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DSA

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Presentation

Socio-Economic Benefits of IMT verus RLAN in the 6425-7125 MHz Band

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Socio-economic benefits of IMT vs RLAN in the 6425 – 7125 MHz in Europe

LS telcom
Smart Spectrum Solutions

VVA
Valdani Vicari & Associati

Agenda

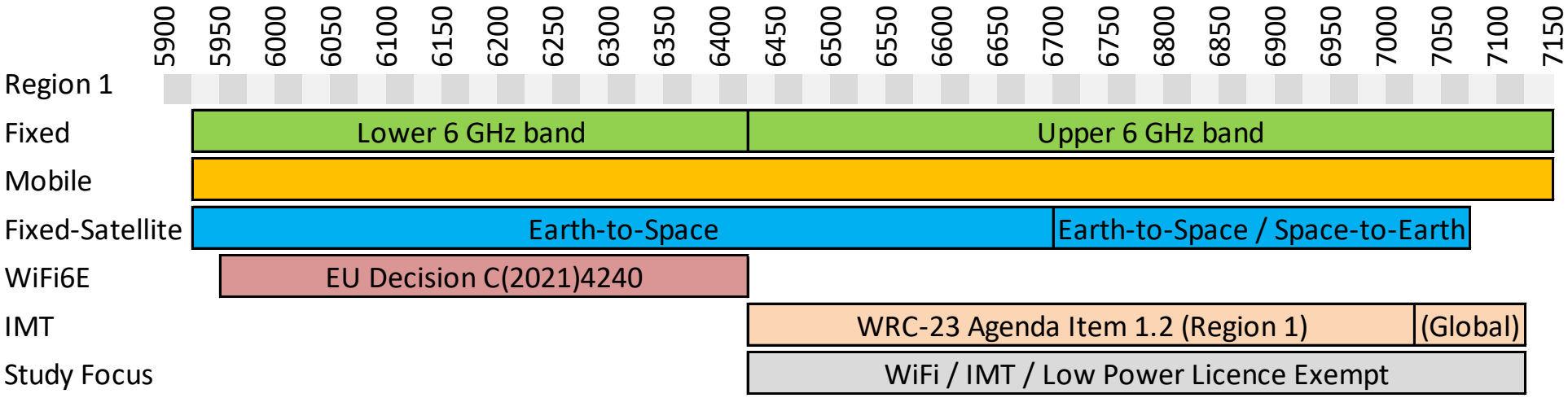
- Scope of the study
- Scenario overview
- Techno-economic outcomes from scenarios 1, 2 and 3
- Conclusions

This study has been prepared and produced on behalf of Dynamic Spectrum Alliance by LS telcom and VVA

Scope of the study

- DSA wanted to understand the socio-economic benefits of IMT vs RLAN in the band 6425 – 7125 MHz specifically within Europe.
- Demonstrate, across particular scenarios, the technical and economic benefits of designating the upper 6 GHz to IMT or RLAN in order to compare and determine which approach delivers greatest value to the EU

