CO-EXISTENCE TASK GROUP
IEEE 802.N-WEST

Initial Views and Comments from Task Group Members

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I have discussed the issues of co-existence with everyone participating in the current co-existence study group, as well as others who have expressed an interest, but are not actively participating. In general, everyone with whom I have discussed this is in agreement that co-existence is a major issue which needs to be addressed. There is, however, little consensus on the matter. The following comments represent the thoughts of various people on what a co-existence standard means:

"Fill void left by FCC on Channel Plan."

"To allow different vendors equipment to operate in the same area. The FCC did not define TX/RX bands; this needs to be done. "

"Need to define mask for emissions. For spectrum mask within channel, use FCC generic mask (FCC Part 101)."

"FCC dictates spectral mask that applies to licensee for edge of band. However, FCC posting web page soliciting inputs from organizations like N-WEST for recommendations for spectral mask."

"Should include channelization plan"

"Should NOT include channelization plan. Leave this to the service providers and or license holders"

"Should only address TX and RX bands, i.e., the set of frequencies to be used by base stations to transmit and receive."

"Should not address any in-band, in service area co-existence issues; only across BTA boundaries."

"BTA boundary co-ordination already adequately covered."

"Co-existence should apply internationally, e.g., co-exist with other license holders. Channelization should be band by band. Paired or non-paired TX/RX OK."

"Should focus on U.S. LMDS co-existence."

"What about effects of rain on the co-existence issues?"

Many people with whom I spoke questioned why a separate PAR was needed on co-existence. Of the people I talked to, everyone seemed to agree co-existence should be addressed, but most felt that it could be/should be covered under the interoperability PAR. Or some of the issues could be addressed in the PHY layer. There was some concern, however, that the interoperability PAR could take too long, and a separate co-existence PAR (which would be quickly completed) would be desirable.

In addition, I received various comments on co-existence and how the issues may be addressed. I have summarized (in some cases paraphrased) comments.

For channel plan, choose raster or basic increment. Plan to allow full usage of band. Allow freedom to use TDD and FDD in a BTA, but not specify band allocations for either. Use multiples of some channel spacing, e.g. 2.5 MHz. Define minimum set of rules for co-existence. Fold co-existence under interoperability PAR

Some people believe that only symmetrical service is of interest, and hence a band segmentation plan should only address symmetrical service.

Comments on band segmentation included: The 29.1 – 29.25 can not be used for upstream: use 29.1 –29.25 downstream paired with 31.075 –31.225 band upstream for FDD only. Allow TDD on Block B frequencies.

There were varied opinions on how the 27.5 – 28.35 GHz band would be used. They included no band segmentation; splitting the band into four equal sub-bands about 210 MHz wide; splitting the band into two equal sub-bands (each 412 MHz wide); splitting this band into two asymmetrical bands; splitting the band into three sub-bands, one for guard band/and/or TDD operation and others.

On channelization, there were even more diverse views. Some people favor defining channels which are consistent with the 38 GHz channel plans; others do not want any channel plan. Still others do not care as long as the spacing increment is sufficiently small to permit a wide variety of channel plans. The various channel increments suggested range from 1 MHz increments to 50 MHz increments. Two specific channel plans are 2.5 MHz spacing and 8.33 MHz spacing. At least one person felt that channel plans should be mapped to backhaul data rates, e.g., OC-1. Some people want paired TX and RX channels; others do not want pairing.

On the scope of co-existence standardization, there were also widely divergent opinions. Some would like the scope to be limited to U.S. LMDS. Others would like to see the standards cover international co-existence issues. As one example, the Canadian LMCS equivalent has some unique co-existence issues (with satellites). In some countries, the band is divided in frequency to facilitate multiple license holders. Even within the U.S., there are widely differing views on what should be included.

Some of the participants have written papers on co-existence issues including band segmentation and channelization. I have asked them to submit these papers directly to Roger for posting on the web site.

In order to save time at the meeting the week of March 9, I would like for everyone to consider the comments summarized above and be prepared to discuss the co-existence issues on an informed technical basis. At this point, all reasonable proposals concerning co-existence will be considered. I believe the above comments capture most of the topical issues. (If there are any others not covered, please forward them to me and I will include them in the summary.)

