Hytera

DMR Radio SFR

Application Notes

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Contents

Documentation Information

Conventions

Icon

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.

Notation

Notation	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	Release Date	Description
R2.0	September 2017	Added the SFR feature to the duplex MD78X. Firmware version: R8.5.
R1.0	November 2016	Initial release.

1. Overview

1.1 Definition

The SFR (Single Frequency Repeater) enabled radios can forward data and voice services. This expands the communication range of the conventional system without base stations or repeaters. Compared with the repeater, SFR uses one frequency with spectrum utilization.

1.2 Application

SFR is applied to the radios in direct mode (Sender or Receiver for short) to expand the communication distance.

1.3 Principle

The SFR enabled radio (SFR Radio) receives services on one slot and forwards them on the other. See figure below, in conventional direct mode, MS1 and MS3 are beyond communication range while MS2 is within the range of both MS1 and MS3. Enabling SFR on MS2 (in direct mode repeating mode), MS1 and MS3 can communicate. The example shows how a private call is transmitted from MS1 to MS3.

1. MS1 initiates a call to MS3 on slot 1 (S1).

2. MS2 forwards the call on slot 2 (S2) on receiving on S1.
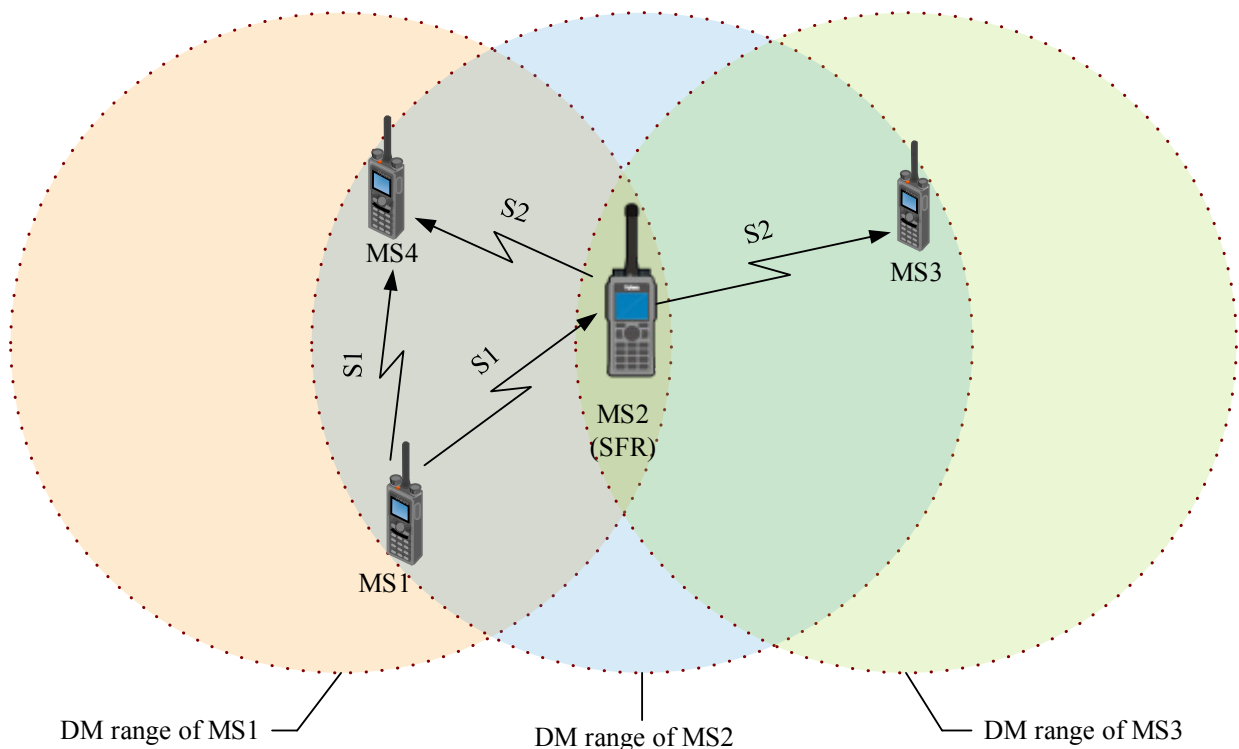
3. MS3 receives the call on S2.

