

轻量化终端 (REDCAP), 助力5G 物联网快速发展

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Make ideas real



COMPANY RESTRICTED

OVERVIEW RELEASE 17

Enhancements of existing features

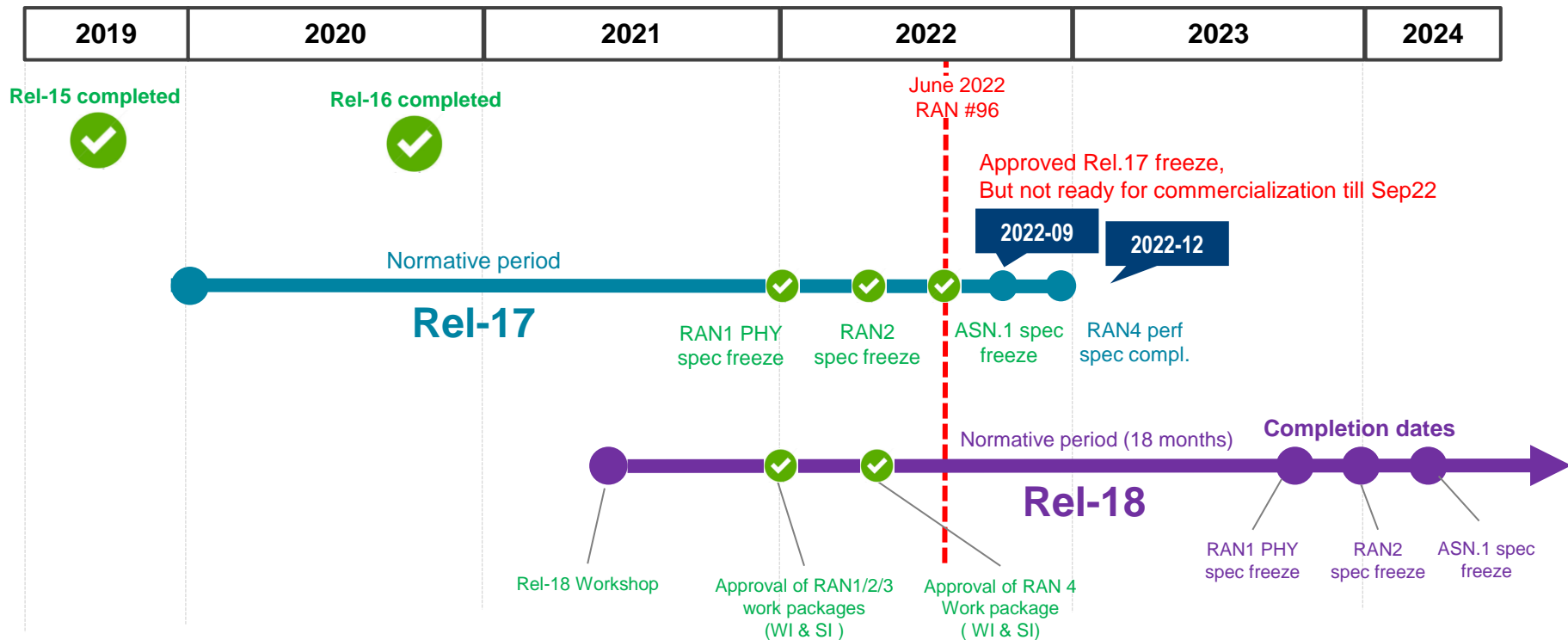
- MIMO
- Dynamic spectrum sharing (DSS)
- Sidelink
- Sidelink relaying
- Positioning
- IIoT / URLLC
- Multi-radio DC/CA
- UE power saving
- Integrated access and backhaul (IAB)
- SON/MDT
- Non-public networks (NPN)
- LTE eMTC and NB-IoT

New features

- Reduced capability devices
- NR over non-terrestrial networks (NTN)
- IoT over NTN
- NR multi-cast transmission
- Multi-SIM support
- RAN Slicing
- Small data transfer in RRC_INACTIVE
- Coverage enhancements
- NR QoE
- NR frequency range 52.6 to 71 GHz

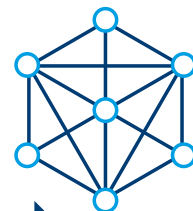
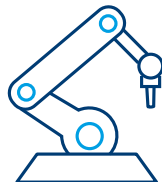
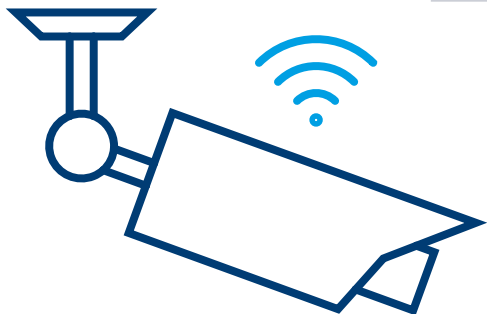
3GPP RELEASE SCHEDULE

