NFC A/B/F
Digital Standard for
R&S®Signal Generators
Operating Manual

1175.7268.02 ─ 09

Test & Measurement

Operating Manual

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®SMBV-K89
  1419.1654.02
- R&S®AMU-K89
  1403.1037.02
- R&S®SMATE-K89
  1404.8906.02
- R&S®SMJ-K89
  1409.3602.02
- R&S®SMU-K89
  1408.8730.02

This manual version corresponds to firmware version:
FW 3.20.281.xx and later of the R&S®SMBV100A
FW 3.20.286.xx and later of the R&S®SMU200A, R&S®SMATE200A, R&S®SMJ100A and R&S®AMU200A

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The following abbreviations are used throughout this manual: NFC Forum™ is abbreviated as NFC Forum, EMV™ is abbreviated as EMV, R&S®SMBV100A is abbreviated as R&S SMBV, R&S®SMU200A is abbreviated as R&S SMU, R&S®AMU200A is abbreviated as R&S AMU, R&S®SMATE200A is abbreviated as R&S SMATE, R&S®SMJ100A is abbreviated as R&S SMJ, R&S®WinIQSIM2™ is abbreviated as R&S WinIQSIM2; the license types 02/03/07/11/13/16/12 are abbreviated as xx.

Contents

1 Preface

1.1 Documentation Overview

The user documentation for the R&S Signal Generator consists of the following parts:

- Online Help system on the instrument,
- "Quick Start Guide" printed manual,
- Documentation CD-ROM with:
  - Online help system (*.chm) as a standalone help,
  - Operating Manuals for base unit and options,
  - Service Manual,
  - Data sheet and specifications,
  - Links to useful sites on the R&S internet.

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S Signal Generator and all available options.

Quick Start Guide

The Quick Start Guide is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and an example of setup are described. The manual includes also general information, e.g., Safety Instructions.

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

These manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the Operating Manual for the base unit, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

In the individual option manuals, the specific functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S Signal Generator is not included in the option manuals.

Service Manual

The Service Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. It describes how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the instrument by the replacement of modules.

This manual can also be orderd in printed form (see ordering information in the data sheet).

Release Notes

The release notes describe new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

Web Help

The web help provides online access to the complete information on operating the R&S Signal Generator and all available options, without downloading. The content of the web help corresponds to the user manuals for the latest product version.

The web help is available on the R&S Signal Generator product page at the Downloads > Web Help area.

Application Notes

Application notes, application cards, white papers and educational notes are further publications that provide more comprehensive descriptions and background information.

The latest versions are available for download from the Rohde & Schwarz website, at http://www.rohde-schwarz.com/appnotes.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.

Convention	Description
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Notes on Screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic test situations.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

1.2.3 Naming of Software Options

In this operating manual, we explicitly refer to options required for specific functions of the digital standard.

The name of software options for signal generators vary in the name of the instrument, but the option name is identical. Therefore we use in this manual the placeholder R&S SMx/AMU.

Example:

Naming for an option of the vector signal generator R&S SMBV100A, e.g:

- R&S SMx/AMU-K99, stands for R&S SMBV-K99

The particular software options available for the corresponding instruments are listed on the back of the title page.

2 About the NFC Digital Standard

The following description is taken from the R&S White Paper 1MA182: "Near Field Communication (NFC) Technology and Measurements" which contains further practical hints.

Near Field Communication (NFC) is a new, short-range wireless connectivity technology that evolved from a combination of existing contactless identification and interconnection technologies. It was jointly developed by Sony and NXP Semiconductors (formerly Philips).

NFC is designed to enable the exchange of various types of information, such as telephone numbers, pictures, MP3 files or digital authorizations between two NFC enabled devices like mobile phones, or between an NFC enabled mobile phone and a compatible RFID chip card or reader that are held close to each other. NFC is intended to be used as an access key to contents and for services such as cashless payment, ticketing and access control.

NFC operates in a frequency range centered on 13.56 MHz and offers a data transmission rate of up to 424 kbit/s within a distance of approximately 10 centimeters. In contrast to the conventional contactless technology in this frequency range (only active-passive communications), communications between NFC-capable devices can be active-active (peer-to-peer) as well as active-passive, NFC therefore represents a link to the RFID world. NFC is backwards compatible with the widely used Smart Card infrastructure based on ISO/IEC 14443 A (e. g. NXP's MIFARE technology) and ISO/IEC 14443 B as well as with the Sony FeliCa card (JIS X 6319-4). For the exchange of information between two NFC devices, a new protocol was developed which is defined in the standards ECMA-340 and ISO/IEC 18092.

To guarantee the function of NFC devices conforming to the standards as well as comprehensive protocol tests, a number of RF tests also have to be carried out. An NFC generator is an essential part of these tests. The option R&S SMx/AMU-K89 enables you to generate signals in accordance with the NFC standard.

The NFC specific abbreviations used in this manual as well as the different types of tag platforms/protocols (e.g. Type 4A Tag, NFC-DEP) are described in the NFC Digital Protocol Technical Specification. All mentioned standards are available under www.nfc-forum.org.

2.1 Basics of Data Transmission with NFC

Like the RFID Standards 14443 and FeliCa NFC uses an inductive coupling. Similar to the transformer principle, the magnetic near-field of two conductor coils is used to couple the polling device (initiator) and listening device (target).

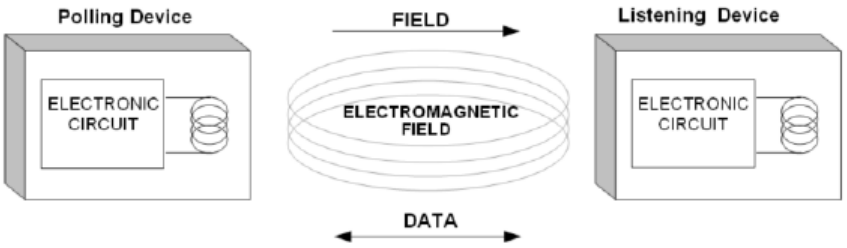


Figure 2-1: Polling device (initiator) and listening device (target) configuration

The operating frequency is 13.56 MHz, and a bitrate of 106 kbit/s (partly also 212 kbit/s and 424 kbit/s) is used. Modulation schemes are amplitude on/off keying (OOK) with different modulation depth (100 % or 10 %) and BPSK.

2.1.1 Power Transmission and Data Transmission from a Polling Device

For transmission to a passive system such as an NFC phone in passive card emulation mode, the passive system uses the 13.56 MHz carrier signal of the polling device as energy source. Modulation scheme of the polling device is ASK. For NFC peer-to-peer mode, both directions are modulated and coded like a polling device. However less power is necessary because both NFC devices use their own power supply and the carrier signal is switched off after end of transmission.

2.1.2 Data Transmission from a Listening Device

Due to the coupling of the coils of a polling and a listening device, a passive listening device also affects the active polling device. A variation in the impedance of the listening device causes amplitude changes to the antenna voltage of the polling device, detected by the polling device. This technique is called load modulation. Load modulation is carried out in listening mode (as with ISO/IEC 14443) using an auxiliary carrier at 848 kHz which is modulated by the baseband and varies the impedance of the listening device. The Figure 2-2 shows the spectrum with load modulation. Modulation spectra of carrier and auxiliary carriers are indicated with triangles (Modulation spectra of carrier and of auxiliary carriers do not appear at the same time because NFC uses time division multiplexing). The modulation scheme is ASK (as with ISO/IEC 14443 A PICC's) or BPSK as with 14443 B PICC's. There is a third passive mode which is compatible to FeliCa where the load modulation is without an auxiliary carrier directly as ASK on the 13.56 MHz carrier.

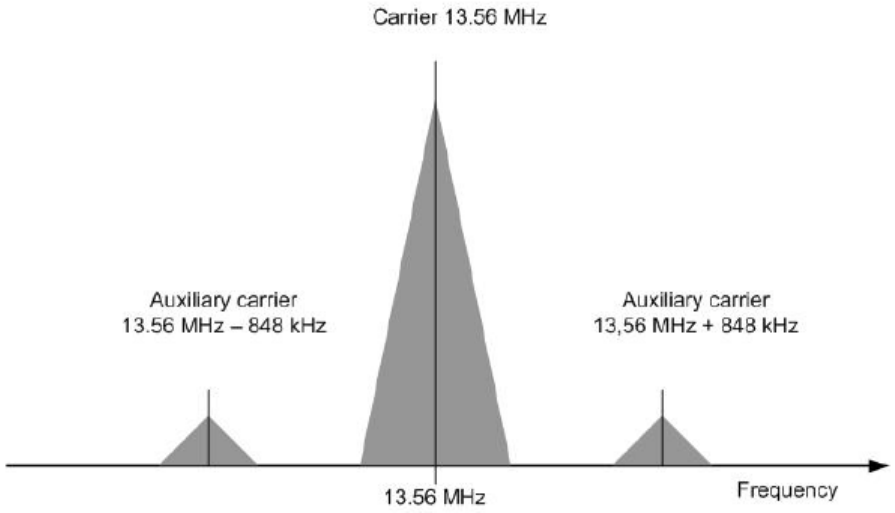


Figure 2-2: Load modulation on a 13.56 MHz carrier with 848 kHz auxiliary carrier.

2.1.3 Modulation Scheme and Coding

Amplitude shift keying (OOK) with different modulation depths (100% or 10%) or BPSK (as with ISO/IEC 14443 B PICC's) is used.

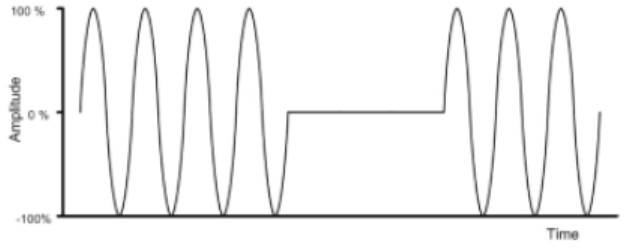


Figure 2-3: ASK with 100% modulation depth

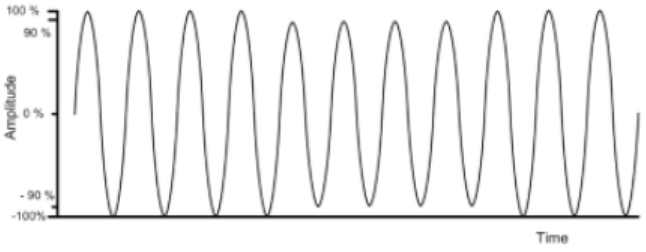


Figure 2-4: ASK with 10% modulation depth

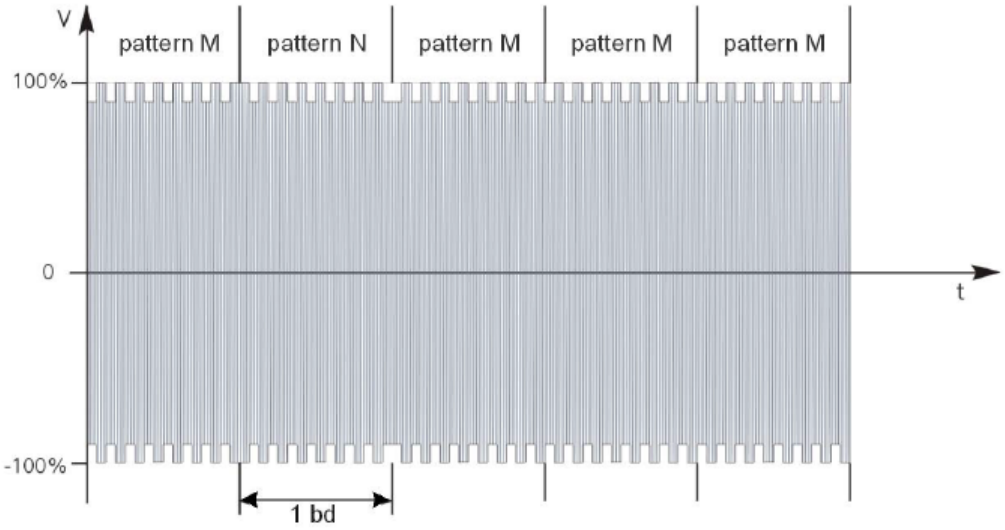


Figure 2-5: NRZ-L Coding with BPSK

NRZ-L, Modified Miller and Manchester Coding are used by NFC.

- With NRZ-L a “high”-state during a bit duration indicates a logic 1, a “low”-state a logic 0.
- With Manchester Coding the first half of a bit will be set to “high”-state at a logic 1, and the second half to “low state”. With a logic 0, the fist half of a bit is set to “low”-state and the second half to “high”-state.
- With Modified Miller Coding with a logic 1 a “low” pulse occurs after half of the bit duration. With a logic 0 a “low”-pulse occurs at the beginning of a bit. Exception: If a logic 0 follows a 1 no pulse occurs, the signal remains high.

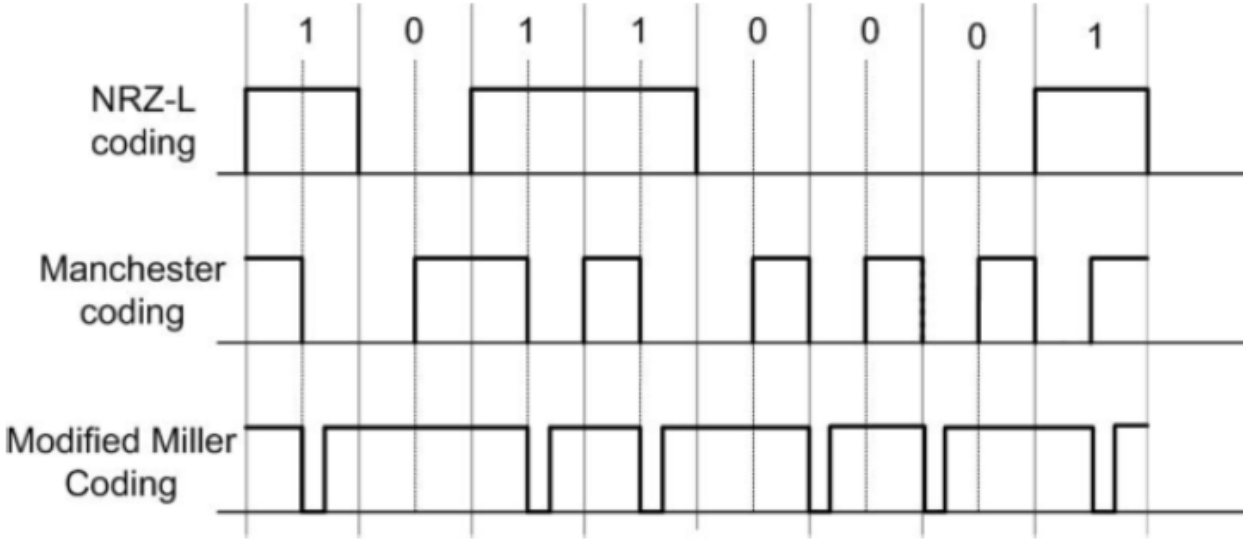


Figure 2-6: Coding with NFC is either NRZ_L, Modified Miller or Manchester

In Figure 2-7 load modulation is visualized for ASK modulation with Manchester Coding (14443 A PICC or NFC-A device in passive card emulation mode, see Chapter 2.1.4, "NFC Operating Modes, Modulation and Coding", on page 13)

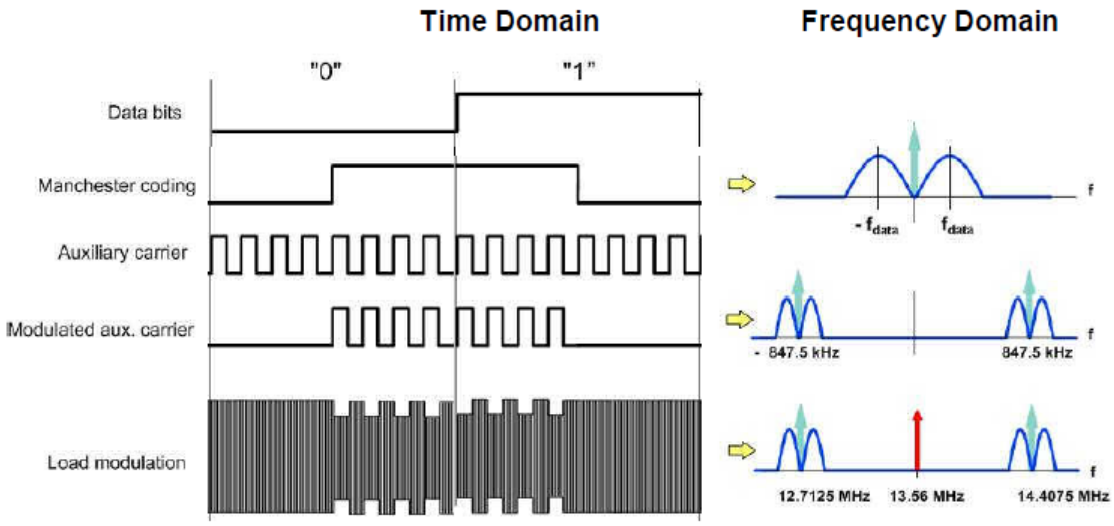


Figure 2-7: Visualisation of load modulation with auxiliary carrier in time and frequency domain

2.1.4 NFC Operating Modes, Modulation and Coding

There are three main operating modes for NFC:

- Card emulation mode (passive mode): the NFC device behaves like an existing contactless card conforming to one of the legacy standards
- Peer-to-peer mode: two NFC devices exchange information. The initiator device (polling device) requires less power compared to the reader/writer mode because the target (listener) uses its own power supply.
- Reader/writer mode (active mode): the NFC device is active and reads or writes to a passive legacy RFID tag.

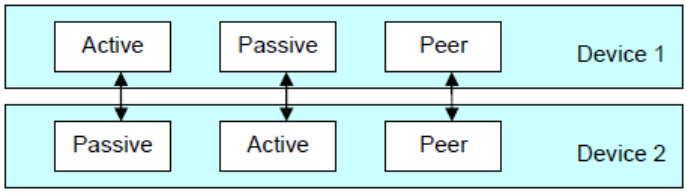


Figure 2-8: NFC operating modes

Every mode (card emulation, peer-to-peer, reader/writer mode) can be combined with one of the following transmission technologies:

- NFC-A (backward compatible to ISO/IEC 14443 A)
- NFC-B (backward compatible to ISO/IEC 14443 B)
- NFC-F (backward compatible to JIS X 6319-4)

To support all the different technologies, an NFC device in polling mode first attempts to get responses from NFC-A, NFC-B and NFC-F tags with the according request signals. When getting a response from a compatible device, the NFC device sets up the corresponding communication mode (NFC-A, NFC-B or NFC-F mode).

Coding and modulation varies depending on active or passive communication mode, NFC-A, -B, -F communication, and bitrate.

The Table 2-1 shows coding, modulation and data rates for NFC-A, -B or -F communication.

Table 2-1: NFC RF Standards Overview

NFC Forum Standard	Polling / Listening	Coding	Modulation	Datarate	Carrier frequency
NFC-A	Polling	Modified Miller	ASK 100%	106 kb/s	13.56 MHz
	Listening	Manchester	Load modulation (ASK subcarrier)	106 kb/s	13.56 MHz +-848kHz subcarrier
NFC-B	Polling	NRZ-L	ASK 10%	106 kb/s	13.56 MHz
	Listening	NRZ-L	Load modulation (BPSK subcarrier)	106 kb/s	13.56 MHz+-848kHz subcarrier
NFC-F	Polling	Manchester	ASK 10%	212 / 424 kb/s	13.56 MHz
	Listening	Manchester	Load modulation (APSK)	212 / 424 kb/s	13.56 MHz (without subcarrier)

2.2 Timing Aspects

The NFC specification defines the duration of the individual commands as a number of bits. This instrument generates the signal as sample sequence where the applied sample rate is user defined. Depending on the selected sampling rate it may be that the duration of a command expressed in samples does not result in an integer number of samples. In this implementation however the length of the sequence is always an integer number of samples, i.e. the software rounds up the number of samples to the next integer value. The rounding up procedure is applied on command basis, even if a command is repeated.

The Figure 2-10 shows this principle as an example.

