



Test Specification Interface

Use-Case-Announcement Message (UCAM) For Vehicle Safety Application Testing under Test Suite Structure and Test Purposes (TSS&TP)

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Broad Approved

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1 Revision History

Version	Date	Description
v0.1	8/30/2024	Initial Test Case Draft & formatted for 14-day WG ballot
v0.2	2/12/2025	WG Approved, Accepted Neil's Changes & prepared for 14-day WG ballot
v0.3	3/11/2025	No 14-day WG ballot comments received & WG approved for 30-day IP Review
V1.0	4/14/2025	No 30-day IP Review and converted as Board Approval - Release

2 Scope

The scope of this document provides specification of the “Use Case Announcement Message” (UCAM) and how it can be enabled, configured, transported to test systems (TS) for the purpose of field and bench application testing. The UCAM’s purpose is for confirming alert generation by a vehicle application system, under various test scenarios as define by test specifications for V2X applications in both bench and field testing.

This UCAM and its configuration is used as part of a system for benchtop and field application testing. This message communicates to the TS when and under what conditions safety warnings were generated, pre-empted by other warnings, or cleared. The exact method or types of warnings, and whether they are audio, visual, haptic, or purely internal to an ADAS system are beyond the scope of this document. The detailed specifications of the application use cases are out of scope, but the UCAM includes an application name field.

3 References

3.1 Normative References

The following referenced documents are necessary for the application of the present document.

- 721-OA-V2X V2X Technical Requirements (i.e., Test Cases and Test Plan)
- 722-OA-CPPM Certification Program Policies Manual
- 737-OA-QTE Qualified Test Equipment Program Manual
- 741-OA-RPCG Recertification and Product Change Guidelines
- 742-OA-RDPM Reference Device Program Manual
- 746-OA-AFTS Authorized Field Test Site Program
- 752-OA-I2F-Interface V2X Infrastructure-to-Roadside Program
- 753-OA-Cert-Matrix Certification Matrix Profiles (a-V2X and b-UHF RFID Tolling)
- 754-OA-V2X-Applications V2X Application Certification Framework Program
- 739-OA-TCI3 Test Control Interface v3
- 762-OA-TSS&TP-J31611 LTE-V2X V-V Minimum Performances & Message Profile
- 763-OA-TSS&TP-16092 WAVE Security Services
- 764a-OA-TSS&TP-CAMP SCMS Certificate & Downloading (CAMP-based)
- 764b-OA-TSS&TP-160921 SCMS Certificate & Downloading (IEEE 1609.2.1 based)
- 765-OA-TSS&TP-16093 WAVE Network Services
- 767-OA-TSS&TP-J29451 V-V Minimum Performance (Bench)
- 768-OA-TSS&TP-J29451A V-V Minimum Performance (Device-Level Field)
- 770-OA-TSS&TP-RSU41 RSU 4.1 Procedure
- 772-OA-TSS&TP-CTI4001 CTI 4001 RSU
- 780a-OA-TSS&TP-V2VApps V2V Applications Set – Field Plugfest
- 780b-OA-TSS&TP-V2IApps V2I Applications Set – Field Plugfest
- 784-OA-TSS&TP-SPAT1202 SPAT Message Transmission with NEMA 1202v3 Interface
- 785-OA-TSS&TP-1218 NTCIP 1218 Interface with V2X Operations
- 792-OA-TSS&TP-V2VApps* V2V Applications Set – Bench & Field
- 793-OA-TSS&TP-V2IApps* V2I Applications Set – Bench & Field

“* - Planned

4 Definitions and Abbreviations

4.1 Definitions

See OmniAir 753(L)-OA-Cert-Matrix Certification Matrix Profiles (a-V2X & b-UHF RFID Tolling) Section 4.

4.2 General Convention

ASN.1 data elements are written as in **this format**.

4.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

16092	IEEE 1609.2.x family of standards that ensure trust and privacy
ADAS	Advanced Driver Assistance System
ASN	Abstract Syntax notation
BI	Behaviour Invalid
BSM	Basic Safety Message
BV	Behaviour Valid
CA	Certificate Authority
CSW	Cure Speed Warning Application, as informed by SAE J2945/4 RSM
C—V2X	Cellular “Vehicle to Everything” referring to LTE-V2X sidelink radio and V2N
EA	Enrolment Authority
I2V	Infrastructure to Vehicle (e.g. SPAT, RSM, Map) flow type of V2X data flows
ITS	Intelligent Transport Systems
IUT	Implementation Under Test
JER	JSON Encoding Rules (For ASN.1 Syntax)
M2M	Machine to Machine (TS to SUT in this doc)
OATCI	OmniAir Test Control Interface, also name of the GitHub project where ASN.1 maintained
OBU	Onboard Unit (the embedded safety computer in a Vehicle)
PDU	Protocol Data Unit
PSID	Provider Service Identifier
RECV	Receive message
RLVW	Red Light Violation Warning, OBU app that warns vehicle may violate intersection rules
RWW	Road Work Warning application, as informed by SAE J2945/4 RSM or WZDX
SEND	Send message
SPDU	Secure Protocol Data Unit.
SUT	System Under Test
TC	Test Configuration System
TCI	Test Control Interface (OmniAir initiated open source ASN.1 communication)
TP	Test Purposes
TS	Test System
TSS	Test Suite Structure
UCAM	Use Case Announcement Message
UTC	Universal Coordinate Time
V2I	Vehicle to Infrastructure like Signal Request Messages or SAE J2945/C Probe Data.
V2V	Vehicle to Vehicle (OBU to OBU) messages like WSM sent over V2X data plane
V2X	Vehicle to Everything (other vehicles, Cloud, RSU Infrastructure, etc.)
WAVE	Wireless Access in Vehicular Environments
WSA	WAVE Service Advertisement Message
WSM	WAVE Short Message
WZDX	Work Zone Data Exchange, operated by USDOT

5 Vehicle Safety Application Use Cases

The Use Case Announcement Message (UCAM) is a mechanism for verifying that a vehicle safety system is producing timely and correct safety warnings. Specifically, for verifying vehicle system under test the alerts are produced, clears and prioritizes warnings at acceptable location, time, heading and other conditions. These alerts primarily today, are driver warnings generated from received V2X messages combined with the SUT's own location and sensors, such as cases in application test specifications. UCAM's can facilitate test automation in autonomous or human operated vehicles, and even VRU OBU applications.

