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

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

In the Matter of )  
)  
Amendment of the Commission's )  
Rules to Establish New Personal )  
Communications Services )

GEN Docket No. 90-314  
RM-7140, RM-7175, RM-7618

To: The Commission

**STATEMENT OF ALCATEL NETWORK SYSTEMS, INC.**

On April 11-12, 1994, the Commission's PCS Task Force conducted a series of panel discussions on pending Personal Communications Service ("PCS") issues. Participants on its Panel IV, "PCS Spectrum and Technical Issues," addressed various topics, including PCS-microwave interference protection, spectrum clearing, and frequency band assignments.<sup>1</sup>

Alcatel Network Systems, Inc. ("ANS") has been active in the Commission's efforts to implement PCS.<sup>2</sup> It proposed the rules, actively participated in the rulemaking, and submitted the compromise plan that facilitated ultimate adoption of the requirements for relocating incumbent 2 GHz fixed microwave users, which were necessary to clear spectrum for PCS.

<sup>1</sup>This Statement is submitted pursuant to the Commission's News Release announcing the PCS Panel Discussions, released April 4, 1994 (Mimeo No. 42480).

<sup>2</sup>ANS is a wholly-owned subsidiary of Alcatel Alsthom ("Alcatel"), one of the world's largest corporations (with annual sales in excess of \$30 billion) and the world's largest manufacturer and supplier of telecommunications equipment. In particular, Alcatel is the world's largest independent manufacturer and supplier of microwave radios. Formerly Collins Radio and Rockwell International, ANS, with over \$500 million in annual sales, is a world leader in manufacturing microwave and light wave transmission systems. ANS' equipment is used for a wide range of services, including short, medium and long-haul voice, video and data transmission. Its microwave customers include all the Bell Operating Companies, most major independent telephone companies, cellular operators, power and other utility companies, oil companies, railroads, industrial companies, and state and local government agencies.

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In addition, ANS management has been involved significantly in industry-wide efforts to ensure a healthy transition for relocating fixed microwave users and for introducing PCS. Phil Salas, ANS' Senior Director, Microwave Product Development, chairs the Telecommunications Industry Association ("TIA") Working Group TR14.11 responsible for "Telecommunications Systems Bulletin No. 10-F, Interference Criteria for Microwave Systems" ("Bulletin 10-F"), which specifically prescribes PCS-microwave interference calculation criteria. Similarly, George M. Kizer, ANS' Senior Product Manager, chairs TIA's Fixed Point-to-Point Communication Section, which represents PCS and microwave equipment manufacturers.

In addition, Mr. Kizer has participated actively in the UTAM Adjacent Channel Interference Working Group, which is developing standards for PCS and microwave users. This ad hoc group is composed of highly qualified microwave and PCS equipment manufacturers and other experts which are particularly interested in addressing adjacent channel interference issues. These working group members include representatives from ANS, AT&T, Northern Telecom, Comsearch, Columbia Spectrum, Motorola, and Harris-Faridon. As detailed in the attached Statement by Mr. Kizer, the UTAM Adjacent Channel Interference Working Group has developed empirically verified models for determining PCS-microwave adjacent channel interference which have been incorporated into Bulletin 10-F.

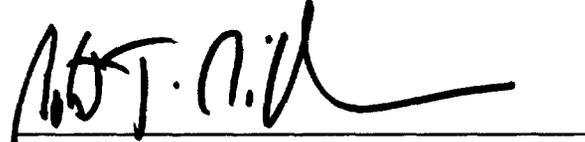
A critical issue in ensuring rapid introduction of PCS is developing co-channel and adjacent channel interference standards to protect fixed microwave users. In the April 12, 1994, Statement of Dr. David C. Nagel, Apple Computer, Inc. ("Apple"), for Panel IV, several issues are raised regarding the need to resolve adjacent channel interference if Data-PCS is to be implemented. Apple claims that adjacent channel PCS-microwave interference will delay Data-PCS deployment, will cost over \$7 million to resolve, and will decrease available spectrum from 10 MHz to 2 MHz because 4 GHz guardbands would be required.

