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Mobile Data Acquisition

WAVEON

W618e

Application Programming Guide

Disclaimer

May 2009

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Review and Approval

This document will be reviewed, approved, and reissued whenever significant updates have been made according to the InfoWave Pte Ltd Document Control Procedure.

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1. OVERVIEW

1.1. INTRODUCTION

Waveon 618e is an advanced vehicle tracker featuring real-time monitoring of vehicular assets with over-the-air (OTA) firmware upgrade flexibility, designed to bring benefits to fleet managers in their day-to-day operations.

Besides providing real-time tracking, Waveon 618e also provides data logging, alerts and notifications, gsensor and geo-fencing functions to meet a wide range of fleet-management solution requirements today.

Waveon 618e is built on the ARM 7 architectural platform, and utilizes leading wireless module from Cinterion, and high-sensitivity GPS module from ublox to provide reliable and efficient real-time monitoring and control of fleets, while at the same time, to improve vehicle and driver safety.

It is suitable for all types of private and commercial vehicles on the road. Featuring a compact and streamlined design that allows for quick and easy installation, Waveon 618e can be easily mounted under the dashboard console or even under the seats for covert installations.

This documentation serves as a guide for application programmers with step-by-step instructions for physical product assembly, firmware configuration and Waveon user commands (WUC).

WUC is a set of proprietary commands for users to support and manage the Waveon 618e operations via the GPRS network.

Note: Waveon 618e is backward compatible with Waveon 606 vehicle tracker.

Note: Users must carry out the specific instructions highlighted in red or blue to obtain the desired results.

1.2. WAVEON 618E TECHNICAL SPECIFICATIONS

Physical Specifications	Communication & Sensor Ports
• 104mm (W) x 75mm (D) x 26mm (H) • 98g (Basic Configuration)	• 2 X Digital Input Active High/Low (9 ~ 28Vdc) • 3 x Active Low Output (Open Drain, 500mA Max Sink) • 1 x Analog ADC Inputs (0 ~ 12Vdc) • 1x External UART Interface
Performance Specifications	**GPRS Module**
• Proprietary Operating System • ATMEL ® ARM7 32Bit CPU	• Siemens MC55i Quad-Band Module • GPRS Mobile Station Class B • GPRS Multi-Slot Class 10 • SIM Interface: 1.8/3Vdc • TCP-IP/SMS Interface
Memory/Storage & OTA Specifications	**GPS Module**
• OTA Firmware Upgrade • 512KB FLASH, 64KB RAM	• U-Blox High Sensitivity LEA-5S • 50-Channel Positioning Engine • Module Circular Accuracy Position: 2.5m CEP (50%); <7.5m 2DRMS (95%) • Module Tracking Sensitivity: -160dBm • Module Reacquisition Sensitivity: -160dBm • Module Cold Start Sensitivity: -144dBm • Start Time*: Hot: 3sec/Warm: 35sec/ Cold: 35sec * Outdoor with open sky
System Indicators	**Packing List**
• GPS LED: 1sec Blink GPS Fix • GPRS LED: 1sec Blink GPRS Network Connected	• 1 x Waveon 618e Mobile Data Acquisition • 1 x GPS Antenna • 1 x GPRS Antenna • 1 x Cable Expansion • **1 x Programming Cable (Optional)***
Power Specifications	
• External Power Directly from Vehicle Fuse Box: 9 ~ 28Vdc • GPS Active, GPRS Active Transmission: 100mA (average) @12Vdc • GPS Active, GPRS Idle: <60mA @12Vdc • GPS Idle, GPRS Idle: <30mA @12Vdc	***Please consult with our Regional Sales Manager if you require these items.**

2. PRODUCT INSTALLATION GUIDE

A typical deployment scenario is shown below in Fig 1.0. This scenario illustrates how Waveon 618e can be configured or interfaced with various devices and the backend server.

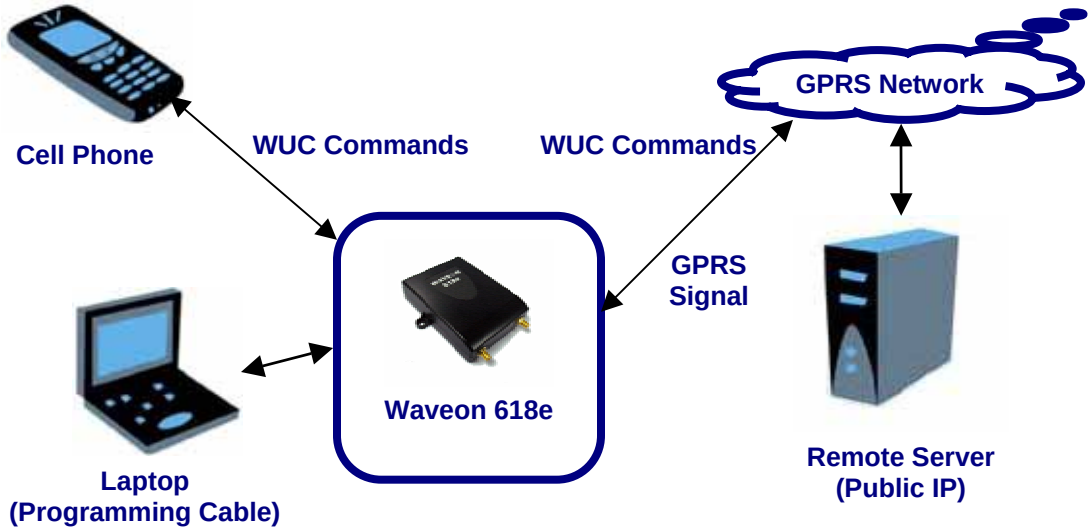


Fig 1.0. Waveon 618e Typical Deployment Scenario

This documentation will guide users with steps for the following:

- Physical assembly and setup,
- Firmware installation,
- Waveon 618e firmware configuration via programming cable, and
- Waveon 618e configuration via WUC commands.

2.1. PRODUCT COMPONENTS

The picture below shows the standard components required for product assembly and firmware configuration.

Fig 2.0. Product Components of Waveon 618e

	Components	Specific Parts	Remarks
A	SIM Card		Not included in the standard packing list.
B	Waveon 618e		
C	GSM/GPRS Antenna		Comes with sticky tape for easier installation.
D	GPS Antenna		Comes with a magnet for easier installation. You can use a sticky tape if necessary.
E	25-pin Connector (See Appendix B for detail PIN description)	Programming Cable	Not included in the standard packing list but it can be purchased from InfoWave.
F	RS232 Connector (connect to PC COM port)		
G	12-volt Power Cables		
H	Other input/output signal cables		

I	Micro SD Card		Not included in the standard packing list.

2.2. PRODUCT ASSEMBLY

The following steps will illustrate how to assemble product together. Please note that a Phillips screwdriver is needed before proceeding with the assembly.

2.2.1. SIM CARD INSERTION

Insert the SIM card into the SIM card holder as indicated.

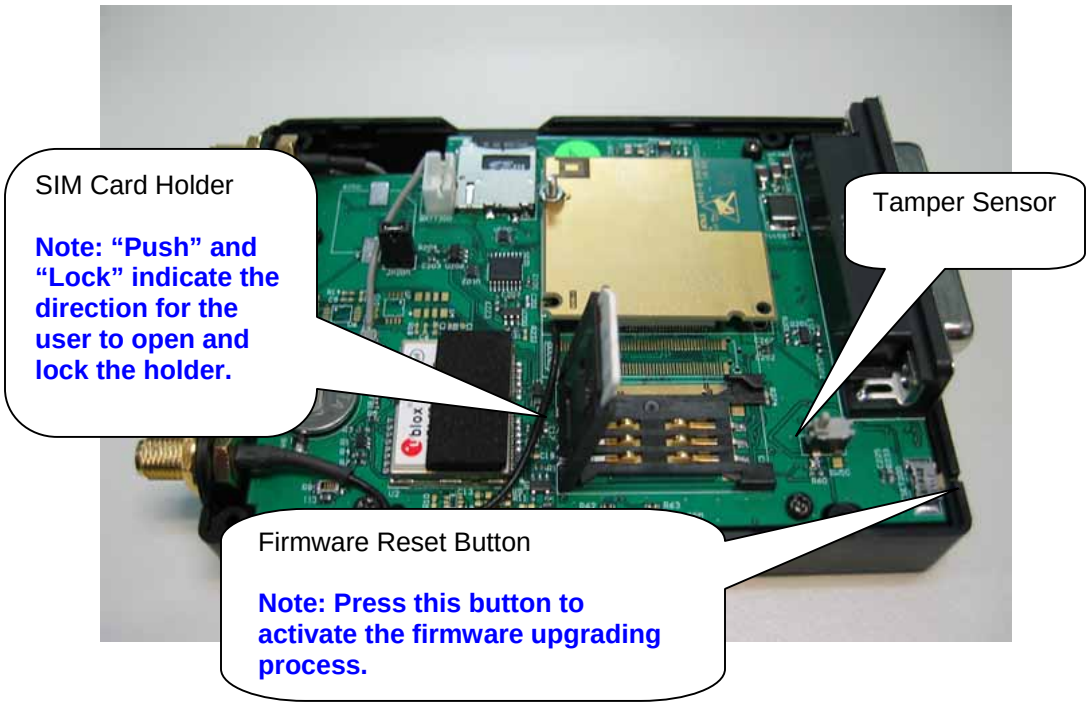


Fig 2.1. SIM Card Installation

2.2.2. MICRO SD (OPTIONAL) INSTALLATION

Insert the Micro SD card into the SD card holder to the circuit in the following page.

.

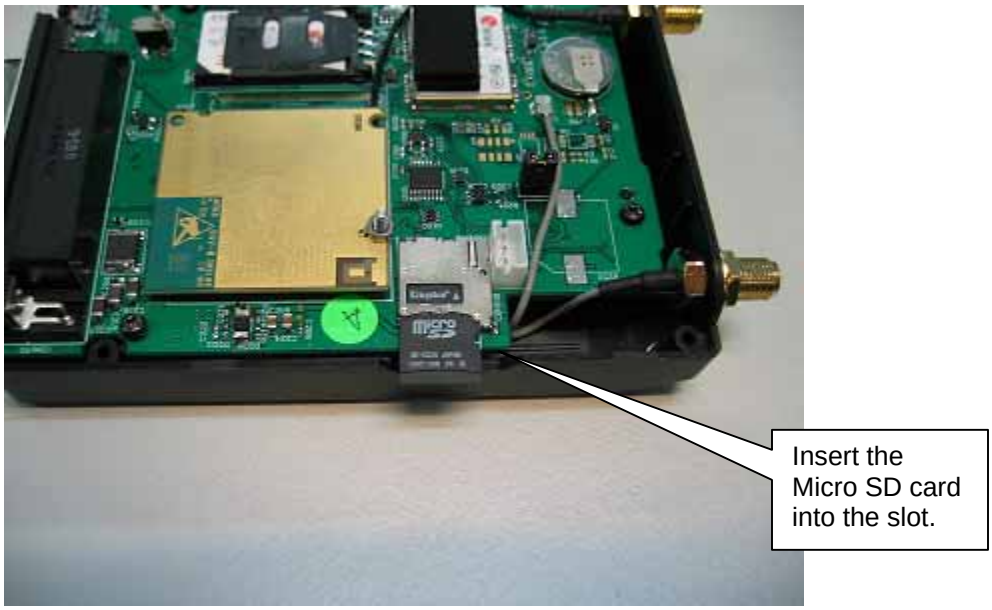


Fig 2.2. MicroSD Card Installation

2.2.3. SECURE WAVEON 618E HOUSING

Close the Waveon 618e with the upper housing.

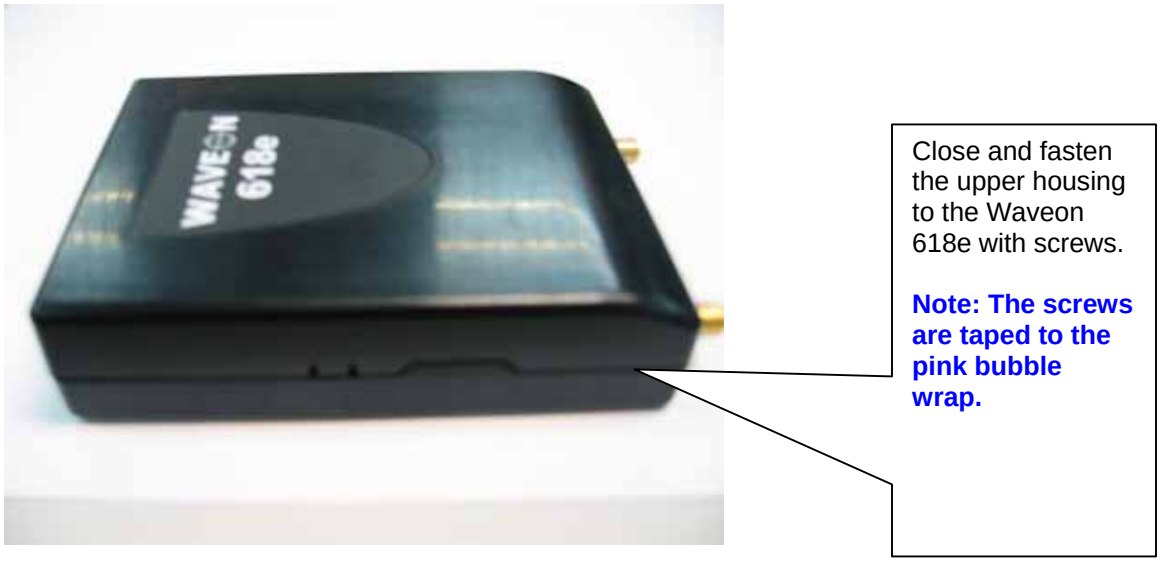


Fig 2.3. Secure Waveon 618 Device Housing

2.2.4. GPS/GPRS ANTENNAS CONNECTION

Connect the GPS and GPRS antennas in the following page.

Note: The GPS and GPRS connectors on W618 are of different polarities (male and female) so that they can only be connected in their respective antennas.

Fig 2.4. Antenna Connection

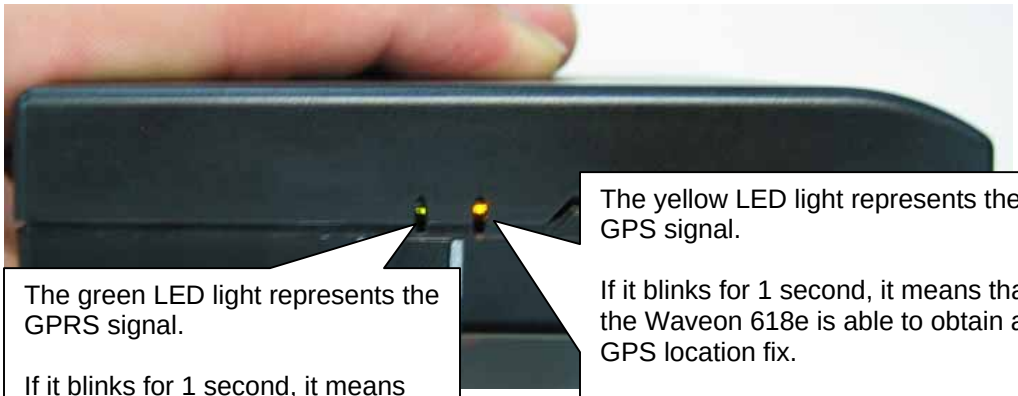


Fig 2.5. LED Lights

2.2.5. PROGRAMMING CABLE CONNECTION

Connect the 25-pin connector of the programming cable to the Waveon 618 device. This is to be followed by connecting the RS232 Connector to the PC COM port (Refer to Section 2.1 Product Components if necessary). Once this is done, the laptop can be used to configure the Waveon 618e firmware.

