SONY

CXD5603GF

User's Manual for Positioning assistance functions

Ver. 0.08

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History of Revisions

Revised ID	Details of revisions made	Preparation date	Approval date	Remarks
0.01	Established first edition.	2013/10/10	2013/10/15	preliminary
0.02	The description is changed in part.	2013/11/05	2013/11/06	release
0.03	Add @CEPA command	2013/11/13	2013/11/19	
0.04	Add @CEPC command	2013/12/24	2013/12/27	
	1st release of English version			
0.05	Add a note of caution to issue @CEPE and @CEPW at Idle state.	2014/10/14	2014/10/14	
	Corrected some errors.	2014/10/14	2014/10/14	
0.06	Corrected updating interval of PA data on the server.	2014/11/20	2014/11/20	
	Modified the descriptions for the CXD5603.	2017/10/10	2017/10/10	
0.07	Added the explanations of AEP.	2017/10/13	2017/10/30	
0.08	Added the error code.	2017/11/10	2018/2/13	
	Corrected the erroneous description.	2017/11/14	2018/2/13	
	Added the constraints in the flash-less boot system.	2018/1/5	2018/2/13	
	Added @AEPG command.	2018/1/30	2018/2/13	

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1 What this document contains

This document is CXD5603GF user's manual for positioning assistance function.

Please refer to a CXD5603GF user's manual along with this document.

2 Positioning assistance functions

Positioning Assistance (it abbreviates to PA after this) functions are the functions which make a hot start (pseudo hot start) possible also in the state before the CXD5603GF receives an almanac and ephemeris.

PA includes two solutions, CEP and AEP.

PA (CEP and AEP) supports only GPS satellites. GLONASS and QZSS are not supported by this functionality.

2.1 CEP

CEP is a function which makes a pseudo hot start by injecting the position assistance data (CEP data) into the CXD5603GF. CEP data is distributed via a network. The operation image of CEP function is shown below.

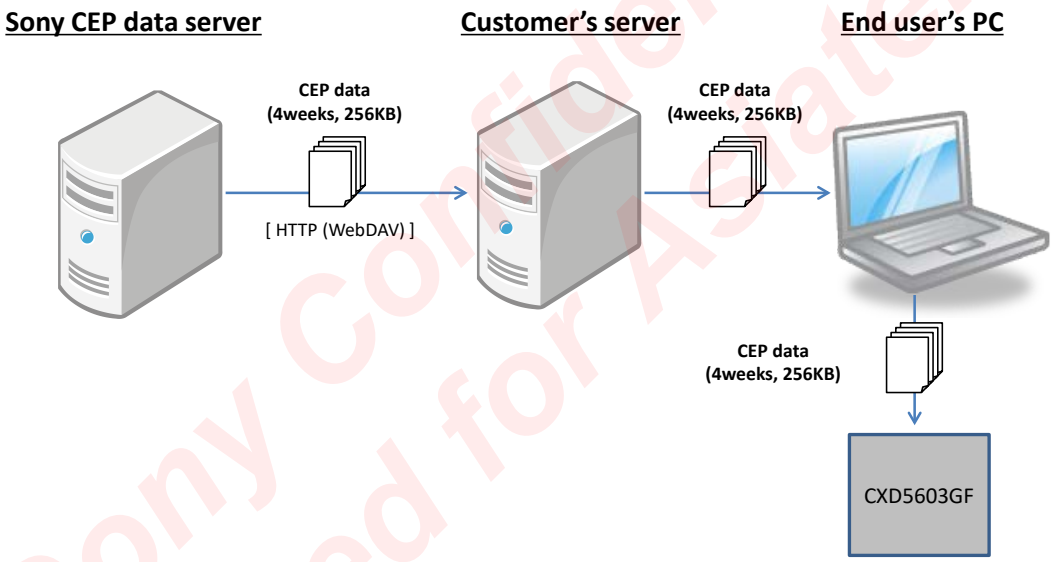


Fig.1. CEP function operation image

2.1.1 CEP data

The data size of the CEP data distributed by the CEP data server is 256KB and is valid for 28 days (4weeks) after being generated (smaller size and shorter lifetime CEP data are also available in the server) . It is used in a format as it is, injecting this data into the CXD5603GF via customer's server and end-user PC. The injected CEP data is stored in flash memory connected to the CXD5603GF.

When CEP data is injected to the CXD5603GF, it uses @CEPE and @CEPW command. Please refer to command specification in detail.

