CEPT ECC
Electronic Communications Committee

ECC Report 230

Harmonisation Possibilities for Assistive Listening Devices in the Band 174-216 MHz

Approved May 2015

0 EXECUTIVE SUMMARY

This Report focusses on analogue FM modulated ALD systems with a 100% duty cycle and a bandwidth of ≤50 kHz (dominantly 25 kHz) and an effective radiated power (e.r.p.) of max. 10mW.

Assistive Listening Devices systems transmit the acoustic signal from the sound source (e.g. a teacher, loudspeaker or pupils talking) directly to a hearing impaired person.

It is not expected that these ALD systems will become digital in the foreseeable future due to the lack of the capture ratio provided by FM systems which allows closer frequency re-use, e.g. needed in a school with a multiple class room equipped environment. There is also the challenge of the latency present in digital systems and potentially less efficient frequency re-use.

This Report investigates the possible use of the 174-216 MHz band as a tuning range by ALD, primarily in schools and educational establishments, to relieve the current congestion issues in the frequency band 173.35 MHz to 175.05 MHz and has concluded that use of unused channels in this band is possible on a license exempt basis.

All ALD and wireless microphones in the terrestrial broadcast band III use the ETSI harmonised standard EN 300 442 [4].

ALD equipment including the most typically usage scenario in schools is described in section 2 of this Report.

The frequency band 174-216 MHz is also used by PMSE applications. In this context it is important to note that PMSE applications use higher emission levels than ALD applications (typically 50 mW e.r.p.) in the band 174-216 MHz, i.e. PMSE applications tend to interfere to ALD applications before ALD applications start to interference to PMSE applications. Both, PMSE and ALD applications use analogue FM and the FM capture ratio actually fosters a better frequency re-use.

In addition to the FM capture ratio, it can be assumed that ALD applications and PMSE applications are typically not used at the same location. If they are, exceptionally, then this can be handled locally, e.g. by a school frequency plan. If PMSE applications are individually authorised, it also means that the ALD applications has to move in frequency to ensure co-existence.

The ALD system operating distances could be observed during the measurements carried out for different type of ALD devices. The ALD communications are more or less limited to the building where these systems are used (including the very close surroundings), and not noticeable under normal circumstances in neighbouring buildings or sites some tenth of meters away.

Only few interference cases have been reported by administrations in response to a questionnaire (see section 8 of this Report)

ALD is an SRD application which cannot claim for protection and which shall not interfere any incumbent application operating in this frequency band. In case of changes in the DAB channel usage, ALD applications need to move onto other free frequency channels. In this regard, ALD applications will benefit from wide tuning range capabilities. DAB channel usage may be for example available on the internet.

ALD usage under general authorisation is possible if a form of testing, e.g. a site survey in order to identify all emission to be protected) is applied which can be decided by the National Administration. It is also proposed to include this example test procedure within the ETSI harmonised European Standard EN 300 422 [4] in an informative annex (see example in section 5 of this Report).

Measurement campaign results concluded that an ALD device should operate under all circumstances at least 300 kHz away from the channel edge of an occupied DAB channel.

In addition, some ALD immunity measurements were conducted. The result was that ALD systems require a S/(I+N) of about 40 dB.

This Report also shows the possibility of an automatic DAB signal detection based on a fixed threshold which can be introduced within the ETSI Standard EN 300 422 [4] as a possible mitigation approach. The value of this threshold, subject to the DAB signal strength measurements taken around the ALD operating site, should be 35 dBµV/m to ensure the protection of a DAB receiver located at 1.5 m from the ALD device.

Finally, it is proposed to define a regulatory framework based on a new entry in ERC/REC 70-03 [3] Annex 10, see section 10.

Compatibility reports are included in ANNEX 1 and ANNEX 2 of this report which contains further detailed information.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Abbreviation	Explanation
ALD	Assistive Listing Device
CEPT	European Conference of Postal and Telecommunications Administrations
DAB	Digital audio Broadcasting
DVB-T	Digital Video Broadcast - Terrestrial
ECC	Electronic Communications Committee
EHIMA	European Hearing Instrument Manufacturers Association
e.r.p.	Effective radiated power
ETSI	European Telecommunication Standardisation Institute
FM	Frequency Management
GTEM	Gigahertz Transversal Electromagnetic Mode
ITU	International Telecom Standardisation Union
LTE	Long Term Evolution
NRA	National Regulatory Authority
PMR	Private Mobile Radio
PMSE	Programme Making and Special Events
SRD/MG	Short Range Devices Maintenance Group
TRS	Telecoil Replacement Service
UHF	Ultra High Frequency
VHF	Very High Frequency
WG FM	Working Group Frequency Management

1 INTRODUCTION

The band 174-230 MHz (also known as Band III) was allocated to analogue TV using 405 line television throughout Region 1, this migrated to 625 line TV and DAB in sub-bands 2 and 3.

In May and June 2006 the ITU held a planning conference in order to enable the implementation of digital radio (DAB) and television (DVB). This considered:

- VHF Band III spectrum (174-230 MHz);
- UHF Bands IV & V (470-865 MHz);
- Across all of Europe, Africa, the Middle East and western Asia.

The ITU considers Bands III, to be primary a broadcasting band although the UK has so called co- primary use for private mobile radio (PMR) services in Band III.

All other services are considered to be secondary. These include:

- Programme making & special event (PMSE) services;
- Short range devices (SRD) including wireless microphones and assistive listening devices (ALD).

1.1 BAND III 174-230MHz

Wireless microphones have used the band 174-230 MHz on a geographically restricted, tuning range basis since the 1960s. This has been reduced later on to 174-216 MHz. Annex 10 of ECC/REC 70-03 states that some countries may allow radio microphones and aids for the hearing impaired to operate in parts of this band with maximum transmitter power of 10 mW e.r.p.. Talk-back systems currently use ALD style equipment for program production in this band.

1.2 ALD REGULATION

The current ERC/REC 70-03 includes an entry for ALD and PMSE applications to be authorised to operate within 174-216 MHz under the following conditions:

	Frequency Band	Power / Magnetic Field	Spectrum access and mitigation requirements	Channel spacing	ECC/ERC Delieverable	Notes
d	174-216 MHz	50 mW e.r.p.	No requirement	No spacing	ERC Report 42[5]	On a tuning range basis. Individual licence required

Frequency Issues

Sub-band d)
Some countries may allow radio microphones and aids for the hearing impaired to operate in parts of this band with maximum transmitter power of 10 mW e.r.p. and without individual licence. Detailed information can be obtained from national administrations.

It should be noted that band d) already appears in both radio microphones and aids for the hearing impaired.

1.3 ALD SPECTRUM ISSUES

Currently 173.35 to 175.05 MHz is used for ALD in many CEPT countries, where DAB block 5A is planned to be used. ALD will probably lose use of spectrum above 173.95 MHz and this reduces access to some 22 channels out of a previous 35.

Compatibility reports included in ANNEX 1: and ANNEX 2: of this Report provide further information.

The current situation of the ALD and hearing issues is included in ETSI TR 102-791 [1].

1.4 TECHNICAL CHARACTERISTICS

Technical characteristics and functionalities of ALD systems are similar to wireless microphones, both are specified in ETSI harmonised European Standard EN 300 422 [4]. The only differences are that ALD systems have reduced power (≤10mW e.r.p. rather than 50mW) and reduced bandwidth (≤50 KHz (typically 25 kHz) as opposed to 200 kHz for radio microphones).

2 ALD

This Report focusses on ALD systems with the following features:

1. FM systems with a 100% duty cycle and a bandwidth of ≤50 kHz (dominantly 25 kHz) and an effective radiated power (e.r.p.) of 10mW.

2. Figure 1 illustrates the spectrum mask for which each ALD system which operates within 174-216 MHz shall comply. The -90 dBc point shall be ±1 MHz from fc measured with an average detector.

