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Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: WT Docket No. 11-79

Spectrum Needs for the Implementation of the Positive Train Control Provisions
of the Rail Safety Improvement Act of 2008

Dear Ms. Dortch,

After reading comments filed by railroads with the FCC regarding Docket No. 11-79, I would like to file the following comments. I am concerned that the commission may not have received enough information in the filings to make an informed decision regarding any potential spectrum changes for supporting the wireless component of Positive Train Control (PTC) as mandated by the Rail Safety Improvement Act of 2008 (RSIA).

I am a communications engineer and I work as a consultant in the communications industry. I am not affiliated with any product vendor, nor am I being requested to provide comments by any license holders of 220 Mega-Hertz (MHz) spectrum or of any other spectrum. Most of the clients I have consulted with are transportation agencies and I have over 13 years experience planning, designing, managing the construction of, and troubleshooting transportation agency communication networks. Many of the networks I have worked on are those of commuter rail operations. My experience includes commuter rail properties on both coasts and I have particular experience with commuter rail use of both Very High Frequency (VHF) voice radio systems and the 900 MHz Advanced Train Control System (ATCS). I hold a Ph.D. in Electrical Engineering (specializing in communications), and I have additional previous experience both in designing industrial process control protocols and in manufacturing and selling radio data modems.

In the interest of full disclosure, I will state that I am an FCC licensed amateur radio operator. However, I do not operate any equipment in the 219-220 MHz segment, as permitted on a secondary basis by frequency sharing agreements in FCC rule 97.303.

COMMENTS

My comments address several issues that the Wireless Telecommunications Bureau (WTB) requested information on in Docket 11-79. Each issue I have comments for is discussed separately below.

Issue 1: The WTB states in Docket 11-79 that "*The Bureau seeks comment from stakeholders regarding the frequency bands and amount of spectrum needed to successfully implement PTC."*

After reading through the comments submitted by the railroads under this docket it is my opinion that at this time the commuter railroads do not have a compelling reason to use the 220 MHz band for implementing PTC. The commuter railroads that filed comments have indicated that they must use the same band that the freight railroads are using to be interoperable with them and to save money by avoiding the installation of two radios instead of one.

The commuter railroad's reasoning for the use of 220 MHz is not compelling for several reasons. First, based on my experience helping develop cost estimates for installing radio equipment on board commuter rail vehicles, when all of the complexities associated with making the necessary PTC rail vehicle modifications are considered, the cost impact of the addition of a single radio to each vehicle will be small. Indeed, when the mitigating factors presented below are considered there may be no cost difference at all. Since none of the filers quantified this cost impact it is difficult to assess its significance.

Second, there are still questions regarding how interoperability will work and in particular how adjacent territories would hand off rail vehicles that are using the same frequency band to operate their PTC systems. Since none of the railroads have provided simulation results or field trial results in their filings regarding this matter it is also difficult to assess how interoperability is enhanced by using the same band. In fact quite the opposite may be true. Interoperability may be more difficult if adjacent properties, operating different protocols, attempt to use the same frequency band at the same moment in time. PTC-220 LLC echoed this in their filing suggesting that "railroads not wishing to conform to the same protocols used by PTC-220 may not be able to share the spectrum because of the risk of interference created by incompatible protocols[1]." In addition, the use of the same frequency band may require more equipment in the way of filters to address these interference issues. This additional equipment might tend to offset the cost savings argument.

The third reason that the commuter railroad's reasoning for the use of the 220 MHz spectrum is not compelling is that there is a concern that the radio marketplace will not be able to support the demand for radio products if a large number of the nation's PTC implementations simultaneously attempt to procure 220 MHz radios. It may very well be an unprecedented event in the commercial radio products sector complicated by the fact that there is not currently a high demand for 220MHz products. Industry production capabilities would need to be initiated and/or expanded to respond to the procurements. Due to these production ramp-up costs, and due to the significant but short-term high-volume demand of a captured market, the cost of such radios will also likely be higher than that of comparable radios in other bands. This may even reverse any cost savings the commuter railroads are anticipating by using a single radio in the 220 MHz band. Without any supportive radio market data from the filers, it is difficult to thoroughly assess this aspect of the issue as well.

