Application Note AN0024

Raw Measurement

Binary Message Extension

Of

SkyTraq Venus 6 GPS Receiver

Ver 0.6

November 4, 2009

Binary Message Protocol

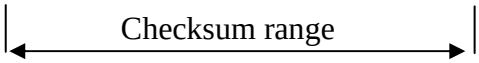
The Skytraq binary message protocol manual provides the detailed descriptions on the SkyTraq binary protocol serving as a communicating interface between SkyTraq GPS receivers and an external host such as PC, Notebook and mobile personal device. It is a standard protocol used by all SkyTraq devices and provides users a satisfactory control over the GPS receivers.

The SkyTraq GPS receiver outputs standard NMEA messages during normal operation. This NMEA messages may be a scheduled output at a specified rate subject to user's requests. The SkyTraq binary message protocol is designed with cares on reliable transmissions of data, ease & efficiency of implement, and payload independence mechanism which ensure users to retrieve data in a most effective & flexible way. The overall binary protocol messages can be categorized as input and output messages. Input messages provide the functionality to users to control the behavior of the GPS receiver and to retrieve the detailed information of the GPS status in real-time. Output messages, on the other hand, are information strings that GPS receiver responses to requests from hosts and can optionally periodically reports the Position, Velocity and Time (PVT) via NMEA or binary messages.

BINARY MESSAGE STRUCTURE

Message Format

The following picture shows the structure of a binary message.



Start of Sequence	Payload Length (PL)	Payload		Checksum (CS)	End of Sequence
		Message ID	Message Body		
0xA0, 0xA1	Two bytes	Message ID: 1 bytes; Payload up to 65535 bytes		One byte	0x0D, 0x0A

The syntax of the message is shown below.

<0xA0,0xA1><PL><Message ID><Message Body><CS><0x0D,0x0A>

Start of Sequence

This field contains two bytes of values 0xA0, 0xA1 which indicate start of Messages.

Payload Length

The payload length (PL) field contains 16 bits of value which indicates the length of payload.

Payload

The payload field consists of 2 sub-fields, Message ID and Message Body. Message ID field defines the message ID.

Sub-Field	Values
Message ID	0x01~0xFF
Message Body	Data Bytes

Checksum

Checksum (CS) field is transmitted in all messages. The checksum field is the last field in a message before the end of sequence field. The checksum is the 8-bit exclusive OR of only the payload bytes which start from Message ID until the last byte prior to the checksum byte. A reference to the calculation of CS is provided

below,

CS = 0, N=PL;
For n = 0 to N
CS = CS ^ <Payload Byte # n>

End of Sequence

This field contains two bytes of values 0x0D, 0x0A which indicate end of Messages.

Data Byte Ordering

All payloads in binary protocol are transferred in big-endian format. The high order byte is transmitted first followed by the low order byte for data size larger than a byte (e.g. UINT32, DPFP).

Data Type Definition

UINT8	8 bit unsigned integer
UINT16	16 bit unsigned integer
UINT32	32 bit unsigned integer
SINT8	8 bit signed integer
SINT16	16 bit signed integer
SINT32	32 bit signed integer
SPFP	32 bit single precision floating point number
DPFP	64 bit double precision floating point number

MESSAGE FLOW

Host can perform actions to GPS receiver by issuing a request or a set message. The message flow between Host and GPS receiver is designed under the considerations of certain reliable transmission. SkyTraq binary message protocol requires an ACK response from the GPS receiver upon receiving a successful input message and on the other hand, requires a NACK response from the receiver to a failed input message. Figure 1 shows a message flow that a host requests information from GPS receiver and the GPS receiver responses with an ACK and information respectively. Figure 2 shows a message flow with un-successful input message. Therefore, all requests (input messages) will have a corresponding ACK or NACK to be related with. However, output messages will not require the host to confirm by an ACK or NACK back in current design.

