



Hytera DMR Conventional Series

Pseudo Trunk Application Notes

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1 Function Overview

1.1 Definition

Pseudo Trunk allows subscribers to work in Dual Time Slot mode. Thus, when one time slot is busy, the subscriber will automatically switch to work at the other.

1.2 Application

Usually, a channel has access to only one flow of voice signals or data communication, which can't satisfy multi-subscriber systems. Pseudo Trunk can help such systems to optimize the use of the channel resources.

1.3 Principle

Pseudo Trunk is a function innovated by Hytera. This function is used to assign two time slots dynamically in direct mode. When one slot is busy, the subscriber will have communication on the other slot automatically. Thus, a channel can use two time slots at the same time for two calls taking place with it. Pseudo Trunk realizes the dual-time-slot work in the conventional system, and it also supports the dynamic distribution of the time slots for communication transmission in Repeater mode.

DMR protocol adopts TDMA technology, dividing the 12.5 KHz channel into two time slots, so that two users can share the same channel without interfering with each other. In practice, however, in Direct mode the subscriber can only transmit signals and data on one slot, which means that the other slot is wasted; in Repeater mode, the subscriber can only transmit and receive signals and data on the designated slot, disabling it to use the other slot as well. Hence, to make use of the unused slot will greatly increase the frequency efficiency. This digital function manifests a big advantage over analog technology.

Having been turned on, the subscriber will verify the activities of the current channel before transmission. It will transmit on Slot 1 directly if this slot is free, otherwise, it will switch to Slot 2 automatically. Once both slots are occupied, the subscriber will determine whether to transmit on Slot 1 according to the settings at TX Admit under CPS; In case of active analog carrier detected, the former situation shall apply.

Caution: once both slots are occupied, the subscriber's forcible transmission will interfere with the communications among other subscribers.

In Pseudo Trunk mode, you can prevent a slot from being occupied by designating

the specific conditions to enable it. Such designation will allow the subscriber to transmit on the specific slot but will not affect the normal reception of data and voice signals from any slot. By optimizing the use of channels, this feature makes the communication system more orderly and manageable.

Pseudo Trunk only supports voice service, data service and auxiliary functions such as alarm and kill.

1.4 Version

DMR conventional R2.0 releases Pseudo Trunk, and R4.5 releases the Tx slot designation function.

** Consult your dealer for more information on DMR conventional series software.*

1.5 Restriction

Pseudo Trunk is only available for digital subscribers and can work in Repeater mode. It is a channel-related function, which can only be set via the CPS. The subscriber receives no indication when the function is enabled.

2 References

None

3 Requirements

1) Subscribers (DMR subscribers such as PD78X, MD78X, etc.)

** Please refer to [Hytera DMR Conventional Series Device List](#), or contact your dealer for details.*

2) Repeaters (such as RD98X, etc.)

** Please refer to [Hytera DMR Repeater Series Device List](#), or contact your dealer for details.*

4 Connection and Configuration

4.1 Configuration Tools

If you just use Pseudo Trunk without designating its Tx time slot, DMR CPS R2.0 or above is workable. If you need to designate the Tx time slots, R4.5 or above is required.

** Contact your dealer for details.*

4.2 Digital Subscriber Configuration

Pseudo Trunk is a channel-related function. To enable it on a channel, see the following steps.

1. Open the CPS and read the subscriber data.
2. After reading the data, select “Conventional -> Channel -> Digital Channel” and double click one of the channels. See Figure 4.2-1.

