Activity of Disseminating Japanese EWBS Technology
- Emergency Warning Broadcast System -

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Abstract – The Japanese digital terrestrial broadcasting system (ISDB-T) has been adopted by 14 countries in Latin America. DiBEG extends technical support and cooperation to help with the implementation of ISDB-T in these countries. The Emergency Warning Broadcast System (EWBS) is one of the key features of ISDB-T and is expected to be introduced as a national communication system for emergency situations. The "EWBS Superimpose Dissemination System", improved from the Japanese original version by meeting local requirements in Latin America, has successfully been developed in Japan. Taking advantage of the robustness of the ISDB-T "One-seg" technology, making maximum use of the existing broadcasting networks, this system realizes simple utilization and wide coverage with outstanding reliability. This system has already been introduced to some Latin American countries and been evaluated highly. Japan continues technical cooperation so that EWBS can contribute to disaster prevention and mitigation in these ISDB-T adopting countries.

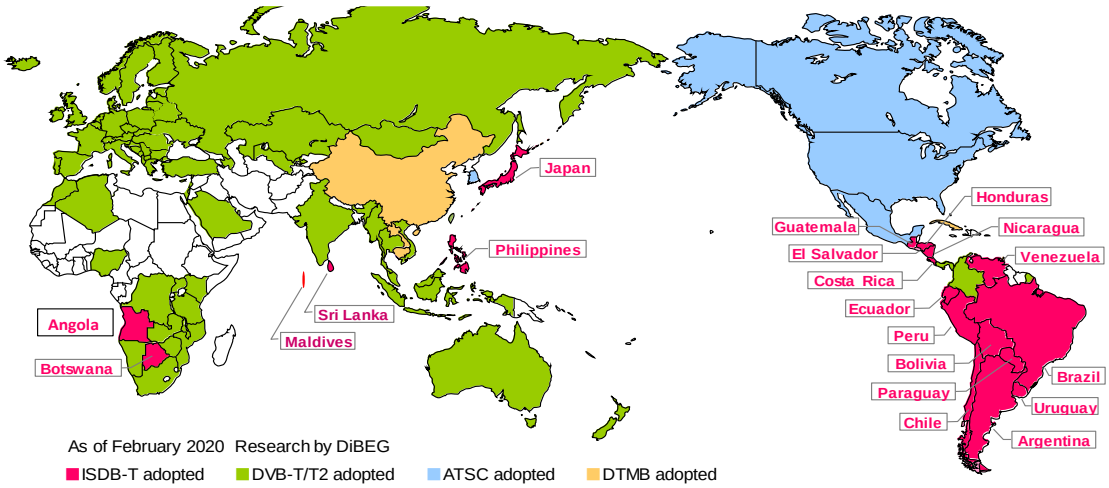

Figure 1: Countries adopting ISDB-T (in red)

1. Technical Requirements for EWBS in Latin American Countries

Japan's Early Warning System, quickly communicating emergency information such as tsunami and earthquake warnings to the public, has been introduced mainly by a mobile communication network and has long been available on a wide variety of mobile devices equipped with features such as area mail and SNS. On the other hand, although the EWBS using a broadcasting network has long been in operation by the most broadcasters in Japan, compatible receivers are limited and not widespread enough. In that sense EWBS is no more than a complementary measure in Japan.

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In most countries in Latin America, because the mobile communication networks have not been well established with enough resilience to sudden line disconnections, the EWBS through broadcasting networks is expected to be a core system for disseminating information for national disaster prevention. In order for EWBS to play this core role, some improvements were required for it to work as a more reliable system that will not miss an alarm under any conditions. There are also many differences in broadcasting operation between Japan and Latin America. The original Japanese EWBS version could not be introduced as–is, and local requirements in Latin America had to be satisfied.

The differences in EWBS requirements are shown below.