Fig2.6. Programming Cable Connection

3. FIRMWARE INSTALLATION AND CONFIGURATION

Note: These steps are for Windows XP users; other operating system users may experience different results.

3.1. FIRMWARE INSTALLATION

After the W618 and the laptop are connected via the programming cable, users are required to install the firmware configuration software to set configurations in the W618.

Follow the steps below to install the software. Note: It is recommended that the user laptop is equipped with Windows XP or newer Microsoft operating systems such as Windows Vista. Linux and other operating systems are not supported by this application.

Download the file “waveon618_v1.00.bin” to your desktop and double-click on it.

Note: if the user is using Windows Vista, please right-click on the program file and click “Run as administrator” before double-clicking the file.

Click next for the next few steps as shown unless you need to change the installation folder.

Fig 3.0. Firmware Installation

3.2. FIRMWARE BASIC CONFIGURATION

Go to the Windows desktop and click start.

Find the folder “WAVEON618” and double-click “Wave_PC_Monitor.exe”.

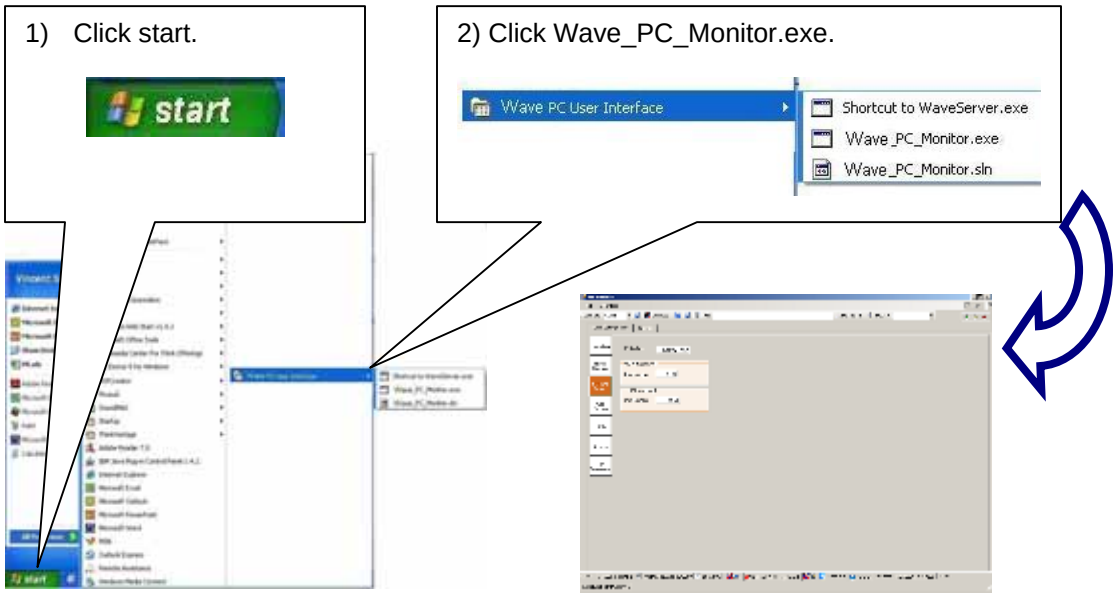


Fig 3.1. Opening the Firmware Configuration

3.2.1. CONNECTION

Select the COM port which your Waveon 618e is connected to and click “Connect”.

Note: Ensure that the laptop and the Waveon 618e are well connected with the programming cable before proceeding to the next step. The Waveon 618e also is also required to be connected to a power source (Refer to 2.26 Power Source Connection).

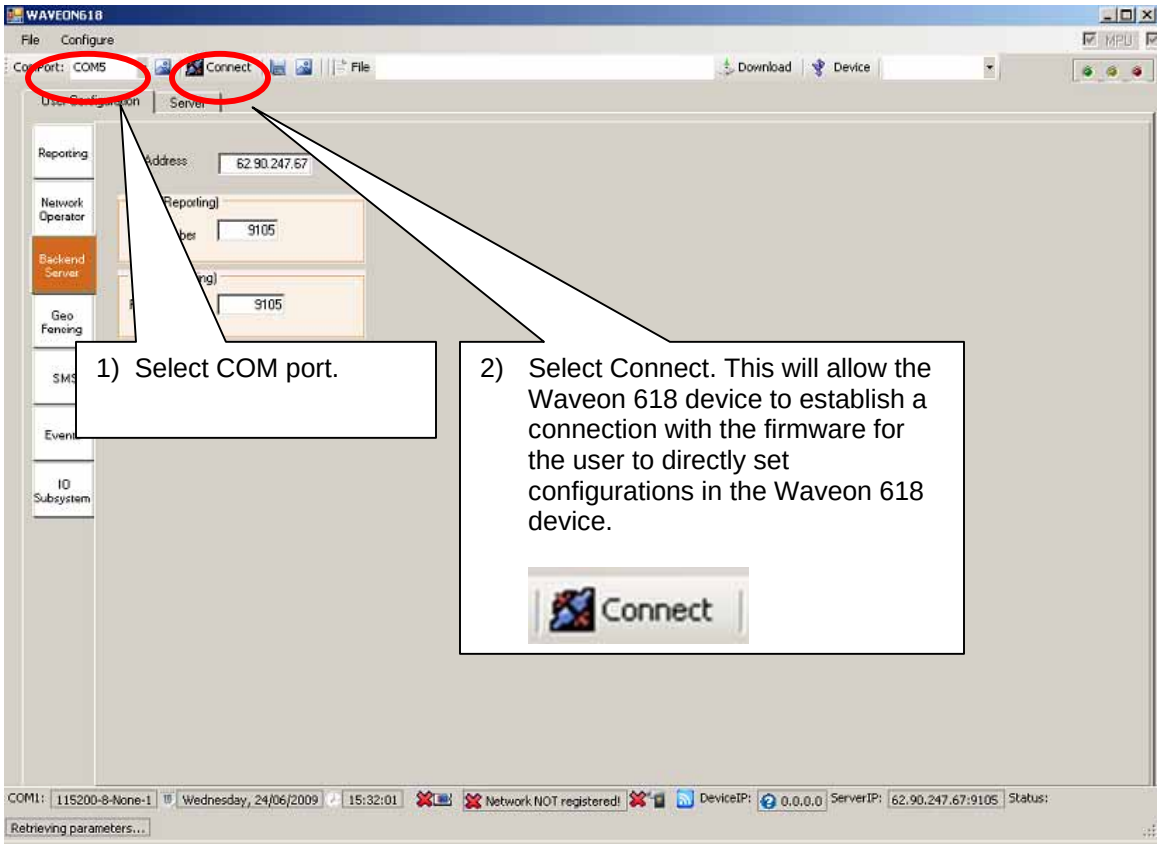


Fig 3.2. Firmware Connection to Waveon 618 Device

3.2.2. BACKEND SERVER IP ADDRESS CONFIGURATION

Click on the tab “User Configuration”.

Click on the left tab “Backend Server”.

Configure IP address setting (as shown below in Fig 3.3).

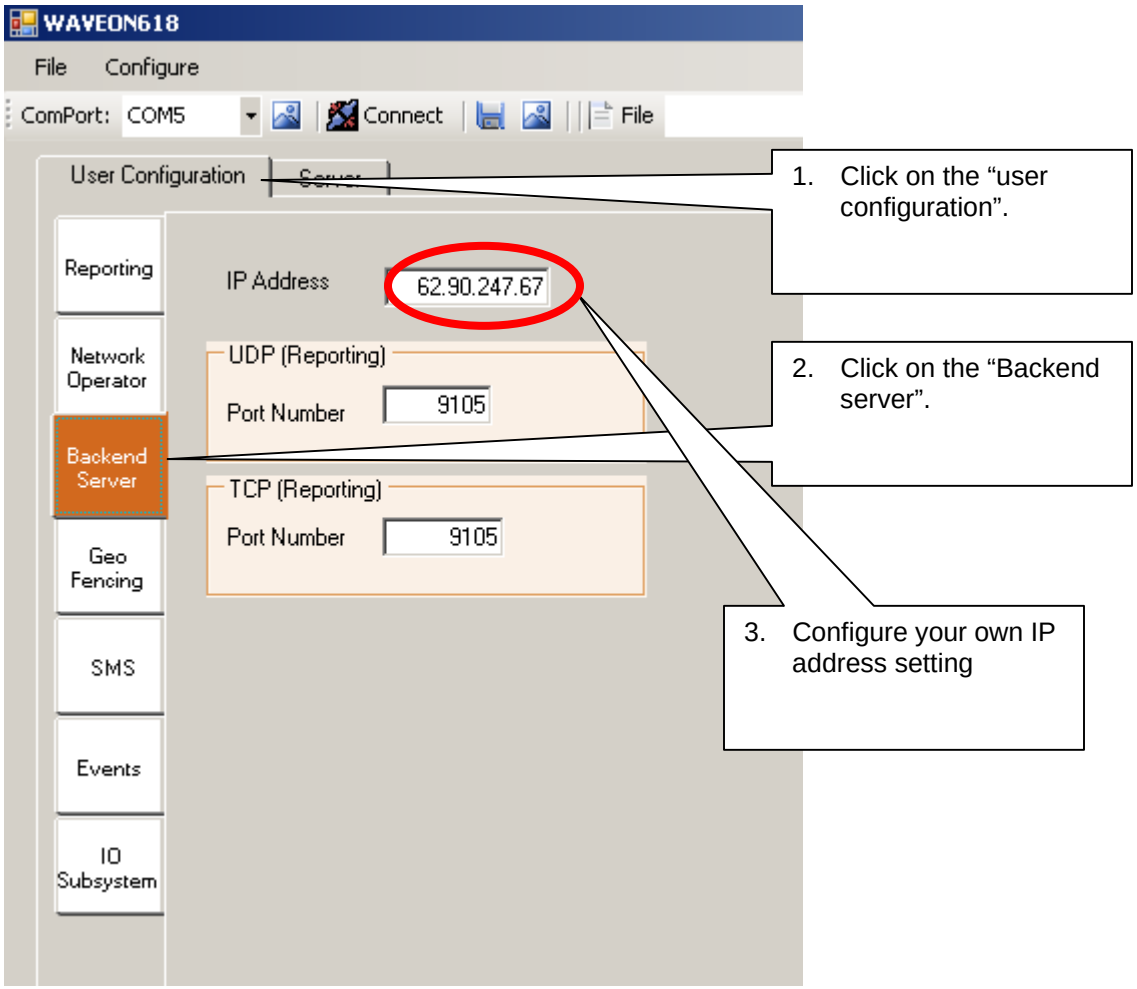


Fig 3.3. Firmware IP Address Configuration

3.2.3. BACKEND SERVER UDP AND TCP PORT CONFIGURATION

Configure the UDP (Reporting) and TCP (Reporting) port number settings (as shown below in Fig3.4).

Click the save icon to save the settings.

Note: The UDP (Reporting) & TCP (Reporting) port number must be the same.

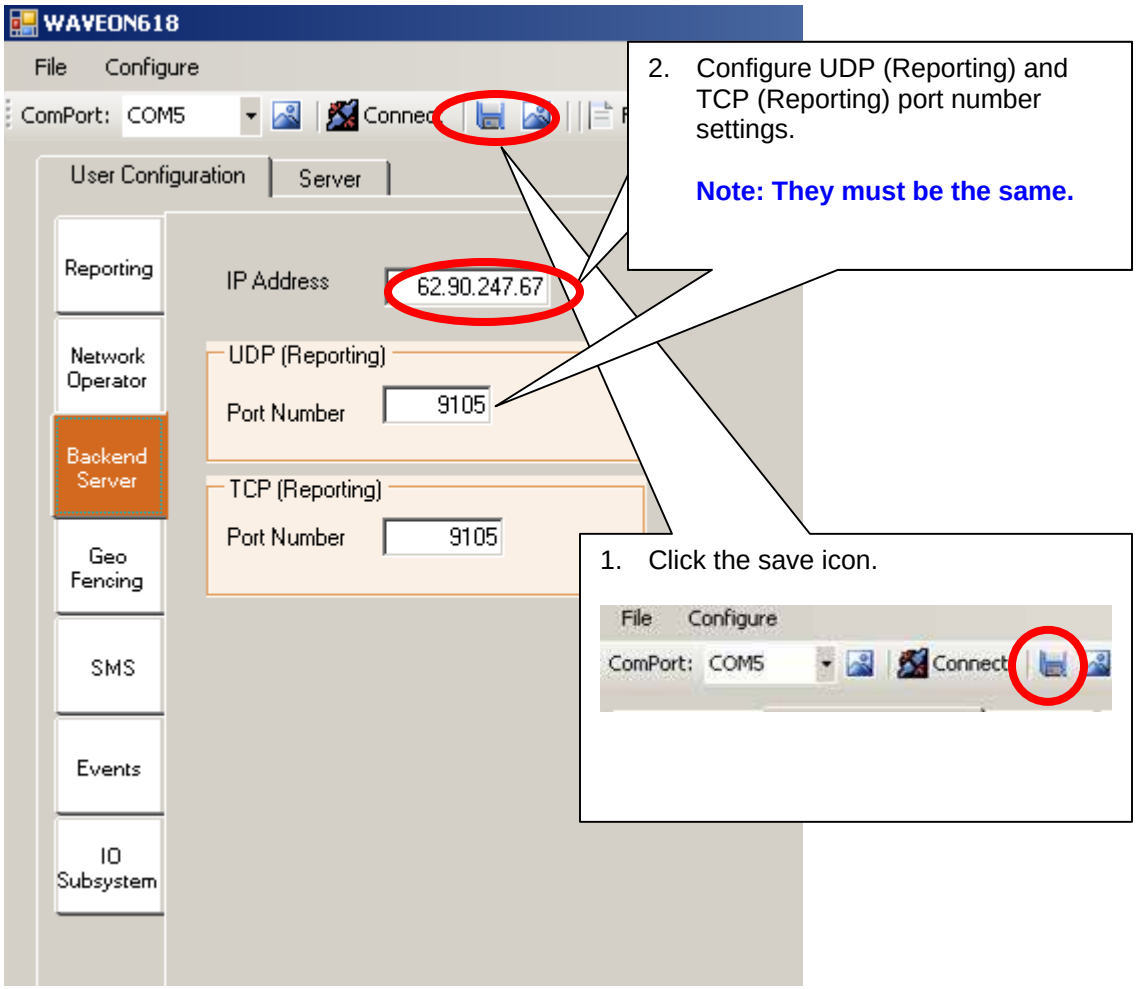


Fig 3.4. Firmware UDP and TCP Port Configuration

3.2.4. REPORT GENERAL SETTING

Click on the tab “User Configuration”.

Click on the left tab “Reporting”, then followed by the tab “General”.

Configure the reporting settings as shown below in Fig 3.5.

Note: The settings illustrated here are for tutorial purposes. Users can set the configurations based on their needs and requirements.

