CEPT ECC
Electronic Communications Committee

ECC Recommendation (20)01

Guidelines to support the introduction of 5G while ensuring, in a proportionate way, the use of existing and planned FSS transmitting earth stations in the frequency band 24.65-25.25 GHz and the possibility for future deployment of these earth stations

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INTRODUCTION

To ensure coexistence between 5G MFCN systems and transmitting FSS earth stations operating in the frequency band 24.65-25.25 GHz, coordination zones and coordination contours may be required around FSS earth stations. The exact coordination zone and contour will have to be calculated on a case-by-case site specific basis, depending on the diffraction (due to terrain profile), clutter, site shielding and polarisation losses around the specific earth station and the characteristics of the specific FSS earth station and 5G MFCN base stations.

This Recommendation provides guidance to administrations on the calculation of such coordination zones and coordination contours around transmitting FSS earth stations. The calculation of coordination contours could help administrations to implement coordination zones around FSS earth stations (with respect to 5G MFCN base stations).

Moreover, guidelines will be helpful for the deployment of 5G MFCN the 26 GHz frequency band allowing for continued development of FSS earth stations, while minimising the risk of interference to 5G MFCN in the frequency band 24.65-25.25 GHz.

The calculated zone highlights the area where the operation of 5G MFCN base station(s) would need to be taken into further consideration.

This Recommendation is to support the introduction of 5G while facilitating continued use of existing FSS transmitting earth stations and the possibility for future deployment in the frequency band 24.65-25.25 GHz* while ensuring that number and locations of new earth stations are determined as not to impose disproportionate constraints on the 5G MFCN subject to market demands.

Note 1: this Recommendation complements Appendix 7 of the Radio Regulations [1], and does not intend to replace it

*Note 2: EU Decision 2019/784, article 5 [2]

ECC RECOMMENDATION 20(01) OF 6 MARCH 2020 ON GUIDELINES TO SUPPORT THE INTRODUCTION OF 5G WHILE ENSURING, IN A PROPORTIONATE WAY, THE USE OF EXISTING AND PLANNED FSS TRANSMITTING EARTH STATIONS IN THE FREQUENCY BAND 24.65-25.25 GHZ AND THE POSSIBILITY FOR FUTURE DEPLOYMENT OF THESE EARTH STATIONS, CORRECTED 7 NOVEMBER 2025

"The European Conference of Postal and Telecommunications Administrations,

considering

a) that ECC Decision (18)06 [3] provides harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the 26 GHz (24.25-27.5 GHz) band;

b) that the frequency band 24.65-25.25 GHz is allocated to the Fixed-Satellite Service (FSS) (Earth-to-space), subject to RR provision 5.532B [1] which limits its use in ITU-R Region 1 to earth stations with a minimum antenna diameter of 4.5 m which will be at known locations;

c) that technical studies conducted in the frequency band 24.65-25.25 GHz between 5G MFCN systems and FSS earth stations at known locations, assuming certain technical characteristics and propagation models, show that coexistence can be achieved through the calculation of geographic separation distances and the determination of coordination zones around FSS earth stations, where further consideration may be needed if 5G MFCN base stations were inside these zones;

d) that a methodology as described in Annex 1 in order to evaluate the geographic separation distances and coordination zones around FSS earth stations will help administrations calculate their contours and ensure coexistence between 5G MFCN and FSS;

e) the examples for national approaches for the calculation of the clutter losses in Annex 2 and the examples for national approaches to identify possible locations for the deployment of FSS earth stations as outlined in Annex 3;

f) that ECC Decision (18)06 [3] considers that appropriate provisions are needed in the authorisation for 5G MFCN to define precisely how to safeguard in a proportionate way the use of existing FSS transmitting earth stations and the possibility for future earth station deployments in the 24.65-25.25 GHz frequency band;

g) that the coordination zones in *considering d)* will vary on a case by case basis as a function of earth station antenna diameter, receiver characteristics, elevation angle, surrounding terrain, diffraction loss, clutter loss, site shielding, polarisation loss and 5G MFCN network characteristics and system design;

h) that the determination of coordination zones and coordination contours around FSS earth stations should where possible utilise an appropriate propagation model such as Recommendation ITU-R P.452 [6] together with suitable terrain data for the area surrounding the earth station. The methods to calculate coordination zones in this Recommendation will tend to over-estimate separation distances that are required;

i) that the impact of satellite Earth stations on the deployment of 5G networks could be minimised if they are deployed in sparsely populated areas, away from major centres/cities, where the demand for 5G MFCN in the 26 GHz frequency band could be expected to be low. This will also mean that achieving coexistence is less complex.

recommends

1. that the methodology and examples of calculations of coordination zones (where further consideration may be needed if 5G MFCN base stations were inside these zones) around FSS earth stations transmitting to satellites in the GSO orbit in the frequency band 24.65-25.25 GHz provided in Annex 1 can be used by administrations as a guideline to implement coordination zones and support the coexistence between 5G MFCN BS and FSS transmitting earth stations;
2. that where feasible, administrations may wish to consider locating future FSS satellite earth stations away from populated areas where 5G MFCN BS may operate.

