Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	ET Docket No. 00-258
Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems	)	
	)	
Petition for Rulemaking of the Cellular Telecommunications Industry Association Concerning Implementation of WRC-2000: Review of Spectrum and Regulatory Requirements for IMT-2000	)	RM-9920
	)	
Amendment of the U.S. Table of Frequency Allocations to Designate the 2500-2520/2670-2690 MHz Frequency Bands for the Mobile-Satellite Service	)	RM-9911

COMMENTS OF LUCENT TECHNOLOGIES, INC.

Lucent Technologies, Inc. (Lucent), a global manufacturer of wireless network equipment, respectfully submits the following comments in response to the Commission's *Notice of Proposed Rulemaking* in ET Docket No. 00-258,[1] regarding proposed allocations below 3 GHz for advanced wireless services. Lucent has developed and manufactured numerous innovative technologies for wireless communications and actively participates in wireless standards development throughout the world. Lucent is particularly interested in this proceeding, because the Commission's allocation decisions could impact standards development and the design of wireless infrastructure and

[1] Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, *Notice of Proposed Rulemaking and Order*, FCC 00-455 (rel. Jan. 5, 2001) ("NPRM").

terminals worldwide. Accordingly, Lucent addresses several of the issues raised by the Commission in the NPRM and proposes a specific band plan for the Commission's consideration.

THE IMT-2000 STANDARDS ARE SUFFICIENT FOR PLANNING ADVANCED WIRELESS SYSTEM SPECTRUM REQUIREMENTS

The Commission sought comment on whether IMT-2000 radio interface standards are sufficient for planning advanced wireless system spectrum requirements. Lucent believes that they are. Industry groups have been negotiating standards for third generation (3G) systems consistent with the requirements for IMT-2000 as set forth by the ITU for several years. These standards have become quite well developed and, in fact, IMT-2000 standards have already been commercially deployed.[2] The standards describe technical parameters, including carrier spacing and permitted emission bandwidth, for several radio interface technologies and afford operators the flexibility to select systems consistent with their present and future needs.

Additional effort is already underway in standards bodies to update the IMT-2000 radio interface specifications to provide additional or enhanced capabilities, as well as to define the mechanisms to support intersystem and global roaming. In some cases, updates to regional standards have already been published. Further, work is beginning to identify parameters that will define systems beyond 3G.

Because they are well developed and are continuing to grow to support new capabilities, IMT-2000 standards are sufficient for planning the allocation of spectrum for advanced wireless systems. However, it should be anticipated that market demand will

[2] SK Telecom (Korea) launched the first commercial 3G system in October 2000, and has realized data rates of over 150 kbps, exceeding the 144 kbps required by standard. Additional cdma2000 commercial

grow, requirements will change, technology will continue to advance, and the radio systems deployed in the new spectrum allocated for advanced wireless services will evolve. Therefore, Lucent urges the Commission to maintain its current policy of technological-neutrality, thereby providing operators with the maximum flexibility to determine the optimal use of the available spectrum.

THE DEVELOPMENT OF FUTURE STANDARDS SHOULD NOT NEGATIVELY IMPACT THE COMMISSION'S ALLOCATION OF SPECTRUM

The Commission questioned whether anticipated standards development will negatively impact its spectrum allocation decisions. While standards for enhanced 3G services are in early developmental stages, Lucent does not foresee the possibility that these or any other new wireless standards will render any currently proposed spectrum allocations obsolete. It is anticipated that wireless systems based upon such future standards developments will be implemented in the cellular and PCS bands currently licensed for Commercial Mobile Radio Service (CMRS), as well as in new spectrum that may be allocated as a result of this proceeding. These standards, generally, will focus on increasing the efficiency and utility of the existing networks and licenses.

Given that standards development is often prompted by carriers' market requirements, Lucent expects that future standards will provide greater flexibility in terms of the applications to which the proposed allocations may be put. Therefore, as long as the spectrum is allocated in a technology-neutral manner, the Commission's allocation decisions in this proceeding should not be negatively impacted by future standards development.

