

SKG121 GNSS Protocol Specification

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1. Introduction

SKG121 GNSS module supports GPS, GLONASS, BeiDou, Galileo, QZSS and IRNSS constellations and features accurate acquisition. The module supports autonomous GNSS C/A and SBAS functions. It can be used in the positioning, navigation and other industries.

This document describes the software aspects of SKG121. SKG121 supports NMEA 0183 standard messages. ST NMEA extended commands are supported to control and configure SKG121 GNSS module.

2. Commands

2.1. ST NMEA Commands List

The table below summarizes all the commands supported by the ST NMEA layer.

Table 1: ST NMEA Commands List

Syntax	Description
\$PSTMINITGPS	Initialize GPS position and time
\$PSTMINITTIME	Initialize GPS time
\$PSTMFCOLD	Perform cold start
\$PSTMFWARM	Perform warm start
\$PSTMHOT	Perform hot start
\$PSTMSRR	Reset system
\$PSTMSETCONSTMASK	Set GNSS constellation mask
\$PSTMPPS	Manage command interface for pulse per second
\$PSTMFORCESTANDBY	Force the platform to enter into standby mode
\$PSTMCFGCONST	Configure constellation
\$PSTMCFGPORT	Configure char port
\$PSTMCFGMSGL	Configure message list
\$PSTMSETANTSENSOPMODE	Set antenna sensing operating mode
\$PSTMSETANTSENSMANUAL	Control antenna state manually

2.2. ST NMEA Commands

2.2.1. \$PSTMINITGPS

The command initializes GPS position and time using UTC format. It must be issued after a cold reset or it fails. The date issued with parameters Day, Month and Year must be later than January 2018, and this threshold can be changed using the configuration options.

Synopsis:

```
$PSTMINITGPS,<Lat>,<LatRef>,<Lon>,<LonRef>,<Alt>,<Day>,<Month>,<Year>,<Hour>,<Minute>,<Second><cr><lf>
```

Arguments:

Parameter	Format	Description
Day	dd – Decimal, 2 digits	Day of month (01 to 31)
Month	mm – Decimal, 2 digits	Month (01 to 12)
Year	YYYY – Decimal, 4 digits	Year (2018 - ...)
Hour	HH – Decimal, 2 digits	Hour (00 to 23)
Minute	MM – Decimal, 2 digits	Minute (00 to 59)
Second	SS – Decimal, 2 digits	Second (00 to 59)

Results:

The time will be initialized.

The following message will be output on NMEA communication channel:

```
$PSTMINITTIMEOK<cr><lf> If successfully initialized the GPS time.
```

```
$PSTMINITTIMEERROR<cr><lf> If failed to initialize the GPS time.
```

Example:

```
$PSTMINITTIME,23,02,2018,09,44,12
```

2.2.2. \$PSTMINITTIME

The command initializes GPS time using UTC format. The date issued with parameters Day, Month and Year must be later than January 2018, and this threshold can be changed using the configuration options.

Synopsis:

```
$PSTMINITTIME,<Day>,<Month>,<Year>,<Hour>,<Minute>,<Second><cr><lf>
```

Arguments:

Parameter	Format	Description
-----------	--------	-------------

Day	dd – Decimal, 2 digits	Day of month (01 to 31)
Month	mm – Decimal, 2 digits	Month (01 to 12)
Year	YYYY – Decimal, 4 digits	Year (2018 - ...)
Hour	HH – Decimal, 2 digits	Hour (00 to 23)
Minute	MM – Decimal, 2 digits	Minute (00 to 59)
Second	SS – Decimal, 2 digits	Second (00 to 59)

Results:

The time will be initialized.

The following message will be output on NMEA communication channel:

\$PSTMINITTIMEOK<cr><lf>If successfully initialized the GPS time.

\$PSTMINITTIMEERROR<cr><lf>If failed to initialize the GPS time.

Example:

\$PSTMINITTIME,23,02,2018,09,44,12

2.2.3. \$PSTMCOLD

The command performs a cold start.

Synopsis:

\$PSTMCOLD,<Mask><cr><lf>

Parameter	Format	Description
Mask	Integer	Optional parameter to invalidate time, position, ephemeris and almanac: 0x1 – clear almanac 0x2 – clear ephemeris 0x4 – clear position 0x8 – clear time

Results

Cold start initialization and system restart 1).

If <Mask> parameter is used, only the selected GPS data is invalidated for this actual cold start. Multiple selects are supported (i.e. 0xD).

If <Mask> parameter is not used, default is 0xE (clear ephemeris, time and position).

Example:

\$PSTMCOLD,6

NOTE

¹⁾The GPS engine will be reset. It is not a system reboot.

2.2.4. \$PSTMWARM

The command performs a warm start.

Synopsis:

\$PSTMWARM<cr><lf>

Arguments:

None.

Results

Warm start initialization and system restart ¹⁾.

Example:

\$PSTMWARM

NOTE

¹⁾The GPS engine will be reset. It is not a system reboot.

2.2.5. \$PSTMHOT

The command performs a hot start.

Synopsis:

\$PSTMHOT<cr><lf>

Arguments:

None.

Results

System restart ¹⁾

Example:

\$PSTMHOT

NOTE

¹⁾The GPS engine will be reset. It is not a system reboot.

2.2.6. \$PSTMSRR

The command executes a system reset. The GNSS firmware is rebooted.

Synopsis:

\$PSTMSRR<cr><lf>

Arguments:

None.

Results

The GNSS firmware reboots.

No message will be sent as reply.

Example:

\$PSTMSRR

2.2.7. \$PSTMSETCONSTMASK

The command sets the GNSS constellation mask. It allows switching the GNSS constellation at run-time. In case of reset, constellation mask is restored to default value.

