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

In the Matter of	)	
	)	
GE HEALTHCARE	)	ET Docket No. 08-59
	)	
Petition for Rulemaking	)	

To: The Commission

REPLY COMMENTS OF AEROSPACE AND FLIGHT TEST RADIO COORDINATING COUNCIL

Aerospace and Flight Test Radio Coordinating Council ("AFTRCC"), by its counsel, hereby submits its Reply Comments in the above-captioned proceeding.

I.

BACKGROUND

In its opening Comments, AFTRCC demonstrated that the fundamental premises for GE Healthcare's ("GEH's") proposal are wrong: Flight test telemetry receiving stations are not limited to remote areas, and the tracking antennas do not generally operate at high elevation angles, as GEH has argued.[1] AFTRCC also demonstrated that ubiquitous body sensor networks ("BSNs") would be vulnerable to co-channel interference from test aircraft during pre-flight check-out, while taxiing, on take-off/landing approach, and even during operations within flight test areas -- during which events BSN receivers are likely to be well within the interference range of aircraft-mounted aeronautical mobile telemetry ("AMT") transmitters.

[1] See GEH Comments at page 20.

AFTRCC further explained how it was that the linchpin of GEH's sharing case -- contention-based protocol -- would not help. In major areas of the country, where the S-band is used "wall-to-wall" for flight testing, there is no vacant spectrum for BSNs to hop to. Moreover, GEH's frequency hopping actually worsens the interference to flight testing, as explained at page 18 of AFTRCC's Comments, and in the Engineering Statement attached thereto.

Finally AFTRCC observed that the GEH proposal represents the worst of both worlds for spectrum policy: (1) It would put the Commission in the untenable position of having to protect -- yet again -- nominally "secondary" medical telemetry devices used for "life-critical" patient monitoring; and (2) there is no way of enforcing the no-interference operation of ubiquitous BSNs as against primary incumbent services.

For all of these reasons, sharing between BSNs and flight testing is a particularly bad idea. Nothing in the opening Comments detracts from that conclusion. On the contrary, the Comments lend further support for the aerospace position.

II.

DISCUSSION

One of the key elements in the Commission's consideration of the GEH matter must be the usage of the S-band for flight testing. As The Boeing Company observes, the "Trends in the aerospace manufacturing and testing industry have caused exponential growth in the demand for spectrum ...." This has resulted in "heavy use of the 2360-2390 MHz band."[2] Boeing goes on to say that "[t]he shortage of spectrum is already causing delays in the testing of some new aircraft and aircraft components, resulting in significant expense to aircraft manufacturers and their

[2] Boeing Comments filed May 27, 2008 at 4.

customers."[3] In this regard, Boeing noted that the budget for just three test flights of the X-43 was $250 million.[4]

Boeing also observed that its flight test centers are located in or near major metropolitan areas in proximity to hospitals and other health care facilities.[5] Boeing notes that "[a]ircraft manufacturers would ... have no effective recourse if BSNs repeatedly disrupt flight test operations,"[6] and urges that the Commission not initiate a rulemaking on the proposal.

GEH's opening Comments do not advance its proposal. For example, GEH's presentations speak repeatedly of its plan for BSNs to have "secondary" status,[7] a plan reiterated in the Commission's Public Notice inviting comment on its proposal.[8] However, the footnotes proposed by GEH for the Table of Allocations would eliminate the aeronautical mobile telemetry allocation from the band 2370-2390 MHz. In particular, proposed footnote NG 186 reads as follows:

> The 2360-2400 MHz band is allocated on a secondary basis for non-Federal mobile use (except aeronautical mobile uses are prohibited in 2370-2390 MHz) and is limited to Medical Body Area Network Service (MBANS) operations. MBANS stations are authorized by rule on the condition that they do not cause harmful interference to, and

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[3] *Id.*

[4] *Id.* at 9.

[5] *Id.* at 7.

[6] *Id.* at 9.

