WIRELESS MULTIMEDIA SERVICES REGULATION IN ARGENTINA

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[2] Universidad Nacional de Quilmes
[3] Facultad de Ingeniería de la Universidad de Buenos Aires
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ABSTRACT

Multimedia Services (MS) enable the simultaneuos transmission of voice, data, texts and images; and allow interactivity between human users and between a human user and a server. Such services require audiovisual user terminals, a return path and in general a great bandwidth in one or both communication channel directions. That a market for these services does exist has been demonstrated by the espectacular growth of Internet, which is the greatest for a massive communication medium in history. This fact is more impressive if we consider that this growth has occurred in spite of the fact that for most of people the use of Internet is not easy: it is necessary to have a PC, to know how to use it, and it also happens that downloading information is a tedious work for the long time it usually requires. This implies that the growth could have been even bigger.

Wireless Multimedia Services (WMS) are those MS provided through radio links by means of the new wireless technologies, and as they do not use wires they allow to extend MS to mobile users (so we call them Personal Multimedia Services) and to users in remote, low density or very difficult access areas, where wireline networks would be antieconomic to deploy. WMS enable new entrant operators in a deregulated environment to offer MS quickly without the need to know precisely where the demand will be. Also incumbents could have in WMS an alternative to offer MS without upgrading their existing networks.

Since November 1999 a progressively deregulated environment exists in Argentina. There are four main competitors in fixed and mobile communications: two of them of European origin and the other two from the USA. These operators are incumbent in some parts of the country and new entrant in other parts of it. Besides these four, there is an increasing quantity of smaller incumbent and new entrant operators fighting to obtain access to the richest market segments in voice, data, value-added and Internet services. All of these operators are eager to have new networks developed as soon as possible. For them, WMS are of early consideration because wireless technologies are the fastest way to deploy networks. The variety of wireless technologies under conditions of being chosen was enlarged by the Argentinean government that opened numerous new frequency bands.

In this paper an enumeration is made of all frequency bands available in Argentina to be used by incumbent and new entrant operators. Further analysis is carried on about the possible usage of each frequency band to implement WMS based either on terrestrial, stratospheric or satellite platforms. The conclusion to reach will be that Argentina constitutes a special case for WMS, because regulation allows competition between certain wireless technologies that are not allowed to compete between them in any other part of the world. Argentina is perhaps the first country in the world where almost all new wireless technologies are able to be tested and used in WMS commercial deployment.

INTRODUCTION

In this paper we will call "Multimedia Services" (MS) those services that allow simultaneous transmission of a combination of *all-known electronic means of information content* : voice, music, data, texts, graphics, animations, pictures and video; and that provide *interactivity* either between people or between people and servers. The main features of this kind of services is the requirement of audiovisual-capable user terminals, the existence of a return path and a great bandwidth in one or both ways of the communication channel. Examples of MS are the Internet, video on demand and teleconference.

That a market does exist for MS has been proved in a very impressive way by the explosive growth of Internet users, the greatest for a massive communication media in history. This growth takes place although for the layman to connect to Internet is not an easy task, since he needs to have a PC, to know how to use it, and even so downloading information from the Internet is usually tedious for the long time it takes. Therefore it is assumed that in the future, when MS become more friendly and easier to use, its penetration will be even greater than today.

We will call "*wireless* multimedia services" (WMS) to those MS offered through a radiolink. Due to wire elimination, WMS make possible MS to mobile users, in which case we call them "Personal Multimedia Services".

By means of new wireless technologies it will also be possible to deploy MS oriented to fixed users located in areas where wireline networks are not economically viable: remote, difficult access or low users' density areas.

In the deregulated markets, wireless technologies offer new entrant operators an alternative to deploy networks in a very short time and to take advantage of the growing demand of MS, without the need of building a wired network. The flexibility of wireless in very important because at the beginning they will not know precisely where customers are located.

Also, in deregulated markets new wireless technologies are an option for incumbent operators that want to deploy MS without making the upgrade of their existing wired or wireless networks.

