Before the Federal Communications Commission
Washington, DC 20554

In the Manner of:	ET Docket 98-153
Revision of Part 15 of the FCC's Rules Regarding Ultra-Wideband Transmission Systems	

Comments of : Broadband Telecom Systems
600 Bellevue Way SE, Suite 102
Bellevue, WA 98004

Broadband Telecom Systems provides consulting services to broadband telecommunications equipment and service providers in the areas of network architecture, equipment specifications and service requirements.

Summary of Comments

BTS urges the FCC to not revise the Part 15 rules in order to support the deployment of UWB technologies on both technical and policy grounds.

Technical Concerns

BTS believes that interference caused by UWB transmissions below 1 GHz on current widely deployed RF receivers such as televisions, VCRs, and residential antenna signal boosters, along with cable television line amplifiers, can be very significant and could potentially damage or degrade the performance of these devices. Furthermore, UWB transmissions can potentially effect the design of future communications transceivers operating in similar bands, increasing their cost and degrading performance.

Policy Concerns

UWB systems are being considered as a method of delivering broadband communications utilizing an "unlicensed" channel. BTS believes that sufficient spectrum exists in current unlicensed band allocations for those applications, and that it would be more appropriate to modify rules regarding use of these bands to support this modulation method.

BTS regards this proposed re-allocation as more deeply motivated by the urgent need for alternate methods of providing broadband services to residential customers. BTS believes that the proposed approach does not best support this need, and that a licensed allocation of adequate bandwidth at a sufficiently low frequency to enable high visibility access into commercial and residential structures at a low technology cost is a much more appropriate approach.

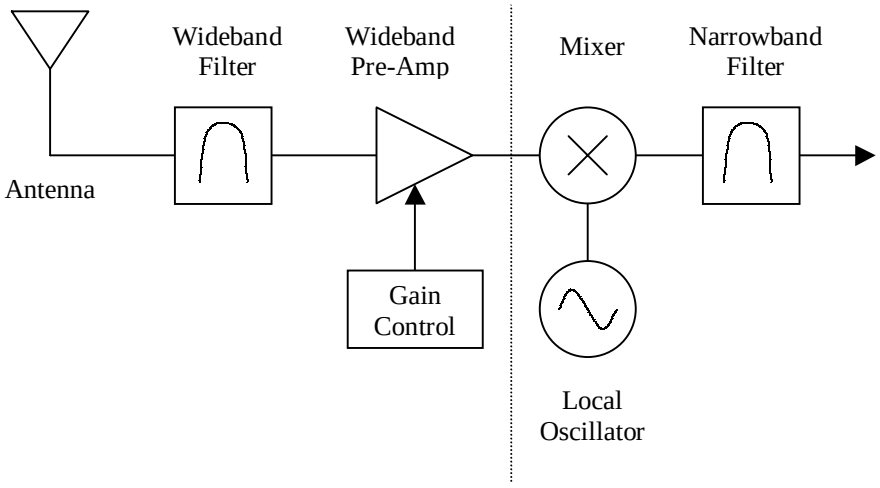
1. Technical Concerns

BTS believes that other submissions have provided sufficient background on UWB technology. The key issue is with the interference potential. Essentially, proponents of UWB state that:

1) On a frequency-domain basis, the average power spectral density is within Part 15 unintentional radiator emissions specifications.
2) On a per-channel basis, particularly below 1GHz, the total interference power received in any one channel (where a channel may occupy up to 10MHz) is also extremely small and will not interfere.

Assuming the UWB systems proposed for communications occupy maintain their stated pulse energy specifications, and a broad transmission bandwidth of nearly 1GHz, these statements are essentially correct.

What has been overlooked is that a large percentage of narrowband receivers are designed to tune over a wide carrier frequency range, using a standard superheterodyne topology as depicted below:



In this topology, the Wideband Filter, Pre-Amp and Mixer/Oscillator are used to translate a specific carrier to a fixed frequency, and then all further filtering and conversion are performed at that frequency. The actual "channel" filter is placed after the mixer. In many cases, the wideband filter has a passband of hundreds of megahertz, and the Pre-Amp is provides high gain with a low noise floor. Nonlinear distortion of the received spectrum is a key specification of this component, and significant effort and expense goes into its design to prevent nonlinear response based upon anticipated input power levels.

Such a topology is found in television receivers, VCRs, CATV off-air rebroadcast equipment, and other general-purpose communications transceivers.

In the case of CATV "line" amplifiers, and antenna signal boosters, only the first half of the topology applies (no down-conversion). In these cases, the bandwidth of the filter/pre-amp is even greater – on the order of 400 to 800 MHz.

In all of the above cases, a large percentage of the UWB pulse energy is absorbed by the front end components and must be considered a significant source of interference.

Some of the key issues include:

a) Given the range of applications being discussed, what is the expected proximity of the UWB sources to existing equipment, and what level of UWB signal power might be expected at the receiver front end?

b) What is the response of the broadband filter to the UWB pulses. How much energy actually is rejected? What is the effective pulse response of the filter, and the expected concentration or dispersion of energy from the incident pulse?

c) What is the effect of the "filtered" response on the pre-amp? How much distortion is generated in the front end due to pre-amp overloading? Will the pre-amp be driven into saturation? What is the recovery time to linear response?

d) Are additional distortion and saturation mechanisms present at the mixer?