JUNE 2022



5G NR REDUCED CAPABILITY MOTIVATION & JUSTIFICATION

RedCap evolution	5G eMBB	Rel. 17	Rel. 18
Bandwidth	100 MHz	20 MHz	5 MHz
Peak rate	2 Gbps	100 Mbps	10 Mbps
Cost assessment	100%	-60%	-71%



Rel. 17: Industrial sensors, video surveillance & wearables , possible for mobile phones

Rel. 18: Improve industrial sensors, video surveillance & wearables

Smart grid

RECAP TPUT

		1T1R		1T2R	
		5ms单周期	2.5ms双周期	5ms单周期	2.5ms双周期
TDD (20MHz, 64QAM)	DL	63	52	126	105
	UL	17.5	26	17.5	26
FDD (20MHz, 64QAM)	DL	85		170	
	UL	90		90	

DEVICE OPTIMIZATION

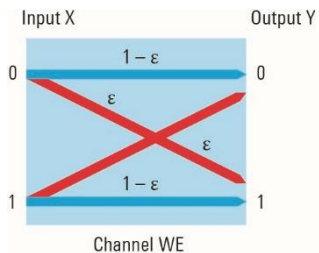
► Reduced capability (RedCap)

- 20 MHz (FR1), 100MHz (FR2)
- 1 or 2 Rx (more complex in reality: MIMO, FR1/2 etc.)
- 256QAM optional (FR1)
- Half duplex FDD (but full-duplex is optional)
- Lower transmit power (e.g. power class 7 for some bands in FR2)
- Limited mobility/handovers (e.g. low mobility devices, relaxed RRM)

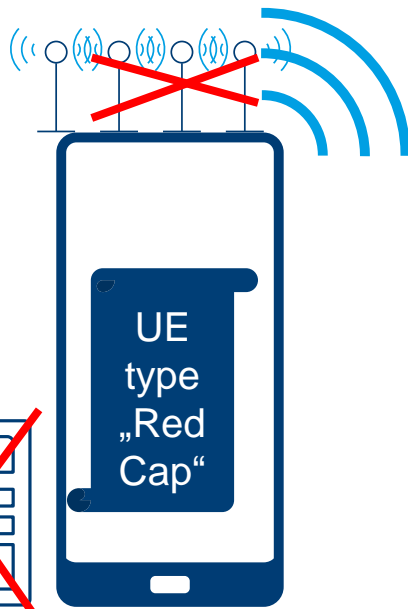


5G NR REDUCED CAPABILITY - OBJECTIVES

Reduce #layers in MIMO



Reduce #antennas



SIB info to allow RedCap UE to camp on cell



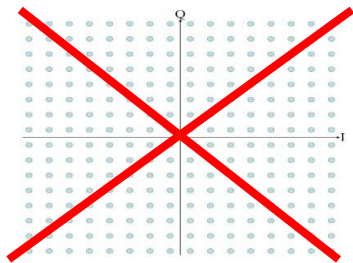
Reduced bandwidth



Half duplex operation



Relaxed modulation order



Relaxed UE processing and time capability (in discussion)

