MASTR® III RADIO LINK REPEATER OPTIONS SXMK3J and SXMK3K

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MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
C	Mar. 2005	Added narrowband alignment and added feedback info., Updated company name and address.

M/A-COM Technical Publications would particularly appreciate feedback on any errors found in this document and suggestions on how the document could be improved. Submit your comments and suggestions to:

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NOTE

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

INTRODUCTION

This publication provides information on the installation and operation of the Radio Link Option which reconfigures a MASTR III Base Station for radio link (Back-to-Back) operation. The installation information contained in this manual supplements the MASTR III Base Station Installation manual MM102554V1.

RELATED DOCUMENTS

MM102554V1	MASTR III Installation Manual
MM102555V1	MASTR III System Maintenance Manual
LBI-38983	MASTR III Antenna Systems Assembly Manual
MS102518VV1	MASTR III PC Programming Guide

RADIO LINK APPLICATION KIT

The Radio Link (Back-to-Back) Application Kit includes Options SXMK3J and SXMK3K. These kits are used to modify two standard MASTR III Base Stations for use as Remote Control (Back-to-Back) Base Stations.

OPTION SXMK3J

The first station (referred to as Station A in this manual) uses the SXMK3J Radio Link Application Kit. This kit includes the interconnect harness (19B803976P1) and factory programming to reconfigure the station as a radio link repeater.

In addition to customer specific parameters, factory programming of Station A turns on the Repeater function and enables the Back-to-Back Repeater Option.

OPTION SXMK3K

The second station (referred to as Station B in this manual) uses the SXMK3K Radio Link Application Kit to configure the station as a simplex station.

In addition to customer specific parameters, factory programming of Station B turns on the RF Simplex function and enables the Back-to-Back Repeater Option.

DESCRIPTION

The MASTR III Back-to-Back repeater option allows two conventional MASTR III Base Stations to be connected together for simultaneous operation. A typical Remote Control Base Station system, shown in Figure 1, consists of one or more control stations, a repeater (two frequencies), a simplex (one frequency) base station, and mobile and/or portable units. In the diagram, "R1" is used to indicate a receiver on frequency F1, "T2" is used to indicate a transmitter on frequency F2, etc. F3 is the mobile frequency, F1 is the uplink frequency, and F2 is the downlink frequency.

