

Metrom Rail, LLC
Experimental STA Request
June 30, 2017

Narrative Statement

Pursuant to Section § 15.519 of Subpart F of the Commission's rules, 47 C.F.R, Metrom Rail, LLC respectfully requests temporary authority ("STA") for a six-month period, commencing as soon as possible, for outfitting fixed installation Ultra-Wideband equipment along rail lines. Metrom Rail, LLC is committed to the advancement of Ultra-Wideband technology specifically in regards to rail transit safety products. Metrom Rail, LLC requests to test and demonstrate a prototype system in a variety of scenarios and locations.

Applicant

Metrom Rail, LLC
1125 Mitchell Court
Crystal Lake, IL 60014
FRN: 0025086000

Subpart F - Ultra-Wideband Operation

Subpart F outlines regulations for unlicensed, ultra-wideband transmission systems. The Commission's rules prohibit the use of antennas mounted on outdoor structures or any fixed outdoor infrastructure per section § 15.519, section 2.

The central technology in the AURA System is Time Domain's PulsON 440, FCC ID NUF-P440-A. The PulsON 440 (P440) meets all Subpart F requirements. With the current development effort, Metrom Rail, LLC is requesting temporary authority to mount the P440 radio with a directional antenna on the wayside of transit rail. Due to the experimental nature of the testing, the UWB waysides will be moved around to various locations along the rail line and not permanently installed.

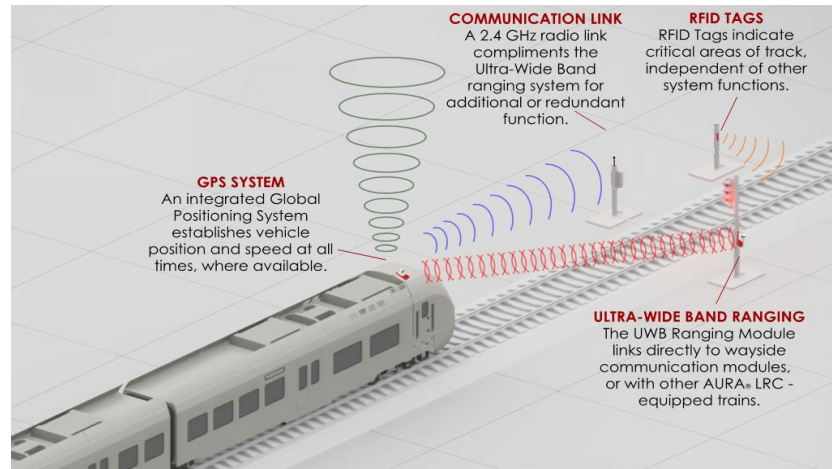
It is Metrom Rail, LLC expectation that testing during this 6-month period will prove that the AURA System serves the public interest while not interfering with other licensees' operations. Data generated and test reports will be made available to the FCC, NTIA, or any other applicable federal agency, as requested. The prototype testing reports will be utilized to request a permanent waiver for fixed infrastructure for transit and short-line rail applications. Metrom Rail, LLC expects limited yearly deployments of the ultimate product.

The Ultra-Wideband technology is the only technology that provides the multipath robustness, precision range measurement, and accuracy needed to ensure public safety while not compromising passenger capacity of the transit system. Metrom Rail, LLC has considered a variety of alternate technologies including narrowband radio at both 900MHz and 2.4MHz as well as alternate time-of-flight technologies including chirp spread spectrum and frequency hopping spread spectrum. The P440 solution is the only solution on the market today that meets all system requirements.

Description of Operations

Metrom Rail, LLC develops and markets rail safety equipment. The AURA system, which is currently in development, provides signal compliance, end of track protection, speed limit enforcement, collision avoidance,

and personnel protection. The system consists of multiple technologies including ultra-wideband ranging. Metrom Rail, LLC has utilized the same technologies for vehicle-to-vehicle collision avoidance in Class 1 maintenance-of-way vehicles for five years and over 3,000 vehicles.



Both the train and wayside will include the UWB ranging module and a 2.4 GHz communication link. The wayside will interact with the signal and communicate signal aspect to the train. Providing up-to-date signal aspect information with real-time distance to the signal allows the train system to determine whether to brake. For end of track and personnel protection, the wayside will communicate the appropriate scenario as well as closing distance allowing the train system to determine when to stop.

