# Introduction

Technical conditions for 5G MFCN have been regulated in ECC Dec(11)06, it is already licensed and deployed in different countries. The objective of the study is to define the regulatory technical conditions for WBB LMP under condition that the adjacent band 5G MFCN and several other in-band and adjacent band systems are properly protected.

This document provides technical studies on the adjacent-band co-existence between WBB LMP local area network above 3800 MHz using the agreed WBB LMP system parameters and the 5G MFCN network below 3800 MHz.

# system Parameters and simulation scenarios

## WBB LMP system parameters and deployment assumptions

WBB LMP system parameters and deployment assumptions are given in Table 1.

Table 1. WBB LMP system and deployment parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | WBB LMP BS | WBB LMP UE | Note |
| Centre frequency (MHz) | 3850,  3940 | |  |
| Channel bandwidth (MHz) | 100  (98.280 MHz Nrb=273 Rb=12\*30kHz) | |  |
| SCS (kHz) | 30 | |  |
| BS Tx Maximum Power (EIRP dBm/100 MHz) for non-AAS and AAS  (baseline study) | 31 to 49 |  | 31 dBm/100 MHz EIRP with maximum Hbs=10m in urban/sub-urban area  Up to 49 dBm/100 MHz in Rural area without Hbs limitation |
| BS Tx Power (EIRP dBm/100 MHz) for non-AAS and AAS  (incremental study) | 31 to 51 |  | In urban, sub-urban, and Rural area, no BS antenna height limitation. |
| Non-AAS antenna gain (dBi) | 12 dBi for LP BS  16 dBi for MP BS |  |  |
| Non-AAS antenna pattern | ITU-R F.1336 |  | Omni For LP BS, Directive for MP BS |
| AAS antenna configuration | 4x4 |  | For MP BS, a MP AAS BS correspond a LA AAS BS as defined in 3GPP TS38.104 |
| Element gain (dBi) | 6.4 |  | For MR BS |
| H\_Spacing  V\_Spacing | 0.5 for H  0.7 for V |  | For MR BS |
| BS antenna height (m) | 10, 20, 25, 30 |  | Outdoor MR BS |
| BS antenna downtilt(°) | 0° for Hbs=10 m below clutter  -6° for Hbs=20m in urban and Hbs=25 m in suburban area  -3° for Hbs=25m in rural area |  |  |
| Noise figure (dB) | 10 for MR BS  13 for LA BS | 9 |  |
| BS Tx mask | ACLR= 31 dB for LP non-AAS BS with 31 dBm/100 MHz EIRP  ACLR=38 dB for MP non-AAS BS with 49 dBm/100 MHz EIRP  ACLR=40 dB for MP non-AAS BS with 51 dBm/100 MHz EIRP  ACLR=33.7 dB for AAS (4x4) MP BS with 49 dBm/100 MHz EIRP  ACLR=35.7 dB for AAS (4x4) MP BS with 51 dBm/100 MHz EIRP |  |  |
| BS Rx mask | 32.3  For both MP BS for LP BS |  | ACS is calculated with -47 dBm with NF=10 dB for MR BS  -44 dBm for LP BS with NF=13 dB |
| UE Tx Power (dBm) |  | TRP=23 dBm for Mobile/Nomadic  Maximum TRP=28 dBm for Mobile/Nomadic UE  EIRP=48 dBm/100 MHz for FWA terminal | In the simulation, 23 dBm UE is used |
| Outdoor UE H\_ue (m) |  | 1.5 above ground |  |
| Mobile/Nomadic UE antenna gain (dBi) |  | -4 |  |
| Mobile/Nomadic UE body loss (dB) for data user |  | 0 |  |
| FWA terminal gain (dBi) |  | 20 |  |
| UE Tx mask |  | 30 for class 3 UE (Tx P=23 dBm)  31- for class 2 UE (TxP=26 dBm) | 3GPP TS.38.101 |
| UE Rx mask |  | ACS=30 dB | 3GPP TS.38.101 |
| Network loading (%) | 100% for single BS case  50% for network case | | The simulation is done on single BS with 100% load |
| Indoor/outdoor UE percentage | 70% / 30% in urban/suburban  50% / 50% in Rural | | For outdoor BS |
| Wallloss (dB) | 12 | |  |
| Cell Range (m) | Urban & Suburban:  400 m for Hbs=25m  250 m for Hbs=10m  Rural:  1000 m for Hbs>= 20m BS MR  500 m for Hbs=10m | |  |

The ACLR absolute *basic limit* for non-AAS BS is specified in table 6.6.3.2‑2 of 3GPP TS38.104.

|  |  |
| --- | --- |
| Category B Wide Area BS | -15 dBm/MHz |
| Medium Range BS | -25 dBm/MHz |
| Local Area BS | -32 dBm/MHz |

The non-AAS BS Tx mask for 31 dBm EIRP with 12 dBi antenna is 31 - 12 – 45 = - 26 dBm/98.28 MHz = -45.9 dBm/MHz, which is much below the ACLR absolute basic limit for both MR BS and LA BS.

The non-AAS BS Tx mask for 49 dBm EIRP with 16 dBi antenna is 49 - 16 – 45 = - 12 dBm/98.28 MHz = -31.9 dBm/MHz, which is also below the ACLR absolute basic limit for MR BS.

