

**Report No. 23**  
**Report from the UMTS Forum**

**A harmonized frequency solution for early  
implementation of UMTS/IMT-2000 in Central  
and South American countries**

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## 0 Executive summary

The objective of this report is to provide information relating to the implementation of UMTS/IMT-2000 in Central and South American countries, including information on current usage of the frequency bands for public mobile networks below 3 GHz . It also highlights the factors that are needed for global harmonization and benefits of it.

In order to fully benefit from global spectrum identification, the Forum encourages and supports global harmonisation of frequency arrangements for UMTS/IMT-2000. The harmonisation of frequency arrangements is a key element in reducing cost and complexity of IMT-2000 implementation and to facilitate global roaming. The third key enabler for harmonized spectrum usage is the globally common standard for UMTS/IMT-2000. These elements are needed for the players to be able to benefit of the advantage of economies of scale on terminals and infrastructure equipment. They also facilitate global roaming.

Each possible solution for UMTS/IMT-2000 frequency arrangements was evaluated and the conclusion was that an early, harmonized UMTS/IMT-2000 implementation is only possible in the WARC-92 bands. The choice of an alternative band arrangement would either delay the implementation of UMTS/IMT-2000, due the lack of suitable equipment, and/or would not offer the expected third generation services, especially, global roaming.

The collected information shows that most of Central and South American countries have made or could make the WARC-92 bands available for UMTS/IMT-2000. Other such countries are using parts of the WARC-92 band for 2<sup>nd</sup> generation networks and these frequency plans are assumed to continue for 3<sup>rd</sup> generation networks.

Based on the findings, the following recommendations<sup>1</sup> were made:

### Recommendation 1:

Central and South American countries should start the implementation of UMTS/IMT-2000 in the WARC-92 frequency bands (1920 – 1980 /2110 – 2170 MHz for paired operation) as most of them could make all or parts of these bands available. This would enable them to fully benefit of early availability of equipment, economies of scale and roaming possibilities. This is the best solution for global harmonization in both the short-term and longer-term.

### Recommendation 2:

The GSM1800 bands (or parts of it) could be used for implementation of UMTS/IMT-2000 in those Central and South American countries where the WARC-92 frequency bands are not available. This solution could support global harmonisation in the longer-term.

### Recommendation 3:

Operators in Central and South American countries should choose UMTS technology (W-CDMA), which has the best potential to enable the benefits of economies of scale and global roaming.

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<sup>1</sup> Regarding the preferred minimum spectrum requirement per public UMTS operator, UMTS Forum recommendations are given in Report 5.

**Recommendation 4:**

The issued licenses should be national<sup>2</sup>. It will improve spectrum efficiency and minimise the need for guard bands.

**Recommendation 5:**

Future plans to fulfill the spectrum demand beyond the WARC-92 frequency bands should be prepared early enough and should take into account spectrum harmonization aspects (especially the band 2500-2690 MHz) to enable further growth and evolution of UMTS/IMT-2000 services and networks

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<sup>2</sup> UMTS Forum Report 4 "Considerations of Licensing Conditions for UMTS Network Operations" gives more information on licensing.

## 1 Introduction

This report provides information on the current usage of the frequency bands for public mobile networks below 3 GHz and the possible implementation of UMTS/IMT-2000 in Central and South American countries. It also supports the UMTS Forum (the Forum) objective to encourage global implementation of UMTS/IMT-2000.

In order to fully benefit from global spectrum identification, the Forum encourages and supports global harmonisation of frequency arrangements for UMTS/IMT-2000. The harmonisation of frequency arrangements is a key element in reducing cost and complexity of IMT-2000 implementation and to facilitate global roaming. This can be achieved by taking advantage of economies of scale on terminals and infrastructure equipment, which will then benefit manufacturers and operators and especially the consumer.

Most of the current public mobile networks in Central and South America use the 800 MHz spectrum. 2 GHz frequency bands (1710-2025MHz/ 2110-2200MHz) are, in general, just recently taken into public mobile use. However, many countries are in the phase of planning their frequency decisions for the UMTS/IMT-2000 networks and this report is intended to contribute to this activity.

## 2 Background

After several years of substantial increase of the mobile voice service penetration and usage around the world, recently the mobile data service growth with short messages and mobile access to Internet has been experienced and is continuously growing. To an increasing extent, users adopt these data services in spite of their limitations, such as low bit rates of current systems, poor ergonomics and interactivity and limited selection of suitable services. The demand for global roaming is strong and increasing, which is a step towards seamless services. The 2G experiences show that roaming is a key feature that helps to develop market, and to strengthen operator's revenues due to the roaming users coming from abroad even if the roaming functionality is not used regularly by all users.

The additional spectrum identified by WRC-2000 would be needed to fulfil the mobile market demand before the year 2010, especially, in the high-density traffic areas. It is anticipated that Central and South America will follow this trend.

