GARDNER, CARTON & DOUGLAS
1301 K STREET, N.W.
SUITE 900, EAST TOWER
WASHINGTON, D.C. 20005
(202) 408-7100
FAX (202) 289-1504
INTERNET: gcdlaw.dc@gcd.com

CHICAGO, ILLINOIS

WRITER'S DIRECT DIAL NUMBER
(202) 408-7113

ORIGINAL

DOCKET FILE COPY ORIGINAL

September 18, 1998

HAND DELIVERED

Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Andrew Corporation, Petition for Rule Making

Dear Ms. Salas:

Transmitted herewith on behalf of Andrew Corporation is an original and nine (9) copies of a Petition for Rule Making seeking amendment of Section 22.367(a)(4) of the rules and regulations of the Federal Communications Commission.

The Commission is requested to issue a *Public Notice* seeking comment on this Petition.

Should there be any questions, however, the Commission is asked to contact this office directly.

Respectfully submitted,

Russell H. Fox

RHF:df
Attachment

cc: Daniel B. Phythyon, Esq. (via hand delivery)
Steven Weingarten, Esq. (via hand delivery)
Roger Noel (via hand delivery)

No. of Copies rec'd 4
List ABCDE

238542.1

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

In the Matter of	)	
Amendment of Section 22.367(a)(4)	)	RM _____
of the FCC's Rules	)	

To: The Secretary

PETITION FOR RULE MAKING OF ANDREW CORPORATION

Andrew Corporation ("Andrew"), by its attorneys and pursuant to the provisions of Section 1.401 of the Rules and Regulations of the Federal Communications Commission ("FCC" or "Commission"), hereby requests that the FCC initiate a rule making proceeding designed to amend the provisions of Section 22.367(a)(4) of the regulations to eliminate the requirement that licensees of cellular radiotelephone systems employ only base stations with vertical polarization.

I. INTRODUCTION

Andrew, founded in 1937, is a global provider of electronic communications systems, equipment, and services. Recognized as a company with a tradition of technological innovation and customer satisfaction, Andrew provides products and services to countless markets and for numerous applications worldwide. The principal products manufactured or distributed by Andrew include:

Coaxial cable, Connectors and Accessories
Terrestrial Microwave, Earth Station, Base Station, and Broadcast Antennas
Wireless Handset Accessories
In-Building Communications Systems
Defense Electronics

Andrew Corporation is headquartered in Orland Park, Illinois and has in excess of 4200 employees worldwide.

Currently, licensees of cellular communications systems are restricted to employing base station antennas that transmit with vertical polarization only. Section 22.367 prescribes the polarization required of various types of antennas used in the public mobile services. In particular, Section 22.367(a)(4) states that waves radiated by base, mobile, and auxiliary test transmitters in the cellular radiotelephone service must be vertically polarized.[1/]

Andrew believes that circumstances have changed since the FCC adopted rules requiring base station transmit antennas to be vertically polarized. As demonstrated below, Andrew submits that it is now in the public interest to permit cellular licensees to employ base station transmit antennas to employ any orientation of linear polarization, *i.e*,. not exclusively vertical. Accordingly, it requests that the FCC change the wording of Section 22.367(a)(4) to read as follows: "Mobile and auxiliary test transmitters in the Cellular Radiotelephone Service."

1/ Andrew recognizes that Section 22.901(d)(2) of the FCC's regulations exempts cellular systems employing digital technologies from complying with Section 22.367(a)(4) of the rules. *See*, letter from Roger S. Noel, Chief, Licensing and Technical Analysis Branch, Commercial Wireless Division, Wireless Telecommunications Bureau, to Russell H. Fox, August 14, 1998. Application of Section 22.367(a)(4) is still contrary to the public interest for analog cellular systems. If the FCC eliminates the rule, as Andrew requests, analog cellular system operators will no longer be restricted to using vertically polarized antennas. Accordingly, in addition to requesting modification of Section 22.367(a)(4), the Commission would be required to modify Section 22.901(d) to eliminate reference to Section 22.367.

II. DISCUSSION

A. Polarization Diversity is An Alternative to Space Diversity

Conventional base stations used for cellular radiotelephone services typically use directional antennas to provide coverage to each of, usually, three sectors. In addition, typical systems often use a space diversity receive antenna arrangement, where two single, vertically polarized antennas are spaced several wavelengths apart. Diversity combining is used to exploit the difference between the two instantaneous signals to give a so-called diversity improvement, which gives an effective increase in the uplink system margin without the need to increase mobile transmit power. Typical systems use at least one antenna, and possibly more, for the transmit function. This means that there can often be nine or more antennas mounted on top of a base station site tower.

