

ETSI EN 303 348 V1.2.1 (2021-06)



**Audio frequency induction loop drivers up to 45 amperes
in the frequency range 10 Hz to 9 kHz;
Harmonised Standard for access to radio spectrum**

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).
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The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.8] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.1].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

National transposition dates	
Date of adoption of this EN:	26 May 2021
Date of latest announcement of this EN (doa):	31 August 2021
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2022
Date of withdrawal of any conflicting National Standard (dow):	28 February 2023

Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

Audio Frequency Induction Loop System (AFILS) has been on the market since the middle of the twentieth century, with the first recognizable patents appearing circa 1938. AFILS are primarily used to facilitate improved communication to people with impaired hearing and are an important tool in the reduction of discrimination against disabled people. They are also used in a number of industries including Broadcast and studio.

The present document covers the "drivers" for the loop antenna and represents the performance of equipment which is currently on the market, which has not previously been subjected to compliance to a "radio" directive.

AFILS are installed in places of worship, places of entertainment, places of education, ticket booths and service counters, etc. as well as in domestic situations, providing huge benefits to users with impaired hearing.

AFILS provide an audio frequency magnetic field that couples with a receiving coil (telecoil) fitted in hearing aids, cochlear implants, loop listeners and testing devices. This magnetic field is generated in a wire loop that is fed by an audio frequency driver which is capable of driving current through the "induction loop" which, in turn, is fed from external signals such as those generated by microphones, audio-visual equipment and musical instruments.

AFILS operate below 9 kHz and have a very limited range (some few metres) and there is no known evidence of interference with radio equipment.

AFILS are provided in a range of sizes and can cover areas up to approximately 3 000 m². They are also used in vehicles and lifts and interaction with structural metal means that a complete AFILS can only be tested when fitted in their final location. This means that the "Loop" is as an external antenna which is not covered by the Radio Equipment Directive [i.1] and the present document only covers "Drivers".

The market for AFILS is relatively small compared with technologies such as RFID, and is physically separated from most radio systems, so the opportunity for mutual interference problems is reduced compared to other users of the spectrum in this frequency range.

As AFILS drivers use base band audio signals without additional carrier tones, and so when no input signal is present, there will be no output signal and so no magnetic field will be generated, ensuring spectrum efficiency.

The present document has been developed in response to Directive 2014/53/EU [i.1] and is the first radio standard that has been produced for AFILS equipment and has been prepared to allow the assessment of audio frequency induction loop drivers and receivers for compliance with Directive 2014/53/EU [i.1].

1 Scope

The present document specifies technical characteristics and methods of measurements for audio frequency induction loop drivers operating from 10 Hz to 9 kHz used in Audio Frequency Induction Loop System (AFILS) with an upper limit of 45 A_{rms}.

NOTE 1: The object of an AFILS is to transmit an audio signal to people with hearing difficulties. The receiver in this case is normally a hearing aid or cochlear implant with a built in telecoil, both of which are covered by ETSI EN 300 422-4 [i.11].

These radio equipment types are capable of operating in the frequency band within the 10 Hz to 9 kHz range:

- with (an) output connection(s);
- for audio frequency baseband transmission (un-modulated and without the use of a carrier).

The present document covers induction loop drivers with output connectors. Integral antenna systems are covered by ETSI EN 300 422-4 [i.11].

NOTE 2: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.1] is given in annex A.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced document are necessary for the application of the present document.

- | | |
|-----|---|
| [1] | Void. |
| [2] | CEPT/ERC/Recommendation 74-01E (Siófok 98, Nice 99, Sesimbra 02, Hradec Kralove 05, Cardiff 11): "Unwanted Emissions in the Spurious Domain". |

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- | | |
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| [i.1] | Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC. |
| [i.2] | Void. |

- [i.3] Void.
- [i.4] IEC 60118-4:2014: "Electroacoustics - Hearing aids - Part 4: Induction loop systems for hearing aid purposes - Magnetic field strength".
- [i.5] Void.
- [i.6] Void.
- [i.7] Void.
- [i.8] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.9] Void.
- [i.10] Void.
- [i.11] ETSI EN 300 422-4: "Wireless Microphones; Audio PMSE up to 3 GHz; Part 4: Assistive Listening Devices including personal sound amplifiers and inductive systems up to 3 GHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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For the purposes of the present document, the terms given in Directive 2014/53/EU [i.1] and the following apply:

artificial loop: load equal to the nominal resistance and impedance of the loop specified by the manufacturer

audio frequency induction loop driver: audio amplifier designed to drive audio-frequency current in an inductive loop, thus generating an audio-frequency magnetic field

Audio Frequency Induction Loop System (AFILS): system including induction loop driver(s), microphones and/or other signal sources, in which a magnetic field is created by the flow of audio-frequency current in a conductor arranged in the form of a loop or coil

clipping: form of waveform distortion that occurs when an induction loop driver is overdriven and attempts to deliver an output voltage or current beyond its maximum capability

conducted measurements: measurements that are made using a direct connection to the equipment under test

hearing aid: personal amplification system, worn entirely on the listener, which is designed to enable a person with impaired hearing to hear more easily

hearing instrument: hearing aid or cochlear implant

hearing loop system: non-technical name for AFILS used by the hard-of-hearing community

in band emissions: emissions on a frequency or frequencies which are inside the necessary bandwidth (10 Hz to 9 kHz)

induction loop: current carrying loop or coil of an AFILS used to create the magnetic field