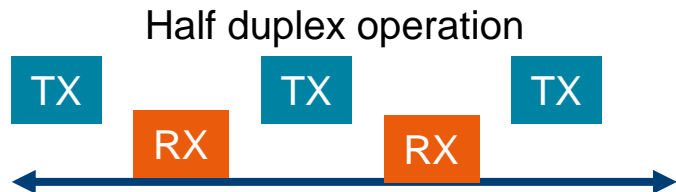
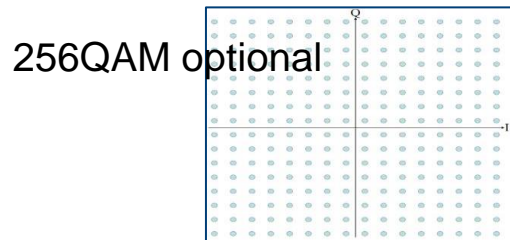
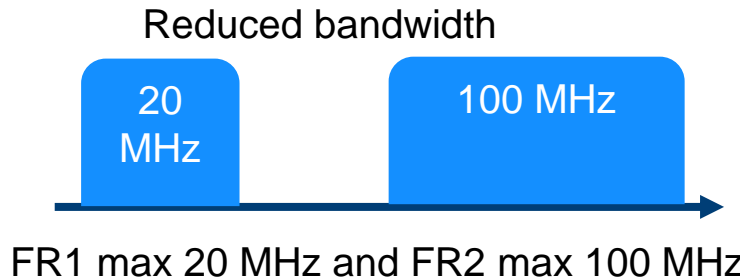
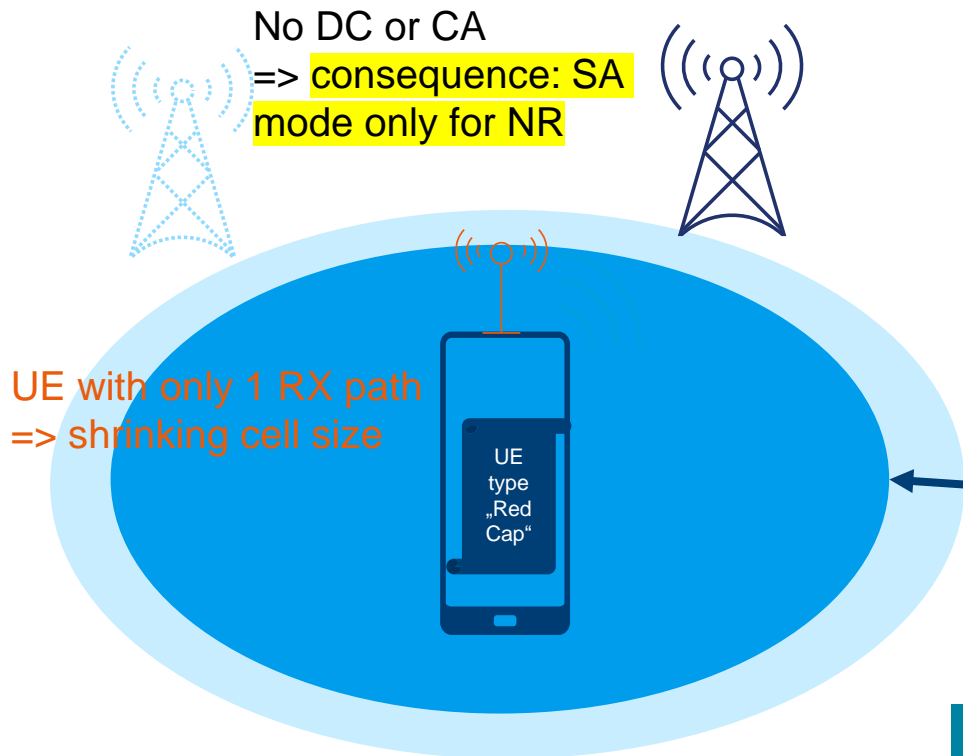
KEY PROTOCOL FEATURE

► Reduced capability (RedCap)

