Communication Architecture

1828 Cherry St.
Jacksonville FL 32205
Phone: 904 386 3082
Ron Lindsey <comarch@aol.com>
Web: www.strategicrailroading.com

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To: The Federal Communications Commission

Re: WT Docket No. 11-79, In the Matter of Spectrum Needs for the Implementation of the Positive Train Control Provisions of the Rail Safety Improvement Act of 2008

Comments

I am an independent consultant in the rail industry, meaning that I neither do sales for nor accept commissions from suppliers. My 38+ years in the industry include Director (Chief Engineer) Communications (wireless) and Director Advanced Traffic Control for Class I railroads. In the latter position I conceived and directed the development of the first overlay PTC system that provided the primary foundation for the current PTC systems being pursued by the freight railroads to meet the 12/31/2015 PTC mandate as stated in the Rail Safety Improvement Act of 2008. In addition to my ongoing involvement with PTC, I have performed market studies and held strategy sessions regarding wireless for Class I railroads, major suppliers, and the FRA. My credentials as to PTC and wireless technologies in the railroad industry are provided as an Attachment to this submission.

I have been commissioned by the Skybridge Spectrum Foundation to submit an objective analysis of the use of the 220 MHz band for PTC. As such, this submission addresses two primary points:

First, I am providing below a brief understanding of PTC as to it designs, capabilities and benefits. This is critical to do so as to ensure objectivity when addressing 220 and PTC in that there continues to be an unfortunate amount of disinformation being put forth by those with an unjustified bias to implement PTC, including suppliers and even the FRA.

Second, I am providing a brief understanding of the use of wireless technologies in the railroad industry in general, and the applicability of 220 band for PTC specifically.

PTC: WHAT IT IS … AND WHAT IT ISN'T

To understand PTC first requires an understanding of the three categories of systems that are used by railroads, both freight and passenger, in various configurations across the globe.

1. **Traffic Control** systems provide for the integrity of train movements, of which there are two primary types: signaled and non-signaled. These systems are responsible for

providing the *movement authorities* (permission) to trains to advance without conflict with the movement of other trains. The primary role of traffic control systems is to avoid accidents due to errors that train dispatchers could make in routing trains manually. These systems are often referred to as being "vital" given their purpose of providing for safe operations.

2. Traffic Management systems are being increasingly used by railroads to increase the efficiency of the traffic control system in effect. That is, traffic management systems provide for the business perspective of running a railroad by advising train dispatchers how to improve the efficiency of the traffic control system that provides for the safety. These systems are advancing now in the U.S. given the substantial increase in rail traffic in the last decade, largely due to rapid growth in intermodal traffic, thereby minimizing the investment railroads would otherwise need to make in infrastructure and equipment.

3. **Enforcement** systems are used to prevent train crews from exceeding the time, distance, and speed parameters of the movement authorities generated by the traffic control system. Enforcement systems enhance the safety of operations, but are not vital. That is, if the enforcement system is not operational, then trains can proceed safely given the traffic control system in place. Additionally, enforcement systems do not affect the efficiency of movement authority generation, as does traffic management, and therefore provide no business benefits.

From the Federal government standpoint, PTC is synonymous with enforcement system. While there are a number of enforcement systems across the globe, PTC from a U.S. freight railroad standpoint refers to a singular type of enforcement system that is required to be interoperable across all freight, commuter, and regional transit systems that operate jointly on the nation's infrastructure. That is, the PTC systems that are being pursued by the U.S. freight railroads differ substantially from the "PTC" system that is installed on Amtrak, which is referred to as ACSES (Advanced Civil Speed Enforcement System). For purposes in this submission, the term PTC will refer only to those systems being pursued by the freight railroads.

As mandated, PTC has 4 core objectives: 1. Keep trains from hitting trains; 2. Keep trains from overspeeding; 3. Keep trains from endangering workers in work zones; and 4. Keep trains from moving through mis-aligned switches.

As to design, PTC is a *locomotive-centric* system that operates outboard of the traffic control and traffic management systems. That is, when movement authorities are generated by a traffic control system, either in the dispatching office or from equipment along the wayside, then the parameters are automatically sent via wireless data to the on-board PTC platform. The on-board platform then uses positioning data, e.g., GPS, to determine the train's position relative to the speed, distance, and timing of the set of authorities currently active for the train. This is a continuous calculation by the on-board platform to ensure that the braking capability of the train is sufficient for each authority. Should the on-board system determine that the train may exceed an authority in some fashion, then the train driver is given a warning to bring the train within its braking capability, e.g., by slowing the train. Should the driver fail to respond effectively within sufficient time, then the on-board PTC platform activates the train's braking system thereby bringing the train to a stop prior to the movement authority being violated.

