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

In the Matter of	**)**	
	)	
Amendment of the Commission's Rules	**)**	**ET Docket 08-59**
To Provide Spectrum for the Operation	**)**	
Of Medical Body Area Networks	**)**	

To: The Commission

COMMENTS OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to the *Notice of Proposed Rule Making*, FCC 09-57, 74 Fed. Reg. 39249, released June 29, 2009 (the Notice), hereby respectfully submits its comments in response to the Commission's proposal to allocate spectrum and establish service and technical rules for the operation of wireless Medical Body Area Network (MBAN) systems using body sensor devices. These would permit wireless networking of multiple body sensors used to monitor a patient's physiological data. In the interest of the Amateur Radio Service in avoiding interference to and from MBANs in Amateur allocations around 2 GHz, ARRL states as follows:

I. Background

1. The Notice in this proceeding stemmed from a proposal by GE Healthcare (GE), filed originally as written *ex parte* comments in response to a *Notice of Inquiry* in the so-called "MedRadio" proceeding, ET Docket 06-135 on or about December 27, 2007. GE proposed that the band 2360-2400 MHz be allocated on a secondary basis for

MBANs. The Commission properly treated the proposal as a rulemaking petition separate from the proposal in the MedRadio proceeding. MBAN systems are to be used for wireless patient monitoring. They are very short-range networks consisting of multiple body-worn sensors and nodes, connected via wireless to nearby hub stations as the Commission put it, "primarily" at medical facilities, but apparently to be located in homes as well. The only Amateur spectrum affected by the original GE Healthcare proposal was the band 2390-2400 MHz, which is a primary allocation.[1] The 2360-2400 MHz allocation proposal was heavily contested when the Commission issued a *Public Notice* [2] in this proceeding, seeking comment on the GE proposal. The instant Notice, basically, reiterates the proposal but considers alternative bands as well. At paragraph 7 of the Notice, the Commission indicates that it is sensitive to the necessity of affording interference potential to incumbent primary users, particularly Aeronautical Mobile Telemetry (AMT), which operates at 2360-2395 MHz. As well, it states that it is interested in the potential for interference *to* MBAN devices and the attendant risk to patients using MBAN systems.

2. Apparently based solely on the counterproposal of the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) that the Commission consider certain specific alternatives to an allocation of the 2360-2400 MHz band to MBANs, the Notice at Paragraphs 4 and 11 discusses alternative allocations for MBANs at 2300-2305 MHz; 2395-2400 MHz; 2400-2483.5 MHz; and one other band at 5 GHz. Of the "alternatives" in the vicinity of 2 GHz, (all of which are Amateur allocations), none is suitable for various reasons. The Commission should instead consider spectrum around 5 GHz or

[1] The Amateur Service has a secondary allocation at 2300-2310 MHz; a primary allocation at 2390-2417 MHz; and a secondary allocation at 2417-2450 MHz, as is more fully discussed herein.
[2] Public Notice, DA 08-953, released April 24, 2008.

above for these short-range networks, or, perhaps more appropriately, they should operate in the Wireless Medical Telemetry Service under Part 95 rules.

II. The 2300-2305 MHz Band is Especially Unsuitable for MBANs

3. Of the bands counterproposed by AFTRCC (in classic "NIMBY" fashion) as alternatives to band sharing at 2360-2395 MHz between MBAN and AMT operations, AFTRCC's suggestion of 2300-2305 MHz is particularly inappropriate. At paragraph 11 of the Notice, the Commission seeks comment on the possibility of limiting MBAN operations to the 2300-2305 MHz and 2395-2400 MHz bands, rather than the single band 2360-2400 MHz requested by GE Healthcare. These two blocks of spectrum separated by 90 MHz are under consideration for either secondary or primary allocation to MBANs, thus to avoid protection requirements for MBANs relative to AMT operations. The Notice asks specifically whether MBAN operations can exist compatibly with incumbent Amateur Service users in the 2300-2305 MHz and 2390-2400 MHz bands. The segment 2300-2305 MHz is of extreme importance to the Amateur Service, especially for weak-signal communications and propagation research, including beacon operation, due to the low noise levels in that band. It is *completely unsuitable* for the addition of MBAN operation, and MBANs would, in that band in particular, be subject to extremely high ERP transmitted signals from Amateur stations at unpredictable times, in unpredictable geographic locations, which would inevitably disrupt the MBAN systems, potentially with disastrous consequences for the medical patients.[3]

4. Internationally, the 2300-2305 MHz band is allocated to the fixed, mobile and radiolocation services in ITU Region 2, but there is an Amateur secondary allocation as

[3] It is notable that in this proceeding, unlike the Docket 09-36 proceedings dealing with biomedical implants, there is no claim whatsoever by the proponent of the medical devices that MBANs are immune to co-channel or adjacent channel interference from incumbent licensed services.

well. Domestically, there is no primary allocation for any service, but the secondary Amateur allocation is, in this instance, a *de facto* primary allocation as the result. There is good reason for this.

