ATIS-0700041.v002

ATIS Standard on -

**Wireless Emergency Alerts (WEA) 3.0
Device-Based Geo-Fencing (DBFG)**

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ATIS Standard on

Wireless Emergency Alerts (WEA) 3.0 Device-Based Geo-Fencing (DBGF)

Alliance for Telecommunications Industry Solutions

Approved August 26, 2022

Abstract

This standard specifies methods for delivering the Alert Originator provided geometric shapes (circle(s) or polygon(s)) defining the Alert Area to the mobile device along with the WEA 3.0 alert text, as well as the encoding of the WEA 3.0 Warning Area Coordinate (WAC) Information Element (IE) for the geometric shapes.

Foreword

The Alliance for Telecommunications Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Wireless Technologies and Systems Committee (WTSC) develops and recommends standards and technical reports related to wireless and/or mobile services and systems, including service descriptions and wireless technologies. WTSC develops and recommends positions on related subjects under consideration in other North American, regional, and international standards bodies.

The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word *may* denotes an optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, WTSC, which was responsible for its development, had the following leadership:

> M. Younge, WTSC Chair (T-Mobile USA)
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> P. Musgrove, WTSC Vice Chair (AT&T)
>
> T. Brooks, WTSC SN Chair (T-Mobile USA)
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> P. Musgrove, WTSC SN Vice Chair (AT&T)
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> F. Khatibi, Technical Editor (Qualcomm)

The Systems & Networks (SN) subcommittee was responsible for the development of this document.

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1   Scope & Purpose

1.1 Scope

On January 30, 2018, the Federal Communications Commission (FCC) adopted a Second Report and Order (R&O) and Second Order on Reconsideration to enhance the effectiveness of Wireless Emergency Alerts (WEA) [Ref 3]. The Second R&O seeks to improve the accuracy emergency managers can geographically target the delivery of WEA messages to areas within their jurisdiction and can precisely target at-risk populations while minimizing disruption to others.

Specifically, the Second R&O requires Participating Commercial Mobile Service Providers (CMSPs) to meet the new requirements without affecting the 360-character text allotment:

- Deliver alert messages to an area that matches the target area specified by the alert as a circle or polygon to 100 percent of the target area with no more than 0.1 of a mile overshoot or to an area that best approximates the target area on only those elements of its network infrastructure incapable of matching the target area.
- Preserve alert messages in a consumer-accessible format and location for at least 24 hours after the message is received on the mobile device, or until deleted by the user.

   NOTE: Some CMSPs may interpret "is received" to mean "is presented."

The use of the term WEA in this specification refers to WEA 3.0, unless otherwise indicated. This specification is intended for use by participating CMSPs per the FCC definition described in ATIS-0700035, *Wireless Emergency Alert (3.0) Service Description* [Ref 100], and all references to CMSPs in this specification refer to participating CMSPs.

The regulatory background is described in detail in the Service Description in ATIS-0700035 [Ref 100].

1.2 Purpose

The purpose of this standard is to specify methods for delivering the Alert Originator provided geometric shapes (circle(s) or polygon(s)) defining the Alert Area to the mobile device along with the WEA 3.0 alert text, as well as the encoding of the WEA 3.0 Warning Area Coordinate (WAC) Information Element (IE) for the geometric shapes.

2   References

The following standards contain provisions which, through reference in this text, constitute provisions of this ATIS Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this ATIS Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

2.1 Normative References

   [Ref 1]   FCC 08-99, *Federal Communications Commission First Report and Order in the Matter of The Commercial Mobile Alert System*; April 9, 2008.[1]

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[1] This document is available from the Federal Communications Commission. <http://www.fcc.gov/>

[Ref 2]   FCC 16-127, *Federal Communications Commission Report and Order and Further Notice of Proposed Rulemaking in the Matter of Wireless Emergency Alerts Amendments to Part 11 of the Commission's Rules Regarding the Emergency Alert System*; September 29, 2016.[1]

[Ref 3]   FCC 18-4, *Federal Communications Commission Second Report and Order and Second Order on Reconsideration;* January 30, 2018.[1]

[Ref 4]   3GPP TS 23.041, *3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Technical realization of Cell Broadcast Service (CBS)*.[2]

[Ref 5]   ATIS-0700036, *Wireless Emergency Alert (WEA) 3.0 Mobile Device Behavior (MDB) Specification*.[3]

[Ref 6]   ATIS-0700010, *Wireless Emergency Alert (WEA) 3.0 via EPS Public Warning System Specification*.[3]

[Ref 7]   3GPP TS 36.331, *Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification*.[2]

[Ref 8]   3GPP TS 38.331, *NR; Radio Resource Control (RRC) protocol specification*.[2]

2.2 Informative References

[Ref 100]   ATIS-0700035, *Wireless Emergency Alert (WEA) 3.0 Service Description*.[3]

3   Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < https://glossary.atis.org/ >.