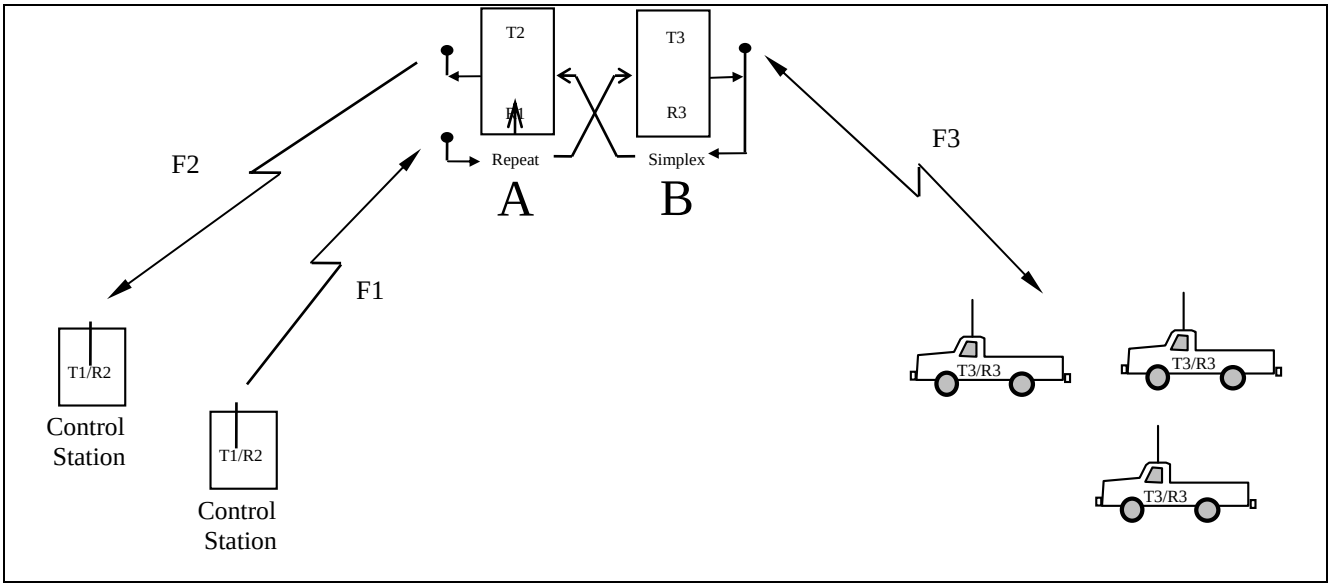


Figure 1. Typical Remote Control Base Station Diagram

In this configuration, when the repeater, Station A, receives a signal on F1 it re-transmits the signal on F2. It also routes the signal to the simplex base station, Station B, which is keyed by R1 to re-transmit the signal on F3. When Station B receives a signal on F3, it routes the signal to Station A which is keyed by R3 to re-transmit the signal on F2. The mobile units can talk to each other on F3.

The linked stations can use the same RF frequency band/split or different frequency bands/splits.

CIRCUIT ANALYSIS

Reference to signal flow is shown in Figure 2. For locations of specific connectors and pin-outs refer to the Interconnection Diagrams at the end of this manual.

When Station A detects a carrier, a carrier with the proper Channel Guard tone, or a transmit key from a remote controller, it applies a ground to the Repeat PTT Out (P2-16). This signal is connected to the Repeat PTT In (P2-13) of Station B. Filtered Receiver Audio Out (P2-6 & 7) from Station A is connected to the TX Audio In (P2-8 & 9) at the transmitter in Station B. Grounding the Repeat PTT In keys Station B routing the audio to the transmitter which re-transmits the signal on F3.

When Station B receives a valid signal, it applies a ground to the Repeat PTT Out (P2-16). This signal is connected to the Repeat PTT In (P2-13) of Station A. Filtered Receiver Audio Out (P2-6 & 7) from Station B is connected to the TX Audio In (P2-8 & 9) at the transmitter in Station A. Grounding the Repeat PTT In keys Station A routing the audio to the transmitter which re-transmits the signal on F2. The Repeat/Simplex operation is configured using the PC Programmer, TQS3353.

INSTALLATION

Install the MASTR III Stations using the standard procedures as directed in MM102554V1. The only exceptions will be installing the Back-to-Back repeater harness, verifying correct antenna installation, and programming the personalities of the two stations.

INTERCONNECTIONS

Install the Back-to-Back Repeater Harness (19B803976P1) as follows:

1. Connect the harness connector P201 to the Station A - T/R Shelf Backplane connector A1P2.
2. Route the interconnecting harness to Station B.
3. Connect the harness connector P202 to the Station B - T/R Shelf Backplane connector A1P2.
4. Ensure antennas are installed according to MM102554V1 and LBI-38983.

PROGRAMMING

Back-to-Back repeaters configured for Remote Control Base Station operation are factory programmed. However, the personalities required for Back-to-Back operation may be verified using the TQS3353 PC Programmer.