[7] *See* GEH Comments at 1, 14, and 17; *see also, e.g.,* Ex Parte Comments filed December 27, 2007 in ET Docket No. 06-135 at 1, 9, and 12.

[8] DA 08-953, released April 24, 2008. In its own Comments, Wireless Communications Association International, Inc. ("WCAI") notes that the "GEHC *ex parte* submission advancing its BSN proposal consistently references that BSNs will be limited to secondary status ...." WCAI Comments filed May 27, 2008, at 1-2. WCAI goes on to express concern about the prospect of interference from operations in adjacent bands, such as the Wireless Communications Service, to BSNs, especially into the bands 2360-2370 and 2390-2400 MHz, "the very portions of the 2360-2400 MHz band most susceptible to OOBE interference." *Id.* at note 6.

> must accept interference from, stations authorized to operate on a primary basis in the 2360-2400 MHz bands.[9]

In explanation GEH has stated that:

> [It] proposes dividing this 40 MHz allocation into two channel sets - an inner set, consisting of 2370-2390 MHz, and an outer set, consisting of 2360-2370 MHz and 2390-2400 MHz. The outer channel set would be available for MBANS operations in any environment and would support modest MBANS usage densities in the presence of most incumbent operations. Inclusion of the inner set will ensure that even the highest expected MBANS usage densities (e.g. as may occur in hospitals) can be reliably supported even in the presence of significant incumbent operations. In order to protect radio astronomy operations incumbent to the inner set its use would be limited to health care facilities as described above. In this manner maximum MBANS deployment scenarios for GEHC's BSN application can be accommodated along with other MBANS applications.[10]

Putting aside the total disconnect between the proposal, and the rules offered to implement that proposal, the explanation GEH provides is revealing:

First. The radioastronomy operation it claims to protect is located in Arecibo, Puerto Rico, a remote location several hours drive into the mountains of Western Puerto Rico. There would be no need to eliminate the entire aeronautical mobile allocation, CONUS-wide, simply to protect one location 1,000 miles from the U.S. mainland if protection of radioastronomy were the only goal.

Second. The avowed concern for protection of BSNs in hospitals as against "significant incumbent operations," *coupled with* proposed elimination of the aeronautical mobile allocation, suggests, contrary to the "secondary" rhetoric, that GEH is very much concerned about the prospect of co-channel usage by, i.e. interference to and/or from, flight test telemetry.

Third. GEH's proposal to eliminate 20 MHz of critical flight-test spectrum for commercial testing of aircraft such as the Bell Helicopter Model 429; the Boeing 787 and 747-8;

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[9] Ex Parte Comments of GE Healthcare filed December 27, 2007 in ET Docket No. 06-135 at page 18 (emphasis added). The Ex Parte is cited at note 1 of GEH's opening Comments in this proceeding.

[10] Comments filed May 27, 2008 at 17.

the Learjet; and Cessna business and very light jets, to name a very few, is, if possible, even more groundless than its proposal for a "secondary" allocation. Such a result would cost billions of dollars in handicapped aircraft development, delayed FAA certification and customer delivery, and lost revenue.

Although GE's proposal is for a Non-Government footnote, it could also impact military development programs such as the Joint Strike Fighter, F-22, F-16, F-18, C-17, KC-767 Tanker, and V-22, among a few of the higher profile programs.

In short, GE's proposal would cause serious harm to US commercial and military flight-test programs. It also underscores how much of a moving target GEH's proposal really is, lurching from one spectrum request to another, from one power level to another, and from one regulatory classification to another.[11] In key respects neither AFTRCC, nor other parties like WCAI, nor the Commission itself are in a position to know what it is GEH wants. For this reason as well, its proposal should be rejected.

