Annex 1 - Technical conditions for the 26 GHz band

The Electronic Communications Committee (ECC) of CEPT has produced a Draft ECC Decision for the 26 GHz band (24.25-27.5 GHz)[1]. This ECC Decision is expected to be finalised and approved at the next ECC plenary meeting in Rome on 3-6 July. The most recent draft of this ECC Decision is proposing technical conditions that, if accepted, would severely constrain use of the 26 GHz band for 5G in Europe. These conditions include, in particular:

- Overly stringent limits on unwanted emissions from mobile communications equipment (5G base stations and user equipment) operating in the band.
- Restrictive conditions that would constrain how 5G networks could be deployed in the 26 GHz band by licensees.

The conditions in such ECC Decisions are meant to be "least restrictive technical conditions", however the technical conditions that are currently included in the Draft ECC Decision for the 26 GHz band do not fit this description.

Unwanted emissions limits

The Draft ECC Decision for the 26 GHz band is currently proposing a value of [-42/-44] dBW/200 MHz for unwanted emissions from 5G base stations in order to protect Earth Exploration Satellite Service (EESS) passive sensors in the band 23.6-24 GHz. Although we agree there is a need to protect EESS (passive), we believe the emissions limits that are proposed in the Draft ECC Decision are excessively tight.

These emissions limits will inevitably have significant negative impact on 5G networks and services in the 26 GHz band (e.g. in terms of coverage, performance, throughput and costs) and, based on information from 3GPP, would also lead to a situation where the lower part of the 26 GHz band cannot be used for outdoor 5G base stations.

The tighter the limits the greater the impact will be, and the greater the risk/likelihood that the development of 5G in the 26 GHz band in Europe will be substantially impeded. We propose that the limit for unwanted emissions from outdoor 5G base stations into 23.6-24 GHz should be in the range -32 to -37 dBW/200 MHz (noting also that levels of unwanted emissions from mobile equipment will usually, in practice, be well below the regulatory limit).

Although there is clearly a need to protect EESS (passive) operations in 23.6-24 GHz, it is important not to over-protect EESS in such a way that would unnecessarily restrict 5G networks and services. Reasons for this can be seen, for example, in a document that was sent from 3GPP to ITU-R last December[2] regarding the impact of different levels of IMT-2020 (5G) unwanted emissions limits on the performance of 5G systems.

3GPP has been studying the feasibility of meeting more stringent unwanted emissions limits than the baseline requirement that is currently specified in 3GPP. Preliminary results from these studies indicate that, for example, with an emissions limit for base stations of -37 dBW/200 MHz there would be a substantial impact on coverage, performance, throughput and costs of 5G networks and services in the 26 GHz band. This would also require a large frequency separation of around 1 - 1.5 GHz between the mobile transmissions and the EESS (passive) band, resulting in the lower part of the 26 GHz band not being usable for outdoor 5G base stations.

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[1] Draft ECC Decision (18)FF, "Harmonised technical conditions for Mobile/Fixed Communications Networks (MFCN) in the band 24.25-27.5 GHz"

[2] ITU-R Working Party 5D Document 5D/784, "Liaison statement on unwanted emissions of IMT-2020"

The value of -37 dBW/200 MHz for unwanted emissions limit from IMT-2020 base stations would thus still have significant adverse implications for 5G networks and services. Although some parties are arguing that a tighter limit is needed in order to protect EESS, based on compatibility studies they have performed, we believe that a value in the range -32 to -37 dBW/200 MHz is more than sufficient, and is supported by other compatibility study results. Main differences between these study results are due to different assumptions for aspects such as antenna patterns, apportionment of interference between services, IMT station densities, and interpretation of EESS protection criteria.

Considering each of these aspects in turn: (i) it is clear that a beamforming antenna model is more accurate for such studies than a 'single element' model; (ii) a recent study into apportionment has demonstrated that the fixed service requires only a small fraction of the margin given to it in apportionment schemes; (iii) we believe that assumptions about 5G/IMT-2020 deployment densities provided by the expert group in ITU-R are realistic, and higher density values used in some other studies would result in excessive margin at the start of 5G deployments when excessively tight emissions limits could potentially curtail development of 5G in the 26 GHz band below 26.5 GHz; and (iv) there is a lack of clarity regarding how protection criteria for EESS (passive) should be interpreted and applied in studies, and uncertainty regarding whether existing compatibility studies have implemented them in the right way. The Arab Spectrum Management Group (ASMG) recently decided to investigate and specify an unwanted emissions limit for IMT-2020 base stations in the 26 GHz band in the range -32 to -37 dBW/200 MHz.

It should also be noted that regulatory limits for unwanted emissions will usually be significantly higher than emissions that will be seen from mobile networks in practice. In order to be able to reliably satisfy the limits, suppliers of mobile equipment will need to design their products such that unwanted emissions are typically at least several dBs below the limit, in order to achieve good yields from their manufacturing processes and conformity testing under extreme conditions at reasonable cost. This is another factor that causes results from compatibility studies to be conservative.

Other technical conditions

In addition to unwanted emissions limits, other technical conditions on use of 5G in the 26 GHz band have also been proposed in the Draft ECC Decision. These are being justified on the basis of being needed to protect other services in the 26 GHz band (in particular satellite services), however sharing studies for these services show there is a large protection margin between the level of emissions that would be expected from a 5G network and level that could potentially cause interference to a satellite.

The current version of the Draft ECC Decision contains proposals for an "in-band power limit" and/or "EIRP mask for positive elevation angles" for 5G base stations (essentially, restrictions on emissions in directions above horizontal). Any such conditions are likely to have a negative impact on the deployment, operation and performance of 5G networks and services, and should be avoided. We believe there is no need to include such technical conditions/restrictions as part of the "least restrictive technical conditions" in the ECC Decision.

We believe that imposition of a strict "EIRP mask" or "in-band power limit" for transmissions from 5G base stations would be over-restrictive, impractical and unnecessary, and would further restrict the development and implementation of 5G in the 26 GHz band in Europe. In an IMT-2020 network in this band, beamforming will be used to direct the main beam from a base station in the direction of each user equipment (UE) to be served, and a restriction on emissions at positive elevation angles is likely to be impractical to implement. The vast majority of UEs will be located below the height of the base station to which they are connected, and hence elevation angles greater than 0° will be atypical, and are unlikely to have significant impact on interference into other services. Imposition of an EIRP mask would place

unnecessary constraints on a 5G network operator's ability to provide 5G services in an efficient and effective manner. Furthermore, such EIRP masks have never been imposed in ECC Decisions for mobile spectrum in the past, even though other bands have also faced interference scenarios between mobile and satellites.

More generally, there is an inherent logical problem with the idea of taking parameter values from sharing/compatibility studies and using them as regulatory limits. Sharing and compatibility studies such as those that are being performed for the 26 GHz band should use parameter values that are realistic and represent typical/representative values, rather than worst-case values that would lead to results that predict levels of interference much greater than would be experienced in practice. Taking parameter values from such studies and using them as maximum limits will inherently lead to technical conditions that are unnecessarily restrictive.

It should also be noted that almost all of the sharing studies that have been conducted into potential interference from 5G networks into satellite space station receivers in the 26 GHz band indicate that there is a substantial margin between the level of interference calculated and level that could potentially cause interference at the satellite receiver.