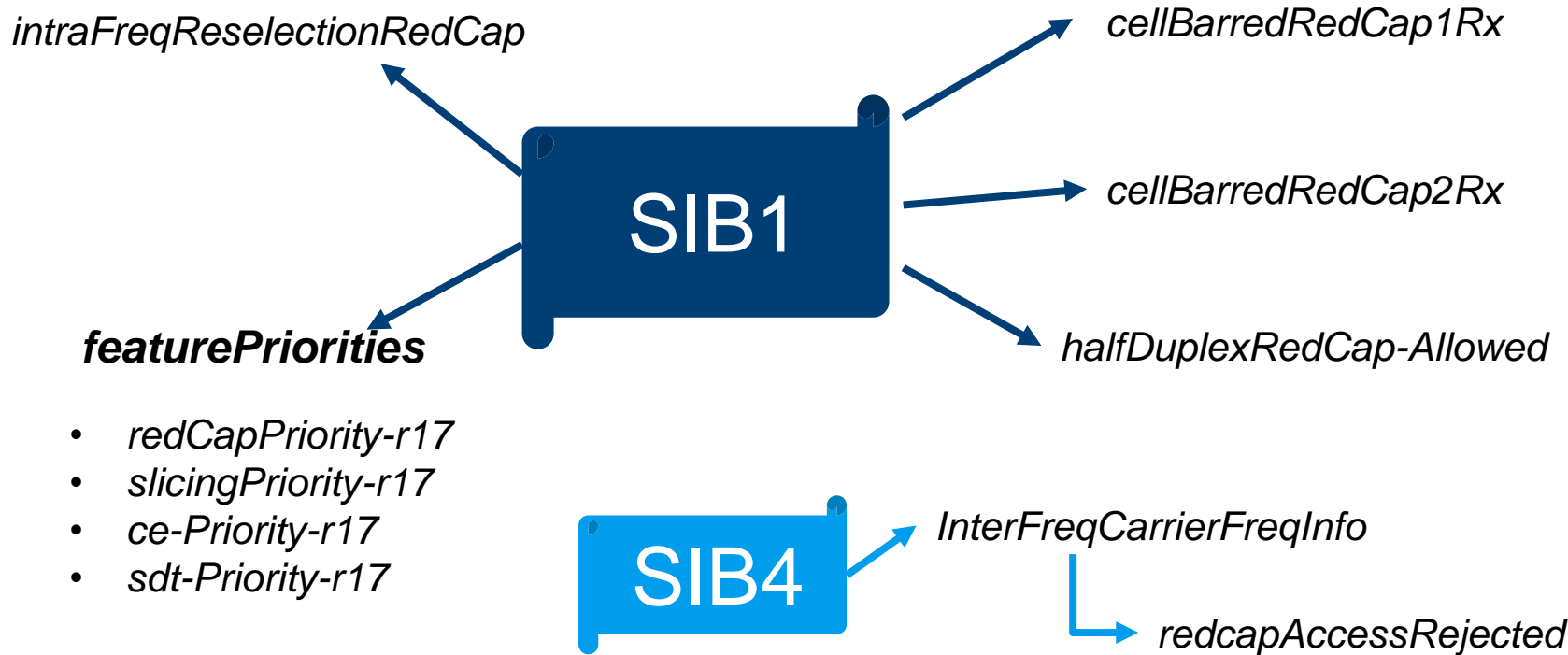
- Redcap Specific Initial BWPs
- Use of NCD-SSB
- Random Access Indication in MSG1
- Cell-Barring for Redcap devices
- Reduced RRM Relations
- eDRX



5G NR REDUCED CAPABILITY - OBJECTIVES



5G NR REDCAP: SYSTEM INFORMATION ASPECTS



5G NR REDCAP: CELL BARRING ASPECTS

Network can restrict access on cell level! Specific for RedCap features!
But: There is no "RedCap-only" cell!