The UCAM philosophy is to provide alternative to OEM proprietary logs to enable automated application system performance testing. These UCAM messages are very light and low bandwidth, with an ASN.1 encoding specification that is both human and machine readable for test automation. UCAM test feedback enables TS to run through many scenarios quickly and in an automated way, using a M2M notification (the UCAM) of what the vehicle safety applications are “producing” as their output warnings.

Essentially any vehicle alert, that is either as driver warnings or ADAS consumed, is possible to test with UCAM notifications. UCAM takes the place of an instrumented HMI or having to watch a tablet. Instead of watching a HMI screen for alerts, UCAM allows essentially “logging” (over a network interface) of the exact location and time where any alerts were triggered/cleared in a common, easily implemented message. While the first uses of this test automation are for testing correct V2V use-case alerts (EEBL, FCW) and I2V based messaging, like RLVW, CSW, Wrong way driver, RSM based RWW, and others, there is nothing V2X specific about the UCAM, it can be used to test vehicle alert/event based safety use-cases even if purely sensor or related to other application alerts, (e.g., system unprotected). Sensor alerts like “Lane Departure Warning” (LDW), or Pedestrian Automatic Emergency Braking (PAEB), or Blind Spot Intervention can be tested with this UCAM, with or without TCI enablement control and transport.

UCAM is useful for internet/cloud networked environment supporting TS/SUT that are remote to each other through the internet, as well as automating application testing in virtual environments.

UCAM are defined for testing various cybersecurity use-cases DoS attack detection, certificate revoke, a crash/reboot and other things that would be difficult to confirm in a pure black-box testing.

6 Prerequisites and Test Configurations

6.1 Test Configurations

Though this is not a test specification, two different configurations are anticipated. Others are possible.

TC1 is the “bench testing” where the Test System (TS) provides stimulus to the IUT which may be a combination of TCI messages, and or GNSS simulation, and a wired or wireless link back from the IUT to configure and monitor or the UCAM's indicating where and when applications are triggered, cleared, etc.

For TC1, this bench testing document also explains the companion TCI module, that enables TCI DriveCast or a blend of DriveCast and GNSS Simulation data feed into the SUT of all the position, time, acceleration, flags, lights, etc. that are provided via local standards-based messages like the ETSI ITS CAM, DENM, China BSM, or SAE BSM. Details about DriveCast drive and sensor injection.

TC1 Bench Testing Configuration:

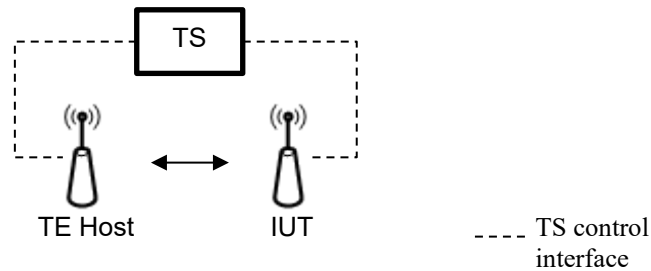


Figure 1: TC (1) Test Configuration System

TC2 starts the same as TC1 but moves into field testing, where the UCAM is enabled and configured by TS, and SUT is optionally disconnected from the TS and moved out to the field for testing. For TC2, **SetUseCaseAnnouncementConfig** TCI requires the SUT to enable a persistent (meaning across OBU or power-cycles or ignition off/on sequences.) state. In this UCAM enabled state the SUT produces the UCAMs until the configured expiration time. The “persistence” requirement enables field testing logistics, in case of accidental power-cycles/reboots, and some specific test-cases.

TC2 Field Testing Enablement Diagram:

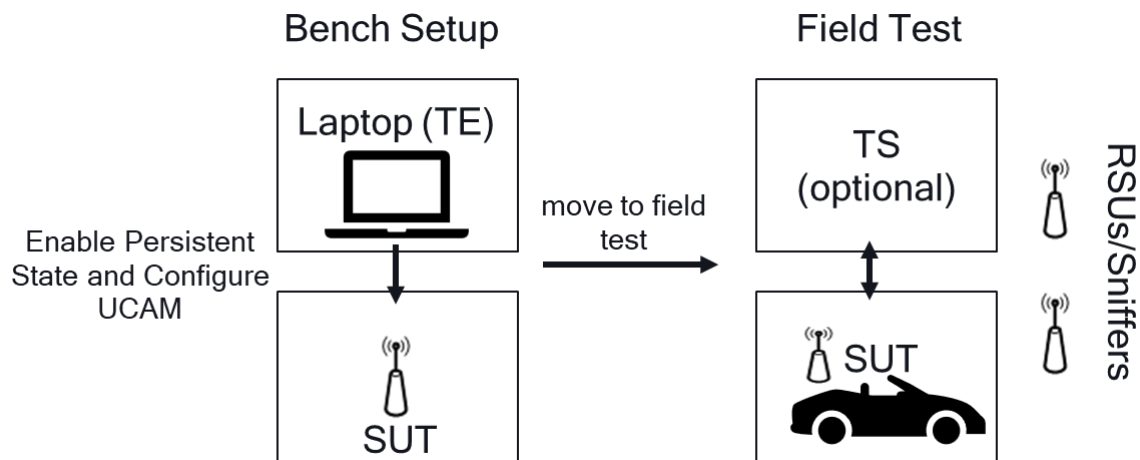


Figure 2 TC (2) Configuration to Field Test Overview

6.2 States in Initial Conditions

When the execution of the initial condition does not succeed, it leads to the assignment of an Inconclusive verdict. Figure 3 depicts the overall state diagram for a test system below.

