

Source: Document 4-5-6-7/TEMP/161

**Annex 24 to
Document 4-5-6-7/715-E
22 August 2014
English only**

Annex 24 to Joint Task Group 4-5-6-7 Chairman's Report

PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R BT.[DVBTPROT700]

Assessment of the protection of DTTB reception considering the cumulative interference from IMT base stations for application in the GE06 area

Scope

This Recommendation describes the method for assessing changes of interference at any reference point on the territory of one administration in the GE06 Planning Area when neighbouring administration intends to deploy IMT networks in frequency band 694-790 MHz instead of its GE06 Plan entries. It is aimed to assist administrations in the GE06 Planning Area in cross-border coordination of IMT networks.

The ITU Radiocommunication Assembly,

considering

- a)* that the WRC-12 resolved to allocate the band 694-790 MHz for the mobile, except aeronautical mobile service through Resolution **232 (WRC-12)** and subject to its provisions;
- b)* that some administrations in the GE06 Planning Area may continue developing and evolving digital terrestrial television broadcasting in the frequency band 694-790 MHz while neighbouring administrations may decide to deploy IMT networks instead of its digital entries in GE06 Plan in this band;
- c)* that digital entries in GE06 Plan, based on No. **5.1.3** of the GE06 Agreement¹, may be used with different characteristics for transmissions in other primary terrestrial services provided that they do not cause more interference nor claim more protection than the original plan entries;
- d)* that it would be appropriate if the abovementioned provision and its conditions could be taken into account in the border coordination of IMT base stations along with their cumulative interferences,

¹ Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (GE06 Agreement).

recommends

- 1 that the method provided in Annex 1 may be used by administrations involved in coordination of IMT networks;
- 2 that reference and changed interferences (I_{ref} and I_{comp}) at reference points should be calculated as per Annex 2.

ANNEX 1

Method for assessing changes of interference on reference points

The following steps are to assess the changes of interference levels on reference points when one administration in GE06 Planning area intends to deploy IMT networks in 694-790 MHz frequency band instead of its GE06 digital entries while another affected administration intends to continue deploying and evolving its digital broadcasting networks in this frequency band. The method for calculation of I_{ref} and I_{comp} is presented in Annex 2.

- 1 Calculate the reference interference level (I_{ref}) from GE06 entries of the IMT country(ies);
- 2 Calculate the changed interference level (I_{comp}); this time with GE06 entries being replaced by proposed IMT base stations;
- 3 If $I_{comp} \leq I_{ref}$, then cumulative interference from IMT base stations does not exceed the reference interference level established in the GE06 Plan.

ANNEX 2

Method for the calculation of I_{ref} and I_{comp}

General

The calculation of I_{ref} and I_{comp} is carried out in four steps:

- 1) Determine which reference points are within (*IN*) and which of them are outside (*OUT*) the coverage of GE06 entries of a likely affected² administration;
- 2) Calculate/establish the reference interference level (I_{ref}) for each reference point;
- 3) Calculate the changed interference level (I_{comp}) for each reference point;
- 4) Compare I_{comp} with I_{ref} on each reference point and conclude whether the cumulative interference from IMT base stations exceeds ($I_{comp} > I_{ref}$) the reference interference level established in GE06 Plan or not ($I_{comp} \leq I_{ref}$).

The following definitions have been made for describing this method:

- MS** Designation of the administration in GE06 Planning area wishing to deploy IMT networks in the frequency band 694-790 MHz instead of it GE06 entries
- MS_{IMT}** Set of IMT base stations transmitters proposed by “MS” is specified as $MS = \{TX_{MS_IMT}^i, i=1, \dots, L\}$. The frequency range of these transmitters is F_{IMT_min} and F_{IMT_max}
- MS_{GE06D}** Set of GE06 or bilaterally coordinated digital plan entries of “MS” on those TV channels overlapped with F_{IMT_min} and F_{IMT_max} is specified as $MS_{GE06D} = \{TX_{MS_GE06D}^j, j=1, \dots, M\}$
- BS** Designation of an administration in the GE06 Planning area wishing to maintain GE06 DTT usage in the frequency band 694-790 MHz
- BS_{GE06D}** Set of GE06 or bilaterally coordinated digital entries of “BS” on those TV channels overlapped with F_{IMT_min} and F_{IMT_max} is specified as $BS_{GE06D} = \{TX_{BS_GE06D}^k, k=1, \dots, Q\}$
- RP** Set of reference points located in the territory of “BS” is specified as $RP = \{RP^t, t=1, \dots, N\}$
- CH** Set of UHF TV channels overlapped with F_{IMT_min} and F_{IMT_max} is specified as $CH = \{CH^s, s=1, \dots, P\}$

