Using DECT NR+

Christian Amsüss
chrysn@fsfe.org

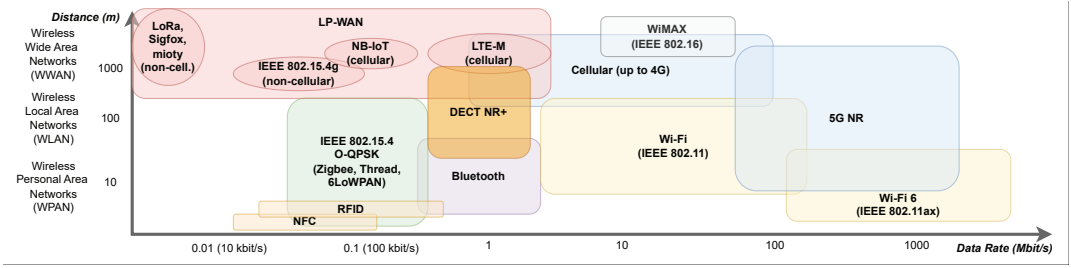
2026-09-01
1AD, Grenoble

Plan for today

1. Briefly: Introducing DECT NR+
2. Hardware
3. Software
4. What we can do with it

What is DECT NR+...

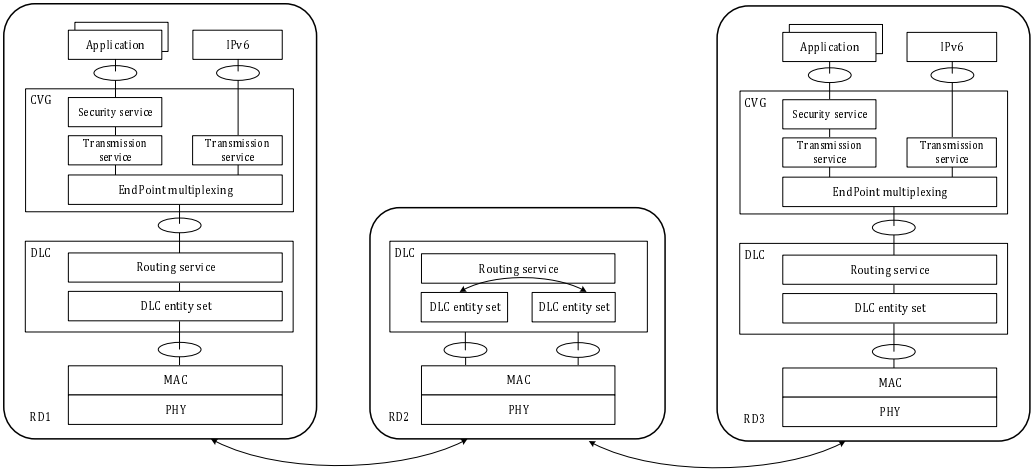
...in the context to radio technologies you know?



[1]F. Graf, T. Watteyne and M. Villnow, "What to Expect When Using DECT NR+", in IEEE Communications Magazine, vol. 64, no. 2, pp. 16-22, February 2026, doi: 10.1109/MCOM.001.2500286

Radio stack

271 pages in 1 picture



[2] Diagrams from ETSI TS 103 636-[1-5] v2.1.1 unless noted otherwise.

