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A comment on line spectra at pilot sub-carriers

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INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION STUDY GROUPS

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PRELIMINARY DRAFT NEW RECOMMENDATION [8A-9B-T5/AA]

EIRP DENSITY LIMIT AND OPERATIONAL RESTRICTIONS FOR RLANS[1] OR OTHER WIREL 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 MH

(Questions ITU-R 212/8, ITU-R 142/9 and ITU-R 284/4)

The ITU Radiocommunication Assembly,

considering

a) that the band 5 150 —5 250 MHz is allocated world-wide to the FSS (Earth-to-space) for the 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 world-wide 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-95)/No.S9.11A for the use of NGSO MSS feeder links on a world-wide 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 5150-5250 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 co-ordination 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 —5250 MHz on a national basis under an unlicensed regime and un-coordinated basis;

g) that the potential large scale deployment of RLAN transmitters and other wireless portable transmitters in the band 5150 — 5250 MHz within the above allocation (S5.447) may cause unacceptable levels of interference and reduction in satellite capacity to NGSO MSS satellite receivers

[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).

modulation and access schemes (e.g. narrow-band TDMA-FDMA and wide-band 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 up-links (Earth-to-space) S5.447 (e.g. non-regenerative and regenerative satellite systems);

k) that there is a need to specify appropriate restrictions to EIRP 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[1] EIRP 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 10mW in any 1MHz (or equivalently 0.04 mW in any 4 kHz) per transmitter, in conjunction with an overall mean EIRP 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 5150-5250 MHz under S5.447;

[**3a** 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 dBW/m^2/MHz or Y dBW/m^2/4kHz.]

One administration and one organisation members propose

[**3b** that RLANs could be newly deployed in the 5150-5250 MHz under footnote S5.447 on a short-term interim time frame (until year TBD).]

Note 1: The values of EIRP and EIRP 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).

[Note 2a: For a particular type of RLANs standard (HIPERLANs Type 1), the mean EIRP limit defined in Recommends 1 should apply, while the EIRP 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 EIRP 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.

[1] The "mean" power refers here to the EIRP radiated during the transmission burst at the power control protocol which corresponds to the highest power, if power control is implemented.

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Extract

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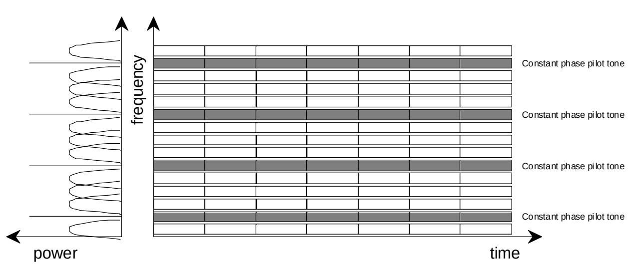
Constant phase pilot signal in current Draft

17.3.5.9 OFDM modulation (part of pilot signals)

The contribution of the pilot subcarriers is produced by Fourier transform of sequence *P*, given by:

$P_{-26,26}$= {0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, **0**,
0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,–1, 0, 0, 0, 0, 0 }×(1+j)/√2 (19)

This cause line spectra at the pilot sub-carriers.



Pilot signal allocation and signal power spectrum

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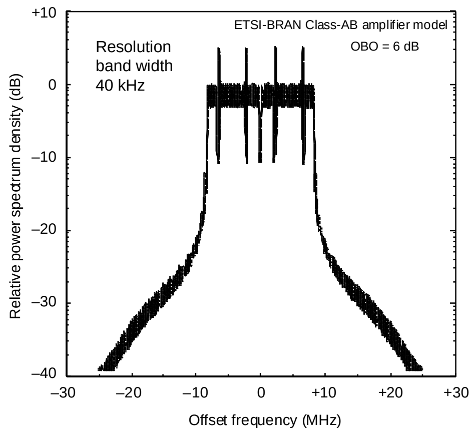
Power spectrum of modulated signal with constant phase pilot tone

The constant phase pilot tones generate line spectra at the pilot sub-carriers.



Power spectrum of modulated signal

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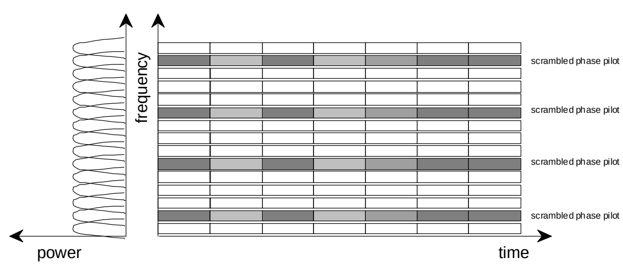
Scrambled pilot signal

To avoid generating line spectra, the pilot signal is desired to be modulated by scrambled pattern.

- This causes no performance degradation in demodulation.
- Extra hardware is negligible (simple random pattern generator)
- The pattern generation method in tk's comment is a good solution.



Pilot signal modulated by scrambled pattern