Using CEP function, the whole CEP data needs to be stored in the CXD5603GF. It does not support the partial

injection of CEP data. If the injection of CEP data is stopped on the way, a checksum error is caused at the time of PA functional starting, and it cannot do pseudo hot start.

2.1.2 CEP data server

Sony Semiconductor Solutions Corps hosts the CEP server. CEP files can be accessed through HTTP (WebDAV) protocol. CEP data is updated once per day (every day 0:30/UTC) on a CEP data server.

2.1.3 Pseudo hot start using CEP function

When execute a pseudo hot start by the CXD5603GF using PA data, it is necessary to provide the last know position and the current time beforehand to the CXD5603GF.

Since the last fixed position is stored by @BUP command, if the receiver did not move significantly from the previously fixed position at the time of next starting, a new, a pseudo hot start may be possible without providing a position.

2.2 AEP

AEP is a function to enable a hot start (pseudo hot start) acquisition by generating the position assistant data autonomously (AEP data) inside of the CXD5603GF. AEP function can be enabled and disabled by @AEPS command.

2.2.1 AEP data generation

When AEP function is enabled, the CXD5603GF generates AEP data in the background after receiving the required broadcasted ephemerides. It takes around a few tens of seconds per satellite.

For generating AEP data for a specific satellite, two broadcasted ephemerides from this satellite must be received and stored. The date of the two ephemerides must be more than one day and up to 3days apart.

When the new broadcasted ephemerides are received, the CXD5603GF generates new AEP data and updates.

The generated AEP data is used for the position calculation automatically when AEP function is enabled.

2.2.2 The valid period of AEP data

The valid duration of AEP data is 3days. If AEP data did not get updated over 3days, the CXD5603GF could not do pseudo hot start.

2.2.3 AEP data storage

The generated AEP data are stored in the flash memory connected to the CXD5603GF. AEP function cannot be used on the flash-less boot system. It also cannot be used in the case of 8Mbit flash memory are used.

2.3 The priority of PA data and broadcasted ephemeris

If both a valid CEP data and a valid AEP data for a specific satellite are existed inside of the CXD5603GF, AEP data is used for the position calculation in priority to CEP data. If a valid broadcasted ephemeris for specific satellite exists, the broadcasted ephemeris is used in preference to CEP and AEP.

3 Command specification

This section explains the specification of each command.

3.1 @AEPG: AEP generation status acquisition

This command is used to acquire the status of AEP data generation.

When this command is issued, the CXD5603GF returns 2 of 32 bits data in ASCII strings.

AAAAAAAA,BBBBBBBB

"AAAAAAAA" indicates the satellites that are waiting for their AEP data generated. The satellites are assigned to each of the bits of this string (bit 0: SV1, bit 1: SV2, … , bit 31: SV32) . "BBBBBBBB" indicates the satellites which AEP data has already been generated. The satellites are assigned to each of the bits of this string.

It takes time to generate AEP data for each satellite, and the CXD5603GF should not be turned off or transferred to sleep mode until AEP data generation finished. It is desirable that the host controller checks the status with this command and wait for AEP data generation finished.

AEP data is always updated when new ephemeris is received. So, there is the case that the same bits of both "AAAAAAAA" and "BBBBBBBB" are set to "1" .

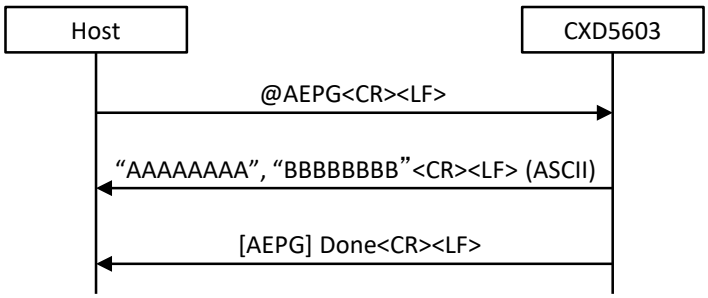
Format : **@AEPG<CR><LF>**

Argument : none

Response :

Sentence	Description
"[AEPG] Done"	This indicates that the command has been executed successfully.
"[AEPG] Err n"	This indicates that an error has occurred.

Sequence :



3.2 @AEPS: AEP function control

This command is used to enable and disable AEP function.

This command enables AEP function. The CXD5603GF generates AEP data and uses it for the position calculation automatically. This command can also disable AEP function, AEP data are not used for the position calculation.