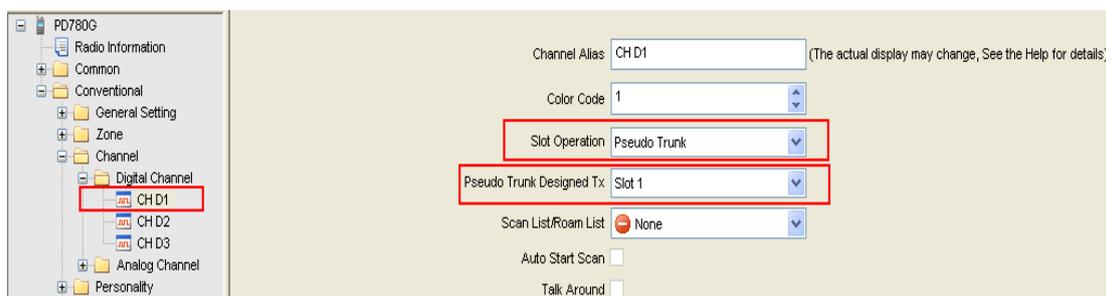


Figure 4-1 Pseudo Trunk Setting Interface

3. Configure the parameters:

Slot Operation: choose a time slot for voice communication and data transmission, or select Pseudo Trunk to enable it.

Pseudo Trunk Designed Tx: designate the slot for transmission. Then the subscriber can transmit on that slot only, but can still receive voice signals and data from any slot.

Caution: The response to an incoming must be made via the slot where the call is received. The designated slot is invalid for such purpose.

4. After the above steps are finished, write the configuration data into the subscriber.

4.3 Repeater Configuration

Pseudo Trunk function is not supported by repeater, but it is available for subscribers working in Repeater mode, so there is no special setup required with the repeater.

5 Pseudo Trunk Application Introduction

5.1 Application in Direct Mode

The bi-slotted operation is available in Direct mode once you have activated it on your desired channel.

In Direct mode, Pseudo Trunk is usually applied in three instances:

There are only the subscribers which are using Pseudo Trunk function.

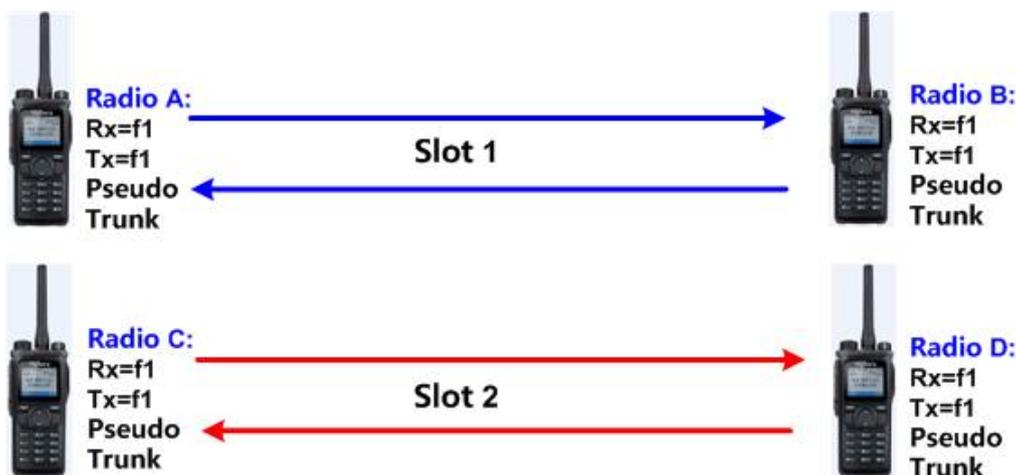


Figure 5-1 Pseudo Trunk Application in Direct mode 1

Before transmitting, Subscriber A will detect the activities in the channel. If the channel is free, it will transmit on Slot 1 and will set up the communication here with the receiver, Subscriber B. If Slot 1 is occupied, Subscriber A will transmit on Slot 2. Then Subscriber B will receive A's call and the communication is set up in Slot 2. If A transmits again when the previous call is over, it will detect Slot 1 first and transmit and establish the communication here when the slot is available. Once both slots are occupied, the subscriber will have forcible transmission on Slot 1 according to TX Admit settings.

When Slot 1 is occupied by the communication between A and B, Subscriber C will detect Slot 2 after Slot 1, and establish the communication with Subscriber D on Slot 2 if this slot is free. If both slots are occupied, C will determine whether to have forcible transmission on Slot 1 according to TX Admit settings.

See the details as follows for the situations mentioned above:

TX Admit	Entire Channel Free	Only One Slot Free	Entire Channel Occupied
Always allow	Tx is allowed.	Tx is allowed.	Tx on Slot 1.
Channel free	Tx is allowed.	Tx is allowed.	Tx is not allowed.
Color code free	Tx is allowed.	Tx is allowed.	Tx is not allowed.

