

# Recognised Spectrum Access as applied to Radio Astronomy

**Consultation**

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## Section 1

# Summary

This consultation concerns proposals by Ofcom in respect of introducing recognised spectrum access (“RSA”) for the radio astronomy service.

This document is structured as follows:

- Section 2 sets out a general description of the radio astronomy service;
- Section 3 sets out a general description of RSA;
- Section 4 sets out Ofcom’s proposals for the introduction of RSA in relation to radio astronomy;
- Section 5 sets out a provisional timetable and next steps for introducing RSA in relation to radio astronomy.

The concept of RSA is a legal one in the sense that section 159 of the Communications Act 2003 (the “2003 Act”) prescribes the circumstances relevant for a grant of RSA, namely:

- i a person is proposing to use or to continue to use a station or apparatus for wireless telegraphy;
- ii the circumstances of the use are circumstances specified for the purposes of that section in regulations made by Ofcom;
- iii that use does not require a wireless telegraphy licence but will involve the emission of electro-magnetic energy with a view to the reception of anything at places in the United Kingdom or in the territorial waters adjacent to the United Kingdom; and
- iv for the purposes of that section it is immaterial whether the emissions are from a place within the United Kingdom or from a place outside the United Kingdom.

As a general rule, the establishment or use of any station (or apparatus) for wireless telegraphy is prohibited under the Wireless Telegraphy Act 1949 (the “1949 Act”) unless a licence has been granted or such establishment or use is subject to an exemption under statutory regulations. Licensing is reserved for equipment that Ofcom considers has the potential to cause harmful interference.

When carrying out functions under enactments relating to the management of the radio spectrum, Ofcom must act in accordance with various statutory duties including sections 3, 4 and 154 of the Communications Act 2003 (the “2003 Act”). In particular, section 154 provides that Ofcom must have regard to:

- the extent to which the electro-magnetic spectrum is available for use, or further use, for wireless telegraphy;
- the demand for use of that spectrum for wireless telegraphy;
- the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy; and

- the desirability of promoting (i) the efficient management and use of the part of the electro-magnetic spectrum available for wireless telegraphy; (ii) the economic and other benefits that may arise from the use of wireless telegraphy; (iii) the development of innovative services; and (iv) competition in the provision of electronic communications services.

Put simply, the grant of RSA would have the effect of requiring Ofcom under section 160 of the 2003 Act to take account of receiving equipment on a comparable basis to a licensed use. In other words, where for instance Ofcom carries out a licensing function under section 1 of the 1949 Act, Ofcom would be under a duty to take into account the existence of any grant of RSA in respect of radio astronomy that is in force and the provisions imposing restrictions and conditions subject to which the grant has effect to the same extent as Ofcom would take into account a wireless telegraphy licence.

Radio astronomy is based on the detection of radio signals from the cosmos to further our knowledge about the universe and its origins. As radio astronomy is a so-called 'passive service' (i.e. it receives signals from space but does not transmit so cannot, by definition, interfere with other radio use), radio astronomy is exempt from licensing. However, it is very vulnerable to interference from man-made electro-magnetic noise as it attempts to detect extremely weak signals across the vast distances of outer space.

The introduction of RSA for radio astronomy would place use of spectrum for radio astronomy on a more substantial footing. Under Ofcom's proposals, radio astronomers will gain enhanced certainty about the levels of interference they can expect to receive in the radio astronomy bands; and spectrum pricing and trading may be extended to provide incentives to use spectrum more efficiently.

These proposals will, however, involve a net increase in the overall amount paid for spectrum used for radio astronomy. The government has indicated that this will not prejudice the UK's world-class position in the field.

These proposals are in line with recommendations of the Cave review of radio spectrum management and the government's response [Radio Spectrum Management Review<sup>1</sup>](#).

This consultation seeks views on the principle of introducing RSA for radio astronomy and the technical parameters proposed to be used to define the RSA.

It will be of particular interest to those involved in radio astronomy and to other radio users whose services share or are adjacent to the frequency bands used by the radio astronomy service.

As the introduction of RSA for radio astronomy would require various statutory regulations to be made, Ofcom will consult on the substance of these regulations following the conclusion of this consultation.

<sup>1</sup> Review of Radio Spectrum Management by Professor Martin Cave for DTI and HM Treasury – March 2002.

## Section 2

# The Radio Astronomy Service

This section provides background information on the use of radio spectrum for radio astronomy.

## 2.1 Radio astronomy

Radio astronomy consists of the observation of radio signals and the background radio 'noise' for research into the properties of stars, the nature of galaxies and the age of the universe.

Frequencies of observation are largely, if not completely, governed by the physical characteristics of the extra-terrestrial transmissions and fundamental physical constants. So radio astronomers, unlike many other radio users, have little choice about the frequencies they use<sup>2</sup>. A significant range of frequencies is allocated to radio astronomy and are detailed in annex D of UK frequency allocation table<sup>3</sup>, some pursuant to international agreements. The International Telecommunication Union (ITU) has allocated some 2% of the spectrum below 50 GHz to radio astronomy. About one-third is harmonised globally for passive use and is shared with other passive applications, such as remote sensing and earth observation. The remaining two-thirds are shared with active services that transmit including terrestrial fixed and mobile services. These services can interfere with radio astronomy and the degree of protection afforded to specific radio astronomy sites can significantly constrain deployment of other services.

Radio astronomy involves detecting extremely weak signals (billions times weaker than man made signals) emanating from deep space. The extremely sensitive receivers that are required to detect these tiny signals are likely to be swamped by other emissions from man made sources and radio astronomers need a low ambient noise environment.