But putting all of this aside, GEH's other points likewise have no merit. For example, GEH quotes from the Commission's *Seventh Report and Order* in Docket Nos. 00-258 and 02-8 for the proposition that "[a]eronautical mobile use of the band will likely be predominantly at remote locations," and that the potential for interference "would be small, due to the high altitudes of aeronautical mobile flight testing transmitters, and the correspondingly high elevation and off-axis attenuation of high gain flight testing receive antennas on the ground."[12]

The *Seventh Report and Order* reflects a misunderstanding of flight test telemetry operations: While downrange airspace used for flight testing is, indeed, predominantly in

[11] See AFTRCC's opening Comments at page 3 (upping spectrum request from 5-10 MHz to 20-40 MHz, and power from -10 dBm to 0 dBm (1 mW)).

[12] GEH Comments filed May 27, 2008 at 20, citing FCC 04-246, 19 FCC Rcd 21350 (2004) at para. 47 (emphasis added).

remote, sparsely populated areas for safety's sake, flight test receive stations are frequently located in or proximate to population centers. And it is the receiving stations -- not the aircraft -- which are of interest in assessing the interference potential to flight testing.[13]

Likewise, the *Seventh Report and Order* reflects a misunderstanding of the geometry of flight testing. While aircraft undergoing flight test are often at high altitude,[14] that does not make for a "correspondingly high elevation and off-axis attenuation of high gain flight testing receive antennas on the ground."[15] On the contrary, because aircraft are "routine[ly]" tested at extended distance from the telemetry receive sites, the elevation angle of the tracking antennas (which are themselves mounted on towers or roof-tops) is typically at 1.5° or less, as the first-hand Declarations of flight test experts attached to AFTRCC's Comments and the Boeing Comments (at 7) demonstrate.[16]

In short, the *Seventh Report and Order* does not help GEH's argument that its devices would not interfere with flight testing.

GEH nonetheless asserts that its devices "satisfy[ ] the ITU-R M.1459 recommendation at a separation distance of 218 meters between [BSN] transmitter and aeronautical telemetry receiver."[17] However, as the attached Engineering Statement observes, GEH's calculation is merely a measure of the separation required to avoid interference to telemetry when BSNs are

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[13] Currently, AMT transmissions are primarily one-way, i.e. from aircraft to the ground. However, this is changing. See AFTRCC Comments at note 16.

[14] *Id.*

[15] *Seventh Report and Order, supra*, at para. 47.

[16] The tests conducted by Learjet and Cessna demonstrate the severe effects of the interference from BSNs to AMT tracking antenna sites. *See* AFTRCC Comments at Exhibits G and H.

[17] *Id.* at 22.

looking at the AMT antenna at an offset angle of 24 degrees.[18] Based on this assumption, GEH is able to avoid discussing the devastating effects to flight test telemetry when BSNs transmit into the main lobe of the AMT tracking antennas. Its approach is based on the discredited notions that tracking antennas are located in the "remote" areas and operate only at "high elevation angles." When corrected for BSN interference into the main lobe of the tracking antenna, BSNs fail miserably to meet M.1459 standards.

In particular, the Engineering Statement demonstrates that proper application of the antenna characteristics in Figure 1 of ITU-R Rec. M.1459 increases the calculated interference from BSNs by a factor of 30 dB; and that this factor needs to be increased by a further 21 dB to take proper account of BSN duty cycle, peak (vs. average) power, and the propagation exponent, for a total of 51 dB. Recomputation of the pdf level from a 1mW BSN at a line of sight range of 218 meters yields a power flux density at the AMT receive antenna that is <u>68 dB in excess</u> of M.1459's -180 dBW/m^2/4 kHz protection level.

GEH also cites from AFTRCC Comments in Docket No. 00-258 for the proposition that there is a "negligible likelihood of interference from an aeronautical flight test transmitter to an omnidirectional, terrestrial receiver, such as a DARS or proposed [BSN] receiver."[19] But GEH's citation reflects, again, a misunderstanding of the issue, and renders its analogy inappropriate.

