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NRC7292 Evaluation Kit User Guide

(CLI Application)

Ultra-low power & Long-range Wi-Fi

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NEWRACOM, Inc.

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Ultra-low power & Long-range Wi-Fi

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1 Overview

This document introduces NRC7292 command line interface (CLI) application. The user can utilize the CLI application to check basic information for firmware, monitor channel quality; such as: received signal strength indicator (RSSI), signal to noise ratio (SNR), adjust transmit power, and configure NRC7292 to run in specific operating condition. The source code of this application is offered to user's so users can build an executable file suitable for the host.

1.1 Software structure of CLI application

As shown in Figure 1.1, the CLI application is a user-level application program. The CLI application uses Netlink library to communicate with NRC 11ah driver running on a Linux kernel. The CLI command initiated by the user and goes to the NRC 11ah driver and then to NRC7292 via host serial peripheral interface (HSPI).

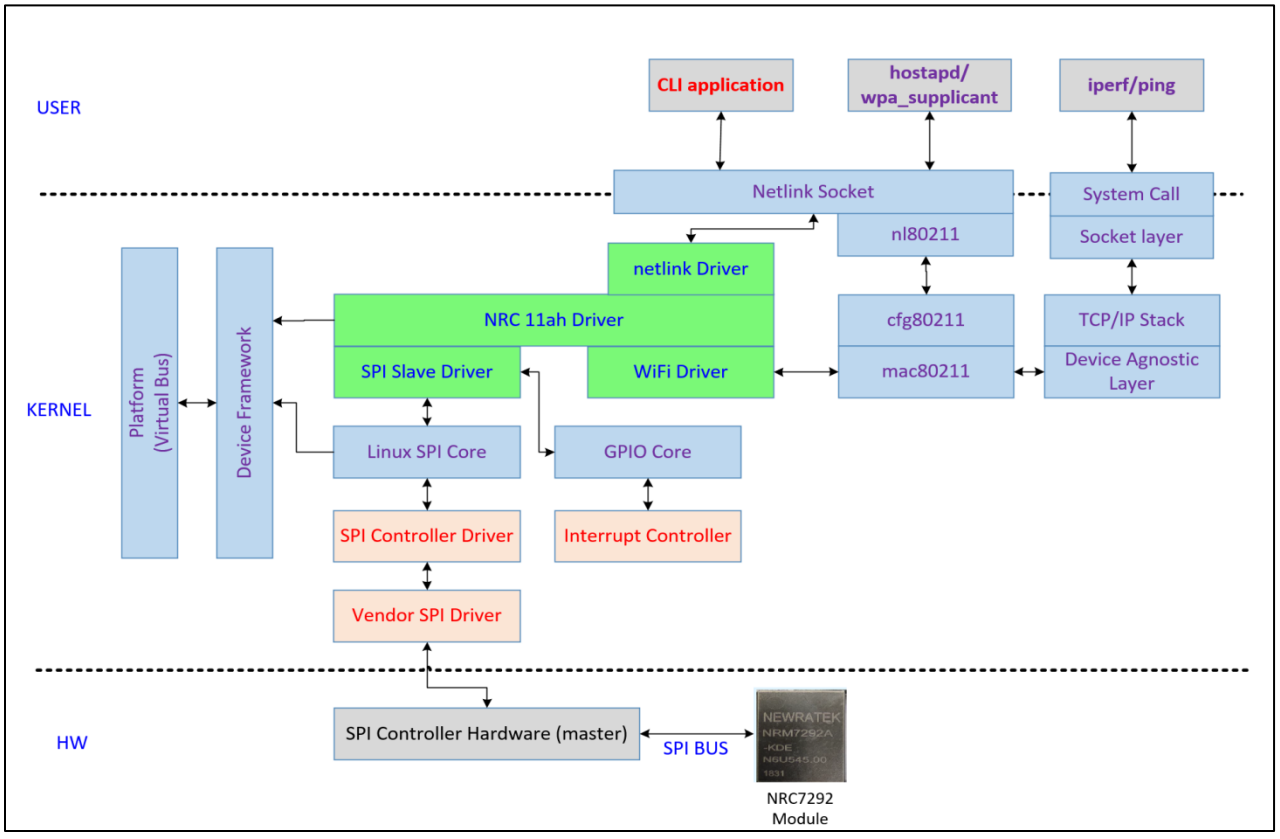

Figure 1.1 Software structure of CLI application

1.2 Build CLI application

A user can build the source code of CLI application with Makefile which is provided along with the source code. Once the user successfully builds it, the user can find "cli_app" executable file in the same directory where the user runs Makefile.

```
pi@raspberrypi:~/cli_app $ make clean;make
libcli_app.a
cli_app
pi@raspberrypi:~/cli_app $
```

Figure 1.2 Build CLI application

1.3 Start CLI application

“NRC>” prompt appears if a user executes "cli_app", then the user can enter in a CLI command into the prompt.

```
pi@raspberrypi:~/nrc_pkg/script $ ./cli_app
================================================
    Newracom Command Line Application (2.19.0)
================================================

NRC>
```

