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| **Radiocommunication Study Groups** |  |
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| Received: 29 August 2022  Subject: WRC-23 agenda item 1.5 | **Document 6-1/121-E** |
| **30 August 2022** |
| **English only** |
| Saudi Arabia (Kingdom of), Egypt (Arab Republic of), United Arab Emirates | |
| Proposed amendments to the working document  on sharing and compatibility studies in task group 6/1  for WRC-23 Agenda item 1.5 | |
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# 1 Introduction

Task Group 6/1 (TG 6/1) established an informative Correspondence Group (CG) in accordance with § 1.3.2.9 and § 1.3.2.10 of Resolution ITU-R [1-8](https://www.itu.int/pub/R-RES-R.1-8-2019), to address the open questions on the compatibility and sharing studies. Multiple administrations presented their serious concerns regarding the CG activities and the results submitted, which did not take into consideration several documents and contributions, and simply noted them without taking appropriate action in their regard. Some of the concerns regarding the activities of this CG are as follows:

• In accordance with the Chairman Report of the fourth TG 6/1 meeting (Document [6‑1/106](https://www.itu.int/md/R19-TG6.1-C-0106/en)) there were strong objections by multi Administrations in the TG 6/1 meeting to the establishment of this intersessional correspondence group considering objections to discuss any CPM text in the informative correspondence activity.

• Despite these strong objections, some of the administrations submitted input contributions to balance the results from the new studies submitted to the CG and to progress the work in order to reach consensus. Although the CG agreed to consider these input contributions in the meeting dated 4th July 2022, the Convener of the CG decided to just note several input contributions from ASMG Administrations without taking appropriate actions and without proper justification.

• Convener of the CG did not follow the Terms of Reference (ToR) (Annex 4 to Document 6-1/106) in terms of the time given to address all input contributions in a fair and balanced manner. He decided to end discussions in early July 2022 without proper justifications, rather than considering time allocated till late August (as stipulated in the ToR “…at least two weeks before the start of the fifth meeting.” of TG 6/1 in September 2022).

• The ToR of this CG was also not followed since new studies were introduced, rather than addressing the open issues and align on the summary of the studies. However, CG Convener did not consider similar studies submitted by ASMG administrations after his ruling to consider new studies.

• During the last meeting of the CG, the CG Convener refused to take proper actions for **selected** contributions (similar to other contributions), and instead proceeded to conclude the CG, even though the deadline to consider contributions and modifications to the CG was still more than a month ahead.

# 2 Proposal

In accordance with the above, the Co-signing Administrations object to the consideration of the outcomes of the informal CG which did not consider all inputs in a fair and balanced manner. Accordingly, the following contributions were submitted by the aforementioned administrations, for re-evaluation of certain sharing and compatibility studies in the frequency band 470-694 MHz in Region 1, which were submitted to the CG as well, but were not properly addressed.

|  |  |  |
| --- | --- | --- |
| Attachment # | Reference in CG |  |
| 1 | 6-1/CGShaComp/28 | Questions and comments on sharing studies in TG 6/1 for WRC-23 agenda item 1.5 |
| 2 | 6-1/CGShaComp/29 | Re-evaluation of sharing studies in TG 6/1 for WRC-23 agenda item 1.5 |
| 3 | 6-1/CGShaComp/30 | Proposed modifications to the overall summary of the sharing studies in TG 6/1 for WRC-23 agenda item 1.5 |
| 4 | 6-1/CGShaComp/32 | Re-evaluation of sharing studies in TG 6/1 for WRC-23 agenda item 1.5 |

**Attachments:** 4

ATTACHMENT 1

*Considerations from Document 6-1/CGShaComp/28*

#### 3.1.2.3 New study 2 - Interference from IMT user equipment to broadcasting receiver in co-channel

*{Editor’s note: Source Document 6-1/CGShaComp/1}*

Coordination of an assignment to a receiving station of the mobile service is addressed by the GE06 Agreement. Yet, at a national level, administrations may wish to conduct further detailed analysis to evaluate possible interference to the broadcasting service from IMT user equipment (UE).

This study calculates the necessary distance between an IMT UE and a roof top antenna to protect DTTB reception against IMT UE co-channel interference.