The issue addressed in AFTRCC's earlier Comments concerned a request by XM and Sirius for the imposition of tighter out-of-band emission limits on AMT transmitters given an anticipated influx of Government fixed and mobile systems migrating from the 1710-1755 MHz band to 2360-2390 MHz. AFTRCC observed that there was little likelihood of aircraft

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[18] GEH's path loss exponent assumption of 2.4, rather than two (GEH Ex Parte Comments filed December 27, 2007 in ET Docket No. 06-135 at page 40), at 218 meters is plainly erroneous. AMT receive antennas are typically mounted on towers and rooftops well above ground level. Under these circumstances, where there is a clear line of site, as there often will be, the exponent should retain its free space value of 2.

[19] GEH Comments at 21.

interference to DARS when at high altitude (where a no-gain DARS antenna would be unable to detect the telemetry signal), or at low altitude (where ground attenuation and geographic separation between aircraft and the general public minimize the risk). GEH argues that the same factors preclude interference to BSNs.

What GEH fails to mention, much less address, is the fact that its devices would be co-channel to AMT -- not separated by a 15 MHz guard band (2345-2360 MHz).[20] What it also fails to mention is that even by its own calculations, a 10 kilometer separation would be required between a test aircraft and a BSN in order to avoid interference to the BSN.[21] This is a far cry from the 1400 feet at issue (0.42672 km) in the DARS case. There is no way of enforcing any kind of keep-out zone when dealing with distances measured in kilometers. And while attenuation is a factor, it is much less so for BSNs, being co-channel, than in the DARS case. Moreover, GEH's vision for ubiquitous use[22] makes it likely that BSN-equipped patients would be located between a tracking antenna and a distant aircraft undergoing flight tests, and with a clear line of sight (or minimal attenuation) to the antenna.

Thus, there is a clear and tangible risk of harmful interference to BSN devices and the "life-critical" telemetry GEH contemplates. In light of this, GEH's Comments elsewhere to the Commission are troubling. In WT Docket No. 07-100, for example, GEH has argued at length that medical telemetry manufacturers, like itself, should have no "obligation [to] ensure a customer's compliance with the Commission's Part 95 requirements" for Wireless Medical Telemetry Service ("WMTS") devices (GEH has likewise proposed Part 95 operation for BSNs).

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[20] SDARS operates at 2320-2345 MHz.

[21] *See* GEH Reply Comments filed December 4, 2006 in ET Docket No. 06-135 at 9 and Appendix A at page 1 (assuming free space propagation). The distance is much greater as calculated by AFTRCC's consulting engineer, Daniel G. Jablonski, namely at least 17.8 to 71 km (depending on attenuation assumptions).

[22] A use facilitated by GEH's plan for "disposable devices." Comments at note 22.

Instead, GEH has argued that it should be up to hospitals and health care providers to see to compliance with FCC Rules.[23] This reflects precisely the same sort of dysfunctionality which has attended other efforts to regulate medical telemetry, whether secondary or primary. GEH's invitation to the Commission to revisit that experience -- when it assiduously avoids taking any responsibility itself -- is preposterous. It underscores the reasons why medical telemetry must not be allowed to share spectrum with primary non-medical incumbents.[24]

Finally, AFTRCC notes the Comments of ARRL, the National Association for Amateur Radio ("ARRL"). The amateur community has a co-primary allocation at 2390-2395 MHz with flight testing, an allocation effectuated by the *Seventh Report and Order, supra.* ARRL observes that there will be increasing use of this band by amateurs, and that existing use is an unreliable predictor of future use for purposes of determining BSN compatibility in the same band.[25]

When the Commission made the co-primary allocation in 2004, it was based on the fact that amateur use of the band was "relatively light," i.e. chiefly for fast scan television.[26] Even still, AFTRCC expressed serious concern about the potential for interference, and urged that the Commission adopt a coordination regime for this sub-band, a result which the Commission did not see fit to adopt. This has left the 2390-2395 MHz band under a cloud from the aviation standpoint, with the result that AFTRCC Member Companies have been able to make only

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[23] Reply Comments of GE Healthcare filed September 11, 2007 at 3.

