Hytera

# DMR Conventional Radio

# Full Duplex Call

# Application Notes

# Copyright Information



# Disclaimer



If you have any suggestions or would like to learn more details, please visit our website at:
http://www.hytera.com.

# Contents

# 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 |
|---|---|
| " " | The quotation marks enclose the name of a software interface element. For example, click "OK". |
| **Bold** | The text in boldface denotes the name of a hardware button. 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 | Release Date | Description |
|---|---|---|
| R2.0 | September, 2018 | The radio can initiate full duplex call in Repeater Mode and to telephones. |
| R1.0 | March 15, 2018 | Initial release |

# 1. Overview

## 1.1 Introduction

Full duplex call refers to a private call, during which both the called party and the calling party can send and receive voice simultaneously.

Full duplex call can be set up between two radios or a radio and a telephone (including PSTN, PABX, VoIP and mobile phone). It not only frees your hands but also guarantees long-time talk whenever required. In addition, it simplifies operations and improves communication efficiency.

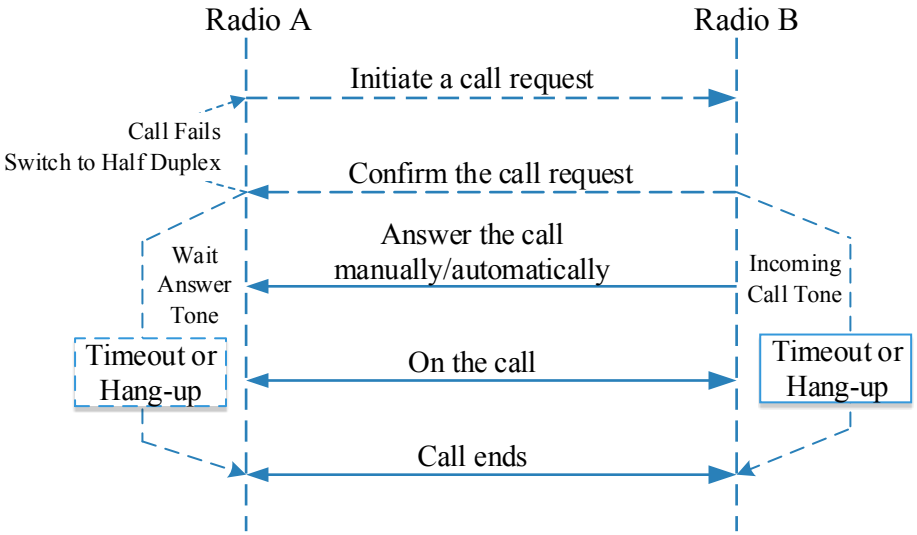
## 1.2 Principle

The full duplex call can be set up on digital channel in Direct Mode or Repeater Mode.

### Direct Mode

In Direct Mode, the radio transmits and receives voice on two slots with the same frequency.

The service flow is as below.