Due to the wide range of design for in-service equipment operating in the 10 to 1 GHz band, and the unclear deployment scenarios of UWB, it is not possible to answer these questions precisely. Rather, it would be appropriate to identify a few potential examples of likely applications with potential interference concerns. Some examples include:

a) Video/Data communications device utilizing a television as a display where the UWB transceiver is within 3 ft of the television and an indoor antenna is in use.

b) UWB antenna within 10 feet of residential antenna pre-amp for Broadcast Video and AM/FM reception

c) Non-terminated CATV in-house wiring and poorly shielded CATV distribution facilities providing an upstream transmission path for broadband pulses, directing UWB pulse energy to CATV line amplifiers

Although a definitive analysis of the wide range of potential interference scenarios is a significant undertaking, BTS believes that the drive for low-cost communications in the highly attractive low-band frequencies will result in the pushing of the technology to the regulatory limits of its capability, and needs to be well understood before permitting.

As a clear example of the interference potential of UWB systems, a UWB transmission system can be built with the following characteristics:

1 milliwatt of total average radiated power
1 nanosecond pulse width
10 KHz repeat rate

This system would radiate over a full 1GHz of bandwidth, with the power per unit hertz bandwidth in the picowatts, which is apparently benign. However, the individual pulses have 100 Joules of energy – comparable to the energy absorbed by an antenna from a direct lightning strike. Broadband systems exposed to energy pulses such as these could easily be destroyed or face serious degradation in performance due to amplifier saturation in the front end.

2. Policy Concerns

Identification of interference sources

From the perspective of an existing operator, the strengths of UWB technology can be cause for significant concern. Given the unlicensed/unregistered status of the new operators, and the

broadband, random nature of the UWB signals, existing licensed operators will have a much more difficult time identifying UWB systems as a source of interference. Furthermore, conventional testing and measurement equipment commonly used to identify problems with narrowband interferers is in many cases unable to detect UWB signals – even if these signals are effecting the operators' equipment.

In this way, allowing UWB will potentially place new cost burdens on existing operators by forcing them to obtain new equipment and training for their personnel in order to identify and eliminate UWB interference. These cost burdens should rightly be placed on the new operators and equipment manufacturers. Should UWB be allowed, the rules should be written to reflect that.

Spectrum for unlicensed telecom applications as vehicle for local access competition

Currently, over 600MHz has been reserved for unlicensed spread-spectrum communications operations covering a wide range of carrier frequencies. When allocated, it was anticipated that the spectrum might enable the development of low-cost local (in-building or on-campus) and metropolitan networks both for private communications paths and for companies interested in becoming competitive local access providers. Although the applications for this spectrum is still developing, it has become clear that the use of this spectrum for business-critical telecom applications has not seen wide acceptance. Few internal telecom organizations are willing to make equipment purchases and take the risk that at some future date, their link capacities may be arbitrarily decreased as other systems are activated without control or coordination. And for common carrier services, use of the spectrum is considered inappropriate because it is not possible to guarantee a particular level of service quality and reliability to the customer base.

Given the healthy portion of allocated unlicensed spectrum, and what appears to be limited need by both private communications operators and CLECs, it would appear appropriate to postpone the UWB option until it is truly needed.

Alternate use of spectrum

Much of the driving force for a re-examination of the part 15 rules has come from companies who have applications other than telecom. However, the majority of this response have been focused on the communications application of the spectrum. This is because of the huge market for telecom equipment and services relative to most other applications of spectrum. It can be expected that, if an opportunity to utilize the spectrum for telecom can be done, it will. For this reason, an "arbitrary use" spectrum allocation or technology endorsement must be considered from the perspective of its use as a telecom access media, with the potential for widespread deployments and aggressive interpretation of operating rules and regulation.

As can be seen from other submissions, most non-telecom applications of the spectrum have a limited deployment and are of a very localized, transitory nature. These systems are much less likely to create interference issues. In these cases, it would seem appropriate to enable such uses as long as power transmission levels are set appropriately. Whether this is done through a class of service regulation or approval on a case-by-case basis, it would appear that such regulatory methodologies have been previously implemented with success.

Providing more appropriate solutions for competitive local access

BTS believes that the interest in the use of UWB as a method of "mining" the VHF/UHF band is a good example of an incorrect solution for a more fundamental problem – the lower frequency

bands that are the most attractive for providing wireless broadband access for residential applications are inefficiently utilized and allocated based upon out-of-date priorities.

Over the last five years, residential and business communications and entertainment patterns have radically shifted due to the penetration of computers and the internet into the residential market. As of last year, over 40% of U.S. homes had computers, and with the current trend toward consumer audio and video price points, computing/internet devices will be as common as the television. Furthermore, the technology for broadband wireless communications devices has significantly matured – providing high reliability, high transport capacity and high reliability at low cost.

In this environment, it is essential that the FCC consider how its most valuable assets - the VHF/UHF spectrum allocations are being utilized. Does the current utilization plan truly serve the greatest public good as we move into the next century? BTS believes that it does not – that instead, it makes sense to revisit these allocations given the emerging requirements for high-speed bi-directional communications and create an appropriate, licensed band which may finally provide an alternative access carrier the opportunity to truly compete – with comparable capacities and cost structures to the incumbent wireline providers.

BTS believes that enabling deployment of technologies like UWB could delay and hinder the process of providing a more appropriate solution to this clear need and ultimately increase the future cost of providing a more appropriate telecom solution due to unforeseen interference issues.

3. Summary Recommendations

BTS supports the use of UWB technology for instrumentation and sensor applications but does not support its use for commercial communications.

BTS believes that further study is needed to truly determine the interference potential of UWB devices given the diversity of existing receivers in operation.

At a minimum, BTS recommends that operation of UWB devices be subject to the following constraints:

a) Energy content preferably limited to existing unlicensed transmission bands or,

b) Highly restrictive maximum peak power and total pulse energy limitations enabling very short range applications under the assumption that other broadband receivers are present.

Respectively Submitted,

Steven D. Warwick
Broadband Telecom Systems
600 Bellevue Way Suite #102
Bellevue, WA 98004
425-462-5279