ITU Workshop on Market Mechanisms for Spectrum Management

Next Generation Mobile Networks – Opportunities and Spectrum Implications

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T-Mobile International
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Agenda

EU Review 2006 - New approach to Radio Spectrum Policy

Today and the future:

From seamless mobility to mobile broadband

Spectrum demand to enable a successful development

Review 2006 - Spectrum Policy Overview

European Commission: Flexibility and Efficiency need to be improved

Objectives of EC

- **Access to radio resources**
- **More freedom to spectrum usage**
- **Coordinated approach to spectrum management at EU level**

Measures

- **General authorizations as baseline approach**
- **Individual licensing only as exception → risk of harmful interference**
- **Shift towards a market-based approach (if individual rights are applied, the aim is to be least restrictive)**
- **Spectrum Trading**

- **Technology Neutrality**
- **Service Neutrality**

⇒ **Refarming**

- **Possibility of agreeing common authorization conditions in appropriate cases**
- **Decision mechanism for coordinated spectrum management**

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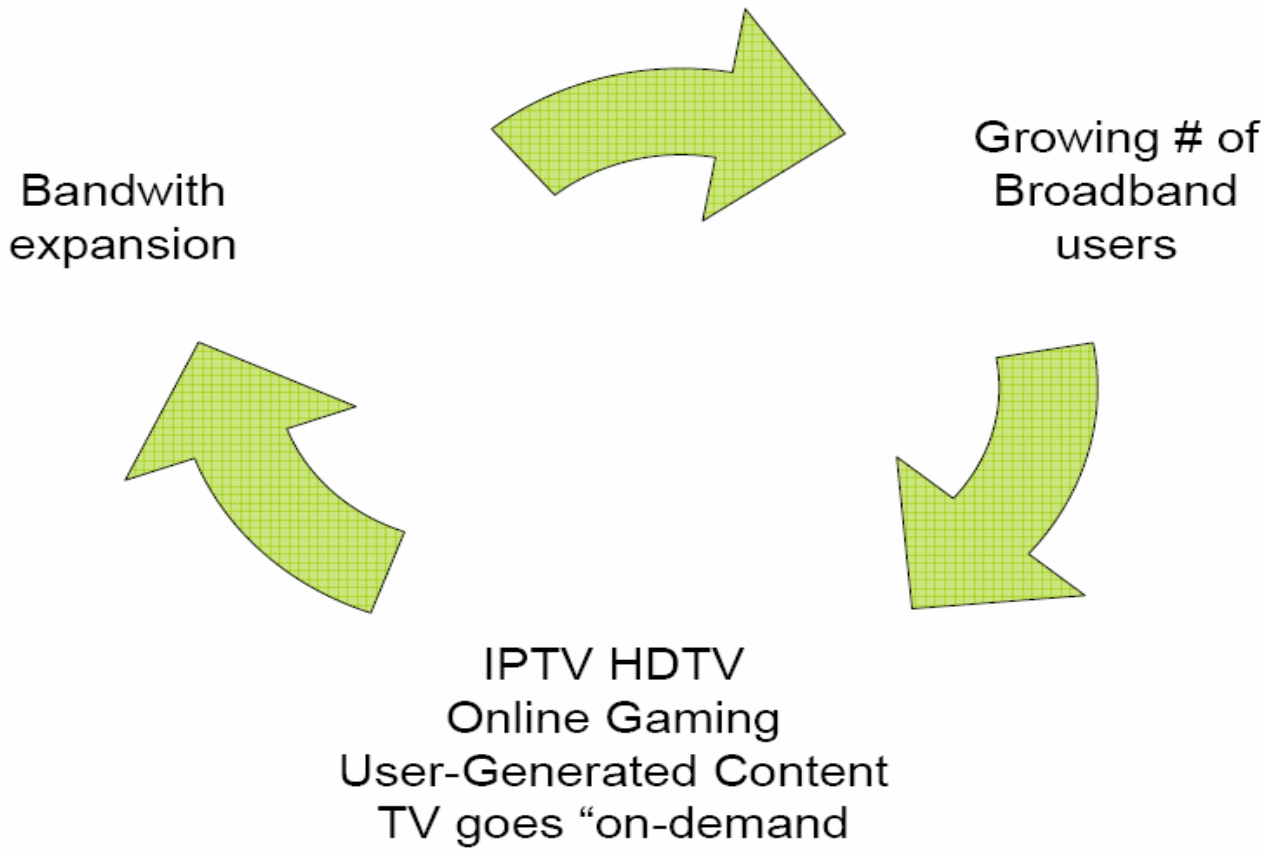
The world of multimedia today
Seamless mobility

