HOGAN & HARTSON

Hogan & Hartson LLP
Columbia Square
555 Thirteenth Street, NW
Washington, DC 20004
+1.202.637.5600 Tel
+1.202.637.5910 Fax

www.hhlaw.com

September 10, 2008

Ari Q. Fitzgerald
Partner
(202) 637-5423
AQFitzgerald@hhlaw.com

BY ELECTRONIC FILING

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

Re: **GE Healthcare *Ex Parte***
ET Docket No. 08-59

Dear Ms. Dortch:

GE Healthcare hereby provides notice of permitted *ex parte* communications in the above-referenced proceeding. On September 9, 2008, Neal Seidl, Wireless System Architect, GE Healthcare, David Davenport, Electrical Engineer, GE Global Research, and the undersigned, counsel to GE Healthcare, met in five separate meetings with Charles Mathias, Legal Advisor to Chairman Kevin Martin; Bruce Gottlieb, Legal Advisor to Commissioner Michael Copps; Wayne Leighton, Special Advisor to Commissioner Deborah Taylor Tate; Angela Giancarlo, Chief of Staff and Senior Legal Advisor to Commissioner Robert McDowell; and Julius Knapp, Geraldine Matise, Jamison Prime, Jeffrey Dygert, Gary Thayer, and Ira Keltz from the Commission's Office of Engineering and Technology. The undersigned also spoke by teleconference with Charles Mathias on September 10, 2008.

During the meetings, GE Healthcare discussed comments filed in response to the Commission's Public Notice seeking comment on GE Healthcare's MBANS proposal. In particular, GE Healthcare discussed the potential uses for MBANS devices and the need for an MBANS spectrum allocation. GE Healthcare also explained in detail how MBANS and aeronautical mobile telemetry operations can coexist easily without causing harmful interference to one another, including through the use of contention-based protocols, geographic exclusion zones, and additional coordination. GE Healthcare distributed the attached presentation at the meetings.

In accordance with Section 1.1206(b) of the Commission's rules, this letter is being filed electronically with your office.

Sincerely,

/s/ Ari Q. Fitzgerald

Ari Q. Fitzgerald
Counsel to GE Healthcare

cc: Charles Mathias
Bruce Gottlieb
Wayne Leighton
Angela Giancarlo
Julius Knapp
Geraldine Matise
Jamison Prime
Jeffrey Dygert
Gary Thayer
Ira Keltz

Proposal for Medical Body Area Network Service (MBANS)

GE Healthcare

Presentation to the FCC

ET Docket No. 08-59

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Meeting objective

"GE Healthcare urges the Commission to move expeditiously by preparing an NPRM which . . . proposes the new spectrum allocation and rule changes necessary to make the next generation of wireless medical devices a reality."

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Tremendous Societal Need to Improve Health Care Delivery and Efficiency

National Health Expenditure ("NHE") fact sheet compiled by the Department of Health and Human Services includes the following statistics:

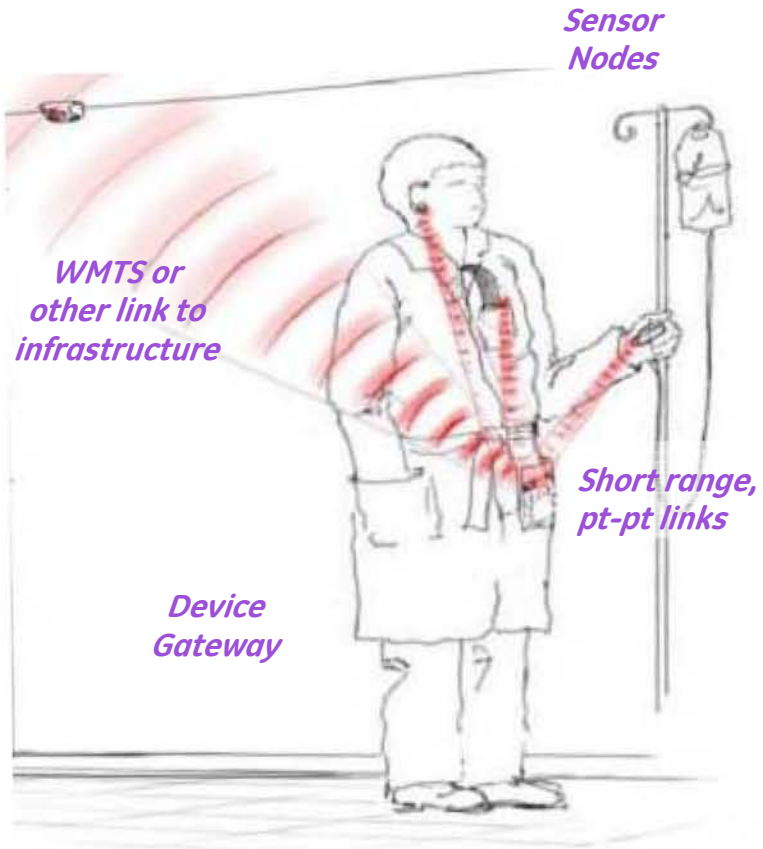
- NHE grew 6.7% to $2.1 trillion in 2006, or $7,026 per person, and accounted for 16% of Gross Domestic Product ("GDP").
- Medicare spending grew 18.7% to $401 billion in 2006, or 19 percent of total NHE.
- Private spending grew 5.4% to $1.1 trillion in 2006, or 54 percent of total NHE.
- Hospital expenditures grew 7.0% in 2006, a slightly slower rate than the 7.3% in 2005.
- Growth in NHE is expected to be 6.7% in 2007 and average 6.7% per year from 2006-2007.
- The health share of GDP is projected to reach 19.5 % by 2017.
- Spending on hospital services is projected to grow 7.5% in 2007 to $697 billion. Average growth of 6.9% per year is expected from 2006-2017.

Body Sensor Network (BSN) for Medical Monitoring

A wireless network of sensors around a patient

Clinical Benefits

- Patient mobility, comfort, infection control
- Monitoring flexibility and scalability
- Extension of monitoring into care areas that are currently unmonitored
- Reduced clinical errors
- Reduced overall monitoring and health care costs



Initial MBANS Proposal

GEHC has provided a comprehensive MBANS proposal which includes detailed modifications to Part 95:

Eligibility & Permissible Communications

- Low-power, short-range operations for monitoring, diagnosing, or treating patients, including, but not limited to, BSNs.
- Secondary, licensed operations by authorized health care professionals (and by any other person, if such use is prescribed by a health care professional).

