Annexes to Report for Ofcom

International interference analysis for future use of 1452-1492MHz range

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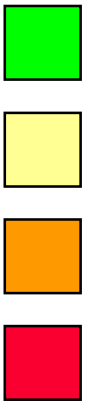
Annex A: Incoming interference charts by block

The following maps show the levels of incoming interference from Continental T-DAB systems in each of the 16 Lower L-Band frequency blocks. In these maps, areas of the UK that have sufficiently low interference to not affect signal quality for the stated network types are colour coded as follows:



WiMAX (duplex), UMTS TDD (duplex), PMSE (city-wide video links) as well as all the network types below

T-DAB, DMB and DVB-H hand-held devices at 99% of locations, outdoor coverage

T-DAB, DMB and DVB-H hand-held devices at 99% of locations, indoor and outdoor coverage

Short-range PMSE only

Exhibit A.1: *Colour codes used in maps of incoming interference [Source: Analysys, Mason 2006]*

Exhibit A.2: *UK incoming interference from Continental T-DAB systems –* ***Block LA*** *[Source: Analysys, Mason 2006]*

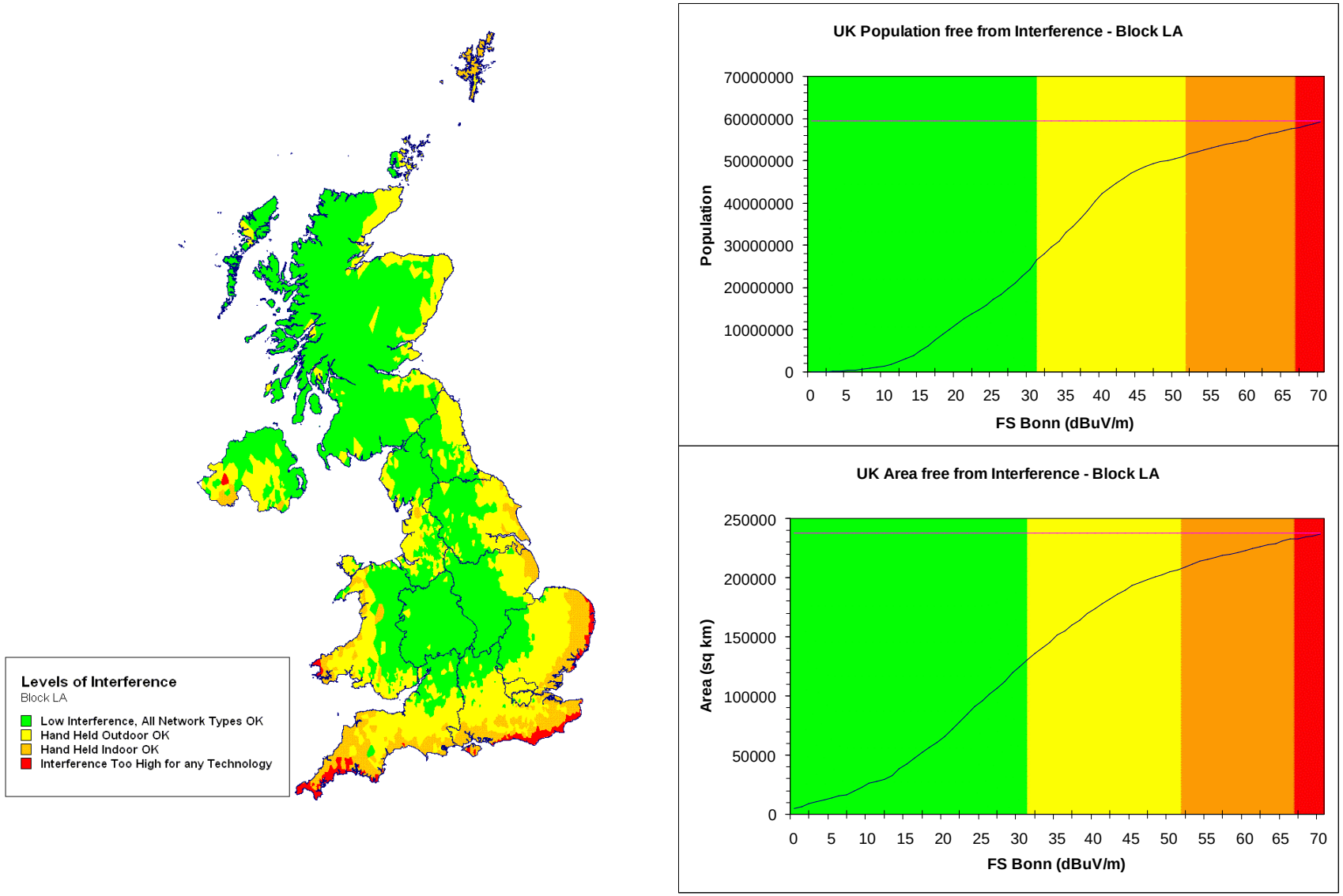


Exhibit A.3: *UK incoming interference from Continental T-DAB systems –* ***Block LB*** *[Source: Analysys, Mason 2006]*

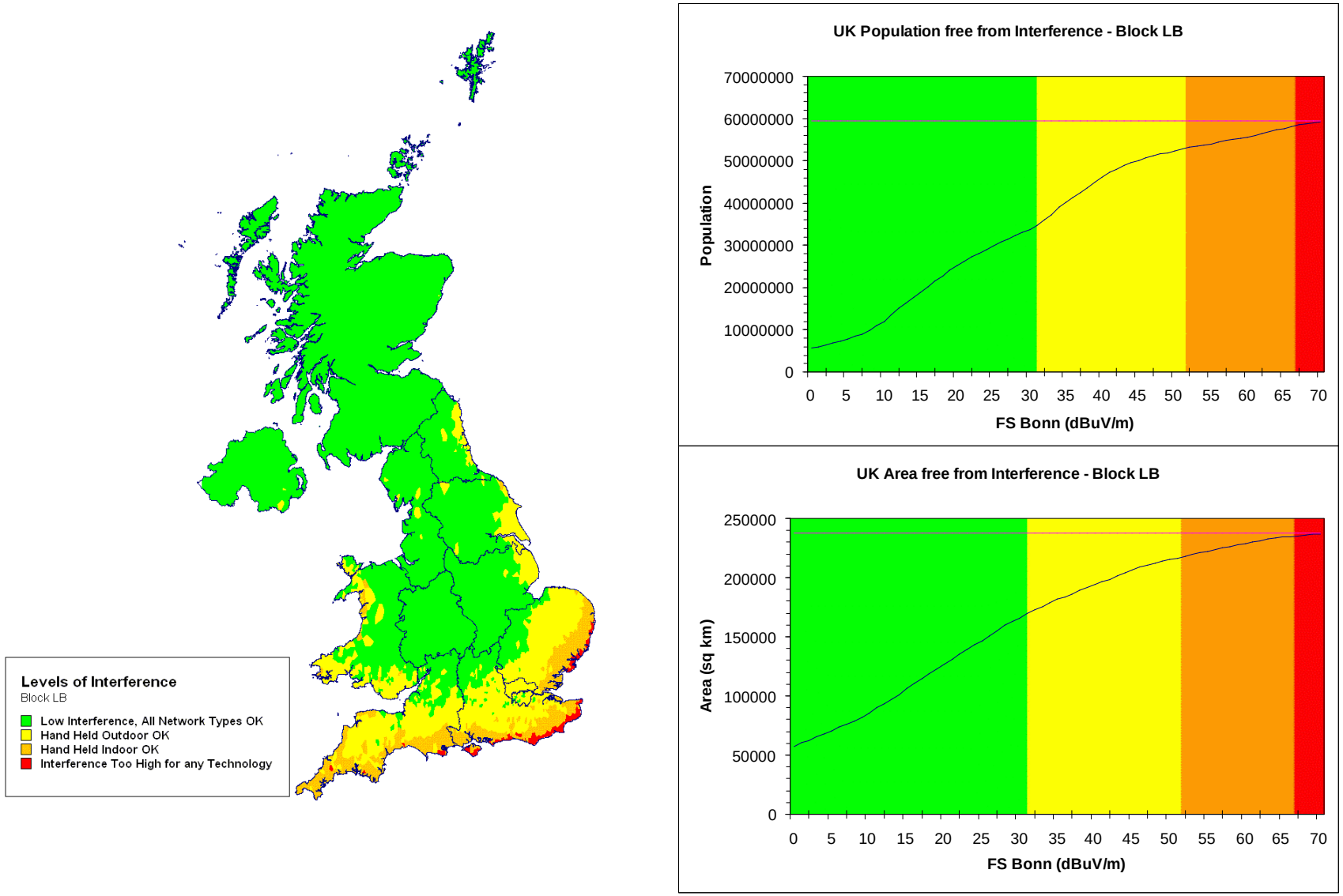


Exhibit A.4: *UK incoming interference from Continental T-DAB systems –* ***Block LC*** *[Source: Analysys, Mason 2006]*

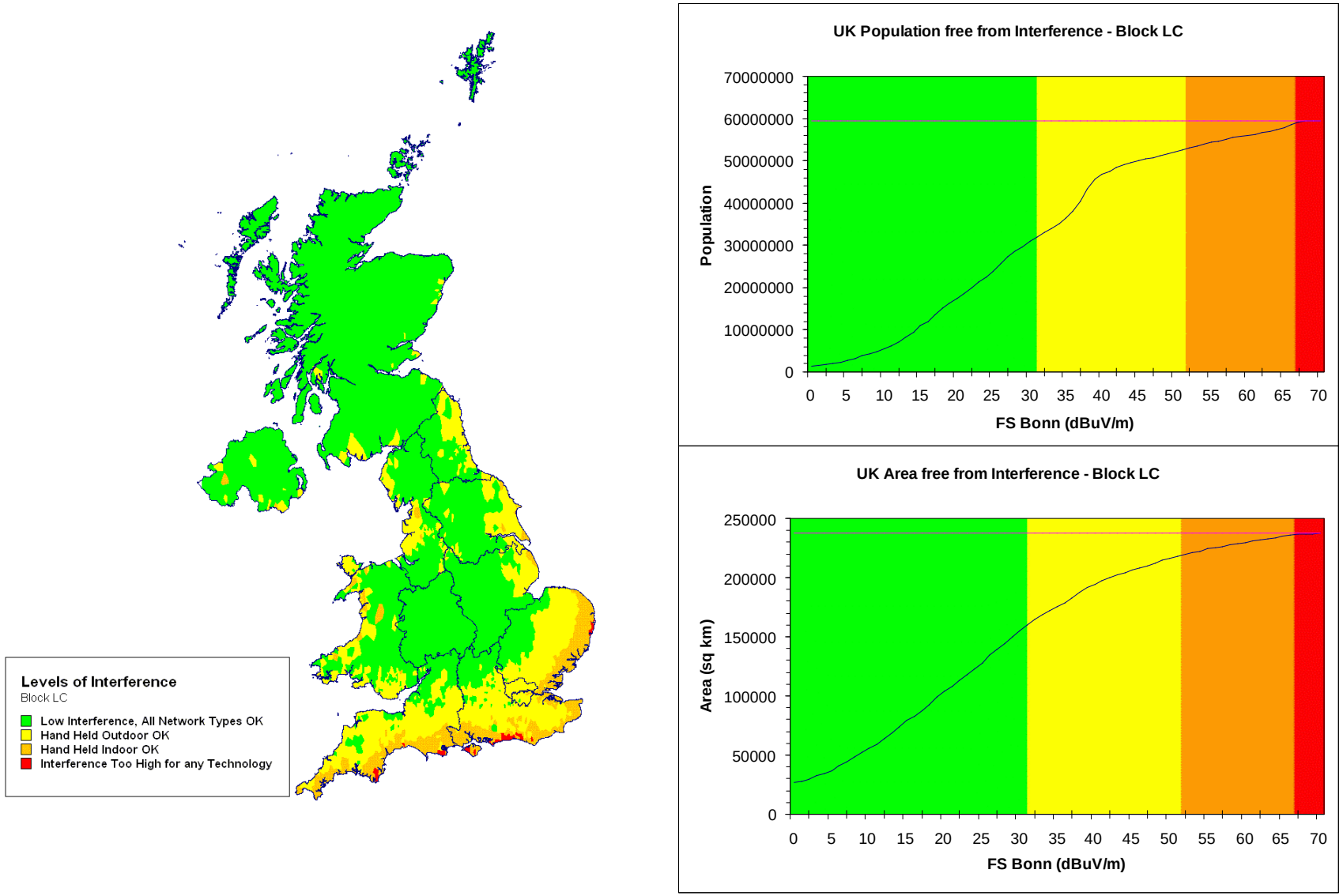


Exhibit A.5: *UK incoming interference from Continental T-DAB systems –* ***Block LD*** *[Source: Analysys, Mason 2006]*

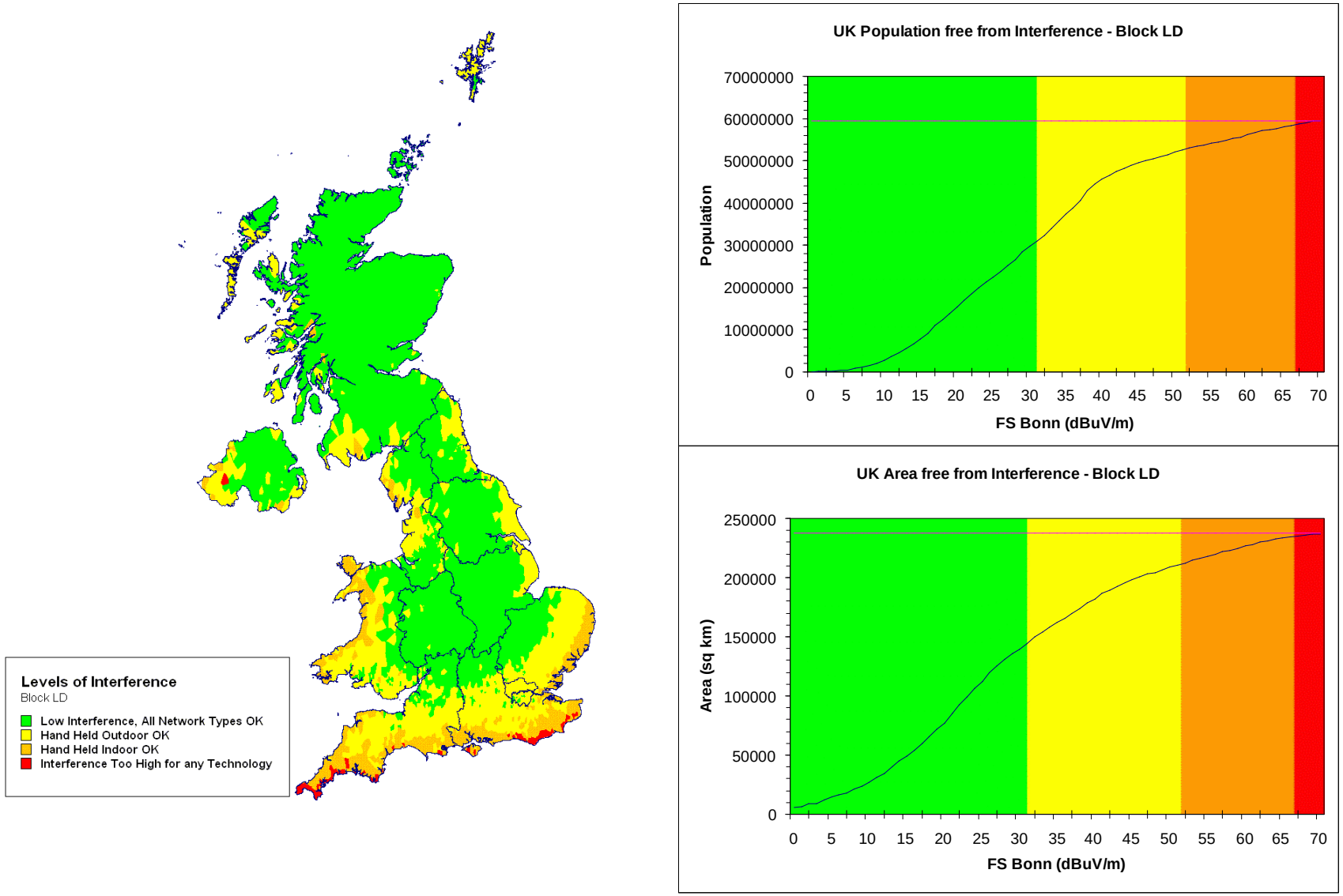


Exhibit A.6: *UK incoming interference from Continental T-DAB systems –* ***Block LE*** *[Source: Analysys, Mason 2006]*

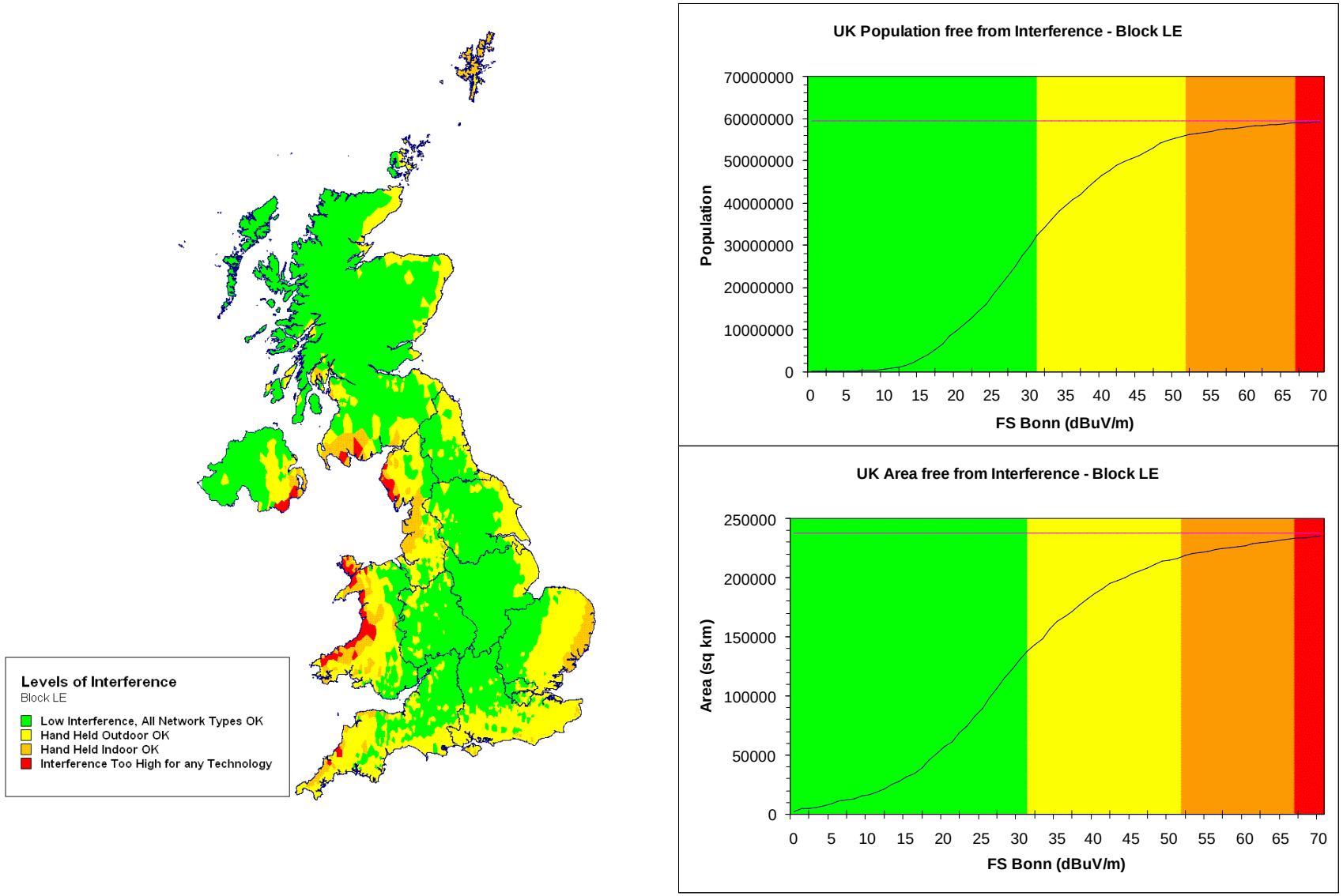


Exhibit A.7: *UK incoming interference from Continental T-DAB systems –* ***Block LF*** *[Source: Analysys, Mason 2006]*

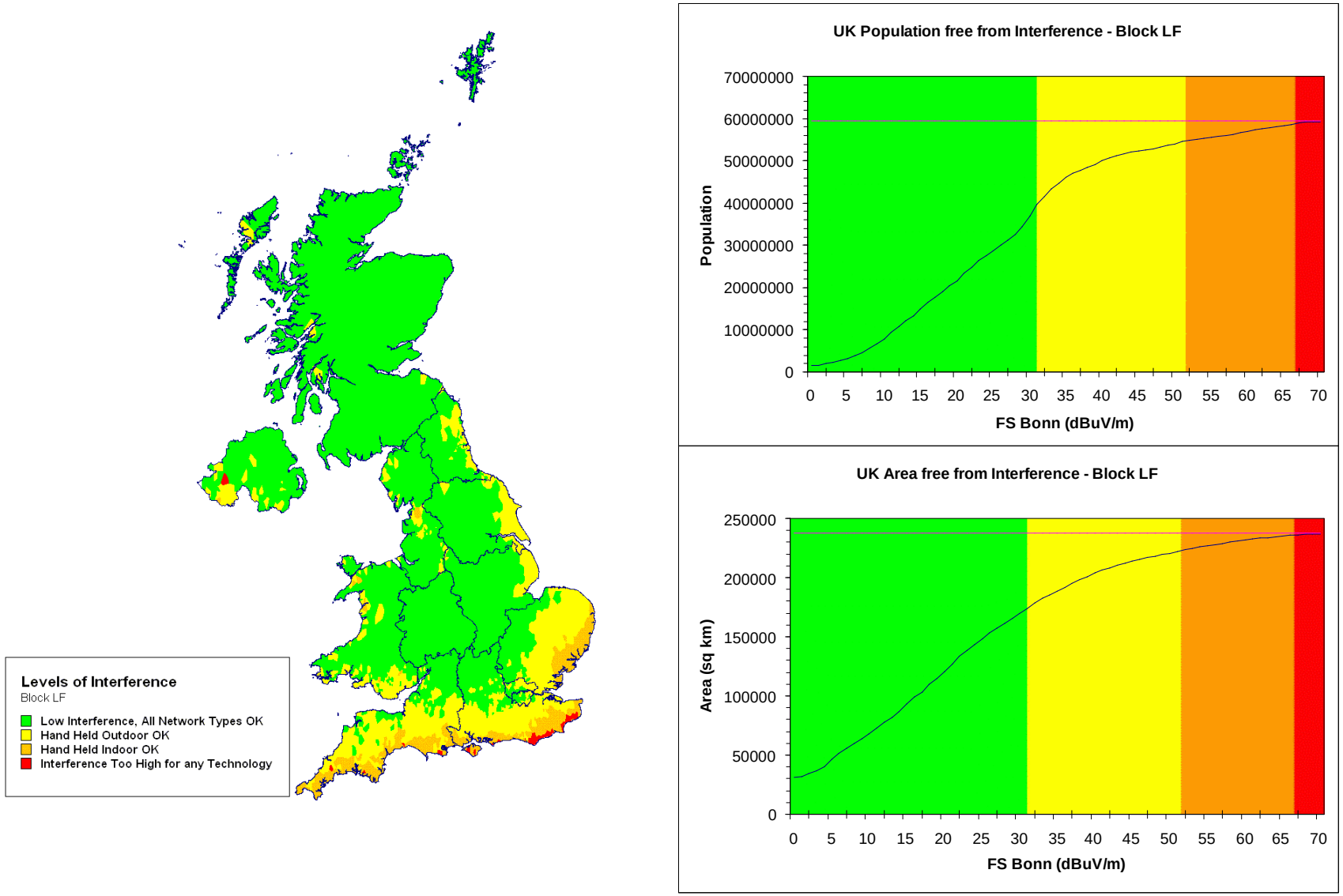


Exhibit A.8: *UK incoming interference from Continental T-DAB systems –* ***Block LG*** *[Source: Analysys, Mason 2006]*

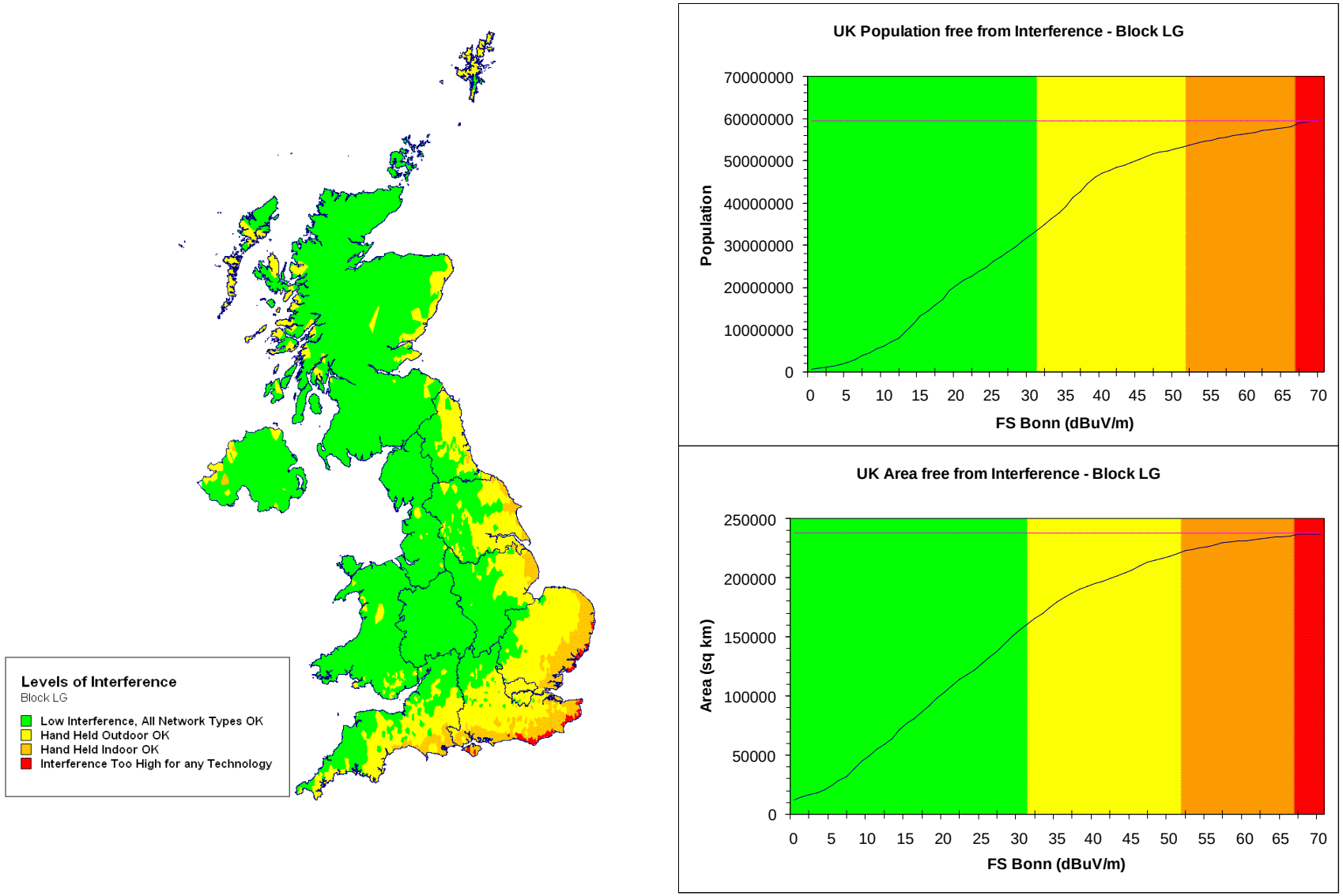


Exhibit A.9: *UK incoming interference from Continental T-DAB systems –* ***Block LH*** *[Source: Analysys, Mason 2006]*

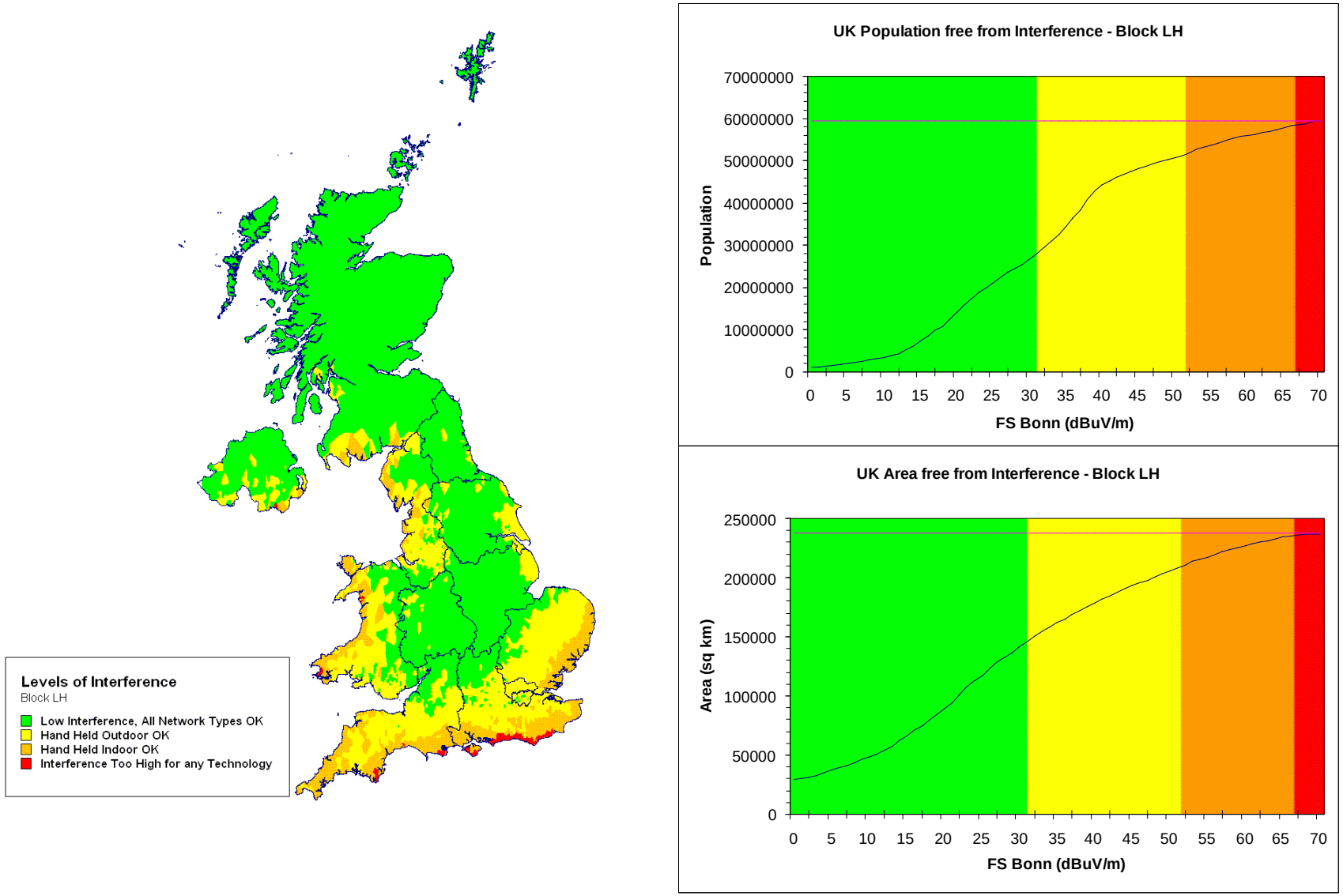


Exhibit A.10: *UK incoming interference from Continental T-DAB systems –* ***Block LI*** *[Source: Analysys, Mason 2006]*

