

# **Licensing Framework for Third Generation Mobile Services**

## **An Industry Consultation Paper**

**21 March 2000**

### **1. Introduction**

1.1 Public mobile radiotelephone services (PMRS) based on the cellular technology were introduced into Hong Kong in the mid-1980s. By the early 1990s, three operators had been licensed to provide the first generation (analogue) PMRS. The number of subscribers grew steadily over this period to a total of around 0.19 million by the end of 1991. In 1992, the Government introduced the second generation (digital) PMRS in order to overcome the capacity limitation of the analogue systems. The number of operators was increased to four. The number of subscribers then grew to a total of around 1.2 million by the end of 1996. Following the granting of six licences for Personal Communications Services (PCS) at the end of September 1996 and full digitalisation of networks by the PMRS operators by 1998, the number of subscribers grew to the level of 2.86 million by the end of 1998. The implementation of mobile number portability (MNP) in March 1999 further stimulated demand as prices fell substantially due to keen competition among the operators. As of the end of January 2000, the mobile population reached 3.82 million, representing a penetration rate of 55%, which is one of the highest in the world.

1.2 This exciting growth is attributable both to the pro-competition approach we have adopted for the mobile telecommunications market and to the success of second generation (2G) mobile communications using digital cellular radio technology. As the costs of both handsets and services have decreased to levels affordable to the vast majority of the population, the number of mobile service users is expected to exceed the corresponding number in fixed services in the very near future<sup>1</sup>. Also, mobile operators are expanding the range of their services beyond mere voice telephony and we can expect to see the trend of increasing proportion of non-voice traffic over the services as a result of technology advances and market development.

1.3 As increasing competition is stimulating consumer interest in the sector, customer demand is becoming more sophisticated. Current 2G mobile

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<sup>1</sup> As of the end of January 2000, there were 3.85 million fixed telephone lines and 3.82 million mobile subscribers in Hong Kong. Average annual growth rates in the past three years were 4.1 % for fixed telephone lines and 46.1 % for mobile subscribers.

networks can only cater for voice and low speed data (up to 9.6 kbps) transmissions but not broadband applications like high speed Internet access, multimedia or video services. To meet market demand, some mobile operators are investing in the so-called “second-and-half-generation” (2½G) mobile services. 2½G services such as General Packet Radio Services (GPRS) can offer transmission speeds up to 115 kbps, but this can only be regarded as an interim solution as the data rates will not be sufficient to meet the demand of highly interactive multimedia and high resolution video services.

1.4 The next major step in upgrading to broadband capabilities for mobile services lies in what in the industry is called the third generation (3G) systems which will offer data rates up to 2 Mbps<sup>2</sup> and hence will be able to deliver multimedia and other innovative services which are emerging over the broadband fixed networks. 3G mobile services aim to offer mobile personalised multimedia communications to the mass market regardless of location, network or terminal.

1.5 Considerable work has been carried out in a number of international forums in recent years on the introduction of 3G mobile services. Regulatory authorities in some countries have already issued licences (e.g. Finland) or allocated spectrum for 3G services (e.g. the UK, France and Germany) while some others (e.g. Singapore) are consulting the industry on the regulatory regime for these new services. The Telecommunications Authority (TA) considers it appropriate for Hong Kong to initiate the consultation process in order to solicit input from the industry so as to allow the timely introduction of 3G mobile services.

1.6 *This paper discusses the various issues on the introduction of 3G mobile services and consults the industry and any interested party on these issues, prior to finalisation of the regulatory framework for 3G mobile services in Hong Kong. The TA intends to invite applications for 3G licences in the last quarter of 2000.*

## 2. Standards Issues

### *International 3G standards*

2.1 The international 3G standards are developed by the International Telecommunication Union (ITU), an international organisation with standardisation of telecommunications as one of its functions, under the name of IMT-2000 (International Mobile Telecommunications - 2000). The Radiocommunication

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<sup>2</sup> The ITU has specified different data rates for different environments for the operation of IMT-2000. These are 2 Mbps for stationary indoor use, 384 kbps for use at pedestrian speeds and 144 kbps for use at vehicular speeds.

Sector of the ITU (ITU-R) Task Group 8/1 meeting in Helsinki held from 25 October to 5 November 1999 approved a comprehensive set of terrestrial radio interface specifications for IMT-2000. These include: -

<b>ITU Designations</b>	<b>Commonly Known Designations</b>	<b>Technology</b>
IMT - DS (Direct Spread)	UTRA FDD (Universal Mobile Telecommunications System Terrestrial Radio Access - Frequency Division Duplex)	Wideband Code Division Multiple Access (WCDMA)
IMT - MC (Multi-Carrier)	cdma2000	CDMA
IMT - TC (Time Code)	UTRA TDD (Universal Mobile Telecommunications System Terrestrial Radio Access - Time Division Duplex); and TD-SCDMA (Time Division - Synchronous Code Division Multiple Access)	a combination of CDMA and Time Division Multiple Access (TDMA)
IMT- SC (Single Carrier)	UWC-136 (Universal Wireless Communications -136)	TDMA
IMT - FT (Frequency Time)	DECT (Digital Enhanced Cordless Telecommunications)	a combination of TDMA and Frequency Division Multiple Access (FDMA)

2.2 The UTRA FDD based on WCDMA is a completely new technology and is not related to, or limited by, existing 2G technology. It is expected to be deployed in areas where the GSM technology is used at present. The cdma2000 and UWC-136 standards stipulate radio access interfaces that offer evolutionary upgrade for the existing IS-95<sup>3</sup> and IS-136<sup>4</sup> systems respectively in use in Hong Kong.

### ***Current Status of National and Regional Development of 3G Standards***

2.3 National and regional standardisation bodies in different parts of the

<sup>3</sup> The standard for a CDMA service currently offered by Hutchison Telephone Company Limited.

