

Appendix I: MRF Groups and the Voting Subsystem

The Ultra-Com Dispatch system has a built in voting subsystem. The voting subsystem provides the ability to combine channels into groups called Mobile Radio Frequency (MRF) Groups. Each MRF Group is a voting group. When a receive event occurs on one or more of the member channels of a voting group, the system picks the best quality audio from the receiving channels and presents this audio to the dispatchers.

Each MRF Group has at least one member channel. Only TRC2 channels can belong to MRF Groups. There may be up to 24 member channels in an MRF Group. The Ultra-Com system can handle multiple MRF Groups. The number of groups is limited by the maximum number of channels in the system.

Each member channel controls a single base station radio. All member channels within an MRF Group are single frequency channels and all member channels operate at the same frequency

When a receive event is detected by the member channels they vote to determine which one has the best quality audio. The channel with the best quality audio is called the voted channel. Only the receive audio of the voted channel is presented to operator's headset, select speaker (if the MRF Group or a member of the group is selected) or the un-select speaker. Un-voted channel audio is typically routed to an auxiliary speaker at a reduced volume level.

MRF Group member channel receivers use status tone signaling or relay signaling (Carrier Operated Relay (COR) signaling). For status tone signaling the status tone may be 2175, 1950 or 1600 Hz. Channels within an MRF Group may use different signaling methods.

Each receiver in a MRF Group is assigned a transmit channel. This channel is called the steered-to channel. The system transmits on the steered-to channel of the voted channel when the operator transmits on the MRF Group.

One channel in the group is called the home site channel. The home site channel is the default transmit channel for the group when a MRF Group is in vote/steer mode (see below). The system reverts back to the home site channel after a period of voting inactivity.

There are two types of MRF Groups. A simulcast MRF Group uses multiple transmitters tied together and controlled by a simulcast controller. Simulcast controller systems are manufactured by other companies and are not provided by Moducom. A single channel within the group is designated as the simulcast controller channel. The simulcast controller channel connects to the simulcast controller system. The simulcast controller channel of a simulcast MRF Group is a transmit-only channel and does not participate in voting. The second type of MRF Group is called a vote/steer group. A vote/steer MRF Group does not contain a simulcast controller channel. The vote/steer MRF Group transmits on the steered-to channel of the currently voted member channel or the home site channel. A simulcast MRF Group may operate in either simulcast mode or vote/steer mode.

Channels are broken into three logical classifications when using MRF Groups and the voting subsystem. Primary channels are member channels of an MRF Group. Secondary channels are transmit/receive channels that do not belong to an MRF Group. Monitor channels are receive only channels.

There are several changes to the standard button function operations that must be clearly understood in order to design the system screens. The following subsections describe these changes.

Voting Controls

Voting is an automatic process conducted by the member channels of an MRF Group when they detect a receive event. Voting restarts for each receive event. A channel's voted status on previous receive events does not affect the outcome of voting for subsequent receive events. Voting is a free-running process. This

means that the voted channel can change during the receive event as the audio quality of the member channels changes.

Operators can over-ride or influence the operation of the voting process by using a button control called the MRF Voter Control button. Changes made to the voting operations are global operations. This means that changes made to a MRF Group by one operator position will be seen by all operator positions in the system that are using that MRF Group.

The MRF Voter Control button can be programmed to perform one of three voter control functions. These functions are Normal, Disable and Force. To change the voting operation of a member channel, the operator clicks on a MRF Voter Control button and then clicks on the Channel Cell button of the MRF Group member channel.

When a member channel is in normal mode it participates in voting and may become the voted channel if it has the best quality audio.

When the operator puts a single member channel in Forced Vote mode that channel's receive audio will always be the voted audio. If another member channel was in forced vote mode then that channel will revert back to normal mode. Forcing a channel to vote only affects the receive audio, it does not affect the currently steered-to channel for the MRF Group.

When the operator puts a single member channel in Disabled mode then that channel will not participate in voting and it will mute its un-voted audio. A member channel will remain disabled until the operator places it in normal mode or changes that channel to the force voted channel.

Transmitter Steering

When a MRF Group is in simulcast mode the simulcast controller channel performs all transmit operations for the group.

When a MRF Group is in vote/steer mode the system automatically selects the transmit channel for the group based upon the currently voted member channel. This process is called transmitter steering. Each member channel has a channel assigned to it called the steered-to channel. This is the channel that will be the transmit channel for the group when that member channel is currently voted.

After a period of voting inactivity the system changes the steered-to channel back to the home site channel for the MRF Group. The "Vote Timeout Interval" setting in the MRF Group Setup dialog controls how long the system will wait before switching back to the home site transmitter.

Operators can over-ride transmitter steering by placing a vote/steer MRF Group in Force Steer mode. The MRF Force Steer button allows the operator to switch between free steering and forced steering mode. When the operator changes to forced steering mode he selects one of the member channels to be the steered-to channel. The steered-to channel will not change until an operator changes it while in forced steering mode or switches the MRF Group back to free steering mode.

Changing the steering mode of a MRF Group does not affect receive audio.

Select/Un-Select for MRF Groups

Operators can select a MRF Group as they would select any standard radio channel. When a MRF Group is selected via its MRF Group Cell button, the voted audio for that group is routed to the select (primary) speaker (or radio headset) at full channel volume. When the operator performs a Push To Talk (PTT) operation, the system transmits on the currently steered-to channel of the selected MRF Group.

When a primary member channel is selected, the voted audio of the MRF Group it belongs to is routed to the select (primary) speaker at full channel volume. A PTT operation will transmit on the currently selected

primary member channel. When a primary member channel is un-selected, the voted audio of the MRF Group it belongs to is routed to the un-select (secondary) speaker at full channel volume.