The key conditions necessary for achieving seamless services and low cost terminals are the harmonisation of spectrum use and the worldwide co-ordination and implementation of standards. These will assist to create global mass market and give benefits from economies of scale. These will also allow true competition between suppliers and potentially a much wider choice of equipment and suppliers for network operators and service providers.

The World Administrative Radio Conference, WARC-92, identified the frequency bands 1885 – 2025 MHz and 2110 – 2200 MHz for the implementation of IMT-2000. The bands 1980 – 2010 MHz and 2170 – 2200 MHz were reserved for the satellite component of IMT-2000.

The World Radiocommunication Conference, WRC-2000, identified the bands 806 – 960 MHz, 1710 – 1885 MHz and 2500 – 2690 MHz in addition for IMT-2000.

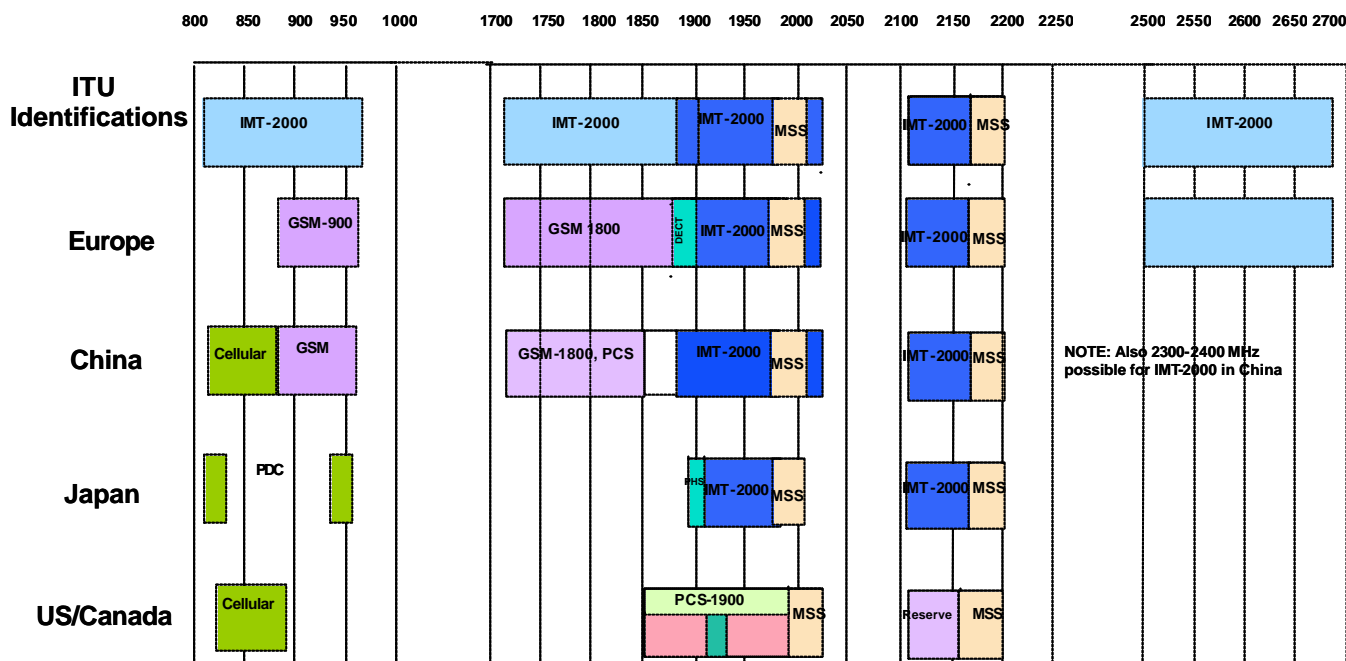


Figure 2.1

**ITU-R identifications for IMT-2000 and allocations of public mobile networks in some regions and countries.**

The major difficulties in finding globally harmonized frequency solutions for UMTS/IMT-2000 concern the use of FDD, frequency division duplex. This report is therefore limited to the study of frequency arrangements for FDD. It is believed that for TDD, time division duplex, appropriate frequency bands may be allocated from the bands identified for IMT-2000 in the ITU Radio Regulations, albeit that they may differ slightly among regions of the world. It seems probable that in most countries appropriate frequency bands for TDD may be identified in the range 1880 – 2025 MHz, e.g. in parts of 1880 – 1930 and 2010 – 2025 MHz

The first UMTS/IMT-2000 networks using FDD are already in operation in the WARC-92 bands 1920 – 1980 / 2110 – 2170 MHz and a number of networks in different countries and regions will start operation in these bands during the year 2002.

### 3 Current situation in Central and South American countries

Information on the current public mobile networks in Central and South America has been collected in the Annex.

