

RN00003

PN5190 Firmware 02.05

Rev. 1.1 — 27 June 2022

Release note

1 Document purpose

This document describes the tested functionality and limitations of the firmware FW02.05 for the PN5190.

The functionality and limitations of the hardware and product support material (e.g. customer development board and support software) is described in separate documents.



2 Released versions

PN5190 software version: v02.05

Firmware version: v02.05

For new designs, it is recommended to use always the latest available firmware version.

3 Supported functionality and known limitations

The PN5190 firmware version 02.05 supports the following functions:

RF protocols:

- Reader Mode A (106/212/424/848 Kbps)
- Reader Mode B (106/212/424/848 Kbps)
- Reader Mode FeliCa (212/424 Kbps)
- Reader mode ISO15693 (26/53/106/212Kbps)
- Reader Mode ISO/IEC18000 3M3 - all data rates as specified in data sheet
- Reader Mode ISO/IEC15693 - all data rates as specified in data sheet
- Host card emulation / Card mode ISO/IEC 14443 A-106, A-212, A-424, A-848
Peer-Peer Passive communication (ISO18092, PI106, PI212, PI424, PT106, PT212, PT424)
Peer-Peer Passive communication with proprietary baud rates (PI212, PI424, PI848, PT212, PT424, PT848)

Other functionality

- Low Power Card Detection (LPCD) and Ultra Low Power Card Detection (ULPCD)
- Dynamic Power Control
- Automatic Waveshape Control
- Automatic Receiver Control
- Internal DC-DC for TX driver
- Over temperature protection (Automatic shutdown of TX drivers and entering low-power mode (Standby), over temperature event on GPIO)
- Current Limiter (Automatic shutdown of TX drivers and event notification to host)
- Supported to route Analog and Digital signal on AUX1(Analog) and GPIO0(Digital).
- Trimming of RF parameters (TX_NOV, Current sensor, NFCLD, RFLD)

Verified compliancy with this firmware and hardware PNEV5190B (customer development board)

- EMVCo L1 digital compliance
- ISO 10373-PCD digital compliance
- ISO 10373-PICC digital compliance
- NFC Forum CR11 analog and digital compliance
- ISO 23917 Peer-Peer Passive and Active compliance

Known limitation

- With the default FDT settings for ISO18000 (dwFDT_18000_DefVal parameter which is 1.26 ms), performance @ -40C is reduced for only when TARI=18.88us. This shall be appropriately adjusted for better performance.

4 Version history

Hardware version history

The previously released hardware version had been "B1"

Firmware version history

Table 1. v02.03 to v02.05

| Number | Function |
|--------|---|
| 1 | In case of XTAL error during Boot, the error notification is sent as XTAL START ERROR bit as part of General Error event in BootStatus. |
| 2 | Added support to route Analog and Digital signal on AUX1(Analog) and GPIO0(Digital). This is done as part of AnalogTestbus Instruction in Combined mode. Hence we configured Combined_Mode Signal payload field with value 2(Analog and Digital Combined) then Analog and Digital test bus is routed on AUX1(Analog Signal) and GPIO0(Digital Signal). The signals to be routed are configured in the EEPROM offset address as mentioned below: "DigitalTBSignalIndex" Offset="0xCE9" Value="0x9B" "DigitalTBSignalBit" Offset="0xCEA" Value="0x04" "AnalogTBSignal" Offset="0xCEB" Value="0x78" Refer to Instruction: CONFIGURE_TESTBUS_ANALOG (CMD ID: 0x13) Introduced new instruction to configure Signals from two test bus at once. Refer to: Command CONFIGURE_MULTIPLE_TESTBUS_DIGITAL (CMD ID: 0x2A) |
| 3 | Added FastFieldON as a configuration at Bit4 position in SYSTEM_CONFIG(Addr: 0x00) Register. If this bit is set, TXLDO/DCDC is not disabled during RF OFF instruction. Only TX_DRIVER is disabled as part of RF OFF and in RF ON TX_DRIVER is enabled. |
| 4 | New CLIF Registers CLIF_TIMER0_OUTPUT, CLIF_TIMER1_OUTPUT, CLIF_TIMER2_CONFIG, CLIF_TIMER2_RELOAD and CLIF_TIMER2_OUTPUT are provided for user configuration |
| 5 | Modified value of bGuardTimeBeforeTx to 0xFF: During PN5190 dynamic stability analysis with Type A-106 tags, there were errors such as parity/integrity/protocol error observed, therefore it is decided to change the value of bGuardTimeBeforeTx to 0xFF, which corresponds to 255us guard time before TX. |

Table 2. v02.01 to v02.03

| Number | Function |
|--------|---|
| 1 | The GPIO1 (general-purpose input/output) pin can be enabled to wake up an external DC-DC from power down for the VDDPA supply during LPCD. |
| 2 | Updated Type-A 106 Antenna-specific Protocol register settings for EMVCo to solve few EMVCo Card activation failures during fast card movement within the Field. |
| 3 | Update to handle SWITCH_MODE_NORMAL (Abort) scenarios even when Functional CMD and SWITCH_MODE_NORMAL CMD are sent to back to back within 10micro sec |
| 4 | Introduced a new DPC_CONFIG register to handle Dynamic Enable/Disable of DPC without depending on the DPC setting from EEPROM User Area. |
| 5 | Card Mode (SWITCH_MODE_AUTOCOLL Command) support with Ultra Low-Power Standby feature (in Autonomous mode with standby mode) along with the existing Low-Power Standby configuration using EEPROM settings. |
| 6 | Update to indicate Length Error when received FeliCa response is greater than 28 Bytes when RX_MULTIPLE is Enabled |