Table 3.1.2.2-1

Distance between stations to protect DTTB fixed rooftop reception from   
IMT UE co-channel interference (*I/N*=-10 dB)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | rooft top DTTB receiver interfered with by an LTE UE (w/o Rx ant discr) | rooft top DTTB receiver interfered with by an LTE UE (w/ Rx ant discr) |  |
| F | receiver noise figure | 6 | 6 | dB |
| k | Boltzmann's constant | 1.38E-23 | 1.38E-23 | J/K |
| T0 | absolute temperature | 290 | 290 | K |
| B | receiver noise bandwidth | 7.77E+06 | 7.77E+06 | Hz |
| Pn | receiver noise input power | -129.1 | -129.1 | dBW |
| I/N | protection criterion as per Rec. ITU-R BT.1895 | -10 | -10 | dB |
| Ps max | maximum unwanted receiver input power | -139.07 | -139.07 | dBW |
|  |  |  |  |  |
| f | frequency | 6.50E+08 | 6.50E+08 | Hz |
| c | light speed | 3.00E+08 | 3.00E+08 | m/s |
|  | wavelength | 0.46 | 0.46 | m |
| G | antenna gain related to half dipole | 11.1 | 11.1 | dBd |
| Aa | effective antenna aperture | -4.46 | -4.46 | dB m2 |
| max | maximum unwanted power flux-density at receiving place | -130.51 | -130.51 | dB(W/m2) |
| Emax unw 10 m | maximum unwanted field strength at the location of the receiving antenna | 15.3 | 15.3 | dB(μV/m) |
| Lf | feeder loss | 4.1 | 4.1 | dB |
| Gequiv | Giso - Lf | 9.2 | 9.2 | dBi |
| D | antenna discrimination (Rec. ITU-R BT.419) | 0(1) | 16(2) | dB |
| Hrx | DTTB Rx antenna height | 10 | 10 | m |
| Htx | UE antenna height | 1.5 | 1.5 | m |
| EIRP | UE EIRP | 23 | 23 | dBm |
| Lbody | body loss | 4 | 4 | dB |
| EIRPequiv | UE EIRP - body loss | 19 | 19 | dBm |
|  | percentage of time | 50 | 50 | % |
| Lpath | path loss | 137.2 | 121.2 | dB |
| **d** | **Distance between stations calculated with Rec. ITU-R P.1546-6** | **5.4** | **2.5** | **km** |
| 1. No antenna discrimination. LTE UE is located between DTTB Tx and Rx (vertical elevation angle between DTTB Rx and LTE UE antennas is about 0.09° at 5.4 km separation distance)  2. Full (maximum) antenna discrimination. LTE UE is located behind the DTTB Rx antenna | | | | |

The table above shows that a distance of several kilometres is necessary to protect a DTTB rooftop antenna from possible co-channel interference by an IMT UE.

Table 2 of Report ITU-R M.2292 mentions that the IMT cell radius is around 8 km in a rural scenario. Hence, to protect DTTB receivers, it might be necessary to prevent LTE base stations rollout closer than 13.5 km to a DTTB service area (. This distance may be appropriate when DTTB and LTE uplink are operating on a shared channel.

Study 3.1.2.3 Questions and Comments

This study is missing many critical aspects and parameters and should be re-evaluated to ascertain its accuracy.

• The study does not mention the methodology used, however it is assumed to be MCL, as it is describing interference from an (single) IMT UE to a broadcasting DTTB receiver. What is it?

• The study mentions 50% time percentage, is this for the IMT system or for the interference from IMT to broadcasting? 50% is not the recommended value of time percentage for interference into broadcasting.

• What is the percentage of indoor/outdoor IMT UEs?

• No mention of activity factor or average UE Tx power, or aggregate interference?

• No description of geometry, clutter, deployment scenario, etc.

ATTACHMENT 2

*[Considerations from Document 6-1/CGShaComp/29 (New Study 12)]*

# 1 Introduction

This contribution provides a sharing and compatibility study between IMT user equipment and broadcasting receivers within the frequency band 470-694 MHz in Region 1. This study considered the parameters of Study 3.1.2.3 as submitted in the CG as revisions to the TG 6/1 Chairman’s Report. The study analyses the possibility of interference from IMT UEs to broadcasting receivers. This study calculates the necessary distance between an IMT UE and a roof top antenna to protect DTTB reception against IMT UE co-channel interference.

