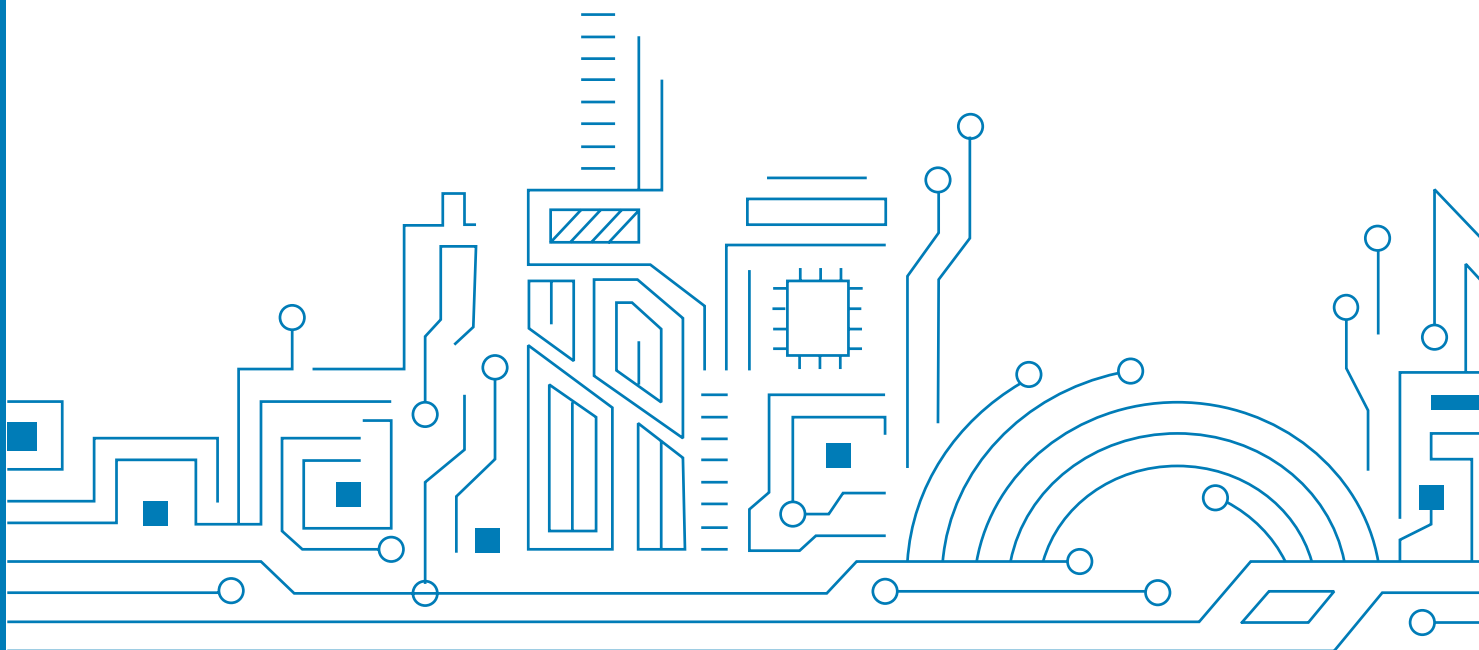




华大北斗  
ALLYSTAR

# 华大北斗 GPS 所需 PVT 在 Android 上的解算



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# 1 引言

## 1.1 编写目的

GNSS 固件输出 PVT 的协议说明，Android 上解析方法说明。

## 1.2 适用范围

本文档的预期读者为软件开发人员、测试人员等。

## 1.3 定义

gps.defaultl.so: Android 系统上添加设备，从该设备上获取 gnss 数据并解析，上报到 framework、app 层。

PVT: gnss 模块定制输出的原始观测量，具体协议请见下面说明。

## 2 定制 PVT 协议

协议样例如下：

D3 00 40 65 24 0C 28 00 00 00 7F 00 12 00 00 00 00 00 FF E5 38 A9 D4 8E 01 00 00 00 00 00 00  
00 3E 40 00 00 00 00 00 00 00 00 00 BC DE 0A 71 42 44 1B 41 00 00 00 00 00 40 8F 40 00 D7 24 B6  
E0 F0 F2 C1 00 00 00 00 00 00 34 40 05 00 43 00 28 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA  
4E 00 00 00 00 00 00 00 16 F0 9F 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 40 DE 4C  
10 40 9A 99 99 99 99 99 B9 3F 0E CB ED 44 29 1B 81 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 28  
00 01 00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 14 24 05 00 00 00 00  
10 00 00 00 00 00 00 00 80 C6 42 10 40 9A 99 99 99 99 99 B9 3F 4B 93 92 4C 29 1B 81  
41 9A 99 99 99 99 99 A9 3F 05 00 43 00 07 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00  
00 00 00 00 00 7C FD 9C 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 20 41 CE 10 C0 9A  
99 99 99 99 99 B9 3F 2B AE 6C 13 3B 22 81 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 27 00 01 00  
00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 A4 70 A2 5F D1 8E 01 00 10 00 00  
00 00 00 00 00 00 00 A0 24 D9 50 C0 9A 99 99 99 99 99 B9 3F 29 0C 65 09 29 15 81 41 9A 99  
99 99 99 99 A9 3F 05 00 43 00 10 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00  
00 00 00 DB AA 96 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 C0 3D FC 5B C0 9A 99 99  
99 99 99 B9 3F 40 C6 B1 1F 65 31 81 41 9A 99 99 99 99 99 A9 3F 01 00 43 00 1B 00 01 00 00 82  
01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00 00 00 00 00 5D E9 3D A5 D4 8E 01 00 10 00 00 00 00  
00 00 00 00 00 00 E0 AB 6D 6F 40 9A 99 99 99 99 99 B9 3F 03 2C 1A D8 C0 17 73 41 9A 99 99  
99 99 99 A9 3F 01 00 43 00 1B 00 01 00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00  
00 00 10 5A 03 00 00 00 00 10 00 00 00 00 00 00 00 00 00 00 12 6F 6F 40 9A 99 99 99 99

