Annex 6: Draft Digital Radio Technical Code

DRAFT

This document is a draft of Ofcom's Digital Radio Technical Code. It is published now as part of the Broadcast Digital Radio Technical Codes and Guidance Consultation on updates and amendments, to provide information on Ofcom's proposals. Revisions from the current version are highlighted.

Subject to consultation responses which we receive on the content of this draft, after the consultation closes Ofcom hopes to publish a final version of this Digital Radio Technical Code. Given that Ofcom is currently consulting, Ofcom's thinking and final decisions will depend on feedback received under the consultation process. Areas of proposed change to the current Digital Radio Technical Code are highlighted in grey; the final version may differ from this draft.

NB: Until such time as Ofcom announces the implementation of a new Digital Radio Technical Code, the current Digital Radio Technical Code, (located on Ofcom's website) is still in force.

Publication date: Draft for consultation

Contents

Section 1

Introduction

1.1 Radio Multiplex licences (national and local) and the associated WT Act Licences (or relevant parts thereof) issued by Ofcom require adherence to this Digital Radio Technical Code, which incorporates technical requirements common to all licences. Additional technical requirements specific to individual licences are given in Part V of the Annex to national multiplex licences and Part IV of the Annex to local multiplex licences; and in the associated WT Act licences[1].

1.2 A separate document *'Technical Policy Guidance for DAB Multiplex Licensees'* gives guidance on the principles which Ofcom will apply to the application of this Code. That document may change in response to changing market conditions and to further experience gained in the deployment of digital radio multiplexes.

1.3 This Code, and specific requirements within individual licences, are additional to, or specify the applicable options within, the applicable digital radio standards, EN 300 401[i] and TS 102 563[ii], which are published by the European Telecommunications Standards Institute (www.etsi.org). Abbreviations used within this Code are defined within those standards, unless explicitly defined herein.

1.4 [Previous paragraph 1.4 removed]

Other Responsibilities

1.5 The conditions in this Code relate solely to the requirements of Ofcom. Compliance with these requirements does not absolve the licensee from other legal responsibilities outside the interests of Ofcom. These general requirements include but are not limited to the following examples:

1.5.1 compliance with the current Health and Safety at Work Act (including adherence to specification IEC 215 - 'Safety Requirements for Radio Transmitting Equipment');

1.5.2 duties and liabilities imposed by law by virtue of ownership, occupation or use of a building and surrounding land;

1.5.3 securing that operators, and members of the public are not exposed to electromagnetic radiation fields in excess of those recommended by Public Health England. These limits may be found at the HPA's website, at http://www.hpa.org.uk[2];

1.5.4 any requirements which may be applied by Her Majesty's Government in pursuance of EEC directive no. 89/336/EEC as amended by directives 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC concerning

[1] The relevant provisions should in principle be applied respectively as follows: constraints on transmitters and their radiated signals in the WTAct licence, coverage obligations and multiplex management (transport streams, capacity use etc.) in the Broadcasting Act licence. However, for the time being some detailed aspects of transmission constraint are contained within the BAct licence (see Section 2 of this Code). All licensees must adhere to the terms of both licences, which have been drawn up so as to avoid inconsistency

[2] Publication: 1998 ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz): NRPB Advice on Aspects of Implementation in the UK

electromagnetic compatibility, and any subsequent supplementary directives; and

1.5.5 compliance with the general requirements of the 2003 Communications Act which are outside the explicit scope of this licence; particularly in respect of Part 2, Chapter 1 (Electronic Communications Networks and Services).

Section 2

Radiated Signals

Commissioning tests and subsequent modifications

2.1 Tests will need to be carried out by or on behalf of the licensee before it is permitted to transmit to air from any given transmitter. Ofcom will require satisfactory evidence of compliance with this specification, and the particular conditions of the licence, at least four weeks before such permission might be expected to be granted (assuming compliance is achieved). The tests and associated evidence should provide a reasonable confidence level that transmissions will remain compliant after commissioning.

2.2 Ofcom reserves the right to conduct its own tests on-site before giving permission to transmit, or at any time thereafter. If such tests are deemed by Ofcom to be necessary because of inadequacies or ambiguities in the evidence supplied by the licensee, then an additional fee will be payable to Ofcom at its sole discretion.

2.3 No modification or adjustment to the RF characteristics of the transmission system, including aerials, may be carried out without the prior permission of Ofcom. Four weeks' notice of such changes will normally be required.

Inspection and Monitoring

2.4 Ofcom will have access to the transmitter installation from time to time to conduct inspections, and tests thereof, to verify continued compliance with this specification. Ofcom also reserves the right to conduct such other tests as it sees fit, including the remote measurement of the licensees' transmissions, without notifying the licensee. Licensees should ensure that arrangements made with third parties, and the quality and availability of documentation facilitate any of these inspections and tests.

