Protocol for S-911 Series of GPS Tracking Product

Version 1.00

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LAIPAC TECH

Release History

Revision	date	Content	Author
1.00	2010/09/01	It is initial release and based on a. Extended S911/Starfinder Protocol V1.00 (Aug. 16, 2010) b. S911 Bracelet Locator Communication Protocol V1.02 (June 8, 2010)	**MF** **Gao** **Tony**

Note:

The Typical S911 series of GPS tracking product includes

a. S911 Personal Locator - V3 (S911-V3), whose latest released firmware version is V1.50E

b. S911 Bracelet Locator (Bracelet-V1.xx), whose latest released firmware version is V1.37

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Introduction

This communication protocol is being used between Location Based Service Server (LBS Server or Server) and Laipac's new S911 series of GPS tracking products (unit), such as 911 Bracelet Locator (Bracelet V1.xx). This document aims to aid the development of LBS Server application program.

The communication channel between unit and Server can select GPRS network, or SMS. This protocol aims at GPRS network and TCP/IP protocol. As a supplement and back-up mechanism, most of command sets also can be used when unit is under SMS communication mode.

The command sets of this protocol can be categorized into the following 4 classes

● Request

● Configuration

● Control

● Extended

Table A shows some typical command sets belonging to different classes above.

In most of cases, Server is in charge of initiating command set sequence and unit responds it. But under the following 3 situations, the command set sequence will be initiated from unit side

● Unit reports its position/way point to Server according to the preset time or distance interval.

● When certain event has been trigged on unit and reported to the server, such as, SOS button being pressed, Sever should send acknowledgement back to unit.

● Unit actively queries if its GPRS connection with Server is still active. Sever should respond when it receives this kind of inquiry.

Fig. A shows user how

● Server develops connection with unit and complete registration procedure

● Server handles a regular position event report and a SOS event report from a unit

● Unit and Sever work together to keep their GPRS connection active. When communication channel is based on GPRS network, if there is no data transmitting/receiving activities on this channel during a certain time interval, such as, several hours, the carrier of GPRS network will cut off this channel. This idle period of time is called TCP/IP time out and it varies by carrier.

To further help user understand and experience how this protocol is being used in Laipac's tracking products, Laipac has developed a protocol analyzer even though it aims at the Server application programming and firmware development of Bracelet product. Find its details in "Bracelet protocol V1.XX analyzer user manual".

Command Clarification	CMD No.	Description	Sending/Receiving Command Sets between Server and BL unit	End Indicator	
Request	1	Request system information	**Send:** $AVREQ, ?*CHKSUM **Receive:** $AVSYS, UnitID, Firmware Version, Serial No, Memory Size* CHKSUM	0x0D	0x0A
	3	Request unit's current position	**Send:** $AVREQ, PSW, 1* CHKSUM **Receive:** $AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator, Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, Current Mileage, GPS on/off, Analog Port 1, Analog Port 2* CHKSUM	0x0D	0x0A
	8	Request current Phone Number	**Send:** $AVREQ,PSW,9*CHKSU **Receive:** $AVPHN, Unit ID, Phone0, Phone1, Phone2, Phone3*CHKSUM	0x0D	0x0A
Configuration	12.1	Set Phone Number	**Send:** $AVCFG, PSW, h, Phone0, Phone1, Phone2, Phone3, Time Interval, Distance Interval, Report Event Mask* CHECKSUM **Receive:** $AVCOM, Unit ID, Phone0, Phone1, Phone2, Phone3, Time Interval, Distance Interval, Report Event Mask* CHECKSUM	0x0D	0x0A
	14	Set Mileage and Speed Limit	**Send:** $AVCFG, PSW, 5, Set Mileage Value, Set Speed Limits Value* CHKSUM **Receive:** $AVMST, Unit ID, Mileage Value Confirmed, Speed Limits Value Confirmed*CHKSUM	0x0D	0x0A
		No condition Reset Devices	**Send:** $AVRESET, Unit ID, PSW* CHKSUM	0x0D	0x0A
Extended	54	End to End Checking	**Receive:** $ECHK, Unit ID, Seq No*CHKSUM (Unit sends to Server) **Send:** $ECHK, Unit ID, Seq No*CHKSUM (Server responses to Unit)	0x0D	0x0A

Table A

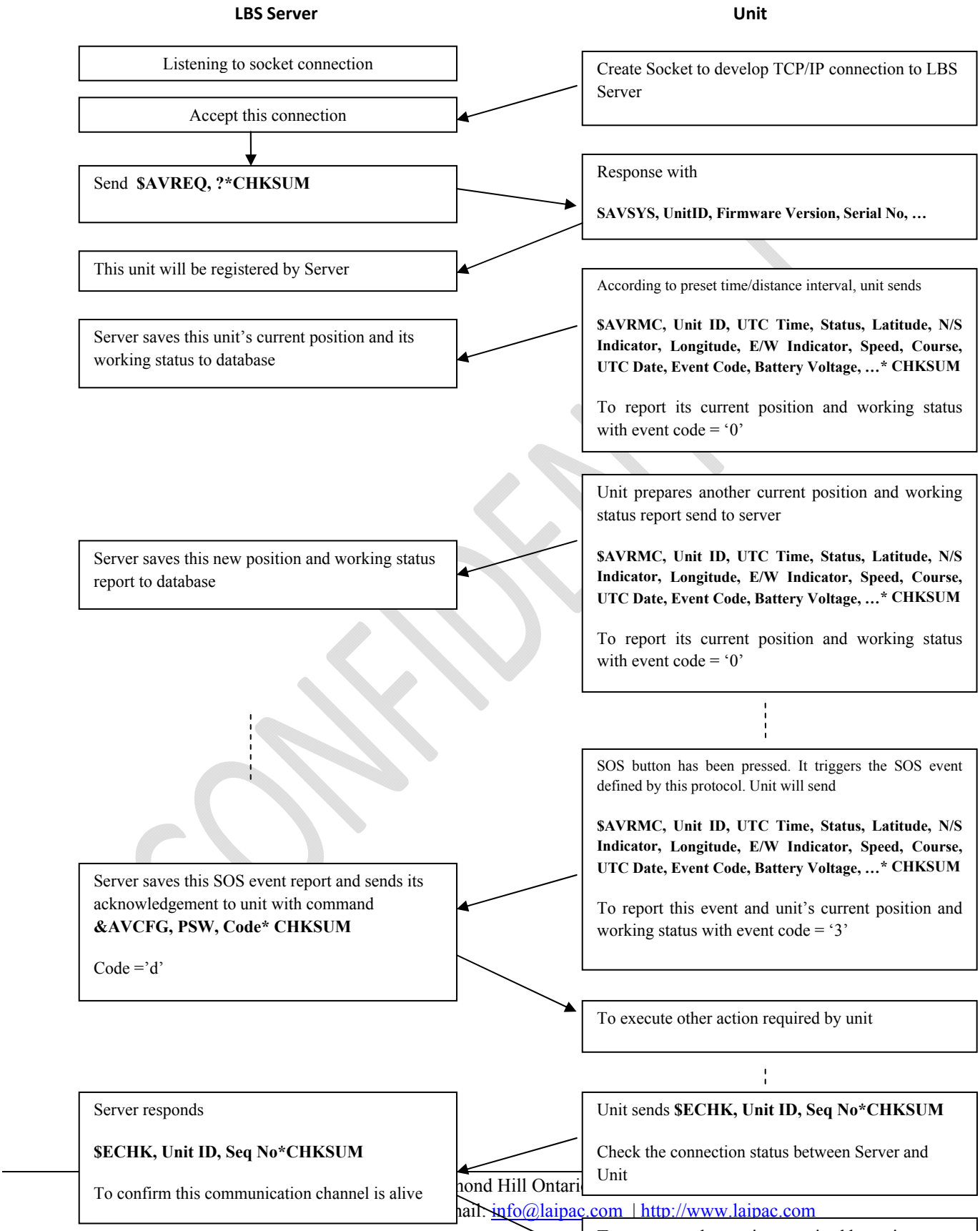

LBS Server
Unit
Listening to socket connection
Create Socket to develop TCP/IP connection to LBS Server
Accept this connection
Send $AVREQ, ?*CHKSUM
Response with
SAVSYS, UnitID, Firmware Version, Serial No, …
This unit will be registered by Server
According to preset time/distance interval, unit sends
$AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator, Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, …* CHKSUM
To report its current position and working status with event code = '0'
Server saves this unit's current position and its working status to database
Unit prepares another current position and working status report send to server
$AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator, Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, …* CHKSUM
To report its current position and working status with event code = '0'
Server saves this new position and working status report to database
SOS button has been pressed. It triggers the SOS event defined by this protocol. Unit will send
$AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator, Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, …* CHKSUM
To report this event and unit's current position and working status with event code = '3'
Server saves this SOS event report and sends its acknowledgement to unit with command &AVCFG, PSW, Code* CHKSUM
Code ='d'
To execute other action required by unit
Server responds
$ECHK, Unit ID, Seq No*CHKSUM
To confirm this communication channel is alive
Unit sends $ECHK, Unit ID, Seq No*CHKSUM
Check the connection status between Server and Unit
To execute other action required by unit

