Emergency Warning Broadcast System

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DiBEG JAPAN
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Contents

- Outline of the Emergency Warning Broadcast System (EWBS)
- EWBS for analog broadcasting
- EWBS for digital broadcasting “ISDB-T”
- Automatic activation of One-Seg handheld receivers by EWBS
1. Outline of the Emergency Warning Broadcast System (EWBS)
What’s the EWBS? (I)

The emergency warning broadcast system is • • •

- EWBS is a remote activation system for Radio & TV.
- EWBS transmits alert/warning information to viewers and listeners about disasters.
- EWBS has been operating since September 1985 in Japan.
- Test signals/programs are broadcast monthly in Japan (every 1st day)
- EWBS is operated in response to large-scale earthquake warnings, Tsunami Alerts and broadcast requests from local governors
Is it possible to do remote activation by not only broadcasting but also communication?

Yes, it is. However, they both have merits and demerits, and the system should be designed to make the best use of these merits.

Remote activation by communication (telephone)

- Merits: possible to control individual receivers
- Demerits: In case of a large scale disaster, traffic congestion is very likely.

Remote activation by broadcasting

- Merits: possible to quickly activate many receivers simultaneously
- Demerits: difficult to customize activation control for individual receivers
Remote activation by communication (email, etc.)

- Reliability
  In case of disasters, congestion is very likely.
- Speed
  Need more time to inform a huge number of people
- Locality
  Possible to control activation in local area

Communication

Remote activation by mail

Broadcasting

Remote activation by Emergency warning broadcast
Remote activation by EWBS

- **Reliability**
  No traffic congestion, anybody can receive it in the broadcasting area.
  Broadcasters offer reliable news by filtering information.

- **Speed**
  Possible to inform an extremely large number of people simultaneously.

- **Locality**
  The system used in Japan is controlled by prefectural area.

**Broadcasting is an ideal media to deliver disaster information**

Remote activation and emergency warning broadcast reception by EWBS
The history of EWB

EWB: Emergency Warning Broadcast

- Around 1980  NHK STRL launched EWBS study
- Sep. 1, 1985  EWB operation start in Japan
- Mar. 18, 1987  First EWB operation for tsunami alert
- Jan. 13, 2007  Most recent EWB operation for tsunami alert
- Up to now  EWB has operated 15 times during 21 years
- Test broadcasting takes place on 1st of every month at noon
- shipment of receivers: about 550,000

*reference:
On Sep. 1\textsuperscript{st}, 1923, a large scale earthquake attacked Tokyo area and more than 100,000 people died. It became a trigger to start radio broadcasting in Japan. Sep. 1\textsuperscript{st} is the day of disaster prevention in Japan.
List of Recent Significant Earthquakes (from December 2004)

<table>
<thead>
<tr>
<th>Date</th>
<th>Place</th>
<th>Fatalities</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 26, 2004</td>
<td>Off northwest coast of Sumatra, Indonesia</td>
<td>300,000</td>
<td>9.3</td>
</tr>
<tr>
<td>Feb. 22, 2005</td>
<td>Zarand, Iran</td>
<td>Over 500</td>
<td>6.4</td>
</tr>
<tr>
<td>Mar. 28, 2005</td>
<td>Northern Sumatra, Indonesia</td>
<td>1,000-2,000</td>
<td>8.7</td>
</tr>
<tr>
<td>Oct. 8, 2005</td>
<td>Kashmir, Pakistan</td>
<td>100,000 (estimated)</td>
<td>7.6</td>
</tr>
<tr>
<td>May. 26, 2006</td>
<td>Java, Indonesia</td>
<td>Over 6,000</td>
<td>6.3</td>
</tr>
<tr>
<td>July. 17, 2006</td>
<td>Java, Indonesia</td>
<td>Over 500</td>
<td>7.7</td>
</tr>
</tbody>
</table>
Conditions for operation of EWB in Japan

- In Japan, EWB broadcasts only in three cases where there is great risk to human lives and property,

1. When a precautionary declaration of a large-scale earthquake such as the Tokai earthquake is issued, (First-class nationwide)

2. When a Tsunami (tidal wave) alert is given, (Second-class nationwide, prefecture wide)

3. When the local governor requests an emergency warning broadcast (First-class nationwide)
2. Analog EWBS
ISDB-T, the Future of Digital Television in the Philippines

Analog EWBS transmission and reception block diagram

Program signal → Switch → Transmitter

Control signal generator

Program signal reception

Control signal reception

Broadcasting station

Receiver with warning function

Radio

TV

Alarming sound, followed by announcement
Connection of Emergency Information

Earthquake

206 points all over Japan
A start sign and end sign are transmitted by an FSK 640Hz/1024Hz signal combined with a warning sound.