As noted earlier, PTC as an enforcement system only does not provide for business benefits. Where much of the confusion on this issue comes from is first purposeful misrepresentation by

some parties, but also by the inability of some to separate the functionality from the technology. That is, PTC is an application that requires a wireless data system. Advanced traffic management is an application that also requires a wireless data system, and a very simple one at that. Hence, installing PTC is one way to get the necessary wireless platform for advanced traffic management. But, PTC does not deliver those business benefits. The case in point is that NS has implemented a very simple data system, without and before PTC, and is realizing such business benefits.

There continues to be confusion across the industry and various agencies as to PTC being vital or not (This can be a critical issue for testing and accepting PTC). This confusion is exasperated by the fact that one version of the PTC systems being pursued by some freight railroads is referred to as VPTC, with the V meaning vital. The truth here is that functionality of PTC is not vital, but the on-board platform on which the application resides is designed in a vital fashion, thereby indicating a very high reliability as to the equipment not failing.

PTC & WIRELESS

As noted above, wireless data networks are used to transmit the movement authority parameters to the on-board platform. Below, I list a number of issues relative to the use of wireless for PTC in general, and the issues associated with 220 specifically relative to PTC.

- Depending upon the type of traffic control system in place, as well as the level of traffic density, the transmission of movement authority parameters (a.k.a. targets) for an individual train can be as infrequent as an hour apart and as frequent as every 5 minutes. In any event, this is not *real-time* transmission and certainly not challenging for even moderate private or commercial wireless systems.

- Without going into in-depth detail, it should be noted that most of the Class I railroads are pursuing a PTC system design that significantly exceeds the requirements of the PTC mandate as to handling what is referred to as intermediary signals (ISs). It is not clear why they are doing so, but such a design would seemingly contribute to their justification for a complex wireless data network such as that being designed by the railroads using 220. In fact, not only are the ISs not required to be incorporated, but one Class I railroad is planning to use its current wired and wireless networks to connect both the ISs and the remaining portion of the PTC wayside infrastructure referred to as *control points*. This alternative method of communication avoids a substantial investment in a 220 network that would have otherwise been required. All Class I railroads have this same capability available to them to a great extent.

- To my knowledge, there has been no data demand analyses made as to PTC requirements. Regarding this point, I recently questioned a consultant in a management position responsible for the wireless network to implement Metrolink's PTC system. He stated that there had been no data load analysis made. I have no reason to believe that any other railroad has made such an analysis, at least not one that would support the need for 220 in consideration of other wireless options that railroads have, as explained below in **RAILROADS' WIRELESS**.

- Approximately a decade ago, UP was pursuing the implementation of a ***Precision*** Train Control (PTC™), which was to be the combination of the most advanced traffic control system (referred to as moving block), traffic management, and enforcement. PTC™ failed partially due to the phenomenal complexity of the wireless data platform that could not be cost-effectively deployed at that time. Unfortunately, the confusion between PTC™ and PTC has contributed to the misunderstanding of the latter as to its capabilities and the necessary wireless data requirements.

- Neither the PTC mandate nor the associated FRA rulemaking make any statements as to the design or technologies to be deployed in implementing PTC. This includes no statement as to the wireless technologies or spectrums to be used

- The PTC on-board platform includes a mobile access router (MAR) that permits the use of multiple wireless bands.

- Just as the Class I railroads plan to do as to having multiple wireless paths available for PTC, as provided for by the MAR, so will passenger operators be able to do so without purchasing or sharing the 220 MHz network. While they will need to have access to 220 when operating on some of the Class Is, they are free to use what they have available when on their own property.

- The 220 MHz band was purchased prior to the PTC mandate. Several Class Is that did not participate in that purchase had planned to use other existing wireless services, both private and commercial

RAILROADS' WIRELESS

I have performed studies and held strategy/tactical sessions on the use of wireless in the rail industry for nearly two decades, both as rail management and as a consultant.
Arguably, the most notable and applicable to this submission are the following:

1. I was commissioned by the FRA in 2007 to perform an extensive study on the demand and supply of wireless in the rail industry. This study involved a large number of interviews and work sessions with railroad personnel, both technicians and operations management, as well as suppliers.

2. I was engaged by the Skybridge Spectrum Foundation in 2011 to write a white paper "Wireless for Railroads", partially in consideration of the effects of the PTC mandate on the railroads' use of wireless.

