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GURMAN, KURTIS, BLASK & FREEDMAN
CHARTERED

SUITE 500
1400 SIXTEENTH STREET, N.W.
WASHINGTON, D.C. 20036

(202) 328-8200
TELECOPIER: (202) 462-1784

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January 19, 1995

William F. Caton, Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Stop Code 1170
Washington, D.C. 20554

Re: Ex Parte Submission
PR Docket No. 93-61

Dear Mr. Caton:

On behalf of Southwestern Bell Mobile Systems, Inc. ("SBMS"), this ex parte communication responds to a letter dated January 9, 1995 filed by AirTouch Teletrac in this docket.

Though Teletrac devotes most of its filing to belittling the spectral efficiency of the Quiktrak technology employed by SBMS, Teletrac-- knowing that a decision in this docket was imminent-- elected not to serve SBMS with a copy of its filing. SBMS fortuitously discovered the filing on January 12 by reviewing documents recently received by the Commission. Needless to say, Teletrac's tactic violates the spirit if not the letter of the Commission's ex parte rules.[1/] In the interest of fairness and developing a complete and accurate record, SBMS respectfully requests that the Commission take its opposing views into account before rendering a decision.

Essentially Teletrac's submission is premised on the mistaken notion that assignment of a large block of AVM spectrum to each provider, preferably in the range of six to eight MHz, is the only

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1/ The ex parte rules were "crafted to achieve fundamental fairness and a full record, while permitting the vigorous exchange of information necessary for reasoned and informed decisionmaking [footnote omitted]." In the Matter of Amendment of Subpart H of the Commission's Rules and Regulations Concerning Ex Parte Communications and Presentations in Commission Proceedings, 62 RR2d 1759, 1762 (1987); see also Redwood Microwave Association, Inc., 38 RR 1073, 1081 (1976) (considerations of fairness, due process and common sense are applicable even where the ex parte rules are not).

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means to achieve "necessary" capacity and that such a large block of spectrum is essential to providing a quality service to the public. As we show below, the record evidence is directly to the contrary and Teletrac's analysis relies on several distortions of SBMS' positions in this proceeding.

First, by taking a sentence out of a context from SBMS' November 9 Comments,[2/] Teletrac improperly suggests that even SBMS needs more than two MHz for its wideband to operate a viable AVM system.[3/] However, SBMS never stated that it "plans to use more than one [two MHz] block."[4/] Rather, SBMS' position clearly was (and is) that in an auction regime, just like any other bidder for AVM spectrum, it should have the right to bid on more than one two MHz block. The obvious point was that AVM providers should have the right to buy whatever amounts of spectrum they need or desire.

Second, contrary to Teletrac's suggestion, SBMS has not advocated operation in non-contiguous blocks of two MHz as an optimal condition, for either its own or others' AVM systems.[5/] Last August, when the Commission's staff was floating the idea of carving out only two exclusive wideband AVM blocks of six MHz each, coupled with the grandfathering of hundreds of Teletrac and MobileVision licenses, SBMS placed on the record, in the spirit of compromise, a "three x four MHz" band plan, with one of the four MHz blocks split in half in non-contiguous spectrum.[6/] This possible compromise was put out for discussion in response to the urging of the Commission's staff to attempt to reach a consensus among the AVM widebanders, and to the unchallenged record evidence that even the less efficient technologies of MobileVision or Teletrac required no more than 4 MHz. This alternative plan held out the possibility that there might at least be three wideband competitors in major markets instead of two. MobileVision and Teletrac wanted no part of this compromise, and continued to assert that they required six to eight MHz.

The fact of the matter is that Teletrac's claim about the disadvantages of non-contiguous spectrum is a red herring. It has

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2/ Ex Parte Comments of Southwestern Bell Mobile Systems, Inc. in PR Docket No. 93-61, filed November 9, 1994.

3/ Ex Parte Comments of Air Touch Teletrac in PR Docket 93-61, filed January 9, 1995 at 1, n.2 (hereinafter "Teletrac January 9 Comments").

4/ Id. at 1.

5/ Id.

6/ Ex Parte Comments of Southwestern Bell Mobile Systems, Inc. in PR Docket No. 93-61, filed August 12, 1994 at 5.

not been advocated as optimal for SBMS' own or other AVM systems. Furthermore, it has never been shown that adoption of a two MHz building block plan would result in winning bidders holding non-contiguous spectrum. The non-contiguity of SBMS' August compromise proposal resulted solely from SBMS' desire to accommodate the present band positions of Teletrac's existing systems and MobileVision's few transmitters in Chicago and elsewhere. Since such a compromise was flatly rejected by the incumbent licensees, the Commission should now be guided solely by considerations of the public interest and spectral efficiency, and not the narrow private interests of these parties.

