U.S. Department
of Transportation
**Federal Railroad
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

APR 12 2013

Mr. Radomir Bulayev
Superintendent, Power, Signal and Communications
Port Authority Trans-Hudson
One PATH Plaza, 8th Floor
Jersey City, NJ 07306

Re: Type Approval (FRA-TA-2013-02) for the Communications-Based Train Control (CBTC) Positive Train Control (PTC) System (Docket Number FRA-2010-0034)

Dear Mr. Bulayev:

The Federal Railroad Administration (FRA) has completed its review of your August 29, 2012, Communications-Based Train Control System (CBTC) Positive Train Control Development Plan (PTCDP), Revision 3, submitted in fulfillment of, and in compliance with, the final rule for PTC systems, Title 49 Code of Federal Regulations (CFR) Section 236.1013, *PTC Development Plan and Notice of Product Intent content requirements and Type Approval.*

FRA finds that the CBTC system, if built and implemented as described within the PTCDP, will satisfy the requirements of a PTC system as specified within 49 CFR Part 236, Subpart I. Accordingly, FRA approves the August 29, 2012, CBTC PTCDP, Revision 3, with special conditions identified within the body of this letter as is provided for in 49 CFR § 236.1009(g)(1). FRA is simultaneously issuing the enclosed Type Approval, FRA-TA-2013-02 for CBTC (Enclosure) in accordance with 49 CFR §§ 236.1009(f) and (g), and § 236.1013(b).

FRA would like to remind you that the CBTC system must be developed and implemented as defined within the Type Approval issued for the CBTC system. Any modifications of the CBTC system beyond the provisions outlined in the Type Approval will require the submittal of a Request for Amendment (RFA) for the modified PTC system, in accordance with 49 CFR §§ 236.1009(b) and 236.1013. FRA may reconsider the Type Approval upon revelation of factors outlined in 49 CFR § 236.1009(g). An impact-assessment statement that clearly identifies the potential impact of the change must also accompany an RFA to this Type Approval. Each railroad using this CBTC Type Approval for the implementation of a PTC system is responsible for the assessment of potential impact of any amendments to this

Type Approval on their operations, their PTC system implementation, making appropriate PTC system modifications, and requesting Type Approval modifications to ensure system interoperability with other CBTC PTC system implementation.

As special conditions of issuance of this CBTC Type Approval, FRA requires you to submit not later than 60 days from the date of this letter:

1. A complete listing of all CBTC-configurable items and variables along with their maximum and minimum values. Specific values assigned to these variables must then be identified in the PTCSP for approval by FRA.

2. Until roadway workers are using an Employee-in-Charge (EIC) terminal that allows the EIC to control access of the train into and through the work zone, Port Authority Trans-Hudson will develop and adhere to an FRA-approved plan to control train movements into and through work zones.

3. The Human Machine Interface information detailed in Section 7 of the CBTC PTCDP for inclusion in the public record with the Type Approval.

Failure to provide the above information may invalidate this Type Approval.

All railroads electing to use this Type Approval are reminded of the requirements of 49 CFR §§ 236.1015(b) and (c) regarding the use of Type Approvals in support of a PTCSP.

Should you have any questions regarding this letter, or its conditions, please feel free to contact Mr. Robert Scieszinski, PTC Branch Chief. Mr. Scieszinski may be reached at (360) 883-5811 or Robert.Scieszinski@dot.gov.

Sincerely,

Robert C Lauby

Robert C. Lauby
Deputy Associate Administrator
for Regulatory and Legislative Operations

Enclosure

U.S. Department
of Transportation

**Federal Railroad
Administration**

Type Approval Number: FRA-TA-2013-02

TYPE APPROVAL

This Type Approval is issued to attest that the following system meets the minimum regulatory performance requirements for Positive Train Control (PTC) systems required by Section 104 of the Rail Safety Improvement Act of 2008 (RSIA) and by 49 Code of Federal Regulations (CFR) Part 236, Subpart I.

System

Communications Based Train Control (CBTC)

Type

CBTC

This Type Approval is not valid if presented without the full attachment schedule composed of seven sections.

