

## Hytera DMR Conventional Series

Back-to-Back Mobile Radio Application Notes









# **Hytera DMR Conventional Series**

## **Back-to-Back Mobile Radio**

## **Application Notes**

Version 1.0

Date: January 28, 2011 Web: http://www.hytera.com



## **Revision History**

Version	Date	Description	Remarks
R1.0	01-28-2011	Initial release	



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## 1. Overview

### **1.1 Definition**

The "back-to-back" is a system solution on accessory pins. It is used to achieve cross-band communication among analog and digital radios.

## **1.2 Principle**

#### 1.2.1 Back-to-Back Mobile Radio

The back-to-back function realizes communication between analog and digital mobile radios. It works as below:

1) When the portable radio R1 transmits, the portable radio R2, R3 and the mobile radio1 will receive the signals from R1 simultaneously.

2) During retransmitting, the mobile radio 1 will output the audio signals to the mobile radio 2 via accessory pin and activate its Mic PTT, triggering the mobile radio 2 to transmit. This operation is not subject to the working mode and frequency of two mobile radios.

3) The radios R4, R5 and R6 receive the same audio signals from mobile radio 2. In this way, R1 achieves communication with R2, R3, R4, R5 and R6 successfully.

4) The mobile radio 2 can also output the audio signal to mobile radio 1 via accessory pin, enabling all portable radios within the coverage of two mobile radios to communicate with others.





Figure 1.2.1-1 Back-to-Back Work Principle

#### 1.2.2 Accessory Pin

#### 1.2.2.1 Input

On both analog and digital channels, the mobile radio can trigger or terminate the transmission via the accessory pin, and the audio signals to be transmitted will be sampled via the input pin as well.

Function	Туре	Applicable Mode	Definition
EXT Mic PTT	A fixed function	Analog and	When a valid level is input, the mobile
(via accessory		Digital	radio will trigger its external PTT and
PTT)			transmit the audio signal sampled from
			Codec. However, the transmission will be
			stopped in case of invalid level.
Tx Audio	A fixed function	Analog and	When the external PTT is enabled, the
(via external		Digital	mobile radio will transmit the audio
MIC signal)			signals.

 Table 1.2.2.1-1 Definition of Accessory Pin Input



#### 1.2.2.2 Output

On both analog channel and digital channels, the mobile radio can output (in level form) the status of call request as well as the call contents from the portable radio via the accessory pin. The definition of involved pins is given below:

Function	Туре	Applicable Mode	Definition
Speaker Open	Programmable	Analog and	When the speaker is detected unmuted,
Detect		Digital	the mobile radio will output a valid level.
(for speaker			However, it will output an invalid level
detection)			when the speaker is muted.
Rx Audio	A fixed function	Analog and	When any audio signal is received, the
Output		Digital	mobile radio will output such signal via
(for audio			the accessory pin.
output)			

Table 1.2.2.2-1 Definition of Accessory Pin Output

## 1.3 Version

1) DMR Conventional Series R2.5: Back-to-Back mobile radio available (A/D conversion).



## 2. Required Equipment

1) Mobile radio (see Hytera device list for details)

2) Accessory pin cable

\* Please refer to Hytera DMR Conventional Series Terminal List. You can

contact your dealer for specific model.

\* The cable is provided by the third-party supplier.



## 3. References

N/A



## 4. Equipment Connection

At present, you can connect two terminals using the appropriate accessory pin cable. For any customized or expansion design, the method may vary.

## 4.1 Back-to-Back

The mobile radios can be connected in a back-to-back manner as below (Figure 4.1-1):



Figure 4.1-1 Back-to-Back Connection

1) Ground wire

To connect Pin2 of mobile radio1 and that of mobile radio 2.

2) Activation of mobile radio transmission

To connect Pin3 of mobile radio 1 and Pin16 of mobile radio 2.

To connect Pin16 of mobile radio1and Pin3 of mobile radio 2.

3) Audio signal output

To connect Pin8 of mobile radio 1 and Pin7 of mobile radio 2.

To connect Pin7 of mobile radio 1 and Pin8 of mobile radio 2.

Note: Pin3 is programmable and can be replaced by Pin12, Pin20, Pin22 or

Pin23. All other pins must be connected.



## 5. Equipment Configuration

## 5.1 Tools

DMR CPS V2.5 or above.

\* Contact your dealer for details.

## 5.2 Configuring an Analog Mobile Radio

1) Run the CPS and read the existing configuration data.

2) Go to "General Setting -> Accessories". See Figure 5.2-1.

Accessories		
MD780     Radio Information     Ceneral Setting     Feature Control     Accessories     Buttons	Ignition Sense Ignition Sense Type Disable Ignition Off Time 00: 00	Ignition Off
Menu     Alerts/Indication     Microphone     Sim Network     Zone     Channel	GPIO Pins Debounce Duration [ms] 100 Public Address Public A	.ddress 1 ♥
DMR Services     HDC1200 Services	Feature	Active Level Debounce
	Pin#3 Speaker Open Detect V	Low 🔽 🔽
Hergency	Pin#12 None V	Low 🔽
	Pin#20 None 🔽 I	Low 🔽
	Pin#22 None 🔽 I	Low 🔽
	Pin#23 None 🔽 I	Low 🔽
	Pins Preview	

Figure 5.2-1 Accessories Configuration for Analog Mobile Radio 1

3) In the "GPIO Pins" box, set the option"Pin#3" to "Speaker Open Detect". See Figure 5.2-1.

