The 25th International Space Radio Monitoring Meeting (ISRMM) 2024 Conference

الاجتماع الدولي الـ 25 لمراقبة ردايو الفضاء

Communications Regulatory Authority State of Qatar

هيئة تنظيم الاتصالات دولة قطر

Name

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Presentation Title

Terrestrial-Satellite Communications Coexistence.. A Successful Story to Continue...

Abstract

Mobile and satellite communication systems have coexisted on the same bands for years. Resolution 220 (WRC-23) on "Terrestrial component of International Mobile Telecommunication (IMT) within the frequency band 6 425 7 125 MHz" resolved that IMT and FSS service can coexist with certain considerations. In this speech, we will explore the possibilities for "Terrestrial-Satellite Communications" coexistence in the upper 6GHz band.

Bio data

A telecom-industry expert with more than 20 years of experience in regulatory, strategy, business, and technology. He works for Ooredoo Qatar as Assistant Director for Regulatory Operations and Compliance. Recently, he led a collaboration between top MENA mobile operators to shape a joint position for the identification of upper 6GHz band for IMT during WRC-23. He also participated as a speaker and as a panelist in many local and regional forums and conferences.

TERRESTRIAL-SATELLITE NETWORKS COEXISTENCE

Upgrade your World

A Successful Story to Continue…

3 September 2024

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Karam Alshorbassi

- A telecom-industry expert with more than 20 years of experience in regulatory, strategy, business, and technology
- Working for Ooredoo Qatar as “Assistant Director for Regulatory Operations and Compliance”
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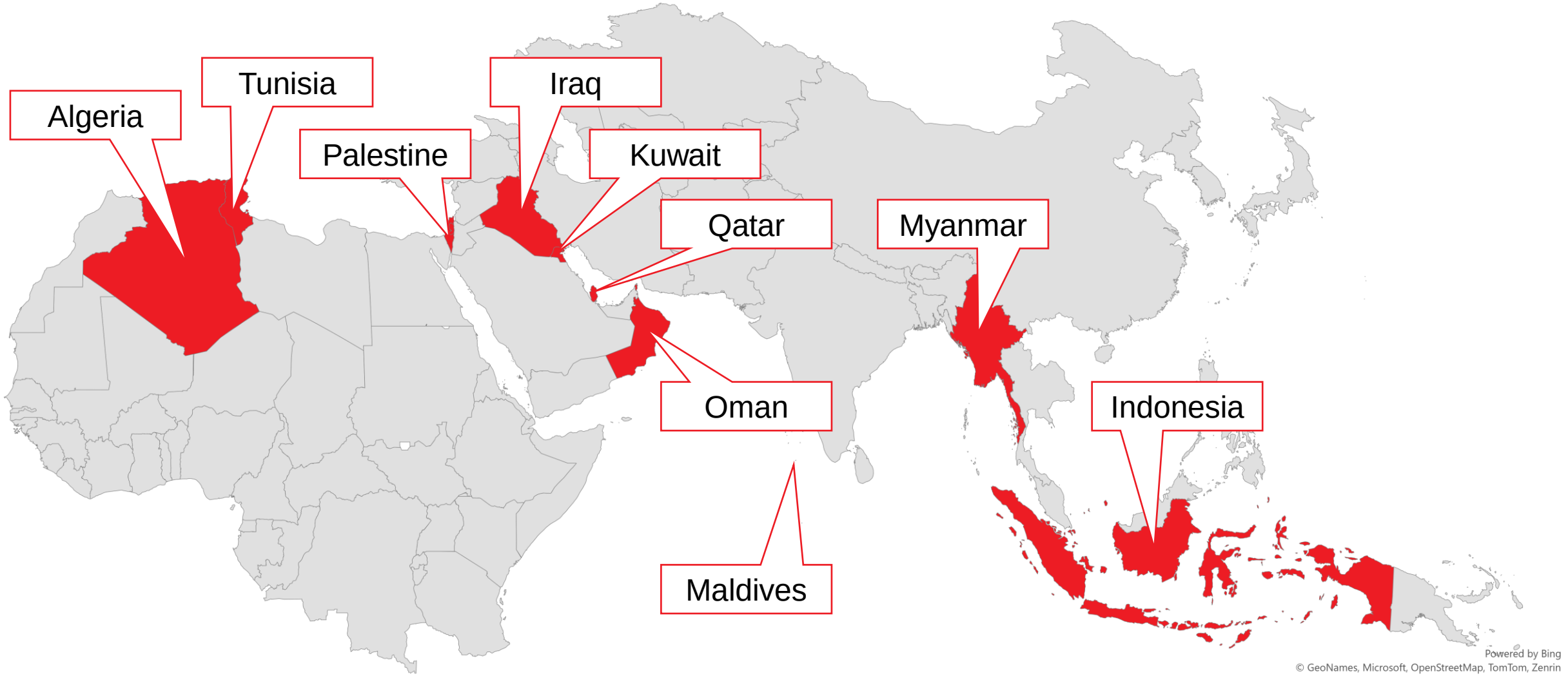