# 2 Parameters and Deployment

The study is conducted using the recommended propagation model ITU-R P.1546-6. The deployment scenario is to protect DTTB fixed rooftop reception from IMT UE co-channel interference in an urban setting. Monte Carlo simulations were conducted to evaluate interference probability using the given parameters.

|  |  |  |
| --- | --- | --- |
| New Study 12 | Parameter | Value |
| **IMT UE Tx** | EIRP (dBm) | 19 |
| Height (m) | 1.5 |
| Body Loss (dB) | 4 |
| Indoor Percentage | 70 |
| Typical Gain (dBi) | -3 |
| Percentage Time (%) | 50 |
| **Broadcasting Rx** | Antenna Gain (Rx) (dBi) | 9.15 |
| Antenna Height (Rx) (m) | 10 |
| Antenna Pattern (Rx) | ITU-R BT.419-3 |
| Noise Figure (Rx) (dB) | 6 |
| Bandwidth (MHz) | 7.77 |
| *I/N* (dB) | -10 |

# 3 Results

The below results were obtained by re-conducting the study using the available parameters and assumptions from TG 6/1 parameter tables. Monte Carlo methodology was used, and 9 UE’s per IMT sector, with 21 sectors (single tier IMT system). Full discrimination between the systems is considered. The protection distance was calculated as below:

|  |  |
| --- | --- |
| Probability of interference from 10 MHz IMT UL UE's into 8 MHz DTTB reception;  IMT BS-DTTB co-channel – 9 UE's per BS Sector - Single Tier System | |
| Minimum separation distance | Probability of Interference |
| (m) |
| 10 | 6.10% |
| 100 | 4.40% |
| 200 | 3.00% |
| 300 | 1.20% |

As can be seen from the above Monte Carlo study results using the same parameters as found in Study 3.1.2.3 in the TG 6/1 Chairman’s Report, the protection distances from IMT UE’s to DTTB receivers is in the range of few hundred meters.

ATTACHMENT 3

*[Considerations from Document 6-1/CGShaComp/30]*

# 5 Overall summary regarding the sharing studies done for WRC-23 agenda item 1.5

[Editor’s note: subject to revision, based on additional information and studies supplied to TG 6/1.]

[Editor’s note: Reconsideration of the following text may be needed in order to reflect the views of those participants that may not support the overall summary.]

Editor’s note: Careful reconsideration of the following text would be needed in the following meetings to ensure that studies conducted by one party based on their view of their relevance to the WRC‑23 agenda item 1.5 scope are reflecting these studies results and not as a conclusion from the TG 6/1.]

## 5.1 Overall summary regarding Broadcasting and Mobile services where studies of applications are available

[Ed. Note: Move this first paragraph between brackets to the end of this section] [A sharing and compatibility study showed that co-channel operation of DTTB transmitter and IMT uplink receiver may require separation distances around 100‑300 km which may vary widely in the real world. Other studies indicated that the separation distance co-channel operation of DTTB transmitters and IMT base station receivers can be significantly lower of around 30 km, depending on the deployment cases. These studies also indicated that adjacent channel operation between DTTB transmitter and IMT receivers could be possible with minimal separation distance, in the range of tens of meters. Due to the different views presented on whether or not this scenario of incumbent interference to new service is within the scope of WRC-23 agenda item (AI) 1.5, other studies were not submitted, which may have different results, and accordingly the results could not be validated.]

The results of the studies on the impact from IMT base station to DTTB reception in co-channel varies significantly based on the assumptions considered in the studies. The results of some studies showed distances between IMT base stations and DTTB receivers can be up to few tens of kilometres. The results of other studies using baseline parameters showed that the separation distance range from few km up to few tens of kilometres. Some other studies showed that the separation distance between IMT networks and DTTB receivers can be as low as a few km, depending on the interference criterion considered, indicating the possibility of co-existence between the systems. The implementation of mitigation measures would reduce the distances between IMT base stations and DTTB receivers.

Mitigation measures (e.g. e.i.r.p. reduction, antenna tilting and orientation) may help reducing the separation distance. Also, this interference might be further reduced by taking advantage of situations such as favourable terrain, large unpopulated areas, cross-border coordination and regional harmonisation of the band.

Indoor DTT reception is possible , but this is an unprotected mode in relevant countries.

Bilateral coordination is also a possible option to further eliminate potential interference, if any.

A non-IMT trunked ad hoc Mobile system can, as necessary, change its operating channel, and may therefore operate inside a DTTB service area by avoiding the DTTB channels used in that area, subject to cross border coordination where relevant (a study showed that co-channel separation distances with DTTB transmitters and receivers are in the order of some tens of kilometres).

The results of compatibility studies for adjacent channel situations showed that interference distances can be limited generally to hundreds of meters for IMT and to some tens of meters for trunked ad hoc. In addition, mitigation measures such as ACLR improvement may be defined on national and/or regional basis.

