

# **Nortel CDMA Base Station GPS Receiver / GPS Timing Module Serial Interface Specification**

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The serial interface provides a bi-directional interface for the purpose of performing the following main functions:

- Retrieving Time of Day
- Status reporting: alarm and current mode notifications
- Configuration of the GPSR/TM
- Diagnostic tests
- Manual modes of operation
- Code download
- Continuous GPSR 10 MHz and 1 PPS outputs
- Continuous GPSTM 9.8304 MHz and Even\_Second outputs
- Specific information/commands receive/send
- GPSR/TM log/error reading
- Query GPSR/TM Status Register

## Message Descriptions

The tables below show the list of message types and descriptions that are exchanged over the serial interface. The following notational conventions are used in the tables:

Commands are identified by **C:** and Responses by **R:**.

Strings are explicit (including quotes): **diag:log:clear**

Numeric ranges are expressed by: **-32,768 to 32,767**

Character templates appear as follows: **aaa,n\*.nnn\*,xx,x\*,b,E,A,"x\*"**

Where place holders are used as follows: **a = alpha character, n = numeric character, x = alpha-numeric character, b = byte, E = exponential expression and A = ASCII string.** String expressions appearing in quotes indicate the quoted string and the quotes are mandatory. The number of characters defines the field layout and the \* indicates zero or more additional characters. Place holders can appear as components of command strings. Comma can be used as delimiters in the command strings.

# 1. GPS Timing Module Message Types

**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
1	Time code query	C: Get Time Code Info. Query R: Time Code Information String	Character 13 Character n	ptime:tcode? x*
2	Accumulate leap seconds query	C: Request difference between UTC and GPS time R: Time in seconds	Character 22 Character n	ptime:acc:leapsecond? n*
3	Time of next leap second correction query	C: Request time of next GPS system leap second adjustment R: GPS time of next pending leap second	Character 19 Character n	ptime:leapsecond? n*
4	Preset receiver command	C: Reset GPS Command R: none	Character 12	syst:preset
5	Receiver identification query	C: Identification Query R: Manufacturer and revision information	Character 6 Character n	*idn? x*,x*,x*,x*,x*,x*,x*
6	Set Receiver Position	C: Specify Position Command R: none	Character n	gps:position a,n*,n*,n*,.n*,a,n*,n*,nn.n*.n*.n*
7	Get Receiver Position	C: Position Query R: Location	Character 14 Character n	gps:position? A,n*,n*,n.n*E[+-] ]n*,A,n*,n*,n.n*E[+-] ]n*,n.n*E[+-]n*

**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
8	Set antenna delay	C: Antenna delay in seconds R: none	Character 27	gps:ref:adelay .nnnnnnnnnn
9	Get antenna delay	C: Query antenna delay R: Antenna Delay in seconds	Character 16 Character n	gps:ref:adelay? n.n*E[+-]n*
10	GPS survey command	C: Survey mode command R: none	Character 25 or Character 20	gps:pos:survey[:stat] once
11	GPS survey query	C: Query if GPS is surveying R: status	Character 23 Character 1	gps:pos:survey:status? 0 1
12	Set manual holdover mode	C: Holdover Initiate Command R: none	Character 15	rosc:hold:init
13	Set manual holdover recovery	C: Recover from manual hold-over R: none	Character 19	rosc:hold:rec:init
14	Holdover duration query	C: Holdover Duration Query R: Holdover Duration in Seconds	Character 15 Character n	rosc:hold:dur? n.n*E[+-]n*,0   1
15	List of Satellites being tracked	C: Tracked Satellites Query R: List of satellites ID's	Character 18 Character n	gps:sat:tracking? n*,n*,n*,n*,n*,n*,n*,n*
16	List of predicted Satellites In View	C: Satellites in View Query R: List of predicted Satellites in view	Character 18 Character n	gps:sat:vis:pred? n*,n*,n*,n*,n*,n*,n*,n*

**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
17	Run self test command	C: Initiate internal self test R: Status	Character 12 Character 1	*tst? n where n=0 (pass), or non-zero value (test specific code)
18	Oscillator control value query	C: Request oscillator control voltage R: Current percentage of the maximum oscillator control voltage	Character 11 Character n	rosc:cont? n*
19	Holdover reason query	C: Query holdover reason R: Reason.	Character 15 Character n	rosc:hold:reason? “x*”
20	GREEN LED command	C: Command LED status R: None	Character 12	led:green 0 1
21	GREEN LED query	C: Query LED status R: status	Character 11 Character 1	led:green? 0 1
22	YELLOW LED command	C: Command LED status R: None	Character 13	led:yellow 0 1
23	YELLOW LED query	C: Query LED status R: status	Character 12 Character 1	led:yellow? 0 1
24	RED LED command	C: Command LED status R: none	Character 10	led:red 0 1
25	RED LED query	C: Query LED status R: status	Character 9 Character 1	led:red? 0 1
26	LOCK LED query	C: Query LED status R: status	Character 12 Character 1	led:locked? 0 1