- Based on GPRS, UMTS, EDGE and W-LAN, four powerful mobile technologies for mobile data transmission
- The aim is to achieve integrated communications across all four multimedia networks
- T-Mobile deploys the four technologies in such way that they complement each other meaningfully – for the benefit of the customer
- EDGE (Enhanced Data for GSM Evolution) allows access to applications in the Internet and intranet at up to four times the speed of ISDN in places not yet reached by the UMTS network
- High speed UMTS: With the HSDPA (High Speed Downlink Packet Access) technology, a new generation of mobile phones supports data transmission at DSL speed

The Future: The Broadband „Perpetuum Mobile“



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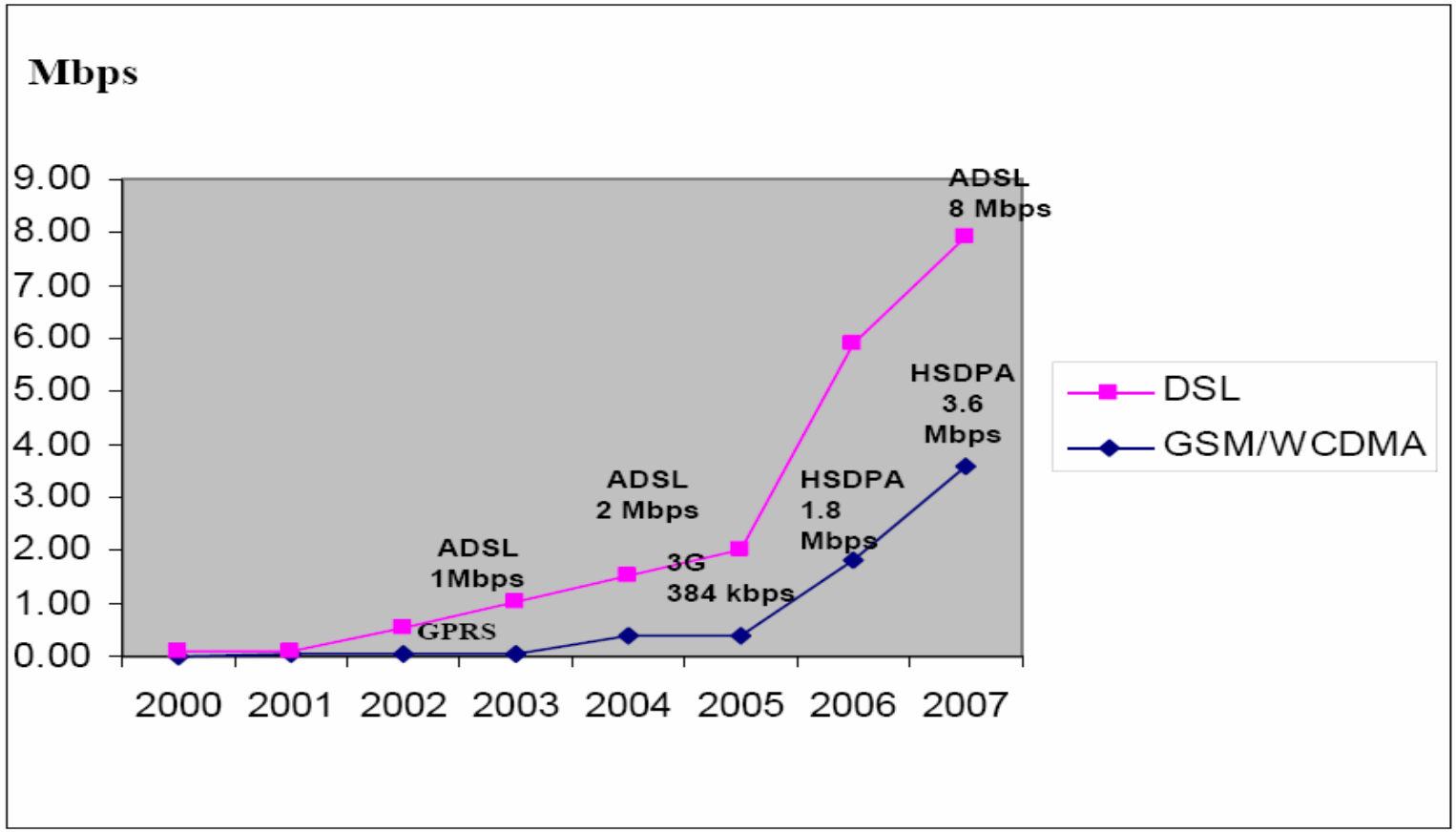
The Future: DSL Performance Defines User Expectations