6 GHz current and future proposed allocations



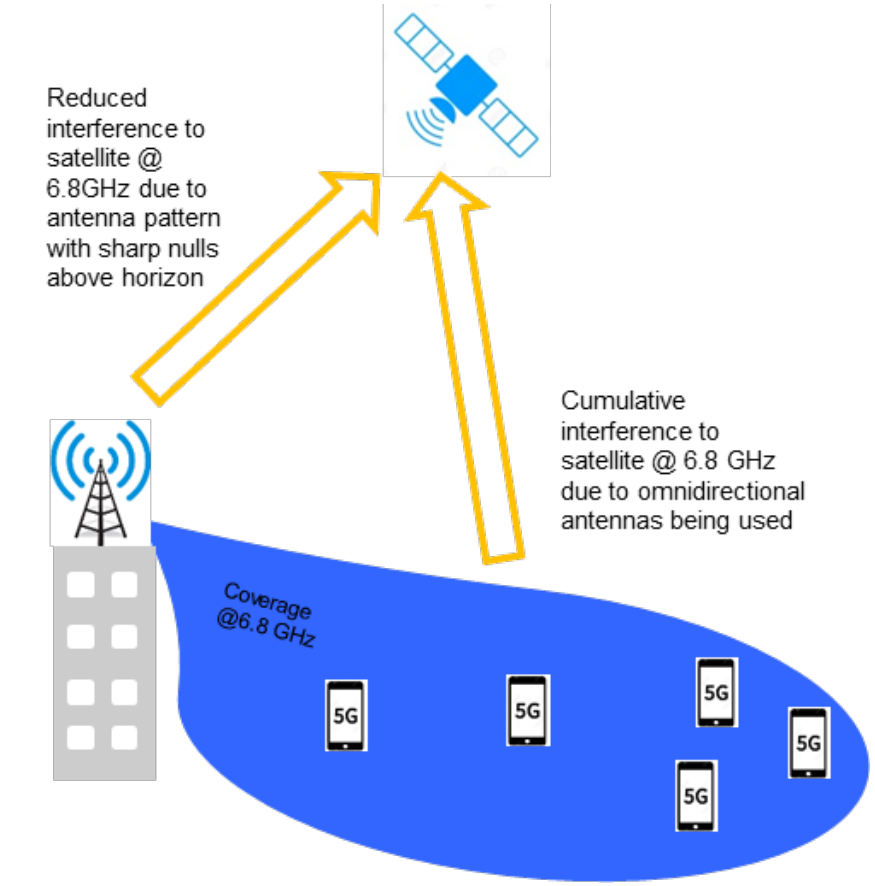
Scope of the study

- Study was divided into two parts a technical analysis and economic analysis
- Explore in each study the technical and economic benefits of the upper 6 GHz band for a range of scenarios, broadly:
  - Licensed nationwide IMT (high power)
  - Local licensed IMT
  - RLAN

Scenario	Description (use of upper 6 GHz)	Comparison with
1	Licensed nationwide IMT (high power)	3.4 – 3.8 GHz
2	Local licensed IMT	400 MHz within C-Band
3	Licence-exempt	Lower 500 MHz vs full 1200 MHz

Main technical input assumptions across all

Example parameters	Assumption
IMT deployments in Upper 6 GHz	Small cells (urban areas) and tri-sector macrocells co-located with 3.5 GHz
Typical cell range of upper 6 GHz sites (national licensed)	<1 km
Typical cell range of 3.5 GHz sites (national licensed)	2.5 km
MIMO (IMT)	64
IMT target user throughputs	100 Mbps
Coexistence with FSS and FS in upper 6 GHz	5G nationwide – Yet to be determined by 2023
	5G local networks – Possible
	Wi-Fi – Yes



Scenario 1 – Technical benefits of nationwide IMT

- **Upper 6 GHz**:
  - More capacity available compared 3.4 – 3.8 GHz
  - Smaller service area with fewer can get a better share of the cell's capacity.
  - Offload traffic from 3.4 – 3.8 GHz (and other MNO bands) in capacity peak areas
  - Ideal for localised high capacity layer
  - Can serve higher rate applications e.g. HD/UHD video streaming in concentrated areas but may also use other bands for carrier aggregation

- **3.4 – 3.8 GHz**:
  - 5G pioneer band almost fully deployed in EU
  - 400 MHz available to support 4 MNO market
  - Delivers real 100+ Mbps speeds to mobile consumers
  - Widely embedded in 5G ecosystem
  - Better coverage and more suited to wide area networks compared to upper 6 GHz range

#Users	Estimated throughput per user (Mbit/s)	
	3.5GHz	6.8GHz
1	470.0	842.0
2	198.0	421.0
5	60.4	168.4
10	30.2	120.5
20	14.5	84.2
50	5.9	42.1
100	3.0	28.1

Scenario 1 – Economic benefits of nationwide IMT

- Economic elements

Investment costs:

- **Market sizing: 75 urban cores in the EU**
  - 63.2 million people (14% of EU pop.)
  - 20,632 km² (0.5% of EU area)

	Microcells	Macrocells
Number of cells	263,171	65,677
Overall deployment costs	€7.3B	€5.9B

Downstream Applications:

Sectors	Fitness vs user needs
Agriculture	**Medium**
Construction	**Low**
Education	**Low**
Public services	**Low**
Healthcare	**Low**
Manufacturing	**Low**

- Few applications expected to take place in an outdoor environment
- Wide area coverage requirements can be equally met by alternative networks

MCA: Low 0 to 1 ; Medium >1 to <2 ; High >2

QoS

- At least 2 times more simultaneous users served within a given area
- However, it will effectively address a limited number of sectors and users

Scenario 2 – Technical benefits of local licensed IMT

- Upper 6 GHz:
  - Offers more bandwidth for high data rate channels compared to C-Band frequencies
  - More applications can be supported at higher speeds
  - Useful for indoor very high rate applications

- 400 MHz within C-Band:
  - Sufficient bandwidth to handle capacity and device bit rates of 5G private networks
  - First mover advantage with industrial (vertical) equipment supporting C-Band for 5G
  - Evolving regulatory environment in the EU to support private 5G networks

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Sector	Application	Area per location	Approx number of devices	Estimated number of sites per area C-Band	Estimated number of sites per area 6.425 - 7.125 GHz
Construction	Remote sensor monitoring of equipment, machines and materials or UHD surveillance	0.04 km²	50	1	3
Healthcare	Wireless tele-surgery	0.16 km²	250	2	6
Manufacturing	Machinery monitoring for predictive maintenance and remote-control: reduced downtime	0.04 km²	10000-20000	5	10
Ports	e.g. Real-time inventory and asset tracking UHD surveillance	c. 2km²	400-1000	5	10
Airports	e.g. Autonomous airside vehicles and collision avoidance	c. 2km²	10000-20000	5	10
Stadiums	e.g highly flexible multiple UHD wireless camera provision	0.04 km²	50	1	3

Private 5G networks focusing on **URLLC** and **mMTC** rather than high bit rates offered by upper 6 GHz

Scenario 2 – Economic benefits of local licensed IMT

- Economic elements

Investment costs:

- **Market sizing: 18,557 campus networks in the EU**
  - Over 4 sectors considered: Construction, Healthcare, Manufacturing, Infrastructure (i.e. Ports Airports and Stadiums)
  - # cells based on sectors requirements and average area to be covered
- **Overall deployment costs:** 12.35 billion EUR.