5. The Amateur Service has suffered the steady erosion of allocations between 2300 and 2450 MHz over a relatively short period of time. This allocation formerly constituted a contiguous, secondary allocation for the Amateur Service of 150 MHz. The Amateur Service was excluded domestically from the segment 2310-2390 MHz in 1984, in order to accommodate aeronautical flight test telemetry in that band in certain areas. Just below the Amateur allocation at 2300 MHz, NASA operates the Government Deep Space Network, which requires protection from interference. There are other government operations below 2300 MHz as well. Amateur weak signal operation, centered generally near 2304 MHz, and other Amateur operation in the band 2300-2305 MHz has been demonstrated over time to be entirely compatible with NASA operations, and with other associated government operations below 2300 MHz.

6. In 1993, pursuant to the *Omnibus Budget Reconciliation Act of 1993,* Pub. L. 103-66, 107 Stat. 312, enacted August 10, 1993 ("OBRA"), NTIA reallocated from government use, among other bands, 2300-2310 MHz.[4] Congress instructed, in connection with that allocation,[5] that the Secretary of Commerce must avoid "excessive disruption of existing use of Federal government frequencies by Amateur Radio licensees." Furthermore, in identifying spectrum for reallocation and considering possible non-government uses of the bands identified, the Secretary of Commerce was to consider

[4] OBRA ordered NTIA to identify at least 200 MHz of spectrum, which was then allocated for use by Federal government agencies below 5 GHz, which could be transferred to private sector use. At least 100 MHz of this spectrum had to be below 3 GHz. 47 U.S.C. § 923(e)(2)(A) and (B). NTIA in fact identified 235 MHz of spectrum, among these being 2300-2310 MHz.
[5] See, Section 6001(a).

"the extent to which, in general, commercial users could share the frequency with amateur radio licensees." This obligation was again noted in the 1997 Balanced Budget Act ("BBA") at Title III.[6] As noted in the NTIA *Final Spectrum Reallocation Report,* NTIA Special Publication 95-32, February, 1995, at Appendix B, page 26:

> Sharing between Federal government users and the amateur service has been successful largely because Federal operations are generally located outside of highly populated areas (citation omitted). *It is very unlikely that the Amateur Service will enjoy an analogous situation with a commercial or other private sector service. If commercial services are to share with the weak signal operations located at 2303.75 – 2304.75 MHz, they must be able to withstand potential interference from the high-powered transmitters used for those operations, but not create interference to the sensitive receivers used.*
>
> (emphasis added)

This NTIA technical finding is accurate. There is no indication that MBANs, which clearly are not going to be able to withstand unpredictable, geographically proximate Amateur narrowband transmissions at transmitter power levels up to 1500 watts, and ERP levels in the megawatt range, in the middle of the 2300-2305 MHz band. Nor is there any ability to coordinate MBAN operation relative to Amateur operation in this band, such that MBAN interference to the sensitive receivers used by radio Amateurs in residential or temporary fixed locations (which are typical Amateur Station configurations in this band) can be avoided.

7. Notwithstanding Congress' clear admonition to NTIA to avoid disruption of incumbent Amateur operation in any reallocation proceeding pursuant to OBRA or BBA, the Commission [7] in Docket 96-228 created the Wireless Communications Service, later

[6] See, 47 U.S.C. § 923(c)(1)(C)(iii).
[7] The Commission was constrained by the *Omnibus Consolidated Appropriations Act*, Pub. L. 104-208, which in part ordered the Commission to auction the 2305-2320 MHz and 2345-2360 MHZ bands to wireless services.

