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3GPP TSG RAN Meeting #89e

RP-201527

Electronic Meeting, 14- 18 Sep, 2020

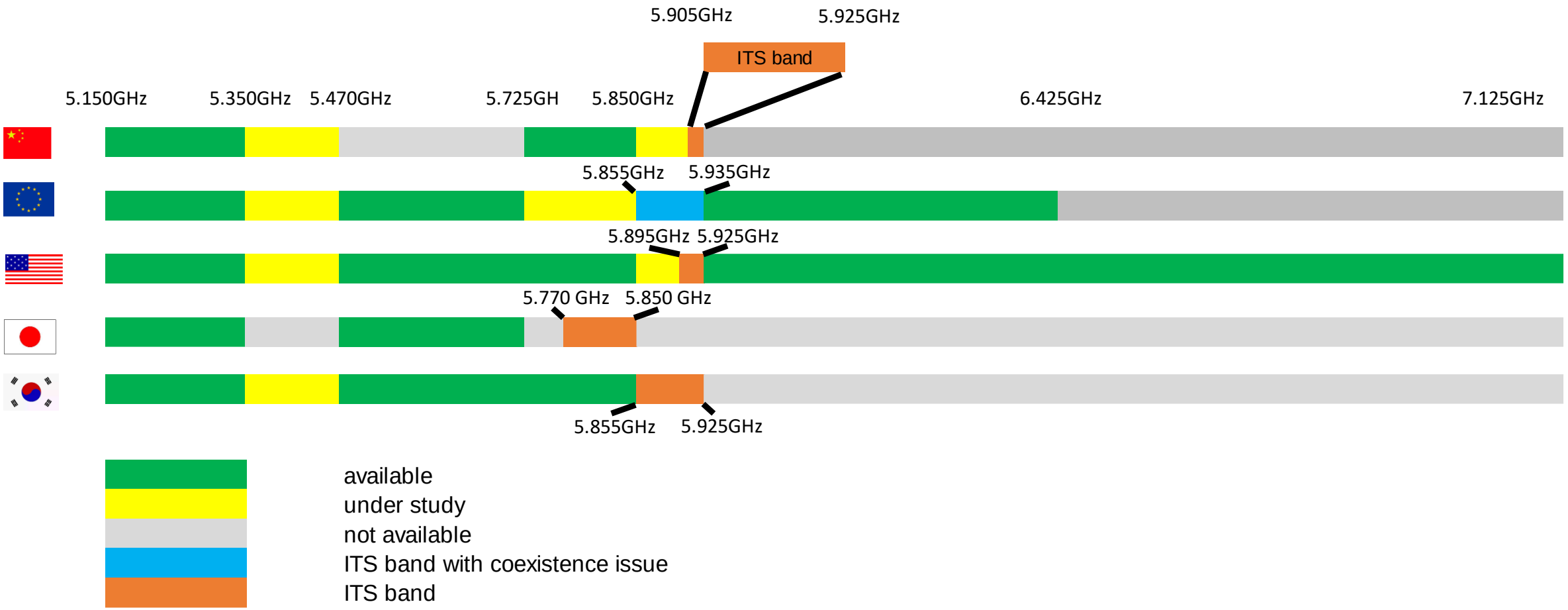
Motivation of sidelink with unlicensed spectrum