Third, SBMS has never claimed that "LMS systems that use less spectrum are inherently more efficient simply because they use less spectrum."[7/] Rather, SBMS' position has always been that: (1) licensing 2 MHz for a system that may need only 2 MHz within which to operate is more efficient than licensing, for example, 8 MHz for a system that needs only 3.87 MHz (which is the case with Teletrac); and (2) SBMS's system (which happens to be a 2 MHz system) is more efficient than Teletrac's system (which happens to be a 3.87 MHz system).

Fourth, comparisons of efficiency that compare capacity over <u>occupied</u> bandwidth are not nearly as meaningful as comparisons of efficiency that compare capacity of <u>licensed</u> bandwidth, especially when one is using such capacity as an argument for the proposed size of spectrum blocks in a new band plan.[8/] In any event, as shown below, SBMS is more efficient than Teletrac under either analysis. Teletrac claims "the SBMS system can perform about 45,000 locations per hour"[9/] and credits SBMS' General Attorney, Wayne Watts, with this quote. Mr. Watts said no such thing. He actually estimated that SBMS' capacity was 240,000 locations per hour, which, in fact, is an understatement.[10/] SBMS' location-only capacity is somewhere in excess of 400,000 locations per hour, still within a wideband of 2 MHz. Compare this with Teletrac's 200,000 locations per hour within 8 MHz <u>licensed</u>, or 3.87 MHz <u>occupied</u>.

Measuring efficiency by the method proposed by Teletrac, i.e. locations per hour per megahertz, SBMS's system is by far more spectrally efficient.

7/ Teletrac January 9 Comments at 2.

8/ <u>Id</u>. at 3.

9/ <u>Id</u>. at n.6.

10/ A fuller discussion of the SBMS system's capacity is included in Appendix A.

	Capacity	Licensed Wideband	Licensed Efficiency	Occupied Bandwidth	Occupied Efficiency
Teletrac	200,000 loc/hr	8 MHz	25,000 loc/hr/MHz	3.87 MHz	51,680 loc/hr/MHz
SBMS	400,000 loc/hr	2 MHz	200,000 loc/hr/MHz	2.00 MHz	200,000 loc/hr/MHz
SBMS compared to Teletrac		SBMS is 8.00 times more efficient than Teletrac		SBMS is 3.87 times more efficient than Teletrac	

SBMS presents this information to the Commission not to demonstrate that SBMS' system is superior to Teletrac, but rather to give a concrete example of a system that does more with less bandwidth. It provides clear evidence of the fallacy of AirTouch's assertion that 6 to 8 MHz of bandwidth per system is required.

Fifth, it appears that Teletrac is offering yet another band plan. In the past, Teletrac claimed that no business could survive in less than 8 MHz; then it proposed 10 MHz and timesharing. Now it thinks 7 MHz is the right number and that timesharing is infeasible.[11/] SBMS has a full business with AVM as a stand-alone product in 2 MHz (not connected with cellular service.)

The remainder of Teletrac's letter depends on the assumption that capacity increases as the square of bandwidth. As shown in Appendix A hereto, and confirmed in the Virginia Tech Final Report,[12/] which is the only independent unbiased study in the record, capacity increases with bandwidth but less than squared. That fact renders Teletrac's Figure 1 and Table I incorrect, as well as all of its ensuing discussion. As the Virginia Tech Final Report notes, there are other more spectrally efficient ways of increasing capacity, such as SBMS' orthogonal channelization, that do not require consumption of inordinate amounts of bandwidth.[13/]

11/ Id. at 4.

12/ See "Capacity and Interference Resistance of Spread-Spectrum Automatic Vehicle Monitoring Systems in the 902-928 MHz ISM Band, Final Report," by Raymond Zhen, Jay Tsai, Rick Cameron, Lara Beisgen, Brian D. Woerner and Jeff H. Reed of the Mobile and Portable Radio Research Group, Bradley Department of Electrical Engineering, Virginia Tech; October 14, 1994 (hereinafter "Virginia Tech Final Report").

13/ Virginia Tech Final Report at 14.