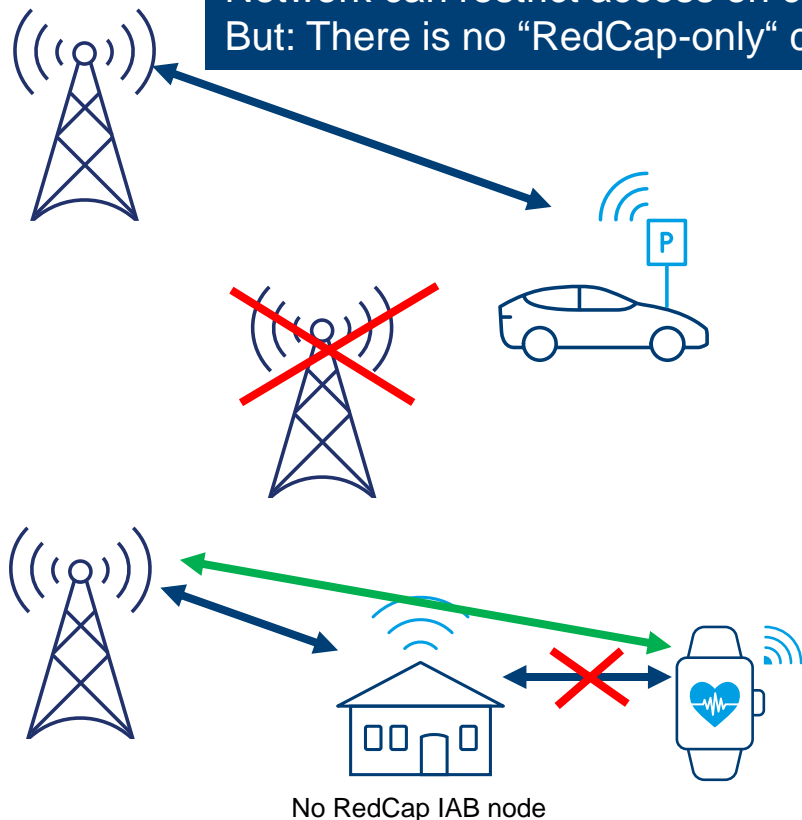
Cell barred for 1RX UE only

Cell barred for 2RX UE only

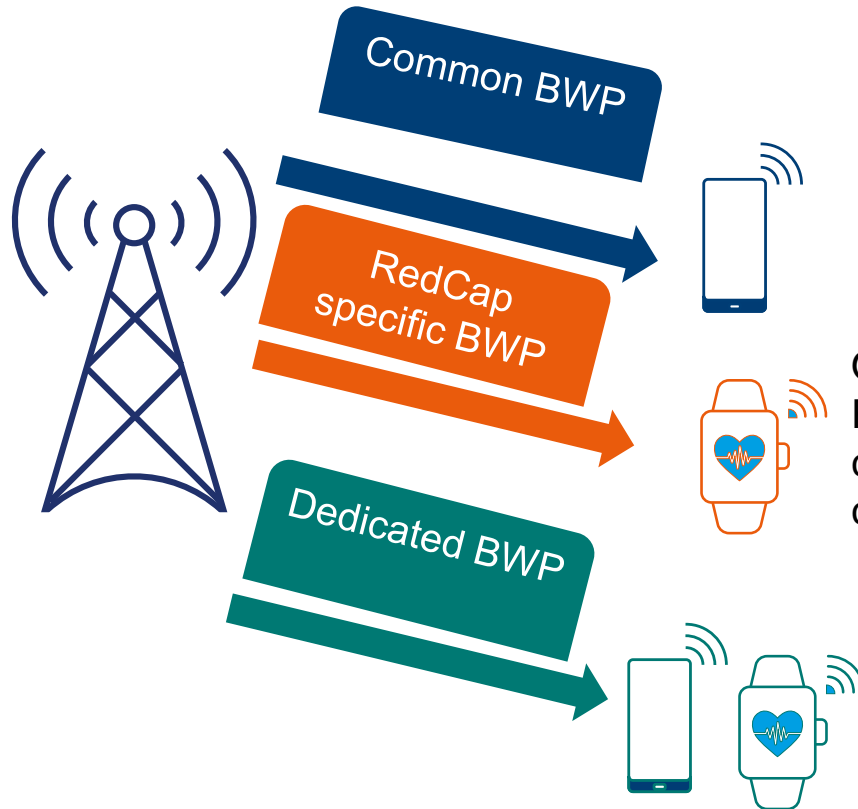
Cell barred for half-duplex UE (HD-UE) only

SIB1

Barred cell may use intra frequency reselection RedCap field to assist reselection



5G NR REDCAP – BANDWIDTH PART (BWP) OVERVIEW



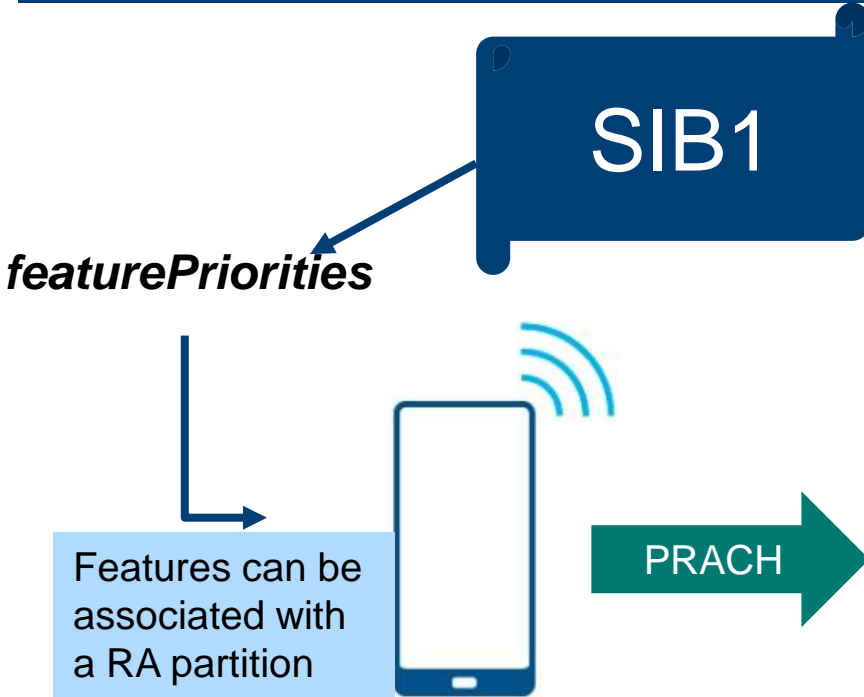
Network schedules a BWP common for all UEs. Drawback is that this BWP is not allowed to be larger than the UE capability!

Optionally, the network schedules a BWP specific for RedCap UEs. Drawback is that this BWP needs to cover the UE bandwidth, otherwise cell is considered as “barred”.