Note:

Please check the ECO Documentation Database https://docdb.cept.org/ for the up to date position on the implementation of this and other ECC Recommendations.

ANNEX 1: METHODOLOGY FOR CALCULATING THE COORDINATION ZONES AROUND FSS EARTH STATIONS TRANSMITTING IN THE FREQUENCY BAND 24.65-25.25 GHZ

A1.1 INTRODUCTION

FSS earth stations transmitting in the 24.65 GHz to 25.25 GHz frequency range have the potential to cause interference to 5G MFCN. This may require the establishment of coordination zones and a coordination contour around these FSS earth stations to minimise the risk of interference to 5G MFCN. Calculation of these coordination zones needs to be site specific and on a case-by-case basis.

FSS earth stations operating in the 24.65 GHz to 25.25 GHz frequency range are subject to RR 5.532B [1] where an antenna size larger than 4.5 m is required. These earth stations are normally feeder links (e.g. for BSS) to GSO satellites. This means that these earth stations are large and sparsely distributed.

The coordination zone which is determined through this methodology can be relatively large given worst case analysis is used. Hence, such zones should be considered as coordination zones within which 5G MFCN could still be deployed, after more detailed analysis beyond this methodology is conducted or an agreement can be reached between the FSS earth station and 5G MFCN operators.

Given that in an MFCN system, the user equipment will operate indoor or in heavy clutter, the methodology focusses on the 5G MFCN base station, only considering a single 5G MFCN base station.

A1.2 GENERAL METHODOLOGY

The general methodology for calculating a coordination zone is set out in the following steps:

1. Determine the parameters for both the FSS earth station and the 5G MFCN base stations. This is on a site-specific case by case basis where the specific details of the FSS earth station should be used as shown in section A1.3.

2. Using the parameters calculate the Interference (I) for each pixel on a grid based on 20 x 20 metre to 50 x 50 metre pixel size (i.e. I determined for each pixel in the grid)[1]. The area of the grid for the calculation should be set large enough to cover the entire coordination zone. The interference (I) between a transmitting FSS earth station and a receiving 5G MFCN base station will be calculated by evaluating the transmit power and antenna gain of an FSS transmit earth station towards an MFCN Base Station (BS) as shown in section A1.4.

3. Compare the calculated interference for each pixel (on a grid based on 20 x 20 metre to 50 x 50 metre pixel size) with the interference protection criteria for 5G MFCN as shown in section A1.5.

4. Determine and draw the coordination zone and coordination contour based on the comparison of interference to the 5G MFCN protection criteria for each pixel as shown in section A1.6.

5. Consider a range of mitigations should an 5G MFCN base station be located in the coordination zone as shown in section A1.7.

A1.3 DETERMINATION OF THE PARAMETERS

The interference is a combination of variable parameters: MFCN BS antenna gain towards the FSS earth station, and fixed parameters: propagation and clutter losses, site shielding, FSS earth station antenna gain towards the MFCN BS, polarisation loss and MFCN antenna ohmic losses.

Note: Terrain, clutter data and site shielding should be taken into account.

[1] This is based on simulation software that uses a raster / grid / pixel basis in its calculation method. Alternatively, in some simulation software, the coordination zone may be calculated on radials. This is where for each azimuth around the FSS earth station, the corresponding distance from the FSS earth station location is calculated

A1.3.1 Satellite earth station antenna gain towards the MFCN BS

Information on the FSS earth station antenna pattern is required to be able to make the interference calculations. The resulting gain towards the 5G MFCN base station will be a combination of the antenna pattern, elevation and azimuth (i.e. compound angle). The FSS earth station antenna gain towards the MFCN BS will need to be calculated for each pixel on a grid based on 20 x 20 metre to 50 x 50 metre pixel size (each pixel in the grid) in determining the coordination zone. The antenna pattern alone, unless pointed at nadir will result in a non-circular coordination zone.