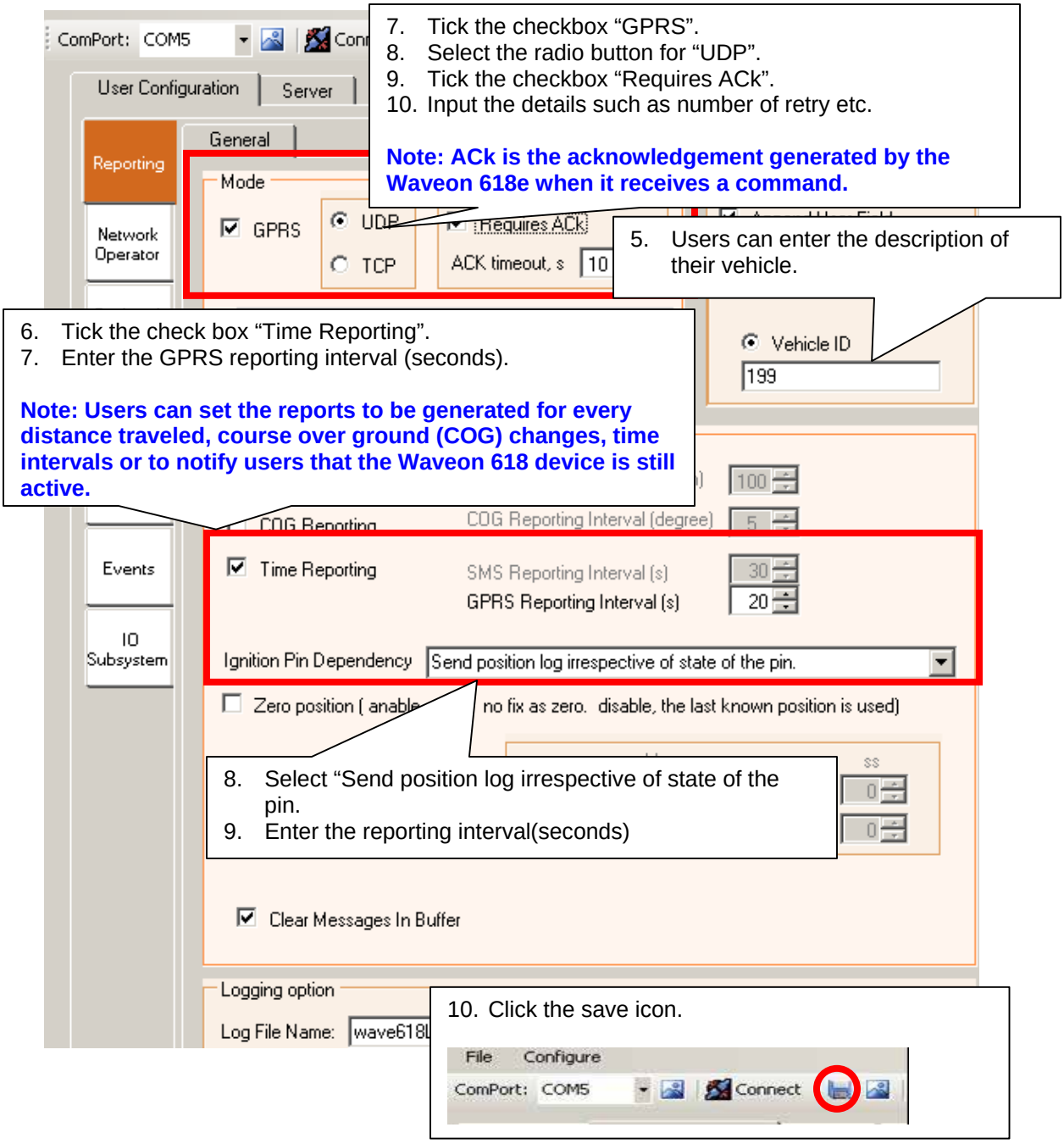


Fig 3.5. Firmware Reporting Configuration

Click on the left tab “IO subsystem” and configure the settings as shown below in Fig 3.6.

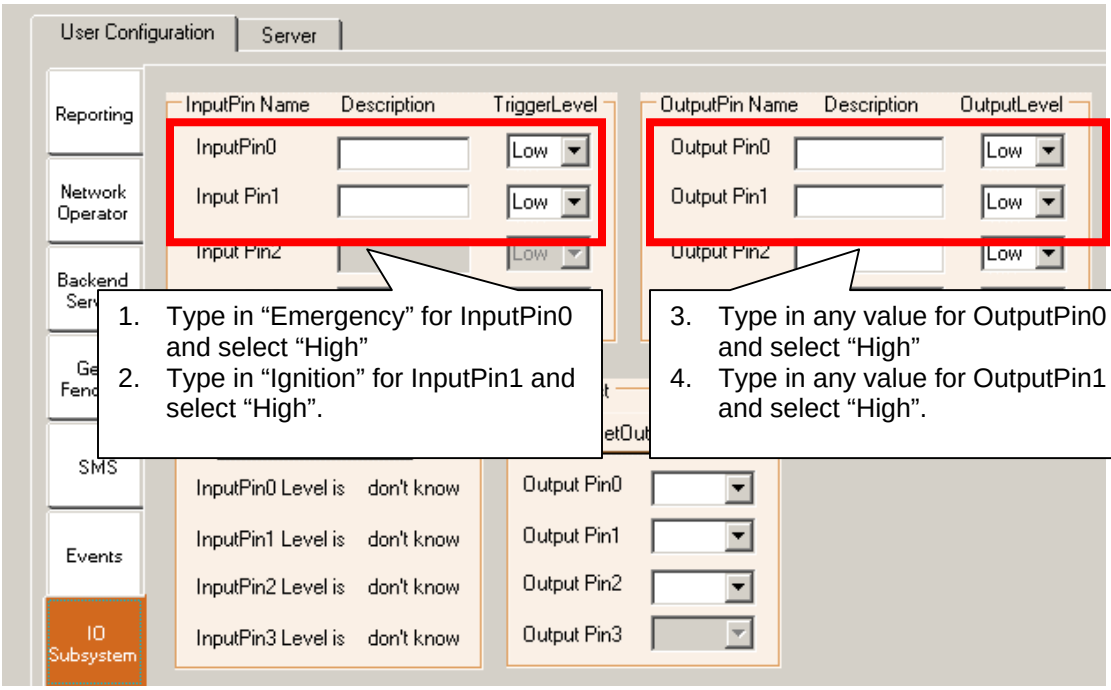


Fig 3.6. Firmware Reporting Configuration

3.2.5. NETWORK OPERATOR SETTING

Click on the tab “User Configuration”.

Click on the left tab “Network Operator tab”.

Configure the network operator settings as shown below in Fig 3.7.

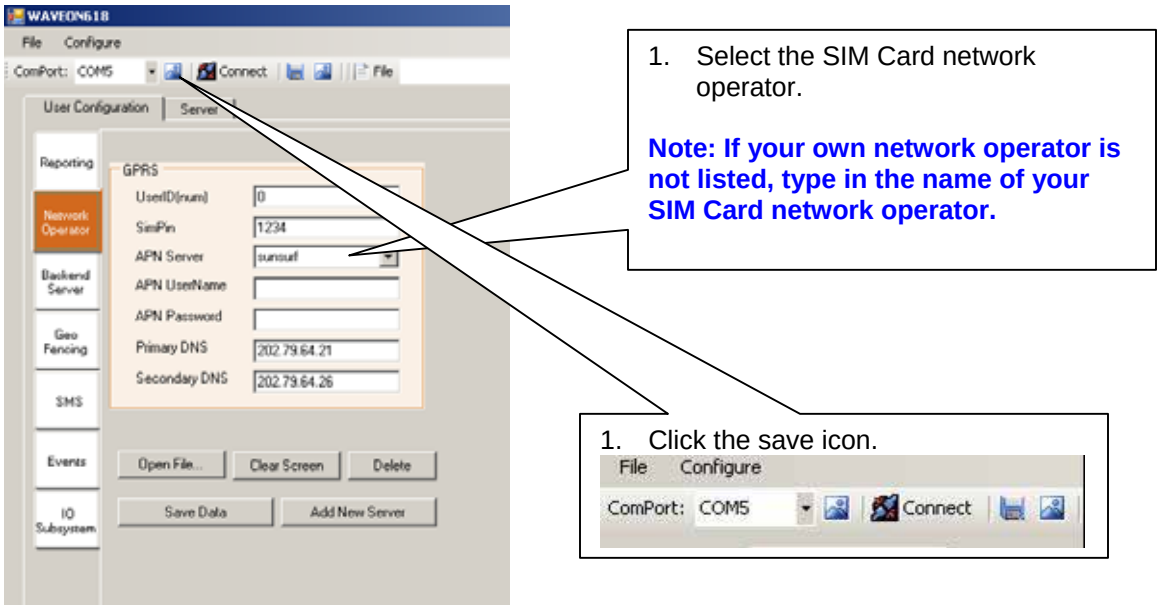


Fig 3.7. Firmware Network Operator Configuration

3.2.6. ACCESSING MICRO SD CARD DATA LOG

Note: The Micro SD card must be inserted into the Waveon 618e as shown in section 2.2.2 Battery and Micro SD Installation (Optional) before you can proceed with this step.

No further settings are required as the data logged is automatically stored in the Micro SD card. The data can be read by accessing the log file in the Micro SD card and using the Windows notepad application as shown below in Fig 3.8.

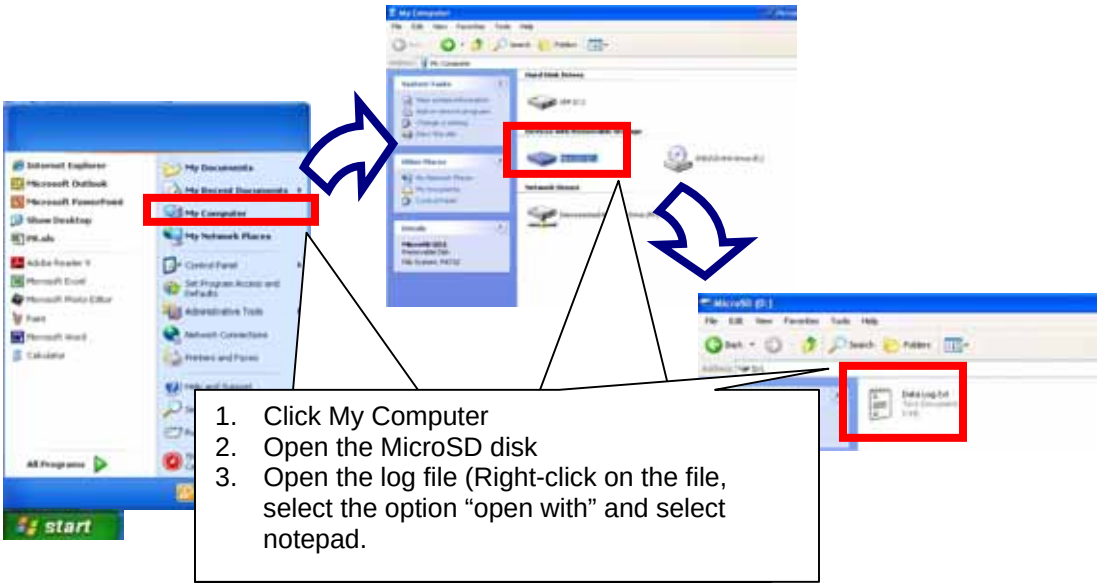


Fig 3.8. MicroSD Card Data Log

3.2.7. BACKEND SERVER REPORTING

Go to the Windows desktop and click start.

Find the folder “Wave PC User Interface” and double-click “shortcut to WaveServer.exe”.

Note: The instruction as shown in Fig 3.9.1 is based on the Waveon 618e report settings done in Fig 3.2.4 Report General Settings. Users can do a different configuration based on what is actually entered in the Waveon 618e report general settings. For example, if the option “TCP” is used in the report general settings, the user should select “TCP” as the socket type here.

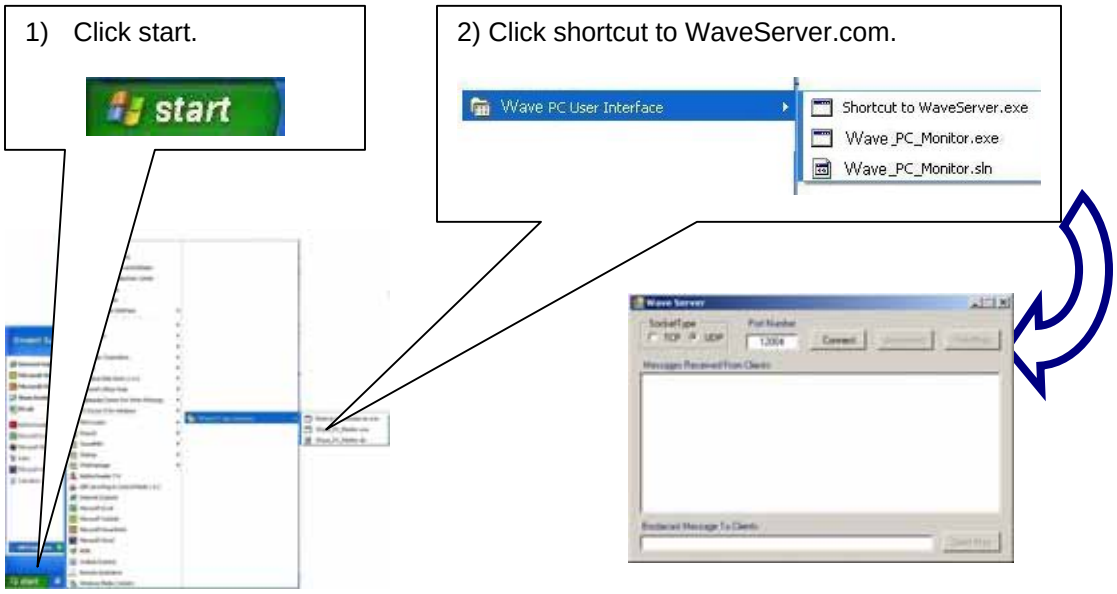


Fig 3.9. Opening the Backend Server Reporting Software

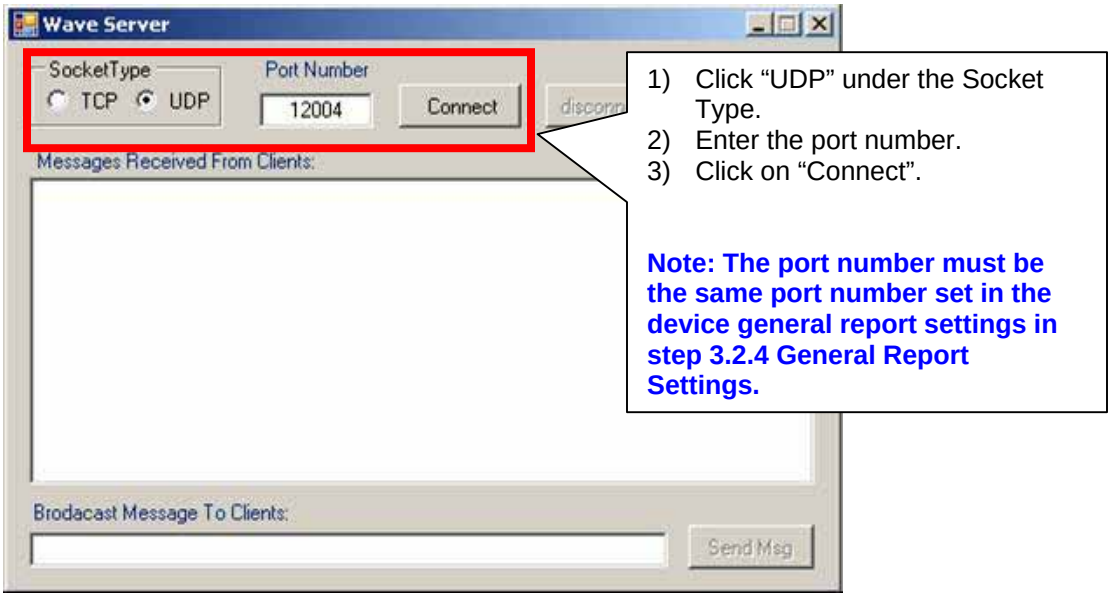


Fig 3.9.1 Backend Server Reporting

4. WAVEON USER COMMANDS OVERVIEW

Waveon user commands (WUC) are a set of commands for users to manage and configure the Waveon 618 device operations.

