IEEE P802.11
Wireless LANs

Joint Statement to ITU-R Working Party 4A and Joint Rapporteurs Group 8A-9B from ETSI BRAN, IEEE802.11 and MMAC-PC (DRAFT)

Frequency sharing issue between RLANs and MSS feeder links in the 5GHz band

Date: Jan. 15, 99

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1. Introduction

Three organizations, ETSI BRAN, IEEE802.11 and MMAC-PC, each responsible for regional standardization works for RLANs, met together in mid January 1999 at Orlando,USA, and exchanged views on the above sharing issue from the RLAN expert standpoint. The meeting also considered technical contributions from WIN-Forum and Bristol University dealing with the same subject.
After extensive discussion we produced this joint statement, and based on its content request ITU-R concerned Parties to facilitate the work toward draft Recommendations on this issue. The following sections in this statement present our views on the used frequency band as well as each parameter affecting the sharing studies.

2. Basic understanding

We would note the following points concerning the use of this frequency band 5150 to 5250MHz.

(1) The 5150 to 5250MHz band is a frequency band available for broadband RLANs commonly in Japan, North America and CEPT countries.
(2) Co-existence with other radio services, in particular with MSS feeder links, in this band is quite important and will give great impact on the RLAN market in the above regions.
(3) It is necessary to early establish the frequency sharing criteria with MSS feeder links which is allocated to that band in all the Regions.
(4) RLAN terminals in this band have status belonging to the mobile service specified in the Radio Regulations whether or not they need a radio license.
(5) Technical constraints on RLAN devices in ITU-R Recommendations should be specified under the agreement of both RLAN and MSS communities.

3. Operational conditions and market demand for RLAN terminals

This is the most important point on which RLAN community should express its view under the total agreement of three organizations.
It is our basic understanding that RLAN terminals to be developed in this band will operate in unlicensed basis. Therefore, we recognize the concern of MSS community that "unlicensed" terminals will become "unlimited" in number and their total effect may cause harmful interference to the Mobile Satellite Service.
However, the specification of the RLANs in this band are intended for "professional use", or in other words "business use". Such a terminal is usually realized by applying a wireless adapter to a wired LAN terminal, and consequently its cost is higher than wired alternatives. We assume that 40% of total population may be classified as professionally employed, and 10% of them will use RLAN terminals in this band. The 4% penetration will result in maximum 16 million terminals for the CEPT countries with 400 million people, which is most densely populated area among the above three regions.
In next generation's wireless devices the 4% penetration may be changed, however, it is difficult to expect high-density frequency reuse operation within the current 100MHz bandwidth. Accordingly we have agreed that much more spectrum other than 5150-5250MHz should be required.
In unlicensed applications it is assumed that most of terminals operate indoors and this will also

contribute to satisfactory sharing with MSS feeder links.

4. Consideration on factors affecting the sharing studies

(1) Methodology

We support $\Delta T/T$ method which is more appropriate for today's MSS feeder links. Even if $\Delta T_{sat}/T_{sat}$ method might be preferred for future satellite systems as proposed by WP4A, it is not desirable that by developing a new technology the drastic change, a 100 times stringent requirement, would be made to the sharing condition resulting in much less deployment of the other co-primary service sharing the same frequency band. Generally speaking new technologies should be adopted for efficient spectrum utilization and not for exclusion of the sharing partner.

Historically terrestrial fixed service sharing the frequency bands with the fixed satellite service has raised its capacity by employing multi-state modulation schemes, i.e. from 4PSK to 16QAM or 64QAM. These high efficient modulation schemes apparently lead to systems more sensitive to interference. However, the terrestrial side has never requested tighter power flux density (PFD) limits for space stations in this technology development.

(2) Interference criteria

It is generally understood that the interference criterion for aggregate effects of a co-primary service is around 10% of the total noise,. Sharing studies in the ITU-R have produced many Recommendations with interference criteria or PFD limits derived from the above principle, for example Recommendations SF357 or SF615.

Since an MSS system is composed of a feeder link and a service link to mobile terminals, it can be regarded as a two-hop link whose performance obtained at the end-user is decided by total effects of these two hops. Therefore, 10% allowance in the total noise for $\Delta T/T$ method is reasonable. There is no Recommendation which gives an interference criterion of the order of 1% to a co-primary service.

