UGANDA COMMUNICATIONS COMMISSION

THE DRAFT DIGITAL AUDIO BROADCASTING TECHNICAL CODE

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1. BACKGROUND

1.1 Over the years, radio broadcasting in Uganda has largely been provided using analogue systems over the FM band. Due to the limitations of the band and the technology, the provision of radio broadcasting services was hindered. The Eureka 147 project, funded by the European Commission, commenced the development of a system to relay audio and data to fixed, portable, or mobile receivers.

1.2 This led to the birth of Digital Audio Broadcasting (DAB) technology. The technology was first standardized as ETS 300 401 at ETSI in 1995. The subsequent DAB standard updates have been supported by WordDAB Forum. The recent version was published at ETSI in January 2017 as EN300 401 V2.1.1.

1.3 The DAB technology allows the aggregation of several radio channels into a single transport stream that is decoded at the receiver. Alongside the radio channels, a host of other services and applications can be carried, such as traffic data, advertorial information such as logos, program information, text messages, and mobile video, among others.

1.4 Uganda piloted DAB in 2023. This aroused the industry interest and generated a need for the next course of action.

1.5 Section 5(1)(i) of the Uganda Communications Act Cap 103 (the Act) mandates the Uganda Communications Commission (the Commission) to set national standards and ensure compliance with national and international standards and obligations laid down by international communication agreements and treaties to which Uganda is a party.

1.6 Further, Section 5(1)(m) of the Act mandates the Commission to improve communications services generally and to ensure equitable distribution of services throughout the country.

1.7 The Commission is thus desirous to establish technical standards that are necessary for the rollout of a DAB network.

2. OBJECTIVE

2.1 The objective of this standard is to:

a) Enable conformity of all DAB networks to the same technical standards and specifications.

b) Enable the provision of a quality, safe, and reliable DAB network that is satisfactory to consumers.

c) Foster and promote a faster DAB rollout.

3. AMENDMENT

This standard shall be amended periodically to ensure continued relevance with developments in the industry and emerging best practices.

4. INTERPRETATIONS

4.1 In this document, unless the context otherwise requires –

a) **"*DAB signal*"** means DAB or DAB+ transmitted radio frequency signal.

b) **"Symbol"** is the unit of data transmitted during a certain duration.

c) **"*Guard Interval*"** is a cyclic prolongation of the period in which useful information can be extracted from symbols that are delayed.

d) **"*MCOFDM system*"** means a low-power transmitter system that generates more than one OFDM block with an overall RF system filter spanning all blocks.

e) **"*Ensemble*"** means the transmitted DAB signal, comprising a set of regularly and closely-spaced orthogonal carriers. In general, it contains programme and data services.

f) **"*Ensemble Identifier*"** means a unique 16-bit code, allocated to an ensemble, and intended to allow unambiguous world-wide identification of that ensemble**.**

g) **"*Multiplex Operator*"** means a licensee authorised to aggregate content or streams from multiple content service providers.

h) ***"Fast Information Channel (FIC)":*** part of the transmission frame, comprising the Fast Information Blocks, which contains the multiplex configuration information together with optional service Information and data service components.

i) "***Extended Programme Associated Data (X-PAD)":*** extended part of the PAD carried towards the end of the DAB audio frame, immediately before the Scale Factor Cyclic Redundancy Check (CRC).

j) ***"Program Associated Data (PAD)"*** is information which is related to the audio data in terms of contents and synchronization.

k) "***Out of Band Emissions***" refers to emissions on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process but excludes spurious emissions.

l) "***Frequency Stability"*** refers to the variation of frequency against a predetermined time scale.

5. APPLICABLE LEGAL FRAMEWORK

The following legal and regulatory provisions shall be considered in the implementation of this standard:

a) The Uganda Communications Act Cap 103

b) The Uganda Communications (Equipment Type Approval) Regulations, 2019 (as amended).

6. SCOPE

This code prescribes the multiplexing algorithms, channel coding, modulation, error protection techniques, system configuration, and the nominal characteristics of the emitted DAB signal. The aspects related to the receiver design are not considered in this document.