<sup>4</sup> The standard for a TDMA service currently offered by Cable & Wireless HKT CSL Limited.

world have been actively developing standards for 3G mobile services. In Europe, the 3G standard is developed by the European Telecommunications Standards Institute (ETSI) under the designation UMTS (Universal Mobile Telecommunications System). The radio access interface of the UMTS, namely, UTRA comprises two standards for operation in the FDD and TDD modes. Both interfaces have been accepted by the ITU as radio interface specifications for IMT-2000 and are designated as IMT-DS and IMT-TC respectively. In the US, the Telecommunications Industry Association (TIA) is driving the standards development of the 3G mobile systems and is currently working on cdma2000 and UWC-136 radio interfaces, both complying with IMT-2000 requirements. China's proposal of IMT-2000 radio interface based on SCDMA using adaptive TDD scheme has also been accepted by the ITU as one of the IMT-2000 radio access interface standards, which is now designated as IMT-TC.

2.4 Japan and Korea have also been actively participating in the development of 3G standards through the Third Generation Partnership Project (3GPP) and Third Generation Partnership Project 2 (3GPP2) respectively. The 3GPP has been established by ETSI, in collaboration with major national standards organisations including Association of Radio Industries and Businesses (ARIB) and Telecommunications Technology Committee (TTA) of Japan, Wireless Telecommunications Standard Group (CWTS) of China and the Telecommunications Technology Association (TTA) of Korea, to achieve international cooperation in the development of technical specifications for UMTS based on the evolved GSM core network and UTRA. The 3GPP2 has been established by the TIA, in collaboration with major standards organisations including Japan's ARIB and TTC, Korea's TTA and China's CWTS, to achieve international cooperation in the development of technical specifications based on cdma2000.

### ***3G Standards in Hong Kong – Single or Multi-standards?***

2.5 It has always been the policy of the Office of the Telecommunications Authority (OFTA) to adopt open and non-proprietary standards in telecommunications. When the digital PMRS was introduced in 1992, the technology to be adopted by each operator was specified in the licences. Currently, five PMRS networks are operated under various standards including GSM 900, IS-136 and IS-95. In view of the evolution of various emerging technologies when the PCS was introduced, the TA adopted the technology-neutral approach in licensing the PCS operators in 1996. The PCS licensees were allowed to use any technology available within their assigned frequency bands. The six licensed PCS operators have chosen the GSM 1800 technology for implementation of their networks. That GSM 1800 was chosen as the technology was the result of commercial decisions of the licensees, not a licence requirement.

2.6 From the current development of 3G standards, it is clear that all major areas of the world will adopt the ITU IMT-2000 standards for 3G services. The World Trade Organisation (WTO) Agreement on Technical Barriers to Trade requires members to use international standards as a basis for their technical regulations. Being a member of the WTO, Hong Kong should adopt the standards as recommended by the ITU as far as possible.

2.7 The ITU has failed to adopt one common standard for the radio interface of the 3G services because different standards have been proposed to suit the evolution to 3G of different types of 2G systems in existence. One issue is whether Hong Kong should adopt a single 3G standard or multiple 3G standards. At present, 2G standards adopted by mobile operators in Hong Kong include GSM 900, GSM 1800, IS-95 and IS-136. The TA notes that the IMT-2000 standards will offer 3G evolutionary upgrades for all these 2G systems. The TA is of the view that the decisions that the prospective licensees will take on which technologies to be used will depend on the complex relationship between existing and developing technologies for both 2G and 3G services, available spectrum and customer benefits. In view of the rapid development of technologies and standards for 3G, the TA does not see the need to mandate a single standard for 3G. The mandatory use of a single 3G standard will reduce flexibility of operators in evolving their 2G networks to 3G and limit the choice of terminal equipment by consumers.

2.8 On the other hand, the TA is interested to promote the adoption of technical standards that are compatible with each other from the users' point of view. One objective is to facilitate competition between networks in that customers may migrate to other networks and obtain similar services without having to replace their terminals. Another objective is maximize the convenience of users in accessing roaming services without having to change handsets when they travel to places outside Hong Kong, particularly the more popular destinations of Hong Kong people. In theory, the use of software defined radio terminals could overcome the problem of incompatibility among the multiple standards, but the extent to which such compatibility can be achieved and the timescale for the commercial availability of equipment are still relatively uncertain. Finally, the choice of 3G radio interface standards will necessarily have to be constrained by the band plans in Hong Kong for 3G services.

2.9 *The TA intends to open to the prospective operators to use any IMT-2000 standards within their assigned 3G frequency bands for 3G mobile services, subject to the TA being satisfied that the various technical standards are compatible with each other from the users' point of view. The main consideration is to ensure that customers can easily switch from one network to another to obtain similar services and to maximize convenience in using roaming services without having to*

change the mobile terminals. The TA invites views from the industry on his proposal.

### 3. Spectrum Issues

#### *Availability of Spectrum for 3G Systems*

3.1 The ITU has allocated the frequency bands 1885-2025 MHz and 2110-2200 MHz on a worldwide basis for IMT-2000 which includes a terrestrial component in 1885-1980 MHz, 2010-2025 MHz and 2110-2170 MHz and a satellite component<sup>5</sup> in 1980-2010 MHz and 2170-2200 MHz, as shown in Fig.1.

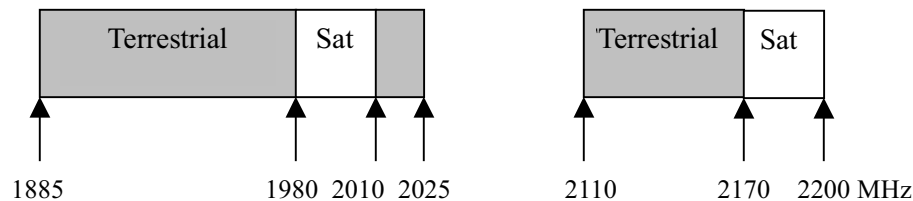


Fig. 1 ITU IMT-2000 Spectrum Allocation

3.2 The IMT-2000 terrestrial components include a natural pairing of two 60 MHz blocks: 1920-1980 MHz paired with 2110-2170 MHz for systems operating in frequency division duplex (FDD) mode (the core band). The other 50 MHz in the 1885-1920 MHz and 2010-2025 MHz are unpaired spectrum blocks for systems operating in time division duplex (TDD) mode. The FDD mode will provide efficient operation in many 3G environments, providing wide area coverage and full mobility applications. The TDD mode will allow operators flexibility in network deployment and to support the predicted traffic asymmetry in an efficient way.

