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Recommendation ITU-R BO.1774-2
(10/2015)

**Use of satellite and terrestrial broadcast
infrastructures for public warning,
disaster mitigation and relief**

BO Series
Satellite delivery



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SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
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Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BO.1774-2*¹**Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief**

(Question ITU-R 290/4)

(2006-2007-2015)

Scope

This Recommendation provides characteristics of satellite and terrestrial broadcasting systems used for disaster mitigation and relief operations. Detailed descriptions of these systems are given in Annex 1 as guidance, and may also be found in § 5 of Report ITU-R BT.2299 – Broadcasting for public warning, disaster mitigation and relief.

Keywords

Public warning, emergency warning system (EWS), automatic receiver activation

The ITU Radiocommunication Assembly,

considering

- a) the recent natural tragedies due for example, to earthquakes and their consequences, alongside the possible role of communications in public warning, disaster mitigation and relief;
- b) that all administrations recognize the need to organize information dealing with public warning, disaster mitigation and relief;
- c) that in cases, when the “wired” or “wireless” telecommunication infrastructure is significantly or completely destroyed by a disaster, broadcasting services can often still be employed for public warning, disaster mitigation and relief operation;
- d) that broadcast frequency bands are largely globally harmonized and could be used for disseminating public alert messages and advice to large sections of the population;
- e) that broadcast frequency bands could be used for coordination of relief activities by disseminating information from relief planning teams to the population and provide information on the well-being of individuals, especially from the affected area;
- f) that within the terrestrial broadcasting infrastructure there are a number of systems offering communication services that allow global or regional coverage;
- g) that users of the broadcasting services are expected to be using both portable and fixed terminals for emergency services, especially in sparsely populated, uninhabited or remote areas;
- h) that within the broadcasting services there is a great and growing need to determine standard international routing procedures for emergency traffic;

* This Recommendation should be brought to the attention of Telecommunication Standardization Study Groups 2 and 9, and Telecommunication Development Study Group 2.

¹ Radiocommunication Study Group 4 made editorial amendments to this Recommendation in the year 2016 in accordance with Resolution ITU-R 1.

- i) that many administrations have already established emergency communication traffic procedures including means for secure control of their utilization;
- j) that distress, emergency, safety and other communications are defined in the Radio Regulations (RR);
- k) that individual broadcasters will always have their own security control over their programme material and their network;
- l) that many stations operating in the broadcasting service can operate without externally provided power for some time (up to weeks);
- m) that sound and television broadcasting organizations have developed techniques often referred to as “electronic news gathering” for the dissemination of information in programmes called “news bulletins” to inform the public of the extent of disasters and the recovery efforts being undertaken,

recognizing

- a) that the broadcasting infrastructure is actually used to reach several billion people in a short period of time;
- b) that in some countries, such alert systems such as the emergency warning system (EWS) or emergency alert broadcasting have been implemented in which broadcasting stations are connected to governmental or international organizations which issue disaster forecasts;
- c) that a single transmitter operating in the LF, MF and HF frequency bands as well as space stations of the BSS cover large service areas;
- d) that the RR foresee provisions by means of which BSS feeder links subject to Appendix 30A can be converted into FSS links (e.g. for VSAT operations in an emergency area);
- e) that in some cases, a broadcasting station has its own seismometers in the country, analyses the seismic intensities, and voluntarily issues precautions to the public through broadcasts;
- f) that ITU-R has established studies into spectrum usage and users requirements for terrestrial electronic news gathering in Radiocommunication Study Group 6,

noting

that Report ITU-R BT.2299 – Broadcasting for public warning, disaster mitigation and relief, provides a compilation of supporting evidence that broadcasting plays a critically important role in disseminating information to the public in times of emergencies,

recommends

- 1 that responsible agencies should prepare procedures and routines to send information on public warning, disaster mitigation and relief to transmitting or network distribution centres in accordance with agreed technical signal protocols;
- 2 that broadcast transmitters and receivers should be equipped to receive material prepared by the responsible agencies;
- 3 that systems for transmission and reception should include the possibility for forcing suitably equipped and suitably primed receivers (whether switched on or in standby mode) to present programme material for disaster mitigation and relief without intervention from the listener or viewer; so that all citizens can become informed of a possible disaster within the shortest possible period of time; with a robust mechanism against abuse of this feature;
- 4 that for *recommends* 1 to 3, public warning systems on broadcasting as given in Annex 1 may be considered;

5 that for *recommends* 1 to 4, public warning system control signals for analogue broadcasting as given in Annex 2 may also be considered by administrations implementing a public warning system;

6 that in case of public warning, disaster mitigation and relief, broadcasting transmitters should disseminate information advising at a local, national level and/or, potentially, even across national borders as appropriate;

7 that administrations should coordinate where possible with sound and television broadcasting organizations the application of electronic news gathering resources in the disaster area to maximize the potential for using the information gathered in a timely and coordinated fashion to assist the disaster mitigation and relief efforts.

Annex 1

Public warning systems for broadcasting

1 Introduction

This Annex presents an overview of public warning systems in the broadcasting service.

2 Outline of public warning systems for broadcasting

Broadcasters have two functions in disaster management. One is gathering or receiving information from disaster radiocommunication networks connected to administrative organizations. The exclusive line connected to administrative organizations is preferably to be used for urgent alerts and such information as earthquake and tsunami data. The other function is delivering information to the general public. Some municipalities in some countries may have a multicasting system to outdoor receivers with loudspeakers in their own disaster radiocommunication network. However, it may be difficult to hear the sound indoors, especially in bad weather such as storms or heavy rain. Therefore, disaster alerts and information via broadcasting is particularly useful in such situations.

3 Emergency warning system for analogue broadcasting

The system should use relatively simple equipment to ensure stable operations. In an emergency, the EWS control signal, which is an analogue signal, automatically activates the receivers equipped with the EWS function even when they are standby.

Depending on its characteristics, the EWS control signal might also be used as an alarm sound to draw the attention of listeners/viewers to the emergency broadcasting programme. Broadcasters operating analogue platforms can transmit the EWS control signal. The EWS control signal could include an area code as well as a time code, keeping the receiver protected from intentionally fake control signals.

For a specific EWS for analogue sound broadcasting, an EWS control signal as described in Annex 2 is recommended, for automatic activation of receivers compliant with the systems described in Appendix 1 to Annex 1 for public warning, disaster mitigation and relief.

4 Emergency warning system for digital broadcasting

In digital broadcasting, the EWS control signal is transmitted by multiplexing with the broadcast signal. It automatically activates the receivers equipped with the EWS function when they are in standby mode. The EWS control signal should be robust against the abuse of this feature. It is foreseen that digital broadcast receivers will be installed in mobile terminals such as cellular phones, being an effective way to send emergency information to such terminals. Therefore, it would be advantageous for such terminals to be equipped with the EWS function.

