



# Coverage and planning policy for analogue radio broadcasting services

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## Section 1

# Introduction

## Background and scope

- 1.1 This document explains Ofcom's role and policy in planning and managing the spectrum on which local analogue sound broadcasting services (both commercial radio and community radio, but not including restricted services) operate and deliver their coverage. Ofcom is established under the statutory framework of the Communications Act 2003 ("the 2003 Act"), which confers on it a duty to secure a radio broadcasting environment which meets certain public policy objectives. In particular, Ofcom is required to secure the optimal use for wireless telegraphy of the electro-magnetic spectrum (section 3(2)(a) of the 2003 Act) and the availability throughout the United Kingdom of a wide range of radio services which (taken as a whole) are both of high quality and calculated to appeal to a variety of tastes and interests (section 3(2)(c) of the 2003 Act). This requires and enables Ofcom to plan and manage frequencies to form a 'virtual infrastructure' out of the finite and common resource that these frequencies represent.
- 1.2 The delivery of a good signal to listeners is at the heart of the sound broadcasting business. The extent of coverage and quality of that signal depends on:
- the resources made available by the regulator (Ofcom); and,
  - the use made of those resources by the licensee.
- 1.3 This document describes the degrees of freedom available to a licensee to make the best use of its frequency resource, which is the core asset of its business. The three annexes are more technical in nature, and require a relevant amount of technical expertise to be accurately interpreted.

## Objectives

- 1.4 Ofcom's two most important objectives in this area of its interest are to:
- achieve the best balance between (on the one hand) the effectiveness of coverage of an individual licence and (on the other), the scope to maintain the development of new services;
  - protect existing services from interference (this is part of achieving effective coverage).

## Principal responsibilities

There are three principal elements which characterise the Ofcom–licensee relationship:

- i) The licensee has the responsibility to make the most efficient use of its frequency resources.
- ii) Ofcom's responsibility is to the radio sector as a whole, including opportunities for future development. Its ability to modify the distribution of resources to individual licences at the behest of just one user is very limited.

- iii) The burden of understanding this regulatory environment falls on the licensee, and the licence applicants before the licence is awarded. Likewise that burden also falls on the buyers and sellers of licences (or holdings therein), rather than Ofcom, when the ownership of licences changes.

## Section 2

# Summary

2.1 These points are elaborated at greater length in Section 3 of this document:

- Every **commercial radio** licence relates to a specified 'licensed area' (i.e. the area the service provided under the licence is designed to cover), described in the majority of cases at the time of licence advertisement, within which coverage is allowed and encouraged (subject to suitable frequency resources being available). For local commercial radio licences which were awarded by the Radio Authority under the so-called 'sally' process<sup>1</sup>, the 'licensed area' is that defined by the successful applicant. This licensed area may be varied under the terms of Section 106(4)-(6) of the Broadcasting Act 1990.
- The coverage of a service is defined by Ofcom exclusively by consistent technical criteria (see Annex A), and is typically a sub-set of the licensed area (Section 106(2) of the 1990 Broadcasting Act seeks to make the coverage as large a sub-set of the licensed area as possible).
- For commercial radio licences, the available frequency resources are described in the licence advertisement by a set of relevant criteria, typically some or all of:
  - power, aerial height and other parameters for a notional (or real) transmitter site; (this acts as a reference point to which alternatives should be equivalent in their interference effects);
  - predicted field strength limits at specified boundary locations (how strong the signal can be at specified places);
  - the anticipated interference environment (to how much interference the frequency is subject).
- The 'licensed area' for a **community radio** service is the area which the licensee is able to cover from its chosen transmission site, within the constraints of the frequency attributed to the licence and Ofcom's general policy for community radio services. This area is not necessarily the same as the area defined by a licensee in its application, and is specified at the time of licence award. For FM community radio services, a typical maximum effective radiated power (erp) of 25 watts is allowed in the vertical plane. This may be supplemented by up to an additional 25 watts in the horizontal plane, if required by the applicant and local circumstances permitting. The actual power level required to meet the general 5km radius coverage limit will depend on aerial height. Because greater aerial height is generally the most effective approach to securing better coverage, a higher site may result in a lower erp. Where an FM community radio service is proposed for a large rural area with a dispersed population and at a distance from major population centres, a higher power may be allowable in exceptional circumstances, and subject to frequency availability.

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<sup>1</sup> Rather than specifying the area to be covered by the licence, the Radio Authority advertised the availability of frequencies in a wider area, and applicants were invited to specify the locality within this wider area that they wished to cover (it was not possible to cover the whole area). As a result, the description of the licence area for licences granted under the 'sally' process is contained within the applications of the successful applicants.