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The Future: From GSM to IP-based LTE

Year

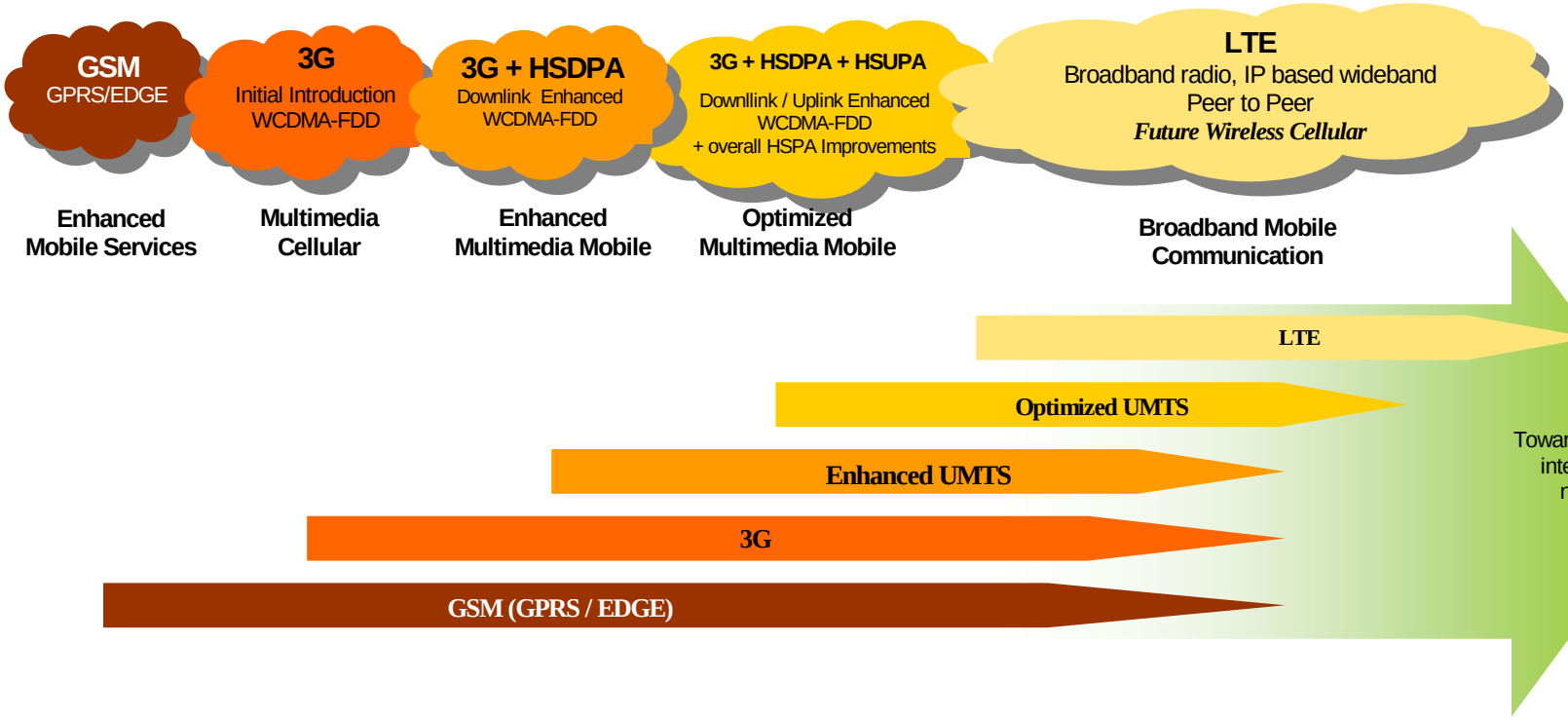
2002 – 3	2003 - 4	2005 - 6	2007 – 9	Next decade
64 – 144 kbps	64 – 384 kbps	0.384 – 4 Mbps	0.384 – 7 Mbps	20+ to > 50 Mbps