Categorizing the reference points as “IN” or “OUT”

This initial categorizing (*IN* or *OUT*) of reference points (RP^t) may be required in I_{ref} and I_{comp} calculations in order to determine whether the DTT receiver antenna polarization and directivity discrimination to be taken into account (i.e. considered reference point is actually served by an identified DTT transmitter) or not (i.e. reference point belonging to an allotment without a specific transmitter or outside the coverage of any DTT transmitter). Alternatively, concerned administrations may bi-laterally agree whether to use the antenna directivity and polarization discrimination at a given RP^t or not. In this case, this initial categorization would not be needed.

² Likely affected administration is the administration which intends to protect its territory from IMT base stations at the level currently established in GE06 Plan.

One method of such categorization of RP^f is presented below.

Any reference point (RP^f) in any given channel (CH^s) is assumed to be located within (IN) the coverage of a GE06 plan entry (BS_{GE06D}) of administration “BS” if

- a) the reference point is located within the boundary of an allotment, or
- b) the following equation is true for that reference point:

$$E_w \geq E_u \geq E_{min} \quad (1)$$

where

- E_w Median field strength (dB(μ V/m)) of $TX^k_{BS_{GE06D}}$ providing wanted service at the given reference point;
- E_u Usable field strength (dB μ V/m) calculated at the given reference point taking into account of digital plan entries in GE06 Plan;
- E_{min} Minimum median field strength (dB(μ V/m)) in respect with $TX^k_{BS_{GE06D}}$ providing wanted service at the given reference point.

Note: All above field strength values shall be calculated as per the methods described in GE06 Agreement1. The exception is the time percentage in calculation of nuisance field strength (i.e. the part of calculation of usable field strength) which is 1.7% instead of 1%.

The result of above exercise shall categorize each reference point in the following hierarchy:
in what TV channel (CH^s)

what reference point (RP^f)

- is located within (IN) the coverage of specific MFN DTT station ($TX^k_{BS_{GE06D}}$), or
- is located within (IN) the coverage of the best server of specific SFN network ($TX^k_{BS_{GE06D}}$), or
- located within (IN) the boundary of an allotment ($TX^k_{BS_{GE06D}}$), or
- located outside (OUT) of any GE06 plan entry of the administration “BS”.

Calculation of the reference interference level, I_{ref}

The reference cumulative interference level, I_{ref} from MS_{GE06D} is established at each reference point (RP^f) separately in each TV channel (CH^s) as:

$$I_{ref} = 10 \log \left(\sum_{j=1}^M 10^{\frac{I^j}{10}} \right) \quad (2)$$

where:

- I^j interference level (in dBm) from j-th co-channel GE06 digital entry of administration “MS”, $TX^j_{MS_{GE06D}}$

I^j is defined (in dBm) as:

$$I^j = E_{INT} - 20 \log f - 75.05 + G_{RX} - D_{DIR} - D_{POL} - F_L \quad (3)$$

where:

- E_{INT} field strength (dB(μ V/m)) of $TX^j_{MS_GE06D}$ at the reference point RP^f calculated at 10 m height for 1.7% time and 50% location;
- G_{RX} Broadcast receiver's maximum antenna gain (dBd). Typical values are 12 dBd for fixed reception; 0 dBd for portable and mobile reception;
- D_{DIR} broadcast receiver antenna directivity discrimination ($D_{DIR} \geq 0$ dB) with respect to j-th interfering $TX^j_{MS_GE06D}$ and k-th wanted $TX^k_{BS_GE06D}$ defined for the reference point RP^f in the given TV channel (CH^s). $D_{DIR} = 0$ dB if the reference point was categorized as "OUT" or as "IN" but within the boundary of an allotment in the given channel (CH^s);
- D_{POL} Broadcast receiver polarization discrimination ($D_{POL} \geq 0$ dB) with respect to j-th interfering $TX^j_{MS_GE06D}$ and k-th wanted $TX^k_{BS_GE06D}$ defined for the reference point RP^f in the given TV channel (CH^s). Value of D_{POL} for "OUT" reference points should be agreed by concerned administrations;
- F_L Feeder Loss of the broadcast receiving installation (dB). Typical values are 5 dB for fixed reception; 0 dB for portable and mobile reception;
- f assigned frequency (MHz) of j-th interfering $TX^j_{MS_GE06D}$.

