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

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

ORIGINAL

To: Chief, Office of Engineering and Technology

RESPONSE TO REPLY TO OPPOSITION

Maritime Telecommunications Network, Inc. ("MTN"), by its attorneys, hereby files its response to the "Reply to Opposition" ("Reply") filed on June 15, 2000, by the Fixed Wireless Communications Coalition ("FWCC"), the Association of American Railroads ("AAR"), the American Petroleum Institute ("API"), the 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").[1]

I. The Interference Protection Criteria Used by MTN Fully Protect Terrestrial Microwave Systems

In their Reply, the Joint Petitioners present new engineering data in support of their claim that MTN's interference protection criteria are inappropriate and inadequate to protect terrestrial microwave systems. However, as in their opening pleading, their analysis is based on purely theoretical calculations using erroneous assumptions. As a result, the arguments presented by the Joint Petitioners are inconsistent with real world experience and show nothing more than that anything can be proven in a lab if the assumptions necessary to get to that conclusion, however invalid, are nonetheless made.

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[1] MTN is simultaneously filing a "Motion to Accept 'Response to Reply to Opposition.'"

As explained in the Supplemental Engineering Statement of Daniel J. Collins of Pinnacle Telecom Group, contrary to the claims of Joint Petitioners, the short-term interference protection level of -131 dBW/4kHz is not something developed out of thin air by MTN. Rather, it is the established short-term interference protection objective that has been used by all earth station frequency coordinators in the United States and internationally for many years. Further, it is the appropriate objective to be used for earth stations on board vessels ("ESVs") in motion. The International Telecommunications Union ("ITU"), based on analysis by its technical study groups, has specifically determined that the interference exposures from ESVs in motion are short term in nature, and that therefore a short-term frequency interference objective should be used.[2] Therefore, the Joint Petitioners proposed use of the ITU-recommended long-term interference objective of -170 dBW/4kHz for ESVs in motion is incorrect. Because Joint Petitioners began their analysis by applying the wrong objective, the foundation for Joint Petitioners' calculations falls apart.

Moreover, as also explained by Mr. Collins, the short-term objective of -131dBW/4kHz can be exceeded up to 0.0025 percent of the time, which amounts to 788 seconds per year for each earth station. This is a big difference from the 16 seconds per hop per year limit imagined by Joint Petitioners. Since each ship operates on different frequencies, and each ship has a limited number of passes per year in each port, the 788 seconds per year limit is not exceeded, and the frequencies were coordinated accordingly.[3]

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[2] As explained by Mr. Collins, the short-term objective of -131 dBW/4kHz used in the United States is actually more stringent than the -103dBW/1MHz short term objective recommended by the ITU for potential interference to digital systems.

[3] As explained by Mr. Collins, the frequency coordination process eliminated all instances where the short term objective would be exceeded.

Since the assumptions used by Joint Petitioners are wrong, the calculations used by Joint Petitioners' consulting engineer and referred to in page 4 of the Reply are useless and have no relationship to the real world.[4]

II. If MTN's Operations Cannot Be Detected and Are Not Causing Any Harmful Effects, Then There Is No Harmful Interference and No Need to Find the Source of Non-Interfering Signals

Contrary to the claims of the Joint Petitioners, MTN is not confusing the separate concepts stated on page 5 of the Reply as follows: "(1) the existence of interference that can cause an outage in a digital microwave system, and (2) the ability of the system operator to identify the facility causing the interference." However, what Joint Petitioners refuse to acknowledge is that if there is no harmful interference, then there is no need to identify any facilities causing the non-interference. So if MTN's operations cannot be "seen" because they are not causing any real-world harmful interference, then there is no harm.