Appendix 1 to Annex 1

Examples of public warning systems for broadcasting

1 Introduction

This Appendix presents a system overview and the current status of public warning systems in the broadcasting service in some countries/regions.

2 Emergency Warning System

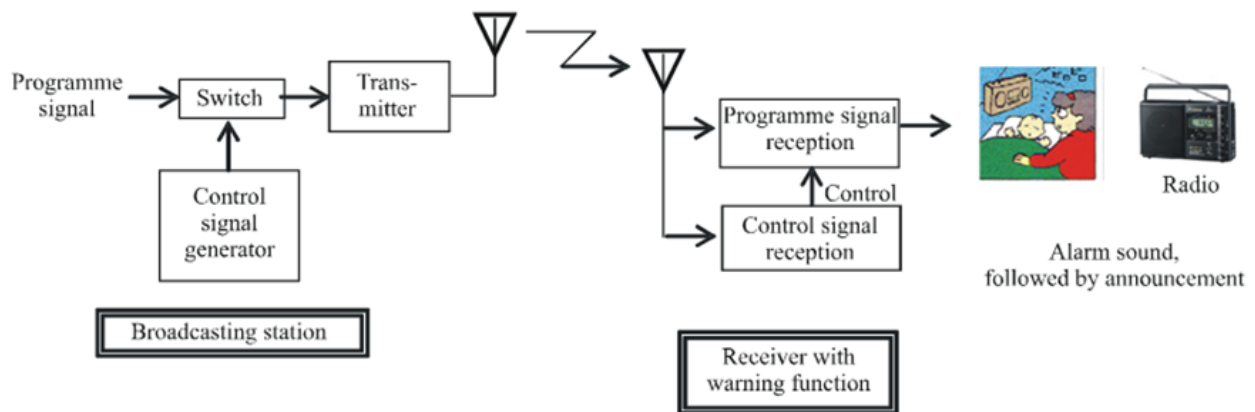
This section describes the Emergency Warning System (EWS), for public warning systems via broadcasting platforms.

2.1 EWS for analogue sound broadcasting

2.1.1 Overview

The composition of a typical emergency warning system is shown in Fig. 1. In an emergency situation, the control signal breaks into the programme signal, to activate the EWS receivers automatically, even when they are in standby mode. The audio level of the control signal is higher than the normal programme signal level. The control signal can also be used for the alarm sound. The system configuration should be simple for quick and reliable activation.

FIGURE 1
Composition of emergency warning system for analogue broadcasting



When the EWS receiver detects the control signal, the alarm will sound, to draw the attention of listeners to the emergency broadcast. The control signal can be transmitted to MW and FM receivers. The control signal includes an area code as well as a time code, thereby protecting the EWS receiver against malicious or fake control signals.

2.1.2 Operation of EWS

The following table shows the two different start signals which can be used according to the emergency situation:

	Example emergency situation	Start signal	Area code
(1)	Large-scale earthquake warning	Category I	Nationwide
(2)	Medium-scale earthquake warning	Category I	Prefecture or wide area
(3)	Tsunami warning	Category II	Nationwide, or regional

Category I activates all EWS receivers in the service area. Category II activates only the relevant EWS receivers.

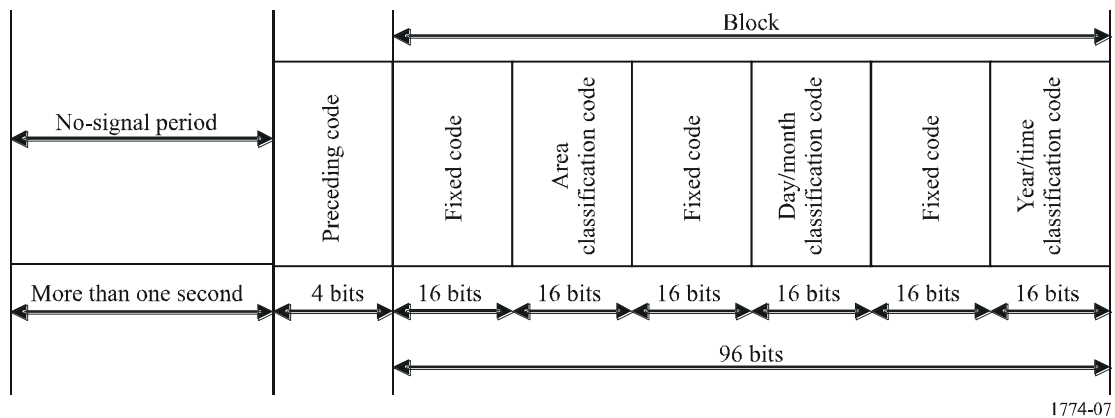
In cases (1) and (2), broadcasters transmit the Category I start signal. In case (3), broadcasters transmit the Category II start signal, as inland users do not need to evacuate.

After the emergency warning message, broadcasters transmit the end signal, which may be used to return EWS receivers to their previous state.

2.1.3 Specification and configuration of EWS signal

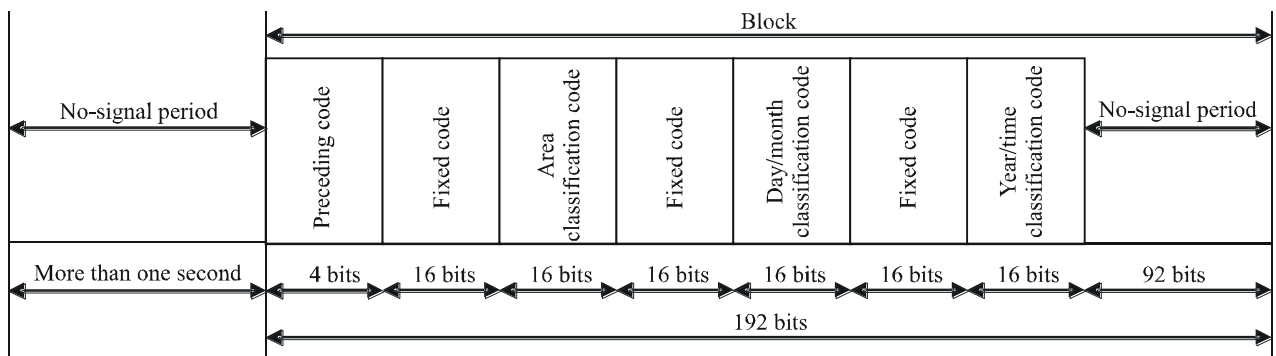
The modulation method of the EWS signal is the frequency shift keying (FSK) method with a space frequency of 640 Hz and a mark frequency of 1 024 Hz. The allowable frequency deviation is plus or minus ten parts per million in each case. The transmission speed of the EWS signal is 64 bits per second and the deviation is ten parts per million. Signal distortion is below 5%. The configurations of the Category I start signal and Category II start signal are shown in Fig. 2, and that of the end signal is shown in Fig. 3.