	Japan	Latin America
Main Operator	Broadcasters (all)	Government (National Organization for Disaster Prevention)
Concept of using broadcast radio waves	Means of delivering broadcasters' program content	Means of delivering "national disaster prevention information"
Target Areas	ⓐ Nationwide ⓑ Regional areas	ⓐ Nationwide, ⓑ Regional areas ⓒ Local areas
Information disseminated	ⓐ Early warning	ⓐEarly warning ⓑ Information after the occurrence (Post-event information)
Target recipient	TV Viewers in general households	Public places (offices, firefighting stations, hospitals, etc.) and general households
Type of receivers	TV receivers for home use	Various receivers for public / home use ・Public signage, sirens, etc. ・TV receivers for home use

Table 1: Differences in requirements for EWBS

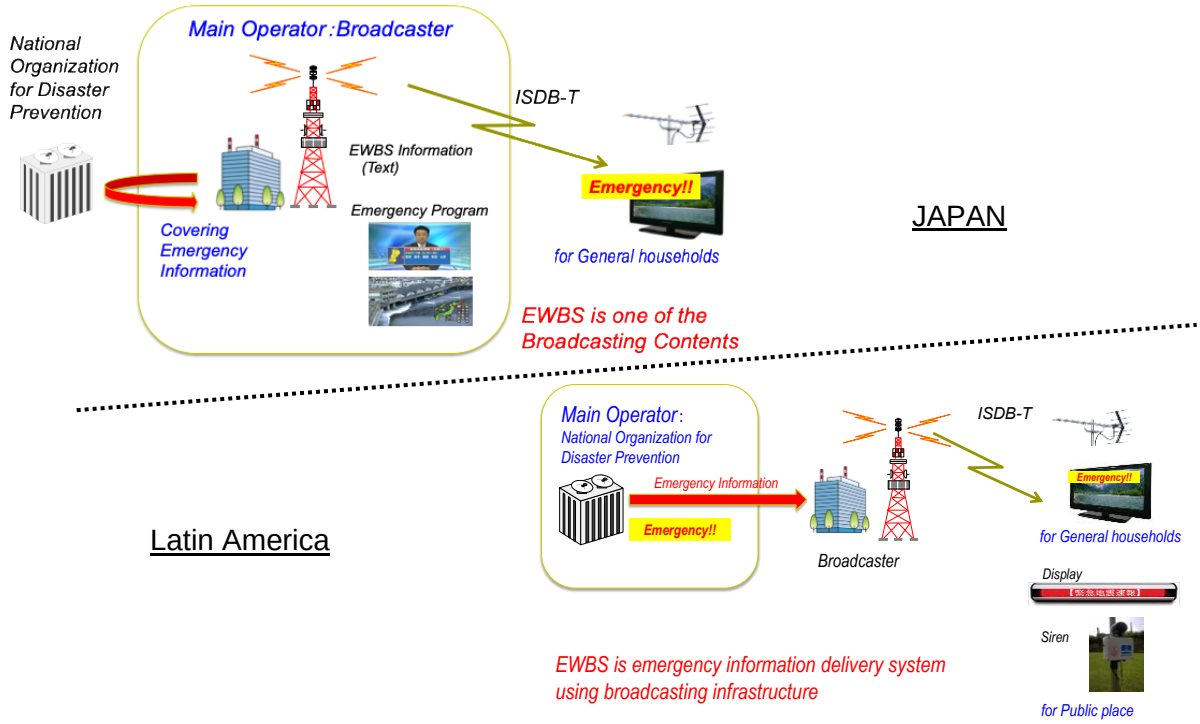


Figure 2: Difference in EWBS Operation between Japan and Latin America

2. Development of the “EWBS Superimpose Dissemination System”

In collaboration with several manufacturers in Japan and Argentina, we have developed an "EWBS Superimpose Dissemination System" to better serve local requirements in Latin America. In addition to the EWBS signals originally operated in Japan, this system will also transmit character “Superimpose" signal, which will be received and displayed on various types of EWBS receivers.

The “Superimpose” function of ISDB-T transmits text information independently in the background of the broadcasting program. This function is proposed to be used in combination with EWBS in Latin America for the purpose of communicating disaster information. By using some control codes of Superimpose, we also developed a function that can identify and activate receivers to respond according to the type of alarm. We have also designed several device tests and training modes to accommodate various required operational patterns.

A message signal can be easily inserted into an existing terrestrial digital network, and wide coverage and robust transmission characteristics can be realized easily and at low cost by using One-segment signals. This feature enables it to be easily introduced in Latin American countries where disaster prevention information transmission systems have not been developed well yet.