- For AM community radio services, the exact maximum power level allowed will also depend on the coverage limits and the frequency used, but 20 to 70 watts effective monopole radiated power (emrp) would be a typical maximum licensed power allowed.
- The scope to add further frequency resources (i.e. relay transmitters) or power increases during the course of a licence is generally nil, although exceptions are sometimes made for commercial radio services, typically in the less central and less populated parts of the UK, where there is a prima facie case that the impact on the possible future development of new services is negligible, and it is consistent with our statutory duties, stated policies and other objectives. When sufficient internal resources are available taking account of other priorities (see also below), such enhancements will be considered by Ofcom on a case-by-case basis using, in the first instance, evidence from the licensee.
- The above considerations will apply whether a licensee wishes to extend and/or enhance coverage within its licensed area, or beyond its current licensed area (in which case the section 106(4)-(6) requirements are applied).
- The coverage aspirations of the licensee, even if embodied in its audience research survey area (the 'TSA', which is of its own choosing) or (in the case of a community radio licence) in its original application for the licence, do not justify a claim on frequency resources above that already attributed to the licence.
- It is the responsibility of licensees, potential purchasers of, and applicants for, licences, to evaluate the coverage potential of the frequency resources made available for that licence.
- Protection from interference is only applied (using the specified criteria and methodology), to the coverage area, rather than the licensed area of a service.
- The *Ofcom Site Engineering Code for Analogue Radio Broadcast Transmission Systems* applies to all services referenced in this policy. It can be found at: [http://stakeholders.ofcom.org.uk/broadcasting/guidance/tech-guidance/eng\\_code/](http://stakeholders.ofcom.org.uk/broadcasting/guidance/tech-guidance/eng_code/)
- Ofcom will prioritise its work on frequency clearance applications in the following order:
  - 1) bringing new services on-air, and emergency site moves
  - 2) relays for new services that have recently come on-air (where the advertisement specifically allows this)
  - 3) small scale commercial radio service power increases to 100W per plane and co-channel relays, and
  - 4) other enhancements (e.g. new relay transmitters not covered under 2) above, power increases not covered under 3) above).

## Section 3

# General coverage policy for analogue radio services

## Licensed Area and Coverage Area

- 3.1 A **licensed area** for a **commercial radio** service is the area which the licensee is allowed to cover, and within the constraints of the frequency or frequencies attributed, encouraged to cover. An Ofcom local commercial radio licence refers to the 'licensed area' as 'the area designed to be served' by the transmitter network (not the area that it actually does serve, which is the coverage area, defined in paragraph 3.6 below). A licensed area is described within each licence advertisement<sup>2</sup> (or where applicable, re-advertisement); some requirements of coverage may be described in general terms. Limitations on allowable coverage may be explicit and detailed, or they may be of a more general nature. The form of expression of these limitations varies from licence to licence, and even within different parts of a licensed area; it typically depends on the context, especially in relation to adjacent licence areas. An advertisement may include specific details of the technical standards used to define coverage, as a subset or variation of those given in Annex 1 to this document (this is relevant where higher levels of interference raise the strength required of the signal).
- 3.2 There are some exceptions to this approach, where "small-scale alternative location licences" (also known as "sallies") were advertised (typically in the later 1990s) in terms of a wider area within which one or more smaller licences would be created, according to intentions expressed in the application. In these cases, Ofcom would expect to base its view of a 'licensed area' (at least in terms of its permitted extent of coverage) on the short-form description offered by the original applicant for the licence concerned (question 2 of the application form). The wider area advertisement for these "sallies" are also on the Ofcom website along with the successful applicants' definitions of their licensed areas.
- 3.3 The **licensed area** for a **community radio** service is the area which the licensee is allowed to cover from its chosen transmission site within the constraints of the frequency attributed to the licence and our general policy for community radio services, as set out below. In the first instance, each licensed area will be based upon the area defined by the applicant in their application. However, this may be adjusted to take account of some or all of the following factors: the size of the proposed area, bearing in mind our general policy; the coverage achieved by the transmission site and parameters given in the application at an erp of 25 watts; the likely interference environment, and; any editorial or outgoing interference restrictions required. Our policy is that as community radio services are in general intended for small-scale localised coverage, we seek to identify frequencies which could not support commercially-sustainable services but which might be usable for non- or partly-commercially funded stations. We consider that frequencies which cannot deliver a coverage area of more than a 5km radius are not likely to be able to support economically viable commercial radio services, but however may be suitable for community radio services. An Ofcom community radio licence refers to the 'licensed

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<sup>2</sup> For licences originally awarded by the Radio Authority, the licensed area was defined in a document called a 'coverage brief'.



area' as 'the area designed to be served' by the transmitter (in the vast majority of cases, this equates to the area that it actually does serve, which is the coverage area, defined in paragraph 3.7 below). This will be defined by a combination of: the area specified in the original application; the coverage achievable with the transmission parameters given in the original application (taking account of the erp or emrp limits defined above) along with any licensing constraints applied.

