Maritime VHF Spectrum Pricing – Impact on markets and customers

Final Report

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1 Introduction

1.1 General

This document has been prepared by Helios Technology Ltd and Plum Consulting for Ofcom.

It presents the results of our study considering the impact of the proposed introduction of AIP on maritime VHF spectrum users.

1.2 Context

Our analysis starts from a presumption that users of spectrum, along with other inputs, should face the opportunity cost of such inputs to ensure that overall economic efficiency is promoted (just as users of electricity or land typically pay for such inputs and this is viewed as efficiency promoting). In relation to spectrum utilised by the maritime sector Ofcom proposed the introduction of AIP in a consultation document published on July 2008[1].

It is not the purpose of this study to inform the level of AIP that is efficient, nor is it the purpose of this study to demonstrate that economic benefits of applying AIP outweigh the costs. This study is focussed on the responses to AIP and the distribution of impacts.

In considering the response to and impacts of AIP our terms of reference focus on impact assessment. Previous studies have considered the possible response to AIP in terms of spectrum efficiency gains. Whilst we comment briefly on the range of possible responses we note that the purpose of pricing is to promote efficiencies that cannot all be anticipated in advance. It is not therefore possible or meaningful to attempt to fully anticipate the efficiency responses to pricing.

In considering the impact of AIP an indication of the magnitude of prices (based on the figures outlined in Ofcom's consultation), industry specific information and an overall framework for considering the impacts is required. Our industry knowledge draws on previous consultations and studies, our own work and discussions with those involved with the maritime sector. The details are set out in subsequent sections.

The economics behind the overall framework that informs our analysis of impacts is set out in Appendix A. To summarise, we find that:

- The starting point in the absence of spectrum pricing could be deemed to be distorted and inefficient, since whilst users may be using existing spectrum resources "efficiently" in a technical sense, they in general have not faced the "opportunity cost" in relation to alternative competing uses/users of spectrum required to promote overall economic efficiency.
- In a competitive market the costs of AIP, after spectrum specific efficiency savings, will in general be passed on to end users.
- Short run and long run responses will differ with greater gains in spectrum efficiency over time as capital equipment is replaced and other longer term adjustments made. The cost impact on intermediate users of spectrum and

[1] "Applying spectrum pricing to the Maritime and Aeronautical sectors. Consultation document", 30 July 2008

end users from a given level of AIP would therefore be expected to diminish over time as intermediate and final demand responses grow.

- For some transhipment ports substitution of activity away from the UK is a possibility. However, this is not anticipated to be material given the magnitude of AIP in relation to other costs. Nor would such a response be inefficient since if, internationally competing activities cannot pay the local resource costs in terms of alternative use required, those resources would deliver more value in alternative uses.
- Responses where AIP is applied to not-for-profit or non-end user funded entities may differ. In particular, spectrum efficiency gains may be larger or smaller depending on how other sources of funding adjust, and were funding increases to only partially offset costs associated with AIP not-for-profit entities might economise on other non-spectrum inputs and outputs (increased savings in relation to non-spectrum inputs are not anticipated for commercial entities subject to AIP).
- Commercial contractual relationships may change the incidence of AIP in the short term. Whilst the terms of such contracts are in general private, the possible introduction of AIP has been signalled at least since the Cave review of radio spectrum management in 2002 and we would anticipate pass-through in the near or medium term.
- The magnitude of AIP relative to other input costs at its point of application may be significantly greater than it magnitude relative to end user prices or costs. The reason for this is that spectrum is one among many inputs in the value chain

1.3 Structure of this Document

This document has been structured as follows:

- Section 2 details the existing spectrum licence fee structures within the maritime industry and discusses Ofcom's proposed AIP fee structure.
- Section 3 discusses the structure of the UK maritime industry as it is affected by AIP, identifies the different categories of users and details the flow-through of spectrum fees.
- Section 4 presents a number of case-studies in which the specifities of the impact of AIP on particular organisations are explored.
- Section 5 provides an economic analysis of the impact of AIP in the maritime industry.
- Annex A details the economic framework used to consider the impact of AIP.

2 Ofcom's AIP Proposals

2.1 Introduction

This section identifies the existing licence fee structure for maritime VHF systems, and the revised fees which Ofcom asked us to assume when compiling this report.

Ofcom asked us to examine the impact of potential AIP based fees on VHF users, initially using the proposals set out in the July 2008 consultation for the purpose. Subsequently, taking into account the outcome inputs from the consultation responses, Ofcom asked us to re-examine impacts using some revised illustrative assumptions on the structure of fees. The results are reported herein. The illustrative assumptions are set out below.

Ofcom indicated to us that the illustrative assumptions we have used for this report may not represent the fee structure they will propose in all respects. Nevertheless they have advised us that the illustrative assumptions used in this report are likely to provide a reasonable indication of impacts.

2.2 Spectrum Fees in the Maritime Sector

2.2.1 Existing Fees

The table below details the fees payable under the existing Ofcom pricing structure for each of the different licence types based on The Wireless Telegraphy (Licence Charges) Regulations 2005.

Licence Type	Annual Fee
Coastal Station Radio (Marina)	£75 for each base station in respect of channels M (157.850 MHz), M2 (161.425 MHz) and channel 80 (157.025 MHz).
Coastal Station Radio (International)	£100 for each international maritime channel (except channel 80 (157.025 MHz)) per base station, provided that channels designated for emergency use shall not be taken into account.
Coastal Station Radio (UK)	£180 for each channel in respect of non-international maritime channels per base station (including associated mobile stations).
Differential Global Positioning System	(a) £250 for each channel per VHF station. (b) £1,000 for each channel per MF or UHF station.
Maritime Navigational Aids	(a) £40 for each frequency per navigational aid (or radar station), except for the use of a pair of VHF channels AI51 and AI52. (b) £40 for each pair of VHF channels AI51 and AI52.

Table 2-1: Existing Maritime Licence Fee Structure

2.2.2 Proposed Fees under AIP

Ofcom's published proposals for maritime fees for VHF communications varied depending on:

- the coverage of the station,
- whether the frequency in use is international or UK-specific;
- and whether or not the station is located in a high, medium or low density zone;

Having considered responses to the initial consultation, Ofcom asked us to base the current report on the following assumptions about the level of fees for maritime VHF communications. These too are based on the parameters of the station in question, the area in which the station is located and whether the channels concerned are UK specific or international. These are set out in the tables below. The figures below vary somewhat from those of the initial consultation and represent Ofcom's latest view on how it might apply AIP for maritime VHF services.

For the 8 international simplex 25 kHz maritime channels[2] where the demand for location specific port transmitter assignments exceeds supply, the following fees are proposed:

	High Coverage	Medium Coverage	Low Coverage
High Density	£500	£400	£300
Medium Density	£200	£150	£125
Low Density	£100	£75	£75
No congestion[3]	£75	£75	£75

Table 2-2: Proposed Fees for subset of International Simplex Channels

For the other international channels the following fees are proposed:

[2] Roughly equivalent to existing CSR (International) channels

[3] A 50km x 50km grid square with 2 or less assignments in the core charged international simplex port operations channels.

Channels	Proposed fee
6 calling and distress channels and associated guard band	Free of charge
8 search and rescue channels	Free of charge to end users
3 maritime weather reporting channels	£75
Package of 3 marina channels	£75
Training schools, suppliers and demonstrators	£75
AIS	Free of charge to end users
Charities with “safety of life in an emergency” objective	50% discount
Duplex channels	£75
Area defined licences	£9,275 per channel for all-UK licences in simplex channels with fees reduced pro-rata for sub-UK areas. Admin based fees for duplex.

Table 2-3: Proposed Fees for other International channels

For the 41 UK simplex 25 kHz maritime channels[4] that are not currently allocated for search and rescue or marina channels, the following fees are proposed:

	High Coverage	Medium Coverage	Low Coverage
High Density	£740	£370	£100
Medium Density	£250	£170	£85
Low Density	£90	£80	£75

Table 2-4: Proposed Fees for subset of UK Simplex Channels

For the exceptions to the above table the following Fees will apply:

Channels	Fees
3 search and rescue channels	Free of charge to end users
Package of 3 marina channels	£75
Charities with “safety of life in an emergency” objective	50% discount
Duplex channels	Double the stated fee
Area defined licences	£8,250 per channel for all-UK licences in simplex channels with fees reduced pro-rata for sub-UK areas.

Table 2-5: Proposed Fees for other UK channels

[4] Roughly equivalent to existing CSR (UK) channels.

With respect to international simplex frequencies, we were asked to assume that the following definitions apply (where 'P' represents transmitter power and 'A' represents antenna height):

Coverage Level	Definition
High	P>=25 and A>=10
	P>=10 and A>=20
	P>=5 and A>=30
Medium	P>10 and A <5
	P>5 and 5<A<10
	P<25 and 10<A<20
	P<10 and 20<A<30
	P<5 and A>30
Low	P<=5 and A<=10
	P<=10 and A<=5

Table 2-6: Coverage definitions for International Simplex channels

With respect to UK maritime frequencies, the following definitions, as per the standard Business Radio definitions, apply (where 'P' represents transmitter power and 'A' represents antenna height):

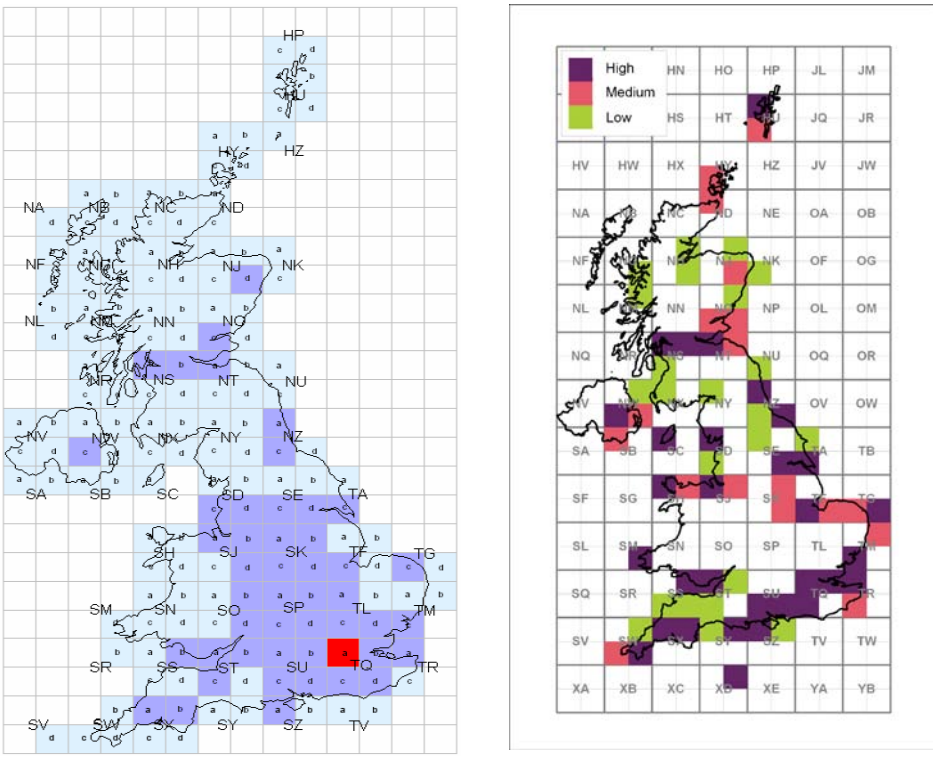
Coverage Level	Definition
High	P>5 and A>10
	P<=5 and A>30
Medium	P<=5 and 10<A<=30
	P>5 and A<=10
Low	P<=5 and A<=10

Table 2-7: Coverage definitions for UK maritime frequencies

In respect of the relative 'density' of different areas, we were asked to make the following working assumptions:

- The density of UK-specific channels to be defined as per map the map which currently applies to Business Radio use,
- The density of international channels to be defined as per the map provided to us by Ofcom.