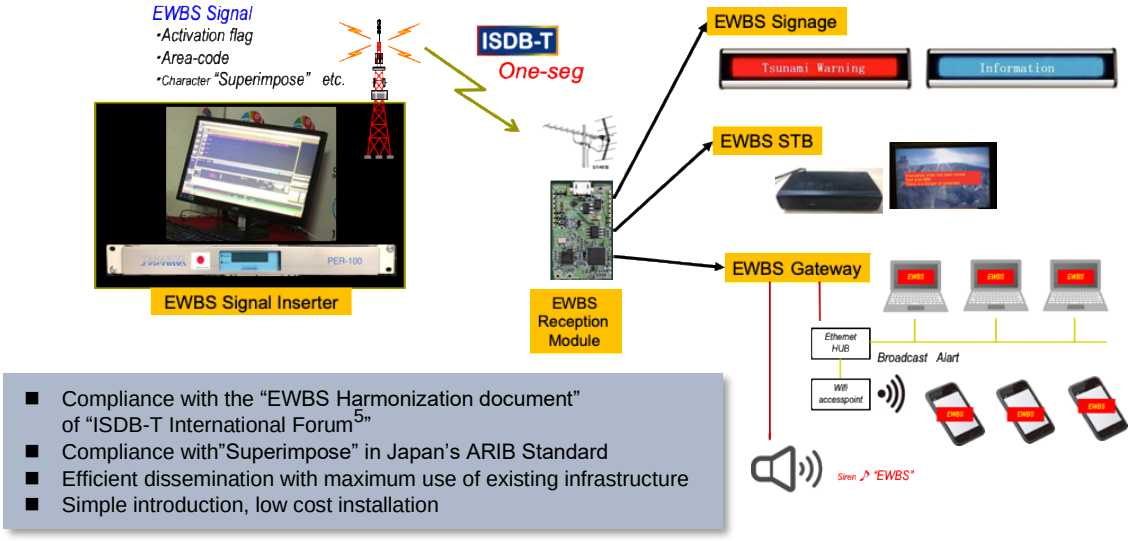


Figure 3: EWBS Superimpose Dissemination System for Latin American countries[4]

[4] ISDB-T International Forum: An international group of ISDB-T adopting countries for the purpose of harmonizing the practical application of ISDB-T digital broadcasting