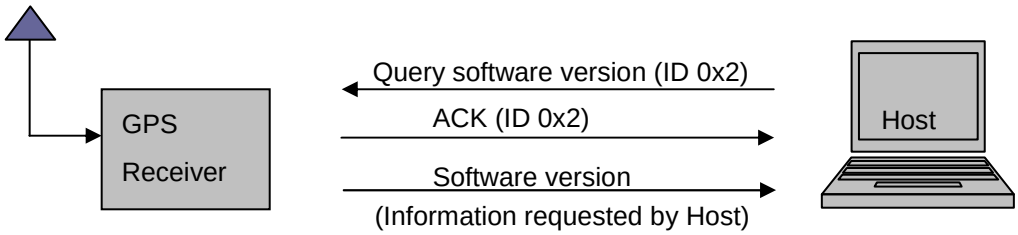


Figure 1

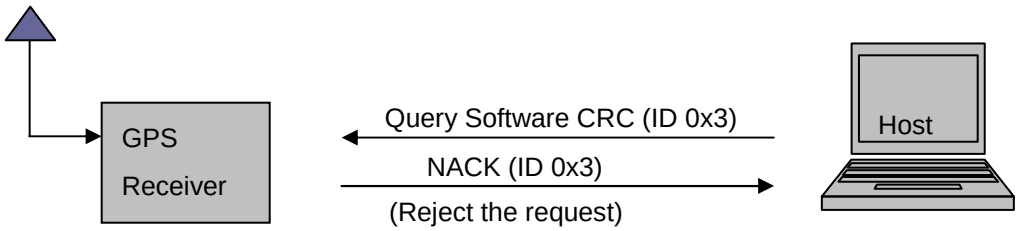


Figure 2

MESSAGE LIST

This section provides brief information about available SkyTraq binary input and output messages shown in a tabular list. All the messages are listed by Message ID. Full descriptions of input and output messages will be described in later Sections.

Input System Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x09	9	Input	Configure Output Message Format	Configure the output message format from GPS receiver
0x12	18	Input	Configure binary measurement output rates	Configure the output rates of the binary measurement outputs
Input GPS Messages				
0x11	17	Input	Get Almanac	Retrieve almanac data of the GPS receiver
0x30	48	Input	Get Ephemeris	Retrieve ephemeris data of the GPS receiver
Output System Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x80	128	Output	Software version	Software revision of the receiver
0x81	129	Output	Software CRC	Software CRC of the receiver
0x83	131	Output	ACK	ACK to a successful input message
0x84	132	Output	NACK	Response to an unsuccessful input message
Output GPS Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x87	134	Output	GPS Almanac Data	Outputting the GPS Almanac Data of GPS receiver
0xB1	177	Output	GPS Ephemeris Data	Outputting the GPS Ephemeris Data of GPS receiver
0xDC	220	Output	MEAS_TIME	Measurement time information
0xDD	221	Output	RAW_MEAS	Raw channel measurements
0xDE	222	Output	SV_CH_STATUS	SV and Channel status information
0xDF	223	Output	RCV_STATE	GPS receiver navigation state
0xE0	224	Output	SUBFRAME	Subframe buffer data

INPUT MESSAGES

Configure Output Message Format– Configure and select output message type (NMEA/BINARY) (0x09)

This is a request message which will change the GPS receiver output message type. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><09>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 09 00 00 09 0D 0A

1 2 3

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	09		UINT8	
2	Type	00	00 : No output 01 : NMEA message 02 : Binary Message	UINT8	
3	Attributes	00	0: update to SRAM 1: update to both SRAM & FLASH	UINT8	
Payload Length : 3 bytes					

Configure Binary Measurement Output Rates– Configure binary message output rates (0x12)

This is a request message which will set binary output message rate configuration. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 8 bytes. Currently the output rate configuration supports 1Hz / 2Hz / 4Hz / 5Hz / 10Hz / 20Hz.

