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What is FirstNet?

FirstNet is a nationwide public safety LTE broadband network that provides data services to first responders in times of emergencies. FirstNet services primary objective is to provide first responders with graphical and other data information utilizing an existing and proven high availability, high speed and high bandwidth dedicated technology proven technology – LTE.

This will be of tremendous benefit to first responders to help them assess situations and make decisions that can positively impact, contain or reduce emergencies quicker.

AT&T has been steadily building out FirstNet's™ LTE broadband public safety network for the past couple of years and is currently about 60% complete, with 80% expected to be completed by 2021[1]. Many jurisdictions around the Country have already started utilizing FirstNet to complement their Land-Mobile-Radio (LMR) mission-critical communications. In fact, Washington, D.C. recently updated it's ordinance to require FirstNet support to be installed in all new building construction starting in 2020[2] .

And moving forward, more jurisdictions will look to accept the FirstNet network as a reliable source for their wireless broadband needs.

In addition to graphical information (real time video, maps, building layout diagrams) and other types of "pure data" delivery, FirstNet will also provide supplemental back up voice communications for specialized handheld devices (for example, cell phones with PTT capabilities). *Note that FirstNet voice services are not intended to replace LMR for critical voice communications.*

Initially, the plan was to deliver these services over a dedicated band within the 700MHz spectrum – specifically, Band 14. However, recently AT&T/FirstNet has announced that they have the capability to deliver FirstNet services over any of their currently deployed commercial bands (700MHz LABC, 850MHz,1900MHz, and 2100MHz), as well as over Band 14. And, in any given market, they may choose any one, or any combination of, any of their available spectrums. AT&T/FirstNet will make the decision on which bands to use on a market by market basis.

When FirstNet services are delivered over AT&T commercial bands, the First Net traffic will be pre-empted and prioritized to assure first responders of the same QoS that dedicated Band 14 can provide.

In consideration of this – it is obvious then that from an RF perspective, FirstNet services <u>are just like any other commercial services</u> that are provided by AT&T.

When designing inbuilding DAS systems to support both LMR public safety (ERRCS system) and FirstNet, what design considerations need to be made so that both systems work properly and do not interfere with each other?

The first consideration must be: should the system to support FirstNet and LMR be "converged" (meaning one system supporting both) – or should they be separate systems? Many industry experts, and many jurisdictions, strongly suggest or mandate that the systems be separate. The advantage of converged systems is the potential of reducing costs (for example, by eliminating duplicate antennas and antenna coax cables). However, there are tradeoffs to any potential cost savings – things like the cost and space required for battery backup of the LMR system only vs. backing up the entire converged DAS, the requirements for DAS equipment supporting LMR to be in NEMA enclosures, etc.

Additionally, there can be system performance advantages to supporting FirstNet and LMR as separate systems.

As previously mentioned, FirstNet in reality is simply specialized services being delivered over standard LTE cellular technology and systems. Whether the DAS system supporting FirstNet is “converged” with support for LMR, or the FirstNet DAS and LMR ERRCS systems are separate, considerations must be made to ensure that there is no conflict between the two technologies. *(And in reality, these consideration really also apply to many cellular DAS systems – even those not concerned with FirstNet.)*

Take a look at the FirstNet Band 14 downlink signal range (758-768MHz) and the 700MHz LMR downlink signal range (769-775MHz) – you will see that the Band 14 upper end is 768MHz and the 700 LMR lower end is 769MHz – almost on top of each other as shown in Figure 1 below.

FirstNet and LMR *Downlink* Signals adjacent to each other

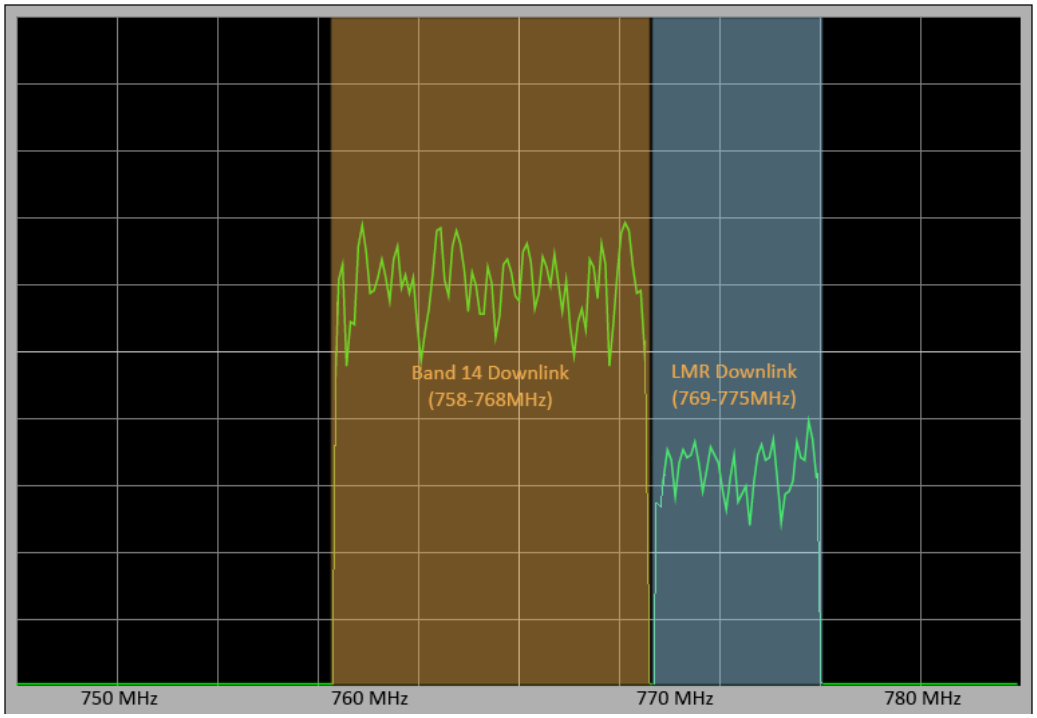

Figure 1.