For Federal Railroad Administration,

At: 1200 New Jersey Ave, SE

Washington DC 20590

Robert C. Lauby

Deputy Associate Administrator for Regulatory and Legislative Operations

Robert C Lauby

Date of Issue: APR 12 2013

This Type Approval remains valid until the date 5 years from its issuance, unless canceled or revoked, subject to automatic and indefinite extension provided that at least one FRA PTC System Certification using the subject PTC system has been issued within that period and not revoked and the product remains satisfactory in service. This Type Approval will not be valid if the applicant makes any changes or modifications to the approved product, which have not been notified to, and agreed upon, by the Federal Railroad Administration.

This Type Approval consist of 9 pages

THE SCHEDULE OF APPROVAL

1. PRODUCT DESCRIPTION

1.1 Purpose

The Communications Based Train Control System (CBTC) was designed and manufactured by Siemens Industry Inc. based on the Trainguard MT CBTC product to serve as a vital stand-alone Positive Train Control (PTC) system, as defined in 49 Code of Federal Regulations (CFR) Part 236, Subpart I, Section 236.1015(e)(3). CBTC replaces the existing traffic control method of operation by requesting an override of the wayside signal system to display a Flashing Green or Flashing Yellow (if the green aspect does not illuminate) signal aspect. Display of these signal aspects is indication that the CBTC system is active and in control of train movements. This system provides for automatic train operation while providing enforcement of movement authority limits; maximum authorized speeds; permanent and temporary speed restrictions; proper station berthing and door control; and positive train stop at interlocking home signals and controlled wayside signals. This system also provides for moving virtual blocks that divide the physical track circuit blocks into smaller sections to allow for greater headway while maintaining positive train separation and providing for proper train braking distances. The existing wayside signal equipment is being replaced with newer technology micro-processor equipment that will act as a Secondary Train Detection System (STDS). The trip stops associated with the wayside signals will remain in service to provide redundant positive train separation for equipment not in a protected CBTC state. This wayside equipment is compliant with 49 CFR Part 236 Subparts A through H. The STDS will remain in constant communication with CBTC to provide for route integrity and provide for a back-up method of operation in the event of a CBTC system failure. In the event of a CBTC system failure, positive train separation will be limited to the established physical block limits of the STDS and not that of the CBTC virtual blocks, as is done with traditional signaling systems. As the Port Authority Trans-Hudson (PATH) is an isolated rail system with no connection to the general rail system, the interoperability requirements, as defined in 49 CFR Part 236 Subpart I Section 236.1011(a)(3), are not addressed for this Type Approval. If another railroad, having tenant operations, intends to utilize this Type Approval, interoperability of the system must be described as a variance of this Type Approval.

1.2 Main System Components

CBTC is constituted of the following essential elements designed, built, operated, and maintained as described in the Port Authority Trans-Hudson (PATH) Positive Train Control Development Plan, Revision 3, dated August 29, 2012 and to the specifications in Section 2:

1.2.1 Automatic Train Supervision (Office Segment)

Automatic Train Supervision (ATS) provides facilities for managing the operation of the territory. The central elements of ATS are the servers located at the Operations/Train Control Centers and Remote Workstations (RWKS) provided at strategic field locations. The ATS servers exchange information with the dispatching system and the wayside zone controllers (ZCs). Train movement information (movement authority limits, speed restrictions, train mission, work zones, etc.) is delivered electronically from the ATS servers to the ZCs which will vitally store and/or deliver the information to the locomotive CBTC equipment and the STDS wayside equipment as necessary. A mission defines for each train an origin, a destination, a path (which can be modified), and actions to be carried out by the train (i.e., service of the stations and reversal of the trains). All movements associated with a particular mission can be identified by a unique mission identifier. Most missions represent trips derived from the timetable and system special instructions, but all CBTC movements will have an associated mission. A train cannot run under CBTC control if it does not have an assigned mission. When a train arrives at the destination of its preceding mission, the on-board CBTC equipment sends a message to the ATS to indicate that its mission is complete. Until the ATS grants the train a new mission, it will remain stopped in a standby state waiting for a mission

1.2.2 Data Communications Subsystem (Communications Segment)

The Data Communications Subsystem (DCS) is made up of two major subsystems:

The Wayside CBTC Network (WCN) is a land-based IP network based on commercial off the shelf (COTS) networking products (i.e., switches, routers, etc.). The network design includes ring architecture, redundant network elements, and redundant links to avoid single points of failure. Single-mode fiber will be used for links between rooms, while connections of devices within a signal room will be implemented with Fast Ethernet over copper because of its simplicity and proven performance.