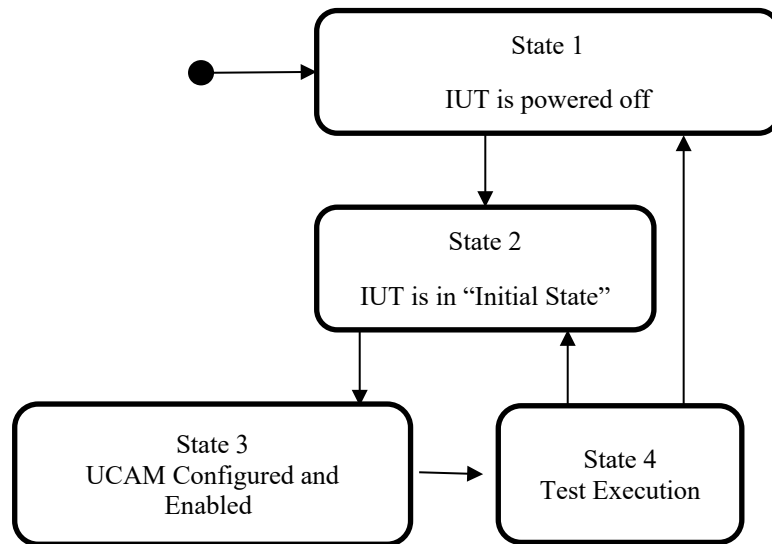


Figure 3: State Diagram

7 Test Equipment UCAM Control and sequences

For Application testing, the TS will use TCI command **SetUseCaseAnnouncementConfig** to enable and configure the SUT to produce UCAMs: including for how long, how and where to send, and some other details. This includes some basic timing parameters, and the destinations for where/how the UCAM will be delivered to TE, or other sniffers/RSU(s). This **SetUseCaseAnnouncementConfig** is a new TCI command added to TCI dictionary in 2024, after TCIv3. It is possible some SUT's may support other mechanisms to enable the UCAM, besides the TCI **SetUseCaseAnnouncementConfig**, (e.g. OEM specific Linux commands, switches, button push sequences) but TCI is the preferred method.

The TCI configuration, in addition to enabling the UCAM production optionally sets the SUT's name, so that UCAM's can be recognized. This is a short, friendly human-readable ASCII string, conveyed in the **SetUseCaseAnnouncementConfig** ASN.

8 UCAM SUT Configuration

The TCI command **SetUseCaseAnnouncementConfig** is used to configure several behavioral parameters in the SUT, including a global enable, along with the persistent duration for how long the UCAM is enabled. There is also an optional heartbeat message, that is produced at the minimum interval configured through this TCI as **heartbeatSeconds**.

8.1 enableUcamMinutes non-volatile UTC auto-shutoff

In its simplest form, the TS issues the **SetUseCaseAnnouncementConfig**, with at least the **enableUcamMinutes** data element set to the number of minutes duration for which the SUT will produce UCAM heartbeats and application alert announcements. The configuration is encoded in the standard OER rules, even though the actual UCAM broadcast back to the Test equipment is always encoded with JSON Encoding Rules (JER) when the “enableUcamMinutes” is specified to enable UCAM production, a UTC time is calculated and stored non-volatile method such the after that UTC time, UCAM will no longer be produced.

To enable field testing, the **enableUcamMinutes** is required to persist through a power-cycle and/or stack stop/start. Though for basic bench testing of V2X applications it should not be required. It can never be enabled indefinitely but can be set up to the maximum allowed value in the ASN.1, (which is about 1 day) . it will always auto-disable after this. OEM’s may choose to add other logic to automatically disable, when they are certain testing is complete. However, for the field testing, the idea is that a TS is connected once, perhaps in the bench to enable and configure UCAM’s to be broadcast over ethernet UDP, or WSMP/DSMP; and then the SUT may be brought to a vehicle and installed, and powered-up, at which point UCAM heartbeats and use-case alerts are expected, until **enableUcamMinutes** has elapsed from the UTC when it was last configured.

The **SetUseCaseAnnouncementConfig** is used not just to enable but also to disable the UCAM production, by sending with enableUcamMinutes=0.

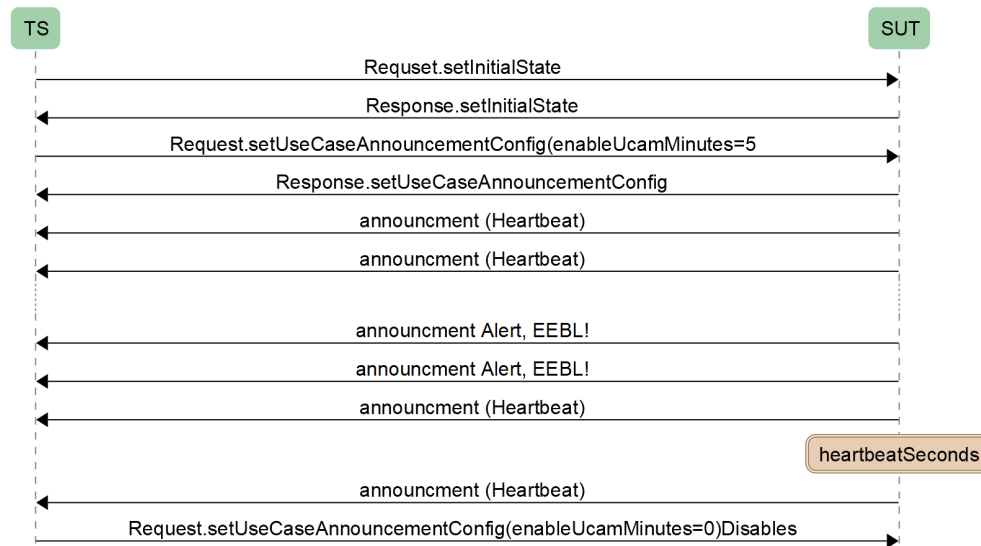
8.2 Heartbeat UCAM’s

After enabling the UCAM in a SUT, even before any alerts trigger, “Empty” UCAMs are optional and possible for SUT to confirm that UCAM is alive and ready to report any use-cases that trigger. A heartbeat is a UCAM where no Alerts list (sequence) is included. This is sent at the configured rate, when no message has been sent since **heartbeatSeconds**. Even without any events triggered the SUT will generate a UCAM with no alert, called a heartbeat UCAM, at least at the minimum rate of **heartbeatSeconds**. Any alert starting or ending, would reset the heartbeat timer.