Figure 1.3 Execution of CLI application

“help” is a useful command which displays all the CLI commands with its usages as shown in Figure 1.4.

```
NRC> help
=================================================================================================================================
 help                                                                    :show CLI tree
 write {address} {data}                                                  :write a 32-bit value to memory
 exit                                                                    :exit program
 show version                                                            :show version
 show config [vif_id]                                                    :show configuration
 show edca                                                               :show EDCA parameters
 show uinfo [vif_id]                                                     :show UMAC information
 show ampdu | show ampdu clear                                           :show/clear AMPDU count
 show signal {start|stop} [interval] [number]                            :show rssi/snr, {options} are only valid in cli_app prompt
 show maxagg                                                             :show max aggregation
 show duty                                                               :show duty cycle
 show autotxgain                                                         :show autotxgain
 show recovery stats                                                     :show recovery
 show detection stats                                                    :show detection
 show temp                                                               :show temp
 show wakeup_pin                                                         :show wakeup pin configuration
 show wakeup_source                                                      :show wakeup source configuration
 show sta [vif_id] {all|aid [aid_index]}                                 :show station information
 show ap [vif_id]                                                        :show ap information
 show tx_time                                                            :show tx_time about {CS time} {Blank time}
 show cca_thresh                                                         :show cca_thresh(unit: dBm)
 show self_config {Country(KR,US...)}{BW}{dwell time}                    :show self_config
 show app_version                                                        :show app version
 show xtal_status                                                        :show xtal_status
 show stats simple_rx                                                    :show received packet information
 show mac clear                                                          :clear TX/RX Statistics
 show mac tx stats                                                       :show TX Statistics
 show mac tx clear                                                       :clear TX Statistics
 show mac rx stats                                                       :show RX Statistics
 show mac rx clear                                                       :clear RX Statistics
 set gi {short|long|auto|capa} [0|1]                                     :set guard interval
 set maxagg {AC(0-3)} {Max(0-8(1Mhz),0-16(2,4Mhz),0:off)} {size:default=0}  :set aggregation
 set ack_mode {no|ndp|normal|show}                                       :set ack mode
 set rc {on|off} [vif_id] [mode]                                         :set rate control
 set duty {on|off} {duty window} {tx duration}                           :set duty cycle
 set duty_debug {on|off}                                                 :set debug mode for duty cycle
 set txpwr {auto|limit|fixed} {value}                                    :set tx power and type
 set wakeup_pin {Debounce(on|off)} {PIN Number(0~31)}                    :set wakeup pin for deepsleep
 set wakeup_soruce rtc gpio hspi                                         :set wakeup source for deepsleep
 set addba [tid] {mac address}                                           :set addba tid / send addba with mac address
 set delba [tid] {mac address}                                           :set delba tid / send delba with mac address
 set rts {on|off|default} <threshold> <vif_id> {ndp:1, legacy:0}          :set rts on/off
 set tx_time {CS time} {Blank time}                                      :set tx_time about {CS time} {Blank time}
 set drop [vif id] [mac address] {on|off}                                :set drop frames from configured mac address
 set self_config {Country(KR,US...)} {BW} {dwell time}                   :set self_config
 set tsensor [GPIO for SCL] [GPIO for SDA]                               :set temperature sensor scl, sda
 set cca_thresh {CCA threshold(unit:dBm, -100~-35)}                      :set cca threshold
 set color {value}                                                       :set color
 set probe_resp_vendor_ie {on|off}                                       :set probe_resp_vendor_ie
 set deepsleep_gpio {dir} {out} {pullup}                                 :set GPIO direction/out data/pull during deepsleep operation
 set report {on/off}                                                     :set lmac periodic report
 set support_ch_width [0|1]                                              :set supported ch width in s1g capa ie
 test mcs [mcs index]                                                    :test mcs
 gpio read [pin number]                                                  :gpio read
 gpio write [pin number] [0|1]                                           :gpio write
 gpio direction [pin index] {[0(input)|1(output)]}                       :read/write gpio direction
 gpio pullup [pin index] {[0(off)|1(on)]}                                :read/write gpio pullup enable|disable
=================================================================================================================================
OK
```

Figure 1.4 “help” CLI command

To stop the CLI application, a user can use “exit” command.

```
NRC> exit
=================================================
      Exit Newracom Command Line Application
=================================================
pi@raspberrypi:~/nrc_pkg/script $
```

Figure 1.5 Exit of CLI application

2 CLI Commands

The categories of CLI commands is described in the below.

Table 2.1 Category of CLI commands

Category	Description
show	Display statistics, status, signal, etc.
set	Set MAC-layer parameters
test	Set test parameters
write	Write a 32-bit value to memory
gpio	Write/read GPIO, set GPIO dirction & pullup

2.1 Show Commands

2.1.1 show version

Display Firmware version and Gerrit/master number.

Parameters

N/A

```
NRC> show version
Newracom Firmware Version        : 01.04.00
gerrit/master                    : e1d9236
OK
```

2.1.2 show uinfo [vif_id]

Display 11ah capability information.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

```
NRC> show uinfo 0
-----------------------------------------------------|* AP INFO *|-----------------------------------------------------------
[    0]  bssid(00:00:00:00:00:00)      ssid()  ssid_len(0)     security(0)     beacon_interval(0)
         short bi(0)                   assoc_s1g_channel(0)    cssid(0x0)      change_seq_num(0)
support: s1g_long(0)    pv1(0)         nontim(0)               twt(0)          ampdu(0)
         ndp_pspoll(0)                 traveling pilot(0)      shortgi(1mhz:0, 2mhz:0, 4mhz:0) 1m_ctrl_resp_preamble(0)
         maximum mpdu_len(0)           ampdu_len_exp(0)        minimum mpdu_start_spacing(0)   rx_s1gmcs_map(0x0)      color(0)

-----------------------------------------------------|* STA INFO *|-----------------------------------------------------------
[    0]  mac_addr(8c:0f:fa:00:29:01)   aid(0)                  listen_interval(0)
support: s1g_long(1)    pv1(0)         nontim(1)               twt(0)                          ampdu(1)
         ndp_pspoll(0)                 traveling_pilot(0)      shortgi(1mhz:0, 2mhz:0, 4mhz:0) 1m_ctrl_resp_preamble(0)
         maximum mpdu_len(0)           ampdu_len_exp(1)        minimum mpdu_start_spacing(0)   rx_s1gmcs_map(0xfd)


-------------------------------------------------------------------------------------------------------------------------
OK
```

2.1.3 show config [vif_id]

