Proposal for the spectrum mask in IEEE 802.16

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Purpose:

This document is a contribution about spectrum mask requirements in 802.16

IEEE 802.16 PHY

Proposal for the spectrum mask

History of the spectrum masks in 802.16

- 802.16.1/D1
  - Subscriber station transmitter: Per relevant local regulation requirements
  - Basestation transmitter: TBD by co-existence group
- 802.16/D2
  - Subscriber station transmitter: Per relevant local regulation requirements
  - Basestation transmitter: Per relevant local regulation requirements
- Session #12
  - Subscriber station transmitter: Apply block spectrum mask from co-existence document
  - Basestation transmitter: Apply block spectrum mask from co-existence document

Interpreting the block spectrum mask

- Proposed in Session #12
- As no written contribution clarifyng the corner points of the spectrum mask was given the following interpretation is assumed:

  According to the co-existence document the unwanted emission spectral density should be attenuated by at least $A=11+40*f_{offset}/B_0$ dB where f_{offset} is the frequency offset from the band edge and B_0 is the *occupied bandwidth*. Attenuation greater than 50 dB is not required. The o*ccupied bandwidth* is defined as the bandwidth containing 99% of the total mean emitted power.

Computing the occupied bandwidth

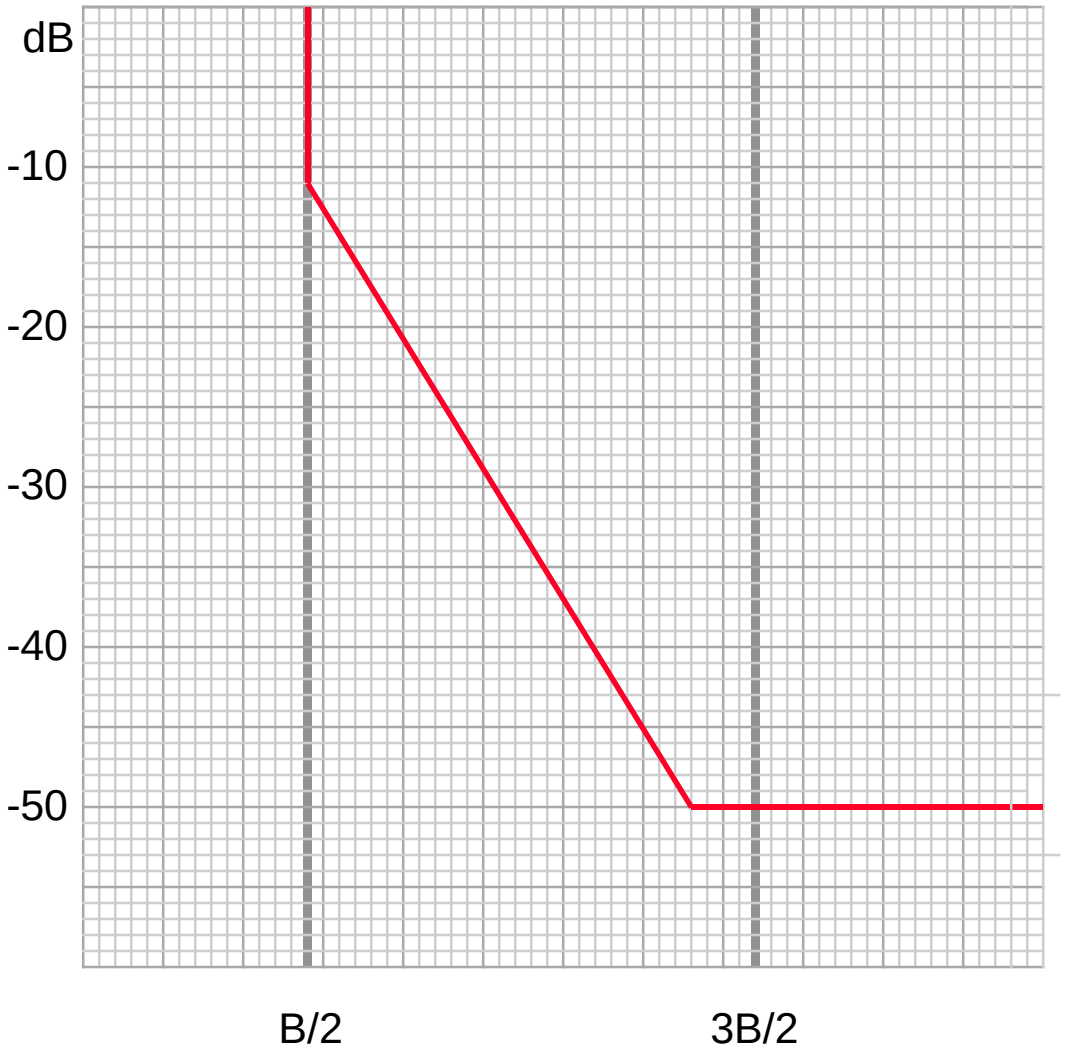
- The occupied bandwidth can be computed as a function of the nominal bandwidth by solving the following equation:

$$\int_0^{x \cdot B} |H(f)|^2 \, df = 0.99 \int_0^{B} |H(f)|^2 \, df$$

where H(f) is the transfer function of the square-root raised cosine pulse defined for baseband pulse shaping in 802.16 and B is the nominal bandwidth