Synopsis:

\$PSTMSETCONSTMASK,<constellation_mask><cr><lf>

Arguments:

Parameter	Format	Description
constellation_mask	1 - 9999	It is a bit mask where each bit enables/disables a specific constellation independently by the others: bit 0: Enabling/disabling GPS constellation bit1: Enabling/disabling GLONASS constellation bit2:Enabling/disabling QZSS constellation Bit3:Enabling/disabling Galileo constellation Bit7:Enabling/disabling BeiDou constellation bit10:Enabling/disabling IRNSS constellation

Results

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If the command is executed successfully, the following message is returned:

\$PSTMSETCONSTMASKOK,<constellation_mask>*<checksum><cr><lf>

If there is any error, the following message is returned:

\$PSTMSETCONSTMASKERROR*<checksum><cr><lf>

Example:

Enabling GPS only:

\$PSTMSETCONSTMASK,1

Enabling GLONASS only:

\$PSTMSETCONSTMASK,2

Enabling GPS and GLONASS:

\$PSTMSETCONSTMASK,3

Enabling IRNSS:

\$PSTMSETCONSTMASK,1024

2.2.8. \$PSTMPPS

The command allows interfacing all parameters for Pulse Per Second management. This is a parametric command.

Synopsis:

\$PSTMPPS,<cmd_mode>,<cmd_type>,<par_1>,...,<par_N><cr><lf>

Arguments:

Parameter	Format	Description
cmd_mode	Decimal, 1 digit	Select the command operation mode: 1 = GET operation (to get data from PPS manager) 2= SET operation (to set data into PPS manager) 1= PPS_IF_ON_OFF_CMD 2= PPS_IF_OUT_MODE_CMD 3= PPS_IF_REFERENCE_CONSTELLATION_CMD 4 = PPS_IF_PULSE_DELAY_CMD 5 = PPS_IF_PULSE_DURATION_CMD 6 = PPS_IF_PULSE_POLARITY_CMD 7 = PPS_IF_PULSE_DATA_CMD 8 = PPS_IF_FIX_CONDITION_CMD 9 = PPS_IF_SAT_TRHESHOLD_CMD 10 = PPS_IF_ELEVATION_MASK_CMD 11 = PPS_IF_COSTELLATION_MASK_CMD 12 = PPS_IF_TIMING_DATA_CMD 13 = PPS_IF_POSITION_HOLD_DATA_CMD 14 = PPS_IF_AUTO_HOLD_SAMPLES_CMD 15 = PPS_IF_TRAIM_CMD 16 = PPS_IF_TRAIM_USED_CMD
cmd_type	Decimal	

par_1 ... par_N

17 = PPS_IF_TRAIM_RES_CMD
18 = PPS_IF_TRAIM_REMOVED_CMD
19 = PPS_IF_REFERENCE_TIME_CMD
Parameters list according to the command type specification (see below).

2.2.8.1. Getting PPS Data (cmd_mode=1)

PPS_IF_PULSE_DATA_CMD

\$PSTMPPS,1,7<cr><lf>

Reply:

\$PSTMPPS,1,7,<out_mode>,<reference_time>,<pulse_delay>,<pulse_duration>,<pulse_polarity><cr><lf>

Parameter	Format	Description
out_mode	Decimal, 1 digit	0= PPS always generated 1 = PPS generated on even seconds 2= PPS generated on odd seconds 0= UTC 1= GPS_UTC 2= GLONASS_UTC 3= UTC_SU 4= GPS_UTC_FROM_GLONASS 5=COMPASS_UTC 6= UTC_NTSC 7= GST 8= UTC_GST 9= GPS_FROM_GST
reference_time	Decimal, 1 digit	NOTES: UTC(SU) is the Soviet Union UTC, it is derived from GLONASS time applying the UTC delta time downloaded from GLONASS satellites. GPS_UTC_FROM_GLONASS is the GPS time derived from GLONASS time applying the GPS delta time downloaded from GLONASS satellites. If the software is configured to work in GLONASS only mode,UTC(SU)isidenticaltoUTCand GPS_UTC_FROM_GLONASS is identical to GPS_UTC.
pulse_delay	Decimal	Pulse delay [ns]
pulse_duration	Double	Pulse duration [s]
pulse_polarity	Decimal, 1 digit	0= not inverted 1= inverted

PPS_IF_TIMING_DATA_CMD

\$PSTMPPS,1,12<cr><lf>

Reply:

\$PSTMPPS,1,12,<fix_condition>,<sat_th>,<elevation_mask>,<constellation_mask>,<gps_rf_delay>,<glonass_rf_delay>*<checksum><cr><lf>

Parameter	Format	Description
fix_condition	Decimal, 1 digit	1 = No fix 2 = 2D fix 3 = 3D fix
sat_th	Decimal	Minimum number of satellites for the PPS generation
elevation_mask	Decimal	Minimum satellite elevation for satellite usage in timing filtering
constellation_mask	Decimal (bit mask)	Satellite constellation selection for usage in timing filtering. bit0 = GPS bit1 = GLONASS bit7 = BeiDou
gps_rf_delay	Decimal	GPS path RF delay [ns]
glonass_rf_delay	Decimal	GLONASS path RF delay [ns]

PPS_IF_POSITION_HOLD_DATA_CMD

\$PSTMPPS,1,13<cr><lf>

Reply:

\$PSTMPPS,1,13,<on_off>,<lat>,<lat_dir>,<lon>,<lon_dir>,<h_msl><cr><lf>

Parameter	Format	Description
on_off	Decimal, 1 digit	0= Position hold disabled 1= Position hold enabled
lat	DDMM.MMMM	Position hold position latitude
lat_dir	M	North or south direction
lon	"N" or "S"	Position hold position longitude
lon_dir	DDDMM.MMM	East or west direction
h_msl	MM	Position hold mean sea level altitude

PPS_IF_TRAIM_CMD

\$PSTMPPS,1,15<cr><lf>

Reply:

\$PSTMPPS,1,15,<traim_enabled>,<traim_solution>,<ave_error>,<used_sats>,<removed_sats><cr><lf>

Parameter	Format	Description
traim_enabled	Decimal, 1 digit	TRAIM ON/OFF status: 0= OFF 1= ON

traim_solution	Decimal, 1 digit	TRAIM algorithm status: 0= UNDER alarm 1= OVER alarm 2= UNKNOWN
ave_error	Decimal	Average time error [ns]
used_sats	Decimal	Number of satellite used for timing correction
removed_sats	Decimal	Number of satellites removed by the timing correction