Display device configurations including device mode, MAC address, frequency, bandwidth, etc.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

```
NRC> show config
-------------------------------------------------
[MAC Configuration]
Device Mode                     : STA
MAC Address                     : 8c:0f:fa:00:29:01
Country                         : US
Bandwidth                       : 4M
Frequency                       : 9060
MAC80211_freq                   : 2447
Rate Control                    : ON
 -MCS                           : 7
 -bw                            : 4 Mhz (NRC Auto)
Guard Interval                  : LONG
Security                        : OFF
RTS                             : OFF
RTS threshold                   : 0
Format                          : S1G
Preamble type                   : S1G_SHORT
Promiscuous Mode                : OFF
color                           : 0x0
Auto CFO Cal                    : ON

[PHY Configuration]
TX_Gain                         : AUTO
Base RX_Gain                    : 82
Compensated RX_Gain             : 82
Tx Power Type                   : ~24 [LIMIT]
Tx Power                        : 16
-------------------------------------------------
OK
```

2.1.4 show ampdu [clear]

Display statistics for aggregated MPDU (A-MPDU).

Parameters

clear : clear all statistics

```
NRC> show ampdu
------------------
  AMPDU : Value
------------------
 1      : 831
 2      : 0
 3      : 0
 4      : 0
 5      : 0
 6      : 0
 7      : 0
 8      : 0
 9      : 0
10      : 0
11      : 0
12      : 0
13      : 0
14      : 0
15      : 0
16      : 0
------------------
OK
```

2.1.5 show edca

Display the Enhanced Distributed Channel Access (EDCA) parameters per access category (AC).

Parameters

N/A

```
NRC> show edca
-------------------------------------------------
[AC]                            : 0
 - priority                     : 0
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 2
 - cw min                       : 16
 - cw max                       : 1024
 - txop limit                   : 0
 - txop max                     : 0

[AC]                            : 1
 - priority                     : 1
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 2
 - cw min                       : 16
 - cw max                       : 1024
 - txop limit                   : 0
 - txop max                     : 0

[AC]                            : 2
 - priority                     : 2
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 2
 - cw min                       : 16
 - cw max                       : 1024
 - txop limit                   : 0
 - txop max                     : 0

[AC]                            : 3
 - priority                     : 3
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 2
 - cw min                       : 16
 - cw max                       : 1024
 - txop limit                   : 0
 - txop max                     : 0

[AC]                            : 4
 - priority                     : 4
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 1
 - cw min                       : 1
 - cw max                       : 1
 - txop limit                   : 0
 - txop max                     : 0

[AC]                            : 5
 - priority                     : 5
 - aggregation                  : 0
 - max agg num                  : 16
 - aifsn                        : 3
 - cw min                       : 16
 - cw max                       : 1024
 - txop limit                   : 0
 - txop max                     : 0

-------------------------------------------------
OK
```

2.1.6 show sta [vif id] <all|aid <aid index>>

Display station information including TX/RX PHY rate.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

all | aid <aid index> : 'all' shows information of whole connected stations. 'aid <aid index>' shows information of the specified station.

```
NRC> show sta 0 all
STATION    MAC_ADDR            AID    STATE     TX bit rate        RX bit rate
================================================================================
0          ca:fe:ba:be:01:33   1      ASSOC   6.50MBit/s(MCS 7)  6.50MBit/s(MCS 7)
Duplicate AID count : 0
================================================================================
OK
```

2.1.7 show ap [vif id]

Display ap information including TX/RX PHY rate.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

```
NRC> show ap 0
        BSSID         BW          TX bit rate        RX bit rate
=====================================================================
8c:0f:fa:00:29:01     2M        5.20MBit/s(MCS 5)   6.50MBit/s(MCS 7)
=====================================================================
OK
```

2.1.8 show signal [start|stop] [interval] [number]

Display channel quality information (RSSI and SNR).

Parameters

start : start periodic display with interval (Ex. show signal start 1: display RSSI & SNR every 1 second)
stop : stop displaying
interval : period in second unit (default 1 second)
number : number of samples to display

Returns

```
NRC> show signal
MAC addr : 8c:0f:fa:00:2b:0e    rssi     : 9           snr      : 25
OK
```

※ 'show siganl' and 'show stop' could not support in one line command operation.

```
NRC> show signal start
OK
NRC> Mac Addr : 8c:0f:fa:00:2b:0e       rssi: 9         snr: 26

Mac Addr : 8c:0f:fa:00:2b:0e    rssi: 9         snr: 26

Mac Addr : 8c:0f:fa:00:2b:0e    rssi: 9         snr: 26

Mac Addr : 8c:0f:fa:00:2b:0e    rssi: 9         snr: 26

show signal stop
-------------------------------------------------
[MAC Addr]: 8c:0f:fa:00:2b:0e
[Total]   : 23
[RSSI]
 average  : 1.565
 std_dev  : 3.411
[SNR]
 average  : 4.522
 std_dev  : 9.855
-------------------------------------------------
OK
```

Total : total number of samples displayed,
average : average value of RSSI and SNR
std_dev : standard deviation

2.1.9 show maxagg

Display aggregation status per AC.

Parameters

N/A

```
NRC> show maxagg
------- VIF0 -------
[Base info]
AC_BK: OFF (16,    0 bytes)
AC_BE: OFF (16,    0 bytes)
AC_VI: OFF (16,    0 bytes)
AC_VO: OFF (16,    0 bytes)
OK
```

2.1.10 show cca_thresh

Display CCA threshold value.

Parameters

N/A

```
NRC> show cca_thresh
-70
OK
```

2.1.11 show duty

Show status of duty cycle function.

If it is on, it shows duty window, tx duration, remain tx duration time in usec and duty error count.

Parameters

N/A

Returns

```
NRC> show duty
Duty cycle                      : off
OK
```

or

```
NRC> show duty
Duty cycle                      : on
Duty window                     : 60000000
Tx duration                     : 5000000
Remain tx duration              : 3375200
Duty error                      : 0
OK
```

2.1.12 show autotxgain

Show status of autotxgain function.