Technical Parameters

- All stations must employ unrestricted contention-based protocols.
- Maximum emission bandwidth of 1 MHz.
- Maximum EIRP not to exceed the lesser of 1 mW or 10 log B dBm, where B is the 20 dB emission bandwidth in MHz.
- Same out-of-band (more than 500 kHz outside of band) field strength limits as apply to MICS.

Frequencies & Authorized Locations

- 2370-2390 MHz (the "inner MBANS channel set") -- limited to health care facilities and other environments where health care professionals monitor, diagnose, and treat patients, including in ambulances.
- 2360-2370 MHz and 2390-2400 MHz (the "outer MBANS channel set") -- operations permitted anywhere CB radios may operate.

Rationale for Proposed Frequencies

- Frequencies were selected in consultation with NTIA.
- Band is very sparsely utilized over USA geography, time, and frequency.
- High-power, long-range AMT and Amateur incumbent operations are good coexistence candidates for opportunistic low-power, short-range MBANS devices.
- Proposed allocation is aligned with ETSI ERM TG30 – Medical Devices proposal (TR102 655).
- Proposal is supported by IEEE 802.15 Task Group 6, Body Area Networks
- Allows 2.4 GHz off-the-shelf components to be leveraged and permits small, efficient antennas.
- 40 MHz allocation affords good frequency diversity and provides ample opportunities for opportunistic secondary operations, even in highest usage density hospital settings.
- 40 MHz allocation facilitates wide (~1 MHz) channels / high symbol rates necessary to maintain low duty cycles and limit device power consumption.

Comments Support Clinical / Public Benefits

Michael Shabot (M.D., VP and Chief Quality Officer, Memorial Hermann Healthcare): "As a surgeon and critical care intensivist, I strongly support the allocation of bandwidth to support wireless medical Body Sensor Networks. Such a network would free critically ill patients from electrical patient monitoring cables that are inconvenient, obtrusive and even unsafe at times. If these cables could be eliminated with a Body Sensor Network, patients would be more comfortable and physicians and nurses would be able to provide better care."

Kim Bonzheim (Director, Cardiac Services, William Beaumont Hospital): "[T]he ability to reduce or eliminate wires and cords would be a significant benefit to caregivers."

Marilyn Rantz (RN, PhD, FAAN, Prof., Sinclair School of Nursing, University of Missouri): "If we are to manage the enormous population of older adults in our society and begin to meet their chronic illness needs, technology must be developed that can be used to support home and community based care as well as traditional long term care services. Dedicated radio spectrum frequencies for the wireless communication of these technological advances are critical to their success. Please support this petition."

Lisa Gaudet (Director, Remote Care Technology, Northeast Health, Troy, NY): "I support the application for new spectrum allocation for wireless service. This increase will allow us to provide more pervasive monitoring of our patients. This will offer improved quality outcomes, efficient use of resources, and better quality of life for our patients."

David Pugliese (D.O., Geisinger Specialty Clinic, Wilkes-Barre, PA): "[Wireless monitoring] is definitely a benefit to patient care, [both] with regard to logistics and quality of care."

Comments Support Proposal's Technical Viability

IEEE 802: "There is a benefit of specialized, protected spectrum for coexistence and noninterference of medical body area networks."

"IEEE 802 recommends that the FCC support this petition for rulemaking and the establishment of the Medical Body Area Network Service. IEEE 802 encourages the Commission to move expeditiously towards an NPRM to make the next generation of wireless medical devices a reality."

Texas Instruments: "[M]edical devices incorporating these [existing 2.4 GHz] chips could benefit from economies of scale -- and the corresponding cost-effective prices -- and from the ready availability of essential components."

Integra Systems: "Dedicating the use of 40 MHz from 2360 MHz to 2400 MHz will ensure peaceful coexistence and non-interference for this medical application."

Prof Yang Hao and Dr Akram Alomainly, Queen Mary University: "Our experience suggests that the allocation of a new frequency band at 2.360 - 2.400 GHz would help us to tackle issues such as interference and channel co-existence. We believe that the proposal is well justified and founded in terms of developing future body worn devices for healthcare applications. We strongly support this proposal and also advise the Commission to accept it based on further technical and market analysis and investigations."

Dr. W. G. Scanlon, Queens University: "On the basis of more than ten years of published research in bodyworn communications, I am convinced that this proposal is well-founded in terms of favourable antenna and propagation conditions . . . and in terms of benefits for healthcare facilities and patients alike. "

ARRL: "ARRL does not, frankly, expect a significant amount of harmful interference to Amateur operations at 2390-2400 MHz from [MBANS] BSNs."

Sirius and XM Radio: "It is extremely unlikely that [MBANS] devices would experience harmful interference from satellite radio terrestrial repeaters."

Wireless Communications Association International: "WCA has no objection to the proposed reallocation, provided that BSNs truly will be limited to secondary status . . . ."

MBANS and AMT Can Easily Coexist

Very low probability of AMT interference to MBANS:

- Limited number of flight test locations and operations, especially near populated areas.
- Building structures attenuate signals from aircraft.
- AMT license data shows that most frequencies are unused at most AMT sites.
- Regional "wall-to-wall" use of band cited by AFTRCC is actually multiple aircraft transmitting at different frequencies from different flight test locations.
- Frequency agility permits MBANS devices to find vacant channels (including the use of 1 MHz separation between AMT channels and use of the 2395-2400 MHz band, which has no AMT allocation) for robust operation.

Very low probability of MBANS interference to AMT:

- AMT receive sites are controlled premises and tend to be well-separated from hospitals.
- Terrestrial propagation, building structures, and antenna polarization misalignment attenuate MBANS devices' low power (*i.e.* 1 mW), wide band, low duty cycle emissions.
- Fixed locations of AMT receive sites enable coordination.
- AMT has thus far not been negatively affected by existing fundamental and/or spurious emissions from Amateur radio, SDARS, MSS-ACT, WCS, BRS/EBS and a host of unlicensed devices.