At the risk of over simplifying the definition for the purposes of addressing co-existence in the 802 standards, I have formulated the following definition based on comments from many people:

Co-Existence Definition

Co-existence means using the allocated spectrum to provide more than one service and/or using more than one type of transmission format within the band without causing harmful interference to each other. As a minimum, co-existence will apply to systems deployed by different license holders in adjacent or near-by BTAs.

The issue of Out-of-Band emissions is specifically excluded from the co-existence definition above because OOB emissions are a regulatory issue, not a standards issue. The 802 standards efforts should, however, support the works of various regulatory agencies such as the FCC to help define the OOB emissions. Another reason that the standard should not address OOB emissions requirements is that these may vary from country-to-country and band-to-band, and are mandatory requirements rather than voluntary requirements.

It is very important to separate the issues associated with co-existence from those associated with interoperability. The two are related, but not the same.

Co-existence, from a general perspective, addresses the ability of two or more systems to share the frequency band (but not necessarily the same frequency in the same geographic area) without causing intolerable interference to each other. As an example, various TV stations share the same frequency with little interference, i.e., they co-exist. This is possible because the FCC awards license to stations on the same frequency or channel only when the stations are geographically separated some minimum distance. Most of the time these stations do not cause harmful interference with each other. (On rare occasions, particularly on the lower channels, propagation conditions may cause sporadic interference.)

Another example is the use of the same frequencies between satellite systems or between satellite systems and terrestrial systems. This is usually achieved by achieving spatial separation via highly directional antennas.

A third example is the use of the ISM bands for multiple purposes, e.g., cordless phones, wireless LANs, point-to-point links, etc. Co-existence is achieved by using spread spectrum techniques.

A final example is the use of frequency sub-bands to allow users to share a band of frequencies without causing intolerable interference to each other. This is sometimes called band segmentation. This is not a full frequency re-use technique, but is often used to manage multiple users of a band of frequencies. The technique assigns separate sub-bands for Transmit and Receive functions, and, in some cases, different modes of operation.

For extensions of the standard to cover multiple international Broadband Wireless Access systems, other co-existence issues must be addressed. For example, some countries have allowed two (or more) license holders to share the same band (not necessarily the same frequency) in a given geographic area. If the standard is to apply internationally, then other co-existence issues arise. It may be the responsibility of 802 to define spectral mask for in-band emissions, i.e., to define the spectral masks which will be applied to the license holders' signals within the LMDS (or equivalent) band.

The co-existence standard can also define a set of standards which permit different services using different equipment to co-exist within the same BTA. These systems may not be interoperable, but would be able to co-exist in the same area using the LMDS band. One example is a band segmentation plan. For Frequency Division Duplex (FDD) operation, it is necessary to divide the band into Transmit and Receive bands for the base stations with a guard band between the two. An example of this, defined by the FCC, is the TX and RX bands assigned to cellular telephones. However, the FCC has not allocated any such structure within the LMDS bands. Industry could define such a bandplan by agreeing on a standard TX sub-band and an RX sub-band. Such a standard would facilitate co-existence along BTA boundaries. It would also set limits on how LMDS hardware would be built. However, it would also limit the equipment designs to FDD approaches which may not be desirable. Such a split could utilize the natural band separation for the LMDS frequencies, e.g., 27.5 GHz – 28.35 GHz for the base station transmit band and 31.0 GHz – 31.3 GHz for the base station receive band.

An alternative would be to divide the 27.5 – 28.35 GHz band into two sub-bands with a guard band in between. For example, use 27.5 – 27.9 GHz for base station transmit; 27.9 – 28.1 GHz for the guard band and 28.1 – 28.35 GHz for the base station receive band. The guard band may appear to be wasted spectrum. However, other services could be offered. For example, the frequencies 27.9 – 28.1 GHz could be paired with the 29.1 – 29.25 GHz band or the 31.075 – 31.225 band to provide another service. The 27.9 – 28.1 GHz band could also be used to provide TDD services. These are only examples, but they are all examples of addressing the co-existence problem.

For additional information, please review the white papers from other members posted to the web site. Finally, additional comments are welcome. Please provide any white papers on the subject of co-existence to me and/or to Roger for posting on the web site. If you want to discuss your views on the subject, please feel free to send me e-mail, or call.

Thanks,

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