Example:

The Figure 2-9 shows an example of a sequence with the following settings:

- Sample Rate = 20.1 Msps
- Technology > NFC-A
- Transmission Mode > Poll

Command Type	Rep.	Duration (µs)
"SENS_REQ"	1	(calculated and displayed automaticaly)
"IDLE"	1	0.05

Command Type	Rep.	Duration (µs)
"ALL_REQ"	2	(calculated and displayed automaticaly)
"BLANK"	1	0.1

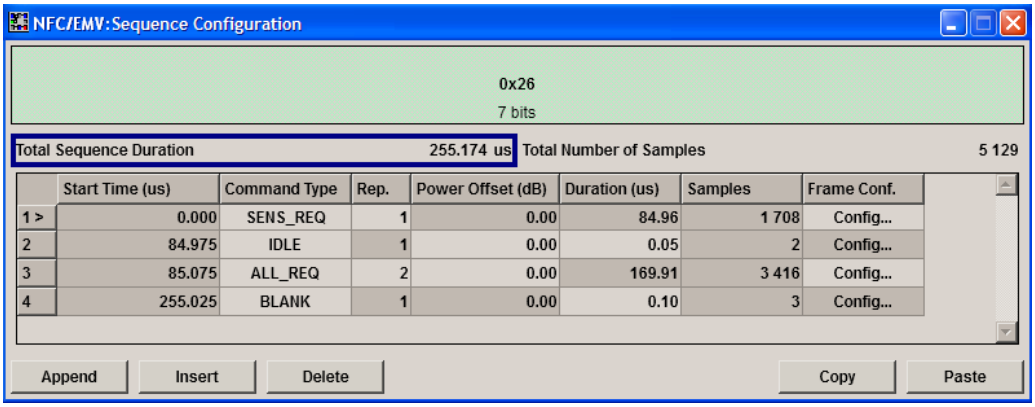


Figure 2-9: Example of sequence configuration settings

The Figure 2-10 illustrates the calculation of the Start Time per command and the parameters Total Sequence Duration and Total Number of Samples.

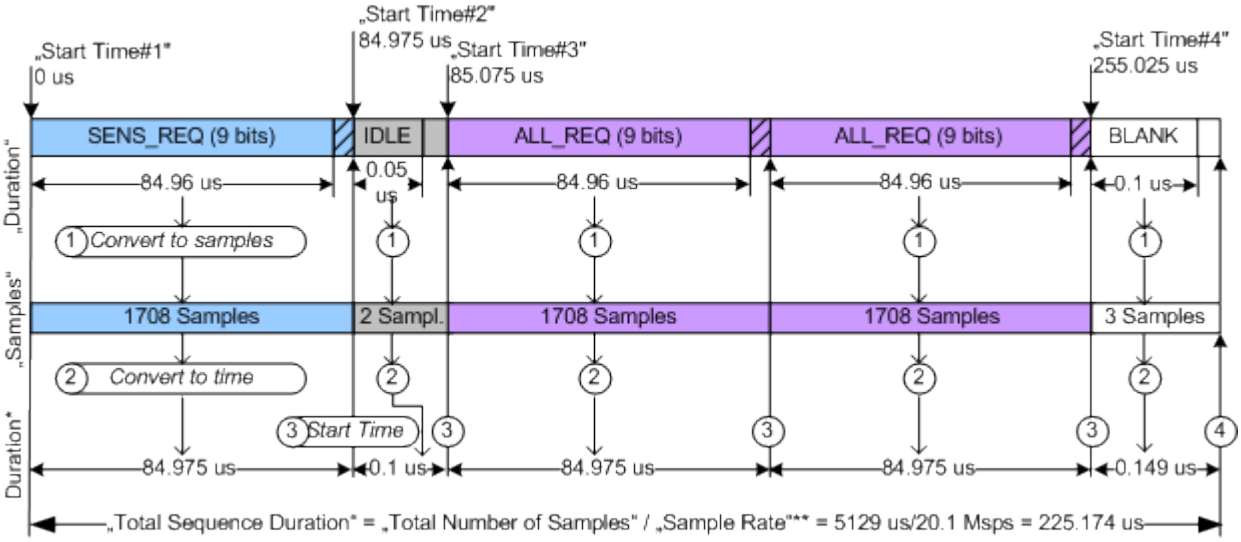


Figure 2-10: Calculation of duration and number of samples for "Sample Rate" = 20.1 Msps

1 = "Duration" * "Sample Rate" = # Samples, "Samples" = ceil (# Samples)
2 = Duration* = "Samples"/"Sample Rate"
3 = "Start Time"$_N$ = (Duration*$_1$ + .. + Duration*$_{N-1}$) = ("Samples"$_1$ + ... + "Samples"$_{N-1}$)/"Sample Rate"
4 = "Total Number of Samples" = "Samples"$_1$ + ... + "Samples"$_N$

For some modulation settings, especially for those that cause very smooth signal edges, it might be necessary that the implementation not only rounds up to the next integer number of samples, but also that it enlarges the commands even more, in order to prevent a sharp cutting of the last signal edge of the command.

2.3 Leveling aspects

This chapter describes general leveling aspects.

2.3.1 Interpretation of "RF Level" indication

This chapter describes the interpretation of the RF Level.

The "RF Level" indication of the generators does not display the RMS signal level!

The "RF Level" indication in the header of the instrument refers to the power during the unmodulated parts of the signal, i.e. the part where the relative signal voltage is 100% (outside of overshoots) and the "Power Offset" is 0 dB (see Figure 2-11).

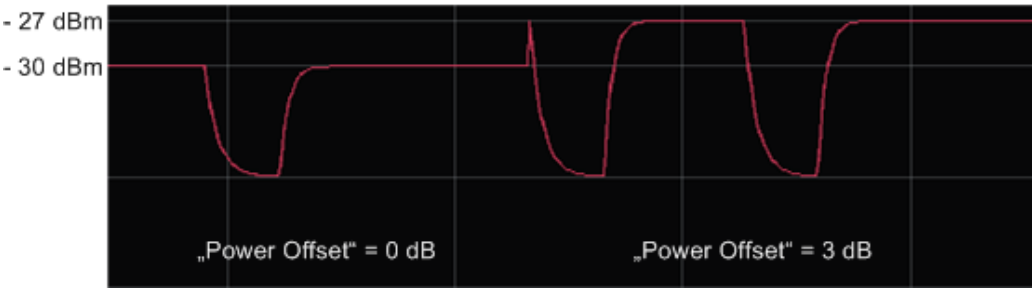


Figure 2-11: Signal leveling of a sequence build from two commands with "Power Offset" of 0 dB and 3 dB respectively, "RF Level" = -30dBm and "PEP" = -27 dBm

2.3.2 Desired voltage of the unmodulated signal

Several test cases require a listener test signal prior to the modulation on the RF carrier. This test signal is then supplied to the reference listener antenna. Three leveling parameters are provided to calculate the settings to reach the required voltage of the unmodulated signal automatically.

These parameters are available for "Transmission Mode > Listen" and "NFC State > On", for details see "Unmodulated Parts Voltage To Peak Voltage Ratio" on page 24 , "Desired Voltage In Unmodulated Signal parts" on page 24 and "Update Analog I/Q Settings For Desired Voltage" on page 25.

To use these leveling parameters...

1. Define the "Desired Voltage In Unmodulated Signal Parts".
2. Select "Update Analog I/Q Settings For Desired Voltage" to automatically adjust the settings at the I/Q output connectors ("I/Q Level Vp (EMF)").

Parameter "Unmodulated Parts Voltage To Peak Voltage Ratio" displays the ratio of the voltage in the unmodulated parts of the signal to its peak value.

3 About the EMV Contactless Digital Standard

EMV is a standard that defines the interaction between an integrated circuit (IC) cards and IC cards processing devices for payments. EMV stands for Europay, MasterCard and Visa, the companies that initiated the development of the EMV specifications in the mid 1990s. Over the years the initiator companies were joint by JCB, American Express and China Union Pay. Today the EMV standard is defined by the EMVCo LLC corporation.

The EMV Contactless is based on ISO/IEC 14443 "Identification cards -- Contactless integrated circuit cards-- Proximity cards" . It sets a standard for the usage of contactless systems for contactless payments.

In 2012 the EMVCo and NFC Forum agreed to work in collaboration on establishing a framework for the synchronization of the NFC Forum and EMVCo Specificitions and the management of contactless product certification. The option R&S SMx/AMU-K89 enables you to generate signals in accordance with the NFC standard and the EMV Contactless standard thus allowing you to perform the tests needed to guarantee the proper performance of your devices.

The EMV specific abbreviations used in this manual as well as the different types of tag platforms/protocols are described in the EMV Contactless Specifications for Payment Systems. The specifications are available under www.emvco.com.

3.1 Basics of Data Transmission with EMV Contactless

A contactless system consists of two basic components: a contactless reader (PCD) and a transponder (PICC). The EMV Contactless uses the electormagnetic near field of two conductor coils (a primary coil of the PCD and a secondary coil of the PICC) to couple the contactless reader and the transponder, see Figure 3-1.

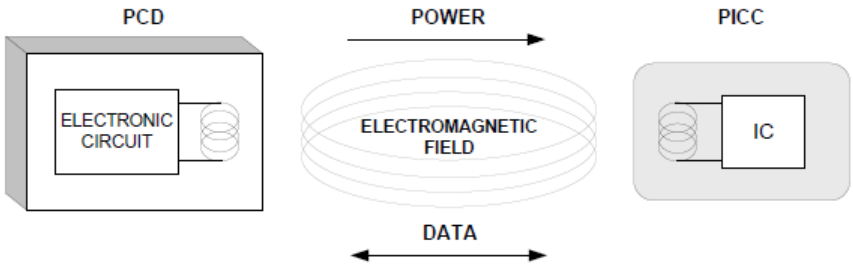


Figure 3-1: PCD (Contactless reader) and PICC (transponder) configuration

The operating frequency is 13.56 MHz, and a bitrate of 106 kbit/s is used. Modulation schemes are amplitude shift keying (ASK) with different modulation depth (100 % or 10 %), amplitude on/off keying (OKK) and BPSK.

3.2 EMV Contactless Transmission Technologies, Modulation and Coding

The EMV contactless has two main communication signal interfaces (based on ISO/IEC 14443):

- Type A
- Type B

The Table 3-1 shows coding and modulation for the EMV Type A and the EMV Type B communication.

Table 3-1: EMV Contactless Standards Overview

Standard	PCD-PICC / PICC-PCD	Coding	Modulation
Type A	PCD-PICC	Modified Miller	ASK 100%
	PICC-PCD	Manchester	Load modulation (OOK subcarrier)
Type B	PCD-PICC	NRZ-L	ASK 10%
	PICC-PCD	NRZ-L	Load modulation (BPSK subcarrier)

Refer to Chapter 2.1.3, "Modulation Scheme and Coding", on page 11 for a description of the used modulation schemes and coding.

4 User Interface

► To access the dialog for setting the NFC digital standard, select "Baseband Block > Config > NFC / EMV" or press the MENU key and select "Baseband > NFC/ EMV".

4.1 General Settings

In this dialog, you can enable and reset the digital standard NFC, and configure all the settings required for the signal in both transmission modes and the different technologies. The provided parameters vary depending on the "Technology", "Transmission Mode" and "Trigger/Marker...".

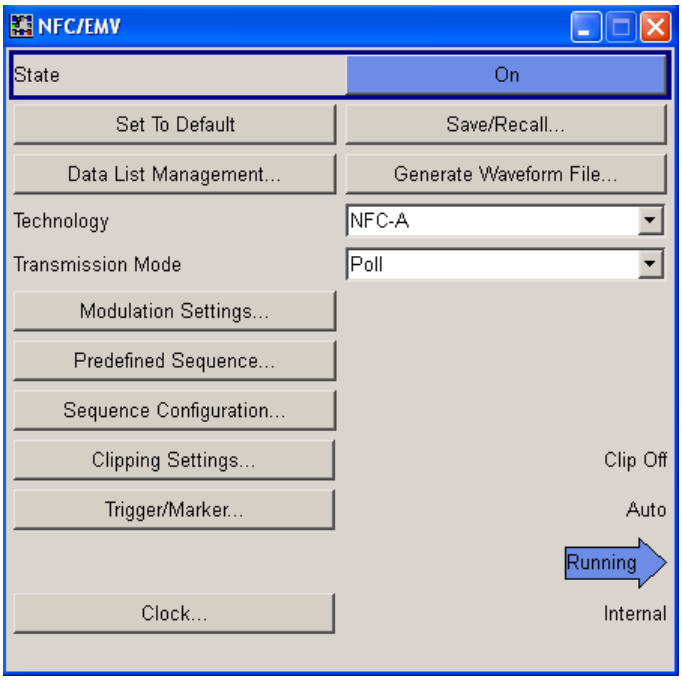


Figure 4-1: NFC main dialog

State
Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Remote command:
`[:SOURce<hw>]:BB:NFC:STATe` on page 72

Set to Default
Calls the default settings. The values of the main parameters are listed in the following table.

Parameter	Value
State	Not affected by "Set to default"
Technology	NFC A
Transmission Mode	Poll
Clipping	Off
Trigger	Auto
Clock	Internal
Command Type (in "Sequence Configuration" dialog)	for NFC-A, Poll: SENS_REQ for NFC-B, Poll: SENSB_REQ for NFC-F, Poll: SENSF_REQ

Remote command:
`[:SOURce<hw>]:BB:NFC:PRESet` on page 72

Save/Recall ...
Calls the "Save/Recall" dialog.

From the Save/Recall dialog the "Save/Recall Settings" windows for saving and recalling NFC configurations and the "File Manager" can be called.

NFC configurations are stored as files with the predefined file extension `*.nfc`. Their file name and directory are user-definable.

The complete settings in the "NFC" dialog are saved and recalled.

"Recall NFC Setting" — Opens the "Recall Settings" window for loading a saved NFC configuration.
The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

"Save NFC Setting" — Opens the "Save Settings" window for saving the current NFC signal configuration.
The name of the file is specified in the File name entry field, the directory selected in the save into field. The file is saved by pressing the "Save" button.

"File Manager" — Calls the "File Manager".
The "File Manager" is used to copy, delete and rename files and to create new directories.

Remote command:
`[:SOURce<hw>]:BB:NFC:SETTing:CATalog?` on page 73
`[:SOURce<hw>]:BB:NFC:SETTing:LOAD` on page 74
`[:SOURce<hw>]:BB:NFC:SETTing:STORe` on page 74
`[:SOURce<hw>]:BB:NFC:SETTing:STORe:FAST` on page 74
`[:SOURce<hw>]:BB:NFC:SETTing:DELete` on page 74

Data List Management...
Calls the "Data List Management" dialog. This dialog is used to create and edit a data list.

All data lists are stored as files with the predefined file extension `*.dm_iqd`. Their file name and directory are user-definable.

The data lists must be selected as a data source from the subsection under the individual function.

Note: All data lists are generated and edited by means of the `SOURce:BB:DM` subsystem commands. Files containing data lists usually end with *.dm_iqd. The data lists are selected as a data source for a specific function in the individual subsystems of the digital standard.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA` on page 87
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:DSELection` on page 87

Generate Waveform File...
With enabled signal generation, triggers the instrument to store the current settings as an ARB signal in a waveform file. Waveform files can be further processed by the ARB and/or as a multi carrier or a multi segment signal.

The file name and the directory it is stored in are user-definable; the predefined file extension for waveform files is `*.wv`.

Remote command:
`[:SOURce<hw>]:BB:NFC:WAVeform:CREate` on page 73

Technology
Selects the NFC/EMV technology.

"NFC-A, NFC-B, NFC-F"
NFC technology. For details see the NFC Digital Protocol Technical Specification.

"EMV Type A, EMV Type B"
EMV Technology. For details see the EMV Technical Specification.

Remote command:
`[:SOURce<hw>]:BB:NFC:TECHnology` on page 72

Divisor(Bit Rate)
Available for "Technology > NFC-F", this parameter selects the used divisor (2 or 4) and determines the increased resulting bit rate of 212 Kbit/s or 424 Kbit/s respectively.

Remote command:
`[:SOURce<hw>]:BB:NFC:DIVisor` on page 71

Transmission Mode
Selects the transmission mode.

"Poll / Listen" Available for "Technology > NFC-A /NFC-B/ NFC-F"
For details see Figure 2-1.

"PICC to PCD / PCD to PICC"
Available for "Technology > EMV Type A / EMV Type B"

Remote command:
`[:SOURce<hw>]:BB:NFC:TMODe` on page 72

Modulation Settings...
Opens the "Modulation Settings" dialog. See Chapter 4.2, "Modulation Settings", on page 25

Predefined Sequence
Available for "Transmission Mode > Poll" and "Transmission Mode > PCD to PICC ".

Opens the "Predefined Sequence" dialog. See Chapter 4.3, "Predefined Sequence", on page 30.

Sequence Configuration...
Opens the "Sequence Configuration" dialog. See Chapter 4.4, "Sequence Configuration Settings", on page 31

Clipping Settings...
Opens the "Clipping Settings" dialog. See Chapter 4.6, "Clipping Settings", on page 53

Trigger/Marker...
Accesses the "Trigger/Marker/Clock" dialog, see Chapter 4.7, "Trigger/Marker/Clock Settings", on page 53.

Execute Trigger
Executes trigger manually.

You can execute the trigger manually only if you select an internal trigger source and a trigger mode other than "Auto".

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:EXECute` on page 108

Clock...
Accesses the "Trigger/Marker/Clock" dialog. See Chapter 4.7, "Trigger/Marker/Clock Settings", on page 53

Unmodulated Parts Voltage To Peak Voltage Ratio
Available only for "Transmission Mode > Listen / PICC to PCD" and "State > On".

Displays the ratio of the voltage in the unmodulated parts of the signal to its peak value. See Chapter 2.3, "Leveling aspects", on page 16.

Remote command:
`[:SOURce<hw>]:BB:NFC:UPVoltage?` on page 73

Desired Voltage In Unmodulated Signal parts
Available only for "Transmission Mode > Listen / PICC to PCD" and "State > On".

Defines the desired voltage in unmodulated signal parts.

The displayed "Unmodulated ... Ratio" depends only on the signal and is not changed by the input of a "Desired Voltage".

See Chapter 2.3, "Leveling aspects", on page 16.

Remote command:
`[:SOURce<hw>]:BB:NFC:DVOLtage` on page 71

Update Analog I/Q Settings For Desired Voltage
Available only for "Transmission Mode > Listen / PICC to PCD" and "State > On".

Automatically adjusts the related parameters of the analog I and Q outputs to the desired voltage.

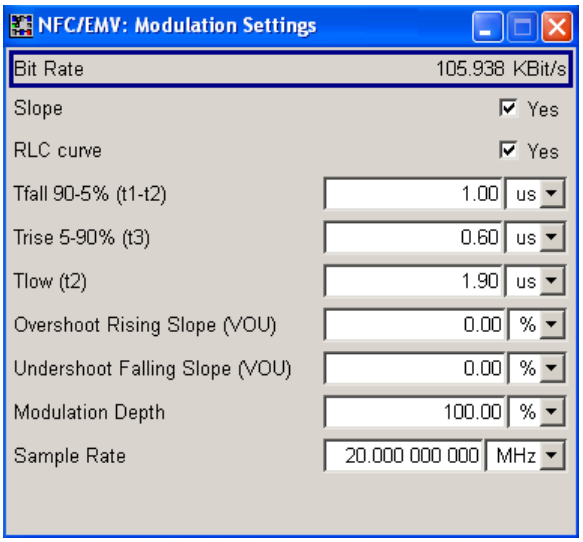
For detailed description of all parameters, refer to section "Output of the Baseband Signal" in the operating manual of the signal generator.

See Chapter 2.3, "Leveling aspects", on page 16.

Remote command:
`[:SOURce<hw>]:BB:NFC:UAISetting` on page 72

4.2 Modulation Settings

► To access the modulation settings, select "Main Dialog > Modulation Settings".



This dialog contains the parameters for configuring the signal modulation. The available Various parameters vary depending on the selected technology and transmission mode, and if "Slope" or "RLC curve" is activated.
The current resulting bit rate is indicated.

Bit Rate
Indicates the current resulting bit rate in Kbit/s.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:BRATe?` on page 104

Slope
Determines the transition between the modulated and unmodulated parts.

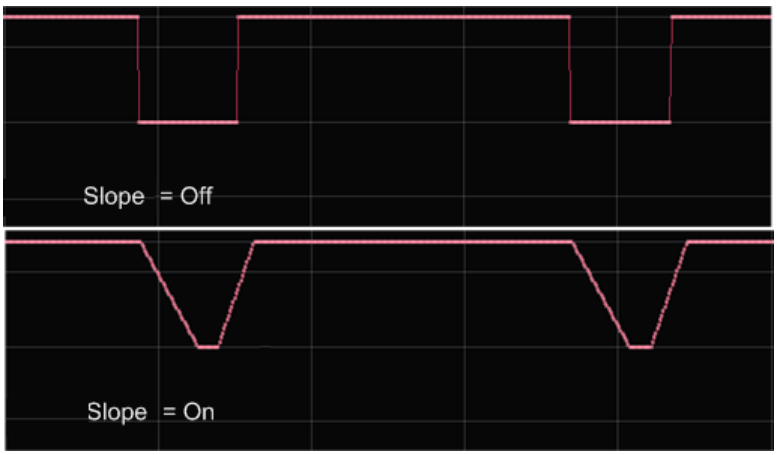


Figure 4-2: Impact of the "Slope" parameter ("RLC Curve" = Off)

"Off" A bursted signal with pulse like shape is generated. The transition time from high to low or low to high is only one sample.