AFTRCC Concerns Are Unfounded

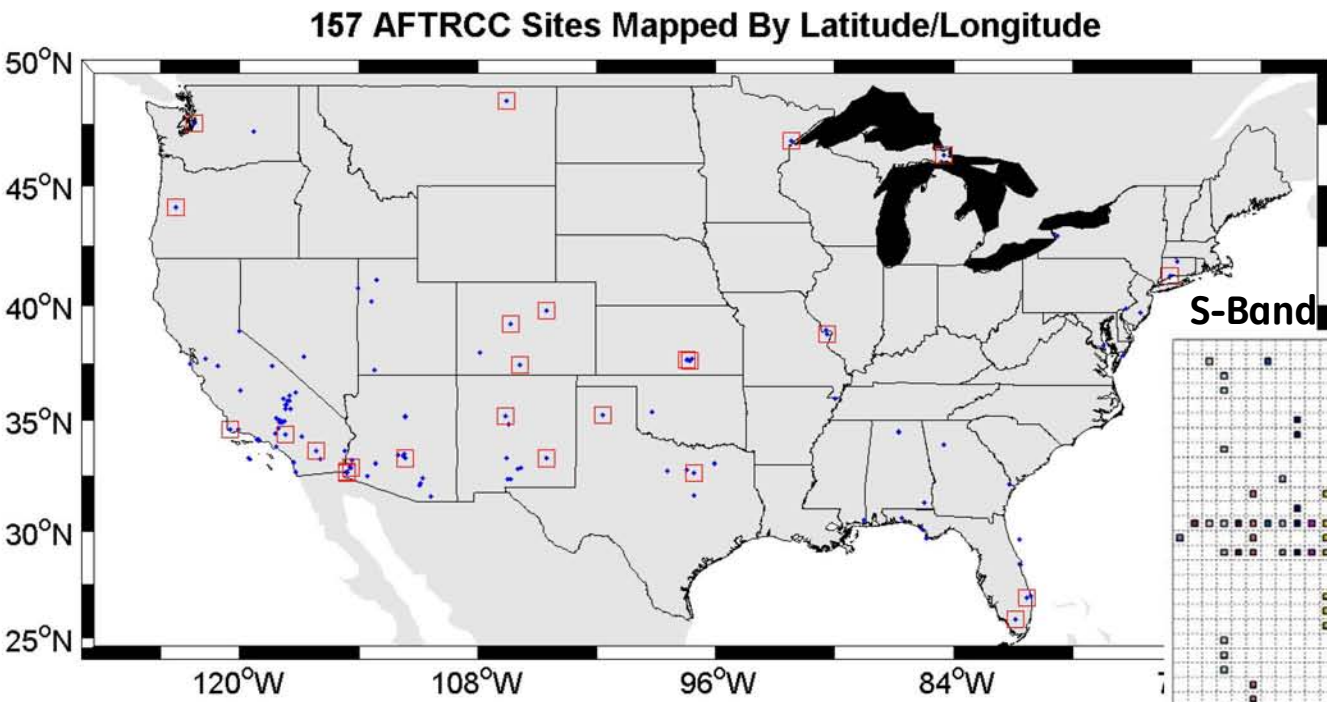
Predictions regarding likelihood and impact of harmful interference from MBANS to AMT are overblown:

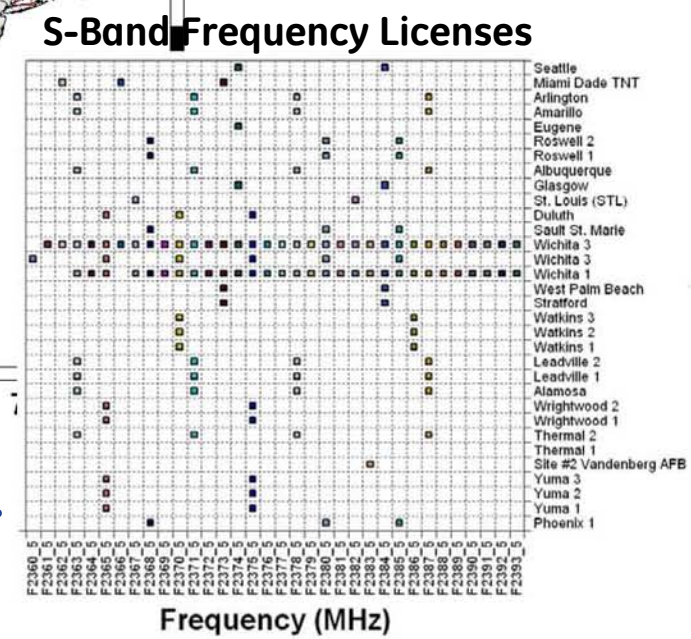
- AFTRCC provided only static, worst-case analysis based on overly stringent PFD limit from needlessly conservative ITU-R M.1459 recommendation.
- Learjet field tests were flawed in several respects.
- Purported AMT link budget reveals non-zero baseline outage probability even in a pristine, interference-free environment.

(details in Technical Appendix)

Engineering centerpieces do not stand up to technical scrutiny – both likelihood and impact of interference are grossly overstated.