[24] GEH's Reply Comments in WT Docket No. 07-100 are noteworthy in another respect as well; namely, an insistence that secondary status for WMTS devices in portions of the 1427-1432 MHz band not be allowed "because of the significant risks to patient care that secondary WMTS use would create," and its reference, with approval, to Comments by the American Society for Healthcare Engineering for the proposition that "any secondary use 'should not be relied upon for functions that are critical to patient safety.'" GEH Reply Comments at 4th and 5th pages. One can only wonder how patients equipped with "life-critical," but secondary, BSNs would feel about GEH's product if they knew its views on the vulnerability of secondary status.

[25] ARRL Comments filed May 27, 2008 at 3.

[26] *Seventh Report and Order*, supra, at para.47.

limited use of the band. This needs to be addressed further in order to regularize operation in the band for the benefit of both communities, amateur and flight test.

In any event, a coordination regime such as flight test and amateurs might adopt, is beside the point when it comes to BSNs, with which it is impossible to coordinate as GEH itself has conceded.[27]

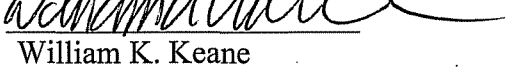
III.

CONCLUSION

GEH's proposal for a secondary allocation in the band 2360-2400 MHz will provide neither reliable life-critical service for patients, nor the protection of flight safety communications for test pilots. For the reasons stated herein and in its opening Comments, the GEH proposal should be rejected, and this proceeding closed forthwith.

Respectfully submitted,

AEROSPACE and FLIGHT TEST RADIO
COORDINATING COUNCIL

By: 

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June 11, 2008

[27] GEH ex parte filing of July 25, 2007 in ET Docket No. 06-135 at 14 ("Coordination by frequency rules do not [sic] accommodate frequency agile BSNs").

Engineering Statement

Pertinent technical points in reply to General Electric Healthcare's (GEH's) Comments are summarized below:

1. Incorrect GEH assumptions regarding AMT ground station antennas

The GEH analysis assumes that the receive gain of an AMT antenna, with respect to interference from a BSN transmitter, is 0 dBi. The proper values will range from 26 – 40 dBi. A nominal value of 30 dBi is used in Recommendation ITU-R M.1459 for demonstrating the side-lobe performance of an AMT antenna relative to its main-beam gain and beam-width. As has been noted repeatedly by AFTRCC in its filings and ex parte comments, the assumption that BSN's will be in the side-lobe of an AMT antenna is incorrect.

In particular, the presumption in the BSN analysis (GEH ex parte of Dec. 27, 2007 at pages 39-40) that the receive gain of an AMT antenna is 0 dBi corresponds, with respect to Figure 1 of Rec. M.1459, to assuming that the BSN lies at an offset of 24 degrees from the bore-sight of an AMT antenna having the characteristics shown in the figure. This places the BSN in the null between the 3rd and 4th sidelobes of the AMT receive antenna, an unrealistic assumption when assessing the interference potential of BSNs to AMT.

Furthermore, for the interference threshold range of 218 meters calculated by GEH (Dec. 27, 2007 ex parte at page 40), the assumption that the path loss exponent is 2.4, rather than 2.0, is easily shown, both experimentally and theoretically, to be incorrect. For an AMT receive antenna mounted on a pedestal even a few feet above the ground, much less the 50 – 100 feet or more that is typical of AMT ground stations, the exponent should retain its free space value of 2.

Thus, proper application of antenna characteristics, as demonstrated in Figure 1 of ITU-R Rec. M.1459, increases the calculated interference from BSN's by a factor of 30 dB. Note that for every 6 dB increase in antenna gain, the BSN-transmitter-to-AMT-receive-antenna distance required for maintaining a constant level of interference increases by as much as a factor of 2, depending on one's choice of propagation exponent. Thus, an increase of 30 dB to acknowledge the proper value of receive antenna gain requires as much as a 2^5 increase in separation distance. This changes the interference distance in this particular example from 218 meters to 7 km.

