UMTS Forum

A view of the future

Spectrum for future developments of IMT-2000 and IMT-Advanced

UMTS Forum views on the ITU WRC-07
Agenda Items 1.4 and 1.9

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Mobile broadband deployment status

Rapid growth in the uptake of IMT-2000 services continues globally, with around 200 3G/UMTS networks now operating commercially in more than 80 countries. As of end September 2007, there were over 160 million subscribers to 3G/UMTS networks.

More than 135 mobile operators have already deployed HSDPA (High Speed Downlink Packet Access) commercially, giving their customers access to even higher data rates and exciting new service possibilities. Of this total, a growing number of HSDPA networks support the higher bit rate of 3.6 Mbps. Global HSDPA subscriptions, meanwhile, were approaching 8 million by end September 2007.

In the same timeframe, around ten operators had introduced HSUPA (High Speed Uplink Packet Access) networks, providing a corresponding boost to uplink data speeds.

There is already an extensive choice of more than 700 WCDMA devices. This includes around 300 HSDPA devices spanning handheld terminals, PC cards, USB modems and notebook PC cards with embedded SIM cards.

Preparing for WRC-07: UMTS Forum inputs

A number of Forum studies and reports have been used in preparation for WRC-07 Agenda Item 1.4:

- Study for CEPT/ECC/TG4: *"Creating a 112 MHz sub-band within UHF band for Mobile Services" (September 2007)*
- Report 40 *"Development of spectrum requirement forecasts for IMT-2000 and systems beyond IMT-2000 (IMT-Advanced)"* (December 2005)
- Report 38 *"Coverage Extension Bands for UMTS/IMT-2000 in the bands between 470-600 MHz"* (January 2005)
- Report 37 *"Magic Mobile Future 2010-2020"* (April 2005)
- Report 35 *"Mobile Market Evolution and Forecast: Long term sociological, social and economical trends"* (June 2004)
- Report 33 *"3G Offered Traffic Characteristics"* (November 2003)
- Report 31 *"UMTS Next Generation Devices"* (January 2004)

Mobile market growth will remain strong

In 2003, UMTS Forum Report 33 estimated that mobile traffic will have doubled by the year 2010. Furthermore, Report 37 estimated for the year 2020 that total daily traffic will be as much as 23 times greater than traffic in 2012. New networks and more spectrum will be needed to deliver such traffic.

The calculations in ITU-R Report M.2078 resulted in two total mobile spectrum requirement figures for year 2020, one for a 'lower market' scenario and one for a higher market. The spectrum requirement for the lower market is 1280 MHz, and for the higher market 1720 MHz.

The UMTS Forum conducted an alternative study about the future mobile spectrum requirements based on a different calculation model than the ITU-R. The UMTS Forum results, based on the traffic estimates in UMTS Forum Report 37 and EU FMS studies, are shown in Figure 1.