The Radio Communications System (RCS) will provide wireless data communication between the wayside and carborne CBTC elements. CBTC radios will operate over unlicensed 5.8 GHz band. Carborne radios will be active at the open ends of all trains equipped for CBTC. Wayside radios will be sited based on a detailed study of radio propagation in the territory.

1.2.3 Carborne CBTC Equipment (Locomotive Segment)

The main functions of the carborne CBTC equipment are to localize the train on the rail network, compute the train speed and determine train length, protect train movement in CBTC modes of operation according to the Movement Authority and signaling indications received from the Zone Controllers (ZC's), and operate the train in the various modes of operation (e.g., Automatic

1.2.5 Transponders (Wayside Segment)

The CBTC system uses transponders located between the rails to determine train location. Each transponder is uniquely identified with its location along the right of way, including track number. These transponders contain vitally encoded messages that are vitally decoded by the carborne CBTC equipment. Transponders are placed in sets of two at each location. As a train passes over the first transponder and reads its data message, it determines the exact location of that transponder. Once the train reads the second transponder, it determines its direction of movement along with its location.

Transponders are read by both the CBTC equipment on the head of the train and the CBTC equipment on the rear of the train. The equipment on the rear of the train sends its location information to the equipment on the head of the train. The head end, or controlling equipment, uses this data to determine train length. Between transponders the system uses the axle mounted optical pulse generators (OPG) input to track distance traveled.

Train speed is determined by the OPGs, which produce a series of pulses directly proportional to the axle rotation. Two independent OPGs are used and their inputs are independently processed to achieve a vital speed/distance measurement system. In addition, accelerometers are used to determine wheel slip/slide events. During wheel slip/slide events the OPG inputs may not accurately reflect the vehicle movement or speed. By detecting the occurrence and length of these events the on-board computer can decrease location uncertainty to assure protection of the train.

The train location report, including uncertainty, is communicated to the wayside system elements. In addition to the CBTC equipped trains determining their location and reporting it to the wayside ZC, the track circuits included in the STDS will also track the trains.

2. DOCUMENTS AND DRAWINGS

For dated references, only the edition cited applies. For undated references, the latest revision of the referenced document applies, including amendments.

2.1 Communications-Based Train Control (CBTC) Positive Train Control Development Plan (PTCDP) Revision 3, dated August 29, 2012.

2.2 PATH Book of Rules.

2.3 IEC 62279: 2002, Railway Applications: Communications, Signaling, and Processing Systems–Software for Railway Control and Protection Systems.

2.4 IEEE 1474.1 IEEE Standard for Communications-Based Train Control (CBTC) Performance and Functional Requirements.

2.5 IEEE 1475-1999 IEEE Standard for the Functioning of and Interfaces Among Propulsion, Friction Brake, and Train-borne Master Controller on Rapid Transit Vehicles.

2.6 IEEE 1483 IEEE Standard for Verification of Vital Functions in Processor-Based Systems Used in Rail Transit Control.

2.7 American Railroad Engineering and Maintenance Association (AREMA) Communications & Signal Manual.

2.8 RFC 1918 Address Allocation for Private Networks.

2.9 ISO/IEC 7816-4 Identification cards–Integrated circuit cards–Part 4 Organization, Security, and Command for Interchanges.

2.10 FIPS 196–Federal Information Processing Publication Entity Authentication using Public Key Cryptography.

2.11 IEC/TR 62380 Reliability Data Handbook (formerly known as: UTE C 80-810).

2.12 MIL HDBK-217F Reliability Prediction of Electronic Equipment.

2.13 CNET RDF 93–1993 Module for Reliability Prediction based on CNET, French Reliability Prediction Method for Commercial Applications.

2.14 IEC 62278 Railway Applications–Specification and Demonstration of Reliability, Availability, Maintainability, and Safety (RAMS).

2.15 EN 50129 Railway Applications. Communications, Signaling, and Processing Systems Safety Related Electronic Systems for Signaling.