DL Throughput

Peak data rate reference values in good radio conditions

HSPA= HSDPA + HSUPA

LTE = Long Term Evolution



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Success Factors for “LTE” the Evolution of the IMT 2000 Mobile Standard

Technical Success Factors

More capacity – highest possible spectral efficiency

Spectrum and bandwidth flexibility to accommodate deployment flexibility

20 MHz Blocks at minimum

Flat all-IP architecture with full multi-vendor “plug and play” capability

High levels of throughput alongside low levels of latency

End-to-end Quality of Service (QoS) – full network resource control

Integrated network security and encryption and differentiated Quality of Service

Backward compatibility with legacy networks and ability to eventually replace those

Economic Success Factors

Cost per bit -- comparable to xDSL, at introduction and over time

Maximum reuse of existing assets – sites and site infrastructure

Minimal hardware changes – software defined evolution including radio

Easy to maintain and operate – self configuration and optimisation

A workable IPR regime – transparent, capped, ex-ante regime

Sufficient affordable spectrum

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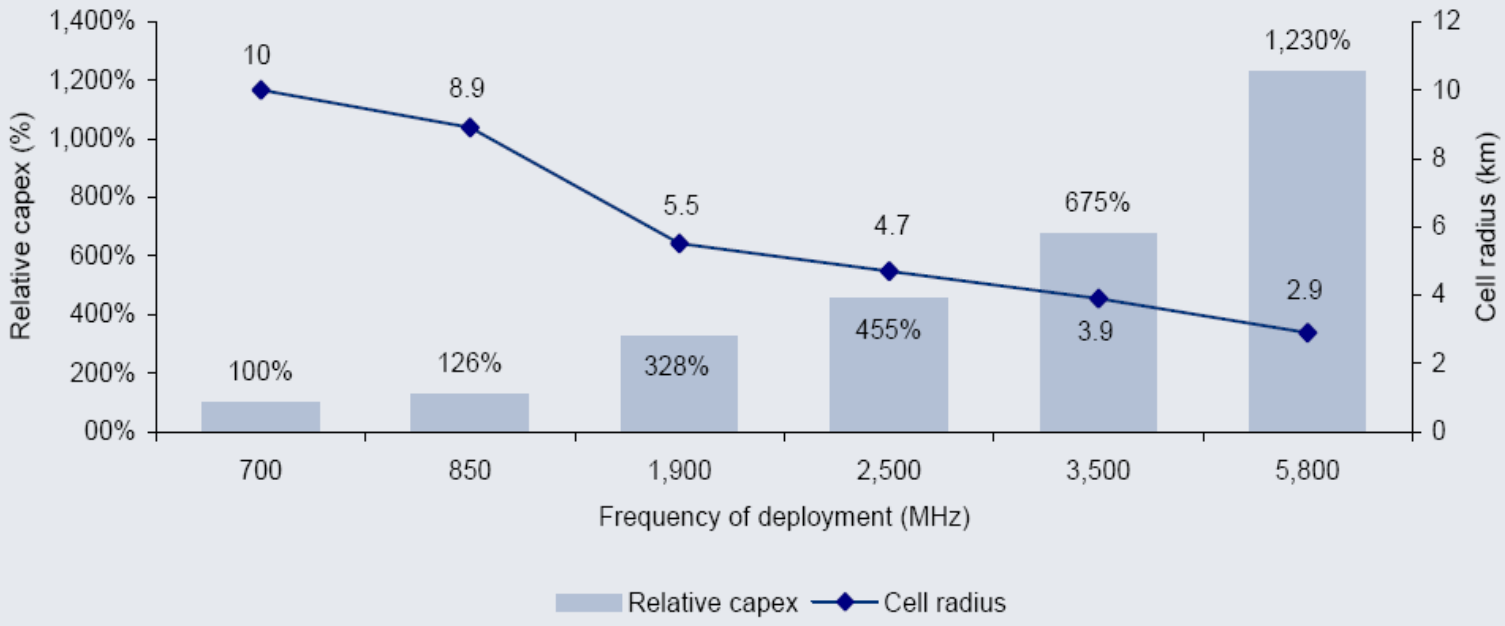
A side glance: Why lower frequencies are better…

Fig 6 The importance of frequency and the trade-off between capex and coverage



Note: Capex comparison as a function of deployment spectrum in a suburban environment

Source: Intel analysis

- **Lower frequencies deliver higher capacities over wide areas**
- **With increasing frequencies the costs increase**

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Spectrum Demand for LTE

