

Report for Vodafone

Mobile backhaul market: Phase 2 report

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1 Executive summary

This document is the final report of phase 2 of a project carried out by Analysys Mason on behalf of Vodafone. In this report we review the approaches taken to regulation of the terminating segments of leased lines in a selection of six EU countries (France, Germany, Italy, the Netherlands, Spain and the UK), the impact of this regulation on mobile base station backhaul, and implications for future regulation in this area.

Context

The European regulatory framework for electronic communications imposes *ex ante* regulatory remedies on operators found to have significant market power (SMP) in relevant markets as a result of a formal market review by their national regulatory authority (NRA). The markets to be assessed are either taken from the European Commission's ('the EC' or 'the Commission') Recommendation on relevant markets susceptible to *ex ante* regulation¹, or can be analysed by the NRA subject to the NRA showing that the relevant market passes the so-called 'three-criteria test'². A market that is not included in the Recommendation but is so defined by the NRA is subject to a Commission veto through the so-called "Article 7 process"³.

Each mobile operator needs to connect its base stations with its core network electronics; these links from the base stations back into the core network are often referred to as 'backhaul'. These links are, or are based on,⁴ leased lines (with a variety of interfaces, usually synchronous digital hierarchy (SDH) or Ethernet). A mobile operator has a variety of options to provide these links:

- building its own links, often using microwave point-to-point radio
- leasing commercial inputs, where these are available
- buying regulated inputs from the SMP operators; in many EU countries there exists a variety of regulated wholesale leased-line inputs.

While the fixed incumbent operator may well have access to a fibre-based input as a matter of course, these inputs are not always made available to competing operators as a wholesale or retail product with the desired interface, quality, speed or price. The fact that the required inputs are not available, or are extremely expensive, may dampen competition in the mobile market in some countries because the fixed incumbent operator is usually (with the exception of the UK) also a

¹ The currently in-force version is the Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services.

² See for example "Report on guidance on the application of the three criteria test", ERG, June 2008.

³ Referring to Article 7 of the Framework directive 2002/21/EC. See for example <https://ec.europa.eu/digital-agenda/en/consultation-procedures>.

⁴ For example, a multi-protocol label switching (MPLS) network could be based on an Ethernet point-to-point connection from an aggregation node to each base station.

major mobile operator and can gain benefits as a result of this vertical integration – specifically the much greater capillarity of its fibre network.

The EC has recently launched a consultation on a revised Recommendation containing a list of relevant markets⁵. The proposed list of relevant markets does not include a business-focused wholesale broadband access market (which might also have been useful for cell-site backhaul), and instead contains (omitting the irrelevant markets for this purpose):

- **Market 3:**
 - 3a: Wholesale local access provided at a fixed location.
 - 3b: Wholesale central access provided at a fixed location for mass-market products.
- **Market 4:** Wholesale high-quality access provided at a fixed location. This is the market of most interest to this study.

Approach

In this study, we have looked at the different approaches taken in a selection of EU countries to ensure a sufficiently competitive high-speed access market (in particular, in support of mobile backhaul). We have been interested in lessons that can be learnt for the future review of this market by NRAs; and the implications of these lessons for the EC Recommendation on relevant markets or for the explanatory note to this Recommendation.

We have examined the existing regulation in the following six European countries:

- France
- Germany
- Italy
- the Netherlands
- Spain
- UK.

For each country, we summarise the most recent review of the market for terminating segments of leased lines:⁶

- market definition
- findings of SMP
- remedies imposed
- related remedies imposed through other relevant markets
- implications of the process and results for mobile backhaul in the context of the revised Recommendation on relevant markets.

⁵ Public consultation on the revision of the Recommendation on relevant markets, October 2012 to January 2013.

⁶ Market 6 in the second EC Recommendation on relevant markets.

Lessons learnt

A variety of lessons in relation to the EC Recommendation on relevant markets and the future of market analysis in this area can be learnt from the points we have illustrated in this report. Importantly, this is an opportune time to address these points.

If the EC is seeking improved harmonisation in the approach of NRAs to regulation of relevant markets, then it would be useful for all regulators to ensure they start their market analysis from the same initial point. This is the proper role of the Recommendation on relevant markets. In this regard, it would therefore seem helpful for the market for wholesale terminating segments of leased lines to be retained in the Recommendation.

Failing this, it would be very useful for explicit guidance to be provided by the Commission within the explanatory note to the new Recommendation to cover the way in which the mobile backhaul market (or failing that, the market for wholesale terminating segments of leased lines) needs to be considered, possibly drawing on the example of the HQWBA/LL market review in the Netherlands. BEREC may also have a role to play.

The specific role of leased lines in supporting other retail markets needs to be a key part of the analysis of the leased-line market. Current non-integrated mobile operators are making heavy use of microwave radio links (typically serving the majority of their sites by these means). By comparison, the integrated former incumbent operators are already making a strong migration towards fibre backhaul for LTE base stations. As we have described elsewhere, the capacity of the microwave links will soon become insufficient. As a result, if products suitable for mobile backhaul are not available, the likely consequence will in the near future be a reduction in the ability of non-integrated mobile operators to compete on a level playing field in relation to LTE services, to the detriment of end-users. Therefore, the impact of vertical integration (including the possibility of leverage of dominance from the leased-line market to mobile markets) will need to be considered.

Some form of harmonisation of the approach to deciding whether the market for terminating segments includes terminating segments ending at network nodes rather than end-user premises may also be appropriate.

Finally, a similar argument can be made for retaining the relevant market for passive infrastructure access. Unless the use of duct and dark fibre for mobile backhaul is explicitly considered within the wholesale local access market, there is a danger that the existing strong differences across Member States (in both their approach and the outcomes in terms of prices for high-speed point-to-point connections) will increase. As can be seen in Figure 3.5 of this report, there are already stark differences in the monthly prices of high-speed point-to-point connections across the EU.

2 Introduction

Vodafone has commissioned Analysys Mason Limited (Analysys Mason) to review the different approaches taken by national regulatory authorities (NRAs) across Europe to ensure a sufficiently competitive high-speed access market (in particular, in support of mobile backhaul). We are interested in lessons that can be learnt for the future review of this market; and the implications of these lessons for the Recommendation on relevant markets or its explanatory note.

We have examined the existing regulation in the following six European countries:

- France
- Germany
- Italy
- the Netherlands
- Spain
- UK.

For each country, we summarise the results of the most recent review of the market for terminating segments of leased lines:⁷

- market definition
- findings of significant market power (SMP)
- remedies imposed
- related remedies imposed through other relevant markets
- implications of the process and results for the mobile backhaul market in the context of the proposed revised EC Recommendation on relevant markets

The remainder of this document is laid out as follows:

- Section 3 documents the main findings from our analysis of the review of relevant markets in the selected countries
- Section 4 sets out the conclusions of our review.

⁷

Market 6 in the second EC Recommendation on relevant markets.

3 Relevant market reviews in the selected countries

This section documents the main findings from our analysis of the market reviews of relevant markets in the following six European countries:

- France (Section 3.1)
- Germany (Section 3.2)
- Italy (Section 3.3)
- the Netherlands (Section 3.4)
- Spain (Section 3.5)
- UK (Section 3.6).

3.1 France

On 17 March 2010, the French regulator ARCEP (*Autorité de Régulation des Communications Électroniques et des Postes*) published the results of its review of the wholesale markets for terminating segments of leased lines and for trunk segments of leased lines, and of the retail market for leased lines.⁸ In light of the results of its review of relevant markets, ARCEP decided to impose a number of regulatory remedies, documented by the Commission in its Article 7 taskforce under the Case FR/2010/1050.⁹

3.1.1 Market definition

ARCEP defines the wholesale market for terminating segments of leased lines as including all the terminating segments of leased lines, regardless of transmission capacity, up to the first switch/multiplexer for services with traditional interfaces, and the first ATM or equivalent switch for services with alternative interfaces. ARCEP concluded that the relevant geographical market is national.