FIGURE 2
Configuration of Category I and II start signal



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FIGURE 3
Configuration of end signal



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Notes for Figs. 2 and 3:

- 1 Fixed code consists of a 16-bit code inherent in the EWS signal. It is used to extract the EWS signals from sound signals. Furthermore, it is used to distinguish between the Category I and Category II start signal.
- 2 Area classification code is used for EWS receiver operation in specified regions. The purpose of this code is to avert the activation of EWS receivers in other areas by abnormal propagation of broadcasts.
- 3 Year/month/day/time classification code is used to transmit real-time information to prevent the activation of receivers by fake signals. It is recorded and retransmitted after the EWS signals have been transmitted.

2.2 Digital emergency warning system (digital EWS)

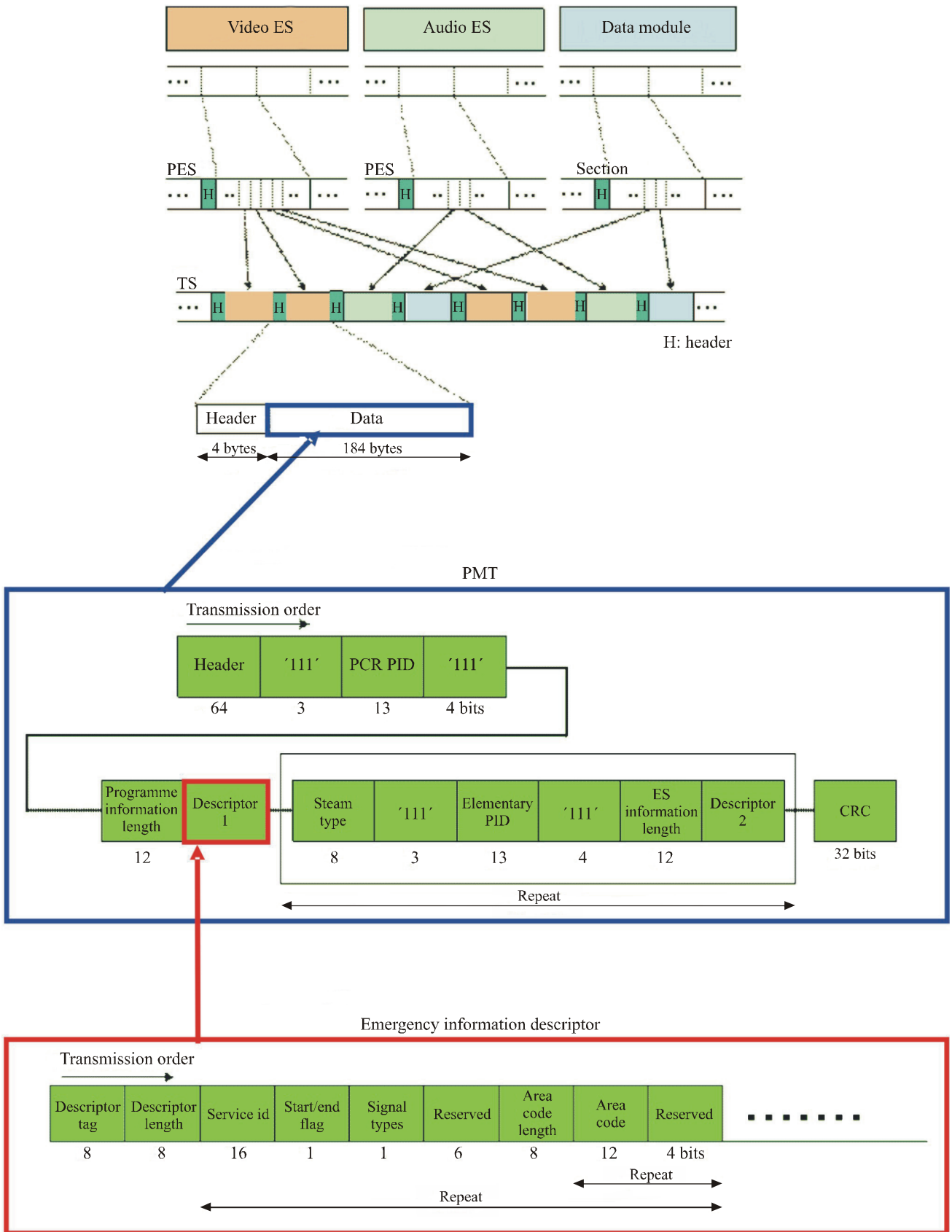
This section introduces details regarding the digital emergency warning system (digital EWS) using digital television broadcasting.

In digital television broadcasting, the EWS signal is transmitted by multiplexing it with the broadcast signal, in the same way as with analogue sound broadcasting. Television receivers can also be turned on automatically when they detect the EWS signal, even if they are in standby mode.

2.2.1 Technical specifications of digital EWS

The emergency information descriptor may be used only for ISDB-T_{SB} recommended in Recommendation ITU-R BS.1114 (System F), ISDB-T recommended in Recommendation ITU-R BT.1306 (System C), broadcasting-satellite service (sound) system recommended in Recommendation ITU-R BO.1130 (System E), and ISDB-S recommended in Recommendation ITU-R BO.1408. The emergency information descriptor for EWS is placed in the Descriptor 1 field of the programme map table (PMT), which is periodically placed in the transport stream (TS). The details of the emergency information descriptor is shown in Fig. 4.

FIGURE 4
Structure of TS, PMT and emergency information descriptor



Notes to Fig. 4:

- 1 ES (elementary stream) is encoded video and audio, etc.
- 2 PES (packetized elementary stream) is the unit for packets of elementary streams.
- 3 TS (transport stream) is a 188 byte stream within the PES, including 32 bytes of the header.
- 4 PID (packet identifier) indicates what the transmitted packet is.
- 5 CRC (cyclic redundancy check) is a type of hash function used to produce a checksum, which is a small number of bits, from a large block of data, such as a packet of network traffic or a block of a computer file, in order to detect errors in transmission or storage.
- 6 Descriptor tag shall be 0xFC, representing the emergency information descriptor.
- 7 Descriptor length shall be a field that writes the number of data bytes following this field.
- 8 Service id shall be used to identify the broadcast programme number.
- 9 Start/end flag shall be '1' when the transmission of the emergency information signal starts (or is currently in progress) and '0' when the transmission ends.
- 10 Signal types must be '0' for Category I and '1' for Category II start signals.
- 11 Area code length shall be a field that indicates the number of data bytes following the field.
- 12 Area code shall be a field which indicates the area code.