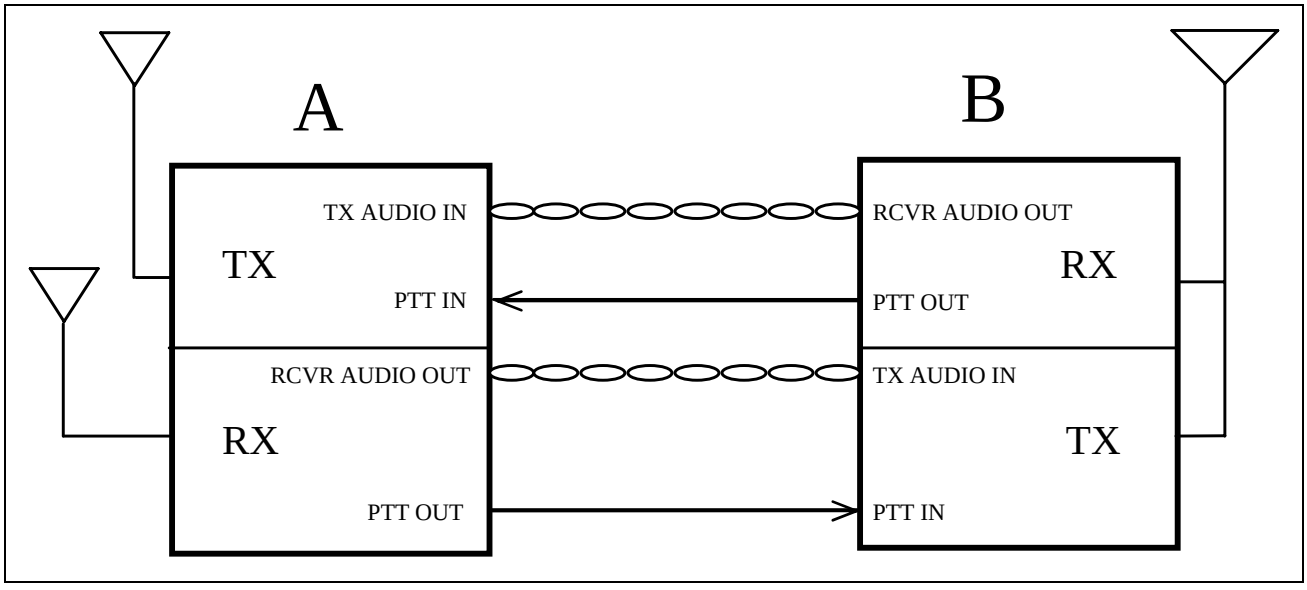


Figure 2. Signal Routing

Station A

1. Select the MASTR III Control Shelf Programming, Channel Data screen.
2. Ensure the operating parameters for channel 1 are correct with the RF Simplex field set to “NO” and the Repeat (Rpt) field set to "YES." This enables the channel to act as a repeater channel.
3. Select the Control Shelf Options screen and ensure the Repeater Option is set to "Back-to-Back."

Station B

1. Select the MASTR III Control Shelf Programming, Channel Data screen.
2. Ensure operating parameters for channel 1 are correct with the RF Simplex field set to “YES” and the Repeat (Rpt) field set to "NO." This allows the channel to act as a simplex (one frequency) channel.
3. Select the Control Shelf Options screen and ensure the Repeater Option is set to "Back-to-Back."

Key Priority

The key priority determines which audio signal takes precedence over the system operation. Stations with personalities programmed for channel 1 (default) operate using the Repeat Priority. If the station’s personality is programmed for channel 2, it will operate using the Link Priority.

Repeat Priority

When using Channel 1 on Station A the key priority is as follows:

1 Local Service Mic

2 Remote (DC or Tone)

3 Repeater

4 Link

The audio from station A will take priority over the audio from station B, for re-transmission by station A.

For Example, (refer to Figure 1) if control station 1 transmits on F1 then a mobile transmits on F3, the audio signal being re-transmitted by station A on F2 will not switch from the control station's audio to the mobile's audio, but will continue to use the audio from the control station.

Link Priority

When using Channel 2 on Station A, the key priority is as follows:

1 Link

2 Local Service Mic

3 Remote (DC or Tone)

4 Repeater

The audio from station B will take priority over the audio from station A, for re-transmission by station A.

For Example, (refer to Figure 1) if control station 1 transmits on F1 then a mobile transmits on F3, the audio signal being re-transmitted by station A on F2 will switch from the control station's audio to the mobile's audio.

ADJUSTMENT AND TEST

Follow the Station Alignment procedure found in the MASTR III Installation Manual (MM102554V1). Make final adjustments using the supplemental instructions described in Table 1.