If it is on, it shows Tx power index for each MCS (Modulation Coding Scheme).

Parameters

N/A

```
NRC> show autotxgain
Auto txgain                     : on
Tx power index for MCS 0        : 23
Tx power index for MCS 1        : 22
Tx power index for MCS 2        : 22
Tx power index for MCS 3        : 19
Tx power index for MCS 4        : 19
Tx power index for MCS 5        : 17
Tx power index for MCS 6        : 17
Tx power index for MCS 7        : 16
Tx power index for MCS 10       : 23
OK
```

2.1.13 show recovery stats

The count statistics of recovery function entered.

Parameters

N/A

```
NRC> show recovery stats
-------------------------------------------------
Number of Recovery Count : 0
Number of RX Frame regarding RX Buffer discard : 0
SN missing by QM
-------------------------------------------------
QM[#]    Missing Count          Max diff
-------------------------------------------------
QM[0]          0                 0
QM[1]          0                 0
QM[2]          0                 0
QM[3]         30                17
QM[4]          1                48
QM[5]          0                 0
-------------------------------------------------
OK
```

2.1.14 show detection stats

The count statistics of detection function entered, which are tx triggered.

Parameters

N/A

```
NRC> show detection stats
-------------------------------------------------
Tx Triggered Detection Count : 0
Rx Triggered Detection Count : 0
-------------------------------------------------
 --Non-zero Length NDP:  0
 --IP Length:            0(0)
 --MPDU Length Mismatch: 0
 --Buffer Mismatch:      0
 --MPDU Length Size:     0
-------------------------------------------------
OK
```

2.1.15 show temp

The temperature of temperature sensor. If temperature sensor is not existed, it displays Not Support'.

Parameters

N/A

```
NRC> show temp
Temperature                    : 0x1A(26)
OK
```

2.1.16 show tx_time

Show tx_time parameters.

Parameters

N/A

```
NRC> show tx_time
CS time                         : 988
TX delay                        : 100
OK
```

2.1.17 show wakeup_pin

Get configuration of wakeup gpio pin from deep sleep mode.

Parameters

N/A

```
NRC> show wakeup_pin
Debounce : off                  Pin number : 11
OK
```

2.1.18 show wakeup_source

Get configuration of wakeup source from deep sleep mode.

Parameters

N/A

```
NRC> show wakeup_source
Wakeup source                   : RTC GPIO HSPI
OK
```

2.1.19 show xtal_status

Show 32MHz crystal status.

Parameters

N/A

※ It is not used in NRC7292

2.1.20 show app_version

Show cli appication version.

Parameters

N/A

```
NRC> show app_version
2.19.0
OK
```

2.1.21 show stats simple_rx

Display received packet information.

Parameters

N/A

Returns

RSSI : received signal strength indication

CS_Cnt : number of carrier sense counted

PSDU_Succ : number of PSDU count successfully received (SIG CRC OK)

MPDU_Rcv : number of MPDU count received

MPUD_Succ : number of MPDU count successfully received (FCS OK)

SNR : signal to noise ratio

※ The PSDU_Succ counts NDP packets. However, the MPDU_Rcv does not count NDP packet. In addition, The PSDU_Succ regards A-MPDU packet as 1 packet.

```
NRC> show stats simple_rx
-------------------------------------------------
RSSI                            : -27
CS_Cnt                          : 595182
PSDU_Succ                       : 2603
MPDU_Rcv                        : 1134
MPDU_Succ                       : 1046
SNR                             : 31
-------------------------------------------------
OK
```

2.1.22 show mac clear

Clear MAC-layer TX and RX statistics.

Parameters

N/A

```
NRC> show mac clear
success
OK
```

2.1.23 show mac tx stats

Display MAC-layer TX statistics.

Parameters

N/A

Returns

```
NRC> show mac tx stats
-------------------------------------------------------------------------
 MAC TX Statistics (OK count:24728, RTX count:259, last MCS:0)
-------------------------------------------------------------------------
- AC[BK]        : OK(          0/          0)  RTX(          0/          0)
- AC[BE]        : OK(        228/      28426)  RTX(        214/      25084)
- AC[VI]        : OK(          0/          0)  RTX(          0/          0)
- AC[VO]        : OK(        823/      84826)  RTX(         45/       4565)
- AC[BC]        : OK(      23677/     805039)  RTX(          0/          0)
- AC[GP]        : OK(          0/          0)  RTX(          0/          0)
-------------------------------------------------------------------------
- TYPE[MGMT]    : OK(        820/      83730)  RTX(         45/       4565)
- TYPE[CTRL]    : OK(          0/          0)  RTX(          0/          0)
- TYPE[DATA]    : OK(        231/      29522)  RTX(        214/      25084)
- TYPE[BEAC]    : OK(      23678/     805066)  RTX(          0/          0)
-------------------------------------------------------------------------
- MCS[ 0]       : OK(        168/      19824)  RTX(         36/       4248)
- MCS[ 1]       : OK(          0/          0)  RTX(          0/          0)
- MCS[ 2]       : OK(         37/       6168)  RTX(          0/          0)
- MCS[ 3]       : OK(          0/          0)  RTX(          0/          0)
- MCS[ 4]       : OK(          0/          0)  RTX(         59/       6962)
- MCS[ 5]       : OK(          0/          0)  RTX(         55/       6490)
- MCS[ 6]       : OK(          0/          0)  RTX(          4/        472)
- MCS[ 7]       : OK(          0/          0)  RTX(         57/       6726)
- MCS[10]       : OK(      24525/     892353)  RTX(         48/       4751)
-------------------------------------------------------------------------
OK
```

OK (number of packets successfully transmitted / total aggregated bytes successfully transmitted)

RTX (number of packets retransmitted / total aggregated bytes retransmitted)

※ AC[GP] : GP stands for general purpose. This is used to send a frame which is the highest priority. This is a vendor-specific function.