2.2.2 Mobile reception

The advantages of digital reception on a mobile terminal, such as a cellular phone include:

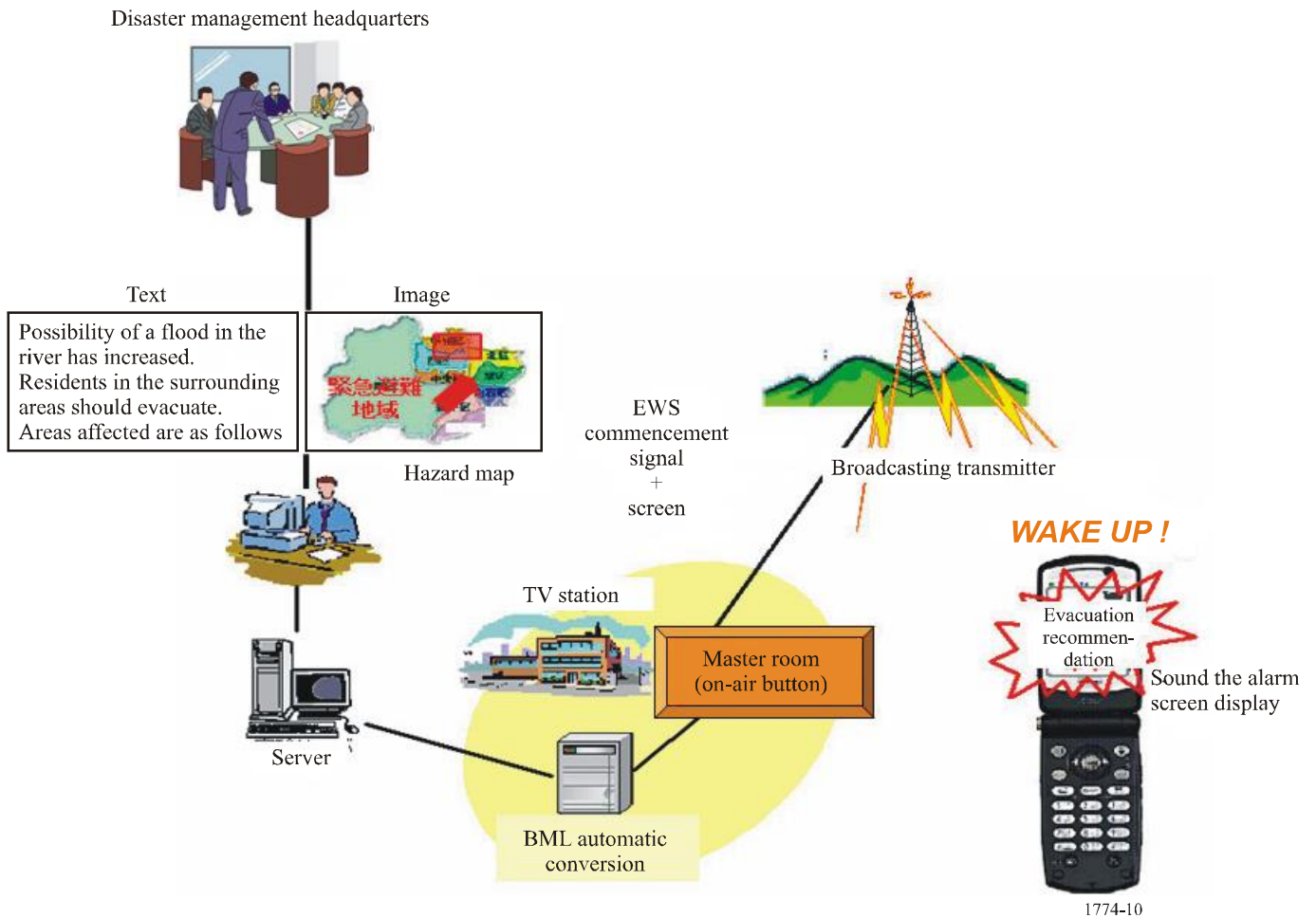
- Development of congestion-free transmission paths even in times of disaster;
- Development of stable information transmission even in times of emergency or disaster, through start-up control;
- Development of communication paths according to areas and targets.

2.2.3 Automatic activation of handheld receivers by EWS signals

The emergency warning mechanism of digital terrestrial television broadcasting is similar to that of analogue sound broadcasting. Broadcasting differs from telecommunications in that it can send information to a large number of handheld receivers at the same time. The ability to activate handheld receivers to receive emergency information can potentially help to reduce the damage caused by a disaster. For this to be effective, the handheld receiver will have to be in the constant standby mode for receiving the EWS signals. If the power consumption is too high, it will be difficult to maintain standby for long periods. Figure 5 shows a conceptualisation of digital EWS for mobile reception.

FIGURE 5

A concept of digital EWS for mobile reception



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Figure 6 shows handheld receiver activation using EWS signals for digital terrestrial television broadcasting.

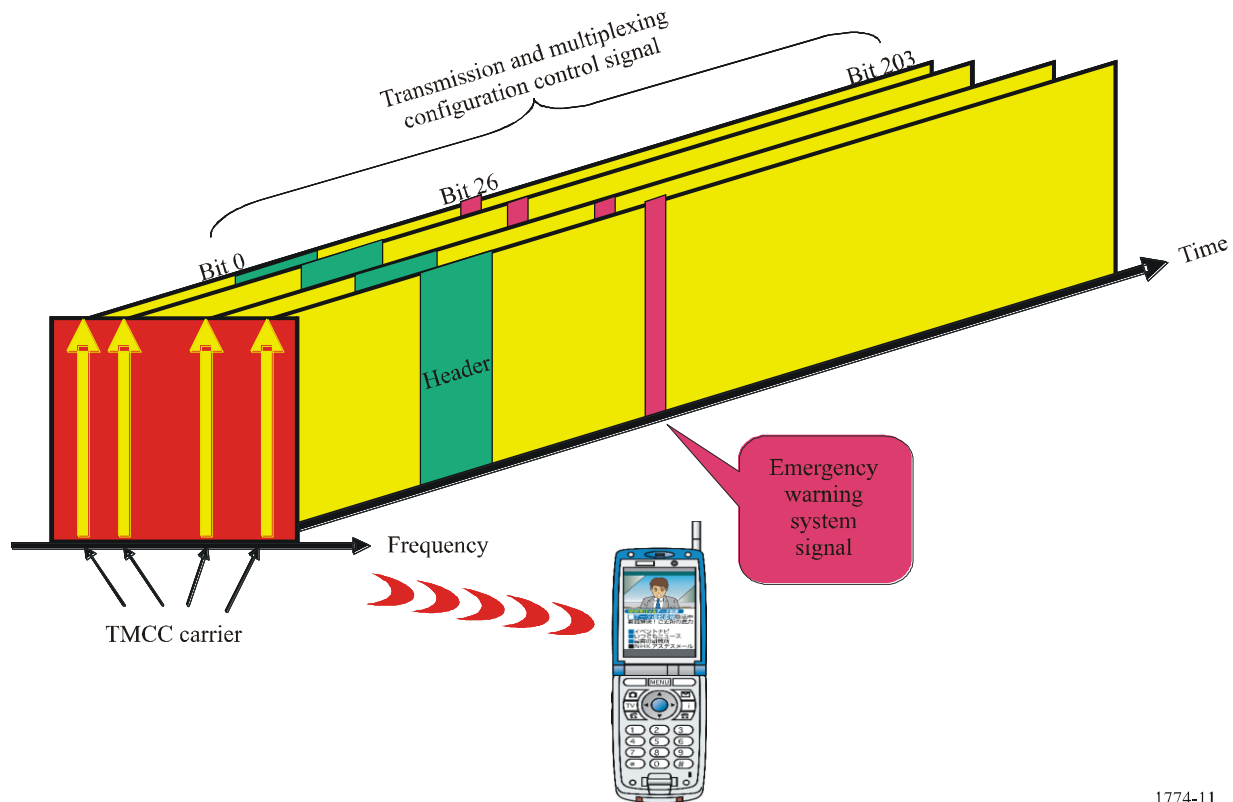
An EWS signal is indicated by bit 26 of the Transmission and Multiplexing Configuration Control (TMCC) signal comprising 204 bits in System C of Recommendation ITU-R BT.1306. In the case of Mode 3 (number of carriers: 5 617), the number of TMCC carriers is 52 in total for 13 segments, or four carriers per segment. The TMCC signals modulated by differential binary phase shift keying (DBPSK) are transmitted at an interval of approximately 0.2 s.

