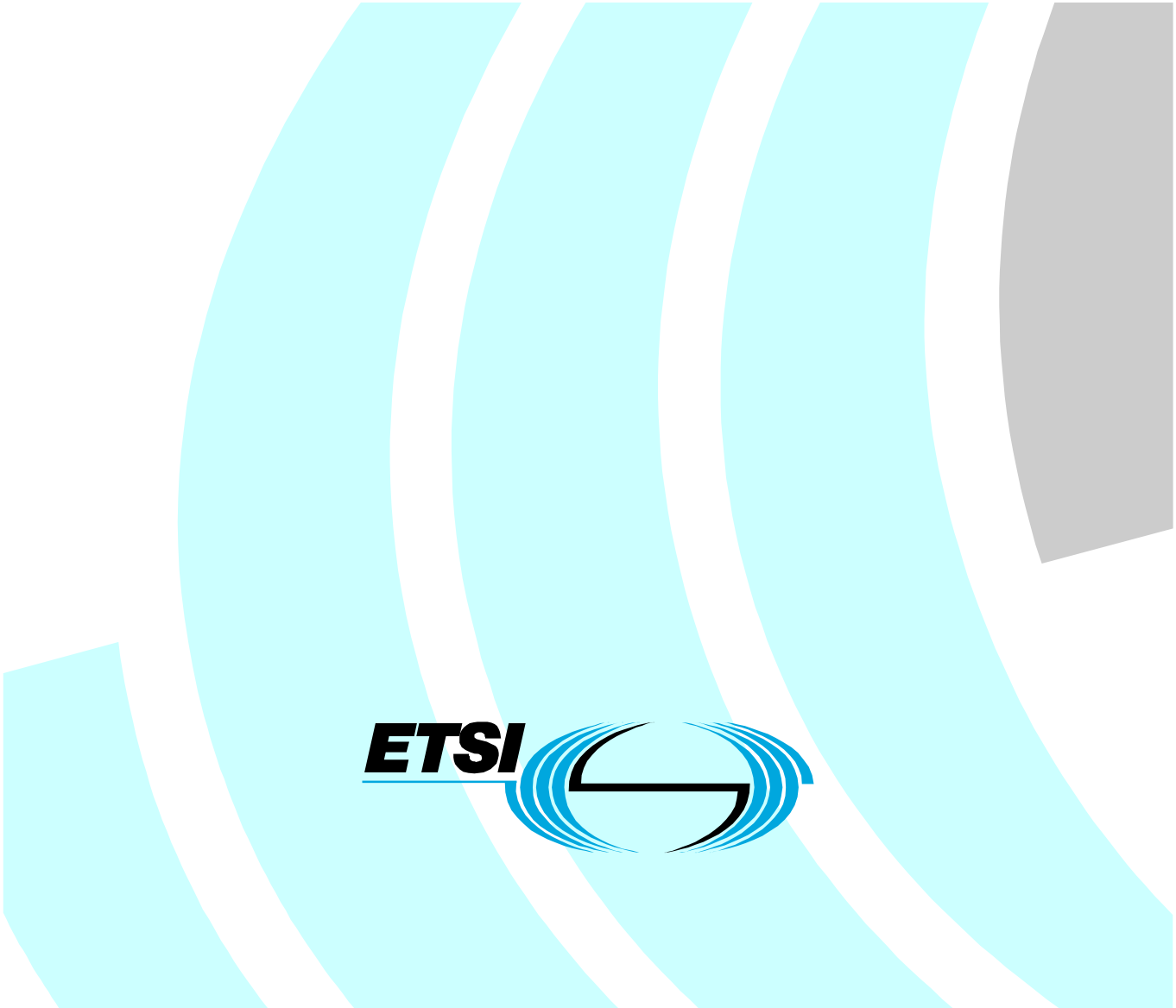
ETSI TR 102 315 V1.1.1 (2004-03)

Technical Report

Electromagnetic compatibility and Radio spectrum Matters (ERM); Ultra Low Power Animal Implant Devices (ULP-AID) operating in the frequency bands: 1 MHz to 3 MHz, 11,5 MHz to 12,5 MHz, 13,5 MHz to 14,5 MHz, 15,5 MHz to 16,5 MHz; System reference document



Reference
DTR/ERM-RM-027

Keywords
SRDoc, radio, SRD, HF, MF

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

1 Scope

The present document applies to the radio sections of inductive loop ULP-AID systems to be used by the medical and pharmaceutical industries in medically related animal studies of the efficacy and safety of drug and surgical procedures. These devices are typically simplex short-range transmitters and receiver systems that operate in one of the following four bands, 1 MHz to 3 MHz, 11,5 MHz to 12,5 MHz, 13,5 MHz to 14,5 MHz, or 15,5 MHz to 16,5 MHz.

