(Formerly ABTO)

14th July 2004

AUSPI / 12 / 2004 / 127

Shri Pradip Baijal,
Chairperson,
Telecom Regulatory Authority of India,
A - 2/14, Safdarjung Enclave,
New Delhi 110 029.

Sub: AUSPI Response to TRAI Consultation Paper No 11/2004 dtd 31st May 2004 on Spectrum Related Issues

Dear Sir,

AUSPI commends the exhaustive work done by TRAI in drawing up its Consultation Paper on the important subject of Spectrum which covers issues regarding efficient utilization, allocation and pricing. We are grateful to TRAI for having given an opportunity to all stakeholders for a well deliberated response.

AUSPI's members have discussed all issues raised in the Paper and we are pleased to submit our detailed response which is enclosed herewith.

In addition to the above response, AUSPI had also commissioned an independent study by an international consultant – Indepen and Interconnect of UK to examine the various issues raised by TRAI in its Consultation Paper. We are pleased to also enclose a detailed report we have received from them.

We sincerely hope that the views contained in our response as well as the additional report being submitted will be favourably considered while TRAI is in the process of examining the responses of various stakeholders on various issues and drawing up its recommendations. Please do revert for any clarifications on these if necessary which we will be glad to respond to.

Yours faithfully,

S C Khanna
Secretary General

Encl: a.a.

CC: Dr D P S Seth, Member, TRAI
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AUSPI RESPONSE TO CONSULTATION PAPER ON SPECTRUM RELATED ISSUES

Chapter 2: Current spectrum availability and requirement

(i) ***Should the 450 MHz or any other band be utilised particularly to meet the spectrum requirement of service providers using CDMA technology?***

CDMA operators world-over are utilising at least 10+10 MHz to 20+20 MHz on an average 15+15 MHz spectrum per operator to meet their requirement to provide various services on their networks deploying CDMA technology. In this connection please refer to Annexe – I. In contrast in India, actual allocations to CDMA operators are maximum 2.5 MHz spectrum initially.

CDMA operations in India is in the frequency band 824 – 844 MHz paired with 869 – 889 MHz which is inadequate. This band allows only 20 MHz spectrum with only 14 carriers for use by CDMA operators as against internationally accepted 800 MHz standard of 25 MHz spectrum in the 824 – 849 MHz band paired with 869 – 894 MHz.

The spectrum requirement of CDMA operators in India is to be made closer towards international requirements of 10+10 MHz to 20+20 MHz average of 15+15 MHz / operator.

We should, therefore, look for additional appropriate spectrum to meet the requirement of service providers using CDMA technology. The spectrum so chosen should be in the bands in line with international practices so that the operators do not face problems relating to the availability of equipment and the handsets which are compatible with the existing networks. The frequency band chosen should not pose any problem in international roaming as well. The operators also should not be left at the mercy of one or two vendors in world market otherwise cost effectiveness will be lost.

CDMA operators are using 800 MHz and 1900 MHz bands wherever they are operating. Please refer to Annexe – II. The 1900 MHz band referred to here is also known as US PCS band (1850 – 1910 MHz paired with 1930 – 1990 MHz). In all countries except Korea CDMA technology uses either 800 or 1900 MHz band. The Korean PCS band is (not standard DCS 1800 MHz band) not suitable for India amongst many other reasons the important ones being one or two vendors making equipment and handsets in this band, FDD spacing different and unique, no compatibility with 800 MHz band being used in India, no dual mode / multimode 800 MHz/KPCS even after 8 years or so of its implementation in Korea. In India the requirements of additional spectrum for CDMA network should be in this 1900 MHz US PCS band.

This US PCS band or 1850 MHz – 1910 MHz paired with 1930 MHz – 1990 MHz is proposed due to the following important reasons amongst many other reasons.

- In consonance with ITU-R regulation.
- Multiple vendors of infrastructure throughout the world and also a number of handset vendors.
- Compatibility of handsets and infrastructure equipment between 800 / 1900 MHz in CDMA network.
- Dual band handsets and infrastructure equipment are internationally available with many vendors in 800/ 1900 MHz band.
- International roaming feasible with 800/ 1900 MHz (i.e., US PCS band), as majority of the CDMA networks internationally are there in these bands.