3.4 The Broadcasting Act 1990 (Section 106(4) to (6)) provides for Ofcom to authorise an extension to a licensed area into any adjoining area or locality. Under the terms of the statute, Ofcom may only exercise this power if:

- a) it would not result in a significant increase in the licensed area, or;
- b) it considers that the increase in the licensed area is justifiable in the exceptional circumstances of the case.

3.5 The core considerations which Ofcom applies therefore include:

- i) whether the area or locality into which the licensee wishes to extend its coverage adjoins the existing licensed area;
- ii) whether the increase in the licensed area could be reasonably considered to be "significant". In determining this, Ofcom will have regard to the size of the population increase which would result from the extension to the licensed area, but also to the size of the adjoining area or locality and its relationship and degree of affinity to the existing licensed area (e.g. an extension of coverage to small villages surrounding a central town or city is less likely to be considered "significant" than an extension of coverage to another sizeable population centre). Each case will be different, and will be judged on its merits;
- iii) whether there are any exceptional circumstances which would justify an increase which would be reasonably considered to be "significant"
- iv) if additional frequency resource is required to facilitate the requested extension, whether suitable resource exists;
- v) the impact that an appropriately-dimensioned increase in frequency resources (i.e. relay transmitters, or power of an existing transmitter actually to bring coverage to that extended area) would have on frequency availability over a (much) wider area.

3.6 The **coverage area** for commercial radio services is defined by technical criteria described in Annex 1. Isolated areas where the technical criteria may be satisfied, but which lie outside the main coverage area, will typically be excluded from the definition. Ofcom publishes, within a few months of the station going on air (or of a change to transmission parameters) a map of what it regards as the coverage area for administrative purposes; this is after its analysis of field measurements and other data has been made. This map may be amended from time to time if additional information comes to light, or if background circumstances change. Where it is known that circumstances, notably levels of interference, will change over the course of the licence, provisional assumptions are made in determination of the coverage area. The coverage maps for commercial radio services are available on the Ofcom website at: <http://www.ofcom.org.uk/static/radiolicensing/mcamaps/MCAs.htm>

- 3.7 The **coverage area** for community radio services is also defined by technical criteria described in Annex 1 (and, as set out above, usually equates to the licensed area). Isolated areas where the technical criteria may be satisfied, but which lie outside the main coverage area, will typically be excluded from the definition. Ofcom publishes, within a few months of the station going on air (or of a change to transmission parameters) a map of what it regards as the coverage area for administrative purposes. This map may be amended from time to time if additional information comes to light, or if background circumstances change. However, in the case of community radio services coverage is shown at two field strength levels; 54 and 64dB $\mu$ V/m, and does not take account of incoming interference. The lower level shows the area over which stereo coverage may be available and the higher one indicates a more realistic coverage area when interference is taken into account. It is the higher, 64dB $\mu$ V/m, coverage area which Ofcom will normally seek to protect. The coverage maps for community radio services are available (via each individual station entry) on the Ofcom website at:  
<http://www.ofcom.org.uk/static/radiolicensing/Community/community-main.html>
- 3.8 For both commercial and community radio services, the defined coverage area as shown on the relevant map is inevitably a simplification of the situation which exists in practice, as well as being a derived estimate rather than a fully measured contour. Small localised deficiencies in coverage are typically not shown. Not only do older assessments not reveal them, but also any estimate is just that, a prediction of probability, not an establishment of certainty. For historical reasons, the **coverage area** is referred to as the 'Measured Coverage Area' (MCA), even if it has not been measured.

## Technical criteria

- 3.9 The technical criteria described in Annex 1 are known to work well for most listeners in most situations with most kinds of radios, whilst allowing Ofcom also to license the range and number of services that it does. This involves compromises, which in turn means that not every listener or every potential advertiser will be happy, even inside the (technically-defined) coverage area. However, it is often the case that listeners can also enjoy reception outside a coverage area (even at significantly lower technical standards).

## Coverage requirements

- 3.10 Ofcom, in agreeing to a particular transmission arrangement proposed by a commercial radio licensee, requires that as much as possible of the licensed area is covered, within the constraints of what is technically achievable with the frequency resources attributed to the licence, and economically realistic in the context of the licence concerned. At least to date, Ofcom has very seldom, if ever, required a licensee to make significant changes of plan, as commercial judgements made by the licensee will generally fulfil the requirements adequately. Apart from any specific requirements described when the licence is advertised, Ofcom will accept proposals aimed at delivering higher field strengths to more densely populated areas, even if this is to a modest extent at the expense of the overall numbers of people actually covered. For a community radio licensee, their licensed area will to a large extent be defined by their choice of transmission site, as well as the frequency resources attributed to the licence and Ofcom's general policy as set out in this document.
- 3.11 Although guidance may be given in general terms, for administrative purposes (application fees etc.), and Ofcom may perform analyses for its own purposes,

licences are advertised (or, in the case of community radio, applications for licences are invited) with no quantified statement or prediction of coverage. It is the responsibility of licensees and applicants to evaluate the coverage potential of the frequency resources made available for a licence, and to predict for themselves the extent to which it will be realised by their transmission proposals. A shortfall between the coverage achieved in practice and that predicted or desired (by the licensee) does not justify an increase in frequency resources.