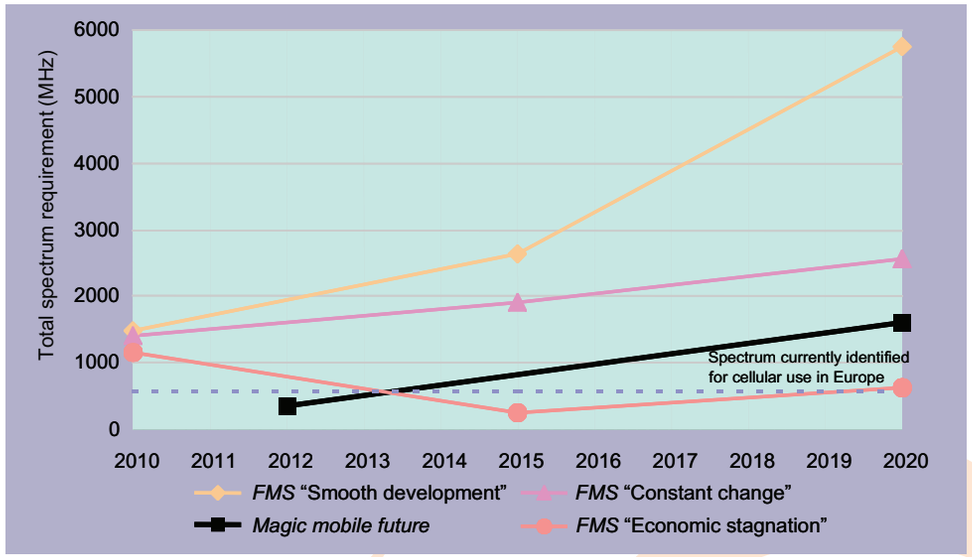

Figure 1: Spectrum requirements calculated using spectrum forecasts in Europe, UMTS Forum Report 40 (based on market studies in UMTS Forum Report 37 'Magic Mobile Future' *and EU FMS-study[1])*

The results – both in ITU-R and the UMTS Forum – show clearly that significant additional mobile spectrum is needed beyond that identified for IMT-2000 at WARC-92 and WRC-2000.

Spectrum bands should be globally common and be identified below 5 GHz

It is expected that IMT-Advanced technologies will be about 10-15 times[2] more spectrally efficient than today's mobile technologies. In addition, the cellular industry is developing new concepts – such as Flexible Spectrum Use (FSU) – that would allow enhanced sharing capabilities and higher overall spectrum efficiency. However, these developments cannot alone address forecasted spectrum demand. The expected improvement in spectrum efficiency is not high enough to fulfil the traffic needs. Furthermore, so-called cognitive radio/network technologies will not be available to solve this issue in the foreseen future.

[1]Available at www.jrc.es. The estimations of the FMS Study cover mobile, nomadic and broadcasting environments, i.e. all four RAT (Radio Access Technologies) groups identified by ITU-R WP8F.

[2]Based on the figures in ITU-R WP8F Reports M.2078[IMT.ESTIMATE] and M.2074[IMT.RADIO_ASPECTS]

The requirement of harmonised spectrum therefore remains important for the next decade and beyond.

The global spectrum harmonisation and the regulatory clarity achieved for IMT-2000 at WARC-92 and WRC-2000 have resulted in many successful UMTS/IMT-2000 deployments to the benefit of consumers globally who enjoy affordable services and terminal devices. The UMTS Forum view is that current footnotes and resolutions in ITU Radio Regulations should be retained.

WRC-07 is the right time to identify the new spectrum for IMT

For WRC decisions, it has typically taken around a decade between the time when the spectrum is identified and when it is made available/licensed. A WRC-07 decision would enable IMT-Advanced deployment in the timeframe of 2015-2020. This is the right timing, based on the ITU studies and on the UMTS Forum's own market studies.

Frequency band 3.4 – 4.2 GHz: a solution for the capacity demand

The 3400 – 4200 MHz band offers the best potential to fulfil most of the expected capacity demand due to its size. This band could also accommodate IMT-Advanced systems which are envisaged with large carrier bandwidths up to 100 MHz.

Currently the band 3400 – 4200 MHz is allocated for and used by FSS (Fixed Satellite Service) and FS (Fixed Service) systems, including Fixed Wireless Access. Identification of the band for IMT has to take the possible future FSS usage into account.

It is either possible that IMT-Advanced and FSS both use the same band by utilising geographical and frequency domain separation or that band segmentation is used. The possibility to use the same band is shown in Figure 2 opposite.

The draft new report "Sharing between IMT-Advanced systems and the Fixed Satellite Service in the 3400 – 4200 and 4500 – 4800 MHz frequency bands" has recently been finalised by the ITU-R. The study addresses co-channel and adjacent band interferences and saturation of the LNA (Low Noise Amplifier) of the FSS receiver due to IMT-Advanced emissions within the receive bands of LNAs.

The study concludes that in such cases an exclusion zone will be needed around the FSS Earth Stations (ESs) ranging from less than 1 km to several hundreds of kilometres. It is noted that several mitigation techniques can be used to minimise the size of the exclusion zones and these mitigation techniques are not taken into account in the ITU-R studies.

