

Proposal for the Delivery  
of a

## **GPS Receiver for Space Applications**


For

**IIT, Mumbai**  
India

Submitted by

**Accord Software and Systems Private Limited**

37 K R Colony, Domlur Layout  
Bangalore, INDIA

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 1 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Revision History

Issue No.	Description of Amendment	Change Request No.	Release Date
Draft 1.1	Preliminary Draft	None	11 March 2009

WRITTEN BY:

G VYASARAJ  
PROJECT MANAGER

SIGNATURE & DATE: \_\_\_\_\_

APPROVED BY:


G S VARADARAJ / J K RAY  
GROUP MANAGER

SIGNATURE & DATE: \_\_\_\_\_

ISSUE AUTHORIZED BY:

S PURUSHOTHAM  
EXECUTIVE DIRECTOR

SIGNATURE & DATE: \_\_\_\_\_

	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 2 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## About The Document

This document describes a proposal for the delivery of GPS Receiver for Space applications to IIT, MUMBAI, Bangalore


The document is broadly divided into four parts.

Part I contains general information about the proposal.

Part II has technical information about the receiver to be delivered.


Part III has business terms and conditions, product roadmaps, IP rights etc.

Part IV includes the company's credentials, track records and the past projects related to this development.

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 3 of 22
<i>Proposal for GPS Receiver for Space applications</i>			

## Table of Contents


Revision History .....	1
About The Document .....	2
Table of Contents .....	3
Executive Summary .....	4
Part I – General .....	5
Introduction.....	5
Project Title .....	5
Project Mnemonic .....	5
Contact Name and Address .....	5
Scope of this document.....	5
References .....	5
Acronym .....	5
Part II – Technical .....	6
About this section .....	6
Receiver Overview .....	6
Block Diagram .....	7
Receiver Specification.....	8
Antenna Specification .....	9
Connector Interface.....	9
Message Structure .....	10
Output Messages: .....	10
List of Accord's custom Binary Messages.....	10
Part III –Commercial Business Terms and Conditions .....	20
About this Section .....	20
Accord's Responsibilities .....	20
IIT, Mumbai's Responsibilities.....	20
Intellectual Property Rights .....	21
Warranty.....	21
Acceptance.....	21

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 4 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Executive Summary

This proposal describes Accord's GPS Receiver for Space applications for IIT, MUMBAI. The following is the summary of milestones and schedule:

SL. No.	Delivery Schedule	Item
Milestone 1	T0	Project initiation
Milestone 2	T0 + 4 months	GPS Receiver for acceptance testing

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 5 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Part I – General

### Introduction

This document describes a proposal for the development of GPS Receiver for Space applications as per the relevant specifications. This development shall be carried out by Accord Software and Systems Private Limited, Bangalore, India based on their proprietary GPS receiver technology.

### Project Title

Proposal for GPS Receiver for Space applications (GPSSPACE)

### Project Mnemonic

GPSSPACE

### Contact Name and Address

Contact Person: G S Varadaraj, Group Manager - Marketing  
Authorized Signatory: S Purushotham, Executive Director  
Accord Software and Systems Pvt. Ltd.  
37 Krishna Reddy Colony, Domlur Layout  
Bangalore: 560 071, INDIA  
Phone: +91-80-2535 0105, +91-80-2535 0136, +91-80-2535 0138 Ext : 503  
Fax: +91-80-2535 2723  
Email: [varadaraj@accord-soft.com](mailto:varadaraj@accord-soft.com)

### Scope of this document


This document addresses the technical overview, technical description, interfaces, business terms and condition for the development and delivery of the GPS Receiver for Space applications for IIT, MUMBAI.

