# Sharing study between FSS ES and LANWBB LMP in the band 3800-4200 MHz

This annex concentrates on studying the required separation distance to protect FSS ES taking into account a single unsynchronized localized BS deployed for vertical use.

This annex will consider various power options for the IMT BS to determine the impact of a local-area BS into an FSS ES.

## Technical characteristics

### Interferer characteristics: Terrestrial wireless broadband systems providing local-area network

#### Case 1: directional AAS antenna modelling

The following table is based on agreed characteristics for AAS IMT BS.

Table 1: WBB LMP Base station AAS characteristics

|  |  |
| --- | --- |
| Base station characteristics | |
| Cell radius (AAS) | 0.4 km (this is within the range for both low and medium power BS) |
| Sectorization | 1 sector |
| Frequency reuse | 1 |
| Maximum AAS BS output power | See below considerations on maximum e.i.r.p. density limits |
| TDD / FDD | TDD |
| BS TDD activity factor | 75% |
| Network loading factor | 50% |

The antenna pattern chosen for the AAS is based on the agreed WBB LMP Base station AAS antenna characteristics.

Table 2: WBB LMP Base station AAS antenna characteristics

|  |  |
| --- | --- |
| AAS antenna pattern | Recommendation ITU-R M.2101 (section 5)  Extended AAS Model 3GPP TR 38.803 (Section 5.2.3.2.4) |
| Element gain (dBi) | 6.4 |
| Horizontal/vertical front‑to‑back ratio (dB) | 30 for both H/V |
| Antenna polarization | Linear ±45º |
| Antenna array configuration (Row × Column) (Note 2) | 8 x 8 elements |
| Horizontal/Vertical radiating element/sub-array spacing, *dh* /*dv* | 0.5 of wavelength for H, 0.7 of wavelength for V |
| Base station horizontal coverage range (degrees) | ±60° |
| Base station vertical coverage range (degrees) (Note 3) | 0 to -30 |
| Mechanical downtilt (degrees) | 0 |
| Note 1: Only needed when subarray antenna model is used  Note 2: For the small/micro cell case, 8 × 8 means there are 8 vertical and 8 horizontal radiating elements. For the extended AAS model case, 4 × 8 means there are 4 vertical and 8 horizontal radiating sub-arrays.  Note 3: The vertical coverage range is given in global coordinate system, i.e. 0° being at the horizon. | |

#### Case 2: directional non-AAS antenna modelling

The following table is based on agreed characteristics for non-AAS IMT BS.

Table 3: WBB LMP Base station non-AAS antenna characteristics

|  |  |
| --- | --- |
| Base station characteristics/Cell structure | |
| Cell radius / Deployment density (non-AAS) | Cell radius 0.4 km |
| Sectorization | 1 sector |
| Non-AAS BS downtilt (degrees) | 10 degrees |
| Frequency reuse | 1 |
| Non-AAS BS antenna pattern | Recommendation ITU-R F.1336 (*recommends* 3.1)  *ka* = 0.7  *kp* = 0.7  *kh* = 0.7  *kv* = 0.3  Horizontal 3 dB beamwidth: 65 degrees  Vertical 3 dB beamwidth: determined from the horizontal beamwidth by equations in Recommendation ITU-R F.1336.  Vertical beamwidths of actual antennas may also be used when available. |
| Maximum Non-AAS BS output power | See below consideration on power limits |
| Maximum Non-AAS BS antenna gain | 10 dBi (for medium range BS) |
| TDD / FDD | TDD |
| BS TDD activity factor | 75% |

#### Case 3: Omnidirectional BS

For this case, the antenna is assumed to have a 0 dBi gain in all directions.

#### Power limits

For this study 3 different maximum e.i.r.p. limitations are considered:

* “Low power”: maximum e.i.r.p. = 18 dBm/5MHz
* “Medium power”: maximum e.i.r.p. = 36 dBm/5MHz
* Limit based on 5A/322: maximum e.i.r.p. = 24 dBm/5MHz

#### BS height

For all the cases considered in this study, the terrestrial local-area network base station is assumed to be at 10m height. This assumption can have an important impact on the results of the sharing studies. A higher antenna height could lead to higher separation distances.

### Receiver characteristics: FSS ES

FSS parameters are based on characteristics provided by ITU-R WP 5A[[1]](#footnote-1) as well as on characteristics of existing FSS ES where indicated, as shown in the table below.

Table 4: FSS earth station parameters

|  |  |
| --- | --- |
| Parameter | Typical value |
| Antenna size (m) | 2.4-12 m |
| ES Carrier Bandwidth (MHz) | 40 MHz |
| Antenna reference pattern | ITU-R S.465 |
| Receiving system noise temperature | 120 K for small antennas (1.2-3 m)  70 K for large antennas (4.5 metres and above) |
| Antenna gain | 37.8-51.8 dBi (Note 1) |
| ES antenna elevation pointing | 10 degrees |
| ES Antenna Centre Height above ground | 10 m |
| Note 1: Antenna gain not important since S.465 antenna pattern will have same resulting gain at off-axis 10 degrees | |

FSS protection criterion for in-band studies is defined by ITU-R WP 4A as shown in Table 5.

Table 5: Protection Criteria for FSS (in-band)

|  |  |  |
| --- | --- | --- |
| Frequency Ranges | Percentage of time for which the *I/N* value could be exceeded (%) | I/N Criteria (dB) |
| 3 600-3 800 MHz | 20%  0.005% | −10.5  −1.3 |

## Simulations

### Case 1: local area AAS BS impact into FSS ES receiver

Given the time varying characteristic of the AAS antenna assumed a statistical analysis is conducted. A number of iterations are performed:

* The distance between the AAS antenna and the FSS ES is set at the beginning of the analysis
* For each iteration:

The AAS antenna is pointing in a given direction within its coverage area (combination of its mechanical and electrical pointing)

The interference towards the FSS ES is calculated and stored

* The resulting CDF is plotted and compared with the FSS ES protection criteria
* If the protection criteria are not met with the set distance, the statistical analysis is conducted once again assuming a larger separation distance.