"On" A longer transition time is used.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:SLOPe` on page 104

RLC curve
Determines if an RLC curve (= discharge/charge curve of an RLC-circuit) is applied to the signal.

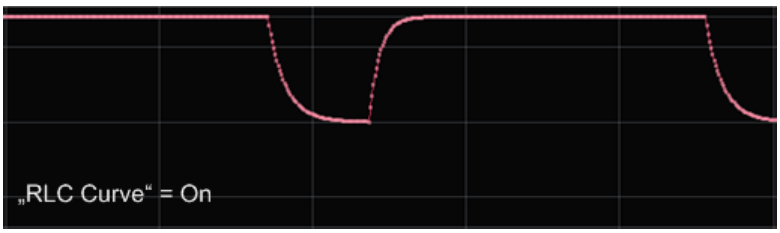


Figure 4-3: Impact of the "RLC Curve" parameter ("RLC Curve" = On)

"On" An "RLC curve" is applied to the signal

"Off" A linear ramp is used.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:RCURve` on page 105

Tfall 90-10 % / 90-5 % (t1-t2)
Defines the signals fall time (90 to 5 % or 90 to 10%) in µs.

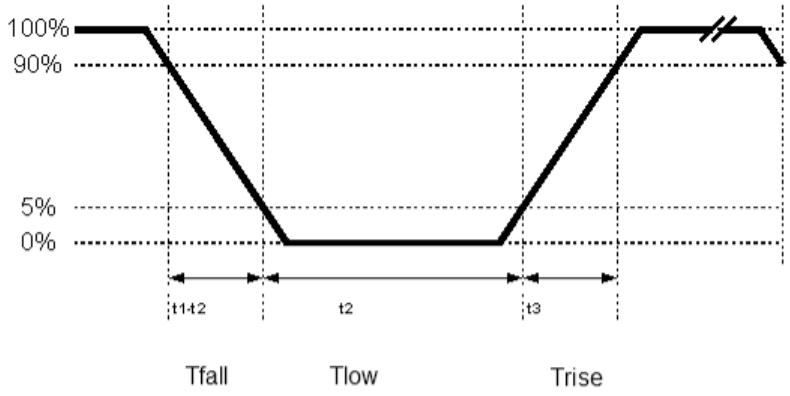


Figure 4-4: Definition of Tfall, Trise, Tlow at an NFC-A Polling Device to Listening Device

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:TFALl` on page 106

Trise 10-90 % / 5-90% (t3)
Defines the signals rise time (5 to 90 % or 10 to 90 %) in µs, see also "Tfall 90-10 % / 90-5 % (t1-t2)" on page 26.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:TRISe` on page 106

Tlow (t2)
Available only for NFC-A in "Transmission Mode > Poll" and EMV A in "Transmission Mode > PCD to PICC".

Defines the signals low time (below 5%) in µs.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:TLOW` on page 106

Overshoot Rising Slope (VOU)
Determines the size of the overshoot after the rising slope. The parameter corresponds to the value V_{OU} in the NFC Analog Technical Specification. Overshoot Rising Slope is in percent of the difference between the nominal high voltage to the nominal low voltage, according to the following formula:

Overshoot in Volts = V_{OU} x (V_a - V_b),

where V_a is the nominal high voltage and V_b is the nominal low voltage.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:OSRise` on page 105

Undershoot Falling Slope (VOU)
Determines the size of the undershoot (ringing) after the falling slope. The parameter corresponds to the value V_{OU} in the NFC Analog Technical Specification. Undershoot Falling Slope is in percent of the difference between the nominal high voltage to the nominal low voltage, according to the following formula:

Undershoot in Volts = V_{OU} x (V_a - V_b),

where V_a is the nominal high voltage and V_b is the nominal low voltage.

Remote command:
[:SOURce<hw>]:BB:NFC:MSET:USFall on page 107

Modulation Depth
Available only for NFC-A in "Transmission Mode > Poll" and EMV A in "Transmission Mode > PCD to PICC".

Sets the ASK modulation depth. The modulation depth indicates the magnitude of the voltage drop during the low state transition. The modulation depth is a percentage relative to the voltage of the carrier signal (V_1).

Remote command:
[:SOURce<hw>]:BB:NFC:MSET:MDEPth on page 105

Modulation index
Defines the signal's modulation index in %.

The modulation index represents the power drop during the low state transitions as a ratio of voltages at defined locations of the low state transition.

$$m_i = \frac{V_a - V_b}{V_a + V_b}$$

where V_a is the nominal high voltage and V_b is the nominal low voltage.

Remote command:
[:SOURce<hw>]:BB:NFC:MSET:MINDex on page 105

Inverse Modulation
When selected, inverse modulation will be used.

Remote command:
[:SOURce<hw>]:BB:NFC:MSET:IMODulation on page 104

Baseband Output
Available only for all "Listen" and "PICC to PCD" modes.

The default state is "On". When activated the signal at the baseband output changes between 0% and 100% voltage to be able to control the Reference Listeners. When deactivated baseband output delivers the envelope of the RF signal.

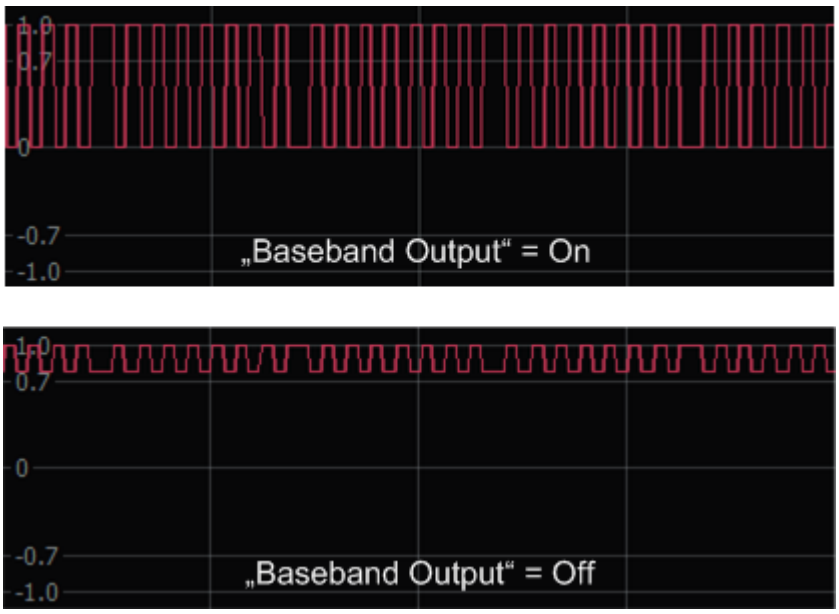


Figure 4-5: Impact of the parameter "Baseband Output"

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:BOUTput` on page 104

Sample Rate
In contrast to mobile radio standards (where this parameter is the "Sample Rate Variation"), the NFC standard does not prescribe a sample- or chiprate, but defines requirements e.g. for edge steepness.

At mobile radio standards, a change of the "Sample Rate Variation" does not change the number of samples per slot/frame/superframe etc., but rather plays the signal "faster" or "slower".

At NFC, the "Sample Rate" parameter changes the time resolution of signal generation, e.g. of how many samples an NFC-A bit duration is formed.

The 20 MSamples/s default value is a good trade-off between signal quality and required calculation time.

Remote command:
`[:SOURce<hw>]:BB:NFC:MSET:SRATe` on page 106

4.3 Predefined Sequence

► To access this dialog select "Main Dialog > Predefined Sequence"

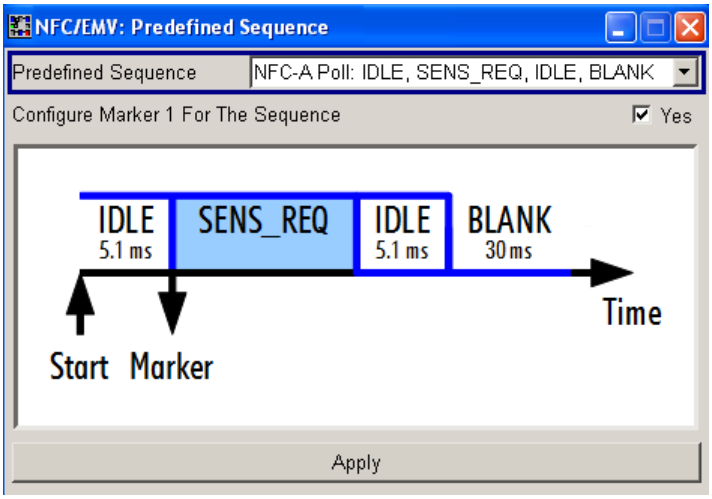


Figure 4-6: Predefined Sequence dialog. The marker is available for signal generators only.

This dialog contains the parameters to define a predefined sequence for transmission modes "Poll" and "PCD to PICC".

Predefined Sequence
Selects a predefined sequence.

Remote command:
`[:SOURce<hw>]:BB:NFC:PRED:SEQuence` on page 75

Configure Marker 1 For The Sequence
Note: Available for signal generators only.

Enables Marker 1 as shown in the picture of the dialog.

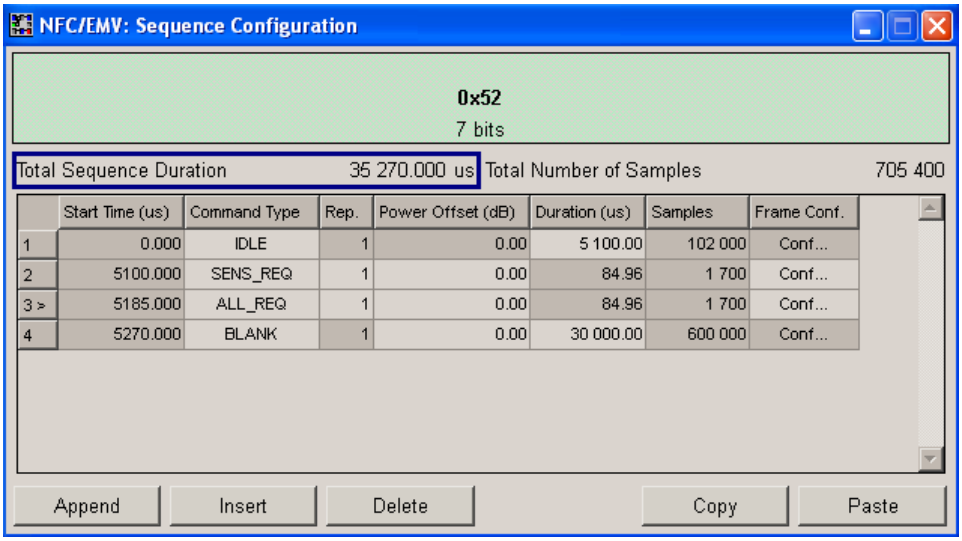
Remote command:
`[:SOURce<hw>]:BB:NFC:PRED:CNFMarker` on page 75

Apply
Activates the selected "Predefined Sequence" and marker status.

Remote command:
`[:SOURce<hw>]:BB:NFC:PRED:APPLy` on page 76

4.4 Sequence Configuration Settings

► To access this dialog select "NFC > Sequence Configuration...".



In this dialog you can define elements of the frame sequence, (e.g. start time, repetition, frame duration, power offset) for each command block.

The example in the screenshot shows some available command types for "Technology > NFC-A", "Transmission Mode > Poll".

For each command block selected, the resulting frame content of the frames of the command block appears on top of the dialog. The content depends not only on the selected command type, but for some command types also on the parameters set in the "Frame Configuration" dialog.

For available command types see Table 4-1.

Total Sequence Duration
Displays the overall sequence duration.

The value of this parameter is not the sum of the durations of the individual commands but is determined by the Total Number of Samples and the Sample Rate as follows:

Total Sequence Duration = Total Number of Samples / Sample Rate

For an example, see Figure 2-10.

Remote command:
`[:SOURce<hw>]:BB:NFC:SCONfiguration:TSDuration?` on page 79

Total Number of Samples
Displays the total number of samples allocated to the current sequence configuration. The displayed value is the sum of the samples of the individual commands.

Total Number of Samples = $Samples_1$ + ... + $Samples_N$

For an example, see Figure 2-10.

Remote command:
[:SOURce<hw>]:BB:NFC:SCONfiguration:TNSamples? on page 78

Sequence Table
Contains the elements of the command sequence.

The first table column shows the successive command block number.

Start Time
Displays the exact start time of the corresponding command (in µs). The value is calculated as the sum of the samples of all preceding commands converted to time.

$Start\ Time_N = (Samples_1 + ... + Samples_{-1}) / Sample\ Rate$

For an example, see Figure 2-10.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:STIMe? on page 78

Command Type
Determines the command type for each command block.

For the different technologies and transmission modes you can select command types as listed in Table 4-1.

The different types of tag platforms (used in the table header) are described in the NFC Digital Protocol Technical Specification.

Table 4-1: Available command types for "Technology > NFC-A" and the corresponding SCPI-command parameters (in brackets).

"Transmission Mode"	Platform / Protocol				
	General command type	Type 1 Tag	Type 2 Tag	Type 4A Tag	NFC-DEP
"Poll"	"ALL_REQ" (ALAQ) "SENS_REQ" (SNAQ) "SDD_REQ" (SDAQ) "SEL_REQ" (SLAQ) "SLP_REQ" (SPAQ) "GENERIC" (GENE) "BLANK" (BLNK) "IDLE" (IDLE)	"RID" (RDAQ) "RALL" (RLAQ) "READ"(T1RQ) "WRITE-E" (WREQ) "WRITE-NE"(WNEQ) "RSEG" (RSGQ) "READ8" (RD8Q) "WRITE-E8" (WE8Q) "WRITE-NE8" (WN8Q)	"READ" (T2RQ) "WRITE" (T2WQ) "SECTOR SELECT" (SSLQ)	"RATS" (RATQ) "DATA" in "ISO-DEP" (T4AD)	"ATR_REQ" (ATRQ) "PSL_REQ" (PSLQ) "DEP_REQ" (DEPQ) "DSL_REQ" (DSLQ) "RLS_REQ" (RLSQ)
"Listen"	"SENS_RES" (SNAS) "SDD_RES" (SDAS) "SEL_RES" (SLAS) "BLANK" (BLNK) "IDLE" (IDLE)	"RID" (RDAS) "RALL" (RLAS) "READ" (T1RS) "WRITE-E" (WRES) "WRITE-NE" (WNES) "RSEG" (RSGS) "READ8" (RD8S) "WRITE-E8" (WE8S) "WRITE-NE8" (WN8S)	"READ" (T2RS) "ACK" (ACK) "NACK" (NACK)	"ATS" (ATSS) "DATA" in "ISO-DEP" (T4AD)	"ATR_RES" (ATRS) "PSL_RES" (PSLS) "DEP_RES" (DEPS) "DSL_RES" (DSLS) "RLS_RES" (RLSS)

Table 4-2: Available command types for "Technology > NFC-B" and corresponding SCPI-command parameters (in brackets).

"Transmission Mode"	General command type	Platform / Protocol
		Type 4 B Tag
"Poll"	"ALLB_REQ" (ALBQ) "SENSB_REQ" (SNBQ) "SLOT_MARKER" (SMAR) "SLPB_REQ" (SPBQ) "GENERIC" (GENE) "BLANK" (BLNK) "IDLE" (IDLE)	"ATTRIB" (ATBQ) "DATA" in "ISO-DEP" (T4BD)
"Listen"	"SENSB_RES" (SNBS) "SLPB_RES" (SPBS) "BLANK" (BLNK) "IDLE" (IDLE)	"ATTRIB" (ATBS) "DATA" in "ISO-DEP" (T4BD)

Table 4-3: Available command types for "Technology > NFC-F" and corresponding SCPI-command parameters (in brackets).

"Transmission Mode"	General command type	Platform / Protocol	
		Type 3 Tag	NFC-DEP
"Poll"	"SENSF_REQ" (SNFQ) "GENERIC" (GENE) "BLANK" (BLNK) "IDLE" (IDLE)	"CHECK" (CHKQ) "UPDATE" (UPDQ)	"ATR_REQ" (ATRQ) "PSL_REQ" (PSLQ) "DEP_REQ" (DEPQ) "DSL_REQ" (DSLQ) "RLS_REQ" (RLSQ)
"Listen"	"SENSF_RES" (SNFS) "BLANK" (BLNK) "IDLE" (IDLE)	"CHECK" (CHKS) "UPDATE" (UPDS)	"ATR_RES" (ATRS) "PSL_RES" (PSLS) "DEP_RES" (DEPS) "DSL_RES" (DSLS) "RLS_RES" (RLSS)

Table 4-4: Available command types for "Technology >EMV Type A" and corresponding SCPI-command parameters (in brackets).

"Transmission Mode"	General command type
"PCD to PICC"	"WUPA" (ALAQ) "REQA" (SNAQ) "ANTICOLLISION" (SDAQ) "SELECT" (SLAQ) "HLTA" (SPAQ) "RATS" (RATQ) "DATA_Type_A" (T4AD) "BLANK" (BLNK) "IDLE" (IDLE)
"PICC to PCD"	"ATQA" (SNAS) "ANTICOLLISION" (SDAS) "SAK" (SLAS) "ATS" (ATSS) "DATA_Type_A" (T4AD) "BLANK" (BLNK) "IDLE" (IDLE)

Table 4-5: Available command types for "Technology >EMV Type B" and corresponding SCPI-command parameters (in brackets).

"Transmission Mode"	General command type
"PCD to PICC"	"WUPB" (ALBQ) "REQB" (SNBQ) "HLTB" (SPBQ) "ATTRIB" (ATBQ) "DATA_Type_B" (T4BD) "BLANK" (BLNK) "IDLE" (IDLE)
"PICC to PCD"	"ATQB" (SNBS) "HLTB" (SPBS) "ATTRIB" (ATBS) "DATA_Type_B" (T4BD) "BLANK" (BLNK) "IDLE" (IDLE)

Note: The IDLE command produces an unmodulated signal part of a configurable length while the BLANK command produces a signal part without any output signal.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:CTYPe` on page 76

Rep.
Determines the number of times to repeat the generation of a frame.

See also Figure 2-10.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:REPetition` on page 78

Power Offset (dB)
Determines the value of the power offset in dB.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:POFFset` on page 78

Duration (µs)
For "Command Type > BLANK/IDLE", determines the frame period in µs. For all other commands, the duration is displayed as defined in the standard.

For an example, see Figure 2-10.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:DURation` on page 77

Samples
Displays the number of the samples used for the command. For the calculation of the value, the Duration (µs) is converted to samples and rounded up.

Samples = ceiling (Duration * Sample Rate)

For an example, see Figure 2-10.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:SAMPles?` on page 78

Frame Configuration
Accesses the "Frame Configuration " dialog for each command block, see Chapter 4.5, "Frame Configuration Settings", on page 37.

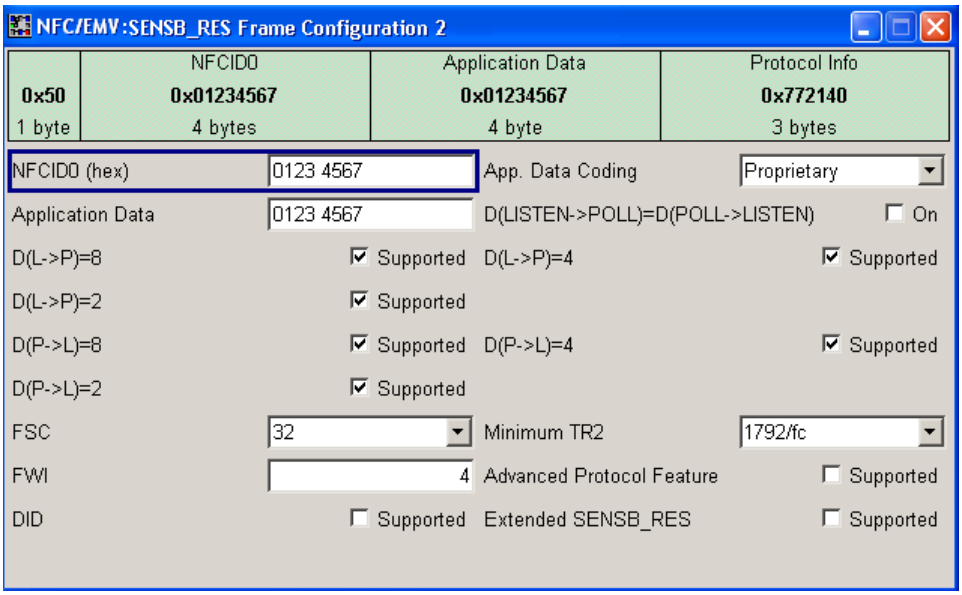
Append, Insert, Delete, Copy, Paste
General functions for editing the sequence configuration, as append, insert, delete, copy or paste a command block.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock:APPend` on page 76
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:INSert` on page 77
`[:SOURce<hw>]:BB:NFC:ICBLock` on page 77
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:DELete` on page 77
`[:SOURce<hw>]:BB:NFC:DCBLock` on page 77
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:COPY` on page 76
`[:SOURce<hw>]:BB:NFC:CCBLock` on page 76
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:PASTe` on page 77
`[:SOURce<hw>]:BB:NFC:PCBLock` on page 77

4.5 Frame Configuration Settings

For each "Command Type" listed in the Table 4-1 a "Frame Configuration" dialog is available.