### References

In Response to telephone conversation held on 09/03/2009

### Acronym

DSP	Digital Signal Processing
GPS	Global Positioning System
GLONASS	GLobal Navigation Satellite System
ICD	Interface Control Document
PVT	Position Velocity Time
RF	Radio Frequency

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 6 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Part II – Technical

### About this section

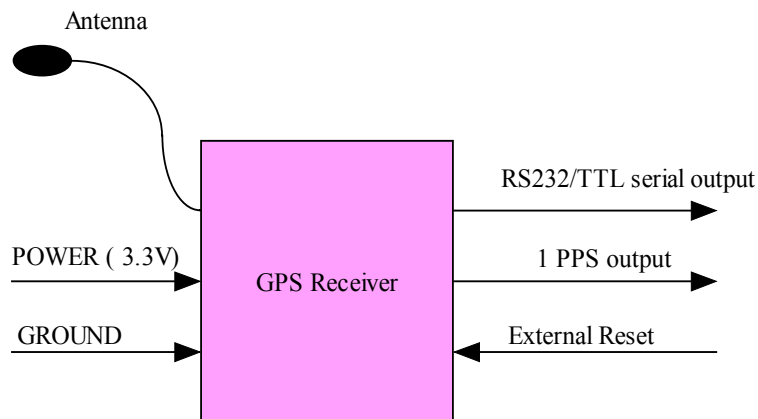
This section gives a technical description of the GPSSPACE

### Receiver Overview


GPSSPACE is a high dynamics 12-channel C/A code Global Positioning system receiver based on FPGA correlator. This receiver is custom designed for small satellite applications and it has a small form factor. The outputs of GPSSPACE can be used for precise positioning of the spacecraft and satellite orbit determination.

GPSSPACE interfaces to a standard GPS antenna through SMA connector for receiving RF signal. Receiver has a standard 9-pin DB connector for power and signal interface. Receiver is powered from single 3.3V supply with power consumption of less than 2W. Receiver computes navigation data such as position, velocity and time and this data is transmitted serially through RS232 interface. GPSSPACE provides 1 PPS output, which is synchronized with GPS time. Receiver also has provision to accept external reset.

Figure 1 shows a simple interface diagram of GPSSPACE:



**Figure 1: GPSSPACE Interface diagram**

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 7 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

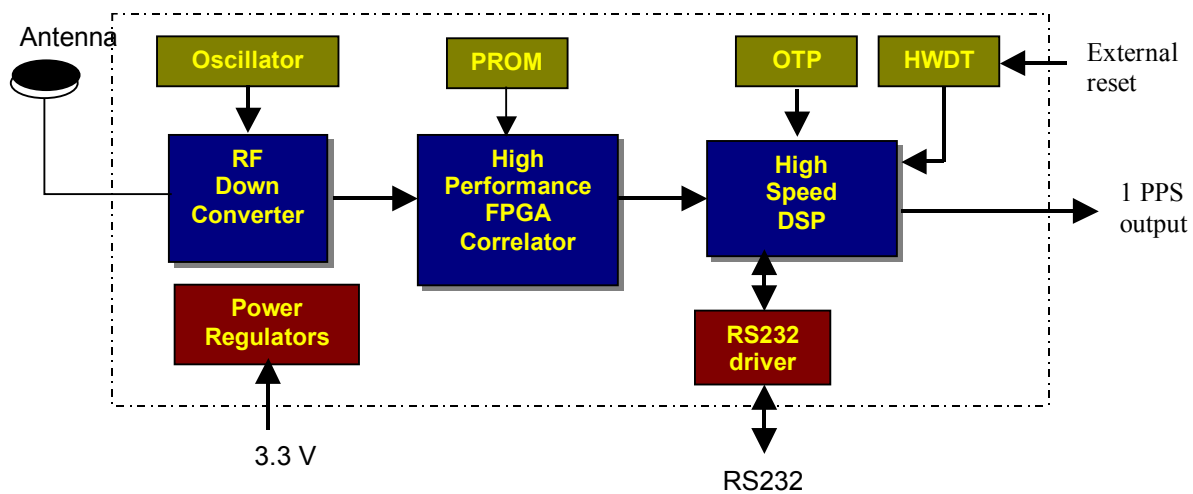
## Block Diagram

The receiver mainly comprises of an RF down converter, Field Programmable Gate Array (FPGA) based GPS correlator core, DSP based navigation processor and RS232 drivers

The L1 GPS signal, received through an active antenna, gets down converted to a low IF in the RF front end - designed around a VLSI down converter. High performance FPGA performs correlation on the digitized IF signal. Carrier & code tracking loops and computation of user's position, velocity and time as well as the communication interface to a host are all implemented in software running on the DSP.


