Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
GE Healthcare Petition for Rulemaking	)	ET Docket No. 08-59
for New Medical Body Area Network	)	
Service at 2360-2400 MHz	)	

To: The Commission

COMMENTS OF TEXAS INSTRUMENTS

I. SUMMARY

Texas Instruments Incorporated ("TI") hereby submits these comments in response to the Commission's Notice of Proposed Rulemaking ("NPRM") in this proceeding.[1] TI applauds the Commission for recognizing that dedicated medical spectrum will foster the introduction of promising new wireless medical technologies based on Medical Body Area Network ("MBAN") and these devices will improve the health and well being of the American public. TI urges the Commission expeditiously to allocate the 2360-2400 MHz band for this new generation of innovative medical devices.

II. INTRODUCTION

TI is one of the largest semiconductor companies in the world, and more specifically, TI is a leading supplier of integrated circuits ("chips" or "microprocessors") for medical devices, including: diagnostics and therapy equipment such as automatic external defibrillators; imaging equipment such as portable ultrasound systems; and consumer medical devices such as hearing aids, glucose meters and digital thermometers.

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[1] *See* GE Healthcare Petition for Rulemaking for New Medical Body Area Network Service at 2360-2400- MHz, Notice of Proposed Rulemaking, FCC 09-57 (released June 29, 2009).

As the Commission knows, TI is also a leading supplier of chipsets to the global mobile handset market, for which TI designs and manufactures state-of-the-art baseband modems and applications processors, as well as various complementary low power radiofrequency solutions, including Bluetooth, Bluetooth Low Energy, WiFi, and GPS. TI also designs and produces specialized low power radio frequency solutions such as IEEE 802.15.4 (often supporting the ZigBee standard) and ISM band transceivers and system-on-chip devices (SoCs) for remote industrial control, wireless PC peripherals, and home automation and lighting controls, in addition to medical applications. By combining its expertise in wireless solutions, signal processing, power management and applications processors, TI provides cutting-edge chips for the medical equipment market.[2]

III. FREQUENCY ALLOCATION

A. 2360-2400 MHz Is the Preferred Option for MBAN Devices

A contiguous allocation of the 40 MHz of spectrum at 2360 – 2400 MHz for the operation of wireless MBAN devices on a secondary basis, as originally proposed by GE Healthcare ("GEHC"), is the best way to achieve low-cost, low-power consumption wireless medical devices.[3] The 2360 – 2400 MHz band is immediately adjacent to the 2400 MHz band, which is used for a wide variety of Part 15 unlicensed devices worldwide. TI and other vendors design and manufacture a wide variety of low power transceiver chips for the 2400 MHz band that support various standards including Bluetooth, WiFi and ZigBee. These chips can be modified to operate in the 2360 – 2400 MHz band. As a result, it is expected that medical

[2] Wireless medical equipment supported by TI chips includes cardiac implants, cardiac monitors, continuous glucose monitors, and patient and asset tracking systems.

[3] Several other bands already allocated to medical services are also well-suited for use by low power medical devices. Some of these bands, such as the 401-406 MHz MedRadio/MICS band, will complement body sensor networks.

devices incorporating these chips would benefit from economies of scale -- and the corresponding cost-effective prices -- and from the ready availability of essential components.

Another important advantage of the 2360 – 2400 MHz band is the possibility for worldwide harmonization. ETSI ERM TG30 – Medical Devices (TR 102 655) has also independently identified the 2360 – 2400 MHz band as a candidate band for wireless MBAN devices. The potential for harmonization further bolsters the likelihood of widespread adoption and economies of scales necessary for MBAN viability.

An allocation of 40 MHz will provide sufficient bandwidth to enable frequency diversity techniques, which will be necessary to combat multi-path and shadowing; ability to avoid strong narrowband interference, or out-of-band emissions from the 2.4 GHz ISM band; and allow for operation of multiple co-located MBAN devices in a small area, such an elevators in a hospital, emergency rooms, or intensive care units.[4] [5]

B. 2300-2305, 2395-2400 MHz Is Not Suited for Wireless MBAN

Allocation of 2300 – 2305 and 2395 – 2400 MHz would be less useful and not suited for wireless MBAN operations. Specifically, a disjointed allocation of two 5 MHz bands separated by 90 MHz would require more costly and complex solutions. For example, the narrowband matching networks that would be required will be more difficult and costly in addition to resulting in possible losses in sensitivity (reduction in supported range) for the MBAN receivers. Finally, the pre-select filter, which is designed to isolate signals in the desired bands (2300 – 2305, 2395 – 2400 MHz) and reject signals out-of-band signals (for example, 2305 – 2395 MHz),

[4] *See ex parte* comments of GE Healthcare, ET Docket Number 06-135, submitted December 27, 2007, bottom of page 30: “GE Healthcare envisions multiple, collocated BSNs within the hospital or other environments. Illustrative examples of BSN collocation can be drawn from patients gathered in an elevator lobby, eating in the cafeteria or visiting a lounge area”.

[5] *See ex parte* comments of GE Healthcare, ET Docket Number 08-59, submitted May 27, 2008, bottom of page 13: "In order to avoid capacity constraints within high patient-density facilities such as hospitals, at least 20 megahertz of spectrum will need to be available for BSN communications at any given time and location".

will be much more difficult to design, because the filter needs to provide for (1) two narrowband band-pass regions instead of one, and (2) for a deep notch in the 2305 – 2395 MHz band to suppress high-powered interferers, such as WiMax; and more costly, since manufactures would have to design a custom part.[6] All of these factors will lead to a higher-cost and higher-power solution.