99 B9 3F 7D 3B 13 09 C1 17 73 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 2B 00 01 00 00 82 01 00  
0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 00 DA 29 65 62 D1 8E 01 00 10 00 00 00 00 00 00  
00 00 00 00 60 CB 91 6F C0 9A 99 99 99 99 99 B9 3F F1 F1 3A 10 65 EC 74 41 9A 99 99 99 99 99  
A9 3F 05 00 43 00 2B 00 01 00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 4C  
76 0C 00 00 00 00 10 00 00 00 00 00 00 00 00 00 80 42 92 6F C0 9A 99 99 99 99 99 B9 3F  
FF 19 92 43 65 EC 74 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 03 00 01 00 00 82 01 00 0F 43 00  
00 EE 18 BA 4E 00 00 00 00 00 00 00 00 00 A1 1F 96 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00  
00 00 C9 C0 15 40 9A 99 99 99 99 99 B9 3F 73 E1 01 06 B3 32 81 41 9A 99 99 99 99 99 A9 3F 05  
00 43 00 0A 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 00 73 9A 6E 5F  
D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 00 42 86 32 C0 9A 99 99 99 99 99 B9 3F CC 8A B6  
62 7B 91 81 41 9A 99 99 99 99 99 A9 3F 04 00 43 00 C7 00 01 00 00 82 01 00 0F 40 00 00 01 CE  
BB 4E 00 00 00 00 00 00 00 00 71 09 FD A1 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 A0 9C  
4B 14 40 9A 99 99 99 99 99 B9 3F 24 CC 81 9F 64 59 81 41 9A 99 99 99 99 99 A9 3F 04 00 43 00  
C7 00 01 00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 00 00 E3 B5 09 00 00 00  
00 10 00 00 00 00 00 00 00 00 00 00 00 A0 AB 64 14 40 9A 99 99 99 99 99 B9 3F 61 CC B1 BB 64 59  
81 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 09 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00  
00 00 00 00 00 00 52 24 6A 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 00 A0 3C E5 63 C0  
9A 99 99 99 99 99 B9 3F 5C AD 08 A7 2E 9C 81 41 9A 99 99 99 99 99 A9 3F 06 00 43 00 07 00 01  
00 00 82 01 00 0F 5C 00 00 01 CE BB 4E 00 00 00 00 00 00 00 00 00 34 8A 75 A4 D4 8E 01 00 10 00  
00 00 00 00 00 00 00 00 80 DC 80 35 40 9A 99 99 99 99 99 B9 3F 80 7C F9 2A DF D8 76 41  
9A 99 99 99 99 99 A9 3F 01 00 43 00 04 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00  
00 00 00 00 00 53 C5 20 A5 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 00 E0 B4 BA 62 40 9A 99