**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
27	HOLDOVER LED query	C: Query LED status R: status	Character 14 Character 1	led:gpsholdover? 0 1
28	Last held position query	C: Last position query R: Location	Character 19 Character n	gps:last:hold:pos? A,n*,n*,n.n*E[+-] ]n*,A,n*,n*,n.n*E[+-] ]n*,n.n*E[+-]n*
29	Immediate Synchronization Command	C: Synchronize GPS system R: none	Character 15	sync:immediate
30	Time interval query	C: Even second drift R: Time interval	Character 16 Character n	pstime:interval? n.n*E[+-]n*
31	System Language command	C: System mode command R: none	Character 20	syst:lang "PRIMARY"   "INSTALL"
32	Module firmware download	C: Send firmware Motorola S-Record R: status	Character n  Character 1	diag:down "A" Where "A" is a Motorola S-Record in double quotes 0 1
33	Erase memory command	C: Erase Flash Memory Command R: Erase flash confirmation	Character 10 Character n	diag:eras +1Erased   Not erased
34	System Language Query	C: System mode query R: System Mode String	Character 11 Character 7	syst:lang? "PRIMARY"   "INSTALL"
35	Frequency Figure of Merit query	C: Freq. Figure of Merit Query R: Frequency figure of merit	Character 11 Character n	sync:ffom? n*

**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
36	Initialization assistance command	C: Initialize with estimate time, date and/or position R: none	Character 19 Character 21 Character n	gps:init:dtime nn,nn,nn and/or gps:init:ddate nnnn,nn,nn and/or gps:init:dposition a,n*,n*,n*,n*,a,n*,n*,nn.n*.n*.n*
37	Survey progress query	C: Survey Progress Query R: Percent of Survey completed.	Character 25 Integer	gps:pos:survey:progress? 0 to 100 decimal
38	Clear error queue command	C: Clear Error Command R: none	Character 5 none	*cls
39	Log data query	C: Read Log Entry Query R: Log Entry Data	Character 20 Character n	diag:log:read? [n] “x*”
40	Clear log entries command	C: Clear log entries command R: none	Character 15	diag:log:clear
41	Log entries query	C: Query log entries R: Number of entries in log.	Character 16 Character n	diag:log:count? n*
42	Operation status register query	C: Query operation status register R: Status register	Character 28 Character n	status:operation:condition? n*
43	Hardware status register query	C: Query hardware status register R: Status register	Character 27 Character n	status:hardware:condition? n*

**Table 1: GPS Timing Module Message Types**

	Commands	Command / Responses	Format	Value / Range
44	Life time Counter query	C: Get Lifetime Count Query R: Total Powered-On Time	Character 21 Character n	diag:lifetime:count? n*
45	Return Last Response query	C: Request last response Command R: Last Response string	Character 16 Character n	diag:query:resp? x*
46	Antenna system interface query	C: Antenna System query R: Antenna Status String	Character 19 Character n	antenna:condition? “x*”
47	Operational mode query	C: Operational mode Query R: Operational mode	Character 23 Character n	gps:operational:mode? “x*”
48	Switch between internal firmware	C: Switch firmware command R: Status	Character 16 Character 1	switch:firmware 0 1
49	Commit new firmware	C: Commit firmware command R: Status	Character 6 Character 1	commit 0 1
50	Determine firmware revisions and which revision is active	C: Query firmware revision R: Firmware revision and which is active	Character 16 Character n	rev:act:inact? x*,x*
51	Port initialization	C: Initialize port R: none	Character 1	\r\n
52	Copy firmware command	C: Copy firmware R: Status	Character 8 Character 1	diag:cpy 0 1
53	Copy Firmware Status Query	C: Copy firmware R: Status	Character 9 Character 1	diag:cpy? 0 1

## 2. GPS Timing Module Message Descriptions

Table 2: GPSTM message descriptions

	Commands	Descriptions
1	Time Code Query	<p>Returns Time Code : T1#H20AF16AC41+00B4</p> <p>T1 == format identifier  #H == number-representation identifier  20AF16AC == date and time of next on-time edge, expressed in seconds since start of GPS system (hex)  4 == Time Figure of Merit <sup>1</sup>  1 == Frequency Figure of Merit <sup>2</sup>  + == leap second indicator, (+ leap second pending, while a “0” to indicate no pending GPS leap second )  0 == alarm indication  0 == service request  B4 == checksum <sup>3</sup></p> <p>1. Time figure of merit (TFM) calculation:  <math display="block">TFM := MIN((INT(LOG (time\_error\_in\_nanosec)) + 1), 9)</math></p> <p>2. Frequency figure of Merit (FFM) assignment:  see: Frequency Figure of Merit Query above</p> <p>3. Calculate the checksum: <i>Convert all the characters as if they were ascii, except the checksum byte, to hex and then sum up the values.</i></p>