MARKET DEREGULATION IN ARGENTINA

A progressively deregulated environment does exist in Argentina in year 2000. In November 1999 the exclusivity period that Telecom (France Telecom,Telecom Italia) and Telefónica (Telefónica de España) were enjoying since 1990 arrived to its end. Up to that moment Telecom was the only basic telephony operator in the northern half of the country and Telefonica was the same in the southern half. Buenos Aires City Area, the main economic part of Argentina, was also divided in halves: one served by Telecom and the other by Telefónica.

Since November 1999 Telecom and Telefónica are able to operate telephony services in the whole country in competition. Another two operators, Telefonos del Plata and Compañía de Telecomunicaciones Integrales, are also since then allowed to operate telephony services all over the country.

Teléfonos del Plata is a new group leadered by CRM[5] "Movicom" (Bellsouth, Motorola), a Buenos Aires City Area cellular operator. Compañía de Telecomunicaciones Integrales is another new group leadered by CTI[6] (GTE, Grupo Clarín), a cellular operator in the interior part of the country. Movicom and CTI were given this grant as a consideration of the magnitude of investments they had made. There were other three cellular operators in Argentina: Personal (Telecom) in the northern part of the country; Unifón (Telefónica) in the southern part of the country, and Miniphone (50% belonging to Telecom and 50% belonging to Telefonica) in the Buenos Aires City Area.

Therefore, from November 1999 on, in any part of the country there are one incumbent and three new entrant operators, all in competence for telephony services.

Another group of companies has already obtained licenses to enter competition in the local and long distance telephony segments by the end of year 2000. Among these new entrant the most important are : IMPSAT (Pescarmona, BT[7]), Comsat Argentina, Keytech (AT&T)[8] and Techtel (Grupo Techint). All of them nowadays are only data transmission operators that compete with Telecom Soluciones (Telecom) and Advance (Telefónica). Techtel belongs to Grupo Techint which had been partner of Telefonica in the first part of the '90s but then retired.

Also in mobile telephony there is now an increased competition, since the adjudication in 1999 of two PCS[9] licenses in every part of the country. Up to that moment, Movicom competed with Miniphone in the Buenos Aires City Area and CTI competed with Personal in the northern part of the country and with Unifon in the southern part of it. The PCS lincenses were given by a public auction and the winners were Unifon and Movicom in the north, Personal and Movicom in the south, and CTI and a joint-venture Telecom-Telefónica in the Buenos Aires City Area. All the incumbent cellular operators made use of the option they had of buying the remaining PCS spectrum at the same price that resulted in the auction. After the auction, Telecom and Telefonica had to divide between them, and in halves, the PCS spectrum they won in he Buenos Aires City Area and they were also forced to divide the cellular operator Miniphone and the PCS spectrum that it had bought as incumbent.

The split of Miniphone is the only case in the world of division of a cellular operator. All assets were shared out (PCS spectrum, customers and employees) except the cellular network which couldn't be divided and it's been, since then, operated by an independent company.

[5] Compañía de Radiocomuniaciones Móviles S.A.
[6] Comapñía de Teléfonos del Interior S.A.
[7] British Telecom
[8] Keytech was a national capital company till February 2000 when it was bought by AT&T
[9] Personal Communication System

As a result, there are four important operators that compete all over the country in fixed and in mobile communications: Telecom, Telefonica, Movicom and CTI. Two of them are of European origin and the other two are from the USA. These operators are incumbent in some parts of the country and new entrant in other parts of it. Besides these four, there is an increasing quantity of smaller incumbent and new entrant operators fighting to obtain access to the richest market's segments in voice, data, value-added and Internet services. All of these operators are eager to have new networks developed as soon as possible. For them, WMS are of early consideration because wireless technologies are the fastest way to deploy networks. The variety of wireless technologies under conditions of being chosen was enlarged by the Argentinean government that opened numerous new frequency bands.

In what follows an enumeration is made of all frequency bands available in Argentina to be used by incumbent and new entrant operators. Further analysis is carried on about the possible usage of each frequency band to implement WMS based either on terrestrial, stratospheric or satellite platforms.

