INTEROPERABILITY NOW

Field Optimization Guide

RSP-Z2

Dual Channel Analog-IP Interface

Designed and Manufactured by:

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1 General

This guide is an adjunct to the Installation and Maintenance guide and assumes that the information there was used for basic understanding of the various configuration settings options as well as for basic set up. The purpose of this Field Optimization Guide is to assist with the adjustments and "tweaks" of the analog for best performance with the varying radio systems encountered in the field.

There are several paths to optimization, based on the following. Most important is:

- Are you using a JPS Custom Radio Interface Cable or creating your own interface cable?

Of lesser importance:

- Are you able to locate a JPS Channel Profile within the RSP-Z2 that corresponds to the type of radio being interfaced?
- Are you also using one of the Plantronics USB Headsets certified for operation with the RSP-Z2? See *Table 1-4 – Optional Equipment - Not Supplied* in the Installation and Operations Guide.

Some explanation of these options/paths:

The ***JPS Custom Radio Interface Cables*** were designed by JPS Systems Engineers who investigated the radio's analog interfaces, then designed an appropriate interface between the radio and the JPS equipment, and verified it in the lab. Some interfaces are simple, others not so. Some require DC blocking capacitors or unusual level-setting networks. The JPS cables include a small circuit board that contains every type of matching/interface network ever required while interfacing hundreds of different radio makes & models.

Along with each JPS radio interface cable is an Applications Note specific to the type or types of radios associated with that cable. The Application Note lists the basic settings to optimize the interface within the JPS equipment in tandem with the cable. Just as importantly, it lists any radio programming, or switch/level settings required at the radio for proper operation. It is always the best option for interfacing a radio to the RSP-Z2 or other JPS equipment.

The ***JPS Channel Profiles*** speed this process by automatically setting the RSP-Z2's radio interface configuration options to those listed in the Application Notes that accompany the cable. These settings are only correct when using the JPS cable. Note: Users can also create & save their own profiles.

A ***USB Headset*** can be helpful because it can be used when setting up any other interface – a known good interface (the headset) to a (yet unproven) interface. For example, assume there a problem is encountered when interfacing a pair of radios to the RSP-Z2, or interfacing a radio to an RoIP backhaul channel. Use of the headset, connected individually to each of the channels in turn, will quickly identify the problematic channel. Best is to initially set up and optimize each channel while it's connected to just the headset – and only then connect the other two (now fully proven) channels to each other.

It's easy to see how the headset can help, particularly if difficulties are experienced, but it is certainly not required.

2 Radio Interface Using JPS Custom Radio Cables

This section will assume that a JPS radio interface cable is used. See the next section if not.

The cable should easily connect to the radio; many are built by splicing a cable manufactured for the specific radio to the appropriate signal lines on the JPS cable.

Follow the instructions of the Application Notes that came with the cable. If the notes are missing, simply download a new set from the JPS Interoperability Solutions website. Included in the Application Notes are:

- Configuration settings for the Radio Channel, optimized for the JPS Cable when used with the associated radio. Note that Applications Notes were created for use with a variety of JPS gateways; pay attention only to the configuration settings available on the RSP-Z2 Radio Channel Settings Page.
- Changes that may be required or suggested for the radio itself; either in its configuration or programming.

If you apply the Channel Profile for the radio, the profile will automatically apply the appropriate configuration settings.

Next step is to take care of optimization and/or settings that must be set in the field. Most of the following are best accomplished using a test count from another radio that's communication with the donor radio cabled to the RSP-Z2. Listen in a USB headset or to another device cross-connected via the RSP-Z2 with the donor radio.

2.1 RX Audio Level (Receive Input):

Some minor adjustment may be required, mainly due to radio-to-radio variations. A way to make sure the level is correct is to:

- Associate the RSP-Z2 Front Panel Level meter with the donor radio interface.
- Use a second radio to communicate with the donor radio. Speak into the microphone of that radio in a normal voice level. The RSP-Z2 level meter should flash its red (top) LEDs occasionally on voice peaks. Adjust if it never or constantly flashes red.
- Note: The Receive Input levels in the RSP-Z2 GUI indicate the actual level of audio being received. If the incoming level is -12 dBm, the Receive Input setting of the Radio Channel should be set to -12dB. This must be understood to know which way to change the audio level for proper operation. If the Radio Channel, when set to -12 dB, is not receiving enough audio, the number in the GUI must be set to a lower number to correspond to the actual input level. The RSP-Z2 will then apply additional gain/reduced attenuation

2.2 TX Audio Level (Transmit Gain):

Set to properly modulate the donor radio transmitter. Audio coming from the donor radio, when doing a normal voice volume radio count, should be heard in the field radio at the same level as received conversations from other radios in the system (as heard in the field radio).