- Start sign
- End sign

Usual Program  Emergency warning broadcasting program  Usual Program

time
Analog EWB conventional receivers

- Receiver with a Clock
- Portable AM/FM Receiver
- Receiver with Power on switch
Analog EWB New Receivers (New development)

(1) New receiver for EWS

(2) Onboard EWS decoder

A new algorithm capable of running on a multi-purpose processor IC integrated in home electronics has been developed
3. Digital EWBS and ISDB-T
ISDB-T, the Future of Digital Television in the Philippines

ISDB-T (Integrated service digital broadcasting terrestrial)

- Supports 3 reception types on one channel
- Dec. 2003 commenced
- 6 MHz
- 13 segments

- Fixed reception
- Mobile reception
- Home receiver
- Mobile reception
- HDTV
- Diversity Reception
- Receiver in vehicle
- Audio
- Visual
- Data
- Handheld receiver
- One-Seg
- 2006.4 commenced

TV station

- 13 segments

- 1 segment
ISDB-T, the Future of Digital Television in the Philippines

ISDB-T services example

- **ISDB-T**
  - Mobile receiver
  - Handheld receiver
  - Fixed receiver (Multi SD, HDTV)

- **6 MHz**

- **One-Seg**: Mobile & handheld
  - Data bit-rate: 416Kbps
  - Modulation: QPSK (2/3)
  - Features: Robustness for mobile reception

- **Fixed receiver**
  - Data bit-rate: 16.9Mbps
  - Modulation: 64QAM (fec:3/4)
  - Features: HDTV & 5.1ch surround sound or Multi SD serviced

Digital broadcasting experts group
ISDB-T, the Future of Digital Television in the Philippines

**ISDB-T One-Seg receivers**

Number of shipments as of Dec 2007: over 20,000,000 (JEITA statistics)

- **au by KDDI** W33SA
- **SoftBank** 905SH
- **FOMA P901iTV**
- **Laptop Computer**
- **Portable DVD player**
- **Antenna for One-Seg receiver**

Digital broadcasting experts group
ISDB-T, the Future of Digital Television in the Philippines

ISDB-T mobile receivers

Number of shipments as of Dec 2007: about 1,030,000 (JEITA statistics)

- **Panasonic**
  - CN-HDS960TD
  - CN-HDS635TD

- **SANYO**
  - NV-HD870DT
  - NVA-HD1500DT

- **Pioneer**
  - AVIC-VH009MDG

- **Fujitsu ten**
  - AVN7406HD

- **ALPINE**
  - VIE-X07B1/S1

- **Toyota**
  - TDT-H56

From each company’s web site
ISDB-T Transmitter block diagram

Service
- Video
- Audio
- Data

MPEG-2 Source coding

Coding

Multiplexer

Channel coding
- Hierarchical parallel processing
- Error correction
- Mapping
- Interleaving

OFDM Frame

TMCC add.

Addition of EWB Descriptor

Addition of Activation signal for EWB

OFDM Signal

TMCC : Transmission and Multiplexing Configuration Control
EWB Descriptor (ISDB-T)
Arrangement of TMCC in mode 3

TMCC
(204 bits / frame)

Header

Activation signal for EWB

Seg. #0
(429 kHz)

Seg. #1
(429 kHz)

Seg. #2
(429 kHz)

Seg. #3
(429 kHz)

Seg. #4
(429 kHz)

Seg. #5
(429 kHz)

Seg. #6
(429 kHz)

Seg. #7
(429 kHz)

Seg. #8
(429 kHz)

Seg. #9
(429 kHz)