Ideally, on first enablement/power-up when enabled, first heartbeat UCAM shall report the SUT software system version number, then continue to periodically make heartbeats until an Alert (Use case) is triggered, and then a UCAM is generated that records the SUT’s location and time where that alert first occurred and was presented or used by an ADAS system. As that alert or others persist, the heartbeat message is presented with a periodic “ongoing” Alert type until all alerts have cleared. When each active alert is no longer “triggered” or relevant, the SUT will include that alert one last time along with the location and time that this clearing occurred, along with the **AlertState=“done”**

8.3 Basic UCAM Configuration and Production Sequence

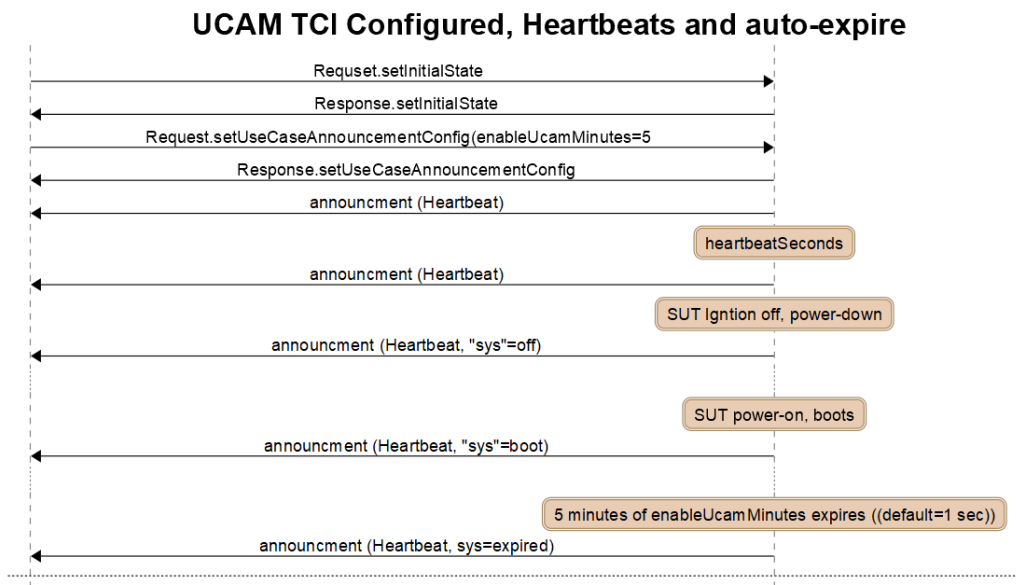
UCAM TC1 Config & Testing



The configuration is quite basic, only a few options are expected. The only one required is the one already mentioned which turns the UCAM production on or off. Everything else is optional to use, like the setting of a friendly name, the tuning of the rate of heartbeats, or of ongoing UCAM alerts. However it is essential that setting the friendly name is supported to allow for easier device identification in the field, but is unlikely to be requested for bench testing.

The enableUcamMinutes is a significant field, intended to be non-volatile and essentially is a future UTC time when the UCAM generation will be automatically shut-off. A special “expired” UCAM system state (**SystemEvent=“expired”**) is included when that happens.

Sample Sequence Diagram:



The ASN for the UCAM configuration also specifies options for UCAM broadcast over V2X radios, or to other ethernet TCP servers, for advanced testing. All devices, particularly on the vehicle side, are encouraged to add support for at least the UDP broadcast OTA or China DSMP broadcast of these alerts OTA for field testing.

9 SUT UCAM Behavior Requirements

Once enabled via `enableUcamMinutes` in the `SetUseCaseAnnouncementConfig`, the SUT will begin producing UCAM messages whenever any alerts are triggered, ending or ongoing.

If `heartbeatSeconds` is configured to 0, no heartbeat UCAM will be produced and only Alerts that are actively started, ongoing or ended will create UCAM's.

At the very simplest OBU SUT form, all that is required is that the SUT produces at least a single UCAM at the moment any new application/use case alert is generated, and then another one `AlertState="done"`, when the use-case is no longer applicable.

More advanced optional & configurable UCAM is the `AlertState="ongoing"`, which happens over and over, so long as the event alert is still being presented/alerting, produced at the configured interval, called `repeatRateMilliseconds` in the `SetUseCaseAnnouncementConfig`. This should not be necessary for bench test-cases, where it is clear that if the event has triggered, then it is assumed by TS to be continuously alerting until its either marked as "hidden" or "done." But these repeating "ongoing" alert state are useful to indicate at a glance which alerts are triggered, especially in field testing where the broadcast of UCAM might have some packet losses.

10 JSON "JER" UCAM Encoding, and TCI Transport

TCI `UseCase.announcement` is the default transport of the UCAM from SUT to TS. However, the actual ASN.1 definition of the UCAM itself is not a part of the TCI dictionary, nor encoded the same as other TCI (OER). The ASCII String text of the JSON Encoding of the UCAM is loaded into this `UseCase.announcement` Data element to deliver from SUT to TS.

The JSON JER coding has been chosen specifically for the following reasons

1. Allows easy addition of UCAM using "sprintf" to encode, rather than complex ASN.1 library
2. It is both machine and human readable, including being used by a radio sniffer without TCI dissectors.
3. By having its own encoding rule, as JER it can be transported over UDP/TCP/WSMP outside TCI sessions.

The ASN.1 specification in the OATCI GitHub is the normative definition for exact details, but a general overview of the data elements in the UCAM is in the table portion of this section.