- If you have a headset, cross-connect it with the radio interface so that speaking into the headset causes the donor radio to transmit.

- If you do not have a headset, the you will need to cross connect another channel that has its RX audio level properly set up (the second radio channel, or a backhaul channel.

Note: Doing the RX level adjustment before setting the TX audio level (or using a headset) and verifying it via the level meter will help prevent a mutually-erroneous condition where a too-low RX audio input is compensated by a too-high TX audio input on a cross-connected channel. This condition is particularly troubling whenever a third interface is introduced to the system – its incoming audio will be too low for one of the mutually erroneous interfaces and too high for the other.

2.3 VOX or VMR threshold:

Either threshold may benefit from optimization (either more or less sensitive) due to system variations or user preferences. More sensitive means less audio level (VOX) or characteristics related to human speech (VMR) must be detected for the incoming audio to be declared valid. Less sensitive is of course the opposite. Increased sensitivity makes it more likely that falsing (declaring the input valid when it is not) will occur; decreased sensitivity increases the potential that valid speech may be missed. Changes may be desired due to level of static on the channel, quiet talkers, or desire to never miss any audio, even if some falsing occurs.

2.4 Transmit Audio Delay

If the donor radio is used with a trunked radio system, it may be necessary to adjust the TX audio delay. If initial syllables are missing in the RX audio of the field radio (when listening to transmissions from the RSP-Z2/donor radio) increase the TX audio delay of RSP-Z2 analog interface connected to that donor radio.

Explanation: When a radio user initiates a transmit sequence for a trunked radio, that user depresses the PTT switch on the radio, which sends a signal to the system's trunking controller, asking to be assigned to a free (not currently busy) channel. The trunking controller sends a signal back to the user's radio that automatically sets the radio to a free channel, and signals this to the radio user by tone called a *channel acquisition tone* or simply a *go-ahead* tone. The trunked system radio user is trained to not begin talking until this tone is heard.

Unfortunately, this tone can't be heard by users on other systems that are cross-connected by the RSP-Z2 to the trunked radio system. They simply begin talking, if n a non-radio device, or if using a non-trunked radio, they simply press PTT and begin talking. TX audio delay on the donor trunked radio channel holds up the audio, storing it in a buffer, until enough time has gone by for a typical channel acquisition time to have elapsed. See Section 1 of the Operations and Installation manual for a more complete explanation, including diagrams.

This test is best done when talking into a USB headset that is cross-connected with the radio interface. The reason is that use of the headset precludes any chance that any audio is missing initial syllables *before* being sent to the donor radio to be transmitted to the trunking system.

RX Audio Delay must be increased if initial syllables are clipped on incoming audio of a Radio Channel; see below. If you are using a cross-connected radio channel instead of a headset, and additional increases in TX Audio Delay have no effect on missed first syllables in the field radio, then it may be necessary to increase the RX Audio Delay in that cross-connected Radio Channel. An uncommon but possible condition.

2.5 RX Audio Delay

Delay in the RX audio occurs by processing the COR detection immediately, but holding the incoming audio in a buffer and spooling it out after the set delay time. This resolves the (uncommon) condition for a Radio Channel where the COR indication or detection occurs late and initial incoming syllables are therefore clipped.

The RSP-Z2 Radio Channel interfaces are designed to prevent this as well a practical, through proper design of the various COR Detection algorithms and by including a minimum 100ms RX Audio Delay, but additional delay can be added if needed.

2.6 Audio Levels and Delays for Transport Channels

There are no associated configuration options for RX or TX level settings, or to change RX or TX audio delays for the digital transport channels – RoIP, SIP, RTP, VIA. These channels send the digital representation of the audio signal at whatever level it was in the sending (TX) side. Modifying the levels or delays is done at the audio input or output channels.

For example, if a pair of RSP-Z2s is used to connect radios via IP that are on opposite sides of the world, if the RX input of each radio is correct, the level received by the distant radio on the other side of the RoIP link will be correct

3 Radio Interface Using Customer-Designed Radio Cables

For customers who plan to create their own radio interface cables, JPS strongly recommends using the Unterminated Radio Cable, JPS P/N 5961-291115. This shielded cable includes the D15 end of the cable that plugs into either of the RSP-Z2 analog ports, along with the small PCB that's in other JPS cables – this circuitry has a variety of variable attenuating, terminating and DC-blocking components; essentially everything that JPS Systems Engineers have deemed necessary to interface any of the several hundred types of radios they have created custom cables for. This seven-pin cable is unterminated on the radio side, allowing radio specific portion of the cable to be spliced on.

