



DMR Conventional Radio

GPS

Application Notes



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Documentation Information

This section describes the conventions and revision history of this document.

Conventions

Icons

Icon	Description
 Tip	Indicates information that can help you make better use of your product.
 Note	Indicates references that can further describe the related topics.
 Caution	Indicates situations that could cause data loss or equipment damage.
 Warning	Indicates situations that could cause minor personal injury.
 Danger	Indicates situations that could cause major personal injury or even death.

Notations

Item	Description
Bold	The text in boldface denotes the name of a hardware button or a software interface element. For example, press the PTT key.
->	The symbol directs you to access a multi-level menu. For example, to select "New" from the "File" menu, we will describe it as follows: "File -> New".

Revision History

Version	Date	Description
R3.0	September, 2018	<ul style="list-style-type: none"> Added TF Card GPS Record, Location Info Priority, Single GPS and Single GPS Encrypt/Decrypt features. The radio without positioning chip can query location of the radios with positioning chip through Call Location and Query Location features. Modify CPS path of RSSI Report and Voice w/Location. Software Version: R9.0

Version	Date	Description
R2.0	March 15, 2018	<ul style="list-style-type: none">● Added Call Location feature.● Modified the following parameter names:<ul style="list-style-type: none">➤ “RRS & GPS Radio ID” modified as “Control Center ID”➤ “GPS Port” modified as “Location Port”➤ “GPS Revert Channel” modified as “Location Info Revert Channel”➤ “Voice with GPS” modified as “Voice w/Location”➤ “In Call GPS Revert” modified as “In Call Location Revert” <p>Software Version: R8.5</p>
R1.0	January 3, 2017	Initial Release.

1. Overview

1.1 Introduction

The Global Positioning System (GPS) feature facilitates location-based applications, allowing visible dispatch by the dispatch station. When this feature is enabled, the user can obtain its real-time location information or query that of another radio, and can report location to another radio or to the dispatch station.

1.2 Applicable Models

The GPS feature is available to the following models.

- Radios with positioning chip support all GPS features.

The ninth character of the model number is G, C or R, for example, PD980-T00C000D-MB0000-Ux-0-D.

- "G" means the radio supports GPS.
- "C" means the radio supports both GPS and BeiDou Navigation Satellite System (COMPASS).
- "R" means the radio supports both GPS and Global Navigation Satellite System (GLONASS).

To view the model number, click **Radio Information** in Customer Programming Software (CPS) after the radio is connected. For more information, please contact Hytera or your supplier.

- Radios without positioning chip can query location of the radios with positioning chip through Call Location or Query Location.
- Repeater

Currently, the GPS feature is available only to RD96X, which only reports location at preset time interval.

This document takes PD98X as an example.

1.3 Principle

Each satellite continually broadcasts a signal with pseudorandom code and transmission time. The radio with positioning chip receives this signal and calculates its location, and sends the location information to the dispatch station or another radio in the system.

1.4 Versions

- R9.0: TF Card GPS Record, Single GPS, Singal GPS Encrypt features added. The radios without positioning chip support Call Location and Query Location features.

- R8.5: Call Location feature added. The parameter names “RRS&GPS Radio ID”, “GPS Port”, “GPS Revert Channel”, “Voice with GPS” and “In Call GPS Revert” are modified as “Control Center ID”, “Location Port”, “Location Info Revert Channel”, “Voice w/Location” and “In Call Location Revert” respectively.
- R8.0: Voice with GPS and Query Location features added.
- R6.0: COMPASS supported.
- R5.5: Quick GPS and GPS Data Compression features added.
- R5.0: GLONASS supported.
- R4.0: Time Zone feature added.
- R3.0: Application Programming Interface (API) for GPS-based dispatch and control, GPS Revert Channel, GPS Automatic Update and GPS Active Report features added.
- R2.0: GPS icon, Position View and GPS Msg added.

1.5 Restrictions

- The radios without positioning chip can query location of the radios with positioning chip through Call Location or Query Location only.
- The satellite signal reception is subject to the environment in which the radio is located. The signal strength may be low in such unfavorable places as basement, train, or subway.

1.6 References

- CPS Help (on-line)
- Release Notes

2. Configuration

This chapter describes how to configure the radio and the repeater. For the dispatch station, refer to relevant documents.