Table 1 - Supplemental Tests and Adjustments

PROCEDURE	INDICATIONS AND ADJUSTMENTS
1. Set both stations for no Compression.	Following the procedures in MM102554V1, set the Compressor Gain (CP) pot to the preset setting (1023) on both stations. Set the Compressor Threshold (CT) pot to 32767 on both stations.
2. Align Line Output (LO) Pot (refer to MM102554V1).	Align the Line Output (LO) pot on both stations according to the procedures in MM102554V1 except, set the pot for -10 dBm (245mV) output level instead of 0 dBm (775mV).
3. Apply an "on Channel" RF signal to the receiver of station A, modulated with a 1000 Hz tone at the deviation level shown below. If the station has Channel Guard (CG), add the appropriate CG tone with an additional amount of FM deviation as shown: Station bandwidth / Deviation / CG deviation *Narrowband station* 1.5 kHz 500 Hz *NPSPAC station* 2.4 kHz 600 Hz *Wideband station* 3.0 kHz 750 Hz 4. Remove the RF signal from the receiver of station A.	Station B should transmit. Measure the FM deviation of Station B. Verify that the deviation is as follows, ±100 Hz: Station bandwidth / w/o CG / with CG Narrowband 1.5 kHz 2.0 kHz NPSPAC 2.4 kHz 3.0 kHz Wideband 3.0 kHz 3.75 kHz If necessary, adjust the Station A Line Output (LO) for the proper deviation as measured at Station B. If Station A is configured as a repeater, measure the FM deviation out of the Station A transmitter and verify the deviation is within ±100 Hz of the values shown above. If necessary, re-check the Repeater Gain adjustment on Station A to obtain the correct level.
5. Apply an "on Channel" RF signal to the receiver of station B, modulated with a 1000 Hz tone at the deviation level shown below. If the station has Channel Guard (CG), add the appropriate CG tone with an additional amount of FM deviation as shown: Station bandwidth / Deviation / CG deviation *Narrowband station* 1.5 kHz 500 Hz *NPSPAC station* 2.4 kHz 600 Hz *Wideband station* 3.0 kHz 750 Hz 6. Remove the RF signal from the receiver of station B.	Station A should transmit. Measure the FM deviation of Station A. Verify that the deviation is as follows, ±100 Hz: Station bandwidth / w/o CG / with CG Narrowband 1.5 kHz 2.0 kHz NPSPAC 2.4 kHz 3.0 kHz Wideband 3.0 kHz 3.75 kHz If necessary, adjust the Station B Line Output (LO) for the proper deviation as measured at Station A. If Station B is configured as a repeater, measure the FM deviation out of the Station B transmitter and verify that the deviation is within ±100 Hz of the values shown above. If necessary, re-check the Repeater Gain adjustment on Station B to obtain the correct level.

ALTERNATE CONFIGURATIONS

The MASTR III Radio Link Repeater option may also be installed in one of the following configurations:

- Simplex Link - which configures two stations for simplex operation.
- Linked Repeaters - which configures both stations for repeater operation.

Each of these configurations is fully explained in the following sections of this manual.

SIMPLEX LINK

In the Simplex Link configuration the two stations connected together using the 19B803976P1 interconnect harness. However, both stations are configured for simplex (single frequency) operation. When Station A receives a signal on Frequency One (F1), it routes the signal to Station B which re-transmits the signal on Frequency Two (F2). When a signal is received by station B on F2, it routes the signal to Station A which re-transmits the signal on F1. The conventional stations can use the same RF frequency band/split or different frequency bands/splits.

If the stations use the same RF transmit and receive frequencies, Station A will also require installation of the Antenna relay option, SXSU3J (not included in the Radio Link Option).

In the Simplex Link configuration shown in Figure 3, the control station can talk to the mobile units through the Simplex Link and the mobile units can talk directly to each other on F2.

In the Simplex Link configuration shown in Figure 4, the simplex mobile units (T3/R3) are also able to talk to the mobile units on the other repeater (T1/R2) which effectively extends the range of Station A.

Programming

Program both stations using TQS3353 as follows:

1. Program the RF Simplex field to "YES," which automatically sets the Repeat (Rpt) field to “NO.”
2. Program the Repeater Option for "Back-to-Back."