Figure 1-1 SFR Schematic Diagram

MS2 forwards the service from MS3 to MS1 in the same way. MS4 is within the communication range of both MS1 and MS2. M4 can receive the call from MS1 on S1, and can also receive the call forwarded by MS2 on S2. However, it only receives the call on the slot that has been decoded first.

SFR radio can forward data, voice and supplementary services. It supports end-to-end encryption and over the air encryption.

1.4 Examples

Demo 1: In a large industrial park, the distance between radios inhibits direct communications. Radios centrally located can communicate with all others. Placing SFR enabled radio (MS2) centrally allows complete radio communication.
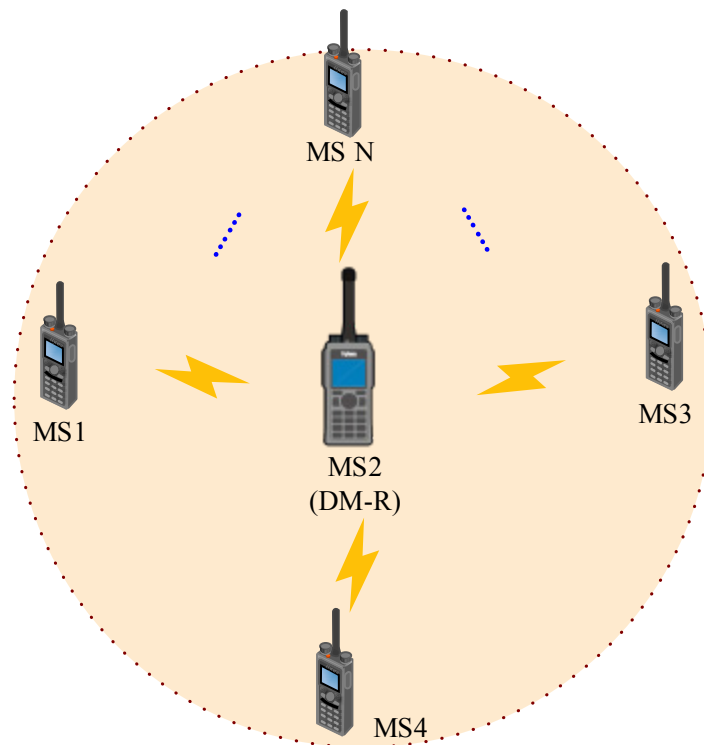

Figure 1-2 Demo 1

Demo 2: Worker (MS1) in a tunnel needs to communicate with worker (MS3), but the distance between them is too great. Positioning a SFR enabled radio (MS2) centrally will establish communications for MS1 and MS3.
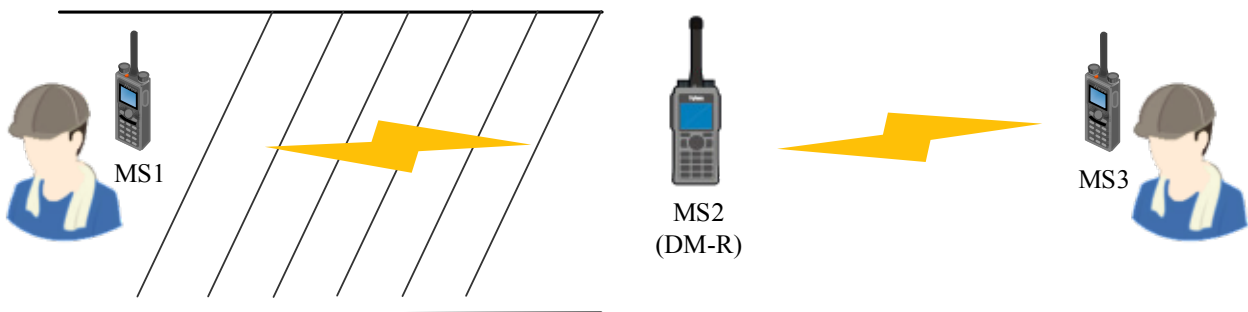

Figure 1-3 Demo 2

1.5 Restrictions

- The SFR Radio must be in the communication range of all Sender/Receiver in direct mode.