When a base station uses a vertically polarized antenna for transmit, then the surrounding environment will depolarize a portion of that energy into the orthogonal polarization, *i.e.* horizontal polarization as seen at the mobile. In a truly random process, half of the energy would be de-polarized, and converted to horizontal polarization, although the exact fraction (more or less than half) depends upon the scattering environment. Conversely, if the base station antenna transmitted horizontal polarization, then the scattering environment would de-polarize half of that energy, in a random process, into vertical polarization. This effect also occurs for the mobile station as well as the base station. The use of a portable, rather than a mobile transmitter unit, creates many more situations where the polarization state of the transmitting antenna of the portable telephone handset cannot be guaranteed to be vertical.

Technical studies have shown that in most cellular environments, and specifically in urban and suburban environments, there is sufficient scattering and de-polarization of the signal to give sufficiently high decorrelations between the instantaneous fading characteristics of the signals received on two orthogonal polarizations.[2] This permits the possibility of using these two decorrelated receive signals in a diversity scheme, referred to as "polarization diversity." Thus, Andrew asserts that polarization diversity may be an acceptable alternative to space diversity, dependent upon the operator's system design considerations and requirements.

B. Polarization Diversity will Produce More Pleasing Aesthetic Structures

The concept of polarization diversity can be exploited by antenna manufacturers to provide antenna structures which have more visual appeal. Despite the recent efforts to ameliorate tension between wireless service providers and local planning entities,[3] antenna siting remains a sensitive issue. Andrew's proposal will allow wireless providers to construct structures that may be less objectionable to local planning authorities.

As noted above, the typical sector of a cellular network requires three directional antennas, usually one transmit and two receive. Use of polarization diversity means that the two, single vertically polarized antennas used for the receive function can be replaced by one dual polarized antenna. Thus, use of dual polarization can mean that the number of antennas required to serve a sector can be reduced from three to two. There can be further reductions if

---

[2] Polarization Diversity System for Mobile Radio, W. C. Y. Lee, Y. S. Yeh, IEEE Transactions on Communications, Vol. COM-20, No. 5, October 1972, pp. 912 - 922.

[3] See *Historic Agreement by Local and State Governments and Wireless Industries on Facilities Siting Issues, Statement of FCC Chairman William Kennard*. News Release, August 5, 1998.

a frequency duplexer is used to separate out transmit and receive bands. In this case, only one antenna is required to serve each sector. One of the polarizations of the dual polarized antenna is used to support both transmit and receive functions, *e.g.*, main receive branch (the frequency bands are separated out by the duplexer), and the other polarization supports the alternative receive function, *e.g.* diversity receive branch. This potential reduction in the number of antennas required to serve a particular sector significantly reduces the visual impact of an antenna structure and helps to facilitate construction approvals.

Aside from reducing the number of antennas, the use of dual polarized antennas would potentially eliminate the need for the large triangular structure on top of the antenna tower used by cellular operators typically used to support the three antennas needed for each of the three sectors in a cellular system employing space diversity. Using dual polarized antennas, there is no requirement for each of the antennas for the three sectors to be spatially separated. If a frequency duplexer is also used, then the three antennas (one for each sector) can be placed as close to each other as their size and interference interactions will permit. Andrew has developed innovative mounting structures that will permit the mounting of three dual polarized antennas around a vertical mounting pipe. The overall diameter of the envelope enclosing the three antennas can be reduced to slightly less than 20 inches, representing a significant reduction in overall envelope of the antennas including the support structure.

C. Choice of Antenna Polarization for Use in Polarization Diversity Systems

Two options are available to achieve the required two orthogonal polarizations, e.g. vertical and horizontal and dual polarized, slant 45 degree (45 degree left and right). Of these two choices to use in a polarization diversity scheme, Andrew believes that the use of slant 45

degree type is preferable for several reasons. First, the use of slant 45 degree polarization is much more efficient and cost efficient because it provides an antenna with the two orthogonal polarizations having the same radiation pattern. The same pattern is required in order to optimize hand-off performance. Additionally, there is a slightly improved polarization match to the typical user of a portable phone, because the handset is often oriented at approximately 45 degrees to the vertical in normal use (although this improvement only occurs in areas where there is a reduced amount of scattering between the base site and portable). Moreover, field trials comparing signal quality when space and polarization diversity systems are tested (vertical / horizontal polarization as well as slant 45 degree polarization) generally show slightly superior results when using slant 45 degree polarization.[4/]