Fig. A

Overview of protocol, its related products and their communication mode

Command Set		The related products and their communication mode		
Type	**No.**	**Bracelet-V1.24**	**Bracelet-V1.35 or upper**	**S911-V3-V1.50E**
Request	1	GPRS	GPRS/SMS	GPRS/SMS
	2	GPRS	GPRS/SMS	GPRS/SMS
	3	GPRS	GPRS/SMS	GPRS/SMS
	4	GPRS	GPRS/SMS	GPRS/SMS
	5	GPRS	GPRS/SMS	GPRS/SMS
	6	GPRS	GPRS/SMS	GPRS/SMS
	7	GPRS	GPRS/SMS	GPRS/SMS
	8	GPRS	GPRS/SMS	GPRS/SMS
	8.1	GPRS	GPRS/SMS	GPRS
	9	GPRS	GPRS/SMS	GPRS/SMS
Configuration	10	GPRS	GPRS/SMS	GPRS
	11	GPRS	GPRS/SMS	GPRS/SMS
	12	GPRS	GPRS/SMS	GPRS/SMS
	12.1		GPRS/SMS	GPRS/SMS
	13	GPRS	GPRS/SMS	GPRS/SMS
	13.1	GPRS	GPRS/SMS	GPRS/SMS
	14	GPRS	GPRS/SMS	GPRS/SMS
	15	GPRS	GPRS/SMS	GPRS
	16			GPRS/SMS
	17			GPRS/SMS
	18	GPRS	GPRS/SMS	GPRS/SMS
	18.1			GPRS/SMS
Control	20	GPRS	GPRS/SMS	GPRS/SMS
	21	GPRS	GPRS/SMS	GPRS/SMS
	22			GPRS
	24			GPRS/GSM

	25			GPRS
	27	GPRS		GPRS
	28	GPRS	GPRS/SMS	GPRS
	30	GPRS	GPRS/SMS	GPRS

Extended Command Set		The related products and their communication mode		
Type	**No.**	**Bracelet-V1.24**	**Bracelet-V1.35 or upper**	**S911-V3-V1.50E**
Multi-Geo-fence	31		GPRS/SMS	
	32		GPRS/SMS	
	33		GPRS/SMS	
	34		GPRS/SMS	
Others	54		GPRS	
	56		GPRS/SMS	

Command Format

- **Each sentence begins with a '$' and ends with a carriage return/line feed sequence (0x0D 0x0A)**
- **A checksum at the end of every sentence is mandated and must be capitalized (00~FF in hex)**
- **The checksum field consists of a '*' and two hex digits representing the exclusive OR of all characters between, but not including, the '$' and '*'**

Calculation of Check Sum

Calculation of checksums is based on the National Marine Electronics Association (NMEA) standard. This standard is supported by most GPS systems.

The format of an NMEA sentence is as follows:

$GPRMC,235947.000,V,0000.0000,N,00000.0000,E,,,041299,,*1D<Carriage return>

The checksum immediately follows the '*' (asterisk) character and is computed by taking the bit-wise Exclusive-OR of all characters between the '$' and the '*'. The checksum is reported in hexadecimal and is 1D (decimal 29) for the example sentence above.

The following standard C code demonstrates the checksum calculation.

```
#include <stdio.h>

unsigned char calc_checksum(const char *s)
{
 unsigned char result;
 result = 0;
 s++; // Skip dollar sign
 while ((*s != '*') && (*s != '\0'))
        result ^= *s++;
 return result;
}

int main()
{
 unsigned char checksum;
 checksum = calc_checksum

("$GPRMC,235947.000,V,0000.0000,N,00000.0000,E,,,041299,,*");
```

```
  printf("Checksum = %02X\n", checksum);
  return 0;
}
```

When executed, the program produces the following output: Checksum = 1D

Request Commands

1. Request System Information

Send: $AVREQ,?* CHKSUM
Receive: $AVSYS, Unit ID, Firmware Version, Serial Number, Memory Size* CHKSUM

$AVREQ Sentence
Command ID = 1 byte
CHKSUM = 2 bytes

$AVSYS Sentence
Unit ID <= 8 bytes
Firmware Version <= 5 bytes
Serial Number <=10 bytes
Memory Size <= 5 bytes
CHKSUM = 2 bytes

Example:
Send: $AVREQ,?*42
Receive: $AVSYS,99999999,V1.17,SN0000103,32768*16

2.Request Logged Data (optional)

Send: $AVREQ, PSW, 0* CHKSUM
Receive:
Unit should send all its logged data to Server, then, send the command below
$AVALL, UnitID, RESPCode, Number of Logs Sent* CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVALL Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)

Number of Data Logs sent <=3 byte (ASCII digit, range '0' to 675)

Example:
Send: $AVREQ,00000000,0*61
Receive: $AVALL,99999999,00,3*49

In this example, 3 logs were sent from the unit

3.Request Current Position

Send: $AVREQ, PSW, 1* CHKSUM
Receive: $AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator,Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, Current Mileage, GPS on/off, Analog Port 1, Analog Port 2* CHKSUM

$AVREQ Sentence
PSW = 8 bytes
CHKSUM = 2 bytes

$AVRMC Sentence
Unit ID <= 8 bytes
UTC Time <= 6 bytes
Status = 1 byte ('A', 'V' or 'R', see detail in section 3.1 -- Status)
***Latitude** <= 9 bytes (ddmm.mmmm)
N/S Indicator = N/S 1 bytes
***Longitude** <= 10 bytes (dddmm.mmmm)
E/W Indicator = E/W Indicator 1 byte
Speed <= 8 bytes
Course <= 6 bytes
UTC Date <= 6 bytes
Event Code = 1 bytes, see also next pager for detail
Battery Voltage (mV) <= 4 bytes
Current Mileage (Km) <= 7 bytes
GPS on/off <= 1 byte (1 = on, 0 = off)
Analog Port 1 (mV) <= 4 bytes (0-3000mV)
Analog Port 2 (mV) <= 4 bytes (0-3000mV)**)**
CHKSUM = 2 bytes

Note:

For product which not contain Analog Port 1 and 2, the last 2 fields can be skipped directly or by ",," as well as filled with '0'. Refer to examples below.

Example for S911-V3
Send: $AVREQ,00000000,1*60
Receive:
$AVRMC,80000551,144811,A,4351.3789,N,07923.4712,W,0.00,153.45,091107,A,,161,1*64

Example for Bracelet V1.xx
Send: $AVREQ,00000000,1*60
Receive:
$AVRMC,80000551,144811,A,4351.3789,N,07923.4712,W,0.00,153.45,091107,A,,161,1,0,0*64

Note:

Bracelet V1.xx has not any analog port at present, but as special treatment, it fills '0' in both Analog Port1 and Port2 fields.

Longitude is denoted in (dddmm.mmmm) and **Latitude** is denoted in (ddmm.mmmm). d: degree and m: minute.