Radiated Signals

2.5 Radiated signals shall comply with the specification ETS 300 401. Options within clauses 14 and 15 of the specification should be applied as detailed below.

2.5.1 Transmission Mode:

- National multiplex (VHF Band III) - Mode I
- Local multiplex (VHF Band III) - Mode I or Mode II.

2.5.2 Transmitter Identification Information (TII). Use of these codes is optional, but if transmitted at all, they must be both accurate and appropriate, within the provisions of ETS 300 401.

2.5.3 Spectrum Mask. Unless specifically permitted otherwise in the licence, the radiated output of all national and local transmitters, measured downstream of all combining and filtering equipment, must comply with the 'Critical' mask as specified in Clause 15 of ETS 300 401, intended to ensure compatibility with adjacent channels. This requires that at frequencies (f_r) relative to the centre carrier frequency (f_c) emissions should not exceed:

f_r (MHz)	Level (dBc)
$f_c \pm 0.97$	-45
$f_c - 1.75 < f_r < f_c - 0.97$ $f_c + 0.97 < f_r < f_c + 1.75$	$-[45 + \{35(f_r - 0.97)/0.78\}]$
$f_c - 3 < f_r < f_c - 1.75$ $f_c + 1.75 < f_r < f_c + 3$	-80
$f_r < f_c - 3$ $f_r > f_c + 3$	Spurious emissions as detailed in ETS 302 077-2

Demonstration of compliance will require use of a capable spectrum analyser with appropriate input filtering, resolution bandwidth and averaging. It may be necessary for adjacent channel transmitters combining onto the same antenna, to be switched off during the relevant part of these tests.

Where Very Low Power Repeaters are being used, these are permitted to radiate from (and including) Block 10B (211.648 MHz) to Block 12D (229.072 MHz). These devices will be required to meet the 'critical mask' as defined above, out to 3MHz below block 10B f_c and 3 MHz above 12D f_c. For spurious emissions outside of those two limits, EN 302 077-2 will again apply. These devices and associated antennas are not to be capable of radiating an ERP of more than 10mW, and will be required to employ both input and output filtering to ensure adherence to spurious emission limits, even under conditions of instability.

2.5.4 Frequency Accuracy. The centre carrier (which may be nulled) must be within 1 kHz of the assigned frequency. In practice, the operator will seek to achieve far greater accuracies than this, to ensure the integrity of any multiplex using more than one transmitter.

2.5.5 Timing. Offsets may be determined by the licensee and subject to adjustment as required to optimise coverage to the licensee's requirements consistent with, or better than, its originally proposed Technical Plan. Ofcom requires to be informed of timing offsets once the network has stabilised.

2.6 Other requirements in respect of the radiated signals are that:

2.6.1 an absolute limit of radiated power from any one transmitter should be respected, of not more than -50 dBm in a 50 kHz band centred on 243 MHz[3];

2.6.2 vertical polarisation only shall be employed; and

[3] Required for protection of the international Aircraft Emergency frequency

2.6.3 specific out-of-band requirements relating to the protection of other services may be applied if necessary, and will be notified in the Licence.

Transmitter Equipment – general

2.7 Multiplex licensees are advised to take reasonable precautions against the inadvertent adjustment of transmissions by unauthorised persons.

2.8 The transmitter must incorporate a suitable meter indicating, or uniquely related to, the RF output power. Also, a forward/reverse monitor point and associated calibration data must be provided, presented as fixed coaxial connectors (50 ohm), fed via suitable directional coupling mechanisms from the transmitter RF output, downstream of all combining and filtering equipment. These provisions are to facilitate regulatory checks respectively of output power and spectral content without, if possible, interrupting the multiplex service. Nevertheless, Ofcom reserves the right to take any transmitter out of service at 15 minutes' notice and without compensation to inspect any aspect of the equipment's set up and operation, for which the licensee must provide reasonable assistance as required.

Feeder Arrangements and Performance

2.9 Provision should be made for any transmitter which is in or may be switched into the transmission chain, to be fed into a dummy load provided by the licensee, to facilitate testing without the transmitter being on-air. The transmitting aerial must be matched to the characteristic impedance of its RF feeder cable to provide a reflected power of no more than -16dBc. The reflected power presented to the transmitter RF output, or to the combiner output in the case of multiple transmitters, must not be greater than -14dBc. These performances must be achieved over a bandwidth of at least 1.5MHz at all of the relevant frequencies. (The requirements for feeder performance are to ensure that a useful correlation will exist between measurements taken of transmitters when they are, and are not radiating).

