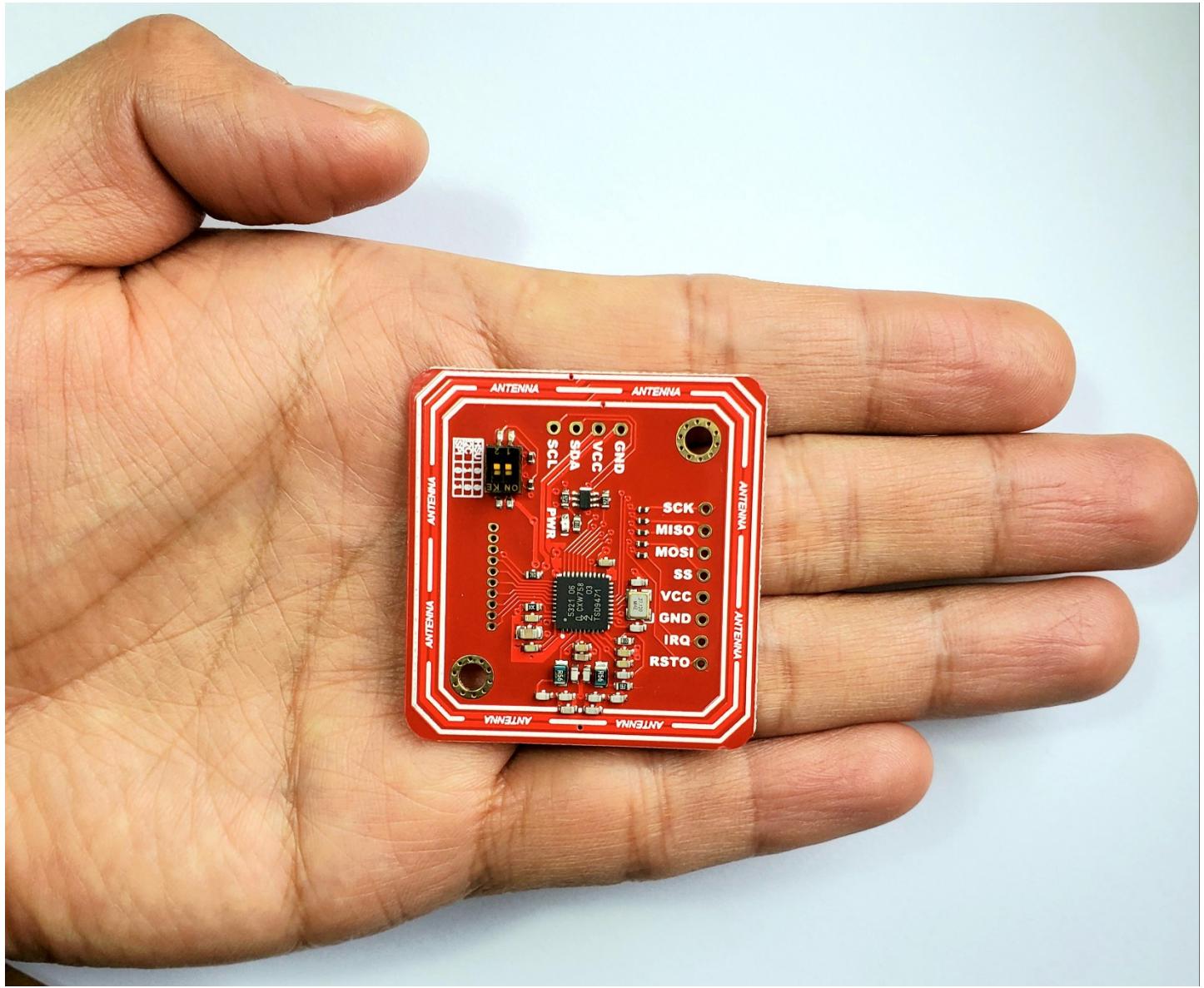


PN532 NFC RFID Module User Guide

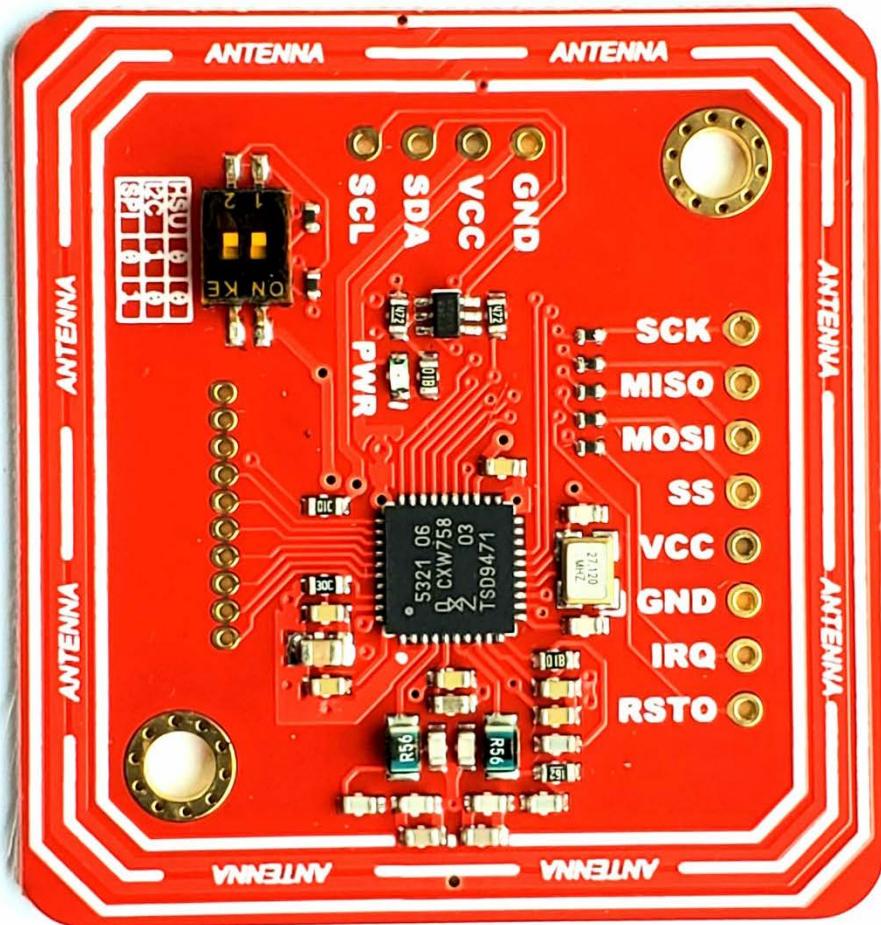
Version V4

Introduction



Near field communication (NFC) is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters.

