

**Consultation Document: Ref. 2004/2**

**Consultation paper on the  
implementation of  
3G Mobile in Mauritius**

**14<sup>th</sup> July 2004**

## Explanatory memorandum

*Considering that:*

- 1) the ICT Authority has one of its objects, under section 16(g) of the Information and Communication Technologies Act 2001, to “*further the advancement of technology, research and development relating to information and communication technologies through modern and effective infrastructure taking into account the convergence of information technology, media, telecommunications, and consumer electronics*”;
- 2) the National Telecom Policy NTP-2004 sets out, as one of the policies of Government, to introduce third generation (3G) and beyond Mobile Cellular Networks and services in Mauritius;
- 3) government has given its approval to the introduction of 3G mobile services in Mauritius as from 1<sup>st</sup> January 2005.

*The Information and Communication Technologies Authority resolves to:*

- 1) make available for public consultation the Consultation Document Ref 2004/2;
- 2) invite views, contributions, and comments on the Consultation Document, which shall be sent to the **Chairman, ICT Authority, Jade House, Remy Ollier street, Port Louis**, or by email to [icta@intnet.mu](mailto:icta@intnet.mu), at latest by 31<sup>st</sup> July 2004.

**A B Radhakisson**

**Chairman, ICT Authority**

## Executive Summary

The purpose of this paper is to examine the issues involved in the implementation of 3G for mobile broadband communication services in Mauritius. It analyses some fundamental technologies prior to 3G, and introduce International Mobile Telecommunications (IMT-2000). The market demand for 3G applications is also considered with a view to setting out a proper regulatory framework for 3G in Mauritius. The proposal of the Authority is made and views are invited on the proposal.

### 1.0 Introduction

The world of telecommunications has entered in a new era with the introduction of third generation (3G) mobile networks in several countries around the globe. 3G promises a plethora of new services, but more importantly, it is a concerted view worldwide that in 3G, the technology should under no circumstances act as a limitation as far as the services to be offered are concerned. In 3G, the network is more a kind of a “service network” rather than a classical plain cellular network<sup>1</sup>; the network operators become more an “intelligent enabler” than subscribers and contents owners<sup>2</sup>. The goal of 3G mobile communication systems therefore is the delivery of multimedia services to the users in the mobile domain<sup>3</sup>.

