ANSI/CTA Standard

Emergency Alert Messaging for Cable

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FOREWORD

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1. Introduction

1.1. Scope

This standard defines an Emergency Alert signaling method for use by cable TV systems in the United States to signal emergencies to digital receiving devices that are offered for retail sale. Such devices include digital set-top boxes that are sold to consumers at retail, digital TV receivers, and digital video recorders.

The Emergency Alert signaling (EAS) scheme defined in this standard allows a cable operator to disseminate emergency alert information related to state and local-level emergencies and warnings in an efficient way, while minimizing disruption to programming. While it is possible for a cable operator to comply with EAS requirements by simply replacing the source signal for all programs with an emergency information channel, such switching is disruptive to viewing, is overly intrusive for many kinds of local warnings and is overly-complex for the cable operator to implement in a digital cable environment where each transport stream may carry many programs that would have to be individually interrupted. Based on the priority level of the alert, the Emergency Alert message may instruct the receiving device to force-tune to a designated emergency broadcast channel.

Section 5 of this standard defines the syntax of the Emergency Alert message and related descriptors. This message is in the form of a standard MPEG-2 table and, when necessary, is delivered in-band on cable transport streams that carry one or more programs in-the-clear. Receiving devices without Point Of Deployment (POD)[1] modules in place process such messages in accordance with requirements described in Section 7 of this standard. For programs that are scrambled on a cable system, the Emergency Alert message is delivered to the POD module using the cable system's forward data channel. The POD module processes the message as necessary and delivers it to the receiving device out-of-band. As used in this standard, "out-of-band" refers to the Extended Channel interface defined in ANSI/SCTE 28 [4]. As delivered to the receiving device by the POD module, the Emergency Alert message is in the form of an MPEG-2 table as defined in Section 5 of this standard. The receiving device then processes the message in accordance with Section 7 of this standard.

The behavior of receiving devices in response to user actions, such as channel changes or accessing on-screen displays, where such user actions relate to acquisition and processing of Emergency Alert messages, is out of scope of this standard.

1.2. Overview

Emergency message support for receiving devices involves the following elements:

a) A signaling scheme to identify the presence of an Emergency Alert.
b) The start time and expected duration of the alert event.[2]
c) A textual description of the emergency alert.

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[1] The Point Of Deployment module is also known as a CableCARD™ device.

[2] For example, a flood warning might start at 4pm and last for 8 hours.

d) An indication of the availability and location of the "details" channel, an audio/video service pertaining to the alert.
e) An indication whether the event is of sufficient importance that tuning to the details channel shall be done unconditionally.
f) A pointer to an optional audio channel that can be used to replace the audio of the current service for the duration of the Emergency Alert message.

This standard defines a **cable_emergency_alert()** message in the form of an MPEG-2 **private_section()** (per MPEG-2 Systems [2] Table 2-30), compatible with MPEG-2 transport.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. Normative Reference List

[1] ATSC A/65:2009, Program and System Information Protocol for Terrestrial Broadcast and Cable, Advanced Television Systems Committee, 2013.

[2] ITU-T Rec. H.222.0 | ISO/IEC 13818-1: 2017, Information Technology—Generic coding of moving pictures and associated audio information - Part 1: Systems

[3] FCC Rules, 47 C.F.R. Part 11, Emergency Alert System (EAS)

[4] ANSI/SCTE 28 2012, Host-POD Interface Standard, Society of Cable Telecommunications Engineers.

[5] CTA-542-D, Cable Television Channel Identification Plan, Consumer Technology Association,

[6] ISO/IEC 13818-6:1998—Information technology—Generic coding of moving pictures and associated audio information -- Part 6: Extensions for DSM-CC

[7] ANSI/SCTE 106 2010, DOCSIS Set-Top Gateway (DSG) Specification, Society of Cable Telecommunications Engineers.

[8] ANSI/SCTE 55-1 2009, Digital Broadband Delivery System: Out Of Band Transport Part 1: Mode A, Society of Cable Telecommunications Engineers.

[9] ANSI/SCTE 55-2 2008, Digital Broadband Delivery System: Out Of Band Transport Part 2: Mode B, Society of Cable Telecommunications Engineers.

[10] IEEE 802 2007, Standard for Local and Metropolitan Area Networks: Overview and Architecture, Institute of Electrical and Electronics Engineers.

2.2. Normative Reference Acquisition

ATSC Standards:

- Advanced Television Systems Committee (ATSC), 1750 K Street N.W., Suite 1200, Washington, DC 20006; Phone 202-872-9160; Fax 202-872-9161; Internet http://www.atsc.org/

IEC Standards:

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet http://global.ihs.com; Email global@ihs.com
- IEC Central Office, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland; Phone +41 22 919 02 11; Fax +41 22 919 03 00; Internet http://www.iec.ch; Email pubinfor@iec.ch

ITU Standards:

- International Telecommunications Union, Place des Nationas, CH-1211 Geneva 20, Switzerland; Phone +41 22 730 5111; Fax +41 22 733 7256; Internet http://www.itu.ch/publications/bookstore.html Email itumail@itu.int

FCC Rules

- U.S. Code of Federal Regulations (C.F.R.), U.S. Government Printing Office, Washington, D.C. 2040; http://www.ecfr.gov

SCTE Standards:

- Society of Cable Telecommunications Engineers (SCTE), 140 Philips Road, Exton PA 19341; Phone 800-542-5040; Fax 610-363-5898; Internet http://www.scte.org; Email info@scte.org

IEEE Standards:

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740; Internet http://global.ihs.com; Email global@ihs.com

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. Informative Reference List

[11] ATSC A/53, Digital Television Standard, Advanced Television Systems Committee.

[12] ANSI/SCTE 65, Service Information Delivered Out-of-Band for Digital Cable Television

[13] IEEE OUI Registration Authority

[14]OASIS Common Alerting Protocol v1.2 – 1 July 2010 (http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.pdf)

[15]FEMA Common Alerting Protocol, v. 1.2 USA Integrated Public Alert and Warning System Profile Version 1.0 - 13 October 2009 (“IPAWS CAP Profile v1.0) (http://docs.oasis-open.org/emergency/cap/v1.2/ipaws-profile/v1.0/cap-v1.2-ipaws-profile-v1.0.pdf

[16]EAS-CAP Industry Group (ECIG) Recommendations for a CAP EAS Implementation Guide (ECIG-IG-1.0) - May 17, 2010 (http://www.eas-cap.org/ECIG-CAP-to-EAS_Implementation_Guide-V1-0.pdf)

[17]ANSI/SCTE 164 2010, Emergency Alert Metadata Descriptor, Society of Cable Telecommunications Engineers.

3.2. Informative Reference Acquisition

ATSC Standards:

- Advanced Television Systems Committee (ATSC), 1750 K Street N.W., Suite 1200, Washington, DC 20006; Phone 202-872-9160; Fax 202-872-9161; Internet http://www.atsc.org/

IEEE OUI Registration Authority:

- http://standards.ieee.org/regauth/oui/index.shtml

SCTE Standards:

- Society of Cable Telecommunications Engineers (SCTE), 140 Philips Road, Exton PA 19341; Phone 800-542-5040; Fax 610-363-5898; Internet http://www.scte.org; Email info@scte.org

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Emergency Alert Message (Normative)

The **cable_emergency_alert()** message shall be delivered out-of-band (Extended Channel per ANSI/SCTE 28 [5]) to the receiving device in packets identified with the **SI_base_PID** value of 0x1FFC (per SCTE 28 [4] Section 8.9.1). For transport streams carrying one or more programs in the clear, the **cable_emergency_alert()** message shall be delivered to the receiving device in the MPEG-2 [2] transport stream for that channel in packets identified with the **base_PID** value of 0x1FFB.

The syntax of the **cable_emergency_alert()** message that shall be used is defined in Table 1. Acronyms **uimsbf**, **bslbf**, and **rpchof** are as defined in ISO/IEC 13818-1 [2] Section 2.2.6.

The MPEG-2 **table_ID** for this message is 0xD8. Refer to ISO/IEC 13818-1 [2] MPEG-2 systems for a description of the fields common to the MPEG-2 private section syntax.

The **cable_emergency_alert()** message is limited to 4096 bytes maximum length, which means that the **section_length** field may have a maximum value of 4093 decimal.

table_ID—This is an 8-bit field which shall be set to 0xD8, identifying this table as the **cable_emergency_alert()** message.

section_syntax_indicator—This 1-bit field shall be set to '1'. It denotes that the table section follows the generic MPEG-2 section syntax beyond the **section_length** field

zero—This 1-bit field shall be set to '0'.

