Project	IEEE P802.16 Broadband Wireless Access Working Group		
Title	In-Block Spectrum Mask, Out-of-Block Emission Limits, and Frequency Stability Requirements of Broadband Wireless Access Systems		
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Re:	Call for contributions to be considered for inclusion in the Coexistence Practice Document. Specifically, this document deals with in-block, out-of-block, and frequency stability requirements.		
Abstract	The document contains excerpts from the draft Canadian Radio Standards Specification (RSS 191) for Local Multipoint Communication Systems (LMCS) in the 28 GHz band, point-to-point and point-to-multipoint broadband communication systems in the 24 GHz and 38 GHz band.		
Purpose	To assist in the drafting of the Coexistence Practice document.		
Notice	This document has been prepared to assist the IEEE P802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.		
Release	The contributor acknowledges and accepts that this contribution may be made publicly available by 802.16.		

In-block spectrum mask, Out-of-block emission limits, and Frequency Stability Requirements of Broadband Wireless Access Systems

1.0 INTRODUCTION

This document contains excerpts from the Canadian DRAFT Radio Standards Specification[1] (RSS) for broadband wireless systems relating to in-block and out-of-block requirements. It should be noted that the referenced document is in its drafting stage, thus, the following information could be revised.

2.0 IN-BLOCK SPECTRUM MASK

Currently, there is no "in-block" spectrum mask requirements for equipment certification in Canada.

3.0 OUT-OF-BLOCK EMISSION LIMITS

The unwanted emissions should meet the following standard:

Excerpts from Draft RSS-191:

> "5.6.1 Emission Bandwidth
>
> *Occupied bandwidth* for a single carrier is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power. This is also known as the 99% bandwidth.
>
> For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.
>
> …

[1] DRAFT Radio Standards Specification (RSS 191) for Local Multipoint Communication Systems in the 28 GHz band; Point-to-point and Point-to-multipoint Broadband Communication Systems in the 24 GHz and 38 GHz Bands

6.3 Unwanted emissions:

Unwanted emissions comprise of out-of-band emissions (emission on a frequency or frequencies immediately outside the **occupied** bandwidth), spurious emissions and harmonics. They are to be measured when the transmitter is operating at the manufacturer's rated power and modulated as in section 6.2. Unwanted emissions are to be measured at the output of the final amplifier stage or referenced to that point. The **occupied** bandwidth (B_o) shall be stated in the test report by the certification applicant.

Single-carrier and multi-carrier tests are described below. If multicarrier operations are intended, then both tests are required.

6.3.1 Single Carrier Test

For the 24 GHz band, testing shall be performed at either blocks B and D or B' and D', depending upon which sub-band the transmitter under test is designed to operate. Likewise, for the 38 GHz band, testing shall be performed at either blocks B and M or B' and M'.

The purpose of specifying the tests at the inner blocks (e.g. block B and not A) is to avoid the attenuating effects of any RF filters that may be included in the transmitter design. Note that although testing is specified for only two blocks (to reduce the number of test runs required) the transmitter is expected to perform similarly for all remaining blocks within the assigned band.

For testing in block B (B'), set the carrier frequency close to the bottom edge, f_L, of block B (B'), record f_L and plot the RF spectrum. Likewise, perform the highest frequency test of block D (D') (in the case of 24 GHz) or block M (M') (in the case of 38 GHz) with the carrier frequency near the upper edge, f_U, of the block.

It is to be noted that the SRSPs permit licensees to have more than one frequency block (Tables 1 and 3) for their systems. Equipment intended to have an occupied bandwidth wider than one frequency block per carrier shall be tested using such a wideband test signal for the section 6.3.3(1) requirement.

For the 28 GHz band (25.35-28.35 GHz), the single carrier test is performed in a similar manner as above, with the exception that, for test purposes, the lower and upper edges of the carrier must be offset a minimum of 40 MHz from the lower and upper edges of the assigned band. The purpose of the 40 MHz minimum offset is to avoid the attenuating effects of any RF filters.

