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Challenges Associated with the Use of Marketplace Forces in Spectrum Management

Remarks by

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I am very pleased to be able to participate in this Sixth Annual International Symposium on Advance Radio Technologies. I first spoke at this event in September 2000 when I was still at the Federal Communications Commission as Chief of the Office of Engineering and Technology.

In that speech, I discussed – in general terms – four basic techniques for reducing spectrum scarcity: (1) reallocating spectrum from one use to another, (2) increasing the technical efficiency with which we use the spectrum, (3) increasing the amount of sharing among users of the scarce resource and (4) extending the upper-most range of the useable spectrum through improvements in devices and systems. I rather quickly dismissed the first possibility -- outright, involuntary reallocation of spectrum -- as a long term solution because of the increasing difficulty of finding a new home for displaced licensees/users and, although I did not dwell on it at the time, the associated difficulty of actually accomplishing such involuntary reallocations – on anything close to a timely basis – in the Washington political environment.

Consequently, I spent most of my time in that speech concentrating on the last three of the techniques and, especially, on techniques for increasing the amount of sharing among users of the resource. I noted that spectrum sharing was not a new concept and that it had been widely – and successfully – used in the past. I also noted that added sharing of the resource could come about in two fundamental ways: (1) through involuntary sharing following a traditional "command and control" regulatory approach and (2) through voluntary agreements following an economic or market approach. I concluded, based in no small part on my own personal frustration with the command and control approach and the inevitable – and seemingly interminable – litigation associated with it, that we needed to focus more on the economic or market approach to encourage further sharing of the resource. Among other things, I discussed the possibility of a secondary market in spectrum and how software defined radio and other advanced radio technologies – like those discussed at the symposium – could facilitate the more dynamic – or shorter term – exchanges of spectrum capacity.

A lot of things have happened in spectrum management since I gave that speech three and one-half years ago. Perhaps the most significant was the creation of the Commission's high-level, multi-disciplinary, internal Spectrum Policy Task Force (SPTF) under the new Chairman, Michael Powell. I think it is fair to say that the release of the SPTF report in November of 2002 set the terms of the debate over spectrum reform. It has served not only as an impetus for a number of important actions by the Commission, but also as a catalyst for increased research on spectrum management and advanced radio technologies. We are fortunate to have with us at this conference, a number of the key players in the Commission's efforts in spectrum management reform – including Bryan Tramont, Paul Kolodzy and Peter Tenhula.

As we have all learned, one of the key findings of the SPTF report is that the underlying problem is not so much one of physical scarcity, *per se*, but, rather, one of administrative rigidities that prevent more intensive use or sharing of this unique natural resource. I agree completely with that finding and with the SPTF report's conclusion that

attributed these rigidities to the traditional, engineering-oriented, "command and control" approach to spectrum management.

The SPTF described two approaches for reducing those rigidities. The *first* is for the Commission to move spectrum management further in the direction of a market-oriented approach wherein the exclusive rights to use the resource are traded on a decentralized basis more like other resources. The *second* method is for Commission to eliminate the rigidities in the current approach by relying more heavily the spectrum "commons" concept wherein unlimited numbers of unlicensed spectrum users are allowed to share spectrum as long the devices used conform to specified technical standards (e.g., maximum power restrictions) and/or etiquettes.

Although I am fascinated with the potential of the second – spectrum commons – approach, I would like to concentrate the balance of my remarks here this morning on the first approach – moving further in the direction of using market-place forces to assure the efficient allocation of this increasingly important resource. Before I do so, however, I would like to offer one more prefatory comment.

As you will learn in a moment, I think there are significant difficulties – challenges, if you will – associated with the trading of spectrum rights on a more market-oriented, decentralized basis. But I want to make it absolutely clear that, despite these challenges, I think it is imperative that we move in the direction of relying more on the use of the profit motive to provide economic incentives for voluntary, consumer welfare enhancing economic transactions by licensees who hold private property-like rights. My purpose in raising these challenges to a more market-oriented approach is *not* to discourage such a movement. Rather my purpose is to identify (1) what gains policymakers can realistically expect by moving further towards the market approach, (2) areas that may need special rules or other forms of government intervention to facilitate marketplace exchanges, and (3) subjects that might benefit from further multi-disciplinary research in the academic community.

In this country, we have generally favored marketplace competition as a way of organizing economic activity because of the benefits that it produces for consumers, businesses and the economy more broadly. We favor marketplace competition because, as a general rule, consumers generally benefit from lower prices, more choice, greater responsiveness from producers, faster innovation, and so forth. One of the major benefits of marketplace competition in the production of goods and services is that it leads to the efficient allocation of scarce resources – something that, as recent history in the former-Soviet Union clearly demonstrated, is extremely difficult to do on a centralized, command and control basis.