450 MHz band (452.5-457.5 MHz paired with 462.5-467.5 MHz) available for mobile services is only 5 MHz and is not sufficient. This band is being considered only in far flung rural areas. However, AUSPI recommends 450 MHz band be utilized as a complement and not as a substitute to 1900 MHz US PCS band.

It is proposed that apart from existing spectrum, further requirement for CDMA be made in the following bands. This is in line with the ITU-R Recommendations and permits flexibility and use of different bands as relevant here & elsewhere. It would ensure that CDMA Operators can co-exist and compete on a fair basis with other technology operators.

- 1850-1880 MHz p/w 1930-1960 MHz (2 x 30 MHz) for CDMA (B3).
- 1900-1910 MHz p/w 1980-1990 MHz (2 x 10 MHz) for CDMA (B3).
- 1755-1805 MHz p/w 2110-2160 MHz (2 x 50 MHz) for Equal spectrum for CDMA and GSM (B5).
- 452.5 – 457.5 MHz p/w 462.5-467.5 MHz (2x5 MHz) for CDMA.

The above suggestions will:

- Ensure effective and efficient global sourcing of equipment and handsets leading to cost reduction and availability of voice and broadband services to the masses at affordable price;
- Provide adequate bandwidth for the growth of CDMA mobile services in the country;
- Ensure the most efficient and optimal utilization of spectrum;
- Ensure level playing field between GSM and CDMA operators, thus ensuring technology neutral approach of the Government.

(ii) ***The consultation paper has discussed ITU method for assessment of spectrum requirement. Based upon the methodology submit your requirement of spectrum for next 5 years. While calculating the required spectrum, please give various assumptions and its basis?***

It is projected by different market analysts that the Indian telecom market will exceed 200 million wireless subscribers in the next 5 years i.e. by 2009. Out of this, we expect that about 50% of the market will be with CDMA operators, i.e. ~100 million. **Each operator will require 20+20 MHz of spectrum in the appropriate bands over a period of 5 years.**

[Market research data: Evli Bank plc have projected a figure of 109 million CDMA subscribers by 2010. Ernst & Young have estimated 142 million wireless subscribers by 2007. ABTO (now AUSPI) had projected 18 million CDMA subscribers by March '05].

(iii) ***Whether IMT 2000 band should be expanded to cover whole or part of 1710 – 1785 MHz band paired with 1805 – 1880 MHz?***

Yes, whole of the band.

(iv) ***Should IMT 2000 spectrum be considered as extension of 2G mobile services and be treated in the same manner as 2G or should it be considered separately and provided to operators only for providing IMT 2000 services?***

IMT-2000 spectrum must be considered as an extension of 2G mobile services and must necessarily be treated in the same manner as 2G. There is nothing exclusive about the IMT-2000 spectrum or services. 3G services are capable of being provided in various bands as has been recognized by ITU and it is for these reasons that ITU has identified additional bands for 3G services. ITU has explicitly stated that different administrations have allocated different bands for different services and hence for IMT-2000 applications also ITU has identified different bands. There is no specific IMT-2000 band reserved for 3G services all bands globally identified for IMT-2000 have equal status. Depending on the country any band including all existing bands where 2G services are available, IMT-2000 can be provided.

Under Unified Licensing Regime, which is technology and service neutral, service providers are permitted to provide all types of services and the licences do not define whether the service being provided is 2G or 3G, nor does the licence provide which technology should be used. **Therefore, there is no justification that spectrum in the IMT-2000 bands be considered separately for provisioning of only IMT-2000 services as these services are in no manner different from what is possible in other bands identified by ITU.**

(v) ***Reorganisation of spot frequencies allotted to various service providers so as to ensure the availability of contiguous frequency***

band is desirable feature for efficient utilisation of spectrum. Please suggest the ways and means to achieve it?

Reorganisation of spot frequencies allotted to various service providers will bring about efficient utilization as one operator will have a contiguous band mitigating the need for guard bands which results in wastages.

Therefore, while reorganization is desirable for efficient utilization of spectrum, the following actions are necessary:

Setting up of a task force involving industry representatives to prepare and implement a time-bound action plan for:

- Vacating of spectrum by non telecom service providers.
- Harmonization of carrier assignments (especially for CDMA) which are currently in non-standardised channeling plans.

