1) To acquire signal through antenna

To provide enough power supply to the RFID card, the minimum coupling coefficient between antenna and card is 0.3. The inductance of antenna coil is:

$$L=2*I*\ln(1/D)*N^{1}.8$$

(L: antenna inductance, I: length of ring conductor, D: width of conductor, N: coil turns)

2) To acquire signal through transformer

The fundamental functions of transformer and antenna in the first plan are identical, except that transformer could turn wireless signal into wire signal.

3) To acquire output signal directly by wire

This method is mainly used to compare with the two other methods above.

C. Software development

The software in the system is developed in the ADS1.2 environment.

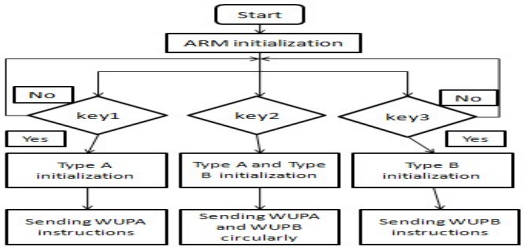

Fig. 8 software framework

As is shown in Fig.8, system initialization includes ARM register, SPI, RF chip initialization. After initialization, it would check the three keys' statuses. When the A key is pressed, interruption will be generated, the system will configure PN512 chip Type A and Type B relevant register through the SPI bus. Otherwise it will circularly send WUPA and WUPB instructions.

IV. EXPERIMENTAL RESUTLS

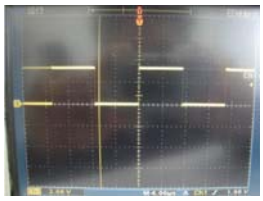

Fig. 9 (a) SPI bus signal

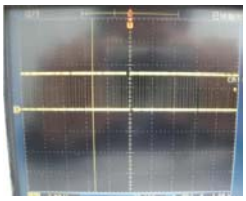

Fig.9 (b) MISO pin signal

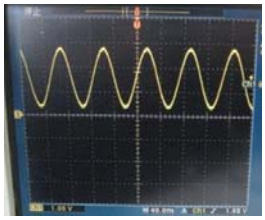

Fig. 9 (c) 13.56 MHz carrier

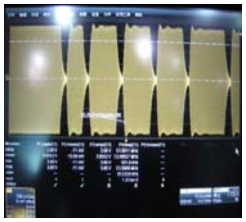

Fig. 9 (d) Type A 100% ASK modulation

We compile and run the software with ADS1.2, download it in the hardware through ISP. The results are as following: clock signal in ARM, namely SPI bus clock signal is shown in Fig. 9(a), which indicates that the crystal oscillator works successfully. MISO pin signal is displayed in Fig. 9 (b), which is the signal from ARM to PN512 chip to configure the relevant register. The configured PN512 register output 13.56MHz (displayed in Fig. 9 (c)), which is a precondition for the future signal modulation. Type A signal waveform is shown in Fig. 9 (d). According to the WUPA frame format, ARM send 0x52 (awaking instruction) to RF chip by SPI bus.

V. CONCLUSION

The paper presents an improved contactless IC card communication signal source design which is based on ISO/IEC14443 standard. PC, READER and signal acquisition unite are integrated on a circuit board of communication signal source and the test tool can be simplified and the test efficiency can be improved. By using ISP and JTAG to download software, we accomplished the communication between ARM and RF chip. Besides, we also realized the configuration of registers of Type A and Type B, WUPA frame instructions sending, sending data with antenna or transformer by PN512's modulation.

However, the stability of the system has to be enhanced. In order to make our design to a real product, we should integrate amplifier module, monitor module and etc. on a single PCB board. At last, the current system does not involve operate system due to meet our basic needs. So we should improve the development performance of our system in the future.

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