Project	IEEE 802.16 Broadband Wireless Access Working Group		
Title	Proposed Outline for “Recommended Antenna Specifications” Document		
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Re:	Call for contributions on antenna requirements for Broadband Wireless Access systems.		
Abstract	This document outlines the recommended specifications for BTS and STS antennas of a BWA system.		
Purpose	It is proposed that 802.16.2 (Coexistence Task Group) adopt the outline contained in this document as a basis for “Recommended Antenna Specifications” document.		
Notice	This document has been prepared to assist the IEEE 802.16. 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.		

Proposed Outline for “Recommended Antenna Specifications” Document

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Introduction

For the purpose of covering all the antenna-related issues, it is hereby suggested that the Coexistence Task Group adopt a document called “Recommended Antenna Specifications” which is outlined below.

Due to special frequency-dependent considerations in the antenna design and varying levels of external interference in different bands, the outline suggests the consideration of three frequency ranges. These ranges are 10-20 GHz, 20-38 GHz, and 38-66 GHz. Recommended specifications may be different from one range to another.

Three electrical classes of antennas are suggested, moreover, depending on the severity of the interference—either internal or external: class 1 for benign interference environments, class 2 for moderate interference environments, and class 3 for environments with excessive amounts of interference. Excessive levels of interference require tighter restriction on antenna sidelobe level (SLL), front-to-back ratio (FBR), and cross-polar discrimination (XPD).

Introducing two mechanical classes of antennas could also capture environmental factors. These two classes are normal-duty and heavy-duty antennas. While hurricane-prone areas will require heavy-duty antenna systems, other areas could benefit from cheaper normal duty antennas.

Adoption of multiple classes has a definite relieving effect on the manufacturing and deployment of BWA systems. In other words, tight requirements should only be applied to cases that definitely need such requirements. This will lower the overall equipment cost, deployment cost, and the deployment time, and it will eventually bring lower service rates to subscribers.

In order to allow the use of polarization orthogonality throughout a BWA network, the document needs to address the type of polarization, acceptable purity of polarization, and minimum required cross-polar discrimination (XPD). Also, minimum required inter-port isolation and cross-polar isolation (XPI) need to be discussed if dual-polarized antennas are used.

Since many sector angles are possible, any limits on gain of the BTS antenna should be given as a function of its half power beamwidth (HPBW). As for the STS antennas, this outline suggests two gain categories: low-gain and high-gain. While the low gain category is used under normal conditions, the high gain category antenna can be used a) to provide additional dBs in the link budget for certain STSs and b) to control the level of interference given the smaller beamwidth of such antennas.

Given the classes and categories mentioned above, azimuth and elevation Radiation Pattern Envelops (RPE) depicting co- and cross-polar cases should be defined and plotted for each of the three frequency ranges.

Proposed Document Outline

1. Introduction
2. Definition of Terms
3. Frequency Ranges
   - 3.1. Range 1: 10 GHz To 20 GHz
   - 3.2. Range 2: 20 GHz To 38 GHz
   - 3.3. Range 3: 38 GHz To 66 GHz
4. Antenna Classes
   - 4.1. Electrical Classes
     - 4.1.1. Class 1: Low Interference Environments
     - 4.1.2. Class 2: Moderate Interference Environments
     - 4.1.3. Class 3: Excessive Interference Environments
   - 4.2. Mechanical Classes
     - 4.2.1. Normal Duty
     - 4.2.2. Heavy Duty
5. BTS Antenna
   - 5.1. Electrical Characteristics
     - 5.1.1. Linear Polarization
       - 5.1.1.1.Polarization Purity
       - 5.1.1.2.Minimum Cross-Polar Discrimination (XPD)
       - 5.1.1.3.Minimum Cross-Polar Isolation (XPI)
       - 5.1.1.4.Inter-Port Isolation
     - 5.1.2. Radiation Pattern Envelop (RPE)
       - 5.1.2.1.Azimuth
         - 5.1.2.1.1. Co-Polar
         - 5.1.2.1.2. Cross-Polar
       - 5.1.2.2.Elevation
         - 5.1.2.2.1. Co-Polar
         - 5.1.2.2.2. Cross-Polar
     - 5.1.3. Minimum Boresight Gain Vs. Half Power Beam-Width (HPBW)
     - 5.1.4. VSWR
     - 5.1.5. Passive Intermodulation (PIM)
   - 5.2. Mechanical Characteristics
     - 5.2.1. Temperature Range
     - 5.2.2. Wind Loading
     - 5.2.3. Ice Loading
     - 5.2.4. Stability
   - 5.3. Peripherals
     - 5.3.1. Radomes
     - 5.3.2. Connectors
     - 5.3.3. Labeling
     - 5.3.4. Mechanical Tilting Assembly
6. STS Antenna
   - 6.1. Electrical Characteristics
     - 6.1.1. Linear Polarization
       - 6.1.1.1.Polarization Purity

- 6.1.1.2.Minimum Cross-Polar Discrimination (XPD)
- 6.1.1.3.Minimum Cross-Polar Isolation (XPI)
- 6.1.1.4.Inter-Port Isolation
- 6.1.2. Radiation Pattern Envelop (RPE)
  - 6.1.2.1.Azimuth
    - 6.1.2.1.1. Co-Polar
    - 6.1.2.1.2. Cross-Polar
  - 6.1.2.2.Elevation
    - 6.1.2.2.1. Co-Polar
    - 6.1.2.2.2. Cross-Polar
- 6.1.3. Gain Categories
  - 6.1.3.1.Gain Category 1 (Low-Gain)
  - 6.1.3.2.Gain Category 2 (High-Gain)
- 6.1.4. VSWR
- 6.1.5. Passive Intermodulation (PIM)

6.2. Mechanical Characteristics

- 6.2.1. Temperature Range
- 6.2.2. Wind Loading
- 6.2.3. Ice Loading
- 6.2.4. Stability

6.3. Peripherals

- 6.3.1. Radomes
- 6.3.2. Connectors
- 6.3.3. Labeling
- 6.3.4. Mechanical Tilting Assembly