Note:

- **Users must take note of words, statements or portions highlighted in red and blue.**
- **Users should refer to Appendix E: Definitions and Abbreviations for information on the types of parameters such as U8_TYPE and U32_TYPE.**

4.1. GENERAL SYNTAX

Users should follow the general syntax as shown below; the details of each field in the syntax will be explained in the table below,

<AT><Name><Type>[<Value1>,<Value2>…][@VEID][*CHKSUM]<CR><LF>

Fields	Definitions
<AT>	AT is the **required** start mark for all commands sent from backend server to Waveon 618e. It must be in **CAPITAL** characters.
<Name>	Users should refer to subsection **4.3 Command Names** for more details on commands. It must be in **CAPITAL** characters.
<Type>	Users should refer to subsection **4.2 Command Types** on what operators they should use.
[<Value1>,<Value2>…]	Users should refer to subsection **4.3 Command Names** for more details on the parameters used by each command. **Note: For 2 or more parameters, every input value are separated by a comma (',') with no space between them. A good example would be [1,2,3,4].**
[@VEID]	VEID is a 16-bit **DECIMAL** value with a range from 0001 to FFFF. It serves as a unique Waveon 618e identifier. The Waveon 618e may append this field when it sends command to the backend.
[*CHKSUM]	CHKSUM provides limited error-checking capability. It comprises of 8-bits **HEX** value and is XOR (exclusive) of all characters between '$' and '*'. **Note: '$' and '*' are not included in the checksum calculation.**

<CR><LF>	This is the **required** terminal mark for all commands sent from backend to Waveon 618e. A good example would be AT$PSVL?[*CHKSUM]<CR><LF>

Please take note of the following for the general syntax:

- All characters, unless specifically stated, are in printable ASCII form
- **NO SPACE** is allowed inside in the general command syntax
- All commands from backend server to Waveon 618e have the prefix "AT"
- All commands from Waveon 618e to backend server DO NOT have the prefix "AT"
- All values are in decimal values except for the field [*CHKSUM] which is in hexadecimal
- For fields denoted in "[]" are optional while fields denoted in "<>" are compulsory.
  For example, <Name> means that the command name must be entered, whereas [@VEID] means it is not compulsory field.
- All commands must be appended with terminal mark <CR><LF>
- Parameters with the label (Optional) means that they are not necessary inputs during configuration

Users are required to send the command "AT$SCFG=1<CR><LR>" to the device after all the configurations updates are completed.

‘

4.2. COMMAND TYPES

The table below shows the four (4) different commands types that users can use by entering the respective operator into the general syntax. Examples are also provided below for users to better understand how they can apply it to the general command syntax.

Command Type	Operator	Send Directions	Purposes
SET	=	Backend to Waveon 618e	o Update Waveon 618e configurations and features; o Erase flash space;
GET	?	Backend to Waveon 618e	o Query current configurations or status from Waveon 618e.
REPORT	:	Waveon 618e to backend	o Report GPS position at intervals; o Answer GET command from backend; o Report system status; o Report alert and error message if any;
ACK	!	Either direction	o Acknowledgement after handling SET/GET/REPORT command. It can be enabled/disabled by the $AKTO command.

- **Example(s) of the general format for SET command by using ('=')**

  AT$XXXX=[<value1>,<value2>,<value3>…<valueN>][*CHKSUM]<CR><LF>

  Note: The field [@VEID] is NOT required as it is always sent from backend to Waveon 618e.

- **Example(s) of the general format for GET command by using ("?")**

  AT$XXXX?[*CHKSUM]<CR><LF>
  AT$XXXX?<value>[*CHKSUM]<CR><LF>

  Note: The field [@VEID] is NOT required as it is always sent from backend to Waveon 618e.

- **Example(s) of the general format for REPORT command by using (":")**

  $XXXX:<value1>[,<value2>,<value3>…<valueN>][@VEID][*CHKSUM]<CR><LF>

- **Example(s) of the general format for ACK command by using ("!")**

  When sent from backend:
  AT$XXXX! [*CHKSUM]<CR><LF>
  AT$XXXX![value][*CHKSUM]<CR><LF>

  When sent from Waveon 618e:
  $XXXX! [@VEID][*CHKSUM]<CR><LF>

$XXXX![value][@VEID][*CHKSUM]<CR><LF>

4.3. COMMAND NAMES

To better facilitate users understanding of every command, every subsections are organized into the following segments:

Segment	Descriptions
Definition	Describes the command purpose and objective
Command Type(s)	Lists down the command types which are usable for this particular command name. The general syntax will illustrate what is the appropriate command line and parameters to be used with each type of command. **Note: The ACK ('!') command type is supported by all commands. But other command types which are not listed here are not supported.**
Parameters	List down the values which can be put into the command. If no values are entered, the default value stated for this portion will be used. **Note: Values embedded in the format "[A, B]" means integer values from A to B, inclusive of values A and B are valid inputs.** **For example,** **Legal values: [0, 65535] means all integers from 0 to 65535 are valid values for input.** **Values embedded in the format "{x, y, z, a}" means only discrete values x, y, z and a are valid values for input.** **For example,** **Legal values: {0, 1} means only 0 and 1 are valid values for input.**
Examples	Show examples how the command name can be applied.
Notes	Additional notes and precautionary statements.

Please note that strings include the NULL terminal.

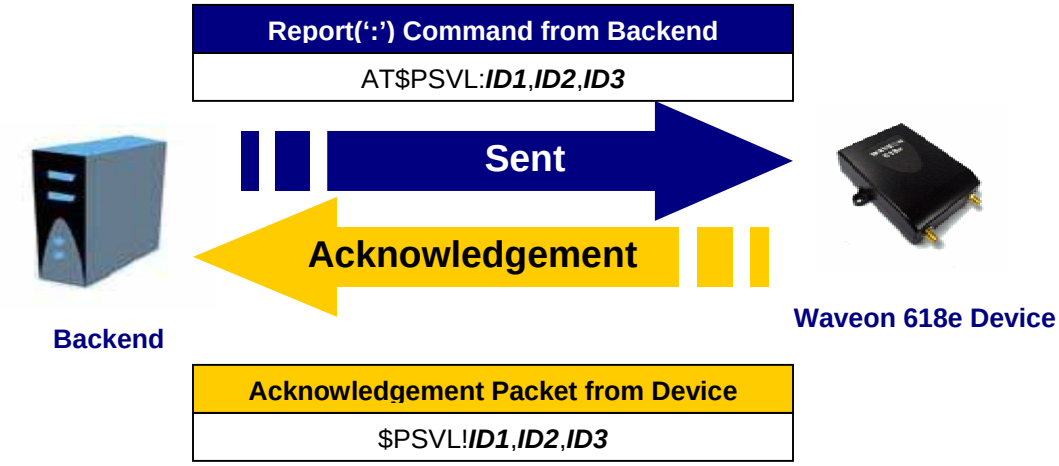
For example, the parameter APN password legal value is a string of up to 32 characters. The actual APN password can only contain 31 characters.

4.3.1. "$XXXX" (Acknowledgement)

- **Definition**

Every command sent will be acknowledged by a packet indicating the execution result of received command.

To illustrate this point, an example shown in Fig 4.0 using the $AKTO command with SET (‘=’) is provided below for users to understand what an actual acknowledgement packet will be like.



Note that ID1, ID2 and ID3 represent 3 parameters.

Fig 4.0 Example of the device acknowledges after receiving a Report (‘:’) type, $PSVL Command from Backend

Generally, the acknowledgement packet will be used under the following situations/conditions:
- When the backend receives a command, it acknowledges with AT$XXXX![<value>]
- When the backend receives a binary packet, it acknowledges with AT$XXXX!<value>
- When the Waveon 618e receives a SET command, it acknowledges with $XXXX![<value>]

- **Command Type(s)**

Type	General Syntax
AcK (‘!’)	AT$XXXX!***ID1***,***ID2***

Note: ID 2 is optional.

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Value	U16_TYPE		Legal Values : [0, 65535] Default Value: N/A ---------- 0~5000: ACK when WUC succeeds (0 can be omitted) Others: Undefined. When a command fails, the error information will be returned by the $STER command.
ID2	Human String	STRING (Optional)		A string generated to help users to identify the error codes.

- **Examples**

Type	Examples	Comments
Ack ('!')	**AT$PSVL!**	Backend acknowledges a successful $PSVL report.
	$GPRS!	Waveon 618e acknowledges a successful $GPRS SET command.
	$STER:xx,…	Waveon 618e acknowledges failure to execute a report command.

4.3.2. "$AKTO" (AcKnowledge and TimeOut)

- **Definition**

Enable/disable acknowledgement or Ack('!') for the $PSVL command and adjust UDP timeout value. Users can refer to section **4.3.1 "$$$$"Acknowledgement** for more information on acknowledgement.

Please take note of the following issues during configuration:

- Although the GPS report or $PSVL command does not require acknowledgement, the other commands dependent/related to this command **may be affected when acknowledgement is disabled**. As a result, the GPS report may become unstable.
- If acknowledgement is enabled, the Waveon 618e will send an acknowledgement when it receives a command and the backend is expected to do the same for commands received from the Waveon 618e.

  For example, if the Waveon 618e sends out a command to the backend, it will wait for an acknowledgement until the maximum Timeout milliseconds is over. If no acknowledgment is received, the Waveon 618e will resend the same command for up to 2 more times.

  If there is no further acknowledgement, the Waveon 618e will take the following course of actions:
  - If the GPS report is not acknowledged, the Waveon 618e will store the command in a buffer until it can successfully communicate to the backend.
  - Other commands which are not acknowledged will be deleted.

- If the Waveon 618e keeps re-sending too many commands to the backend, users are advised to increase the value for Timeout (millisecond) parameters.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$AKTO?
SET('=')	AT$AKTO=***ID1***,***ID2***,***ID3***
REPORT(':')	$AKTO:***ID1***,***ID2***,***ID3***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Acknowledgement	U8_TYPE		Legal Values: {0,1} Default Value: 1 ---------- 0: Disable 1: Enable When acknowledgement is disabled, the $PSVL command does not require acknowledgement or Ack ('!').

ID2	Timeout	U16_TYPE	Millisecond	Legal Values: [2000, 15000] Default Value: 8000 This sets the maximum time for the Waveon 618e to wait for acknowledgement from the backend. It is valid only when acknowledgement is enabled.
ID3	ACK times	U8_TYPE		Legal Values: [10, 254] Default Value: 30 Note: This sets the number of times the Waveon 618e will resend the command when it does not receive acknowledgement within the Timeout period. It is recommended that users use any value from 4 to 6 for this parameter.

- **Examples**

Type	Examples	Comments
Set ('=')	**AT$AKTO=1,8000,30**	
Get ('?')	**AT$AKTO?**	
Report (':')	**$AKTO:1,8000,30**	

4.3.3. "$PSVL" (PoSition and VeLocity)

- **Definition**

This is the GPS report to the backend. Users can set the Waveon 618e to send the GPS report to the backend within user-defined time intervals. The GPS message is packed in a proprietary format as shown in the segment "Parameters".

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$PSVL?
REPORT(':')	$PSVL:***ID1***,***ID2***,***ID3***,***ID4***,***ID5***,***ID6***,***ID7***,***ID8***,***ID9***,***ID10***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Date	U32_TYPE	ddmmyy	Current date.
ID2	UTC Time	U32_TYPE	hhmmss	**If "Date" is not ZERO** The Waveon 618e will indicate the current UTC time. **If "Date" is ZERO** Before the Waveon 618e obtains the first valid GPS report, it will indicate the Waveon 618e uptime.
ID3	Position Fix	U8_TYPE	-	Legal Values: {0, 1, 9} Default Value: N/A 0: No fix / Invalid 1: Standard GPS (2D/3D) 9: Last known STANDARD GPS (ON/ OFF by $ADRP, refer to section **4.7. "$ADRP"Advance RePort**). The position fix indicator. **Note: If "Position Fix" is NOT fixed (or "Position Fix" ==0), all values from ID4 to ID10 will be considered invalid and will not be up-dated in the application.**
ID4	Number of satellites	U8_TYPE	-	Legal Values: [1, 12] Default Value: N/A **Note: This will be a dummy value if "Position Fix" ==0.**

ID5	Latitude	DOUBLE	Degree	North:+, South: - "Precision" in 1/1000000 degree **Note: This will be a dummy value if "Position Fix" ==0.**
ID6	Longitude	DOUBLE	Degree	East:+, West: - "Precision" in 1/1000000 degree **Note: This will be a dummy value if "Position Fix" ==0.**
ID7	Altitude	FLOAT	Meter	"Precision" in 0.1m **Note: This will be a dummy value if "Position Fix" ==0.**
ID8	Speed	FLOAT	Kilometer per hour	"Precision" in 0.01kph If "Position Fix" ==0, this field MUST be ignored. **Note: When the value keeps changing, it is an indication that the GPS module is alive and able to get a GPS location fix. Users can make use of this indicator to debug their applications.**
ID9	True course	FLOAT	Degree	Valid Values : [0, 359] Default Value: N/A "Precision" in 0.01degree Course Over Ground. If "Position Fix" ==0, this field MUST be ignored. **Note: This value indicates the current battery level in units of mV. Users can make use of this indicator to debug their applications.**
ID10	HDOP	FLOAT	-	"Precision" in 0.01 Horizontal Dilution of Precision

				When "Position Fix" == 0, this field MUST be ignored. **Note: This value indicates current GSM signal strength in units of dBm. Users can make use of this indicator to debug their applications.**

- **Examples**

Type	Examples	Comments
Report (':')	**$PSVL:030805,013553,1,5,1.387785,103.849695,31.1,0.015,341.79,1.92**	

- **Notes**

The term **"Precision"** does not indicate the precision of the position itself. It is, however, determined by the least significant bit in the parameter value. The actual precise position precision is determined by the GPS system as well as the GPS module itself.

4.3.4. "$RPIT"(RePort InTerval for $PSVL messages)

- **Definition**

Using this command, users can define the time interval for the Waveon 618e to relay the GPS report to the backend via GPRS. It is also known as the "Time Interval" in short.