(vi) ***Whether the band 1880 – 1900 MHz be made technology neutral for all BSOs / CMSPs / UASLs and be made available with the pair 1970 – 1990 MHz or should it be kept technology neutral but reserved for TDD operations only?***

Pairing of 1880-1900 MHz band should be with 1960-1980 MHz and not 1970-1990 MHz (it is presumed that this is a typographical error).

Making the band 1880-1900 MHz technology neutral would be in sync with the Government's overall technology and service neutral approach.

One of our members HFCL Infotel Ltd., has a different view on this question.

Chapter 3: Technical efficiency of spectrum utilization

(vii) ***Please offer your comments on the methodology outlined in this Chapter for determining the efficient utilisation of spectrum. Also provide your comments, if any, on the assumptions made?***

Comments on the methodology:

In para 3.2.2 of the Consultation Paper, the terminology relates to GSM network only. Such as Broadcast Control Channel in GSM network corresponds to pilot channel for CDMA.

A few comments on assumptions:

1. The calculation on the minimum spectrum requirement for hierarchical networks in GSM (refer Para 3.2.2.3) uses a different set of assumptions than those used to estimate spectral efficiency specially in the frequency reuse factors of the macro and micro cell layers. It would better if all assumptions were consistent.

2. Regarding Efficiency Factor computed for CDMA: The assumed capacity of 25 Erlangs/Carrier/Sector will decrease as the packing density increases. It is estimated that the Erlang capacity per sector could decrease as much as a factor of 2 when the packing density reaches 5 cells/sqkm. As intercell interference stops decreasing as a 4^{th} power of distance, and starts decreasing as a 2^{nd} power of distance (i.e. as in free space loss.)

All of the above mentioned points highlight the point that technology neutrality is an important consideration in allocating spectrum. To be considered technology-neutral, the regulatory agency must come out with recommendations and incentives that supports technology and services neutral approach.

(viii) ***Please provide your perception of the likely use of data services on cellular mobile systems and its likely impact on the required spectrum including the timeframe when such requirements would develop?***

AUSPI considers rollout of data services in wireless medium easier than in wireline. It is expected that data services on mobile systems will see an exponential growth in the coming years as has been observed in South Korean example. There is a significant revenue growth in this market due to provision of data services. Popular wireless data content and applications available on CDMA networks in Korea include video messaging, video (news/TV) on demand, recording and sending of video clips, multi-media messaging, broadband Internet access, interactive gaming, live music downloads (songs and videos), etc. Wireless data services can also be used in a number of other applications such as the provision of emergency services, ATM connectivity, and Internet access in a variety of places.

We also believe that expansion of data services will result in creation of a substantial number of jobs. Also we believe that the availability of the content in regional languages will boost the usage of data services in rural areas.

AUSPI considers a requirement of 2x5 MHz spectrum / operator for data services as adequate, and this allocation should be made available immediately.

Chapter 4: Spectrum Pricing

(ix) ***Is there a necessity to change from the existing revenue share method for determining the annual spectrum charge?***

Yes, there is a necessity to change.

(x) ***If yes, what methodology should be used to determine spectrum pricing for existing and new operators? (Please refer table in Section 4.8)?***

AUSPI proposes the methodology as per the following table to determine spectrum pricing for existing and new operators:

Table: Spectrum Pricing

	New Entrants	**Spectrum to Existing Operators upto 2x15 MHz**	**Additional allocation to all existing operators beyond 2x15 MHz**
One-time Entry Fee	Same charge as the existing licensees have paid to ensure Level Playing Field	NIL	NIL
Annual Charges	Cost recovery for all spectrum*	Cost recovery for all spectrum*	AIP

*****Cost recovery based on actual costs incurred by the regulatory authority in connection with management of radio spectrum.

(xi) ***In the event AIP is adopted as a means to price spectrum, would it be fair to choose GSM as a reference for determining the spectrum price?***

The value of the spectrum should be based on the "second best" technology, since this provides users of that technology with an incentive to use it in the most effective and efficient manner whilst avoiding panelizing users of the efficient technology.

(xii) ***Please provide your comments on the assumptions used in A.I.P.?***

We agree to the assumptions used in A.I.P. In addition, we recommend cell density per sq km to be also considered.

(xiii) ***In case Auction methodology is used for pricing the spectrum, please give suggestions to ensure that spectrum pricing does not become very high and spectrum is available to those who need it?***

We do not recommend auctions as the methodology for pricing spectrum.