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launches in Korea are expected in the next few months, with rollouts in Japan, North America, and Australia coming later this year.

THE COMMISSION SHOULD CONSIDER SYMMETRIC SPECTRUM ALLOCATIONS

The Commission sought comment on the advantages and disadvantages of various methods of accommodating asymmetric traffic relating to the use of spectrum for advanced wireless services, including third generation wireless systems. Lucent believes the Commission should consider allocations that are symmetric, rather than asymmetric.

Because systems based on asymmetric band pairing and variable duplex technology have not yet been commercialized anywhere in the world, it is expected that most of the carriers providing advanced services initially will deploy systems based on one of the IMT-2000 standards. All of the IMT-2000 standards that use frequency division duplex (FDD), (CDMA-DS, CDMA-MC, and TDMA-SC) require symmetric paired spectrum bands. Therefore, if the Commission were to adopt asymmetric band pairs, any new licensee using these technologies would be unable to utilize all of its spectrum. Thus, in most cases, an allocation on an asymmetric basis would result in spectral inefficiencies, *i.e.* stranded spectrum.

Furthermore, asymmetric band pairs may be unnecessary because much of the future advanced service traffic is likely to be symmetrical in nature. While current advanced wireless data services, such as wireless Internet access, may become increasingly more asymmetric, it is expected that voice traffic, which is typically symmetric, will continue to constitute a significant percentage of overall network traffic. In addition, future potential high bit rate advanced wireless data services, such as video conferencing or image transferring, may likely require symmetric operation or may have asymmetric properties opposite those related to current wireless Internet access.

Moreover, asymmetric traffic can be supported within symmetrical band pairing. Higher order modulation techniques for symmetrical operations can be deployed in the up-link and/or downlink directions to support higher data rates. For example, the planned introduction of the cdma2000 1x-EV-DO feature will support 2.4 Mbps data access in the 1.25 MHz downlink of existing PCS or cellular licenses. This data rate should be more than sufficient to accommodate Internet web browsing and other future advanced wireless asymmetric applications.

Therefore, to maintain its principle of flexible allocations, allow licensees maximum flexibility to meet market demand, and to promote spectral efficiency in both the near and longer terms, the Commission should implement a symmetric, paired spectrum band plan.

MULTI-BAND DEVICES ARE NECESSARILY MORE COMPLEX AND COSTLY; SPECTRUM ALLOCATIONS HARMONIZED WITH OTHER REGIONS SHOULD PROVIDE ECONOMIES OF SCALE

The Commission requested information on the comparable costs associated with multi-band and single-band devices. It is generally accepted that the need to operate in markets using different spectrum band plans clearly adds to the complexity and cost of equipment. The added complexity is largely associated with the need to incorporate the necessary filtering and to support multiple transmitters and receivers. Accommodating theses needs is likely to be particularly burdensome in mobile terminals. Additional costs are also associated with the capital and human resources that are necessary to develop and deploy systems that operate in many different bands and band plans.

Although multi-band and multi-mode equipment exists today and, therefore, can be manufactured as the market demands, complexity and costs are mitigated with the

need to accommodate fewer spectrum allocations and the creation of a more globally harmonized advanced wireless market. Indeed, the success of the U.S. wireless industry in the development and the deployment of wireless systems would be enhanced if the U.S. frequency allocations were to align with the current and future allocations around the world. This alignment will enable vendors to realize the economies of scale afforded by a global market, to the ultimate benefit of U.S. consumers.