3.1 $AVRMC message, Event Code and Status

$AVRMC message

Besides as a unit's response to Command -- **$AVREQ, PSW, 1* CHKSUM,** unit also can send $AVRMC sentence to Server actively as

a. a regular position/way point report, or

b. an event triggering report

Event Code

Event code is used to classify the event cause. Table 3.1 summarizes all those event codes used by current product. Here are some examples of regular position/way point report and event triggering report

For unit's Geo-fence enter event
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,X,3.727,17,1,0,0*5F

For unit's tamper detection switch open event (Bracelet V1.xx)
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,T,3.727,17,1,0,0*53

For unit's power status, this event report that unit is powered off by user, or by plugging the charger.
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,H,3.727,17,1*4F

For unit's GSM network connection, its status is just changed to roaming.
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,F,3.727,17,1*41

For unit's GSM network connection, its status is just changed back to home network.
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,E,3.727,17,1*42

For unit's G-Sensor 1 event, it reports accident/shock happened on unit
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,8,3.727,17,1,0,0*3F

For Instance Geo-fence exit event
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,7,3.727,17,1,0,0*30

For Over-speed event
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,6,3.727,17,1,0,0*31

For Geo-fence exit event
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,4,3.727,17,1,0,0*33

For SOS button pressed event
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,3,3.727,17,1,0,0*34

For SOS button pressed event (S911-V3):
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,1,3.727,17,1,0,0*36

For regular way point report
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,0,3.727,17,1,0,0*37

Event		The Related Product		
Code	**Description**	**BraceletV1.xx**	**S911-V3**	
X	Geo-fence enter alert	●		
T	Tamper detection switch is open alert	●		
S	Tamper detection switch is close alert	●		
H	Unit is powered off or charger is plugged in	●	●	
F	GSM connection changed to roaming	●	●	
E	GSM connection back to home network	●	●	
8	G-Sensor alert 1	●	●	
7	Instance Geo-fence exit alert	●	●	
6	Over speed alert	●	●	
4	Geo-fence exits alert	●	●	
3	Panic/SOS button pressed alert	●		
1	SOS button pressed alert		●	
0	Regular report	●	●	

Table 3.1 Event Code and its related product

Note:

● Indicate this Event Code has been implemented in its related product

Status

Technically speaking, unit's position, speed and other instant information are either directly gotten from or calculated based on those data provided by its internal GPS device. Sometimes, due to unit's actual GPS signal receiving condition becoming worse, unit is not able to acquire this group of real time information from the GPS device.

Status field is used to identify if a waypoint or event triggering report coming with real time position as well as other information provided by GPS device or not.

Among "**$AVRMC, …**" message, the following fields are directly from or based on unit's GPS device

Latitude <= 9 bytes (ddmm.mmmm)
N/S Indicator = N/S 1 bytes
Longitude <= 10 bytes (dddmm.mmmm)
E/W Indicator = E/W Indicator 1 byte
Speed <= 8 bytes
Course <= 6 bytes
Current Mileage (Km) <= 7 bytes

The following fields are not dependent on GPS device and provided by unit directly

Battery Voltage (mV) <= 4 bytes
GPS on/off <= 1 byte (1 = on, 0 = off)
Analog Port 1 (mV) <= 4 bytes (0-3000mV)
Analog Port 2 (mV) <= 4 bytes (0-3000mV)

The 2 fields below, being used as Time Stamp for all "**$AVRMC, …**" message, are very special. They can be provided by GPS devices or by unit's own real time clock.

UTC Time <= 6 bytes
UTC Date <= 6 bytes

The selection of timer resources is decided by the value below of "**Status**" field.

'A': The position, speed, course and Current Mileage are real time data, based on GPS device. UTC Time and Date are provided by GPS device

'V': Since unit is powered on or reset, it is not able to get the meaningful position, speed, course information from its GPS device. Normally, at this time, unit should be under very bad GPS signal receiving condition. The values in all those fields based on GPS device are invalid. UTC Time and Date are provided by unit own real time clock. It is the time when waypoint or event triggering report is generated.

'R': The position, speed, course and Current Mileage are not real time data, based on GPS device. As reference, the last time meaningful group of real time data based on GPS device is repeated here. UTC Time and Date are provided by unit own real time clock. It is the time when waypoint or event triggering report is generated.

4. Request Current Status

Send: $AVREQ, PSW, 2* CHKSUM
Receive: $AVSTS, Unit ID, Geo-fence, Panic, Opto2, Opto1, Relay2, Relay1* CHKSUM

$AVREQ Sentence
PSW = 8 bytes
CHKSUM = 2 bytes

$AVSTS Sentence
Unit ID <= 8 bytes
Geo-fence = 1 byte (0 /1: exit Geo-fence; 2: enter Geo-fence; 3: enter/exit Geo-fence; 4: disable)
Panic = 1 byte (0 is no input, 1 is with input)
Opto2 = 1 byte (0 is no input, 1 is with input)
Opto1 = 1 byte (0 is no input, 1 is with input)
Relay2 = 1 byte (0: =off; 1=on)
Relay1 = 1 byte (0: =off; 1=on)
CHKSUM = 2 bytes

Example:
Send: $AVREQ,00000000,2*63
Receive: $AVSTS,99999999,1,0,0,0,0,0*6E

Note

1. For new S911 series of products, Input/Opto1, Input2/Opto2, Relay1 and Relay2 fields should be filled '0'
2. For Bracelet with V1.35 and upper, because it has implemented the multi-geo-fence function, **Geo-fence** field become uncertain. It is suggested that this command set should not be used, in LBS Server's application program, to check Bracelet's Geo-fence setting status.

5. Request Current Settings

Send: $AVREQ, PSW, 3* CHKSUM
Receive: $AVSET, Unit ID, Log Time Interval, Log Dist Interval, Log Event Mask, Report Time Interval, Report Dist Interval, Report Event Mask, GeoCentLat1, GeoCentLon1, GeoDeviation1, *GeoCentLat2, GeoCentLon2, GeoDeviation2 CHKSUM**

$AVREQ Sentence
PSW = 8 bytes
CHKSUM = 2 bytes

$AVSET Sentence
Unit ID <= 8 bytes
Log Time Interval <= 4 bytes
Log Dist Interval <= 4 bytes
Log Event Mask = 2byte
Report Time Interval <= 4 bytes **Report**
Dist Interval <= 4 bytes
Report Event Mask =2 byte
GeoCentLat 1, *2* <= 10 bytes (ddmm.mmmm)
GeoCentLon 1, *2* <= 11 bytes (dddmm.mmmm)
GeoDeviation 1, *2* <= 5 bytes (in meters)
CHKSUM = 2 bytes

Note:

1. The Geo-fence here is circular in shape
2. GeoCentLat1, GeoCenLon1 and GeoDeviation1 used for Geo-fence 1
   GeoCentLat2, GeoCenLon2 and GeoDeviation2 used for Geo-fence 2
   See the definition of Geo-fence 1 or 2 in Table 5 below
3. For Log/Report Event Mask definition, refers to Command 12
4. For Bracelet with V1.35 and upper, because it has implemented the multi-geo-fence function, GeoCentLat1, GeoCenLon1 and GeoDeviation1 no longer be used, these fields will be filled with '0' in unit's response sentence

Example:
Send: $AVREQ,00000000,3*62
Receive: $AVSET,99999999,60,1000,15,60,1000,15,0,0,0,,,*49

Product	Geo-fence 1	Geo-fence 2
S911 V3	Normal Geo-fence	Instant Geo-fence
Bracelet V1.24	Normal Geo-fence	Instant Geo-fence
Bracelet V1.35 or upper	NA	Instant Geo-fence

Table 5

6. Request Current Mileage and Speed Limits

Send: $AVREQ, PSW, 4* CHKSUM
Receive: $AVMLG, Unit ID, Current Mileage, Current Speed Limit* CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVMLG Sentence
Unit ID <= 8 bytes
Mileage <= 7 bytes
Speed Limit <= 4 bytes
CHKSUM = 2 bytes

Example:
Send: $AVREQ,00000000,4*65
Receive: $AVMLG,99999999,1234567,123*7D

7. Request and Clear Logged Data

Send: $AVREQ, PSW, 5* CHKSUM
Receive:
Unit should send all its logged data to Server, send the command below and erase all those logged data from its memory
$AVALL, UnitID, RESPCode, Number of Logs Sent* CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVALL Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)

Number of Data Logs sent <= 3 bytes (range '0' to 675)
CHKSUM = 2 bytes

Product	Number of Data Logs sent
S911-V3	0 ~ 675
Bracelet – V1.xx	0 ~ 675

Table 5

Example:

Send: $AVREQ,00000000,5*64 (sent by Server)

After receiving the command above, unit may send out 3 sets of logged data below

Receive:
$AVRMC,99999999,164339,A,4351.0542,N,07923.5445,W,0.29,78.66,180703,0,3.727,17,1,0,0*37
Receive: $AVRMC, …. **(omit)**
Receive: $AVRMC, …. **(omit)**

Then unit will send the command below to Server and erase those 3 sets of logged data from its memory

Receive: $AVALL,99999999,00,*3*49

8. Request Current Phone Number

Send: $AVREQ,PSW,9*CHKSUM
Receive: $AVPHN, Unit ID, Phone0, Phone1, Phone2, Phone3*CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVPHN Sentence
Unit ID <= 8 bytes
Phone0 <= 16 or 31 bytes
Phone1 <= 16 or 31 bytes
Phone2 <= 16 or 31 bytes
Phone3 <= 16 or 31 bytes
CHKSUM = 2 bytes

Phone0 – SMS Base station phone No.
Phone1 - Arbitrary phone No. 1 (such as, Father's phone No.)
Phone2 - Arbitrary phone No. 2 (such as, Mother's phone No.)
Phone3 - SOS service center phone No.