[1] Page 8, PTC-220, LLC comments regarding FCC Docket 11-79, filed June 20, 2011.

The FCC also requested comments on the amount of spectrum needed to implement PTC. I was disappointed to learn from the filings that more than two and a half years after RSIA took effect, many of the railroads still only have at best a rough estimate of the amount of spectrum they will need to implement PTC. Most of the filers did not indicate that they had any simulation data or test data regarding this matter. References were made in the filings regarding a Transportation Technology Center, Inc study and a Transportation Research Board project. Both efforts are expected to yield results regarding the complex urban environment and how much spectrum is needed. However, neither report is expected prior to the three year mark since the RSIA was passed. In my opinion, the urgent requests from the railroads for the FCC to secure spectrum for them and expedite waivers are somewhat muted at this stage of the process by their inability to more accurately identify exactly what they need.

Issue 2: The WTB states in Docket 11-79 that *"The Bureau further recognizes that PTC system functionalities and components may differ depending upon the frequencies and amount of spectrum available, so we seek information regarding how the use of different frequencies and amounts of spectrum could affect the functionalities and components of a PTC system. We also seek input regarding how aspects of various rail operations affect the amount of spectrum or frequencies needed to successfully implement PTC."*

From reading the filings it appears that the approach to implementing PTC that the commuter railroads are taking is to implement a wireless real-time process control network, tailored for their own more stringent operational environments, by adopting the technologies and protocols of a similar but less stringent implementation. Most of the northeast corridor commuters who filed comments have indicated they will use Amtrak's current version of the Advanced Civil Speed Enforcement System (ACSES II), while other commuters have indicated they will use the Interoperable Electronic Train Management System (I-ETMS) developed by the freight railroads. In both cases, the protocols in question were developed for rail operations with less frequent and less dense train operations than that of many of the commuter railroads who plan to use them. While there are significant advantages to this approach, there are significant risks. It would seem prudent in such a situation to establish through detailed simulations and field trials that the protocols to be adapted are appropriate for the more stringent commuter rail operation in question. These efforts would yield valuable input toward answering the question regarding the exact amount of spectrum that is needed to successfully implement PTC.

Many of the filers have indicated that they have determined that they will require either 12.5 kHz or 25 kHz channel widths at 220 MHz to implement PTC. In the absence of any design or simulation data or other justification for this requirement, it appears based on ACSES II and I-ETMS and the associated 220 MHz products available in the marketplace. Several of the filers also indicated that they would need a minimum of one of these channels per location and would be able to support either 12 or 24 trains. There are several concerns regarding these statements and again without simulation results it is difficult to assess whether the design approaches are sound. Characteristics such as redundancy and latency need to be considered and there are very few indications in the filings that the associated design criteria necessary to support PTC on the more stringent commuter railroad operations are being met by these channel plans.

One significant area of concern regarding how much spectrum will be needed and in particular whether one channel per location will suffice is the impact of propagation anomalies on operating a wireless real-time process control network. It did not appear that any filer addressed this significant issue in their stated plans for the spectrum they will need. Propagation anomalies such as tropospheric ducting and sporadic E-layer

ionospheric refraction are extremely difficult anomalies to completely design around in VHF systems. At least one commuter railroad I have designed radio systems for has recognized this in the past and modified their design approach by installing VHF voice radio base stations at lower heights to avoid the effects of tropospheric ducting. In addition, CSX, along with their consultant ARINC, determined that to combat interference effects due to tropospheric ducting on their 900 MHz ATCS network they would at times need to disconnect every other ATCS base station in the problem area[2]. This effectively removed their system redundancy and therefore reduced their reliability. Clearly a real time process control network cannot operate optimally if these anomalies are not considered in the design process.

