Welcome and introduction

Svenn-Tore Larsen, CEO

Agenda

- Welcome and introduction   Svenn-Tore Larsen, CEO

- nRF91 Series; Product readiness   Svein-Egil Nielsen, CTO

- nRF91 Series; Product excellence   Peder Rand, Product Manager Cellular IoT

- Customer reception   Geir Langeland, Director Sales & Marketing

- Demonstrations   Svein-Egil Nielsen, CTO

nRF91 Series; Product Readiness

Svein-Egil Nielsen, CTO

nRF91 Series with a large set of deliverables

- The nRF91 Series development deliverables:

  - nRF91 System-on-Chip (SoC) with RF, Baseband, Application MCU, Flash, RAM

  - nRF9160 System in Package (SiP); nRF91 SoC with RF Front End, Power Management System, Passives and Crystal in an ultra compact 10x16x1 mm SiP

  - LTE Connectivity for both cellular IOT protocol stacks

    - CAT-M

    - NB-IOT

  - GPS software

  - Certifications and approvals

  - SDK Software; MQTT, TLS, TCP, UDP, RTOS, Drivers

  - Cloud connectivity through nRFCloud

nRF9160 in production

- nRF9160 in volume ramp
    - Significant Wafer Starts

- Final hardware characterization and qualifications ongoing

- Minor adjustments to Silicon

- Variants in the pipeline

Hardware	Supported features	December 12th 2018	April 30th 2019
nRF9160-SICA	LTE-M/NB-IoT/GPS	Public Sampling	Production
nRF9160-SIBA	LTE-M		Production
nRF9160-SIAA	NB-IoT		Public Sampling

Connectivity and GPS Software Readiness

- Software solutions quickly maturing with Nordic's LTE-M software available first

- Release schedule of NB-IoT and GPS in place

- Limited sampling of NB-IoT and GPS

| Software	December 12th 2018	March 31st 2019	July 31st 2019
LTE-M	Public Sampling	Production	
NB-IoT		Public Sampling	Production
GPS		Public Sampling	Production

Certifications in place

- The key certifications are in place for a typical set of bands
- Ongoing activities to add additional band, additional territories and carrier specific certifications
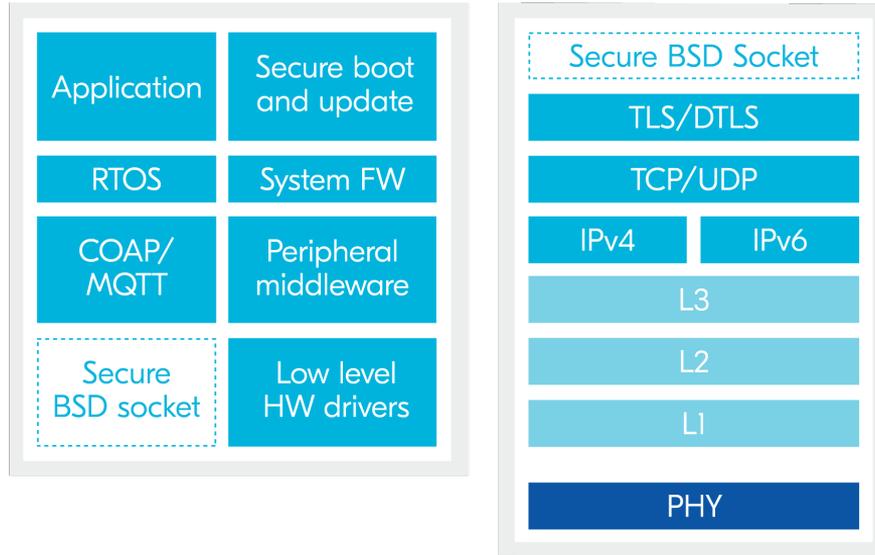- Status: nordicsemi.com/9160cert

- The regulatory certifications are regional in nature and are required in order to sell radio equipment into a region. In essence, this testing ensures that the device behaves nicely in the spectrum and does not interfere unduly with other equipment.
- The GCF certification is designed to ensure compatibility with the LTE 3GPP specification so that it can communicate with the eNBs (base stations) over the LTE-M or NB-IoT subsets.