These two maps are reproduced in Figure 2-1 below.



Business Radio 'Density' International Maritime Radio 'Density'

Figure 2-1: Business and Maritime Radio Density Maps

As a comparison, the cost of the whole band in use for maritime communications would, based on a figure of £371,000 per national MHz, be £1.25 million per annum[5]. There are approximately 4,400 maritime VHF licences on issue implying an average per-licence fee of £283 per annum based on equal sharing of the cost of the band in use. Some of this spectrum is not fully occupied, and Ofcom has also asked us to assume that any fees for the following channels used for search and rescue would be paid centrally by Government:

- International channels 10, 15, 16, 17, 24, 62, 63, 64, 67 70, 73, 75 and 76;
- UK channels 0 and 00, and AIS1 and AIS2.

In addition, Ofcom have asked us to assume that the existing charging structure for the three Marina channels will remain unchanged.

2.2.3 Phasing of Fee Introduction

Historically, Ofcom has taken a phased approach to the introduction of AIP across other markets and there is no reason to presume that the same approach will not be taken in the case of maritime users. As such, it is to be expected that the fees will be introduced over a number of years, typically three.

We have therefore assumed that the profile of fees will begin, in the first year of implementation with 33% of the figures calculated above. Year 2 the fees will increase to 66%, and in year 3 the full amount will be charged.

[5] In reality, some of this spectrum is not heavily used in some parts of the country and as such the total level of fees assumed is less than this sum – see for example Figure 4.3 below.

3 Cost Structures within the Maritime Industry

3.1 Overview

The provision of safe navigation, vessel traffic management, search and rescue, security and environmental protection at sea and on waterways inland drives a need for spectrum for maritime communications, surveillance and navigation systems. Particular frequency bands are internationally allocated for these purposes (although not always on an exclusive basis).

Ofcom issue three different licence types for Coastal Station Radio – International, UK and Marina. All VHF channels are currently 25kHz wide and can be simplex or duplex. International assignments are co-ordinated with neighbouring states, although known interference problems still exist. UK assignments are specific to the UK and are not designated internationally. Marina licences cover two simplex UK channels, known as M and M2 as well as a duplex international channel 80. VHF Licences are also issued for DGPS data-links and for AIS stations and beacons. Typical usage of these assignments is illustrated below.

Licence	Usage	Example Systems
Coastal Station Radio (International)	Port operations, shipping movement services, vessel traffic management, safety communications.	VHF communications.
Coastal Station Radio (UK)	Port operations, shipping movement services, private commercial channels.	VHF communications, data services.
Coastal Station Radio (Marina)	Marina operations, race control, club safety.	VHF communications.
Maritime Navigational Aids (and Radar)	Tracking of vessels, marking of channels and hazards, safety communications.	AIS, DSC.
Differential GPS	Port survey and positioning.	Local area VHF DGPS.

Table 3-1: Usage of maritime VHF licence types

There are more than 4,500 individual channel assignments covering the licences above alone to approaching 900 licensees. However, there is a clear polarisation between large and small licence holders. A few organisations dominate the assignments, as can be seen in Figure 3-1 below. The Maritime and Coastguard Agency is by far the largest user of maritime VHF spectrum, followed by the RNLI, the individual lighthouse authorities, Associated British Ports and BP Offshore Exploration. The top 10 organisations hold approximately 33% of all assignments between them whereas 52% of all licensees have 10 or fewer assignments.

Notably a large number of assignments are held by charities or non-governmental organisations involved in the discharge of public safety activities, that otherwise could place a significant cost burden on the government such as the RNLI, National Coastwatch Institution and many smaller search and rescue operations.

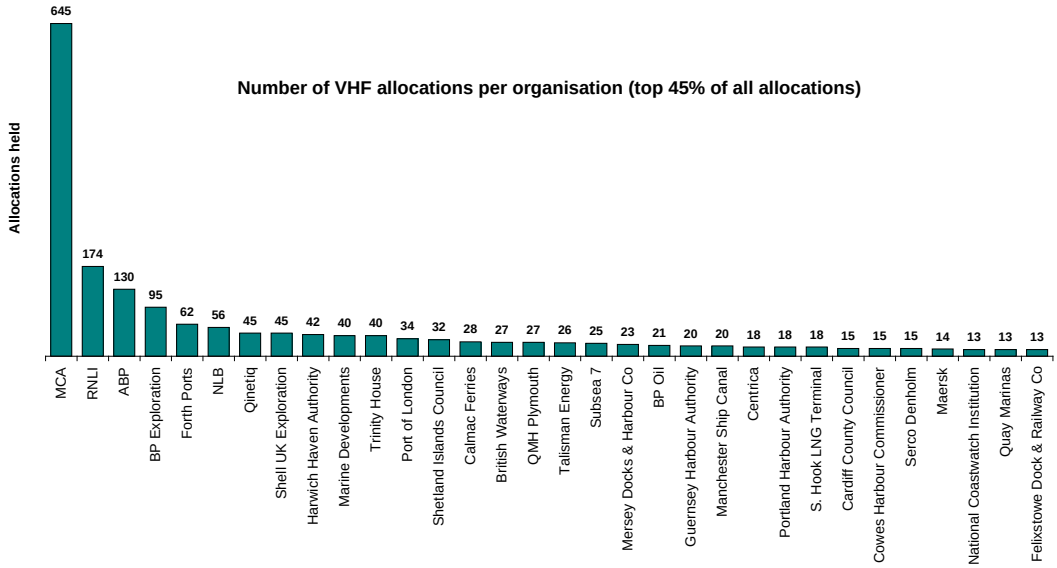


Figure 3-1: Assignments per organisation for the top 50% of all assignments

There are a wide variety of radio spectrum users in the maritime domain covering a broad range of industries, services and applications. The sector is significantly more diverse than for example the aeronautical domain and in comparison is not subject to as much regulation. Furthermore, there are a range of flows of funds and charges with a number of end-users impacted by costs passed on by the organisations utilising spectrum. An illustration of the variety is shown in the figure below.

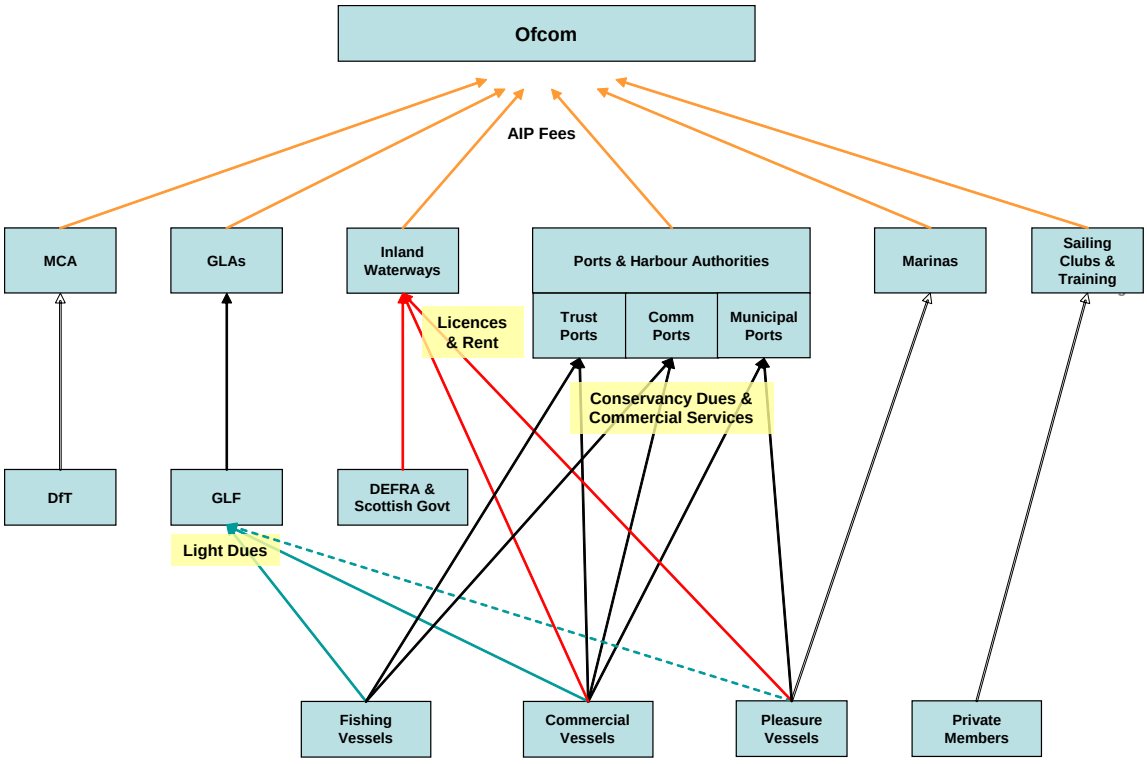


Figure 3-2: Flow of maritime funds and charges

The largest spectrum user, the Maritime and Coastguard Agency (MCA) is directly funded by government through the Department for Transport (DfT). The lighthouse authorities are funded through light dues on vessels arriving at UK ports. Inland waterways are part funded by government grant and in part by charges on the users. Ports charge fees on vessels for the maintenance of a safe navigable waterway. Marinas charge pleasure vessels for berthage and sailing clubs typically charge membership fees. All of these classes of user typically have alternate sources of income of varying levels. A typical commercial vessel arriving at a UK port could expect to pay a variety of port charges, light dues as well as the costs associated with loading and unloading the vessel.

The figure below illustrates what proportion of the total VHF AIP charges each group of maritime users is likely to share. UK ports incur by far the greatest share of AIP costs for VHF communications.

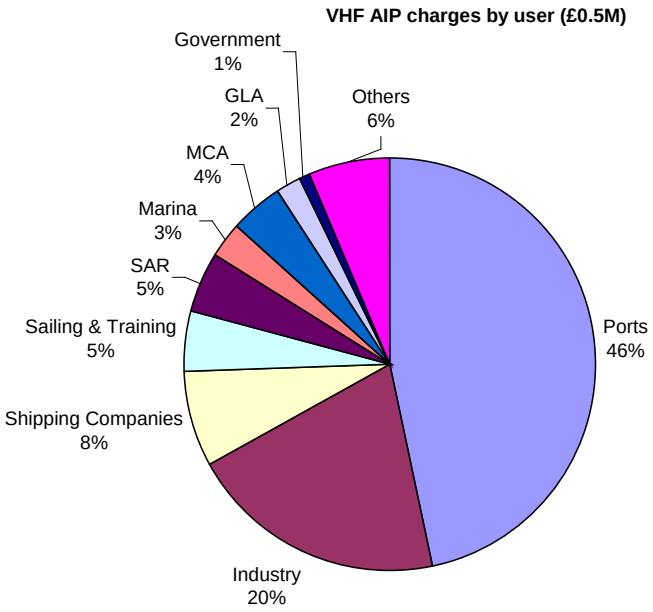


Figure 3-3: Incidence of AIP charges per user group

As is indicated in the figure below the majority of VHF AIP costs arise from CSR (international) allocations being both those typically used for port operations and the MCA's coastal network as well as generally being operated at higher power levels more often than UK or marina channels.