2.1.24 show mac rx stats

Display MAC-layer RX statistics.

Parameters

N/A

Returns

```
NRC> show mac rx stats
-------------------------------------------------------------------
 MAC RX Statistics (OK count:4673, NOK count:12, last MCS:10)
-------------------------------------------------------------------
- AC[BK]        : OK(          0/          0) NOK(          0/          0)
- AC[BE]        : OK(       3778/    5319311) NOK(         12/      16672)
- AC[VI]        : OK(          0/          0) NOK(          0/          0)
- AC[VO]        : OK(        895/      38776) NOK(          0/          0)
- AC[BC]        : OK(          0/          0) NOK(          0/          0)
- AC[GP]        : OK(          0/          0) NOK(          0/          0)
-----------------------------------------------------------------------------
- TYPE[MGMT]    : OK(        889/      38332) NOK(          0/          0)
- TYPE[CTRL]    : OK(          0/          0) NOK(          0/          0)
- TYPE[DATA]    : OK(       3784/    5319755) NOK(         12/      16672)
- TYPE[BEAC]    : OK(          0/          0) NOK(          0/          0)
-----------------------------------------------------------------------------
- MCS[ 0]       : OK(         58/      17980) NOK(          0/          0)
- MCS[ 1]       : OK(          1/        130) NOK(          0/          0)
- MCS[ 2]       : OK(         21/      31710) NOK(          0/          0)
- MCS[ 3]       : OK(          5/       6114) NOK(          0/          0)
- MCS[ 4]       : OK(         29/      43790) NOK(          0/          0)
- MCS[ 5]       : OK(         11/      12318) NOK(          1/       1510)
- MCS[ 6]       : OK(        137/     206870) NOK(          3/       4530)
- MCS[ 7]       : OK(       3488/    4997538) NOK(          7/      10570)
- MCS[10]       : OK(        923/      41637) NOK(          1/         62)
-----------------------------------------------------------------------------
OK
```

OK (number of packets successfully received / total aggregated bytes successfully received)

NOK (number of packets received but discarded / total aggregated bytes discarded)

※ NOK : Even though the MPDU is successfully received, it can be discarded due to duplication or address mismatch.

2.1.25 show mac tx clear

Clear MAC-layer TX statistics.

Parameters

N/A

```
NRC> show mac tx clear
success
OK
```

2.1.26 show mac rx clear

Clear MAC-layer RX statistics.

Parameters

N/A

```
NRC> show mac rx clear
success
OK
```

2.1.27 show self_config <Country> <BW> <dwell time>

Show self config.

Parameters

Country : Country Code. KR, US, EU……

BW: scan channel bandwidth (1m, 2m, 4m)

dwell time: scan time for CCA (10 ~ 1000 ms)

```
NRC> show self_config US 1m 100
        Frequency       CCA     bandwidth
--      902.5 MHz       21.7%   1M
--      903.5 MHz       0.0%    1M
--      904.5 MHz       0.0%    1M
--      905.5 MHz       0.0%    1M
--      906.5 MHz       0.0%    1M
--      907.5 MHz       0.0%    1M
--      908.5 MHz       1.8%    1M
--      909.5 MHz       2.1%    1M
--      910.5 MHz       0.0%    1M
--      911.5 MHz       0.0%    1M
--      912.5 MHz       0.0%    1M
--      913.5 MHz       0.0%    1M
--      914.5 MHz       4.6%    1M
--      915.5 MHz       2.7%    1M
--      916.5 MHz       0.9%    1M
--      917.5 MHz       0.0%    1M
--      918.5 MHz       3.1%    1M
--      919.5 MHz       3.6%    1M
--      920.5 MHz       23.3%   1M
--      921.5 MHz       27.9%   1M
--      922.5 MHz       4.2%    1M
--      923.5 MHz       3.7%    1M
--      924.5 MHz       10.3%   1M
--      925.5 MHz       10.3%   1M
--      926.5 MHz       0.8%    1M
--      927.5 MHz       6.3%    1M
[Optimal freq.] 903.5 MHz (CCA:0.0%, BW:1M)
[*]ch_num:3
OK
```

2.1.28 show optimal_channel <Country> <BW> <dwell time>

Optimize your channel selection to significantly reduce scan time. This feature is designed to enhance efficiency and improve the overall scanning process.

※ Please note that it is not available for use in small channel sizes such as K0, K1, K2, JP, and EU.

Parameters

Country : Country Code (US, AU, NZ, CN, TW)

BW: scan channel bandwidth (1m, 2m, 4m)

dwell time: scan time for CCA (10 ~ 1000 ms)

```
NRC> show optimal_channel US 1m 100
[Optimal freq.] 907.5 MHz (CCA:0.0%, BW:1M, Legacy channel number:11)
OK


NRC> show optimal_channel US 2m 100
[Optimal freq.] 907.0 MHz (CCA:0.0%, BW:2M, Legacy channel number:10)
OK


NRC> show optimal_channel US 4m 100
[Optimal freq.] 906.0 MHz (CCA:0.0%, BW:4M, Legacy channel number:8)
OK
```

2.1.29 show cal_use

Show whether calibration data is used and country code.

Parameters

N/A

Returns

```
NRC> show cal_use
Calibration_use : on                    Country  : US
OK
```

2.1.30 show sysconfig

Show NRC WiFi board system configurations.

