**ANNEX 9: INDUCTIVE APPLICATIONS**

**Scope of Annex**

This annex covers frequency bands and regulatory as well as informative parameters recommended for inductive loop systems, which use magnetic fields for near field communication and determination applications. This includes for example:

• car immobilisers,

• radio frequency identification (RFID) applications including for example automatic article identification, asset tracking, alarm systems, waste management, personal identification, access control, proximity sensors, antitheft systems, location systems, NFC applications e.g. used for data transfer to handheld devices, anti-theft systems including RF anti- theft induction systems (e.g. EAS),

• metal and proximity sensors,

• wireless control systems,

• animal identification,

• cable detection,

• wireless voice links,

• automatic road tolling.

It should be noted that other types of anti-theft systems can be operated in accordance with other relevant annexes.

**Table 9: Regulatory parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Frequency Band** | | **Power / Magnetic Field** | **Spectrum access and mitigation requirements** | **Modulation / occupied bandwidth** | **ECC/ERC Deliverable** | **Notes** |
| **a0** | 100 Hz-9 kHz | 82 dBµA/m at 10 m | No requirement | Not specified |  | Antenna size of < 1/20 λ (see note 1) |
| **a1** | 9-90 kHz | 72 dBµA/m at 10 m - The limit is reduced according to Table 9bis | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed. Magnetic field strength level descending 3 dB/octave above 30 kHz |
| **a2** | 90-119 kHz | 42 dBµA/m at 10 m | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed |
| **a3** | 119-135 kHz | 66 dBµA/m at 10 m - The limit is reduced according to Table 9bis | No requirement | See note 2 |  | In case of external antennas only loop coil antennas may be employed. Magnetic field strength level descending 3 dB/octave above 119 kHz |
| **b** | 135-140 kHz | 42 dBµA/m at 10 m | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed |
| **c** | 140-148.5 kHz | 37.7 dBµA/m at 10 m | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed |
| **d** | 400-600 kHz | -5 dBµA/m at 10 m in total -8 dBµA/m at 10 m per 10 kHz | No requirement | ≥ 30kHz |  | For RFID only. In case of external antennas only loop coil antennas may be employed. |
| **e** | 3155-3400 kHz | 13.5 dBµA/m at 10 m | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed |
| **f** | 6765-6795 kHz | 42 dBµA/m at 10 m | No requirement | Not specified |  |  |
| **g** | 7400-8800 kHz | 9 dBµA/m at 10 m | No requirement | Not specified |  |  |
| **h** | 10200-11000 kHz | 9 dBµA/m at 10 m | No requirement | Not specified |  |  | |
| **i** | 13553-13567 kHz | 42 dBµA/m at 10 m | No requirement | See note 3 |  |  | |
| **j** | 13553-13567 kHz | 60 dBµA/m at 10 m | No requirement | See note 3 | ECC Report 208 | For RFID only | |
| **k1** | 148.5-5000 kHz | -5 dBµA/m at 10 m in total -15 dBµA/m at 10 m per 10 kHz (see also Table 9bis) | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed. | |
| **k2** | 5000 kHz-30 MHz | -5 dBµA/m at 10 m in total -20 dBµA/m at 10 m per 10 kHz | No requirement | Not specified |  | In case of external antennas only loop coil antennas may be employed. | |

**Table 9bis: Standard frequency and time signals to be protected within 9-90 kHz and 119-135 kHz**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stations** | **Frequency** | **Protection bandwidth** | **Maximum field strength at 10 m** | **Location** |
| MSF | 60 kHz | +/-250Hz | 42 dBµA/m | United Kingdom |
| HBG | 75 kHz | +/-250Hz | 42 dBµA/m | Switzerland |
| DCF77 | 77.5 kHz | +/-250Hz | 42 dBµA/m | Germany |
| DCF49 | 129.1 kHz | +/-500Hz | 42 dBµA/m | Germany |
| ALS162 | 162 kHz | +/-250Hz | -15 dBµA/m | France |

**Additional Information**

**Harmonised Standards**

EN 303 447 sub-bands a0), a1) to a3), b) and c)

EN 303 454 sub-bands a0), a1) to a3), b) and c)

EN 300 330 all sub-bands except a0)

**Technical parameters also referred to in the harmonised standard**

Note 1: Sub-band a0):

The antenna size is described by the distance between those two points on the antenna that have the largest distance between them (e.g. for a rectangle shaped antenna the largest diagonal; for a circular shaped antenna the diameter).

Sub-bands a1) and a3):

In case of loop antennas used within bands a1) and a3) integral or dedicated within an area between 0.05 m² and 0.16 m², the field strength is reduced by 10 x log (area/0.16 m²); for an antenna area less than 0.05 m² the field strength is reduced by 10 dB.

Note 2: Sub-band a3):

RFID operating in the frequency sub-band 119-135 kHz shall meet the spectrum mask given in EN 300 330. This will permit a simultaneous use of the various sub-bands within the range 90-148.5 kHz.

Note 3: Sub-bands i) and j):

Devices operating in the 13.56 MHz band shall meet the transmission mask and antenna requirements for all combined frequency segments, including the limits in the sub-bands k1) and k2), as described in harmonised standard EN 300 330. This will permit the simultaneous use of the sub-bands i) or j) together with the limits of the sub-bands k1) and k2).

**Frequency issues**

Users should be aware that emissions from inductive applications could cause interference to nearby receivers of other radio services.

Particular attention should also be paid to the more stringent protection requirements identified by the ITU for global distress and safety communications frequencies in the same or adjacent bands.

Sub-band a0):

Some administrations do not regulate use below 9 kHz, but the provided limits allow usage on a non-interfering basis. See national implementation status (Appendix 1).