9

Development kits in mass production
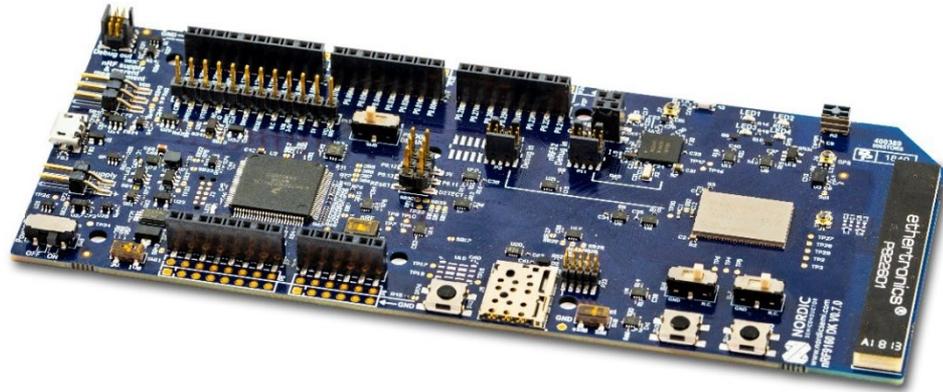
The nRF9160 DK is an affordable, pre-certified single-board development kit for evaluation and development on the nRF9160 SiP for LTE-M and NB-IoT. It has a dedicated LTE-M and NB-IoT antenna that supports a wide range of bands, to operate globally. It has a dedicated antenna for GPS which is supported on the nRF9160.

Extensive SDK software offering

Application	Secure boot and update
RTOS	System FW
COAP/ MQTT	Peripheral middleware
Secure BSD socket	Low level HW drivers

Secure BSD Socket
TLS/DTLS
TCP/UDP
IPv4 / IPv6
L3
L2
L1
PHY

You can find the application SDK examples here:

https://github.com/NordicPlayground/fw-nrfconnect-nrf/tree/master/samples/nrf9160

- asset_tracker – sensor-to-cloud example using MQTT over TCP with TLS security

- at_client – tunnels AT commands to the modem

- lte_ble_gateway – collects data over Bluetooth and transfers it to a cloud server

- secure_boot – secure bootloader needed to run non-secure application code

Included now: MQTT, secure BSD sockets, peripheral and DK board drivers

Coming soon: flash writing, CoAP, HTTP, LWM2M, DFU

nRF9160 supported by nRF Connect for Cloud

nRF Connect for Cloud supports:

- SIM activation

- Development kit management

- Tracking of development kit metrics and geographical location

- Monitoring of cellular data usage

- Cellular data visualization

- Multiple connection of development kits

- Asset tracker example application

https://nrfcloud.com

nRF91 Series; Product excellence

Peder Rand, Product Manager Cellular IoT

New low power LTE technologies

	LTE-M	NB-IoT
Also known as	eMTC, LTE CAT-M1	LTE CAT-NB1
Bandwidth	1.4 MHz	200 kHz
Max throughput (UL/DL)	300/375 kbps	30/60 kbps
Range	<11 km	<15 km
Mobility	Yes	No
Roaming	Yes	Not yet
Battery lifetime	15 years	

LTE-M and NB-IoT strengths

Why it's important to do both…

LTE-M

- Higher throughput

- Low latency

- Roaming

- Mobility

- Most power efficient at medium data rates

- Suitable for TCP/TLS end-to-end secure connection

NB-IoT

- Longer range

- Most power efficient at low data rates

Typical LTE-M applications

Asset tracking

Wearables/Medical

Retail and POS

Home security

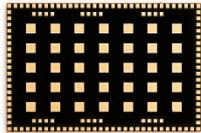# Typical NB-IoT applications

Smart metering

Smart agriculture

Smart city

Predictive maintenance

A complete Nordic cellular IoT solution

Devices

nRF9160 SiP

Further variants coming

Stacks & SW

Secure BSD Socket
TLD/DTLS
TCP/UDP
IPv4 | IPv6
L3
L2
L1
PHY
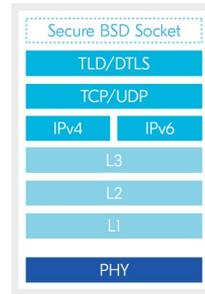
Protocol stacks

Extensive SDKs

RTOS

Tools

Embedded Studio

Develop

Evaluate & test

Deploy

Developers best friend

- Get nRF9160 DK up and running in a few minutes

- Single board development kit

- Free development tools

- Open-source software

- Device management nRF Connect for Cloud

- SiP measures: 16mm x 10mm x 1mm

- nRF9160 + nRF Connect suite is EASY

10mm

1mm

16mm

End-to-end security enabled

- Our application example implements end-to-end security – fully accelerated by hardware

- State-of-the art authentication and encryption to a commercial cloud service

- All application source code and hardware design files available to customers now