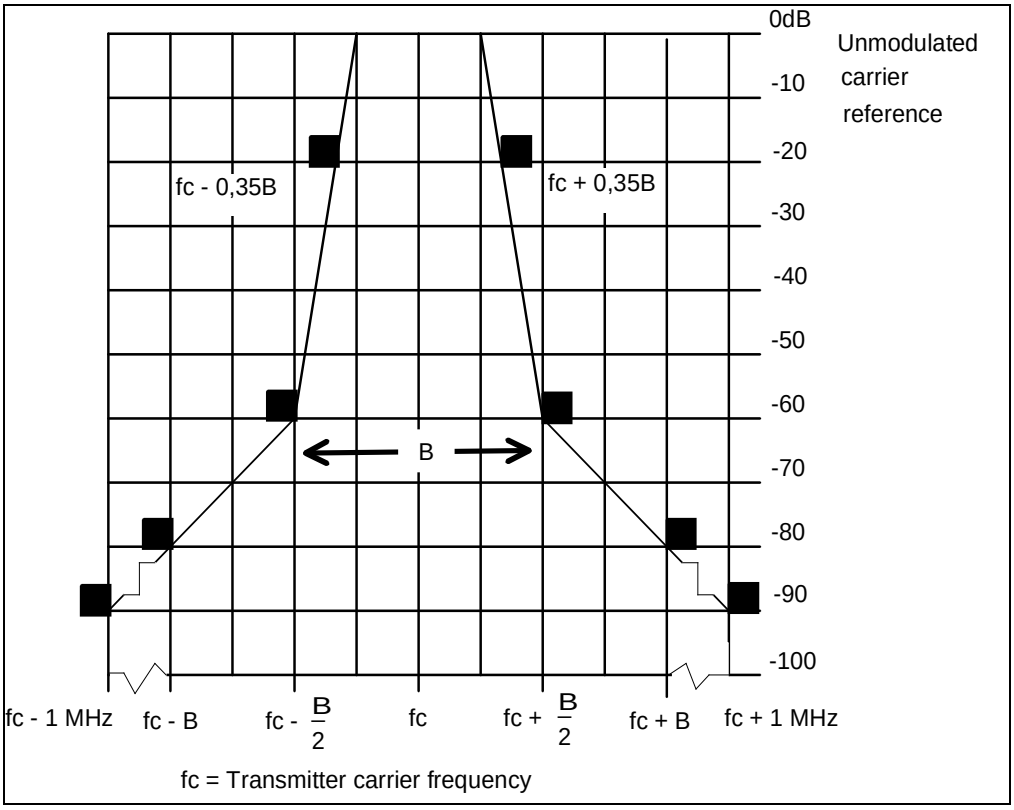

Figure 1: Spectrum mask for analogue systems in all bands

3. These systems consist of:

- A multi-frequency FM transmitter (body worn or handheld equipment) with direct channel synchronisation, entirely new multi-talker network possibility for team teaching environments or a Bluetooth connection to a mobile phone;
- A miniaturised multi-frequency receiver with flexible channel management. The receiver can be directly connected to the hearing aid or via a unit containing the receiver normally on the chest, which communicates with the hearing aid via an inductive loop worn around the neck;
- In the school environment a third component can be added to an FM System - an automatic channel synchroniser mounted on the wall of a room for all students entering that room;
- The biggest ALD installation reported so far in the market did not exceed a channel usage of more than 110 x 25 kHz. The typical ALD installation use between 20 to 40 channels.

It is not expected that these ALD systems will become digital in the foreseeable future due to the lack of the capture ratio provided by FM systems which allows closer frequency re-use, e.g. needed in a multi school

class room environment, and the challenge of the latency present in digital systems also a potentially less efficient frequency use.

The measurement campaign performed by EHIMA at the Baldock radio station has been carried out with typical ALD systems (10 mW e.r.p., 25 kHz channel bandwidth, analogue FM).

The typical ALD usage scenario is reflected in the following Figure 2, Figure 3 and Figure 4.

Figure 2: Only teacher has a transmitter

Figure 3: In this mixed situation both teacher and pupils with normal hearing have transmitters

Figure 4: Use in schools

3 PMSE EQUIPMENT IN THE 174-216 MHz

In this frequency band, audio PMSE applications are used (see questionnaire information in section 8) and authorised (see row d) of Annex 10 of ERC/REC 70-03) with a typical radiated power of 50 mW.

Wireless microphone application (e.g. talk back), which is the main PMSE application in this frequency band, is based on the same ETSI Harmonised European Standard EN 300 442 [4] as the ALD applications.

4 DAB

An upgraded version of the DAB system was released in February 2007, which is called **DAB+**. DAB is not forward compatible with DAB+, which means that DAB-only receivers are not able to receive DAB+ broadcasts. However, broadcasters can mix DAB and DAB+ programs inside the same transmission and so make a progressive transition to DAB+. DAB+ is approximately twice as efficient as DAB due to the adoption of the AAC+ audio codec, and DAB+ can provide high quality audio with as low as 64 kbit/s Reception qualities is also more robust on DAB+ than on DAB due to the addition of Reed-Solomon error correction coding.

DAB allocation as with the previous analogue allocation the channel usage will vary from country to country and channel to channel. Examples shown below provide the worst and average case from initial planning criteria of DAB. Channel 12 shown in Figure 5 below provide little space for ALD use but Figure 6 showing Block 10A provides a range of geographical options for ALD use

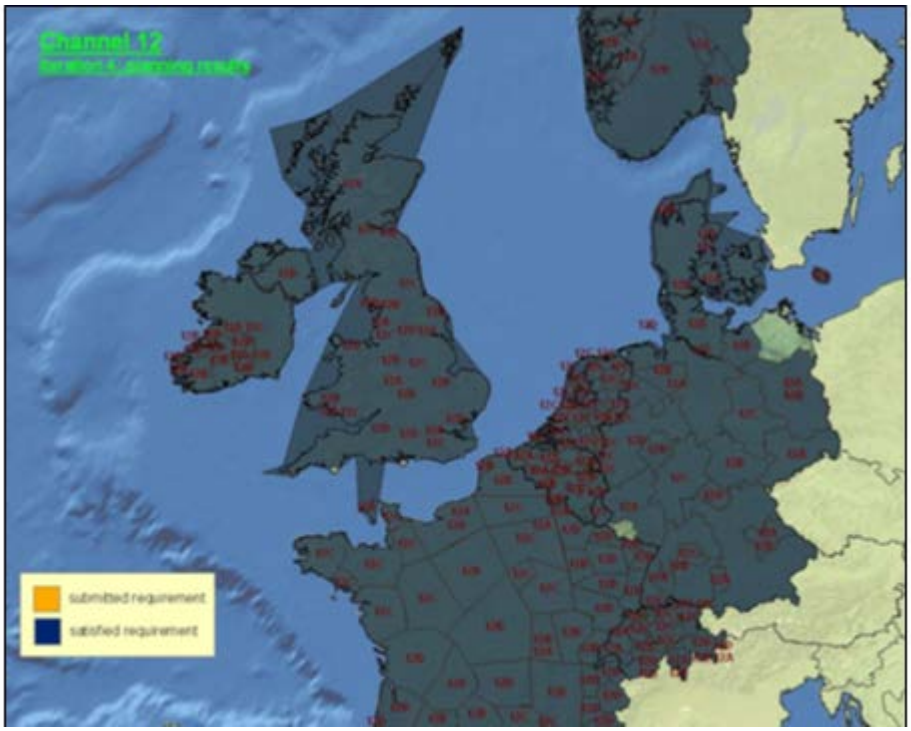

Figure 5: Channel 12

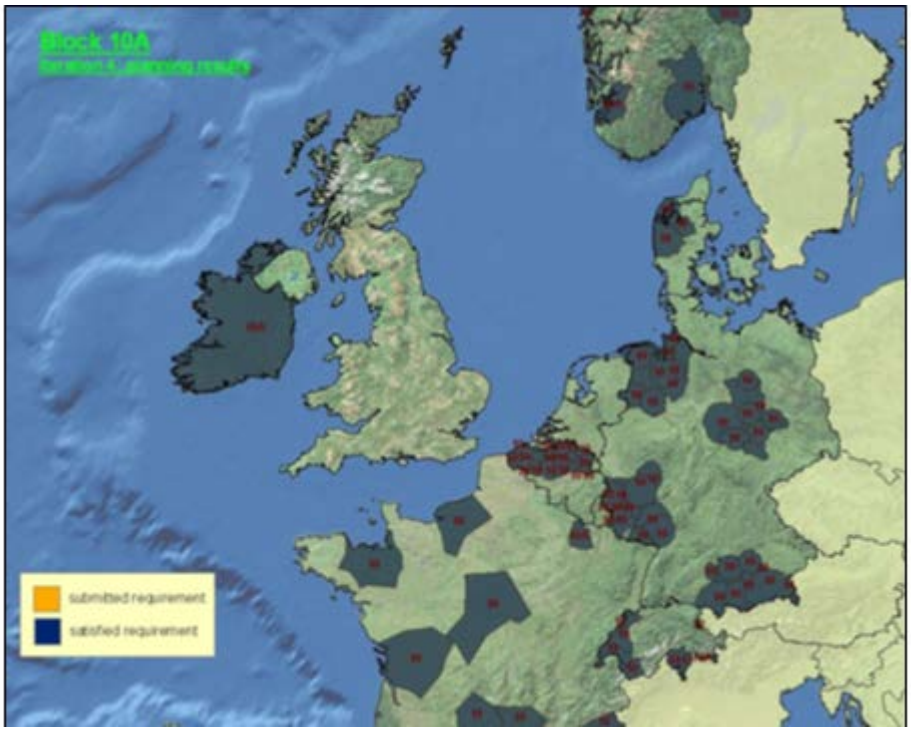

Figure 6: Block 10A

5 DVB-T

The maps shown for DAB reflect similar planning density and distribution for DVB-T and therefore section 3.1 is valid for both DAB and DVB-T. Test Procedure: Ofcom UK have facilitated two compatibility studies undertaken by EHIMA which are contained in Annex 1 and 2 they conclude from this work that license exempt use is possible if a form of testing is applied which can be decided by the National Administration, using any one or a combination of the options below is:

1. As a low level of DAB signal will prevent the interference free use of that channel by the ALD system, Administrations may authorise use of the 174-216 MHz band without individual location checks
2. Administrations may choose to provide access to the DAB transmitter coverage maps and allow installers to identify clear channels
3. Administrations may choose to provide an on line database which when interrogated identifies available channels at the location specified. In some countries an online system to identify the local transmitter is available an example is: http://www.ukdigitalradio.com/coverage/postcodesearch/

Require a specific test procedure which should be included in ETSI standard EN 300 422 [4] in an informative annex. Such a procedure consists in a site survey in order to identify all emissions to be protected which will help the manual frequency planning of the ALD system. An example is provided below:

The measurement is across signal bandwidth, i.e. 1.536 MHz; not across a normal ALD signal bandwidth

Using a dipole antenna centred on 185 MHz connected to a receiver or scanning receiver which can be calibrated, take measurements from a height of

- Some 10 metres from outside the windows of the building or on a mast where a level of 45 dBµV/m must be protected.
- or measured outdoors at 1.5 metres above ground level where a level of 35 dBµV/m must be protected.
- A measurement is required at each side of the building or buildings where the ALD system will be used

6 PMSE AND ALD CO-EXISTENCE

First of all, it is important to note that PMSE applications use higher emission power levels than ALD applications in the band 174-216 MHz, i.e. PMSE applications (typically 50 mW e.r.p.) tend to interfere to ALD applications before ALD applications start to interference to PMSE applications.

Both, PMSE and ALD applications use analogue FM and the FM capture ratio actually fosters a better frequency re-use.

Since the 1980s professional PMSE has moved to the UHF bands (470-862MHz) due to the increase in noise floor and use of shorter antenna.

Considering typical usage scenario as illustrated in Figure 2, Figure 3 and Figure 4, ALD applications and PMSE applications are usually not present at the same location. If they are, exceptionally, then this can be handled locally, e.g. by a school frequency plan, ALD applications could change the operating frequency avoiding to be interfered.

The ALD system operating distances could be observed during the measurements carried out for several ALD devices. The ALD communications are more or less limited to the building where these systems are used (including the very close surroundings), and not noticeable under normal circumstances in neighbouring buildings or sites some tenth of meters away.

Regarding the unbalanced situation especially in terms of authorised radiated power, frequency separation between ALD and PMSE is not necessary and actually, this would lead to less efficient use of the spectrum due to blocking many of the frequency opportunities in the band.

7 DAB AND ALD CO-EXISTENCE MEASUREMENTS WITHIN THE WGFM / SRD/MG FRAMEWORK

7.1 OVERVIEW

A study into co-existence between Digital Audio Broadcasting (DAB) and Assisted Listening Devices (ALDs) has been carried out to determine if more channels can be allocated to ALDs. The main technical question is whether an ALD causes audio degradation to a DAB receiver before the DAB signal causes interference to the ALD.

The aim of these measurements was to determine the range at which an ALD transmitter, operating at its maximum power of 10mW, causes noticeable degradation to the audio output on a DAB receiver. This will allow the point at which an ALD interferes with a DAB receiver to be quantified.

After a limited number of range measurements it was determined that interference was pre-dominantly a local effect, and there was a relationship between the distance the ALD was located from the DAB receiver and the DAB receivers ability to reject adjacent channel signals, through its Adjacent Channel Selectivity (ACS).

Measurements were made at three ALD power levels: 10mW, 1mW and 0.1mW. The ALD signal was swept across the frequency band with the lower and upper frequency points where interference ceases being recorded. This frequency offset was taken as ALD centre frequency to DAB band edge frequency.

The testing of the ALD systems verified that these were actually transmitting at max. 10 mW e.r.p. and under normal usage condition of close to the body.

7.2 DAB SIGNAL STRENGTH

Measurements were made by EHIMA within a conference room at Ofcom's Laboratories in Baldock, Hertfordshire (United Kingdom) in October 2014. The measurements used off air DAB transmissions in 3 different blocks. The DAB power measured was approximately -70dBm/1.56dBm in each block. The DAB channels used are summarised in the table below:

Table 1: DAB channels used

DAB Block	Frequency	Tuned Station
10D	215.072	Radio Northampton
11D	222.064	Classic FM
12B	225.648	Radio 2

The analyser settings used to measure the DAB signal strength were:

Table 2: spectrum analyser settings

Parameter	Setting
RBW	10kHz
VBW	30kHz
Detector	RMS
Channel Bandwidth	1.56MHz

7.3 FAILURE CRITERIA

The failure criteria used for these measurements was determined subjectively as the point at which a listener could begin to hear audio break through. The DAB radio station was listened to in an interference free environment to ensure there that the audio was clear of interference effects. The ALD signal was then transmitted and interference was noted at the point the listener began to hear audio degradation.

7.4 REAL ALD TRANSMISSIONS

Transmissions were initially made using real devices supplied by a manufacturer. However, the lowest tuning frequency available was 216.010 MHz, which did not allow for measurements down to the band edge of DAB Block 10D.

7.5 SIMULATED ALD TRANSMISSIONS

To allow more flexibility in the ALD transmissions a signal generator was used to produce the FM signal. The ALD transmission was modulated with a 1 kHz sine wave and set to a deviation of +/-12.5 kHz.

The simulated ALD transmission was radiated using an omni-directional miniature-biconical antenna, calibrated for the frequency range.

A comparative measurement between the real ALD and simulated ALD were made to check deviation and power levels, the 2 signals were comparative within 1dB when transmitting in free space.

7.6 ADJACENT CHANNEL SELECTIVITY RESULTS

The ALD transmission was swept across the relevant DAB channel whilst the audio output of the receiver was monitored. For all co-channel cases the ALD caused audio degradation, the ALD was then tuned up and down in frequency, with the point at which audio is no longer degraded being recorded. The results are summarised in the tables below, all frequencies are in MHz:

Table 3: Adjacent channel selectivity results (1)

10D mW	*Radio 2* DUT	Lower (MHz) Higher (MHz)	214.319 215.825	Frequency Offset (MHz)	
10	DUT 1	210.68	216.5	3.639	0.675
	DUT 2	210.34	216.6	3.979	0.775
	DUT 3	211.7	233.8	2.619	17.975
1	DUT 1	213.89	216.13	0.429	0.305
	DUT 2	213.96	216.12	0.359	0.295
	DUT 3	211.74	217.99	2.579	2.165
0.1	DUT 1	214.23	215.93	0.089	0.105
	DUT 2	214.24	215.89	0.079	0.065
	DUT 3	214.15	216	0.169	0.175

Table 4: ADJACENT CHANNEL SELECTIVITY RESULTS (2)

11D mW	*Classic FM* DUT	Lower (MHz) Higher (MHz)	221.311 222.817	Frequency Offset (MHz)	
10	DUT 1	210.68	216.5	3.639	0.675
	DUT 2	210.34	216.6	3.979	0.775
	DUT 3	211.7	233.8	2.619	17.975
1	DUT 1	221.01	223.02	0.301	0.203
	DUT 2	221.15	223.02	0.161	0.203
	DUT 3	221.16	222.9	0.151	0.083
0.1	DUT 1	221.28	222.85	0.031	0.033
	DUT 2	221.26	222.85	0.051	0.033
	DUT 3	221.29	222.85	0.021	0.033

7.7 CHANGE IN THE DAB STRUCTURE

ALD is an SRD application which cannot claim protection and which shall not interfere with any incumbent application operating in this frequency band. In case of changes in the DAB channel usage, ALD applications will need to move to another free frequency channel. In this regard, ALD applications and DAB both benefit from wide tuning range of ALD equipment. DAB channel usage information may be for example available on internet.