For remote activation, the EWS signals in one or more TMCC carriers are to be continuously monitored by each receiver. Furthermore, continuous monitoring shall be achieved without substantially shortening the standby time of handheld receivers. To reduce the power consumption of handheld receivers, the following schemes can be employed:

- Handheld receivers extract only TMCC carriers,
- Handheld receivers monitor only the EWS signals by limiting time slots.

Handheld and fixed receivers are using EWS signals in TMCC for remote activation.

FIGURE 6
Handheld receiver activation using EWS signals of digital terrestrial broadcasting



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2.3 Bibliography (informative)

The information on the Emergency Warning System is available in the following references.

ARIB Standard, BTA R-001 Receiver for Emergency Warning System (EWS): (<http://www.arib.or.jp/english/>).

ARIB Standard, ARIB STD-B31 Transmission System for Digital Terrestrial Television Broadcasting: (<http://www.arib.or.jp/english/>).

ARIB Standard, ARIB STD-B32 Video Coding, Audio Coding and Multiplexing Specifications for Digital Broadcasting: (<http://www.arib.or.jp/english/>).

ARIB Technical Report, ARIB TR-B14 Operational Guidelines for Digital Terrestrial Television Broadcasting: (<http://www.arib.or.jp/english/>).

3 Emergency Alert System

3.1 Specification for FM radio alarm broadcasting

This specification employs the Radio Data System (RDS) Radio Text (RT) feature to deliver the emergency message without interruption of the main programme. After differential encoding of the message, it is inserted in the amplitude modulated auxiliary subcarrier, which is the third harmonic (57 kHz) of the baseband pilot signal. The data rate is about 1 187.5 bit/s. The main function is similar to the analogue TV standard, except that the message is presented with audio, using an optional Text-To-Speech (TTS) system, instead of closed-caption text. Table 1 illustrates the message format.

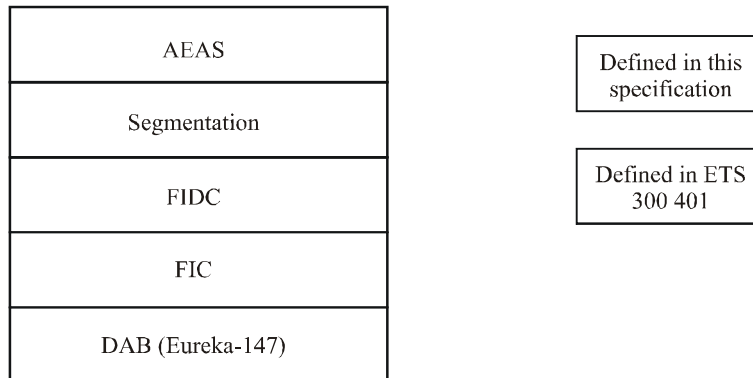
TABLE 1
Emergency message format for FM radio

Control code	Start code	Date and time	Duration	Number of Area	Area1	...	AreaN	Event code	Checksum	Presentation time	Text	End of presentation	End code
Hex	24		xx	xx	xx/xx/xx/xx	...	xx/xx/xx/xx	01 - FF		02		03	40
Size in Byte	1	5	1	1	4	...	4	1	1	1	variable	1	1

3.2 Automatic emergency alert service (AEAS) for terrestrial digital multimedia broadcasting (T-DMB)

The AEAS message format is designed to be short with essential information for swift delivery. In serious situations, detailed information, such as event descriptions and evacuation instructions in text or in other multimedia formats, will be followed in other services. The AEAS message format provides fields for the short text message and/or the external links. The AEAS provides targeted service according to the location of the receiver. Figure 7 illustrates the protocols stack necessary for the delivery of AEAS.

FIGURE 7
Protocol stack for the automatic emergency alert service



AEAS: Automatic emergency alert service
FIDC: Fast information data channel
FIC: Fast information channel

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3.2.1 AEAS message format

An AEAS message contains information associated with an event, e.g. natural disasters and incidents. Table 2 illustrates the structure of the AEAS message.

TABLE 2
AEAS message format

EventCode	Severity	d&t	tGeocode	nGeocode	rfu	Geocodes	Desc&Link
3 bytes	2 bits	28 bits	3 bits	4 bits	3 bits	variable	variable

The following are the syntax and semantics of each field:

- *EventCode*: This field shall contain the event code which is defined in Annex 1 of the standard. The major portions of the EventCode are quoted from USA’s FCC Rule 47 Part 11.
- *Severity*: This 2 bit field shall indicate the severity of the event, as in Table 3:

TABLE 3
Severity

Severity	Semantics
00	“Unknown” – Severity unknown
01	“Moderate” – Possible threat to life or property
10	“Severe” – Significant threat to life or property
11	“Extreme” – Extraordinary threat to life or property

- *d&t (date and time)*: This 28 bit field shall indicate the date and time when the emergency information is announced by an originator. The first 17 bits shall be the modified Julian data and the next 11 bits shall be the UTC code (short form), which is defined in ETS 300 401 v1.4.1 section 8.1.3.1.
- *tGeocode (Geocode type)*: This 3 bit field shall indicate the type of geocode used in the message.

An AEAS message shall include only one type of Geocode. When tGeocode is 000, nGeocode shall be set to 0000 and no Geocode shall be included in the message.

