

TELEMETRY, AERONAUTICAL AND MEDICAL: NEW FRONTIERS IN SPECTRUM SHARING

BY

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In May of this year, the Federal Communications Commission issued a path-breaking decision making spectrum available for a new type of medical telemetry device known as Medical Body Area Networks (or “MBANs”). That spectrum is in a band reserved for flight test telemetry.

An MBAN consists of an array of low power sensors placed on a patient’s body for purposes of monitoring heart functions, respiration, and the like. Each of the sensors transmits its data to a hub, either worn on the patient’s belt, or perhaps to a unit affixed to the wall of the patient’s room. The device offers a means of freeing patients and their care-givers from the tangle of cables connecting sensors to monitors as required today. It will increase patient mobility, is expected to reduce the rate of infection, and should lower health care costs. It will facilitate more continuous monitoring of patients and, according to an FCC news release of May 24, “give health care providers the chance to identify life-threatening problems or events before they occur.” It also fulfills objectives of the FCC’s Broadband Action Plan, as noted by FCC Chairman Genachowski, who indicated when the Order was released that: “The National Broadband Plan identified health care as an area of enormous promise for broadband-enabled innovation.”

The FCC’s decision was the product of over five years’ worth of proposals, litigation, and ultimately an agreed settlement between the aerospace industry and Federal agencies, on the one hand, and medical technology vendors, chiefly GE Healthcare and Philips Healthcare, on the other hand. FCC Commissioner Rosenworcel mentioned the exemplary cooperation between the various parties to the negotiations, noting: “They have served as a model for developing shared use policies for spectrum that address interference concerns while allowing new services to flourish. With the growing demand for spectrum resources, it is cooperative efforts like this that give us hope and faith.”

This article discusses the background to the decision and its details, and offers some comments about the decision’s import for spectrum policy.

Introduction

Aeronautical mobile telemetry (or “AMT”) has long enjoyed an exclusive allocation of spectrum for flight testing. This is a reflection of the fact that AMT represents safety-related communications, providing a real-time link between the pilot or aircrew and ground-based engineers. By means of this link, engineers are able to monitor key aspects of a vehicle's condition and performance.

In the event the telemetry stream shows anomalies, ground-based engineers are in a position to warn the pilot and advise on corrective measures before a critical situation gets worse. If, despite best efforts, disaster should strike, the telemetry record can be used to reconstruct the cause of an accident in a much more efficient manner.

Finally, by means of flight test telemetry, operators are able to accelerate test programs. Instead of a vehicle being required to return to base after each set of test points have been completed so that the data can be downloaded and analyzed, and only then cleared to proceed to the next set of test points, aircraft which successfully complete one set of test points can be cleared to proceed to the next set on the same flight. This greatly improves the efficiency of the test program and greatly reduces costs and delays.

Two principal bands are used for manned aircraft flight testing in the United States: The L-band (1435-1525 MHz) and the S-band (2360-2390 MHz). These two bands have been set aside for flight testing, and only flight testing, for many years. Indeed, they are “Restricted” bands as that term is defined by the FCC in Part 15.205, i.e. bands where the fundamental emissions of even Part 15 devices are off-limits.

The FCC Proceeding

In late 2006, GE Healthcare proposed a new type of medical telemetry device which has come to be known as the above-referenced Medical Body Area Network. The proposal was that the devices would occupy the same S-band spectrum as AMT, but on a secondary (i.e. non-interference) basis. The devices would transmit at a power of 1 mW.

The FCC invited comment on the proposal in early 2008. The Aerospace and Flight Test Radio Coordinating Council (“AFTRCC”), the association of the nation’s principal airframe manufacturers, intervened in the FCC’s proceeding. AFTRCC expressed grave reservation about the notion of mixing two safety-related services.

AFTRCC observed that there was no apparent means of enforcing secondary status for the MBAN units. AFTRCC noted that, despite medical telemetry having nominally secondary status, in some cases medical telemetry had been accorded de facto super-primary status, in one notorious episode leading the FCC to shutting down a major market VHF television station’s digital operation in order to protect “secondary” medical telemetry in nearby hospitals.

Medical device vendors and AFTRCC also sparred over the likelihood of interference. The vendors argued that the chances of interference were low. AFTRCC countered that AMT dish antennas were so sensitive that even a 1 mW signal received from a transmitter miles away would cause loss of data and, if the interference were prolonged, loss of the antenna’s ability to track the test vehicle. This argument was reinforced by actual flight tests involving surrogate 1 mW devices.

If data is lost, maneuvers or even the entire flight must be repeated: Test standards commonly requiring bit error rates of 10^{-6} underscored AMT’s vulnerability to interference. Of course, if

loss of data, or worse, loss of track, occurred during a critical condition on board the aircraft, the threat to the safety of the pilot and persons on the ground would be material.

The litigation continued for two years until, finally, medical device proponents introduced a new concept, namely that MBANs be confined to indoor use at healthcare facilities like hospitals. Under this concept, no hospital could operate MBAN devices unless and until it had received an electronic authorization.