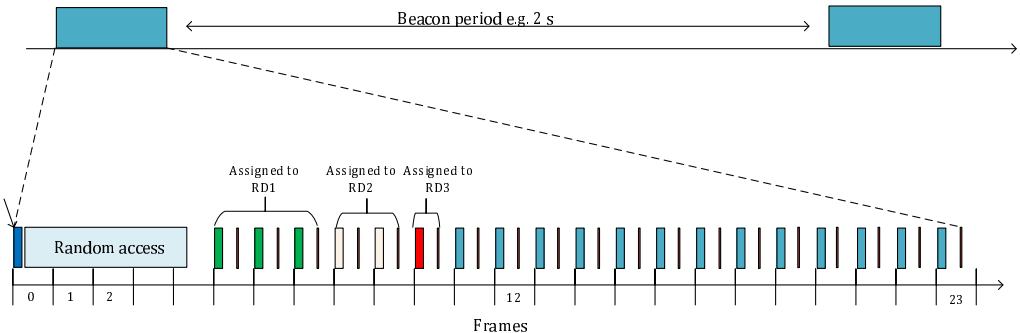
PHY layer: key properties

- 20 MHz at 1.9 GHz (new bands incoming)
- Error correction tools in PHY: FEC, HARQ, CRC
- OFDM, modulation
- Throughput depends on SNR
- Buffers limit packet size

MAC: Roles & topology

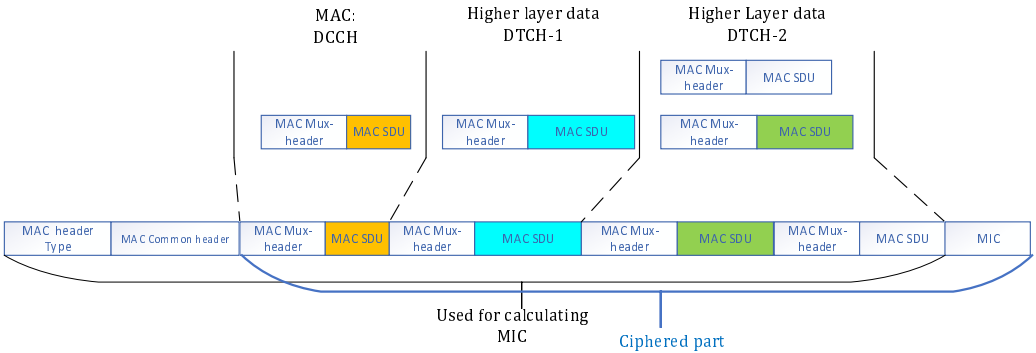
- Cluster: coordinated by “Fixed Termination points” (FT) associated with “Portable Termination points” (PT)
- Tree topology. Or just star. Or point-to-point.
- Root: “Sink”

MAC: Cluster Beacons



MAC

Data in PDC (PHY data channel)



MAC: Data

Typical elements found

- Beacon details
- Association management

  Forms tree, or star, or point-to-point connection.
- Data item(s!)
- Security: AES. Keys “not our department” – CoJP/LAKE to the rescue?

IP over DECT NR+

- Full IPv6 packet or 6lo header compression
- Routed based on local part constructed from DECT addresses

Hardware

https://www.nordicsemi.com/Products/nRF9151

NORDIC SEMICONDUCTOR

Products Applications Resources News & Events Company

Home / Products / nRF9151

Eng | 简体

Ask us about this

SiP 12x11 mm

Where to Buy

NRF9151-LACA-R

Newark 3866 in stock Buy Now

Mouser Electronics

nRF9151

System-in-Package

Low power SiP with integrated LTE-M/NB-IoT/NTN and DECT NR+ modem, and GNSS

The nRF9151 module sets a new standard for highly integrated and compact System-in-Package (SiP) solutions, specifically designed for cellular IoT and DECT NR+ applications. Leveraging low power LTE technology, advanced processing capabilities, and robust security features, the nRF9151 offers unparalleled performance and versatility, and supports 3GPP release 14 LTE-M/NB-IoT, NB-NTN (Non-Terrestrial Network) and DECT NR+.

