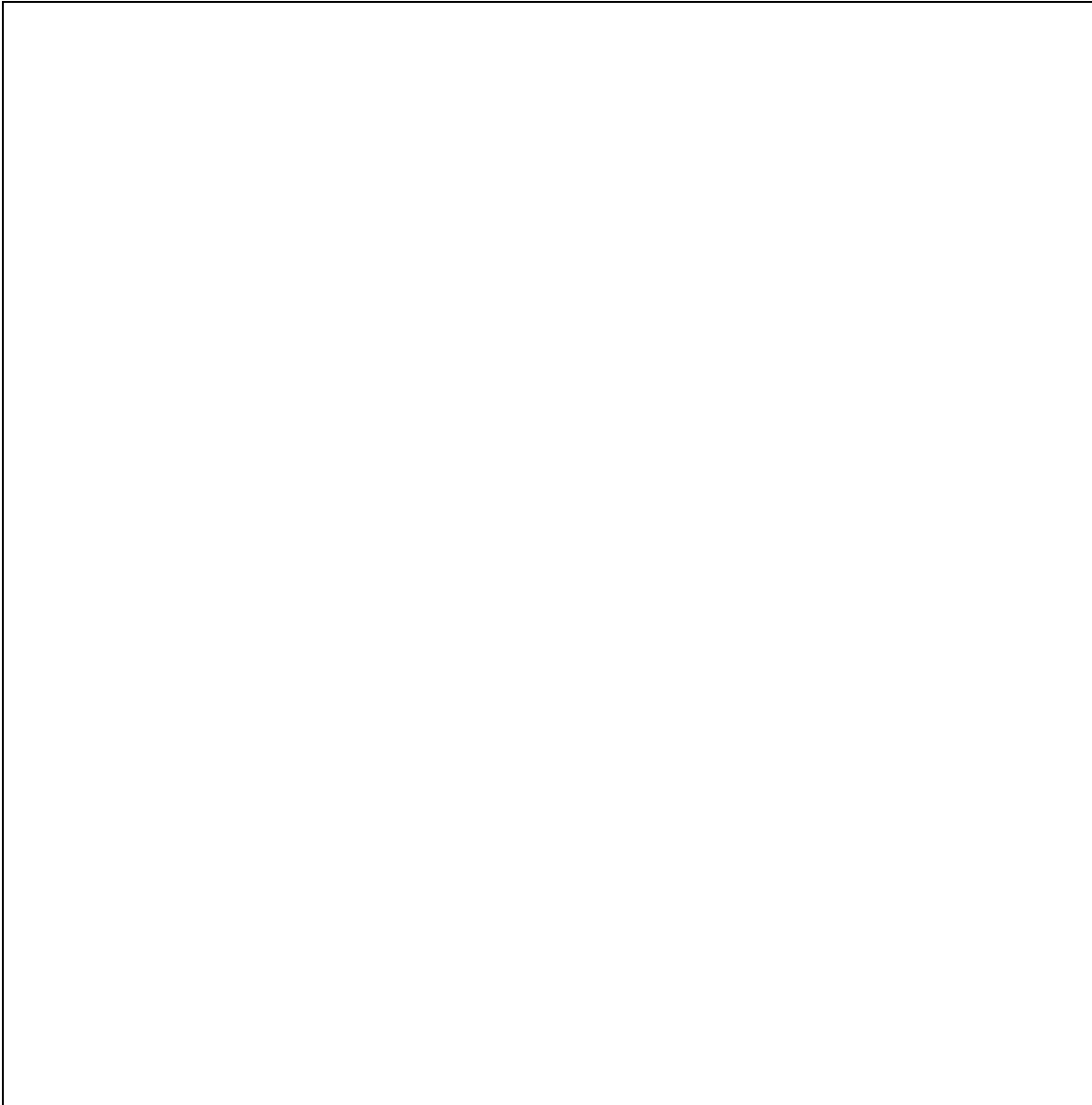


**UK SPECTRUM CO-ORDINATION
DOCUMENT**

**Co-ordination of licensed services in the band
3605 to 3689 MHz paired with 3925 to 4009 MHz**

OfW188



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Contents

Section	Page
References	2
Foreword	3, 4
Introduction	5
Use of the frequency band 3600 to 4200 MHz	6, 7
The Role of Ofcom	8
Methods and procedures for Co-ordination	9 - 12
Annex 1	13
Document History	14