For each of the cases presented below, the required separation along with the corresponding CDF of interference is presented.

Some intermediate results are presented below in order to provide more insight behind the results of each of the sub-cases below:

#### BS elevation and azimuth distribution

At each iteration, a user equipment is assumed to be randomly deployed within the BS service area. The following figure illustrates the distribution of such UEs step after step.

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Figure 1:

At every step, the BS is pointing to the randomly distributed UE. The following figures present the distribution in elevation and azimuth of the BS.

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Figure 2:

It’s important to note that the BS coverage is limited to a range of 30 degrees which is common for AAS antenna characteristics.

#### BS gain distribution towards the FSS ES

The resulting gain CDF can be established from the above pointing distribution of the BS.

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Figure 3:

The gain of the AAS antenna is considered to determine the correct e.i.r.p. in the direction of the FSS ES victim:

#### Clutter modelling at each iteration

This case 1 assumed two scenarios:

* The first assuming no clutter attenuation;
* The second assuming the clutter modelling following section 3.2 of ITU-R P.2108. The clutter was assumed systematically at the BS end, assuming that the local-area network would be deployed below the clutter height in order to mitigate interference into existing services. The following figure presents the CDF of the clutter losses. The height of the local area network is also key in ensuring that the local area network is within the surrounding clutter environment.

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Figure 4:

It is important to note that the P.2108 model only applies to suburban and urban environments. As shown in the above figure this model provides an important amount of attenuation (15-50dB with an average of 32 dB). For the analyses cases that consider clutter attenuation, a fixed value of clutter loss of 31 dB was assumed (corresponding to 50% location).

#### Case 1.1: Medium power – max. e.i.r.p. = 36 dBm/5MHz

The following table summarizes the required separation distances to meet the long term and short term FSS ES protection criteria in turn. The CDF of interference versus the percentage of time for the required separation distance are presented.