This proposal offered a way to solve the enforcement conundrum. Instead of relying on FCC Rules alone and/or good intentions, there appeared to be a technological means of ensuring that only properly registered and coordinated MBAN devices would be able to access 2360-2390 MHz.

AFTRCC and Philips Healthcare, joined by GEH, opened negotiations regarding this concept and whether it offered a means of assuring the protection that flight test telemetry had long enjoyed and required as an operational imperative. The three parties, up to that point adversaries, set about negotiating toward a common goal, namely actual terms and conditions for MBAN use. The negotiations were long and complex. But they produced positive results.

For openers, the parties agreed that any hospitals within line-of-sight of an S-band AMT facility would first need to be registered for any MBAN use. The registration process would be handled by a frequency coordinator designated by the FCC for the medical community. Registration of any hospital within line-of-sight would in turn depend upon coordination with AFTRCC representing the AMT community. Those coordinations would be carried out consistent with the relevant ITU-R Recommendation M. 1459 and good engineering practice.

If a hospital were found to be within line-of-sight, and there was inadequate terrain or building blockage between the hospital and the AMT antenna, the parties agreed to conduct a closer analysis centering on path loss as possibly achieving sufficient attenuation of the MBANs signal to satisfy the ITU-R Recommendation's protection value at the aperture of the AMT antenna.

If that analysis did not produce a favorable result, then the parties agreed to look at the possibility of coordinated access to 2360-2390 MHz on a time and/or channel availability basis.

Of chief importance, the parties agreed that any hospital's use of an MBAN device must be contingent on the device being controlled by a beacon signal within the hospital such that, if a patient left the hospital's confines, the device would shut off.

Meanwhile, the parties also agreed that the above restrictions need not apply to 2390-2400 MHz where flight testing did not enjoy exclusive status. In this band, MBANs devices would be allowed to operate up to 20 mW and at any location including patient's homes.

The joint proposals were presented to the FCC in early 2011. There followed multiple meetings and conferences with the FCC staff to explain the intricacies of the rules, and improve same by way of amendments based on the FCC staff's feed-back.

FCC Decision

The Commission's decision on MBANs rules was adopted on May 24, 2012. The decision reflects a diligent effort to capture the intent behind the parties proposed rules, and in almost all respects the rules adopted by the agency track the parties' proposals.

However, in a number of respects the agency determined that the specific terms and rules proposed by the parties were not appropriate for adoption.

For example, the Commission stopped short of specifying use of a particular protocol for ensuring that an MBAN would shut down in the absence of a control message (the term adopted by the agency in lieu of "beacon"). In this and other respects, the agency opted for user flexibility.

In other instances, the agency felt that the proposed rules may have been overly prescriptive. For example, the parties had proposed that the rules require each hospital to sign a "transition plan" spelling out the terms and conditions and responsible personnel for effecting a shut-down or change to 2390-2400 MHz frequencies if such should become necessary. The Commission concluded that this was overly-intrusive; that it delved too deeply into hospital prerogatives to operate their systems the way they see fit.

Instead, the Commission expects the MBAN coordinator and AFTRCC to enter into coordination agreements covering each hospital. These agreements will be required to ensure hospital compliance.

In yet another example, the Commission adopted its pre-existing definition of health care facilities in defining eligible users for MBAN devices. This definition goes beyond that proposed by the parties to include small clinics.

These and other issues may be the subject of further action by the FCC. But whether that is the case or not, the United States will remain the first nation in the world to allocate spectrum for this new type of medical device.

Lessons Learned

In spectrum policy circles, sharing is the talk of the town. Policy-makers have come to the conclusion that there is simply not enough spectrum to accommodate all the different types of potential applications and, as is said of real estate, "they're not making any more of it."

In that sense, the MBANs decision represents a path-breaking approach toward spectrum sharing. However, one must be cautious in not over-drawing conclusions from this one case.

Sharing works here for several reasons which may not be replicated elsewhere.

First. Hospitals are not generally located near flight test centers. It is estimated that only about six percent of hospitals are within line of sight of an AMT antenna.

Second. Sharing is helped by the fact that the power of an MBANs device is very low, 1 mW.

Third. Sharing can be made to work because operation of MBAN devices is subject to a stringent set of terms and conditions which will protect the primacy of aeronautical spectrum, while at the same time enabling MBAN devices to fulfill their purposes: Conditions like indoor use only, with provision for automatic shut-off if the device is moved outdoors; prior registration and coordination for any line-of-sight hospital; and the use of electronic authorizations to prevent unregistered, uncoordinated health care facilities from lighting up, are all significant.

These characteristics are special. They would not be applicable for many fixed and mobile uses where, for example, power levels can range in the thousands of watts, and user ubiquity may be the norm.

Nevertheless, despite the caveats the MBAN result is a concrete illustration of the kind of creative, cooperative thinking which will be increasingly required as the Nation struggles to find spectrum for all the new and different wireless technologies on the horizon.

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