RUT955 GPS Protocols

Contents

RUT955 GPS DATA PROTOCOL

AVL data array

Because the smallest information amount that can be written is one bit, there can be some bits left unused when result is byte array. Any unused bits should be left blank.

Codec ID	Number of Data	Data	Number of Data
1 Byte	*1 Byte*	*...*	*1 byte*

Number of data – number of encoded data (number of records). In RUT955 codec ID is 08

Data

AVL Data ... AVL Data

AVL data – encoded data element.

AVL Data

Timestamp	Priority	GPS Element	IO Element
8 Bytes	*1 Byte*	*15 Bytes*	*...*

Timestamp – difference, in milliseconds, between the current time and midnight, January 1, 1970 UTC.

Priority

0	low
1	High
2	Panic
3	Security

GPS Element

Longitude	Latitude	Altitude	Angle	Satellites	Speed
4 Bytes	*4 Bytes*	*2 Bytes*	*2 Bytes*	*1 Byte*	*2 Bytes*

```
X           Longitude
Y           Latitude
Altitude    In meters above sea level
Angle        In degrees, 0 is north, increasing clock-wise
Satellites  Number of visible satellites
Speed        In km/h. 0x0000 if GPS data is invalid
```

Longitude and latitude are integer values built from degrees, minutes, seconds and milliseconds by formula:

```
d            Degrees
m            Minutes
s            Seconds
ms           Milliseconds
p            Precision (10000000)
```

If longitude is in west or latitude in south, multiply result by –1. To determine if the coordinate is negative, convert it to binary format and check the very first bit. If it is 0, coordinate is positive, if it is 1, coordinate is negative. Example:

Received value: 20 9c ca 80

Converted to BIN: 00100000 10011100 11001010 10000000 first bit is 0, which means coordinate is positive

Convered to DEC: 547146368

For more information see two‘s compliment arithmetics.

I/O Element

I/O elements (sent to server only if enabled)			
Property ID	Property Name	Bytes	IO Element
1	Digital Input Status 1	1	Logic: 0/1
2	Digital Input Status 2	1	Logic: 0/1
9	Analog Input 1	2	Voltage: mV, 0 - 30 V
21	GSM level	1	GSM signal level value in scale 1 - 5

Example

```
Received data:
08040000015C1A473FC0000E3BD4A520B53DC3005701670700000004030201010015040109158500000000015C1A475348000E3BD4AE20B53DC0005701670800000004030201010015040109158500000000015C1A4766D0000E3BD4AE20B53DBF00570167080000000403020101001504010915850000000015C1A477A58000E3BD4B120B53DBD0057016708000000040302010100150401091585000000004
```

```
08 – Codec ID
           04 - Number of Data (4 records)
                       1st record data
                           0000015C1A473FC0 – Timestamp in milliseconds
(1495089496000 → 1495089496,000 in Unix Timestamp = 18 May 2017 06:38:16 UTC)
                           00 – Priority

                           GPS Element
                           0E3BD4A5 – Longitude 23.8802085 = 23.8802085 º N
                           20B53DC3 – Latitude 54.8748739 = 54.8748739 º E
                           0057 – Altitude 87 meters
                           0167 – Angle 359º
                           07 – 7 Visible satellites
                           0000 – 0 km/h speed

                           I/O Element
                           00 – IO element ID of Event generated (in this
case when 00 – data generated not on event)
                           04 – 4 IO elements in record
                           03 – 3 IO elements, which length is 1 Byte
                           02 – IO element ID = 02
                           01 – 2’nd IO element’s value = 1
                           01 – IO element ID = 01
                           00 – 1’st IO element’s value = 0
                           15 – IO element ID = 21
                           04 – 21’nd IO element’s value = 4
                           01 – 1 IO element, which value length is 2 Bytes
                           09 – 1 IO element ID = 09
                           1585 – 9’th IO element’s value = 5509
                           00 – 0 IO elements, which value length is 4 Bytes
```

00 – 0 IO elements, which value length is 8 Bytes

2’nd record data

0000015C1A475348000E3BD4AE20B53DC00570167080000000403020101001504010915850000

3’d record data

0000015C1A4766D0000E3BD4AE20B53DBF00570167080000000403020101001504010915850000

4’th record data

0000015C1A477A58000E3BD4B120B53DBD00570167080000000403020101001504010915850000

04 – Number of Data (4 records)

Sending data over TCP/IP

AVL data packet

AVL packet is used to encapsulate AVL data and send it to server.

