IEEE P802.11
Wireless LANs

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Subject: Task 5 of JRG 8A-9B (Sharing between RLANs and MSS feeder links at 5 GHz)

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SHARING BETWEEN U-NII DEVICES AND THE MOBILE SATELLITE SERVICE

AN UPDATE OF THE WINFORUM ANALYSIS

1 Introduction

As is widely known WINForum are one of the key industry groups promoting the development of 5 GHz RLAN systems and applications. WINForum have recently updated their analysis of the sharing between Unlicensed National Information Infrastructure (U-NII) devices and Mobile Satellite Service (MSS) feeder links in the 5150 - 5250 MHz band. The analysis is presented in the document referenced above and is discussed below.

2 Methodology and criterion.

The WINForum analysis relating to the ICO system has been based on an evaluation at the satellite receiver of the interference power density relative to the noise power density due to the thermal noise of the Earth. The document considers that the power density at the satellite receiver from unlicensed devices should be at least 15 dB below the power density from Earth thermal noise at the satellite.

It can be noted that WINForum have therefore effectively based their analysis on an assessment of the increase in the satellite receive system noise temperature, i.e. $\Delta T_{satellite}$, where the reference satellite receive system noise temperature has been taken to be the temperature of the Earth, 290 K.
The 15 dB margin that WINForum have specified can therefore be translated into a $\Delta T_{satellite}$ of 3.2% (with respect to a receive system noise temperature of 290 K). The ICO satellite receive system noise temperature is 400 K so the power level at the satellite receiver from unlicensed devices, as used by WINForum in their analysis, is actually equivalent to a real $\Delta T_{satellite}$ of 2.3%.

The methodology and criterion specified by WINForum for use in the assessment of interference from unlicensed devices into the ICO system is therefore almost completely in line with ICO proposals (1% $\Delta T_{satellite}$, reflecting the regulatory status of RLANs) and the current situation within the ITU-R.

3 Analysis

Even on the basis of a 3.2% ΔT_{Earth} (2.3% $\Delta T_{satellite}$) criterion the WINForum analysis claims that hundreds to thousands of million RLAN devices will be able to coexist with ICO feeder links assuming that the devices are restricted to 12.5 mW/MHz power spectral density (to a limit of 250 mW). In the first instance the numbers of devices quoted are not correct because of an inconsistent formula specified in the document. Furthermore a number of parameter values that have been used are inconsistent with those used for example within European fora. In summary these differences and their impact are:

- Coefficient in formula should be 0.41 rather than 1.9. Factor 4.6.
- The power spectral density has been averaged down by a factor 2.7 on the basis of claims that the devices will have widely varying bandwidths and that there will be little commonality of centre frequencies (and therefore no common spectrum peaks in any MSS band). In the case of HIPERLAN Type 1 this is not the case and in addition there is a factor 4 to account of the LBR/HBR contention. Factor 10.8.
- Number of 20 MHz channels available in the 300 MHz bandwidth available = 15 (compared to the 3 channels assumed in Europe). Factor 5, or Factor 15 if considering the population in a single HIPERLAN channel.
- EIRP limit = 250 mW (compared to 100 mW reference level used in European studies). Factor 0.4.
- Activity factor = 2.48% (compared to 5% in Europe). Factor 2.
- Composite excess attenuation = 10.9 dB assuming 1% outdoor use (compared to 10.52 dB in Europe). Factor 0.9.
- Criterion = 3.2% ΔT_{Earth} or 2.3% $\Delta T_{satellite}$ (compared to 1% $\Delta T_{satellite}$). Factor 2.3.

Overall the difference in the assessment due to the factors identified above comes to a factor of 1234 (as the WINForum analysis covers a 300 MHz band and the European analysis addresses a single HIPERLAN channel). The WINForum figure of 879 million devices therefore becomes 712,000 HIPERLAN Type 1 devices in a single channel which compares with the 744,000 derived in the European analysis (the difference probably being attributable to an aggregation of rounding errors).
It is also very interesting to note that the WINForum values for the two parameters that have taken up so much discussion within Europe in CEPT and ETSI, namely the activity factor and the composite excess attenuation, are not so very different from the values being used in Europe.

