UNITED STATES DISTRICT COURT
DISTRICT OF DELAWARE

Metrom Rail, LLC Plaintiff, v. Siemens Mobility, Inc., Thales Transport & Security, Inc., Thales USA., Inc., Humatics Corp., and Piper Networks, Inc, Defendants.	No. _____ **DEMAND FOR JURY TRIAL**

COMPLAINT

Metrom Rail, LLC ("Metrom") alleges the following:

SUBJECT MATTER JURISDICTION

1. This action arises, in part, under the patent laws of the United States, Title 35 of the United States Code. This court has subject matter jurisdiction under 28 U.S.C. §§ 1331, 1332, 1338, and 1367.

PERSONAL JURISDICTION

2. Defendants Siemens Mobility, Inc. ("Siemens"), Thales Transport & Security, Inc., also d/b/a Thales Transport or Thales GTS, and Thales USA, Inc. (collectively, "Thales"), Humatics Corp. ("Humatics"), and Piper Networks, Inc.

("Piper") are all domestic Delaware corporations subject to general personal jurisdiction in Delaware.

VENUE

3. Venue is proper under 28 U.S.C. Sections 1391(b)-(d) and 1400(b).

4. Joinder of the Defendants in this action is proper under 35 U.S.C. § 299 because the claims herein arise from a common nucleus of operative facts related to the same transaction or series of transactions.

BACKGROUND

5. Metrom Rail, LLC ("Metrom") is a pioneer in the area of decentralized train control with Ultra Wide Band ("UWB") technology. Founded in 2010, Metrom is an Illinois Corporation with a headquarters in Lakemoor, Illinois.

6. Railroad equipment is heavy and can travel at speeds over 80 miles per hour while pulling railcars filled with people. While generally very safe, accidents do happen. And, because of the sheer size and speed that trains can travel, the results of an accident can be devastating.

7. Metrom has developed the innovative "AURA" system and other worker and railway equipment protection products using UWB for new and existing rail systems. Metrom's products are designed, built, and tested in Illinois.

8. Historically, railroads have implemented complex and expensive systems to avoid accidents. Despite these systems, accidents still occur, and the traditional suppliers of signal systems have not fielded low cost, reliable train control systems for precisely locating and controlling commuter trains in high traffic, urban rail environments.

9. In 2012, Metrom introduced its first AURA brand product and the first commercially successful application of UWB in the railroad environment, a collision avoidance system for railroad maintenance of way ("MOW") vehicles.

10. Railroad MOW equipment is especially subject to collisions because the equipment tends to operate in groups of small but independently powered and operated vehicles in "work trains" with close spacing. For example, a series of machines for performing different kinds of maintenance on the rail bed, cross ties, and rails. Collisions are surprisingly frequent, since workers are focused on their maintenance work, sightlines on the equipment are poor or obstructed, and the equipment is operated in close proximity with frequent starts and stops.

11. Metrom's collision avoidance technology solved the problem of MOW collisions by equipping each unit with UWB radios that accurately determine the range to the MOW vehicle ahead and automatically warns the operator or brakes the MOW equipment if the operator does not act within a margin of safety. Metrom filed

for and obtained patents on this system, including U.S. Patent Nos. 8,812,227 and 9,043,131.

12. Since its introduction, Metrom's AURA system has been installed on over 3,000 railroad maintenance vehicles in the U.S. and Canada with overall reductions in incidents of 90% or greater and no collisions between equipped vehicles when the system was properly installed, maintained, and used, avoiding countless injuries and saving millions of dollars in equipment damage.

13. Metrom also pioneered and demonstrated worker safety systems that allow real time alerts to the operators of equipment and MOW workers on the tracks regarding the presence of approaching trains. Metrom has been awarded a series of patents for those innovations including U.S. Patent Nos. 10,179,595 and 10,737,709.

14. In 2013, Metrom began exploring ways to expand its successful collision avoidance system to the mass transit context. Urban mass transit is an environment with some characteristics similar to the MOW environment, with close headways and high numbers of trains. At peak periods, it is desirable for transit agencies to allow trains to run as close together as possible.

15. Traditional signal control for mass transit rail divided train lines into a series of fixed track segments ("blocks"), with complex, cumbersome equipment designed to prevent two trains from entering the same fixed section of track at the

same time. Smaller blocks allow for higher volume but each block adds additional signals, controls, and points of failure for maintenance.

16. In the 1980s, systems that allowed for "moving" blocks that allowed a moving buffer region before and after a train were developed. Defendants Siemens and Thales are two of a handful of companies in the world that offer these systems for transit agencies. Their offering in the U.S. is known as "Communications Based Train Control" or CBTC. In order to meet safety requirements, legacy CBTC systems employed complex networks of track side equipment that communicated train status to a central control point, which communicates authority to operate to each train. The technology is subject to large positional errors, is prone to failure, and while it is an improvement on fixed block systems, is very costly for even small improvements in performance.

17. The problems were especially acute for the New York MTA ("MTA"), which by 2017 attributed 30% of its major incidents to signal issues. At that time, more than 40% of the signaling equipment in the MTA was also more than 50 years old.

18. The MTA and its sub-units, including New York City Transit, are organized as New York public benefit corporations that are not immune from suit under the U.S. Constitution, Amendment XI.

19. An illustration of CBTC complexity and cost is MTA's "Flushing" line. The MTA budget for converting Flushing to CBTC was $588 million, and the project took 9 years to complete 10.5 miles of track from June of 2010 to March of 2019. The project is at least 5 years late and $157 million over budget.

20. Responding to increasingly severe quality of service issues, in 2017 the MTA solicited "genius" applications from the public for solutions to its ageing, outmoded, and inefficient centralized CBTC system and even older "fixed block" signaling infrastructure. Metrom responded to that invitation with Metrom's design for a system using UWB technology that accurately and continuously resolved train position at the vehicle level and supplied that positioning information in vehicle for immediate application to train control, greatly reducing position errors and communication delay and allowing for higher frequency and more reliable train operation at a lower cost. Metrom referred to its solution as "Positive Train Control System based on Ultra-Wideband for Communications and Location" or PTCS-2, since Metrom's solution provided the high level of automated control and safety in preventing unsafe train operation with decentralized command authority based on the train. Metrom's proposal was selected by the MTA as a "Genius" challenge finalist in December of 2017 and a Genius challenge winner in March of 2018. http://www.mta.info/press-release/mta-headquarters/mta-announces-8-winners-mta-genius-transit-challenge.

21. The success of Metrom's technology with the MTA was a threat to Defendants Siemens and Thales existing business with the MTA. At that time, Siemens and Thales were promoting a multi-billion dollar retrofit of the NYCT system using their existing CBTC technology, which was developed in the 1980s and was effectively unchanged since that time. Metrom's solution obsoleted billions of dollars of legacy trackside and in-cab equipment that supports CBTC resulting in no justification for the MTA to purchase that equipment if Metrom's solution was fully implemented. Metrom's PTCS-2 system cost half as much with higher reliability and superior operational performance.

22. Siemens began a campaign to interfere with the technically superior Metrom offering by filing a patent application dated August 8, 2017 claiming a collision avoidance solution using UWB, international application number WO 2019/030018 ("WO '018"), that appears to be an attempt to file on the same collision avoidance technology that Metrom had already patented. Siemens' application has not been allowed in any jurisdiction, and the primary references cited against allowance of that application are Metrom's patents.

23. The WO '018 application is not the only patent application filed by Siemens attempting to claim inventorship for inventions developed and patented by Metrom and disclosed to Siemens by Metrom. Siemens has also filed, naming as

inventors two of Siemens' employees who had been working with Metrom, at least three other patent applications that claim inventions previously disclosed to Siemens by Metrom or already disclosed by Metrom's patents and pending applications. Those cases are United States application number 16/516,456 ("Train Control System and Train Control Method Including Virtual Train Stop"); 16/778,529 ("Ultra-Wideband Work Train Protection"); and 16/778,595 ("Ultra-Wideband Based Vital Train Tracking").

24. Siemens' declarations and course of prosecution in its previously filed cases, filed with knowledge of Metrom's patent position, are admissions by Siemens' agents that Metrom's earlier patents directed to the same inventions are not obvious or anticipated in view of art that Siemens was aware of when Siemens' later applications were filed.

25. Metrom's initial "Proof of Concept" demonstrations of Metrom's technology to the MTA in 2017 and 2018 were compelling. Metrom's solutions were awarded "Genius" prizes by the MTA, and were so compelling that Metrom's technology and architecture was the basis for the MTA's first large scale pilot demonstration RFP in 2019 for upgrading the decaying MTA signal infrastructure.

26. Metrom's general equipment arrangement is shown below, including power, operator interface, dual redundant controllers, vehicle host interface, vehicle interface, and UWB radio modules:

27. Metrom's advanced train control solutions are the subject of a number of Metrom patent applications, including the application issued as U.S. Patent No. 10,778,363 on September 15, 2020.

28. Thales, historically the second source for MTA train control equipment, engaged with Metrom on a proof of concept demonstration using UWB in 2018 after Metrom was selected as a "Genius" winner by the MTA.

29. Siemens did not do a Proof of Concept demonstration using UWB, but did convince Metrom to join with Siemens in an unsolicited joint proposal to the MTA for a train control system for the MTA "Lexington" line, using Metrom's technology.

30. Late in 2018, the MTA asked Metrom to submit its own proposal based on Metrom's Proof of Concept demonstrations, for the next "pilot demonstration phase."

31. The MTA's pilot demonstration RFP then issued with a series of amendments between January 15 and February 7, 2019, also referred to herein as the "Pilot RFP" or "NYCT RFP." The RFP, No. W-81199, was based on Metrom's pioneering system design.

32. Because the MTA requested a bid from Metrom without Siemens and Thales, and because Siemens and Thales lacked any significant experience with UWB signaling as contemplated by Metrom's winning architecture, Siemens and Thales partnered with UWB radio suppliers. Siemens partnered with Defendant Humatics, and Thales partnered with Defendant Piper to submit bids. Siemens/Humatics, Thales/Piper, and Metrom were the only three bidders for the Pilot RFP.

33. In February of 2018, Defendant Humatics acquired a company known as "5D", which had in turn acquired a company known as "Time Domain". Time Domain was a long-time manufacturer of UWB radios, was Metrom's supplier for UWB radios for at least the prior five years, and was accordingly familiar with Metrom's unique requirements and specifications for the railroad environment.

34. Despite Metrom's pioneering patent position and first mover technical leadership, however, the MTA awarded the pilot demonstration projects to its entrenched incumbent signal equipment suppliers, Defendants Siemens and Thales. While the final award removed some aspects of Metrom's Proof of Concept system to make it easier for Siemens and Thales to comply with the bid requirements, the MTA retained features developed, proven, demonstrated, and patented by Metrom.

35. Siemens has a history of using improper means to secure business. In 2008, Siemens was fined $800,000,000 by the SEC for violations of US law in connection with the payment of bribes to foreign officials, and ultimately eight Siemens executives and agents were charged with violations of the FCPA. https://www.justice.gov/opa/pr/eight-former-senior-executives-and-agents-siemens-charged-alleged-100-million-foreign-bribe.

36. A reasonable opportunity for discovery is likely to show that Siemens evades MTA rules on lobbying and doing business with the MTA by former employees, by having former MTA or Siemens employees establish themselves as consultants, funding their businesses with agreements with Siemens, and then using them to lobby the MTA on issues of interest to Siemens.

37. Siemens is motivated to maintain the status quo and exclude a disruptive supplier. Siemens or its affiliates have 2,500 employees in New York,

with a large number of them dedicated to supporting an enormous installed base of unreliable, obsolete, and expensive legacy signal equipment for the MTA.

38. A reasonable opportunity for discovery is likely to show that one or more Defendants conspired with the RFP authors to alter the RFP and issue an RFP "addendum" favorable to Siemens, which was intentionally withheld from Metrom so that Metrom had no opportunity to timely amend Metrom's proposal.

39. A reasonable opportunity for discovery is likely to show that Siemens has acquired dominance in the market for signaling equipment for the MTA; and its practices in writing equipment specifications and RFPs for the MTA, contracting with former employees of the MTA, and appropriating the technology of disruptive competitors has stifled competition in that market.