7.8 CONCLUSIONS FROM THE MEASUREMENTS

Measurement campaign results concluded that an ALD device should operate under all circumstances at least 300 kHz away from the channel edge of an occupied DAB channel.

In addition, some ALD immunity measurements were conducted:

- with an ALD wanted link of 5-6 meters (due to limitations of the test room);
- ALD with 10 dBm e.r.p.;
- DAB reception at a centre frequency at 2.5 MHz separation from ALD frequency.

The ALD immunity measurements showed that ALD systems need an S/(I+N) of about 40 dB. Under the test conditions, this represented an ALD reception level at around -30 dBm and DAB signal level of -70 dBm. In a more realistic situation, with somewhat greater ALD operating range, in e.g. a class room, levels of -40 dBm and -80 dBm respectively. In this regard, it is unlikely that ALD systems would be installed to operate at channels at a given location where DAB reception is intended.

8 QUESTIONNAIRE TO CEPT ADMINISTRATIONS

Within the WGFM, the SRD/MG carried out a questionnaire to administrations in 2014 concerning the use of the 174-216 MHz band identified in ERC/REC 70-03 annex 10d for Assistive Listing Devices (ALD) [3]. The aim of the questionnaire was to find more precise implementation information about ALD usage opportunities in the VHF band and to collect more precise information about ALD usage in the band 174-216 MHz.

The EFIS database (www.efis.dk) also contains some additional information about the ALD use in this band under SRD regulations (see under ERC/REC 70-03 Annex 10).

20 administrations responded to this questionnaire: Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

Question 1: For which specific applications (other than terrestrial broadcasting, e.g. ALDs or radio microphones) have you usage opportunities in your countries in the VHF broadcast band in 174-216 MHz?

Table 5: Usage opportunities in CEPT countries

Country	Applications
Czech Republic	This band may be used by devices as radio microphones and earpieces (inclusive ALD) in the Czech Republic
Denmark	180.5 MHz, 187.5 MHz, 194.5 MHz, 201.5 MHz, 208.5 MHz, 215.5 MHz are used for wireless microphones including in ear monitoring. These frequencies are mentioned in the Danish Radio Interface 00 025
Estonia	The band 174-216 MHz is permitted to radio microphones for secondary usage. 173.35-174.77 MHz is for ALD for secondary usage
Finland	Radio microphone systems (including in ear monitoring systems and hearing aids) in the 174-230 MHz band: Secondary use, interference may occur, regional restrictions.
France	Audio PMSE from 174 to 223 MHz
Germany	Radio microphones and ALD (50 mW)
Ireland	174-174.015 MHz: Aids for the hearing impaired. 174-216 MHz: Wireless Microphone/In-ear Monitoring
Latvia	ALDs and radio microphones
Lithuania	Radio microphones
Luxembourg	Radio microphones and ALD (174 – 216 MHz) Aids for hearing impaired (173.965 - 174.015 MHz)
Netherlands	High power PMSE under individual licence. In the range 195-202MHz, licence exempt radio microphones and ALDs with an e.r.p. of 50 mW are allowed
Norway	No current implementation for any other applications than terrestrial broadcasting
Portugal	For PMSE, mainly wireless microphones and ALDs

Country	Applications
Slovakia	Wireless microphones
Slovenia	As in ERC/REC 70-03
Spain	ALD, radio microphones and SAP/SAB vehicular audio links
Sweden	Radio microphones and ALDs
Switzerland	A: Radio microphones according to ERC/REC 70-03 Annex 10 band d B: Personal hearing aids (ALD) C: Medical telemetry D: T-DAB low power indoor repeater E: Ground- and Wall Probing Radar imaging systems using Ultra-Wideband (UWB) technology according to ECC/DEC/(06)08
Turkey	There is no usage other than terrestrial broadcasting, ALD or radio microphones
United Kingdom	In addition to terrestrial broadcasting, some military applications in the band. Radio microphones Assistive Listening Devices

Question 2: Please provide the technical restrictions for these applications in terms of max. radiated power (e.r.p.), possible frequencies/tuning range (it is important to state the precise possible frequencies as much as possible), ALD bandwidth restrictions, regional restrictions, specific application restrictions.

Country	Restrictions				
Czech Republic	These applications should be operated only under conditions of secondary service, i.e. shall not interfere the reception of television signals as well as shall not claim protection from interference caused by television signals. Radiated power is limited to 50 mW				
Denmark	Band	Frequency band (MHz)			Maximum power
	d	180.500 187.500 194.500 201.500 208.500 215.500 222.500			50 mW e.r.p.
	Bandwidth	Band *d*: 50 kHz			Bandwidth
	Terms of use	The frequencies in band *d* can only be used for hearing aid equipment.			
Estonia	Nomative	No	Parameter	Description	Comments
		1	Radio communication service	Short range devices	
		2	Applications	Aids for the hearing impaired	
		3	Radio frequency band	173.350-174.770 MHz	
		4	Channel spacing	Maximum 50 kHz	
		5	Modulation/bandwidth used	-	
		6	Duplex/simplex communication	-	

Country	Restrictions				
			Duplex gap		
		7	Transmission power/power density	Maximum e.r.p. 2 mW	
		8	Channel usage conditions	-	In the 174.000-174.770 MHz radio frequency band, the possibility of radio interference caused by a broadcasting transmitted should be taken into account
		9	Frequency authorisation regime	Exempted from a frequency authorisation	
		10	Additional requirements on the basis of subsection 123(3) of the Electronic Communications Act	-	
		11	Basis for planning radio frequencies	-	
	Informative part	12	Planned changes	-	
		13	References to documents	Recommendation: CEPT/ERC/REC70-03 (Annex 10) Harmonised standards: EN 60950; EN 50371; EN 301 489-1; EN 301 489 3; EN 300 422-2 Estonian radio frequency allocation plan on the basis of subsection 9(3) of the Electronic Communications Act	
		14	Communication number	2013/314/EE	
		15	Notes		
	In the band 174-174.77 it must be taken into account the possibility of radio interference by the TV-broadcasting transmitter. Radio microphones: CEPT/ERC/REC 70-03 (Annex 10), EN 300 422				
Finland	Radiated power typically max. 50 mW e.r.p. and bandwidth 200 kHz, authorised frequency range 174-230 MHz. In the place of use of a radio microphone system may use only a frequency band, which is not allocated to television and broadcasting				
France	e.r.p : 50 mW, for professional usage				
Germany	VVNoeml, chapter 9.2.2 – 174-230 MHz (TV channels 5 to 12) 50 mW e.r.p., channel bandwidth max. 200 kHz, channel raster of 25 kHz Individual authorisation for outdoor use only for broadcasters or any other program producer				