ARCEP defines the wholesale market for trunk segments of leased lines as including the submarine cables, the landing stations and the terrestrial complements up to France Telecom's (FT) centre for terminating services in the overseas areas, and the first point of presence of the other operator on mainland France. All trunk segment services are included regardless of transmission capacity and type of interface.

ARCEP decides that the relevant geographic market is nationwide for trunk segments within one territory (intra-territorial) and seven sub-markets for the trunk segments between territories (the inter-territorial market). We are not concerned with the inter-territorial market (as it is concerned with remote territories) and will not discuss it further.

⁸ See http://www.arcep.fr/uploads/tx_gspublication/consult-projdec-sercap-160210.pdf

⁹ See [https://circabc.europa.eu/sd/a/9f542806-4056-4e33-9192-83e1d8c89a5a/FR-2010-1050%20acte\(1\)_EN%20nr%20et%20date.pdf](https://circabc.europa.eu/sd/a/9f542806-4056-4e33-9192-83e1d8c89a5a/FR-2010-1050%20acte(1)_EN%20nr%20et%20date.pdf)

After applying the so-called three-criteria test, ARCEP concluded that the market for intra-territorial trunk segment services did not warrant *ex ante* regulation on the basis of alternative operators providing intra-territorial trunk segment services and availability of passive capacity on the main routes.

Finally, ARCEP defines the retail market for leased lines as including analogue and digital leased lines, regardless of transmission capacity and type of interface, and that the geographical scope of this relevant market is national. ARCEP conducted a three-criteria test and found that the regulatory remedies imposed in the relevant wholesale market significantly reduced the barriers to entry in the retail market. As a result, ARCEP concluded that the retail market for leased lines no longer warranted *ex ante* regulation.

3.1.2 SMP findings in the market for terminating segments

ARCEP found FT to have SMP in the wholesale market for terminating segments of leased lines.

3.1.3 Remedies imposed

In the market for wholesale terminating segments of leased lines, ARCEP imposed the following remedies:

- access including the continuation of currently provided services and the provision of associated interconnection services and envisaged product evolutions
- transparency and a reference offer
- non-discrimination
- cost accounting and accounting separation
- price control
 - tariffs based on cost orientation for leased lines with a capacity below 10Mbit/s
 - no excessive prices for leased lines with a capacity above 10Mbit/s.
- quality of service (QoS).

3.1.4 Related remedies imposed through other relevant markets

Under the market for ‘wholesale (physical) network infrastructure access’,¹⁰ ARCEP imposed the following obligations on FT:¹¹

- access
 - unbundled access to copper loops and sub loops
 - deliver ancillary services including physical and distant co-location as well as connecting radio base stations (RBSs)

¹⁰ Market 4 in the second EU Recommendation on relevant markets

¹¹ See [https://circabc.europa.eu/sd/a/ad7ecb2e-8c48-455f-9047-36c990470300/FR-2011-1213-1214%20Acte\(5\)_EN+date+nr.pdf](https://circabc.europa.eu/sd/a/ad7ecb2e-8c48-455f-9047-36c990470300/FR-2011-1213-1214%20Acte(5)_EN+date+nr.pdf)

- continuation of the existing commercial offer for providing a fibre link between two main distribution frames (MDFs) and between an MDF and an alternative operator's point of presence (PoP)
 - access to FT's civil works infrastructure, including any underground, chambers and overhead infrastructures
- non-discrimination
 - transparency, including the publication of a reference offer
 - QoS
 - price control based on cost orientation
 - cost accounting and accounting separation.

Duct access is therefore available to the mobile operators to lay their own fibre should this be necessary. Access to dark fibre is not regulated in France, except for in-building wiring for fibre-to-the-home (FTTH) deployments.

3.1.5 Solutions available to mobile operators

As Vodafone does not operate in France, we do not have anecdotal evidence in relation to the solutions used.

3.1.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

The interesting features of the French telecoms market are:

- access to leased-line tails with synchronous digital hierarchy (SDH) and alternative interfaces (i.e. including Ethernet)
- access at cost-oriented prices for 10Mbit/s and below
- access to FT ducts at cost-oriented prices.

3.2 Germany

On 9 August 2012, the German regulator *Bundesnetzagentur* (BNetzA) published its review of the market for wholesale terminating segments of leased lines in Germany.^{12 13} In light of the results of its review of relevant markets, BNetzA decided to impose a set of regulatory remedies in these markets, documented by the Commission in its decisions concerning Case DE/2011/1277 (wholesale terminating segments of leased lines)¹⁴ and Case DE/2012/1321 (price control for

¹² See http://www.bundesnetzagentur.de/SharedDocs/Downloads/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Marktanalysen/Festlegung_Markt6.pdf?__blob=publicationFile&v=1

¹³ See http://www.bundesnetzagentur.de/DE/Service-Funktionen/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK2-GZ/2012/BK2-12-001R_BKV/Beschluss_BK2a_12_001R_bf.pdf?__blob=publicationFile&v=4

¹⁴ See https://circabc.europa.eu/sd/a/cb5b90de-3301-4073-8845-22eca8eafccc/DE-2011-1277%20Acte_2_%20EN+date+nr.pdf.pdf

wholesale terminating segments of leased lines in Germany). On 27th July 2012, the Commission issued a ‘serious doubts’ letter in relation to this notification. BNetzA subsequently withdrew and re-notified the draft measures to be imposed in the relevant market, as Case DE/2012/1348¹⁵.

3.2.1 Market definition

BNetzA defined the wholesale market for terminating segments of leased lines as including all leased-line connections that did not belong to long-distance/core network segments. Leased lines with both traditional and Ethernet-based interfaces were also included in the market definition, but dark fibre was excluded. BNetzA divided the relevant market into four segments, according to the bandwidth provided:

- analogue terminating segments and segments with a bandwidth of less than 2Mbit/s
- terminating segments with a bandwidth of more than 2Mbit/s up to and including 10Mbit/s
- terminating segments with a bandwidth of more than 10Mbit/s up to and including 155Mbit/s
- terminating segments with a bandwidth of more than 155Mbit/s.

After applying the so-called ‘three criteria test’, the market segments with a bandwidth of less than 2Mbit/s and with a bandwidth of more than 155Mbit/s were deemed not to be susceptible to *ex ante* regulation. In the case of the segments with a bandwidth of less than 2Mbit/s, BNetzA concluded that competition alone was sufficient to adequately address any market failure(s). In the case of the terminating segments with a bandwidth of more than 155Mbit/s, BNetzA concluded that there were no high and non-transitory barriers to entry since many alternative network operators already had their own infrastructure in urban areas where there was a demand for very high bandwidths. We note that this high level of competition for >155Mbit/s may not continue to be true in the future as demand for mobile backhaul bandwidth increases: mobile base stations are not all located in dense urban areas. Accordingly, we believe that this point will need to be revisited in the future.

The wholesale market for trunk segments of leased lines was defined by BNetzA under case DE/2007 0677-0678¹⁶ as comprising all connections between the leased-line nodes situated in the trunk cities. The relevant market included leased lines with both traditional and alternative leased lines, irrespective of the bandwidth provided.

The relevant geographical market for both terminating and trunk segments of leased lines was defined as national.

3.2.2 SMP findings

BNetzA found Deutsche Telekom as having SMP in the market for terminating segments with a bandwidth of 2Mbit/s to 10Mbit/s and 10Mbit/s to 155Mbit/s.