40. Siemens and Thales conspired with their partners Humatics and Piper to mimic Metrom's technology and take the MTA UWB signaling business.

41. Metrom promptly protested the award of the Pilot Project on various grounds, including the facts that Metrom had an exclusive IP position in the system that the RFP requested bids for, Defendants had no demonstrated history or experience in fielding UWB based controls for a rail system, and Defendant Siemens had not participated in any UWB proof of concept system for the MTA or any other customer at any time. Metrom's protest was not successful.

42. A reasonable opportunity for discovery is likely to show that Metrom was not the high bidder.

43. A reasonable opportunity for discovery is likely to show that as Defendants gained experience with UWB implementation, the Defendants' have offered more features covered by Metrom's patents, and that as the MTA builds out its new signaling infrastructure, Defendants will supply or intend to supply those features, or are promising to supply them in order to keep the entirety of the MTA signal business for themselves. Unless enjoined, the total value of those contracts over time is expected to reach over seven billion dollars.

44. A reasonable opportunity for discovery is likely to show that Defendants are preparing to bid on the first complete signal replacement of one or more of New York's 15 subway lines, at an estimated cost on the order of $200-400 million per line.

45. The MTA RFP will require the winning bidder to implement Metrom's proprietary, patented technology to deliver all of the features sought by the MTA.

46. A reasonable opportunity for discovery is likely to show that further contracts will follow, as the MTA eventually replaces all of the signaling on all 15 of its subway lines with systems covered by Metrom's patent claims.

47. A reasonable opportunity for discovery is likely to show that the systems Defendants are offering will be capable of implementing additional features covered by Metrom's patents, and that the future capability to implement those features are offered for sale by Defendants and are a material aspect of Defendants' bids and the MTA's selection.

48. The MTA accounts for 60% of the dollars spent on transit infrastructure in the United States each year and has plans to spend over 7 billion dollars in the next few years on new signaling and train control systems. Without an injunction against the Defendants, Defendants will have permanently displaced Metrom and all other competitors from the single largest market for Metrom's technology, depriving Metrom of not just the initial sales of signal equipment but ongoing maintenance and support, as well as a reference installation that is an invaluable sales tool for convincing other transit agencies to adopt Metrom's technology.

49. Because the New York MTA alone comprises more than half the market in the U.S. for signaling equipment for dedicated rail transit systems, MTA suppliers acquire an immediate advantage over competitors in scale and first mover advantage, since other metro rail systems look to the MTA for reference designs.

50. Defendant Siemens is already a dominant participant for signal equipment for the MTA, with Thales consistently taking a minority share to satisfy

"dual source" requirements. A reasonable opportunity for discovery is likely to show that Siemens has consistently taken 60-70% of the MTA's train control business annually, with Thales accounting for the balance, and as a practical matter because Siemen and Thales control the specifications for train control opportunities, it is very difficult for a small innovator to bid on subsequent follow-on orders for those systems.

51. Nationally, Siemens is by far the largest market participant for signaling equipment sold to transit agencies for heavy rail.

52. Siemens' patent infringement has allowed Siemens to maintain its duopoly for MTA signal equipment, and raises a dangerous probability that Siemens will obtain a monopoly position in the balance of the U.S. transit agency heavy rail market for advanced signaling systems. Defendants' actions have suppressed the technical pioneer for UWB train control from the U.S. railway mass transit market, raised prices for advanced signaling systems, and slowed the adoption of a disruptive technology.

53. The monetary and business damage to Metrom, absent an injunction, is enormous, potentially threatening Metrom's survival as a company and is irreparable if allowed to continue. A preliminary injunction is necessary to preserve the status

quo and allow Metrom to compete for the delivery of the very systems that Metrom pioneered.

54. Defendants, and their customer the MTA, have actual notice of Metrom's patent rights, including at least by correspondence from Metrom dated June 24, 2019. That letter explicitly identified the '227, '131, and '595 patents, and the applications that led to the '363 and '709 patents. A reasonable opportunity for discovery is likely to show that Defendants have monitored Metrom's patent activity, submitted art anonymously in pending patent applications, and agreed to indemnification agreements specifically concerning Metrom's patent rights. A reasonable opportunity for discovery is also likely to show that Metrom's patents have been cited against Siemens' attempts to apply for "me to" patents based on Metrom's demonstrations to the MTA of novel control solutions, and that one or more Defendants has monitored Plaintiff's website that lists Metrom's patents at https://metrom-rail.com/patents.

55. Despite the knowledge of Metrom's patent rights, Defendants did, and a reasonable opportunity for discovery is likely to show will, continue with the acts complained of, knowing and with the intent to have the MTA purchase systems that infringe or would be used by the MTA to infringe Metrom's patent rights.

56. Exhibit F is a true and correct copy of a Piper press release taken from Piper's web site.

57. Exhibit G is a true and correct copy of a Humatics brochure taken from Humatic's website.

58. Exhibit H is a true and correct copy of a Humatics sales sheet taken from Humatic's website.

59. Exhibit I is a true and correct copy of a Piper sales sheet taken from Piper's website.

60. In the claim charts that follow, Metrom identifies a response in the Defendants' systems for each limitation of each identified claim, and each row is an allegation under Fed. R. Civ. P. 8(b)(1)(B) that must be admitted or denied.

COUNT I – PATENT INFRINGEMENT, U.S. PATENT NO. 10,778,363, 35 U.S.C. § 281 – ALL DEFENDANTS

61. The allegations in the preceding paragraphs are incorporated herein.

62. This claim is brought under 35 U.S.C. § 281 and the court has original and exclusive jurisdiction under 35 U.S.C. § 1338.

63. Metrom is the owner of duly issued U.S. Patent No. 10,778,363 ("'363 patent") (Exhibit A) titled "Methods And Systems For Decentralized Rail Signaling

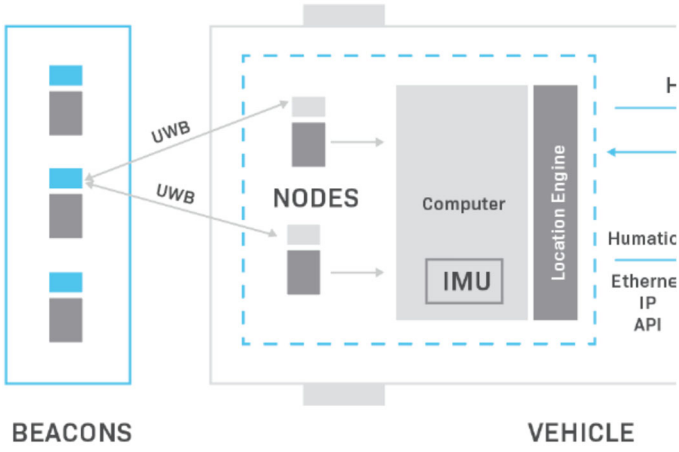
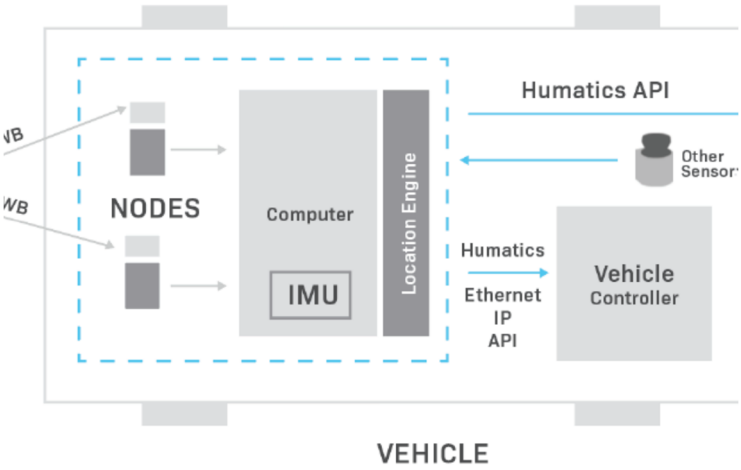
And Positive Train Control" and has been the owner at all times material to this claim.

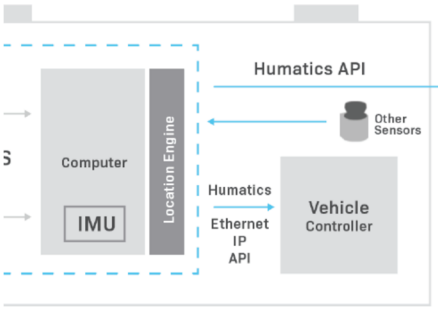
64. Defendants Siemens and Thales are coordinating the installation and maintenance of a rail signaling system using UWB to enable positive train control and other features for the MTA, with their UWB partners Defendants Humatics and Piper, respectively. The ongoing offer and sale of that system includes the "Pilot" project described by the NYCT RFP and a planned series of contracts for full scale implementation scheduled to be awarded from 2022 forward, referred to herein as "Defendants' system."

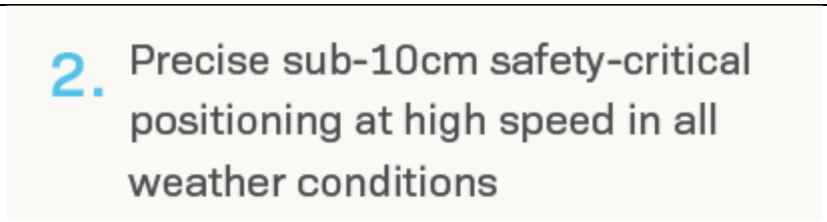
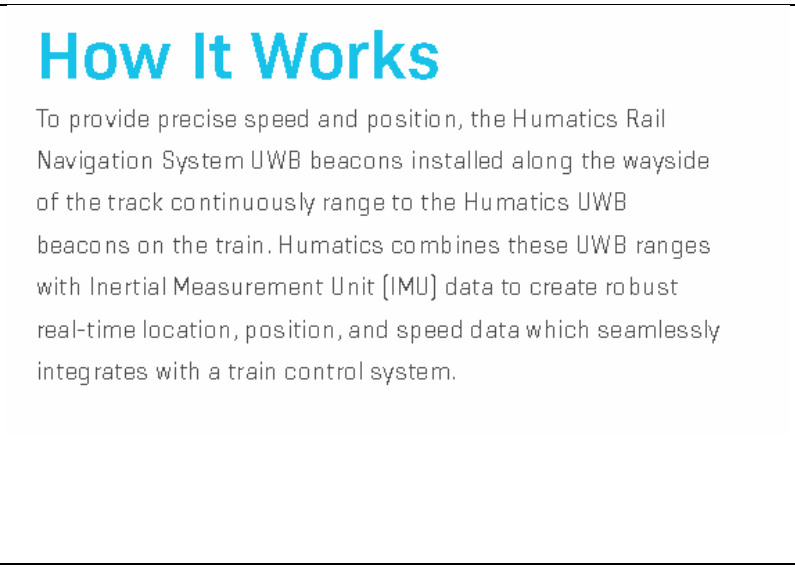
65. Where implemented on the MTA, the system will infringe at least one claim of the '363 patent, either literally or by equivalence, either alone or as installed in the MTA system. The following table[1] recites each limitation of at least one claim and the corresponding response in the accused system:

Claims 1-8, 10, 12-14 of the '363 patent	**Defendants' System**
1. A system for providing decentralized control operations	The MTA UWB system is designed to operate so that the local vehicle controller can pre-empt operation of the train without receiving train command and control information

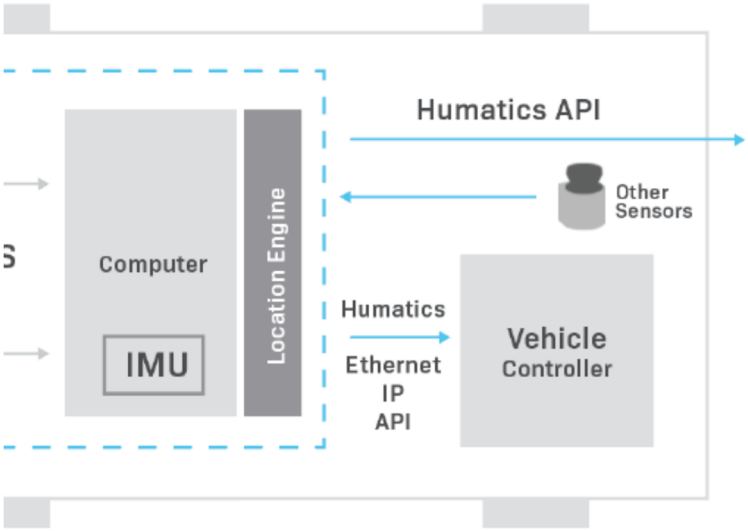
[1] The documents from which the figures and quotes are taken are attached as Exhibits G-I.