- 3.12 However, Ofcom may review the question of frequency resources if rigorous and firm evidence can be assembled that incoming interference levels for a particular licence are generally significantly higher than those stated, predicted or implied, at the time of original advertisement, or changed from those obtaining or calculable or stated at the time of licence re-advertisement, as appropriate. A licensee seeking to press a claim on these grounds is advised to seek advice from Ofcom before committing expenditure to research.

## Frequency resources

- 3.13 For commercial radio services the power, aerial height and other parameters allowed by Ofcom for the transmitter or transmitters of a licence are often described in the advertisement in explicit terms. They represent Ofcom's view of the best compromise between enabling the licensee to achieve as much coverage as possible of the licensed area, and on the other hand, disciplined and efficient spectrum use. This balance of requirements is influenced by the nature of the area to be served, and the requirements relating to other areas of relevance to the frequency planning; there is no fixed algorithm. Boundary conditions are expressed additionally or alternatively in terms of the field strength predicted to be achieved at specified locations; maximum transmission parameters may be derived from these boundary conditions. Ofcom's responsibilities are only to attribute adequate spectral resources to a licence from a macroscopic perspective.
- 3.14 Commercial radio licensees may in principle choose any transmission site from which coverage can be obtained consistent with that described in the advertisement. However limits of power, aerial pattern and aerial height will also be applied such that outgoing interference potential (to any notional and unspecified hypothetical future service, as well as to existing ones) will not increase in relation to the equivalent nominal or real transmitter assignment described in the advertisement. In other words, changing transmitter sites does not usually justify increasing power or aerial height, but a significant change may require power limits to be reduced.
- 3.15 For FM community radio services a typical maximum effective radiated power (e.r.p.) of 25 watts is allowed in the vertical plane. This may be supplemented by up to an additional 25 watts in the horizontal plane, if required by the applicant and local circumstances permitting. The actual power level required to meet the general 5km coverage limit will depend on aerial height. Because greater aerial height is generally the most effective approach to securing better coverage, a higher site may result in a lower e.r.p. Where an FM community radio service is proposed for a large rural area, a higher power (or, in very exceptional circumstances, a second frequency) may be allowable subject to frequency availability.
- 3.16 For AM community radio services, the exact maximum power level allowed will also depend on the coverage limits and the frequency used, but 20 to 70 watts effective monopole radiated power (e.m.r.p.) would be a typical maximum licensed power allowed.

## Protection from interference

- 3.17 Ofcom will endeavour to protect the coverage area of existing commercial and community radio services from interference to the consistent standards defined in Annex 1, and where significant populations may be affected, more conservative assumptions may apply at Ofcom's discretion. Ofcom will not protect coverage which lies outside the licensed area, nor isolated areas of coverage outside the main coverage contour of the transmitter concerned. Nor can Ofcom protect the availability of sub-standard but audible reception of a service which is received within the licensed area, but which lies outside the coverage area (although desirable, this undertaking would be an excessive constraint on the use of spectrum for other services). Where a licence uses more than one frequency, only one will be protected at a given location.
- 3.18 In some cases a change in the interference environment may have eroded coverage in relation to a previously published coverage (MCA), but because the changes may have occurred some time ago this erosion may not be reflected in the MCA map, if it has never been re-evaluated in that detail. In those cases Ofcom would not expect to take steps to reverse the previous erosion, but would seek to restrain further noticeable increases in interference levels. Short of freezing almost every new development or change to the radio network, the extent of protection from interference cannot be absolute across the entirety of a coverage area, but Ofcom will endeavour to protect the resource defined for the licence. (The technical standards described in Annex 1 are susceptible to review from time to time).
- 3.19 The practical consequence of this is that when a new transmitter comes on air (or an existing one is changed in some respect), listeners to other, existing services will notice a change, and some may complain. This may be due to poor receiving equipment, and listeners outside Ofcom's technically-defined coverage area are by definition likely to experience difficulties. Some listeners may have been conditioned to easier reception conditions than usual, and this can also understandably be the root cause of some complaints.

