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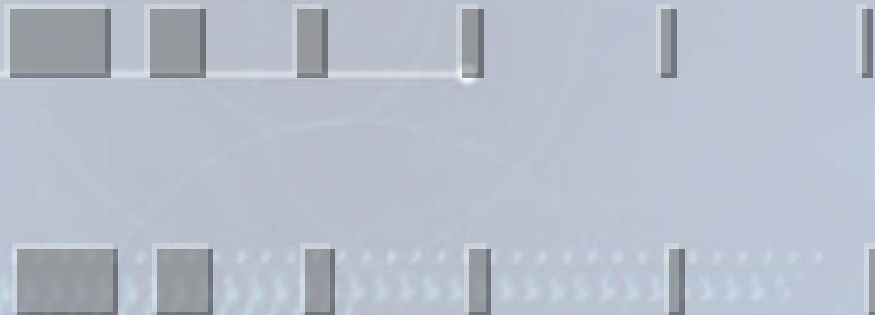
active links

Radio regulation

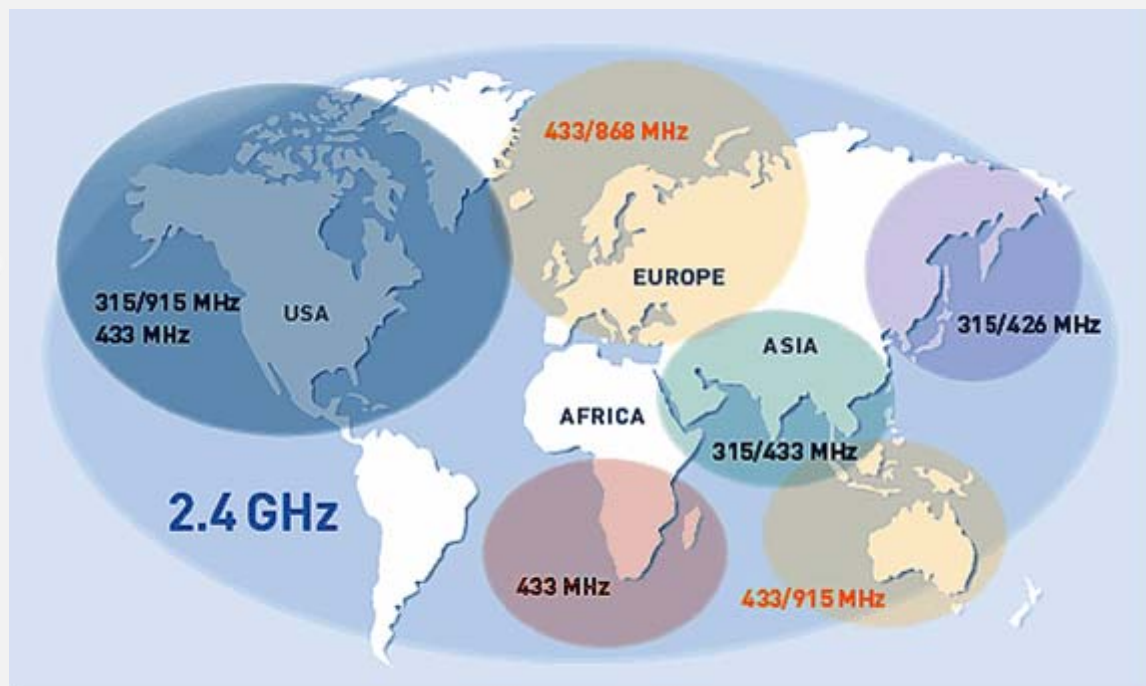
European ISM regulation

American ISM regulation