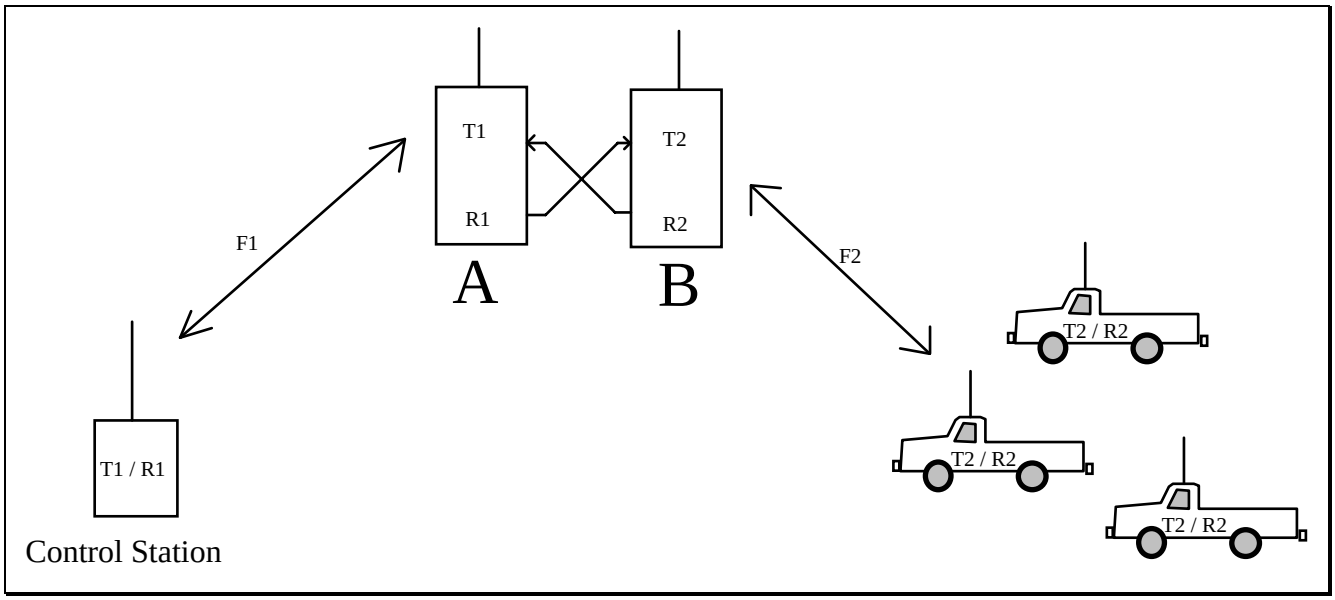


Figure 3. Example 1 - Simplex Link

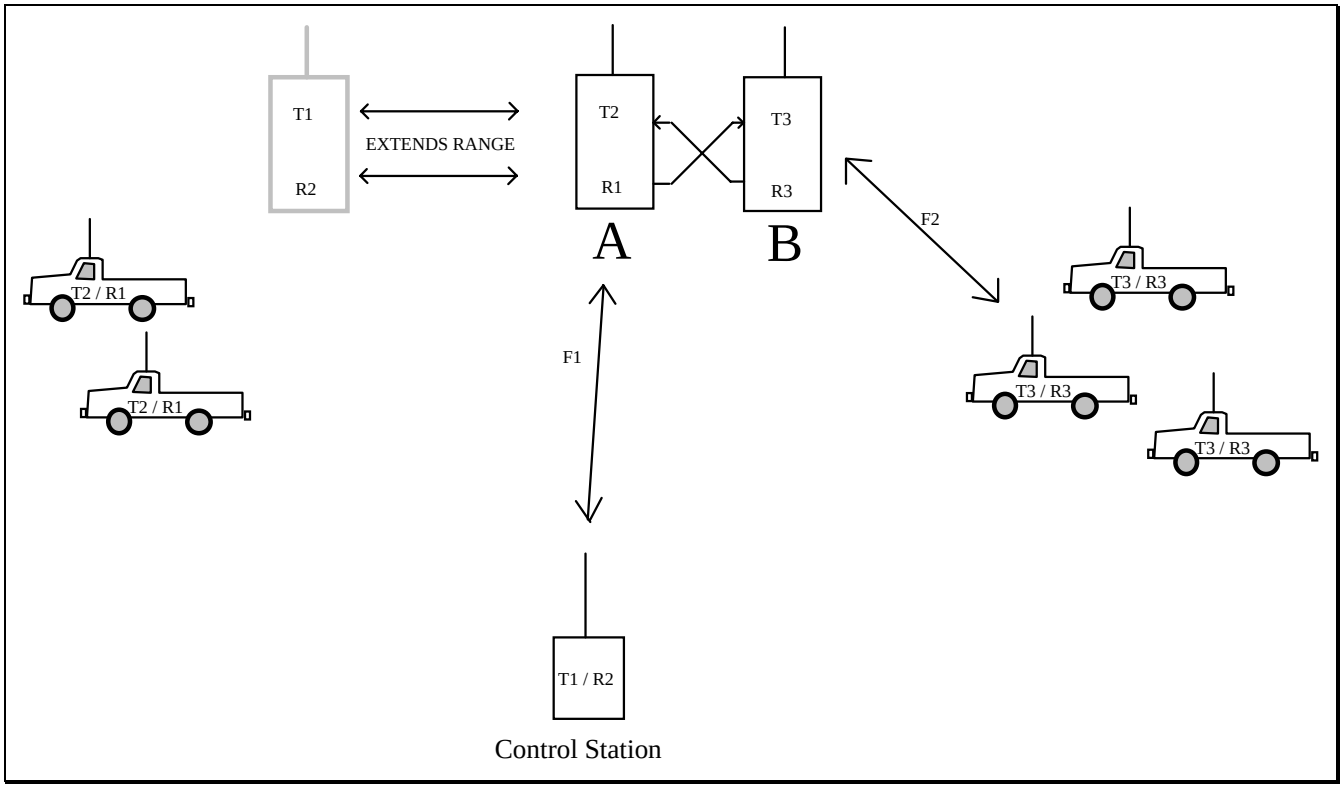


Figure 4. Example 2 - Simplex Link

LINKED REPEATERS

In the Linked Repeater configuration, the two stations are interconnected using the 19B803976P1 harness. Both stations are configured for repeater (two frequency) operation. When Repeater A receives a signal on F1, it re-transmits the signal on F2. It also routes the audio to Repeater B which re-transmits the signal on F4. When Repeater B receives a signal on F3, it re-transmits the signal on F4. It also routes the audio to Repeater A, which re-transmits the signal on F2. The conventional stations can use the same RF frequency band/split or different frequency bands/splits.

In the Linked Repeater configuration shown in Figure 5, the control station can talk simultaneously to the mobile units (F1/F2) through the (R1/T2) repeater and the mobile units (F3/F4) through the (R3/T4) linked repeater. On the other side of the link, the mobile units (F3/F4) can talk to each other through the (R3/T4) repeater and to the control station and mobile units (F1/F2) through the (R1/T2) linked repeater at the same time.

Programming

Program both stations using TQS3353 as follows:

1. Program the Repeat (Rpt) field to "YES," which automatically sets the RF Simplex field to “NO.”
2. Program the Repeater Option for "Back-to-Back."

Key Priority

The key priority determines which audio signal takes precedence over the system operation. Stations with personalities programmed for channel 1 (default) operate using the Repeat Priority. If the station’s personality is programmed for channel 2, it will operate using the Link Priority.

Station A - Repeat Priority

When using Channel 1 on Station A the key priority is as follows:

1	Local Service Mic
2	Remote (DC or Tone)
3	Repeater
4	Link

The audio from Station A will take priority over the audio from Station B, for re-transmission by Station A.

For Example, if the control station transmits on F1 then a mobile transmits on F3, the audio signal being re-transmitted by Station A will continue to be the audio from the control station.