Format : **@AEPS <arg 1><CR><LF>**

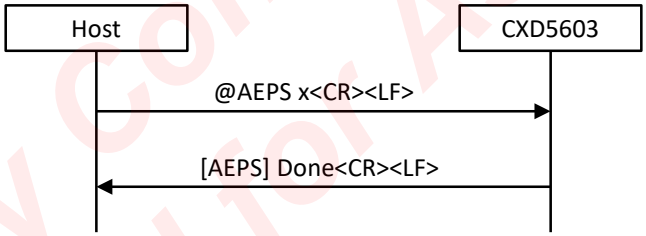
Argument :

Field	Description
arg 1	Controlling AEP function. 0 : Disable (default) 1 : Enable

Response :

Sentence	Description
"[AEPS] Done"	This indicates that the command has been executed successfully.
"[AEPS] Err n"	This indicates that an error has occurred.

Sequence :



3.3 @CEPA : Getting CEP data information

This is a command which retrieves information about the CEP data currently stored in the CXD5603GF. This command retrieves the beginning of day/time and the term of validity of CEP data information stored in the CXD5603GF. This information is an ASCII data format. The 1st data shows the beginning day of CEP data, and 2nd data shows the term of validity.

It means with a modified Julius day (MJD) at the time of a beginning day. From MJD to YMD Conversion can be done by the following formulas. In addition, the start time of CEP data is always 0:00 (GPS time).

If CEP data does not exist, an error returns.

```
JD12 = floor(MJD + 2400001)
e = floor((JD12 - 1867216.25) / 36524.25)
f = JD12 + (e - floor(e / 4) + 1)
g = f + 1524
h = floor((g - 122.1) / 365.25)
i = floor(365.25 * h)
j = floor((g - i) / 30.6001)

d = g - i - floor(30.6001 * j)
m = j - 12 * floor(j / 14) – 1
w = h - 4716 + floor((14 - m) / 12)

if w > 0 then y = w else y = w - 1
```

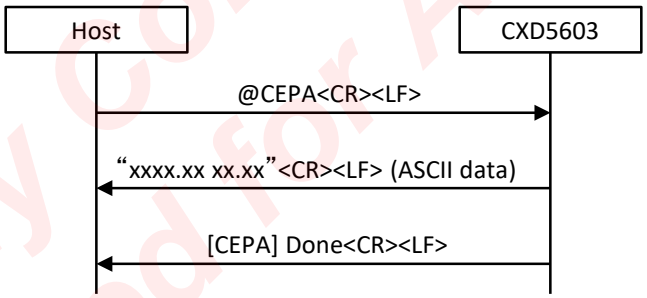
Format : **@CEPA<CR><LF>**

Argument : none

Response :

Sentence	Description
"[CEPA] Done"	This indicates that the command has been executed successfully.
"[CEPA] Err n"	This indicates that CEP data does not exist.

Sequence :



3.4 @CEPC : Check of CEP data validity

It is a command which checks whether CEP data stored in CXD5603GF is correct. In case of correct CEP data, it returns [CEPC] Done". However, in case of invalid PA data or if CEP data does not exist, it returns an error.

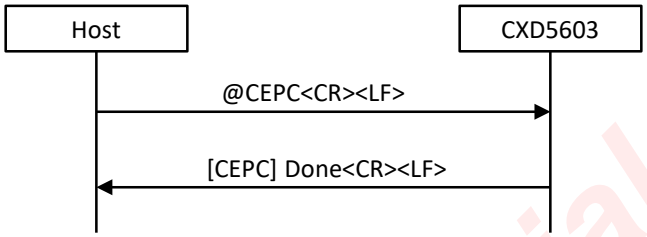
Format : **@CEPC<CR><LF>**

Argument : None

Response :

Sentence	Description
"[CEPC] Done"	This indicates that the correct PA data is stored.
"[CEPC] Err n"	This indicates that CEP data does not exist or invalid CEP data is stored.

Sequence :



3.5 @CEPE : Erase of CEP data

It is a command which erases CEP data stored in CXD5603GF. It is a necessity to erase CEP data stored in the CXD5603GF before injecting new CEP data using @CEPW command.

This command must be issued at Idle state.

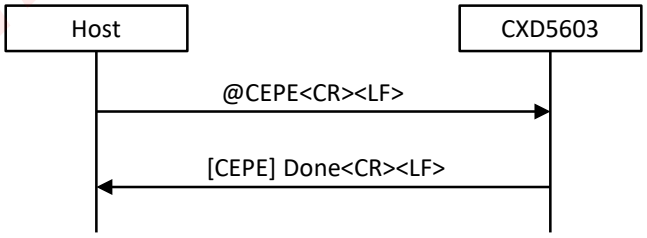
Format : **@CEPE<CR><LF>**

Argument : none

Response :

Sentence	Description
"[CEPE] Done"	This indicates that the command has been executed successfully.
"[CEPE] Err n"	This indicates that an error has occurred. "n" is where the error code is entered.