**Without clutter attenuation**

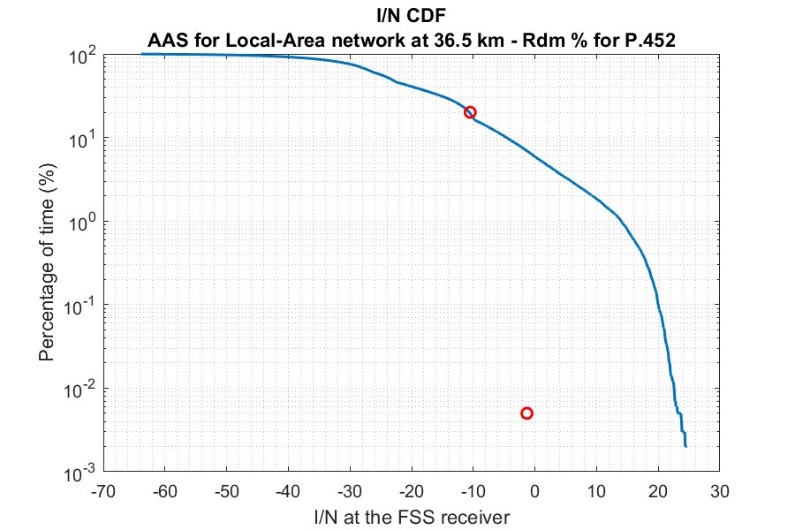


Figure 5: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 36.5 km

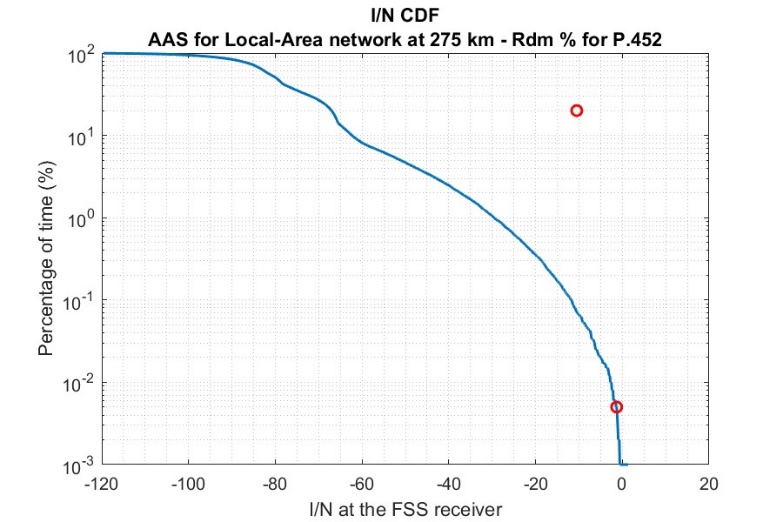


Figure 6: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 275 km

**With clutter attenuation (P.2108) – 31 dB clutter attenuation**

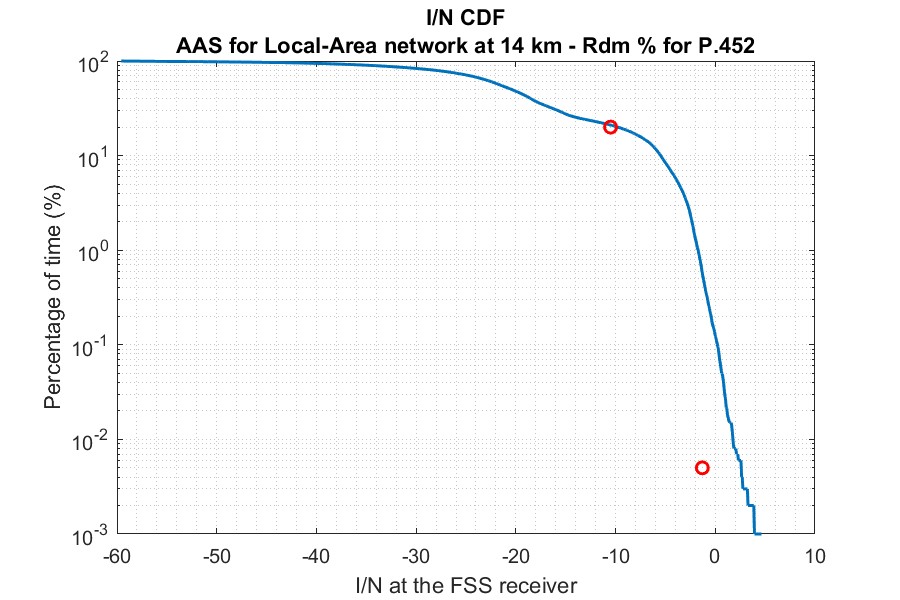


Figure 7: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 14 km

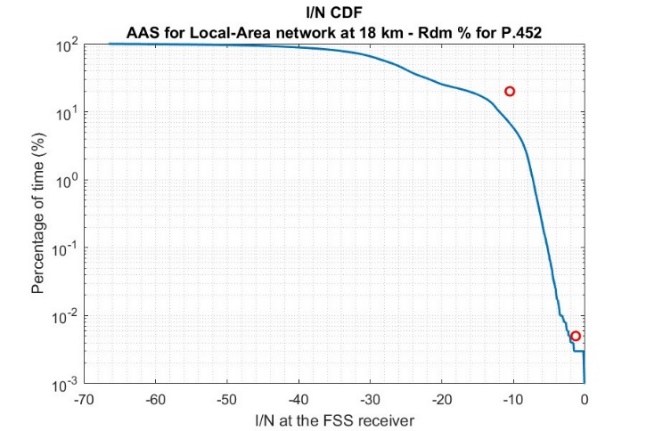


Figure 8: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 18 km

#### Case 1.2: Low power – max. e.i.r.p. = 18 dBm/5MHz

**Without clutter attenuation**

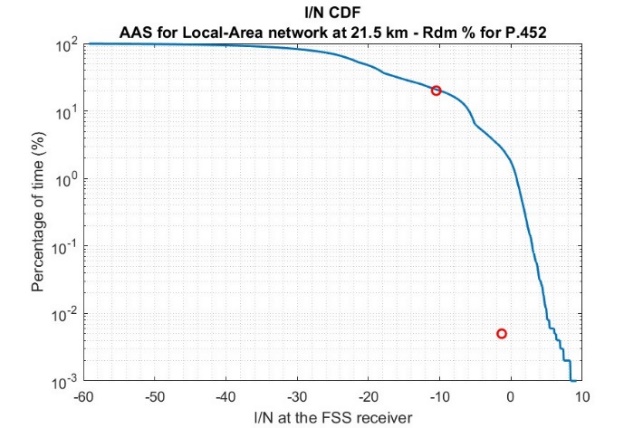


Figure 9: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 21.5 km

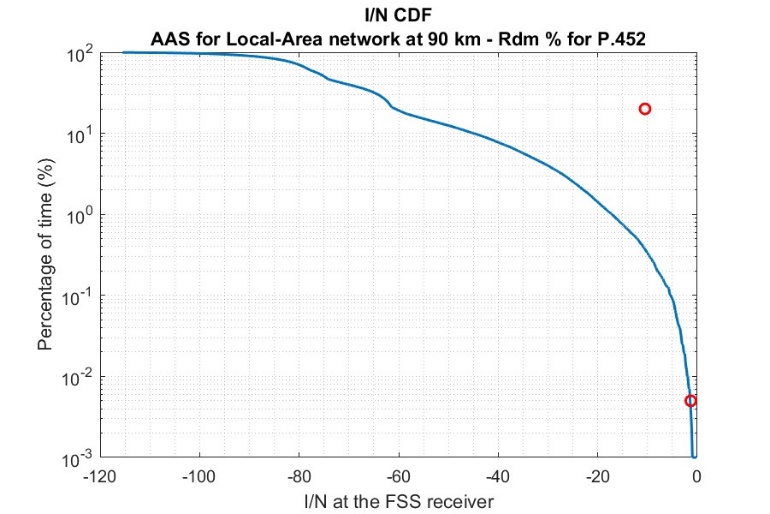


Figure 10: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 90 km

**With clutter attenuation (P.2108) – 31 dB clutter attenuation**

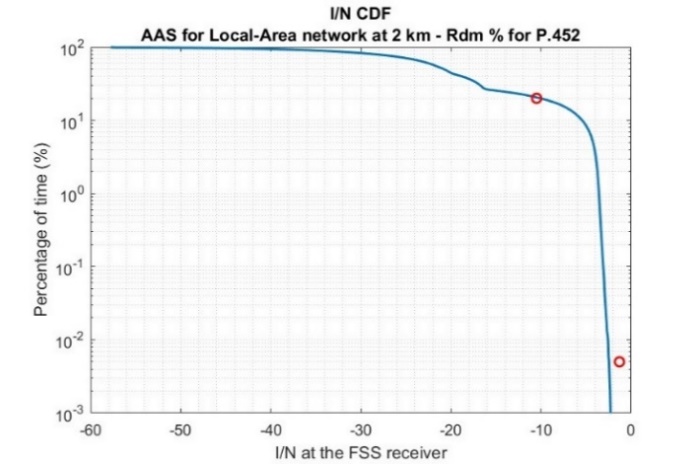


Figure 11: Long-term and short-term protection criteria Required separation distance: 2 km