The ACLR to be used in the simulation for LA BS with 12 dBi antenna gain with 31 dBm/100 MHz EIRP is

ACLR = 31 – 12 – (-32+10\*log10(98,28)) = 31 dB

The ACLR to be used in the simulation for MR BS with 16 dBi antenna gain with 31 dBm/100 MHz EIRP is

ACLR = 31 – 16 – (-25+10\*log10(98,28)) = 20 dB

The ACLR to be used in the simulation for MR BS with 16 dBi antenna gain with 49 dBm/100 MHz EIRP is

ACLR = 49 – 16 – (-25+10\*log10(98,28)) = 38 dB

The ACLR to be used in the simulation for MR BS with 16 dBi antenna gain with 51 dBm/100 MHz EIRP is

ACLR = 51 – 16 – (-25+10\*log10(98,28)) = 40 dB

The ACLR for AAS BS is defined as TRP, in 3GPP TS38.104 section 9.7.3.2, it is said

The ACLR (CACLR) absolute *basic limits* in table 6.6.3.2-2 + X, 6.6.3.2-2a + X (where X = 9 dB) or the ACLR (CACLR) *basic limit* in table 6.6.3.2-1, 6.6.3.2-2a or 6.6.3.2-3, whichever is less stringent, shall apply.

The TRP ACLR absolute *basic limit* for AS BS is specified in table 6.6.3.2‑2+ 9 dB in 3GPP TS38.104.

|  |  |
| --- | --- |
| Category B Wide Area BS | -6 dBm/MHz |
| Medium Range BS | -16 dBm/MHz |
| Local Area BS | -23 dBm/MHz |

The BS *rated carrier TRP output power* for *BS type 1-O* shall be within limits as specified in table 9.3.1-1.

Table 9.3.1-1: BS *rated carrier TRP output power* limits for *BS type 1-O*

|  |  |
| --- | --- |
| BS class | Prated,c,TRP |
| Wide Area BS | (note) |
| Medium Range BS | ≤ + 47 dBm |
| Local Area BS | ≤ + 33 dBm |
| NOTE: There is no upper limit for the Prated,c,TRP of the Wide Area Base Station. | |

It should be pointed out that the MP AAS BS with EIRP=49 dBm/100 MHz or 51 dBm/100 MHz, the corresponding AAS BS class is the Local Area BS with a TRP<=33 dBm.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BS Tx Power EIRP (dBm/98.28 MHz) | 49 | | 51 | |
| AAS antenna | 4x4 |  | 4x4 |  |
| Antenna Gain (dBi) | 18.4 |  | 18.4 |  |
| BS Tx Power TRP (dBm/98.28 MHz | 30.6 |  | 32.6 |  |
| Absolute TRP ACLR (dBm/MHz) | -23 |  | -23 |  |
| Relative ACLR (dB/98,28 MHz) | 33.7 |  | 35.7 |  |

WBB LP non-AAS BS Rx mask (NF=13 dB):

|  |  |  |
| --- | --- | --- |
| Frequency offet (MHz) | dBm | dBc |
| 3740-3800 | -35 | 41.3 |
| 3700-3740 | -15 | 61.3 |

WBB MP non-AAS BS Rx mask (NF=10 dB):

|  |  |  |
| --- | --- | --- |
| Frequency offet (MHz) | dBm | dBc |
| 3740-3800 | -38 | 41.3 |
| 3700-3740 | -15 | 64.3 |

WBB MP AAS BS Rx mask (NF=10 dB):

|  |  |  |
| --- | --- | --- |
| Frequency offet (MHz) | dBm | dBc |
| 3740-3800 | -38 | 41.3 |
| 3700-3740 | -30.6 (Type 1-O)  -15 (Type 1-H) | 48.6(Type 1-O)  64.3 (Type 1-H) |

5G MFCN system parameters and deployment assumptions are summarized in Table 2.

Table 2. 5G MFCN system and deployment parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | BS | UE | Note |
| Centre Frequency (MHz) | 3750 | |  |
| Channel bandwidth (MHz) | 100  (98.280 MHz Nrb=273 Rb=12\*30kHz) | |  |
| BS Tx Power (EIRP dBm/100 MHz) | 76  Macrocell BS  MR BS AAS from 3GPP TS 38.104 for outdoor smallcell BS  LA BS non-AAS from 3GPP TS 38.104 for indoor BS |  |  |
| BS AAS antenna | 8x8  for macrocell BS  24.46 (gain max)  4x8 for MR BS  21.45 (gain max) |  | Composite gain for in-band and the first adjacent channel |
| Element gain (dBi) | 6.4 |  | Element gain from the second adjacent channel and away |
| V\_Spacing  H\_Spacing | 0.5 for H  0.7 for V |  |  |
| BS antenna height (m) | 20m for outdoor macrocell BS in Urban  25m for outdoor macrocell BS in Sub- urban and Rural  10m for outdoor smallcell BS  Same height as LMP indoor BS for indoor MFCN BS |  |  |
| BS downtilt (°) | -6° in urban/suburban for macrocell BS  -3° in rural for macrocell BS  0° for outdoor smallcell and indoor BS |  |  |
| BS Tx Mask | 3800-3840 MHz: ECC Dec(11)06 Table 6  Above 3840 MHz: -30 dBm/MHz |  |  |
| BS Rx Mask | 3800-3890 MHz: ACS=43.3 dB (-43 dBm in-band blocking) for Macrocell BS with NF=3 dB  For MR BS (NF=10 dB): in-band blocking: -38 dBm, ACS=41.3 dB  BS type 1-O:  3860-4200 MHz: ACS=55.7 dB (-30.6 dBm out-of-band blocking ) for Macrocell BS with NF=3 dB  BS type 1-H:  3860-4200 MHz: ACS=71.3 dB (-15 dBm out-of-band blocking ) for Macrocell BS with NF=3 dB  For MR BS type 1-O: (NF=10 dB): out of band blocking=0.36 V/m=-37 dBm before antenna, and -30.6 dBm after antenna with element gain of 6.4 dBi: ACS=48.6 dB  For MR BS type 1-H: (NF=10 dB): out of band blocking=-15 dBm after antenna: ACS=64.3dB |  | BS type 1-O  0.36 V/m=-37 dBm Out of band blocking (OTA)  -37 dBm+6.4 dB=-30.6 dBm after AAS antenna in the frequency range > 3860 MHz.  BS type 1-H  Out of band blocking (conducted): -15 dBm |
| BS noise figure (dB) | 3 for WA Macrocell AAS BS  10 for MR AAS BS | 9 |  |
| Cell range (m) | Urban: 400  Suburban: 1000  Rural: 2000 |  |  |
| UE Tx power (dBm) |  | 23 |  |
| UE Tx Mask |  | 30 for class 3 UE (Tx P=23 dBm)  31- for class 2 UE (TxP=26 dBm) |  |
| UE antenna gain (dBi) |  | -4 |  |
| Body loss (dB) |  | 4 |  |
| Indoor/outdoor UE |  | Urban/suburban: 70%/30%  Rural: 50%/50% |  |
| Building wall loss (dB) | 12 |  |  |
| UE heights (building floors) |  | 1.5 m |  |
| TDD activity factor | 75% DL |  |  |