Please note:

- The parameters ***ID2*** and ***ID3*** are the time intervals values for the different reporting mediums. When the value expires, the Waveon 618e will report the current GPS position. Users can refer to Section **4.3.6. "$ADRP" (ADvanced REport)** to see other options available to further optimize the Waveon 618e reporting behavior.

- Besides the option of "Time Interval", the Waveon 618e also supports "Distance/Course Interval" option. Users can refer to Section **4.3.5. "$DSCG" (DiStance and Course over Ground)**.

  However, both $RPIT and $DSCG commands **cannot be enabled** at the same time. When one command is enabled, the other must be disabled beforehand.

  For example, users must enter disable $DSCG by sending the command "**AT$DSCG=0,0,0**" before enabling $RPIT.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$RPIT?
SET('=')	AT$RPIT=0,***ID2***,***ID3***,0
REPORT(':')	$RPIT: 0,***ID2***,***ID3***,0

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Dummy			
ID2	GPRS Report Interval	U16_TYPE	second	Legal Values : {0, [MIN_RPT_TIME*, 65535]} Default Value: 30 ---------- 0: disable Time in units of seconds. Valid in **MODE_GPRS_ONLY**,

				MODE_GPRS_SMS and **MODE_GSM_DATA_ONLY**.
ID3	SMS Report Interval	U16_TYPE	second	Legal Values : {0, [MIN_RPT_TIME*, 65535]} Default Value: 30 0: disable Time in units of seconds. Valid in **MODE_SMS_ONLY** and **MODE_GPRS_SMS** (when fail-over from GPRS)
ID4	Dummy			

- **Examples**

Type	Examples	Comments
Set ('=')	AT$RPIT=0,30,40,0	
Get ('?')	AT$RPIT?	
Report (':')	$RPIT:0,30,40,0	

- **Notes**

*MIN_RPT_TIME is 10 seconds.

4.3.5. "$DSCG" (DiStance and Course over Ground)

- **Definition**

Using this command, users can define the distance interval for the Waveon 618e to relay the GPS report to the backend via GPRS. It is also known as the "Distance/Course Intervals" in short.

Please note:

- The parameters ***ID1*** and ***ID2*** specify the distance and course intervals. When the user-defined interval expires, the Waveon 618e will report the current GPS position.
- As mentioned in section **4.3.4. "$RPIT"(RePort InTerval for $PSVL messages)**, both $RPIT and $DSCG commands **cannot be enabled** at the same time. When one command is enabled, the other must be disabled beforehand.

  For example, users must enter disable $DSCG by sending the command "**AT$RPIT=0,0,0,0**" before enabling $RPIT.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$DSCG?
SET('=')	AT$DSCG=***ID1***,***ID2***,***ID3***
REPORT(':')	$DSCG: ***ID1***,***ID2***,***ID3***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Distance Interval	U16_TYPE	meter	Legal Values : {0, [50, 65535]} Default Value: 0 ---------- 0: disable Distance in the unit of meters. The GPS message will be sent based on distance. The minimum valid distance should be calculated based on your average speed and a 10-second timeframe:

<table>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><th>Speed (Km per hour)</th><th>Minimum dist (meters)</th></tr>
<tr><td>25</td><td>69</td></tr>
<tr><td>50</td><td>138</td></tr>
<tr><td>75</td><td>208</td></tr>
</table>

Note: The performance is heavily dependent on the quality of GPS signal. The higher quality of GPS signal, the more accurate interval. It will stop reporting when there is no GPS signal.
</td></tr>
<tr><td>ID2</td><td>Interval of COG (Course over ground)</td><td>U16_TYPE</td><td>degree</td><td>Legal Values : {0, [2, 359]}
Default Value: 0

0: disabled
Others: enabled.

When the COG difference exceeds this value which the user defines, the GPS message will be sent.

Note: The performance is heavily depending on the quality of GPS signal. It will stop reporting when there is no GPS signal.</td></tr>
<tr><td>ID3</td><td>Reserve</td><td>U16_TYPE</td><td>second</td><td>Reserved for system configurations.</td></tr>
</table>

- **Examples**

Type	Examples	Comments
Set (‘=’)	AT$DSCG=1000,50	
Get (‘?’)	AT$DSCG?	
Report (‘:’)	$DSCG:1000,50,8	

4.3.6. "$ADRP"(Advanced RePort)

- **Definition**

Users can use this command to set advanced options for $RPIT commands. Some examples of advanced options are

- Report last known GPS position
- Stop reports when ignition is off
- Switching to a different reporting interval when ignition is off
- Disconnecting from GPRS network when ignition is off

Some examples are available below for users to understand how this can be used for some scenarios.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$ADRP?
SET('=')	AT$ADRP=***ID1***,***ID2***,***ID3,ID4,ID5***
REPORT(':')	$ADRP: ***ID1***,***ID2***,***ID3,ID4,ID5***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Report zero position	U8_TYPE		Legal Values : {1} Default Value: 1 --- 1: Report real-time zero position when Waveon 618e cannot get a GPS location fix.
ID2	Report when ignition ON	U8_TYPE		Legal Values: {0, 1, 2} Default Value: 2 --- 0: Waveon 618e reports when ignition is ON. The GPS report will be triggered when Waveon 618e registers that **Ignition ON is an active LOW**. The Waveon 618e will keep reporting when ignition pin is switched to LOW. Only when the ignition pin is switched to HIGH, the Waveon 618e may stop reporting or continue with a different

				report interval based on settings in parameter ***ID4***. 1: Waveon 618e reports when ignition is ON. The GPS report will be triggered when Waveon 618e registers that **Ignition ON is an active HIGH**. The Waveon 618e will keep reporting when ignition pin is switched to HIGH. Only when ignition pin is switched to LOW, the Waveon 618e may stop reporting or continue with different report intervals depending based on settings in parameter ***ID4***. 2: The Waveon 618e will send GPS reports regardless of the ignition status. This is also known as **Active Always**. When this is enabled, parameters ***ID3*** and ***ID4*** will be ignored. **Note: This parameter is valid only for "Time Interval" but NOT for "Distance/Course Intervals".**
ID3	Additional Reports after ignition OFF	U16_TYPE		Legal Values: [0, 65535] Default Value: 0 --- When ignition is detected as OFF, the Waveon 618e has the ability to further send out X additional reports at the same intervals. X is configurable via this parameter. **Note: This parameter is valid only when parameter *ID2* is set to 0 or 1 (Report when ignition ON).**
ID4	Action after ignition is detected OFF and additional reports are finished	U16_TYPE		Legal Values: {0, 1, [30, 65535]} Default Value: 0 --- 0: Waveon 618e will stop GPS reporting but it will maintain the GPRS connection. 1: Waveon 618e will stop GPS reporting and disconnect the GPRS connection. **Unless it is necessary,** users are not

				recommended to use this setting since it will disconnect the GPRS connection and prevent the Waveon 618e from sending out alerts when the ignition is switched to OFF. **>=30 (seconds):** Waveon 618e will generate GPS reports at different time intervals. The new time interval will be specified by this parameter. When ignition is switched ON again, the Waveon 618e will automatically switch back to original interval in $RPIT pre-defined by the user. **Note: This parameter is valid only when parameter *ID2* is set to 0 or 1 (Report when ignition ON).**
ID5	Buffer non-fix GPS (Optional)	U8_TYPE		Legal Values: {0, 1} Default Value: 0 --- 0: Discard non-fix GPS when TX failed. **(Recommended)** 1: Buffer non-fix GPS when transmission failed. If the Waveon 618e is unable to communicate or capture acknowledgement via GPRS with the backend for a specified period of time, the Waveon 618e can be set to temporarily buffer a limited number of the latest reports into its memory for re-sending to the backend when the Waveon 618e can establish communication with the backend again. This option also provides users with the option to store non-fix GPS information by using the value 1. However, the **recommended value is 0 as this option will allow the Waveon 618e to store more valid GPS information**.

- **Examples**

Type	Examples	Comments

Set ('=')	**AT$ADRP=0,2,0,0,0 (default)**	This is the default command. The Waveon 618e will report the last known position, regardless of ignition pin status.
	AT$ADRP=1,2,0,0,0	The Waveon 618e will report the real-time zero position, regardless of ignition pin status.
	AT$ADRP=1,0,0,0,0	The Waveon 618e will report the real-time zero position, only when the ignition pin is switched to LOW (ignition ON). It will stop reporting immediately when ignition pin is switched to HIGH (ignition OFF).
	AT$ADRP=0,1,5,0,0	The Waveon 618e will report the last known position, only when the ignition pin is switched to HIGH (ignition ON). It will stop reporting after 5 reports when ignition pin is switched to LOW (ignition OFF).
	AT$ADRP=0,1,10,1,0	The Waveon 618e will report the last known position, only when the ignition pin is switched to HIGH (ignition ON). It will stop reporting after 10 additional reports when ignition pin is switched to LOW (ignition OFF) and disconnect the GPRS.

	AT$ADRP=0,1,10,300,0	The Waveon 618e will report the last known position. The Waveon 618e will revert to the user-defined $RPIT intervals only when the ignition pin is switched to HIGH (ignition ON). The Waveon 618e will report at user-defined $RPIT intervals for 10 reports. Following that, the Waveon 618e will switch to the new 300 seconds interval until the ignition is switched to HIGH again.

4.3.7. "$SHTM" (Shift TiMe)

- **Definition**

Users can define a valid time window for the Waveon 618e to do GPS reports. When the valid time window is over, the Waveon 618e will stop reporting.

For example, the Waveon 618e can be set to report GPS messages from 7:00:00 (hh:mm:ss) to 12:00:00.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$SHTM?
SET('=')	AT$SHTM=***ID1***,***ID2***,***ID3***
REPORT(':')	$SHTM:***ID1***,***ID2***,***ID3***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Enable/Disable	U8_TYPE		Legal Values : {0, 1, 2} Default Value: 0 ---------- 0: Disable 1: Enable ONE time window
ID2	TW1_start	U32_TYPE	hhmmss	Legal Values : [000000, 235959] Default Value: 0 Note: Users can only specify ONE time window.
ID3	TW1_end	U32_TYPE	Hhmmss	
ID4	Dummy			
ID5	Dummy			

- **Examples**

Type	Examples	Comments
Set ('=')	AT$SHTM=0	Disable shift time feature.

	AT$SHTM=1,100533,230000	Time window for the Waveon 618e starts from 10:05:33 and end at 23:00:00
Get ('?')	AT$SHTM?	
Report (':')	$SHTM:0*08 $SHTM:1,100533,230000*0C	

4.3.8. "$GPRS"(GPRS network parameters)

- **Definition**

Users can configure the Waveon 618e GPRS network parameters, Backend IP address and port number.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$GPRS?
SET('=')	AT$GPRS= ***ID1***,***ID2***,***ID3***,***ID4***,***ID5***
REPORT(':')	$GPRS:***ID1***,***ID2***,***ID3***,***ID4***,***ID5***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	APN server	STRING		Legal Values : String of up to 48 characters Default Value: internet
ID2	APN username	STRING		Legal Values : String of up to 32 characters Default Value: EMPTY_STR
ID3	APN password	STRING		Legal Values : string of up to 32 characters Default Value: EMPTY_STR
ID4	Server IP address	STRING		Legal Values : string of up to 16 characters Default Value: 127.0.0.1 Note: Server IP is in dotted-decimal format **XXX.XXX.XXX.XXX**.
ID5	Port num	U16_TYPE		Legal Values : [1024, 65535] Default Value: 12000 Port numbers are divided into 3 ranges namely:

				Well Known Ports: [0,1023] Registered Ports: [1024,49151] Dynamic/Private Ports:[49152,65535]

- **Examples**

Type	Examples	Comments
Set ('=')	AT$GPRS=internet,uname,passwd,127.0.0.1,12001	
Get ('?')	AT$GPRS?	
Report (':')	$GPRS:internet,uname,passwd,127.0.0.1,12001	

4.3.9. "$SMSN" (SMS Network parameters)

- **Definition**

Users can configure the SMS parameters.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$SMSN?
SET('=')	AT$SMSN=***ID1***,***ID2***,***ID3***
REPORT(':')	$SMSN:***ID1***,***ID2***,***ID3***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Optional type	U16_type		Legal Values : [0, 1,2,3] Default Value: 0 ---------- 0: enable sending the GPS report ($PSVL) and alert via SMS message. 1:Enable sending of the GPS report ($PSVL) message but disable the alert via SMS message. 2:Disable sending of the GPS report ($PSVL) but enable the alert via SMS message 3: Disable both the GPS report ($PSVL) and alert via SMS message
ID2	SMS recipient number	STRING		Legal Values : string of up to 32 characters Default Value: "+6512345678" **Note: The Waveon 618e will only send all SMS messages to this number.**

ID3	SMS center number (DUMMY)	STRING		Legal Values : [0, 1] Default Value: 0 ---------- 0: Only respond to the number defined in SMS recipient number 1: Enable response to any cell phone SMS commands if password is correct.

- **Examples**

Type	Examples	Comments
Set ('=')	AT$SMSN=0,+6512345678,0	
Get ('?')	AT$SMSN?	
Report (':')	$SMSN:0,+6512345678,0*19	

4.3.10. "$EVMN" (EVent MaNagement)

- **Definition**

Users can set how the Waveon 618e handles all the available events. These events are shown in an additional segment "**Predefined Events**", which can be triggered upon their "**Trigger Condition"**.

The Waveon 618e may handle events in two ways. One way is to send an alert to the backend as shown in command "$ALER". This method is configurable by using parameter ***ID1*** to turn the event alert ON/OFF.

The other way is to log the event into the Waveon 618e internal log database which can be retrieved by using commands "$ELRQ" and "$ELDA". The second method is configurable by using parameter ***ID2*** to turn the event logging ON/OFF.

Please note that both parameters are **bit-wise decimal values** with every bit corresponding to one event.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$EVMN?
SET('=')	AT$EVMN=***ID1***,***ID2***
REPORT(':')	$EVMN:***ID1***,***ID2***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Event Alert ON/OFF	U32_TYPE	-	Legal Values : [0, 1880031219] or [0, 0x700EFFF3] Default Value: 371 (=0x173) ---------- 0: Disable 1: Enable **Note: It is a bit-wise decimal value. Each bit corresponds to a type of event.**

ID2	Event Logging ON/OFF	U32_TYPE	-	Legal Values : [0, 1880031219] or [0, 0x700EFFF3] Default Value: 307 (=0x133) ---------- 0: Disable 1: Enable **Note: It is a bit-wise decimal value. Each bit corresponds to a type of event.**

- **Examples**

Type	Examples	Comments
Set ('=')	AT$EVMN=51,2	Note: Refer to the description below.
Get ('?')	AT$EVMN?	
Report(':')	$EVMN:51(0x33),2(0x2)	

This is an example for users to

1. Turn ON **alert** functionality for events **EVENT_EMERG_CALL**, **EVENT_TAMPER**, **EVENT_POWER_LOW** and **EVENT_POWER_LOST**,
2. Turn ON **logging** for an event **EVENT_TAMPER** and turn OFF alert/logging for all other events.

Based on the segment "**Predefined Event**", users must first calculate the value for both parameters:

1st parameter = sum (0x00000001+0x00000002+0x00000010+0x00000020) = 0x33(HEX) = **51** (Decimal).

2nd parameter= sum (0x00000002) = 0x2(HEX) = **2** (Decimal)

Then users must enter the command "**AT$EVMN=51,2**" to enable alert and logging functionalities as desired. The Waveon 618e will acknowledgement the command successfully by sending the acknowledgement "**$EVMN!51,2**".