Source: OPPO

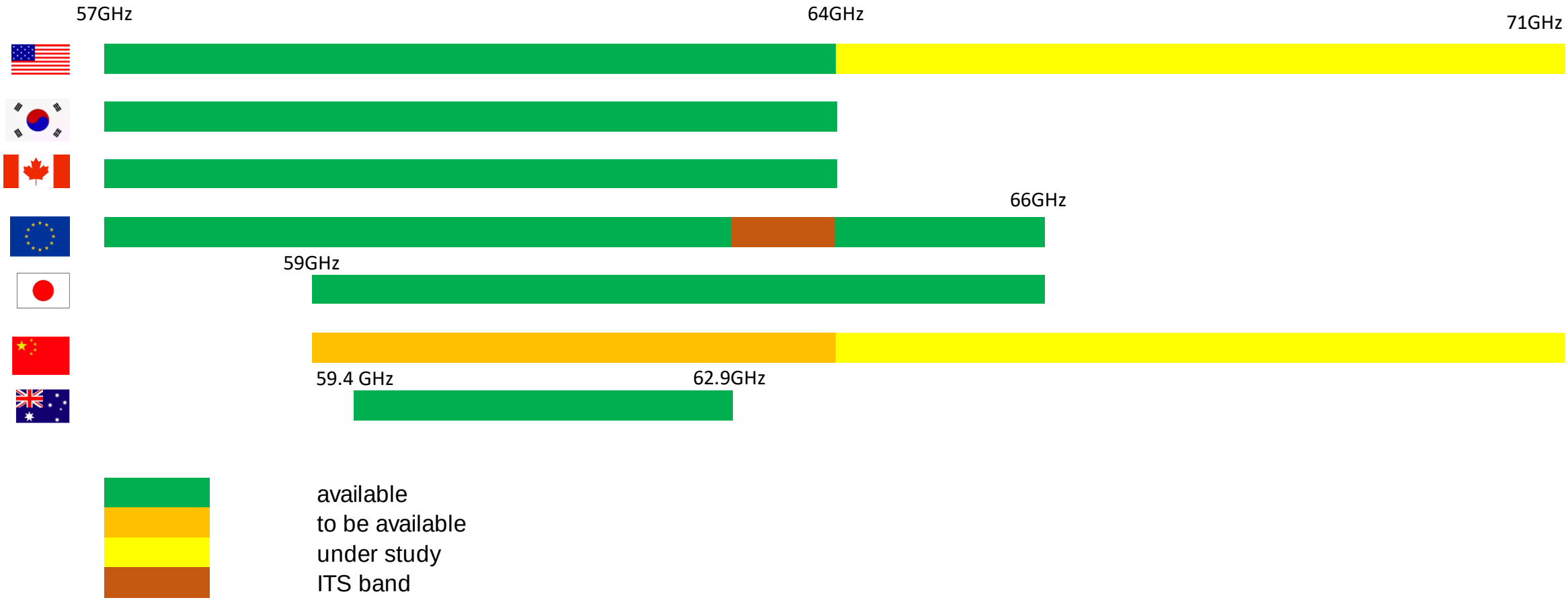
Justification and motivation in general

- Use cases
  - ✓ In future some applications among co-located users e.g. XR gaming will be popular
  - ✓ The requirement of some of the advanced V2X service e.g. extended sensors actually can't be met by current V2X framework due to limited spectrum
  - ✓ In some environment in factory direct communication is more efficient in factory or warehouse
  - ✓ The communication between wearable devices could also count on sidelink communication
- Sidelink based on unlicensed spectrum has potential
  - ✓ Compared to non-3GPP RAT e.g. Wifi
    - ➢ No collision among sidelink devices based on resource allocation mode 1
    - ➢ Low latency due to direct communication by nature instead through AP
    - ➢ Capable of Unicast and broad/group cast type, and flexible combine or switch among them
    - ➢ More efficient power control&saving and frequency resource utilization mechanism
    - ➢ More reliable link thanks to powerful HARQ scheme
  - ✓ Multi carrier operation with licensed band can improve the performance in terms of latency and reliability of the system, and further boost data rate with better control over sidelink
  - ✓ Much wider bandwidth e.g. up to 1GHz in 5GHz band; up to 1 GHz in 6GHz band; up to 14 GHz in 60GHz
- The study of sidelink based on unlicensed spectrum is motivated by:
  - ✓ Better QoE from user perspective compared to communication through Uu interface indirectly
  - ✓ Operator control and delivery of service when application needs server verification and authentication
    - ➢ Offloading Uu throughput to PC5
    - ➢ Saving licensed spectrum e.g. FR2 for other cellular coverage or hot spot
  - ✓ Benefit for other use cases e.g. home network, e-health care etc.