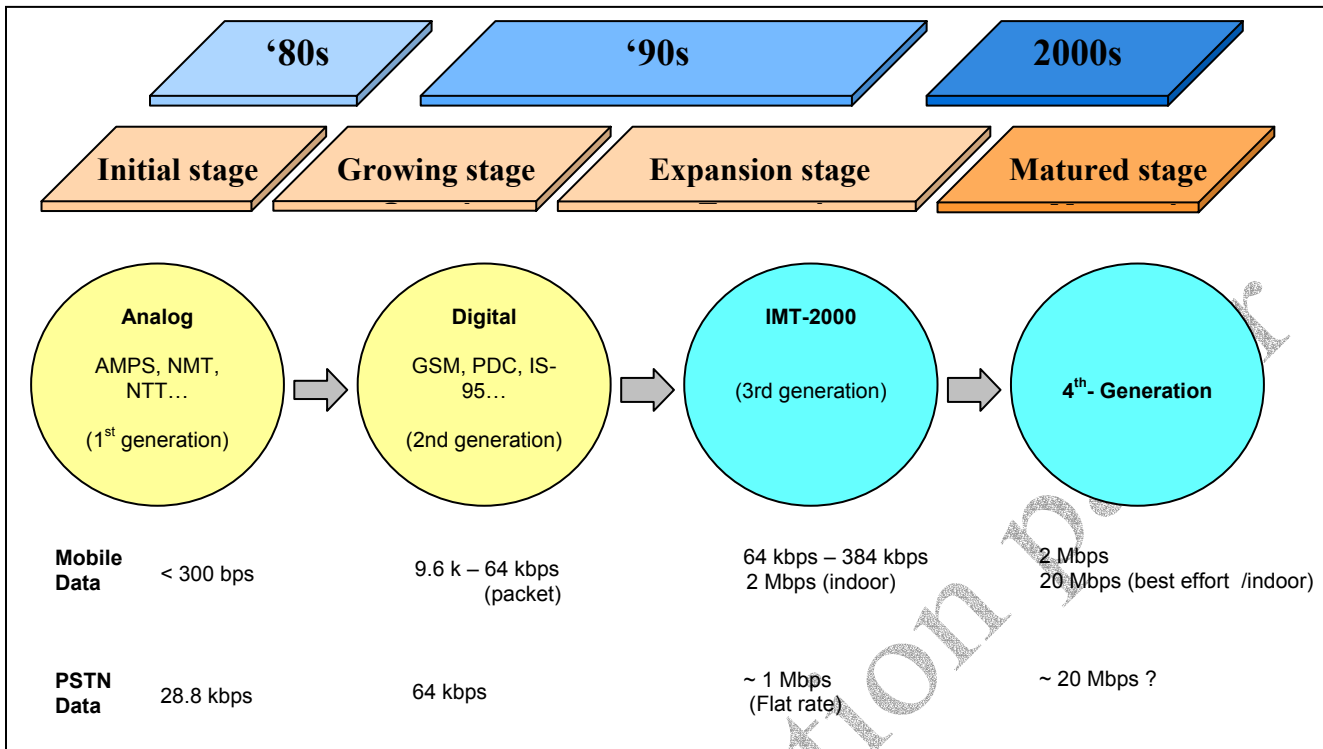
It is recognised worldwide that there has been an establish model for the evolution of the mobile sector in terms of distinct generations over time, as depicted in Figure 1. The so-called first generation, 1G, systems were semi-analogue. Examples are the Advanced Mobile Phone Service (AMPS) and the European Total Access System (ETACS). In Mauritius, the latter system had been in use by Emtel Ltd, until April 2002 when it was switched off to give way to a full GSM network. The 1G system was very limited in terms of services offered. Moreover, their analogue nature made them particularly prone to noise and interference with very poor privacy and security attributes. Conversations were easily intercepted and the phone sets could be easily cloned. Finally these systems were developed with national scope only and there was no interoperability between the different systems especially across borders.

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<sup>1</sup> H. Kaaranen et al., *UMTS Networks, Architecture, Mobility and Services*, John Wiley & Sons, Ltd, 2001

<sup>2</sup> J P Conti, Importing i-mode. Europe’s new go at Internet mobile telephony, with Japanese flavour. IEE Communications Engineer, February/March 2004.

<sup>3</sup> K. W. Richardson, *UMTS Overview*, IEE Electronics & Communication Engineering Journal, June 2000.



**Figure 1: Evolutions of Mobile Systems with respect to time<sup>4</sup>**

2G systems were created with the main objective of becoming a global mobile system. However, they turned out to be only a semi-global one. The main difference between 2G and 1G is the fact that the former is a fully digital system and thereby bringing about a marked improvement in terms of susceptibility to noise and interference, as well as in terms of security. Out of the different 2G systems that were developed for the market, Global System for Mobile Communications (GSM) has emerged out as a commercial success story. Today 71% of the world's mobile communications subscribers use GSM<sup>5</sup>.

Currently in Mauritius some dynamics in the mobile sector have been noted, especially with the liberalisation of the telecommunications since January 2003. A wide range of value added services are presently being offered by the mobile operators; more recently, Multimedia Messaging System (MMS) has been launched by one of the mobile operators. There is presently indication about the demand for new spectrum for 3G services.

<sup>4</sup> Source: IEEE Communications magazine, July 2001.

<sup>5</sup> G. Platt, *GSM is a '3G' System in its own right*, IEE Communication Engineer, April 2003

The objective of this paper is to present 3G mobile systems from concept to technology, services and regulation, as it is currently understood, and to consider the different issues to be addressed in relation to the introduction of same in Mauritius. The paper is organised as follows: Section 2 recalls the basics of GSM, Section 3 is an introduction to IMT-2000, Section 4 is an introduction to UMTS, Section 5 addresses the demand issue for 3G, Section 6 is concerned with the regulatory considerations related to 3G, and in Section 7 the proposal of the Authority is made.