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
in a railway network, the system comprises:	from a centralized system, and the functionality is implemented at the vehicle level. Both Siemens (with Humatics) and Thales (with Piper) have installed pilot demonstration systems on the MTA, and a reasonable opportunity for discovery is likely to show that the Thales-Piper combination is equivalent to the Siemens-Humatics installation. Piper press release, January 29, 2020 (Exhibit F).
a. a plurality of wayside units, each configured for placement on or near tracks in the railway network; and	The MTA UWB system includes a plurality of wayside units, called "beacons" or "anchors." 
b. one or more train-mounted units, each configured for deployment on a train operating in the railway network;	

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
c. wherein each train-mounted unit is configured to: communicate with any wayside unit or other train-mounted unit that comes within communication range of the train-mounted unit,	Humatics' Rail Navigation System operates similarly to satellite positioning serving as "terrestrial satellites" and works by continually ranging from carborne beacons to a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels. **AUTOMATIC TRAIN OPERATION (ATO)** Train-to-train UWB ranging provides the ultra-precise high-frequency relative positioning information necessary for vehicle platooning. In addition, train-to-train UWB communication enables the synchronization of braking and traction between trainsets.
d. wherein the communicating comprises use of ultra-wideband (UWB) based signals; and	Through its high-availability and ultra-precise UWB localization network, Humatics enables safety-critical train positioning in all conditions, unlocking a variety of applications including automatic train operations, platooning, advanced driver assistance, platform door control, roadway worker safety, and emergency location services.
e. generate based on the communication, control information configured for use in controlling one or more functions of the train in conjunction with operation	 **SYSTEM ARCHITECTURE** Humatics' Rail Navigation System ha architecture allowing installation wit and on any track, interfacing into vel and systems that depend on safety-c information: CBTC, ERTMS/ETCS, PT

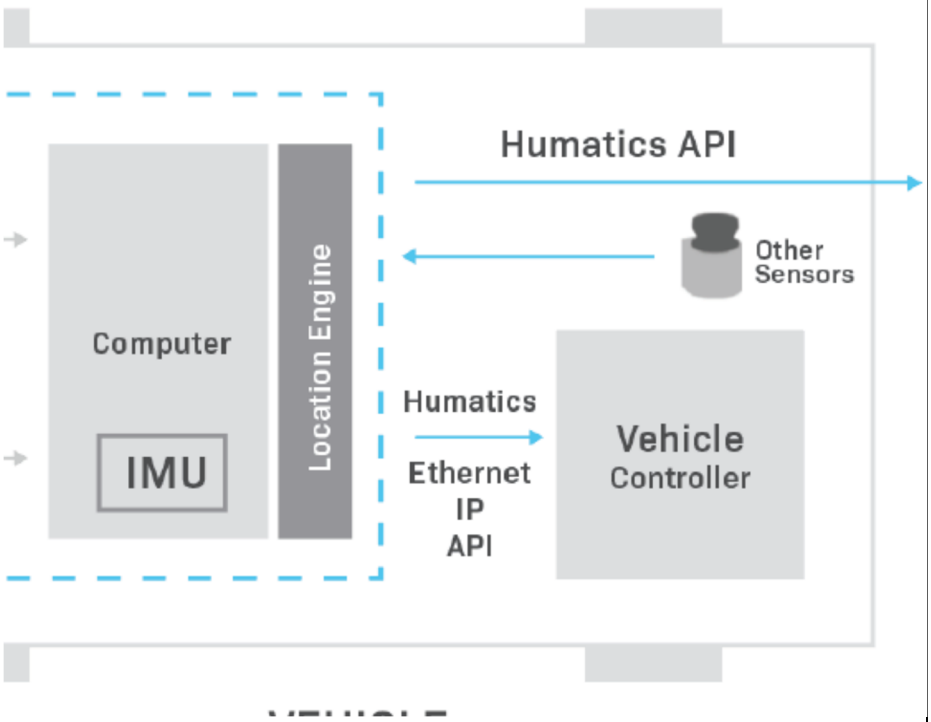
Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
in the railway network,	
f. wherein generating the control information comprises or is based on obtaining ranging measurements, and	
g. wherein obtaining the ranging measurements comprises: broadcasting ultra-wideband (UWB) based signals within a wireless range of the train-mounted unit,	
h. the UWB based signals comprising information identifying the train-mounted unit;	A reasonable opportunity for discovery is likely to show that in order to determine which train is generating the ranging measurement, the UWB based signals include information that identifies the train-mounted unit.
i. selecting based on received responses to the broadcast	A reasonable opportunity for discovery is likely to show that the car borne units select from the responses received, one or

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
UWB based signals, one or more of the plurality of wayside units; and	more of the plurality of wayside units, each of which has a known location in the system. Humatics "success story" MTA video at 1:14 to 1:30, taken from the web at https://www.humatics.com/products/humatics-rail-navigation-system
j. determining ranging information corresponding to each of the one or more wayside units, based on ultra-wideband (UWB) based signals communicated respectively with each of the one or more of the plurality of wayside units.	The Humatics car borne system determines a range to each of the wayside units detected. Humatics "success story" MTA video.

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
2. The system of claim 1, wherein the train-mounted unit is configured to generate at least part of the control information based on sources other than processing of the ultra-wideband (UWB) based signals.	 Flexible sensor fusion with GNSS, Lidar, Eurobalise, and other commonly used odometry technologies
3. The system of claim 2, wherein the train-mounted unit is configured to: assess based on the processing of the ultra-wideband (UWB) based signals, one or more conditions relating to operation of the train within the railway network; when at least one condition meets one or more particular criteria, determine one or more responsive actions; and	The train mounted unit determines the location of the train based on the UWB signals, and when the location is such that a safety envelope for braking is violated, responds by automatically braking the train. b. UWB-based Train Control System is defined as a Train Control System which offers some form of ATO and ATP while utilizing UWB as the primary source for Speed and Position determination, at a minimum. NYCT RFP p.22.

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
perform or cause performing each of the one or more responsive actions.	
4. The system of claim 3, wherein, when the one or more responsive actions comprise providing indication or feedback, relating to the at least one condition, to a train operator, the train-mounted unit is configured to: monitor actions of the train operator; assess based on the monitoring, the train operator's compliance with at least one expected subsequent responsive action; and when the train operator fails to do so, directly perform the at least one expected subsequent responsive action	See dependent claim 3; a reasonable opportunity for discovery will show that the train mounted unit provides feedback to the train operator indicating that braking should commence, and instituting braking if the operator does not institute braking. The Defendants also at least offer for sale the user interface to allow communication with and input from the train operator. **DRIVER ASSISTANCE SYSTEMS** Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
or perform an alternative action.	
5. The system of claim 1, wherein the train-mounted unit is configured for utilizing non-UWB based signals for communicating at least some data with the wayside unit and/or another train-mounted unit.	The Defendants' system also communicates with legacy "zone controllers" that pass information to a central control point and to other trains.
6. The system of claim 1, wherein the train-mounted unit is configured for handling radio-frequency identification (RFID) based signals with RFID devices used within the railway network.	The Defendants' system receives input from RFID tags embedded in the MTA system at predetermined locations in the rail network.
7. The system of claim 1, wherein the train-mounted unit is configured for handling satellite based signals.	The Defendants system includes GPS/GNSS receivers on the trains.
8. The system of claim 7, wherein	The Defendants system incorporates GPS/GNSS information into the "location engine."

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
the train-mounted unit is configured for obtaining from received satellite based signals information, and generating or adjusting the control information based on the obtained information.	 a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels.
10. The system of claim 1, comprising one or more input/output (I/O) components, for receiving input from an operator of the train and/or for providing output to the	A reasonable opportunity for discovery is likely to show that the Defendants' system provides for input/output to the train operator.

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
operator of the train.	
12. The system of claim 1, wherein the train-mounted unit is configured for communicating, directly or via at least one of the wayside unit and another train-mounted unit, with one or more other components or devices in the railway network, the one or more other components or devices in the railway network not being part of decentralized train control system.	The Defendants' system includes an interface to the MTA's centralized train control system.
13. The system of claim 1, wherein the train-mounted unit is configured to substantially continually determine absolute position of the train, based on the ranging information obtained from	The Defendants' system determines position substantially continuously using UWB ranging information, down to as little as 10cm or less. 2. Precise sub-10cm safety-critical positioning at high speed in all weather conditions

Claims 1-8, 10, 12-14 of the '363 patent	Defendants' System
ranging with wayside units.	
14. The system of claim 13, wherein the train-mounted unit is configured to determine the absolute position of the train based on the ranging information and positioning information obtained without ranging to wayside units.	The Defendants' system also incorporates information from other sensors, such as RFID tags, GNSS (GPS), and odometry, which are fed into the train mounted "location engine."

66. Defendants directly infringe the claims by offering and selling their UWB and related components to the MTA, and indirectly infringe by aiding and abetting the MTA in the operation of those systems.

67. A reasonable opportunity for discovery is likely to show that Defendants are offering their infringing system for sale to other transit agencies and using the Pilot project installations as a reference.

68. Defendants are also contributory infringers, because the components sold by Defendants for installation in the MTA system are customized for the MTA's unique requirements and have no substantial non-infringing use.

69. Metrom is entitled to damages adequate to compensate Metrom for Defendants' infringement, as provided by 35 U.S.C. § 284 and in no event less than a reasonable royalty.

COUNT II – PATENT INFRINGEMENT, U.S. PATENT NO. 8,812,227, 35 U.S.C. § 281 – ALL DEFENDANTS

70. The allegations in the preceding paragraphs are incorporated herein.

71. This claim is brought under 35 U.S.C. § 281 and the court has original and exclusive jurisdiction under 35 U.S.C. § 1338.

72. Metrom is the owner of duly issued U.S. Patent No.8,812,227 ('227 patent) (Exhibit B) titled "Collision Avoidance System for Rail Line Vehicles" and has been the owner at all times material to this claim.

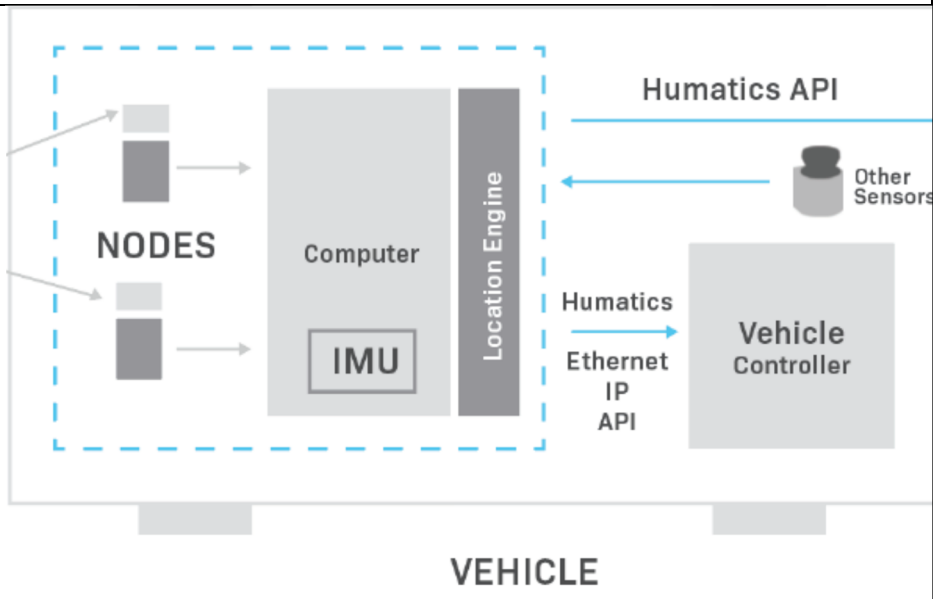
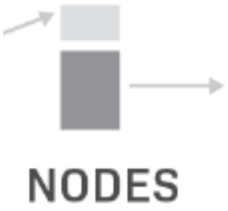
73. Defendants Siemens and Thales are coordinating the installation and maintenance of a rail signaling system using UWB to enable positive train control and other features for the MTA, with their UWB partners Defendants Humatics and Piper, respectively. The ongoing offer and sale of that system includes the "Pilot" project described by the NYCT RFP and a planned series of contracts for full scale implementation scheduled to be awarded from 2022 forward, referred to herein as "Defendants' system."

