

ACP 245 – Application Communication Protocol

**Prepared by
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DENATRAN: ACP 245 V 1.2 – Protocol Specification

Revision History

Revision	Date	Author	Description
1.2	17/02/2009	DENATRAN	Item 2.1 Rules is added.
1.2	17/02/2009	DENATRAN	A note is added under the table 1 of Item 2.5
1.2	17/02/2009	DENATRAN	Value 32 is added in Item 3.1.2
1.2	17/02/2009	DENATRAN	Value 135 is added in Item 3.1.3
1.2	17/02/2009	DENATRAN	Auth. Key field is included in the structure of Item 3.4
1.2	17/02/2009	DENATRAN	Table from Item 3.4.1 is updated
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1.2	17/02/2009	DENATRAN	A comment for value = 0 is added in item 3.8.5
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1.2	17/02/2009	DENATRAN	A comment is added in item 4.1.2 Private Flag
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1.2	17/02/2009	DENATRAN	Grace Time is added to structure of Item 5.2 and Item 5.2.1.6
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1.2	17/02/2009	DENATRAN	Message Type table is added in Item 6.1
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1.2	17/02/2009	DENATRAN	Message Type table is added in Item 7.1
1.2	17/02/2009	DENATRAN	The structure of Item 7.3 is updated according ACP v. 3.1.0.2
1.2	17/02/2009	DENATRAN	Message Type table is added in Item 8.1
1.2	17/02/2009	DENATRAN	Text is updated in Bit 1 of Item 8.4.1.3.1
1.2	17/02/2009	DENATRAN	Message Type table is added in Item 9.1
1.2	17/02/2009	DENATRAN	Mandatory parameters are defined in Appendix I.
1.2	19/02/2009	DENATRAN	Removed "Raw Data" table from Item 3.7.2.
1.2	19/02/2009	DENATRAN	Keep Alive Timer in Item 12.1.5 is changed to 180 seconds.
1.2	19/02/2009	DENATRAN	The "Type" of APN, Login and Password is merged to max. 90 Bytes in Item 12.1.6
1.2	19/02/2009	DENATRAN	Example 1, 2 and 3 in Appendix II are revised.
1.2	06/03/2009	DENATRAN	Added new Data Type to TCU Service Activation/ Deactivation
1.2	06/03/2009	DENATRAN	Changed all the Auth key sizes from 8 bytes to undefined
1.2	06/03/2009	DENATRAN	Item 3.8 - Inserted the location element structure according to ACP 3.1.0.2
1.2	06/03/2009	DENATRAN	Item 2.1 - Removed "optional" word
1.2	06/03/2009	DENATRAN	Item 3.4 - "Simcard id" and "Auth key" order changed
1.2	06/03/2009	DENATRAN	Item 3.6.1 - Removed "vehicle blocking" and vehicle unblocking". Added "Anti theft blocking (ACP245)"
1.2	06/03/2009	DENATRAN	Item 5.2.1.3.1 – Added target Application ID as 0 to mandatory configuration parameters
1.2	06/03/2009	DENATRAN	Item 9.4 – Added vehicle descriptor element to the message structure
1.2	06/03/2009	DENATRAN	Item 12.1.1 – Changed default values to 300
1.2	06/03/2009	DENATRAN	Item 12.1.5 – Changed type index 0x0051 type to unsigned int/2 bytes. Added definition for value 0

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1.2	06/03/2009	DENATRAN	Item 12.1.6 – fixed data type indexes from 0x0061 to 0x0063 type to “Max 91 bytes (sum)”
1.2	06/03/2009	DENATRAN	Changed server ports types to 2 bytes
1.2	06/03/2009	DENATRAN	Item 13.2.1, 13.2.2, 13.3.1 - Fixed example

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New Features

Feature	Date	Author	Description
1.2	17/02/2009	DENATRAN	Entity Id = 17 is added in the table of Item 3.6.1
1.2	17/02/2009	DENATRAN	Added HDOP value in Item 3.8.9 to represent position uncertainty estimate.
1.2	17/02/2009	DENATRAN	It is added the possibility of sending status of breakdown source using breakdown data in Item 3.9.2 (Bit 7) & Item 3.9.3
1.2	17/02/2009	DENATRAN	TCU data element modified to allow multiple configuration parameters
1.2	17/02/2009	DENATRAN	Added TCU data error element in item 3.12 to allow reply multiple configuration parameters
1.2	17/02/2009	DENATRAN	Added new message types ID=8 e 9 to allow multiple configurations and ID=10 for SMS message in item 6.1
1.2	17/02/2009	DENATRAN	Added new configuration reply message #2 ACP 245 ID=9 in Item 6.4
1.2	17/02/2009	DENATRAN	Added new message types ID=4 e 5 to allow keep alive messages in items 9.4 and 9.5
1.2	19/02/2009	DENATRAN	Added Auth.Key field in Item 3.4 Vehicle Descriptor Element
1.2	19/02/2009	DENATRAN	Added new error element 27, 28 and 29 in Item 3.5.1
1.2	19/02/2009	DENATRAN	Section 10 is added.

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ACRONYMS

The following acronyms apply to this document.

Acronym	Definition
ACP	Application Communications Protocol
DENATRAN	National Traffic Department
FOTA	Firmware Over The Air
GMT	Greenwich Mean Time
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
IE	Information Element
IMEI	International Mobile Equipment Identity
LSB	Least Significant Bit
MSB	Most Significant Bit
SIM CARD	Subscriber Identity Module
SO	Service Operator
TCP	Transmission Control Protocol
TCU	Telematics Control Unit
UDP	User Datagram Protocol
UTC	Coordinate Universal Time

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1 INTRODUCTION

This document was based on Application Communication Protocol (ACP), developed by Motorola Inc. (version 3.1.0.2 / November, 2000 and made public in the year of 2002) and describes the basic ACP services to use in tracking tracing systems, in agreement with DENATRAN regulation. It suggests the flow messages on each ACP service as well correspondent composition and minimal message structure elements. Tracking device and Service Operator are responsible for exchange messages and keeping available services.

1.1 Telematic Applications

The Basic telematics services IDs. Table 1 presents the basic, but not limited, telematic applications in accordance with DENATRAN regulation. They have the purpose to group different messages, originating the idea of services and context.

Application ID	Definition	Brief description
1	Provisioning	Basic messages whereby the TCU establishes and manages configurations for applications required for activation.
2	Configuration	Application configurations that are not handled by the generic provisioning service.
6	Remote Vehicle Function	This application allows control functions to occur within the vehicle. Examples are remote door unlock.
10	Vehicle Tracking	This application provides the ability to track a vehicle, usually due to theft.
11	Alarm	This application provides the ability to recognize unauthorized starting or movement of a vehicle.

Table 1. Basic telematics services IDs.

This document describes in section 2 brief rules about the data used in each information element into the messages. It follows with a description of elements and data structures that will composite an ACP message.

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2 Data Description

This section describes the data format used in ACP Protocol for message exchange between TCU and SO. The information below was extracted from the ACP Specification [1].

2.1 Rules

This section describes the message formats used in the exchange of data between a TCU and the SO. Message formats consist of information elements as needed to create a meaningful message. This standard defines the minimal set of messages necessary to support the telematics functions. Undefined and non-supported messages and information elements can be skipped. The intent is to allow for the addition of messages information elements without affecting existing applications of current customers. This rule is intended to promote robustness and is not intended to encourage sending useless information between TCU and SO.

The basic unit of data is an information element. Information elements can be combined to form message types, the unit used for the transfer of data by the transport level. A number of message types are defined in this standard along with their use.

The information element is position dependent in the message structure. Elements that do not contain data must still be included. Elements may not be included in one of three ways:

1. The length field and More Flag of the element is zero,
2. A control flag is used to indicate the presence or absence of an element,
3. The length field of the parent element does not include the element.

2.2 Bit Order

Bits in an octet are numbered from 0 to 7 from most significant bit (MSB) to least significant bit (LSB). Multi-octet fields have the most significant octet in the in the first octet of the field.

2.3 More Flag

This value identifies if the last information in the octet was not finished and will be continue in the next octet. The value 0 means no more information, while the value 1 means more data.

Octet / Bit	0	1	2	3	4	5	6	7
1	IE Identifier		More Flag=1	Length ₀ = 2				
2	More Flag=0	Length ₁ = 4						

Table 2. More flag sample

In this example, presented by table 2, the field Length in the first octet continues in the second octet because More Flag is set with the value 1. It means Length is composed by Length₀ (MSB) and Length₁ (LSB).

2.4 Additional Flag

This concept is the same of More Flag. The additional flag (Addl Flag) is used to indicate when an element of like kind is repeated in the following octet. An example would be status flags pertaining to GPS status in Field₀ would have additional status flags pertaining to GPS in Field₂ and Field₄.as showed in table 3.

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Octet / Bit	0	1	2	3	4	5	6	7
1	Addl Flag=1	Field ₀			Field ₁			
2	Addl Flag=1	Field ₂			Field ₃			
3	Addl Flag=0	Field ₄			Field ₅			

Table 3. More Flag sample

2.5 Element Definition

The information element identifies a block of data. The initial octet has three fields, respectively: Identification Element (IE) – 2 bit, More Flag – 1 bit and Length (data size of block). The more flag is related with the Length field. If the length field value exceeds 32 octets of data (0..31 - 5 bits) then more flag must be set 1 and another Length field follows. The final value is composed by Length₀ (5 bits) and Length₁ (7 bits) – 12 bits; as in the example bellow.

Octet / Bit	0	1	2	3	4	5	6	7
1	IE Identifier = a		More Flag = 1	Length ₀ = x				
2	More Flag=0	Length ₁ = y						

The valid values for IE are:

Value	Definition	
0	Transparent data (binary)	Number of 8 bit octets
1	Text (ISO 8859-1) / 8bits per character	Number of 8 bit octets
2	Packed decimal	Number of 8 bit octets
3	Extended	Extended definition

Table 1 - Default IE (Identification Element) values.

Example: a = 0, x = 2 and y = 4 - **Binary** data with **Length** = 000010 (Length₀) 0000100 (Length₁) = 0000100000100₂ = 260.

The ACP 245 must be fully implemented by the SO's. The TCU's will use the option IE values that are for alphanumeric data = 1 (Text (ISO 8859-1) / 8bits per character) and for numeric field = 2 (Packed decimal/BCD)

If IE value is *Extended*, the initial structure of the element will be changed. The first bit of Length₀ field starts at the next information octet.

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Octet \ bit	0	1	2	3	4	5	6	7
1	IE = 3 (Extended string definition)		More Flag = 1	Extended IE identifier (0..31) = a				
2	More Flag = 0	Length ₀ (number of octets that follow) (0..127) = x						
3...n-1	Data = b							

The valid values for Extended IE are:

Value (Decimal)	Definition
0	Transparent data (binary)
1	Text (ISO 8859-1) / 8bits per character
2	Packed decimal
3	Reserved
4	UNICODE
5	UTF-8
6	Shift JIS
7..30	Reserved
31 *	Extended Private Identifier

Table 2 - Extended IE (Identification Element) values.

* The value of 31 indicates that the element is not defined in this document and is considered proprietary or private.

Example: a = 1, x = 20, b = “Test of ACP Protocol” - Text data with Length = 00010100₂ = 20.

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3 Message Elements

All the messages are composed by elements -information units. Find bellow examples of common elements.

3.1 Version Element

Define information about manufacturers of the vehicle and TCU.

Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Version Element	IE Identifier = 0		More Flag	Length				
	Car Manufacturer ID							
	TCU Manufacturer							
	Major hardware release							
	Major software release							

3.1.1 IE Identifier

Transparent Data. See definitions at section 2.5.

3.1.2 Car Manufacturer ID

Identifies the vehicle in which the hardware/software product is resident. This informative to the receiver of the message who should act upon this information if it is a version it cannot handle.

Value	Description		Value	Description
0	Mercedes-Benz		18	Iveco
1	Renault		19	Hyundai
2	GM		20	Kia Motors
3	Porsche		21	Subaru
4	Ford		22	Chrysler
5	PSA		23	BMW
6	Jaguar		24	Audi
7	Fiat		25	Harley-Davidson
8	Volkswagen		26	Honda Motorcycles
9	Mitsubishi		27	Susuki Motorcycles
10	Honda		28	Dafra
11	Toyota / Lexus		29	Kasinski
12	Nissan		30	Sundown Motorcycles
13	Ford Trucks		31	Traxx
14	Volkswagen Trucks		32	Effa Motors
15	Yamaha Motors		33	Others
16	Scania		34-127	Not currently used
17	Volvo			

Table 3 – Version Element: Car Manufacturer IDs.