Table 1 - Emergency Alert Message Format

Syntax	Bits	Description
cable_emergency_alert() {		
table_ID	8	uimsbf value 0xD8
section_syntax_indicator	1	'1'
zero	1	'0'
reserved	2	'11'
section_length	12	uimsbf
table_id_extension	16	uimsbf '0x0000'
reserved	2	'11'
sequence_number	5	uimsbf
current_next_indicator	1	bslbf
section_number	8	uimsbf
last_section_number	8	uimsbf
protocol_version	8	uimsbf
EAS_event_ID	16	uimsbf
EAS_originator_code	24	uimsbf three ASCII characters
EAS_event_code_length	8	uimsbf
EAS_event_code	var	uimsbf
nature_of_activation_text_length	8	uimsbf
nature_of_activation_text()	var	uimsbf
alert_message_time_remaining	8	uimsbf seconds range 0..120
event_start_time	32	uimsbf
event_duration	16	uimsbf minutes range 15..6000
reserved	12	bslbf
alert_priority	4	uimsbf
details_OOB_source_ID	16	uimsbf
reserved	6	'111111'
details_major_channel_number	10	uimsbf
reserved	6	'111111'
details_minor_channel_number	10	uimsbf
audio_OOB_source_ID	16	uimsbf
alert_text_length	16	uimsbf
alert_text()	var	Per ATSC A/65C [1], Sec. 6.10
location_code_count	8	uimsbf range 1..31
for (i=0; i<location_code_count; i++) {		
state_code	8	uimsbf range 0..99
county_subdivision	4	uimsbf range 0..9
reserved	2	'11'
county_code	10	uimsbf range 0..999
}		
exception_count	8	uimsbf
for (i=0; i<exception_count; i++) {		
in_band_reference	1	bslbf
reserved	7	'1111111'
if (in_band_reference) {		
reserved	6	'111111'
exception_major_channel_number	10	uimsbf
reserved	6	'111111'
exception_minor_channel_number	10	uimsbf
}		
else {		
reserved	16	bslsbf
exception_OOB_source_ID	16	uimsbf
}		
}		
reserved	6	'111111'
descriptors_length	10	uimsbf
for (i=0; i<N; i++) {		
descriptor()	var	Optional
}		
CRC_32	32	rpchof
}		

reserved—Fields in this standard marked **reserved** shall not be assigned by the creator of the message, but shall be available for future use. Receiving devices are expected to disregard reserved fields for which no definition exists that is known to that unit. Each bit in the fields marked **reserved** shall be set to one until such time as they are defined and supported.

section_length—12-bit field specifying the number of remaining bytes in this section immediately following the **section_length** field up to the end of the section. The value of the **section_length** shall be no larger than 4093.

table_id_extension—This 16-bit field shall be set to zero (0x0000).

sequence_number—This 5-bit field is the sequence number of this **cable_emergency_alert()** message. The **sequence_number** shall be incremented by 1 (modulo 32), when any change occurs in the information carried in the **cable_emergency_alert()** message. Receiving devices process the **sequence_number** in order to detect and discard duplicate transmissions. Duplicates of any alert may be sent to overcome possible message loss due to channel noise.

When the last-used **sequence_number** is known, generating equipment shall increment **sequence_number** by one (modulo 32) when any data in the alert message changes. In case the last-used **sequence_number** is unknown (which can occur if a new piece of equipment is brought on line), generating equipment shall send an Emergency Alert with **alert_priority** zero to establish a new **sequence_number** in all receiving devices before sending any actual alerts.

current_next_indicator—This 1-bit indicator shall always be set to '1' indicating that the table sent is always currently applicable.

section_number—The value of this 8-bit field shall always be 0x00 (this table shall be at most one section long).

last_section_number—The value of this 8-bit field shall always be 0x00.

protocol_version—An 8-bit unsigned integer field whose function is to allow, in the future, this table type to carry parameters that may be structured differently than those defined in the current protocol. At present, the only valid value for **protocol_version** is zero.

EAS_event_ID–-A 16-bit value that shall identify the particular Emergency Alert event. Each time a new EAS message is distributed throughout the cable system, a new **EAS_event_ID** shall be assigned.

A new **EAS_event_ID** shall be assigned if any parameter defining the event changes; that is, any field following the **EAS_event_ID** itself, excluding the **alert_message_time_remaining** field.

> NOTE—An Emergency Alert event with **EAS_event_ID** value A may be followed later by another event with **EAS_event_ID** value B. Since B represents a change to the contents of the **cable_emergency_alert()** message, the **sequence_number** for B is incremented. The notification of event A could then be repeated, with the **sequence_number** incremented yet again. As long as no aspect of event A was changed, the originally assigned **EAS_event_ID** value for that event could be used for the repeat notification. Receiving devices that had seen and processed the original event A, could then recognize this as a repetition and discard it.

NOTE—Design consideration should be given to initial acquisition of a **cable_emergency_alert()** table section.

EAS_originator_code—The EAS originator code defined by 47 C.F.R. Part 11 [3] as ORG codes, indicating the entity that originally initiated the activation of the EAS. Receiving devices process the **cable_emergency_alert()** message for any value in this field. Processing of the **EAS_originator_code** in receiving devices is optional, but may be used with **EAS_event_code** to trigger various alarms or attention-getting behavior in the equipment. **EAS_originator_code** is coded as three ASCII characters. "Originator" codes defined in 47 C.F.R. §11.31(d) [3] are reprinted in Table 2.

Table 2 - EAS FCC-Defined Originator Code (Informative)

EAS_originator_code	Meaning
PEP	Primary Entry Point System
WXR	National Weather Service
CIV	Civil Authorities
EAS	EAS Participant

EAS_event_code_length — An 8-bit unsigned integer that shall indicate the length in bytes of the **EAS_event_code** field to follow.

EAS_event_code—The EAS event code defined by 47 C.F.R. Part 11 [3] as "Event" (EEE) codes, indicating the nature of the EAS activation. Receiving devices process the **cable_emergency_alert()** message for any value in this field. Processing of the **EAS_event_code** in receiving devices is optional, but may be used to trigger various alarms or attention-getting behavior in the equipment beyond handling the mandatory actions required by the **cable_emergency_alert()** message. **EAS_event_code** shall be coded as n ASCII characters, where n is given by **EAS_event_code_length**. "Event" codes defined in 47 C.F.R. §11.31(e) [3] are reprinted in Table 3.

Table 3 - Example EAS Event Codes add new codes

EAS_ event_ code	Nature of Activation		
National Codes:			
EAN	Emergency Action Notification (National only)		
EAT	Emergency Action Termination (National only) – Deprecated (Note 1)		
NIC	National Information Center		
RMT	Required Monthly Test		
RWT	Required Weekly Test		
NPT	National Periodic Test		
Local Codes:			
ADR	Administrative Message	**HLS**	Hurricane Statement1 (Note 2)
AVW	Avalanche Warning	**LEW**	Law Enforcement Warning
AVA	Avalanche Watch	**LAE**	Local Area Emergency
BZW	Blizzard Warning	**NMN**	Network Message Notification
BLU	Blue Alert	**TOE**	911 Telephone Outage Emergency
CAE	Child Abduction Emergency	**NUW**	Nuclear Power Plant Warning
CDW	Civil Danger Warning	**DMO**	Practice/Demo Warning
CEM	Civil Emergency Message	**RHW**	Radiological Hazard Warning
CFW	Coastal Flood Warning	**SVR**	Severe Thunderstorm Warning
CFA	Coastal Flood Watch	**SVA**	Severe Thunderstorm Watch
DSW	Dust Storm Warning	**SVS**	Severe Weather Statement
EQW	Earthquake Warning	**SPW**	Shelter in Place Warning
EVI	Evacuation Immediate	**SMW**	Special Marine Warning
EWW	Extreme Wind Warning	**SPS**	Special Weather Statement
FRW	Fire Warning	**SSA**	Storm Surge Watch
FFW	Flash Flood Warning	**SSW**	Storm Surge Warning
FFA	Flash Flood Watch	**TOR**	Tornado Warning
FFS	Flash Flood Statement	**TOA**	Tornado Watch
FLS	Flood Statement	**TRW**	Tropical Storm Warning
FLW	Flood Warning	**TRA**	Tropical Storm Watch
FLA	Flood Watch	**TSW**	Tsunami Warning
HMW	Hazardous Materials Warning	**TSA**	Tsunami Watch
HWW	High Wind Warning	**VOW**	Volcano Warning
HWA	High Wind Watch	**WSW**	Winter Storm Warning
HUW	Hurricane Warning (Note 2)	**WSA**	Winter Storm Watch
HUA	Hurricane Watch (Note 2)		

NOTES—

1. In 2012, the FCC deprecated the Emergency Action Termination (EAT) and deleted it from Part 11. Continued use of the EAT **EAS_event_code** in this protocol is allowed.
2. In Pacific Ocean regions, hurricanes are known as typhoons. In Indian Ocean regions, hurricanes are known as cyclones or tropical cyclonic storms.

nature_of_activation_text_length—An 8-bit unsigned integer that shall indicate the total length in bytes of the **nature_of_activation_text()** field to follow. A value of zero shall indicate the **nature_of_activation_text()** field is not included in this alert message.

nature_of_activation_text()—A data structure containing a **multiple_string_structure(),** which represents a short textual representation of the event code for on-screen display. The **multiple_string_structure()** shall be as defined in ATSC A/65C [1] Section 6.10. Table 3 shows examples of text representing different types of events.

alert_message_time_remaining—An 8-bit unsigned integer field in the range 0 to 120 that shall indicate the time remaining in the alert message, in seconds. The start time of the message shall be defined as the time the last bit of the CRC was received. A value of zero shall indicate an alert message period of indefinite duration. For the purposes of this standard, the "end point" of any given **cable_emergency_alert()** message shall be defined as the point in time N seconds following the start time, where N is given by **alert_message_time_remaining**. When **alert_message_time_remaining** is zero, the end point shall be in the indefinite future.

The end point of the **cable_emergency_alert()** message represents the point in time a receiving device should attempt to restore audio/video to the service that had been selected prior to the interruption caused by processing the message.

> NOTE—In the case that alert audio is rendered via a proprietary method, that method may indicate the end of the audio segment. If available, that indication is used in preference to the end point determined by **alert_message_time_remaining.**

event_start_time—A 32-bit unsigned integer quantity representing the start time of this alert event as the number of seconds since 00 hours UTC[3], January 6th, 1980, with the count of intervening leap seconds included. The **event_start_time** may be converted to UTC without use of the **GPS_UTC_offset** (per A/65C [1] Section 6.1) value indicated in the System Time table. A value of zero shall indicate that the event start time is immediate.

> NOTE—**cable_emergency_alert()** messages are processed upon their reception, without regard to the value in the **event_start_time** field.

event_duration—A 16-bit unsigned integer that, when nonzero, represents the number of minutes the alert is expected to last. A value of zero indicates that the event duration is unknown (indefinite). When nonzero, the value of **event_duration** shall be in the range 15 to 6000 (100 hours). For example, the **event_duration** for a tornado watch may be four hours. The duration given in **event_duration** is relative to the start time of the event as given in **event_start_time**. A receiving device implementation may use **event_duration** and **event_start_time** to discard obsolete Emergency Alert events if these events are kept in memory for possible review by the user. A receiving device implementation may choose not to store events specified with a valid **event_start_time** but with an indefinite duration, or may choose to store them.