3.1 Definitions

Alert Area: An Alert Area is the area specified by the Alert Originators for an alert. An alert may have multiple Alert Area instances. Each instance of an Alert Area shall have an area description, at least one geo-code, and optionally, one or more geometric shapes (polygon(s) or circle(s)). Each polygon is defined by a set of sequential coordinate pairs. Each circle is defined by a coordinate and a radial distance.

Alert Message: An Alert Message is a message that is intended to provide the recipient information regarding an emergency, and that meets the requirements for transmission by a Participating Commercial Mobile Service Provider as defined in the *FCC First Report and Order for the Commercial Mobile Alert System* [Ref 1].

Broadcast Area: The Broadcast Area represents the area in which the alert is broadcast based on the Alert Area. The Broadcast Area may vary by wireless operator cell/sector selection and coverage.

Commercial Mobile Service Provider (CMSP): A CMSP is an FCC licensee providing commercial mobile service as defined in section 332 (d)(1) of the Communications Act of 1934 (47 U.S.C. 332(d)(1)). Section 332(d)(1) defines the term commercial mobile service as any mobile service (as defined in 47 U.S.C. 153) that is provided for profit and makes interconnected service available: (a) to the public; or (b) to such classes of eligible users as to be effectively available to a substantial portion of the public, as specified by regulation by the Federal Communications Commission.

Warning Area Coordinates (WAC) Information Element (IE): The coordinates defining one or more geometric shapes (see Alert Area) are carried by this IE. See 3GPP TS 23.041, *3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Technical realization of Cell Broadcast Service (CBS)* [Ref 4].

WEA Handset Action Message (WHAM): The WHAM message is a Cell Broadcast Service (CBS) message broadcast by the network to direct devices to perform a geo-fencing check on selected active alerts.

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[2] This document is available from the 3rd Generation Partnership Project (3GPP) < http://www.3gpp.org/ >

[3] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS). < http://www.atis.org >

Wireless Emergency Alert (WEA) 3.0: Further WEA Alert improvements leveraging advancements in technology (e.g., device-based geo-fencing) as defined in the FCC Second Report and Order and Second Reconsideration, FCC 18-4 [Ref 3]

3.2 Acronyms & Abbreviations

3GPP	3rd Generation Global Partnership*
ATIS	Alliance for Telecommunications Industry Solutions
CB	Cell Broadcast
CBS	Cell Broadcast Service
CMAC	Commercial Mobile Alert for C Interface
CMSP	Commercial Mobile Service Provider
DBGF	Device-Based Geo-Fencing
E-UTRAN	Evolved-UMTS Terrestrial Radio Access Network
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
IE	Information Element
NR	New Radio
SIB	System Information Block
TLV	Tag-Length-Value
TS	Technical Specification
R&O	Report and Order
WAC	Warning Area Coordinates
WHAM	WEA Handset Action Message
WEA	Wireless Emergency Alert

*3GPP™ is a Trademark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

4 WEA Geo-fencing Requirements

[WEA-DBGF-RQMT-0010] The CMSP network shall map polygon(s) and circle(s) information received within the alert area to the Warning Area Coordinates IE according to Clause 5.2.

[WEA-DBGF-RQMT-0020] The Warning Area Coordinates IE shall be sent to the mobile devices over the E-UTRAN within the SIB12 segment as defined in 3GPP TS 36.331 [Ref 7], and over New Radio (NR) within the SIB8 segment as defined in 3GPP TS 38.331 [Ref 8].

[WEA-DBGF-RQMT-0030] The WHAM shall support references to one or more WEA messages.

[WEA-DBGF-RQMT-0040] The Warning Message Contents of a WHAM shall be in Cell Broadcast (CB) data format as defined in TS 23.041 [Ref 4].

[WEA-DBGF-RQMT-0050] The Warning Message Contents of WHAM shall be limited to one CB page (max 20 referenced WEA messages).

[WEA-DBGF-RQMT-0060] The Broadcast Area for a WHAM shall be the union of the Broadcast Areas of the referenced WEA message(s).

NOTE: The WHAM does not carry the Warning Area Coordinates IE.