- *Geocodes*: This field shall include one or more geographic codes delineating the affected area of the AEAS message. The type and the number of geocodes are defined in tGeocode and nGeocode fields, respectively. The length of the geocode shall be fixed and defined implicitly.
- *Desc&Link*: This variable length field shall present short human readable text and an external link associated with the AEAS message. The text includes description of the event and instruction for targeted recipients. The external link shall be surrounded by double quotes (“”). The external field may be used for any additional information for the message, for example, uniform resource identifier (URI) for web or other DMB services. The URI shall be full and absolute.

3.2.2 AEAS message segmentation

An AEAS message shall be delivered via FIDC (FIG 5/2). The AEAS message shall be segmented into several FIGs. The data field of an FIG shall contain one, and only one segment of the AEAS message. For this purpose, a 2 byte segment header shall be used, as shown in Table 4.

TABLE 4

Segment header fields

Current	nSegment	AEASId
4 bits	4 bits	8 bits

- *Current (n)*: This 4 bit field shall be the $(n + 1)$ th sequence number of the current segment.
- *nSegment (m)*: This 4 bit field shall be the total number of segments of the AEAS. The total number is $(m + 1)$. Since an FIG can accommodate at most 26 bytes of AEAS message, therefore, the maximum size of an AEAS message is $26 \text{ bytes/FIG} \times 16\text{FIG} = 416$ bytes.
- *AEASId*: This Id enables an AEAS receiver to assemble an AEAS message from FIG segments. In addition, the Id prevents the AEAS receiver from presenting duplicate AEAS messages. Since, during an emergency, an AEAS message will be emitted repeatedly, the AEAS receiver should always remember the AEASId that has been presented. However, if the AEASId is managed by a local authority, a mobile receiver can face with problematic situations: the same AEAS message has different AEASId, or two different AEAS messages have the same AEASId. In order to avoid these situations, the AEASId shall be nationally managed by a central authority, so that identical emergency information should always have a same AEASId nationwide.

TABLE 5

AEASId fields

OriginL (Originator level)	MsgId (Message Id)
3 bits	5 bits

- *OriginL (Originator level)*: this 3 bit field shall indicate the originator group of the AEAS message. It represents three levels of government, i.e. national, state and local governments.

TABLE 6

List of originator level

OriginL	Description
000	National Government
001	Large city, Province
010	Small city, County
100~111	Future use

- *MsgId*: this 5 bit, modulo 32 counter shall be incremented by one for each successive AEAS message.

3.2.3 Delivery of AEAS message

AEAS messages and the associated signalling are encoded in the fast information data channel (FIDC), specifically in Extension 2 of FIG type 5 (FIG 5/2). Figure 8 shows the structure of the FIG 5/2.

The following definitions apply to the flags D1 and D2:

D1: This 1 bit flag shall be reserved for future use of the Type 5 field.

D2: This 1 bit flag shall signal whether the Type 5 field contains AEAS message or just padding.

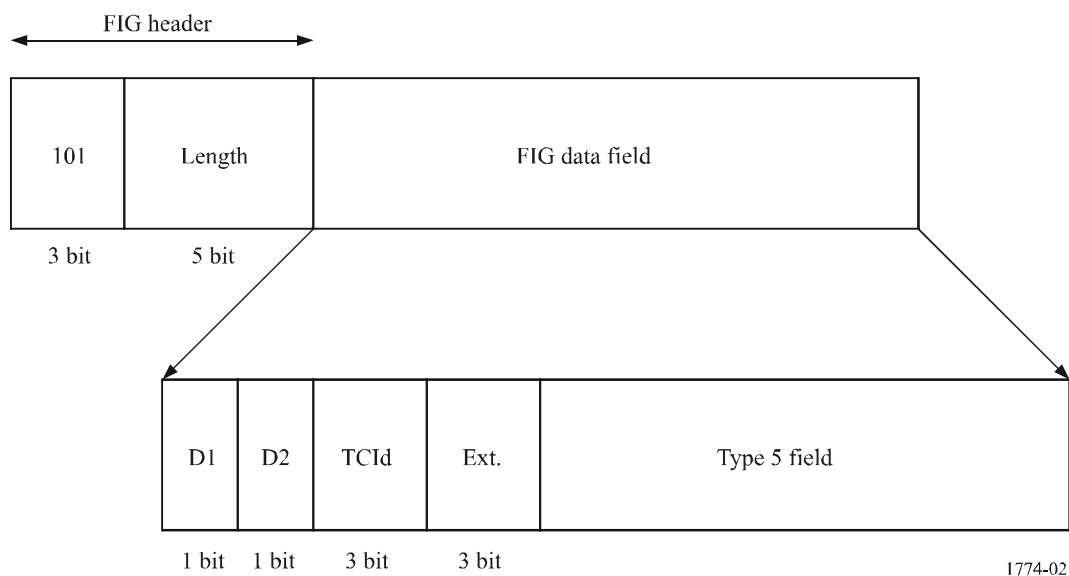
0: padding.

1: presence of AEAS message.

The TCId shall be 000.

When there is no emergency, the padding message with D2 = 0 shall be transmitted every 0.5 second or less. The size of padding is 29 bytes, so that the FIG with the padding message can occupy a whole fast information block (FIB). The padding message signals the presence of the AEAS service in the current ensemble. It also guarantees the necessary bandwidth for immediate insertion of the AEAS message. Signalling of AEAS with multiplex configuration information (MCI) shall not be used. When emergency information arrives from the management office, associated AEAS messages shall be generated and emitted immediately. The AEAS message has the highest priority over other broadcasting services. During the emergency, the AEAS message shall continue to be emitted repeatedly. When a receiver receives the AEAS message, it shall immediately present the emergency information with highest priority over other services.

FIGURE 8
Structure of FIG Type 5



Annex 2

Common emergency warning system control signal for analogue sound broadcasting

1 Introduction

The EWS described in this Annex enables a public warning to be issued in the case of an emergency due to natural disasters etc. via analogue sound platforms. As analogue sound broadcasting is one of the most widespread broadcasting services, this is an especially effective way to alert the public.

The control signal of this EWS for public warnings activates receivers that are in standby mode. Automatic activation of the receivers depends on keeping a part of the receiver circuit always alive, in order to monitor the emission of the control signal.

2 Audible baseband EWS control signal

In an emergency, the EWS control signal breaks into the programme signal (analogue radio), to automatically activate EWS receivers, even when they are in standby mode. The audio part of the EWS control signal is also used as an alarm sound to draw the attention of all the listeners to the emergency broadcast that will follow the EWS control signal.

The EWS control signal is an FSK modulated signal that employs two audio frequencies, 640 Hz and 1 024 Hz, and is capable of transmitting 64 bit/s data. It is preferable that the modulation level for the EWS control signal is about 80% in order for the EWS control signal to be detected reliably.

The EWS control signal comprises two kinds of signals; a start signal and an end signal. The audible start signal denotes the beginning of the emergency broadcast and activates EWS receivers. An audible end signal denotes the end of the emergency broadcast, and the activated receiver may return to its previous state.

