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DECT NR+ for Professional Audio:
From PHY Capability to Reliable Coexistence

Axel Schmidt – 04.11.2026

Professional Audio - KPIs

- No common definition, but can be specified by a set of KPIs:

📡 **RF robustness**: modulation and coding scheme (MCS)

🎵 **Audio quality**: bit depth and sample rate

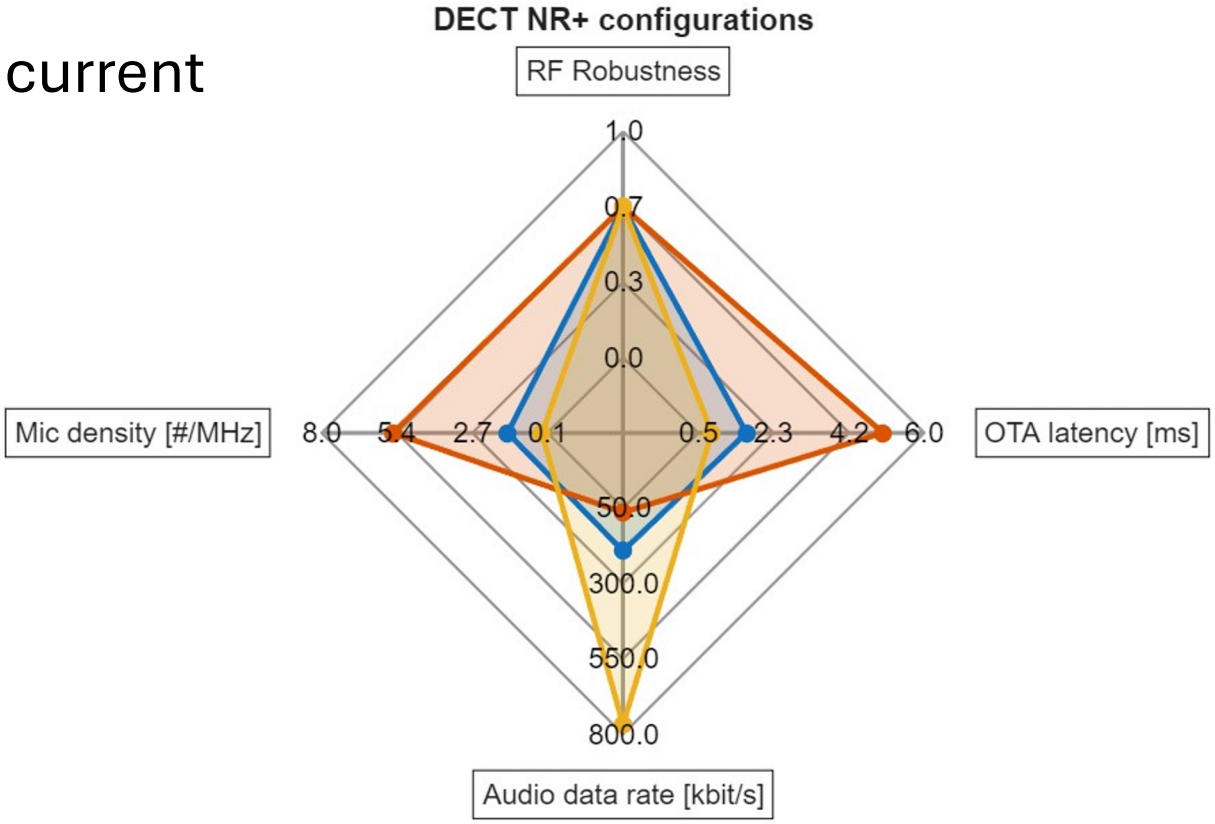
📶 **Spectral efficiency**: audio links per MHz (mic density)

⏱️ **Latency:** audio source-to-sink delay

Analysis of DECT NR+

- Calculations are based on current DECT NR+ specifications

- Highly flexible air interface
- Adaptable to a broad range of deployment scenarios
- Supports the performance requirements of professional audio systems
- Multiple KPIs can be satisfied simultaneously



$$\text{RF Robustness} = \frac{1}{\text{modulation order} \cdot \text{coding rate}}$$

