

REPORT ITU-R M.2079

**Technical and operational information for identifying Spectrum
for the terrestrial component of future development
of IMT-2000 and IMT-Advanced***

(2006)

1 Introduction

To meet the ever increasing demands for mobile wireless communication and the expected higher data rates, as one of the initial steps, Recommendation ITU-R M.1645 defines the framework and overall objectives of the future development of IMT-2000 and IMT-Advanced. This framework is based on the global user and technology trends, including the needs of developing countries. Further ITU-R Recommendations will develop these concepts in more detail.

Based on Resolution 228 (Rev.WRC-03), WRC-03 established Agenda item 1.4 for the World Radiocommunication Conference 2007 (WRC-07) to consider frequency-related matters for the future development of IMT-2000 and IMT-Advanced. Resolution 228 (Rev.WRC-03) invites ITU-R to report, in time for WRC-07, on the results of studies on the spectrum requirements and potential frequency ranges suitable for the future development of IMT-2000 and IMT-Advanced.

Based on the above situation, ITU-R has studied frequency-related matters for the future development of IMT-2000 and IMT-Advanced as follows:

a) Report ITU-R M.2072

User demand predictions in future systems such as the amount of traffic in the year 2010 onwards were considered as input for the calculation of required spectrum bandwidth for the future development of IMT-2000 and IMT-Advanced. Report ITU-R M.2072 addresses service and user demand issues of IMT-Advanced.

b) Report ITU-R M.2074

Studies in radio aspects are also indispensable for the calculation of required spectrum bandwidth and the determination of suitable frequency ranges, taking into account technical trends and predictions of the technical capabilities and characteristics in the year 2010 onwards. Report ITU-R M.2074 provides radio-related technical information which is relevant to the preparations of WRC-07 Agenda item 1.4. It describes technical matters related to radio aspects such as requirement for technical characteristics that are needed for the spectrum requirements calculations, values of the required radio parameters, spectrum efficiency values, and suitable spectrum range preference from a technical aspect. These matters are reflected in the process to calculate the required spectrum and to determine

* For ease of use, this report uses the terminology proposed in draft Resolution ITU-R [IMT.NAME], which will be considered for adoption at the Radiocommunication Assembly 2007. It resolves:

- that the term “IMT-2000” encompasses also its enhancements and future developments;
- that the term “IMT-Advanced” be applied to those systems, system components, and related aspects that include new radio interface(s) that support the new capabilities of systems beyond IMT-2000; and
- that the term “IMT” be the root name that encompasses both IMT-2000 and IMT-Advanced collectively.

suitable frequency ranges for the future development of IMT-2000 and systems beyond IMT-2000 from the year 2010 onwards to fulfil the framework shown in Recommendation ITU-R M.1645.

c) **Report ITU-R M.2078**

ITU-R Report M.2078 addresses spectrum requirements for the future development of IMT-2000 and IMT-Advanced. The spectrum requirements were calculated with the spectrum calculation methodology defined in Recommendation ITU-R M.1768. In the spectrum calculation for the future development of IMT-2000 and IMT-Advanced new concepts are introduced including a mix of services, multiple complementary systems and radio access technique groups.

2 Scope

This Report provides useful information for administrations to consider when processing spectrum selection for the future development of IMT-2000 and IMT-Advanced in preparation for WRC-07. The selection process for candidate bands must consider compatibility, coordination and sharing with other primary services. To aid this process, the ITU-R evaluated suitable frequency ranges to fulfil the vision for the future development of IMT-2000 and IMT-Advanced.

