



*QUALCOMM welcomes the opportunity to respond to Ofcom's public consultation on the 2.6 GHz, 2.1 GHz and 2.3 GHz bands. While QUALCOMM supports Ofcom's plans to introduce greater flexibility in spectrum management, we have serious concerns with Ofcom's proposals to deviate from the agreed European 2.6 GHz harmonized band plan as set in ECC DEC(05)05. **We believe that the UK's suggested FDD/TDD flexibility scheme will not provide the expected benefits to either paired or unpaired operations and will be detrimental to the ongoing success of mobile broadband services in Europe. We therefore urge Ofcom to reconsider its plans to divert from the agreed European band plan for the 2.6 GHz.***

Question 1: Do you agree with these proposals for the awards of the three bands or have any other comments on the contents of this document?

QUALCOMM believes that the award of the 2.6 GHz and 2010 MHz bands will sustain the fast market growth of 3G services. With more than 100 million subscribers worldwide, 3G technologies are continuing to evolve towards higher data rate capabilities (such as HSPA+, Long Term Evolution (LTE) & Ultra Mobile Broadband (UMB)) that will benefit from the 2.6 GHz wide bandwidth. For instance, QUALCOMM recently announced the sampling of HSPA+ chipsets in the 2.6 GHz band by the end of 2007. HSPA+, based on the 3GPP Release 7 standard, provides data rates of up to 28 Mbps on the downlink and 11 Mbps on the uplink, significant increases in network capacity, reduced latency and an enhanced user experience for many data-intensive applications.

QUALCOMM therefore supports Ofcom's plans to release the 2.6 GHz and 2010 MHz bands to the market. However, QUALCOMM urges Ofcom to adopt the 2.6 GHz European harmonised band plan as set in ECC DEC(05)05. Indeed irrespective of what technologies or services that may be deployed, a common and harmonized band plan facilitates economies of scale, which in turn brings benefits to consumers and citizens.

QUALCOMM also believes that it is essential that a clear statement on the reuse of the 900 MHz and 1800 MHz spectrum is given prior to the award of the 2.6 GHz spectrum. We note that many other countries in Europe are at a more advanced stage in allowing the reuse of the GSM spectrum for other technologies such as WCDMA.

Question 2: Do you agree with the analysis in section 5 or have any comments on adjacent interference issues?

QUALCOMM agrees with the conclusions of the technical analysis provided by Ofcom on adjacent band compatibility with regards to the 2.6 GHz and 2010-2025 MHz bands. QUALCOMM believes that the technical conditions associated with the use of the band should be clearly defined prior to the award process.

Question 3: Do you agree that Ofcom should authorise use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?

QUALCOMM supports Ofcom's plan to authorise the bands 2500-2690 MHz and 2010 – 2025 MHz concurrently. QUALCOMM has no firm views on the 2290-2300 MHz.

Question 4: Do you agree that awarding licences by auction would be the appropriate mechanism for authorising use of the spectrum bands 2500-2690 MHz, 2010-2025 MHz and 2290-2300 MHz?

QUALCOMM believes that it is important to maintain fair and transparent treatment in the award of the various frequency bands that would potentially allow offering similar services. Taking into account that the authorisation process chosen in the UK for the award of the 2 GHz band was auction, it seems appropriate to apply the same mechanism in the award of the bands 2500-2690 MHz and 2010-2025 MHz.

QUALCOMM has no specific views concerning the band 2290-2300 MHz.



Question 5: Do you agree that it is likely to be in the interests of citizens and consumers to proceed with the award of the 2.6 GHz and 2010 MHz bands as soon as practicable, rather than to delay the award pending reduction in uncertainty relating to other bands?

QUALCOMM urges Ofcom to release a clear statement allowing the reuse of the 900 MHz and 1800 MHz bands for 3G technologies, in line with ECC Decision (06)13 and the ongoing discussions within the European Radio Spectrum Committee. Clarity is needed prior to the 2.6 GHz band award in order to provide market players additional regulatory certainties with regards to the auction of the 2.6 GHz and 2010 MHz bands.

Question 6: Do you agree Ofcom should aim to award the bands 2500-2690 MHz, 2010-2025 MHz and 2290-2302 MHz by the end of 2007, while keeping the position on the 2.6 GHz and 2010 MHz bands under review in the light of possible developments in European regulatory fora?