► To access the frame configuration dialog, select "Config..." in the corresponding row in the "Sequence Configuration" table.



The top of the "Frame Configuration" dialog shows the resulting frame content for the current settings. The parameters and functions in the "Frame Configuration" dialog depend on the "Command Type" selected in the sequence configuration.

For the following command types only the bit value of the frame is displayed because the value is fixed:

ALL_REQ, ACK, SENS_REQ, SLP_REQ, RID

4.5.1 Parameters of the Frame Configuration Dialog

In the following chapter the settable parameters of all command types are listed alphabetically. Each command type uses only some of these parameters. The availability of some settings depends on other settings in the same dialog and on the selected "Technology" and "Transmission Mode".

Some parameters have the same functionalites for the NFC and the EMV technologies, but are named differently for the specific technology. In the following chapter the equivalent parameters are described only once. The parameter names for both technologies are contained in the parameter title and both names are devided by a "/". The parameter name for the NFC tecnology is written on the first place.

Example:

"NFCID1 (hex) / UID (hex)", where "NFCID1 (hex)" is the parameter name for the NFC technology and "UID (hex)" the parameter name for the EMV technology.

ACK, NACK
Available only for "PDU Type > ACK-NACK" or "Block Type > R-block".

Selects ACK or NACK.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:ANSelection` on page 80

Advanced Protocol Features supported
Enables/disables the support of advanced protocol features.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:APFSupported` on page 81

AFI
Sets the application family being selected.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:AFI` on page 80

AID Length
For "Application Data Coding > CRC-B", determines the length of AID.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:ALENgth` on page 80

AID (hex)
Determines the value of AID.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:AID` on page 80

Application Data
If "Application Data Coding > Proprietary" is used, enters the application data in hex format.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:ADATa` on page 79

Application Data Coding
Determines the way the application data is coded: with a "Proprietary" code or using a "CRC-B" compressing method.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:ADCoding` on page 80

ATN or Timeout
Available only for "PDU Type > Supervisory".

Determines whether a "ATN" (Attention) or "Timeout" supervisory PDU type is used.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:ATIMeout` on page 83

BCC Error
Used for error detection. If enabled, an error is added intentionally to the BCC (Block Check Character) by adding 1 to the BCC Byte.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:BCCError` on page 83

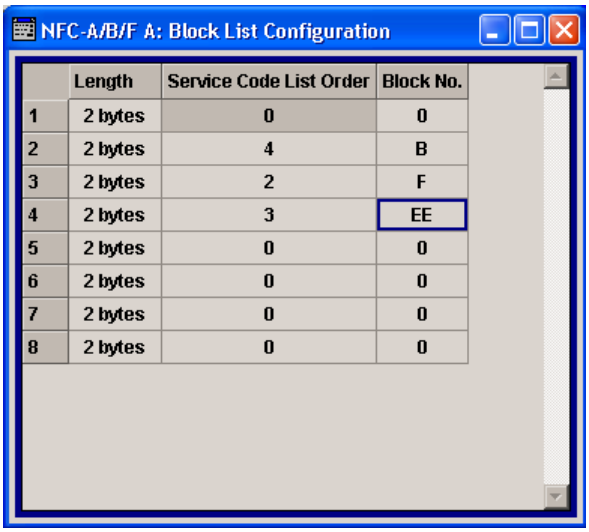
Bit Frame SDD / Bit Frame Anticollision
Determines the Bit frame SDD / Anticollision.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:BFSDd` on page 84
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:BFANticollision` on page 83

Block List, Block Data, Block List Configuration
Available with "Command Type > CHECK". Accesses the "Block List Configuration" dialog.

The available functions in the "Block List Configuration" dialog depend on the selected "Transmission Mode".

With "Transmission Mode > Poll" the block list appears.



	Length	Service Code List Order	Block No.
1	2 bytes	0	0
2	2 bytes	4	B
3	2 bytes	2	F
4	2 bytes	3	EE
5	2 bytes	0	0
6	2 bytes	0	0
7	2 bytes	0	0
8	2 bytes	0	0

The number of rows in the block list is determined by the parameter Number of Blocks.

With "Transmission Mode > Listen" the block data appears.

"Length" Sets the block length in bytes.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:LEN on page 84

"Service Code List Order" Sets the service code list order.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:SLORder on page 85

"Block Number" Sets the block number.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:BNUMber on page 84

"Block Data" Enters the block data in hex format.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:BDATa on page 84

Block Number (BNo)
Selects the block number to be read or written.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BNO on page 85

Block Number (for I-block type or R-block type)
Available for I-block type or R-block type. Indicates if a valid I-block or a valid R (ACK) block is received.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:IBNumber on page 92

Block or Byte Selection (ADD)
Selects a block/byte to be read or written.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLKSelection on page 84
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BYTSelection on page 86

Block Type
Determines the used block type.

"I-block" Used to convey information for use by the application layer.

"R-block" Used to convey positive or negative acknowledgements. An R-block never contains an INF field. The acknowledgement relates to the last received block.

"S-block" Used to exchange control information between the reader/writer and the card emulator.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BTYPe on page 85

Chaining
Available only for "Block Type > I-block".

Determines if chaining is applied.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:CHAining on page 86

Configuration Type
Only used in case NFCID1 is not completed.(Cascade bit == “On”).

Determines what platform or protocol the device in Listen mode is configured for.

"Type 2 Tag" This platform uses the following characteristics of NFC-A:

- synchonization mechanism
- bit level coding
- transmits Commands and Responses in NFC-A standard frames, except for the ACK and NACK Response.

"Type 4A Tag" This platform uses the following characteristics of NFC-A:

- synchonization mechanism
- bit level coding
- transmits commands and responses in NFC-A standard frame format.

"NFC-DEP" This protocol uses the following characteristics of NFC-A or NFC-F, depends on the configuration :

- sequence format
- bit level coding
- frame format.

"NFC-DEP&Type 4A Tag"
Used for devices capable of both, NFC-DEP and Type 4A Tag. For more details see the NFC Digital Protocol Technical Specification.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:CFGType on page 86

Data (hex)
Sets the data for the corresponding frame.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:BOData on page 81
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:SHData on page 81
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STData on page 82
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:DATA on page 82
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:DATA on page 82

Data Length
Determines the length of the transmitted user data / general data.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:LENGth on page 87

Data Source (Data)
Determines the data source type for the frame.

"All 0 / All 1" Generates 0 or 1 data.

"PN9 / 11 / 15 / 16 / 20 / 21 / 23"
Generates PRBS data in accordance with ITU-T with period lengths between 2^9-1 and 2^{23}-1.

"Data List" Uses data from a programmable data list. The data can be generated with the binary editor in the instrument or externally with any editor. Data list files are selected from the "Select Data List" dialog.

"Pattern" Defines a bit pattern. For Pattern input select "Data Pattern".

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA on page 87
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:DSELection on page 87
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:PATTern on page 87

DESELECT or WTX
Available only for "Block Type > S-block".

Determines whether a "DESELECT" or a "WTX" (waiting) is sent.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DWSelection on page 91

DID Supported / CID Supported
Determines if DID / CID is supported.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DSUPported on page 91
[:SOURce<hw>]:BB:NFC:CBLock<ch>:CSUPported on page 87

DID (DID field)/ CID (CID field)
Determines the value of DID (Device Identification Number) / CID (Cryptogram Information Data).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DID on page 88
[:SOURce<hw>]:BB:NFC:CBLock<ch>:CID on page 86

DID following (I-block type, R-block type or S-block type)
Determines if a DID is following.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DFOLlowing on page 88

D(LISTEN->POLL)=D(POLL->LISTEN) / D(PICC->PCD)=D(PCD->PICC)
Determines if the same bit rate divisor for both directions is supported.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DEQD on page 88

D(L->P=8), D(L->P=4), D(L->P=2)
In the transmission direction listen to poll, indicate support of the corresponding divisor, i.e. determine the bit rate capability.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP8 on page 89
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP4 on page 88
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP2 on page 88

D(P->L=8), D(P->L=4), D(P->L=2)
In the transmission direction poll to listen, indicate support of the corresponding divisor, i.e. determine the bit rate capability.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL8 on page 89
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL4 on page 89
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL2 on page 89

Divisor (LISTEN to POLL), Divisor (POLL to LISTEN) / Divisor (PCD to PICC), Divisor (PICC to PCD)
Available for "Command Type > ATTRIB".

Set the divisor in the corresponding transmission direction.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLTPoll on page 89
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPTListen on page 90
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPPicc on page 90
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPPCd on page 90

DRI
Selects the divisor (1, 2, 4, 6, 8, 16, 32, 64) in communication direction from target to initiator. The divisor determines the bit rate.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DRI on page 90

DSI
Selects the divisor (1, 2, 4, 6, 8, 16, 32, 64) in communication direction from initiator to target. The divisor determines the bit rate.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:DSI on page 90

EoD (CRC)
Selects if the EoD is present or not. The EoD contains a 2-byte CRC.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STEPresent on page 83

Extended SENSB_RES / Extended ATQB
Determines if "Extended SENSB_RES" / "Extended ATQB" is supported.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:ESSupported on page 91
[:SOURce<hw>]:BB:NFC:CBLock<ch>:EASupported on page 91

Frame Type
Selects a frame type for "Command Type > GENERIC".

"Short Frame"	Used to initiate communication. A short frame consists of an SoF, up to 7 data bits and an EoF.
"Standard Frame"	Used for data exchange. A standard frame consists of an SoF, n*(8 data bits + odd parity bit) where n≥1 and for the case of a Poll - Listen communication an EoF.
"Bit Oriented SDD Frame"	Used for collision resolution. A bit oriented SDD frame results from a standard frame of 7 bytes that is divided into two parts.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:FTYPe on page 81

FSC
Selects the maximum frame size in bytes.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FSC on page 91
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MFSize on page 93

FWI
Determines the FWI (Frame Waiting time Integer) which is needed to calculate the FWT (Frame Waiting Time).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FWI on page 92

General Data
Determines if the bytes with General Data are available.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:GDAVailable on page 92

Global Block Selection (ADD)
Selects 8-byte block to be read or written.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:GBSelection on page 92

k
Determines the number of historical bytes to be used. To set the bytes T_1 to T_k themself, use the parameter T1 to Tk.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:KPARameter on page 93

Length Reduction
According to the NFC specification, the length reduction bits (LR) are used to restrict the payload size.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:LREDuction on page 93

Lock Control or Status
Enables/disables status information on lock for the corresponding block ("BLOCK-1" to "BLOCK-C").

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:LOCKed on page 85

MBLI
Determines the Maximum Buffer Length Index (MBLI).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MBLI on page 93

MI (more information) Chaining
If enabeld, the More Information (MI) bit indicates chaining. Chaining indicates that a larger data block is split into several PDUs and the current PDU contains only a part of the data.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MICHaining on page 93

Minimum TR0, TR1, TR2
Indicates the minimum value of TR0/TR1/TR2 supported. The fc stands for the carrier frequency.

"1008/fc, 768/fc, 256/fc"
Minimum supported TR0

"1254/fc, 1024/fc, 256/fc"
Minimum supported TR1

"1792/fc, 3328/fc, 5376/fc, 9472/fc"
Minimum supported TR2.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR0 on page 94
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR1 on page 94
[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR2 on page 94

NACK
Determines the value of NACK.

"0 / 1 / 4 / 5" Value of NACK in hex.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NACK on page 94

NAD
Available only for "NAD following > On".

Determines the value of NAD.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NAD on page 95

NAD following
Determines if NAD is following.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NFOLlowing on page 95

NAD Supported
Enables/disables the support of NAD.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSUPported on page 97

NFCID0 (hex) / PUPI (hex)
Determines the entire value of NFCID0/ PUPI. The length of NFCID0 /PUPI is fixed to 4 in octet.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID0 on page 95
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PUPI on page 98

NFCID1 (hex) / UID (hex)
Determines the entire value of NFCID1/ UID.

The length of NFCID1/ UID is configurable to up to 10 bytes.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID1 on page 95
[:SOURce<hw>]:BB:NFC:CBLock<ch>:UID on page 103

NFCID1 not complete / UID not complete
Determines whether NFCID1 / UID is complete or not.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NNComplete on page 96
[:SOURce<hw>]:BB:NFC:CBLock<ch>:UNComplete on page 103

NFCID1 Size / UID Size
Determines the size of NFCID1/ UID.

"Single " The size is 4 bytes.

"Double" The size is 7 bytes.

"Triple" The size is 10 bytes.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSIZe on page 96
[:SOURce<hw>]:BB:NFC:CBLock<ch>:USIZe on page 103

NFCID2 Format Type
Indicates if the NFCID2 format is for NFC-DEP Protocol or Tag Type 3 platform.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:N2FType on page 94

NFCID2 (hex)
Determines the entire value of NFCID2. The value of Byte 2 in NFCID2 is fixed to “FE”, except at command type 3.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID2 on page 95

Number of Applications
Determines the number of applications.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NOAPplications on page 96

Number Of Bits
Sets the length of a short frame.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:SHLength on page 82

Number Of Bits For Part 1
Sets the length of the first part of a bit oriented SDD frame.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:BOLength on page 81

Number of Blocks
Determines the number of blocks.

Select the Block List, Block Data, Block List Configuration to access the dialog with further settings.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NBLocks on page 95

Number Of Data Bytes
Shows the total length of a frame in bytes.

The length for the different NFC technologies is calculated as follows:
- NFC A: the sum of the "Number Of Payload Bytes" and if "EoD (CRC)" is present, 2 additional bytes are added
- NFC B: the sum of the "Number Of Payload Bytes" and 2 additional bytes added for "EoD (CRC)"
- NFC F: the sum of the "Number Of Payload Bytes", 2 additional bytes added for "EoD (CRC)" and 1 additional byte added for SoD

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STDLength? on page 82
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:DLENgth? on page 82
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:DLENgth? on page 82

Number Of Payload Bytes
For "Technology > NFC A" sets the length of a standard frame.

For "Technology > NFC B /NFC F" sets the length of a frame.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STPLength on page 83
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:PLENgth on page 83
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:PLENgth on page 83

Number of Services
Sets the number of services. The value determines the row numbers in the "Service Code List Configuration" dialog.

To access this dialog, select Service Code List....

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSERvices on page 96

Number of Slots
Determines number of slots (1, 2, 4, 8 or 16).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:NOSLots on page 96

Number of Time Slots
Determines how many time slots are used. The coding of the Time Slot Number TSN byte is performed accordingly.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:TSN on page 103

A,B,E Parameter for MRTI (CHECK) or (UPDATE)
Sets the value of the corresponding parameter, i.e. determines the format of the Maximum Response Time Information $MRTI_{CHECK}$ and $MRTI_{UPDATE}$.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:ACHK on page 79
[:SOURce<hw>]:BB:NFC:CBLock<ch>:AUPD on page 79
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BCHK on page 79
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BUPD on page 79
[:SOURce<hw>]:BB:NFC:CBLock<ch>:ECHK on page 79
[:SOURce<hw>]:BB:NFC:CBLock<ch>:EUPD on page 79

Packet Selection
Selects if the first or second packet of the SECTOR_SELECT command is transmitted.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PSELection on page 98

PAD0, PAD1, PAD2
Sets the value of PAD0/PAD1/PAD2 (hex).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD0 on page 97
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD1 on page 97
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD2 on page 97

PDU Type
Selects the type of PDU (Protocol Data Unit).

"Information" Used to convey Application Layer Data in the transport data bytes. Application Layer Data is information for use by the adjacent upper layer.

"ACK/NACK" Used to convey positive or negative acknowledgements. This PDU never contains transport data bytes. The acknowledgement relates to the last received PDU.

"Supervisory" Used to exchange control information between the initiator and the target. Two different types of "Supervisory" PDUs are defined.
For more details refer to the NFC Digital Protocol Technical Specification.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:PDUType` on page 97

PNI
Only used with "PDU Type > Information". Determines Packet Number Information (PNI).

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:PNI` on page 98

Power Level Indication
Determines the Power Level Indication.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:PLIN` on page 97

Power Level Indicator
Power Level Indicator.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:PLIR` on page 97

RC
Determines the Request Code (RC) ("No System Code info requested", "System Code info requested", "Advanced Protocol features supported") used to retrieve additional information.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:RC` on page 98

RTOX
With seleted "PDU Type > Supervisory" and "ATN/Timeout > Timeout", sets the response timeout extension (RTOX) request value.

With a RTOX request, a target indicates that more time than the defined RWT is required to process the received PDU.

Remote command:
`[:SOURce<hw>]:BB:NFC:CBLock<ch>:RTOX` on page 98

SC
Sets the System Code.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SCODe on page 99

Segment Selection (ADD)
Selects a segment to be read.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SEGSelection on page 99

SEL_CMD / SEL
Selects the cascade level (CL) of the NFCID1 / UID requested by the device.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SCMD on page 99
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SEL on page 99

SEL_PAR_UPPER
Together with SEL_PAR_LOWER, the parameter SEL_PAR_UPPER determines where the NFC-A Bit oriented SDD Frame is split into the SDD_REQ and SDD_RES parts. Therefore this parameter influences the lengths of the SDD_REQ or SDD_RES commands. SEL_PAR_UPPER determines the number of full bytes of the SDD_REQ part.

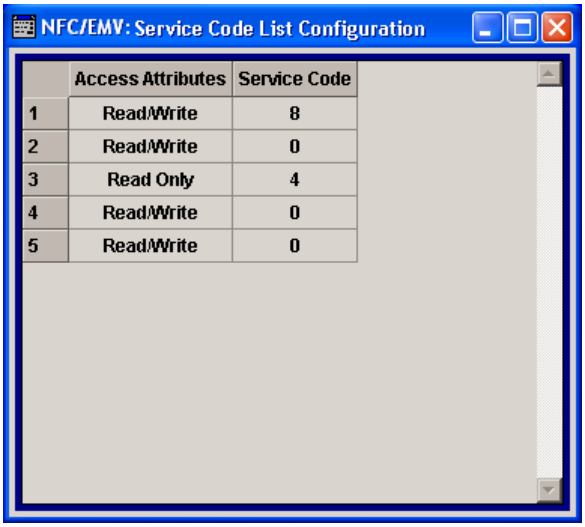
Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SPUPper on page 101

SEL_PAR_LOWER
Together with SEL_PAR_UPPER, the parameter SEL_PAR_LOWER determines where the NFC-A Bit oriented SDD Frame is split into the SDD_REQ and SDD_RES parts. Therefore this parameter influences the lengths of the SDD_REQ or SDD_RES commands. SEL_PAR_LOWER determines the number of those bits of the SDD_REQ part, which are not part of full bytes.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SPLower on page 101

Service Code List...
Accesses the "Service Code List Configuration" dialog.

The number of rows corresponds to the value selected for the paramter Number of Services.



"Access Attributes" Determines whether the attributes are "Read/Write" or "Read Only".

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SERVice<st>:AATTributes on page 100

"Service Code" The "Service Code" is an element of the type 3 tags. Services are similar to files in a file system. Each service has a number of memory blocks associated with it. Services can be addressed using their service code, which must be unique inside each type 3 tag.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SERVice<st>:SNUMber on page 100

SFGI
Determines the Start-up Frame Guard Time (SFGT).

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SFGI on page 101

Slot Number
Determines the slot number ("Slot Number 2" to "Slot Number 16"), i.e defines the start of the response time slot during collision resolution.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SNUMber on page 101

SNo
For "Packet Selection > Packet 2", determines the sector number.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SNO on page 101

Status Flag 1, Status Flag 2
Sets the status flags to specify a Type 3 tag's error condition. A value of 0 signals a successful execution, values different from 0 indicate errors.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SF1 on page 100
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SF2 on page 100

Suppression of EoS,SoS Not Required
Determines whether a suppression of EoS (End of Sequence)/SoS (Start of Sequence) is required or not.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SENRequired on page 100
[:SOURce<hw>]:BB:NFC:CBLock<ch>:SSNRequired on page 102

T1 to Tk
For number of historical bytes k greater than 0, sets the historical bytes T_1 to T_k.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:T1TK on page 102

Type 1 Tag Platform Configured
Determines whether Type 1 Tag platform is configured or not.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:T1TConfigured on page 102

Total No. Apps in the PICC
Sets the total number of applications in the PICC (Proximity Inductive Coupling Card), i.e. in the NFC Forum Device in listener mode.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:TAIPicc on page 102

WT
Sets the Waiting Time (WT) that codes the Response Waiting Time (RWT). The "WT" value determines the least significant bits (b4 to b1) of the TO field in the ATR_RES command.