The information contained in this Report is as follows:

- a) A listing of related ITU-R Recommendations and Reports.
- b) Background analysis on bands identified for IMT-2000 and the needs of developing and developed countries in relation to identifying possible world-wide spectrum for the future development of IMT-2000 and IMT-Advanced.
- c) A summary of related technical and user demand predictions that influence spectrum requirements and the range of radio frequencies suitable for the future development of IMT-2000 and IMT-Advanced as further detailed in Reports ITU-R M.2072 and ITU-R M.2074.
- d) A summary of estimated spectrum requirements for the future development of IMT-2000 and IMT-Advanced as outlined in Report ITU-R M.2078.
- e) A summary of the investigation on current bands usage and sharing studies results.
- f) The advantages and disadvantages of the candidate bands for possible candidate bands for the future development of IMT-2000 and IMT-Advanced.
- g) Appendix 1 – Information document reflecting the views of Administrations related to candidate frequency ranges.

3 Related ITU-R Recommendations and Reports

Recommendations:

ITU-R M.687	International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.819	International Mobile Telecommunications-2000 (IMT-2000) for developing countries
ITU-R M.1457	Detailed specification of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
ITU-R M.1645	Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000

ITU-R M.1768	Methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000
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Reports:

ITU-R M.2023	Spectrum requirements for International Mobile Telecommunication-2000 (IMT-2000)
ITU-R M.2024	Summary of spectrum usage survey results
ITU-R M.2039	Characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses
ITU-R M.2072	World mobile telecommunication market forecast
ITU-R M.2074	Radio aspects for the terrestrial component of IMT-2000 and systems beyond IMT-2000
ITU-R M.2078	Spectrum requirements for the future development of IMT-2000 and IMT-Advanced

4 Background

4.1 IMT-2000 and IMT-Advanced

IMT-2000 systems are third generation mobile systems, which provide access to a wide range of telecommunication services, supported by the fixed telecommunication networks (e.g. PSTN/ISDN/IP), and to other services which are specific to mobile users.

Key features of IMT-2000 are:

- high degree of commonality of design worldwide;
- compatibility of services within IMT-2000 and with the fixed networks;
- high quality;
- small terminal suitable for worldwide use;
- worldwide roaming capability;
- capability for multimedia applications within a wide range of services and terminals.

The capabilities of IMT-2000 systems are being continuously enhanced in line with user demand and expectations and technology trends.

The specifications for IMT-2000, are defined in Recommendation ITU-R M.1457.

Recommendation ITU-R M.1645 defines the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000. That framework is based on the global user and technology trends, including the needs of developing countries. Further ITU-R Recommendations will develop these concepts in more detail.

The ITU first identified spectrum for IMT-2000 at WARC-92, in No. 5.388 of the Radio Regulations (RR). WRC-2000 considered issues related to IMT-2000, resulting in the identification of additional spectrum for the terrestrial component of IMT-2000 in No. 5.317A and No. 5.384A. The spectrum identification for IMT-2000 at WRC-2000 was based on the total forecasted need for spectrum by the year 2010. Based on the above, the ITU identified 749 MHz of spectrum for use by IMT-2000 to include: 806-960 MHz (No. 5.317A, Resolution 224), 1 710-1 885 MHz and 2 500-2 690 MHz (No. 5.384A, Resolution 223), 1 885-2 025 MHz and 2 110-2 200 MHz (No. 5.388, Resolution 212). The pre-IMT-2000 and IMT-2000 systems in the above bands

continue to exist and have been evolving over time. However, the spectrum already identified for IMT-2000 may not be sufficient to meet the increasing demand for wireless communication, the expected higher data rates and the needs of developing countries.

WRC-03 approved Resolution 228 (Rev. WRC-03) and set an agenda item for WRC-07 to consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 and invited ITU-R to report, in time for WRC-07, on the results of studies on the spectrum requirements and potential frequency ranges suitable for the future development of IMT-2000 and IMT-Advanced.