(xiv) ***Should the new pricing methodology, if adopted, be applicable for the entire spectrum or should we continue with revenue share mechanism till 10 + 10 MHz, and apply the new method only for spectrum beyond this?***

We do not consider the revenue sharing as appropriate and accordingly recommend discontinuance of revenue sharing mechanism.

The price mechanism should be as follows:

- Upto 15+15 MHz spectrum – cost recovery based on actual costs incurred by the regulatory authority in connection with management of radio spectrum.

- Beyond 15+15 MHz spectrum based on A.I.P.

In this connection please refer to our response to question (X).

(xv) ***What incentives be introduced through pricing to encourage rural coverage and / or using alternative frequency bands like 450 MHz?***

Spectrum charges should be totally waived for wireless coverage in rural / remote areas and / or for using alternative frequency bands like 450 MHz. This will help in reducing costs of provisioning of service in these areas where revenue generated is far below the costs. This will come as a big relief to operators to provide services in rural areas also.

(xvi) ***Does M X C X W formulae for fixed wireless spectrum pricing need a revision? If so, suggest the values for M, C, W?***

Yes for UASLs. We recommend that fixed wireless spectrum pricing be revised and should be the same as is adopted for GSM cellular operators now.

The present rate of 0.25% of AGR for bandwidth of 112 MHz for the Circle and 224 MHz for the Metro may be retained. Additional spectrum of 28 MHz for the Circle and 56 MHz for the Metro may be charged at 0.05% of AGR.
In view of this, the formulae M X C X W is no longer valid.

This should be effective from date of migration of BSOs to UASL.

We would like to bring the following facts regarding **disparity in frequency spots allocation** with our views:

UASLs who apply for microwave links are allocated frequency spots on town-wise basis for a particular circle whereas CMSPs are allocated the frequency spot for the entire circle and need not take permissions for each and every town where service is being commissioned. In the light of migration to UASL regime, UASLs should also be allocated

frequency spots for the entire circle as is being given to CMSPs instead of town-wise allocations. This will reduce and simplify the procedures and UASLs would not have to file applications for various towns as they rollout their network but would get one allocation for the entire circle.

(xvii) ***Should there be different pricing levels for shared spectrum versus spectrum that is allocated with protection? How should this be determined?***

The entry fee paid by the operator allows the licensee the right to use the spectrum which is protected under the license. Additionally, each licensee pays annual license fee charges for usage of this spectrum through a revenue share. Therefore, no further increased / higher charges are payable for this “protected” spectrum by licensed service providers.

However, for shared spectrum, this should be charged in proportion to the number of users.

Chapter 5: Spectrum allocation

(xviii) ***How much minimum spectrum (refer approach (I) and (II)) in section 5.4) should each existing operator be provided? Give the basis for your comments?***

In a price sensitive, highly competitive market like India's, there is substantial change in traffic as tariffs vary and therefore, this upsets the basic assumption of constant traffic pattern. This phenomenon is likely to continue as we can expect a higher uptake of mobile services in the years to come. Thus, networks in India have to be robust and designed and planned in such a manner that these fluctuations are factored into without affecting the quality of service. Operators would have to do a techno-economical trade-off between adding infrastructure say in a particular metro area as compared to another urban centre vis-à-vis getting additional allocation of spectrum.

Keeping all these factors and international practices in mind, it is better in the Indian context that the Government allows each CDMA operator an average of 2x15 MHz allocations immediately in internationally accepted bands viz. 800 and US PCS 1900 MHz bands as suggested in Approach II outlined in the Consultation Paper. This would allow operators to plan efficient and reliable network keeping the overall network cost down. This approach is far more suitable to ensure the growth and viability of market place here.

We do not recommend Approach I. This Approach I has very serious flaws including that it is not technology neutral as required in Unified Licensing Regime.

