Radio Modem Recommendations for the NXIC Series

Currently the data downloads capabilities of the NXIC do not fully support packetized radio transmissions. The main issue is the NXIC has no flow control capabilities. A NXIC download is done as a continuous stream of data, with no flow control and no error checking, and this can be a problem for long downloads over a radio link where transmission errors and subsequent link delays are common.

Typically radio modems break the data stream into discrete blocks or packets and add error checking, radio address and synchronization information. All these extras are removed at the receiving end and only the original data is delivered. If there is an error detected then the radio requests the packet again. This is repeated until the packet is received correctly or a link failure is declared. The radio modem transmitter has a **First In First Out** or **FIFO** data buffer where it can store new data as it comes in from the user while the outgoing packet of previous data is being transmitted. When the previous data is transmitted successfully a new block of data is taken from this buffer and processed for the next transmission. Only the amount of data that can fit into a packet is removed from the buffer – if there is more than one packet worth the remaining data stays in the buffer until the packet is successfully sent and the next packet is to be assembled.

All this breaking up the data into blocks and packetizing takes time, as well as the possibility of retries on errors, so it is possible that new data coming into the buffer will have no place to go and the buffer will then overflow and data will be lost. This is what is normally handled by handshaking, where the radio modem would tell the data device to stop sending data because the buffer is full. This mechanism for shutting off the data flow does not exist on the NXIC, so buffer overflow and subsequent data loss is a real possibility.

The radio link can be viewed as three sections: the connection between the sender or data originator and the modem, the modem-to-modem link, and the connection between the data receiver end and the PC. Each of these links in the serial data chain are independent communication channels and can run at their own baud rates and have their own handshaking. It is possible for the device to transmit modem to have a 1200 baud no handshaking, the over the air modem to modem baud of 19.2K, and the receiver to PC have a baud of 9600. The over the air baud is usually not changeable and is often the limiting factor. This leads to the first recommendation for the NXIC and the first corollary:

Without Flow control the data transmitter baud rate should always be less than the over the air baud rate. Corollary: Use a radio modem with the highest over the air baud rate practical.

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The data written into the buffer needs to come in at a slower baud rate than the over the air baud rate so that the radio to radio data has time to complete transmission over the air and be verified before the new incoming data overflows the buffer. As another corollary to the above:

The modem's packet size should be smaller than the modem's input buffer.

This will give the radio time to transmit a complete packet before the buffer fills with the newest data. For example: the buffer size is fixed at 1024 bytes and the packet size is set to 256 bytes. The over the air baud is 19.2K and the data to modem baud is 9600, so the radio link is twice as fast if you ignore the packetizing overhead. At 1ms per character the data would fill the buffer enough for one packet in about 1/4 second. The packet should be gone is about 1/8 second, so the buffer is never more than half full. This leaves 500ms for the radio link to deal with overhead due to an occasional error.

If possible, set up an exclusive modem to modem connection

If the modem setup offers it set up an exclusive connection between the transmitter and receiver modems so that no interrupts from other radio modems will be accepted.

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