4.2 Needs of developing countries

It is widely acknowledged that the level of economic and social development as well as spectrum availability across administrations and regions varies. For the convenience of analysis, countries can be simply divided into two categories, developed countries and developing countries. Information and communications technologies (ICT), such as IMT-2000 and IMT-Advanced have the ability to improve lifestyles, social interactions and productivity. The international trend is to use telecommunications as a means to reduce social and economic differences by enabling entire populations, despite their location and resources, to have full coverage and access to telecommunication services. ICT are also being used to optimize and increase the efficient use of scarce resources, such as spectrum.

Advanced wireless technologies can offer developing countries new opportunities and services which take into account the fast growth of teledensity, the need to balance geographic and social distribution of services, increased coverage, and improved use of suitable spectrum. In the era of globalization, the telecommunications needs of developing countries or underserved areas are similar to the needs of developed countries. However, developing and developed countries have different considerations and requirements which are often due to economic and social factors. For example, developing countries have low levels of income per inhabitant, large population densities, vast rural areas and areas of difficult geographical terrain. Thus needs of developing countries include affordable pricing of mobile services and technical solutions that enable coverage of rural areas with varied terrain characteristics. Therefore developing and developed countries may require different frequency ranges and the different amounts of spectrum over various time frames, which should be taken into account when examining potential candidate bands.

4.3 Factors to consider in analyzing potential candidate bands

The following factors are relevant to choosing potential spectrum for the future development of IMT-2000 and IMT-Advanced:

- a) the future development of IMT-2000 and IMT-Advanced are defined by a set of interdependent ITU-R Recommendations and Reports of which this Report is a part;
- b) bands currently identified for IMT-2000 may be used by existing and future systems under current allocations, including 806-960 MHz (No. 5.317A, Resolution 224), 1 710-1 885 MHz and 2 500-2 690 MHz (No. 5.384A, Resolution 223), 1 885-2 025 MHz and 2 110-2 200 MHz (No. 5.388, Resolution 212);
- c) WRC-07 will consider spectrum related issues for the future development of IMT-2000 and IMT-Advanced;
- d) The time-frame in which the spectrum will be needed in the most countries;
- e) evaluation of suitable frequency ranges including the advantages/disadvantages and the results of sharing studies;

- f) consideration of spectrum and technical solutions that enable coverage of rural areas with varied terrain characteristics such as bands below those already identified for IMT-2000 in No. 5.317A and through the satellite component of IMT-2000.

5 General considerations

To investigate possible candidate bands for the future development of IMT-2000 and IMT-Advanced in order to satisfy WRC-07 agenda item 1.4 and Resolution 228 (Rev. WRC-03) the following technical factors should be considered:

- The steady and continuous evolution of IMT-2000, which is expected to support new applications, products and services with data rates up to approximately 30 Mbit/s under optimum signal and traffic conditions.
- Possible use of the frequencies below those already identified for IMT-2000.
- For IMT-Advanced there may be a requirement for a new radio interface(s) for the terrestrial component around the year 2010. ITU-R is considering new technologies, including the “new mobile access” and “new nomadic/local area wireless access” technologies:
 - new mobile access to handle low to high mobility applications with a wide range of supported target peak data rates of up to approximately 100 Mbit/s;
 - new nomadic/local area wireless access to handle low mobility applications with a wide range of supported peak data rates up to 1 Gbit/s.

Moreover, as mentioned in Recommendation ITU-R M.1645, various other complementary access technologies (e.g. WPAN, WLAN, Digital Broadcast, and FWA) could be used in conjunction with the future development of IMT-2000 and IMT-Advanced and should be considered when examining potential candidate bands since they may impact the spectrum and service usage.

5.1 General user demand trends

The services and user demands of the future development of IMT-2000 and IMT-Advanced are fully detailed in the Report ITU-R M.2072. In particular, § 5 of the Report discusses some of the many issues and types of services that can be considered when forecasting the user demand as far as 2020. Included is the need to define services based on parameters, such as segmentation (e.g. consumer or business, adult or youth). The Report also discusses the transmission speeds expected for future mobile communications systems based on the projected growth of data access speeds in mobile and fixed communication systems. As both high performance mobile terminals and rich content become available, transmission speeds tantamount to those of fixed systems are required. This is becoming a reality with IMT-2000 systems, which offer transmission speeds of several hundred kbit/s to Mbit/s.