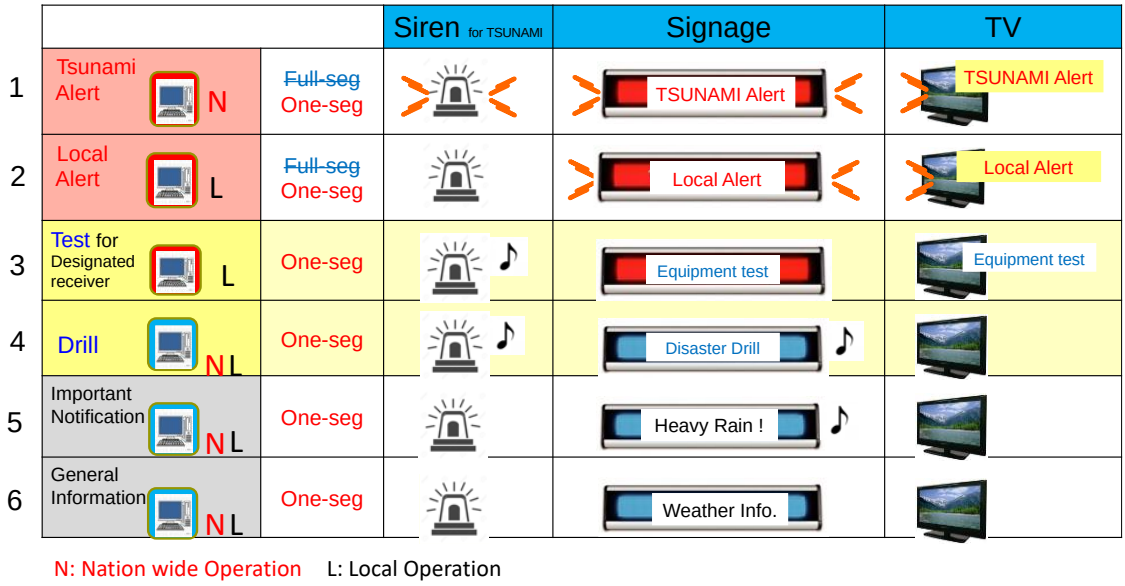


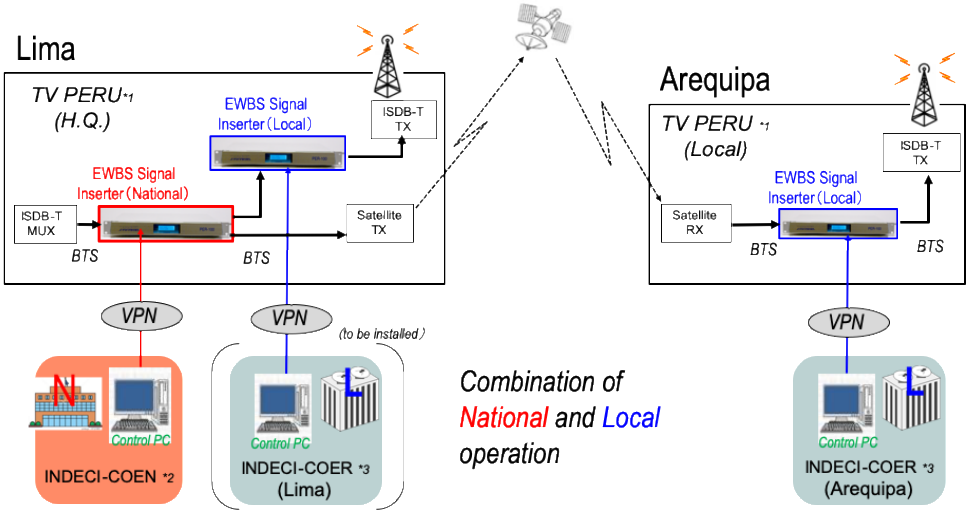
Figure 4: EWBS Latin American version – application to various operation patterns

1) EWBS Signal Inserter (Transmitting device)

The EWBS Signal Inserter enables insertion of an EWBS signal, such as an emergency flag, text Superimpose, or Area-code, into the Broadcast Transport Stream (BTS) as defined by ISDB-T. Inserting the EWBS signal at the BTS stage enables EWBS operation to be implemented quite easily in the Latin American countries adopting ISDB-T, where various manufacturers have supplied various ISDB-T broadcasting systems. The EWBS Signal Inserter can be installed in the master control room at a broadcast center; or at a local transmitting station to insert location-specific information into a TV program. A control terminal (PC) installed at a national organization for disaster prevention can be connected easily to the EWBS Signal Inserter through an IP network. Peru has increased the reliability and security of the entire system by establishing IP connections through a VPN configuration over a microwave link.

Figure 5 shows an example of operation in Peru. It ensures that national and local information can be transmitted in a flexible manner according to its specific purposes and target areas.

With the cooperation of a local manufacturer in Argentina, we have also developed an EWBS signal transmission system to optimize the DVB distribution format, which is widely used in Latin America.



*1: TV Peru: National States Broadcaster in Peru
*2: INDECI-COEN: National operation center of the organization for disaster prevention in Peru
*3: INDECI-COER: Regional operation center of the organization for disaster prevention in Peru

Figure 5: Example of EWBS operation in Peru

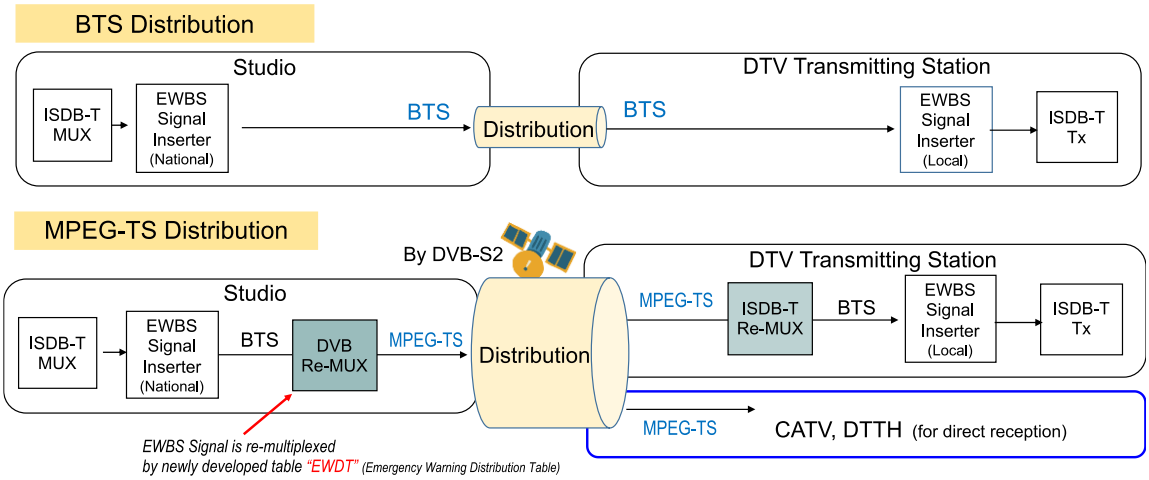


FIGURE 6: EWBS SIGNAL TRANSMISSION SYSTEM THAT SUPPORTS DVB DISTRIBUTION

2) EWBS Reception Module (Reception device)