Looks good, but …

- The KPI analysis assumes
  - dedicated spectrum access
  - no external interference and no competing DECT networks
- In practice
  - the DECT band is shared
  - multiple systems may operate simultaneously and coexistence mechanisms become critical
- => beyond PHY performance, network coexistence behavior must be evaluated

DECT NR+ has the radio capabilities for professional audio;
the remaining challenge is ensuring robust coexistence in real-world deployments

How DECT Achieves Reliable Coexistence

- Key Mechanisms:
  - Dynamic channel selection (DCS)
  - Continuous RF environment monitoring
  - Early interference detection
  - Automatic channel reassignment

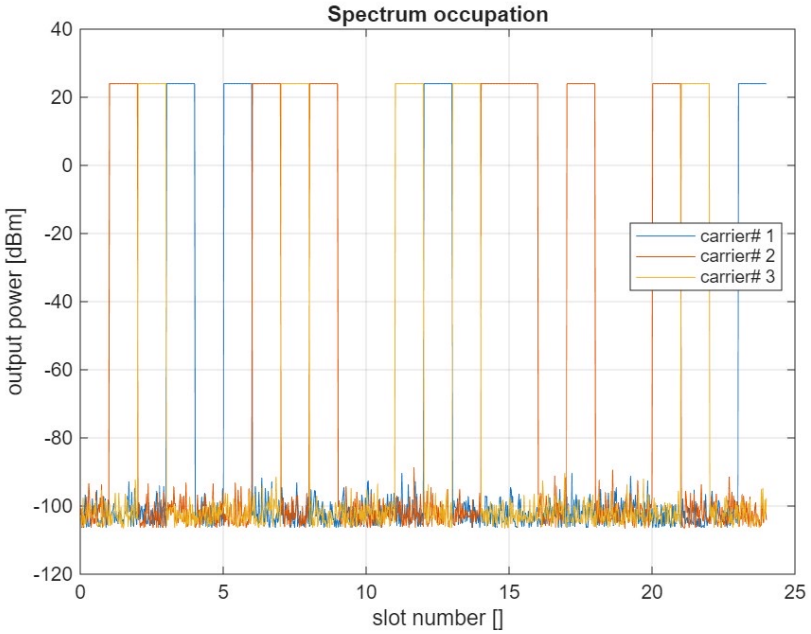
- It works, because
  - neighboring DECT networks exhibit predictable behavior
  - transmissions occur regularly and can be observed
  - of a high likelihood of detecting occupied resources
  - networks can avoid interference before service is affected