For radio astronomers to be able to continue to make their observations, it is essential that this receive-only service is recognised in the management of the radio spectrum and terrestrial emissions excluded or limited in terms of interference potential. In the UK, radio astronomy activities are funded through the Particle Physics and Astronomy Research Council (PPARC). Historically, spectrum has been set aside for radio astronomy and radio astronomers have paid fees to the spectrum regulator to cover the costs of investigating interference and of representing their interests in both national and international fora deciding spectrum usage. With growing demand for spectrum, the radio astronomy bands are likely to come under increasing pressure and radio astronomers will continually have to justify their need for allocations at particular frequencies.

Despite their special requirements, there are steps radio astronomers can take to mitigate the effects of interference, such as using sites remote from areas of high terrestrial radio use or using overseas facilities to obtain data. The application of pricing and trading will provide incentives to influence these choices in a way that makes the best possible use of the spectrum, at least within those bands in which the UK has scope under the international radio regulations to deploy transmitting radio services on a shared basis.

<sup>2</sup> For example, spectral lines of H<sub>2</sub>O (water) at around 22 GHz and NH<sub>3</sub> (ammonia) at around 23 GHz  
<sup>3</sup> [http://www.ofcom.org.uk/licensing\\_numbering/radiocomms/ukfat/fat2004.pdf](http://www.ofcom.org.uk/licensing_numbering/radiocomms/ukfat/fat2004.pdf)

The continued limitation of interference in large and potentially valuable blocks of spectrum for radio astronomy imposes a cost on the economy, which is likely to increase as commercial demands on spectrum grow. The Cave review recommended that UK radio astronomy should be subject to administrative incentive pricing (AIP) in bands in which the UK has scope under international regulations to deploy other radio services; and that radio astronomers should be compensated where they allow other services to deploy within their defined spectrum access. This would make the opportunity cost of radio astronomy, in terms of denying spectrum access to other services, transparent and guide rational decisions on how much of the available spectrum should be devoted to radio astronomy. It would also provide incentives for radio astronomers to share spectrum with other users.

In its response to the Review of Radio Spectrum Management by Professor Martin Cave, the government reaffirmed its commitment to support world-class radio astronomy in the UK; (a) accepted that radio astronomers, like other radio users, should face incentives of pricing and trading to use spectrum efficiently; and (b) agreed that any financial benefit that arises from arrangements that allow greater commercial use of radio astronomy bands should be retained for supporting radio astronomy or other areas of scientific research. It further stated that account would be taken in future arrangements of the long-term nature of radio astronomy research and the need to ensure security of access to spectrum and financial certainty.

Ofcom agrees with these principles, which are reflected in the proposals in this document.

## Section 3

# Recognised Spectrum Access – General Description

## 3.1 Introduction

This Section provides a description of the main features of RSA.

Ofcom has identified a number of issues to be considered before RSA can be introduced for particular applications. These may be summarised as follows:

- process for initial grant of RSA;
- setting technical and geographical parameters for recognition that provide sufficient quality of spectrum without excessively excluding other services;
- the term of the RSA and security of tenure in case of revocation or variation;
- the basis for setting and the level of fees for RSA that are no higher than necessary to provide sufficient incentives for spectrum efficiency;
- the conditions under which RSA should be tradable and convertible into licences and what, if any, restrictions should be imposed on alternative uses;
- publication of information about individual grants of RSA .

## 3.2 Ofcom's approach to managing spectrum

Radio spectrum is used for a wide variety of purposes, including broadcasting, mobile telephones, business radio, radar and scientific research, including radio astronomy. The spectrum is a finite resource of considerable economic importance and demand for it is increasing.

Use of the radio spectrum has to be planned and managed to avoid interference that can destroy its value. This is underpinned by a system of licensing the installation and use of radio equipment under the Wireless Telegraphy Act 1949 (the "1949 Act"), as amended by the Communications Act 2003 (the "2003 Act"). In granting licences, Ofcom imposes various technical conditions in order to avoid unacceptable interference between neighbouring users, e.g. power limits or guard bands between the frequencies licensed to adjacent users.

There are three main approaches to managing spectrum.

- **Command and control:** the regulator decides, often in considerable detail, how spectrum is to be used.
- **Exemption from licensing:** users have unrestricted access to spectrum, normally with restrictions on power levels. This is suitable for services that are unlikely to cause interference and can co-exist in an open environment without defined levels of spectrum quality;
- **Market mechanisms:** auctions, incentive pricing and spectrum trading are applied to provide incentives to maximise economic efficiency. Users have freedom within a liberalised regulatory framework to decide for themselves how best to use the spectrum.

Historically, command and control has dominated. However, Ofcom believes that market mechanisms are generally more effective than centralised control in achieving optimal use of the radio spectrum and that traditional spectrum management methods based on regulation are no longer sustainable in the face of growing demand for spectrum and proliferating technologies. Ofcom is reforming spectrum management to make greater use of market mechanisms as described in the recent publication Spectrum Framework Review, which is available on Ofcom's web site <http://www.ofcom.org.uk/consult/condocs/sfr/>.

Ofcom believes that the shift to the use of market mechanisms to ensure optimal use of the radio spectrum can and should be applied not only to transmitting equipment but also to receive or receive-only equipment. Receiving systems impose constraints on the use of radio spectrum in much the same way as transmitting systems; hence, if Ofcom were required to take into account receiving systems in the management of spectrum, the appropriate market mechanisms should be available to the relevant operators.

If a service is unlikely to involve any undue interference with wireless telegraphy, Ofcom is required by section 1AA of the 1949 Act and the EU Authorisation Directive 2002/20/EC, to exempt it from licensing.