QUALCOMM believes that the band 2500-2690 MHz is of great importance for the development of 3G technologies and their evolutions (such as HSPA+, LTE, UMB) due to its unique wide bandwidth. We further believe that harmonised channelling arrangements across Europe are crucial for mobile communications services. QUALCOMM therefore supports the timeline established by Ofcom for the award of the bands 2.6 GHz and 2010 MHz while conforming to the ECC band plan and the split between the FDD and TDD blocks. If Ofcom would like to divert from the agreed European band plan, it would set a precedent that would be very detrimental for the European mobile market.

QUALCOMM supports Ofcom's proposal to keep the position on the 2.6 GHz and 2010 MHz under review in the light of possible development in Europe as a pan-European harmonised approach is beneficial to the industry and the consumers.

Question 7: Do you agree with Ofcom's proposals for licence conditions (technology neutrality, tradability, conditions of tenure and absence of roll-out obligations)?

QUALCOMM supports flexibility in spectrum management. We support technology neutrality. We believe, on the other hand, that 'radio' service neutrality needs to be carefully considered on a case by case basis as it would raise serious difficulties in terms of interference management and competition.

Concerning the 2.6 GHz band, QUALCOMM believes that the IMT-2000 process established by the ITU is valuable as it enables global collaboration taking into account the interests of administrations, operators and manufacturers in order to reach harmonisation and technical compatibility. QUALCOMM will therefore continue to support and contribute to the IMT-2000 global spectrum harmonisation that includes the 2.6 GHz band.

Question 8: Do you have views on whether or not there should be a "safeguard" cap on the amount of spectrum that any one bidder could win in an award for the 2.6 GHz bands and, if so, do you have a view on whether 90 MHz would be an appropriate size for a safeguard cap?

QUALCOMM believes that a "safeguard" cap is important in order to guarantee competition and avoid having one market player hoarding the entire spectrum. The spectrum cap should favour competition and allow the deployment of the currently foreseen technologies evolutions, including LTE and UMB. However, we believe that the value of 90 MHz for the "safeguard" cap is too excessive and should be therefore be lowered.

Question 9: Do you agree with Ofcom's proposal to package spectrum as lots of 2 x 5 MHz for paired use and 5 MHz lots for unpaired spectrum and to allow the aggregation of lots by bidders?

QUALCOMM supports Ofcom's proposal to package spectrum in the 2.6 GHz band as lots of 2 x 5 MHz for paired use and lots of 5 MHz for unpaired use and to allow aggregation of contiguous lots up to the "safeguard" cap.



Question 10: Do you agree with Ofcom's proposed approach to allowing the respective amounts of paired to unpaired spectrum for the band 2500-2690 MHz to be varied (maintaining the 120 MHz duplex spacing and allowing additional unpaired spectrum, if needed, at the top end of the band)?

QUALCOMM has serious concerns with Ofcom's proposals to deviate from the European harmonised channelling arrangements as set in ECC DEC(05)05 and which defines the split between FDD and TDD blocks. A flexible band plan in terms of TDD and FDD blocks assignment will be detrimental to the development of mobile services in Europe.

It will be highly difficult for an FDD handset to operate in both ECC and Ofcom band plans with one Transmit/Receive (Tx/Rx) chain while protecting the unpaired spectrum from Tx interference. For example, in the FDD/TDD arrangement given in Figure 2 of Section 1, the FDD handset for the ECC band plan would not meet the emission level of -66 dBm/MHz required to protect the TDD handset until about 2600 MHz. Therefore, an FDD terminal that protects more of the Ofcom unpaired spectrum has to use a set of duplexer filters different from the one used for the CEPT band plan. An FDD terminal with roaming capabilities between ECC and Ofcom band plans would therefore require a second set of PA/Duplexer/LNA. This assumes no TDD Uplink noise or blocking which would complicate the situation. However, this complication occurs if blocks 35 through 38 in the Ofcom band plan are used for TDD Uplink. Any TDD uplink implementation in the unpaired blocks shall meet the FDD handset Rx band requirements for noise which is about -66 dBm/MHz (or -60 dBm/3.84MHz). This means that the use of blocks 35 through 38 in the Ofcom band plan for TDD Uplink is not likely to be feasible since the requirements on the TDD terminal Tx would be too difficult to meet. Furthermore, the terminal mask proposed by Ofcom does not seem sufficient to protect FDD downlink. As a result, the Ofcom band plan will lead to an inefficient use of spectrum due to the multiple guard bands that would be needed. It will also ultimately impact the consumers as it may lead to UK specific handsets which cannot roam within other European countries. Such equipments will be more costly and deny UK consumers' access to new capable high bit rates services while visiting neighbouring countries. Terminals with roaming capabilities between UK and the rest of Europe will require more complex implementation resulting in higher cost, higher power consumption, bigger form factor and shorter coverage due to higher filter insertion loss.