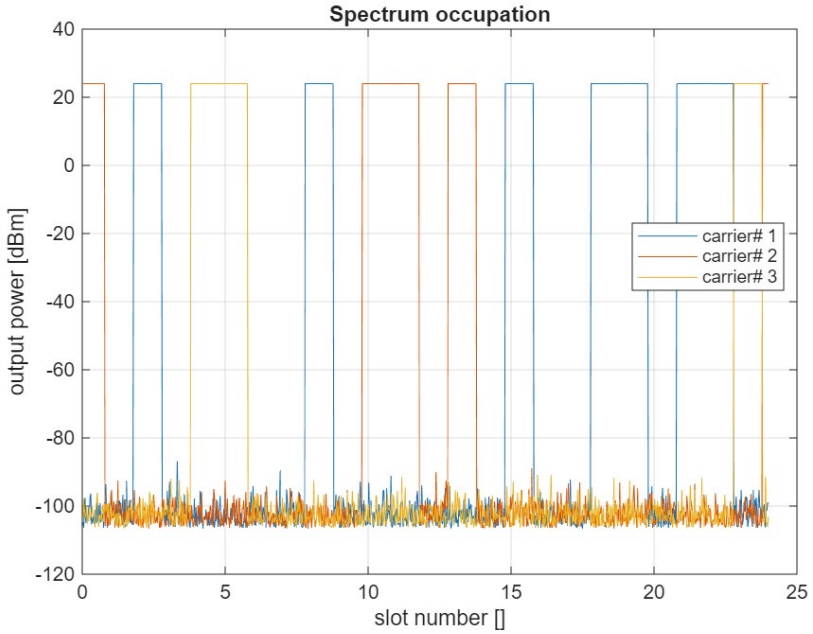
Coexistence Evaluation Scenario

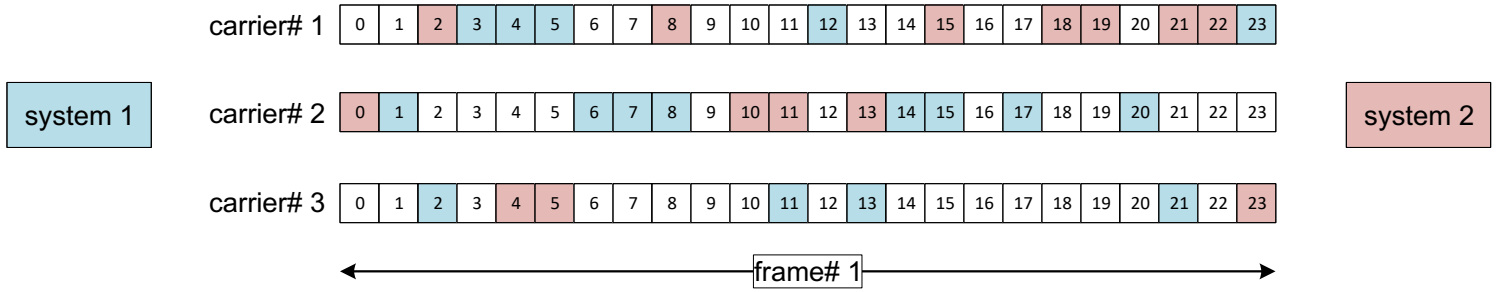
- Test Setup:
  - Two independent Classic DECT systems
  - Shared spectrum environment
  - Reduced spectrum availability (3 carriers)
  - High transmitter power (24 dBm)
  - Realistic frequency offsets (15 ppm)
- Network configuration:
  - System 1: 1 FP + 7 PPs
  - System 2: 1 FP + 6 PPs
- Frame structure:
  - Full-slot operation
  - 24 slots per frame
  - Two subframes per frame

Key objective: evaluate how independent DECT systems coexist when competing for limited spectrum resources