The results of two of those activities are summarized briefly below, as well as the reports being provided as Attachments to this submission: *Wireless Study-Lindsey.pdf* and *Wireless Report.pdf,* respectively

- The railroads' primary wireless band, 160-161 MHz that is used primarily for voice, is subject to the FCC's refarming (narrowbanding) Point & Order. This mandate requires splitting of the channels by 2013, with a subsequent split as some to-be-determined time. For the industry, this means replacing an estimated 250,000 radio units. Some

railroads initially planned to replace the analog equipment with analog equipment that could handle the initial split. Fortunately, however, the decision was made to go a digital platform in the light of the second split. Unfortunately, the railroads elected a conventional radio approach instead of a trunked radio network which would have been ideal for the most congested portions of the industry's operation, i.e., major metropolitan areas. As the result of this decision, the efficiency of the 160-161 band is substantially less than it could have been. Hence, there is little doubt from my standpoint that if the railroads went to a digital trunked operation, then the data requirements of PTC could be readily handled with the 160-161 band.

- There appears to be no strategic perspective of the use of wireless by many if not all of the Class Is individually, yet alone together as an industry. That is, the plan to use and design a sophisticated 220 network has become the default wireless network for the future of the industry without any analysis, or justification, of what is actually required. Implementing 220 along with the narrowband 160-161 will result in two parallel, powerful wireless networks across the industry supporting only voice and a modicum of data applications it seems. As noted in both of the referenced reports, the railroads can achieve substantial business value with very simple wireless data systems, and without implementing PTC. The proof of this is, again, the success of NS in deploying a simple wireless system to report the position of trains, thereby permitting them to implement advanced traffic management systems.

- BNSF had purchased the Meteorcomm network with the intention of using it for its PTC system, ETMS. That spectrum is available nationwide and can readily reside on the current tower infrastructure that the railroads have for their 160-161 and 900 MHz networks.

- With 220's inferior propagation capability compared to 160-161 MHz, the railroads will be required to add additional towers to some extent to build a parallel wireless network.

- The railroads' use of the 900 band, that was originally freely granted by the FCC for an advanced train control system 2 decades ago, would clearly not be required for its current use of supporting relatively low data applications. The railroads' use of the band has already been limited by the FCC by "ribboning" the permitted territory along the railroads' trackage.

In summary as to the use of the 220, there is no need of it for PTC alone, especially in the light of the Meteorcomm 40 Mz band and the opportunity to deploy digital trunking in the 160-161 MHz band to meet the narrowbanding mandate. Clearly, the industry can benefit from an industry-wide network, but that opportunity is not limited to using 220. While the railroads may be able to use the 220 at some future point, I have seen no evidence to date of a strategic demand study being performed by railroads, either individually or collectively, as to how the railroads can advance with 220 or any other band. Sadly, the true cost of the PTC mandate will not just be the installation of the systems across the industry, but also the tremendous lost in business benefits in that the railroads have stalled on advancing their operations so as to meet the PTC mandate.

Lastly, it needs to be stated that the railroads are very safe. As noted in the GAO's report of December 2010 on Rail Safety (GAO-11-133, also attached), the cost of implementing PTC relative to the safety benefits that will be provided over 20 years is 20/1. While I believe that the

cost of PTC can be greatly reduced as noted earlier as to ISs and control points, as well as by avoiding 220 in favor a digital trunked 160-161, the cost / benefit ratio remains an egregious expenditure for the railroads to go it alone without Federal assistance. While the Rail Safety Improvement Act of 2008 was a knee-jerk reaction by Congress to and within less than 2 months of the Metrolink – UP tragedy, it will have one phenomenal effect on the industry that would have been difficult to achieve otherwise. That is, the PTC mandate finally brought the railroads together to pursue a nationwide wireless data network. Unfortunately, I believe the railroads reacted in a knee-jerk fashion as well as to pursuing the 220 without taking on what could be done with digital trunked 160-161 and/or the use of the Meteorcomm network, cellular systems, and perhaps other possibilities such as available via advancing technologies including software defined radio.

My objective in these Comments, as a professional in these areas and a citizen, is to advance the best interests of the nation in wise use of radio spectrum for railroad wireless and safety.

In closing, the Skybridge Spectrum Foundation is willing to sponsor the use of my services to formally or informally meet with FCC to further discuss any of the points provided in this submission, including the attachments.

Sincerely

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Ronald A. Lindsey

Attachments:

Credentials – Ron Lindsey
Wireless Study- Lindsey.pdf (the FRA sponsored study)
Wireless Report.pdf (the Skybridge Spectrum Foundation whitepaper)
GAOFRAtech.pdf