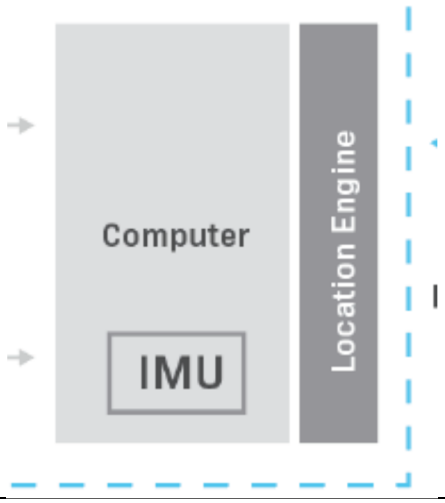
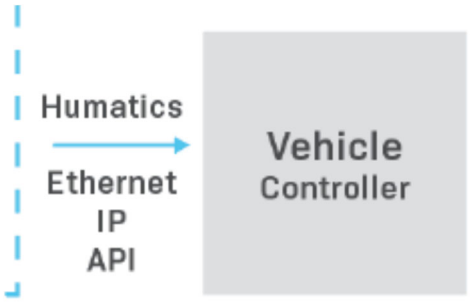
74. Defendants are including, in their offers and solicitations to the MTA and others, collision avoidance features that will warn and prevent train operators from colliding with other trains, using UWB technology pioneered by Metrom, with a significantly higher degree of precision than was possible with prior systems.

75. Collision avoidance is of great interest to the MTA, and a reasonable opportunity for discovery is likely to show that the future availability of this feature with no or minimal hardware changes to the Defendants' installed systems is a factor in awarding contracts to the Defendants.

76. Metrom's '227 patent covers the collision avoidance features that Defendants have offered for sale, will sell, and operate in a UWB system for the MTA, as shown in the following table, either literally or by equivalence, either alone or as installed in the MTA system:

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	**Defendants' System**
1. A collision avoidance system comprising:	The MTA UWB system is a collision avoidance system. Both Siemens (with Humatics) and Thales (with Piper) have installed pilot demonstration systems on the MTA, and a reasonable opportunity for discovery is likely to show that the Thales-Piper combination is equivalent to the Siemens-Humatics installation. Piper press release, January 29, 2020 (Exhibit F).

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
a. one or more vehicle mounted modules, each vehicle mounted module mountable on a rail vehicle, each vehicle mounted module comprising:	
b. a transponder sensor module operable to send and receive data wirelessly, the transponder module comprising a first ultra wideband unit and a first antenna;	

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
c. a control electronics module comprising a processor in communica-tion with at least the transponder sensor module unit; and	
d. a user interface module including a user interface, the user interface being operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator; and	The Defendants' system includes a user interface module mounted on the vehicle, that provides information to an operator and can also receive control information from the operator.  DRIVER ASSISTANCE SYSTEMS Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
e. wherein each vehicle mounted module is operable to	A reasonable opportunity for discovery is likely to show that the vehicle mounted modules will communicate with and range to any other vehicle mounted module that is within range.

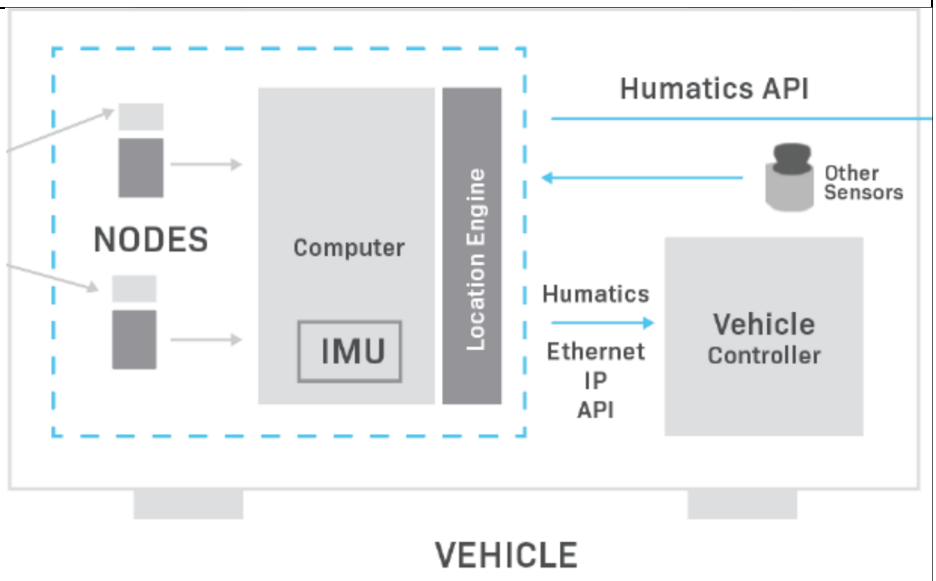
Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
communicate with at least one other vehicle mounted module mounted on at least one other rail vehicle, and	
f. wherein each vehicle mounted module is operable to apply a time of flight technique to determine a separation distance between the rail vehicles.	A reasonable opportunity for discovery is likely to show that Defendants' system determines this distance, based on a time of flight technique.
2. The collision avoidance system of claim 1, further comprising a central tracking unit in communication with the first vehicle mounted module and the second vehicle mounted module,	The Defendants' system also tracks train location centrally, using an external communications system. 

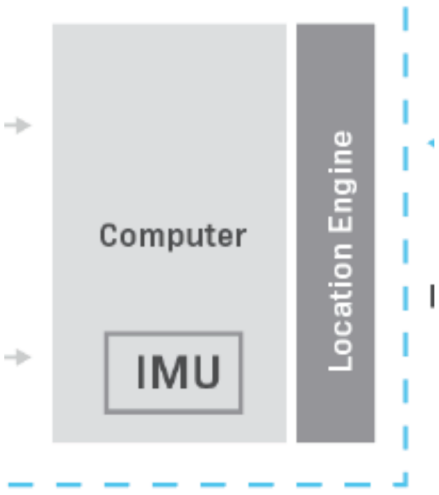
Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
wherein the central tracking unit is operable to track the location of at least the first vehicle mounted module and the second vehicle mounted module.	
7. The collision avoidance system of claim 1, wherein the first vehicle mounted module further comprises a global positioning system unit, the global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the rail vehicle, wherein the global positioning system unit is in communication with the control electronics module.	The Defendants' system includes an "other sensor" that is a GNSS/GPS position input. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels.

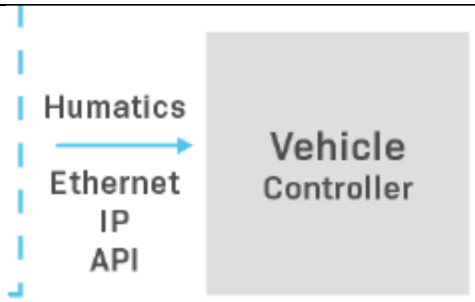
Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
8. The collision avoidance system of claim 7, wherein the first vehicle mounted module receives information generated by the global positioning system unit and the first ultra wideband unit to determine whether one or more vehicle separation criteria are violated, and generates a warning signal when one or more vehicle separation criteria are violated.	The Defendants' system includes an "other sensor" that is a GNSS/GPS position input. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels. The Defendants' system will use GNSS data to supplement position information to avoid a collision.
9. The collision avoidance system of claim 1, wherein the first vehicle mounted module is operable to execute a progressive warning signal if one or more vehicle separation	A reasonable opportunity for discovery is likely to show that the in vehicle operator warnings are progressive.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
criteria are violated, and	
a. wherein the progressive warning signal increases in at least one of signal rate, signal frequency, signal prominence, signal volume, or signal severity as the violation of the vehicle separation criteria approaches or extends beyond a vehicle separation threshold.	A reasonable opportunity for discovery is likely to show that the progressive warning is based on one of these properties (rate, frequency, volume, severity) as separation approaches or exceeds a threshold.
10. The collision avoidance system of claim 9, wherein the first vehicle mounted module executes an adaptive threshold feature that modifies one or more vehicle	A reasonable opportunity for discovery is likely to show that the threshold is adaptive, based at least in part on the speed of the vehicles.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
separation thresholds based on the speed of the first rail vehicle and the speed of the second rail vehicle.	
12. The collision avoidance system of claim 1, further comprising an inertial measurement unit in communication with at least the control electronics module, the inertial measurement unit being operable to detect changes in the speed of the first rail vehicle.	The Defendants' system includes an inertial measurement unit (IMU). 
13. The collision avoidance system of claim 12, wherein the inertial measurement unit comprises at least one of an accelerometer or a gyroscope.	A reasonable opportunity for discovery is likely to show that the IMU includes at least an accelerometer.

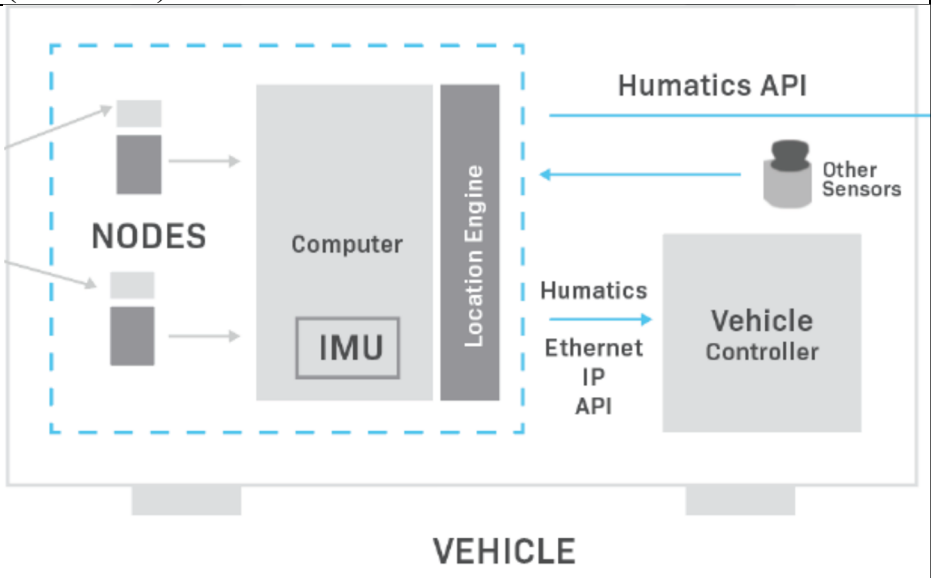
Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
17. A rail vehicle module mountable on a rail vehicle, the module comprising:	
a. a transponder sensor module comprising:	The "nodes' are the transponder sensor module.
b. a radio communication unit operable to employ time of flight techniques to detect a distance between the rail vehicle and at least one other vehicle;	The nodes include an UWB, time of flight radio that detects distance to any neighboring nodes, including nodes on vehicles.
c. a wireless communications antenna operable to send and	The module includes a radio for communicating with a central system, including an over the air antenna.