Structure:

<0xA0,0xA1>< PL><12>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 07 12 06 01 01 01 00 01 00 08 0D 0A

1 2 3 4 5 6 7 8

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	12		UINT8	
2	Binary measurement output rate for Meas_time / Raw_meas / SV_CH_Status	06	00: 1Hz 01: 2Hz 02: 4Hz 03: 5Hz 04: 10Hz 05: 20Hz Others: 20Hz	UINT8	
3	Meas_time Enabling	01	00: Disable 01: Enable Others: Disable	UINT8	
4	Raw_meas Enabling	01	00: Disable 01: Enable Others: Disable	UINT8	
5	SV_CH_Staus Enabling	01	00: Disable 01: Enable Others: Disable	UINT8	
6	RCV_State Enabling	00	00: Disable 01: Enable (only 1Hz supported) Others: Disable	UINT8	
7	Subframe Enabling	01	00: Disable 01: Enable Others: Disable	UINT8	
8	Attributes	00	0: update to SRAM 1: update to both SRAM & FLASH	UINT8	
Payload Length : 8 bytes					

Get Almanac– Get almanac used of firmware (0x11)

This is a request message which is issued from the host to GPS receiver to retrieve almanac data. The GPS receiver should respond with an ACK along with information on almanac for assigned satellites when successful and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><11>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 11 00 82 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	11		UINT8	
2	SV #	00	0: means all SVs 1~32 : mean for the particular SV	UINT8	
Payload Length : 2 bytes					

Get Ephemeris – Get ephemeris used of firmware (0x30)

This is a request message which is issued from the host to GPS receiver to retrieve ephemeris data. The GPS receiver should respond with an ACK along with information on ephemeris when successful and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><30>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 30 2D 0D 0A

1

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	30		UINT8	
2	SV #	00	0: means all SVs 1~32 : mean for the particular SV	UINT8	
Payload Length : 2 bytes					

OUTPUT MESSAGES

SOFTWARE VERSION – Software version of the GPS receiver (0x80)

This is a response message which provides the software version of the GPS receiver. This message is sent from the GPS receiver to host. The example below output the SkyTraq software version as 01.01.01-01.03.14-07.01.18 on System image. The payload length is 14 bytes.

Structure:

<0xA0,0xA1>< PL><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0E 80 01 00 01 01 01 00 01 03 0E 00 07 01 12 98 0D 0A

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	80		UINT8	
2	Software Type	00	0: Reserved 1: System code	UINT8	
3-6	Kernel Version	00010001	X1.Y1.Z1 = SkyTraq Kernel Version Ex. X1=01, Y1=00, Z1=01 (1.0.1)	UINT32	
7-10	ODM version	00010307	X1.Y1.Z1 = SkyTraq Version Ex. X1=01, Y1=03, Z1=01 (1.3.1)	UINT32	
11-14	Revision	00060C0F	YYMMDD = SkyTraq Revision Ex. YY=06, MM=01, DD=10 (060110)	UINT32	
Payload Length : 14 bytes					

SOFTWARE CRC – Software CRC of the GPS receiver (0x81)

This is a response message which provides the software CRC of the GPS receiver. This message is sent from the GPS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><81>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 81 01 98 76 6E 0D 0A

1 2 3 4

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	81		UINT8	
2	Software Type	00	0: Reserved 1: System code	UINT8	
3-4	CRC	9876	CRC value	UINT16	
Payload Length : 4 bytes					

ACK – Acknowledgement to a Request Message (0x83)

This is a response message which is an acknowledgement to a request message. The payload length is 2 bytes

Structure:

<0xA0,0xA1>< PL><83>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 83 02 81 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	83		UINT8	
2	ACK ID	02	Message ID of the request message	UINT8	
Payload Length : 2 bytes					

NACK – Response to an unsuccessful request message (0x84)

This is a response message which is a response to an unsuccessful request message. This is used to notify the Host that the request message has been rejected. The payload length is 2 bytes

Structure:

<0xA0,0xA1>< PL><84>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 84 01 82 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	84		UINT8	
2	ACK ID	01	Message ID of the request message	UINT8	
Payload Length : 2 bytes					

GPS ALMANAC Data– almanac data of GPS receiver (0x87) (polled)

This is a response message which provides the almanac information. This message is sent from the GPS receiver to host. The payload length is 28 bytes.