TYPES OF WIRELESS MULTIMEDIA SERVICES

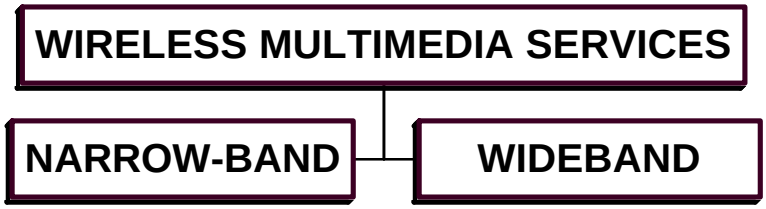

Figure 1: Types of Wireless Multimedia Services

In Figure 1 we can see a clasification of the WMS in narrow-band and wideband. Narrow-band WMS are, in general, adaptations of existing networks in order to offer Internet and low speed data services. Wideband WMS, on the other hand, include services that are specifically being planned, all over the world, to offer MS at higher speeds. Some of them are oriented toward mobile users, but may also be used by fixed customers. Others are oriented to fixed users exclusively. We will see which ones of them are forecasted for Argentina.

Narrow-band wireless multimedia services

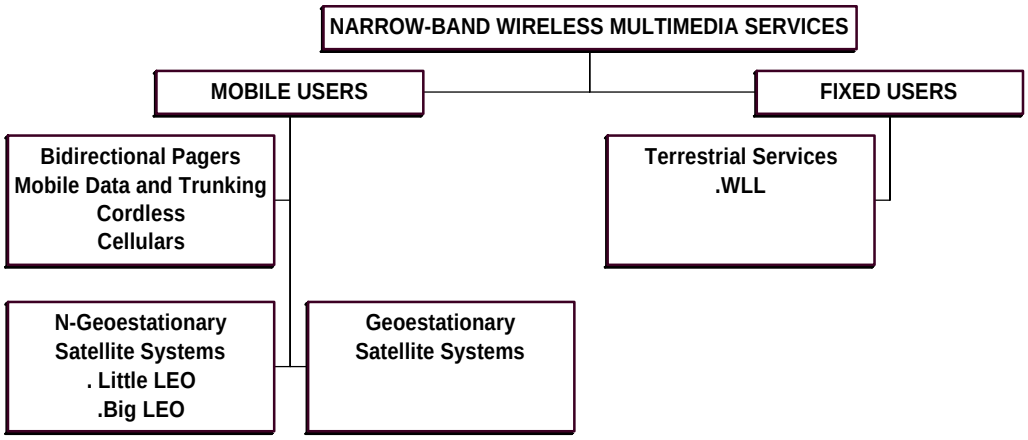

Figure 2: Narrow Band Wireless Multimedia Services[10]

Beginning with the mobile narrow-band services (Figure 2), in Argentina there are frequency bands allocated for bidireccional paging and mobile data services, but no commercial deployments have taken place. There are several unidireccional paging networks in operation, the biggest belonging to Skytel, but this business never has reached an important penetration (there are about 150.000 users), and in the last years has suffered because of the implementation of calling party pays (CPP) in the cellular service. There are also an important deployment of trunking networks, being CRM (Movilink), Nextel, and Unifon Team (Telefónica) the main operators.

Mobile operators have analogic first generation AMPS[11] and NAMPS[12] technologies, second generation D-AMPS[13] and recently deployed PCS networks. Personal and Unifon have chosen TDMA PCS technology meanwhile that CRM and CTI have chosen CDMA.

There has not been any important deployment in Argentina of cordless low mobility networks like DECT[14], PHS[15] or PACS.[16]

For wireless local loop (voice only) there are frequency bands allocated in 362-366 MHz (outside a circle of 180 km around Buenos Aires City) ; 905-915 MHz; 950-960 MHz; 898,5-905 MHz and 943,5-950 MHz; 1910-1930 MHz. These bands can only be used for POTS[17]. There are some deployments done in GSM for fixed service in 900 MHz and in proprietary technologies in 1910-1930 MHz.

[10] WLL: Wireless Local Loop
[11] Advanced Mobile Phone System
[12] Narrow-AMPS
[13] Digital AMPS
[14] Digital European Cordless Telephone
[15] Personal Handyphone System
[16] Personal Access Communication System
[17] Plain Old Telephone System

The following satellite constellations are already operating in Argentina: Orbcomm (little LEO[18]), which has a gateway in San Luis Province; Iridium (big LEO); Globalstar (big LEO), which has a gateway[19] in Córdoba Province and Inmarsat (GEO[20]) . Ellipso has already got a license to operate in Argentina in 1999, but it will not be operative for a pair of years. Studies are carried out about the way to implement direct audio broadcasting (DAB) services. By the end of 1999 Argentinean Regulator called for the presentation of proposals to set a Super GEO satellite working in L band, to offer mobile and fixed communication services.