The WINFORUM analysis can therefore be seen to support the European analysis once the parameter values reflecting the European situation are taken into account. If the currently proposed HIPERLAN Type 1 EIRP limit of 200 mW is taken into account then the number of HIPERLAN Type 1 devices that might be tolerated by the MSS feeder links will be of the order of 350,000 - 400,000 per channel.

4 Conclusions

It should be noted that the technical basis of the most recent WINForum analysis of the RLAN/MSS sharing situation in the band 5 150 - 5 250 MHz generally supports the position taken by the MSS community.
When the WINForum analysis is corrected and adjusted to reflect the parameter values agreed within Europe, it confirms that even with of 200 mW EIRP and indoor-only use, only a relatively limited number of HIPERLAN Type 1 devices will be tolerable. It is on this basis that ICO believes that the proposed restrictions only allow for the near term introduction of these devices and not their continuing deployment in the long term in the band 5 150 - 5 250 MHz.

JRG 8A-9B

PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R M.[8A-9B-T5/AA]

E.I.R.P. DENSITY LIMIT AND OPERATIONAL RESTRICTIONS FOR RLANS[1] OR OTHER WIRELESS ACCESS TRANSMITTERS OPERATING UNDER RR S5.447 IN ORDER TO ENSURE THE PROTECTION OF NGSO MSS FEEDER LINKS IN THE FREQUENCY BAND 5 150 - 5 250 MHz

The Joint Rapporteur Group 8A-9B (JRG 8A-9B) has prepared the preliminary draft Recommendation in Attachment 1, which is included here for information of Working Party 8A. This has been a controversial topic within JRG 8A-9B and the document needs further work. In particular, it is expected that it will be considered at the meeting of Working Party 4A in April 1999. The preliminary draft Recommendation would then be finalized at a meeting of JRG 8A-9B.
Since Working Party 8A does not plan to meet before the meeting of Study Group 8 in November 1999, where the draft Recommendation would be considered for adoption, in order to be able to submit it to Study Group 8, the JRG 8A-9B would like Working Party 8A to consider these options:

1. Give permission to JRG 8A-9B to submit directly to Study Group 8 (through the Chairman of Working Party 8A).
2. Convene a special half day meeting of Working Party 8A, just prior to the meeting of Study Group 8, to consider adoption of the draft Recommendation for submission to Study Group 8.

Attachment: PDNR [Doc. 8A-9B/TEMP/22(Rev.1)]

[1] In this Recommendation RLAN means Radio Local Area Network, or any other portable or fixed devices offering local network connectivity (WLAN or others; see also Recommendation ITU-R F.1244 and PDNR 8A-9B/TEMP/20).

JRG 8A-9B

PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R M.[8A-9B-T5/AA]*, **

E.I.R.P. DENSITY LIMIT AND OPERATIONAL RESTRICTIONS FOR RLANS[2] OR OTHER WIRELESS ACCESS TRANSMITTERS OPERATING UNDER RR S5.447 IN ORDER TO ENSURE THE PROTECTION OF NGSO MSS FEEDER LINKS IN THE FREQUENCY BAND 5 150 - 5 250 MHz

(Questions ITU-R 212/8 and ITU-R 142/9)

The ITU Radiocommunication Assembly,

considering

a) that the band 5 150 - 5 250 MHz is allocated worldwide to the FSS (Earth-to-space) for use by NGSO MSS feeder links on a primary basis without restriction in time as per S5.447A;

b) that the band 5 150 - 5 250 MHz is also allocated on a worldwide primary basis to the Aeronautical Radio Navigation Service (ARNS) under Article S.5;

c) that the band 5 150 - 5 216 MHz is allocated to the FSS (space-to-Earth) under S5.447B and under the provisions of Resolution 46(Rev.WRC-97)/No. S9.11A for the use of NGSO MSS feeder links on a worldwide basis;

d) that the band 5 150 - 5 216 MHz is also allocated to the feeder links of radiodetermination satellite service (RDSS space-to-Earth) subject to footnote S5.446;

e) that the band 5 150 - 5 250 MHz is also allocated via footnote S5.447 to the mobile service on a co-primary basis in a limited number of countries and subject to coordination under S9.21;

f) that some administrations are considering the introduction of RLANs in respect of the mobile service footnote S5.447 in the band 5 150 - 5 250 MHz on a national basis under an unlicensed regime and un-coordinated basis;

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* This Recommendation was jointly developed by experts of ITU-R Study Groups 8 and 9, and future revisions should be undertaken jointly (JRG 8A-9B).