Enhanced technical capabilities, a wider range of available services and breadth of applications will be progressively introduced as systems evolve to IMT-Advanced. The need to provide these new capabilities at high data rates with high mobility will need to be considered when choosing potential candidate bands.

5.2 Technical issues influencing spectrum range preferences

Report ITU-R M.2074 includes detailed analysis of some of the technical issues surrounding the spectrum range preferences for the future development of IMT-2000 and IMT-Advanced. Section 5.4 of the Report highlights the following issues:

- Target peak data rates.

- Target grade of mobility.
- Target coverage range with reasonable trade-off.
- The implications of frequency ranges on mobile device power consumption.
- The availability and feasibility of required RF components within the required time frame.
- Spectrum ranges influencing technology.
- Spectrum range preference.

In summary, Report ITU-R M.2074 states that the technical issues affecting frequency range preferences are primarily based on the requirements and target characteristics for the envisioned system. The high level requirements may result in several requirements or preferences on the possible frequency bands and spectrum ranges. For example, a new radio access system, covering the full range of capabilities of IMT-Advanced is envisaged to support a wide range of data rates according to economic and service demands in multi-user environments. There will be target peak data rates of up to approximately 100 Mbit/s for high mobility such as mobile access and up to approximately 1 Gbit/s for low mobility such as nomadic/local wireless access.

It may be possible to reach considerably higher overall spectrum efficiency than today's technologies, but even under the most optimistic assumptions discussed today and in favourable radio reception conditions, the 1 Gbit/s transmission rate may require bandwidth in the order of 100 MHz or more.

With respect to preferred frequency ranges for the future development of IMT-2000 and IMT-Advanced, Report ITU-R M.2074 suggests that the new spectrum for such new technologies that can fulfil the full range of requirements of the ITU for IMT-Advanced, including both the “new mobile access” and “new nomadic/local area wireless access” as they are presented in Recommendation ITU-R M.1645 should be identified below 6 GHz due to a number of technical reasons. In particular, bands below 5 GHz allow sufficient mobility and there is an acceptable trade-off between cost and full area coverage. Availability of required RF hardware components is seen as feasible in the required timeframe and mobile terminal complexity and power consumption could stay at an acceptable level. However, some administrations believe that some of this capacity can be met in bands above 6 GHz.

For technologies aiming at covering only one of the new capabilities envisioned by the future development of IMT-2000 and IMT-Advanced, such as the “new nomadic/local area wireless access,” the technical constraints may be different, possibly resulting in different preferences about the spectrum ranges.

For example, frequency ranges above 5 GHz may be considered for this purpose, including bands identified in RR 5.446A, though the coexistence studies between RLAN and IMT-Advanced nomadic radio interface have not been carried out.

Geographic coverage is especially important to developing countries because many people who do not at present have access to mobile communications live in parts of the world where the population density, teledensity, and/or income levels are low. The favourable propagation characteristics of the frequency bands below those identified for IMT-2000 and the associated coverage advantages should be considered for the deployment of cost effective systems for large areas with low user density or where there is no existing infrastructure, which is often the situation in developing countries. Specifically the frequency bands below those already identified for IMT-2000 offer longer-range radio wave propagation characteristics than higher frequency bands and therefore would allow operators to provide IMT-2000 network coverage with a reduced number of base station sites.

6 Estimated required spectrum bandwidths

The detailed study results of the estimated required spectrum bandwidths is described in § 8 of Report ITU-R M.2078 on spectrum requirements for the future development of IMT-2000 and IMT-Advanced.

The requirements were calculated with the spectrum calculation methodology defined in Recommendation ITU-R M.1768. In spectrum calculations for the future development of IMT, new concepts have been introduced including a mix of services, multiple complementary systems and radio access technique groups.

