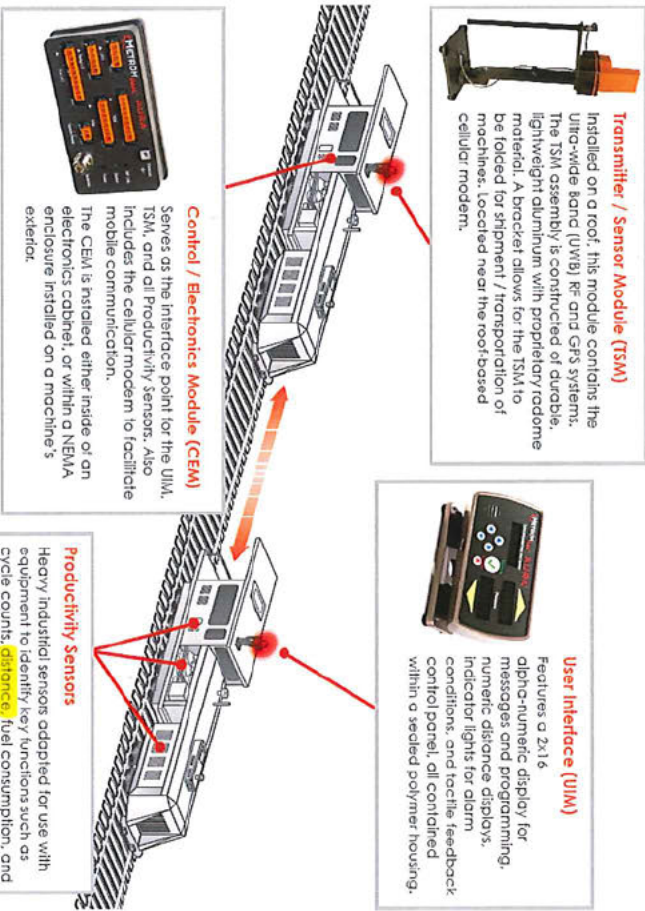


TC Claim Chart for Claims 1 & 7 of U.S. Patent No. 9,043,131

Claims 1 and 7	AURA Collision Avoidance System
I. A collision avoidance system	The AURA Maintenance System of Way Utility (MU) combines the field-proven capabilities of the Metrom Rail Collision Avoidance System with a comprehensive productivity suite, providing customers with an industry-leading safety and efficiency platform.  Transmitter / Sensor Module (TSM) Installed on a roof, this module contains the ultra-wide band (UWB) RF and GPS system. The TSM assembly is constructed of durable, lightweight aluminum with proprietary rodome material. A bracket allows for the TSM to be folded for shipment / transportation of machines, located near the roof-based cellular modem. Control / Electronics Module (CEM) Serves as the interface point for the UIM, TSM, and all Productivity Sensors. Also includes the cellular modem to facilitate mobile communication. The CEM is installed either inside of an electronics cabinet, or within a NEMA enclosure installed on a machine's exterior. User Interface (UIM) Features a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and tactile feedback control panel, all contained within a seeded polymer housing. Productivity Sensors Heavy industrial sensors adapted for use with equipment to identify key functions such as cycle counts, distance, fuel consumption, and other customer-specific factors.

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PC

Claims 1 and 7	AURA Collision Avoidance System
1. A first vehicle mounted module mounted on a first rail vehicle, the first vehicle mounted module comprising: A first transponder sensor module operable to send and receive data wirelessly, the first transponder sensor module comprising a first radio communication unit and a first antenna; a first control electronics module comprising a first processor in communication with at least the first transponder sensor module; and	 Transmitter / Sensor Module (TSM) Installed on a roof, this module contains the Ultra-wide Band (UWB) RF and GPS systems. The TSM assembly is constructed of durable, lightweight aluminum with proprietary radome material. A bracket allows for the TSM to be folded for shipment / transportation of machines. Located near the roof-based cellular modem.  Control / Electronics Module (CEM) Serves as the interface point for the UIM, TSM, and all Productivity Sensors. Also includes the cellular modem to facilitate mobile communication. The CEM is installed either inside of an electronics cabinet, or within a NEMA enclosure installed on a machine's exterior.

TC

Claims 1 and 7	AURA Collision Avoidance System
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; a second vehicle mounted module mounted on a second rail vehicle, the second vehicle mounted module comprising: a second transponder sensor module operable to send and receive data wirelessly, the second transponder sensor module comprising a second radio communication unit and a second antenna;	User Interface (UIM) Features a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and tactile feedback control panel, all contained within a sealed polymer housing.  Transmitter / Sensor Module (TSM) Installed on a roof, this module contains the Ultra-wide Band (UWB) RF and GPS systems. The TSM assembly is constructed of durable, lightweight aluminum with proprietary radome material. A bracket allows for the TSM to be folded for shipment / transportation of machines. Located near the roof-based cellular modem. 

TC

Claims 1 and 7	AURA Collision Avoidance System	
a second control electronics module comprising a second processor in communication with at least the second transponder sensor module; and	 Control / Electronics Module (CEM) Serves as the interface point for the UIM, TSM, and all Productivity Sensors. Also includes the cellular modem to facilitate mobile communication. The CEM is installed either inside of an electronics cabinet, or within a NEMA enclosure installed on a machine's exterior.	
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;	 User Interface (UIM) Features a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and tactile feedback control panel, all contained within a sealed polymer housing.	