Teletrac argues that, for a given amount of spectrum in which AVM/LMS systems may operate, having three operators is inherently less efficient than two. That would lead to the conclusion that one operator is most efficient. Again, the fallacy of all this is the underlying assumption that capacity increases as the square of bandwidth. As shown in the Virginia Tech Final Report, this assumption is fallacious even when examining location-only capacity. However, all of the wideband proponents in this docket, including Teletrac, have or propose systems that include data in the form of messaging and/or general data streams as an integral component of their service. The Virginia Tech Final Report concludes that, while there is "some advantage" in position location capacity for systems which employ a larger bandwidth, "[t]he communications capacity of a spread spectrum system increases only linearly as a function of bandwidth, even using detailed analysis for the effects of interference."[14/]

Teletrac selectively quotes the Virginia Tech Final Report out of context on the bandwidth/capacity issue by stating that the Report finds that the views of Teletrac's expert, Dr. Raymond Pickholtz, "regarding the relationship between location performance and bandwidth are 'essentially correct.'"[15/] What the Virginia Tech Final Report actually said, however, is contrary to Teletrac's position and is worth reciting here in full:

> Although this argument is essentially correct for the operation of edge detection, some confusion may result from the multiple operations performed by the AVM system. One can imagine two distinct definitions of capacity: the position location capacity of the system and the communications capacity of the system. The former measures the number of position fixes which may be generated in a fixed time and bandwidth, while the latter measures the amount of data which can be transmitted in a given time and bandwidth.
>
> The shorter time required for a single position fix may result in a higher position location capacity for wider bandwidth systems (although the improvement will be less the indicated above because the time required for other overhead operations and the guard time between successive position fixes remains unchanged). However, the information carrying capacity of any system only increases linearly with bandwidth. This result follows directly from information theory [Cov91]. As a result, there is no disadvantage from subdividing this bandwidth for different systems. While the position location

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14/ Virginia Tech Final Report at 14.

15/ Id. at 2.

> operation may be slightly more efficient at higher bandwidth, there is no such relationship for the messaging capabilities of the system.[16]

Teletrac states that, "Based on extensive technical and economic analysis, [it] believes between 6 and 8 MHz is necessary to sustain an LMS business at the levels of service quality and pricing the market demands."[17] Teletrac's claims of knowing what pricing the market demands are bogus. Teletrac dropped its prices in Chicago by more than 60% when it realized that SBMS was about to introduce its competing service. Clearly, bandwidth is not the driving factor for pricing. If anything, the Chicago experience of price sensitivity to competition suggests that the Commission should adopt a band plan that facilitates market entry and competition by multiple providers by allocating more and smaller blocks of spectrum.

According to Teletrac, "By reducing the segments from 8 to 6 MHz, service providers will be forced to provide the quality of service and meet the price points expected by the public in less spectrum."[18] SBMS agrees. And by reducing spectrum assignments further to blocks of two MHz, the Commission will encourage providers to become even more efficient. Teletrac continues to claim the need for additional spectrum (i.e., six, seven, eight or ten MHz) without identifying how it would be used. It simply asserts "future needs." Teletrac does not even use half of the spectrum it currently holds. On what record basis should the Commission believe Teletrac when it says it needs more?

Teletrac states that it knows "the driving cost factors for operating an LMS business are coverage area and service quality."[19] However, all Teletrac's arguments purporting to show that it understands what it takes to create a viable business in the AVM industry should be taken lightly. Its business record suggests that it may know very little about offering a successful business in AVM/LMS. It lost more than $120 million from 1990 (when Teletrac introduced its service) through June 30, 1993.[20]

Teletrac claims that if the AVM rules favor more service providers with less spectrum each, "the total number of customers

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[16] Virginia Tech Final Report at 7 (emphasis added).

[17] Teletrac January 9 Comments at 7.

[18] Id.

[19] Id.

[20] See Washington Telecom Week (Sept. 10, 1993) at 7 (Appendix B).

that could be served by all providers combined would be less and the variety of services would be reduced."[21] The record is to the contrary. As Dr. Jay E. Padgett observed, two AVM providers with 4 MHz each could actually serve more customers than a single provider with 8 MHz.[22] Moreover, having more competitors leads to greater diversity of services, more innovation in product and service design, competition in pricing, and greater market awareness.[23] The net effect is a broadening of the market for all competitors.