Wideband wireless multimedia services

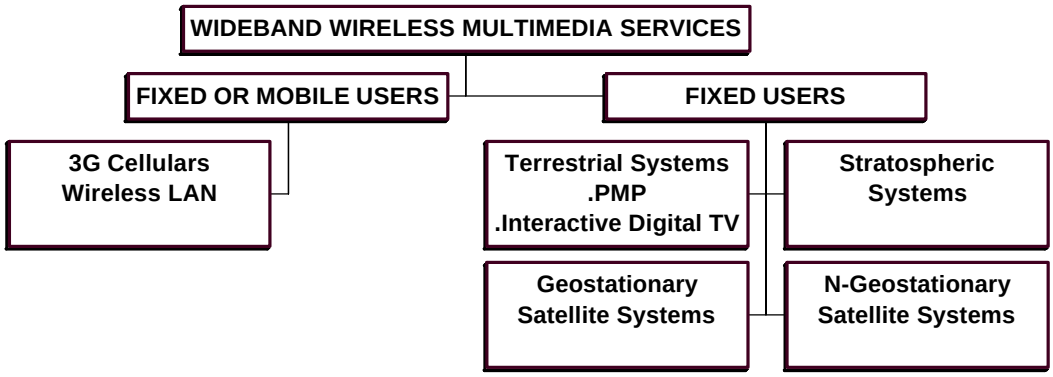

Figure 3: Wideband Wireless Multimedia Services

In Figure 3 we can see a clasification of the types of wideband WMS being planned to be implemented all over the world in the following years.

With respect to 3 G[21] cellular networks, there are no previsions in Argentina so far. ISM[22] unlicensed bands are enabled in 900 MHz; 2,4 GHz and 5 GHz, and it is therefore possible to apply all kinds of wireless LAN equipments that work on standards like IEEE 802.11[23], Hiperlan[24] or NII/Supernet[25], and also devices such as pico-LANs working on Bluetooth[26] or HomeRF[27] standards.

[18] Low Earth Orbit Satellite constellation
[19] Inaugurated at February 2000
[20] Geostationary Earth Orbit satellite
[21] Third generation (3G) multimedia cellular networks will be the succesors of actual second generation (2 G) digital cellular networks
[22] Industrial, Scientific and Medical.
[23] Wireless Ethernet LAN standard
[24] High Performance Radio LAN is the European Community's standard for wireless LAN
[25] NII/SUPERNet devices facilitate interconnection to NII (National Information Infraestructure)
[26] Bluetooth Group: industry consortium developing technology specifications for small form factor, low-cost, short range radio links between mobile PCs, mobile phones and other portable devices.
[27] HomeRF Working Group: working to establish an open industry specification for unlicensed RF digital communications for PCs and consumer devices anywhere, in and around the home

The systems oriented toward fixed users can be classified in: terrestrial, stratospheric, GEO satellites and LEO satellites. Among the terrestrial ones point to multipoint (PMP) systems are having an increasing importance and new spectrum is being allocated worldwide for them. We can mention the following frequency bands that have been dedicated to such systems:

UHF TV channels, MMDS band and 3,3 GHz band.

In 1998, the Argentinean Regulator broadened the attribution of UHF TV and MMDS channels, that up to that moment were reserved for broadcasting applications only, and made them also available for telecommunication services, specially Internet access, by means of PMP systems. UHF TV channels include 512 - 608 MHz and 614 - 806 MHz bands. MMDS (Multichanel Multipoint Distribution Service) channels include 2500-2686 MHz band. With respect to MMDS, the mentioned 1998's regulation applied only in the interior part of Argentina but not in the Buenos Aires City Area. In this last area, MMDS frequencies were being used by point to point microwave conventional links.

The bandwidth of each channel is of 6 MHz, which is relatively reduced. In UHF there are one-way applications only. So they require another medium, like a telephone line, to implement the return path. But in MMDS there are several equipment providers developing two-way technologies.