¹⁵ See https://circabc.europa.eu/sd/d/7d83111a-8464-41e7-8019-d0ceb483c9e8/DE-2012-1348%2520ACTE_EN%2520%2B%2520date%2520et%2520cote.doc.pdf

¹⁶ See [https://circabc.europa.eu/sd/a/37950be3-58fc-4505-8f53-ac16dcaee9fc/DE-2007-0677-678%20Acte\(3\)_ENr.pdf](https://circabc.europa.eu/sd/a/37950be3-58fc-4505-8f53-ac16dcaee9fc/DE-2007-0677-678%20Acte(3)_ENr.pdf)

Considering evidence based on market shares, BNetzA further concluded that there was effective competition in the market for trunk segments and no operator had SMP in the relevant market.

3.2.3 Remedies imposed

In the market for wholesale terminating segments of leased lines with a bandwidth of 2Mbit/s to 10Mbit/s and 10Mbit/s to 155Mbit/s, BNetzA imposed the following remedies:

- access, including an obligation to provide co-location
- transparency, including an obligation to publish a reference offer
- non-discrimination
- *ex ante* price control (notably including Ethernet leased lines, which previous German remedies treated differently).

3.2.4 Related remedies imposed through other relevant markets

Under the market for ‘wholesale (physical) network infrastructure access’ (WPNIA),¹⁷ on 24 January 2011 BNetzA imposed the following remedies¹⁸ on the wholesale (physical) network infrastructure:

- unbundled access for both copper (local loop unbundling (LLU) and sub-loop unbundling (SLU)), as well as the fibre-based products ISIS and OPAL) and fibre passive optical network (PON) unbundling at the splitter (including co-location)
- to support access to this relevant market, access to ducts, and access to dark fibre where access to ducts is not feasible; support backhaul from the point of interconnection (i.e. only from the cabinet)
- transparency
- non-discrimination
- price control based on cost orientation other than FTTH
- *ex ante* price control for FTTH based on a margin-squeeze test.

We note that access to PON at the splitter is probably not a very suitable input for mobile backhaul (because, for example, the mobile base station is not located at the splitter).

There are three main points stemming from the Commission’s Article 7 comments in relation to this WPNIA market. Firstly, the Commission notes that restrictions on duct access are not in line with the 2007 EC Recommendation on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation:

¹⁷ Market 4 in the second EC Recommendation on relevant markets.

¹⁸ See https://circabc.europa.eu/sd/a/04ad24f5-d59d-4077-959b-74b28d6c3ef8/DE-2011-1177%20Acte_4__EN+date+nr.pdf

“Whilst the Commission welcomes BNetzA's proposal to impose an obligation on DT to provide access to its ducts, the Commission also takes note that this obligation shall only apply in order to facilitate access to the street cabinet in the case of subloop unbundling / FttC. The Commission draws BNetzA's attention to the fact that the NGA Recommendation does not restrict the requirement to provide duct access to such a scenario but rather recommends that NRAs should mandate access to civil engineering infrastructure wherever duct capacity is available, i.e. potentially also between the street cabinet and the end-user.”

Allowing duct access for purposes other than sub-loop backhaul would enable their use for leased lines and mobile backhaul.

Secondly, and more widely, the Commission is in favour of access to dark fibre being not just where duct access is impossible, but also where this is economically preferable for the operator seeking wholesale access.

“It cannot, therefore, be excluded that in certain cases, even where duct access would, in theory, be possible, it might only be economically feasible for alternative operators to reach the street cabinet or distribution point located at the building by accessing dark fibre instead of laying down own fibre lines in DT's ducts. In the view of the Commission, it is important that SLU is supplemented by appropriate backhaul measures to make SLU effective and that access seekers should be able to select the solution best fitting their requirements.”

Thirdly, in the summary of its comments on the 2010 BNetzA notification, the Commission notes the following:

“The Commission (i) reminded BNetzA, with regard to the exclusion of fibre lines serving large business customers, that regarding market definition the Commission's Market Recommendation does not draw a distinction between access lines based on the type of end-users they serve and (ii) invited BNetzA to impose a set of appropriate remedies in the relevant market without undue delay.”

Although this comment relates to a different relevant market it is quite different to the approach used by the Italian regulator, AGCOM, in relation to leased lines (see Section 3.3 for further details), where the type of end users is a critical part of the market definition.

3.2.5 Solutions available to mobile operators

In Germany, Vodafone tends to self-provide its backhaul networks using microwave (a majority of cell sites). Where microwave is not feasible to install at a given site, Vodafone tends to either purchase commercially negotiated active managed services (most of the remainder) or, on an exceptional basis, leased-line products from the incumbent operator.

The reason Vodafone does not tend to purchase regulated SDH/alternative interface leased lines (with a capacity less than 155Mbit/s) from the incumbent operator is due to their high pricing.¹⁹ Instead, Vodafone tends to use leased lines/managed services from alternative operators, which are usually more cost effective.

With the increasing demand for capacity on LTE sites, Vodafone will increasingly need high-speed leased lines (with capacity greater than 155Mbit/s) for backhaul purposes. However, as mentioned in Section 3.2.1 of this document, high-speed leased lines are not regulated in Germany. As a result, Vodafone tends to purchase its high-speed leased lines and/or high-speed managed services products from alternative operators, which tend to be more cost effective than the leased lines purchased from the incumbent operator, especially in competitive areas.

3.2.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

In Germany, access to both SDH and alternative interface products with speeds from 2Mbit/s to 155Mbit/s is regulated. As noted in our Phase 1 report, these bandwidths are too low for LTE sites.

In the market segments with a bandwidth greater than 155Mbit/s, BNetzA concluded that there were no high and non-transitory barriers to entry since many alternative network operators already had their own infrastructure in urban areas where there was a demand for very high bandwidths. We note that this high level of competition for >155Mbit/s may not continue to be true in the future as demand for mobile backhaul bandwidth increases: mobile base stations are not all located in dense urban areas. Accordingly, we believe that this point will need to be revisited in the future.

As noted in section 3.2.4 the restriction of use of duct access for LLU/SLU backhaul and FTTH means that duct access is not usable by mobile operators to lay their own fibre to provide backhaul.

3.3 Italy

On 30 October 2009, the Italian regulator AGCOM (*Autorità per le Garanzie nelle Comunicazioni*) published the results of a public consultation on the identification and analysis of the wholesale national markets for trunk segments of leased lines and for terminating segments of leased lines.²⁰ In light of its review of relevant markets, AGCOM decided to impose a number of remedies in the market for terminating segments of leased lines, as notified to the European Commission in Cases IT/2009/0999-1000.²¹

¹⁹ In this context, Vodafone has taken legal action to revise the prices of regulated alternative leased lines in access areas.

²⁰ See <http://www.agcom.it/default.aspx?message=visualizzadocument&DocID=3448>

²¹ See [https://circabc.europa.eu/sd/a/04e452cd-95bc-48bc-9e7f-848267320d33/IT-2009-0999-1000%20Acte\(1\)_EN%20.pdf](https://circabc.europa.eu/sd/a/04e452cd-95bc-48bc-9e7f-848267320d33/IT-2009-0999-1000%20Acte(1)_EN%20.pdf)

3.3.1 Market definition

AGCOM defined two markets for the provision of terminating segments of leased lines:

- Market A – circuits provided between a Telecom Italia (TI) node and a customer’s premises
- Market B – circuits provided between a TI node and a mobile operator’s base transceiver station (BTS).

After applying the so-called three-criteria test, AGCOM found no evidence of the presence of high and non-transitory barriers to entry in the market for trunk segments and therefore concluded that this market was not susceptible to *ex ante* regulation. Consequently, AGCOM withdrew the existing regulatory obligations.

Data presented by AGCOM

The table in Figure 3.1 below shows the share of use of wireless backhaul by operator in Italy (as summarised by AGCOM and reproduced by the EC):

Figure 3.1: Use of wireless mobile backhaul in Italy [Source: AGCOM, 2009]

MNO	BTS	% of BTS linked by wireless technologies
TI Mobile	17 383	12%
Vodafone	14 271	84%
Wind	12 340	85%
H3G	9657	76%
TOTAL	53 650	–

The difference in behaviour between the vertically integrated TI and the other operators is striking: TI chiefly uses leased lines and the other operators use microwave self-supply.