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3.1.3 TCU Manufacturer ID

This just identifies the source of the hardware/software product. It is informational. This informative to the receiver of the message who should act upon this information if it is a version it can not handle.

Value	Definition
0	Reserved
1	Motorola
2	Nokia
3	Becker
4	Clarion
5-127	Not currently used
128	Continental
129	Delphi
130	Johnson Controls
131	Kostal
132	Magneti Marelli
133	PST
134	Visteon
135	Quanta
136	Others
137-255	Reserved

Table 4 – Version Element: TCU Manufacturer IDs.

3.1.4 Major Hardware Release

This is a binary number that identifies the current revision of the hardware. This informative to the receiver of the message who should act upon this information if it is a version it cannot handle.

3.1.5 Major Software Release

This is a binary number that identifies the current revision of the software release. This informative to the receiver of the message who should act upon this information if it is a version it cannot handle.

Example:

Octet / Bit	0	1	2	3	4	5	6	7
Version Element	IE Identifier = 0		More Flag = 0	Length = 4				
	Car Manufacturer ID = 8							
	TCU Manufacturer ID = 131							
	Major hardware release = 1							
	Major software release= 3							

5 octet message binary data – Car manufacturer = Volkswagen, TCU manufacturer = Kostal, Hardware release = 1 and Software release = 3 → 00000100 00001000 1000011 00000001 00000011

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3.2 Timestamp Element

This element specifies the date and time information.

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
1	Year(00=1990, 01=1991 ranges up to 62=2052)						Month of year range (1...12)	
2	Month of year		Day of month, range (1...31)					Hour of day
3	Hour of day, range (0...23)				Minutes, range (0...59)			
4	Minutes		Seconds, range (0...59)					

3.2.1 Year

This specifies the year beginning in 1990. The field allows for a year of up to 2052. The value of 63 is reserved for future expansion if needed. (6 bits)

3.2.2 Month

This field represents the month of the year which ranges from 1 to 12 where 1 is January and 12 is December.(4 bits)

3.2.3 Day

This field represents the day of the month and ranges from 1 to 31. (5 bits)

3.2.4 Hour

This field represents the hour of the day and ranges 0 to 23.(5 bits)

3.2.5 Minute

This field represents the minute of the hour and ranges from 0 to 59.(6 bits)

3.2.6 Seconds

This field represents the seconds of the minute and ranges from 0 to 59.(6 bits)

Example: March 14th, 2008 – 3:48:56 pm

Year = 2008	→ 18	→ 010010	(6 bits)
Month = March	→ 3	→ 0011	(4 bits)
Day = 14	→ 14	→ 01110	(5 bits)
Hour = 15	→ 15	→ 01111	(5 bits)
Minute = 48	→ 48	→ 110000	(6 bits)
Second = 56	→ 56	→ 111000	(6 bits)

Message: 01001000 11011100 11111100 00111000

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3.3 TCU Descriptor Element

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
TCU Descriptor Element	IE Identifier		More Flag	Length				
	Reserved							
	IE Identifier		More Flag	Length				
	Device ID							
	IE Identifier		More Flag	Length				
	Version ID							

3.3.1 Device ID

This describes the device for which we want the version number.

Value	Definition
1	TCU hardware version number
2	TCU hardware manufacturer number
3	TCU software version number
4	TCU CAN version number
5	ACP transport layer version number
6	ACP application layer version number
7-255	Reserved

Table 5 - TCU Descriptor Element: Device IDs

3.3.2 Version ID

This specifies the version information for the specified device. The version number can be a number and taken from the following version table, or it can be a character string for version not in the table. The currently defined decimal versions are

Value	Version
1	1
2	2
3	3
4	4
5	5
:	:
n-255	

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3.4 Vehicle Descriptor Element

The intent of this information element is to define the vehicle to the service operator.

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 0		More flag	Length				
2	Vehicle Descriptor Flag1							
3	Vehicle Descriptor Flag2							
4	Language							
5	Model year							
6..p-1	VIN							
p..n-1	TCU serial #							
n..m-1	License Plate							
m..k-1	Vehicle Color							
k..j-1	Vehicle Model							
J...l-1	IMEI							
l...h-1	SIM Card ID (ICCID)							
H...i-1	Auth. Key							

Octet \ bit	0	1	2	3	4	5	6	7
Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

3.4.1 Flags

In the above table, a bit value of 0 indicates the element is absent while a bit value of 1 indicates the element is present. If the bit indicates the element is present, but the length of its element is 0, then the field has no data following it. If the length is not 0, then the element specifies the new value. If all bits are 0, then no elements are present, and only 1 octet of storage is used.

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Field Names	Description
VIN	Vehicle Number Identification (optional)
TCU Serial	Serial number (optional)
IMEI	IMEI identification number (optional)
SIM Card	SIM Card number - ICCID (mandatory)
Vehicle Color	Vehicle color (optional)
Vehicle Model	Vehicle model (optional)
License Plate	License plate (optional)
Language	Language (optional)
Model Year	Model year (optional)
Auth. Key	Auth.Key (mandatory only on Telematic Service Activation/Deactivation message)

Table 6 - Vehicle Descriptor Element: Fields

3.5 Error Element

This element represents error information.

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
Error Element	IE Identifier = 0		More Flag	Length				
	Error Code							

3.5.1 Valid Error Codes

Code	Description
0	Everything OK, no mistake
1	Service currently not available
2	Incorrect application
3	Unknown version
4	Unknown message type
5	Unknown data in message
6	Unknown transport version
7	Data error in transport frame
8	Security violation
9	No access; no customer
10	No access; service not available
11	Not access; authentication failure
12	No access; other reasons
13	Invalid session ID
14	Reserved
15	Language not supported
16	Descriptor in <i>Provision Update Message</i> does not match data in the TCU
17	SIM identifier in the TCU is not the provisioned SIM

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18	Provisioning layer received, but unable to process
19	General non-specific error
20	No access to protected phonebook on SIM card
21	Unable to write to EEPROM
22	Invalid phone number
23	VIN does not match
24	Vehicle type does not mat
25	Provisioning request not processed. Too many target applications specified. Provision with a smaller group.
26	Missing phone number
27	Invalid TCU Service Activation
28	Invalid TCU Service Deactivation
29	Buffer Overflow
30...255	Available

Table 7 - Error Element: Error Codes.

3.6 Control Function Element

This element represents the remote vehicle entity to control.

Structure

Octet \ bit	0	1	2	3	4	5	6	7
Control Function	IE Identifier=0		More Flag	Length				
	Entity ID							
	Reserved				Transmit Units			
	Transmit Interval							

3.6.1 Entity ID

Controlled Entity

ID	Description
0	Door Locks
1	Vehicle Tracking
2	Covert Mode
3	Microphone
4	Reserved
5	Transmit Interval
6	Reserved
7	Vehicle Tracking with commit
8	Commit to Vehicle Tracking
9	Vehicle anti theft alarm facilities (lights, horn)
10	Immobilize vehicle*
11	Remote door locks function
12	Primary antenna

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13	Call Service Operator for provisioning using pre-programmed phone numbers
14	Call Service Operator on data bearer.
15	Fuel Pump Blocking
16	Siren
17	Vehicle position history
18...127	Reserved
128	Anti-theft Blocking (ACP245)
129...255	Reserved

* Auto immobilizer device

Table 8 - Control Function Element: Entities IDs

3.6.2 Transmit Units

It specifies the unit of interval at which a message is sent on a regular period.

Value	Command Definition
0	Second
1	Minute
2	Hour
3	Send message one more time
4	Send only one message

3.6.3 Transmit Interval

It specifies the interval at which a message is sent to SO.

3.7 Function Command Element

This element represents the action required or report the status of the tracking device (tracking entity).

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
Function Command	IE Identifier=0		More Flag	Length				
	Function Command or Status							
	Raw Data							

3.7.1 Function Command or Status

Value	Command Definition	Status Definition
0	Permit	Permitted
1	Reject	Rejected
2	Enable (Start)	Enabled (Started)
3	Disable (Stop)	Disabled (Stopped)
4	Request	Completed

Table 9 - Function Command Element: Available actions or status.

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3.7.2 Raw Data

It is used to transmit any raw data between the TCU and SO.

Octet \ bit	0	1	2	3	4	5	6	7
	IE Identifier=0		More Flag	Length				
	Raw Data							

3.8 Location Element

This group defines the position history of the vehicle.

Octet \ bit	0	1	2	3	4	5	6	7
Location	IE Identifier=0		More Flag	Length				
	Current GPSRawData (3.8.1)							
	Prior GPSRawData (3.8.1)							
	Current Dead Reckoning Data (3.8.16)							
	Array of Area Location Delta Coding (3.8.17)							

The current GPSRawData and prior GPSRawData are only needed when the GPS is co-located with the TCU and, therefore, is optional.

3.8.1 GPSRawData Element

The GPS raw data location. If no data available the field length must be set to 0 and follow octet is next element.

Octet \ bit	0	1	2	3	4	5	6	7
GPSRawData Element	IE Identifier=0		More Flag	Length				
	Area Location Coding (3.8.2)							
	Number of Satellites (0..n)				Reserved			
	Satellite ID (0)							
	Satellite ID (n)							

3.8.2 Area Location Coding

Octet \ bit	0	1	2	3	4	5	6	7
Area Location Coding	IE Identifier=0		More Flag	Length				
	More Flag	AreaLocationStatusFlag1						
	More Flag	AreaLocationStatusFlag2						
	Area Type			LocationTypeCoding			Reserved	
	More Flag	Time Difference						
	Longitude (byte 0)							
	Longitude (byte 1)							
	Longitude (byte 2)							
	Longitude (byte 3)							
	Latitude (byte 0)							
	Latitude (byte 1)							

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	Latitude (byte 2)		
	Latitude (byte 3)		
	Altitude (byte0)		
	Altitude (byte 1)		
	Position Uncertainty Estimate		K/ HDOP
	Heading Uncertainty Estimate	Heading	
	Reserved set to 0	Distance Flag	Time Flag
	Velocity		

3.8.3 AreaLocationStatusFlag1

Bit	Definition
1	Reserved and set to 0
2	1=No 3D fix available 0=Is using 3D fix
3	1=No 2D fix available 0=Is using 2D fix
4	1=Position data is not valid 0=Position data is valid
5	1=Differential GPS is being used 0=Differential GPS not being used
6	1=Heading data is not valid 0=Heading data is valid
7	1=Almanac is bad 0=Almanac is good

3.8.4 AreaLocationStatusFlag2

Bit	Definition
1	Reserved, set to 0
2	0=old GPS data used from satellites 1=new GPS data from satellites
3	Reserved, set to 0
4	Reserved, set to 0
5..7	0=North 1=North East 2=East 3=South East 4=South 5=South West 6=West 7=North West

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3.8.5 Area Type

Area Type Definitions for Location and Deltas.

Value	Definition
0	Point (latitude, longitude, altitude) in milliarcseconds increments
1	Point (latitude, longitude, altitude) in 100 milliarcseconds increments
2-7	Reserved

3.8.6 LocationTypeCoding

The element *location type coding* defines the coordinate system used to define the location of the TCU.

Value	Definition
0	WGS 84
1-7	Reserved

3.8.7 Time Difference

The time difference is the time that has elapsed between a prior GPS reading and the current GPS reading or the time difference between the current GPS reading and the actual cause for transmission. The default value is in seconds unless defined by Time Flag. The value = 0 means that this field is NULL or not calculated.

3.8.8 Longitude

The longitude may vary from -180 to +180. The number corresponds to the Greenwich meridian. The value may range from -648,000,000 to +648,000,000. The units are in millisarceconds and allow for the range from -648,000,000 to +648,000,000. One unit corresponds to approximately .03 meter. Positive values are East of the Greenwich median and negative values are West.

3.8.9 Latitude

The latitude may vary from -90 to +90. The number corresponds to the equator. The units are in milliarcseconds and allow for the range from -324,000,000 to +324,000,000. One unit corresponds to approximately .03 meter. Positive values are north and negative values are south.

3.8.10 Altitude

The altitude may vary from -1000m to 18,000 meters. The number 0 corresponds to sea level. One unit corresponds to 1 meter.