renamed the Miscellaneous Wireless Communications Service (Part 27 of the Commission's Rules), in 1997, to which it allocated, among other bands, 2305-2320 MHz.[8] That action, though it retained the Amateur secondary allocation in the 2305-2310 MHz band, made Amateur use of that segment distinctly problematic, and caused a shift in some Amateur operation there downward, into the band 2300-2305 MHz. The extremely low desired signal levels used in Amateur weak-signal operation in the 2 GHz band can only be reliably received in the 2300-2305 MHz band, a uniquely low-noise environment in the 2 GHz range. Amateurs use the remainder of the 2300-2310 MHz allocation for point-to-point links, paired with frequencies in the 2390-2400 MHz band. The nature of Amateur operations at 2300-2305 MHz renders the Service uniquely capable of protection of NASA and other government operations below 2300 MHz, but uniquely incapable of protection of any co-channel operation in other services.

8. On October 10, 2002, the Commission issued an order dismissing three rulemaking petitions.[9] Each of those petitions had proposed changes to the domestic Table of Allocations, 47 C.F.R. § 2.106, with respect to the 2300-2305 MHz band. Two of those petitions were filed by proponents of personal location and monitoring services. The third was filed by ARRL seeking an upgrade of its allocation to primary status in the 2300-2305 MHz band. All three petitions were denied by the Commission, but the Commission noted that all Amateur operations in that band would be protected. It also noted that the commercial services could be accommodated elsewhere, and that the *status quo ante* would be maintained at 2300-2305 MHz "until the Commission reevaluates the spectrum reserve at some future date." The "spectrum reserve" was a reference to a

[8] See, *Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service*, 6 CR 771, FCC 97-50, released February 19, 1997.
[9] *Order*, DA 02-2587, dismissing RM-9797, RM-10165 and RM-10166.

November 22, 1999 *Spectrum Policy Statement* [10] which set forth guiding principles for reallocation of spectrum to encourage the development of telecommunications technology for the new millennium. Therein, the Commission stated that it was holding the 2300-2305 MHz band in reserve because commercial operations would be subject to "significant constraints" in order to protect the Deep Space Networks. In addition, the *Policy Statement* noted a statutory requirement to maintain a spectrum reserve until 2006. There has not, since that time, been any reevaluation of the "spectrum reserve." Therefore, any piecemeal additional allocations for this band at the present time are inappropriate.

9. Operation of MBANs at 2300-2305 MHz has not to date been shown to be compatible with the Deep Space Network below 2300 MHz. More fundamentally, however, MBAN operation is absolutely incompatible with Amateur operation at 2300-2305 MHz. GE admitted as much in its proposal for the allocation of the entire 2360-2400 MHz band for BSN devices. The GE proposal specifically mentioned Amateur Radio and claimed that, because the band 2390-2400 MHz is "designed (sic) for fast scan video, high rate data, packet, control and auxiliary applications" and <u>not</u> weak signal communications, it was therefore well-suited for sharing with the BSN (i.e. MBAN) systems. Thus, GE conceded that the band 2300-2305 MHz is not compatible with MBANs, due to the substantial use of the band for Amateur weak-signal communications. Weak signal Amateur communications utilize long propagation paths, very low received signal levels, and very high transmitted signal levels and effective radiated power. These operations optimally utilize tall antennas located in residential areas, or at unpredictable, temporary fixed locations. Because of this unpredictable

[10] *Policy Statement*, 14 FCC Rcd. 198868 (1999).

geographic proximity and the difficult radio frequency environment, any compatibility analysis (none has been submitted by AFTRCC as the proponent of 2300-2305 MHz as an alternative to 2360-2400 MHz, or by the Commission or any other party to date), must anticipate a close geographic proximity between MBANs and weak-signal Amateur Radio operation. Quite simply, there is no compatibility whatsoever between incumbent Amateur operation an MBAN operation at 2300-2305 MHz, and the Commission must reject AFTRCC's irresponsible attempt to slough off MBANs to other bands without the slightest technical justification therefor.