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
2	Accumulate Leap Seconds Query	This query returns the accumulated time difference between GPS and UTC time in seconds.
3	Time of next Leap Second Correction Query	This query returns the GPS time of the next pending leap second.
4	Preset Receiver Command	This command returns the receiver to the following state - Returns the unit to factory settings -The unit assumes the Power-up mode and starts to survey
5	Receiver Identification Query	<p>This query returns the following information.</p> <p>All software releases require:</p> <ul style="list-style-type: none"> <li>- Manufacturer code      Format: manufacturer's discretion</li> <li>- Model number            Format: manufacturer's discretion</li> <li>- Serial Number            Format: manufacturer's discretion</li> <li>- Firmware Revision      Format: manufacturer's discretion</li> </ul> <p>NBSS 7.1 and later requires the following additional fields:</p> <ul style="list-style-type: none"> <li>- Common Product Code    Format: Axxxxxxx    (i.e. A0681847)</li> <li>- Nortel Pec Code          Format: NTxxxxxxx    (i.e. NTGS50AA)</li> <li>- Release Number          Format: REL xx        (i.e. REL W1)</li> </ul> <p>All fields are alphanumeric and comma delimited.</p>
6	Set GPS Position	Places the GPSTM at a specific location.
7	Get GPS Position	Query the GPSTM location.

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
8	Set Antenna Delay	The unit sets the delay from the antenna unit to receiver unit measured in decimal seconds. The window for the antenna delay is +/- 50ms.
9	Get Antenna Delay	The unit returns the delay from the antenna unit to receiver unit measured in decimal seconds. Factory default setting is 0 ns. The GPSTM will return exponential values if the delay is small enough.
10	GPS Survey Command	Initiates a survey to determine location of GPSTM.
11	GPS Survey Query	This query returns a value of 0 or 1 indicating if the GPS is surveying. 0 means the GPS is not surveying and 1 means the GPS is surveying.
12	Set Manual Holdover Mode	Place the GPSTM in a holdover mode. The GPSTM will stay in this mode until commanded otherwise.
13	Set Manual Holdover Recovery	Place the GPSTM out of holdover mode.
14	Holdover Duration Query	This command returns the length of time the unit has been in a holdover mode and a single digit status flag of 0 or 1. If not currently in a holdover mode the status flag is "0" and unit will return the length of the last holdover mode. Otherwise the flag is set to "1" indicating the unit is in holdover. Units are in seconds.
15	List of Satellites being Tracked	The units returns a list of satellite ID numbers (SVID) of the satellites currently being tracked by the unit. A "0" returned means no satellites are currently being tracked. The response is "n*,n*,n*,n*,n*,n*,n*" where n = SVID of satellite and n = 0 means that the channel is not tracking a satellite.

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
16	List of Predicted Satellites In View	The unit will return a list of satellites ID numbers (SVID) of the satellites predicted to be over the horizon. This prediction is based upon the almanac, date time and position.
17	Run Self Test Command	The commands the unit to perform a self test. This command returns a “0” if passes, and non-zero value is test specific code.
18	Oscillator Control Value Query	The unit returns the current percent of the maximum control voltage to the oscillator.
19	Holdover Reason Query	<p>The unit returns the reason why it is in a holdover mode. This query returns a quoted string as follow.</p> <ul style="list-style-type: none"> <li>• <i>Not in holdover</i></li> <li>• <i>GPS data not available</i></li> <li>• <i>GPS data invalid</i></li> <li>• <i>GPS data rejected by TRAIM</i></li> <li>• <i>User initiated holdover</i></li> <li>• <i>In recovery</i></li> <li>• <i>Antenna feed line fault</i></li> </ul>
20	GREEN LED Command	This command toggles the status of the GREEN LED. This LED shall be deactivated by the GPSTM if the RED LED is activated to indicate an internal hardware alarm condition as defined in the Hardware Status Register.
21	GREEN LED Query	Query the status of the GREEN faceplate LED. It returns a value of 0 or 1, where 0 means the GREEN LED is off and 1 means the GREEN LED is on.

