



ITU SATELLITE WORKSHOP ON EFFICIENT USE OF ORBIT / SPECTRUM RESOURCE

Danang, Vietnam / 29 September 2015

ENSURING SUSTAINABLE & VIABLE ACCESS TO SPECTRUM FOR SATELLITE SERVICES AND IMT / 5G SERVICES

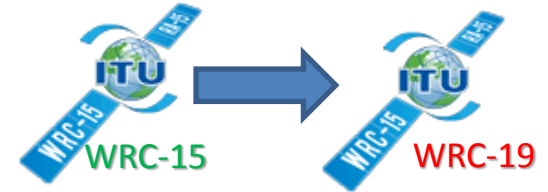
**Kumar Singarajah,
Director, Regulatory Affairs & Business Development
Avanti Communications
kumar.singarajah@avantiplc.com**



I BACKGROUND TO WRC-2015 / AI-10 5G / IMT SPECTRUM

BACKGROUND ITU WRC-2015 / AGENDA ITEM 10

- Proposal to WRC-15 made for a future agenda item for WRC-19 for additional spectrum for 5G / IMT.
- **5G/IMT request ITU to consider almost ALL frequency bands above 6 GHz for ITU-R study for future 5G/IMT !!!**

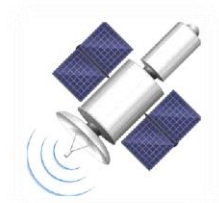


- Avanti View:
 - ✓ 5G is not only mobile technology – more than **“Cellular”**;
 - ✓ **Essential role for Satellite in 5G Ecosystem**
 - ✓ **Viable and sustainable spectrum access for satellite** systems to deliver existing and planned services.

“Wireless”;

“Cellular”;

What 5G is about



- Key Objectives for 5G/IMT
 - Very high spectrum (e.g. > 1 GHz per carrier);
 - **Globally harmonized** allocation;



RECENT MOBILE INDUSTRY INPUT ON 5G / IMT

Extract from Input By Ericsson, Huawei, Nokia Networks, Samsung Electronics to CEPT CPG
(September 2015)

*“Considering the currently proposed frequency bands **above 30 GHz by APT, CITELE and in the draft proposal of CEPT**, it is clear that there are a number of suitable bands, considering both bandwidth and availability. We see no reason to add further to the total set of bands that have been proposed, but urge CEPT to enable harmonization with other regions to the extent possible.”*

*“Regarding the **range between 6 GHz and 30 GHz** the following aspects are in our view important to consider:*

§ the expected needs for bandwidths will vary with the frequency range, and could be of the order of hundreds of MHz, which the meeting could consider to take into account when suggesting potential candidate bands;

§ different frequency ranges above 6 GHz will provide different characteristics; “lower” (6 – 30 GHz) frequency ranges can provide better propagation properties than “higher” frequencies (30 – 100 GHz) which are suited for very high bit rates through wider bandwidths for indoor and hotspot indoor/outdoor deployments;

§ keeping in mind that one step in the process still remains, the WRC-15 itself, where the number of bands will be subject to further assessments, in all likelihood; accordingly, CEPT could choose to be generous with regard to the number of bands proposed to allow for consensus based global harmonization, and

RECENT MOBILE INDUSTRY INPUT ON 5G / IMT

Extract from Input By Ericsson, Huawei, Nokia Networks, Samsung Electronics to CEPT CPG
(September 2015)

*“§ to consider to study a selection of desired bandwidths for different frequency bands in the ranges **7 GHz (e.g. 6 – 8.5 GHz), 10 GHz (e.g. 10 – 11.7 GHz), 15 GHz (e.g. 14.4 – 15.35 GHz), 17 GHz (e.g. 17.8 – 19.7 GHz) and 26 GHz (e.g. 24.25 – 29.5 GHz)**, in particular considering the progress in other regional organizations on discussions of frequency ranges below 30 GHz for ITU studies towards WRC-19.*

For instance, the range from 24.25 to 29.5 GHz has been proposed by CITELE and also supported by some countries in APT. Part of this range is also supported by some CEPT administrations.

In order to gain the benefits of economies of scale as much as possible, it is important to consider the technical feasibility of covering harmonized frequency ranges with common radio units. As a rule of thumb, a bandwidth of about 10% of the carrier frequency can be covered with one radio with reasonable complexity. This rule of thumb could be used to create tuning ranges that potentially cover more than one region.

Therefore, CPG is encouraged to support studies for the entire range so to create an opportunity for a band plan where all or significant part of the 24.25 to 29.5 GHz range could potentially be supported by one common radio, thus driving the economies of scale.”