3.3 In Hong Kong, part of the spectrum in the IMT-2000 band is currently used for the operation of Microwave Multipoint Distribution Systems (MMDS) and microwave fixed links. OFTA has already requested the users in this band, and they have agreed, to relinquish the spectrum by the end of May 2001 for the introduction of 3G mobile services. However, the spectrum in the 1880-1900 MHz and 1895-1906.1 MHz have been allocated for private cordless phones conforming to the Digital Enhanced Cordless Telecommunications (DECT) and Personal Handy-

<sup>5</sup> The scope of this consultation paper only covers the licensing framework for 3G services employing the terrestrial component in the IMT-2000 band. The licensing framework for 3G services employing the satellite component will not be covered.

phone System (PHS) standards<sup>6</sup>. There are still compatibility issues for the co-existence of IMT-2000 services and DECT and/or PHS equipment in the overlapping frequency bands below 1906.1 MHz which require further studies before the lower part of the IMT-2000 bands could be assigned for 3G services<sup>7</sup>.

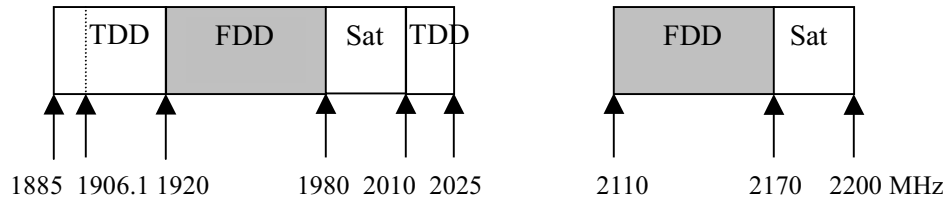


Fig. 2 Hong Kong 3G Spectrum Allocation

3.4 *Taking into consideration that the spectrum in the 1885-1906.1 MHz band is currently in use for private cordless telephones and that a guard band is necessary between TDD and FDD systems of the 3G services, there will be 2 x 60 MHz paired spectrum and some 25 MHz to 29 MHz unpaired spectrum available for terrestrial 3G mobile services in Hong Kong at this stage, as shown in Fig. 2.*

#### ***Additional ITU IMT-2000 Spectrum Allocation***

3.5 The ITU Task Group 8/1 has approved an additional 160 MHz allocation to be made available before year 2010 for the terrestrial component of IMT-2000 expansion in Region 3<sup>8</sup>. A number of bands including some bands currently in use by the 2G systems are being considered for IMT-2000 expansion. The proposal will be discussed in the coming World Radiocommunication Conference of the ITU to be held in May 2000 in Istanbul (WRC-2000). The availability of additional spectrum for IMT-2000 expansion and the timing of such availability will depend on the decisions of the WRC-2000 and the constraints due to local utilization of the respective IMT-2000 expansion bands in Hong Kong. *The TA will consult the industry again on the allocation of the IMT-2000 expansion bands for 3G services in Hong Kong when there is further development in the ITU.*

<sup>6</sup> The TDD channels within the 1885-1904.9 MHz range in the IMT-2000 band totally overlap with the DECT and PHS bands. The TDD channel of 1904.9 - 1909.9 MHz has some 1.2 MHz (equivalent to four PHS carriers) overlap with the PHS band. The TDD channel with partial frequency overlapping with the PHS band should be able to co-exist with PHS because PHS uses dynamic channel allocation to search for a free channel in the whole PHS band in 1895-1906.1 MHz.

<sup>7</sup> As the spectrum has been allocated for “private” cordless phone applications, there may be difficulty for OFTA to recover the spectrum and re-allocate it for 3G services in the short term.

<sup>8</sup> For the allocation of frequencies, the ITU has divided the world into three regions. Hong Kong and Mainland are included in Region 3 which covers mainly Asia (except Russian territory in Asia) and Australasia.

### ***3G Services in 2G Spectrum***

3.6 As mentioned in paragraph 3.5, there are now WRC-2000 proposals for allocating spectrum in the 800/900 MHz and 1700/1800 MHz bands for the longer term implementation of 3G services. The extra spectrum allocated may overlap with existing 2G bands. Subject to market demand, equipment manufacturers may respond to this by producing equipment in the existing 2G spectrum for the provision of 3G services. In the US, the part of the IMT-2000 spectrum below 1990 MHz has already been allocated for 2G services and there is no new spectrum available for migration from 2G to 3G. The evolution of US 2G standards (IS-136 and IS-95) to 3G standards (UWC-136 and cdma2000) will have to be achieved within the 2G spectrum.

3.7 In Europe, a slightly different approach is adopted. The European countries expect that 2G and 3G are likely to co-exist for a notable period, as not all mobile service customers will see an immediate need for the full range of 3G services. Ultimately, as the coverage and penetration of 3G services increase, 2G services might be expected to be progressively withdrawn if significant user migration occurs, allowing the 2G spectrum to be re-allocated for use by 3G services. Equipment manufacturers expect that 3G equipment will be produced to operate in the 2G bands subject to global demand. However, such development and the timing for the availability of 3G equipment for use in the 2G bands are uncertain at this time.

3.8 *To allow existing 2G mobile operators to evolve their networks to 3G and to be in line with the adoption of the technology neutrality policy discussed in paragraphs 2.5-2.9, the TA intends to open to the existing 2G operators, whether they are successful or not in obtaining 3G spectrum, to use any IMT-2000 standards within their assigned 2G frequency bands for 3G mobile services when equipment is commercially available in the market, subject to the TA being satisfied that the various technical standards are compatible with each other from the users' point of view and that the interest of existing 2G consumers is adequately safeguarded.*

### ***Band Plan for 3G Services***

3.9 Japan and Europe have basically allocated the spectrum in compliance with the ITU IMT-2000 band plan. The Australian Radiocommunication Consultative Council's Working Group has recently recommended to the Australian Communications Authority to follow the ITU band plan in the 3G allocation. As GSM 1800 is currently adopted by most of the Asia Pacific countries, the implementation of UMTS for 3G is likely to be the choice for many administrations in Asia.



