



This article takes a closer examination of why there should be widespread support for greater international harmonization of microwave regulation.

RULES OF THE GAME: LOW LATENCY MICROWAVE IN A MULTI-REGULATORY ENVIRONMENT

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Over the course of the last 18 months, a new application has grown by leaps and bounds for microwave networks: low latency. Low-latency microwave networks find most of their applicability in financial transactions, such as for executing trading instructions between major stock exchanges and trading houses in other cities. Typically, low-latency microwave is used to “replace” traditional fiber-based networks linking financial centers. The business driver for microwave-instead-of-fiber in low latency is the time it takes to transmit trading instructions. With microwave, latency is reduced by a few milliseconds as compared to fiber. Nevertheless, those few milliseconds can translate into a trading edge over rival investors, which means big bucks. Low latency investors will pay a premium for this edge resulting in increased revenue for low-latency microwave network operators.

However, as with most financial functions, low latency is subject to a set of stringent regulations. The scenario is doubly difficult when low-latency microwave networks transmit across international boundaries. This compares to linking financial centers within a single country, which is relatively straightforward from a regulatory perspective because there is only one set of rules. The fact is when connecting financial centers in different nations and the operator’s network has to traverse other countries’ borders, the process becomes orders of magnitude more complex. This article takes a closer examination of some of these issues and why there should be widespread support for greater international harmonization of microwave regulation.

COMPARING THE WORLD’S BUSIEST LOW LATENCY ROUTES

When Aviat Networks helped build the McKay Brothers LLC low latency network between Chicago and New York—the world’s busiest route for low latency financial networks—there were some technical testing challenges with which to deal. The solutions to these challenges had to meet the FCC’s part 101 regulations. Moreover, as complex as that undertaking was, it turned out to be simple in comparison to the level of regulatory complexity we experienced when we went to Europe to construct a low latency network linking the continent’s leading financial hubs of London and Frankfurt.

TECHNICAL CHARACTERISTICS

Before looking at the regulatory landscape for low latency, it is first necessary to understand the technical underpinnings of the field. As explained above the key factor in low latency networks is to reduce to an absolute minimum the time it takes for a signal to get from point A to point B. This is the overriding factor and everything else is secondary in the minds of the network user. For the network designer this presents two primary challenges:

1. Network to have as few sections as possible
2. Minimize equipment signal processing delays

The first of these tends to push the network toward the lower frequencies allowing longer hops, i.e. 13 GHz and lower, while the second tends to dictate modulation schemes such as 16 or 64 QAM. ACM tends not to be used as the extra processing adds to the overall delay.

NETWORK ARCHITECTURE

Another factor to be considered is that the network is unlike any other type of network in that it purely links point A to point B with no branches over long distances. This means that the overall capacity of the network is limited by the “slowest/lowest capacity” segment. This is an important factor, especially when the network may span several countries and may have to cross natural barriers such as water and mountain ranges that will dictate the choice of both sites and frequency bands. In some cases, countries may simply be transit locations for the network with no traffic entering or leaving the network. In those nations, sites are effectively just used to regenerate the signal.

The low-latency network is unlike any other in that it purely links point A to point B with no branches over long distances. This means the overall capacity of the network is limited by the “slowest” segment.

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Quite simply, the lowest capacity segment controls the achievable minimum bit rate for these networks, and although other parameters could be changed, the bit rate cannot, regardless of the objectives of regulators. In any event, because regulatory requirements are not updated at the same speed as that at which technology evolves, this creates discrepancies between the available technology and the rules that are supposed to be applied to them. Therefore, we believe that for specific types of networks, certain parameters could be subject to a waiver, typically safeguarded by the closed nature of such networks.

FREQUENCY BANDS

In an ideal world, the same frequency bands would be available under the same conditions in every country, but unfortunately, that is not the case. This together with extra national restrictions, such as frequency bands reserved for certain classes of users, can severely limit the choice. Thus, even before we have examined technical regulatory requirements such as minimum bit rate and modulation schemes, the effective choice may be severely limited—even more so when geographic limitations are added to this mix. The thing about geographic limitations is that they cannot be changed—mountains cannot be moved and oceans have to be crossed—whereas other obstacles are manmade and as such are open, in theory, for discussion.

THE PROCESS OF HARMONIZATION

When building a trans-national low latency network, the regulatory bottlenecks will always occur on the border-crossing link. These can be further exasperated if the border is also a geographic challenge such as an ocean or mountain range. In these situations, it is very helpful that some national regulators do allow a sort of waiver that allows the network to land in a new country with a profile that is not normally allowed in-country on the understanding that any subsequent links wholly within the country comply with national requirements. Typically, waivers are granted for regulatory parameters, such as:

- Restrictions on the type of user that can use a particular frequency band
- Harmonizing to the lowest modulation scheme and minimum bit rate applicable to the link from the two countries containing the link

While these waivers solve the immediate problem in constructing a through network by allowing a pragmatic approach to coping with different regulatory regimes, they only apply to cross border links. Thus, the technical characteristics of the network will change several times over its entire length and, while technically achievable, it is not the most desirable option. A greater degree of harmonization between individual countries would help reduce the number of these changes.

From a European perspective, one of the aims of the ECC (European Communications Committee) is harmonization of frequency plans and subsequent technical requirements. ECC Recommendations are published with harmonized details. However, because these are “recommendations,” they are left to individual national regulators to put into force (either partially or in full) in each member country. It is this process where the differences of implementation creep in. Overall, this process does not cause the microwave industry too many problems as most links are contained wholly within one country, although this does lead to the need to support country-specific variants. It is only when trans-national networks are being constructed, including those previously discussed, that the inconsistencies in implementation really become apparent and start to cause problems.

A solution would be to give these “recommendations” some form of legal (i.e., mandatory) status whereby all 42 CEPT countries implement them in full. Of course, this could be wishful thinking because national interests and approaches to spectrum ownership mean both the current and legacy situations have to be catered to. However, with the growth of trans-national networks this is a proposal that requires serious consideration even if such solutions are reserved for trans-national networks!

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