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We Keep You Connected

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We've developed.....

a whole new way to communicate! We call it UltraComm II. You'll call it incredible!

There are two components to the system – the *RoadTalk Pro*, a completely self contained vehicle repeater system that extend the range of any portable radio to be equal to that of a mobile! The use of *RoadTalk Pro* completely eliminates the need for a mobile radio since all functionality is transferred to the portable!

You'll learn more about *RoadTalk Pro* in the information that follows this cover letter. For now, let's just say that this amazing system is less than \$1,500 complete with the capability to operate on standard 25 kHz, 12.5 kHz narrow band, or even 6.25 kHz very narrow band channels in both analog AND digital modes with full FCC compliance BEYOND 2018! *RoadTalk Pro* is ideally suited for anyone who relies on efficient portable communications!

The companion to *RoadTalk Pro* is the *UltraComm II* fixed station system. *UltraComm II* is ideally suited for establishment of a wide area communications network that does NOT rely on costly mountain top repeaters. In addition to reducing cost, the *UltraComm II* system provides enhance paging coverage, better talkback range from mobiles or portables AND system redundancy through overlapping coverage. With a typical system, you can lose one of your fixed stations and STILL operate at full efficiency!

The price is right – less than \$5,500 for the first station, and less than \$4,500 for additional stations (the first station price includes the cost of a master FCC license covering all stations, mobiles, and portables used as a part of the system.

You can use any existing mobile or portable with sufficient channel capacity for use in controlling *RoadTalk Pro* vehicular repeaters or *UltraComm II* fixed station units.

If you are contemplating upgrading to narrow band and/or digital communications capability, we invite you to consider the ICOM F3161DS portable or F5161 mobile with full analog and digital operating capability for 25, 12.5, or 6.25 kHz operation. The price is the same for either unit – just \$595 complete. Additional information is included in the following material. Take a few minutes to learn more about the UltraComm II system – your time will be well spent!

Burch H. Falkner

AN INTRODUCTION TO *UltraComm II*



Once upon a time.....



long, long ago, the benefits of 2-way radio were recognized by public safety users, and later by transportation users (railroads, taxis, and trucking companies were among the first users). All of these users had two things in common. First, they all operated in the 30-50 MHz range which had superior range over the other bands (still does), but it had a problem with long distance skip interference (like CB). Second, all of these systems were designed for base to mobile use (there were no portables around at that time). Most everything operated at 100 watts with a bandwidth of 50 kHz.



Base stations were generally rack mounted or enclosed in a 60" cabinet. In recent years the size has been reduced (typically using a 42" rack or cabinet with essentially five components consisting of the radio transceiver, power supply, power amplifier, duplexer for repeaters, and an option panel for control circuits, trunking controllers, etc.

The station shown at the left (vintage 1980) is the first private carrier (non-PSC controlled) paging station licensed in the USA. This station was custom designed, licensed, and installed near Gastonia, NC for Pete Huffstickler by Falcon Direct.

In the 60's most users moved to the VHF (150-174 MHz) band. More efficient antennas and miniaturization of components made equipment smaller, less expensive, and easier to service. The UHF 406-512 MHz band became very popular in the 70's and the 800 MHz band along with trunking became the choice of larger metro government agencies and commercial fleets during the 80's. It might be noted that the VHF band is still the most popular of all the bands and is used by more county agencies and municipalities than all others combined.

So what's the point of this little history lesson? Simply this - Virtually all radio communications systems being used today were designed for MOBILES or for long range one way communications. Thankfully, the development of better receivers has allowed 50 watt mobiles to have about equal talkback range to a 100 watt station. That same situation does NOT apply to a 5 watt portable!

To compound the issue, more and more users are depending on personal portable radios, rather than mobiles (how many "mobile" cell phones have you seen lately?). Clearly, the need exists for an efficient PORTABLE system. All kinds of solutions have been tried, including multiple transmitter sites and receiver voting systems but most solutions have proven to be inefficient and expensive. The time is right for something new. That "something new" is *UltraComm II*!

Why UltraComm II?

Actually *UltraComm II* (we'll call it UCII from this point forward) is the infrastructure that supports the concept on an all portable which we call *RoadTalk Pro* (we'll call it RTP from this point on).