Four zeros	Data length	Data	CRC

Four zeros	Four zero bytes (0x00)
Data length	Number of bytes in data field (Integer)
Data	Any AVL data array
CRC	16bit CRC value of data (Integer). Polynomial 0xA001.

Communication with server

First when module connects to server, module sends its IMEI. IMEI is sent the same way as encoding barcode. First comes short identifying number of bytes written and then goes IMEI as text (bytes).

For example IMEI 123456789012345 would be sent as 000F313233343536373839303132333435.

After receiving IMEI, server should determine if it would accept data from this module. If yes server will reply to module 01 if not 00. Note that confirmation should be sent as binary packet.

Then module starts to send first AVL data packet. After server receives packet and parses it, server must report to module number of data received as integer (four bytes).

If sent data number and reported by server doesn’t match module resends sent data.

Example:

Module connects to server and sends IMEI:

000F313233343536373839303132333435

Server accepts the module:

01

Module sends data packet:

AVL data packet header	AVL data array	CRC
Four zero bytes, 'AVL data array' length – 254	CodecId – 08, NumberOfData – 2. (Encoded using continuous bit stream. Last byte padded to align to byte boundary)	CRC of 'AVL data array'
00000000000000FE	0802...(data elements)...02	00008612

Server acknowledges data reception (2 data elements): 00000002

SENDING DATA OVER UDP/IP

UDP channel protocol

UDP channel is a transport layer protocol above UDP/IP to add reliability to plain UDP/IP using acknowledgment packets. The packet structure is as follows:

UDP datagram			
UDP channel packet x N	Packet length	2 bytes	Packet length (excluding this field) in big endian byte order
	Packet Id	2 bytes	Packet id unique for this channel
	Packet type	1 byte	Type of this packet
	Packet payload	m bytes	Data payload

Packet Type	
1	Data packet requiring acknowledgment

Acknowledgment packet should have the same packet id as acknowledged data packet and empty data payload. Acknowledgement should be sent in binary format.

Acknowledgement packet		
Packet length	2 bytes	0x0003
Packet id	2 bytes	The same as in acknowledged packet
Packet type	1 byte	0x01

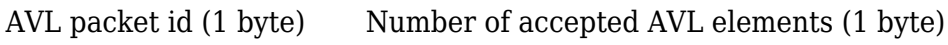
Sending AVL data using UDP channel

AVL data is sent encapsulated in UDP channel packets (Data payload field).

AVL data encapsulated in UDP channel packet


```
AVL packet id (1 byte)    id identifying this AVL packet
Module IMEI               IMEI of a sending module encoded the same as with
TCP
AVL data array            array of encoded AVL data
```

Server response to AVL data packet



AVL packet id (1 byte) – id of received AVL data packet

Number of AVL data elements accepted (1 byte) – number of AVL data array entries from the beginning of array, which were accepted by the server.

Scenario:

Module sends UDP channel packet with encapsulated AVL data packet (Packet type=1).

Server sends UDP channel packet with encapsulated response (Packet type=1).

Module validates AVL packet id and Number of accepted AVL elements. If server response with valid AVL packet id is not received within configured timeout, module can retry sending.

Example:

Module sends the data:

UDP channel header	**AVL packet header**	**AVL data array**
Len – 253, Id – 0xCAFE, Packet type – 01	AVL packet id – 0xDD, IMEI – 1234567890123456	CodecId – 08, NumberOfData – 2. (Encoded using continuous bit stream)
00FDCAFE01	DD000F3133343536373839303132333435	0802...(data elements)...02

Server must respond with acknowledgment:

UDP channel header	**AVL packet acknowledgement**
Len – 5, Id – 0xCAFE, Packet type – 01	AVL packet id – 0xDD, NumberOfAcceptedData – 2
0005CAFE01	DD02