Of course the main fact that Joint Petitioners ignore is that not only have they been unable to demonstrate a case of actual interference, but also they have been unable to provide even a case of suspected or unexplained interference. MTN has been operating its ESVs for years, and for years Joint Petitioners have been shouting the battle cry of "interference," but not even once have Joint Petitioners ever provided a date, time and place of suspected or unexplained interference. As discussed by Mr. Collins in his Supplemental Engineering Statement, if MTN's operations are as harmful as claimed by Joint Petitioners, then we would surely by now have heard of specific

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[4] As explained in MTN's "Opposition to Petition for Expedited Action," filed on May 24, 2000, mathematicians have been able to "prove" that bumble bees cannot fly and the human heart is too small to be able to pump the blood around the human body. That is what happens when a theoretical scientist never steps outside his or her laboratory.

instances of system outages. Because we have heard of none, it is clear that MTN is not causing the theoretical disruptions to terrestrial microwave systems described by Joint Petitioners as "absolutely certain."

III. Conclusion

The Joint Petitioners' new technical analysis is but another in a long series of attempts by the Joint Petitioners to obscure the fundamental fact that MTN's ESVs and microwave stations have co-existed for years without a single reported case of even suspected or unexplained interference. Relying on invalid assumptions, the Joint Petitioners ignore not only the real world experience, but also the long-established standards effectively applied by United States frequency coordinators. As explained by Mr. Collins in his Supplemental Engineering Statement, MTN has coordinated its frequency usage in accordance with the established United States standards which are a combination of predictive calculations tempered by real world experience.

Notwithstanding MTN's real world demonstration that its ESVs have never caused harmful interference to and can co-exist with terrestrial microwave facilities, all Joint Petitioners can do is "prove" on paper that the experiment is a failure. They seem to lose sight of the purpose of an experiment, a significant part of which is to test in the real world whether paper calculations are correct. It is time for the Commission to recognize that Joint Petitioners are engaged in a last-ditch attempt to preclude co-primary earth station users of access to radio spectrum as to which the Joint Petitioners desire exclusive rights.

Because the analysis of the Joint Petitioners is inherently flawed and incorrect, it must be rejected, and the Commission should grant MTN's application to renew its experimental license and to expand the number of ships.

Respectfully submitted,

MARITIME TELECOMMUNICATIONS
NETWORK, INC.

By: _____
Helen E. Disenhaus
Eliot J. Greenwald

Its Attorneys
SWIDLER BERLIN SHEREFF FRIEDMAN, LLP
3000 K Street, N.W.
Suite 300
Washington, D.C. 20007
(202) 424-7500

July 18, 2000

Supplemental Engineering Statement

Prepared by
Daniel J. Collins
Chief Technical Officer
Pinnacle Telecom Group, LLC

July 17, 2000

I have carefully reviewed the Reply to Opposition and its attached Supplemental Engineering Statement filed by the Fixed Wireless Coalition *et al* in connection with the application for experimental license renewal by Maritime Telecommunications Network, Inc. ("MTN").

The Petitioners and Mr. Salas continue to display a surprising lack of familiarity with the principles and parameters of frequency coordination to control potential earth station interference to microwave systems – as well as with the FCC regulations and practice regarding experimental licensing. I have prepared the following technical response in support of MTN.

The Short-term Interference Objective

The interference objective used to coordinate MTN's shipboard earth stations (-131 dBW/4kHz) is the identical interference objective used to protect against short-term interference to microwave stations from every C-band transmitting earth station that has ever been coordinated in this country, and there have been some 3,500 of them.