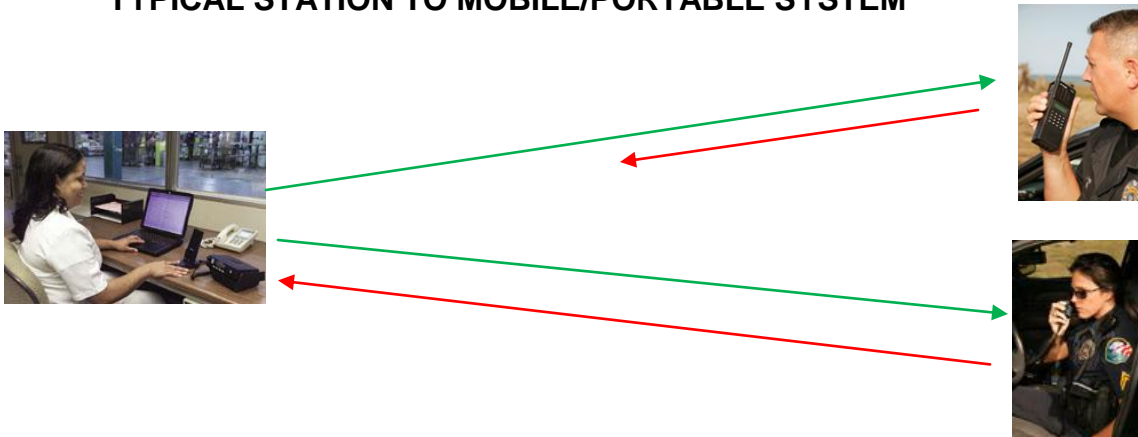
In essence RTP provides a simple and affordable vehicular repeater that makes it possible for 5 watt portable radios to function like a 50 watt mobile. The heart of the system is an RF transponder (repeater to the old timers). The package includes a portable radio that can operate on standard 25 kHz, 12.5, or 6.25 kHz frequencies in either an analog or digital mode. A rapid vehicular smart charger completes the package.

The RTP was originally designed for EMS ambulances with two portables provided with one in the driver's compartment and the other in the patient transport area, each with a vehicular charger. More recently, the RTP has proven to be extremely beneficial for use by law enforcement users, particularly those that serve in rural areas. Fire departments are recognizing the benefits for improving fire ground portable communications back to dispatch as well as utilization as a pocket repeater to fill in poor coverage areas.

Additional information on the *RoadTalk Pro* with application information for EMS, Fire and Law Enforcement users is available at www.falcondirect.com/facts or you can view a product data sheet at www.info4u.us/RoadTalkPro.pdf.

To better understand *UltraComm II*, we will start by reviewing a few scenarios that are fairly typical for many public safety users. The diagram below pretty much tells the story for systems that were designed for use with mobiles that are now being used with portables.

TYPICAL STATION TO MOBILE/PORTABLE SYSTEM



The example above assumes a VHF 50 watt base station communicating to a 50 watt mobile and a 5 watt portable. The reception range from the base station is about equal for the mobile and the portable as indicated by the green lines from the station to the portable and the mobile. The mobile will have talkback power essentially the same as the base station since both are rated at 50 watt. However the five watt portable will have basically half the talkback range of the mobile as indicated by the red arrows above. The mobile gets back, the portables do not and that in simple terms is the problem. Fortunately, the *RoadTalk Pro* provides a solution.

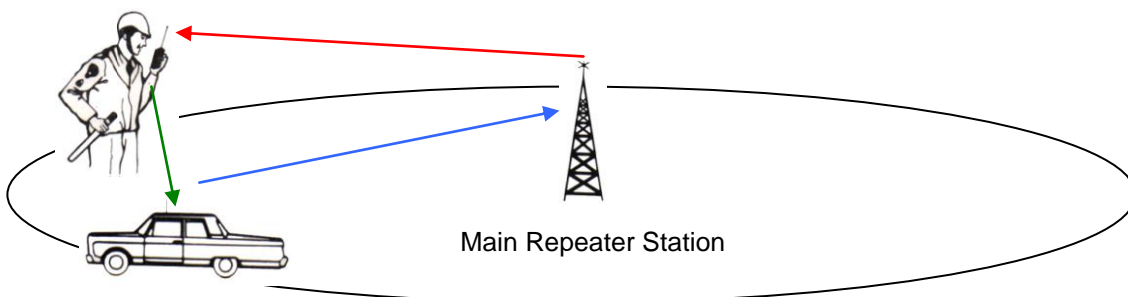
Putting it all together!

Now let's look at a couple of scenarios beginning with a typical *RoadTalk Pro* application. Before proceeding further, you may want to download and print a copy of www.info4u.us/RoadTalkPro.pdf.