III. The 2390-2400 MHz Band is Likewise Incompatible With Incumbent Amateur Operation

10. ARRL has stated earlier in this proceeding, relative to the 2390-2400 MHz band, that ARRL does not, frankly, expect a significant amount of harmful interference *to* Amateur operations at 2390-2400 MHz from MBANs. In suggesting this segment as part of its proposed allocation, however, GE made some erroneous assumptions about Amateur uses in that band. As the result, and with the absence of a technical compatibility showing evaluating typical Amateur systems, the interference potential of MBAN devices *to* Amateur Radio stations in residential areas is not known. There are no limitations on the type of Amateur operations to be conducted in the 2390-2400 MHz band.[11] The band may in fact be used in some areas for weak signal communications, on a completely unpredictable basis. The uses of this band by radio Amateurs, though

[11] In summarizing what it assumed were limited uses made by licensees of the 2390-2400 MHz Amateur Primary allocation, GE apparently had consulted ARRL's *Repeater Directory* for a list of general uses of the 2390-2400 MHz band. The Amateur uses listed in the general band plan for the 2390-2400 MHz segment include fast-scan TV, high-rate data, packetized data, and control and auxiliary links. The most recent *Repeater Directory* (2007-2008) and, it is believed, all prior iterations of this publication, note at the top of the section listing the band plan for the 2300-2310 and 2390-2450 MHz bands specifically, that "this bandplan is a general recommendation. Spectrum usage can be different depending on location and regional coordination differences. Please check with your Frequency Coordinator for information."

guided overall by a national band plan, are very much subject to local variation dictated by custom and usage. It is improper to make assumptions about the specific types of Amateur operations in this band, now or in the future, and the Commission should not rely on any of GE's misleading assumptions in making any decision in this proceeding. Furthermore, because of the growing use of 2400-2450 MHz for short-range wireless broadband and other unlicensed uses, some Amateur operation in that segment of the band has migrated, and will inevitably continue to migrate to the 2390-2400 MHz segment. It is, therefore, inappropriate to use existing activity as a predictor of future Amateur activity in the 2390-2400 MHz band, for purposes of determining compatibility of a new device or service under consideration for overlay in the same band.

11. ARRL is far more concerned, however, as it has stated earlier in this proceeding, about potential interference to BSNs from licensed Amateur Radio operation in the 2390-2400 MHz band. The ramifications of radiofrequency interference (RFI) to these systems in terms of danger to medical patients are obvious, and potentially severe. ARRL asserts that the potential for interference from Amateur Radio operations, which are in this band occasionally itinerant and mobile, but most often fixed or temporary fixed, in residential and rural areas, to MBANs is a substantial problem. MBANs, which GE states will "become ubiquitous," must, according to GE, "be capable of reliably conveying unprocessed life-critical monitoring data to devices that are responsible for processing and primary alarming. In these scenarios, if the link were lost, a serious event such as arrhythmia or hypoxia could go unalarmed." [12] If GE's products in fact require "extremely reliable" communications links with a predictable quality of service, they will not find that in the 2390-2400 MHz band and should look elsewhere. Amateur Radio

[12] *See*, GE *Ex Parte* comments, at pages 7,8 and 12.

operation in this band is unpredictable, as are the types of communications conducted in a given area, which are subject to local custom and local band plans. As is the case at 2300-2305 MHz, the substantial transmitted power levels and exceptionally high antenna gain figures used by radio Amateurs in the 2390-2400 MHz band will provide no reliability of MBANs in this segment whatsoever, and the results of such interference would be potentially disastrous, as GE has itself admitted.

12. The 2390-2400 MHz band was allocated to the Amateur Service on a primary basis in 1994 following government reallocation pursuant to ET Docket No. 94-32.[13] In the Advanced Wireless proceeding, ET Docket No. 00-258, the Commission added AMT operation on a co-primary basis with the Amateur Service in the 2390-2395 MHz segment. No limits were imposed on sharing between AMT and Amateurs in that segment, in part because it is not feasible to do so, given the mobile nature of Amateur operations at 2390-2400 MHz:

> Also, as indicated by the lack of agreement regarding coordination between ARRL and AFTRCC, and especially given the flexibility of amateur to operate without specific station authorization or registration on the Commission's database, it appears impractical to establish an effective coordination requirement at this time. We also conclude that, because most flight testing is conducted at high altitudes with low output power at remote facilities, the reverse potential for interference from flight testing operations into amateur operations is also small. Therefore, we will not require that flight testing operations be coordinated with Amateur operations. [14]

The Commission's findings regarding sharing at 2390-2395 MHz all indicate that compatible sharing between MBANs and Amateur operations at 2390-2400 MHz is not

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[13] See, *Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use, First Report and Order and Second Notice of Proposed Rule Making,* 10 FCC Rcd.4769 (1995).