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
22	YELLOW LED Command	This command toggles the status of the YELLOW LED. The GPSTM will maintain this LED OFF as long as the communication between the CM and the GPSTM is not interrupted for longer than 60 seconds. The LED shall be deactivated after communication is re-established. The GPSTM shall make an entry to the diagnostic log each time the LED is activated due to a communication fault.
23	YELLOW LED Query	Query the status of the YELLOW faceplate LED. It returns a value of 0 or 1, where 0 means the YELLOW LED is off and 1 means the YELLOW LED is on.
24	RED LED Command	Toggle the status of the RED faceplate LED. This would be done remotely to indicate to field staff that the module can be removed. If the GPSTM has toggled the RED LED on to indicate an internal alarm, the LED cannot be deactivated by the user.
25	RED LED Query	Query the status of the RED faceplate LED. It returns a value of 0 or 1, where 0 means the RED LED is off and 1 means the RED LED is on.
26	LOCK LED Query	Query the status of the LOCK LED. It returns a value of 0 or 1, where 0 means the LOCK LED is off and 1 means the LOCK LED is on.
27	HOLDOVER LED Query	Query the status of the HOLDOVER LED. It returns a value of 0 or 1, where 0 means the HOLDOVER LED is off and 1 means the HOLD-OVER LED is on.



**Table 2: GPSTM message descriptions**

	Commands	Descriptions
28	Last Held position Query	This query returns the last held position in memory.
29	Immediate Synchronization Command	Immediate synchronization of the 10MHz, SYS_CLK, and EVEN_SECOND outputs to the GPS system.
30	Time Interval Query	This query returns the difference (in second) between the output Even_Second and the GPS system Even_Second signals.
31	System Language Command	This command changes the I/O mode between “INSTALL” for firmware downloading and “PRIMARY” for normal operation.
32	Firmware Download	This command sends one Motorola S-Record to the GPSTM. The S-Record is enclosed with quotes and appended to the program SCPI string. The S-Record is always sent to the inactive FLASH device. This command returns a value of 0 or 1, where 0 means download failure and 1 means download successful.
33	Erase Memory Command	The unit erases its flash memory. This command is only available in the “INSTALL” mode.
34	System Language Query	Query the GPSTM for what language enabled: <ul style="list-style-type: none"> <li>• “PRIMARY”</li> <li>• “INSTALL”.</li> </ul>

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
35	Frequency Figure of Merit Query	The unit returns this value indicating the uncertainty of the 10MHz output of the unit. This value is defined as: . 0 - indicates that the output is stable, unit is locked. . 1 - indicates that the output is stabilizing, unit is locked. . 2 - indicates that the unit is unlocked and in holdover. . 3 - indicates that the unit is unlocked but not in holdover (still in initial power-up)
36	Initialization Assistance Command	The user sends an estimated time, date or position to speed up the initialization process.
37	Survey Progress Query	The unit returns the percent complete of the survey process.
38	Clear Error Queue Command	Clears the error queue.
39	Log Data Query	Returns an entry from the log. This query returns a quoted string.
40	Clear Log Entries Command	The unit clears the log.
41	Log Entries Query	Returns the number of entries in the log.
42	Operation Status Register Query	The unit returns the contents of this register as a decimal value.
43	Hardware Status Register Query	The unit returns the contents of this register as a decimal value.
44	Life Time Counter Query	The unit returns the current value in the lifetime counter. This counter is initially zero at the factory, and is increased by one every three hours of operation.

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
45	Repeat Last Response Query	This query returns the last response message that had been sent through the Serial interface.
46	Antenna System Interface Query	Query the status of the antenna system. This query returns a quoted string. The following are the antenna condition response strings: <ul style="list-style-type: none"> <li>• <i>Antenna feed open circuit fault</i></li> <li>• <i>Antenna feed short circuit fault</i></li> <li>• <i>Antenna feed ok</i></li> </ul>
47	Operational Mode Query	This query returns a quoted string from the GPSTM to indicate which mode the unit is operating on. The following are the operational mode response strings: <ul style="list-style-type: none"> <li>• <i>Power Up Mode</i></li> <li>• <i>Lock Mode</i></li> <li>• <i>Holdover Mode</i></li> <li>• <i>Manual Holdover Mode</i></li> <li>• <i>Recovery Mode</i></li> <li>• <i>Free-Run Mode</i></li> </ul>
48	Switch Firmware Load Command	This command causes the GPSTM to load new firmware from the inactive FLASH. It returns a value of 0 or 1, where 0 means failure and 1 means success.
49	Commit Firmware Load Command	This command causes the GPSTM to change the flag status of each FLASH device. The inactive FLASH becomes active and vice versa. It returns a value of 0 or 1, where 0 means failure and 1 means success.

