Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <http://ieee802.org/20/>
Title	**Proposed RF Metrics for Minimum Performance**
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Re:	MBWA Minimum Performance Specification Project
Abstract	This contribution introduces and describes various minimum performance parameters proposed for the new Minimum Performance Specification in 802.20
Purpose	For consideration of 802.20.
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1 Introduction

In this contribution we identify a set of RF metrics to be used for MBWA RF MPS. These metrics are to be defined for every MBWA channel bandwidth (BW).

Table 1 summarizes the proposed common RF metrics for access terminal (AT) and access network (AN). Table 2 summarizes additional requirements for AN. The remaining part of the document describes the metrics in more details.

In future contributions we will cover more details of each metric and the required limits to be met by AN/AT. In addition, we will also specify the test configuration for each metric.

Table 1. SUMMARY OF PROPOSED RF METRICS FOR MBWA MPS – COMMON FOR AN/AT

TX/RX	AN/AT RF Metrics
Transmitter RF Characteristics	Transmit Power Maximum output power boost Maximum output power reduction
	Frequency Error
	Transmit Waveform Quality Spectral flatness
	RF Emissions Spectrum Emission Mask ACLR Spurious Emissions
Receiver RF Characteristics	Reference Sensitivity
	Received signal dynamic range
	Adjacent Channel Selectivity
	Blocking Characteristics
	Intermodulation Characteristics

Table 2: ADDITIONAL RF METRICS FOR AN

TX/RX	AN RF Metrics
Transmitter RF Characteristics	Transmitter intermodulation requirements
	Co-existence requirements
Receiver RF Characteristics	In-Channel Selectivity requirements
	Receiver spurious emission requirements

2 AN/AT Transmitter characteristics

2.1 Transmit Power

These metrics include:

- The maximum output power assuming non-special assignments[1].
- The maximum output power boost for MBWA special assignments. This requirement is needed since with special assignments the transmitted power can exceed maximum output power for non-special assignments.
- The maximum power reduction (MPR) which is a leverage given to AT in some cases. For instance, in order to coexist with some other technologies or to meet some regulatory requirements, the AT may need to meet tougher emission requirements. The MPR will allow the AT to reduce its power for this purpose.

2.2 Frequency Error

Frequency Error is the tolerated modulated carrier frequency accuracy. The accuracy is defined in PPM. The duration of the measurements should be at least one frame (i.e. ~1msec).

2.3 Output RF Spectrum Emissions

2.3.1 The Spectrum Emission Mask (SEM):

The SEM is defined as a general emission mask that may not seem some regulatory requirements in general. Additionally, the AT is required to conform to other more stringent masks to either meet regulatory requirements or to coexist with other technologies. The MPS will specify what scenarios are to be entertained and the corresponding additional requirements. Conforming to

[1] In MBWA the scheduler may restrict the user to some assignment size or some assignment location to allow for increase in transmit power without violating emission requirements. The three special assignments are: 1. Having one tile in any part in the channel. 2. Restricting the user's assignment to the sub-band at the edge of the channel. 3. Restricting the user's assignment to the sub-band not at the edge of the channel.

additional requirements by the AT can occur during system determination or through signaling (to be determined later).

2.3.2 Adjacent Channel Leakage Ratio (ACLR)

The ACLR is the ratio between the unwanted radiated power measured on adjacent channels to the total power transmitted in the channel BW. In this sense the ACLR captures the average energy radiated in adjacent channels as opposed to SEM which focuses on the spectral roll off in those channels. The metric when considering the first and second adjacent bands is denoted by ACLR1 and ACLR2 respectively.

The MPS should include a minimum requirement for ACLR. Besides, the MPS should include additional requirements to accommodate cases of coexistence with other technologies as discussed before.

2.3.3 Spurious Emissions

Those are the requirements to be met outside the SEM limits. They are mostly dictated by regulatory requirements.

2.4 Transmit Waveform Quality

The error vector magnitude (EVM) is used for the purpose of assessing the quality of the transmitted signal. Different EVM values corresponding to different modulation orders can be specified.

The EVM is measured only on the tones used for data transmission (assignment tones) and after performing time correction, frequency correction, and channel estimation. That is, EVM is measured after FFT (in frequency domain).

Another EVM metric needs to be defined for the tones that are not part of the assignment but still within the desired channel BW. For those tones, the noise level caused by the assignment tones leakage can be high enough (if not regulated) that it dominates other noise sources. The out of assignment EVM is defined to be the total noise seen outside the assignment to the transmit power inside the assignment. This metric can be frequency dependent by defining it as a function of the frequency offset from the assignment band.

3 AN/AT Receiver Charactristics

3.1 Receiver Reference Sensitivity

The reference sensitivity is defined to be the minimum received power level at the AT antenna ports for which the average throughput exceeds some limit.

3.2 Received signal dynamic range

This requirement is to assure that the AT is capable of attaining high data rates when the SNR is very high. Typically self-noise, due to the AT device imperfections such as I-Q imbalance, becomes more detrimental to performance at high SNR. The received power can be set to as high as -25dBm and a throughput corresponding to 64 QAM packet format should be specified.

3.3 Adjacent Channel Selectivity (ACS)

The ACS is a measure of how well an AT can receive data in the presence of an adjacent channel at a given offset from the desired signal and at a certain power level.

The adjacent channel jammer is also assumed to be an 802.20 MBWA modulated waveform. The adjacent channel is assumed to be the first channel next to the signal channel BW.

The MPS will also define some jammer scenarios where the adjacent channel is x dB stronger than the desired channel. The input signal level at the desired channel (i.e. without the interferer) shall be within the range from the receiver sensitivity plus y dB (TBD) to the maximum received level minus x dB (TBD). The y dB is a leverage given to the terminal due to the presence of the interferer.

3.4 Blocking Characteristics

That is the ability of the AT to receive a desired signal in the presence of an interferer at a frequency offset other than the adjacent channel without the interferer degrading the performance by much. The blocker is also MBWA modulated waveform.

3.5 Intermodulation Characteristics

In this case two interferers (one of them is CW and the other has a BW that is the minimum of the desired channel BW and 5 MHz) are located at certain offsets from the desired signal carrier such that their third and higher order intermod products fall in the desired signal channel.

4 Additional TX RF Metrics For The AN

4.1 Transmit Intermodulation

The transmit intermodulation measures the ability of the transmitter to function in the presence of unwanted signals like blockers and still being able to meet the different emission requirements. In a sense it is a measure of the non-linearity of the transmitter since unwanted emissions are out of channel BW.

4.2 Co-existence requirements

Several co-existence requirements are appropriate for the MPS. These requirements address (1) protecting the receivers of the access networks from being desensitised by emissions from an access network transmitter, (2) protecting an access terminal and/or access network operating in other frequency bands in the same geographical area, and (3) protecting the access networks of other technologies that are co-located with an MBWA system.

5 Additional Receiver RF metrics for the AN

5.1 In channel Selectivity Requirements

The In-channel selectivity (ICS) requirement of the MBWA system is specified as a measure of the capability of the receiver to receive a desired MBWA signal (denote by victim) at its assigned tile locations in the presence of another in-channel desired signal (denote by aggressor) received at adjacent tile allocations which are received at higher PSD.

5.2 Receiver Spurious Emission Requirements

These requirements for receiver spurious emissions generated or amplified applies only for AN with separate receiver and transmitter antenna ports. Those spurious emission requirements are based on internationally recognized limits and parallel to the transmitter spurious requirements.

References

[1] 802.20 standard air interface for mobile broadband wireless access systems.