To promote the sale and permeation of EWBS receivers in the consumer market, we have developed a basic module called "EWBS reception module" that can be deployed in various receivers. This module constantly monitors the terrestrial digital One-seg signal of a specific broadcasting station carrying the EWBS signal, and once it detects an EWBS signal, it decodes the signal and outputs an emergency flag and a text message. In Latin America, information terminals such as electronic bulletin boards and speakers can be seen around the city. Mounting this module on these exiting terminals enables them to be applied as alarm indicator devices.

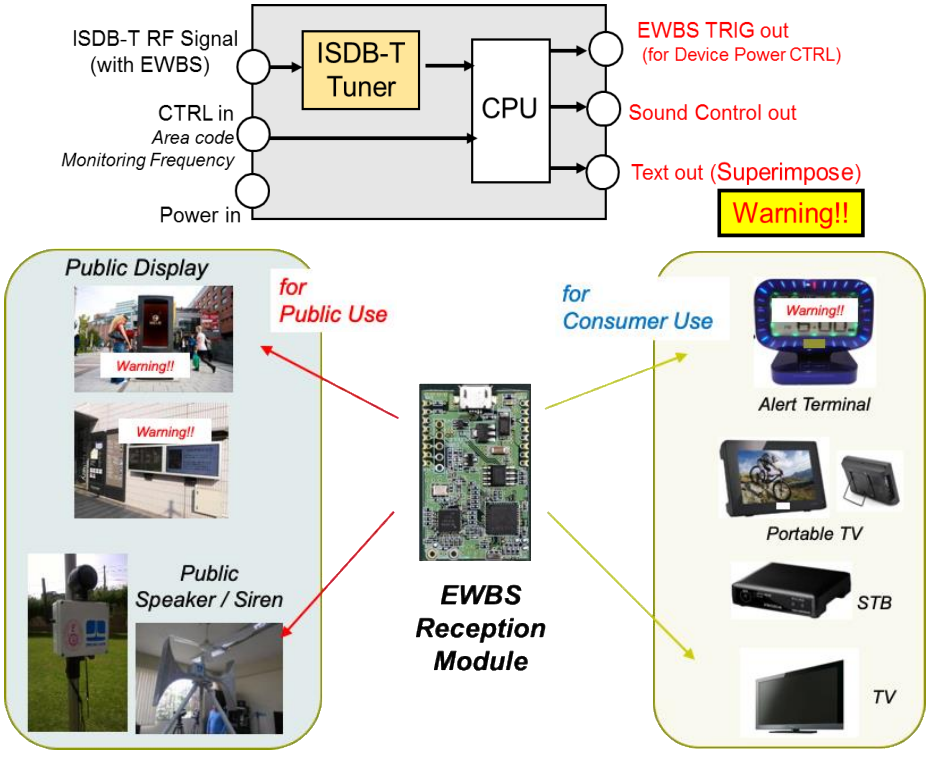


Figure 7: Wide-ranging applications of the EWBS reception module

3) EWBS Signage (Reception device)

We have also developed text display terminals (EWBS signage) equipped with the EWBS reception module. These are intended for installation in public facilities where people gather, such as government offices, fire stations and any other disaster prevention locations, as well as in shopping centers. As a notable installation location, Peru has installed terminals at radio stations in local cities and regions. When installed in a radio booth, if a warning is received, the radio announcer can read messages to the listeners as they are displayed.

The expected application of signage is for dissemination of information right after a disaster ("Post-event information" in Table 1). An example of application is to install a display in an evacuation center, providing daily lifeline information to the evacuees, such as the status of restoring lifeline services and volunteer activities.

Figure 8: EWBS signage in operation at a radio station in Lima, Peru

4) EWBS Set-top Box (Reception device)

Since an ordinary STB has only one tuner, it will receive EWBS signals while watching a broadcast channel that is operating the EWBS, but it will miss alarms while watching other broadcast channels. The STB that we have developed implements a separate, dedicated tuner that monitors EWBS 24 hours-a-day, so it can receive EWBS and not miss any EWBS messages. It also uses the HDMI-CEC function to automatically start up the TV and it has a function to switch viewing to the HDMI port. HDMI-CEC is a function of HDMI for Consumer Electronics Control (CEC), which links operation of electronic products such as TV receivers and HDD recorders by exchanging control signals between them through an HDMI cable. This STB utilizes the one-touch display function, which is a common command function that automatically turns on a TV if it is switched off and switches the input to the EWBS channel.