In rendering its final decisions in this docket, the Commission should accord great weight to the independent expert findings contained in the Virginia Tech Final Report. Those findings, particularly as to the relationship between bandwidth and capacity, directly undercut the arguments of those who would hoard large blocks of spectrum nationwide (especially by grandfathering unbuilt systems), and support adoption of a band plan that maximizes the opportunities for competitive entry. SBMS urges the Commission to give reasoned consideration to this factual record.[24]

An original and one copy of this ex parte presentation are being filed in accordance with Section 1.1206(a)(1) of the Commission's Rules.

Very truly yours,

Louis Gurman

Louis Gurman
Counsel for Southwestern Bell Mobile Systems, Inc.

cc: See Attached List

21/ Teletrac January 9 Comments at 8.

22/ Padgett, Jay E., "Analysis of Teletrac Receiver Performance and Part 15 Interference," October 22, 1993, at ii.

23/ See Johnson, Leland, "Competition In Wideband Location Monitoring Services" submitted in Supplement to Reply Comments of Southwestern Bell Mobile Systems, Inc. in PR Docket No. 93-61, October 15, 1993.

24/ See Petroleum Communications, Inc. v. FCC, 22 F3d 1164, 1172-1173 (D.C. Cir. 1994).

Appendix A

DISCUSSION OF AIRTOUCH TELETRAC'S APPENDIX TO ITS JANUARY 9, 1995 EX PARTE COMMENTS

By Keith Rainer and Cameron Coursey

AirTouch has again chosen to claim that system capacity for location increases as the square of the bandwidth, though this claim has been refuted directly by the analysis presented by Dr. Jay Padgett and was unsupported by the work completed by Virginia Polytechnic Institute and State University. The essence of the debate centers around the Cramer-Rao inequality expression for location accuracy,

$$\sigma_\tau^2 \geq T_c / [\alpha^2 B^2 (S/N) T]$$

For a fixed location accuracy, this expression can be written as an equality and tradeoffs can be made--between pulse duration, number of pulses, bandwidth, pulse shape, energy per pulse, and receiver thresholds--to achieve the desired accuracy. As noted by Teletrac and others, the system noise is also a function of bandwidth:

$$N = N_o B$$

As the bandwidth increases, the system noise increases and the signal power must therefore increase to maintain the signal-to-noise ratio required by the receiver. Taking this into account, the expression can be rewritten as,

$$\sigma_\tau^2 \geq T_c / [\alpha^2 B (S/N_o) T]$$

While other factors--such as pulse duration, number of pulses per locate, signal power, and base station site density--affect capacity, and capacity does increase with bandwidth, the relationship is less than square. To achieve the square proportionality, S/N must be increased portional to the increase in bandwidth, and real world factors such as fading margin and cell size must be examined. This, is the basis of Dr. Padgett's and Virginia Tech's refutation of Teletrac's capacity argument.

SBMS' SYSTEM CAPACITY

In a recent ex parte filing with the FCC, Teletrac stated that the SBMS AVM System "can perform about 45,000 locations per hour."[1/] Teletrac attributed the source of its information to a statement

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1/ AirTouch Teletrac ex parte in PR Docket No. 93-61, filed January 9, 1995, page 3.

made by Mr. Wayne Watts of SBMS.[2/]

Teletrac's assertion of the SBMS system capacity is untrue and no statement assigning that value to the SBMS AVM system has been made by SBMS or by any representative of SBMS.

The location capacity of SBMS' AVM system as currently operating in the Chicago area is in excess of 65,000 locations per hour depending on the mix of location and messaging traffic. The wideband channel base station equipment deployed in Chicago can provide in excess of 130,000 locations per hour. If there is sufficient subscriber demand for the AVM service, the system capacity can be doubled again by expanding use of the proposed 250 KHz narrowband channels to provide over 260,000 locations per hour. This capacity can be accomplished within 2 MHz of spectrum for the wideband channel using SBMS' current technology platform.

It is worth noting that some of the SBMS system wideband channels are assigned primarily to messaging traffic. If all wideband channels were assigned exclusively to the locating function, the system location capacity would be in excess of 400,000 locations per hour. In its ex parte filing, Teletrac stated that its currently operating AVM system can perform over 200,000 locations per hour in 4 MHz of spectrum, and it restated its claim that system location capacity increases as the square of the bandwidth.