Structure:

<0xA0,0xA1>< PL><87>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 1C 87 01 … 82 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	87		UINT8	
2	PRN	01	Satellite PRN 01-32	UINT8	Hz
3	WORD 3 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 3rd word of the almanac.	3 bytes	
4	WORD 4 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 4th word of the almanac.	3 bytes	
5	WORD 5 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 5th word of the almanac.	3 bytes	
6	WORD 6 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 6th word of the almanac.	3 bytes	
7	WORD 7 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 7th word of the almanac.	3 bytes	
8	WORD 8 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 8th word of the almanac.	3 bytes	
9	WORD 9 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 9th word of the almanac.	3 bytes	
10	WORD 10 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 10th word of the almanac.	3 bytes	
11	WNA		Week number of almanac	SINT16	week
Payload Length : 28 bytes					

GPS Ephemeris data – ephemeris data of the GPS receiver (0xB1) (polled)

This is a response message which provides the Ephemeris Data of the GPS receiver to Host. This message is sent from the GPS receiver to host. The payload length is 87 bytes.

Structure:

<0xA0,0xA1>< PL><B1>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 57 B1 00 02 00 77 88 04 61 10 00 00 00 00 00 00 00 00 00 00 00 00 DB DF 59 A6 00 00 1E 0A

1 2 3 …… 28 29

47 7C 00 77 88 88 DF FD 2E 35 A9 CD B0 F0 9F FD A7 04 8E CC A8 10 2C A1 0E 22 31 59 A6 74 00 77

30 31 . ……... 62 63

89 0C FF A3 59 86 C7 77 FF F8 26 97 E3 B9 1C 60 59 C3 07 44 FF A6 37 DF F0 B0 5E 0D 0A

64 65 …… 86 87

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	B1		UINT8	
2-3	SV id	02	Satellite id	UINT16	
4	Reserved	0	A reserved byte	UINT8	
5	Subframe 1 WORD 2 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 2nd word of subframe 1.	3 bytes	
6	Subframe 1 WORD 3 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 3rd word of subframe 1.	3 bytes	
7	Subframe 1 WORD 4 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 4th word subframe 1.	3 bytes	
8	Subframe 1 WORD 5 bit 01~ bit24		Bit01- Bit24 (MSB->LSB) of 5th word of subframe 1.	3 bytes	
9	Subframe 1 WORD 6 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 6th word of subframe 1.	3 bytes	
10	Subframe 1 WORD 7 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 7th word of subframe 1.	3 bytes	
11	Subframe 1 WORD 8 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 8th word of subframe 1.	3 bytes	
12	Subframe 1 WORD 9 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 9th word of subframe 1.	3 bytes	
13	Subframe 1 WORD 10 bit01~ bit24		Bit01- Bit24 (MSB->LSB) of 10th word of subframe 1.	3 bytes	
14-23	Subframe 2 WORD 2~ WORD10		Words 2 through 10 of subframe 2, same as field 4-13.		
24-33	Subframe 3 WORD 2~		Words 2 through 10 of subframe 3,		

	WORD 10		same as field 4-13.		
Payload Length : 87 bytes					

MEAS_TIME– Measurement time information (0xDC) (Periodic)

This is the time information on when the raw GPS measurement is taken. This message is sent from the GPS receiver to host. The payload length is 10 bytes

Structure:

<0xA0,0xA1>< PL><DC>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0A DC 01 00 01 11 3A ……..82 0D 0A

1 2 3 4 ……..

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	DC		UINT8	
2	IOD	01	Issue of Data from (0-255)	UINT8	
3	Receiver WN	0001	Receiver Week number (0-65535)	UINT16	weeks
4	Receiver TOW	113A	Receiver TOW (0-604799999)	UINT32	ms
5	Measurement period	03E8	Measurement period (1-1000)	UINT16	ms
Payload Length : 10 bytes					

RAW_MEAS– Raw measurements from each channel (0xDD) (Periodic)

This is the raw measurement from the GPS receiver. This message is sent from the GPS receiver to host. The measurement data of a channel is provided only when the corresponding satellite signal is under lock status. The payload length is (3+Number_of_measurement*23) bytes.