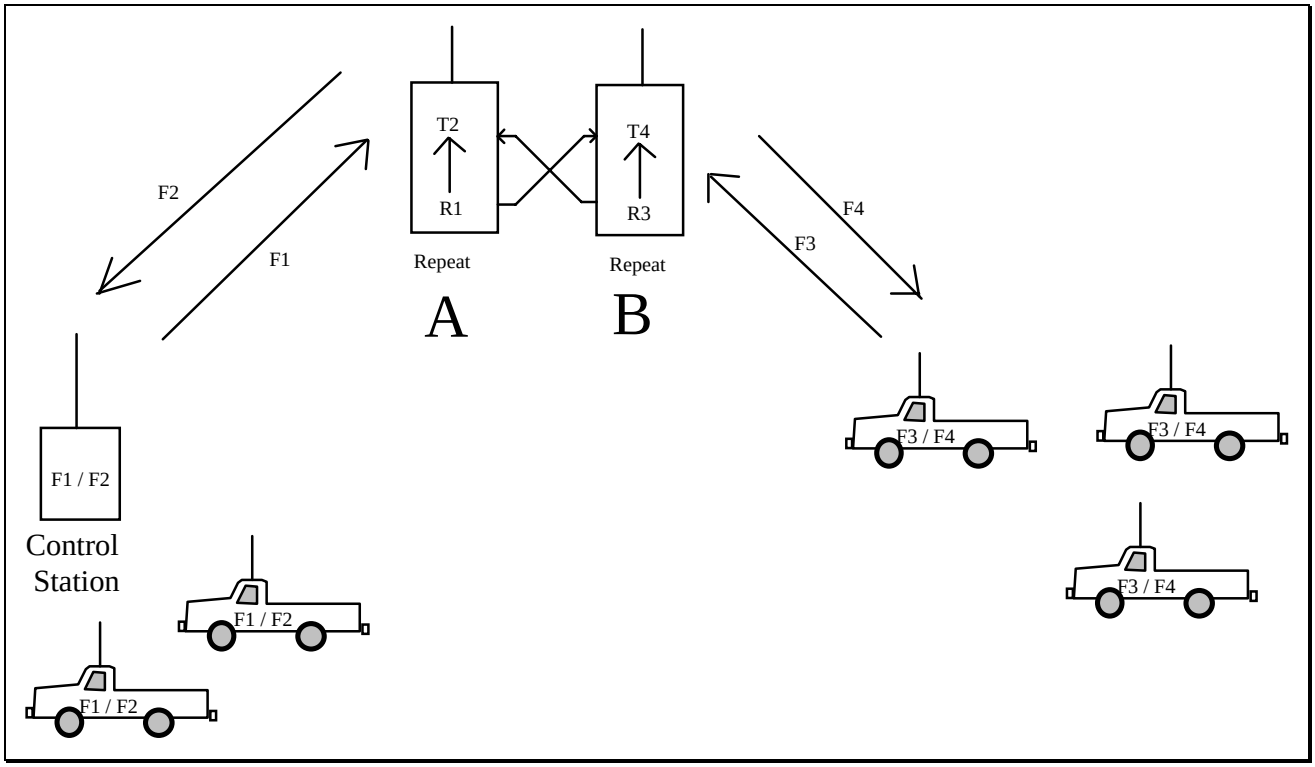


Figure 5. Linked Repeaters

Station A - Link Priority

When using Channel 2 on Station A the key priority is as follows:

1 Link

2 Local Service Mic

3 Remote (DC or Tone)

4 Repeater

The audio from Station B will take priority over the audio from Station A, for re-transmission by Station A.

For Example, if the control station transmits on F1 then a mobile transmits on F3, the audio signal being re-transmitted by Station A on F2 will switch from the control station's audio to the mobile's audio.

Station B - Repeat Priority

When using Channel 1 on Station B the key priority is as follows:

1 Local Service Mic

2 Remote (DC or Tone)

3 Repeater

4 Link

The audio from Station B will take priority over the audio from Station A, for re-transmission by Station B.

For Example, if a mobile transmits on F3 then the control station or a mobile transmits on F1, the audio signal being re-transmitted by Station B will continue to be the audio from the F3 mobile.