There are subscribers using Pseudo Trunk and a single time slot respectively.

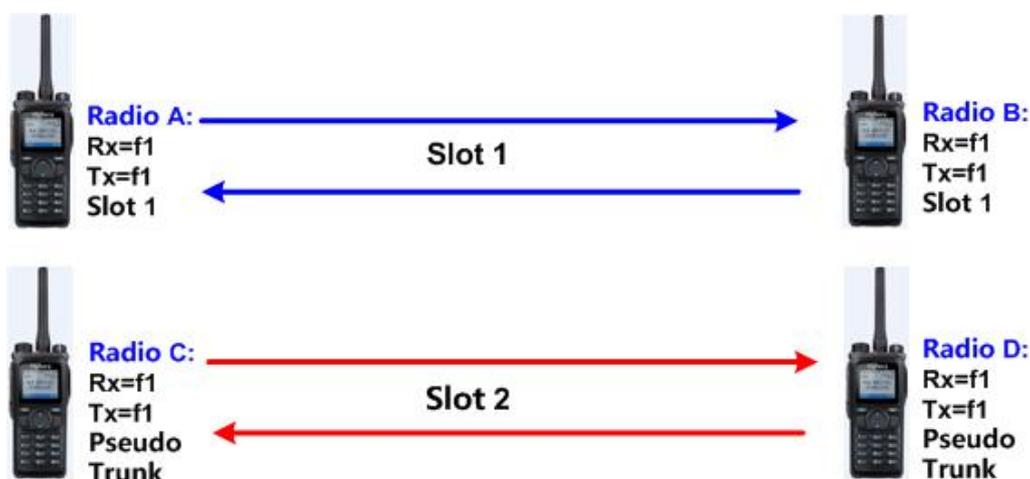


Figure 5-2 Pseudo Trunk Application in Direct mode 2

Pseudo Trunk supports the communication with non-Pseudo Trunk subscriber, which means that a subscriber with Pseudo Trunk can have normal communication with a subscriber with a conventional single time slot on the same channel.

As is shown in Figure 5-2, if both Subscriber A and B select Slot 1, they can only have communication in Slot 1. Both Subscriber C and D select Pseudo Trunk, so they can have communication in any time slot on the channel. In Pseudo Trunk mode, the subscriber will take Slot 1 as its default Tx slot. If there are activities on the channel, Slot 1 must be occupied. Thus, Subscriber A and B will have their transmissions according to TX Admit settings if they are to establish communication now.

If they are to call another subscriber in Pseudo Trunk mode, they can only transmit in Slot 1. If the object subscriber is free, Subscriber A or B will transmit on Slot 1. Whether to transmit depends on the status of the channel and TX Admit settings of the transmitter itself. If the called Pseudo Trunk subscriber is busy, it will not response to the call.

The Pseudo Trunk subscriber can only call Subscriber A and B which are in a single time slot in Slot 1, otherwise, there will be no response at all. However, the Pseudo Trunk subscriber is unable to ensure that it must transmit on Slot 1, so you can

consider designating the Tx slot for it. After you designate the Tx slot, the Pseudo Trunk subscriber can only transmit on that slot but can receive signals and data from both slots.

Calls between Pseudo Trunk subscribers can take place in any time slot. However, if the called subscriber is busy, it will not have any response. If the called subscriber is in transmitting state, the call must be made in its current slot so that the communication can be set up.

The analog carrier occurs in the channel.

The occurrence of the analog carrier on the digital channel will be taken as that both slots are occupied, and the subscriber will determine whether to transmit according to TX Admit settings.

TX Admit	Analog Carrier
Always allow	Tx on Slot 1.
Channel free	Tx is allowed.
Color code free	Tx on Slot 1.

5.2 Application in Repeater Mode

Pseudo Trunk supports the application in Repeater mode in three occasions, too.

There are only subscribers using Pseudo Trunk.

