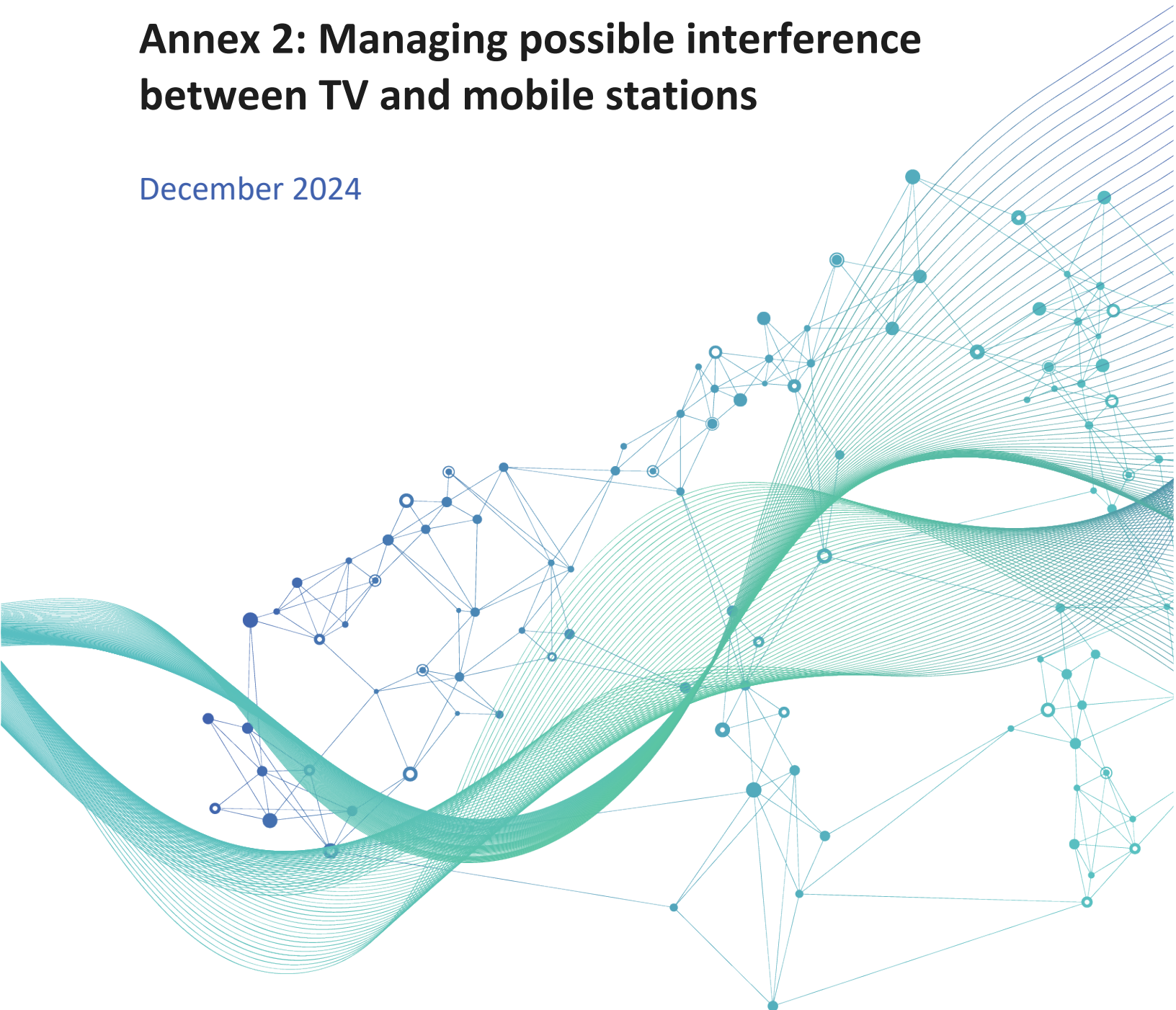




Reallocation of the 600 MHz band for mobile broadband in Brazil – Annex 2: Managing possible interference between TV and mobile stations

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1. Managing possible interference between TV and mobile stations