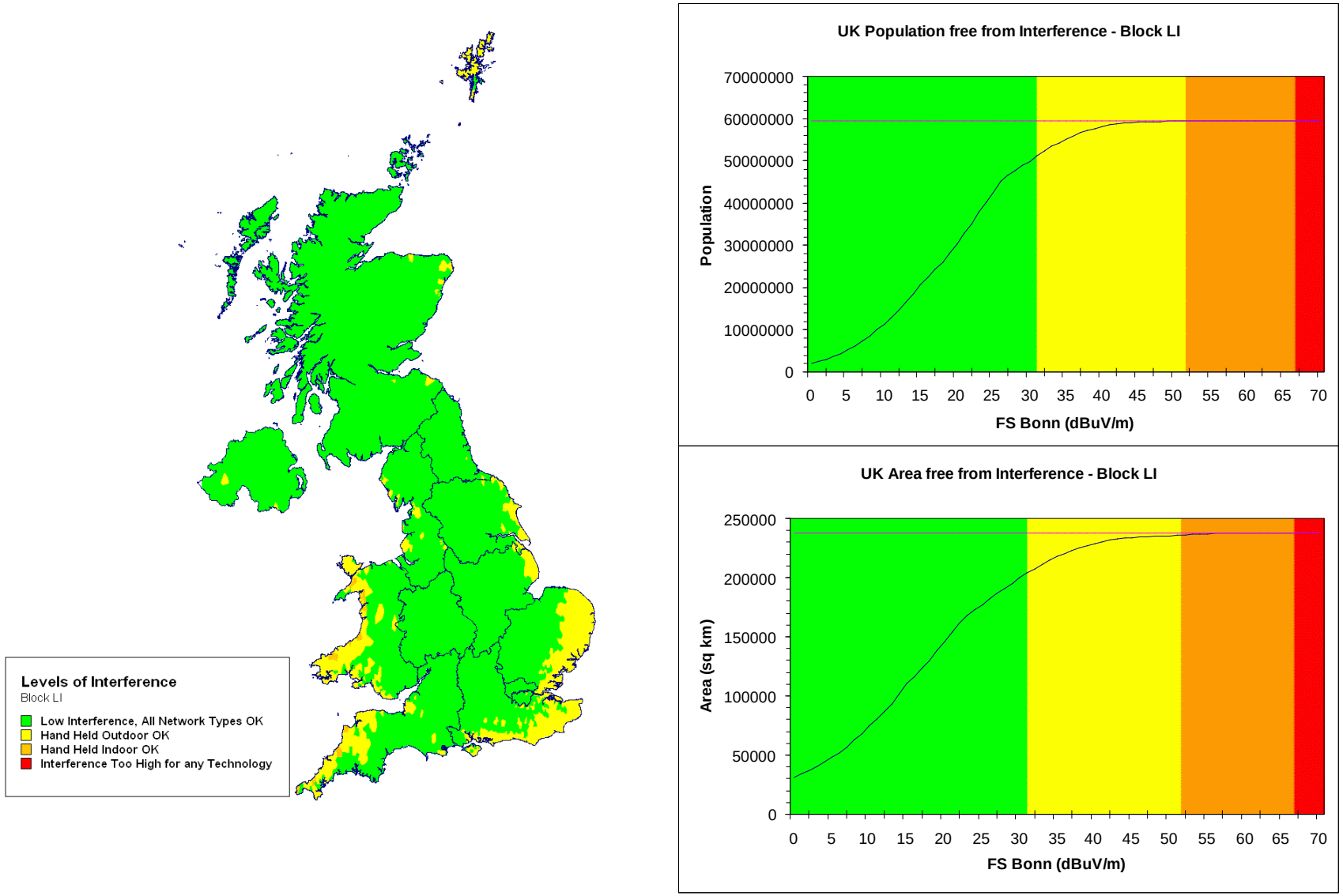


Exhibit A.11: *UK incoming interference from Continental T-DAB systems –* ***Block LJ*** *[Source: Analysys, Mason 2006]*

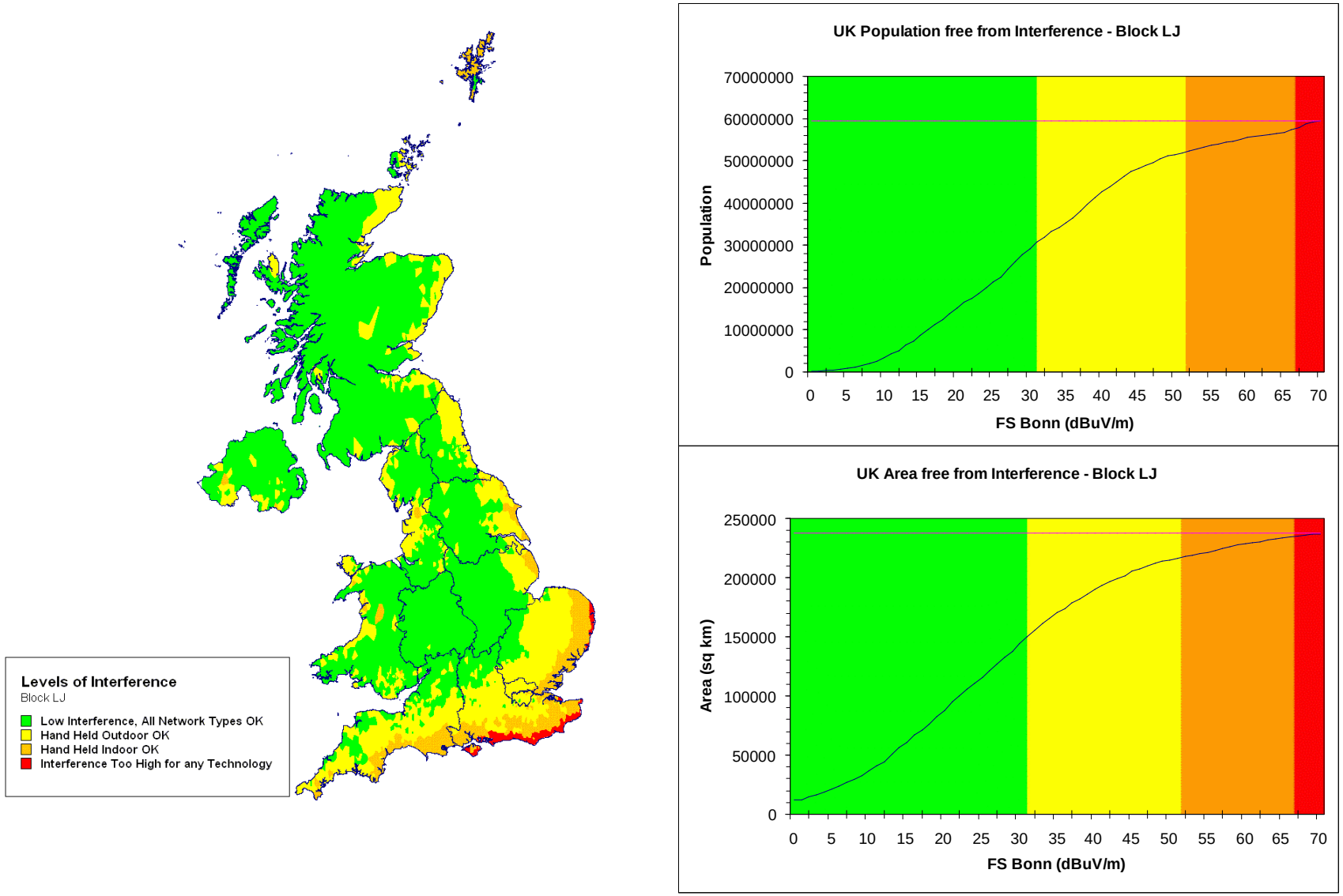


Exhibit A.12: *UK incoming interference from Continental T-DAB systems –* ***Block LK*** *[Source: Analysys, Mason 2006]*

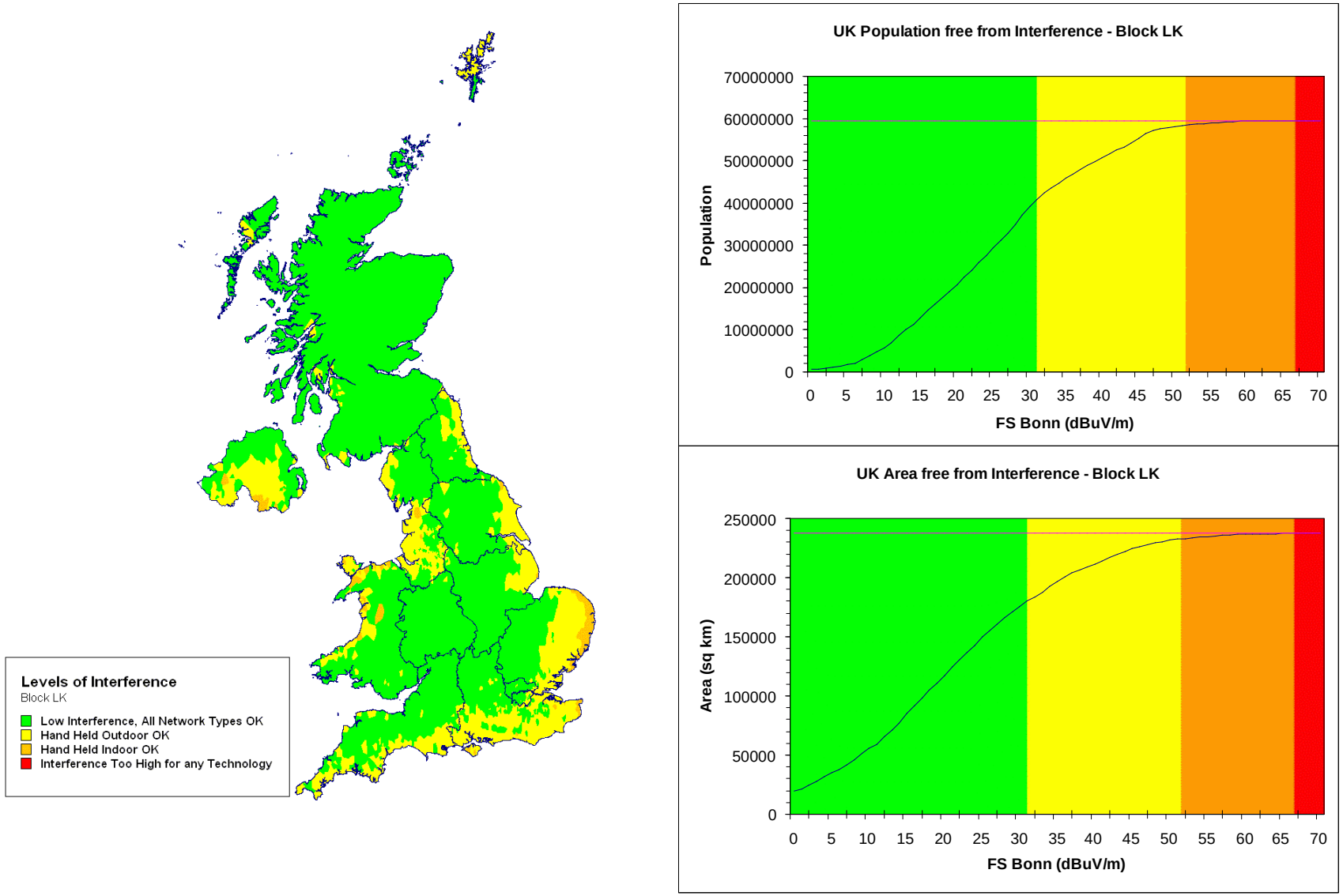


Exhibit A.13: *UK incoming interference from Continental T-DAB systems –* ***Block LL*** *[Source: Analysys, Mason 2006]*

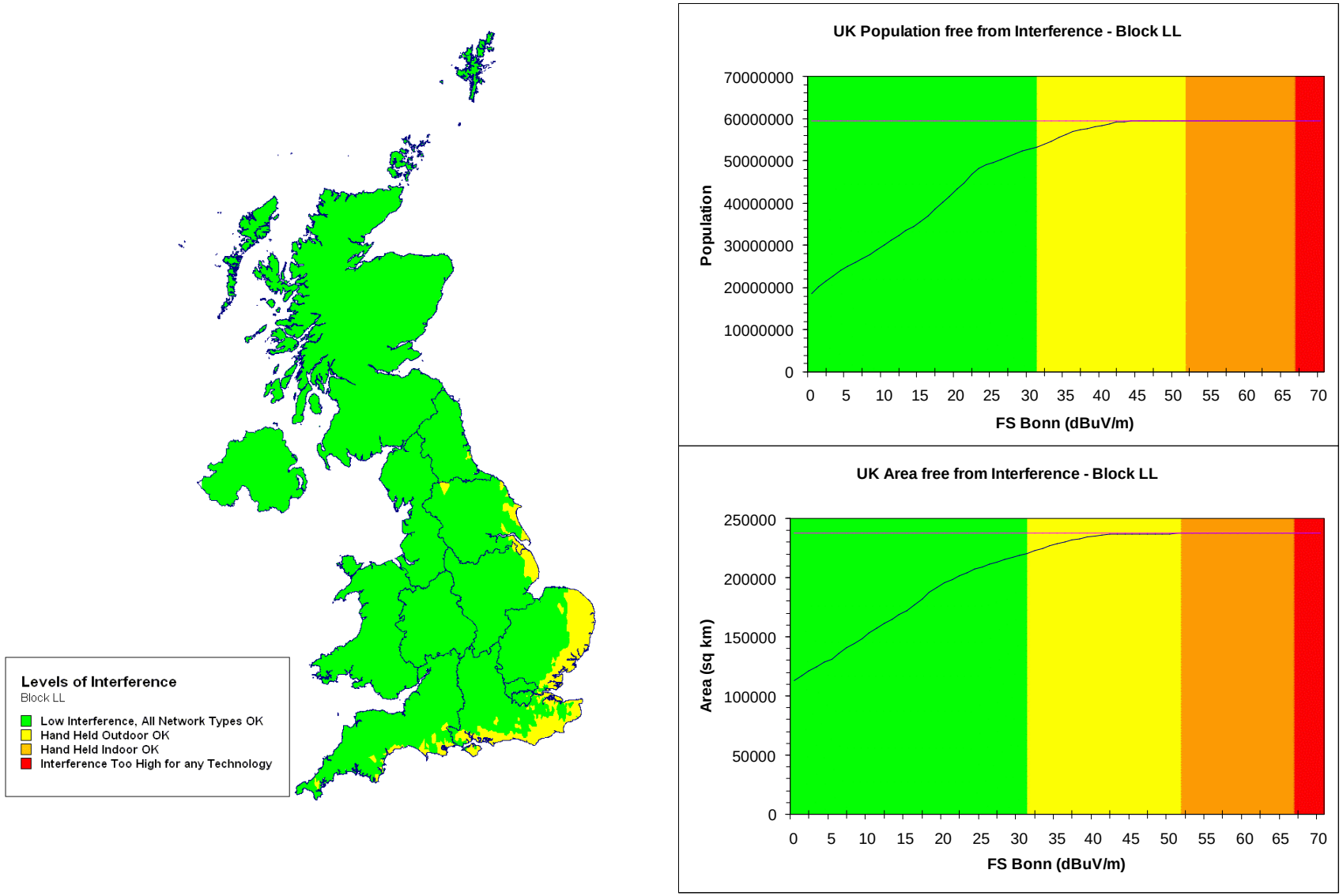


Exhibit A.14: *UK incoming interference from Continental T-DAB systems –* ***Block LM*** *[Source: Analysys, Mason 2006]*

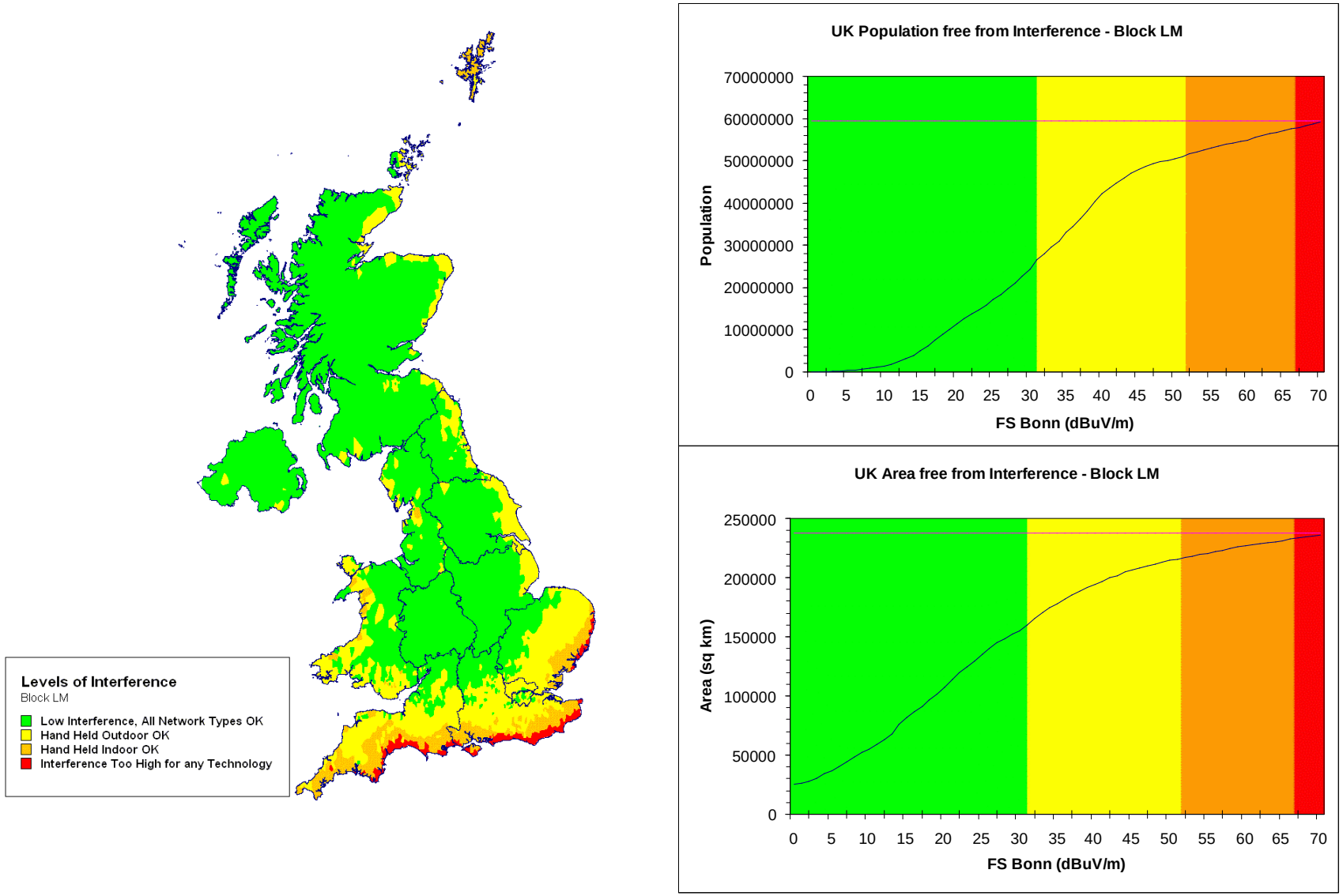


Exhibit A.15: *UK incoming interference from Continental T-DAB systems –* ***Block LN*** *[Source: Analysys, Mason 2006]*

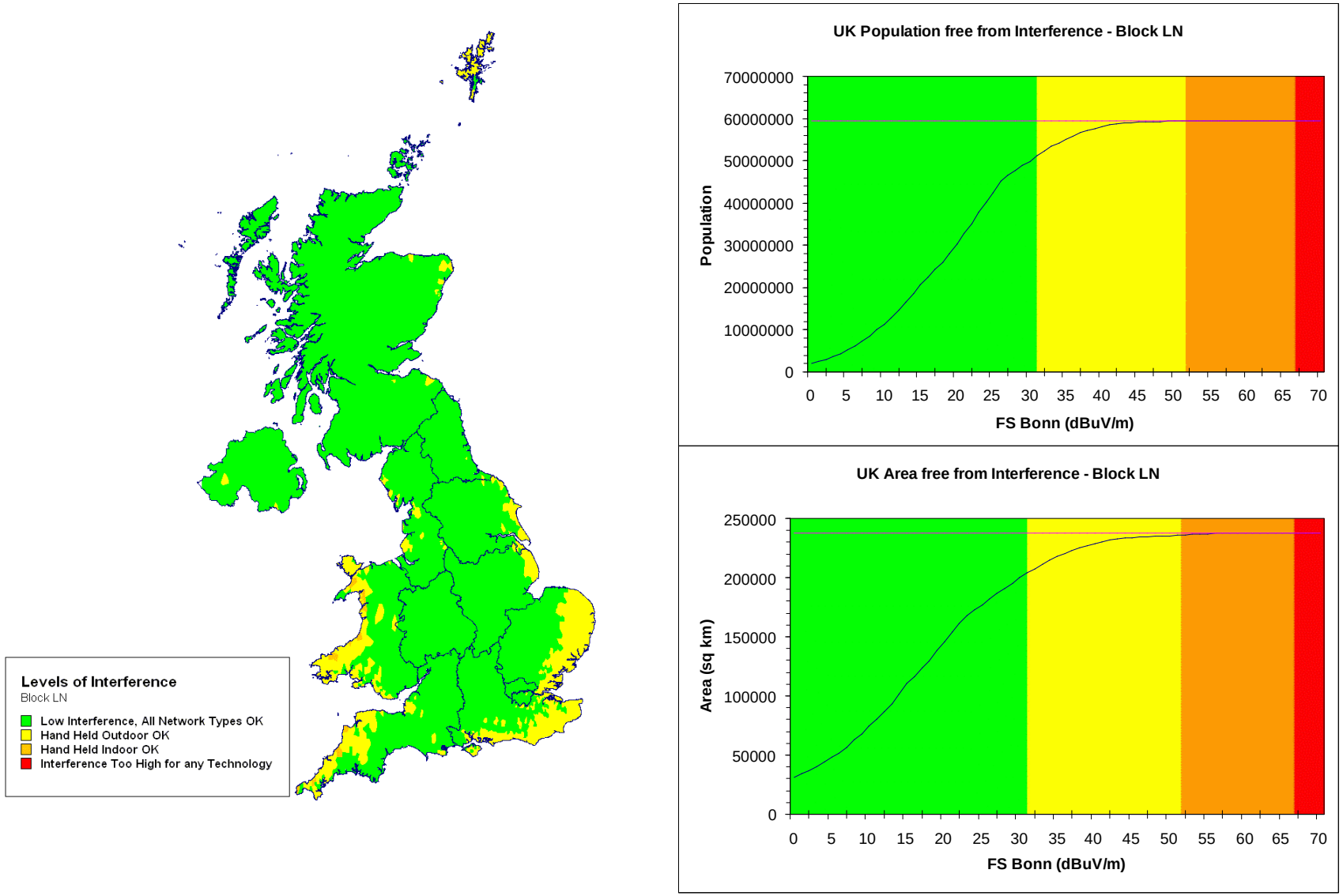


Exhibit A.16: *UK incoming interference from Continental T-DAB systems –* ***Block LO*** *[Source: Analysys, Mason 2006]*

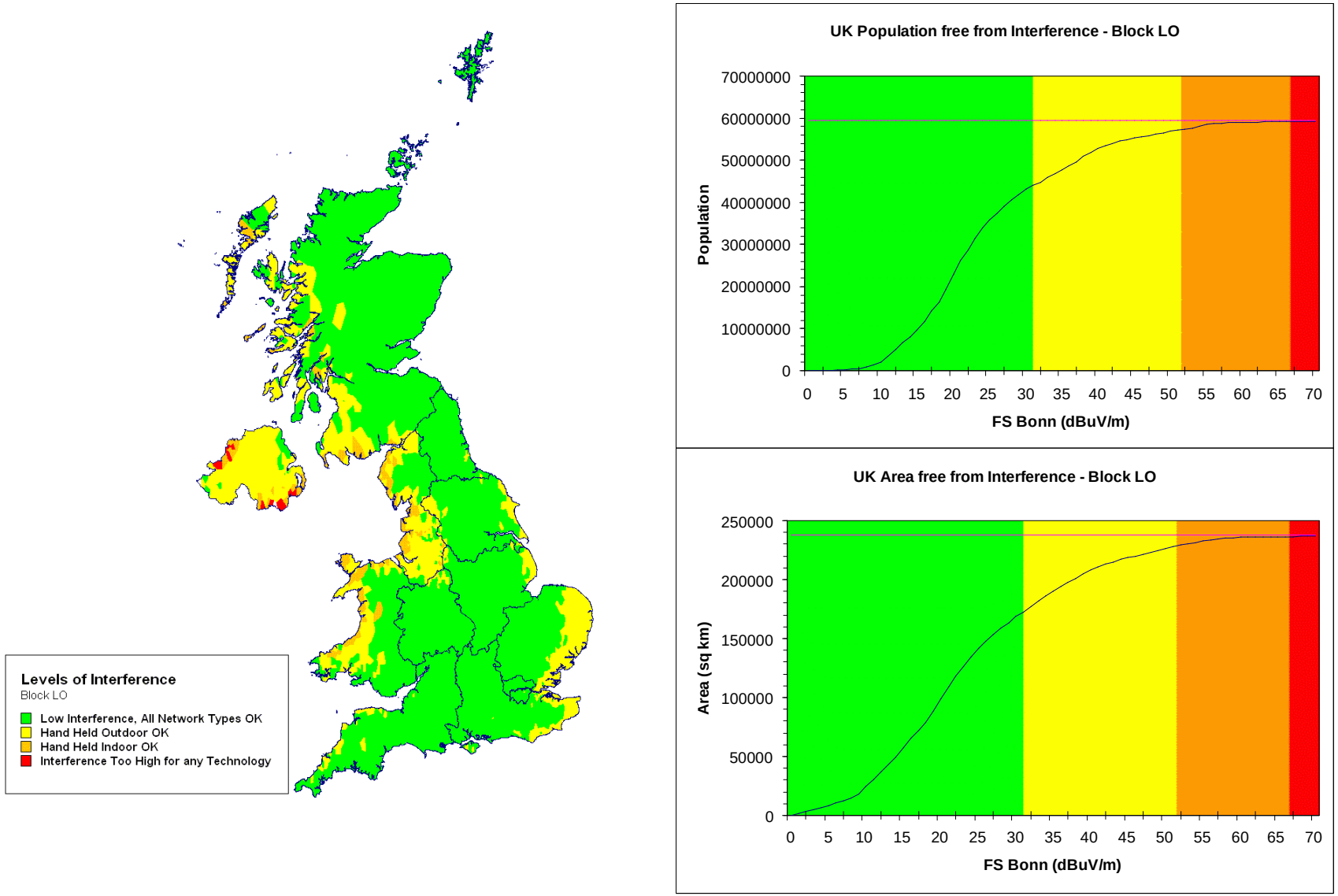
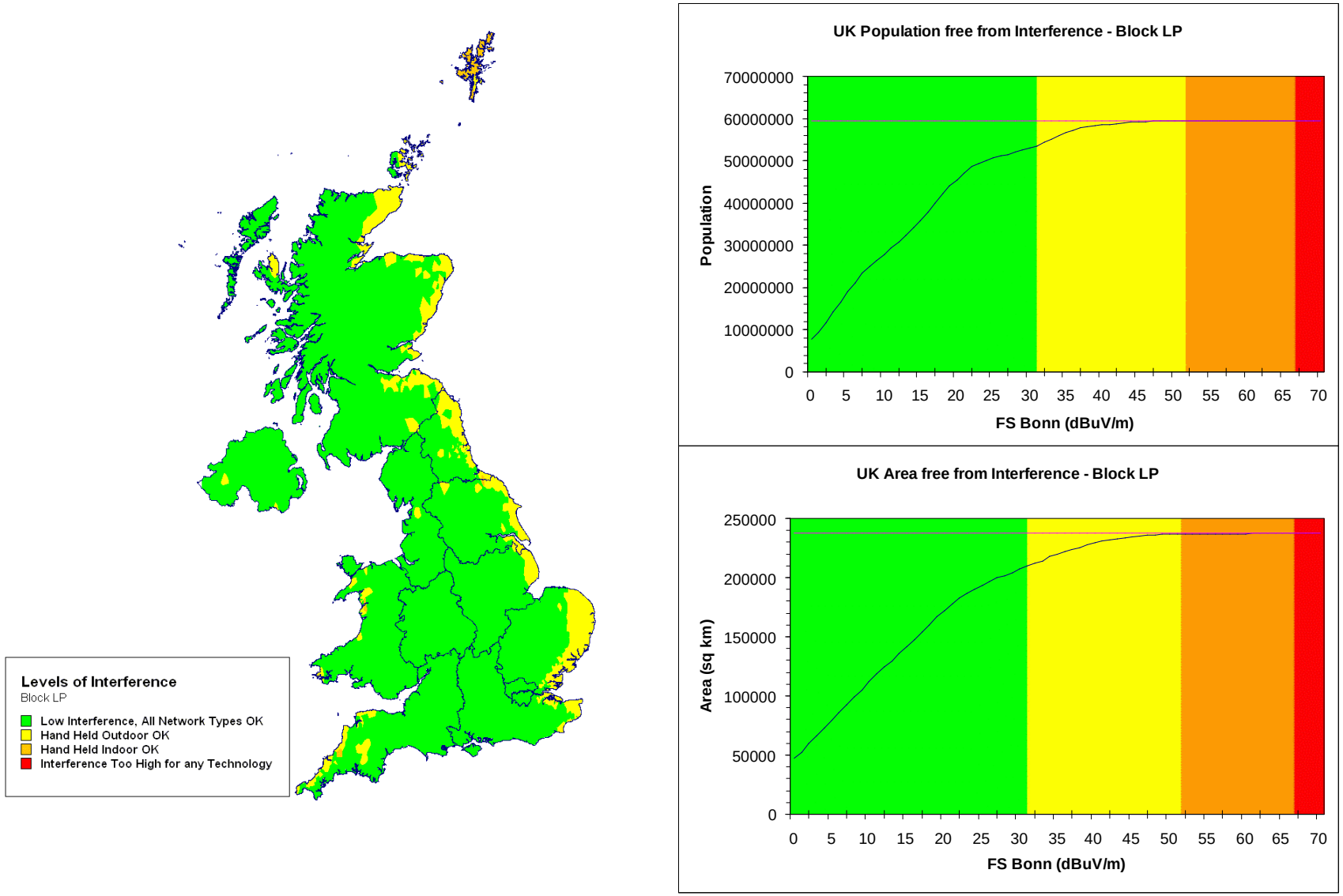
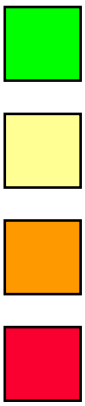