- Evolution on top of today's 3G/3.5G radio interface
  - For multimedia applications and fast internet access user data rates of up to 100 Mbps at low mobility and 10 Mbps in full mobile environment are required
- OFDM modulation most likely (at least for downlink)
- The system should generally be capable of using the existing 3G spectrum
  - 2 * 20 MHz contiguous spectrum per carrier (and per operator) required
  - Carrier bundling possibly necessary
- Network economy requires reuse of existing sites
  - Site acquisition becomes more and more an issue
  - Operating frequency should therefore not exceed today's frequencies

- For an economical deployment in less dense areas low frequencies (<1 GHz) are needed to avoid "digital divide"

Where to find 2 * 20 MHz Spectrum for LTE ?

- UMTS core band spectrum
  - Allocated, mostly 2 x 10 MHz per operator
  - Limited flexibility to shift to other frequency blocks
  - 2 x 15 … 20 MHz contiguous spectrum per operator is impossible
- UMTS extension band
  - 2 * 70 MHz of FDD spectrum are ideally suited for 3.9G system, but are not sufficient for 4 or more competing 3G operators
- GSM 900 band
  - Refarming for a 20 MHz carrier is impossible without completely removing one or more GSM networks (even with E-GSM bands)
- GSM1800 band
  - Theoretically refarming with 3.9G possible if operators own significantly more than 2 * 20 MHz
  - Additional investment for the transition phase to shift the GSM traffic into other bands needed (if other bands would be available)
- UHF band allocated for broadcast (Region 1); sufficient amount of spectrum for broadcast and other usage, definition of a harmonized sub-band necessary