**Table 2: GPSTM message descriptions**

	Commands	Descriptions
50	Firmware Load Query	The query returns the revision number of the firmware load in the active and inactive FLASH devices, we assume the first revision number is the active flash and the second is the inactive flash. The response will be - active firmware revision, inactive firmware revision
51	Serial Port Initialization Command	The command sends a carriage return and a new line sequence to the GPS.
52	Copy Firmware Command	This command copies firmware from the primary (boot) flash device to the secondary flash device.
53	Copy Firmware Status Query	This command gives the status of the firmware copy operation. The possible error prompts are -824 for copy in progress and -825 for no prior copy operation.

### 3. GPS Timing Module Status Register Maps

**Table 3: GPS Timing Module Operation Status Register**

Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Alarm Bit	TOD Service Request Bit	GPSTM RED LED	Event written to Diagnostic Log?
0	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
1	Locked Operation	Set = 1 if the unit is operating in the Locked mode; set = 0 otherwise.	N	0	0	0	Y
2	Holdover Status	Set = 1 if the module is operating in the Auto Holdover, Manual Holdover, Recovery, or Free-Run Modes; set = 0 otherwise.	Y	1	0	0	Y
3	Position Hold operation	Set = 1 when a survey is completed and the position is stored in the unit's memory; set = 0 otherwise.	N	0	0	0	Y
4	Sufficient satellites to Lock	Set = 1 if the unit is tracking sufficient satellites to synchronize its timing and frequency outputs to the GPS constellation; set = 0 otherwise.	N	0	0	0	N

**Table 3: GPS Timing Module Operation Status Register**

Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Alarm Bit	TOD Service Request Bit	GPSTM RED LED	Event written to Diagnostic Log?
5	Hardware Status summary	Set = 1 if hardware register value > 0; set = 0 otherwise.	N	1	0	0	N
6	Diagnostic log almost full	Set = 1 if diagnostic log nearly full. The user may want to read and clear the log; set = 0 otherwise.	N	0	0	0	N
7	Module over-temperature fault	Set = 1 if the internal temperature sensor detects an internal ambient temperature > 70C; set = 0 otherwise.	N	1	0	0	Y
8	Module under-temperature fault	Set = 1 if the internal temperature sensor detects an internal ambient temperature < 0C, set = 0 otherwise.	N	1	0	0	Y
9	Antenna circuit fault	Set = 1 if open/short circuit detected by internal GPSTM circuitry; set = 0 otherwise.	Y	1	1	0	Y
10	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
11	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
12	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
13	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A

**Table 3: GPS Timing Module Operation Status Register**

Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Alarm Bit	TOD Service Request Bit	GPSTM RED LED	Event written to Diagnostic Log?
14	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
15	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A

**Table 4: GPS Timing Module Hardware Status Register**

Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Header Alarm Bit	TOD Header Service Request Bit	GPSTM RED LED	Event written to Log?
0	Self-test failure fault	Set = 1 if power-up or user-initiated self-test reports internal failure; set = 0 otherwise.	N	0	0	1	Y
1	Internal power supplies out of range	Continuously monitored and set = 1 if any of the internal power supplies exceed operational bounds for a predetermined duration (TBR); set = 0 otherwise.	N	1	1	1	Y
2	GPS 1 PPS fault	Continuously monitored and set = 1 if the OCXO drifts such that the OCXO-derived 1 PPS signal internal threshold (TBR) is exceeded; set = 0 otherwise.	N	1	0	0	Y
3	10 MHz OCXO frequency fault	Continuously monitored and set = 1 if the internal threshold (TBR) of the 10 MHz crystal output is exceeded due to excessive drift; set = 0 otherwise.	N	1	0	0	Y
4	10 MHz OCXO steering voltage fault	Continuously monitored and set = 1 if the internal D/A converter that steers the OCXO approaches either of its power supply rails (within 10%); set = 0 otherwise.	N	1	1	1	Y



Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Header Alarm Bit	TOD Header Service Request Bit	GPSTM RED LED	Event written to Log?
5	9.8304 MHz PLL circuitry failure	Continuously monitored and set = 1 if the circuitry that generates the 9.8304 MHz frequency reference output fails; set = 0 otherwise.	N	1	1	1	Y
6	EEPROM check fault	Set = 1 if the EEPROM check fails during a self-test; set = 0 otherwise.	N	0	0	1	Y
7	RAM check fault	Set = 1 if the RAM check fails during a self-test; set = 0 otherwise.	N	0	0	1	Y
8	FPGA check fault	Set = 1 if the RAM check fails during a self-test; set = 0 otherwise.	N	0	0	1	Y
9	RF high condition	Continuously monitored and set = 1 if the RF input from the GPS antenna exceeds upper threshold; set = 0 otherwise.	Y	1	1	0	Y
10	RF low condition	Continuously monitored and set = 1 if the RF input from the GPS antenna exceeds lower threshold; set = 0 otherwise.	Y	1	1	0	Y
11	No usable GPS satellites	Continuously monitored and set = 1 if TRAIM determines that all GPS satellite information is erroneous; set = 0 otherwise.	Y	1	0	0	Y