Exhibit A.17: *UK incoming interference from Continental T-DAB systems –* ***Block LP*** *[Source: Analysys, Mason 2006]*



Annex B: Outgoing interference charts by block

The following maps show the power limits that are needed in order to prevent outgoing interference to Continental T-DAB systems. Each of the 16 lower L-Band frequency Blocks is shown on a separate page. Areas of the UK are colour-coded to show the transmitter power limits required to ensure that the signal quality of Continental T-DAB systems is not affected. The colour codes are as follows:



Typical omni-directional transmitter for T-DAB, DMB and DVB-H

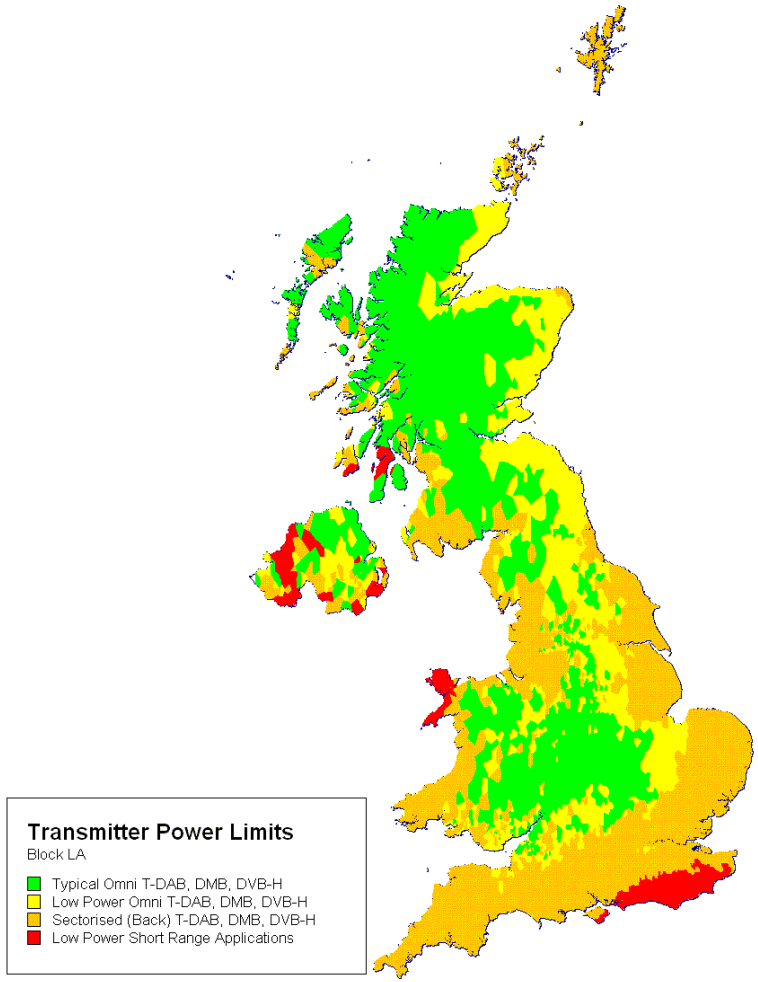
Low-power omni-directional transmitter for T-DAB, DMB and DVB-H

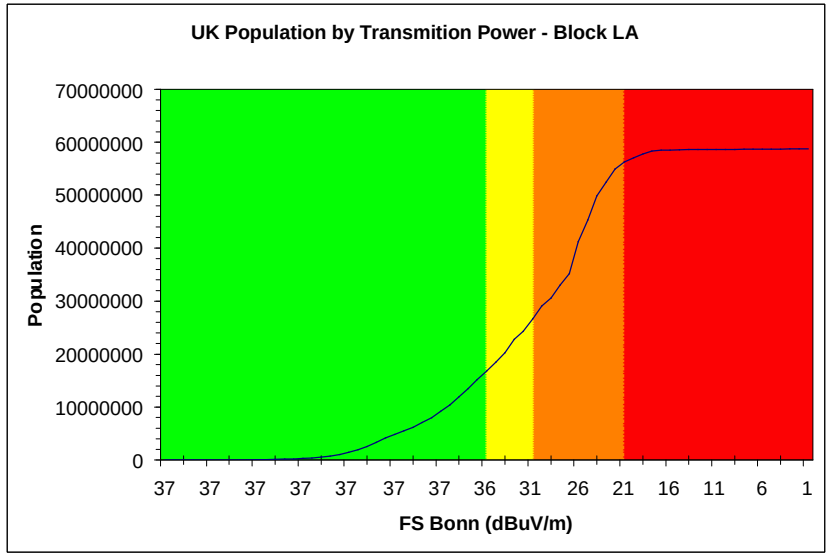
Sectorised (back) transmitter for T-DAB, DMB and DVB-H

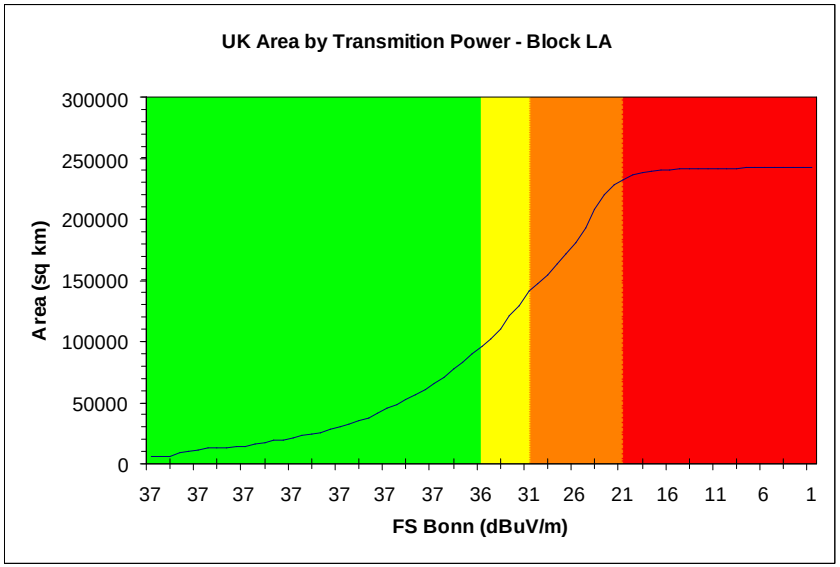
Low-power, short-range PMSE applications only

Exhibit B.1: *Colour codes used in maps of outgoing interference [Source: Analysys, Mason 2006]*

Exhibit B.2: *UK outgoing interference to Continental T-DAB systems –* ***Block LA*** *[Source: Analysys, Mason 2006]*







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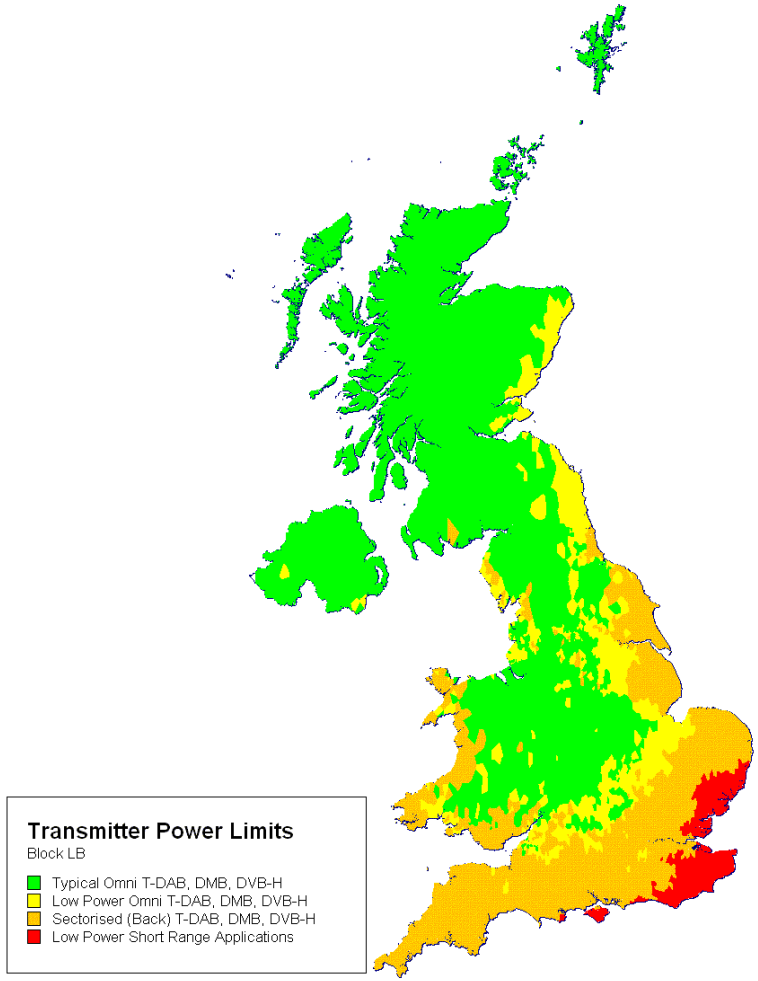
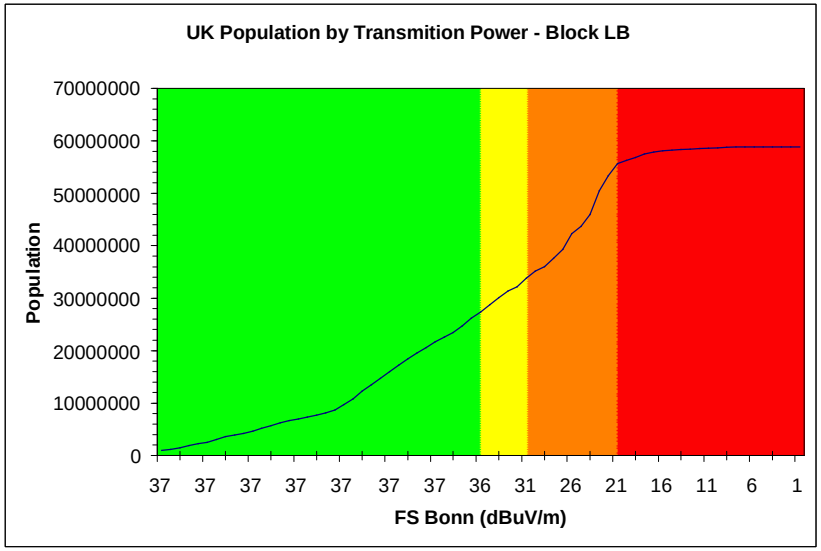
Analysys

Exhibit B.3: *UK outgoing interference to Continental T-DAB systems –* ***Block LB*** *[Source: Analysys, Mason 2006]*





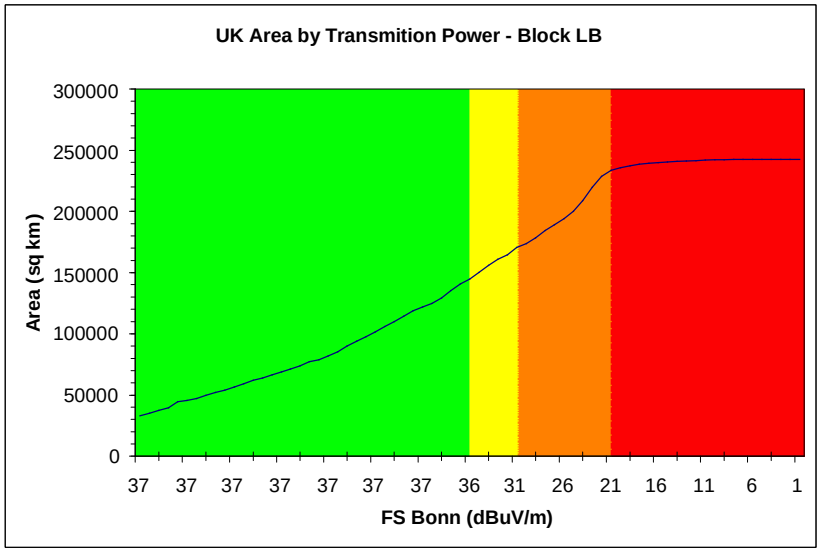
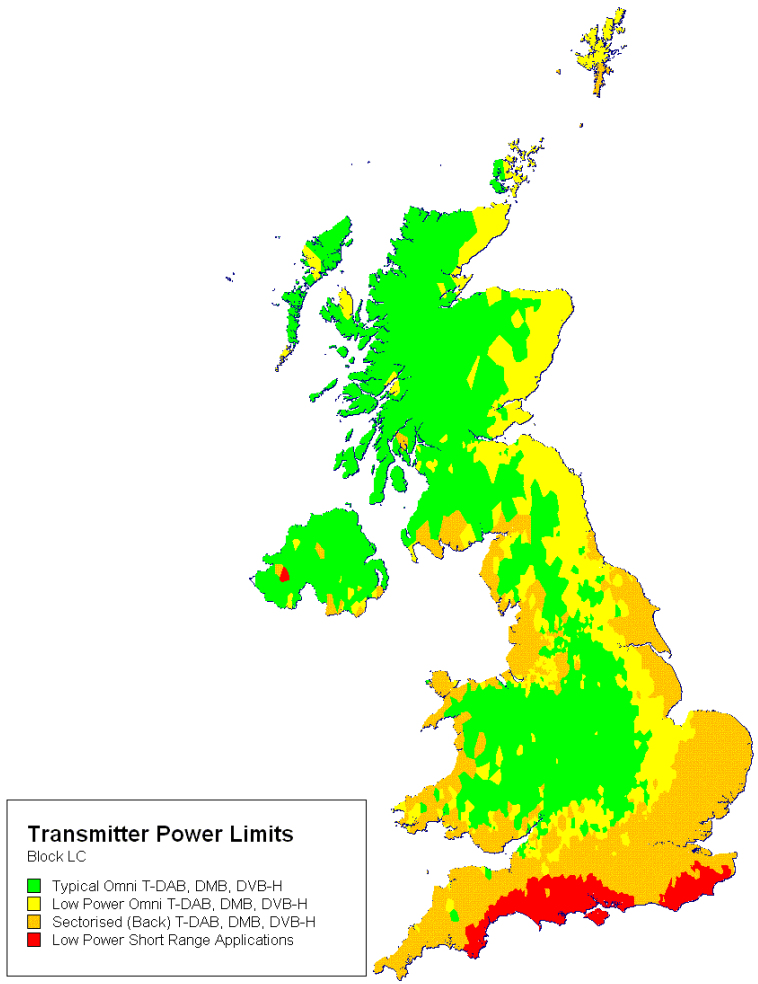
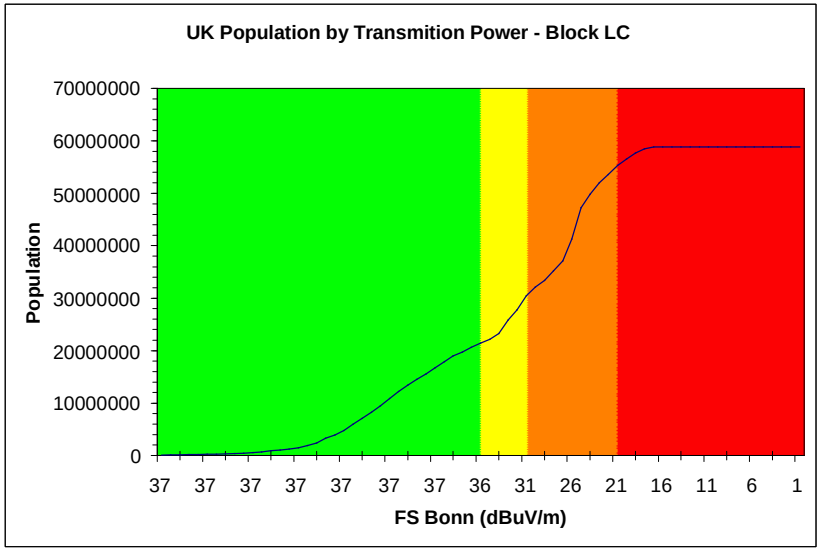


Exhibit B.4: *UK outgoing interference to Continental T-DAB systems –* ***Block LC*** *[Source: Analysys, Mason 2006]*





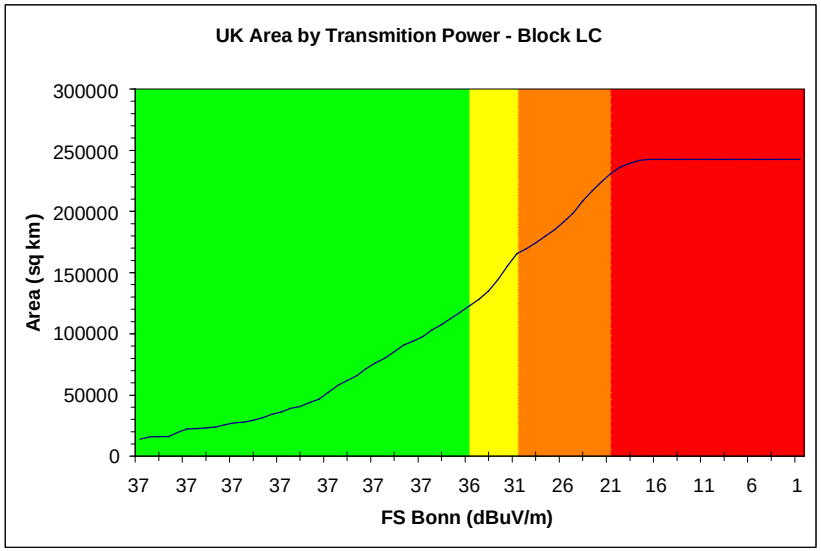
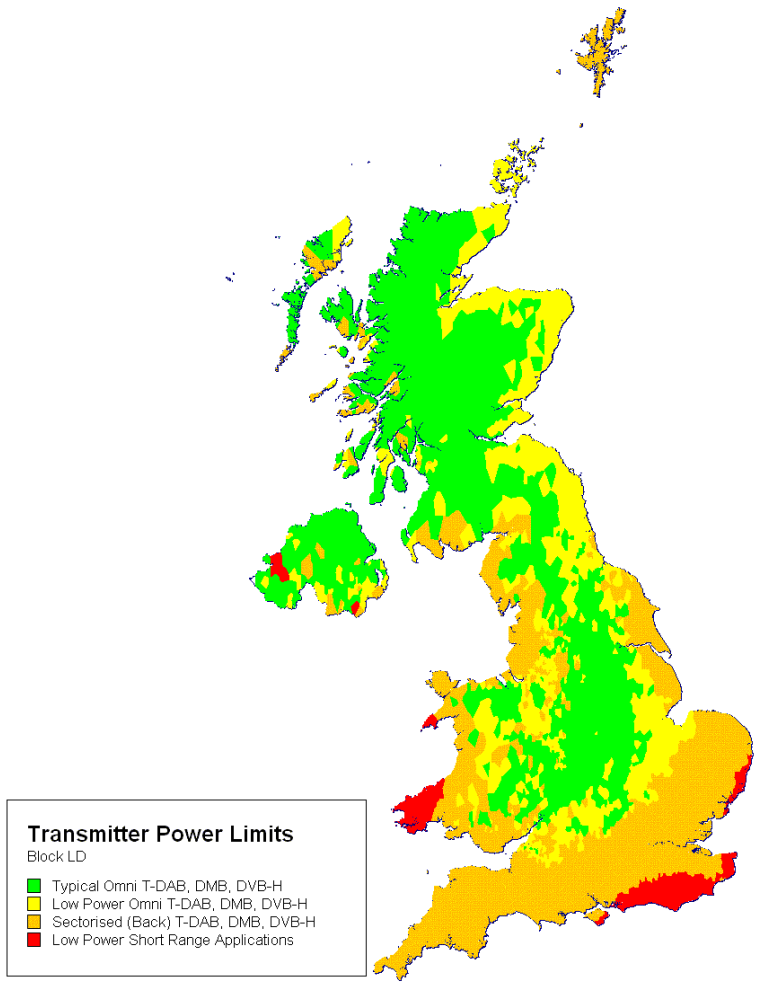
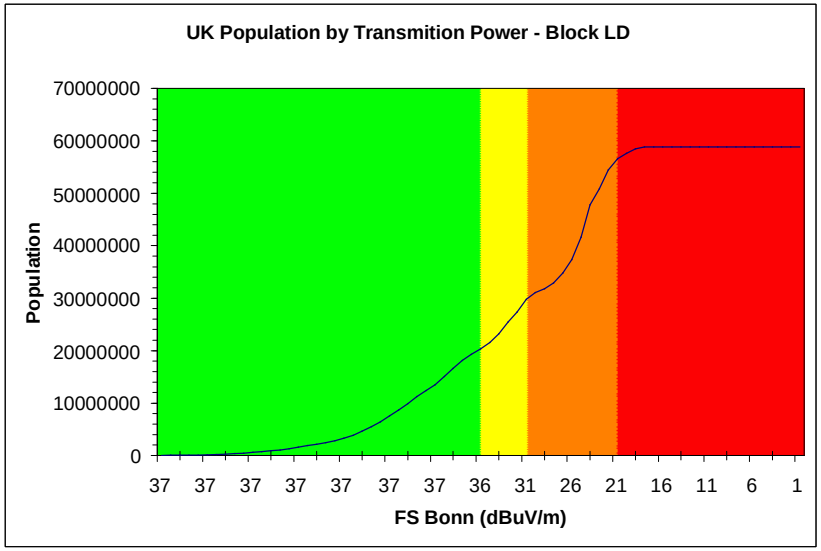


Exhibit B.5: *UK outgoing interference to Continental T-DAB systems –* ***Block LD*** *[Source: Analysys, Mason 2006]*





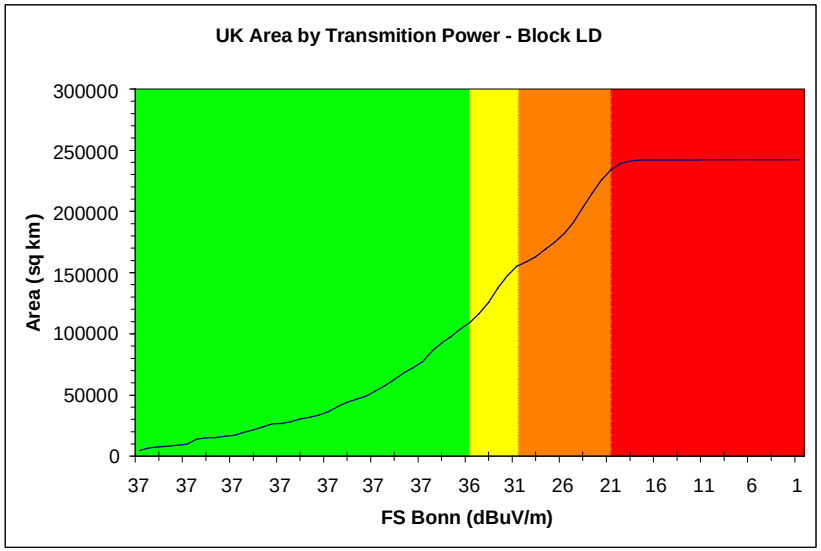
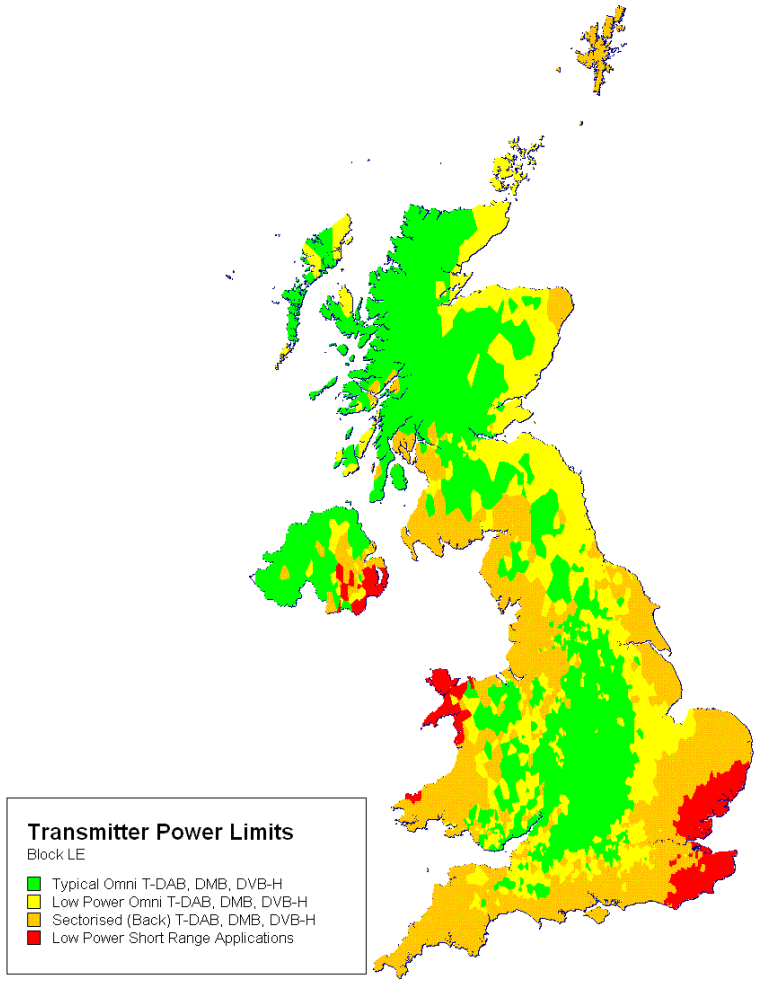
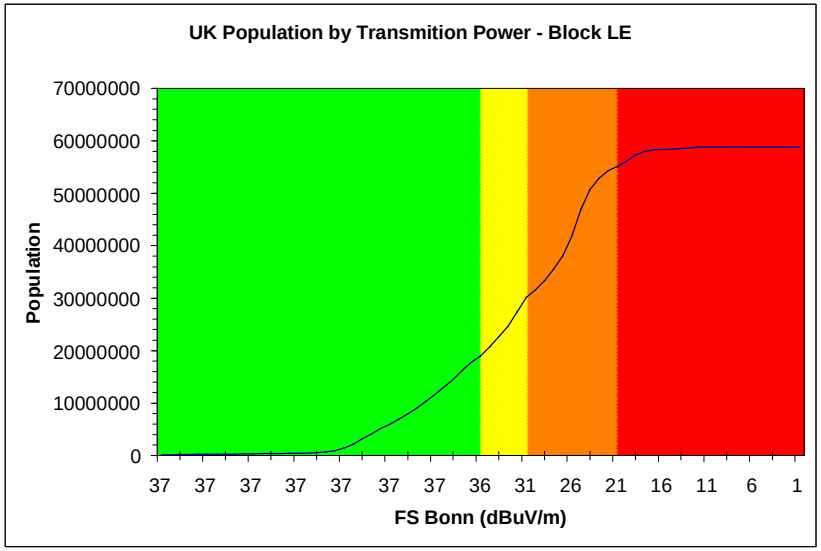


Exhibit B.6: *UK outgoing interference to Continental T-DAB systems –* ***Block LE*** *[Source: Analysys, Mason 2006]*