## Commercial radio licences: increasing the allowable frequency resources

- 3.20 It is unusual for a commercial radio licensee's signal to cover all of the area which it is licensed to cover. For community radio services, the licensed area is effectively defined by the coverage area. The general scarcity of spectrum means that it will in most parts of the UK not usually be possible to add more resources (power, relays) to a commercial radio or community radio licence during its currency. This has as much to do with keeping the resource available for new services of all kinds (including restricted services and community radio services) and, in respect of community radio, our general policy, as to do with avoiding interference to existing services. However, for commercial radio licences only, Ofcom may be willing to consider enhancements, primarily in terms of e.r.p., on a case-by-case basis.
- 3.21 Where an e.r.p. above that originally advertised, or in use, is sought licensees must supply reasonable evidence of the coverage improvement that the increase would produce. In doing this they should take full account of the defined licensed area as well as any existing licence restrictions. Such requests will be considered only on a case-by-case basis, and will be agreed only where the impact on other (existing and potential new) services is considered to be negligible. All such enhancements must be implemented within 12 months of clearance being completed, otherwise Ofcom

reserves the right to reduce the transmission parameters to the original levels. It should be noted that Ofcom's ability to deal with such initiatives is finite, and there is likely to be a delay in processing applications, depending on factors which include the prevailing level of demand from licensees, and the volume of other, higher priority, work.

- 3.22 In a few circumstances, there may be directionally selective restrictions on radiated transmitter power applied to protect existing or specific, but not confirmed, possibilities for future development of other services. Where these requirements are superseded, the restrictions may be eased.
- 3.23 There are two particular circumstances in which, in respect of commercial radio licences, transmitters may be added, or characteristics of existing transmitters may be modified. These are, respectively 'co-channel relays', and for many 'small-scale' commercial radio licences, a 'polarisation-related power allowance'. Licensees may apply to effect these changes according to the considerations, criteria and procedures set out respectively in Annexes 2 and 3. Ofcom's scrutiny of applications and a reasonable dialogue which may refine proposals to achieve acceptability is not intended to substitute for the licensee's responsibility to make properly-founded technical plans for itself.
- 3.24 Co-channel relays. A commercial radio licensee may add one or more small relay transmitters, if using a frequency already attributed to the licence, and if Ofcom considers that the relay has a negligible opportunity cost in use of frequencies. This is subject to compliance with the advertisement. Where a licence already uses two frequencies, each frequency may possibly be re-used for a small transmitter on the opposite side of the composite coverage area. This will only work effectively under particular circumstances and with appropriate engineering implementation, as the two transmitters on the same frequency are liable to interfere with each other. If the licence has just one frequency, a small co-channel transmitter may be added, but the coverage gained by it will inevitably be offset by a zone of interference between the two transmitters. The engineering of co-channel transmitters is difficult and therefore likely to be expensive. Ofcom is in principle supportive of their use, but does not claim them to be a panacea for coverage problems. Ofcom may not approve a proposal for a co-channel relay if it believes that the coverage lost would include areas which it regards as significant for the licence as advertised. The calculation methods and qualifying criteria used by Ofcom in approving such proposals are given in Annex 2.
- 3.25 A polarisation-related power allowance applies to many commercial radio licences with a smaller scale of coverage. An overall power limit of 100 watts ('effective radiated power', or 'e.r.p.') as a (power) sum of the vertically and horizontally-polarised components is applied as an envelope within which those licensees are expected to work; this has been specified in the original advertisement. The licensee concerned may apply for the licence conditions to be relaxed to one of 100 watts e.r.p. in each plane of polarisation and in some cases Ofcom may be willing to allow an e.r.p. somewhat higher than 100 watts in one or both planes. The procedure, criteria and requirements of such a change are given in Annex 3.

## Annex 1

# Technical criteria for defining a coverage area

## How do we define the coverage area (MCA)?

A1.1 Adequate reception depends upon delivering to the receiver a signal which is both:

- i) sufficiently strong to overcome noise within the receiver (manifest as 'hiss'), and normal levels of electrical noise in the environment (manifest for example as 'crackles' or 'buzzes' or 'hiss', depending upon the source);
- ii) sufficiently strong to be free from interference from other radio stations.

## FM services

A1.2 A service area is defined as that area covered by a particular transmitter (or transmitters, if more than one is utilised by a licensee) within which both of the following technical criteria are fulfilled:

- i) the median signal field strength, within the area of analysis (typically a 'pixel' of dimensions approximately 100m x 100m) assessed at a height of 10m, is at least 54dB $\mu$ V/m for commercial radio services and is at least 64dB $\mu$ V/m for community radio services. This field strength being available in either the horizontal or vertical planes of polarisation;
- ii) the wanted signal exceeds the power sum of unwanted signals on each of the relevant frequencies (in either polarisation; with aerial oriented towards the wanted transmitter) each increased by the 'protection ratios' given in Table 1 for stereo services and Table 2 for services required to operate in mono; the receiving aerial having directional characteristics as defined in Table 2.

