Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy Task Force	)	DA 02-1311
Seeks Public Comment on Issues	)	ET Docket No. 02-135
Related to the Commission's	)	
Spectrum Policies	)	

To: Edmond J. Thomas, Chief
Office of Engineering and Technology

COMMENTS OF ARRAYCOMM, INC.

ArrayComm, Inc. (hereinafter "ArrayComm") is pleased to submit the following Comments in the above-entitled matter.

Respectfully submitted,

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EXECUTIVE SUMMARY

ArrayComm commends the Commission for initiating this inquiry focused on spectrum policies. Radio spectrum is the lifeline of the wireless communications industry, and the Commission's initiative to solicit inputs from the industry is appreciated.

ArrayComm also lauds the Commission for the broad scope of topics for which comments are being solicited and for encouraging "comments on spectrum-related issues even if they do not respond directly to any particular question posed."

ArrayComm believes that it brings a different perspective and unique competencies that can assist the Spectrum Policy Task Force.

- ArrayComm is a small company, which has participated in a number of FCC and other governments' spectrum management proceedings.
- ArrayComm, through its subsidiary, CKW Wireless, has been a successful bidder in a recently-held 3G spectrum auction in Australia.
- ArrayComm is the world leader in adaptive antenna technology (also known as "smart antennas") that substantially improves spectrum efficiency. The company is internationally recognized as a center of excellence in this area.
- ArrayComm has extensive deployment and field experience in the application of "smart antennas" to wireless networks. ArrayComm is willing to share this experience and expertise in support of this proceeding.
- ArrayComm has also been a proponent and pioneer of Time Division Duplex ("TDD") systems. When deployed in conjunction with smart

antennas with an Internet access system based on TDD spectrum format, a network delivers packet data communications between portable devices and the Internet with spectral efficiency, as much as forty times higher than the spectral utilization of conventional mobile networks.

- ArrayComm has been addressing the matter of spectral coexistence in various international forums, to assist in the efficient allocation of spectrum for new services. ArrayComm believes that licensed spectrum is important to attract carrier-grade profitable services and a large consumer base for these services for wireless communications.

ArrayComm believes that achieving the best possible spectrum efficiency is, and should be, an important goal of the Spectrum Policy Task Force. We advocate that incentives to promote efficiency must be developed at a national level to encourage the most effective use of spectrum. In addition, spectrum harmonization on an international basis should be encouraged when it does not adversely impact U.S. consumers or vital national interests.

I. WHO IS ARRAYCOMM?

ArrayComm is a Silicon Valley-based technology company. ArrayComm's adaptive antenna technology IntelliCell®[1] creates "personal cells" (a conceptual representation of our technology) that make any personal wireless communications system more spectrally efficient, which, in turn, results in improvements in cost, coverage and capacity. While traditional cellular base stations are incapable of focusing the radio energy associated with any subscriber's cell, using ArrayComm's technology, a personal cell is created for each user, and follows that user while he or she communicates, and is dismantled when the communication is over. These personal cells reduce interference, allow revolutionary improvements in voice quality, consistent ubiquitous coverage and clearer signals, all at low cost.

The adaptive spatial processing algorithms and signal processing tools are the core technology for creating these personal cells in mobile wireless systems. Personal cells are made possible by the company's patented implementation of spatial processing – a mathematical representation of each user's physical location in a service area. ArrayComm's technology calculates a unique spatial signature for each user, focusing energy precisely where they need it. Similarly, for signal reception, the system is able to "listen" selectively for signals generated by a particular user, and to reject interference from undesired signal sources. As users move, the signature is continually recalculated to optimize signal strength and quality. Personal cells are the synthesis of ten years of research and real-world implementation, a combination that makes ArrayComm the foremost authority on spatial processing technology. ArrayComm's expertise is reflected in a portfolio of 200 issued or pending patents.

[1]This smart antenna technology is used in more than 100,000 base stations worldwide, including such countries as China, Japan, Ethiopia and the United Arab Emirates.

ArrayComm has also been a leader in the utilization of TDD technology, particularly to transmit high-speed wireless data. In a TDD system, base station and mobile devices transmit and receive on the same channel but on different timeslots. This is in contrast to FDD systems in which base station and mobile units operate on separate, discrete channels. Combined with the deployment of adaptive or smart antennas, TDD can be used to transmit voice traffic in a more spectrally efficient manner than is possible with traditional systems. The efficiency of this combination of technologies for packetized data transmissions is unparalleled. Applying these same techniques to an end-to-end Internet Protocol network has resulted in the development of ArrayComm's I-Burst™ system, the first affordable broadband wireless Internet network suited for broad consumer adoption..

II. ARRAYCOMM'S COMPETENCIES.

The combination of smart antennas and TDD has brought international recognition to ArrayComm and its technologies.[2] The United States, however, has been slower to embrace these technologies than International markets. In Docket No. 99-168, ArrayComm filed substantive comments illuminating the benefits of TDD spectrum allocations for high speed Internet services. ArrayComm (and others) pointed out, however, that the Notice of Proposed Rulemaking in that proceeding proposed to auction all the channels in pairs as though all participants would employ FDD systems.