3.8.11 Position Uncertainty Estimate

In the Position Uncertainty Estimate field there are 7 bits for data and 1 bit to select between K or HDOP:

bit value (K/HDOP)	Description
0	K
1	HDOP

3.8.11.1 Position Uncertainty Estimate using K value

The *position uncertainty estimate using K value* is defined by a variation on the Binomial expansion. The uncertainty, expressed in meters, is mapped to a number K, with the following formula $R = C((1+x)^K - 1)$.

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Value of K	Uncertainty
0	0 m
1	1 m
2	2,1 m
...	
20	57,3 m
...	
40	443 m
...	
60	3 km
...	
127	1800 km

3.8.11.2 Position Uncertainty Estimate using HDOP value

The *position uncertainty estimate using HDOP value* is defined according table below that is calculated by GPS module.

HDOP Value	Rating	Description
1	Ideal	This is the highest possible confidence level to be used for applications demanding the highest possible precision at all times
2-3	Excellent	At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications
4-6	Good	Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user
7-8	Moderate	Positional measurements could be used for calculations, but the fix quality could still be improved. A more open view of the sky is recommended
9-20	Fair	Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location
21-50	Poor	At this level, measurements are inaccurate by as much as 300 metres with a 6 meter accurate device (50 dop * 6 meters) and should be discarded
>50-127	No Signal/ Discard	At this level, measurements are inaccurate-discard

3.8.12 Heading Uncertainty Estimate

The *heading* is defined as the azimuth that means the angle between the horizontal plan and an element. The *heading uncertainty estimate* is defined in the following table.

Value	Heading Uncertainty
0	$\leq 6^{\circ}$
1	$\leq 9^{\circ}$
2	$\leq 12^{\circ}$
3	$\leq 15^{\circ}$
4	$\leq 20^{\circ}$
5	$\leq 25^{\circ}$

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6	$\leq 30^\circ$
7	$> 30^\circ$ or NULL

3.8.13 Heading

The heading has multiples of 15 degrees. For example, a heading value of 3 is 45 degrees or North East.

3.8.14 Distance Flag

Value	Definition
0	Units are not defined
1	Kilometers
2	Miles

3.8.15 Time Flag

Value	Definition
0	Seconds
1	Minutes
2	Hours
3	Reserved

3.8.16 Current Dead Reckoning Data

The Dead Reckoning Data follows the WGS4 format. The specific format for Dead Reckoning is extracted from the WGS84 reference ellipsoid. It is the current position including the dead reckoning data. If no data available the field length must be set to 0 and follow octet is next element.

Octet \ bit	0	1	2	3	4	5	6	7
Current Dead Reckoning Data	IE Identifier=0		More Flag	Length				
	Latitude							
	Longitude							

3.8.17 Array of Area Location Delta Coding

This element defines a more compact form for specifying the position history of a vehicle. If no data available the field length must be set to 0 and follow octet is next element.

Octet \ bit	0	1	2	3	4	5	6	7
Area Location Delta Coding	IE Identifier=0		More Flag	Length				
	More Flag	Delta Longitude 1						
	More Flag	Delta Latitude 1						
						
	More Flag	Delta Longitude n						
	More Flag	Delta Latitude n						

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This 1 octet fields allow for a value range of –64 to +63 milliarcseconds or 100 milliarcseconds increments as defined by Area Type in section 17.16. This provides for 3.1 meter resolution which is an acceptable compromise for standard maps having 5 meter resolution. This also reduces the computational requirements of the TCU. Since the range for milliarcseconds is ± 63 (100s) milliarcseconds, this equates to a distance of ± 195 meters at the equator and gets smaller as the north/south pole is approached.

The deltas are always paired as a Longitude and Latitude. The first delta location (Delta 1) is relative to the Prior GPS Raw Data location. The second delta location is relative to the first delta location. Delta N location is first location recorded and is relative to Delta N-1. Positive deltas indicate a direction in the north and east directions.

3.9 Breakdown Status Element

This group defines the nature of the breakdown.

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
Breakdown Status Element	IE Identifier=0		More Flag	Length				
	More Flag=1	Breakdown Source (<i>First flag</i>)						
	More Flag=1	Breakdown Source (<i>Second flag</i>)						
	More Flag (*)	Breakdown Source (<i>Third flag</i>)						
	More Flag	Breakdown Sensor						
	IE Identifier		More Flag	Length				
	Breakdown Data							

(*) More Flag default = 0 – Defines the use of first, second and third flag only. More flag = 1 means that there is additional breakdown sources flags defined by TCU suppliers.

3.9.1 Breakdown Source

This octets flags fields define the cause for the breakdown.

First Flag

Bit	Breakdown Definition
0	Additional flag
1	Manually activated
2	Vehicle rolled
3	Air bag activated
4	Crash sensor activated
5	Floating car data input
6	Tow truck needed
7	Vehicle initiated theft tracking (Theft alarm triggered)

Second Flag

Bit	Breakdown Definition
0	Additional flag
1	Vehicle is started (ignition on)
2	Vehicle is turned off (ignition off)
3	Vehicle is moved
4	Other sensor activated
5	Re-send location (TCU button pressed)
6	Re-send location (SO sent message)
7	Unauthorized vehicle movement as defined by Theft Alarm

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Third Flag

Bit	Breakdown Definition
0	Additional flag
1	1=Siren off
2	1=Siren on
3	1=Main battery is reconnected
4	1=Main battery is disconnected
5	0=Panic button is off 1=Panic button is on
6	1=Blocking is on
7	1=Blocking is off

3.9.2 Breakdown Sensor

For automatically detected emergencies, this byte defines the sensor within the class *Breakdown source* that initiated the emergency request.

Bit	Crash sensors definition
0	Additional flag
1	Rollover sensor activated
2	Front sensor
3	Rear sensor
4	Side sensor
5	Vehicle Alarm activated
6	Reserved
7	Breakdown data = 1 (Status)

3.9.3 Breakdown Data

This allows for additional descriptive data to be included with the emergency notification message. In case of Breakdown sensor bit 7=1 then the format of breakdown data is the same as Item 3.9.1 representing status.

3.10 Information Type Element

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
Information Type Element	IE Identifier=0		More Flag	Length				
	Addl Flag	Information Type						
	IE Identifier		More Flag	Length				
	Raw Data							

3.10.1 Information Type

This flag defines the type of proprietary information packed as raw data.

Value	Definition
0	Reserved
1	Verbal Information
2	Stock Information
3	Travel Route Information

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4	Hotel Information
5	Traffic information requested (verbal)
6	Traffic information requested (automated)
7	ASCII Text String
8	Point of Interest
9	Cargo
10	Private
11	Environmental Data
12	Timestamp
13	Mobile country code
14	Menu button
15..127	Reserved

Table 10 - Information Type Element: Valid information types.

3.10.2 Raw Data

Raw data transmitted in information type element.

3.11 TCU Data Element

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
TCU Data Element	IE Identifier =0		More Flag	Length				
	Data Type MSB (0)							
	Data Type LSB (0)							
	Length Data Type (0)							
	Configuration Data (0)							
	...							
	Data Type MSB (n)							
	Data Type LSB (n)							
	Length Data Type (n)							
	Configuration Data (n)							

3.11.1 Data Type

This element describes the configuration parameter index to be changed. See definitions at appendix I (Available Configuration Parameters Indexes).

3.11.2 Length Data Type

This element means the length of the parameters data.

3.11.3 Configuration Data

This defines the new configuration parameter value to be changed.

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3.12 TCU Data Error Element

Structure:

Octet \ bit	0	1	2	3	4	5	6	7
TCU Data Error Element	IE Identifier =0		More Flag	Length				
	Data Type MSB (0)							
	Data Type LSB (0)							
	Length Data Type (0)							
	Configuration Data (0)							
	Error Element (0)							
	...							
	Data Type MSB (n)							
	Data Type LSB (n)							
	Length Data Type (n)							
	Configuration Data (n)							
	Error Element (n)							

3.12.1 Data Type

This element describes the configuration parameter index to be changed. See definitions at appendix I (Available Configuration Parameters Indexes).

3.12.2 Length Data Type

This element means the length of the parameters data.

3.12.3 Configuration Data

This defines the new configuration parameter value to be changed.

3.12.4 Error Element

This field is previously defined in item 3.5.

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4 HEADER DESCRIPTION

Octet / Bit	0	1	2	3	4	5	6	7
1	Reserved Set to 0	Private flag	Application ID					
2	Reserved Set to 0	Private flag	Test Flag	Message Type				
3	Version Flag	Version			Message Control Flag			
4	More flag	Reserved Set to 0					Message Priority flag	
5, 6	Message Length							

Table 11 - Header Structure (Binary)

Example: See appendix II at section 13.1.

4.1 Message Elements Definition

4.1.1 Private flag

ACP Protocol reserved field. The default value is 0 and is used for standard ACP 245 messages. Value = 1 is used for private messages.

4.1.2 Application ID

See section 1.1.

4.1.3 Test Flag

If the value is 0, then this message is release message. If the value is 1, then this message is a test message and its implementation is not finished.

4.1.4 Message Type

This field defines the message type. It is unique for a specific message. If a message is constructed with a unique combination of message elements then that message will have a unique message type. If the *Test Flag* bit is set, then this is a test message.

4.1.5 Version Flag

This is intended to allow for extended control information in the header that is common among many applications. If the value is 0, then this is the last byte of the header before next field data. If the value is 1, then another version control octet of information follows this octet.

4.1.6 Version

This is the version of the application. This version number allows the application to be revised and identified independent of the overall ACP version number.

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4.1.7 Message Control Flag

These bit definitions define various actions that are common over many applications.

BitNumber	Definition
0	Reserved, set to 0
1	0 = Use TLV (Type, Length, Value / Variable)
2	0 = The message length field is 8 bits 1 = The message length field is 16 bits
3	0 = Application level response is not expected 1 = Application level response is expected

4.1.8 Message Priority Flag

This flag defines the behavior of sender. This field requires version flag with the value 1.

Value	Definition
0	Reserved
1	Abort: the sender wants to abort the connection. The message length must be 0. Otherwise, the <i>error element</i> follows.
2	Pause: the sender wants to pause the communication.
3	Resume: the sender wants to resume the communication.

4.1.9 Message Length

The message length is the total number of octets in the message including the header.

4.1.10 More Flag

See section 2.3.

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5 PROVISIONING SERVICE (APPLICATION ID = 1)

These are messages that allow the service operator SO and the TCU in the vehicle to provision applications. This allows for the establishment of features and services by application. Parameter updates are usually done within an application. This can include subscription information depending on the business model of the SO. It can cover the means whereby the TCU customer pays (e.g. on a usage basis or for a fixed period basis or some other combination). If the service operator wants to sign up a customer when the service is 1st used, then more information must be supplied as part of the application, and information the customer may not readily have at time of use. [1]

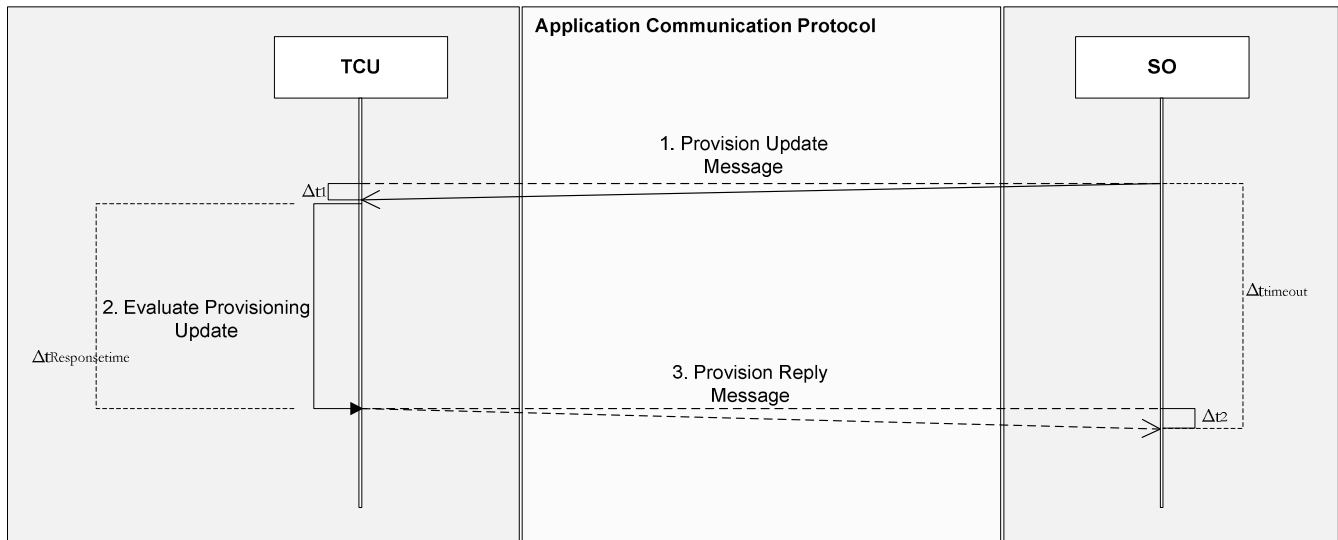


Figure 1- Provisioning Application Message Flow.