However, as it has been noted by TRAI in the Consultation Paper, while there is some additional frequency available after this allocation (2x10 MHz / operator) for GSM in the 900 and 1800 MHz bands, there is actually a deficit of 2x10 MHz in non-metro areas which goes upto 2x20 MHz in metro areas for CDMA. While earmarking these bands, it is imperative to appreciate that current availability of equipment in the proposed bands alongwith their compatibility with existing 800 MHz systems (infrastructure and handsets) already deployed is a pre-requisite so that operators can benefit from the economies of scale. **With this background, we feel that additional allocations for CDMA services be made in the US PCS band (1850-1910 MHz paired with 1930-1990 MHz).**

(xix) ***At what stage the amount of spectrum allocation to new entrants be considered in the 800 MHz / 900 MHz / 1800 MHz frequency bands?***

Presently, there are about 7-8 licensed and / or operational networks in each service area (Metros / Category A & B circles) and similarly about 5-6 networks in Category C circles. This fact exhibits the high level of competition across the country. The Government should allocate on an average of 2x15 MHz / operator irrespective of circle and technology opted for by the operator. For new entrants, allocations should be

made only after the existing operators have been allocated an average of 2x15 MHz of spectrum.

(xx) ***Should spectrum be allocated in a service and technology neutral manner?***

While considering India specific spectrum related issues, it has to borne in mind that the Government of India has adopted technology neutral approach and has issued Unified Access Licenses under which licensees can provide any kind of services, spectrum too should be allocated in a service and technology neutral manner. That is, a licensed service provider will be totally free to use any technology to provide any kind of service without any regulatory restrictions.

(xxi) ***What should be the amount of cap on the spectrum assigned to each operator?***

The amount of cap per operator should be on an average of 2x20 MHz of spectrum and it should be reviewed from time to time as and when required.

(xxii) What procedure for spectrum allocation be adopted for areas where there is no scarcity and in areas where there is scarcity?

India, being a divergent country with varying income levels and socio-economic patterns presents a complex market where no "straight-jacket" / "one size fits all" solution can emerge. **We feel that in areas where there is no scarcity today, spectrum may be allocated on demand.**

(xxiii) ***Which competitive spectrum allocation procedure (Auction / Beauty Contest) be adopted in cases where there are scarcity?***

For competitive allocation procedure, AUSPI strongly proposes that no auctions should be there for allocation of spectrum.

2x15 MHz spectrum must be allocated and priced as cost recovery based on actual costs incurred in connection with management of radio spectrum.

After the allocation of 2x15 MHz / operator, we recommend the adoption of AIP as enumerated in our response to Chapter 4 of the Consultation Paper to price the spectrum.

(xxiv) ***Should we consider giving some spectrum in 900 MHz band to fourth CMSPs?***

The telecom landscape in India is witnessing dramatic change with the announcement of mergers and acquisitions. Under the M & A Guidelines announced by the Government, spectrum caps have been instituted on merged entities. While this restructuring continues, the Government should ensure that 900 MHz band which is currently being utilized by the 1st, 2nd and 3rd Operators is freed up by 5 MHz (890-894 MHz) and GSM operators are accommodated in the 1800 MHz band to allow for usage by CDMA as per the international practice so that the 25+25 MHz can be fully utilized by CDMA operators. CDMA operators are short of 5 MHz of spectrum in the 800 MHz band and this harmonization will make up for some of this shortfall for the CDMA operators. This will allow for effective utilization of 5 MHz (845-849 MHz) which is presently being wasted and cannot be used due to GSM occupying its corresponding band (890-894 MHz).

(xxv) ***Comments of stakeholders are invited on the minimum blocks such as 2 X 2.5 MHz / 2 X 5 MHz of additional spectrum to be allocated to existing service providers in situations where IMT 2000 band is opened as well as in situation where it is not opened. Additionally, comments are also invited on the minimum allocation to new entrants?***

Unified Licensing Regime is technology and service neutral, AUSPI therefore proposes that additional spectrum for existing operators be allocated in minimum blocks of 2x5 MHz / operator. International practice supports the allocation of blocks of 5, 10 and 15 MHz of spectrum.

As regards allocation to new entrants, we propose that after meeting the requirements of existing operators, allocation of spectrum to new entrants be considered.

(xxvi) ***In the event that IMT 2000 spectrum is treated as continuum to 2G, should existing operators using spectrum below the specified benchmark be treated as those eligible for IMT 2000 spectrum?***

Yes

Chapter 6: Re-farming, Surrender, Spectrum trading and M&A

Re-farming:

(xxvii) ***What approach should be adopted to expedite the re-farming of 1800 MHz and IMT-2000 spectrum from existing users?***

The Government funding should be the approach for the re-farming of the existing users whether Government or private sector. Government can fund this out from the revenue earned from entry fee, spectrum fee, etc. to anyone.