FR1 unlicensed spectrum and ITS band(so far)

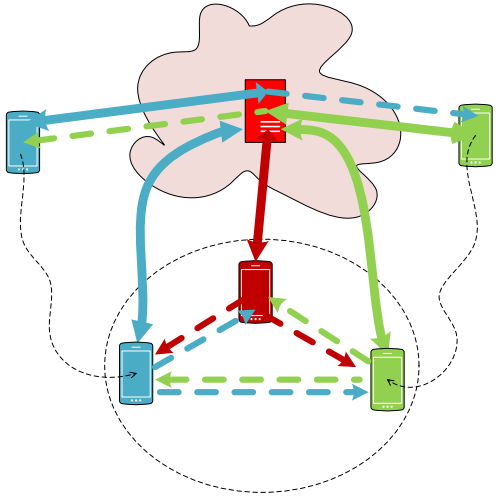


FRX unlicensed spectrum



EMBB use cases

- XR gaming
  - ✓ Co-located users exchange live streams and control signal with each other and/or centralized game service
- Real-time sharing of XR content
  - ✓ A bidirectional or unidirectional A/V channel could be open between users to exchange real-time stream of motion signals and effects that influence the rendering of the 3D object
- Media sharing
  - ✓ Offline sharing is used for sharing 3D models/objects and 3D MR scenes amongst UEs
- Wireless tethered connection
  - ✓ AR/VR glass or helmet-mounted etc. could be tethered to a smart phone to get access to cloud



[1] TR 26.928 Extended Reality (XR) in 5G

Requirement(s)

Use Cases	Characteristic parameter (KPI)			Influence quantity		
	Max Allowed End-to-end latency	Service bit rate: user-experienced data rate	Reliability	# of UEs	UE Speed	Service Area (note 2)
Gaming or Interactive Data Exchanging (note 3)	10ms (note 4)	0.1-[1] Gbit/s supporting visual content (e.g. VR based or high definition video) with 4K, 8K resolution and up to120fps content.	99.99% (note 4)	≤ [10]	Stationary or Pedestrian	20 m x 10 m; in one vehicle (up to 120 km/h) and in one train (up to 500 km/h)
Consume VR content via tethered VR headset (note 6)	[5 -10] ms (note 5)	0.1-[10] Gbit/s (note 5)	[99,99%]	-	Stationary or Pedestrian	-

NOTE 2:Length x width (x height).

NOTE 3:Communication includes direct wireless links (UE to UE).

NOTE 4: Latency and reliability KPIs can vary based on specific use case/architecture, e.g. for cloud/edge/split rendering, and may be represented by a range of values.

NOTE 5: The decoding capability in the VR headset and the encoding/decoding complexity/time of the stream will set the required bit rate and latency over the direct wireless link between the tethered VR headset and its connected UE, bit rate from 100 Mbit/s to [10] Gbit/s and latency from 5 ms to 10 ms.

NOTE 6: The performance requirement is valid for the direct wireless link between the tethered VR headset and its connected UE.

[1] 22.261 table 7.6.1-1 KPI Table for additional high data rate and low latency service

V2X use case

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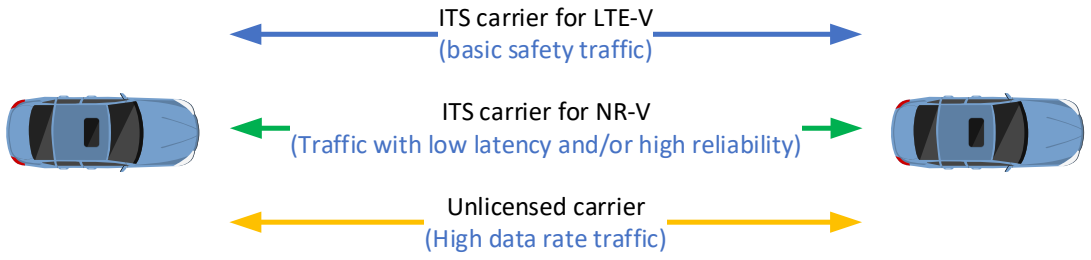
- Extended Sensors enables the exchange of raw or processed data gathered through local sensors or live video images among vehicles, road site units, devices' of pedestrian and V2X application servers.
- Extended sensor can be widely equiped for platooning, remote driving and automatic driving etc.
- The peak date rate of current sidelink is about [200]Mbps
  - ✓ Assuming 20MHz bandwidth, 256QAM and 2 MIMO layer