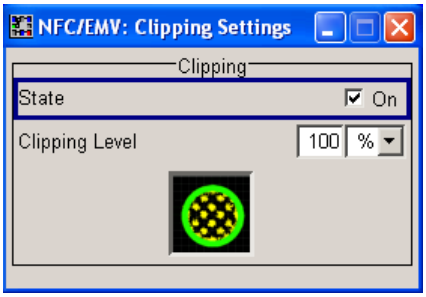
Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:WT on page 103

WTXM (INF field of S(WTX) request, response)
Only used when "DESELCT/WTX > WTX" is set. Sets the value of the WTXM in a waiting time extension request/response command.

Remote command:
[:SOURce<hw>]:BB:NFC:CBLock<ch>:WTXM on page 103

4.6 Clipping Settings

► To access this dialog, select "Main dialog > Clipping Settings".



The dialog comprises the settings, necessary to configure the baseband filter, sample rate variation and clipping.

Clipping State
Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

With baseband clipping, the signal level is limited to a settable value ("Clipping Level"). This level is specified as a percentage of the highest peak value.

Remote command:
`[:SOURce<hw>]:BB:NFC:CLIPping:STATe` on page 107

Clipping Level
Sets the limit for clipping.

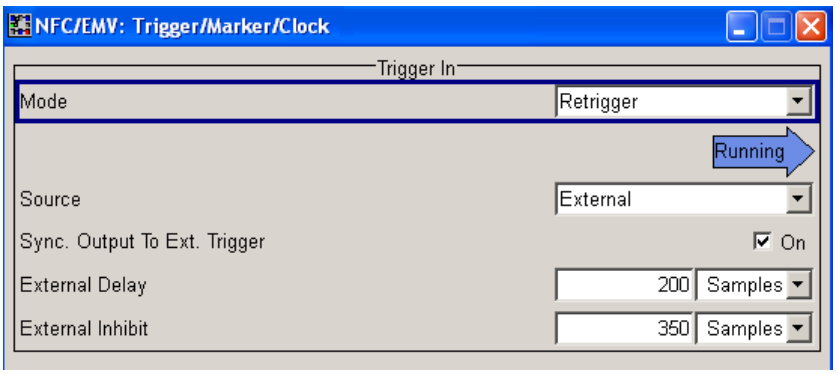
This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote command:
`[:SOURce<hw>]:BB:NFC:CLIPping:LEVel` on page 107

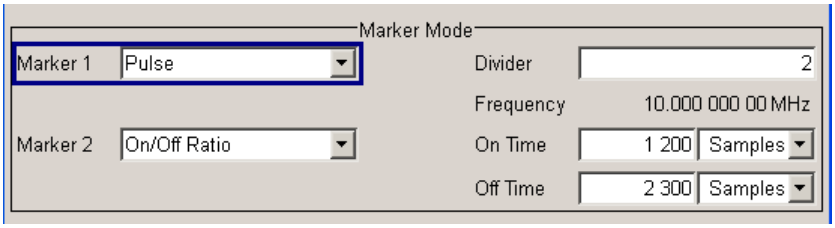
4.7 Trigger/Marker/Clock Settings

► To access this dialog select "Main dialog > Trigger/Marker".

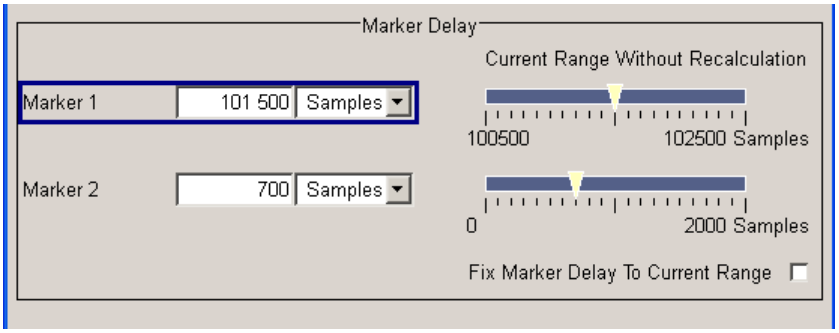
The "Trigger In" section allows setting of the trigger for the signal. Various parameters will be provided for the settings, this depends on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



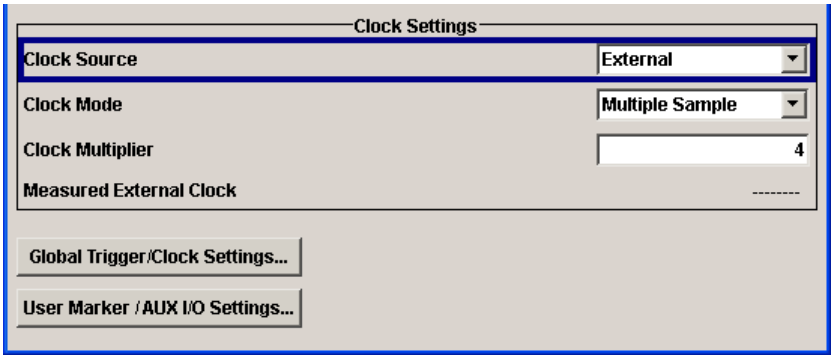
The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.



In the "Marker Delay" section you can define the marker signal delay, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



In the "Clock Settings" section you can select the clock source and - in case of an external source - the clock type.
The buttons in the last section lead to subsection for general trigger, clock and mapping settings.



4.7.1 Trigger Settings

In the "Trigger in" dialog the trigger for the signal is set. Various parameters will be provided for the settings, this depends on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

Trigger Mode
Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed_Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Armed_Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal with or external) causes a restart.
- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Remote command:
`[:SOURce<hw>]:BB:NFC[:TRIGger]:SEQuence` on page 110

Signal Duration Unit
Available in Single Trigger Mode. Defines the unit for describing the length of the signal sequence to be output.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:SLUNit on page 110

Signal Duration
Enters the length of the signal sequence to be output in the "Single" trigger mode.

Use this parameter to deliberately output part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:SLENgth on page 110

Running/Stopped
For enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"
  The signal is generated; a trigger was (internally or externally) initiated in triggered mode.
- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:RMODe? on page 109

Arm
For trigger modes "Armed Auto" and "Armed Retrigger", stops the signal generation until subsequent trigger event occurs.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:ARM:EXECute on page 108

Execute Trigger
Available only with internal trigger source and a trigger mode other than "Auto". Executes the trigger manually.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:EXECute on page 108

Trigger Source
Selects trigger source. This setting is effective when a trigger mode other than "Auto" has been selected.

- "Internal"
  The trigger event is executed by "Execute Trigger".
- "Internal (Baseband A/B)"
  (two-path instruments)
  The trigger event is the trigger signal from the second path
- "External (Trigger 1/2)"
  The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER 1/2 connector.
  Use the "Global Trigger/Clock Settings" dialog to define the polarity, the trigger threshold and the input impedance of the trigger signal.

Remote command:
[:SOURce<hw>]:BB:NFC:TRIGger:SOURce on page 110

Sync. Output to External Trigger
(enabled for Trigger Source External)

Enables/disables output of the signal synchronous to the external trigger event.

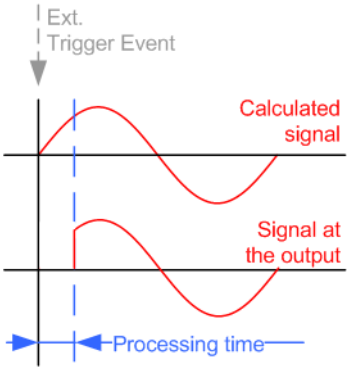
For R&S SMBV instruments:

For two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See below for an overview of the required settings.

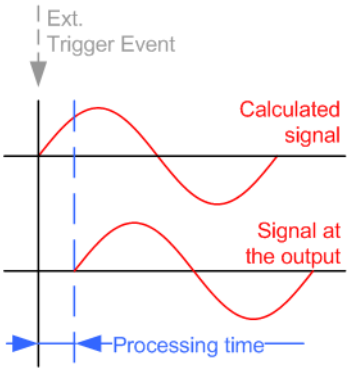
Typical Applications

- All instruments are synchronous to the external trigger event
  - System Trigger = common External Trigger event for the master and the slave instruments
  - "Sync. Output to External Trigger" = ON
- All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event
  - System Trigger = common External Trigger event for the master and the slave instruments
  - "Sync. Output to External Trigger" = OFF
- All instruments are synchronous among themselves
  - System Trigger = internal trigger signal of the master R&S SMBV for the slave instruments
  - "Sync. Output to External Trigger" = OFF

"On" Corresponds to the default state of this parameter.
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



"Off" The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is output.
This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.



Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:EXTernal:SYNChronize:OUTPut` on page 109

Trigger Delay / External Delay
Delays the trigger event of the signal from:
- the external trigger source
- the other path

Use this setting to:
- synchronize the instrument with the device under test (DUT) or other external devices

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger[:EXTernal<ch>]:DELay` on page 108
`[:SOURce<hw>]:BB:NFC:TRIGger:OBASeband:DELay` on page 109

Trigger Inhibit / External Inhibit
Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering or on internal triggering via the second path.

For two-path instruments, the trigger inhibit can be set separately for each of the two paths.

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger[:EXTernal<ch>]:INHibit` on page 108
`[:SOURce<hw>]:BB:NFC:TRIGger:OBASeband:INHibit` on page 109

4.7.2 Marker Settings

The marker output signal for synchronizing external instruments is configured in the marker settings section "Marker Mode".

The R&S SMBV supports only two markers.

4.7.2.1 Marker Mode Settings

Marker Mode
Selects a marker signal for the associated "MARKER" output.

"Trigger" Marker singal, generated on received internal or external trigger signal.

"Restart" A marker signal is generated on every repetition of the complete frame sequence.

"Pulse" A regular marker signal is generated. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, the resulting pulse frequency is displayed below it.

"Pattern" A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 64 bits and is defined in an input field which opens when pattern is selected.

"ON/OFF Ratio" A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.
The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when ON/OFF ratio is selected.

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:MODE` on page 111
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PULSe:DIVider` on page 112
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PULSe:FREQuency?` on page 112
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PATTern` on page 112
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:ONTime` on page 112
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:OFFTime` on page 112

4.7.2.2 Marker Delay Settings

The delay of the signals on the marker outputs is set in the "Marker Delay" section.

The R&S SMBV supports two markers.

Marker x Delay
Enters the delay between the marker signal at the marker outputs and the start of the signal.

If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay` on page 113

Current Range without Calculation
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay:MINimum?` on page 113
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay:MAXimum?` on page 113

Fix Marker to Current Range
Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

Remote command:
`[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut:DELay:FIXed` on page 113

4.7.3 Clock Settings

The clock settings are used to set the clock source.

Sync. Mode
(for R&S SMBV only)

Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signals of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

- "None"
  The instrument is working in stand-alone mode.
- "Sync. Master"
  The instrument provides all connected instruments with its synchronisation (including the trigger signal) and reference clock signal.
- "Sync. Slave"
  The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

Remote command:
`[:SOURce<hw>]:BB:NFC:CLOCk:SYNChronization:MODE` on page 115

Set Synchronization Settings
(for R&S SMBV only)

Performs an automatic adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Synchronization Mode".

Remote command:
`[:SOURce<hw>]:BB:NFC:CLOCk:SYNChronization:EXECute` on page 115

Clock Source
Selects the clock source.

- "Internal"
  The internal clock reference is used to generate the symbol clock.
- "External"
  The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.
  The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).
  The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".
  In the case of two-path instruments this selection applies to path A.

Remote command:
`[:SOURce<hw>]:BB:NFC:CLOCk:SOURce` on page 114

Clock Mode
Enters the type of externally supplied clock.

"Sample" A sample clock is supplied.

"Multiple" A multiple of the sample clock is supplied. The symbol clock is derived internally from this.

Remote command:
`[:SOURce<hw>]:BB:NFC:CLOCk:MODE` on page 114

Clock Multiplier
Enters the multiplication factor for "Clock Mode > Multiple Sample".

Remote command:
`[:SOURce<hw>]:BB:NFC:CLOCk:MULTiplier` on page 114

Measured External Clock
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
`CLOCk:INPut:FREQuency?`

4.7.4 Global Settings

The buttons in this section lead to dialogs for general trigger, clock and mapping settings.

Global Trigger/Clock Settings
Calls the "Global Trigger/Clock/Input Settings" dialog.

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.

User Marker / AUX I/O Settings
Calls the "User Marker AUX I/O Settings" dialog, used to map the connector on the rear of the instruments.

See also "User Marker / AUX I/O Settings" in the Operating Manual.

5 How to Generate Signals with the NFC A/B/F Option

The section provides examples on test setups for testing NFC enabled devices in polling and listening mode.

5.1 How to Generate a Signal for Test of an NFC Device in Polling Mode

A test setup for an NFC enabled mobile phone in polling mode, for testing carrier frequency, power level, modulation waveform and load modulation sensitivity requires a listener test signal ("Transmission Mode" = "Listen").

This is generated by an R&S SMx Vector Signal Generator with option R&S SMx/AMU-K89.

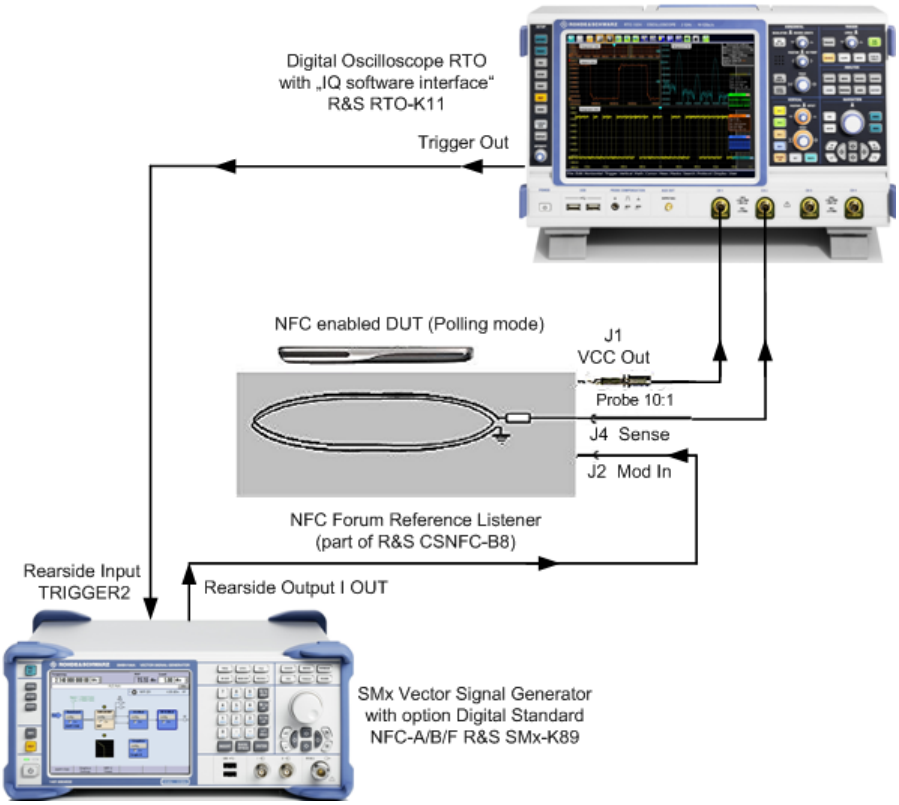


Figure 5-1: Test setup for an NFC mobile phone in polling mode (simplified schematic).

To generate the listener test signal proceed as follows:

1. Connect the I OUT connector of the R&S SMx to the XJ2 (MOD IN) connector of the NFC Forum reference listener, see Figure 5-1.

2. Provide an external trigger signal to the R&S SMx:
   Connect the trigger out connector of the measuring equipment (R&S RTO) to the TRIGGER connector (= input for external triggering of digital modulations and standards and ARB) of the R&S SMx.
3. Press the PRESET hardkey at the R&S SMx.
4. Select the technology, for example NFC-B ("NFC/EMV > Technology > NFC-B").
5. Select the listen transmission mode ("NFC/EMV > Transmission Mode > Listen").
6. Select external triggering ("NFC/EMV > Trigger/Marker... > Trigger In > Mode > Single " and "NFC/EMV > Trigger/Marker... > Trigger In > Source > External Global Trigger2").
7. Select the command type, for example "SENSB_RES" ("NFC/EMV> Sequence Configuration > Command Type > SENSB_RES"), see Table 4-1 .
8. Activate the NFC signal ("NFC/EMV > State > On") .

If settings other than the default settings are required, add the following operating steps:

1. Set the modulation settings ("NFC/EMV > Modulation Settings"), see Chapter 4.2, "Modulation Settings", on page 25.
2. Configure the frame ("NFC/EMV> Sequence Configuration > Frame Conf."), see Chapter 4.5, "Frame Configuration Settings", on page 37.
3. Set the clipping settings ("NFC/EMV > Clipping Settings"), see Chapter 4.6, "Clipping Settings", on page 53.
4. Set the marker and clock settings ("NFC/EMV > Trigger/Marker..."), see Chapter 4.7, "Trigger/Marker/Clock Settings", on page 53.
5. Set the parameter for "Desired Voltage in Unmodulated Signal parts" e.g. to 1.5 V ("NFC/EMV > Desired Voltage In Unmodulated Signal parts > 1.5 "), see Chapter 2.3, "Leveling aspects", on page 16.

5.2 How to Generate a Signal for Test of an NFC Device in Listener Mode

A test setup for an NFC enabled mobile phone in listener mode for test of load modulation, frame delay time etc., requires a poller test signal ("NFC A/B/F > Transmission Mode > Poll"). This is generated by the R&S SMx Vector Signal Generator with option R&S SMx/AMU-K89.

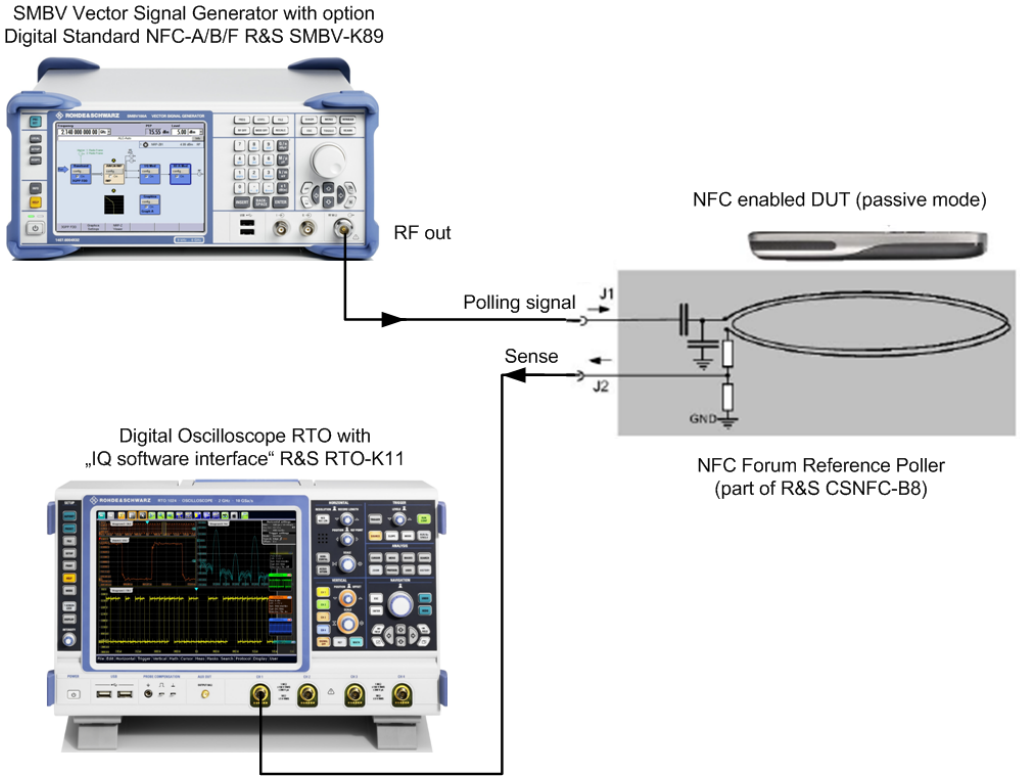


Figure 5-2: Test setup for an NFC mobile phone in listening mode (simplified schematic).

To generate the poller test signal proceed as follows.

1. Connect the RF OUT connector of the R&S SMx to the X1 connector of the NFC Forum reference poller, see Figure 5-2.
2. Press the PRESET hardkey at the R&S SMx.
3. Select the technology, for example NFC-B ("NFC/EMV > Technology > NFC-B").
4. Select the poll transmission mode ("NFC/EMV > Transmission Mode > Poll").
5. Select the command type, for example "ATTRIB" ("NFC/EMV > Sequence Configuration > Command Type > ATTRIB"), see Table 4-1.
6. Activate the NFC signal ("NFC/EMV > State > On") .

