MAY 1 6 2000

Before the
Federal Communications Commission
Washington, D.C. 20554

In Re	)	
	)	
Application of Maritime	)	
Telecommunications Network, Inc.	)	File No. 0100-EX-RR-1999
for Renewal of Experimental	)	
Authorization (Call Sign KI2XEE)	)	

To: Chief, Office of Engineering and Technology

PETITION FOR EXPEDITED ACTION

The Fixed Wireless Communications Coalition ("FWCC"), the Association of American Railroads ("AAR"), the American Petroleum Institute ("API"), Association of Public-Safety Communications Officers International ("APCO") and the United Telecom Council (formerly the Utilities Telecommunications Council, or "UTC"), (hereinafter collectively referred to as "Joint Petitioners"), hereby request expedited action by the Commission on the above-captioned application for renewal of the experimental license of Maritime Telecommunications Network, Inc. ("MTN").

Specifically, the Joint Petitioners request that the Commission act expeditiously and favorably on the long-pending petitions requesting denial of MTN's renewal application. By granting the pending petitions and denying MTN's renewal application, the Commission will finally bring to a halt the ill-advised "experiment" initiated several years ago to demonstrate the feasibility of allowing the operation of satellite earth stations aboard vessels ("ESVs") in the 5925-6425 MHz band (the "6 GHz Band"), which is shared with the Fixed Service (FS). It is now abundantly clear that the successful coexistence of ESVs with the Fixed Service is not feasible; that the experiment was a failure; and that MTN's experimental license should not be renewed.

I. DESCRIPTION OF JOINT PETITIONERS' INTEREST

Joint Petitioners' members are electric, gas and water utility companies, petroleum and pipeline companies, railroads, cellular telephone carriers, and public safety agencies, all of whom use the 6 GHz Band for Fixed Service (FS) point-to-point microwave relay systems for critical communications links. Many of these 6 GHz FS networks are located in coastal areas and near ports, as exemplified by those described in the attached letter from Mr. Joe Hanna, President of APCO, to Mr. Frank Williams, U.S. Department of State, dated October 25, 1999, which lists 20 public safety agencies that operate 6 GHz digital links near port cities and coastal areas of the United States. Joint Petitioners have participated in this and related proceedings in the past, and have a direct and vital interest in the subject matter of MTN's renewal application.

II. PROCEDURAL BACKGROUND

MTN operates 45 earth stations aboard vessels (ESVs) under Experimental Call Sign KI2XEE, as the successor-in-interest to Crescomm Transmission Services, Inc. The experimental authorization was granted to Crescomm pursuant to delegated authority in 1996 in Crescomm Transmission Services, Inc., 11 FCC Rcd 10944 (OET, IB, 1996) (hereinafter "Crescomm Order").

On July 25, 1997, MTN requested the Commission to expand its authority pursuant to Experimental Call Sign KI2EE by expanding the number of vessels to be equipped with ESVs from 45 to 250. On November 21, 1997, the FCC denied MTN's request to expand the number of ships, and on December 19, 1997, MTN filed a Petition for Partial Reconsideration of that denial. MTN's Petition for Partial Reconsideration is still pending.

The Commission issued Public Notices on December 16, 1998, and February 3, 1999, announcing the filing of 32 applications by MTN seeking authority to operate ESVs at 32 different dockside locations in 17 port cities in the U.S.[1] On December 18, 1998 and March 5, 1999, Joint Petitioners and others filed petitions to deny the 32 MTN applications for additional dockside authority.[2]

On January 22, 1999, MTN filed its above-captioned application for renewal of its experimental authorization. At the same time, it reiterated its Petition for Partial Reconsideration of the Commission's previous denial of its request to increase the number of ships from 45 to 250.[3] On March 24 and April 27, 1999, AAR, CDMS and

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1 Public Notice, Report No. SES-00033, December 16, 1998; Public Notice, Report No. SES-0049, February 3, 1999.

2 Petitions were filed by AAR, API, APCO, UTC, FWCC, Century Telephone of Washington, Inc., the Consortium Digital Microwave System ("CDMS"), the County of Los Angeles, and WJG MariTEL Corporation.

3 On March 24, 1999, AAR and CDMS jointly opposed MTN's reiteration of its

API filed Petitions to Deny MTN's renewal application for Experimental Call Sign KI2XEE.

III. NOW IS THE TIME TO BRING THIS ILL-CONCEIVED EXPERIMENT TO A HALT

When it granted MTN's experimental authority in the Crescomm Order, the FCC's primary concern was "the potential for harmful interference from the shipboard uplink transmissions to fixed stations on land."[4] Addressing that concern so as to "prevent any risk of harmful interference" to FS stations, the FCC imposed a "blanket restriction" forbidding ESVs from transmitting within 100 km of land unless prior coordination had been achieved, and requiring MTN to "successfully coordinate" its proposed operations with all existing FS stations along a particular route.[5] If the ESV route was not "successfully coordinated," then the ship would be required to stop transmitting when it came within the 100 km restricted distance.

If the experience gained through this "experiment" to date shows anything, it is that the coordination regime adopted by the Commission to protect FS systems is simply unworkable because (1) the ESV proponents refuse to use the correct criteria for the coordinations, and (2) even if the correct coordination criteria were used, the distance restriction is unenforceable.

"Petition for Partial Reconsideration."

4 Crescomm, supra, at 10949.

5 Id.

A. There Has Been No Meaningful Frequency Coordination To Date.

Attached to this Petition is an "Engineering Statement" by Mr. M. Philip Salas, Senior Manager for Fixed Wireless Product Engineering at Alcatel USA. Mr. Salas has broad experience in the design, operation and coordination of point-to-point microwave radio systems operating in the 6 GHz Band. Mr. Salas is the Chairman of the TR14 Fixed Wireless Engineering Committee of the Telecommunications Industry Association ("TIA"). TIA's TR14.11 subcommittee (Interference Criteria for Microwave Systems) was responsible for TSB-10F which established interference criteria for the Fixed Service.