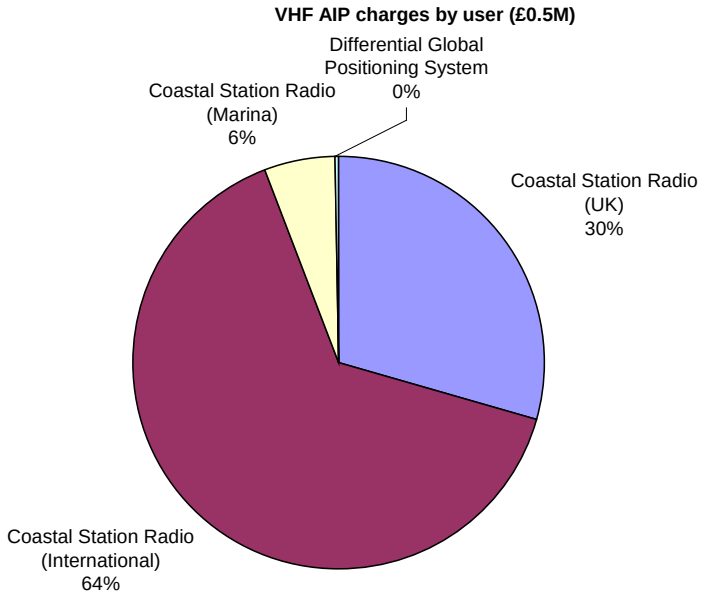


Figure 3-4: Incidence of AIP charges per licence category

Under AIP the costs associated with the CSR (International) allocations falls primarily onto UK ports, the MCA and industry (mostly the offshore industry). Marina charges will fall predominantly onto sailing clubs and marinas.

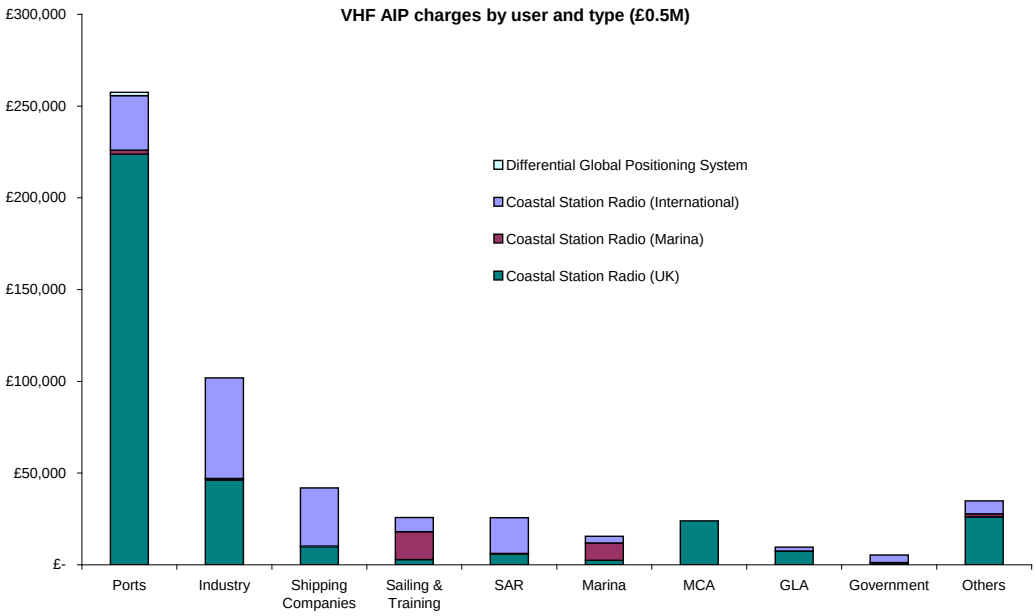


Figure 3-5: Incidence of VHF AIP charges by user and type

The following sections describe the main categories of spectrum user in more detail and outline how they charge users for the services that they provide.

3.2 Maritime and Coastguard Agency

Maritime and Coastguard Agency – Current Assignments	
Automatic Identification System	**153**
Coastal Station Radio (International)	
Simplex	**593**
Duplex	**52**

Source: Ofcom licences

Table 3-2: Assignments held by the MCA

The MCA is the body tasked with supporting the DfT in developing and implementing the Government's maritime safety and environmental protection strategy. It does this by promoting safety at sea and on the coast, providing a 24-hour maritime Search and Rescue co-ordination service, preventing pollution from ships and minimising the effects of pollution incidents by reacting quickly and effectively, maintaining the quality of ships on the UK Ship Register through regular surveys and inspections and promoting high levels of maritime safety and security. There are approximately 1,160 coastguard staff stationed around the UK. There are 19 coastguard stations and 19 search and rescue centres.

The MCA is funded directly by the DfT under a 3-year grant programme with further income obtained from the registration of ships on the UK ship register, certification of seafarers and through the undertaking of marine surveys. The organisation's net operational cost for the year 2006-07 was £130.2M. In the same period £13.9M of external income was obtained.

The MCA is the UK National Competent Authority for the Automatic Identification System (AIS) and operates an AIS infrastructure of 51 base stations around the coastline of the UK. These stations provide information about ships on passage with coverage out to a minimum of 30 nautical miles around the UK coastline. AIS helps to increase the safety of ships at sea through enhancing MCA's capabilities for the co-ordination of both search & rescue and marine pollution control, as well as supporting enforcement, hydrographic, security, environmental and regulatory activities.

The MCA are the responsible organisation for the provision of Traffic Separation Schemes (TSS) around the UK and maintain an active watch on the busy Dover Straight TSS through the Channel Navigation Information Service (CNIS). The infrastructure supporting the CNIS includes two MCA radar stations, AIS base-stations and VHF communication channels. The MCA also has overall responsibility for vessel traffic services but delegates responsibility for provision of these services in and around ports to port and harbour authorities and on inland waterways to British Waterways.

There are two types of VTS; Port and Coastal. A Port VTS is mainly concerned with vessel traffic to and from a port or harbour, while a Coastal VTS is mainly concerned with vessel traffic passing through the area and usually only an Information Service is rendered. In the case of ports the provision of services is generally undertaken by the local port or harbour authority. The MCA is competent authority for the provision of VTS in UK coastal waters.

In a few situations coastal VTS are provided by third party organisations on behalf of the MCA. These include the eastern Solent, where services are provided by

Southampton VTS (operated by ABP Southampton) on behalf of the MCA and Queens Harbour Master Portsmouth and in the Bristol Channel where Severn VTS services are provided by ABP South Wales on behalf of the MCA. Both of these VTS are provided on the basis of a MoU between the VTS provider and the MCA. To ensure that safety and environmental standards are maintained, these agreements provide for auditing and monitoring of the service provider and the service provided.

In mid 2007 a new TSS was in the process of being implemented in the Sunk. The implementation required the extension of current VTS arrangements and the provision of the associated VTS facility was offered by the MCA on a competitive tendering basis in accordance with Government procurement rules. However, no contract was ultimately awarded. This would have represented the first example of VTS provision on behalf of the MCA with an associated revenue stream. Currently, the services are planned to be provided by the MCA themselves.

The CSR (International) infrastructure is operated by the MCA to provide complete coastal coverage out to 30NM from the shore on a number of frequencies. A large number (151) of base stations are deployed, each of which typically operates four or more VHF channel assignments. Maritime Safety Information (MSI) broadcasts are made every four hours on VHF channels 10, 23, 73, 84 or 86 and exceptionally on VHF Channel 67. Some of these broadcasts can be in excess of 20 minutes. Channels 10, 67 and 73 are the typical working channels of the MCA. Channel 16 is used internationally as an emergency calling channel; however no licence fees are levied for the use of this channel.

In addition to the assignments that the MCA uses in its day to day operations it also obtains the necessary assignments for many of the land search and rescue organisations within the country. The SAR organisations are not charged for channels that the MCA obtains on their behalf.

The services provided by the MCA using the spectrum utilising infrastructure are not charged to maritime users. Furthermore, as many of the vessels in receipt of the services are transiting UK waters without a scheduled stop there is no practical mechanism available through which to charge them anyway. As a consequence of this, together with the MCA's role and remit for other aspects of marine operations including safety and environmental response the infrastructure is not driven solely by traffic levels, but by the need to provide total coastal coverage.

3.3 General Lighthouse Authorities

General Lighthouse Authorities – Current Assignments	
Automatic Identification System	**69**
Coastal Station Radio (International)	**48***
Coastal Station Radio (UK)	
Simplex	**40**
Duplex	**1**

Source: Ofcom licences
Note: A number of CSR assignments in Ofcom's data relate to AIS stations.

Table 3-3: Assignments held by the GLAs

The General Lighthouse Authorities (GLAs) are tasked with the provision of an appropriate Aid to Navigation (AtoN) infrastructure around the coast of the UK and Ireland. They are comprised of three organisations:

- Trinity House covering the coastline of England, Wales, the Channel Islands and Gibraltar;
- Northern Lighthouse Board covering the coastline of Scotland and the Isle of Man;
- Commissioners of Irish Lights covering the coastline of Ireland and Northern Ireland.

The GLAs deploy a range of AtoNs around the coast of the British Isles that include AIS base stations, Radar Beacons (Racons) and radar stations. The GLAs also have a significant number of Coastal Station Radio licences. Deep sea pilotage services are also provided by Trinity House for vessels traversing the English Channel. It should be noted that both Trinity House and the Commissioners of Irish Lights are registered charities and currently receive a discount on their radio licences.

CSR (International) assignments are primarily held by NLB for communication links to/from lighthouses. CSR (UK) assignments are variously used for communication from lighthouses and for quay operations at the organisations depots.

The GLAs receive funding for their activities through the General Lighthouse Fund (GLF) that is administered by the UK Department for Transport. The GLF is funded predominantly from Light Dues levied on vessels entering UK[6] and Irish ports. In addition, the Irish Government provides an annual grant. The GLF income therefore depends upon the maritime trading pattern of the UK and Ireland together with Parliament's willingness to agree appropriate changes to both the light dues regulations and the rates charged. The fees are collected from vessels by light dues collectors in each port.

Light dues are levied at the rate of 35p per ton, with a tonnage ceiling at 35,000 tons making the maximum charge £12,250. These rates have now been held constant since 2006. In any year, a vessel is not required to pay light dues for more than seven voyages in total. Hence, the cost per actual visit for frequent visitors such as cross channel ferries, is minimal, see Table 3-4 below.

[6] No charges are levied on traffic that passes the UK coast utilising the infrastructure, but which do not stop at a UK port.