## **2.0 Basic Global System for Mobile Communications (GSM) – 2G**

Global System for Mobile Communication (GSM) in its basic form is a second generation (2G) technology that was introduced in Europe in the 1990's so as to solve the fragmentation problems of the first cellular systems. GSM was the first cellular system to specify digital modulation and network level architectures and services. GSM was specified to operate in the 900 MHz band but later technically equivalent offshoots such as the DCS 1800, which operates in the 1800 MHz band, were developed. The main application for which GSM was specified was voice. Hence, GSM is based upon circuit switching technology, and it offers limited data possibilities with a data rate of 9.6 kbps symmetric connection between network and terminal.

With the advent of the Internet and other data networks, along with the increasing popularity of multimedia services, and the need to have access to these services while on the move, there was a rising need to deliver the aforesaid services in the mobile domain. This requirement revealed the limitations of basic GSM in that respect, the data rate being too low. This was the main reason why 3G came into existence.

## **3.0 International Mobile Telecommunication – 2000 (IMT-2000) – 3G**

The goal of third generation (3G) mobile communication systems is the delivery of multimedia services to users in the mobile domain<sup>3</sup>. The paradigm behind 3G is the widespread provision of multimedia services and application to users while on the move, therefore adding a multimedia flavour to the “anytime and anywhere” concept<sup>6</sup>. This objective can only be met if a substantially higher user data rate than with GSM can be provided. Additionally, wideband and broadband radio

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<sup>6</sup> M Dinis and J Fernades, Provisioning of sufficient transmission capacity for broadband mobile multimedia, IEEE Communications magazine, August 2001

technologies are necessary as well as a panoply of fancy enhanced colour, multimode, and multi-band terminals will be required to satisfy market needs.

IMT-2000 is a family of the 3G mobile communication standards that has been defined by the International Telecommunication Union (ITU); the concept and the objectives that are to be met by IMT-2000 are defined in ITU-R Recommendation M.687-2, and are summarised hereunder:

- High data rates with a minimum of 144 kbps in all radio environments and 2 Mbps in low mobility and indoor environments.
- Symmetrical and asymmetrical data transmission
- Circuit switched and packet switched services, such as Internet Protocol (IP) traffic and real-time video.
- Voice quality comparable to wire-line quality
- Greater capacity and improved spectrum efficiency
- Several simultaneous services to end-users and terminals for multimedia services
- Seamless incorporation of 2G cellular systems
- Global roaming between different IMT-2000 operational environments
- Economies of scale and an open global standard that meet the needs of the mass market.

The ITU had set out a vision to specify at least one common global radio interface technology, however, due to many parallel activities in regional standardisation bodies this effort turned into promotion of common architectural principles among the family of IMT-2000 systems<sup>1</sup>. The standards adopted for IMT-2000 are as shown in Table 1:

Full name	Common names
IMT-2000 CDMA Direct Spread	UTRA FDD WCDMA UMTS
IMT-2000 CDMA Multi-Carrier	CDMA2000 1x and 3x CDMA2000 1xEV-DO CDMA2000 1xEV-DV
IMT-2000 CDMA TDD (time-code)	UTRA TDD 3.84 Mchip/s high chip rate UTRA TDD 1.28 Mchip/s Low chip rate (TD-SCDMA) UMTS
IMT-2000 TDMA Single-Carrier	UWC-136 EDGE
IMT-2000 FDMA/TDMA (frequency-time)	DECT