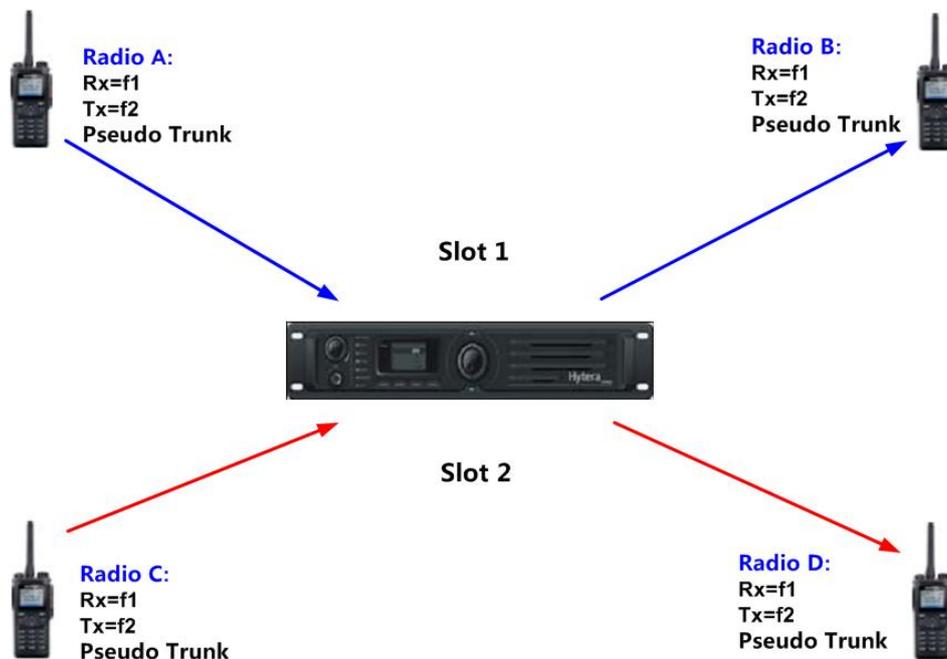


Figure 5-3 Pseudo Trunk Application in Repeater Mode 1

In Repeater mode, the subscribers using Pseudo Trunk will have the same transmission as in Direct mode, but the transmitted signals or data will be transferred by the repeater. Repeaters don't support Pseudo Trunk feature, as their time slots are fixed. Yet they support the transmission of the subscribers using Pseudo Trunk.

Same as in Direct mode, before calling Subscriber B, Subscriber A will also detect the activities on the channel, and then determine whether to transmit based on the status of the slots. If its Tx slot is designated, A will detect the status of the Tx slot first, and then determine whether to transmit according to TX Admit settings. If the channel is free, and Subscriber A doesn't have a designated Tx slot, Slot 1 will be the default Tx slot for A to establish the communication with B. If Subscriber C is going to call D now, it will find Slot 1 busy and have the transmission and communication to D in Slot 2.

If the whole channel is occupied when the subscriber is transmitting, the subscriber will take Slot 1 as the default Tx slot and determine whether to transmit according to TX Admit settings. The transmission process is the same as in Direct mode, and the repeater is used for transferring the signals or data.

See the following details of transmission:

TX Admit	Entire Channel Free	Only One Slot Free	Entire Channel Occupied
Always allow	Tx is allowed.	Tx is allowed.	Tx on Slot 1.
Channel free	Tx is allowed.	Tx is allowed.	Tx is not allowed.
Color code free	Tx is allowed.	Tx is allowed.	Tx is not allowed.

There are both subscribers using Pseudo Trunk and a single time slot respectively.