As shown in Mr. Salas' Engineering Statement, there has been no agreement between the ESV community and the FS users and equipment vendors regarding appropriate ESV interference levels to use in coordinations. In fact, the interference levels used thus far in coordinations have been "accepted" only by the ESV proponents, not by the FS users and manufacturers. [6] Importantly, the long term and short term coordination criteria being used for ESV/FS coordinations (-154 dBw/4kHz and –131 dBw/4kHz) are analog criteria, whereas virtually all FS receivers in the 6 GHz Band are digital receivers operating with 64 QAM or 128 QAM modulation. These criteria are inadequate to protect digital FS systems. A "compromise" proposal by the ESV proponents (i.e., –145 dBw/4 kHz) is equally unacceptable, as demonstrated in the

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6 Engineering Statement at 1.

attached Engineering Statement, because that level is insufficient to protect digital receivers and because of the potentially long duration of ESV interference events.[7]

The attached Engineering Statement also shows that antenna discrimination cannot be used as an interference-mitigation technique because ESVs are mobile interferers which can move across the boresight of an FS antenna. Similarly, terrain blockage or ground clutter cannot be relied upon to reduce potential interference because it is non-existent on an over-water path.[8] Mr. Salas also demonstrates that "space diversity" installations for FS systems do not help the interference situation, and actually can make matters worse;[9] and that multi-path upfades and ducting also can exacerbate interference from an ESV transmitter into an FS receiver.[10]

Finally, Mr. Salas demonstrates in his Engineering Statement that Automatic Transmit Power Control (ATPC), which is integrated into most digital FS systems built within the last 10-15 years, causes digital links to be even more susceptible to ESV interference than otherwise.

The inescapable conclusion to be drawn from Mr. Salas' Statement is that the analog interference criteria used in ESV coordinations to date are woefully inadequate

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7 Id. at 1-3.

8 Engineering Statement at 2.

9 Id. at 6.

10 Id. at 6-7.

to protect digital FS receivers, which constitute the vast majority of 6 GHz FS equipment deployed today.

B. Given the Mobile Nature of ESVs, the Commission's Coordination Regime is Essentially Unenforceable.

Even if MTN accepted the digital interference criteria suggested by Mr. Salas in the attached Engineering Statement, the coordination regime mandated by the Commission in the Crescomm Order would still be unworkable because it is unforceable. There are two reasons why this is so.

First, the assumption underlying the FCC's coordination regime is that a ship will cease transmissions from its ESV once it crosses into the "restricted zone" if the ESV has not reached a coordination agreement for a particular harbor, port or coastal area. Given the oceangoing, mobile nature of the vessels that transport the ESVs, it is literally impossible to enforce a restriction forbidding ESVs from transmitting after they cross an imaginary line a given distance from shore.[11] Remember, these passive transmitters are installed aboard ocean-going vessels that operate under the autonomous control of a ship's captain whose attention is not directed at ESV transmissions. Even assuming the vessel could be identified as the source of an unauthorized transmission inside a "restricted zone," there are serious questions as to the FCC's enforcement jurisdiction if the vessel is operating beyond the territorial limits

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[11] In this regard, it does not matter whether the "coordination distance" is 100 km, 400 km or 1,000 km from shore.

of the U.S. Furthermore, these ESV devices are not equipped with any means of automatic shut-off in the event the ship enters into a "restricted zone" without a coordination agreement, and even if they were so equipped, it would be impossible to prevent someone from tampering with and disabling the shut-off feature.

The second reason why the Commission's coordination regime is unenforceable is because it is impossible to identify a particular ship's ESV as the cause of interference to an FS receiver. Because the interference emanates from a mobile source, it is intermittent with respect to any given FS receiver. Obviously, an ESV operator will demand proof that it has caused the interference, but as Mr. Salas demonstrates in his Engineering Statement, the only way to find this type of interference is to stop all communications traffic on the FS system and hope to observe and record the intermittent interference and then correlate it with a documented location of a particular ship at a particular time. In other words, interference cannot be "seen" on an operating FS system; and in order to "see" it, the FS system operator must shut down the system.[12] Obviously, stopping traffic on an FS system is extremely problematic because the operator would be required to suffer a total system outage for the entire duration. Recalling that the FS systems operated by Joint Petitioners' members are used to control vital infrastructure functions such as pipeline flow, railroad traffic, police, fire and emergency support communications, delivery of electric and water utility services, and cellular telephone backhaul service, it would be wholly

12 See Engineering Statement at 8-9.

unrealistic to expect cessation of such operations in order to try to identify an itinerant ESV as the source of interference.

In summary, if the "experiment" has succeeded in showing anything, it is that that ship operators cannot be forced to turn off their ESVs in international waters as they approach "restricted zones" near shore, and that digital FS systems cannot identify an ESV as an interference source without shutting down the system thereby disrupting vital infrastructure services.

IV. FURTHER PROLIFERATION OF ESVs POSES A GREAT RISK OF SYSTEM OUTAGES

It is apparent from the procedural history recited at the outset of this Petition[13] that MTN's objective is not merely to renew its existing experimental authorization, but also to expand greatly the scope of its commercial operation by increasing the number of ships from 45 to 250 and increasing substantially the number of U.S. ports where ESVs would be allowed to operate. That sort of expansion and proliferation should not be permitted. Perhaps the only factor that has prevented major FS system outages thus far is the very limited nature of MTN's current ESV deployment, limited as it is to only 45 vessels.

As explained in Mr. Salas' Engineering Statement, ESV interference events that last for longer than two seconds have a "very high probability" of causing major system-wide problems owing to the manner in which the FS digital networks are configured to

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13 See Section II, supra, "Procedural Background."

deal with outages. In this regard, a "Carrier Group Alarm" ("CGA") will terminate all traffic in process if there is an outage exceeding two seconds in duration; thereafter, all traffic must be manually re-initiated once the CGA is cleared. In a cellular system using a 6 GHz network for backhaul traffic, for example, the re-initiation process can take from many minutes to many hours, depending upon the size of the switch, the number of cell-site switches affected, and the size of the cellular system.[14] For rail, pipeline, and utility services, multi-hour system outages can have a cascading effect on an entire infrastructure delivery system because of backups, delays and consequent system-wide congestion. Rather than risk this kind of serious disruption in the delivery of essential services to the public as a result of expanded ESV authorization, the Commission should eliminate the risk altogether by denying MTN's renewal application.

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14 See Engineering Statement at 8.

IV. CONCLUSION

For the foregoing reasons, the Commission should act expeditiously to terminate the MTN experiment concerning ESV deployment at 6 GHz by denying MTN's application for renewal of its experimental license.

Respectfully submitted,

AMERICAN PETROLEUM INSTITUTE

Wayne V. Black (JS)
Wayne V. Black
Peter A. Saari
Keller and Heckman LLP
1001 G Street, N.W.
Suite 500 West
Washington, D.C. 20001
(202) 434-4100

ASSOCIATION OF AMERICAN RAILROADS

Julian Shepard
Julian L. Shepard
Verner, Liipfert, Bernhard,
McPherson and Hand, Chartered
901 - 15th Street, N.W.
Suite 700
Washington, D.C. 20005-2301
(202) 371-6111

UNITED TELECOM COUNCIL

Jeff Sheldon (JS)
Jeffrey L. Sheldon
Thomas Goode
UTC
1140 Connecticut Avenue, N.W.
Suite 1140
Washington, D.C. 20036
(202) 872-0030

FIXED WIRELESS COMMUNICATIONS COALITION

Leonard Raish (JS)
Leonard R. Raish
Mitchell Lazarus
Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street
11th Floor
Arlington, VA 22209
(703) 812-0440

ASSOCIATION OF PUBLIC SAFETY COMMUNICATIONS OFFICIALS INTERNATIONAL, INC.