5.1 Provisioning Message Set

Message Type Id	Message Type
01	Provision Update Message #1
02	Optional Provision Update Commit Message
03	Provision Reply Message #1
04	Optional Provision Reply Commit Message #2
05	Provision Request Message
06	Provision Status Message
07	Provision Update Message #2
08	Provision Reply Message # 2

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5.2 Provision Update Message #1 (From SO to TCU)

General Message Format:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION	Header Element							
	Version Element							
	More Flag	Target Application ID						
	ApplFlag1		ControlFlag1					
	ControlFlag2							
	Start Time (Timestamp Element)							
	End Time (Timestamp Element)							
	Grace Time (Timestamp Element)							
	TCU Descriptor Element							
	Vehicle Descriptor Element							

Table 12 - Provision Update Message: elements.

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard	Application ID (default=0x01)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x01)				
	Version Flag	Application Version			Message Control Flag			
	Message Length							

Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Message Fields	More Flag	Target Application ID									
	ApplFlag1					ControlFlag1					
	ControlFlag2										

Start Time (Timestamp)	Year (00=1990, 01=1991 ranges up to 62=2052)				Month of year range (1...12)	
	Month of year		Day of month, range (1...31)			Hour of day
	Hour of day, range (0...23)			Minutes, range (0...59)		
	Minutes		Seconds, range (0...59)			

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End Time (Timestamp)	Year (00=1990, 01=1991 ranges up to 62=2052)		Month of year range (1...12)	
	Month of year	Day of month, range (1...31)		Hour of day
	Hour of day, range (0...23)		Minutes, range (0...59)	
	Minutes	Seconds, range (0...59)		

TCU Descriptor Element	IE Identifier	More Flag	Length
	Reserved		
	IE Identifier	More Flag	Length
	Device ID		
	IE Identifier	More Flag	Length
	Version ID		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

5.2.1 Message Elements Definition

5.2.1.1 Header Element

See definitions at section 4.1

5.2.1.2 Version Element

See definitions at section 3.1.

5.2.1.3 Message Fields

5.2.1.3.1 Target Application ID

It is used to identify the application that is to be provisioned. The Additional Flag is used to provide a list of Application Ids to be provisioned with the same data. The Provisioning and Configuring target Applications Ids should not be used in the Provision update message. In the Mandatory Configuration Parameters must be used Target Application ID 0.

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5.2.1.3.2 *ApplFlag1*

This table defines the provisioning to perform.

Value	Definition
0	No change to application
1	Activate application
2	Deactivate application
3	Change for this application

The value 0 (zero) is used to realize a consult or a request about the currently configuration status of a specific target application identified by the field target application id.

The value 1 (one) will activate (provisioning) the target application, while the vale 2 (two) will deactivate (not provisioning) the currently target application identified by the field target application id.

The 3 (three) value will request a change or update of the target application pointed by the field target application id.

5.2.1.3.3 *ControlFlag1*

This is defined as a 6 bit field with bit 0 on the left and bit 5 on the right. Remember that this field does not begin on a byte boundary.

Bit Number	Definition
0	1=A 2nd byte ControlFlag2 exists 0=This is the last Control Flag
1	1=Grace Time is present 0=Grace Time is absent
2	1=Start Time field is present 0=Start Time field is absent
3	1=End Time or Expiration Time field is present 0=End Time or Expiration Time field is absent
4	1=Vehicle Descriptor element is present 0=Vehicle Descriptor element is absent
5	1=Provisioning uses <i>provision update commit message</i> 0=Provisioning does not use <i>provision update commit message</i>

5.2.1.3.4 *ControlFlag2*

Bit Number	Definition
0	Additional Flag
1..3	0=Use the profile method of collection 1=Use the sample method of collection 2..7=Reserved
4	0=Number of samples is not present 1=Number of samples is present
5..7	0=No sample unit 1=Sample units are in minutes 2=Sample units are in kilometers

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5.2.1.4 Start Time (Timestamp Element)

This is the time at which service is to start. If it is absent, then it is the current time or another predefined time. See definitions at section 3.2.

5.2.1.5 End Time (Timestamp Element)

This is the time at which service is to end. If it is absent, then it no end time is defined. This field is only required when activating a service and establishing the ending time. If a service is to be deactivated and this element is not present, then the deactivation is immediate. If this element is present for a service deactivation, then it specifies the date where the service ends. See definitions at section 3.2.

5.2.1.6 Grace Time (Timestamp Element)

If supported in the TCU, this is the time after end time whereby service for the application is still supported. See definitions at section 3.2

5.2.1.7 TCU Descriptor Element

See definitions at section 3.3.

5.2.1.8 Vehicle Descriptor Element

See definitions at section 3.4.

5.3 Provision Reply Message #1 (From TCU to SO)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <small>Message fields</small>	Header Element							
	Version Element							
	More Flag	Target Application ID						
	ApplFlag1		ControlFlag1					
	Status Flag1		TCU Response Flag			Reserved 0)		
	Error Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x01)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x03)				
	Version Flag	Application Version				Message Control Flag		
	Message Length							

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Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Message Fields	More Flag	Target Application ID						
	ApplFlag1		ControlFlag1 (default=2)					
	Status Flag1		TCU Response Flag			Reserved (default=0)		

Error Element	IE Identifier =0	More Flag	Length
	Error Code		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

5.3.1 Message Elements Definition

5.3.1.1 Header Element

See definitions at section 4.1.

5.3.1.2 Version Element

See definitions at section 3.1.

5.3.1.3 Message Fields Element

Initial definitions are at section 5.2.1.3.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

5.3.1.3.1 StatusFlag1

This indicates the current provisioning status of the application.

Value	Definition
0	Application already provisioned
1	Application not already provisioned
2	See Error element for more details at 3.5
3	Reserved

5.3.1.3.2 TCU Response Flag

This indicates the reason for this reply message.

Value	Definition
0	Reserved
1	TCU initialize mode
2	TCU response to <i>provision update message</i>
3	TCU response to <i>provision commit message</i>

5.3.1.4 Error Element

See definitions at section 3.5.

5.3.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

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6 CONFIGURATION (APPLICATION ID = 2)

These are messages that allow the service operator (SO) and the TCU in the vehicle to configure applications. This allows for the establishment of features and services by application. [1]

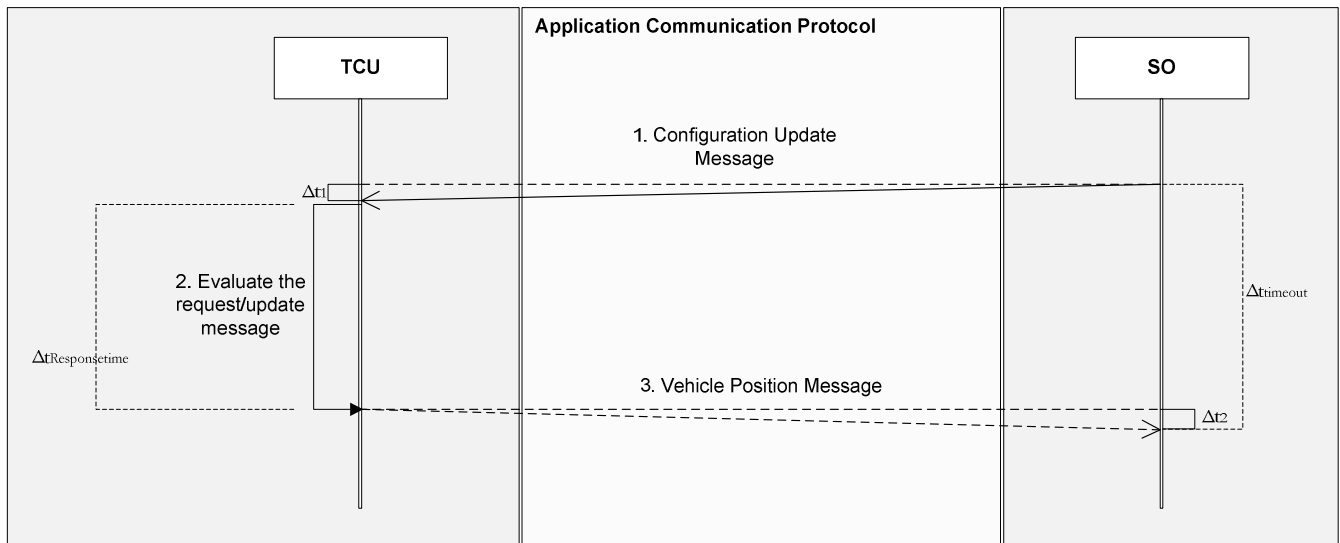


Figure 2 - Configuration Message Flow.

6.1 Configuration Message Set

Message Type Id	Message Type
01	Configuration Update Message
02	Optional Configuration Update Commit Message
03	Configuration Reply Message
04	Optional Configuration Reply Commit Message
05	Configuration Request Message
06	Configuration Status Message
07	Configuration Edit Message
08	Configuration Update Message #2 ACP 245
09	Configuration Reply Message #2 ACP 245
10	Configuration TCU Service Activation/Deactivation Message ACP 245

DENATRAN: ACP 245 V 1.2 – Protocol Specification

6.2 Configuration Update Message #2 ACP 245 (From SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
<div>MESSAGE COMPOSITION</div> <div>Message Fields</div>	Header Element							
	Version Element							
	More Flag	Target Application ID						
	ApplFlag1		ControlFlag1					
	ControlFlag2							
	Reserved							
	Start Time (Timestamp Element)							
	End Time (Timestamp Element)							
	Grace Time (Timestamp Element)							
	Vehicle Descriptor Element							
	TCU Descriptor Element							
	TCU Data Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header Element	Reserved Set to 0	Non Standard Flag	Application ID (default=0x02)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x08)				
	Version Flag	Application Version			Message Control Flag			
	Message Length							

Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Target Application ID	More Flag	Target Application ID									
	ApplFlag1				ControlFlag1						
	ControlFlag2										
	Reserved										

Start Time (Timestamp)	Year (00=1990, 01=1991 ranges up to 62=2052)			Month of year range (1...12)	
	Month of year	Day of month, range (1...31)			Hour of day
	Hour of day, range (0...23)			Minutes, range (0...59)	
	Minutes	Seconds, range (0...59)			

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End Time (Timestamp)	Year (00=1990, 01=1991 ranges up to 62=2052)		Month of year range (1...12)	
	Month of year	Day of month, range (1...31)		Hour of day
	Hour of day, range (0...23)		Minutes, range (0...59)	
	Minutes	Seconds, range (0...59)		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIM Card ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

TCU Descriptor Element	IE Identifier	More Flag	Length
	Reserved		
	IE Identifier	More Flag	Length
	Device ID		
	IE Identifier	More Flag	Length
	Version ID		

TCU Data Element	IE Identifier	More Flag	Length
	Data Type MSB (0)		
	Data Type LSB (0)		
	Length Data Type (0)		
	Configuration Data (0)		
	...		
	Data Type MSB (n)		
	Data Type LSB (n)		
	Length Data Type (n)		
	Configuration Data (n)		

6.2.1 Message Elements Definition

6.2.1.1 Header Element

See definitions at section 4.1.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

6.2.1.2 Version Element

See definitions at section 3.1.

6.2.1.3 Message Fields Element

See definitions at section 5.2.1.3.

6.2.1.4 Start Time (Timestamp Element)

This is the time at which service is to start. If it is absent, then it is the current time or another predefined time. See definitions at section 3.2.

6.2.1.5 End Time (Timestamp Element)

This is the time at which service is to end. If it is absent, then it no end time is defined. This field is only required when activating a service and establishing the ending time. If a service is to be deactivated and this element is not present, then the deactivation is immediate. If this element is present for a service deactivation, then it specifies the date where the service ends. See definitions at section 3.2.

