Cognitive Radio Demo
HL

Build cognitive radio demo prototype system with the following requirements:

1. Use Lora RF module (www.semtech.com) to establish SPI interface to your embedded system, e.g., LPC769. The pin connectivity table is given below (courtesy per CTI One Corporation, www.ctione.com).

Sx1276 SCH	LPC1769 PIN
RFI_LF(P.1)	SCK1
VR_ANA(P.2)	VIO3V3
VBAT1(P.3)	MOSI1
VR_DIG(P.4)	GND
NRESET(P.7)	SSEL1
DIO0(P.8)	MISO1
DIO2(P.10)	GPIO (P 0.2)
RFO_HF(P.22)	VIO3V3
VBAT2(P.24)	GND
GND(CON_P.32)	GND
VDD_FEM(CON_P.34)	VIO3V3

Table 1. RF module pin connectivity.

Note the SPI pin assignment for LPC1769 can be found from its schematic document, LPCXpresso1769_CD_revD.pdf, as shown below:

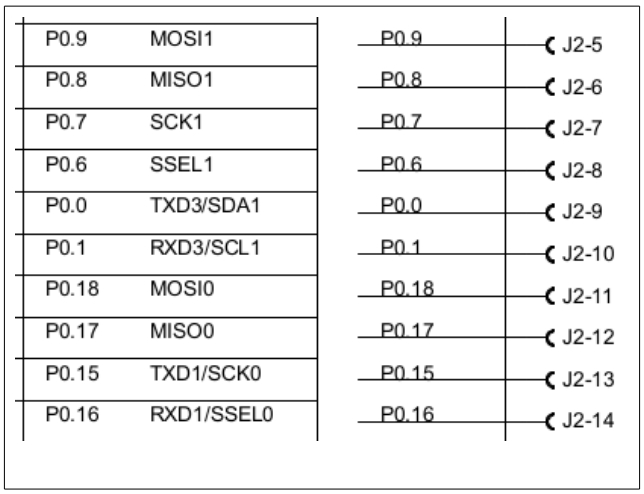

Figure 1. LPC1769's SPI pin assignment.

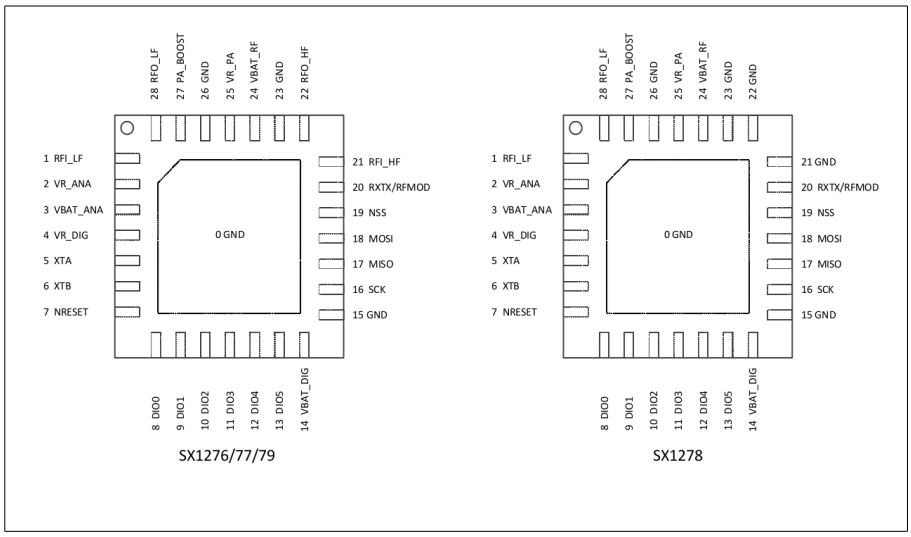

Figure 2. RF Chip pin assignment.

2. Use the sample code provided to this class to establish handshaking between 2 nodes, say, node N1 and N2. Note Lora RF module data packet format is given in the data sheet, as shown in Figure 3 below.

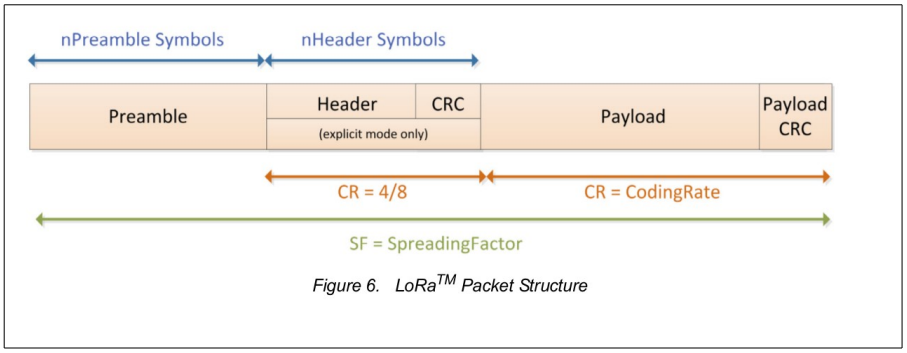

Figure 3. Lora RF module data packet, pp. 31 from the data sheet.

3. For the cognitive radio demo, you will have to fulfill the following requirements:

3.1. Identify each category of the RF communication,which can be

modify by setting control registers, such as those parameter of:

(1) FBW: Frequency band （lower frequency bands below 525

MHz, or the upper frequency bands above 779 MHz, pp. 106);

(2) WFR: Working frequency range;

(3) BWD: Bandwidth;

(4) CDR: Coding rate (bit rate settings, pp. 46);

(5) SPD: Spreading factor;

(6) FHSS: Frequency hopping spread spectrum (hoping, pp. 59);

(7) CRC: error correction and detection based technique (pp. 77)

(8) ADR: address based communication (pp. 74 and 77);

(9) SCR: scrambling (whitening, pp. 79);

(10) BCN: Beacon Tx Mode (pp. 79);

(11) PWR: Tx power (high power, pp. 84);

(12) RSSI: Relative signal strength indicator (pp. 86) ;

(13) CNL: Channel filter (pp. 88).

Read datasheet, identify and create a lish of the responsible control register(s) for each of the category mentioned above.

3.2 Develop a technique to allow the selection of proper tunable parameters in the RF communications, the general rule is to associate the cost and performance with each selected RF communication parameter, then optimize (minimize) the cost function to gain the beter or best performance.

3.3 Describe the technique with flow chart (see sample flow chart in the datasheet pp. 43, on CAD, e.g., channel action detection) and algorithm. In addition, provide state machine to describe your design implementation (see sample state machine illustration in the datasheet, pp. 64).

3.4 Addressed based communication for this Rf module (see pp. 77 datasheet) adds better performance to deal with RF modules beyond just single pair of Rx and Tx, employ this technique for your design. Choos the address per your preference, for example, your last 2 or 4 digits phone number.

4. Read datasheet, section 7, illustrate your handshaking operation with the diagram similar in Section 7 (pp. 118).

5. Write IEEE style lab report to give both hardware and software implementation details. Submit your report once the demo is ready.

(END)