Seg. #10
(129 kHz)

Seg. #11
(429 kHz)

Seg. #12
(429 kHz)

Time axis

Frequency axis

BW : 5.6MHz
4. Automatic activation of One-Seg handheld receivers by EWBS
Possibility of EWBS and One-Seg service

- One-Seg service commenced on April 2006
  - One-Seg service is capable of transmitting EWBS
  - Most people carry mobile phones in Japan

Broadcast studio
Transmitter station

A huge number of people can get disaster information quickly in the field if the One-Seg receiver can receive EWBS
Automatic activation of One-Seg receivers

- Receiver Stand-by with low power consumption
- Automatic reception of emergency warning broadcasting
- Tsunami disaster information...
- We have news of an earthquake...
- Automatic activation of One-Seg receiver circuit by EWB activation signal
To automatically activate One-Seg receivers by EWBS

- EWBS receivers need to monitor the EWB activation signal on the TMCC carriers continuously

- Continuous operation of the receiver circuit causes wasting of the battery

  Power-saving of receiver circuit is indispensable!

- The characteristics of a trial receiver circuit have been tested which demodulates only four TMCC carriers and uses diversity combining technologies

- The activation signal is received intermittently in synchronization with the timing of the activation signal transmission format
**Arrangement of TMCC Carriers (Mode 3)**

Band Width: 5.6MHz

- **One-Seg Band Width (=429kHz)**
  - Seg #11 (429kHz)
  - Seg #9 (429kHz)
  - Seg #7 (429kHz)
  - Seg #5 (429kHz)
  - Seg #3 (429kHz)
  - Seg #1 (429kHz)
  - Seg #2 (429kHz)
  - Seg #4 (429kHz)
  - Seg #6 (429kHz)
  - Seg #8 (429kHz)
  - Seg #10 (429kHz)
  - Seg #12 (429kHz)

*Demodulate only four carriers*

**Band Width:** 5.6MHz

**One-Seg Band Width:** (429kHz)

**Frequency:**

- Seg #101
- Seg #131
- Seg #286
- Seg #349

(DBPSK)
When the handheld receiver is in stand-by mode, only the One-Seg tuner and activation signal detector are working.

- The activation signal detector uses a simple circuit without FFT.

- When the activation signal is active, the demodulator and display are started, the One-Seg tuner operates continuously and the emergency warning broadcast is displayed.
Control power switching interval of One-Seg tuner

1 frame (204 symbols)

Activation signal (27th symbol)

Synchronization signal

Parity

7 symbols

27 symbols

Tuner active

Tuner inactive

Control power switching intermittently to save the power consumption
Activation signal detector for One-Seg

Prototype activation signal detector

The Activation signal detector connected to a cellular phone
Usage for EWBS

Not only
- Earthquake forecast
- Tsunami forecast
But also
- Hurricane forecast
- Flood warning
- Eruption warning
- Fire warning
- Other warning
Conclusion

- Broadcasting is an ideal media to deliver disaster information.
- EWBS is a broadcasting system which remotely activates radio & TV in the case of emergency alerts.
- EWBS for analog AM/FM radio, analog and digital TV has already commenced operation in Japan.
- Research and development of an EWB receiver for One-Seg.
  - Automatic activation of handheld receiver by EWBS is very effective.
  - Power consumption saving is required while EWB is in stand-by.
EWBS introduction DVD
Please visit the EWBS demonstration!
Thank you for your attention!

NHK STRL
http://www.nhk.or.jp/strl/english/index.html
References
Block diagram of activation signal receiver

RF signal

- Tuner
- AGC
- A/D
- Quadrature demo
- AFC

Control
Turn On/Off

- Frequency shift
- Frequency shift
- Frequency shift

Interval pulse generator
Symbol & frame Counter
TMCC Sync detect

Diversity combiner

Decision under majority rule between frames

EWS signal

Demodulate TMCC and detect activation signal by a simple circuit without complex FFT
Sony’s products “Bravia”
X7000 series, X5050 series,
X5000 series and W5000 series

Panasonic’s Car Navigation &
AV System “Strada”.

The screen changes when
EWS is detected!!