Parameters

N/A

Returns

```
NRC> show sysconfig
[sysconfig]
 version        : 2
 mac_addr0      : 8c:0f:fa:00:2b:9a
 mac_addr1      : 8c:0f:fa:00:52:aa
 cal_use        : 1
 hw_version     : 65535
 rf_pllldo12_tr : 0xA5A5A5A5 (Disabled)


[user_factory]


OK
```

2.1.31 show bcn_mcs [vif id]

Show the MCS (Modulation and Coding Scheme) level for beacon transmissions.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

Returns

```
NRC> show bcn_mcs 0
------------------------ current beacon rate --------------------------
VIF#:0, Current beacon mcs = 10

-----------------------------------------------------------------------
OK


NRC> show bcn_mcs 1
------------------------ current beacon rate --------------------------
VIF#:1, Current beacon mcs = 0

-----------------------------------------------------------------------
OK
```

2.1.32 show rc_pf

Show rate control profile used.

1 : for strong RF field.

2 : for middle/low RF field.

Parameters

N/A

Returns

```
NRC> show rc_pf
Profile#                        : 1

OK
```

2.1.33 show rc_param

Show rate control parameters.

EWMA : The percentage of Exponentially Weighted Moving Average (EWMA) used in rate control

Update interval : shows the frequency at which EWMA data is updated (unit : ms)

Parameters

N/A

Returns

```
NRC> show rc_param
EWMA(%)   : 30          Update interval(ms) : 500
OK
```

2.2 Set Commands

2.2.1 set gi <short|long> [vif_id]

Set Guard Interval.

Parameters

short : Short Guard Interval

long : Long Guard Interval (default)

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

```
NRC> set gi short
OK
```

2.2.2 set maxagg <ac> <maxagg> {options}

Set maximum number of MPDU of AC in A-MDPU.

(AP)

set maxagg ac maxagg // set maxagg for all-sta

set maxagg ac maxagg maxsize // set maxagg and maxsize for all-sta

set maxagg ac maxagg vif aid // set maxagg for specifi aid

(STA)

set maxagg ac maxagg //set maxagg

set maxagg ac maxagg maxsize //set maxagg and maxsize

Parameters

ac : access category

maxagg : number of MPDU in AMPDU (0-8(1Mhz), 0-16(2,4Mhz), 0: off)

maxsize: aggregation threshold size (default : 0)

vif : virtue interface identification

aid: association identification

```
NRC> set maxagg 0 2
-- updated aggregation
[STA AID:    0]
AC(BK): STATUS(ON) MAXNUM( 2) SIZE(0)
OK
```

2.2.3 set ack_mode {mode}

Set ACK mode.

Parameters

mode: no|ndp|normal|show

```
NRC> set ack_mode no
ACK_MODE                        : NO

OK
```

2.2.4 set rc <on|off> [vif_id]

Set rate control on / off.

Parameters

on : enable rate control (automatic selection of MCS based on the link condition) (default)

off : disable rate control (user can select MCS manually by using “test mcs” command)

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

```
NRC> set rc on
------------------------ updated rate control -------------------------
rc       : on           vif_id   : 0            mode     : NRC
-----------------------------------------------------------------------
OK
```

2.2.5 set duty <on|off> {duty window in usec} {tx duration in usec}

Set duty cycle.

Parameters

on|off : enable|disable duty cycle function (default; off)

duty window : specify duty cycle window in usec. (default: 60 sec)

tx duration : specify allowed tx duration within duty cycle window in usec. (default: 5 sec)

(ex) duty window 10000000 (10sec) and tx duration 1000000 (1sec) will be set to access the channel 1 second during every 10 seconds.

```
NRC> set duty on 10000000 1000000
Duty cycle                      : on
Duty window                     : 10000000
Tx duration                     : 1000000
OK
```

2.2.6 set duty_debug <on|off>

Set duty cycle debug on/off.

Parameters

on|off : enable|disable duty cycle debug

```
NRC> set duty_debug on
duty debug : on
OK
```

2.2.7 set cca_thresh <value>

Set CCA threshold value.

Parameters

value: CCA threshold value (-100 dbm ~ -35 dbm)

```
NRC> set cca_thresh -70
-70
OK
```

2.2.8 set txpwr <auto|limit|fixed> <value>

Set tx power type and value.

Parameters

type :

auto: The device will automatically adjust its Tx power based on the current network conditions and signal strength.

limit : The device will use a specified maximum Tx power limit.

fixed : The device will use a fixed Tx power level, which can be useful for testing or for applications where a consistent power level is required.

value : 1~30

```
NRC> set txpwr fixed 17
Type     : fixed        Tx power : 17
                        OK
```

2.2.9 set wakeup_pin <debounce> <pin index>

Configure a wakeup-gpio-pin when system state is uCode or deepsleep.

Parameters

debounce : on|off

pin index : 0~31

```
NRC> set wakeup_pin off 18
Debounce : off                  Pin number : 18
OK
```

2.2.10 set wakeup_source <wakeup_sources>

Configure wakeup sources when system state is deepsleep.

Parameters

wakeup_sources : rtc gpio hspi

※ It is possible to assign multiple sources (ex) set wakeup_source rtc gpio

```
NRC> set wakeup_source rtc gpio
Wakeup source                   : rtc gpio
OK
```

2.2.11 set addba [tid] {mac address}

Set addba tid / send addba with MAC address.

Parameters

tid: Traffic Identifier

mac address : mac address

```
NRC> set addba 1
OK
```

2.2.12 set delba [tid] {mac address}

Set delba tid / send delba with MAC address.

Parameters

tid: Traffic Identifier

mac address : mac address

```
NRC> set delba 1
OK
```

2.2.13 set rts <on|off|default> <threshold> <vif_id>

Enable/disable RTS, set RTS threshold.