7. APPLICABILITY AND EXCEPTIONS

The code applies to all potential DAB networks in Uganda. However, it is inapplicable to any other digital sound broadcasting technology that may be used to deliver sound broadcasts in Uganda.

1. The DAB Standard

<table>
<tr><th>Parameter</th><th>Standard</th></tr>
<tr><td colspan="2">DAB Radiated Signal</td></tr>
<tr><td>a) Transmission Mode</td><td>All DAB transmission networks shall adopt the transmission mode in the table below in accordance with EN 300 401 V2.1.1

<table>
<tr><th>Typical Use</th><th>Mode 1
Terrestrial VHF</th></tr>
<tr><td>Number of Carriers</td><td>1536</td></tr>
<tr><td>Carrier Spacing (kHz)</td><td>1</td></tr>
<tr><td>Useful Symbol Duration (µs)</td><td>1000</td></tr>
<tr><td>Guard Interval (µs)</td><td>246</td></tr>
<tr><td>Total Symbol Duration (µs)</td><td>1246</td></tr>
</table>
</td></tr>
<tr><td>b) Spectrum Mask (Out of Band Emission)</td><td>DAB transmission signal shall adopt Critical Case 1 emission mask as described in EN 302 077 V2.1.1.</td></tr>
<tr><td>c) Frequency Stability</td><td>The centre frequency of the RF channel shall not deviate more than 10% of the relevant carrier spacing from its nominal value. In transmission mode I, the limit is 100 Hz.

The stability of the centre frequency shall not deviate more than 1% of the relevant carrier spacing from its nominal value within a three-month period when measured under identical operating conditions at the start and at the end of the period. In transmission mode I, the limit is 10 Hz.

EN 302 077 V2.1.1.</td></tr>
<tr><td colspan="2">Transmitter Equipment</td></tr>
</table>

a) Output Power Accuracy	The output power of the DAB transmitter shall be within -0.5dB of the rated output power under normal operating conditions defined by the manufacturer. **N.B.** For MCOFDM systems, the rated output power is the conducted power of the highest-powered OFDM block within the MCOFDM group as defined in EN 302 077 V2.1.1
b) Electromagnetic Fields Emission (EMF)	All DAB transmitters shall conform to international guidelines on electromagnetic emissions (EMF) issued by the International Commission on Non – Ionizing Radiation Protection (ICNIRP)[1] to ensure the protection of the public.
c) Channel Coding	The channel coding shall be Equal Error Protection Level 3A (EEP – 3A) as defined by EN 300 401 V2.1.1. **N.B**. The Commission shall not accept an error protection level less than EEP -3A.
d) Audio Coding	The audio coding shall be MPEG-4 (High Efficiency Advanced Audio Coding v2 – HEAACv2) as defined by TS 102 563.
Multiplex and Service Features	
a) **Ensemble identifier**	The Ensemble shall in accordance with EN 300 401 V2.1.1 have a Unique identifier for each multiplex assigned by the Commission in the Broadcast License.
b) **Ensemble Label**	Each Ensemble shall in accordance with EN 300 401 V2.1.1, have a Unique label for each multiplex. This shall be proposed by the licensee, approved and registered by the Commission in the Broadcast License.
c) **Country Codes**	**Optional** Country codes may be implemented in accordance with ETSI TS 101 756.

[1] https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf

	Country Code for Uganda is (Hex) “4” Extended Country Code is (Hex) “D2”
d) **Time and Date**	**Optional** The time and date may be provided. Must be accurate if provided in line with EN 300 401 V2.1.1
e) **Timing Offset**	To be determined by the licensee and notified to the Commission for each transmitter. EN 300 401 V2.1.1
f) **Transmitter Identification Information (MainId and SubId)**	**Optional** The TII may be implemented in line with EN 300 401 V2.1.1. If implemented, the licensee must notify the Commission for registration for each transmitter
g) **Service Identifier**	The Commission shall allocate a Unique code for each service, regardless of the multiplex in accordance with EN 300 401 V2.1.1.
h) **Service Label**	Each service shall have a unique label similar to the RDS PS (station) name in line with EN 300 401 V2.1.1. It shall be proposed by the licensee, approved and registered by the Commission.
i) **Static PTy, Dynamic PTy, and Pnum**	Not a mandatory requirement or a 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 simulcasts). Static PTy should be provided if dynamic PTy is not. The presence of PTy should be flagged according to whether static or dynamic in accordance with EN 300 401 V2.1.1.