Communication scenario				Payload (Bytes)	Max end-to-end latency (ms)	Reliabi-lity (%)	Data rate (Mbps)	Communication range (meters)
Section #	Description		CPR #					
5.3	Between UEs supporting V2X application Fully automated driving		[CPR.E-001]		10	95	Peak data rate [25]	
5.6	Between UEs supporting V2X application	Driver control	[CPR.E-002]	[1600]	100	99		1000
		Fully automated driving	[CPR.E-003]		3	99.999		200
			[CPR.E-004]		10	99.99		500
			[CPR.E-005]		50	99		1000
			[CPR.E-006]				1000	50
5.16	Between UEs supporting V2X application	Driver control/ Limited automated driving	[CPR.E-007]		[50]	90	[10]	[100]
		Fully automated driving	[CPR.E-008]		[10]	99.99	[700]	[500]

[1] TR 22.886 Extended Reality (XR) in 5G

IIOT use case(1/2)

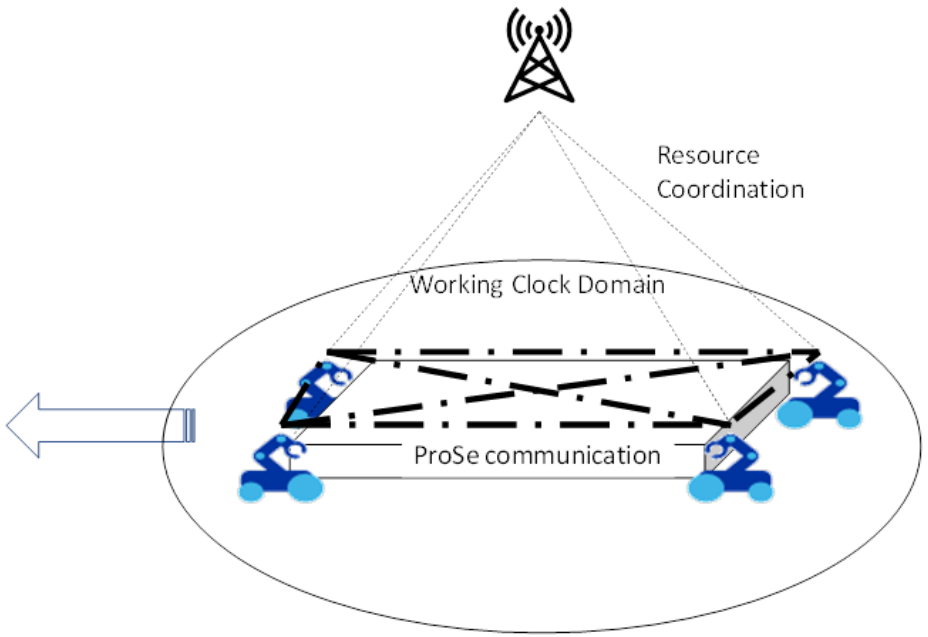


Figure 5.11.2-1(22.832): ProSe communication setup for mobile robots/AGVs carrying a work piece

