HELLENIC REPUBLIC
NATIONAL TELECOMMUNICATIONS AND POST COMMISSION

Licences Award Process

for the provision of 3G (UMTS) and 2G (GSM/DCS) mobile services

Annexes of Information Memorandum

Maroussi, May 2001

National Telecommunications and Post Commission

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ANNEX 1 : TECHNICAL DESCRIPTION OF UMTS

A1.1. Background

A1.1.1.The 3G concept

3G technology is intended to revolutionize the capabilities of mobile communications. Equipped with high-speed data capabilities 3G should offer users advanced services on the move.

1G cellular mobile telecommunications systems were based on analogue technology, providing simple voice telephony, using either handheld or vehicle mounted terminals.

2G systems, which in Europe are based on the GSM standard, offered digital cellular communications for the first time, allowing for improved frequency efficiency and the provision of narrowband data services as well as voice telephony. GSM was developed as a common European standard and operates in harmonized spectrum across Europe. The initial spectrum designated across Europe for GSM was in the 900 MHz band. Additional spectrum was then identified at 1800 MHz, and the GSM standard expanded to incorporate GSM 1800 operation (also known as DCS 1800). Expansion spectrum for GSM at 900 MHz was also identified (the “Extended GSM” or “E-GSM” bands) as well as additional spectrum allocated for use at high speeds for trains systems, GSM-R.

The basic data rate over GSM is 9.6 kbps, allowing users to access a number of data based services including fax, e-mail and low speed internet access. The ETSI Special Mobile Group (“ETSI SMG”) committee is standardizing a number of additional features that will facilitate higher data rates over GSM.

A candidate for upgrading GSM networks is the General Packet Radio Service (“GPRS”), which will offer packet switched services on GSM at speeds in excess of 100 kbps. A number of announcements on the introduction of GPRS have already been made by operators and equipment manufacturers. Also being considered is High Speed Circuit Switched Data (“HSCSD”), which will offer circuit switched services on GSM at speeds of also in excess of 100 kbps. In order to achieve this bit rate, however, operators will have to combine channels up to the full capacity of a transceiver and, therefore, implementation will place additional pressure on spectrum capacity.

Another possible GSM standardization upgrade is EDGE (“Enhanced Data for GSM Evolution”), which uses a higher order modulation scheme to enable higher data rates than are possible with the current GSM modulation scheme. This is envisaged to increase the bit rate up to 384 kbps, although the range is reduced, making this data rate likely to be technically capable of implementation only in micro and pico cells.

2G systems such as GSM are now well established worldwide. Apart from GSM, there are a number of other 2G technologies in use across the world - for instance, the CDMA in the USA and other countries, and the Personal Handyphone System (PHS) in Japan. The widespread use of these 2G systems has led to the market for these types of systems expanding significantly over recent years. Service requirements have also evolved, with applications involving, for example, multimedia now being demanded.

3G mobile is expected to provide more enhanced services than are possible over existing cellular systems, including higher bit rates services and greater capacity and service capability.

On a global level, the definition of 3G mobile systems has been led within the ITU, within the project known as IMT-2000.

A1.1.2.IMT-2000

The services envisaged to be delivered by 3G mobile systems, and the consequential technology, operational and spectrum related requirements have been studied by the ITU.

These studies led to the identification of spectrum at 2 GHz for IMT-2000 at WARC-92. This spectrum was subsequently designated within the CEPT according to ERC/DEC/97(07).

At a global level, the ITU has also co-ordinated the definition of IMT-2000, by inviting the submission of candidate radio technologies from national or regional standards organizations. IMT-2000 has been considered as encompassing a family of compatible technologies as fully harmonized as possible. The culmination of an extensive technology evaluation process was the agreement in principle in March 1999 of the key characteristics of the IMT-2000 radio interfaces. Based on the key characteristics, work continues on the definition of the detailed radio specifications for the IMT-2000 radio interfaces. A summary of the candidate terrestrial technologies submitted to the ITU is given in Section A1.1.4.

A1.1.3.European implementation of IMT-2000

Role of ETSI

ETSI is a non-profit making organization, set up to produce and publish European telecommunications standards. Members of ETSI include national administrations, manufacturers, network operators, service providers and users. The standards produced by ETSI are largely voluntary, although some standards are subsequently adopted as the basis of regulatory or other regimes for equipment approval. Standardization within ETSI is normally carried out within technical committees. The development of 3G mobile standards in ETSI was originally the responsibility of ETSI SMG, which is also the responsible committee for maintenance of the GSM specifications. Following the creation of 3GPP in 1998, ETSI SMG's role is now to approve specifications developed in 3GPP for publication as ETSI standards.

Role of 3GPP

The 3GPP has been set up to produce specifications for terrestrial UMTS, including the UMTS Terrestrial Radio Access ("UTRA") candidate for IMT-2000. Membership of 3GPP is open to members of the partner standards development organizations (ARIB, CWTS, ETSI, TTA, TTC, T1) as well as industry groups. Once the specifications are agreed in 3GPP, the individual organizations approve and publish them as their own standards.

ETSI's activities in 3G mobile

As a partner in 3GPP, ETSI is involved in the development of technical specifications for UMTS. 3GPP also influences the ITU, through individual members, on the development of its recommendations on radio key characteristics and specifications.

UTRA is the radio interface of the UMTS specification being elaborated in 3GPP. It combines two modes of operation: Frequency Division Duplex ("FDD") utilizing paired radio spectrum and Time Division Duplex ("TDD") utilizing unpaired spectrum.

The decision on the UTRA technology was taken by ETSI in January 1998, based on consensus within the ETSI membership. It combines the use of Wideband CDMA ("W-CDMA") with Time Division CDMA ("TD-CDMA"). Brief descriptions of these technologies are provided in Sections A1.5.1 and A1.5.2.

A1.1.4.Relationship to other 3G standards

The ITU received 10 terrestrial candidate technologies in response to the request for submissions for IMT-2000; these are shown in the table below.

Table A1.1: Radio Transmission Technology (RTT) Proposals

Proposal	Description	Source
DECT	Digital enhanced cordless telecommunications	ETSI Project (EP) DECT
UWC-136	Universal wireless communications	United States, TIA TR45.3
WIMS W-CDMA	Wireless multimedia and messaging services	United States, TIA TR46.1
TD-SCDMA	Time-division synchronous CDMA	China Academy of Telecommunication Technology (CATT)
W-CDMA	Wideband CDMA	Japan, ARIB
CDMA II	Asynchronous DS-CDMA	Republic of Korea, TTA
UTRA	UMTS terrestrial radio access	ETSI SMG2
NA:W-CDMA	North American: wideband CDMA	United States, T1P1-ATIS
Cdma 2000	Wideband CDMA (15-95)	United States, TIA TR45.5
CDMA 1	Multiband synchronous DS-CDMA	Republic of Korea,TTA