The present document includes necessary information to support the co-operation between ETSI and the Electronic Communications Committee (ECC) of the European Conference of Post and Telecommunications Administrations (CEPT), including:

- Detailed market information (annex A);
- Technical information (annex B);
- Expected compatibility issues (annex C).

2 References

For the purposes of this Technical Report (TR) the following references apply:.

[1] ETSI EN 302 195-1 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radio equipment in the frequency range 9 kHz to 315 kHz for ultra low power active medical implants and accessories; Part 1: Technical characteristics and test methods".

[2] ETSI EN 302 195-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radio equipment in the frequency range 9 kHz to 315 kHz for ultra low power active medical implants and accessories; Part 2: Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".

[3] CEPT/ERC Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)".

[4] European Treaty Series, ETS 123: "European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes".

[5] European Treaty Series, ETS 170: "Protocol of Amendment to the European Convention for the Protection of Vertebrate Animals used for Experimental and other Purposes".

[6] CEPT/SE24 meeting M16, June 2002, "Documents M16-57R1- SE24-30M-ANNEX -2.doc and M16-57R1- SE24-LS to SRDMG on 30 MHz for SRD inductive systems".

[7] CEPT/ERC Report 44: "Sharing between inductive systems and radiocommunication systems in the band 9 - 135 kHz".

[8] ECC/SE(04)015 (2004): "Protection distances for radiocommunication services from inductive SRD applications in the frequency range 135 kHz - 30 MHz".

[9] CEPT/ERC Report 25: "The European Table of Frequency Allocations and Utilisations Covering the Frequency Range 9 kHz to 275 GHz: Lisboa January 2002 - Dublin 2003 - Turkey 2004".

[10] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

[11] ITU Radio Regulations - Editon 2001.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

integral antenna: permanent fixed antenna, which may be built-in or designed as an indispensable part of the equipment

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

ULP-AID: system composed of an ultra low power animal implantable transmitter/sensor used in medically related scientific studies that transmits physiological parameter data from an animal to an external receiver

ULP-AMI: transceiver part of an active implantable medical device

3.2 Symbols

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

f	Frequency
H	Magnetic field strength
P	Power
R	Distance
t	Time

3.3 Abbreviations

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

AID	Animal Implantable Device
LBT	Listen Before Talk
LF	Low Frequency
RF	Radio Frequency
ULP-AID	Ultra Low Power-Animal Implantable Device
ULP-AMI	Ultra Low Power-Active Medical Implant

4 Executive summary

Ultra Low Power Animal Implant Devices (ULP-AID) using inductive loop techniques have found acceptance and application in the medical and pharmaceutical industries for many medically related scientific applications. This magnetic field technology allows lossless penetration of most materials encountered in medical environments including animal tissue, which is very desirable for implant applications.

4.1 Status of the System Reference Document

The ERM-RM working group, in its 26th meeting in Helsinki, has reviewed the content of the present document and has since approved it by correspondence.

4.2 Technical issues

4.2.1 System description

There is currently a European treaty obligation, ETS 123 [4], that endeavours to protect the rights of animals used in scientific studies. The document is the subject of a pending amendment that will require certain conditions to be afforded to caged animals used in scientific studies such as medically related testing to insure the safety and efficacy of newly developed drugs. The effect of these new regulations will in many cases require certain species of animals to be housed in groups in a single cage. This treaty obligation will require additional bands to be made available in order to accommodate large groups of closely located animals used in medically related studies.

Existing implant technology will migrate to the new bands as the market demands to meet the requirements of the treaty obligations are known. This technology utilizes various sensors in conjunction with pulse position modulation coding to transmit physiological parameter information to a separate receiver.

4.2.2 Market briefing

The market for ULP-AID used by hospitals, laboratories and the pharmaceutical industry involved in medically related scientific studies is very small. Currently there are approximately 5 200 of the devices in Europe with expected sales increases of less than 10 % per year with a customer base of approximately 250 institutions (R&D centres and hospitals). That means proliferation of these devices is non-existent. The figures given here are valid for the totality for applications for ULP-AID in Europe independent of the number of frequency bands allocated to this application. Even if additional bands are allocated to the application, the total numbers given above will remain.

4.2.3 Spectrum requirement and justifications

The effect of the referenced legislation is to require implanted animals of the same species to be housed in such close proximity that individual reception of signals from implants will require multiple bands to be available to permit reliable reception of the telemetry data. Current ULP-AID technology and embedded devices cannot support band sharing by multiple devices. Battery life, ULP-AID size, as well as other considerations limit the technical capabilities that these devices can incorporate.