RS232 drivers provide serial interface for the navigation data output. Hardware watchdog timer provides recovery mechanism for processor hang ups induced by radiation.

The block diagram of the GPSSPACE receiver is as shown below:




**Figure 2: GPSSPACE Block Diagram**



 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 8 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Receiver Specification

Characteristics		Specification	Compliance
No of Channels		12	Yes
Update Rate		1 Hz	Yes
TTFF		75 seconds (Cold Start, Typical), Warm start and Hot Start feature not available	Yes
Accuracy	Position	10 m (95%)	Yes
	Velocity	0.12 m/s (95%)	Yes
	Time	500 ns	
Signal Dynamics		+/- 12 Km / s	Yes
Altitude Limit		No Limit	Yes
Data Interface		RS232 levels	Yes
Baud Rate		9600 bps for UART	Yes
Voltage Input		3.3 V DC	Yes
Power Consumption		2 W (Typical)	Yes
Vibration Specifications		15 g (rms)	Yes
Temperature Specifications		-25° to +65° C	Yes
Radiation Levels		Better than 10K Rads	Yes
Provision for external reset		Available	Yes
RF Input		SMA Connector	YES
Signal / Power Input		9-pin D type connector (male)	Yes
Mechanical Dimension of the box		85 (L) x 55 (W) x 40 (H) mm (approximate)	Yes
Weight of the box		500g (Approximate)	Yes

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 9 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Antenna Specification

Characteristics	Specification	Compliance
Polarization	RHCP	YES
Power input to active antenna	+3.3V	YES


## Connector Interface

The GPSSPACE has a 9 pin male connector.

The pin outs of the above connector are as per the following table:

**Table 1: Connector Interface**

Pin Number	Signal	Description
1	DT1	Main GPS Data
2	Reset	250 ms active low input
3	3.3V	Supply main
4	DT2	Redundant GPS Data
5	GND	Ground
6	1 PPS	TTL 3.3V, Buffered output
7	DGND	Ground
8	3.3V	Supply redundant
9	GND	Ground

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 10 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

## Message Structure

<b>Interface:</b>	RS232 compatible
<b>Baud rate:</b>	9600 baud
<b>Message formats:</b>	Accord's proprietary binary
<b>Start bits:</b>	1
<b>Data bits</b>	8
<b>Stop bits:</b>	2
<b>Parity check:</b>	No
<b>Flow control:</b>	None

## Output Messages:

### Binary

User's present position in terms of Latitude, Longitude, Altitude, ECEF/Geodetic coordinates, Time, DOP, Receiver status, Signal to noise ratio, Solution time.

## List of Accord's custom Binary Messages


Message ID	Message Name	Units	Message Attributes	Size (Bytes)
AC04	<b>Position in ECEF</b>	Mm	T, P	22
AC05	<b>Velocity in ECEF</b>	Mm/s	T, P	22
AC06	<b>Solution Time</b>	Sec	T, P	18
AC08	<b>Receiver Status</b>		T, P	24
AC0A	<b>SNR</b>	dB /Hz	T, P	18
AC0B	<b>DOP</b>		T, P	14
AC0E	<b>Geodetic Position</b>		T, P	22
AC0F	<b>Time date</b>		T, P	13

T – Transmit; P – Periodic

### Note:

The periodicity of these messages is 1 seconds. Accord's custom binary message will have the following format:

Field	Meaning	Size in bytes
'??'	Indicates beginning of a binary message	2
Message ID	Message identification	2

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 11 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

Body of the message	Body of the message	Variable length
Checksum	Checksum for all bytes in the message up to the end of the body of the message	1
Line Feed	Indicates the end of the message	1

#### Checksum Computation

Checksum is computed by logically XOR-ing all bytes till the end of the body of the message.