Sharing studies conducted by QUALCOMM between FDD and TDD Base Stations show that the lowest frequency block of a licensee's unpaired spectrum is not viable for usage because of tough requirements on Tx filtering (up to 74 dB filtering required for FDD vs. TDD or TDD vs. TDD and around 49 dB for TDD vs. FDD, at the top of ACLR values which have been specified for TDD and FDD). It is also highly questionable whether the second lowest block of a licensee's unpaired spectrum is viable for usage in the case of co-located base stations (up to 100 dB filtering required for FDD vs. TDD or TDD vs. TDD and 75 dB for TDD vs. FDD at the top of ACLR values which have been specified for TDD and FDD). The efficiency of spectrum use is therefore considerably reduced.

Sharing studies between FDD and TDD mobile user terminals show that the lowest block of a licensee's unpaired spectrum is not viable for usage (for 5 m separation, the following amount of Tx filtering would be required at the top of ACLR values which have been specified for TDD and FDD: up to 40.3 dB for TDD vs. FDD and up to 42.5 dB for FDD vs. TDD or TDD vs. TDD). The 2nd lowest block of a licensee's unpaired spectrum is also not viable for usage (for 5 m separation, the following amount of Tx filtering would be required at the top of ACLR values which have been specified for TDD and FDD: up to 22.3 dB for TDD vs. FDD and up to 32.5 dB for FDD vs. TDD or TDD vs. TDD). The efficiency of spectrum use is considerably reduced in this case. On the other hand, mitigation techniques envisaged for reducing the interference between FDD and TDD mobile terminals are questionable.

Furthermore, the probability of service degradation estimated by statistical analysis is by far optimistic. The application of such analysis for the calculation of mutual interference between terminals in a network where the user terminals are uniformly distributed will result in too optimistic conclusions.

QUALCOMM therefore believe that although it could be envisaged to mitigate the risk of interference on the base stations through additional site engineering measures such as filtering, it would be nearly impossible to mitigate the impact on user terminals while maintaining roaming capabilities within European countries which implement the harmonised ECC band plan.



Question 11: Do you agree with Ofcom's proposals for a 5 MHz restricted block between FDD and TDD neighbours and between TDD and TDD neighbours and with a modified out-of-band base station mask for second adjacent 5 MHz blocks?

The technical analysis performed by QUALCOMM leads to the belief that neither the 5 MHz restricted block between FDD and TDD neighbours nor the 5 MHz restricted block between TDD and TDD neighbours is usable. In addition, the usage of the second 5 MHz block adjacent to the restricted block is nearly impossible, as indicated in the response to Question 10.

Question 12: Do you agree with Ofcom's proposals to award the 2010 MHz band as a single 15 MHz lot?

QUALCOMM supports the availability of the band 2010 -2025 MHz for either TDD or FDD (uplink) paired with the 2.6 GHz in line with ECC /DEC/(05)05 and ECC/DEC/(06)01. If the band is to be used for TDD, QUALCOMM supports Ofcom's proposals to award the 2010 MHz band as one single block as it would be highly inefficient to introduce guard bands within the 2010 MHz to avoid interference between adjacent TDD neighbours.

Question 13: Do you agree with Ofcom's proposals to award the 2290 MHz band as a single 10 MHz lot?

QUALCOMM has no specific views on the award of the band 2290-2300 MHz.

Question 14: Do you agree with Ofcom's proposals to combine the award of the 2.6 GHz and 2010 MHz bands and to hold the award of the 2290 MHz band separately and in advance?

QUALCOMM agrees with Ofcom that the 2010-2025 MHz and the 2.6 GHz bands could be close substitutes (e.g. TDD blocks) and/or complements (e.g. FDD pairing) and therefore should be combined within the same award process. The 2290 -2300 MHz band is independent in terms of spectrum usage from the two other bands and should be treated in a separate process as proposed by Ofcom.

Question 15: Do you agree with Ofcom's proposals for a two-stage auction design for the 2.6 GHz and 2010 MHz bands?

QUALCOMM supports auctioning the 2.6 GHz band in lots in compliance with the FDD/TDD split as set in the harmonised band plan defined in ECC/DEC(05)05. Under this assumption, QUALCOMM supports Ofcom's proposals for a two stage auction design for the 2.6 GHz and 2010 MHz.

Question 16: Do you agree with Ofcom proposals to award the 2290 MHz band through a second price sealed bid auction?