2.1 Start signal

The structure of the start signal is shown in Fig. 9. The start signal comprises an Unmodulated signal period, Preceding code, Fixed code and Arbitrary code. The Unmodulated signal period allows the EWS control signal to be clearly distinguished from the broadcast program by silence.

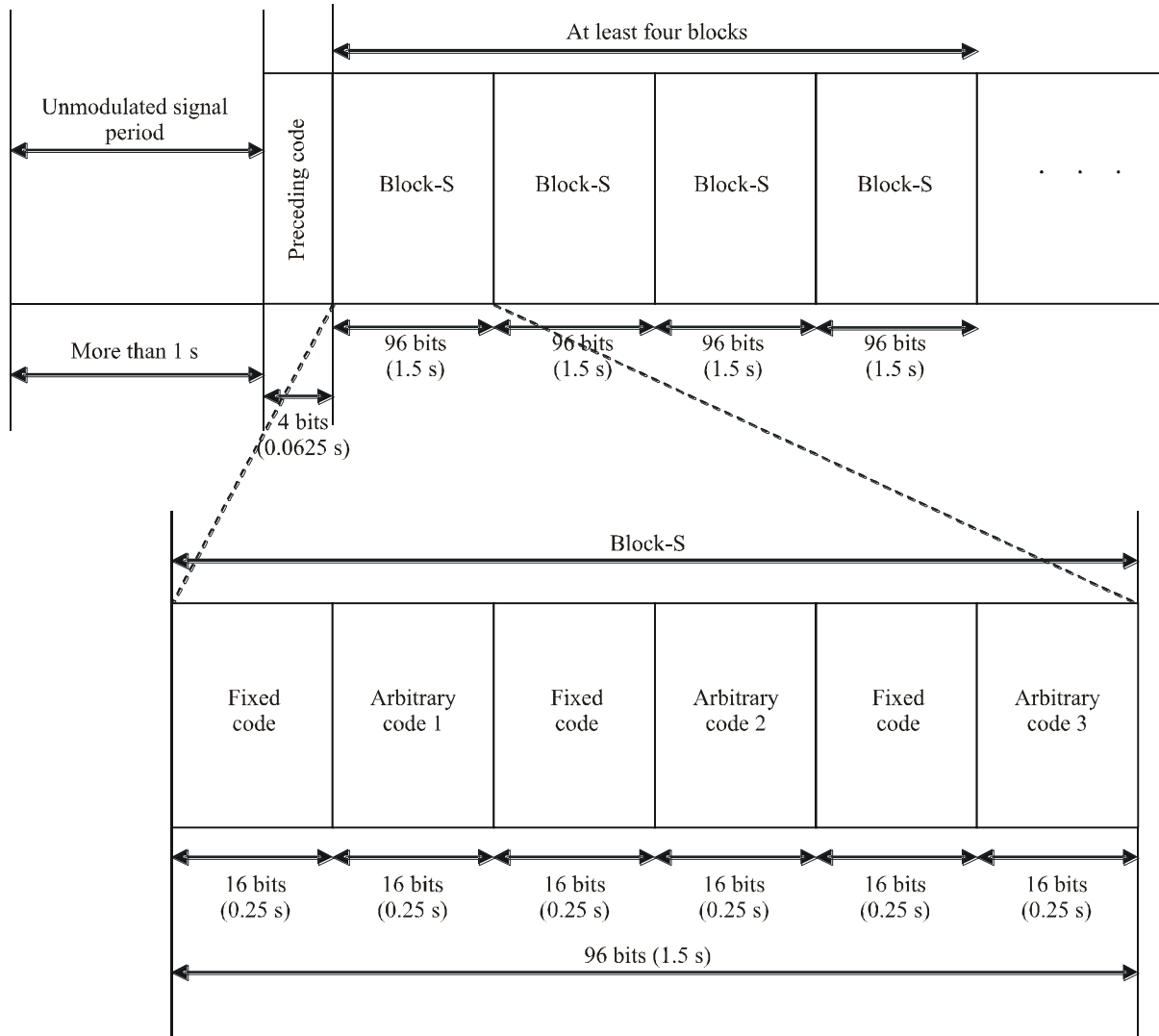
The Preceding code can be used as an indication as to whether the signal is a start signal or end signal. The Fixed code is the most important code in the EWS control signal. The Fixed code has the following two functions: 1. Receiver activation, 2. Timing reference for the Arbitrary code. The Arbitrary code carries additional information such as the time or location of the event. BLOCK-S, as shown in Fig. 9 comprises Fixed and Arbitrary codes and should be transmitted repeatedly - at least four times. This multiple transmission of the Fixed codes prevents mis-activation of receivers and also ensures activation of receivers in a poor reception environment.

The specification of each code is as follows:

- The Unmodulated signal period lasts more than one second
- The Preceding code for the start signal is “1100”
- The Fixed code is a 16 bit code word that starts with “00” and ends with “01”
- The Arbitrary code is a 16 bit code word that starts with “01” or “10”, and ends with “00” or “11”. The remaining 12 bits can be any bit patterns, providing for quick and reliable receiver operation.

The first and last two bits of the Fixed and Arbitrary codes are set so that no identical bit pattern for the Fixed and Arbitrary codes ever appears.