** This Recommendation should be brought to the attention of ITU-R Study Group 4 (WP 4A).

[2] In this Recommendation RLAN means Radio Local Area Network, or any other portable or fixed devices offering local network connectivity (WLAN or others; see also Recommendation ITU-R F.1244 and PDNR 8A-9B/TEMP/20).

g) that the potential large scale deployment of RLAN transmitters and other wireless portable transmitters in the band 5 150 - 5 250 MHz within the above allocation (S5.447) may cause unacceptable levels of interference and reduction in satellite capacity to NGSO MSS satellite receivers operating their feeder-uplinks in this band under S5.447A and that therefore the medium- to long-term sharing may not be feasible;
h) that there is a need to protect different types of satellite, including those being developed, employing various modulation and access schemes (e.g. narrow-band TDMA-FDMA and wideband CDMA-FDMA);
j) that there is a need to protect the long-term use of the 5 150 - 5 250 MHz band by the NGSO MSS feeder uplinks (Earth-to-space) S5.447 (e.g. non-regenerative and regenerative satellite systems);
k) that there is a need to specify appropriate restrictions to e.i.r.p. density limit for RLAN and other wireless access transmitters in this band in order to protect non-GSO MSS feeder-links;
l) that the deployment of RLAN applications in this band is intended mainly for indoor use;
m) that for the purpose of the sharing studies it has been assumed that 99% of the RLANs are expected to operate indoor if a restriction to indoor use is imposed;
n) that the excess path loss provided by indoor to outdoor propagation environment can be considered beneficial to the sharing between NGSO MSS and RLANs,

recommends

1 that administrations should ensure that the mean[3] e.i.r.p. density limit of RLAN or other wireless access transmitter devices operating in the band 5 150 - 5 250 MHz under RR S5.447 should be no greater than 10 mW in any 1 MHz (or equivalently 0.04 mW in any 4 kHz) per transmitter, in conjunction with an overall mean e.i.r.p. of 200 mW per transmitting device (NOTE 1, NOTE 2);
2 that administrations should take measures, as far as practicable, to ensure that RLAN or other wireless access transmitters are operated indoors in the bands 5 150 - 5 250 MHz under S5.447;
[3a that for protection of MSS feeder links, power flux-density limit of total RLAN interference observed at the victim satellite receiver should be no greater than X dB(W/m^2 per MHz) or Y dB(W/m^2 per 4 kHz);]
One administration and one Sector Member alternatively proposed:
[3b that RLANs could be newly deployed in the 5 150 - 5 250 MHz under footnote S5.447 on a short-term interim time-frame (until year - time to be determined)];

NOTE 1 - The values of e.i.r.p. and e.i.r.p. spectral density limits in *recommends* 1 are basically derived from the RLAN operational condition stated in *recommends* 2. These limits will be reviewed in the sharing studies to be conducted by Study Group 4 (Working Party 4A).

[3] The "mean" power refers here to the e.i.r.p. radiated during the transmission burst at the power control protocol which corresponds to the highest power, if power control is implemented.

[NOTE 2a - For a particular type of RLANs standard (HIPERLANs Type 1), the mean e.i.r.p. limit defined in *recommends* 1 should apply, while the e.i.r.p. density limit should apply only during the payload transmission. This is permitted due to the limited market expected for these specific devices and to the late phase of their development.]

[NOTE 2b - Due to the imminent market deployment by some administrations of a particular type of RLAN standard (HIPERLAN type 1), the e.i.r.p. density limit of up to 40 mW/1 MHz may be allowed in order to take into account for the low bit rate (1.4 Mbps) GMSK transmissions of the HIPERLAN type 1 standard. Such an upper limit has been agreed to apply only on a interim time basis (i.e. until 2002), after which it is assumed that other more efficient types of RLAN standards have been developed and this whole note will not be applicable.]

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