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Source: ooredoo.com

Definitions

Fixed-Satellite Service (FSS)

- A radiocommunication service between earth stations at given positions, when one or more satellites are used … this service includes … inter-satellite service; … may also include feeder links for other space radiocommunication services.

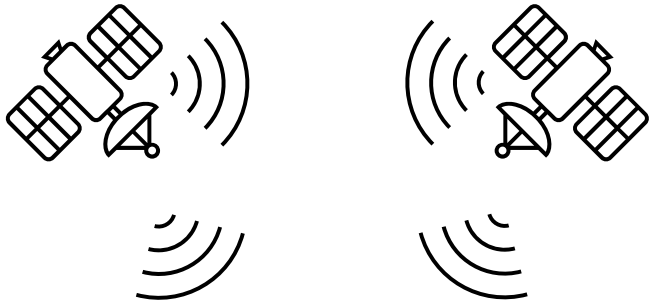
Terrestrial Radiocommunication

- Any radiocommunication other than space radiocommunication or radio-astronomy. In this presentation, it refers to IMT.

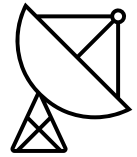
Harmful Interference

- Interference which endangers the functioning of … or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations.

Inter-satellite Communication



Earth-to-Space Communication



Terrestrial Communication

Source: ITU Definitions

Terrestrial vs. Satellite Networks

Terrestrial

Pros

- Ultra High Speed
- Low Cost
- Important to support the economy

Cons

- Limited Coverage in Rural Areas
- Cross-Border Interference

Satellite

Pros

- Wide Area Coverage
- Unattended Use-Cases
- Cross-Border Mobility

Cons

- Security
- Numbering
- QoS

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Source: Cost is the setup cost per user/capita

Why Do We Need More Spectrum for IMT?

- 2 GHz of mid-band spectrum is required for 5G citywide capacity before 2030
- Accelerates 5G network rollouts, services, and use-cases
- Paves the way for 6G post 2030

Source: GSMA-Coleago Report

Why IMT Identification of 6GHz is Vital?

It is the last contiguous spectrum in the mid-band

Enables cost-efficient, energy-efficient & spectrum-efficient 5G expansions

Ecosystem is Ready (Standards, Regulations, Chipsets, Devices, Network Equipment)

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Source: GSMA-Coleago Report

Can IMT and Satellite Networks Coexist in 6GHz Band?