TC

Claims 1 and 7	AURA Collision Avoidance System
wherein: the first vehicle mounted module is operable to communicate with the second vehicle mounted module mounted on the second rail vehicle; and 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.	Ultra-Wide Band RF (UWB) Allows the MU to provide accurate and reliable range measurements between equipment without being affected by the same multi-path distortion effects that limit traditional 900 Mhz or 2.4 Ghz systems. The AURA MU deploys advanced radio technology to provide the most accurate time-of-flight ranging system in the industry. The system offers the flexibility of operator-defined detection and alarm criteria, with integrated, expandable hardware options and the ability to function in all environments and terrain – even tunnels.
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 vehicle; and the first global positioning system unit is in communication	Advanced GPS Technologies - Utilized for speed acquisition for mode-based alerts and alarms. - Universal to all current GPS platforms, including GNSS, GONASS, QZSS, and SBAS technologies.

Claims 1 and ~~7~~	AURA Collision Avoidance System
with the first control electronics module.	

Claim Chart for Claims 1 & 7 of U.S. Patent No. 8,812,227

Claims 1 and 7	AURA Collision Avoidance System
I. A collision avoidance system	The AURA Maintenance of Way Utility (MU) combines the field-proven capabilities of the Metrom Rail Collision Avoidance System with a comprehensive productivity suite, providing customers with an industry-leading safety and efficiency platform. The diagram illustrates the AURA Collision Avoidance System components and their installation on a train. A central image shows a train with two red dots on its roof indicating the locations of the Transmitter / Sensor Module (TSM) and the Control / Electronics Module (CEM). A red arrow points from the TSM to the CEM. To the left, a box titled 'Transmitter / Sensor Module (TSM)' contains an image of the module and text describing its installation on a roof and its function as a UWB RF and GPS system. To the right, a box titled 'Control / Electronics Module (CEM)' contains an image of the module and text describing its role as the interface point for the UIM, TSM, and productivity sensors. Below the CEM box, a box titled 'Productivity Sensors' contains text describing heavy industrial sensors for cycle counts, distance, fuel consumption, and other customer-specific factors. To the right of the CEM box, a box titled 'User Interface (UIM)' contains an image of the interface and text describing its features, including a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and a tactile feedback control panel. Transmitter / Sensor Module (TSM) Installed on a roof, this module contains the Ultra-wide Band (UWB) RF and GPS systems. The TSM assembly is constructed of durable, lightweight aluminum with proprietary radome material. A bracket allows for the TSM to be folded for shipment / transportation of machines. Located near the roof-based cellular modem. Control / Electronics Module (CEM) Serves as the interface point for the UIM, TSM, and all Productivity Sensors. Also includes the cellular modem to facilitate mobile communication. The CEM is installed either inside of an electronics cabinet, or within a NEMA enclosure installed on a machine's exterior. Productivity Sensors Heavy industrial sensors adapted for use with equipment to identify key functions such as cycle counts, distance, fuel consumption, and other customer-specific factors. User Interface (UIM) Features a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and tactile feedback control panel, all contained within a sealed polymer housing.

Claims 1 and 7	AURA Collision Avoidance System
one or more vehicle mounted modules, each vehicle mounted module mountable on a rail vehicle, each vehicle mounted module comprising: a transponder sensor module operable to send and receive data wirelessly, the transponder module comprising a first ultra wideband unit and a first antenna a control electronics module comprising a processor in communication with at least the transponder sensor module unit; and	 Transmitter / Sensor Module (TSM) Installed on a roof, this module contains the Ultra-wide Band (UWB) RF and GPS systems. The TSM assembly is constructed of durable, lightweight aluminum with proprietary radome material. A bracket allows for the TSM to be folded for shipment / transportation of machines. Located near the roof-based cellular modem.  Control / Electronics Module (CEM) Serves as the interface point for the UIM, TSM, and all Productivity Sensors. Also includes the cellular modem to facilitate mobile communication. The CEM is installed either inside of an electronics cabinet, or within a NEMA enclosure installed on a machine's exterior.

Claims 1 and 7	AURA Collision Avoidance System
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	User Interface (UIM) Features a 2x16 alpha-numeric display for messages and programming, numeric distance displays, indicator lights for alarm conditions, and tactile feedback control panel, all contained within a sealed polymer housing.  wherein each vehicle mounted module is operable to communicate with at least one other vehicle mounted module mounted on at least one other rail vehicle, and wherein each vehicle mounted module is operable to apply a time of flight technique to determine a separation distance between the rail vehicles.
	Ultra-Wide Band RF (UWB) • Allows the MU to provide accurate and reliable range measurements between equipment without being affected by the same multi-path distortion effects that limit traditional 900 Mhz or 2.4 Ghz systems. The AURA MU deploys advanced radio technology to provide the most accurate time-of-flight ranging system in the industry. The system offers the flexibility of operator-defined detection and alarm criteria, with integrated, expandable hardware options and the ability to function in all environments and terrain – even tunnels.

Claims 1 and 7	AURA Collision Avoidance System
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.	Advanced GPS Technologies • Utilized for speed acquisition for mode-based alerts and alarms. • Universal to all current GPS platforms, including GNSS, GONASS, QZSS, and SBAS technologies.