There are many households in Latin American countries viewing TV programs by cable, and in such households the inability to receive EWBS signals (by way of digital terrestrial broadcasting) has been an issue. This STB can switch the HDMI port to show EWBS information even while the TV viewer is watching a cable TV program. This feature stimulated and attracted the attention to this STB product.

In order to check that the CEC function of the STB is effective and never misses an alarm, we performed EWBS reception trials in Peru and Costa Rica, in cooperation with a local electronics retailer in these two countries, using several TV receivers for sale in stores. The trials confirmed automatic startup on most of the TV receivers of major manufacturers, with only a few exceptions.

This STB can be applied in ordinary households and also in public places where a TV is normally installed, such as school classrooms, and hospital waiting areas.

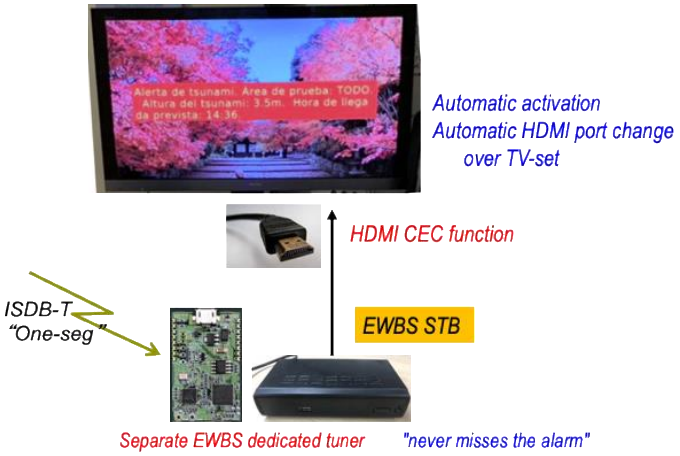


Figure 9: Functions of the EWBS STB

FIGURE 10 : MANY TV RECEIVERS ON DISPLAY AT AN ELECTRONICS SHOP IN COSTA RICA

5) EWBS Gateway (Reception device)

The last item of EWBS receiver to be introduced here is the “EWBS gateway”. The initial demand for this item was from the Peruvian national organization for disaster prevention which requested for the development of a mechanism to notify the alarm to PCs connected to the intranet of the organization. The idea of applying this to a Wi-Fi router immediately came to the development. As a result, EWBS signal transmission to mobile devices such as smartphones, once considered difficult to receive directly because of the problem of battery consumption due to standby power consumption, has been realized. The EWBS gateway also has the function of synthesizing the received text information and outputting it to a voice display terminal such as a speaker. The configuration consists of the headend in the intranet receiving the EWBS signal, pushing the message on the internet when an alarm is received.

In order to notify the EWBS to general end-users, it is necessary to have an EWBS receiver purchased. However, once an EWBS gateway is installed at the head-end of an existing communication system such as a Wi-Fi router or a community reception system such as in-house audio system in the hall, the EWBS can be received by using the receiving terminal (smartphones, speakers, etc.) in the communication system as it is. This concept of “range expansion of warning notice through the existing facility” has gained high reputation in the field and is strongly expected as the performance is gradually known to the people.

FIGURE 11 : PROTOTYPE GATEWAY AND ITS DEMONSTRATION (SEP. 2019 IN ALEQUIPA, PERU)

3. Current Status of EWBS Implementation in Latin American Countries

The EWBS Superimpose Dissemination System has been supplied on an experimental basis to some of the Latin American countries adopting ISDB-T. The current status of technical cooperation from Japan and the actual implementation in these countries is described below.

In all of these countries, the equipment has worked well. Locally in Peru, the system was evaluated very highly, and full-scale operation has already started.
We believe that the key to further system expansion is to improve the operational level. Each of the countries was required to start everything from the very beginning, including expansion of equipment maintenance, establishing an organization for system operation, and securing government budget for such purposes.