It starts with an FCC license. We will assume for now that you are operating under the authority of the license of another user. Even if that is the case, you will need a "control" frequency separate and apart from the frequencies you are now using. This will be the "receive" frequency of the RTP transponder unit shown at the left. These devices are designed to receive on one frequency and transmit on the frequency normally used to transmit from a mobile to the associated base station or repeater.



The RTP is a completely self contained 50 watt repeater station. The following diagram would apply to using the RTP to extend the range of portable radios in a either a fire ground application or a police officer on foot where you want to improve the communications range from portable radios back to dispatch. Before proceeding further, you may want to review a 2005 document that is commonly used as reference material to help better understand the different types of "repeaters", what they do, and how they work. For additional information, check out www.info4u.us/RepeaterPlanner.pdf.



Frequency 1 – Transmitted by Main Repeater station. Received by mobile and handheld

Frequency 2 - Main Repeater station receive frequency. Can be heard directly from mobile, but not from handheld due to talk-back range limitations of handheld.

Frequency 3 – Cross-link transmit frequency from handheld. Received by mobile and re-transmitted on the mobile transmit frequency to Main Repeater Station.

Now, let's take a more detailed look at how this happens. Remember that FCC frequency thing we were talking about earlier? That's **Frequency 3**, the one you probably don't have. If you have an extra mobile frequency, well and good – if not, you are going to need another frequency.

To get that frequency, you'll have to pay someone to prepare the forms, someone to find an available frequency, and submit an application on your behalf to the FCC for a ten year authorization. That will cost you \$400. However, we suggest you plan ahead and apply not only for a control frequency, but for a repeater frequency pair (Frequencies 4 and 5) at a cost of \$950. In the long run, this is your best choice. We'll discuss this in more detail later.

After getting the frequency issue out of the way, we can take a more detailed look at the actual equipment. On the preceding page, we introduced the RTP transponder (actually a URFR5000 12 volt repeater. It's about the same size as a regular mobile radio (7" x 7" x 2"). There are no knobs, channels selectors, or other control switches. When you connect it to 12 volts DC, it's ON. Indicator lights on the front show you when the unit is ON, RECEIVING, and TRANSMITTING. There is also a microphone jack, used primarily for testing, not for operational use.



It's the back of the unit where the work is done. There is the aforementioned power cable that connects to switched 12 volt DC power and two antenna connectors, one for the receive antenna which picks up signals from an associated portable radio.

Receive antenna connector

Transmit antenna connector

The antenna connectors are shown above. The Type N female jack on the left side connects to the receive antenna and the one on the right connects to a transmit antenna.



In a vehicular installation, a 6" flexible antenna similar to a portable rubber duck antenna is mounted inside the vehicle (that's it shown on the left).

The transmit antenna is a mobile type whip supplied with a magnetic base which requires no hole drilling (A permanent roof mount antenna with a 3/4" hole mount is optionally available).

The aforementioned configuration is ideally suited for both law enforcement and fire ground operations using a single control channel for activating the vehicle repeater and using the normal portable receive channel for direct reception of dispatch calls. However, there are other capabilities of the *RoadTalk Pro* (RTP) which will be of interest to many users.

The RTP, unlike most repeaters is NOT limited to a single channel, nor is it limited to a specific frequency separation between transmit and receive frequencies. This creates some interesting possibilities. Actually the RTP can be programmed on up to 32 channels with scan in conventional 25 or 12.5 kHz narrow band channels, or even 6.25 kHz DIGITAL channels! This means that you are fully compliant with all FCC rules BEYOND 2018! Actually, the operational considerations are of more benefit than regulatory compliance.

You may be interested in knowing the top five reasons most users prefer digital operation over analog. The answers at www.info4u.us/WhyDigital.pdf will probably surprise you, but we're getting off the subject. What we want to discuss is how to use the RTP for enhanced capabilities. Let's start with an example of how to practically use the multiple channel scan capability for a volunteer fire department locating in a fringe area that is experiencing problems both with receiving page calls, AND talking back on portables from the fire ground.

Here's how we solve the problem. We program TWO channels in the RTP with scan. The first channel is set to receive calls from dispatch (let's assume 154.130 MHz) and to transmit on the "control" channel (remember that 3rd channel we've been talking about?) with a specific CTCSS, DCS, or digital NAC code to control channel selection. The second channel is set to transmit to dispatch and the control channel uses a different CTCSS, DCS, or NAC code. Both channels are in scan.