#### 3.1 800 MHz bands (824 – 849 / 869 – 894 MHz)

These bands are heavily used in Central and South American countries. There are a number of different technologies in use. These are detailed in the Annex.

### **3.2 GSM900 bands (880 – 915 / 925 – 960 MHz)**

GSM900 is in use in a number of countries in Central and South America, e.g. in Argentina, Cuba, El Salvador, Guatemala, Jamaica, Panama and Venezuela. In many cases, the operation has just started during the year 2001. These bands could be used for UMTS/IMT-2000 in the longer term.

### **3.3 GSM1800<sup>3</sup> bands (1710 – 1785 / 1805 – 1880 MHz)**

Some countries like Brazil, Costa Rica and Uruguay already decided to make available at least parts of these bands for GSM1800. Some other countries like Ecuador and Venezuela have similar plans. These bands are available in Central and South American countries and could be used for UMTS/IMT-2000.

### **3.4 PCS1900 bands (1850 – 1910 / 1930 – 1990 MHz)**

These bands are taken into use or at least planned to be taken into use in a number of countries: Argentina, Bolivia, Brazil, Chile, Colombia, Dominican Republic, El Salvador, Guatemala, Mexico, Paraguay, Peru, Puerto Rico and Uruguay. There are a number of technologies in use in these bands, see Annex. In general, networks in these bands are in their initial phase and so far, the number of users is low but it is increasing (see Figure 3.2).

### **3.5 WARC-92 bands (1920 – 1980 / 2110 – 2200 MHz)**

In most of the Central and South American countries all or part of the WARC-92 bands could be used for initial deployment of UMTS/IMT-2000 (see Annex). However, in some other countries that have licensed the whole PCS1900 band, the WARC-92 bands are not presently available for UMTS/IMT-2000.

### **3.6 Number of subscribers in Central and South American public mobile networks<sup>4</sup>**

The population in Central and South America is about 510 Million, and the total number of subscribers in September 2001 was about 81 Million, which gives about 16 % penetration. About 70 Million users are using the 800 MHz networks.

The distribution of the subscriber numbers among the different types of public mobile telecommunication networks in Central and South America is shown in the diagram in Figure 3.1.

The diagram in Figure 3.2 shows is an enlargement showing the subscriber numbers for all networks except those in the 800 MHz frequency band.

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<sup>3</sup> Also known as DCS-1800

<sup>4</sup> All numbers are calculated from the information of Global Mobile 1/2002. They should not be considered as definite values but indicate the order of size.