Vessel Type	Dues Paid	Chargeable Visits	Av. Dues per Ch. Visit	%	Total Visits	Av. Dues per Visit
Tanker	£16,385,496	4,605	£3,558	23	22,034	£744
General Cargo	£7,889,805	9,738	£810	11	33,307	£237
Dry Bulk Carrier	£8,286,092	1,356	£6,111	12	3,095	£2,677
Container	£27,556,058	3,816	£7,221	39	8,630	£3,193
Passenger	£1,092,555	237	£4,610	2	1,922	£568
Other	£5,406,032	3,591	£1,505	8	21,683	£249
Ro-Ro Ferry	£3,757,218	1,610	£2,334	5	85,106	£44
Total	**£70,373,256**	**24,953**			**175,777**	

Source: Adapted from MDS Transmodal & DTZ Pieda (2004) Table 2.2.

Table 3-4: Light dues paid in 2002 by vessel type

UK-registered fishing vessels and tugs also pay an annual charge based on the length of the vessel. The minimum payment for a 10-metre vessel is £202 with a payment of £21 per additional metre. Vessels under 10 metres in length are exempt. Foreign fishing vessels and tugs are also charged a proportion of the annual charge if a call is made in a UK port. Pleasure craft with a net tonnage of more than 20 tons are required to make a payment of £77 per annum.

Income to the GLF from dues in the year ended 31st March 2007 amounted to some £70M[7], including £3.1M collected in the Irish Republic. In the same period the operating costs of the 3 GLAs totalled £66M. Income to the GLF has been declining over a long period as a result of both maintaining historic charges as well as due to the change in the number and size of vessels entering UK ports.

The GLA's are currently engaged in the development of the IMO e-Navigation concept through which an opportunity to further improve service standards is envisaged. e-Navigation is likely to be strongly dependent upon enhanced ship-shore communications, so it is clear that the need for VHF radio spectrum is likely to increase. This concept is being developed by the IMO, so there is a potential impact on the GLAs use of radio spectrum if at some point the IMO choose to mandate the carriage of e-Navigation equipment.

In addition to e-Navigation the GLAs are looking to develop the use of AIS as an Aid to Navigation by equipping buoys, light-vessels, etc. with AIS transponders as a complement, or potentially replacement to Racons.

[7] *The General Lighthouse Fund 2006 – 2007*, Department for Transport, HC161, 28 January 2008.

3.4 Ports

Ports – Current Assignments			
	Commercial	Trust	Municipal
Automatic Identification System	18	21	0
Differential GPS (VHF)	5	3	2
Coastal Station Radio (International)			
Simplex	258	198	172
Duplex	45	19	28
Coastal Station Radio (UK)			
Simplex	27	26	16
Duplex	10	13	5
Coastal Station Radio (Marina)			
Simplex	13	16	28
Duplex	7	8	14

Source: Ofcom licences

Table 3-5: Assignments held by the Ports

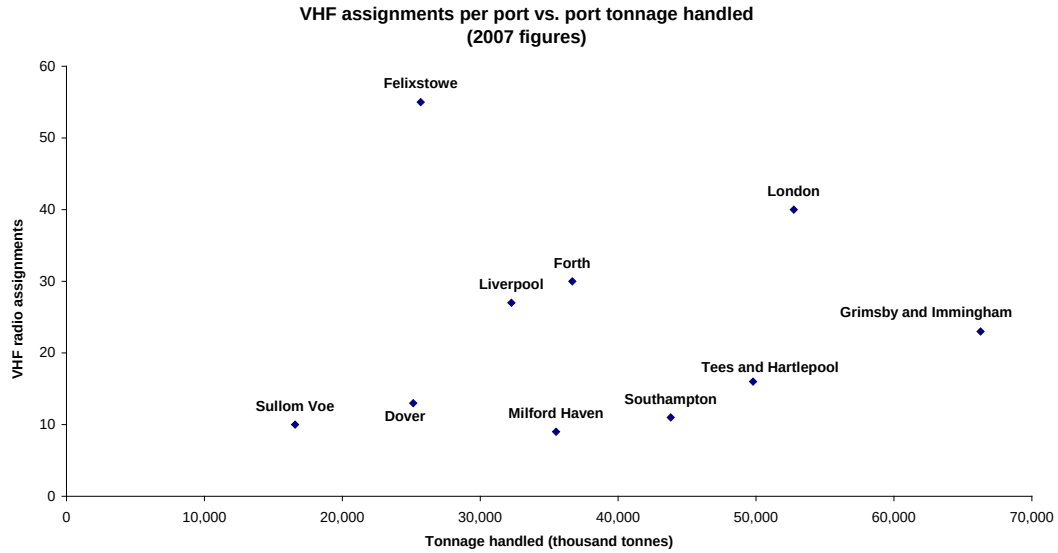
The port industry in the UK can be broken down on the basis of ownership of the primary operating organisation, be it a port or harbour authority. There are three main categories:

- **Commercial and Private Ports** – being those ports operated primarily to generate an adequate return on investment for the owner (typically a public listed company), or else being operated for the benefit of a single organisation or a specific sector of the maritime industry (e.g. a ferry operator).
- **Trust Ports** – being '*independent statutory corporations, governed by their own unique local legislation and controlled by an independent board*'[8]. A key feature of trust ports is that they do not distribute profits to investors: instead they are recycled for the benefit of the port. Often non-financial objectives of the port and its stakeholders can be prioritised over profit generation, for example by investment in infrastructure with limited return potential or by setting charges below the level which would maximise profits.
- **Municipal Ports** – being those ports operated by a local authority and therefore subject to local government rules and financing requirements. Ports accounts can be 'assured', that is protected from having surplus funds or receipts from assets sales transferred to other parts of the local authority not connected with the port. However, this is not the case everywhere and in some locations any surplus can be used to contribute to the local authority's budgets. It is clear that the autonomy provided to an individual port can vary significantly from being under direct control, to being more akin to a trust.

Ports provide both AtoNs, port information, pilotage service and vessel traffic services that are dependent upon VHF voice and data communications as well as,

[8] Price Waterhouse Coopers for the Department for Transport, Trust Port Advice, Final Report, 18 May 2007

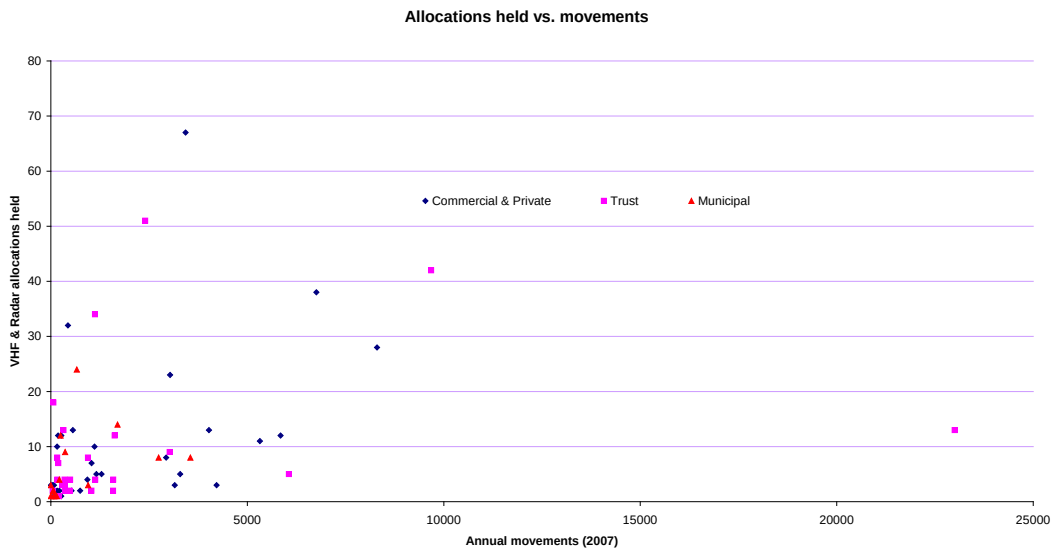
in some instances, AIS. In maintaining a navigable waterway a number of ports also utilise other spectrum utilising technologies such as DGPS data-links. The extent of the deployment of the port infrastructure is not purely driven by traffic. Instead it is a function of a number of factors including traffic density, complexity of the port environment (e.g. hazards, number and location of berths, etc.), the geographic scope of the ports responsibilities as well as other factors related to navigational safety.



Source: Ofcom licences, DfT port statistics, Helios analysis

Figure 3-6: Port radio assignments vs. port tonnage handled

Figure 3-6 shows the number of VHF radio assignments held by the UK's 10 largest ports (on the basis of tonnage) in 2007. The figures include the assignments to the port and harbour authority that in most cases includes those used by the local VTS service. It is clear that there is no direct correlation between being busy and the levels of infrastructure required. Figure 3-7 illustrates the total assignments held by each port in the UK on the basis of vessel movements. This figure reinforces the fact that it is local specifics rather than traffic levels alone that drive spectrum requirements. Other factors such as port layout, geographic area covered and proximity of other ports can have a much more significant impact, see for example the Port of London case study. This could result in the costs of AIP falling upon a port being a consequence of geography and location rather than any commercial or traffic related concerns.



Source: Ofcom licences, DfT port statistics, Helios analysis

Figure 3-7: Assignments held vs. vessel movements for all ports

On occasion a harbour authority may provide these services on behalf of a number of ports and/or docks in a given area – for example the Harwich Haven Authority that serves the Port of Harwich, Felixstowe and ABP Ipswich. VTS provision can range from a purely informational service[9] through a traffic organisation[10] service to direct navigational assistance[11]. Only the larger port and harbour authorities such as Harwich, Humber, London, Southampton and Shetland provide a navigation assistance service. The complexity of the infrastructure increases significantly under a navigation assistance service as a surveillance picture must be provided to the port authorities.

In two cases, Southampton and Severn, local ports provide coastal VTS on behalf of the MCA. In the case of Southampton, ABP Southampton operate the Solent VTS out to the Eastern Solent. Vessels en-route to Southampton, Portsmouth, Cowes, Fawley, Gosport, Langstone and Chichester will avail themselves of this VTS. However, under the terms of the agreement with the MCA the costs of this service are recovered solely from vessels berthing at Southampton. Similarly ABP South Wales provides the Severn VTS for vessels travelling to and from Barry, Swansea, Port Talbot, Cardiff and Newport. However, in this case ABP provides

[9] Defined by IMO as 'a service to ensure that essential information becomes available in time for on-board navigational decision-making'. May include for example : Reports on the position, identity and intentions of other traffic; Waterway conditions; Weather; Navigational hazards.

[10] Defined by IMO as 'a service to prevent the development of dangerous maritime traffic situations and to provide for the safe and efficient movement of vessel traffic within the VTS Area.' Includes for example : Forward planning of vessel movements; Congestion and dangerous situations; The movement of special transports; Traffic clearance systems; VTS sailing plans; Routes to be followed; Adherence to governing rules and regulations.

[11] Defined by IMO as 'a service to assist on-board navigational decision-making and to monitor its effects, especially in difficult navigational or meteorological circumstance or in case of defect or deficiencies.' This is a service that is intended to assist in the navigational decision making process on board and to monitor its effects.

services at all of these ports, so the VTS costs can be recovered from most participating vessels.