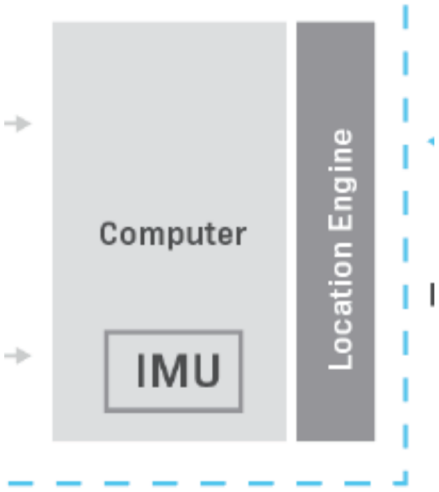
Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
receive data over the air; and	
d. a global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the rail vehicle;	The Defendants' system includes an "other sensor" that is a GNSS/GPS position input. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels. The Defendants' system will use GNSS data to supplement position information to avoid a collision.
e. a control electronics module comprising a processor in communication with at least the first transponder sensor module; and	
f. a user interface module including a user interface operable to provide rail vehicle information to	The Defendants' system includes a user interface module mounted on the vehicle, that provides information to an operator and can also receive control information from the operator.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
a vehicle operator and to receive input from the vehicle operator; wherein the rail vehicle module communicates with at least one other module mounted on at least one other vehicle to detect a separation distance between the rail vehicle and the at least one other vehicle.	 DRIVER ASSISTANCE SYSTEMS Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
18. The rail vehicle module of claim 17, wherein the radio communication unit comprises an ultra wideband unit configured to send and receive ultra wideband signals.	The "Nodes" are UWB units.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
21. The rail vehicle module of claim 17, wherein the rail vehicle module is operable to utilize information generated by the radio communication unit and the global positioning system unit to determine whether one or more vehicle separation criteria are violated, and generate a progressive warning signal if one or more vehicle separation criteria are violated, wherein the progressive warning signal increases in at least one of signal rate, signal frequency, signal prominence, signal volume, or signal severity as the violation of	A reasonable opportunity for discovery is likely to show that the in vehicle warnings are progressive relative to a separation threshold.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
the vehicle separation criteria approaches or extends beyond a vehicle separation threshold.	
22. The rail vehicle module of claim 17, further comprising a central tracking unit component, wherein the central tracking unit component is in communication with a central tracking unit component mounted on the at least one other vehicle.	The Defendants' system also tracks train location centrally, using an external communications system. 
23. The collision avoidance system of claim 16, further comprising an inertial measurement unit in communication with at least the control electronics module, the inertial measurement unit	The Defendants' system includes an inertial measurement unit (IMU).  The IMU includes an accelerometer, which detects changes in speed.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
being operable to detect changes in the speed of the first rail vehicle.	
24. A collision avoidance system comprising	The MTA UWB system is a collision avoidance system. Both Siemens (with Humatics) and Thales (with Piper) have installed pilot demonstration systems on the MTA, and a reasonable opportunity for discovery is likely to show that the Thales-Piper combination is equivalent to the Siemens-Humatics installation. Piper press release, January 29, 2020 (Exhibit F).
a. one or more vehicle mounted modules, each vehicle mounted module mountable on a rail vehicle, each vehicle mounted module comprising:	
b. a transponder sensor module comprising:	The "Nodes" include a transponder sensor module.
c. a radio communication unit operable to employ time of flight techniques to detect a	Each node includes an UWB time of flight radio that measures distance to other UWB radios, including nodes mounted on other vehicles.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
distance between rail vehicles; and	
d. a global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the rail line vehicle;	A reasonble opportunity for discovery is likely to show that the system includes a GNSS receiver. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels. The Defendants' system will use GNSS data to supplement position information to avoid a collision.
e. a control electronics module comprising a processor, the control electronics module being in communicatio n with at least the transponder sensor module; and	
f. a user interface operable to provide rail vehicle	The Defendants' system includes a user interface module mounted on the vehicle, that provides information to an operator and can also receive control information from the operator.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
information to a vehicle operator and to receive input from the vehicle operator;	
g. wherein each of the two or more rail vehicle modules communicate to determine a separation distance between each rail vehicle, and wherein each rail vehicle module is operable to use information provided by the radio communicatio n unit and the	The Defendants' system combines data from neighboring nodes, including nodes on other vehicles, with GNSS data to determine separation and generate a warning if separation criteria are exceeded.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
global positioning system unit to determine whether one or more vehicle separation criteria are violated, and to generate a warning signal if one or more vehicle separation criteria are violated.	
25. The collision avoidance system of claim 24, wherein each radio communication unit comprises an ultra wideband unit.	The Nodes include UWB radios.
26. The collision avoidance system of claim 24, wherein the progressive warning signal increases in at least one of signal rate, signal frequency, signal	A reasonable opportunity for discovery is likely to show that the user warnings are progressive.

Claims 1-2, 7-10, 12-13, 17-18, 21-27 of the '227 Patent	Defendants' System
prominence, signal volume, or signal severity as the violation of the vehicle separation criteria approaches or extends beyond a vehicle separation threshold.	
27. The collision avoidance system of claim 24, further comprising a central tracking unit in communication with each rail vehicle module, the central tracking unit operable to track the location of each rail vehicle module.	The Defendants' system includes a central tracking unit, that monitors the location of multiple vehicles equipped with vehicle modules. 

77. Defendants directly infringe the claims by offering the Defendants' system for sale to the MTA and others, and Defendants Siemens and Thales aid and abet that infringement by assisting the MTA in operation and inducing the MTA to use infringing systems.

78. Defendants are also contributory infringers, because the components sold by Defendants for installation in the MTA system are customized for the MTA's unique requirements and have no substantial non-infringing use.

79. A reasonable opportunity for discovery is likely to show that Defendants are offering their infringing system for sale to other transit agencies and using the Pilot project installations as a reference.

80. Metrom is entitled to damages adequate to compensate Metrom for Defendants' infringement, as provided by 35 U.S.C. § 284 and in no event less than a reasonable royalty.

COUNT III – PATENT INFRINGEMENT, U.S. PATENT NO. 9,043,131, 35 U.S.C. § 281 – ALL DEENDANTS

81. The allegations in the preceding paragraphs are incorporated herein.

82. This claim is brought under 35 U.S.C. § 281 and the court has original and exclusive jurisdiction under 35 U.S.C. § 1338.

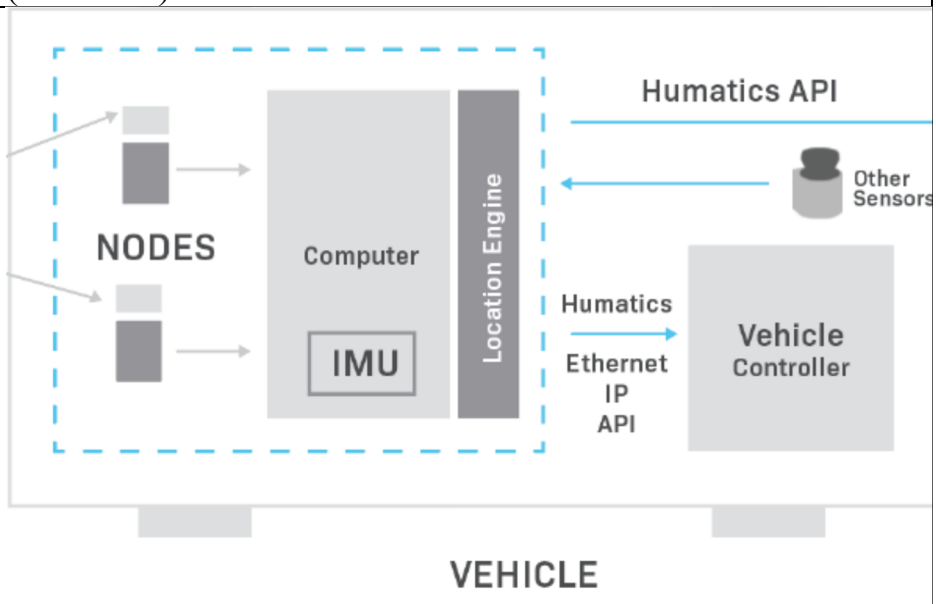
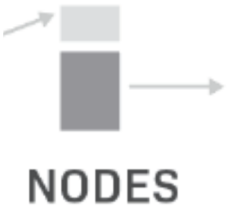
83. Metrom is the owner of duly issued U.S. Patent No. 9,043,131 ("'131 patent") (Exhibit C) titled "Collision Avoidance System for Rail Line Vehicles" and has been the owner at all times material to this claim.

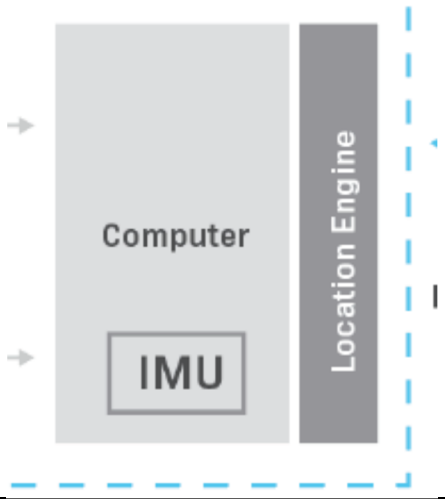
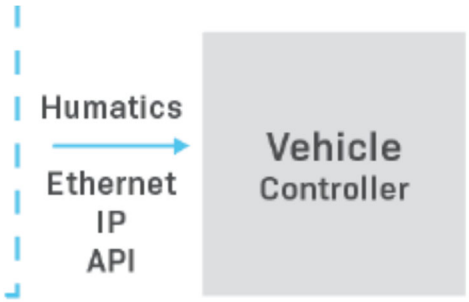
84. Defendants Siemens and Thales are coordinating the installation and maintenance of a rail signaling system using UWB to enable positive train control and other features for the MTA, with their UWB partners Defendants Humatics and Piper, respectively. The ongoing offer and sale of that system includes the "Pilot" project described by the NYCT RFP and a planned series of contracts for full scale implementation scheduled to be awarded from 2022 forward, referred to herein as "Defendants' system."

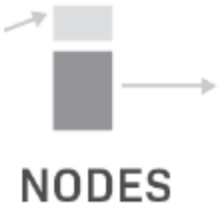
85. Defendants are including, in their offers and solicitations to the MTA and others, collision avoidance features that will warn and prevent train operators from colliding with other trains, using UWB technology pioneered by Metrom, with a significantly higher degree of precision than was possible with prior systems.

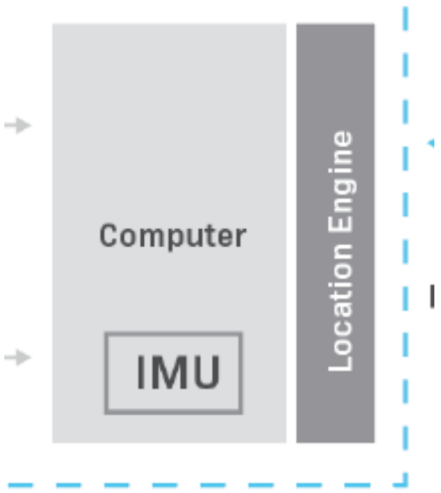
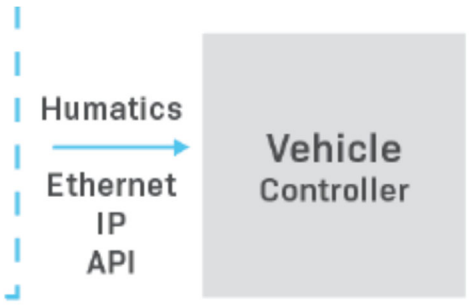
86. Collision avoidance is of great interest to the MTA, and a reasonable opportunity for discovery is likely to show that the future availability of this feature with no or minimal hardware changes to the Defendants' installed systems is a factor in awarding contracts to the Defendants.