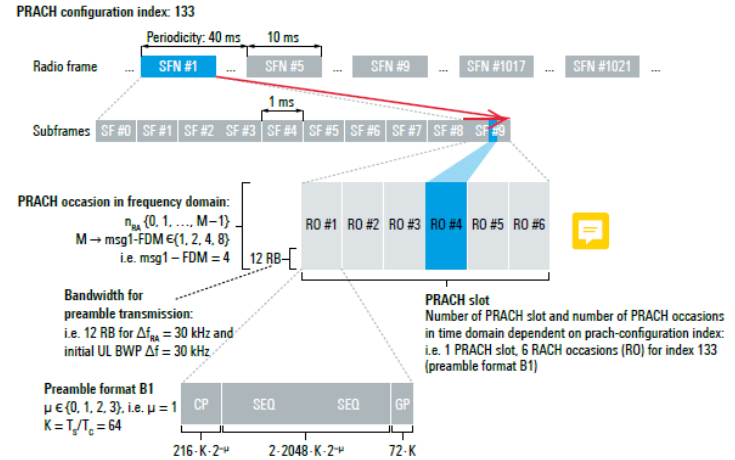
For both, RedCap or non-RedCap UEs, the network may configure a dedicated DL BWP (i.e. via serving cell config) => higher flexibility to adjust BWP to UE needs.

5G NR REDCAP: RANDOM ACCESS ASPECTS

Reduced capability UE may be permitted to indicate RedCap in Msg1 transmission already [TS 38.321]

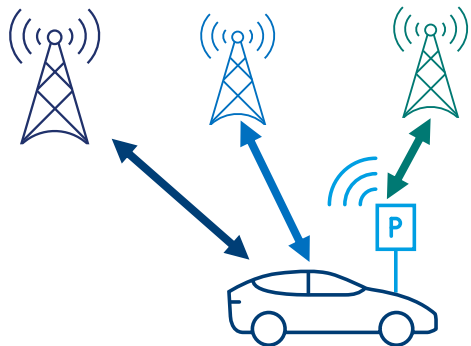


The network may configure a PRACH resource for RedCap indication
=> UE selects Preamble associated to those features

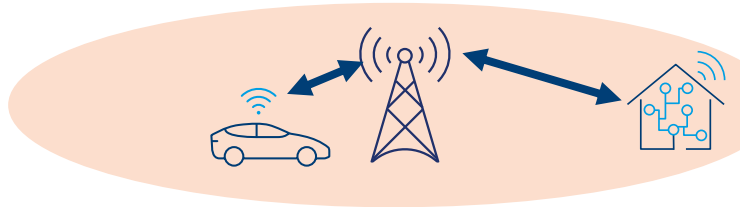


5G NR REDCAP: RELAXED MEASUREMENT ASPECTS

To reduce complexity and energy consumption, the network can configure the RedCap UE for relaxed measurements [TS 38.304]



Relaxed measurement rules for intra-frequency, inter-frequency and inter-RAT measurements



Motivation:

- Stationary devices
- Devices not at the cell edge

Relaxed measurement criterion for stationary RedCap UE (RRC connected):

When „relaxed measurement“ condition is true, the UE performs less measurements (larger DRX cycles)

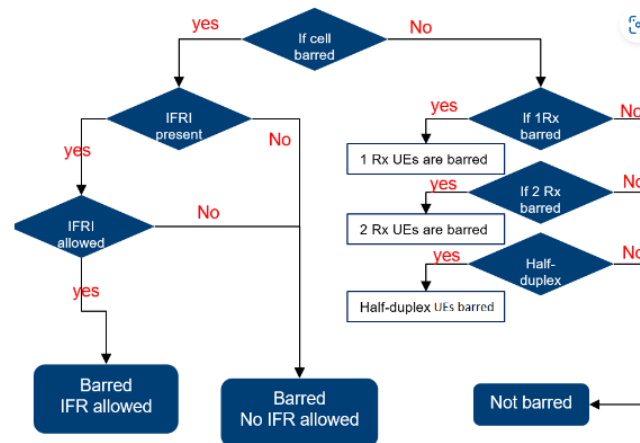
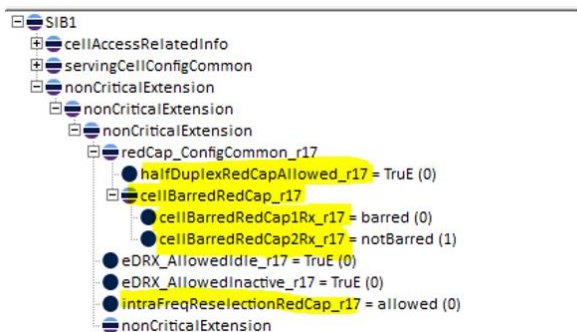
$$(S_{rxlev}_{RefStationary} - S_{rxlev}) < S_{SearchDeltaP-Stationary}$$