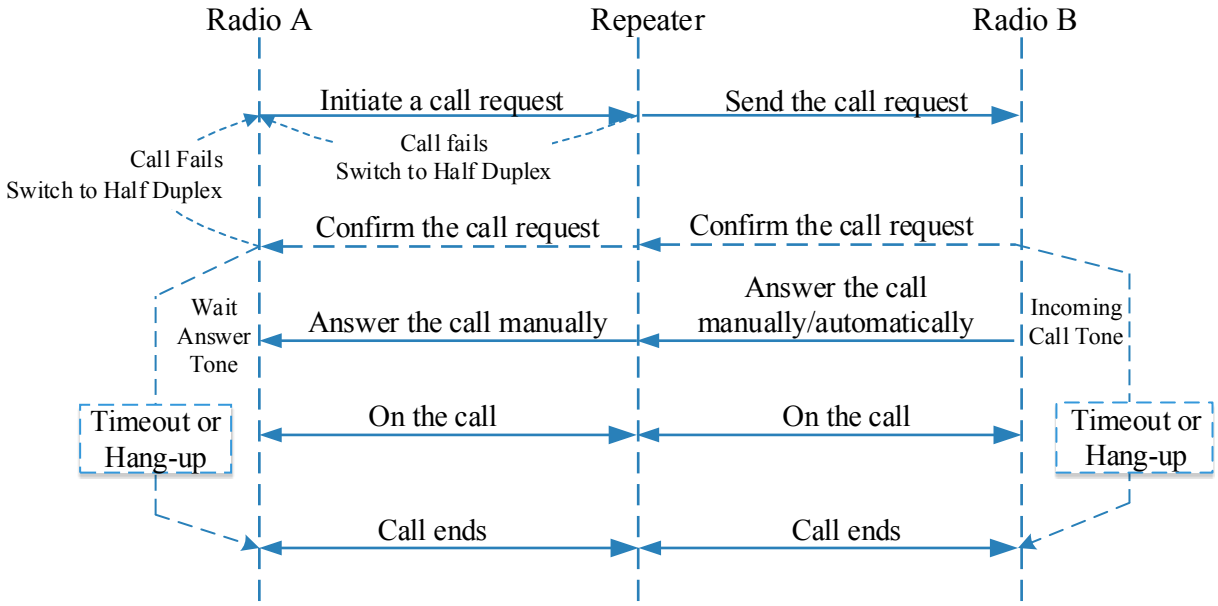

1. Radio A initiates a full duplex call to Radio B.
   - The call sets up if Radio B supports full duplex call.
   - The call fails if Radio B does not support full duplex call. But if Adaptive Switch to Half-duplex is enabled on Radio A, the user can initiate the call in half duplex mode, in which the calling radio and the called radio can either send or receive voice.
2. When receiving the call, Radio B answers it according to the Answer Mode configured via CPS.
   - OACSU: The radio answers the call automatically.
   - FOACSU: You need to hold down **PTT** or Full Duplex Call programmed key to answer the call.

3. After the full duplex call sets up, the microphones and speakers of Radio A and Radio B are enabled.

4. The call ends if Radio A or Radio B hangs up.

## Repeater Mode

In Repeater Mode, the radio or telephone receives and transmits voice on two slots of the repeater. The service flow shows how full duplex call sets up between two radios.




1. Radio A initiates a full duplex call to Radio B.

   - If two slots of the repeater are idle, the repeater forwards the call to Radio B. In IP multi-site connect system, the repeater forwards the call to another repeater over the internet, and then to Radio B.
   - If two slots of the repeater are not idle and Adaptive Switch to Half-duplex is enabled on Radio A, the user can initiate the call in half duplex mode. In this mode, the calling radio and the called radio can either send or receive voice.

2. When receiving the call,

   - Radio B answers the call according to Answer Mode configured via CPS, if it supports full duplex call.
     - OACSU: answers the call automatically.
     - FOACSU: hold down **PTT** or Full Duplex Call programmed key to answer the call.
   - if Radio B does not support full duplex call and Adaptive Switch to Half-duplex is enabled on Radio A, the user can initiate the call in half duplex mode. In this mode, the calling radio and the called radio can either send or receive voice.

3. After the full duplex call sets up, the microphones and speakers of Radio A and Radio B are enabled.

4. The call ends if Radio A or Radio B hangs up.

## 1.3 Application Example

Due to no key operations required after a full duplex call is setup, radios with this feature are ideal for scenarios where long-time talk is required and both hands are occupied, such as field operation guidance, on-site status reporting, emergency and rescue, and etc.

For example, when an inspector in oil and chemistry industry found that a fault occurs on a critical equipment. He/she needs to detail the fault to a technical expert and carry out the solution. In this case, radio featuring full duplex call is essential for preventing the deterioration of the fault and implementing first-aid security measures.

## 1.4 Restrictions

- Only normal private call between radios or between a radio and a telephone can be initiated in full duplex mode. Other call services, such as group call, emergency call, can only be initiated in half duplex mode, and the calling and the called radios can either send or receive voice signals.
- The full duplex call is not available for Remote Monitor.
- The SFR feature must be disabled (CPS path: Conventional -> Channel -> Digital Channel -> CH DX -> SFR) and Battery Save Mode must not be set as 1-4 (CPS path: Conventional -> General Setting -> Setting -> Battery Save -> Battery Save Mode).
- In IP multi-site connect system, Jitter Buffer Length of the repeater must not be larger than 3. The CPS path is Conventional -> General Setting -> Network -> IP Connect Configuration.

## 1.5 Versions

- R9.0: The repeater with firmware V9.00.04.405.iM or later supports full duplex call.
- R8.6: Duplex MD78Xi with firmware V8.06.01.138 or later supports full duplex call.
- R8.5: PD98X and duplex MD78X with firmware V8.05.06.005 or later support full duplex call.