With the ratification of ETS 170 [5], there will be an almost instantaneous need for frequencies in order to continue these medically necessary studies. To date, 12 ratifications have been obtained with 3 countries having accepted but not signed at this time.

4.2.4 Current regulations

For spectrum conformity testing the radio will comply with revised harmonised standard EN 302 195–2 [2]. The revision to include this band will be undertaken by ERM_TG30 which has the responsibility for wireless medical systems including ULP-AID devices.

4.2.5 Proposed regulation

It is proposed that CEPT adopt provisions in annex 12 of CEPT/ERC Recommendation 70-03 [3] for ULP-AID systems to permit operation of animal implant devices in the frequency bands listed in the table below. Incorporation of the additional frequencies in annex 12, bands d, e, f, and g, specifically for ULP-AID equipment, will provide that other SRDs will not proliferate in this frequency band.

Frequency Band		Power	Duty cycle	Channel spacing	ERC Decision	Notes
a	402 MHz to 405 MHz	25 µW e.r.p.	No Restriction	25 kHz	ERC DEC (01)17	Individual transmitters may combine adjacent channels for increased bandwidth up to 300 kHz
b	9 kHz to 315 kHz	30 dBµA/m at 10 m	< 10 %	No spacing		
d	1 MHz to 3 MHz	-5 dBµA/m at 10 m	< 10 %	No spacing		
e	11,5 MHz to 12,5 MHz	-5 dBµA/m at 10 m	< 10 %	No spacing		
f	13,5 MHz to 14,5 MHz	-5 dBµA/m at 10 m	< 10 %	No spacing		
g	15,5 MHz to16,5 MHz	-5 dBµA/m at 10 m	< 10 %	No spacing		

4.2.6 Compatibility issues

Many inductive applications are permitted in the CEPT countries for general usage or specific usage applications. Above 1 MHz the allocations of the ITU in the frequency bands for the equipment listed in the present document are stated in clause C.2. The European Common Allocation Table gives further information on the utilisation in CEPT countries [9].

As later discussed, based on the mitigating factors related to sharing of the band by ULP-AID, it is expected that there is no risk of disturbance to any of the above services from these devices operating in the bands at the proposed power level.

5 Main conclusions

Business, social, humanitarian, international manufacturing, trade and use considerations, dependency of the public on having available safe and effective drugs, reduction in patient related medical cost, and benefit for society in general, justifies the request to permit ULP-AID devices to use the bands from 1 to 3 MHz, 11,5 to 12,5 MHz, 13,5 to 14,5 MHz and 15,5 to 16,5 MHz.

- Inductive LF ULP-AID systems have been deployed by research institutions worldwide for many years in applications related to testing of drugs and other medical techniques.
- Because of the extremely low magnetic fields from these ULP-AID systems (-9 dBµA/m at 10 m), location in the environment and the extremely small numbers of devices it is expected that there is little probability of any potential for interference to existing services.
- ULP-AID devices only radiate electromagnetic energy when activated by a laboratory technician and have a very limited lifetime. Further, even during activation, the duty cycle of these devices is less than 10 %. Field strength levels for operation in the proposed bands are near or below the noise floor at distances of approximately 10 m.
- These systems are located in industrial high ambient field locations with a maximum of 250 locations throughout Europe.

5.1 Expected timing for products to market

Products for use for medically related research are now available worldwide from highly specialized manufacturers.

5.2 ECC and ETSI actions

ETSI requests the ECC to consider the following actions:

- If relevant, verification of the compatibility among others with broadcasting, fixed, maritime mobile, land mobile, radiolocation, amateur, standard frequency and time signal, aeronautical mobile, and amateur-satellite services by the ECC spectrum engineering project team SE24.
- Incorporation of bands d, e, f, and g at the requested parameters in annex 12 of CEPT/ERC Recommendation 70-03 [3] by the ECC.
- Adoption of an ECC DECISION on those applications by the ECC.

ETSI actions:

- The spectrum parameters for inductive loop ULP-AID systems that are the subject of the present document are intended to be included as a normative annex to EN 302 195-2 [2] as a revision to that document.

Annex A:
Detailed market information

A.1 Range of applications

Animal Implantable Devices (AID) find applications in small (mice), medium (rat) and large dogs, and primate animals. Small size devices are typically single channel using blood pressure, temperature, and/or biopotential sensors. Medium size devices use the same types of sensors as the small animal series, however, they can accommodate multiple sensors in 3 to 4 channel versions. Large devices can use the above sensor devices with the ability to couple multiple sensors in 2 and 3 channel versions.

The market for these devices is to hospitals, laboratories involved in medical research and pharmaceutical manufacturing facilities. As such, they are all within industrialized areas with high levels of existing ambients in the band.