FREQUENCY DIVISION DUPLEX (FDD) SYSTEMS HAVE TYPICALLY BEEN USED IN HIGH MOBILITY, LARGE SCALE WIRELESS SYSTEM DEPLOYMENTS

The Commission asked for a comparison of the merits of frequency division duplex (FDD) and time division duplex (TDD) systems. FDD systems have typically been used in high mobility, large scale deployments, while TDD systems are generally used in low power, lower mobility applications, often within unlicensed spectrum. TDD applications might include alternative access for telephony and/or the provision of higher data rates in a densely populated area, where the desired area of coverage is small. Operators might therefore consider a mix of FDD and TDD systems, dependent upon traffic density, the services demanded, and the relative costs.

Although licenses for 3G services in some European countries include unpaired spectrum together with paired spectrum, such allocations may result in spectrum that remains unused if the licensee has no plans for the use of TDD systems. It would appear more efficient, therefore, to allocate paired spectrum and permit the licensee the flexibility to deploy TDD systems if they desired. In theory, the recipient of a license for paired spectrum could deploy TDD systems in its licensed spectrum consistent with requirements for out of band energy (OOBE) and interference. Interference between

adjacent TDD and FDD systems can be problematic as TDD transmit into FDD receive and FDD transmit into TDD receive must be considered. Compliance with OOBE requirements may, therefore, demand that a TDD operator implement guard bands of significant size within their licensed spectrum, adjacent to the boundary with FDD systems, or require a reduction in the TDD transmitter power. Further, interference between TDD systems can also be problematic as the time synchronization required for intersystem coordination between TDD systems is complex and generally more difficult to implement than the intersystem coordination necessary for FDD systems.

THE CHARACTERISTICS OF THE 3G STANDARDS PRESCRIBE THE NECESSARY SPECTRUM BLOCK SIZE

The Commission sought comment on the appropriate size spectrum blocks for advanced wireless services. In accordance with the 3G Characteristics Table, to accommodate any of the IMT-2000 radio interfaces the minimum size spectrum block that should be allocated for advanced wireless systems, including 3G services, is 5 MHz. The allocation should be done in paired increments of 5 MHz, resulting in licenses of 2 x 5*n* MHz. Larger assignments (e.g., 2x10 MHz or 2x15 MHz) are desirable as they can accommodate future, higher data rates, and provide the operators with additional capacity and, importantly, with greater flexibility. This kind of allocation would achieve the Commission's goal of technological neutrality by allowing the operator maximum flexibility in the selection of technology.

Indeed, the allocations in those countries where 3G spectrum has already been assigned have typically provided between 2 x 10 MHz and 2 x 20 MHz to each licensee.

THE COMMISSION SHOULD CAREFULLY CONSIDER THE NECESSARY DUPLEX SPACING IN THE DEVELOPMENT OF ITS BAND PLAN

In addition to the size of spectrum blocks, the Commission solicited comment on the frequency separation needed for efficient operation. Ideally, duplex spacing should be about 10% of the frequency range in which the allocation is located. Existing allocations (e.g., PCS), however, typically provide considerably less duplex spacing than might be desired. The reduced duplex spacing is accommodated through more complex and costly filter designs necessary to keep unwanted transmit energy from system receivers.

The Commission should also be aware of the potential difficulties that could arise if duplex spacing is overly wide, providing a large separation between uplink and downlink, (for example, if the 1.7 GHz band were paired with the 2.5 GHz band). Such an arrangement could require the use of distinct antennas for each (uplink and downlink) direction of transmission, which would add to the cost of deployment. The Commission must be cognizant of these duplex spacing issues when devising its band plan.

THE COMMISSION MUST CONSIDER EXISTING ALLOCATIONS IN ITS EFFORTS TO ALLOCATE NEW SPECTRUM FOR ADVANCED SERVICES

The Commission sought comment on the impact of using currently allocated spectrum and new spectrum for advanced services. Lucent contends that the Commission must consider existing allocations in its efforts to allocate new spectrum for advanced services. In order to afford carriers' maximum flexibility to evolve their systems, the Commission should strive to adopt a band plan that continues to support the use of the PCS band for 2G and 3G services, and beyond. Furthermore, to facilitate global roaming, the Commission should seek to achieve an allocation that is harmonized, to the extent possible, with commercial mobile allocations throughout the world.