#### Case 1.3: Power level from 5A/322 document – max. e.i.r.p. = 24 dBm/5MHz

**Without clutter attenuation**

Figure 12: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 25.5 km

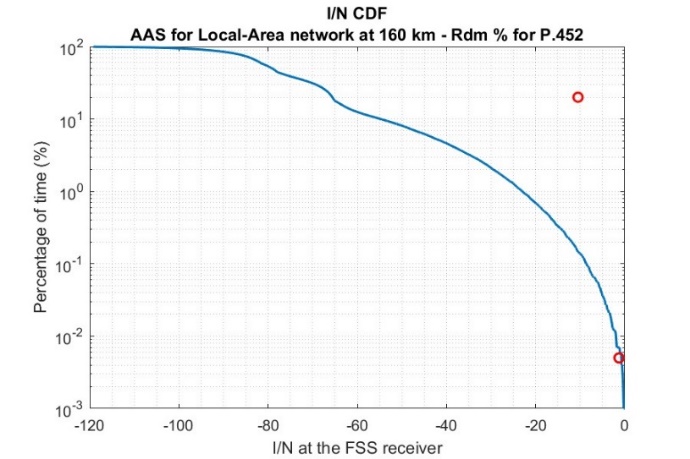


Figure 13: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 170 km

**With clutter attenuation (P.2108)**

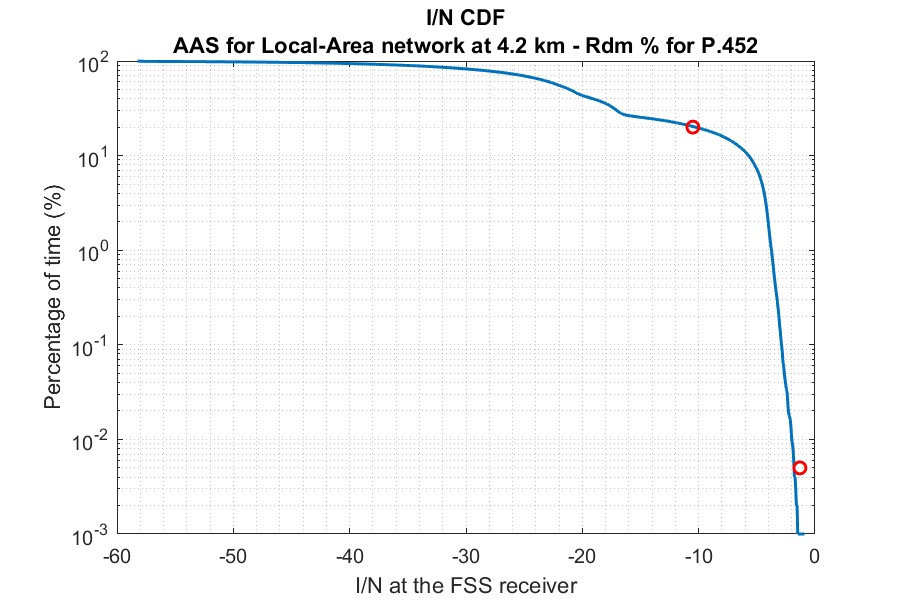


Figure 14: Long-term and short-term protection criteria   
Required separation distance: 4.2 km

### Case 2: local area non-AAS BS impact into FSS ES receiver

The non-AAS antenna has a fixed mechanical down-tilt. The antenna pointing is therefore non-time variant. The analysis will therefore assume that the non-AAS BS is pointing towards the FSS ES in azimuth. The following figure presents the non-AAS antenna pattern following F.1336:

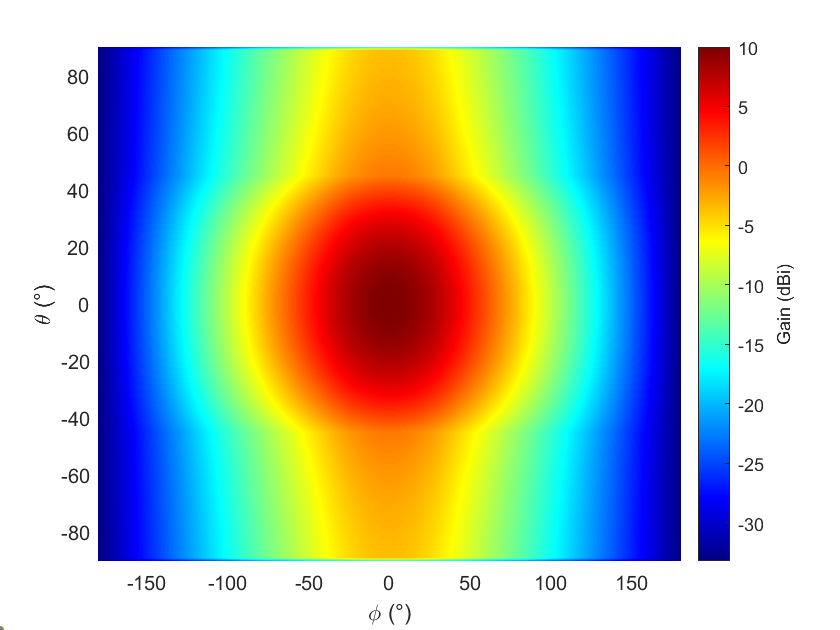


Figure 15:

Assuming the 10 degrees mechanical downtilt, the non-AAS gain towards the FSS ES is 9.4 dBi (0.6 dB lower than the peak antenna gain).The results are presented in the form of an interference versus distance graph for each of the cases considered below. To complement the results, several FSS ES elevations were assumed: 10, 15, 30 and 48 degrees. Once again both long-term and short-term analysis results are provided. For this case, the only time varying parameter is the propagation model. For each of the cases the percentage of time associated with the protection criteria is used when implementing the ITU-R Recommendation P.452 propagation model. The following figure presents the propagation model P.452 using different percentage of time:

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Figure 16:

For this case, the clutter model P.2108 was not considered since this is not a statistical analysis and there are no time varying parameters.