NOTE: This is equivalent to the term "antenna" used in other ETSI documents and is used in the present document as it is the term commonly understood by the AFILS industry.

induction loop driver: audio driver designed to drive an induction loop

NOTE: This is equivalent to the term "transmitter" used in other ETSI documents and is used in the present document as it is the term commonly understood by the AFILS industry.

induction loop listener: portable listening device that is designed to give an audible output in response to signals produced by an AFILS

induction loop monitor receiver: equipment designed to verify the performance of an AFILS by audio and visual means:

- a) providing visible indication that it is powered and indicating when the strength of the magnetic field produced by the loop falls within a specified range; and
- b) providing an audio-frequency output by which the sound quality of the AFILS transmissions can be assessed

induction loop system: See AFILS.

internal loop: loop designed as a fixed part of the equipment, without the use of an external connector and as such which cannot be disconnected from the equipment by the user

loop: See induction loop.

loop listener: See induction loop listener.

metal compensation: method of compensating for amplitude and frequency dependant magnetic field losses due to the interaction of the magnetic field generated by the loop with nearby metal

mobile audio frequency induction loop driver: equipment normally installed in a vehicle (bus, coach, train, etc.)

out of band emissions: emissions on a frequency or frequencies immediately outside the necessary bandwidth (10 Hz to 9 kHz), but excluding spurious emissions

phased loop array: system of overlapping loops in which the currents are out of phase with each other used to provide an even field strength and to limit overspill of the magnetic field

portable audio frequency induction loop driver: driver intended to be carried or attached

radiated measurements: measurements which involve the absolute measurement of a radiated field

rated load: load, stated by the manufacturer, to which the driver output is connected for measurement purposes

reference magnetic field strength level: 0 dB reference for magnetic field strength levels, which is $400 \text{ mA}\cdot\text{m}^{-1}$

spurious emissions: emissions on a frequency or frequencies which are outside the necessary bandwidth (10 Hz to 9 kHz) and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

telecoil: magnetic pickup coil intended to receive signals from an audio frequency induction loop system

NOTE: A telecoil can be part of a hearing aid, cochlear implant, or of any other device for receiving signals from an audio frequency induction loop system in accordance with IEC 60118-4 [i.4].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

A	ampere
C	correction factor
E	electrical field strength
f	frequency
f_C	centre frequency in Hz
H	magnetic field strength
H _f	H-field-strength limit
H _C	H-field strength at the centre of the frequency of interest
H _S	H-field-strength limit for radiated spurious emissions
I _C	audio frequency in band output current

I_S	spurious output current
λ	wavelength
N	number of turns for a loop
P	power
t	time
Ω	ohm

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AFILS Audio Frequency Induction Loop System

NOTE: Also known as a Hearing Loop.

AMN	Artificial Mains Network
CDN	Coupling/Decoupling Network
CEPT	Conférence Européenne des Postes et Télécommunications
EC	European Community
EFTA	European Free Trade Association
ERC	European Radiocommunications Committee
EU	European Union
EUT	Equipment Under Test
ISN	Impedance Stabilization Network
LISN	Line Impedance Stabilization Network
RF	Radio Frequency
RFID	Radio Frequency Identification Device
rms	root mean square
SRD	Short Range Device

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4 Technical requirements specifications

4.1 Environmental conditions

4.1.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 General requirements

4.2.1 Presentation of induction loop driver equipment for testing purposes

Each equipment submitted for testing shall fulfil the requirements of the present document when operated as intended.

The range of operating conditions and power requirements for tests shall be defined based on the supplied technical documentation and operating manuals.

Drivers shall be supplied with the appropriate test jig incorporating an artificial loop.

Equipment shall be operated at its maximum intended operational current with a duty cycle of 60 s on, 240 s off in order to prevent thermal shutdown.

NOTE: AFILS drivers are designed to deliver long term speech or music signals which are constantly varying in amplitude, they are not designed to deliver sine waves for long periods.

4.2.2 Choice of model for testing

Stand-alone equipment shall be supplied by the manufacturer complete with any ancillary equipment needed for testing.

If an equipment has optional features that are considered not to affect the RF parameters, then the tests need only to be performed on the equipment configured with that combination of features considered to be the most complex, as shown in the manufacturers published technical information.

Equipment offered for test shall provide an output connector for conducted RF measurements.

The performance of the equipment submitted for testing shall be representative of the performance of the corresponding production model.

4.2.3 Controls

Controls that may need to be adjusted after installation such as input gain, loop drive, bass, treble, tone or "metal compensation" may be provided. However, any controls that might increase the interfering potential of the equipment, if misadjusted, shall not be easily accessible to the user.

4.2.4 Driver shut-off facility

If the driver is equipped with an automatic shut-off facility (such as a time-out device, over or under temperature, voltage or current, etc.) it should be made inoperative for the duration of the test, or be monitored to ensure that the shut-off facility is not activated during the test.

4.2.5 No input signal, no output signal

The loop driver shall provide no intentional drive to the induction loop when it has no audio input signal.

4.2.6 Information from the manufacturer

When submitting equipment for test, the manufacturer shall provide all information which may be required by an external laboratory.

4.2.7 Test jig

All necessary test jig, test signal sources and set-up information shall accompany the equipment submitted for testing and shall be included in the test report.

5 Testing for compliance with technical requirements

5.1 Environmental conditions for testing

5.1.1 General requirements

Tests defined in the present document shall be carried out at representative points within the boundary limits of the operational environmental profile defined by its intended use.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the operational environmental profile defined by its intended use) to give confidence of compliance for the affected technical requirements.