C. 5150 – 5250 MHz Would Require Higher Power and Cost

The 5150 – 5250 MHz unlicensed band is not a preferred choice for wireless MBAN devices. To obtain the same range as in the 2360 – 2400 MHz band, MBAN devices operating in the 5150 – 5250 MHz band would need to transmit four times higher power, which would increase the transmit power consumption by a factor of four. In addition, because of the higher operating frequencies, the receiver power consumption could increase by as much as 40 – 50%. The increase in power consumption, both at the transmitter and receiver, would significantly shorten battery life and make it more difficult, if not impossible, for MBAN devices to operate for one week on inexpensive paper batteries.

IV. CHANNELIZATION, TRANSMIT POWER, UNWANTED EMISSIONS AND FREQUENCY STABILITY

TI believes that the technical rules for MBANS need not define a particular channel plan, but rather just specify a maximum permitted bandwidth. This approach would provide flexibility for development of standards, such as those being developed by IEEE 802.15.6.

TI supports limiting MBAN transmitter operation within the 2360 to 2390 MHz band to indoor operations within health care facilities. In addition, outdoor operation should be permitted in the 2390 to 2400 MHz band to support various application use-case environments including ambulance.

[6] TI is not aware of any off-the-shelf pre-select filters that isolate the 2300 – 2305 MHz and 2395 – 2400 MHz bands.

TI believes that a limit of 1mW EIRP per megahertz of bandwidth is sufficient for medical body sensor networks. TI also supports the unwanted emissions limits, both in-band and out-of-band, as proposed in the NPRM.[7] TI also supports the frequency stability of +/- 100 ppm as suggested in the NPRM.[8]

V. PERMISSIBLE COMMUNICATIONS

TI believes that MBAN control transmitters should be allowed to relay information collected from body worn sensors to any receiver, including one that is not part of the MBAN network. By allowing this type of operation, bedside gateway devices could pass the sensor information to a hospital's infrastructure via wireless links, such as WMTS or WiFi, or via wired links, such as Ethernet. This bridging functionality would allow the data stream to be captured in the patient's electronic medical records and would avoid manual data entry, thereby reducing the risk of human input errors.

TI also believes that there are medical applications that can benefit from communications between MBAN body sensors or other intra-MBAN network communication, and therefore, this type of communication should be allowed. TI further believes that an external MBAN control transmitter should be allowed to coordinate communications of MBAN body sensors on multiple patients, i.e., an external MBAN control transmitter should not be limited to controlling the body sensor transmitter for only a single patient.

VI. CONTENTION-BASED SPECTRUM ACCESS PROTOCOLS

TI recognizes that contention-based protocols can provide for efficient spectrum sharing and coexistence amongst MBAN devices. TI believes the definition of contention-based protocol adopted by the Commission for the operation of wireless devices under Part 90 of the rules in the

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[7] *See* NPRM, *supra* note 1 at paragraph 68.

[8] *Id.* at paragraph 69.

3650 MHz band is appropriate for MBAN devices, in particular the portion that states "a transmitter provides reasonable opportunities for other transmitters to operate".[9] TI also believes that there are other approaches, such as pseudo-randomly rotating temporal and spectral occupancies of MBAN devices and limiting the duty cycle that can ensure reasonable opportunities for MBAN transmitters from separate networks to access the medium. TI believes that the Commission should not allow synchronization or deterministic time sharing between MBAN networks as this might allow some MBAN devices to block access to the spectrum for other MBAN devices.

Listen-before-talk ("LBT") is ill-suited for use in MBAN devices. The overhead associated with the LBT protocol of the MedRadio Service (10 msec monitoring of a selected channel within 5 seconds of the intended use of that channel for a communication session) may be much longer than the time required for transmitting an MBAN data message at 1 Mbps data rate. Furthermore, an additional 5 second silent period is required at the end of a MedRadio communication session and a new LBT activity must be initiated before subsequent communication sessions can start. There exist applications where a network of MBAN devices may be asleep in a silent, battery saving mode for five or more seconds. Having to perform LBT for each wake-up may add significant complexity for MBAN devices having to re-discover the operating frequency channel each time they awaken. For these reasons, TI believes generic service rules for contention-based protocols can achieve the same goal, or a better one, than the LBT was intended to, without causing adversary side effects such as excessive power consumption for MBAN devices. These generic service rules would also enable interested parties to develop access protocols complementary to contention-based protocols that support various

[9] *See* 47 C.F.R. § 90.7.

applications and are effective in spectrum sharing, power management, and can help meet latency and throughput requirements.

TI believes that the Commission should provide generic service rules for MBAN devices that ensure effective spectrum sharing. The service rules should be generic enough to allow for both contention-based random-access protocols, which can be used to support event-driven data applications and alarm messages; and contention-free or time-division multiple-access ("TDMA") type access protocols, which can be used to support continuous monitoring applications and also allows for power-efficient operations of MBAN devices. The specification of the actual access protocols that observe these generic service rules should be left to international standards bodies, such as IEEE 802.15.6, and individual vendors.

VII. CONCLUSION

As a leading supplier of chips for medical devices and for wireless devices, TI supports the allocation of additional spectrum for medical devices. In particular, TI supports allocation of the 2360 – 2400 MHz band for innovative medical applications, including body area networks (BANs). TI urges the Commission expeditiously to allocate the 2360 - 2400 MHz band to make next generation of wireless medical devices a reality.

Respectfully submitted,

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October 5, 2009