Coexistence is Achievable

- Coexistence Techniques
- WRC-23 Resolutions
- Examples of Coexistence

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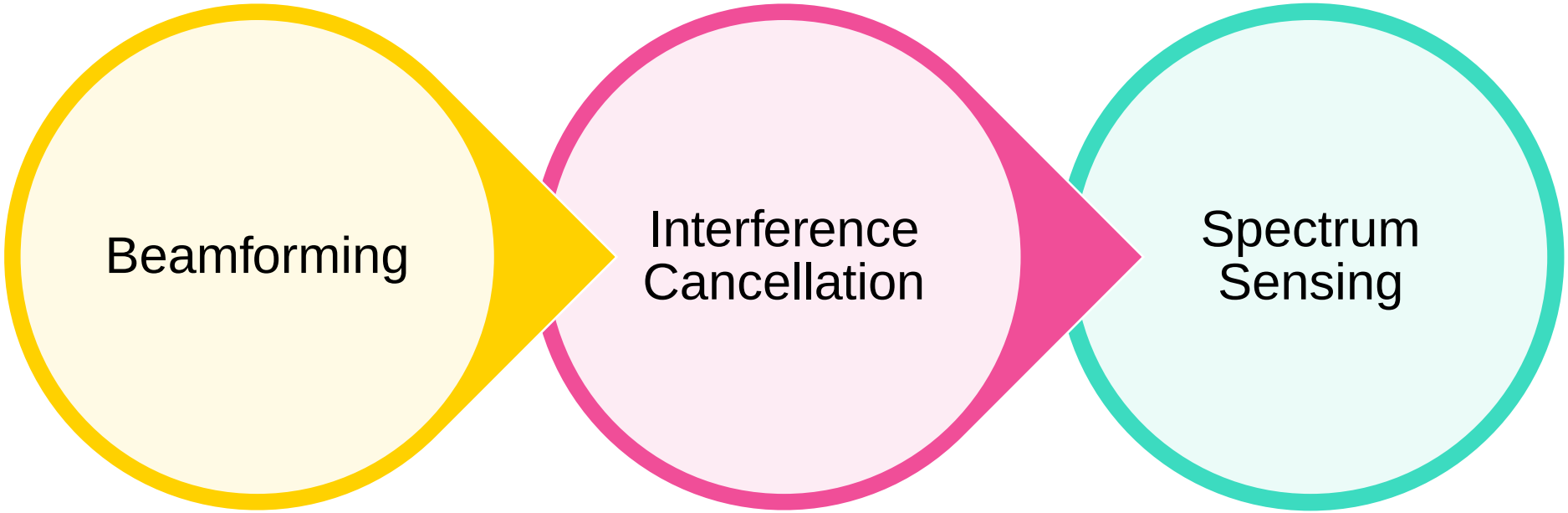
Coexistence Techniques



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Resolution 220 (WRC-23) – Coexistence Conditions

2 that, in order to ensure protection for the FSS (Earth-to-space), and taking into account *considering d)*, the level of expected e.i.r.p. spectral density emitted by an IMT base station as a function of the vertical angle above the horizon shall not exceed the following values (No. **21.5** does not apply):

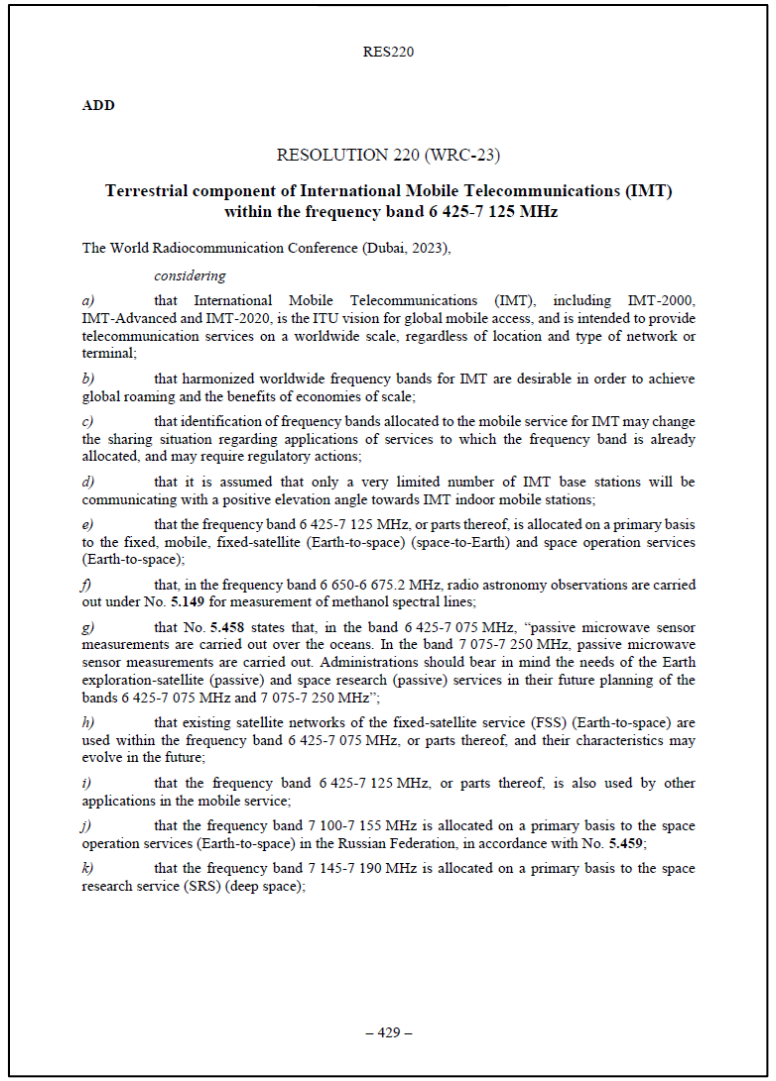
Vertical angle range $\theta_L \le \theta < \theta_H$ (vertical angle θ above horizon)	Expected e.i.r.p. (dBm/MHz) (See NOTES 1, 2 and 3)
$0° \le \theta < 5°$	27
$5° \le \theta < 10°$	23
$10° \le \theta < 15°$	19
$15° \le \theta < 20°$	18
$20° \le \theta < 30°$	16
$30° \le \theta < 60°$	15
$60° \le \theta \le 90°$	15