5GPPP - MOBILE WORLD CONGRESS VISION FOR 5G / IMT

Europe's 5G vision in more detail:

- *“The consideration of any new bands for such services will require **careful assessment and recognition of other services using, or planning to use, these bands.**”*
- *“**Utilisation of new spectrum must not negatively impact the long term investments in those bands.**”*
- *“**Maintaining a stable and predictable regulatory and spectrum management environment is critical for the long term investments.**”*

MiWave Project

- *“**More specifically, targeting the 57 — 66 GHz band where up to 9 GHz of total bandwidth is available in Europe, which translates to more than 10 times currently available bandwidth**”-*

Ericsson Comment

- *“**very large amounts of spectrum and the possibility of very wide transmission bandwidths, in the order of 1GHz or even more, will only be available in frequency bands above 30 GHz**”. Ericsson– 5G Radio access Feb 2015**

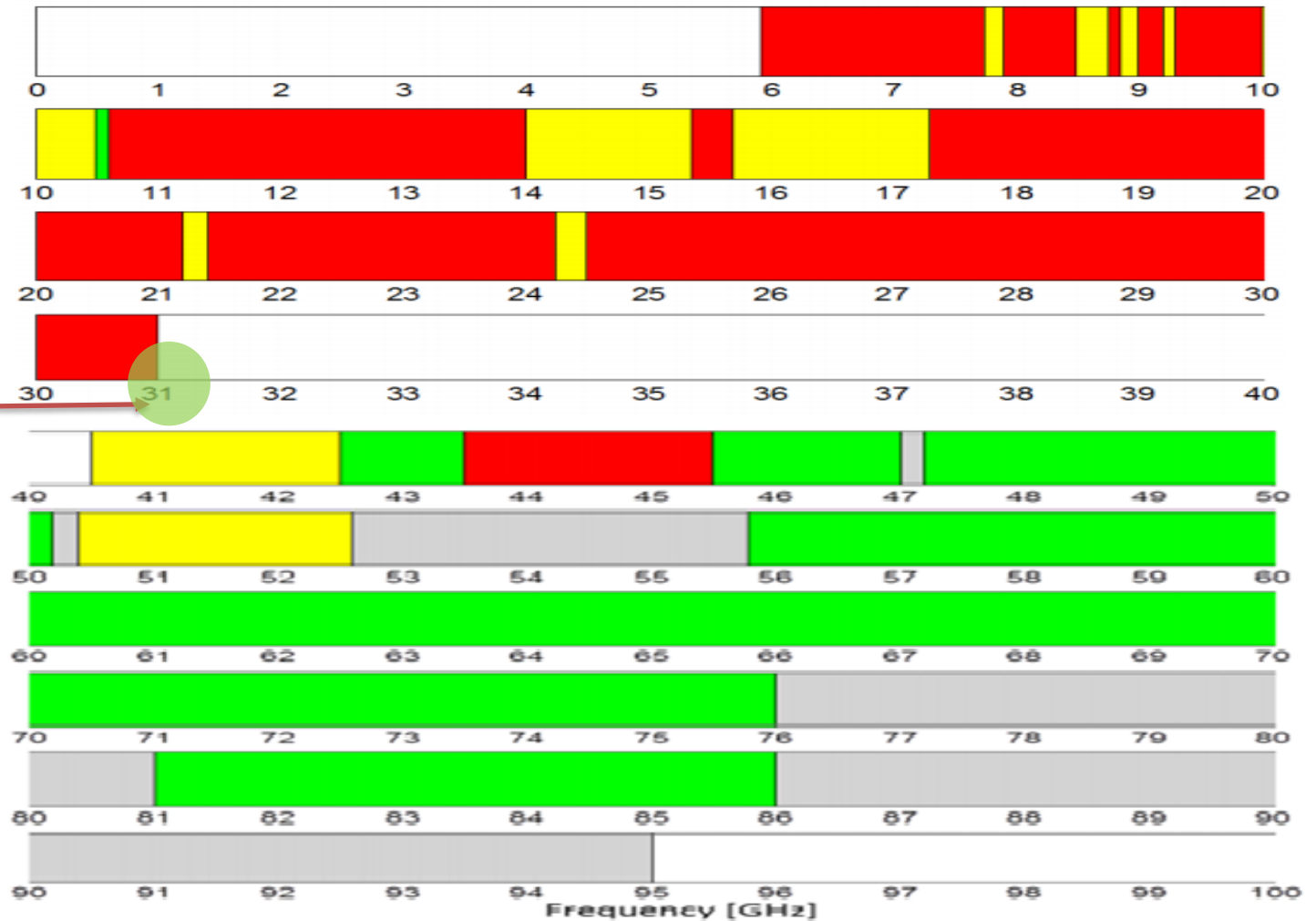
5GPPP Members: Airbus Defence and Space, **Alcatel Lucent**, ATOS, CTTC, **Ericsson**, **Huawei**, IMDEA Networks, **Intel**, InterDigital Europe, **NEC Europe**, **Nokia**, **Orange**, **Samsung**, Sequans, SES, **Telecom Italia**, **Telefonica**, **Telenor**, Thales Alenia Space, TNO, University of Aveiro, University of Bologna, University of Carlos III.

