IEEE 802.19.1a
Wireless Coexistence

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| Comment resolution on CID89 in 1st TG review |
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Abstract

This document provides comment resolution on CID89 in 1st TG review.

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| **Comment ID** | **Page No.** | **Section** | **Line No.** | **Type (General, Editorial, Technical)** | **Comments** | **Proposed changes** | **Resolutions** |
| 89 | 79 | 7.2.2.9.4.1 | 15 | Technical | Calculation of MI is not specified.Should provide how to calculate. | Need proposal | wait for contributions |

# **Summary**

This document provides comment resolution for CID 89 in 1st TG review.

The resolution itself is to add the explanation of how to calculate *MI* in section 7.2.2.8.4.1 of D0.5 but the author also provides the editorial changes to that parent section 7.2.2.8 globally in order to improve the readability and to use correct wordings.

===== (Text starts below)

* + - 1. Algorithm for EIRP control
				1. Introduction

It is very important for a coexistence system to mitigate harmful interference in the service area of GCOs. For example, one of the services to be protected will be of a prioritized ~~WSO~~GCO (i.e. early comer in each corresponding channel). Specifically in a case where multiple similar/dissimilar ~~WSO~~GCOs are operating on the same channel when they are included in each other’s coexistence sets, a harmful interference may occur in the service area of the prioritized GCO. To solve this problem, coexistence system shall support the calculation of EIRP for GCOs to achieve coexistence with the other similar/dissimilar GCOs. The following summarizes the calculation methodologies for EIRP of GCOs to achieve coexistence.

1. Identification of interference-victim reference points (7.2.2.8.2)
2. EIRP calculation (7.2.2.8.3)
3. Aggregated interference margin based EIRP (7.2.2.8.3.1)
	1. Location-specific EIRP (7.2.2.8.3.1.1)
	2. Aggregated interference margin calculation (7.2.2.8.3.1.2)
		1. Fixed/Predetermined margin (7.2.2.8.3.2.1)
		Location-specific EIRP is calculated in accordance with 7.2.2.8.3.1.1, where *MI* is calculated based on the predetermined assumption on the maximum number of target GCOs operating simultaneously.
		2. Flexible margin (7.2.2.8.3.2.2)
		Location-specific EIRP is calculated in accordance with 7.2.2.8.3.1.1, where *MI* is calculated based on the actual number of active target GCOs.
		3. Flexible minimized margin (7.2.2.8.3.2.3)
		Location-specific EIRP is calculated in accordance with 7.2.2.8.3.1.1, where *MI* is calculated based on the total aggregated in-block emission level and out-block level of the active target GCOs in neighborhood area.
			* 1. Identification methods of Interference-victim reference points

In identifying interference-victim reference points, the location information of the target GCOs, which are interferers to the prioritized GCO, is needed. The location information of target GCO may include that of the master GCO and/or that of the slave GCO managed by the master GCO. It depends on the potential interference level whether which types of GCO (i.e. master or slave) is considered as interferer.

The location information of the target GCO may be of master GCO, if the interference from the slave GCO managed by master GCO to the edge of service area of the protected GCO can be ignored. In this case, only one selection criterion, which shall be to choose the closest point for each ~~WSO~~GCO in the service area to be protected as shown in ~~Figure 87~~Figure 64, would be.



~~Figure 87~~Figure 64 Selection criterion of the interference-victim reference points for the calculation of the EIRP of multiple target ~~WSO~~GCOs

The location information of the target ~~WSO~~GCO may be that of one of the closest slave ~~WSO~~GCO or virtual slave ~~WSO~~GCO in its network coverage area to the contour of service area of the prioritized GCO, if the interference signal which is caused by the transmission of the slave ~~WSO~~GCO and which is received at the reference point is larger than the interference signal caused by the transmission of the target master ~~WSO~~GCO according to the operational parameters of those. The “virtual” means here that a slave ~~WSO~~GCO is assumed to be on the edge of network coverage area of the target ~~WSO~~GCO as shown in ~~Figure 88~~Figure 65. In these cases, the operational parameters of the slave ~~WSO~~GCO are used for this calculation step, and the interference-victim reference point of the slave GCO should be each closest point to the edge of the service area of the prioritized GCO.