Instead of using a rubber duck antenna as the receive antenna on the RTP, we use a standard rooftop antenna for both the RTP receive and transmit antennas. When the engine is garaged, the RTP is set on Channel 1 to retransmit paging signals received from dispatch. Upon receipt of the call, designated users will have the ability to use their portables to switch from control channel 1 to control channel 2. Let's assume the control channel is 158.955 MHz with a CTCSS tone of 127.3 Hz for control channel 1 and 156.7 Hz for control channel 2 (the frequency will be the same).

After switching to channel 2 on selected portables, the user will be able to talk back to dispatch through the RTP. When the run is completed, the officer switches back to channel 1 to be ready to receive paging calls on the control channel. If desired, the officer portables can be set to scan the regular dispatch frequency AND the control channel frequency. This will guarantee reception of page calls regardless of location within the coverage area of both the dispatch transmitter and the RTP.

The aforementioned scenario assumes that the RTP is left ON while the apparatus is garaged with the battery connected to an AC charging system. In some cases, the user may prefer to place the RTP in the STATION rather than in the vehicle. Although a little more expensive, there are some significant benefits to placing the RTP in the station. Notably, the fixed station system can use much better antennas with more height for increased range and reliability. Here's how it works!



First, we put our RTP in to a desktop cabinet. Inside that cabinet, we put a very different type of power supply to allow operation of the repeater on AC power. We'll talk more about that

shortly. For now, we will point out the main differences in the mobile repeater and the fixed station repeater. As you will note from the picture at the left, the fixed station unit is bigger (mostly wider, measuring 20" across as compared to 7" with the RTP). We also have some added control functions, such as being able to change channels, send page tones, control scan, etc., which on the RTP can only be done from an associated portable radio.

Fixed station radios, regardless of brand or model, are generally designed to operate on 12 volts. For fixed operation, a power supply is used to convert 110 volts AC to 12 volts DC. There are two basic types – switching (lightweight and more compact) and transformer (better protection from irregular line voltage and optionally available with an optional battery backup). As a general rule, switching power supplies can be mounted inside the radio housing whereas transformer type supplies are normally mounted externally.

Most radio system providers recommend battery backup to assure continued operation in the event of temporary AC power failure – good idea! Unfortunately, the power supplies with optional battery backup capability generally place a constant charge on the associated battery which leads to very short battery life (the constant charge literally burns them up). We've got a better idea!



We don't operate our fixed station units (technically known as the FR5000/6000) from AC power supplies. We operate them directly from a high capacity 12 volt battery maintained by a highly efficient linear charger that charges the battery only when battery drops below a specified level. When the battery reaches a fully charged level, the linear charger (which is mounted inside the station housing) automatically switches off to eliminate overcharging. Batteries last longer, with more efficiency with reduced replacement cost.

As a general rule, repeaters use a device known as a duplexer which is a fancy name for a filter that lets allows you to use a single antenna for simultaneous transmit and receive capability (which is what a repeater does). For the repeater station we provide for use at fire stations, we don't use a single antenna with duplexer – we use TWO antennas especially designed for the needs of those we serve.



The antenna we use is a highly efficient omnidirectional radiator with a rated gain of 7 dBd over an ordinary mobile antenna. Weighing just 10 pounds, the G7-150 has a vertical height of just over 15 feet, well below the FCC 20 foot height requirements (we'll discuss this in more detail shortly).

The G7-150 is less than half the price of comparable antennas even though it is built to withstand sustained winds of 100 mph. The G7-150 can mount on a standard 2" pipe, but we prefer to use three sections of Rohn/Radian #25G tower set in concrete and optionally bracketed to the side of the building for additional support.

We mount the receive antenna on top of the tower and the transmit antenna mounted directly below of the side of the tower.

Now – let's go back to the FCC for just a moment. You will recall that you have three options relative to an FCC license, which you MUST have. You can use an existing license, whether yours, or under the authority of a licensed user with a written agreement specifying you will operate under the same requirements as the primary licensee. Your second option is to apply for \$400 a "control" frequency to activate your mobile repeater OR a fixed repeater with a transmit frequency with an antenna height to the top not exceeding 20' above an existing structure (that mean a building, not a tree!). The third option is to apply for a new repeater frequency pair that can be used either for mobile or fixed use (See 20' option) at a cost of \$950.

A new repeater frequency pair can also be used on a central repeater location with virtually unlimited stations complying with the under 20' rule and associated mobiles. We'll be discussing this in more detail shortly.