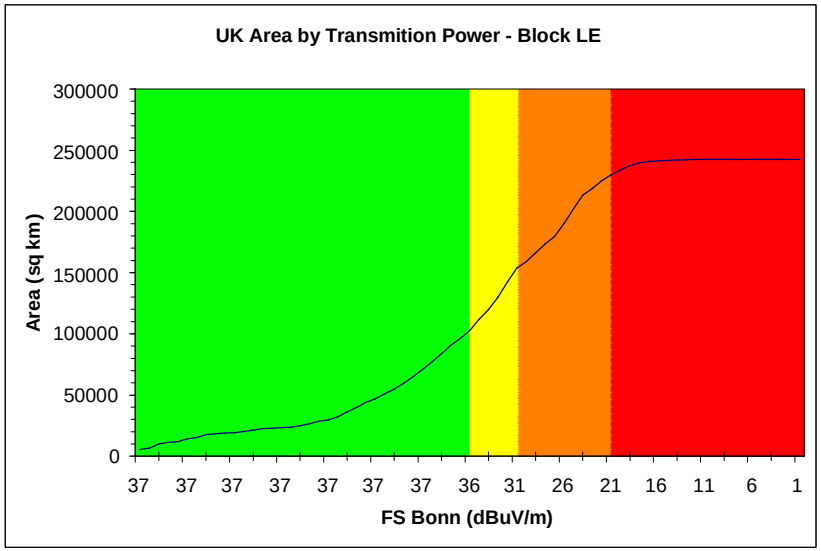
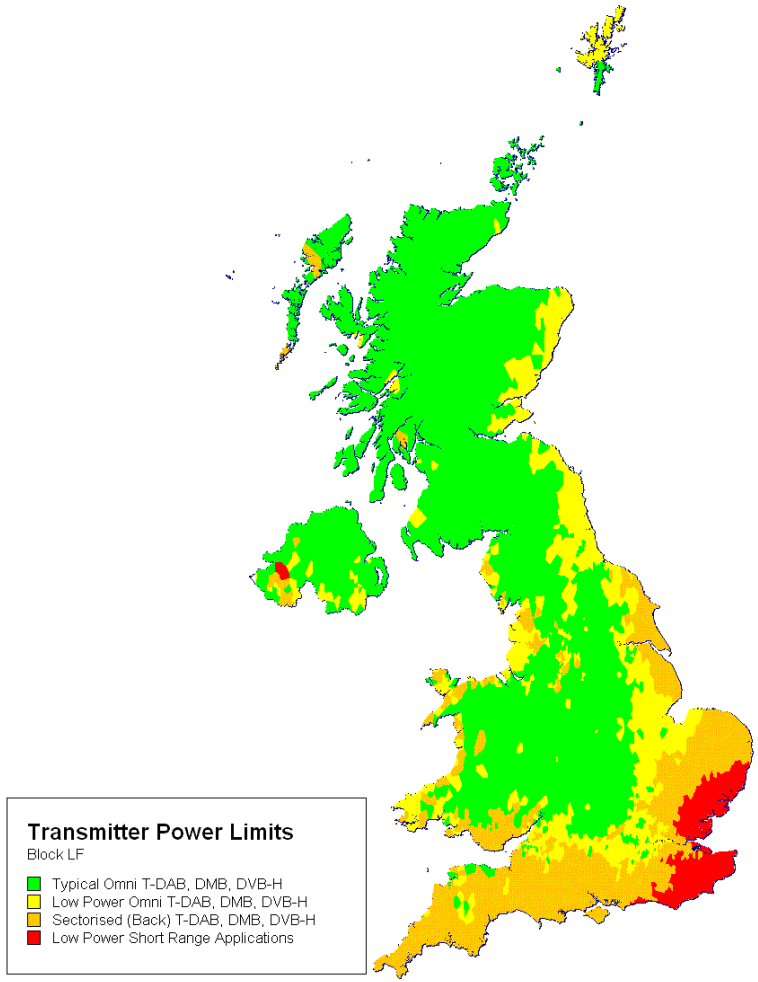
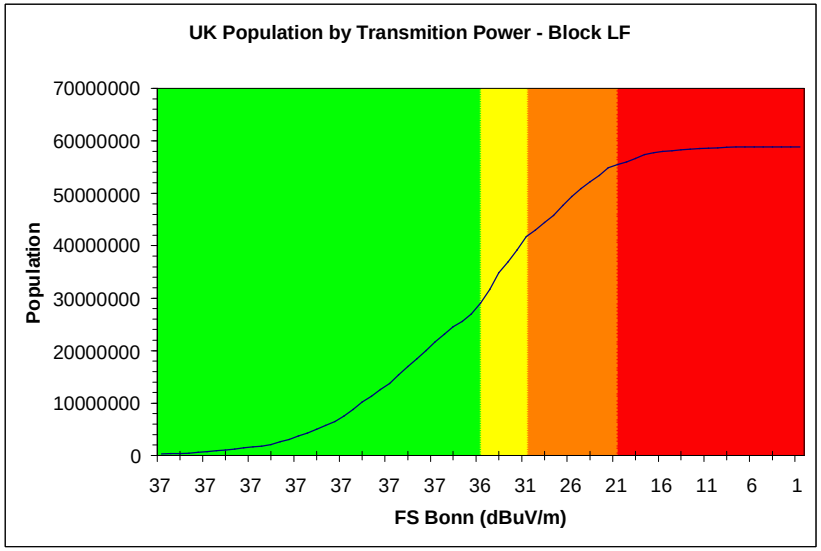


Exhibit B.7: *UK outgoing interference to Continental T-DAB systems –* ***Block LF*** *[Source: Analysys, Mason 2006]*





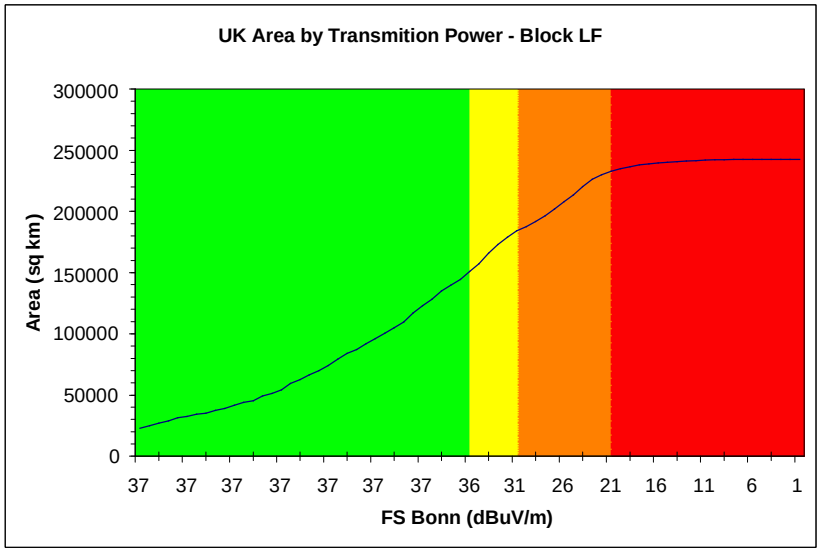
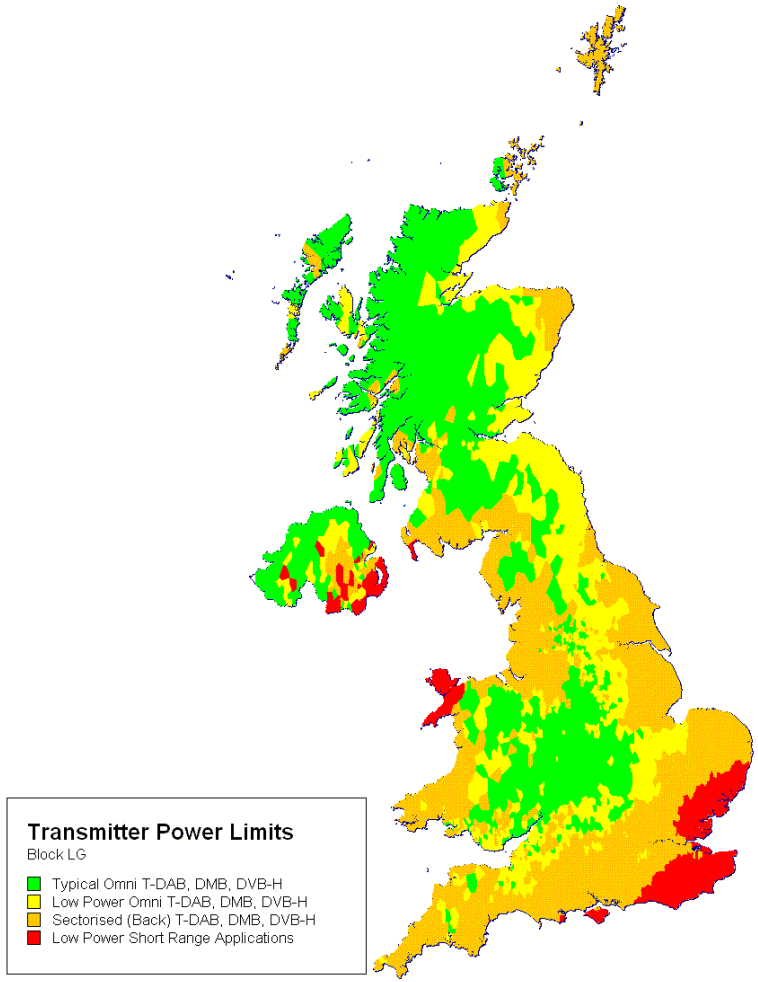
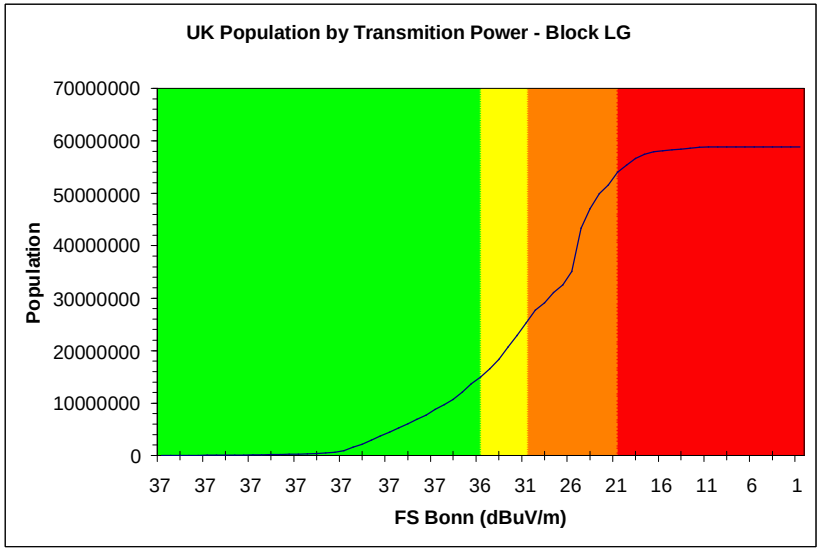


Exhibit B.8: *UK outgoing interference to Continental T-DAB systems –* ***Block LG*** *[Source: Analysys, Mason 2006]*





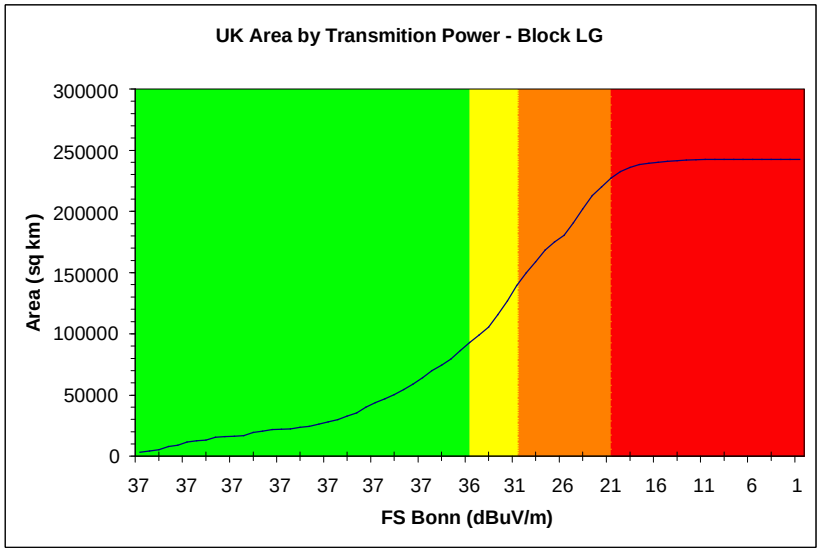
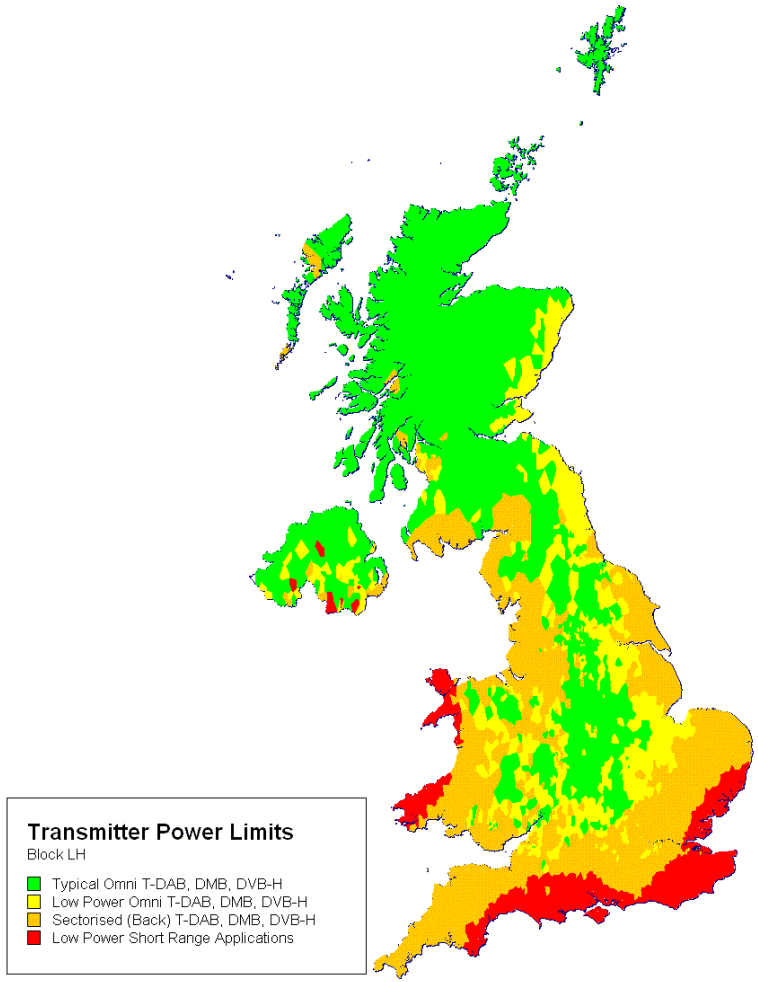
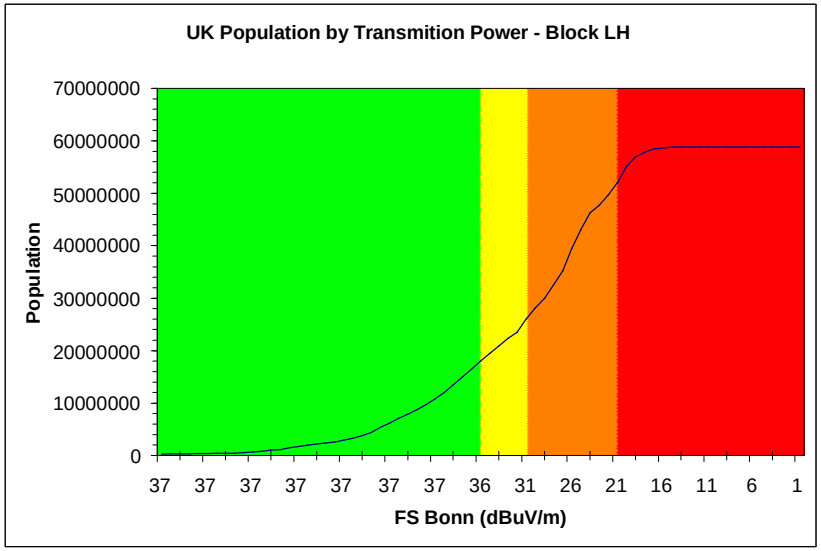


Exhibit B.9: *UK outgoing interference to Continental T-DAB systems –* ***Block LH*** *[Source: Analysys, Mason 2006]*





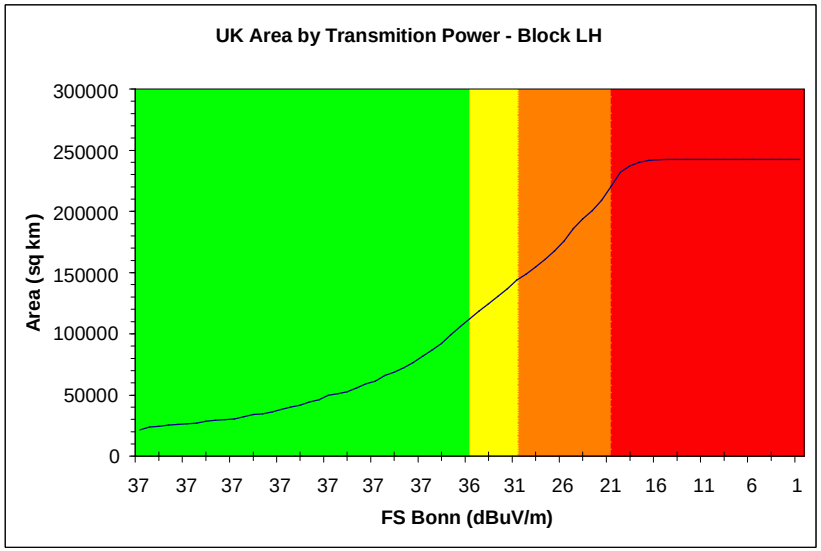
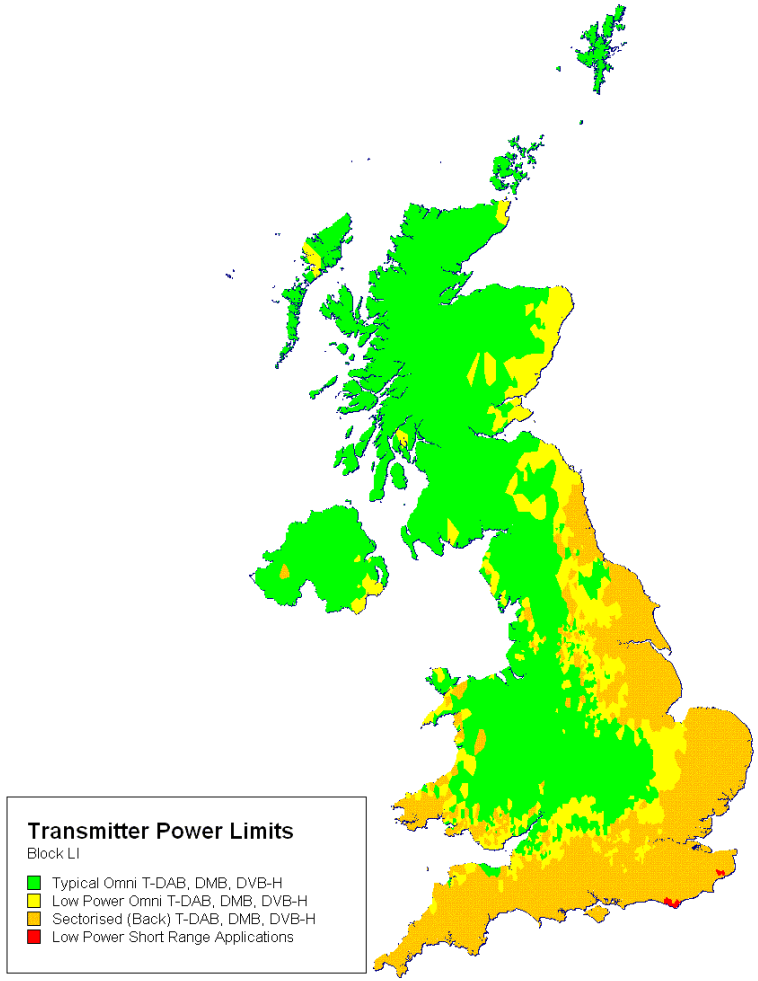
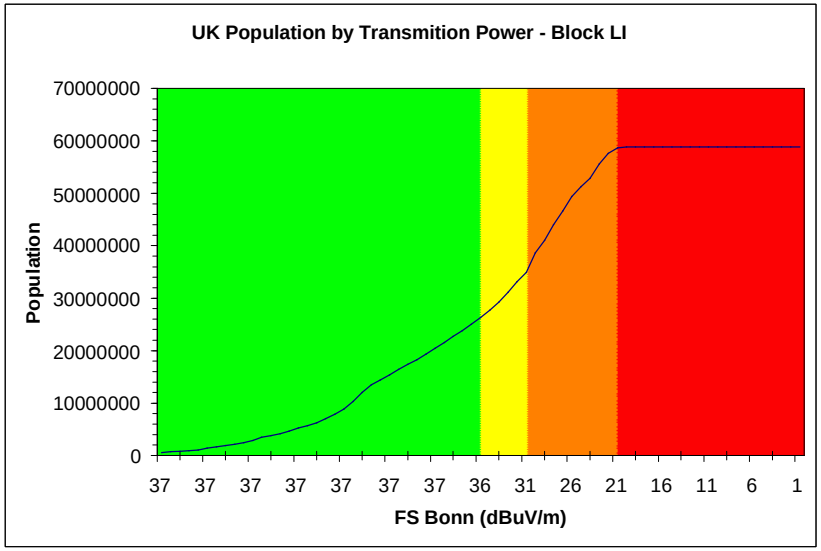


Exhibit B.10: *UK outgoing interference to Continental T-DAB systems –* ***Block LI*** *[Source: Analysys, Mason 2006]*





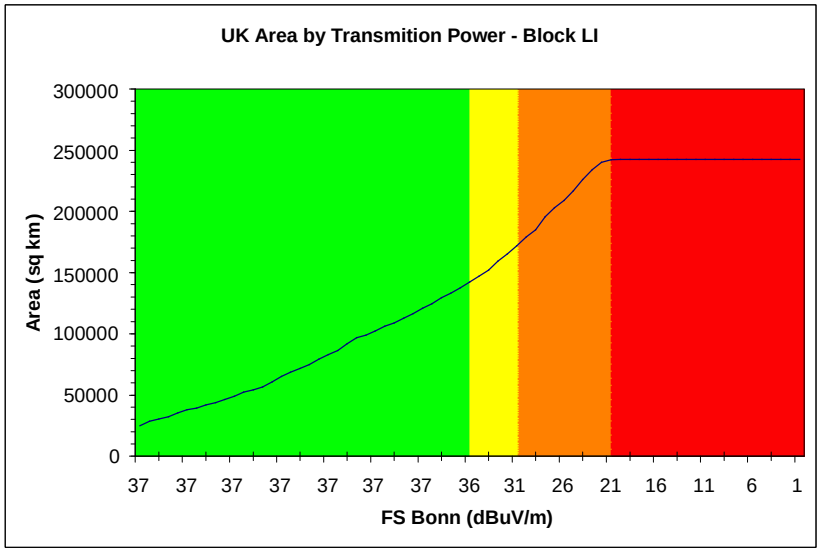
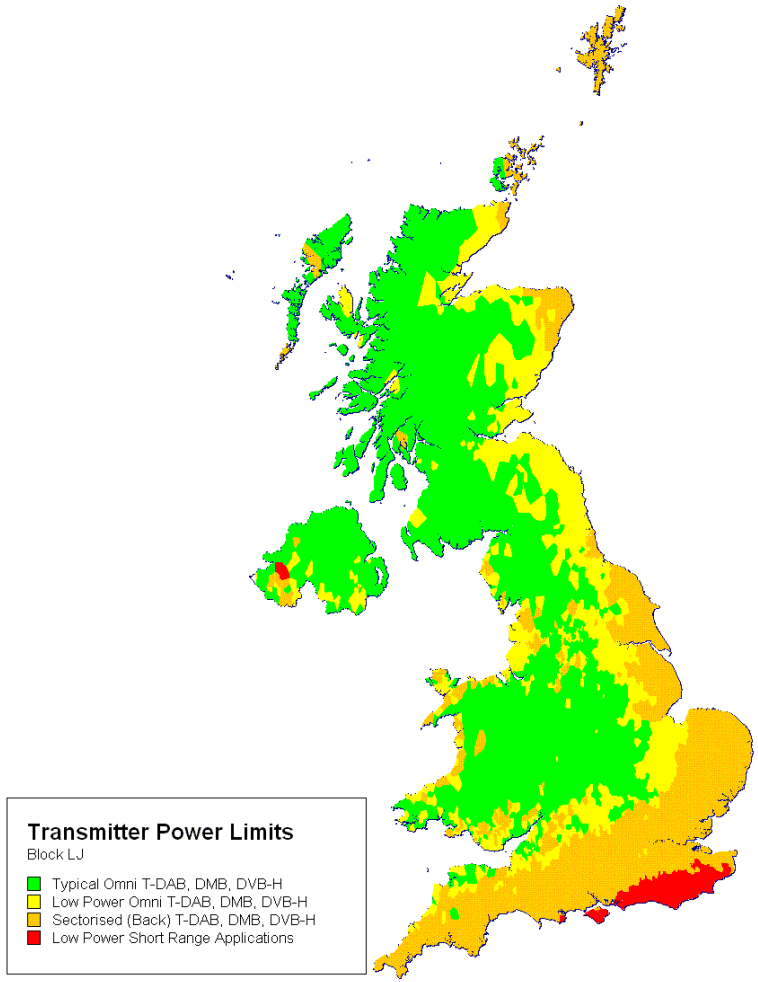
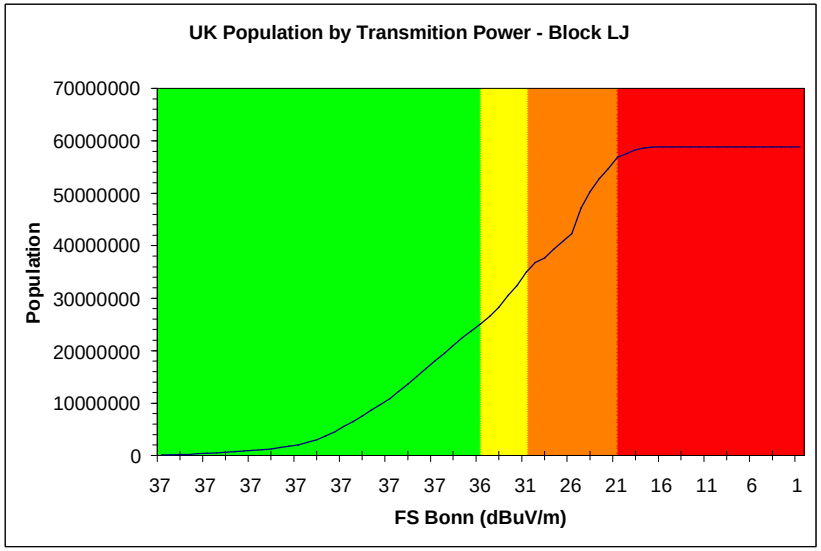


Exhibit B.11: *UK outgoing interference to Continental T-DAB systems –* ***Block LJ*** *[Source: Analysys, Mason 2006]*





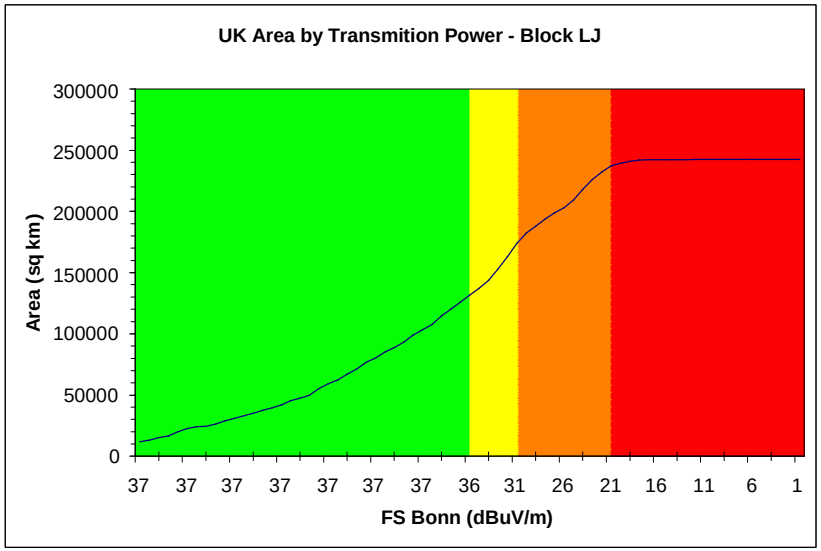
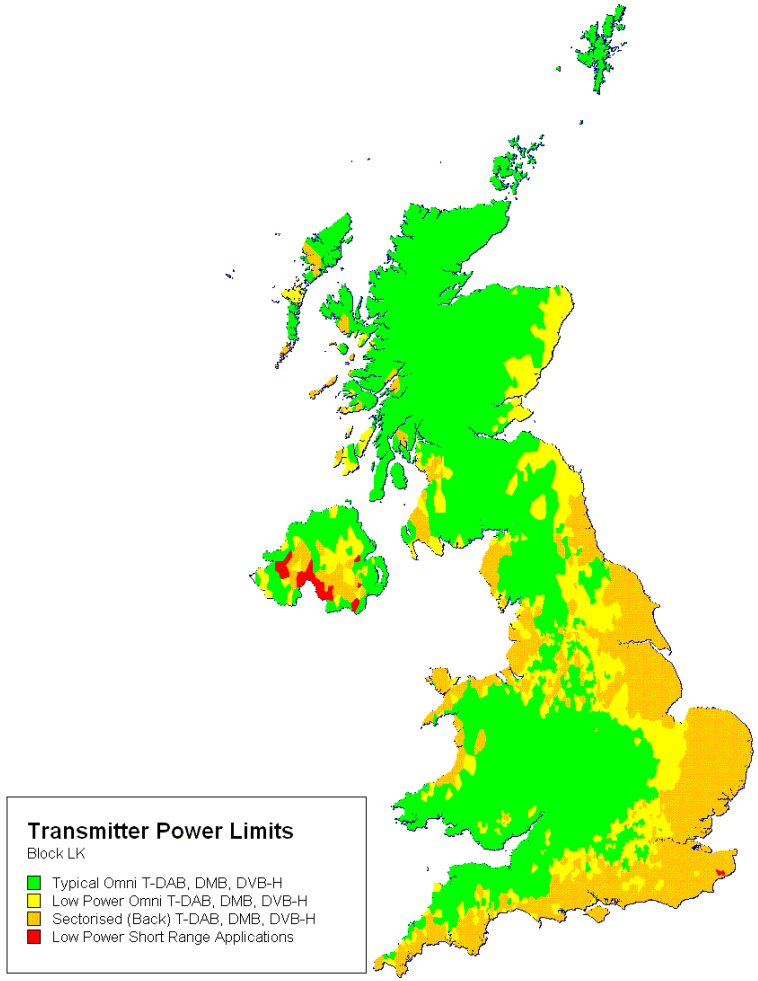
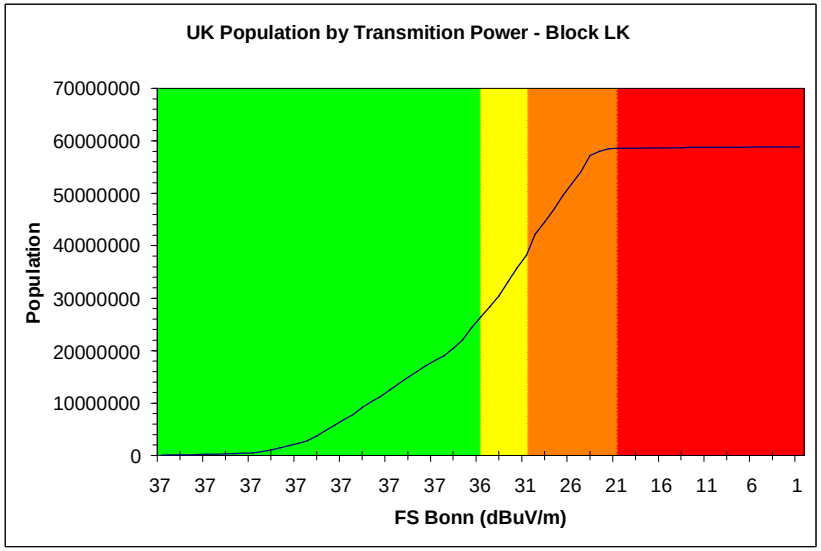


Exhibit B.12: *UK outgoing interference to Continental T-DAB systems –* ***Block LK*** *[Source: Analysys, Mason 2006]*