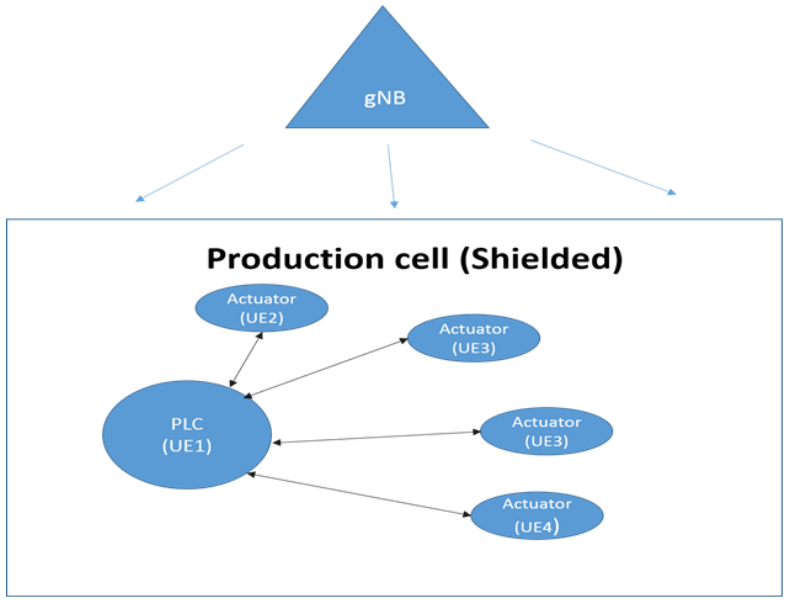
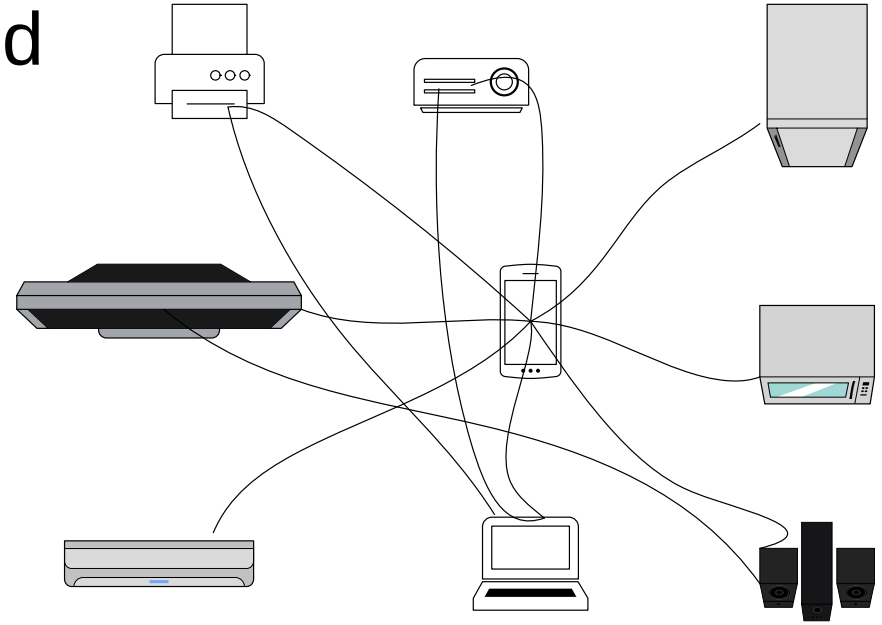


Figure 5.10.2.1-1(22.832)

- [PR-5.11.6-001]The 5G system shall be able to support direct wireless communication (ProSe) between a group of UEs for communication with service performance requirements in Table 5.11.6-1.
- UEs confined within poor coverage such as production cell need communication with each other. For example it is more efficient for PLC (Programmable Logic Controller) to communication with actuators around it via sidelink

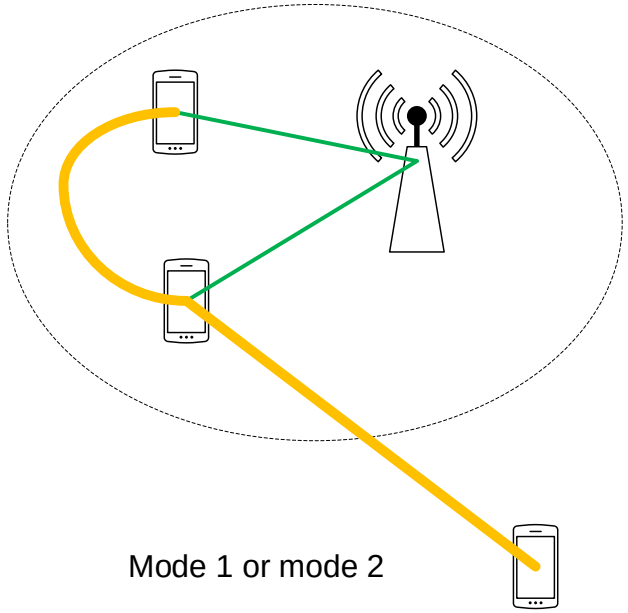
Home network

- Intelligent electronics could be connected with each other or via smart phone or controlled by smart phone based on sidelink communication
- Requirements
  - ✓Data rate could be up to 500Mbps
  - ✓Latency could be low to 10ms
  - ✓Connectivity could be around 20