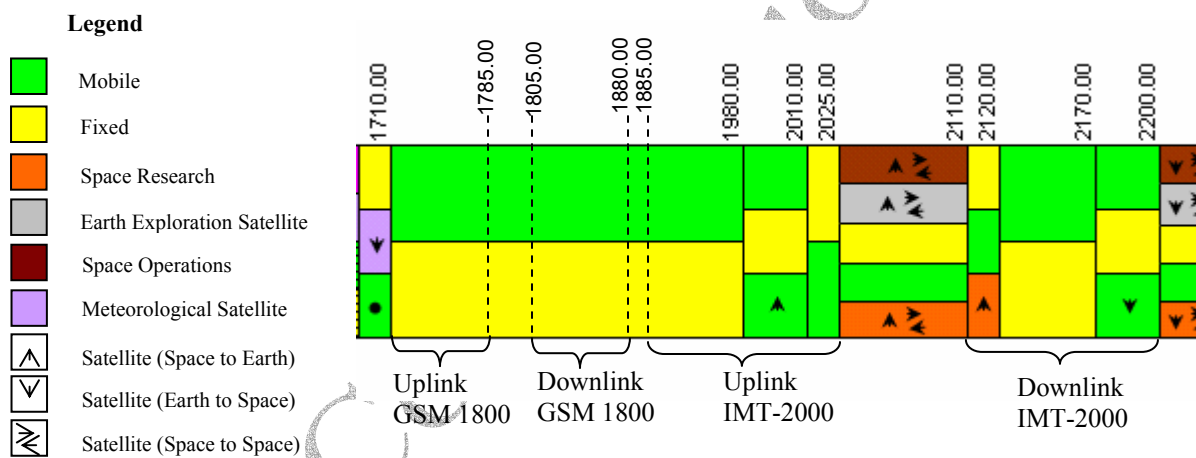
**Table 1: IMT-2000 terrestrial radio interfaces**<sup>7</sup>

<sup>7</sup> Source: ITU, Deployment of IMT-2000 System, June 2003

### 3.1 Spectrum Consideration for IMT-2000

ITU Radio Regulations Article RR S5.388 allocates the bands 1 885-2 025 MHz and 2 110-2 200 MHz for use on a worldwide basis by administrations intending to implement International Mobile Telecommunications-2000 (IMT-2000). Such use does not preclude the use of these bands by other services to which they are allocated. Also, sub-bands 1 980-2 010 MHz and 2 170-2 200 MHz are for the satellite component of IMT-2000. Furthermore, in accordance with Resolution 212 (Rev.WRC-97), Administrations shall resolve to make available the aforesaid allocated bands for IMT-2000 services in their respective national radiofrequency spectrum allocation plan.

The frequency bands that have been ear-marked nationally for IMT-2000 in the Mauritian Radiofrequency Spectrum Allocation Chart, approved in February 2003, are as shown in the applicable extract from the said plan, in Figure 2.



**Figure 2:** IMT-2000 allocation for Mauritius—extract from Mauritian Spectrum Allocation Chart

In addition to the spectrum identified at the WRC-92/97, new bands were proposed at the WRC-2000 to meet the growing demand of the mobile telecommunications market, which had exceeded the 1 billion mark in 2003<sup>8</sup>, and the expected boom in the multimedia mobile applications as clearly borne out in the forecast data provided in Figure 3. These frequency bands are: 2 500 – 2 690 MHz, 1 710 – 1 885 MHz, and 806 – 960 MHz. It is to be noted however that assignment for GSM 1800 has already been done very close to the previously reserved bands for IMT-2000, i.e. on the 1 710 – 1 885 MHz band, as shown in Figure 2. Indeed in Europe also, the 900 MHz and the 1800 MHz

<sup>8</sup> Source: ITU database

bands have already been assigned to, and will continue to be commercially used by, 2G systems (GSM), up to and beyond the date by which additional spectrum is expected to be needed. Studies undertaken at CEPT<sup>9</sup> has confirmed that the preferred band to accommodate additional terrestrial IMT-2000 requirement is the 2 500 – 2 690 MHz band.