#### Case 2.1: Medium power – max. e.i.r.p. = 36 dBm/5MHz

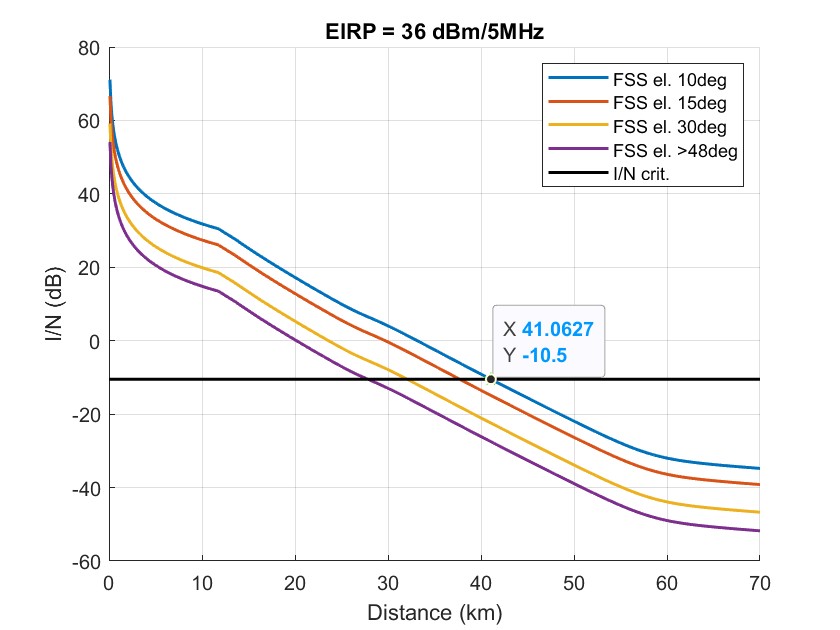


Figure 17: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 41 km

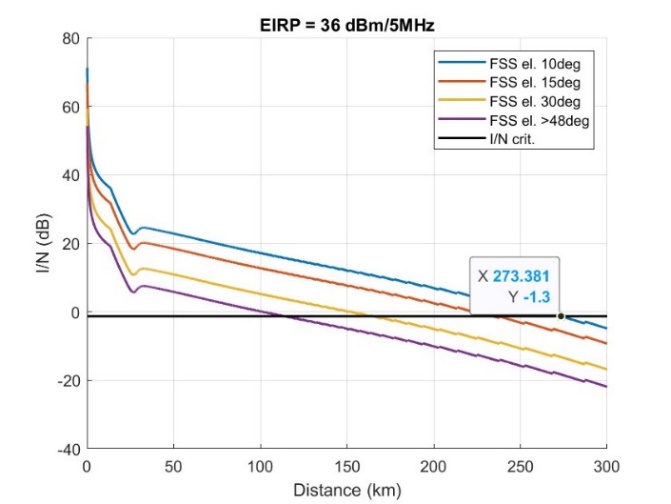


Figure 18: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 273.4 km

#### Case 2.2: Low power – max. e.i.r.p. = 18 dBm/5MHz

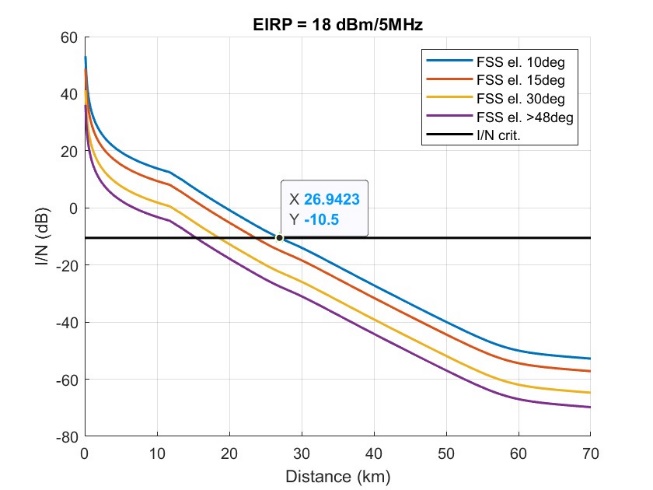


Figure 19: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 27 km

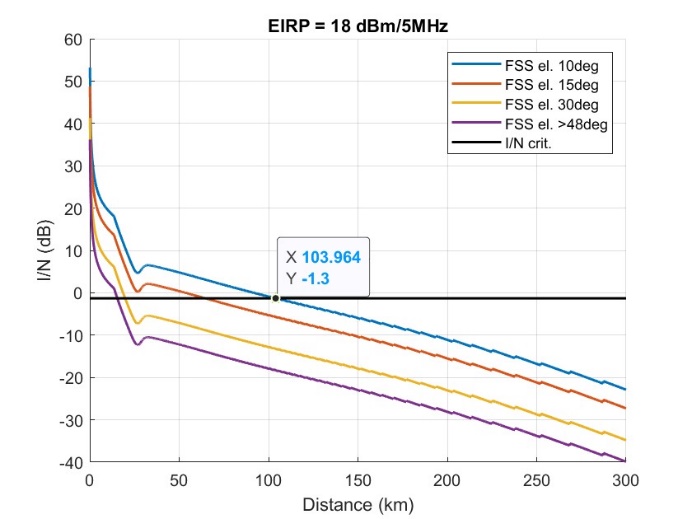


Figure 20: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 103.9 km

* + - 1. Case 2.3: Power level from 5A/322 document – max. e.i.r.p. = 24 dBm/5MHz