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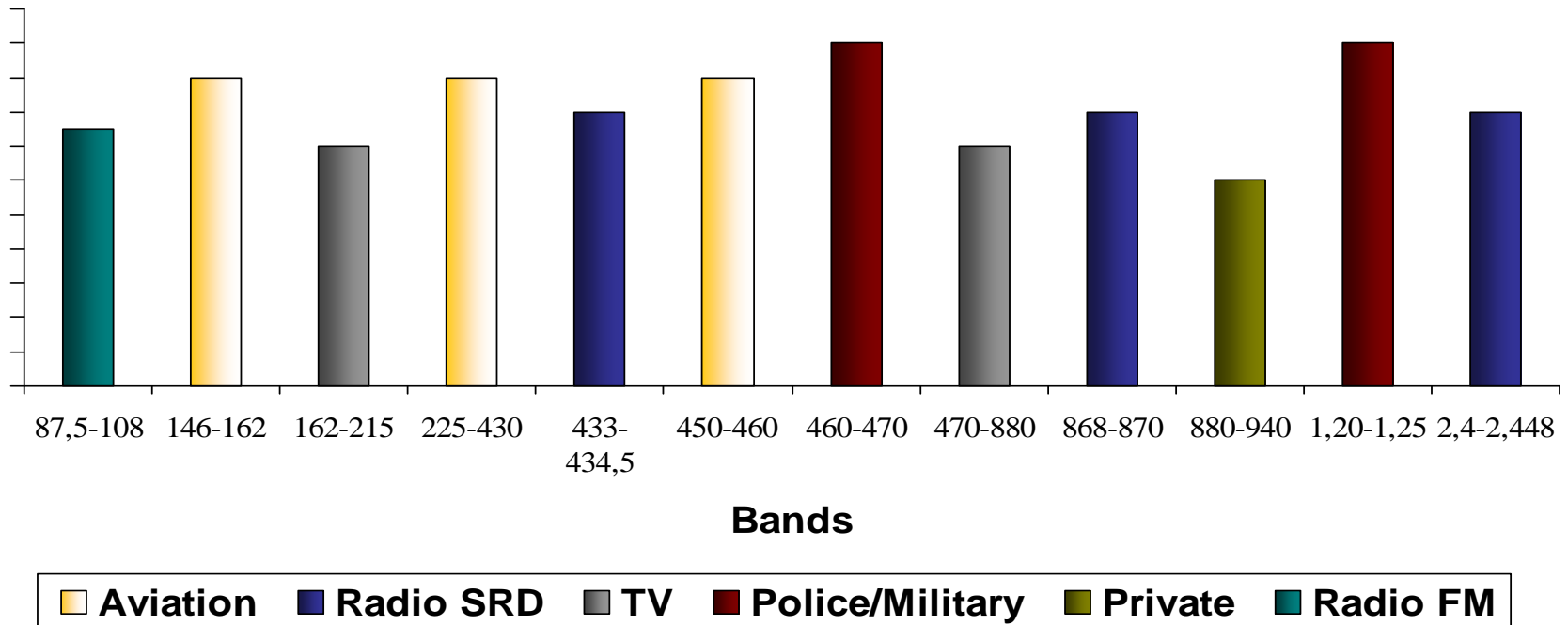


Radio Regulations.



ISM – Industrial Scientific Medical

Frequency bands: Allocation example (France)



ISM Band Regulations Covered Here:

European: REC70-03, ETSI EN 300 220-1

American: FCC §CFR 47 Part 15



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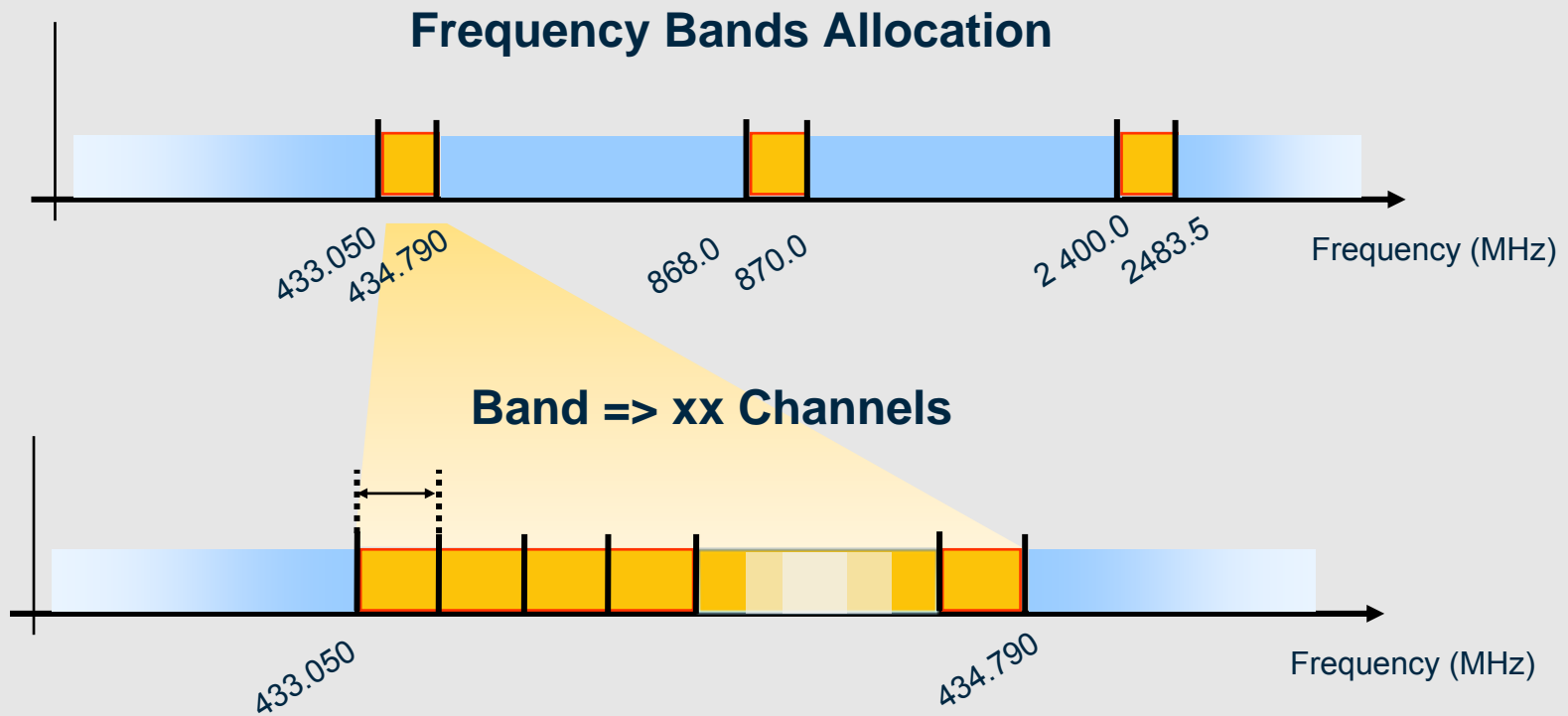
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Radio Regulations – REC70-03.