Bit	Information Reported	Comments	Transitions from Locked to Holdover Mode?	TOD Header Alarm Bit	TOD Header Service Request Bit	GPSTM RED LED	Event written to Log?
12	PDOP too high	Continuously monitored and set = 1 if the PDOP information from the decoded GPS constellation exceeds upper threshold (overdetermined GPS position solution); set = 0 otherwise.	Y	1	0	0	TBR
13	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
14	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A
15	Not currently used	N/A	N/A	N/A	N/A	N/A	N/A

## 4. GPS Receiver Message Types

**Table 5: GPS Receiver message types**

	Commands	Command/Response	Format	Value/Range
1	Time code query	C: Get Time Code Info. Query R: Time Code Information String	Character 13 Character n	ptime:tcode? x*
2	Preset receiver command	C: Reset GPS Command R: none	Character 12	syst:preset
3	Receiver identification query	C: Identification Query R: Manufacturer and revision information	Character 6 Character n	*idn? x*,x*,x*,x*[,x*,x*,x*]
4	Set Receiver Position	C: Specify Position Command R: none	Character n	gps:position a,n*,n*,n*.n*,a,n*,n*,nn.n*,n* .n*
5	Get Receiver Position	C: Position Query R: Location	Character 14 Character n	gps:position? A,n*,n*,n.n*E[+-] ]n*,A,n*,n*,n.n*E[+-] ]n*,n.n*E[+-]n*
6	Set antenna delay	C: Antenna delay in seconds R: none	Character 27	gps:ref:adelay .nnnnnnnnn
7	Get antenna delay	C: Query antenna delay R: Antenna Delay in seconds	Character 16 Character n	gps:ref:adelay? n.n*E[+-]n*
8	GPS survey command	C: Survey mode command R: none	Character 25 or Character 20	gps:pos:survey[:stat] once

	Commands	Command/Response	Format	Value/Range
9	Set manual holdover mode	C: Holdover Initiate Command R: none	Character 15	rosc:hold:init
10	Set manual holdover recovery	C: Recover from manual holdover R: none	Character 19	rosc:hold:rec:init
11	Holdover duration query	C: Holdover Duration Query R: Holdover Duration in Seconds	Character 15 Character n	rosc:hold:dur? n.n*E[+-]n*,0   1
12	List of Satellites being tracked	C: Tracked Satellites Query R: List of satellites ID's	Character 18 Character n	gps:sat:tracking? n*,n*,n*,n*,n*,n*,n*,n*
13	List of predicted Satellites In View	C: Satellites in View Query R: List of predicted Satellites in view	Character 18 Character n	gps:sat:vis:pred? n*,n*,n*,n*,n*,n*,n*,n*
14	Immediate Synchronization Command	C: Synchronize GPS system R: none	Character 15	sync:immediate
15	System Language Query	C: System mode query R: System Mode String	Character 11 Character 7	syst:lang? "PRIMARY"   "INSTALL"
16	Frequency Figure of Merit query	C: Freq. Figure of Merit Query R: Frequency figure of merit	Character 11 Character n	sync:ffom? n*
17	Survey progress query	C: Survey Progress Query R: Percent of Survey completed.	Character 25 Integer	gps:pos:survey:progress? 0 to 100 decimal
18	Clear error queue command	C: Clear Error Command R: none	Character 5 none	*cls

	Commands	Command/Response	Format	Value/Range
19	Log data query	C: Read Log Entry Query R: Log Entry Data	Character 15 Character n	diag:log:read? [n] “x*”
20	Clear log entries command	C: Clear log entries command R: none	Character 15	diag:log:clear
21	Log entries query	C: Query log entries R: Number of entries in log.	Character 16 Character n	diag:log:count? n*
22	Operation status register query	C: Query operation status register R: Status register	Character 28 Character n	status:operation:condition? n*
23	Life time Counter query	C: Get Lifetime Count Query R: Total Powered-On Time	Character 21 Character n	diag:lifetime:count? n*
24	Return Last Response query	C: Request last response Command R: Last Response string	Character 16 Character n	diag:query:resp? x*
25	Port initialization	C: Initialize port R: none	Character 1	\r\n
26	Set GPS Satellite Elevation Mask Angle	C: Elevation Mask Angle Query R: none	Character 21	gps:sat:trac:emangle n*
27	Get GPS Satellite Elevation Mask Angle	C: Get Elev. Mask Angle Query R: Elevation mask angle in degrees	Character 22 Byte	gps:sat:trac:emangle? 0 to 89 decimal