### **3.3 Legal and Regulatory Framework**

The concept of RSA is a legal one in the sense that section 159 of the 2003 Act prescribes the circumstances relevant for a grant of RSA, namely:

- i a person is proposing to use or to continue to use a station or apparatus for wireless telegraphy;
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When carrying out functions under enactments relating to the management of the radio spectrum, Ofcom must act in accordance with various statutory duties including sections 3, 4 and 154 of the Communications Act 2003 (the "2003 Act"). In particular, section 154 provides that Ofcom must have regard to:

- the extent to which the electro-magnetic spectrum is available for use, or further use, for wireless telegraphy;
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- the demand that is likely to arise in future for the use of that spectrum for wireless telegraphy; and
- the desirability of promoting (i) the efficient management and use of the part of the electro-magnetic spectrum available for wireless telegraphy; (ii) the economic and other benefits that may arise from the use of wireless telegraphy; (iii) the development of innovative services; and (iv) competition in the provision of electronic communications services.

Put simply, the grant of RSA would have the effect of requiring Ofcom under section 160 of the 2003 Act to take account of receiving equipment on a comparable basis to a licensed use. In other words, where for instance Ofcom carries out a licensing function under section 1 of the 1949 Act, Ofcom would be under a duty to take into account the existence of any grant of RSA in respect of radio astronomy that is in force and the provisions imposing restrictions and conditions subject to which the grant has effect to the same extent as Ofcom would take into account a wireless telegraphy licence.

In addition to specifying the above-mentioned circumstances of the RSA use in regulations made by Ofcom, Ofcom has powers to make regulations under section 159 of the 2003 Act to prescribe the procedures in accordance with which an application for a grant of RSA must be determined. Such procedures would include provision for (i) time limits for dealing with applications for a grant of RSA; (ii) requirements which must be met before a grant is made; and (iii) the restrictions and conditions to which a grant may be made subject.

Under section 159 of (and Schedule 5 to) the 2003 Act, Ofcom has also got powers to revoke and modify a grant of RSA.

Section 162 of the 2003 Act empowers Ofcom to make regulations to provide for the conversion of a grant of RSA into a wireless telegraphy licence and vice versa.

Section 168 of the 2003 empowers Ofcom to make regulations to provide for rights and obligations under a grant of RSA to be tradable.

Finally, section 1 of the Wireless Telegraphy Act 1998 (the “1998 Act”) empowers Ofcom to make regulations to prescribe fees payable for the making of a grant of RSA. Under section 2(2) of the 1998 Act, Ofcom may, if it thinks fit in the light of its duties under section 154 of the 2003 Act, prescribe fees which would be greater than those that would be necessary for the purposes of recovering costs incurred by Ofcom in connection with its functions under the enactments relating to the management of the radio spectrum. In other words, section 2(2) of the 1998 Act (as amended by the 2003 Act) has facilitated the use of market mechanisms in spectrum management for the first time in the UK. In particular, that provision has enabled ‘Administrative Incentive Pricing’, whereby prices for annual licence fees are set above administrative cost to reflect the above-mentioned spectrum management objectives.

### **3.4 What is RSA?**

RSA is essentially a new spectrum management instrument that fills a significant gap in the management of the radio spectrum. The 2003 Act<sup>4</sup> empowers Ofcom to introduce RSA on a selective basis to manage the radio spectrum more effectively. Ofcom believes that RSA has the potential to promote better use of the radio spectrum for a number of receive-only radio services including radio astronomy.

In planning the use of the radio spectrum, Ofcom aims to provide a certain level of freedom from unwanted emissions for licensed services. Licence exempt radio receiving equipment,

<sup>4</sup> Section 403(7)(a).

on the other hand, operates on a 'non interference, non protection' basis, and since they are not formally authorised, they do not have defined benchmarks of spectrum quality. RSA provides the holder of the grant the opportunity to identify frequency bands and geographic areas within which Ofcom will endeavour to ensure that agreed levels of interference are not exceeded. Such levels would typically be identified by the holder of the RSA in his application and Ofcom would then use the relevant criteria in its subsequent planning arrangements. RSA does not provide an absolute guarantee of protection from interference but provides a higher degree of certainty than would otherwise be the case.

Main features of RSAs are as follows:

- RSA only be applied after Ofcom has made the necessary regulations.
- Ofcom would have a duty to take account of the existence of RSA in the same way as it would in respect of a licence. For example, Ofcom will plan to limit the levels of licence emissions into spectrum and geographical areas covered by RSA.
- RSA would not be mandatory even in bands in which it has been introduced. It will remain perfectly lawful to operate without RSA, although users without RSA will forego the benefits that derive from RSA.
- Ofcom would be able to charge fees for RSA that reflect the economic value of the spectrum to which it relates. As for licences, there are statutory safeguards to ensure that fees are no higher than required for spectrum management purposes. RSA may also be made tradable and convertible into licences.
- Similar provisions would apply to the issue, variation and revocation of RSA as apply to licences.

### **3.5 Possible future candidate services for introducing RSA**

Satellite receive-only systems are similar to the radio astronomy service in that the transmissions they receive originate from sources outside the UK that are not licensed by Ofcom. As a consequence, Ofcom has no means of formally recognising their use of spectrum for spectrum planning purposes or of applying market mechanisms to encourage efficient use of spectrum. Difficulties have arisen, for example, where the satellite receive band is shared with transmitting equipment of terrestrial services. RSA would appear to offer a solution to these situations.

Ofcom intends, in late 2005, to further consider the issues relating to the introduction of RSA for satellite services. There will be full and detailed policy consultation, preceded by a dialogue with principal stakeholders, followed by a statutory consultation on the substance of proposed regulations before RSA is made available to other services.

### **3.6 Tradability and conversion**

Ofcom believes that, in general, spectrum trading, combined with liberalisation, can generate considerable benefits. A report for the European Commission<sup>5</sup> and Ofcom documents on trading and liberalisation referenced above give further details of the rationale for this.