[14] *Allocation of Spectrum Below 3 GHz for Advanced Wireless Services, Seventh Report and Order,* FCC 04-246, 69 Fed. Reg. 77938, released October 21, 2004. This same rationale that the Commission used in determining that Amateur and AMT operations are compatible at 2390-2395 MHz may also be applied to the compatibility of AMT and MBAN operations at 2360-2390 MHz.

possible. The mobile and itinerant nature of Amateur operations in this band, the unpredictability of such operation, the operating parameters, and the fact that the geographic separation between two mobile, terrestrial uses in the band could be very small, precludes advance coordination between Amateur and MBAN operation, and makes interference instances completely unpredictable.

IV. The 2400-2402 MHz, and 2402-2417 MHz Bands

13. The Commission is also considering as an alternative candidate band for MBANs the 2400-2483.5 MHz band. The Notice acknowledges that the band 2400-2417 MHz is allocated to the Amateur Service on a primary basis, and asks whether MBANs can be certified and operated on an unlicensed Part 15 basis in the 2400-2483.5 MHz band. The band 2400-2417 MHz was allocated to the Amateur Service on a primary basis in 2003, in ET Docket 02-98.[15] While this band is compromised somewhat by relatively high noise levels from Part 15 and Part 18 (ISM) devices, the Commission's 2003 action upgrading the Amateur allocation to primary was intended to "provide additional protection to the amateur service in this band from future licensed operations." [16] The Commission clarified there that the Amateur Service at 2400-2417 MHz is entitled to protection as well from Part 15 operations in that band, but would be subject to any received interference from ISM devices there.

14. Though the Commission did not similarly create a primary allocation for the Amateur-satellite Service, substantial Amateur satellite operations are regularly conducted in the 2400-2402 MHz band. Amateur-satellite receivers, as the Commission noted in Docket 02-98, are "at greater risk from aggregate interference" than are

[15] See, the *Report and Order*, FCC 03-105, released May 14, 2003.
[16] *Id.*, at ¶ 43.

terrestrial Amateur receivers due to the sensitivity of the former. While currently, the Amateur-satellite service operates on a non-interference basis to other radio services pursuant to international footnote 5.282,[17] the incumbency of large numbers of Amateur-satellite service stations in the 2400-2402 MHz band, and the sensitivity of receivers used[18] must be taken into account when deciding whether to add additional licensed services or uses to the segment at 2400-2402 MHz. As to the remainder of the Amateur primary allocation, 2402-2417 MHz, the situation is similar to that of 2390-2400 MHz; there is no technical compatibility showing that has been offered by any proponent of this alternative to the 2360-2400 MHz band, and no indication whatsoever that incumbent Amateur operation, including wideband video and other high-duty-cycle operations would be compatible with MBAN operation at 2400-2402 MHz. ARRL asserts that the contrary is true; there is no compatibility between MBAN operation and Amateur operation in, at least, 2400-2402 MHz.

V. Alternative Bands Should be Considered for MBANs

15. Alternatives to the 2390-2400 MHz band for MBANs should be considered. These should include medical telemetry bands. They should not in any case utilize a band actively used by licensed services for mobile or itinerant applications or those with close geographic proximity to MBANs. Furthermore, high microwave bands might be appropriate for MBANs, but not bands in the vicinity of 2 GHz, which has exceptionally long-distance propagation characteristics. There is no indication that bands below 5 GHz are necessary or suitable for these systems, and because of the short ranges utilized by

[17] See, 47 C.F.R. § 2.106, footnote 5.282.

[18] In addition, the constantly changing azimuths and elevations of terrestrial Amateur-satellite service antennas (due to the non-geostationary status of Amateur satellites at the present time) make interference prediction to MBANs in any given area difficult or impossible.

MBANs, they should be placed in bands not used for long distance communications. MBANs apparently require the protection of a safety service. There are bands set aside for the purpose and those should be used. Alternatively, it is unclear to ARRL why MBANs could not make use of the bands 608-614 MHz, 1395-1400 MHz or 1427-1429.5 MHz in the Part 95, subpart H Wireless Medical Telemetry Service, which seems to be well-suited to MBAN applications, or in the MICS on bands other than 2390-2400 MHz.

Accordingly, ARRL, the National Association for Amateur Radio, respectfully requests that the Commission not proceed with the proposal to permit MBANs to operate in the 2300-2305 MHz band under any circumstances. Nor should they be permitted in the 2390-2400 MHz, 2400-2402 MHz, or 2402-2417 MHz bands.

Respectfully submitted,

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October 5, 2009