If settings other than the default settings are required, add the following operating steps:

1. Set the modulation settings ("NFC/EMV > Modulation Settings"), see Chapter 4.2, "Modulation Settings", on page 25.
2. Configure the frame ("NFC/EMV > Sequence Configuration > Frame Conf."), see Chapter 4.5, "Frame Configuration Settings", on page 37.
3. Set the clipping settings ("NFC/EMV > Clipping Settings"), see Chapter 4.6, "Clipping Settings", on page 53.

4. Set the marker and clock settings ("NFC/EMV > Trigger/Marker..."), see Chapter 4.7, "Trigger/Marker/Clock Settings", on page 53.

6 Remote-Control Commands

The following commands are required to perform signal generation with the NFC option in a remote environment. We assume that the R&S Signal Generator has already been set up for remote operation in a network as described in the R&S Signal Generator documentation. A knowledge about the remote control operation and the SCPI command syntax are assumed.

Conventions used in SCPI command descriptions

For a description of the conventions used in the remote command descriptions, see section "Remote Control Commands" in the R&S Signal Generator operating manual.

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
SOURce<hw>	[1]|2	available baseband signals R&S SMBV supports one baseband signal.
OUTPut<ch>	1 .. 4	available markers R&S SMBV supports two markers.
EXTernal<ch>	1|2	external trigger connector
CBLock<ch>	1 .. 100	successive number of the command block in the sequence configuration table
BLOCk<st>	1 .. 100	Index of the entry in the "Block List Table"
SERVice<st>	1 .. 100	Index of the entry in the "Service List Table"

Placeholder <root>

For commands that read out or save files in the default directory, the default directory is set using command `MMEM:CDIRectory`. The examples in this description use the place holder `<root>` in the syntax of the command.

- `D:\` - for selecting the internal hard disk of a Windows instrument
- `E:\` - for selecting the memory stick which is inserted at the USB interface of a Windows instrument
- `/var/user/` - for selecting the internal flash card of a Linux instrument
- `/usb/` - for selecting the memory stick which is inserted at the USB interface of a Linux instrument.

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, this includes:

- Managing settings and data lists, i.e. storing and loading settings, creating and accessing data lists, accessing files in a particular directory, etc.
- Information on regular trigger, marker and clock signals as well as filter settings, if appropriate.
- General instrument configuration, such as configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S Signal Generator operating manual.

The following commands specific to the NFC are described here:

6.1 Programming Example

With the following programm the configuration as described in Chapter 5, "How to Generate Signals with the NFC A/B/F Option", on page 63 is set at the instrument via remote control. Note that different setups and remote command sequences are required for listener and poller test signal.

The settings have been tested with a software tool which provides an environment for the development and execution of remote tests. To keep the example as simple as possible, only the "clean" SCPI syntax elements are reported. Non-executable command lines (e.g. comments) start with two // characters.

At the beginning of most remote control programs, an instrument (p)reset is recommended to set the R&S Signal Generator to a definite state. The commands `*RST` and `SYSTem:PRESet` are equivalent for this purpose. `*CLS` resets the status registers and clears the output buffer.

In the example we assume that a remote PC is connected to the instrument, the remote PC and the instrument are switched on and a connection between them is established. The other connections are setup as shown in Chapter 5, "How to Generate Signals with the NFC A/B/F Option", on page 63.

Example: Generate a listener test signal

The following example generates a listener test signal.

```
// ****************************************************************
// Reset NFC settings
// Query the used NFC FW-Version.
// Response:"NFCForum-TS-DigitalProtocol-1.0 NFCForum-TS-Analog-1.0
// Set technology to NFC-B
// Set transmission mode to listen
// For signal generators only: Select external trigger source at the
// connector TRIGGER1
// ****************************************************************
*RST
SOURce:BB:NFC:PRESet
*CLS
SOURce:BB:NFC:VERSion?
SOURce:BB:NFC:TECHnology NFCB
SOURce:BB:NFC:TMODe LISTEN
SOURce:BB:NFC:TRIGger:SOURce EXTernal

// ****************************************************************
// Select command type SENSB_RES and activate NFC signal
// ****************************************************************
SOURce:BB:NFC:CBLock1:CTYPe SNBS
SOURce:BB:NFC:STATe ON
```

If settings other than the default settings are required, add the following operating steps:

```
// ****************************************************************
// Set modulation settings
// Activate slope
// Set risetime to 0.25 us, other modulation settings stay default
// For signal generators only: Set the "desired voltage in unmodulated
// signal parts"
// ****************************************************************
SOURce:BB:NFC:MSET:SLOPe 1
SOURce:BB:NFC:MSET:TRISe .25

// ****************************************************************
// Configure the frame (for command type SENSB_RES)
// Set application data to "2345 ABCD" (Hex)
// ****************************************************************
SOURce:BB:NFC:CBLock1:ADATa #H2345ABCD, 32

// ****************************************************************
// For signal generators only:
// Set the "Desired Voltage in Unmodulated Signal parts" to 1.5 Volts.
// Cause the instrument to automatically adjust the related parameters
```

```
// of the analog I and Q outputs
// *****************************************************************
SOURce:BB:NFC:DVOLtage 1.5
SOURce:BB:NFC:UAISetting
```

Example: Generate a poller test signal

The following example generates a poller test signal.

```
// *****************************************************************
// Set technology to NFC-B
// Set transmission mode to poll
// Select command type ATTRIB and activate NFC signal
// *****************************************************************
*RST
*CLS
SOURce:BB:NFC:TECHnology NFCB
SOURce:BB:NFC:TMODe POLL
SOURce:BB:NFC:CBLock1:CTYPe ATBQ
SOURce:BB:NFC:STATe ON

// Alternatively set the predefined NFC-A sequence APA
// (IDLE, ALL_REQ, IDLE, BLANK)
// For signal generators only: position marker1 after first idle
// Activate the sequence and marker (if applicable)
*RST
*CLS
SOURce:BB:NFC:TMODe POLl
SOURce:BB:NFC:PRED:SEQuence APA
SOURce:BB:NFC:PRED:CNFMarker ON
SOURce:BB:NFC:PRED:APPLy
```

```
// *****************************************************************
// Set technology to NFC-B
// Set transmission mode to poll
// Select command type ATTRIB and activate NFC signal
// *****************************************************************
*RST
*CLS
SOURce:BB:NFC:TECHnology NFCB
SOURce:BB:NFC:TMODe POLL
SOURce:BB:NFC:CBLock1:CTYPe ATBQ
SOURce:BB:NFC:STATe ON

// Alternatively set the predefined NFC-A sequence APA
// (IDLE, ALL_REQ, IDLE, BLANK)
// For signal generators only: position marker1 after first idle
// Activate the sequence and marker (if applicable)
```

```
*RST
*CLS
SOURce:BB:NFC:TMODe POLl
SOURce:BB:NFC:PRED:SEQuence APA
SOURce:BB:NFC:PRED:CNFMarker ON
SOURce:BB:NFC:PRED:APPLy
```

If settings other than the default settings are required, add the following operating steps to the set predefined NFC-A sequence:

```
// ***************************************************************
// Configure the sequence and the frame:
// Set command type of first sequence-command to "DATA_Type4A"
// Set the block type to I-Block
// Set the data length to 2 bytes
// Set the data pattern 0110 0101 0011 1100
// ***************************************************************
SOURce:BB:NFC:CBLock1:CTYPE T4AD
SOURce:BB:NFC:CBLock1:BTYPe TPI
SOURce:BB:NFC:CBLock1:DATA:LENGth 2
SOURce:BB:NFC:CBLock1:DATA:PATTern #B0110010100111100, 16
```

6.2 Primary Settings

[:SOURce<hw>]:BB:NFC:DIVisor <DivForMod>

Selects the divisor and thus the datarate for technology NFC-F.

Parameters:

<DivForMod> DIV2 | DIV4

*RST: DIV2

Manual operation: See "Divisor(Bit Rate)" on page 23

[:SOURce<hw>]:BB:NFC:DVOLtage <DVoltage>

Sets the desired voltage in unmodulated signal parts.

Parameters:

<DVoltage> float

Range: 0.020 to 1.5
Increment: 0.001
*RST: 1

Example: See Chapter 6.1, "Programming Example", on page 68
.

Manual operation: See "Desired Voltage In Unmodulated Signal parts" on page 24

[:SOURce<hw>]:BB:NFC:PRESet

Sets the parameters of the digital standard to their default values (`*RST` values specified for the commands).

Not affected is the state set with the command `SOURce<hw>:BB:NFC:STATe`.

Example: See Chapter 6.1, "Programming Example", on page 68

Usage: Event

Manual operation: See "Set to Default" on page 21

[:SOURce<hw>]:BB:NFC:STATe <State>

Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 0

Example: See Chapter 6.1, "Programming Example", on page 68

Manual operation: See "State" on page 21

[:SOURce<hw>]:BB:NFC:TECHnology <Protocol>

Selects the NFC/EMV technology.

Parameters:

<Protocol> NFCA | NFCB | NFCF | EMVA | EMVB

*RST: NFCA

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Technology" on page 23

[:SOURce<hw>]:BB:NFC:TMODe <Transmission>

Selects the transmission mode.

Parameters:

<Transmission> POLL | LISTen

*RST: POLL

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Transmission Mode" on page 23

[:SOURce<hw>]:BB:NFC:UAISetting

Triggers the instrument to automatically adjust the related parameters of the analog I and Q outputs.

Example: See Chapter 6.1, "Programming Example", on page 68
.

Manual operation: See "Update Analog I/Q Settings For Desired Voltage" on page 25

[:SOURce<hw>]:BB:NFC:UPVoltage?

Displays the ratio of the voltage in the unmodulated parts of the signal to its peak value.

Return values:
<UPVoltage> integer
Range: 0 to 100
*RST: 0

Usage: Query only

Manual operation: See "Unmodulated Parts Voltage To Peak Voltage Ratio" on page 24

[:SOURce<hw>]:BB:NFC:VERSion?

Queries the version of the NFC-Forum and EMVCo specifications used for the signal generation.

Return values:
<Version> string

Example: See Chapter 6.1, "Programming Example", on page 68.

Usage: Query only

[:SOURce<hw>]:BB:NFC:WAVeform:CREate <Filename>

Stores the current NFC signal as ARB signal in a waveform file with the filename given in the parameter.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Generate Waveform File..." on page 23

6.3 Save/Recall Operations

[:SOURce<hw>]:BB:NFC:SETTing:CATalog?

Catalog settings file name.

Return values:
<Catalog> string

Usage: Query only

Manual operation: See "Save/Recall ..." on page 22

[:SOURce<hw>]:BB:NFC:SETTing:DELete <Filename>

Deletes the NFC settings file with the filename given in the parameter.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall ..." on page 22

[:SOURce<hw>]:BB:NFC:SETTing:LOAD <Filename>

Loads the NFC setting file with the name given in the parameter.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall ..." on page 22

[:SOURce<hw>]:BB:NFC:SETTing:STORe <Filename>

Stores current NFC settings in a file with the name given in the parameter.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall ..." on page 22

[:SOURce<hw>]:BB:NFC:SETTing:STORe:FAST <Fast>

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

Note: This function is not affected by the "Preset" function.

Parameters:
<Fast> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Save/Recall ..." on page 22

6.4 Predefined Sequence

[:SOURce<hw>]:BB:NFC:PRED:SEQuence <Sequence>

Available only for "Transmission Mode > Poll" and "Transmission Mode > PCD to PICC".

Selects a predefined sequence.

Parameters:

<Sequence> FPS | BPA | BPS | APA | APS

FPS
Predefined NFC-F sequence with the elements: IDLE, SENSF_REQ, IDLE, BLANK

BPA
Predefined NFC-B sequence with the elements: IDLE, ALL_REQ, IDLE, BLANK or a predefined EMV Type A sequence with the elements: IDLE, WUPB, IDLE, BLANK

BPS
Predefined NFC-B sequence with the elements: IDLE, SENS_REQ, IDLE, BLANK or a predefined EMV Type B sequence with the elements: IDLE, REQB, IDLE, BLANK

APA
Predefined NFC-A sequence with the elements: IDLE, ALL_REQ, IDLE, BLANK or a predefined EMV Type A sequence with the elements: IDLE, WUPA, IDLE, BLANK

APS
Predefined NFC-A sequence with the elements: IDLE, SENS_REQ, IDLE, BLANK or a predefined EMV Type A sequence with the elements: IDLE, REQA, IDLE, BLANK

*RST: APS

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Predefined Sequence" on page 30

[:SOURce<hw>]:BB:NFC:PRED:CNFMarker <Conf>

Available for signal generators only.

If enabled marker 1 is positioned after the first idle.

Parameters:

<Conf> 0 | 1 | OFF | ON

Example: See Chapter 6.1, "Programming Example", on page 68
.

Manual operation: See "Configure Marker 1 For The Sequence" on page 30

[:SOURce<hw>]:BB:NFC:PRED:APPLy

Activates the selected "Predefined Sequence" and marker.

Example: See Chapter 6.1, "Programming Example", on page 68
.

Usage: Event

Manual operation: See "Apply" on page 30

6.5 Sequence Configuration

[:SOURce<hw>]:BB:NFC:CBLock:APPend

Appends a command block to the end of the command sequence.

Usage: Event

Manual operation: See "Append, Insert, Delete, Copy, Paste" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:COPY
[:SOURce<hw>]:BB:NFC:CCBLock <CcBlock>

Copies a command block for later use.

Setting parameters:

<CcBlock> integer

Range: 1 to 100
*RST: 1

Usage: Setting only

Manual operation: See "Append, Insert, Delete, Copy, Paste" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CTYPe <Cmd>

Selects the command type.

Parameters:

<Cmd> ALAQ | SNAQ | SDAQ | SLAQ | SPAQ | RDAQ | RLAQ | T1RQ | WREQ | WNEQ | RSGQ | RD8Q | WE8Q | WN8Q | T2RQ | T2WQ | SSLQ | RATQ | T4AD | ATRQ | PSLQ | DEPQ | DSLQ | RLSQ | ALBQ | SNBQ | SMAR | SPBQ | ATBQ | T4BD | SNFQ | CHKQ | UPDQ | SNAS | SDAS | SLAS | RDAS | RLAS | T1RS | WRES | WNES | RSGS | RD8S | WE8S | WN8S | T2RS | ACK | NACK | ATSS | ATRS | PSLS | DEPS | DSLS | RLSS | SNBS | SPBS | ATBS | SNFS | CHKS | UPDS | GENE | IDLE | BLNK

*RST: SNAQ

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Command Type" on page 32

For command types and the corresponding SCPI-command parameters see the overview in Table 4-1.

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DELete
[:SOURce<hw>]:BB:NFC:DCBLock <DcBlock>

Removes a command block from the command sequence.

Setting parameters:
<DcBlock> integer
Range: 1 to 100

Usage: Setting only

Manual operation: See "Append, Insert, Delete, Copy, Paste" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DURation <Duration>

Determines the frame period in µs.

Parameters:
<Duration> float
Range: 0 to 1E6
Increment: 0.01
*RST: 84.9557522

Manual operation: See "Duration (µs)" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:INSert
[:SOURce<hw>]:BB:NFC:ICBLock <IcBlock>

Inserts a default command block before the selected command block. The command block with this position must be existing, otherwise an error is returned.

Setting parameters:
<IcBlock> integer
Range: 1 to 99

Usage: Setting only

Manual operation: See "Append, Insert, Delete, Copy, Paste" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PASTe
[:SOURce<hw>]:BB:NFC:PCBLock <PcBlock>

Pastes a command block (which was copied before) at the given position into the command sequence.

Setting parameters:
<PcBlock> integer
Range: 1 to 99

Usage: Setting only

Manual operation: See "Append, Insert, Delete, Copy, Paste" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:POFFset <OFFSet>

Determines the power offset value in dB.

Parameters:
<OFFSet> float

Range: -20 to 20
Increment: 0.01
*RST: 0

Manual operation: See "Power Offset (dB)" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:REPetition <Repet>

Determines the number of times to repeat the generation of a frame.

Parameters:
<Repet> integer

Range: 0 to 9999
*RST: 1

Manual operation: See "Rep." on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SAMPles?

Queries the total number of samples in a selected command block.

Return values:
<Samples> float

Usage: Query only

Manual operation: See "Samples" on page 36

[:SOURce<hw>]:BB:NFC:CBLock<ch>:STIMe?

Queries the exact start time of the corresponding command.

Return values:
<STime> float

Usage: Query only

Manual operation: See "Start Time" on page 32

[:SOURce<hw>]:BB:NFC:SCONfiguration:TNSamples?

Queries the total number of samples allocated to the current frame.

Return values:
<TNSamples> integer

Usage: Query only

Manual operation: See "Total Number of Samples" on page 31

[:SOURce<hw>]:BB:NFC:SCONfiguration:TSDuration?

Queries the total sequence duration for the current settings.

Return values:
<TSDuration> float

Usage: Query only

Manual operation: See "Total Sequence Duration" on page 31

6.6 Frame Configuration

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ACHK <ACheck>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:AUPD <AUpdate>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BCHK <BCheck>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:BUPD <BUpdate>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:ECHK <ECheck>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:EUPD <EUpdate>

Determines the format and value of the Maximum Response Time Information $MRTI_{CHECK}$ and $MRTI_{UPDATE}$.

Parameters:
<EUpdate> integer

Range: 0 to 3
*RST: 0

Manual operation: See "A,B,E Parameter for MRTI (CHECK) or (UPDATE)" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ADATa <AData>

Application data input (hex value).

Parameters:
<AData> integer

Example: See Chapter 6.1, "Programming Example", on page 68
.

Manual operation: See "Application Data" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ADCoding <ADCoding>

Determines if application is proprietary or CRC-B.

Parameters:
<ADCoding> PROP | CRCB
*RST: PROP

Manual operation: See "Application Data Coding" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:AFI <Afi>

Sets the application family being selected.

Parameters:
<Afi> integer
Range: 0 to 255
*RST: 0

Manual operation: See "AFI" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:AID <Aid>

Determines the value of AID.

Parameters:
<Aid> integer

Manual operation: See "AID (hex)" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ALENgth <ALength>

Determines the length of AID.

Parameters:
<ALength> integer
Range: 1 to 16
*RST: 1

Manual operation: See "AID Length" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ANSelection <ANSelection>

Available only for "PDU Type > ACK-NACK" or "Block Type > R-block".

Selects ACK or NACK.

Parameters:
<ANSelection> ACK | NACK
*RST: ACK

Manual operation: See "ACK, NACK" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APFSupported <APFS>

Determines if Advanced Protocol Features are supported.

Parameters:
<APFS> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Advanced Protocol Features supported" on page 38

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:BOData <BoFrameData>

Sets the data for a bit oriented SDD frame.

Parameters:
<BoFrameData> integer
*RST: #H0000

Example: `:BB:NFC:CBL1:APG:BOL 18`
sets the length of the standard frame to 18 bits
`:BB:NFC:CBL1:APG:BOD #H3FFFF,18`
sets the data

Manual operation: See "Data (hex) " on page 41

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:BOLength <BoFrameLen>

Sets the length of the first part of a bit oriented SDD frame.

Parameters:
<BoFrameLen> integer
Range: 16 to 55
*RST: 16

Manual operation: See "Number Of Bits For Part 1 " on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:FTYPe <FrameType>

Selects a frame type for "Command Type > GENERIC".

Parameters:
<FrameType> SHORt | STANdard | BOSDd
*RST: SHORt

Manual operation: See "Frame Type" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:SHData <ShortFrameData>

Sets the data bits of a short frame.

Parameters:
<ShortFrameData> integer
*RST: #H00

Example: `:BB:NFC:CBL1:APG:SHL 7`
sets the length of the short frame to 7 bits
`:BB:NFC:CBL1:APG:SHD #H26,7`
sets the data

Manual operation: See "Data (hex) " on page 41

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:SHLength <ShortFrameLen>

Sets the length of a short frame in bits.

Parameters:
<ShortFrameLen> integer
Range: 1 to 7
*RST: 7

Manual operation: See "Number Of Bits " on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:DATA <Data>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:DATA <Data>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STData <StdFrameData>

Sets the data for a standard frame in hexadecimal values.

Parameters:
<StdFrameData> integer

Example: `:BB:NFC:CBL1:APG:STPL 4`
sets the length of the standard frame to 4 bytes
`:BB:NFC:CBL1:APG:STD #H01234567,32`
sets the data

Manual operation: See "Data (hex) " on page 41

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:DLENgth? <DataLength>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:DLENgth? <DataLength>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STDLength?
<StdFrameDataLen>

Shows the total length of a standard frame in bytes.

Parameters:
<StdFrameDataLen> integer
Range: 1 to 10
*RST: 3

Usage: Query only

Manual operation: See "Number Of Data Bytes" on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BPGeneric:PLENgth <PayloadLength>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:FPGeneric:PLENgth <PayloadLength>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STPLength <StdFramePayLen>

Sets the length of a standard frame.