Sequence :



3.6 @CEPW : Injection of CEP Data

It is a command that injects CEP data into CXD5603GF. The injected CEP data is stored in the flash memory

connected to the CXD5603GF.

It is necessary to divide 256KB of CEP data into 128 packets each 2KB from a head and send each packet in order by this command. This command will be executed 128 times to send all the assistant data. It is necessary to add a header and footer like the usual binary data transmitting, before and after 2KB data. (Please refer to CXD5603GF user's manual about specification of header/footer)

Before executing this command, it is necessary to erase stored CEP data by @CEPE command. This command must be issued at Idle state.

It does not support the partial injection of CEP data. Using CEP function, it needs to inject all of 256KB CEP data by this command. If the injection of CEP data is stopped on the way, CEP function does not work.

Format : **@CEPW <arg 1><CR><LF>**

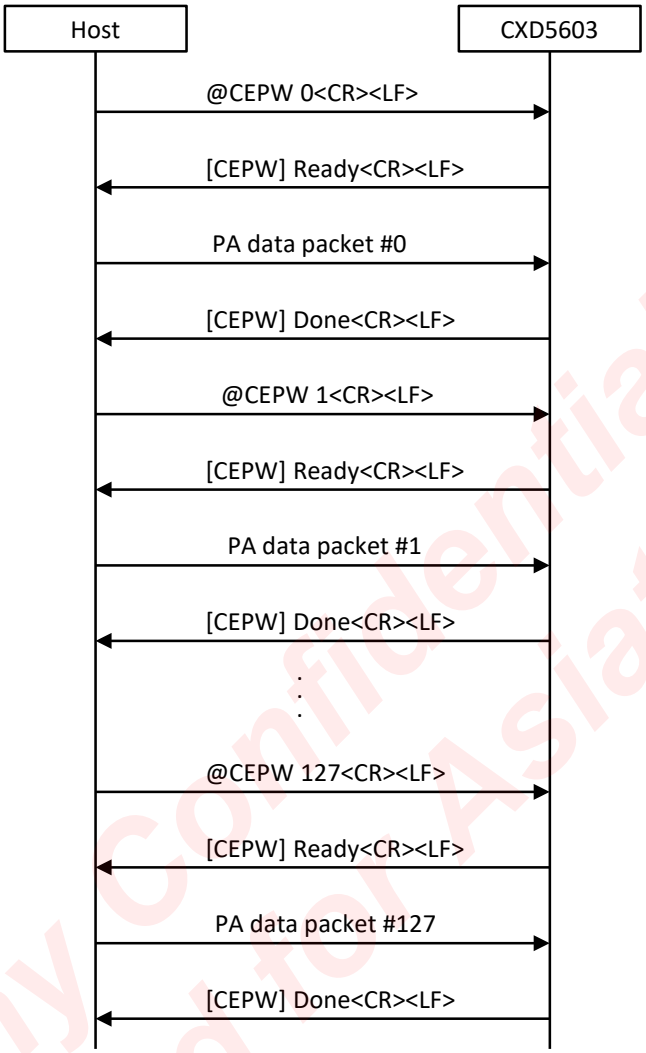
Argument :

Field	Description
arg 1	It is specified from a head the how many packets they are. (0～127)

Response :

Sentence	Description
"[CEPW] Done"	This indicates that the command has been executed successfully.
"[CEPW] Err n"	This indicates that an error has occurred. "n" is where the error code is entered.

Sequence :



4 Constraints in the flash-less boot system

When the CXD5603 work with the flash-less boot, some specifications are limited.

Functionality	Normal	Flash-less boot
CEP	Up to 28 days CEP file can be injected.	Only 1 day CEP file can be injected.
AEP	Available	Not available

5 Error codes

When the CXD5603GF responds with an error reply to a command issued by the host, an error code indicating the nature of the error is transmitted with the reply. This is a negative value or "0" which is a POSIX standard subset. The error codes are listed in the table below.

Also refer to CXD5603GF UsersManual.

Value	Definition	Significance
0	0	Command processing successful
-61	-ENODATA	The data is not exist.

6 Requests and checkpoints regarding the use of this document

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