EX PARTE OR LATE FILED

KEY FACTS CONCERNING

SCS MOBILECOM, INC.'S BROADBAND CODE DIVISION MULTIPLE ACCESS PERSONAL COMMUNICATION SERVICES SYSTEM

RECEIVED
JUL 9 1992
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

ET DOCKET 92-9

ORIGINAL FILE

No. of Copies rec'd 0+5
List A B C D E

SCS MOBILECOM, INC.
85 OLD SHORE ROAD
SUITE 200
PORT WASHINGTON, NEW YORK 11050
(516) 883-0760

Question 1: What did the experiments, performed in Houston and Orlando, using Broadband-CDMA (B-CDMA) demonstrate?

Answer: The experiments performed more than one year ago in Houston and Orlando demonstrated conclusively that B-CDMA could share the spectrum with fixed service microwave users.

The first series of experiments was performed in Houston without the use of a notch filter[1]. The results showed that 46 PCS users could communicate simultaneously per base station without interfering with the fixed microwave receiver. Since a PCS cell is typically 1/20 square mile, 920 PCS users can be accommodated per square mile. This capacity is approximately an order of magnitude greater than what is available in todays cellular systems and is calculated from a "worst case" scenario in the presence of a microwave signal without a notch filter. It should also be noted, only 3% - 5% of PCS base stations in a typical city are anticipated to be located within range of a microwave tower.

---

[1]The notch filter, often used in military communication systems to remove intentional jamming, is used in a B-CDMA transmitter to reduce the power transmitted in the frequency band occupied by a microwave receiver. Since the power transmitted is small in a B-CDMA PCS system, the transmission range is limited, typically to less than 1000 feet radius, and the probability of more than one microwave receiver being affected by the B-CDMA transmitter is near zero. Hence, only one notch filter is needed - even in a region of intense microwave use, such as Houston.

The second series of experiments was performed in Orlando in order to demonstrate that a far larger number of users could be accommodated using a notch filter. In the experiment the notch was tuned to the frequency band of the fixed microwave receiver. Calculations made from the measurements taken showed that more than 126 simultaneous users per base station could communicate when the notch filter was employed. This number corresponds to 2,520 users per square mile.

Thus, the use of the notch filter demonstrated that spectrum sharing could occur and still yield extremely high capacity service.

Question 2: How much bandwidth is needed by a B-CDMA system if sharing the spectrum is not required?

Answer: SCS recommends that the total bandwidth per service provider exceed 20 MHz and be as wide as possible to insure good indoor performance. Bandwidth affects the number of simultaneous PCS users per base station (capacity), the data rate of each PCS user, and the probability of "static" or of a dropped call.

B-CDMA can operate at any bandwidth in a way that maximizes capacity and data rate while minimizing the probability of a dropped call.

A rule-of-thumb is that in a microcellular PCS system the total bandwidth required is 5 times the product of the number of users and the transmitted data rate. Thus, in order for 250 PCS users to simultaneously communicate using 32 kb/s digitized speech requires a bandwidth of 40MHz. Either full duplex operation, in which the transmit and receive bandwidths are each 20 MHz, or time division duplex operation, in which the transmit and received bandwidths are each equal to the total bandwidth of 40 MHz, can be employed. If ISDN users operating at 144 kb/s are communicating, only 55 simultaneous users can be accommodated at this higher data rate.

Effectively, there is a total amount of data (measured in bits) which can be accommodated in each cell. For a 40 MHz full duplex system this equates to eight (8) Mbps. This capacity can be dynamically allocated, thus efficiently serving the individual needs of the user.

Figure 1 is an experimentally obtained curve showing how the transmission bandwidth affects the depth of a fade and hence the probability of a dropped call or the bit error rate. The curve shows that the probability of a fade (signal attenuation) exceeding a given amount is equal to the probability of 0.1, 0.01, or 0.001, as a function of the transmission bandwidth. Note that as the transmission bandwidth decreases, the