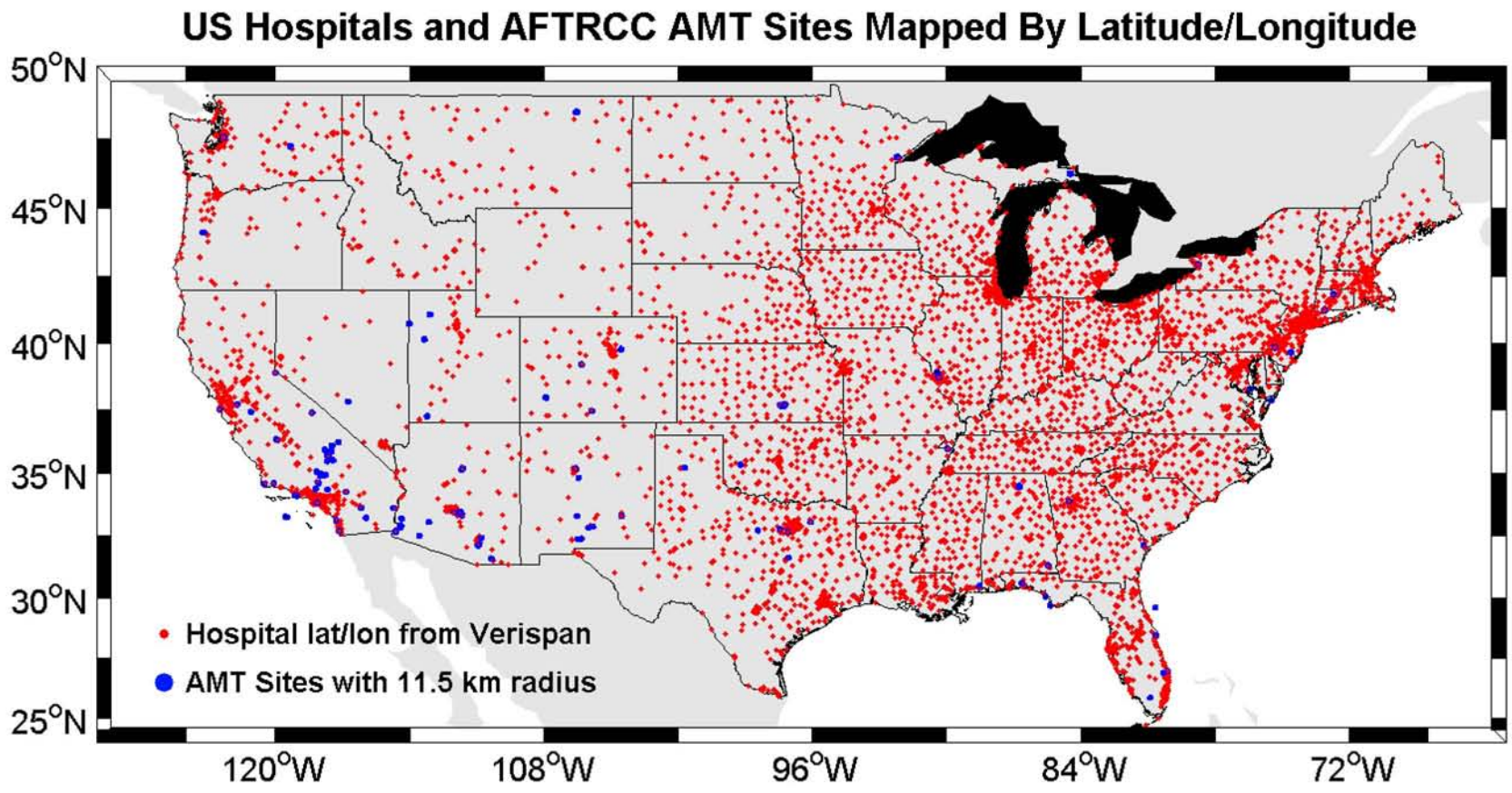
AMT Receive Operations are Very Sparsely Distributed in Space, Frequency and Time.





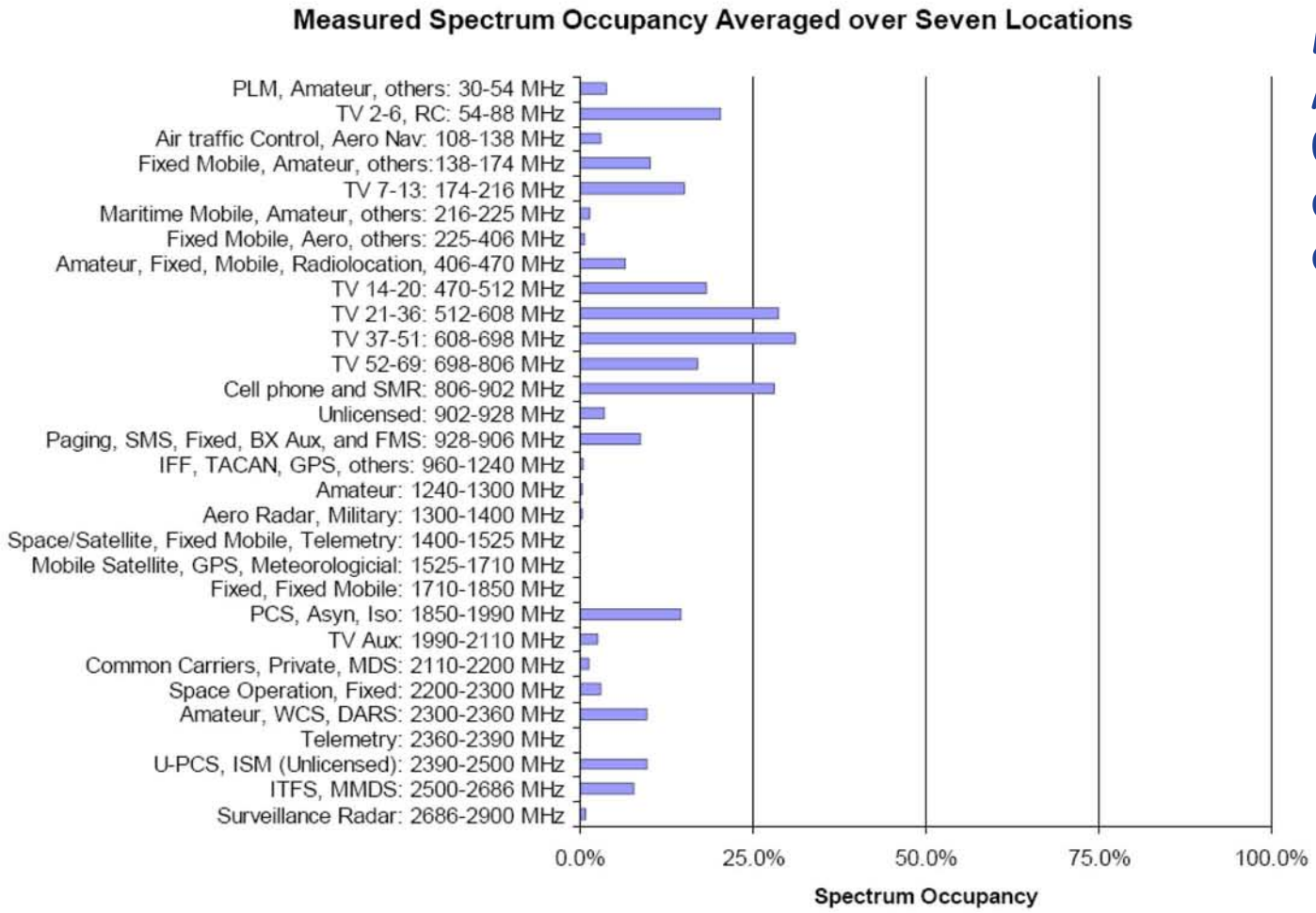
- **Only 32 of 157 AMT sites have an S-band license.**
- **30 AMT sites use 4 or fewer channels out of 34.**
- **Fight test operations are inherently non-continuous and sporadic in nature.**

The MBANS proposal represents an opportunity to put the 2360-2400 MHz band to use for substantial public benefit throughout over 99% of the United States.