Ultra low power active medical animal implants, for purposes of the present document, are defined as transmitters designed to transmit digital information in the frequency bands specified in the present document for the purpose of providing a one-way radio link between an ULP-AID and an external receiver. These medically related implants are diagnostic in nature containing a power source and designed to be implanted in the body of an animal.

These implants find wide acceptance for applications such as measuring body temperature, blood pressure, heart rate, hydration level, etc., either as a single physiologic parameter measurement or in multiple configurations.

A.2 Market size and value

Animal implants used world-wide in medically related studies total approximately 15 000 units yearly. Of the 15 000 units worldwide, it is estimated that 2 500 units will be utilizing the additional bands in Europe as a result of ETS 123 [4].

Active medical implants for use in these animal studies are the only technology capable of providing continuous pulse coded data which is required due to the need for constant monitoring of the study subject. These studies ultimately serve to preserve and enhance the quality of life for millions of patients worldwide as physicians prescribe the various medications developed using this technology.

A.3 Traffic evaluation

The emission of magnetic field strength and the actual frequency usage is extremely low.

The reasons are that:

a) There are relatively very few animal implant transmitters in use at one time. With a total population of 5 200 units in Europe, only about 500 or less are actually in use at a given time and these would be deployed at numerous locations. It is expected that no more than 20 to 30 units would ever be active at a specific location at one time and even this would be rare. The duty cycle is less than 10 %.

b) Transmitters are only activated on demand and have a limited battery life on average of one month before implant replacement is required. Further, there are only approximately 250 locations within Europe where these medical studies are performed.

c) Animal implantable device field strengths measured in accordance with EN 302 195-2 [2] are of the order of -9 dBµA/m at 10 m.

d) ULP-AID in the bands covered by this document will represent only a relatively small portion of the total of 5 200 units since these bands will only be needed when implanted animals are congregated in groups.

Annex B:
Technical information

B.1 Detailed technical description

These devices are very low power animal implantable transmitters providing a simplex communications link to an associated nearby receiver. The implant and one or more of a series of different sensors is implanted in an animal being used in a laboratory to determine the efficacy of a drug product or medical technique. The data is transmitted using a pulse position coding providing minimal battery drain to maximize the life of the implant. The associated receiver is located very near the cage containing the implanted animal (typically directly under the cage) to maximize coupling between the implant and receiver.

Animal implants consist of two sections, the physiologic parameter sensor or sensors and the transmitter section to enable the telemetry function. The RF pulse drive circuit is typically integrated into a hybrid chip that drives an internal coil capacitor circuit. This coil is the radiating antenna for the implant. Generally, the package is sealed in a suitable polymer case with sensor leads extending through the case.

Active medical implants for use in these animal studies are the only technology capable of providing continuous pulse coded data which is required due to the need for constant monitoring of the study subject. These studies ultimately serve to preserve and enhance the quality of life for millions of patients worldwide as physicians prescribe the various medications developed using this technology.

B.1.1 Magnetic field requirements for inductive systems

These systems use a variety of coil configurations using various core sizes. Maximum antenna size is approximately 10 cm diameter with a 20 turn coil. Due to the varied construction used to accommodate different types of animals, a number of units were tested. For the implanted devices the maximum H field measured was-9 dBµA/m and minimum H field was -60 dBµA/m. ULP-AID have several characteristics in common:

a) typically, they are totally implanted within an animal body;

b) the function they perform in providing physiological data cannot reasonably be obtained by any other method;

c) they are expected to reliably transmit data continuously in performing their intended function for periods of time on average of a month;

d) they are capable of being refurbished and reused at the end of their life cycle;

e) they are not capable of being programmed by a programming device.

The ambient noise level:

The ambient noise is dependent on the location of the equipment. Medical facilities can be considered an industrial or commercial environment. In these environments the ambient noise is very high. The main noise sources are the harmonics of different electric equipment, for example switch mode power supplies, PCs, other medical equipment, ISM devices, fluorescent lights, electric distribution in general, etc. According to CEPT/ERC Report 44 [7], the noise level in this type of environment, measured in a 1 kHz bandwidth, is expected to vary in the range 5 dBµA/m to 30 dBµA/m at 50 kHz. A typical level is 13 dBµA/m at 50 kHz. The noise level falls at a 3,5 dB/octave and it is typically -1 dBµA/m at 1 MHz. At 16 MHz the noise floor will be approximately -14 dBµA/m.

B.2 Technical justifications for spectrum

B.2.1 Field Strength

A maximum carrier power level of -5 dBµA/m measured at 10 m distance is requested. This level will allow for production tolerance relative to the measured maximum level of -9 dBµA/m at 10 m. Further, to limit any possible use of this band for devices other than animal implant devices used in support of medically related scientific studies, it is proposed that annex 12, which covers ULP-AMI equipment, be revised to list the bands 1 MHz to 3 MHz, 11,5 MHz to 12,5 MHz, 13,5 MHz to 14,5 MHz and 15,5 MHz to 16,5 MHz for use by ULP-AID only.