For electronics geeks, we also want to use NFC technology to make our own things. So we build this NFC RFID module. This module is built around NXP PN532. NXP PN532 is very popular in NFC area. And the company offers much technology documents to help developers. We developed this module based on the official documents. To make things easier, we also build library for this module.



We have updated this module to version 4.

Compared with V3 have the following improvement:

Performance	PN532 NFC V3	PN532 NFC V4	Description
Reading Distance on PVC Mifare tag	5~6cm	6~8cm	Improved performance on ISO14443A tags
Reading Distance on PVC SRT512	1~2cm	2~4cm	Improved performance on ISO14443B tags

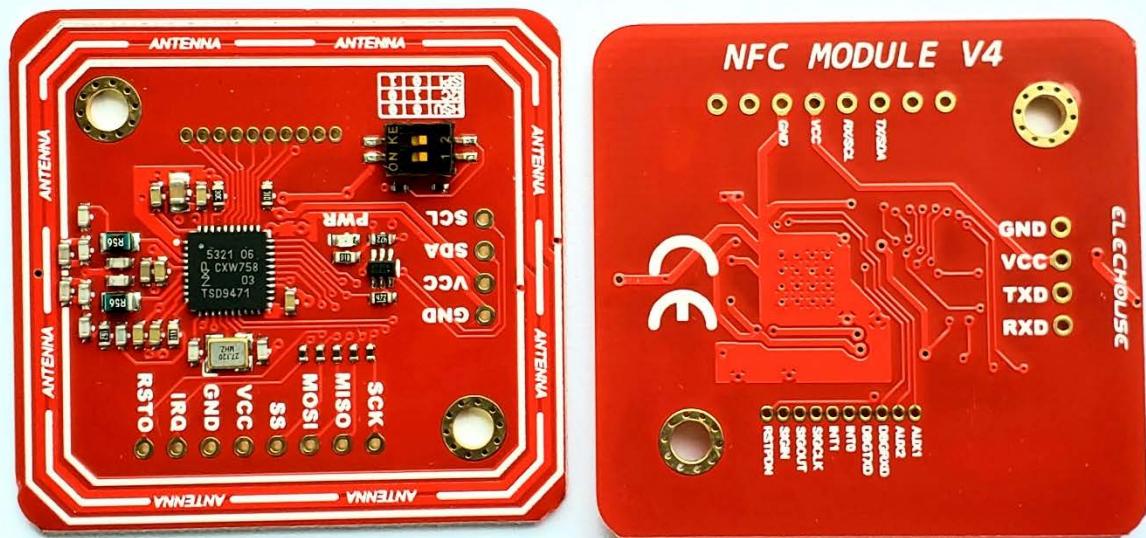
Feature

1. **Compatibility:** it is compatible with V3 both in hardware and software.
2. **Smaller:** the size now is as small as 42.7mm*40.4mm*4mm
3. **Easy to change mode:** with a small SMD toggle Switch, it becomes very easy to change among IIC, SPI and HSU modes
4. **Longer distance:** the reading distance becomes 6~8cm

5. Open source Arduino library

Features

1. Support I2C, SPI and HSU (High Speed UART)
2. RFID reader/writer mode support
 - Mifare 1k, 4k, Ultralight, and DesFire cards
 - ISO/IEC 14443-4 cards such as CD97BX, CD light, DesFire, P5CN072 (SMX)
 - Innovision Jewel cards such as IRT5001 card
 - FeliCa cards such as RCS_860 and RCS_854
3. Plug and play, Arduino compatible
4. Built in PCB Antenna, with 6cm~8cm communication distance
5. On-board level shifter, Standard 5V TTL for I2C and UART, 3.3V TTL SPI
6. Work as RFID reader/writer
7. Work as 1443-A card or a virtual card
8. Support NFC with Android phone
9. Small size: 43mm*41mm*4mm

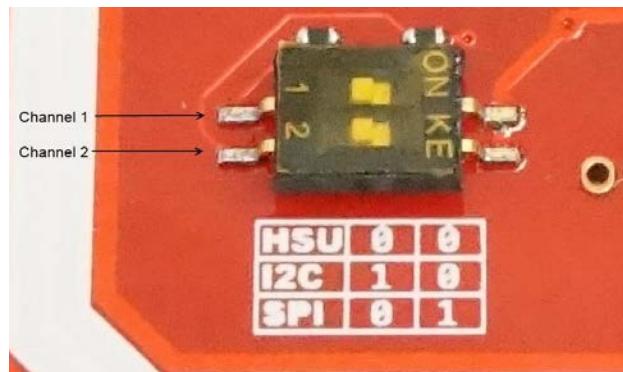


Interface

- VCC: 3.3V~5V
- Current: Max 120mA

- *I2C/UART: 3.3V~24V TTL*
- *SPI: 3.3V TTL with 100 ohm resistors in series. It could be connected directly to 5V interface of microcontroller such as Arduino.*