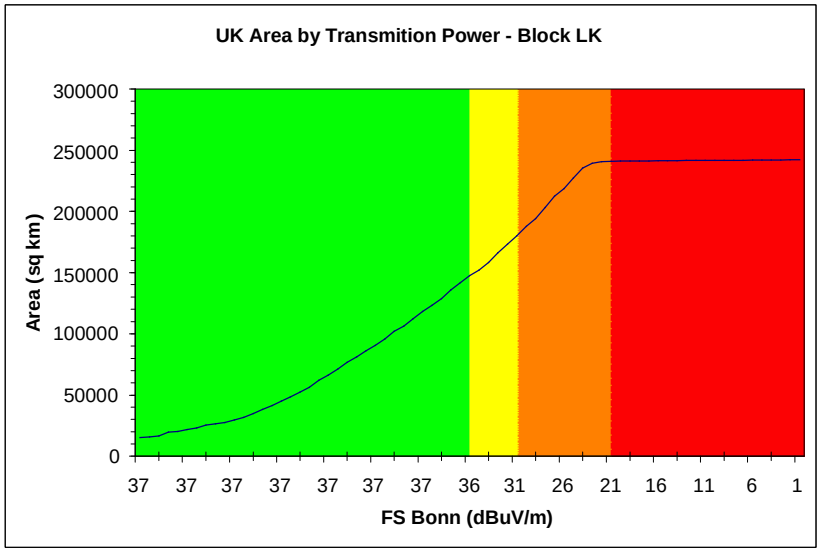
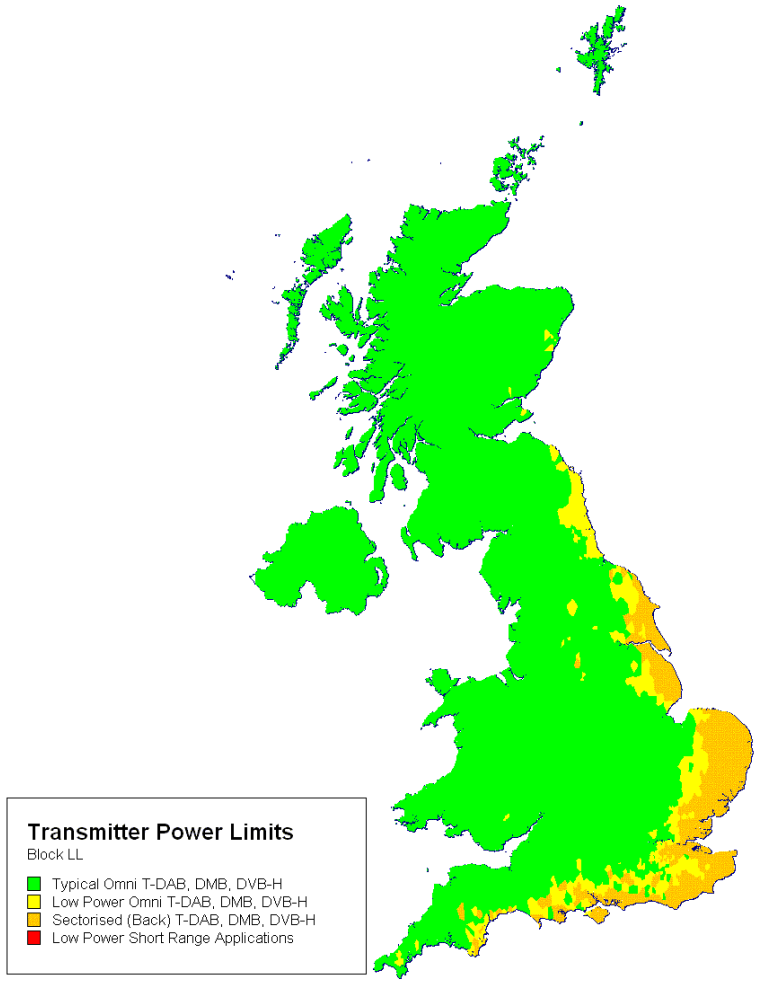
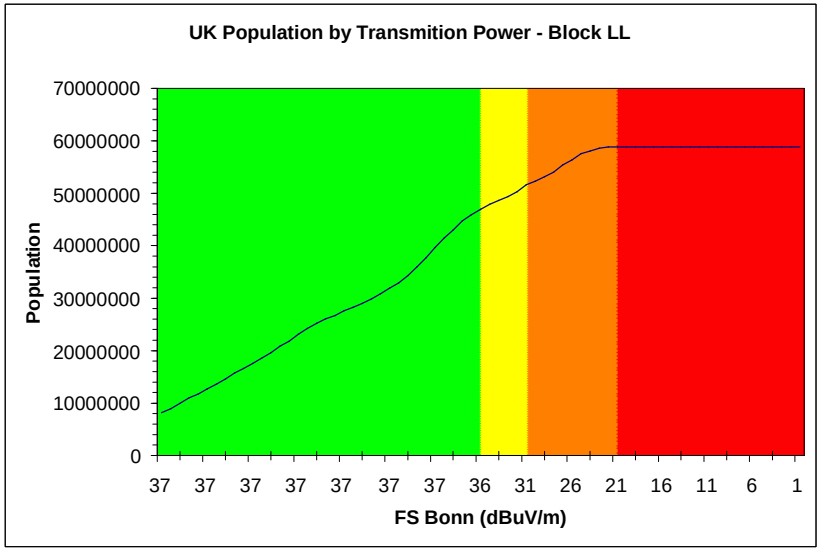


Exhibit B.13: *UK outgoing interference to Continental T-DAB systems –* ***Block LL*** *[Source: Analysys, Mason 2006]*





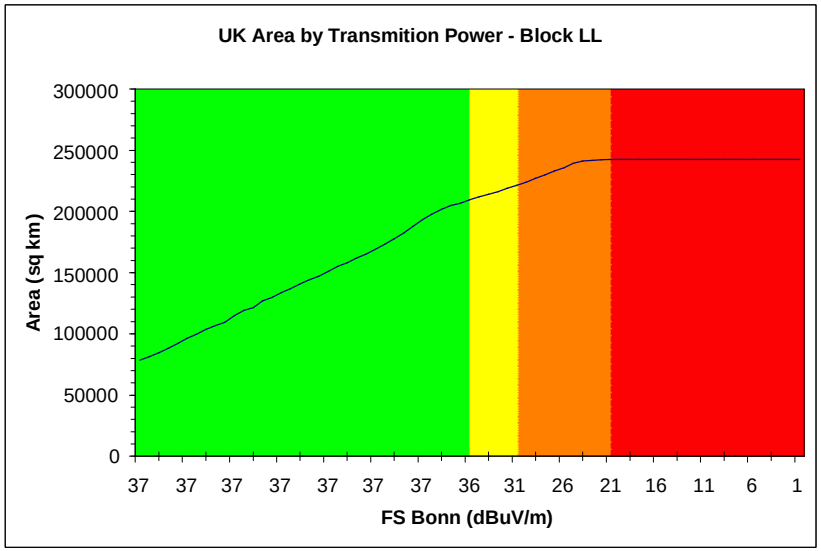
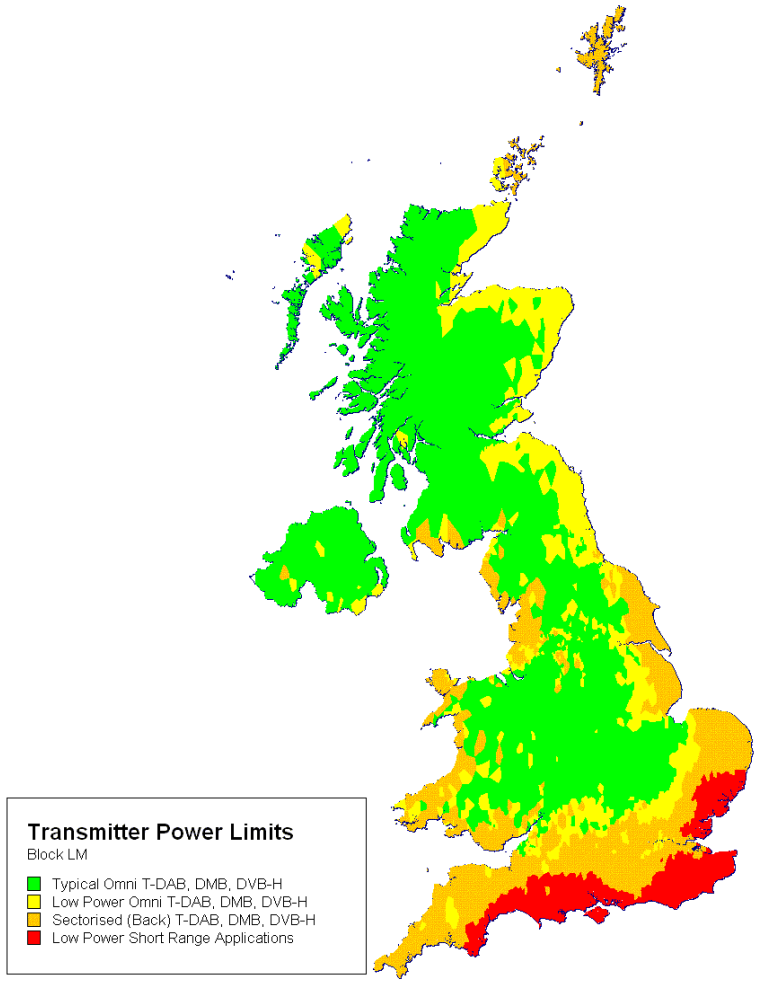
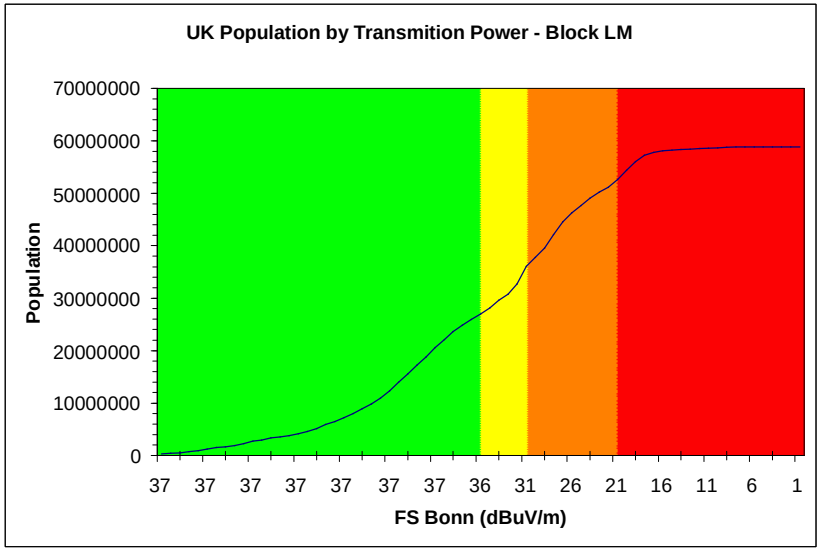


Exhibit B.14: *UK outgoing interference to Continental T-DAB systems –* ***Block LM*** *[Source: Analysys, Mason 2006]*





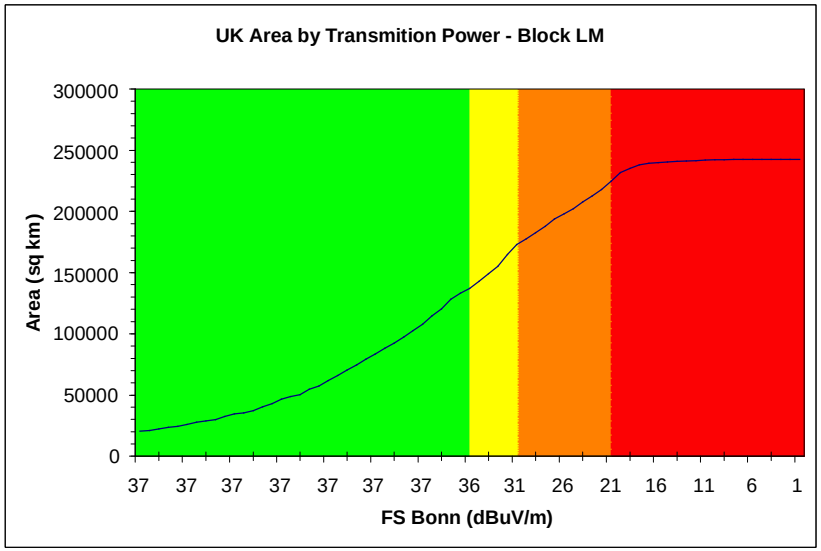
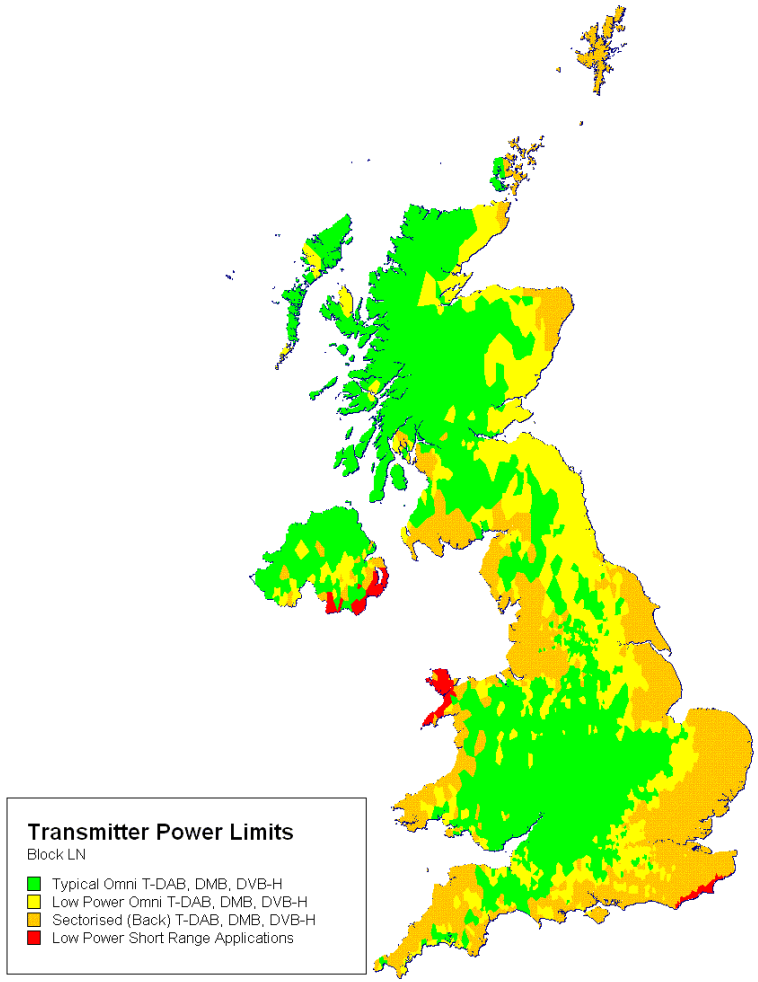
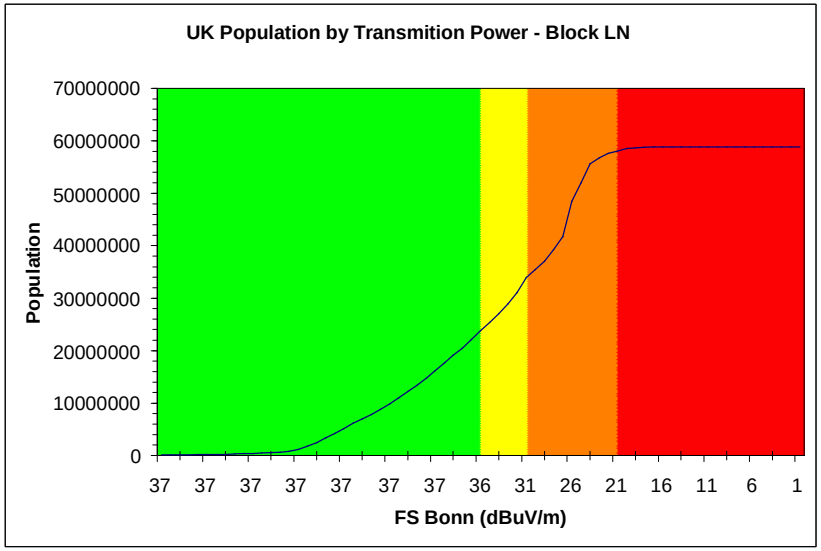


Exhibit B.15: *UK outgoing interference to Continental T-DAB systems –* ***Block LN*** *[Source: Analysys, Mason 2006]*





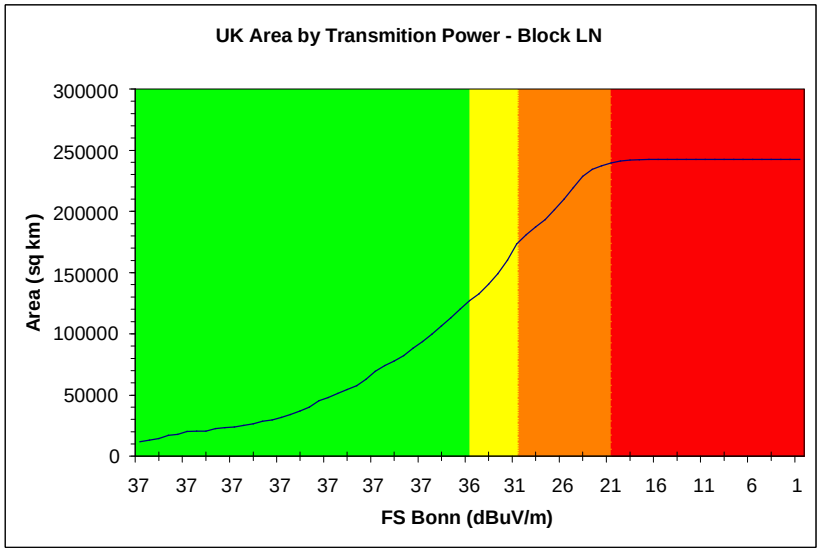
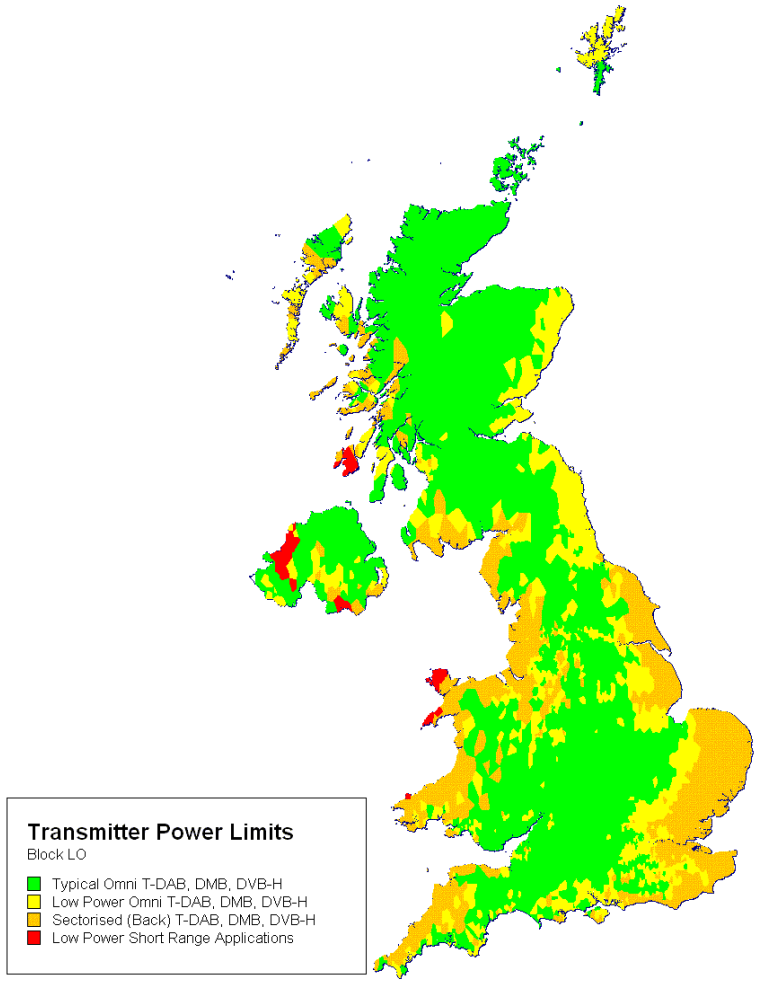
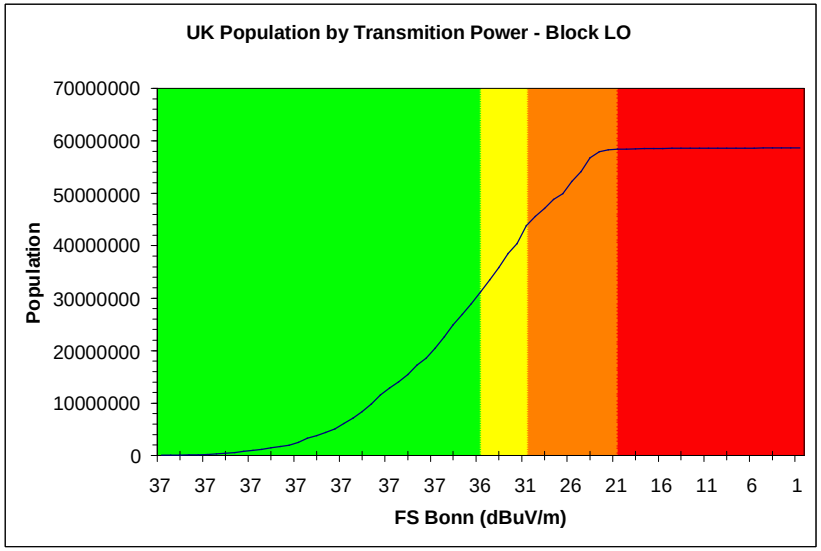


Exhibit B.16: *UK outgoing interference to Continental T-DAB systems –* ***Block LO*** *[Source: Analysys, Mason 2006]*





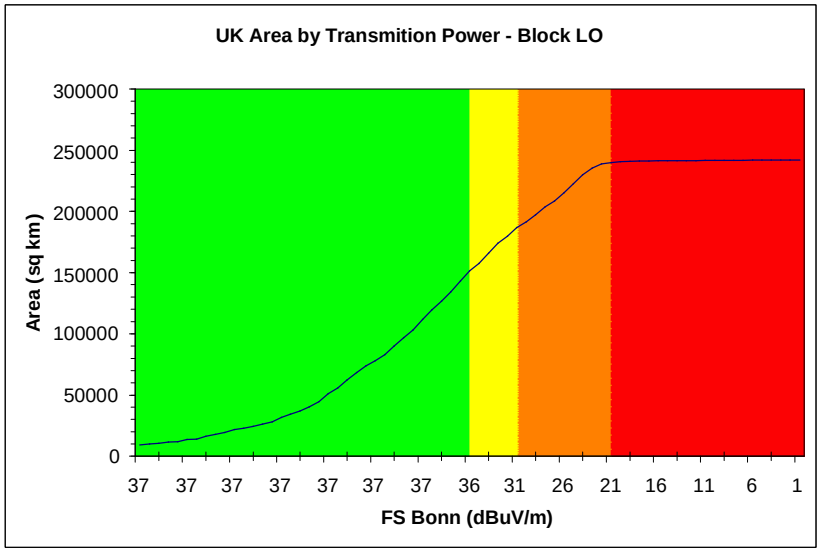
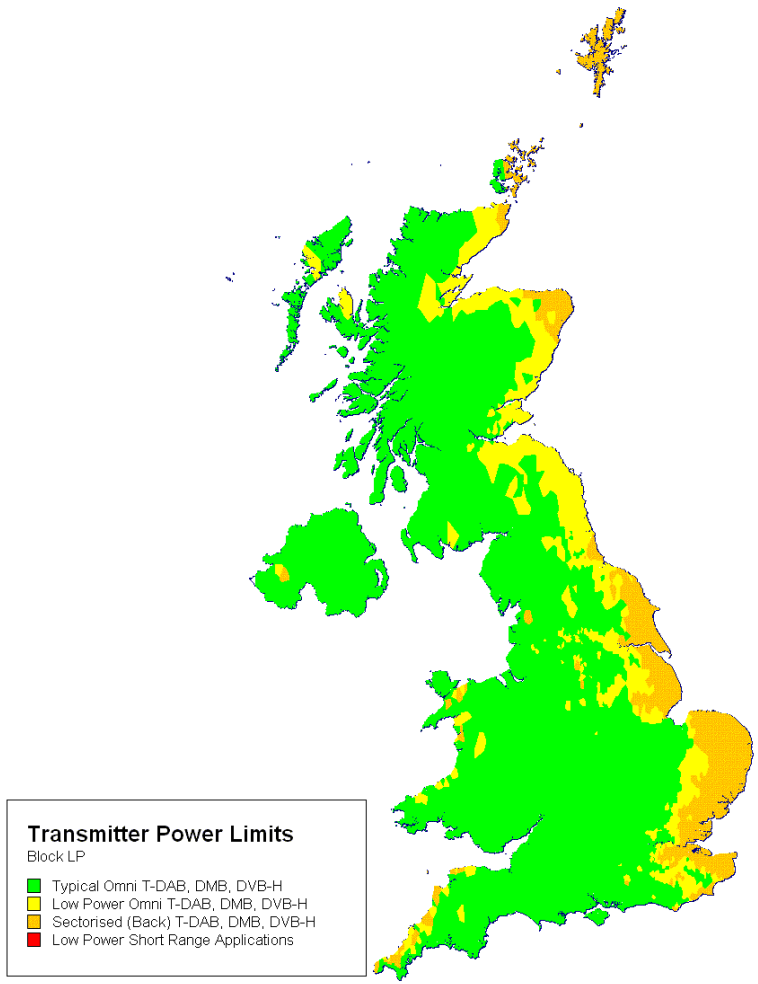
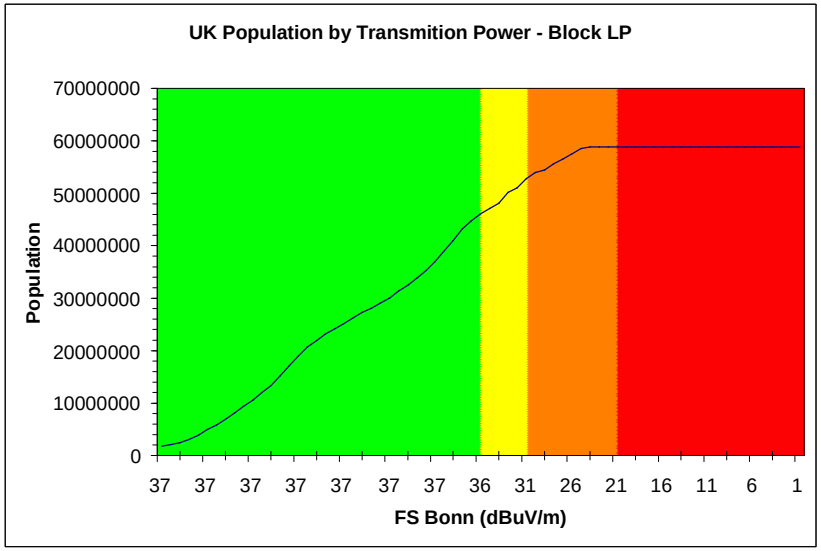
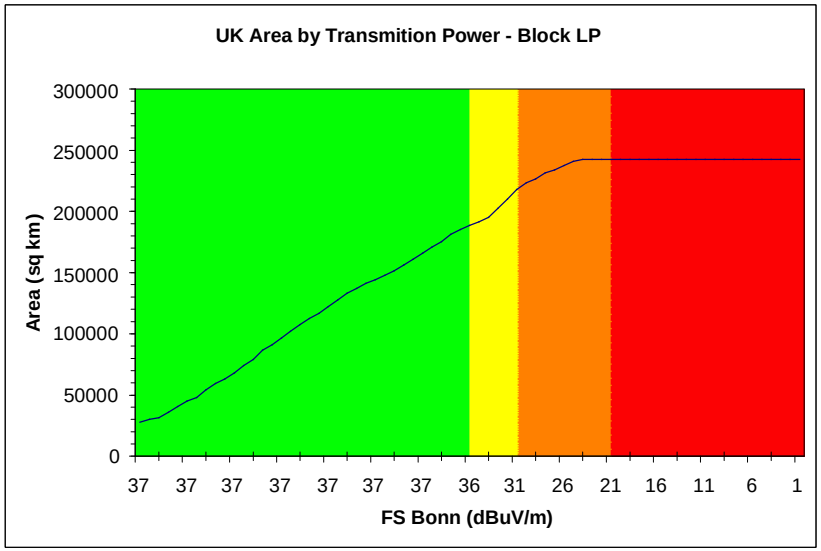


Exhibit B.17: *UK outgoing interference to Continental T-DAB systems –* ***Block LP*** *[Source: Analysys, Mason 2006]*







Annex C: Comparison of incoming and outgoing interference by block

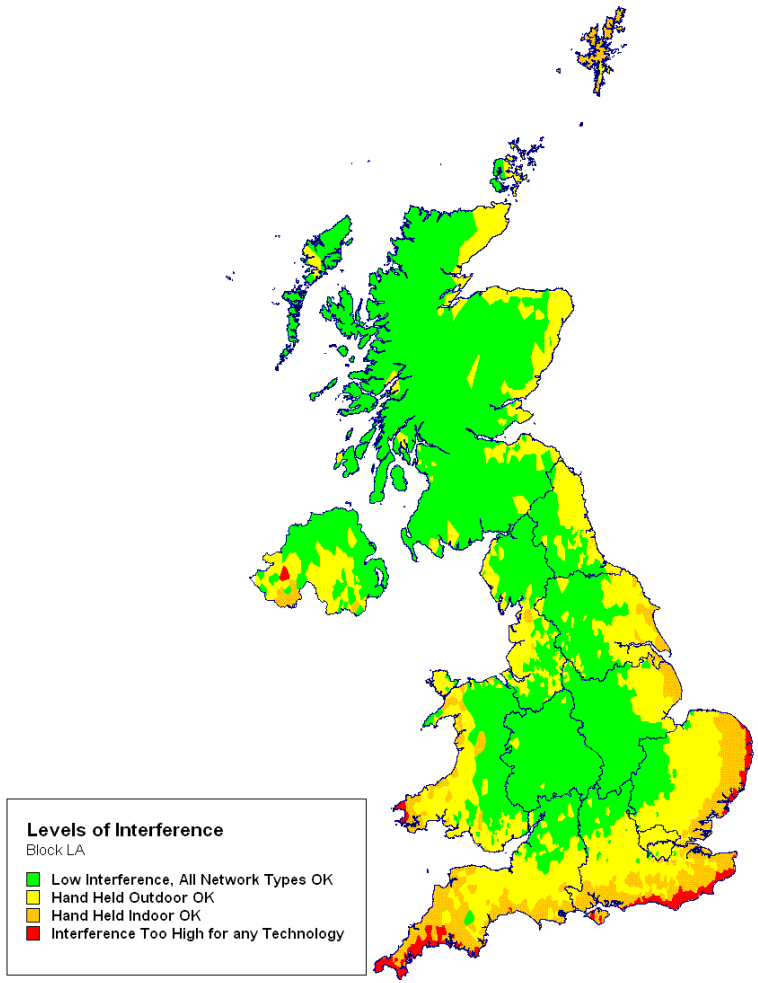
This annex presents in side-by-side format the maps already included in Annexes A and B, allowing ready comparison of incoming interference from, and outgoing interference to, Continental T-DAB systems in each of the 16 lower L-Band frequency blocks.

