

PUBLIC SAFETY REPORT

COMMUNICATIONS SOLUTIONS FOR PUBLIC SAFETY

Navigating Uncharted Waters:

800 MHz Vehicular Repeater Licensing

By William J. Carlin

Frequency coordination above 800 MHz seems to be cut and dry, without much room for discussion, especially to frequency coordinators. However, when a new technology comes on the scene, it causes the industry to re-examine its position on long-held assumptions and take a closer look at FCC rules.

Increasingly, organizations with wide-area coverage needs, such as

Licensing vehicular repeaters at 800 MHz is not a common practice, rather it's comparable to navigating uncharted waters.





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as the mobile as long as it is within the vehicular repeater’s coverage area, typically within a mile of the vehicle. The handheld and vehicular repeater operate on a simplex channel, even though the conversation is repeated in real time; the mobile frequency makes up the other half of the frequency pair. A state trooper located between two metropolitan areas—particularly a trooper in a foot race with a suspect—could make good use of a vehicular repeater.

Vehicular repeaters can provide interoperability among agencies that are licensed under different frequency bands or trunking formats. For example, agencies responding to serious traffic incidents may include the highway patrol using an 800 MHz system and fire and emergency rescue departments using separate VHF frequencies. Installing an 800 MHz vehicular repeater with a VHF mobile gives public-safety officers using an 800 MHz portable in conventional

mode direct access to mutual aid and fire frequencies at a scene. In addition, installing an 800 MHz vehicular repeater with an 800 MHz EDACS trunking mobile allows users with Motorola or LTR trunking handhelds to access an EDACS system via an 800 MHz conventional channel.

Vehicular repeaters also provide logic control for multivehicle mode operations, where several mobiles may arrive at a scene, but only one repeater/mobile combination handles all transmissions from base to portable and from portable to base. Generally, the first mobile at a scene establishes itself as the priority mobile, sending messages to the other mobiles involved. The multivehicle format automatically re-establishes a new priority mobile if the first priority leaves or is disabled. Vehicular repeaters automatically detect if two or more units are at priority status and remedy the situation without user intervention.

When a user arrives at a scene, the user enables the repeater when he leaves the vehicle. The repeater monitors the channel and sends a short tone burst if the channel is idle, then assumes priority mode and repeats all transmissions between base and portable. Another vehicle arrives and enables another repeater sending the same tone burst; the first unit receives the tone burst, increments an internal counter and ceases operation as priority because the newly arrived repeater assumes priority status. As each new repeater arrives and is enabled, all previously enabled repeaters are moved to nonpriority status, each with a unique count. This technique is commonly referred to as “last man out.”

The nonpriority repeaters continue to monitor all radio traffic after they are bumped from priority status. If one repeater’s mobile is receiving, it checks whether another repeater is transmitting, indicating the priority repeater is still on scene. If the repeater receives a transmission from a portable, it checks for mobile receive activity indicating the priority repeater has keyed its mobile. If either condition fails to happen within a prescribed amount of time, all repeaters will begin to decrement their internal counters until one of them reaches count zero and begins repeating. The other repeaters sensing the new priority repeater will cease counting and remain at nonpriority status preserving the countdown hierarchy. Because each repeater has a different internal count, only one will reach priority status at a time.

public-safety agencies and utilities, have been abandoning conventional frequencies in favor of statewide 800 MHz networks. Unfortunately, many new 800 MHz users are discovering they have inadequate coverage when using handhelds in remote areas. As more agencies migrate toward 800 MHz trunking networks, they find themselves isolated from agencies that use VHF or UHF frequencies, unless they carry two portables. Vehicular repeaters offer a cost-effective means of linking two systems together in addition to extending handheld range.

Until recently, vehicular repeaters operated in the UHF and VHF bands without much fanfare or controversy. As soon as one vehicular repeater manufacturer expanded its product line to include 800 MHz, the door was opened to debate on how frequency coordination for this service would be addressed. This article investigates some problems 800 MHz users are likely to encounter in the coordination process and discusses possible solutions.