As each FSS Earth Station receives using only a small portion of the whole band 3400 – 4200 MHz (typical range of FSS ES receiver carrier bandwidths is 4 kHz – 72 MHz), it should be noted that the remaining part of the full band could be used by IMT-Advanced networks inside the exclusion zones. Of course if multiple exclusion zones would overlap, all bands actually in use by the FSS Earth Stations would be unavailable for IMT-Advanced.

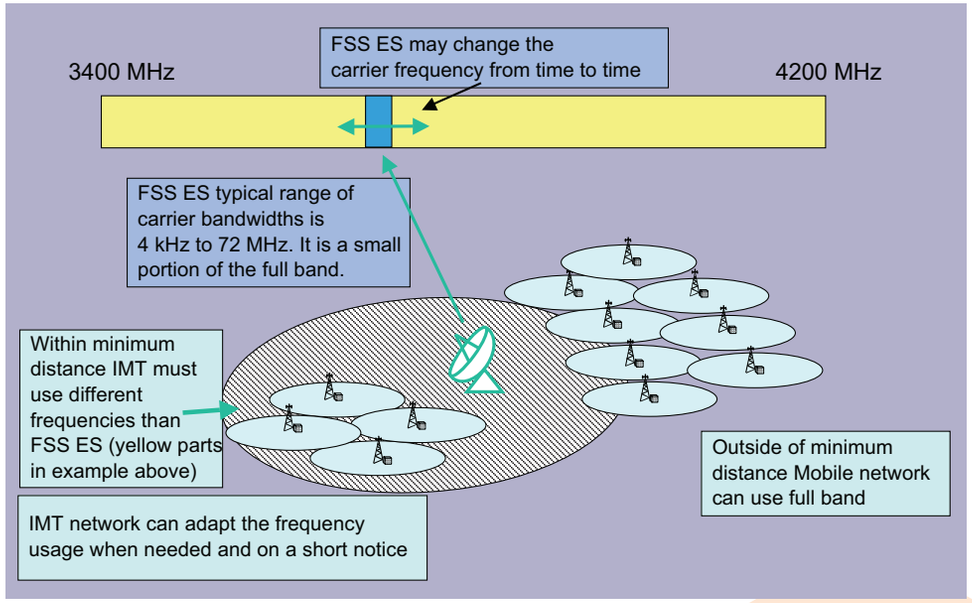

Figure 2: Separation between IMT and FSS both in geographical and frequency domains. Sources: ECC Report 100, ITU-R Doc 8/185, WINNER deliverables at www.ist.winner.org.

However, for example in Europe there are only a few locations where several exclusion zones would overlap, and even in those cases still only a portion of the full band would actually be used by the FSS earth stations receivers – leaving the rest available for mobile use. Furthermore, in several European countries there are wide areas where there would be no exclusion zones due to the small number of FSS earth stations in use. In those areas there would be no limitations for IMT-Advanced from the FSS usage.

In some countries there are only a few FSS ESs and the locations and the operation frequencies of them can be determined by regulatory or technical means. In some other countries, though, there are thousands of ESs in place whose locations and technical characteristics are unknown.

If the location of the FSS ESs and their characteristics cannot be determined, then one possibility to allow deployment of IMT-Advanced could be band segmentation. Even a limited globally common identification would allow those countries to have some degree of IMT-Advanced deployment. The ITU-R spectrum requirement estimates indicate the predicted overall spectrum need by the year 2020. Also, the deployment of IMT-Advanced networks is expected to happen some time around the year 2015. All this may allow using the band segmentation in a timely manner.

Frequency band 470 – 862 MHz: extending mobile coverage

GSM subscriber numbers, traffic and coverage are increasing strongly in the global scale. However, in 2007 many growth markets still have mobile coverage limited to main cities. These markets should be particularly addressed in the short-term with optimised and enhanced GSM and IMT-2000/UMTS solutions for affordable provisions of voice, text messaging and Internet connections. In the medium and longer term, there is a need for very cost effective IMT-2000/UMTS coverage solutions, business models and affordable devices.