2.1 Configuration Tool

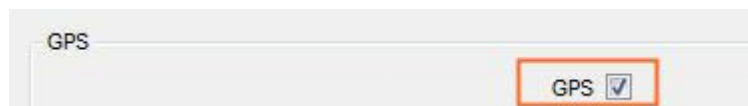
CPS V9.00.07.015 or later

2.2 Configuring Common Parameters

Step 1 Enable the GPS feature.

CPS Path: Conventional -> General Setting -> Accessories -> GPS.

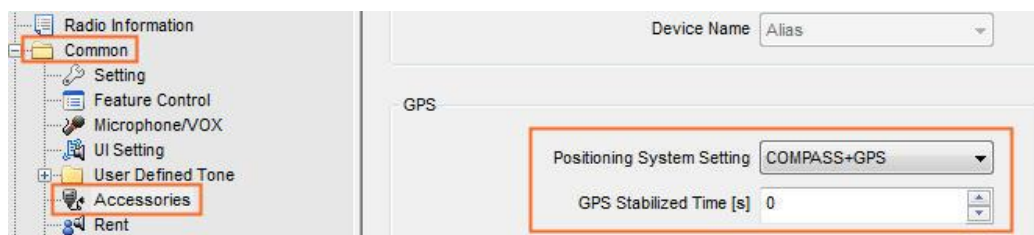
Parameters: GPS. Refer to *CPS Help* for detailed description.



Step 2 Select the positioning system and set the GPS stabilized time.

CPS Path: Common -> Accessories -> GPS.

Parameters: Positioning System Setting and GPS Stabilized Time.



The Positioning System Setting is used to set the positioning system, and only available for the radios that support COMPASS or GLONASS.

The GPS Stabilized Time is the time in which the radio considers satellite signal invalid for positioning. Because the positioning needs time, there will be deviation when the radio first receives the broadcasted signal. The GPS Stabilized Time helps to improve location accuracy of the radio.

Note

If accurate location is required, it is recommended to set GPS Stabilized Time at or more than 5.

2.3 Configuring Parameters Related to Location Query

Step 1 Configure the parameters for location information display, and enable or disable TF Card GPS Record and GPS Data Compression.

CPS Path: Conventional -> General Setting -> Accessories -> GPS.

Parameters: See below figure. For parameter description, see the Table below.



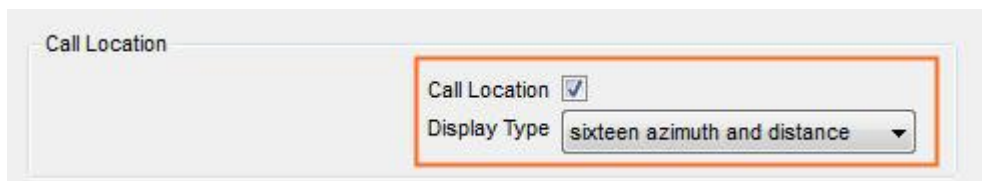
Parameter	Description	Setting
TF Card GPS Record	<p>This feature is used to collect GPS data for radio management.</p> <p>With the feature enabled, the radio records GPS data in the TF card (Micro SD card) according to the following preset parameters.</p> <ul style="list-style-type: none"> When GPS is enabled, the radio records GPS data according to Time, Distance and Relationship Between Time and Distance set in GPS Trigger (see Step 2 in section 2.4). When Quick GPS is enabled, the radio records GPS data according to Report Interval Time (see Step 4 in section 2.4). In emergency mode, the radio records GPS data every 20 seconds. 	<p>Default: Unchecked.</p> <p>Note:</p> <ul style="list-style-type: none"> This feature is available for PD78XE and PD98X only. This parameter is available only when GPS is selected. User can use SmartDispatch to read GPS data in TF card and view radio tracks on the map. For operations, refer to <i>Hytera Smart Dispatch Configuration Guide</i>.
Speed Unit	Sets the unit of the current movement speed of the radio, including km/h, mile/h, and sea mile/h.	<p>Default: km/h.</p> <p>Note: This parameter is available only when GPS</p>

Parameter	Description	Setting
		feature is enabled.
GPS Update Time	Sets the time interval at which the radio updates location information.	<p>Range: 1-60s.</p> <p>Default: 5s.</p> <p>Note: This parameter is available only when GPS feature is enabled.</p>
GPS Display Unit	Sets the unit to display location information, including ddd.ddddd, ddd.mm, and ddd.mm.ss.	Default: ddd.ddddd.

Step 2 Enable Call Location.