And finally to save the configuration, users must enter the command "**AT$SCFG=1**" to save this setting in the Waveon 618e.

- **Event Message Content**

ID	Parameters	Type	Unit	Comments
ID1	Event Alert ON/OFF	U32_TYPE	-	Legal Values : [0, 1880031219] or [0, 0x700EFFF3]

				Default Value: 371 (=0x173) ---------- 0: Disable 1: Enable **Note: It is a bit-wise decimal value. Each bit corresponds to a type of event.**
ID2	Event Logging ON/OFF	U32_TYPE	-	Legal Values : [0, 1880031219] or [0, 0x700EFFF3] Default Value: 307 (=0x133) ---------- 0: Disable 1: Enable **Note: It is a bit-wise decimal value. Each bit corresponds to a type of event.**

- **Event Message Content**

Id	Parameters	Type	Unit	Comments
1	Event type	U32_TYPE	-	Legal Values : refer to "**Predefined Events**" Default Value: N/A
2	Event value	U32_TYPE	-	Legal Values: refer to "**Predefined Events**" Default Value: 0
3	Date	U32_TYPE	ddmmyy	Current date
4	UTC Time	U32_TYPE	hhmmss	**When "Date" is not ZERO**, it indicates Current UTC time. **When "Date" is ZERO**, that is, before getting the first valid GPS position, it indicates Waveon 618e uptime.
5	Position Fix	U8_TYPE	-	Legal Values : {0, 1, 9} Default Value: N/A ---------- 0: No fix / Invalid 1: Standard GPS (2D/3D) 2: Differential GPS 9: Last known STANDARD GPS (ON/OFF via $ADRP)
6	Latitude	DOUBLE	degree	
7	Longitude	DOUBLE	degree	
8	Altitude	FLOAT	degree	
9	Speed	FLOAT	Km per	

			hour	
10	Total distance	U32_TYPE	meter	Distance is calculated based on GPS position. Its accuracy is dependent on the quality of the GPS signal. Please use "$TRSD" to further reduce its ERROR.

- **Predefined Events**

Events Type	HEX	Trigger Condition	Event Value
EMERG_CALL	0x00000001	The emergency call button is clicked.	0
TAMPER	0x00000002	When the tamper sensor is released from its original pressed status.	0
STATIC_IGNITION_ON	0x00000004		0
POWER_LOW	0x00000010	Battery power level drops to level 1 or voltage of DC charger gets lower than pre-defined POWER_LOW threshold in $GSPW.	{4, 2,} 4 (Battery), 2 (12VDC),
POWER_LOST	0x00000020	Battery power level drops to level 0 or voltage of DC charger becomes lower than pre-defined POWER_LOSS threshold in $GSPW.	{4, 2} 4 (Battery), 2 (12VDC),
NO_GPS_NMEA	0x00000040	When the GPS module reported fewer NMEA messages than expected.	0
PEAK_OVERSPEED	0x00000080	1) If the current speed exceeds max speed specified in "$MSCL". 2) If vehicle is accelerating based on speed gathered from the GPS module. When the Waveon 618e receives notification on the vehicle speeding, it will send fewer messages than OVER_SPEED. Typically, either PEAK_OVERSPEED or	{X} X is Current Speed.

		OVER_SPEED needs to be enabled, depending on how often the user needs to receive the speeding alert.	
IGNITION	0x00000100	Status change in Ignition pin. (Level triggered)	{0, 1} 0 (LOW), 1 (HIGH)
CNTX_GPS_LOSS	0x00000200	When the Waveon 618e receives X continuous non-fix GPS reports since first fix. Value X is adjustable via "$MSCL".	{X}
GEOZONE_IN	0x00000400		
GEOZONE_EXIT	0x00000800		
DINPUT_1	0x00001000	Status change in digital input pin 1. (Level triggered)	{0, 1} 0 (LOW), 1 (HIGH)
DINPUT_2	0x00002000	Status change in digital input pin 2. (Level triggered)	{0, 1} 0 (LOW), 1 (HIGH)
OVER_SPEED	0x00004000	Current speed exceeds max speed in "$MSCL". When the Waveon 618e registers a speeding, it sends more messages than PEAK_OVER_SPEED. Usually, either PEAK_OVERSPEED or OVER_SPEED needs to be enabled, depending on how often the user needs to receive the speeding alert.	{X} X is Current Speed.
ACTIVE_DINPUT_1	0x00008000	Optional. See "$VSDM" for details.	
	0x00010000	N/A	
INCOME_CALL	0x00020000	Call 2 pin is set HIGH.	
MOVE_FM_STATIC	0x00040000	When the Waveon 618e registers vehicle movement. User need to define the speed for moving/stationary	{X} X is Current Speed.

		judgment via $MSCL ("move-judge-speed").	
STATIC_FM_MOVE	0x00080000	When the Waveon 618e registers a stop in movement. User need to define the speed for moving/stationary judgment via $MSCL ("move-judge-speed").	
NO_INTERVAL	0x10000000	Time report interval ($RPIT) is disabled.	
TX_TIMEOUT	0x20000000	UDP transmission failed after maximum retries. (Can only be sent via SMS)	{1, 2, 4} 1(GPS report), 2 (AT cmd), 4 (Log data)
NETWORK_FAILURE	0x40000000	Failure to connect to the GSM/ GPRS data network. (Can only be sent via SMS)	

- **Notes**

The reliability of some events, such as PEAK_OVER_SPEED, OVER_SPEED and MOVE_FM_STATIC, are dependent on the quality of GPS signal and may encounter serious ERROR when the GPS module cannot capture the GPS location well.

The difference between PEAK_OVER_SPEED and OVER_SPEED is illustrated in Fig3.1. Assuming the maximum speed *Vmax* is set to 100 kilometer per hour, PEAK_OVER_SPEED event is triggered at 1, 2, and 8, that is, when speed is above *Vmax* and keeps increasing till peak or from below *Vmax* to above *Vmax*. OVER_SPEED event is triggered at 1, 2, 3, 4, 5 and 8, that is, whenever speed exceeds *V*max. The interval *T* is around 10 seconds and may be longer when speed keeps fluctuates up and down along *V*max.

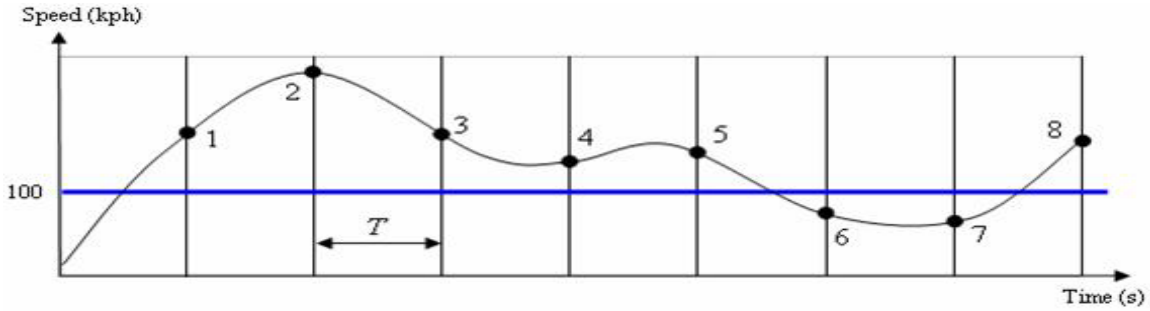


Fig 4.1 PEAK_OVER_SPEED vs. OVER_SPEED

4.3.11. "$GFMN" (Geographic Fence MaNagement)

- **Definition**

Users can enable or disable GEO zones which are configurable via the command $GFDA by referring to section **4.3.13. "$GFDA" (Geography Fence Data)**.

Each bit of its parameter corresponds to one type of GEO zone in $GFDA. For example, Bit_0 corresponds to zone_0, bit_1 to zone_1 and so on.

Please note:

- **"$GFMN"(Geographic Fence MaNagement)** can ONLY enable GEO zones which are properly defined in **"$GFDA"(Geography Fence Data)**. If the user tries to enable an invalid GEO zone, all flags will be disabled.

- Geographic fence is ONLY valid in the following operational modes:

    - MODE_GPRS_ONLY,
    - MODE_GPRS_SMS and
    - MODE_GSM_DATA_ONLY.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$GFMN?
SET('=')	AT$GFMN=***ID1***
REPORT(':')	$GFMN:***ID1***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	ON/OFF of GEO zone	U32_TYPE	Number of zone	Legal Values: [0x00000000, 0x000003FF] Default Value: 0 ---------- 0: Disable 1,3,7,15,31,63,123,255,511 or 1023: Enable

				One bit corresponds to one GEO zone. It supports up to 32 GEO zones. Currently, only 10 circle zones are supported.
ID2	Zone data indicator flag			Legal Values: [0x00000000, 0x000003FF] Default Value: 0 --- 0: Data as zero 1: Data as non zero One bit corresponds to one GEO zone. It supports up to 32 GEO zones. Currently, only 10 circle zones are supported.

- **Examples**

Type	Examples	Comments
Set ('=')	AT$GFMN=0	
	AT$GFMN=1,3,7,15,31,63,123,255,511, 1023	
Get ('?')	T$GFMN?	
Report(':')	$GFMN:7,7	

- **Note**

The set ('=') command only accept decimals values.

For example, if you set 5 GEO zones, need to convert hex "0x1F" to decimal "31", so the set command is AT$UART="AT$GFMN=31".

4.3.12. "$GFDA" (Geography Fence Data)

- **Definition**

Users can configure parameters of the GEO zones.

- **Command Type(s)**

Type	General Syntax
Get ('?')	AT$GFMN?***ID1***
SET('=')	AT$GFMN=***ID1***,***ID2***,***ID3***,***ID4***
REPORT(':')	$GFMN:***ID1***,***ID2***,***ID3***,***ID4***

- **Parameters**

Parameters may be different in different types of GEO zones. The table below lists necessary parameters for circle zones.

Circle Zone (1~10)				
ID	**Parameters**	**Type**	**Unit**	**Comments**
ID1	Index	U8_TYPE		Legal Values : [0, 9] Default Value: N/A ---------- 0:GEO_zone_0 1:GEO_zone_1 … 9: GEO_zone_9 Index of GEO zones.
ID2	Latitude	DOUBLE	degree	
ID3	Longitude	DOUBLE	degree	
ID4	Radius	float	meters	Legal value:{1.0, 4294967295}

- **Examples**

Type	Examples	Comments

Set ('=')	AT$GFDA=1,4.14700,7.74200,100	Index = 1 lat=4.14700 lon = 7.74200 radius=100
Get ('?')	AT$GFDA?1	
Report(':')	$GFDA:1,4.14700,7.74200,100.0*0C $GFDA:2,0.00000,0.00000,0.0*0E	**Note: Radius value must bigger than zero.**

4.3.13. "$ALER" (ALERt when certain event happen)

- **Definition**

When an event happens, the Waveon 618e will pack its event content (Refer to Section **4.3.11. "$EVMN" EVent MaNagement**, segment on "**Event Message Content**") into $ALER message and send it out to the backend.

- **Command Type(s)**

Type	General Syntax
REPORT(':')	$ALER:***IDx***

Note: For IDx, users must refer to the parameters stated in 4.3.11. "$EVMN" EVent MaNagement.

- **Parameters**

ID	Parameters	Type	Unit	Comments
Parameters are in the same format as stated in **4.3.11. "$EVMN" EVent MaNagement**, users need to refer to segment on "**Event Message Content**" and "**Predefined Events**".				

- **Examples**

Type	Examples	Comments
Report(':')	$ALER:2,0,021006,055324,1,1.359959,103.841202,55.4,0.20,161	Event type = 2 Event value = 0 Date = 021006 UTC Time = 055324 Position Fix = 1 Latitude = 1.359959 Longitude = 103.841202 Altitude = 55.4 Speed = 0.20 Total distance = 161

- **Notes**

Alert for EMERG_CALL has the highest priority. If it fails to be sent out or the acknowledgement or Ack ("!") is not received, the Waveon 618e will buffer it and resend it once the GPRS connection is re-established.

4.3.14. "$VEID"(VEhicle ID)

- **Definition**

Assign a unique vehicle ID to Waveon 618e and manage the appendant VID and checksum. Appending VID helps Backend to identify the source of received message. Appending checksum helps Backend to verify the integrity of received message. The IMEI of the unit is also another feature that can be appended.

- **Command Type(s)**

Type	General Syntax
GET('?')	AT$VEID?
SET('=')	AT$VEID=***ID1***,***ID2***,***ID3***
REPORT(':')	$VEID:***ID1***,***ID2***,***ID3***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Vehicle ID number	U16_TYPE		Legal Values : [0, 65535] Default Value: 0 --- 0: default vehicle ID. 1 ~ 65535: valid vehicle ID. Users are responsible for assigning unique vehicle IDs during deployment.
ID2	Append VID	U8_type		Legal Values : {0, 1,2} Default Value: 0 --- 0: Do not append VID 1: Append VID 2: Append IMEI Appending the VID helps users to easily identify the sender. **It is recommended for users to turn this ON**.

ID3	Append Checksum	U8_type		Legal Values : {0, 1} Default Value: 0 --- 0:Do not append Checksum **(recommended)** 1: Append Checksum Appending the checksum provides users with an additional way to validate received data. However, It **may not be necessary** during application implementation as WUC is based on UDP and UDP provides a stronger checksum compared to this one. **It is recommended for users to turn this OFF**.

- **Examples**

Type	Examples	Comments
Set('=')	AT$VEID=8000,1,1	Set VID==8000, Append VID and Append checksum.
Get('?')	AT$VEID?	
Report(':')	$VEID:8000,0,1*2D	

4.3.15. "$CSMS"(Configure via SMS)

- **Definition**

When commands are sent via SMS, users are required to append the actual command to this command header $CSMS.

The command syntax is shown below, where the actual command being encapsulated into $CSMS with the parameter ***ID1*** (password):

AT$CSMS=<Password>,"<WUC command>"

After receiving the SMS command, the Waveon 618e will first verify the password. If password is valid, it will extract, execute the encapsulated actual command and return its execution result via SMS.

- **Command Type(s)**

Type	General Syntax
SET('=')	AT$CSMS=***ID1***,***ID2***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Password	STRING		Legal Values: String of up to 16 characters Default Value: Default Please note that password is **case-sensitive**. It is configured in $PSWD.
ID2	"WUC command"	STRING		Legal Values: String of up to 96 characters. Default Value: N/A Please note that the **quotation marks " "** MUST be used to encapsulate actual command.

- **Examples**

Type	Examples	Comments
Set('=')	AT$CSMS=default,"AT$GPRS=shwapint,,,127.0.0.1,12000"	The password is default. The actual command is "AT$GPRS=shwapint,,,127.0.0.1,12000".

4.3.16. "$RSET" (RESET Waveon 618e)

- **Definition**

Users can trigger a software reset, which is necessary to make new configuration effective in the Waveon 618e.

For example, when users configure the Waveon 618e via the UART port, the standard procedures comprises of:

1. Configuring the Waveon 618e with the commands listed in this document;
2. Saving updated configurations and settings by using the "AT$SCFG=1" command;
3. Resetting the Waveon 618e by using the "AT$RSET=1" command so that the new configurations will take effect.

