

INTEROPERABILITY NOW

Field Optimization Guide

NXU-2B Network Extension Unit



Designed and Manufactured by:

JPS Interoperability Solutions

5800 Departure Drive

Raleigh, NC 27616

919-790-1011

Email: sales@ipsinterop.com / support@ipsinterop.com

www.ipsinterop.com

1 General

This guide is an adjunct to the NXU-2B Manual 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 and communications systems encountered in the field.

There are several paths to optimization, most important is:

- Are you using a JPS Custom Radio Interface Cable (strongly recommended)?
- Are you creating your own interface cable?

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, including verification 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 required for the interfaces to 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/jumper plug settings required at the radio for proper operation. JPS cables are always the best option for interfacing a radio to the NXU-2B or other JPS equipment.

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, request a new set from JPS Customer Service at support@jpsinterop.com or (919) 790-1011.

Included in the Application Notes are:

- Configuration settings for the rear analog interface, optimized for the JPS Cable when used with the associated radio or other communications device. Note that Applications Notes were created for use with a variety of JPS gateways; pay attention only to the configuration settings available on the NXU-2B Configuration Page.
- Changes that may be required or suggested for the radio itself; either in its configuration or programming.

Next step is to take care of optimization and/or settings that must be adjusted in the field. Most of the following are best accomplished using a test count from a “companion radio” that’s in communication with the donor radio cabled to the NXU-2B.

Note: If replacing an NXU-2A with a new NXU-2B, be sure to remove the audio crossover adapter at the rear panel AUDIO/CONTROL connector (assuming one is currently being used). This adapter is not needed when using a JPS Radio Interface Cable with an NXU-2B; the unit will not function properly with it .

2.1 RX Audio Input Level

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

- Use a companion radio to communicate with the donor radio, speaking into the microphone in a voice level consistent with standard usage. The Audio Input LED should flash with voice peaks. Adjust if it never or constantly flashes.
- Note: The RX (receive) input level values on the NXU-2B Configuration page indicate the actual level of audio being received. If the incoming level is -12 dBm, the Receive Input Level should be set to -12dB. This must be understood to know which way to change the audio level for proper operation. If the NXU-2B, when set to -12 dB, is not receiving enough audio, the value must be set to a lower number to correspond to the actual input level. The NXU-2B will then apply additional gain/reduced attenuation.

2.2 TX Audio Output Level

The TX (transmit) output level should be 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 companion radio at the same level as received conversations from other radios in the system (as heard in the companion radio).

Note: Doing the RX level adjustment before setting the TX audio level and verifying it 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 worsened 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/VMR Sensitivity

The VOX threshold may benefit from optimization (either more or less sensitive) due to system variations or user preferences. More sensitive means less audio level 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 TX Audio Delay

If the donor radio is used with a trunked radio system, it may be necessary to adjust the TX (transmit) Audio Delay. If initial syllables are missing in the RX audio of the field radio (when

listening to transmissions from the NXU-2B/donor radio) increase the TX delay of NXU-2B 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.

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 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 NXU-2B is designed to prevent this as well as practical, through proper design of the various COR Detection algorithms and by including a minimum RX Audio Delay for VOX & VMR modes, but additional delay can be added if needed.

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 directly into the NXU-2B rear analog port, along with the small PCB found 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, 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 NXU-2B.

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 delay

Solution: Increase TX DELAY

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/VMR HANGTIME

Alternative Solution: Decrease VOX/VMR SENSITIVITY (make it more sensitive)

Alternative Solution: Verify that RX audio level is sufficiently high – a talker at normal level should cause flashing of the Audio Input LED with voice peaks.

4.3 *Symptom: User in Field Complains of Dropped Audio (not necessarily always initial or mid-conversation)*

Cause: Radio Channel not always activating VOX or VMR COR Detection Type when it should

Solution: Decrease VOX/VMR SENSITIVITY (make it more sensitive)

Alternative Solution: Verify that RX audio level is sufficiently high – a talker at normal level should cause flashing of the Audio Input LED with voice peaks.

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

Cause: ‘Ping-Pong’ is caused by the tendency of some radios to temporarily unscquelch at the end of a transmit sequence. This momentary Active COR condition in a donor radio 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 with the same ‘momentary unscquelch at the end of a transmit sequence’, then the Radio 1 momentary unscquelch will key Radio 2, whose resulting momentary unscquelch keys Radio 1 in a continuing sequence.

Solution: Use the COR INHIBIT (after PTT) TIME function to make the receiving NXU-2B ignore an incoming Active COR signal for a short time after the channel ends a PTT session. Watch the Channel Active LED on the NXU-2B panel and increase the COR Inhibit time until the Channel Active LED no longer flashes at the cessation of PTT.

Alternative Solution: Change COR SENSE to VMR

4.5 *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

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

Alternative Solution: Modify antenna placement

Alternative Solution: Change COR SENSE to VMR

4.6 Symptom: Radio Channel Experiencing Continuous Active COR State

Cause: Donor radio is introducing continuous noise

Cause: Donor radio is non-FM type, without the quieting characteristic of a frequency modulated signal. These are most likely Amplitude Modulated radios, such as commonly used by aircraft, or HF/single side band radios. They typically lack a Hardware COR output and high noise level causes VOX to false on the noise.

Solution: Change COR SENSE to VMR

4.7 Symptom: Audio Sounds Too Weak

Cause: Received audio level from donor radio (or other device type) is too low

Solution: Lower RX INPUT LEVEL until NXU-2B Audio Input LED flashes with voice peaks

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

Solution: Increase TX OUTPUT LEVEL until donor radio is properly modulated.

4.8 Symptom: Audio Sounds Too Loud or Distorted

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

Solution: Increase RX INPUT LEVEL until NXU-2B Audio Input LED flashes with voice peaks

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

Solution: Lower TX OUTPUT LEVEL until donor radio is properly modulated.

End of Document