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[3] Since unanimous agreement could not be achieved by the ITU on using either the English word order, CUT, or the French word order, TUC, a compromise to use neither was reached.

alert_priority—A 4-bit unsigned integer value that shall indicate the priority of the alert. **alert_priority** shall be coded according to Table 4. Mandatory receiving device behavior with regard to processing of **alert_priority** is presented in Section 7.5.

NOTE— A receiving device may process any alert in a way consistent with a higher value of **alert_priority**, at its discretion. For example, a user option could cause text display for **alert_priority** 1 events, even though such display is not required.

Receiving devices treat reserved values of **alert_priority** the same as the next-highest defined value.

Table 4 - Alert Priority

Alert_priority	Meaning	Audio Required
0	**Test message**: the alert is discarded (after **sequence_number** processing) by receiving devices except those designed to acknowledge and process test messages. Priority zero is also used to establish a new sequence number per the **sequence_number** definition.	No
1-2	[Reserved for future use]	
3	**Low priority**: the alert may be disregarded if processing the alert would interrupt viewing of an access-controlled service, as indicated by the presence of a **CA_descriptor()** (ISO/IEC 13818-1 [2] Sec. 2.6.16) in the **TS_program_map_section()** corresponding to the program.	No
4-6	[Reserved for future use]	
7	**Medium priority**: the alert may be disregarded if processing the alert would interrupt viewing of a pay-per-view or video on demand event.	No
8-10	[Reserved for future use]	
11	**High priority**: the alert is processed unconditionally, but can involve text-only display if no audio is available.	No
12-14	[Reserved for future use]	
15	**Maximum priority**: the alert is processed unconditionally. If audio is available without tuning to the details channel, that audio is substituted for program audio for the duration of the alert message. If audio is not available by means other than by tuning to the details channel, the receiving device acquires the details channel for the duration of the alert message.	Yes

A details channel associated with the alert may be available. The **cable_emergency_alert()** message can include a pointer to a details channel for use when the receiving device is navigating using out-of-band service information (SI), and it can include a pointer for use when out-of-band SI is not available. In the case that out-of-band SI is not available the channel reference is through major/minor channel number. Both analog and digital channels may be referenced using the major/minor channel number method.

With appropriate virtual channel table entries, the major channel number can be used as a frequency reference to acquire an analog channel or a digital Transport Stream. For the digital case, the minor channel number identifies the service within the multiplex.

details_OOB_source_ID—When non-zero, **details_OOB_source_ID** shall indicate the Source ID of a virtual channel carrying details relevant to the Emergency Alert, where the Source ID references a virtual channel described in out-of-band SI. Receiving devices disregard this field when out-of-band SI is not available. A value of zero for **details_OOB_source_ID** shall indicate that no out-of-band details channel reference is available.

details_major_channel_number, **details_minor_channel_number** —These two 10-bit fields shall represent a virtual channel number, in either two-part or a one-part channel number format, as defined in ATSC A/65C [1] Section 6.3.2, associated with a details channel. Both fields shall be set to zero when no in-band details channel reference is available.

> NOTE—Users of this standard should be aware that although the current standard allows the **details_major_channel_number**, **details_minor_channel _number** fields to be coded in one-part channel number format, the original ANSI-J-STD-042 referenced ATSC A/65A, which defined only the two-part channel number format. Some deployed receiving devices have been built to the earlier version of the standard.

> NOTE—Some Unidirectional Digital Cable-Ready devices require the presence of a Virtual Channel Table (CVCT or TVCT) defining the virtual channel referenced by **details_major_channel_number**, **details_minor_channel_number**, delivered in-band in the same Transport Stream that delivers the Emergency Alert Message.

audio_OOB_source_ID—When non-zero, **audio_OOB_source_ID** shall indicate the Source ID of an audio-only virtual channel providing audio related to the alert event, where the Source ID references a virtual channel described in out-of-band SI. Receiving devices disregard this field when out-of-band SI is not available. When **audio_OOB_source_ID** is zero, no virtual channel is available to provide related audio.

> NOTE— Emergency alert audio may be available to some receiving devices via proprietary means, independent of the value of **audio_OOB_source_ID**.

alert_text_length—A 16-bit unsigned integer number that shall define the total length in bytes of the **alert_text()** field to follow. A value of zero indicates the **alert_text()** field is not included in this alert message.

alert_text()—A data structure containing a **multiple_string_structure()** which shall represent a textual description of the emergency alert for on-screen display. Receiving devices scroll alert text slowly across the top of the video screen, from right to left. The **multiple_string_structure()** shall be as defined in ATSC A/65C [1] Section 6.10.

location_code_count—An 8-bit unsigned integer number in the range 1 to 31 that shall represent the number of region definitions to follow in the “for” loop.

state_code—An 8-bit unsigned number in the range 0 to 99 that represents the State, Territory or Offshore (Marine Area) affected by the emergency alert. **state_code** shall be coded according to State and Territory codes per 47 C.F.R. §11.31 [3]. The value of 0 shall indicate all states, or a national level alert.

county_subdivision—A 4-bit number in the range 0 to 9 that defines county subdivisions as shown in Table 5.

NOTE—In creating the **cable_emergency_alert()** message, implementers should note that the incoming EAS message has the county subdivision code (P) before the state code (SS).

Table 5 - County Subdivision Coding

County_subdivision	Meaning
0	All or an unspecified portion of a county
1	Northwest
2	North Central
3	Northeast
4	West Central
5	Central
6	East Central
7	Southwest
8	South Central
9	Southeast

county_code—An unsigned number in the range 0 to 999 that identifies a county within a state. **county_code** shall be the numeric representation of the "CCC" field in the EAS Protocol coded as defined in 47 C.F.R. §11.31 [3]. A value 0 shall indicate the entire state or territory.

The **cable_emergency_alert()** may include a list of services, called *exception services*, for which this Emergency Alert event shall not apply. For example, a service supplier may have contracted with the cable operator to handle this alert on its own. Or, simply at the discretion of the cable operator, certain services may be excluded from Emergency Alert events of this type.

exception_count—An 8-bit unsigned integer number that shall represent the number of iterations of the "for" loop to follow.

in_band_reference—A Boolean flag that shall indicate, when set to "1", that the **exception_major_channel_number** and **exception_minor_channel_number** values in this iteration of the "for" loop refer to services provided within in-band navigation data (SI). When **in_band_reference** is false (clear), the **exception_OOB_source_ID** references SI data transported out-of-band.

exception_major_channel_number, **exception_minor_channel_number**—These two 10-bit fields shall represent, in either two-part or one-part channel number format as defined in ATSC A/65C [1] Section 6.3.2, the virtual channel number of an exception channel, relative to in-band SI.

NOTE— Users of this standard should be aware that although the current standard allows the **exception _major_channel_number**, **exception_minor channel_number** fields to be coded in one-part channel number format, the original ANSI-J-STD-042 referenced ATSC A/65A, which defined only the two-part channel number format. Some deployed receiving devices have been built to the earlier version of the standard.

exception_OOB_source_ID—A 16-bit number that shall indicate the Source ID of an analog or digital exception service, relative to out-of-band SI.

Receiving devices process the **cable_emergency_alert()** message to determine if the currently acquired service is referenced. If a reference is found, receiving devices discard this **cable_emergency_alert()** message.

NOTE— When the **cable_emergency_alert()** message is received and processed out-of-band, the out-of-band service information is the authoritative source for the exception channels that are identified by **exception_OOB_source_IDs**, and no tuning to a details channel is to be performed in response if the receiving device is tuned to one of those.

NOTE— When the **cable_emergency_alert()** message is received and processed in-band, the in-band service information is the authoritative source for the in-band services identified by pairs of **exception_major_channel_number** and **exception_minor_channel_number** values, and no tuning to a details channel is to be performed in response if the receiving device is tuned to one of those..

descriptors_length—Total length (in bytes) of the optional descriptor list that follows.

descriptor()—A data structure formatted as an 8-bit **descriptor_tag** field followed by an 8-bit length field, followed by a number of data bytes given by the length field. The **cable_emergency_alert()** message may include zero or more descriptors. Descriptor format is defined in Section 5.1.

CRC_32—The 32-bit CRC defined in ISO/IEC 13818-1 [2] MPEG-2 Systems for PSI sections.

5.1. Descriptors

One or more descriptors may be present within the descriptors loop at the end of the **cable_emergency_alert()** message. A descriptor is either a standard descriptor or a user private descriptor, as indicated by the value of the **descriptor_tag**. Table 6 defines descriptor tag values and ranges.

Table 6 - Descriptor Tags

descriptor_tag	Meaning
0x00	In-Band Details Channel Descriptor
0x01	In-Band Exceptions Channel Descriptor
0x02	Audio File Descriptor
0x03	Emergency Alert Metadata Descriptor, ANSI/SCTE 164 [17]
0x04-0xAC	Reserved for future use
0xAD	ATSC Private Information Descriptor
0xAE-0xBF	Reserved for future use
0xC0-0xFF	User private

5.1.1. In-Band Details Channel Descriptor

The purpose of the In-Band Details Channel descriptor is to provide an optional additional pointer to the details channel referenced in the details_major_channel_number and details_minor_channel_number fields. The In-Band Details Channel descriptor references the details channel by means of its CTA-542 [6] RF channel designation and (if digital) its MPEG-2 program number. This descriptor is intended only for use when the cable_emergency_alert() message is processed in-band.

The bit stream syntax for the In-Band Details Channel descriptor is shown in Table 7

Table 7 - Bit Stream Syntax for the In-Band Details Channel Descriptor

Syntax	Bits	Description
in_band_details_channel_descriptor() {		
descriptor_tag	8	0x00
descriptor_length	8	uimsbf
details_RF_channel	8	uimsbf
details_program_number	16	uimsbf
}		

descriptor_tag—This 8-bit unsigned integer shall have the value 0x00, identifying this descriptor as the **in_band_details_channel_descriptor()**.

descriptor_length—This 8-bit unsigned integer shall specify the length (in bytes) immediately following this field through the last byte of this descriptor.

details_RF_channel—This 8-bit unsigned integer shall identify the 6 MHz RF frequency band of the analog or digital carrier of the details channel, using the RF channel identification number defined in CTA-542 [6].

details_program_number—For digital details channels, this 16-bit unsigned integer shall associate the details channel with a **program_number** value found in the MPEG-2 Program Association Table (PAT) in the

MPEG-2 TS found at the RF channel given in the **details_RF_channel** field. For analog details channels, the value of **details_program_number** shall be set to 0xFFFF.