NOTE 1: The expected e.i.r.p. is defined as the average value of the e.i.r.p., with the averaging being performed:

- over horizontal angles from −180° to +180°, with the IMT base station beamforming in a specific direction within its horizontal and vertical steering range,
- over different beamforming directions within the IMT base station horizontal and vertical steering range, and
- over the specified vertical angle range $\theta_L \le \theta < \theta_H$.

NOTE 2: An IMT base station shall comply with the specified limits on expected e.i.r.p. spectral density for all mechanical tilts with which it can be deployed, taking into account *considering m)*.

NOTE 3: See the Annex to this Resolution for additional details on how the expected e.i.r.p. can be calculated for this frequency band.



RES220

ADD

RESOLUTION 220 (WRC-23)

Terrestrial component of International Mobile Telecommunications (IMT) within the frequency band 6 425-7 125 MHz

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that International Mobile Telecommunications (IMT), including IMT-2000, IMT-Advanced and IMT-2020, is the ITU vision for global mobile access, and is intended to provide telecommunication services on a worldwide scale, regardless of location and type of network or terminal;

b) that harmonized worldwide frequency bands for IMT are desirable in order to achieve global roaming and the benefits of economies of scale;

c) that identification of frequency bands allocated to the mobile service for IMT may change the sharing situation regarding applications of services to which the frequency band is already allocated, and may require regulatory actions;

d) that it is assumed that only a very limited number of IMT base stations will be communicating with a positive elevation angle towards IMT indoor mobile stations;

e) that the frequency band 6 425-7 125 MHz, or parts thereof, is allocated on a primary basis to the fixed, mobile, fixed-satellite (Earth-to-space) (space-to-Earth) and space operation services (Earth-to-space);

f) that, in the frequency band 6 650-6 675.2 MHz, radio astronomy observations are carried out under No. **5.149** for measurement of methanol spectral lines;

g) that No. **5.458** states that, in the band 6 425-7 075 MHz, "passive microwave sensor measurements are carried out over the oceans. In the band 7 075-7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the bands 6 425-7 075 MHz and 7 075-7 250 MHz";

h) that existing satellite networks of the fixed-satellite service (FSS) (Earth-to-space) are used within the frequency band 6 425-7 075 MHz, or parts thereof, and their characteristics may evolve in the future;

i) that the frequency band 6 425-7 125 MHz, or parts thereof, is also used by other applications in the mobile service;

j) that the frequency band 7 100-7 155 MHz is allocated on a primary basis to the space operation services (Earth-to-space) in the Russian Federation, in accordance with No. **5.459**;

k) that the frequency band 7 145-7 190 MHz is allocated on a primary basis to the space research service (SRS) (deep space);