We note in passing that the table in Figure 3.1 above is likely to be based on pre-2009 data, and that it appears to be based on a different set of sites to the UMTS/LTE sites reported by TI in Figure 3.2 below. We assume that it includes all mobile sites including, for example, 2G-only sites. It does not imply that microwave links will be sufficient in the future.

AGCOM also provides some old but still useful data on the size of the mobile backhaul market as a fraction of the total market, as shown in the table below.²²

²² DELIBERA N. 2/10/CONS. Available at http://organodivigilanza.telecomitalia.it/Documenti_AGCOM/Delibera_2_10_CONS.pdf

Figure 3.2: Mobile backhaul as a fraction of the leased-line market in Italy [Source: AGCOM, 2010]

Circuit end points	2006		2007		2008	
	Revenue (EUR million)	%	Revenue (EUR million)	%	Revenue (EUR million)	%
End-user-PoP (Market A)	144,76	53,52	173,48	55,85	197,27	72,13
BTS-PoP (Market B)	125,74	46,48	137,16	44,15	76,23	27,87
Total	270,50	100	310,64	100	273,50	100

It is apparent that mobile backhaul makes up a substantial part of the leased-line market in Italy, accounting for about half of the total in 2006 and 2007. We interpret the decline in the fraction of the market that is mobile backhaul in 2008 to the increased use of self-provision by the mobile operators (the value of this self-provision will not have been captured in the above statistics).

3.3.2 SMP findings in the market for terminating segments

AGCOM found TI as having SMP in Market A. However, no operator was deemed to have SMP in Market B due to:

- market shares (operators other than TI were largely using microwave point-to-point links)
- the limited presence of non-replicable infrastructures (demonstrated by the use of microwave links)
- the countervailing power exercised by mobile network operators (due to the volume of circuits they buy)
- the absence of competition problems arising from the vertical integration of TI due to the similar vertical integration of the mobile network operators in this regard.²³

3.3.3 Remedies imposed

AGCOM imposed the following regulatory remedies in Market A:

- access to, and use of, specific network facilities
- transparency
- non-discrimination
- accounting separation
- price control based on cost orientation
- cost accounting.

²³ This is true in the context of self-supply using microwave point-to-point links, but if such self-supply is no longer possible it may become a material issue.

3.3.4 Related remedies imposed through other relevant markets

Under the market for ‘wholesale (physical) network infrastructure access’,²⁴ on 23 May 2001 AGCOM imposed the following remedies on the wholesale (physical) network infrastructure:²⁵

- access to ducts, trenches and dark fibre, including obligation to build out lines where dark fibre lines are not available
- transparency
- non-discrimination
- accounting separation
- price control based on cost orientation
- cost accounting.

In addition, a symmetrical remedy (access at fair and reasonable prices) was imposed under case IT/2013/1482²⁶ in relation to FTTH networks, but this does not cover fibre leased lines.

Furthermore, it is obligatory for public entities conducting civil works to provide a suitable size of manholes and service ducts for laying of fibre, as well as access on fair and non-discriminatory terms.

3.3.5 Solutions available to mobile operators

Vodafone Italy tends to self-provide (using microwave technology) its backhaul networks due to their flexibility and the high cost of leased lines. However, whenever microwave systems are not a feasible option, (e.g. lack of line-of-sight visibility, lack of radiofrequency channels and antenna installation issues), Vodafone has no alternative but to purchase dark fibre products (where available) or leased lines.

Since regulated dark fibre products (fibre to the building, or FTTB) are only available in a few cities where TI has its own FTTH network, the opportunity for mobile network operators to purchase regulated dark fibre is limited and therefore the vast majority of dark fibre is commercially negotiated under indefeasible rights of use (IRU) terms. Also, in metropolitan areas, alternative fibre providers have typically been able to offer fibre at a competitive price relative to TI’s commercial offers. Finally, mobile network operators cannot purchase dark fibre in rural areas due to the lack of availability of fibre in these areas (TI has very little fibre in rural areas).

In 2012, TI published its planned backhaul evolution over the next few years, as shown in the following table.²⁷

²⁴ Market 4 in the second EC Recommendation on relevant markets.

²⁵ See https://circabc.europa.eu/sd/a/d7006ad1-5da6-476f-a9c4-eb5e6e34a842/IT-2011-1230-1231%20Acte_4__EN+date+nr.pdf

²⁶ See https://circabc.europa.eu/sd/a/770f2d32-bfbf-4689-b007-5f6c2bfeb107/IT-2013-1482%20Adopted_EN.pdf

²⁷ See <http://www.telecomitalia.com/content/dam/telecomitalia/it/archivio/documenti/Innovazione/NotiziarioTecnico/2012/h2-2012/capitolo10.pdf>

Figure 3.3: TI's planned backhaul technology evolution [Source: TI, 2012]

Backhaul technology	2011	2012	2013	2014
Fibre optic	3154	6364	8576	10 921
Radio	727	1567	3555	5799
Bonding	788	788	738	638
Traditional (nxE1)	8248	4898	2678	749
Total UMTS/LTE sites	12 917	13 617	15 547	18 107

This planned evolution is highly consistent with our thesis that LTE base stations will require fibre-based backhaul.

3.3.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

Points of interest stemming from our analysis of the relevant market reviews in Italy are:

- There is regulated access to both duct and dark fibre, which would enable their use for mobile backhaul.
- The data presented by AGCOM in its review, *albeit* somewhat dated, shows that mobile operators' backhaul links are a significant fraction of the leased-line market (in that as mobile operators started to use self-supplied links, the total volume of links declined).
- It is also interesting that AGCOM noted that, even as its use of self-supply increased, the fraction of the remaining links purchased by the mobile operators from TI increased. This implies that TI still has considerable strength in those parts of the market where point-to-point links are not suitable (which might for example be in highly mountainous areas).
- The data presented by AGCOM also shows that the behaviour of the vertically integrated incumbent operator TI is to use its own wireline network, with only a small fraction of its base stations using wireless backhaul. This difference in behaviour is interesting and is also consistent with the behaviour of incumbent operators in other countries. This suggests that TI believes that wireline backhaul provides either:
 - A benefit in terms of the speeds it can offer now or in the future; or
 - A direct financial benefit. The vertical integration may mean that it prefers to make incremental use of its wireline network (benefiting its fixed arm) rather than buying additional microwave point-to-point radios. If so, then it suggests that the current price of the TI leased lines may be inefficiently high in terms of its ability to attract mobile operators as customers for these links.

- It is also possible that the preference of the non-incumbent mobile operators for self-supply using point-to-point microwave was caused by the high prices of leased lines. This would be an example of the ‘cellophane fallacy’: the price charged for a product can bring into play false substitutes which can compete only if the price is excessive. We note the analysis conducted by the CMT in Spain and presented in Figure 3.5, which shows high prices for certain services in Italy.
- It is very interesting that AGCOM concluded that mobile backhaul had such different conditions of supply and demand as to constitute a separate relevant market. This indicates to other NRAs and the EC that this possibility will occur in other Member States and might in itself merit recognition within the list of relevant markets or the Explanatory Note to the EC Recommendation on relevant markets.

As noted in the related first part of this study, the reasoning of AGCOM in relation to the use of self-supply using microwave point-to-point links may not continue to be true in the future as demand for backhaul bandwidth from individual mobile sites grows. Without the option of access to leased lines at reasonable prices, this could cause a loss of competitive dynamism in the mobile market.