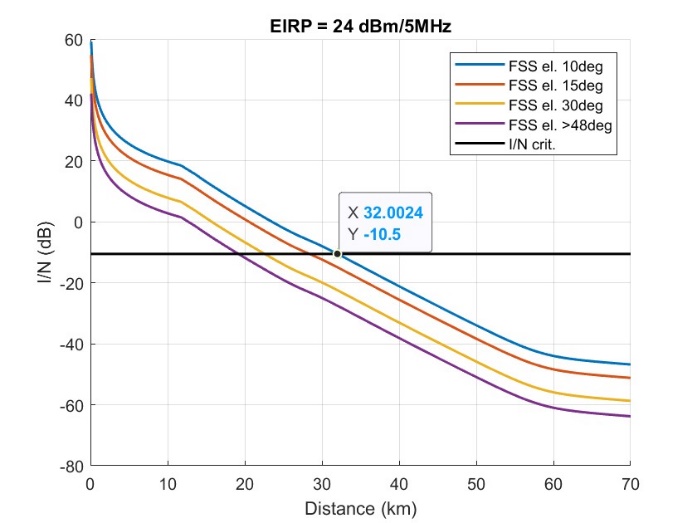


Figure 21: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 32 km

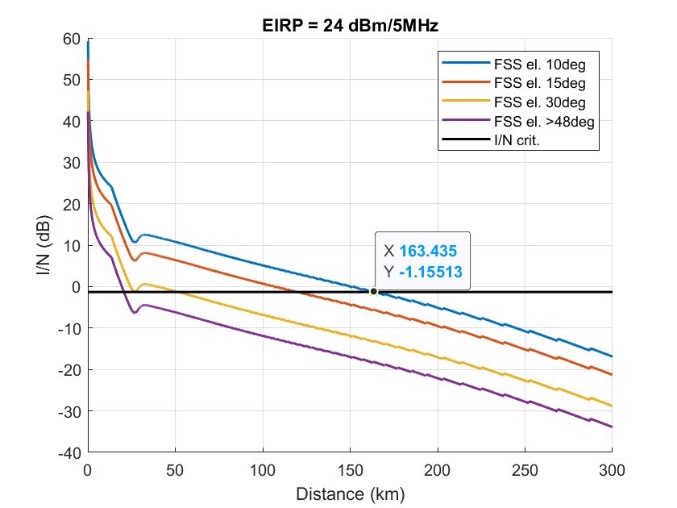


Figure 22: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 163.4 km

#### Additional results for cases 2.1/2.2/2.3 considering different deployment scenarios and clutter attenuation following Recommendation ITU-R P.452

Various deployment scenarios are assumed for the WBB LMP BS and FSS ES deployment: industrial site, urban, suburban and rural.

Recommendation ITU-R P.452 (Section 4.5.2), provides several clutter categories including a nominal clutter height and distance from the antenna for each. The various categories considered in this study have been reflected in the table below.

Table 6: Nominal clutter heights and distances (Rec. ITU-R P.452)

|  |  |  |
| --- | --- | --- |
| Clutter (ground-cover) category | Nominal height, ha (m) | Nominal distance, dk (km) |
| High crop fields  Park land  Irregularly spaced sparse trees  Orchard (regularly spaced)  Sparse houses | 4 | 0.1 |
| Suburban | 9 | 0.025 |
| Urban | 20 | 0.02 |
| Industrial zone | 20 | 0.05 |

The FSS ES is assumed to be in a rural or suburban area with an antenna height of 10m. This is taken to represent one of the typical FSS ES deployment. For this section the FSS ES is assumed to be pointing at 10 degrees elevation.

Two different WBB LMP BS antenna heights are assumed in turn: 10m and 20m.

The resulting I/N versus separation distances are contained in the tables below:

**Results – Long-term protection criteria[[2]](#footnote-2)**

|  |  |
| --- | --- |
| **BS height = 10m** | |
| Rural/Suburban BS -> Rural/suburban FSS ES | Urban site BS -> Rural/suburban FSS ES |
| Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 41 km * e.i.r.p. = 24 dBm/5MHz ==> 32 km * e.i.r.p. = 18 dBm/5MHz ==> 27 km | Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 35km * e.i.r.p. = 24 dBm/5MHz ==> 25.3 km * e.i.r.p. = 18 dBm/5MHz ==> 20.9 km |
| Industrial site BS -> Rural/suburban FSS ES    Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 35.5km * e.i.r.p. = 24 dBm/5MHz ==> 25.7km * e.i.r.p. = 18 dBm/5MHz ==> 21.2km | |
| **BS height = 20m** | |
| Same result for all deployment cases as BS is above nominal clutter height:  Rural/Suburban/Urban/Industrial BS -> Rural/suburban FSS ES | |
| Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 47.5 km * e.i.r.p. = 24 dBm/5MHz ==> 38.1 km * e.i.r.p. = 18 dBm/5MHz ==> 32.8 km | |