# 2. Radio Configuration

The configuration of PD98X and duplex MD78X/MD78Xi is the same. This chapter takes duplex MD78X as an example.

## 2.1 Tool

CPS of V9.00.07.712.iM or later is required.

## 2.2 Procedure

**Step 1** Set call setup mode of **PTT** to Full Duplex, and configure Answer Mode of the radio.

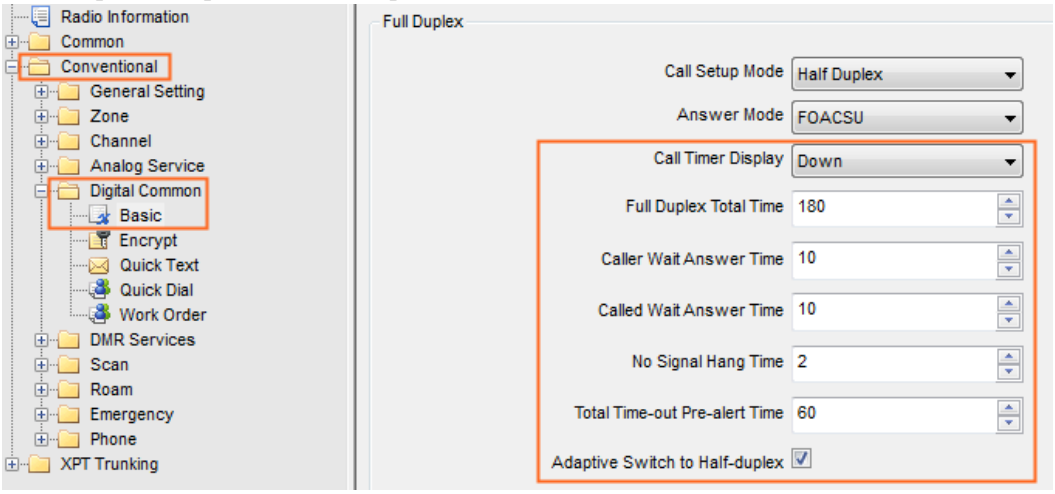
**CPS path**: Conventional -> Digital Common -> Basic -> Full Duplex.

**Parameter**: Call Setup Mode and Answer Mode. For parameter descriptions, refer to *CPS Help*.


**Step 2** Enable Adaptive Switch to Half-duplex, and set time parameters to control full duplex call.

**CPS path**: Conventional -> Digital Common -> Basic -> Full Duplex.

**Parameter**: Call Timer Display, Full Duplex Total Time, Caller Wait Answer Time, Called Wait Answer Time, No Signal Hang Time, Total Time-out Pre-alert Time and Adaptive Switch to Half-duplex. For parameter descriptions, see table below.




| Parameter | Description | Setting |
|---|---|---|
| Call Timer | Sets the way to display the call duration. | **Default:** Down |

| Parameter | Description | Setting |
|---|---|---|
| Display | ● None: Do not display the call duration.<br>● Up: Display the talk time, starting from "00:00".<br>● Down: Display the remaining talk time, starting from the preset "Full Duplex Total Time". | |
| Full Duplex Total Time | Sets duration of a full duplex call. The call ends when this time is up. | **Range**: 10～600s<br>**Default**: 180s |
| Caller Wait Answer Time | Sets waiting time of the calling radio before the called radio answers the call. The call ends when this time is up. | **Range**: 2～60s<br>**Default**: 10s |
| Called Wait Answer Time | Sets how long the called radio rings when it receives a full duplex call. The call ends when this time is up. | **Range**: 2～60s<br>**Default**: 10s |
| No Signal Hang Time | Sets hold time of the radio if no signal on the channel. The call ends when this time is up. | **Range**: 1～60s<br>**Default**: 2s |
| Total Time-out Pre-alert Time | Sets the time to remind the user that the radio will exit the call, exactly, when the remaining time for the call comes to this time, the radio will remind the user. | **Range**: 0～240s<br>**Default**: 60s |
| Adaptive Switch to Half-duplex | With this feature enabled, the radio prompts "Adapt to Half Duplex by PTT" when the full duplex call fails. The user can hold down PTT to initiate a half-duplex call.<br>● Checked: Enable the Adaptive Switch to Half-duplex feature.<br>● Unchecked: Disable the Adaptive Switch to Half-duplex feature. | **Default**: Unchecked |