As mentioned above, the 2003 Act empowers Ofcom to make regulations to make RSA tradable and to provide for the use of spectrum that is subject to RSA to be converted to a

<sup>5</sup>

[http://europa.eu.int/information\\_society/policy/radio\\_spectrum/docs/ref\\_info/secontrad\\_study/secontrad\\_final.pdf](http://europa.eu.int/information_society/policy/radio_spectrum/docs/ref_info/secontrad_study/secontrad_final.pdf)

use requiring a licence. An example of how this might work in practice would be a situation where an RSA holder did not wish to use the facility for several months a year. In this event, they may wish to make this time available to other services for the duration of the downtime. This could be done either by simply trading the RSA or by converting the RSA into a licence to use the spectrum during the downtime to provide an alternative service. Ofcom proposes that the RSA holder would be able to trade that right. The conversion step is necessary to allow the transaction to go ahead as RSA does not authorise the use of spectrum to make radio transmissions.

It would equally be open to RSA holders to acquire spectrum licences to extend their RSA.

Ofcom proposes to allow trading and conversion of RSA for radio astronomy with the procedure for trading which would mirror that already established for licences as set out in the Wireless Telegraphy (Spectrum Trading) Regulations 2004. This will require the parties to notify Ofcom and to apply for its consent to the transfer. The Spectrum Trading and Wireless Telegraphy Register<sup>6</sup> and Trading Guidance Notes<sup>7</sup> provide further details.

Ofcom proposes that the procedure for conversion will be analogous to that already established for change of use by licence variation as set out in Ofcom's statement on spectrum liberalisation and associated guidance notes. It would be necessary to apply for a grant of RSA to Ofcom, who will consider the application and decide whether to allow it. Amongst the factors Ofcom will consider are compliance with international obligations, including binding Community measures, and whether the proposed change would cause unacceptable interference to third parties, including licensed services in the same and adjacent bands. If satisfied, Ofcom will vary the RSA and issue a licence for the other service. For further details of the procedure for change of use, see Ofcom's Spectrum Liberalisation Statement<sup>8</sup> and Liberalisation Guidance Notes<sup>9</sup>.

Trading and change of use through conversion are separate. In practice, they are likely to take place as part of the same transaction. However, there is no reason in principle why trading would not be undertaken without conversion.

<sup>6</sup> [http://www.ofcom.org.uk/licensing\\_numbering/radiocomms/spectrum/ukpfa/intro?a=87101](http://www.ofcom.org.uk/licensing_numbering/radiocomms/spectrum/ukpfa/intro?a=87101)

<sup>7</sup> [http://www.ofcom.org.uk/licensing\\_numbering/radiocomms/trading/tradingguide/?a=87101](http://www.ofcom.org.uk/licensing_numbering/radiocomms/trading/tradingguide/?a=87101)

<sup>8</sup> <http://www.ofcom.org.uk/consult/condocs/liberalisation/>

<sup>9</sup> [http://www.ofcom.org.uk/licensing\\_numbering/radiocomms/trading/libguide/?a=87101](http://www.ofcom.org.uk/licensing_numbering/radiocomms/trading/libguide/?a=87101)

## Section 4

# RSA for Radio Astronomy

This Section sets out Ofcom's specific proposals for granting RSA for radio astronomy, the technical specification of the RSA and for determining fees.

## 4.1 Managing spectrum for radio astronomy

Radio astronomy is exempt from licensing as it is a passive, receive-only service that cannot cause interference to other uses. This exemption has the following drawbacks.

- From the radio astronomers' point of view (in shared bands), there is no formal security that Ofcom will not license terrestrial services that may interfere with reception to an extent greater than the radio astronomers would wish. Ofcom would endeavour to avoid this but has a statutory duty to manage spectrum in the interests of all who may wish to use it. At a time of growing demand and increasing spectrum congestion, RSA would require that Ofcom take into account radio astronomy users when assessing optimal use of the spectrum. Ofcom proposes that RSA would be subject to similar provisions as licences on security of tenure.
- From the point of view of effective management of the valuable spectrum resource, Ofcom has no basis for giving receive-only users incentives to use spectrum more efficiently or to transfer it to others who have a higher value use. Spectrum management tools of incentive pricing, auctions and trading cannot be applied in respect of a non-statutory registration scheme.

For the reasons set out in the preceding section and taking into consideration the outcome of the consultation held by the Radiocommunications Agency in July 2002 on Introducing Recognised Spectrum Access (the "July 2002 consultation") and more recent discussions with PPARC, Ofcom believes there is significant benefit in introducing RSA for radio astronomy.

## 4.2 Scope of RSA for radio astronomy

Introducing RSA for radio astronomy would formalise the present arrangement and place radio astronomers' use of spectrum on a more secure basis. Spectrum access and quality would be achieved through a statutory duty requiring Ofcom to take account of radio astronomy within specified technical parameters when planning spectrum and licensing other services. It would also enable spectrum pricing and trading policies to be applied to spectrum used by radio astronomy. Ofcom believes that it is important, as a general rule, to give all spectrum users incentives to use spectrum efficiently. Ofcom is therefore seeking views on its proposals for introducing RSA for radio astronomy.

Ofcom has taken account in formulating these proposals of preliminary discussions with PPARC on behalf of the radio astronomy community in the UK, and also the recommendations of the Cave report on spectrum management and the government's response, as described in the previous section.

Radio astronomy is not a commercial service. Nonetheless, it is important and desirable that non-commercial services should face incentives to use spectrum efficiently.

