

# Nemo Handy and Nemo Walker Air

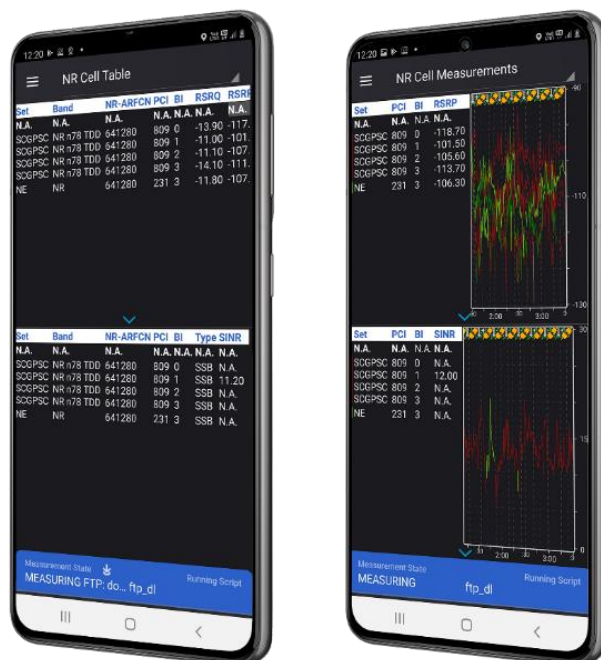
MediaTek-Based terminals

## Fast, Effective Testing of Complex In-Building or Outdoor Wireless Networks

Nemo Handy provides you with smart and discreet solutions for thorough and advanced measurement and optimization of wireless air interface and mobile application quality of service (QoS) and quality of experience (QoE).

Nemo Walker Air is an ideal solution for performing indoor measurements and benchmarking on multiple technologies. It is lightweight, easy to carry and set up, and the complete system operates for up to 10 hours.

To use MediaTek M70/M80-based devices with Nemo Handy, Nemo Diagnostic Module (NDM) is needed.



# Technical Specifications

## Device specific features<sup>1</sup>

Device	5G NR	LTE	WCDMA
Samsung Galaxy A32 5G SM-A326B	<b>NSA:</b> 1, 3, 5, 7, 8, 20, 28, 38, 40, 41, 66, 78 <b>SA:</b> 2, 5, 7, 38, 41, 66, 77, 78	<b>FDD:</b> 1-5, 7, 8, 12, 17, 20, 26, 28, 66 <b>TDD:</b> 38, 40, 41	850, 900 GSM, 1900 PCS, 2100, AWS-1
Samsung Galaxy A34 SM-A346B	<b>NSA/SA/Sub6:</b> 1, 3, 7, 8, 20, 28, 38, 40, 41, 77, 78	<b>FDD:</b> 1-5, 7, 8, 12, 17, 20, 26, 28, 32, 66 <b>TDD:</b> 38, 40, 41	HSDPA 850, 900, 1700(AWS), 1900, 2100

## Application Protocols

- FTP (multi-thread, download/upload)
- SFTP
- TWAMP
- Ping
- iPerf2
- HTTP/HTTPS (multi-thread, download/upload)
- HTTP PUT
- HTTP browsing
- HTML browsing

1. The test devices tested and sold by Keysight Nemo Wireless Network Solutions are intended for testing purposes only. Software changes in devices may limit their normal use. Keysight Nemo Wireless Network Solutions does its best to provide test devices without any limitations, but it is not always possible. Keysight Nemo Wireless Network Solutions assumes no liability if any commercial application or feature is blocked or limited due to software or other device-related modifications. If the test device is moved to another country or used in the network of another operator than initially ordered, it is possible that the device does not support all network features. Some of the listed capabilities and KPIs in this document may vary depending on the SIM card, the network, or the terminal chipset/modem. Keysight Nemo Wireless Network Solutions assumes no liability for the completeness, correctness, and accuracy of the content in this document.