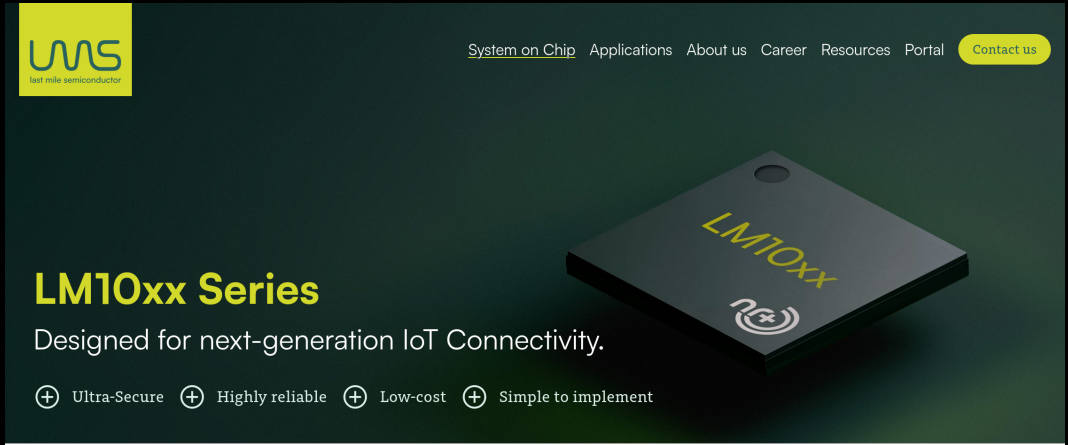
Compared to its predecessor (nRF9160), it boasts a significant footprint reduction of 20% and brings additional support for Power Class 5 20 dBm.

Key features

- Fully integrated SiP module for cellular IoT, NTN and DECT NR+
- Multimode LTE-M/NB-IoT/NTN modem with DECT NR+ support and GNSS
- 700-2200 MHz LTE band support
- Power Class 5 20 dBm
- Power Class 3 23 dBm
- 915 MHz & 1.9 GHz NR+ band support

Hardware

https://www.lm-semi.com/lm10xx-series-system-on-chip/



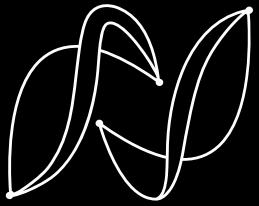
Our LM10xx Series System-on-Chip is based on the globally free, non-cellular 5G standard NR+, provides a low-cost, secure and reliable

Available hardware: nRF9151

- Application core
- Locked network core
- Default firmware: LTE
- Alternative firmware: NR+ PHY and MAC

Implementations on nRF9151

- Proprietary
  - Wirepas – metering
  - Lynq – audio
  - Stratum9 – industrial / deterministic
  - DSR – IoT
- Research: MERCI project
- Working examples: Nordic's DECT shell (on MAC firmware)



OPENER

Opener Initiative

https://opener-initiative.org/

- full implementation, eventually
- building bottom-up

  current work on drivers and MAC layer
- developed on Zephyr, written in C


ARIELOS

hophop

https://github.com/ariel-os/hophop/

- making DECT available in Rust
- focus: on high-level

  IPv6 for Ariel OS
- currently on nRF MAC; plan to switch to Opener
- contributing to Opener

Using hophop today: Documentation

https://github.com/ariel-os/hophop/

Getting started with hophop

Basic steps common to all examples and applications

- Get two (better four) nRF9151-DK, connect them and turn them on.

  (Wider hardware support will be added, but this is what the examples assume).

- Ensure you are set up to run Ariel OS examples.

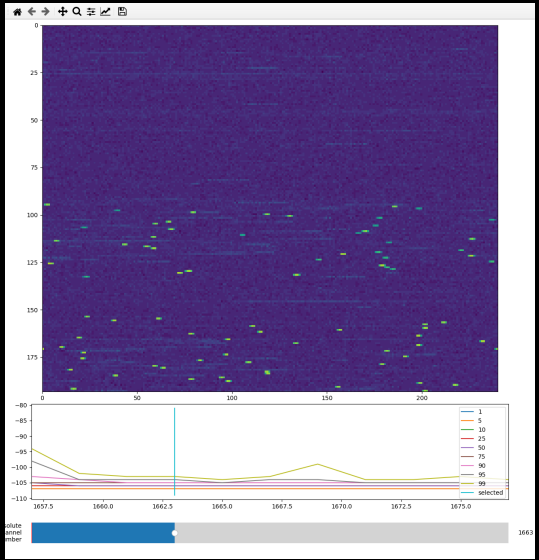
  For the time being, it's easiest to follow the Getting Started section in the Ariel OS book.