Country	Current Status
Nicaragua	3/2018 Field trial of hardware
El Salvador	10/2018 Field trial of hardware 10/2019 Start of trial operation by national organization for disaster prevention, and support for reception tests
Costa Rica	10/2018 Field trial of hardware 3/2019 Start of trial operation by national organization for disaster prevention, and support for reception tests
Peru	1/2019 Field trial of hardware 3/2019 Start of support for operation training 11/2019 Tested in a large-scale evacuation test on World Tsunami Awareness Day (Nov. 5, 2019) --- National organization for disaster prevention announced official adoption of EWBS
Brazil	12/2019 Field trial of hardware

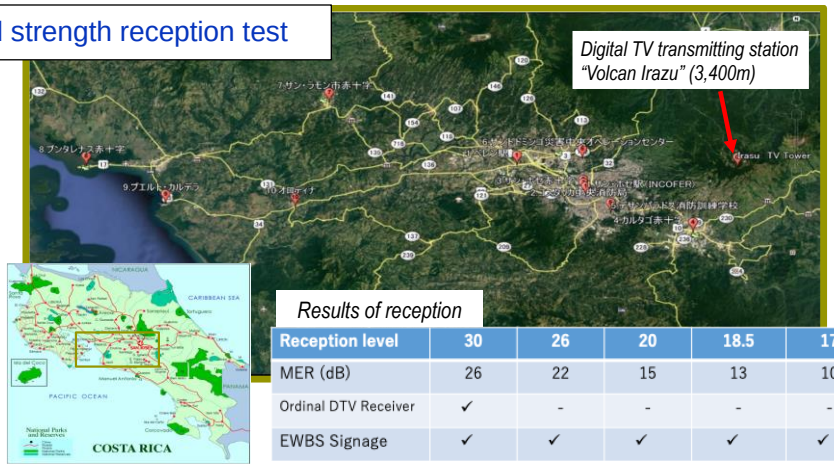
Table 2: Status of EWBS implementation with support from Japan (in Latin America)

Reports with some topics on the latest implementation status in Costa Rica, Peru and Brazil are as follows:

1) Costa Rica "One-seg EWBS" Highly Appreciated

In March 2019, we performed a reception evaluation test using actual radio waves in Costa Rica. We measured reception in areas with weak field strength and mobile reception. Costa Rica is a mountainous country. But even in shadow areas where Full-seg cannot be received due to topographic conditions, One-seg signals could easily be received with a simple receiver antenna. For mobile reception, we conducted reception tests on traveling trains, vehicles and on boats with a signage receiver. We were able to verify and show very stable reception characteristics, which was greatly appreciated by local people. We were able to ensure that One-seg can be a key element for information and communications in the event of a disaster.
In Costa Rica, the feasibility of the EWBS was confirmed, and the government is studying the establishment of a new organization and securing budget for full-scale EWBS operation.

Poor field strength reception test



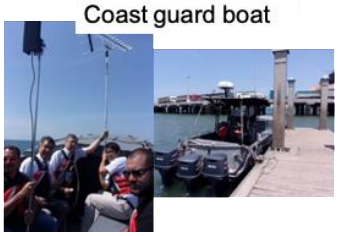
Results of reception

Reception level	30	26	20	18.5	17	15.5
MER (dB)	26	22	15	13	10	7.5
Ordinal DTV Receiver	✓	-	-	-	-	-
EWBS Signage	✓	✓	✓	✓	✓	✓

Mobile reception test

Railway carriage

Coast guard boat



Vehicle

FIGURE 12: FIELD SURVEY OF EWBS RECEPTION IN SAN JOSE, COSTA RICA (MARCH 2019)

2) Peru: Utilization in large scale evacuation drills on World Tsunami Awareness Day

Peru is the country where EWBS operation is the most advanced. Peru has a large land area and a variety of natural disasters such as wide-area tsunamis on the coast, heavy rain and landslides in the Andes areas, flooding of the Amazon River, and cold-weather damage in the high mountain areas. It is thus necessary to design and implement EWBS operations in due consideration of these various disasters. It is also important for the EWBS to establish operational rules and standardization, including nationwide and local operations and region code allocations. As the digital terrestrial network expands nationwide in the future, the EWBS operation will also have to develop and expand nationwide. We have improved the software of EWBS operations in order to meet these future requirements in Peru, and the system has achieved a high level of operational performance. We expect that the permeation of receivers will naturally expand as the operational level of EWBS advances.

On November 5, 2019 commemorating World Tsunami Awareness Day, extensive evacuation drills were conducted in Peru, and EWBS played an important role for these drills. A message transmitted via EWBS was displayed on a large screen outside the shopping center at the main venue. An EWBS signage was also used in a disaster ministerial meeting.