5.1.2. In-Band Exception Channels Descriptor

The purpose of the In-Band Channels descriptor is to provide an optional additional identification of the exception channels by means of the combination of their CTA-542 [5] RF channel identification number and the assigned MPEG-2 program number (or numbers) within the transport stream on that RF channel. This descriptor is intended only for use when the **cable_emergency_alert()** message is processed in-band.

The bit stream syntax for the In-Band Exception Channels descriptor is shown in Table 8.

Table 8 - Bit Stream Syntax for the In-Band Exception Channels Descriptor

Syntax	Bits	Description
in_band_exception_channels_descriptor() {		
descriptor_tag	8	0x01
descriptor_length	8	uimsbf
exception_channel_count	8	uimsbf
for (i = 0; i <exception_channel_count; i++) {		
exception_RF_channel	8	uimsbf
exception_program_number	16	uimsbf
}		
}		

descriptor_tag—This 8-bit unsigned integer shall have the value 0x01, identifying this descriptor as the **in_band_exception_channels_descriptor()**.

descriptor_length—This 8-bit unsigned integer shall specify the length (in bytes) immediately following this field through the last byte of this descriptor.

exception_channel_count—This 8-bit unsigned integer shall specify the number of iterations of the "for" loop to follow.

exception_RF_channel—This 8-bit unsigned integer shall identify the 6 MHz frequency band of the RF carrier of each exception channel that contains one or more **exception_program_number**s, using the RF channel identification numbers defined in CTA-542 [6]. When more than one **exception_program_number** is present in an RF channel, the descriptor loop shall contain the RF channel number associated with each **exception_program_number**. (This field's value would not be unique per descriptor).

exception_program_number—This 16-bit unsigned integer shall identify the **program_number** value of a specific exception channel found in the MPEG-2 Program Association Table (PAT) in the MPEG-2 Transport Stream found at the RF channel given in the preceding **exception_RF_channel** field.

5.1.3. Audio File Descriptor

The purpose of the Audio File Descriptor is to provide one or more pointers to sources of alert audio. The descriptor, when used, can reference broadcast audio streams or audio files carried in DSM-CC Object or Data carousels, and can reference audio files available on the out-of-band channel. The

inclusion of the Audio File Descriptor is optional in the Cable Emergency Alert message, and receiving devices need not support it. When the descriptor is used, the cable operator may choose to support only one of the audio delivery formats and/or a subset of the audio compression formats currently defined. Likewise, a given receiving device built to support the Audio File Descriptor may support a subset of the defined delivery formats and compression formats.

The bit-stream syntax for the Audio File Descriptor shall be as shown in Table 9.

Table 9 - Bit-stream Syntax for Audio File Descriptor

Syntax	Bits	Description
audio_file_descriptor() {		
descriptor_tag	8	uimsbf value 0x02
descriptor_length	8	uimsbf
number_of_audio_sources	8	uimsbf
for (i=0; i<number_of_audio_sources; i++) {		
loop_length	8	uimsbf
file_name_present	1	bslbf
audio_format	7	uimsbf
if (file_name_present) {		
file_name_length	8	uimsbf
for (j=0; j<file_name_length; j++) {		
file_name_char	8	uimsbf
}		
}		
audio_source	8	uimsbf
if (audio_source == 0x01) {		
program_number	16	uimsbf
carousel_id	32	uimsbf
application_id	16	uimsbf
} else if (audio_source == 0x02) {		
program_number	16	uimsbf
download_id	32	uimsbf
module_id	32	uimsbf
application_id	16	uimsbf
} else {		
reserved	8*n	bslbf
}		
}		

descriptor_tag—This 8-bit unsigned integer shall have the value 0x02, identifying this descriptor (in the context of the **cable_emergency_alert()**) as the **audio_file_descriptor()**.

descriptor_length—An 8-bit unsigned integer count of the number of bytes following the **descriptor_length** itself.

number_of_audio_sources—An 8-bit unsigned integer count of the number of audio sources to be defined in this instance of the descriptor; indicates the number of iterations of the "for" loop to follow.

loop_length—An 8-bit unsigned integer count of the number of bytes following the **loop_length** field itself in this instance of the "for" loop. Receiving devices shall use **loop_length** to determine the last byte in each iteration of the "for" loop. Future versions of this standard may add new **audio_source** values (with correspondingly different **loop_length** values). Use of the **loop_length** field enables receivers that do not support those fields to skip over them.

file_name_present—A flag that indicates, when set to '1', that a file name is included in this iteration of the "for" loop, in the position indicated. When set to '0,' no file name is present.

audio_format—An 7-bit unsigned integer that indicates the compression format of the audio content described in this iteration of the "for" loop. The **audio_format** field shall be coded as shown in Table 10.

Table 10 - Audio Format Coding

audio_format	Meaning
0x00	Reserved
0x01	Audio Interchange File Format (AIFF) - Basic
0x02	Audio Interchange File Format (AIFF) - Extended
0x03	Waveform audio format (WAV) - Basic
0x04	Waveform audio format (WAV) - Extended
0x05	MPEG-1 Audio Layer 3 (MP3) - Basic
0x06	MPEG-1 Audio Layer 3 (MP3) - Extended
0x07-0x3F	Reserved for future use
0x40-0x7F	Private use

file_name_length—An 8-bit unsigned integer count of the number of characters in the file name to follow.

file_name_char—A character of the file name coded in ASCII. File names shall be of the format filename, period (ASCII 0x2E), three-character file extension. Filename characters shall be alphanumeric (A-Z, a-z, 0-9) and may include the hyphen character (ASCII 0x3D) or underscore (ASCII 0x5F).

audio_source—An 8-bit unsigned integer that indicates the source of the audio content described in this iteration of the "for" loop. The **audio_source** field shall be coded as shown in Table 11.

Table 11 - Audio Source Coding

audio_source	Meaning
0x00	Reserved
0x01	Out-of-band DSM-CC Object Carousel
0x02	Out-of-band DSM-CC Data Carousel
0x03-0x7F	Reserved for future use
0x80-0xFF	Private use

program_number—A 16-bit unsigned integer number corresponding to the MPEG-2 **program_number** per ISO/IEC 13818-1 [2].

carousel_id—The Carousel ID shall be the same as Download ID as defined in chapter 7 (Table 7-6) in ISO-13818-6 [6].

download_id—DSM-CC Download ID shall be as defined in ISO-13818-6 [6].

module_id—Module ID shall be as defined in ISO-13818-6 [6].

application_id — The Application ID shall be as defined in ANSI/SCTE 106 [7], Sec. 5.3.1.2.4.4. The **application_id** field shall be disregarded in the receiving device when the out-of-band channel is being received via ANSI/SCTE 55-1[8] or ANSI/SCTE 55-2 [9].

5.1.3.1. Audio Format Constraints

Audio shall be one channel (mono). Audio files for **audio_format** values 0x01, 0x03 and 0x05 shall comply with the constraints specified in Table 12. Constraints for the "extended" formats (**audio_format** values 0x02, 0x04, and 0x06) are not specified in this standard, but may be defined in future revisions or in other standards or recommended practices.

Table 12 - Audio Format Constraints

Audio Format	File Ext.	Sample Freq.	Other
0x01 AIFF - Basic	.AIFF	5.5 kHz, 11 kHz, 22 kHz, 32 kHz, 44.1 kHz, or 48 kHz	Bits per sample = 8 or 16
0x03 WAV - Basic	.WAV	5.5 kHz, 8 kHz, 16 kHz, 11 kHz, 22 kHz, 32 kHz, 44.1 kHz, or 48 kHz	Resource Interchange File Format (RIFF) Compression Code = 1 (PCM/uncompressed) Bits per sample = 8 or 16
0x05 MP3 - Basic	.MP3	32 kHz, 44.1 kHz, or 48 kHz	Encoded bit rate = 32, Kbps, 40 Kbps, 48 Kbps, 56 Kbps, or 64 Kbps

5.1.4. Emergency Alert Metadata Descriptor

ANSI/SCTE 164 [17] defines the Emergency Alert Metadata Descriptor, **descriptor_tag** value 0x03, for use in the **cable_emergency_alert()** message.

5.1.5. User Private Descriptors

User private descriptors shall include a 24-bit Organizationally Unique Identifier (OUI) as defined in IEEE 802 [10] Section 9.1 and assigned by the IEEE (see [13]). The OUI is also known as a **company_ID**. Table 13 shows the required structure of user private descriptors.

Table 13 - User Private Descriptor Format

Syntax	Bits	Description
user_private_descriptor() {		
descriptor_tag	8	uimsbf value 0xC0-0xFF
descriptor_length	8	uimsbf
company_ID	24	uimsbf IEEE-assigned OUI
for (i=0; i<N; i++) {		N is descriptor_length minus 3
private_data_byte	8	uimsbf
}		
}		

The current private information descriptor is in use in legacy equipment and its continued use is allowed. The **user_private_descriptor()** method is only defined for use in the Cable Emergency Alert Message and nowhere else. The ATSC Private Information Descriptor (described in ATSC A/53E [11] Annex C Section 5.7.3.4, with **descriptor_tag** value 0xAD) should be used for inclusion of private information in the Cable Emergency Alert Message.

6. Transmission Requirements (Normative)

This section describes requirements related to the structure and contents of the transmitted **cable_emergency_alert()** message.

