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July 23, 1997

VIA HAND DELIVERY

William J. Caton, Acting Secretary
Federal Communications Commission
Experimental Licensing Branch
2000 M Street, NW
Suite 230, MS 1300E1
Washington, D.C. 20554

Re: Spike Technologies, Inc.
Experimental Station WA2XCV
Nashua, New Hampshire
Progress Report

Dear Mr. Caton:

Submitted herewith on behalf of Spike Technologies, Inc. ("Spike"), licensee of the above-referenced experimental facility, is an original facsimile and one copy of the station's 6-month progress report pursuant to Section 5.204(a) of the Commission's rules. It is anticipated that the signed, original report will be available for filing tomorrow.

As summarized in the attached report, many aspects of two-way wireless communications systems were explored by Spike during the second six months of its experimental license. Experimentation included -- but also moved beyond -- the testing and refinement of individual system components. For example, the integration of computer networking equipment and software with the broadband RF equipment was one important area of focus. Other key areas of exploration concerned issues raised in the Petition for Rulemaking ("Petition")[1] filed on March 14, 1997 by various wireless cable-related parties, which suggested enabling MDS and ITFS licensees to utilize their spectrum for fixed, two-way transmissions. Although Spike very enthusiastically supports the flexibility of spectrum use as suggested in the Petition, it is using its experimental station to explore ways to

[1] *In the Matter of Amendment of Parts 21 and 74 to Enhance the Ability of Multipoint Distribution Service and Instructional Fixed Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions*, RM-9060, DA 97-637.

simplify and refine the technical rules proposed therein. For example, preliminary experiments have indicated that a very modest increase in return path power could reduce the need for costly and complicated cellularization of service areas, without increasing harmful interference.

Please contact undersigned counsel if there are any questions.

Respectfully submitted,

E. Lawrence Zolt

cc (via Hand Delivery): H. Franklin Wright, OET

Enclosure

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Progress Report 2

Introduction

Spike Technologies is a microwave equipment provider with technical facilities in Nashua, New Hampshire. Spike's technical strengths include a proprietary sectored antenna system that creates a multitude of narrow, individually-focused beams, resulting in greatly increased capacity through frequency reuse, two-way capabilities, and the ability to reduce interference to and from the system by positioning the beams accordingly.

In late 1995, Spike began developing equipment for bi-directional delivery of digital services such as Internet, data connectivity, videoconferencing and telephony over MMDS channels. These services will enable the wireless cable operator to more effectively compete against the traditional cable operator.

In July 1996 Spike was granted an experimental license to test its systems using MMDS spectrum in the vicinity of the Company's Nashua, New Hampshire technical facility. The license specifies that Spike is required to submit semi-annual reports of its progress to the Commission. The first of such reports was filed in January 1997 ("the January 1997 Report"), and contains details of Spike's accomplishments in both technical and market development issues.

This is the second of Spike's semi-annual updates to the FCC, and is drafted with the assumption that the reader has already seen the January 1997 Report. In order to avoid repetition, we will refer to that report as appropriate.

Summary of Action Items from the January 1997 Report

Throughout the January 1997 Report, we touched on various technical issues, and in many cases we mentioned our tactics going forward in these respective areas. To save time, we will summarize the items from that report.

By January 1997, we had made significant progress in our component-level designs, and our planned enhancements for our components were fairly clear. We needed to add diagnostic capabilities to our transceivers, so they could be monitored remotely. Also, we needed to examine additional modem designs, to explore different modulation techniques. But we were less clear on what system-level issues might arise, although we knew they were certain to surface.

Our progress during the past six months has focused mostly on system-level issues. We did make some design changes to our transceivers, but the diagnostic enhancements must be made in concert with overall system modifications, so we moved our attention to those system issues. Unfortunately, additional modem prototypes suitable for bidirectional broadband data transmission have not become available, despite promises from several manufacturers. So our system-level testing is still based on the QPSK symmetrical modems we used six months ago. We are quite comfortable with these modems, and their reliability has allowed us to move forward aggressively on several fronts.

This report will focus on several issues: (i) Integration of computer networking equipment with the broadband RF equipment; (ii) macro cell size issues; (iii) the pending two-way ruling and our system; (iv) future development plans.

Network Integration

Our early development focused mostly on the RF/microwave portion of the system. Originally we underestimated the complexities of integrating the RF gear with the computer networks. This task is actually quite daunting, and the scarcity of personnel with backgrounds in both areas does not help. But we have managed to make significant progress in this area.

Network Integration procedures are largely dictated by the type of data traffic the operator expects. The RF modems we currently deploy provide an Ethernet connection. Fortunately, Ethernet is a popular standard networking protocol. Most local area networks (LANs) run on Ethernet, making the hubs and network adapter cards readily available and affordable. Also, the 10 Mbps data rate that is achievable using QPSK modulation with a 6 MHz channel is perfect, because standard Ethernet operates at that speed. However, the choice of switching equipment must be made carefully, based on the demographics of the system and market.

We believe that an important feature of a point-to-multipoint broadband data system is the ability to interconnect the subscribers so that they can communicate with one another at high speeds. Videoconferencing is one application that depends on this interconnection. But an operator who is solely concerned with providing Internet access may not be as concerned with connecting the subscribers. The choice of networking equipment prior to launch will affect the data rates at which the subscribers can interact with one another. For example, if the majority of subscribers are medium-sized businesses with numerous locations in the base station coverage area, then it follows that they will be interconnecting their LANs. This may make it desirable to use a high-speed Ethernet switch that can create virtual LAN segments, thus preventing these subscribers from loading down the entire system. The networking equipment in our Nashua Base Station is all switch-based, in comparison to the traditional router-based approach.