Extensive testing at the Metrom Rail, LLC headquarters in Crystal Lake, Illinois is required during development of the system. Ranging is accomplished using ultra-wideband technology with a directional antenna. The UWB antenna contains redundant, vertically polarized antennas with a GPS receiver fixed on a ground plane above the directional antenna. The directionality of the antenna coupled with the narrow pulsed, UWB technology spread over 1 to 2 GHz of bandwidth (3.1-5.3GHz), with low power transmission ensures that the signal will not cause interference with existing radio frequencies.

Metrom Rail, LLC has been awarded a Proof of Concept demonstration to the Massachusetts Bay Transportation Authority (MBTA), RFP Number 24-16. The Proof of Concept demonstration on MBTA property is anticipated this fall (2017). To successfully trial this new system, Metrom Rail, LLC will need to temporarily test fixed-location UWB antennas along the wayside of train lines.

The Proof of Concept will consist of in-depth testing of all functionalities including stopping a train when customer rules are violated. The Proof of Concept will consist of testing train-to-train UWB communication to stop a train prior to a collision. Additional testing will encompass train to wayside communication to stop a train if the signal is red, if the end of the track is approaching, if the operator is speeding, or if the operator is at an unsafe speed approaching a work zone.

Testing will require mounting UWB transceivers and signals at a variety of locations along the MBTA Green Line. These fixed location UWB transceivers will communicate with train mounted UWB transceivers. Both transceiver types, wayside and train mounted, will be connected to a highly directional antenna, both in elevation and

azimuth, which will focus the RF energy along the track ahead of the train. The tracks have restricted access, are owned by the government, or are underground in subways where UWB system will not penetrate walls or floors. The system will be installed and tested by trained personnel.

Additionally, Metrom Rail, LLC is in communication with Los Angeles to demonstrate the signal compliance functionality of the system in the fall of 2017. Fixed location UWB antennas are required for the completion of the tests. This demonstration will concentrate on signal compliance and braking the train if the train operator fails to properly respond to a restrictive (red) signal.

Dates of Operation

Metrom Rail, LLC requests STA for 6 months, commencing as soon as possible. Metrom Rail, LLC anticipates testing of temporarily mounted RF devices in Crystal Lake, IL is expected for the entirety of the 6-month license. The Proof of Concept demonstration on MBTA Green Line is anticipated to be held from September to December 2017 and the demonstration of the Los Angeles Expo Line is scheduled for August 2017.

Classes of Stations

Metrom Rail, LLC proposes to operate directional, Ultra-wideband transmission from 3.1-5.3GHz at fixed terrestrial locations along the wayside of transit rail lines and predetermined testing locations.

Locations of Proposed Operations

Metrom Rail, LLC requests authority to conduct the proposed assessment throughout the continental United States. As noted above, Metrom Rail, LLC will coordinate the deployment and operation of its RF transmitters in advance with the FCC and NTIA, as may be required.

Development testing will be in a 6 to 25 km radius of Crystal Lake, IL including a testing site in Huntley, IL. Fixed UWB transceivers on the wayside will communicate with moving transceivers on the train. Testing will include a variety of antenna heights but none over 6m.

In Boston MBTA, the fixed location wayside antennas will be temporarily placed throughout the Green Line on or near existing signal and switching structures. The structure heights are variable, typically between 2-12 feet, and the antenna will sit directly on top of the structure at a height of approximately 6 inches.

For the demonstrations in Los Angeles, California, the fixed location wayside antennas will be mounted on or near existing signals, on temporary tripods, raised between 5-7 feet. The antenna will sit on top of the temporary structure at a height of approximately 6 inches.

Site	Latitude	Longitude	Average Radius (km)	City
MRTST001	42.2105	-88.2887	10	Crystal Lake, IL
MRTST002	42.2261	-88.4914	10	Huntley, IL
MRTST003	42.3366	-71.2537	15	Boston, MA
MRTST004	42.3489	-71.0970	10	Boston, MA
MRTST005	34.0565	-118.2559	25	Los Angeles, CA

The proposed assessment will involve the procurement, deployment, and operation of radio transmitters in fixed locations in the 3100-5300 MHz band. Metrom Rail, LLC will coordinate the development and operation of

the radio transmitters at those locations in advance with the FCC and NTIA, as may be required, including the frequencies and power levels used.