The UMTS Forum has studied the alternative planning possibilities for the UHF band in Europe so that, at the same time, the current number of digital TV layers, as in the GE-06 plan, could be provided and also a harmonised digital dividend of around 100 MHz could be found, when anologue TV has been switched off. A harmonised sub-band identified for IMT would allow efficient solution in terms of coverage and it would also provide the best feasible way to facilitate successful IMT-2000/UMTS and IMT-Advanced deployments.

Views concerning the 2.6 GHz band and Agenda Item 1.9

With over 160 million IMT-2000/UMTS subscribers globally and growing fast, the UMTS Forum believes that the band 2500 – 2690 MHz will be extremely important for the extension of capacity of IMT-2000/UMTS networks to offer evolving services in the next few years.

The 2.6 GHz band will also offer a unique opportunity for the deployment of enhanced IMT-2000/UMTS, like LTE (Long Term Evolution) in channels of up to 20 MHz, allowing the provision of very high data rate services. A globally common channelling arrangement for the 2.6 GHz band is equally of extreme importance since it enables economies of scale while allowing interference free operation and global roaming.

The harmonised global band plan should comprise 2x70 MHz of paired spectrum (for FDD operation) and 50 MHz of unpaired spectrum (for TDD or FDD downlink operation). This would give ample spectrum to facilitate both FDD and TDD operations and a flexible support of asymmetric traffic situations. Any guard band should be kept to a minimum and taken from the unpaired spectrum. CEPT and CITEL have already adopted such a harmonised band plan.

With regard to sharing with satellite services, the current ITU-R regulations of power flux density (PFD) limits applicable to space services will lead to significant interference with IMT-2000/UMTS systems considerably above the appropriate sharing criteria. It is therefore necessary to tighten these limits to protect terrestrial IMT-2000/UMTS systems, allowing for the cost effective developments of IMT-2000/UMTS and IMT-Advanced.

Therefore the UMTS Forum urges WRC-07 under agenda item 1.9 to review the regulatory provisions applicable to space services in the band 2500 – 2690 MHz in order to protect future terrestrial IMT-2000/UMTS services in this band.

UMTS Forum key messages for WRC-07 Agenda Item 1.4

1. Mobile market growth continues to be strong in terms of subscribers, traffic, coverage, usage of current services, as well as development of new services and applications.

2. Higher data rates enhance the mobile user experience and enable new and advanced services leading to increased usage.

3. In 2007, many emerging markets still have a coverage limited to main cities. Therefore, there is a need for very cost effective IMT-2000/UMTS coverage solutions, business models and affordable IMT-2000/UMTS devices.

4. More spectrum will be needed for the very high-data rate IMT-Advanced services and as a response to increased traffic:
   - UMTS Forum estimates over 40 times traffic volume increase from today to the year 2020
   - EU FMS Smooth Development scenario estimates 30 times increase from 2010 to 2020

5. The UMTS Forum supports the spectrum requirement of 1720 MHz, including the existing IMT-2000 spectrum, for mobile communication by year 2020 in Europe and in some other countries. This value is based on the 'higher market' scenario as in Report ITU-R M.2078, and is also supported by the Forum's own studies on the future spectrum requirement. In this case the required new spectrum amount is about 1 GHz. However, in some other countries the required new spectrum amount can be less, subject to environment and scenarios.

6. Bands for the very high data-rate IMT-Advanced services and high capacity should be globally common and below 5 GHz.

7. WRC-07 is the right time to make decisions to enable deployment of the very high data-rate IMT-Advanced services in the timeframe of 2015-2020.

8. For these reasons:
   - The candidate bands 2300 – 2400 MHz and 3400 – 4200 MHz should be allocated to Mobile Services on a primary basis and identified for IMT at WRC-07;
   - The candidate band 470 – 862 MHz should be allocated to the Mobile Service and about 100 MHz harmonised sub-band should be identified for IMT in WRC-07.