QUALCOMM has no specific views on the award of the 2290 MHz band.

Question 17: Do you have a preference for either of the two approaches to specifying technical licence conditions?

QUALCOMM believes that each of the approaches proposed by Ofcom, Spectrum Usage Rights or transmitter spectrum mask, has its own merits. However, QUALCOMM considers that neither of these two approaches would be a sufficient substitute of current spectrum management practices that are based on close cooperation between standards organisations (e.g. ETSI, 3GPP ...) and CEPT. Indeed, in both approaches solely the transmitter parameters are taken into account and defined. Proven experiences conclude that both the transmitters' and the receivers' parameters need to be considered in order to ensure coexistence and compatibility.



Question 18: Do you have any comments on the transmitter spectrum masks defined below?

The transmitter spectrum masks for both base station and mobile station, as defined by Ofcom, are derived from 3GPP specifications. QUALCOMM considers that the BS spectrum mask is appropriate for a 5 MHz bandwidth system such as WCDMA/HSPA. We assume that Ofcom mobile station transmitter spectrum mask for a 5 MHz block is derived from the WCDMA UE relative spectrum mask by assuming a maximum Tx power of 30 dBm/3.84MHz (approximately 24 dBm/MHz) in band power. Such a UE power class is not defined in the UMTS specifications. The out-of-band emissions resulting from this approach allows more interference from a TDD terminal to a nearby FDD terminal or the other way round. Therefore, we suggest that the OOB emissions in the transmitter spectrum mask should be derived from a WCDMA Power Class 3 UE (24 dBm/3.84MHz). This will result in OOB emission figures which are 6 dB tighter than those defined by Ofcom, i.e. -6 dB should be added to all entries in the “Maximum mean EIRP” column below (e.g. -25 dBm/MHz instead of -19 dBm/MHz, etc.). The in-band EIRP density 24 dBm/MHz would remain unchanged.

Mobile Stations – using either paired or unpaired spectrum blocks

- 9.20 For all paired and unpaired 5 MHz spectrum blocks a within the 2.6 GHz band, the maximum mean EIRP density that may be transmitted from any mobile station in-band will be 24 dBm/ MHz.
- 9.21 For mobile station operating in unpaired spectrum, the following out-of-block emissions in the bands immediately adjacent to the assigned spectrum block will apply:
 - the maximum mean EIRP shall not exceed the following mask:

Table 6: 2.6 GHz band – Mobile Station Out-of-block EIRP Mask for paired and unpaired spectrum

Offset from relevant block edge	Maximum mean EIRP
-10.0 to -6.0 MHz (lower edge)	-19 dBm/ MHz
-6.0 to -5.0 MHz (lower edge)	-9 + 10(Δ_F + 5.0) dBm/ MHz
-5.0 to -1.0 MHz (lower edge)	-5 + (Δ_F + 1.0) dBm/ MHz
-1.0 to 0.0 MHz (lower edge)	-5 + 15(Δ_F) dBm/30kHz
0.0 to +1.0 MHz (upper edge)	-5 - 15(Δ_F) dBm/30kHz
+1.0 to +5.0 MHz (upper edge)	-5 - (Δ_F - 1.0) dBm/ MHz
+5.0 to +6.0 MHz (upper edge)	-9 - 10(Δ_F - 5.0) dBm/ MHz
+6.0 to +10.0 MHz (upper edge)	-19 dBm/ MHz

Where: Δ_F is the frequency offset from the relevant block edge (in MHz)

QUALCOMM would like to highlight that for 20 MHz bandwidth LTE systems, Ofcom masks would be very challenging to meet.

Question 19: Do you have any comments on the SUR parameters defined below?

QUALCOMM believes that Spectrum Usage Rights methodology and parameters are still at a very early stage of development. This methodology is currently being addressed at CEPT level. We therefore recommend waiting for the outcome of CEPT studies prior to implementing this unproven methodology in the 2.6 GHz band, which constitutes a prime band for mobile communications services.



Question 20: Do you have any comments on the SUR methodology and assumptions detailed in this annex?

See response to Question 19.

Question 21: Do you have any comments on the use of the Visualyse tool as described, on the assumptions or the propagation model proposed in this annex?

QUALCOMM has no specific comments to make on the use of the Visualyse tool. It is our view that a common industry approach with regards to simulation tools and assumptions are needed in order to agree with any interference simulation output.

Question 22: Do you have any comments on the assumptions detailed in this annex?

QUALCOMM has no specific views on the assumptions detailed in the annex