Vehicular Repeater Overview

Vehicular repeaters are low-power transceivers that provide extended handheld coverage by connecting to an existing high-power mobile and repeating transmissions in both directions. When the mobile radio receives a transmission, the vehicular repeater rebroadcasts the recovered audio to a handheld on a separate simplex frequency. If a handheld user keys a portable on the same simplex frequency, the vehicular repeater keys the mobile and rebroadcasts the recovered handheld audio over the mobile frequency at higher power.

The portable essentially has the same range



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During base-to-portable transmissions, the vehicular repeater will periodically unkey to check for activity on the channel. If the repeater detects a carrier on the channel, it will pause to check for CTCSS tone as well. If tone is detected, it means a handheld is transmitting and the repeater will switch directions enabling portable-to-base transmissions. In this manner, the portable is given priority and cannot be locked out if the mobile goes open squelch. If the repeater detects carrier without tone, it means another repeater is transmitting and the sampling repeater will change to nonpriority status and cease repeating. This is the self-clearing mechanism.

Frequency Objections

The FCC defines a vehicular repeater as “a mobile station authorized to re-transmit automatically on a mobile service frequency, communications to or from hand-carried transmitters.” Section 90.247 of the FCC rules states, “A mobile station authorized to operate on a mobile service frequency above 25 MHz may be used as a mobile repeater to extend the communications range of hand-carried units subject to the following:

“(a) Mobile repeaters and/or associated hand-carried transmitters may be assigned separate base/mobile frequencies for this use ... in addition to the number of frequencies normally assignable to the licensee.”

The first sentence is an important one be-

cause often a coordinator’s first objection is that vehicular repeaters are not allowed to operate at 800 MHz. FCC’s section 90.247 states otherwise. In fact, the FCC licensing office in Gettysburg, Pa., confirms this, stating the class designator MO3 for vehicular repeaters is not band specific, and licenses will be granted if a user or coordinator requests them.

For systems operating above 800 MHz, section 90.623(c) provides that a non-SMR single-user licensee can be authorized additional frequency pairs, if “the additional frequency pair will be used to provide radio facilities to a single entity and the additional frequency pair is justified on the basis of the requirements of the proposed single user.”

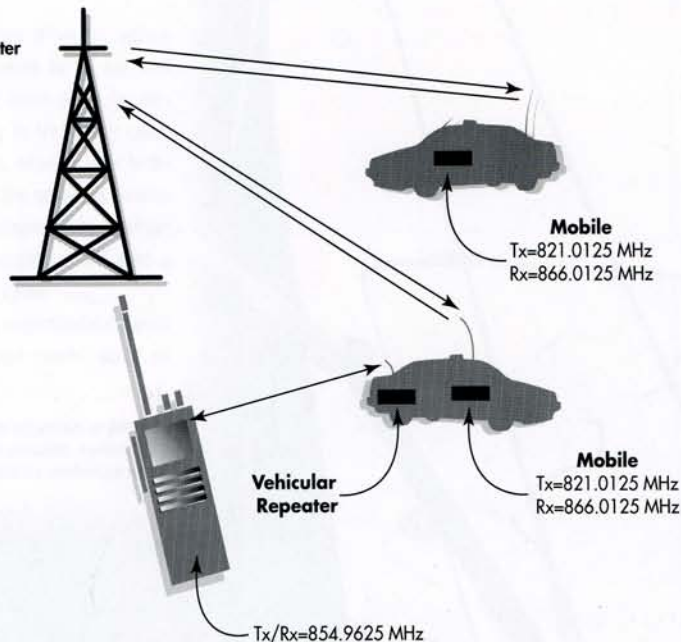
Because a public-safety entity desiring to operate an 800 MHz vehicular repeater system clearly is justified for use of an additional frequency pair, a frequency coordinator would not have a valid basis for refusing to coordinate a frequency pair for that purpose. Coordinators could argue that no frequency pairs are available for coordination; all may be assigned.