99 99 99 99 B9 3F A5 05 2B 50 88 A3 73 41 9A 99 99 99 99 99 A9 3F 01 00 43 00 04 00 01 00 00  
82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 00 7E BA 04 00 00 00 00 10 00 00 00  
00 00 00 00 00 00 E0 4F B9 62 40 9A 99 99 99 99 99 B9 3F 1F 67 4F 93 88 A3 73 41 9A 99 99  
99 99 99 A9 3F 04 00 43 00 C2 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00 00  
00 00 3E 3D 56 A1 D4 8E 01 00 10 00 00 00 00 00 00 00 00 20 79 08 4D 40 9A 99 99 99 99  
99 B9 3F 9A 04 2B 2B 6E E9 82 41 9A 99 99 99 99 99 A9 3F 04 00 43 00 C2 00 01 00 00 82 01 00  
01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 6E C2 0A 00 00 00 00 10 00 00 00 00 00  
00 00 00 00 A0 05 0C 4D 40 9A 99 99 99 99 99 B9 3F FA B9 EC 58 6E E9 82 41 9A 99 99 99 99  
A9 3F 05 00 43 00 0B 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 4D  
0B 5A 62 D1 8E 01 00 10 00 00 00 00 00 00 00 00 80 B3 9A 2E C0 9A 99 99 99 99 99 B9 3F  
3C DE 68 FD BA 21 75 41 9A 99 99 99 99 99 A9 3F 06 00 43 00 1E 00 01 00 00 82 01 00 0F 5C 00  
00 01 CE BB 4E 00 00 00 00 00 00 00 60 89 55 A4 D4 8E 01 00 10 00 00 00 00 00 00 00 00  
00 E0 27 D0 5E 40 9A 99 99 99 99 99 B9 3F 37 1F 86 A9 61 72 77 41 9A 99 99 99 99 99 A9 3F 05  
00 43 00 19 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 00 BE 3F 4C 62  
D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 A0 68 16 44 40 9A 99 99 99 99 99 B9 3F 6A A9 D4  
C5 E6 63 75 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 3B 00 01 00 00 82 01 00 0F 40 00 00 EE 18  
BA 4E 00 00 00 00 00 00 00 00 31 98 65 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 40 80  
E9 26 40 9A 99 99 99 99 99 B9 3F C4 80 9D B3 16 A7 81 41 9A 99 99 99 99 99 A9 3F 03 00 43 00  
14 00 01 00 00 82 01 00 CF 40 00 00 7E 1B BF 4E 00 00 00 00 00 00 00 00 00 B5 BB E8 2F BC 0F 00  
00 10 00 00 00 00 00 00 00 00 00 00 00 A0 6B 1A 7C C0 9A 99 99 99 99 99 B9 3F B5 DD DA 3A 60  
6D 73 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 3C 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E  
00 00 00 00 00 00 00 00 33 52 4E 5F D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 60 58 3D 24