Ports typically provide a range of services to visiting vessels and as a consequence levy a variety of charges upon them. Charges can vary substantially from port to port depending upon the nature of the vessels that visit as well as on the services provided. Typically - at the larger ports - the costs associated with maintaining a navigable waterway including maintenance of up-to-date charts, the provision of aids to navigation and vessel traffic services will be passed to vessels through harbour conservancy dues. This charge is set on the basis of gross tonnage, but there is no standard and charges can be varied by vessel type, purpose and on the basis of other attributes such as vessel length.

Radio licensing costs typically relate to the AtoN infrastructure, port information and to VTS, therefore the AIP costs will form an element of the conservancy charge. In addition, pilotage services are generally charged separately to conservancy charges and AIP costs will be incurred here too (see section on pilots below). Typical charges for various container vessels at a number of ports are illustrated in Table 3-6 below. Port traffic statistics are presented in Annex B.

Port	Harwich Haven	Southampton	Aberdeen
Type	Trust	Commercial	Trust
Applicability	All vessels over 50 GT	All merchant vessels	All vessels
Conservancy charges	Banded from 1.73p to 13.41p per GT	16p per GT (UK) 25p per GT (foreign)	23p to 37p depending upon type and purpose
Example 10,000 GT vessel	£202	£1,600	£370
Example 25,000GT vessel	£2,855	£6,250	£9,250
Example 117,000GT vessel	£15,093	£29,250	£43,290

Table 3-6: Example conservancy dues at a number of ports

All port dues are paid by the vessels master upon arrival and typically cover both arrival and departure.

Other typical sources of income to ports include:

- pilotage dues, for the provision of pilots to aid safe navigation through the harbour environment,
- berthage dues and/or rent, for the provision of a secure berth and access to/from it,
- wharfage dues, for the loading/unloading of cargo. Sometimes separate charges are made for craneage and also rental charges can be levied on stored goods,
- passenger dues, associated with the provision of facilities for passenger ferries,
- towage charges, for the provision of tugs to move or tow a vessel,

- waste disposal charges and the sale of water.

Ports and harbours are free to establish whatever level of charging is appropriate for their given customer base as well as for their scale and scope of operations. In the case of Trust Ports the total income from all sources is capped so as not to make a profit in the longer term. They can therefore set charges that do not necessarily maximise profits.

A decision by the Office for National Statistics (ONS) in 2001 resulted in the new borrowings of the seven largest trust ports[12] being accounted for within DfT's budget. Each of these ports have since applied for Harbour Revision Orders (HROs) that would remove certain controls that DfT has over them with the result that they would cease to be classified as Public Corporations. To date only the Port of London Authority's HRO has been granted. The other six remain outstanding. Hence, borrowing within these six ports falls is subject to Government rules on public sector borrowing. This may influence the investments made by these ports.

There are various reasons why a shipping company would choose one port over another beyond purely the cost element including port facilities, proximity to market, etc. Within the UK ports compete for traffic with each other subject to appropriate facilities and proximity to the cargo's destination, but in the South and South East ports also compete with the continent. There are a number of factors driving this competition including the cost effectiveness of transporting containers by road to/from Europe as well as the growth in the transhipping market whereby the contents of large container vessels are offloaded and redistributed onto smaller vessels for direct transport to a port near their destination. Shipping agents will take into account the cost differential between shipping directly to a UK port, as opposed to shipping to a port on the continent and then transhipping to the UK destination (and vice versa). This produces a greater competitive effect in the south-east of the UK where there is close proximity to continental Europe (particularly between container ports such as Felixstowe-Southampton and Rotterdam). The effect can be seen through the tiered charges that some ports offer to make UK based transhipment more attractive (see for example the Port of Southampton).

[12] Dover, Harwich, Milford Haven, Poole, Shoreham, London and Tyne.

3.5 Marinas

Marinas – Current Assignments		
Coastal Station Radio (International)		
	Simplex	**9**
	Duplex	**5**
Coastal Station Radio (UK)		
	Simplex	**8**
	Duplex	**3**
Coastal Station Radio (Marina)		
	Simplex	**261**
	Duplex	**130**

Source: Ofcom licences

Table 3-7: Assignments held by Marinas

There are in excess of 100 dedicated commercial marina operators around the country excluding those operated by yacht clubs. These organisations are predominantly commercial operations. The vast majority of which utilise a single set of 3 CSR (Marina) channels. There are however four larger companies who specialise in the operation of marinas: Premier Marinas, Quay Marinas, Marina Developments Ltd and Dean & Reddyhoff Ltd. Between them they hold more than 20% of all assignments.

Marinas typically provide boat owners with a wide range of services including berths, fuel, power, telephone and Internet communications, maintenance, water and many more. All marinas charge a fee for berthage that, depending upon location, may incorporate some of the other services. Often the add-on services are charged on a usage basis.

Berthage fees are usually levied on the basis of the size of the vessel and duration of stay although discounts are often provided for regular users. Fixed annual rates are also common for vessels for whom the marina represents a home base.

As an example, Premier Marinas operate eight south coast marinas. Daily berthing rates are some £2.65 per metre of vessel length. Annual berths cost between £5,900 and £12,400 for a 20 metre vessel depending upon the marina chosen and between £2,150 and £3,800 for a 7.5 metre vessel. At Brighton alone there are 1,600 berth holders. To operate these marinas Premier have 8 CSR (Marina) licences with 3 assignments each, 4 CSR (International) assignments and 3 CSR (UK) assignments.

For a typical operation with a single CSR (Marina) licence providing duplex Channel 80 for marina operations, together with two simplex channels M and M2 a marina is charged £75 per annum. These three channels are known as shared marina channels, they are uncoordinated and no protection is afforded between the transmissions from other marinas even if there are many in the vicinity. There is little opportunity for efficiency gains in an individual CSR (Marina) licence unless it becomes more affordable to request a single assignment from within the licence. Ofcom asked us to assume that there would be no changes to the current administrative fees for these channels.

3.6 Inland Waterways

Inland Waterways – Current Assignments		
Coastal Station Radio (International)		
	Simplex	**62**
	Duplex	**2**
Coastal Station Radio (UK)		
	Simplex	**3**
	Duplex	**3**
Coastal Station Radio (Marina)		
	Simplex	**10**
	Duplex	**5**

Source: Ofcom licences

Table 3-8: Assignments held by Inland Waterways

A number of organisations utilise radio spectrum whilst providing services and managing infrastructure on the UK's inland waterways.

British Waterways is the largest user in their operation of many of the UK's canals and non-tidal rivers. British Waterways is a public corporation responsible to the UK and Scottish Governments to maintain and manage the waterways. They receive an annual grant from Department for Environment, Food & Rural Affairs in England and Wales, and in Scotland, from Minister of Transport, Infrastructure and Climate Change. In 2006/07 this grant accounted for approximately 30% of operational costs. The balance is funded by commercial income (property rents and boat licences) with the remainder from third party contributions to works from e.g. local authorities, businesses and house boat owners. The organisation made a small loss in 2006/07.

Leisure boat fees range from around £200 p.a. to £800 p.a. depending upon boat size, geographic scope of the licence and payment terms. Various discounts are available and shorter duration licences are possible for the infrequent user. Commercial licences range from around £350 to in excess of £2,300 depending upon vessel size, purpose and geographic scope. In the 2007/08 British Waterways had a total of 32,566 licences issued in England and Wales producing an average per licence revenue of £398, with a further 565 licenses in Scotland producing average per licence revenues of £112 .

Other organisations using radio spectrum in the inland waterways include statutory bodies such as the Broads Authority as well as a number of local authorities together with Transport for London and the Environment Agency who use VHF communications for bridge, lock and barrier control purposes. None of these organisations seeks to recover costs from maritime operators.

3.7 Sailing clubs and training establishments

Sailing Clubs and Sail Training – Current Assignments		
Coastal Station Radio (International)		
	Simplex	**7**
	Duplex	**1**
Coastal Station Radio (UK)		
	Simplex	**22**
	Duplex	**5**
Coastal Station Radio (Marina)		
	Simplex	**417**
	Duplex	**200**
Class Training		**198**

Source: Ofcom licences

Table 3-9: Assignments held by Sailing Clubs and Sail Training

There are a large number of sailing clubs and sail training establishments around the country. Many of these clubs hold CSR (Marina) licences. The licence covers communications concerning the movement and berthing of pleasure craft and the control of races. The licence may also allow a number of associated hand held VHF radio sets to operate on the channels e.g. at the slipway, or quayside. However, if these radios have access to other international maritime channels, then it will be necessary to obtain a Ship Portable Radio licence set.

The use of the channels within a CSR (Marina) licence varies; if the club also operates a marina then Channel 80 will typically be used for marina operations and management. Most clubs use one of the other channels M and M2 to support – typically safety related - communications during club racing and training events. Two channels may be used if multiple events are on-going, or else if two clubs in close proximity agree to use particular channels to avoid interference. CSR (Marina) assignments are unprotected and not coordinated. Hence, there could be many users of the same channel in the local area.

Most clubs are affiliated to the Royal Yachting Association (RYA) and offer RYA approved training for people of all ages. This training includes maritime radio training, hence the large number of class training licences held by clubs. Many clubs also offer RYA Sailability facilities for encouraging disabled sailors to take part in sailing events.

Sailing clubs are typically funded by membership subscriptions. They may also have various other sources of income such as fees on training courses, marina operations as well as hospitality services in their clubhouses.

3.8 Industry

Industry – Current Assignments		
Automatic Identification System		**33**
Coastal Station Radio (International)		
	Simplex	**184**
	Duplex	**19**
Coastal Station Radio (UK)		
	Simplex	**255**
	Duplex	**106**
Coastal Station Radio (Marina)		
	Simplex	**22**
	Duplex	**11**
Equipment Supplier		**81**

Source: Ofcom licences

Table 3-10: Assignments held by Industry

There is a broad array of industrial users of VHF technology in the maritime environment. These users include amongst others:

- Offshore renewables, oil & gas exploration and production,
- Docks, berths, terminals and boatyards,
- Shipping agents,
- Military ranges,
- Fishing organisations,
- Commercial research and development organisations,
- Equipment and boat supply companies.

The category is dominated by the offshore energy industry who are heavy users of the VHF radio spectrum.

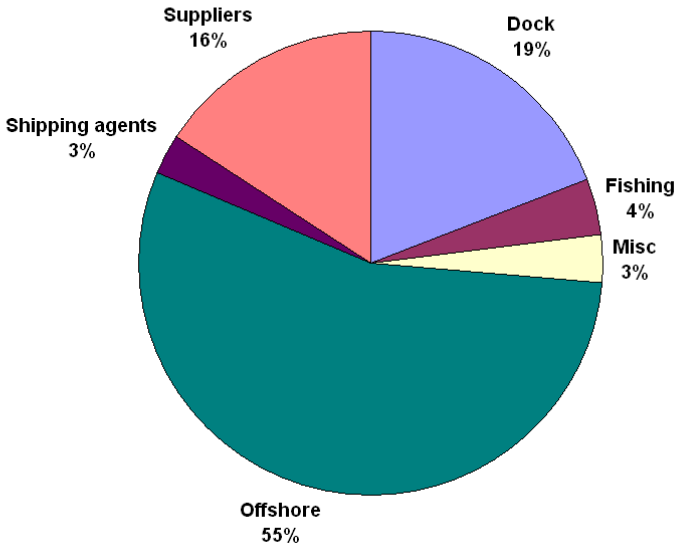


Figure 3-8: Organisation types within industry category

All of these commercial operators utilise the spectrum primarily for voice communications. The oil & gas industry also deploys a number of AIS beacons for the purposes of navigational safety in the vicinity of offshore platforms. Currently 9 AIS stations are deployed on platforms in the North Sea, 8 by BP and 1 by NPower.