MMDS were tradicionally used to build CATV[28] programming distribution networks in places where coaxial cable were impracticable. For this reazon they are also called "wireless cable" systems.

In general, UHF and MMDS channels are effectively occupied by TV or CATV services. So it must be analised if it is economically viable to use one or two of them in order to offer Internet access.

In the USA, MMDS also has a broadened attribution that enables to offer telecommunication services. In that country there are some commercial unidireccional and bidireccional services already offered, being one of them "Internet quick downloading". Providers assure that with a single 6 MHz channel it is possible to offer service to thousands of users with an average download speed of 1 Mbit/s. That this technology is gainning importance has been demonstrated last year when Sprint and MCI bought many companies that were licensees of those frequencies in the USA, as a reaction to the strategy of AT&T of buying CATV companies. Every operator is trying to increase as much as possible the bandwidth of their access to customers.

There is an important diference betweem the allocation made in the USA and the one that exists in the interior part of Argentina. In the USA the MDS (Multipoint Distribution Service) channels in 2150-2162 MHz are allocated for the same application, and have a very good separation from MMDS channels. So MDS channels are used to implement the return path. As in the interior part of Argentina, MDS

[28] Cable Television

channels do not exist, to be able to offer bidirectional services it would be necesary to have 2 MMDS channels with a separation between them of the order of 60 MHz (at least 10 channels). This fact produces that bidirectional services with the return path made by radio will be very difficult to implement in the interior part of Argentina.

It is important to remark that in the USA the 3,5 GHz and 10,5 GHz are not available and then MDS/MMDS band in 2,1- 2,5 GHz appears as the only option in that frequency range, with a similar geographic reach.

In 1999 the Argentinean government changed the attribution of MMDS frequencies in the Buenos Aires City Area, that as mentioned above, were employed to implement conventional point to point links. Those frequencies were attributed to telecommunication use, specially PMP systems. The channel pattern that were stablished can be seen in Fig 4 in the appendix. We can see that MDS channels were included, so now it is perfectly possible to apply in Buenos Aires City Area the exactly same equipments already developed for the USA's market. Actual users of those frequencies for radio links were given a period of a pair of years to free the frequencies.

Also in 1999 Argentinean government created the 3,300-3,400 GHz band allocation that can be seen in Fig 5 in the appendix for the PMP systems; with similar bandwidth characteristics to UHF, MMDS and MDS bands; and with a nationwide footprint.

3,5 GHz; 10,5 GHz and 24 GHz Bands.

The band that we will refer to as 3,5 GHz (see Fig. 6 in the appendix) includes the entire 300 MHz portion from 3,4 to 3,7 GHz. It is divided in 6 subbands of 25 + 25 MHz each. Two of them have a duplex separation of 50 MHz and the other four of 100 MHz.

The covered area in this band is of about 15 Km and if we analize the equipment available we will observe that most of it is oriented to offer voice service and data up to a rate of 64 or 144 Kbit/s. With a single cell it is possible to offer services of this kind to about 2.500 users. It is possible therefore to apply this equipments in urban areas to attend the demand of residential customers that live in a single home building or SOHO[29] customers.

The 10,5 GHz band includes five 30 + 30 MHz subbands each (see Figure 7 in the appendix). The covered area in this band is of about 5 Km, depending of the rain characteristic. If we analize the equipment available for this band in the market, we will see that most of it is oriented to offer 2 Mbit/s E1 links. Therefore they are ideal for attending urban residential customers that are concentrated in a multi-dwelling building where it is possible to arrive with a E1 and to distribute among apartments in wired form, or medium/small companies (PABX conection, data service or Internet access). Also they are suitable to build the "backbone" of a cellular or PCS network, because they are able to offer the E1 transmission neccessary to connect the MSC (Mobile

[29] Small Office-Home Office

Switching Center) with the radiobases. Due to their applications, these equipments are sometimes refered as "medium density" because they are half the way between low density systems like the previously mentioned 3,5 GHz band systems and the so called high density LMDS systems that work at 28 and 38 GHz frequencies.