– 429 –

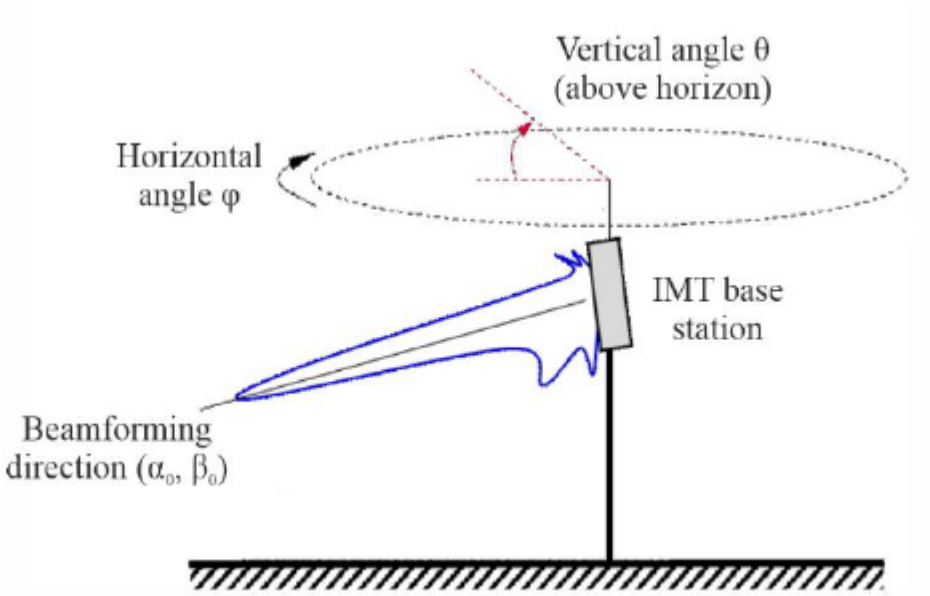
Source: ITU-R, World Radiocommunication Conference 2023 (WRC-23) Final Acts

Resolution 220 (WRC-23) – Coexistence Conditions

The e.i.r.p. of an IMT base station in the horizontal (azimuth) direction $-\pi \leq \varphi \leq \pi$ and vertical (elevation) direction $0 \leq \theta \leq \pi/2$ above the horizon can be written as $P(\theta, \varphi; \alpha, \beta)$. The parameters α and β are the horizontal and vertical beamforming directions, i.e. the angles towards which the base station electronically steers a beam. These are illustrated in Figure 1 below.

FIGURE 1

Illustration of horizontal (azimuth) angle, vertical (elevation) angle and beamforming directions



Source: ITU-R, World Radiocommunication Conference 2023 (WRC-23) Final Acts

Examples of Coexistence

C-Band	**3 400 - 3 600 MHz** **FIXED** **FIXED - SATELLITE (space -to- Earth)** **MOBILE except aeronautical mobile** 5.430A **Radiolocation** 5.431	FIXED FIXED - SATELLITE (space - to - Earth) MOBILE (except Aeronautical Mobile) Radiolocation	– Fixed wireless access – Radars Upper limit for airborne radars is 3410 MHz – Mobile applications – IMT – Ultra-Wide Band Technology Applications	The allocation of the frequency band 3 400-3 600 MHz to the mobile, except aeronautical mobile, service is subject to agreement obtained under No. **9.21** (No. 5.430A)
	3 600 - 4 200 MHz **FIXED** **FIXED - SATELLITE (space -to- Earth)** **Mobile**	FIXED FIXED - SATELLITE (space - to - Earth) MOBILE	– IMT (3600 – 3800 MHz) – Coordinated earth stations in FSS – Medium/high capacity fixed links (3800 – 4200 MHz) – Ultra-Wide Band Technology Applications	
mmWave Band	**24.65 - 24.75 GHz** **FIXED** **FIXED - SATELLITE (Earth -to- Space)** 5.532B **INTER-SATELLITE** **MOBILE except aeronautical mobile** 5.338A 5.532AB	FIXED FIXED - SATELLITE (Earth - to - Space) INTER – SATELLITE MOBILE except aeronautical mobile	– Terrestrial IMT – Fixed links – Fixed wireless access systems	The use of the band 24.65-25.25 GHz by the fixed-satellite service (Earth-to-space) is limited to earth stations using a minimum antenna diameter of 4.5 m (No. 5.532B)
	24.75 - 25.25 GHz **FIXED** **FIXED - SATELLITE (Earth -to- Space)** 5.532B **MOBILE except aeronautical mobile** 5.338A 5.532AB	FIXED FIXED - SATELLITE (Earth - to - Space) MOBILE except aeronautical mobile	– Terrestrial IMT – Fixed links – Fixed wireless access systems	The use of the band 24.65-25.25 GHz by the fixed-satellite service (Earth-to-space) is limited to earth stations using a minimum antenna diameter of 4.5 m (No. 5.532B)

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Conclusions

Terrestrial and Satellite Networks are Important

Terrestrial and Satellite Networks can Coexist

IMT use of 6GHz – socioeconomic benefits

It is Safe to Identify 6GHz for IMT

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Q&A

THANK YOU