Parameters:
<StdFramePayLen> integer
Range: 1 to 8
*RST: 1

Manual operation: See "Number Of Payload Bytes" on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:APGeneric:STEPresent
<StdFrameEodPres>

Selects if the EoD is present or not.

Parameters:
<StdFrameEodPres> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "EoD (CRC)" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ATIMeout <ATimeout>

Only used with PDU type "supervisory". Determines whether an "ATN" (Attention) or "Timeout" supervisory PDU type is used.

Parameters:
<ATimeout> ATN | TOUT
*RST: ATN

Manual operation: See "ATN or Timeout" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BCCError <BCCError>

If enabled, an error is added intentionally to the BCC (checksum).

Parameters:
<BCCError> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "BCC Error" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BFANticollision <BFANticol>

Determines the bit frame Anticollision.

Parameters:
<BFANticol> SDD0 | SDD2 | SDD1 | SDD4 | SDD8 | SDD16

Manual operation: See "Bit Frame SDD / Bit Frame Anticollision" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BFSDd <BFSdd>

Determines Bit frame SDD.

Parameters:
<BFSdd> SDD0 | SDD2 | SDD1 | SDD4 | SDD8 | SDD16
*RST: SDD1

Manual operation: See "Bit Frame SDD / Bit Frame Anticollision" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:BDATa <BData>

Sets the value of "Block Data" .

Parameters:
<BData> integer

Manual operation: See "Block List, Block Data, Block List Configuration" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLKSelection <BlockSel>

Selects a block to be read/written.

Parameters:
<BlockSel> integer
Range: 0 to 14
*RST: 1

Manual operation: See "Block or Byte Selection (ADD)" on page 40

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:BNUMber <BNumber>

Sets the block number in the block list.

Parameters:
<BNumber> integer
Range: 0 to depends on block list length
*RST: 0

Manual operation: See "Block List, Block Data, Block List Configuration" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:LEN <BLLength>

Sets the block length.

Parameters:
<BLLength> LEN2 | LEN3
*RST: LEN2

Manual operation: See "Block List, Block Data, Block List Configuration" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:LOCKed <LControl>

Enables/disables status information on lock for the corresponding block ("BLOCK-1" to "BLOCK-C").

Parameters:
<LControl> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Lock Control or Status" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BLOCk<st>:SLORder <SCLOrder>

Sets the service code list order.

Parameters:
<SCLOrder> integer
Range: 0 to dynamic
*RST: 0

Manual operation: See "Block List, Block Data, Block List Configuration" on page 39

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BNO <BNo>

Selects the block number to be read/write.

Parameters:
<BNo> integer
Range: 0 to 255
*RST: 1

Example: BB:NFC:CBLock<CH>:BNO 78
Selects the block number 78 to be read/written

Manual operation: See "Block Number (BNo)" on page 40

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BTYPe <BType>

Selects the block type to be sent.

Parameters:
<BType> TPI | TPR | TPS
*RST: TPI

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Block Type" on page 40

[:SOURce<hw>]:BB:NFC:CBLock<ch>:BYTSelection <ByteSel>

Selects a byte to be read/written.

Parameters:

<ByteSel> integer

Range: 0 to 7
*RST: 1

Manual operation: See "Block or Byte Selection (ADD)" on page 40

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CFGType <ConfType>

Determines what platform or protocol the device in listen mode is configured for.

Parameters:

<ConfType> T2 | T4A | NDEP | DT4A | OFF | 0 | ON | 1

*RST: T2

Manual operation: See "Configuration Type " on page 41

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CHAining <Chaining>

Determines if chaining is applied.

Parameters:

<Chaining> 0 | 1 | OFF | ON

*RST: 0

Manual operation: See "Chaining" on page 41

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CID <CID>

Determines the value of CID.

Parameters:

<CID> float

*RST: 1

Manual operation: See "DID (DID field)/ CID (CID field)" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CIl4 <ConfType>

Determines what platform or protocol the device is configured for.

Parameters:

<ConfType> T2 | T4A | NDEP | DT4A | OFF | 0 | ON | 1

[:SOURce<hw>]:BB:NFC:CBLock<ch>:CSUPported <CSupported>

Determines if CID is supported.

Parameters:
<CSupported> 0 | 1 | OFF | ON

Manual operation: See "DID Supported / CID Supported" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA <Data>

Selects the data source type.

Parameters:
<Data> ZERO | ONE | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt

*RST: PN9

Manual operation: See "Data List Management..." on page 22

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:DSELection <DSelection>

Selects a Data List.

Parameters:
<DSelection> string

Manual operation: See "Data List Management..." on page 22

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:LENGth <Length>

Determines the length of the transmitted user data / general data.

Parameters:
<Length> integer

Range: 0 to 65536
*RST: 0

Example: See Chapter 6.1, "Programming Example", on page 68
.

Manual operation: See "Data Length" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DATA:PATTern <Pattern>

Defines a bit pattern.

Parameters:
<Pattern> 64 bits

*RST: #H0,1

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Data Source (Data)" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DEQD <DivEqDiv>

Determines if the same bit rate divisor for both directions is supported.

Parameters:
<DivEqDiv> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "D(LISTEN->POLL)=D(POLL->LISTEN) / D(PICC->PCD)=D(PCD->PICC)" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DFOLlowing <DFollowing>

Determines if a DID is following.

Parameters:
<DFollowing> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "DID following (I-block type, R-block type or S-block type)" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DID <DID>

Determines the value of DID (Device Identification Number).

Parameters:
<DID> integer
Range: 0 to 14
*RST: 1

Manual operation: See "DID (DID field)/ CID (CID field)" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP2 <TaDlp2>

Enables support of divisor 2 for LISTEN to POLL (Bit Rate Capability).

Parameters:
<TaDlp2> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "D(L->P=8), D(L->P=4), D(L->P=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP4 <TaDlp4>

Enables support of divisor 4 for LISTEN to POLL (Bit Rate Capability).

Parameters:
<TaDlp4> OFF | ON | 1 | 0
*RST: ON

Manual operation: See "D(L->P=8), D(L->P=4), D(L->P=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLP8 <TaDlp8>

Enables support of divisor 8 for LISTEN to POLL (Bit Rate Capability).

Parameters:
<TaDlp8> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "D(L->P=8), D(L->P=4), D(L->P=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DLTPoll <Dltp>

In ATTRIB command, sets the divisor in the corresponding transmission direction.

Parameters:
<Dltp> DIV1 | DIV2 | DIV4 | DIV8
*RST: DIV1

Manual operation: See "Divisor (LISTEN to POLL), Divisor (POLL to LISTEN) / Divisor (PCD to PICC), Divisor (PICC to PCD)" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL2 <TaDpl2>

Enables support of divisor 2 for POLL to LISTEN (Bit Rate Capability).

Parameters:
<TaDpl2> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "D(P->L=8), D(P->L=4), D(P->L=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL4 <TaDpl4>

Enables support of divisor 4 for POLL to LISTEN (Bit Rate Capability).

Parameters:
<TaDpl4> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "D(P->L=8), D(P->L=4), D(P->L=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPL8 <TaDpl83>

Enables support of divisor 8 for POLL to LISTEN (Bit Rate Capability).

Parameters:
<TaDpl83> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "D(P->L=8), D(P->L=4), D(P->L=2) " on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPPCd <DPPCd>

In ATTRIB command, sets the divisor in the corresponding transmission direction.

Parameters:
<DPPCd> DIV1 | DIV2 | DIV4 | DIV8

Manual operation: See "Divisor (LISTEN to POLL), Divisor (POLL to LISTEN) / Divisor (PCD to PICC), Divisor (PICC to PCD)" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPPicc <Dpp>

In ATTRIB command, sets the divisor in the corresponding transmission direction.

Parameters:
<Dpp> DIV1 | DIV2 | DIV4 | DIV8

Manual operation: See "Divisor (LISTEN to POLL), Divisor (POLL to LISTEN) / Divisor (PCD to PICC), Divisor (PICC to PCD)" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DPTListen <Dptl>

In ATTRIB command, sets the divisor in the corresponding transmission direction.

Parameters:
<Dptl> DIV1 | DIV2 | DIV4 | DIV8
*RST: DIV1

Manual operation: See "Divisor (LISTEN to POLL), Divisor (POLL to LISTEN) / Divisor (PCD to PICC), Divisor (PICC to PCD)" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DRI <Dri>

Sets DRI.

Parameters:
<Dri> D1 | D2 | D8 | D4 | D16 | D32 | D64
*RST: D1

Manual operation: See "DRI" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DSI <Dsi>

Sets DSI.

Parameters:
<Dsi> D1 | D2 | D8 | D4 | D16 | D32 | D64
*RST: D1

Manual operation: See "DSI" on page 43

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DSUPported <DSupported>

Determines if DID is supported.

Parameters:
<DSupported> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "DID Supported / CID Supported" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:DWSelection <DWSelection>

Selects DESELECT or WTX.

Parameters:
<DWSelection> DSEL | WTX
*RST: DSEL

Manual operation: See "DESELECT or WTX" on page 42

[:SOURce<hw>]:BB:NFC:CBLock<ch>:EASupported <EAtqb>

Determines if Extended ATQB is supported.

Parameters:
<EAtqb> 0 | 1 | OFF | ON

Manual operation: See "Extended SENSB_RES / Extended ATQB" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:ESSupported <ESensbres>

Determines if Extended SENSB_RES is supported.

Parameters:
<ESensbres> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Extended SENSB_RES / Extended ATQB" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:FSC <Fsc>

Selects the maximum frame size in bytes.

Parameters:
<Fsc> F16 | F24 | F32 | F40 | F48 | F64 | F96 | F128 | F256
*RST: F32

Manual operation: See "FSC" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:FWI <Fwi>

Determines the FWI which is needed to calculate Frame Waiting Time (FWT).

Parameters:
<Fwi> integer
Range: 1 to 8
*RST: 4

Manual operation: See "FWI" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:GBSelection <GBSelection>

Selects 8-byte block to be read/written.

Parameters:
<GBSelection> integer
Range: 0 to 255
*RST: 1

Example: `BB:NFC:CBLock<CH>:GBSelection 122`
Selects GB number 122.

Manual operation: See "Global Block Selection (ADD)" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:GDAVailable <GDAvailable>

Determines if General data is available.

Parameters:
<GDAvailable> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "General Data" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:IBNumber <IBNumber>

Indicates if a Valid I-block or a Valid R(ACK) block is received.

Parameters:
<IBNumber> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Block Number (for I-block type or R-block type)" on page 40

[:SOURce<hw>]:BB:NFC:CBLock<ch>:KPARameter <KParameter>

Determines the number of historical bytes (T1 to Tk).

Parameters:

<KParameter> integer
Range: 0 to 15
*RST: 0

Manual operation: See "k" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:LREDuction <LReduction>

Selects the length reduction (LR).

Parameters:

<LReduction> LR64 | LR128 | LR192 | LR254
*RST: LR64

Manual operation: See "Length Reduction" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MBLI <Mbli>

Determines the Maximum Buffer Length Index (MBLI).

Parameters:

<Mbli> integer
Range: 0 to 15
*RST: 1

Manual operation: See "MBLI" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MFSize <MFSize>

Selects the maximum frame size in bytes.

Parameters:

<MFSize> F16 | F24 | F32 | F40 | F48 | F64 | F96 | F128 | F256

Manual operation: See "FSC" on page 44

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MICHaining <MChaining>

Determines if more information (MI) is chained.

Parameters:

<MChaining> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "MI (more information) Chaining" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR0 <MTr0>

Sets the minimum value of TR0 supported.

Parameters:
<MTr0> TR00 | TR01 | TR02
*RST: TR00

Manual operation: See "Minimum TR0, TR1, TR2" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR1 <MTr1>

Sets the minimum value of TR1 supported.

Parameters:
<MTr1> TR10 | TR11 | TR12
*RST: TR10

Manual operation: See "Minimum TR0, TR1, TR2" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:MTR2 <MTr2>

Sets the minimum value of TR2 supported.

Parameters:
<MTr2> TR20 | TR21 | TR22 | TR23
*RST: TR20

Manual operation: See "Minimum TR0, TR1, TR2" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:N2FType <NFType>

Determines which protocol or platform the NFCID2 format is for.

Parameters:
<NFType> NDEP | TT3
*RST: NDEP

Manual operation: See "NFCID2 Format Type" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NACK <Nack>

Determines the value of NACK.

Parameters:
<Nack> NCK1 | NCK0 | NCK4 | NCK5
*RST: NCK0

Manual operation: See "NACK" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NAD <Nad>

Determines the value of NAD.

Parameters:
<Nad> integer

Manual operation: See "NAD" on page 45

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NBLocks <NBlock>

Determines the number of blocks.

Parameters:
<NBlock> integer
Range: 1 to dynamic
*RST: 1

Manual operation: See "Number of Blocks" on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NFOLlowing <NFollowing>

Determines if NAD is following.

Parameters:
<NFollowing> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "NAD following" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID0 <Nfcid0>

Determines the entire value of NFCID0.

Parameters:
<Nfcid0> integer

Manual operation: See "NFCID0 (hex) / PUPI (hex)" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID1 <Nfcid1>

Determines the entire value of NFCID1.

Parameters:
<Nfcid1> integer

Manual operation: See "NFCID1 (hex) / UID (hex)" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NID2 <Nfcid2>

Determines the entire value of NFCID2. Is a virtual parameter for SCPI to set the NFCID2 either in NFC-DEP or Type 3 Tag mode.

Parameters:
<Nfcid2> integer

Manual operation: See "NFCID2 (hex)" on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NNComplete <Nfcid1NotCom>

Determines whether NFCID1 is complete or not.

Parameters:
<Nfcid1NotCom> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "NFCID1 not complete / UID not complete" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NOAPplications <NOApplication>

Determines the number of applications.

Parameters:
<NOApplication> integer
Range: 0 to 15
*RST: 1

Manual operation: See "Number of Applications" on page 47

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NOSLots <NOSlots>

Determines the number of slots.

Parameters:
<NOSlots> S1 | S2 | S4 | S8 | S16
*RST: S1

Manual operation: See "Number of Slots" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSERvices <NService>

Sets the number of services.

Parameters:
<NService> integer
Range: 1 to 16
*RST: 1

Manual operation: See "Number of Services" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSIZe <Nfcid1sz>

Determines the size of NFCID1.

Parameters:
<Nfcid1sz> SINGle | DOUBle | TRIPle
*RST: SINGle

Manual operation: See "NFCID1 Size / UID Size" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:NSUPported <NSupport>

Determines if NAD is supported.

Parameters:
<NSupport> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "NAD Supported" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD0 <Pad0>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD1 <Pad1>
[:SOURce<hw>]:BB:NFC:CBLock<ch>:PAD2 <Pad2>

Sets the value of PAD0/PAD1/PAD2 (hex).

Parameters:
<Pad2> integer
*RST: #H00

Manual operation: See "PAD0, PAD1, PAD2" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PDUType <PDUType>

Selects the type of PDU.

Parameters:
<PDUType> INFO | ANACk | SUPer

Manual operation: See "PDU Type" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PLIN <PLIndication>

Only used when DESELCT/WTX is set to WTX. Determines Power Level Indication.

Parameters:
<PLIndication> integer
Range: 0 to 3
*RST: 1

Manual operation: See "Power Level Indication" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PLIR <PLIndicator>

Sets the Power Level Indicator.

Parameters:
<PLIndicator> integer
Range: 0 to 3
*RST: 1

Manual operation: See "Power Level Indicator" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PNI <Pni>

Only used with PDU type Information. Determines Packet Number Information (PNI).

Parameters:
<Pni> integer
Range: 0 to 3
*RST: 1

Manual operation: See "PNI" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PSELection <PSelection>

Selects if the first or second packet of the SECTOR_SELECT command is transmitted.

Parameters:
<PSelection> PCK1 | PCK2
*RST: PCK1

Manual operation: See "Packet Selection" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:PUPI <PUPI>

Determines the entire value of PUPI.

Parameters:
<PUPI> integer

Manual operation: See "NFCID0 (hex) / PUPI (hex)" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:RC <Rc>

Indicates the Request Code (RC).

Parameters:
<Rc> NSCI | SCIR | APFS
*RST: NSCI

Manual operation: See "RC" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:RTOX <Rtox>

Determines the response timeout extension request value (RTOX).

Parameters:
<Rtox> integer
Range: 1 to 59
*RST: 1

Manual operation: See "RTOX" on page 49

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SCMD <SCmd>

Selects the cascade level (CL) of the NFCID1 requested by the NFC Forum Device in Poll Mode.

Parameters:
<SCmd> CL1 | CL2 | CL3
*RST: CL1

Manual operation: See "SEL_CMD / SEL" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SCODe <SCode>

Sets the System Code.

Parameters:
<SCode> integer
*RST: #Hffff

Manual operation: See "SC" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SEGSelection <SegmentSel>

Selects a segment to be read.

Parameters:
<SegmentSel> integer
Range: 0 to 15
*RST: 1

Manual operation: See "Segment Selection (ADD)" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SEL <SELect>

Selects the cascade level (CL) of the UID.

Parameters:
<SELect> CL1 | CL2 | CL3

Manual operation: See "SEL_CMD / SEL" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SENRequired <SENRequired>

Determines whether a suppression of EoS (End of Sequence)/SoS (Start of Sequence) is required or not.

Parameters:
<SENRequired> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Suppression of EoS,SoS Not Required" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SERVice<st>:AATTributes <AAttributes>

Enables the Service Code List Configuration.

Parameters:
<AAttributes> AARW | AARO
*RST: AARW

Manual operation: See "Service Code List..." on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SERVice<st>:SNUMber <SNumber>

Determines the number of services.

Parameters:
<SNumber> integer
Range: 0 to 1023
*RST: 0

Manual operation: See "Service Code List..." on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SF1 <SFlag1>

Sets the status flag 1 to specify a Type 3 tag's error condition. A value of 0 signals a successful execution, values different from 0 indicate errors.

Parameters:
<SFlag1> integer

Manual operation: See "Status Flag 1, Status Flag 2" on page 51

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SF2 <SFlag2>

Sets the status flag 2 to specify a Type 3 tag's error condition. A value of 0 signals a successful execution, values different from 0 indicate errors.

Parameters:
<SFlag2> integer

Manual operation: See "Status Flag 1, Status Flag 2" on page 51

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SFGI <Sfgi>

Determines the Start-up Frame Guard Time (SFGT).

Parameters:

<Sfgi> integer
Range: 0 to 8
*RST: 0

Manual operation: See "SFGI" on page 51

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SNO <SNO>

Only available when packet selection is set to Packet2. Determines the sector number.

Parameters:

<SNO> integer
Range: 0 to 254
*RST: 1

Manual operation: See "SNo" on page 51

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SNUMber <SNumber>

Determines the slot number.

Parameters:

<SNumber> SN2 | SN3 | SN4 | SN5 | SN6 | SN7 | SN8 | SN9 | SN10 | SN11 | SN12 | SN13 | SN14 | SN15 | SN16
*RST: SN2

Manual operation: See "Slot Number" on page 51

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SPLower <SPLower>

Determines the bit count.

Parameters:

<SPLower> integer
Range: 0 to 7
*RST: 0

Manual operation: See "SEL_PAR_LOWER" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SPUPper <SPUpper>

SEL_PAR_UPPER determines the number of full bytes of the SDD_REQ part.

Parameters:
<SPUpper> integer
Range: 2 to 6
*RST: 2

Manual operation: See "SEL_PAR_UPPER" on page 50

[:SOURce<hw>]:BB:NFC:CBLock<ch>:SSNRequired <SSNRequired>

Determines whether a suppression of EoS (End of Sequence)/SoS (Start of Sequence) is required or not.

Parameters:
<SSNRequired> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Suppression of EoS,SoS Not Required" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:T1TConfigured <T1TPConfigured>

Determines whether Type 1 Tag platform is configured or not.

Parameters:
<T1TPConfigured> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Type 1 Tag Platform Configured" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:T1TK <T1totk>

For number of historical bytes k greater than 0: sets the historical bytes T1 to Tk.

Parameters:
<T1totk> integer

Manual operation: See "T1 to Tk" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:TAIPicc <TNAIPicc>

Sets the total number of applications in the PICC (Proximity Inductive Coupling Card), i.e. in the NFC Forum Device in listener mode.

Parameters:
<TNAIPicc> integer
Range: 0 to 15
*RST: 1

Manual operation: See "Total No. Apps in the PICC" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:TSN <Tsn>

Indicates the TSN (Time Slot Number).

Parameters:

<Tsn> TSN1 | TSN2 | TSN4 | TSN8 | TSN16
*RST: TSN4

Manual operation: See "Number of Time Slots" on page 48

[:SOURce<hw>]:BB:NFC:CBLock<ch>:UID <UID>

Determines the entire value of UID.

Parameters:

<UID> integer

Manual operation: See "NFCID1 (hex) / UID (hex)" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:UNComplete <UIDNotCom>

Determines whether UID is complete or not.