PPS_IF_TRAIM_USED_CMD

\$PSTMPPS,1,16<cr><lf>

Reply:

\$PSTMPPS,1,16,<traim_enabled>,<used_sats>,<sat1>,...,<satN><cr><lf>

Parameter	Format	Description
traim_enabled	Decimal, 1 digit	TRAIM ON/OFF status: 0= OFF 1= ON
used_sats	Decimal	Number of satellite used for timing correction
sat1..satN	Decimal	List of satellites IDs

PPS_IF_TRAIM_RES_CMD

\$PSTMPPS,1,17<cr><lf>

Reply:

\$PSTMPPS,1,17,<traim_enabled>,<used_sats>,<res1>,...,<resN><cr><lf>

Parameter	Format	Description
traim_enabled	Decimal, 1 digit	TRAIM ON/OFF status: 0= OFF 1= ON
used_sats	Decimal	Number of satellite used for timing correction
res1..resN	Decimal	List of satellites residuals [ns] Each residual corresponds to the satellite in the used sat list at the same message position

PPS_IF_TRAIM_REMOVED_CMD

\$PSTMPPS,1,18<cr><lf>

Reply:

\$PSTMPPS,1,18,<traim_enabled>,<rem_sats>,<sat1>,...,<satN><cr><lf>

Parameter	Format	Description
traim_enabled	Decimal, 1 digit	TRAIM ON/OFF status: 0= OFF 1= ON
rem_sats	Decimal	Number of satellite removed by timing correction
sat1..satN	Decimal	List of satellites IDs

2.2.8.2. Setting PPS Data (cmd_mode=2)

PPS_IF_ON_OFF_CMD

\$PSTMPPS,2,1,<on_off><cr><lf>

Parameter	Format	Description
on_off	Decimal, 1 digit	0= PPS disabled 1= PPS enabled

PPS_IF_OUT_MODE_CMD

\$PSTMPPS,2,2,<out_mode><cr><lf>

Parameter	Format	Description
out_mode	Decimal, 1 digit	0= PPS always generated 1= PPS generated on even seconds 2= PPS generated on odd seconds

PPS_IF_REFERENCE_TIME_CMD

```
$PSTMPPS,2,19,<reference_time><cr><lf>
```

Parameter	Format	Description
		0 = UTC 1=GPS.UTC. 2=GLONASS.UTC. 3=UTC_SU 4= GPS.UTC_FROM_GLONASS 5 =COMPASS.UTC 6= UTC_NTSC 7=GST 8=UTC_GST 9=GPS_FROM_GST NOTE: UTC(SU) is the Soviet Union UTC, it is derived from GLONASS time applying the UTC delta time downloaded from GLONASS satellites. GPS.UTC_FROM_GLONASS is the GPS time derived from GLONASS time applying the GPS delta time downloaded from GLONASS satellites. If the software is configured to work in GLONASS only mode, UTC(SU) is identical to UTC and GPS.UTC_FROM_GLONASS is identical to GPS.UTC
reference_time	Decimal, 1 digit	

PPS_IF_PULSE_DELAY_CMD

```
$PSTMPPS,2,4,<pulse_delay><cr><lf>
```

Parameter	Format	Description
pulse_delay	Decimal	Pulse delay [ns]

PPS_IF_CONSTELLATION_RF_DELAY_CMD

```
$PSTMPPS,2,20,<sat_type><time_delay><cr><lf>
```

Parameter	Format	Description
		Satellite constellation type: 0 = GPS 1 =GLONASS 3 = Galileo 7 = COMPASS
Sat-type	Decimal	

Parameter	Format	Description
time_delay	Decimal	Time delay [ns]

PPS_IF_PULSE_DURATION_CMD

\$PSTMPPS,2,5,<pulse_duration><cr><lf>

Parameter	Format	Description
pulse_duration	Double	Pulse duration [s]

PPS_IF_PULSE_POLARITY_CMD

\$PSTMPPS,2,6,<pulse_polarity><cr><lf>

Parameter	Format	Description
pulse_polarity	Decimal, 1 digit	0= not inverted 1= inverted

PPS_IF_PULSE_DATA_CMD

\$PSTMPPS,2,7,<out_mode>,<reference_time>,<pulse_delay>,<pulse_duration>,<pulse_polarity><cr><lf>

Parameter	Format	Description
out_mode	Decimal, 1 digit	0= PPS always generated 1 = PPS generated on even seconds 2= PPS generated on odd seconds
reference_time	Decimal, 1 digit	0= UTC 1= GPS_UTC 2 = GLONASS_UTC 3= UTC_SU 4= GPS_UTC_FROM_GLONASS
pulse_delay	Decimal	Pulse delay [ns]
pulse_duration	Double	Pulse duration [s]
pulse_polarity	Decimal, 1 digit	0= not inverted 1= inverted

PPS_IF_FIX_CONDITION_CMD

\$PSTMPPS,2,8,<fix_condition><cr><lf>

Parameter	Format	Description
fix_condition	Decimal, 1 digit	1 = No fix 2 = 2D fix 3 = 3D fix

PPS_IF_SAT_TRHESHOLD_CMD

\$PSTMPPS,2,9,<sat_th><cr><lf>

Parameter	Format	Description
sat_th	Decimal	Minimum number of satellites for the PPS generation

PPS_IF_ELEVATION_MASK_CMD

\$PSTMPPS,2,10,<elevation_mask><cr><lf>

Parameter	Format	Description
elevation_mask	Decimal	Minimum satellite elevation for satellite usage in timing filtering

PPS_IF_CONSTELLATION_MASK_CMD

\$PSTMPPS,2,11,<constellation_mask><cr><lf>

Parameter	Format	Description
constellation_mask	Decimal (bit mask)	Satellite constellation selection for usage in timing filtering. bit0 = GPS bit1 = GLONASS bit7 = BeiDou NOTES: This parameter enables the usage of mixed constellations satellites in the timing filtering. If bit0 is enabled GPS satellites are used to correct the GLONASS reference time together with GLONASS satellites. If bit1 is enabled, GLONASS satellites are used to correct the GPS reference time together with the GPS satellites. When constellation mask is zero (default) only GPS sats are used to correct the GPS reference time and only GLONASS sats are used to correct the GLONASS reference time. Same description is valid also for GPS and BeiDou constellations enabling/disabling bit0 and bit7.

