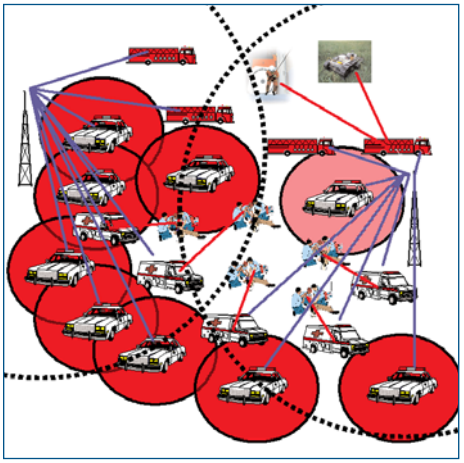
TECHNICAL CORNER

4.9 GHZ PUBLIC SAFETY OPERATIONS

PART I OF III, WHAT CAN I USE 4.9 GHZ FOR?

To Use or Not To Use…

No doubt many readers are aware that the Federal Communications Commission (FCC) has released 50



MHz of spectrum at 4.9 GHz to support public safety operations. Many of you in fact already have a license to use the spectrum; however not everyone has applied for a license yet – and there are scores of agencies across the country that do not plan on utilizing 4.9 GHz spectrum at all.

Those with plans to utilize this precious spectrum resource usually see it as a way to introduce broadband and high data rate applications on dedicated public safety spectrum; such applications normally could *not* be supported unless unlicensed spectrum at 2.4 or 5 GHz were tapped. Those who scoff at the use of 4.9 GHz often point to the low power and range limitations inherent to such high frequency operations.

In this issue, we will begin to look at the issues involved with supporting public safety operations at 4.9 GHz. Specifically, we will focus on some of the types of applications and deployment scenarios with which 4.9 GHz is associated.

Applications that Protect and Serve

For the first time the public safety community will be able to utilize high data rate applications that are supported by dedicated public safety spectrum resources. The timing for this could not be better, as our first responder community has certainly assumed a critical role in the protection of our homeland against terrorist aggression. One of the most important weapons for successfully tackling this job is information. First responders continually collect and survey massive amounts of information; however, this information cannot be processed at the side of the road. It needs to interact with powerful analysis software and databases. Our front lines need high data rate connections to feed back all of the information that they collect. The 4.9 GHz spectrum can be used to provide this connection.

What are some of these applications? Since there is little broadband public safety precedent to draw upon, the range here is wide open, and as they say, "the sky's the limit." Video is an obvious application, but it is only a beginning. Mobile high data rate connections can provide an extension of agency LANs right to the vehicle or even the individual. Keep in mind that it is becoming an "all IP" world, and 4.9 GHz can provide what amounts to a mobile Ethernet connection. This connection can be used not only to support the roadside MDT query, it can be used to provide surveillance and identification/recognition video, retinal or fingerprint scans, and even Voice Over IP (VOIP). It can also be used to quickly retrieve aerial, satellite, or infrared (IR) imagery at an incident scene to achieve better situational awareness. These types of applications save lives, and once our first responders have the capability to transfer data at these rates, even more applications will flourish.

Excuse Me, What's the Size of Your Net?

You've probably heard about WLANs (Wireless Local Area Networks), but what about MANs (Metropolitan Area Networks)? Or how about, RANs (Regional Area Networks), VANs (Vehicular Area Networks), PANs (Personal Area Networks), or piconets? Loosely stated, these all refer to the size of a given wireless network.

As previously mentioned, there are many folks out there who point to propagation effects as a reason to stay away from 4.9 GHz. Admittedly, you cannot expect 4.9 GHz to provide the same communications range you get with VHF or even 800 MHz; however, innovation, technology, and raw bandwidth can go a long way toward offsetting the laws of physics. The many possible technology implementations of 4.9 GHz systems (more on this in Part II) bring supported communications ranges from 3 meters to 3 kilometers or more. This implies that everything but RANs can be supported with 4.9 GHz alone. Remember that in a world of IP switching, all packets *are* equal; therefore a RAN can easily consist of multiple physical layer technologies, with 4.9 GHz filling the broadband gap. Some vendors have already discussed the development of multi-band routers that simultaneously handle 700/800 MHz narrowband digital voice and narrowband data, 700 MHZ wideband data, and 4.9 GHz broadband data.