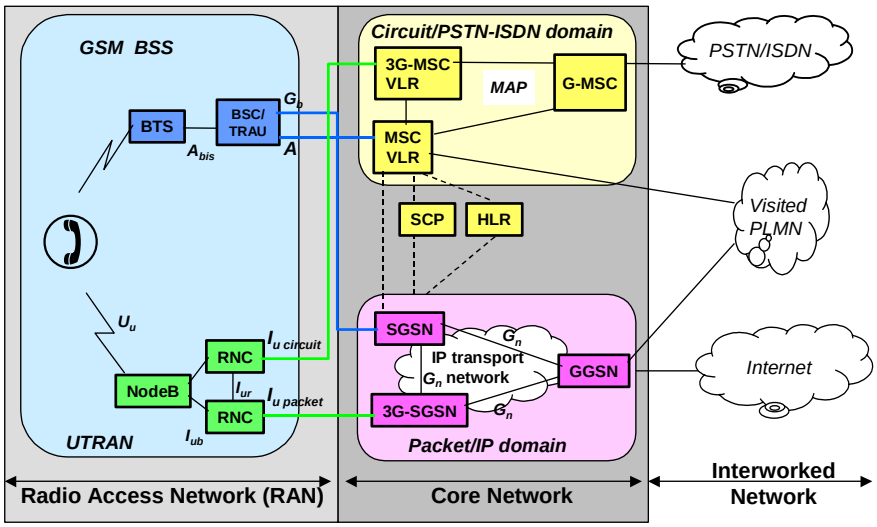
The above proposals can be found in details at

http://www.itu.int/imt/2_rad_devt/proposals/index.html

A1.2. System Architecture

The basic UMTS network infrastructure is shown below.

Figure A1.1: UMTS System Architecture



where:

GSM BSS	: GSM Base Station Subsystem
BTS	: Base Transceiver Station
BCS	:Base Station Controller
TRAU	: Transcoding and Rate Adaptation Unit
RNC	:Radio Network Controller
MSC VLR	:Mobile/service Switching Centre
SCP	:Service Control Point
HLR	:Home Location Register
SGSN	:Serving GPRS Support Node
GGSN	: Gateway GPRS Support Node
PLMN	:Public Lan Mobile Network
PSTN	: Public Switched Telecommunications Network
ISDN	: Intergrated Services Digital Network
MAP	: Mobile Application part

A1.3. 3G mobile services

A1.3.1. Projected 3G mobile services

As a result of the increased data transmission rates and improved technology discussed in Section A1.1, it is expected that 3G mobile will be able to provide a wide range of telecommunications services not currently available over mobile networks. The capabilities of existing data related services are also likely to be significantly improved. 3G mobile should, therefore, be capable of offering services such as:

- video telephony and teleconferencing;
- high speed internet access and electronic mailing;
- interactive user services, such as online banking or shopping; and
- entertainment such as audio or video on demand and video games.

One of the key goals in the development of 3G mobile is the creation of the "Virtual Home Environment" where users can be provided with the same set of personal services at home, in the office or on the move. Service charging and billing may also be combined. This personalized service may also be available to the user on a consistent basis when roaming onto other 3G mobile networks abroad.

The services available over 3G mobile need not be restricted to mobile multimedia and cellular mobile services. It could potentially be used as an alternative to wired access and private network provision such as wireless office PBXs, corporate intranets or cordless systems with local mobility. The 3G mobile concept also incorporates a satellite element that will operate alongside the terrestrial networks and so users with combined satellite/terrestrial terminals will have access to terrestrial and satellite networks that will enable improved global coverage.

Licenses to use the spectrum allocated to 3G satellite are not included in the current licensing process.

Wireless Application Protocol

The introduction of advanced services is likely to be accelerated by the introduction of Wireless Application Protocol ("WAP"), which enables internet content to be distributed to and displayed in standard mobile phones.

WAP is not dependent on specific radio interface standards or mobile devices. It can therefore be used over any digital network (including GSM or GPRS) and the information content can by optimized for display on any particular mobile device. The typical mobile phone, with its small screen and limited memory is not well-suited to displaying websites containing high resolution graphics. However, such phones could show some useful information, and software houses have developed "microbrowsers" that use the WAP standard to achieve this aim.

A1.4. Data rates

3G mobile radio interfaces are being standardized with the intention of achieving transmission rate capabilities of at least 64 kbps for full mobility applications in all environments, 384 kbps for limited mobility applications and 2 Mbps for low mobility applications, the latter particularly in micro and pico cellular environments. The bit rate offered to 3G mobile users will, however, depend on operators' network deployment strategies and radio planning. The total spectrum allocation per operator may also impact on the operators' ability to provide the highest 3G mobile data rates.

A1.5. Technical standards

When the radio interface technologies for 3G mobile were considered, they were evaluated in Europe by ETSI SMG2 on the basis of a number of defined 3G mobile requirements. These requirements included:

- support for high data rate transmission (384 kbps with wide area coverage and 2 Mbps with local area coverage);
- high service flexibility, i.e. support of variable user bit rates;
- capacity/coverage; and
- efficient utilisation of the frequency spectrum.

At the ETSI SMG meeting of 28th to 29th January 1998, it was agreed that the system should adopt:

- W-CDMA (FDD) in the paired band; and
- TD-CDMA (TDD) in the unpaired band.

This agreement assumed the paired and unpaired bands as outlined below.

A1.5.1. W-CDMA / paired spectrum

Following agreement at ETSI SMG, W-CDMA technology has been elaborated as UTRA FDD mode.

Direct-sequence CDMA permits multiple users to access a single radio frequency carrier by allocating a discrete code to each. This code is used to spread the user's data stream over a wide bandwidth for transmission over the radio link. The receiver uses the appropriate code to "despread" the user's required signal to reproduce the original data stream. The use of codes to distinguish individual channels also allows adjacent base stations to use the same carrier. In all cases, for bi-directional communication, separate radio frequency carriers are used for uplink (mobile station to base station) and downlink (base station to mobile station). UTRA FDD is designed to operate with uplink carriers in the sub-band 1920 - 1980 MHz and downlink carriers in the sub-band 2110 - 2170 MHz, although this does not preclude deployment in other frequency bands.

The latest releases of UTRA FDD specifications agreed by TSG-RAN are available from the 3GPP website at fttp://ftp.3gpp.org/specs/.

A1.5.2. TD-CDMA / unpaired spectrum

Following the ETSI SMG agreement, TD-CDMA has been elaborated as the UTRA TDD mode. The TD-CDMA concept includes both a TDMA component and a CDMA component. The TDMA component defines discrete time slots and within each time slot CDMA codes define individual traffic channels. Each timeslot can be allocated to either uplink or downlink thus allowing TDD mode to be used for bidirectional communication on a single carrier. In any configuration, at least onetime slot will be allocated to the downlink and at least one timeslot will be allocated to the uplink.

The latest releases of UTRA TDD specifications agreed by TSG-RAN in 3GPP are available from the 3GPP website at ftp://ftp.3gpp.org/specs/.