Robert Gurss (js)
Robert M. Gurss
Shook, Hardy & Bacon, L.L.P.
600 14th Street, N.W.
Suite 800
Washington, D.C. 20005
(202) 662-4856

Dated May 10, 2000

ATTACHMENT

Letter from

Mr. Joe Hanna
President of APCO

to

Mr. Frank Williams
U.S. State Department

Dated October 25, 1999

APCO International

ASSOCIATION OF PUBLIC-SAFETY COMMUNICATIONS OFFICIALS INTERNATIONAL, INC.

EXECUTIVE DIRECTOR
John K. Ramsey

APCO INTERNATIONAL
HEADQUARTERS
2040 SOUTH RIDGEWOOD AVENUE
SOUTH DAYTONA, FLA. 32119-8347
888 APCO 9-1-1 OR 904-322-2500

APCO INTERNATIONAL
GOVERNMENT AFFAIRS OFFICE
1666 K STREET, NW SUITE 1100
WASHINGTON, D.C. 20006-2897

October 25, 1999

Mr. Frank Williams **(VIA FAX: 202 647-3491)**
United States Department of State
2201 C Street, N.W.
Washington, DC 20520

and

Mr. John T. Gilsenan
United States Department of State
2201 C Street, N.W.
Washington, DC 20520

RE: 6 GHz Earth Stations On Board Vessels (ESVs)

Dear Messrs. Williams and Gilsenan:

On October 6, 1999, APCO submitted a letter (US CPM/58) to you regarding our concerns with 6 GHz Earth Stations on Board Vessels (ESVs), and the potential for interference to critical public safety fixed microwave operations. I understand that some parties subsequently questioned the validity of our concerns, and the extent to which the 5925-6425 MHz band is in fact used by public safety agencies. This letter and the enclosed attachments are in response to those concerns, and should be considered as an Annex to my prior letter, US CPM/58.

Attachment A hereto includes a list of fixed microwave licensees in the 5925-6425 MHz band, as provided to APCO by Comsearch. Among those listed are the following public safety agencies located in coastal states:

Alaska State Information Services
State of California
Connecticut State Police Department
Grays Harbor County (WA) (coastal county)
Hawaii County Police Department
State of Hawaii
Hernando County (FL) (coast N. of Tampa)
Lee County (FL) (Ft. Myers area)
City of Los Angeles
County of Los Angeles
State of Louisiana
Massachusetts Highway Department
New York Division of State Police

Orange County (CA)
Oregon State Police
Pinellas County (FL) (St. Petersburg area)
Riverside County (CA)
San Diego County
Suffolk County (NY) (Long Island)
Washington State Patrol

Many of these public safety licenses operate digital links with Automatic Transmitter Power Control (ATPC), which I understand may place those links at even greater risk of interference from ESVs. For example, Attachment B hereto is a list of Los Angeles County 6 GHz links with ATPC. Seven (7) of those are in the 5925-6425 MHz band. The County uses its microwave links to provide the backbone for the Sheriff's Department multi-site mobile communications system.

I hope that this information is useful in your deliberations. For further information, please contact our counsel in Washington, Robert Gurss, at 202-457-7329.

Sincerely,

Joe Hanna
President

cc: Ed Jacobs, FCC IB

5925-6425

Attachment A

ownercode	company_name	state1
S00024	ALABAMA ELECTRIC COOPERATIVE, INC.	AL
✓S00031	ALASKA STATE INFORMATION SERVICES DIV.	AK
ALBUQU	ALBUQUERQUE CITY	NM
S10218	ARCTIC REGION SUPERCOMPUTING CENTER	AK
S00059	ARIZONA ELECTRIC POWER COOPERATIVE, INC.	AZ
S00060	ARIZONA PUBLIC SERVICE COMPANY	AZ
S00060	ARIZONA PUBLIC SERVICE COMPANY	NM
S64003	ARKANSAS STATE POLICE	AR
ARLMHF	ARLINGTON MEMORIAL HOSPITAL FOUNDATION	TX
S00071	ATCHISON TOPEKA AND SANTA FE RAILROAD	KS
S07314	ATLANTIC CITY ELECTRIC COMPANY	NJ
SAUSTX	AUSTIN CITY OF TEXAS POLICE DEPARTMENT	TX
S10563	AVISTA CORPORATION	WA
SAUOPA	AVOYELLES PARISH COMMUNICAITON DISTRICT	LA
S08775	BANGOR & AROOSTOOK RAILROAD COMPANY	ME
S00890	BASIN ELECTRIC POWER COOPERATIVE	CO
S00890	BASIN ELECTRIC POWER COOPERATIVE	ND
S00890	BASIN ELECTRIC POWER COOPERATIVE	NE
S00890	BASIN ELECTRIC POWER COOPERATIVE	WY
BEXWAT	BEXARMET WATER DISTRICT	TX
SBOENM	BOARD OF REGENTS EASTERN NEW MEXICO UNIV	NM
S00123	BP COMMUNICATIONS ALASKA INC	AK
S001[illegible]	BRAZOS ELECTRIC POWER COOPERATIVE INC	TX
BRLNSF	BURLINGTON NORTHERN AND SANTA FE RAILWAY	IA
BRLNSF	BURLINGTON NORTHERN AND SANTA FE RAILWAY	IL
BRLNSF	BURLINGTON NORTHERN AND SANTA FE RAILWAY	MN
BRLNSF	BURLINGTON NORTHERN AND SANTA FE RAILWAY	WI
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	CO
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	IA
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	IL
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	KS
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	MN
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	MO
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	MT
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	ND
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	NE
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	OK
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	TX
S13505	BURLINGTON NORTHERN RAILROAD COMPANY	WI
✓S00141	CALIFORNIA STATE	CA
CALAUT	CALIFORNIA STATE AUTOMOBILE ASSOCIATION	CA
CARTEL	CARITAS TELECOMMUNICATIONS	CA
S00149	CAROLINA POWER & LIGHT COMPANY	NC
S00149	CAROLINA POWER & LIGHT COMPANY	SC
CARCOU	CARVER COUNTY SHERIFF'S OFFICE	MN
S01655	CENTRAL LINCOLN PUBLIC UTILITY DISTRICT	OR
S00168	CENTRAL NEBRASKA PUBLIC POWER	NE
S18545	CHEVRON USA, INC.	GM