In addition to its expertise regarding TDD, ArrayComm's deployment of adaptive antennas has led to significant contributions in the mitigation of interference among different systems. Much of this work has involved the relationship between FDD and TDD systems operating on adjacent

[2]See http://www.economist.com/displayStory_ID=1176136 for an article from the Economist Newspaper in which ArrayComm and smart antennas are identified, the latter as a technology that has the potential to make 3G wireless networks irrelevant.

channels in the same area.[3] It is also relevant to interference considerations TDD to TDD and FDD to FDD. ArrayComm believes that the research and study it has contributed to various ITU and IEEE committees can assist the Task Force's effort to improve spectrum utilization.[4]

III. SPECIFIC POINTS OF INTEREST TO ARRAYCOMM.

(As the Commission will note, these points are interrelated. They are separated merely for the purpose of categorization.)

1. The Influence of the Commission's auction philosophy on spectrum allocation.

The FCC follows an open market approach, in that auction winners are given virtually total freedom to use the spectrum won as they choose. Many countries have similar policies, but the winners there are constrained by a given allocation objective or by a technology or standards mandate.

In the United States there are no such allocation caveats or limitations placed on auctioned spectrum,[5] except that the Commission's Rules regarding interference [and fixed versus mobile services] must be adhered to. Theoretically, all spectrum auctioned in a particular band might be utilized for a single purpose, or it might be used for different purposes by each winner. Technologies could be identical or totally diverse. The Commission relies solely on the marketplace for an appropriate balance to be reached.

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[3]The current attempt to address the interference experienced by public safety and other systems at 800 MHz from Nextel's iDen system as an example. There is agreement that all systems meet the Commission's technical requirements.

[4]See footnote 7 *infra* on page 4 for a list of the ITU and IEEE work efforts involved.

[5]A TIA "White Paper" contains the caution that "auctions may be an effective assignment license tool, but they are not a substitute for sound spectrum allocation decisions. . ."

Thus, as we noted above, under one such scenario, disparate systems (FDD and TDD, for example) could be authorized in the same area. Other countries, such as Australia, which also use auctions, create separate allocations for FDD and TDD.[6] The specific allocations in these countries follow the ITU Table of Allocations. There is, then, an explicit recognition that those technologies are not identical, that to a significant degree they may serve different needs, and that each ought to be available. In the United States there is a further complication. The interference potential between FDD and TDD systems sharply limits coexistence. Substantial work has been done internationally (much of it by ArrayComm) to calculate the extent of the interference and to develop mitigation techniques to limit the problem. Present Commission Rules relating to interference are not sufficiently stringent to deal effectively with this problem.[7] The essence of these reports indicates that, with the right regulations, coexistence on adjacent channels with relatively short distance separations is achievable. More generally, FDD and TDD systems can coexist so long as good engineering practices are employed.

[6] ArrayComm, through its subsidiary, CKW Wireless, acquired 5 MHz of unpaired spectrum. This 3g auction was the first to auction paired and unpaired spectrum separately. Each was then available for new technologies.

[7] Among the work being done on the subject of coexistence, see Document 8F/653-E 20 May 2002: Proposal for the development of a preliminary Draft New Report of Mitigating Techniques to address coexistence between IMT-2000 TDD and FDD air interface technologies in adjacent bands and in the same geographical area; Draft New Report on TDD-FDD Coexistence (approved by WP8F at its 7th meeting), scheduled for approval by Study Group 8 in February 2003); Preliminary Draft New Revision of ITU-R Rec. M. 1036 - Frequency Arrangements for IMT-2000 (scheduled for approval at 9th meeting of WP8F in September 2002). Also, a paper contributed to IEEE 802-16 by ArrayComm on the impact of adaptive antenna systems on the new 802.16 systems.

2. Spectral Efficiency.

Given that the longevity of any spectrum regulation and allocation is often measured in decades, a deep understanding of spectral efficiency and technologies which enhance spectrum utilization is critical. ArrayComm believes that spectral efficiency is pivotal to this proceeding.

Adequate spectrum is essential to meet the needs of an ever-growing population and to provide for the new technologies and services of the future. Furthermore, the range of available spectrum for use with mobile devices (typically accepted as frequencies below 3 GHz) is also limited; this becomes even more of a challenge.

Spectrum efficiency has always been advocated; however, as technology has evolved, the implementation of allocation policies reflecting the state of available technology has lagged. During the'50s, '60s and '70s, the private land mobile services led the way in implementing narrow-band technologies to create "more" spectrum out of what they already had. Although the FCC at that time conceded that more spectrum was needed to meet sharply higher demand, it was unable to find vacant spectrum. That increased demand, coupled with the inability to meet it, spurred manufacturers to develop equipment to reduce channel bandwidths from 120 kHz to 30 kHz and even 15 kHz. Licensees and potential users were willing to pay for these improvements. Thus, the incentives to be efficient were present.