- **Command Type(s)**

Type	General Syntax
SET('=')	AT$RSET=***ID1***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Operation	U8_TYPE		Legal Values : {1} Default Value: N/A ---------- 1: Reset the Waveon 618e

- **Examples**

Type	Examples	Comments
Set('=')	AT$RSET=1	Reset Waveon 618e

4.3.17. "$GPOU"(General Purpose OUtput)

- **Definition**

Users can set or clear the general purpose digital output pin. The last known status will be buffered by the Waveon 618e and restored after resetting.

- **Command Type(s)**

Type	General Syntax
SET('=')	AT$GPOU=***ID1***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Pin	U8_TYPE		Legal Values : {12} Default Value: N/A --- 12: Digital output pin
ID2	Value	BOOLEAN		Legal Values : {0, 1} Default Value: N/A --- 0: Set PIN to LOW 1: Set PIN to HIGH

- **Examples**

Type	Examples	Comments
Set('=')	AT$GPOU=12,1	Digital output pin is set to HIGH (10~12V)

4.3.18. "$GPIN"(General Purpose INput)

- **Definition**

Users can use this to read the status of general purpose digital input pins.

- **Command Type(s)**

Type	General Syntax
GET('?')	AT$GPIN?***ID1***
REPORT(':')	$GPIN: ***ID1***,***ID2***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Pin	U8_TYPE		Legal Values : {10, 2, 3} Default Value: N/A ---------- 10: Digital_input_1 2: Digital_input_2 3: Ignition pin (For testing purpose.)
ID2	2	value	BOOLEAN	Legal Values : {0, 1, Unknown} Default Value: N/A ---------- 0: PIN is LOW 1: PIN is HIGH Unknown: Invalid pin number.

- **Examples**

Type	Examples	Comments
Get('?')	AT$GPIN?2	
Report(':')	$GPIN:2,0	Digital_input_2 pin is in LOW status.

4.3.19. "$EDOP"(Enable Distance field of PSVL message)

- **Definition**

Users can enable or disable appending distance fields of PSVL message.

- **Command Type(s)**

Type	General Syntax
GET('?')	AT$EDOP?
SET('=')	AT$EDOP=***ID1***,***ID2***
REPORT(':')	$EDOP:***ID1***,***ID2***

- **Parameters**

ID	Parameters	Type	Unit	Comments
ID1	Operation	U8_TYPE		Legal Values : {0,1} Default Value: 0 ---------- 0:Disable appending distance field 1:Append ignition on-off distance field Its performance is greatly dependent on the quality of GPS signal. The better the GPS signal, the distance value gets more accurate. Please use $TRSD command to reduce GPS distance error.
ID2	Operation	U8_TYPE		Legal Values : {0, 1, Unknown} Default Value: N/A ---------- 0: PIN is LOW 1: PIN is HIGH Unknown: Invalid pin number.

- **Examples**

Type	Examples	Comments
Set('=')	AT$EDOP=1,0	

- **Note**

The distance measured by virtual odometer will always be less than the actual distance traveled because the algorithm is measured by a straight line between every two GPS locations.

An example is shown below in Fig 4.2 Distance, if a vehicle is traveled from A to B, the measured distance (straight line) will be less than the actual distance (dotted line).

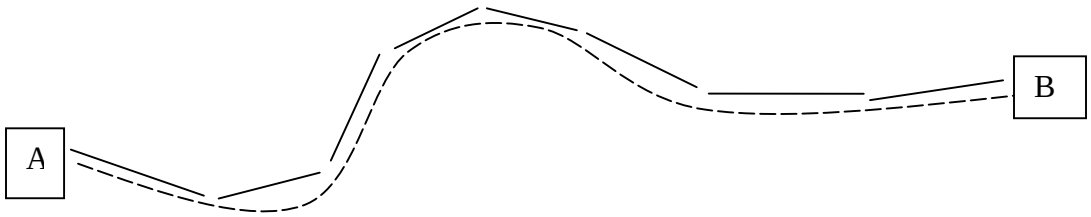


Fig4.2 Distance

If the user enables the Waveon 618e acknowledgement (**Refer to Section 4.3.2. "$AKTO" (AcKnowledge and TimeOut)**) with the vehicle ID, the backend is require to acknowledge to the unit when it relays information on the distance.

An example would be

Steps	Send Direction	Actual Command
1	Waveon 618e to backend	$PSVL:0005,100408,034256,0,0,0,0,0,209,4919,-54,1,2
2	Backend to Waveon 618e	AT$PSVL!0005
3	Waveon 618e to backend	$ALER:0003,256,1,100408,043824,1,1.359931,103.841189,25.1,0.18,0
4	Backend to Waveon 618e	AT$ALER!0003

5. HELP AND SUPPORT CENTER

Users can refer to the appendices for reference or more information to help in their application development and deployment.

For further troubleshooting and support enquiries, please contact our team at:

600 Sin Ming Avenue
4th Floor Citycab Building
Singapore 575733
Email: support@infowave.sg
Phone: +65 6483 0228
Fax: +65 6483 0388

APPENDIX A: A SIMPLE SERVER APPLICATION EXAMPLE IN C LANGUAGE

The portion of an application source code shown below is an illustration of how users can easily set the backend server to communicate with the Waveon 618 device such as evaluating a message sent from the Waveon 618e itself.

Please note that this script does not support $ELDA.

/* Sample written in C language */

```
/* START >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>*/
char *atcmd = NULL;
char buffer[512];
char response[48];
int respLength = 0;

while(1) {
    memset((void *)buffer, 0, sizeof(buffer));
    memset((void *)response, 0, sizeof(response));

    /* Receive UDP packet by polling */
    if(recvfrom(udpSocket, buffer, sizeof(buffer), 0, (struct sockaddr*)&from, &fromlen) !=
SOCKET_ERROR)
    {
        printf("%s", buffer);  //Print the string received from the Device.

        /* Handle received Message */
        //E.g. convert $PSVL to NMEA $GPGGA.

        /* Send back acknowledgement if required. */
        atcmd = strchr (buffer, '$');              //Search for string started with '$'
        if ( NULL != atcmd ) {                     //If found, pack the ACK packet.
            strcpy(response,"AT");                 //Add "AT" prefix.
            strncat(response, atcmd, 5);       //Append WUC command "$XXXX" read from
RX buffer.                          strcat(response, "!\r\n");          //Append <CR><LF>
required by WUC format.
```

```
                respLength = strlen(response);              //Get length of ACK packet.

                /* Acknowledgement */
                sendto(udpSocket, response, respLength, 0, (struct sockaddr*)&from, fromlen);
            }
        }

        Sleep(100);         //Sleep 100ms.
    }

    /* <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< END */
```

APPENDIX B: DESCRIPTION OF 25-PIN CONNECTOR AND CABLE

This section serves as a guide for users to connect Waveon 618e to the vehicle wiring system during installation. It is divided into 3 portions as shown below.

Segments	Description
F.1 Electrical connection	Guide to pin and cable connection
F.2 Programmable cable specification	Pin diagram of the programming cable
F.3 Expansion cable specification	Pin diagram of the expansion cable

F.1 Electrical Connection

To get started, users should implement the following steps:

1) Connect the (-) cable number 4 (Black) to the vehicle. (Twisted with the Red Cable)
2) Connect the (+) cable number 5 (Red) through the 5A fuse to the permanent tension source 12V/24V; it has to be connected directly to the vehicle's fuse box and not to other plug points such as clock, radio, cigarette lighter etc.
3) Roll out the rest of the cables, attached and secure them with a plastic label before placing them in a stable area in the vehicle.
4) Refer to **Fig B.1**, **Fig B.2** and the **table with cables description** for more information on how the cables and pins are connected correctly.

- **The negative pole of the vehicle battery must be disconnected before beginning with the installation.**
- **All electric connections should be soldered.**
- **Do not use any test light bulb, tension meter, or LED light. Using a tester light bulb could irreversibly damage to the vehicle system.**

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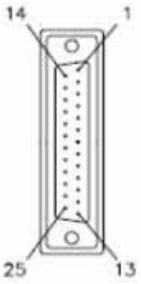
Image of the actual programming cable



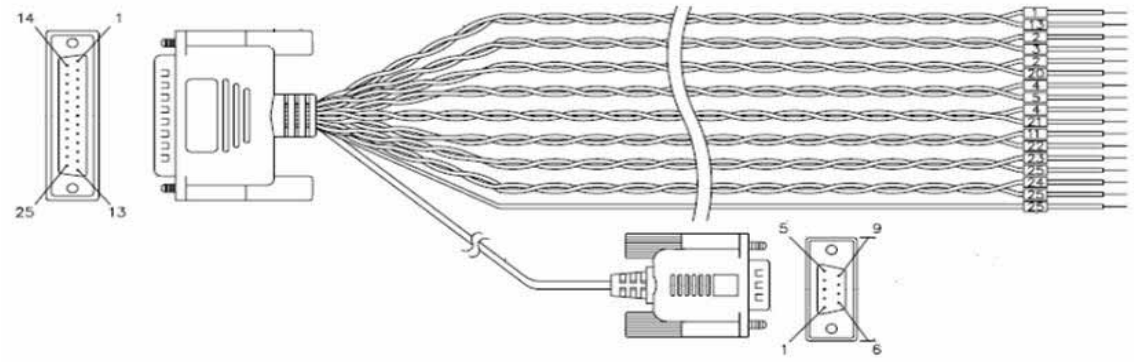
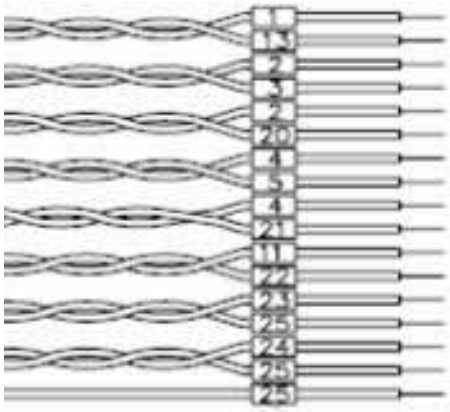


Fig B.1 Pin and Wiring Outlook

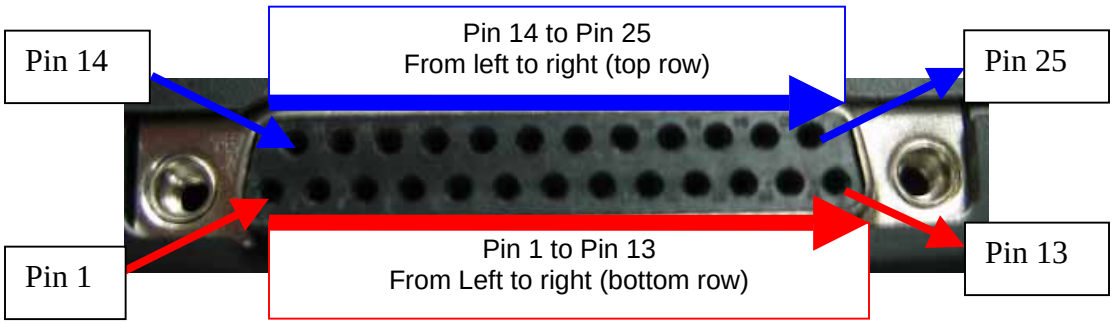
Table with Cables Description						
Pin	**Designation**	**Description**	**Label**	**Colour of Wire**	**Remarks**	**DB9 Connector**
1	ana_IN0	Analog Input	AIN	ORANGE	TWISTED WIRE	
2	GND	Ground	GND	BLACK	TWISTED WIRE	
3	DC_OUT	DC Output	DC_OUT	GREEN	TWISTED WIRE	
4	GND	Ground	GND	BLACK	TWISTED WIRE	
5	VIN	Power Input (12V/24V)	VIN	RED	TWISTED WIRE	
6	SPEED+		NC	NC	NC	
7	extTXD		AWG28 SHIELDED CABLE	BLACK	CONNECT TO DB9F (FEMALE)	TXD (PIN 2)
8	extRXD					RXD (PIN 3)
9	extCTS					CTS (Pin 8)
10	extRTS					RTS (Pin 7)
11	GND					GND (PIN 5)
12	nFWD+1		NC			
13	ADC_GND	Ground	ADC_GND	BROWN	TWISTED WIRE	
14	RS485_a		NC	NC	NC	
15	RS485_b		NC	NC	NC	
16	MISO		NC	NC	NC	
17	MOSI_buff		NC	NC	NC	
18	SPCK_buff		NC	NC	NC	
19	nPCS2_buff		NC	NC	NC	
20	Con_IN0	Emergency Signal	IN1	YELLOW	TWISTED WIRE	
21	Con_IN1	Ignition Signal	IN2	VIOLET	TWISTED WIRE	
22	Con_OUT0	Output Signal 1	OUT1	BROWN	TWISTED WIRE	
23	Con_OUT1	Output Signal 2	OUT2	BLUE	TWISTED WIRE	
24	Con_OUT2	NC	OUT3	WHITE	TWISTED WIRE	
25	GND	Ground	GND	BLACK	TWISTED WIRE	

5) Connect the Emergency Signal cable number 20 (Yellow) to the vehicle airbag signal. (optional)
6) Connect the Ignition Signal cable number 21 (Violet) to the vehicle ignition wire.
7) Connect the Ground Signal cables (Black) together with the vehicle ground wire.