~~Figure 88~~Figure 65 Example of interference-victim reference point in considering a potential interfering GCO for the calculation of the EIRP of ~~WSO~~GCOs

* + - * 1. Algorithm description of EIRP calculation

Aggregated interference margin based EIRP

Aggregated interference is one of the problems to be solved for coexistence. Coexistence system can provide the EIRP that mitigates aggregated interference to the prioritized GCOs. In the following subclauses, at first, fundamental calculation of EIRP that is derived location-specifically is shown. Second, the calculation of the aggregated interference margin that is adopted to the location-specific EIRP is shown.

Location-specific EIRP calculation

Location-specific EIRP is calculated with considering the maximally allowed interference level of receiver at interference-victim reference point and path loss between the receiver and the target GCO.

If the target ~~WSO~~GCO uses the same channel as the usage channel(s) of receiver at the interference-victim reference point, the EIRP of GCO *k* on the target frequency channel *fj*. can be computed location-specifically as follows,



If the target ~~WSO~~GCO uses a different channel with the usage channel(s) of receiver at the interference-victim reference point, the EIRP of GCO *k* on the adjacent frequency channel *fjj*. can be computed location-specifically as follows,



Definition of each parameter is given in Table 4. *MI* is aggregated interference margin, which is assumed to be an adjustable value according to the number of target ~~WSO~~GCOs.

Table 4 Parameters for the location-specific EIRP calculation

|  |  |
| --- | --- |
| Parameter | Notes |
|  (dBm) | Maximally allowed interference level of the receiver at interference-victim reference point *i* on the target frequency channel *fj*. |
|  (dBm) | Location-specific EIRP of ~~WSO~~GCO *k* on the target frequency channel *fj*. |
|  (dB) | Median path loss between ~~WSO~~GCO *k* and interference-victim reference point *i* on the target frequency channel *fj*. |
|  (dBm) | Location-specific EIRP of ~~WSO~~GCO (*k* or *kk*) on the target frequency channel *fj* or adjacent frequency channel *fjj*. of *fj*.. |
|  (dB) | Median path loss between ~~WSO~~GCO (*k* or *kk*) and the interference-victim reference point *i* on the target frequency channel *fj* or adjacent frequency channel *fjj* of *fj*. |
|  (dB) | Total gain of ~~WSO~~GCO (*k* or *kk*) on the target frequency channel *fj* or adjacent frequency channel *fjj* of *fj*. |
|  (dB) | Total rejection level of ~~WSO~~GCO *kk* for adjacent frequency channel *fjj* for the target frequency channel *fj*. |
| *SM* (dB) | The margin to compensate the variation of path loss due to shadowing (i.e., fading). |

The details of the aggregated interference margin *MI* are shown in the following subclauses.

Aggregated interference margin calculation

Fixed/Predetermined margin

The simplest way to meet the maximally allowed interference level of the receiver assumed to be at interference-victim reference point is to allocate the maximally allowed interference level equally to the interfering GCOs.

If the coexistence system has assumption on the maximum number of GCOs operating simultaneously, the aggregated interference margin *MI* can be predeterimined as follows;

*MI* = 10 log (*N*max, TargetGCOs(*fj*)) [dB],

where *N*max, TargetGCOs(*fj*) is the predetermined assumption on the maximum number of GCOs operating simultaneously on the channel *fj*.

**Flexible margin**

Aggregated interference margin *MI* can be calculated based on the number of active target GCOs, which would give interference to the prioritized GCO.

If all the active target GCOs operate on the same channel as the prioritized GCO, *MI* can be calculated as follows.

*MI* = 10 log (*N*ActiveTargetGCOs(*fj*)) [dB],

where *N*ActiveTargetGCOs(*fj*) stands for the number of active target GCOs on the channel *fj*. This equation means that the maximally allowed interference level *Iacceptable*(*i*, *fj*) [dBm] is equally allocated to all the active target GCOs.

If some of the active target GCOs operate on the channel that is partially-overlapped with the operating channel of the prioritized GCO, maximally allowed interference level *Iacceptable*(*i*, *fj*) [dBm] cannot be allocated equally to all the active target GCOs because interference from one target GCO to the prioritized GCO consists of both co- and adjacent-channel interference. In this case, the substantial number of active target GCOs, which can be assumed to operate on the same channel with the prioritized GCO, can be used to calculate *MI* in. For *n*-th GCO, the following number of GCOs can be assumed to operate on the same channel with the prioritized GCO.