Please note, that while the data element English names seem terse, abbreviated (e.g. "ver" instead of `firmwareVersionNumber`). This is intentional to keep them compact yet human readable, yet still remain within MTU limits. This is because of the choice to use JER encoding rather than UPER or OER rules. In JER the names are included in the steams, unlike the binary encodings.

Wherever possible, extension markers "..." in the ASN.1 specification are to allow future enhancements. Most fields are optional, allowing the simplest OBU implementation to more easily generate UCAM's.

The UseCase.announcement has a limit of 1455 Bytes, so that it can still fit into the UDP used between TS, SUT with a 1500 Byte UDP MTU. While the JER is not terribly compact (as compared to UPER encoding) the UCAM can easily exceed 1000+ bytes if it contains many alerts and many of the optional debug fields. Because of this MTU limitation, before transmitting over TCI, the length of the UCAM shall be checked, and recomposed/corrected if it's exceeding the 1445 Bytes specified in the UseCase.announcement ASN. If too many alerts are overlapping, a UCAM risks exceeding 1445, so the SUT's logic should have a limit coded to the max number of Alerts they include and to spread the alerts into multiple UCAMs.

To minimize the UCAM size, please consider eliminating all superfluous white-space JSON.

11 UCAM Common Container Data Element Details

In every UCAM, there is a timestamped location, which is communicated by the common alert message frame, which includes a UTC Time, latitude, longitude, altitude, speed, heading, acceleration, and heading. For the purposes of this doc, referring to this timestamped location/motion fix as a "4D-fix." This 4D fix in the UCAM main header body is set to mean one of the following things, depending on the reason for the UCAM's production:

- A. Where/when Alert was first generated/presented, of any Alert listed as "**first**" **AlertState**
- B. The time/position of any Alert that is being cleared/removed out of the Alerts list.
- C. The location/time of the SUT when the heartbeat is produced (no alert)

All of the fields below for which this 4D-fix time is referring to are marked as "4D-fix" below in the of Table 1 details.

Note: The timestamp is always UTC time rather than GNSS time.

Table 11-1 – UCAM Common Data Elements

Element	Type	Details on Units
ver	INTEGER (0..127)	UCAM Version number, mandatory on every UCAM, Set to 1 for the initial / current version. A value of zero should not be used but will highlight an uninitialized field.
nam	UTF8String (SIZE(1..8)) OPTIONAL	Friendly SUT Vehicle Name. Must be provided if set, otherwise must be excluded.
seq	INTEGER (0..255)	short sequence number. Every UCAM generated, increments this, until it wraps. Intended to detect lost UCAM's, and detect out-of-order issues.
ms	INTEGER(0..60000)	4D-fix Time milliseconds of current minute/ Requires SUT and TE to be synchronized to at least current UTC minute, similar to BSM SecMark, or ETSI CAM.
tot	INTEGER(0..999)	Total number/counter of unique alerts generated, (not counting different alertLevels) since the safety application booted up.
sys	SystemEvent (Enum) OPTIONAL	boot (0), -- Sent once on safety application boot to help detect crash/restarts. expired (1), -- Sent once, as last UCAM when the configured duration has elapsed. off (2), -- Once, on App shutdown. Safety application being disabled by driver, ignition, or similar
lat	INTEGER(-900000000..900000000),	4D-fix latitude where degrees*1E7, position where alert first triggered, or was cleared, or if just ongoing. In WGS-84 or GCJ-02 geodetic datum depending on SUT standards.
lon	INTEGER(-1800000000..1800000000)	4D-fix Similar to longitude above, same 1E7 degrees. In WGS-84 or GCJ-02 geodetic datum depending on SUT standards.
alt	INTEGER(-10000..600000) OPTIONAL	4D-fix centimetres altitude above the geodetic datum in use.
hpe	INTEGER (0..100000) OPTIONAL	4D-fix Estimated horizontal position error in cm if relevant to any use-cases alerts
head	INTEGER (0..359)	SUT vehicle heading in degrees the same (lat , lon , alt) time above. Same coordinates as BSM/CAM.
vel	INTEGER(0..16380)	4D-fix cm/sec speed in heading t point UCAM was produced, or of Alert if first alert included.
acc	INTEGER(-2000..2000), OPTIONAL	4D-fix vehicle axis longitudinal accel, in cm/s^2, at the alert time if relevant to any use-cases alerts.
Sw	UTF8String (SIZE(1..8)) OPTIONAL	SUT top level Software version (rarely added). Shall be transmitted only on boot-up or after UCAM is first configured to be enabled.
Id	OCTET STRING (SIZE(4..8)) OPTIONAL	linkage to the BSM/CAM/C-BSM temporary ID to the Ego SUT's pseudonym ID
flwon	BOOLEAN OPTIONAL	When present, notes that there is an additional UCAM message following this one containing additional alert information. When absent this is the only UCAM or is the last in a sequence. Note: when present, the SEQ field will continue to increment through all UCAM messages in the sequence.
alerts	SEQUENCE (SIZE(1..16)) OF Alert OPTIONAL	if no alerts sequence, this is considered a "heartbeat" UCAM. Up to 16 Alerts may be actively triggered, or ending. If more than 16 are required, then additional UCAM's should be produced, and the flwon field included in all except the last UCAM in the sequence.

11.1 Per Alert Data Elements

In addition to the 4D-fix, and version and shared header container of the UCAM, there is the **SEQUENCE OF Alert**, contains up to 16 alerts that are starting, ending, ongoing or one time only. Each of those alerts has at least the name of the alert, and if being used in OmniAir testing, the “**omniAir**” specific name data element specified in Appendix, (Table 13-1), If the alert is not the “first” state, then every alert includes a relative timestamp, along with some optional details, about the specific alert.