A portion at 24 GHz band has also been attributed for telecommunications services in Argentina in 1999. It includes five 40 + 40 MHz subbands (see Fig 8 in the appendix) . This attribution is exactly the same that exists in the USA for the service called DEMS (Digital Electronic Messaging Service). We must remark that in the USA the five subbands were assigned to the same operator, Teligent, making a total bandwidth of 200 + 200 MHz. In Canada in the 1999 24 MHz auction, spectrum allocated was exactly the same 400 MHz all in one license. As equipment in the market tends to be oriented to satisfy the american and canadian markets, the adaptation to shorter bandwidths will be very expensive, if the subbands are assigned one by one to different operators.

High density bands

High density bands have been allocated in Argentina in the 28 GHz, 38 GHz and 41 GHz bands.

The 28 GHz band, reserved for LMDS (Local Multipoint Distribution Service), is formed by six 500 + 75 MHz subbands as can be seen in Fig 9 in the appendix. The covered area in this band reduces to a pair of kilometers strongly depending on rain regime. Among all bands attributed for PMP systems, this is the one that has the greatest subbands bandwidth.

An analysis of the equipment that exist will show that most of it is in a very early developing stage. Older equipment is oriented toward CATV distribution, because it was supposed that the first application of LMDS would be the distribution of broadband services to residential customers. The most recient equipment, on the contrary, is oriented toward corporate market, offering high speed links (up to 155 Mbit/s), because now the forecasted services are: videoconference, LAN connection, Internet and Intranet access. It can be estimated that this technology will be first applied to urban commercial micro-cores and then, when it reaches certain maturity, it may perhaps be extended to the residential market.

The 38 GHz band, includes in Argentina thirteen 100 + 100 MHz subbands, allocated in the 37-40 GHz portion (see Fig. 10 in the appendix). In this band it is deployed the so called "wireless fiber" service, oriented toward the corporative market and to operators. At present, only point to point links are offered, or as they are called "multi-point to point", but PMP services has been announced to be deployed in the near future. Coverage radio is still shorter than with 28 GHz radios.

Finally, there is also spectrum allocated for PMP systems in the 41 GHz band, including three 250 + 250 MHz subbands, in the 41-42,5 GHz portion, as can be seen in Fig 11 in the appendix. There have not been commercial deployments announced in

this band, which is due to the almost inexistence of equipment. The service offered in this portion of spectrum is usually denominated MVDS (Multichannel Video Distribution Service), or also European LMDS, because it was the one originally allocated in Europe for the wireless local distibution. But at present in Europe there are only CATV programming distribution in some places only.

Interactive digital TV.

At present, in Argentina interactive services like Internet are only available to PC users. The number of household with PC in Argentina is not very high, but almost all households have a TV receiver. Because of this, the possibility of broadening the potencial market of interactive services, including e-commerce (B2C[30]), through digital TV calls great attention. Some trials are going on related to terrestrial wave digital TV transmission.

Stratospheric platforms

An option considered was to set stratospheric platforms (the balloons from Sky Station) over the main cities of Argentina, like Buenos Aires, Córdoba and Santa Fe-Rosario. They would work in the 47 GHz band, and the main target would be to offer multimedia services such as videotelephony.

Also, in 1999 another stratospheric system, based in HALO (High Altitude Long Operation)[31] aircrafts, was presented in Argentina.

Broadband GEO satellite systems

There are two Direct Broadcasting Systems commercially operating in Argentina: TDH (Grupo Vila) and DirecTV (Grupo Clarín); and recently a third one, Sky Argentina (Sky-Telecom), has incorporated. All of them have announced the implementation in the short- term of interactive services, using a telephone line as the return path. DirecPC service is also offered in Argentina, through Impsat. DirecPC service allows that the user, connected to Internet through a telephone line, could be able to download big files by means of a satellite link using a parabollic antenna similar to DirecTV service.

Besides, several of the new GEO satellite systems in Ka band (17 to 30 GHz) that are planned in a worldwide scale include South America between their target markets. These systems will use the technology developed by NASA through the ACTS

[30] Business to Consumer.
[31] see http://www.angelhalo.com/

(Advanced Communication Technology Satellite) satellite launched in 1993. They will include on board processing, ATM switching, call routing, intersatellite links, spot beam technology and bidirectionality.