Structure:

<0xA0,0xA1>< PL><DD>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 62 DD 01 05 ……..82 0D 0A

1 2 3 ……..

Field	Name		Example(hex)	Description	Type	Unit
1	Message ID		DD		UINT8	
2	IOD		01	Issue of Data from 0-255	UINT8	
3	NMEAS		05	Number of measurement	UINT8	
4	Channel 1 Measurement	PRN	02	Satellite PRN	UINT8	
5		CN0	28	Channel CNR	UINT8	dBHz
6		Pseudo-range	7530	Channel pseudo-range	DPFP	meter
7		Accumulated carrier cycle	C1D5DB26F29E872B	Accumulated carrier phase measurement, The carrier phase measurement is accumulated after carrier lock is achieved. Discontinuity in the carrier phase will be indicated by the cycle slip flag. We also adjust the polarity of the carrier phase measurement before output. The polarity of accumulated carrier cycle is defined such that an approaching satellite has decreasing	DPFP	Cycles (L1)

				accumulated carrier cycle measurement, the same as RINEX convention.		
8		Doppler frequency	C49A51CB	The sign of Doppler frequency is defined such that the approaching satellite has positive doppler frequency.	SPFP	Hz
9		Channel Indicator	07	Bit 0 ON: pseudo-range is available in the channel. Bit 1 ON: Doppler frequency is available in the channel. Bit 2 ON: carrier phase is available in the channel. Bit 3 ON: cycle slip is possible in the channel. Bit 4 ON: coherent integration time of the channel is equal to or more than 10ms. (* Bit 0 is LSB)	UINT8	
10-15	Channel 2 measurement					
15-21	Channel 3 measurement					
:	:		:	:	:	:
Payload Length : 3+NMEAS*23 bytes						

SV_CH_STATUS– SV and channel status (0xDE) (Periodic)

This is the information about channel and satellite status. This message is sent from the GPS receiver to host. The payload length is (3+Num_of_satellite*10) bytes.

Structure:

<0xA0,0xA1>< PL><DE>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 35 DE 01 05 00 02 ……..82 0D 0A

1 2 3 4 5……..

Field	Name		Example(hex)	Description	Type	Unit
1	Message ID		DE		UINT8	
2	IOD		01	Issue of Data from 0-255	UINT8	
3	NSVS		05	Number of SVs	UINT8	
4	SV-CH 1 Status	Channel ID	00	Channel ID 0-11	UINT8	
5		PRN	02	Satellite PRN	UINT8	
6		SV Status indicator	07	Bit 0 ON: Almanac is received for this satellite Bit 1 ON: Ephemeris is received for this satellite Bit 2 ON: This satellite is healthy (*Bit 0 is LSB)	UINT8	
7		URA	00	User range accuracy	UINT8	
8		CN0	28	CNR	SINT8	dBHz
9		Elevation	2D	SV Elevation	SINT16	deg
10		Azimuth	8A	SV Azimuth	SINT16	deg
11		Channel Status indicator	1F	Bit 0 ON: Pull-in stage is done for this channel Bit 1 ON: Bit synchronization is done for this channel Bit 2 ON: Frame synchronization is done for this channel Bit 3 ON: Ephemeris is received for this channel Bit 4 ON: Used in normal fix mode	UINT8	

				Bit 5 ON: Used in differential fix mode (*Bit 0 is LSB)		
12-19	SV-CH 2 status					
20-27	SV-CH 3 status					
:	:		:	:	:	:
Payload Length : 3+NSVS*10 bytes						

RCV_STATE– Receiver navigation status (0xDF) (Periodic)

This is the navigation status calculated by of the GPS receiver. This message is sent from the GPS receiver to host. The payload length is 81 bytes. This information is for reference purpose only.

Structure:

<0xA0,0xA1>< PL><DF>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 51 DF 01 02 05…….82 0D 0A

1 2 3 4 ……..