The potential exists to accommodate these goals as some of the bands being considered are, in fact, consistent with existing 2G and 3G frequency arrangements (DCS 1800; IMT-2000 downlink). If the Commission were to allocate the new spectrum from within the 1710-1850 MHz range, in a manner that is compatible with the existing frequency arrangement used by 2G systems (DCS 1800) that operate in that band in other countries U.S. consumers may be able to benefit from increased possibilities for global roaming and global manufacturing economies of scale.

Use of the 2.5 GHz band, at this time, would not accomplish the goals outlined above. The 2.5 GHz band is not currently in operation anywhere in the world for commercial mobile radio services. This band is sufficiently far from the PCS and DCS 1800 bands that it would impose greater challenges to support the operation of multi-band terminals. This allocation would also require significant changes in equipment to enable successful deployment of advanced wireless systems. Furthermore, while the EU has indicated that it may allocate 2.5 GHz for UMTS in the 2005-2010 timeframe, such allocations are not guaranteed to occur as projected and will be dependent upon business and market considerations. Thus, because use of this band at this time would not promote global roaming or create global economies of scale, Lucent believes that it would be premature to employ the 2.5 GHz band for advanced wireless services.

SOME OF THE 3G STANDARDS SUPPORT DEPLOYMENT OF ADVANCED SYSTEMS IN SPECTRUM CURRENTLY USED BY 1G AND 2G SYSTEMS

The Commission requested information on the ability of 1G and 2G systems to utilize existing spectrum to deploy 3G services. In many countries, including the U.S., operators of mobile networks have the regulatory flexibility to evolve their existing infrastructure to provide 3G capabilities. Many U.S. cellular operators still support both

1G (analog) and 2G (digital) handsets throughout their networks. Most U.S. operators are planning to evolve their networks to provide advanced services, and some are likely have 1G, 2G and 3G systems coexisting in their networks.

Several of the IMT-2000 radio interfaces were designed specifically to be deployable on currently operating systems and within their existing license. CDMA-MC provides and easy evolution path for ANSI-95 (cdmaOne) networks to introduce advanced (3G) services. Also, TDMA and GSM operators may choose to deploy GPRS and/or EDGE to provide higher data rate services before deploying UMTS as their long term 3G vehicle. Equally important, operators must have the flexibility to evolve their 3G capabilities within their currently assigned spectrum, thus providing the opportunity to deploy capabilities consistent with market demand.

While every U.S. operator has the regulatory flexibility to deploy advanced services on their network, their ability to evolve from their current 2G systems to the various IMT-2000 systems varies depending on which 2G standard they are currently using and to which IMT-2000 standard they want to evolve. In other words, the extent to which the IMT-2000 standards are backward compatible with existing 2G networks varies depending on which 2G to 3G migration path is employed. For example, CDMA-MC was designed to allow operators of ANSI-95 (cdmaOne) networks, as noted in the FCC's NPRM, to clear a portion of their spectrum, transition existing subscribers and upgrade the cleared spectrum. This can be done by clearing only 1.25 MHz of spectrum at a time, and can be implemented in licenses as small as 2x5 MHz. Of course, the new CDMA-MC network would support both CDMA-MC and the ANSI-95 handsets. Likewise, TDMA-SC was designed to be backward compatible with the existing ANSI-

136 networks. However, other IMT-2000 standards were not developed to be backward compatible with an existing 2G network. CDMA-DS was designed only to be implemented in new spectrum with a 2x5 MHz minimum bandwidth requirement. As such, an operator with only a 2x5MHz license would have to clear their entire license (*i.e.* discontinue their 2G service) in order to implement CDMA-DS in their license.