S18545	CHEVRON USA, INC.	LA
S00196	CHUGACH ELECTRIC ASSOCIATION, INC.	AK
S01980	CINCINNATI NEW ORLEANS AND TEXAS PACIFIC	TN
S00792	CINERGY - PSI ENERGY INC.	IN
S00792	CINERGY - PSI ENERGY INC.	KY
S00792	CINERGY - PSI ENERGY INC.	OH
S02150	COAST COMMUNITY COLLEGE DISTRICT	CA
SCOLDU	COLLEGE OF DUPAGE	IL
S00220	COLORADO INTERSTATE GAS COMPANY	CO
S00220	COLORADO INTERSTATE GAS COMPANY	WY
CORIVE	COLORADO RIVER COMMISSION	NV
SCOSPU	COLORADO SPRINGS UTILITIES-BIS TELECOMMU	CO
S00223	COLORADO STATE TELECOMMUNICATIONS SVCS	CO
S02238	COLUMBIA COUNTY	PA
S00237	CONNECTICUT STATE POLICE DEPARTMENT	CT
S02386	CONSOLIDATED EDISON COMPANY OF NEW YORK	NY
S00258	DAIRYLAND POWER COOPERATIVE	MN
S00258	DAIRYLAND POWER COOPERATIVE	WI
S26002	DALLAS CITY COMMUNICATIONS SERVICES	TX
S02611	DALLAS COUNTY COMMUNITY COLLEGE DISTRICT	TX
S00269	DAYTON POWER & LIGHT COMPANY	OH
S00273	DELMARVA POWER & LIGHT COMPANY	DE
S02803	DESERET GENERATION & TRANSMISSION COOP	CO
S02803	DESERET GENERATION & TRANSMISSION COOP	UT
S02810	DETROIT EDISON COMPANY	MI
SDURNC	DURHAM CITY	NC
S00305	EAST OHIO GAS CO	OH
S03056	EAST RIVER ELECTRIC POWER COOPERATIVE	MN
S03056	EAST RIVER ELECTRIC POWER COOPERATIVE	SD
S00308	EL PASO ELECTRIC COMPANY	NM
S00601	ENTERGY SERVICES INC	AR
S00601	ENTERGY SERVICES INC	LA
SFACPA	FAYETTE COUNTY EMERGENCY MANAGEMENT	PA
S03385	FLORIDA POWER AND LIGHT COMPANY	FL
S34358	FORT WORTH CITY	TX
S00354	FRESNO COUNTY CALIFORNIA	CA
S00382	GRAND RIVER DAM AUTHORITY	OK
SGRAHA	GRAYS HARBOR COUNTY COMMUNICATIONS CNTR	WA
S03871	GREENSBORO CITY - TECHNICAL SERVICES DIV	NC
S39932	HANOVER COUNTY	VA
S04010	HAWAII COUNTY POLICE DEPARTMENT	HI
S00403	HAWAII STATE	HI
S04094	HENNEPIN COUNTY SHERIFFS DEPARTMENT	MN
S04111	HERNANDO COUNTY FLORIDA	FL
HOMELE	HOMER ELECTRIC ASSOCIATION INC.	AK
S00426	HOUSTON LIGHTING AND POWER COMPANY	TX
S00437	IDAHO STATE BUREAU OF COMMUNICATIONS	ID
IDAHST	IDAHO STATE DEPARTMENT OF ADMINISTRATION	ID
S43745	IHC HOSPITALS, INC.	UT

IJNTIN	IJNT INTERNATIONAL	CA
S04440	ILLINOIS STATE TOLL HIGHWAY AUTHORITY	IL
S00448	INDIANA STATE POLICE COMMUNICATIONS DEPT	IN
S04618	IOWA CENTRAL COMMUNITY COLLEGE	IA
S46760	JACKSON ELECTRIC MEMBERSHIP CORPORATION	GA
S00472	JERSEY CENTRAL POWER & LIGHT COMPANY	NJ
S04747	KAISER FOUNDATION HEALTH PLAN	CA
S00475	KAMO ELECTRIC COOPERATIVE	OK
S00476	KANSAS CITY POWER & LIGHT COMPANY	KS
S00476	KANSAS CITY POWER & LIGHT COMPANY	MO
S00492	KENTUCKY UTILITIES COMPANY	KY
✓S04940	KERN COUNTY COMMUNICATIONS DIVISION	CA
S49401	KERN COUNTY SUPERINTENDENT OF SCHOOLS	CA
SKERED	KERN ED TELECOM CONSORTIUM	CA
LARCTY	LAREDO CITY	TX
S00510	LARIMER COUNTY SHERIFF'S DEPARTMENT	CO
✓S51550	LEE COUNTY	FL
✓S53002	LOS ANGELES CITY OF COMMUNICATIONS SRV	CA
✓S00533	LOS ANGELES COUNTY FCC/LICENSING SECTION	CA
✓S00538	LOUISIANA STATE OF, COMM. SECTION	LA
S00541	LOUISVILLE GAS & ELECTRIC COMPANY	KY
S00542	LOWER COLORADO RIVER AUTHORITY	TX
S55090	MAINE DARTMOUTH FAMILY PRACTICE RESIDENC	ME
S00557	MARICOPA COUNTY RADIO & MICROWAVE DIV	AZ
✓SMASCO	MASSACHUSETTS HIGHWAY DEPARTMENT	MA
S58625	MCNC	NC
SMETNE	METRO NETWORKS COMMUNICATIONS, INC.	FL
SMETNE	METRO NETWORKS COMMUNICATIONS, INC.	UT
S00580	METROPOLITAN EDISON COMPANY	PA
S05818	METROPOLITAN WATER DISTRICT OF SO CA	CA
S05795	MINNESOTA DEPARTMENT OF TRANSPORTATION	MN
S06033	MISSISSIPPI STATE AUTHORITY FOR ED TV	MS
S00604	MISSOULA COUNTY DEPT. OF COMMUNICATIONS	MT
S00613	MOBIL OIL TELCOM LTD	GM
S00613	MOBIL OIL TELCOM LTD	LA
S00623	MONTANA POWER COMPANY	MT
S06447	NEBRASKA PUBLIC POWER DISTRICT	NE
S00648	NEVADA POWER COMPANY	NV
S06503	NEVADA STATE, DEPT. OF INFO TECHNOLOGY	NV
S00658	NEW MEXICO STATE OF	NM
✓S00666	NEW YORK DIVISION OF STATE POLICE	NY
S00676	NORFOLK & WESTERN RAILWAY CO	IN
S00676	NORFOLK & WESTERN RAILWAY CO	KY
S00676	NORFOLK & WESTERN RAILWAY CO	OH
S00676	NORFOLK & WESTERN RAILWAY CO	VA
S00676	NORFOLK & WESTERN RAILWAY CO	WV
SNORSO	NORFOLK SOUTHERN RAILWAY	GA
SNORSO	NORFOLK SOUTHERN RAILWAY	VA
S68745	NORTHERN BORDER PIPELINE COMPANY	MN