**Step 3** Enable Private Call Encode.

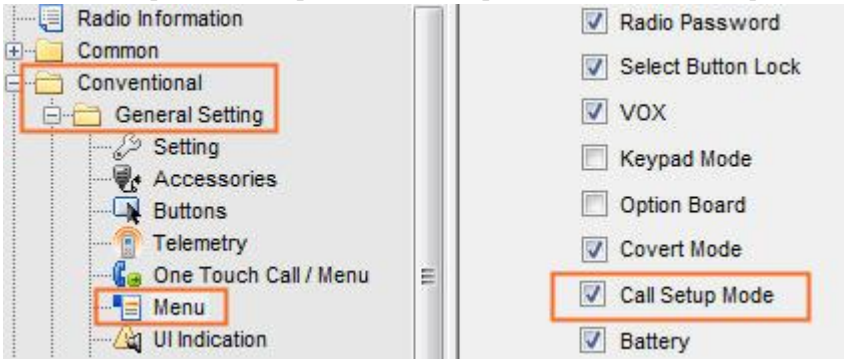
**CPS path**: Conventional -> Digital Common -> Basic -> Encode.

**Parameter**: Private Call Encode. For parameter descriptions, refer to *CPS Help*.


**Step 4** (Optional) Switch the call setup mode through radio menu.

**CPS path**: Conventional -> General Setting -> Menu -> Common Menu -> Radio Settings.

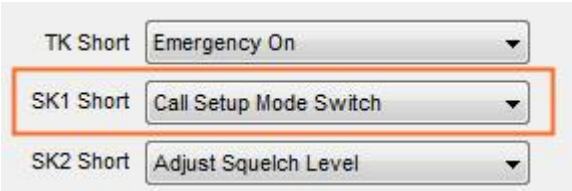
**Parameter**: Call Setup Mode. For parameter descriptions, refer to *CPS Help*.




**Step 5** (Optional) Switch the call setup mode through a programmable key.

**CPS path**: Conventional -> General Setting -> Buttons.

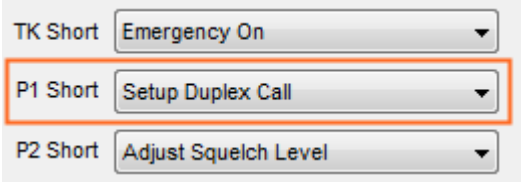
**Parameter**: Call Setup Mode Switch. Take SK1 Short as the example.




**Step 6** (Optional) Initiate a full duplex call through a programmable key.

**CPS path**: Conventional -> General Setting -> Buttons.

**Parameter**: Setup Duplex Call. Take P1 Short as the example.




**Step 7** (Optional) Enable Off Hook Answer Call or On Hook Clear Call to answer or end a full duplex call.

**CPS path**: Common -> Accessories -> Hook.

**Parameter**: Off Hook Answer Call and On Hook Clear Call. For parameter descriptions, refer to *CPS Help*.


**Note**

PD98X does not support Off Hook Answer Call and On Hook Clear Call.

**Step 8** (Optional) Configure phone parameters.

This step is necessary when the radio and telephone communicates through full duplex call.

The parameter configuration of the radio and repeater is the same as that for half-duplex call. Refer to Section 4.2 Configuration of *DMR Conventional Radio_SIP Phone_Application Notes* for details.

# 3. User Operations

This chapter describes how a radio initiates, answers/rejects, and ends a full duplex call.

## 3.1 Initiating a Full Duplex Call

The full duplex call can be initiated through **PTT** key or a programmed Setup Duplex Call key. If through **PTT** key, the call setup mode of the radio switches to Full Duplex.

### Through PTT Key

**Step 1** Switch call setup mode of the radio to Full Duplex.

- If **Full Duplex** has been configured (Step 1 in 2.2), you can hold down **PTT** to initiate a full duplex call.
- If **Call Setup Mode** menu has been configured (Step 4 in 2.2), you can switch the call setup mode to full duplex via radio menu (Menu -> Settings -> Radio Settings -> Call Setup Mode -> Full Duplex).
- If a programmed Call Setup Mode Switch key has been configured (Step 5 in 2.2), you can switch the call setup mode to full duplex via this key.

When the call setup mode switches to Full Duplex, the radio displays ⇄ icon on the screen.