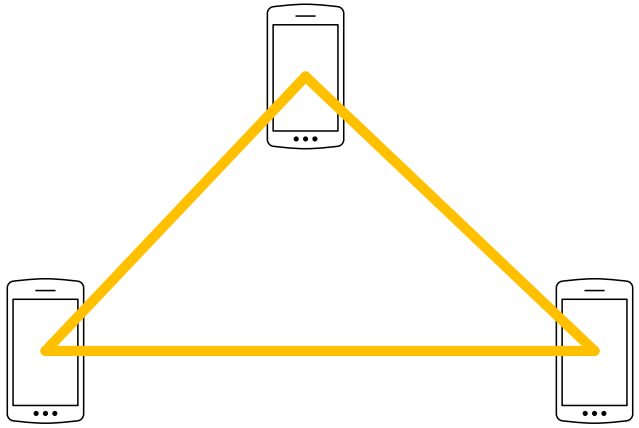


Deployment scenarios(1/2)

- Support in-coverage, partial coverage and out of coverage scenarios
- At least support mode 1 and mode 2 or new resource allocation scheme introduced in R17 and R18
  - ✓In case of mode1, gNB could support LBT operation and schedule sidelink



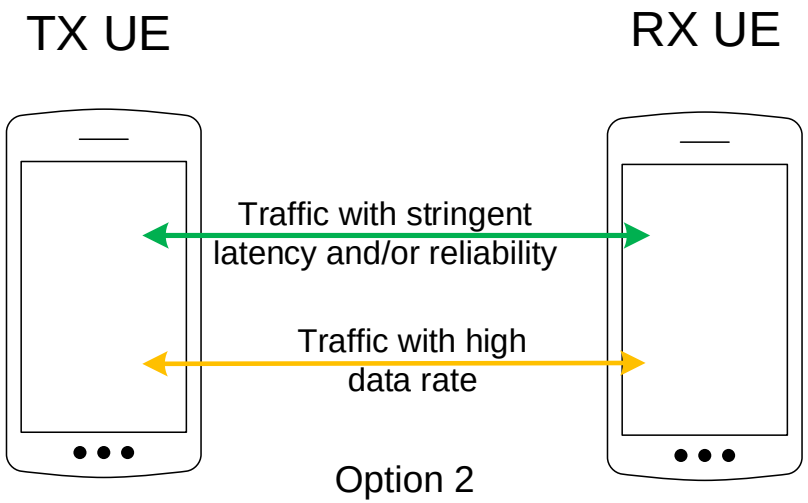
Mode 1 or mode 2

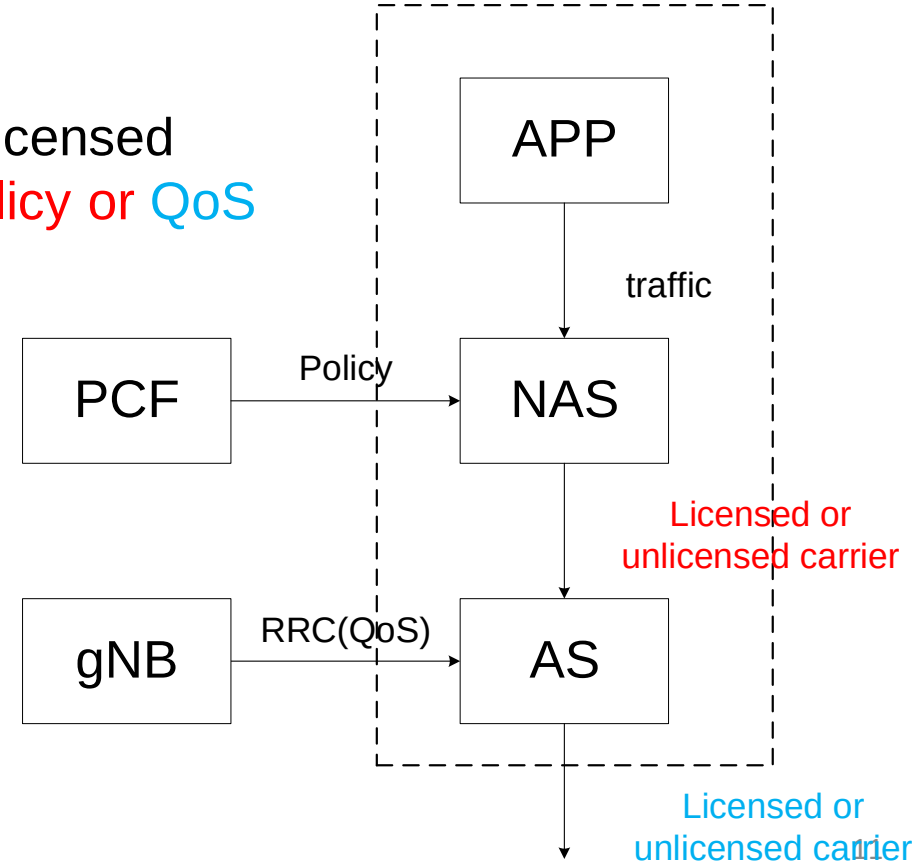


Mode 2

Deployment scenarios (2/2)

- Options over PC5 interface
  - ✓Option1: Unlicensed carrier(s) only
  - ✓Option 2: Licensed/ITS carrier(s) and unlicensed carrier(s)
    - ➢ Traffic will go to either licensed carrier or unlicensed carrier or both based on service type and policy or QoS and measurement etc.