Operators can simul-select MRF Groups, secondary, monitor (receive-only) and primary member channels. Operators can also select primary channels from different MRF Groups as well as any combinations of primary channels, secondary channels and monitor channels. It is not possible to simul-select a MRF Group and a member channel of that group.

Mute Operation

It is possible to mute an entire MRF Group or a member channel of a MRF Group. The operator can mute a MRF Group by pressing Mute button and then pressing a MRF Group Cell button. Muting a MRF Group mutes the voted audio for that group. The un-voted audio level of the member channels is not affected.

When the operator mutes a MRF Group member channel the system only mutes the un-voted audio of that member channel. The member channel's audio is heard if it is the voted channel.

Patch Operation

If a MRF Group is in simulcast mode it is possible to add the MRF Group to a radio patch group. If a MRF Group is in vote/steer mode it is possible to add individual member channels of the group to a radio patch group.

The following list describes the rules for patching MRF Groups and primary channels.

1. It is not possible add a MRF Group that is in vote/steer mode to a patch.
2. It is not possible to add individual member channels to a patch if the MRF Group is in vote/simulcast mode.
3. If a MRF Group is in simulcast mode and belongs to a patch, that group is automatically removed from the patch when it is switched to vote/steer mode.
4. It is possible to add individual member channels of a MRF Group to a patch if that group is in vote/steer mode.
5. It is not possible to add the simulcast controller channel of a MRF Group to a patch group even if the MRF Group is in vote/steer mode.
6. If a MRF Group is in vote/steer mode and has member channels that belong to patch groups, then the software removes those member channels from their patch groups when the operator switches the MRF Group to simulcast mode.
7. It is not possible to add a MRF Group to a patch group if that MRF Group is currently in Self Repeat mode.

Self Repeat

When a simulcast MRF Group is in simulcast mode that group can be set to self repeat mode. In this mode the simulcast controller channel will automatically re-transmit the voted audio for the group during receive events. The MRF Group Repeat button can be used to turn self repeat on or off for a simulcast MRF Group.

If a MRF Group is in vote/steer mode then individual member channels can be put in self repeat mode with the Self Repeat button function. When a member channel is in self repeat, it re-transmits the voted audio for the MRF Group (not its own receive audio) during receive events for the entire group. Note that the member channel may transmit even through it is not actually receiving (voting).

Ultra-Com System Programming Manual

The following options in the Functions tab of the Transmit Receive Card Setup dialog must be enabled for a member channel or the simulcast controller channel of a MRF Group to operate in self repeat mode.

1. 4 Wire
2. Self Repeat
3. Full Duplex

Recommended Settings for MRF Group Member Channels

The following table lists a subset of the main controls for MRF Groups. See the section entitled “MRF Group and MRF Group Voting Functions” for a complete list of functions related to MRF Groups. The following list is the minimum set of screen controls required for MRF Group and voting operations.

Button Function	Description
MRF Group Cell	The MRF Group Cell is the main control for a MRF Group. This button allows the operator to view the current status of a MRF Group, select the group, mute the audio for the group or transmit to the group.
Channel Cell	The standard Channel Cell button is used to control individual member channels.
MRF Voter Status	This is a status indicator button that shows the current voting status of a member channel of a MRF Group. The status indications are: Normal, Disabled, Fail, Voted and Forced.
MRF Voter Control	The MRF Voter Control button allows you to set the state of a member channel of a MRF Group to normal, forced or disabled. This button can be programmed to set a member channel to one of these states. In normal mode the member channel participates in the voting process. In forced mode the member channel is always the voted channel and other member channels do not vote. In disabled mode, the member channel does not participate in voting.
MRF Simulcast/Steer Mode	This button allows the operator to switch a simulcast MRF Group between simulcast mode and vote/steer mode. This button does not function for vote/steer only MRF Groups.

Use Channel Cell buttons for each member channel of a MRF Group. Group the Channel Cells for member channels of MRF Groups near the MRF Group Cell for the group.

Use a Voter Status indicator for each member channel and place the button near the Channel Cell assigned to each member channel.

Disable the Call Light in the Transmit Receive Setup → Functions tab for each MRF Group member channel. You do not need the individual call light indications for member channels of MRF Groups because the Voter Status buttons indicate when the member channel is receiving and the MRF Group Cell indicates the call light status for the entire group.

Do not use the receive side of channels that are used for the simulcast controller channel for a vote/simulcast MRF Group because simulcast controller channels do not participate in voting.

Set the Default Speaker selection to Aux. 1 (or some other auxiliary speaker) for member channels of a MRF Group and provide a speaker for the un-voted channel audio. This will allow operators to control the speaker volume for un-voted audio independently of the voted audio presented on the select (primary) and un-select (secondary) speakers.

If a dispatch system has a combination of vote/steer and vote/simulcast MRF Groups, then its best to enable the mode display for the MRF Group Cell button for all MRF Group Cells by checking the Enable Mode Display check box in the button settings. This will ensure that all MRF Group Cell buttons will use the same font size and ensure consistency in their appearance.

Ultra-Com System Programming Manual

MRF Voter Control buttons for Normal, Disable and Force should be programmed for Channel Cell Control operation and placed on a common screen. This saves a lot of screen space because if you program the voter control buttons for each member channel you will need three additional buttons per member channel.

Individual channel volume controls for MRF Group member channels control only the un-voted audio for the channel. The un-voted audio is normally routed to an auxiliary (monitor) speaker. Individual channel volume controls may be used for the member channels of MRF Groups but be aware that an un-voted channel volume control (i.e. a MRF Volume Control programmed to control un-voted volumes) will override all individual channel volume controls.