Ofcom's duty to take account of the interests of all who may wish to use spectrum would include the interests of non-commercial services such as radio astronomy. Ofcom appreciates the importance and desirability of having thriving and successful world-class radio astronomy centres of excellence in the UK. However, in Ofcom's view, its statutory remit to secure optimal use of the spectrum is in general best achieved through giving all users, including radio astronomy, appropriate incentives to use spectrum efficiently. This implies the application of appropriate pricing and opportunities to trade spectrum within a liberalised regulatory regime.

**Question 1:** *Do you agree that the RSA is an appropriate spectrum management tool for radio astronomy?  
If not, what alternative mechanism would you propose?*

### 4.3 Technical and geographical parameters

Given the sensitivity of radio astronomy receivers, it is necessary to ensure considerable geographical separation between radio astronomy and transmitting equipment operating within the same frequency bands. The problem is especially acute in the case of mobile services, for which planning is made more difficult as the location of the terminals is unconstrained and cannot be known with certainty.

The geographic area and bandwidth incorporated in an RSA are entirely dependent on the parameters listed in this consultation. The magnitude of these parameters will be established through the RSA application process and the specific requirements of the applicant. These will vary from site to site and also by frequency depending on the level of interest and the nature of observations. In setting these parameters, it is necessary to balance the interests of radio astronomers in not suffering levels of interference that would prevent accurate observations and of users in the same frequency bands in not being subject to excessive constraints.

Listed below are the proposed parameters for use in the development of RSA for radio astronomy.

- Frequency Band
- Category of Co-ordination
- ITU-R Recommendations and footnotes (Detrimental Interference and Compatibility)
- Type of observation measurement - Spectral line or Continuum
- Single Dish or MERLIN or very long baseline interferometry (VLBI)
- Number of Radioastronomy Service Sites and NGRs
- Typical Interference/Noise performance criteria
- Status of frequency allocation
- Co-ordination Distance (radius)
- Time sharing agreement

**Question 2:** *Do you agree with the list of proposed RSA parameters for radio astronomy?  
Should other parameters be recorded in RSA?*

#### 4.4 Benefits of RSA for radio astronomy

RSA would provide radio astronomers with a number of benefits such as enhanced security. It would provide radio astronomers with recognition through which Ofcom will have a statutory duty to take radio astronomy into account in spectrum planning. Incentives for efficient spectrum use as radio astronomers might also benefit from the proceeds of spectrum trading under arrangements agreed with the government.

#### 4.5 Term of RSA and security of tenure

Ofcom appreciates the importance of long-term stability for radio astronomy in view of the long-term nature of much research. Accordingly, Ofcom proposes that RSA should be granted for a rolling term with a 5-year period of notice of revocation or variation. This would place RSA on a comparable footing to existing spectrum licences to which spectrum trading has been extended. The 5-year notice period, together with the need for any revocation or variation decision to be objectively justified, should give sufficient stability for the radio astronomy community.

**Question 3:** *Is a rolling 5 year term, without fixed termination date, appropriate for RSA for radio astronomy?*

#### 4.6 Basis of fees for RSA for radio astronomy

Ofcom proposes that fees for RSA for radio astronomy, like those for licences, should be based on the value of the alternative use of the spectrum (i.e. opportunity cost). The fee algorithm would take account of (a) bandwidth (b) co-ordination area and (c) impact factor (i.e. the constraint on deployment of other services). This is in line with the approach recommended by the review of spectrum pricing carried out by Indepen, Aegis Systems and Warwick Business School in February 2004<sup>10</sup>

The fees for exclusive frequency bands would, for the present, be zero rated. This is because under international agreement, no alternative use of spectrum can be applied and there is therefore zero opportunity cost.

Radio astronomy operators currently use frequency bands at fixed locations, thus constraining the use by other services in certain geographic areas. These frequency bands are listed in Annex D of UK frequency allocation table.

The listed frequency bands can, if no longer required for radio astronomy, be converted to other use. This would result in a reduction in the fee paid for radio astronomy. The government has indicated in its response to the Cave review that any cost savings made by the Radio astronomy Service for spectrum fees will be available to invest in developing radio astronomy.<sup>11</sup>

**Question 4:** *Do you agree with the proposed basis for fees for radio astronomy RSA? If you disagree, please give your reasons and suggest alternatives.*

#### 4.7 Tradability and conversion for radio astronomy RSA

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[http://www.ofcom.org.uk/research/industry\\_market\\_research/m\\_i\\_index/spectrum\\_research/independent\\_review/?a=87101](http://www.ofcom.org.uk/research/industry_market_research/m_i_index/spectrum_research/independent_review/?a=87101)

<sup>11</sup> The Government Response to the Review of Radio Spectrum Management – October 2002; section 11.5

Ofcom believes that it would be advantageous to make radio astronomy RSA tradable and also convertible. This would provide both a mechanism and an added incentive to make the best possible use of the spectrum. However, conversion would not be allowed in radio astronomy bands in which international agreements prohibit any radio transmission.

Ofcom would therefore propose to introduce regulations that allow radio astronomy RSA to be traded and converted into licences and vice versa. It is likely that RSA for radio astronomy would be divided into frequency bands, by location and by time. This would make holdings as flexible as possible and facilitate trading and change of use. Ofcom will consult on the proposed introduction of regulations for trading and conversion in due course.

Ofcom appreciates that the radio astronomy community will continue to make research its main priority. Nonetheless, there could be worthwhile benefits to be gained from facilitating flexibility in the use of radio astronomy bands. It would be for the RSA-holder in the first instance to decide whether to trade, the amount of the frequency band and the time slot to offer and which alternative uses to accommodate. Trading and change of use would require Ofcom's consent.