In some cases, accurate information on the FSS earth station antenna pattern may be available from the manufacturer/operator. Otherwise the two most relevant recommendations are:

- Recommendation ITU-R S.465 [4];
- Recommendation ITU-R S.1855 [5].

A1.3.2 Calculation of propagation losses between the FSS earth station and the MFCN BS

The signal propagating from the FSS GSO earth station to the MFCN BS is subject to the following propagation losses/attenuations:

- Free space pathloss;
- Diffraction (i.e. from terrain);
- Clutter loss;
- Site shielding (where applicable).

The method prescribes the two recommendations for calculation of the propagation losses (including clutter losses), which are presented in Annex 2 as examples.

For each pixel on a grid based on 20 x 20 metre to 50 x 50 metre pixel size (or each azimuth around the FSS earth station and each distance from the FSS earth station, depending on the simulation software) the propagation loss should be determined using an appropriate propagation model such as the one contained in Recommendation ITU-R P.452-16 [6], considering the terrain elevation in the area of the grid for the calculation the coordination zone.

The terrain elevation model can be the 1-arcsec resolution terrain profile data of the Shuttle Radar Topography Mission (SRTM), however more detailed terrain models, including built area models, may be used. The terrain profiles can be sampled with an azimuth step of 1 degree around the earth station of interest and a distance step of 25 m. The losses can then be computed around the station with an azimuth step of 1 degree and a distance step of 100 m.

Higher resolution terrain data, or a surface database plus a built area model, and/or higher resolution sampling, may be used to more accurately reflect built up areas.

A1.3.3 Polarisation losses

Polarisation loss will be specific to the FSS earth station and its polarisation, this will need to be looked at on a case by case basis. Where specific information is not available, the losses that could be considered are :

- 3 dB for circular to linear polarisation (or vice-versa);
- 1.5 dB for same polarisation;
- 0 dB for worst case analysis.

A1.3.4 Site shielding

Some FSS earth stations may have site shielding where the FSS earth station is located behind a building or there is a structure (e.g. a wall) that shields the antennas from likely locations of 5G MFCN in populated areas. This will need to be considered on a case by case basis and an appropriate loss/attenuation figure will need to be determined.

A1.3.5 MFCN BS antenna gain distribution towards FSS earth station

The MFCN BS antenna gain is described in Recommendation ITU-R M. 2101 [7], section 5 Implementation of MFCN Base Station (BS) and User Equipment (UE) Beamforming Antenna Pattern.

A1.4 INTERFERENCE CALCULATION

The interference is calculated by applying formula (1) below. The level of interference I must be calculated for each pixel on a grid based on 20 x 20 metre to 50 x 50 metre pixel size. The interference should be calculated using the following formula:

$$\mathrm{I} = \mathrm{e.i.r.p._{FSS}}(\theta_{\mathrm{FSS}}) - \mathrm{Losses} + \mathrm{G_{MFCN}}(\theta_{\mathrm{MFCN}}) - \mathrm{PL} \quad (1)$$

where:

- Interference in dBW/Hz;
- $\mathrm{e.i.r.p._{FSS}}(\theta_{\mathrm{FSS}})$: FSS transmit earth station signal off-axis e.i.r.p. density in the direction of the MFCN receive BS in dBW/Hz;
- Losses: Propagation loss in dB (including losses due to terrain, clutter and site shielding);
- $\mathrm{G_{MFCN}}(\theta_{\mathrm{MFCN}})$: MFCN base station receive antenna gain in direction of the FSS transmit earth station in dBi;
- PL: Polarisation Losses in dB, MFCN BS beam orientation related to the FSS E/S antenna (e.g. circular to linear or vertical to horizontal).

A1.5 5G MFCN PROTECTION CRITERIA

Administrations could apply the following criteria at national level:

Option 1:
Based on a protection criterion of I/N =-6 dB, the maximum interference level has been evaluated as follows: MFCN receiver noise floor – 6 dB = thermal noise + noise figure – 6 dB= -204 dB(W/Hz) + 10 dB -6 dB= -200 dB(W/Hz).
The maximum interference level acceptable for an MFCN BS is -200 dB(W/Hz).

Option 2:
Apply a different measure for the protection of MFCN on a case by case basis (e.g. degradation of receive signal strength, percentage of throughput loss, etc.).

A1.6 DETERMINATION OF THE COORDINATION CONTOUR

The calculation of all coordination contours should be on a case by case basis and site specific as the size and shape of the coordination contour can vary significantly depending on the FSS earth station site.