Ref: www.5g-ppp.eu/roadmaps // February 2015

BACKGROUND: EU METIS STUDY REPORT ON CANDIDATE BANDS FOR 5G

The study results show that the **High** priority frequency bands for 5G

(i.e. > 31 GHz) are more favourable for 5G from a regulatory and technical view point.





TECHNOLOGY TRIALS SHOW THAT 5G ABOVE 31 GHz & BELOW 3.4 GHz IS FEASIBLE

Samsung has tested **5G propagation at 39 GHz**. Field trials conducted “found that **39 GHz mobile base stations can sustain 100 % coverage with a 200-meter radius in high-density urban areas,**”

Ref: the FCC said. (from: <http://arstechnica.com/information-technology/2014/10/gigabit-cellular-networks-could-happen-with-24ghz-spectrum-fcc-says/>)

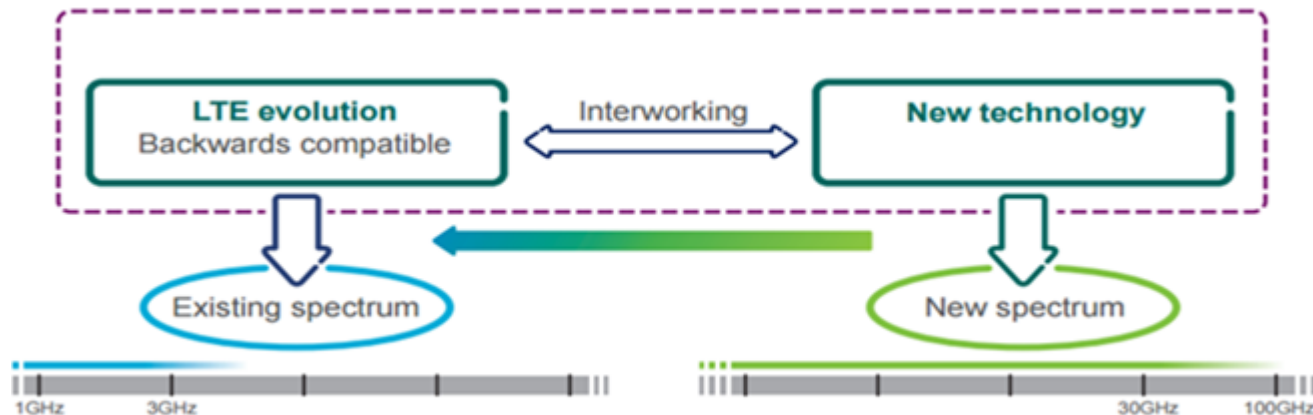
Samsung has already tested **5G RLAN systems at circa 61 GHz**. Samsung developed **60 GHz WiFi capable of 4.6Gbps, will be in devices next year**

Ref: <http://www.extremetech.com/computing/191872-samsung-develops-60ghz-wifi-capable-of-4-6gbps-will-be-in-devices-next-year>

Nokia combined spectrum from two 20 MHz carriers in the **1800 MHz and 2600 MHz** and one 10 MHz carrier in the **800 MHz** band. **Nokia achieved peak download speeds of 365Mbps** by combining 20MHz and 40MHz of TD-LTE on Qualcomm’s Snapdragon X12 LTE modem.

A SCENARIO - THE OVERALL 5G/ IMT WIRELESS-ACCESS SOLUTION

5G Technology: LTE evolution and new 5G technology



5G Coverage considerations suggests that "low-band" spectrum is needed (< 3.4 / 3.6 GHz)

5G Bandwidth requirement suggests that new "high-band" spectrum is needed (> 31 GHz)

- The possibility to introduce 5G/ IMT capabilities in a backward-compatible way, allowing 3G/4G legacy devices to continue to be served on the same carrier, is highly beneficial and, in some cases, even vital.
- Use of carrier aggregation & multi-band radios in 5G expected together with RLAN (5 GHz, 60 GHz) capability.