#### Message Details:

##### Position in ECEF co-ordinates:

??AC041234CL

- 1 X Position in ECEF co-ordinates – Long
- 2 Y Position in ECEF co-ordinates – Long
- 3 Z Position in ECEF co-ordinates – Long
- 4 GPS time in seconds – unsigned Long
- C Checksum
- L Line feed

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	04	Message ID	LSB
4	AC	Message ID	MSB
5	1-A	X-position in ECEF	LSB
6	1-B	X-position in ECEF	2 nd Byte
7	1-C	X-position in ECEF	3 rd Byte
8	1-D	X-position in ECEF	MSB
9	2-A	Y-position in ECEF	LSB
10	2-B	Y-position in ECEF	2 nd Byte

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 12 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

11	2-C	Y-position in ECEF	3 rd Byte
12	2-D	Y-position in ECEF	MSB
13	3-A	Z-position in ECEF	LSB
14	3-B	Z-position in ECEF	2 nd Byte
15	3-C	Z-position in ECEF	3 rd Byte
16	3-D	Z-position in ECEF	MSB
17	4-A	GPS time in seconds	LSB
18	4-B	GPS time in seconds	2 nd Byte
19	4-C	GPS time in seconds	3 rd Byte
20	4-D	GPS time in seconds	MSB
21	C	Checksum	1 Byte
22	L	Linefeed	1 Byte

*Data Type:*


Long (4 bytes), has been chosen. The limits of position is between -7500Km to 7500Km. The unit in which position is represented is cm. The range of long, which is,  $2^{31} = 2147483648$  mm/s, is adequate to accommodate the required range of position values.

#### **Velocity in ECEF:**

??AC051234CL

- 1 X Velocity in ECEF co-ordinates- Long
  - 2 Y Velocity in ECEF co-ordinates – Long
  - 3 Z Velocity in ECEF co-ordinates – Long
  - 4 GPS time in seconds – Un-singed Long
- C Checksum
- L Line feed

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	05	Message ID	LSB

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 13 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

4	AC	Message ID	MSB
5	1-A	X-Velocity in ECEF	LSB
6	1-B	X-Velocity in ECEF	2 nd Byte
7	1-C	X-Velocity in ECEF	3 rd Byte
8	1-D	X-Velocity in ECEF	MSB
9	2-A	Y-Velocity in ECEF	LSB
10	2-B	Y- Velocity in ECEF	2 nd Byte
11	2-C	Y- Velocity in ECEF	3 rd Byte
12	2-D	Y- Velocity in ECEF	MSB
13	3-A	Z- Velocity in ECEF	LSB
14	3-B	Z- Velocity in ECEF	2 nd Byte
15	3-C	Z- Velocity in ECEF	3 rd Byte
16	3-D	Z- Velocity in ECEF	MSB
17	4-A	GPS time in seconds	LSB
18	4-B	GPS time in seconds	2 nd Byte
19	4-C	GPS time in seconds	3 rd Byte
20	4-D	GPS time in seconds	MSB
21	C	Checksum	1 Byte
22	L	Linefeed	1 Byte


*Data Type:*

Long (4 bytes), has been chosen. The limits of velocity is between -12,000 m/s to 12000 m/s. The unit in which velocity is represented is mm/s. The range of long, which is,  $2^{31} = 2147483648$  mm/s, is adequate to accommodate the required range of velocity values.

**Solution Time:**

??AC06123CL

- 1 Nanosecond
- 2 Seconds
- 3 Week Number
- C Checksum
- L Line feed

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 14 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	06	Message ID	LSB
4	AC	Message ID	MSB
5	1-A	Nanosecond	LSB
6	1-B	Nanosecond	2 nd Byte
7	1-C	Nanosecond	3 rd Byte
8	1-D	Nanosecond	MSB
9	2-A	Second	LSB
10	2-B	Second	2 nd Byte
11	2-C	Second	3 rd Byte
12	2-D	Second	MSB
13	3-A	Week Number	LSB
14	3-B	Week Number	2 nd Byte
15	3-C	Week Number	3 rd Byte
16	3-D	Week Number	MSB
17	C	Checksum	1 Byte
18	L	Linefeed	1 Byte


*Data Type:*

The data type that is used for the solution time is unsigned long.