2.16 Human-Machine Interface Specification–Train Operator Display CDRL 11-14.

2.17 Wire and Terminal Marking and Designation System CDRL 22-4 Secondary Train Detection System Layout CDRL 8-6.

2.18 CMMI Level 3 Evaluation Report (7/4/2011).

2.19 EN 50159-2 Railway Applications–Communications, Signaling, and Processing Systems Part 2: Safety Related Communication in Open Transmission Systems.

2.20 CBTC System Functional Description PATH-SPEC-10-0003

3. APPLICATION/LIMITATIONS/PROVISIONS

3.1 Application

Properly implemented, CBTC as described in the PTCDP may be used to achieve PTC functionalities required by 49 CFR Part 236 Subpart I. Any deviations from this Type Approval without prior FRA approval invalidate this Type Approval for use as described in § 236.1015(c).

3.2 Limitations

3.2.1 This Type Approval does not authorize operation of CBTC in revenue or revenue demonstration service without prior FRA approval.

3.2.2 This Type Approval does not authorize operation of CBTC for testing on the general rail system without prior FRA approval.

3.2.3 Use of CBTC applications by an individual railroad is not authorized unless certified by FRA for that specific railroad.

3.2.4 The maximum operational speed with CBTC equipped components is 59 mph. CBTC must be cut in and operational. When CBTC is cut out operations must comply with 236.1029.

3.2.5 This Type Approval is valid for PA-5 locomotive/control cars only.

3.2.6 Until roadway workers are utilizing an Employee in Charge (EIC) terminal which allows the EIC to control access of the train into and through the work zone, the railroad will develop and adhere to a FRA approved plan to control train movements into and through work zones.

3.2.7 All public and private crossings shall be fully integrated into the CBTC system, providing fail-safe indication to the PTC system that each crossing is active (i.e., gates horizontal) prior to a movement authority through and beyond the crossing.

3.3 Provisions

3.3.1 Prior to use of CBTC on any other class of locomotive, the locomotive class must complete successful testing acceptable to FRA that demonstrates the CBTC correctly operates on that locomotive.

3.3.2 FRA expects changes to the Operations and Maintenance manual and other supporting documents that adversely affect Safety and Reliability to the system will require an RFA submission. FRA does not expect RFA submissions for benign changes that do not adversely affect safety or reliability of the system.

4. TYPE APPROVAL VALIDITY

4.1 This Type Approval will remain valid if any component implementations are upgraded to a newer version as long as the manufacturer or railroad presenting this certificate notifies and receives FRA agreement that no change is introduced to the intended functionality and/or applicability of the named components. FRA will require proof that newer versions of CBTC components underwent a full safety engineering analysis, full regression testing if applicable, and meet all software safety criteria and did not in any way compromised safety.

4.2 Any significant modification to CBTC hardware and/or software components listed in Section 1.2 of this document that changes the intended functionality and/or applicability of CBTC will require a new type approval.

4.3 Any deviations from the documents and drawings listed in Section 2 and the supplementary conditions listed in Section 3 of this document that introduces changes in CBTC system principle of operation or applicability will require a new type approval.

5. PRODUCTION SURVEY REQUIREMENTS

5.1 CBTC is to be manufactured and installed in accordance with the approved type described in the Type Approval. Conformance testing of the installed system must be done to assure that the product faithfully implements the specification requirements. The documentation on conformance testing of CBTC hardware/software must follow a standard format that includes the description of the product, condition to claim conformance, core profile, extension profile (if applicable), implementation define features, alternative features (if applicable), reference implementation used, and conformance test suite used subject to FRA approval. All testing must comply with the requirements of § 236.1035.

5.2 FRA reserves the right to attend and modify tests, conduct examinations of installation work, or perform relevant audits.

6. SYSTEM CERTIFICATION PROCESS FOR THE USERS OF THIS TYPE APPROVAL

This Type Approval does not constitute System Certification for revenue operation. In order to obtain System Certification for the system designed and built using CBTC architecture under this type approval, the applicant referencing this type approval must fulfill all the requirements of 49 CRF Part 236, Subpart I, §236.1015.

7. DISCLAIMER

The United States Government and its employees makes no warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose; assume no legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed; and do not represent that the use of this Type Approval would not infringe upon privately owned rights. Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government, and shall not be used for advertising or product endorsement purposes.

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