Mason

Analysys

Exhibit C.1: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LA*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

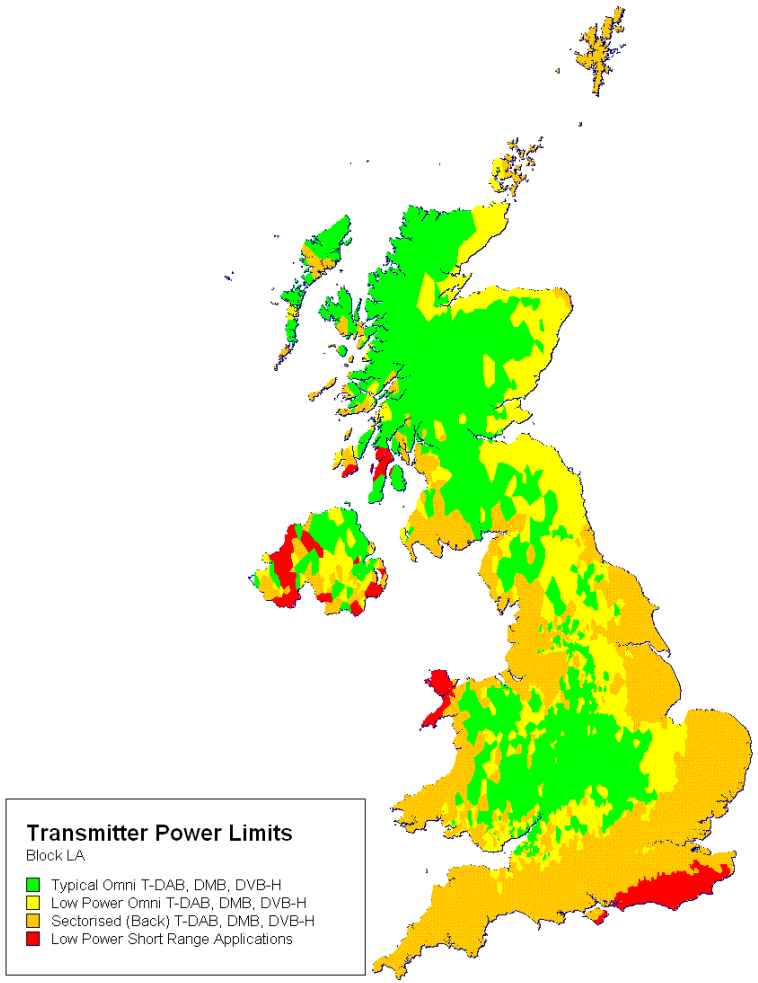
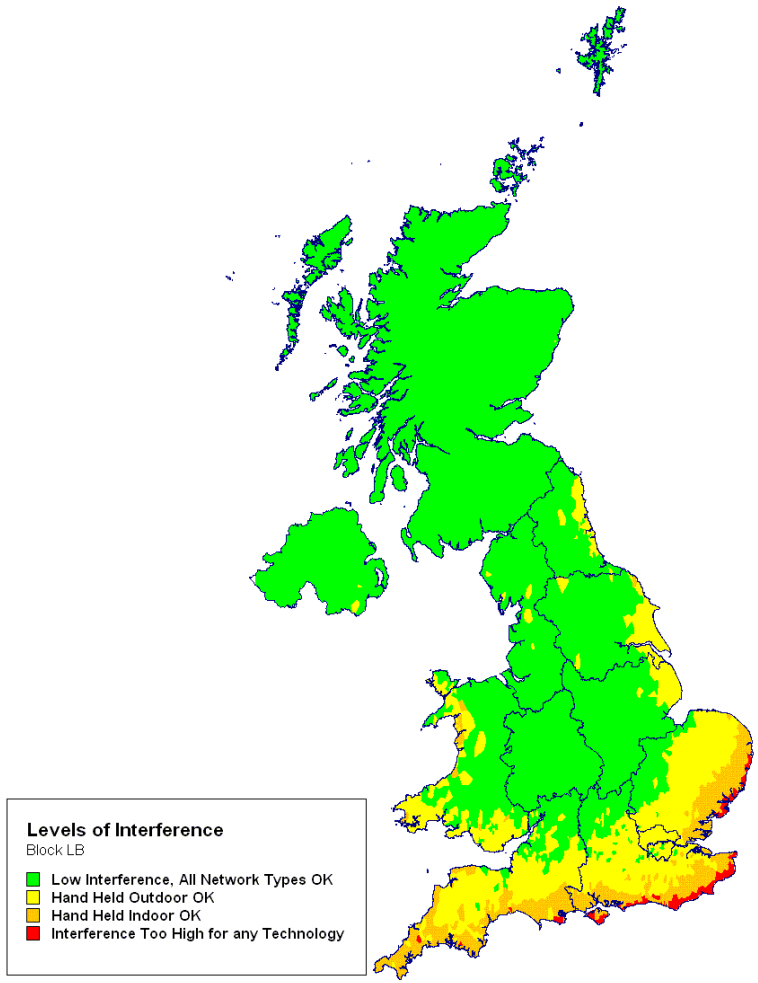


Exhibit C.2: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LB*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

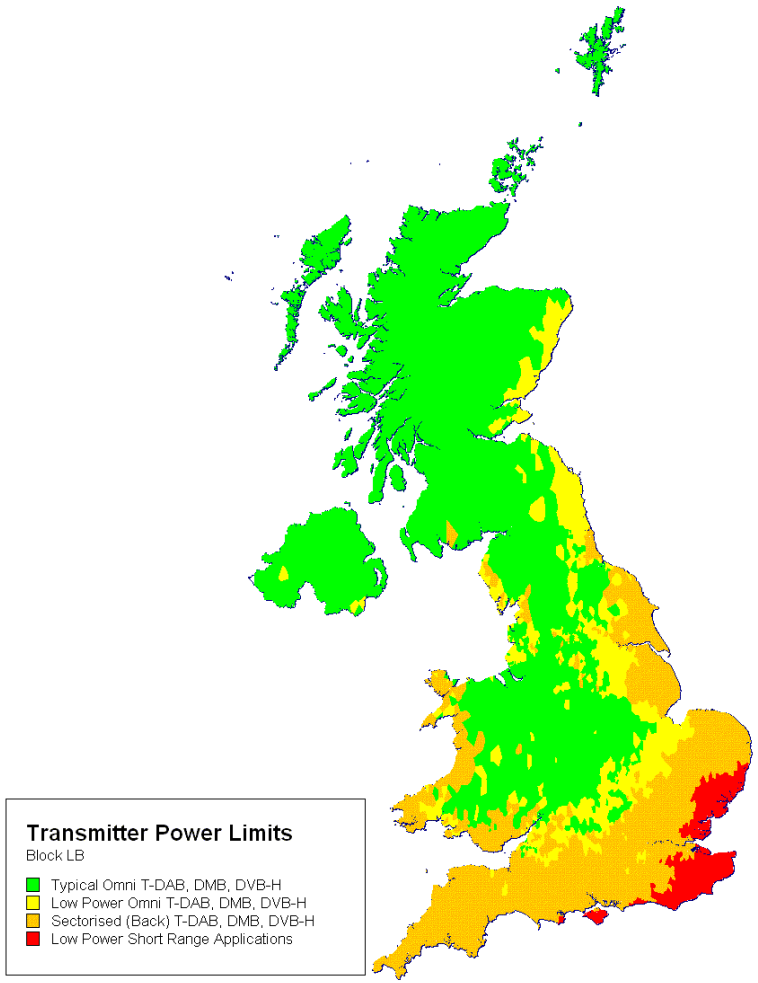
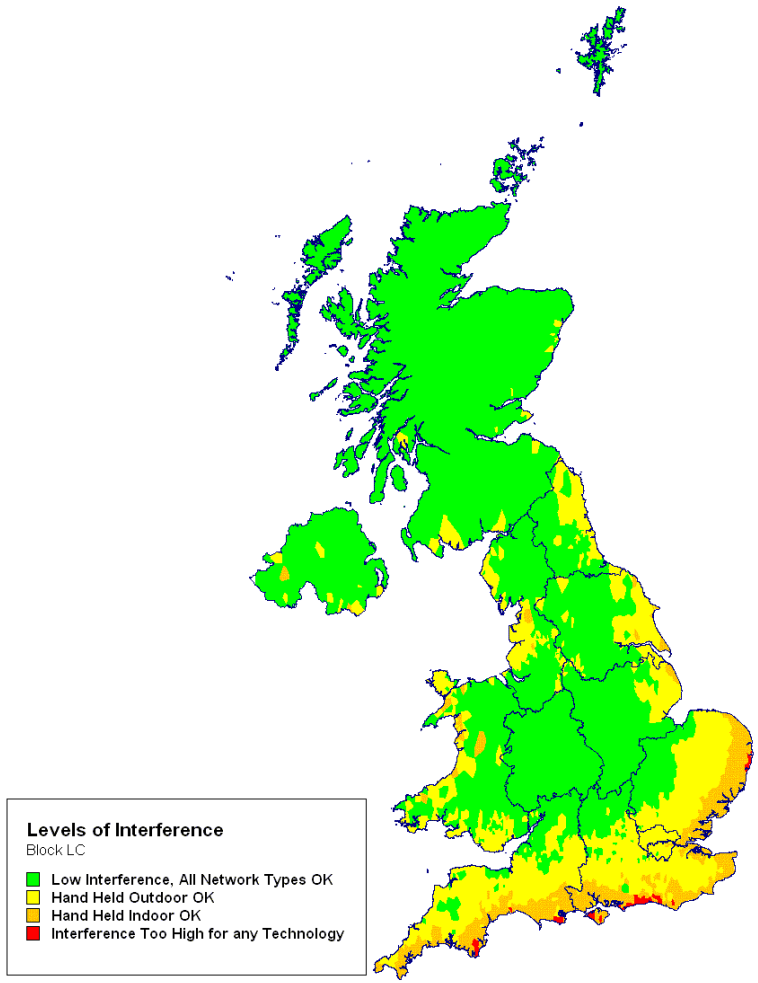


Exhibit C.3: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LC*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

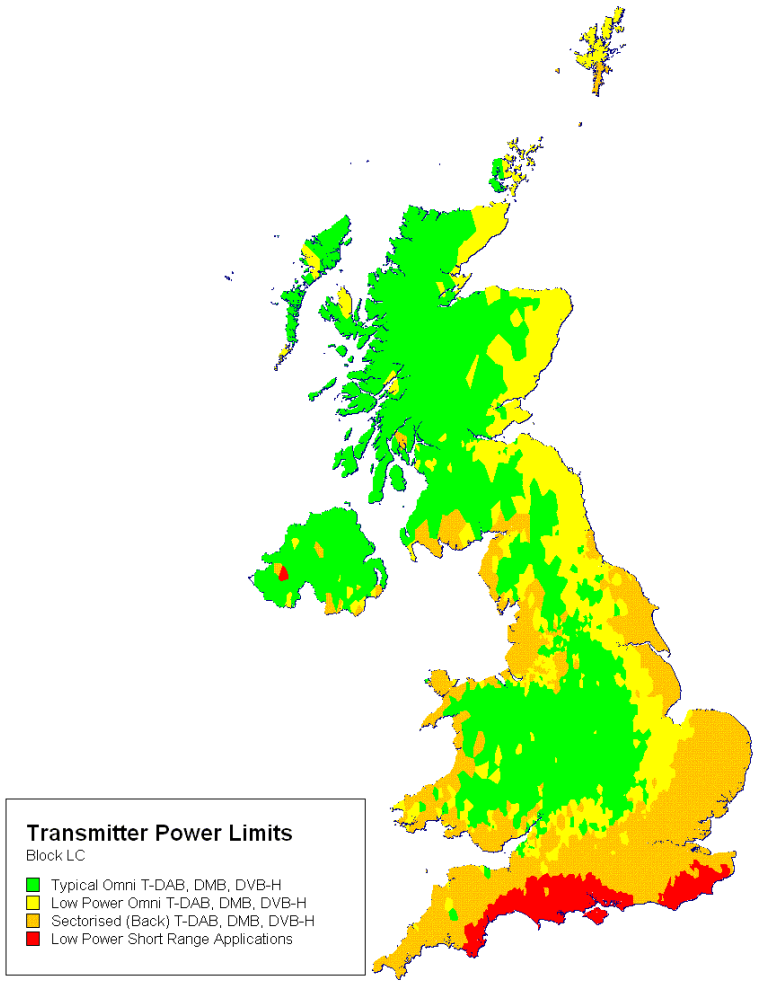
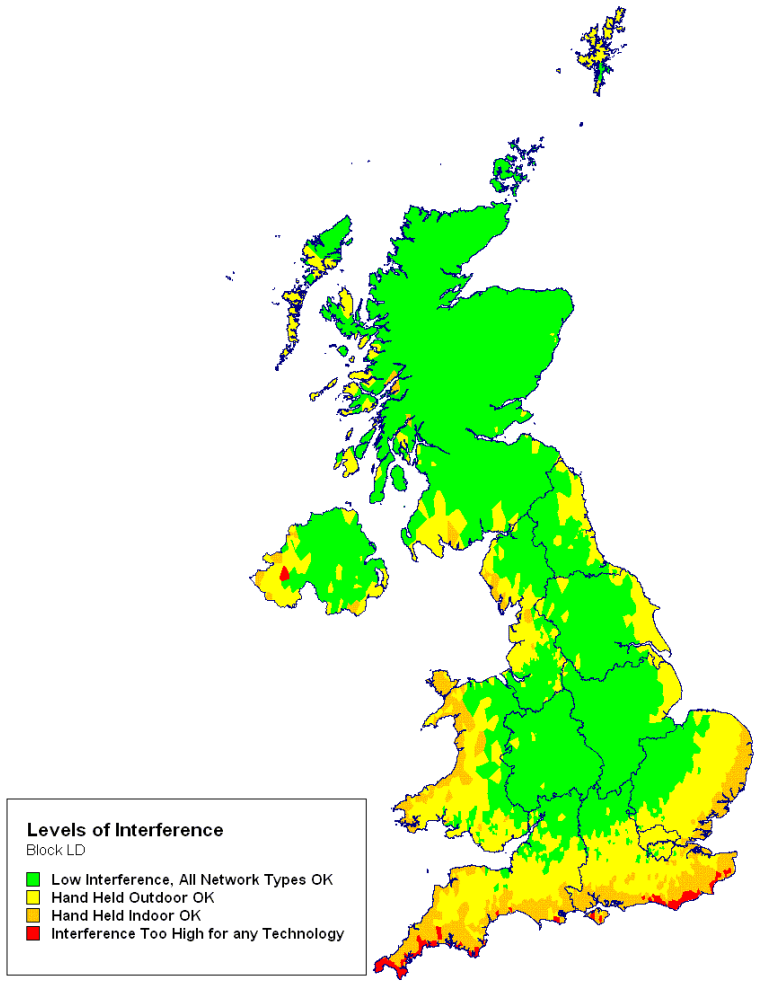


Exhibit C.4: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LD*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

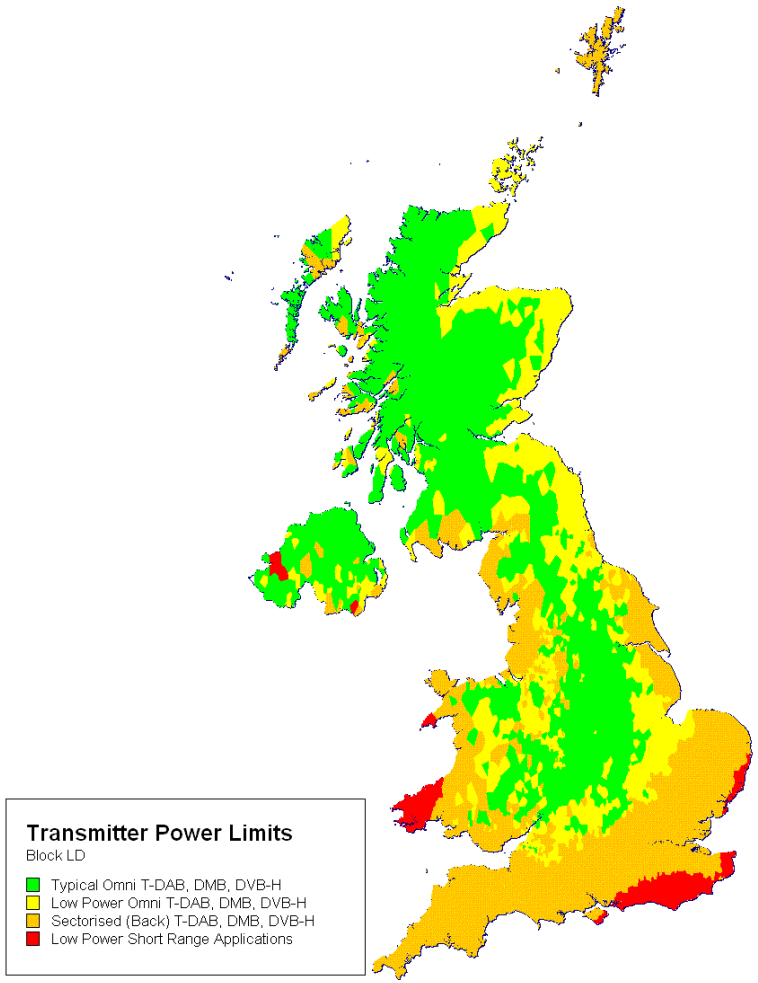
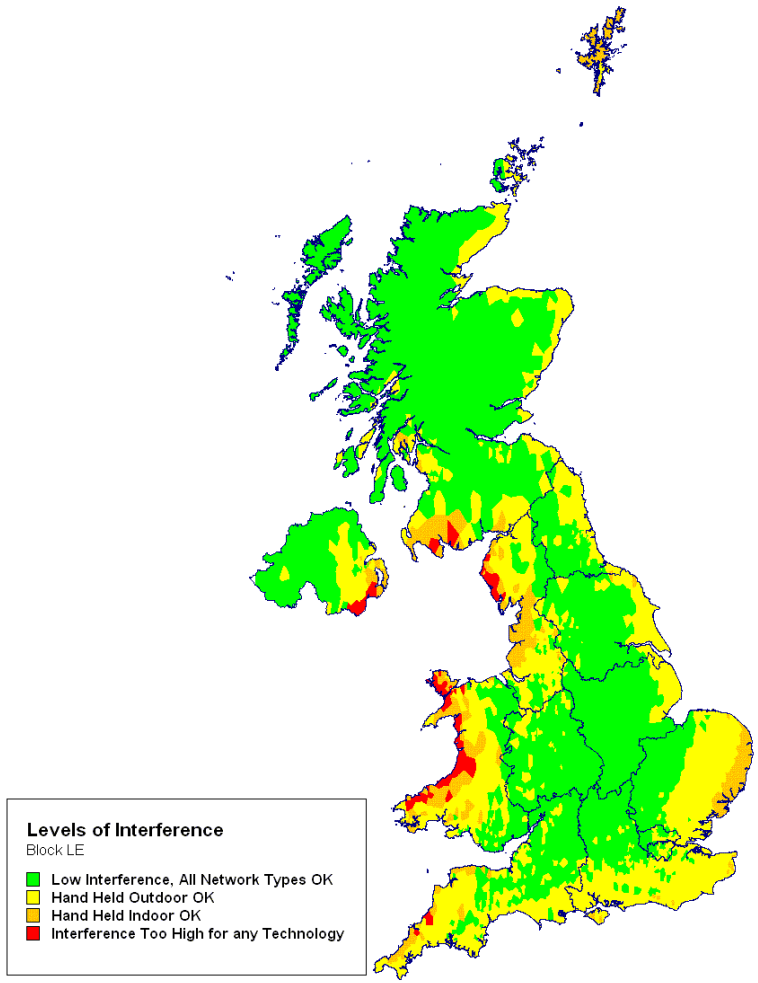


Exhibit C.5: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LE*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

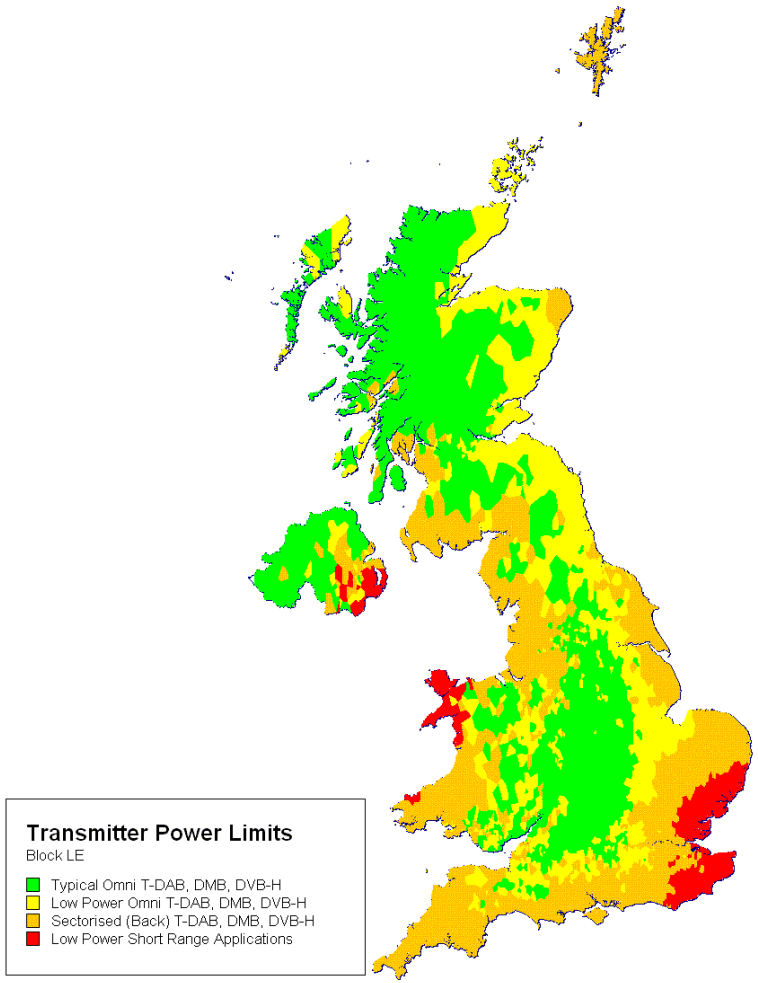
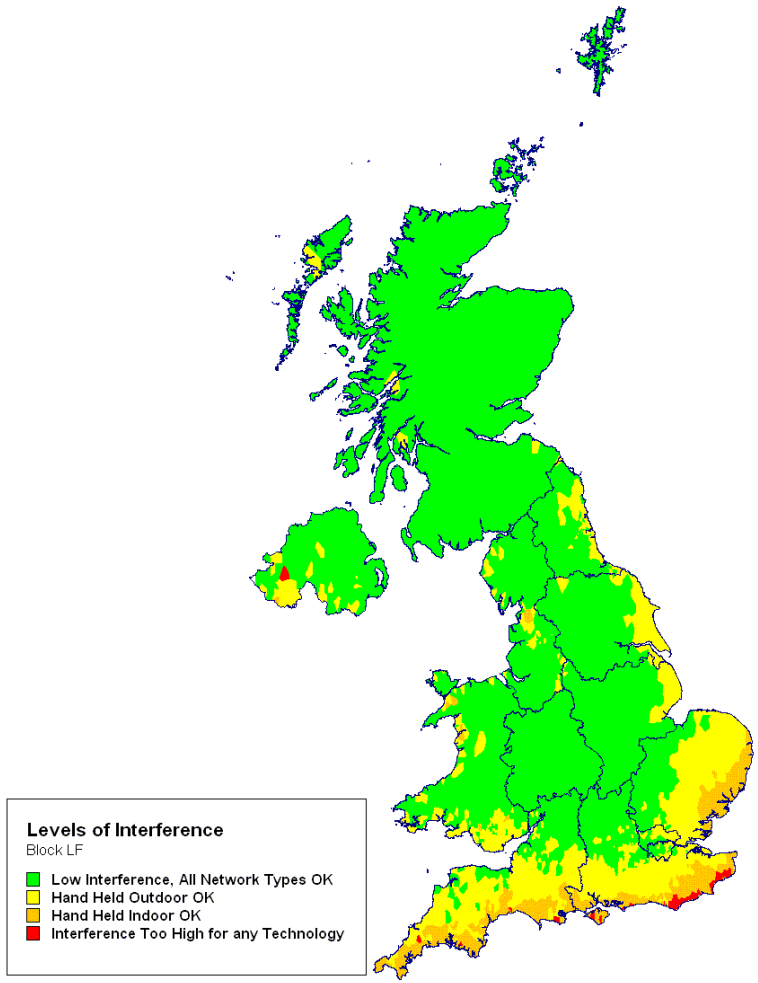


Exhibit C.6: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LF*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

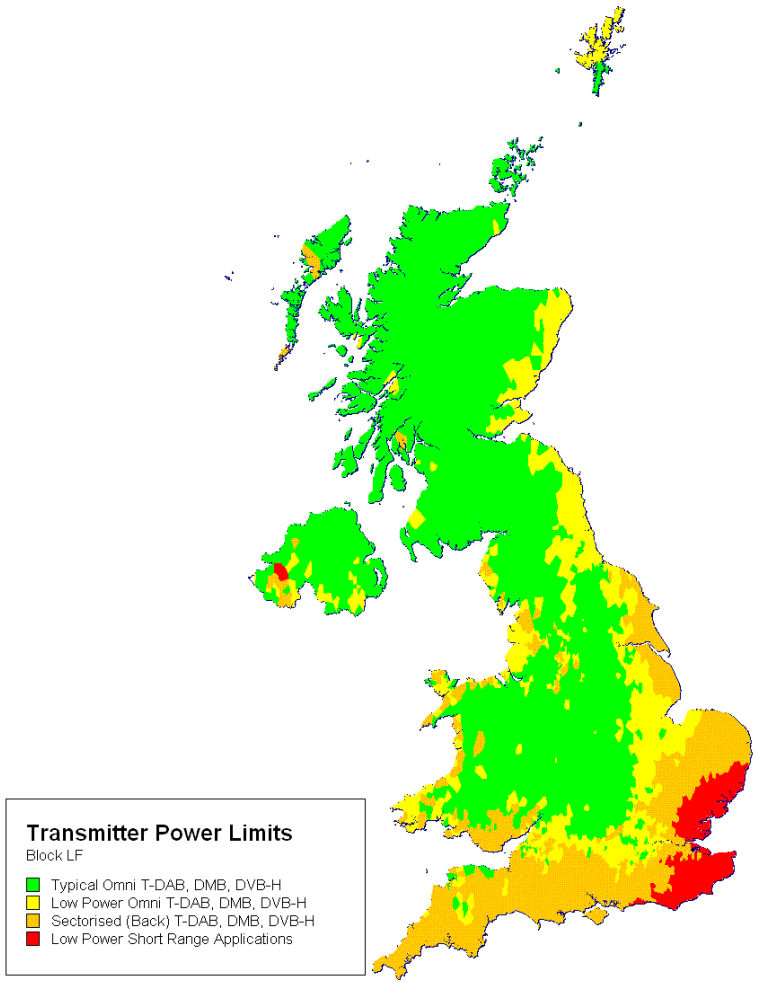
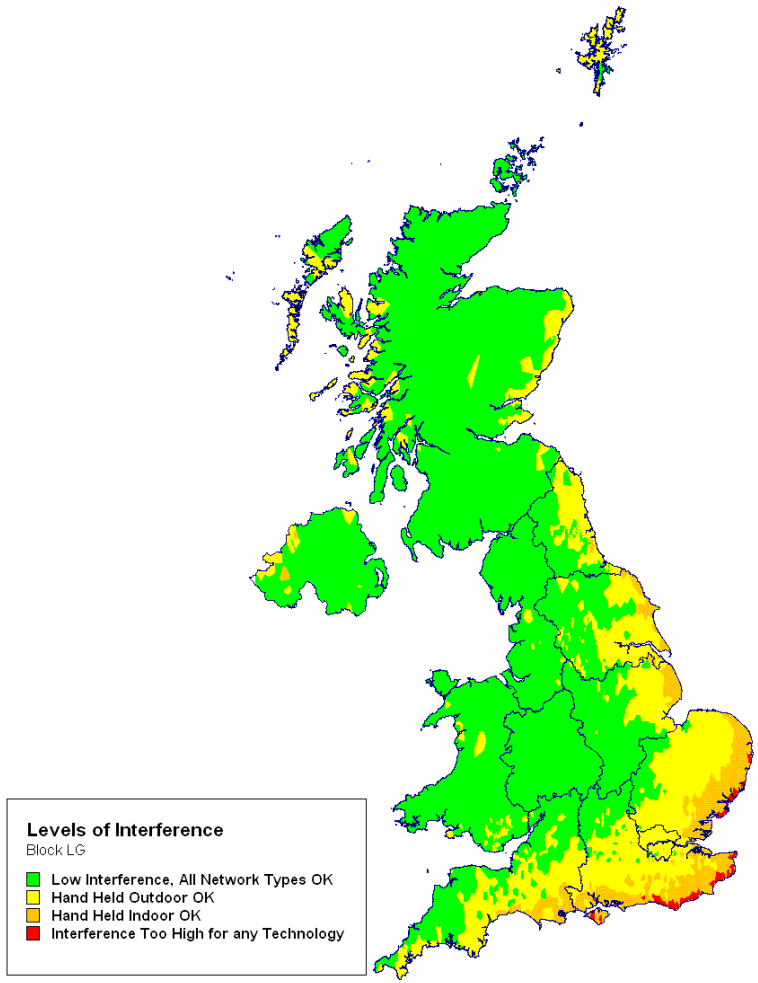


Exhibit C.7: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LG*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