Measurements Confirm Sparse Utilization

Spectrum utilization measurements from NSF's NRNRT research



E.g., utilization of AMT band only 0.021% in Chicago during 46 hours of observation.

Location

#1 (Great Falls, VA)
#2 (Vienna, VA)
#3 (Arlington VA)
#4 (New York, NY)
#5 (Green Bank, WV)
#6 (Vienna, VA)
#7 (Chicago, IL)

Reference: http://www.sharedspectrum.com/measurements/

An NPRM is the Appropriate Next Step

- GEHC views its MBANS proposal as a solid *starting point* and believes that an NPRM is now the best mechanism for addressing the proposal.
- GEHC looks forward to cooperating with spectrum incumbents, medical device manufacturers, health care providers, and other interested parties.
- Based on initial reaction to the MBANS Public Notice, GEHC already anticipates a few potential refinements:
  - Correct proposed footnote NG186 in Table of Allocations to clarify that, in order to protect radio astronomy receivers, aeronautical mobile use is prohibited only for MBANS devices in 2370-2390 MHz band and that the status of all currently-allocated services (including AMT) remains unchanged.
  - Consider requiring coordination of MBANS operations with AMT, to further reduce the potential for harmful interference.
  - Consider MBANS device duty cycle limits and/or appropriate reductions of emissions limits if demonstrated to be necessary after sound compatibility analysis.

Thank You!

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Technical Appendix

ITU-R M.1459 is Overly Conservative

The ITU-R M.1459 recommendation, which is at the crux of AFTRCC's analysis, itself states:

"When interference calculations are being made, worst-case scenarios are likely to be used, which could tend to lead to the [potentially incorrect] conclusion that co-frequency or co-channel sharing by different services cannot occur."

"[A]dditional studies have been introduced in the ITU-R for determining the probability of interference to telemetry stations in the aeronautical mobile service which could lead to less stringent protection values . . . ."

"[T]elemetry stations in the aeronautical mobile service have a wide range of characteristics and some may have less stringent protection criteria values . . . . "

"pfds are currently specified in a 4 kHz bandwidth . . . limiting the interference levels in such a narrow bandwidth may lead to overly protective criteria."

"The maximum practical [tolerable I/N] value is considered to be approximately 0.5 (-3 dB)."

The M.1459 power flux density limit is too stringent and is particularly inappropriate for S-band.

- For typical 31 dBi receiver, the M.1459 PFD limit actually equates an I/N ratio of –9.4 dB.
- Absurd conclusions result when applying AFTRCC's analysis, which is based on ITU-R M.1459 PFD limit, to S-band operations that are already-permitted:
  - OOBE from a single, 2.4 GHz Part 15 unlicensed device would interfere with AMT operations at a radius of 1.2 km.
  - OOBE from a single 2.4 GHz Part 18 ISM device (*e.g.*, microwave oven, plasma discharge light, etc.) would interfere with AMT operations at a radius of 7.0 km.
  - OOBE from a single Part 27 WCS device would interfere with AMT operations at a radius of 17.8 km.
  - Fundamental emissions of a 10 Watt Amateur radio would interfere with AMT at a radius of 1,370 km line-of-sight, and the associated spurious OOBE, even assuming 60 dB suppression, would interfere with AMT operations at a radius of 4.4 km.

Learjet Field Test Had Several Serious Flaws

Learjet's reported measurements of received interfering signal power are completely implausible, greatly exceeding both the expected non-free-space and the theoretically bounding free-space values.

- AFTRCC recently claimed this discrepancy was due to the receive antenna's low-noise amplifier. However, the Learjet test report did not disclose any such additional gain but simply provided measurements that, on their face, greatly exaggerate the received interference.
- Moreover, AFTRCC's recent qualitative explanation notwithstanding, details on the additional gain present in the Learjet field test still have not been disclosed.

Learjet used continuous narrowband test signals that were not representative of proposed MBANS devices (*e.g.*, the test signals used much higher power spectral density).

The only portion of Learjet's test that included a desired AMT signal, in order to allow assessment of actual interference effects, was conducted with the interference source located at a fixed distance of only 0.7 miles from the receive site – the location yielding the highest received interfering signal power (-61 dBm).

All claims about interference occurring at distances beyond 0.7 miles are based only on measured violations of the conservative M.1459 PFD limit and not on any actual observed harmful interference effects.