Given the location capacity of the SBMS AVM system and given Teletrac's claims, one can only conclude that either Teletrac has deployed an inferior AVM technology, or its assertions of the relationship of capacity to bandwidth are inaccurate. It is also possible that both conclusions are correct, but, at a minimum, the

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[2/] SBMS has been on record since June of 1993 that within 2 MHz, its Chicago system was expected to have an initial capacity of 60,000 location messages per hour with the ability to readily double that amount. See Comments of Southwestern Bell Mobile Systems, Inc. in PR Docket No. 93-61, June 29, 1993, at 7-8.

latter is true. This assertion is supported by analysis already presented in this proceeding.[3/] [4/]

[3/] See, for example, Dr. Jay E. Padgett's analysis, in "Wide Area Pulse-Ranging AVM/LMS: Messaging/Locating System Design Tradeoffs and Part 15 Interference," August 8, 1994.

[4/] See "Capacity and Interference Resistance of Spread-Spectrum Automatic Vehicle Monitoring Systems in 902-928 MHz ISM Band," Dr. Brian Woerner et al, Virginia Polytechnic Institute and State University, October 14, 1994. For example, "There appears to be some advantage in position location capacity for systems which employ larger bandwidth. However, other techniques are available which also increase position location capacity of systems..." Note that the Teletrac assertion of an increase of capacity as the square of the bandwidth is not supported in this statement and in the analysis that follows. Further note that there are other, more spectrally efficient, techniques for increasing capacity. Finally note that the report states "Communication capacity of spread spectrum systems increases only linearly as a function of bandwidth..." Since Teletrac's, SBMS's, MobileVision's, and Pinpoint's systems <u>all include data in the form of messaging and/or general data streams as an integral component of their AVM service</u>, making bandwidth decisions based solely on system location capacity is unjustified.

PACTEL'S TELETRAC LOSING MILLIONS OVER PAST FEW YEARS

PacTel Corp. revealed in a filing with the Securities & Exchange Commission that its subsidiary Teletrac, which provides automatic vehicle monitoring systems, has been losing millions of dollars over the past several years. Teletrac has become the focus of attention because the Federal Communications Commission is close to issuing a frequency allocation rule that could be a boon for the company or could seriously impair its ability to function.

In the filing with the SEC, PacTel said that Teletrac reported net losses of $49.1 million for 1992, $36.8 million for 1991 and $12.7 million for 1990. Net losses were $24.6 million for the six months ending June 30. "The Company [PacTel Corp.] does not expect Teletrac's operations to be profitable for several years and does not intend to significantly expand Teletrac's operations until its services achieve a higher level of commercial acceptance," PacTel Corp. said. "The Company is continuously evaluating and considering other commercial applications of its technology and radio location spectrum."

PacTel Corp.'s income declined from $50 million in 1990 to a loss of $10.9 million in 1992 as a result of increasing start-up losses from international wireless ventures, other expenses associated with international business and operating losses from Teletrac, the filing with the SEC said. Although the company had $10.2 million in income during the six months ending June 30, it only expects to break even for 1993 primarily as a result of income tax rate changes in the United States and Germany and the effect of certain accounting changes.

Teletrac's vehicle location business in the start-up phase and its services have not yet achieved a significant degree of commercial acceptance, the filing with the SEC said. Teletrac initiated operations in Los Angeles, Chicago, Detroit and Dallas/Fort Worth in 1991 and in Miami and Houston in 1992. The vehicle location services revenues were $0.7 million in 1991, $2.4 million in 1992 and $1.7 million in the first six months of this year.

Teletrac offers two primary services: fleet tracking and stolen vehicle locations. Fleet tracking allows subscribers to monitor the location of all of their vehicles equipped with vehicle location units, such as taxicabs, ambulances and truck delivery services. The filing with the SEC noted that with fleet tracking, Teletrac's competitors include satellite services and traditional fleet management services such as specialized mobile radio, which allows a driver to communicate with a dispatcher.

PacTel Corp. said that it believes major license awards in the next several years will establish two or more cellular competitors in most of the world's developed countries and that international cellular opportunities thereafter will arise primarily through acquisitions or combinations with existing license holders or through awards by developing countries.

Internationally, the company is competing or planning to compete for wireless licenses in Mexico, Belgium, the Netherlands, South Korea, Spain, Italy, France, Japan and other markets of the world. PacTel Corp. said that once it establishes an initial wireless presence in an international market, it will seek to enter other telecommunications businesses as well. For example, it has begun offering paging services in Spain and intends to pursue cellular opportunities there. It also plans to provide paging and long distance services in Germany.