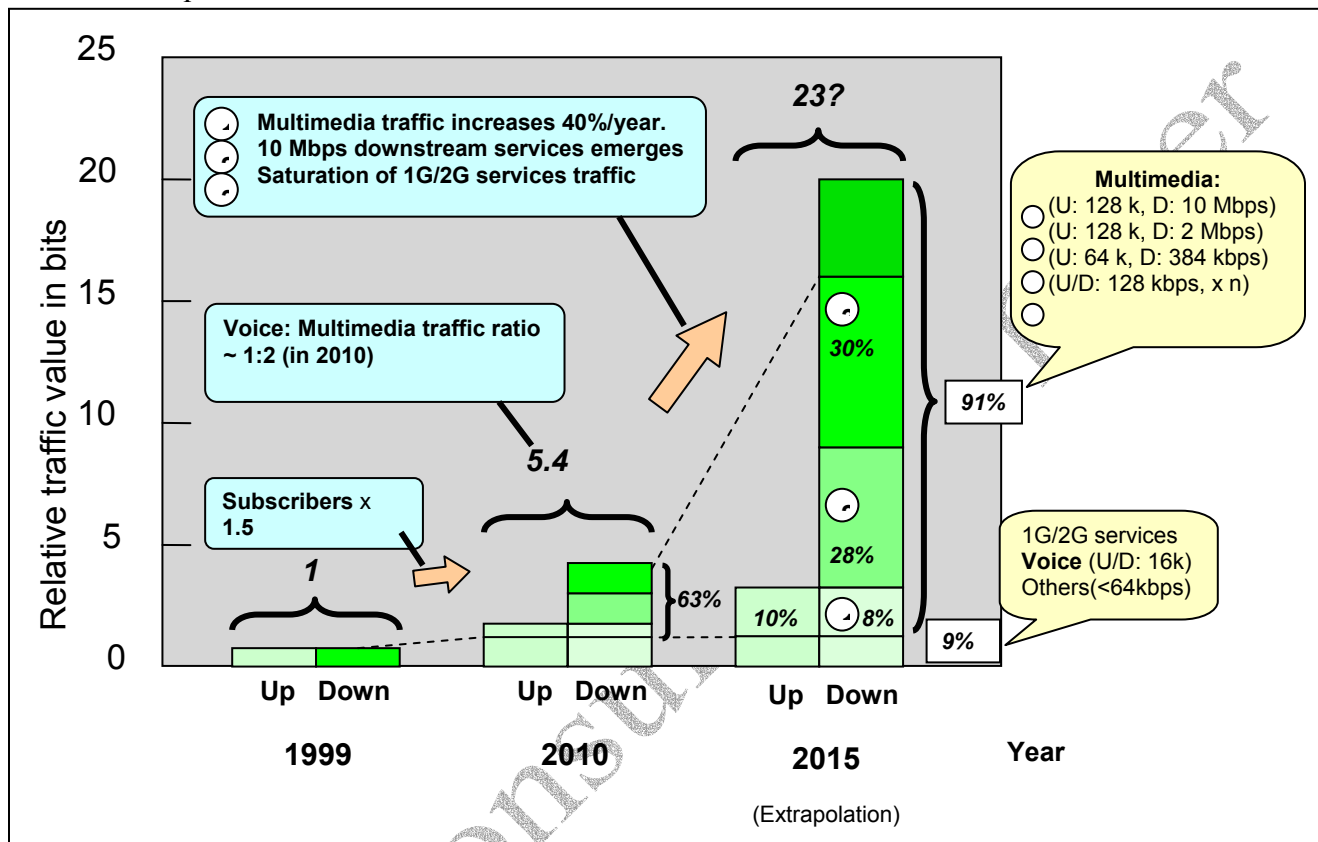


Figure 3: Mobile forecast traffic<sup>4</sup>

#### 4.0 Universal Mobile Telecommunications System (UMTS)

UMTS is the radio access scheme for 3G mobile defined by the European Telecommunications Standards Institute – Special Mobile Group (ETSI – SMG) in January 1998<sup>10</sup>. This system uses Wideband CDMA (W-CDMA) with 5 MHz channel spacing and it can support both voice and data with bit rates up to 2 Mbps. The UMTS Radio Access or UTRA consists of two modes:

- Frequency Division Duplex (FDD) - links to and from the base station use different frequencies;

<sup>9</sup> CEPT ECC, Final report from CEPT to the EC under mandate 4, November 2002

<sup>10</sup> Martin Haardt et al., *The TD-CDMA based UTRA TDD Mode*, IEEE Journal on Selected Areas in Communications, Vol. 18, No.8, August 2000



- Time Division Duplex (TDD) - links to and from the base station share the same channel but are time-multiplexed.