	Commands	Command/Response	Format	Value/Range
28	Get list of Specific Satellites not Tracked.	C: Get Ignored Satellites Query R: List of satellites ID's	Character 21 Character n	gps:sat:trac:ignore? n*
29	Set Ignored (disable tracking) of Specific Satellites	C: Set Ignored Satellites Command R: none	Character (21 + size of sat. list)	gps:sat:trac:ignore n*,n*, ...
30	Get Included Satellites	C: Get Included Satellites Query R: List of satellites ID's	Character 22 Character n	gps:sat:trac:include? n*, n*,...
31	Set Included for Specific Satellites	C: Set Included Satellites Command R: none	Character 21 (+sat. list)	gps:sat:trac:include n*,n*,...
32	Set Enable LED	C: Enable LED Command R: none	Character 14	led:enabled 1
33	Reset Enable LED	C: Disable LED Command R: none	Character 14	led:enabled 0
34	Time interval query	C: Even second drift R: Time interval	Character 16 Character n	ptime:interval? n.n*E[+-]n*
35	Antenna system interface query	C: Antenna System query R: Antenna Status String	Character 19 Character n	antenna:condition? "x"

## 5. GPS Receiver Message Descriptions

**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
1	Time Code Query	<p>Return Time Code: T1#H20AF16AC41+00B4</p> <p>T1 == format identifier  #H == number-representation identifier  20AF16AC == date and time of next on-time edge, expressed in seconds since start of GPS system (hex)  4 == Time Figure of Merit <sup>1</sup>  1 == Frequency Figure of Merit <sup>2</sup>  + == leap second indicator, (+ leap second pending, while a “0” to indicate no pending GPS leap second )  0 == alarm indication  0 == service request  B4 == checksum <sup>3</sup></p> <p>1. Time figure of merit (TFM) calculation:  <math>TFM := MIN((INT(LOG (time\_error\_in\_nanosec)) + 1) , 9)</math></p> <p>2. Frequency figure of Merit (FFM) assignment:  see: Frequency Figure of Merit Query above</p> <p>3. To calculate checksum: <i>Convert all the characters as if they were ascii, except the checksum byte, to hex and then sum up the values.</i></p>

**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
2	Preset Receiver Command	This command returns the receiver to the following state - Returns the unit to factory settings - The unit assumes the Power-up mode and starts to survey
3	Receiver Identification Query	This query returns the following information. All software releases require: - Manufacturer code      Format: manufacturer's discretion - Model number            Format: manufacturer's discretion - Serial Number            Format: manufacturer's discretion - Firmware Revision      Format: manufacturer's discretion  NBSS 7.1 and later requires the following additional fields: - Common Product Code    Format: Axxxxxxx    (i.e. A0681922) - Nortel Pec Code            Format: NTxxxxxxx    (i.e. NTPX26AB) - Release Number            Format: REL xx        (i.e. REL W1)  All fields are alpha-numeric and comma delimited.
4	Set GPS Position	Places the GPS Receiver at a specific location.
5	Get GPS Position	Query the GPS Receiver location.
6	Set Antenna Delay	The unit sets the delay from the antenna unit to receiver unit measured in decimal seconds. The window for the antenna delay is +/- 50ms.



**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
7	Get Antenna Delay	The unit returns the delay from the antenna unit to receiver unit measured in decimal seconds. Factory default setting is 0 ns. The GPSR will return exponential values if the delay is small enough.
8	GPS Survey Command	Initiates a survey to determine location of GPS Receiver.
9	Set Manual Holdover Mode	Place the GPS Receiver in a holdover mode. The receiver will stay in this mode until commanded otherwise.
10	Set Manual Holdover Recovery	Place the GPS Receiver out of holdover mode.
11	Holdover Duration Query	This command returns the length of time the unit has been in a holdover mode and a single digit status flag of 0 or 1. If not currently in a holdover mode the status flag is “0” and unit will return the length of the last holdover mode. Otherwise the flag is set to “1” indicating the unit is in holdover. Units are in seconds.
12	List of Satellites being Tracked	The units returns a list of satellite ID numbers (SVID) of the satellites currently being tracked by the unit. A “0” returned means no satellites are currently being tracked. The response is “n*,n*,n*,n*,n*,n*,n*,n*” where n = SVID of satellite and n = 0 means that the channel is not tracking a satellite.
13	List of Predicted Satellites In View	The unit will return a list of satellites ID numbers (SVID) of the satellites predicted to be over the horizon. This prediction is based upon the almanac, date time and position.