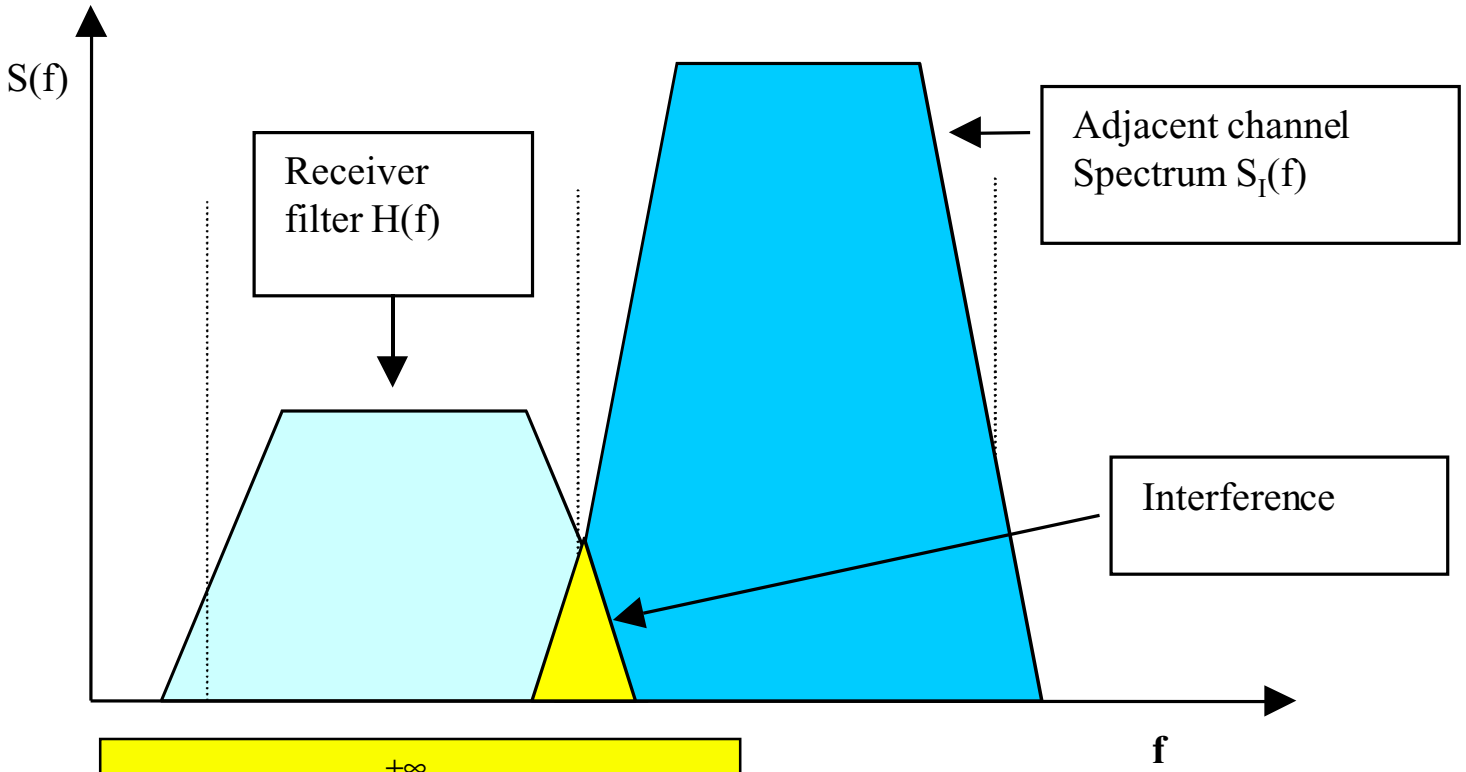
- Solving the equation will give x=0.882 which implies that the occupied bandwidth is given by
  $B_0 = 0.882B$
- The spectrum mask expressed as a function of the nominal bandwidth is then given by $A \sim 11 + 45 * f_{offset}/B$ (dB)

Spectral mask proposed in Session #12



- With this information we can finally draw the spectrum mask proposed in session #12

Net Filter Discrimination (NFD)



$$NFD = \frac{\int_{-\infty}^{+\infty} S_I(f)\,df}{\int_{-\infty}^{+\infty} S_I(f)\left|H(f)\right|^2 df}$$