3.10 In the US, the allocation approach is different from that of Europe and Japan. The US market encompasses a range of 2G mobile technologies and this has resulted in a fragmented spectrum environment that makes the task of implementing compatible 3G technologies complex.

3.11 In Hong Kong, most of the spectrum in the US PCS base-receive band (1850-1910 MHz) has already been allocated to the GSM 1800 systems. Also, the transmit and receive direction (between the base stations and the mobile stations) of the upper paired block of the spectrum of the US PCS systems (1930 - 1990 MHz) is opposite to that of the UTRA FDD systems expected to be adopted in most Asian and European countries. If the Hong Kong 3G band plan is to accommodate the US PCS allocation, additional guard bands will be required between the part of the spectrum used for systems compatible with the UTRA FDD band plan and that used for systems compatible with the US PCS band plan. Such allocation will reduce the useable spectrum and the number of potential 3G systems. It will also fragment and complicate spectrum allocation.

3.12 *Taking into consideration paragraphs 3.9-3.11, the TA is of the view that Hong Kong should adopt a 3G band plan that is in compliance with the ITU IMT-2000 allocation<sup>9</sup>. Any comment on this issue is welcome.*

### ***Individual Operator's Bandwidth Requirements***

3.13 Some telecommunications authorities have already taken a decision on the number of licences issued and the amount of spectrum assigned to each 3G operator. In Japan, the Ministry of Posts and Telecommunications decided to license a maximum of three operators in each geographical area and allocate 2 x 20 MHz spectrum to each licensee. In the UK, spectrum auction conducted by the Radiocommunications Agency is currently in progress for five licences for 3G services – one licensee (who must be a new entrant) will be granted 2 x 15 MHz paired plus 5 MHz unpaired spectrum; one licensee will be granted 2 x 15 MHz paired spectrum; and three licensees will be granted 2 x 10 MHz paired plus 5 MHz unpaired spectrum.

3.14 In Finland, the Finnish Telecommunications Administration Centre issued licences to four operators in March 1999 and allocated 2 x 15 MHz paired spectrum plus 5 MHz unpaired spectrum to each operator. In France, the French

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<sup>9</sup> The Radio Spectrum Advisory Committee (RSAC) has also made similar recommendation to the TA at the sixteenth meeting of the RSAC in 1998 (RSAC Paper 3/1998). RSAC is an advisory committee set up by the TA. One of the major terms of reference of the committee is to advise the TA on the planning of the use of the radio frequency spectrum in Hong Kong. RSAC Paper 3/1998 can be downloaded from OFTA's home page at <http://www.ofa.gov.hk>.

regulatory body planned to license four 3G mobile operators. Each operator would be allocated 2 x 15 MHz paired and 5 MHz unpaired spectrum. In Germany, the regulatory authority will make available 2 x 10 MHz paired plus 5 MHz unpaired or 2 x 15 MHz paired plus 5 MHz unpaired spectrum for auction in mid-2000.

3.15 In its consultation document of 25 October 1999, the preliminary view of the Infocomm Development Authority of Singapore was to issue four to six licences with 2 x 10 MHz paired and 2 x 15 MHz paired spectrum assigned to licensees. In Australia, the Working Group on IMT-2000 in its report of December 1999 preliminarily advised the Radiocommunications Consultative Committee that the minimum spectrum allocation for a new mobile operator is 2 x 15 MHz paired spectrum or 2 x 10 MHz paired plus 5 MHz unpaired spectrum. The Australian Working Group on IMT-2000 also advised that for an existing operator, 2 x 10 MHz would be considered a workable minimum for urban and regional population areas and 2 x 5 MHz might be sufficient for highways and low-density rural areas.

3.16 To sum up, the amount of spectrum allocated to each operator by the authorities in various countries is either 2 x 10 MHz paired plus 5 MHz unpaired, 2 x 15 MHz paired, 2 x 15 MHz paired plus 5 MHz unpaired or 2 x 20 MHz paired.

3.17 In Hong Kong, the OFTA Focus Group<sup>10</sup> has examined the spectrum requirements for a UMTS system from the angle of frequency re-use, data rate, types of services that can be accommodated, system capacity and spectral efficiency. A table summarizing the technical limitations for the cases of 2 x 5 MHz, 2 x 10 MHz, 2 x 15 MHz and 2 x 20 MHz is in the Annex.

3.18 For an optimal 3G radio network employing UTRA FDD standard, the network should be planned using a three-layer hierarchical cell structure using macro, micro and pico cells. A new operator will need an allocation of paired spectrum for FDD macro cell operation, but an existing 2G operator may upgrade its 2G system to provide the macro layer. A macro layer is necessary to provide the wide area coverage and is also used for mobile users in fast moving vehicles. The micro cells are used at street level for outdoor coverage to provide extra capacity where macro cells could not cope. Pico cells would be deployed mainly indoors, where there is a demand for high data rate (2 Mbps) services such as laptops networking or multimedia conferencing.

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<sup>10</sup> OFTA IMT-2000 Focus Group was established in 1998. It comprised members from local mobile and fixed network operators, equipment manufacturers, industrial and professional associations, Consumer Council, overseas standard setting bodies and network operators. The Focus Group collected members' views on technical matters relating to the introduction of 3G mobile services to Hong Kong. The Focus Group completed its task and produced a report in September 1999. The report can be downloaded from OFTA's home page.

3.19 *Based on the considerations in paragraphs 3.13-3.18, the TA is of the view that a new 3G operator will need 2 x 15 MHz paired spectrum in order to allow the implementation of three-layer hierarchical cell structure and the provision of full range of 3G services including the high speed multimedia services at 2 Mbps in an indoor environment. For incumbent 2G operators, the TA considers that less spectrum would be required because they can upgrade their 2G systems and use them to provide the macro layer. In this case, the minimum spectrum per existing operator is 2 x 10 MHz. If the foregoing spectrum allocation is adopted, between four to six licences can be issued for 3G services, depending on the licensing model adopted (see paragraph 4.5 below). The TA invites comments from the industry on the proposed minimum 3G spectrum allocation to new and existing operators.*

### ***Allocation of TDD spectrum***

3.20 The allocation of 5 MHz unpaired spectrum will allow the 3G services to handle asymmetric traffic, such as Internet access, in an efficient way. However, the standardisation of TDD for the unpaired band segment would be about a year behind that of FDD for the paired bands. There appears to be no urgent need to assign the TDD spectrum. In Europe, the European Radiocommunications Committee has just recently identified the 2010-2020 MHz band for self-provided applications operating in self-coordinating mode<sup>11</sup>. The development in this band is still uncertain. Furthermore, the electromagnetic compatibility between 3G and DECT/PHS in the IMT-2000 band below 1906.1 MHz in Hong Kong is still unresolved. There appears to be no real purpose at this stage with issuing licences for the unpaired bands as it is clear that the rest of the world is not doing this yet and hence compatible terminal equipment for an unpaired fully TDD approach would not be commercial available in the near future.