Parameters

threshold : RTS & CTS threshold in Byte

vif_id : virtue interface identification

Ex1) send RTS regardless of packet length (set rts on 0 0)

Ex2) no use of RTS (set rts off 0 0)

Ex3) set RTS threshold (set rts default 1000 0)

```
NRC> set rts on 0 0
OK
```

2.2.14 set tx_time <CS time> <Blank time>

Set tx_time about <CS time> <Blank time>. CS time at least [(AFISN offset * 16 + 1) * 52us]

Parameters

CS time: Carrier sensing time. Listen before talk (52~13260 in us)

Blank time: Tx pause time (1~65535 in us)

```
NRC> set tx_time 52 10000
OK
```

2.2.15 set drop [vif id] [mac address] {on|off}

Set drop frames from configured MAC address.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

mac address: drop frames from mac address

on|off: Enable disable drop mac address

2.2.16 set tsensor [GPIO for SCL] [GPIO for SDA]

Set temperature sensor scl, sda.

Parameters

SCL: GPIO for SCL (default 31)

SDA: GPIO for SDL (default 30)

```
NRC> set tsensor 31 30

OK
```

2.2.17 set self_config <Country> <BW> <dwell time>

Set self-config assesses CCA in each channel and suggests the optimal frequency by analyzing signal strength, interference, and noise levels.

Parameters

Country : Country Code. KR, US, EU……

BW: scan channel bandwidth (1m, 2m, 4m)

dwell time: scan time for CCA (10 ~ 1000 in ms)

```
NRC> set self_config US 1m 100
        Frequency       CCA     bandwidth
--      902.5 MHz       8.9%    1M
--      903.5 MHz       0.2%    1M
--      904.5 MHz       0.0%    1M
--      905.5 MHz       0.0%    1M
--      906.5 MHz       0.0%    1M
--      907.5 MHz       0.0%    1M
--      908.5 MHz       0.6%    1M
--      909.5 MHz       2.1%    1M
--      910.5 MHz       0.0%    1M
--      911.5 MHz       0.0%    1M
--      912.5 MHz       0.0%    1M
--      913.5 MHz       0.0%    1M
--      914.5 MHz       6.0%    1M
--      915.5 MHz       4.1%    1M
--      916.5 MHz       0.6%    1M
--      917.5 MHz       0.0%    1M
--      918.5 MHz       1.8%    1M
--      919.5 MHz       4.7%    1M
--      920.5 MHz       11.9%   1M
--      921.5 MHz       13.0%   1M
--      922.5 MHz       1.1%    1M
--      923.5 MHz       1.3%    1M
--      924.5 MHz       6.4%    1M
--      925.5 MHz       6.9%    1M
--      926.5 MHz       0.9%    1M
--      927.5 MHz       0.0%    1M
[Optimal freq.] 904.5 MHz (CCA:0.0%, BW:1M)
[*]ch_num:5
OK
```

2.2.18 set color {value}

Set color bit.

Parameters

value : 0 -7

```
NRC> set color 1
OK
```

※ We just added a value to the beacon frame in our Wi-Fi setup, but it is currently not being utilized.

2.2.19 set probe_resp_vendor_ie <on|off>

Set probe response with vendor IE.

Parameters

on|off : enable|disable

```
NRC> set probe_resp_vendor_ie on
Vendor IE in probe_response :ON
OK
```

2.2.20 set report <on|off>

Set LMAC periodic report on/off.

Parameters

on|off : enable|disable

```
NRC> set report on
set report : on
OK
```

[Target conole log after 'set report on']

```
-------------------------------------------------------------------------------------------------
1. RX:     0 Kbps      TX:     2 Kbps(    2 Kbps)      CPU:   150K Idle/sec
-------------------------------------------------------------------------------------------------
 2. CS                :       103 (total)     |        34 (1M corr)     |        59 (2M corr)      |        10 (SAT)
 3. SYNC      ( 29%)  :        30 (done)      |        73 (miss)        |         0 (timeout)
 4. SIG       (100%)  :        30 (ok)        |         0 (err)         |
 5. MAC CRC   ( 96%)  :        29 (ok)        |         0 (err)         |         0 (delimeter error)
 6. NDP BA Error      :         0             |         0 us (MAX)
 7. SNR(1Mhz)         :        27 (pri)       |         0 (sec)
 8. RSSI              :       -75
 9. Avg CFO (Last 16) :      -1.56 ppm
10. CCA               :         0%(1M)       |         0%(2M pri)      |         0 %(2m sec)
11. Noise (RSSI-SNR)  :      -102
12. TX Idle Time      :         0 us          |         0 ea
-------------------------------------------------------------------------------------------------
```

2.2.21 set deepsleep_gpio <dir> <out> <pullup>

Set the GPIO direction, output data, and pullup settings using a 32-bit mask during deep sleep operation.

Parameters

dir : GPIO direction

out : GPIO output value

pull-up : GPIO pull-up option

```
NRC> set deepsleep_gpio 0x00c00000 0x10203000 0x00000000
OK
```

2.2.22 set support_ch_width [0|1]

Set the supported channel width in S1G capability IE.

Parameters

0:1/2M, 1:1/2/4M

```
NRC> set support_ch_width 1
set support_ch_width : 1
OK
```

2.2.23 set ampdu_mode [mode]

Set the AMPDU(Aggregate MAC Protocol Data Unit) mode

Parameters

mode : auto, manual or auto.

Returns

```
NRC> set ampdu_mode auto
OK
```

2.2.24 set bcn_mcs [vif id] [MCS]

Set the MCS (Modulation and Coding Scheme) level for beacon transmissions.

Parameters

vif_id : interface ID (default 0, vif_id can be 0 or 1 when the concurrent mode is enabled)

MCS level : 10, 0, 1, 2, 3, 4, 5, 6, 7

Returns

```
NRC> set bcn_mcs 0 5
set bcn_mcs: 5
OK


NRC> show bcn_mcs 0
------------------------ current beacon rate --------------------------
VIF#:0, Current beacon mcs = 5

-----------------------------------------------------------------------
OK
```

2.2.25 set rc_pf [Profile number]

set rate control profile.