5G MFCN Macrocell BS Tx mask:

|  |  |  |
| --- | --- | --- |
| EIRP | 76 | dBm/100 MHz |
| Gain | 24.5 | dBi |
| TRP | 51.5 | dBm/100 MHz |
|  | dBm/5 MHz | dBc/5 MHz |
| 3800-3805 | 11.5 | 40 |
| 3805-3810 | 8.5 | 43 |
| 3810-3840 | 1 | 50.5 |
| 3840-4000 | -23 | 74.5 |

5G MFCN Smallcell (MR) BS Tx mask:

|  |  |  |
| --- | --- | --- |
| EIRP | 68.45 | dBm/100 MHz |
| Gain | 21.45 | dBi |
| TRP | 47 | dBm/100 MHz |
|  | dBm/5 MHz | dBc/5 MHz |
| 3800-3805 | 7 | 44.5 |
| 3805-3810 | 4 | 47.5 |
| 3810-3840 | 1 | 50.5 |
| 3840-4000 | -23 | 74.5 |

5G MFCN Macrocell BS Rx mask (NF=3 dB) (1-O):

|  |  |  |
| --- | --- | --- |
| Frequency offset (MHz) | dBm | dBc |
| 3800-3860 | -43 | 43.3 |
| 3860-4200 | 0.36 V/m OTA=-37 dBm before antenna  -30.6 dBm after antenna | 55.7 |

5G MFCN Macrocell BS Rx mask (NF=3 dB) (1-H):

|  |  |  |
| --- | --- | --- |
| Frequency offset (MHz) | dBm | dBc |
| 3800-3860 | -43 | 43.3 |
| 3860-4200 | -15 dBm after antenna | 71.3 |

5G MFCN Smallcell (MR) BS Rx mask (NF=10 dB) (1-O):

|  |  |  |
| --- | --- | --- |
| Frequency offset (MHz) | dBm | dBc |
| 3800-3860 | -38 | 41.3 |
| 3860-4200 | 0.36 V/m OTA=-37 dBm before antenna  -30.6 dBm after antenna | 48.6 |

5G MFCN Smallcell (MR) BS Rx mask (NF=10 dB) (1-H):

|  |  |  |
| --- | --- | --- |
| Frequency offset (MHz) | dBm | dBc |
| 3800-3860 | -38 | 41.3 |
| 3860-4200 | -15 dBm after antenna | 64.3 |

Propagation models used in the simulations are summarized in Table 3 and Table 4.

Table 3: Propagation model for the BS to UE link

|  |  |  |
| --- | --- | --- |
| Radio Links | Urban/Sub-urban area | Rural area |
| BS to UE for BS antenna above clutter | 3GPP TR38.901 Uma LOS Probability  (12 dB Wall loss for indoor UE) | 3GPP TR38.901 RMa LOS Probability |
| BS to UE for BS antenna below clutter | 3GPP TR38.901 Umi LOS Probability  (12 dB Wall loss for indoor UE) |  |

Table 4: Propagation model for the BS to BS link

|  |  |  |
| --- | --- | --- |
| Case | Urban/Suburban | Rural |
| Both ends above clutters | ITU-R P.452 / P.2001 50% of time, without clutter loss  Note: ITU-R P.1546 may be used for studies beyond radio horizon | |
| One end above clutters and one end within clutters | ITU-R P.452/P.2001 50% of time, with ITU-R P.2108 fixed clutter loss corresponding to 50% locations (for urban) or 30% (for sub-urban) applied to one end for D>=250m  For D<250m,   * 3GPP TR38.901 UMa LOS Probability between Macrocell BS and microcell BS in Urban/suburban areas * 3GPP TR38.901 RMa LOS Probability between Macrocell BS and microcell BS in Rural area | ITU-R P.1546 Land Rural 50% of time |
| Both ends within clutters | ITU-R P.452 / P.2001 50% of time, with- ITU-R P.2108 fixed clutter loss corresponding to 50% locations (for urban) or 30% (for sub-urban) applied to two ends for D>= 1km  Clutter loss applied to one end for 1000m>D>=250m  For D<250m,   * 3GPP TR38.901 Umi LOS Probability between Microcell BSs in Urban/suburban areas |  |
| Both BSs below rooftops and in the same street adjacent to each other | 3GPP TR38.901 Umi LOS |  |
| Both BSs are in indoor area in the same building | ITU-R P.1238 for BSs in the same building, other valid model can be used with explanation |  |
| One or two BSs are in indoor area in different building | Outdoor model + Wall Loss 12 dB at each indoor BS or P.2109 for incremental study |  |

For FWA terminal maximum EIRP=48 dBm, it is assumed a 28 dBm TRP with a 20 dB antenna gain.