6.3.2. Multi-Carrier Test

This test is applicable for multi-carrier modulation. It applies equally to multi-transmitters into a common power amplifier. Note that the multi-carrier transmitter must be subjected to the single carrier testing, described above, in addition to the tests specified below.

For multi-carrier testing, the single carrier test method of 6.3.1 can be used except that the single carrier is replaced by a multi-carrier modulated signal that is representative of an actual transmitter. The number of carriers should be representative of the maximum number expected from the transmitter, and be grouped side by side near the lower end of the assigned band (in the case of the 28 GHz band) or block B (in the case of the 24 and 38 GHz bands), with guardbands, f_{LG} and f_{UG} (lower and upper guardband respectively), if required by the design of the equipment. Likewise test near the upper edge of the assigned band or top blocks (D' or M'). Record their spectrums, the number of carriers used and the guardband sizes ($f_{LG,}$ f_{UG}). The guardband is the frequency separation between the edge of the assigned band and the edge of the occupied emission.

The user manual shall contain instructions, such as details on the minimum guardband sizes required and the maximum number of carriers or multi-transmitters permitted, to ensure that the radios remain compliant to the certification process.

6.3.3 Minimum Standard:

Unwanted emissions spectral density shall be attenuated by A (dB) below the total mean output power as follows:

(1) For a single carrier transmitter **(see section 6.3.1)** :

In any 1.0 MHz reference bandwidth, outside the assigned band/channel block, and removed from the identified edge frequency of the occupied emission by up to and including $\pm$200% of the **occupied** bandwidth (i.e. 2 B_o): at least $A = 11 + 40\ f_{offset}/B_o + 10\ \log_{10}(B_o)$, dB, where B_o is in MHz and f_{offset} = frequency offset from the edge of the occupied bandwidth. Attenuation greater than $56 + 10\ \log_{10}(B_o)$, dB, or to an absolute level lower than -43 dBW/MHz, is not required. For emissions in which the occupied bandwidth is less than 1 MHz, the required attenuation is to be calculated using $A= 11 + 40\ f_{offset}/Bo$, dB.

(2) For a multi-carrier transmitter or multi-transmitters into a common final stage amplifier (see section 6.3.2).

The mask is to be the same as in (1), using the **occupied** bandwidth that is defined for multi-carrier transmitters in section 5.6.1. The total mean power is to be the sum of the individual carrier/transmitter powers. Guardbands if used in the equipment design must also be used in testing the spectrum mask.

Note: Several transmitters into a common non-active antenna cannot use the multi-carrier mask for the composite signal. In this case the appropriate mask applies to the

individual transmitter.

(3) In any 1.0 MHz band which is removed from the identified edge frequency by more than ±200% of the **occupied** bandwidth : at least 43 + 10 $\log_{10}$ (P_{mean}) dB (i.e. –43 dBW), or 80 dB below P_{mean}, whichever is less stringent. P_{mean} is the mean output power of the transmitter (or, in the case of multi-carriers/multi-transmitters, the sum of the individual carrier/transmitter powers) in watts.

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated or used, without exceeding 40 GHz.
”

4.0 FREQUENCY STABILITY

The RF frequency should be measured:

“

(a) at temperatures of -30 °C, +20°C and +50 °C at the manufacturer's rated supply voltage. The frequency stabilities can be tested to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. If automatic inhibition of operation is not provided, the manufacturer’s lesser temperature range intended for the equipment is allowed provided that it is specified in the user manual.

(b) at 85% and at 115% of rated supply voltage, with temperature at +20 °C .

Minimum Standard:

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at 20°C and rated supply voltage) in excess of ± 10 ppm.

In lieu of meeting the above stability value, the test report may show that the frequency stability is sufficient to ensure that the occupied bandwidth emission mask (see section 6.3) stays within the licensee’s frequency band, when tested to the temperature and supply voltage variations specified above. The emission tests shall be performed using the outermost assignable frequencies which shall be stated in the test report.

”

5.0 OTHER REQUIREMENTS

This paper has addressed only the in-block spectrum mask, out-of-block emission limits, and frequency stability, however, it should be noted that other requirements such as receiver spurious emissions need to be satisfied in order for the equipment to be certified in Canada.