

Metrom Rail, LLC
Experimental STA Request
September 18, 2018

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.

The New York MTA is investigating ultra-wideband for a variety of safety applications and has requested a demonstration of Metrom Rail's products. Metrom Rail, LLC is committed to the advancement of ultra-wideband technology in rail transit safety.

Applicant

Metrom Rail, LLC
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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 on the wayside of transit rail.

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.

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 currently provides transit safety systems incorporating Ultra-Wideband technology. The technology is pulse based, low energy and uniquely tolerant of multi-path environments. The technology is applied in Metrom Rail's products to perform time-of-flight distance measurements which are used to establish equipment location relative to transponders or to other equipment. The distance information is processed in real time to

prevent collisions and to ensure compliance to signals and location based rules. For the demonstration in New York, Metrom Rail will establish the location capabilities of the UWB technology and the ability of the system to carry data. The demonstration will implement Ultra-Wideband nodes to provide ranging anchors and to establish an ad-hoc network for data delivery.

The train will include the UWB ranging module and a 2.4 GHz communication link. The wayside will include UWB ranging module only. These fixed location UWB transceivers will communicate with train mounted UWB transceivers and provide real-time location of the train. The train mounted transceiver 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 wayside transceiver will be connected to the omnidirectional antenna that was FCC certified for the radio module.

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.

Extensive testing at the Metrom Rail, LLC headquarters in Crystal Lake, Illinois is required during development and testing of the system. Ranging is accomplished using ultra-wideband technology with a directional antenna on the train and either a directional or omnidirectional antenna on the wayside. The directional UWB antenna contains redundant, vertically polarized antennas with a GPS receiver fixed on a ground plane above the 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. The omnidirectional antenna is a single antenna with the same spread and power.

Metrom Rail, LLC has been awarded a Proof of Concept demonstration on the MTA Lexington Line in Brooklyn, NY. The Proof of Concept demonstration is anticipated in Spring 2018. To successfully trial this new system, Metrom Rail, LLC will need to install fixed-location UWB antennas in the subway and on one above-ground location along the wayside of train lines.

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 the MTA Culver Test line is anticipated to be held from mid-October to December 2018.

Classes of Stations

Metrom Rail, LLC proposes to operate omnidirectional, 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.

Site	Latitude	Longitude	Average Radius (km)	City
MRTST001	42.2105	-88.2887	10	Crystal Lake, IL
MRTST002	42.2261	-88.4914	10	Huntley, IL
MRNY001	40.6709	-73.9900	15	Brooklyn, NY

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.

Time Domain's BroadSpec elliptical dipole antenna that was FCC certified with the Pulson 440 will be used on the wayside.

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.

Waiver Request

Metrom Rail has submitted a Request for Waiver for New York and Boston. It is anticipated that this will be the final STA required.

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