Element	Type	Units and Details
state	AlertState OPTIONAL	Alert ending, just triggered or ongoing. Mandatory for triggered and ending alerts. If absent it is interpreted as ongoing.
omniAir	UTF8String (SIZE(1..8)) OPTIONAL	OmniAir standard 740a-OA required use-case alert names for 780a/b and other specific tests. Only populated if the use-case is a specific OmniAir defined application behaviour. (see Table 13-1)
usecase	UTF8String (SIZE(1..15)) OPTIONAL	Free-form App use-case name, OEM choice, as opposed to the OmniAir names.
level	AlertLevel OPTIONAL	Sub detail on the intensity of the warning. (Advisory, imminent)
hidden	BOOLEAN OPTIONAL	True if higher priority app pre-empted and is more active to driver than this one. The field being absent is equivalent to being present with value false.
dur	INTEGER(0..60000) OPTIONAL	Duration elapsed time since first Alert, vs. current UCAM header "ms" dur is quite important for knowing when the alert first triggered. if the AlertLevel changes. then a new UCAM is made for the new "level" and dur is reset.
speedLimit	INTEGER(0..200) OPTIONAL	The variable speed limit if the alert is based on speed (e.g. CSW). Always converted to Units Km/H, even if statutory limit, TIM, RSM has speed other measurement units.
speedAdvice	INTEGER(0..200) OPTIONAL	Speed advised from GLOSA/Green-wave, green-speed applications. Always converted to Units Km/H, even if statutory limit, TIM, RSM has speed other measurement units.
ttg	INTEGER(0..1000) OPTIONAL	Time to Green (seconds), for traffic light information, if presented to Driver
code	INTEGER(0..65535) OPTIONAL	Alert Code, like an ITIS Code, TIM/RSM
String	UTF8String (SIZE(1..500)) OPTIONAL	ITIS String, or other regional details from the specific alert, or notes
Fields in the per-alert ASN.1 that are mostly there just for debugging, and not required. Could perhaps be used for certain test-cases some day.		
id	OCTET STRING (SIZE(1..8)) OPTIONAL	RV, VRU or RSM Common container or TIM triggering this alert
ttc	INTEGER(0..60000) OPTIONAL	Time to collision in milliseconds
d2c	INTEGER(0..1000000) OPTIONAL	Distance(cm) to the hazard/intersection/RV of concern
regID	INTEGER(0..65535) PTIONAL	Regulatory ID source alert source (Road Regulator ID, etc.)
lane	INTEGER(0..255) OPTIONAL	Lane ID as used in a Spat/Map movement TODO: is approach & lane both needed?
group	INTEGER(0..255) OPTIONAL	Signal Group Identifier if a RLVW, IMA or alert using Map/SPAT
approach	INTEGER(0..255) OPTIONAL	Intersection Access-point Approach identifier
oemExt	UTF8String (SIZE(1..200)) OPTIONAL	Optional OEM debug additional info that can help root-cause issues. Vehicle Software can populate this with any information that may be helpful to have correlated with the UCAM, for possible debugging.

12 TCI Transport

In UCAM most simple use, it is delivered back to TS, in-band, over the TCI session. However additional config options in **SetUseCaseAnnouncementConfig** allow can configure UCAM to be sent a variety of ways, like over IP TCP, UDP6, or even WSMP/DSMP broadcast over the C-V2X sidelink radio, with the configured PSID. These features are not required for bench testing automation, but enable virtual testing, and field /RSU/Sniffer based testing of applications.

The UCAM itself is encoded with JER to be human readable, though is typically transported to TS via TCI frame as an **announcement** type of **Use Case** frame, as a string. More on this in section 10 , JSON “JER” UCAM Encoding, and TCI Transport.

13 UCAM SetUseCaseAnnouncementConfig Messages and Information Element Content

This section contains details about the TCI that configures and enables UCAM. The ASN.1 in GitHub for this message has some details on the units, but detailed table here documents some of the details of the units. The notes in the ASN.1 are meant to be the main governing normative definition of units and requirements, however.

In theory, a SUT could enable/configure start/stop the UCAM for basic testing without necessarily supporting this new **SetUseCaseAnnouncementConfig** TCI, but to allow the highest test automation possible, all equipment and devices shall eventually be required to implement at least some of the basic data elements configurable via TCI.

14 Vehicle UCAM Minimum Performance Requirements

A max latency of producing the UCAM from when message presented is generous, **vMaxAlertLatency**, as long as all the data contained within the UCAM is accurate and describing the use-case alert properly, **vMaxAlertLatency** =1 second. This means at least the first UCAM with any given alert should be transmitted within 1 second.

All composed UCAM time stamp (the “**ms**” and per-alert “**dur**” duration data-elements) should be accurate to within **vMaxAlertTimeErr**=10ms of the actual Alert State change (new, ending, etc). This tolerance includes any of the SUT’s own UTC timing error, which is covered by regional device requirement specifications. This is an accuracy of UCAM alert contents and not a requirement on when the UCAM was transmitted/emitted by the SUT, which can be up to **vMaxAlertLatency** later The constrained value has been chosen to ensure accurate reporting of events which need to be reported within 50ms (ref. TP-J29451-BSM-ST-BV-01-X)

15 Concurrent Alerts Testing

An important aspect of testing various OBU based vehicular safety applications is the possible conflicting priorities of different competing alerts (Use Cases) that may all be simultaneously present (triggered), yet not all use-case warnings should be presented to human driver at once, and some have relatively higher priority than others. UCAM test feedback message has provisions enabling test cases to ensure that SUT's are correctly prioritizing overlapping use-cases. Test automation can then cover large combinations of overlapping use-cases and that the most important warnings are not preempted by lower priority warnings. Test cases can ensure SUT correctly behaves when multiple stimulations are near or overlapping in time. The OBU UCAM feature required that enables testing these multiple overlapping test cases are as follows.

When more than one concurrent alert is active or presenting, if being presented to a human driver some expectation for suppressed alerts may cause lower priority alerts to be “hidden” The per alert data element named “**hidden**” is used to test this.

Additionally, alerts may have relative “importance” within each individual concern. Via the data element” **level**.” Test cases can check that informational alerts vs imminent for example are correctly interleaved for driver attention.