3.4 The Netherlands

On 23 November 2012, the Dutch regulator OPTA (*Onafhankelijke Post en Telecommunicatie Autoriteit*) published the results of its analysis on high-quality wholesale broadband access and leased lines in the Netherlands.²⁸ OPTA decided to impose a number of regulatory remedies on the leased-line market; this is documented by the EC in its decision concerning Case NL/2012/1407 (unbundled access to business fibre networks in the Netherlands) and Case NL/2012/1408 (high-quality wholesale broadband access and leased lines in the Netherlands).²⁹

3.4.1 Market definition

Leased lines at the local level in the public switched telephone network (PSTN) and at the metro level in KPN’s all-IP network were defined as the terminating segments of leased lines.

In the Netherlands, only lines that terminate at end-user premises are included in the market for terminating segments, so links terminating at network sites such as mobile base stations are therefore excluded from this market. Nevertheless, the analysis conducted by OPTA is interesting, so we do describe it in full below.

Unlike other NRAs, OPTA included wholesale terminating segments of leased lines, irrespective of transmission capacity and technology, in the definition of the market for wholesale broadband access (WBA),³⁰ instead of a separate market for wholesale terminating segments of leased lines.³¹ This WBA market was found to include two sub-markets: low-quality wholesale broadband access and high-quality wholesale broadband access including terminating segments of leased lines (HQWBA/LL).

²⁸ See <https://www.acm.nl/nl/download/publicatie/?id=11038>

²⁹ See https://circabc.europa.eu/sd/a/ec302add-7eda-49ae-8c59-3d734204b711/NL-2012-1407-1408%20Adopted_EN.pdf

³⁰ Market 5 in in the second EU Recommendation on relevant markets.

³¹ Market 6 in the second EU Recommendation on relevant markets.

OPTA recognised the difference in contention ratio for leased lines and the remainder of the high-quality WBA market. However, OPTA also highlighted that increased capacity in high-quality WBA resulted in greater substitutability, thus increasing competition between leased lines and high-quality WBA. In addition, both products had similar capacity (up to 100Mbit/s), service level agreements (SLAs), similar accessibility and were provided via the same networks.

OPTA defined the relevant geographical market as national.

All segments of leased lines at a higher level of the network hierarchy than terminating segments of leased lines were defined as trunk segments. The market for trunk segments of leased lines was found to be competitive by OPTA.³²

3.4.2 SMP findings in the market for terminating segments

KPN was deemed as having SMP in the market for terminating segments.

3.4.3 Remedies imposed

OPTA imposed the following remedies in the HQWBA/LL market:

- access over copper and fibre, including access to associated facilities
- with regard to HQWBA/LL access over fibre, a so-called ‘near-net’ service (obliging connection of new sites if they are within a certain distance of the existing network) – this was later suspended by a Court decision
- transparency, including the obligation to publish a reference offer
- non-discrimination on the basis of equivalence of outputs, including a margin-squeeze test (so called ‘ND-5 test’)
- tariff regulation based on an embedded direct costs (EDC) methodology, allowing some freedom to allocate common costs across different speed products based on commercial value (or set by the margin-squeeze test if this results in a lower price).

This decision is currently subject to appeal and likely to be decided by Q1 2014.

3.4.4 Related remedies imposed through other relevant markets

OPTA also notified a market review of the market for fibre to the office (FTTO), accessed at the optical distribution frame (ODF); FTTO ODF access is a form of unbundled access which allows alternative operators to access the FTTO network.

As part of this analysis, OPTA looked at multi-site contract characteristics in the Netherlands. The results showed that KPN has by far the highest number of contracts and connections. OPTA also points out that KPN’s competitors depend on buying FTTO ODF access from each other or from

³² See [https://circabc.europa.eu/sd/a/9368ae26-5d07-43af-aba6-d8a7ebd54627/NL-2008-0823-0824-0825%20acte\(2\)_en.pdf](https://circabc.europa.eu/sd/a/9368ae26-5d07-43af-aba6-d8a7ebd54627/NL-2008-0823-0824-0825%20acte(2)_en.pdf)

KPN, while KPN can largely serve such customers by means of its own network, which is generally located closer to the smaller locations; this is an important cost-reducing factor for KPN, making its average digging costs to new business locations lower than for its competitors.

However, this FTTO SMP decision was thrown out in November 2013 as a result of an appeal filed with the Dutch court of appeal.

3.4.5 Solutions available to mobile operators

In the Netherlands, Vodafone tends to self-provide its backhaul networks using microwave (on a majority of cell sites) due to the lack of regulation for leased lines to cell sites. Vodafone has also used commercial dark fibre services, un-regulated managed services using leased lines and xDSL copper lines from the incumbent operator for sites where microwave is not feasible to install.

However, with the increased capacity requirement of 3G and LTE, Vodafone is gradually replacing xDSL copper lines with commercial dark fibre. Also Vodafone is deploying dark fibre closer and closer to the cell sites, with the objective of reducing the number of microwave hops for sites backhauled using microwave technology.

KPN has the largest dark fibre footprint in the Netherlands, but does not offer dark fibre to non-incumbent mobile network operators in order not to cannibalise their managed services revenue. However, Vodafone, and mobile network operators in general, can in some cases purchase commercial dark fibre services from Eurofiber³³ or more fragmented regional fibre providers.

3.4.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

The interesting features of the Netherlands market are:

- regulated access to leased-line tails with SDH and alternative interfaces
- access at prices set using EDC for a specified range of speeds
- the analysis of the combined HQWBA and LL markets together is potentially relevant to the revised Recommendation on relevant markets, as this also contains a high-quality WBA market, showing how regulators can consider leased lines within this market and provide suitable remedies to SMP operators in this area
- the FTTO remedy would be of interest to mobile operators with sites close to the existing fibre routes; however, it is currently unavailable due to the appeal decision.

3.5 Spain

The Spanish regulator, the CMT (*Comisión del Mercado de las Telecomunicaciones*), published the results of its market review of the wholesale markets for terminating³⁴ and trunk segments³⁵ of

³³ A commercial provider of dark fibre connections, Ethernet services and optical transmission services in the Netherlands.

³⁴ See http://www.cmt.es/c/document_library/get_file?uuid=b18e1f1a-cb0b-43d6-925f-7e4a6b289af2&groupId=10138

leased lines on 11 April 2013. In light of the results of its review of relevant markets, the CMT decided to impose a set of regulatory remedies in these markets, documented by the Commission in its Decision concerning cases ES/2013/1425³⁶ and ES/2013/1426.³⁷

3.5.1 Market definition

Regarding terminating segments of leased lines, the CMT defined the relevant market in which symmetric transmission capacity is provided as part of the access network, including both traditional interfaces and Ethernet, and without switching functionalities that can be controlled by the user. The relevant geographical market was national.

The market for trunk segments of leased lines was identified as the circuits with a fixed capacity provided between two nodes of the trunk network, regardless of the technology used to supply the capacity, including Ethernet interfaces and wavelengths, and without switching functionality that can be controlled by the user. Dark fibre was not included in the market definition.

Ten different geographical markets were identified as relevant corresponding to specific submarine routes, with all of them meeting the three-criteria test.

The market for intra-mainland trunk segments of leased lines was deemed to be competitive.

3.5.2 SMP findings

The CMT found Telefónica to have SMP in the market for terminating segments of leased lines and in ten specific geographical markets for underwater trunk segments of leased lines.

3.5.3 Remedies imposed in the market for terminating segments

In the market for terminating segments of leased lines, the CMT imposed the following remedies:

- access to leased lines with traditional interfaces with different capabilities
- price regulation based on cost orientation for traditional leased lines and retail-minus for Ethernet leased lines
- accounting separation
- non-discrimination
- transparency obligation, including the publication of a reference offer.