PPS_IF_TIMING_DATA_CMD

\$PSTMPPS,2,12,<fix_condition>,<sat_th>,<elevation_mask>,<constellation_mask><cr><lf>

Parameter	Format	Description
fix_condition	Decimal, 1 digit	1 = No fix 2 = 2D fix 3 = 3D fix
sat_th	Decimal	Minimum number of satellites for the PPS generation
elevation_mask	Decimal	Minimum satellite elevation for satellite usage in timing filtering
constellation_mask	Decimal (bit mask)	Satellite constellation selection for usage in timing filtering. bit0 = GPS bit1 = GLONASS

PPS_IF_POSITION_HOLD_DATA_CMD

\$PSTMPPS,2,13,<on_off>,<lat>,<lat_dir>,<lon>,<lon_dir>,<h_msl><cr><lf>

Parameter	Format	Description
on_off	Decimal, 1 digit	0= Position hold disabled 1= Position hold enabled
lat	DDMM.MMMMM	Position hold position latitude
lat_dir	"N" or "S"	North or south direction
lon	DDDMM.MMMMM	Position hold position longitude
lon_dir	"E" or "W"	East or west direction
h_msl	Double	Position hold mean sea level altitude

PPS_IF_AUTO_HOLD_SAMPLES_CMD

\$PSTMPPS,2,14,<auto_ph_samples><cr><lf>

Parameter	Format	Description
auto_ph_samples	Decimal, 1 digit	Number of position samples for the auto position algorithm. If the number of samples is set to "0" the auto position hold feature is disabled. The position average evaluation is restarted every time the command is executed.

PPS_IF_TRAIM_CMD

\$PSTMPPS,2,15,<on_off>,<alarm><cr><lf>

Parameter	Format	Description
on_off	Decimal, 1 digit	0= TRAIM disabled 1= TRAIM enabled
alarm	Double	TRAIM alarm [s] – scientific notation is allowed

Results:

According to the operation mode and the command type, data is set into or is retrieved from the PPS manager.

2.2.9. \$PSTMFORCESTANDBY

The command forces the platform to enter into standby mode.

Synopsis:

\$PSTMFORCESTANDBY,<duration><cr><lf>

Parameter	Format	Description
duration	Decimal, 5 digits	Duration of the standby time in seconds

Results:

If the command is executed successfully, the following message is returned:

\$PSTMFORCESTANDBYOK*<checksum><cr><lf>

If there is any error, the following message is returned:

\$PSTMFORCESTANDBYERROR*<checksum><cr><lf>

2.2.10. \$PSTMCFGCONST

The command configures constellation.

Synopsis:

\$PSTMCFGCONST,<gps>,<glonass>,<galileo>,<qzss>,<beidou>,<irnss><cr><lf>

Arguments:

Parameter	Format	Description
gps	Unsigned	GPS constellation status: 0= Constellation off 1= Constellation tracked 2= Constellation tracked and used in positioning
glonass	Unsigned	GLONASS constellation status: 0= Constellation off 1= Constellation tracked 2= Constellation tracked and used in positioning
galileo	Unsigned	Galileo constellation status: 0= Constellation off 1= constellation tracked 2= Constellation tracked and used in positioning
qzss	Unsigned	QZSS constellation status: 0= Constellation off 1= constellation tracked 2= Constellation tracked and used in positioning
beidou	Unsigned	BeiDou constellation status: 0= Constellation off 1= Constellation tracked 2= Constellation tracked and used in positioning
irnss*	Unsigned	IRNSS constellation status: 0= Constellation off 1= constellation tracked 2= Constellation tracked and used in positioning

Results:

If the command syntax is correct and parameters are correctly set, the following confirmation message is returned:

```
$PSTMCFGCONFOK*<checksum><cr><lf>
```

If there is any error, the following message is returned:

```
$PSTMCFGCONFERROR*<checksum><cr><lf>
```

NOTE

"*" means under development.

2.2.11. \$PSTMCFGPORT

The command configures a general-purpose port for NMEA, STBIN, DEBUG or RTCM purpose.

Synopsis:

\$PSTMCFGPORT,<port_type>,<protocol_type>,<par_1>,<par_2>,...,<par_N><cr><lf>

Arguments:

Parameter	Format	Description
port_type	Decimal, 1 digit	Select the port type: 0= UART 1= I2C
protocol_type	Decimal, 1 digit	Select the protocol type: 0= NMEA
par_1 ... par_N	Integer	Parameters list according to the command type Specification (see below).

Results:

One or more parameters of swconfig are set according to the command parameters. If there are no errors, the following message is returned:

\$PSTMCFGPORTOK*<checksum><cr><lf>

If there is any error, the following message is returned:

\$PSTMCFGPORTERROR*<checksum><cr><lf>

2.2.11.1. Parameters when port_type is UART

Parameter	Format	Description
-----------	--------	-------------

portnumb	From 0 to 255	UART GPIO ID (Linearly addressed) 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, 460800, 921600
baudrate	Integer	

2.2.11.2. Parameters when port_type is I2C

Parameter	Format	Description
slaveaddr	Hexadecimal, 2 Bytes	The I2C slave address 0= Speed mode STANDARD
mode	Decimal, 1 digit	1= Speed mode FAST 2= Speed mode HS

2.2.12. \$PSTMCFGMSGL

The command configures the message list.