3.21 *The TA therefore considers that there may be no immediate need to make a decision on the allocation of the TDD spectrum. However the TA will reserve the TDD spectrum in the 3G band for use by the licensed 3G operators and will further consult these operators when it is timely to allocate this spectrum. The TA invites views from the industry on the proposed allocation of TDD spectrum.*

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<sup>11</sup> UMTS is envisaged to encompass a range of operating environments, including operation in spectrum designated for an operator as well as self provided applications, such as in the private or business environments operating in a self-coordinating mode in share spectrum. "Shared spectrum" in this context means spectrum where private cordless or business/office systems are deployed in a self-coordinating manner.

## 4. Licensing Issues

### *Need for New Entrant*

4.1 As there are already 11 mobile telecommunication networks in operation in Hong Kong, the TA notes that the competition in the mobile service market is intense. Competition will intensify with new entrants to provide 3G mobile services. He is also mindful of the physical constraints and other difficulties new entrants may face in installing their networks, given the experience of the incumbents in rolling out their networks. The new section 14 of the Telecommunication (Amendment) Bill will help them in establishing access to shielded public places (e.g. shopping malls) in the event that commercial negotiations fail.

4.2 The number of mobile service customers has reached 3.82 million by end January 2000, representing a penetration rate of 55%. Although the growth in the number of customers has slightly slowed down in the immediate past few months, with evolving mobile technologies, the TA is of the view that there will be new market opportunities for mobile operators. In particular, the 3G services will provide higher data rates than the current 2G services. It is anticipated that the scope of the mobile services market will be considerably expanded by new service developments, such as mobile Internet access and mobile electronic transaction activities, thereby providing further fuel for the continued growth of the mobile services market.

4.3 *In view that 3G technologies may provide the scope for innovative service developments and, as a new entrant would not be constrained by any legacy network elements, it would have more flexibility in developing its network for new service applications and providing new input to the benefit of the industry and consumers. The TA therefore considers that the introduction of new entrants to the 3G market will be beneficial to market development and to consumers.*

### *Incumbent Operators*

4.4 Another issue is whether existing operators should be allowed to bid, or even given priority (such as the right of first refusal) for the 3G licences. It is expected that economies of scale will exist between 2G and 3G mobile networks. The existing mobile operators have made significant investments which, given the nature of some of the technology developments, would represent economically efficient migration paths. They also have established customers and a degree of expertise and competence in serving the Hong Kong market. To deny them access to new technologies could prove punitive in the sense that they could be constrained to operate an obsolete technology well before the expiry of their licences. However

to give the existing operators priority or right of first refusal would deny consumers the benefits from potential new operators with new areas of expertise and marketing ideas as discussed in paragraphs 4.1 - 4.3. *The TA is therefore of the preliminary view that there are benefits in allowing incumbent operators to bid for the 3G services, but they should not be given any priority over new entrants in the bidding process. Views and comments are sought on this issue.*

### ***Licensing Options***

4.5 The TA has considered the following licensing options:

- Option 1: The existing mobile operators and new entrants will be given an *equal opportunity* to compete for the four new 3G licences. Each operator will be allocated with 2 x 15 MHz paired, with one 5 MHz unpaired spectrum to be reserved for each licensee for allocation at a later stage. Four licences can be accommodated in this option. The merit of this option is that, without giving preference to any group of potential applicants, the competition will be on a fair basis and the TA will have greater flexibility to select the best proposers to be granted the licences. The demerit of this option is that the existing operators could enjoy some inherent advantages in their proposals which might favour them over new entrants in the selection process. For example, they may be able to pledge a quicker rollout of their 3G mobile services using their already established 2G networks. As a result, it is possible that only incumbent 2G mobile operators would succeed in entering the 3G market.
- Option 2: While the new entrants and the existing operators will, as in Option 1, compete on the basis of the same set of selection criteria, instead of giving the same width of spectrum to each of the new and incumbent operators, an incumbent operator who is successful in its bid for the licence will be allocated 2 x 10 MHz paired spectrum whereas a new entrant will be allocated 2 x 15 MHz paired spectrum. Another 5 MHz unpaired spectrum will be reserved for allocation to each operator at a later stage. This option allows more licences to be issued. The number of 3G licences to be issued will vary from four to six, depending on the mix of new entrants and incumbents who are successful.
- Option 3 : The TA will reserve part of the 3G spectrum *to new entrants only* and the remaining part to the incumbents. Similar to Option 1, each operator (incumbent or new entrant) will be allocated 2 x 15 MHz paired, with one 5 MHz unpaired spectrum to be reserved

for allocation to each licensee at a later stage. This option allows a ‘mix’ of four new and existing licensees to operate the 3G services. If this option is pursued, the TA needs to decide on the mix (e.g. two new entrants plus two incumbents, or one new entrant plus three incumbents, etc.)

- **Option 4** : Like Option 3, the TA will reserve part of the 3G spectrum to new entrants only. However, instead of giving the same width of spectrum to each of the new and existing operators, an incumbent operator who is successful in its bid for the licence will be allocated 2 x 10 MHz paired spectrum whereas a new entrant will be allocated 2 x 15 MHz paired spectrum. Another 5 MHz unpaired spectrum will be reserved for allocation to each operator at a later stage. The number of 3G licences that can be issued will be increased to five, whether the mix is two new entrants plus three incumbents, or one new entrant plus four incumbents.