f	Frequency Band	Power /	Duty cycle	Channel	ECC/ERC	Notes
f	433.050 - 434.790 MHz (note 4)	10 mW e.r.p.	< 10 %	No spacing	ECC DEC (04)02	
f1	433.050 - 434.790 MHz (note 4bis)	1 mW e.r.p. -13 dBm/10 kHz	up to 100%	No spacing	ECC DEC (04)02	Power density limited to -13 dBm/10 kHz for wideband modulation with a bandwidth greater than 250 kHz
f2	434.040-434.790 MHz (note 4bis)	10 mW e.r.p.	up to 100%	Up to 25 kHz	ECC DEC (04)02	
g	863 - 870 MHz (note 3, 4 and 6)	≤ 25 mW e.r.p.	≤ 0.1% or LBT (note 1 and 5)	≤ 100 kHz for 47 or more channels (note 2)		FHSS modulation
		≤ 25 mW e.r.p (note 6) Power density : - 4.5 dBm/100 kHz (note 8)	≤ 0.1% or LBT (note 1, 5 and 6)	No spacing		DSSS and other wideband modulation other than FHSS
		≤ 25 mW e.r.p.	≤ 0.1% or LBT (note 1 and 5)	≤ 100 kHz, for 1 or more channels (note 2 and 7)		Narrow /wide-band modulation
g1	868.000 - 868.600 MHz (note 4)	≤ 25 mW e.r.p.	≤1% or LBT (note 1)	No spacing, for 1 or more channels (note 2)	ERC DEC (01)04	Narrow / wide-band modulation No channel spacing, however the whole stated frequency band may be used
g2	868.700 - 869.200 MHz (note 4)	≤ 25 mW e.r.p.	≤ 0.1% or LBT. (note 1)	No spacing, for 1 or more channels (note 2)	ERC DEC (01)04	Narrow / wide-band modulation No channel spacing, however the whole stated frequency band may be used
g3	869.400 - 869.650 MHz (note 4)	≤ 500 mW e.r.p	≤ 10% or LBT. (note 1)	25 kHz (for 1 or more channels)	ERC DEC (01)04	Narrow / wide-band modulation The whole stated frequency band may be used as 1 channel for high speed data transmission
g4	869.700 - 870.000 MHz (note 4bis)	≤ 5 mW e.r.p.	up to 100%	No spacing (for 1 or more channels)	ERC DEC (01)04	Narrow / wide-band modulation No channel spacing, however the whole stated frequency band may be used