The calculation of interference for each pixel on a grid based on 20 x 20 metre to 50 x 50 metre pixel size is compared to the MFCN interference protection criteria to determine the risk of interference in each pixel. This is then used to determine the size and shape of the coordination zone. Alternatively, depending on the simulation software being used, the coordination zone could be calculated on radials. This is where for each azimuth around the FSS earth station, each of the distances from the FSS earth station location is calculated. Figure 1 shows an example of coordination contour around an FSS earth station.

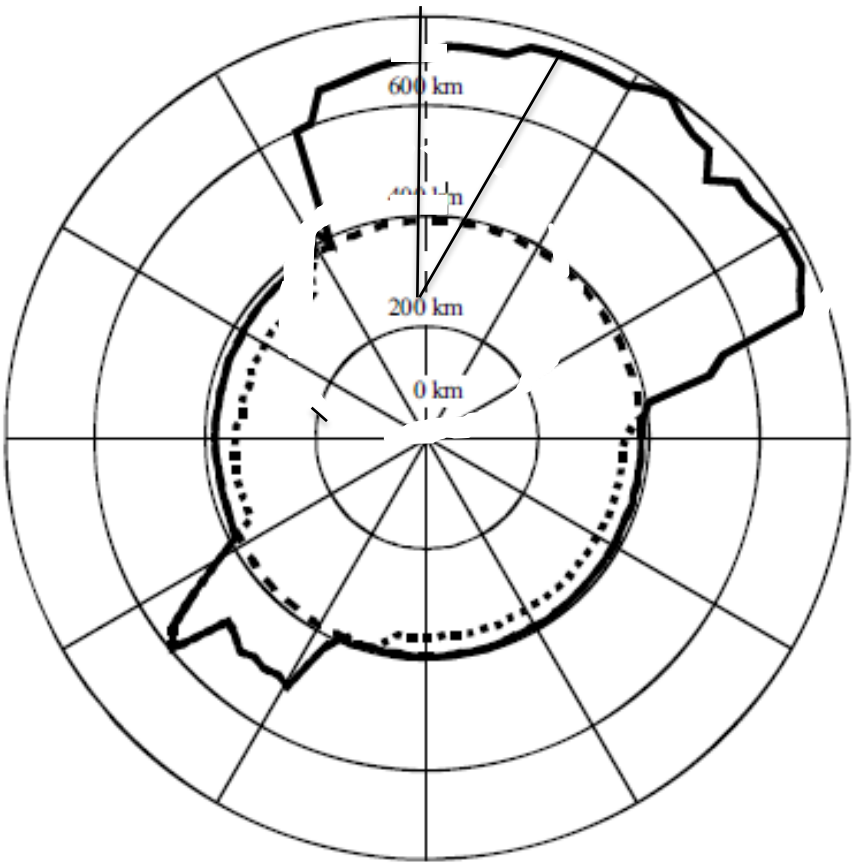


Figure 1: Example of coordination contour around an FSS earth station

A1.7 MITIGATION MEASURES FOR THE CASE THAT 5G MFCN OPERATES IN THE COORDINATION ZONE

The coordination zone will generally be based on worst case assumptions. If 5G MFCN operates within the coordination zone there are a number of mitigations that could be available to both the FSS earth station and 5G MFCN operator to minimise the risk of interference. Administrations could choose to:

1. Undertake further detailed technical analysis to determine the level of interference risk; and/or;

2. Ask/request that the FSS earth station and 5G MFCN operators undertake coordination and discussions.

Some of the technical mitigations that could be considered include:

1. The presence of additional site shielding at the FSS earth station site;

2. Further consideration of the likely azimuth and elevations of the 5G MFCN BS main beam (e.g. sector pointing). It is noted that the general methodology as described in section A1.2 leads to a worst case where the 5G MFCN base station is pointed directly at the FSS earth station with its maximum gain to determine the coordination contour and the resulting coordination zone;

3. The 5G MFCN operator's tolerance to interference (through discussion). Depends on where the 5G MFCN base station is in the coordination zone, interference may only result in a reduction of coverage and capacity for particular azimuths and elevations.

Other technical mitigations may be available beyond what is mentioned here.

ANNEX 2: EXAMPLES OF NATIONAL APPROACHES FOR THE CALCULATION OF THE CLUTTER LOSSES

Approach 1:

Apply clutter loss as described in Recommendation ITU-R P.2108 [8] for urban and suburban environments, which is a statistical model (see also Annex 1 of that Recommendation “Statistical models are to be used when precise knowledge of the radio path is not known such as the width of streets, heights of buildings, depth of vegetation”).