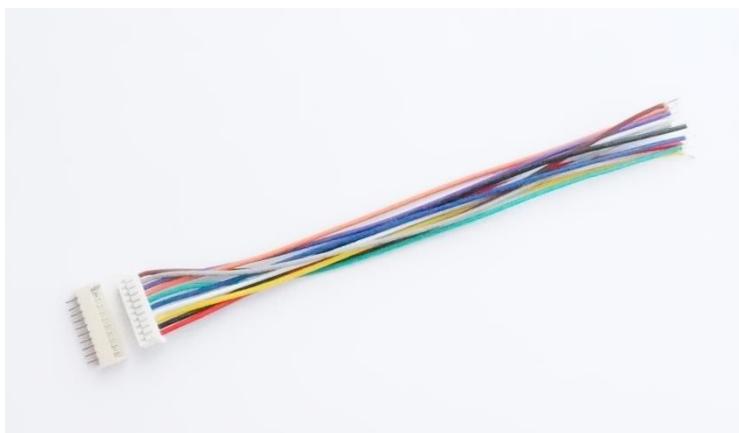
The I2C and HSU shares the same pins. The definition of IIC pins is printed at front and the HSU's is printed at the back. The HSU mode is configured as the default mode. But you could change the interface by setting the toggle switch.



The switch setting is shown as follows:

Working Interface	Channel 1	Channel 2
HSU	OFF	OFF
I2C	ON	OFF
SPI	OFF	ON

We break all the PN532 pins out. The 1.27mm connector hole contains those pins which might not be used for most users. If some developers need to connect those pins, we could supply connectors.



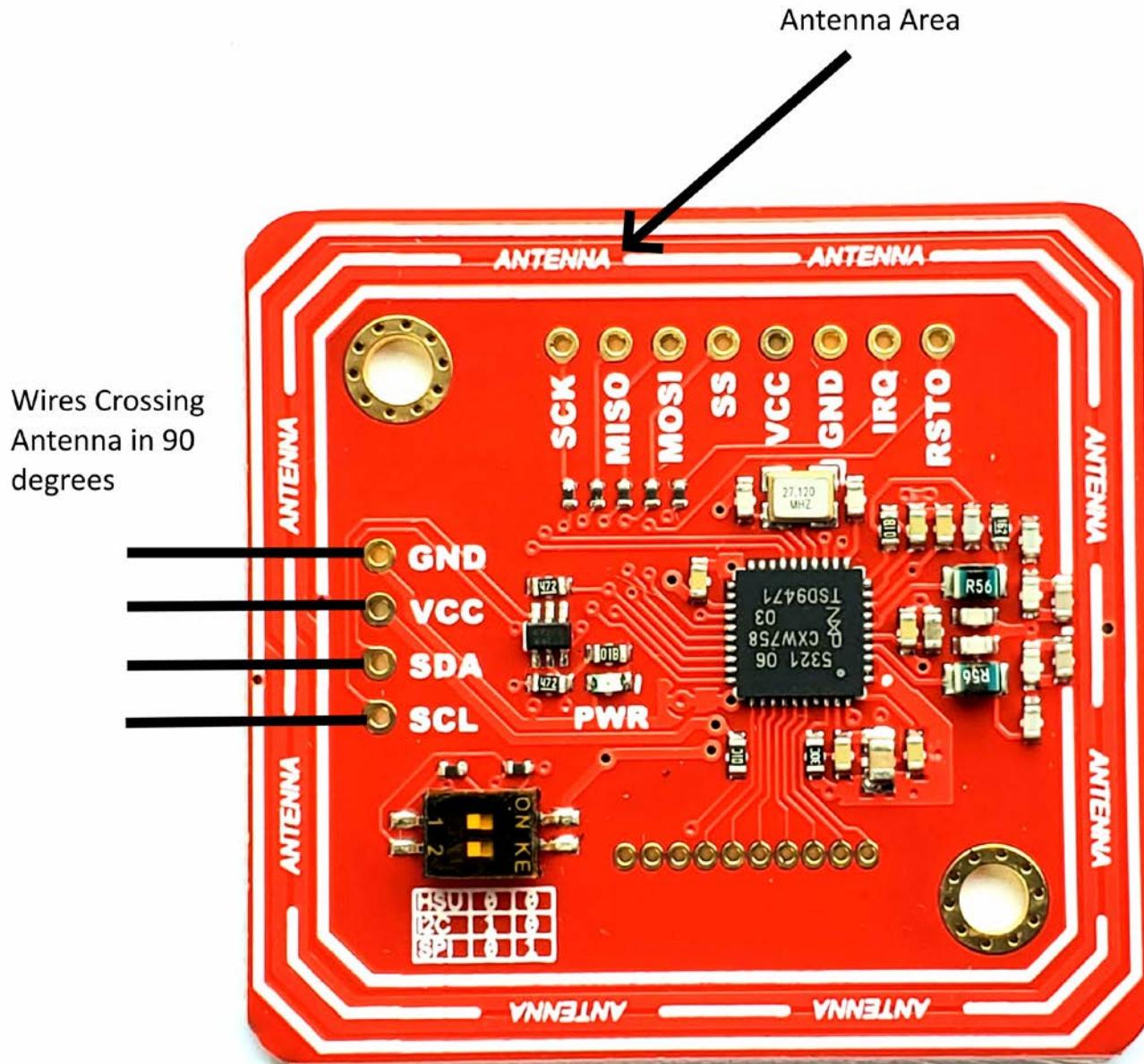
[You could find this product here.](#)

Hardware Installation

Solder the connector

The bended male pins come with the NFC board.

Some users might need soldering other types of connectors or directly solder wires on it. Anyway, make sure the wires go across the antenna lines in 90 degree.