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	DF		UINT8	
2	IOD	01	Issue of Data from 0-255	UINT8	
3	Navigation State	02	00: NO_FIX, 01: FIX_PREDICTION 02: FIX_2D 03: FIX_3D 04: FIX_DIFFERENTIAL	UINT8	
4	WN	05F2	GPS week number	UINT16	weeks
5	TOW	41134EFC 00000000	GPS TOW	DPFP	sec
6	ECEF POS_X	C146C60AF89C8B3E	ECEF POS_X	DPFP	meter
7	ECEF POS_Y	4152F1BAEC433B0A	ECEF POS_Y	DPFP	meter
8	ECEF POS _Z	41444679FC67CED3	ECEF POS _Z	DPFP	meter
9	ECEF VEL_X	BBA49C10	ECEF VEL_X	SPFP	m/s
10	ECEF VEL_Y	3C9BC4A0	ECEF VEL_Y	SPFP	m/s
11	ECEF VEL_Z	00000000	ECEF VEL_Z	SPFP	m/s
12	Clock Bias	61616161FC59E1F4	Clock Bias of receiver	DPFP	meter
13	Clock Drift	41D79E49	Clock Drift of receiver	SPFP	m/s
14	GDOP	3F99999A	GDOP	SPFP	
15	PDOP	3F99999A	PDOP	SPFP	
16	HDOP	3F99999A	HDOP	SPFP	
17	VDOP	3F99999A	VDOP	SPFP	
18	TDOP	3F99999A	TDOP	SPFP	
Payload Length : 81 bytes					

SUBFRAME– Sub frame buffer data (0xE0) (Periodic)

This is the information about the sub frame data bits currently collected in GPS receiver. The data bits are composed from the 24 higher bits of each of the navigation words and the parity bits are not included in the output. Only when all 10 navigation words have been verified by parity checking, the data bits in the sub frame are output. Before being sent out to the host, the data bits are also polarity-adjusted. The 8 preamble bits of a sub frame, for example, can be obtained from the first byte of the 3-byte field of navigation word 1. This message is sent from the GPS receiver to host. The payload length is 33 bytes.

Structure:

<0xA0,0xA1>< PL><E0>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 21 E0 01 01 00 00 00 ……..82 0D 0A

1 2 3 4 5……..

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	E0		UINT8	
2	PRN	01	Satellite PRN	UINT8	
3	SFID	01	Sub-frame ID (1-5)	UINT8	
4	WORD 1 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 1	3 bytes	
5	WORD 2 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 2	3 bytes	
6	WORD 3 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 3	3 bytes	
7	WORD 4 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 4	3 bytes	
8	WORD 5 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 5	3 bytes	
9	WORD 6 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 6	3 bytes	
10	WORD 7 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 7	3 bytes	
11	WORD 8 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 8	3 bytes	
12	WORD 9 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 9	3 bytes	
13	WORD 10 bit01~ bit24		24 parity-checked and polarity-adjusted bits of subframe word 10	3 bytes	
Payload Length : 33 bytes					

Change Log

Ver 0.6, Nov.04, 2009

1. The definition about the polarity of accumulated carrier cycle is added.

Ver 0.5, October 9, 2009

2. Description about raw measurement 0xDD message and its definition of accumulated carrier phase is modified.

Ver 0.4, September 25, 2009

1. Corrected little endian to big endian on message format.
2. Updated raw measurement output 0xDD accumulated carrier cycle to DPFP, message length is changed from 3+19xN to 3+23xN. Sign of Doppler frequency is made positive when satellite is approaching.
3. Binary message output 0xE0 is data bit polarity adjusted before output.

Ver 0.3, September 21, 2009

1. Adding scaling information on binary message 0xDD accumulated carrier cycle output

Ver 0.2, April 8, 2009

1. Modified to support 1 / 2 / 4 / 5 / 10 / 20 Hz carrier phase raw data output

Ver 0.1, Mar 14, 2009

1. Initial release.

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