B.2.2 Frequency

The band from 9 kHz to 315 kHz is generally recognised within the CEPT countries for ULP-AMI applications where primary usage is centred in hospital and clinical environments at a power level of 30 dBµA/m at 10 m. The manmade contribution to the ambient noise in the spectrum below 1 MHz is increasing as the proliferation of noise sources continues to increase. Co-band, co-location operation on frequencies with ULP-AMI is not desirable and new bands must be opened for ULP-AID devices to satisfy the requirement for humane treatment of these animals. Opening new bands for ULP-AID devices will preclude any increase in the noise floor in the ULP-AMI band and will minimize any disturbance threat that would otherwise exist due to the potential co-location of the two types of devices.

The band 315 kHz to 600 kHz is most likely to be granted for the application of ULP-AID systems, however, one band will not permit co-location of multiple animals that have ULP-AID implanted at the same laboratory. Current devices have a maximum duty cycle of <10%. However, this fact does not enable multiple devices to share the band if they are in close proximity to each other. Band sharing under these conditions requires each device to be aware of the existence of the other devices. This means the transmitters must be synchronized such that no two transmitters will attempt to transmit at the same time. Synchronization requires very stable long-term time bases or alternatively each transmitter must have some way of sensing that another device is using the spectrum (LBT). The incorporation of either of the above technologies in these devices would so limit their lifetime due to battery drain, that they would be basically useless for even short term projects of one to two weeks. Therefore, it is absolutely necessary to have additional bands available for this application at the same site (e.g. research centre) to permit multiple implanted animals to be co-located in the same cage.

Further, there is currently a European treaty obligation, ETS 123 [4], that endeavours to protect the rights of animals used in scientific studies. The document is the subject of a pending amendment that will require more humane conditions to be afforded to caged animals used in scientific studies such as medically related testing to insure the safety and efficacy of newly developed drugs. The effect of these new regulations will in many cases require certain species of animals to be housed in groups in a single cage. This treaty obligation will require additional bands to be made available in order to accommodate large groups of closely located animals.

B.2.3 Bandwidth and other radio parameters

Several factors have bearing on the circuitry used and therefore the device's operating bandwidth. Prime consideration relative to design is to conserve power to the extent possible. Reduced battery life causing replacement of an implant during a study could invalidate the entire study. One technique to reduce power is the use of pulse position modulation techniques. Another issue is output filtering. Such filtering would obviously have losses. Such losses reduce battery life and thus minimal filtering is incorporated in ULP-AID transmitters. Bandwidth is also a function of the data rate which is related to the number of sensor information channels that are the data source for the transmitters. A high data rate system (15 kHz) has a 20 dB bandwidth of approximately 300 kHz when measured in accordance with the test set up in EN 302 195-2 [2]. EN 302 195-2 [2] will be revised to cover the bands specified in the present document.

B.3 Information on current version of relevant ETSI standard

ETSI intends to revise the current EN 302 195-1 [1] and EN 302 195-2 [2], to incorporate the additional frequency bands for ULP-AID equipment.

Annex C:
Expected compatibility issues

C.1 Coexistence studies

Work has already been done in this area by CEPT, see in particular:

SE24M16-57 Rev 1: SE24-LS to SRDMG: "Generic Limit below 30 MHz for SRD inductive systems".

ECC/SE(04)015: "Protection distances for radiocommunication services from inductive SRD applications in the frequency range 135 kHz - 30 MHz", 2004 [8].

C.2 Current ITU allocations

The ITU Radio Regulations (ed. 2001) [11] lists in Region 1:

526,5 kHz to 1 606,5 kHz	BROADCASTING 5.87 5.87A
1 606,5 kHz to 1 625 kHz	FIXED MARITIME MOBILE 5.90 LAND MOBILE 5.92
1 625 kHz to 1 635 kHz	RADIOLOCATION 5.93
1 635 kHz to 1 800 kHz	FIXED MARITIME MOBILE 5.90 LAND MOBILE 5.92 5.96
1 800 kHz to 1 810 kHz	RADIOLOCATION 5.93
1 810 kHz to 1 850 kHz	AMATEUR 5.98 5.99 5.100 5.101
1 850 kHz to 2 000 kHz	FIXED MOBILE except aeronautical mobile 5.92 5.96 5.103
2 000 kHz to 2 025 kHz	FIXED MOBILE except aeronautical mobile (R) 5.92 5.103
2 025 kHz to 2 045 kHz	FIXED MOBILE except aeronautical mobile (R) Meteorological aids 5.104 5.92 5.103
2 045 kHz to 2 160 kHz	FIXED MARITIME MOBILE LAND MOBILE 5.92
2 160 kHz to 2 170 kHz	RADIOLOCATION 5.93 5.107
2 170 kHz to 2 173,5 kHz	MARITIME MOBILE
2 173,5 kHz to 2 190,5 kHz	MOBILE (distress and calling) 5.108 5.109 5.110 5.111
2 190,5 kHz to 2 194 kHz	MARITIME MOBILE
2 194 kHz to 2 300 kHz	FIXED MOBILE except aeronautical mobile (R) 5.92 5.103 5.112
2 300 kHz to 2 498 kHz	FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113 5.103
2 498 kHz to 2 501 kHz	STANDARD FREQUENCY AND TIME SIGNAL (2 500 kHz)