LTE   Cellular Core Network

TCP/TLS
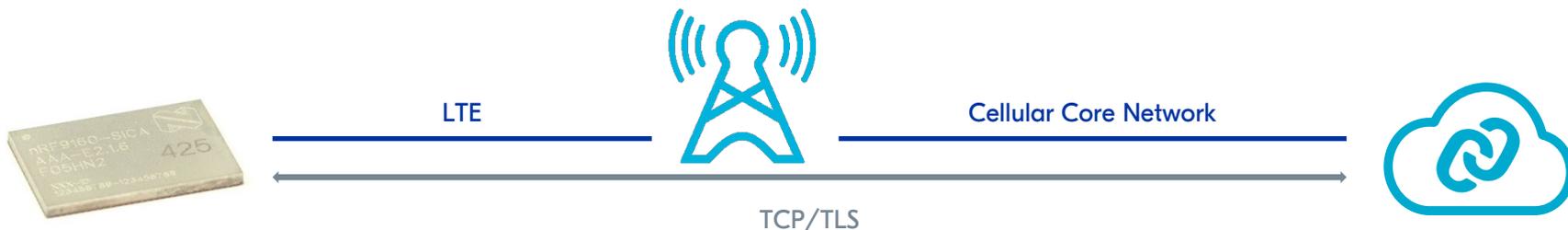
A complete solution in a package
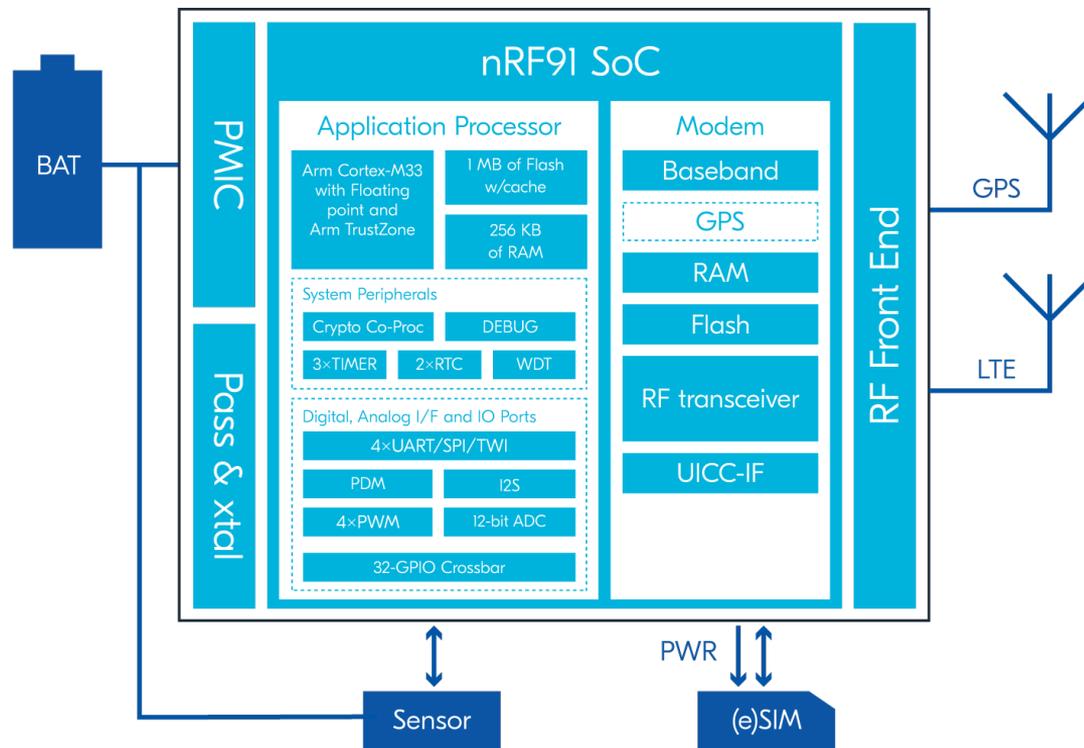
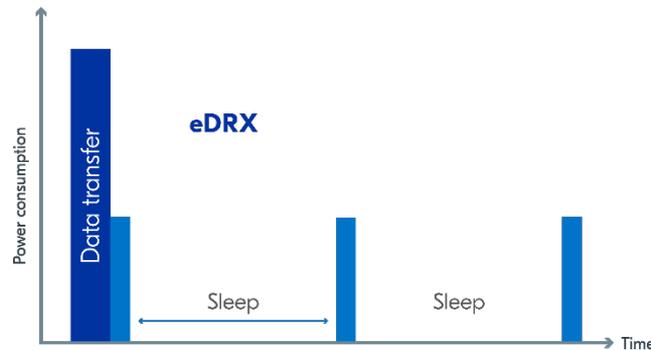# nRF9160 with global support in same device
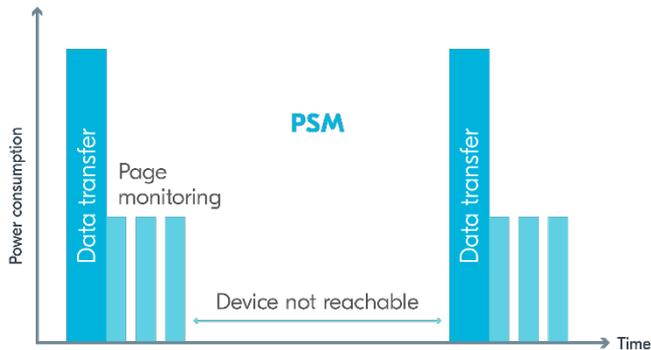
US:
B2, B4, B5, B12, B13