4) Go to "Channel -> Analog Channel" and select the channel which the mobile radio is working on. See Figure 5.2-2.



CH A1								
Radio Information		Cha	innel Alias	CH A1	(Th	e actual display may cha	nge, See the Help for deta	ails)
General Setting		Channel Spa	cing (KHz)	25	×			
Feature Control		CTCSS Tail Rev	ert Option	180				
Buttons		Circ	alian Truna	HDC1000				
Alerts/Indication		sign	alling Type	HDC1200				
Microphone			Scan List	Scan List 1				
E Zone		Auto : Tr	start Scan					
🖃 🔄 Channel	Emp De-emp 🔽							
Analog Channel     CH A1	Scrambler							
CH A2			Rx Only					
CH A3     DMR Services		Rx	Ъ.	)ffeet (MHz)		Tx		
HDC1200 Services	Receive Frequency [MHz]	136.000000		0000	Transmit Frequency (	MHz] 136.000000		
🗄 🧫 Emergency	Rx CTCSS/CDCSS Type	CTCSS			TX CTCSS/CDCSS	Type CDCSS	~	
	CTCSS	67.0	1	CobA	ст	rcss 67.0		
	CDCSS	023	1		cr	023		
	Rx Signaling Syste	m System 1	<b>~</b>		Tx Signaling Sy	stem System 1	~	
	Rx Squeich Mo	de CTCSSICDCSS			Emergency Sv	stem HDCSvs 1		
	Monitor Squeloh Mo	la Carrier			Power I	evel Low		
	Monitor Squeler Mo	ic Contrict			FOWERL	LOW		

Figure 5.2-2 Analog Mobile Radio Configuration 2

5) Configure the Rx and Tx parameters. Make sure that the option "Signaling Type" is defined before configuration. See Figure 5.2-2.

The Rx and Tx parameters can specify the conditions for receiving and transmitting.

6) After the above steps are finished, write the configuration data into the mobile radio.

## 5.3 Configuring a Digital Mobile Radio

1) Go to "General Setting -> Accessories" and set the parameters (refer to step 3 in 5.2).

2) Go to "Channel -> Digital Channel" and select the channel which the mobile radio is working on. See Figure 5.3-1.

3) In the "Rx" and "Tx" box, set the option "Rx Group List" and "Tx Contact Name". The former defines the groups that can be responded (not required for private call and all call), and the latter defines the target address. See Figure 5.3-1.



x	
Channel Alias CHD1 (The actual display may change, See the Help	o for details)
- A Setting	
Teature Control	
Accessories Stat Overation Stat 1	
Buttons	
Menu Scan List 1	
Auto Start Scan	
Windowski State St	
Taik Around	
Channel RX Only	
RRS	
Offset [MHz]	
CH US     Receive Frequency (MHz)     136.00000     Transmit Frequency (MHz)     136.00000     Transmit Frequency (MHz)	
HDC1200 Services	
B Scan Emergency Alarm Indication Emergency System DmrSys 1	
Emergency Emergency Alarm Ack	
Prevenency Cellindication	
Tx Admit Always Allow	

Figure 5.3-1 Digital Mobile Radio Configuration

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

mobile radio.



## 6. Application Demo

The back-to-back function can realize cross-band communication among analog and digital mobile radios.

## 6.1 Communication among Analog-Digital Mobile Radio



Figure 6.1-1 Communication among Analog-Digital Mobile Radio 1





Figure 6.1-2 Communication among Analog-Digital Mobile Radio 2



## **7. FAQ**

#### 7.1 How many mobile radios can be connected in the

#### back-to-back way?

To ensure an optimal performance, only two mobile radios are supported at present.

### 7.2 Can the communication go with the same frequency?

It is recommended to use different frequencies to avoid signal interference.

### 7.3 Is there any suggestion for configuring the frequency?

To ensure communication performance, it is recommended to maintain the frequency space at 100 KHz or more.

#### 7.4 Is there any requirement on the bandwidth?

The bandwidths of two mobile radios can be different. For example, the bandwidth of digital mobile radio is12.5KHz and the bandwidth of analog mobile radio is 12.5 KHz, 20 KHz, or 25 KHz. The bandwidth difference does not affect the back-to-back performance.

#### 7.5 How long is the accessory pin cable?

It is recommended to keep the cable length within one meter.

## 7.6 Why does the prompt "Service Rejected" appear

### frequently?

The reason is that the mobile radio is transmitting via the external Mic PTT, making it unable to handle other call requests. You can try it again later.



## 7.7 How to deal with back-to-back function failure?

When the back-to-back function does not work, take steps below:

- 1) Check whether the accessory pin cable is connected properly;
- 2) If the cable gets loose, reconnect it;
- 3) Restart the mobile radio;
- 4) If the above steps do not help, please contact your dealer.