CPS Path: Conventional -> General Setting -> Accessories -> Call Location.

Parameters: Call Location and Display Type. Refer to *CPS Help* for detailed description.



With this feature enabled, the radio displays talker's location after the call sets up. The talker (transmitting radio) must enable Voice w/Location ([Step 8](#) in section [2.4](#)), otherwise the receiving radio will not display his/her location. The radio without positioning chip does not support Voice w/Location feature, thus it only displays other talker's location.

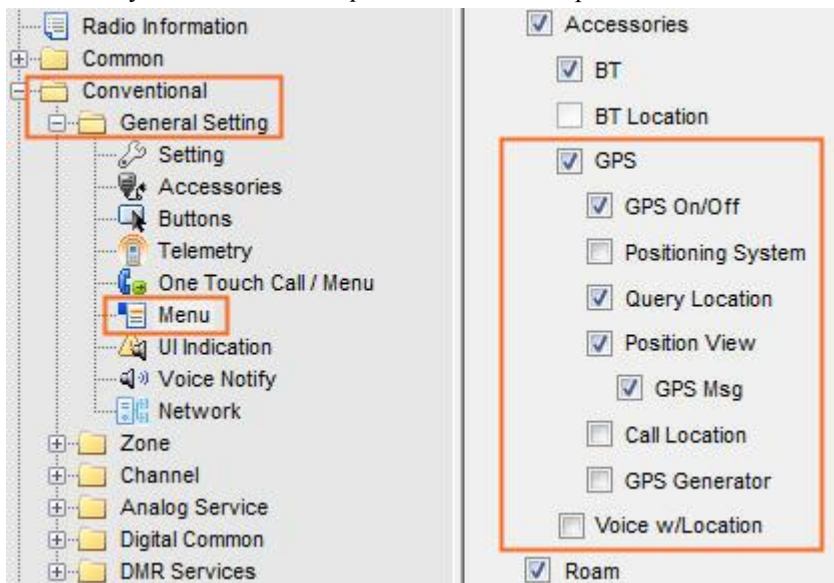
The radio displays the received location according to Display Type.

- Radios with positioning chip
 - Sixteen Azimuth and Distance: To display sixteen azimuth and distance.
 - Accurate Azimuth and Distance: To display accurate azimuth and distance.
 - Talker Location: To display longitude and latitude.
- Radios without positioning chip
 - Talker Location: To display longitude and latitude.

Step 3 (Optional) Configure menus if you want to enable or disable GPS related features through radio menu.

CPS Path: Conventional -> General Setting -> Menu -> Accessories.

Parameters: See below figure. The radio without positioning chip displays Call Location and Query Location menus only. Refer to *CPS Help* for detailed description.



Note

The Query Location is used to query location of the radios with GPS enabled. After obtaining the location, the radio with positioning chip displays distance, direction, longitude and latitude of the target radio, while the radio without positioning chip displays longitude and latitude only.

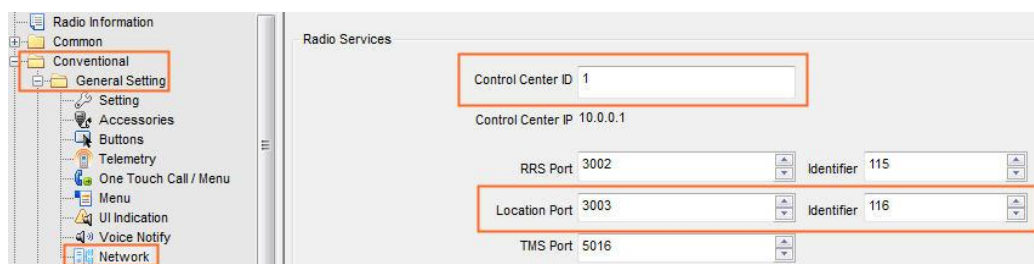
2.4 Configuring Parameters Related to Location Information Report

The radio automatically reports its location to the dispatch station after the following parameters are configured.

Step 1 Configure Control Center ID and Location Port to specify the target radio or repeater.

CPS Path: Conventional -> General Setting -> Network -> Radio Services.

Parameters: Control Center ID, Location Port and Identifier.