So if the BDA for LMR picks up the Band 14 D/L signal, and it is too strong - this could cause saturation of the BDA (and potentially even damage) immediately. And if the Band 14 D/L signal is weak – then the BDA will allocate power to amplifying the Band 14 signal, resulting in LESS power being available to the LMR signals. *(Note in certain cases, some Class A BDAs might be able to account for this – but this is ALWAYS a significant risk when using Class B BDAs.)* This would negatively affect the LMR performance!

Now take a look at the uplink side of things – the LMR uplink frequencies range from 799-805MHz; the FirstNet Band 14 uplink range is from 788-798MHz. You will see that the low end of the LMR uplink range and the upper end of the FirstNet Band 14 are again almost on top of each other as shown in Figure 2 below.

FirstNet and LMR *Uplink* Signals adjacent to each other

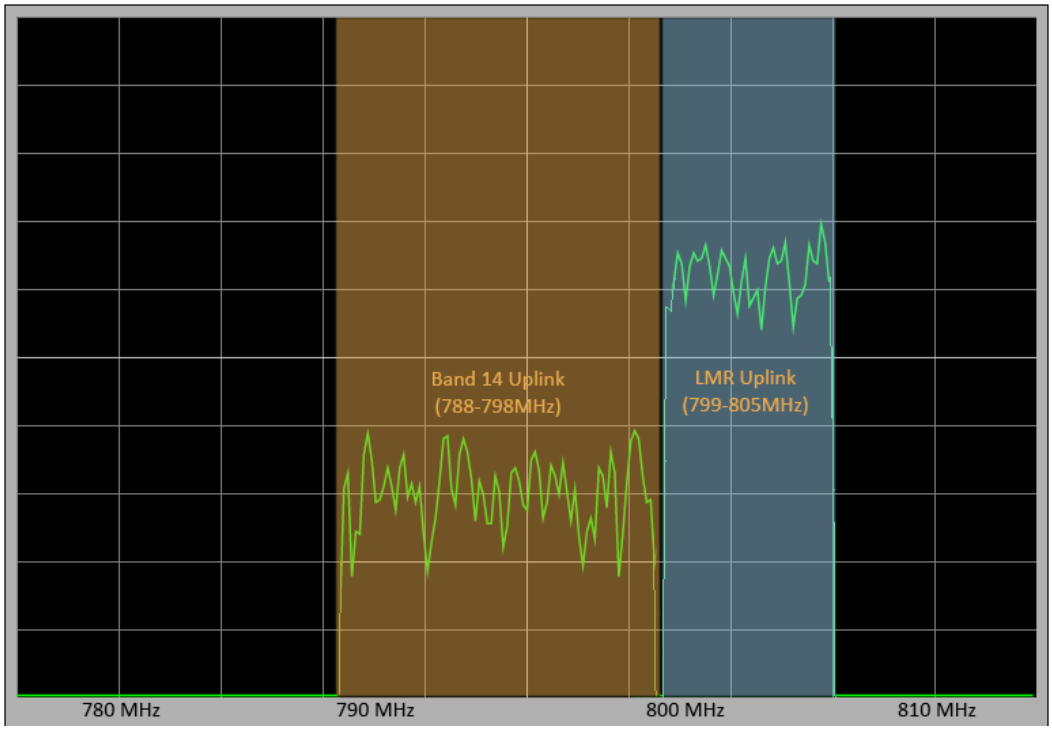

Figure 2.

If the LMR uplink signal is received by the FirstNet Base Station, any LMR out of band noise floor could be injected into that FirstNet Band 14 U/L signal generating poor or unusable FirstNet services and network.

What is the solution to either or both of these problems? Comba Telecom offers specialized filters that are installed between the LMR donor antenna and the LMR BDA that will ensure that the LMR services and FirstNet services can live together, without any chance of negative impact to either network or service – thereby assuring first responders of excellent service from both of the services. If you want to look further into these filters – they are Comba part numbers FP-78-IN1 and FP-78-IN2.

Ensuring FirstNet signals do not interfere with LMR mission-critical voice communications is vital to a properly designed and operating in-building public safety system. If you have questions about FirstNet or about any of Comba Telecom's public safety products including the rejection filters mentioned above, please contact your Comba sales representative for more information.

[1] - AT&T Expects to Hit 60%, 80% FirstNet Buildout Milestones 6 Months Ahead of Schedule
- https://www.rrmediagroup.com/News/NewsDetails/newsID/18328

[2] -Office of Unified Communications D.C. In-Building Technical Requirements
- https://ouc.dc.gov/sites/default/files/dc/sites/OUC/page_content/attachments/3-0-DC-In-Building-Radio-System-Technical-Requirements.pdf