Network Management Software is an important issue that needs further attention. This software has been developed extensively for the wired computer networking environment, and needs to be enhanced for wireless applications. See "Future Developments – Network Management Software."

The complexity of a point-to-multipoint broaband digital system leads to link budget issues. As more and more components are added to a communications system, the degree to which these components are matched becomes increasingly important. For example, each stage of the transceiver needs to be presented with signals of a certain amplitude and phase. As more stages are added, these amplitude and phase levels must be controlled even more carefully. The RF modems are in essence another stage, as is the computer networking equipment. Our PRIZM System contains many stages, so the degree of engineering required to get them all working together was quite high.

Macro Cell Size Issues

There has been a divergence of opinions with regard to the optimum cell sizes for two-way MMDS. As indicated in the January 1997 Report, our PRIZM Broadband Delivery System has the unique ability to sector the coverage area into 20 sectors, thereby greatly increasing the capacity of a given piece of spectrum. Companies using a cellular approach would have to build out at least 20 (probably many more) additional base stations, resulting in greatly increased cost. This could severely impact the feasibility of their business model. If such an approach were adopted, the cell sizes, by necessity, would be relatively small, in many cases just a few miles across. However, using our approach, larger cell sizes are acceptable because of the frequency reuse. But higher power is required for the subscriber units, so that those subscribers near the perimeter of the cell can effectively transmit back to the base station. We have studied the implications of this power issue, and have determined that the macro cell approach is indeed quite feasible.

Currently our Nashua system operates with a power level of 5 watts EIRP. Because our base station and subscriber antennas are highly directional, the actual power output from the transceivers is much lower. The system in Nashua has a range of 6-8 miles. But the traditional range of MMDS systems is 30-35 miles. In order for our system to reach that far, EIRP power levels would need to be increased to almost 50 watts. Our base station antenna has gain of approximately 20 dB, so the actual power out of the base station transceiver would be about 500 milliwatts. These power levels are certainly within an acceptable range. Using highly directional subscriber antennas near the perimeter, subscribers could be located within 100 meters of the 35 mile protected service area border without causing interference. Thus, large cells can be operated without causing undue interference

Component costs associated with this increase in power should not exceed $100 per unit. In most cases, this added cost will not exceed the alternative (the cost of additional base stations). Therefore, both interference levels and component costs remain within acceptable levels given large cells of up to 30 miles.

Two-Way Rulemaking

On February 10, 1997, a Petition for Rulemaking ("the Petition") was filed by several MMDS groups. It contains a technical study that outlines some issues and concerns that must be considered when assessing the interference potential of a two-way system. Our system overcomes a significant portion of those concerns.

The Petition indicates that numerous subscribers transmitting simultaneously can create an interference hazard because the signals are additive, and even if they are low in power, they can add to create the equivalent of a very strong undesired signal.

The nature of our multiple access technique is such that only one subscriber transmits at a time within a given sector. So with 20 sectors, we have a maximum of 20 subscribers transmitting simultaneously. Each of these subscribers uses a directional antenna aimed inward toward the base station, further reducing signal levels leaving the protected area. For subscribers near the perimeter of the coverage area, special antennas with low backlobes can be used. So clearly, our multiple access techniques, combined with our directional subscriber antennas, serve to reduce unwanted interference.

Future Developments

Digital Repeaters

We have begun development of a digital repeater that can extend the range of a base station in a given direction. This repeater actually demodulates the RF signal, reducing it to digital information, and then creates an entirely new RF signal that represents the same info. The alternative would be to downconvert the RF signal, and then upconvert the resultant baseband signal for retransmission. Unfortunately, this approach adds unwanted noise to the signal, making it difficult for the RF modems to operate properly. Our fully digital repeaters have been tested internally, and we will notify the Commission of any further developments in this regard.

Telephony

Our system is capable of providing broadband data to numerous subscribers, but we have been seeking additional technology to allow our system to provide telephone services. We are now testing a software-based approach that will allow our system to function as a backbone for a variety of telephone services. Our ultimate goal is to provide the best system for data and telephony. We are not focusing on video at this time, as we believe the business model for video is very different than for telephony or data.

Network Management Software

Most devices on the network can be monitored using the Simple Network Management Protocol (SNMP). Each such device contains a chip that sends vital information back to the network management software. A systems administrator can view a map of the network, identifying any defective devices and disconnecting them as needed. As networks become larger and more complex, this software becomes a necessity.

Two-way wireless systems will require specially modified network management software. Because the bandwidth within a sector is shared, it is important to monitor the usage within each sector to see who is hogging the bandwidth. Good network management software can keep a count of how much data each user transfers. This can relate directly to billing, because if usage can be monitored, a usage-sensitive rate structure can be developed. We are now using the management software that is provided by the RF modem manufacturer, but we feel that additional development can add significant functionality to the management capabilities of the system. Specifically, our systems administrator should be able to keep track of all vital RF modem parameters, all transceiver performance issues, and all repeater traffic statistics. We have begun internal development in this regard.