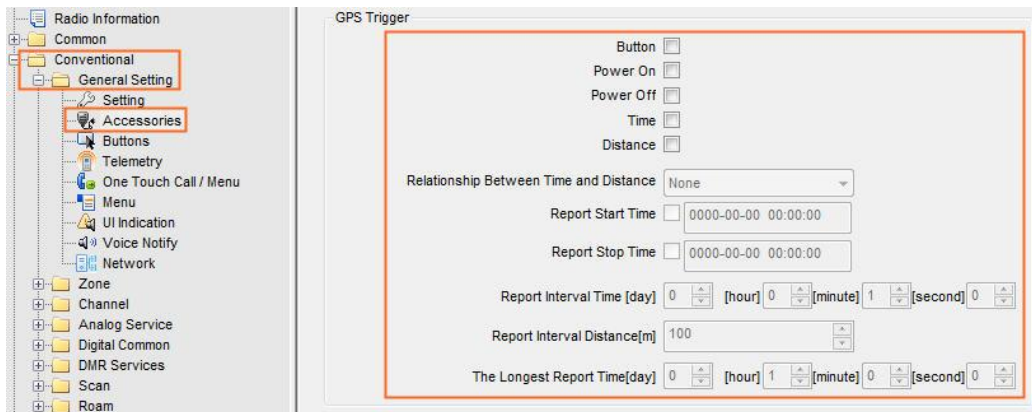
Caution

The Control Center ID must be unique and comply with the dial rules of the system.

Step 2 Configure the conditions under which the radio automatically reports location.

CPS Path: Conventional -> General Setting -> Accessories -> GPS -> GPS Trigger.

Parameters: See below figure. For parameter description, see the Table below.



Parameter	Description	Setting
Button	<p>Sets whether the radio reports location when the programmed GPS Report key is pressed (See Step 3 for the configuration).</p> <ul style="list-style-type: none"> ● Checked: The radio reports location when this key is pressed. ● Unchecked: The radio doesn't report location when this key is pressed. 	<p>Default: Unchecked</p>
Power On	<p>Sets whether the radio reports location when it is powered on.</p> <ul style="list-style-type: none"> ● Checked: The radio reports location when it is powered on. ● Unchecked: The radio doesn't report location when it is powered on. 	<p>Default: Unchecked</p>
Power Off	<p>Sets whether the radio reports location when it is powered off.</p> <ul style="list-style-type: none"> ● Checked: The radio reports location when it is powered off. ● Unchecked: The radio doesn't report location when it is powered off. 	<p>Default: Unchecked</p>
Time	<p>Sets whether the radio reports location at preset time interval. This feature is subject to the following three parameters.</p> <ul style="list-style-type: none"> ● Report Start Time: If this parameter is set to "0", 	<p>Default: Unchecked</p> <p>Note: The three parameters are</p>

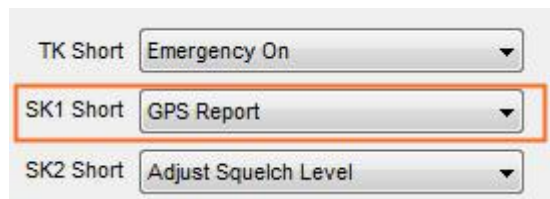
Parameter	Description	Setting
	<p>the radio reports location after programming.</p> <ul style="list-style-type: none"> ● Report Stop Time: If this parameter is set to "0", the radio periodically reports location, until it powers off or the system requests it to stop reporting. ● Report Interval Time: If this parameter is set to "0", the radio does not report location periodically. 	<p>available only when Time is selected.</p>
Distance	<p>Sets whether the radio reports location when it moves beyond Report Interval Distance from the last reported position.</p> <p>With this feature enabled,</p> <ul style="list-style-type: none"> ● the radio reports location it first receives after programming. ● the radio reports location as requested by the dispatch station. If no location information is available, the radio will report it when the information is available. 	<p>Default: Unchecked</p> <p>Note: The Report Interval Distance is available only when Distance is selected.</p>
Relationship Between Time and Distance	<p>Sets the conditions under which the radio reports the location if both Time and Distance are selected.</p> <ul style="list-style-type: none"> ● Time Or Distance: the radio reports location when either the time-related or distance-related conditions are satisfied. ● Time And Distance: the radio reports location only when both the time-related and distance-related conditions are satisfied. 	<p>Default: Time Or Distance</p> <p>Note: This parameter is available only when both Time and Distance are selected.</p>
The Longest Report Time	<p>Sets the interval time for the radio to automatically report GPS data to the control station when no GPS trigger conditions are satisfied.</p>	<p>Note: This parameter is available only when Relationship Between Time and</p>

Parameter	Description	Setting
		Distance is set to Time And Distance.

