Low Power Radio Association

WWW.LPRA.EU

ESSENTIAL SOURCES OF SRD INFORMATION

Recommendation 70-03: Probably the most useful document for SRD users and manufacturers in the European region. *www.erodocdb.dk*

Understanding FCC Regulations for Low Power, Non-Licensed Transmitters: An Office of Engineering and Technology Federal Communications Commission publication, OET Bulletin No 63. *www.fcc.gov*

EN 300 220, Parts 1 & 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive: Technical characteristics, test methods plus electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1000MHz frequency range with power levels ranging up to 500mW. *www.etsi.org*

EN 300 330 Parts 1 & 2: Harmonized EN under article 3.2 of the R&TTE Directive: Technical Characteristics, Test Methods, plus Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz. *www.etsi.org*

EN 300 440, Parts 1 & 2: Harmonized EN under article 3.2 of the R&TTE Directive: Technical characteristics, test methods, electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range. *www.etsi.org*

ETSI EN 301 489 Parts 1 & 3: Common and specific requirements for Short Range Devices (SRD) operating in the range 9KHz to 40GHz Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services. *www.etsi.org*

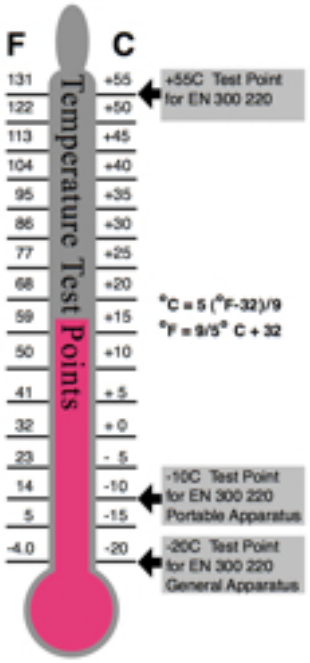
The "Blue Book": Guide to the implementation of directives based on the New Approach and the Global Approach including the R&TTE Directive. *www.ec.europa.eu*

FCC Part 15.225: Operation within the band 13.553-13.567MHz, General purpose, used for close range RFID tagging. *www.fcc.gov*

FCC Part 15.245: Operation within the bands 10.5-10.55GHz: Applicable to field disturbance (Doppler radar) sensors. *www.fcc.gov*

FCC Part 15.247: Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz: Applicable to frequency hopping and direct sequence spread spectrum intentional radiators. *www.fcc.gov*

FCC Part 15.249: Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0-24.54GHz: Applicable to adaptive frequency hopping spread spectrum intentional radiators *www.fcc.gov*



Reactance

$$X_C = \frac{1}{2\pi f C} \qquad Q = \frac{f_0}{BW\,(3dB)}$$

Line-of-Sight Communications

Power Received $P_r = \frac{P_t G_r G_t \lambda^2}{(4\pi d)^2}$ (excluding losses)

Quality Factor

$$Q = \frac{X_L}{R} = \frac{X_C}{R}$$

KNOW YOUR LEGAL RESPONSIBILITIES

Generic checklist of key technical characteristics essential for legal SRD operation:

1. **Frequency** – your product should operate on the right frequency/s for the application, be stable with temperature and antenna loading etc.
2. **Power** – the radiated power, magnetic field or EIRP should not exceed that specified including any antenna gain. Harmonics and spurious emissions must also be within specified limits.
3. **Deviation & Modulation** – the transmission envelope must lie within the specified radio channel/s, modulation envelope or in the case of spread spectrum not exceed spectral power density limit.
4. **Low Battery** – if battery operated the transmission should be switched off or not become unstable when the battery is low.
5. **Duty Cycle** – where applicable duty cycle limits should be observed.
6. **LBT (listen before talk)** – where applicable the strategy must be followed.
7. **Channelisation –** where applicable all user selectable channels must be within the permitted band/s and those outside disabled.
8. **Modulation Inputs** – where applicable must be protected to ensure that data / audio tones input cannot cause the occupied spectrum to exceed the specified bandwidth.
9. **Switching Transients** – power should be suppressed until the frequency of the transmitter is stable.
10. **EMC Immunity** – the transmission quality must not be impacted upon by external electromagnetic disturbances within specified limits.
11. **Receiver Performance** – although not generally mandatory, good performance is essential to prevent blocking, co-channel interference, unwanted radiation and ultimately customer dissatisfaction.

Radio Spectrum is a finite resource and is hence protected by international laws against pollution from illegal devices.

Wavelength λ to Frequency f

$$c = f\lambda \qquad \lambda = \frac{c}{f} \qquad c = 3 \times 10^8$$

λ in meters

Reflection Coefficient

$$\Gamma_L = \frac{Z_L - Z_o}{Z_L + Z_o} \qquad VSWR = \frac{1+r}{1-r}$$

Mismatch Loss ML

$$ML = -10\log(1-[r]^2) \qquad ML = -10\log\left[1-\left(\frac{VSWR-1}{VSWR+1}\right)^2\right]$$

Transmitter Spurii Test Limits

47 to 74MHz 87.5 to 118MHz 174 to 230MHz 470 to 862MHz	Other Frequencies Below 1.0GHz	Frequencies Above 1.0GHz
Operating 4nW	250nW	1 µW
Standby 2nW	2nW	20nW

As defined in EN 300 220 Parts 1 & 2

Transmitter to Receiver Path Losses

The LPRA e-Newsletter sifts, edits and filters the plethora of short range device news from around the world into a single monthly e-mail with links to the big stories and legislation changes that directly affect you and your business.

Please subscribe ***free*** by calling
0800 107 5879
or e-mail
subscribe@business-synergies.co.uk

To Convert	Multiply by:
Cubic Feet to Cubic Metres	0.0283
Cubic Inches to Cubic Centimetres	16.3871
Cubic Inches to Fluid Ounces	0.5767
Cubic Inches to Litres	0.0164
Cubic Yards to Cubic Metres	0.7646
Degrees Fahrenheit to Degrees Celsius	-32 x 5 ÷ 9
Feet to Metres	0.3048
Fluid Ounces to Cubic Inches	1.7339
Fluid Ounces to Millilitres	28.4130
Fluid Ounces to Litres	0.0284
Gallons to Litres	4.5460
Grains to Grams	0.0648
Inches to Millimetres	25.4000
Inches to Centimetres	2.5400
Miles to Kilometres	1.6093
Centimetres to Inches	0.3937
Cubic Centimetres to Cubic Inches	0.0610
Cubic Metres to Cubic Feet	35.3147
Cubic Metres to Cubic yards	1.3079
Degrees Celsius to Degree Fahrenheit	x 9 ÷ 5 + 32
Grams to Ounces	0.0353
Grams to Pounds	0.0022
Kilograms to Hundredweights	0.0197
Kilograms to Pounds	2.2046
Litres to Fluid Ounces	35.2113
Litres to Pints	1.7598
Litres to Gallons	0.2200
Pints to Litres	0.5683
Pounds to Kilograms	0.4536
Square Inches to Square Millimetres	645.1612
Square Inches to Square Centimetres	6.4516
Square Feet to Square Centimetres	929.0310
Square Feet to Square Metres	0.0929
Square Yards to Square Metres	0.8361
Square Miles to Square Kilometres	2.5899
Yards to Metres	0.9144