Product	Maximum Bytes			
	Phone0	Phone1	Phone2	Phone3
S911 V3 1.50d2 and earlier	16	16	16	16
S911 V3 1.50D3 and later	16	16	16	16
Bracelet V1.xx	31	31	31	31

Example:

Send: $AVREQ,00000000,9*68
Receive: $AVPHN,99999999,+1234567890,0023456789,+1234567890,00123456789*5C

8.1 Delete All Logged Data

Send: $AVREQ, PSW, 8* CHKSUM
Receive: $AVDEL, Unit ID*CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVDEL Sentence
Unit ID <= 8 bytes
CHKSUM = 2 bytes

Example:

Send: $AVREQ,00000000,8*69
Receive: $AVDEL,99999999*76

9. Request GPRS Parameters

Send: $AVREQ, PSW, 7* CHKSUM
Receive: $AVPAR, Unit ID, APN, Username, Password, TCP Server, Port, DNS 1, DNS 2* CHKSUM

$AVREQ Sentence
PSW <= 8 bytes
CHKSUM = 2 bytes

$AVPAR Sentence
Unit ID <= 8 bytes
APN <= 32 char
Username <= 15 or 31chars
Password <= 15 or 31 chars
TCP Server <= 15 or 31 chars
Port <= 5 char (0-99999)
DNS 1, DNS 2 <= 15 chars (255.255.255.255)
CHKSUM = 2 bytes

Example:

Send: $AVREQ,00000000,7*66
Receive: $AVPAR,88888888,internet.fido.ca,fido,fido,laipgw1.com,1688,209.148.64.42,207.136.100.41*03

Product (support this command)	Username (byte)	Password (byte)	TCP Server (byte)
S911-V3 early version	15	15	15
S911-V3-1.50E	31	31	31
Bracelet V1.24/V1.25	15	15	15
Bracelet V1.26 or later	31	31	31

Table 9 Product and the field definition of its APN setting

Configuration Commands

10. Data Logging Configuration

Send: $AVCFG, PSW, 1, Time Interval, Dist Interval, Log Event Mask* CHKSUM
Receive: $AVLOG, Unit ID, Time Interval, Dist Interval, Log Event Mask* CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Time Interval <= 5 bytes (1 - 99999, 0 for disable)
Dist Interval <= 5 bytes (1 - 99999, 0 for disable)
Log Event Mask = 2 byte
CHKSUM = 2 bytes

$AVLOG Sentence
Unit ID <= 8 bytes
Time Interval = 5 bytes
Dist Interval = 5 bytes
Log Event Mask = 2 byte
CHKSUM = 2 bytes

Note: See also Command 12 for Log Event Mask Definition.

Example:
Send: $AVCFG,00000000,1,60,1000,15*4B
Receive: $AVLOG,99999999,60,1000,15*50

11. Login Account Registration Configuration

Send: $AVCFG, PSW, 2, New UNIT ID, New PSW* CHKSUM
Receive: $AVREG, Unit ID, New PSW * CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
New UNIT ID <= 8 bytes
New PSW <= 8 bytes
CHKSUM = 2 bytes

$AVREG Sentence
New UNIT ID <= 8 bytes
New PSW <= 8 bytes
CHKSUM = 2 bytes

Example:
Send: $AVCFG,00000000,2,LAIPAC01,11111111*70
Receive: $AVREG, LAIPAC01, 11111111*50

12. Send Message Configuration (not recommended)

Send: $AVCFG, PSW, 3, *Phone0/Phone3, Phone1, Phone2*, Time Interval, Distance Interval, Report Event Mask*CHKSUM
Receive: $AVCOM, Unit ID, *Phone0/Phone3, Phone1, Phone2*, Time Interval, Distance Interval, Report EventsMask* CHKSUM

$AVCFG Sentence
PSW<= 8 bytes
Phone0/Phone3 <= 16 or 31 bytes
Phone1 <= 16 or 31 bytes
Phone2 <= 16 or 31 bytes
Time Interval <= 5 bytes
Dist Interval <= 5 bytes
Report Events Mask = 2byte
CHKSUM = 2 bytes

$AVCOM Sentence
Unit ID <= 8 bytes
Phone0/Phone3 <= 16 or 31 bytes
Phone1 <= 16 or 31 bytes
Phone2 <= 16 or 31 bytes
Time Interval <= 5 bytes
Dist Interval <= 5 bytes
Report Events Mask = 2byte
CHKSUM = 2 bytes

Note:

For Bracelet with V1.35 or upper, this command set has been stopped to use.
Phone0 – SMS Base station phone No.
Phone1 - Arbitrary phone No. 1 (such as, Father's phone No.)
Phone2 - Arbitrary phone No. 2 (such as, Mother's phone No.)
Phone3 - SOS service center phone No.

Product	Maximum Bytes			
	Phone0	Phone1	Phone2	Phone3
S911 V3 1.50d2 and earlier	SMS/16	16	16	NA
S911 V3 1.50D3 and later	NA	16	16	SOS/16
Bracelet V1.xx	NA	31	31	SOS/31

Table 12

Example:
Send: $AVCFG,00000000,3,,,,60,2000,15*66
Receive: $AVCOM,99999999,,,,60,2000,15*7A

Definition of Report and Log Event Mask

Bit	Definition	Related product
Bit 7	Undefined	None
Bit 6		
Bit 5		
Bit 4		
Bit 3	=1, trigger on Geo-fence ➔send Geo-fence alert report to Sever	S911V3, Bracelet v1.xx
Bit 2	=1, trigger on Panic/SOS button ➔send Panic/SOS alert report to Sever	S911V3, Bracelet v1.xx
Bit 1	=1, trigger on Opto2 ➔send Opto2 event report to Sever	None
Bit 0	=1, trigger on Opto1 ➔send Opto1 event report to Sever	S911V3

Definition of Report Event Mask

Bit	Definition	Related product
Bit 7	Undefined	None
Bit 6		
Bit 5		
Bit 4		
Bit 3	=1, trigger on Geo-fence ➔log Geo-fence alert event	S911V3, Bracelet v1.xx
Bit 2	=1, trigger on Panic/SOS button ➔ log Panic/SOS alert event	S911V3, Bracelet v1.xx
Bit 1	=1, trigger on OPto2 ➔ log Opto2 event	None
Bit 0	=1, trigger on OPto1 ➔ log Opto1 event	S911V3

Definition of Logger Event Mask

Report and Log Event Mask are 2 different fields specified by this protocol. Respectively, they are used to decide if unit will execute the following actions when it is triggered by certain event.

- Send report to Server or
- Log this event to unit's internal memory

The binary indication of Report or Log Event Mask field is shown above. But in the actual command, 2 digits ASCII codes are used to stand for it. For detail, see examples below

15 (0x0f) = All event triggers active
8 (0x08) = Only Geo-fence event trigger active
0 (0x00) = Disable all trigger events

12.1 Phone Number Configuration

Send: $AVCFG, PSW, h, Phone0, Phone1, Phone2, Phone3, Time Interval, Distance Interval, Report Event Mask*CHKSUM
Receive: $AVCOM, Unit ID, Phone0, Phone1, Phone2, Phone3, Time Interval, Distance Interval, Report Events Mask* CHKSUM

$AVCFG Sentence
PSW<= 8 bytes
Phone0 <= 16 or 31 bytes
Phone1 <= 16 or 31 bytes
Phone2 <= 16 or 31 bytes
Phone3 <= 16 or 31 bytes
Time Interval <= 5 bytes
Dist Interval <= 5 bytes
Report Events Mask = 2byte
CHKSUM = 2 bytes

$AVCOM Sentence
Unit ID <= 8 bytes
Phone0 <= 16 or 31 bytes
Phone1 <= 16 or 31 bytes
Phone2 <= 16 or 31 bytes
Phone3 <= 16 or 31 bytes
Time Interval <= 5 bytes
Dist Interval <= 5 bytes
Report Events Mask = 2byte
CHKSUM = 2 bytes
Phone0 – SMS Base station phone No.
Phone1 - Arbitrary phone No. 1 (such as, Father's phone No.)
Phone2 - Arbitrary phone No. 2 (such as, Mother's phone No.)
Phone3 - SOS service center phone No.