THE COMMISSION CAN FACILITATE GLOBAL/REGIONAL ROAMING

The Commission asked for suggestions on what it can do to facilitate global roaming. It is clear that allocating spectrum consistent with allocations common to most parts of the world is an important step in the widespread implementation of global roaming.

Achieving spectrum harmonization and global roaming requires each Administration to consider, during their domestic proceedings, the availability of spectrum and its planned use in other countries. Toward that end, the Commission should take note of the support that other CITEL administrations gave to the 1710-1850 MHz band as being the sole band in the Americas for 3G, as well as the opposition that these administrations had to the 3G use of the 2.5 GHz band, which they are planning to use for MMDS/MMCS services.

Further, the Commission should recognize that global roaming is facilitated not only by common spectrum allocations worldwide, but also by compatibility among the wireless networks deployed by operators around the world. Several industry fora are currently addressing issues relevant to this matter; that is, for example, the need for interworking between ANSI-41 and GSM MAP. Specifically, the GSM Global Roaming Forum (GGRF) is investigating the compatibility issues between GSM and CDMA (IS-95), and

the GSM-ANSI-136 Interoperability Taskforce (GAIT) is looking at interworking between GSM and TDMA (IS-136).

THE COMMISSION SHOULD CONSIDER THE FOLLOWING PAIRING OPTIONS

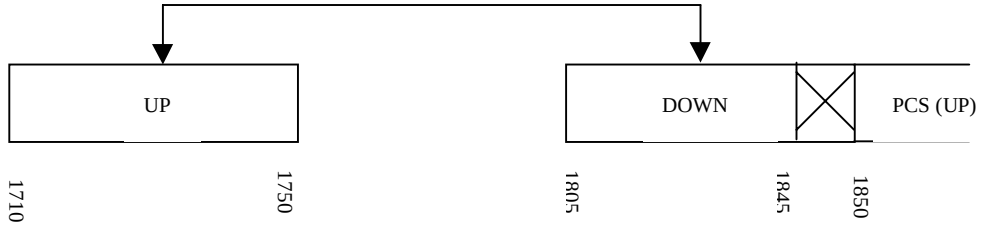
Lucent believes the Commission should consider the following objectives for 3G spectrum allocations in the United States:

- The plan should be harmonized and/or compatible, to the greatest extent possible, with spectrum allocations implemented in the rest of the world.
- The plan should recognize the services that use adjacent spectrum (e.g., outside 1755-1850 MHz) and mitigate the potential interference into these bands.
- The plan should facilitate the growth and development of a global 3G market, while attempting to avoid complexities, within either the base station or terminal, required for achieving global roaming and interoperability.
- The plan should provide an adequate amount of spectrum for the U.S. market while reducing, to the greatest extent possible, the need to share spectrum with U.S. Government services.
- The plan should minimize the need for and cost of relocating U.S. Government services currently operating within the band 1755-1850 MHz, thereby reducing the barrier to obtaining commercial access to that spectrum to provide 3G services.
- The plan should avoid the further fragmentation of the global 3G market, protect the financial investments of both wireless equipment suppliers and service providers, and minimize the cost of introducing new 3G services to promote the profitability of the wireless industry.

Lucent encourages the Commission to consider for adoption the 1710-1750/1805-1845 MHz band pairing for advanced wireless services and to leave a 5 MHz guard band to avoid interference to and from the PCS band. This plan would be consistent with the objectives discussed above.[3] This band plan also is a subset of the DCS 1800 band plan (1710-1785/1805-1880 MHz) and would establish a globally harmonized frequency arrangement that would be used by both 2G and 3G systems.