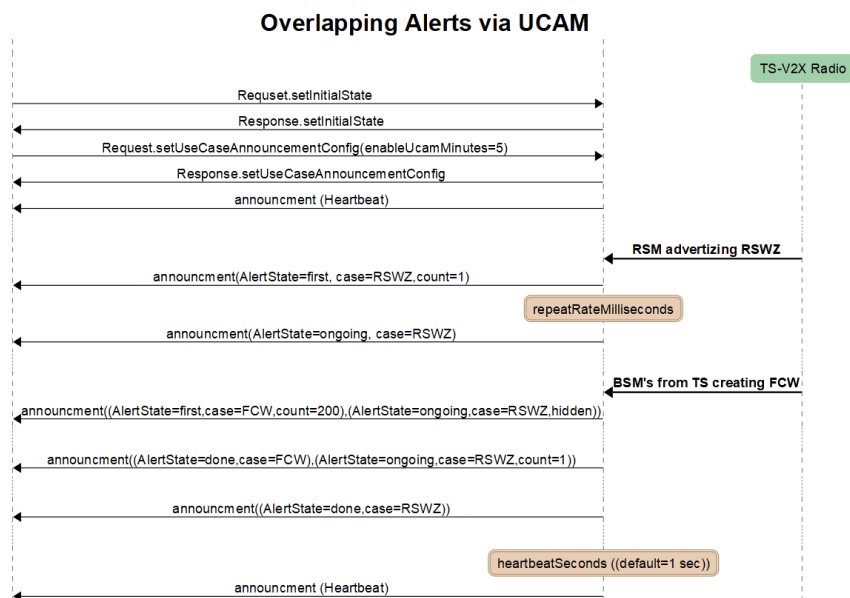
```
AlertLevel ::= ENUMERATED {
    internal      (0),  -- was not actually presented to a human but may
                       have been quietly delivered to ADAS
    informational (1),
    advisory      (2),  -- a non imminent advisory was presented driver
    imminent      (3),
    ...
}
```

Test cases may use per-alert values of “**level**” and “**hidden**” to ensure lower-priority warnings do not ever mix with higher priority ongoing critical alerts.

When testing automated/ADAS systems not intended for human drivers, prioritization tests may not apply.

A sequence example showing a Reduced Speed Work Zone, preempted by a FCW is below.

Figure 4 - Complex scenario, with first/ongoing/done and overlapping use cases.



Appendix A: ASN.1 for UCAM

** ASN.1 specification is in the OATCI GitHub

<https://github.com/OATCI/OmniAir-Test-Control-Interface>

Appendix B: ASN.1 UCAM Use Case Control Configuration -TCI

The TCI for the ASN configuring the UCAM is in GitHub (on branch for now)

<https://GitHub.com/OATCI/OmniAir-Test-Control-Interface/tree/UCAM/ASN1>

TCIDispatcher has been updated to allow a new **UseCase** Message:

```
Frame ::=CHOICE {
    d16093dsrc [1] TCI16093DSRC,
    --d16092 [2] TCI16092, module is redundant with TCI16093
    d80211 [3] TCI80211,
    d16094 [4] TCI16094,
    d29451 [5] TCI29451,
    sutCtrl [6] TCISutControl,
    ...,
    d16093cv2x [7] TCI16093PC5,
    d31611 [8] TCI31611,
    proxyCv2x [16] TCIPROXYCV2X,
    driveCast [17] TCIDriveCast, -- casts test drives sensor & events into vehicle
    UseCase [18] TCIUseCase - UCAM configuration and Transport
}
```

ASN file with the new control/configuration GitHub link: [TCIUseCase.asn](#)

Appendix C: Specific Defined Use-Case “OmniAir” Alert Values

The UCAM alert name is essentially a free-form text string that indicates what the OEM wants to call any given use-case/application warning. However, to enable OmniAir test-case automation, standardization on what to call these use-cases is required. This is the reason for the second test case string in the alert called “alert.omniAir” which is an 8 character field. For specific test case/alerts the name should be set per the following table.

Table 13-1

OA TS&SP	Specific Test Case	IUT Test Case Alert Description	Required SUT UCAM alert.omniAir (8 chars max)
OA-780a	V2V-EEBL-RECV-BV-01	EBL warning	EEBL
	V2V-EEBL-RECV-BV-06	EEBL due to adjacent left lane RV’s BSM indicating HardBrakingEvent Flag	EEBL
	V2V-FCW-RECV-BV-01	Forward Collision Warning indicates RV location indicates HV’s trajectory collides.	FCW
	V2V-FCW-RECV-BV-02		FCW
	V2V-BSW-RECV-BV-01	Blind Spot Warning (BSW) based on RV BSM	BSW
	V2V-BSW-RECV-BV-02		BSW
	V2V-IMA-RECV-BV-01	Intersection Movement Assist	IMA
	V2V-IMA-RECV-BV-02		IMA
OA-780b	V2I-RLVW-RECV-BV-01	Red Light Violation Warning (RLVW)	RLVW BSM also set stopLineViolation event
	V2I-LCWZ-RECV-BV-01	Lane Closure warning	LCWZ
	V2I-PCW-RECV-BV-01	Pedestrian conflict warning when appropriate, based on PSM	PCW
	V2I-PCW-RECV-BV-02	Host Pedestrian in crosswalk warning	PCW-X
	V2I-RSWZ-RECV-BV-01	Reduced Speed Work Zone	RSWZ
	V2I-SWW-RECV-BV-01	Spot Weather Warning	SWW
	V2I-WWDA-RECV-BV-01	Wrong Way Driving Alert	WWDA
TBD	TBD	Denial of Service Attack Detected/Ongoing	DoS
TBD	TBD	Safety System Failure. Any type of failure that indicates the vehicle safety system is not operational (TX or RX, GNSS, etc)	Fail
TBD	TBD	V2X antenna fault (e.g. breakage) or other detected (not used for no SV/signals fix)	Antenna
TBD	TBD	Lost GNSS signals (regardless of DR or other positioning) Defined as 2-dimensinal fix from GNSS not possible.	BadGNSS
TBD	TBD	Dead Reckoning Uncalibrated. (Used for SLSS/tunnel testing, regardless of dead reckoning type) this indicates dead reckoning not usable	DrCal
TBD	TBD	Radio hardware fault, anything other than antenna	Radio
763-OA-TSS&16092	16092-EXPCERT-SEND-BV-01	IUT can’t transmit due to expired Root Certs	ExpRca
763-OA-TSS&16092	16092-EXPCERT-SEND-BV-02	IUT can’t transmit due to expired Intermediate Certs	ExpIca
763-OA-TSS&16092	16092-EXPCERT-SEND-BV-03	IUT can’t transmit due to expired Pseudonym Certs	ExpCerts
TBD	TBD	Received message that could not be verified. If decodable, per alert “id” set to offending message per 740a	BadVerif
TBD	TBD	Received message that could not be verified due to signing certificate chain. If decodable, per alert “id” set to offending message per 740a	CertFail
TBD	TBD	Verification failure due inconsistent SPDU Length	SPDULen
TBD	TBD	Received a message contains features not authorized in SSP	BadSSP
TBD	TBD	CRL overdue tolerance exceeded	Overdue