## Simulation scenarios and method

The simulation scenario is illustrated in Figure 1.In order to take into account the intra-network inter-cell interference in the simulation of 5G MFCN network, the 5G MFCN network is modelled as a cluster of 7 tri-sector sites, the reference cell is chosen in the middle of the 5G MFCN network cluster. A Single LAN BS (non-AAS or AAS) is in face of a 5G MFCN network reference cell AAS BS . The AAS BS main beams are following UEs within its cell, UEs are randomly generated within the coverage area of the base station. a separation distance of 100 m between the WBB LMP BS and the 5G MFCN reference cell BS, which was the reference distance used in different CEPT reports (CEPT Report 19, CEPT Report 39) and ECC reports on the determination of BEMs for other frequency bands.

The separation distance for deriving the Least Restrictive Conditions for unsynchronised TDD operation in 3.4-3.8 GHz band in the ECC report #203 and ECC report #281 was 70 m between two Macrocellular BS.

The separation distances between different types of BS in 3.4-3.8 GHz MFCN BSs are summarized in the Table 11 of the ECC report 203:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Direct Horizontal Distance | MACRO | MICRO | PICO | FEMTO |
| MACRO | 70 m | 30 m | 30 m | 30 m |
| MICRO | 30 m | 30 m | 15 m | 15 m |
| PICO | 30 m | 15 m | 10 m | 10 m |
| FEMTO | 30 m | 15 m | 10 m | 10 m |

A red hexagon with blue lines

Description automatically generated

Figure 1: Simulation scenario

5G MFCN reference cell uplink throughput loss is simulated. The WBB LMP BS out of band emission level below 3800 MHz is tuned to reach the target 5G MFCN BS uplink throughput of 5% with a consideration of balancing the 5G MFCN BS receiver blocking level.

# Simulation results of interference from LAN BS to 5G MFCN BS

## Urban area Simulation results

### LP 100 MHz carrier placed at 3850 MHz

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB LMP 100 MHz channel is placed at 3800-3900 MHz. The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 5.

Table 5: Simulation results for LP BS antenna height Hbs=10m (downtilt=-0°) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz)  Below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 31 | -31 | -96.6 | -110.7 (1-O)  -111.0 (1-H) | 8.959% | 8.878% |
| 31 | -44 | -109.7 | -100.4  -111.1 (1-H) | 2.426% | 2.392% |

The simulation results in Table 5 show that when the WBB LP non-AAS BS 100 MHz channel is placed at 3800-3900 MHz without any frequency separation with a Hbs=10m, under the condition that WBB LP BS out of band emission below 3800 MHz is -44 dBc, that is 19-44=-25 dBm/100 MHz=-45 dBm/MHz (EIRP=-45+12+10\*log10(5)=-26 dBm/5 MHz), 5G MFCN reference cell BS uplink throughput loss is below 5%.

Table 6: Simulation results for LP BS antenna height Hbs=20m (downtilt=-6°) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz)  Below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 31 (Hbs=20m -6° Downtilt) | -44 | -108.5 | -109.7 (1-O)  -110.0 (1-H) | 3.531% | 3.525% |
| 31 (Hbs=20m 0° Downtilt) | -44 | -99.1 | -100.4 (1-O)  -100.3 (1-H) | 9.782% | 9.857% |

The simulation results in Table 6 show that for WBB LP non-AAS BS antenna height at 20m, 5G MFCN reference cell BS suffers more interference, in particular for the case of LP non-AAS BS with 0° downtilt.

### LP 100 MHz carrier placed at 3910 MHz (5G MFCN Macrocell BS)

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB LMP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz. The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 7.

Table 7: Simulation results for LMP non-AAS BS antenna height Hbs=10m in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/100MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-O 5G MFCN UL TP Loss (%) |
| 31 | -44 | -109.6 | -119.4 (1-O)  -135.0 (1-H) | 1.742% | 1.588% |

The simulation results in Table 7 show that when the WBB LP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz with antenna height of 10m, under the condition that WBB LP BS out of band emission below 3800 MHz is -44 dBc, that is 19-44=-25 dBm/100 MHz=-45 dBm/MHz (EIRP OOBE=-45+12+10\*log10(5)=-26 dBm/5 MHz), 5G MFCN reference cell BS uplink throughput loss is below 5%.

The simulation with WBB LP non-AAS BS at different antenna heights has been performed, for the LMP BS antenna height from 10m to 30m, an antenna downtilt of -6° and ITU-R P.452 propagation model were used for Hbs>=15m. The simulation results are given in Table 8.

Table 8: Simulation results for LMP non-AAS BS EIRP=31 dBm/100 MHz in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Hbs (m) | LMP BS OOBE (dBc/100MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 20(0° downtilt) | -44 | -99.3 | -104.4  -120.0 (1-H) | 8.163% | 7.461% |
| 20(-6° downtilt) | -44 | -108.5 | -113.8 (1-O)  -129.3 -1-H) | 2.802% | 2.538% |

The simulation results in Table 8 show that for WBB LP non-AAS BS antenna height at 20m, 5G MFCN reference cell BS suffers more interference, in particular for the case of LP non-AAS BS with 0° downtilt.

### LP 100 MHz carrier placed at 3910 MHz (5G MFCN Smallcell BS)

For the case of 5G MFCN Smallcell BS 100 MHz channel is placed at 3700-3800 MHz, WBB LMP non-AAS BS 100 MHz channel is placed at 3860-39600 MHz, the simulated scenario is that both smallcell 5G MFCN BS and WBB LP BS are located in the same street (a large avenue of 50 m) with 50 m separation distance. The propagation model for the link BS to BS is 3GPP TR38.901 UMi LOS. The simulation results are given in Table 9

Table 9: Simulation results for LMP non-AAS BS and 5G MFCN BS antenna height Hbs=10m in Urban Area (D=50m) (Pointing to each other)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 31 | -44 | -84.2 | -91.2  -106.8 (1-H) | 69.385% | 59.349% |

The simulation results in Table 9 show that when the WBB LP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz at antenna height of 10m, in case that the 5G MFCN Smallcell BS and WBB LMP BS antenna are placed in the same street in line of sight, it is very difficult to co-exist in unsynchronized operation.

