

Spectrum considerations for global broadband access

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1. Introduction

The ITU Radiocommunication Sector (ITU-R) mission is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using satellite orbits. In implementing this mission, ITU-R aims at creating the conditions for harmonized development and efficient operation of existing and new radiocommunication systems, taking due account of the interest of all parties concerned.

One of the ITU-R's primary objectives is to ensure interference free operations of radiocommunication systems. This is ensured through implementation of the Radio Regulations and Regional Agreements, and the efficient and timely update of these instruments through World and Regional Radiocommunication Conferences.

Furthermore, the ITU-R standardization process establishes 'Recommendations' intended to assure the necessary performance and quality in operating radiocommunication systems. It also seeks ways and means to conserve spectrum and ensure flexibility for future expansion and new technological developments.

2. Background

For the last 25 years, ITU has been coordinating the development of the global broadband multimedia international mobile telecommunication system, known as IMT.

Since 2000, the world has seen the introduction of the first family of standards derived from the IMT concept – IMT-2000 (commonly referred to as 3G). 3G is now widely deployed and being rapidly enhanced.

“IMT-Advanced” provides a global platform on which to build the next generations of mobile services - fast data access, unified messaging and broadband multimedia - in the form of exciting new interactive services and applications. IMT-Advanced brings major improvements over IMT-2000, including:

- increased spectrum efficiency - more users at higher data rates per radio channel
- fully packet-based architecture – reduced costs, comprehensive support for broadband wireless data
- lower latency – more responsive Internet and multimedia applications
- improved radio resource management and control – enhanced quality of service.
- new capabilities for the physical layer of the radio interface - including wideband radio channels, MIMO smart antennas and flexible deployment options.

IMT-Advanced standards will be approved by ITU's membership in early 2012. Some countries are expected to launch IMT-Advanced services in 2012, and they are expected to be widespread by 2015-2016.

3. IMT broadband standards development

The development process for IMT-Advanced, shown in Fig. 1, is similar to that used for the IMT-2000 (3G) standards.

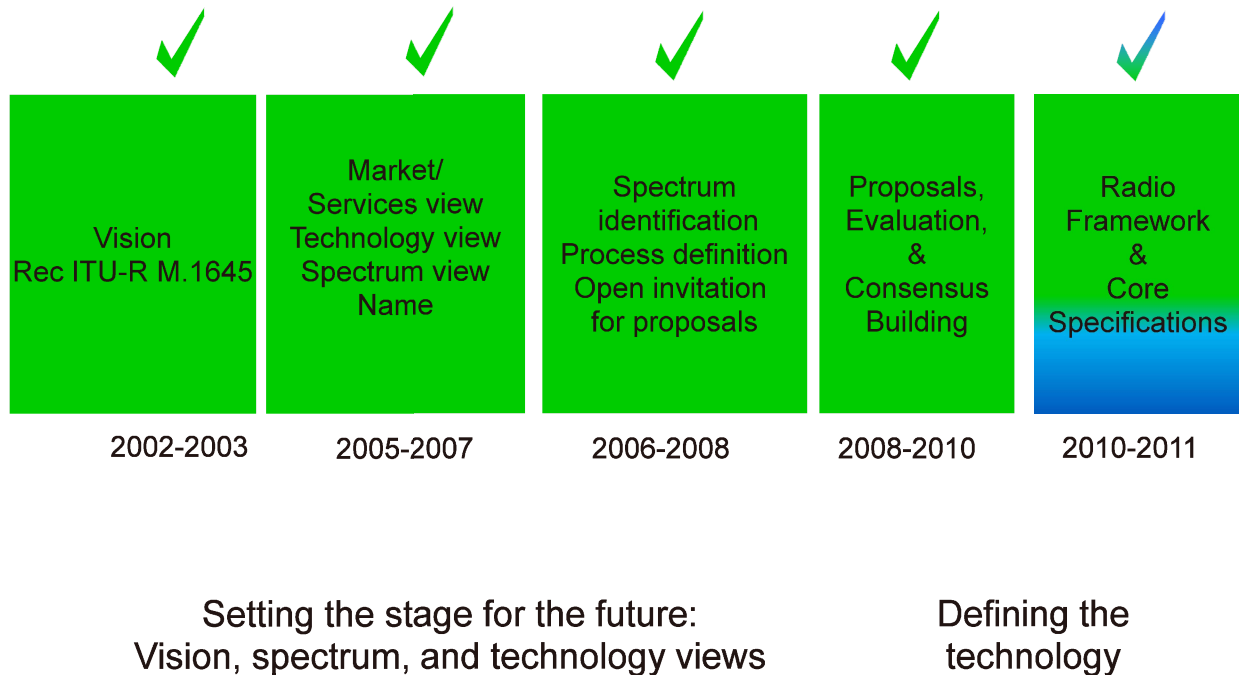


Figure 1: The IMT-Advanced process

The initial “vision” phase involved establishing the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000. This was followed by an assessment of the anticipated demand for mobile broadband and of the types of service that would be provided. The amount of radio frequency spectrum required was then calculated, taking into account anticipated improvements in spectrum utilization efficiency as a result of advances in technology.