1. The transmitted **cable_emergency_alert()** message shall conform to the syntax and semantics specified in Section 5.
2. Any **cable_emergency_alert()** message sent in-band shall provide alert text, a valid details channel (**details_major_channel_number, details_minor_channel_number** pair), or both.
3. Any **cable_emergency_alert()** message sent out-of-band shall provide alert text, a valid **details_OOB_source_ID**, or both.
4. For a **cable_emergency_alert()** message sent in-band, when **alert_priority** is set in the 12-15 range (maximum priority), a valid (**details_major_channel_number, details_minor_channel_number**) pair shall be provided.
5. For a **cable_emergency_alert()** message sent out-of-band, when **alert_priority** is set in the 12-15 range (maximum priority), a valid **details_OOB_source_ID** shall be provided.
6. A **cable_emergency_alert()** message shall be included in-band in any Transport Stream containing unscrambled services unless the particular alert would exclude all unscrambled services on this Transport Stream.

7. For a **cable_emergency_alert()** message sent out-of-band, when **alert_priority** is set in the 12-15 range (maximum priority), and when **alert_text** is provided, shall define a valid **audio_OOB_source_ID** and a valid **details_OOB_source_ID**.

    NOTE— Receiving devices or connected displays may respond to content advisory information present in the details channel and block the viewing of that channel. Content advisory information in the details channel should be set to minimize the possibility of content-related blocking in the receiver or display. Consideration should also be given to content protection settings on the details channel. Content protection in the details channel should be set to permit delivery on all outputs from the receiving device.

7. Emergency Alert Message Processing for Receiving Devices (Normative)

Processing requirements are specified while the receiving device is "on" (normal television viewing operation). No requirements are specified for processing the **cable_emergency_alert()** message when a device is not in the "on" state, even though the device may be internally powered up and able to monitor an SI data stream.

7.1. General Requirements

1. Receiving devices shall recognize **table_ID** value 0xD8 as a **cable_emergency_alert()** message.
2. If a POD module is present in the receiving device and the out-of-band channel (Extended Channel per ANSI/SCTE 28 [4]) is available, and the receiving device is in a power "on" state, the **SI_base_PID** (0x1FFC) shall be monitored for instances of the **cable_emergency_alert()** message and any **cable_emergency_alert()** message received in-band shall be discarded.

    NOTE—Receiving devices that discard an Emergency Alert message due to any of Requirements #2, #4, #8, #21, #22, #23, #28, or #40, are not obligated to perform any additional actions related to information contained in the discarded message (e.g. ensuring that the device remains tuned to an exception channel for a particular length of time).

3. If a POD module is not present in the receiving device, or if the Extended Channel flow to Transport Stream packets of PID 0x1FFC from the POD has not been established, and the receiving device is in a power "on" state, the in-band **SI_base_PID** (0x1FFB) shall be monitored for instances of the **cable_emergency_alert()** message and **cable_virtual_channel_table()** message. The receiving device shall be able to tune to a details channel defined in a **cable_virtual_channel_table()** message within 1,000 milliseconds of reception of a complete **cable_virtual_channel_table()** message.
4. Any **cable_emergency_alert()** message in which the value of **sequence_number** matches the **sequence_number** of the most recently received **cable_emergency_alert()** message shall be discarded.
5. The value of **sequence_number** shall be considered unknown following initial application of power to the receiving device, and (when the in-band channel is being monitored for alerts) following any change in the physical tuned channel. In that state, the **cable_emergency_alert()** message shall not be discarded based on its **sequence_number**.
6. Immediately following establishment of communication on the out-of-band channel (e.g., immediately after POD module initialization and/or application of main power to the unit),

the **sequence_number** shall be considered to be unknown. Therefore, in that state, the receiving device shall not discard a **cable_emergency_alert()** message based on its **sequence_number**.

7. Immediately following loss of communication on the out-of-band channel (e.g., immediately after POD module removal), the **sequence_number** shall be considered to be unknown. Therefore, in that state, the receiving device shall not discard a **cable_emergency_alert()** message based on its **sequence_number()**.
8. Any **cable_emergency_alert()** message in which the value of **protocol_version** is non-zero shall be discarded.
9. Fields in the **cable_emergency_alert()** message marked **reserved** shall be disregarded.
10. Receiving devices shall not discard the **cable_emergency_alert()** message based on any value of the **EAS_originator_code** field.
11. Receiving devices shall not discard the **cable_emergency_alert()** message based on any value of the **EAS_event_code** field.
12. Receiving devices shall process **cable_emergency_alert()** messages upon their reception, even if the **event_start_time** field indicates a time in the future.
13. Receiving devices shall disregard any unrecognized descriptors found in the **descriptor()** loop of the **cable_emergency_alert()** message.

7.2. Overlapping Message Processing

14. If there is a prior alert message currently being processed, the receiving device shall update the value of **alert_message_time_remaining** from the new message.
15. If there is a prior alert message currently being processed and the value of **EAS_event_ID** in the new message does not match the value of **EAS_event_ID** of the prior alert, the receiving device shall terminate the display of any alert-related text that may be in progress.
16. If there is a prior alert message currently being processed and the value of **EAS_event_ID** in the new message matches the value of **EAS_event_ID** of the prior alert, processing the prior message shall continue without interruption.
17. When tuned to a details channel as a result of processing a **cable_emergency_alert()** message, and when a new **cable_emergency_alert()** message arrives that passes duplicate detection, exception processing, and alert priority tests, and when that new alert involves text display only (i.e. no details channel), the receiving device shall attempt to re-acquire the channel that had been interrupted by the original alert and then process the new alert.

    NOTE— If the audio/video content that had been interrupted was originally acquired by a resident application (e.g. VOD client) utilizing a hidden channel or a tune by frequency, then the receiving device should not attempt to re-acquire the audio/video content unless the application that originally acquired the interrupted audio/video content initiates the re-acquisition.

18. When tuned to a details channel as a result of processing a **cable_emergency_alert()** message, and when a new **cable_emergency_alert()** message arrives that is discarded for any reason (duplicate detection, exception processing, alert priority tests, etc.) processing the prior alert shall be unaffected.

19. When tuned to a details channel as a result of processing a **cable_emergency_alert()** message, and when a new **cable_emergency_alert()** message arrives that passes duplicate detection, exception processing, and alert priority tests, and when that new alert requires tuning to a different details channel, the receiving device shall tune to the new details channel.
20. For a **cable_emergency_alert()** message that involves tuning to a details channel, if that same details channel is currently tuned, processing the current message shall cause no interruption in audio/video.

7.3. Optional EAS Event ID Processing

The following requirement describes the implementation option where repeat instances of the **cable_emergency_alert()** message may be discarded, based on **EAS_event_ID**:

21. When the value of **EAS_event_ID** in the **cable_emergency_alert()** message matches the value of **EAS_event_ID** of a previously processed alert that has not yet expired and there is no alert message currently being processed, the current **cable_emergency_alert()** message may be discarded, where "expired" has the following meaning: if a non-zero **event_start_time** is indicated, a given alert shall be considered “expired” when the current time of day passes the point in time indicated by that event’s **event_start_time** added to its **event_duration**; if a value of zero for **event_start_time** is indicated, a given alert shall be considered “expired” after the number of minutes indicated by the value of **event_duration**, relative to the time of reception of the message.

7.4. Exception Processing

The following requirement applies to the case that the out-of-band channel is being monitored for instances of the **cable_emergency_alert()** message:

22. When a **cable_emergency_alert()** message includes an instance of **exception_OOB_source_ID** matching the value of **source_ID** of the currently tuned virtual channel where the currently tuned virtual channel is being presented on the primary presentation path, that **cable_emergency_alert()** message shall be discarded.

    NOTE— The primary presentation path is associated with the video/audio being presented to the end user on the NTSC outputs, DVI/HDMI outputs and 1394 output, where, if picture in picture (PIP) is active, the tuned virtual channel is presented in the primary PIP window.

The following requirement applies to the case that the in-band channel is being monitored for instances of the **cable_emergency_alert()** message:

23. When a **cable_emergency_alert()** message includes an instance of **exception_major_channel_number**, **exception_minor_channel_number** pair matching the value **major_channel_number**, **minor channel_number** of the currently tuned virtual channel, that **cable_emergency_alert()** message shall be discarded.

7.5. Alert Priority Processing

24. A receiving device that processes a **cable_emergency_alert()** message that passes duplicate detection and exception processing tests and that has a value of **alert_priority** of 12 or higher shall acquire alert audio and substitute the audio in place of the virtual channel’s audio for the duration of the alert. Alert audio shall be acquired from one of the following sources:
    a) The audio program element identified by **audio_OOB_source_ID**. This audio source may be used if the message is received via the out-of-band path and defines an **audio_OOB_source_ID** and acquisition of the audio service defined will not interrupt the currently tuned virtual channel.

b) A privately-acquired audio source. This audio source may be used if the message defines a private descriptor and the receiver supports a private descriptor mechanism and is able to successfully parse the contents of the private descriptor and obtain information necessary to acquire an alternative audio source and the receiver is able to acquire the alternative audio source without interrupting the tuned virtual channel.
c) The service defined by **details_OOB_source_ID**. This source may be used if the message is received via the out-of-band path.
d) The service defined by the virtual channel referenced by the **details_major_channel_number**, **details_minor_channel_number** pair. This source may be used if the message is received via the in-band path.
e) Audio content identified by the **audio_file_descriptor()** provided in a format supported by the receiving device.
f) Audio content identified by other SCTE standardized methods provided in a format supported by the receiving device.