**Results – Short-term protection criteria**

|  |  |
| --- | --- |
| **BS height = 10m** | |
| Rural/Suburban BS -> Rural FSS ES | Urban site BS -> Rural FSS ES |
| Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 273.4km * e.i.r.p. = 24 dBm/5MHz ==> 163.4km * e.i.r.p. = 18 dBm/5MHz ==> 103.9km | Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 119.6 km * e.i.r.p. = 24 dBm/5MHz ==> 28.6 km * e.i.r.p. = 18 dBm/5MHz ==> 22.5 km |
| Industrial site BS -> Rural FSS ES    Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 123.5km * e.i.r.p. = 24 dBm/5MHz ==> 29 km * e.i.r.p. = 18 dBm/5MHz ==> 23km | |
| **BS height = 20m** | |
| Same result for all deployment cases as BS is above nominal clutter height:  Rural/Suburban/Urban/Industrial BS -> Rural FSS ES | |
| Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 270.5 km * e.i.r.p. = 24 dBm/5MHz ==> 159.4km * e.i.r.p. = 18 dBm/5MHz ==> 100.2 km | |

Separation distances vary depending on the deployment scenario and associated clutter:

* Long term protection criteria:

e.i.r.p. = 36 dBm/5MHz: 35 – 47.5 km

e.i.r.p. = 24 dBm/5MHz: 25.3 – 38.1 km

e.i.r.p. = 18 dBm/5MHz: 20.9 – 32.5 km

* Short term protection criteria:

e.i.r.p. = 36 dBm/5MHz: 120 – 273 km

e.i.r.p. = 24 dBm/5MHz: 29 – 163 km

e.i.r.p. = 18 dBm/5MHz: 23 – 104 km

### Case 3: local area omnidirectional BS into FSS ES receiver

Similarly to case 2, the antenna pointing is non-time variant. The BS is considered to have a gain of 0 dBi in all directions. The BS e.i.r.p. is therefore the same level in all directions. The results are presented in the form of an interference versus distance graph for each of the cases considered below. It is important to note that the distance required to meet the FSS protection criteria is in this case applicable in all direction around the BS.

#### Case 3.1: Medium power – max. e.i.r.p. = 36 dBm/5MHz

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Figure 23: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 41.5 km

Chart, line chart

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Figure 24: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 276.8 km

#### Case 3.2: Low power – max. e.i.r.p. = 18 dBm/5MHz

Chart, line chart

Description automatically generated

Figure 25: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 27.4 km

Chart, line chart

Description automatically generated

Figure 26: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 109.2 km

#### Case 3.3: Power level from 5A/322 document – max. e.i.r.p. = 24 dBm/5MHz

Chart, line chart

Description automatically generated

Figure 27: Long-term protection criteria I/N = -10.5 dB not to be exceeded for more than 20%  
Required separation distance: 32.4 km

Chart, line chart

Description automatically generated

Figure 28: Short-term protection criteria I/N = -1.3 dB not to be exceeded for more than 0.005%  
Required separation distance: 167.2 km

#### Additional results for cases 3.1/3.2/3.3 considering different deployment scenarios and clutter attenuation following Recommendation ITU-R P.452

Various deployment scenarios are assumed for the WBB LMP BS and FSS ES deployment: industrial site, urban, suburban and rural.

Recommendation ITU-R P.452 (Section 4.5.2), provides several clutter categories including a nominal clutter height and distance from the antenna for each. The various categories considered in this study have been reflected in the table below.

Table 7: Nominal clutter heights and distances (Rec. ITU-R P.452)

|  |  |  |
| --- | --- | --- |
| Clutter (ground-cover) category | Nominal height, *ha* (m) | Nominal distance, *dk* (km) |
| High crop fields  Park land  Irregularly spaced sparse trees  Orchard (regularly spaced)  Sparse houses | 4 | 0.1 |
| Suburban | 9 | 0.025 |
| Urban | 20 | 0.02 |
| Industrial zone | 20 | 0.05 |

The FSS ES is assumed to be in a rural or suburban area with an antenna height of 10m. This is taken to represent one of the typical FSS ES deployment. For this section the FSS ES is assumed to be pointing at 10 degrees elevation.

Two different WBB LMP BS antenna heights are assumed in turn: 10m and 20m.

The resulting I/N versus separation distances are contained in the tables below:

**Results – Long term protection criteria**

|  |  |
| --- | --- |
| **BS height = 10m** | |
| Rural/Suburban BS -> Rural/suburban FSS ES | Urban site BS -> Rural/suburban FSS ES |
| Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 41.5 km * e.i.r.p. = 24 dBm/5MHz ==> 32.4 km * e.i.r.p. = 18 dBm/5MHz ==> 27.4 km | Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 35.8 km * e.i.r.p. = 24 dBm/5MHz ==> 25.9 km * e.i.r.p. = 18 dBm/5MHz ==> 21.5 km |
| Industrial site BS -> Rural/suburban FSS ES  Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 36.2 km * e.i.r.p. = 24 dBm/5MHz ==> 26.2 km * e.i.r.p. = 18 dBm/5MHz ==> 21.8 km | |
| **BS height = 20m** | |
| Same result for all deployment cases as BS is above nominal clutter height:  Rural/Suburban/Urban/Industrial BS -> Rural/suburban FSS ES | |
| Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 47.9 km * e.i.r.p. = 24 dBm/5MHz ==> 38.5 km * e.i.r.p. = 18 dBm/5MHz ==> 33.3 km | |