6.2.1.6 Grace Time (Timestamp Element)

If supported in the TCU, this is the time after end time whereby service for the application is still supported. See definitions at section 3.2.

6.2.1.7 Vehicle Descriptor Element

See definitions at section 3.4.

6.2.1.8 TCU Descriptor Element

See definitions at section 3.3.

6.2.1.9 TCU Data Element

See definitions at section 3.11.

6.3 Configuration Reply Message (From TCU to SO)

Used for a single error element response.

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
<div>MESSAGE COMPOSITION</div> <div>Message Fields</div>	Header Element							
	Version Element							
	Reserved							
	More Flag		Target Application ID					
	ApplFlag1			ControlFlag1 (default=2)				
	Status Flag1			TCU Response Flag			Reserved	
	Error Element							
	Vehicle Descriptor Element							

Message Structure:

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x02)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x03)				
	Version Flag	Application Version			Message Control Flag			
	Message Length							

Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Message Fields	More Flag	Target Application ID						
	AppIFlag1		ControlFlag1 (default=2)					
	Status Flag1		TCU Response Flag			Reserved		

Error Element	IE Identifier =0	More Flag	Length
	Error Code		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

6.3.1 Message Elements Definition

6.3.1.1 Header Element

See definitions at section 4.1.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

6.3.1.2 Version Element

See definitions at section 3.1.

6.3.1.3 Message Fields Element

See definitions at section 5.2.1.3.

6.3.1.4 Error Element

See definitions at section 3.5.

6.3.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

6.4 Configuration Reply Message #2 ACP 245 (From TCU to SO)

Used for a multiple error element response.

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
<div>MESSAGE COMPOSITION</div> <div>Message Fields</div>	Header Element							
	Version Element							
	More Flag	Target Application ID						
	ApplFlag1		ControlFlag1 (default=2)					
	Status Flag1		TCU Response Flag			Reserved		
	TCU Data Error Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x02)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x09)				
	Version Flag	Application Version			Message Control Flag			
	Message Length							

Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Message Fields	More Flag	Target Application ID	
	ApplFlag1	ControlFlag1 (default=2)	
	Status Flag1	TCU Response Flag	Reserved

TCU Data Error Element	IE Identifier	More Flag	Length
	Data Type MSB (0)		
	Data Type LSB (0)		
	Length Data Type (0)		
	Configuration Data (0)		
	Error Element (0)		
	...		
	Data Type MSB (n)		
	Data Type LSB (n)		
	Length Data Type (n)		
	Configuration Data (n)		
	Error Element (n)		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

6.4.1 Message Elements Definition

6.4.1.1 Header Element

See definitions at section 4.1.

6.4.1.2 Version Element

See definitions at section 3.1.

6.4.1.3 Message Fields Element

See definitions at section 5.2.1.3.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

6.4.1.4 TCU Data Error Element

See definitions at section 3.12.

6.4.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

6.5 Configuration TCU Service Activation/ Deactivation Message ACP 245 (From SO to TCU)

Used to TCU Service Activation and Deactivation. This process is better described at section 10.

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header Element							
	APN Configuration Element							
	Server Configuration Element							
	Control Byte1							
	Vehicle Descriptor Element (ICCID and Auth.Key)							

6.5.1 Message Elements Definition

6.5.1.1 Header Element

See definitions at section 4.1.

6.5.1.2 APN Configuration Element

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 0		More flag	Length				
2..p-1	APN Address Element							
p..q-1	APN Login Element							
q..r-1	APN Password Element							

6.5.1.2.1 APN Address Element

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 1		More flag	Length				
2..p-1	APN Address (Text Format)							

6.5.1.2.2 APN Login Element

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 1		More flag	Length				
2..p-1	APN Login (Text Format)							

DENATRAN: ACP 245 V 1.2 – Protocol Specification

6.5.1.2.3 APN Password Element

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 1		More flag	Length				
2..p-1	APN Password (Text Format)							

6.5.1.3 Server Configuration Element

Octet \ bit	0	1	2	3	4	5	6	7
1	IE Identifier = 0		More flag	Length = 13				
2..5	First Server IP (4 bytes)							
6..7	First Server Port (2 bytes)							
8..11	Second Server IP (4 bytes)							
12..13	Second Server Port (2 bytes)							
14	Protocol ID							

6.5.1.3.4 Protocol ID

Values	Definition
0	ACP 245
1..31	Reserved
32..255	Defined by TCU Manufacturer

6.5.1.4 Control Byte

Octet \ bit	0	1	2	3	4	5	6	7
1	More flag	Control Value	Reserved					

6.5.1.4.5 Control Value

Bit	Definition
0	More Flag bit, set as 0
1	0= Deactivation (reset all configuration to factory defaults) 1= Activation
2..7	Reserved

6.5.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

7 REMOTE VEHICLE FUNCTION SERVICE (APPLICATION ID = 6)

The remote vehicle function application allows vehicle functions to be controlled remotely by the SO. These functions may include devices such as door lock motors, window motors, trunk release, or modes such as tracking mode, covert mode, etc. In general, a request is made to the SO by either the TCU or the driver for a specific remote vehicle function to be performed. The SO then initiates the remote vehicle function, assuming a successful authentication. [1]

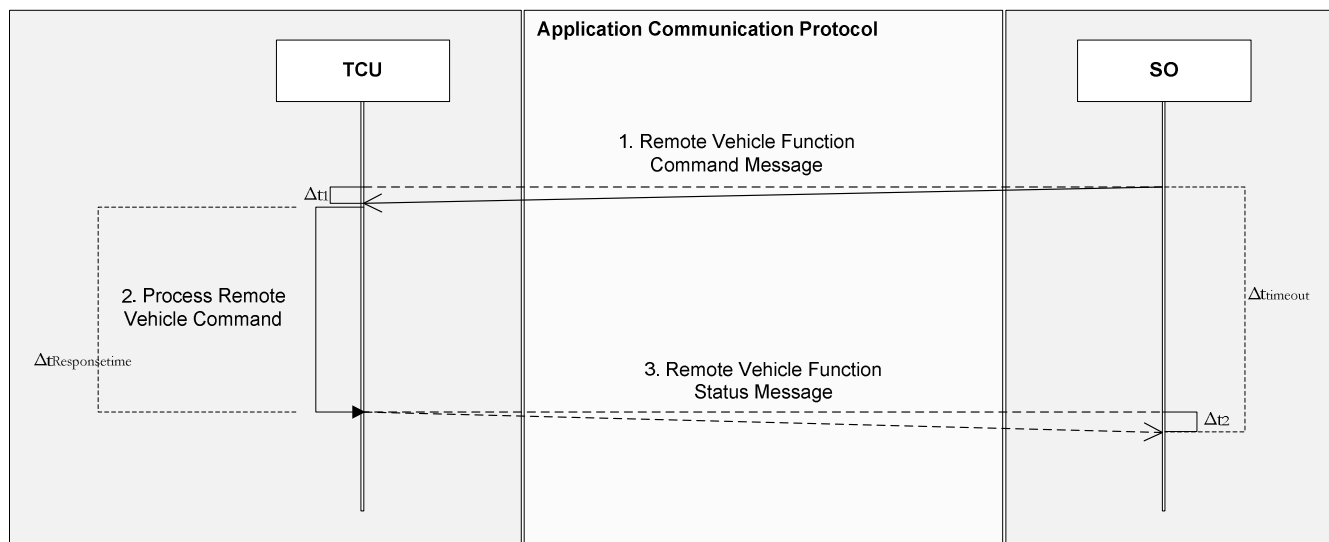


Figure 3 – Remote Vehicle Function Message Flow.

7.1 Remote Vehicle Function Message Set

Message Type Id	Message Type
01	Remote Vehicle Function Request
02	Remote Vehicle Function Command
03	Remote Vehicle Function Status

7.2 Vehicle Function Command (From SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION Message Fields	Header							
	Version Element							
	Control Function Element							
	Function Command Element							
	Vehicle Descriptor Element							

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x06)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x02)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier =0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Control Function	IE Identifier	More Flag	Length	
	Entity ID			
	Reserved		Transmit Units	
	Transmit Interval			

Function Status	IE Identifier	More Flag	Length
	Function Command or Status		
	IE Identifier	More Flag	Length
	Raw Data		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

Example: See appendix II at section 13.2.1.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

7.2.1 Message Elements Description

7.2.1.1 Header Element

See definitions at section 4.1

7.2.1.2 Version Element

See definitions at section 3.1.

7.2.1.3 Control Function Element

See definitions at section 3.6.

7.2.1.4 Function Command Element

See definitions at section 3.7.

7.2.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

7.3 Vehicle Function Status (From TCU to SO)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header							
	Version Element							
	Control Function Element							
	Function Status Element							
	Error Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x06)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default = 0x03)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier=0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Control Function	IE Identifier	More Flag	Length	
	Entity ID			
	Reserved		Transmit Units	
	Transmit Interval			

Function Command	IE Identifier	More Flag	Length
	Function Command or Status		
	IE Identifier	More Flag	Length
	Raw Data		

Error Element	IE Identifier=0	More Flag	Length
	Error Code		

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

Example: See appendix II at section 13.2.2.

7.3.1 Message Elements Description

7.3.1.1 Header Element

See definitions at section 4.1

7.3.1.2 Version Element

See definitions at section 3.1.

7.3.1.3 Control Function Element

See definitions at section 3.6.

7.3.1.4 Function Command Element

See definitions at section 3.7.

7.3.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

7.3.1.6 Error Element

See definitions at section 3.5.

DENATRAN: ACP 245 V 1.2 – Protocol Specification

8 VEHICLE TRACKING SERVICE (APPLICATION ID = 10)

The vehicle tracking application sends vehicle location information to the SO on a periodic basis. This enables the SO to track the vehicle in the event that a vehicle was reported missing. Tracking may automatically be enabled in a SO response of another application. However, in the event a vehicle owner reports the vehicle missing, the SO must enable the vehicle tracking manually. In general, the SO is notified of a missing vehicle by the vehicle owner. The SO then sends a vehicle tracking command message to the TCU to enable vehicle tracking. Periodic messages are sent by the TCU to the SO with location information used in the tracking of the vehicle. A vehicle tracking command message can be sent from the SO to the TCU to disable tracking when it is determined that it is no longer needed. [1]

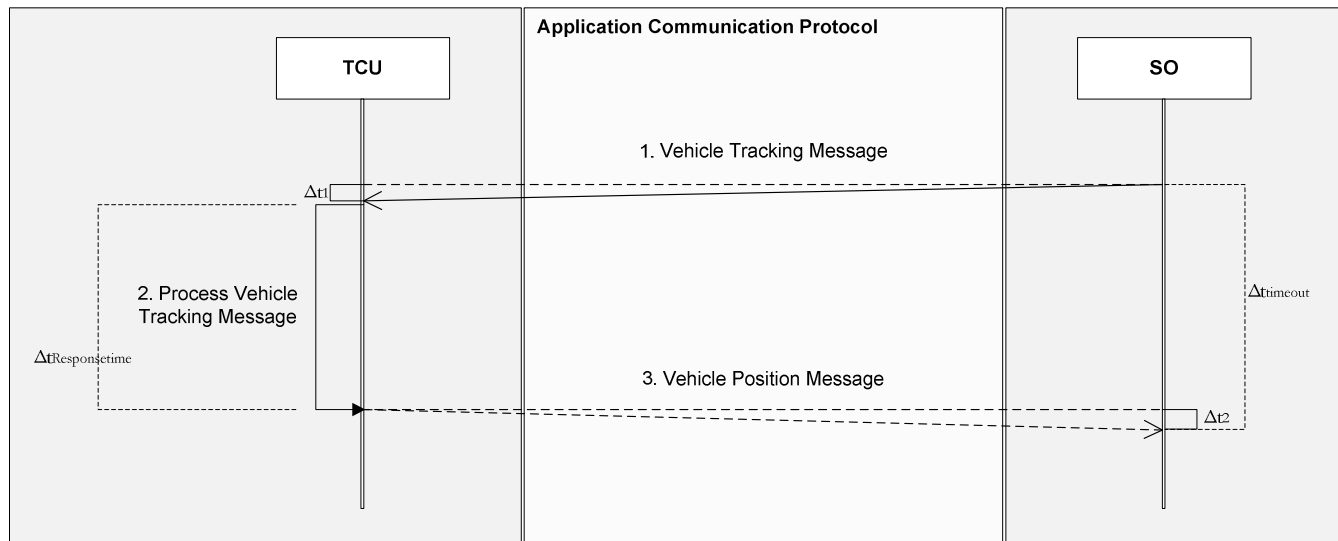


Figure 4 - Vehicle Tracking Message Flow.