**Question 5:** *Do you think that spectrum trading and liberalisation should be applied to radio astronomy RSA?*

## Section 5

# RSA for Radio Astronomy Provisional Timetable and Next Steps

## 5.1 Next steps

Ofcom proposes to introduce RSA for radio astronomy, and will consult on the regulations necessary to give effect to that decision as required by sections 159(9) and 403 of the 2003 Act. To achieve this, Ofcom has set a provisional timetable as follows:

<b>Activity</b>	<b>Period</b>
Publication of consultation document on RSA	Quarter 2: 2005
Receipt of responses (10 weeks)	Quarter 2: 2005
Publication of statement	Quarter 3: 2005
Consultation on draft regulations	Quarter 3: 2005
Introduction of Radio Astronomy RSA	Quarter 1: 2006

Ofcom will consider the responses to this document and aims to make a statement with its conclusions in the latter part of June 2005.

Following the publication of that statement, the next step will be a statutory consultation on proposed regulations necessary to give effect to the policy proposals set out in this document.

At present, Ofcom expects that the necessary regulations in respect of RSA for radio astronomy would be made by Ofcom and come into force within the next 12 months.



## Section 6

# Regulatory Impact Assessment

The analysis presented in this Section, when read in conjunction with the rest of this document, represents a Regulatory Impact Assessment (“RIA”), as defined by section 7 of the Communications Act 2003. You should send any comments on this RIA to Ofcom by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals.

RIAs provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making and are commonly used by other regulators. This is reflected in section 7 of the Act, which means that generally we have to carry out RIAs where our proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom’s activities. In accordance with section 7 of the Act, in producing the RIA in this document Ofcom has had regard to such general guidance as it considers appropriate, including related Cabinet Office guidance.

The first part of this Section considers the principle of introducing RSA for radio astronomy; the second part discusses the specific proposals.

Separate RIAs will be published for regulations Ofcom proposes to make to implement RSA for radio astronomy.

## 6.1 Policy, purpose and intended effect

Ofcom’s objective is to exercise its functions in relation to spectrum used for radio astronomy in a way that complies with international obligations and makes optimal use of the spectrum in accordance with its statutory duties. It aims to do this by maximising the value created by use of the radio spectrum while recognising the non-commercial benefits of scientific research. The proposals in this document will achieve this by:

- making transparent the economic cost of making spectrum available for radio astronomy and so assisting rational and informed decision-making;
- providing appropriate incentives for radio astronomers while empowering them to choose whether or not to relinquish spectrum;
- ensuring, through funding arrangements that are the responsibility of the government and PPARC, that financial support for radio astronomy will not be reduced as a result of the proposals and could even increase.

Ofcom has considered two scenarios: introduction of RSA for radio astronomy and continuation of the status quo without RSA.

## 6.2 Benefits of RSA

As discussed in Section 4, Ofcom believes that RSA will be beneficial for radio astronomy.

RSA will provide radio astronomers enhanced security and incentives to use spectrum optimally. It will open up opportunities for alternative uses of spectrum that could promote innovation and competition, benefiting radio-using businesses and consumers.

Radio astronomers would also benefit from the proceeds of spectrum trading under arrangements agreed with the government. Government has indicated that arrangements will be put in place by the government to ensure that funding available for radio astronomy and science is not reduced by the introduction of fees for RSA<sup>12</sup>

The main benefits of radio astronomy are not economic, nonetheless radio astronomy research contributes to the UK economy by training high quality scientist and engineers and therefore increasing UK industrial competitiveness.

Radio astronomy also contributes to technology development and has collaborated with industry on development of low noise measurement receiver and antenna technologies.

### 6.3 Costs of RSA

The costs of RSA will be the increase in fees compared to the amount currently paid by PPARC to Ofcom. Fees will be no greater than necessary for spectrum management purposes. Ofcom understands that the increase in fees will be factored into the financial support available to radio astronomy so that any additional financial burden would be offset.

Ofcom proposes to review fees for radio astronomy RSA approximately every 5 years or when PPARC proposes amendments to the RSA. The fee charged will be based on spectrum management considerations. Any change would be preceded by consultation and increases could, if appropriate, be phased in.

### 6.4 Options and assessment

The following table analyses the options, the benefits, costs and risks and mitigating measures associated with the proposals discussed in this document.

Option/issue	Benefits	Costs/risks	Mitigation
Introduce RSA	Enhance security for radio astronomy	Increased fees reduce funding for radio astronomy and impacts UK achievements in field	Radio astronomers can decide whether or not to take advantage of RSA.  Funding for radio astronomy sufficient to offset the impact of RSA fee.
Technical parameters of RSA	Recognition will provide enhanced assurance as Ofcom will have a statutory duty to take radio astronomy into account in spectrum planning	If parameters are too demanding, other services will be unduly constrained.  If they are too relaxed, radio astronomy will be affected by harmful	Appropriate choice of technical parameters based on international standards  Trading will provide a mechanism to adjust boundaries with commercial

<sup>12</sup> The Government Response to the Review of Radio Spectrum Management – October 2002; section 11.4

Option/issue	Benefits	Costs/risks	Mitigation
		interference	services
Level of fees	<p>Incentives for spectrum efficiency.</p> <p>Transparency aids decision-making</p>	Financial impact on radio astronomy and reduction in funds for research	<p>Funding arrangements by government take spectrum fees into account.</p> <p>Fees no higher than necessary and based on spectrum management considerations.</p> <p>Possible phasing of fee changes.</p> <p>Any reductions of fees from more efficient use will be retained for science.</p>
Trading and conversion of RSA	<p>Incentives for optimal spectrum use</p> <p>Promotes innovation and competition</p>	Reduced opportunities for radio astronomy if spectrum is converted to use of transmitting equipment.	<p>Decision to trade spectrum is voluntary. Radio astronomers can decide whether or not to retain spectrum and terms on which to make it available for other use.</p> <p>Radio astronomers can acquire spectrum through the market if needed.</p> <p>Scientific funding will benefit from financial proceeds of trading.</p>