### WBB MP AAS BS 100 MHz carrier placed at 3850 MHz (5G MFCN Macrocell BS)

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB MP AAS BS 100 MHz channel is placed at 3800-3900 MHz with 49 dBm/100 MHz EIRP (30.5 dBm/100 MHz TRP). The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 10 (Hbs=10m with 0° downtilt) and Table 11 (Hbs=20 m with -6° downtilt).

Table 10: Simulation results for MP AAS BS Hbs=10m (0° downtilt) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP AAS BS Tx Power (dBm/100 MHz) | MP AAS BS OOBE (dBc/100 MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=49 dBm/100 MHz  TRP=30.5 dBm/100 MHz | -33.7 | -88 | -97.0 (1-O)  -97.2(1-H) | 24.761% | 24.553% |
| EIRP=49 dBm/100 MHz  TRP=30.5 dBm/100 MHz | -44 | -98.1 | -97.0 (1-O)  -97.3 (1-H) | 14.542% | 14.264% |

Table 11: Simulation results for MP AAS BS Hbs=20m (-6° downtilt) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP AAS BS Tx Power (dBm/100 MHz) | MP AAS BS OOBE (dBc/MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=49 dBm/100 MHz  TRP=30.5 dBm/100 MHz | -33.7 | -96.2 | -100.7 | 14.64% | 14.474% |
| EIRP=49 dBm/100 MHz  TRP=30.5 dBm/100 MHz | -44 | -106.5 | -100.7 | 7.71% | 7.739% |

Simulation results in Table 10 and Table 11 show the co-existence between 5G MFCN macrocell BS and WBB MP AAS BS with EIRP=49 dBm/100 MHz (TRP=30.5 dBm/100 MHz) in 3800-3900 MHz in unsynchronized operation is difficult without applying appropriate coordination measures.

### WBB MP AAS BS 100 MHz carrier placed at 3910 MHz (5G MFCN Macrocell BS)

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB MP AAS BS 100 MHz channel is placed at 3860-3960 MHz with 49 dBm/100 MHz EIRP (30.5 dBm/100 MHz TRP). The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 12 (Hbs=20 m with -6° downtilt).

Table 12: Simulation results for MP AAS BS (EIRP=49 dBm/100 MHz) Hbs=20m (-6° downtilt) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP AAS BS Tx Power (dBm/100 MHz) | MP AAS BS OOBE (dBc/100 MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=49 dBm/100 MHz  TRP=30.5 dBm/100 MHz | -44 | --106.8 | -110.9 (1-O)  -126.6 (1-H) | 4.679% | 4.421% |

Simulation results in Table 12 show that the co-existence between 5G MFCN macrocell BS and WBB MP AAS BS with EIRP=49 dBm/100 MHz (TRP=30.5 dBm/100 MHz) in 3860-3960 MHz in unsynchronized operation is possible with an OOBE of -44 dBc/100 MHz, which is 30.5-44 = -13.5 dBm/100 MHz = -33.5 dBm/MHz TRP.

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB MP AAS BS 100 MHz channel is placed at 3860-3960 MHz with 51 dBm/100 MHz EIRP (32.5 dBm/100 MHz TRP). The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 13 (Hbs=20 m with -6° downtilt).

Table 13: Simulation results for MP AAS BS (EIRP=51 dBm/100 MHz) Hbs=20m (-6° downtilt) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP AAS BS Tx Power (dBm/100 MHz) | MP AAS BS OOBE (dBc/100 MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=51 dBm/100 MHz  TRP=32.5 dBm/100 MHz | -47.5 | --107.9 | -109.2 (1-O)  -124.9 (1-H) | 4.402% | 3.691% |

Simulation results in Table 13 show that the co-existence between 5G MFCN macrocell BS and WBB MP AAS BS with EIRP=51 dBm/100 MHz (TRP=32.5 dBm/100 MHz) in 3860-3960 MHz in unsynchronized operation is possible with an OOBE of -47.5 dBc/100 MHz, which is 32.5-47.5 = -15 dBm/100 MHz = -35 dBm/MHz TRP.

### WBB MP non-AAS BS 100 MHz carrier placed at 3910 MHz (5G MFCN Macrocell BS)

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB MP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz with 51 dBm/100 MHz EIRP. The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 14 (Hbs=20 m with -6° downtilt).

Table 14: Simulation results for MP AAS BS (EIRP=51 dBm/100 MHz) Hbs=20m (-6° downtilt) in Urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP AAS BS Tx Power (dBm/100 MHz) | MP AAS BS OOBE (dBc/100 MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=51 dBm/100 MHz | -60 | -115.5 | -104.6 (1-O)  -120.1 (1-H) | 1.771% | 0.864% |

Simulation results in Table 14 show that the co-existence between 5G MFCN macrocell BS and WBB MP non-AAS BS with EIRP=51 dBm/100 MHz in 3860-3960 MHz in unsynchronized operation is possible with an OOBE of -60 dBc/100 MHz, which is 51-16-60 = -25 dBm/100 MHz = -45 dBm/MHz conducted.

## Suburban Area simulation results

### LMP 100 MHz carrier placed at 3850 MHz

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB LMP 100 MHz channel is placed at 3800-3900 MHz. The propagation model for the link BS to BS is ITU-R P.1546 Suburban. The simulation results are given in Table 15.

Table 15: Simulation results for LP non-AAS BS antenna height Hbs=10m in Sub-urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz)  Below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 31 | -44 | -113.1 | -114.3 | 2.931% | 2.938% |

The simulation results in Table 15 show that the WBB LP non-AAS BS 100 MHz channel is placed at 3800-3900 MHz without any frequency separation with antenna height of 10m, under the condition that WBB LP BS out of band emission below 3800 MHz of -44 dBc, that is 19-44=-25 dBm/100 MHz=-45 dBm/MHz conducted (EIRP OOBE=-45+12+10\*log10(5)=-26 dBm/5 MHz), 5G MFCN reference cell BS uplink throughput loss is below 5%.