8.1 Vehicle Tracking Message Set

Message Type Id	Message Type
01	Vehicle Tracking Command
02	Vehicle Position Message
03	Vehicle Position Reply
04	Vehicle Tracking Command with Commit
05	Commit to Vehicle Tracking Command

DENATRAN: ACP 245 V 1.2 – Protocol Specification

8.2 Vehicle Tracking Command (From SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header Element							
	Version Element							
	Control Function Element							
	Function Command Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x0A)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x01)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier=0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Control Function	IE Identifier	More Flag	Length		
	Entity ID				
	Reserved		Transmit Units		
	Transmit Interval				

Function Command	IE Identifier	More Flag	Length (default=1)
	Function Command or Status		
	IE Identifier	More Flag	Length (default=1)
	Raw Data		

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

Example: This message structure is equal than Vehicle Function Command changes in Entity ID at Control Function Element (Tracking Entity). For more details, see section 7.2.

8.2.1 Message Elements Definition

8.2.1.1 Header Element

See definitions at section 4.1

8.2.1.2 Version Element

See definitions at section 3.1.

8.2.1.3 Control Function Element

See definitions at section 3.6.

8.2.1.4 Function Command Element

See definitions at section 3.7.

8.2.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

8.3 Vehicle Position Message (From TCU to SO)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header							
	Version Element							
	Timestamp Element							
	Location Element							
	Vehicle Descriptor Element							
	Breakdown Status Element							
	Information Type							

DENATRAN: ACP 245 V 1.2 – Protocol Specification

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x0A)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type(default=0x02)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier=0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Timestamp	Year (00=1990, 01=1991 ranges up to 62=2052)				Month of year range (1...12)	
	Month of year		Day of month, range (1...31)			Hour of day
	Hour of day, range (0...23)			Minutes, range (0...59)		
	Minutes		Seconds, range (0...59)			

Location Element	IE Identifier=0	More Flag	Length
	Current GPSRawData (3.8.1)		
	Prior GPSRawData (3.8.1)		
	Current Dead Reckoning Data (3.8.16)		
	Array of Area Location Delta Coding (3.8.17)		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

Breakdown Status Element	IE Identifier		More Flag	Length	
	More Flag =1	Breakdown Source (<i>First flag</i>)			

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	More Flag =1	Breakdown Source (<i>Second flag</i>)		
	More Flag	Breakdown Source (<i>Third flag</i>)		
	More Flag	Breakdown Sensor		
	IE Identifier		More Flag	Length
	Breakdown Data			

Information Type Element	IE Identifier=0		More Flag	Length	
	Add Flag	Information Type			
	IE Identifier		More Flag	Length	
	Raw Data				

Example: See appendix II at section 13.3.1.

8.3.1 Message Elements Definition

8.3.1.1 Header Element

See definitions at section 4.1.

8.3.1.2 Version Element

See definitions at section 3.1.

8.3.1.3 Location Element

See definitions at section 3.8.

8.3.1.4 Vehicle Descriptor Element

See definitions at section 3.4.

8.3.1.5 Breakdown Status Element

See definitions at section 3.9.

8.3.1.6 Information Type Element

See definitions at section 3.10.

8.4 Vehicle Position Reply Message (From SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
SAG E COM POSI TION Message	Header							
	Version Element							

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	Confirmation	Transmit Units
	Ecall ControlFlag2	
	Error Element	

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x0A)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x03)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier=0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Message Fields	Confirmation		Transmit Units	
	Ecall ControlFlag2			

Error Element	IE Identifier =0	More Flag	Length
	Error Code		

8.4.1 Message Elements Definition

8.4.1.1 Header Element

See definitions at section 4.1.

8.4.1.2 Version Element

See definitions at section 3.1.

8.4.1.3 Message Fields Element

8.4.1.3.1 Confirmation

This element represents the confirmation status of an assistance reply message.

Bit	Confirmation Definitions
0	Additional Flag
1	1=Assistance notification accepted and processing continues 0=Assistance notification rejected.
2	1=Turn Speaker On

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	0=Turn Speaker Off
3	1=Processing [tracking] should start or continue 0=Processing [tracking] should stop

8.4.1.3.2 Transmit Units

The value in this element is only valid if the *Confirmation* element indicates tracking should start or continue.

Value	Transmit Units
0	Second
1	Minute
2	Hour
3	Send emergency call message one more time
4	Send only one message

8.4.1.3.3 EcallControlFlag2

This element defines additional control functions in the ecall message.

Bit	Confirmation Definitions
0	Additional Flag
1	1=Cancel the alarm 0=No alarm related action
2	1=Re-send the Ecall request 0=No re-send requested
3	1=Do not allow voice call or drop current voice call 0=Allow voice call (default if EcallControl Flag 2 not present)
4-7	Reserved

8.4.1.4 Error Element

See definitions at section 3.5

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9 THEFT ALARM (APPLICATION ID = 11)

The theft alarm application informs the SO that a vehicle event has been triggered. The vehicle manufacturer defines the set of conditions that define a condition event. [1]

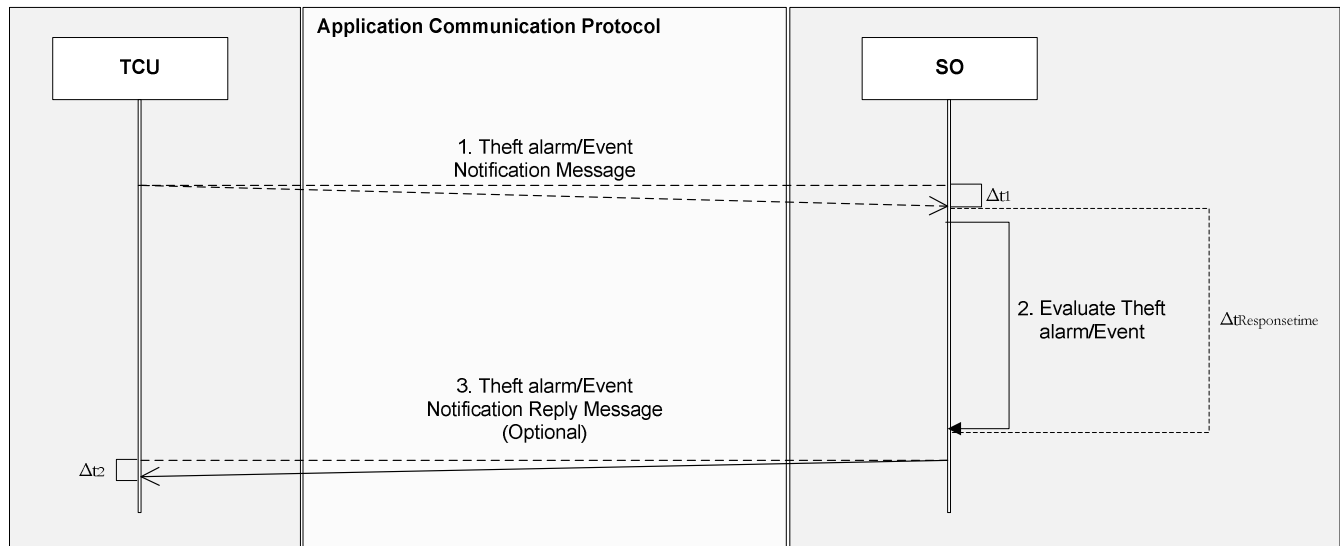


Figure 5 - Theft Alarm Message Flow.

9.1 Theft Alarm Message Set

Message Type Id	Message Type
01	Theft Alarm Notification
02	Theft Alarm Reply
03	Vehicle Position Message
04	Keep Alive
05	Keep Alive Reply

9.2 Theft Alarm Notification (From TCU to SO)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION Message Fields	Header Element							
	Version Element							
	Timestamp Element							
	Location Element							
	Vehicle Descriptor Element							
	Breakdown Status Element							
	Information Type Element							

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Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x0B)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type (default=0x01)				
	Version Flag	Application Version			Message Control Flag (default=2)			
	Message Length							

Version Element	IE Identifier=0	More Flag	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Timestamp	Year (00=1990, 01=1991 ranges up to 62=2052)				Month of year range (1...12)	
	Month of year		Day of month, range (1...31)			Hour of day
	Hour of day, range (0...23)			Minutes, range (0...59)		
	Minutes		Seconds, range (0...59)			

Location Element	IE Identifier=0	More Flag	Length
	Current GPSRawData (3.8.1)		
	Prior GPSRawData (3.8.1)		
	Current Dead Reckoning Data (3.8.16)		
	Array of Area Location Delta Coding (3.8.17)		

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

Breakdown Status Element	IE Identifier=0		More Flag	Length				
	More Flag =1	Breakdown Source (First flag)						

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	More Flag =1	Breakdown Source (<i>Second flag</i>)		
	More Flag	Breakdown Source (<i>Third flag</i>)		
	More Flag	Breakdown Sensor		
	IE Identifier		More Flag	Length
	Breakdown Data			

Information Type Element	IE Identifier=0		More Flag	Length
	Add Flag	Information Type		
	IE Identifier		More Flag	Length
	Raw Data			

9.2.1 Message Elements Definition

9.2.1.1 Header Element

See definitions at section 4.1.

9.2.1.2 Version Element

See definitions at section 3.1.

9.2.1.3 Timestamp Element

See definitions at section 3.2.

9.2.1.4 Location Element

See definitions at section 3.8.

9.2.1.5 Vehicle Descriptor Element

See definitions at section 3.4.

9.2.1.6 Breakdown Status Element

See definitions at section 3.9.

9.2.1.7 Information Type Element

See definitions at section 3.10.

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9.3 Theft Alarm Reply (From SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION	Header Element							
	Version Element							
	Confirmation				Transmit Units			
	Ecall ControlFlag2							
	Error Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header	Reserved Set to 0	Non Standard Flag	Application ID (default=0x0B)					
	Reserved Set to 0	Non Standard Flag	Test Flag	Message Type				
	Version Flag	Application Version			Message Control Flag			
	Message Length							

Version Element	IE Identifier =0	More Flag (default=0)	Length
	Car Manufacturer ID		
	TCU Manufacturer ID		
	Major hardware release		
	Major software release		

Message Fields	Confirmation	Transmit Units
	EcallControlFlag2	

Error Element	IE Identifier =0	More Flag (default=0)	Length
	Error Code		

9.3.1 Message Elements Definition

9.3.1.1 Header Element

See definitions at section 4.1.

9.3.1.2 Version Element

See definitions at section 3.1.

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9.3.1.3 Message Fields Element

See definitions at section 8.4.1.

9.3.1.4 Error Element

See definitions at section 3.5.

9.4 Message Keep Alive (TCU to SO)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header Element	Reserved Set to 0	Private Flag	Application ID (default = 0x0B)					
	Reserved Set to 0	Private Flag	Test Flag	Message Type (default = 0x04)				
	Version Flag	Version			Message Control Flag			
	Message Length							

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

9.4.1 Header Element

See definitions at section 4.1.

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9.4.2 Vehicle Descriptor Element

See definitions at section 3.4.

9.5 Message Keep Alive Reply (SO to TCU)

Message Definition:

Octet / Bit	0	1	2	3	4	5	6	7
MESSAGE COMPOSITION <i>Message Fields</i>	Header Element							
	Vehicle Descriptor Element							

Message Structure:

Octet / Bit	0	1	2	3	4	5	6	7
Header Element	Reserved Set to 0	Private Flag	Application ID (default = 0x0B)					
	Reserved Set to 0	Private Flag	Test Flag	Message Type (default = 0x05)				
	Version Flag	Version			Message Control Flag			
	Message Length							

Vehicle Descriptor Element	IE Identifier=0		More Flag	Length				
	Addl Flag=1	Language	VIN	TCU Serial	Vehicle Color	Vehicle Model	License Plate	IMEI
	Addl Flag=0	Model Year	SIMCard ID	Auth. Key	0	0	0	0
	IE Identifier=1		More Flag	Length				
	Text Format (VIN Number)							
	IE Identifier		More Flag	Length				
	(TCU Serial Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (IMEI Number)							
	IE Identifier=2		More Flag	Length				
	BCD Format (SIM Card ID)							
	IE Identifier=0		More Flag	Length				
	Binary Format (Auth. Key)							

9.5.1 Header Element

See definitions at section 4.1.