AT&T's announcement that it will merge with McCaw Cellular may increase competition in Los Angeles and Sacramento, where PacTel Corp.'s cellular operations compete with McCaw. PacTel pointed out that the merger will permit McCaw to use the AT&T brand name in marketing its cellular services and give McCaw access to AT&T's sales, customer service and distribution channels. It will also give McCaw access to the research and development capabilities of AT&T Bell Laboratories. -- *Joe Burey*

CERTIFICATE OF SERVICE

I, Jamie C. Whitney, a secretary with the law firm of Gurman, Kurtis, Blask & Freedman, Chartered, hereby certify that copies of the foregoing "EX PARTE SUBMISSION OF SOUTHWESTERN BELL MOBILE SYSTEMS, INC." were hand delivered, this 19th day of January, 1995, to the following individuals:

Chairman Reed E. Hundt
Federal Communications Commission
1919 M Street, N.W.
Room 814
Washington, D.C. 20554

Commissioner Andrew C. Barrett
Federal Communications Commission
1919 M Street, N.W.
Room 826
Washington, D.C. 20554

Commissioner Rachelle B. Chong
Federal Communications Commission
1919 M Street, N.W.
Room 844
Washington, D.C. 20554

Commissioner Susan Ness
Federal Communications Commission
1919 M Street, N.W.
Room 832
Washington, D.C. 20554

Commissioner James H. Quello
Federal Communications Commission
1919 M Street, N.W.
Room 802
Washington, D.C. 20554

Ruth Milkman
Office of the Chairman
Federal Communications Commission
1919 M Street, N.W.
Room 814
Washington, D.C. 20554

Lauren Belvin
Office of Commissioner James Quello
Federal Communications Commission
1919 M Street, N.W.
Room 802
Washington, D.C. 20554

Rudy Baca
Office of Commissioner James Quello
Federal Communications Commission
1919 M Street, N.W.
Room 802
Washington, D.C. 20554

David R. Siddall
Office of Commissioner Susan Ness
Federal Communications Commission
1919 M Street, N.W.
Room 832
Washington, D.C. 20554

Jane Mago
Office of Commissioner Rachelle B. Chong
Federal Communications Commission
1919 M Street, N.W.
Room 844
Washington, D.C. 20554

Jill M. Luckett
Office of Commissioner James Quello
Federal Communications Commission
1919 M Street, N.W.
Room 802
Washington, D.C. 20554

James R. Coltharp
Office of Commissioner Andrew Barrett
Federal Communications Commission
1919 M Street, N.W.
Room 826
Washington, D.C. 20554

Ralph A. Haller, Deputy Chief
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5002
Washington, D.C. 20554

F. Ronald Netro
Engineering Assistant to the Chief
Commercial Radio Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5002
Washington, D.C. 20554

Rosalind K. Allen, Chief
Commercial Radio Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5202
Washington, D.C. 20554

Gerald P. Vaughan, Deputy Chief
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5002
Washington, D.C. 20554

Martin D. Liebman, Engineer
Policy Division
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W.
Room 5202
Washington, D.C. 20554

Bruce A. Franca, Deputy Chief Engineer
Office of Engineering and Technology
Federal Communications Commission
2025 M Street, N.W.
Room 7002A
Washington, D.C. 20554

Richard M. Smith, Chief
Office of Engineering and Technology
Federal Communications Commission
2025 M Street, N.W.
Room 7002
Washington, D.C. 20554

Michael J. Marcus
Office of Engineering and Technology
Federal Communications Commission
2025 M Street, N.W.
Room 7102
Washington, D.C. 20554

Richard B. Engleman, Chief
Technical Standards Branch
Office of Engineering and Technology
Federal Communications Commission
2025 M Street, N.W.
Room 7122B
Washington, D.C. 20554

David E. Hilliard, Esquire
Wiley, Rein & Fielding
1776 K Street, N.W.
Washington, D.C. 20006

* Kathleen Abernathy, Esquire
AirTouch Communications
1818 N Street, N.W.
Washington, D.C. 20036

Henry M. Rivera, Esquire
Larry S. Solomon, Esquire
Ginsburg, Feldman & Bress
1250 Connecticut Avenue, N.W.
Washington, D.C. 20036

Henry Goldberg, Esquire
Henrietta Wright, Esquire
Goldberg & Spector
1229 19th Street, N.W.
Washington, D.C. 20036

John J. McDonnell, Esquire
Reed Smith Shaw & McClay
1200 18th Street, N.W.
Washington, D.C. 20036-2506

George Lyon, Esquire
Lukas, McGowan, Nace & Gutierrez
1111 19th Street, N.W.
Suite 1200
Washington, D.C. 20036

Jamie C. Whitney

Jamie C. Whitney

* Also being sent via telecopier.