87. Metrom's '131 patent covers the collision avoidance features that Defendants have offered to sell, and will sell and operate, in a UWB system for the MTA, as shown in the following table, either literally or by equivalence, either alone or as installed in the MTA system:

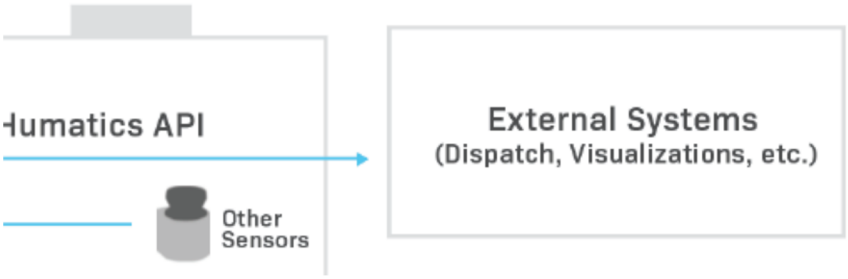
Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	**Defendants' System**
1. A collision avoidance system comprising:	The MTA UWB system is a collision avoidance system. Both Siemens (with Humatics) and Thales (with Piper) have installed pilot demonstration systems on the MTA, and a reasonable opportunity for discovery is likely to show that the Thales-Piper combination is equivalent to the Siemens-Humatics installation. Piper press release, January 29, 2020 (Exhibit F).
a. a first vehicle mounted module mounted on a first rail vehicle, the first vehicle mounted module comprising:	
b. a first transponder sensor module operable to send and receive data wirelessly, the first transponder sensor module comprising a first radio communica-	

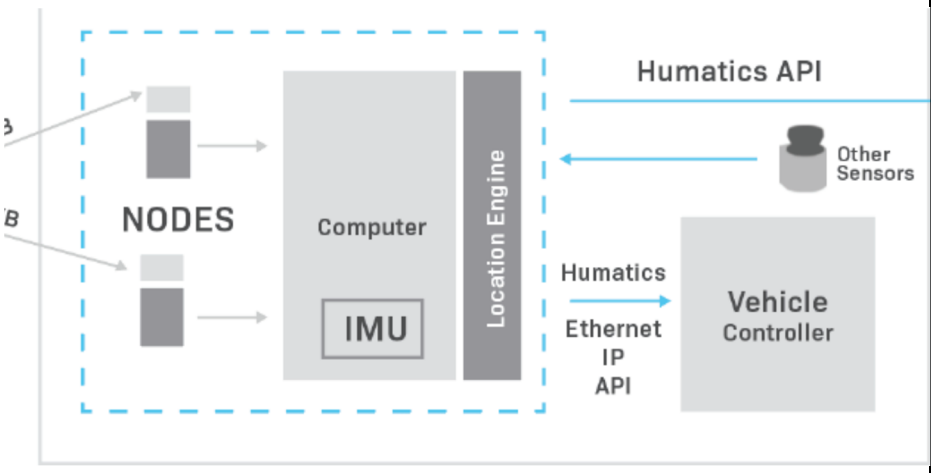
Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
tion unit and a first antenna;	
c. a first control electronics module comprising a first processor in communication with at least the first transponder sensor module; and	
d. a first user interface module including a first user interface, the first user interface operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator;	The Defendants' system includes a vehicle mounted user interface module that provides information to an operator and can also receive control information from the operator.  DRIVER ASSISTANCE SYSTEMS Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
e. a second vehicle mounted	The Defendants' are providing multiple vehicle modules for use on multiple vehicles in the MTA system.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
module mounted on a second rail vehicle, the second vehicle mounted module comprising:	
f. a second transponder sensor module operable to send and receive data wirelessly, the second transponder sensor module comprising a second radio communicatio n unit and a second antenna;	

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
h. a second control electronics module comprising a second processor in communica-tion with at least the second transponder sensor module; and	
g. a second user interface module including a second user interface, the second user interface operable to provide rail vehicle information to the vehicle operator and to receive input from the vehicle operator;	The Defendants' system includes a vehicle mounted user interface module that provides information to an operator and can also receive control information from the operator.  DRIVER ASSISTANCE SYSTEMS Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
h. wherein: the first vehicle mounted	A reasonable opportunity for discovery will show that the accused system was at least offered for sale with this feature, if the feature has not already be enabled.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
module is operable to communicate with the second vehicle mounted module mounted on the second rail vehicle; and	AUTOMATIC TRAIN OPERATION (ATO) Train-to-train UWB ranging provides the ultra-precise high-frequency relative positioning information necessary for vehicle platooning. In addition, train-to-train UWB communication enables the synchronization of braking and traction between trainsets.
i. the first vehicle mounted module and the second vehicle mounted module are operable to apply a time of flight technique to determine a separation distance between the first rail vehicle and the second rail vehicle.	The UWB radios range using a time of flight technique.
2. The collision avoidance system of claim 1, further comprising: a central tracking	The Defendants' system also tracks train location centrally, using an external communications system.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
unit in communication with the first vehicle mounted module and the second vehicle mounted module, wherein the central tracking unit is operable to track a location of the first vehicle mounted module and a location of the second vehicle mounted module.	
7. The collision avoidance system of claim 1, wherein: the first vehicle mounted module further comprises a first global positioning system unit, the global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the first rail	A reasonable opportunity for discovery is likely to show that the vehicle mounted modules include GNSS/GPS positioning. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels.

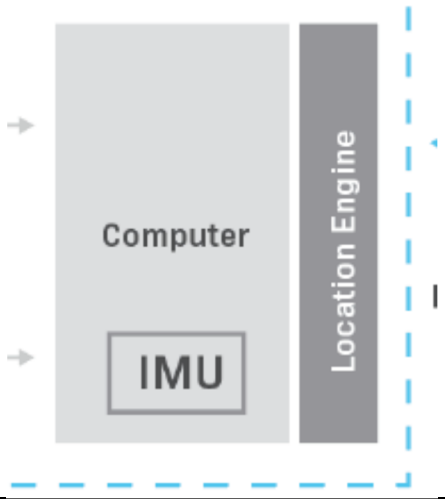
Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
vehicle; and the first global positioning system unit is in communication with the first control electronics module.	
8. The collision avoidance system of claim 7, wherein: the first vehicle mounted module receives information generated by the first global positioning system unit and the first radio communication unit to determine whether one or more vehicle separation criteria are violated; and the first vehicle mounted module generates a warning signal when one or more vehicle separation criteria are violated.	The Defendants' location engine combines GPS ("Other Sensors") and UWB positioning information to generate warning signals. 

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
9. The collision avoidance system of claim 1, wherein: the first vehicle mounted module is adapted to execute a progressive warning signal if one or more vehicle separation criteria are violated; and the progressive warning signal increases in at least one of signal rate, signal frequency, single prominence, signal volume, or signal severity as the violation of the vehicle separation criteria approaches or extends beyond a vehicle separation threshold.	A reasonable opportunity for discovery is likely to show that the in cab collision warnings are progressive.
10. The collision avoidance system of claim 1, wherein the first vehicle mounted module executes	A reasonable opportunity for discovery is likely to show that the warning threshold is adapted based on the rate of change of the distance (speed) between the vehicles.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
an adaptive threshold feature that modifies one or more vehicle separation thresholds based on a speed of the first rail vehicle and a speed of the second rail vehicle.	
12. The collision avoidance system of claim 1, further comprising: a first inertial measurement unit in communication with at least the first control electronics module, the first inertial measurement unit being operable to detect changes in a speed of the first rail vehicle.	The Defendants' system includes an inertial measurement unit (IMU). 
13. The collision avoidance system of claim 12, wherein the first inertial measurement unit comprises at least	A reasonable opportunity for discovery is likely to show that the IMU includes either an accelerometer, gyroscope, or equivalent motion sensor.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
one of an accelerometer or a gyroscope.	
14. The collision avoidance system of claim 1, wherein the first radio communication unit is operable to transmit and receive signals with varying center frequencies.	A reasonable opportunity for discovery is likely to show that the Defendants are implementing the accused system with a Qorvo chip set that includes the ability to vary the center frequency of the UWB signal.
17. A rail vehicle module mountable on a first rail vehicle, the module comprising:	The Defendants' system includes modules mounted on a first rail vehicle.
a. a transponder sensor module comprising:	The Defendants' system includes a transponder sensor module that comprises the following components:
b. a radio communica-tion unit operable to employ time of flight techniques to detect a separation distance	The radio communication unit utilizes a time of flight technique for distance measurement that detects a separation distance between the first and second rail vehicles.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
between the first rail vehicle and a second vehicle;	
c. a first wireless communications antenna operable to send and receive data representing the separation distance over the air;	The UWB node includes an antenna that sends and receives data used to determine the time of flight.
d. a global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the first rail vehicle;	The Defendants' system includes an "other sensor" that is a GNSS/GPS position input. a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
e. a control electronics module comprising a processor in communication with the transponder sensor module; and	
f. a user interface module including a user interface operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator,	The Defendants' system includes a user interface for communicating with the driver and control the train. **DRIVER ASSISTANCE SYSTEMS** Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
g. wherein the rail vehicle module communicates with a second rail vehicle module mountable on the second	Defendants' system is at least capable of this limitation, it is an element of the NYCT RFP, and the Defendants' offer it for sale: **AUTOMATIC TRAIN OPERATION (ATO)** Train-to-train UWB ranging provides the ultra-precise high-frequency relative positioning information necessary for vehicle platooning. In addition, train-to-train UWB communication enables the synchronization of braking and traction between trainsets.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
vehicle to detect a separation distance between the first rail vehicle and the second vehicle.	
19. The rail vehicle module mountable on a first rail vehicle of claim 17, wherein:	
a. the rail vehicle module is operable to utilize information generated by the radio communications unit and the global positioning system unit to determine whether one or more vehicle separation criteria are violated, and	The Defendants' module determines whether at least one minimum distance criteria has been violated.
b. the rail vehicle module is	A reasonable opportunity for discovery is likely to show that the module generates a progressive warning.

Claims 1-2, 7-10, 12-14, 17, and 19 of the '131 patent	Defendants' System
further operable to generate a progressive warning signal if one or more vehicle separation criteria are violated; and	
c. the progressive warning signal increases in at least one of signal rate, signal frequency, signal prominence, signal volume, or signal severity as the violation of the vehicle separation criteria approaches or extends beyond a vehicle separation threshold.	A reasonable opportunity for discovery is likely to show that the progressive warning includes at least one of rate, frequency, prominence, volume, or severity as the criteria is approached or exceeded.

88. Defendants directly infringe the claims by offering the Defendants' system for sale to the MTA and others, and Defendants Siemens and Thales aid and abet that infringement by assisting the MTA in operation and inducing the MTA to use infringing systems.

89. Defendants are also contributory infringers because the components sold by Defendants for installation in the MTA system are customized for the MTA's unique requirements, and have no substantial non-infringing use.

90. A reasonable opportunity for discovery is likely to show that Defendants are offering their infringing system for sale to other transit agencies, and using the Pilot project installations as a reference.

91. Metrom is entitled to damages adequate to compensate Metrom for Defendants' infringement, as provided by 35 U.S.C. § 284 and in no event less than a reasonable royalty.

COUNT IV – PATENT INFRINGEMENT, U.S. PATENT NO. 10,737,709, 35 U.S.C. § 281 – ALL DEFENDANTS

92. The allegations in the preceding paragraphs are incorporated herein.

93. This claim is brought under 35 U.S.C. § 281 and the court has original and exclusive jurisdiction under 35 U.S.C. § 1338.

94. Metrom is the owner of duly issued U.S. Patent No. 10,737,709 ("'709 patent") (Exhibit D) titled "Worker Protection System" and has been the owner at all times material to this claim.