Pin 2, Pin 4, Pin 13 & Pin 25	Ground – Black Wire
Pin 1	Analog Input – Orange Wire
Pin 3	DC Output – Green Wire
Pin 5	Power Input 12V/24V– Red Wire
Pin 20	Emergency Input – Yellow Wire
Pin 21	Ignition Input – Violet Wire
1. PiClick on the “user configuration”.	Output Signal 1 – Brown Wire
Pin 23	Output Signal 2 – Blue Wire

Fig B.2 Pin and Input Connections



F.2 Programmable Cable Specification:

Pin	Designation	Label	Colour of Wire	Description	DB9 Connector
1	ana_IN0	AIN	ORANGE	ANALOG IN 0	
2	GND	GND	BLACK	GROUND	
3	DC_OUT	DC_OUT	GREEN	DC OUT, 4.2V, 250mA	
4	GND	GND	BLACK	GROUND	
5	VIN	VIN	RED	POWER SUPPLY INPUT	
6	SPEED+	NC	NC	SPEED + (FOR DR VERSION)	
7	extTXD	AWG28 SHIELDED CABLE	BLACK	CONNECT TO DB9F (FEMALE)	TXD (PIN 2)
8	extRXD				RXD (PIN 3)
9	extCTS				CTS (Pin 8)
10	extRTS				RTS (Pin 7)
11	GND (Qty: 2)				GND (PIN 5)
12	nFWD+1	NC		FORWARD/REVERSE SIGNAL (FOR DR)	
13	ADC_GND	ADC_GND	BROWN	ANALOG GROUND	
14	RS485_a	NC	NC	RS485 - SIGNAL A	
15	RS485_b	NC	NC	RS485 - SIGNAL B	
16	MISO	NC	NC	SPI INTERFACE - MISO	
17	MOSI_buff	NC	NC	SPI INTERFACE - MOSI	
18	SPCK_buff	NC	NC	SPI INTERFACE _SPCK	
19	nPCS2_buff	NC	NC	SPI INTERFACE _nPCS2	
20	Con_IN0	IN1	YELLOW	DIGITAL INPUT 0 (IGNITION DETECTION)	
21	Con_IN1	IN2	VIOLET	DIGITAL INPUT 0 (EMERGENCY)	
22	Con_OUT0	OUT1	BROWN	DIGITAL OUTPUT 0 (IMMOBILIZER)	
23	Con_OUT1	OUT2	BLUE	DIGITAL OUTPUT 1 (HAZARD LIGHT/HORN)	
24	Con_OUT2	OUT3	WHITE	DIGITAL OYTPUT 2 (DOOR RELEASE)	
25	GND	GND	BLACK	GROUND	

Note: Input Voltage Vcc: +12 V or +24 V (Pin 5)

F.3 Expansion Cable Specification:

Pin	Designation	Label	Colour of Wire	Description
1	ana_IN0	AIN	ORANGE	ANALOG IN 0
2	GND	GND	BLACK	GROUND
3	DC_OUT	DC_OUT	GREEN	DC OUT, 4.2V, 250mA
4	GND	GND	BLACK	GROUND
5	VIN	VIN	RED	POWER SUPPLY INPUT
6	SPEED+	NC	NC	SPEED + (FOR DR VERSION)
7	extTXD	NC	NC	RS232 - TXD1
8	extRXD			RS232 - RXD1
9	extCTS			RS232 - CTS
10	extRTS			RS232 - RTS
11	GND (Qty: 2)			GROUND
12	nFWD+1	NC		FORWARD/REVERSE SIGNAL (FOR DR)
13	ADC_GND	ADC_GND	BROWN	ANALOG GROUND
14	RS485_a	NC	NC	RS485 - SIGNAL A
15	RS485_b	NC	NC	RS485 - SIGNAL B
16	MISO	NC	NC	SPI INTERFACE - MISO
17	MOSI_buff	NC	NC	SPI INTERFACE - MOSI
18	SPCK_buff	NC	NC	SPI INTERFACE _SPCK
19	nPCS2_buff	NC	NC	SPI INTERFACE _nPCS2
20	Con_IN0	IN1	YELLOW	DIGITAL INPUT 0 (EMERGENCY)
21	Con_IN1	IN2	VIOLET	DIGITAL INPUT 0 (IGNITION DETECTION)
22	Con_OUT0	OUT1	BROWN	DIGITAL OUTPUT 0 (IMMOBILIZER)
23	Con_OUT1	OUT2	BLUE	DIGITAL OUTPUT 1 (HAZARD LIGHT/HORN)
24	Con_OUT2	OUT3	WHITE	DIGITAL OYTPUT 2 (DOOR RELEASE)
25	GND	GND	BLACK	GROUND

Note: Input Voltage Vcc: +12 V or +24 V (Pin 5)

APPENDIX C: $SPIN RELATED GSM AT COMMANDS

ME	Mobile Equipment	Refers to the GSM engines
MS	Mobile Station	Refers to the GSM engines
DTE	Data Terminal Equipment	Refers to the host terminal/application in control
DCE	Data Communication Equipment	Refers to the Waveon 618e controlled by the host

F.1 Enter PIN +CPIN

Description: This command is used to enter ME with a password before it can be operated (SIM PIN, SIM PUK, PH-SIM PIN, etc.). If the PIN required is SIM PUK or SIM PUK2, the second pin is required. This second pin, <newpin>, is used to replace the old pin in the SIM.

When the Read command is executed, it will return an alphanumeric string indicating whether the password(s) is/are required or not. It is dependent on the user's application to validate the PIN status every time ME is reset or power on.

- **General Syntax**

The syntax is:

AT+CPIN=<pin>

Command	Possible response(s)
AT+CPIN=<pin>[,<newpin>]	*+CME ERROR: <err>*
AT+CPIN?	+CPIN: <code> *+CME ERROR: <err>*
AT+CPIN=?	
AT+CPIN?	+CPIN: SIM PIN
AT+CPIN="1234" Note: enter SIM PIN	OK Note: SIM PIN is correct

- **Defined values:**

<pin>, <newpin>: string type values

<code> values reserved by the present document:

READY	ME is not pending for any password
SIM PIN	ME is waiting SIM PIN to be given
SIM PUK	ME is waiting SIM PUK to be given
PH-SIM PIN	ME is waiting phone-to-SIM card password to be given
PH-FSIM PIN	ME is waiting phone-to-very first SIM card password to be given
PH-FSIM PUK	ME is waiting phone-to-very first SIM card unblocking password to be given
SIM PIN2	ME is waiting SIM PIN2 to be given (this <code> is recommended to be returned only when the last executed command resulted in PIN2 authentication failure (i.e. +CME ERROR: 17); if PIN2 is not entered right after the failure, it is recommended that ME does not block its operation)
SIM PUK2	ME is waiting SIM PUK2 to be given (this <code> is recommended to be returned only when the last executed command resulted in PUK2 authentication failure (i.e. +CME ERROR: 18); if PUK2 and new PIN2 are

	not entered right after the failure, it is recommended that ME does not block its operation)
PH-NET PIN	ME is waiting network personalization password to be given
PH-NET PUK	ME is waiting network personalization unblocking password to be given
PH-NETSUB PIN	ME is waiting network subset personalization password to be given
PH-NETSUB PUK	ME is waiting network subset personalization unblocking password to be given
PH-SP PIN	ME is waiting service provider personalization password to be given
PH-SP PUK	ME is waiting service provider personalization unblocking password to be given
PH-CORP PIN	ME is waiting corporate personalization password to be given
PH-CORP PUK	ME is waiting corporate personalization unblocking password to be given

F.4 Facility lock +CLCK

- **Description:**

This is used to lock, unlock or interrogate a ME or a network facility (as known as **<fac>**). Password is normally needed for function.

- **General Syntax:**

The syntax is:

AT+CLCK=<fac>,<mode>[,<"passwd">[,<class>]]

Command	Possible response(s)
AT+CLCK=<fac>,<mode>[,<"passwd">[,<class>]]	*+CME ERROR: <err>* when <mode>=2 and command successful: +CLCK: <status>[,<class1> [<CR><LF>+CLCK: <status>,<class2> [...]]
AT+CLCK=?	+CLCK: (list of supported <fac>s) *+CME ERROR: <err>*
AT+CLCK="SC",1,"1234"	OK Note: SIM lock enabled
AT+CPIN="1234"	OK Note: Correct PIN entered
AT+CLCK="SC",0,"1234"	OK Note: SIM lock disabled

AT+CLCK="AO",2 Note: Query BAOC status	+CLCK: 1,1 OK Note: BAOC is active.
AT+CLCK=?	+CLCK: ("SC","AO","OI","OX","AI","IR","AB","AG","AC","FD","PS","PN","PU","PP","PC","PF")

- **Defined values:**

<fac> values reserved by the present document:
"SC" SIM (lock SIM card) (SIM asks password in ME power-up and when this lock command issued)
"AO" BAOC (Barr All Outgoing Calls)
"OI" BOIC (Barr Outgoing International Calls)
"OX" BOIC-ex HC (Barr Outgoing International Calls except to Home Country)
"AI" BAIC (Barr All Incoming Calls)
"IR" BIC-Roam (Barr Incoming Calls when Roaming outside the home country)
"AB" All Barring services (refer GSM 02.30 [19]) (applicable only for <mode>=0)
"AG" All outgoing barring services (applicable only for <mode>=0)
"AC" All incoming barring services (applicable only for <mode>=0)
"FD" SIM fixed dialing memory feature (if PIN2 authentication has not been done during the current session, PIN2 is required as <passwd>)
"P2" SIM PIN 2

<mode>:
0 unlock
1 lock
2 query status

<status>:
0 not active
1 active

<passwd>: string type; it shall be the same as password specified for the facility from the ME user interface or with command Change Password +CPWD

<class*x*> is a sum of integers each representing a class of information (default 7):
1 voice (telephony)
2 data (refers to all bearer services; with <mode>=2 this may refer only to some bearer service if TA does not support values 16, 32, 64 and 128)
4 fax (facsimile services)
8 short message service
16 data circuit sync
32 data circuit async
64 dedicated packet access
128 dedicated PAD access

F.5 Change password +CPWD

- **Description:**

This command sets a new password for the facility lock function defined by command Facility Lock +CLCK.

- **General Syntax:**

The syntax is

AT+CPWD=<fac>,<"oldpwd">,<"newpwd">

Command	Possible response(s)
AT+CPWD=<fac>,<oldpwd>,<newpwd>	*+CME ERROR: <err>*
AT+CPWD=?	+CPWD: list of supported (<fac>,<pwdlength>)s *+CME ERROR: <err>*
AT+CPWD="SC","1234","6789"	OK Note: SIM PIN changed from 1234 to 6789.
AT+CPWD=?	+CPWD: ("SC",4),("AO",4),("OI",4),("OX",4),("AI",4),("IR",4),("AB",4),("AG",4),("AC",4),("P2",4)

- **Defined values:**

<fac>:
"P2": SIM PIN2 refer Facility Lock +CLCK for other values

<oldpwd>, <newpwd>: string type; <oldpwd> shall be the same as password specified for the facility from the ME user interface or with command Change Password +CPWD and <newpwd> is the new password

<pwdlength>: integer type maximum length of the password for the facility

APPENDIX D: OPTIMIZING GPS RECEPTION THROUGH CORRECT POSITIONING OF GPS ANTENNA

- **Introduction**

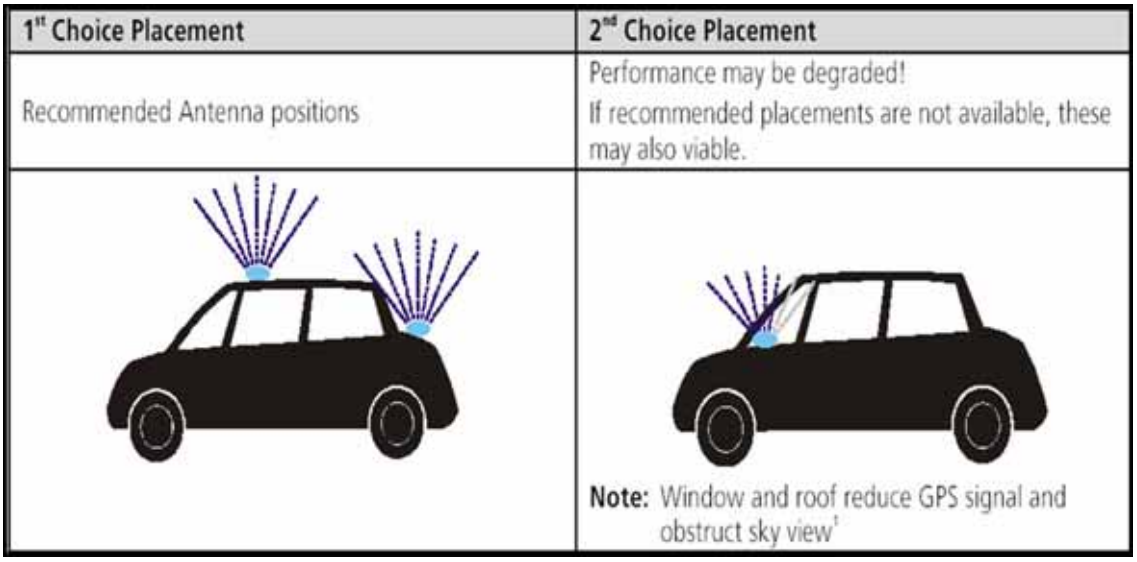
The signal from GPS satellites operates with a minimum signal level. The signal strength on Earth is approximately 15dB below the thermal noise floor. With such low signal strength, the GPS antenna must have a clear view of the sky to acquire the signal. This means that the antenna must be mounted either on a roof or in some cases on the back of a rear view mirror.

When using a patch antenna, it is always preferable to mount the antenna on the vehicle roof, as it has the best view of the sky. Any obstructions may degrade the performance by blocking the satellite signals.

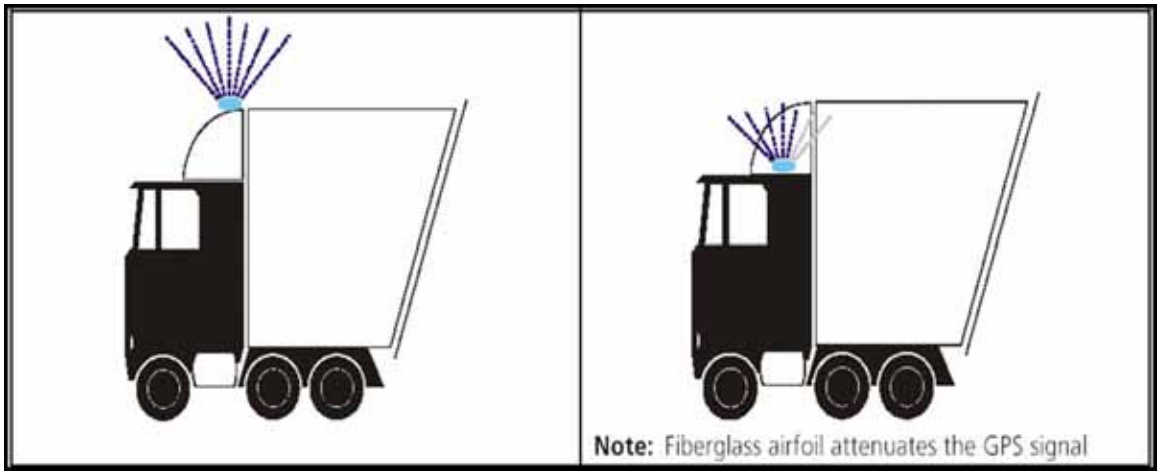
Alternatively, the antenna can be mounted by the windscreen. This will improve the upward visibility from the antenna to the sky.

The rear-view mirror mounted antenna is required in cases where it is not possible to mount it on the windscreen where it is obstructed by the metallic coating.

The following diagrams show the proper installation of GPS antennas in vehicles.



FigD.1 Proper GPS Antenna Placements



FigD.2 Proper GPS Antenna Placements

- **Conclusion**

InfoWave recommends the installation of the GPS antenna in the positions recommended in the diagrams for users to be assured of the optimal performance of Waveon 618e in their vehicles during deployment.

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APPENDIX E: DEFINITIONS AND ABBREVIATIONS

Definitions	Meaning
U8_TYPE	8-bit unsigned char
BOOLEAN	0 or 1
U16_TYPE	16-bit unsigned integer
U32_TYPE	32-bit unsigned integer
INT	32-bit integer
FLOAT	32-bit float
DOUBLE	64-bit float
STRING	String end with NULL character.
<VALUE>	VALUE is **compulsory**.
[VALUE]	VALUE is **optional**.
Waveon 618e	Waveon618
Backend	The remote facility used to manage Waveon 618e, E.g., Remote Server, Mobile Phone etc.
WUC	Wavelet User Command
EMPTY_STR	An empty string.
<CR>	Carry Return
<LF>	Line Feed
MIN_RPT_TIME	10 seconds. Minimum GPS report time.
WORD	32-bit value.
TX / RX	Transmit / Receive

End of Document

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions
(1) This device may not cause harmful interference and
(2) This device must accept any interference received, including interference that may cause undesired operation

Mobile Data Acquisition for mobile devices without co-location condition (the transmitting antenna is installed or located more than 20cm away from the body of user and near by person)
FCC RF radiation exposure statement:
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
d. for mobile devices with co-location condition (the transmitting antenna is installed or located more than 20cm away from the body of user and near by person