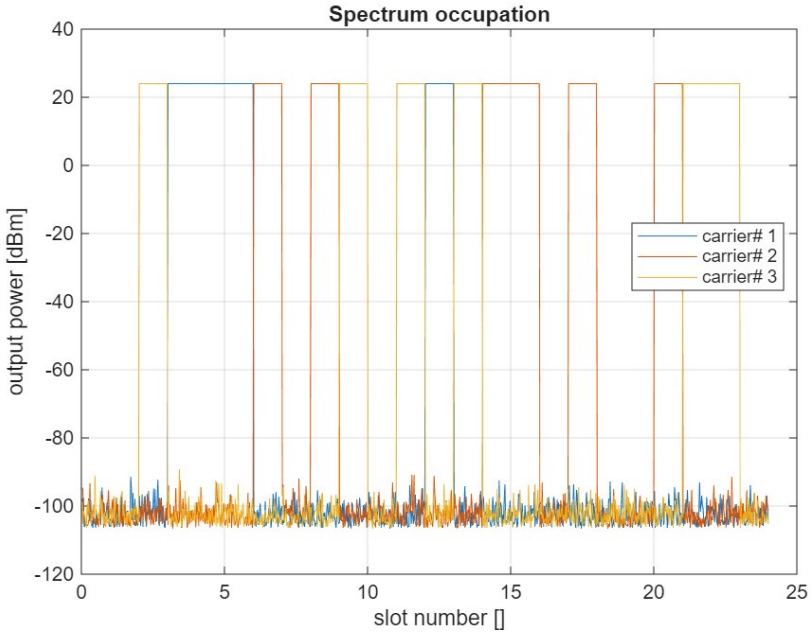
Simulation: Initial Setup

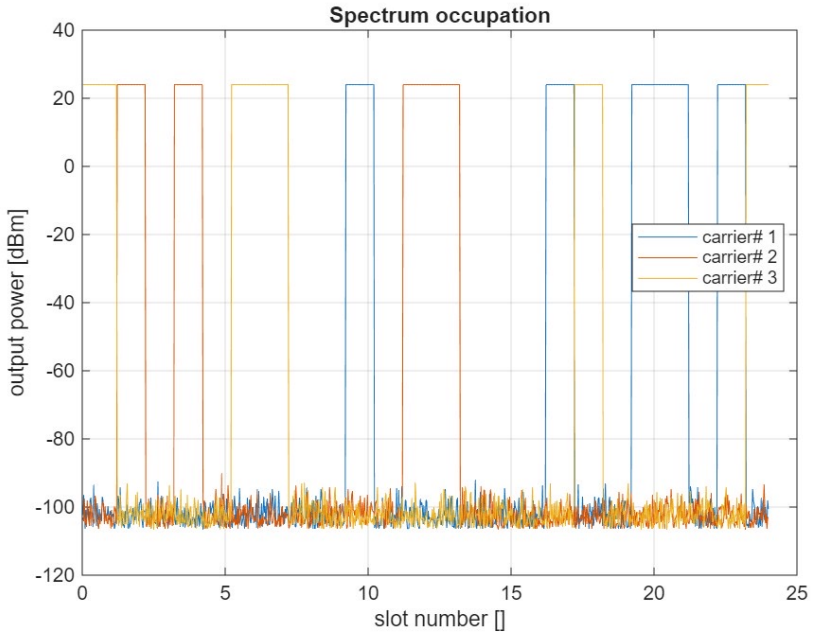


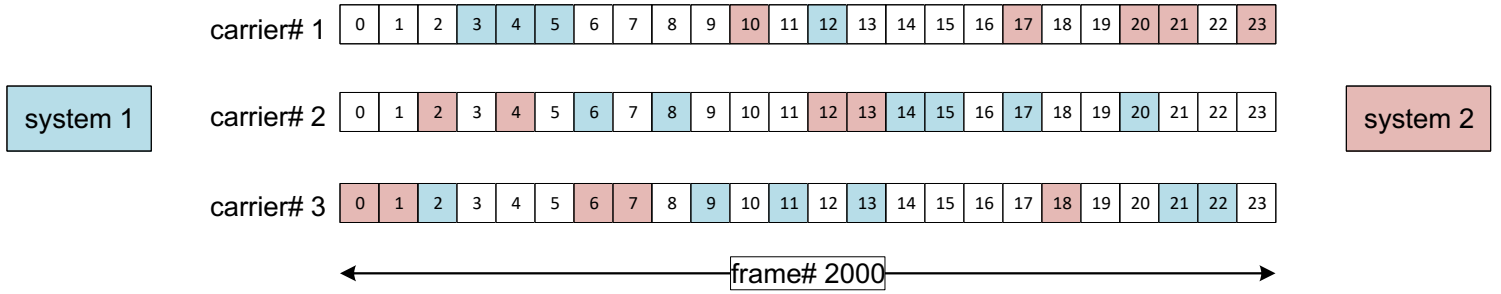




Simulation: Setup after 20s







Dynamic Behavior

- Causes of the dynamic behavior are time drift and changes in the RF channel (movements of PPs)

System 1:

- 4 handovers in UL
- no handovers in DL
- in total 32000 packets transmitted
- no packets lost

System 2:

- 3 handovers in UL
- 3 handovers in DL
- in total 28000 packets transmitted
- 2 packets lost in DL

