Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Corrections to ACR for 802.16-2004**
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Re:	Response to Sponsor Ballot on IEEE802.16-2004/Cor1/D3 document
Abstract	This document describes the reasons why ACR is incorrect in the current version of the 802.16 standard.
Purpose	This document is background material for a correction to ACR required in 802.16-2004
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Correction to ACR in 802.16-2004

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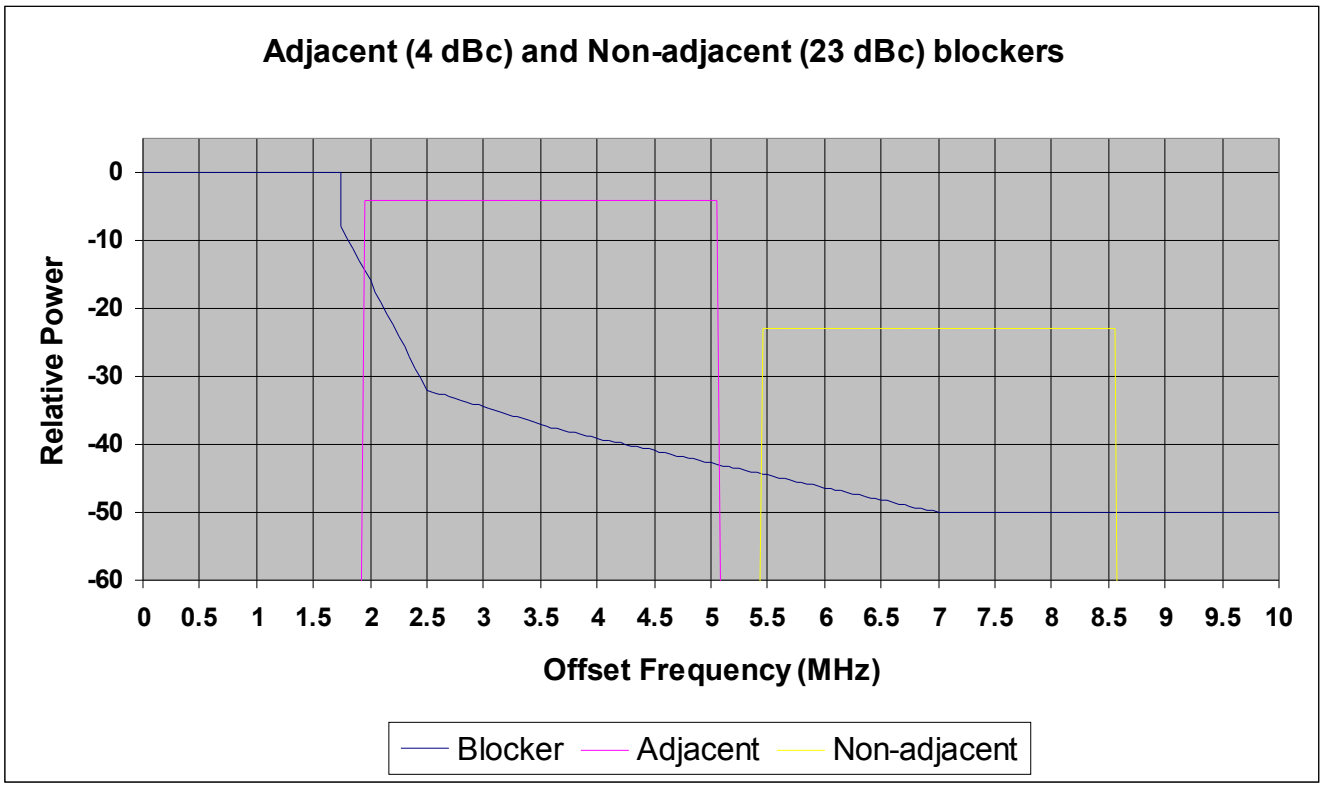
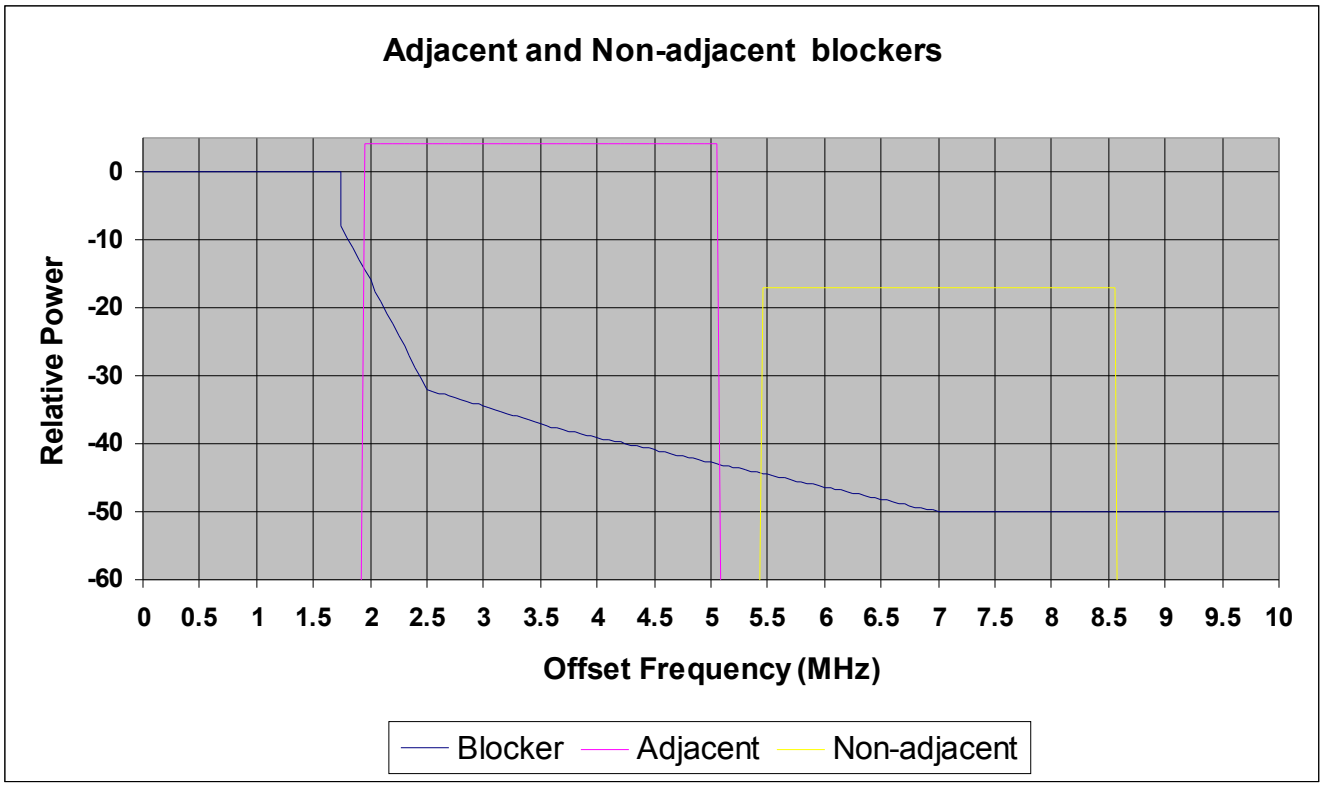
There is an issue with ACR in the current 802.16-2004 standard.
The standard says that for 64-QAM, the non-adjacent blocker is to be applied at a level 23 dB above the desired signal. For 64QAM-3/4 with OFDMA, we need to have an SNR of 20 dB at the receiver. Implementation loss is 5 dB, so that the real SNR required is 25 dB. For a blocker 2 channels away, when we integrate the type G ETSI mask to determine how much of the blocker power leaks into the desired channel, we see that the in-band blocker energy can be as high as -43 dBc (and this is the mask most often used).
Putting these together means that there is no way that anyone could ever meet the 23 dBc non-adjacent blocker spec. For example, assume that the desired signal is at -65 dBm. If the blocker is 23 dB above this, it will be at a level of -42 dBm. Since the blocker's in-band skirts are about -43 dBc, the in-band energy from the blocker is -85dBm. This only gives us a 20dB SNR. Since we need 25 dB, there is absolutely no way that we could hope to demodulate the desired signal.
