Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
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Supplementary Text for LB#11 comments

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Note:

Modified text is highlighted

1. Test Procedure for Constellation Error

To ensure that the receiver SNR does not degrade more than 0.5 dB due to the transmitter SNR, the relative constellation RMS error, averaged over carriers, OFDM frames, and packets, shall not exceed a burst profile dependent value according to Table 1.

Table 1: Allowed relative constellation error versus data rate

Burst type	Relative constellation error (dB)
QPSK-1/2	-19.4
QPSK-3/4	-21.2
16QAM-1/2	-26.4
16QAM-3/4	-28.2
64QAM-2/3	-32.7
64QAM-3/4	-34.4

All measurement errors taken together shall be 10dB less than the required noise level, i.e. if a specification is TX S/N = 10dB, the measurement S/N should be at least 20dB. For all PHY modes, measurements shall be taken with all non-guard carriers active.

The sampled signal shall be processed in a manner similar to an actual receiver, according to the following steps, or an equivalent procedure:

a) Start of frame shall be detected.

b) Transition from short sequences to channel estimation sequences shall be detected, and fine timing (with one sample resolution) shall be established.

c) Coarse and fine frequency offsets shall be estimated.

d) The packet shall be de-rotated according to estimated frequency offset.

e) The complex channel response coefficients shall be estimated for each of the carriers.

f) For each of the data OFDM symbols: transform the symbol into carrier received values, estimate the phase from the pilot carriers, de-rotate the carrier values according to estimated phase, and divide each carrier value with a complex estimated channel response coefficient. For unused subcarriers in the case of subchanelized transmission use the estimated channel response coefficient of the nearest used subcarrier.

g) For each data-carrying carrier, find the closest constellation point and compute the Euclidean distance from it. For unused subcarriers in the case of sunchanelized transmission use 0+j0 constellation point to compute the distance.

h) Compute the RMS average of all errors in a packet. It is given by:

$$\text{Error}_{\text{RMS}} = \frac{1}{N_f}\sum_{i=1}^{N_f}\sqrt{\frac{\sum_{j=1}^{L_P}\left(\sum_{\substack{k=-N_{\text{used}}/2 \\ k\neq 0}}^{N_{\text{used}}/2}\left\{\left[I(i,j,k)-I_0(i,j,k)\right]^2+\left[Q(i,j,k)-Q_0(i,j,k)\right]^2\right\}\right)}{\sum_{j=1}^{L_P}\left(\sum_{\substack{k=-N_{\text{used}}/2 \\ k\neq 0}}^{N_{\text{used}}/2}\left\{I_0(i,j,k)^2+Q_0(i,j,k)^2\right\}\right)}} \quad (1)$$

where

L_P is the length of the packet;

N_f is the number of frames for the measurement;

$\{I_0(i,j,k), Q_0(i,j,k)\}$ denotes the ideal symbol point of the i^{th} frame, j^{th} OFDM symbol of the frame, k^{th} carrier of the OFDM symbol in the complex plane;

$\{I(i,j,k), Q(i,j,k)\}$ denotes the point of the i^{th} frame, j^{th} OFDM symbol of the frame, k^{th} carrier of the OFDM symbol in the complex plane;

2. Spectral Masks

Current spectral masks for OFDM are impractical in that a single corner point determines the operating backoff, and does not allow the utilization of most of the mask region.

The proposed masks are similar to those of IEEE802.16a section 8.6.2. The masks are scaled to support other bandwidths. We propose to modify the mask of 802.16a around point B (5.25MHz @ BW=10MHz). This is to allow the relaxation of the spectral requirements, as demonstrated below.

Table XXX mask for unlicensed bands

Point	A	B	C	D
Frequency	0.95*BW	1.09*BW	1.95*BW	2.95*BW
Amplitude	0dB	-25dB	-32dB	-50dB

2.1 Simulation results

In Figure the spectrum of an OFDM waveform with BW=10MHz is shown vs. the current and the proposed spectral masks. The OFDM signal is distorted by a power amplifier (Rapp model p=2) with an input back-off of 8dB. It can be seen the inter-modulation skirts violate the current 802.16a mask, around 5MHz. The modification prevents the violation.

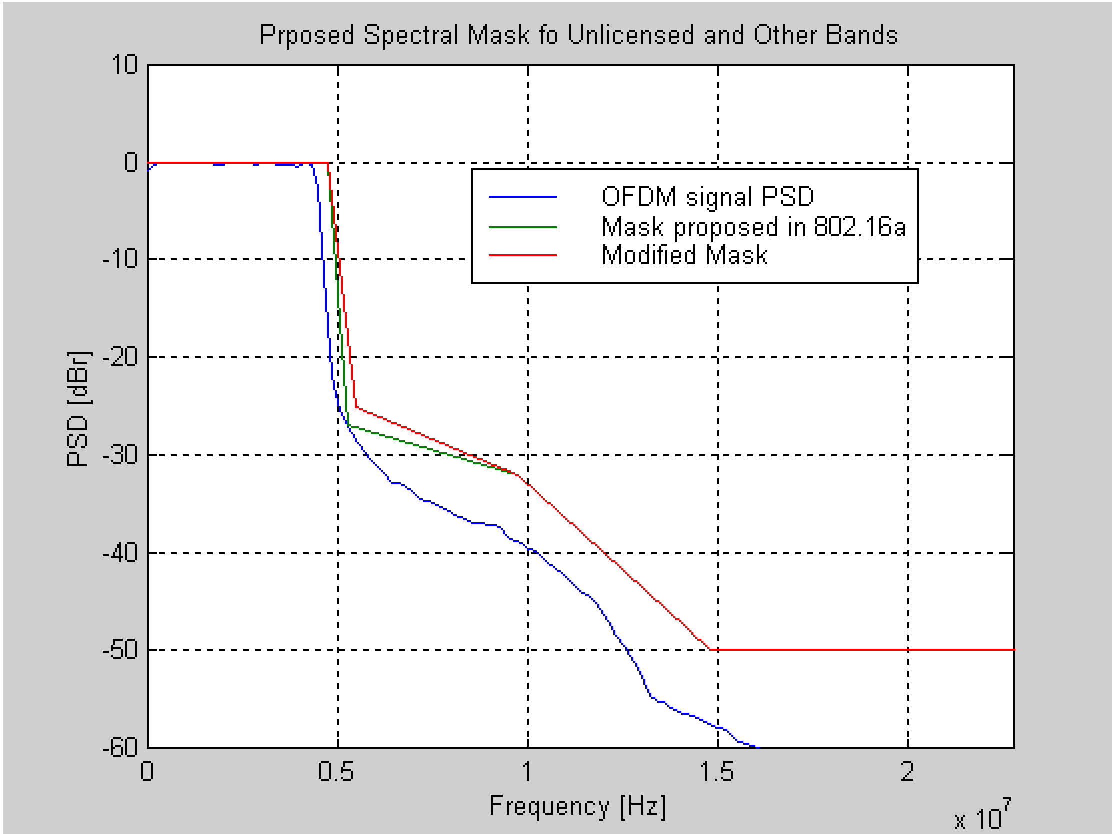

Figure 1: Spectral Masks for BW=10MHz

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