Section 3

Multiplex Technical Management

General principles

3.1 The effects of the multiplexer's handling and referencing of services carried within the multiplex must be in accordance with ETS 300 401, accurate, effective and (particularly between sound programme services) non-discriminatory.

3.2 Information relating to individual services should reflect the preferences and interests of the service provider concerned, including those with reserved capacity, provided that this does not unreasonably impinge on the interests of other services on this (or other) multiplex(es).

Technical Quality: channel capacity

3.3 The attribution of channel capacity to individual programme services on the multiplex must be consistent with the provision of generally high standards of technical quality across the audio services carried by the multiplex, taken as a whole.

3.4 [Previous paragraphs 3.3 – 3.5 amended or removed]

3.5 Ofcom regards the basic quality of audio as originated and supplied to the multiplex operator as being a matter for the sound programme service licensee to control and agree with the multiplex operator.

3.6 Audio quality should generally be of a standard consistent with reasonable expectations for the majority of listeners, taking into account the nature of the content and the sound programme service concerned. Factors relevant to expectations may include the target audience, and the quality with which the service concerned may be delivered on other platforms.

3.7 The licensee shall broadcast sound programme services whose principal packaging characteristics[4] are as recorded in the technical annex to the multiplex licence.

Audio encoding

3.8 Audio encoding shall conform to the MPEG Layer II model as described in ISO/IEC 11172-3[iii], ISO/IEC 13818-3[iv] and EN 300 401.

3.9 Where prior written consent has been obtained from Ofcom, alternative audio encoding may be adopted that conforms to the subset of the MPEG-4 High Efficiency Advanced Audio Coding v2 (HE AAC v2) Layer 2 profile described in ISO/IEC 14496-3[v] and TS 102 563.

Supplementary signalling

3.10 Transmission of the Traffic Programme (TP) flag by sound broadcast services is not permitted unless dynamic control of the Traffic Announcement (TA) flag is available and in current use.

[4] For the purposes of this clause, technical packaging characteristics means the parameters ‘stereo or mono’ and ‘full or half rate coding’.

Relationship between multiplex elements

3.11 The interruption of services on a multiplex in order to carry announcements should only be by agreement with the programme service provider concerned.

3.12 A complete set of MCI information should be transmitted at least ten times per second (this may be halved in the six seconds preceding a reconfiguration of the multiplex).

3.13 An adequate repetition rate should be maintained for Service Information (SI) carried within the FIC.

3.14 If data services are carried in the FIDC, any overflow in the FIC should be addressed by use of the Auxiliary Information Channel facility to carry those services.

3.15 Adequate and agreed information exchange and synchronisation should be provided between service providers and the multiplex licensee, particularly in the context of multiplex reconfiguration.

Section 4

Relationship of data services to bearer conduits

4.1 Under the ETS 300 401 specification, data services may be sent in any of the following conduits within a digital radio multiplex:

a) a sub-channel dedicated to data; or

b) X-PAD within an audio channel; or

c) the FIDC.

Although it is possible to convey more than one data service within any one channel of any of the above types, Ofcom requires that each data service carried on the multiplex is set out in the annex to the licence as being in one and only one of the following categories:

4.1.1 an ancillary service (data related to a digital sound programme service and provided by the relevant digital sound programme service licensee) or an additional service (data related to a digital sound programme service, but not provided by the relevant digital sound programme service licensee); or

4.1.2 an additional service carrying programme-related or stand-alone advertising material; or

4.1.3 an additional service (general telecommunications - not carrying advertising material); or

4.1.4 a technical service (for encryption of sound programme services).

For the purpose of enforcing its licence conditions limiting the proportion of multiplex capacity attributable to additional services each identifiable individual data channel formed by any of the means (a) to (c) above must carry data which is entirely composed of the above-defined types as described in 4.1.1 to 4.1.4.

However, it will be permitted to carry within a single identifiable data channel, a combination of data types as described in 4.1.1 and 4.1.2, provided that the multiplex licensee is able to provide a reasonably reliable analysis of the proportion of capacity within that data channel which is used respectively for the two types. It may not be necessary to measure the relative usage directly if the analysis is based on a well-founded derivation. If data types as described in 4.1.1 and 4.1.2 are to be mixed in this way, the method of analysis must be proposed to and agreed by Ofcom beforehand.

Multiplex and Service Features

4.2 The following table summarises the conditions/requirements applied by Ofcom in respect of particular features defined in ETS 300 401. The 'Reference' column denotes whether the detail is specific to a given licence, and therefore defined therein, or defined in this Code. Inclusion of relevant Codes in the licence will in most cases be for the purpose of ensuring compatibility with other multiplexes and

services, but it is intended also to enable Ofcom to provide a centralised and accurate source of reference for outside agencies, and particularly for receiver manufacturers testing new designs.