### LMP 100 MHz carrier placed at 3910 MHz

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB LP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz. The propagation model for the link BS to BS is ITU-R P.1546 Sub-urban. The simulation results are given in Table 16.

Table 16: Simulation results for LP non-AAS BS antenna height Hbs=10m in Suburban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-O 5G MFCN UL TP Loss (%) |
| 31 | -44 | -113.1 | -121.5 (1-O)  -137.0 (1-H) | 1.658% | 1.647% |

The simulation results in Table 16 show that when the WBB LP non-AAS BS 100 MHz channel is placed at 3860-3960 MHz at antenna height of 10m with a frequency separation of 60 MHz, under the condition that WBB LP BS out of band emission below 3800 MHz is -44 dBc, that is 19-44=-25 dBm/100 MHz=-45 dBm/MHz (EIRP OOBE=-45+12+10\*log10(5)=-26 dBm/5 MHz), 5G MFCN reference cell BS uplink throughput loss is below 5%.

The simulation results for LP non-AAS BS with 31 dBm/100 MHz EIRP at antenna height of 25m are given in Table 17.

Table 17: Simulation results for LMP non-AAS BS EIRP=31 dBm/100 MHz in Sub-urban Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Hbs (m) | LMP BS OOBE (dBc/MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 25m (downtilt=0°) | -44 | -93.7 | -103.6 (1-O)  -118.2(1-H) | 22.442% | 20.608% |
| 25 (downtil=-6°) | -44 | -102.9 | -112.0 (1-O)  -127.6 (1-H) | 8.487% | 8.209% |

The simulation results in Table 17 show that the 5G MFCN UL throughput loss is much higher when the LP non-AAS BS antenna height is at 25 m, in particular at 0° downtilt, the 5G MFCN BS UL suffers more interference with the increase of WBB LMP BS antenna height.

## Rural Area simulation results

### LMP 100 MHz carrier placed at 3850 MHz

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB MP non-AAS BS (EIRP=51 dBm/100 MHz) 100 MHz channel is placed at 3800-3900 MHz. The propagation model for the link BS to BS is P.452. The simulation results are given in Table 18.

Table 18: Simulation results for MP BS non-AAS antenna height Hbs=25m (-3° downtilt) in Rural Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz)  Below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 51 | -44 | -73.6 | -74.8 (1-O)  -75.1 (1-H) | 89.597% | 89.563% |
| 51 | -60 | -89.5 | -74.9 | 84.669% | 84.223% |

The simulation results in Table 18 show that the WBB MP non-AAS BS with 51 dBm/100 MHz EIRP 100 MHz channel is placed at 3800-3900 MHz without any frequency separation, even with an out of band emission level of -60 dBc/100 MHz (35-60=-25 dBm/100 MHz=-45 dBm/MHz conducted), the 5G reference cell BS uplink still suffer too much interference, the uplink throughput loss is 84%, the 5G BS receiver blocking is the limiting factor.

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB LMP AAS (4x4) 100 MHz channel is placed at 3800-3900 MHz with an antenna height of 25 m (-3° downtilt). The propagation model for the link BS to BS is P.452. The simulation results are given in Table 19.

Table 19: Simulation results for MP AAS BS antenna height Hbs=25m (-3° downtilt) in Rural Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz)  Below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=51 (TRP=32.5) | -47.5 | -89.9 | -86.0 (1-O)  -87.9 (1-H) | 56.355% | 54.173% |

The simulation results in Table 19 show than the WBB MP AAS BS with 51 dBm/100 MHz EIRP (TRP=32.5 dBm/100 MHz) 100 MHz channel is placed at 3800-3900 MHz without any frequency separation, with an out of band emission level of -47.5 dBc/100 MHz (TRP=32.5-47.5=-15 dBm/100 MHz=-35 dBm/MHz TRP), the 5G reference cell BS (1-H) uplink still suffer too much interference, the uplink throughput loss is 54%. the 5G BS receiver selectivity is the limiting factor.

### LMP 100 MHz carrier placed at 3910 MHz

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB LMP non-AAS BS 100 MHz channel is placed at 3890-3990 MHz. The propagation model for the link BS to BS is ITU-R P.452. The simulation results are given in Table 20

Table 20: Simulation results for LMP MR BS non-AAS antenna height Hbs=25m (-3° downtilt) in Rural Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power EIRP (dBm/100 MHz) | LMP BS OOBE (dBc/MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| 51 | -60 | -89.7 | -83.4(1-O)  -99 (1-H) | 62.357% | 50.211% |
| 51 | -69 | -98.7 | -83.3 (1-O)  -99 (1-H) | 48.326% | 33.111% |

The simulation results in Table 20 show that when the WBB MP non-AAS BS 100 MHz channel with an EIRP=51 dBm/100 MHz is placed at 3860-3960 MHz, with the MP non-AAS BS out of band emissions level of -69 dBc/100 MHz, that is 35-69=-34 dBm/100 MHz = -54 dBm/MHz (conducted) for EIRP=51 dBm/100 MHz non-AAS BS, 1-H 5G BS uplink throughput loss is about 33%.

5G MFCN 100 MHz channel is placed at 3700-3800 MHz, WBB MP AAS BS 100 MHz channel is placed at 3860-3960 MHz. The propagation model for the link BS to BS is ITU-R P.452. The simulation results are given in Table 21.