Station B - Link Priority

When using Channel 2 on Station B the key priority is as follows:

1 Link

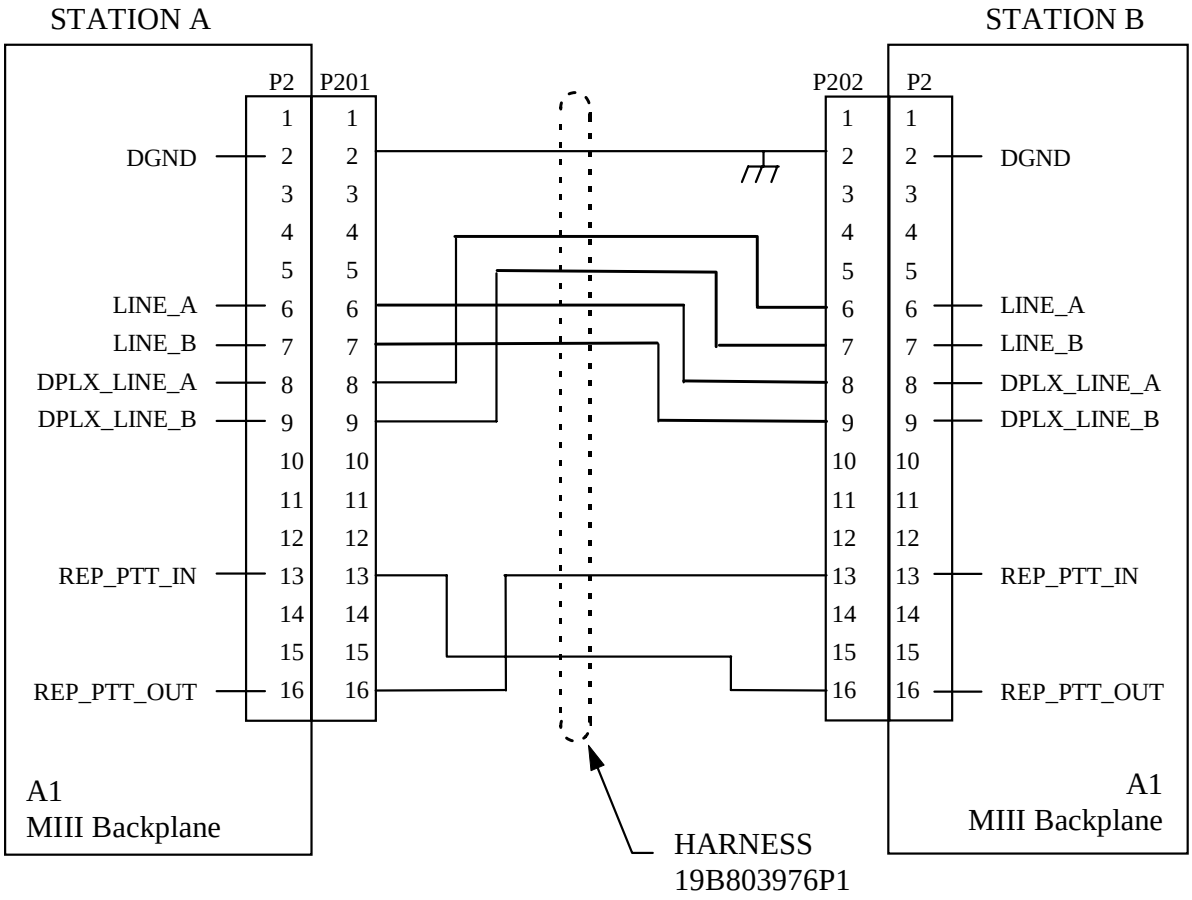
2 Local Service Mic

3 Remote (DC or Tone)

4 Repeater

The audio from Station A will take priority over the audio from Station B, for re-transmission by Station B.

For Example, if a mobile transmits on F3 then the control station or a mobile transmits on F1, the audio signal being re-transmitted by Station B on F4 will switch from the F3 mobile to the control station's or the F1 mobile's audio.



MASTR III BACK-TO-BACK REPEATER HARNESS
19B803976P1

SYMBOL	PART NUMBER	DESCRIPTION
1	19A700041P42	Housing: sim to Molex 22-01-2165 (qty. 2).
2	19A704779P26	Contact #24: sim to Molex 08-55-0101 (qty.14).
3		Jacketed cable: 7 conductor, 24 AWG; sim to Belden 9537 (qty. 9-ft.)

REPEATER INTERCONNECTION & HARNESS
19B803976P1
(19B804016 Sh. 1, Rev. 1 and 19B803976 Sh. 1, Rev. 1)

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