Appendix D: Sample UCAM Alert Encodings

Sample UCAM's are maintained in the OATCI GitHub (URL below), but some included here as well.

<https://GitHub.com/OATCI/OmniAir-Test-Control-Interface/tree/UCAM>

Sample UCAM in simplest JSON JER Encoding:

```
{ "ver":1,
  "seq":99,
  "ms":5150,
  "tot":32,
  "lat":418924150,
  "lon":124837023,
  "hpe":150,
  "head":120,
  "vel":1500,
  "acc":-2000,
  "alerts":[
    {
      "omniAir":"RLVW",
    }
  ]
}
```

More Sophisticated UCAM JER Sample, showing the “first” Trigger in a Series

```
{
  "ver":1,
  "seq":100,
  "ms":5260,
  "tot":32,
  "lat":418924150,
  "lon":124837023,
  "hpe":150,
  "head":120,
  "vel":1500,
  "acc":-2000,
  "alerts":[
    {
      "state":"first",
      "omniAir":"RLVW",
      "usecase":"acme CICAS",
      "level":"advisory",
      "dur":0,
      "d2c":30000,
      "approach":5
    }
  ]
}
```

TCIMsg containing UCAM “Announcement” OER Encoded,, with JSON Payload

```
value1 TCIMsg ::= {  
    version currentVersion,  
    time 0,  
    frame useCase : announcement : "{ ""ver"":0, ""seq"":99, ""ms"":5150, ""tot"":32, ""lat"":418924150,  
    ""lon"":124837023, ""hpe"":150, ""head"":120, ""vel"":1500, ""acc"":-2000,  
    ""alerts"":[ { ""omniAir"":""RLVW"" } ] } "  
}
```

OER Encoding:

```
00 04 00 00 00 00 00 00 00 00 92 81 A3 82 81 A0  
7B 20 22 76 65 72 22 3A 30 2C 20 22 73 65 71 22  
3A 39 39 2C 20 22 6D 73 22 3A 35 31 35 30 2C 20  
22 74 6F 74 22 3A 33 32 2C 20 22 6C 61 74 22 3A  
34 31 38 39 32 34 31 35 30 2C 20 22 6C 6F 6E 22  
3A 31 32 34 38 33 37 30 32 33 2C 20 22 68 70 65  
22 3A 31 35 30 2C 20 22 68 65 61 64 22 3A 31 32  
30 2C 20 22 76 65 6C 22 3A 31 35 30 30 2C 20 22  
61 63 63 22 3A 2D 32 30 30 30 2C 20 22 61 6C 65  
72 74 73 22 3A 5B 20 7B 20 22 6F 6D 6E 69 41 69  
72 22 3A 22 52 4C 56 57 22 20 7D 20 5D 20 7D 20
```

TCIMsg for Configuring the UCAM Production

```
value1 TCIMsg ::= {  
    version currentVersion,  
    time 0,  
    frame useCase : request : {  
        messageId 2,  
        value SetUseCaseAnnouncementConfig : {  
            enableUcamMinutes 480,  
            repeatRateMilliseconds 500,  
            setSystemName "acme1",  
            heartbeatSeconds 2,  
            wiredUcamDelivery netDisable,  
            wirelessBroadcastEnable FALSE  
        }  
    }  
}
```

Example of 16 Overlapping Alerts in one UCAM

```
{ "ver":0,"seq":101,"ms":5460,"tot":32,"lat":418924250,"lon":124837023,"hpe":155,"head":121,"vel":1400,"acc":-2000,"alerts":[{"state":"ongoing","omniAir":"RLVW","level":"imminent","dur":200,"d2c":250000,"approach":5},{state":"ongoing","omniAir":"EEBL","level":"informational","hidden":false},{state":"ongoing","omniAir":"FCW","level":"imminent"}, {"state":"once","omniAir":"CSW","level":"informational","hidden":false},{state":"once","omniAir":"IMA","level":"internal","hidden":false},{state":"ongoing","omniAir":"LCWZ","level":"advisory","hidden":false},{state":"once","omniAir":"PCW","hidden":false},{state":"once","omniAir":"PCW-X","level":"advisory"}, {"state":"once","omniAir":"SWW","hidden":false,"dur":5000},{state":"first","omniAir":"WWDW"}, {"state":"ongoing","omniAir":"DoS","usecase":"cloning","level":"advisory","hidden":false},{state":"once","omniAir":"BadGNSS"}, {"state":"ongoing","omniAir":"BadRadio"}, {"omniAir":"ExpRca"}, {"state":"ongoing","omniAir":"ExpCerts"}]}
```

The above sample is not a realistic combination of alerts, but showing how 16 Alerts can be combined, in a single UCAM, which has a size under about 1000 Bytes, which will fit in the TCI UseCase Announce, and still on the UDP 1500 Byte MTU.

■ End of Document ■