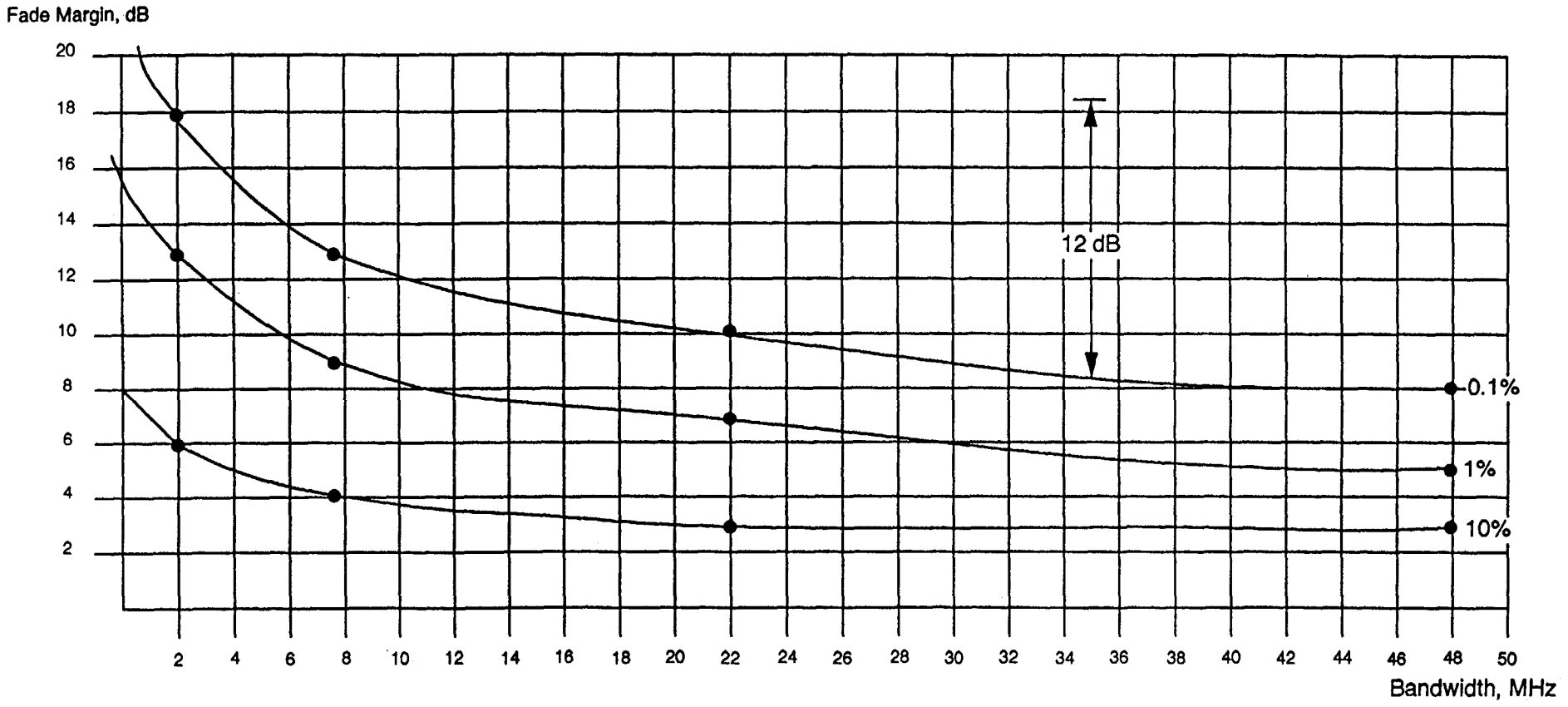

FIGURE 1: FADE MARGIN

possible signal attenuation (fade) is more likely to increase. Note thatbelow 8 MHz this increase becomes extremely severe.

SCS recommends that the total bandwidth per service provider exceed 20 MHz and be as wide as possible to insure good indoor performance. Either full-duplex or time division duplex could be used. B-CDMA is a flexible approach designed to operate either full-duplex or time division duplex, in order to meet the Commission's as well as the Service Provider's requirements.

Question 3: What is the difference to the user and service provider between full duplex and time division duplex?

Answer: Full duplex (FDPX) is the transmission of a signal on one frequency band and the simultaneous reception of another signal on another frequency band. Time division duplex (TDD) is the time shared use of the same frequency band for transmission and reception, each occurring during a separate time interval.

SCS' B-CDMA can operate equally well using either approach. However, SCS prefers the full duplex approach for the following reasons:

The disadvantages of TDD are linked to its requirement to resynchronize during each receive time interval. To minimize the synchronization time, the receive and transmit time interval must occur within milliseconds. Further, in order for the required adaptive power control (APC) feature to operate properly, while driving in an automobile, the receive and transmit intervals must be limited to about 1 millisecond.

A guard time is required in any TDD system, during which no user transmits or receives, to take into account the variation in distance between mobile users and the base station. The ratio of guard time to transmit (or receive) time is an indication of system efficiency, the lower the ratio the higher the efficiency. Thus a small receive (or transmit) time interval, necessary to insure good APC performance, severely limits the efficiency.

The only possible advantage to a TDD system is the fact that a wider bandwidth system is more immune to multipath than a narrowband system. Thus, Figure 1 shows that 1 - 2 MHz systems should not be used. However, the variation between a 20 MHz system and a 40 MHz system is very small and readily compensated for through the use of forward error correction coding.

Question 4: If sharing will not be employed, what are the advantages of B-CDMA?

Answer: The fundamental advantages of B-CDMA are that it provides wiredline quality service with wireless convenience, i.e., privacy, no dropped calls, no satellite-like speech delays and excellent quality, as well as bit-rate-on-demand up to ISDN rates and dramatically improved capacity over todays wireless technology.

Question 5: Will this improved voice and data service, provided by SCS, result in a more costly handset?

Answer: The SCS B-CDMA system is a wideband system. Thus, it operates in the preferred spread spectrum way. As a result, no "band-aids" are required to improve the system operation, such as RAKE, space diversity, elaborate forward error control systems, expensive voice digitizer chips, etc.

Hence, SCS' B-CDMA handset will be less costly than the narrowband alternatives which required the above listed components. Another equally important advantage of a "wideband" system, which does not require band-aids, is the tremendous improvement in power consumption efficiency. This significantly improves "talk time" per battery charge.

Question 6: What is the difference between SCS' B-CDMA system and Rockwell's CDMA system?

Answer: Rockwell is considering developing a chip using B-CDMA features and operating using TDD with a bandwidth of 40 MHz. The Rockwell chip has not yet been built and as seen from Question 3, the development of a TDD system is somewhat risky.