Notes: 10mW => +10dBm 25mW => +14dBm 500mW => +27dBm

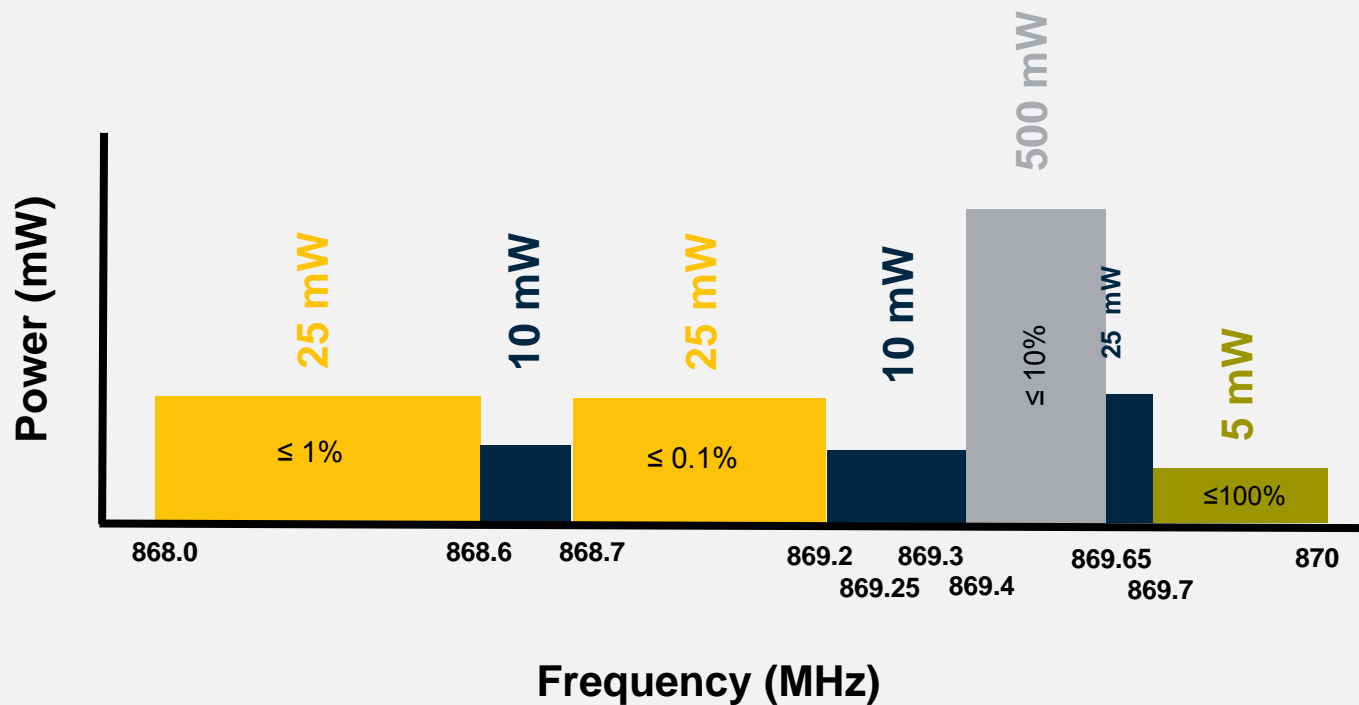
Frequency bands division = Canalization



ERC recommendation 70-03				
Band	Frequency band (Mhz)	Maximum radiated power (mW)	Channel spacing (khz)	Duty cycle %
1f	868.0 – 868.6	25	No channel spacing specified	1
7a	868.6 - 868.7	10	25	0.1
1g	868.7 - 869.2	25	No channel spacing specified	0,1
7d	869.2 – 869.25	10	25	0.1
7b	869.25 – 869.3	10	25	0.1
1h	869.3 – 869.4	10	25	100
1i	869.4 - 869.65	500	25 or wideband	10
7c	869.65 – 869.7	25	25	10
1k	869.7 – 870.0	5	No channel spacing specified	100

Notes: 10mW => +10dBm 25mW => +14dBm 500mW => +27dBm

Radio Regulations – REC70-03.



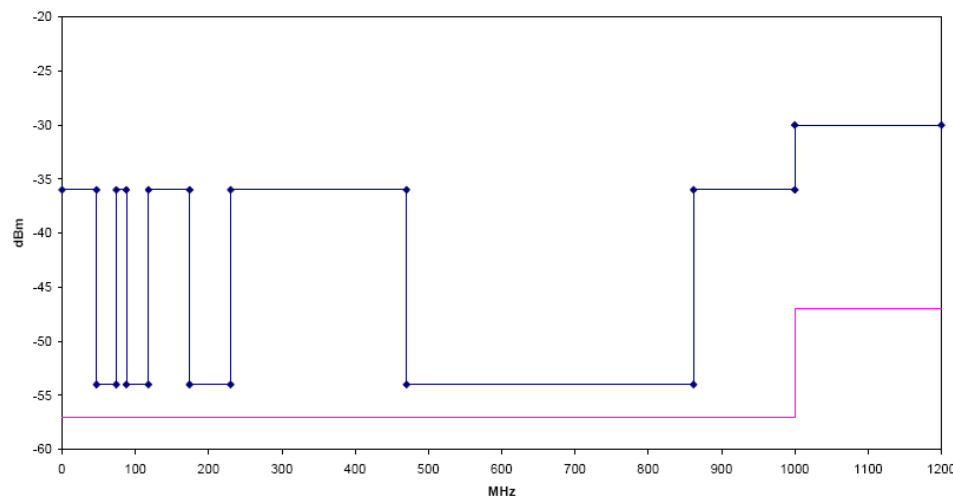
- 1. Apply to radio transmitters and receivers from 25 MHz to 1GHz with power level up to 500mW (+27dBm)**
 1. EN 300 220-1 contains the technical characteristics for radio equipments referencing CEPT/ERC recommendation
 2. EN 300 220-2 describes the technical characteristics and test methods