If MSS community insists on use of $\Delta T_{sat}/T_{sat}$ method, assuming regenerative repeaters at the MSS satellite and thus separating performance evaluation of the feeder link from the total link, we would like to point out another example of the sharing study within ITU-R. Extensive studies have been made by JRG8D-9D concerning frequency sharing between the MSS and the terrestrial fixed service in the 2GHz band. These have already resulted in Recommendations IS.1141 and 1142, where MSS systems, interfering side, have allowable interference level of -6 dB to the thermal noise floor of the FS receiver. That corresponds to 25% of the thermal noise in each hop. This number is based on Recommendation F.758, which is derived from the principle of 1dB additional margin for interfered-with side. In the light of the above example, we believe that the 1dB margin is well acceptable to next generation's satellite receiver.

(3) Average loss in excess of free space loss

At the January 1999 Joint meeting, there were contributions from WINForum and Bristol University, indicating more building shielding loss than is assumed in Doc.8A-9B/68 (Attachment 7). According to the recent experiments it has been demonstrated that we can assume at least 15 to 18 dB shielding loss. Since this factor is so important in evaluating the total effects of the interference that we hope further discussion will be made at the next JRG8A-9B or WP4A meetings.

(4) Activity ratio

We have made agreement from technical viewpoint that aggregated activity ratio of a large number of RLAN terminals falls well below the order of 1%. Therefore, 1% can be used as reference number for the worst case interference evaluation. We strongly doubt the aggregated ratio of 5%, which appears in Doc.8A-9B/68 (Attachment 7). This implies that many of terminals operate in activity ratios higher than 5%. It should be noted that RLANs developed in the band have through-put of more than 20Mbit/sec, which is designed to be shared by many terminals in business environments. If average value of activity ratio is 5%, one terminal user receives 3.6Gbyte within 8 working hours. Do all the millions of RLAN users exchange such enormous amount of information everyday? In this consideration even 1% activity ratio seems too high.
We hope that ITU-R would not develop the Recommendations from such an unrealistic model.

(5) Average output power

We have agreed that RLAN terminals may be operated with transmit power of 200mW in terms of average RF power, and this number can be used as reference for the sharing studies.

(6)Outdoor operation

There is argument that since most of unlicensed RLANs are operated indoors, there will be little effect on MSS feeder links from small amount of outdoor terminals, say 1% of the total number. However, even in unlicensed applications, there may be practical demand for outdoor operation in company or campus premises. We think that it is not desirable to entirely inhibit such possibility by regulatory method.

We assume that RLANs used in outdoor environments will be operated in cellular-type service areas. In such an application, several (or sometimes more) terminals transmit their signals toward one base station. Therefore activity ratio of the base station transmitter will be sum of the activity ratios of all the connected terminals. On the other hand it should be noted that the antenna at the base station is generally tilted downward resulting in much smaller interference to the direction of satellite stations, and that effect of a base station can be regarded as the same order of one terminal. An important thing is to assume, from a realistic model, the aggregate effect of all the deployed RLAN terminals, whether they are used indoors or outdoors (See Annex).

5. Conclusion

It is our basic view that we should avoid harmful interference to MSS feeder links. Therefore, we have carefully considered market demand, technical parameters and operational conditions for RLANs to be developed in the band 5150-5250MHz, where 4RF channels are arranged with 20MHz separation. In order to demonstrate that the tolerable numbers of RLAN deployment for each planned MSS feeder link become well above the assumed demands of 16 million (i.e. 4 million per RF channel), Annex 1 presents the calculation results using parameters agreed by ETSI BRAN, IEEE802.11 and MMAC-PC for consideration in the ITU-R meetings.

Annex : Calculation of tolerable number of RLAN terminals
(in order to demonstrate that the tolerable number is well above 16 million for 4 RF channels)

Methodology and interference criterion	$\Delta T/T$: 10% or $\Delta T_{sat}/T_{sat}$: 25%
Average loss in excess of free space loss	15dB
Activity ratio	1%
EIRP	200mW
Outdoor use ratio	1 %

(Calculation results to be added)