5 Message and Information Element Coding

This section describes the coding of the content of specific Cell Broadcast information elements defined in TS 23.041 [Ref 4] to provide support for WEA Device-Based Geo-Fencing (DBGF) in order to meet accuracy requirements mandated in FCC's 18-4 [Ref 3].

5.1 WEA Handset Action Message (WHAM)

The WHAM message is a Cell Broadcast Service (CBS) message broadcast by the network to direct devices to perform a geo-fencing check on selected active alerts. Active alerts are defined in ATIS-0700010 [Ref 6]. The geo-fencing check and its application to WEA is specified in ATIS-0700036 [Ref 5].

The total number of all Active Alert Identity Tuples in a WHAM is limited to 20.

5.1.1 WHAM Tag-Length-Value (TLV)

At the most basic level, the WHAM is made up of one or more Tag-Length-Values (TLVs) indicating specific parameters and the values of the parameters.

Each WHAM TLV is illustrated in Table 1.

Table 1 - WHAM TLV

8	7	6	5	4	3	2	1	
Tag				Length				Octet 1
Length			Reserved					Octet 2
Value								Octet 3
								…
Value								Octet N

Where:

Tag (4 bits): Indicates the type of parameter.

Length (7 bits): Indicates the length of the entire WHAM TLV in octets.

Reserved (5 bits): Shall be set to 0 by the network and ignored by the device.

Value (variable number of octets, up to 80): The value of the parameter.

5.1.2 WHAM TLV Characteristics

The following attributes apply to the WHAM TLV in the WHAM:

- WHAM may contain multiple TLVs (up to 27).
- Combined number of octets for all TLVs in a WHAM shall be limited to 82.
- There may be more than one WHAM TLV with the same tag unless otherwise specified.
- There is no ordering significance to WHAM TLVs in a WHAM.
- If a WHAM tag is not recognized by a device the WHAM TLV shall be ignored.
- WHAM TLVs shall be padded with binary 0s to octet boundaries.

5.1.3 WHAM Tag Coding

Table 2 identifies the WHAM TLV tags defined for WEA.

Table 2 - WHAM TLV tags

Bits 8 7 6 5	
0 0 0 1	Active Alert Identity Tuple List
0 0 1 0	Active Alert Identity Tuple List - Common Warning Area Coordinates
1 1 1 1	CMSP Defined Use
other values	reserved for future use

The specific tag values are described below.

5.1.4   WHAM Active Alert Identity Tuple List

This WHAM TLV contains a list of active WEA alert identity tuples for DBGF.

There may be one or more WHAM Active Alert Identity Tuple List TLVs (up to 20) in a WHAM.

The WHAM Active Alert Identity Tuple List TLV is illustrated in Table 3.

Table 3 - WHAM Active Alert Identity Tuple List TLV

8	7	6	5	4	3	2	1	
0	0	0	1	Length				Octet 1
Length			0	0	0	0	0	Octet 2
Active Alert Identity Tuple 1								Octet 3 Octet 4 Octet 5 Octet 6
…								…
Active Alert Identity Tuple M								Octet N-3 Octet N-2 Octet N-1 Octet N

5.1.5   WHAM Active Alert Identity Tuple List – Common Coordinates

This WHAM TLV contains a list of active WEA alert identity tuples all sharing the same coordinates for the Alert Area description. This TLV indicates to the mobile that only one DBGF must be performed against the common set of the coordinates and the result applies to all alerts in this list.

There may be one or more WHAM Active Alert Identity Tuple List – Common Coordinates TLVs (up to 20) in a WHAM.

The WHAM Active Alert Identity Tuple List – Common Coordinates TLV is illustrated in Table 4.

Table 4 - WHAM Active Alert Identity Tuple List – Common Coordinates TLV

8	7	6	5	4	3	2	1	
0	0	1	0	Length				Octet 1
Length			0	0	0	0	0	Octet 2
Active Alert Identity Tuple 1								Octet 3
								Octet 4
								Octet 5
								Octet 6
…								…
Active Alert Identity Tuple M								Octet N-3
								Octet N-2
								Octet N-1
								Octet N

5.1.6 Active Alert Identity Tuple

This tuple uniquely identifies an active WEA alert.

The WHAM Active Alert Identity Tuple List TLV is illustrated in Table 5.

Table 5 - WHAM Active Alert Identity Tuple List TLV

8	7	6	5	4	3	2	1	
Message Identifier								Octet 1
								Octet 2
Serial Number								Octet 3
								Octet 4

Message Identifier is the active alert message identifier specified in TS 23.041 [Ref 4].