In these adjacent channel situations, other mitigation approaches may include the following:

- Consider guard band and/or filters, as appropriate.

- Other technical mitigation measures including providing suitable filters for the DTTB receiving installations[[1]](#footnote-1).

ATTACHMENT 4

*[Considerations from Document 6-1/CGShaComp/32 (New Study 13 & New Study 14)]*

# 1 Introduction

Monte Carlo simulations were conducted on Studies 3.1.1.2 and 3.1.1.4 to show the impact from IMT systems into DTTB. This contribution provides a sharing and compatibility study between IMT base station equipment and broadcasting receivers within the frequency band 470-694 MHz in Region 1. This study considered the parameters of Studies 3.1.1.2 for adjacent channel interference and 3.1.1.4 for co-channel interference, as submitted in the TG 6/1 Chairman’s Report.

# 2 Parameters and Deployment

The original parameters used in the studies are provided in the table below. Some of the parameters are modified with the following adjustments:

- A rural DTTB receiver is interfered with by 19 urban cell sites (two tiers), with 50% and 20% network activity factor.

- IMT cell radius is changed from 0.75 km to 0.5 km.

- Recommendation ITU-R P.1546-6 is used for both wanted and unwanted level prediction

- Unwanted (DTTB) level is predicted using 1.75% of time.

- Location probability of 50% is considered for IMT system.

- 10 MHz IMT bandwidth is used.

- Feeder losses of 3 dB were considered as per Table 2 in Report ITU-R M.2292-0.

- -6 dB protection criteria for IMT-advanced is considered as per Table 5 in Report ITU‑R M.2292-0.

| Parameters | | Study 3.1.1.2 | Study 3.1.1.4 |
| --- | --- | --- | --- |
|  | | Adjacent | Co-channel |
| IMT BS | Centre Frequency | 662 | 650 |
| Antenna Height | 30 m | 30 m |
| BS EIRP | 58 | 58 |
| Down tilt | 3 dB | 3 dB |
| IMT base station Tx VRP | -1 dB | |
| Cell Radius (Urban/suburban macro) | 0.5 km | |
| Channel BW | 10 MHz | 10 MHz |
| 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 beam width: 65 degrees  Vertical 3 dB beam width: determined from the horizontal beam width by equations in Recommendation ITU-R F.1336. Vertical beam widths of actual antennas may also be used when available. | |
| DTTB parameters | Centre Frequency | 650 | 650 |
| Channel BW | 7.77 MHz | 7.77 MHz |
| Noise Figure | 6 dB | 6 dB |
| DTTB gain | 9.15 dBi | 9.15 dBi |
| Effective Antenna Height | 300 m | 300 m |
| HTHP EIRP | 85.15 dBm | 85.15 dBm |
| Protection criterion | | I/N = -6 | I/N = -10 |
| Type of study (Tool) | | SEAMCAT (Monte Carlo) & MCL | SEAMCAT (Monte Carlo) |
| Propagation prediction information | Propagation Prediction method | Extended Hata | P.1546-6 |
| Percentage of time | 1%, 5%, 10% and 50% time | 1.75% for multiple interferer |
| Percentage of locations | 50 % | Uniform distribution 1-99% |
| Path type | Land | |
| Configuration of interfering source(s) | | 7 tri-sectorized Base Stations | 19 tri-sectorized Base Stations |
| Loading Factor / Network Activity | | 50% and 20% | 50% and 20% |

# 3 Results

Using the parameters defined previously and reference to Studies 3.1.1.2 and 3.1.1.4 in Annex 3 to Task Group 6/1 Chairman’s Report, it should be noted that:

- Distance of 15 km is required for co-channel scenario with 50% activity factor.

- Distance of 12 km is required for co-channel scenario with 20% activity factor.

- Distance of 100 m is required for adjacent scenario with 50% activity factor.

- Distance of 30 m is required for adjacent scenario with 20% activity factor.

The updated study in this report re-simulates Studies 3.1.1.2 and 3.1.1.4 in Annex 3 to TG 6/1 Chairman’s Report using modified parameters that are in line with ITU-R Working Party 5D ”Characteristics of terrestrial components of IMT for sharing and compatibility studies in preparation for WRC-23 agenda item 1.5”. Results showed distance of 15 km for co-channel scenario while considering full DTTB coverage interfered by IMT BS with 50% activity factor. Results showed distance of tens of meters for adjacent channel scenario.

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1. For example, band-reject filters may be required. [↑](#footnote-ref-1)