So, we can expect in a few years to have in Argentina interactive satellite services with satellite return from the customer's antenna, from systems like Spaceway (Hughes), Astrolink (Lockheed Martin) and GE*Star (GE Americon), all three with deployment planned from 2002 on. Due to the use of spot beam technology in the Ka band, these satellites will produce thinner spots than the ones operating in the C or Ku bands. Because of that, these systems will be able to offer regionalised broadcasting, that means different programmings in adyacent areas of the same country, as they will be iluminated by different beams.

Wideband LEO satellite constellations

Argentina is the second country in the world, after the USA, to give a license to the Teledesic system. Teledesic Argentina already exists. As a consequence, reserve has been made of the spectrum portions that this operator will use: 18,8-19,3 GHz and 28,6-29,1 GHz. This fact already has effects in the industry: new radiolinks in those portions of the spectrum are not allowed. Those radiolinks were traditionally used in Argentina for digital microwave links, and besides, it is necessary to draw existing links before a certain date previous to the planned beginning of Teledesic system.

CONCLUSION

From the above expressed it can be appreciated that Argentina has a very special situation in which regulation allows competition between certain wireless technologies that are not allowed to compete between them in any other part of the world**.** As an example, we can mention what we said that in the USA and Canada 3,5 GHz and 10,5 GHz bands are not allocated for telecommunications use as they are in Argentina.

Also, Argentina will be a special case in the world taking into account the quantity of spectrum attributed to telecommunication use. If we sum up all that is allocated to the fixed PMP service we will reach almost 9 GHz.

Due too to the liberalization process that is taking place, Argentina is one of the first countries in the world in which wireless networks based in the new technologies will have the opportunity to be tested and developed commercially.

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APPENDIX

2,1-2,7 GHz Band: spectrum allocation in Argentina.

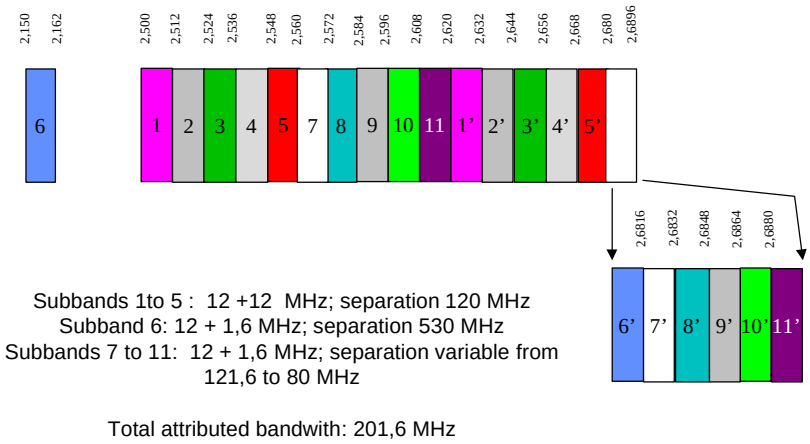


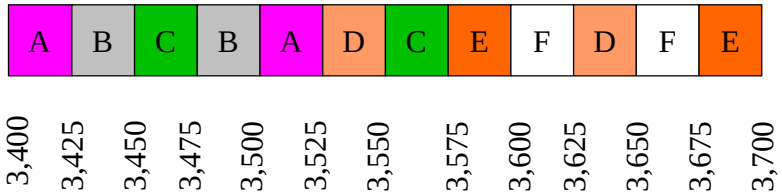
Figure 4

3,300-3,400 GHz Band: spectrum allocation in Argentina.

subbands bandwith: 12+12 MHz
separation: 76 MHz
Total attributed spectrum: 48 MHz

Figure 5

3,4-3,7 GHz Band: spectrum allocation in Argentina.