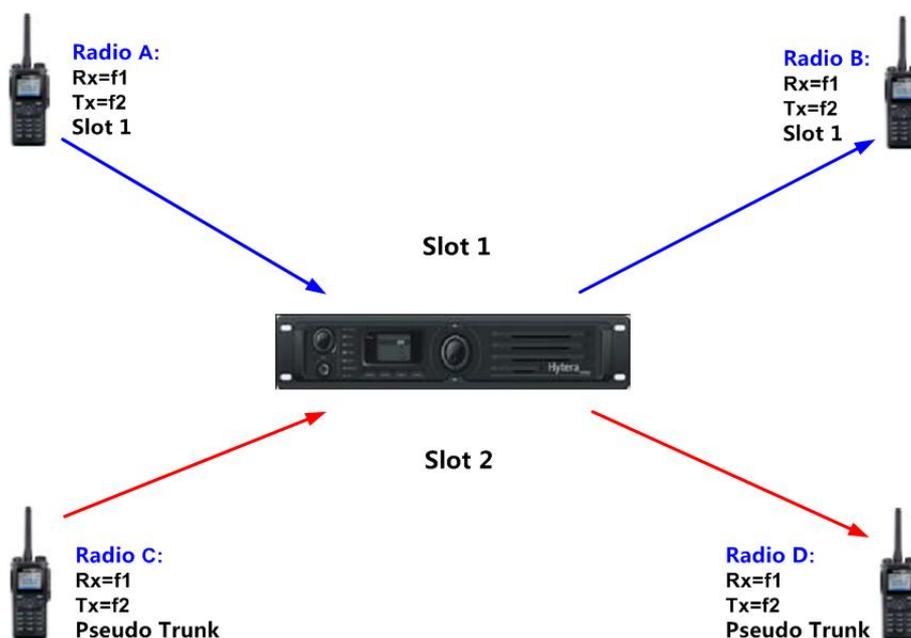


Figure 5-4 Pseudo Trunk Application in Repeater Mode 2

In this circumstance, the subscriber with single time slot can only use its own designated time slot, and the subscriber with Pseudo Trunk can use any slot for transmission if it doesn't have designated Tx slot. As the figure above shows, the single-time-slot Subscriber A and B can only use Slot 1, while pseudo-trunk Subscriber C and D can use Slot 1 and Slot 2, but will take Slot 1 as their default Tx slot. Thus, Slot 1 will have big probability to be occupied. Once this happens, the pseudo-trunk subscribers will determine whether to transmit according to their TX Admit settings.

Comparatively, slot 2 will have small probability to be occupied, as it will only be selected by the subscriber using Pseudo Trunk when Slot 1 is busy, so we suggest you to designate Slot 2 for part of the pseudo-trunk subscribers.

Repeater mode has a difference from Direct mode that the signals and data are transferred by the repeater with fixed slot. The repeater itself doesn't support Pseudo Trunk, but it won't affect the use of Pseudo Trunk by the subscribers.

The analog carrier occurs in the channel.

The subscriber will take the occurrence of the analog carrier on the digital channel as that both slots are occupied, and determine whether to transmit according to TX Admit settings.

TX Admit	Analog Carrier
Always allow	Tx on Slot 1.
Channel free	Tx is allowed.
Color code free	Tx on Slot 1.

5.3 Designed TX Slot application Introduction

You can designate the Tx slot for Pseudo Trunk through the CPS, and then the subscriber will only transmit on that slot but can receive signals or data in both slots.

If you don't designate any Tx slot, the subscriber will transmit on a free slot and take Slot 1 as the default one.

5.3.1 Designating the Tx Slot for Direct Mode

Set to "None" and the subscriber will select a free slot for transmission.

If no carrier or analog signal is detected, the subscriber will transmit in Slot 1; in case of activities in the channel, the first used slot is taken as Slot 1, and if Slot 1 is in transmission, the new transmission will be made in Slot 2. when the subscriber receives a call, it will call back by PTT in the slot where the call is received. Once both slots are occupied or interfered by analog signals, the subscriber will determine whether to transmit according to TX Admit.

Set to "Slot 1": The subscriber will transmit in Slot 1 in Pseudo Trunk mode, except for the response to an incoming call.

If no carrier or analog signal is detected, the transmission will be done in Slot 1; in case of activities on the channel, the first used slot will be taken as Slot 1. When the subscriber receives the call in Slot 1, it will call back in Slot 1, too. If Slot 1 is occupied, the subscriber will determine whether to transmit according to TX Admit settings.

- When TX Admit is set to "Allow", the subscriber will transmit in Slot 1.
- When TX Admit is set to "Color Code Free", and a call with the same color code

is made in Slot 1, the transmission will be refused here, otherwise, it is allowed.