The specific spectrum requirements relevant to the scenario of large coverage areas with low teledensity have not been addressed.

7 Bands usage and sharing studies results

Based on proposals from individual countries on frequency bands which could be considered for the possible identification for the future development of IMT-2000 and IMT-Advanced, the usage and the preliminary sharing studies results for the bands below 5 GHz are found in Table 1. It is emphasized that it should not be concluded from this Table that these bands are candidate bands agreed for the future development of IMT-2000 and IMT-Advanced.

It should be noted that nomadic applications may be accommodated in the 5 GHz bands allocated to the mobile service at WRC-03, if such use is in accordance with RR No. 5.446A and Resolution 229 (WRC-03), and in other bands above 6 GHz. Identification specifically for nomadic application of IMT in the RR may not be necessary and bands above 5 GHz were not addressed in Table 1.

Information related to the band usage is based on materials provided either in written form or verbally by the membership of ITU-R but may not represent complete information. Moreover even if complete information on the existing spectrum utilisations is available that information in no way excludes the use of the band in future by the services to which the band is allocated in Article 5 of the RR.

In accordance with *resolves* 5 of Resolution 228 (Rev.WRC-03) Table 1 contains information on those bands considered and includes the information on the results of relevant sharing studies so far available.

TABLE 1

Candidate frequency ranges, band usage (including bands currently identified for IMT-2000), and results of sharing studies so far available for identifying spectrum for the terrestrial component of future development of IMT-2000 and IMT-Advanced

Frequency range (MHz)	Band usage	Sharing studies
410-430	This frequency band is allocated worldwide to the fixed, and mobile services on a co-primary basis, however these allocations are not the only service allocations within the band. In India, the band 410-430 MHz is being extensively used for variety of public and government applications. Part of this band is also allocated and being used for digital trunk radio and digital seismic telemetry. Utilisation in CEPT is for analogue and digital land mobile, PMR/PAMR for public safety and emergency networks in some countries. This band presents complex interlacing between PMR, PAMR and civil/governmental usage. In Japan, the band 381.3-420 MHz is used for digital airport radio, anti-disaster emergency radio telephones, public services by the national government, local governments and public institutions for transportation, and for miscellaneous services by private companies. In Japan, the band 381.3-420 MHz is used for unlicensed stations such as implantable medical data transmission equipment and medical telemeters. In Japan, the band 420-430MHz is used for unlicensed low-power stations such as radiophones, data transmission equipment and medical telemeters. In New Zealand the band 410-430 MHz is allocated to the fixed and mobile service. The band is heavily used by traditional commercial and public safety mobile applications, and narrowband fixed linking applications. Sri Lanka is considering the band 410-435 MHz which is allocated to mobile and fixed service. It is currently being analyzed for mobile and/or fixed systems, including CDMA2000.	For space applications and meteorology, Annex 1 of Recommendation ITU-R SA.1236 contains one approach to evaluate protection for fixed and mobile services while for remote sensing systems Annex 2 of Recommendation ITU-R RS.1260-1 provides information on the feasibility of sharing between active spaceborne sensors and other services in the range of 420-470 MHz (this Recommendation replaces Recommendation ITU-R SA.1260-1).