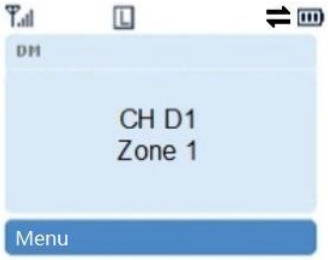



Figure 3-1 Full Duplex Call Setup Mode

**Step 2** Input the target number.

- To call a radio: Input a private contact number, or go to "Contact -> Favorite Contact/Private Contact" to select a private contact.
- To call PSTN/PABX/VoIP/mobile phone: Press the programmed DTMF Keypad key or go to Menu -> Phone -> DTMF Keypad to enter DTMF keypad mode and then input the phone number. The radio displays ⌨ in the DTMF Keypad mode.

**Step 3** Hold down **PTT** key to initiate a full duplex call.

The following interface appears when the radio initiates a full duplex call.


Figure 3-2 Initiating a Full Duplex Call to Another Radio


Figure 3-3 Initiating a Full Duplex Call to a Phone

### Through programmed Setup Duplex Call key

**Step 1** Input the target number.

- To call a radio: Input a private contact number or go to "Contact -> Favorite Contact/Private Contact" to select a private contact.
- To call PSTN/PABX/VoIP/mobile phone: Press the programmed DTMF Keypad key or go to Menu -> Phone -> DTMF Keypad to enable DTMF keypad and then input the phone number.

**Step 2** Press the programmed Setup Duplex Call key to initiate a full duplex call.

## 3.2 Answering/Rejecting a Full Duplex Call

The following interface appears when a radio receives a full duplex call.


Figure 3-4 Receiving a Full Duplex Call from Another Radio


Figure 3-5 Receiving a Full Duplex Call from a Phone

## Rejecting a Full Duplex Call

- From Radio

  Press  (Home Key) or the programmed Clear Down key (CPS path: Conventional -> General Setting -> Buttons) to reject the call. The calling radio displays “Call Rejected”.

- From Phone

  Press the programmed DTMF Keypad key or go to Menu -> Phone -> DTMF Keypad to enable DTMF keypad, press Disconnect Code key and then press PTT.

  If One-Key Disconnect is enabled, press the Disconnect Code key to reject the call directly.

## Answering a Full Duplex Call

- From Radio
  - If Answer Mode is set as OACSU, the radio answers the call automatically.
  - If Answer Mode is set as FOACSU, you need to press **PTT** key or the programmed Full Duplex Call key within the preset Called Wait Answer Time to answer the call.
  - For duplex mobile radio, if Off Hook Answer Call is enabled (Step 7 in 2.2), the radio answers the call in case of off-hook operation.

  The following interface appears after the full duplex call is set up.


Figure 3-6 Full Duplex Call between Two Radios

- From Phone

  Press the programmed DTMF Keypad key or go to Menu -> Phone -> DTMF Keypad to enable DTMF keypad, press Connect Code key and then press PTT.

If One-Key Connect is enabled, press the Connect Code key to answer the call directly.

The following interface appears after the full duplex call is set up.


Figure 3-7 Full Duplex Call between a Radio and a Phone

## 3.3 Ending a Full Duplex Call

You can perform any of the following operations to end the call.

- From Radio
  - Press  (Home Key).
  - Press the programmed Clear Down key (CPS path: Conventional -> General Setting -> Buttons)
  - For duplex mobile radio, if On Hook Clear Call is enabled (Step 7 in 2.2), the radio ends the call in case of on-hook operation.
- From Phone

  Press the programmed DTMF Keypad key or go to Menu -> Phone -> DTMF Keypad to enable DTMF keypad, press Disconnect Code key and then PTT.

  If One-Key Disconnect is enabled, press the Disconnect Code key to end the call directly.

**Note**

If no Disconnect Code key is configured, you must access DTMF keypad, input Disconnect Code and press PTT to end the call.

# Abbreviations

| Abbreviation | Full Name |
|---|---|
| CPS | Customer Programming Software |
| DMR | Digital Mobile Radio |
| SFR | Single Frequency Repeat |
| PABX | Private Automatic Branch eXchange |
| PSTN | Public Switched Telephone Network |
| VoIP | Voice Over Internet Protocol |

Address: HYT Tower, Hi-Tech Industrial Park North, Beihuan RD., Nanshan District, Shenzhen, China
Postcode:518057
http://www.hytera.com