The Application Notes for this cable, available for download like all other JPS Custom Radio Cables Application Notes, contains information to help in the cable design and, in particular, explains how to determine which of the various configuration options is best (e.g. how to decide how to choose between the COR options of VOX, VMR, or Hardware COR?).

This useful information will not be repeated in this document.

Note: Older versions of the Unterminated Radio Cable Application Notes relate to its use with the ACU-1000 or ACU-T gateways. All relevant information applies also to the RSP-Z2.

4 Radio Interface Troubleshooting Tips

4.1 Symptom: User in Field Complains of Missed First Syllables

Cause: Donor radio is trunked, need to compensate for Channel Acquisition Delay

Cause: Slow-to-key transmitter on donor radio

Cause: Secure donor radio, need to compensate for encryption or scrambling

Solution: Increase TRANSMIT AUDIO DELAY of the RSP-Z2 Radio Channel supporting the donor radio

4.2 Symptom: User in Field Complains of Missed Syllables Mid-Conversation

Cause: Dropout from Radio Channel using VOX or VMR COR Detection Type

Solution: Increase VOX or VMR HANGTIME of the Radio Channel supporting the donor radio

Solution: Increase VOX or VMR THRESHOLD of the Radio Channel supporting the donor radio

4.3 Symptom: Continuous Ping-Pong of COR / PTT between Cross Connected Radios

Cause: "Ping-Pong" is caused by the tendency of some radios to temporarily unsquelch at the end of a transmit sequence. This momentary Active COR condition in a donor radio (Radio 1) will cause a momentary transmit sequence in any devices that are cross-connected to that donor radio. If one of the cross-connected devices is another donor radio (Radio 2) with the same "momentary unsquelch at the end of a transmit sequence, then the Radio 1 momentary unsquelch keys Radio 2, whose resulting momentary unsquelch keys radio one in a continuing sequence.

Solution: Change COR DETECTION TYPE to VMR

4.4 Symptom: False Keying of Donor Radio by Radio Channel

Cause: Extraneous RFI emissions present at frequency/level that keys a donor radio

Solution: Eliminate RFI emission source

Solution: Transit power of other, nearby donor radios may be excessive, so if possible. reduce to just enough to link to repeater

Solution: Modify antenna placement

Solution: Change COR DETECTION TYPE to VMR

4.5 Symptom: Radio Channel Experiencing Continuous Active COR State

Cause: Donor radio is introducing continuous noise to Radio Channel

Cause: Donor radio is an unsquelchable Amplitude Modulated receiver (i.e. HF, aircraft radio, etc.)

Solution: Change COR DETECTION TYPE to VMR

4.6 Symptom: Audio Sounds Too Weak

Cause: Received audio level from donor radio (or other device type) is too low; verify using RSP-Z2 front panel Level meter.

Solution: Change RECEIVE INPUT audio setting of the receiving Radio Channel (or other type of channel) until RSP-Z2 front panel Level meter red LEDs flicker with voice peaks of incoming speech. Note: The number in the RSP-Z2 GUI indicates the actual level of audio being received. If the incoming level is -12 dBm, the Receive Input setting of the Radio Channel should be set to -12dB. This must be understood to know which way to change the audio level for proper operation. If the Radio Channel, when set to -12 dB, is not receiving enough audio, the number in the GUI must be set to a lower number to correspond to the actual input level. The RSP-Z2 will then apply additional gain/reduced attenuation.

Cause: Transmit audio level delivered to donor radio is too low (verify/rectify cause above first!)

Solution: Increase TRANSMIT GAIN of transmitting Radio Channel until donor radio is properly modulated.

4.7 Symptom: Audio Sounds Too Loud or Distorted

Cause: Receive audio level from donor radio (or other device) is too high.

Solution: Change RECEIVE INPUT audio setting of the receiving Radio Channel (or other type of channel) until RSP-Z2 front panel Level meter red LEDs only flicker with voice peaks of incoming speech; not on at all times when speech is being received. Note: The number in the RSP-Z2 GUI indicates the actual level of audio being received. If the incoming level is -12 dBm, the Receive Input setting of the Radio Channel should be set to -12dB. This must be understood to know which way to change the audio level for proper operation. If the Radio Channel, when set to -12 dB, is receiving too much audio, the number in the GUI must be set to a higher number to correspond to the actual input level. The RSP-Z2 will then apply less gain/more attenuation.

Cause: Transmit audio level delivered to donor radio too high (verify/rectify cause above first!)

Solution: Lower the TRANSMIT GAIN of transmitting Radio Channel until donor radio is properly modulated.

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