Note:
1. Sending a space ' ' on field phone0/1/2/3 will clear the existing phone number in those correspondent fields.
2. Using '' to directly skip field phone0/1/2/3 will not change the existing phone number in those correspondent field

Example:
Send: $AVCFG,00000000,h,+1234567890,0023456789,+1234567890,00123456789,600,1000,15*13
Receive: $AVCOM,99999999,+1234567890,0023456789,+1234567890,00123456789,600,1000,15*54

Product	Maximum Bytes			
	Phone0	Phone1	Phone2	Phone3
S911 V3 1.50d2 and earlier	16	16	16	16
S911 V3 1.50D3 and later	16	16	16	16
Bracelet V1.xx	31	31	31	31

Table 12.1

13. Geo-fence Configuration

Send: $AVCFG, PSW, 4, Report Mode, CentLatitude, CentLongitude, Deviation, Mask* CHKSUM
Receive: $AVGOF, Unit ID, Current Status, Center Latitude, Center Longitude, Deviation, Mask*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Report Mode = 1byte (ASCII digit code, range 0 to 4, 0/1: report if exit Geo-fence, 2: report if enter Geo-fence; 3: report if exit/enter Geo-fence; 4: disable Geo-fence, refers to Table 13)
***CentLatitude** <= 10 bytes (ddmm.mmmm)
***CentLongitude** <= 11 bytes (dddmm.mmmm)
Deviation <= 5 bytes
Mask = 1byte (used to set both Log AND Report Event Mask, refer to Command 12)
CHKSUM = 2 bytes

$AVGOF Sentence
UNIT ID <= 8 bytes
Report Mode = 1byte (ASCII digit code, range 0 to 4, its definition refers to Table 13)
***CentLatitude** <= 10 bytes (ddmm.mmmm)
***CentLongitude** <= 11 bytes (dddmm.mmmm)
Deviation <= 5 bytes (radius in meters)
Mask = 1 byte ('1' Enable / '0' Disable unit's Geo-fence function)
CHKSUM = 2 bytes

Note:

For Bracelet with V1.35 and upper, because unit has implemented Multi-Geo-fence, it will no longer respond this command

1. *A negative (-) must be used to denote South (S) or West (W)!
2. If Mask ='1' ➔ it will result in setting both Log and Report Event Mask byte's bit3 = 1
3. For effective exit or enter Geo-fence alert settings, once those Geo-fences are triggered, they needs to be re-enabled, refer to 13.1. For exit/enter Geo-fence alert setting, it can keep active even it has been triggered before.

Example:
Send: $AVCFG,00000000,4,1,4352.0670,-07928.5180,500,1*6C
Receive: $AVGOF,99999999,1,4352.0670,-07928.5180,500,1*78

Product	Report Mode setting, its correspondent condition of Geo-fence alerting and sending Report (R)				
	0	1	2	3	4
S911-V3	within Geo-fence	Exit Geo-fence (R)	Undefined	Undefined	Undefined
Bracelet V1.xx	Exit Geo-fence (R)	Exit Geo-fence (R)	Enter Geo-fence (R)	Exit or Enter Geo-fence (R)	Disable Geo-fence

Table 13 Report Mode setting and unit's correspondent status while sending Geo-fence Alert Report

13.1 Re-enable or Disable Current Geo-fence

Send: $AVCFG, PSW, 4, Report Mode, CentLatitude, CentLongitude, Deviation, Mask* CHKSUM
Receive: $AVGOF, Unit ID, Current Status, Center Latitude, Center Longitude, Deviation, Mask*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Report Mode = 1byte (**'0'**)
CentLatitude < =10 byte (**skip by ','**)
CentLongitude < = 11 byte (**skip by ','**)
Deviation < = 5 bytes (**skip by ','**)
Mask = 1 byte ('1' Enable / '0' Disable unit's Geo-fence function)

$AVGOF Sentence
UNIT ID <= 8 bytes
Report Mode = 1byte (ASCII digit code, range 0 to 4, 0/1: report if exit Geo-fence, 2: report if enter Geo-fence; 3: report if exit/enter Geo-fence; 4: disable Geo-fence, refers to Table 13)
***CentLatitude <=** 10 bytes (ddmm.mmmm)
***CentLongitude <=** 11 bytes (dddmm.mmmm)
***Deviation <=** 5 bytes (radius in meters)
Mask = 1 byte ('1': Geo-fence re-enabled, '0': Geo-fence has been disabled)
CHKSUM = 2 bytes

Note:

For Bracelet with V1.35 and upper, because unit has implemented Multi-Geo-fence, it will no longer respond this command

1. *They are current Geo-fence settings inside of the unit
2. *A negative (-) must be used to denote South (S) or West (W),

Example:

Send: $AVCFG,00000000,4,0,,,,1*4C
Receive: $AVGOF,99999999,1,4352.0670,-07928.5180,500,1*78

14. Set Mileage and Speed Limit

Send: $AVCFG, PSW, 5, Set Mileage Value, Set Speed Limits Value* CHKSUM
Receive: $AVMST, Unit ID, Mileage Value Confirmed, Speed Limits Value Confirmed*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Set Mileage Value <= 7 bytes
Set Speed Limits Value <= 3 bytes
CHKSUM = 2 bytes

$AVMST Sentence
UNIT ID <= 8 bytes
Mileage Value Confirmed <= 7 bytes
Speed Limits Value Confirmed <= 3 bytes
CHKSUM = 2 bytes

Example:

$AVCFG,00000000,5,1234567,123*60
$AVMST,99999999,1234567,123*71

15. Set GPRS Parameters

Send: $AVCFG, PSW, c, APN, Username, Password, TCP Server, Port, DNS 1, DNS 2* CHKSUM
Receive: $AVRSP, Unit ID, RESPCode*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
APN <= 32 char
Username <= 15 or 31 char (refer to Table 15)
Password <= 15 or 31 char (refer to Table 15)
TCP Server <= 15 or 31 char (refer to Table 15)
Port <= 5 char (0-99999)
DNS 1 <= 15 (199.199.199.199)
DNS 2 <= 15 (199.199.199.199)
CHKSUM = 2 bytes

$AVRSP Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)
CHKSUM = 2 bytes

Example:

$AVCFG,00000000,c,internet.fido.ca,fido,fido,laipgw1.com,1688,209.148.64.42,207.136.100.41*4D
$AVRSP,99999999,00*46

Product (support this command)	Username (byte)	Password (byte)	TCP Server (byte)
S911-V3 early version	15	15	15
S911-V3-V1.50E	31	31	31
Bracelet V1.24	15	15	15
Bracelet V1.26 or upper	31	31	31

Table 15 Products and the definition of some fields related to them

Note

"TCP Server" here is correspondent to the primary server setting, such as, "Domain Name 1a" of Bracelet configuration utility. Other server setting can not be re-configured by using this command set.

16. Set Awake Time

Send: $AVCFG, PSW, e, Awake Time Flag* CHKSUM
Receive: $AVFLG, Unit ID, G-Sensor Flag, GPS Flag, Server Query Interval, Auto-answer Mode, Awake Flag, Sleep Flag*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Awake Time Flag <= 2 bytes (A: 10 min B: 20 min C: 30 min D: Always on)
CHKSUM = 2 bytes

$AVFLG Sentence
UNIT ID <= 8 bytes
G-Sensor Flag = 1 byte (0 = Disabled, 1 = Enabled)
GPS Flag = 1 byte (0 = GPS Receiver off, 1 = GPS Receiver on)
Server Query Setting <= 2 bytes (Server Query Interval setting in minutes)
Auto-answer mode = 1 byte (0 = Disabled, 1 = Enabled)
Awake Flag = 1 bytes (A: 10 min B: 20 min C: 30 min D: Always on)
Sleep Flag = 1 bytes (A: 30 min B: 1hour C: 2 hour D: 12 hour E: 24 hour F: never)
CHKSUM = 2 bytes

Example:
$AVCFG,00000000,e,D*58
$AVFLG,88888888,0,1,60,0,D,F*43

17. Set Sleep Time

Send: $AVCFG, PSW, f, Sleep Time Flag* CHKSUM
Receive: $AVFLG, Unit ID, G-Sensor Flag, GPS Flag, Server Query Interval, Auto-answer Mode, Awake Flag, Sleep Flag*CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Sleep Time Flag <= 2 bytes (A: 30 min B: 1hour C: 2 hour D: 12 hour E: 24 hour F: never)
CHKSUM = 2 bytes

