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## **Realization of Simplified Notice Test Equipment for Digital Train Radio System**

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### **Abstract**

After the digital train radio system is introduced in the local railroad section, the notice transmission system is introduced in some local railroad sections. At the time of performing the examinations of the notice transmission system, the arrangement of the train which ran was necessary, and was not able to perform the examinations in our communication department alone conventionally. Therefore we developed the portable examination device about the notice transmission system for the digital train radio system of the conventional line, and we were it in use. Therefore we came to be able to carry out examinations without using a train, and we could save our labor for term of works to system introduction.

**Keywords:** the digital train radio system, the notice transmission system

### **1 Introduction**

The digitalization of Railway Radio for the Railways in the provincial area is in progress. With the utilization of Digital Train Radio System, the increased bandwidth made data communication possible and changes the system from calls between commander and onboard crew via the train radio to Notice System that utilizes the onboard monitor to show data regarding notifications for Onboard Crew. In the tests for implementing the digital train radio system, the telecommunication system teams are able to independently test the devices by utilizing “Base Station Test Equipment” that is being deployed in each of Technology Center of our company, where maintenance of equipment is based. However, when Notice System

is implemented, Test Train utilization becomes necessary for various tests, Resulting in dependency to the cooperation of the department in charge of train/vehicle and department in charge of the train timetable. This makes it difficult for the telecommunication system team to perform tests independently. Notice System is planned to be implemented in provincial area railway. Based on the previous notification tests, on average test train will run 5 times during the night for each line, which means that a lot of running test will be expected. If every test requires a test train to be arranged, and these arrangement will consume a significant amount of time, resulting in a significant workload for coordination. Therefore, the development and realization of a simplified notice test equipment is conducted in order to reduce the need of coordination to train/vehicle department and the transportation department, thus making the independent test for notice system by telecommunication system team possible.

## **2 Methods**

### **2.1. Notice System**

Up until now, the transmission of the notification to each train is conducted utilizing voice communication. However, through the notice system the information that is transmitted by the transportation command center can be transmitted directly to the monitor in the driving room. Upon receiving the notification, the onboard crew press the receive button after confirming the contents and the commander can then confirm receiving procedure conducted by the onboard crew straight from command center. Furthermore, the direct monitoring from the command center results in the possibility to promptly transmit notification to all trains and recover early in the event of disruption.

The notification related to operation such as train suspension, the change of returning station, change of line of arrival and departure line and other forms of notification is created based on input information from notification terminal. Furthermore, the notification regarding driving regulations like wind speed regulations is created automatically based on the driving regulation information of disaster prevention system.

### **2.2. Specification of Terminal**

Determining the terminal specification and functional specification considers the idea of conducting functional test of notice system without depending on actual train arrangement. Furthermore, the specification also takes into account the fact that the tests will be conducted along railway lines and on platforms. Considering these aspect, the terminal specification is explained below

(1) Size and Weight

Considers the size that can be carried by 1 person weighing 4kg

(2) Operating time

Can be operated by battery for 4 hours or more

### **2.3. Function Specification**

(1) Base station test equipment communication function

- The function to connect with the base station test equipment. By establishing serial connection to the base station test equipment via RS-485, connection to notice server via digital train radio system channel is possible.
- (2) Train numbers settings function  
Function that simulates registration and changing of train numbers and simulates the removal of route card for train.
  - (3) Location Information Settings Function  
Function that simulate the position and changing of position within the railway line
  - (4) Receiving Response Function  
Function that returns “receiving response” to the notification of disaster prevention information system and operation control notification received from the notice server. The notification test device will automatically returns “receiving response” after a certain period of time
  - (5) Notification Information Display Function  
Displaying log of received notification information from notice server

### 3 Results

Utilizing Windows Note PC, a simplified notice test equipment with the size that can be carried by 1 person is developed (Shown in figure 1)  
Furthermore, the software that reproduce data exchange with the notice server is also developed to replace an actual train with the simplified notice test equipment. The software enables the sending of notification from the notice server to the simplified notice test device and reply to the notice server from the simplified notification test device in the form of “receiving response”, simulating an actual train during the test.



Figure 1. Simplified Notification Test Device

In addition, since the test is conducted by using actual railway radio, the simplified notice test device shown in Figure 1 can be connected to the base station test equipment that is currently deployed at the maintenance base. The base station test device can transmit and receive digital train radio calls and data transmission on wireless channels, and supports wireless channels on all railway line within the jurisdiction area of our company.

An operation test was conducted using the developed product on the environment of communication equipment room for train radio test system. The simulation of train position is possible by inputting the same position information as the train information. Furthermore, the test of notice system utilizing the developed product is also confirmed.

### 3.1. Notification Transmission Test

Notification transmission test was confirmed by properly displaying the railway line on the notice terminal when the train number, position on the railway line, route, etc. is set the same as actual train information. Furthermore, it was also confirmed that “receiving response” can be returned when the notification of the disaster prevention information system and the operation control notification are sent from the notification terminal to the train number on the railway line.

### 3.2. Visibility and Operability

Visibility and operability of the simplified notice test equipment is also examined by developing the test on a simulated onboard monitor that mimics real life onboard monitor. Furthermore, to mimic the actual operation of the train driver, “receive response” key is also mounted on the monitor screen of the simplified notice test equipment. The improvement of the ability to receive notification at any time also makes the practical test of notification transmission possible and the test can be conducted in accordance to driver’s operating procedure (Shown in Figure 2)



Figure 2. Notification Receiving Screen

## 4 Conclusions and Contributions

In this research, a simplified notice test system is developed and created. From the results of the operation test, it was confirmed that the communication system alone could be used for the disaster prevention information system notification and operation control notification tests using this test device.

As a result, it is possible to greatly reduce the work of coordinating the arrangement of test trains related to the test. In the notification test of the 14 target lines in the construction of the actual notification transmission system introduction, a simple notification test device was used instead of the planned four test train tests except for the final running test per line section. Was tested. For the planned running test, we were able to reduce the total of 56 times for the relevant line section. Since the notification transmission system is planned to be introduced for the remaining 3 lines in the future, we will continue to utilize the simplified notification test equipment to reduce the number of test trains.

In addition, since it has become possible to reduce the number of test trains in the actual results, we have deployed a simple notification test device to each maintenance department of our company, which is useful as a confirmation test after a defect or repair of the notification transmission system.

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## **References**

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