IEEE P802.11
Wireless LANs

TGa Channel Spacing and Related Issues

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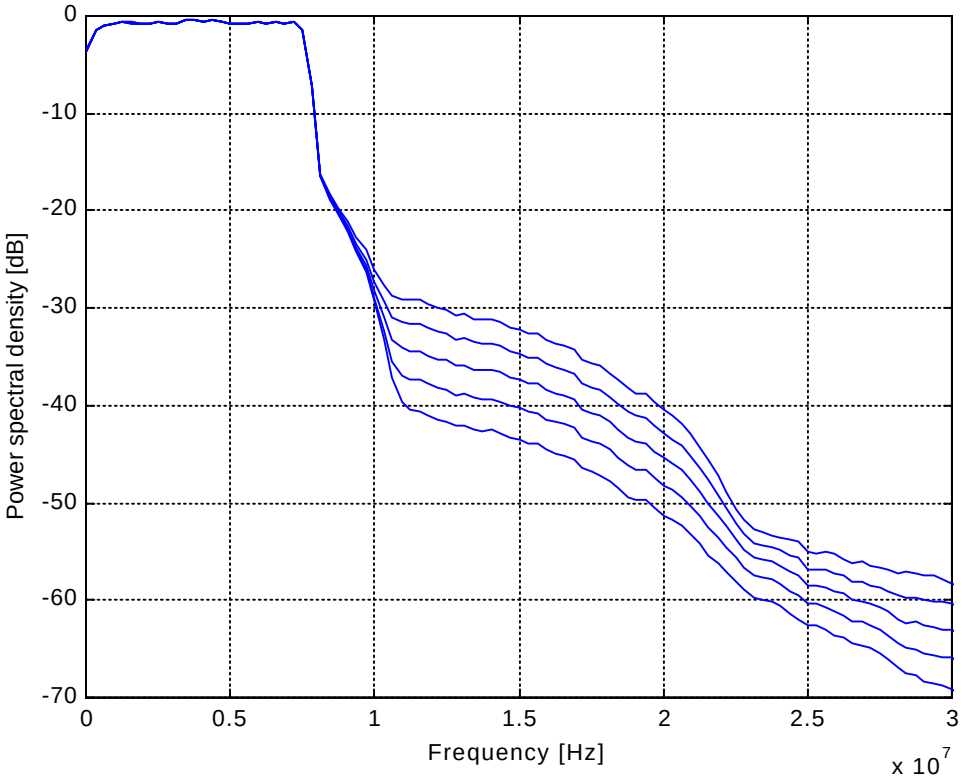
Channel Spacing

The channel spacing issue was identified as the issue most important to co-operation with BRAN. The suggestion worked with BRAN was to use 20 MHz channel spacing. However, subsequent checks performed by BreezeCom have shown that retaining the 20 MHz spacing of the outermost channel from band edge increases the backoff requirements by some additional 6 dB, which we consider unacceptable. The figure below illustrates the simulated transmitted spectrum for backoffs of 6-10 dB (Rapp's model, P=2).



The solution which was worked out by a team of TGa members was to use a 20/64 MHz subcarrier spacing with 48 subcarriers, but reduce the channel spacing to 18 MHz. By that several advantages are achieved:

- The 20 MHz sampling rate, which determines the data rate, is maintained.
- The number of subcarriers is retained at 48, which was considered a "magic number" - it is divisible by 8, it gives enough distance from aliased frequencies for convenient filter implementation etc.
- The 18 MHz spacing enables synthesizer design with 1 or 2 MHz step, which is conveniently derived from 20 MHz reference frequency
- Increase the distance of outermost channel from band edge to 23 MHz (for 4 channels in a 100 MHz band)

The ACI degradation caused by decrease in channel spacing will be checked by simulation. An initial impression coming from examination of power spectra is that the degradation will be insignificant.

Channel Grid

The channel grid proposed is

Fc(n) = F_lower_edge + 23 MHz + n*18 MHz, n>=0.

For 100 MHz wide band starting at 5150 MHz (lower U-NII, restricted HIPERLAN bands) it translates into:

5173, 5191, 5209 and 5227 MHz (note the symmetric 23 MHz distance from edges on both sides).

For 100 MHz wide band starting at 5725 MHz (upper U-NII band) it translates into:

5748, 5766, 5784 and 5802 MHz (note the symmetric 23 MHz distance from edges on both sides).

For 150 MHz wide band starting at 5150 MHz (unrestricted HIPERLAN band) it translates into:

5173, 5191, 5209, 5227, 5245, 5263 and 5281 MHz (note that the upper channel is just 19 MHz from the edge and might require higher backoff to pass local regulations).

For 200 MHz wide band starting at 5150 MHz (lower and middle U-NII bands) it translates into:

5173, 5191, 5209, 5227, 5245, 5263, 5281, 5299, 5217 and 5235 MHz (note that the upper channel is just 15 MHz from the edge and might require even higher backoff to pass local regulations).

We propose to consider the support of operation in the outermost channel closer that 23 MHz from band edge as optional, not affecting device's status as being 802.11a compliant.

Note: A higher spacing from the edge could be obtained by using different starting frequencies for different band widths. We preferred, however, to create a single, hopefully world-wide applicable frequency grid.

Subcarrier Spacing (FFT size) and Guard Interval

Previous 802.11 parameters were 15.833 MHz/64 subcarrier spacing and 12 point GI for each 64 sample interval. Due to increase in sampling rate to 20 MHz we decided to remain with 64 point FFT but increase the GI to 16 points. The resulting data rates are 6, 12, 18, 24 and 36 Mbit/s.

We examined the 128 point FFT issue and decided not to adopt it, in spite of lower overhead. The reasons are marginal increase in performance in multipath (maybe some problem in simulation related to preamble processing, but that's the best we had for a decision) and a verified degradation of 3-4 dB in terms of phase noise tolerance. Given the additional increase in complexity and in decoding latency we decided to decline for the time being the 128 point FFT option.

Oscillator Accuracy

Due to tighter spacing between channels we propose to specify the center frequency tolerance to be 120 KHz. At 6 GHz this corresponds to 20 ppm. Same 20 ppm accuracy requirement will apply to sampling rate.

Optional 64QAM mode

We decided to add an optional 64QAM modes with coding rates of R=2/3 and 3/4, for data rates of 48 and 54 Mbit/s. This enhanced modes may as well address the desire of some MMAC members to have >38 Mbit/s data rates.

Summary

Parameter values (channels and subcarrier spacing, guard interval) preferred by 802.11 due to regulatory restrictions and implementation convenience were presented. These parameters are proposed to be accepted by 802.11, and then those will be passed to BRAN for consideration.