,

where  stands for floor function and *ACIRn* is adjacent channel interference ratio (ACIR) of *n*-th GCO can be computed based on the following equation and Figure 66,



Figure 66 Interference cases to be considered in calculating ACIR



This substantial number is derived by considering the ratio of the interference from *n*-th GCO operating on the partially-overlapped channel to the interference from *n*-th GCO being assumed to operate on co-channel, which is equivalent to ACIR. Then, *MI* can be calculated by summation of each substantial number of GCOs as follows.

 [dB]

Flexible minimized margin

The aggregated interference margin *MI* that is calculated based on the fixed/predetermined or flexible margin becomes redundant when the actual number of active target GCO(s) is smaller than the estimated number of active interfering GCOs. Because the fixed/predetermined or flexible margin based calculation does not differentiate between the in-band emission by all the GCOs from the out-of-band emission by all the GCOs, harmful aggregated interference to the receiver on the edge of service area to be protected could be occured. Therefore, the aggregated interference margin *MI* should be defined based on the maximum actual number of active interfering GCOs on the operating channel of the prioritized GCO, but the value has some redundancy when the operating channels of the active interfering GCOs are different each other. Flexible minimized margin based calculation can reduce such redundancy.

Considering the mutual in-block/out-of-block interference effects among ~~WSO~~GCOs, one of the possible calculation methods is as follows:

Step 0:

* The inputs are the intrinsic parameters as described in Table 4..

Step 1:

* The location specific EIRP of ~~WSO~~GCO, *Ptx(fj, k)*, for each operational frequency, *fj*, of the active target GCO, *k*, is calculated. The interference victim reference point is selected based on the criteria to find the closest geo-location point for each target ~~WSO~~GCO on the edge of the service area to be protected, as shown in ~~Figure 87~~Figure 64.

If the target ~~WSO~~GCO uses the same channel as the operating channel(s) of the receiver at the interference-victim reference point, *P’TX*(*fj*, *k*) is calculated as follows:

*P’TX*(*fj*, *k*) = *Iacceptable*(*i*, *fj*) + *LP*(*i*, *fj*, *k*) – *G*(*fj*, *k*) – *MI* – *SM*

If the target ~~WSO~~GCO uses a different channel from the operating channel(s) of the receiver at the interference-victim reference point, *PTX*(*fj*, *k*) is calculated as follows:

*P’TX(fjj, kk) = Iacceptable(i, fj) + LP(i, fjj, kk) – G(fjj, kk) – MI – SM + H(fj, fjj, kk)*

For both cases, *MI* is calculated based on fixed/predetermined or flexible margin as shown in 7.2.2.8.3.1.2.2 and 7.2.2.8.3.1.2.3.

Step 2:

* In this step, the coexistence system finds the most severe interference-victim reference point in all the reference points of the target ~~WSO~~GCOs. The point can be found according to the following criterion:



where

 is the set of indexes of target ~~WSO~~GCOs which use the frequency channel *fj*

 is the set of indexes of adjacent frequency channel *fjj* of the operating frequency channel *fj* of the prioritized GCO, and

 is the set of indexes of the target ~~WSO~~GCOs which use adjacent frequency channel *fjj* of the operating frequency channel *fj* of the prioritized GCO

Step 3:

* The EIRP adjustment value, Δ, is calculated based on the most severe interference-victim refrence point, *i’*, to reduce the redundancy of the margin value due to the fixed/predetermined or flexible margin setting while satisfying the maximally allowed interference level of the receiver at the edge of service area of the prioritized GCO in the following criteria:



* To help ensure fairness for communicaton opportunity among all the target ~~WSO~~GCOs, all the values of *Δk* and *Δkk* are set to be the same value, Δ.The value of Δ is calculated as follows:



* Recalculation of location-specific EIRP for each target ~~WSO~~GCO with the in-block/out-of-block interference effects from the other target ~~WSO~~GCO(s), which could be calculated based on the results *PTX*(*fjj*, *kk*) of step 1 for each target ~~WSO~~GCO, in the following form:



Step 4:

* The final results of the location-specific EIRP of the target ~~WSO~~GCOs based on the flexible minimized margin is calculated as follows:



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