Synopsis:

\$PSTMCFGMSGL,<listid>,<rate>,<listlow>,<listhigh><cr><lf>

Arguments:

Parameter	Format	Description
listid	Decimal, 1 digit	List selector: 0 = NMEA list 0
rate	From 0 to 255	Message list rate scaler
listlow	Hexadecimal, 8 digits	Low 32 bits

listhigh Hexadecimal, 8 digits High 32 bits

For each bit:

0 means feature disabled

1 means feature disabled

Bit	Bitmask(32 bits)	Function
	Low 32 bits	
0	0x1	\$GPGNS message
1	0x2	\$GPGGA message
2	0x4	\$GPGSA message
3	0x8	\$GPGST message
4	0x10	\$GPVTG message
5	0x20	Reserved
6	0x40	\$GPRMC message
7	0x80	Reserved
8	0x100	Reserved
9	0x200	Reserved
10	0x400	Reserved
11	0x800	Reserved
12	0x1000	Reserved
13	0x2000	Reserved
14	0x4000	Reserved
15	0x8000	Reserved
16	0x10000	Reserved
17	0x20000	Reserved
18	0x40000	Reserved
19	0x80000	\$GPGSV message
20	0x100000	\$GPGLL message
21	0x200000	Reserved
22	0x400000	Reserved

23	0x800000	Reserved
24	0x1000000	\$GPZDA message
25	0x2000000	Reserved
26	0x4000000	Reserved
27	0x8000000	Reserved
28	0x10000000	Reserved
29	0x20000000	Reserved
30	0x40000000	Reserved
31	0x80000000	Reserved
High 32 bits		
32	0x1	Reserved
33	0x2	Reserved
34	0x4	Reserved
35	0x8	Reserved
		\$PSTMANTENNASTATUS
36	0x10	message
37	0x20	Reserved
38	0x40	Reserved
39	0x80	\$GPD TM message
40	0x100	Reserved
41	0x200	Reserved
42	0x400	Reserved
43	0x800	Reserved
44	0x1000	Reserved
45	0x2000	\$GPGBS message
46	0x4000	Reserved
47	0x8000	Reserved
48	0x10000	Reserved
49	0x20000	Reserved
50	0x40000	\$PSTMODO message
		\$PSTMGEOFENCESTATUS
51	0x80000	message
52	0x100000	Reserved

53	0x200000	Reserved
54	0x400000	Reserved
55	0x800000	Reserved
56	0x1000000	Reserved
57	0x2000000	Reserved
58	0x4000000	Reserved
59	0x8000000	Reserved
60	0x10000000	Reserved
61	0x20000000	Reserved
62	0x40000000	Reserved
63	0x80000000	\$GARLM message

Results:

One or more parameters of swconfig are set according to the command parameters. If there are no errors, the following message is returned:

```
$PSTMCFGMSGLOK*<checksum><cr><lf>
```

If there is any error, the following message is returned:

```
$PSTMCFGMSGLError*<checksum><cr><lf>
```

2.2.13. \$PSTMSETANTSENSOPMODE

The command set antenna sensing operating mode: auto or manual.

Synopsis:

```
$PSTMSETANTSENSOPMODE,<operating_mode><cr><lf>
```

Arguments:

Parameter	Format	Description
operating_mode	Decimal, 1 digit	Select the antenna sensing operating mode:

0= Auto
1= Manual

Results

Antenna sensing operating mode is set according to the command parameter. If there are no errors, the following message is returned:

\$PSTMSETANTSENSOPMODEOK*<checksum><cr><lf>

If there is any error, the following message is returned:

\$PSTMSETANTSENSOPMODEERROR*<checksum><cr><lf>

2.2.14. \$PSTMSETANTSENSMANUAL

Manage the Antenna Sensing ON-OFF, RF switching, antenna status reading and antenna detection enabling/disabling by command. It can be used only after set Antenna Operating mode to MANUAL.

Synopsis:

\$PSTMSETANTSENSMANUAL,<power_onoff>,<rf_switch_onoff>,<ant_status_reading_en>,<ant_sens_onoff><cr><lf>

Arguments:

Parameter	Format	Description
power_onoff	Decimal, 1 digit	Antenna power ON/OFF by command:
		0= Do nothing
		1= Antenna power ON
rf_switch_onoff	Decimal, 1 digit	2= Antenna power OFF
		Antenna RF switching by command
		0= Do nothing
ant_status_reading_en	Decimal, 1 digit	1= Switch to external antenna
		2= Switch to internal antenna
		0= Do nothing
ant_sens_onoff	Decimal, 1 digit	1= Antenna status reading
		Antenna sensing feature ON/OFF
		0= Antenna sensing ON (update status ON and NMEA sentence ON)
		1 = Antenna sensing OFF (update status OFF and

NMEA sentence OFF)

Results

One or more antenna features are set according to the command parameters. If there are no errors, the following message is returned:

```
$PSTMSETANTSENSMANUAL,<power_onoff>,<rf_switch_onoff>,<op_mode>,<antenna_status>,<ant_s  
ens_onoff>*<checksum><cr><lf>
```

If antenna operating mode is auto, it returns error. In this case, the following message is returned:

```
$PSTMSETANTSENSMANUALERROR*<checksum><cr><lf>
```

Example

Switch to external antenna manually

```
$PSTMSETANTSENSOPMODE,1  
$PSTMSETANTSENSOPMODEOK*10  
$PSTMSETANTSENSMANUAL,1,1,0,0  
$PSTMSETANTSENSMANUAL,1,1,1,3,0*0C
```

Switch to internal antenna manually

```
$PSTMSETANTSENSOPMODE,1  
$PSTMSETANTSENSOPMODEOK*10  
$PSTMSETANTSENSMANUAL,1,1,0,0  
$PSTMSETANTSENSMANUAL,1,2,1,3,0*0F
```

2.3. System Commands

The GNSS software utilizes a “Configuration Data Block” that holds the working parameters for the system.

2.3.1. \$PSTMSAVEPAR

The command saves current configuration data block into the backup memory.

Synopsis:

\$PSTMSAVEPAR<cr><lf>

Arguments:

None.

Results:

The current configuration data block, including changed parameters, will be stored into the backup memory (NVM).

If there is no error, the following message is returned:

\$PSTMSAVEPAROK

If there is any error, the following message is returned:

\$PSTMSAVEPARERROR

Example:

\$PSTMSAVEPAR

2.3.2. \$PSTMRESTOREPAR

The command restores the factory setting parameters. The configuration data block stored in NVM, if present, will be invalidated. Any changed parameter will be lost.

