IEEE 802.19.1a  
Wireless Coexistence

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| Text proposal on the coexistence management over a region by controlling the number of co-channel GCOs | | | | |
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| Author(s): | | | | |
| Name | Company | Address | Phone | Email |
| Chen Sun | Sony China |  |  | Chen.Sun@sony.com.cn |
| Sho Furuichi | Sony |  |  | Sho.Furuichi@jp.sony.com |
| Naotaka Sato | Sony |  |  | naotaka.sato@ieee.org |

Abstract

This contribution provides text proposals for coexistence management over a region by controlling the number of co-channel GCOs based on 802.19.1 standard and approved text.

1. Coexistence mechanisms and algorithms
   1. Coexistence algorithms
      1. Coexistence decision algorithms

***Insert the following text***

7.2.2.x Algorithm for coexistence management over a region by controlling the number of co-channel GCOs

7.2.2.x.1 Introduction

Instead of providing the available channels for a single location, the GCO can provide the available channels that are valid for a certain region. When there are multiple GCOs that operate within a common region, the coexistence manager which manages the GCOs such as small cells over an area, e.g., a residential area. A statistical model can be used to model the random location within the given region. From this information, the CM can calculate the each GCO’s individual capacity as well as the sum capacity of all GCOs taking into account the interference among these GCOs. Given the expected QoS from the GCOs, the CM can determine the maximum number of GCOs and the minimum number of assigned channels to GCOs while achieving a satisfactory QoS of individual GCO and sum capacities of GCOs.

7.2.2.x.2 Capacity calculation of randomly located GCOs over a region

Figure XX describes the system model where the GCOs are assumed to operate in the TV band. The GCOs in a given residential area are grouped into one management area with radius R. Without loss of generality, we can assume that there is one GCO at the center of the management area. The distance between the center of the management area and the closest point on the TV broadcast contour (also referred to as critical point in ECC Report 186 [xx]) is denoted as . The GCO at the center of the management area is denoted as GCO-0 and it’s the n-th nearest neighbor is denoted as GCO-n. *N* is the maximum number of the GCOs. The distance between them is denoted as . The angle between and is , which is uniformly distributed from 0 to 2π. The distance from GCO-n to the critical point denoted by as shown in the figure can be calculated as

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which is for determining the pathloss in the emission limit calculation . We can write the probability density function of as follows

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where denotes the Gamma function. The density of the GCO in the management area is calculated as , where M is the total number of randomly distributed GCOs in a given management area.



**Figure XX** System model

To give a radio access technology agnostic analysis, we use Shannon channel capacity to evaluate the performance of GCOs’ spectrum usage. As mentioned previously, we assume that the each GCO employs dynamic channel access by choosing one out of the total available channels. If all GCOs are given an identical set of N available channels, each GCO using the same channel only with its *kN*-th neighbor GCO, k = 1, 2, ... K, where K is the maximum number of GCOs operating on a particular TVWS channel. The instantaneous capacity of GCO-0 can be written as follows.

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where is the distance between end user and the GCO while β is the associated pathloss exponent. Here, is the noise power at the end user’s receiver. And, w is the channel bandwidth of a TVWS channel. Note that the capacity is a function of the distance from GCO to the critical point on the TV service contour and the distance between its co-channel neighbor GCOs. Since the locations of the GCOs are randomly distributed, we calculate the mean capacity of each GCO as

Without loss of generality, assume *M = (K+1)N*. Then, the network capacity turns into

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We can see that the individual capacity and the network are dependent on density of GCOs and the number of available channels for Dynamic Frequency Selection.

7.2.2.x.3 Algorithm description

The flowchart is shown in Figure YY. The processes are as follows.

* P#1  
  P#1 is the procedure operated at the CDIS where the CDIS obtains the receiver information of the GCO through the GCO registration procedure as specified in 5.2.3.1 GCO registration procedure.
* P#2  
  In this stage the CM obtains the information on the number of GCOs that will potentially operate in the same region and using the same channels by checking GCOs’ available frequencies over *operationRange*. The information can be obtained through the GCO Registration Procedure in 5.2.2.1. When there are multiple CMs, the information can be obtained through the Obtaining Operating Frequency Information procedure in 5.2.18 and Obtaining Operating Frequency Information procedure over Coordination Enabler in 5.2.19.
* P#3  
  In the process, the CM use the statistical model as described in the previous subclause to determine the individual and network capacity for different number of GCOs. Given the desired QoS, the CM can decide a limit on the number of GCOs that can operate simultaneously in the same channel at any location within the region.
* P#4  
  In P#4 CM use the 5.2.10.1 GCO Reconfiguration procedure to send the limit on the number to the GCOs. When there are multiple CMs, the information on the number limit can be sent with parameter *coChGCOLimit* using 5.2.10.2 Sending reconfiguration request from CM to another CM.



Figure YY Flowchart of the coexistence management by controlling the number of co-channel GCOs