D. Issues Concerning Vertical Transmit Polarization

The possibility of reducing the number of antennas required to serve a cellular sector from three to one would plainly benefit cellular operators as well as the public. However, the use of slant 45 degree polarization antennas is not currently permitted by the FCC's rules for cellular base station transmitters. This means that this important advantage is not available to operators, without some additional difficulty, cost and performance degradation. One way to achieve the desired results is to employ frequency duplexers on both ports of the dual polarized antenna and use a combiner to add the two slant 45 degree polarizations in the right phase to give vertical polarization on transmit. This is a costly option, because it requires the use of an additional duplexer and splitter. In addition, inclusion of these components increases

---

4/ Experimental Evaluation of Polarization Diversity Gain at the Base Station End in a GSM900 Network, J Laiho-Steffens, J Lempiainen, M Salmenkaita, J Siltaniemi, O Jukarainen, IEEE Conference on Vehicular Technology, 1998, Ottawa

the total attenuation in the system and increases the likelihood of additional intermodulation products being generated. The second method is to not use one antenna, but employ two antennas - one being vertically polarized for the transmit frequency band and the other being slant 45 degree dual polarized for receive operation. This approach greatly reduces the usefulness of Andrew's proposal, since it is no longer possible to obtain the maximum reduction in number of antennas. Nevertheless, some operators may possibly use this approach, on the basis of other considerations.

E. Modification of the Regulations is Appropriate

Because of the advantages of dual polarized antennas noted above, Andrew believes modification of the regulations is appropriate. It therefore requests modification of Section 22.367(a)(4) to permit transmit polarizations other than exclusively vertical.

The FCC most recently considered the retention of Section 22.367 of the regulations when it "rewrote" Part 22 of the Rules.[5/] At that time, the FCC offered two reasons for retention of the regulations. First, the FCC stated that operating with cross polarizations significantly reduces the probability of interference between facilities using the same or adjacent spectrum for different purposes. Second, the Commission found that the regulations promote common antenna designs and interoperability. None of these concerns remain relevant today.

First, Andrew asserts that the use of vertical polarization is not necessary to protect adjacent channel operations, in general, and analog domestic TV receiver units, in particular (the apparent cause of the FCC's concern in the "Part 22 Rewrite" proceeding). The scattering

---

5/ *Amendment of Part 22 of the Commission's Rules*, 9 FCC Rcd 6513, Appendix A (1994).

which occurs from obstacles in the mobile environment will give rise to substantial components of horizontally polarized energy. Moreover, the FCC has allocated part of the spectrum closest to the frequency band assigned to the Cellular Radio-telephone Service for land mobile and other commercial operations.[6] Second, common antenna designs are no longer critical for cellular systems. Modern antenna design and manufacture makes it as straightforward to provide typical directional antennas for sector coverage with vertical or non-vertical polarizations, even though horizontally polarized omnidirectional antennas represent a greater design and cost challenge than vertically polarized ones. It is also no longer necessary to specify the use of vertically polarized antennas to promote interoperability. The scattering environment de-polarizes signals to a level where there is no benefit in the typical cellular system to maintaining a single transmit polarization orientation.

The Commission should also reconsider the requirement that cellular providers employ vertically polarized antennas as a matter of regulatory parity. There is no such requirement for any other commercial mobile radio service ("CMRS"), most notably personal communications services ("PCS") and specialized mobile radio ("SMR") services, which are direct competitors to cellular service. Finally, as noted above, the FCC appears to have eliminated the requirement that cellular operators providing digital service employ vertically polarized base station antennas. Andrew is unaware of any problems that have been created by this exemption from the requirement to use vertical polarization. The exemption should be extended, therefore, to all cellular providers.

---

[6] *Reallocation Of Television Channels 60-69, The 746-806 MHz Band*, 10 Comm. Reg. 648 (1998).

III. CONCLUSION

Andrew submits that the FCC should change Section 22.367(a)(4) to delete reference to cellular base stations. Polarization diversity offers a useful performance alternative to space diversity, and further system improvements and network deployment advantages can be obtained by choice of a transmit polarization other than vertical. Use of dual polarized antennas can lead to significant reduction of the visual impact of the antenna structure and to easing the problems associated with acquiring planning permission for new cell sites.

WHEREFORE, THE PREMISES CONSIDERED, Andrew Corporation submits the foregoing petition for rule making and requests that the Federal Communications Commission initiate a rule making proceeding designed to amend the regulations in the manner outlined herein.

Respectfully submitted,

ANDREW CORPORATION

Russell H Fox

Russell H Fox

GARDNER, CARTON & DOUGLAS
1301 K Street, N.W.
Suite 900. East Tower
Washington, D.C. 20005
202-408-7100

Its Attorneys

Dated: September 18, 1998