SPECTRUM CONCERN RELATED TO 5G / IMT

Key issue for 5G / IMT is spectrum. Where and how much? Is there another way

Spectrum demands for 5G/IMT will be significant.

[Finding harmonized spectrum for 5G/ IMT is like trying to build a new 10-lane highway through a large city. There is no way to do it without running into many, many obstacles.]

Are we heading into an WRC-2015 Agenda Item 1.1. again???

The ITU process will be **complex and prolonged.**

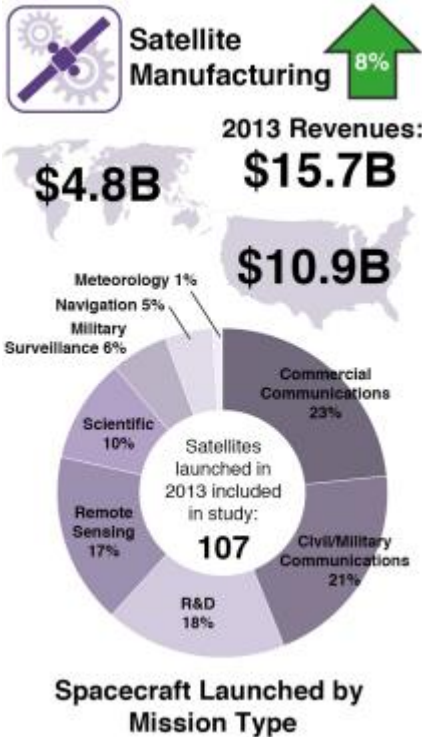
[There is simply **no easy spectrum through which to “build a 10 lane highway”**]

The best way is to identify spectrum above 31 GHz for 5G/IMT.



II GROWTH OF THE SATELLITE INDUSTRY

THE CONTINUED GROWTH OF SATELLITE INDUSTRY (INCLUDING FOR KA-BAND SATELLITE SYSTEMS)



Global Satellite Industry Revenues (\$ Billions)



As C and Ku band are becoming more and more extensively used, one will find that many new broadband and telecommunication satellites will also increasingly deploy Ka-band technology in the coming years

Sustainable & viable access to Ka-band needs to be ensured to enable future growth of satellite industry.

THE CONTINUED GROWTH OF SATELLITE INDUSTRY (INCLUDING FOR KA-BAND SATELLITE SYSTEMS)

Today, there are over **63 GEO civil Ka-band satellite systems**.
By 2020-2022 there will likely be in excess of over 100 GEO Ka-band satellite systems.

Using Ka-band (including 27.5 – 30.0 GHz)

Today, there are **2 Non-GEO civil Ka-band satellite systems**.
By 2020-2022 there will likely be 3 to 4 operational Global Non-GEO Ka-band satellite systems

Using Ka-band (including 27.5 – 29.5 GHz)

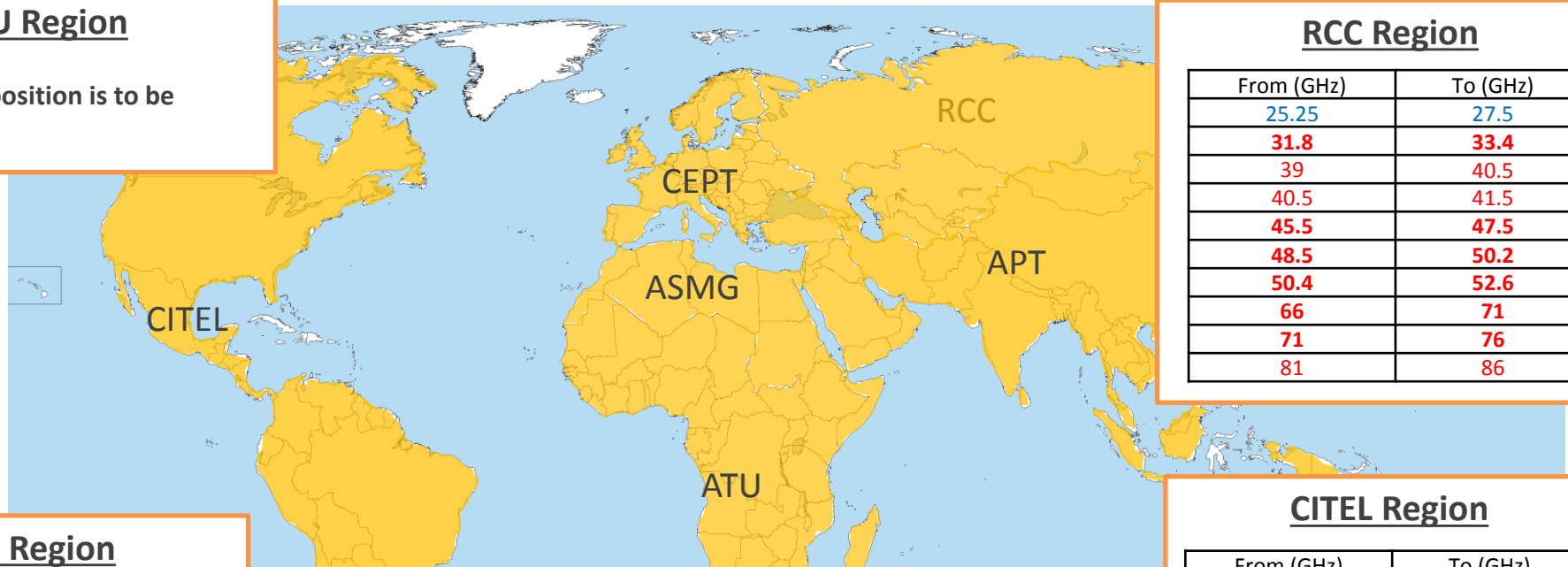
**A sustainable & viable future growth for both GEO and Non-GEO Satellite Systems
in Ka-band needs to be ensured**