A1.3 This means that in some cases, the field strength required actually to deliver a commercial radio service is greater than 54dB $\mu$ V/m and greater than 64dB $\mu$ V/m to deliver a community radio service. This may be due to localised factors of which Ofcom can take no account, e.g. man-made noise may be higher than that assumed in derivation of the general figure. However, Ofcom's protection of some services may be applied only to areas where a higher field strength than this is achieved, in cases where and to the extent that this expectation is stated in the relevant licence advertisement, in anticipation of a particular level of interference applying to the frequency concerned.

A1.4 Apart from a very few exceptional cases where polarisation discrimination has been applied in planning the protection of one service from another, Ofcom's planning assumes equivalence and independence between the vertical and horizontal planes of polarisation. That is, planning assumes the use of just one plane of polarisation (vertical), with the orthogonal polarisation (horizontal) mirroring it, although with no requirement on a licensee to implement both planes.

**TABLE 1a: Stereo protection ratios in normal conditions (50% time)**

<b>Carrier Frequency Spacing (MHz)</b>	<b>Minimum Protection Ratio (dB)</b>
0	45
0.1	33
0.2	7
0.3	-7
0.4	-20

**TABLE 1b: Stereo protection ratios in conditions of interference by long-range propagation (5% time)**

<b>Carrier Frequency Spacing (MHz)</b>	<b>Minimum Protection Ratio (dB)</b>
0	37
0.1	25

**TABLE 2a: Mono protection ratios in normal conditions (50% time)**

<b>Carrier Frequency Spacing (MHz)</b>	<b>Minimum Protection Ratio (dB)</b>
0	36
0.1	12
0.2	6
0.3	-7
0.4	-20

**TABLE 2b: Mono protection ratios in conditions of interference by long-range propagation (5% time)**

<b>Carrier Frequency Spacing (MHz)</b>	<b>Minimum Protection Ratio (dB)</b>
0	28
0.1	12

(These are as described in ITU-R recommendation 412-9)

**TABLE 3: Receiving aerial discrimination**

$\alpha$ Angle relative to direction of main response, in <u>either</u> direction of azimuth	(dB)
0° -27°	-0
27° -60°	-12 $[(\alpha -27) \div (60-27)]$
60° -180°	-12

(in other words, between 27° and 60°, discrimination increases linearly from 0 to 12dB, as described in ITU-R Rec. 599)

- A1.5 In protecting existing services from new, or relocated or otherwise modified transmitting installations, Ofcom may in some circumstances not take account of discrimination of the receiving aerial to the full, or even any, extent. The use of this discretion by Ofcom will be heavily influenced by two considerations, namely:
- whether coverage of a key settlement of a 'victim' area might be affected (in which case protection may be more conservative);
  - whether the change of transmissions is for a new licence, or an existing licence (the latter being treated more cautiously in respect of protecting other areas).

### AM services

- A1.6 The principles applying to AM (medium wave) services are much the same as for FM. The particular standards which Ofcom applies to determine coverage are that:
- i) the field-strength limited contour is defined by a field strength of at least 66dB $\mu$ V/m for commercial radio services and is at least 76dB $\mu$ V/m for community radio services measured 1.5 metres above ground;
  - ii) the interference-limited contour is defined by a co-channel protection ratio of 27 dB, and an adjacent channel (9 kHz separation) protection ratio of 3 dB; for synchronous services a co-channel protection ratio of 7 dBs is used.
- A1.7 These standards apply to daylight hours only. In darkness hours (this is approximately the period starting one hour before dusk, and ending about ½ hour before dawn), 'sky-wave' interference from other transmitters will mean that the interference-limited contour will shrink significantly, and sometimes dramatically.
- A1.8 In protecting existing services, Ofcom will also have regard to the potential for a transmitter to have some impairment to (UK) services using the second-adjacent frequency in its vicinity.
- A1.9 As with FM, localised sources of man-made interference may in specific locations raise the required field strength above that made in this generalised determination, but Ofcom does not take account of this in its regulation and planning. It should particularly be noted that this level of field strength will not always provide adequate protection from interference from some wire-based telecommunications systems (such as 'ADSL'); even if such systems operate within their permitted limits of radiation.



## Annex 2

# Co-channel frequency re-use within the same licence

- A2.1 A commercial radio licensee may apply to add a relay frequency assignment to its licence subject to the proposal fulfilling the following criteria:
- a) the relay must use a frequency already attributed to the licence;
  - b) the extent of coverage obtained must respect the conditions of the advertisement against which the licence was advertised, and particularly the definition of the licensed area;
  - c) there must be a predicted net gain of coverage (for the licence as a whole, taking all transmitters into account) with respect to the existing arrangements, and negligible (net) loss of coverage within the core settlements within the licence area (particularly any from which it takes its name);
  - d) the outgoing co- and adjacent- channel interference potential from the relay transmitters should not significantly exceed that of the original transmitter on that frequency;
  - e) the use of the relay does not inhibit use of neighbouring frequencies for new services by virtue of an increased protection requirement from or interference to them;
  - f) reception of existing services is not unduly impaired;
  - g) programme material, including commercials, should be identical from all transmitters which use the same frequency within the licence.
- A2.2 Ofcom's assessment of criterion (f) will follow the standard approach described in paragraph 3.17-3.19 of the main document. The assessment of criterion c) d) and e) will be as follows.