Synopsis:

3 Messages

3.1. Standard NMEA Messages List

Syntax	Default	Description
\$--RMC	ON	NMEA: Recommended minimum specific GNSS data

\$--VTG	ON	NMEA: Track made good and ground speed
\$--GGA	ON	NMEA: Global position system fix data
\$--GSA	ON	NMEA: GPS DOP and active satellites.
\$--GSV	ON	NMEA: GPS satellites in view.
\$--GLL	ON	NMEA: Geographic position latitude/longitude

3.2. ST NMEA Messages List

Syntax	Default	Description
\$PSTMAANTENNASTATUS	ON	ST: Reports the status of the antenna

3.3. Standard NMEA Messages Specification

These messages are defined within the “NMEA 0183” specification.

Table 2: Structure of Standard NMEA Messages

Filed	Length (Bytes)	Description
\$	1	Each NMEA message starts with ‘\$’
Talker ID	1~2	GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode GN: If system works in multi-constellation mode
NMEA Message ID	3	NMEA message ID
Data Field	Variable, depend on the NMEA message type	Data fields, delimited by comma ‘,’
*	1	End character of data field
Checksum	2	A hexadecimal number calculated by exclusive OR of all characters between ‘\$’ and ‘*’
<CR><LF>	2	Each NMEA message ends with ‘CR’ and ‘LF’

NOTE

The default output message of L89 series has the following six sentences: RMC, VTG, GGA, GSA, GSV and GLL.

3.3.1. \$--RMC

Recommended minimum specific GPS/transit data. Time, date, position and speed data provided by the GNSS receiver.

Format for NMEA 0183 Rev 3.01 (Default):

\$GPRMC,<Timestamp>,<Status>,<Lat>,<N/S>,<Long>,<E/W>,<Speed>,<Trackgood>,<Date>,<MagVar>,<MagVarDir>,<mode><checksum><cr><lf>

Format for NMEA 0183 Rev 4.10:

\$<TalkerID>RMC,<Timestamp>,<Status>,<Lat>,<N/S>,<Long>,<E/W>,<Speed>,<Trackgood>,<Date>,<MagVar>,<MagVarDir>,<mode>,<Nav_status><checksum><cr><lf>

Example for NMEA 0183 Rev 3.01 (Default):

\$GPRMC,183417.000,V,4814.040,N,01128.522,E,0.0,0.0,170907,0.0,W*6C

Example for NMEA 0183 Rev 4.10:

\$GNRMC,202340.000,A,4045.53297,N,01447.20361,E,0.2,0.0,291117,,,A,C*18

Field	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode
Timestamp	hhmmss.sss	UTC Time of GPS Sample: hh: hours (Fixed two digits) mm: minutes (Fixed two digits) ss: seconds (Fixed two digits) .sss: decimal fraction of seconds (Variable length) Note that decimal fraction assumes non zero values when the fix rate is bigger than 1Hz.

		Note that for Rev 4.10, this field is empty in case of invalid value.
Status	"A" or "V"	'V'=Invalid 'A'=Valid
Lat	DDMM.MMMMM	Latitude as degrees: DD: Degree (Fixed two digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes (Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
N/S	"N" or "S"	Latitude direction: 'N'=North 'S'=South Note that for Rev 4.10, this field is empty in case of invalid value.
Long	DDDMM.MMMMM	Longitude as degrees: DDD: Degree (Fixed three digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes (Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
E/W	"E" or "W"	Longitude direction: 'E'=East 'W'=West Note that for Rev 4.10, this field is empty in case of invalid value.
Speed	x.x, variable length field	Speed over ground in knots
Trackgood	x.x, variable length field	Course made good, max. 999.9
Date	Decimal, 6 digits	Date in format 'ddmmyy'
MagVar	Decimal, 4 digits	Magnetic variation in degree, not being output
MagVarDir	"E" or "W"	Magnetic variation "E" or "W" indicator, not being output
Mode	"D", "A", "N" or "E"	Positioning system Mode Indicator: "D" = Differential mode "A" = Autonomous mode "N" = data not valid "E" = Estimated (dead reckoning) mode
Nav_status	"S", "C", "U" or "V"	Navigational status indicator: "S" = Safe "C" = Caution

	"U" = Unsafe
	"V" = Not valid
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.3.2. \$--VTG

Course over ground and ground speed, and this message provides the actual course and speed relative to ground.

Format for NMEA 0183 Rev 3.01(Default):

\$GPVTG,<TMGT>,T,<TMGM>,M,<SoGN>,N,<SoGK>,K,D*<checksum><cr><lf>

Format for NMEA 0183 Rev 4.10:

\$<TalkerID>VTG,<TMGT>,T,<TMGM>,M,<SoGN>,N,<SoGK>,K,D*<checksum><cr><lf>

Example:

\$GPVTG,73.2,T,,M,0.2,N,0.4,K,D*50

Filed	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode.
TMGT	ddd.d in degrees	Track in reference to "true" earth poles
T		Indicates "terrestrial"
TMGM	ddd.d in degrees	Track in reference to "magnetic" earth poles
M		Indicates "magnetic"
SoGN	ddd.d in knots	Speed over ground in knots
N		Indicates "knots"
SoGK	ddd.d in km/h	Speed over ground in kilometers per hour
K		Indicates "kilometres"

D	Char	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated mode
*		End character of data field
Checksum		Hexadecimal checksum
<CR><LF>		Each of message

3.3.3. \$--GGA

Global positioning system fixed data.