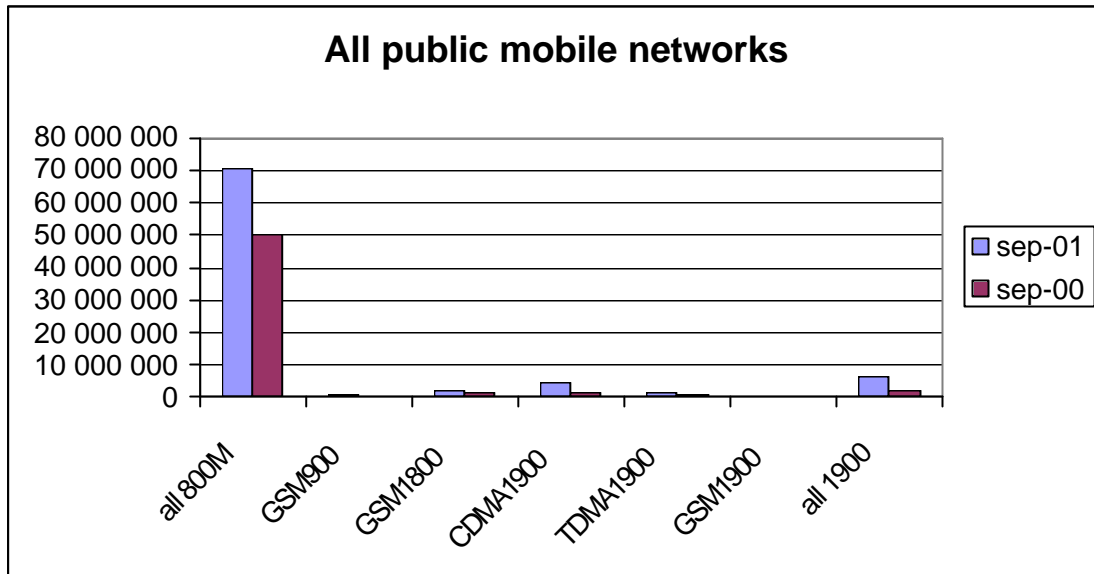


Figure 3.1

**Subscriber numbers of all public mobile networks in Central and South America,  
9/2001, Global mobile 1/2002.**

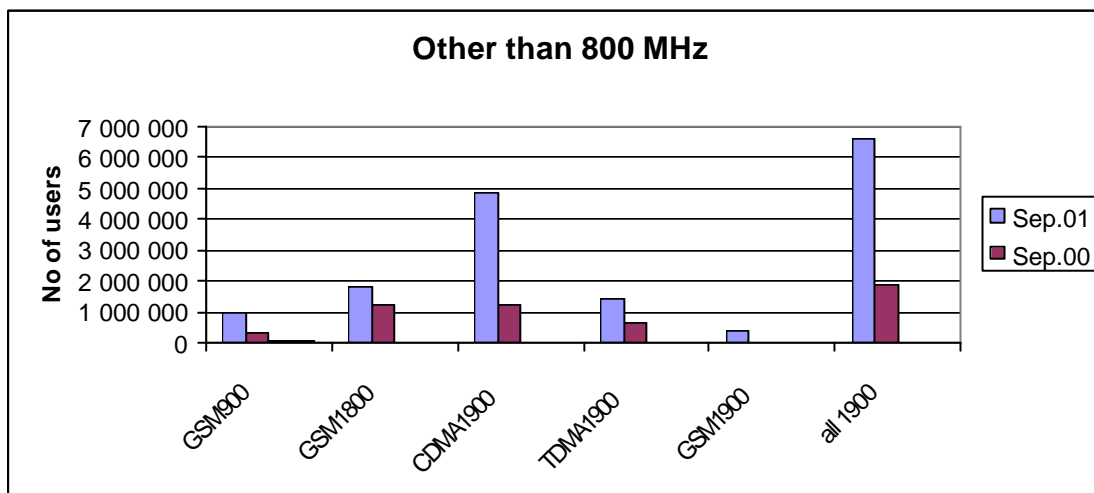


Figure 3.2

**Subscriber numbers of public mobile networks in the 900, 1800 and 1900 MHz  
frequency bands in Central and South America,  
9/2001, Global Mobile 1/2002.**

### 3.7 Summary of the current and planned public mobile networks and related frequency bands

Information on the current and planned public mobile networks in Central and South America has been collected. The use of frequency bands is described in detail in the Annex. Table 1 summarizes information from the Annex. It should be noted that the information gathered was the best available at the time when this report was prepared. The use and plans may have changed since then.

MS Tx (MHz)	824 – 849	880 – 915	1710 – 1785	1850 – 1910	1920 – 1980
BS Tx (MHz)	869 – 894	925 – 960	1805 – 1880	1930 – 1990	2110 – 2170
Examples of standards:	AMPS/ TDMA/ CDMA 800 MHz	GSM900	GSM1800	PCS1900 TDMA/ CDMA/ GSM	UMTS/IMT-2000 in WARC-92 bands
Argentina					
Bolivia					
Brazil					
Chile					
Colombia					
Costa Rica					
Cuba					
Dominic. Rep.					
Ecuador					
El Salvador					
Guatemala					
Honduras					
Jamaica					
Mexico					
Nicaragua					
Panama					
Paraguay					
Peru					
Puerto Rico					
Uruguay					
Venezuela					

Table 1

**Summary of the public mobile networks in Central and South America, based on the information in the Annex.**

A filled box indicates that a frequency band is in use or planned for public mobile networks. For the GSM1800, PCS1900 and WARC-92 bands the columns have been split for countries where only part of the band is used.

## **4 UMTS/IMT-2000 implementation in Central And South America**

### **4.1 Minimum spectrum per operator**

The Forum recommendations on preferred minimum spectrum per operator can be found in UMTS Forum Report #5 “Minimum spectrum demand per public terrestrial mobile operator in the initial phase”, 8 September 1998.

The possibility of additional spectrum allocations is a second step in fulfilling the demand of further developments of UMTS/IMT-2000 systems (increased bandwidth or data rates, but also increased voice and data traffic due to increased competition). As sufficient amount of spectrum is one of the key facilitators for public mobile networks, a plan should be prepared in good time for access to the necessary additional spectrum.

### **4.2 IMT-2000 family of standards**

IMT-2000 standards are defined in ITU-R Recommendation M.1457. Operators should be free to choose any of the standards within the family of IMT-2000 standards approved by ITU-R.

Harmonized frequency arrangements and a common standard enable the benefits of economies of scale and global roaming. The Forum believes that UMTS technology (W-CDMA) has the best potential to be a global standard, since UMTS licenses have already been awarded in many countries in Region 1 and Region 3.

### **4.3 National licences**

The Forum study on licensing issues has been published as UMTS Forum Report #4 "Considerations of Licensing Conditions for UMTS Network Operations".