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9.5.2 Vehicle Descriptor Element

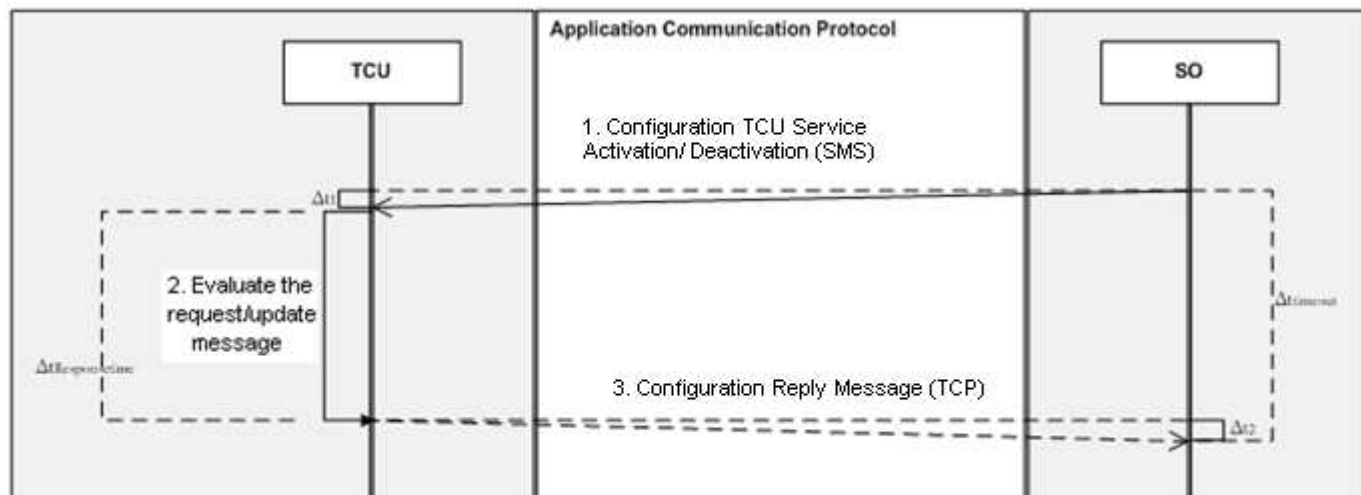
See definitions at section 3.4.

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10 TCU Service Activation/ Deactivation

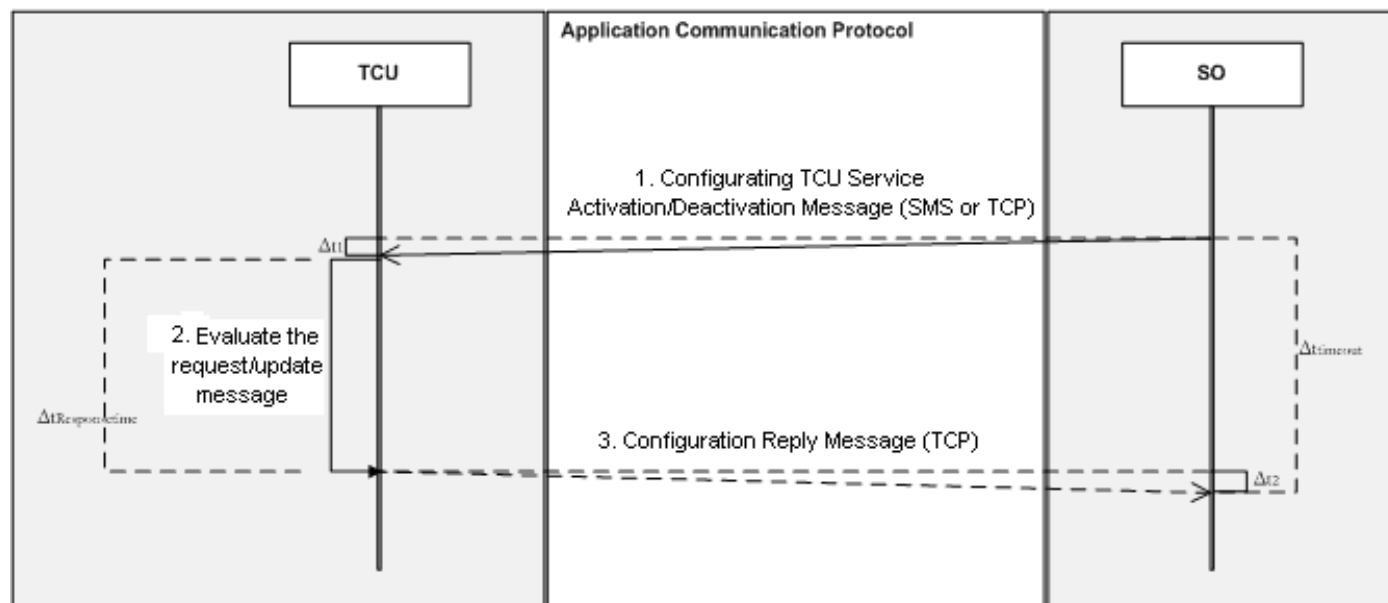
10.1 Activation process

This picture below shows the message flow between SO and TCU in TCU Service Activation process.



10.2 Deactivation process

This picture below shows the message flow between SO and TCU in SMS deactivation process.



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11 REFERENCES

[1] *Application Communication Protocol. Application Layer Message Set Definition*. Version 3.1.0.2. Motorola, Inc. November 2000.

[2] *DENATRAN Resolution n°245/2007*. July 27, 2007.

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12 Appendix I

12.1 Available Configuration Parameter Indexes

The table below

12.1.1 Tracking Service

Available indexes to change configuration parameters of tracking service.

Index below marked with * must be configurable in TCU (mandatory).

Data Type Index	Parameter	Description	Type/Size	Default Unit	Default Value
* 0x0011	Tracking Timer	Transmission interval used to send periodically the Vehicle's position.	unsigned integer/ 2 Bytes	Seconds	180
0x0012	Tracking Timer at Sleep Mode	Transmission interval used to send periodically the Vehicle's position, now in Sleep Mode.	unsigned integer/ 2 Bytes	Seconds	43200
0x0013	Type of GPS Quality	Consists of the type of GPS Signal Indication: BIT 0 = Digital indication (0=bad, 1=good) BIT 1 = DOP (Dilution of Precision) in upper nibble and # of satellites in lower nibble of state table.	unsigned char/1 Byte	Enumeration Type	1
0x0014	Direction Change Threshold	Limit used by GPS to detect a direction change	unsigned char/ 1 Byte	degrees	45
0x0015	Direction Change Speed Threshold	Limit used by GPS to alarm detect a direction change	unsigned char/ 1 Byte	Km/h	250
0x0016	Maximum Speed	Maximum Speed to monitoring	unsigned char/ 1 Byte	Km/h	250
0x0017	Odometer Limit	Limit used to count a maximum odometer's values	unsigned long/ 4 Bytes	Km	0 (Unlimited)
0x0018	Odometer Save Threshold	Value used to consider to the odometer counting	unsigned integer/ 2 Bytes	Km	10
0x0019	Tracking Timer at Event Mode	Transmission interval used to send periodically the Vehicle's position, now in Event Mode	unsigned integer/ 2 Bytes	Seconds	300

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12.1.2 Immobilizer Service

Available indexes to change configuration parameters of immobilizer service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0021	Immobilizer Timer	Necessary timer used to activate the immobilizer device after turn off the car's ignition.	unsigned integer/ 2 Bytes	Seconds	300

12.1.3 Anti-Theft Service

Available indexes to change configuration parameters of anti-theft service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0031	Anti-Theft Timer	Necessary timer used to activate the anti-theft system after ignition is turn off.	unsigned integer/ 2 bytes	Seconds	30
0x0032	Enable/Disable Anti-Theft	Enable/disable the Anti-Theft system.	Boolean/ 1 bit	-	True

12.1.4 System Service

Available indexes to change configuration parameters of system service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0041	Sleep Timer	Necessary timer used to put the system in Sleep Mode after the ignition key is turn off.	unsigned integer/ 2 bytes	Seconds	60
0x0042	Enable Panic Button Configuration	Enable a system's input to work like panic button or anti-theft.	Boolean/1 bit	-	False (Anti-Theft is enabled)
0x0043	Enable Transportation Flag.	If this flag is enabled the system will be stay in Transportation Mode.	Boolean/1 bit	-	True
0x0044	Enable Contract Flag.	Flag used to enable/disable the contract with the SO. Initially and currently only using a SMS message it's possible to enable this flag. After enabled is possible disable it through a GSM/GPRS connection.	Boolean/1 bit	-	False
0x0045	Auth. Key	Authentication key used for SMS validation.	unsigned integer/8 bytes		
*0x0046	TCU Service Activation/Deactivation	Enable/ Disable the SMS to TCU Service Activation/Deactivation	Boolean/1 bit	-	True

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12.1.5 Network Service

Available indexes to change configuration parameters of network service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0051	Keep Alive Timer	Necessary timer to send a small message to verify the connection status between the TCU and the SO. (value 0 – disables)	unsigned int / 2 byte	Seconds	180
0x0052	Default Transport Protocol	Default transport protocol used to establish connection between the TCU and the SO.	unsigned char/ 1 byte	-	0 (TCP)

12.1.6 Connectivity Service

Available indexes to change configuration parameters of connectivity service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
* 0x0061	APN (Access Point Name)	Access point used to start or to establish a connection.	Max. 91 Bytes (Sum)	-	-
* 0x0062	Login	Login or user name used to access the services provided by SO (Service Operator)		-	-
* 0x0063	Password	Password used to access the services provided by SO (Service Operator)		-	-
* 0x0064	Server's IP # 1	First IP used to establish a connection in the SO network.	4 Bytes	-	0.0.0.0
* 0x0065	Server's Port # 1	First port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x0066	Server's Transport Protocol Type # 1	Type of the transport protocol used (currently: TCP = 0, or UDP =1)	unsigned char/ 1 Byte	-	0 (TCP)
0x0067	Server's IP # 2	Second IP used to establish a connection in the SO network.	4 Bytes	-	0.0.0.0
0x0068	Server's Port # 2	Second port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x0069	Server's Transport Protocol Type #	Type of the transport protocol used (currently: TCP = 0, or	unsigned char/ 1 Byte	-	0 (TCP)

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	2	UDP =1)			
0x006A	Server's IP # 3	Third IP used to establish a connection in the SO network.	4 Bytes	-	0.0.0.0

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0x006B	Server's Port # 3	Third port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x006C	Server's Transport Protocol Type # 3	Type of the transport protocol used (currently: TCP = 0, or UDP =1)	unsigned char/ 1 Byte	-	0 (TCP)
0x006D	Server's IP # 4	Fourth IP used to establish a connection in the SO network.	4 Bytes	-	0.0.0.0
0x006E	Server's Port # 4	Fourth port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x006F	Server's Transport Protocol Type # 4	Type of the transport protocol used (currently: TCP = 0, or UDP =1)	unsigned char/ 1 Byte	-	0 (TCP)
0x0070	Server's IP # 5	Fifth IP used to establish a connection in the SO network.	4 bytes	-	0.0.0.0
0x0071	Server's Port # 5	Fifth port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x0072	Server's Transport Protocol Type # 5	Type of the transport protocol used (currently: TCP = 0, or UDP =1)	unsigned char/ 1 Byte	-	0 (TCP)
0x0073	Server's IP # 6	Sixth IP used to establish a connection in the SO network.	4 bytes	-	0.0.0.0
0x0074	Server's Port # 6	Sixth port number used to establish data transmission between client/server in the SO network.	unsigned integer /2 Bytes	-	0
0x0075	Server's Transport Protocol Type # 6	Type of the transport protocol used (currently: TCP = 0, or UDP =1)	unsigned char/ 1 Byte	-	0 (TCP)

12.1.7 Power Service

Available indexes to change configuration parameters of power service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0081	Minimal Voltage for the Main Battery.	Minimal voltage value allowed to operate the system with Main Battery	unsigned integer/ 2 Bytes	-	109
0x0082	Maximum Voltage for the Main Battery	Maximum voltage value allowed to operate the system with Main Battery	unsigned integer/ 2 Bytes	-	727