A1.5.3. European timetable for finalization of technical standards

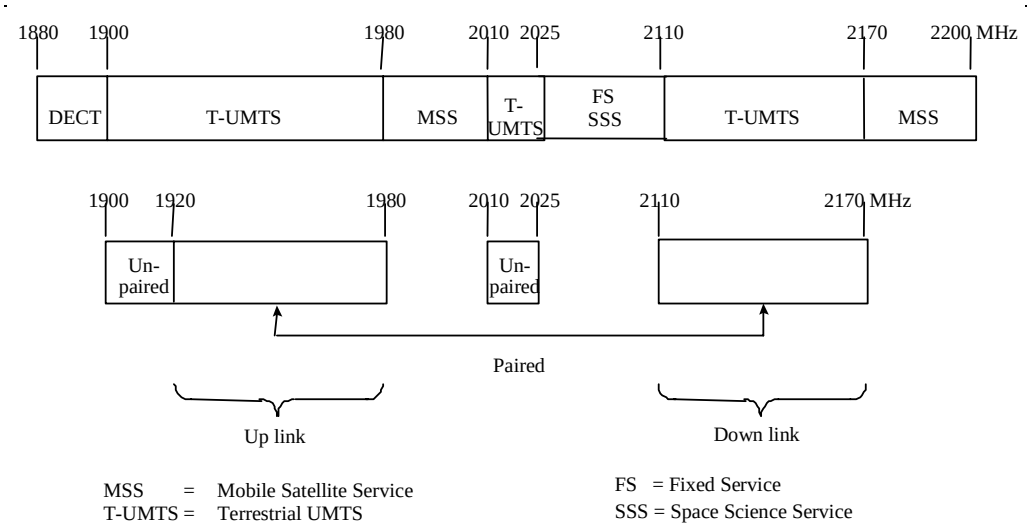
3GPP is defining UMTS using a phased approach and within each phase there are annual releases. For Phase 1, two releases have been identified: Release 99 and Release 2000, available in December 1999 and December 2000 respectively. After 3GPP has published the specifications, ETSI converts them into ETSI standards.

A1.6. Spectrum for 3G mobile

A1.6.1.European spectrum plan in the 2 GHz band

Based on the spectrum identified in the Radio Regulations for IMT-2000, the European band plan for the 2 GHz band is as shown below.

Figure A1.2: European band plan



A1.6.2.Designation and utilization of 3G spectrum in Europe

The Radio Regulations currently identify the bands 1885 - 2025 MHz and 2110 - 2200 MHz for use, on a worldwide basis, for IMT-2000. Within these bands, the Radio Regulations allocate the portions 1980 - 2010 MHz and 2170 - 2200 MHz to the Mobile Satellite Service (“MSS”) on a worldwide basis, for use by the satellite component of IMT-2000.

The ERC Decision ERC/DEC/(97)07 of 30th June 1997 on the frequency bands for the introduction of UMTS designated 155 MHz of spectrum for UMTS in Europe and the frequency bands 1900 - 1980 MHz, 2010 - 2025 MHz and 2110 - 2170 MHz to terrestrial UMTS applications. It is envisaged that the bands will be used as shown in the diagram above. This allows for the sub-band 1920 - 1980 MHz to be paired with 2110 - 2170 MHz while the sub-bands 1900 - 1920 MHz and 2010 - 2025 MHz have no pairing. Currently, the 1885 - 1900 MHz portion of the global IMT-2000 spectrum is only available in Europe for DECT, which has been allocated 1880 - 1900 MHz.

To facilitate harmonized use of the spectrum identified in ERC Decision ERC/DEC/97(07) and to allow for both FDD and TDD deployment, TG1 has developed the Decision ERC/DEC/99(25) on the harmonized use of the UMTS spectrum. This new Decision covers paired and unpaired spectrum arrangements for FDD and TDD use, requirements to protect adjacent services according to the diagram above and the identification of spectrum 2010 MHz – 2020 MHz for License Exempt use.

A1.7. Frequency planning

A1.7.1. European frequency planning

The total spectrum requirements for terrestrial mobile services in Europe have been studied by the UMTS Forum, who concluded that the total spectrum requirement was 582 MHz by the year 2010. This total requirement includes the spectrum already designated in Europe according to ERC/DEC/97(07), that is used by 2G mobile systems (GSM and DECT) and an additional requirement forecast to meet the expected demand for services by 2010.

The ITU-R TG8/1 concluded at its meeting in March 1999 that the additional spectrum requirement for terrestrial IMT-2000 in the 3 ITU Regions was 160 MHz. This requirement has been included in a new ITU-R Report, “Spectrum requirements for IMT-2000”. Taking account of changes in some of the original parameters, the total spectrum requirement for Europe is identified in the Report to be 555 MHz. This total spectrum requirement is forecast for dense urban traffic areas of major cities and, therefore, it is recognized that the total requirement may not be needed in all geographic areas.

As noted earlier in the Memorandum, the WRC-2000 will consider the identification of additional spectrum for IMT-2000 and seek to find spectrum to meet the additional requirement forecast in the ITU-R Report.

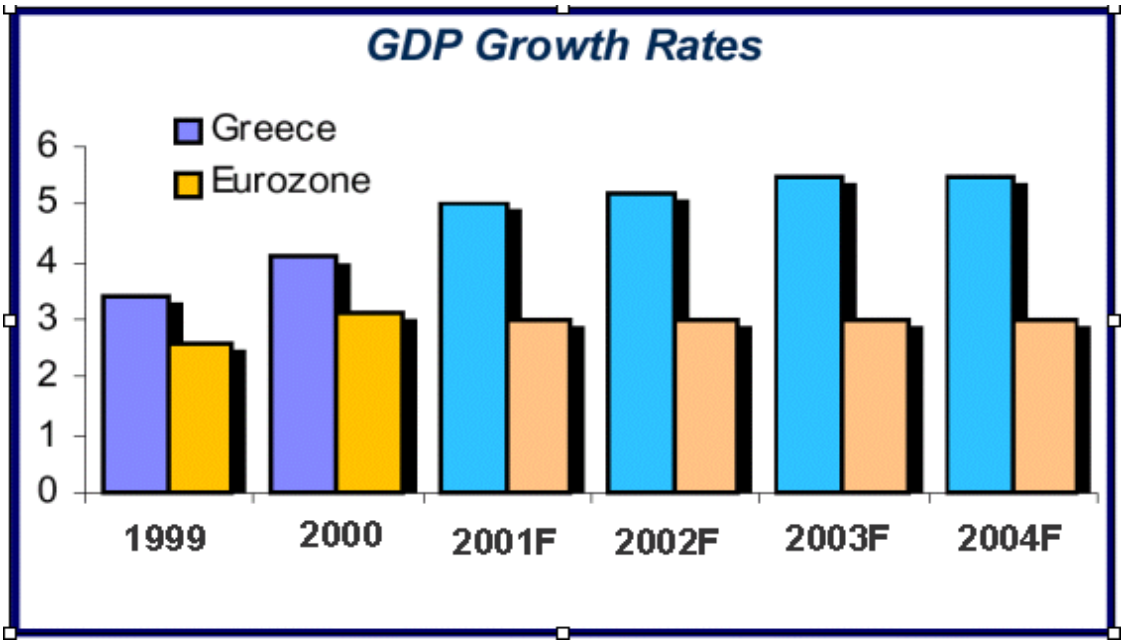
ANNEX 2 : THE GREEK MARKET

A2.1. Economic Indicators and demographics

A2.1.1. Introduction

Greece's entry to the European Monetary Union (EMU) in January 2001 was accomplished by the achievement of the economic targets that were set out at Maastricht. Greece is now expected to be the fastest growing economy in the EU over the next 3 years, averaging an annual GDP growth rate of 5.3 %.