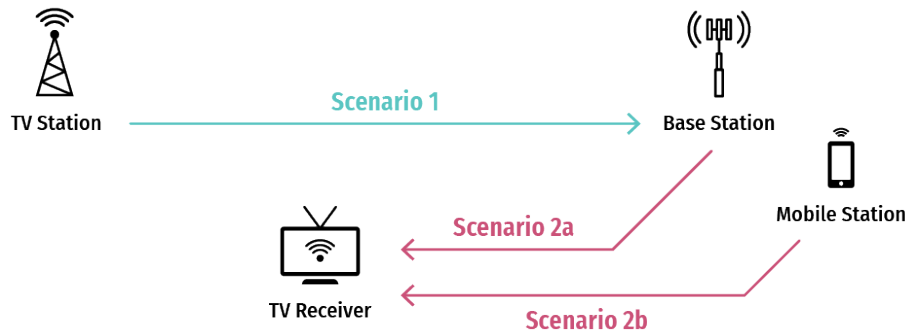
This annex assesses the technical conditions for implementing TV stations and mobile base stations in the nearby geographical areas when both are using spectrum in the 600 MHz band, which can support the definition of coordination measures for a phased implementation of the use of the band by mobile service in different cities in Brazil.

1.1. Possible interference scenarios

The main scenarios for possible harmful interference cases considered are shown in Figure 1:

- Scenario 1: Possible interference from TV station transmitter into mobile base station receiver,
- Scenario 2a: Possible interference from mobile base station transmitter into TV receiver, and
- Scenario 2b: Possible interference from mobile station transmitter into TV receiver.

Figure 1. Identification of possible harmful interference scenarios



Source: TMG.

1.2. Technical parameters for the analysis

The technical specifications used for mobile networks internationally are summarised in Table 1, based on parameters defined by the 3GPP and used in the ITU technical studies.¹

Table 1: IMT parameters for bands below 1 GHz

Base station characteristics	
Antenna height	30 m
Sectorisation	3 sectors
Downtilt	3 degrees
Antenna pattern	Recommendation ITU-R F.1336

¹ ITU, Characteristics of terrestrial component of IMT for sharing and compatibility studies in preparation for WRC-23, June 2021, https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-0716!H4-N4.04!MSW-E.docx, based on 3GPP, TS 38.104 v.16.6.0 and TS 38.101-1 v.16.6.0, December 2020, http://www.3gpp.org/ftp/Specs/archive/38_series/38.104/38104-g60.zip and http://www.3gpp.org/ftp/Specs/archive/38_series/38.101-1/38101-1-g60.zip.

Antenna polarisation	Linear/±45 degrees
Cross-polarisation	3 dB
Antenna discrimination	1.19 dB
Feeder loss	3 dB
Noise figure	5 dB
Sensitivity	-105 dBm
Protection criteria (I/N)	-6 dB
Typical channel bandwidth	10 MHz
Maximum base station output power (Report ITU-R M.2292)	46 dBm in 10 MHz
Maximum base station antenna gain (Report ITU-R M.2292)	15 dBi
Duplex mode	FDD
Mobile station characteristics	
Mobile station height	1.5 m
Typical antenna gain for user terminals	-3 dBi
Sensitivity	-100.2 dBm
Body loss	4 dB
Maximum user terminal output power	23 dBm

Source: TMG based on ITU.

The parameters for TV stations vary widely depending on the situation and country of implementation. This example considers parameters that are deemed more relevant in the case of Brazil. For scenarios of interference analysis around different areas of the country, the most representative would be a medium-power TV station, with the parameters as summarised in Table 2.

Table 2: TV medium power station parameters

Antenna height	150 m
Equivalent radiated power (e.r.p.)	5 kW
Protection criteria (C/N)	-19 dB

Source: TMG.

1.3. Calculation of interference levels

The calculation of the service and interference levels is done by defining, for the TV station and mobile base station, the relevant field strength levels. It is then possible to calculate the distance to the respective contour using the appropriate propagation method.

For the TV station, a service field strength of 51 dB(μ V/m) is considered. This value is considered to be adequate for outdoor antenna coverage. Taking into account a TV protection criterion of C/N = -19 dB, the maximum level of interference would be the service value minus the protection criterion, thus the mobile base station interference field strength can be considered as 32 dB(μ V/m), equivalent to -104 dBm.

Additional outdoor TV receiver antenna discrimination may be considered, such as 16 dB, which is widely applied in some of the compatibility studies between mobile and TV broadcasting services carried out in the ITU process. As such, a level of -88 dBm is considered for the calculation of the interference from mobile base station into the TV receiver.