## FM services

- A2.3 The coverage of the transmitters using the same frequency will be assessed by predicting field strengths (from transmission details as proposed by the licensee) to 100m square 'pixels' of territory from each of the transmitters concerned, using a computer-based propagation tool which takes account of databases of ground height and ground cover. Wanted field strengths are applied in the usual way, and receiving aerial discrimination is not applied. The protection ratio applied in calculation will be dependent upon the extent of modulation delay control which the licensee undertakes to provide. The two transmitters must have their carrier frequency fully synchronised.
- A2.4 Different protection ratios will apply to different pixels, according to the time-offset of transmission from the relay transmitter relative to the main (co-channel) transmitter, and the difference in propagation time to the pixel from the two transmitters.

**Allowable Delay: relay relative to main transmitter**

<u>main-relay signal delay inequality</u>	<u>Protection Ratio</u>
<u>stereo:</u>	
≤ 5 μs	10 dB
≤ 20μs	16 dB
≤ 100μs	19 dB
other	25 dB
<u>mono:</u>	
≤ 20μs	3dB
≥ 20 μs	10dB

A2.5 These figures are permission thresholds, namely minimum requirements, **not recommended norms**. They are based on sources including ITU-R Rec. 412-9, figure 9, and an expectation of achieving impairment quality grade 3 or 4 but making permissive allowance for factors such as some limited receiver aerial discrimination (on portables), and the possibly less exacting nature of the programme material broadcast in some cases, all of which the licensee may choose to take into account if it sees fit. To obtain satisfactory results, greater protection ratios are likely to be needed. Ofcom takes no responsibility for the level of satisfaction or otherwise which the licensee will experience with the arrangements implemented. Other than where no synchronisation is applied, the time-offset of transmission will be taken as advised by the licensee, and that figure would, if the licensee’s proposal were accepted, be **reflected as a licence condition**.

A2.6 The additional co-/1<sup>st</sup> adjacent outgoing interference potential from a co-channel FM relay transmitter will be deemed acceptable (in the context of this policy) if the 33dBμV/m contour of the co-channel relay transmitter lies entirely (to a reasonable approximation) within the 33dBμV/m contour of the existing transmitter.

A2.7 Assessment of whether the potential for new services would be inhibited by an increased protection requirement (or increased outgoing interference potential on the second, third and fourth adjacent channels) is made by assessing separately for each channel up to and including 400 kHz from the relay’s frequency, within the 54dBμV/m contour of the relay, whether over more than about 30% of that area any existing service puts in field strengths as follows, referred to the channel under analysis (as opposed to the relay frequency itself):

co-channel (to channel under analysis)	>35 dBμV/m (or 36dBμV/m for >5% time)
<u>±100 kHz adjacent:</u>	>40 dBμV/m (or 48 dBμV/m for >5% time)
<u>±200 kHz adjacent:</u>	>67 dBμV/m
<u>±300 kHz adjacent:</u>	>80 dBμV/m
<u>±400 kHz adjacent:</u>	>90 dBμV/m

- A2.8 If the criterion is satisfied for any of these, the channel under analysis is deemed to be already unusable, and therefore not prejudiced by the relay proposal. Every channel analysed must be 'not-prejudiced' for the relay proposal to be acceptable.
- A2.9 The channel-by-channel analysis need not include calculations for frequencies co-channel, 100 or 200 kHz-separated from the relay frequency if the 48dB $\mu$ V/m contour of the proposed relay lies within the 48 dB $\mu$ V/m contour of the main (existing) station.
- A2.10 Note that this above analysis includes certain relationships which may be excluded in any case for other reasons (e.g. a relay transmitter would not be sited in-area to an existing service 300, 400, or (in many cases) 500 kHz away in frequency).

### **AM services**

- A2.11 A zone of impairment will be defined (as a non-covered area, or 'mush zone') between the main and the proposed relay transmitter. For ease of calculation, this will consist of predicting 66 and 74 dB $\mu$ V/m contours of both transmitters, and taking two straight-line loci, one being the intersection of one transmitter's 74 dB $\mu$ V/m contour with the other's 66 dB $\mu$ V/m contour, and vice versa. This will imply that the licensee will be required to implement a difference in carrier frequencies of less than 0.1Hz, and a modulation delay inequality better than 1ms.
- A2.12 The additional outgoing interference potential from a co-channel AM relay transmitter will be deemed acceptable in the context of this policy if:
- the total effective monopole radiated power (e.m.r.p.) of the two transmitters combined does not increase by more than 1dB.
  - the coverage of all existing services is unaffected (based on both ground wave and skywave calculations).
  - international co-ordination would be successful, under the terms of the ITU Final Acts of the Regional Administrative LF/MF Broadcasting Conference for Regions 1 and 3 ('GE75').
- A2.13 In the AM context, the use of co-frequency working, together with the implications of constraints (c) and (d), will be taken as satisfying to a reasonable extent the requirements to maintain the utility of other frequencies.