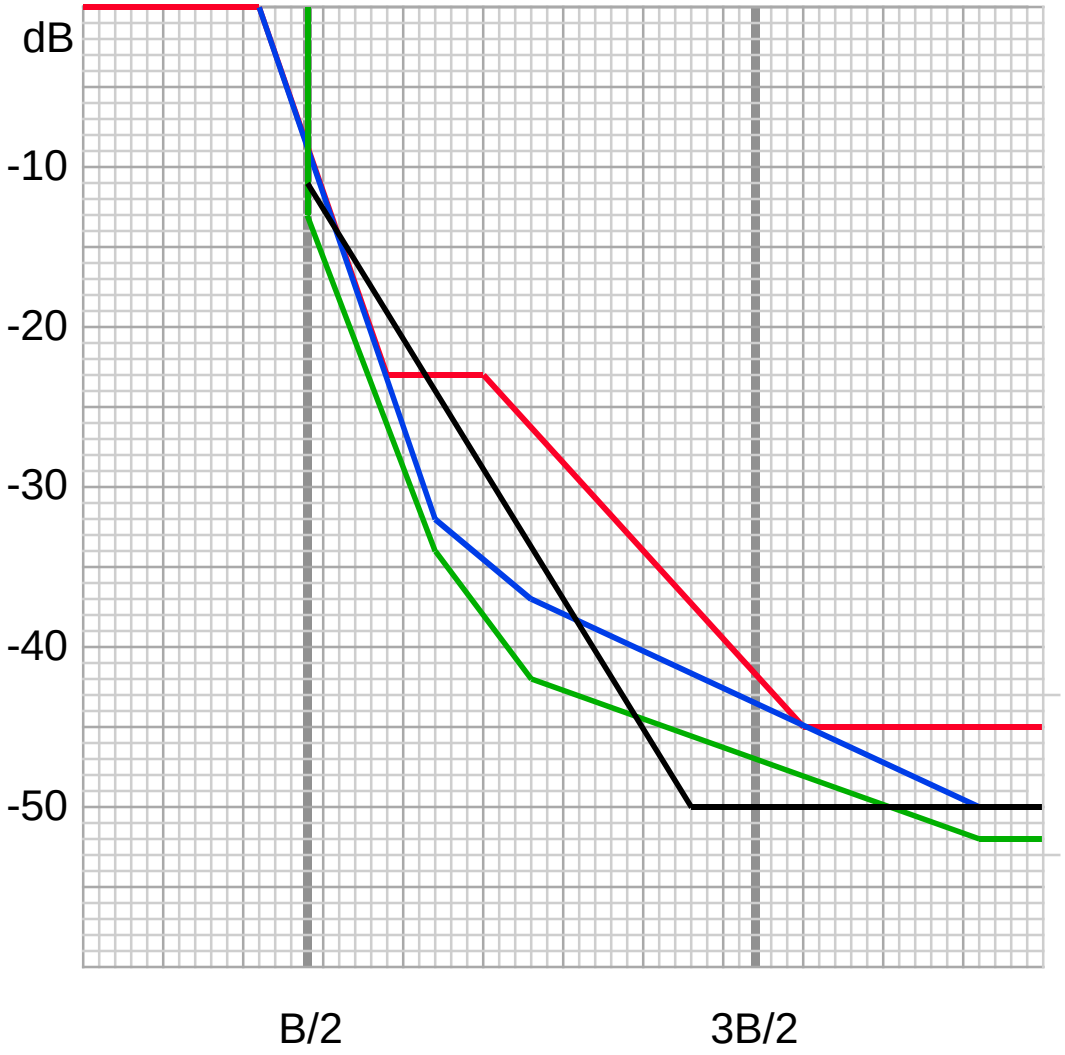
Ratio between the power transmitted by the interfering system and the portion that can be measured after the receiver filter in the adjacent channel

ETSI spectrum masks

- ETSI has defined the System A, System B and System C spectrum masks in EN 301 213-3
- The ETSI spectrum masks and the Session #12 spectrum masks can be compared by computing the NFD for each of them assuming an ideal root-raised cosine receiver filter with roll-off 0.25

	NFD (dB)
System A	24.6
System B	26.7
System C	30.9
Session #12	25.4

ETSI A, B and C masks and Session #12 mask



- ETSI System A
- ETSI System B
- ETSI System C
- Session #12

Observations

- 802.16 has a good chance of becoming an international standard. In Europe equipment in the 26-28 GHz range must conform to the relevant ETSI System masks. It is noted that the Session #12 spectrum mask does not meet the requirements of **any** of the ETSI system masks. ETSI System masks are an example of a requirement of the "local regulator". When using ETSI masks the most stringent mask associated with the modulation complexity in the adjacent channels should be used.
- ETSI System masks tends to be more "anatomic" than the Session #12 spectrum mask meaning that they are modeled to better accommodate typical PA:s and still having a good NFD value. The Session #12 spectrum mask is also very stringent in the upper part of the adjacent channel making it hard to deal with fifth order intermodulation products.
- Where local requirements are more relaxed a spectrum mask according to session #12 might be used

Conclusions

- The conclusion is to revert to the decision in 802.16/D2:
  - Subscriber station transmitter: Per relevant local regulation requirements
  - Basestation transmitter: Per relevant local regulation requirements