4.3 In order to ensure compatibility between commercial and BBC multiplexes and services, where applicable, allotments of available codes have been agreed between Ofcom and the BBC.

Feature	Reference	Comments
Ensemble Identifier	Licence	Unique for each multiplex. Allocated by Ofcom from the range: (Hex) "C (0-F) (8-F) (0-F)"
Ensemble Label	Licence	Unique for each multiplex. Proposed by the licensee, approved and registered by Ofcom
Country Codes	Code	Country Code for UK is (Hex) "C" Extended Country Code is (Hex) "E 1"
Time and Date	Code	Not compulsory, but must be accurate if provided
Regional Definitions and Labels	Licence	If used, to be proposed by the licensee, and approved and registered by Ofcom, at least until the desirability of standardisation across multiplexes has been further studied
TII (MainId and SubId) Main from range 00-45 Hex Sub from range 01-17 Hex	Licence	Not required, but if implemented, to be advised (by transmitter) by the licensee, and registered by Ofcom[5]. Licensees are required to ensure that where SubIds are intended to be re-used geographically, respective transmitters' outputs do not interfere with each other. Ofcom may apply constraints to ensure that SubIds are compatible with other co-frequency multiplexes
Timing Offset	Licence	To be determined by the licensee and notified, for each transmitter, to Ofcom
Service Identifier (Audio)	Licence	Unique code for each service, regardless of multiplex. Allocated by Ofcom from the same range as available for RDS PI Codes, ie: (Hex) "C (0-F) (8-F) (0-F)" To date RDS PI Codes have been confined to the range (8-B) in the third digit and the intention is to allocate Sids from the remainder, ie (C-F) in the third digit. Where, however, a service is simulcast on both VHF and DAB or DAB+, with no opt-outs, the existing PI Code may be used as the SId also. Alternatively different codes can be used and connected via a suitable 'linkage' mechanism
Service Identifier (Data)	Licence	Unique code for each service, allocated from the range: (Hex) "E 1 C (0-F) (0-F) (0-F) (8-F) (0-F)" It may prove useful to use one of the digits (probably the last) as a means of qualifying data type.
Service Label	Licence	Similar to RDS PS Name. Unique to each service. Proposed by the licensee, approved and registered by Ofcom
Linkage Set Number	Licence	These are to come from the range (Hex) "(1-F) (8-F) (0-F)" One LSN may apply to services across different multiplexes therefore until compatibility issues are fully assessed, codes will be controlled and issued by Ofcom in liaison, where applicable, with the BBC
Static PTy, Dynamic PTy, and Pnum	Code	No requirement or prohibition, but if provided it must be effective in operation, accurate, and non-discriminatory, and subject to these conditions, it should reflect the preferences/advice of the programme service provider (including simulcasters). Static PTy should be provided if dynamic PTy is not. The presence of PTy should be flagged according to whether static or dynamic.
Minimum Protection Level	Licence	Minimum levels, where required, will be detailed for each service

[5] Ofcom will allocate each transmitter a TII so as to provide some future proofing should use of TII become necessary. Licensees should advise Ofcom when the TII is brought into use.

4.4 Service following should be implemented in accordance with ETSI TS 103 176v.1.1.2 (2012 – 08).This specification allows hard-linking at times when stations are broadcasting identical content. This specification also allows soft-linking for 'related' services.

4.5 Ofcom has determined the definition of ‘related’ services as follows: soft-linking will be allowed only for stations which are also using hard-linking for a significant amount of time on a daily basis and then only at times when such stations are broadcasting separate local programming (or advertising). In all other cases, soft-linking is not permitted.

4.6 This rule applies between and within platforms (e.g. DAB to DAB, DAB to FM).

4.7 Linkage, whether 'hard' or 'soft' for handover to analogue services (and similar vectoring arrangements for announcements), is neither required nor prohibited, save that simulcast services in particular must have an adequate capacity and execution given within the FIC to provide for reasonably effective handover of listeners to equivalent analogue services, to the extent that the simulcast operators concerned require it.

Section 5

[Previous Section 5 – *Other provisions: General* has been removed.]

References

[i] ETSI EN 300 401 Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers

[ii] ETSI TS 102 563 Digital Audio Broadcasting; Transport of Advanced Audio Coding (AAC) audio

[iii] ISO/IEC 11172-3 Information Technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s – Part 3: Audio

[iv] ISO/IEC 13818-3 Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems

[v] ISO/IEC 14496-3: Information technology – Coding of audio-visual objects – Part 3: Audio