Use of digital dividend – possible WIN-WIN situation

Digital switchover broadens capacity of channels by factor 4

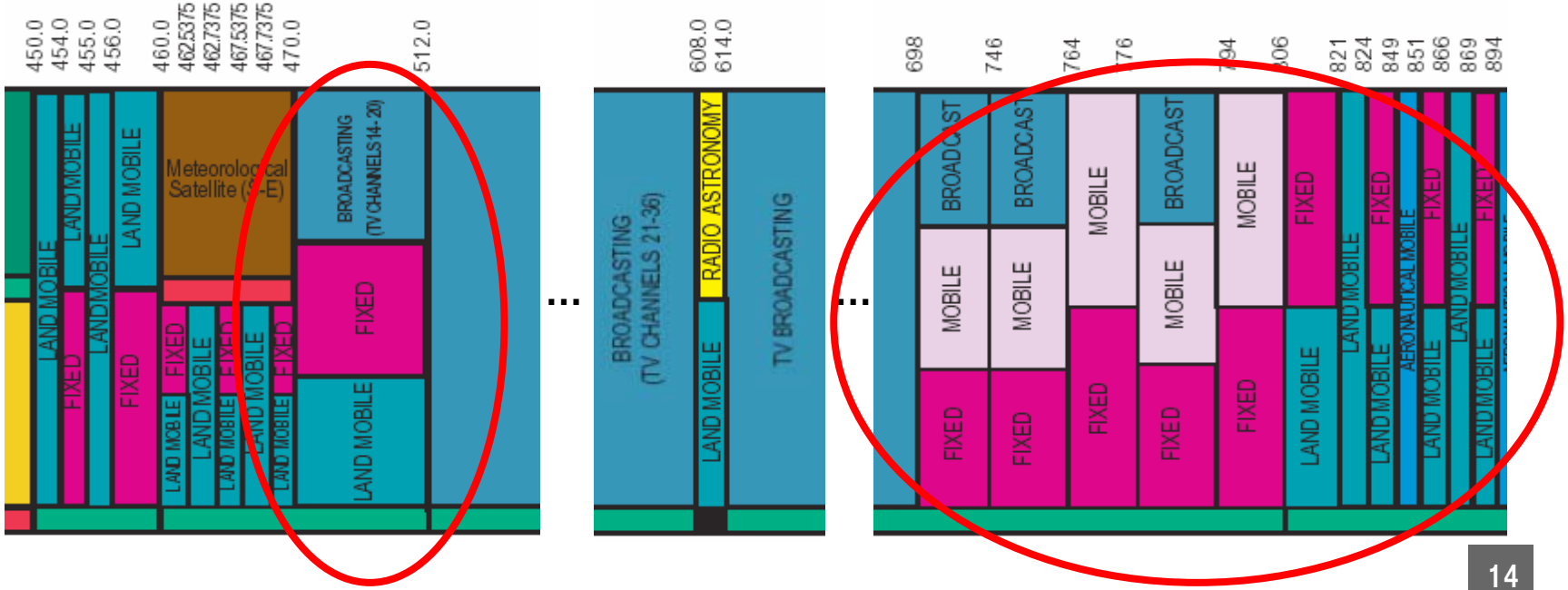
Demand for mobile services will rise (at the latest in about 10 years, see EC FMS study)

If spectrum allocation would foresee flexible usage, demand could make the decision between broadcast or mobile use

The US-spectrum allocation is an example

Possible outcome: Broadcasters gain more “channels” and mobile operators get more “spectrum”

Excerpt from the US spectrum table:



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Spectrum to reduce “digital divide”

- Goal of i2010 initiative: Broad geographical access to broadband
  → reduction of the “digital divide” in Europe

- Economic realization is only possible with wireless systems
- Only a few spectrum bands are feasible for country wide coverage
- The technology of choice is already implemented in the markets: IMT and the next generations including IP-based Long Term Evolution (LTE)
- Political and spectrum policy environment to be adjusted to gain the high goals:
  - WRC07 to identify spectrum for IMT and beyond
  - WRC07 to open viable UHF bands for mobile use
  - Identification of sub-band for mobile
  - Adjustment of radio planning mechanisms to incorporate all services depending on spectrum

Thank you for your attention.