References

1	OfW 30	Technical Frequency Criteria: Fixed Point-to-Point radio services operating in the frequency ranges 3.6 to 3.875 GHz paired with 3.925 to 4.2 GHz.
2	ITU-R Rec. P.452	Prediction procedure for the evaluation of microwave interference between stations on the surface of the earth at frequencies above 0.7 GHz
Note:	<p>For information;</p> <p>The ITU website for radio regulatory information is located at; http://www.itu.int/ (Registration and a fee maybe required for ITU-R Recommendations)</p> <p>Ofcom is not responsible for the content of external internet websites and is not responsible for documents it does not produce.</p>	

Foreword

This document sets out the co-ordination process and relevant parameters that Ofcom will apply to licensed services that make use of the 3605 to 3689 MHz and 3925 to 4009 MHz spectrum bands.

Fixed Satellite Service (FSS) earth stations, Fixed (wireless) Service Point to Point (FS P-P)¹ and Fixed Wireless Access (FWA)² operate in these spectrum bands.

In applying the co-ordination process Ofcom will:

- identify stations that might be affected by interference from a proposed FWA station where Ofcom predicts that the level of interference will exceed the limits in the agreed co-ordination process;
- initiate a detailed co-ordination process between the FWA licensee and affected FSS earth station licensees;
- write to affected FSS earth station licensees that an FWA licensee has requested detailed co-ordination.
- where undertaken, record co-ordination agreements between the FWA licensee and third parties;
- record all co-ordinated FWA stations in the 3605 to 3689 MHz and 3925 to 4009 MHz spectrum bands, and
- as far as possible, ensure that the spectrum quality of licensed users will not be degraded by undue interference.

¹ In this document, the term; “Point to Point (P-P)” will refer to fixed (wireless) services that have been assigned and individually licensed, by Ofcom. This will be in accordance with Technical Frequency Criteria (TFAC) OfW30 [1].

² FWA can be either Point to Multipoint (P-MP) or P-P (non OfW30 [1]).

This co-ordination process does not replace Ofcom's Technical Frequency Assignment Criteria (TFAC) for assignment of FS P-P systems or the co-ordination between FS P-P systems and FSS earth stations, operating in the band 3600 to 4200 MHz. Details of Ofcom's other licensing and co-ordination requirements for this spectrum band can be found at: <http://www.ofcom.org.uk/radiocomms/ifi/tech/tfacs/> .

Ofcom may from time to time amend the co-ordination process described in this document and the parameters used.

Operators and manufacturers can obtain the latest copy of this document from the Ofcom website. If you do not have access to the internet you can ask for a printed copy to be posted to you from the Ofcom Contact Centre by telephoning 0845 456 3000.

Please see below for full contact details:

Ofcom website: www.ofcom.org.uk

Ofcom Contact Centre
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Tel: 0845 456 3000
Fax: 0845 456 3333
Email: contact@ofcom.org.uk

1. Introduction

This document describes the process used to facilitate the co-ordination of FWA stations with FSS earth stations (space-to-Earth) and FS P-P systems within the UK.

- Section 2 describes how the 3600 to 4200 MHz band is segmented within the UK.
- Section 3 describes how Ofcom will facilitate the co-ordination process.
- Section 4 defines the FWA system technical parameters that will be used in the co-ordination process.
- Section 5 describes the methods and detailed procedures for effecting co-ordination.