The offshore industry makes use of a small number of CSR (International) simplex allocations – located on 3 platforms belonging to Shell. Each platform in the group has the same two channels. Much wider use is made of CSR (UK) channels, both simplex and duplex.

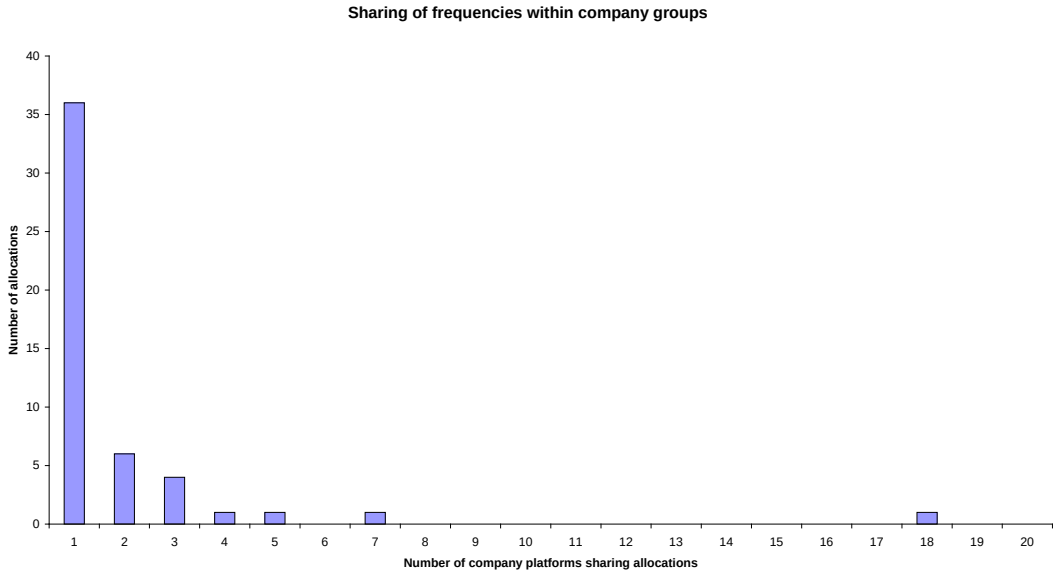


Figure 3-9: Number of offshore platforms sharing CSR (UK) allocations

Figure 3-9 above illustrates that where particular offshore operators run a field of platforms in vicinity of each other it is possible that the CSR(UK) allocations will be shared between that operators platforms. Clearly there are a significant number of platforms for which no significant channel planning takes place. However about a quarter of platforms are within a group that share a number of simplex and/or duplex channels on a collective basis. In the extreme case a field of 18 platforms belonging to the same operator share the same 3 simplex channels. There would appear to be no sharing of allocations between operators.

Overall, the industrial users of the radio spectrum recover the costs of radio licensing through their normal commercial activities.

3.9 Shipping companies

Shipping Companies – Current Assignments		
Coastal Station Radio (International)		
	Simplex	**33**
	Duplex	**12**
Coastal Station Radio (UK)		
	Simplex	**109**
	Duplex	**44**
Coastal Station Radio (Marina)		
	Simplex	**8**
	Duplex	**3**

Source: Ofcom licences

Table 3-11: Assignments held by Shipping Companies

In addition to being the customers for many of the maritime organisations outlined in this report, shipping companies are also a user of the VHF radio spectrum and as such hold a number of CSR licences proposed to be subject to AIP. Such shipping companies include international operators, coastal and port ferry services, tugs as well as services on inland waterways. The frequencies are used predominantly for business operations necessitating shore-to-ship communication.

These companies are commercial concerns of varying sizes ranging from large ferry operators such as Stena and Caledonian MacBrayne through to pleasure cruise companies with only one or two vessels.

3.10 Commercial Pilots

Commercial Pilots – Current Assignments	
Coastal Station Radio (International)	**21**
Coastal Station Radio (UK) duplex	**2**

Source: Ofcom licences

Table 3-12: Assignments held by Commercial Pilots

Pilotage services are provided to vessels in ports around the UK. Depending upon the location pilotage may be compulsory. Pilots board arriving vessels at sea, and departing vessels in port and together with the bridge crew ensure safe passage through the port and harbour environment. Pilot organisations can be both a part of the local port company or authority, or may be private commercial organisations as is the case with this category.

The costs associated with pilotage services are passed on directly to those vessels that utilise the service. Exemptions from pilots are available for masters who frequently visit a particular port. In order to achieve such an exception the master must be certificated and the pilot services receive payment for this process. Pilotage charges typically vary on the basis of vessel gross tonnage[13].

3.11 Search and Rescue

Search and Rescue – Current Assignments		
Coastal Station Radio (International)		
	Simplex	**28**
	Duplex	**1**
Coastal Station Radio (UK)		
	Simplex	**152**
	Duplex	**71**
Coastal Station Radio (Marina)		
	Simplex	**10**
	Duplex	**5**

Source: Ofcom licences

Table 3-13: Assignments held by Search and Rescue organisations

There are a wide range of organisations engaged in both land and sea search and rescue throughout the UK. The majority of these organisations do not receive from central government despite their essential role in public safety and depend entirely on donations from the public. The larger national operators include the Royal National Lifeboat Institute and the National Coastwatch Institution who between them hold 72% of all of the assignments to search and rescue organisations.

S&R activities that utilise the VHF spectrum are wide ranging and include:

- Maritime search and rescue (inshore and offshore)
- Coastal (e.g. cliff and beach) search and rescue
- Beach lifeguards
- Mountain rescue
- Dog rescue teams
- Dive teams

[13] For example per visit charges at Harwich range between £340-£1335, at Portsmouth between £211-£1056 and at Sullom Voe 4p per gross tonne with a minimum charge of £86.

The organisations providing these services are a diverse mix of charities, clubs, emergency services and local authorities. The majority of S&R organisations hold few or single VHF assignments. Notable exceptions are the RNLI who are a significant user of the radio spectrum and the National Coastwatch Institution

3.12 Other users

Current Assignments	Research Institutes	Charities	Government	Individuals, Societies & Club	Outdoor Sport Centres
Automatic Identification System	**3**	**-**	**-**	**-**	**-**
Coastal Station Radio (International)					
Simplex	**1**	**-**	**9**	**-**	**-**
Duplex	**-**	**1**	**3**	**-**	**-**
Coastal Station Radio (UK)					
Simplex	**2**	**9**	**8**	**6**	**16**
Duplex	**-**	**-**	**4**	**2**	**1**
Coastal Station Radio (Marina)					
Simplex	**-**	**4**	**2**	**12**	**20**
Duplex	**-**	**2**	**1**	**7**	**9**

Source: Ofcom licences

Table 3-14: Assignments held by other users

There are various other small scale users of the VHF spectrum in the maritime domain such as:

- Scientific research institutes – undertaking maritime and marine environment research work primarily for academic purposes.
- Individuals, societies and clubs – such as angling clubs and water sport clubs who undertake waterborne recreational activities typically funded by the membership.
- Governmental users – ranging from the MoD who have assignments for marine range control, through local government (e.g. port health or fisheries departments) to local police ports units.
- Miscellaneous charities - such as the Princes Trust and Sea Cadets who are encouraging young people to partake in recreational activities on the water to various ends.

4 Case Studies

4.1 Introduction

Below are presented a number of specific case studies relating to the maritime industry.

4.2 Port of London Authority

The Port of London Authority (PLA) is a large self-financing trust port authority concerned with the movement of vessels on the tidal Thames. It provides: pilotage services, VTS services along the river and out into the estuary, harbour patrols, marine services (salvage, diving, etc.), undertakes hydrographic surveys and dredging. It receives its income from conservancy charges, pilotage dues, river works licensing and rents for facilities in, under or over the river.

In 2007 the Port of London had a turnover of £40.7M and made an operating profit of £198,000 compared with a profit of £1.79M the previous year. The PLA employs approximately 350 staff in conduct of its operations. The port also has a share in a joint venture company Estuary Services Ltd that provides a boarding and landing service for pilots joining and leaving ships trading to London and Medway ports.

In support of its operations the PLA deploys a complex VTS system underpinned by a significant AIS, radar surveillance and VHF communications infrastructure. The PLA's port control centre uses the largest vessel control system in the UK to manage over 30,000 commercial vessel movements within the port each year. An additional 200,000 leisure craft movements a year are also monitored.

The driver for the scope and scale of the infrastructure is predominantly the large geographic area covered by the PLA, together with the built up environment around the Thames that drives the need for multiple stations to ensure total river coverage. The surveillance infrastructure has been developed in support of port safety and is deemed necessary to ensure safe movement of vessels along the river in all weather conditions. The VHF communications infrastructure has been designed to offer redundant coverage along the river to ensure the continuity of VTS operations in the event of the loss of a single station.

5 AIS base stations are deployed along with 15 radars to provide a full surveillance picture with correlated AIS and radar from the estuary to Greenwich with AIS coverage to Teddington Lock. 27 simplex Coastal Station Radio (International) transceivers on 8 channels, and 3 duplex Coastal Station Radio (International) transceivers on 2 channels are deployed in support of port operations including VTS channels and various docks and piers and 3 simplex Coastal Station Radio (UK) channels are used, 1 for trials and 2 for communication with PLA vessels. Furthermore, 2 VHF DGPS datalinks are also used for port survey and hydrography.

No additional installation of AIS stations are envisaged, unless developments within London and down the estuary, through the Government's Thames Gateway development impact on the services employed. The same is true for VHF.

The PLA charge maritime users for the costs associated with their communication, navigation and surveillance infrastructure through conservancy charges. Conservancy charges are levied upon all vessels operating in the Thames Estuary to/from London and the Medway ports on the basis of tonnage. Further charges are levied upon vessels loading or unloading within the port limits on the basis of

tonnage and type. Finally, specific charges are levied upon each tonne of cargo and vary depending upon the type of cargo such as trailers, containers, oils, etc[14].

On the basis of currently held licences shown in Ofcom's database, upon renewal the total licence fee for the Port of London Authorities VHF allocations would be £3,640. Under the proposed AIP scheme we estimate their annual licence fees to be £12,370. Eight of the CSR(Int) allocations held by PLA would not be charged for.

	Current Fees	AIP Fees	Delta	% Increase
VHF allocations	£3,640	£12,370	£8,740	240%

Table 4-1: Fees payable by the PLA

The initial implementation of AIP charging on VHF channels would increase the PLA's licensing costs by some £8,740. This constitutes less than 0.1% of conservancy dues received in 2007. If passed directly onto maritime customers in 2007 without being offset by any other internal efficiencies it would have represented an average conservancy dues increase of £0.41[15] per commercial vessel movement, which in the PLA's case would be spread reasonably evenly across conservancy charges on vessels and cargo.