- The SFR Radio and the Sender/Receiver must be on the same channel.

- Only the digital channel supports SFR.

- SFR is available only when **Receive Only** is deselected.

- SFR is available only when **Priority Interrupt Encode, Priority Interrupt Decode** and **TDMA Direct Mode** are deselected.

- One conventional system supports only one SFR Radio. For end-to-end encryption enabled systems, multiple SFR Radios are supported, provided that all of them use different encryption keys.

1.6 Versions

SFR Radio

- Duplex MD78X with firmware version R8.5 or later supports SFR

- PD98X with firmware version R8.0 or later supports SFR

Sender/Receiver

Portable radio complied with DMR Tier1 or Tier2.

2. Configuration

You need to configure the SFR Radio and Sender/Receiver via CPS before using the feature.

The SFR Radio and Sender/Receiver must use the same channel, i.e., they must use the same colour code and frequency. The channel of Colour Code 1 and receive & transmit frequency 403.00 MHz is taken to introduce the configuration hereinafter.

2.1 Configuration Tool

● Duplex MD78X: CPS V8.05. 06.007 or later

● PD98X: CPS V8.00.07.000 or later

2.2 Configuration Procedure

2.2.1 Configuring the SFR Radio

Perform the following steps to configure the SFR Radio.

Step 1   Activate the SFR feature.

The SFR is a paid feature and requires a license to activate it. For operations, refer to *DMR Radio_Authorization_Operation Guide*.

Step 2   Configure the SFR channel.

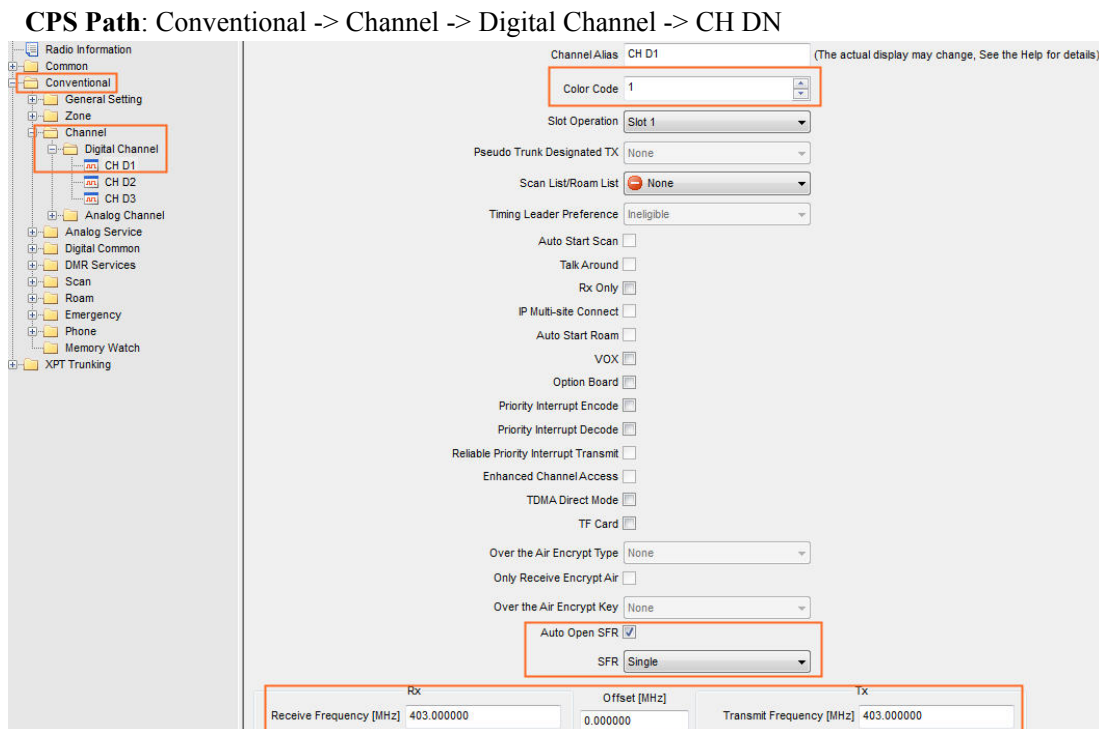**CPS Path**: Conventional -> Channel -> Digital Channel -> CH DN

Figure 2-1 Configure the SFR channel

1. Configure the colour code.

2. Set **SFR** as **Single** to enable SFR feature for the channel.

3. (Optional) Enable the Auto Open SFR.