The coverage area of the base station depends on the sensitivity of the mobile station, for which the value of -100.2 dBm is considered. The following calculation is done to determine the TV station interference field strength:

$$E_{dB(uV/m)} = 77.2 + 20 \log(F_{MHz}) + I_{dBm} - G_{dBi} + A_d = 37 \text{ dB(uV/m)}$$

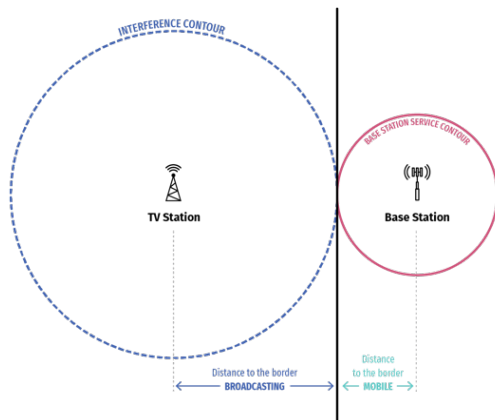
where:

- I_{dBm} is the received interference power;
- G_{dBi} is the isotropic antenna gain, including feeder losses;
- A_d is the antenna directivity discrimination; and
- F_{MHz} is the frequency in MHz.

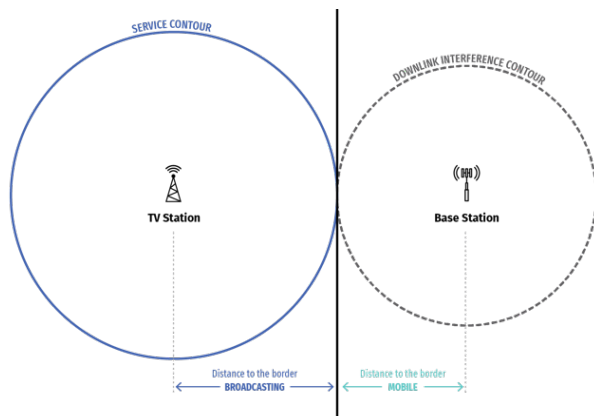
The propagation model used for IMT is Okumura-Hata, and for TV is Recommendation ITU-R P.1546. The scenario and contours are shown in Figure 2, with the results of the calculation summarised in Table 3.

Figure 2. TV and mobile stations service and interference contours in different scenarios

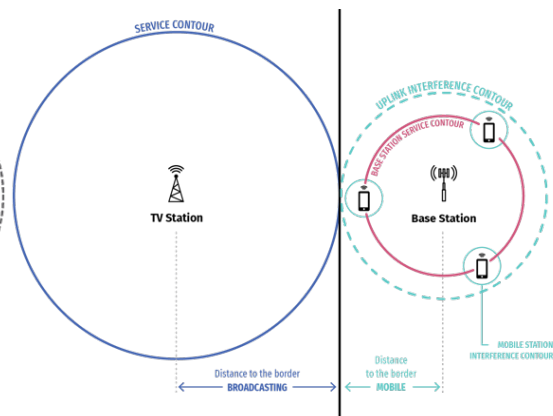
SCENARIO 1



SCENARIO 2A



SCENARIO 2B



Source: TMG.

Table 3: Interference calculation results for each scenario

Scenario 1	Scenario 2a	Scenario 2b
TV station may interfere with the mobile base station receiver.	Mobile base station may interfere with the TV receiver.	Mobile station may interfere with the TV receiver.
TV station interference contour is 70 km when considering a field strength of 37.1 dB(μ V/m) and using Recommendation ITU-R P.1546.	Mobile base station interference contour is 9 km when considering an interference level of -88 dBm and Okumura-Hata.	Mobile station interference contour is 1 km, which should be added to the base station service contour of 12 km, resulting in 13 km, based on the different levels for each part of the network and Okumura-Hata.
Mobile base station service contour is 12 km when considering transmission power of 46 dBm and Okumura-Hata.	TV station service contour is 39 km when considering a power level of 5 kW, field strength of 51 dB(μ V/m), and Recommendation ITU-R P.1546.	TV station service contour is 39 km when considering a power level of 5 kW, field strength of 51 dB(μ V/m), and Recommendation ITU-R P.1546.

Source: TMG.



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