Step 3 Configure a programmable key if you want the radio to report location when this key is pressed.

CPS Path: Conventional -> General Setting -> Buttons

Parameters: GPS Report. SK1 Short is taken as an example.

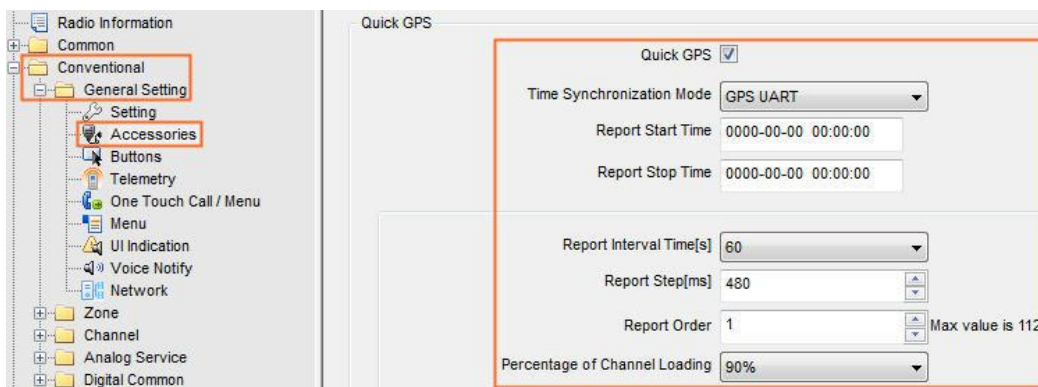


Step 4 Enable Quick GPS and Single GPS if a great number of radios are required to report location frequently.

CPS Path: Conventional -> General Setting -> Accessories -> GPS -> Quick GPS.

Parameters: See below figure. For parameter description, see the Table below.

The Quick GPS feature improves channel utilization and transmission efficiency. With this feature enabled, the system divides the Report Interval Time into different time slices with the same time length. Then the radio transmits GPS data in accordance with Report Order of its own time slices. In this way, GPS data of all radios under the same control station can be transmitted at the same interval.



 **Note**

The radio cannot report location through the programmed key after the Quick GPS feature is enabled.

Parameter	Description	Setting
Quick GPS	Sets whether to enable the Quick GPS feature.	Default: Unchecked Note: This parameter is

Parameter	Description	Setting
	<ul style="list-style-type: none"> ● Checked: The Quick GPS is enabled. ● Unchecked: The Quick GPS is disabled. 	available only when GPS feature is enabled (See Step 1 in section 2.2).
Time Synchronization Mode	<p>Sets the mode of time synchronization to transmit GPS data through the Quick GPS feature.</p> <ul style="list-style-type: none"> ● GPS UART: The time for GPS data transmission synchronizes with the UART of the GPS chip. ● 1PPS Pulse: The time for GPS data transmission synchronizes with the 1PPS pulse of the GPS chip. This option is available only for the radios that support the detection of the 1PPS pulse. 	<p>Default: GPS UART</p> <p>Note: This parameter is available only when Quick GPS is selected.</p>
Report Start Time	Set the start time to transmit GPS data through the Quick GPS feature.	<p>Range: 0000-00-00 00:00:00 to 9999-12-31 23:59:59</p> <p>Default: 0000-00-00 00:00:00</p> <p>Note: This parameter is available only when Quick GPS is selected.</p>
Report Stop Time	Set the stop time to transmit GPS data through the Quick GPS feature.	<p>Range: 0000-00-00 00:00:00 to 9999-12-31 23:59:59</p> <p>Default: 0000-00-00 00:00:00</p> <p>Note: This parameter is available only when Quick GPS is selected.</p>
Report Interval Time	Sets the time interval to transmit GPS data through the Quick GPS feature.	Range: 3s, 5s, 10s, 20s, 30s, 40s, 50s, 60s, 120s, 180s, 240s,