The following Table provides a sense of perspective on a conservancy dues increase per vessel due to AIP in relation to other port related costs for a typical 5,500 tonne vessel calling at a UK deep sea container port.[16]

Port cost item	
Port charges on vessel	£2,500
Cost of vessel (estimate for 1 day)	£28,000
Port chargers on cargo	£2,500
Stevedoring (1,100 moves)	£88,300
Light dues	£12,000
Total	£133,300

Table 4-2: Make up of PLA conservancy fees

It is apparent that due to the relatively small proportion that port costs constitute, even a large increase in their level is unlikely to significantly impact the overall costs incurred by the vessel operator. It should however be noted that in this scenario the light dues could also increase due to AIP, so the cost impact would be greater than that due to port costs alone. However, it is reasonably safe to say that the economic impact of AIP charges on the VHF spectrum would be largely insignificant.

[14] Port of London Authority Schedule of Charges, http://www.pla.co.uk/pdfs/pp/6612.pdf

[15] For information the average per movement conservancy charge paid to the Port of London in 2007 was £1,350.

[16] Amended from MDS and LTZ. 2004. Study of effect of light dues. Report for Department of Transport.
http://www.dft.gov.uk/pgr/shippingports/ports/coll_studyofeconomiceffectofligh/studyofeconomiceffectoflight5004

The VTS provided by the PLA in the Thames estuary also benefit vessels operating to/from the Medway Ports. As such these ports also contribute toward the costs of the VTS operation in the estuary. An impact of AIP charge increases will be for the PLA to effectively increase the costs to vessels operating to the Medway Ports too. This has not been reflected in the estimates shown above.

4.3 The Gosport and Fareham Inshore Rescue Service

The Gosport and Fareham Inshore Rescue Service (GAFIRS[17]) is a small search and rescue operation based in Hampshire. The service operates three rescue boats in addition to a canoe section and two vehicles. GAFIRS provides free maritime rescue cover in the Solent, along the coast from Portsmouth Harbour to Titchfield Haven. Furthermore, the service is also available to respond to inland emergencies such as rescuing people trapped by floods. In recent years the service has averaged 109[18] calls per year for GAFIRS assistance in rescues.

All GAFIRS lifeboat crews are volunteers and the organisation has no funded employees, all those involved do so purely on a voluntary basis. The crews are on call with the MCA around the clock.

GAFIRS is established as a limited company, but is also a registered charity. It also operates training activities to teach its own lifeboat crews and as a fully approved RYA Training Centre, undertakes training of local Fire Officers, yachtsmen, Scuba divers and fishermen. All donations to the service go directly to funding operating costs and future investment.

GAFIRS state that their annual fundraising income must reach some £35,000[19] to cover short term operating costs. Furthermore, this does not include capital projects, such as fund raising for a new lifeboat (estimated at £150,000) or the replacement of equipment.

The organisation holds 2 radio licences, one for a simplex Coastal Station Radio (UK) VHF channel used for shore-ship communication with the lifeboats (call-sign 'Gosport Rescue'), the other for a radar used together with an AIS display to develop a surveillance picture of the Eastern Solent.

Currently the annual GAFIR VHF licence fees amount to £90 (£180 for the VHF channel but with a 50% discount for a charity).

For the purposes of establishing the AIP charges for the VHF CSR (UK) channel, Gosport is located in a 'low density' zone and the transmitter is classed as 'medium coverage'. This implies an annual fee of £80.

Under the proposed AIP charging scheme, GAFIRS as a registered charity with the safety of human life as their primary objective will continue to be entitled to a 50% discount on fees. Therefore, on this basis the cost of the CSR (UK) licence would be £40 (a £50 or 55% decrease).

GAFIRS also receives an annual grant of the order of £2,000 from the Solent Sea Rescue Organisation a part of Hampshire County Council established to coordinate the 8 independent search and rescue organisations at work in the

[17] http://www.gafirs.org.uk

[18] Annual Report 2007, GAFIRS.

[19] Ibid, at 17

Solent. SSRO also holds licences for 9 CSR (UK) channels that it allows the SAR organisations to utilise. Under AIP the cost of licences to SSRO is also likely to decrease, therefore there is unlikely to be any negative impact of AIP a reduction in this grant to GAFIRS.

4.4 Aberdeen Harbour Board

Aberdeen Harbour is managed by the AHB and is a trust port. In 2007 the port handled 8,481 vessel arrivals and a record 5.13million tonnes of imports and exports. The marked trend for larger ships to call was ongoing, adding up to 24.02 million gross tonnes. In 2007 the turnover of the port was £20.9M with £6.6M retained profit (up from £6M the preceding year). The board employs 117 staff.

In providing port operations and VTS (traffic organisation and information services) the AHB utilises two simplex Coastal Station Radio (International) VHF channels. The annual licensing costs are therefore £200.

Under the proposed AIP charging scheme, Aberdeen is located in a “medium density area”. Therefore the potential VHF AIP licensing costs will represent £200 each (assuming a high coverage service) making a total of £400. This constitutes a £200 or 200% increase.

4.5 Portsmouth Commercial Port

Portsmouth Commercial Port is a Municipal Port located in Hampshire owned in its entirety by Portsmouth City Council. It is mainly a specialist freight (fruit) and passenger ferry port providing connections to France, Spain and the Channel Islands. It is run by a small port authority of around 100 direct employees. In 2007 the port had a turnover of £19.3M and returned a surplus of £6.6M to the city council that was used predominantly to offset council tax charges.

Portsmouth Port currently operates four simplex Coastal Station Radio (International) assignments under one licence. Current licensing costs are therefore £400 per annum.

Under the proposed AIP charging scheme Portsmouth Municipal Port is in a ‘high density’ zone. The CSR (International) transmitters are categorised as high coverage, therefore the per licence cost under AIP will be £500 per station. One of the allocations held by Portsmouth Port is not charged for. The total licence fee will therefore be £1500, an £1100 or 275% increase in fees.

This AIP increase is very small in comparison to the achieved surplus and would translate to a totally insignificant figure on a per car, per passenger or per tonne of freight basis.

It should be noted that vessels approaching Portsmouth benefit from a Vessel Traffic Service provided by Southampton VTS on behalf of the MCA in the Solent. The costs of the related infrastructure and their AIP dues are only incurred by vessels that berth in the Port of Southampton itself. It could therefore be argued that Portsmouth traffic is benefitting from a service and infrastructure towards which it does not contribute. Additionally, with Portsmouth having a significant military presence the traffic into and out of the port is controlled by the Queens Harbour Master – effectively a Royal Navy position. As such an element of the port VTS cost is not charged to the commercial traffic.

4.6 Conclusions

The case studies have considered a range of maritime organisations - from the large to the small - and have assessed the impact of AIP upon them and their end users. In light of the proposed AIP charging scheme it would be expected that organisations in more heavily congested areas making use of CSR (UK) allocations would see the greatest increase in costs. In practice the results were as expected. In the most extreme of the case study organisations (the Port of London - holding a number of UK and International allocations) we have seen a near two and a half times increase in licence fees, in others a much smaller increase - or even a decrease - have been observed. There were no examples observed amongst the case study organisations of a rise due to AIP that would be likely to lead to a change in end customer behaviour or else to substantive fiscal challenges.

5 Economic Analysis

5.1 Overall impacts taking account of economic, regulatory and contractual considerations

The previous sections have considered the magnitude of assumed AIP relative to other revenues and in terms of end user impacts.

Impacts were assessed on the basis of an assumed 100 per cent pass through along the value chain, no change in spectrum demand and no reduction in final demand. In practice dynamic adjustments can be expected which will change the magnitude and potentially the distribution of impacts over time. Further, contractual and regulatory arrangements could alter the timing and magnitude of impacts along value chains. The implications of these considerations are discussed below.

5.1.1 Impact spectrum demand

In relation to spectrum demand, in some areas demand is growing in the absence of AIP, for example, maritime communications. The application of AIP would be expected to reduce spectrum demand relative to a business as usual scenario (and potentially in absolute terms for some services) as operational and equipment purchase/replacement decisions are reassessed to reduce spectrum costs. Assuming overall demand for spectrum is reduced the impact of AIP on costs and prices would be less than calculations in this report indicate. However, demand reduction would occur over time, so initially estimates of impacts based on current use are reasonable, but overstate longer term impacts.

5.1.2 Overall impact including final demand response

In relation to final demand, as, and to the extent that, AIP is passed on to final consumers demand will be correspondingly reduced. In the maritime sector little information is available, although European price elasticity of demand estimates range from -1.1 for Le Havre to -4.4 for Bremen Ports.

However, the magnitude of final price increase involved with the application of AIP for VHF, assuming full pass through, is very modest In the maritime sector AIP on use of VHF can be compared to other port related costs. The conservancy dues increase due to AIP is extremely modest compared to estimated other port related costs for a typical 5,500 tonne vessel calling at a UK deep sea container port of £142,600 (including a cost of vessel estimate of £28,000 for one day). A negligible reallocation of maritime activity away from the UK is anticipated as a result (see Appendix for details).

In conclusion, AIP is designed to change behaviour in relation to spectrum use. Relative to other costs in relation to spectrum related services AIP would be material and would reasonably be expected to change behaviour over time. However, in relation to overall costs in the value chain comprising final service provision proposed levels of AIP are very modest and would be expected to have a negligible impact on final demand for services.

A Economic Framework

A.1 Potential Responses to AIP

The impact of AIP and the incidence in terms of who pays ultimately depend on the response to AIP. The response to AIP involves three elements:

- A potential reduction in the amount of spectrum used to generate a particular service. This might require additional use of other resources such as capital labour to reduce spectrum demand, for example, through re-planning of the way in which frequencies are used to release spectrum.
- A potential reduction in final demand for the services that create demand for intermediate services and therefore spectrum. To the extent that spectrum charges are passed through to end consumers - after allowing for any efficiently savings – they will result in some reduction in demand.
- A potential change in supply in response to the change in demand which in turn which in turn may change unit costs and the incidence of the final impact.

It is likely in practice that the first response will dominate the other two, given that spectrum costs would make up a far greater proportion of the costs of say ports than they are of overall maritime sector costs. Nevertheless, in terms of the final incidence of charges supply and final demand responses do matter. We also consider the possibility that introduction of AIP would motivate efficiency unrelated to spectrum use.

Other considerations that would impact on the magnitude and timing of price pass through and response are contractual considerations and economic regulation (a form of "contract"). Both contractual relationships and regulation could result in a lag before AIP charges are passed along the value chain.

Competitive conditions can also impact on the pass through of costs. Pass through of increased costs into final prices would be expected in competitive markets where the cost increase is common to all service providers. In contrast, with imperfect competition pass through may be more or less than 100%. We assume 100% pass through on average.

Finally, if constraints apply to other inputs then final end user prices may already be elevated reflecting scarcity and end user prices may be relatively unresponsive to the introduction of AIP.

A.2 Static Picture of Supply, Demand and Incidence

It is helpful in thinking about responses to AIP to have a simple picture of supply and demand in mind. Two cases need to be considered:

- The supply and demand for spectrum.
- The supply and demand in intermediate and final service markets where spectrum is one input among many.