As you no doubt recall from your introductory course in economics, economists explain the workings – and benefits – of the marketplace system by relying upon an ideal model based upon the notion of perfect competition. Typically, an introductory economics textbook will list four necessary conditions for perfect competition. Perfect competition assumes that:

- There are lots of buyers and sellers none of whom are large enough or strong enough to influence the price of the product or service – i.e., no one can exercise market power in terms of affecting price or quality
- The product or service is homogenous
- Both producers and consumers have perfect knowledge about prices and quality
- There is freedom of entry to and exit from the market

Economists formally define market failure as a situation where markets fail to efficiently provide or allocate goods and services. This arises when the price of the product or service in the marketplace does not equal the cost (including a reasonable profit) of producing it. Long term departures of price from cost – market failures – are explained in terms of deviations from the ideal model. For example, a producer with market power can restrict output and raise prices above economic costs and thereby earn monopoly profits or rents as economists would refer to them. This, clearly, violates the first condition I listed – that no single producer or consumer can influence the price of the product or service. Note that – as my friend and colleague Phil Weiser points out – I am not talking about shorter-term departures of price from cost that are part of the normal dynamic marketplace as producers, for example, gain and loose competitive advantage.

With that brief background, let me examine each of the four basic conditions in terms of moving further in the direction of relying upon market place forces in the allocation of the spectrum resource. The first condition is associated with having a large number of both producers and consumers. Given the expressed interest in gaining access to spectrum, I think we can set aside the latter – having a large number of consumers.

The more difficult issues are on the supply side. Of course, no one can enter the market to produce spectrum analogous to the way that I can enter the laundry and dry cleaning business here in Boulder if I sense a profit can be made. Instead, the spectrum will have to come from existing holders of the resource and, ideally, in sufficient quantities to establish a market with frequent and transparent transactions. There are a number of reasons that this may not occur – especially in the more desirable regions of the spectrum – i.e., in the 300 MHz to 3 GHz range I mentioned earlier.

First, some of the spectrum may not readily come to market because, for example, it is being held for important public safety, national defense or homeland security purposes or because its use is constrained by international agreements.

Second, existing spectrum holders – say the providers of cellular/PCS services – may withhold spectrum from the market for strategic reasons. By restricting the supply of spectrum, they can raise the cost to new entrants or prevent them from entering the market entirely. The potential for such strategic behavior is exacerbated by the fact that the trend in wireless networks is towards platforms that can support a wide range of voice, data, image, and video services. This means that, whereas at one time, leasing or selling excess spectrum for, say, night-time data telemetry services would not be competitive with a cellular carrier's offerings, today that might not be the case. In short,

why would an existing spectrum holder help create a new competitor unless, of course, there were so many other potential leasers/sellers that withholding the resource would be fruitless? The potential the for strategic withholding of spectrum from the market is also exacerbated by the fact that the carrying costs associated with holding excess spectrum are generally minimal.

Third, and on a related point, many modern wireless systems require a substantial block of spectrum for both spectral and economic efficiency reasons and, increasingly, they require the spectrum on a nationwide basis. The transaction costs associated with assembling such substantial blocks of spectrum may be prohibitive especially when the sellers are not strongly motivated. I have heard anecdotal evidence that suggests that transaction costs have held back the development of secondary markets under the existing rules. As Kevin Werbach pointed out in his recent paper, aggregating blocks of spectrum can be thwarted not only by the transaction costs but also by the same type of "holdout" problems that are well known in the real estate field.

Given these difficulties, it is not at all clear to me whether an active market for spectrum with lots of buyers and sellers will develop in the long term. Because of the rather unique characteristic of spectrum – namely, that it is not consumed by use like coal or oil – it may make sense to impose build-out and other requirements on licensees to discourage them from "warehousing" the resource. Annual spectrum fees for licensees who have not received their licenses through auctions would be another possibility for encouraging holders not to leave spectrum fallow. Auditing actual spectrum use, as the Commission is currently doing, is another option. Finally, for services that involve a high degree of public interest, utilizing the equivalent of the right of eminent domain may be a solution for the holdout problem. I am somewhat more optimistic about the possibility of shorter term, "spot" markets in spectrum developing and taking advantage of advanced radio techniques that have been talked about by other speakers.