Diagram A2.1: Forecast GDP Growth Rate



Source: Ministry of National Economy and Finance

The Greek Government is fully committed to achieving "real convergence" which is being brought about by monetary and fiscal reforms, and by structural reforms that include deregulation and privatisation programmes. There are good reasons for Greece to deliver a robust performance for the years leading up to the Olympic Games in 2004:

- Entry to EMU will encourage economic stability: EMU convergence reforms have had a significant impact on growth and economic stability. The positive factors of Greece's entry into EMU include a low interest rate and inflationary environment, a decline in debt burden, tax reforms, as well as structural reforms.

- Community support framework III: Greece has been allocated a stimulus package of EURO 20 billion distributed up to the year 2006. A significant proportion of this funding will be allocated to the 'INFORMATION SOCIETY' programme.

- Olympic games in 2004: The hosting of the Olympic Games is expected to contribute between 2.3-2.6 % towards the country's GDP in that year.

- Greece is the primary gateway to the Balkan states: Greece serves as a springboard for EU's extension into central and eastern Europe by virtue of its location, cultural understanding of the region, coupled with practical experience of conducting business in the region. There is an existing network of 2,500 Greek companies that have initiated direct investment programs or marketing agreements in the regional emerging markets. Thessaloniki, the capital of northern Greece, offers the financial and trading services needed in order to conduct business in the regional markets and is the seat for the Black Sea Trade and Development Bank.

A2.1.2. Main economic indicators

Some significant economic indicators are presented in table A2.1.

Table A2.1: Greece's main economic indicators

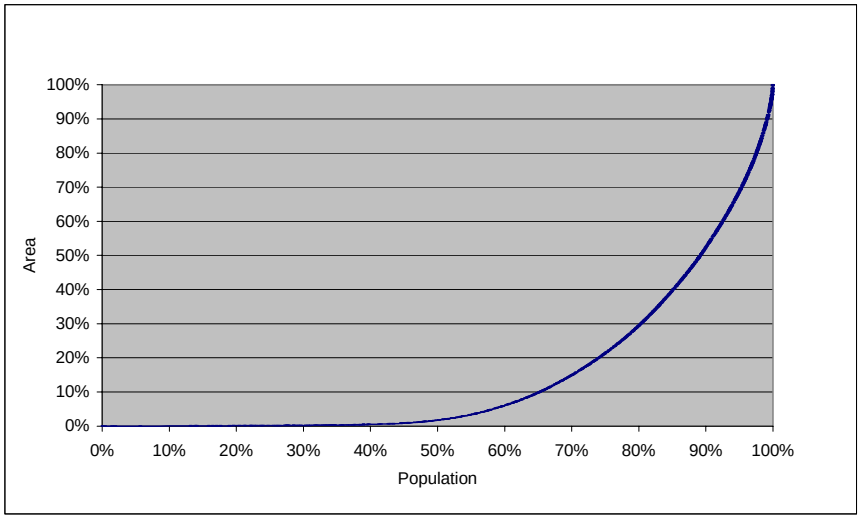
	2000	**2001***
Real GDP Growth	4.1%	5%
Unemployment rate	11.3%	10.4 %
Average CPI change	3.1%	3.3 %
Central govt budget balance	- 0.8% of GDP	+ 0.5% of GDP
12-month Treasury bill yield (average)	6.1%	4.5%
Short-term bank lending rate (year end)	10.5%	8.5%
Current account balance	-5.5% of GDP	…

*Official estimates
Source : Alpha Bank Economic Research Division

A2.1.3. Population distribution

The Greek population is highly urbanised, with a large proportion of the population, approximately 50%, living in Attiki (wider Athens area) and in Kentriki Makedonia (wider Thessaloniki area).

Diagram A2.2: Lorentz curve of population versus area in Greece



source: Central Union of Municipalities of Greece (KEDKE)

Table A2.2: Population distribution per region in 1998

GEOGRAPHICAL REGION	POPULATION	
	N	%
Attiki	3,450,890	33%
Sterea Ellada & Evia	662,802	6%
Peloponnisos	670,284	6%
Ditiki Ellada	737,117	7%
Ionio	202,000	2%
Ipiros	371,690	4%
Thessalia	743,075	7%
Ditiki Makedonia	302,892	3%
Kentriki Makedonia	1,792,304	17%
Anatoliki Makedonia & Thraki	561,838	5%
Vorio Aigeo	183,682	2%
Notio Aigeo	270,115	3%
Kriti	562,276	5%
TOTAL	10,510,965	100%

Source: Institute of Regional Development– 1998

A2.2. The Greek Mobile telecommunications market

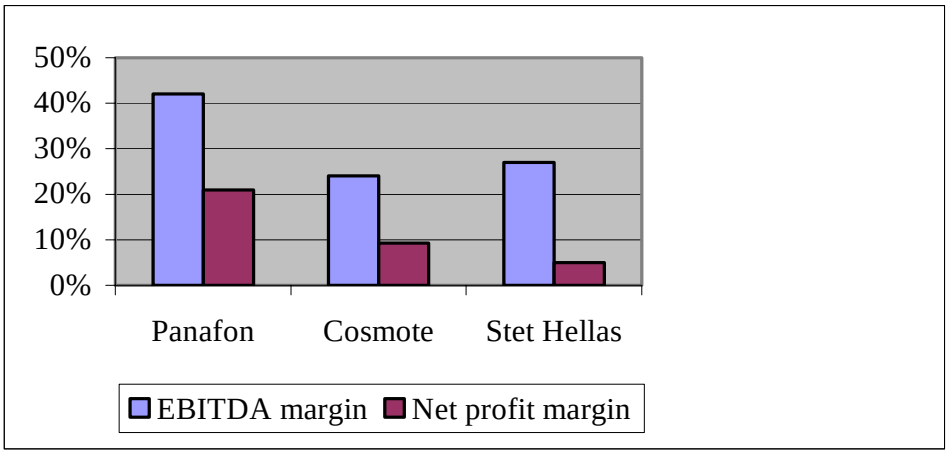
A2.2.1. Overview of the Greek telecommunications market

The Greek telecommunications market is one of the most dynamic and profitable in Europe. The market capitalisation of the Greek telecommunication industry is valued at EURO 4.3 Billion with the mobile telecommunications market being valued at EURO 1.5 Billion. There are currently three mobile telecom operators: Panafon-Vodafone, CosmOTE, and STET Hellas.

A2.2.2. Financial profile of the Greek Mobile Operators

Attractive valuation multiples: The Greek Telecommunications sector's earnings for 2001 are forecasted to grow at 16%, with the sector trading at a PE multiple of 17.6 in 2000. The European Telecommunications sector earnings for 2001 are expected to grow at 18.2% while trading at a PE of 38. This translates into a favourable PEG ratio for the Greek telecommunication sector of 1.1, as compared to a peg ratio of 2.1 for a sample of European operators (source: Schroder Salomon Smith Barney). The EBITDA and net profit margins of the Greek mobile telecommunication operators for 2000 are illustrated below.