Parameter	Description	Setting
	See Percentage of Channel Loading for the relation among Report Interval Time, Report Step, Report Order and Percentage of Channel Loading.	300s, 360s, 480s, 600s, 900s and 1200s. Default: 60s. Note: This parameter is available only when Quick GPS is selected.
Report Step	Sets the duration that the radio transmits GPS data through the Quick GPS feature. See Percentage of Channel Loading for the relation among Report Step, Report Interval Time, Report Order and Percentage of Channel Loading.	Range: 300~2100ms Default: <ul style="list-style-type: none"> ● 480ms when Single GPS is disabled. ● 240ms and cannot be modified when Single GPS is enabled and Time Synchronization Mode is set as GPS UART. ● 120ms when Single GPS is enabled and Time Synchronization Mode is set as 1PPS Pulse. Note: This parameter is available only when Quick GPS is selected.
Report Order	Sets the order in which the radio transmits GPS data through the Quick GPS feature. See Percentage of Channel Loading for the relation among Report Order, Report Step, Report Interval Time and Percentage of Channel Loading.	Range: 1~3600 Default: 1 Note: <ul style="list-style-type: none"> ● This parameter is available only when Quick GPS is selected. ● The report order for each

Parameter	Description	Setting
		<p>radio under the same control station must be unique.</p>
<p>Percentage of Channel Loading</p>	<p>Sets percentage of slices to be used during Report Interval Time by all radios under the same control station to transmit GPS data through the Quick GPS feature. The remaining time slices will be reserved for the radio to respond the system request for location (like the radio transmits GPS data when it is powered on). For example, if Report Interval Time is set to 60s, and Report Step is set to 480ms, the time slice will be 125 (Report Interval Time/ Report Step). If Percentage of Channel Loading is set to 90%, the time slice available to transmit GPS data through the Quick GPS feature will be 112.</p>	<p>Range: 50%、67%、75%、80%、90%</p> <p>Default: 90%</p> <p>Note: This parameter is available only when Quick GPS is selected.</p>
<p>Single GPS</p>	<p>This feature increases transmission speed of Quick GPS, and saves channel resources for GPS data transmission. With the feature enabled, the radio only reports longitude, latitude, reason for sending (in emergency mode or not) and source address when transmitting GPS data through Quick GPS. Any control station with the same frequency and color code as this radio can receive its GPS data.</p>	<p>Default: Unchecked</p> <p>Note:</p> <ul style="list-style-type: none"> ● This parameter is configurable only when Quick GPS is selected. ● The radio transmits GPS data to the control station no matter the GPS data is valid or not.

Parameter	Description	Setting
	<ul style="list-style-type: none"> ● Checked: The Single GPS is enabled. ● Unchecked: The Single GPS is disabled. 	

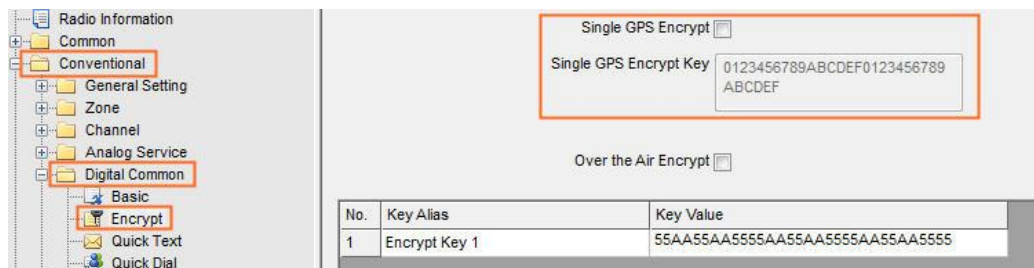
Step 5 Enable Single GPS Encrypt/Decrypt and set Single GPS Encrypt/Decrypt Key to encrypt or decrypt the single GPS data.

To use this feature, the Single GPS must be enabled (see [Step 4](#) in this section).

- For the radio with positioning chip, the parameter names are **Single GPS Encrypt** and **Single GPS Encrypt Key**. The radio encrypts the GPS data before transmitting through Single GPS. When the encrypt keys are the same, the repeater repeats the GPS data and the receiving radio decrypts it.
- For the radio without positioning chip, the parameter names are **Single GPS Decrypt** and **Single GPS Decrypt Key**. The radio only decrypts the received single GPS data.

CPS Path: Conventional -> Digital Common -> Encrypt.