Approach 2:

Apply the clutter correction described in Recommendation ITU-R P.452, section 4.5 [6] which is for a specific case at given locations in an urban, suburban or rural environment. (see also document 5-1/38 “Guidance on the use of ITU-R P-Series Recommendations for interference prediction and sharing studies under WRC-19 agenda item 1.13” [9]).

ANNEX 3: EXAMPLES FOR NATIONAL APPROACHES FOR THE DEPLOYMENT OF FSS EARTH STATIONS

Some national administrations may wish to consider how they set their domestic licensing/authorisation policies regarding FSS earth stations and 5G MFCN. This is entirely a national matter for individual administrations to consider and is outside the scope of this recommendation. This annex gives examples of administrations national approaches.

Country A example

FSS earth stations in this band will be subject to an individual licensing regime and due to antenna size restrictions, there will be limited deployment in term of number of earth stations in any given country.

In the frequency band 24.65-25.25 GHz, MFCN systems could be subjected either to individual licensing regime (either per assignment or national/regional/local allotment) or general authorisation regime according to market demand.

In order to assess potential areas/zones where FSS earth stations may be deployed, administrations could assess the 5G MFCN market demands in order to:categorise the potential territory (rural areas, suburban and urban areas) where MFCN BS could be rolled out;

- further, based on national plans, define present and foreseen/future areas of specific potential interest for MFCN (stadium, train stations ..., which may be in any of the above categories).

Based on result of calculation of the coordination areas, it would be up to each administration to identify the candidate locations for limited number FSS earth stations in such a way to avoid imposing disproportionate constraints on the 5G MFCN.

Subsequently, and via public consultation, administrations could assess the relevant market demand FSS earth stations and confirm the result of above assessment where FSS satellite earth stations may be deployed in short and mid-terms and in an appropriate proportionate way.

Such location of FSS earth station and relevant coordination areas would be recorded and made available to potential FSS and 5G MFCN licence holders in the band. Within the relevant coordination zones, it would then be up to 5G networks to mitigate interferences from FSS satellites earth stations (BS installation, managing the impact of FSS interference, etc.).

Outside such identified locations, in case of 5G MFCN individual authorisations, the licence framework should also leave opportunity for 5G MFCN and FSS satellite operators to negotiate bi lateral agreements in order to identify specific locations to place earth stations on terms proportionate to the potential impact of the operation of the FSS earth station.

The above process should be subject to regular review.

Country B example

FSS earth stations in this band are used for feeder links and are required to have an antenna size of 4.5 m or more (see RR No **5.532B**). This means that these earth stations will be large and sparsely distributed within a territory (limited in number). It is also noted that recommends 2 states: *"that where feasible, administrations may wish to consider locating future FSS satellite earth stations away from populated areas where 5G MFCN BS may operate"*.

The envisaged deployment scenario of 26 GHz MFCN will largely be in built up urban areas and the coordination zones around FSS earth stations are small (generally less than a couple of km). The deployment scenario of FSS is largely in rural areas. It is noted that there are already FSS earth stations established in the band (first in time). The deployment scenarios alone allow for continued deployment of FSS earth stations as there will continue to be locations within national territories where they can operate without causing interference to MFCN.

The band should remain open for authorising specific FSS earth stations but no additional or special provisions would be required. Authorisation of FSS earth stations and 5G MFCN would be on a first in time basis where the system that is authorised first would get the right to transmit and / or be protected.

ANNEX 4: LIST OF REFERENCES

[1] ITU Radio Regulations, Edition of 2024

[2] Decision (EU) 2019/784: “Commission Implementing Decision (EU) 2019/784 of 14 May 2019 on harmonisation of the 24.25-27.5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union”

[3] ECC Decision (18)06: “Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24.25-27.5 GHz”, approved October 2018, latest amended November 2020

[4] Recommendation ITU-R S.465-6: “Reference radiation pattern for earth station antennas in the fixed-satellite service for use in coordination and interference assessment in the frequency range from 2 to 31 GHz”, (01/2010)

[5] Recommendation ITU-R S.1855-0: “Alternative reference radiation pattern for earth station antennas used with satellites in the geostationary-satellite orbit for use in coordination and/or interference assessment in the frequency range from 2 to 31 GHz”, (01/2010)

[6] Recommendation ITU-R P.452-16: “Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz”, (07/2015)

[7] Recommendation ITU-R M. 2101-0: “Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies”

[8] Recommendation ITU-R P.2108-0: “Prediction of Clutter Loss”

[9] ITU-R Document 5-1/38 “Guidance on the use of ITU-R P-Series Recommendations for interference prediction and sharing studies under WRC-19 agenda item 1.13”