With this spectrum requirement in mind, ITU conducted a review of suitable frequency bands and at the World Radiocommunication Conference 2007 (WRC-07) it sought to have additional frequencies identified in the International Table of Frequency Allocations (Article 5 of the ITU Radio Regulations) for use by IMT systems. These spectrum considerations will be addressed in more detail in the following section.

The next phase of the IMT-Advanced process involved an open invitation for proposed candidate radio interfaces. Six proposals aligned around the 3GPP LTE Release 10 and beyond technology and the IEEE 802.16m technology were received. Following evaluation by 14 independent evaluation groups and harmonization of these proposals, ITU selected two radio interfaces for IMT-Advanced: “LTE-Advanced” and “WirelessMAN-Advanced”. The detailed specifications for these radio interfaces are now being finalized in ITU-R and are to be formally approved by ITU’s membership in early 2012.

4. Spectrum identified for IMT

The following frequency bands have been identified for IMT in the Radio Regulations (RR). This identification does not preclude the use of these bands by any application of the services to which they are allocated or identified and

does not establish priority in the RR. The Regional variations for each band are described in the different footnotes applying in each band, as shown in Table 1.

Table 1: Bands identified for IMT and associated footnotes

| Band (MHz) | RR Footnotes identifying the band for IMT |
|-------------------|--|
| 450-470 | 5.286AA |
| 698-960 | 5.313A, 5.317A |
| 1 710-2 025 | 5.384A, 5.388 |
| 2 110-2 200 | 5.388 |
| 2 300-2 400 | 5.384A |
| 2 500-2 690 | 5.384A |
| 3 400-3 600 | 5.430A, 5.432A, 5.432B, 5.433A |

Also, administrations may deploy IMT systems in bands other than those identified in the RR, and administrations may deploy IMT systems only in some or parts of the bands identified for IMT in the RR.

The bands 1 885-2 025 MHz et 2 110-2 200 MHz were the first bands to be identified for IMT-2000, and thus these are the most commonly used. The frequency bands at around 900 MHz and 1800 MHz were originally used for 2G mobile systems, but they are now increasingly being used for IMT systems. The band 2 500-2 690 MHz has now been licensed in many countries, particularly where spectrum has already been assigned to other operators at lower frequencies. The band 450–470 MHz was identified for IMT at the World Radiocommunication Conference 2007 (WRC-07), primarily because at these frequencies it is possible to provide coverage in remote and sparsely populated areas. The 698-960 MHz, 2 300-2 400 and 3 400-3 600 MHz bands were also identified for IMT at WRC-07 – as such, they are relatively little used at present, but they are expected to play an important role in implementing IMT-Advanced in the future.

To the extent possible, ITU-R has sought to harmonize the use of these bands on a global basis, although in some of these bands and in some parts of the world such harmonization has not been able to be achieved due to conflicting requirements for other radio services. This is particularly the case in the 698-960 MHz and 3 400-3 600 MHz bands which have been identified only in some regions and countries and in some cases in different sub-parts of the bands. ITU-R is currently finalizing detailed channel arrangements for these bands and is also conducting studies to facilitate sharing between IMT and other services operating in these bands.

5. Future spectrum needs

While the level of voice traffic on mobile networks is growing at a relatively constant rate, we are now witnessing a very rapid increase in the volume of data traffic. This increase is being accelerated by the introduction of a growing array of advanced multimedia devices and applications.

Although additional frequency bands for IMT were identified at WRC-07, the overall amount of spectrum identified represents only about half of the amount spectrum estimated as being required by 2020 in the ITU studies. Also, as noted above, in some cases harmonization of the bands on a global basis has not been achieved.

There is a long lead time involved in identifying suitable spectrum at the international level, making the spectrum available at the national level and actual system deployment. Consequently ITU-R has commenced an “Analysis and

assessment of global broadband wireless services and marketplace for IMT". A key component of that assessment will be to review the original spectrum estimates developed in preparation for WRC-07 to see whether those forecasts are now being realized or exceeded. A series of ITU regional workshops to further this work are planned in 2011, and the study is expected to be finalized around the end of 2011.

In terms of possible changes to the Radio Regulations to support the demand for global mobile broadband, it should be noted that the timing between WRC's is around 3-4 years, and that the agenda of a WRC is developed by the preceding WRC. Consequently a number of ITU Member States are now considering proposals for the forthcoming WRC-12 to add an item to the WRC-15 agenda to address future spectrum requirements for global mobile broadband.

6. Conclusion

ITU plays a leading role in establishing the standards and spectrum arrangements for the current IMT-2000 (3G) systems and for "IMT-Advanced", which provides the global platform for the next generations of mobile broadband services. It is now timely to review the initial forecasts of spectrum requirements that were made and to assess what further actions may be required to realize global mobile broadband's vast potential to connect the world. This review is being addressed in the ITU-R's Study Group and Conference activities.