### **How to apply: information required (FM and AM)**

- A2.14 Commercial radio licensees wishing to add a transmitter to the licence on this basis should apply in writing to the Head of Broadcast Licensing with the following technical details:
- transmitting site location (national grid reference to 6 figures);
  - ground height of mast (or other supporting structure);
  - aerial height above ground;
  - maximum radiated power (e.r.p.)
  - aerial horizontal radiation pattern (h.r.p.);

- any modulation delay offset which forms part of the proposals.
- A2.15 Additionally, a close-up photograph of the proposed mounting location of the transmitting antenna should be supplied, together with confirmation that agreement with the relevant site landlord (who should be named) has been secured.
- A2.16 The application must include a reasonably-based estimate of the basic coverage of the proposed transmitter, the loss of coverage anticipated due to mutual interference between it and the existing co-channel transmitter, and the extent to which these areas of loss may (if applicable) fall in areas covered by another transmitter of the service on a different frequency. Licensees are advised, although not required, to secure a professional prediction of the metrics outlined above. However, any assertion (in lieu of a pixel-based calculation of mutual interference) that problems will be 'negligible' must be substantiated by properly-considered analysis.

## Annex 3

# Polarisation of 'small-scale' FM commercial radio services

- A3.1 A significant proportion of local commercial radio licences have been advertised with the expectation that the maximum allowable radiated power of the (principal) transmitter site(s) would be 100 watts total (e.r.p.), as a sum of vertically and horizontally polarised components. This is reflected in the licence conditions.
- A3.2 Ofcom is willing to consider requests from individual licensees to increase this limit to up to 100 watts e.r.p. radiated in each plane of polarisation. Ofcom's presumption is to facilitate this. Additionally, and only on a case-by-case basis, Ofcom may be willing to increase this limit beyond 100 watts per plane. However, lower restrictions of power will be applied where necessary to protect other existing licences or protect opportunity for future services, most notably for community radio. This will impinge particularly on licences where directional restrictions already apply; existing restrictions will remain in absolute terms, so for example they will become more significant in relative terms where maximum power in a given plane of polarisation increases.
- A3.3 Licensees need to take into account that Section 2.4 of Ofcom's *Site Engineering Code for Analogue Radio Broadcast Transmission Systems* is not likely to be satisfied by a simple antenna transmitting a mixed polarisation signal. Generally, a correctly-phased two-tier system, or single-tier elliptically polarised antenna is more likely to be compliant.
- A3.4 This aspect of licence compliance is particularly important, since calculations made to avoid interference between FM broadcasts and the aeronautical navigation service assume this level of compliance. It is possible to request more relaxed conditions, but these need to be calculated for expected acceptability, and the frequency recleared, which implies a delay, firstly for Ofcom to undertake the calculation, and then for the frequency to be recleared

### How to apply: information required

- A3.5 Licensees seeking this amendment to their allowable transmission parameters need to write to Ofcom's Head of Broadcast Licensing, stating the change to the licence conditions which is sought (up to 100 watts maximum e.r.p. per plane of polarisation). The letter must be accompanied by a full diagram, with dimensions of each relevant component of the antenna which is to be used, including full details of the relevant parts of the supporting structure and the phase relation of feeds to the radiating components of the antenna. Any subsequent change to antenna design or mounting will trigger a recommencement of the entire process. The letter should be accompanied by a prediction of the total radiated power in the direction directly above the antenna (its zenith); this will be more reliable, and less susceptible to rejection on assessment by Ofcom, if it is made using a recognised professional prediction tool, which takes due account of the supporting structure and its component elements. The application should also include photographs of where the antenna is to be mounted, and the photographs should be of reasonable scale (e.g. such that the antenna array itself would occupy at least one third of the linear dimension of the whole photograph).

- A3.6 Where compliance with the general provision of Section 2.4 of Ofcom's *Site Engineering Code for Analogue Radio Broadcast Transmission Systems* would not be achieved, the application should state the extent of relaxation sought. Requests for relaxation of limits will be noted, and included in bulk runs of aeronautical compatibility made periodically by Ofcom (generally every ten weeks or so).
- A3.7 Ofcom will assess the design proposals submitted. Where these do not comply with Section 2.4 of the *Ofcom Site Engineering Code for Analogue Radio Broadcast Transmission Systems* (or with the requested exemption thereto where this is sought), or with any directional restriction of power in the horizontal plane, ('h.r.p.' in either vertical or horizontal planes of polarisation) the application will be rejected.