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0x0083	Hysteresis value for the Main Battery's voltage	Hysteresis value used to calculate the Main Battery's voltage.	unsigned integer/ 2 Bytes	-	5
0x0084	Minimal Voltage for the Backup Battery.	Minimal voltage value allowed to operate the system with Backup Battery	unsigned integer/ 2 Bytes	-	750
0x0085	Recharge Voltage for the Backup Battery	Voltage value used to start the backup battery's recharge process when in active or inactive mode.	unsigned integer/ 2 Bytes	-	970
0x0086	Charged Voltage for the Backup Battery's	Voltage value used to stop the backup battery's recharge process when in active or inactive mode.	unsigned integer/ 2 Bytes	-	995
0x0087	Hysteresis value for the Backup Battery's voltage	Hysteresis value used to calculate the Backup Battery's voltage.	unsigned integer/ 2 Bytes	-	20
0x0088	Backup Battery's Minimal Temperature	Minimal temperature value used to start/continue the backup battery's recharge process.	unsigned integer/ 2 Bytes	-	697
0x0089	Backup Battery's Maximum Temperature	Maximum temperature value used to start/continue the backup battery's recharge process.	unsigned integer/ 2 Bytes	-	444
0x008A	Hysteresis value for the Backup Battery's temperature	Hysteresis value used to calculate the Backup Battery's temperature.	unsigned integer/ 2 Bytes	-	111
0x008B	Backup Battery's Safety Timer 1	Consist of the first safety timer used to check and validate the recharge process.	unsigned integer/ 2 Bytes	Seconds	90
0x008C	Backup Battery's Safety Timer 2	Consist of the second safety timer used to check and validate the recharge process. This value also establish the maximum backup battery's recharge time.	unsigned integer/ 2 Bytes	Seconds	3300
0x008D	Maximum Backup Battery's Fail Counter	Maximum number to allow a fail during the recharge process. That fail occur if even reached the Safety Timer 2, the backup battery's voltage still below of its charged value.	unsigned char/ 1 Byte	-	3
0x008E	Backup Battery's Validity Year	Value used to establish the validity year of the backup battery <ul style="list-style-type: none"> start year = 2000 = 00 	unsigned char/ 1 Byte	-	12 (2012)
0x008F	Backup Battery's Validity Month	Value used to establish the validity month of the backup battery <ul style="list-style-type: none"> range: 01 – 31 	unsigned char/ 1 Byte	-	01 (January)

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12.1.8 Alarm Service

Available indexes to change configuration parameters of alarm service.

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x0092	Ignition Event – Activation time	Time necessary to activate any output after the ignition event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x0095	Panic Button Event – Activation time	Time necessary to activate any output after the panic button event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x0098	GPS Malfunctioning Event – Activation time	Time necessary to activate any output after the GPS Malfunctioning event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x009B	Main Battery Low Event – Activation time	Time necessary to activate any output after the Main Battery Low event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x009E	Backup Battery Temperature Event – Activation time	Time necessary to activate any output after the Backup Battery's Temperature event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00A2	Anti-Theft Violation Event – Activation time	Time necessary to activate any output after the Anti-Theft Violation event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x01
0x00A5	Sleep Event – Activation time	Time necessary to activate any output after the Sleep event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00A8	Position Violation Event – Activation time	Time necessary to activate any output after the Position Violation event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).

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0x00AB	Weak GSM Signal Event – Activation time	Time necessary to activate any output after the Weak GSM Signal event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00AE	Backup Battery Low Event – Activation time	Time necessary to activate any output after the Backup Battery Low event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00B2	Backup Battery Fail Event – Activation time	Time necessary to activate any output after the Backup Battery Fail event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00B5	Backup Battery End of Life Event – Activation time	Time necessary to activate any output after the Backup Battery End of Life event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00B8	Output Short Circuit Event – Activation time	Time necessary to activate any output after the Output Short Circuit event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00BB	Maximum Speed Event – Activation time	Time necessary to activate any output after the Maximum Speed event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00BE	Course Change Event – Activation time	Time necessary to activate any output after the Course Change event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00C2	Number GPS of satellite drop Event – Activation time	Time necessary to activate any output after the Number GPS of satellite drop event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00C5	GSM Antenna Cutoff Event – Activation time	Time necessary to activate any output after the GSM Antenna Cutoff event to be considered stable and ready to transmit.	unsigned char/1 Byte	0,1 Seconds	0x0000 – Event not allowed to transmit (Event Disable).
0x00C6	Enable/Disable Alarm Services	Enable or disable the notification of alarms and/or events.	Boolean/1 bit	-	True

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12.1.9 FOTA Service

Data Type Index	Parameter	Description	Type	Default Unit	Default Value
0x00D1	Enable/Disable FOTA Service	Enable or disable the service used to Firmware Update Over The Air.	Boolean/1 bit	-	True

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13 Appendix II

This sections shows message examples belongs at some ACP services as well its elements structure. The presented numbers are in base 16 (hexadecimal basis).

13.1 Example 1: HEADER

The example below shows an application header used in a message for Remote Vehicle Function Service (Appl Id = 06), with message type equal to 3 (Remote Vehicle Function Status), application version is 3 and length equal to 0x36:

FULL MESSAGE:

06033036

DESCRIPTION:

Octet	Application Header
1	06 (<i>reserved=0; private flag=0; application id=6</i>)
2	03 (<i>reserved=0; private flag=0; test_flag=0; message_type=3</i>)
3	30 (<i>version_flag=0; version=3; control_flag=0</i>)
4	36 (<i>length=54 bytes</i>)

13.2 Example 2: REMOTE VEHICLE FUNCTION SERVICE (APPLICATION ID = 6)

The examples below shows to us the structure of messages related to the remote vehicle function service, in this case, two different and specific messages types to represent, respectively, Remote Vehicle Function Command and Remote Vehicle Function Status.

13.2.1 Remote Vehicle Function Command (From SO to TCU)

The remote vehicle function sample bellow will be used to enable/start the immobilizer (controlled entity) used on a car.

FULL MESSAGE:

0602311B 0408830103 030A0000 0102 0D80208A12345678901234567890

DESCRIPTION:

Octet	Application Header
1	06 (<i>reserved=0; private flag=0; application id=6</i>)
2	02 (<i>reserved=0; private flag=0; test_flag=0; message_type=2</i>)
3	31 (<i>version_flag=0; version=3; control_flag=1</i>)
4	1B (<i>length=27 bytes</i>)

Octet	Version Element
1	04 (<i>IE_identifier = 0; more_flag = 0; length = 4</i>)

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2	08 (<i>car_manufacturer_id</i> = Volkswagen)
3	83 (<i>tcu_manufacturer_id</i> = Kostal)
4	01 (<i>major_hardware_release</i> = 01)
5	03 (<i>major_software_release</i> = 03)

Octet	Control Function
1	01 (<i>IE_identifier</i> = 0; <i>more_flag</i> = 0; <i>length</i> = 1)
2	0A (<i>controlled_entity</i> = Immobilizer)

Octet	Function Command
1	01 (<i>IE_identifier</i> =0; <i>more_flag</i> =0; <i>length</i> =1)
2	02 (<i>function_command_or_status</i> =2)

Octet	Vehicle Descriptor
1	0D (<i>IE_identifier</i> =0, <i>more_flag</i> =0, <i>length</i> ₀ =13)
2	80 (<i>flags</i> ₀ =10000000)
3	20 (<i>flags</i> ₀ =00100000)
4	8A (SIM – <i>IE_identifier</i> =2, <i>moreflag</i> =0, <i>length</i> =10)
5...14	12345678901234567890

13.2.2 Vehicle Function Status (From TCU to SO)

FULL MESSAGE:

0603301D 0408830103 010A 0102 0D80208A12345678901234567890 0100

DESCRIPTION:

Octet	Application Header
1	06 (<i>reserved</i> =0; <i>private_flag</i> =0; <i>application_id</i> =6)
2	03 (<i>reserved</i> =0; <i>private_flag</i> =0; <i>test_flag</i> =0; <i>message_type</i> =3)
3	30 (<i>version_flag</i> =0; <i>version</i> =3; <i>control_flag</i> =0)
4	1D (<i>length</i> =29 bytes)

Octet	Version Element
1	04 (<i>IE_identifier</i> =0; <i>more_flag</i> =0; <i>length</i> =4)
2	08 (<i>car_manufacturer_id</i> = Volkswagen)
3	83 (<i>tcu_manufacturer_id</i> = Kostal)
4	01 (<i>major_hardware_release</i> =01)
5	03 (<i>major_software_release</i> =03)

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Octet	Control Function
1	01 (<i>IE_identifier=0; more_flag=0; length=1</i>)
2	0A (<i>controlled_entity = Immobilizer</i>)

Octet	Function Command
1	01 (<i>IE_identifier=0; more_flag=0; length=1</i>)
2	02 (<i>function_command_or_status=2</i>)

Octet	Vehicle Descriptor
1	0D (<i>IE_identifier=0, more_flag=0, length₀=13</i>)
2	80 (<i>flags₀=10000000</i>)
3	20 (<i>flags₀=00100000</i>)
4	8A (<i>SIM – IE_identifier=2, moreflag=0, length=10</i>)
5...14	12345678901234567890

Octet	Error Element
1	01 (<i>IE_identifier = 0, More Flag = 0, Length = 1</i>)
2	00 (<i>Error Code = OK for execution of the prior command</i>)

13.3 Example 3: VEHICLE TRACKING SERVICE (Application Id = 10)

13.3.1 Vehicle Position Message (From TCU to SO)

FULL MESSAGE:

0A023136 0408830103 88420000 18 17 1280050000FD39A72CFE99980C00000000000030070503
0D80208A12345678901234567890 00 00

DESCRIPTION:

Octet	Application Header
1	0A (<i>reserved=0; non_standard_flag=0; application id=10</i>)
2	02 (<i>reserved=0; non_standard_flag=0; test_flag=0; message_type=2</i>)
3	31 (<i>version_flag=0; version=3; control_flag=1</i>)
4	36 (<i>length=54</i>)

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Octet	Version Element
1	04 (<i>IE_identifier=0; more_flag=0; length=4</i>)
2	08 (<i>car_manufacturer_id = Volkswagen</i>)
3	83 (<i>tcu_manufacturer_id = Kostal</i>)
4	01 (<i>major_hardware_release=01</i>)
5	03 (<i>major_software_release=03</i>)

Octet	Timestamp
1	88 (<i>year=34; month₀=10</i>)
2	42 (<i>month₁=1; day=1; hour₀=0</i>)
3	00 (<i>hour₁=0; minutes₀=0</i>)
4	00 (<i>minutes₁=0; seconds=0</i>)

Octet	Location
1	18 (<i>IE_Identifier=0; moreflag=0; length=24</i>)

Octet	CurrentGPSRawData
1	17 (<i>IE_Identifier=0; moreflag=0; length=23</i>)

Octet	Area Location Code
1	12 (<i>IE_Identifier=0; moreflag=0; length=18</i>)
2	80 (<i>moreflag=1; AreaLocationStatusFlag₁=0</i>)
3	05 (<i>moreflag=0; AreaLocationStatusFlag₂=5</i>)
4	00 (<i>area_type=0; location_type_coding=0; reserved=0</i>)
5	00 (<i>moreflag=0; time_difference=0</i>)
6...9	FD39A72C (<i>longitude</i>) = -46553300
10...13	FE99980C (<i>latitude</i>) = -23488500
14...15	0000 (<i>altitude</i>)
16	00 (<i>position_uncertainty; K/HDOP=0</i>)
17	00 (<i>heading_uncertainty_estimate=0; headind=0</i>)
18	00 (<i>reserved=0; distance_flag=0; time_flag=0</i>)
19	00 (<i>velocity</i>)

20	30 (<i>number_of_satellites=3; reserved=0</i>)
21	07 (satellite id)
22	05 (satellite id)
23	03 (satellite id)

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Octet	Vehicle Descriptor
1	0D (<i>IE_identifier=0, more_flag=0, length=13</i>)
2	80 (<i>flags₀=10000000</i>)
3	20 (<i>flags₁=00100000</i>)
4	8A (<i>SIM – IE_identifier=2, moreflag=0, length=10</i>)
5...14	12345678901234567890

Octet	Breakdown Status
1	00 (<i>IE_identifier=0, more_flag=0, length=0</i>)

Octet	Information Type
1	00 (<i>IE_identifier=0, more_flag=0, length=0</i>)