For now, let's review the pricing and benefits of setting up a single fixed station licensed by the "under 20' rule" for a volunteer fire department desiring to provide enhanced coverage within their fire district to allow improved communications back to dispatch from the station, mobiles, or portables.

Additionally, this station will have the ability to extend pager or pager/radio reception from dispatch to pagers and/or pager radios within the fire district. We program the radio to normally operate in the "extended range" mode for retransmitting incoming page calls from dispatch. Once a call is received, it can be switched to "local area repeater" mode remotely from any properly programmed mobile or portable radio. In the "local area repeater" mode, the station will repeat calls from mobiles or portables in the fire district back to dispatch at full power!

In most cases, a central repeater (or multiple repeaters) ARE NOT REQUIRED since each fire station and dispatch have high gain mobile antennas. Such systems have been known to have a range of up to 100 miles between stations! Better yet, by operating the system in the 6.25 kHz digital mode, interference IS ELIMINATED!

Dispatch can call a single station, a group of stations, or all stations at once using the same station set up used at the fire station. If desired, every station can be set up to be used as a backup dispatch center in the event of a problem at dispatch. Additionally, if one of the fire station repeaters is disabled, the district will normally be covered by overlapping signals from adjoining station. If you want a fully redundant system always capable of providing communications when needed, the *UltraCom II* system is for you!



We normally recommend the use of three Rohn #25G tower sections for use at each station. There are two 10' sections and an 8' top section. A 3' x 3' x 3' hole is dug and filled with concrete. The bottom section is provided with a base plate and several sections of 2.5' rebar to secure the tower in concrete. This gives us an overall height of 25'. The antenna is 15'. Assuming the typical building height of 20', we would fully comply with the FCC 20' rule. The receive antenna is mounted on the top of the tower and the transmit antenna is mounted on the side with the tip of the transmit antenna extending to the bottom of the receive antenna.

We have a complete kit for shipment anywhere in AL for \$950 for those who can do their own installation, or we will install for \$550 additional.

UltraComm II defies traditional logic which involves the concept of using multiple repeaters to provide county wide coverage. Dead spots are significantly reduced and can be filled in with additional stations. Expensive satellite receiver voting systems, multiple repeaters, even trunking is not required for wide area high capacity usage.

The purpose of this material is not to get into technical detail, but rather to make you aware of affordable alternatives to conventional planning. The system is capable of operating in an analog or digital mode operating on conventional 25 kHz, 12.5 kHz narrow band, or 6.25 kHz channel spacing. If desired, a central repeater can be used, but that is a subject for another time. For now, let's recap the different applications of the *UltraComm II* system.

RoadTalk Pro and UltraComm II System pricing

System Type	RoadTalk Pro Mobile	UltraComm II Station
Primary Function	Vehicular repeater	Fixed station repeater
Primary benefit	Extends talkback range of portable radios	Extends portable radio talkback range & improves dispatch paging
Control frequency required?	Yes	Yes
Available frequency bands	VHF or UHF	VHF or UHF
FCC license cost	\$400 (1)	\$950 (2)
RF Transponder (Repeater) cost	\$1,295	\$1,795 (3)
Antenna system with cable	\$44	\$1,000
Antenna support tower	Not required	\$950 (4)
Optional on-site installation	\$95	\$550
Warranty by manufacturer (ICOM)	2 years	2 years
5 year extended warranty	\$57	\$57
Digital upgradeable analog portable	\$449 (5)	\$449 (5)
Full digital/analog portable	\$595 (6)	\$595 (6)
Add 10 button keypad (7)	\$50	\$50
Add Vehicle rapid charger	\$69	\$69
Mobile radio, digital capable	\$595	\$595

(1) If available, and existing frequency may be used for control of a RoadTalk Pro vehicular repeater. Otherwise, a new FCC frequency will be required.

(2) Assumes licensing of a new pair of frequencies for repeater operation plus a control frequency for use by associated portable or mobile radios.

(3) Price includes linear switching power supply and deep discharge battery.

(4) \$1,500 including on-site installation

(5) Assumes ICOM F3161 analog upgradeable portable

(6) Assumes ICOM F3161DS digital/analog portable

(7) For text message sending and receiving

Note: Other analog portables and mobile radios will also work with the RoadTalk Pro and UltraComm II systems. See www.info4u.us/RoadTalkPro.pdf for more information on the vehicular system and www.info4u.us/UC2.pdf for more information on fixed stations.