4.6 *The TA has not yet formed a view on the preference for any one of the above licensing options and would like to seek comments from the industry prior to making a final decision.*

### ***Operator Selection Arrangement***

4.7 The well-established method for the TA to allocate limited spectrum to telecommunications licensees is by way of evaluation of the merits of applications. However, some regulatory authorities now resort to spectrum auctioning as a means to allocate the scarce public resource. The two alternatives are further discussed in paragraphs 4.8 – 4.13 below.

### ***Selection of Operator – by Evaluation of the Merits of Applications***

4.8 The TA under this approach will call for proposals for the operation of the 3G services. The TA then goes through an evaluation process to select the licensees on the basis of merits. Clear guidance notes setting out the selection criteria will be issued for the interested parties to follow in the preparation of their proposals. The TA has adopted this approach for many years. Precedents include the selection of the fourth PMRS operator in 1992, the fixed telecommunication network services (FTNS) operators in 1993, the PCS operators in 1995 and the local wireless FTNS operators in January 2000.

4.9 The merit for the adoption of such an approach is that, through such a selection exercise by invitation of proposals, the TA may use a set of more extensive criteria to assess the proposals from different perspectives. This will enable the TA

to select the proposals with the greatest merit against the whole range of criteria to be the licensees for 3G services. Many regulatory authorities will use this approach to select 3G licensees e.g. Finland and Sweden. The demerit of such an approach is that, as the licensees will not be required to bid for the spectrum, they will have less incentive to use the radio frequency in the most efficient way possible. They may also subsequently “trade” their licences through corporate restructuring. The premium for the licences will eventually be reflected in the bid price for the entity with the spectrum right.

### ***Selection of Operator by Spectrum Auctioning***

4.10 As the 3G licensees will need to have radio frequency spectrum for the operation of their services, one possible way for the selection of licensees is to ask the interested parties to submit bids for the frequency spectrum required for the operation of their services. The TA then selects the proposers which have submitted the highest bids to be the licensees.

4.11 Some governments have chosen to auction radio frequency spectrum for the operation of mobile services. The argument for this option is that radio frequency spectrum is a scarce public resource and therefore, for government revenue consideration and for the interest of the public to be best served, radio frequency spectrum should be sold through a competitive bidding procedure based on price, rather than assigned through an administrative process.

4.12 The arguments against such an option are set out below:

- (a) Spectrum auctioning will increase the operating costs for the 3G services and such costs will eventually be borne by consumers. Given the speculative nature of some investors in Hong Kong, it is possible that prices will be pushed to a high level. The resultant additional high entry cost could have a serious dampening effect on the rollout of 3G services.
- (b) As the level of bids will be the only selection criteria (possibly after a pre-qualification procedure), the companies which may provide more innovative and advanced services may not succeed in getting a licence. The TA might also be seen to favour big players as they obviously will have the financial strength to out-bid the smaller operators. The worries about a small group of companies dominating the telecommunications market would be heightened.
- (c) Another disadvantage of spectrum auctioning is that it will turn the radio spectrum into a tradable commodity. Some companies may take

advantage of this by bidding for the spectrum with a view to speculation rather than operating the 3G services. This could significantly delay the roll out of the services. It is worthy of note that the use of the auction method in some overseas countries has seen the default of successful bidders in the process.

- (d) Although spectrum auctioning could bring significant capital revenue to the Government, this represents an additional upfront cost to 3G operators and greatly increases their business risks. This could affect adversely the development of the next generation of telecommunications and Internet services in Hong Kong, bearing in mind the untested demand for 3G services, especially in the initial stage of its introduction.

4.13 3G services would provide a mobile broadband platform that would support a full range of multimedia and e-commerce services which are vital to the economic well being of Hong Kong in the Information Age. Taking into account the pros and cons as set out above, the TA considers that spectrum auctioning should not be applied to 3G licensing. Instead, *the TA intends to continue with the well-established approach to select 3G operators by evaluation based on merit.* The economy will stand to benefit more by a vibrant and competitive telecommunications industry underpinning the various economic activities by all sectors of the community.

4.14 *The TA invites comments from industry on his intention to select 3G licensees by evaluation based on merit.*

## 5. Regulatory Issues

### ***Similar Regulatory Framework for Mobile Telephone Services Applies to 3G?***

5.1 At present, mobile telephone services are licensed under the Public Radiocommunication Service Licence (PRSL). The form, General Conditions, licence period and licence fees of a PRSL are given in the Telecommunication Regulations which is subsidiary legislation under the Telecommunication Ordinance (the “Ordinance”). Special Conditions may be specified by the TA, on the grant or renewal of the PRSL, if he considers that the conditions are necessary for the purpose of carrying out the objects of the Ordinance.

5.2 The PRSL only allows the mobile operators to provide PMRS or PCS between the mobile stations of customers, and between mobile customers and customers of other public fixed or mobile telecommunication networks.



Interconnections between the mobile operators and other telecommunication networks and services are governed by section 36A of the Ordinance. Mobile operators are regarded as a “carrier” in interconnection. A carrier has the right to seek interconnection with other carriers and the interconnection charges may be negotiated on a “carrier-to-carrier” basis. The TA encourages commercial settlement of interconnection arrangements, but under section 36A of the Ordinance, the TA has the power of determining the terms and conditions, including technical and commercial terms and conditions, of interconnection.

5.3 The scope of PRSL does not allow the licensee to provide external facilities and services is specified in the Schedule to the FTNS Licence. However, the licensee may provide its customers with access to external services which include the external gateways of other FTNS licensees and the external services operated under Public Non-exclusive Telecommunications Service (PNETS) Licences.

5.4 Mobile operators are prohibited under the PRSL to engage in anti-competitive practices. If a licensee is found to be in breach of the licence condition, the TA may issue directions under section 36B of the Ordinance to require the licensee to stop the breach. The TA may impose financial penalty under section 36C of the Ordinance if the licensee continues to commit the breach.

5.5 Where the TA reasonably forms the opinion that it is in the public interest that certain types of facilities ought to be provided, used or shared by more than one licensee for PRSL, he may issue directions requiring the licensee to coordinate and cooperate with any other licensee or any other authorised person in respect of such provision, use or sharing of any such facility. The licensee for PRSL shall comply with the TA’s directions.