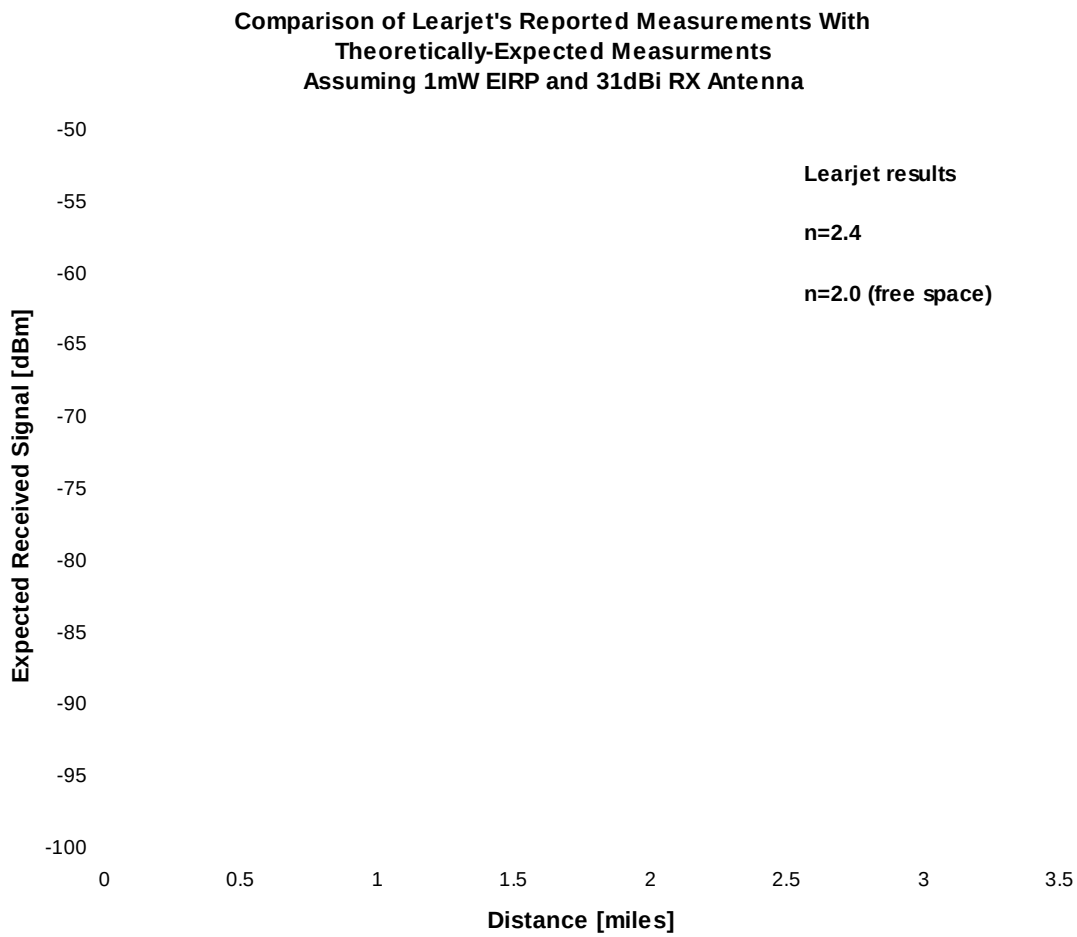
Learjet's Questionable Signal Measurements

Reported measurements of received interference are suspect:

- Was test signal EIRP actually higher than the 1 mW intended?
- Was the signal being measured actually a distinct and unrelated signal from an unknown radiator (*e.g.*, Part 15 or Part 18 OOBE) that was not part of the intended test?
- Measurements had nearly constant received signal level of –67 dBm, despite an increase in separation distance of 0.2 to 3.2 miles.

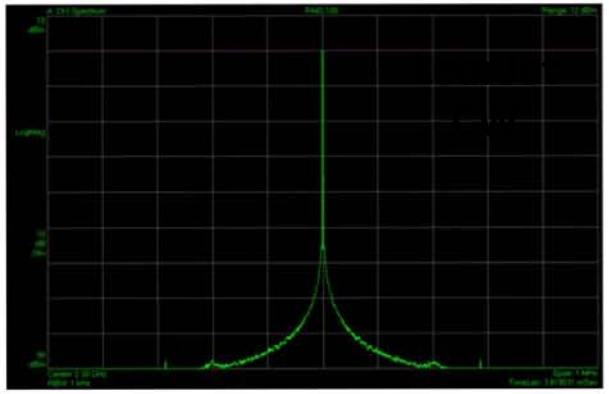
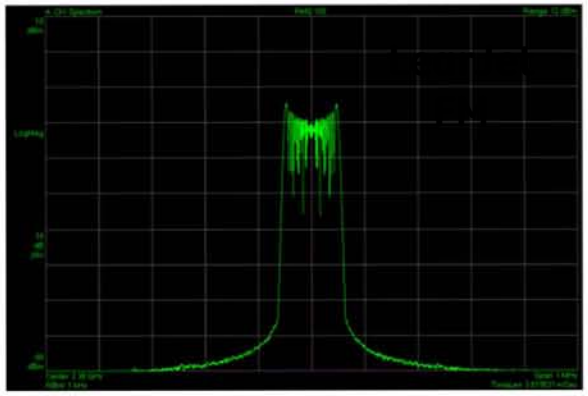
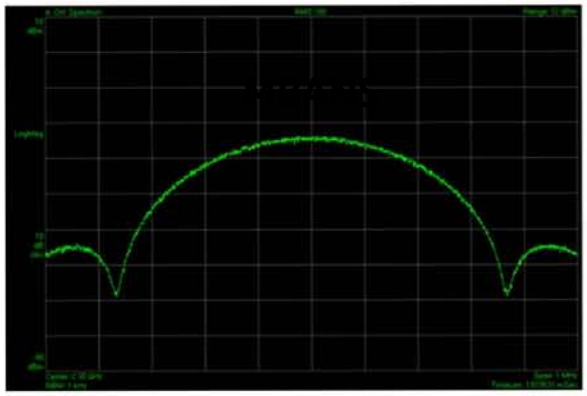
At best, the measurements are highly misleading:

- All measurements exceeded the expected n=2.4 path loss (due to reported ground clutter) by as much as 30 dB with an average of 19.2 dB.
- Four out of five measurements exceeded even the theoretical free space loss by as much as 16 dB with an average of 6.4 dB.
- Although details still have not been disclosed, AFTRCC has recently pointed to additional system gain that was not mentioned in the original test report to explain discrepancy.

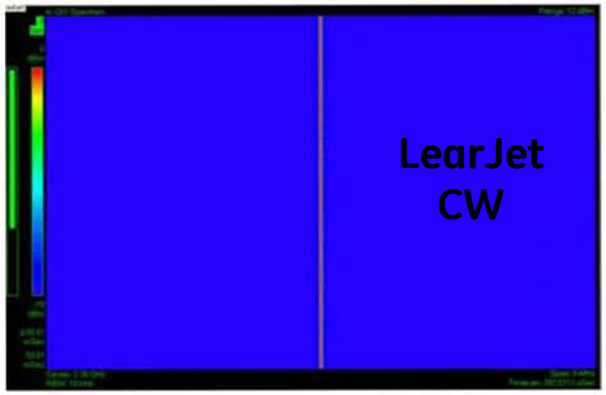


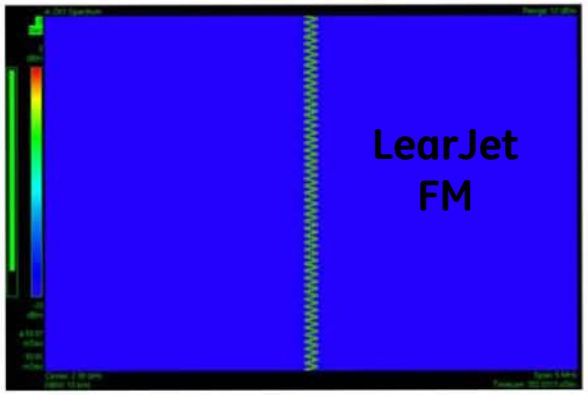
Learjet's Non-Representative Test Signals