The second basic condition for a perfect market is that the product or service be homogenous. That is, the products or services from different suppliers must be perfect substitutes for one another. As we all know, radio spectrum is not homogeneous over wide ranges. That is, spectrum in the Medium Frequency (MF) range has very different characteristics than spectrum in the microwave region. Even within the desirable range of 300 MHz to 3 GHz, the propagation characteristics of the spectrum are different enough to change the value. For example, it takes more cell cites to provide a given level of coverage using the PCS spectrum at 1.9 GHz compared to the original cellular spectrum in the 800 MHz range. Moreover, even in a more market-oriented system, there are apt to be remaining restrictions on the use of different spectrum allocations. For example, there may be restrictions on very high-power operations in spectrum adjacent (in frequency) to, say, a radio astronomy band. There may also be international treaty and other obligations that limit the use to which a particular block of spectrum can be put.

The lack of homogeneity may not be a major problem but it does make it more difficult to establish and compare the price information that is so essential to a properly functioning market. It is not clear that there is anything that the government can do to

further lessen this problem although, as I will describe in more detail in a moment, it is important that the government clearly define the rights and obligations of spectrum licensees to reduce the uncertainties and associated risks of acquiring the resource.

The third basic condition for perfect competition is that both producers and consumers have perfect knowledge about prices and quality. Such knowledge is critical to the decision as to whether to enter or exit a market. A farmer, for example, can decide whether or not to sell stored wheat by reading current commodity prices in a newspaper. I can decide whether or not to put my house here in Boulder on the market by examining the public records associated with property transfers in my neighborhood or by hiring an agent to do it for me. In both of these cases, there are enough transactions and enough public information to gain a good understanding of the market value.

It is not at all clear to me that there will be a sufficient and regularly occurring number of transactions in spectrum to establish clear price signals. This seems especially true when you take into account (1) the varying characteristics of different regions of the spectrum as I pointed out a moment ago and (2) the wide variations in potential value depending upon the geographic location – i.e., the heart of Manhattan versus the prairies of Eastern Colorado. Furthermore, even if the transfer of the spectrum license is recorded at the FCC there is no general requirement for revealing the price at which the transfer occurred and, moreover, the transaction may include equipment and other business assets that may make it difficult to discern that price of the spectrum involved. In addition, large swaths of spectrum may have much higher per-megahertz value than smaller blocks further complicating the calculation. Finally, and fundamentally, the value of the spectrum in the marketplace depends critically on the exact nature of the "property-like right" being conveyed. This is why the "interference temperature" concept developed by the SPTF at the FCC is so important. Uncertain rights make it difficult to ascertain the value of spectrum and potentially undermine the proper functioning of a market for the resource.

Beyond more clearly defining the rights and obligation of spectrum licensees – which I believe is absolutely essential whether or not more emphasis is placed upon the marketplace approach – it is not clear to me what else, if anything, the government should do to make transactions more transparent. With commodities like wheat, it is relatively easy to keep the parties to an individual transaction anonymous even if the price is revealed. Anonymous reporting would not seem to work well in spectrum if I am correct in my analysis about the prospects for numerous transactions covering a wide range of spectrum and locations. In real estate, transaction prices and the parties involved are recorded and made public but, if I understand it correctly, this is more for tax purposes than to facilitate the workings of the market.

I would be remiss if I did not note that the spectrum auctions held by the Commission have greatly increased our sense of the value of the resource. But they are also too infrequent and scattered over too great a range to be able to serve as a more day-to-day indicator of the value of the resource. More to the point, the number of auctions is expected to decline over time as spectrum is shifted to a more property-right like model.

The fourth and final condition for perfect competition is that there is freedom of entry to and exit from the market. As I pointed out earlier, no one can enter the market to produce spectrum analogous to the way a farmer might choose to produce more wheat guided by the prices seen in the marketplace. Instead, existing spectrum licensees must determine whether they are interested in putting their spectrum on the market (e.g., "listing it with an agent") or taking it off of the market at the current price which, as I just discussed, may be difficult to determine. This decision, in turn, may be influenced by the presence (or absence) of sunk costs. For example, the presence of large numbers of poor receivers in the hands of the general public may make it politically and economically difficult to put inefficiently used spectrum on the market as we have found out in a number of well publicized cases – e.g., reclaiming UHF television spectrum.

There are other potential difficulties associated with establishing a more market-oriented approach to spectrum management. Since I have exhausted my time, I will merely list them without further comment. The first is the principal-agent problem and the second is the presence of externalities. The third are issues associated with public-choice theory.

I will conclude by stating my belief that the market does not have to work perfectly to do a better job of allocating the spectrum resource than trying to manage it centrally using the traditional, centralized, command and control approach. As an absolute minimum, market forces and voluntary exchanges can be an important adjunct or supplement to the more traditional approach. As I emphasized earlier, my purpose in raising these challenges to the market place approach was simply to stimulate debate and research.

Thank you very much.