There is also apparently no discussion in the filings from the railroads on consideration of the use of their existing spectrum to assist in implementing PTC. Since ATCS will effectively be replaced by PTC, the existing 900MHz channels that support ATCS should be considered for use by PTC. In addition, it may be possible to use the 160 MHz channels that the railroads use for voice radio operations. It is my understanding that several years ago the TTCI developed a channel plan for moving to 6.25 kHz voice channels that includes the possibility of trunking in urban areas. Perhaps this plan could be adapted to also support some PTC implementations and implemented now. It should also be noted that the specifications for ATCS already include provisions for using 160 MHz channels for train control as an alternative to 900 MHz channels in low density locations[3]. Since the railroads are mobilizing to install PTC train borne radio systems there is an opportunity to leverage that planning effort and installation labor to assist in migrating voice radios to 6.25 kHz now, simultaneously achieving further narrowbanding of the railroad's VHF channels (a probable event forecast by the FCC, although no date has been set) and providing some room for PTC to be implemented within the railroad's own allocations where they already coordinate spectrum.

Issue 3: The WTB states in Docket 11-79 that *"We seek comment regarding whether it is possible for railroads or industry participants that already hold spectrum rights to facilitate PTC implementation for railroads, which are not currently FCC licensees or lessees, operating on the same track or in the same geographic area (e.g., urban area or FCC license area)."*

At the end of my comment replies in issue 2 above, I indicated that there may be alternatives to consider for implementing PTC within the railroads own spectrum. The FCC migrated the 900 MHz ATCS channels to a +/- 70 mile ribbon license in 2001 facilitating industry wide coordination by the American Association of Railroads (AAR). Conversely, in 2007 the FCC chose not to migrate the VHF voice radio channels to a ribbon license when a similar request was made by the AAR. Should the 160 MHz channels now be considered for PTC, it may be prudent to revisit the commission's 2007 decision. Putting the AAR in charge of assigning and coordinating these frequencies for all railroad agencies would streamline the process of implementing PTC.

[2] Duard R. Williams, Barry R. Metzger, Gregory M. Richardson, "Spec 200 Radio Code Line Ducting – Cause and Effect", AREMA 2001 Conference and Exposition, http://www.arema.org/files/library/2001_Conference_Proceedings/00050.pdf

[3] Page K-II-16, Section 3.1.3.7.1.1, Manual of Standards and Recommended Practices, Section K-II, Railway Communications, Association of American Railroads, 2002.

CONCLUSIONS AND RECOMMENDATIONS

From the filings presented, it appears that the railroads have not yet developed their designs to the point where they can accurately speak to spectrum needs. They appear also to have not investigated in detail how interoperability will perform when operating dissimilar PTC protocols in the same band. There is also very little indication that the railroads investigated the use of their own spectrum to support PTC. The lack of presented test data, after specifically being requested by the FCC to provide it, is particularly unsettling at this stage of the development of PTC.

It is my recommendation that before the FCC approves any request to make substantial changes to any spectrum bands that might be used to accommodate PTC they should require the railroads to provide detailed supportive data for the request. This type of supportive data should be readily available as a component to any successful wireless communication design process. The data should include test results and summaries from protocol simulations, interoperability simulations, propagation studies, field tests, spectrum resource studies, and even radio product market studies. In the interest of advancing the process and helping the railroads meet the RSIA deadline, the FCC is encouraged to engage the industry and possibly conduct workshops or conferences on the matter, to ensure that the issues regarding spectrum use and PTC are thoroughly vetted in an expeditious manner. Such events would also help ensure that the railroads understand what is expected of them in justifying requests to secure additional spectrum, or to modify their current spectrum, for a new service such as PTC.

It is also hoped that the Federal Railroad Administration (FRA) will review these filings and understand their culpability in allowing two and a half years to pass since the RSIA became law without the railroads having accurately defined their spectrum needs. Being focused primarily on the more important safety aspects of PTC, none of the FRA PTC plan deliverables require the railroads to address the details of how they will implement the wireless aspects of PTC[4], a challenge clearly identified in last year's Government Accountability Office report on the matter[5]. This review may lead the FRA to consider options regarding how the railroads will eventually comply with the December 31, 2015 deadline.

Please feel free to contact me to discuss these issues further.

Respectfully,

Brian T. Kopp, Ph.D.

Owner, The Semaphore Group

[4] Code of Federal Regulations, Title 49, Subpart I, Positive Train Control Systems.

[5] United States Government Accountability Office, Report to Congressional Committees, Rail Safety: Federal Railroad Administration Should Report on Risks to the Successful Implementation of Mandated Safety Technology, at 2 (Dec. 2010) (GAO Report).