40 9A 99 99 99 99 99 B9 3F AF F4 87 FD E7 DE 81 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 22 00  
01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 06 17 2F 62 D1 8E 01 00 10  
00 00 00 00 00 00 00 00 00 20 5F 19 71 40 9A 99 99 99 99 99 B9 3F 06 89 49 A7 C4 EF 75 41  
9A 99 99 99 99 99 A9 3F 05 00 43 00 22 00 01 00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00  
00 00 00 00 00 32 2A 04 00 00 00 00 10 00 00 00 00 00 00 00 00 00 00 00 00 00 6C 19 71 40 9A 99  
99 99 99 99 B9 3F 1C 3F 9D F4 C4 EF 75 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 17 00 01 00 00  
82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00 00 00 00 34 BD 14 62 D1 8E 01 00 10 00 00 00  
00 00 00 00 00 00 80 92 C1 6F C0 9A 99 99 99 99 99 B9 3F 4C 2E 43 1F 2A 6E 76 41 9A 99 99  
99 99 99 A9 3F 01 00 43 00 09 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00 00 00  
00 00 0C 0B E8 A4 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 20 0F 49 67 C0 9A 99 99 99 99  
99 B9 3F AE 12 FA 00 A3 B3 74 41 9A 99 99 99 99 99 A9 3F 01 00 43 00 09 00 01 00 00 82 01 00  
01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 00 3B 09 09 00 00 00 00 10 00 00 00 00 00  
00 00 00 00 E0 33 4A 67 C0 9A 99 99 99 99 99 B9 3F 77 43 76 3B A3 B3 74 41 9A 99 99 99 99 99  
A9 3F 04 00 43 00 C3 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00 00 00 00 00 4B  
4D D7 A1 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 40 F3 82 2F 40 9A 99 99 99 99 99 B9 3F  
9A D5 AD E7 E4 B3 81 41 9A 99 99 99 99 99 A9 3F 01 00 43 00 10 00 01 00 00 82 01 00 0F 40 00  
00 01 CE BB 4E 00 00 00 00 00 00 00 74 C6 DE A4 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00  
00 00 F1 8A 76 40 9A 99 99 99 99 99 B9 3F FB 3B 63 50 17 E0 74 41 9A 99 99 99 99 99 A9 3F 03  
00 43 00 07 00 01 00 00 82 01 00 CF 40 00 00 FE 4E BF 4E 00 00 00 00 00 00 00 00 00 4C 2E B6 2F  
BC 0F 00 00 10 00 00 00 00 00 00 00 00 00 00 C0 FF BB 81 40 9A 99 99 99 99 99 B9 3F 07 DE C5  
AA DB 5F 74 41 9A 99 99 99 99 99 A9 3F 04 00 43 00 C4 00 01 00 00 82 01 00 0F 40 00 00 01 CE  
BB 4E 00 00 00 00 00 00 00 08 EE 17 A2 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 00 A0 4A

```

1A 51 40 9A 99 99 99 99 99 99 B9 3F A3 0A 38 22 E5 18 81 41 9A 99 99 99 99 99 A9 3F 01 00 43 00
1F 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00 00 00 00 00 00 00 E7 53 9B A4 D4 8E 01
00 10 00 00 00 00 00 00 00 00 00 00 00 A0 4F 2D 7B 40 9A 99 99 99 99 99 B9 3F 59 47 11 76 9D 23
76 41 9A 99 99 99 99 99 A9 3F 05 00 43 00 29 00 04 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00
00 00 00 00 00 00 00 00 34 FE D8 61 D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 80 C3 22 7A 40
9A 99 99 99 99 99 B9 3F 39 54 DE 7E BF 8C 77 41 00 00 00 00 00 00 24 40 05 00 43 00 29 00 01
00 00 82 01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 00 00 BA 9E 09 00 00 00 00 10 00
00 00 00 00 00 00 00 00 00 E0 8A 23 7A 40 9A 99 99 99 99 99 B9 3F C9 6D 6B 76 C0 8C 77 41 9A
99 99 99 99 99 A9 3F 01 00 43 00 1A 00 01 00 00 82 01 00 0F 40 00 00 01 CE BB 4E 00 00 00 00
00 00 00 00 9C AC 8B A4 D4 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 20 FF D5 77 40 9A 99 99
99 99 99 B9 3F 40 BA FF 59 B3 6E 76 41 9A 99 99 99 99 99 A9 3F 01 00 43 00 1A 00 01 00 00 82
01 00 01 00 00 00 68 3E 8C 4E 00 00 00 00 00 00 00 00 00 00 3E 38 08 00 00 00 00 10 00 00 00
00 00 00 00 00 00 00 D5 D5 77 40 9A 99 99 99 99 99 B9 3F C2 17 B0 CA B3 6E 76 41 9A 99 99 99
99 99 A9 3F 05 00 43 00 1C 00 01 00 00 82 01 00 0F 40 00 00 EE 18 BA 4E 00 00 00 00 00 00
00 EF 88 B6 61 D1 8E 01 00 10 00 00 00 00 00 00 00 00 00 00 A0 6B 68 83 C0 9A 99 99 99 99
B9 3F 55 81 5D 26 08 32 78 41 9A 99 99 99 99 99 A9 3F 93 AA 44
    
```

数据结构如下：

Header	Msg ID	Payload Length	Payload	Checksum	Tail
0xD3 0x00	0x40 0x65	2bytes		1byte	0xAA 0x44

注意，数据头固定为 0xD3 0x00，下面的截图的数据头和 MsgID 不同，做了不同客户的区分。



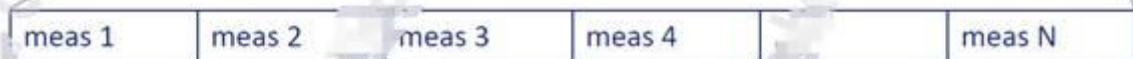
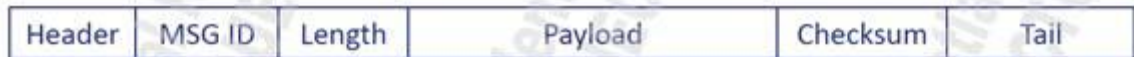
## GMS Structure (1/2)