Country	Restrictions					
Ireland	174 – 174.015 MHz: Aids for the hearing impaired. 2mW Maximum e.r.p. 174 – 216 MHz: Wireless Microphone/In-ear Monitoring. 1W Maximum e.r.p. (Typical e.r.p. = 50 mW). Maximum Channel Bandwidth = 200 kHz. A Licence is required					
Latvia	e.r.p. 50 mW; without channel spacing					
Lithuania	50 mW e.r.p., 174-216 MHz					
Luxembourg	Radio microphones and ALD (174-216 MHz) 50 mW e.r.p., radio interface 2011/466/L Aids for hearing impaired (173.965 -174.015 MHz) 2mW e.r.p. , bandwidth up to 50 kHz, radio interface 2005/0347/L					
Netherlands	For PMSE, whole range, with the exception of 195-202MHz for the whole country. Bandwidth 200 KHz, e.r.p. 10dBW. In the range 195-202MHz licence exempt radio microphones with an e.r.p of 50 mW are allowed, although not explicitly mentioned in our national regulation this may also be used for ALDs. We see no problems to expand the use to the whole band 174-216MHz					
Portugal	For PMSE and for licence exemption the conditions described in annex 10 of ERC/REC 70-03 should be met, namely the 50 mW e.r.p. If the e.r.p. is higher an individual licence is required. All the band is available for PMSE. For ALD the e.r.p. limit is 2 mW and restricted to 174.015 MHz, and the conditions described in annex 10 of ERC/REC 70-03 should be met					
Slovakia	Possible frequencies: 174,3 MHz and 174,7 MHz proposed for wireless microphones only. Radiated power: 20 mW e.r.p. Bandwidth: 50 kHz or 75 kHz No other restrictions					
Slovenia	e.r.p. 50 mW; without channel spacing, EN 300 422					
Spain	ALD in the tuning range 174.050-174.500 MHz, bandwidth channels 50 kHz, power 2 mW e.r.p. Radio microphones: several channels bandwidth 200 kHz, power 50 mW e.r.p.; frequencies 174.1, 174.3, 175.5, 176.3, 179.3, 188.1, 188.5, 189.1, 191.9, 194.5 MHz SAP/SAB mobile links in the range 174-181 MHz and 181-188 MHz, bandwidth channels 200 kHz, power limit as indicated in the license					
Sweden	Technical parameters are the same as for the band 470-790MHz, that is: Power: 50mW e.r.p. bandwidth: 200kHz					
Switzerland		max. radiated power (e.r.p.)	Frequencies / tuning range	ALD bandwidth restrictions	regional restrictions	specific application restrictions
	A	50 mW	174 - 223 MHz		-	NIB / NPB. (Non interference basis / non protection basis)
	B	10 mW	174 - 223 MHz	Channelling max. 50 kHz	-	NIB / NPB. (Non interference basis / non protection basis)
	C	1 mW	174 - 216 MHz		-	NIB / NPB. (Non interference basis / non protection basis)
	D	-12.15 dBm e.r.p. / 1.536 MHz	174 - 230 MHz		-	Indoor only. NIB / NPB. (Non interference basis / non protection basis)
	E	according to ECC/DEC/(06)08				NIB / NPB. (Non interference basis / non protection basis)

Country	Restrictions
Turkey	The maximum power is 50 mW (e.r.p.) for 174-216 MHz. The reference standard for this frequency range is EN 300 422
United Kingdom	See national interface requirement; http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/IR_2030.pdf Specifically, IR2030/24/1, IR2030/24/2 and IR2030/25/3: Radio Microphones, 173.775 to 175.075 MHz, 10 mW e.r.p. Channel spacing 50 kHz Channel numbers 10 to 35 inclusive are available; where the channel centre frequency is equal to 173.3 MHz plus (Channel Spacing times channel number). EN 300 422 Radio Microphones, 173.7 to 175.1 MHz, 10 mW e.r.p The maximum radiated power may be increased to 50 mW e.r.p. for a radio microphone which is intended to be worn next to or strapped to the user's body. Channel spacing 200 kHz Channel numbers 1 to 7 inclusive are available; where the channel centre frequency is equal to 173.6 MHz plus (Channel Spacing times channel number). EN 300 422 Assistive Listening Devices, Equipment may be used airborne 173.325 to 175.075 MHz, 2 mW e.r.p. Channel spacing 50 kHz Channel numbers 1 to 5 inclusive and 7 to 9 inclusive are the preferred channels, channels 10 to 35 inclusive may be used as an alternative but are shared with other applications including radio microphones. The channel centre frequency is equal to 173.3 MHz plus (Channel Spacing times channel number) EN 300 422

Question 3: Please explain the authorisation mechanism (individual or general authorisations)?

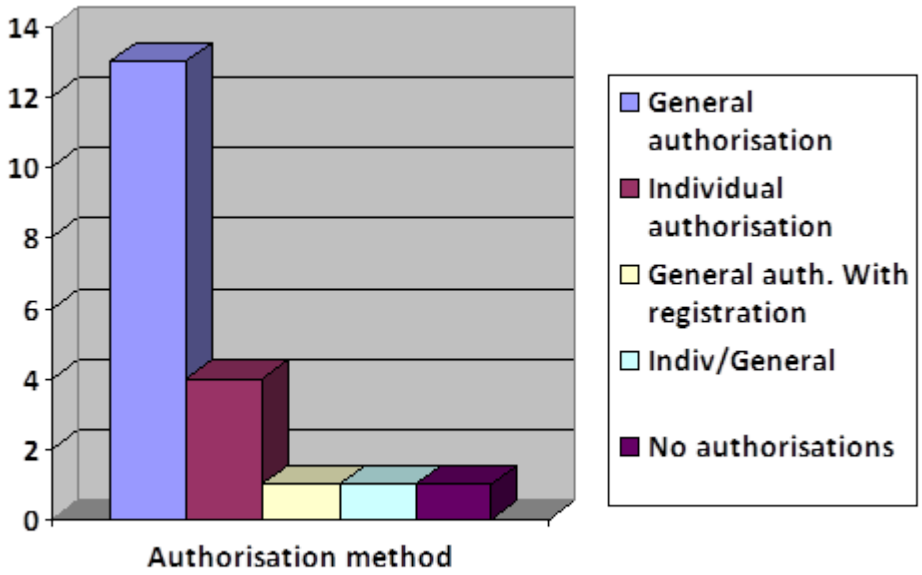

Figure 7: authorisation method

- 1 country (Norway) does not provide authorisations;
- 13 countries use general authorisations for radio microphones/ALD/PMSE up to 50 mW e.r.p. (does not exclude possibility to use higher e.r.p. under individual licenses);
- 1 country uses general authorisations with mandatory registration;
- 4 countries use individual authorisations;
- 1 country has radio microphones and ALDs under individual authorisations while aids for hearing impaired are under general authorisation.

Country	Authorisation mechanism
Czech Republic	General authorisation
Denmark	General authorisation
Finland	Individual authorisation, specific frequencies are not typically mentioned in a licence. Licence-holder is required to use only frequency band (within 174-230 MHz) which is not allocated to television broadcasting in the place of use of a radio microphone system
France	General authorisation
Estonia	General authorisation
Germany	Individual authorisation
Ireland	Individual authorisation required for Wireless Microphone/In-ear monitoring in the band 174-216 MHz. General authorisation for aids for the hearing impaired in the band 174 - 174.015 MHz.
Latvia	Individual authorisation
Lithuania	General authorisation, registration of radio equipment is mandatory in the database maintained by RRT
Luxembourg	General authorisation
Netherlands	Radio microphones and ALDs: General authorisation
Portugal	PMSE up to 50 mW e.r.p.: general authorisation, higher e.r.p.: individual authorisation ALD: general authorisation
Slovakia	General authorisation Wireless microphones may be used in the Slovak Republic on the basis of the general authorisation (No. VPR – 03/2012) providing that technical restrictions mentioned in A2 are met
Slovenia	General authorisation
Spain	ALDs and radio microphones: General authorisation SAP/SAB mobile links: individual authorisation
Sweden	Individual authorisation
Switzerland	General authorisation (A-D)
Turkey	General authorisation
United Kingdom	General authorisation

Question 4: Have you encountered any problems (e.g. interference problems) with ALDs with your current authorisation regime?

Except for Denmark and Finland reporting each one case of interference respectively, no problems were reported by the 16 other administrations responding to the questionnaire and providing authorisations.

Country	Interference problems?
Denmark	We had one case of interference at a school for hearing impaired children. The course of the interference was due to bad frequency planning
Finland	There was a case when an unauthorised use of ALD was transmitting on PMR frequency below 174 MHz and caused interference to an authorised PMR user. Use was switched to an authorised band

Question 5: In case you have encountered interference problems with ALDs, what were the solutions found in your country?

See question 4 – in the absence of substantial problems, no information provided in response to this question. It can be expected in the few cases reported that the change of the operating frequency has solved the problem.

Question 6: Could you please provide either a link to your current regulation or provide a copy of the precise ruling in your response (can be of course in your official language(s))?