By contrast, TV receivers have never achieved a comparable level of efficiency. The viewer has not been able to see the benefits of a set that used less spectrum. TV sets are extremely price sensitive. This, in turn, de-motivates manufacturers from developing such equipment. In simple terms, the incentives to be efficient were and are not present.

The growth of the cellular industry appears to be somewhere between those two previously mentioned cases. Cellular telephone service, particularly portables, has been primarily voice, with

the recent addition of short messaging services as a revenue driver in the industry. Cellular service has been a consumer service in the main, one that has had broad appeal to the general public. There has been intense interest in the size of the phone and in some of the added features available. However, there has not been an irresistible demand for such features as data or video, due largely to lack of compelling applications suitable to a phone-like form factor and to the inability of most systems to deliver broadband services at consumer price points. The industry is undergoing a switch from analog to digital, both to improve quality and capacity, where capacity is typically measured in supportable calls/Hz/cell in the network. There has been a perceptible increase in subscriber dissatisfaction about "dead spots" and dropped calls. It has not been sufficient, however, to warrant any substantial reconstruction of today's cellular telephone system. Once again, one would conclude that the incentives are lacking.

Further proof that there is general tolerance with today's system can be found in the use to which PCS channels have been put. Initially intended to provide competition to cellular carriers at 800 MHz and to make innovative services available, PCS instead offers services that are generally indistinguishable from those provided at 800 MHz.

Given that background, it is understandable that carriers and manufacturers would approach 3G warily. The trade press almost daily reports another industry leader who questions whether there is, in fact, a 3G market different from today's cellular and PCS markets. Doubts about whether a market for data exists are commonly expressed.

The inevitable result is that those auctions that arouse the interest of the "common carrier market" are usually won by existing carriers. Not only do the costs of the auction discourage innovative uses, but the public does not appear to be clamoring for them. Manufacturers who have

their own cost problems are generally loathe to be market trailblazers, so once again, the incentives to act differently, to be more efficient so that new services can be introduced, are absent.

Throughout the world, however, new services are emerging (countries which provide 3G on spectrum wholly apart from that used for cellular voice service are offering these new services, often data-oriented, with increasing frequency). It should be noted, however, that the 3G specifications developed through ITU are essentially for technologies optimized for voice, but capable of providing more data than 2G systems (but comparable to 2.5G). Different solutions will be required for true mass market broadband services.

The strategy of the existing carriers and manufacturers seems clear: approach data cautiously; endeavor to meet demand as it arises by a modification of or transition from today's system. The result will be a system that will, only with great difficulty, be able to provide data at high rates but only by sacrificing spectrum efficiency.

There appears to be a dilemma. If efficiencies are introduced only in response to market demand, they will lag behind both in time and to the extent to which they will be introduced. On the other hand, the Commission may lack information about how to measure spectrum efficiency and how to apply those measurements to existing systems and to potential systems.

While the Commission, of course, should examine all reasonable possibilities to improve efficiency, it should do so with the objective of resolving this dilemma. One approach that ArrayComm believes warrants study would be to define or measure spectrum efficiency prior to an auction.

It could be done on:

a) bits / second / Hertz / cell or

b) bits / second / Hertz/ km2 (delivered information density) or

c) subscribers / Hertz

Each of these has advantages and disadvantages, but they share one virtue: they set a yardstick or measurement level, thereby enabling the Commission to assess a promise vs. performance standard.

IV. INTERNATIONAL.

Federal spectrum managers have endeavored to be responsive to the needs of the U.S. commercial marketplace, as well as to its agencies and departments, notably DOD. One aspect of this policy has been to put the U.S. out of kilter with the spectrum allocations of much of the rest of the world: global harmonization of spectrum has been limited. If the U.S. economy is robust, that decision may have few consequences, at least economically. If our economy lags behind Western Europe and Asia, our domestic manufacturers may not be able to compete effectively in those markets.

Either way, we pay a price politically. Support from Canada and Mexico has eroded. With our leadership and their support, we used to dominate Region 2 spectrum policy decisions. That Region, however, now seeks other solutions and other alliances at international forums. It has become increasingly difficult for our neighboring nations to give the U.S. the unqualified backing that they did in previous years. At WRC meetings, the current trend is to follow the regional proposals before giving consideration to national ones. As such, the U.S. needs the support of Mexico, Canada and other countries in CITEL to pursue its objectives at WRCs. By expressing reservations to various WRC decisions and recommendations, and thereby failing to implement them, we may be able to satisfy our internal interests, but there is an inevitable erosion of our influence abroad.

The task facing the Commission is enormous. There are pressures from the private sector for more mobile wireless spectrum and countervailing pressures from within Government. Yet, time is of the essence. ArrayComm, as should others, stands ready to participate in the discussion of these complex issues.

V. CONCLUSION.

ArrayComm expects that this inquiry will lead to public meetings, as well as the development of position papers on various issues. We look forward to participating in this process and to working with members of the Task Force.