However, the GEH analysis (Dec. 27, 2007 at p.39) assumes that an individual BSN has a duty cycle of 25%, and assumes another 6 dB of isolation based on the corresponding assumption (not demonstrated to be valid) that average, rather than peak, BSN power can be used in the analysis. The further assumption is made that within the 10 MHz bandwidth of an AMT receiver, only a single BSN using 1 MHz of bandwidth is operational, and that this BSN can account for an I/N ratio of -2.68 dB, rather than the ITU-R M.1459 value of -8.13 dB.

Taking these discrepancies into account changes the interference budget by an additional 21 dB, for a total of 51 dB. Correcting these errors, while retaining the propagation exponent of

2.4 that is proposed by GEH, yields the separation distance of 62.1 km computed by AFTRCC in a previous filing (Feb. 4, 2008).

Alternatively, if the GEH separation distance of 218.2 meters is retained in the calculation, and the appropriate exponent of 2.0 for this distance is used, the pfd at the AMT receive antenna is 68 dB above the protection level specified in Rec. M.1459. Thus, the claim by GEH that BSN's will not interfere with AMT ground stations is incorrect, even for the case of a single BSN.

There are no reasonable permutations of duty cycle, bandwidth occupancy, spectrum hopping, etc. that can make a 1 mW interference source look insignificant to a wide bandwidth, noise limited telemetry system that employs a high gain receive antenna. The physics needed to support sharing of AMT spectrum with a ubiquitous, uncoordinated user just is not there. Furthermore, the lay person's notion that a BSN "is only a milliWatt" fails to recognize the combination of extraordinarily low AMT signal strength and exquisite sensitivity that characterizes noise-limited systems, such as AMT ground stations, using high gain antennas.

2. Inability of contention-based protocols to protect AMT operations

GEH stresses its reliance on contention-based protocols as being a useful interference mitigation technique. As stated in previous AFTRCC filings, this will not be the case with regard to flight test telemetry operations. Because of the geometry involved, detection of a signal from an AMT-equipped aircraft has no correlation with whether a BSN will interfere with the corresponding AMT ground station. GEH's insistence on using contention-based protocols might make sense for mitigating interference between and among BSNs trying to use the same spectrum, but it will be of no value in protecting AMT operations.

3. Failure of GEH's "single-entry" analyses to account for aggregate interference effects from BSNs to AMT ground station receivers

As alluded to in point 1, above, GEH's AMT interference analyses make unrealistic assumptions about the ubiquity and spectrum occupancy of BSN devices. For example, GEH states the need for large amounts of spectrum, but has performed interference analyses that assume that within the beam of an AMT antenna, only 1 BSN will be detected within a 10 MHz-wide AMT channel. (Dec. 27, 2007 submission at p. 39, cited in GEH comments of May 27, 2008). If this is indeed the case, BSN spectrum needs can easily be met within small portions of other available S-band spectrum without the need to share with AMT. In any event, with the ubiquity contemplated for BSNs, the failure to take account of aggregate effects is a serious flaw.

4. The need to include out-of-band "roll-off" attenuation when comparing in-band with adjacent band interference

Finally, in its May 27, 2008 filing, GEH compares the BSN-to-AMT in-band interference scenario with that of the out-of-band interference scenarios discussed in the 2003 SDARs filings (Docket 00-258, AFTRCC Comments of 26 November 2003). In the AFTRCC filing, quoted out of context by GEH, there is an additional 65 dB of attenuation (55 + 10 log(P)) due to out-of-band roll-off that does not exist for the in-band case presented by GEH's proposal. GEH does not acknowledge this critical difference.

5. Declaration

I have read and am familiar with the Reply Comments being filed by Aerospace and Flight Test Radio Coordinating Council. These Comments are true and correct to the best of my knowledge and belief.

Daniel G. Jablonski
June 11, 2008

CERTIFICATE OF SERVICE

I, Stephanie M. Lemke, hereby certify that I have caused the attached Comments on GE Healthcare Proposal to be deposited in the U.S. Mail, first-class postage prepaid, this 11th day of June 2008, addressed as follows:

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