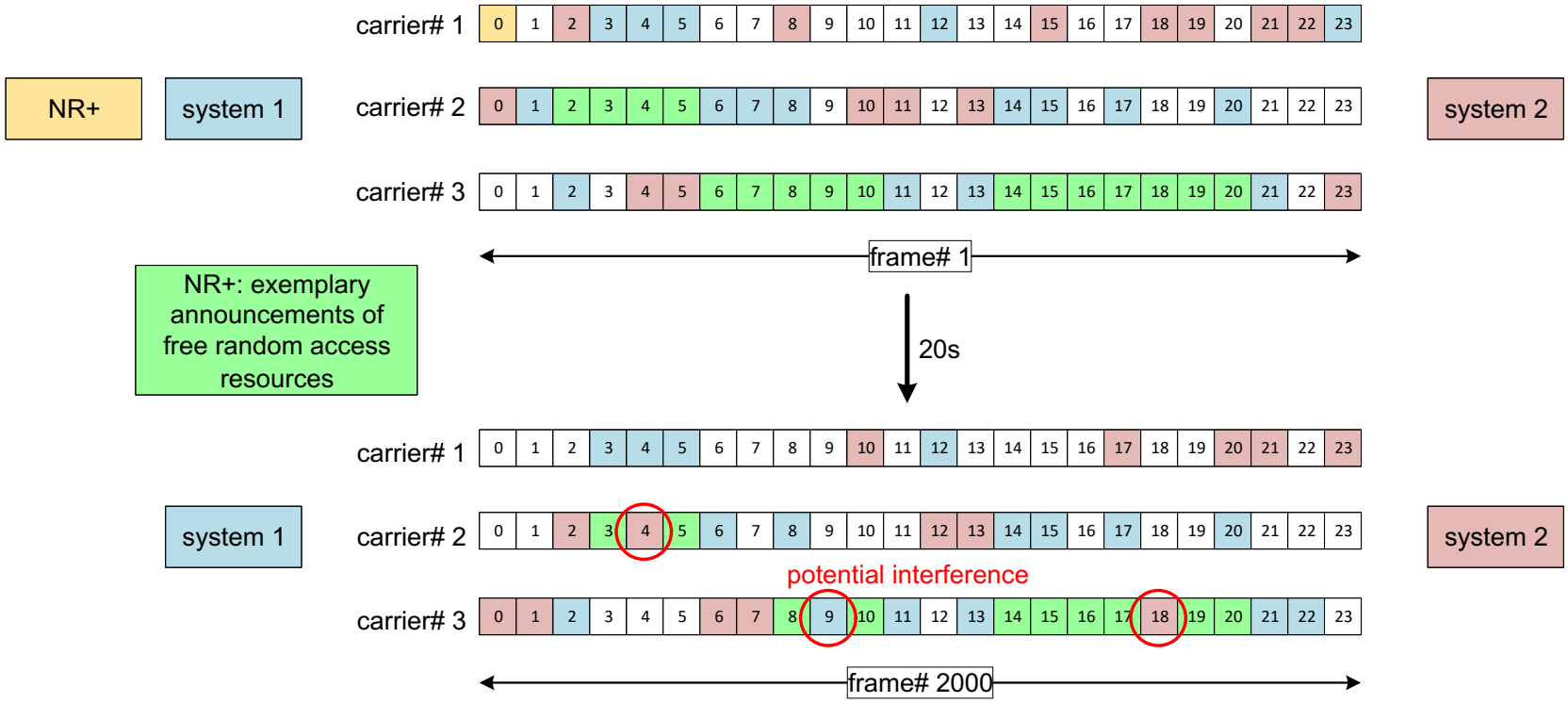
- Similar behavior expected for scheduled access of DECT NR+ in case of a periodic transmissions in every frame

Access Schemes of DECT NR+

Scheduled access	Random access
Periodic occupation of subslots / carrier pair	Random occupation of subslots / carrier pair within a given resource allocation window
Dedicated resources	Shared allocation window
Transmissions can be detected with a certain probability (depends on the repetition rate)	Dynamic transmission with a very low probability of being detected / predicted
Provides improved predictability and coexistence visibility when repetition rate is significantly increased and flexibility is reduced	Provides greater flexibility but may be harder for neighboring networks to detect and track

Random Access of DECT NR+

- Mismatch between scanning intervals of NR+ and the dynamic nature of unsynchronized systems can cause interference



Conclusion

- DECT NR+ PHY meets professional audio requirements
- DECT NR+ MAC enables highly flexible spectrum access
- Flexibility introduces new coexistence scenarios
- Professional audio applications require predictable and detectable spectrum usage
- Further improvements in coexistence mechanisms can help maximize reliability in shared-spectrum deployment


Thank you for your attention!
Any further questions?
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Contact: Axel Schmidt - schmida@shure.com

Comparative Analysis: DECT NR+

- Calculations are based on current DECT NR+ specifications
- The frequency band considered is between 1920 and 1930MHz (US UPCS)

Parameter	Unit	Configuration examples		
Channel bandwidth	MHz	1.728	1.728	6.912
Number of carriers	#	5	5	1
Total required spectrum	MHz	10	10	10
MCS		2	2	2
Modulation order		2	2	2
Audio format (bit/sample @ fs)		4bit@48kHz	4bit@16kHz	16bit@48kHz
Audio data rate per mic	kbit/s	192	64	768
OTA latency	ms	1.67	5.0	0.83
Maximum mic density	#/MHz	1.5	5.5	0.3