# 5G NR

## Serving cell information

- Number of serving cells
- Number of secondary serving cells
- Cell type
- Band
- Band type (FDD/TDD)
- SSB NR-ARFCN/channel
- SSB NR-ARFCN frequency
- SSB GSCN
- Offset to point A (SA only)
- NR cell ID
- PCI
- Beam index
- Beam type
- Measurement type (for beam)
- C-RNTI
- Packet technology
- Packet state
- RRC state (NR/LTE)
- RSRP (NR serving cell)
- RSRP (NR neighbor)
- RSRQ (NR serving cell)
- RSRQ (NR neighbor)
- SINR (NR serving cell)
- SINR (NR neighbor)
- RSSI (NR serving cell)
- RSSI (NR neighbor)
- Pathloss PUCCH
- Pathloss PUSCH
- DL NR-ARFCN Point A
- UL NR-ARFCN Point A
- BWP type (DL/UL)
- BWP ID
- BWP numerology (SCS)
- BWP bandwidth (PRB)
- Resource grid NR-ARFCN (NR)

- Resource grid bandwidth (kHz, PRB)
- NR-ARFCN frequency (BWP)
- NR-ARFCN (BWP)
- TDD pattern size
- TDD pattern 1 DL
- TDD pattern 1 UL

## Physical channel information (for each serving cell)

- PUSCH throughput
- PUSCH throughput (LTE+NR)
- RB ID
- TX power (NR)
- TX power PUCCH
- TX power PUCCH adjustment
- TX power PUSCH
- TX power PUSCH adjustment
- Pathloss PUSCH (NR)
- Pathloss PUCCH (NR)

## Link adaptation (for each serving cell)

- PDSCH MCS CW0
- PDSCH MCS distribution
- PUSCH MCS CW0
- PUSCH MCS distribution
- PDSCH rank
- PDSCH rank distribution (count)
- PUSCH rank
- PUSCH rank distribution (count)
- PDSCH PRBs (count)
- PUSCH PRBs (count)
- PDSCH PRB distribution (count)
- PUSCH PRB distribution (count)
- PDSCH modulation CW0
- PDSCH modulation distribution
- PUSCH modulation CW0
- PUSCH modulation distribution
- PDSCH TBS CW0
- PUSCH TBS CW0

## CSI

- CSI-RS RSRP
- CSI-RS RSRQ
- CSI-RS SINR
- CSI-RS RSSI

## RACH parameters

- RACH access delay
- RACH config
- RACH contention resolution failures
- RACH contention resolution MSG4 decoding failures
- RACH MAX preamble count
- RACH preamble count
- RACH preamble Index
- RACH preamble initial power
- RACH preamble responses with backoff time
- RACH preamble responses with PUSCH resource
- RACH preamble step
- RACH reason
- RACH response window
- RACH result
- RACH SSB ID
- RACH type

## MAC (for each serving cell)

- MAC downlink throughput
- MAC downlink block rate
- MAC downlink BLER (NR)
- MAC downlink residual BLER (NR)
- MAC uplink throughput
- MAC uplink block rate
- MAC uplink new blocks

## RLC/PDCP/SDAP/PPP

- RLC downlink throughput
- RLC downlink throughput per RB
- RLC downlink BLER

- RLC downlink BLER per RB (Radio Bearer)
- RLC downlink block rate
- RLC downlink block rate per RB
- RLC uplink throughput per RB
- RLC uplink block rate
- RLC uplink block rate per RB
- RLC uplink retransmission rate
- RLC uplink retransmission rate per RB
- PDCP downlink throughput per RB (Radio Bearer)
- PDCP downlink block rate
- PDCP downlink block rate per RB (Radio Bearer)
- PDCP uplink throughput
- PDCP uplink throughput per RB
- PPP throughput UL (kbps)
- PPP throughput DL
- Transferred PPP bytes UL (byte)
- Transferred PPP bytes DL (byte)

## Measurement events

- RRC signaling
- L3 signaling
- SIP signaling
- SCell add
- SCell remove
- SCell modify
- Cell reselections events (SA/NSA)
- AMF region ID, set ID, and pointer (SA only)
- HO attempt
- HO success
- HO failure
- Handover type (SA only)

# LTE

## Serving cell information

- Number of serving cells
- Number of secondary serving cells
- Cell type
- Band
- Band type (FDD/TDD)
- MCC
- MNC
- Network operator
- Tracking area code (TAC)
- LTE-ARFCN/channel
- LTE-ARFCN frequency
- LTE cell ID
- PCI
- Physical layer identity
- Packet technology
- Packet state
- RRC state (NR/LTE)
- RRC establishment cause
- EMM state
- EMM substate
- Transmission mode
- RSRP (LTE Pcell/scell)
- RSRP (LTE listed)
- RSRP/P
- RSRQ (LTE Pcell/scell)
- RSRQ (LTE listed)
- RSRQ/P
- SINR (LTE Pcell/scell)
- SINR (LTE listed)
- RSSI (LTE Pcell/scell)
- RSSI (LTE listed)
- RSSI/P
- sCell detected TX antenna ports
- Pcell bandwidth