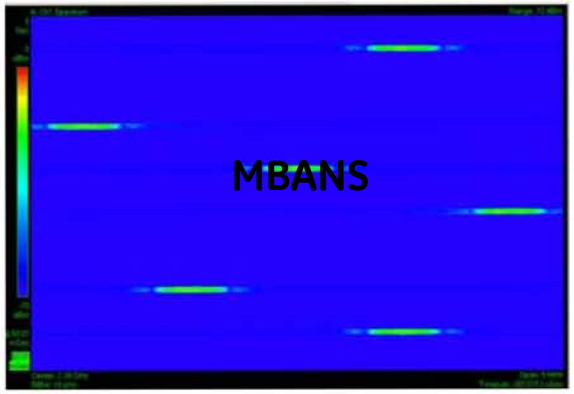
Narrowband signals had power spectral density far exceeding proposed MBANS limit:

Learjet signals were continuous, unlike "bursty" / frequency-hopped MBANS:



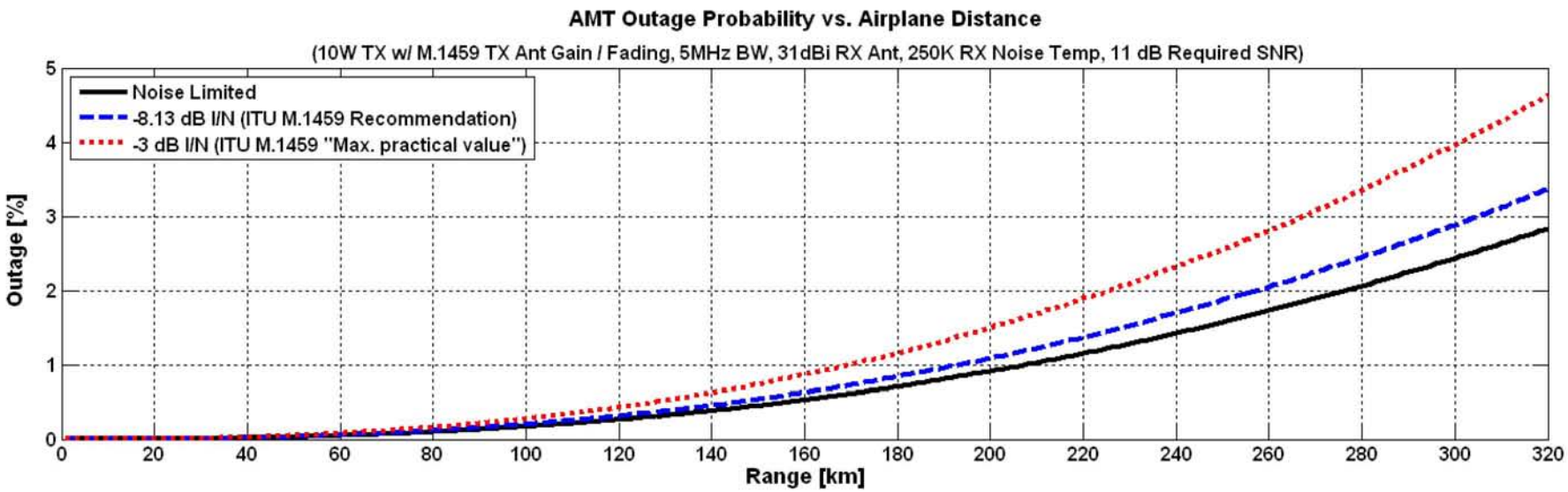




Signals apparently interfered *not by actually overwhelming desired AMT signal, but by disrupting the antenna's tracking algorithm.* This failure mode seems highly unlikely with actual wideband, "bursty," frequency-hopped MBANS signal.

Actual AMT Link Budget vs. Criticality Claims

According to link budget figures from AFTRCC and ITU-R 1459.M, AMT outages should be relatively common, even in the absence of interference:



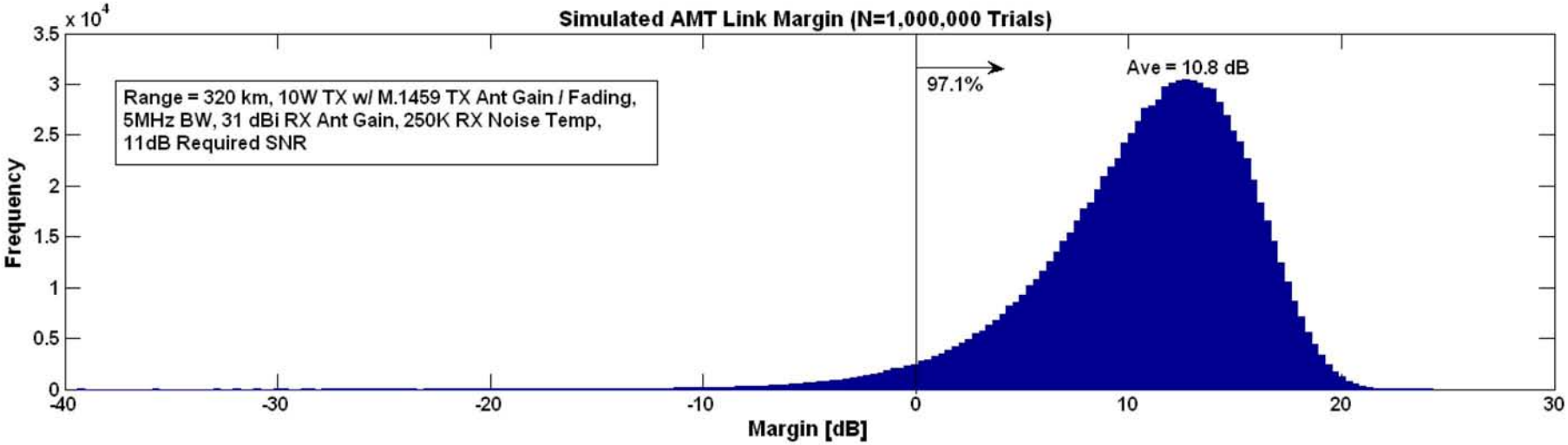
Only two possible conclusions:

1) Outage rates of several percent are, in fact, acceptable and are being tolerated already.