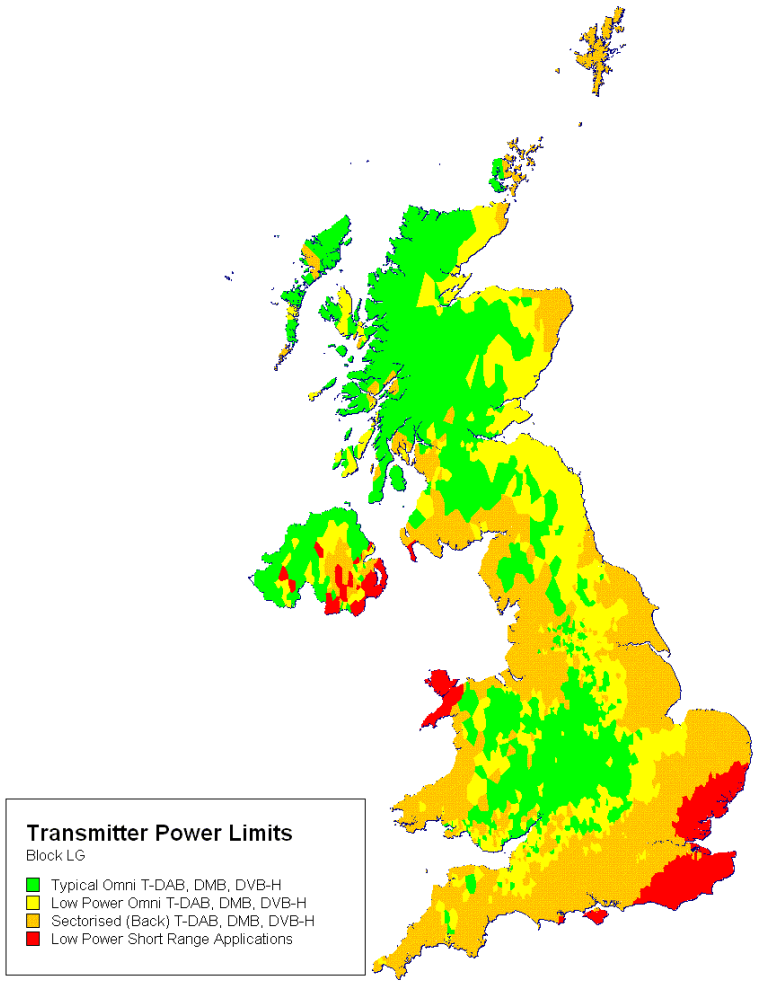
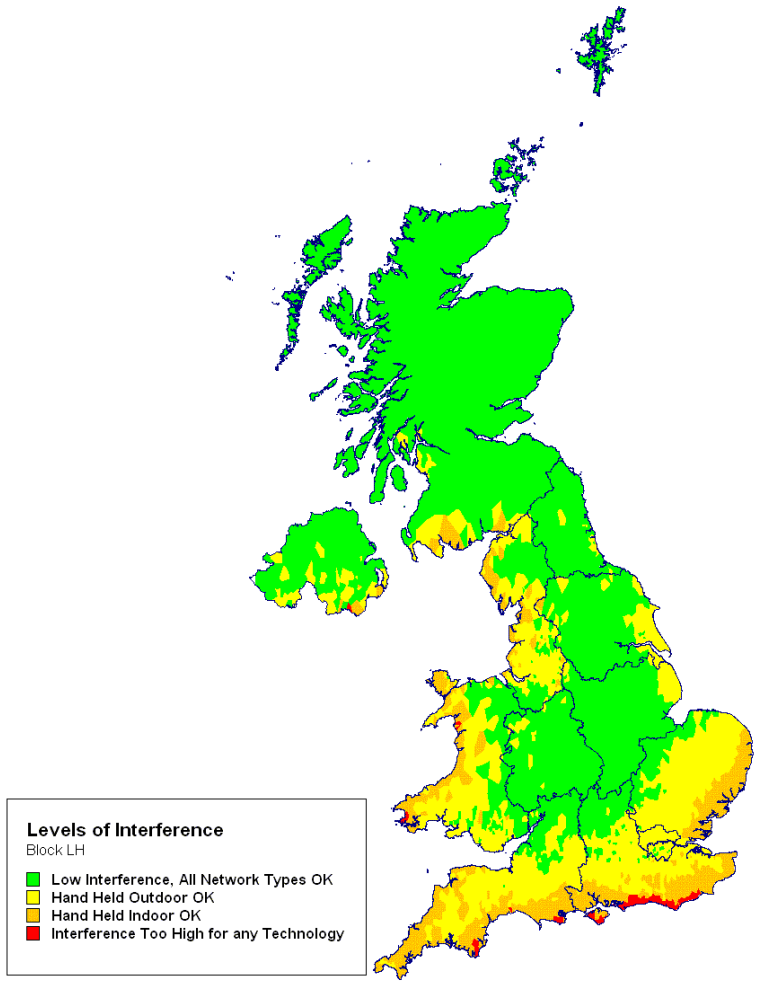


Exhibit C.8: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LH*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

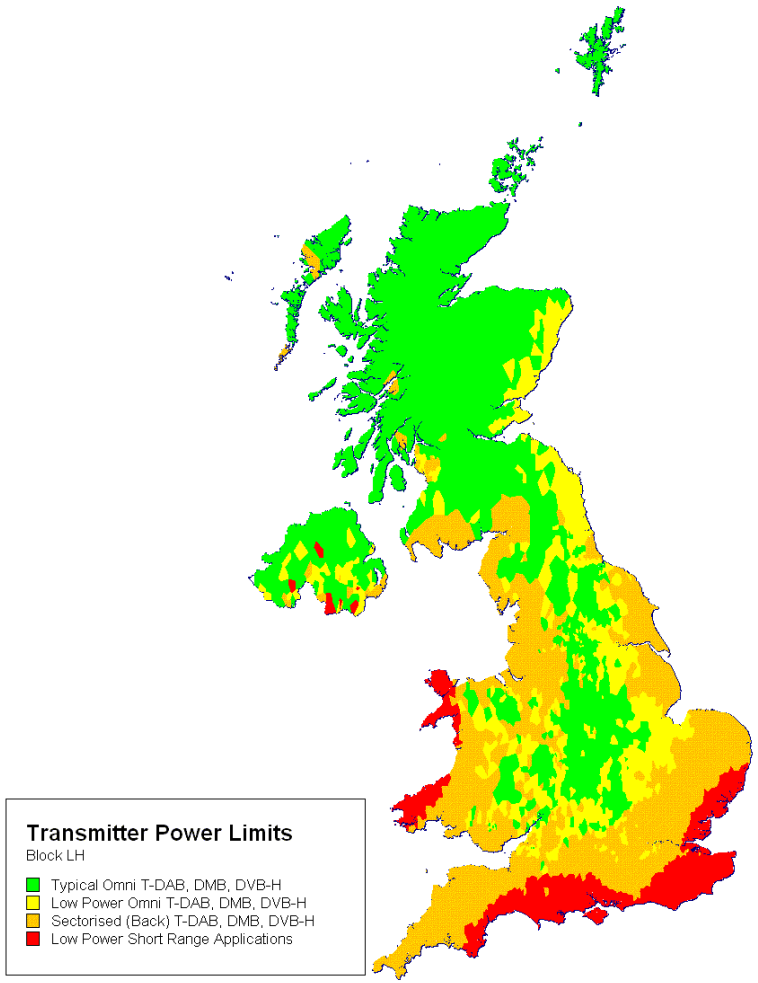
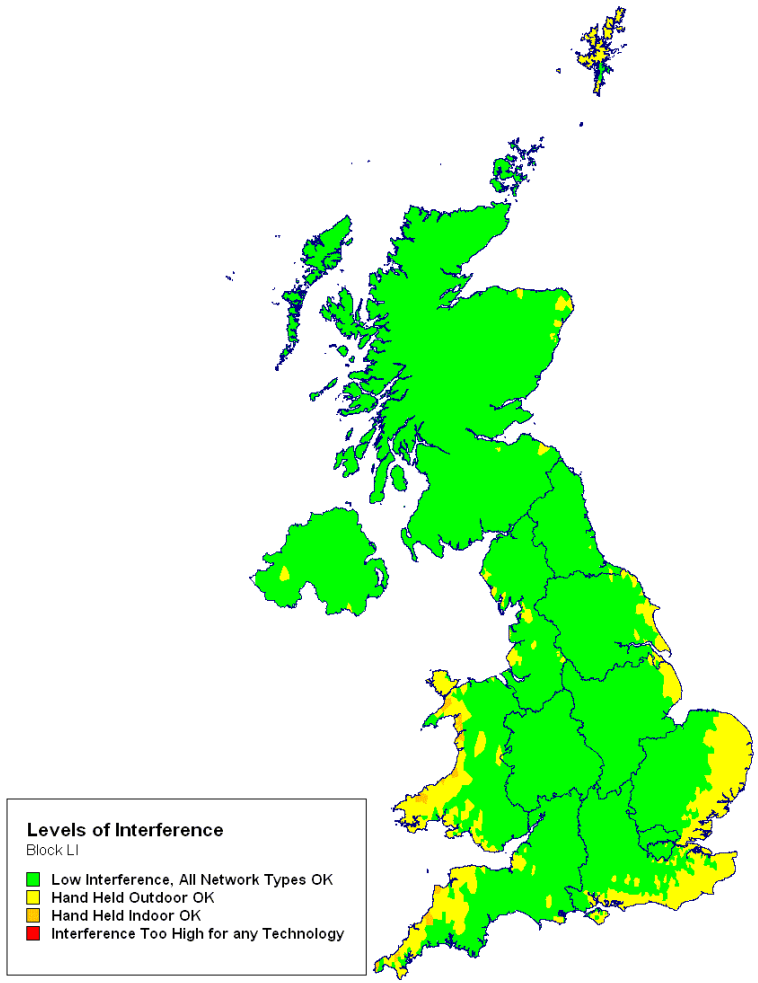


Exhibit C.9: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LI*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

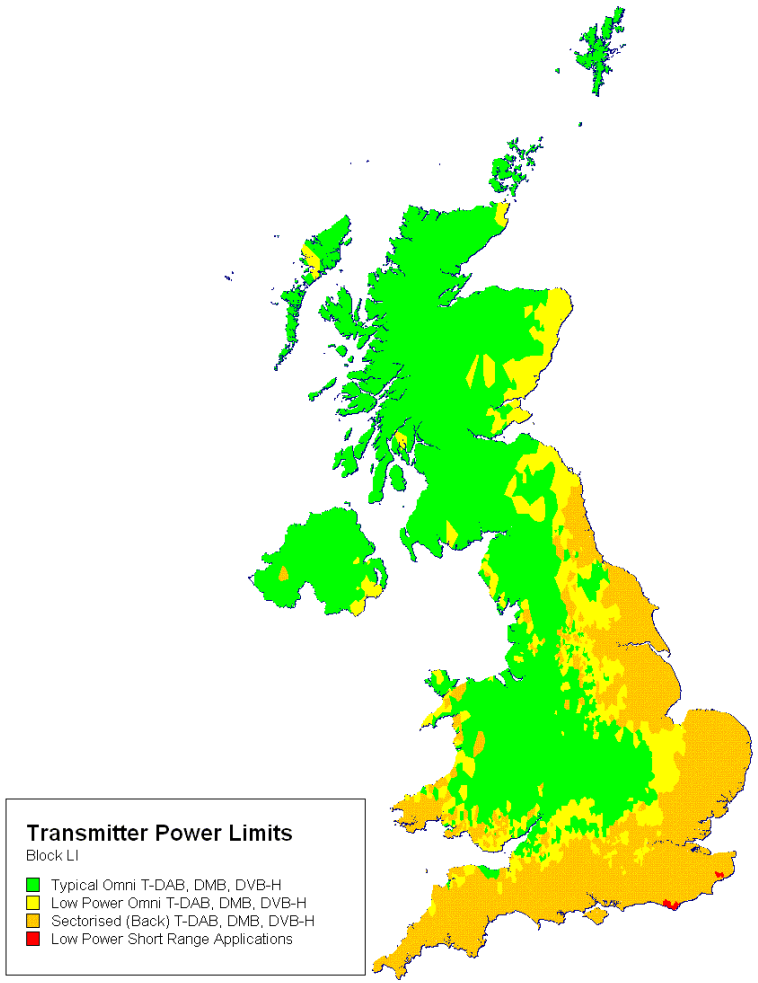
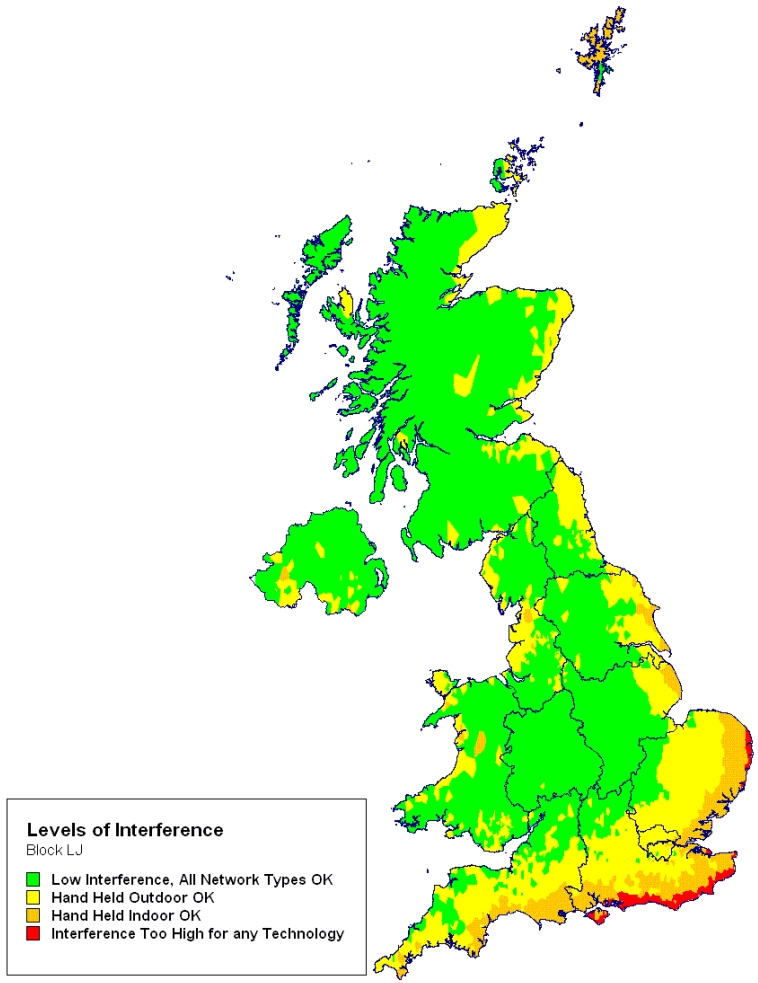


Exhibit C.10: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LJ*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

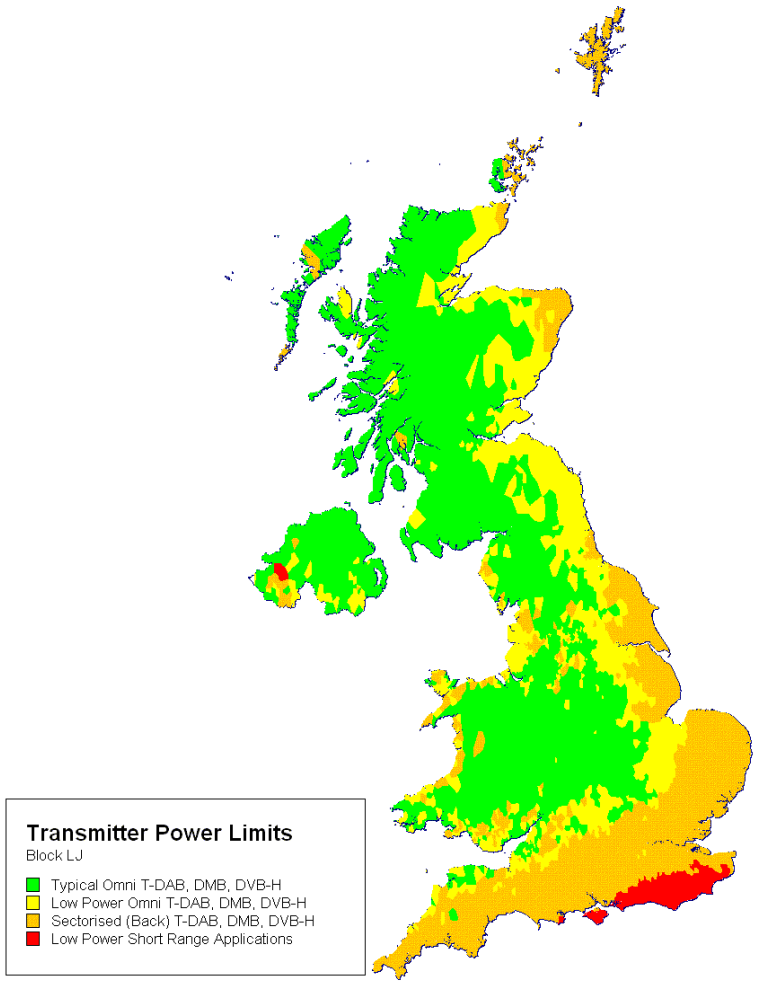
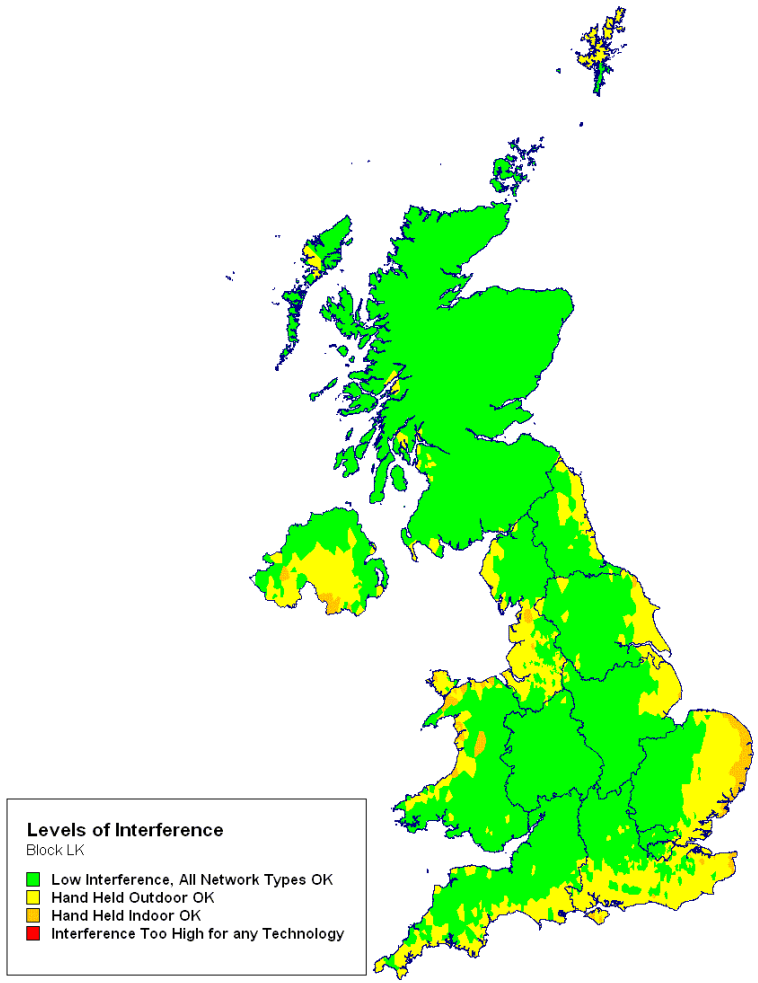


Exhibit C.11: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LK*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

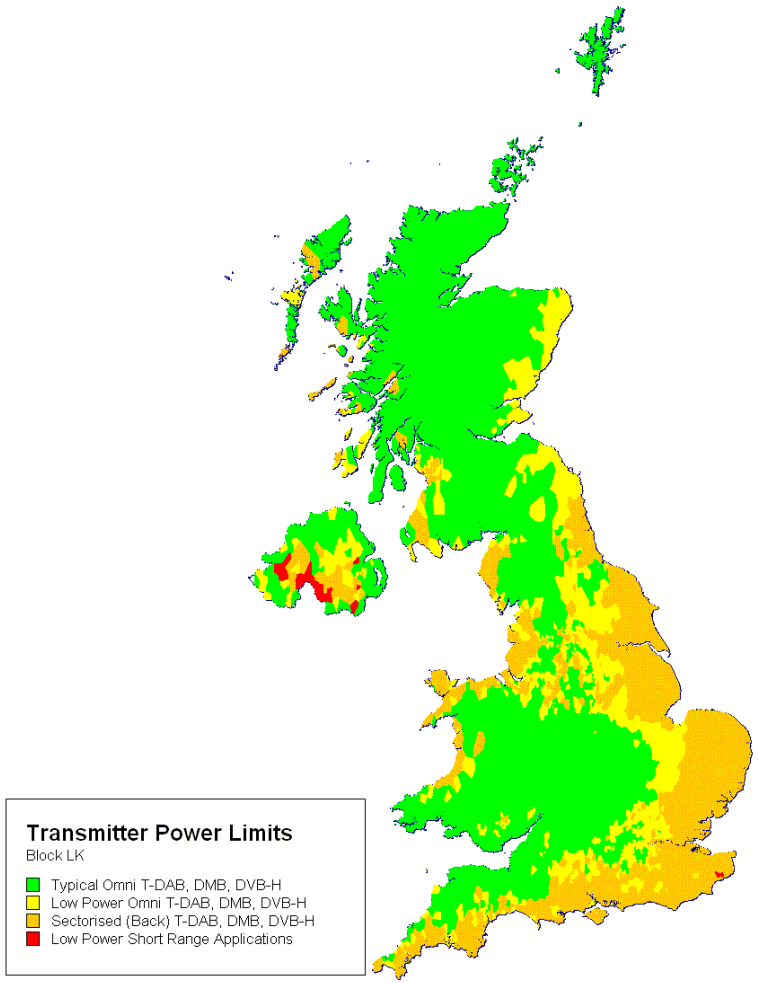
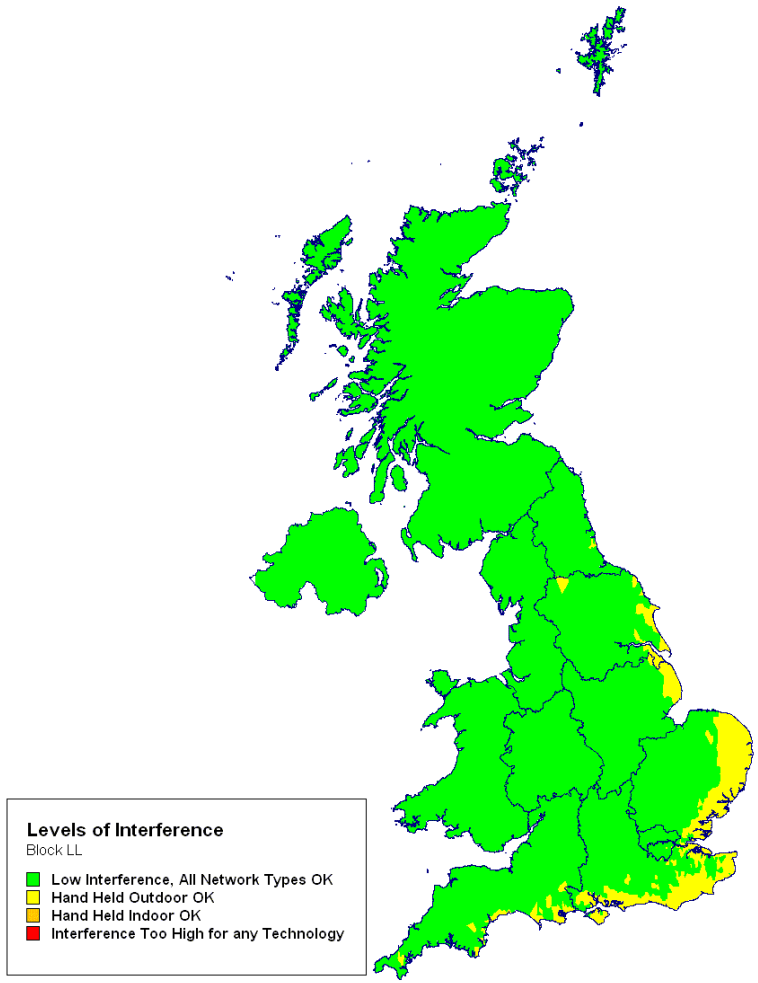


Exhibit C.12: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LL*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

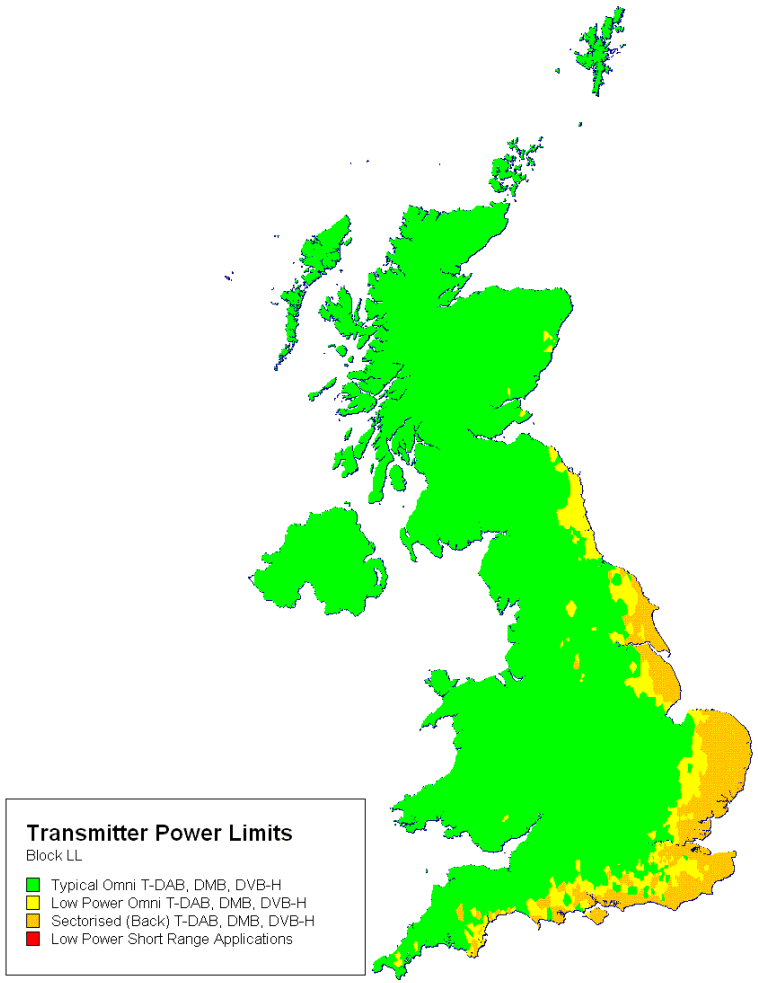
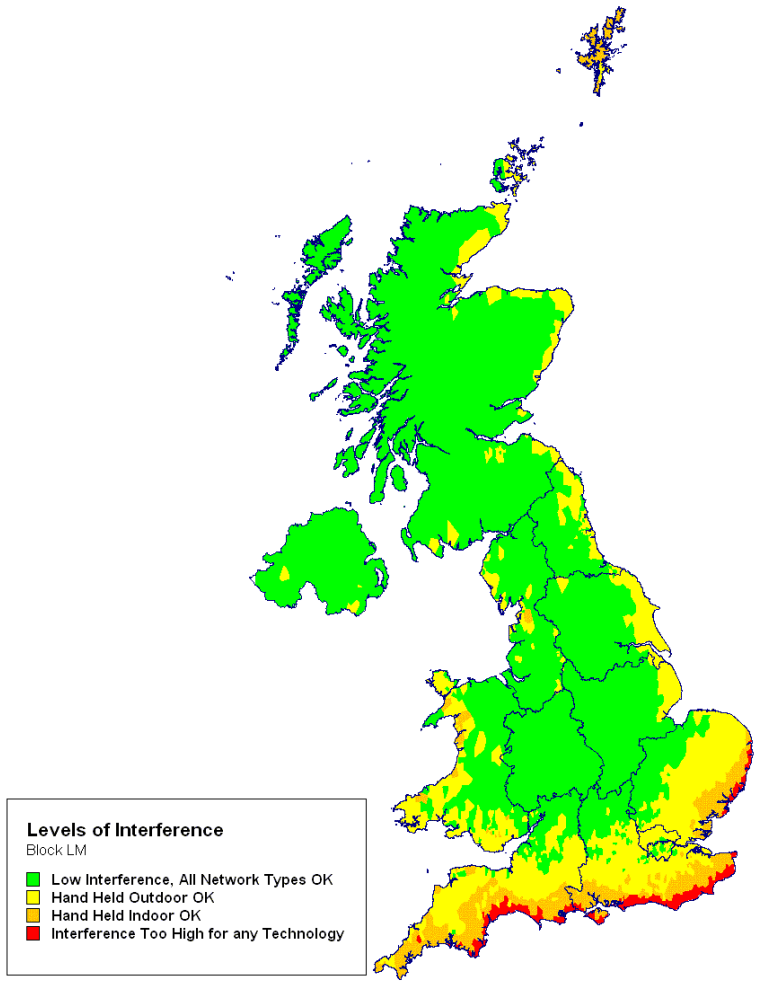


Exhibit C.13: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LM*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