**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
14	Immediate Synchronization Command	Immediate synchronization of the 10MHz and 1 PPS outputs to the GPS system when the GPSR is in the recovery mode only.
15	System Language Query	Query the GPSR for what language enabled: <ul style="list-style-type: none"> <li>• “PRIMARY”</li> <li>• “INSTALL”.</li> </ul>
16	Frequency Figure of Merit Query	The unit returns this value indicating the uncertainty of the 10MHz output of the unit. This value is defined as: <ul style="list-style-type: none"> <li>. 0 - indicates that the output is stable, unit is locked.</li> <li>. 1 - indicates that the output is stabilizing, unit is locked.</li> <li>. 2 - indicates that the unit is unlocked and in holdover.</li> <li>. 3 - indicates that the unit is unlocked but not in holdover (still in initial power-up)</li> </ul>
17	Survey Progress Query	The unit returns the percent complete of the survey process.
18	Clear Error Queue Command	Clears the error queue.
19	Log Data Query	Returns an entry from the log. This query returns a quoted string.
20	Clear Log Entries Command	The unit clears the log.
21	Log Entries Query	Returns the number of entries in the log.
22	Operation Status Register Query	The unit returns the contents of this register as a decimal value.

**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
23	Life Time Counter Query	The unit returns the current value in the lifetime counter. This counter is initially zero at the factory, and is increased by one every three hours of operation.
24	Return Last Response Query	This query returns the last response message that had been sent through the Serial interface.
25	Serial Port Initialization Command	The command sends a carriage return and a new line sequence to the GPS.
26	Set GPS Satellite Elevation Mask Angle	Set the elevation mask angle. 90 degrees is straight up. Factory default setting is 10 degrees.
27	Get GPS Satellite Elevation Mask Angle	Get the elevation mask angle.
28	Get Ignored of Specific Satellites	When queried, the unit returns a list of satellite ID numbers (SVID) of satellites currently being ignored.
29	Set Ignored (disable tracking) of Specific Satellites	This unit can be commanded to ignored tracking specific satellites. A value of 0 ignores the entire constellation.
30	Get Included Satellites	When queried, the unit returns a list of satellite ID numbers (SVID) of satellites currently being tracked.
31	Set Included (enable tracking) for Specific Satellites	This unit can be commanded to tracked specific satellites. A value of 0 ignores the entire constellation.
32	Set Enable LED	Ignites LED.

**Table 6: GPS Receiver message descriptions**

	Commands	Descriptions
33	Reset Enable LED	Extinguishes LED.
34	Time Interval Query	This query returns the difference (in second) between the output 1PPS and the GPS system 1PPS signals.
35	Antenna System Interface Query	<p>Query the status of the antenna system. This query returns a quoted string. The following are the antenna condition response strings:</p> <ul style="list-style-type: none"> <li>• <i>Antenna feed open circuit fault</i></li> <li>• <i>Antenna feed short circuit fault</i></li> <li>• <i>Antenna feed ok</i></li> </ul>

## 6. GPS Receiver Status Register Map

**Table 7: GPS Receiver Operational Status Register**

Bit	Description in Source Code	Usage in BTSC
1	Power up Status register	This summary bit not referenced by BTSC software.
2	Locked on Satellites Indicator	0: Not Locked (in Holdover);    1: Locked on satellites.
3	Holdover Indicator	This summary bit not referenced by BTSC software.
4	Position Hold Indicator	0: GPSR is in survey mode;    1: GPSR is in position hold mode.
5	Satellite View Indicator	0: Insufficient satellites in view;    1: Sufficient satellites in view.
6	Hardware Integrity Indicator	0: Working normally;    1: A hardware fault was detected.
7	Log Present Indicator	0: Log has sufficient room;    1: Log is almost full.
8-16	Unspecified	These bits not referenced by BTSC software.

Note: Bits 1, 3, and 6 are set based on the contents of other tables (i.e. if any hardware error bit is set in the hardware error table, bit 6 is set otherwise bit 6 is clear).

## 7. Revision History

Revision Date	Author	Reasons for Revision.
	Jenny Nguyen	Initial Version
15 Jun 1997	Randall Dunning	Update and modify format for WDC.
1 Aug 1997	Randall Dunning	Changed due to 21 July 1997 Meeting with Trimble
28 Aug 1997	Randall Dunning	Add GPSR Status Word Map for Get Operation Status response. Strikethrough all Oman-A commands. Added specific usage of the Time Code response.
3 Nov. 1997	Claude Bedard	Revise to include new GPSTM commands and to correct errors.
10 Feb. 1998	Randall Dunning	Document in PLS MTXDOC as GPSINTSP.AA01
20 Mar. 1998	Michelle Gu	Separate GPSR and GPSTM message types and message descriptions
12 Mar. 1999	Randall Dunning	Update GPSTM commands with flash copy commands.