Metrom Rail, LLC will work in corporation with the FCC, NTIA, and other interested federal agencies to develop specific assessment plans, including identifying the specific locations for the deployment of radios and the relevant operating parameters, allowing the representatives of those federal agencies to observe and participate in the assessment, as well as grant federal agencies access to reports generated.

Public Interest Basis for STA

A timely grant of STA would enable Metrom Rail, LLC to begin testing as soon as possible and thus gather data that can be used to advance several important product goals.

The Ultra-Wideband functionality of the PulsON 440 (P440) module provides Two-Way Time-of-Flight ranging to measure between two or more P440s with an accuracy of better than 2cm. This accuracy allows precision determination of distances between trains or between trains and signals which translates to better braking algorithms and safer performance, particularly during “double-berthing” operations where trains park at station within feet of each other.

The PulsON 440 is currently certified under FCC Part 15, Subpart F for unlicensed ultra-wideband transmission systems and used in conjunction with Section § 15.503 (m) as portable devices. Under these guidelines, Metrom Rail, LLC has launched over 3,000 Collision Avoidance products on Class 1 railway’s maintenance-of-way vehicles throughout North America. During this time, the number of accidents experienced has decreased from hundreds to zero when the Collision Avoidance system is in operation. This elimination of collisions is preserving lives, avoiding injuries, and saving millions of dollars in equipment damage. This system also utilizes a co-located GPS antenna immediately next to the UWB antenna and a 2.4 GHz data link, and have operated for cumulative millions of hours without interference.

Train accidents result in loss of life and property damage. The Metrom Rail, LLC solution mitigates the risk of accidents by enforcing customer’s existing operating rules. The system can be deployed in a cost effective and accurate manner. The use of UWB technology allows for extremely accurate ranging without sacrificing network throughput and is highly resistant to multipath and other challenging RF environments.

For these reasons, expeditious grant of this STA would serve the public interest and enable Metrom Rail, LLC to gather data on a timely basis that will facilitate the assessment of UWB by the FCC, FRA, NTSB, and other federal agencies.

Equipment to be Used

Metrom Rail, LLC will utilize Time Domain’s P440 radio transmitter, FCC ID NUF-P440-A, for accurate ranging between trains and trains and signals. This radio transmits pulsed Ultra-Wideband (UWB) RF energy in occasional, brief bursts. During an UWB transmission burst, the pulses are sent using a 10 MHz repetition rate, with a duty cycle of less than 1%, at a power spectral density of 25 nanoWatt/MHz. The pulses are shaped to spread the signal over a bandwidth of 1 to 2 GHz in the 3.1 GHz to 5.3 GHz band.

Ranging is completed using a Two-Way Time-of-Flight technique. Pulses are received and decoded using coherent signal processing to improve the signal to noise ratio of the received signals. Independent communication channels are established by pseudo-random encoding and modulating the phase, position,

and/or repetition rate of the pulse train. Due to the extremely brief pulses as well as the low power transmission, the signal appears like background noise and is spread evenly over 1 to 2 GHz of bandwidth.

Metrom Rail, LLC has developed a directional, ultra-wideband antenna specifically designed for rail applications. The antenna consists of two, vertically polarized antennas that operate independently for redundancy. The antennas are highly directional, propagating the signal directly down the tracks. Above the UWB antennas, a GPS antenna sits on top of a ground plane.

Metrom Rail, LLC has completed preliminary testing in a lab environment with the antenna to classify the antenna performance. Preliminary testing shows a 70-degree elevation beam width and a 60-degree azimuth beam width. Metrom Rail, LLC plans to fully test and certify the antennas with the PulSON 440 at a FCC accredited laboratory once the experimental testing is complete and the antenna is accepted.

Type of Emission and Bandwidth

In the 3.1-5.3G band, Metrom Rail, LLC will operate with the following:

Type of Emission: 2G00P1D

Bandwidth: 2GHz

Metrom Rail, LLC has specified the emission designator and calculated the necessary bandwidth in accordance with Sections 2.201 and 2.202 of the Commission's rules.

Overall Height of Antenna(s) Above Ground

Testing of the system will mimic heights of train signals. These heights will not extend 19 feet tall.

Contact Information

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