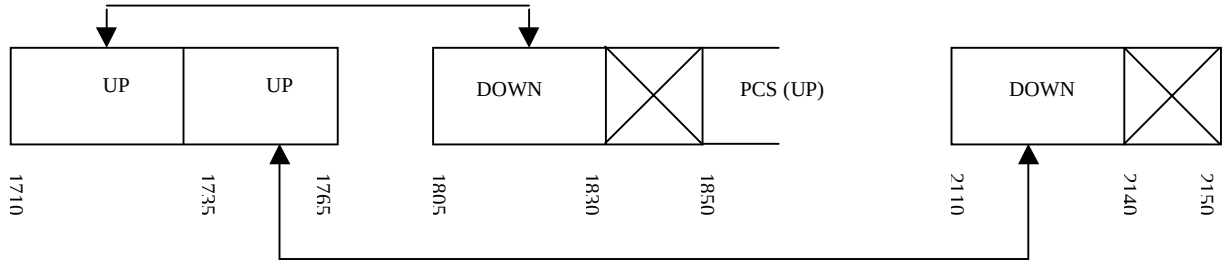
[3] Lucent recognizes that implementation of any proposed band plan that includes spectrum in the 1755-1850 MHz range requires resolution of issues relative to the current use of the band by incumbent government services. Lucent is aware and supports the efforts of the Industry Association Group together with the NTIA and DoD to address the issues of band sharing and segmentation, as well as the matter of incumbent service relocation.

1710-1750 MHz paired with 1805-1845 MHz



If, due to excessive relocation costs within the range 1755 – 1850 MHz currently used by government systems, the need for a guard band adjacent to the PCS uplink larger than 5 MHz, or if the Commission determines that greater than 80 MHz of new spectrum is required for advance wireless services, Lucent proposes for the Commission's consideration an alternative band plan for advanced wireless services; 1710-1735 MHz paired with 1805-1830 MHz and 1735-1765 paired with 2110-2140 MHz. This plan will provide 110 MHz for advanced services, including high-speed asymmetric and symmetric traffic. This pairing overlaps with the DCS 1800 band plan (1710-1785 MHz and 1805-1880 MHz) and maintains its 95 MHz duplexer spacing. Moreover, it uses some (i.e., 2110-2140 MHz) of the 3G downlink spectrum that is being licensed in Europe and Asia for 3G systems. This overlap may provide an opportunity to provide global roaming and interoperability by designing 3G terminals that will transmit in the range 1710-1785 MHz, and will receive in either the 1805 – 1880 MHz range (according to the DCS 1800 plan) or the 2110-2170 MHz range (according to the IMT-2000 band plan). Likewise, it may be possible to have 3G base stations that transmit in the range 2110-2170 MHz receive transmission from either the 1920-1980 MHz or 1735-1765 MHz bands.

Alternate Proposal (1710-1735 paired with 1805-1830 MHz and 1735-1765 paired with 2110-2140 MHz)



This plan also is designed to minimize interference with adjacent PCS and MMDS users. It provides a 20 MHz separation between the downlink portion of the new 3G spectrum and the uplink of the U.S. PCS spectrum, which should be sufficient to eliminate any difficulties associated with complying with Out of Band energy (OOBE) requirements necessary to protect the PCS uplink. In addition, it provides a 10 MHz guard band between the 3G licenses in the 2110-2140 MHz range and the MMDS systems operations which begin at 2150 MHz, mitigating the possible interference problem that could occur if those services operated in adjacent frequency bands.

Furthermore, this arrangement occupies only 35 MHz (i.e., 1755-1765 MHz and 1805-1830 MHz) of the 1755-1850 MHz band and therefore reduces the spectrum that 3G services would share with government applications, or where government services might need to be relocated. Reducing the amount of spectrum that would need to be re-allocated from government to commercial use will both reduce the cost of relocating, if necessary, incumbent services and increase the likelihood of obtaining access to that spectrum for 3G services.

For the reasons discussed above, Lucent believes this proposal provides a good second alternative that will further all of the Commission's policy goals. Therefore, we request the Commission to consider adopting, as a first choice, the allocation of the 1710-

1750/1805-1845 MHz band plan, or as a second choice the alternative band plan described above. .

Respectfully submitted,

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By_____

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