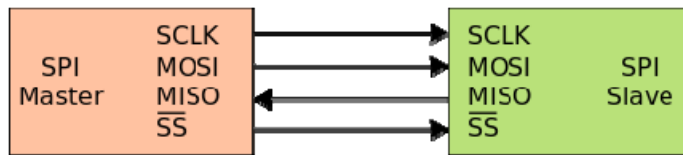


## Introduction

This application note describes how to configure your Amped RF module to transfer data using a Serial Peripheral Interface (SPI). Although SPI can have several slave devices, we will assume in this application note only one slave. This will also assume that the role of the master is filled by the Amped RF Bluetooth module.

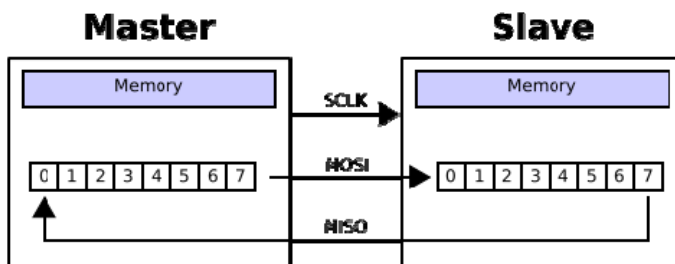
## SPI Signal Lines

The SPI protocol is a Master-Slave protocol where the speed of transfer is determined by the clock (SCLK) sent from the master. The data from the master is sent over the Master Out Slave (MOSI) line, and the data from the slave is sent over using the Master In Slave Out (MISO). The Slave Select line (SS) is used by the master to select the slave device.



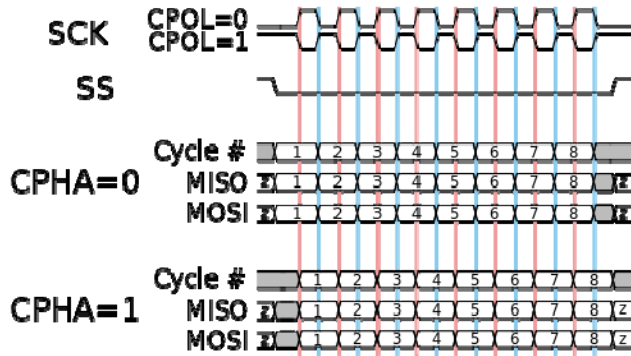
## Data Transmission

Communication between the master and slave can only occur when the slave is selected. After the slave is selected data is then transferred over the MISO and MOSI lines using the clock pulses. When data is clocked to be sent, data is transferred to AND from the master at the same time. This kind of message exchange is called full duplex.



**Clock Polarity and Phase**

In addition to the clock frequency, the master must configure the clock polarity (CPOL) and phase (CPHA). The default settings we use are CPOL=1, and CPHA=1.



**Slave Request (SREQ) for Enhanced SPI**

In a standard SPI protocol, the master controls both SCLK and SS lines, so there is no way for the slave to indicate that it has data to send. We've enhanced SPI to solve this problem by defining an SPI Slave Request line (SREQ). Enabling this line by the slave will indicate to the master that the slave has data to send. The master will then use the SS line to select the slave and pulse the clock (SCLK) until all the data sent by the slave is received by the master.

**SS and SREQ as Interrupts**

These lines may be also be configured to trigger interrupts to speed responses. The SS line may trigger an interrupt for the slave device, while the SREQ line may trigger an interrupt in the master.

**AT Commands**

By default, the abSerial AT commands will always be exchanged using the UART instead of SPI. Once a Bluetooth link has been establish and the module is in BypassMode, the SPI will be in effect. This is the default behaviour when SPI is enabled in the configuration settings:

```
var27 SPIEnable = true
var28 SPIMode   = master
```

Upon closing the Bluetooth link, the UART will once again become the serial interface.

**Typical Application**

Command mode on the Amped RF module is tuned best for UART communication, whereas SPI may be ideal for high speed data transfer. An application can take advantage of this by having the interface be in a UART mode when not connected, and switching to SPI mode when connected to transfer data. This allows easy access for configuration and control with a standard UART interface, while still able to take advantage of the high speed SPI.

Most applications using SPI to exchange data have specific formats. For example, if a message frame is defined with a size of 30 bytes, a 30 byte message can be sent and another received at the same time by taking advantage of the full duplex nature of SPI.