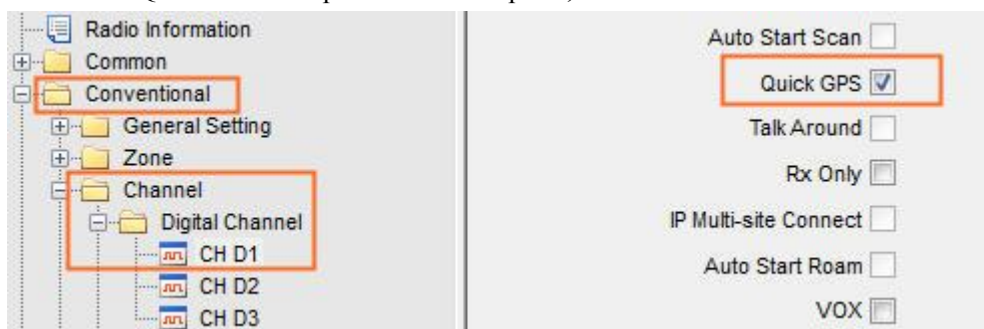
Parameters: Single GPS Encrypt/Decrypt and Single GPS Encrypt/Decrypt Key. For parameter description, see the Table below.



Step 6 Configure a dedicated channel to transmit GPS data through the Quick GPS feature.

CPS Path: Conventional -> Channel -> Digital Channel -> CH DX

Parameters: Quick GPS. For parameter description, see the Table below.



Parameter	Description	Setting
Quick GPS	<p>Defines the current channel as dedicated channel for Quick GPS feature.</p> <ul style="list-style-type: none"> ● Checked: The radio can only transmit GPS data through the Quick GPS feature on this channel. Other data, such as voice, text and RRS, cannot be transmitted. ● Unchecked: The radio transmits GPS data in normal way on this channel if the Quick GPS feature is also disabled on the radio. 	<p>Default: Unchecked</p> <p>Note: This parameter is available only when the Quick GPS feature is enabled and Forward To PC (CPS Path: Conventional -> General Setting -> Network -> Radio to PC Network) is deselected.</p>

Step 7 Set the Location Info Priority if BT Location is enabled.

CPS Path: Conventional -> General Setting -> Accessories -> BT Location.

Parameters: Location Info Priority. For parameter description, see the Table below.

Parameter	Description	Setting
Location Info Priority	<p>Sets the priority of location data the radio sends to the dispatch station.</p> <ul style="list-style-type: none"> ● BT Location: The radio first sends the BT location data to the dispatch station. ● GPS: The radio first sends the GPS location data to the dispatch station. ● GPS+BT Location: The radio sends both the GPS and BT location data to the dispatch station. 	<p>Default: GPS</p> <p>Note:</p> <ul style="list-style-type: none"> ● This parameter is available only when BT Location is selected. ● For more about BT Location feature, refer to <i>DMR Conventional Radio_BT_User Manual</i>.

Step 8 Enable Voice w/Location, and enable or disable the RSSI Report.

CPS Path: Conventional -> General Setting -> Accessories -> Location Application.

Parameters: RSSI Report, Voice w/Location, PTT and Time. For parameter description, see the Table below.



Parameter	Description	Setting
RSSI Report	With this feature enabled, the radio reports RSSI with location to the dispatch station for evaluation of area signal strength.	Default: Unchecked. Note: This parameter is available only when GPS is selected.
Voice w/Location	With this feature enabled, the radio reports location according to PTT operation or preset time. If disabled, the radio does not report location when user holds down PTT to transmit voice. Then the dispatcher will not know location of the radio.	Default: Unchecked Note: <ul style="list-style-type: none"> This parameter is available only when GPS is selected. When BT Location is enabled, the Location Info Priority (Step 7) must be set as GPS.
PTT	Sets whether the radio reports location once when user holds down PTT to transmit voice. <ul style="list-style-type: none"> Checked: The radio reports location once when user holds down PTT to transmit voice. Unchecked: The radio does not report location when user holds down PTT to transmit voice. 	Default: Unchecked Note: This parameter is available only when Voice w/Location is selected.
Time	Sets the time interval for the radio to report location after user holds down PTT to transmit voice. The radio reports location once after user holds down PTT to transmit voice, and then reports location at this preset interval, until the user	Range: 3~230s Default: 60s Note: This parameter is available only when Voice w/Location is

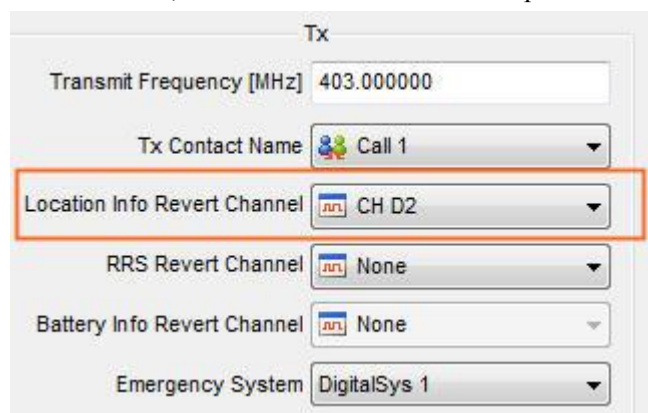
Parameter	Description	Setting
	releases PTT.	selected and PTT is deselected.