Diagram A2.3: EBITDA and Net profit margins of the Greek mobile operators, 2000

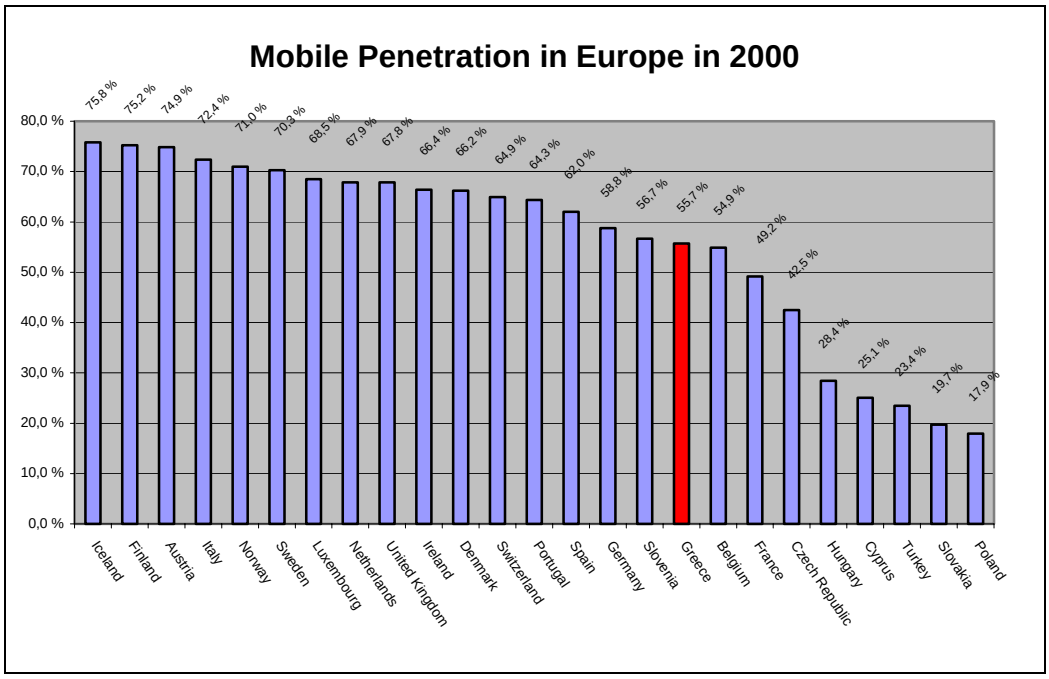


Source: Intersec estimates, 2000

A2.2.3. Mobile penetration ratios in Greece

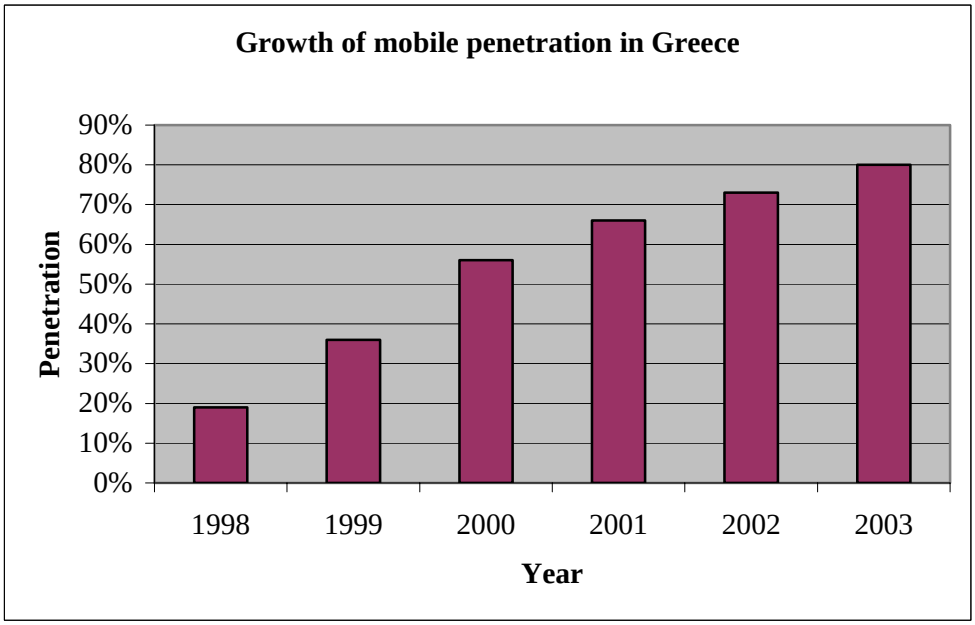
Fast growing penetration ratio: Mobile penetration ratio in Greece in 2000 was 56% and increased by 51% from 1999. This ratio is forecast to reach 66% by the end of 2001 and exceed 80% by 2004. The tables below provide current mobile penetration rates in Europe and Greece and forecasted penetration rates for Greece.

Diagram A2.4: Mobile penetration rates in Europe



Source: EMC(UK)

Diagram A2.5: Mobile penetration rates in Greece

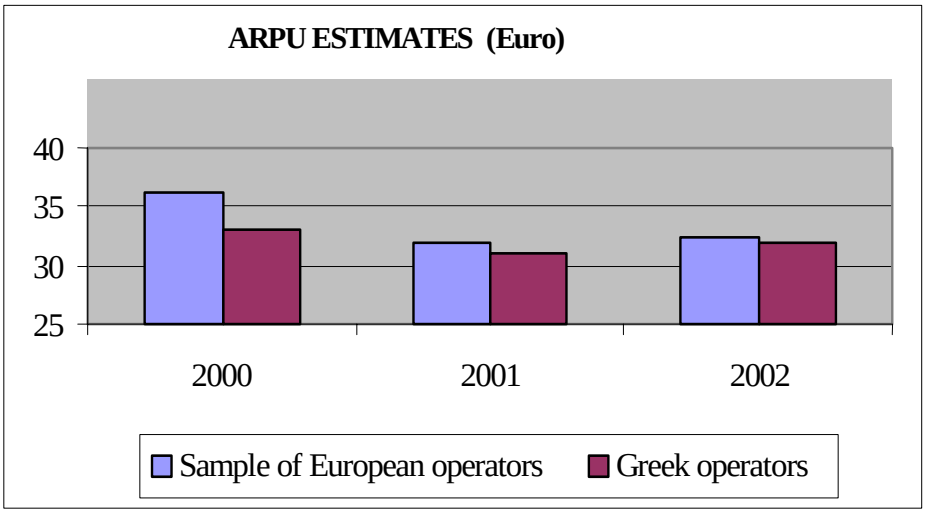


Source: Merril Lynch, September/November 2000

A2.2.4. Average mobile spend in Greece

The ARPU rate (Average Revenue Per User – monthly) of the Greek Mobile Telecommunications providers compares favorably with the average ARPU taken from a sample of European telecommunication operators. This figure is even more impressive when standardized by the respective countries' GDP per capita. A lower GDP per capita (estimated at approximately 65% of the European average) has not deterred the Greek consumer from spending significantly on mobile telecommunications.