EMEA:
B3, B8, B20, B28

APAC:
B3, B5, B8, B28

Low power enables disruptive applications

- Power Saving Mode

- Suitable for more than 10 min latency

- Can sleep up to 413 days

- nRF9160 PSM floor current will be 3 uA

- Extended Discontinous Receive

- Suitable less than 10 min latency

- LTE-M interval 5.12s to 2621.44s (44 min)

- NB-IoT interval 20.48s to 10485s (175 min)

- nRF9160 LTE-M eDRX floor current is 7 uA

PSM

Power consumption

Data transfer

Page monitoring

Device not reachable

Data transfer

Time

eDRX

Power consumption

Data transfer

Sleep

Sleep

Time

Best in class power consumption

~ 15 uA

~ 11 uA

~ 0.5 mA

~ 150 mA

Connected with 10 minutes downlink latency (eDRX)

More than 15 years battery life

Sending tracking information every 20s (DRX)

More than 6 months battery life

Downloading new firmware @ 360 kbps (RRC Connected)

A 512 KB image updated in 30 s

LTE-M, 23 dBm, 3.7 V, 2700 mAh

Range is king

+23 dBm

Output power

- nRF9160 offers the max allowable output power of +23dBm
- Sensitivity
  - -108 dBm: LTE-M
  - -125 dBm: NB-IoT (single sub-carrier BW)
- Output power + sensitivity **is** your range. 'The link budget'
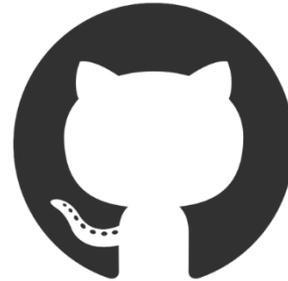- nRF9160 is **range**

Chip, firmware, SDK, module all developed and supported by Nordic

Nordic DevZone

Developer Zone

Engineer-to-Engineer

(1000 cases per month)

GitHub
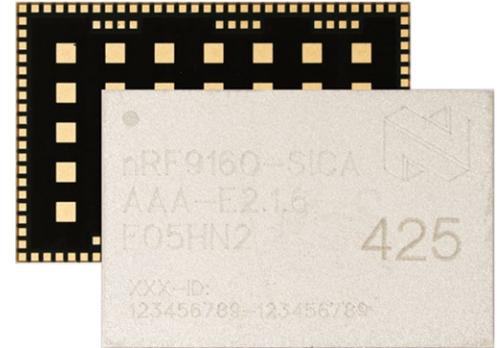

Nordic self-service software on Nordic web and GitHub

(4000 SDK downloads /month)

Customer reception

Geir Langeland, Director Sales & Marketing

The nRF9160 - extremely well received

- Existing nRF customers

- New IoT customers

- Trade press

- Distributors

- Nominated for professional awards

- Carriers are referring customers to Nordic

Not so well received by competitors

Customer deployment ahead of expectations

From Nordic Q3 2018 presentation

Status as of today

- Over 350 lead customers sampled

- Wide online nRF9160 availability (demand outstripping deliveries)

- 1000+ kits shipped from Nordic to distributors in the last week

- Ramping up availability of kits and samples through Dec 2018 to more distributors worldwide

Recognition by industry press and peers

Leading Lights Awards

nRF91 Series shortlisted for The top telecoms industry IoT award in the world - Most Innovative IoT/M2M Strategy (April)

CES Innovation Award

nRF9160 SiP named as 2019 CES Innovation Award Honeree (November)

GSA Awards

Most respected emerging public semiconductor company at the GSA Awards (December)

Wide press coverage since launch

High cellular web traffic since launch

Low power cellular IoT

nRF9160 DK

Software and tools

x10

40%

70%

More pageviews
before vs after launch

Of all pageviews on
Software and Tools pages
(DKs, apps, software, tools)

Increase of Software and tools
pages after the nRF9160 launch

Demonstrations

Svein-Egil Nielsen, CTO

End-End Connectivity

Ease of Use

Building on Existing

NORDIC®
SEMICONDUCTOR