Time period over which the S_{rxlev} variation is evaluated for stationary criterion for relaxed measurement.

$$T_{SearchDeltaP-Stationary}$$

ACCESSIBILITY

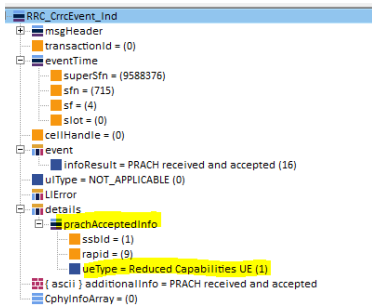
- Specific cell accessibility config for RedCap UEs is available on SIB1 message:
 - **cellBarredRedCap1Rx_r17**: If enabled, RedCap UEs with single Rx branch cannot access
 - **cellBarredRedCap2Rx_r17**: If enabled, RedCap UEs with 2 Rx branch cannot access
 - **halfDuplexRedCapAllowed_r17**: If enabled, RedCap UEs with HD-FDD are barred or allowed
 - **intraFreqReselectionRedCap-r17**: If allowed, a RedCap UE can do reselection to another cell in the same frequency, otherwise treats the cell as barred



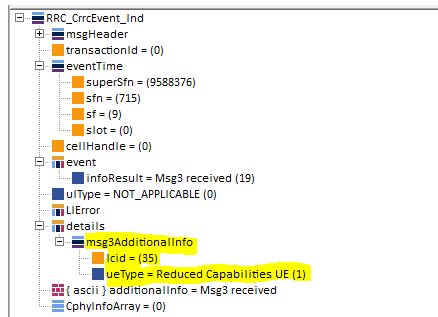
Source: [Confluence](#)

UE IDENTIFICATION

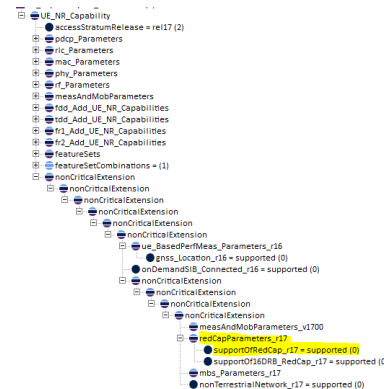
- ▶ A RedCap UE must identify itself as such to the network during registration procedure:
 - Via **MSG1** (PRACH) in 4-step Random Access Procedure
 - Via **MSG3** in 4-step Random Access Procedure (**LCID = 35**)
 - Via **MSG-A** in 2-step Random Access Procedure
 - Via **UE NR Capability** message