A Net Held Together by a Mesh

Another relatively new concept that will be seen in 4.9 GHz deployments is a "mesh network." Typically, public safety looks at a base station to provide coverage over a given area, with point-to-point communications links connecting traffic to central locations for dispatch or database access. This leaves the possibility for both coverage holes and critical failure points. Mesh networking has grown out of the Department of Defense (DoD) operations and involves moving the routing functionality to multiple points that are spread out over the service area.

In a mesh networking deployment, data communications can be "daisy-chained" or repeated though many, if not all, of the communi-

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The New Face of CAPRAD

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Originally envisioned as a notebook of available frequencies in the newly allocated 700 MHz public safety spectrum from which planners could formulate regional plans and select channels for use within their regions, the CAPRAD database has evolved into a suite of tools and resources to assist State and regional planners, coordinators, and users to manage the public safety spectrum. Resources range from tools for regional planning to consumer licensing, and from interoperability planning to communications-related assets inventory. The CAPRAD system continues to facilitate inter-regional coordination in the pre-allotment of 700 MHz frequencies and the development of State and regional plans, but has grown to include a number of expanded functions and enhanced features which make it an even more important national resource for public safety spectrum planning and management.

CAPRAD will emerge this fall with a fresh new look and feel that will provide improved system navigation and an appearance that speaks to its important role in public safety planning. Subtle changes have been made to both the navigation environment and the appearance to enhance the operation of the system. A number of features within the system have been improved as well. Links to more resource sites, tools, and effective practices guides have been added. User profiles and system security have been enhanced along with enhanced data security techniques and improved disaster recovery procedures.

Most significantly, expanded CAPRAD system functions will come on-line during the fourth quarter of this year. Along with the rollout of the 4.9 GHz planning module, which took place in July, CAPRAD will sport a new Communications (SIEC) module and a Communications Assets Inventory module during the late fall of 2004. These new planning and resource modules make tools and resources available to assist with management of the public safety spectrum beyond the 700 MHz band.

The purpose of the Interoperable Communications (SIEC) module of the CAPRAD system is to provide a planning and resource component for statewide plans for public safety interoperability. Planners and user entities are provided with tools to better implement the use of the 99 channels identified as public safety interoperability spectrum nationally and to enhance the management of resources and the fundamentals of the developed plans for interoperable communications. The module offers an on-line plan and document storage library, channel planning and allotment, license application facility, user entity information, assets inventory capability, site locations, and, of course, the CAPRAD standard on-line help and resources pages with information related to the interoperability challenge.

Integrated mapping capabilities for each of the modules will provide graphically illustrated locations of antenna sites and/or access points with associated general information about each site. Fully integrated technical features of the hardware, software, and support equipment continue to provide exceptional system performance, availability, and security of information.

Planning for and operation of the CAPRAD system is administered by the National Law Enforcement and Corrections Technology Center-Rocky Mountain Region. The NLECTC-RM is a program of the National Institute of Justice and is sponsored by the University of Denver through the Denver Research Institute (DRI).

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cations nodes. This creates many possible routing paths and fewer points of failure. Coverage can also be extended naturally as the incident evolves and information is routed through the first responders themselves. For example, at a fire scene, in-building coverage can be achieved by reaching *any* of the firefighters within the building and routing through them to the rest of the fire team inside.

Hybrid networks are also envisioned at 4.9 GHz with area coverage provided by radio sites or access points, and the backbone infrastructure set up as a mesh network. This can significantly reduce implementation costs for many types of systems.

Next Time; Part II, 4.9 GHz Standards

In the next issue, we will move into a discussion of the technologies and standards that can, should, or will be available in 4.9 GHz devices. Until then, feel free to contact me at *ohara@syrres.com* if you have questions or comments.

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