Serial Number is the active alert serial number specified in TS 23.041 [Ref 4].

5.1.7 WHAM CMSP Defined Use

The use and contents of this TLV are defined by the CMSP.

Table 6 - WHAM CMSP Defined Use TLV

8	7	6	5	4	3	2	1	
1	1	1	1	Length				Octet 1
Length			0	0	0	0	0	Octet 2
CMSP Defined Value								Octet 3
								…
								Octet N

CMSP Defined Value can have 1 to 80 octets.

5.2 Warning Area Coordinates (WAC) Information Element (IE)

If the Alert Area description includes coordinates defining one or more geometric shapes, then DBGF is to be performed. In this case, the WAC IE is included to convey the coordinates to the mobile device to allow any WEA 3.0 capable device to perform DBGF. These elements are coded as a finite bit string. In the figures, the bit string is described by octets from top downward, and in the octet from left to right. Number encoding strings start with the most significant bit.

The total number of all geometric shapes (circle(s) and polygon(s)) is limited to 10. The total number of coordinates of all circles and polygons is limited to 100. At least one circle or one polygon shall be included.

5.2.1 WAC Tag-Length-Value (TLV)

At the most basic level the WAC IE is made up of one or more TLVs indicating specific parameters and the values of the parameters.

Each WAC TLV is illustrated in Table 7.

Table 7 - WAC TLV

8	7	6	5	4	3	2	1	
Tag				Length				Octet 1
Length						Reserved		Octet 2
Value								Octet 3 …
Value								Octet N

Tag (4 bits): Indicates the type of parameter.

Length (10 bits): Indicates the length of the entire WAC TLV in octets.

Reserved (2 bits): Shall be set to 0 by the network and ignored by the device.

Value (variable number of octets, up to 1022): The value of the parameter.

5.2.2 WAC TLV Characteristics

The following attributes apply to the WAC TLV in the WAC IE:

- WAC may contain multiple TLVs.
- There may be more than one WAC TLV with the same tag unless otherwise specified.
- There is no ordering significance to WAC TLVs in a WAC IE.
- If a WAC tag is not recognized by a device the WAC TLV shall be ignored.
- WAC TLVs shall be padded with binary 0s to octet boundaries.

5.2.3 WAC Tag Coding

Table 8 identifies the WAC TLV tags defined for WEA.

Table 8 - WAC TLV tags

Bits 8 7 6 5	
0 0 0 1	Geo-fencing Wait Time
0 0 1 0	Polygon
0 0 1 1	Circle
1 1 1 1	CMSP Defined Use
other values	reserved for future use

The specific tag values are described below.

5.2.4 Coordinate Coding

The coordinates of WAC polygons or circles shall be coded as a 22-bit unsigned binary value.

5.2.4.1 Encoding at the Network

In the formula below, Commercial Mobile Alert for C Interface (CMAC) latitude is the latitude portion of a coordinate transmitted in a CMAC message. The WAC latitude is the latitude portion of the coordinate in the WAC IE. The WAC latitude shall be calculated from the CMAC latitude (expressed in degrees) using the following formula:

$$WAC\ latitude = \left\lfloor \left(\frac{CMAC\ latitude + 90}{180} \right) \times 2^{22} \right\rfloor$$

Where:

$$-90 \le CMAC\ latitude < 90$$

In the formula below, CMAC longitude is the longitude portion of a coordinate transmitted in a CMAC message. The WAC longitude is the longitude portion of the coordinate in the Warning Area Coordinates. The WAC longitude shall be calculated from the CMAC longitude (expressed in degrees) using the following formula:

$$WAC\ longitude = \left\lfloor \left(\frac{CMAC\ longitude + 180}{360} \right) \times 2^{22} \right\rfloor$$

Where:

$$-180 \le CMAC\ longitude < 180$$

5.2.4.2 Decoding at the Mobile Device

The latitude expressed in degrees shall be calculated from the WAC latitude using the following formula:

$$Latitude = \left(\frac{WAC\ latitude \times 180}{2^{22}} \right) - 90$$

The longitude expressed in degrees shall be calculated from the WAC longitude using the following formula:

$$Longitude = \left(\frac{WAC\ longitude \times 360}{2^{22}} \right) - 180$$

5.2.5 Radius Coding
5.2.5.1 Encoding at the Network

The radius of WAC circles expressed in kilometers (km) shall be coded as a 20-bit unsigned binary value.