MSG1 example



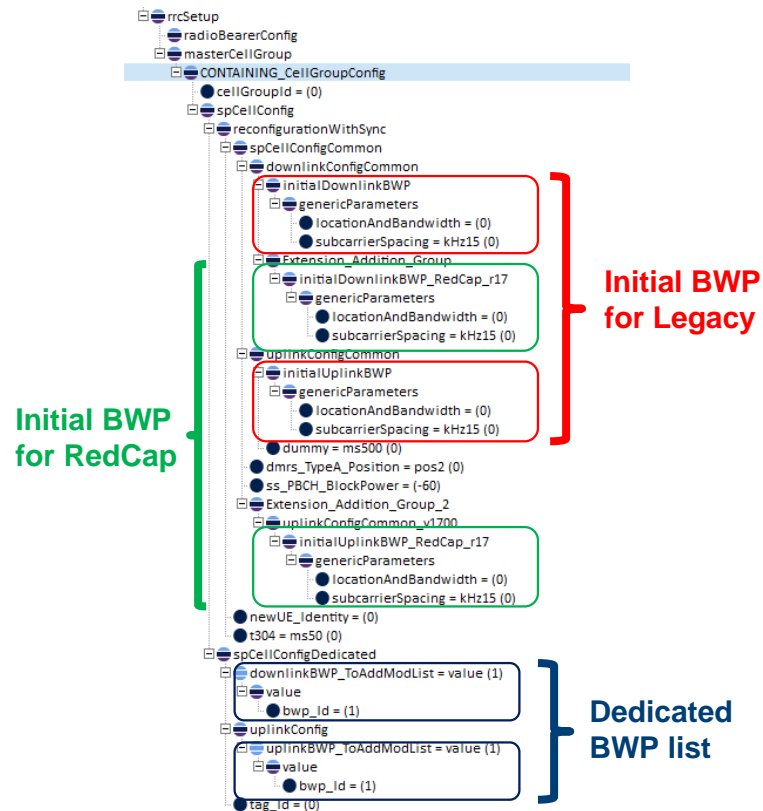
MSG3 example



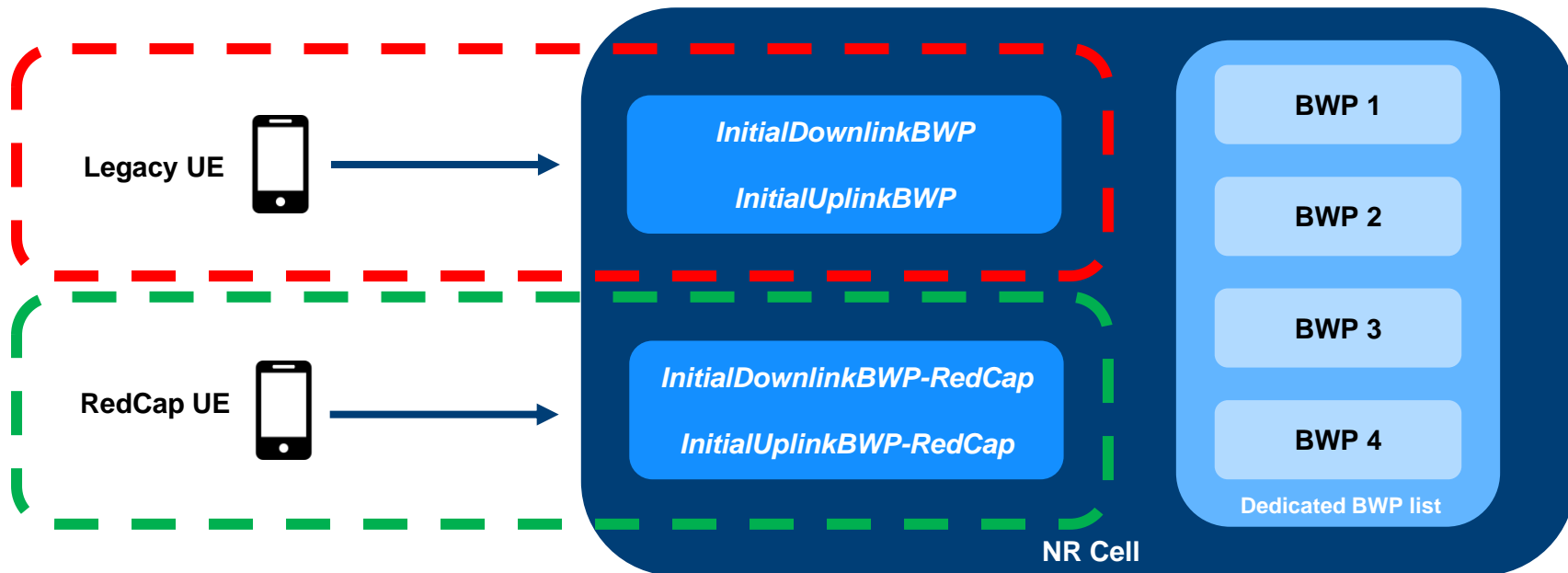
UE NR Capability example

BWP CONFIGURATION

- ▶ A specific BWP for RedCap can be configured. If present, RedCap UEs will use ***initialDownlinkBWP-RedCap-r17 / initialUplinkBWP-RedCap-r17*** instead of the default one
- ▶ If RedCap BWP is absent, RedCap UEs can use ***initialDownlinkBWP / InitialUplinkBWP*** provided that it does not exceed the maximum bandwidth for RedCap



BWP CONFIGURATION



CMX500 CONFIG FOR REDCAP

Designation

R&S@CMX500



R&S@CMX500

OBT

OBT lite

OBT plus

Single CMX500 configuration!

Start configuration

The image shows a screenshot of a web-based configuration interface for the R&S CMX500. At the top, there is a 'Designation' field containing 'R&S@CMX500'. Below this is a photograph of the CMX500 hardware unit. To the right of the photo, the text 'R&S@CMX500' is displayed in blue. Underneath, there are three radio button options: 'OBT', 'OBT lite' (which is selected and has a green checkmark), and 'OBT plus'. Below the radio buttons, the text 'Single CMX500 configuration!' is shown. At the bottom right of this section is a grey button with the text 'Start configuration' in blue.

- CMX-KS617B
- CMX-KC664B
- CMX-KM600
- CMX-KS500B(Optional)

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Thank you!



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