## 6.5 Conclusion

The introduction of RSA for radio astronomy is expected to be beneficial for the economy by promoting efficient use of spectrum and offers radio astronomy users additional security. It is not expected to lead to a reduction in radio astronomy activity in the UK as the government has indicated that account will be taken of the long-term nature of radio astronomy research and the need to ensure security of access to spectrum and financial certainty.(ref Cave report paragraph 11.6) <sup>13</sup>

*Question 6: Are there any regulatory impacts or policy considerations not otherwise mentioned in this consultation that are pertinent to RSA for radio astronomy?*

<sup>13</sup> The Government Response to the Review of Radio Spectrum Management – October 2002; section 11.6

## Section 7

# Responding to this consultation

## How to respond

Ofcom invites written views and comments on the issues raised in this document, to be made by **5pm on 13 June 2005**.

Ofcom strongly prefers to receive responses as e-mail attachments, in Microsoft Word format, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 2), among other things to indicate whether or not there are confidentiality issues. The cover sheet can be downloaded from the 'Consultations' section of our website.

Please can you send your response to [Yvonne.Kenny@ofcom.org.uk](mailto:Yvonne.Kenny@ofcom.org.uk).

Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Yvonne Kenny  
Ofcom  
Riverside House  
2A Southwark Bridge Road  
London SE1 9HA

Fax: 020 7981 3061

Note that we do not need a hard copy in addition to an electronic version. Also note that Ofcom will not routinely acknowledge receipt of responses.

It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 3. It would also help if you can explain why you hold your views, and how Ofcom's proposals would impact on you.

## Further information

If you have any want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Yvonne Kenny on 020 7981 3078.

## Confidentiality

Ofcom thinks it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), ideally on receipt (when respondents confirm on their response cover sheet that this is acceptable).

All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please place any confidential parts of a response in a separate annex, so that non-confidential parts may be published along with the respondent's identity.

Ofcom reserves its power to disclose certain confidential information where this is necessary to fulfil its functions, although in practice it would do so only in limited circumstances.

Please also note that copyright and all other intellectual property in responses will be assumed to be assigned to Ofcom unless specifically retained.

### **Next steps**

Following the end of the consultation period, Ofcom currently expects to publish a statement by July 2005.

Please note that you can register to get automatic notifications of when Ofcom documents are published, at [http://www.ofcom.org.uk/static/subscribe/select\\_list.htm](http://www.ofcom.org.uk/static/subscribe/select_list.htm).

### **Ofcom's consultation processes**

Ofcom is keen to make responding to consultations easy, and has published some consultation principles (see Annex 1) which it seeks to follow, including on the length of consultations.

This consultation will apply Ofcom's standard 10 week period. For guidance on valid reasons see Ofcom's published consultation guidelines, available at [http://www.ofcom.org.uk/consultations/consult\\_method/consult\\_guide.pdf](http://www.ofcom.org.uk/consultations/consult_method/consult_guide.pdf).

If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at [consult@ofcom.org.uk](mailto:consult@ofcom.org.uk). We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, whose views are less likely to be obtained in a formal consultation.

If you would like to discuss these issues, or Ofcom's consultation processes more generally, you can alternatively contact Philip Rutnam, Partner, Competition and Strategic Resources, who is Ofcom's consultation champion:

Philip Rutnam  
Ofcom  
Riverside House  
2A Southwark Bridge Road  
London SE1 9HA  
Tel: 020 7981 3585  
Fax: 020 7981 3333  
E-mail: [philip.rutnam@ofcom.org.uk](mailto:philip.rutnam@ofcom.org.uk)

## Annex 1

# Ofcom's consultation principles

Ofcom has published the following seven principles that it will follow for each public written consultation:

### Before the consultation

- A1.1 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

### During the consultation

- A1.2 We will be clear about who we are consulting, why, on what questions and for how long.
- A1.3 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.
- A1.4 We will normally allow ten weeks for responses to consultations on issues of general interest.
- A1.5 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. This individual (who we call the consultation champion) will also be the main person to contact with views on the way we run our consultations.
- A1.6 If we are not able to follow one of these principles, we will explain why. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

### After the consultation

- A1.7 We will look at each response carefully and with an open mind. We will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

## Annex 2

# Consultation response cover sheet

- A2.1 In the interests of transparency, we will publish all consultation responses in full on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, without disclosing the specific information that you wish to remain confidential.
- A2.2 We have produced a cover sheet for responses (see below) and would be very grateful if you could send one with your response. This will speed up our processing of responses, and help to maintain confidentiality by allowing you to state very clearly what you don't want to be published. We will keep your completed cover sheets confidential.
- A2.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their cover sheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.
- A2.4 We strongly prefer to receive responses in the form of a Microsoft Word attachment to an email. Our website therefore includes an electronic copy of this cover sheet, which you can download from the 'Consultations' section of our website.
- A2.5 Please put any confidential parts of your response in a separate annex to your response, so that they are clearly identified. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only so that we don't have to edit your response.



**Cover sheet for response to an Ofcom consultation**

**BASIC DETAILS**

Consultation title: Recognised Spectrum Access as applied to Radio Astronomy

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

**CONFIDENTIALITY**

What do you want Ofcom to keep confidential?

Nothing	<input type="checkbox"/>	Name/contact details/job title	<input type="checkbox"/>
Whole response	<input type="checkbox"/>	Organisation	<input type="checkbox"/>
Part of the response	<input type="checkbox"/>	If there is no separate annex, which parts?	

