-81PDGX	FM/P25	DES	800	806 - 870 MHz
VCA100-91FCGX	FM	None	900	896 - 941 MHz

Appendix B Acronyms and Abbreviations

ABS	Antilock Break System
AES	Advanced Encryption Standard adopted as standard by U.S. government
DC	Direct Current
DES	Data Encryption Standard
DHS	Department of Homeland Security
EMI	Electromagnetic Interference
FCC	Federal Communications Commission
FICS	First InterComm™ System
FM	Frequency Modulation
GPS	Global Positioning System
IAB	InterAgency Board
IAN	Incident Area Network
IC	Incident Commander
ICTCS	Incident Commander Talkgroup Control Software
LED	Light Emitting Diode
LMR	Land Mobile Radio
LOS	Line Of Sight
MIL-STD	Military Standard
MIPT	Memorial Institute for the Prevention of Terrorism
NIMS	National Incident Management System
P25	Project 25 (encryption protocol for digital communications)
RF	Radio Frequency
SEL	Standardized Equipment List
SMA	Subminiature version A (RF connector)
SOP	Standard Operating Procedures
TNC	Threaded Neill-Concelman (RF connector)
UHF	Ultra High Frequency
VCA	Vehicle Communications Assembly
VHF	Very High Frequency
VoIP	Voice over Internet Protocol
Wi-Fi	Wireless Fidelity