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In Cameroon, Canada, Sri Lanka, Brazil and Venezuela, these bands are allocated to the fixed and mobile service. In Canada, in the band 406-430 MHz, in high density population areas, these bands is are heavily used by traditional commercial and public safety mobile services. In the United States of America, the 410-420 MHz band is allocated on a primary basis to the Federal Government for the fixed, mobile, and space research (space-to-space) services. The 420-430 MHz band is allocated on a primary basis to the Federal Government for the radiolocation service. In the USA, this band is used for ground, ship borne, and airborne long-range surveillance systems, as well as personnel location systems. Radars, which are used for national security, utilize this particular frequency band. These uses are essential for national security and public safety functions. The band, 420-450 MHz is utilized by amateur radio users on non-interference basis. The band 410-420 MHz is used for extra vehicular activity (EVA) communications by both Shuttle and International Space Station astronauts on a primary space research service. The Inter-American Telecommunication Commission – CITEL has recently approved Recommendation PCC.II/REC. 10 (V-05) on the “Use of the 410-430 MHz and 450-470 MHz bands for fixed and mobile services for digital communication particularly in low population density areas”. In Cameroon this band is allocated to the mobile and fixed service, some subscriber radio systems and private specialized mobile radio systems are operating in this band. In Slovenia, 410-430 MHz: currently: ending analogue PAMR, utilized for digital PMR/PAMR.	

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In Mexico, the band 410-430 MHz is used for point-to-point/multipoint applications. In Venezuela the bands 410-430 MHz and 450-470 MHz are allocated to fixed and mobile services. In the Russian Federation the band 420-430 MHz is used for radar applications. In China, the band 410-425 MHz is being widely used for interphone service. The band 425-430 MHz is used for aeronautical radionavigation. In Australia the band 410-430 MHz is heavily used by the land mobile service in urban locations. In the 420-430 MHz band the use of the mobile service is limited to Commonwealth, State and Territory Government purposes.	
450-470	This frequency band is allocated worldwide to the fixed, and mobile services on a co-primary basis, however these allocations are not the only service allocations within the band. In India, the bands 450.5-457.5 paired with 460.5-467.5 MHz have been allocated for cellular mobile technologies especially in rural areas. However, major portion of the band 450-470 MHz is presently used for conventional point-to-point links and mobile applications for variety of commercial and public safety applications. Utilisation in CEPT is for analogue and digital land mobile, cellular networks in some countries, PMR/PAMR for public safety and emergency networks in some countries. This band presents complex interlacing between PMR, PAMR and civil/governmental usage. In Japan, the band 440-470 MHz is used for cargo/passenger transportation services including taxi, railway and bus radio, anti-disaster emergency radio telephones, and aural program transmission by broadcasters.	For space applications and meteorology, Annex 1 of Recommendation ITU-R SA.1236 contains one approach to evaluate protection for fixed and mobile services while for remote sensing systems Annex 2 of Recommendation ITU-R RS.1260-1 provides information on the feasibility of sharing between active spaceborne sensors and other services in the range of 420-470 MHz (this Recommendation replaces Recommendation ITU-R SA.1260-1). Sharing studies between radars in the radiolocation service in the 420-450 MHz band and IMT systems in the 450-470 MHz are being progressed within the ITU-R. Preliminary results indicate that sharing between systems in the 440-450 MHz band is feasible only with mitigation. Application of mitigation techniques to IMT systems and radars is currently being studied to reduce the separation distances for sharing between IMT systems and radiolocation radars.