The graph below shows details. For the adjacent blocker case, the red curve represents the desired signal, while the blue curve is the spectral mask of the blocker. The blocker is at a power level 4 dB above that of the desired signal. The integrated power from the blocker that appears in the passband of the red signal is -22.6 dBm. Since the desired signal is at -4dBm, the SNR will be approximately 18.6 dB. However, the receiver requires an SNR of 25 dB (OFDMA) or 26 dB (OFDM) in order to correctly demodulate the 64QAM-3/4 signal. The noise from the blocker is too high if the blocker is 4 dB above the desired signal.
For the non-adjacent blocker, a similar situation exists. the blocker is still the blue curve. The desired signal is now the yellow curve. It is set so that it is 23 dB below the power level of the blocker. The integrated power of the blocker that appear in the passband of the desired signal is -43.2 dBm. Since the desired signal is at -23 dBm, the SNR is about 20.2 dB. Again, this is below the required 25 dB (OFDMA) or 26 dB (OFDM) SNR required for correct demodulation.



The curve below shows the level of the blocker and desired signals required to meet the 26 dB SNR necessary for demodulating OFDM signals. Note that the level of the desired signals has been increased by 8 dB for the alternate blocker, and by 6 dB for the non-adjacent blocker.



In order to ensure that the receiver can correctly demodulate the desired signal in the presence of adjacent and non-adjacent blockers, the specifications must be relaxed.

For OFDM, where the required SNR is 26 dB for 64QAM and 20 dB for 16QAM, we require:

Modulation	Adjacent Channel Rejection (dB)	Non-adjacent Channel Rejection (dB)
16QAM-3/4	2	23
64QAM-3/4	-4	17

For OFDMA, where the required SNR is 25 dB for 64QAM and 19 dB for 16QAM, we require:

Modulation	Adjacent Channel Rejection (dB)	Non-adjacent Channel Rejection (dB)
16QAM-3/4	3	24
64QAM-3/4	-3	18