Mr. Salas argues that digital microwave stations exposed to an interference level of –131 dBW/4kHz suffer lengthy outages. There is something obviously very wrong with this picture. The fact is that C-band transmitting earth stations are now and always have been *individually* allowed to cause interference to microwave stations at levels higher than –131 dBW/4kHz for up to 0.0025 percent of the time – which on an annual basis adds up to 788 seconds for each earth station. Given the overall number of C-band transmitting earth stations, the even larger population of digital microwave receivers, and the conventional use of the –131 dBW/4kHz objective with its associated 788-second time frame, it is difficult to believe Mr. Salas's assertions about certain draconian effects on digital microwave systems. If he were right, it suggests that many if not most of the digital microwave systems in this country have been suffering severe performance problems, and that the entire C-band microwave community should have risen up quite a while ago to argue that the conventional earth station interference objectives should be made much more strict. However, digital microwave systems began to be implemented about the same time as C-band earth stations grew in popularity, and the two types of systems have managed to co-exist in the band without any of the problems Mr. Salas claims are a certain result of the use of the conventional earth station interference objectives.

Fundamentally, the problems the Petitioners and Mr. Salas claim are a certain result from interference using the –131 dBW/4kHz objective are not limited to shipboard earth stations; all C-band transmitting earth stations use the same objective and should cause

the same problem. Real world evidence, though, indicates there is no such problem. Mr. Salas presents a mathematical analysis – backed by the results of so-called laboratory testing – in an attempt to "prove" his point. The proof, however, is out there in the real world, where there has not been a single complaint of harmful interference experienced as a result of applying an earth station interference objective that is alleged to be inadequate. There is no record of "objectives-related" complaints by microwave operators related to the thousands of existing land-based C-band earth stations, or specifically any interference actually experienced as a result of the shipboard earth stations operated by MTN over the past few years. In industry forums in which Mr. Salas participates, MTN has several times offered to conduct a cooperative test of "real world" interference, but Mr. Salas has apparently chosen to "prove" the interference problem without leaving his laboratory.

ITU Recommendations

Mr. Salas posits that an objective of –170 dBW/4kHz needs to be applied, noting both the need to consider interference-affecting propagation anomalies (such as ducting) and that the source of that interference objective is the ITU.[1] Mr. Salas fails to explain, however, that the –170 dBW/4kHz objective is defined by the ITU as a long-term objective, which is inapplicable to the instant case for a number of reasons. First, it is obvious that interference exposures from ESVs operated in motion are short-term in nature, as they only spend a small fraction of the time in motion and within interference distance of shore, and a much smaller fraction of that subset in a position to potentially cause any interference to a given microwave receiver. Second, digital microwave receivers specifically require interference protection during a relatively deep fade of the desired signal, and deep fading is a short-term phenomenon. Third, short-term interference objectives incorporate assumed probabilities of short-term propagation phenomena (such as ducting) that can affect interference levels – but those same considerations are not made in long-term interference objectives. Mr. Salas thus bases his "harmful ESV interference" arguments on a completely inappropriate mixing of long-term interference objectives and short-term propagation phenomena.

Moreover, the ITU has recently reached the logical conclusion that potential interference from shipboard earth stations is clearly a short-term phenomenon and will be coordinated using a short-term objective. Indeed, the ITU's currently-suggested short-term C-band earth station interference protection objective is –103 dBW/1MHz for digital microwave, which is actually less stringent than the –131 dBW/4kHz short-term protection objective conventionally used in the US for all microwave receivers, independent of modulation scheme.[2]

Mr. Salas also appears to be under the impression that ITU interference objectives are mandates to the member administrations, when they are anything but that. Domestic policy and practice override ITU recommendations. In the US, the policy and practice

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[1] The ITU's suggested interference protection objectives are associated with approximately 20 variables and technical assumptions, none of which Mr. Salas describes in his recommendation to use the figure in question.

[2] Note: With an adjustment of 10 times the log of the ratio of the reference interference bandwidths in question, the –103 dBW/1MHz figure is "bandwidth-equivalent" to –127 dBW/4kHz, which is 4 dB less stringent than the conventional –131 dBW/4kHz short-term interference objective used in the US.

has consistently been to apply a standard set of long- and short-term objectives to control potential C-band earth station interference, and the short-term objective applicable to the instant case is –131 dBW/4kHz, not to be exceeded for more than 0.0025 percent of the time.