S68745	NORTHERN BORDER PIPELINE COMPANY	MT
S68745	NORTHERN BORDER PIPELINE COMPANY	ND
S68745	NORTHERN BORDER PIPELINE COMPANY	SD
SNNMEX	NORTHERN NEW MEXICO LIMITED PARTNSEHIP	CO
SNNMEX	NORTHERN NEW MEXICO LIMITED PARTNSEHIP	NM
S00690	NORTHERN STATES POWER COMPANY (MN)	MI
S00690	NORTHERN STATES POWER COMPANY (MN)	MN
S00690	NORTHERN STATES POWER COMPANY (MN)	WI
S06900	NORTHERN STATES POWER COMPANY (WI)	MI
S06900	NORTHERN STATES POWER COMPANY (WI)	MN
S06900	NORTHERN STATES POWER COMPANY (WI)	WI
S00694	NORTHWEST PIPELINE CORPORATION	ID
S00694	NORTHWEST PIPELINE CORPORATION	WA
S00707	OHIO TURNPIKE COMMISSION	OH
S00716	OMAHA PUBLIC POWER DISTRICT	NE
S00720	ORANGE COUNTY GSA COMMUNICATIONS DIV	CA
S00721	ORANGE COUNTY TRANSIT DISTRICT	CA
S72300	OREGON STATE POLICE	OR
S00732	PACIFIC GAS AND ELECTRIC COMPANY	CA
S73900	PACIFICORP UTAH POWER CORPORATION	UT
S07401	PALM BEACH COUNTY SHERIFFS OFFICE	FL
S00757	PECO ENERGY COMPANY	MD
S00757	PECO ENERGY COMPANY	PA
S74702	PENNSYLVANIA COMMONWEALTH	PA
S00747	PENNSYLVANIA TURNPIKE COMMISSION	PA
S10362	PG&E TEXAS PIPELINE LP	TX
S00758	PHOENIX CITY COMMUNICATIONS SECTION	AZ
PIECOU	PIERCE COUNTY COMMUNICATIONS DIVISION	WA
S07614	PINELLAS COUNTY RADIO SYSTEMS	FL
S00773	PORTLAND GENERAL ELECTRIC COMPANY	OR
S00784	PUBLIC SERVICE COMPANY OF COLORADO	CO
S00789	PUBLIC SERVICE COMPANY OF NEW MEXICO	NM
S00790	PUBLIC SERVICE COMPANY OF OKLAHOMA	OK
S00797	PUBLIC UTILITY DIST #1 OF GRAYS HARBOR	WA
S00801	PUERTO RICO ELECTRIC POWER AUTHORITY	PR
S00802	PUGET SOUND ENERGY	WA
S80287	QUESTAR INFOCOMM, INC.	UT
S80287	QUESTAR INFOCOMM, INC.	WY
S00830	RIVERSIDE COUNTY OF CALIFORNIA	CA
S00834	SACRAMENTO COUNTY	CA
S00845	SAN DIEGO COUNTY	CA
S00846	SAN DIEGO GAS & ELECTRIC COMPANY	CA
S85956	SANTEE ELECTRIC COOPERATIVE INC.	SC
SHELOF	SHELL OFFSHORE SERVICES COMPANY	GM
S08888	SOLA COMMUNICATIONS, INC.	LA
S08945	SOUTH CAROLINA PUBLIC SERVICE AUTHORITY	SC
S08966	SOUTH FLORIDA WATER MANAGEMENT DISTRICT	FL
S00902	SOUTHERN CALIFORNIA EDISON COMPANY	CA
S00904	SOUTHERN CALIFORNIA GAS COMPANY	CA

SOUCOM	SOUTHERN COMPANY SERVICES INC	AL
SOUCOM	SOUTHERN COMPANY SERVICES INC	GA
S00910	SOUTHERN PACIFIC TRANSPORTATION COMPANY	CA
S00910	SOUTHERN PACIFIC TRANSPORTATION COMPANY	OR
S00915	SOUTHWESTERN ELECTRIC POWER COMPANY	AR
S00915	SOUTHWESTERN ELECTRIC POWER COMPANY	LA
S00915	SOUTHWESTERN ELECTRIC POWER COMPANY	TX
SCONDM	SPIRIT ENERGY 76	GM
SCONDM	SPIRIT ENERGY 76	LA
S93703	SUFFOLK, COUNTY OF, POLICE DEPARTMENT	NY
SUNHEA	SUN HEALTH CORPORATION	AZ
S09470	TACOMA CITY; DEPT OF PUBLIC UTILITIES	WA
S00960	TEXACO COMMUNICATIONS INC.	CA
S99400	TRI-STATE TRANSMISSION & GENERATION ASSN	CO
S09990	TUCSON ELECTRIC POWER COMPANY	AZ
TUNCOM	TUNDRA COMMUNICATIONS INC	AK
S01014	UNION PACIFIC RAILROAD COMPANY	CA
S01014	UNION PACIFIC RAILROAD COMPANY	ID
S01014	UNION PACIFIC RAILROAD COMPANY	WA
S34090	UTAH COMMUNICATIONS INC	UT
S10363	UTAH STATE HIGHWAY PATROL	UT
S10360	UTAH STATE INFORMATION TECHNOLOGY SRVCS	UT
S01045	VIRGINIA ELECTRIC & POWER COMPANY	NC
S01045	VIRGINIA ELECTRIC & POWER COMPANY	VA
S01045	VIRGINIA ELECTRIC & POWER COMPANY	WV
S10560	WASHINGTON STATE PATROL	WA
S10660	WEST TEXAS UTILITIES COMPANY	TX
WEVEMS	WEST VIRGINIA EMS TSN,INC.	VA
WEVEMS	WEST VIRGINIA EMS TSN,INC.	WV
S01083	WISCONSIN PUBLIC SERVICE CORP	WI