### 5.0 The Demand for 3G Services

As was explained earlier, the main difference between 2G and 3G services is multimedia in the mobile environment. The main question is whether there is a demand for multimedia services coupled with mobility. In a publication<sup>11</sup> released by Mason Group, a British consultancy firm, in summer 2003, an article explains that mobile operators evolving from 2G, 2.5G through to 3G are facing “an extremely complex and uncertain environment”. It is also mentioned that “the principal sources of these uncertainties are the macro-economic downturn, shifts in the mobile value chain and willingness of a critical mass of customers to adopt and pay for enhanced mobile data services”. Nevertheless, the number of UMTS subscribers as at January 2004 in different European and non-European markets as shown in Table 2 is indicative of the market pickup for 3G services.

Country	Operator	Number of Subscribers as at January 2004
Japan	DoCoMo	2,014,000
Japan	Vodafome KK	123,000
Australia	Hutchison	109,000
Italy	Hutchison	376,000
UK	Hutchison	321,000
Sweden	Hutchison	26,000
Denmark	Hutchison	8,000
Austria	Hutchison	13,000
Austria	Mobilkom	2,000

**Table 2: Number of subscribers to UMTS as at January 2004<sup>12</sup>**

One important aspect of 3G services is in fact the availability of multimedia content. If there is not a high availability, no high demand for 3G can possibly exist. Hence it is mandatory to determine the demand for 3G services before the introduction of such a network in Mauritius. Also, as mentioned in the previous section, GSM itself may now be considered as 3G after enhancement. This may be a strong argument from a regulatory perspective not to make new frequency allocations for 3G per se, as it is recognised that spectrum is a rare commodity which does require diligent administration.

<sup>11</sup> Mason Group, www.mason.biz, *Communiqué*, Summer 2003

<sup>12</sup> Source: Autorité de Régulation des Télécommunications de France - ART

## 6.0 Regulatory Considerations for 3G

The ICT Authority has taken into account the following regulatory issues before making its proposal regarding the introduction of 3G in Mauritius:

**6.1 Spectrum licensing model to be adopted for 3G** – Several possible methods for spectrum assignment exist, namely, first-come first-served, lotteries, comparative bidding (beauty contest), and auctions. Each one of these methods has a number of variations. Recently, mobile operators have had to pay phenomenal rents in auctions for 3G licenses, particularly in Europe. The United Kingdom, for instance, raised 33 billion USD in its April 2000 auction and Germany followed suit at 47.5 billion USD in its 3G auction later that year. Finland, on the other hand, awarded four licenses at no additional cost to the operators on the basis of comparative bidding. As such, there is a wide disparity in license fees and methods across markets. This raises a number of issues related to market structure, pricing and service development<sup>13</sup>.

**6.2 Standardization Issues** – As was explained in section 3, several modes have been defined by the IMT-2000 for the 3G air interface. In this respect the issue is whether regulation has to specify the technology to be used for 3G or not. Currently, the licensing structure defined in the Information and Communication Technologies (Amendment of Schedule) Regulations 2003, is technology-neutral and the Public Land Mobile Network (PLMN) licence does in no case specify the technology to be used. In the case of 3G however, the following has to be taken into consideration in the determinations of the standards to be allowed:

- The current 2G standards being used by the current operators i.e. GSM 900 and GSM 1800
- The migration path proposed for these 2G standards
- The interoperability among the different 3G standards
- Whether all standards can offer the same types and quality of services
- The standards that are being adopted worldwide so that roaming is possible
- The availability of multi-mode handsets

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<sup>13</sup> [http://www.itu.int/osg/spu/ni/3G/resources/licensing\\_policy/](http://www.itu.int/osg/spu/ni/3G/resources/licensing_policy/)

**6.3 Licensing Issues** – It is required to determine whether 3G will be the concern of new entrants as well as incumbents or incumbents only. It has to be taken into consideration that an incumbent will be able to implement 3G in a phased manner by migrating from 2G to 2.5G and finally to 3G and even beyond whereas a new entrant introducing 3G will have to start from scratch. This implies that the capital investment for the new entrants is much more than for the incumbents. One other factor to take into account is that incumbents also have their customer base whereas a new entrant will have to build its own. In that respect, there is the possibility that there is no proper level playing field.