ANS appreciates Apple's interest and observations on this issue. However, as set forth in the attached Statement by Mr. Kizer, these assertions about adjacent channel interference do not tell the entire story. Ongoing studies are developing highly useful data on adjacent channel interference, costs to modify adjacent channels, and spectrum needed to guard against interference. These data could minimize or eliminate Apple's concerns.

Nevertheless, further study is needed on these issues. Members of the TIA TR14.11 committee and the UTAM Adjacent Channel Interference Working Group are prepared to work with the Commission, Apple and the rest of the industry in achieving this goal.

Respectfully submitted,

**ALCATEL NETWORK SYSTEMS, INC.**

A handwritten signature in black ink, appearing to read 'R. J. Miller', written over a horizontal line.

Robert J. Miller  
Gardere & Wynne, L.L.P.  
1601 Elm Street, Suite 3000  
Dallas, Texas 75201

Dated: April 21, 1994

Its Attorney

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**STATEMENT OF GEORGE M. KIZER  
SENIOR PRODUCT MANAGER  
ALCATEL NETWORK SYSTEMS, INC.**

**QUALIFICATIONS**

I am the Alcatel Network System, Inc. ("ANS") microwave radio representative to the U.S. Government and to various industry organizations. Over the past 17 years with ANS/Rockwell International, I have served as system engineer or program manager of several large national and international microwave projects.

Currently I am the chairman of TIA's Fixed Point-to-Point Communication Section. This Section represents microwave and PCS manufacturers. It also sponsors TR14.11, which has written the industry standard for microwave design and frequency coordination, Bulletin 10-F.

I am the author of a leading text book on microwave radio, Microwave Communication, published by Iowa State University Press in 1990. In Chapter 4, External Interference, I exhaustively address the subject of interference into FM microwave receivers.

I hold B.S. and M.S. degrees in Electrical Engineering from Oklahoma State University and Iowa State University, respectively.

**STATEMENT**

In the April 12, 1994, Statement of Dr. David C. Nagel, Senior Vice President and General Manager of Apple Computer, Inc. ("Apple Statement"), several assertions are made regarding PCS-microwave interference that require clarification: (1) the state-of-the-art in controlling adjacent channel interference; (2) the cost of modifying adjacent channel systems to clear spectrum for PCS; and (3) the need for a guardband to protect adjacent channel stations. While the concerns expressed by Apple Computer, Inc. ("Apple") are understandable and perhaps correct under some conditions, they are not entirely justified.

### Adjacent Channel Interference

Dr. Nagel states that, as an unlicensed service, Data-PCS cannot be frequency coordinated. Thus, Apple claims that, "to deploy even the very first Data-PCS-equipped laptop or personal digital assistant (PDA), we have to remove the last microwave link (both co-channel and adjacent channel) . . . ." Apple Statement at 3. Similarly, Dr. Nagel characterizes the problem as being "especially severe when one considers the problem of adjacent-channel microwave stations, which, in reality, must be treated as co-channel or be modified in order to avoid interference to them." *Id.* at 3-4. Finally, he speculates that it could take more than five (5) years to clear spectrum for Data-PCS, and that this delay would be attributable, in large part, to "unresolved adjacent-channel problems." *Id.* at 15.

Implicit in Dr. Nagel's statements is that adjacent channel interference into analog FM microwave receivers is not well understood. This assumption was justified a year ago. However, since then, considerable work has been accomplished by TIA TR14.11 and by the UTAM Adjacent Channel Interference Working Group. Theoretical interference models have been developed by Comsearch, a leading frequency coordinator, and by ANS. Actual tests conducted by UTAM members at Motorola's Chicago facilities verify these models.

PCS radios operate much differently than traditional fixed point-to-point microwave radios. Considerable concern has been expressed by industry members regarding traditional engineering methods to address these new systems. TIA's Fixed Point-to-Point Communication Section, through its TR14.11 committee, took on the challenge of establishing these standards, including standards for adjacent channel interference, through industry consensus.

Engineering methods for Path Propagation and Adjacent Channel Interference estimation were required. Adjacent Channel Interference engineering is based upon two criteria: Threshold

Degradation (faded criterion) and Adjacent Channel Noise (unfaded criterion). Over the years, engineering methods were established for analog FM and for digital radios. It was unclear whether these methods could be applied to PCS.