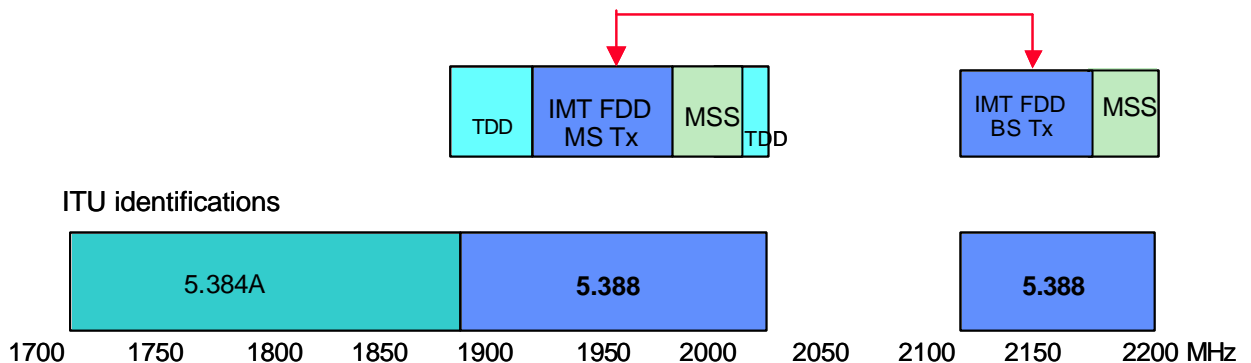
The UMTS Forum advocates national licences which should cover a significant proportion of the population, based firstly on the success of national second-generation licences, and secondly the spectral efficiency of such licences. National licences will also minimise the need for guard bands.

### **4.4 Solutions for potential worldwide UMTS/IMT-2000 harmonization**

The 800 MHz band is widely used in Central and South American countries but due to the different bands and band plans for public mobile networks in different parts of the world, harmonized spectrum plan for UMTS/IMT-2000 in this frequency band is not a short-term possibility. The 2 GHz bands are not yet widely used and this means that they have much more potential as harmonized UMTS/IMT-2000 bands and allow near term implementation.

Most Central and South America countries could have the possibility to introduce UMTS/IMT-2000 using the WARC-92 band plan. Due to the availability of equipment, this would support a rapid implementation of 3<sup>rd</sup> generation services facilitating the access to the global mobile information society in those countries.

#### 4.4.1 Pairing of 1920 – 1980 / 2110 – 2170 MHz



**Figure 4.1**

**Frequency arrangement of the WARC-92 bands  
1880 – 2015 MHz and 2110 – 2200 MHz.**

#### **Advantages:**

- All UMTS/IMT-2000 terminals for Europe and Asia contain this frequency arrangement
- Supports roaming with Europe and Asia due to the common frequency band arrangement
- Early implementation possible
- Has the best potential to become globally harmonized band in the long term
- Possible band availability in most Central and South American countries

#### **Disadvantage:**

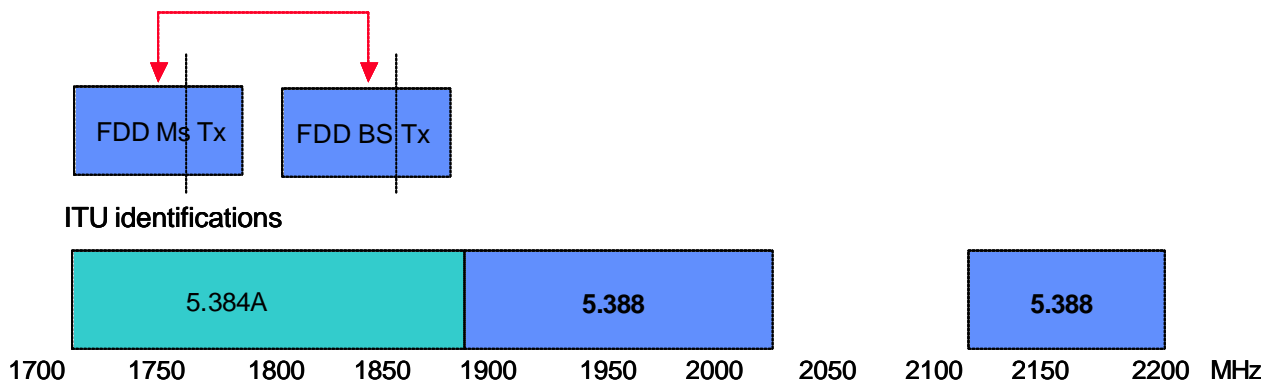
- Does not support roaming with the USA due to the different frequency band arrangement at this stage

#### **Comment:**

- Roaming with the USA could be arranged by multi-mode, multi-band terminals.