LA County 6GHz links w/ATPC

#	Site1		Coordinates		Frequency	Site2		Coordinates		Frequency
1	ONK	Oat Nike	34 19 34	118 35 9	6565.000	WMP	Whitaker Middle Peak	34 34 10	118 44 22	6785.000
2	CCT	Criminal Courts	34 3 18	118 14 33	6855.000	ONK	Oat Nike	34 19 34	118 35 9	6655.000
3	ONK	Oat Nike	34 19 34	118 35 9	6675.000	CPK	Castro Peak	34 5 9	118 47 6	6845.000
4	JPK	Johnstone Peak	34 9 37	117 47 53	6545.000	LBR	Lower Blue Ridge	34 22 28	117 42 19	6705.000
5	EOC	Emergency Oper. Ctr.	34 3 3	118 10 32	6645.000	LRC	Lynwood Regional Ctr.	33 55 38	118 13 33	6815.000
6	CCB	Compton Courts	33 53 39	118 13 28	6595.000	CCT	Criminal Courts	34 3 18	118 14 33	6765.000
7	EAV	Eastern Avenue MW	34 3 12	118 10 8	5974.850	DOW	Downey Data Center	33 54 58	118 7 51	6226.890
8	EAV	Eastern Avenue MW	34 3 12	118 10 8	6152.750	OAT	Oat Mountain	34 19 12	118 33 53	6404.790
9	OAT	Oat Mountain	34 19 12	118 33 53	5935.320	TOP	Topanga Peak	34 5 2	118 38 14	6187.360
10	OAT	Oat Mountain	34 19 12	118 33 53	6286.190	MMC	Mount McDill	34 33 58	118 16 28	6034.150
11	EAV	Eastern Avenue MW	34 3 12	118 10 8	6142.870	BJM	Black Jack Mountain	33 23 12	118 24 0	6394.910
12	EAV	Eastern Avenue MW	34 3 12	118 10 8	6715.000	RIH	Rio Hondo	34 1 5	118 0 46	6745.000
13	DOW	Downey Data Center	33 54 58	118 7 51	6286.190	CCB	Compton Courts	33 53 39	118 13 28	6034.150
14	MMC	Mount McDill	34 33 58	118 16 28	6226.890	LAN	Lancaster Sheriff	34 41 58	118 8 15	5974.850

Attachment B

ATTACHMENT

Engineering Statement

Prepared by
Mr. M. Philip Salas

Dated April 10, 2000

ENGINEERING STATEMENT

The Effect of ESV Interference on FS Availability

Introduction

The purpose of this paper is to assess the impact on Fixed Service (FS) systems due to various proposed interference levels relating to the operation of satellite earth stations aboard vessels (ESVs) in the 5925-6425 MHz Band.

ESV Interference Levels

The current "accepted*" ESV interference levels are:

-154 dBw/4 kHz Long Term Interference (NMT 20% of the time)
-131 dBw/4 kHz Short Term Interference (NMT 0.01% of the time).

*Accepted by the ESV proponents, NOT the terrestrial Fixed Service users and manufacturers.

It is important to note that the above numbers are ANALOG criteria. Virtually all FS receivers in the 5.9-6.4 GHz band are digital receivers operating with 64 QAM or 128 QAM modulation.

An additional "compromise" proposal by the ESV proponents is that –145 dBw/4 kHz be used for all ESV coordinations. The ESV rational is that since all ESV interference is short-term, the -154 dBw/4 kHz long-term criteria is inappropriate and -145 dBw/4 kHz is a good compromise to the -131 dBw/4 kHz short-term criteria.

This "compromise" proposal is flawed. First of all, even the -154 dBw/4 kHz long-term interference level is insufficient to protect Fixed Service digital receivers as will be shown in this paper. And second, while calculations may show that interference may only take place during a small percentage of the year, the duration of each interference event can be quite long. This duration is a function of ship speed, distance, and angle of approach/departure with respect to the FS receive antenna. Long duration interference events can have a significant detrimental effect on a digital FS system, as will also be discussed in this paper.

Interference Levels With Respect To Radio Thresholds and Fade Margin

The kTB noise floor is –204 dBw/hz + Noise Figure. Assuming a typical noise figure of 4 dB, then the typical digital radio thermal noise floor is –200 dBw/hz.

-154 dBw/4 kHz = -190 dBw/hz. This long-term interference level is 10 dB above the thermal noise floor.

-145 dBw/4 kHz = -181 dBw/hz. This interference level is 19 dB above the thermal noise floor.

-131 dBw/4 kHz = -167 dBw/hz. This interference level is 33 dB above the thermal noise floor.

It is very important to note that the "ESV-accepted" –154 dBw/4 kHz ANALOG long-term interference level is inappropriate for digital radio systems since it results in a 10 dB fade margin degradation!

As part of a microwave system implementation, each Fixed Service path must achieve the desired fade margin and availability. A long-term interference level of approximately -170 dBw/4 kHz is required for this to occur (see TIA TSB-10-F Section 4 and Appendix B). While the FS can utilize this criteria between FS systems due to frequency avoidance and antenna discrimination, this is much more difficult when coordinating the FS with satellite up-links in many areas of the country because satellite uplinks coordinate full-band and full-arc. Some of the worst problems occurred when coordinating digital radio hops in the Gulf of Mexico because of the absence of ground clutter to help reduce up-link transmitter interference into the FS receivers. Only FS antenna discrimination provided the ability to achieve the DIGITAL criteria necessary for proper FS operation.

ESVs are a major interference problem because they are mobile interferers. An ESV can move across the boresite of an FS antenna, which eliminates antenna discrimination as an interference-mitigation technique. Also, terrain blockage or ground clutter is non-existent on an over-water path, and cannot be relied upon to reduce the potential interference. In other words, terrain blockage can be minimal-to-none.

FS 6 Ghz Path Design and Availability

Today, paths are designed to precisely provide the availability requirements of the end user (see TIA TSB10-F Section 4.2). This minimizes antenna size (reduces antenna cost and tower loading) and minimizes transmit power levels (solid state linear power amplifiers are the most expensive part of a modern digital radio).

In good-to-fair propagation areas, digital radio paths are usually designed with a 30 dB minimum fade margin. In fair-to-poor propagation areas, digital radio paths are designed with a 35 dB minimum fade margin. Here, a 35 dB minimum fade margin is assumed, since it is expected that coastal areas fall into the fair-to-poor category.

We can easily quantify the effects of fading by examining the commonly-accepted formula for "time below fade level" for point-to-point microwave signals [TIA TSB10-F Section 4]. The formula, which provides reasonable estimates of the accumulated annual time a signal is expected to fade below a certain level, is:

$T = r T_o \times 10^{-(FM/10)}$, where

r	= fade occurrence factor,
T_o	= $(t/50)(8 \times 10^6)$ = length of the fading season in seconds,
t	= average annual temperature (degrees F),
FM	= Fade Margin, in dB, and
r	= $c\,(f/4)\,D^3 \times 10^{-5}$, in which
c	= Climate-Terrain factor (= 1 for average terrain and climate, or as high as 4 over water and in the Gulf coast area),
f	= operating frequency, in Ghz, and
D	= Path length, in miles

Note that the time below fade level, T, has a direct relationship to the numeric equivalent of the fade margin. In an interference- (rather than noise-) controlled path, fade margin is degraded "dB-for-dB" with increasing interference level.

Assuming an average temperature of 50 degrees F and a coastal area (c = 4) the above equation simplifies to:

$T = 480 \times D^3 \times 10^{-FM/10}$

Let us now look at the impact of the three interference levels (-154, -145, and –131 dBw/4 kHz) on an FS path.