The Annex provides diagrams that illustrate the process described in Section 5.

Ofcom will not apply this co-ordination process to apparatus installed and used under a non operational Wireless Telegraphy Act licence³ or to apparatus whose installation and use is exempt from licensing.

³ Details available from
<http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/noperational/>

2. Use of the frequency band 3600 to 4200 MHz

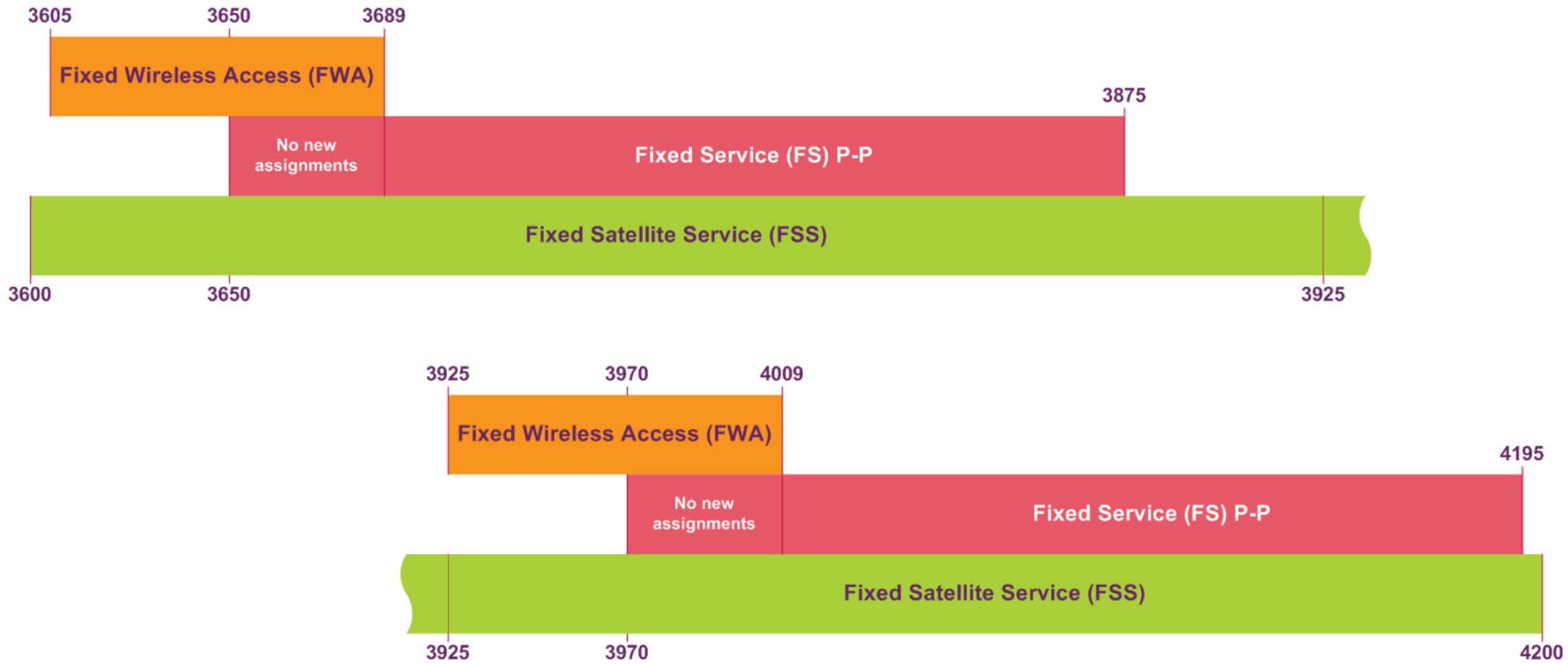
The frequency band 3600 to 4200 MHz is segmented and managed to facilitate FWA as follows:

- The sub-bands 3605 MHz to 3650 MHz and 3925 MHz to 3970 MHz (2 x 45 MHz) will be co-ordinated on a co-primary⁴ basis between the FSS (space to Earth) and FWA stations.
- The sub-bands 3650 MHz to 3689 MHz and 3970 MHz to 4009 MHz (2 x 39 MHz) will be co-ordinated on a co-primary basis between FS P-P systems, FSS (space to Earth) and FWA stations.