8. Data Services and Features

8.1 Data services may be carried in the DAB ensemble in three (03) ways in accordance with EN 300 401 V2.1.1 i.e.

a) A sub-channel dedicated to data or,
b) Extended Program Associated Data (X-PAD) within an audio channel or,
c) The Fast Information Data Channel (FIDC).

8.2 For purposes of maintaining sufficient multiplex capacity, the p roportion of multiplex capacity dedicated to data services shall only constitute;

a) An ancillary service (data service related to the audio service and provided by the respective broadcast licensee or the multiplex operator), or,
b) An additional service carrying program-related or standalone advertising material, or,
c) An additional service (general telecommunications – not carrying advertising material), or
d) A technical service (for encryption of sound program services).

9. Service Information (SI)

9.1 The configuration of service information has been defined in TS 103 176 to provide for reliable and consistent experience to digital radio listeners. The standard prescribes how the Fast Information Channel (FIC) signaling is used and how receivers will interpret and behave in response to receiving the FIC signaling.

9.2 Service information in the DAB ensemble is carried in the FIC as a series of First Information Groups (FIGs) carried in First Information Blocks (FIBs). The different FIGs are used for different purposes and may need to be repeated during transmission or multiplexer reconfiguration.

9.3 Accordingly, the nominal repetition rate of the different FIGs shall be in conformance with TS 102 176.

9.4 As a rule of thumb, depending on the number of services carried in the ensemble, the nominal repetition rates should never fall below one-third of the rates specified in TS 102 176 and EN 300 401.

10. Announcement Switching

10.1 Announcement switching is used to trigger a specific announcement in a radio service, such as traffic updates. Announcement switching is carried in the Fast Information Channel (FIC) of the DAB ensemble.

10.2 Accordingly, where announcement switching is implemented, the interruption period of a user's chosen program shall not be longer than the announcement period. The interruption of services shall be agreed upon between the multiplex operator and the program service provider.

11. Service Following

11.1 Service following enables maintenance of the same audio or data content selected by the receiver despite varying reception conditions. It is defined in ETSI TS 103 176.

11.2 The selected content may be carried on an ensemble with multiple tuning frequencies, on more than one ensemble, may carry common programming with other DAB services, and, for audio services, also may be carried on FM-RDS or another bearer.

11.3 The multiplex operator shall minimize the timing differences between the different bearers for a better listener experience.

11.4 Service linkage for handover to FM-RDS is neither required nor prohibited in this standard.

12. Inspection and Monitoring

The Commission shall have access to the operations of a licensee from time to time to conduct inspections and verify conformance with this standard. The Commission may also conduct remote measurements on the transmitted signal without notification to the licensee.

13. Stakeholder Responsibility

13.1. The Commission

The Commission shall be responsible for

a) Regularly review and update the provisions of this guide to ensure its continued relevance and effectiveness;

b) Ensure smooth implementation of these guidelines.

13.2. The Broadcaster

Acquaint themselves with the other relevant laws, the Commission regulations, and regulatory frameworks and guidelines that relate to broadcasting services as a whole in Uganda.

13. Enforcement and Remedial Measures

14.1. Any DAB operator who fails to comply with the requirements and obligations contained herein after the Commission has notified such failures or non-compliance shall be deemed to have contravened the Uganda Communications Act 2013, and the Regulation issued thereunder;

14.2. Considering the risk of harmful interference to licensed operations as well as to human health and safety, the Commission may require that the authorized person under this guide cease all operations as soon as these risks are made known to the Commission;

14.3. Remedial action by the Commission in respect of such contravention may include:

a) Issuance of a written warning with a deadline for compliance by the respective operator;

b) Imposing a fine or any other measure, as deemed appropriate in the circumstances.