The long-term interference level of –154 dBw/4 kHz is 10 dB above the thermal noise floor of an FS receiver. This results directly in a 10 dB fade margin loss, or a total fade margin of a typical FS link of 25 dB (35 dB – 10 dB FM loss).

Assuming a typical path length of 25 miles, the time below a 25 dB fade is:

T = 480 x 15,625 x 0.003 = 22,500 seconds/year.

Fading is generally found to occur during the "worst 3-month" period. Therefore, fading in excess of 25 dB will occur, on average, 250 seconds per day.

Depending on the number of ESV "crossings," the probability that an ESV will cause a –154 dBw/4 kHz interference level during the 250 seconds/day that the FS receiver is in a 25 dB or greater fade can be very significant.

Let us now look at the proposed "compromise," *i.e.*, the –145 dBw/4 kHz interference level. At this point, the FS station has lost 19 dB of fade margin, so only 16 dB of fade margin remains at this level of interference.

T = 480 x 15,625 x 0.025 = 188,391 seconds

Assuming this fading occurs during the worst 3-month period, this results in 2,093 seconds (35 minutes) of fading per day. So the probability that an ESV will cause a –145 dBw/4 kHz interference level during the 2,093 seconds per day that an FS receiver is faded 16 dB or more is approximately ten times worse than the current - 154 dBw/4 kHz long-term analog criterion.

Finally, for a –131 dBw/4 kHz interference level (33 db fade margin loss = only 2 dB of fade margin):

T = 480 x 15,625 x 0.631 = 4,732,500 seconds. This corresponds to 52,583 seconds (14.6 hours!) per day. The "time-below" equation is probably quite inaccurate for these extremely shallow fades. However, suffice it to say that the path is faded below 2 dB for a significant period of time. This implies that an interference level of –131 dBw/4 kHz will probably cause an outage almost every time it occurs!

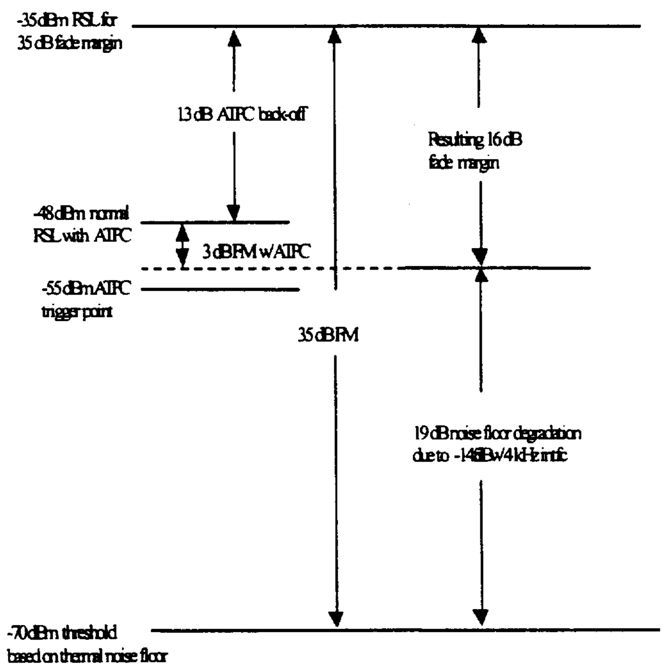
Finally, it is important to note that Fixed Service digital receivers are coordinated against each other utilizing DIGITAL criteria (TIA TSB-10-F Section 4 and Appendix B). Again, the -131 dBw/4 kHz short-term and -154 dBw/4 kHz long-term criteria are not appropriate and ARE NOT USED by the Fixed Service for coordinating Fixed Service digital paths.

The Impact of ATPC on FS Receiver Fade Margin

Most digital radios built within the last 10-15 years include ATPC (Automatic Transmit Power Control). FS radios utilizing ATPC are backed-off from their maximum transmit power by 6-10 dB minimum under normal conditions; therefore the receivers radios are operating at a degraded C/N (ATPC-equipped Tadiran radios are backed off 6 dB minimum, Harris and Alcatel radios are backed-off 10 dB minimum). Under ATPC, transmitter power is increased when the desired signal fades to some pre-determined fade depth. Transmitter power is ONLY increased as a function of fade depth, not interference or bit-error-rate performance.

The impact of ATPC on interference fade margin is that the interference fade margin is reduced by the ATPC back-off. I.e., a thermal fade margin of 35 dB is preserved with ATPC because the transmitter is raised to full power before the threshold of the radio occurs due to thermal fading. However, since transmitter power is not controlled by interference, the fade margin will be reduced by the ATPC back-off when interference dominates. The interference threshold is dominant at the -154 dBw/4 kHz long-term objective (and obviously at the -145/-131 dBw/4 kHz levels even more so).

The chart below better highlights the problem. This illustrates a typical 3-DS3 radio (30 MHz BW) with the normal fade margin, fade margin with -145 dBw/4 kHz interference, and fade margin with ATPC (10 dB minimum; 13 dB typical back-off), and -145 dBw/4 kHz interference. Note that there is effectively <u>no</u> fade margin for ATPC-operating radios at the –145 dBw/4 kHz ESV level.



Interference and Space Diversity

In order to meet required availability, most 6 GHz FS systems utilize space diversity. However, utilization of space diversity does not help the interference problem, and can actually make the problem worse.

Two different types of space diversity are popular in the 6 GHz band: Switched receivers, used in normal hot-standby/space diversity operation, and; Combined receivers, used in multi-line and ring protected systems.

In switched diversity receivers, receiver switching is normally inhibited until relatively low receive signal levels. Since modern digital radios employ powerful error correction algorithms, the data remains error-free until the receiver is very close to threshold. Therefore, there is no need to switch receivers at higher receive signal levels (as must be done in analog receivers in order to keep the S/N as high as possible). Inhibiting the switch as long as possible minimizes activity alarms and status alarms on the system. Therefore, from an interference standpoint, a modern digital space diversity switched receiver operates much like a non-diversity receiver.

Combined receivers are popular in multi-line and ring applications. Since the protect channel in multi-line, and the opposite direction in ring systems provides data protection, completely redundant receivers are unnecessary. Therefore, space diversity RF downconverters are combined at IF (normally 70 MHz) prior to being fed to the rest of the receiver. Interference fading is uncorrelated with the desired FS signal fading. So, when one FS receiver is in a fade, the interference will most often be at normal level in both receivers. The interference will be *combined*. Result: the impact of the interference will be *worse* during FS receiver fading.

Multi-Path Upfades and Ducting

Normal 2-ray multi-path frequently causes both upfades and downfades. Frequent upfades of 6 dB are common due to the vector addition of in-phase primary and secondary (reflected or refracted) signals.