2 501 kHz to 2 502 kHz	STANDARD FREQUENCY AND TIME SIGNAL Space Research
2 502 kHz to 2 625 kHz	FIXED MOBILE except aeronautical mobile (R) 5.92 5.103 5.114
2 625 kHz to 2 650 kHz	MARITIME MOBILE MARITIME RADIONAVIGATION 5.92
2 650 kHz to 2 850 kHz	FIXED MOBILE except aeronautical mobile (R) 5.92 5.103
2 850 kHz to 3 025 kHz	AERONAUTICAL MOBILE (R) 5.111 5.115

11 400 kHz to 11 600 kHz	FIXED
11 600 kHz to 11 650 kHz	BROADCASTING 5.134 5.146
11 650 kHz to 12 050 kHz	BROADCASTING 5.147
12 050 kHz to 12 100 kHz	BROADCASTING 5.134 5.146
12 100 kHz to 12 230 kHz	FIXED
12 230 kHz to 13 200 kHz	MARITIME MOBILE 5.109 5.110 5.132 5.145

13 410 kHz to 13 570 kHz	FIXED Mobile except aeronautical mobile (R) 5.150
13 570 kHz to 13 600 kHz	BROADCASTING 5.134 5.151
13 600 kHz to 13 800 kHz	BROADCASTING
13 800 kHz to 13 870 kHz	BROADCASTING 5.134 5.151
13 870 kHz to 14 000 kHz	FIXED Mobile except aeronautical mobile (R)
14 000 kHz to 14 250 kHz	AMATEUR AMATEUR-SATELLITE
14 250 kHz to 14 350 kHz	AMATEUR 5.152
14 350 kHz to 14 990 kHz	FIXED Mobile except aeronautical mobile (R)

15 100 kHz to 15 600 kHz	BROADCASTING
15 600 kHz to 15 800 kHz	BROADCASTING 5.134 5.146
15 800 kHz to 16 360 kHz	FIXED 5.153
16 360 kHz to 17 410 kHz	MARITIME MOBILE 5.109 5.110 5.132 5.145

Footnotes:

5.87 *Additional allocation:* in Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, the band 526,5 to 535 kHz is also allocated to the mobile service on a secondary basis.

5.87A *Additional allocation:* in Uzbekistan, the band 526,5 to 1 606,5 kHz is also allocated to the radionavigation service on a primary basis. Such use is subject to agreement obtained under No. **9.21** with administrations concerned and limited to ground-based radiobeacons in operation on 27 October 1997 until the end of their lifetime. (WRC-97)

5.90 In the band 1 605 to 1 705 kHz, in cases where a broadcasting station of Region 2 is concerned, the service area of the maritime mobile stations in Region 1 shall be limited to that provided by ground-wave propagation.

5.92 Some countries of Region 1 use radiodetermination systems in the bands 1 606,5 to 1 625 kHz, 1 635 to 1 800 kHz,
1 850 to 2 160 kHz, 2 194 to 2 300 kHz, 2 502 to 2 850 kHz and 3 500 to 3 800 kHz, subject to agreement obtained under No. **9.2**1. The radiated mean power of these stations shall not exceed 50 W.

5.93 *Additional allocation:* in Angola, Armenia, Azerbaijan, Belarus, Georgia, Hungary, Kazakstan, Latvia, Lithuania, Moldova, Mongolia, Nigeria, Uzbekistan, Poland, Kyrgyzstan, Slovakia, the Czech Rep., the Russian Federation, Tajikistan, Chad, Turkmenistan and Ukraine, the bands 1 625 to 1 635 kHz, 1 800 to 1 810 kHz and 2 160 to 2 170 kHz and, in Bulgaria, the bands 1 625 to 1 635 kHz and 1 800-1 810 kHz, are also allocated to the fixed and land mobile services on a primary basis, subject to agreement obtained under No. **9.2**1. (WRC-2000)