Table 21: Simulation results for LMP MR AAS BS antenna height Hbs=25m in Rural Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LMP BS Tx Power (dBm/100 MHz) | LMP BS OOBE (dBc/100 MHz) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 1-O 5G MFCN UL TP Loss (%) | 1-H 5G MFCN UL TP Loss (%) |
| EIRP=51  TRP=32.5 | -47.5 | -88.6 | -96.5 (1-O)  -112.0 (1-H) | 54.331% | 48.074% |
| EIRP=51  TRP=32.5 | -70.5 | -111.6 | -96.4 (1-O)  -112.0 (1-H) | 27.858% | 8.685% |

The simulation results in Table 21 show that when the WBB MP AAS BS (EIRP=51 dBm/100 MHz, TRP=32.5 dBm/100MHz) 100 MHz channel is placed at 3860-3960 MHz with a frequency separation of 60 MHz, with a MP AAS BS out of band emissions level of -70.5 dBc/100 MHz (32.5-70.5=-38 dBm/100 MHz=-58 dBm/MHz TRP), 1-H uplink throughput loss is 8.6%.

# Simulation results of interference from 5G MFCN BS to WBB LMP BS

## Urban/Suburban area Simulation results

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB LMP BS 100 MHz channel is placed at 3800-3900 MHz. The propagation model for the link BS to BS is ITU-R P.1546 Urban. The simulation results are given in Table 22

Table 22: Simulation results for LP BS (3800-3900 MHz) in Urban/suburban Area (D=100m)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LMP BS type & antenna | LMP BS blocking (dBc) | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | LP non-AAS BS UL TP Loss (%) |
| LP non-AAS BS  12 dBi Hbs=10m (0° downtilt) |  | -68.2 | -74.4 | 87.342% |
| LA non-AAS BS  12 dBi Hbs=20m(-6° downtilt) |  | -68.1 | -74.3 | 85.329% |

The simulation results for LP non-AAS BS in 3900-4000 MHz in urban area are given in Table 23.

Table 23: Simulation results for LP non-AAS BS (3900-4000 MHz) in Urban/suburban Area (D=100m)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LMP BS type & antenna | LMP BS blocking (dBc) below 3800 MHz | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | LP non-AAS BS UL TP Loss (%) |
| LP non-AAS BS  12 dBi Hbs=10m (0° downtilt) |  | -92.4 | -74.5 | 80.062% |
| LA non-AAS BS  12 dBi Hbs=20m(-6° downtilt) |  | -86.8 | -74.5 | 86.978% |
| LP non-AAS BS  12 dBi Hbs=10m (0° downtilt) | 61.3 (-15 dBm) | -92.4 | -92.2 | 36.078% |
| LA non-AAS BS  12 dBi Hbs=20m(-6° downtilt) | 61.3 (-15 dBm) | -86.9 | -92.1 | 64.878% |

The simulation results for WBB MP AAS BS in 3900-4000 MHz in urban area are given in Table 24.

Table 24: Simulation results for MP AAS BS (3900-4000 MHz) in Urban/suburban Area (D=100m)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LMP BS type & antenna |  | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | MP AAS BS UL TP Loss (%) |
| MP AAS(4x4) BS  Hbs=10m (0° downtilt) |  | -90.7 | -71.1 | 88.663% |
| MP AAS(4x4) BS Hbs=20m(-6° downtilt) |  | -87.0 | -70.0 | 88.731% |

The simulation results in Table 22, 23, and 24 show that WBB LMP non-AAS and AAS suffer a lot of interference from the high power Macrocell 5G MFCN BS. An enhanced WBB LMP BS receiver blocking performance below 3800 MHz allow to reduce the interference from 5G MFCN BS, but it is not sufficient, since the interference from 5G MFCN BS out of band emissions is still a problem.

## Rural Area simulation results

5G MFCN Macrocell BS 100 MHz channel is placed at 3700-3800 MHz, WBB LMP BS 100 MHz channel is placed at 3900-4000 MHz. The propagation model for the link BS to BS is ITU-R P.452. For WBB LMP BS antenna heights from 25m, cell range is 1 km and antenna downtilt -3° are used. For the case WBB LMP Hbs=10, cell range was 500m and antenna downtilt =0°.

The simulation results are given in Table 25.

Table 25: Simulation results for WBB MP non-AAS and AAS BS in Rural Area (D=100m)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| BS type & antenna | LMP BS blocking (dBc) |  | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | WBB MP BS UL TP Loss (%) |
| MP non-AAS (16 dBi) BS Hbs=10m  (R=500m) |  |  | -83.4 | -65.4 | 92.422% |
| MP non-AAS (16 dBi) BS Hbs=25m  (R=1000 m) |  |  | -74.2 | -56.2 | 95.53% |
| MP AAS 4x4BS Hbs=10m  (R=500km) |  |  | -91.1 | -69.1 | 89.652% |
| MP AAS (4x4) BS Hbs=25m  (R=1km) |  |  | -85 | -65 | 91.131% |

The simulation results in Table 25 show that WBB MP non-AAS and AAS suffer a lot of interference from the high power Macrocell 5G MFCN BS when they are deployed close to each other.

# Simulation results of interference from WBB LMP UL to 5G MFCN BS

## WBB LMP Mobile/Nomadic terminals

The 5G MFCN Macrocell BS (Hbs=25m) 100 MHz channel is placed at 3700-3800 MHz in sub-urban area with Hbs=25m and cell range=1 km, WBB LMP smallcell BS 100 MHz channel is placed at 3800-3900 MHz(Hbs=10 m, Cell range=250m).

Simulation results are given in Table 26 (D=100m), where D is the BS to BS separation distance.

Table 26: 5G MFCN Macrocell BS UL throughput loss caused by WBB LMP UL UE emissions(D=100m)

|  |  |  |  |
| --- | --- | --- | --- |
| UE Tx | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 5G MFCN UL TP Loss (%) |
| 23 dBm with PC at 1.5m  Gain=0 dBi | -139.7 | -162.5 | 2.619% |
| 28 dBm with PC at 1.5m  Gain=0 dBi | -134.8 | -157.6 | 4.311% |

The simulation results in Table 26 show that up to 28 dBm EIRP, the 5G BS uplink throughput loss is below 5%.