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In Japan, the band 440-470 MHz is used for unlicensed low-power stations such as radiophones, data transmission equipment and medical telemeters. In New Zealand the band 450-470 MHz is allocated to the fixed and mobile service. The band is heavily used by traditional commercial and public safety mobile applications. In Cameroon, Canada, Indonesia, Sri Lanka, the United States of America and Venezuela, these bands are allocated to the fixed and mobile service. In Canada, in the band 450-470 MHz, in high density population areas, these bands are used by traditional commercial mobile, broadcast auxiliary and public safety mobile services. In Canada, 30 channels of 12.5 kHz around 462 MHz and 467 MHz are assigned to licence-exempt devices (Family Radio Service & General Mobile Radio Service). The Inter-American Telecommunication Commission – CITEL has recently approved the Recommendation PCC.II/REC. 10 (V-05) on the “Use of the 410-430 MHz and 450-470 MHz bands for fixed and mobile services for digital communication particularly in low population density areas”. In the United States of America, the 450-470 MHz band is allocated on a primary basis to the fixed and mobile services for a wide variety of uses, including public safety applications. The types of systems in the band include: trunking-dispatch, conventional 2-way mobile systems, and some point to point, used for both analog and digital voice, data, and telemetry applications. Rural and urban local, state, regional, and nationwide networks are deployed in this band. This band is extensively used by a wide variety of users including: business, film and video production, forest products, electronic news gathering, manufacturers, medical, motor carrier, petroleum, power, public safety, railroad, relay press, special industrial, taxicab, telephone maintenance, etc.	Sharing studies between systems in the fixed service and non-IMT systems in the mobile service and IMT systems in the 450-470 MHz band are being progressed within the ITU-R. Preliminary results indicate that co-channel sharing between Fixed or non-IMT systems in the mobile service and IMT systems is problematic in most instances. Adoption of mitigation techniques between the IMT systems in the mobile service and systems in the fixed service or non-IMT systems in the mobile service may be required to enable sharing between the two types of systems. Sharing studies between broadcasting services in the 470-480 MHz band and the IMT systems in the mobile service in the 450-470 MHz are being progressed within ITU-R. Preliminary results indicate that sharing between IMT and broadcasting systems in adjacent bands is feasible with the use of mitigation techniques.

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In Cameroon this band allocated to mobile and fixed services, some subscriber radio systems and private specialized mobile radio systems are operating in this band. In Mexico the band 450-470 MHz is used for point-to-point/multipoint applications. In Venezuela, the band 450-470 MHz is allocated to the fixed and mobile services. In Vietnam, 450-470 MHz commercial CDMA2000 1x system is deployed. Band allocated to mobile and fixed services In RCC countries parts of this band are used by analogue public cellular NMT-450 networks, CDMA450 networks providing IMT-2000-like services, narrowband PMR systems, space operation service, Earth exploration-satellite service, radio relays which are being transferred to another band, and by other systems. In Norway, the bands 453-457.5/463-467.5 MHz are used for: CDMA2000. The rest of the band is used for PMR and maritime mobile services. In Sri Lanka the band 440-470 MHz is allocated to mobile and fixed service. Current applications in Indonesia at 450-470 MHz are for fixed and mobile services. Fixed service applications are used for radio point to point, land mobile services. For mobile services, Indonesia currently utilizes digital CDMA2000 450 MHz technology for national coverage. In China, a majority of 450-470 MHz band is used for interphone services and for wireless access technologies in rural areas. In Australia the band 450-470 MHz is heavily used by the land mobile service in urban locations.	

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
470-960	Portions of this frequency band contain allocations to the fixed and mobile services which are harmonized in large regions of the world, however these allocations are not homogenous across the three regions of the ITU and there are other co-primary allocations to other services, in particular the broadcasting service. The band 470-862 MHz is subject to replanning by the Regional Radiocommunication Conference 2006 for Region 1 and one country in Region 3. In the United States of America the 470-512 MHz band is allocated on a primary basis to the broadcasting and mobile services. The 512-608 MHz and 614-698 MHz bands are allocated on a primary basis to the broadcasting service. 470-862 MHz, utilisation in CEPT is for analogue and digital television broadcasting and services ancillary to programme making, and services ancillary to broadcasting. There is a primary allocation for mobile service in the upper part of this band in many countries especially for defence usage. In some European countries the band 645-862 MHz is also used for aeronautical radionavigation service. Within the European Union, the introduction of digital television is ongoing, and in a number of countries digital television has already been successfully introduced and in some countries spectrum has already been freed up. This is accomplished by introducing digital transmission in the currently used channel spacing. After a period during which both digital and analogue transmissions continue in parallel, the analogue TV is being switched off, which is making spectrum available for either additional TV or other services. Some countries have declared that analogue TV will be switched off before 2010 while it might stretch over an additional 10 years in some other countries. Initial deployment of mobile TV and HDTV networks in some countries is occurring.	Concerning the broadcasting service, sharing studies are currently being progressed initially from an IMT perspective to investigate sharing between IMT-2000 and systems beyond IMT-2000 applications and digital television broadcasting applications the band 470-862 MHz. Results of sharing studies presented to date based on low and medium power broadcasting transmitters show feasibilities for coexistence between IMT and broadcasting systems including DVB-T, DVB-H and ATSC with band segmentation, which may require frequency rearrangement also taking into account geographical separations. The feasibility is subject to a number of assumptions and limitations. The feasibility of sharing between IMT and high power broadcasting transmitters has not yet been fully studied. Sharing studies between Broadcasting services in the 470-480 MHz band and the IMT systems in the mobile service in the 450-470 MHz are being progressed within ITU-R. Preliminary results indicate that sharing between IMT and broadcasting systems in adjacent bands is feasible with the use of mitigation techniques.