## Physical channel information (for each serving cell)

- PDSCH throughput
- PDSCH throughput for codeword 0
- PDSCH throughput for codeword 1
- PUSCH throughput
- PUSCH throughput (LTE+NR)
- RB ID
- TX power PUCCH
- TX power PUCCH adjustment
- TX power PUSCH
- TX power PUSCH adjustment
- PUSCH TPC

## Link adaptation (for each serving cell)

- PDSCH MCS CW0
- PDSCH MCS CW1
- PDSCH MCS distribution
- PUSCH MCS CW0
- PUSCH MCS distribution
- PDSCH rank
- PDSCH rank distribution (count)
- PUSCH rank
- PUSCH rank distribution (count)
- PDSCH PRBs (count)
- PUSCH PRBs (count)
- PDSCH PRB % (PRBs/% of allocation time)
- PUSCH PRB % (PRBs/% of allocation time)
- PDSCH PRB distribution (Count)
- PUSCH PRB distribution (Count)
- PDSCH modulation CW0
- PDSCH modulation CW1
- PDSCH modulation distribution
- PUSCH modulation CW0
- PUSCH modulation distribution
- PDSCH TBS CW0
- PDSCH TBS CW1
- PUSCH TBS CW0

## CSI

- CQI periodic reporting mode
- CQI aperiodic reporting mode

## MAC (for each serving cell)

- MAC downlink throughput
- MAC downlink block rate
- MAC downlink BLER
- MAC uplink block rate

## RLC/PDCP/SDAP/PPP

- RLC downlink throughput
- RLC downlink throughput per RB (radio bearer)
- RLC downlink BLER
- RLC downlink BLER per RB
- RLC downlink block rate
- RLC downlink block rate per RB
- PDCP downlink throughput per RB
- PDCP downlink block rate
- PDCP downlink block rate per RB
- PDCP uplink throughput
- PDCP uplink throughput per RB
- PPP throughput UL (kbps)
- PPP throughput DL
- Transferred PPP bytes UL (byte)
- Transferred PPP bytes DL (byte)

## Measurement events

- RRC signaling
- RRC connection events
- L3 signaling
- SIP signaling
- Cell reselections events (SA/NSA)
- HO attempt
- HO success
- HO failure

# General

## GPS events

- Distance
- GPS fix quality
- GPS satellites
- Height
- Latitude
- Longitude
- Velocity

## Other Events/KPIs

Note that some KPIs are NATA-dependent.

- Battery temperature
- Battery charge (%)
- Device battery voltage (V)

## Call information

- Call type
- Call direction MOC/MTC (VoLTE)
- Number of calls
- Call connecting status
- Call connection time from attempt to connected state
- Call attempt time
- Call failure time
- Call failure cause
- Call duration
- Call disconnect cause

## Packet data information

- PDP activation attempt time
- PDP active duration
- PDP activation failure time
- PDP activation failure cause
- PDP context deactivation time
- PDP context deactivation cause
- Packet state

- Packet protocol address
- Attach failure time
- Attach failure cause
- Attach attempt time
- Attach duration
- Detach time
- GMM/SM state
- QoS settings

## WLAN cell measurements

- Channel number
- SSID and BSSID
- IP address
- RSSI
- Quality
- Security mode and link speed
- WLAN state information

## User level data information

- Data transfer protocol
- Data transfer direction
- Data transfer attempt number
- Data transfer host address
- Data transfer host port
- Application data throughput UL/DL
- Application packet error rate
- Transferred bytes UL/DL
- PPP layer data throughput
- Data connection establishment time
- Data connection rate UL/DL
- Data connection duration
- Data connection failure time
- Data connection failure cause
- Data transfer failure cause
- Data size UL/DL
- Data disconnect cause
- Ping rate
- Ping timeout

- Ping time (application data round trip travel time)
- IP access and termination time (when TCP/IP packet capturing enabled from the OS)
- DNS query address
- DNS query latency
- DNS query result
- DNS resolved address