Note, in this regard, that if Mr. Salas claims digital microwave systems require an interference protection level of –170 dBW/4kHz, the conventional application of the long-term –154 dBW/4kHz earth station interference objective (not to be exceeded for more than 20 percent of the time) represents a 16 dB out-of-limits interference problem that should be literally wreaking havoc with digital microwave systems, for up to *6.3 million seconds a year*. Obviously, that objective does not cause such problems, or the entire industry would be well aware of it.

Of some note here is another change the ITU is making in its recommendations. The assumed link margin for a digital microwave radio is being increased by 4 dB, from 33 to 37. In effect, this change alone indicates that the ITU believes digital microwave systems require 4 dB less interference protection than under the old scheme. Moreover, the effective 4 dB net relaxation in the ITU's short-term earth station interference objective (-131 versus –127 dBW/4kHz) indicates that the ITU's recommended overall protection for digital microwave systems against potential earth station interference is to be relaxed by 8 dB.

Mr. Salas also references an "objective" of 16 seconds of outage per hop per year. He is obviously confusing microwave propagation availability (propagation-related outage avoidance) specifications – none of which are addressed in FCC regulations – with objectives for permissible interference. The 16-second-per-year figure relates to a propagation availability specification (99.9999 percent), which is set by equipment manufacturers, end users and system designers – and has nothing to do with the parameters used in frequency coordination and interference avoidance. Moreover, not all entities apply the 99.9999 percent specification; most users apply a figure closer to 99.999 ("five nines") rather than the 99.9999 percent figure Mr. Salas attempts to position as "standard".

Real-world Experience

It is worth pointing out that microwave systems have shared the band with earth stations on a co-equal basis since about 1974. Thus, microwave equipment designers and system engineers have more than 25 years of experience dealing with potential interference from earth stations sharing the band on a primary co-equal basis.

If Mr. Salas is suggesting that microwave equipment design has reached or passed the point that digital systems can effectively operate in the existing interference environment, then before we impose stricter obligations on earth station operation, it seems there might be a need to carefully explain what the FCC means when it allows two types of radio operations to share frequencies co-equally. Let us not forget that both types of operators have equal rights to use what some people might still perceive as a "microwave" band. The idea that earth station operations showed up after microwave was established in the band does not in any way mean that earth station operators have "secondary" rights. Both types of operations have primary co-equal rights.

Mr. Salas also displays a significant misunderstanding of the mechanics of shipboard earth station coordination, suggesting a "certainty" of harmful interference in cases where, in actuality, the "real-world" frequency coordination process obviates any possibility of it. For example, when the extended beam of a microwave receiver crosses the defined operating boundary of a shipboard earth station, absent significant terrain-based interference blockage it is impossible for coordinators to clear the same frequencies for shipboard earth station use. Harmful interference to the microwave system in question is precluded in the interference analysis stage, specifically because the earth station cannot use the same frequencies without causing unacceptable interference. While Mr. Salas describes the situation of such "axis crossing" and claims it represents a significant interference problem, he fails to acknowledge that the first individuals to recognize such an interference problem – and take positive action to avoid it – are frequency coordinators. Frequencies that cannot clear interference analysis are not referenced in the associated prior coordination notifications, never mind used afterwards by the facility in question. In the interference analysis and frequency coordination for MTN's US port operations, there were a number of instances in which such microwave axis-crossings completely obviated any proposed same-channel use by MTN's shipboard earth stations.

The shipboard earth station interference analysis process Mr. Salas describes (the "Critical Contour Point" method) has been in use since February 1997, and MTN's in-motion operations within 100 kilometers from shore proceeded not long after that, at the ports clearly identified in the frequency coordination notifications. If the real-world interference effects were as dramatic as Mr. Salas and the Petitioners continue to claim – it should not have been at all difficult to have identified and documented actual cases of disruptive interference. But that has not been the chosen course of action by those who so vocally oppose shipboard earth station operation. Instead, all we are offered here again are resolute claims of "certain" interference, backed only by mathematical analysis and so-called laboratory tests. My understanding of FCC policy and practice related to experimental license operations is that the FCC will require cessation of operation the moment a case of interference can be traced to the experimental operation.