If you want part of your response, your name or your organisation to be confidential, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

**DECLARATION**

I confirm that the correspondence supplied with this cover sheet is a formal consultation response. It can be published in full on Ofcom’s website, unless otherwise specified on this cover sheet, and I authorise Ofcom to make use of the information in this response to meet its legal requirements. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name Signed (if hard copy)

### Annex 3

## Consultation questions

**Question 1:** *Do you agree that the RSA is an appropriate spectrum management tool for radio astronomy?*

*If not, what alternative mechanism would you suggest?*

**Question 2:** *Do you agree with the list of typical RSA parameters for Radio astronomy?*

*Should other parameters be recorded in RSA?*

**Question 3:** *Is a rolling 5 year term without fixed termination date appropriate for RSA for radio astronomy?*

**Question 4:** *Do you agree with the proposed basis for fees for radio astronomy RSA?*

*If you disagree, please give your reasons and suggest alternatives.*

**Question 5:** *Do you think that spectrum trading and liberalisation should be applied to radio astronomy RSA?*

**Question 6:** *Are there any regulatory impacts or policy considerations not otherwise mentioned in this consultation that are pertinent to RSA for radio astronomy?*

## Annex 4

# Glossary

### **AIP**

Administrative incentive pricing. A fee charged to users of the spectrum to encourage them to make economically efficient use of their spectrum.

### **Allocation**

The process of identifying specific frequency ranges for specific applications; or a frequency band entered in a table of frequency allocations, for use by a particular category of service.

### **Assignment**

Authorisation given by a licensing authority for a radio station to use a specific radio frequency or channel under specified conditions.

### **Band**

A defined range of frequencies that may be allocated for a particular radio service, or shared between radio services.

### **Cave Review**

Review of Radio Spectrum Management, by Professor Martin Cave, published March 2002

### **Coordination**

This term refers to the process under which a new user seeks the agreement of existing users to share access to a particular range of frequencies while avoiding harmful interference.

### **EU**

European Union: Collective of European Member States.

### **FSS**

Fixed Satellite Services: A satellite system, where the ground or earth station is fixed during transmission and/or reception.

### **GHz**

Gigahertz: a unit of frequency equal to 1000 million ( $1 \times 10^9$ ) Hz or cycles per second.

### **Impact Factor**

A measure of the constraints on deployment on transmitting equipment as a result of avoiding interference to radio astronomy sites.

### **Interference**

The effect of unwanted signals upon the reception of a wanted signal in a radio system, resulting in degradation of performance, misinterpretation or loss of information compared with that which would have been received in the absence of the unwanted signal.

### **ITU**

International Telecommunication Union: is an international organization within the United Nations System where governments and the private sector coordinate, discuss and agree the logistics of global telecom networks and services.

**kHz**

Kilohertz: a unit of frequency, equal to 1000 (1 x 10<sup>3</sup>) Hz or of cycles per second.

**Liberalisation**

Allowing licence holders to change the use to which they put their spectrum, within constraints to prevent interference.

**MHz**

Megahertz: a unit of frequency equal to 1,000,000 (1 x 10<sup>6</sup>) Hz or cycles per second.

**Mobile Satellite (MSS)**

A service between mobile earth stations and one or more space stations.

**Ofcom**

Office of Communications. Ofcom took over the RA's responsibility for spectrum management in the UK in December 2003.

**PPARC**

The Particle Physics and Astronomy Research Council. The research council responsible for funding Radioastronomy in the UK.

**Primary**

This is a term used to indicate that a frequency allocation for a particular service has priority over other services in the same band. It is quite frequent to have several services that are 'co-primary' (e.g. fixed and mobile) where both services have equal priority. See paragraphs 5.23 to 5.33 of the ITU Radio Regulations.

**RA**

The Radiocommunications Agency: a former executive agency of the Department of Trade and Industry, which was responsible for the management of most non-military spectrum in the UK and for representing the UK in relevant international bodies. The RA's functions transferred to Ofcom in December 2003.

**Radio astronomy**

The scientific endeavour of observing deep space by means of receiving Radio Frequency signals emitted by celestial bodies

**Radio Spectrum**

A section of frequencies of electromagnetic radiation in the range of approximately 10 kHz to 3000 GHz.

**RIA**

Regulatory Impact Assessment: A process undertaken by policy makers to show why a particular decision was made.

**RSA**

Recognised Spectrum Access: A method of recognising the use of radio spectrum by an operator which is not covered by a Wireless Telegraphy Act Licence or a Licence Exemption.

**Secondary**

This term is defined in paragraphs 5.28 to 5.31 of the ITU Radio Regulations. Stations of a secondary service shall not cause harmful interference to primary services or claim protection from harmful interference from primary services. See 'Primary'.

**Spectrum trading**

Process through which spectrum licence holders are able to transfer some or all of their rights to a third party.

**Terrestrial**

Terrestrial radio service: any radio service other than a space service or radio astronomy.

**Undue Interference**

Interference with any wireless telegraphy that is harmful, as provided by section 183 Communications Act 2003. This includes interference that creates dangers or risks of dangers to the functioning of any radiocommunications service designed for the purposes of navigation or safety services, or if the interference degrades, obstructs or repeatedly interrupts authorised broadcasting or other wireless telegraphy.

**Wireless Telegraphy**

The means of sending information without the use of a wired system.

**WT Acts**

Wireless Telegraphy Act 1949 (as amended by the Wireless Telegraphy Act 1967) and Wireless Telegraphy Act 1998. These Acts are further amended by the Communications Act 2003. WT Acts regulate the use of civil radio spectrum in the UK.

**WT Act licences**

Licences issued under the Wireless Telegraphy Act 1949 (as amended)