#### Receiver Status:

??AC081234CL


- 1 8-bit SV ID for channel 1 to 4
- 2 8-bit SV ID for channel 5 to 8
- 3 8-bit SV ID for channel 9 to 12
- 3 2 bit Channel Status for channels 1 to 12,  
1 bit constel for channels 1 to 12,  
1 bit ephemeris for channels 1 to 12

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 15 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

- 4    1 bit GPS\_mon flag,  
       2 bit Pos Mode,  
       1 bit Time Sync flag,  
       2 bit Almanac avail flag,  
       1 bit Pos avail flag,  
       1 bit GPS avail flag,  
       1 bit Almanac flag for channels 1 to 12,  
       8 bit Version number
- C    Checksum
- L    Line feed

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	08	Message ID	LSB
4	AC	Message ID	MSB
5	1-A	SV ID1	LSB
6	1-B	SV ID2	2 <sup>nd</sup> Byte
7	1-C	SV ID3	3 <sup>rd</sup> Byte
8	1-D	SV ID4	MSB
9	2-A	SV ID5	LSB
10	2-B	SV ID6	2 <sup>nd</sup> Byte
11	2-C	SV ID7	3 <sup>rd</sup> Byte
12	2-D	SV ID8	MSB
13	3-A	SV ID9	LSB
14	3-B	SV ID10	2 <sup>nd</sup> Byte
15	3-C	SV ID11	3 <sup>rd</sup> Byte
16	3-D	SV ID12	MSB
17	4-A	2 bits of status for channels 1 to 4	LSB
18	4-B	2 bits of status for channels 5 to 8	2 <sup>nd</sup> Byte
19	4-C	2 bits of status for channels 9 to 12	3 <sup>rd</sup> Byte



 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 16 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

20	4-D	1 bit Constel flag for channels 1 to 8	MSB
21	5-A	1 bit Constel flag for channels 9 to 12 / 1 bit Ephemeris flag for channels 1 to 4	LSB
22	5-B	1 bit Ephemeris flag for channels 4 to 12	2 <sup>nd</sup> Byte
23	5-C	1 bit GPS_mon flag, 2 bit Pos Mode + 1 bit Time Sync flag + 2 bit Almanac avail flag + 1 bit Pos avail flag + 1 bit GPS avail flag	3 <sup>rd</sup> Byte
24	5-D	1 bit Almanac flag for channels 1 to 8	MSB
25	6-A	1 bit Almanac flag for channels 9 to 12/ Dummy (4-bits)	LSB
26	6-B	Version	MSB
27	6-C	Checksum	1 Byte
28	6-D	Linefeed	1 Byte

**Note:**


GPS\_mon flag can be taken out to say that the receiver is working fine. This bit toggles continuously, reflecting that the receiver health is okay.

**SNR:**

??AC0A12CL

- 1 SNR for channels 1 to 4
- 2 SNR for channels 5 to 8
- C Checksum
- L Line feed

Byte number	Message Field Name	Description	Status
-------------	--------------------	-------------	--------

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 17 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	0A	Message ID	LSB
4	AC	Message ID	MSB
5	1-A	SNR for channel 1	LSB
6	1-B	SNR for channel 2	2 nd Byte
7	1-C	SNR for channel 3	3 rd Byte
8	1-D	SNR for channel 4	MSB
9	2-A	SNR for channel 5	LSB
10	2-B	SNR for channel 6	2 nd Byte
11	2-C	SNR for channel 7	3 rd Byte
12	2-D	SNR for channel 8	MSB
13	3-A	SNR for channel 9	LSB
14	3-B	SNR for channel 10	2 nd Byte
15	3-C	SNR for channel 11	3 rd Byte
16	3-D	SNR for channel 12	MSB
13	C	Checksum	1 Byte
14	L	Linefeed	1 Byte

**DOP:**


??AC0B1CL

1     2 bytes of HDOP and 2 bytes of PDOP

C     Checksum

L     Line feed

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	0B	Message ID	LSB
4	AC	Message ID	MSB


 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 18 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

5	1-A	HDOP	LSB
6	1-B	HDOP	MSB
7	1-C	PDOP	LSB
8	1-D	PDOP	MSB
9	2-A	Gps second	LSB
10	2-B	Gps second	2 <sup>ND</sup> Byte
11	2-C	Gps second	3 <sup>rd</sup> Byte
12	2-D	Gps second	MSB
13	C	Checksum	1 Byte
14	L	Linefeed	1 Byte