#### 4.4.2 Pairing of 1710 – 1785 / 1805 – 1880 MHz

It is widely recognized that UMTS/IMT-2000 will first be implemented in WARC-92 bands. In Europe, additional bands for UMTS/IMT-2000 will come from the band 2500 – 2690 MHz, and after that, 1710 – 1785 and 1805 – 1880 MHz (GSM1800 bands) could be implemented for UMTS/IMT-2000.



**Figure 4.2**

**Frequency arrangement based on the GSM1800 frequency plan,  
1710 – 1785 / 1805 – 1880 MHz.**

#### **Advantages:**

- Parts of the band could be used for implementation of UMTS/IMT-2000 (at least 2x45 MHz), even in countries that have implemented PCS1900.
- Can provide smooth longer-term transition from GSM1800 to UMTS1800
- UMTS1800 is under standardization
- This frequency arrangement is included in 3GPP standards.
- Has the potential to become a globally harmonized band in the long term

#### **Disadvantage:**

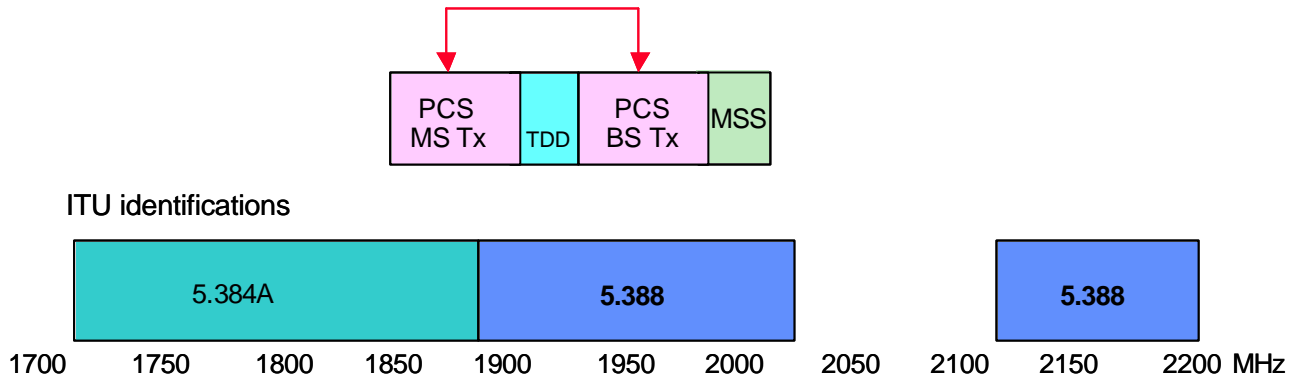
- Availability of the UMTS1800 equipment for this arrangement is not yet known.

#### **Comments:**

- Does not support early harmonization of UMTS/IMT-2000 and the short-term roaming needs to be arranged by multi-mode, multi-band terminals. Almost global roaming can be provided with dual-band GSM1800/UMTS (WARC-92 bands) terminals. Could support, however, long-term harmonization.
- In PCS countries, a combination of the lower part of this paired frequency arrangement (below the PCS band at 1850 MHz) and pairing with frequencies from the WARC-92 downlink band may be possible, i.e. 1710 – 1755 / 1805 – 1850 MHz and 1755 – 1800 / 2110 – 2155 MHz. Availability of the equipment for that combined arrangement and its timing will depend on the ITU-R recommendations and the market situation, preventing early implementation of this combined arrangement for UMTS/IMT-2000.

## 4.5 Other solutions

### 4.5.1 Pairing of 1850 – 1910 / 1930 – 1990 MHz



**Figure 4.3**

**Frequency arrangement for the PCS1900 plan,  
1850-1910 / 1930-1990 MHz.**

In some countries in Region 2 the band 1850 – 1990 MHz is partly or fully used for 2<sup>nd</sup> generation networks (PCS). This means that the pairing of 1920-1980 / 2110-2170 MHz may not always be possible in those countries. By re-farming PCS operation from all or parts of the band, Central and South American countries can implement UMTS/IMT-2000 in the WARC-92 band.

#### **Advantages:**

- UMTS1900 is under standardization
- This frequency arrangement is included in 3GPP standards.
- Roaming with the USA due to the common frequency band arrangement
- The current usage in PCS1900 band can partly continue.