Figure 1 illustrates the impact on the supply and demand for spectrum considering two competing users/uses of spectrum competing for a fixed amount of spectrum.

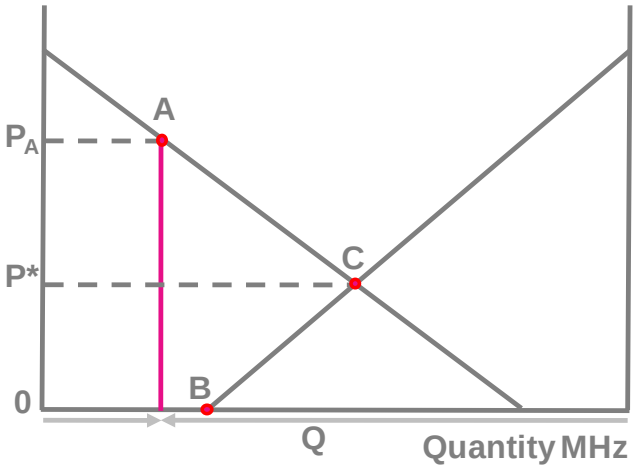


Figure 1: Marginal opportunity cost of spectrum

Figure 1 illustrates two potentially competing uses of a given band, with scarcity of spectrum for use A (say mobile broadband) and no scarcity for use B (say VHF communicationsn). The existing allocation constraint is shown by the vertical line terminating at A. The optimal allocation of spectrum without the constraint is at point C. Spectrum pricing is designed to move towards this efficient allocation, and the efficient price that would achieve this is P*. A further point is that spectrum pricing will be most effective at motivating spectrum efficiency when it is applied to those whose behaviour most directly impacts on spectrum demand.

The imposition of AIP could have a potentially significant impact on spectrum demand (price has moved from zero to an approximation of P*). However, the impact on price and demand in intermediate and final service markets will be much more modest since spectrum is only one input among many. Figure 2 illustrates this.

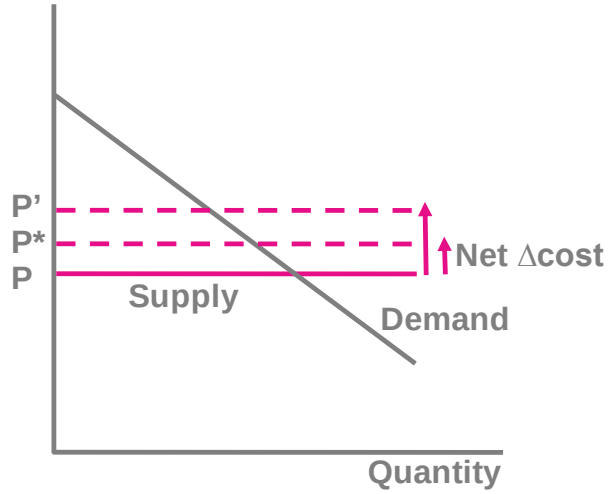


Figure 2: Adjustment in final service market

For illustrative purposes we have assumed that supply is horizontal (unit costs of production are constant) and that the market is competitive. In this case the change in final prices is equal to the change in input costs. Two price changes are shown – P' and P*. The first P' corresponds to the full impact of AIP assuming existing demand for spectrum, the second P* allows for the fact that spectrum demand may fall in response to pricing (as illustrated in Figure 1). In practice there may be intermediate markets, for example, AIP might be applied to maritime VHF communications, which in turn would raise the price of port services, which in

turn would raise the price of ferry services[20]. The demand reduction from end consumers would then feedback through the chain of linked markets.

If the supply curve were upward sloping (unit costs rise with output) then the adjustment to final prices would be smaller than the increase in input costs, and if competition is imperfect the impact on final prices may be larger or smaller than the cost increase.

Finally, if constraints apply to other inputs then final end user prices may already be elevated reflecting scarcity and end user prices may be relatively unresponsive to the introduction of AIP. The reason for this is that where other inputs are scarce one would expect prices to already be marked up, and AIP may be absorbed rather than passed on to final end users.

A.3 Dynamic Consideration

A.3.1 Lagged Response

Adjustment to AIP will take time with the longer term response larger than the short term response since capital investment decisions are involved, existing assets may continue to be utilised for some time and planning and regional or international coordination may be required to achieve potential savings. Regulatory and contractual arrangements may also limit pass through in the short term.

The phased nature of response is not of itself a reason for phasing in price changes. There are short term and long term adjustments in other markets, for example in response to changes in energy prices, yet it is economically efficient to allow these price changes to be reflected through the value chain without artificial delay.

A.3.2 Feedback from Response to Efficient Pricing

The magnitude of anticipated response does, however, potentially impact on the efficient level of pricing. In a market these feedbacks may be near instantaneous and prices will adjust until supply and demand are in equilibrium. When prices are set administratively there will be lags in price adjustment due to the time taken to calculate and adjust prices. These lags, combined with potential asymmetry in the costs of setting prices initially too high (underuse of spectrum) versus too low (insufficient incentive to change behaviour and/or reallocate spectrum) may mean that AIP should be set below or above (less likely) the best estimate of the opportunity cost of spectrum[21].

Historically Ofcom have adopted a conservative approach to spectrum pricing, setting prices below the best estimate of opportunity cost given uncertainty over the likely response and efficient level of pricing in equilibrium. For example, Ofcom note that "*In relation to setting the 'correct price' for spectrum, Ofcom is*

[20] In point of application of a charge within a value chain does not necessarily alter the final incidence in terms of who pays. Harberger. 1962. "The incidence of the corporation income tax." Journal of Political Economy, 70.

[21] Indepen-Aegis. April 2007. "Aeronautical and maritime spectrum pricing." Appendix E. http://www.ofcom.org.uk/research/radiocomms/reports/spectrumaip/aipreport.pdf

aware of the informational issues in setting AIP and has a policy of setting AIP conservatively for that reason" [22].

A.4 Contractual Issues

In a 2007 spectrum pricing study for Ofcom[23] it was noted that contractual arrangements may limit the extent to which changes in cost can be passed on in the short term but these can be expected to be modified in the longer term to take account of changes in spectrum fees. Parties to contracts might be expected to have been aware of the prospect of an increase in spectrum costs since the time of the Cave review in 2002[24], and might be expected to make contractual provision for the change, if they thought it material.

A.5 Potential Spectrum Efficiency Savings

It is not possible to draw on experience and estimated price-demand elasticity relationships to estimate the impact on spectrum demand of AIP since there is no experience of spectrum pricing to draw on (what is the proposed is the introduction of a price, not an incremental change to an existing price). The response to AIP will also depend on future expectations regarding the price of spectrum since investment decisions, both in terms of capital and managerial time, are involved in achieving reductions in spectrum use.

The purpose of pricing is to ensure that users of spectrum factor to their decisions about use of spectrum, including equipment replacement and band planning decisions, the opportunity cost of spectrum. If it were possible to perfectly second guess the response, then it would be possible to impose an efficient outcome administratively. In practice this is not possible and that is the rationale for pricing (and/or spectrum trading).

It is however possible to consider some of the ways in which demand might change and to draw on existing engineering cost estimates of alternative ways of meeting demand for services in the maritime sector to illustrate some of the possible responses to AIP. In principle options for reducing demand for spectrum might include:

- Investing in more infrastructure to achieve the same quantity and quality of service with less spectrum.
- Adopting narrower bandwidth equipment.
- Replanning a band to allow the release of a block of unused spectrum.
- Switching to an alternative band.
- Switching to an alternative service or technology.
- Speeding up technology transitions and switching off legacy systems.

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[22] http://www.ofcom.org.uk/consult/condocs/futurepricing/statement/statement.pdf

[23] Indepen-Aegis, April 2007, "Report on Radio Spectrum Administered Incentive Pricing for Aeronautical and Maritime sectors"

[24] Martin Cave. March 2002. "Review of radio spectrum management." http://www.ofcom.org.uk/static/archive/ra/spectrum-review/2002review/1_whole_job.pdf

- Changing the nature of end use, for example, utilising larger vessels which increase passengers, cargo and revenue per MHz.

New equipment utilising more spectrally efficient technology might also be developed in response to AIP, or replacement purchases of more spectrally efficient technology brought forward.

The overall response to AIP may therefore be more continuous as a function of price than specific existing engineering estimates would suggest. In particular, the option to bring forward equipment replacement would be a continuous function of price in the sense that the economic case for bringing forward replacement improves the higher the price of spectrum and existing assets will have a distributed age profile. It is not therefore sensible to think of a specific threshold at which AIP will have a material impact - the level of AIP should be set based on best available estimates of opportunity cost and potentially modified over time as new information on opportunity cost (including knowledge of the demand response) becomes available.

A.6 Other Potential Efficiency Savings

For a profit motivated firm non-spectrum related efficiency savings would not be anticipated in response to AIP since the firm is seeking to minimise its costs given its output mix and input prices. If non-spectrum prices have not changed, then, aside from an ongoing search for cost savings generally, no change in the efficiency of use of non-spectrum related inputs would be anticipated. For example, the opportunity for fuel related savings is under intense scrutiny at present given the increase in oil and maritime fuel prices[25].

Other considerations might further complicate this picture. For example, constraints on management time rationally lead to limited focus which might shift marginally away from other areas if AIP and opportunities for spectrum efficiency received greater prominence. Increased efficiencies in relation to spectrum use might therefore be associated with a marginal decrease in efficiency elsewhere, rather than AIP motivating greater efficiency across the board.

Finally, not for profit entities may face somewhat different incentives depending on how their budget/revenues respond to changes in input costs. If additional costs are compensated via increased external funding then incentives to improve spectrum efficiency may be weaker (though not necessarily as costs will surely come under some scrutiny). Alternatively, if increased costs in relation to spectrum go uncompensated then a not for profit organisation may be motivated to seek savings in other areas in addition to economising on spectrum use.

A.7 Final Demand Elasticities

A European study reports estimates suggesting that the price elasticity of demand varies considerably between ports with a range from -1.1 for Le Havre to -4.4 for Bremen Ports.[26]

[26] Delft. December 2006. Greenhouse gas emissions for shipping and implementation guidance for maritime fuel sulphur directive. Table 41.
http://ec.europa.eu/environment/air/pdf/transport/final_report.pdf

In relation to maritime sector, there is also a possibility of substitution away from the UK. However, the estimated cost of AIP relative to other costs reported earlier in this report is very modest at around £129 per vessel on average for at the Port of London compared to total port costs including vessel costs for a 5,500 tonne vessel for one day of £142,600.

Further, the study of Lighthouse Dues for the Department of Transport concluded that the routing impacts of the abolition of light dues would be unlikely to be significant. Further, the magnitude of light dues (£71.6 million in 2002/03) is considerably greater than the likely magnitude of AIP applying to the maritime sector.

A.8 Intermediate Supply Side Responses

The assumption of 100% cost pass through rests not only on an assumption of competitive supply, but also a horizontal supply curve i.e. unit costs are constant. If unit costs are rising/falling pass-through will be less/more than the input cost increase since final demand reduction will impact on unit costs. These impacts may also differ in the short and long run, as some supply costs may be fixed in the short term.