**Geodetic Position:**

??AC0E1234CL

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	0E	Message ID	LSB
4	AC	Message ID	MSB
5	1-A	GPS time of week (SECOND)	LSB
6	1-B	GPS time of week (SECOND)	2 <sup>nd</sup> Byte
7	1-C	GPS time of week (SECOND)	3 <sup>rd</sup> Byte
8	1-D	GPS time of week (SECOND)	MSB
9	2-A	Latitude	LSB
10	2-B	Latitude	2 <sup>nd</sup> Byte
11	2-C	Latitude	3 <sup>rd</sup> Byte
12	2-D	Latitude	MSB
13	3-A	Longitude	LSB
14	3-B	Longitude	2 <sup>nd</sup> Byte

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 19 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

15	3-C	Longitude	3 <sup>rd</sup> Byte
16	3-D	Longitude	MSB
17	4-A	Altitude	LSB
18	4-B	Altitude	2 <sup>nd</sup> Byte
19	4-C	Altitude	3 <sup>rd</sup> Byte
20	4-D	Altitude	MSB
21	C	Checksum	1 Byte
22	L	Linefeed	1 Byte


Data Type:

The data types for latitude, longitude and altitude is long and for GPS time of week (second) it is unsigned long. Latitude and longitude, the units is degrees and altitude is meters. Latitude and longitude is scaled by 1e7. Altitude is scaled by 1e2 and it's units is meters.

#### Time and Date Message:

??AC0F1234567CL

Byte number	Message Field Name	Description	Status
1	?	Message Type	1 Byte
2	?	Message Type	1 Byte
3	0F	Message ID	LSB
4	AC	Message ID	MSB
5	1	Hours	LSB
6	2	Minutes	2 <sup>nd</sup> Byte
7	3	Seconds	3 <sup>rd</sup> Byte
8	4	Date	MSB
9	5	Month	LSB
10	6	Year (LSB)	2 <sup>nd</sup> Byte
11	7	Year (MSB)	3 <sup>rd</sup> Byte
12	C	Checksum	1 Byte
13	L	Linefeed	1 Byte

 <u>ACCORD</u>	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 20 of 22
<i>Proposal for GPS Receiver for Space applications</i>			

## Part III –Commercial Business Terms and Conditions

### About this Section


In this section, the commercial business terms and conditions are described. This includes roles and responsibilities, commercial terms, intellectual rights etc.

### Accord's Responsibilities

- 1) Accord shall deliver GPS Receiver for Space applications Card to IIT, Mumbai as per business terms and condition
- 2) Accord shall deliver the Technical documentation
- 3) Accord shall identify a technical and a business point of contact for all communications
- 4) Accord shall give a warranty for manufacturing defects for a period of 12 Months from the date of supply

### IIT, Mumbai's Responsibilities

- 1) IIT, MUMBAI shall promptly respond to Accord's technical and business related queries
- 2) IIT, MUMBAI shall make payments as per the payment terms and conditions
- 3) IIT, MUMBAI shall identify technical and business points of contact for all communications
- 4) IIT, MUMBAI to conduct the performance specification test on the GPS Receiver for Space applications

	<b>Proprietary Confidential</b>	GPS Project Document	Issue Draft 1.1
		Document No. PRD-GPSSPACE	Page 21 of 22
<b><i>Proposal for GPS Receiver for Space applications</i></b>			

### **Intellectual Property Rights**

The rights for the intellectual property used to create this GPS Receiver for Space applications Card shall remain with Accord.

### **Warranty**

Accord warrants that the products delivered will be free of defects in materials and workmanship and will conform to the applicable requirements. If within twelve (12) months from the date of delivery, any product fails to comply with the applicable requirements, and providing that the product has been installed, used and/or serviced in conformity with applicable service manuals, bulletins or instructions, Accord shall at its expense and at its election, either 1) repair, modify or correct the defective product, or 2) replace the defective product. During the warranty period, Accord shall provide email or telephonic support for any software related issues and problems.

### **Acceptance**

Acceptance of GPSSPACE would be based on the Acceptance Test Plan mutually agreed upon.