**Results – Short term protection criteria**

|  |  |
| --- | --- |
| **BS height = 10m** | |
| Rural/Suburban BS -> Rural FSS ES | Urban site BS -> Rural FSS ES |
| Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 276.8 km * e.i.r.p. = 24 dBm/5MHz ==> 168.2 km * e.i.r.p. = 18 dBm/5MHz ==> 109.2 km | Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 126.2 km * e.i.r.p. = 24 dBm/5MHz ==> 29.1 km * e.i.r.p. = 18 dBm/5MHz ==> 23.1 km |
| Industrial site BS -> Rural FSS ES    Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 129.3 km * e.i.r.p. = 24 dBm/5MHz ==> 29.7 km * e.i.r.p. = 18 dBm/5MHz ==> 23.5 km | |
| **BS height = 20m** | |
| Same result for all deployment cases as BS is above nominal clutter height:  Rural/Suburban/Urban/Industrial BS -> Rural FSS ES | |
| Chart, line chart  Description automatically generated  Separation distances:   * e.i.r.p. = 36 dBm/5MHz ==> 275.5 km * e.i.r.p. = 24 dBm/5MHz ==> 164.7 km * e.i.r.p. = 18 dBm/5MHz ==> 104.9 km | |

Separation distances vary depending on the deployment scenario and associated clutter:

* Long term protection criteria:

e.i.r.p. = 36 dBm/5MHz: 35.8 – 47.9 km

e.i.r.p. = 24 dBm/5MHz: 25.9 – 38.5 km

e.i.r.p. = 18 dBm/5MHz: 21.5 – 33.3 km

* Short term protection criteria:

e.i.r.p. = 36 dBm/5MHz: 126.2 – 276.8 km

e.i.r.p. = 24 dBm/5MHz: 29.1 – 168.2 km

e.i.r.p. = 18 dBm/5MHz: 23.1 – 109.2 km

## Overview of results and additional considerations

The following table provides a summary of the above results:

Table 8: Summary of the results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Case # | Antenna type | Max. e.i.r.p. | Distance to meet the FSS long term protection criteria (km) | Distance to meet the FSS long short-term protection criteria (km) |
| 1.1 | AAS antenna without clutter | 36 dBm/5MHz | 36.5 | 275 |
| 1.2 | 18 dBm/5MHz | 21.5 | 90 |
| 1.3 | 24 dBm/5MHz | 25.5 | 160 |
| 1.1 | AAS antenna with clutter (31 dB, 50% location) | 36 dBm/5MHz | 14 | 18 |
| 1.2 | 18 dBm/5MHz | 2 | 2 |
| 1.3 | 24 dBm/5MHz | 4.2 | 4.2 |
| 2.1 | Non-AAS antenna without clutter | 36 dBm/5MHz | 47.5 | 273 |
| 2.2 | 18 dBm/5MHz | 32.5 | 104 |
| 2.3 | 24 dBm/5MHz | 38.1 | 163 |
| 2.1 | Non-AAS antenna with clutter (P.452 clutter) | 36 dBm/5MHz | 35 | 120 |
| 2.2 | 18 dBm/5MHz | 20.9 | 23 |
| 2.3 | 24 dBm/5MHz | 25.3 | 29 |
| 3.1 | Omnidirectional antenna without clutter | 36 dBm/5MHz | 47.9 | 276.8 |
| 3.2 | 18 dBm/5MHz | 33.3 | 109.2 |
| 3.3 | 24 dBm/5MHz | 38.5 | 167.2 |
| 3.1 | Omnidirectional antenna with clutter (P.452 clutter) | 36 dBm/5MHz | 35.8 | 126.2 |
| 3.2 | 18 dBm/5MHz | 21.5 | 23.1 |
| 3.3 | 24 dBm/5MHz | 25.9 | 29.1 |

From the results it can be seen that the required separation distance is longer to protect the short-term protection criteria. One can also note that the separation distance varies greatly depending on the assumptions taken. It is therefore paramount that certain conditions reflecting these technical assumptions are translated and reflected in regulatory text. Through this contribution, it is proposed to consider the following assumptions to be translated into regulation for the potential shared use of the 3.8-4.2 GHz frequency band for terrestrial low powered wireless broadband systems providing local-area network connectivity in CEPT:

* Unsynchronized BS: it is important to highlight that these applications would only be for local area networks and should not be used for wide-spread synchronized mobile deployment. This is key in ensuring that current and future deployments of FSS ES are not impeded in the band.
* Power limitation: this could be in the form of a maximum e.i.r.p. limit. Looking at the results in this annex, it is proposed to use the low e.i.r.p. level of 18dBm/5MHz
* Antenna height: The study presented in this annex analysed presented results using two antenna height of 10m and 20m. As seen from the analysis, the 20m height would lead to higher separation distances given the lack of clutter attenuation on the path. It is therefore proposed to limit the height of the outdoor WBB LMP antennas to 10monly a specific antenna height of 10m. However, the higher the antenna height the more potential impact into other existing services. In addition, a lower antenna height would also help with granting clutter attenuation on the interfering path.
* Antenna downtilt: The study considered different antenna types. The antenna downtilt can ensure lower levels of interference towards the horizon. A minimum downtilt is therefore proposed to be considered as a technical condition. A preliminary proposal of 6 degrees could be considered for both AAS and non AAS antennas.
* Exclusion zones: Given the separation distances obtained in the study above, exclusion zones could be considered as a trigger for coordination around existing FSS ES.
* Licensing framework: This was not addressed in this report. However a clear process needs to be defined to verify the protection of existing services for each local area network demand.
* Protection of future FSS ES: this point is crucial and depends on the above conditions. The deployment of these local area networks for verticals should not constrain future FSS ES deployments in the band.

1. Document 5A/395, available at [https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-WP5A-C-0395https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-WP5A-C-0395](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-WP5A-C-0395) [↑](#footnote-ref-1)
2. Updated results with non AAS with 10 dBi at 10 deg mechanical downtilt. [↑](#footnote-ref-2)