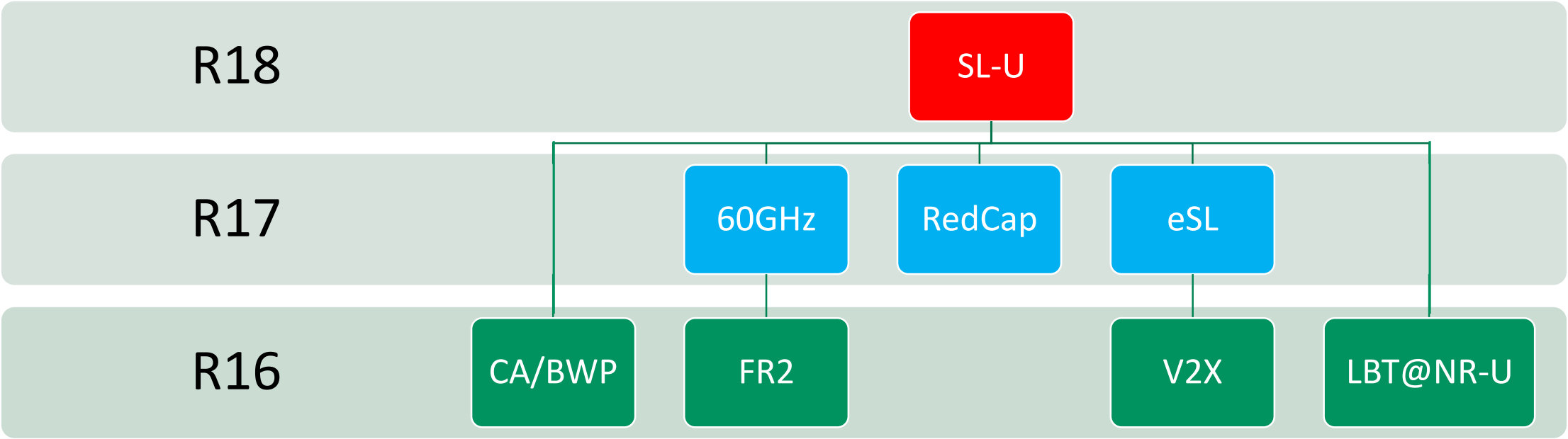




Related on-going WID/SID in 3GPP in Rel17

- Sidelink will be enhanced in R17 WID (RP-201385)
  - ✓ Partial sensing, resource allocation enhancement, DRX
- XR evaluations for NR (RP-201145)
  - ✓ Traffic model and evaluation methodology
- Study on supporting NR from 52.6GHz to 71GHz (RP-200902)
  - ✓ New numerology and directional LBT
  - ✓ Subsequent WID is also planned in R17
- 5G System Enhancement for Advanced Interactive Services (SP-190564)
  - ✓ To define potential QoS parameters e.g. new standardized 5QI(s), corresponding to new QoS requirements (from SA1 NCIS, and SA4 5GXR)

Building blocks



Thank you

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