5.96 In Germany, Armenia, Austria, Azerbaijan, Belarus, Denmark, Estonia, Finland, Georgia, Hungary, Ireland, Israel, Jordan, Kazakstan, Latvia, Liechtenstein, Lithuania, Malta, Moldova, Norway, Uzbekistan, Poland, Kyrgyzstan, Slovakia, the Czech Rep., the United Kingdom, the Russian Federation, Sweden, Switzerland, Tajikistan, Turkmenistan and Ukraine, administrations may allocate up to 200 kHz to their amateur service in the bands 1 715 to 1 800 kHz and 1 850 to 2 000 kHz. However, when allocating the bands within this range to their amateur service, administrations shall, after prior consultation with administrations of neighbouring countries, take such steps as may be necessary to prevent harmful interference from their amateur service to the fixed and mobile services of other countries. The mean power of any amateur station shall not exceed 10 W. (WRC-2000)

5.98 *Alternative allocation:* in Angola, Armenia, Azerbaijan, Belarus, Belgium, Bulgaria, Cameroon, the Congo, Denmark, Egypt, Eritrea, Spain, Ethiopia, Georgia, Greece, Italy, Kazakstan, Lebanon, Lithuania, Moldova, the Netherlands, Syria, Kyrgyzstan, the Russian Federation, Somalia, Tajikistan, Tunisia, Turkmenistan, Turkey and Ukraine, the band 1 810 to 1 830 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-2000)

5.99 *Additional allocation:* in Saudi Arabia, Austria, Bosnia and Herzegovina, Iraq, Libya, Uzbekistan, Slovakia, the Czech Rep., Romania, Slovenia, Chad, Togo and Yugoslavia, the band 1 810 to 1 830 kHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-2000)

5.100 In Region 1, the authorization to use the band 1 810 to 1 830 kHz by the amateur service in countries situated totally or partially north of 40° N shall be given only after consultation with the countries mentioned in Nos. **5.98** and **5.99** to define the necessary steps to be taken to prevent harmful interference between amateur stations and stations of other services operating in accordance with Nos. **5.98** and **5.99**.

5.101 *Alternative allocation:* in Burundi and Lesotho, the band 1 810 to 1 850 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

5.103 In Region 1, in making assignments to stations in the fixed and mobile services in the bands 1 850 to 2 045 kHz, 2 194 to 2 498 kHz, 2 502 to 2 625 kHz and 2 650 to 2 850 kHz, administrations should bear in mind the special requirements of the maritime mobile service.

5.104 In Region 1, the use of the band 2 025 to 2 045 kHz by the meteorological aids service is limited to oceanographic buoy stations.

5.107 *Additional allocation:* in Saudi Arabia, Botswana, Eritrea, Ethiopia, Iraq, Lesotho, Libya, Somalia and Swaziland, the band 2 160 to 2 170 kHz is also allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. The mean power of stations in these services shall not exceed 50 W. (WRC-2000)

5.108 The carrier frequency 2 182 kHz is an international distress and calling frequency for radiotelephony. The conditions for the use of the band 2 173,5 to 2 190,5 kHz are prescribed in Articles **31** and **52** and in Appendix **13**.

5.109 The frequencies 2 187,5 kHz, 4 207,5 kHz, 6 312 kHz, 8 414,5 kHz, 12 577 kHz and 16 804,5 kHz are international distress frequencies for digital selective calling. The conditions for the use of these frequencies are prescribed in Article **31**.

5.110 The frequencies 2 174,5 kHz, 4 177,5 kHz, 6 268 kHz, 8 376,5 kHz, 12 520 kHz and 16 695 kHz are international distress frequencies for narrow-band direct-printing telegraphy. The conditions for the use of these frequencies are prescribed in Article **31**.

5.111 The carrier frequencies 2 182 kHz, 3 023 kHz, 5 680 kHz, 8 364 kHz and the frequencies 121,5 MHz, 156,8 MHz and 243 MHz may also be used, in accordance with the procedures in force for terrestrial radiocommunication services, for search and rescue operations concerning manned space vehicles. The conditions for the use of the frequencies are prescribed in Article **31** and in Appendix **13**.
The same applies to the frequencies 10 003 kHz, 14 993 kHz and 19 993 kHz, but in each of these cases emissions must be confined in a band of ±3 kHz about the frequency.