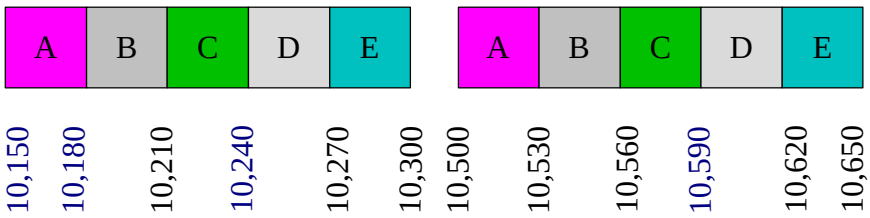


Subbands A, C,D & E separation 100 MHz
Subbands B & F separation 50 MHz

Total allocated bandwith: 300 MHz = 0,3 GHz

Figure 6

10,150-10,650 GHz Band: spectrum allocation in Argentina

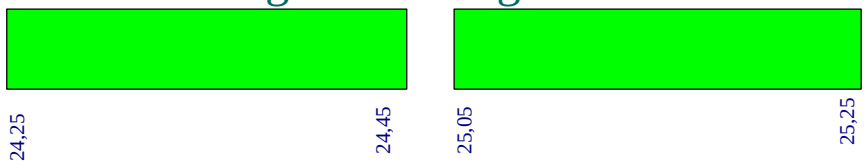


Total allocated bandwith: 300 MHz = 0,3 GHz

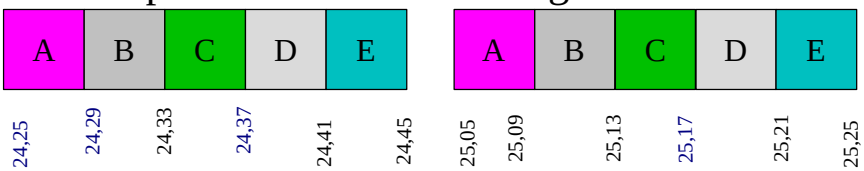
Figure 7

DEMS (24 GHz)

Band assigned to Teligent in USA



Spectrum allocated in Argentina



Separation 800 MHz - Total bandwith allocation: 400 MHz = 0,4 GHz

Figure 8

LMDS: spectrum allocated in Canadá, EEUU and Argentina (GHz)

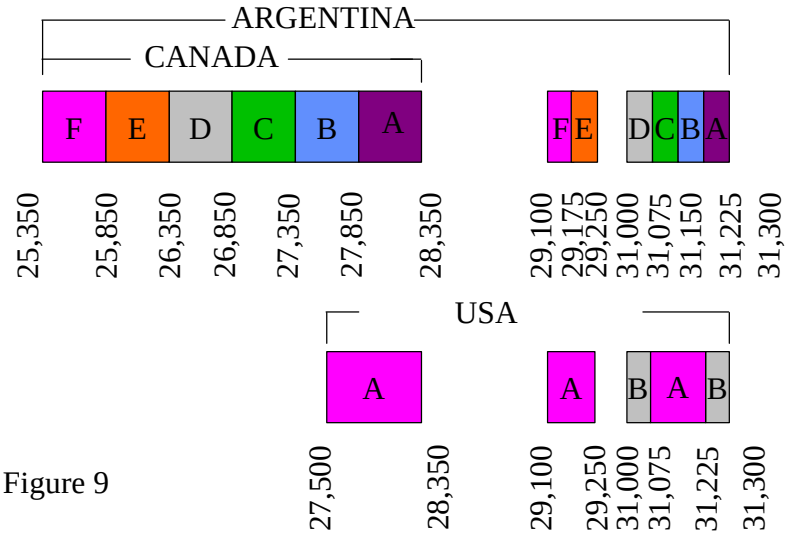
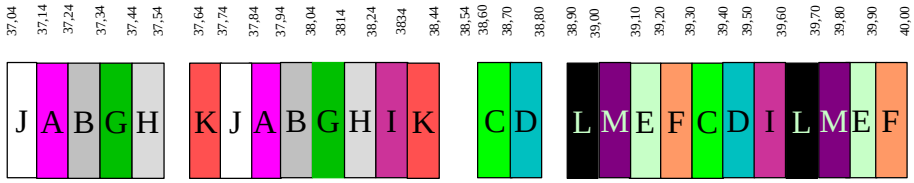


Figure 9

37-40 GHz Band: spectrum allocation in Argentina.



Subbands A to M: 100+100 MHz

Figure 10

Separation 700 MHz except
"I" which separation is 1.260 MHz

Total spectrum allocation: 2.600 MHz = 2,6 GHz