In its analysis,³⁸ the CMT includes the following table summarising the state of regulation in the market for wholesale leased lines at the time.³⁹ We note that the regulatory situation in some of the

³⁵ See http://www.cmt.es/c/document_library/get_file?uuid=69d41b59-f92b-4e00-b544-1b1bbf67d6ba&groupId=10138

³⁶ See https://circabc.europa.eu/sd/a/a559755f-88ff-40e0-ac13-a0d41127cd09/Annex_Draft_measure_MTZ_2012-2017_.pdf

³⁷ See https://circabc.europa.eu/sd/a/53a914f2-5a2f-4197-a0a0-060304952865/Annex_Draft-measure_2012-2019_PUBLIC.pdf

³⁸ *Resolución por la que se aprueba la revisión de precios de la oferta de referencia de líneas alquiladas de Telefónica de España, S.A.U. y se acuerda su notificación a la Comisión Europea y al Organismo de Reguladores Europeos de Comunicaciones Electrónicas (ORECE) (AEM 2013/237)*. Available at http://telecos.cnmc.es:8080/c/document_library/get_file?uuid=41280eeb-5158-4fd8-9971-625df2a80553&groupId=10138

countries listed in Figure 3.4 below may have evolved since this table was originally created. But the table does illustrate that the variation in approaches to remedies in the wholesale market for terminating segments of leased lines goes much wider than the small sample of countries we have investigated in this report.

Figure 3.4: CMT summary of regulatory remedies imposed by some European NRAs in the wholesale market for terminating segments of leased lines [Source: CMT, 2013]

Country	Sub-markets with different obligations	Regulated access (Yes/No)	Price control
Austria	Below 2Mbit/s	Yes	Price cap
	More than two below 155Mbit/s	Yes (except in the 12 largest cities)	Price cap
	More than 155Mbit/s	No	–
Belgium	No one market	Yes	–
Denmark	Below 2 Mbit/s	Y	Cost orientation
	More than 2Mbit/s	Yes, limited to access, transparency and non-discrimination	–
France	Below 10Mbit/s	Yes	Cost orientation
	More than 10Mbit/s	Yes	No margin squeeze
Greece	Below 200Mbit/s	Yes	Cost orientation
Germany	Less than 2Mbit/s	No	–
	From 2 to 155Mbit/s	Yes	Cost orientation
	More than 155Mbit/s	No	–
Ireland	Below 155Mbit/s	Yes	Cost orientation
	More than 155Mbit/s	No	–
Italy	Enterprise site connections	Yes (below 2,5Gbit/s)	Cost orientation
	To connect mobile operator sites	No	–
Netherlands	No	Analysis annulled by the Commercial Tribunal in 2010	–
Norway ⁴⁰	Below 8Mbit/s	Yes	Cost orientation
	More than 8Mbit/s	No	-

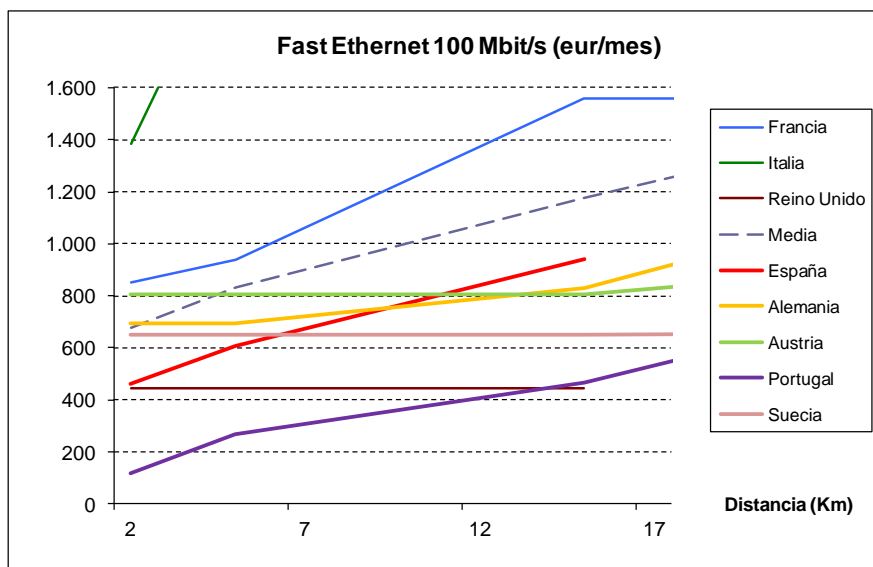
³⁹ Since the original resolution is in Spanish, we have translated the content in English.

⁴⁰ Analysys Mason note: EFTA, not EU

Country	Sub-markets with different obligations	Regulated access (Yes/No)	Price control
Portugal	Traditional interface (below 155Mbit/s)	Yes	Cost orientation
	Ethernet (below 1Gbit/s)	Yes	Retail minus
Spain	Traditional interface (below 155Mbit/s)	Yes	Cost orientation
	Ethernet (below 1Gbit/s)	Yes	Retail minus
	More than 1Gbit/s	Yes	Reasonable prices
UK	Traditional interface (below 8Mbit/s)	Yes	Cost orientation
	Traditional interface (more than 8Mbit/s, below 155Mbit/s)	Yes (except London)	Cost orientation
	Traditional interface (more than 155Mbit/s)	No	–
	Ethernet below 1Gbit/s	Yes	Cost orientation
	Ethernet more than 1Gbit/s	N	–

The CMT also presents the following remarkable price comparison chart.

Figure 3.5: Monthly prices of 100Mbit/s circuits in different European countries [Source: CMT, 2013]



As can be seen in Figure 3.5 above, the difference in the prices of 100Mbit/s circuits across EU countries is, to say the least, considerable.

3.5.4 Related remedies imposed through other relevant markets

Under the market for ‘wholesale (physical) network infrastructure access’,⁴¹ on 13 October 2008 the CMT imposed the following regulatory remedies⁴² on the physical network infrastructure owned by Telefónica:

- access to passive infrastructure at cost-oriented prices, subject to negotiation between Telefónica and the access seekers; if access to a given duct is not physically possible, Telefónica is obliged to provide alternative physical infrastructure access such as use of dark fibre
- accounting separation
- a transparency obligation
- non-discrimination.

3.5.5 Solutions available to mobile operators

In Spain, Vodafone’s backhaul infrastructure consists mainly of self-provided microwave systems (a majority of sites). Vodafone has also deployed self-provided dark fibre through the duct access reference offer (roughly half the remainder). The remaining fraction of backhaul infrastructure is provided through a mix of xDSL and regulated leased lines purchased from the incumbent operator.

However, with the increased capacity requirements caused by 3G and LTE, Vodafone is building its fibre network closer to its cell sites using the duct access reference offer from Telefónica. Duct access is available nationwide. However, in areas where duct access is not available, Telefónica has to provide regulated dark fibre services to mobile network operators. In practice, regulated dark fibre is not often available or provided in that case, and Vodafone and the other mobile network operators have to purchase commercial dark fibre services.

3.5.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

Interesting items of note in the CMT’s decision in Spain include:

- access to SDH and Ethernet leased lines (*albeit* with prices set based on a retail-minus approach)
- access to TESAÚ’s duct
- the summary of approaches to remedies in this area, showing a considerable variation in approaches across Europe
- the summary of prices in a number of countries, also showing that there is a significant variation in the prices of 100Mbit/s connections across the EU.

⁴¹ Market 4 in the second EC Recommendation on relevant markets.