  Note that in particular, you need to have access to the boards you are using as a user; this is only mentioned in the Ariel documentation indirectly by referring to the probe-rs documentation. That includes verifying that your user is part of the `plugdev` group, and placing the probe-rs rules file inside `/etc/udev/rules.d`. The typical error that indicates that this step is missing is "USB device: permission denied".

- Ensure that you have the DECT firmware running.

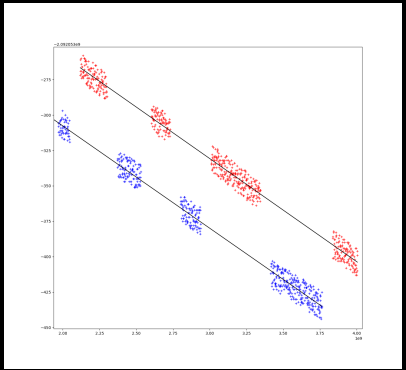
- Beware that this is a research example, and that depending on your location, regulation on operating these devices does apply, especially as some examples emit transmissions controlled by the user alone.

Using hophop today: RSSI (on PHY)

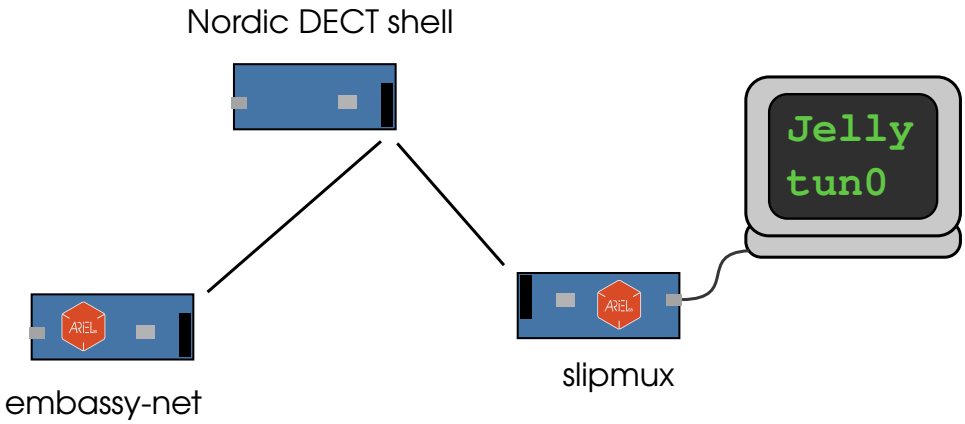


Using hophop today: more PHY examples

- Transmit
- Receive and decode
- Measure clock drift



Using hophop today: IP transport



Using hophop today: IP transport

```
$ ping fe80::70d1:776d:f9cf:c820%tun0
64 bytes from …: icmp_seq=1 ttl=64 time=3077 ms
64 bytes from …: icmp_seq=2 ttl=64 time=2086 ms
```

Using hophop today: IP transport

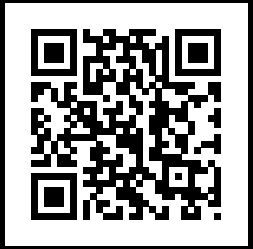
```
$ ping fe80::70d1:776d:f9cf:c820%tun0
64 bytes from …: icmp_seq=1 ttl=64 time=3077 ms
64 bytes from …: icmp_seq=2 ttl=64 time=2086 ms
```

```
$ aiocoap-client 'coap://[fe80:…]/hello' --credentials cred.diag
Hello from hophop
```

Next steps

- FT role
- Automatic network configuration
- Star topology: Opener
- Telemetry and remote configuration
- Secure joining: ETSI?

Run an IoT network.



Sponsored by Silano.