Nemo FSR1

For GSM, WCDMA, CDMA2000, EVDO and LTE Wireless Networks

Nemo FSR1 scanner is a revolutionary, modular, digital scanning receiver that provides accurate, reliable high-speed RF measurements of wireless networks. The unique architecture with field installable RF down converters provides complete band flexibility. Multiple signal processing chains provide efficient support for multiple technologies. The Nemo FSR1 is designed from the ground up to provide both performance and value.

GENERAL

- Latest firmware version: 03.01
- Scanner supports: LTE FDD/TDD, WCDMA, GSM, CDMA2000, and EVDO.
- Support for new technologies when available only requires a firmware and license upgrade.
- Advanced band scan (blind scan) finds valid channels and returns levels and identifiers for wideband signals.
- Narrowband RSSI measurements with 10, 30, 50 kHz BW.
- Spectrum RSSI measurements with 1.875, 3.75, 7.5, 30, 60 and 120 kHz BW.
- Cell information decoding including cell ID, MCC, MNC, and LAC for GSM and UMTS
- System information decoding (BCCH) for GSM and UMTS.
- Two RF down converters supported per FSR1 scanner.
- Support for up to four bands per down converter (eight in total).
- Down converters contain all RF circuitry and associated calibration files.
- Only the down converters require calibration, meaning the scanner does not need to be taken out of service if extra down converters are available.
- Down converters can be quickly and easily be changed in the field.
- Internal reference source and self-check is performed at startup to warn if scanner is approaching or is out of calibration.
- Compact size and low power consumption.
- Ethernet connectivity (100 BASE-T) leaves USB ports free.
- Front panel two port Ethernet switch.
- Nemo FSR1 with firmware version 03.01 requires Nemo Outdoor version 6.40 or later

OPERATIONAL MODES

LTE

Frequency Scanning Parameters

- Channel number
- Carrier RSSI

Scanning Options

- Channel to be scanned
- Channel style (BW 10, 30, 50 kHz)
- Measurement period (1- 30000ms)

Pilot Scanning Parameters (RS)

- Channel number
- Carrier RSSI
- PCI (physical cell ID)
- RSRP
- RSRQ
- RS CINR
- RS cyclic prefix
- CINR, RSRP, and RSRQ per antenna port
- Delay
- Delay spread

Pilot Scanning Parameters (Sync Signals)

- Channel number
- PCI (physical cell ID)
- P-SCH and S-SCH RSRP
- P-SCH and S-SCH RSRQ
- Cyclic prefix

Top-N Scanning Options

- Maximum number of physical cell IDs (1-90)
- Measurement period (1- 30000ms)
- CINR (RS, S-SCH, and P-SCH)
- Time offset
- Delay spread
- Sync signal
- Reference signal
- Cyclic prefix (auto detect, normal, extended)
- System info (MIB) message decoding

GSM

Frequency Scanning Parameters

- Channel number

- BSIC
- RSSI/RX level
- C/I

Scanning Options

- Top-N scanning
- BSIC decoding
- BSIC threshold
- BCCH C/I
- Cell information decoding
- System information decoding

WCDMA

Frequency Scanning Parameters

- Channel number
- Carrier RSSI

Scanning Options

- Channel to be scanned
- Channel style (BW 10, 30, 50 kHz 3.84MHz)
- Measurement period (1- 30000ms)

Pilot Mode

- Pilot measurement mode
  - High speed
  - High dynamic range
- Channels to be scanned
- Data processing method (aggregated)

Scanning Options

- Top-N scanning (1-32 pilots)
- Cell information decoding
- Time of arrival
- Delay spread measurements
- P-SCH measurements
- S-SCH measurements
- System information decoding

Pilot Scanning Parameters

- Channel number
- RSSI
- CPICH scrambling code
- CPICH Ec/N0
- P-SCH Ec/N0
- S-SCH Ec/N0
- Delay
- CPICH delay spread

CDMA/EVDO

Frequency Scanning Parameters

- Channel number
- Carrier RSSI

Scanning Options

- Channel to be scanned
- Channel style (BW 10, 30, 50 kHz 1.25MHz)

- Measurement period (1- 30000ms)

Pilot Scanning Parameters

Top-N PN Scan

- Channel number
- PN
- Carrier RSSI (pilot mode)
- Provides peak Ec/Io
- RSCP
- Multiple simultaneous Top-N PN scans supported
- Top-N maximum of 32 pilots
- Maximum of 32 carriers

Scanning Options

- Top-N scanning
- Pilot Ec/I0 threshold

OTHER SCANNING FEATURES

Spectrum Analyzer Measurements

- Spectrum analyzer measurements can be done simultaneously either with frequency scanning, pilot scanning, or with all modes. Scanner does not use any priority orders between different measurement modes.
- Up to 32 scanning frequency sets can be selected simultaneously.
- Spectrum scanning parameters with Nemo Outdoor
  - Sweep total RX level
  - Frequency spectrum
- Spectrum analyzer measurements
  - User defined parameters:
    - Start and stop frequency or center frequency and bandwidth
  - Sensitivity -109dBm
  - Frequency range: frequencies supported by the down converter
  - Max. number of sample counts: 2000
  - RBW: 1875, 3750, 7500, 15000, 30000, 60000 and 120000 kHz