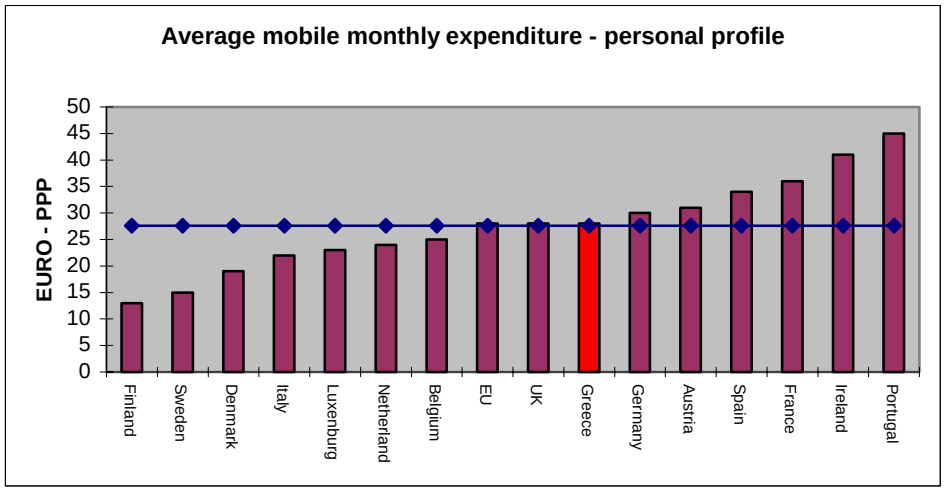
Diagram A2.6: Comparative ARPU estimates; Greek v sample of EU operators

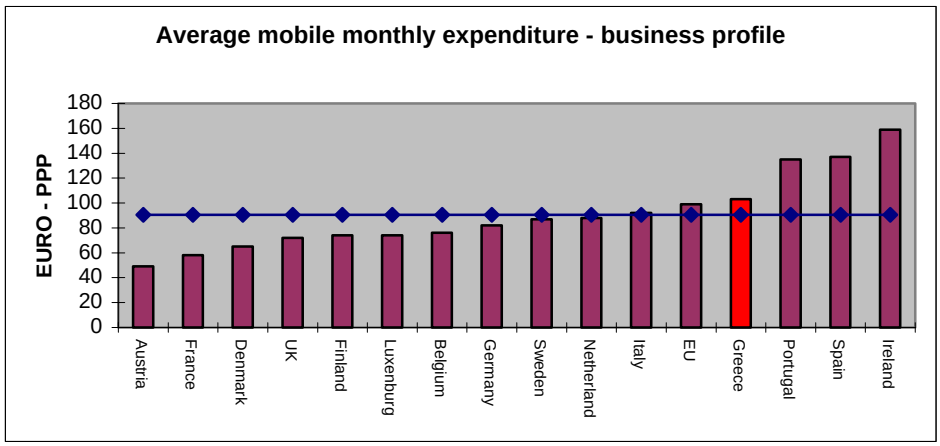


Source: Schroder Salomon Smith Barney

The two charts below illustrate the average mobile monthly expenditure for both personal profile and business profile for European countries for August 2000 (at PPP exchange rates) illustrating the relatively high spend in Greece during the peek of the tourist period.

Diagram A2.7a and A2.7b: Average monthly expenditure (August 2000) - personal and business profile – EU, Greece





Source: European Telecommunications Services Observatory

A2.2.5. Other characteristics of the Greek mobile market

Other differentiating characteristics of the Greek market include:

- Greeks change their cellular handsets three times more often than European counterparts – (source Intersec).
- Greece has significant SMS penetration rates (eg SMS comprised 8% of CosmOTE's[1] revenue after 8 months of operation, average SMS per month were 25/customer for Stet[2] in the 2nd quarter of 2000);
- Roaming contributes a significant percentage of the mobile operators revenue stream.
- Greece's annual tourist arrivals exceed 10 mn and are forecasted to grow further; tourists are expected to have significantly higher demand for information and location based services compared to the average mobile user.

[1] Source: Schroder Salomon Smith Barney, "Greek Value", 29 January 2001

[2] Source: Stet Hellas 2000 first half results

ANNEX 3: LICENSING FOR 3G (UMTS) AND 2G (GSM/DCS) INDIVIDUAL LICENCES

3G (UMTS) Auction

Phase 1. (Allocating up to four basic licences)

1. Each basic licence consists of 2 x 10 MHz of spectrum in the frequency band 1920-1980 MHz and 2110-2170 MHz, plus 1 x 5 MHz of unpaired spectrum in the 1900 –1920 MHz frequency band. The location of the licences to be finally awarded is determined in Phase 3.

2. The auction will allow participants to determine whether a four-licence 3G industry, then a three-licence 3G industry and then a two-licence 3G industry is formed. The successive attempts will be called stage 1, stage 2, and stage 3.

3. Each stage will consist of a pay-your-bid, sealed-bid auction.

4. A bid consists of a commitment to pay the amount bid for whatever basic licence a successful holder may be assigned in Phase 3.

5. The payment terms differ according to the stage at which the licences have been awarded. For licences awarded in the first (4-licence) stage the successful bidder will pay 40% of his bid up-front and the remainder in four annual instalments starting in year 2005. For licences awarded in the second (3-licence) stage the successful bidder will pay 70% of his bid up-front and the remainder in three annual instalments starting in year 2005. The payment for licences awarded in the third (2-licence) stage will be made up-front.

6. The reservation price at stage 1 is 50 billion GRD. The reservation price at stage 2 is the maximum of 50 billion GRD and the lowest price paid for a licence at stage 1. The reservation price at stage 3 is the maximum of 50 billion GRD and the lowest price paid for a licence at stage 1 or stage 2.

7. If all the licences offered at some stage are sold, this phase of the auction ends.

8. Suppose **n** licences are offered at some stage. If less than **n** bids at or above the reservation price are made, the attempt to sell **n** licences is deemed to have failed and the auction moves on to the next Stage. Nevertheless, if a New Entrant has bid at or above the reservation price, he, and any other bidder who bid at or above the reservation price at the current stage is awarded a licence at the price he bid.

9. At any stage, the number of licences offered equals the number of licences corresponding to that stage minus the number of licences sold at earlier stages. If this rule results in zero licences being offered at any stage, this Phase of the auction concludes. (For example, if a New Entrant and two Incumbents bid above the reservation price at stage 1, Phase 1 of the auction concludes).

10. If stage 3 ends without any of the licences on offer being sold, the auction ends.

11. Bidders are asked not to risk creating ties by avoiding bids that end in one or more zeros. If ties do occur, they will be broken at random.

Phase 2. (Allocating up to four additional segments of 3G spectrum)

1. Each additional spectrum segment consists of approximately 2 x 5 MHz of spectrum in the band that is assigned for UMTS services. (The exact size and location of the additional spectrum segments is determined in Phase 3).

2. A number **n** of basic licences between 1 and 4 has been allocated at Phase 1; otherwise Phases 2 and 3 do not take place.

3. If **n** licences are sold at Phase 1, then **n** additional spectrum segments are made available. No more than two additional spectrum segments will be awarded to the same licensee.

4. The **n** additional spectrum segments are offered to the holders of basic 3G licences as determined in Phase 1 (and to no other bidders) in a pay-your-bid, sealed-bid auction. Each bidder may submit a bid in each cell of the accompanying table.

1 additional spectrum segment	2 additional spectrum segments

A bid for one additional spectrum segment consists of a commitment to pay the amount bid for a segment to be located adjacent to a successful bidder's basic licence, as determined in Phase 3. A bid for two additional spectrum segments consists of a commitment to pay the amount bid for two segments to be located adjacent to a successful bidder's basic licence, as determined in Phase 3. An empty cell is interpreted as a zero bid. Payment terms are the same as for a licensee's basic licence.

5. If the **n** licensees in Phase 1 include **m** New Entrants, then **m** additional spectrum segments are reserved for these New Entrants.