   With this feature enabled, the radio enters SFR mode automatically when it switches to the SFR channel. If this feature is disabled, you need to configure the SFR menu or a programmable key to enable the SFR feature.

4. Configure the receive frequency and transmit frequency.

   ### Note

   ➢ If the Programming menu is configured (CPS path: Conventional -> General Setting -> Menu), you can set the frequencies and colour code through radio menu. Menu path: Menu -> Program -> Channel -> Frequency/Colour Code.

   ➢ **Do not** set the transmit frequency different from receive frequency through the radio menu, or SFR will not work. Moreover, reconfiguration via CPS is needed to make it take effect.

Step 3   Configure the SFR menu to enable or disable the SFR feature.

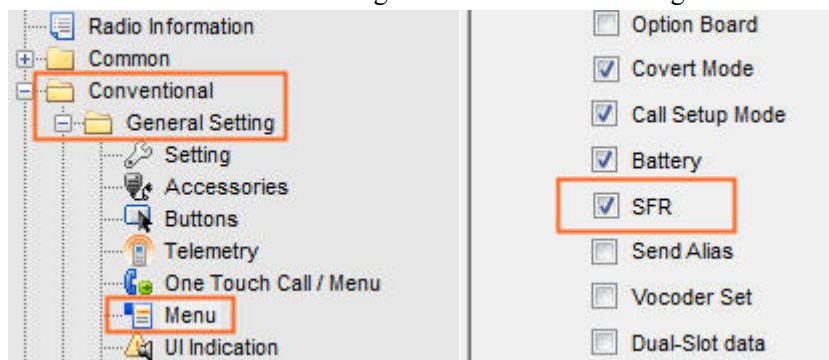**CPS Path**: Conventional -> General Setting -> Menu -> Radio Setting

Figure 2-2 Configure the SFR menu

Note
This parameter is available only when **Radio Settings** is selected.

Step 4   (Optional) Configure an SFR programmable key to enable or disable the SFR feature.

CPS Path: Conventional -> General Setting -> Buttons.

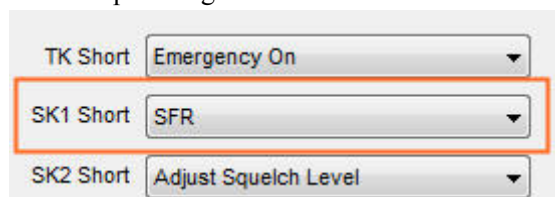**SK1 Short** is taken as the example in figure below.

Figure 2-3 Configure the SFR shortcut key

2.2.2 Configuring the Sender/Receiver

The Sender/Receiver must use a channel exactly the same as that of the SFR Radio, and enables Pseudo Trunk.

CPS Path: Conventional -> Channel -> Digital Channel -> CH DN.

Step 1   Configure the colour code.

Step 2   Select **Pseudo Trunk** as the slot to enhance the transmission success rate.