Connect with Arduino

If without the sensor shield, please connect as following:

Mode	PN532 Module	Arduino UNO		Arduino Leonardo	Arduino Mega (2560)	Arduino Due	
Power	VCC	5V		5V	5V	5V	
	GND	GND		GND	GND	GND	
IIC/I2C Mode	SDA	A4/SDA		Pin 2 /SDA	Pin 20 /SDA	Pin 20 /SDA	
	SCL	A5/SCL		Pin 3/SCL	Pin 21/SCL	Pin 21/SCL	
HSU Mode	TXD	Pin 0	Could not present message in Serial Monitor on PC	Pin 0	Pin 19	Pin 19	
	RXD	Pin 1		Pin 1	Pin 18	Pin 18	
SPI Mode	SCK	Pin 13 or ICSP-3		ICSP-3	Pin 52 or ICSP-3	ICSP-3	
	MISO	Pin 12 or ICSP-1		ICSP-1	Pin 50 or ICSP-1	ICSP-1	
	MOSI	Pin 11 or ICSP-4		ICSP-4	Pin 51 or ICSP-4	ICSP-4	
	SS	Pin 10		Pin 10	Pin 10	Pin 10	

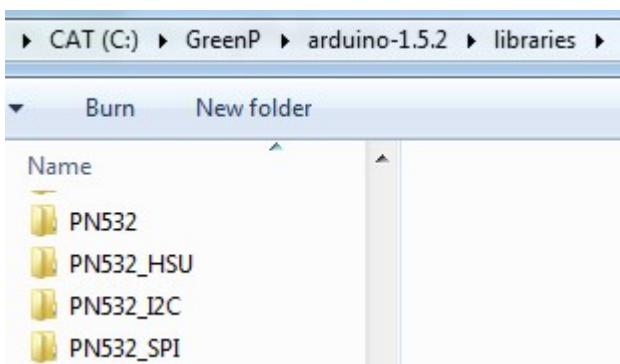
Arduino UNO only has one serial interface which is also connected to USB port to PC. In HSU mode, the serial monitor could not be used as message displaying windows.

Function Test

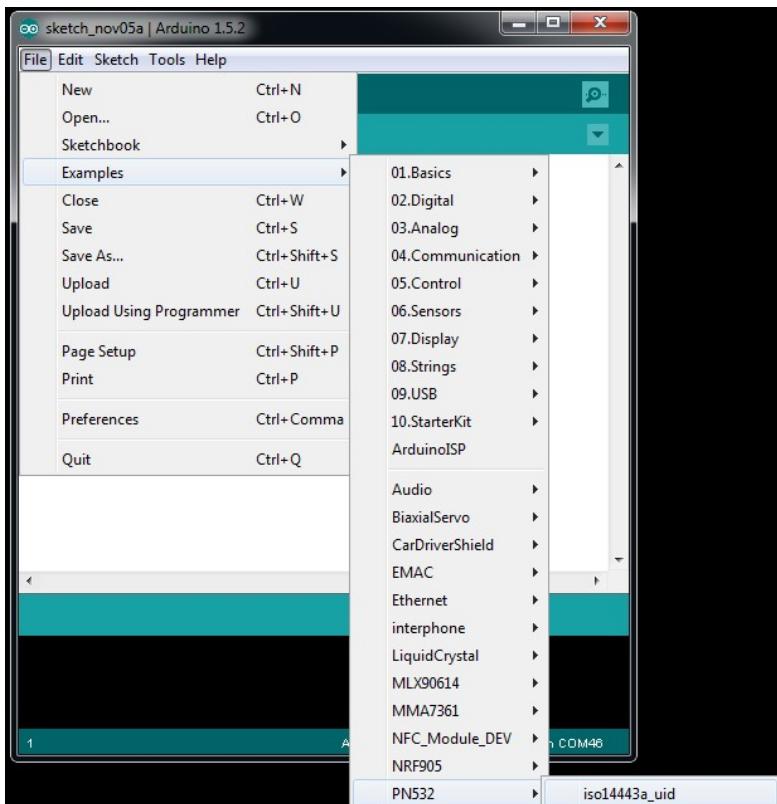
RFID Reader/Writer

Here we show how to read and write RFID card with this module.

Download the library [PN532](#) at our github page. You could find 4 folders in the library. Unzip the 4 folders at the library folder in Arduino IDE.



Start Arduino IDE and choose the example:



Modify the code to choose the right mode:

iso14443a_uid | Arduino 1.5.2

```

File Edit Sketch Tools Help
iso14443a_uid

//*****************************************************************************
Default mode is I2C mode
Do the following to change mode

// choose to SPI or I2C or HSU
#if 0           ← for SPI mode, change this line to: #if 1
  #include <SPI.h>
  #include <PN532_SPI.h>
  #include "PN532.h"

  PN532SPI pn532spi(SPI, 10);
  PN532 nfc(pn532spi);

#elif 0          ← for HSU mode, change this line to: #elif 1
  #include <PN532_HSU.h>
  #include <PN532.h>

  PN532_HSU pn532hsu(Serial1);
  PN532 nfc(pn532hsu);

#else
  #include <Wire.h>
  #include <PN532_I2C.h>
  #include <PN532.h>

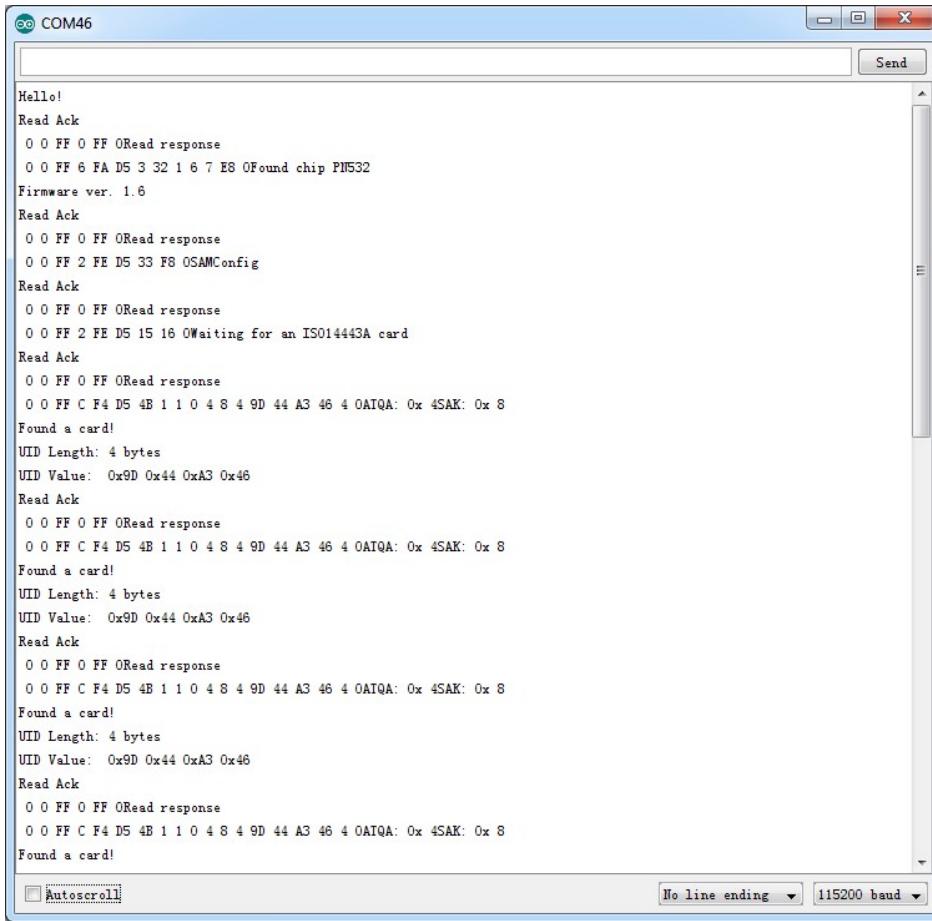
  PN532_I2C pn532i2c(Wire);
  PN532 nfc(pn532i2c);
#endif