$AVFLG Sentence
UNIT ID<= 8 bytes
G-Sensor Flag = 1 byte (0 = Disabled, 1 = Enabled)
GPS Flag = 1 byte (0 = GPS Receiver off, 1 = GPS Receiver on)
Server Query Setting <= 2 bytes (Server Query Interval setting in minutes)
Auto-answer mode = 1 byte (0 = Disabled, 1 = Enabled)
Awake Flag = 1 bytes (A: 10 min B: 20 min C: 30 min D: Always on)
Sleep Flag = 1 bytes (A: 30 min B: 1hour C: 2 hour D: 12 hour E: 24 hour F: never)
CHKSUM = 2 bytes

Example:
$AVCFG,00000000,f,F*59
$AVFLG,88888888,0,1,60,0,D,F*43

18. Feature Flag Configuration

Send: $AVCFG, PSW, Code* CHKSUM
Receive: $AVFLG, Unit ID, G-Sensor Flag, GPS Flag, Server Query Setting, Auto-answer mode, Awake Flag, Sleep Flag* CHKSUM

$AVCFG Sentence
PSW <= 8 bytes
Code <= 1 byte
CHKSUM = 2 bytes

$AVFLG Sentence
UNIT ID <= 8 bytes
G-Sensor Flag = 1 byte (0 = Disabled, 1 = Enabled)
GPS Flag = 1 byte (0 = GPS Receiver off, 1 = GPS Receiver on)
Server Query Setting <= 2 bytes (Server Query Interval setting in minutes)
Auto-answer mode = 1 byte (0 = Disabled, 1 = Enabled)
Awake Flag = 1 bytes (A: 10 min B: 20 min C: 30 min D: Always on)
Sleep Flag = 1 bytes (A: 30 min B: 1hour C: 2 hour D: 12 hour E: 24 hour F: never)
CHKSUM = 2 bytes

Code Definitions for $AVCFG Message:
? = Query current Feature Flag status
6 = Disable G-Sensor
7 = Enable G-Sensor
8 = Disable GPS Receiver (To save power)
9 = Enable GPS Receiver
a = Enable auto-answer mode
b = Disable auto-answer mode
d = Acknowledge SOS/Panic alert message from device* (S911, Bracelet v1.xx)
e = Enable monitor mode (TBD)
f = Disable monitor mode (TBD)
g = Enable Tamper Detection (TBD)
h = Disable Tamer Detection (TBD)
t = Acknowledge Tamper Detection alert message from device** (Bracelet v1.xx only)
x = Acknowledge Geo-fence alert message from device*** (Bracelet v1.xx only)

Example:

Send: $AVCFG,00000000,7*62 (Ask unit to enable G-sensor)
Receive: $AVFLG,99999999,1,1,60,1,D,F*43

(It is confirmed by unit that G-Sensor enabled, GPS Receiver on, Server Query at 60 minutes, Auto-answer on, Always on, Never sleep)

Note:

1. Besides using Command Set 18 to set up some important features of the unit, Server also can use "**$AVCFG, …"**sentence as its acknowledgement when it receives Tamper Detection, SOS, Panic and Geo-gence alert messages from S911 V3/V4, Bracelet V1.xx.

2. **For Bracelet, when Tamper Detection (Command 3 with event code = 'S' or 'T') alert message is received, Server should reply with code 't' to acknowledge this message. If the unit is not able to get this response sent by server in the specified time interval, it should send this Tamper Detection alert message repeatedly until it gets "**$AVCFG, …"**sentence with code 't'

3. *For S911 V3 when SOS (Command 3 with event code = '1') alert message is received, the server should reply with code 'd' to acknowledge the message. If unit is not able to get this response sent by server, the unit will continue sending the SOS alert message every 10 seconds for 1 minute.

4. *For Bracelet, when SOS (Command 3 with event code = '3') alert message is received, the server should reply with code 'd' to acknowledge the message. If the unit is not able to get this response sent by server in the specified time interval, it should send this Tamper Detection alert message repeatedly until it gets "**$AVCFG, …"**sentence with code 'd'

5. ***For Bracelet, when Geo-fence (Command 3 with event code = '4', or 'X') alert message is received, Server should reply with code 'x' to acknowledge the message. If the unit is not able to get this response sent by server in the specified time interval, it should send this Tamper Detection alert message repeatedly until it gets "**$AVCFG, …"**sentence with code 'x'

18.1 Extended Event Report (S911-V3 Only)

Receive: $AVEVN, Unit ID, Extended Event Code, Value 0, Value 1* CHKSUM
or: $AVEVN, Unit ID, Extended Event Code, Value 0, Value 1,Value2* CHKSUM
or: $AVEVN, Unit ID, Extended Event Code, OnOff, Reason* CHKSUM

$AVEVN Sentence
Unit ID<= 8 bytes
Extended Event Code = 1 byte (8 for G-Sensor 2D or 3D event, I for stop GPS by saving power)
Value 0 <= 4 byte (Acceleration in x-axis) (Reserved)
Value 1< = 4 byte (Acceleration in y-axis) (Reserved)
Value 2< = 4 byte (Acceleration in z-axis) (Reserved)
OnOff = 1 byte (0 - Off, 1- On)
Reason = 1 byte (Reserved)
CHKSUM = 2 bytes

Note

1. If the G-Sensor is enabled, when there is an extreme horizontal or vertical acceleration/deceleration happened on the S911-V3 unit, it will actively send Sever

   a. An **"$AVRMC, …"** G-sensor event report with event code '8', and
   b. An "**$AVEVN, Unit ID, Extended Event Code, Value 0, Value 1,Value2* CHKSUM**" extended event report with extended event code '8'

2. For certain customized application based on S911-V3, when unit stops/starts GPS module to enter/leave the defined GPS power saving mode, unit may send a "**$AVEVN, Unit ID, Extended Event Code, OnOff, Reason* CHKSUM"** with extended event code 'I' to inform Server.

   a. with event code '8' to indicate an accident alert
   b. with event code 'Y' to indicate an towering alert

Control Commands

20. Switch Modem Mode

Send: $AVCTL, PSW, 3, Modem Mode* CHKSUM
Receive: $AVMOD, UNIT ID, 3, 0/1* CHKSUM

$AVCTL sentence
PSW <= 8 bytes
Modem Mode = 1 byte (0 = SMS mode, 1 = GPRS mode)
CHKSUM = 2 bytes

$AVMOD Sentence
UNIT ID <= 8 bytes
Modem Mode = 1 byte (0 = SMS mode, 1 = GPRS mode)
CHKSUM = 2 bytes

Example:

Switching from SMS Mode to GPRS Mode:

Send: ***$AVCTL,00000000,3,1*62***
Receive: ***$AVMOD,99999999,3,1*7F***

Switching from GPRS Mode to SMS Mode:

Send: ***$AVCTL,00000000,3,0*63***
Receive: ***$AVMOD,99999999,3,0*7E***

21. Set Default Modem Mode

Send: $AVCTL, PSW, 4, Modem Mode* CHKSUM
Receive: $AVMOD, UNIT ID, 4, S/G* CHKSUM

$AVCTL sentence
PSW <= 8 bytes
Modem Mode = 1 byte (S = SMS mode, G = GPRS mode)
CHKSUM = 2 bytes

$AVMOD Sentence
UNIT ID <= 8 bytes
Modem Mode = 1 byte (S = SMS mode, G = GPRS mode)
. **CHKSUM** = 2 bytes

Example:
Setting GPRS as default modem mode
Send: ***$AVCTL,00000000,4,G*13***
Receive: ***$AVMOD,99999999,4,G*0E***

Setting SMS as default modem mode
Send: ***$AVCTL,00000000,4,S*07***
Receive: ***$AVMOD,99999999,4,S*1A***

22. Stop GSM connection until GPS is fixed or Time is Expired

Send: $AVCTL,PSW,5,Time*CHKSUM
Receive: $AVMOD,UNIT ID, 5,Time*CHKSUM

$AVCTL sentence
PSW <= 8 bytes
Time = 2 byte (minute)
CHKSUM = 2 bytes

$AVMOD Sentence
UNIT ID <= 8 bytes
Time = 2 byte
CHKSUM = 2 bytes

Example:
Send: $AVCTL,00000000,5,2*67
Receive: $AVMOD,99999999,5,2*7A

24. Stop reporting if GPS is off

Send: $AVCTL, PSW, 7, Enable/Disable* CHKSUM
Receive: $AVMOD, UNIT ID, 7, 0/1* CHKSUM

$AVCTL sentence
PSW <= 8 bytes
Enable/Disable = 1 byte (0 = Disable, 1 = Enable)
CHKSUM = 2 bytes

$AVMOD Sentence
UNIT ID <= 8 bytes
Enable/Disable = 1 byte (0 = Disable, 1 = Enable)
CHKSUM = 2 bytes