The radius shall be calculated as

$$WAC\ radius = \lfloor CMAC\ radius \times 2^6 \rfloor$$

In the above formula, the CMAC radius is the radius in kilometers transmitted in a CMAC message. The WAC radius is the radius portion of a circle in the WAC IE.

5.2.5.2 Decoding at the Device

The device shall decode the radius using the following formula:

$$Radius = \left(\frac{WAC\ radius}{2^6} \right)$$

In the above formula, the WAC radius is the radius portion of a circle in the WAC IE.

5.2.6 Polygon

This WAC TLV contains the coordinates for a single polygon shape specified by the Alert Originator and included in the CMAC message.

There may multiple Polygon TLVs in a WAC IE.

Each Polygon TLV shall correspond to a polygon specified by the Alert Originator and contained in the CMAC message.

The Polygon TLV is illustrated in Table 9.

Table 9 - Polygon TLV

8	7	6	5	4	3	2	1	
0	0	1	0	Length				Octet 1
Length						0	0	Octet 2
Polygon latitude of 1st vertex								Octet 3
								Octet 4
								Octet 5
Polygon longitude of 1st vertex								Octet 6
								Octet 7
								Octet 8
Polygon latitude of 2nd vertex								Octet 9
								Octet 10
								Octet 11
Polygon longitude of 2nd vertex								Octet 12
								Octet 13
…								…
								Octet N

Each Polygon TLV describes a single polygon.

The order of the vertices in the polygon determines the shape of the polygon. The first and last coordinates shall match to form the shape.

5.2.7 Circle

This WAC TLV contains the coordinates for the center of a single circle shape and its radius specified by the Alert Originator and included in the CMAC message.

There may be multiple Circle TLVs in a WAC IE.

Each Circle TLV shall correspond to a circle specified by the Alert Originator and contained in the CMAC message.

The Circle TLV is illustrated in Table 10.
Table 10

Table 10 - Circle TLV

8	7	6	5	4	3	2	1	
0	0	1	1	0	0	0	0	Octet 1
0	0	1	0	1	0	0	0	Octet 2
Circle center latitude								Octet 3
								Octet 4
								Octet 5
Circle center longitude								Octet 6
								Octet 7
								Octet 8
Circle radius								Octet 9
								Octet 10

5.2.8 Geo-Fencing Wait Time

DBGF is performed by acquiring the device's location and comparing that location against the Alert Area. As soon as the device determines its location meeting operator policy, it will perform the geo-fencing comparison and present the alert if inside the Alert Area. If the device cannot determine its location meeting operator policy prior to the default geo-fencing wait time, it will proceed directly to presentation of the alert.

WEA 3.0 enabled devices have a pre-configured default geo-fencing wait time. If the Geo-Fencing Wait Time TLV is included, it overrides the default geo-fencing wait time implemented in the device for the alert with which it is received. This allows operator override of the device default geo-fencing wait time. This Geo-Fencing Wait Time TLV value may be greater or less than the device default geo-fencing wait time. This Geo-Fencing Wait Time TLV, when included, shall only occur once in a WAC IE.

The Geo-Fencing Wait Time TLV is illustrated in Table 11.

Table 11 - Geo-Fencing Wait Time TLV

8	7	6	5	4	3	2	1	
0	0	0	1	0	0	0	0	Octet 1
0	0	0	0	1	1	0	0	Octet 2
Geo-Fencing Wait Time								Octet 3

Table 12 identifies the Geo-Fencing Wait Time values defined for WEA.

Table 12 - Geo-Fencing Wait Time values

Values	
0	Zero (0) wait time
1-254	Geo-Fencing Wait Time in seconds
255	Device default wait time (result is the same as not including this TLV)

The values have the following meaning:

0   Use existing device location meeting operator policy on location age. If existing device location does not meet that operator policy, then present the alert rather than initiating a new location determination.

1-254   Use the provided value for the wait time to establish a device location meeting operator policy on location age. If a position meeting the operator policy is not established within the wait time, then present the alert to the user and discontinue further location determination.

255   Use the device default or geo-fencing wait time to establish a device location meeting operator policy on location age. At the end of this wait time, if a location meeting the operator policy is not established, then present the alert to the user and discontinue further location determination.

5.2.9   CMSP Defined Use

The use and contents of this TLV are defined by the CMSP.

Table 13 - CMSP Defined Use TLV

8	7	6	5	4	3	2	1	
1	1	1	1	Length				Octet 1
Length						0	0	Octet 2
CMSP Defined								Octet 3 … Octet N