9. The UMTS Forum supports the identification of the whole band 3.4 – 4.2 GHz for IMT. IMT-Advanced and FSS can in many countries both use the full band. It will also provide flexibility in the implementation of IMT for those countries where parts of band are used for other services.

10. Spectrum identification based on a higher market setting benefits all countries by:
    - Avoiding national or regional bands, which leads to complex frequency arrangements;
    - Allowing flexibility for administrations wishing to implement IMT based on the low market setting scenario within parts of the identified spectrum bands and then benefit from global economies of scale;
    - Some countries, e.g. subject to heavy rainfall, might have the requirement for satellite services and therefore a part of the 3.4 – 4.2 GHz band could remain for the satellite usage in those countries.

11. The UMTS Forum supports a globally harmonised solution for the provision of coverage in large areas of low population density. To fulfil this coverage demand a globally harmonised sub-band, around 100 MHz should be identified for IMT in the upper part of the band 470 – 862 MHz at WRC-07.

12. The harmonisation achieved for IMT-2000 and the current footnotes and resolutions should be retained.

UMTS Forum key messages for the 2.6 GHz band and WRC-07 Agenda Item 1.9

1. The 2.6 GHz band offers a unique short term opportunity for the extension of capacity of IMT-2000/UMTS networks and the deployment of enhanced IMT-2000/UMTS, like LTE (Long Term Evolution) in channels of up to 20 MHz.

2. A globally common band plan for the 2.6 GHz is extremely important as it enables economies of scale and facilitates interference free operation and global roaming. The harmonised global band plan for the 2.6 GHz should comprise 2x70 MHz of paired spectrum (for FDD operation) and 50 MHz unpaired spectrum (for TDD of FDD downlink operation). Any guard band should be kept to a minimum and taken from the unpaired spectrum.

3. The aim of the ITU-R WRC-07 agenda item 1.9 is to review the regulatory provisions applicable to space services in the band 2500 – 2690 MHz in order to protect future terrestrial IMT-2000/UMTS and IMT-Advanced systems in the band.

4. The future deployment of terrestrial IMT-2000/UMTS and IMT-Advanced in the band 2500 – 2690 MHz must be safeguarded globally from satellite interference.

5. The regulatory provisions, earlier adopted by WRC-03, addressing the sharing between GSO (Geo Stationary Orbit) and non-GSO Broadcasting Satellite Service (sound), and terrestrial IMT-2000/UMTS systems in the sub-band 2605 – 2655 MHz could in a future WRC be considered for review in order to protect future terrestrial IMT-2000/UMTS services in this band.

6. In due course, all space services having allocations in the frequency band 2500 – 2690 MHz should be subject to the ITU-R Radio Regulations (RR) Article 21 PFD limit.

7. For WRC-07, except for Broadcasting Satellite Service (sound) in the band 2605 – 2655 MHz, all space services having allocations in the frequency band 2500 – 2690 MHz should be subject to the following Article 21 PFD limits:

-133 dBW/m^2/MHz	$0 \leq \theta \leq 5°$
-133 + 8/20*(0 – 5) dBW/m^2/MHz	$5 \leq \theta \leq 25°$
-125 dBW/m^2/MHz	$25 \leq \theta \leq 90°$

with θ the angle of arrival above the horizontal plane.

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About the UMTS Forum

Founded in 1996, the UMTS Forum is an international industry association that is committed to the success of Third Generation (3G) UMTS mobile systems and their Long Term Evolution. Bringing together players from across the mobile industry on a peer-to-peer basis, the UMTS Forum promotes a common vision of 3G/UMTS and its evolution, as well as its worldwide commercial success. Membership of the UMTS Forum is open to everybody with a commercial interest in 3G/UMTS mobile – including fixed and mobile network operators, infrastructure vendors, terminal device manufacturers, regulators, media/content providers and developers of 3G/UMTS services and applications.

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