Figure 2.1 shows the spectrum allocations between 3600 to 4200 MHz.

⁴ Co-Primary has the meaning described by The International Telecommunication Union (ITU) Radio Regulations, Article 5 (RR5.23 – RR5.36).

Figure 2.1 - UK use of the band 3600 to 4200 MHz (Frequencies in MHz)



3. The Role of Ofcom

3.1 General

Ofcom will facilitate frequency co-ordination in the 3605 to 3689 MHz and 3925 to 4009 MHz spectrum bands by:

- providing guidance and advice to licensees where Ofcom requires co-ordination;
- operating the FWA technical frequency co-ordination tool to assess when FWA stations and FSS earth stations require detailed co-ordination;
- operating the FWA technical frequency co-ordination tool to ensure that the FWA station does not exceed the required FS P-P systems interference criteria, and
- facilitating, on request, detailed co-ordination between parties.

3.2 Application

When Ofcom receives an application for co-ordination of a FWA station it checks the details and enters them into the co-ordination tool.

If the co-ordination tool predicts that a proposed FWA station will cause interference to either FS P-P system(s) or to FSS earth station(s), Ofcom will:

- inform the FWA licensee;
- provide the FWA licensee with an evaluation of the interference calculation;
- if appropriate, recommend that the parties (FWA and FSS earth station operators) enter into detailed co-ordination;
- provide the parties with either (a) typical parameters for the stations concerned or (b) with the consent of the parties, the parameters associated with the actual stations;
- respond to requests for further information that will facilitate co-ordination, and
- reject the FWA application if the tool predicts that a proposed FWA station will cause interference to FS P-P systems that exceeds the technical assignment criteria within OfW30 [1].

3.3 Ofcom's role in the co-ordination process

A party to a co-ordination negotiation may ask Ofcom to facilitate an agreement.

3.4 Mitigation

Ofcom will require that the FWA licensee bears the cost of implementing mitigation in respect of existing FS P-P and FSS stations that Ofcom has recorded. In the case of FSS earth stations, Ofcom will assume that site screening will not provide greater than 20dB of additional mitigation.

4. Methods and procedures for Co-ordination

4.1 Description of FWA Interference

4.1.1 The FWA System

The FWA applicant will supply to Ofcom the technical parameters for each FWA system it wishes to co-ordinate. FWA systems are generally deployed as networks of remote Terminal Stations (TS) that communicate with Central Stations⁵ (CS). A FWA cell is generally defined as a CS (and associated sectored antennas) and all the TSs that it serves. For the purposes of detailed evaluation of interference (for both FSS earth stations and FS P-P systems), the following methods will be used to calculate the potential for interference from a FWA cell.

4.1.2 Description of Interference from Central Stations

The interference from each sector of a FWA CS is calculated on the basis of the maximum e.i.r.p.⁶ spectral density that has been requested. This will take into account the actual antenna height and the radiation pattern envelopes for each sector at the azimuth and elevation directions of the interference path. The calculation of interference takes into account net frequency discrimination where the victim station is part of a FS P-P system.

4.1.3 Description of Interference from Terminal Stations

The unknown distribution of TSs (within each FWA sector) is simulated using an identical, independent and uniform distribution of hypothetical TSs within the FWA cell.