Note: in calculation of E_{int} , the allotments or allotments with linked assignments shall be modelled as described in GE06 Agreement1

Calculation of the changed interference level, I_{comp}

The changed cumulative interference level, I_{comp} from MS_{IMT} is established at each reference point (RP^f) separately in each TV channel (CH^s) as:

$$I_{comp} = 10 \log \left(\sum_{i=1}^L 10^{\frac{I^i}{10}} \right) \quad (4)$$

where:

- I^i interference level (in dBm) of i-th IMT base station of administration "MS", $TX^i_{MS_IMT}$ using an overlapping channel with the considered TV channel (CH^s).

I^i is defined (in dBm) as:

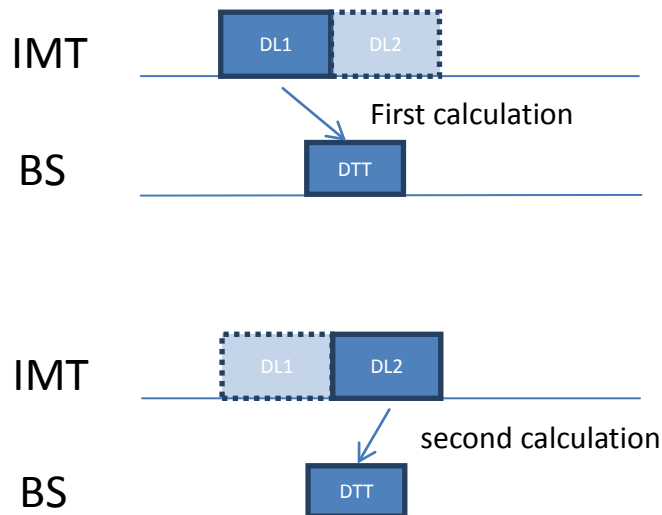
$$I^i = E_{INT} - 20 \log f - 75.05 + G_{RX} - D_{DIR} - D_{POL} - F_L + PR(\Delta f) - PR(0) \quad (5)$$

where:

- E_{INT} field strength (dB(μ V/m)) of $TX^j_{MS_IMT}$ at the reference point RP^f calculated at 10 m height for 1.7% time and 50% location;
- G_{RX} Broadcast receiver's maximum antenna gain (dBd). Typical values are 12 dBd for fixed reception; 0 dBd for portable and mobile reception;
- D_{DIR} broadcast receiver antenna directivity discrimination ($D_{DIR} \geq 0$ dB) with respect to i-th interfering $TX^j_{MS_IMT}$ and k-th wanted $TX^k_{BS_GE06D}$ defined for the reference point RP^f in the given TV channel (CH^s). $D_{DIR} = 0$ dB if the reference point was categorized as "OUT" or as "IN" but within the boundary of an allotment in the given channel (CH^s);

- D_{POL} Broadcast receiver polarization discrimination ($D_{POL} \geq 0$ dB) with respect to i-th interfering $\mathbf{TX}_{MS_IMT}^i$ and k-th wanted $\mathbf{TX}_{BS_GE06D}^k$ defined for the reference point \mathbf{RP}^i in the given TV channel (\mathbf{CH}^i). Value of D_{POL} for “OUT” reference points should be agreed by concerned administrations;
- F_L Feeder loss of the broadcast receiving installation (dB). Typical values are 5 dB for fixed reception; 0 dB for portable and mobile reception;
- f centre frequency (MHz) of i-th interfering $\mathbf{TX}_{MS_IMT}^i$;
- $PR(\Delta f)$ is the protection ratio³ (dB) for wanted $\mathbf{TX}_{BS_GE06D}^k$ interfered with by j-th interfering $\mathbf{TX}_{MS_GE06D}^j$ with a frequency offset of Δf ;
- $PR(0)$ co-channel protection ratio³ (dB) with respect to wanted $\mathbf{TX}_{BS_GE06D}^k$ defined for the reference point.

Note: If the considered TV channel for protection in the BS country is overlapped partially by two IMT downlink blocks (example DL1 and DL2 in the figure below) the calculation of I_{comp} and the comparison with I_{ref} should be made for each overlapping IMT downlink block consecutively.



³ Recommendation ITU-R BT.1368 contains values of protection ratios for wanted DVB-T interfered with by DVB-T or by IMT base stations. If protection ratio values for certain configurations are not available, the concerned administrations may use bilaterally agreed values.