## WBB LMP FWA Terminals

The 5G MFCN Macrocell BS (Hbs=25m) 100 MHz channel is placed at 3700-3800 MHz in sub-urban area with Hbs=25m and cell range=1 km, WBB LMP smallcell BS 100 MHz channel is placed at 3800-3900 MHz (Hbs=10 m, Cell range=250m).

FWA terminal UE antenna height from 1.5m to 10m.

Simulation results are given in Table 27.

Table 27: 5G MFCN Macrocell BS UL throughput loss caused by WBB LMP UL UE emissions (D=100m)

|  |  |  |  |
| --- | --- | --- | --- |
| UE Tx parameter | iRSS\_unwanted (dBm) | iRSS\_blocking (dBm) | 5G MFCN UL TP Loss (%) |
| EIRP=28 dBm  28 dBm with PC at 1.5m  antenna gain=0 dBi  Outdoor | -134.7 | -157.6 | 4.213% |
| EIRP=28 dBm  28 dBm with PC at 10 m  antenna gain=0 dBi  Outdoor | -132.2 | -155 | 4.482% |
| EIRP=28 dBm  28 dBm without PC at 10 m  antenna gain=0 dBi  Outdoor | -116.6 | -139.4 | 21.29% |
| EIRP=28 dBm  28 dBm without PC at 10 m  antenna gain=10 dBi  Outdoor | -106.5 | -129.3 | 38.701% |
| EIRP=28 dBm  28 dBm without PC at 10 m  antenna gain=20 dBi  Body loss=0 dB  Outdoor | -96.7 | -119.5 | 58.31 |

The simulation results in Table 24 show that for the most favourable case of the WBB LMP BS to placed at a position very close to the 5G MFCN BS at 100m separation distance, the FWA terminal EIRP should not go above 28 dBm. The simulation results show also the Power Control is essential to minimize the interference from WBB LMP UL to 5G MFCN.

# Summary and Conclusions

This study provides simulation results of interference from WBB LMP BS to 5G MFCN BS and of interference from 5G MFCN to WBB LMP. In the simulation, both 1-O and 1-H 5G MFCN base station out of band blocking levels are considered. The microcellular 5G MFCN network is modelled with a cluster of 19 tri-sector sites (57 cells), the victim 5G MFCN BS is placed in the centre of this network cluster, in this way the intra-network intercell interference is taken into account in the 5G MFCN uplink throughput loss. 100 m separation distance between the 5G MFCN reference cell base station and LMP base station was used in the simulations.

WBB low power non-AAS BS with an EIRP of 31 dBm/100 MHz with an antenna gain of 12 dBi is considered. Two types of WBB medium power base stations are considered: 1) Non-AAS BS with transmit power of 49 dBm/100 MHz EIRP and 51 dBm/100 MHz EIRP with an antenna gain of 16 dBi; 2) AAS BS with 4x4 AAS antenna configuration (antenna gain 18.5 dBi), the AAS BS transmit power of 49 dBm/100 MHz EIRP (30.5 dBm/100 MHz TRP) and 51 dBm/100 MHz EIRP (32.5 dBm/100 MHz TRP).

Based on the simulation results, the following conclusions can be made:

1. The regulatory technical conditions for WBB LP BS in 3800-4200 MHz in unsynchronized operation with 5G MFCN below 3800 MHz

|  |  |  |
| --- | --- | --- |
|  | Maximum In-band Power Limit and antenna height | Additional Baseline OOBE below 3800 MHz per cell |
| Low Power Non-AAS BS | 31 dBm/100 MHz (EIRP per cell)  Antenna height <= 10m | -45 dBm/MHz conducted |

1. The regulatory technical conditions for WBB MP BS in 3860-4200 MHz in unsynchronized operation with 5G MFCN below 3800 MHz

|  |  |  |
| --- | --- | --- |
|  | Maximum In-band Power Limit and antenna height | Additional Baseline OOBE below 3800 MHz per cell |
| Medium Power Non-AAS BS | 51 dBm/100 MHz (EIRP per cell) | -45 dBm/MHz conducted |
| Medium Power AAS BS | 51 dBm/100 MHz (EIRP per cell)  (33 dBm/100 MHz TRP per cell) | -45 dBm/MHz TRP |

The simulation results show that for Medium Power AAS BS operating in 3860-4200 MHz, an OOBE of -35 dBm/MHz TRP can provide a sufficient protection, but in Rural Area with large cell size of 5G MFCN network, an OOBE of WBB MR AAS BS should be -54 dBm/MHz TRP.

1. The regulatory technical conditions for WBB LMP BS in 3800-4200 MHz in synchronized operation or semi-synchronized operation with 5G MFCN below 3800 MHz

|  |  |  |
| --- | --- | --- |
|  | Maximum In-band Power Limit | Additional Baseline OOBE below 3800 MHz |
| Non-AAS BS | 51 dBm/100 MHz (EIRP per cell) | -25 dBm/MHz conducted per cell below 3800 MHz |
| AAS BS | 51 dBm/100 MHz (EIRP per cell)  (33 dBm/100 MHz TRP per cell) | -23 dBm/MHz TRP per cell below 3800 MHz |

1. The regulatory technical conditions for WBB LMP terminals in 3800-4200 MHz in synchronized operation or semi-synchronized operation with 5G MFCN below 3800 MHz

|  |  |  |
| --- | --- | --- |
|  | Maximum In-band Power Limit | Power control |
| All type terminals including Mobile, Nomadic, IoT, Machine, FWA | 28 dBm EIRP | Obligatory |

1. When the WBB LMP BS and 5G MFCN smallcell BS are deployed in the same street in outdoor area or in the same indoor area, synchronization or other coordination measures are required.