Example:
Stop reporting:
Send: ***$AVCTL,00000000,7,1*66***
Receive: ***$AVMOD,99999999,7,1*7B***

Keep reporting:
Send: ***$AVCTL,00000000,7,0*67***
Receive: ***$AVMOD,99999999,7,0*7A***

25. Set Power Saving Mode

Send: $AVCTL,PSW, a, Mode*CHKSUM
Receive: $AVMOD,UNIT ID, a, Mode*CHKSUM

$AVCTL sentence
PSW <= 8 bytes
Mode = 1 byte (0=Disable, 1=GPS, 2=GSM, 3=Both)
CHKSUM = 2 bytes

$AVMOD Sentence
UNIT ID <= 8 bytes
Mode = 1 byte (0=Disable, 1=GPS, 2=GSM, 3=Both)
CHKSUM = 2 bytes

Example:
Send: $AVCTL,00000000,a,3*32
Receive: $AVMOD,99999999,a,3*2F

27. Server Query for Keeping GPRS Connection

SEND: $AT*15 (sent by the unit)
Receive: $OK*04 (responded by the Server)

Server Query and its usage

Server Query operation procedure is being used to check if the communication between unit and Server/Gateway to be alive. Once this time interval parameter is set to 'n' minutes, unit will send a specified message, **$AT*15**, to Server n-minutes after the last message from the server was received. Once received, Server should respond with message, **$OK*04**. This will reset the unit's internal timer (such as Server Query Interval) setting for Server Query. If the unit does not receive the response message within certain time interval, for example 3 minutes, it will disconnect from the server and attempt to re-develop connection. This feature is only useful for GPRS communication to prevent a device from being accidentally disconnected by the network without notifying the server which may cause a break in communication. A typical setting may be 30 or 60 minutes but is configurable from 1-99 minutes. This is independent of the regular message reporting interval. The timer will be reset when any message is received by the device.

"**Server Query**" should be set by using Configuration Utility in **minutes.**

Note:

For Bracelet with V1.35 or upper, Command Set 54 is being used to play the similar role as this command set does here. Find the detail in Section 54.

28. No Condition Reset Device

Send: $AVRESET, Unit ID, PSW* CHKSUM (sent by Server)

Example:
Send: $AVRESET,80000551,00000000*4B

30. Error Processing

Receive: $AVRSP, Unit ID, RESPCode*CHKSUM (Send to Server by unit)

$AVRSP Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)
CHKSUM = 2 bytes

Whenever unit receives a wrong command, it should respond a **$AVRSP** sentence above. Its **RESPCode** tells Server the type of error.

Extended Command Sets

Multi-geo-fence

This part includes 3 sets of command, which being used by Server to delete, set and acquire Geo-fence setting on Bracelet unit and shown in table below.

Command set	Sent /Received by Server	Description
Command set 31	Sent	Change Report Mode of all valid Geo-fences setting items
	Received	Acknowledgement to command above
Command set 32	Sent	Set one or more Geo-fences items (not more than 5 items)
	Received	Acknowledgement to command above
Command set 33	Sent	Get one Geo-fence item's setting
	Received	Response to command above
Command set 34	Sent	Change Report Mode of several valid Geo-fences setting items
	Received	Acknowledgement to command above

Definition of Multi-Geo-fence

Geo-fence setting item

Bracelet allows up to 100 items of geo-fences inside the unit. Each Geo-fence setting item is made up of 6 fields, which are separated by ‘,’. Respectively, they are “Geo-fence No.”, “Report Mode” and two groups of geomorphologic parameter (LLA coordinator). Table below gives out those fields’ definition.

Field name	Geo-fence Number	Report Mode	LLA coordinate of 1st setting point		LLA coordinate of 2nd setting point	
			Latitude	Longitude	Latitude	Longitude
No. of Byte	<= 2	1	<= 10	<= 11	<= 10	<= 11
Denotation	Digits 0 to 99	Digits 0 to 4	Digit with sign (indicate direction)	Digit with sign (indicate direction)	Digit with sign (indicate direction)	Digit with sign (indicate direction)

Table Definition of Geo-fence setting item

Geo-fence Number

Geo-fence Number is the index for each Geo-fence setting item. It is 2 digits integer with range 0 to 99, which being correspondent to Geo-fence setting item 0 to item 99.

Report Mode

It is one digit integer and used to stand for alert setting status of correspondent Geo-fence setting item.

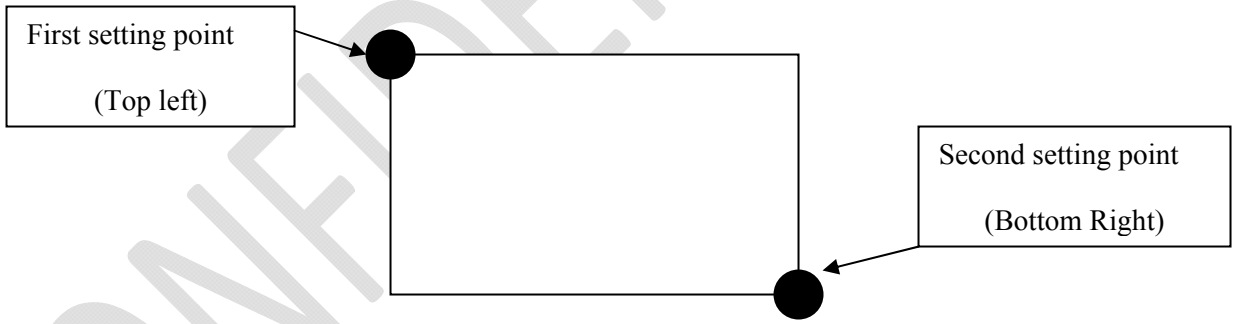
'0' → uncertain, '1'→exit alert, '2'→ enter alert, '3' → exit/enter alert, '4'→ delete

Uncertain: this Geo-fence setting item is still a valid item but its alert setting is uncertain

Delete: this Geo-fence setting item is no longer a valid item

Geo-fence setting geometry pattern

Those two groups of geomorphologic parameter (LLA coordinator) are extracted from a Geo-fence setting geometry pattern, which being defined as a rectangle shown in drawing below.



Theoretically, each rectangle can be uniquely defined by 2 end points of its diagonal. The drawing above and Table "Definition of Geo-fence setting item" above indicate how these 2 setting points' LLA coordinators are selected and to be fit into a Geo-fence setting item.

The denotation of Latitude and Longitude

For these 2 points' coordinates, their longitude is denoted in (dddmm.mmmm) and latitude is denoted in (ddmm.mmmm). d: degree and m: minute

Both longitude (dddmm.mmmm) and latitude (ddmm.mmmm) should be with sign to indicate their directions.

For latitude, north is defined as its positive direction, "+" is omitted and south is negative, "-".

For longitude, east is defined as its positive direction, "+" is omitted and west is negative, "-"

31. Change Report Mode of all valid Geo-fences setting items

Send: $EAVGOF, PSW, 2, Report Mode* CHKSUM
Receive: $EAVRSP, Unit ID, 2, RESPCode *CHKSUM

$EAVGOF Sentence
PSW <= 8 bytes
Report Mode = 1 byte ('0' → uncertain, '1'→exit alert, '2'→ enter alert, '3' → exit/enter alert, '4'→ delete)
CHKSUM = 2 bytes

$EAVRSP Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)
CHKSUM = 2 bytes

Note:

If unit is being with exit, enter or exit/enter Geo-fence alert setting, even those Geo-fences are triggered, unit can continue keep its Log and Report of Geo-fence Event Alert function active without executing any other command to re-enable. It is different from the behaviour of the previous Single Geo-Fence defined by original Laipac's S911/Starfinder protocol (Rev. 080604, 062009).