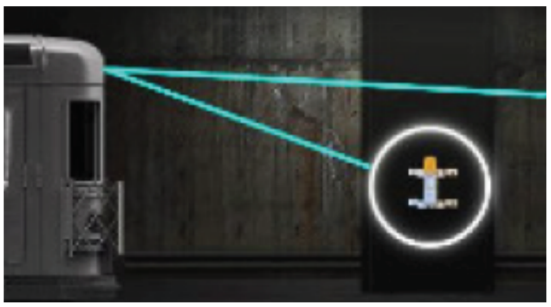
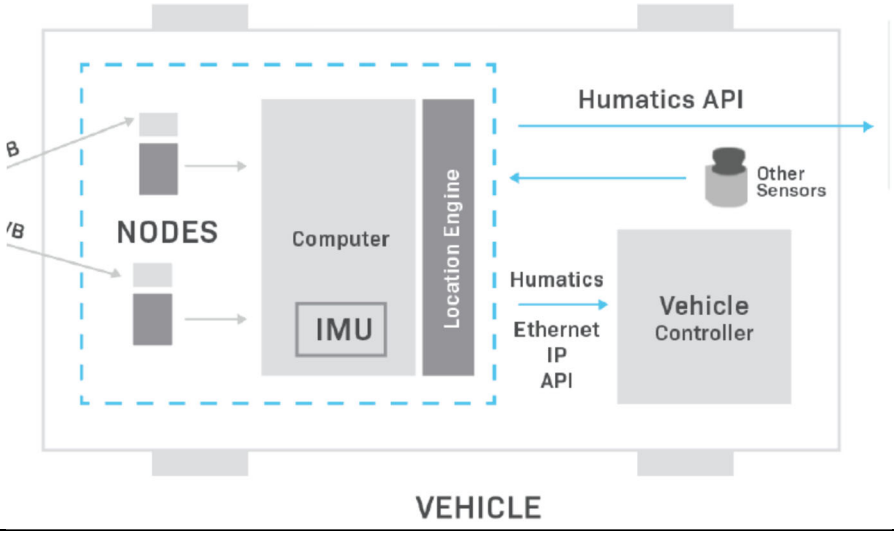
95. Defendants Siemens and Thales are coordinating the installation and maintenance of a rail signaling system using UWB to enable positive train control and other features for the MTA, with their UWB partners Defendants Humatics and Piper, respectively. The ongoing offer and sale of that system includes the "Pilot" project described by the NYCT RFP and a planned series of contracts for full scale implementation scheduled to be awarded from 2022 forward, referred to herein as "Defendants' system."

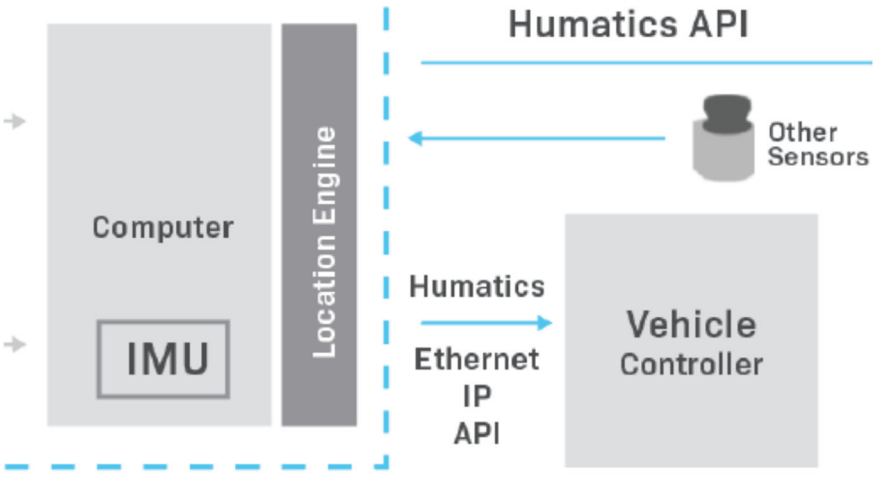
96. Piper and Humatics are including, in their offers and solicitations to the MTA and others, with or without Siemens and Thales, worker protection features using UWB technology pioneered by Metrom.

97. Worker protection is of great interest to the MTA, and a reasonable opportunity for discovery is likely to show that the availability or future availability of this feature with no or minimal hardware changes to the Defendants' installed systems is a factor in awarding contracts to the Defendants.

98. Metrom's '709 patent covers worker protection using UWB that defendants have offered to sell, and will sell and operate in a UWB system for the

MTA, as shown in the following table, either literally or by equivalence, either alone or as installed in the MTA system:

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	**Defendants' System**
1. A system for worker protection, the system comprises:	**HI-RAIL VEHICLES AND ROADWAY WORKER PROTECTION** UWB provides the ranging and communication infrastructure for roadway worker protection systems. The positioning precision allows for making the safety-critical distinction between workers and vehicles on and off the tracks.
a. a train-mounted unit for use on a train, wherein the train-mounted unit comprises:	Defendants are offering a train-mounted unit.  
b. a communication component, comprising one or more	The train mounted unit has UWB "nodes" mounted on the train.

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
antennas, configured to transmit and/or receive wireless signals, wherein the signals comprise ultra-wideband (UWB) signals; and	
c. one or more circuits configured to process signals and data, and perform one or more applications or functions relating to operations of the train-mounted unit; and	Defendants equipment includes vehicle mounted hardware including a location engine and vehicle controller. 
d. wherein the train-mounted unit is configured to operate cooperatively with one or more wayside	The train mounted unit uses the UWB signals to communicate with UWB beacons on the wayside that are associated with workers. The workers are alerted by the wayside units to the presence of an approaching train.

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
units, configured for placement on or near a track traversed by the train, to provide alerts to one or more workers operating on or near the track, based on communication of the UWB signals with at least one of the one or more wayside units.	 
3. The system of claim 1, wherein the train-mounted unit is configured to generate data relating to alerts and/or to other devices or objects in a path of the train, based on the	A reasonable opportunity for discovery is likely to show that the Defendants' system generates alerts based on the location of reported worker-related beacons relative to the position of the train.

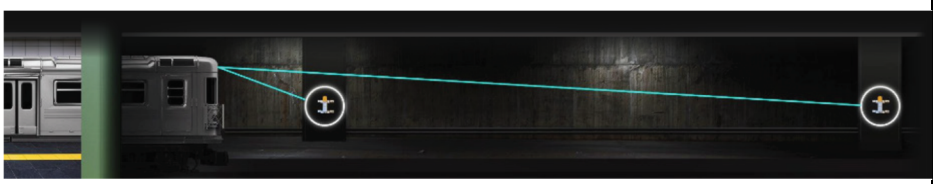
Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
communication of the UWB signals with at least one of the one or more wayside units.	
4. The system of claim 1, wherein the train-mounted unit is configured to generate feedback information for outputting to an operator of the train, based on the communication of the UWB signals with at least one of the one or more wayside units.	A reasonable opportunity for discovery is likely to show that the Defendants' system generates alerts for the train operator based on the location of reported worker-related beacons relative to the position of the train.
7. The system of claim 1, wherein the train-mounted unit comprises one or more input/output (I/O) components, for receiving input from an operator of the train and/or for providing output to the operator of the train.	The Defendants' system includes a user interface for the train operator. **DRIVER ASSISTANCE SYSTEMS** Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	**Defendants' System**
12. A system for worker protection, the system comprises:	**HI-RAIL VEHICLES AND ROADWAY WORKER PROTECTION** UWB provides the ranging and communication infrastructure for roadway worker protection systems. The positioning precision allows for making the safety-critical distinction between workers and vehicles on and off the tracks.
a. one or more wayside units configured for placement on or near a track; wherein each wayside unit comprises:	
b. a communication component, comprising one or more antennas, configured to transmit and/or receive wireless signals, wherein the signals comprise	Each wayside beacon has a UWB radio with an antenna.

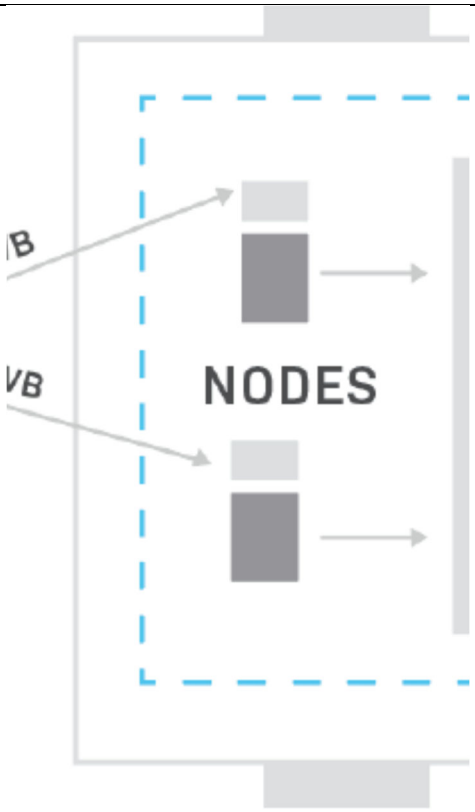
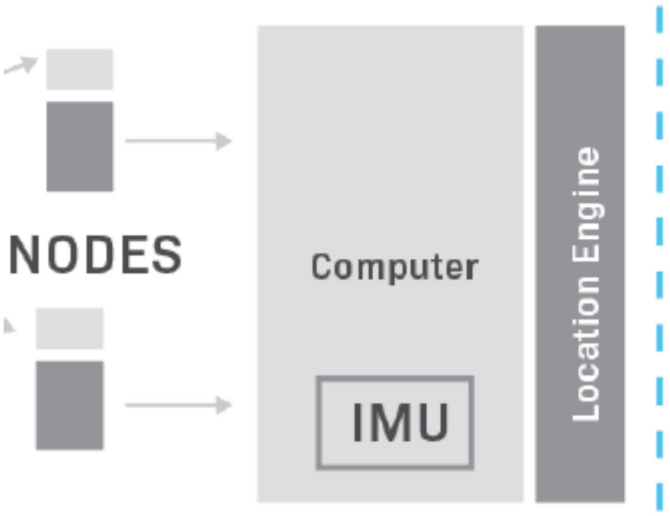
Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
ultra-wideband (UWB) signals; and	
c. one or more circuits configured to process signals and data, and perform one or more applications or functions relating to operations of the wayside detection unit; and	The wayside radios are controlled by a processor that controls operation of the radio.
d. wherein the one or more wayside units are configured to operate cooperatively with any train-mounted unit deployed on a train traversing the track, to provide alerts to one or more workers operating on or near the track, based on communicatio	

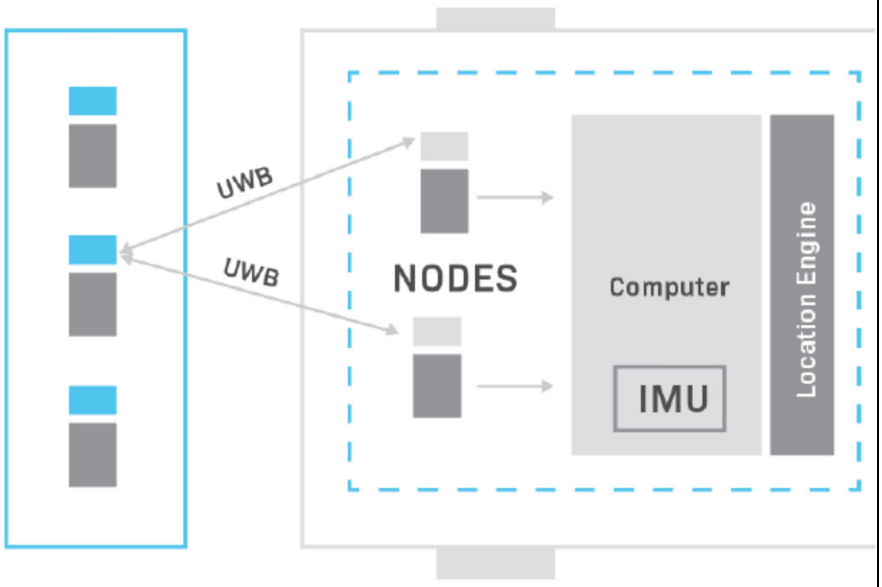
Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
n of the UWB signals between at least one of the one or more wayside units and the train-mounted unit.	
13. The system of claim 12, wherein each wayside unit comprises a power supply for powering components of the wayside unit.	Each wayside unit has a power source.
14. The system of claim 12, wherein each wayside unit comprises a housing for enclosing components of the wayside unit.	The wayside units have a housing, whether mounted on a worker or near the worksite: 

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
	
15. The system of claim 12, wherein each wayside unit comprises a support structure for holding and supporting the wayside unit when placed on or near the track.	The wayside units have a support structure.
16. The system of claim 12, wherein at least one wayside unit is configured to broadcast alert related signals, relating to the train when approaching the wayside unit.	A reasonable opportunity for discovery is likely to show that at least some of the wayside units in Defendants' system broadcasts an alert when a train is approaching the unit.