5.112 *Alternative allocation:* in Bosnia and Herzegovina, Cyprus, Denmark, Greece, Iceland, Malta, Sri Lanka and Yugoslavia, the band 2 194 to 2 300 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-2000)

5.113 For the conditions for the use of the bands 2 300 to 2 495 kHz (2 498 kHz in Region 1), 3 200 to 3 400 kHz, 4 750 to 4 995 kHz and 5 005 to 5 060 kHz by the broadcasting service, see Nos. **5.16** to **5.20**, **5.21** and **23.3** to **23.10**.
5.114 *Alternative allocation:* in Bosnia and Herzegovina, Cyprus, Denmark, Greece, Iraq, Malta, and Yugoslavia, the band 2 502 to 2 625 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-2000)

5.115 The carrier (reference) frequencies 3 023 kHz and 5 680 kHz may also be used, in accordance with Article **31** and Appendix **13** by stations of the maritime mobile service engaged in coordinated search and rescue operations.

5.132 The frequencies 4 210 kHz, 6 314 kHz, 8 416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100,5 kHz are the international frequencies for the transmission of maritime safety information (MSI) (see Appendix **17**).

Footnote 5.134 has been modified by WRC-07 to read:
5.134 The use of the bands 5 900 to 5 950 kHz, 7 300 to 7 350 kHz, 9 400 to 9 500 kHz, 11 600 to 11 650 kHz, 12 050 to 12 100 kHz, 13 570 to 13 600 kHz, 13 800 to 13 870 kHz, 15 600 to 15 800 kHz, 17 480 to 17 550 kHz and 18 900 to 19 020 kHz by the broadcasting service as from 1 April 2007 is subject to the application of the procedure of Article **12**. Administrations are urged to use these bands to facilitate the introduction of digitally modulated emissions in accordance with the provisions of Resolution **517 (Rev.WRC-03)**. (WRC-03)

5.145 The conditions for the use of the carrier frequencies 8 291 kHz, 12 290 kHz and 16 420 kHz are prescribed in Articles **31** and **52** and in Appendix **13**.

5.146 The bands 9 400 to 9 500 kHz, 11 600 to 11 650 kHz, 12 050 to 12 100 kHz, 15 600 to 15 800 kHz, 17 480 to 17 550 kHz and 18 900 to 19 020 kHz are allocated to the fixed service on a primary basis until 1 April 2007, subject to application of the procedure referred to in Resolution **21 (Rev.WRC-95**). After 1 April 2007, frequencies in these bands may be used by stations in the fixed service, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies in the fixed service, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations.

5.147 On condition that harmful interference is not caused to the broadcasting service, frequencies in the bands 9 775 to 9 900 kHz, 11 650 to 11 700 kHz and 11 975 to 12 050 kHz may be used by stations in the fixed service communicating only within the boundary of the country in which they are located, each station using a total radiated power not exceeding 24 dBW.

5.150 The following bands:

13 553 to 13 567 kHz (centre frequency 13 560 kHz),
26 957 to 27 283 kHz (centre frequency 27 120 kHz),
40,66 to 40,70 MHz (centre frequency 40,68 MHz),
902 to 928 MHz in Region 2 (centre frequency 915 MHz),
2 400 to 2 500 MHz (centre frequency 2 450 MHz),
5 725 to 5 875 MHz (centre frequency 5 800 MHz), and
24 to 24,25 GHz (centre frequency 24,125 GHz)

are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. **15.13**.

5.151 The bands 13 570 to 13 600 kHz and 13 800 to 13 870 kHz are allocated, until 1 April 2007, to the fixed service on a primary basis and to the mobile except aeronautical mobile (R) service on a secondary basis, subject to application of the procedure referred to in Resolution **21 (Rev.WRC-95)**. After 1 April 2007, frequencies in these bands may be used by stations in the above-mentioned services, communicating only within the boundary of the country in which they are located, on the condition that harmful interference is not caused to the broadcasting service. When using frequencies in these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations.

Footnote 5.152 has been modified by WRC-07 to read:
5.152 *Additional allocation:* in Armenia, Azerbaijan, China, Côte d"Ivoire, Georgia, Iran (Islamic Republic of), Kazakhstan, Uzbekistan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkmenistan and Ukraine, the band 14 250 to 14 350 kHz is also allocated to the fixed service on a primary basis. Stations of the fixed service shall not use a radiated power exceeding 24 dBW. (WRC-03)

5.153 In Region 3, the stations of those services to which the band 15 995 to 16 005 kHz is allocated may transmit standard frequency and time signals.

C.3 Sharing issues

It is anticipated that sharing with existing services will be possible due to the low probability of co-location, the very low magnetic field radiated by ULP-AID equipment and the high roll-off propagation characteristics of the equipment. Furthermore, the extremely limited numbers of animal implantable devices in the bands from 1 MHz to 3 MHz, 11,5 MHz to 12,5 MHz, 13,5 MHz to 14,5 MHz and 15,5 MHz to 16,5 MHz and the deployment of the animal implants at about 250 locations maximum helps limit any possibility of disturbance to the primary services.

History

Document history		
V1.1.1	March 2004	Publication