32. Set one or more Geo-fences items (not more than 5 items)

Send: $EAVGOF, PSW, 3, Total, Geo-fencei, Report Modei, Latitudei1, Longtitudei1, Latitudei2, Longtitudei2, Geo-fencej, Report Modej, Latitudej1, Longtitudej1, Latitudej2, Longtitudej2, Geo-fencek, Report Modek, Latitudek1, Longtitudek1, Latitudei2, Longtitudek2, Geo-fencel, Report Modei, Latitudel1, Longtitudel1, Latitudel2, Longtitudel2, Geo-fencem, Report Modem, Latitudem1, Longtitudem1, Latitudem2, Longtitudem2* CHKSUM
Receive: $EAVRSP, Unit ID, 3, RESPCode *CHKSUM

$EAVGOF Sentence
PSW <= 8 bytes
Total= 1 byte (digit '1' to '5')
Geo-fencei <= 2 bytes (digit '0' to "99")
Report Modei = 1 byte ('0' → uncertain, '1' →exit alert, '2' → enter alert, '3' → exit/enter alert, '4' → delete)
***Latitudei1**<= 10 bytes (ddmm.mmmm)
***Longtitudei1**<= 11 bytes (dddmm.mmmm)
***Latitudei2**<= 10 bytes (ddmm.mmmm)
***Longtitudei2**<= 11 bytes (dddmm.mmmm)
….
Geo-fencem <= 2 bytes (digit '0' to "99")
Report Modem = 1 byte ('0' → uncertain, '1' →exit alert, '2' → enter alert, '3' → exit/enter alert, '4' → delete)
***Latitudem1**<= 10 bytes (ddmm.mmmm)
***Longtitudem1**<= 11 bytes (dddmm.mmmm)
***Latitudem2**<= 10 bytes (ddmm.mmmm)
***Longtitudem2**<= 11 bytes (dddmm.mmmm)
CHKSUM = 2 bytes

$EAVRSP Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)
CHKSUM = 2 bytes

Note:

1. *A negative (-) must be used to denote South (S) or West (W)!

2. "Geo-fenceNoi, … Longtitudei2" is the setting of Geo-fence item i

3. Total --- Total items of Geo-fence under execution of this command

4. Under SMS mode, only allow set one or two item of Geo-fence

33. Get one Geo-fence item's setting

Send: $EAVGOF, PSW, 4, Geo-fencei* CHKSUM
Receive: $EAVRSP, Unit ID, 4, Geo-fencei, Report Modei, Latitudei1, Longtitudei1, Latitudei2, Longtitudei2* CHKSUM

$EAVGOF Sentence
PSW <= 8 bytes
Geo-fencei <= 2 bytes (digit '0' to "99")
CHKSUM = 2 bytes

$EAVRSP Sentence
PSW <= 8 bytes
Geo-fencei<= 2 bytes (digit '0' to "99")
Report Modei 1 byte('0' → uncertain, '1'→exit alert, '2'→ enter alert, '3' → exit/enter alert, '4'→ delete)
***Latitudei1**<= 10 bytes (ddmm.mmmm)
***Longtitudei1**<= 11 bytes (dddmm.mmmm)
***Latitudei2**<= 10 bytes (ddmm.mmmm)
***Longtitudei2**<= 11 bytes (dddmm.mmmm)
CHKSUM = 2 bytes

Note:

1. *A negative (-) must be used to denote South (S) or West (W)!

1. "Geo-fencei, … Longtitudei2" is the setting of Geo-fence item i

34. Change Report Mode of several valid Geo-fences setting items

Send: $EAVGOF, PSW, 5, Total, Geo-fencei1, …, Geo-fenceik, Report Mode* CHKSUM
Receive: $EAVRSP, Unit ID, 5, RESPCode *CHKSUM

$EAVGOF Sentence
PSW <= 8 bytes
Total = 1 byte (digit '1' to '20', which stands for total item <=20)
Report Mode = 1 byte ('0' → uncertain, '1'→exit alert, '2'→ enter alert, '3' → exit/enter alert, '4'→ delete)
Geo-fencei1, … Geo-fenceik <= 2 bytes (digit '0' to "99",)
CHKSUM = 2 bytes

$EAVRSP Sentence
Unit ID <= 8 bytes
RESPCode = 2 bytes (00: OK, 01: invalid command, 02: invalid password, 03: invalid chksum, 04: invalid parameter, 05: sentence too long)
CHKSUM = 2 bytes

Note:

1. If unit is being with exit, enter or exit/enter Geo-fence alert setting, even those Geo-fences are triggered, unit can continue keep its Log and Report of Geo-fence Event Alert function active without executing any other command to re-enable. It is different from the behaviour of the previous Single Geo-Fence defined by original Laipac's S911/Starfinder protocol (Rev. 080604, 062009)

2. **Geo-fencei1, … Geo-fenceik** is the index for those Geo-fence setting items under execution of this command, they do not need to be concessive.

3. Total --- Total items of Geo-fence under execution of this command, which should <=20

Others

54. End to End Checking (GPRS only)

Send: $ECHK, Unit ID, Seq No*CHKSUM (sent by the unit)
Receive: $ECHK, Unit ID, Seq No*CHKSUM (responded by the Server)

$ECHK Sentence

Unit ID <= 8 bytes
Seq No = 1 bytes (range '0' to '9')
CHKSUM = 2 bytes

This set of command plays the similar role as Command Set 27. Periodically, the unit can use this command set to check if its TCP/IP connection with remote LBS Server is alive.

Because this command is with Unit ID, it becomes easier for Server to implement end to end checking individually unit by unit.

Same as Command Set 27, the time interval for this "Server Query" is also set by using Configuration utility in minute.

56. Special $AVRMC Message and Serve's Acknowledgement (optional)

Receive: $AVRMC, Unit ID, UTC Time, Status, Latitude, N/S Indicator,Longitude, E/W Indicator, Speed, Course, UTC Date, Event Code, Battery Voltage, Current Mileage, GPS on/off, Analog Port 1, Analog Port 2* CHKSUM (sent by unit)

Send: $EAVACK, ACK_Code, ACK_SUM * CHKSUM (responded by Server)

$AVRMC Sentence

Definition for all other fields: see section 3
Status = 1 byte ('a', 'v' or 'r', see detail in section 56's **Extended Status Field**)

$EAVACK Sentence

ACK_Code = 1 byte (It should be the copy of Event Code field from the correspondent **$AVRMC** sentence)

ACK_SUM = 2 byte (It should be the copy of CHKSUM field from the correspondent **$AVRMC** sentence)

CHKSUM = 2 byte

Note

When Sever receives special **$AVRMC** message correspondent to Tamper Detection, SOS, Panic and Geo-fence event alert report, it should not use **$EAVACK** sentence as its acknowledgement since those alert messages above have their own acknowledgement mechanism. Refer to section 3 and section 18.

Example:

Send:$AVRMC,99999999,164339,a,4351.0542,N,07923.5445,W,0.29,78.66,180703,0,3.727,17,1,0,0*17
Receive: $EAVACK,0,17*2D

Send:$AVRMC,99999999,164339,v,4351.0542,N,07923.5445,W,0.29,78.66,180703,0,3.727,17,1,0,0*00
Receive: $EAVACK,0,00*2B

Send:$AVRMC,99999999,164339,r,4351.0542,N,07923.5445,W,0.29,78.66,180703,0,3.727,17,1,0,0*04
Receive: $EAVACK,0,04*2F

Special $AVRMC Message

As mentioned in section 3.1, unit can send **$AVRMC** sentence to Server actively as

a. a regular position/way point report, or
b. an event triggering report

To ensure those regular position/waypoint reports or event triggering reports have been received by Server, unit can send special & **$AVRMC** message which asking Server's acknowledgement.

The following event triggering report should not be included in this kind of special & **$AVRMC** message since they already have their own acknowledgement mechanism.

- Tamper Detection event alert (event code = 'S' or 'T')
- SOS event alert (event code = '3')
- Panic button event alert (event code = '3')

For Geo – fence event alert (event code = '4', '7', 'X'), only Bracelet V1.xx has acknowledgement to it. So other products are allowed to adapt the special & **$AVRMC** message to acquire Server's acknowledgement to their Geo – fence event alert reports.

Extended Status Field

The implement of Server's acknowledgement to this kind of special **$AVRMC** message is based on the value of this message's '**Status'** field, which has been re-defined according to the following definition

1. 'A' → 'a'

'A': The position, speed, course and Current Mileage are real time data, based on GPS device. UTC Time and Date are provided by GPS device
'a': Keep its original definition with 'A' and ask Server's acknowledgement

2. 'V' → 'v'

'V': Since unit is powered on or reset, it is not able to get the meaningful position, speed, course information from its GPS device. Normally, at this time, unit should be under very bad GPS signal receiving condition. The values in all those fields based on GPS device are invalid. UTC Time and Date are provided by unit own real time clock. It is the time when waypoint or event triggering report is generated.
'v': Keep its original definition with 'V' and ask Server's acknowledgement

3. 'R' → 'r'

'R': The position, speed, course and Current Mileage are not real time data, based on GPS device. As reference, the last time meaningful group of real time data based on GPS device is repeated here. UTC Time and Date are provided by unit own real time clock. It is the time when waypoint or event triggering report is generated.
'r': Keep its original definition with 'R' and ask Server's acknowledgement