To my knowledge, based on 30 years of experience in the telecommunications industry, the FCC has never required cessation of an experimental operation based solely on a mathematical analysis or a laboratory test. I believe there is good reason for that approach by the Commission; in wireless propagation and interference analysis, RF engineers know that not everything that can be mathematically modeled or demonstrated in a lab actually occurs out there in the real world. Mr. Salas and the Petitioners should be quite aware of the best example of that. For years, the distance the frequency coordination community used to analyze potential interference from one microwave system to another was 125 miles. That figure had earlier been as high as 200 miles, but it had been progressively shortened over a 15-year period with increasing industry experience. In the 1980s, some evidence of longer-distance, on-axis interference suggested that increasing the microwave coordination distance might be appropriate. At the time, however, some "non-microwave" mathematicians delved into the problem, and "proved" that the appropriate microwave coordination distance should be something over 3,000 miles. The efforts of those mathematicians and their "immutable laws of physics" were, however, rather summarily dismissed, and experienced microwave engineers subsequently developed a keyhole-shaped

coordination contour with distances based on judgment and compromise. That "real-world" compromise has now survived without challenge for more than 10 years.

Experienced microwave (and earth station) engineers understand that the existing frequency coordination process is mathematical and statistically-based, and that it is already designed to be conservative and over-protect against interference. As a result, the existing frequency coordination has been proven effective in preventing interference, and there is no reason to modify its standards to provide purportedly additional protection to microwave stations that are already protected more than adequately, especially when such modifications would be detrimental to achievement of the goal of ensuring that the scarce spectrum resource is shared as efficiently as possible.

Conclusion

In summary, I find that the Petitioners and Mr. Salas continue to present arguments about potential interference that are truly incredible, in the dictionary sense of that word. They argue for a much more stringent objective in this case, but cannot explain why today's systems sharing the band – but built with apparently "inadequate" objectives – seem to be working and co-existing perfectly well. The Petitioners display a basic misunderstanding of the parameters and processes associated with frequency coordination of earth stations and microwave stations, and a particular misunderstanding of the interference analysis and frequency coordination procedure used for shipboard earth stations. They confuse the issue by focusing on parameters applicable only to frequency coordination strictly among microwave stations, and use other specifications that do not relate to interference coordination. They appear to ignore the fact that the frequency band in question is shared with equal rights by earth station operators, and that there is a positive public interest in expanding the use of the existing spectrum.

Daniel J. Collins

July 17, 2000

CERTIFICATE OF SERVICE

I, Penny Jackson, hereby certify that on this 18th day of July, 2000, copies of the attached, "**RESPONSE TO REPLY TO OPPOSITION**", were sent via U.S. Mail, to the following:

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

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

*Charles J. Iseman
Chief, Spectrum Policy Branch
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

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

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

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

*Ari Fitzgerald
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

*Sylvia T. Lam
Engineer, Satellite Engineering Branch
Satellite and Radio Communication
Division
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

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

Wayne V. Black
Peter A. Saari
Keller and Heckman LLP
1001 G Street, N.W., Suite 500 West
Washington, DC 20001

Julian L. Shepard
Verner, Liipfert, Bernhard, McPherson
and Hand, Chartered
901 - 15th Street, N.W, Suite 700
Washington, DC 20005-2301

Jeffrey L. Sheldon
Thomas Goode
UTC
1140 Connecticut Avenue, N.W., #1140
Washington, DC 20036

Leonard R. Raish
Mitchell Lazarus
Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street, 11th Floor
Arlington, VA 22209

Penny Jackson

*Via Hand Delivery