Ducts occur when superrefractive layers occur over subrefractive layers. These conditions occur frequently along and near land-water boundaries. Ducts normally form at the surface of the water, and then they gradually drift upward and inland. Ducts act like waveguide, trapping and guiding signals. As the ducts move upward, normally one receiver (of a space diversity receiver) will be in the duct causing an upfade in this receiver. The second receiver may be outside of the duct causing a downfade in that receiver. This condition reverses as the duct moves up to the upper diversity antenna. Upfades in excess of 20 dB have been recorded in ducting situations. During a 16-month test in the Gulf of Mexico, upfades greater than 11 dB occurred for a total of almost six hours.

Because interference and the desired signal follow different paths, upfades due to ducting are uncorrelated. Therefore, there can be upfading on the ESV interfering signal while there is simultaneous downfading on the desired signal.

Interference Determination

It is important to remember that interference is very difficult to identify, especially when intermittent and from a mobile source. An interfering signal approximately 25 dB **below** the desired signal will cause loss of traffic on a modern digital receiver.

Also, how is one to prove that the problem is interference? An ESV operator will want proof that he is the cause of the interference. The only real way to find interference is to kill traffic and hope to observe and record the intermittent interference, and then correlate this with a documented exact location of the ship at the time along with the exact frequency of operation of the ESV transmitter. Killing traffic on an FS system is very difficult to do since a system outage results for the duration. Normally this is permitted in rare cases only, and then only for short periods of time at night. One has to be very lucky to find a mobile interferer during these rare, agreed-to system shut-downs.

Normally, an interference case (or loss of expected availability) is first suspected to be an equipment malfunction. The user sends out maintenance personnel who make measurements on the suspected FS radios. Frequently, hardware modules are pulled and sent to the equipment vendor. These are often returned as NTF (No Trouble Found). After several months of this, the equipment vendor finally sends his own field personnel to the system. After these folks again check and re-align everything, they finally suspect interference and convince the user to turn down his system so they can look for the interference. Because interference is normally from a stationary location, this can result in the ability to determine where the interference is coming from. However, in the case of an ESV, the interferer is mobile. This will result in a near-impossible interference identification task. In this regard, it is important to emphasize that interference cannot be "seen" on an operating FS system; its effect is simply to shut the system down!

Coordination Distance

The 100 KM coordination distance adopted by the FCC in the Cresscom waiver proceeding is inconsistent with current terrestrial coordination practices and, as such, is severely inadequate. Current NSMA (National Spectrum Managers Association) and TIA TSB-10-F coordination practices are such that a circular coordination contour 200 KM around the new station is used. And, within $\pm$ 5 degrees about the antenna main beam, coordination occurs out to 400 KM. If anything, coordination distances over water should be significantly greater than the coordination distances currently practiced on land. This is because there is no "terrain blockage" over water, and ducting can significantly elevate interference levels as was discussed earlier. Additionally, because the main beam is obviously the most susceptible to ESV interference and because such interference can come from any direction owing to the mobile nature of the ESV, 400KM should be the relevant minimum coordination distance for ESV.

Conclusion

The above calculations indicate how often FS receivers are susceptible to proposed ESV interference levels. The impact of ATPC is a further complicating factor. The period of interference susceptibility will increase by a factor of 20 times (13 dB typical ATPC back-off on digital radios). In the above figure, note that there is only 3 dB of fade margin to the -145 dBw/4 kHz interference level when ATPC is in operation. Note also that, although FS transmitters are licensed at full power, many of them operate using ATPC, and there are no current databases which indicate ATPC operation.

A final major point is that ESV outages have a very high probability of causing major system problems if ESV interference events are longer than two seconds. Carrier Group Alarm Outages in excess of two seconds completely disrupt traffic until 15-20 seconds AFTER sync is recovered. Since the effect of a CGA is to terminate all traffic in process, all traffic must be manually re-initiated once the CGA clears. The traffic outage can significantly exceed this time, however. As an example, when a CGA is detected by a cellular switch, all cellular traffic is disrupted. When the CGA clears, the switch tests each trunk one-at-a-time before bringing the system back up. This can easily take from many minutes to many hours, depending on the size of the switch affected, the number of cell-site switches affected, and the size of the cellular system. At least one vendor's cellular switch actually freezes traffic upon detecting a BER of 10^{-9} or worse. If this BER is sustained for more than two seconds, the results are the same as if a CGA occurred! So, a two second outage (or high BER) on a single hop of radio can disrupt traffic on a large system for a significant period of time. It therefore seems inappropriate to look at interference events on a per-hop basis. It is more appropriate to divide the interference event times agreed to BY THE TOTAL NUMBER OF HOPS of radio in any given system, even though just a single hop may be susceptible to the interference.

In conclusion, for all the reasons stated in this paper, it is readily apparent that the long-term and short-term interference criteria for *analog* systems (-154/ -131 dBw/4 kHz) are inadequate to protect FS receivers from interference from ESV stations. The current FS DIGITAL interference criteria must be used.

M. Philip Salas
Senior Manager
Fixed Wireless Product Engineering
Alcatel USA
1225 N. Alma Road MS401-119
Richardson, TX 75081

Phone 972-996-5372
phil.salas@usa.alcatel.com

April 10, 2000

M.P. Salas has had design responsibility for all Alcatel digital radio products developed since 1986. As such, he has in-depth knowledge of digital radio technology, performance, and interference requirements. Further, he has been directly involved in resolving interference problems on operating field systems. Finally, M.P. Salas has been involved in path design and analysis, and coordination of digital systems comprised of Alcatel digital radio products.

CERTIFICATE OF SERVICE

I, Deirdre A. Johnson, a secretary for the law firm of Verner,Liipfert, Bernhard, McPherson, and Hand, Chartered, hereby certify that I have this 10th day of May, 2000, caused a copy of the foregoing "Petition For Expedited Action" to be sent, via First Class, United States Mail, postage prepaid to each of the following:

Dale N. Hatfield
Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W. – Room 7-C155
Washington, D.C. 20554

Bruce A. Franca
Deputy Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W. – Room 7-C153
Washington, D.C. 20554

Donald Abelson
Chief
International Bureau
Federal Communications Commission
445 12th Street, S.W. – Room 6-C750
Washington, D.C. 20554

Steven Spaeth
International Bureau
Federal Communications Commission
445 12th Street, S.W. – Room 6-B434
Washington, D.C. 20554

Thomas P. Stanley
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W. – Room 3-C460
Washington, D.C. 20554

Sylvia T. Lam
Engineer, Satellite Engineering Branch
Satellite and Radio Communication Division
International Bureau
445 12th Street, S.W.
Washington, D.C. 20554

William T. Hatch
Associate Administrator
Office of Spectrum Management
NTIA
14th & Constitution Avenue, N.W.
Washington, D.C. 20230

Helen E. Disenhaus
Swidler, Berlin et al.
3000 K Street, N.W.
Suite 300
Washington, D.C. 20007

Deirdre A. Johnson