25. A receiving device that processes a **cable_emergency_alert()** message that passes duplicate detection and exception processing tests and that has a value of **alert_priority** in the range of 8 to 11 shall display/output alert text or output alert audio or provide both alert text and alert audio. Alert audio, if output, shall be substituted in place of the virtual channel's audio for the duration of the alert. Alert audio may be acquired from one of the following sources:
    a) The audio program element identified by **audio_OOB_source_ID**. This audio source may be used if the message is received via the out-of-band path and defines an **audio_OOB_source_ID** and acquisition of the audio service defined will not interrupt the currently tuned virtual channel.
    b) A privately-acquired audio source. This audio source may be used if the message defines a private descriptor and the receiver supports a private descriptor mechanism and is able to successfully parse the contents of the private descriptor and obtain information necessary to acquire an alternative audio source and the receiver is able to acquire the alternative audio source without interrupting the tuned virtual channel.
    c) The service defined by **details_OOB_source_ID**. This source may be used if the message is received via the out-of-band path and a valid **audio_OOB_source_ID** is provided.
    d) The service defined by the virtual channel referenced by the **details_major_channel_number, details_minor_channel_number** pair. This source may be used if the message is received via the in-band path and a valid **details_major_channel_number, details_minor_channel_number** pair is provided.
    e) Audio content identified by the **audio_file_descriptor()** provided in a format supported by the receiving device.
    f) Audio content identified by other SCTE standardized methods provided in a format supported by the receiving device.
26. Unless tuned to a pay-per-view event or accessing video on demand, a receiving device that processes a **cable_emergency_alert()** message that passes duplicate detection and exception processing tests and that has a value of **alert_priority** in the range of 4 to 7 shall display/output alert text or output alert audio. Alert audio, if output, shall be substituted in place of the virtual channel's audio for the duration of the alert. Alert audio may be acquired from one of the following sources:
    a) The audio program element identified by **audio_OOB_source_ID**. This audio source may be used if the message is received via the out-of-band path and defines a valid **audio_OOB_source_ID,** and acquisition of the audio service defined will not interrupt the currently tuned virtual channel.

b) A privately-acquired audio source. This audio source may be used if the message defines a private descriptor and the receiver supports a private descriptor mechanism and is able to successfully parse the contents of the private descriptor and obtain information necessary to acquire an alternative audio source and the receiver is able to acquire the alternative audio source without interrupting the tuned virtual channel.
c) The service defined by **details_OOB_source_ID**. This source may be used if the message is received via the out-of-band path and a valid **audio_OOB_source_ID** is provided.
d) The service defined by the virtual channel referenced by the **details_major_channel_number, details_minor_channel_number** pair. This source may be used if the message is received via the in-band path and a valid **details_major_channel_number, details_minor_channel_number** pair is provided.
e) Audio content identified by the **audio_file_descriptor()** provided in a format supported by the receiving device.
f) Audio content identified by other SCTE standardized methods provided in a format supported by the receiving device.

27. Unless tuned to an access-controlled service (as indicated by the presence of a **CA_descriptor()** in the **TS_program_map_section()**), a receiving device that processes a **cable_emergency_alert()** message that passes duplicate detection and exception processing tests and that has a value of **alert_priority** in the range of 1 to 3 shall display/output alert text or output alert audio. Alert audio, if output, shall be substituted in place of the virtual channel's audio for the duration of the alert. Alert audio may be acquired from one of the following sources:
    a) The audio program element identified by **audio_OOB_source_ID**. This audio source may be used if the message is received via the out-of-band path and defines a valid **audio_OOB_source_ID** and acquisition of the audio service defined will not interrupt the currently tuned virtual channel.
    b) A privately-acquired audio source. This audio source may be used if the message defines a private descriptor and the receiver supports a private descriptor mechanism and is able to successfully parse the contents of the private descriptor and obtain information necessary to acquire an alternative audio source and the receiver is able to acquire the alternative audio source without interrupting the tuned virtual channel.
    c) The service defined by **details_OOB_source_ID**. This source may be used if the message is received via the out-of-band path and a valid **audio_OOB_source_ID** is provided.
    d) The service defined by the virtual channel referenced by the **details_major_channel_number**, **details_minor_channel_number** pair. This source may be used if the message is received via the in-band path and a valid **details_major_channel_number, details_minor_channel_number** pair is provided.
    e) Audio content identified by the **audio_file_descriptor()** provided in a format supported by the receiving device.
    f) Audio content identified by other SCTE standardized methods provided in a format supported by the receiving device.
28. Receiving devices shall discard (after **sequence_number** processing) a **cable_emergency_alert()** message that has a value of **alert_priority** of 0.

7.6. Details Channel and Audio

29. When output of alert audio is required, but no access to alert audio other than that available on the details channel is possible, and a valid details channel is accessible, that details channel shall be acquired.
30. When tuning to the details channel, the receiving device shall process **alert_message_time_remaining** to determine the point at which to restore the audio and/or video programming that had been interrupted by the alert message processing.

NOTE—If the audio/video content that had been interrupted was originally acquired by a resident application (e.g. VOD client) utilizing a hidden channel or a tune by frequency, then the receiving device should not attempt to re-acquire the audio/video content unless the application that originally acquired the interrupted audio/video content initiates the re-acquisition.

31. A value of zero of **alert_message_time_remaining** shall be interpreted as an indefinite wait.

    NOTE—An example of an "indefinite wait" may be found in Annex B – Overlapping Message Examples (Informative).

32. Excluding content advisory information that may result in blocking in the receiver, user-accessible settings for a specified channel shall not prevent the tuning and display/output of that channel as the details channel.
33. Tuning to an EAS details channel shall be enabled by the receiver even if the channel is defined with the **hidden** attribute set to "1" in the virtual channel definition.

7.7. Text Processing

34. When the **cable_emergency_alert()** message provides **alert_text()**, and processing it does not involve tuning to the details channel, the receiving device shall scroll the alert text slowly across the top of the video.
35. The display/output of any scrolled alert text shall continue until complete, or until interrupted by a new alert message according to Section 7.2 #15.
36. If processing the **cable_emergency_alert()** message results in tuning to the details channel, alert text (when provided in the message) shall not be displayed.
37. The receiving device shall process multi-lingual **alert_text()**, and shall choose at most one language for display/output when text is provided multi-lingually. Receiving devices shall support the English language (ENG), and the Huffman compression tables in ATSC A/65C [1]. Other languages and their corresponding character sets may also be supported, as an option.

7.8. Optional Processing

38. The receiving device may output alert audio (if available) when processing instances of the **cable_emergency_alert()** message having values of **alert_priority** lower than 12.
39. When output of alert audio/video is desired even though not required, and a valid details channel is accessible, that details channel may be acquired.
40. When the receiving device's geographic location is known, that receiving device may discard an instance of a **cable_emergency_alert()** message indicating a location excluding that of the receiving device.

8. Cable System Operational Issues (informative)

Additional considerations for cable system operators are included in this section.

8.1. Overlapping Messages Are Allowed

The cable operator may send a **cable_emergency_alert()** message for a new Emergency Alert event before the end point of the previous Emergency Alert message has been reached. A "new" Emergency Alert event is defined as one that differs from the previous Emergency Alert message in **EAS_event_ID**.

NOTE— Normally, such overlap does not occur because the headend equipment is able to buffer and delay most types of alerts to provide space between them. In the case of a high-priority national-level alert (EAN or NPT), however, such delay is not possible. An EAN or NPT may interrupt a prior alert event that still may be in progress.

NOTE— Another situation in which a **cable_emergency_alert()** message may be sent before the end point of the previous one is to reduce or extend the time duration. Such a time adjustment may be done for the purposes of reducing or extending the time receiving devices are being asked to stay on the details channel or the timing of audio output.

8.2. The Emergency Alert Message May be Repeated to Ensure its Reception

The cable operator may send multiple copies of a **cable_emergency_alert()** message over a period of five seconds to help ensure its reception at the receiving device. The receiving device discards duplicates based on **sequence_number** checking. A cable operator may repeat a **cable_emergency_alert() message** over a period of several minutes or longer to capture receiving devices that may acquire the service while the alert is in progress.

8.3. Digital Transport Streams with Unscrambled Services

cable_emergency_alert() messages are inserted (in-band) into certain Transport Stream multiplexes by the cable operator, as necessary. Inclusion of a **cable_emergency_alert()** message in the Transport Stream is required unless the particular alert would exclude all unscrambled services on this Transport Stream.

> NOTE— Typically, transport streams originating from terrestrial broadcast sources located in the same geographic region as the cable hub provides the Emergency Alert function within their audio and video. Such a channel can be identified in the **cable_emergency_alert()** message so that the alert does not apply when receiving devices are tuned to this channel. The requirement for carriage of in-band **cable_emergency_alert()** messages is designed to ensure that receiving devices with no access to the out-of-band channel are able to access Emergency Alert information.

8.4. Tuning to the Details Channel

A valid details channel may be identified in the **cable_emergency_alert()** message even in cases where mandatory tuning to it is not required. Tuning to the details channel can be offered as an option to the user if the **details_OOB_source_ID** is non-zero indicating that information pertaining to the alert is available.

9. Optional Processing (Informative)

The **cable_emergency_alert()** message includes a number of parameters that are not part of mandatory processing requirements, or that may be processed in ways that exceed them. This section describes the parameters and some possible uses for them.

9.1. Alert Originator Code and Event Code

The **cable_emergency_alert()** message includes the EAS Originator Code and Event Code. Using these, a receiving device could be designed to filter based on types of events and respond in some programmed way when such events are seen. For example, the appearance of a Hurricane Watch could be made to activate a bell, siren, or bed-shaker.

9.2. Alert Event Start Time and Duration

The **cable_emergency_alert()** message includes the start time and duration of the event. For example, an alert could indicate that a Flash Flood Watch is in effect beginning at 2pm and lasting for six hours. If a receiving device can store Emergency Alert events for later review by the user, the start time and duration information can be used to automatically delete expired events from memory. Start time and duration data can also be used to display summary information about an Emergency Alert event.

9.3. Alert Location Information

In some situations, a receiving device may be given Emergency Alert information that applies to an event that is geographically too far away to be of interest. The **cable_emergency_alert()** message includes the location codes that originally accompanied the EAS event. With knowledge of the location of the cable terminal, the receiving device can be designed to filter out any events that happen to be outside the area of interest.

10.Time Shifted Emergency Alerts (Informative)

A digital Transport Stream carrying Emergency Alerts may be stored on tape or disk for later playback. Hard disk video recorders may be capable of simultaneous record and playback, so that the time shift may be as little as a few seconds.