CDMA/ EVDO/ UMTS Pilot Pollution Analysis

- Source system
- Source band
- Source channel number
- Pilot pollution PN, scrambling code
- Pilot pollution Ec/I0, Ec/N0
- Pilot pollution RSCP

GSM Interference Analysis

- GSM co-channel and adjacent channel analysis is done in real time during a measurement and playback with Nemo Outdoor. Interference detection is done based on GSM terminal and GSM scanner measurements and these measurements are combined together.
- Cell type, serving, co- channel, adjacent channel
- Band
- BSIC
- RX level

Missing Neighbor Detection

- Missing neighbor detection for GSM, WCDMA and CDMA
- Requires a mobile and a GSM/WCDMA/CDMA scanner
- Scanner scans all pilots and mobile scans channels that are on its neighbor list. Nemo Outdoor compares the measurements and reports the neighbor channels that are seen by the scanner but are not in the mobile's neighbor list.

OTHER

GPS

- High performance u-blox five GPS engine with two million correlators and 50 channels means quick lock and solid performance in difficult environments.
- Internal time base is locked to GPS for accuracy and self-alignment.
- GPS data from Nemo FSR1 scanner can be used for location purposes in Nemo Outdoor.

Antennas

- 421010-05, Scanner antenna, MGRM-WLF-1C10
  - 694- 894MHz and 1700- 2700MHz
  - Gain (dB): 3 dBi
  - Maximum power (Watts): 10
  - Cable type: RG58U
  - Cable length: 10'
  - Connector: SMA(M)-installed
- 421010-07, Scanner antenna, mag. antenna MGRM-UMB-1C
  - 750-1250 MHz and 1650-2700 MHz
  - Gain (dB): 3 dBi / 5 dBi
  - Maximum power (Watts): 10
  - Cable type: RG58U
  - Cable length: 10'
  - Connector: SMA(M)-installed

SPECIFICATIONS

RF Characteristics

Frequency range		Down converter dependent
Reference frequency accuracy	Internal	1 ppb
Maximum permissible input level	Continuous input no damage	-5 dBm RMS (0 VDC) all supported bands
	Signal detection/processing operational	-10 dBm RMS (0 VDC) all supported bands
Noise figure		typical 6 dB
Intermodulation-free dynamic range	Input level: -45 dBm	typical -80 dBc (-5dBm TOI) all supported bands
	Input level: -25 dBm	typical -70 dBc (+10 dBm TOI) all supported bands
Independent receive paths		2
VSWR		typical 1.5:1, worst case 2:1
Pre-selection		Band specific ceramic filters
GPS		50 channels
		Accuracy ± 2.5 meter
		Acquisition time, cold start: 29 sec; hot start: <1 sec
		Sensitivity >-145 dBm

LTE Characteristics

Frequency bands supported		LTE FDD bands 700, E800, 850, 900, 1800, 1900, 2100, 2100 AWS and 2600 (E-UTRA bands 1-5, 7, 8, 12, 13, 14, 17, 20, 25)
		LTE TDD bands 33 (1900-1920MHz), 36 (1930-1990MHz), 38 (2570-2620MHz), 40 (2300-2400MHz), and 41 (2496-2690MHz)
Measurement modes		FDD/TDD
Measurement speed (FDD)	1 cell ID	33 channels/second (single channel)
		60 channels/second (multiple channels)
	3 cell IDs	27 channels/second (single channel)
		55 channels/second (multiple channels)
	6 cell IDs	23 channels/second (single channel)
		46 channels/second (multiple channels)
	No signal	38 channels/second (single channel)
		75 channels/second (multiple channels)
Measurement speed (TDD)	1 cell ID	26 channels/second (single channel)
		50 channels/second (multiple channels)
	3 cell IDs	25 channels/second (single channel)
		46 channels/second (multiple channels)
	6 cell IDs	17 channels/second (single channel)
		33 channels/second (multiple channels)
	No signal	38 channels/second (single channel)
		70 channels/second (multiple channels)
Sensitivity for physical cell ID decoding		-118 dBm
CINR dynamic range		Maximum 60 dB, -20 to +40 dB
Bandwidth		6 resource blocks (1.095 MHz)

Anite

GSM Characteristics

Frequency bands supported		no restrictions
Measurement speed (BSIC decode enabled)	20 channel scan with 11 valid channels Wide band signals not containing BSIC RF spectrum below -110 dBm threshold	18 channels / second 220 channels / second 420 channels / second
Sensitivity		-109 dBm
BSIC decoding detection probability	SCH CINR at +2 dB Channel frequency offset < 3 KHz	98%
BSIC decoding dynamic range		CINR from 2 dB to 20 dB
SCH CINR measurement range		CINR from -6 dB to 20 dB
BCCH decoding dynamic range		CINR > 0 dB
RSSI range		-10 to -113 dBm
Measurement accuracy	-10 to -103 dBm	±1 dB
RSSI scan rate		2100 channels / second
Bandwidth		200 KHz