```

Arduino Mega 2560 or Mega ADK on COM46

Upload the code to Arduino and open Serial monitor. Put a card on it:





```
COM46
Hello!
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF 6 FA D5 3 32 1 6 7 E8 0 Found chip PN532
Firmware ver. 1.6
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF 2 FE D5 33 F8 OSAMConfig
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF 2 FE D5 15 16 0 Waiting for an ISO14443A card
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0 ATQA: 0x 4SAK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0 ATQA: 0x 4SAK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0 ATQA: 0x 4SAK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0 Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0 ATQA: 0x 4SAK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Autoscroll: No line ending 115200 baud
```

You could also try other reading/writing example code in the library.



It also supports reading flexible tag. We tested flexible tags of Mifare 1 S50 and Ultralight. The reading distance is up to 5cm.

[You could find those flexible tags here.](#)

P2P NFC

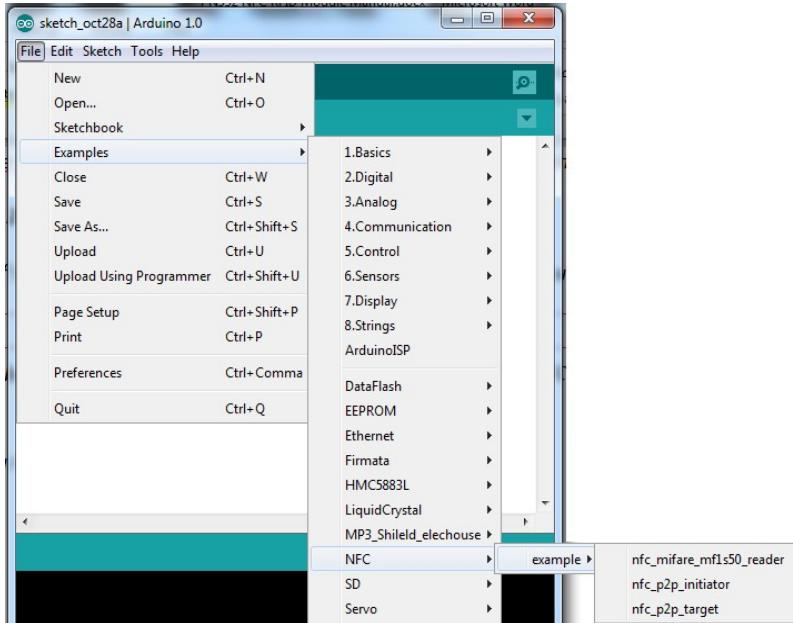
Currently we are still developing the software. The P2P NFC communication between two PN532 modules is only supported by I2C mode. Please [download this library](#).

Note, while testing this library, please remove the libraries in the testing above (or other PN532 libraries) to other folders. Otherwise they might conflict.

Here we need two Arduino boards to test this function. Basically we will program one NFC module as Initiator, and the other as Target.

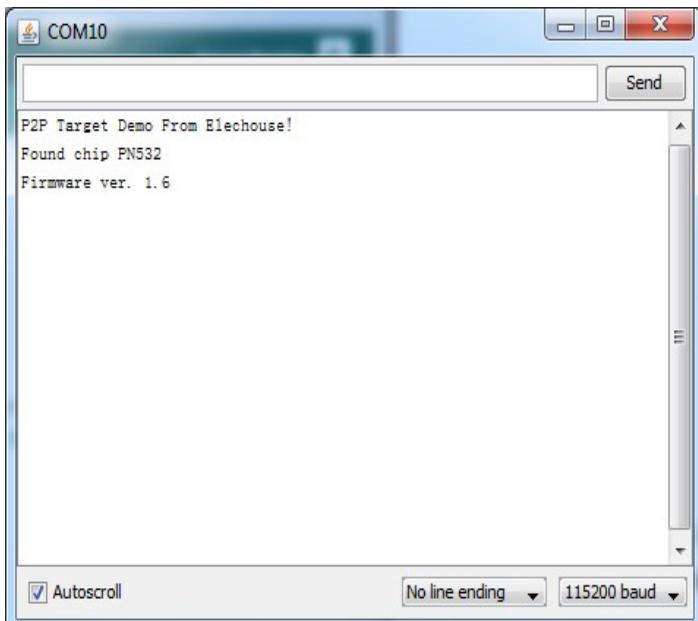
Please upload the following two examples to the two Arduino board:

- *NFC_p2p_initiator*
- *NFC_p2p_target*

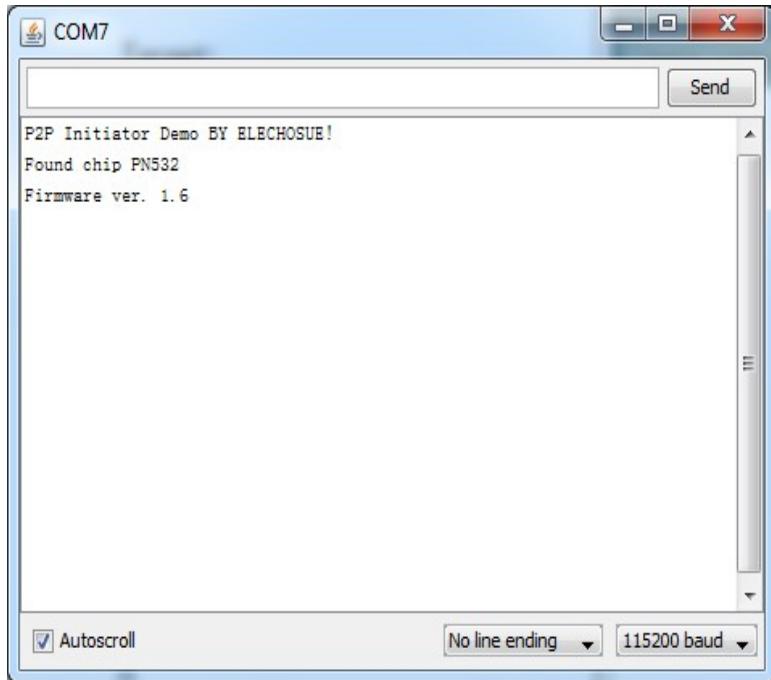


After uploading the sketches, open the Serial Monitor. Please note that Arduino IDE doesn't support opening 2 Serial Monitors. So you need another Serial Tool. Here we have 2 versions of Arduino IDE installed in my PC: Arduino 0022 and Arduino 1.0. We open the two and could have two Serial Monitor working. Note the baud rate is 115200.

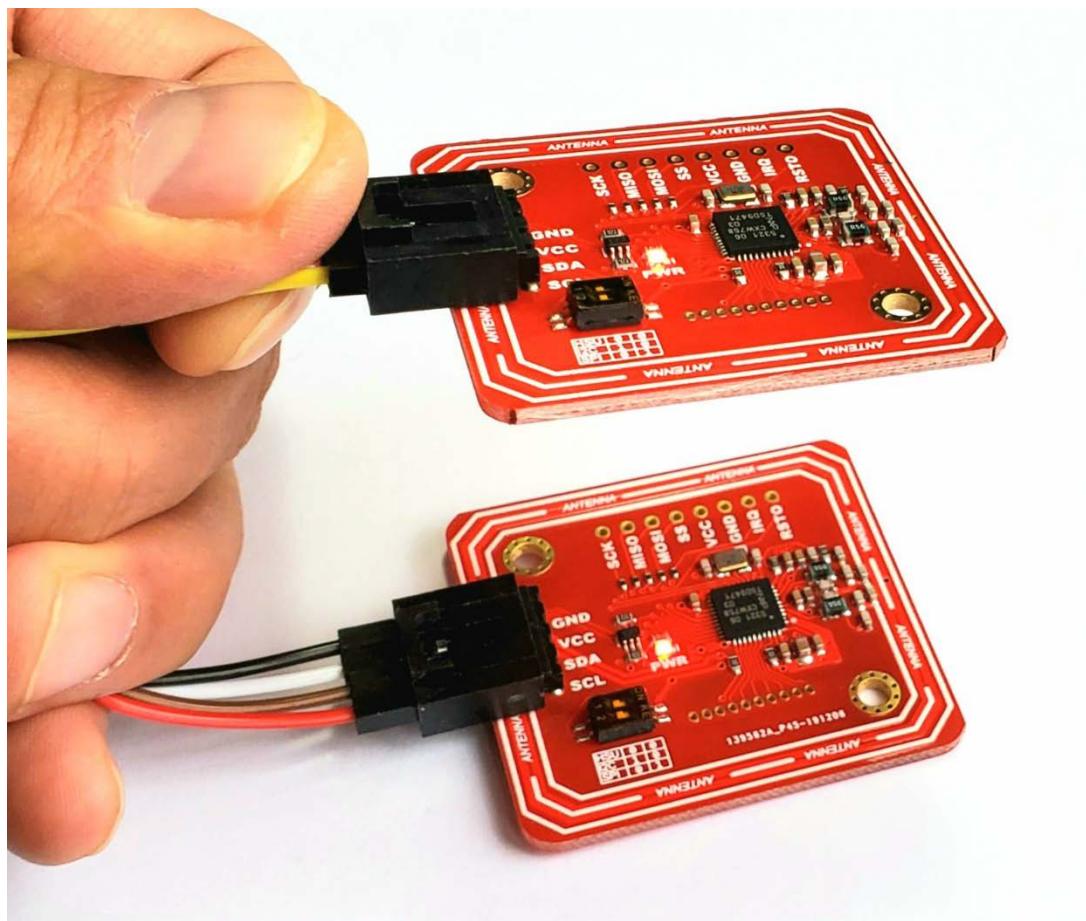
Target:



Initiator:

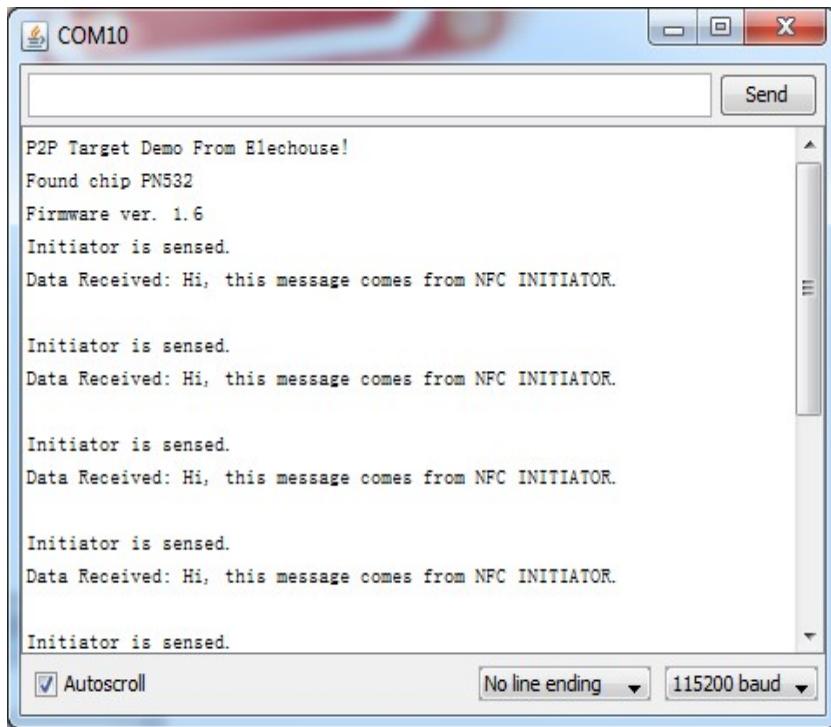


Then put one module above the other:



Finally we get:

Target:



COM1

P2P Target Demo From Elechouse!
Found chip PN532
Firmware ver. 1.6
Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

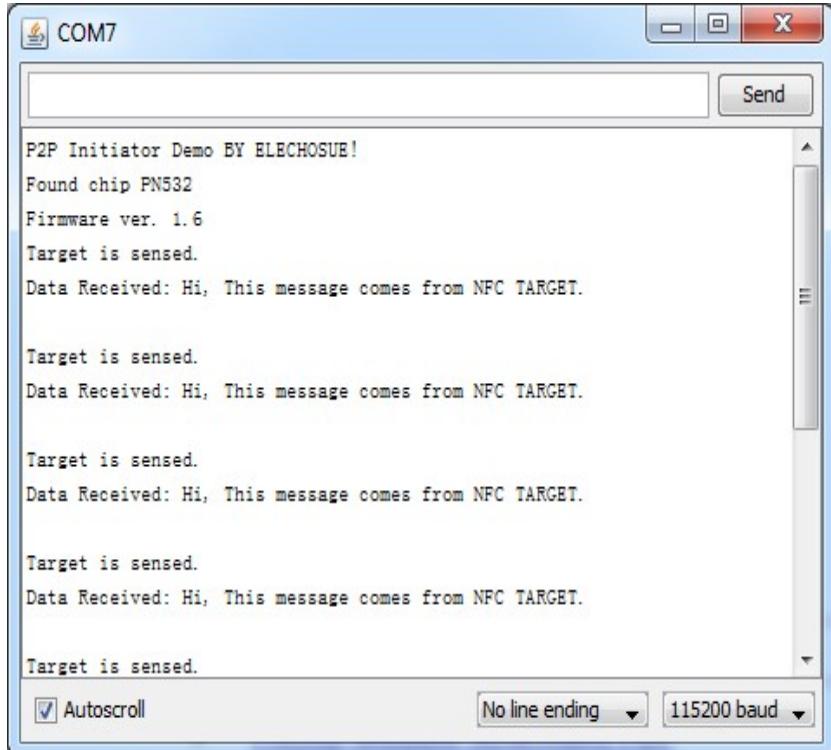
Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.

Autoscroll No line ending 115200 baud

Initiator:



COM7

P2P Initiator Demo BY ELECHOUSE!
Found chip PN532
Firmware ver. 1.6
Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.

Autoscroll No line ending 115200 baud

NFC with Android phone

Download the library of [NFC Module DEV](#) from our github page.

Note, while testing this library, please remove the libraries in the testing above (or other PN532 libraries) to other folders. Otherwise they might conflict.

Currently this library only supports HSU mode. We are still working on more modes. If you want to use SPI mode, you could try [NFC Shield DEV](#). Just connect Arduino with our PN532 module through SPI interface in the way shown in the table above.

Open the example in Arduino Due:



The screenshot shows the Arduino IDE interface with the following details:

- Sketch Name:** nfc_ndef_push_url
- Board:** Arduino 15.2
- Upload Status:** Done uploading.
- Sketch Description:** This example demonstrates pushing a NDEF message from Arduino + NFC Shield to Android 4.0+ devices. It uses the PN532 library and the NFCLinkLayer library. The code includes comments about the Arduino board (Leonardo) and the PN532 module.
- Code Content:**

```
/**  
 * This example demonstrates pushing a NDEF message from Arduino + NFC Shield to Android 4.0+ devices.  
 *  
 * This demo does not support UNO, because UNO board has only one HardwareSerial.  
 * Do not try to use SoftwareSerial to control PN532, it won't work.  
 * SoftwareSerial is not fast and stable enough.  
 *  
 * This demo only supports the Arduino board which has at least 2 Serial,  
 * Like Leonardo(1 USB serial and 1 Hardware serial), Mega ect.  
 *  
 * Make sure your PN532 board is in HSU(High Speed Uart) mode.  
 *  
 * This demo is tested with Leonard.  
 */  
  
#include <PN5321.h>  
#include <NFCLinkLayer.h>  
#include <SNEF.h>  
  
Done uploading.  
Binary sketch size: 14,014 bytes (of a 258,048 byte maximum) - 5% used
```
- Serial Monitor:** Shows the message "Done uploading." and the sketch size information.
- Bottom Status:** Shows the board as "1 Arduino Mega 2560 or Mega ADK on COM46".