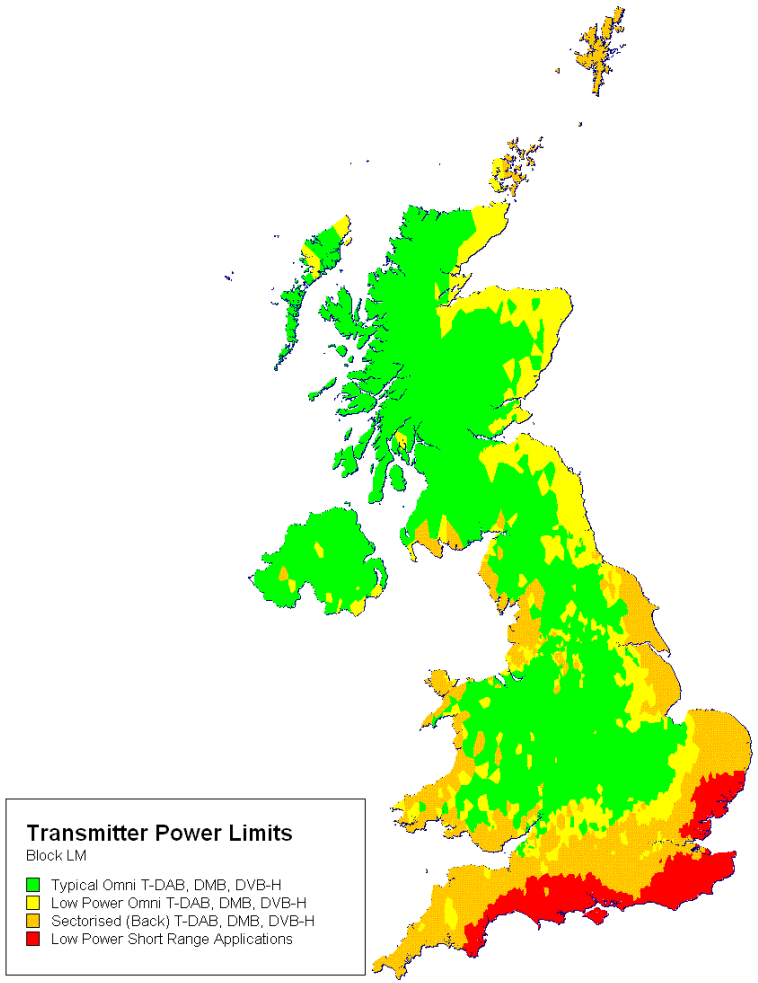
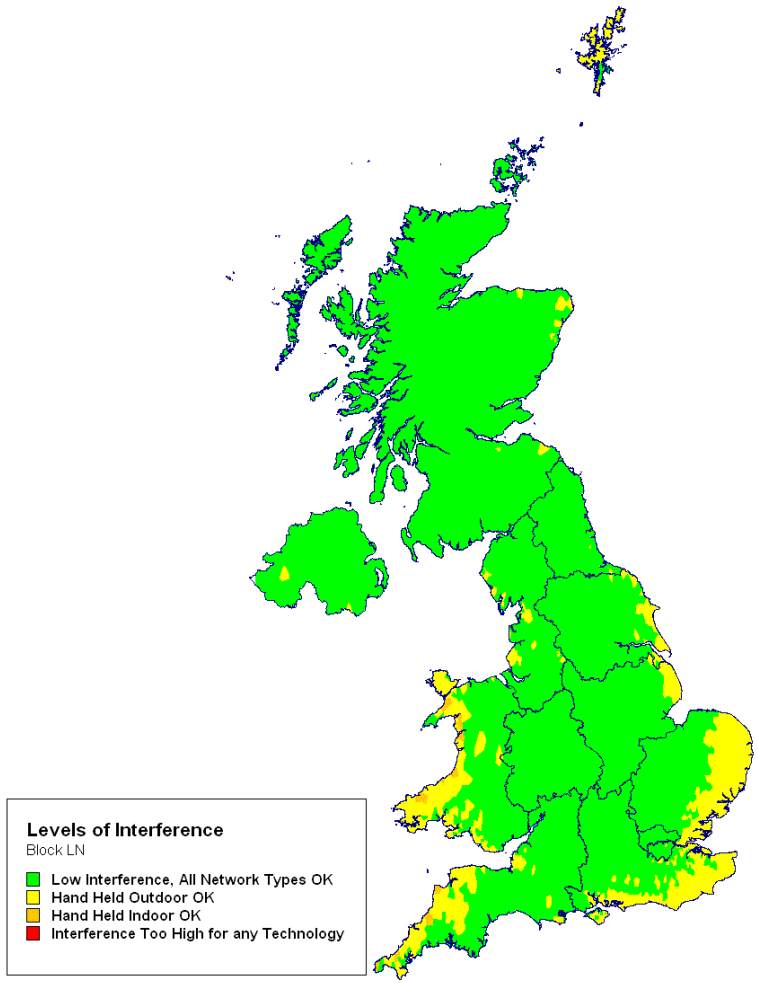


Exhibit C.14: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LN*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

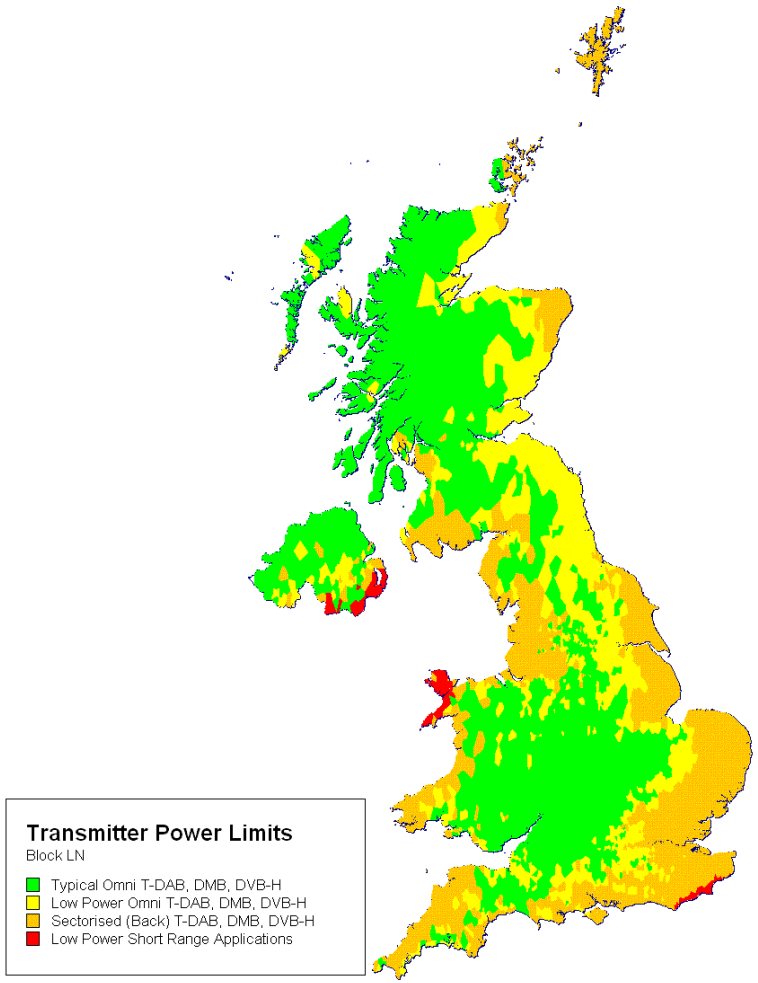
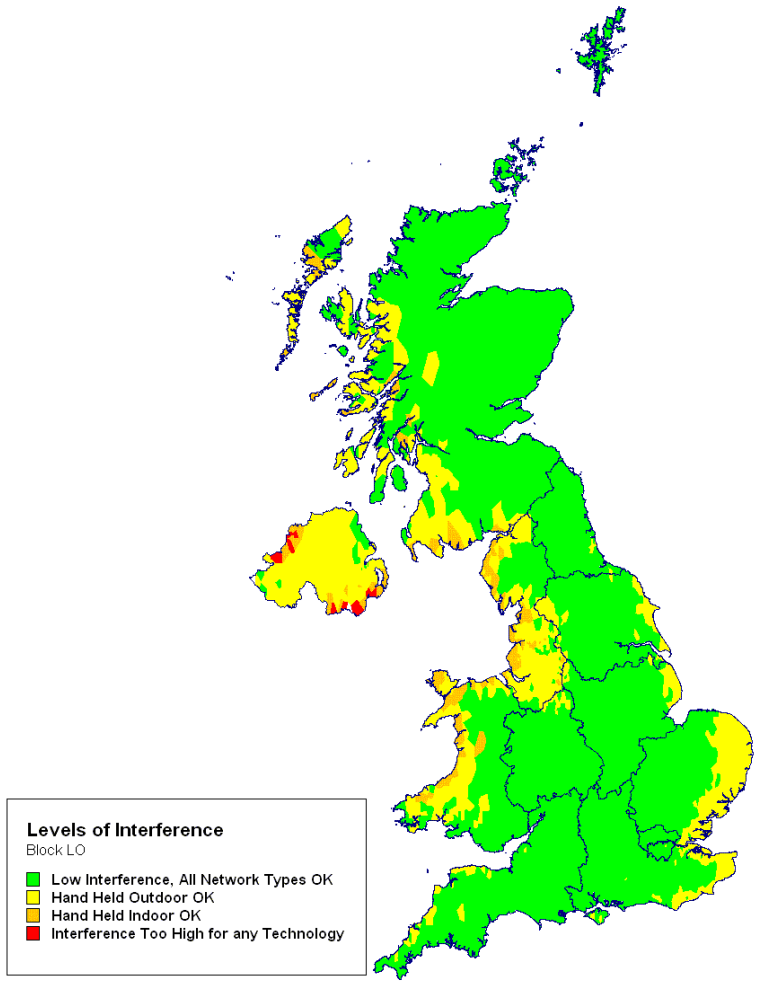


Exhibit C.15: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LO*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing

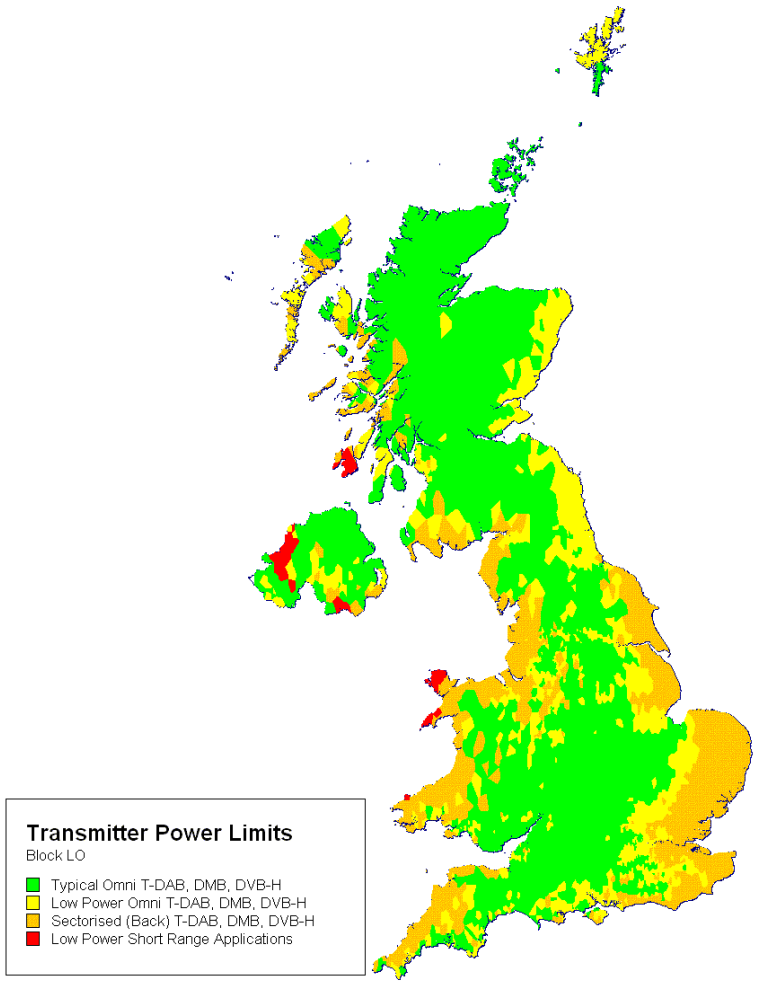
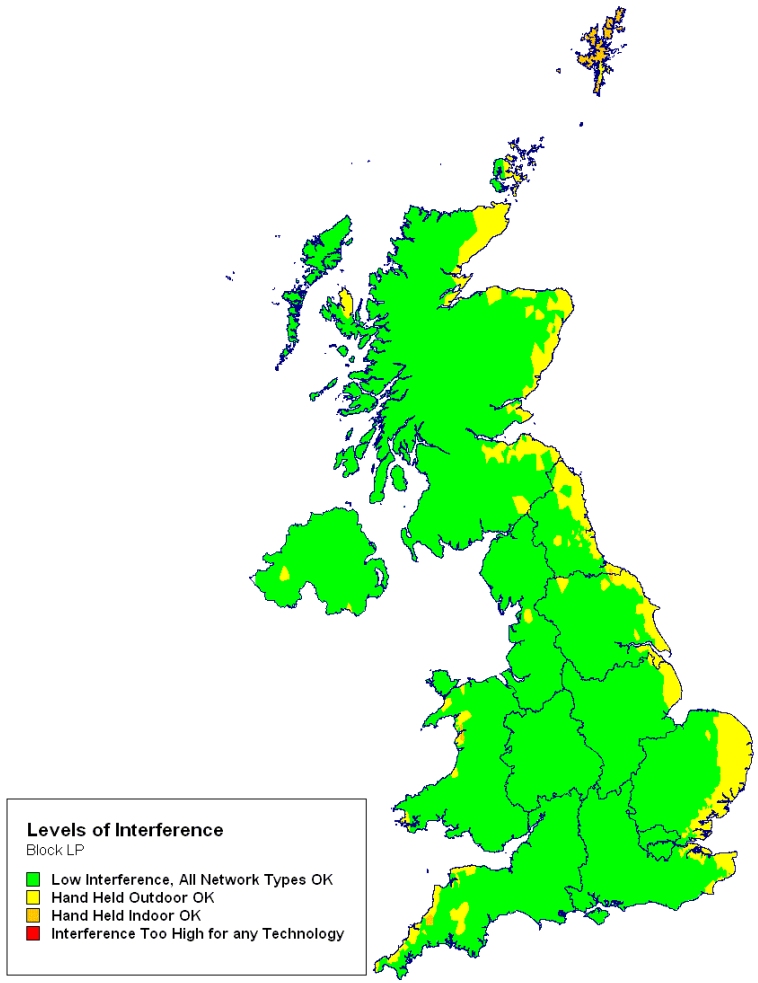
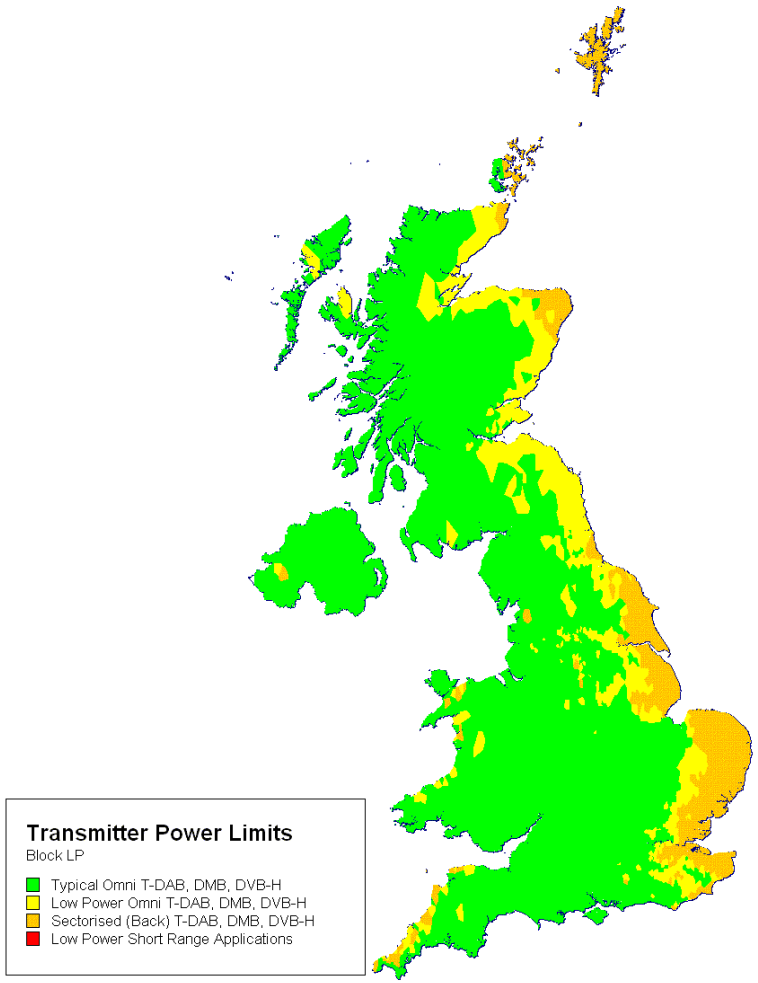


Exhibit C.16: *Incoming UK interference from and outgoing interference to Continental T-DAB systems –* ***Block LP*** *[Source: Analysys, Mason 2006]*

Incoming



Outgoing



Annex D: Maastricht 2002 reference networks

Within the Maastricht 2002 and Wiesbaden 1995 plans, a reference network type (1, 2 or 3) is specified for each allotment. We used these reference networks to model outgoing interference. Within the Maastricht plan, the reference networks are shown as ideal geometrical arrangements. In order to model these networks within the radio-planning tool, we have had to interpret these ideal reference networks and apply them to the irregular shapes of the allotments.

D.1 Reference Network 1 – Open Network

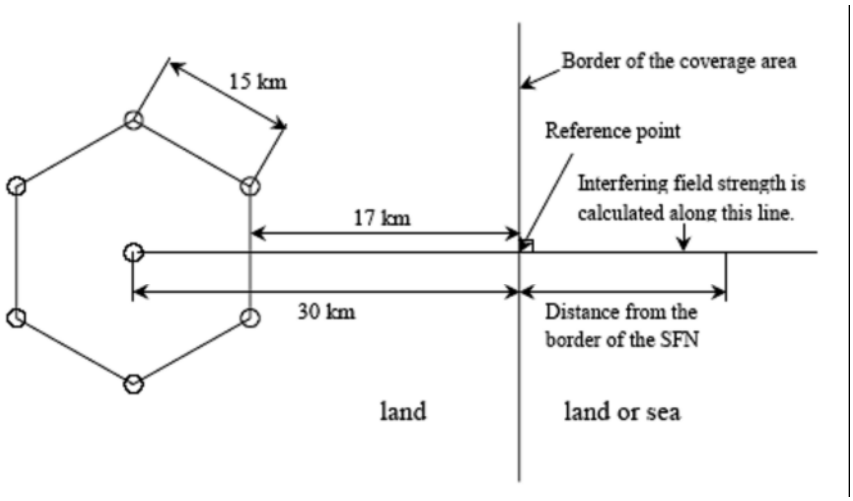


Exhibit D.1: *Reference Network 1: layout diagram [Source: CEPT T-DAB Planning Meeting, Maastricht, 2002]*

The following key parameters can be observed from this layout:

- 17km between the allotment boundary and periphery transmitters
- 30km between the allotment boundary and central transmitters
- Transmitters spaced at 15km on an hexagonal grid
- Periphery transmitter specification:
  - Tx Height above ground: 150m
  - Tx ERP 1kW
  - Tx Antenna Pattern: Omni
- Central transmitter specification:
  - Tx Height above ground: 150m
  - Tx ERP 0.5kW
  - Tx Antenna Pattern: Omni.

These key parameters have been applied to allotments as illustrated below.

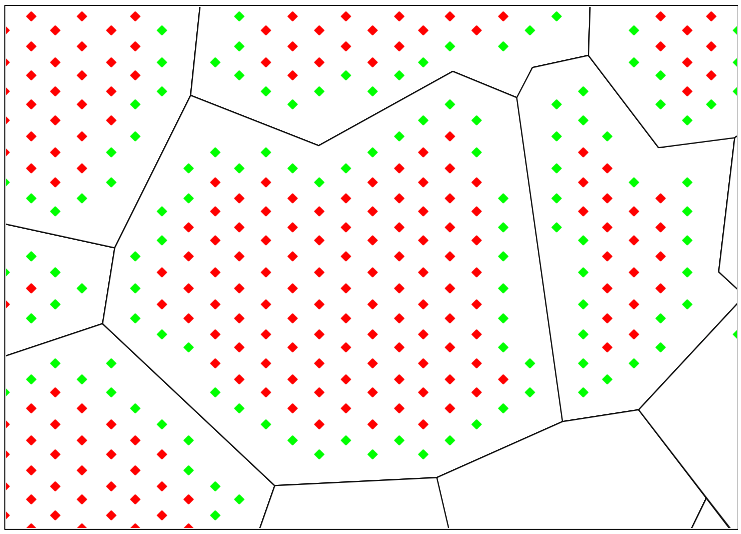


Exhibit D.2: *Reference Network 1: typical allocations (France). Periphery transmitters are shown in green, central transmitters in red [Source: Analysys, Mason 2006]*

D.2 Reference Network 2 – Closed Network

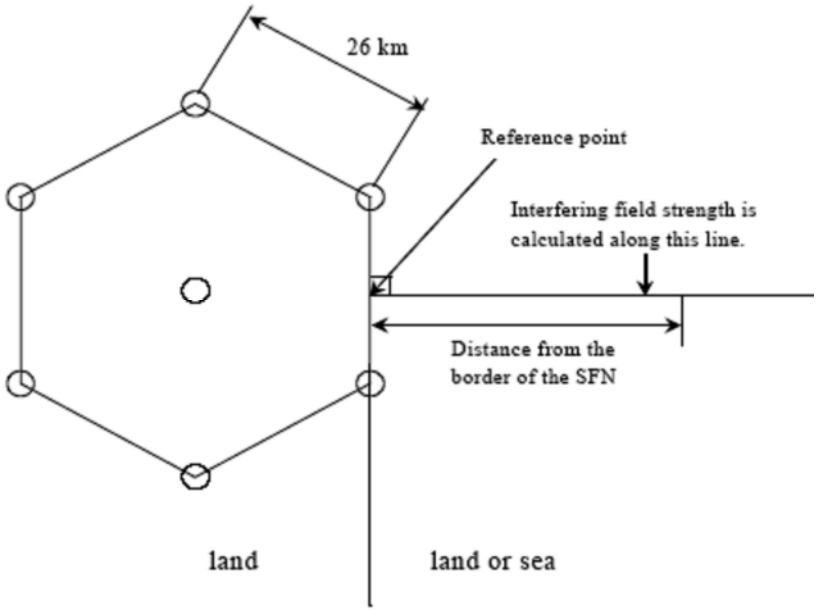


Exhibit D.3: *Reference Network 2: layout diagram [Source: CEPT T-DAB Planning Meeting, Maastricht, 2002]*

The following key parameters can be observed from this layout:

- Periphery transmitters placed on allotment boundary
- A single central transmitter in the centre of the allocation
- Transmitters spaced at 26km
- Periphery transmitter specification:
  - Tx Height above ground: 50m
  - Tx ERP 5kW
  - Tx Antenna Pattern: directional, gain reduced by 12dB for rear 240 degrees. Azimuth faces the central transmitter
- Central transmitter specification:
  - Tx Height above ground: 150m
  - Tx ERP 01.25kW
  - Tx Antenna Pattern: Omni.

These key parameters have been applied to allotments as illustrated below.

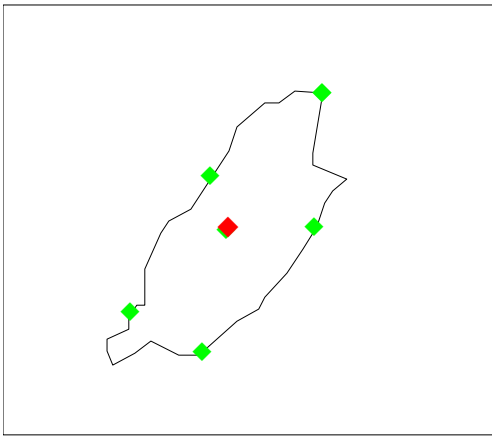


Exhibit D.4: *Reference Network 2: typical allocations (Isle of Man) [Source: Analysys, Mason 2006]*

D.3 Reference Network 3 – Closed Network

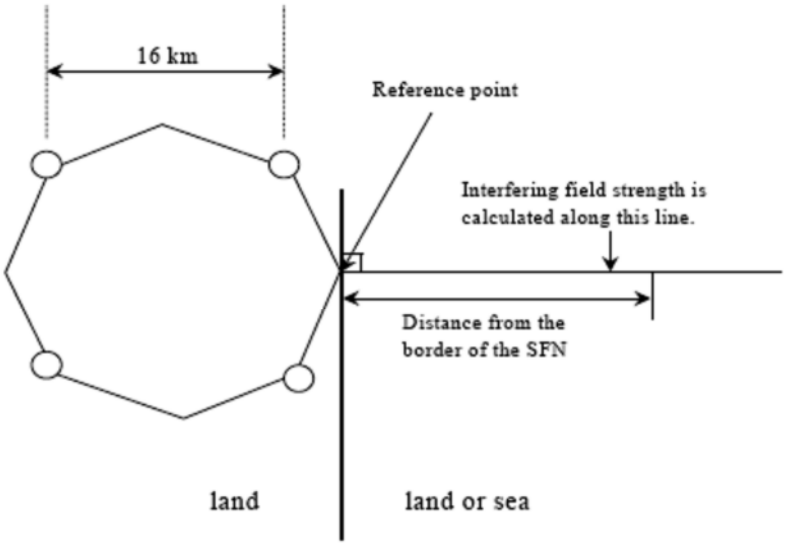


Exhibit D.5: *Reference Network 3: layout diagram [Source: CEPT T-DAB Planning Meeting, Maastricht, 2002]*

The following key parameters can be observed from this layout:

- Periphery transmitters placed 3.314km within the allotment boundary (derived from the geometry of a regular octagon)
- Transmitters spaced at 16km
- Transmitter specification:
  - Tx Height above ground: 50m
  - Tx ERP 1kW
  - Tx Antenna Pattern: directional, gain reduced by 12dB for rear 225 degrees. Azimuth faces the centre of the allocation.

These key parameters have been applied to allotments as illustrated below. In some cases, due to the small size of an allotment, two transmitters cannot be located 16km apart. In these cases a single omni directional central transmitter has been placed in the centre of the region.

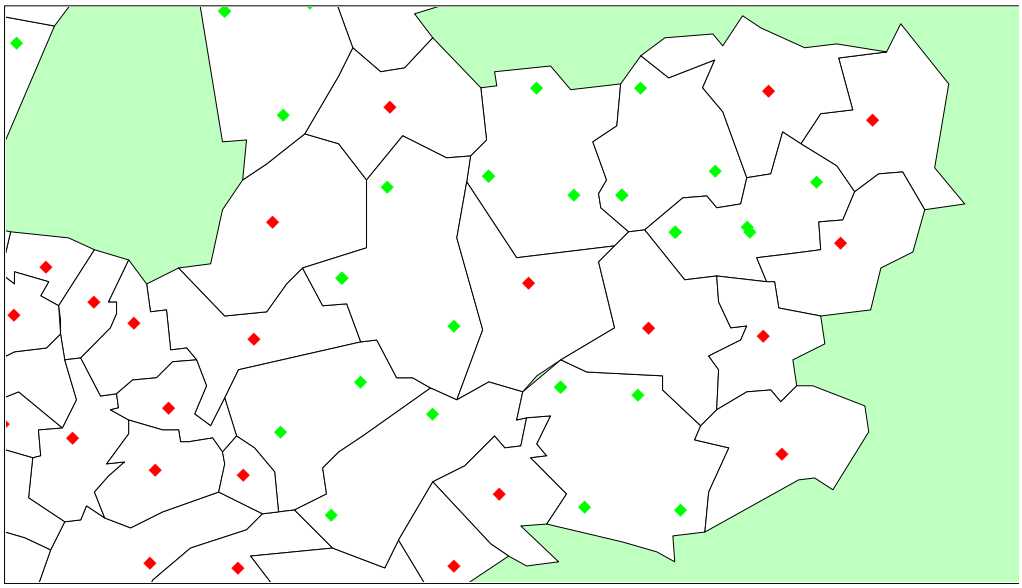


Exhibit D.6: *Reference Network 3: typical allocations (The Netherlands) [Source: Analysys, Mason 2006]*

The following figure illustrates how the three different network types are used in combination to model allotments of various sizes.

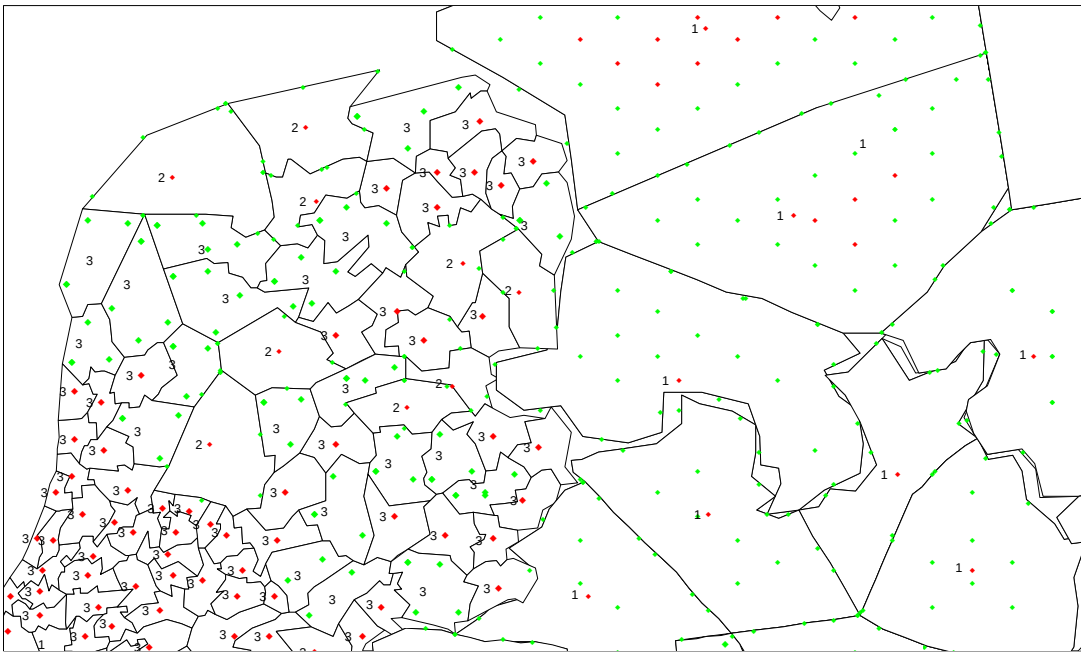


Exhibit D.7: *Mixture of Reference Networks 1, 2 and 3: typical allocations (Netherlands/ Germany) [Source: Analysys, Mason 2006]*

D.4 Summary

The reference networks we have produced for the modelling of incoming interference differ in some respects from the idealised networks described in Maastricht 2002 plan: this has been done to give a better representation of real T-DAB systems. For example, there are some very small allocations in the Maastricht plan: 25 are less than 100km^2 and one is an island of 5km^2. Although in theory these very small allocations should still be served by four 50m 1kw transmitters, this would never be done in practice, so in such cases we have assumed a single transmitter is used. In a similar vein, the largest allocations in the Maastricht plan are over 30 000km^2 and whilst in theory these should generate no more interference than that from the seven transmitters in Reference Network 1, we have added additional central transmitters to emulate a more typical configuration.