⁴² See [https://circabc.europa.eu/sd/a/451c0cba-a898-4f0b-8765-deb397d376a9/ES-2008-0804-0805%20acte_EN%20\(0\).pdf](https://circabc.europa.eu/sd/a/451c0cba-a898-4f0b-8765-deb397d376a9/ES-2008-0804-0805%20acte_EN%20(0).pdf)

3.6 UK

On 28 March 2013, Ofcom published its *Business connectivity market review*⁴³ of the markets for retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments. In light of the results of its market review, Ofcom decided to impose a set of regulatory remedies in these markets, documented by the Commission in its *Decision concerning Case UK/2013/1428: Market for wholesale terminating segments of leased lines in the UK; markets for wholesale trunk segments of leased lines in the UK; and market for retail leased lines in the UK*.⁴⁴

3.6.1 Market definition

Ofcom defined the leased-line market at three levels: retail, wholesale terminating segments and wholesale trunk segments.

At the retail level, Ofcom defined several product markets based on the following criteria:

- the type of interface
 - *traditional interface (TI)*: includes legacy analogue and digital interfaces
 - *alternative interface (AI)*: includes modern interfaces that are commonly used for transmission of Internet Protocol (IP) data
 - *multiple interface (MI)*: includes services delivered using wavelength division multiplexing (WDM) equipment at the customers' premises, and services with bandwidths greater than 1Gbit/s
- the bandwidth provided
- the geographical area
 - UK excluding Kingston upon Hull (i.e. where BT is the former incumbent operator)
 - Kingston upon Hull (a town where, for historical reasons, there is a separate former incumbent operator, KCOM Group, formerly known as Kingston Communications)

Based on these criteria, the relevant markets defined at the retail level were:

- very low-bandwidth TI leased lines (below 2Mbit/s)
- low-bandwidth TI leased lines (up to and including 8Mbit/s)
- low-bandwidth AI leased lines (up to and including 1Gbit/s).

At the wholesale level, Ofcom expects communication providers to purchase access and backhaul products together. Ofcom defines different markets for wholesale terminating segments based on the type of interface. These markets are referred to as:

- TI symmetric broadband origination (TISBO) (i.e. SDH/PDH)
- AI symmetric broadband origination (AISBO) (i.e. Ethernet), and
- MI symmetric broadband origination (MISBO) (high bandwidths or WDM).

⁴³ See <http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/statement1.pdf>

⁴⁴ See https://circabc.europa.eu/sd/a/4a4ae685-de0c-4776-893d-c217d4bf643c/UK-2013-1428%20Adopted_EN.pdf

Based on these criteria, Ofcom identified the following markets for wholesale terminating segments:

- low-bandwidth TISBO (below 8Mbit/s)
- medium-bandwidth TISBO (between 8Mbit/s and 45Mbit/s)
- high-bandwidth TISBO (between 45Mbit/s and 155Mbit/s)
- very-high-bandwidth TISBO (at 622Mbit/s)
- AISBO including only low-bandwidth below or equal to 1Gbit/s
- MISBO including bandwidths over 1Gbit/s and any bandwidth delivered with WDM equipment at the customers' premises.

The relevant geographical market for wholesale terminating segments was defined as:

- a defined area of London, including West, East and Central London plus Slough (WECLA+)
- Kingston upon Hull
- UK excluding WECLA+ and Kingston upon Hull.

Ofcom identified one market for TI regional trunks including all bandwidths due to the location-specific nature of these services.

Finally, in the second paragraph of its Final Statement⁴⁵ Ofcom also noted the large size of the leased-line market in the UK and its importance to mobile communications network operators of leased lines.

“1.2 Leased lines provide dedicated symmetric transmission capacity between fixed locations, and their overall value exceeds £2bn per annum in the UK. They play an important role in business communications services and are used to support a wide variety of applications, both in the private and public sectors. They also play a significant role in delivering fixed and mobile broadband services to consumers, because communications providers (CPs) use them extensively in their networks.”

⁴⁵ See <http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/>

3.6.2 SMP findings in wholesale markets (excluding Hull)

Ofcom found BT to have SMP in the wholesale markets listed in Figure 3.6 below.

Figure 3.6: Summary of Ofcom remedies to be imposed in wholesale leased-line markets in the UK excluding Kingston upon Hull [Source: Ofcom, as summarised by the EC,⁴⁶ 2013]

		Wholesale segments		
		Symmetric broadband origination		Trunk
Interface technology	Bandwidth (Mbit/s)	WECLA+	UK ex WECLA+ and Hull	UK
Traditional (TI)	Very low: <2	BT		National: No SMP Regional: BT
	Low: <=8			
	Med: 8–45	No SMP	BT	
	High: 45–155	No SMP	BT	
	Very high: 622	No SMP		
Alternative (AI)	Low: <=1000	BT	BT	–
Multiple (MI)	>1000 and any if WDM at user's site	No SMP	BT	

3.6.3 Remedies imposed

The table in Figure 3.7 below summarises the remedies imposed by Ofcom in the relevant markets for wholesale leased-lines in the UK excluding Kingston upon Hull:⁴⁷

Figure 3.7: Summary of remedies imposed by Ofcom in the relevant markets for wholesale leased lines in the UK excluding Kingston upon Hull [Source: Ofcom as summarised by the EC, 2013]

	Wholesale TI markets (where there is SMP)	Wholesale AI services within WECLA+ and elsewhere in the UK (except Kingston upon Hull)	Wholesale MI services outside WECLA+
Requirement to provide network access on reasonable request, including fair and reasonable charges, terms and conditions	✓	✓ ⁴⁸	✓ ⁴⁹
Non-discrimination	✓	✓	✓
Publication of a reference offer	✓	✓	✓
Notification of changes to prices, terms and conditions	✓		
Publication of quality-of-service (QoS) information	✓	✓	✓

⁴⁶ (Note: We have corrected an error in the EC table.).

⁴⁷ See https://circabc.europa.eu/sd/a/4a4ae685-de0c-4776-893d-c217d4bf643c/UK-2013-1428%20Adopted_EN.pdf

⁴⁸ Also including: disaggregated Ethernet access and backhaul; end-to-end Ethernet products.

⁴⁹ Also including: disaggregated single-service Ethernet access and backhaul; end-to-end single service Ethernet products; end-to-end and backhaul services with WDM equipment at the customer's premises.

	Wholesale TI markets (where there is SMP)	Wholesale AI services within WECLA+ and elsewhere in the UK (except Kingston upon Hull)	Wholesale MI services outside WECLA+
Notification of changes to technical information	✓	✓	✓
Accounting separation and cost accounting obligation	✓	✓	✓
Charge control	✓	✓ ⁵⁰	✓
Requirements relating to requests for new network access	✓	✓	✓
A direction under the network access obligation requiring BT to provide partial private circuits	✓		
A direction under the network access obligation requiring BT to provide RBS backhaul	✓		
Requirements to provide accommodation in BT e✓ changes and to provide specific types of interconnection services	✓	✓	✓
Requirement to provide network access on the basis of Equivalence of Inputs (EoI)		✓	✓
Notification of changes to charges, terms and conditions		✓	✓
A direction under the network access obligation relating to service-level guarantees		✓	

For clarity, the ‘Radio base station (RBS) backhaul’ wholesale TI service included in Figure 3.7 above is a different (*albeit* extremely similar) service to the ‘Partial private circuit’ wholesale TI service; no such concept of an RBS backhaul-specific variant exists for the AISBO services (mobile operators can use the same version as other wholesale customers).

Ofcom further noted in its 2008 *Business connectivity market review*⁵¹ that the bandwidth demands of mobile backhaul are growing, and that where there are RBS-specific variants they need to develop over time.

⁵⁰ Separate controls apply within and outside the WECLA+.

⁵¹ See http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr/summary/bcmr_pt4.pdf

“8.145 For RBS Backhaul, MNOs have migrated in the past years a substantial portion of their retail leased lines to RBS Backhaul services. We therefore consider that it is appropriate to continue to require BT to offer RBS Backhaul. While the service has well served so far the purpose of MNOs, it needs to develop in the future to account for the predicted growth in bandwidth demand for backhauling mobile data services. The structure of the service needs therefore to account for that, and ensure that it enables MNOs to accommodate efficiently and economically their changing backhaul requirements.”