5.6 The numbering plan of Hong Kong is administered by the TA, with advice from the Telecommunications Numbering Advisory Committee with representatives from the industry, consumer associations, academia, etc. Mobile operators are required, in such manner as the TA may direct and at their own expenses, facilitate the portability of numbers for customers of FTNS, PMRS and PCS licensed under the Ordinance.

5.7 *The 3G mobile systems have the capability of providing broadband multimedia services. It is expected that the scope of services that will be provided by 3G platforms will be substantially more extensive than that of the 2G platform. As the operation and the scope of the 3G services are significantly different, the TA would like to seek the views of the industry on whether the 3G services should be regulated under a similar regulatory framework as that for the mobile telephone services at present. In particular, the TA invites views on whether any safeguarding*

*measures should be introduced or strengthened to preserve effective competition in the 3G market.*

### ***Timing to Review the Current Framework in View of Fixed-mobile Convergence?***

5.8 In Hong Kong, the fixed and mobile services are considered two distinct groups of telecommunication services and regulated under different frameworks. The distinction is made on the criterion of whether “mobility” exists. Under the FTNS Licence, the licensee is allowed to provide telecommunication services between fixed points<sup>12</sup>. However, under the PRSL, the licensee is allowed to conduct both way communications between the mobile stations of customers, and between the mobile customers and customers of other public telecommunication networks. There are significant differences between fixed and mobile service operators in the rights and obligations under the law and their respective licences. One of the most important distinctions is of course the right to use the radio spectrum for mobile services. Another important distinction is the right to open up roads for cable installation for wireline-based FTNS and the statutory right of access to common parts of buildings for the extension of network coverage.

5.9 Apart from the scope of service, right to use spectrum and right of access to land, there are no real needs for the fixed and mobile services to be regulated under two different licences as is the case at present. The FTNS Licence and PRSL in fact contain a number of similar obligations, but the licence conditions are worded somewhat differently. In fact, as the operators of the fixed and mobile networks are both carriers, they can be regulated under a unified “carrier licence” with different conditions applied or disappplied to suit a particular category of carriers or stage of development in the market. For example, there is no particular reason for the licence conditions for fair competition, or accounting practices, to be different for the two categories of carriers. The enactment of the Telecommunication (Amendment) Bill 1999 would, to a certain extent, impose the same obligations to carrier licensees.

5.10 With the advancement of technologies, there is bound to be some overlap in the services offered by fixed and mobile licensees. For example, a mobile telephone user taking a call on his mobile phone at home could be said to be “fixed” and indistinguishable from a customer using a cordless telephone to access an FTNS network. With the lowering of the charges for mobile telephone services, some customers may find that a mobile telephone service may substitute for the FTNS, in terms of charges and functionality.

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<sup>12</sup> Cordless phones provide limited mobility to the users, but cordless phones are regarded as customer premises equipment connected to a fixed service.

5.11 The 3G services will provide customers with greater capacity, more features and may substantially increase the area of overlap between the fixed and mobile services. It is anticipated that the development of 3G services will finally make the fixed market and the mobile market converge and the two services be substitutable for each other.

5.12 The number of mobile customers is now approaching that of fixed telecommunications market and it is likely that the number of mobile customers may exceed the number of fixed customers in the near future. Although we see the need for distinguishing between fixed and mobile carriers in the near term, as there are necessarily differences in their rights under the licences, the adoption of a unified regulatory framework for fixed and mobile carriers would facilitate the progressive development of convergence in the market. *The TA would like to seek views and comments from the industry on the necessity to maintain a regulatory distinction between the fixed services and the mobile services and whether there is a need to maintain separate forms of licences for the FTNS and mobile telephone services.*

### ***Domestic Roaming between 2G and 3G Networks***

5.13 If new entrants for 3G services are to be admitted to the market, these operators may be at a disadvantage during the initial period when the 3G networks are still being rolled out. This is because there will be intense competition from the incumbent operators who have established networks with more comprehensive coverage using the 2G technologies. In order to promote effective competition between the new entrants and the existing operators during this initial period, an arrangement for mandatory roaming within Hong Kong from 3G networks to 2G networks may be considered<sup>13</sup>. Customers of the new 3G networks may temporarily roam to the 2G networks in areas where coverage of the 3G networks has not yet been provided. The operators of the 2G networks would be fairly compensated by the operators of the 3G networks for the use of the 2G network resources. It could be argued that this roaming arrangement if implemented would dilute the incentive of the 3G only operators to improve the coverage of their networks. Thus consideration may be given to a termination date for such an arrangement. *The TA invites views from the industry before deciding on whether such an obligation should be imposed on the 2G network operators if they are successful in obtaining 3G licences, and if so, whether such an obligation should be a short-term one and the applicable charging principles.*

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<sup>13</sup> ETSI is now in the final stage in the standardization of specifications for 2G/3G dual mode handsets. It is expected that dual mode (2G/3G) handsets will be available in the market in 2001/2002. When such products are commercially available, roaming from 3G to 2G networks would be possible.

5.14 As some 2G network operators may not be able to obtain licences for 3G, these operators may be able to participate in 3G services by allowing its customers to roam onto the 3G networks (provided that the customers are equipped with compatible handsets). In effect, the 2G operators would become service providers providing services over the 3G network infrastructure operated by the licensed 3G network operators. *The TA invites views from the industry on whether such a roaming arrangement from 2G networks to 3G networks should be implemented. The TA would also like to seek views on the technical and commercial implications of such a roaming arrangement and whether there are technical and operational difficulties in roaming from 2G to 3G networks.*

### ***Separation of Service Provision from Network Operation***

5.15 As the number of 3G networks is likely to be less than the number of incumbent operators, the incumbent operators may consider forming consortia to bid for the 3G licences. Alternatively the TA could consider implementing the concept of separating service provision from network operation. This means that a service provider needs not at the same time be the network operator although a network operator may not be precluded from acting as a service provider. This concept has been implemented in the initial periods of mobile services in the UK. Recently, there is renewed interest in the European countries such as the UK, Denmark, Finland, Norway and Sweden about the introduction of a similar concept known as Mobile Virtual Network Operator (MVNO). The concept is that MVNOs would not have a licence to use radio spectrum, but would have access to the radio networks of one or more of the mobile network operators and build and operate parts of the networks not requiring the use of radio spectrum, such as elements of an intelligent network. These service providers would then be able to offer 3G services to customers without actually operating the radio networks.