- **Header: 2 byte**
  - 0x04 and 0x24
- **MSG ID: 2 byte**
  - 6001
- **Length: 2 byte**
- **Payload: 68 + 76\*(#meas) byte**
- **Checksum: 1 byte**
  - Range: MSG ID ~ Payload
- **Tail: 2 byte**
  - 0xAA and 0x44



## GMS Structure (2/2)

- **Length = GNSS Clock Size + GNSS Measurement 2 Size**
  - Part 1 Size = 68
  - Part 2 Size = 76\*(#meas)



Field	Type	Scale	Unit	Comments
measurement_count	U2	-	-	Number of measurement
Reserved	U2	-	-	Reserved
flags	U2	-	-	GnssClockFlags
leap_second	I2	-	sec	Leap second data
hw_clock_discontinuity_count	U4	-	-	A 'discontinuity' is meant to cover the case of a switch from one source of clock to another.
time_ns	I8	-	ns	The GNSS receiver internal clock value. This is the local hardware clock value.
time_uncertainty_ns	R8	-	ns	1-Sigma uncertainty associated with the clock's time in nanoseconds.
full_bias_ns	I8	-	ns	The difference between hardware clock ('time' field) inside GPS receiver and the true GPS time since 0000Z, January 6, 1980, in nanoseconds.
bias_ns	R8	-	ns	The error estimate for the sum of this and the full_bias_ns is the bias_uncertainty_ns.
bias_uncertainty_ns	R8	-	ns	1-Sigma uncertainty associated with the local estimate of GPS time (clock bias) in nanoseconds.
drift_nsp	R8	-	ns	The clock's drift in nanoseconds (per second).
drift_uncertainty_nsp	R8	-	ns	1-Sigma uncertainty associated with the clock's drift in nanoseconds (per second).

Field	Type	Scale	Unit	Comments
constellation	U1	-	-	GnssConstellationType
multipath_indicator	U1	-	-	GnssMultipathIndicator
Code type	U1	-	-	Code type (Represented by letters, for instance, 'A', 'B')
c_n0_dbhz	U1	-	dB-Hz	Carrier to noise density ratio
svid	I2	-	-	Satellite vehicle ID number
accumulated_delta_range_state	U2	-	-	Accumulated delta range's state
flags	U4	-	-	GnssMeasurementFlags
state	U4	-	-	GnssMeasurementState
carrier_frequency_hz	R4	-	hz	Carrier frequency at which codes and messages are modulated
time_offset_ns	R8	-	ns	Time offset at which the measurement was taken in nanoseconds.
received_sv_time_in_ns	I8	-	ns	The received GNSS Time-of-Week at the measurement time, in nanoseconds.
received_sv_time_uncertainty_in_ns	I8	-	ns	1-Sigma uncertainty of the Received GPS Time-of-Week in nanoseconds.

Field	Type	Scale	Unit	Comments
pseudorange_rate_mps	R8	-	m/s	Pseudorange rate at the timestamp in m/s.
pseudorange_rate_uncertainty_mps	R8	-	m/s	1-Sigma uncertainty of the pseudorange_rate_mps.
accumulated_delta_range_m	R8	-	m	Accumulated delta range since the last channel reset in meters.
accumulated_delta_range_uncertainty_m	R8	-	m	1-Sigma uncertainty of the accumulated delta range in meters.

## 3 ANDROID 端 HAL 层数据解析说明

### 3.1 Pvt 解析

Android 端的数据解析请参考给的源码中的 imu 解析，请搜宏 `_ALLY_IMU_PARSE_`.

代码端的解析请按照协议来完成，遇到疑问可以和我们沟通。

### 3.2 数据上报

数据解析后，按照 gms 认证所需结构体填充上报，具体的数据要求和认证 app 完成沟通。

## 文件修订履历

版本	修改日期	作者	状态和备注
V1.0			初



[www.allystar.com](http://www.allystar.com)



[info.gnss@allystar.com](mailto:info.gnss@allystar.com)



广东省深圳市龙岗区坂田街道雅南路 1 号星河领创天下二期三楼