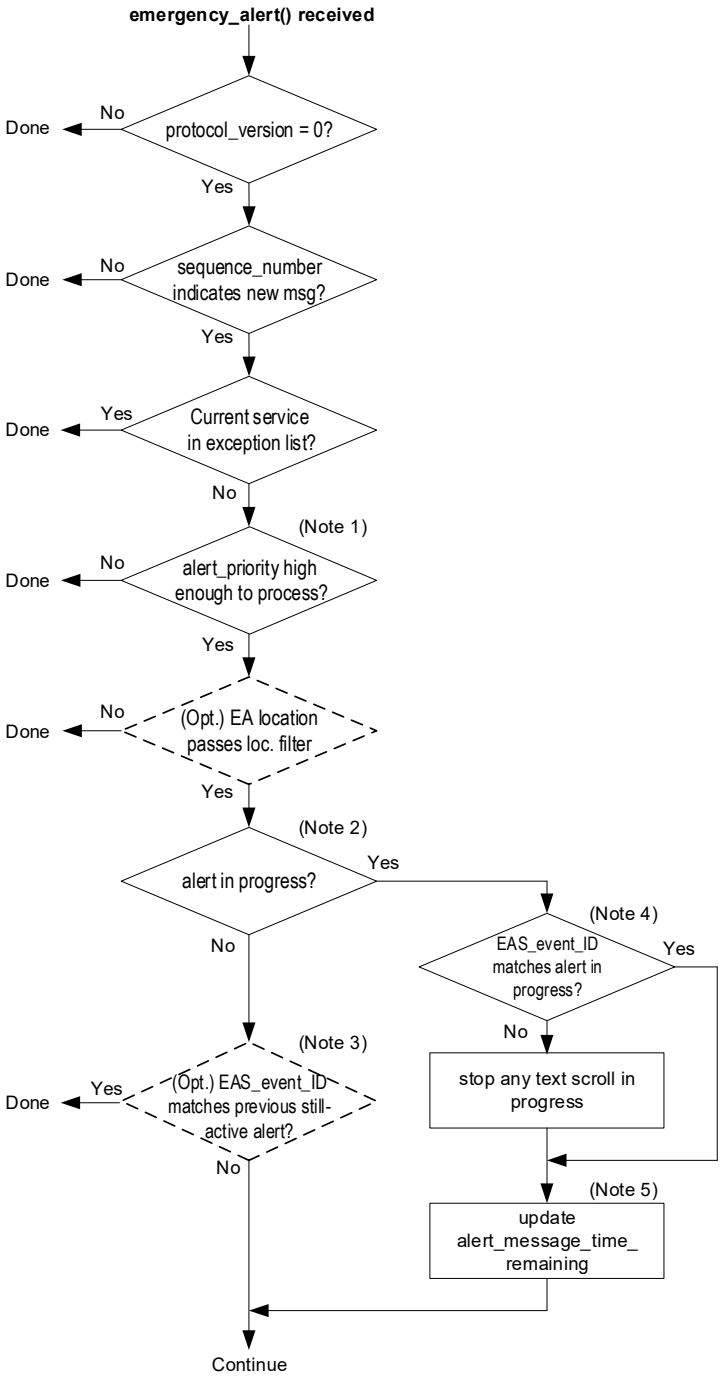
When a receiving device detects an alert that is still active, the user should always be notified.

When time-shifted material is played back, the current time of day can be compared with the **event_start_time** and **event_duration** given in the **cable_emergency_alert()** message. In this way, Emergency Alert events that have expired can be disregarded. Furthermore, the System Time Table representing the current time of day when the recording was made are available on playback; in this way the exact amount of time shift can be determined. Knowledge of the time shift can allow proper processing of some types of Emergency Alert events even when they are time-shifted.

Annex A – Receiving Device Emergency Alert Message Processing (Informative)

Figure 1 is an illustrative flow diagram depicting some aspects of an example implementation.

Figure 1 is for illustration only and is not intended to constrain or define specific implementations.


emergency_alert() received
protocol_version = 0?
No
Done
Yes
sequence_number indicates new msg?
No
Done
Yes
Current service in exception list?
Yes
Done
No
(Note 1)
alert_priority high enough to process?
No
Done
Yes
(Opt.) EA location passes loc. filter
No
Done
Yes
(Note 2)
alert in progress?
Yes
No
(Note 4)
EAS_event_ID matches alert in progress?
Yes
No
stop any text scroll in progress
(Note 3)
(Opt.) EAS_event_ID matches previous still-active alert?
Yes
Done
No
(Note 5)
update alert_message_time_remaining
Continue

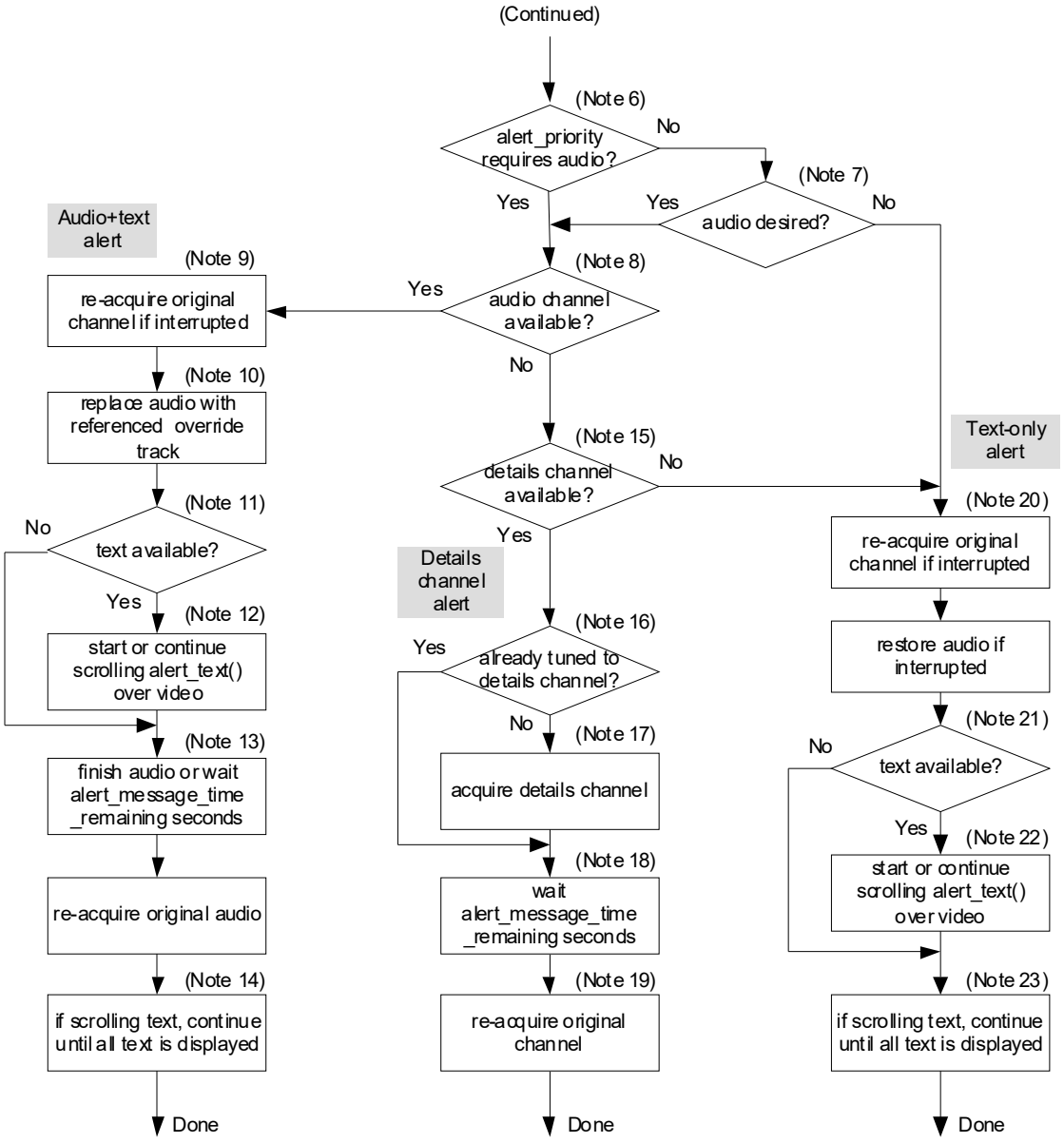


Figure 1 - Emergency Alert Message Example Processing Flow Diagram

NOTES:

1. Alert priority high enough to process? This test involves comparing the **alert_priority field** with the receiving device conditions given in Table 4. Message processing can be considered Done if the priority is low enough, considering (for all but Maximum Priority cases) the type of programming currently being viewed (pay-per-view, access-controlled service, etc.). At the discretion of the receiving device implementation, alert messages with a value of **alert_priority** higher than zero may be processed even though the priority level does not require it. This decision box accommodates these discretionary choices as well as the mandatory ones.
2. Alert in progress? This test evaluates true if the current message has arrived before processing is complete on a prior alert message.
3. **EAS_event_ID** matches previous still-active alert? This test is optional; if skipped, processing continues without discarding the message. For this test to return true, the **EAS_event_ID** value in the current message must match the **EAS_event_ID** corresponding to a previously processed event that is still "active," meaning that the current time has not passed the time indicated by **event_start_time** plus **event_duration**. In some situations, prior values of **EAS_event_ID** are considered unknown, and hence no match can be declared. These situations include the case that the receiving device has been rebooted after being turned off (when the out-of-band path delivers alert messages) and following a change in physical channel (in the case where alerts are being processed in-band).
4. **EAS_event_ID** matches alert in progress? This test evaluates true if the current message has the same value of **EAS_event_ID** as that of the alert being processed when the message arrived.
5. Update **alert_message_time_remaining**. The current message may serve only to reduce or extend the amount of time to be spent on the details channel or on the audio out-of-band channel, so the new value of **alert_message_time_remaining** is used.
6. **alert_priority** requires audio? This test evaluates true if the **alert_priority** is 12 or above, per Table 4.
7. Audio desired? At the discretion of the receiving device implementation, audio may be output even though not required by virtue of an **alert_priority** below 12.
8. Audio channel available? Audio is available by access to the service referenced by **audio_OOB_source_ID** (if provided) when that service is located in the currently acquired Transport Stream, or when a second tuner/demodulator is available to acquire the Transport Stream in which it is located. Alternatively, available audio may be indicated by the **audio_file_descriptor()** or by private means.
9. Re-acquire original channel if interrupted. If the current message has arrived while the receiving device is tuned to a details channel as a result of a prior alert, return to the channel that had been interrupted by the prior alert message.
10. Replace audio with referenced audio track. This step involves switching the audio output from the current program audio to audio decoded from one of the sources listed in Note 8.
11. Text available? Text is considered "available" when the Cable Emergency Alert Message specifies a non-null string in **alert_text()**.
12. Start or continue scrolling alert text over video. Text may already be scrolling as a result of processing a prior instance of Cable Emergency Alert Message that is still in progress. In this case, nothing further needs to be done at this step. If no text is currently scrolling, scrolling of the text given in **alert_text()** of the present Cable Emergency Alert Message is started.
13. Finish audio or wait **alert_message_time_remaining** seconds. If audio is being output from a proprietary method in which the end-point is known, complete it. If **alert_message_time_remaining** is non-zero, create a timer event that executes **alert_message_time_remaining** seconds into the future. If **alert_message_time_remaining** is zero, wait indefinitely. In this case, another alert can be expected that sets a finite value for **alert_message_time_remaining.**

14. Continue until all text is displayed. This step is needed in case the length of time needed to scroll all the text exceeds the end point of the alert message as determined by processing **alert_message_time_remaining**. If all the text has already been displayed by this point, no further action is needed and the alert message processing is complete.
15. Details channel available? A details channel is considered "available" if the Cable Emergency Alert Message specifies a non-zero value for **details_OOB_source_ID** (when processing the out-of-band channel) or **details_major_channel_number, details_minor_channel_number** (when the out-of-band channel is not available).
16. Already tuned to details channel? This condition can occur if the present alert message has arrived before the completion of processing of the prior message (overlapping message) and the current message specifies the same details channel already acquired as a result of processing the prior message. This test avoids any glitch that otherwise might occur if an attempt is made to reacquire the same virtual channel that is currently being viewed.
17. Acquire details channel. For out-of-band operation, channel acquisition involves matching the **details_OOB_source_ID** with the **source_ID** of a virtual channel delivered in the Virtual Channel Table of ANSI/SCTE 65 [12] (either S-VCT or L-VCT), and then tuning to that physical channel (and for digital channels, the demultiplexing the referenced MPEG-2 program within the Transport Stream). For in-band operation, channel acquisition involves matching the given **details_major_channel_number**, **details_minor_channel_number** with a TVCT or CVCT entry found within in-band PSIP, and acquiring that virtual channel.
18. Wait **alert_message_time_remaining** seconds. If **alert_message_time_remaining** is non-zero, create a timer event that executes **alert_message_time_remaining** seconds into the future. If **alert_message_time_remaining** is zero, wait indefinitely. In this case, another alert can be expected that sets a finite value for **alert_message_time_remaining**.
19. Re-acquire original channel. In this step, the channel that was interrupted by the Emergency Alert is re-reacquired.
20. Re-acquire original channel if interrupted. See Note 9.
21. Text available? See Note 11.
22. Start or continue scrolling alert text over video. See Note 12.
23. Continue until all text is displayed. See Note 14.

Annex B – Overlapping Message Examples (Informative)

B.1 Example #1 - EAN Overlapping HWW

Figure 2 is an illustrative timing diagram depicting some aspects of overlapping Cable Emergency Alert messages. The following events occur, identified by the corresponding letters in Figure 2:

a) A High Wind Warning (HWW) event occurs at "a", with an indicated **alert_message_time_remaining** of 50 seconds.
b) At point "b," which occurs 50 seconds later, the **alert_message_time_remaining** is revised to be 20 seconds hence (70 seconds from point a).
c) Five seconds later, at point "c," the time is set to be 15 seconds hence (also 70 seconds from point "a").
d) Before the scheduled end point of the HWW event, at point "d" an Emergency Action Notification (EAN) event occurs. The **alert_message_time_remaining** value is zero, meaning an indefinite time duration.
e) Some time later, at point "e," another EAN is sent defining the end point to be six seconds hence.
f) Four seconds later, at point "f," the EAN end time is extended to another four seconds.
g) Four seconds later, as there have been no further extensions, the EAN expires and the event is over.

The lower timeline in Figure 2 illustrates in a simplified way the expected response in the receiving device.

Table 14 shows the values of some of the pertinent parameters in the Cable Emergency Alert Message corresponding to messages delivered at the various points in time in Figure 2.

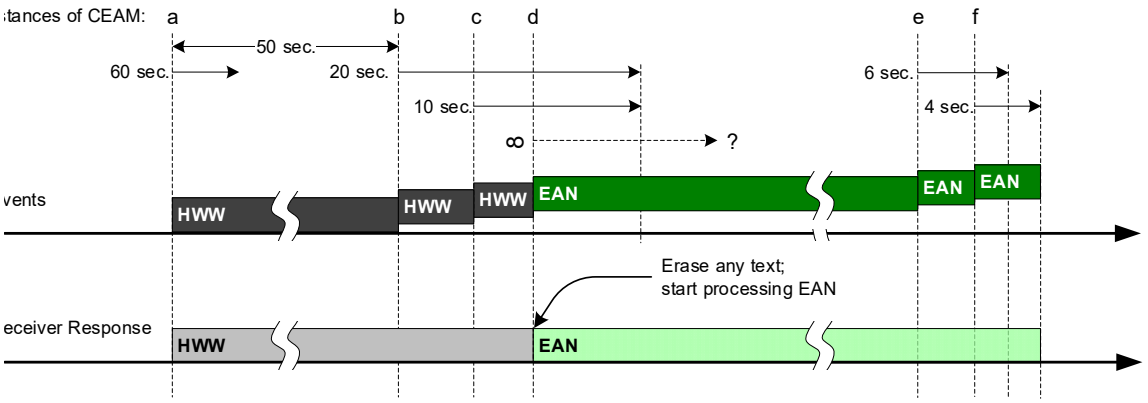


Figure 2 - Example #1 EAS Event Timeline

Table 14 - Parameters for Example EAS Event

	a	b	c	d	e	f
EAS_event_code	**HWW**	**HWW**	**HWW**	**EAN**	**EAN**	**EAN**
EAS_event_ID	15	15	15	16	16	16
sequence_number	10	11	12	13	14	15
alert_message_time_remaining	60	10	10	0	6	4

– CAE Aborted by an Overlapping pseudo Event

Figure 3 is an illustrative timing diagram depicting some aspects of overlapping Cable Emergency Alert messages. This example uses a "pseudo-event" to terminate an in-progress message. A "pseudo-event" is an event with an **EAS_event_code** not corresponding to a real event, whose purpose is only to terminate any prior event that might bin progress. In the example here, the **EAS_event_code** is set to "ABT," but it could just as well be set to any characters.

The following events occur, identified by the corresponding letters in Figure 3:

a) A Child Abduction Emergency (CAE) event occurs at "a," with an indicated **alert_message_time_remaining** of 110 seconds.
b) At point "b", which occurs 18 seconds later, an operator decides to abort the message. An Abort event (ABT pseudo event) is sent with an **alert_message_time_remaining** of 3. To the receiver this appears to overlap the CAE. The receiver stops the display of the CAE and begins display of the ABT pseudo event.
c) Three seconds later (21 seconds from point "a") the ABT pseudo event ends and the receiver returns to the programming that was interrupted by the CAE and ABT events.

The lower timeline in Figure 3 illustrates in a simplified way the expected response in the receiving device.

Table 15 shows the values of some of the pertinent parameters in the Cable Emergency Alert Message corresponding to messages delivered at the various points in time in Figure 3. Note that the **sequence_number** of the ABT message may or may not be equal to one higher than the **sequence_number** of the preceding message. In some instances, the equipment may not be able to synchronize with past **sequence_number** values.

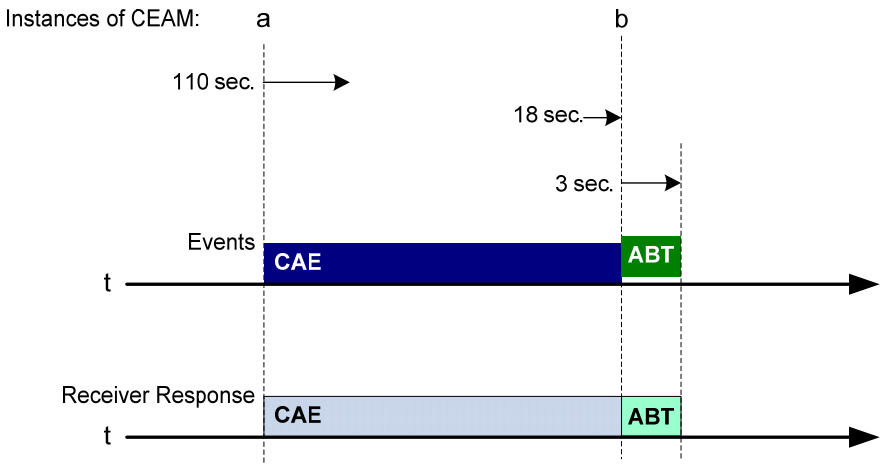


Figure 3 - Example #3 EAS Event Timeline

Table 15 - Parameters for Example #3

	a	b
EAS_event_code	CAE	ABT
EAS_event_ID	18	97
Sequence_number	12	7
alert_message_time_remaining	110	3

Consumer Technology Association Document Improvement Proposal

If in the review or use of this document a potential change is made evident for safety, health or technical reasons, please email your reason/rationale for the recommended change to standards@CTA.tech.

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