5.16 Separating service provision from network operation in the 3G mobile services would enhance competition in the services market and provide customers with more choice and variety of service and price packages. Service providers would develop a wider range of value-added and multimedia services such as mobile access to the Internet, innovative data applications over mobile networks etc. to customers and customers would be able to enjoy wider geographical coverage if service providers team up with more than one mobile network operators.

5.17 There are demerits with this concept. If the new 3G mobile network operators are obliged to open up their networks and systems and share use of the spectrum with the service providers, and such interconnection or sharing were based on cost-based charges, they would have less commercial incentive to invest and build up their own networks, infrastructure and service coverage. Since the 3G

mobile network operators would also be service providers, there would be competition, charging, bill settlement and commercial issues to be tackled among 3G mobile network operators and the service providers. Some regulators are of the view that such matters should best be resolved by commercial negotiations rather than by regulatory intervention<sup>14</sup>.

5.18 *The TA invites views and comments from the industry on the concept of separating service provision from network operation and whether it should be implemented in the 3G mobile services.*

### ***Mobile Number Portability***

5.19 Since 1 March 1999, MNP has been launched in Hong Kong. Customers can retain their mobile numbers with the MNP service when they wish to switch the mobile services from one service provider to another. There has been a substantial public demand for the new service. Currently, the number of ported out mobile numbers is over 60,000 per month. As Hong Kong has successfully implemented MNP in 2G mobile networks, the TA considers that it is essential to extend MNP to 3G mobile network operators in order to allow consumers to enjoy the MNP service for both 2G and 3G mobile networks. *The TA intends to set out MNP as a mandatory requirement in the licensing conditions of the forthcoming 3G licences.*

### ***Numbering Requirement***

5.20 At present, the leading digit “9” in the Hong Kong Numbering Plan is being used for the 2G services. Most of the numbering blocks with leading digit “9” have already been allocated. The numerous advanced services to be provided by 3G services and the addition of new mobile operators will require the use of additional numbering blocks. The TA has reserved about seven million numbers with leading digit “6” for mobile services in the Hong Kong Numbering Plan<sup>15</sup>. *The TA intends to allocate the leading digit “6” primarily for 3G services.*

## **6. Way Forward**

6.1 The TA would like to seek views from the industry and any interested party on the various issues on the 3G mobile services discussed in this consultation

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<sup>14</sup> The UK regulator, OFTEL, in a statement issued in October 1999, indicated that it did not see the need for regulatory intervention to implement the concept of MVNO for the time being.

<sup>15</sup> Please refer to Telecommunications Numbering Advisory Committee Paper No. 4/1999 and Paper No. 8/1999, which can be downloaded @<http://www.ofta.gov.hk>

paper. Views and comments should reach the TA, preferably in electronic form in Microsoft Word 97 version, *on or before 22 May 2000*.

6.2 The TA reserves the right to publish all views and comments and to disclose the identity of the source. Any part of the submission, which is considered commercially confidential, should be clearly marked. The TA would take such markings into account in making his decision as to whether to disclose such information or not. Submissions should be addressed to:

Office of the Telecommunications Authority  
29/F., Wu Chung House  
213 Queen' Road East  
Wan Chai  
Hong Kong

[Attn: Senior Telecommunications Controller  
(Competitive Services)]

Comments may also be sent by fax to 2803 5112 and e-mail may be sent to [dwong@ofta.gov.hk](mailto:dwong@ofta.gov.hk).

**Office of the Telecommunications Authority**  
21 March 2000

**Annex : Technical Limitations on Spectrum Allocation per Operator**

	<b>Frequency re-use (e.g. impact on network hierarchy, etc.)</b>	<b>Data rate (e.g. maximum data rate supported, etc.)</b>	<b>Types of services (e.g. high speed data, interactive multimedia, etc)</b>	<b>System capacity (e.g. traffic handling capability, etc)</b>	<b>Spectral efficiency (e.g. trunking efficiency over other spectrum allocation scenarios, etc.)</b>	<b>Others (e.g. requirement for unpaired block, spectrum sharing with other services, etc.)</b>
2 x 5 MHz	Hierarchical network design not possible.  All data and voice service share same carrier.	384 kbps for wide area applications. 2 Mbps for one user in indoor environment and not in soft handover.	Limited capability in simultaneously supporting multiple voice and data services.	System capacity depends on user mobility, services mix and radio environment, the air interface capacity ranges from 0.8 – 2 Mbps per cell.	For real time high-speed data services, the average end user traffic throughput (at 2% GOS) is estimated at 47.7 kbps/MHz/cell.	TDD spectrum allocation would be beneficial to the provision of high-speed data service.)
2 x 10 MHz	2 hierarchical network layers supported.  Opportunity to segregate high-speed data from low-speed data/voice services	Ditto.	Capable to support medium speed multi-media and voice services simultaneously. Very limited capability in support high-speed multi-media	1.6 – 4 Mbps per cell.	Additional carrier improves trunking efficiency by 76% 84.1 kbps/MHz/cell.	TDD/FDD partitioning could increase downlink capacity if traffic pattern is highly asymmetrical.

	for better system efficiency.		services at 2 Mbps.			For dense urban deployment, TDD/FDD partitioning could provide better overall efficiency.
2 x 15 MHz	Multiple network layers supported.  Opportunity to segregate high-speed data from low-speed data/voice services for better system efficiency.	384 kbps and 2 Mbps for wide area applications.	Support high-speed data and voice services simultaneously.	2.4 – 6 Mbps per cell.	Additional carriers improves trunking efficiency (with respect to 5 MHz allocation) by 98% to 94.4 kbps/MHz /cell.	Ditto.
2 x 20 MHz	Ditto.	Ditto.	Ditto.	3.2 – 8 Mbps per cell.	Additional carriers improves trunking efficiency (with respect to 5 MHz allocation) by 124% to 107 kbps/MHz /cell.	TDD allocation is not needed.