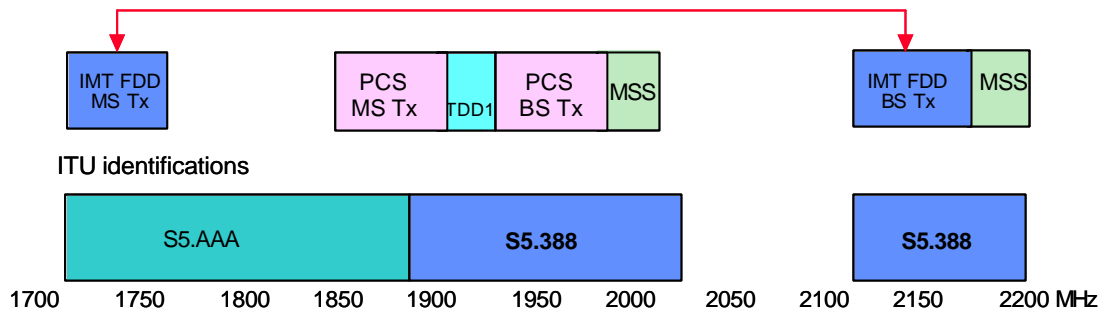
#### **Disadvantages:**

- Availability of terminals depends solely on the US situation and is not yet known.
- Does not support roaming with Europe and Asia due to the different frequency band arrangement
- May not alone give enough frequencies/capacity for UMTS/IMT-2000

#### **Comments:**

- Does not provide harmonization outside countries with PCS1900.
- Roaming outside possible with multi-mode, multi-band terminals.

#### 4.5.2 Pairing of 1710 – 1770 / 2110 – 2170 MHz



**Figure 4.4**

**Frequency arrangement for the bands 1710 – 1770 / 2110 – 2170 MHz.**

#### **Advantages:**

- Availability of the band in Central and South American countries, as the bands are not currently used for public mobile networks
- Roaming with the USA possible, if USA chooses this arrangement
- Provides globally common downlink band

#### **Disadvantages:**

- Does not support roaming with Europe due to the different frequency band arrangement
- Availability of the equipment and timing will depend on the US decision preventing early implementation UMTS/IMT-2000
- This frequency arrangement is not included in 3GPP standards.
- New arrangement that differs from existing frequency arrangements

#### **Comment:**

- Does not support global harmonization as such. It is utilizing the 'globally common downlink' band that may support roaming. Roaming requires multi-mode, multi-band terminals.

#### **4.6 Examples for transition from PCS1900 towards UMTS/IMT-2000 in WARC-92 bands**

Some Central and South American countries already started the transition process from PCS1900 towards UMTS/IMT-2000 in WARC-92 bands:

##### *Brazil:*

In Brazil the Regulator intends to shift of PCS-applications (WLL) to the upper part of PCS1900 band to allow implementation of UMTS/IMT-2000 in the WARC-92 bands. In this way Brazil will clear up 45 MHz (+ 2 x 5 MHz of guard band) of paired IMT-2000 spectrum. In a further step the whole clearing of the PCS1900 band is recommended.

##### *Chile:*

In Chile operations of the their two networks in the PCS1900 bands are being moved to the GSM1800 bands. As a compensation for the loss of PCS1900 operations, operators might be given an IMT-2000 license in the WARC-92 spectrum.

### **5 Conclusions and Recommendations<sup>5</sup>**

Most of Central and South American countries have made or could make the WARC-92 bands available for UMTS/IMT-2000. Others are using part of the WARC-92 band for 2<sup>nd</sup> generation networks and these frequency plans are assumed to continue for 3<sup>d</sup> generation networks.

#### **Recommendation 1:**

Central and South American countries should start the implementation of UMTS/IMT-2000 in the WARC-92 frequency bands (1920 – 1980 / 2110 – 2170 MHz for paired operation) as most of them could make all or parts of these bands available. This would enable them to fully benefit of early availability of equipment, economies of scale and roaming possibilities. This is the best solution for global harmonization in both the short-term and longer-term.

#### **Recommendation 2:**

The GSM1800 bands (or parts of it) could be used for implementation of UMTS/IMT-2000 in those Central and South American countries where the WARC-92 frequency bands are not available. This solution could support global harmonisation in the longer-term.

#### **Recommendation 3:**

Operators in Central and South American countries should choose UMTS technology (W-CDMA), which has the best potential to enable the benefits of economies of scale and global roaming.

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<sup>5</sup> Regarding the preferred minimum spectrum requirement per public UMTS operator, UMTS Forum recommendations are given in Report 5.

**Recommendation 4:**

The issued licenses should be national<sup>6</sup>. It will improve spectrum efficiency and minimise the need for guard bands.

**Recommendation 5:**

Future plans to fulfill the spectrum demand beyond the WARC-92 frequency bands should be prepared early enough and should take into account spectrum harmonization aspects (especially the band 2500-2690 MHz) to enable further growth and evolution of UMTS/IMT-2000 services and networks

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<sup>6</sup> UMTS Forum Report 4 "Considerations of Licensing Conditions for UMTS Network Operations" gives more information on licensing.