Country	Link/Current regulation
Czech Republic	http://www.ctu.cz/cs/download/oop/rok_2014/vo-r_10-05_2014-03.pdf *Article 9, paragraph (2), band f*
Denmark	Below you find a link to the *Order on the use of radio frequencies without permission, and the Amateur Radio Examinations and Call Signs etc.* In Danish: *Bekendtgørelse om anvendelse af radiofrekvenser uden tilladelse samt om amatørradioprøver og kaldesignaler m.v.* **https://www.retsinformation.dk/Forms/R0710.aspx?id=141490&exp=1** Please see Bilag 5, number 38.2 (In English annex 5 number 38.2)
Estonia	The Estonian radio frequency allocation plan is available in http://www.tja.ee/radio-frequency-allocation-plan
Finland	Radio Frequency Regulation 4 and Frequency Allocation Table are available at: https://www.viestintavirasto.fi/en/steeringandsupervision/legislation/regulations/radiofrequencyregulation4.html Regionally available frequencies can be searched by using searching tool at: https://www.viestintavirasto.fi/en/spectrum/radiolicences/wirelessmicrophonesandcameras/searchformicrophonefrequencies.html
France	ARCEP Decision 2010-0849, ARCEP Decision 2010-0850
Germany	VVNoeml, chapter 9.2.2 – 174-230 MHz (TV channels 5 to 12) 50 mW e.r.p., channel bandwidth max. 200 kHz, channel raster of 25 kHz Individual authorisation for outdoor use only for broadcasters or any other program producer The VVnömL can be found here
Ireland	Individual licences are required for Wireless Microphone/In-ear monitoring in the band 174-216 MHz. A link to relevant guidelines is available on the ComReg website, at: http://www.comreg.ie/_fileupload/publications/ComReg0808R3.pdf

<table>
<tr><th>Country</th><th>Link/Current regulation</th></tr>
<tr><td></td><td>Aids for the hearing impaired are licence exempt in the band 174 – 174.015 MHz. A link to the National Short Range Devices Document, where further information can be found regarding this band, is available on the ComReg website, at: http://www.comreg.ie/publications/permitted_short_range_devices_in_ireland.583.104564.p.html</td></tr>
<tr><td>Latvia</td><td>http://likumi.lv/doc.php?id=198903</td></tr>
<tr><td>Lithuania</td><td>List of radio frequencies/channels, which may be used without an individual authorisation, approved by Order No. IV-893 of the Director of the Communications Regulatory Authority of 9 of September 2010</td></tr>
<tr><td>Luxembourg</td><td>Decree of the ILR concerning the national frequency allocation table:
http://www.legilux.public.lu/leg/a/archives/2014/0084/index.html#2014A1384A
In the NTFA, there are references to the concerned radio interface specifications</td></tr>
<tr><td>Netherlands</td><td>For the complete licence exempt regulation:
http://wetten.overheid.nl/BWBR0023553

For the frequency tables:
http://wetten.overheid.nl/BWBR0023553/volledig/geldigheidsdatum_24-06-2014#Bijlage8</td></tr>
<tr><td>Portugal</td><td>Please consult the Portuguese electronic NFTA platform available at:
http://www.anacom.pt/render.jsp?categoryId=348130
The detailed information of our current regulation is available in the pdf file “Isenção de licença de estação” available in the previous link</td></tr>
<tr><td>Slovakia</td><td>General authorisation No. VPR – 03/2012: http://www.teleoff.gov.sk/data/files/25531.pdf</td></tr>
<tr><td>Slovenia</td><td>Link to the National Table of Frequency Allocations (NTFA): http://www.uradni-list.si/files/RS_-2013-091-03312-OB~P001-0000.PDF#!/pdf</td></tr>
<tr><td>Spain</td><td>Notes UN-105 and UN-106 from the NTFA:
UN – 105 Banda 174 – 181 MHz
La utilización de esta banda se indica en la figura 22, y en ella se destinan cinco canales para micrófonos sin hilos y 15 canales para enlaces móviles de transporte de programas de radiodifusión en todo el territorio nacional. El plan de frecuencias ha de ajustarse a la canalización indicada en la figura.
La utilización de las frecuencias indicadas para los servicios auxiliares de la radiodifusión sonora, se realizará exclusivamente por entidades titulares del servicio público de radiodifusión sonora con explotación de emisores en la zona de utilización o por entidades titulares de servicios portadores.
La utilización para micrófonos sin hilos, se ajustará a las condiciones indicadas en la nota UN-95.
Además de los usos indicados anteriormente, en esta banda de frecuencias se dispone bajo la consideración de uso común de los siguientes canales de 50 kHz para el empleo en dispositivos de ayudas auditivas y a discapacitados:
<table><tr><td>174.050 MHz</td><td>174.300 MHz</td></tr><tr><td>174.100 MHz</td><td>174.350 MHz</td></tr><tr><td>174.150 MHz</td><td>174.400 MHz</td></tr><tr><td>174.200 MHz</td><td>174.450 MHz</td></tr><tr><td>174.250 MHz</td><td>174.500 MHz</td></tr></table>
La potencia máxima autorizada para estos dispositivos es de 2 mW (p.r.a.) y la norma técnica de referencia EN 300 422.
UN – 106 Banda 181 – 188 MHz</td></tr>
</table>

Country	Link/Current regulation
	Se destina esta banda de frecuencias para enlaces móviles y unidireccionales de transporte de programas de radiodifusión en todo el territorio nacional. El plan de frecuencias ha de ajustarse a la canalización indicada en la figura 23. La utilización de las frecuencias indicadas para los servicios auxiliares de la radiodifusión sonora, se realizará exclusivamente por entidades titulares del servicio público de radiodifusión sonora con explotación de emisores en la zona de utilización o por entidades titulares de servicios portadores
Sweden	http://pts.se/en-GB/Industry/Radio/Application/Wireless-microphones/
Switzerland	A: http://www.ofcomnet.ch/cgi-bin/rir.pl?id=1009;nb=02 B: http://www.ofcomnet.ch/cgi-bin/rir.pl?id=1009;nb=12 C: http://www.ofcomnet.ch/cgi-bin/rir.pl?id=1006;nb=06 D: http://www.ofcomnet.ch/cgi-bin/rir.pl?id=0201;nb=35 E: http://www.ofcomnet.ch/cgi-bin/rir.pl?id=1023;nb=04
Turkey	EN SITE: http://eng.btk.gov.tr/mevzuat/yonetmelikler/dosyalar/BY-LAW%20ON%20SHORT%20RANGE%20DEVICES.pdf TR SITE: http://btk.gov.tr/mevzuat/yonetmelikler/dosyalar/KETCihazlariHkYonetmelik.pdf
United Kingdom	See national interface requirement; http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-policy-area/spectrum-management/research-guidelines-tech-info/interface-requirements/IR_2030.pdf Specifically, IR2030/24/1, IR2030/24/2 and IR2030/25/3

Question 7: An approach using threshold measurements to find out ALD usage opportunities in the VHF band (i.e. those frequencies where terrestrial broadcast emissions are below a certain emission threshold at a given location where ALDs may be potentially used. The idea is to find a harmonised approach for such a solution, also accompanied by standardisation activities. Is your administration interested in such a regulatory approach and should it be further elaborated in SRD/MG and SE24? If not, please explain the reasons for your reservations.

11 administrations from Estonia, Finland, Ireland, Latvia, Lithuania, Norway, Portugal, Slovenia, Spain, Turkey and the UK are interested in the threshold approach and support the investigations. Finland and the UK seem to see a technical possibility for the approach. Slovenia stated the preference for a sensing approach that is autonomous (without the need to include from the regulator and continuous sensing as much as possible).

Two questions were raised:

1. Currently there are some deployments of Digital Radio in this frequency band. The difficulty is how to ensure that the identified threshold is sufficient to ensure an appropriate protection to digital radio receivers noting that the value of this threshold corresponds to the limit used for radio planning but not for the protection of receivers (e.g. this approach does not take into account the interference caused by an Audio listening device which may be very close to a digital audio receiver (e.g. handheld receiver)).