6. The reservation price for an unreserved additional spectrum segment is 5 billion GRD. The reservation price for a reserved additional spectrum segment is 1 billion GRD.

7. The number **m** of reserved additional spectrum segments is reduced to the total demand from New Entrants (if this total demand is not **m** or larger).[3] If the updated value of **m** is zero, no spectrum is reserved for New Entrants and reference to reserved spectrum in what follows becomes irrelevant.

8. With the updated value of **m**, number the reserved additional spectrum segments: **1**,**2**,….,**m**. Number the unreserved additional spectrum segments: **m+1**, …..,**n**. (This numbering is abandoned at the end of Phase 2)

9. List all possible allocations of additional spectrum segments among the 3G licensees, subject to the following constraints:

   (a) No licensee is allocated more than two additional spectrum segments;

   (b) No Incumbent is awarded any spectrum segment numbered **1**,**2**, …**m**;

[3] The total demand is what the New Entrants would be allocated if no Incumbents were to bid

(c) No spectrum segment numbered **1**,**2**, …**m** is allocated to a bidder if it would then be sold below the reservation price for reserved spectrum. No spectrum segment numbered **m+1**,….,**n** is allocated to a bidder if it would then be sold below the reservation price for unreserved spectrum.

10. The final allocation is chosen from the allocations listed in item 9 to maximise the total value offered by bidders.

Phase 3. (Locating the licences)

1. If n basic 3G licences are allocated along with **t** additional spectrum segments in Phases 1 and 2, then EETT specifies a contiguous (paired) band B of spectrum of 2 x (10 x **n** + 5 x **t**) MHz at the left end of the range 1920-1980 and 2110-2170 MHz.

2. If the band B fills the whole range (because **n**=4 and **t**=4) two guard bands at the ends of the range, equal to a total of 0.6 MHz is subtracted from B. Three of the four additional spectrum segments are then of size 2 x 4.8 MHz and the fourth is of size 2 x 5 MHz. The largest additional spectrum segment is allocated to the licensee who paid most for the licence. (Ties are broken at random).

3. If the band B does not fill the whole range (and so **t**<4), it is displaced 0.3 MHz to the right to establish a guard band. Each additional spectrum segment is then of size 2 x 5 MHz.

4. The **n** 3G licensees (as determined in Phase 1) are ranked in decreasing order of their total bids (including additional spectrum segments). In the order of their ranking, they each choose one of the numbers: **1**,**2**…**n**. The licensee who chooses number **1** is allocated the spectrum he has bought at the left extreme of B. The licensee who chooses number **2** is allocated the spectrum he has bought at the left extreme of what remains of B; and so on.

5. The unpaired spectrum in the range 1900.1 – 1920.1 that accompanies basic licences is allocated in the reverse order of the paired components of the licences[4].

[4] So that the licensee who has the leftmost paired spectrum component of his licence also has the rightmost unpaired component.

2G Auction

Phase 1 (Allocating spectrum)

1. After the 3G auction, there will be an auction of extra 2G spectrum that is not restricted to current 2G Incumbents.

2. No bidder will be allowed to hold a total of less than 2 x 10 MHz of spectrum (including its current holdings) after the auction. No bidder will be allowed to hold more than 2 x 30 MHz of 2G spectrum (including its current holdings) after the auction.

3. The 2G spectrum offered will consist of 2 x 50 MHz of DCS spectrum and 2 x 10 MHz of GSM/EGSM spectrum. This will be offered as ten 2 x 5MHz segments of DCS spectrum and two 2 x 5 MHz segments of GSM/EGSM spectrum.

4. Some of the available spectrum will be reserved for New Entrants (bidders who are not current 2G Incumbents). A New Entrant may be a 3G licensee who is not currently licensed as a 2G operator. The EGSM reserved spectrum will consist of 2 x 5 MHz in the (paired) range 885-890 MHz and 930-935 MHz. The DCS reserved spectrum will consist of 2 x 20 MHz within the (paired) range 1710-1760 and 1805-1855 MHz. (Its location within the range will be determined in Phase 2.)

5. The GSM unreserved spectrum (open to bidding by both 2G Incumbents and New Entrants) will consist of 2 x 5 MHz in the (paired) range 900-905 and 945-950 MHz. The DCS unreserved spectrum will consist of 2 x 30 MHz within the (paired) range 1710-1760 and 1805 – 1855 MHz. (Its location within the range will be determined in Phase 2.)

6. The reservation price for each 2 x 5 MHz spectrum segment of unreserved GSM spectrum is 12 bn GRD. The reservation price for each 2 x 5 MHz spectrum segment of unreserved DCS spectrum is 9 bn GRD. The reservation price for a 2 x 5 MHz spectrum segment of EGSM spectrum is 1 bn GRD. The reservation price for the first 2 x 5 MHz spectrum segment of reserved DCS spectrum sold is 1 bn GRD; of the second, 6 bn GRD; of the third, 7 bn GRD; of the fourth, 8 bn GRD.

7. Reserved spectrum not sold to a New Entrant in the auction will be retained by EETT for allocation at a later stage.

8. The auction will be a pay-your-bid, sealed-bid auction. Each bidder may submit a bid in each cell of the accompanying table[5].

		DCS						
GSM	(MHz)	0	2 x 5	2 x 10	2 x 15	2 x 20	2 x 25	2 x 30
	0							
	2 x 5							
	2 x 10							

[5] Some entries will not count as valid bids because of constraints imposed elsewhere. For example, the maximum of 30 MHz constraint may be active, and 2G Incumbents cannot get 10 MHz of GSM spectrum.

Each bid commits the bidder to pay his bid for the amounts of spectrum corresponding to the cell in which it is written. The bids are exclusive in that at most one bid can be successful.

9. Successful bidders will have to pay their bids within 60 days from the award of licences.

10. No more than four 2G licences will be issued in this auction

11. Number the 2 x 5 MHz DCS spectrum segments reserved for New 2G Entrants: **1**, **2**, **3**, **4**. Number the unreserved DCS spectrum segments: **5**, **6**, **7**, **8**, **9**, **10** (It is unnecessary to number GSM/EGSM spectrum segments).

12. List all possible allocations of the available DCS and GSM/EGSM spectrum, subject to the following constraints:
    (a) No licensee may be allocated more than a total of 2 x 30 MHz (including the 2G spectrum the licensee already holds)
    (b) No licensee may be allocated less than a total of 2 x 10 MHz (including the spectrum the licensee already holds)
    (c) No more than four bidders may be allocated spectrum
    (d) No Incumbent is awarded the reserved EGSM spectrum segment. No Incumbent is awarded DCS spectrum segments **1**, **2**, **3** or **4**
    (e) Neither GSM/EGSM spectrum segment is sold below its reservation price. DCS spectrum segments **1**, **2**, **3** and **4** are not sold below the reservation price for reserved spectrum segments. DCS spectrum segments **5**, **6**, **7**, **8**, **9** and **10** are not sold below the reservation price for unreserved spectrum segments.

13. The final allocation is chosen from the allocations listed in item 12 to maximise the total value offered by the bidders

14. Bidders are asked not to risk creating ties by submitting bids that end in one or more zeros. If ties do occur, they will be broken at random.