(xxviii) ***What approach should be adopted for re-farming of spectrum after expiry of license?***

AUSPI's view is that this is a hypothetical question. There will be active customers even after the expiry of the license.

Surrender of spectrum:

(xxix) ***Should there be any refund for spectrum surrender in principle?***

Today there is no excess spectrum with CDMA service providers to surrender. However, it is felt that in case of forced surrender of spectrum by any operator, there should be a refund.

(xxx) ***Should there be refund for spectrum surrender consequent to Unified Access license policy? If yes, what should be the basis?***

No, for the reasons as follows:-

(a) Refund of spectrum is an operator's internal decision and so no compensation is due;
(b) While the operator was given the spectrum, his competitors were denied the same and accordingly a refund would mean a revenue loss to the Government and denial of services to users.
(c) It is very difficult to bifurcate the amount of entry fees paid at that time between spectrum and service.
(d) Also, the operator has already used the spectrum for a number of years.

(xxxi) ***How should the amount of refund be estimated?***

Not applicable

Spectrum trading:

(xxxii) ***Should we open up the spectrum market for spectrum trading? If yes, what should be the time frame for doing so?***

&

(xxxiii) ***What are the pre-requisites to adopting spectrum trading?***

AUSPI feels that opening of trading of spectrum requires lot of technical and legal preparedness and in any case is not relevant now. It may be considered at a later stage.

Mergers & Acquisitions:

(xxxiv) ***Whether we should specify a cap higher than 2 X 15 MHz for Metros and Category "A" service area and 2 X 12.4 MHz for Category "B" and "C" service area in case of M&As or should it be retained?***

We recommend a cap of 2x20 MHz of spectrum for all service areas, i.e. Metros, Category A, B and C circles in case of mergers and acquisitions.

(xxxv) ***In case, IMT 2000 is considered as a continuum of 2G Services, is there a need to have a cap higher than that without IMT 2000 services? Should there be individual caps on 2G and 3G spectrum or a combined cap?***

We recommend a uniform cap of 2x20 MHz of spectrum per operator. In fact, there is no need to differentiate between the spectrum bands and the cap should be a combined cap.

(xxxvi) ***In case of M&As where the merged entity gets spectrum exceeding the spectrum cap, what should be the time frame in which the service provider be required to surrender the additional spectrum?***

AUSPI proposes a six months time frame as adequate to reduce the allocations to levels within the cap after which deterrent penalties be applicable so that merged entities do not gain undue advantages over their competitors.

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ANNEXE-I

S. No	Country	Operator	*Bandwidth Per Operator*
1.	Argentina	CTI Holdings GTE PCS Movicom BellSouth Moviles SA	15 MHz
2.	Australia	Hutchison Telstra	10MHz
3.	Brazil	BSI-BCP Cellular CRT Global Telecom Telemig Telebahia / Telergipe Telefonia Cellular Telesp Vesper	11.5 MHz
4.	Canada	Bell Mobility (Ontarioa) Telus Mobility	12.5 MHz
5.	Chile	BellSouth Communicaciones SmartCom	10 MHz
6.	China	China-Unicom	10MHz
7.	Dominican Republic	All America Cable & Radio Inc Codetel TRICOM	20 MHz
8.	HongKong	Hutchison	7.5MHz
9.	Indonesia	Komselindo	10MHz
10.	Japan	KDDI	15MHz
11.	Korea	SK Telecom Shinsegi Telecom	12 MHz
12.	Mexico	Baja Cellular Iusacell Pegaso PCS SPC	17.5 MHz
13.	New Zealand	Telecom NZ	20MHz
14.	Philippines	Pitel	10MHz
15.	Taiwan	Asia-Pac Broadband Wireless com (BT)	20 MHz

16.	**Thailand**	**Tawan**	**12.5 MHz**
17.	**USA**	**Alltel** **Alpine PCS Inc** **BRK Wireless Co. Inc** **Cingular Wireless** **ClearComm** **Horizon PCS** **Kansas Personal Communications**	**18 MHz**