The calculation method is based on the information supplied by the applicant and makes the following assumptions and evaluation considerations:

- only one TS is transmitting in a given sector at any one time;
- each TS antenna is pointed directly towards the CS associated with that sector;
- the interference from each hypothetical TS is calculated on the basis of the maximum e.i.r.p. spectral density, taking into account the azimuth and elevation directions of the interference paths to the FSS earth station or FS P-P station;
- the hypothetical TS within each sector that is calculated to have the greatest interfering signal level into either the FSS earth station or FS P-P is used, and
- takes into account, where specified by the applicant, the time and frequency division (e.g. TDD⁷, FDD⁸) aspects of the FWA radio technology.

⁵ In this document the term “Central Station” is identical to Base or Hub, Station.

⁶ Equivalent isotropic radiated power.

⁷ Time Division Duplex.

⁸ Frequency Division Duplex.

4.2 Earth station Co-ordination

4.2.1 FSS Earth Station Technical parameters

The antenna and equipment parameters for any FSS earth station will depend on many factors across a range of service requirements. These parameters are determined by the FSS earth station operator and the satellite operators' requirements. The FWA co-ordination tool uses the FSS earth station operational and technical parameters, which are held on the Ofcom licensing database.

4.2.2 Evaluation of Interference

The evaluation of interference will use the highest earth station antenna gain at the appropriate elevation angle of the radio horizon in the direction towards the site of the planned FWA station for all registered positions of the earth station antenna pointing to the GSO⁹ arc. The evaluation will use propagation results from Recommendation ITU-R P.452 [2] and will include a multiple entry allowance. Ofcom will generally assume a time percentage availability (due to interference) of 99.95%, for the FSS earth station.

The ITU-R P.452 [2] calculation will use only the clear air part of the model (i.e. no hydrometeor scatter), but ducting may be taken into account. The co-ordination tool will use data on UK terrain heights sampled on a 200m basis. The ITU-R P.452 [2] propagation model allows for the actual topography of the interference path to be taken into account. Ofcom will take into account clutter losses at either or both ends of the path, where the clutter scenario is known.

4.2.4 Bi-lateral Co-ordination

Where Ofcom's assessments indicate that detailed co-ordination is required, Ofcom will notify all affecting and affected parties.

The parties involved in the detailed co-ordination process will need to agree on:

- i. the named officials that represent the parties for the purposes of the agreement;
- ii. the appropriate co-ordination methodology using the following parameters:
 - a) the locations and operating frequencies of the stations;
 - b) the maximum e.i.r.p. spectral density of the relevant FWA stations;
 - c) the percentage of time that interference may be allowed to exceed an agreed threshold, as dictated by the nature and quality of operational service requirements;
 - d) the suitability of using frequency avoidance¹⁰ or mitigation techniques;

⁹ GSO – GeoSynchronous orbit.

¹⁰ Dependant on the required Carrier/Noise ratios, a variety of mitigation techniques are available to operators. Mitigation techniques may include combinations of; e.i.r.p. reduction, frequency band selection, sector omission, site screening, pre co-ordination and active antenna cancellation.

- e) specific earth station parameters such as antenna gain, off axis response, noise temperature;
 - f) where appropriate, the orbital locations of satellites to which the earth station operates and the derived antenna gain in the direction of the interference path;
 - g) additional diffraction losses available to antennas which are imbedded in local ground clutter (buildings, vegetation etc.);
 - h) additional screening requirements or filtering;
- iii. the procedure and contact points for purposes of notification of cases of interference;
 - iv. the need for periodic review; and
 - v. the need or otherwise for periodic monitoring by Ofcom.

Where the parties have agreed co-ordination they must submit their agreement to Ofcom.

4.2.5 Existing and new FSS Satellite Earth Stations

The co-ordination of FWA stations will consider all existing FSS earth stations that Ofcom has recorded. Where Ofcom records a new satellite earth station, it will co-ordinate that FSS earth station against recorded FWA stations. Where the process highlights potential interference issues, Ofcom will notify the FSS earth station operator. In these cases, the FSS earth station operator may start the bi-lateral process detailed under 4.2.4.