Upload the code to Arduino, and open Serial Monitor:

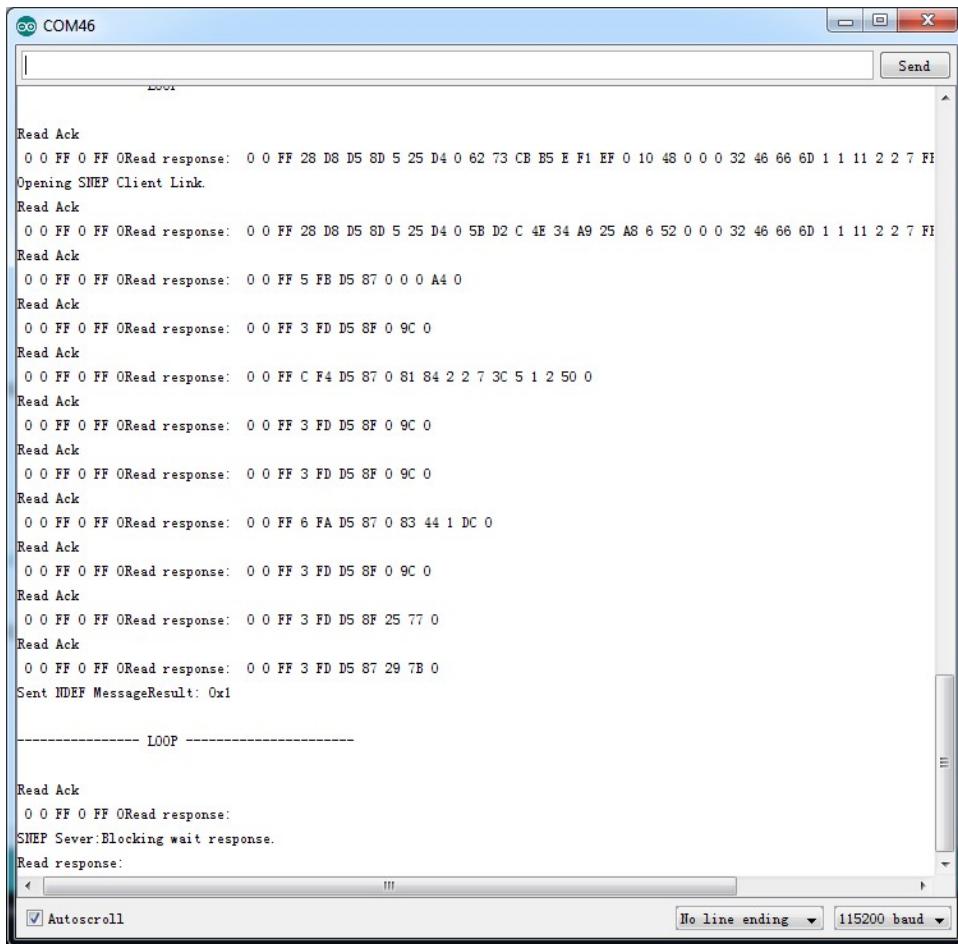
Put an NFC-support phone on the module:



On Android phone, if you have set the default browser, it will start the browser and visit our website: www.elechouse.com

If it doesn't start the browser, please open the browser and try again. Here we tested HTC one and Google Nexus 4. They all work very well. Different NFC phones might have different NFC ICs. If your phone doesn't work with it, try to google information to check if your phone NFC chip is compatible with PN532.

On Serial Monitor you could get the following result:



```
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 28 D8 D5 8D 5 25 D4 0 62 73 CB B5 E F1 EF 0 10 48 0 0 0 32 46 66 6D 1 1 11 2 2 7 F1
Opening SNEP Client Link.
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 28 D8 D5 8D 5 25 D4 0 5B D2 C 4E 34 A9 25 A8 6 52 0 0 0 32 46 66 6D 1 1 11 2 2 7 F1
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 5 FB D5 87 0 0 0 A4 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 8F 0 9C 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF C F4 D5 87 0 81 84 2 2 7 3C 5 1 2 50 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 8F 0 9C 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 8F 0 9C 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 6 FA D5 87 0 83 44 1 DC 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 8F 0 9C 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 8F 25 77 0
Read Ack
0 0 FF 0 FF ORead response: 0 0 FF 3 FD D5 87 29 7B 0
Sent NDEF MessageResult: 0x1

----- LOOP -----

Read Ack
0 0 FF 0 FF ORead response:
SNEP Sever:Blocking wait response.
Read response:
```

Useful link

[PN532 Module Schematic PDF](#)

[NXP PN532 User Manual](#)

[DWG DIMENSION FILE](#)

Library: [PN532](#) or [NFC Module DEV](#)

Where to buy

Please visit this page to buy this product: [PN532 NFC module](#)

Disclaimer and Revisions

[FCC Declare]

The information in this document may change without notice. If you have any problem about it, please visit [www.elechouse.com](#) to contact us.

Revision History

Rev.	Date	Author	Description
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A	Oct. 25 th , 2012	Wilson	Initial version
B	Nov. 5 th , 2013	Wilson	Modify information for V3

FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module 2ABVM-ELECHNFCV4”

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.3

Explanation: This module meets the requirements of FCC part 15C (15.225).it specifically establish the Radiated Spurious Emission, Frequency Tolerance, Occupied Bandwidth

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: Antenna is irreplaceable for Part15 radio. The product compliance only with the one certified antenna.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited

module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is a limited module.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure

statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 0.5 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2ABVM-ELECHNFCV4.

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: Antenna is irreplaceable for Part15 radio. The product compliance only with the one certified antenna.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2ABVM-ELECHNFCV4.

2.9 Information on test modes and additional testing requirements5

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: HK ELECHOUSE ELECTRONICS TECHNOLOGY CO.,LIMITED can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product

manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15

Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.