Step 9 Configure the Location Info Revert Channel.

CPS Path: Conventional -> Channel -> Digital Channel -> CH DX -> TX.

Parameters: Location Info Revert Channel.

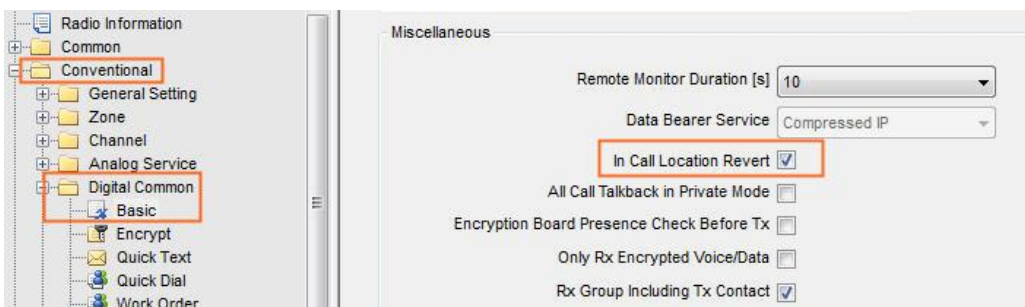
The radio may delay reporting location on current channel if it is occupied by other radios transmitting voice or data signals. To solve this issue, you can set one channel for the radio to report the location. After transmission, the radio switches back to the previous channel.



Step 10 (Optional) Enable the In Call Location Revert feature.

CPS Path: Conventional -> Digital Common -> Basic -> Miscellaneous.

Parameters: In Call Location Revert. For parameter description, see the Table below.



Parameter	Description	Setting
In Call Location Revert	Sets whether to allow the radio to report location when receiving voice. <ul style="list-style-type: none"> Checked: The radio switches to the Location Info Revert Channel to report location when receiving voice. 	Default: Unchecked Note: This feature does not work during full

Parameter	Description	Setting
	<ul style="list-style-type: none"><li data-bbox="469 331 1083 412">● Unchecked: The radio reports location after the voice is received.	duplex call.

 **Caution**

This feature does not work if Location Info Revert Channel is set as Current.

3. Application

This chapter describes the GPS applications on the radio.

- Time Synchronization

To allow the radio to keep its time clock synchronized with the satellite time source, go to "Common -> RTC" in the CPS, and set Priority Time Source to GPS Timing.

- Viewing the location information

- To view the location information, go to "Menu -> Accessories -> GPS -> Position". The real-time location information includes the longitude, latitude, speed, altitude, time, date and the number of visible satellites. If TF Card GPS Record is enabled, user can use Smart Dispatch to read GPS data in the TF card and view radio tracks on map.

- Viewing talker's location during a call

To view talker's location during a call, go to "Menu -> Accessories -> GPS -> Call Location". After the call sets up, the radio displays taker's location if the talker (transmitting radio) enables the Voice w/Location.

- Sending the location information

To send the location information, go to "Menu -> Accessories -> GPS -> Position -> GPS Msg". The user can view location information, and then send it to another radio as a message. The receiving user can locate the sending radio using the third-party application (for example, map).

In addition, the radio automatically reports location to the preset target ID when it enters emergency mode or the telemetry feature is activated (the prerequisite is that Action parameter must be set to Send Status w/GPS Message Command).

- Querying Location

To query location of the radio with GPS enabled, go to "Menu -> Accessories -> GPS -> Query Location". After obtaining location data, the radio with positioning chip displays distance, direction, longitude and latitude of the target radio, while the radio without positioning chip displays longitude and latitude only.

- Reporting location to the dispatch station

The radio automatically reports location to the dispatch station when the preset conditions are satisfied, allowing the dispatch station to locate it for dispatch purpose.

Abbreviations

Abbreviation	Full Name
COMPASS	BeiDou Navigation Satellite System
CPS	Customer Programming Software
GPS	Global Positioning System
DMR	Digital Mobile Radio
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System



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