Software Specification for TPMS PIC MCU

**ACI Link:**

All numerical data sent is little endian (least significant byte first), least significant bit first.

All text data is sent left character first.

The SPI mode is commonly called “Mode 0”, and is given by the following:

|  |  |
| --- | --- |
| Data order | Least significant bit first |
| Clock polarity | Zero (base value of clock is low) |
| Clock phase | Zero (data read on rising edge) |

Big ACI Rules for the nRF8001:

- Only one system command outstanding at once, must get a CommandResponseEvent back before sending the next one.

- Only as many data commands as the buffer holds. Data command buffer size is returned in the initial DeviceStartedEvent, and when slots in the buffer are opened (commands executed and removed from buffer), one or more DataCreditEvents are sent. So the PIC has to keep track of how many credits it has. If a data command is sent without a credit available, a PipeErrorEvent is returned.

- A DataAckEvent DOES NOT grant a credit, DOES NOT allow sending another data command if buffer is full.

- After a DisconnectedEvent or DeviceStartedEvent (after sleep/wakeup or reset or disconnect/connect), no data commands can be sent until a PipeStatusEvent is received which indicates which pipes are open and signals that credits can be used for those pipes.

- No system commands can be sent after a disconnect/connect until a DeviceConnectedEvent is received.

- No system commands can be sent after a reset or sleep/wakeup until a DeviceStartedEvent is received.

- A system command will be responded to within 2 seconds maximum. If a response isn't received within 2 seconds, something is wrong, time to reset.

- Setup commands only need to be sent after a reset. After sleep/wakeup, the nRF8001 immediately enters Active mode with the setup parameters from before the sleep, it does NOT need another Setup command.

- Basically any command that isn't sending or received application data over the wireless (all but SendData, RequestData, SetLocalData, SendDataAck, SendDataNack) is a system command.

If we use advertisement packets to transmit the data, the order of ACI commands could be (TENTATIVE – thoughts?), braces around the command means optional:

PIC16LF1825 nRF8001

Wakeup ----->

<---- DeviceStartedEvent

<---- CommandResponseEvent

{GetDeviceVersion} ----->

<---- CommandResponseEvent

{GetDeviceAddress} ----->

<---- CommandResponseEvent

Setup ----->

<---- CommandResponseEvent

{Setup} ----->

<---- CommandResponseEvent

…

<---- CommandResponseEvent

<---- DeviceStartedEvent

GetTemperature ----->

<---- CommandResponseEvent

{GetBatteryLevel} ----->

<---- CommandResponseEvent

SetTxPower ----->

<---- CommandResponseEvent

SetLocalData ----->

<---- CommandResponseEvent

OpenAdvPipe ----->

<---- CommandResponseEvent

Broadcast ----->

<---- CommandResponseEvent

RadioReset ----->

<---- CommandResponseEvent

Sleep ----->

Multiple Setup commands may be necessary to upload the full bitstream. The nRF8001 “just knows” which Setup command is the last, based on the bitstream, and it will return a DeviceStartedEvent on its own after the last Setup command is received.

The bitstream can be created in nRFgo Studio, a proprietary Windows application from Nordic Semi. It's pretty simple – enter the desired settings in the GUI and click a button to create the bitstream. Then the bitstream can be split into 30-byte chunks – each chunk gets sent inside a Setup command.

PIC Register Settings

The pin-specific registers' settings are given in the “pins.xlsx” file. Here, we can put the settings that need to be used for the general purpose registers.

[TODO]