III NATIONAL & REGIONAL EMERGING POSITIONS ON WRC-2015 AI10

EMERGING REGIONAL POSITIONS FOR WRC-2015 FOR 5G / IMT

ATU Region

- ATU region position is to be determined



RCC Region

From (GHz)	To (GHz)
25.25	27.5
31.8	33.4
39	40.5
40.5	41.5
45.5	47.5
48.5	50.2
50.4	52.6
66	71
71	76
81	86

CEPT Region

(approve by CEPT CPG September 14-18 ,2015)

From (GHz)	To (GHz)
24.5	27.5
31.8	33.4
40.5	43.5
45.5	48.9
66	71
71	76
81	86

APT Region

(subject to vote in September / October 2015)

From (GHz)	To (GHz)
25.25	25.5
31.8	33.4
39	47
47.2	50.2
50.4	52.6
66	76
81	86

ASMGC / GCC Region

Above 31 GHz

CITEL Region

From (GHz)	To (GHz)
10	10.45
23.15	23.6
24.25	27.5
27.5	29.5
31.8	33
37	40.5
45.5	47
47.2	50.2
50.4	52.6
59.3	76



GLOBAL SUMMARY ON WRC-2015 AI10 / BANDS FOR IMT-5G

APT Region

(subject to vote in September / October 2015)

From (GHz)	To (GHz)
25.25	25.5
31.8	33.4
39	47
47.2	50.2
50.4	52.6
66	76
81	86

CEPT Region

(approved by CEPT CPG September 14-18, 2015)

From (GHz)	To (GHz)
24.5	27.5
31.8	33.4
40.5	43.5
45.5	48.9
66	71
71	76
81	86

ASMG / GCC Region

Above 31 GHz

- .
- .
- .
- .
- .
- .

CITEL Region

From (GHz)	To (GHz)
10	10.45
23.15	23.6
24.25	27.5
27.5	29.5
31.8	33
37	40.5
45.5	47
47.2	50.2
50.4	52.6
59.3	76

RCC Region

From (GHz)	To (GHz)
25.25	27.5
31.8	33.4
39	40.5
40.5	41.5
45.5	47.5
48.5	50.2
50.4	52.6
66	71
71	76
81	86

IV

WHAT IS THE WAY FORWARD AT WRC-2015 ?

WRC-2015: PROPOSED APPROACH ON 5G/ IMT

If a future WRC-2019 Agenda Item is agreed at WRC-2015,

- 1 Ensure 5G / IMT frequency bands are **focused** to avoid an WRC-2015 AI 1.1 again.
- 2 Avoid identification to 5G / IMT in existing terrestrial & satellite bands **below 31 GHz**
- 3 Focus on allocation / identification to 5G / IMT in **relevant** bands **above 31.0 GHz**

This approach will...

- 1 Provide opportunities to accommodate 5G/ IMT in higher mmWave frequencies **above 31.0 GHz**
- 2 Avoid detrimental effect to current and future investments in terrestrial and satellite systems.

Win- Win

Spectrum to be identified for 5G/ IMT in relevant frequency bands above 31.0 GHz