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In the Russian Federation the band is also used for: broadcasting satellite system (702-726 MHz and 742-766 MHz), tropospheric scatter radio-relay links (475-525 MHz and 575-625 MHz), radioastronomy (608-614 MHz), aeronautical radionavigation, limited to ground-based radiobeacons (862-960 MHz). The band 470-862 MHz is used for analogue TV stations with the plan to be switched to digital TV. However, the duration of the transitional period from analogue to digital TV can be hampered taking into account the large amount of analogue stations and current use of this band by other services. In India, the band 470-806 MHz is extensively used for analog TV broadcasting. This band is identified for introduction of digital terrestrial TV broadcasting and, during the transition period, both analog and digital TV transmissions will go in parallel. Complete transition from analog to digital terrestrial TV broadcasting is expected to take considerable time. New technologies such as Digital Video Broadcasting-Handheld (DVB-H) and Digital Multimedia Broadcasting (DMB) are also likely to be implemented. Parts of this band are also used extensively for conventional fixed and mobile services. In India, the bands 824-844 MHz paired with 869-889 MHz are presently allocated and used for CDMA based mobile telecom services. In India, the bands 890-915 MHz paired with 935-960 MHz are presently allocated and used for GSM based mobile telecom services. In Japan, the band 470-770MHz is used for television broadcasting. The use of the band 710-770 MHz for television broadcasting will be terminated by 24 July 2012. In Japan, the band 710-722MHz will be used for land mobile services and/or broadcasting services except television broadcasting from 25 July 2012 onward. In Japan, the band 722-770 MHz will be used for land mobile services from 25 July 2012 onward.	

TABLE 1 (cont.)

Frequency range (MHz)	Band usage	Sharing studies
	In Japan, the band 770-806 MHz is used for broadcast auxiliary services (remote pick up units for TV broadcasting). In Japan, the bands 779-788 and 797-806 MHz are used for radio microphones. In Japan, the band 806-810 MHz is used for radio microphones (unlicensed low-power). In Japan, the bands 810-850, 860-901, 915-950 and 956-958 MHz are used for cellular phones. In Japan, the bands 836-838, 850-860, 891-893 and 905-915 MHz are used for MCA (multi-channel access). The use of 836-838 and 891-893 MHz for MCA is allowed only until 31 May 2007. In Japan, the bands 830-832 and 885-887 MHz are used for airport MCA. The use of 831.5-832 and 886.5-887 MHz by airport MCA is allowed only until 30 September 2007. In Japan, the bands 846-850 and 901-903 MHz are used for radio disaster prevention radio. The use of these bands by regional disaster prevention radio is allowed only until 31 May 2011. In Japan, the band 903-905 MHz is used for personal radio communications. In Japan, the band 950-956 MHz is used for RFID. In Japan, the band 958-960 MHz is used for broadcast auxiliary services (remote pick up units for TV broadcasting). In Japan, the band 806-960 MHz is also allocated to the terrestrial components of IMT-2000.	