4.3 FS P-P system Co-ordination

4.3.1 FS P-P Fixed Technical Criteria

Co-ordination between FWA and FS P-P systems will use the submitted FWA parameters and the FS P-P parameters held on the Ofcom licensing database. The co-ordination between FWA and FS P-P systems will evaluate the theoretical signal levels transmitted by a CS and the hypothetical distributions of TSs into FS P-P systems.

4.3.2 Detailed Evaluation of Interference.

The detailed interference evaluation will use the propagation model specified in ITU-R Recommendation P.452 [2]. The evaluation will use the time percentage availability requirement for the considered FS P-P system. The FS P-P system antenna gains, at the elevation angle of the radio horizon and in the direction of the FWA CS, will be calculated using the co-polar or cross polar radiation pattern provided for the station as appropriate.

The ITU-R P.452 [2] calculation will use only the clear air part of the model (i.e. no hydrometeor scatter), but ducting may be taken into account. The co-ordination tool will use data on UK terrain heights sampled on a 200m basis. The propagation model ITU-R P.452 [2] allows for the actual topography to be taken into account. Where Ofcom has details of the clutter scenario it will take into account clutter losses at either or both ends of the path.

The assessment tool includes tables which detail the permitted Wanted/Unwanted ratio for each combination of equipment as a function of frequency separation. The maximum acceptable level of interference into a FS P-P system will be obtained explicitly from the technical characteristics of each FS P-P station.

The tool will then compare the calculated interference signal level against the limit for the Wanted/Unwanted ratios applicable to the appropriate equipment types operating in the band. This will include a multiple entry allowance as referred to in OfW30 [1]. For further information on OfW30 interested parties should contact fixedwirelesservices@ofcom.org.uk.

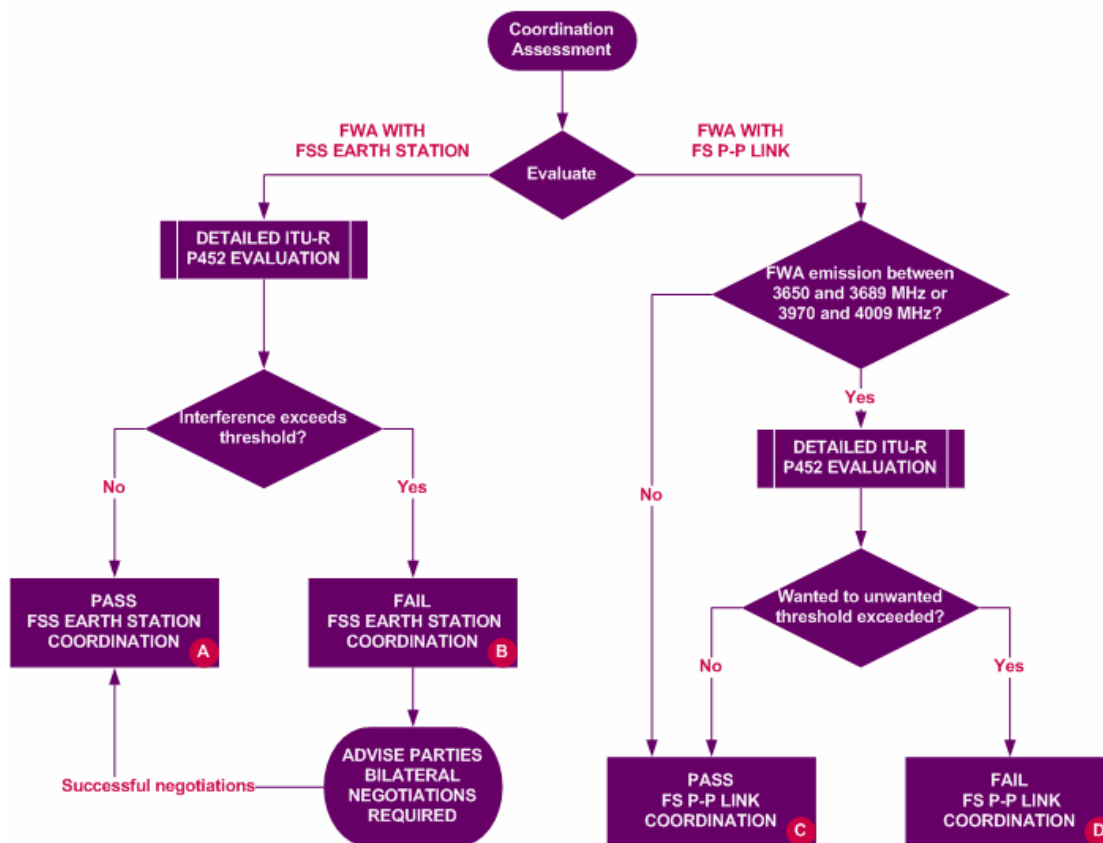
If the calculated interference level is less than the established limit for the individual FS P-P system the proposed FWA system will be considered as successfully co-ordinated against the FS P-P system. Otherwise the FWA applicant will need to re-assess and re-submit the FWA system until co-ordination is achieved.