ANNEXE-II

Country	Operator	Date	Technology	Frequency Band
Korea	SK Telecom	Oct 1, 2000	CDMA2000	800 MHz
Korea	LG Telecom	May 1, 2000	CDMA2000	**1800 MHz (Korean PCS)**
Korea	KT Freetel	May 2, 2000	CDMA2000	**1800 MHz(Korean PCS)**
USA	Monet	Oct 21, 2000	CDMA2000	1900 MHz
Brazil	Telesp	Dec 10, 2001	CDMA2000	800 MHz
USA	Leap Wireless	Jan 17, 2002	CDMA2000	1900 MHz
USA	Verizon Wireless	Jan 28, 2002	CDMA2000	800 and 1900 MHz
USA	MetroPCS	Feb 1, 2002	CDMA2000	1900 MHz
Canada	Bell Mobility	Feb 12, 2002	CDMA2000	800 and 1900 MHz
Japan	KDDI	Apr 1, 2002	CDMA2000	800 MHz
Puerto Rico	Centennial Wireless	Apr 4, 2002	CDMA2000	1900 MHz
Brazil	Telefonica Cellular	Apr 16, 2002	CDMA2000	800 MHz
Canada	Telus Mobility	June 3, 2002	CDMA2000	800 and 1900 MHz
New Zealand	Telecom N.Z.	July 22, 2002	CDMA2000	800 MHz
Chile	Smartcom PCS	July 26, 2002	CDMA2000	1900 MHz
USA	Sprint PCS	Aug 8, 2002	CDMA2000	1900 MHz
USA	Cellular South	Sept 9, 2002	CDMA2000	800 MHz
Moldova	Interdnestrcom	Sept 30, 2002	CDMA2000	800 MHz
Israel	Pele-Phone	Oct 1, 2002	CDMA2000	800 MHz
Colombia	EPM-Bogota	Oct 2, 2002	CDMA2000	1900 MHZ
India	TataTeleservices	Nov 7, 2002	CDMA2000	800 MHz
Venezuela	Telcel	Nov 13, 2002	CDMA2000	800 MHz
USA	KiwiPCS (Comscape)	Nov 14, 2002	CDMA2000	1900 MHz
Venezuela	Movilnet	Nov 20, 2002	CDMA2000	800 MHz
Canada	Aliant Mobility	Nov 25,	CDMA2000	800 MHz

		2002		
Canada	MTS Mobility	Nov 27, 2002	CDMA2000	1900 MHz
Indonesia	Telecom Flexi	Dec 1, 2002	CDMA2000	800 MHz
Australia	Telstra	Dec 1, 2002	CDMA2000	800 MHz
Ecuador	Bell South	Dec 3, 2002	CDMA2000	800 MHz
Panama	Bell South	Dec 3, 2002	CDMA2000	800 MHz
Mexico	IUSACELL	Jan 24, 2003	CDMA2000	1900 MHz
Puerto Rico	Verizon Wireless	Feb 4, 2003	CDMA2000	800 MHz
Thailand	Hutchison CAT	Feb 27, 2003	CDMA2000	800 MHz
Nicaragua	Bell South	Mar 26, 2003	CDMA2000	800 MHz
Dominican Republic	Centennial Dominicana	Mar 27, 2003	CDMA2000	1900 MHz
China	China Unicom	Mar 28, 2003	CDMA2000	1900 MHz
Canada	Sasktel Mobility	Apr 10, 2003	CDMA2000	800 MHz
Columbia	Bell South	Apr 15, 2003	CDMA2000	800 MHz
Brazil	Giro (Vesper)	May 01, 2003	CDMA2000	1900 MHz
India	Reliance Infocomm	May 01, 2003	CDMA2000	800 MHz
India	Garuda 1X	May 19, 2003	CDMA2000	800 MHz
Guatemala	Bell South	May 20, 2003	CDMA2000	1900 MHz
USA	Midwest Wireless	June 16, 2003	CDMA2000	1900 MHz
Vietnam	S-Fone	July 01, 2003	CDMA2000	800 MHz

Guatemala	PCS	July 15, 2003	CDMA2000	1900 MHz
Taiwan	APBW	July 29, 2003	CDMA2000	800 MHz
Chile	BellSouth	Aug 11, 2003	CDMA2000	1900 MHz
Peru	Telefonica Moviles	Dec 1, 2003	CDMA2000	800 MHz