Parameters:

<UIDCom> 0 | 1 | OFF | ON

Manual operation: See "NFCID1 not complete / UID not complete" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:USIZe <UIDsz>

Determines the size of UID.

Parameters:

<UIDsz> SINGle | DOUBle | TRIPle

Manual operation: See "NFCID1 Size / UID Size" on page 46

[:SOURce<hw>]:BB:NFC:CBLock<ch>:WT <Wt>

Sets the Waiting Time (WT) that codes the Response Waiting Time (RWT).

Parameters:

<Wt> integer
Range: 0 to 8
*RST: 1

Manual operation: See "WT" on page 52

[:SOURce<hw>]:BB:NFC:CBLock<ch>:WTXM <Wtxm>

Determines the WTXM. - Only used when DESELCT/WTX is set to WTX.

Parameters:
<Wtxm> integer
Range: 1 to 59
*RST: 1

Manual operation: See "WTXM (INF field of S(WTX) request, response) " on page 52

6.7 Modulation Settings

[:SOURce<hw>]:BB:NFC:MSET:BOUTput <BOutput>

When activated the signal at the baseband output changes between 0% and 100% voltage to be able to control the Reference Listeners.

Parameters:
<BOutput> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Baseband Output" on page 28

[:SOURce<hw>]:BB:NFC:MSET:BRATe?

Returns the resulting bitrate for the current settings.

Return values:
<BRate> float

Usage: Query only

Manual operation: See "Bit Rate" on page 25

[:SOURce<hw>]:BB:NFC:MSET:SLOPe <ESlope>

Determines the transition between the modulated and unmodulated parts (Edge/ Slope).

Parameters:
<ESlope> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Slope" on page 25

[:SOURce<hw>]:BB:NFC:MSET:IMODulation <IModulation>

When selected, inverse modulation will be used.

Parameters:
<IModulation> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Inverse Modulation" on page 28

[:SOURce<hw>]:BB:NFC:MSET:MDEPth <MDepth>

Sets the modulation depth in %.

Parameters:

<MDepth> float

Range: 0 to 100
Increment: 0.01
*RST: 100

Manual operation: See "Modulation Depth" on page 28

[:SOURce<hw>]:BB:NFC:MSET:MINDex <MIndex>

Defines the signal's modulation index in %.

Parameters:

<MIndex> float

Range: 0 to 100
Increment: 0.01
*RST: 12

Manual operation: See "Modulation index" on page 28

[:SOURce<hw>]:BB:NFC:MSET:OSRise <ORise>

Determines the size of the overshoot after the rising slope.

Parameters:

<ORise> float

Range: 0 to 42
Increment: 0.01
*RST: 0

Manual operation: See "Overshoot Rising Slope (VOU)" on page 27

[:SOURce<hw>]:BB:NFC:MSET:RCURve <RCurve>

When activated an "RLC curve" is applied to the signal, otherwise a linear ramp is used.

Parameters:

<RCurve> 0 | 1 | OFF | ON

*RST: 1

Manual operation: See "RLC curve" on page 26

[:SOURce<hw>]:BB:NFC:MSET:SRATe <SRate>

Enters the sample rate, i.e. the time resolution of the generated signal.

Parameters:

<SRate> float

Range: depends on protocol mode to dynamic
Increment: 0.001
*RST: 20E6

Manual operation: See "Sample Rate" on page 29

[:SOURce<hw>]:BB:NFC:MSET:TFALl <TFall>

Defines the fall time (90 to 5 %) in µs.

Parameters:

<TFall> float

Range: 0 to dynamic
Increment: 0.01
*RST: 1

Manual operation: See "Tfall 90-10 % / 90-5 % (t1-t2)" on page 26

[:SOURce<hw>]:BB:NFC:MSET:TLOW <TLow>

Defines the signals low time (below 5%) in µs.

Parameters:

<TLow> float

Range: 0.4 to dynamic
Increment: 0.01
*RST: 1.9

Manual operation: See "Tlow (t2)" on page 27

[:SOURce<hw>]:BB:NFC:MSET:TRISe <TRise>

Defines the signals rise time (5 to 90 %) in µs.

Parameters:

<TRise> float

Range: dynamic to dynamic
Increment: 0.01
*RST: 0.6

Example: See Chapter 6.1, "Programming Example", on page 68.

Manual operation: See "Trise 10-90 % / 5-90% (t3)" on page 27

[:SOURce<hw>]:BB:NFC:MSET:USFall <OFall>

Determines the size of the undershoot (ringing) after the falling slope.

Parameters:

<OFall> float

Range: 0 to 42
Increment: 0.01
*RST: 0

Manual operation: See "Undershoot Falling Slope (VOU)" on page 27

6.8 Clipping Settings

[:SOURce<hw>]:BB:NFC:CLIPping:LEVel <Level>

Sets the limit for clipping.

Parameters:

<Level> integer

Range: 1 to 100
*RST: 100

Manual operation: See "Clipping Level " on page 53

[:SOURce<hw>]:BB:NFC:CLIPping:STATe <State>

Switches baseband clipping on and off.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 0

Manual operation: See "Clipping State" on page 53

6.9 Trigger Settings

The following commands are described here:

[:SOURce<hw>]:BB:NFC:TRIGger:ARM:EXECute

Stops signal generation; a subsequent internal or external trigger event restarts signal generation.

Usage: Event

Manual operation: See "Arm" on page 56

[:SOURce<hw>]:BB:NFC:TRIGger:EXECute

Executes trigger manually.

Usage: Event

Manual operation: See "Execute Trigger" on page 24

[:SOURce<hw>]:BB:NFC:TRIGger[:EXTernal<ch>]:DELay <Delay>

Sets the trigger signal delay in samples on external triggering or on internal triggering via the second path (if applicable).

The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Parameters:

<Delay> float

Range: 0 to 65535
Increment: 0.01
*RST: 0

Example: `BB:NFC:TRIG:SOUR EXT`
sets an external trigger via the TRIGGER 1 connector.
`BB:NFC:TRIG:EXT:DEL 50`
sets a delay of 50 symbols for the trigger.

Manual operation: See "Trigger Delay / External Delay" on page 58

[:SOURce<hw>]:BB:NFC:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

Parameters:

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

Manual operation: See "Trigger Inhibit / External Inhibit" on page 58

[:SOURce<hw>]:BB:NFC:TRIGger:EXTernal:SYNChronize:OUTPut <Output>

For an external trigger signal, enables/disables the output of a signal synchronous to the external trigger event.

Parameters:

<Output> 0 | 1 | OFF | ON

*RST: 1

Manual operation: See "Sync. Output to External Trigger" on page 57

[:SOURce<hw>]:BB:NFC:TRIGger:OBASeband:DELay <Delay>

Available for two-path instruments only. Internal other baseband trigger delay. Sets the trigger signal delay in samples on internal triggering via the second path.

Parameters:

<Delay> float

Range: 0 to 65535
Increment: 0.01
*RST: 0

Example: `BB:NFC:TRIG:SOUR OBAS`
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
`BB:NFC:TRIG:OBAS:DEL 50`
sets a delay of 50 symbols for the trigger.

Manual operation: See "Trigger Delay / External Delay" on page 58

[:SOURce<hw>]:BB:NFC:TRIGger:OBASeband:INHibit <Inhibit>

Available for two-path instruments only. Internal other baseband trigger inhibit. Sets the trigger signal inhibit in samples on internal triggering via the second path.

Parameters:

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

Manual operation: See "Trigger Inhibit / External Inhibit" on page 58

[:SOURce<hw>]:BB:NFC:TRIGger:RMODe?

Queries the status of signal generation.

Return values:

<RMode> STOP | RUN

Usage: Query only

Manual operation: See "Running/Stopped" on page 56

[:SOURce<hw>]:BB:NFC:TRIGger:SLENgth <Slength>

Defines the length of the signal sequence to be output in the `SINGle` trigger mode.

Parameters:

<Slength> integer

Range: 1 to 4294967295.0
*RST: 1

Manual operation: See "Signal Duration" on page 56

[:SOURce<hw>]:BB:NFC:TRIGger:SLUNit <Slunit>

Defines the unit for the entry of the signal sequence length.

Parameters:

<Slunit> SEQuence | SAMPle

*RST: SEQuence

Manual operation: See "Signal Duration Unit" on page 55

[:SOURce<hw>]:BB:NFC:TRIGger:SOURce <Source>

Selects the trigger source.

Parameters:

<Source> INTernal|OBASeband|BEXTernal|EXTernal

`INTernal`
manual trigger or `*TRG`.
`EXTernal|BEXTernal`
trigger signal on the TRIGGER 1/2 connector.
`OBASeband`
trigger signal from the other path

*RST: INTernal

Example: See Chapter 6.1, "Programming Example", on page 68

Manual operation: See "Trigger Source" on page 56

[:SOURce<hw>]:BB:NFC[:TRIGger]:SEQuence <Sequence>

Selects a regular trigger mode.

Parameters:

<Sequence> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

*RST: AUTO

Manual operation: See "Trigger Mode" on page 55

6.10 Marker Settings

The following commands are described here:

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:MODE <Mode>

Parameters:

<Mode> PULSe | RESTart | PATTern | RATio | TRIGger

PULSe
A regular marker signal is generated. The frequency is derived by dividing the sample rate by the divider, which is input with the command `[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PULSe:DIVider` on page 112.

RESTart
A marker signal is generated on every repetition of the complete frame sequence.

PATTern
A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 64 bits and is defined with the command `[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PATTern` on page 112

RATio
A marker signal corresponding to the Time Off / Time On specifications in the commands `[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:ONTime` on page 112 and `[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:OFFTime` on page 112

TRIGger
On received internal/external trigger signal. A trigger event is feeded through to the marker connector.

*RST: RESTart

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:OFFTime <OffTime>

Sets the number of sampels in a period (ON time + time, during which the marker signal on the marker output is OFF) for marker `RATio`.

Parameters:

<OffTime> integer

Range: 1 to 16777215
*RST: 1

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:ONTime <OnTime>

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:NFC:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

Parameters:

<OnTime> integer

Range: 1 to 16777215
*RST: 1

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PATTern <Pattern>

A marker signal that is defined by a bit pattern is generated.

Parameters:

<Pattern> 64 bits

*RST: #H2,2

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PULSe:DIVider <Divider>

Sets the divider for the pulsed marker signal.

Parameters:

<Divider> integer

Range: 2 to 1024
*RST: 2

Example: `BB:NFC:TRIG:OUTP2:PULS:DIV 2`

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:PULSe:FREQuency?

Queries the pulse frequency of the pulsed marker signal.

Return values:
<Frequency> float
Range: 0.0 to max

Example:
```
BB:NFC:TRIG:OUTP2:MODE PULS
BB:NFC:TRIG:OUTP2:PULS:DIV 4
BB:NFC:TRIG:OUTP2:PULS:FREQ?
```
Response: 600.000 Hz

Usage: Query only

Manual operation: See "Marker Mode" on page 59

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay <Delay>

Defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of the signal units.

Parameters:
<Delay> float
Range: 0 to 2^32-1 chips
Increment: 0.001
*RST: 0

Manual operation: See "Marker x Delay" on page 60

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut:DELay:FIXed <Fixed>

Restricts the marker delay setting range to the dynamic range.

Parameters:
<Fixed> 0 | 1 | OFF | ON
*RST: 0

Manual operation: See "Fix Marker to Current Range" on page 60

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay:MAXimum?

Queries the maximum marker delay for fixed marker delay setting.

Return values:
<Maximum> float
Range: 0 to max

Usage: Query only

Manual operation: See "Current Range without Calculation" on page 60

[:SOURce<hw>]:BB:NFC:TRIGger:OUTPut<ch>:DELay:MINimum?

The command queries the minimum marker delay for setting `:BB:NFC:TRIGger:OUTPut:DELay:FIXed ON`.

Return values:
<Minimum> float
Range: 0 to max

Usage: Query only

Manual operation: See "Current Range without Calculation" on page 60

6.11 Clock Settings

The following commands are described here:

[:SOURce<hw>]:BB:NFC:CLOCk:MODE <Mode>

Sets the type of externally supplied clock.

Parameters:
<Mode> MSAMple | SAMPle
*RST: SAMPle

Manual operation: See "Clock Mode" on page 61

[:SOURce<hw>]:BB:NFC:CLOCk:MULTiplier <Multiplier>

Specifies the clock multiplier.

Parameters:
<Multiplier> integer
Range: 1 to 64
*RST: 4

Manual operation: See "Clock Multiplier" on page 61

[:SOURce<hw>]:BB:NFC:CLOCk:SOURce <Source>

The command selects the clock source.

Parameters:
<Source> INTernal | EXTernal
*RST: INTernal

Manual operation: See "Clock Source" on page 61

[:SOURce<hw>]:BB:NFC:CLOCk:SYNChronization:EXECute

Performs an automatic adjustment of the instrument's settings required for the synchronization mode, set with the command `BB:NFC:CLOC:SYNC:MODE`.

Usage: Event

Manual operation: See "Set Synchronization Settings" on page 61

[:SOURce<hw>]:BB:NFC:CLOCk:SYNChronization:MODE <Mode>

Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signals of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

Parameters:

<Mode> NONE | MASTer | SLAVe

NONE
The instrument is working in stand-alone mode.

MASTer
The instrument provides all connected instruments with its synchronisation (including the trigger signal) and reference clock signal.

SLAVe
The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

*RST: NONE

Manual operation: See "Sync. Mode" on page 60

Glossary: List of the Often Used Terms and Abbreviations

A

Active Communication: A communication mode in which each device generates its own RF field to send a message to another device.

Activity: A process within an NFC Forum Device with well defined pre-conditions and post-conditions, as defined in [ACTIVITY]. An Activity can only start when its pre-conditions are fulfilled. When an Activity ends, its post-conditions are fulfilled.

AID: Application ID

ASK: Amplitude Shift Keying

ATN: Attention.

B

BCC: UID CLn check byte for NFC-A

bd: Bit Duration

BPSK: Bi Phase Shift Keying

C

Card Emulator: A role of an NFC Forum Device, reached when an NFC Forum Device in Listen Mode has gone through a number of Activities and in which the NFC Forum Device behaves as one of the Technology Subsets.

CID: Cryptogram Information Data

CLn: Cascade Level n (1<=n<=3)

Command: An instruction from one device to another device in order to move the other device through a state machine.

Connectionless Transport: An unacknowledged data transmission service with minimal protocol complexity.

Correct Frame: A frame without Transmission Error.

CRC: Cyclic Redundancy Check, a checksum appended within the data segment before transmission, and verified afterwards by the recipient to detect transmission errors

CRC_A: CRC error detection code for NFC-A.

CRC_B: CRC error detection code for NFC-B.

CRC_F: CRC error detection code for NFC-F.

CT: Command type.

D

DID: Device Identification Number.

DRI: Codes the bit rate in communication direction from Target to Initiator.

DSI: Codes the bit rate in communication direction from Initiator to Target.

E

EoD: End of Data.

EoF: End of Frame.

EoS: End of sequence.

F

fc: Carrier frequency.

FSC: Maximum frame size (in bytes).

FWI: Frame waiting time integer.

FWT: Frame waiting time.

I

IC: Integrated Circuit

Initiator: A role of an NFC Forum Device reached when an NFC Forum Device in Poll Mode has gone through a number of Activities; in this mode the NFC Forum Device communicates using the NFC-DEP Protocol.

ISO-DEP Protocol: Half-duplex block transmission protocol defined in Section 13 and based on [ISO/IEC_14443] and [EMV_CLESS].

L

Listen Frame: A frame sent by an NFC Forum Device in Listen Mode.

Listen Mode: Initial mode of an NFC Forum Device when it does not generate a carrier; in this mode the NFC Forum Device listens for the RF field of another device.

lsb: least significant bit

LSB: Least Significant Byte

M

MBL: Maximum Buffer Length

MBLI: Maximum Buffer Length Index

MRT: Maximum response time

MRTI: Maximum response time information

msb: Most Significant Bit

MSB: Most Significant Byte

N

NAD: Node Addressing

NDEF: NFC data exchange format.

NFC: Near Field Communication

NFC Forum Device: A device that supports the following Modus Operandi: Initiator, Target, and Reader/Writer. It may also support Card Emulator.

NFC Tag: A contactless tag or (smart) card supporting NDEF over Passive Communication.

NFC-A: Near Field Communication - Type A Technology

NFC-B: Near Field Communication - Type B Technology

NFC-DEP Protocol: Half-duplex block transmission protocol defined in Section 14 and based on [ISO/IEC_18092].

NFC-F: Near Field Communication - Type F Technology

NFCID0: NFC-B identifier of the NFC Forum Device.

NFCID1: NFC-A identifier of the NFC Forum Device in the passive communication mode.

NFCID2: NFC-F identifier of the NFC Forum Device in the passive communication mode.

NFCID3: NFCIP-1 identifier of the NFC Forum Device. NFCID3 is always 10 byte long.

NFCIP-1: Near field communication interface and protocol as specified in [ISO/IEC_18092].

NRZ-L: Non-Return to Zero (L for Level)

O

OOK: On-Off Keying

Operating Field: The magnetic field created by an NFC Forum Device in poll mode within the operating volume.

Operating Volume: The three-dimensional space, as defined by the NFC Forum, in which an NFC Forum Device in Poll Mode can communicate with an NFC Forum Device in Listen Mode.

P

Passive Communication: A communication mode in which one device generates an RF field and sends Commands to a second device. To respond, this second device uses load modulation (i.e., it does not generate an RF field but it draws more or less power from the RF field).

PCB: Protocol Control Byte.

PCD: Proximity Coupling Device.

PDU: Protocol Data Unit.

PICC: Proximity Inductive Coupling Card

Poll Command: A Command to query an NFC Forum Device in Listen Mode or an NFC Forum Tag:
- ALL_REQ or SENS_REQ Command for NFC-A
- ALLB_REQ or SENSB_REQ Command for NFC-B
- SENSF_REQ Command for NFC-F

Poll Frame: A frame sent by an NFC Forum Device in Poll Mode.

Poll Mode: Initial mode of an NFC Forum Device when it generates a carrier and probes (“polls”) for other devices.

Protocol Error: A Semantic Error or Syntax Error.

PUPI: Pseudo-Unique PICC Identifier available for EMV Type B.

R

Reader/Writer: Role of an NFC Forum Device reached when an NFC Forum Device in Poll Mode has gone through a number of Activities. In this mode, the NFC Forum Device behaves like a legacy contactless reader and uses Commands from one of the Technology Subsets.

Response: Information sent from one device to another device upon receipt of a Command. The information received by the other device should allow this other device to continue the data exchange.

RRDD: Reader-Reader Data Delay

RWT: Response Waiting Time

S

SDD: Single Device Detectiond

Semantic Error: A Correct Frame with no Syntax Error is received when it is not expected.

SFGI: Start-up Frame Guard Time Integer.

SFGT: Start-up Frame Guard Time

SoD: Start of Data

SoF: Start of Frame

SoS: Start of Sequence

Syntax Error: A Correct Frame is received with an invalid content. In this case, the coding of the Command or the block within the frame is not consistent with this specification.

T

Target: Role of an NFC Forum Device, reached when the NFC Forum Device has gone through a number of Activities in which the NFC Forum Device communicates using the NFC-DEP Protocol.

Technology: A group of transmission parameters defined by the NFC standard that make a complete communication protocol. A non-exhaustive list of transmission parameters is: RF carrier, communication mode, bit rate, modulation scheme, bit level coding, frame format, protocol, and Command set. NFC defines three groups and therefore three Technologies: NFC-A, NFC-B, and NFC-F. The three Technologies use the same RF carrier (13.56 MHz). Each Technology uses its own modulation scheme, bit level coding and frame format, but may have the same protocol and Command set.

Technology Subset: A legacy platform supporting a subset of a Technology. A Technology Subset supports at least the Poll Command of the Technology. The four Technology Subsets described in the NFC Digital Protocol Technical Specification are:
- Type 1 Tag platform, which uses a particular subset of NFC-A, excluding anti-collision.
- Type 2 Tag platform, which uses a particular subset of NFC-A, including anti-collision.
- Type 3 Tag platform, which uses a particular subset of NFC-F, including anti-collision.
- Type 4 Tag platform, which uses a particular subset of NFC-A or NFC-B, including anti-collision.

Timeout Error: No Response has been received within the Response Waiting Time (RWT).

Transmission Error: An incorrect frame is received. In this case, the signal modulation, the bit coding, the frame format, the timing, or the checksum is not consistent with this specification.

U

UID: Unique IDentifier available for EMV Type A.

V

Valid Block, Valid PDU: A block or PDU without Protocol Error within a Correct Frame.

Valid Command, Valid Response: A Command or Response without Protocol Error within a Correct Frame.

W

WT: Waiting Time, parameter to code RWT

WTX: Waiting Time Extension, containing 1 byte long INF field.

List of Commands

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