FIGURE 9
Structure of start signal



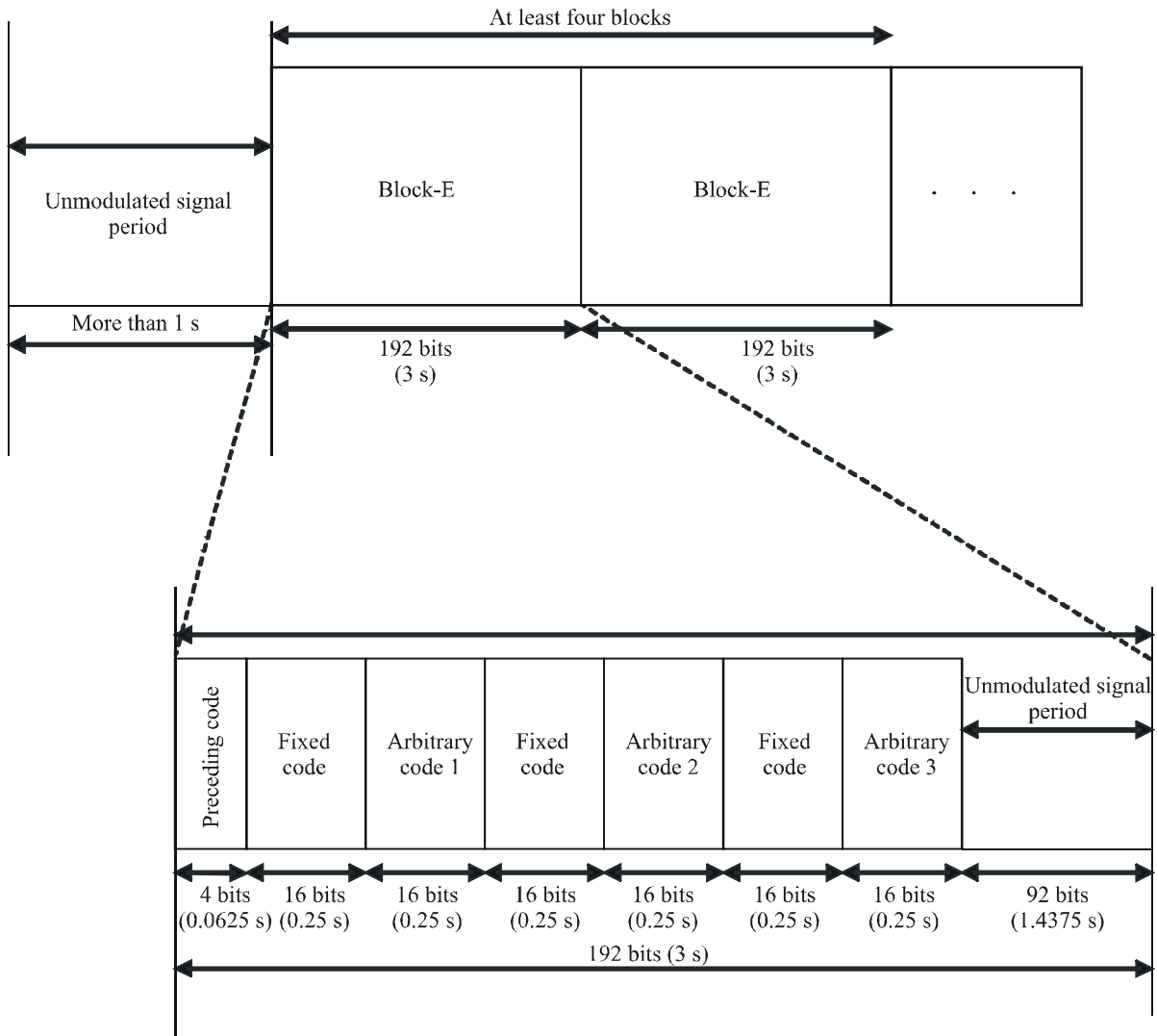
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2.2 End signal

An end signal informs the EWS receiver of the end of the emergency broadcast. The activated receiver returns to its previous state after receiving the end signal. The structure of the end signal shown in Fig. 10 is similar to that of the start signal. The Fixed code employed in the end signal is identical to that of the start signal. The Preceding code of the end signal is “0011”.

To prepare for an actual emergency, it is important to test the automatic activation of the receivers with regularly scheduled (such as monthly) test broadcasts that include the EWS control signal. In such test broadcasts, it is necessary for the receivers to turn off at the end of the test. If a mobile receiver does not turn off, the power source will be exhausted and this could leave its battery unusable when an actual disaster occurs. The end signal can be used to prevent this from happening.

FIGURE 10
Structure of end signal



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2.3 Common fixed code

Some disasters may affect more than one country. Once such a disaster occurs, the emergency warning information needs to be distributed widely, even across national borders. A common EWS control signal is therefore considered desirable. To detect the EWS control signal, an EWS receiver continuously calculates the cross-correlation between the given Fixed code and the input signal. A high correlation indicates the detection of the Fixed code by the receiver. To prevent incorrect detection, the Fixed code should have the following features.

- The number of bits with values “1” and “0” should always be equal. A Fixed code that contains long continuous streams of ones or zeros produces continuous 640 Hz or 1 024 Hz sound components. As these sound components may exist in some broadcasting programmes, such codes are not suitable for use as Fixed codes.
- The bit pattern of a Fixed code should not appear anywhere else within the combination of the Fixed code and any consecutive Arbitrary code. If the bit pattern of this Fixed code reappears, both the correct reference position and the false bit pattern position are detected as EWS reference positions by the receiver. If the detection of multiple reference positions may occur, this is not suitable for demodulation of the Arbitrary codes.

The Fixed codes shown in this Annex satisfy the features above. One of the codes listed in Table 7 should be selected. It is recommended to use the code “0010 0011 1110 0101” as the common Fixed code of the EWS control signal for analogue sound broadcasting. The remaining codes can be used, for example, as regional Fixed codes for particular countries or regions.

TABLE 7

List of Fixed codes

No.	Fixed code
1	0010 0011 1110 0101
2	0000 1011 0011 1101
3	0000 1011 1100 1101
4	0000 1100 1011 1101
5	0000 1110 0110 1101
6	0000 1110 1011 1001
7	0000 1110 1110 1001
8	0000 1111 0011 0101
9	0000 1111 0101 1001
10	0000 1111 0110 0101
11	0001 0001 1110 1101
12	0001 0011 1110 0101
13	0001 0100 1110 1101
14	0001 0100 1111 1001
15	0001 0110 1110 0101
16	0001 1010 0111 1001
17	0001 1010 1110 1001
18	0001 1011 1100 0101
19	0001 1110 1100 0101
20	0001 1110 1101 0001
21	0001 1111 0010 0101
22	0001 1111 0010 1001
23	0010 0001 1101 1101
24	0010 0011 0101 1101
25	0010 0110 0011 1101
26	0010 0111 1001 0101
27	0010 0111 1100 0101
28	0011 0000 1011 1101
29	0011 0000 1111 0101
30	0011 0111 1000 0101
31	0011 1011 0000 1101

TABLE 7 (end)

No.	Fixed code
32	0011 1011 0100 0101
33	0011 1100 1000 1101
34	0011 1100 1001 0101
35	0011 1100 1010 1001
36	0011 1100 1011 0001
37	0011 1110 0010 0101
38	0011 1110 0010 1001
39	0011 1110 0100 0101
40	0011 1110 0101 0001

Code No. 1 in the Table above, “0010 0011 1110 0101” is recommended as the common Fixed code of the EWS control signal for analogue sound broadcasting.

3 Specification for analogue FM radio alarm broadcasting

This specification employs the Radio Data System (RDS) radio text (RT) feature to deliver the emergency message without interruption to the main programme. After differential encoding of the message, it is inserted in the amplitude modulated auxiliary subcarrier, which is the third harmonic (57 kHz) of the baseband pilot signal. The data rate is about 1 187.5 bit/s. The message is presented with audio, using an optional Text-To-Speech (TTS) system. Table 8 illustrates the message format.

TABLE 8

Emergency message format for FM radio

Control code	Start code	Date and time	Duration	Number of area	Area1	...	AreaN	Event code	Checksum	Presentation time	Text	End of presentation	End code
Hex	24			xx		...				02		03	40
Size in Byte	1	variable	variable	1	variable	...	variable	variable	variable	1	variable	1	1