- 2. Channel spacing needs to be declared**
 1. 6.25kHz & 12.5kHz
 2. 25 kHz
 3. 50 kHz
 4. 100 kHz
 5. ≥ 200 kHz (Wideband)

- 3. Wideband (>200kHz) and Narrowband products have different constraints**
- 4. FHSS and DSSS modulations are possible**
- 5. LBT (Listen Before Talk) is made available to release Duty Cycle constraints**

1. Technical characteristics assessment of the Transmitters

1. Frequency error and stability
2. Carrier power and effective radiated power
3. Transient power
4. Modulation parameters
5. Duty cycles (when no LBT is declared)
6. Spurious emissions, including harmonics



1. Technical characteristics assessment of the Receivers vs. classes

1. **Class 1, safety critical SRD communication media**
2. **Class 2, function critical SRD communication media**
 1. **Receiver LBT threshold and transmitter max on time (if applicable)**
 2. **Blocking or desensitization**
 3. **Spurious radiation**
3. **Class 3, non-critical SRD communication media**
 1. **Receiver LBT threshold and transmitter max on time (if applicable)**
 2. **Spurious radiation**

Appendix describing the test methods, specific equipment

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Overview of Regulations

For 902 – 908 MHz operation, regulation falls under the following sub-parts of the regulation:

Part 15.205: Restricted Bands of Operation

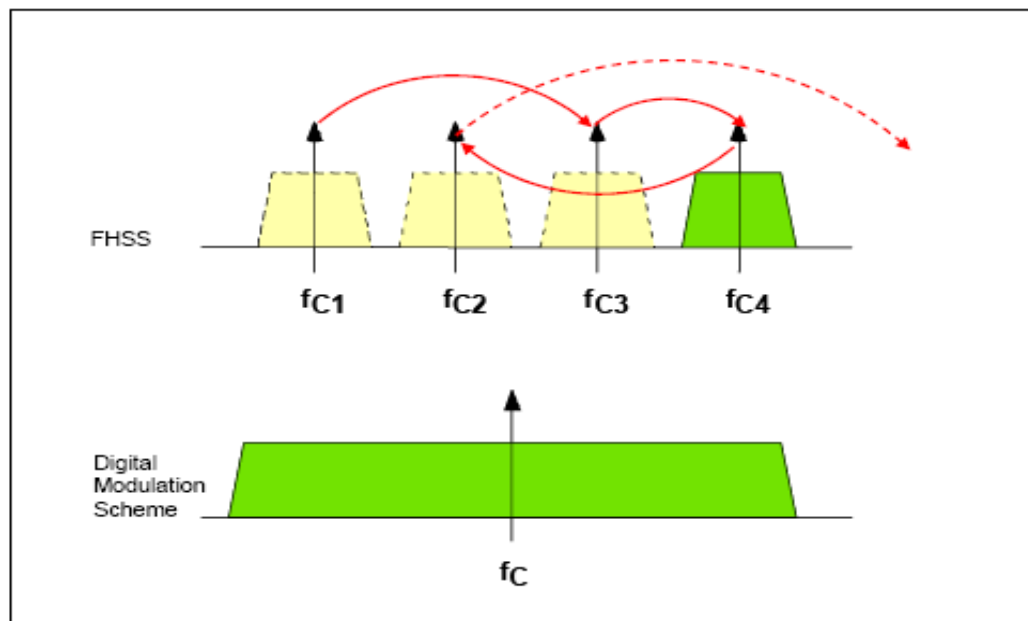
Part 15.207: Conducted emission limits

Part 15.209: Radiated emission limits

Part 15.247: Frequency Hopping (FHSS) and Digital Transmission Systems (DTS)

Part 15.247:

Frequency Hopping Spread Spectrum versus Direct Sequence Spread Spectrum and DTS (Digital Transmission System)