The FCC divided the 806-824 and 851-869 MHz spectrum into three broad categories. SMR consists of 25-kHz channel pairs 1-150 (formerly the general category channels), 80 25-kHz channel pairs in 16 groups between channels 201 and 399, and 25-kHz channel pairs 401-600. Non-SMR is comprised of three radio services and includes 170 25-kHz channels between channels 151 and 400 (70 public safety, 50 business and 50 industrial/land transportation). The National Public Safety Plan channels occupy 12.5-kHz channel pairs 600-830. Public-safety agencies are eligible for licensing in either the non-SMR public-safety pool or National Public Safety Plan channels.

The National Public Safety Plan frequencies are allocated in accordance with regional plans approved by the FCC. These plans typically allocate a number of frequencies to certain agencies—state, county and municipality. Although FCC adoption of a regional plan would make it difficult for an agency to request a new frequency assignment not already allocated to that applicant by the plan, rule sections 90.247(a) and 90.623(c) strongly support an applicant’s request for use of an allocated national plan frequency pair for vehicular repeaters. In fact, if an agency has a frequency pair exclusively assigned to a single system, frequency coordination is not required pursuant to section 90.175(i)(10) of FCC rules.

If a public-safety agency does not wish to reassign an existing National Public Safety Plan frequency, there are 70 channels between channels 151 and 400 from which a coordinator can choose. There are two additional alternatives. A user can share a channel with other users, provided the channel is not fully loaded. In favorable terrain, a user can obtain a license for a new station with minimum separation from existing stations greater than 55 miles without requesting a rule waiver. If noninterference is demonstrated by an engineer, the FCC will consider a rule waiver request for a new station less than 55 miles from an existing station. Both sce-

Figure 1:
Vehicular Repeater
Operation





narios are authorized pursuant to sections 90.621(a)(2) and 90.621(b)(4) respectively. This is the least desirable alternative, as co-channel interference from a conventional or trunking system can cause side effects for vehicular repeater systems operating in multivehicle mode.

Technical Showing

Several public-safety agencies have licensed 800 MHz vehicular repeaters. The Alabama Department of Public Safety's primary channel is VHF, and an 800 MHz system is installed in several pilot areas. Because the agency has inadequate VHF portable coverage, 800 MHz portables crossbanded to VHF mobiles extend VHF portable coverage to the 800 MHz system. The agency has an 800 MHz conventional channel license. Newton County (Mo.) Ambulance District's emergency vehicles are VHF and are required to carry 800 MHz portables to communicate with medical dispatch on a Motorola 800 MHz trunked system.

Users should always work with a coordinator to secure a license; that is a coordinator's job. However, frequency coordinators may not always see "eye to eye" with users, especially in the case of new technologies without a precedent. Therefore, users must arm themselves with the facts necessary to make an informed

decision. Alternatives can be pursued in the event a mutual solution cannot be reached.

Rule section 90.247 establishes the legitimacy of vehicular repeaters and licensing at 800 MHz. Further, it provides authority for an applicant to request an additional frequency or pair of frequencies in any band or bands for the link between a mobile unit and handheld.

When the FCC formally certified frequency coordinating committees in 1986, it provided a procedure for resolving disagreements with coordinators. The procedure is appropriate in a number of circumstances, such as when a coordinator refuses to recommend frequencies even though frequencies appear to be available, or a coordinator suggests that a proposed operation is not in accordance with FCC rules. In either case, an applicant can submit a "technical showing" to a coordinator and request that the coordinator forward the application to the FCC, without coordination, for consideration. A coordinator is permitted to explain the reasons for refusing coordination and offer comments on the application and technical showing.

The FCC did not specify what should be included in a technical showing. In some cases, an engineering study that demonstrates that an application complies with FCC rules and shows no interference will result at existing stations is

appropriate. In other cases, a legal argument demonstrating that the proposed operation will comply with all FCC rules and a coordinator has no reasonable basis for refusing to coordinate is appropriate. In such cases, if the FCC agrees with an applicant, it will either grant the application directly or return the application to a coordinator with instructions to perform the requested coordination.

As more agencies migrate to wide-area 800 MHz trunking networks, the need for low-power vehicular repeaters will continue to increase. Licensing issues may initially appear complex, but as with all new technologies, can be handled when all facts are examined. When in doubt, consult the FCC rules or seek competent legal advice. A coordinator's opinion is not always the final word.

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