Phase 2 (Locating the Licences)

1. There is no choice in the location of GSM/EGSM licences awarded.

2. If DCS spectrum is awarded in the auction to the 2G Incumbent who currently hold DCS spectrum, this is first allocated to him adjacent to his current holdings[6].

3. After the bidder described in item 2 has been allocated his DCS spectrum, there will be **n** licensees who have been assigned DCS spectrum that has yet to be located. These **n** licensees are ranked in decreasing order of their successful bid (for both DCS and GSM spectrum). In the order of their ranking, they then each choose one of the numbers: **1**, **2**,…,**n**. The licensee who chooses number **1** is allocated the spectrum he has bought at the right extreme of the remaining available DCS spectrum. The licensee who chooses number **2** is allocated the spectrum he has bought at the right extreme of the available DCS spectrum that then remains; and so on.

[6] This will consist of at most 2 x 5 MHz in the range 1755-1760 and 1850-1855 MHz, the Incumbent being Cosmote

ANNEX 4 : GLOSSARY OF TERMS

A4.1 Glossary of Terms regarding the Licensing Process

Control: The ability to control a company in accordance with article 4 (ensuing) of Law 703/1977 and the applicable Greek and Community legislation.

Confidential Information: Information with regards to any Bidder, which if become known to other Bidders is likely to affect their bids. Indicatively but not restrictively, such information is considered to be the business plan, the strategy and the highest bid of a Bidder. EETT has the exclusive competence to decide when the announcement of such information may affect a Bid.

Direct Participation: The participation of an Enterprise in another Enterprise

Economic Interest: It is the Indirect Participation held by "Person A" in "Person B" in such a way that the percentage of the Economic Interest of "Person A" with regards to "Person B" is equal or higher than a fixed percentage as specified in the Information Memorandum.

Enterprise: Has the meaning attributed to it in art. 4 of Law 703/1977

Indirect Participation: The Indirect Participation of one Enterprise ("Enterprise A") in a second Enterprise ("Enterprise B") is defined as the product of the Direct Participation possessed by all intermediary Enterprises that intervene from "Enterprise A" to "Enterprise B" in any direct line of participation that leads from "Enterprise A" to "Enterprise B". In the occasion that the Direct Participation percentage of any intermediary Enterprise exceeds 50% then this percentage will be increased to 100% for the multiplicative adjustment. In the event of more than one direct participation line for the estimation of the Economic Interest the sum of all Indirect participation will be calculated.

Participant: Any person that has submitted Application for participation in the Licensing Process. In case of a legal person under incorporation Bidder is the legal person under incorporation to which the individual license will be granted. In case of a consortium, a Participant is the legal person that the parties of the consortium are obliged to establish and to which the special license will be granted.

Related Party of Participants: The Members of a Related Party of Participants are defined as follows:

i) The Participant in the Licensing Process

ii) Enterprises that Control or are Controlled by the Participant and Enterprises that are under the same control with one of the Participants in the Licensing Process (subsidiaries of the same company).

iii) Any Enterprise that Controls or is Controlled by Enterprises falling within categories (i) and (ii) and (iii)

A4.2 Glossary of Technical Terms and Abbreviations

2G	:	Second generation mobile telecommunications.
3G/3G mobile	:	Third generation mobile telecommunications.
bandwidth	:	The range of frequencies occupied by a radio signal.
BS	:	Base Station
CDMA	:	Code Division Multiple Access..
CEPT	:	European Conference of Postal and Telecommunication Administrations.
DCS 1800	:	Digital Communications Standard for Cellular Communications
DECT	:	Digital Enhanced Cordless Telecommunications..
DS-CDMA	:	Direct sequence CDMA.
EDGE	:	Enhanced Data for GSM Evolution..
E-GSM	:	Extended GSM..
ERC Decision	:	Measures approved by the ERC on significant harmonisation matters in the radiocommunications regulatory field, within the context of long term ERC strategy and policy.
ERC	:	European Radiocommunications Committee.
ETSI SMG	:	ETSI Special Mobile Group.
ETSI	:	European Telecommunications Standards Institute.
FDD	:	Frequency Division Duplex.
fixed link	:	A communications link between two fixed points. Such links may be uni-directional (e.g. carrying television programme material to a transmitter) or bi-directional (e.g. carrying telephone traffic), and may be point-to-point or point-to-multipoint.
Frequency Division Duplex	:	A technique for bi-directional communication in which one radio frequency carrier is used for transmission (e.g. the link from the mobile to the base station) and a separate radio frequency
GPRS	:	General Packet Radio Service.
GPS	:	Global Positioning System
GSM	:	Global System for Mobile Communications
HLR	:	Home Location Register

HSCSD	:	High Speed Circuit Switched Data.
IMT-2000	:	International Mobile Telecommunications 2000.
interconnection	:	The physical and logical linking of two or more telecommunication networks.
interface	:	A set of technical characteristics describing the point of connection between two telecommunication entities (for example, between two telecommunication networks or between a telecommunication network and customer apparatus).
ISDN	:	Integrated Services Digital Network.
ITU	:	The International Telecommunication Union.
ITU-R	:	ITU Radiocommunications Sector.
LAN	:	Local Area Network
local loop	:	A generic term applied to the traditional copper network providing connections between customers' telephones and the local telephone exchange.
MSC	:	Mobile-service Switching Center
Multicarrier CDMA	:	A method of generating high bit rate CDMA by combining several adjacent lower rate CDMA carriers.
MVNO	:	Mobile Virtual Network Operator.
ONP	:	Open Network Provision.
paired spectrum	:	Where paired spectrum is defined, two sub-bands are identified and each radio frequency carrier in the lower sub-band has a corresponding carrier in the upper sub-band. FDD may then be implemented in this paired spectrum. One sub-band is used for all mobile terminal to base station links (commonly referred to as “uplinks”) and the other sub-band for the reverse direction (“downlinks”).
PCN	:	Personal Communications Network.
PCS	:	Personal Communications System.
point-to-multipoint	:	Fixed link having at one end a multi-directional antenna for communication with a number of
point-to-point	:	Fixed link, generally using highly directional antennas at each end, for communication
fixed link	:	between two fixed points.
PSTN	:	Public Switched Telephone Network.

radio fixed access	:	Use of point-to-multipoint fixed links to connect subscribers to a telecommunication network.
refarming	:	The use of spectrum, currently licensed for use with one standard, for another standard.
RNC	:	Radio Network Controller
Roaming	:	The use, by a customer of one mobile network operator, of another mobile network operator's network to make and/or receive calls.
SGSN	:	Serving GPRS Support Node
SMG	:	Special Mobile Group.
SMS	:	Short Message System
spectrum	:	A continuous range of frequencies of electromagnetic radiation (for example, radio waves).
TD-CDMA	:	Time Division CDMA.
TDD	:	Time Division Duplex.
TDMA	:	Time Division Multiple Access
TETRA	:	Terrestrial Enhanced Trunked Radio
TSG-RAN	:	Technical Specification Group for the Radio Access Network
UMTS Forum	:	An international body established in 1996, with the aim of promoting awareness of third generation opportunities and issues
UMTS	:	Universal Mobile Telecommunication System
unpaired spectrum	:	A range of radio frequencies defined as a stand-alone band. The radio frequency carriers in unpaired spectrum are not paired with carriers at other frequencies.
UTRA	:	UMTS Terrestrial Radio Access
W-CDMA	:	Wideband CDMA.