2. In this frequency band, PMSE are authorised. How is the coexistence with PMSE ensured?

Country	Interest in approach using threshold measurements
Denmark	The Danish administration do not support the suggestion mentioned above. We find that it will be impossible to implement these ALD systems like other SRD's, since it will require a calculation in each new case. It can however be done with an individual license. The Danish administration do not support that SE24 should investigate this approach further
Estonia	Yes, it should be further elaborated. There is an interest in the use of ALDs in Estonia.
Finland	Our searching tool indicates possibility to use a radio microphone system when field strength value of 45 dBµV/m (calculation based on Recommendation ITU-R P.1546) caused by a television transmitters is not exceeded
France	a. No request has been received to develop such a regulation, therefore this does not trigger any interest to do so. b. Currently there are some deployments of Digital Radio in this frequency band. The difficulty is how to ensure that the identified threshold is sufficient to ensure an appropriate protection to digital radio receivers noting that the value of this threshold corresponds to the limit used for radio planning but not for the protection of receivers (e.g. this approach does not take into account the interference caused by an Audio listening device which may be very close to a digital audio receiver (e.g. handheld receiver)). c. In this frequency band, PMSE are authorised. How the coexistence with PMSE is ensured?
Germany	Germany is of the opinion that individual licensing mechanism is the most efficient way to authorise usage for ALDs.
Ireland	The above outlined approach seems reasonable, and ComReg is amenable to it being further studied in both SRD/MG and SE24, with the goal of developing a harmonised approach to solve the coexistence challenge of ALD and the primary services in Band III (i.e., DAB and DVB-T).
Latvia	Change of existing regulation with individual permits is currently under revision in Latvia. Thus we are interested in harmonised approach for ALDs and PMSE providing least restrictive as well electromagnetic compatible solution.
Lithuania	Yes, interested.
Luxembourg	We do not oppose against any further work concerning ALD usage opportunities in the VHF band.
Netherlands	It is to be expected that ALDs will suffer from interference from T-DAB but the opposite interference towards T-DAB is negligible. The installer of the ALD supporting installation has to assess interference cases towards his own product prior to installation, considering the low risk of interference toward T-DAB we don't see a need for technical solutions.
Norway	Yes, interested
Portugal	For the moment we do not have terrestrial broadcast emissions in the 174 – 216 MHz band, after the release of the band by the analogue broadcast emissions. However, thinking about the future and taking into account the continuous interest for the UHF bands by the mobile

Country	Interest in approach using threshold measurements
	community (470 – 790 MHz), and a possible need to use the VHF band in the future for terrestrial broadcast emissions, we support the study of a such regulatory approach.
Slovakia	We have no reservation with regard to activity SRD/MG and SE24 on ALD usage opportunities in the VHF band.
Slovenia	Continuous sensing is our preferable approach due to lack of human resources and huge financial burden for our Agency with regard to the data base approach. We agree to start and continue with standardisations activities.
Spain	We consider very interesting to get a regulatory approach harmonised, and we consider appropriate that it be treated in the SRD/MG and SE24.
Sweden	Our regulation regarding white space usage in the band 174-216MHz is based on license basis and we will (in the foreseen future) not change to license exempt regulation for white space applications. Since we look at each license application on a case to case basis we don´t see the need for the approach proposed for our regulation.
Turkey	Yes, the threshold approach can be implementable.
United Kingdom	Yes, the UK is interested. We believe threshold measurements provide an opportunity to allow further authorisation possibilities and this method should be considered further.

Question 8: Are there alternative technical approaches/ ideas? If yes, please explain.

See also question 7 (statements from Germany and Sweden). Apart from this, the Netherlands emphasised that a threshold approach should be used in combination with a large tuning range. No further, real alternative approaches were provided.

Country	Alternative technical approaches/ideas
Netherlands	See in Q7 above, in combination with a large tuning range.

Administrations were also please to check the current implementation status information in ERC/REC 70-03 [3] and provide updated information. The current implementation status is as follows:

Country	Implementation Status
Czech Republic	Yes
Denmark	Limited (The frequencies in band d can only be used for hearing aid equipment.)
Estonia	Yes
Finland	Limited
Germany	Yes Individual authorisation for outdoor use only for broadcasters or any other program producer
Ireland	Limited For Radio Microphones (for PMSE and temporary licensing) only. Provisions for assistive listening devices in 174-174.15 MHz are made in adherence with band ‘b’ (Aids for the hearing impaired) in Annex 10 of ERC/REC 70-03.
Latvia	Yes
Lithuania	Yes
Luxembourg	Yes

Country	Implementation Status
Netherlands	Yes
Norway	No
Portugal	Yes
Slovakia	Yes
Slovenia	Yes
Spain	Limited, added under national restrictions: For radio microphones: freq.174.1, 174.3, 175.5, 176.3, 179.3, 188.1, 188.5, 189.1, 191.9, 194.5 MHz.50 mW e.r.p., no license. For ALD devices: 174.050-174.500 MHz, 2 mW e.r.p., no license.
Sweden	Yes
Switzerland	Yes
Turkey	Yes
United Kingdom	Limited. The tuning range in the UK is 173.7 to 175.1 MHz

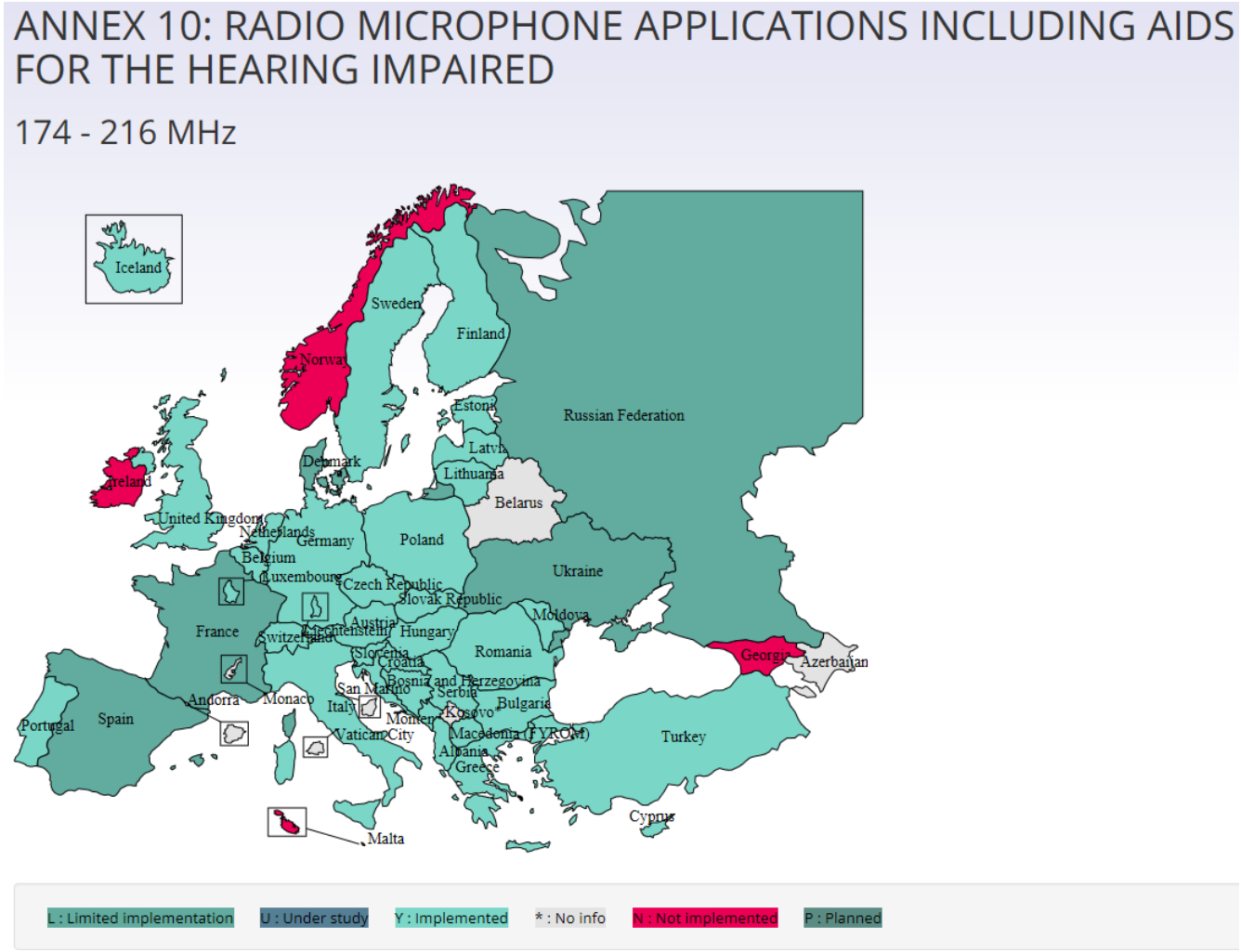

Figure 8: Implementation of radio microphone applications including aids for the hearing impaired 174-216 MHz (end of 2014)

9 THRESHOLD APPROACH

9.1 DAB RECEIVER CHARACTERISTICS

Below are the min sensitivity values for Domestic DAB receivers in the UK as specified by the Digital Radio Action Plan – Technical Expert Group (https://www.gov.uk/.../Digital_Radio_Action_Plan_v10__5___1_.doc in the United Kingdom. Xtf is the uncertainty value which we would add on for the GTEM cell when testing radios.