Table 2. v02.01 to v02.03...continued

| Number | Function |
|--------|--|
| 7 | Update to indicate correct numbers of received bytes when RETRIEVE_RF_DATA is used to retrieve FeliCa response packets received when RX_MULTIPLE is Enabled. |
| 8 | Update to fix issue of EXCHANGE_RF_DATA returning with success even before Receiving RF Response on few IC's upon POR. |
| 9 | Update to clear all pending Interrupt Status bits before performing RF Exchange to fix TX Failure observed when FeliCa response is received around FDT timeout. |
| 10 | Added a new feature to extend RX Guard Timer in Integer multiple of 'dwrXIRQ_GuardTime' EEPROM timeout configuration in order to extend RX Guard Timeout beyond 1.048 sec. |

Version 2.02

Table 3. v02.00 to v02.01

| Number | Function |
|--------|--|
| 1 | NFCLD_ON threshold setting update to PASS NFC Forum Power ON/OFF test. With the new setting, the NFCLD wake-up H-Field strength was changed from 100mA/m to 150mA/m. |
| 2 | Clearing the general error status register on read, ensuring the General Error status register is cleared when READ is performed. |
| 3 | RF-Setting Update to pass NFC Forum Analog, updated the default rise and fall times for Type B |
| 4 | Communication failure due to DCO. In the CLIF_DGRM_CONFIG_REG, the bit field DGRM_DCO_TRACK_TH_SEL was updated to value '3'. This was the stable setting found to solve far distance communication problems |
| 5 | TXLDO_ERROR in GENERAL_ERROR_STATUS set to 1 when communication fail. Ensuring the delay for DC-DC shutdown is sufficient to ensure proper shutdown of DC-DC. The TXLDO error was getting set as part of the next RF ON since the LDO would not start |
| 6 | Update: Dynamic Boost Setting to avoid the sporadic boost noise. Updated the duty cycle for specific boost setting to resolve the sporadic boost noise |

Table 4. v01.07 to v02.00

| Number | Function |
|--------|--|
| 1 | Update of RF settings <ul style="list-style-type: none"> TypeB waveshape settings improvements to pass EMVCo analog with external compliance tool resolved the Undershoot failures with EMVCo PICC2 IIR filter settings update in ARC table for 45x45 antenna. Enable IIR filter for A106 which takes effect at close distance only. Enabling IIR filter reduces the swing of the received ADC data, therefore avoid clipping and give benefit of using the static BBA gain PLL settings update for P2P Active communication to pass interoperability with mobile phones. Updated PLL setting ANA_PLL_CTRL_XTAL value to 0xA6EA8A00. Updated settings for DPC with RDON feature to pass NFC Forum analog compliance. The DPC settings with RDON were not changed, instead DPC Target current was reduced from 306 mA to 286 mA due to limit power within maximum limit for Listener-3 & 6. This was in specific changed for 45x45 antenna and only for NFC Forum. Updated register setting of RM_PREAMBLE_SC_TRIGGER set to 0x08 for F212 and F424. |
| 2 | Fix for 3 failing test cases in NFC Forum CR11 digital compliance for card mode. - This fix is related to an incorrect mapping of a handler for a Register bit in the SystemConfig register. |

Table 4. v01.07 to v02.00...continued

| Number | Function |
|--------|---|
| 3 | Fixed an issue of graceful entry into standby due to temperature error. In this fix, we are Turning RF OFF before entering standby due to temperature error |
| 4 | Updated ARC implementation to refer to the correct ARC_106_FDT table during FDT for TypeA106. - Fix in the ARC algorithm to apply the ARC_106_FDT values during FDT. |

Note: Please note that default settings had been worked out based on the customer development board with default 45x45mm antenna and default matching. A custom antenna or modified matching require a verification and potentially a modification of these default settings.

5 Recommendation

Following clock parameters for XTAL are recommended for Active Communication on the customer development board PNEV5190B and 45x45 antenna.

Table 5. v02.00 to v02.01

| Address | Parameter Name | Default value | Value for active communication |
|---------|-------------------|---------------|--------------------------------|
| 1 | ANA_PLL_CTRL_XTAL | 0x00 | 0xC1 |
| 2 | ANA_PLL_CTRL_XTAL | 0x8A | 0x13 |
| 3 | ANA_PLL_CTRL_XTAL | 0xEA | 0xE8 |
| 4 | ANA_PLL_CTRL_XTAL | 0xA6 | 0xA6 |

6 Precautionary notes

1. Do not disable the DPC and activate the RF field for IC's connected to antennas matched "Symmetric" (e.g. customer development board antenna). Possible damage of the transmitter drivers due to over-current over long period might occur.
2. FW V2.00 or FW V01.XX samples can be upgraded to FW V2.05 via Secure Firmware download. However samples after upgrading to FW V02.00, cannot be reverted to FW V01.XX.
3. The ULPCD requires a specific power configuration with no DC-DC active and requires modifications to both the customer development board PNEV5190B EEPROM settings as described in the application notes.

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