No theory exists for Threshold Degradation calculations. These calculations must be based upon empirical data. Theory exists for adjacent channel noise estimation. However, as of last summer, this theory never had been applied to PCS.

Last summer, Comsearch and ANS began intensive research into applying existing theory to PCS related interference. Theoretical numerical methods recently have been completed. Experimental verification of these methods was needed before they would be widely accepted.

The UTAM Adjacent Channel Working Group volunteered to perform experimental verification of the proposed engineering methods. Motorola, a UTAM member, provided a FM radio and test facilities. UTAM provided test equipment. Representatives of Northern Telecom, Motorola, ANS, Comsearch, and Columbia Spectrum met at Motorola's Chicago facilities and performed actual tests using a 300 channel analog FM radio and simulated PCS signals. Empirical Threshold Degradation data were taken. Data were also taken and used to verify the theoretical adjacent channel interference models.

Based upon this research and testing, PCS-microwave adjacent channel interference now is well understood. Sufficient theory and data exists so that adjacent channel interference decisions may be made on an analytical basis.

This information is incorporated into Bulletin 10-F. Of particular importance is Appendix A, Sections A.9 (Minimum C/I Objective), A.12 (Adjacent Channel Noise), and A.13 (FM Receiver Threshold). Bulletin 10-F has been composed over the last year based on contributions by the following organizations:

American Personal Communications  
ANS  
AT&T/Bell Labs  
Bellcore  
Comsearch  
Harris-Farinon  
Motorola  
National Spectrum Managers Association  
Northern Telecom  
Southwestern Bell Technology Resources  
UTAM

This document represents engineering state-of-the-art on the adjacent channel interference issues raised by Apple. It is a particularly exciting example of fixed point-to-point microwave and PCS groups working together to establish new radio engineering standards.

#### Costs

Dr. Nagel claims that a minimum of 10 MHz is needed to stimulate necessary investment in Data-PCS. To clear the less congested 1910-1920 MHz band, he estimates that "290 adjacent channel stations, at an additional cost of \$7.2 million (290 x \$25,000)" would be necessary. Apple Statement at 17.

The basis for Apple's cost estimate to modify adjacent channels is unclear. No underlying data supporting the \$25,000 per channel estimate are provided.

Indeed, given the increased knowledge now available regarding adjacent channel interference, it is clear that actual costs for modifying channels can vary widely depending upon the method used and the equipment involved. For example, fixed point-to-point microwave radios are a combination of several separate modules interconnected by cables and connectors to perform complex functions. Radios for PCS will be similarly complex. Costs to control adjacent channel interference between a specific microwave radio and a specific PCS radio depend upon what modules must be replaced or modified. Moreover, it is uncertain if Apple's

estimate includes costs for alternate facilities while the changeover is accomplished and the modification verified. Thus, at a minimum, further study must be conducted to quantify the likely costs of protecting against adjacent channel interference.

#### Guardband

Dr. Nagel assumes that 4 MHz guard bands will be needed to protect the remaining adjacent channel stations. *Id.* at 17. This assumption also is not justified.

Actual guard band requirements, if any, should be determined using industry established criteria, such as those described in Bulletin 10-F. Engineering considerations based upon actual interference conditions must be evaluated before a decision can be made regarding the need for guard bands.

#### Conclusion

Apple's concerns over available spectrum for Data-PCS are premature. Further study is needed to test Dr. Nagel's assumptions against the theoretical and empirical studies that TIA and UTAM have conducted.

Apple's conclusions may be correct. However, neither the TR14.11 committee nor UTAM has been provided with engineering proposals which would allow these conclusions to be verified.

Apple appropriately brings forward several important issues. These issues deserve more study. Members of the TIA TR14.11 committee and the UTAM Adjacent Channel Interference Working Group would be delighted to discuss these issues with the Commission, Apple, and other industry representatives as soon as possible.

April 21, 1994  
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**CERTIFICATE OF SERVICE**

I hereby certify that a true and correct copy of the foregoing Statement of Alcatel Network Systems, Inc. was sent via first-class mail, postage prepaid, to counsel for Apple Computer, Inc., Henry Goldberg, Goldberg, Godles, Wiener & Wright, 1229 19th Street, N.W., Washington, D.C. 20036, on the 21st day of April, 1994.

  
Deborah Traugher

April 21, 1994