## ANNEX

### Information of the Latin America cellular networks and frequency situation

Country	Cellular systems and frequency bands (MHz) in operation	Availability of WARC-92 bands (MHz)	Availability of WRC-2000 bands (MHz)	Comments
<b>Argentina</b>	AMPS/CDMA (-89) AMPS/TDMA (-96) AMPS (-96) 824-849/869-894		1710-1755/1805-1850	Penetration (11/01): 19%
	GSM900			
	TDMA1900 (-00) GSM1900 1850-1910/1930-1990			
<b>Bolivia</b>	AMPS (-92) 824-849/869-894	1960-1980 not in PCS use		Penetration: 11%
	GSM1900 (-00) 1850-1880/1930-1960			
<b>Brazil</b>	AMPS (-93) AMPS/CDMA (-93) AMPS/TDMA (-93) TDMA (-98) 824-849/869-894	1950-1980 2110-2170	1710-1850	Penetration: 15%
	CDMA1900 (-00) 1850-1870/1930-1950			
<b>Chile</b>	AMPS/TDMA (-89) 824-849/869-894	2110-2170	1710-1850	Penetration: 26%
	GSM1900 (-98) 1850-1865/1930-1945 1895-1910/1975-1990			
	CDMA1900 (-98) 1870-1885/1950-1965			
<b>Colombia</b>	AMPS/TDMA (-94) AMPS (-94) 824-849/869-894	No PCS operation yet 1945-1980		Penetration: 7%
	Plans for GSM1900			
<b>Costa Rica</b>	AMPS/TDMA (-94) 824-849/869-894			Penetration: 8%
	GSM1800 [Auctioned year 2000]			

Country	Cellular systems and frequency bands (MHz) in operation	Availability of WARC-92 bands (MHz)	Availability of WRC-2000 bands (MHz)	Comments
<b>Cuba</b>	AMPS (-93) 824-849/869-894			Penetration: 0.09%
	GSM900			
<b>Dominican Republic</b>	AMPS/CDMA (-89) AMPS (-92) 824-849/869-894			Penetration: 10%
	CDMA1900 (-00) GSM1900 (-00) 1850-1910/1930-1990			
<b>Ecuador</b>	AMPS/TDMA (-93) 824-849/869-894			Penetration: 5%
<b>El Salvador</b>	AMPS/TDMA (-92) CDMA (-98) 824-849/869-894			Penetration: 15%
	GSM900 (-00)			
	TDMA1900 (-99) 1850-1910/1930-1990			
<b>Guatemala</b>	AMPS/TDMA (-00) 824-849/869-894	3 ops in PCS band 2110-2170	1710-1885	Penetration: 7.5%
	GSM900 909-915/954-960			
	CDMA1900 (-99) 1850-1910/1930-1990			
<b>Honduras</b>	AMPS/CDMA (-96) 824-849/869-894			Penetration: 4%
<b>Jamaica</b>	AMPS (-91) 824-849/869-894			Penetration: 24.5%
	GSM900 (01?)			
<b>Mexico</b>	AMPS/CDMA (-90) AMPS (-90) 824-849/869-894	1890-1910 1970-1980 2110-2170	1710-1850	Penetration: 18%
	AMPS/TDMA (-98) 1865-1870/1945-1950			
	CDMA (-98) 1870-1880/1950-1965			
	CDMA1900 (-99) 1885-1890/1965-1970			
	GSM1900			
<b>Nicaragua</b>	AMPS (-93) TDMA (-99) 824-849/869-894			Penetration: 3%

Country	Cellular systems and frequency bands (MHz) in operation	Availability of WARC-92 bands (MHz)	Availability of WRC-2000 bands (MHz)	Comments
Panama	TDMA (-98) AMPS/TDMA (-96) 824-849/869-894			Penetration: 17%
	GSM900			
Paraguay	AMPS (-92) 824-849/869-894			Penetration: 18%
	TDMA1900 (-98) GSM1900 (-99) 1850-1910/1930-1990			
Peru	TDMA (-90) AMPS/CDMA (-91) 824-849/869-894	Block A in PCS use, blocks B&C reserved for PCS Blocks D&E used for FWA, block F reserved for FWA	1710-1850	Public consultation going on Penetration: 5%
	GSM1900 (-01) 1850-1865/1930-1945			
Puerto Rico	AMPS (-86) 824-849/869-894			Penetration: 40%
	CDMA1900 (-96) 1850-1910/1930-1990			
Uruguay	AMPS/CDMA (-91) AMPS/TDMA (-95) 824-849/869-894	1945-1970 2135-2160	1710-1735 1805-1830 1865-1890	Auction 12/2001 Technology independent, bidders can choose the pairing within the auctioned bands. Plan for GSM1800/PCS1900/ core band Penetration: 19%
Venezuela	AMPS/TDMA (-88) AMPS/CDMA (-91) 824-849/869-894	1885-1980 2110-2170		Will follow Europe and go directly to IMT-2000. Whole WARC-92 band available. Plan for GSM1800. Early implementation but the final time schedule not yet decided. Penetration: 26%
	GSM900 (-98)			