Format for NMEA 0183 Rev 3.01(Default):

\$GPGGA,<Timestamp>,<Lat>,<N/S>,<Long>,<E/W>,<GPSQual>,<Sats>,<HDOP>,<Alt>,<AltVal>,<GeoSep>,<GeoVal>,<DGPSAge>,<DGPSRef>,<checksum><cr><lf>

Format for NMEA 0183 Rev 4.10:

\$<TalkerID>GGA,<Timestamp>,<Lat>,<N/S>,<Long>,<E/W>,<GPSQual>,<Sats>,<HDOP>,<Alt>,<AltVal>,<GeoSep>,<GeoVal>,<DGPSAge>,<DGPSRef>,<checksum><cr><lf>

Example:

\$GPGGA,183417.000,04814.03970,N,01128.52205,E,0,00,99.0,495.53,M,47.6,M,,*53

Filed	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode .GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode.
Timestamp	hhmmss.sss	UTC Time of GPS Sample: hh: hours (Fixed two digits) mm: minutes (Fixed two digits) ss: seconds (Fixed two digits) .sss: decimal fraction of seconds (Variable length) Note that decimal fraction assumes non zero values when the fix rate is bigger than 1Hz. Note that for Rev 4.10, this field is empty in case

		of invalid value.
Lat	DDMM.MMMMM	Latitude as degrees: DD: Degree (Fixed two digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes (Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
N/S	"N" or "S"	Latitude direction: North or South Note that for Rev 4.10, this field is empty in case of invalid value
Long	DDDMM.MMMMM	Longitude as degrees: DDD: Degree (Fixed three digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes (Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
E/W	"E" or "W"	Longitude direction: East or West Note that for Rev 4.10, this field is empty in case of invalid value.
GPSQual	Decimal, 1digit	0 = Fix not available or invalid 1 = GPS, SPS Mode, fix valid 2 = Differential GPS, SPS Mode, fix valid 6 = Estimated (dead reckoning) mode
Sats	Decimal, 2 digits	Satellites in use: example: 08
HDOP	x.x, variable length field	Horizontal dilution of precision, max: 99.0
Alt	x.x, variable length field	Height above mean sea level, max: 100000.0m
AltVal	"M"	Reference unit for altitude ("M" = meters)
GeoSep	x.x, variable length field	Geoidal separation measure in "M" = meters
DGPSAge	Empty	Not supported
DGPSRef	Empty	Not supported
*		End character of data field
Checksum		Hexadecimal checksum
<CR><LF>		Each of message

3.3.4. \$--GSA

GNSS DOP and active satellites. Satellites from different constellations are sent on separate messages. In case of multi-constellation mode, the talker ID is always GN. If NMEA is set as Rev 3.01, it is possible to force the talker ID as GN.

When NMEA is set as Rev 4.10, the talker ID could not be forced and is managed internally to be compliant with the standard. See parameter table for info about Talker ID available values.

Format for NMEA 0183 Rev 3.01(Default):

```
$--GSA,<Mode>,<CurrentMode>,<SatPRN1>,...,<SatPRNN>,<PDOP>,<HDOP>,<VDOP>,<checksum>
<cr><lf>
```

Format for NMEA 0183 Rev 4.10:

```
$<TalkerID>GSA,<Mode>,<CurrentMode>,<SatPRN1>,...,<SatPRNN>,<PDOP>,<HDOP>,<VDOP>,<SystemID>,<checksum>
<cr><lf>
```

Example for NMEA 0183 Rev 3.01 (Default):

```
$GPGSA,A,3,05,21,07,24,30,16,12,,,,,2.4,1.9,1.5*38
```

Example for NMEA 0183 Rev 4.10:

```
$GNGSA,A,3,23,03,22,09,01,19,17,06,31,11,,,1.1,0.6,0.9,1*3E
```

```
$GNGSA,A,3,67,66,81,65,88,75,82,74,,,,,1.1,0.6,0.9,2*3D
```

```
$GNGSA,A,3,03,05,22,08,30,16,12,,,,,1.1,0.6,0.9,3*32
```

Field	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode.
Mode	1 character	M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D

CurrentMode	Decimal, 1 digit	1= Fix not available 2= 2D 3= 3D
SatPRN (1 to 12)	Decimal, 2 or 3 digits	Satellites list used for positioning
PDOP	x.x, variable length field	Position dilution of precision, max: 99.0
HDOP	x.x, variable length field	Horizontal dilution of precision, max: 99.0
VDOP	x.x, variable length field	Vertical dilution of precision, max: 99.0
SystemID	Hexadecimal, 1 digit	The system ID of this message: 1= GPS 2= GLONASS 3= Galileo 4= BeiDou 5= QZSS 6= IRNSS
*		End character of data field
Checksum		Hexadecimal checksum
<CR><LF>		Each of message

3.3.5. \$--GSV

GNSS satellites in view.

Usually GSV messages are organised per constellation and each message carries information about up to 4 satellites in view. Thus, in certain cases, to describe all the satellites in view from a constellation more than a message is needed. This set of message is printed once per each constellation with talker ID related to described constellation.

With NMEA Rev 4.10, the “GN” talker ID is forbidden in order to be compliant with the standard. Thus the module will print a set of messages for each constellation.

Format for NMEA 0183 Rev 3.01(Default):

\$--GSV,<GSVAmount>,<GSVNumber>,<TotSats>,<Sat1PRN>,<Sat1Elev>,<Sat1Azim>,<Sat1CN0>,...,
<Sat4PRN>,<Sat4Elev>,<Sat4Azim>,<Sat4CN0>,<checksum><cr><lf>

Format for NMEA 0183 Rev 4.10:

\$--GSV,<GSVAmount>,<GSVNumber>,<TotSats>,<Sat1PRN>,<Sat1Elev>,<Sat1Azim>,<Sat1CN0>,...,
<Sat4PRN>,<Sat4Elev>,<Sat4Azim>,<Sat4CN0>,<SignalID>,<checksum><cr><lf>

Example for NMEA 0183 Rev

3.01 (Default):

\$GPGSV,3,1,12,02,04,037,,05,27,125,44,06,78,051,23,07,83,021,30*7C

\$GPGSV,3,2,12,10,16,067,30,12,11,119,36,16,24,301,41,21,44,175,50*73

\$GPGSV,3,3,12,23,06,326,28,24,61,118,40,30,45,122,43,31,52,253,37*7C

Example for NMEA 0183 Rev 4.10:

\$GPGSV,3,1,09,30,68,039,49,05,61,266,50,28,52,137,47,07,38,052,48,01*5C

\$GPGSV,3,2,09,13,37,301,45,09,17,105,43,15,07,297,40,08,06,056,41,01*56

\$GPGSV,3,3,09,20,,,41,,,,,,,,,,,,,01*5A

\$GLGSV,2,1,06,68,86,031,43,78,78,013,46,79,51,226,43,69,33,325,38,01*43

\$GLGSV,2,2,06,67,33,139,41,77,26,035,36,,,,,,,,,01*46

\$GAGSV,2,1,05,08,76,129,44,02,65,057,46,30,56,205,45,07,48,311,44,06*4F

\$GAGSV,2,2,05,03,22,129,40,,,,,,,,,,,,,06*7D

Field	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode..
Mode	1 character	M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D
GSVAmount	Decimal, 1 digit	Total amount of GSV messages, max. 8
GSVNumber	Decimal, 1 digit	Continued GSV number of this message
TotSats	Decimal, 2 digits	Total number of satellites in view, max. 32
SatxPRN	Decimal, 2 digits	Satellites list used for positioning.
SatxElev	Decimal, 2 digits	Elevation of satellite x in degree, 0 - 90
SatxAzim	Decimal, 3 digits	Azimuth of satellite x in degree, ref. "North", 000 ... 359
SatxCN0	Decimal, 2 digits	Carrier to noise ratio for satellite x in dB, 00 ... 99
SignalID	Decimal, 1 digits	An identifier to indicate the signal in use. Currently it is 1 for GPS, GLONASS, 2 for BeiDou and QZSS 6 for Galileo
*		End character of data field
Checksum		Hexadecimal checksum

<CR><LF>

Each of message

3.3.6. \$--GLL

Geographic positioning latitude/longitude.

Format for NMEA 0183 Rev 3.01(Default):

\$GPGLL,<Lat>,<N/S>,<Long>,<E/W>,<Timestamp>,<Status>,<mode indicator>,<checksum><cr><lf>

Format for NMEA 0183 Rev 4.10:

\$<TalkerID>GLL,<Lat>,<N/S>,<Long>,<E/W>,<Timestamp>,<Status>,<mode indicator>,<checksum><cr><lf>

Example:

\$GPGLL,4055.04673,N,01416.54941,E,110505.000,A,A*54

Field	Length (Bytes)	Description
\$	Char	Each NMEA message starts with '\$'
TalkerID	String, 2 characters	The talker ID (Fixed two characters). GP: If system works in GPS only mode GL: If system works in GLONASS only mode GA: If system works in Galileo only mode BD: If system works in BeiDou only mode QZ: If system works in QZSS only mode IR: If system works in IRNSS only mode GN: If system works in multi-constellation mode.
Lat	DDMM.MMMMM	Latitude as degrees: DD: Degree (Fixed two digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes (Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
N / S	"N" or "S"	Latitude direction: north or south Note that for Rev 4.10, this field is empty in case of invalid value.
E / W	"E" or "W"	Longitude as degrees: DDD: Degree (Fixed three digits) MM: Minutes (Fixed two digits) .MMMMM: Decimal fraction of minutes

		(Variable) Note that for Rev 4.10, this field is empty in case of invalid value.
Timestamp	hhmmss.sss	UTC time of GGL sample ".sss" is the fraction of seconds; it assumes non zero values when the fix rate is bigger than 1Hz.
Status	"A" or "V"	Validity of data: "A" = valid, "V" = invalid
Mode indicator	"D", "A", "N" or "E"	Positioning system mode indicator: "D" = Differential mode "A" = Autonomous mode "N" = data not valid "E" = Estimated (dead reckoning) mode
*		End character of data field
Checksum		Hexadecimal checksum
<CR><LF>		Each of message

3.4. ST NMEA Messages Specification

3.4.1. \$PSTMANTENNASTATUS

The message reports the status of the antenna (working normally, open or short). It reports also information on antenna detection operating mode as well as the info on which antenna is active (if external or internal).

Synopsis:

\$PSTMANTENNASTATUS,<status>,<op_mode>,<ext_ant>*<checksum><cr><lf>

Arguments:

Parameter	Format	Description
status	Decimal, 1 digit	Antenna status: 0= Antenna NORMAL 1= Antenna OPEN 2= Antenna SHORT 3= Anomalous behavior
op_mode	Decimal, 1 digit	Operating mode: 0 = Auto - the antenna is managed automatically by the software logic

		1 = Manual - the antenna ON-OFF or RF switching is controlled by commands
ext_ant	Decimal, 1 digit	0= External antenna 1= Internal antenna
checksum	Hexadecimal, 2 digits	Checksum of the message bytes without *<checksum><cr><lf> characters.

4. Default Configurations

Table 3: Default Configurations

Item	Default
NMEA port baud rate	9600bps
Datum	WGS84
Rate of position fixing	1HZ
DGPS mode	Off
NMEA output messages	RMC, VTG, GGA, GSA, GSV and GLL

5. Appendix A References

SN	Document Name	Remark
[1]	Quectel_SKG121_Hardware_Design	SKG121 Hardware Design
[2]	Quectel_SKG121_Reference_Design	SKG121 Reference Design

Table 5: Terms and Abbreviations

Abbreviation	Description
GPS	Global Navigation Satellite System
NMEA	National Marine Electronics Association
GGA	NMEA: Global Positioning System Fix Data
RMC	NMEA: Recommended Minimum Position Data
GSA	NMEA: GPS DOP and Active Satellites
GSV	NMEA: GPS Satellites in View
GLL	NMEA: Geographic Position – Latitude/Longitude
GLONASS	Global Navigation Satellite System (The Russian GNSS)
GNSS	Global Navigation Satellite System
VTG	NMEA: Track Made Good and Ground Speed

DGPS	Differential Global Positioning System
PDOP	Position Dilution of Precision
VDOP	Vertical Dilution of Precision
HDOP	Horizontal Dilution of Precision
PPS	Pulse Per Second
UTC	Universal Time Coordinated

6. Contact Information

Skylab M&C Technology Co., Ltd.

深圳市天工测控技术有限公司

Address: 6Floor, No.9 Building, Lijincheng Scientific & Technical park, Gongye East Road,
Longhua District, Shenzhen, Guangdong, China

Phone: 86-755 8340 8210 (Sales Support)

Phone: 86-755 8340 8510 (Technical Support)

Fax: 86-755-8340 8560

E-Mail: technicalsupport@skylab.com.cn(技术支持)

Website: www.skylab.com.cn www.skylabmodule.com