Parameters

Profile number: 1 for strong RF field or 2 for middle/low RF field.

Returns

```
NRC> set rc_pf 2
OK


NRC> show rc_pf
Profile#                        : 2

OK
```

2.2.26 set rc_param [EWMA ID] [Interval ID]

set rate control parameters.

Parameters

EWMA ID : EWMA ID x 10 (%) will be set for EWMA. (1/2/3/4/5)

Interval ID : Interval ID x 100 (ms) will be set for the interval. (1/2/3/4/5/6/7)

Returns

```
NRC> set rc_param 3 5
OK


NRC> show rc_param
EWMA(%)   : 30           Update interval(ms) : 500
OK
```

2.3 Test Commands

2.3.1 test mcs <value>

Set MCS(Modulation Coding Scheme) index.

Parameters

value : 0~7, 10 (10 can be used only in 1MHz bandwidth)

```
NRC> test mcs 7
OK
```

2.3.2 test country <Country>

Set country for a test command

Parameters

Country : Country Code. KR, US, EU……

```
NRC> test country US
OK
```

2.3.3 test cont_tx <freq> <bw> <mcs> <txpwr> | <stop>

test countinous TX

Parameters

freq : frequency (in MHz)

bw : 1m, 2m, 4m

mcs : 0~7, 10 (10 can be used only in 1MHz bandwidth)

txpwr : TX power

[Start]

```
NRC> test cont_tx 9025 1m 7 17
OK
```

[Stop]

```
NRC> test cont_tx stop
OK
```

2.4 GPIO Commands

The GPIO CLI commands listed below can be used to configure GPIO options to read from and write to GPIO pins. Note that GPIO command usage is valid for non-dedicated GPIO pins only. Refer to the NRC7292 Technical Reference Manual for the list of dedicated GPIO pins.

2.4.1 gpio read <pin index>

Read the value (0: low / 1: high) from a GPIO pin.

Parameters

pin index: GPIO pin index

```
NRC> gpio read 18
1
OK
```

2.4.2 gpio write <pin index> <value>

Write a value (0: low / 1: high) to a GPIO pin.

Parameters

pin index: GPIO pin index

value: 0: low / 1: high

```
NRC> gpio write 18 0
0x47fbfff3
OK
```

2.4.3 gpio direction <pin index> [direction]

Get or set the direction (0: input / 1: output) of a GPIO pin.

Parameters

pin index: GPIO pin index

direction: set GPIO direction

[Get]

```
NRC> gpio direction 18
1
OK
```

[Set]

```
NRC> gpio direction 18 1
0x07ffff30
OK
```

※ (For set command only) direction: 0: input / 1: output

2.4.4 gpio pullup <pin index> [pull-up option]

Get or set the pull-up option (0: disable / 1: enable) for a GPIO pin.

Parameters

pin index: GPIO pin index

pull-up option: set pull-up option

[Get]

```
NRC> gpio pullup 7
1
OK
```

[Set]

```
NRC> gpio pullup 18 0
0xc0000080
OK
```

※ (For set command only) pull-up option: 0: disable / 1: enable

3 Revision History

Revision No	Date	Comments
Ver 1.0	2/26/2019	Initial version for customer release created
Ver 1.1	3/25/2019	Add CLI commands (2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 0, 0, 0, 0, 2.1.24, 2.1.20,2.2.1, 2.2.2) Removed CLI commands (“show rx <start | stop> <duration>”, “phy txpower <value>”)
Ver 1.2	10/3/2019	CLI commands description updated
Ver 1.3	11/1/2019	Add set duty, show duty, set autotxgain, show autotxgain commands
Ver 1.4	11/18/2019	Add response example about show 38ignal start/stop
Ver 1.5	12/5/2019	Add response example about set cal_use & show cal_use
Ver 1.6	12/13/2019	Add ‘auto’ option for “set gi <short|long|auto>” command
Ver 1.7	12/19/2019	Add “test recovery <interval> <count>”, “show recovery stats”, “show detection stats” command Add parameter for “set maxagg {ac} {maxagg} {size(optional, 0: default)}” and “set txpwr [val]”
Ver 1.8	12/27/2019	Add ‘test assert’ option for recovery testing
Ver 1.9	1/17/2020	Add gpio, gprf commands
Ver 1.10	4/13/2020	Remove a ‘set autotxgain’ command
Ver 1.11	4/22/2020	Add ‘show temp’
Ver 1.12	5/30/2020	Add ‘set/show wakeup_pin’, ‘set/show wakeup_source’
Ver 1.13	8/3/2020	Add ‘set/show bdf_use’, ‘test ucode’
Ver 1.14	3/10/2021	2.2.21 set rst and 2.3.5 test country jp commands added
Ver 1.15	4/13/2021	Remove gpio/gprf, test recovery/ucode/assert
Ver 1.16	10/19/2021	Add gpio command Update maxagg command
Ver 1.17	12/10/2021	Update maxagg paramter range
Ver 1.18	12/10/2021	set txpwr value range
Ver 1.19	5/20/2022	Remove “read”, “show bdf_use”, “set bdf_use”, “test country jp” Add “write”, “show sta”, “show tx_time”, “show cca_thresh”, “set cca_thresh”
Ver 1.20	9/28/2022	Add vif_id parameter to set gi command
Ver 1.21	12/08/2022	Remove cal_use command
Ver 1.22	2/06/2023	Remove duty margin in show/set duty
Ver 1.23	3/30/2023	Add ‘show ap [vif_id]’ command Display TX/RX PHY rate using ‘show sta’ and ‘show ap’
Ver 1.24	6/12/2023	Update for v1.4 SW package
Ver 1.25	9/8/2023	Remove ‘auto’ parameter for set gi [Added]

		test country, test cont_tx, show cal_use, show sysconfig, show rc_pf, show rc_param, set ampdu_mode, set bcn_mcs, show bcn_mcs