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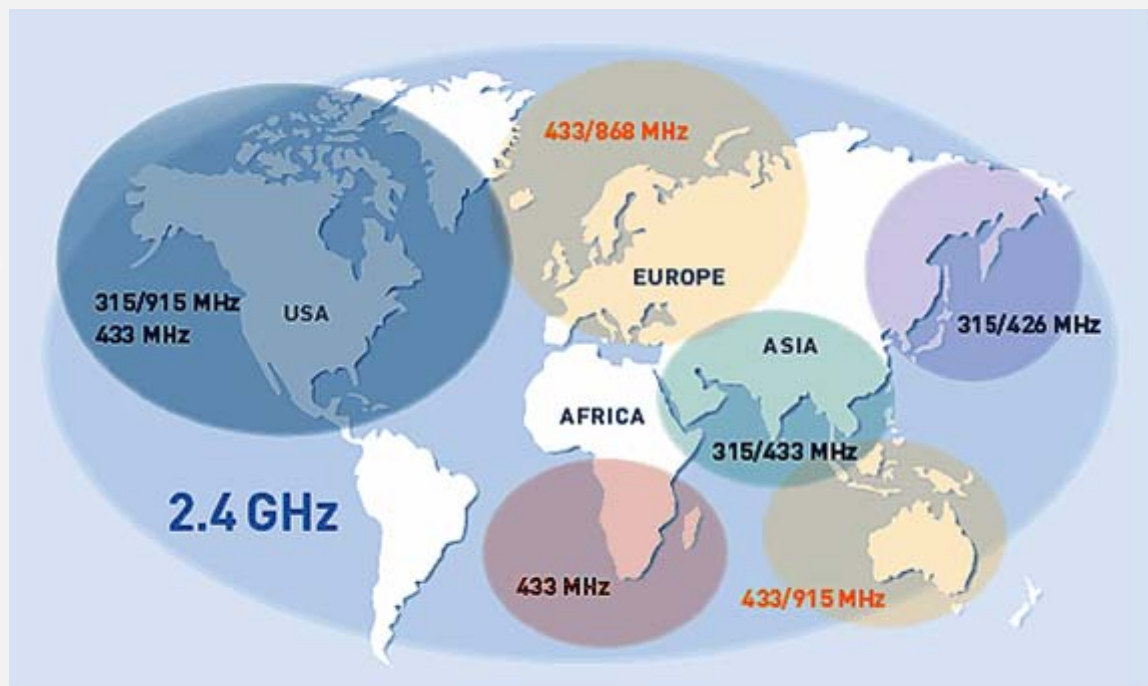
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Radio Regulations.



ISM – Industrial Scientific Medical

1. 433 MHz band

1. Frequency: 433.05 – 434.79 MHz
2. Application: Europe, Australia, South Africa...
3. Standard: ETSI 300-220
4. Power: 10 mW
5. Duty Cycle: 10%
6. Family: TinyOne™ LITE 433MHz

2. 868 MHz band

1. Frequency: 868.00 – 870.00 MHz
2. Application: Europe
3. Standard: ETSI 300-220
4. Power: 5 to 500 mW (depending on sub-band)
5. Duty Cycle: 0.1 to 100 % (depending on sub-band)
6. Families:
 1. TinyOne™ LITE/PLUS/PRO
 2. PowerOne™

3. 915 MHz band

3. Frequency: 902.00 – 928.00 MHz
4. Application: U.S., Canada, Australia
5. Standard: FCC 15.247
6. Power: 1 W with possibility to have 6dB gain antenna
7. Duty Cycle: Frequency Hopping Spread Spectrum, 400ms allowed per channel, hop on 50 channels min
8. Families: TinyOne™ LITE/PLUS/PRO

4. 2.4 GHz band

- Frequency: 2400 – 2483.5 MHz
Application: Worldwide
Power: 10 mW (100mW inside)
Duty Cycle: N/A
Families:
 TinyOne™ 2400MC
 μTinyOne

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