4.3.4 Existing FS P-P systems

The co-ordination of FWA stations will consider all existing FS P-P systems that Ofcom has recorded. Ofcom is not making any new FS P-P assignments in the spectrum in the band that is currently available to FWA.

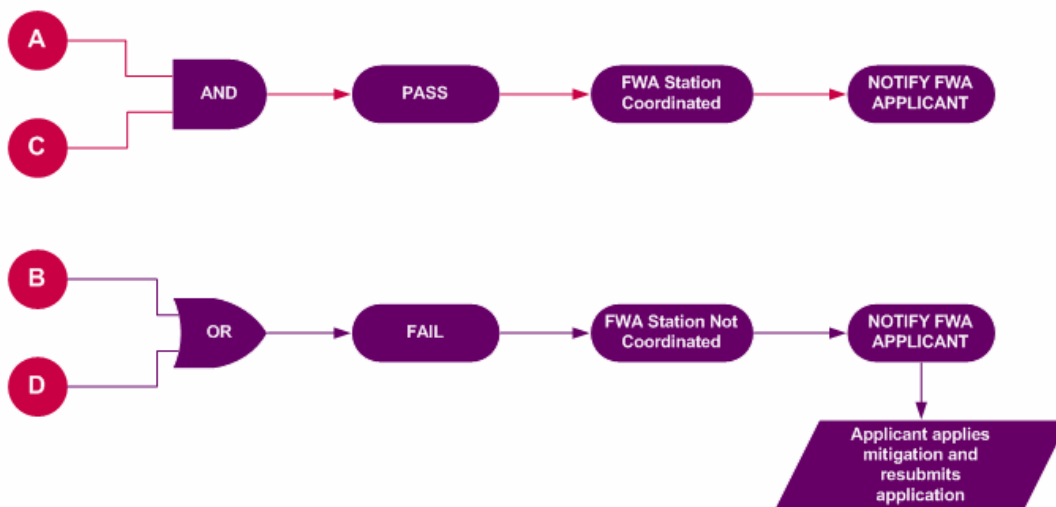
Annex 1

FWA Application Assessment



FWA Applicant Notification

The FWA applicant will be notified of the outcome and provided with a report containing details of the assessment



Document History

Draft	Date	Changes
1.0	August 2004	New format for Ofcom and editorials
1.1	December 2004	Removal of references to POMCO
2.0	January 2008	Complete re-draft
2.1	January 2008	Editorials



Enquiries to;

Tel: 020 7783 4347

Fax: 020 7783 4333

Email: mbt.enquiry@ofcom.org.uk

Website: www.ofcom.org.uk