Table 6: Pass/fail target threshold

Channel	Centre Frequency (MHz)	PASS / FAIL Target Threshold (dBµV/m) for OOI test using U.V (Xtf).
5A	174.928	32.4+ Xtf=
10B	211.648	34.1+ Xtf=
10C	213.36	34.1+ Xtf=
10D	215.072	34.2+ Xtf=
11A	216.928	34.3+ Xtf=
11B	218.64	34.3+ Xtf=
11C	220.352	34.4+ Xtf=
11D	222.064	34.5+ Xtf=
12A	223.936	34.6+ Xtf=
12B	225.648	34.6+ Xtf=
12C	227.36	34.7+ Xtf=
12D	229.072	34.8+ Xtf=

Please note that the values in the above figure are similar to the values measured during the EHIMA Baldock measurements: DAB reception level of -70 dBm (57 dBµV and antenna k factor of 20 dB/m at 215-220 MHz -> +37 dBµV/m), i.e. could be confirmed during the Baldock measurements reported in section 7.

One should note that other factors will help to prevent any interference to DAB reception:

1. that even fringe area DAB field strength will cause interference to ALDs;
2. that ALD system users such as schools do not currently use DAB transmissions for teaching purposes (unlike the old FM transmissions for schools) and therefore there are unlikely to be DAB receivers collocated in the school premises;
3. ALD system installations are usually physically separated from domestic housing;
4. ALD systems are usually within a confined which reduces the ALD signal by the building loss; where multiple ALD systems are installed in one building the transmission power of each system is usually reduced from 10mW to ensure mutual interference does not happen.

9.2 SUGGESTED TEST METHOD

Installers and planners of ALD systems are unlikely to have sophisticated test equipment available.

Following discussion with a number of DAB receiver manufacturers, the following information appears to be common to all their devices:

The required Gaussian sensitivity for compliance is a field strength of <= 34.4 dBµV/m at a center frequency of 220MHz, however this is frequency dependent and its value at other frequencies can be calculated from the following formula:
FSGmin = [34.4 + 20log(F/220)] dBµV/m, where F is the frequency in MHz.

given this level of sensitivity and that all receivers appear to auto tune ,the suggested method is:

1. The DAB channels in use at the site should be identified via information available from the national administration;
2. unused channels are selected for the ALD systems;
3. install (a) test ALD transmitter(s) on site;
4. use a portable DAB receiver at the boundary of the site to check interference free reception;
5. repeat step 4 at nearest house;
6. repeat 4 outside window at first floor of site;
7. if no interference is noted complete installation

10 PROPOSED NEW ENTRY IN ERC/REC 70-03 ANNEX 10

A fixed threshold can be introduced within the ETSI Standard EN 300 422 [4] and introduced as mitigation approach in ERC/REC 70-03 [3].

	Frequency Band	Power / Magnetic Field	Spectrum access and mitigation requirements	Channel spacing	ECC/ERC Delieverable	Notes
New	174-216 MHz	10 mW e.r.p.	Notes 1 and 2 requirement	Modulation Bandwidth ≤ 50 kHz	ERC Report 230	For Assistive Listening Device (ALD) systems. On a tuning range basis. Individual licence may be required
Note 1: a threshold of 35 dBµV/m is required to ensure the protection of a DAB receiver located at 1,5m from the ALD device, subject to DAB signal strength measurements taken around the ALD operating site. Note 2: the ALD device should operate under all circumstances at least 300 kHz away from the channel edge of an occupied DAB channel.						

Harmonised European Standard: EN 300 422

Frequency issues: ECC Report 230 provides information on ALD frequency issues in the frequency band 174-216 MHz including an example for an on-site measurement procedure. It should be noted that ALD applications are a secondary, un-protected application and may need to move in frequency, if changes of the primary service take place.

Note: Some administrations may prefer to use individual site authorisations for ALDs in all or parts of the 174-216 MHz band. However, this Report shows that ALD usage under general authorisation is possible if a form of testing, e.g. a site survey in order to identify all emission to be protected, is applied which can be decided by the National Administration.

11 CONCLUSIONS

This Report focusses on analogue FM modulated ALD systems with a 100% duty cycle and a bandwidth of ≤50 kHz (dominantly 25 kHz) and an effective radiated power (e.r.p.) of max. 10mW.

Assistive Listening Devices systems transmit the acoustic signal from the sound source (e.g. a teacher, loudspeaker or pupils talking) directly to a hearing impaired person.

It is not expected that these ALD systems will become digital in the foreseeable future due to the lack of the capture ratio provided by FM systems which allows closer frequency re-use, e.g. needed in a school with a multiple class room equipped environment, and the challenge of the latency present in digital systems also a potentially less efficient frequency re-use.

This Report investigates the possible use of the 174-216 MHz band as a tuning range by ALD, primarily in schools and educational establishments, to relieve the current congestion issues in the frequency band 173.35 MHz to 175.05 MHz and has concluded that use of unused channels in this band is possible on a license exempt basis.

All ALD and wireless microphones in the terrestrial broadcast band III use the ETSI harmonised standard EN 300 442 [4].

ALD equipment including the most typically usage scenario in schools is described in section 2 of this Report.

The frequency band 174-216 MHz is also used by PMSE applications. In this context it is important to note that PMSE applications use higher emission levels than ALD applications (typically 50 mW e.r.p.) in the band 174-216 MHz, i.e. PMSE applications tend to interfere to ALD applications before ALD applications start to interference to PMSE applications. Both, PMSE and ALD applications use analogue FM and the FM capture ratio actually fosters a better frequency re-use.

In addition to the FM capture ratio, it can be assumed that ALD applications and PMSE applications are typically not used at the same location. If they are, exceptionally, then this can be handled locally, e.g. by a school frequency plan. If PMSE applications are individually authorised, it also means that the ALD applications has to move in frequency to ensure co-existence.

The ALD system operating distances could be observed during the measurements carried out for different type of ALD devices. The ALD communications are more or less limited to the building where these systems are used (including the very close surroundings), and not noticeable under normal circumstances in neighbouring buildings or sites some tenth of meters away.

Only few interference cases have been reported by administrations in response to a questionnaire (see section 8 of this Report)

ALD is an SRD application which cannot claim protection and which shall not interfere with any incumbent application operating in this frequency band. In case of changes in the DAB channel usage, ALD applications will need to move onto other free frequency channels. In this regard, ALD applications will benefit from wide tuning range capabilities. DAB channel usage may be for example available on the internet.

ALD usage under general authorisation is possible if a form of testing, e.g. a site survey in order to identify all emission to be protected) is applied which can be decided by the National Administration. It is also proposed to include this example test procedure within the ETSI harmonised European Standard EN 300 422 in an informative annex (see example in section 5 of this Report).

Measurement campaign results concluded that an ALD device should operate under all circumstances at least 300 kHz away from the channel edge of an occupied DAB channel.

In addition, some ALD immunity measurements were conducted. The result was that ALD systems require a S/(I+N) of about 40 dB..

This Report also shows the possibility of an automatic DAB signal detection based on a fixed threshold which can be introduced within the ETSI Standard EN 300 422 [4] as a mitigation approach possibility. The value of this threshold, subject to DAB signal strength measurements are taken around the ALD operating site, should be 35 dBµV/m to ensure the protection of a DAB receiver located at 1.5m from the ALD device.

Finally, it is proposed to define a regulatory framework based on a new entry in ERC/REC 70-03 [3] Annex 10, see section 10.

ANNEX 1: ASSISTIVE LISTENING DEVICES AND RADIO MICROPHONE CO-EXISTANCE

Please see the embedded document

M75_07R0_SE24_att 2_Annex 1.pdf

ANNEX 2: BLOCK 5A DAB ALLOCATION

Please see embedded document

ANNEX 3: LIST OF REFERENCE

[1] ETSI TR 102-791 Electromagnetic compatibility, and Radio spectrum Matters (ERM); System Reference Document; Short Range Devices (SRD);Technical characteristics of wireless aids for hearing impaired people operating in the VHF and UHF frequency range

[2] EC Decision 2005/928/EC Commission implementing decision, of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC

[3] ERC Recommendation 70-03 on Relating to the use of Short Range Devices (SRD) ANNEX 10: RADIO MICROPHONE APPLICATIONS INCLUDING AIDS FOR THE HEARING IMPAIRED

[4] ETSI harmonised European Standard EN 300 422 Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement Wireless microphones 25 MHz to 3 GHz

[5] ERC Report 42 Handbook on radio equipment and systems radio microphones and simple wide band audio links