At a symposium the following day, INDECI, the national organization for disaster prevention, announced a budget plan for the adoption and nationwide deployment of EWBS in Peru.

FIGURE 13: AT A TV TRANSMITTING STATION IN PERUVIAN ANDES. THIS IS A DISTRICT WHERE 20,000 PEOPLE DIED OF DROWNING BY DEVASTATING GLACIERS FLOODING CAUSED BY THE 1970 EARTHQUAKE. IN THE FUTURE, DIGITIZATION AND EWBS OPERATION WILL CONTRIBUTE TO THE LOCAL SPECIFIC DISASTER PREVENTION.

Emergency message (EWBS) displayed on the large display at the main site of the evacuation drill

Utilization in a local government

EWBS Displays utilized in the Disaster Ministerial meeting

Figure 14: EWBS utilized in an event on World Tsunami Awareness Day, November 2019 in Lima, Peru

3) Brazil: Key country for diffusion of unified EWBS throughout Latin America

In Brazil there has been a growing interest in EWBS recently and they have already taken their first steps with some field trials. Brazil is rather different from other ISDB-T adopting countries in the sense that the EWBS is to be deployed for all types of critical situation, such as the collapse of a dam or a nuclear power plant, and not only for natural disasters.

Brazil was the first country outside Japan to adopt ISDB-T in 2006. DiBEG and SBTVD-Forum, the Brazilian counterpart, have long been working together on implementation of ISDB-T. We established the “EWBS rapporteur group” particularly to study unified EWBS technical standards and operations throughout Latin America. In December 2019, cooperating between Japan and Brazil, we conducted pilot tests of EWBS in its capital city of Brasilia and could show its advantages for many stakeholders. The significance of Brazil's adoption of EWBS is not limited to Brazil. The transmission and reception

equipment and systems for ISDB-T digital terrestrial broadcasting in Latin America have been developed and marketed with close reference to the Brazilian digital TV standards. Broad deployment of EWBS in Brazil will lead to the spread of EWBS throughout Latin America, with unified EWBS operation and equipment.

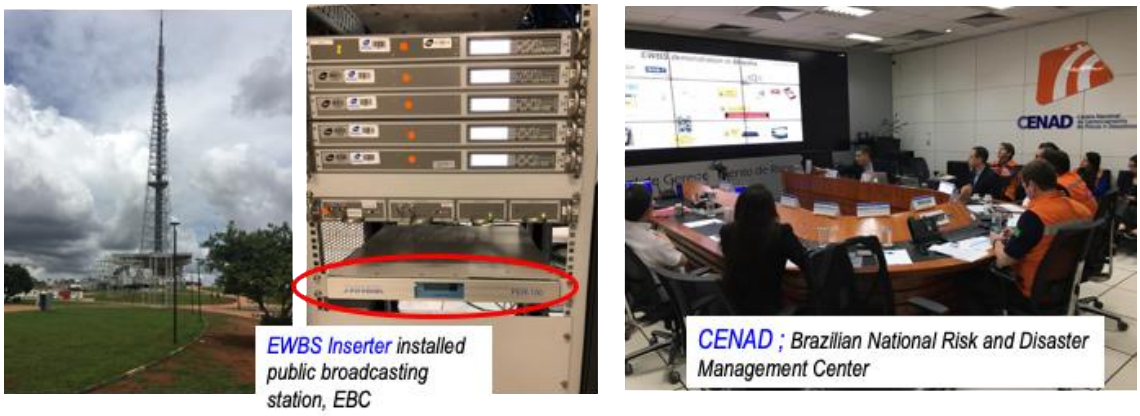


FIGURE 15: EWBS EXPERIMENT IN BRASILIA, BRAZIL (DECEMBER 2019)

Conclusion

The EWBS in these Latin American countries operates differently than in Japan. For this reason, we have worked on technical development of an EWBS Superimpose Dissemination System to satisfy numerous local requirements. The system we have developed is being gradually implemented and verified in Peru and other Latin American countries adopting ISDB-T, and we are continuing technical support and cooperation for stable and reliable system operation.

We are confident that collaboration between Japan and Latin American countries will standardize and unify the most suitable systems in the near future, and that devices will be launched and developed in the market, leading to broad adoption of EWBS and contributing to disaster prevention and mitigation.

Acknowledgments

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We are grateful to the SBTVD-Forum in Brazil, for cooperative study as well as many others in Latin American countries adopting ISDB-T, who have generously extended understanding and cooperation to us in these activities

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