Notably, however, passive remedies (such as access to duct or dark fibre) were not imposed by Ofcom.

3.6.4 Related remedies imposed through other relevant markets

Under the market for ‘wholesale (physical) network infrastructure access’,⁵² Ofcom imposed the following remedies⁵³ on BT specific to next-generation access (NGA) networks:⁵⁴

- physical infrastructure access (PIA) consisting of duct and pole access
- price control based on BT’s long-run incremental cost with a mark-up for common cost recovery
- transparency
- non-discrimination
- accounting separation and cost accounting.

The duct access is restricted to operators seeking to deploy their own NGA networks and does not allow operators to build leased-line services.

3.6.5 Solutions available to mobile operators

In the UK, different mobile network operators have used different strategies to deploy their backhaul. For example, Orange (now part of EE) used to rely almost exclusively on self-provided microwave (~90% of sites in 2008); O2 used to rely almost exclusively on regulated and commercial leased-lines products due to its previous relationship with BT; and Vodafone used a mixed approach (50% self-provided and 50% leased lines/managed services). In order to cope with the increase in backhaul traffic from 3G networks, most UK mobile network operators (except Orange) chose BT Wholesale to be their main partner for the provision of end-to-end connectivity between the cell site and their network PoPs (i.e. managed Ethernet access service, MEAS). The BT Wholesale managed service product is based on a combination of Openreach regulated products (tail circuits) and BTW Ethernet services (based on BT Operate MPLS network between BT exchanges) to provide end-to-end connectivity.

⁵² Market 4 in the second EC Recommendation on relevant markets.

⁵³ See [https://circabc.europa.eu/sd/a/7af83f0d-fab8-4fca-8045-b6c493797cd5/UK-2010-1064-1065%20Acte\(4\).pdf](https://circabc.europa.eu/sd/a/7af83f0d-fab8-4fca-8045-b6c493797cd5/UK-2010-1064-1065%20Acte(4).pdf)

⁵⁴ See <http://www.openreach.com/orpg/home/products/ductandpolesharing/ductandpolesharing/ductandpolesharing/downloads/PIAIRO17thMay.doc>

However, more recently, some mobile network operators (such as Vodafone) have decided to change this trend and directly use regulated leased lines from Openreach (instead of managed service products from BT Wholesale) to reduce their costs. It should be noted that the Openreach regulated product is constructed in such a way that the leased lines have to terminate in a BT exchange, and additional backhaul products (e.g. Bulk Transfer Link product) have to be purchased to link to the mobile network operator's network, thus increasing the costs of the solution.

3.6.6 Implications for mobile backhaul in the context of the revised Recommendation on relevant markets

In the UK, there is access to SDH and Ethernet interface products suitable for mobile backhaul at regulated prices (noting that for AISBO inside WECLA+ the price control is lighter, with only a 'safeguard cap').

- For SDH remedies, there is a mobile backhaul- specific product (RBS backhaul).
- UK AI and MI remedies use of "Equivalence of Inputs" (EoI), due to the functional separation of the network from the rest of BT.

Passive remedies (such as access to duct or dark fibre) were not imposed by Ofcom.

4 Conclusions

Leased lines are a large and important market, as can be seen from the revenue figure quoted by Ofcom in Section 3.6.1 of this report (EUR2 billion per annum in the UK alone). They are important not just for end users, but also for communications providers including mobile network operators, which make up a substantial portion of this market.⁵⁵ This market is growing as end-user needs are developing, and in particular mobile base station backhaul links will require increased bandwidth in the future.

We have showed in our earlier report on the capabilities of microwave links for mobile backhaul that while microwave links are capable of meeting current needs, they will rapidly become insufficient as high bandwidth LTE sites are deployed. These constraints will apply soonest in areas where large quantities of spectrum for such microwave links cannot be made available. This means that the “self-supply” option for providing mobile backhaul will no longer be as capable as the fibre-based option available to an integrated former incumbent mobile operator, unless access to ducts or dark fibre can be achieved. An alternative would be access to regulated wholesale terminating segments.

4.1 Current approaches to regulation of the market for wholesale terminating segments are not well harmonised across EU Member States

Despite the direct importance of the leased-line market for end users and in supporting competition in other telecoms markets, our analysis of the most recent reviews of relevant markets in France, Germany, Italy, the Netherlands, Spain and the UK shows that the approaches adopted by NRAs to ensure effective competition in these markets vary widely:

- In Italy, AGCOM found the mobile backhaul market to be a different market to the enterprise leased-line market, and no operator was found to have SMP in the former market.⁵⁶ A similar view has been taken in the Netherlands, excluding mobile operator sites from the market for terminating segments, *albeit* not through formally defining a separate relevant market. Other countries we have looked at, however, have not adopted this approach and do not exclude mobile sites from the terminating segment market
- National markets are commonly defined; in the sample of six countries we have examined as part of this study, only the UK has adopted sub-national markets (although, as can be seen in Figure 3.4 of this report, the CMT reports that distinct remedies also appear to have been adopted in major cities in Austria).

⁵⁵ Exact up-to-date estimates of the size of the mobile backhaul market are not available, but figures from Italy show that mobile operators accounted for about half of the total leased-line market in the past.

⁵⁶ Possibly for reasons that may no longer be true.

- NRAs have chosen a variety of different approaches to price control, in particular for non-traditional interfaces (e.g. Ethernet) circuits, or for higher bandwidths.
- NRAs have adopted totally different approaches to whether unbundled access to duct or dark fibre is available for the purposes of building leased-line or mobile backhaul networks (in some countries none is available for this purpose; in other countries just duct is available; in others both duct and dark fibre are available).
- Perhaps as a result of this variation in approaches, the prices of 100Mbit/s Ethernet circuits vary widely across Member States.

4.2 A variety of lessons can be learnt

A variety of lessons in relation to the EC Recommendation on relevant markets and the future of market analysis in this area can be learnt from the points we have illustrated in this report. Importantly, this is an opportune time to address these points.

If the EC is seeking improved harmonisation in the approach of NRAs to regulation of relevant markets, then it would be useful for all regulators to ensure they start their market analysis from the same initial point. This is the proper role of the Recommendation on relevant markets. In this regard, it would therefore seem helpful for the market for wholesale terminating segments of leased lines to be retained in the Recommendation.

Failing this, it would be very useful for explicit guidance to be provided by the Commission within the explanatory note to the new Recommendation to cover the way in which the mobile backhaul market (or failing that, the market for wholesale terminating segments of leased lines) needs to be considered, possibly drawing on the example of the HQWBA/LL market review in the Netherlands. BEREC may also have a role to play.

The specific role of leased lines in supporting other retail markets needs to be a key part of the analysis of the leased-line market. Current non-integrated mobile operators are making heavy use of microwave radio links (typically serving the majority of their sites by these means). By comparison, the integrated former incumbent operators are already making a strong migration towards fibre backhaul for LTE base stations. As we have described elsewhere, the capacity of the microwave links will soon become insufficient. As a result, if products suitable for mobile backhaul are not available, the likely consequence will in the near future be a reduction in the ability of non-integrated mobile operators to compete on a level playing field in relation to LTE services, to the detriment of end-users. Therefore, the impact of vertical integration (including the possibility of leverage of dominance from the leased-line market to mobile markets) will need to be considered.

Some form of harmonisation of the approach to deciding whether the market for terminating segments includes terminating segments ending at network nodes rather than end-user premises may also be appropriate.

Finally, a similar argument can be made for retaining the relevant market for passive infrastructure access. Unless the use of duct and dark fibre for mobile backhaul is explicitly considered within the wholesale local access market, there is a danger that the existing strong differences across Member States (in both their approach and the outcomes in terms of prices for high-speed point-to-point connections) will increase.