**6.4 Scope of Service** – The scope of service for 3G is much more extensive when compared with 2G since the former has the capacity of providing broadband multimedia services. In that respect therefore, the best method of regulating these services will have to be found. This aspect of 3G may also be addressed in the on-going discussion in relation to convergence, since it does appear that some form of service-neutrality will need to be introduced with the coming over of 3G.

**6.5 The time scale for 3G introduction** – The main consideration to determine when 3G will have to be rolled out in Mauritius is the demand for it. The demand for 3G will be felt when the users will have a need for multimedia communication services coupled with mobility. Already however, GSM camera phones which include multimedia messaging have appeared on the market. However, the prices of these handsets have not made them popular yet.

## **7.0 Proposal of the ICT Authority**

Taking into consideration the points enumerated at section 7 above the ICT Authority now makes the following recommendations in respect of the different issues that need to be addressed in relation to the introduction of 3G in Mauritius:

### **7.1 Spectrum Consideration**

*Considering that:*

- i) Clause No. **5.388** of the RR states that, *“The bands 1 885-2 025 MHz and 2 110-2 200 MHz are intended for use, on a worldwide basis, by administrations wishing to*

*implement International Mobile Telecommunications-2000 (IMT-2000). Such use does not preclude the use of these bands by other services to which they are allocated. The bands should be made available for IMT-2000 in accordance with Resolution 212 (Rev.WRC-97).”*

- ii) Clause No. **5.384A** of the RR states that: *“The bands, or portions of the bands, 1 710-1 885 MHz and 2 500-2 690 MHz, are identified for use by administrations wishing to implement International Mobile Telecommunications-2000 (IMT-2000) in accordance with Resolution 223 (WRC-2000). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations (WRC-2000).”*

*And further recognizing that:*

- i) Resolution 212 of WRC-97, resolves that:-

Administrations which implement IMT-2000:

- a) should make the necessary frequencies available for system development;
  - b) should use those frequencies when IMT-2000 is implemented;
  - c) should use the relevant international technical characteristics, as identified by ITU-R and ITU-T Recommendations.
- ii) part of the 3G frequency band has been assigned to fixed services in Mauritius

*The ICT Authority proposes to:*

undertake a spectrum re-farming exercise, pursuant to ITU-R Rec. **SM 1047-1**, in order to make available spectrum for IMT-2000.

## **7.2 Licensing**

*Considering that:*

- i) The Licensing and Fees Regulation of 2003 sets out the scope and licence fees payable for PLMN, amongst other licenced activities;
- ii) The licence fee payable for the use of spectrum is set out in the same regulation;

- iii) Licences have been defined to be technology neutral.

*The ICT Authority proposes to:*

- i) apply the licensing regime currently in force in Mauritius for 3G services;
- ii) consider 3G systems as being an evolution of current mobile networks, and thus falling under the scope of the existing PLMN licence;
- iii) apply the spectrum fees as currently obtained under SPL.2 of the Licensing and Fees regulation of 2003 for IMT-2000 spectrum usage.

## **8.0 Conclusion**

In this Consultation paper, we have provided an overview of 2G and presented a comprehensive description of the 3G systems for mobile broadband communications. The issues that are to be addressed with regard to the implementation of 3G in Mauritius have been discussed. The technical standard for the radio access element to be used for Mauritius is proposed. The licensing framework for 3G is presented. The following proposals of the Authority are put up for consultation:

### **8.1 Spectrum Consideration**

The 3G services to be implemented in Mauritius shall operate in bands 1 885-2 025 MHz paired with 2 110-2 200 MHz. In order to make the relevant spectra available for the 3G services, ICTA shall undertake a spectrum re-farming exercise, pursuant to ITU-R Rec. **SM 1047-1**.

### **8.3 Licensing**

- i) apply the licensing regime currently in force in Mauritius for 3G services;
- ii) consider 3G systems as being an evolution of current mobile networks, and thus falling under the scope of the existing PLMN licence;
- iii) apply the spectrum fees as currently obtained under SPL.2 of the Licensing and Fees regulation of 2003 for IMT-2000 spectrum usage.