Downstream Applications:

Sectors	Fitness vs user needs
Agriculture	**Medium**
Construction	**Medium**
Education	**Low**
Public services	**Low**
Healthcare	**Low**
Manufacturing	**High**

- Local IMT in the 6GHz band will unlikely meet all requirements from the public sector
- Good level of fitness for other sectors addressing both indoor and outdoor applications

MCA: Low 0 to 1 ; Medium >1 to <2 ; High >2

QoS

- No additional users served under this scenario in the upper 6GHz. It is thus very likely that no additional benefits will be observed in terms of the number of additional users supported.

Scenario 3 – Technical benefits of RLAN licence-exempt

- Access to the full 1200 MHz in the 6GHz band provides:
  - Significant additional capacity compared to lower 6 GHz, with minimal constraints (e.g. unlike 5 GHz) and **ensures future proof access to spectrum** for innovative applications e.g. access to 320 MHz channels
  - Enables **flexibility of usage and ease congestion** on existing 2.4 GHz and 5 GHz networks – overall uplift in QoS.
  - Limited disruption in many markets due to stable regulatory conditions imposed by countries that have unlocked access to the lower 6 GHz block
  - Coexistence studies which prove **sharing with incumbent services FS and FSS** is possible
  - **Opportunity for controlled outdoor use** under AFC type rules

Wi-Fi 6E 802.11ax & 802.11be	Differences	
	5925-6425 (500 MHz)	5925 -7125 (1200 MHz)
Extremely high channel benefits	3 x 160 MHz channels	7 x 160 MHz channels
	1 x 320 MHz channel	3 x 320 MHz channels
Device frequency support capability	Partial	Full
Cost difference in device	Small	None

Scenario 3 – Economic benefits of RLAN licence-exempt

- Economic elements

Investment costs

- 3 scenarios to estimate the evolution of broadband

Scenario assumptions	Costs (EUR)
All EU broadband subscription will be equipped with a WIFI 6 router.	**9.76 billion**
The proportion of people in the EU with a fixed broadband subscription rises to that of South Korea.	**11.68 billion**
Every household, every registered company and every registered NGO would get its own connection.	**13.25 billion**

Downstream Applications:

Sectors	Fitness vs user needs
Agriculture	Medium
Construction	Medium
Education	High
Public services	High
Healthcare	Medium
Manufacturing	High

- Highest score when it comes to "fitness" of requirements compared to scenario 1 and 2.
- Benefits of additional bandwidth available indoors on an unlicenced basis will far outweigh the relatively small market ponderation and connectivity requirement of sectors with "Medium" fitness

MCA: Low 0 to 1 ; Medium >1 to <2 ; High >2

QoS

- From 3 to 4 times more simultaneous users compared to currently deployed Wi-Fi 5 and below. Scenario 3 (RLAN) will require a limited investment, but it will effectively meet user needs from all sectors.

Conclusions – Upper 6 GHz use

Technical benefits of upper 6 GHz for IMT vs RLAN

Scenario	Technical benefits	
	Upper 6 GHz	**Existing frequency options**
Licensed nationwide IMT (high power)	Useful capacity layer in urban densely populated areas Support higher rate applications over smaller area	3.4 – 3.8 GHz widely deploy across EU supporting 4 MNO market Delivers 100+ Mbps speeds to mobile consumers Widely embedded in 5G ecosystem
Local licensed IMT	Useful for high rate indoor applications	C-Band regulations and market evolving Sharing possible with incumbents
	Technical benefits of 5925 – 6425 MHz	**Technical benefits of 5925 – 7125 MHz**
Licence-exempt	Supports Wi-Fi 6E Provides access to (limited) wider channels Ease congested networks	Supports Wi-Fi 6E Provides access to multiple wider channels Greatly reduce congested networks Future-proof

Conclusions – Upper 6 GHz use

Economic benefits of upper 6 GHz for IMT vs RLAN

- Scenario 3 (RLAN) provides the most suitable results from:
  - An investment cost vs benefit perspective
  - A downstream market perspective
  - A cost versus QoS deployed
- Results are constrained by the scope of the exercise (i.e. upper 6GHz and Digital Decade sectors)

Overview of Fitness vs user needs

	Wide area IMT	IMT Local	RLAN
Agriculture	Medium	Medium	Medium
Construction	Low	Medium	Medium
Healthcare	Low	Low	High
Manufacturing	Low	Low	High
Education	Low	Low	Medium
Public Service	Low	High	High
Average	**Low**	**Medium**	**High**

Thank you
Questions

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