WCDMA Characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		no restrictions

Measurement speed
    Automatic detection of all 512
    scrambling codes.
	High speed (HS) mode	39 channels / second (single channel)
		75 channels / second (two or more channels)

	High dynamic range (HDR) mode	23 channels / second (single channel) 35 channels / second (two or more channels)
Sensitivity		-126 dBm (HDR) -123 dBm (HS)
Scrambling code false detection (ghost code)		< 0.01%
Dynamic range E_c/N_o		-26 dB
RSSI range		-10 to -100 dBm
Measurement accuracy	-10 to -100 dBm	±1 dB
Adjacent channel selectivity		50 dB
RSSI scan rate		340 channels / second
Bandwidth		3.84 MHz

CDMA2000 Characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		no restrictions
Measurement speed (all 512 PNs)	Corr. length 2048, threshold -15dB Corr. length 2048, threshold -20dB	31 channels / second 29.5 channels / second
PN detection sensitivity	Corr. length 2048, threshold -20dB	-117 dBm
Dynamic range E_c/I_o		-0.1 to -20.5 dB
RSSI range		-10 to -104 dBm
Measurement accuracy	-10 to -100 dBm -101 to -104 dBm	±1 dB ±2 dB
RSSI scan rate		340 channels / second
Bandwidth		1.23 MHz

1xEVDO Characteristics

Frequency bands supported		no restrictions
Number of RF carrier frequencies		no restrictions
Measurement speed (all 512 PNs)	Slots 1, threshold -20 dB	11.3 scans / second
	Slots 1, threshold -9 dB	11.4 scans / second
PN detection sensitivity	Slots 1, threshold -9 dB	-114 dBm
Dynamic range E_c/I_o		-0.1 to -20.5 dB
RSSI range		-10 to -104 dBm
Measurement accuracy	-10 to -100 dBm	±1 dB
	-101 to -104 dBm	±2 dB
RSSI scan rate		340 channels / second
Bandwidth		1.23 MHz

Typical Noise Floor Levels

Resolution Bandwidth	Noise Floor 881 MHz	Noise Floor 1960 MHz	Noise Floor 2100 MHz
10 kHz	-127 dBm	-128 dBm	-127 dBm
30 kHz	-123 dBm	-124 dBm	-124 dBm
50 kHz	-121 dBm	-122 dBm	-122 dBm

Product Codes and Options

320081-01	License option, Nemo FSR1 GSM
320081-02	License option, Nemo FSR1 UMTS
320081-03	License option, Nemo FSR1 CDMA/ EVDO
320081-04	License option, Nemo FSR1 LTE
315022-04	License option, Nemo FSR1 Scanner Spectrum Analyzer Option

Physical Characteristics

Operating temperature range	0°C to +50°C
Storage temperature range	-40°C to +85°C
Dimensions (W × H × D)	7.18 x 1.83 x 9.66 in 24.5 x x 4.6 x 18.2 cm
Weight (with 2 down converters)	1.2 kg, 2.6 lb
Power consumption	50 W maximum
Input voltage	10 V to 16 V DC
Input current	4 A DC maximum

Available RF Down Converters

Model	Band 1	Band 2	Band 3	Band 4	Notes
GWIRDC94182126 EU QB	925 – 960 MHz • GSM 900 DL • WCDMA 900 DL, • LTE 900 DL, E-UTRA band 8	1805 – 1880 MHz • GSM 1800 DL • WCDMA 1800 DL • LTE 1800 DL, E-UTRA bands 3	2110 – 2170 MHz • WCDMA 2100 DL, • WCDMA 2100AWS DL • LTE 2100, LTE 2100AWS, E-UTRA bands 1, 4	2496 - 2690MHz • LTE 2300, 2500, 2600, E-UTRA bands 7, 38, and 41	In production
GWIRDC74851921 NA QB	728 – 768 MHz • LTE 700 DL, E-UTRA bands 12, 13, 14, 17	869 – 894 MHz • GSM 850 DL • WCDMA 850 DL • LTE 850 DL, E-UTRA band 5 • CDMA/ EVDO 850 DL	1930 – 1995 MHz • GSM 1900 • WCDMA 1900 DL • LTE 1900 DL, E-UTRA bands 2, 25, 36 • CDMA/ EVDO 1900 DL	2110 – 2170 MHz • WCDMA 2100 DL • WCDMA 2100AWS DL • LTE 2100, LTE 2100AWS, E-UTRA bands 1, 4	In production
GWIRDC80192326 LTE TDD	791 – 821 MHz • LTE 800, E-UTRA band 20	1900 – 1920 MHz • LTE 1900, E-UTRA band 33	2300 – 2400 MHz • LTE 2300, E-UTRA band 40	2496 – 2690 MHz • LTE 2300, 2500, 2600, E-UTRA bands 7, 38, and 41	In production