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
	
20. A system for protecting workers near railroad tracks, comprising:	HI-RAIL VEHICLES AND ROADWAY WORKER PROTECTION UWB provides the ranging and communication infrastructure for roadway worker protection systems. The positioning precision allows for making the safety-critical distinction between workers and vehicles on and off the tracks.
a. one or more UWB radios at pre-determined locations along the railroad tracks;	Radios are mounted at multiple locations along the tracks. 

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
b. one or more worker UWB radios associated with one or more workers on or near the railroad tracks;	 
c. a vehicle UWB radio associated with a vehicle on the railroad track;	The Defendants' system includes UWB radios in the trains:

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
	
d. wherein: the vehicle UWB radio is in communication with a processor, wherein:	The vehicle radio is in communication with a processor. 

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
e. the processor determines a position of the vehicle based on time of flight measurements obtained based on communication between the vehicle UWB radio and at least one of the one or more UWB radios that are located at pre-determined locations;	The processor includes a location engine for determining position, based at least in part on the time of flight ranging to wayside UWB beacons. 
f. the processor determines a location in which the one or more workers are working based on time of flight information obtained based on communication with at least one of the one or more	A reasonable opportunity for discovery is likely to show that the processor determines worker location based on information received from the wayside beacon that includes UWB ranging information from one or more worker UWB radios.

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
worker UWB radios; and	
g. the processor generates an alert to an operator of the vehicle based on the determined location of the one or more workers; and	A reasonable opportunity for discovery is likely to show that the user interface will generate alerts to the operator based on the determined location of workers.
h. at least one worker UWB radio communicates time of flight information between the at least one worker UWB radio and the vehicle UWB radio to a processor in communication with the at least one worker UWB radio, wherein the processor generates alerts to a worker associated with the at	A reasonable opportunity for discovery is likely to show that the alert generated by the worker UWB radio includes an alert based on one of the listed criteria. 

Claims 1, 3-4, 7, 12-16, 20 of the '709 patent	Defendants' System
least one worker UWB radio based on one or more of: a determined distance to the vehicle UWB radio, an estimated time of closest approach of the vehicle UWB radio to a location of the at least one worker UWB radio, and an approach speed of the vehicle UWB radio.	

99. Defendants directly infringe the claims by offering for sale their UWB systems with worker protection or the capability of worker protection to the MTA and others, and Defendants Siemens and Thales aid and abet that infringement by assisting the MTA in operation and inducing the MTA to use infringing systems.

100. Defendants are also contributory infringers because the components sold by Defendants for installation in the MTA system are customized for the MTA's unique requirements, and have no substantial non-infringing use.

101. A reasonable opportunity for discovery is likely to show that Defendants are offering their infringing system for sale to other transit agencies and using the Pilot project installations as a reference.

102. Metrom is entitled to damages adequate to compensate Metrom for Defendants' infringement, as provided by 35 U.S.C. § 284 and in no event less than a reasonable royalty.

COUNT V – PATENT INFRINGEMENT, U.S. PATENT NO. 10,179,595, 35 U.S.C. § 281 – ALL DEFENDANTS

103. The allegations in the preceding paragraphs are incorporated herein.

104. This claim is brought under 35 U.S.C. § 281 and the court has original and exclusive jurisdiction under 35 U.S.C. § 1338.

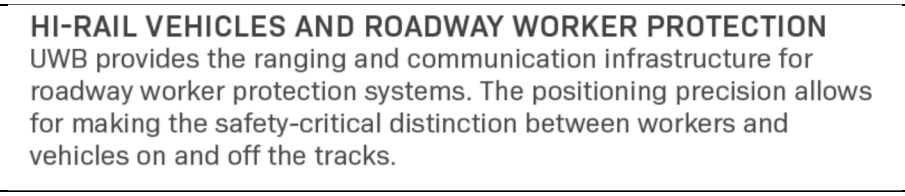
105. Metrom is the owner of duly issued U.S. Patent No. 10,179,595 ("'595 patent") (Exhibit E) titled "Worker Protection System" and has been the owner at all times material to this claim.

106. Defendants Siemens and Thales are coordinating the installation and maintenance of a rail signaling system using UWB to enable positive train control and other features for the MTA, with their UWB partners Defendants Humatics and Piper, respectively. The ongoing offer and sale of that system includes the "Pilot" project described by the NYCT RFP and a planned series of contracts for full scale implementation scheduled to be awarded from 2022 forward, referred to herein as "Defendants' system."

107. Piper and Humatics are including, in their offers and solicitations to the MTA and others, with or without Siemens and Thales, worker protection features using UWB technology pioneered by Metrom.

108. Worker protection is of great interest to the MTA, and a reasonable opportunity for discovery is likely to show that the availability or future availability of this feature with no or minimal hardware changes to the Defendants' installed systems is a factor in awarding contracts to the Defendants.

109. Metrom's '595 patent covers worker protection using UWB that Defendants have offered to sell, and will sell and operate in a UWB system for the MTA, as shown in the following table, either literally or by equivalence, either alone or as installed in the MTA system:

Claims 21, 23 of the '595 patent	Defendants' System
21. A system for worker protection, the system comprises:	
a. a vehicle-mounted alert device, configured for use on a vehicle, the vehicle-mounted alert device comprising:	The Defendants' system has a vehicle mounted alert device that generates alerts within the vehicle for use by the operator of the vehicle.
b. a housing for enclosing components of the vehicle-mounted alert device;	The vehicle mounted device includes at least one housing.
c. a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;	The vehicle mounted device includes at least one communication component, that a reasonable opportunity for discovery is likely to show is a Qorvo UWB transceiver that includes an antenna for receiving and transmitting UWB signals.
d. one or more circuits operable to process signals	The vehicle mounted device includes a computer that processes the data and signals received, to perform the safety function of a worker alert warning.

Claims 21, 23 of the '595 patent	Defendants' System
and data, and to perform one or more applications or functions relating to operations of the vehicle-mounted alert device; and	
e. one or more input/output (I/O) components, for receiving input from an operator of the vehicle and/or for providing output to the operator of the vehicle; wherein the vehicle-mounted alert device is operable to:	The vehicle mounted device includes in interface for the operator to provide alerts and receive input. **DRIVER ASSISTANCE SYSTEMS** Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.
g. broadcast alert triggering signals; and	A reasonable opportunity for discovery is likely to show that the Defendants' system will broadcast an alert related to the presence of a worker in the path of the vehicle
h. generate, in response to triggering of alerts, data relating to alerts and/or to other devices or objects	A reasonable opportunity for discovery is likely to show that Defendants' system generates data relating to the alerts

Claims 21, 23 of the '595 patent	Defendants' System
in path of the vehicle; and	
i. output based on the data, via the one or more I/O components, feedback information to the operator.	A reasonable opportunity for discovery is likely to show that the vehicle mounted device outputs feedback to the operator regarding the alerts.
23. The system of claim 21, wherein the vehicle-mounted alert device is operable to log data relating to alerts triggered in response to movement of the vehicle.	A reasonable opportunity for discovery is likely to show that the vehicle mounted device logs alert data.

110. Defendants directly infringe the claims by offering for sale their UWB systems with worker protection or the capability of worker protection to the MTA and others, and Defendants Siemens and Thales aid and abet that infringement by assisting the MTA in operation and inducing the MTA to use infringing systems.

111. Defendants are also contributory infringers because the components sold by Defendants for installation in the MTA system are customized for the MTA's unique requirements, and have no substantial non-infringing use.

112. A reasonable opportunity for discovery is likely to show that Defendants are offering their infringing system for sale to other transit agencies and using the Pilot project installations as a reference.

113. Metrom is entitled to damages adequate to compensate Metrom for Defendants' infringement, as provided by 35 U.S.C. § 284 and in no event less than a reasonable royalty.

COUNT VI – TORTIOUS INTERFERENCE WITH PROSPECTIVE ECONOMIC ADVANTAGE

114. The allegations in the preceding paragraphs are incorporated herein.

115. This claim is a common law claim for tortious interference with prospective economic advantage.

116. Metrom was reasonably certain to win the Pilot Demonstration Project, and with that project in hand, was reasonably certain to be a supplier to the MTA for the complete UWB signaling project for the NYCT system.

117. Defendants interfered with Metrom's reasonable expectations of success by deliberately infringing Metrom's patents, or submitting proposals to the MTA knowing that they would inevitably infringe Metrom's patent rights in the future.

118. But for submitting proposals that infringed Metrom's intellectual property rights, Defendants would not have won the Pilot Demonstration RFP and would not have been selected as the dual source providers for the MTA UWB system installation.

119. Metrom was damaged by Defendants' conduct, in the loss of profits from the Pilot Demonstration project, the loss of future profits from the UWB system installation, and the loss of a reference design.

COUNT VII CIVIL CONSPIRACY– ALL DEFENDANTS

120. The allegations in the preceding paragraphs are incorporated herein.

121. This is a common law claim and the court has jurisdiction under 35 U.S.C. § 1367.

122. The co-conspirators are Siemens, Humatics, Thales, and Piper.

123. The co-conspirators have embarked on a common course of action to infringe Metrom's patents. Direct evidence of a common scheme or plan includes:

a. In the bidding for the Pilot RFP, the MTA issued a secret "addendum" favorable to Thales and Siemens that was concealed from Metrom.

b. When Metrom notified Siemens, Thales, and Piper of Metrom's patent rights in the summer of 2019, a single anonymous entity responded by filing a prior art submission with the patent office.

c. Recently, the MTA has awarded Siemens/Humatics and Thales/Piper a joint contract to develop a common UWB radio protocol and specification that will be used to infringe Metrom's patents, but that will not be available to Metrom. All four co-conspirators will cooperate to develop the radio specification and communication rules that will be used to infringe Metrom's patent rights, while excluding Metrom as a supplier.

d. A reasonable opportunity for discovery is likely to show that Siemens and Thales have maintained a duopoly for signals equipment with the MTA, with Siemens maintaining a consistent 60-70% of the MTA signaling equipment business.

e. A reasonable opportunity for discovery is likely to show that Siemens/Humatics and Thales/Piper have entered into explicit indemnification agreements allocating the risk that Metrom would assert its patents against one or more of them.

f. A reasonable opportunity for discovery is likely to show that Defendants are all planning to submit bids to the MTA for complete signal

replacement on NYCT subway lines jointly which will infringe Metrom's patents.

124. Metrom has been damaged by the conspiracy to infringe, including to at least the extent of its lost profits in that Metrom has not only been forced to compete with its own technology, it has been locked out of future business with the MTA based on its own technology, deprived of a reference design, and effectively denied the ability to compete for any other commuter rail signal projects.

JURY DEMANDED UNDER FED. R. CIV. P. 38

Metrom demands a jury on all issues so triable.

PRAYER FOR RELIEF

Wherefore, Metrom requests the following relief:

1. A judgment that Defendants have infringed one or more claims of the asserted patents;

2. An accounting for Defendants' profits;

3. All compensatory and punitive damages as may be allowed by statute or law;

4. A decree preliminarily and permanently enjoining Defendants, their principals, officers, directors, employees, agents, successors, assigns, and any

persons in active concert with them from infringing, directly or indirectly, the asserted patents, including immediately ceasing all marketing, offers for sale, sales, and support of systems covered by the patents, under 35 U.S.C. § 283;

5. A judgment and order requiring Defendants to pay Plaintiff its damages, costs, expenses, and prejudgment and post-judgment interest for Defendants' infringement of the asserted patents;

6. A judgment and order requiring Defendants to pay Plaintiff its damages, costs, expenses, and prejudgment and post-judgment interest for Defendants' tortious acts;

7. An award to Plaintiff for enhanced damages resulting from Defendants' deliberate, willful, and bad faith conduct, as provided under 35 U.S.C. § 284;

8. An award to Plaintiff of its reasonable attorney fees, as provided under 35 U.S.C. § 285;

9. An order requiring Defendants to disgorge any profits or unjust enrichment derived from Defendants' tortious conduct to Plaintiff;

10. An order requiring Defendants to notify any United States transit agency to which Defendants submit a bid that includes UWB train control equipment

of this Court's order and injunctions, and to file a quarterly report with the Court certifying compliance with the Court's injunction.

Dated: January 13, 2022

Respectfully submitted,

FARNAN LLP

/s/ Michael J. Farnan

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