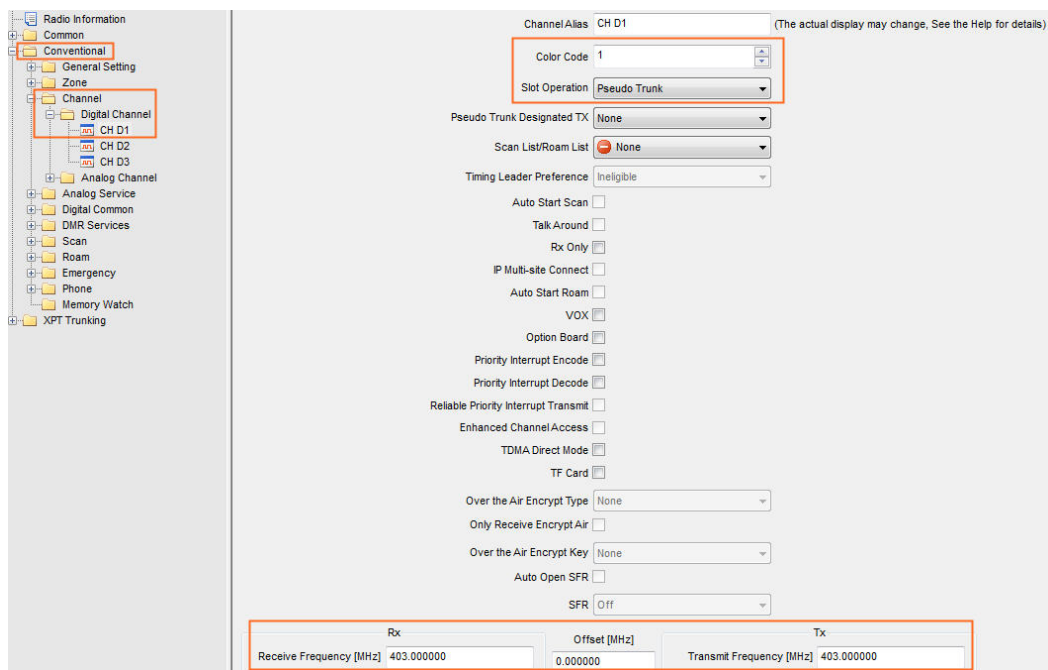**Step 3**   Configure the receive frequency and transmit frequency.

Figure 2-4 Configure the Sender/Receive

📝**Note**

If the **Programming** menu is configured (CPS path: Conventional -> General Setting -> Menu -> Common Menu), you can set the frequencies and colour code via radio menu. Menu path: Menu -> Program -> Channel -> Frequency/Colour Code.

3. Operation

The operation and User Interface (UI) of the Sender/Receiver are the same as in conventional direct mode. This chapter introduces the operation and UI of the SFR Radio.

The Auto Open SFR enabled radio via CPS will enter the SFR mode automatically when it switches to the SFR channel, others by going to "Menu -> Settings -> Radio Set -> SFR -> Enable" or pressing the programmable key. "DM-R" appears on the SFR Radio home interface, as shown below.

Figure 3-1 Home of SFR Radio

During transmission, the Radio uses high power (⊞), the interface shows a forwarding icon, and the LED keeps red. UI for transmitting a call see figures below.
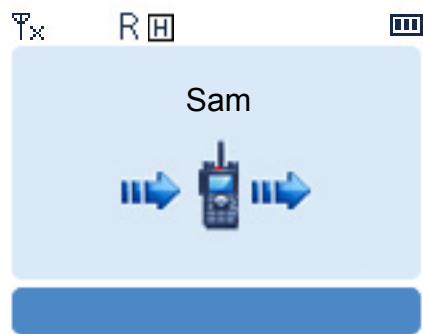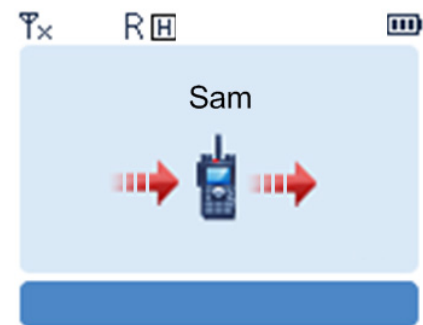

Figure 3-2 Transmitting a Common Call

Figure 3-3 Transmitting an Emergency Call

During transmitting the data service and supplementary service, the SFR Radio uses high power (⊞) and the LED

keeps red.

The Radio cannot monitor or participate in the services between the Sender and Receiver.

The SFR Radio also can be used as a common radio when there is no call forwarding. During the forwarding, it can transmit when PTT is held down. The radio will go back to forwarding after finishing its own service.