- When TX Admit is set to “Channel Free”, and a carrier is detected in Slot 1, transmission will be refused here, otherwise, it is allowed.

Set to “Slot 2”: The subscriber will transmit in Slot 2 in Pseudo Trunk mode, except for the response to an incoming call.

If no carrier or analog signal is detected, Slot 1 will be taken as the default slot for transmission. In case of activities on the channel, the first used slot is Slot 1. Thus, the subscriber will determine whether to transmit in Slot 2 according to TX Admit settings.

- When TX Admit is set to “Allow”, the subscriber will transmit in Slot 2.
- When TX Admit is set to “Color Code Free”, and a call with the same color code is made in Slot 2, the transmission will be refused here, otherwise, it will be allowed.
- When TX Admit is set to “Channel Free”, and a carrier is detected in Slot 2, the transmission will be refused here, otherwise, it is allowed.

5.3.2 Designating the Tx Slot for Repeater Mode

Set to “None” and the subscriber will select a free slot for transmission.

If no carrier or analog interference is detected, the subscriber will transmit on Slot 1 after the repeater is activated; if there are activities on Slot 1, the transmission will be made on Slot 2; if Slot 2 is occupied, the subscriber will make a call again on Slot 1. If the subscriber receives a call, it will call back by PTT on the slot where the call is received. Once both slots are occupied or interfered by analog signals, the subscriber will determine whether to transmit according to TX Admit.

Set to “Slot 1”: The subscriber will transmit on Slot 1 in Pseudo Trunk mode, except for the response.

If no carrier or analog interference is detected, the subscriber will transmit on Slot 1 after the repeater is activated; after receiving a call, the subscriber will respond on the slot where the call is received; once Slot 1 or both slots are occupied, the subscriber will determine whether to transmit on Slot 1 according to TX Admit.

- When TX Admit is set to “Allow”, the subscriber will transmit on Slot 1.
- When TX Admit is set to “Color Code Free” or “Channel Free”, and Slot 1 is busy, the transmission will be refused.

Set to “Slot 2”: The subscriber will transmit on Slot 2 in Pseudo Trunk mode, except for the response.

If no carrier or analog interference is detected, the subscriber will transmit on Slot 2, the default slot, after the repeater is activated; when receiving a call, the subscriber will respond on the slot where the call is received; once Slot 2 or both slots are occupied, the subscriber will determine whether to transmit on Slot 2 according to TX Admit.

- When TX Admit is set to “Allow”, the subscriber will transmit on Slot 2.
- When TX Admit is set to “Color Code Free” or “Channel Free”, and Slot 2 is busy, the transmission will be refused.

6 FAQ

6.1 Does Pseudo Trunk Mode Support Alarm and GPS Revert Channel Settings

This mode supports the Alarm or GPS Revert Channel setting on Pseudo Trunk channel, but these settings are not suggested.

Pseudo Trunk mode has dynamic time slots to choose, so the variable of the related services needs to be backed up sometimes in Slot 1 and sometimes Slot 2. This is complicated. Since the Alarm and GPS Revert Channel services require stable slots, so they are not suggested to be used on Pseudo Trunk channel.

6.2 What Services Does Pseudo Trunk Support

Pseudo Trunk supports conventional voice and data services, including call, SMS and auxiliary function. The auxiliary function mainly consists of Alarm, Radio Check, Call Alert, Kill/Activate, Priority Interrupt, etc. In R5.0, Telemetry will be supported.

6.3 What Does Direct Mode Differ from Repeater Mode in Pseudo Trunk Services?

In Direct mode, the slots on the channel are assigned dynamically. Slot 1 is used by default. While in Repeater mode, the slots are fixed, and the repeater is used for transferring the received voice signals and data. Comparatively, in Direct mode, the subscriber will select the time slot dynamically for transmission. The first used slot will be taken as Slot 1, and the latter one to be used is considered Slot 2. While in Repeater mode, Slot 1 and Slot 2 are fixed, but the subscriber, except the one that has designated the Pseudo Trunk Tx slot, can use any one of them for transmission.