2) The AMT link budget actually has more margin than AFTRCC claims, *e.g.*:

- Not operating out to full 320 km
- Using more TX power than claimed
- Less severe fading than claimed 30 dB
- Incorporating other mitigation techniques (*e.g.*, TX/RX diversity, coding gain, etc.)

AMT Link Characteristics



- At most points in time, AMT link has copious excess margin.
- AMT outages are driven by long "tail" of fading distribution.
- Outages will occur with or without interference.
- Outage rate is relatively insensitive to moderate interference levels (*e.g.* I/N ≤-3dB).
- Although imperfect, the link is quite robust.
- For cases where a perfectly-reliable AMT link really is required, it would best be achieved through techniques like coding or diversity, which can exploit the significant excess margin, and not by preserving fractional dBs of SNR.

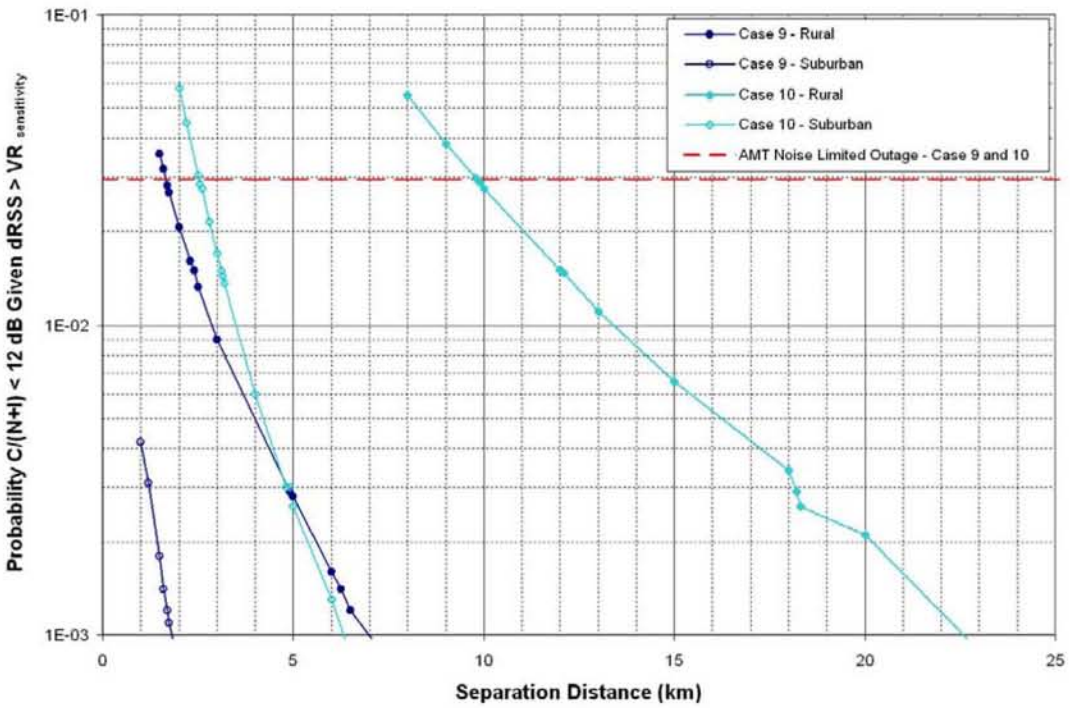
Realistic, Sophisticated Monte Carlo Analysis Confirms MBANS / AMT Coexistence

- The mere *theoretical possibility* of interference should not slam the door on a tremendously promising proposal. Rather, the *realistic probability* of "harmful interference" should be considered.
- Simulation shows actual likelihood of harmful interference is negligible.
- If necessary, a few modifications to the currently-proposed MBANS rules can further reduce the potential for interference while still creating an extremely valuable resource from otherwise fallow spectrum.

More Sophisticated and Realistic Monte Carlo Analysis Confirms MBANS / AMT Coexistence with Modest Separation Distances

Table 14 - Separation Distance for Factor of 1.6 Increase in AMT Noise-Limited Link Outage

		Rural		Suburban	
Case	Description	Separation Distance, Ds [km]	P[C/(N+I < 12 dB | dRSS > $VR_{sensitivity}$] at Ds	Separation Distance, Ds [km]	P[C/(N+I < 12 dB | dRSS > $VR_{sensitivity}$] at Ds
0	AMT max distance link without MBANS	Free Space Loss with Aircraft Antenna Fading Characteristic : P[C/N < 12 dB] = **1.55E-3** 60% = 9.3E-4			
6	50 MBANs, in/out, 25% duty cycle, frequency hopping	3.6	9.26E-4	0.65	9.23E-4
7	50 MBANs, in/out, 25% duty cycle, frequency hopping, in 41.2 dBi mainlobe	16.6	9.00E-4	4.1	9.34E-4
8	AMT max distance link without MBANS, 31 dBi antenna	Free Space Loss with Aircraft Antenna Fading Characteristic : P[C/N < 12 dB] = **0.0295** 60% = 0.0177			
9	50 MBANs, in/out, 25% duty cycle, frequency hopping, 31 dBi antenna	2.2	0.0175	< 0.5 km	0.0130
10	50 MBANs, in/out, 25% duty cycle, frequency hopping, in 31 dBi mainlobe	11.5	0.0172	3.0	0.0170



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Recent ECC Analysis Also Supports Coexistence Conclusion of GEHC's Analysis

Recent ECC draft report 121 considered coexistence of aeronautical telemetry and "PWMS" wireless microphones operating at L-band with 50 mW-per-200 kHz emissions limit.

Despite the the lower operating frequency, narrower bandwidth and substantially higher power of PWMS vs. MBANS devices – corresponding to over 28 dB higher power flux density per Hz at the AMT receiver for the same separation distance – the ECC draft report 121 concludes that:

- PWMS devices can coexist with co-channel aeronautical telemetry unconditionally in urban environments.
- For suburban / rural environments, PWMS devices can coexist with aeronautical telemetry given only relatively modest separation distances of as little as 1.5km.