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Ascom PWT DCT1900 System and RF Safety

The issue of radio frequency emissions and the health risks for users and exposed persons is of a major concern today. The Federal Communications Commission (FCC) and its Local and State Government Advisory Committee (LSGAC) have prepared a guide¹ to address this hot topic. The guide assists state and local governments to devise efficient procedures for ensuring that the antenna facilities located in their communities comply with the FCC's limits for human exposure to radio frequency (RF) electromagnetic fields. The FCC also maintains regulations covering limits for transmitters (i.e. wireless handsets) to be used close to the human body.

The Ascom DCT1900 system is designed for on-site coverage, using low-power radio base stations and handsets. The maximum peak RF power output (90mW) is well below that of cellular radio base stations and handsets (1000mW to 2000mW), but the DCT1900 system can also be set at an even lower power output mode (2mW) where so required. **This is a difference of more than 20 times lower RF power output by the DCT1900 than by current cellular products with an option to operate at up to 1000 times lower if necessary.**

The way to calculate and measure human exposure to RF energy is normally divided into two categories:

- From a handset, used in active mode, close to the human head.
It is very difficult to calculate the human body exposure in this case. Instead, a standardized measurement method and test fixture is used. The fixture uses an artificial human head where measurements are conducted and the exposure calculated. The measurement is called Specific Absorption Rate measurement (SAR) and is measured in power/gram human tissue (mW/g). In literature, values can be found for 10g and 1g tissue calculations.^{2 3 4 5 6}
- Body exposure from a transmitting device at a certain distance from the body.
It is possible to quite accurately calculate the radio electromagnetic field, at a distance from the radiating structure or antenna. This distance is generally greater than one wavelength of the actual operating frequency. The calculation (or measurement of actual field strength) is measured in power over a defined area (power density) and is normally defined as mW/cm².¹

¹ "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance." FCC, June 2, 2000.

² "Automatic Field Scanning System for Dosimetric Assessments" Thomas Schmidt, Oliver Eggers and Nils Kuster. Swiss Federal Institute of Technology (ETH), CH-8092 Zurich, Switzerland.

³ "Probe ETDV4 SN: 1101" Calibration Report, Schmidt & Partner AG, Staffelstrasse 8, 8045 Zurich, Switzerland.

⁴ "Dosimetric Evaluation of Handheld Mobile Communications Equipment with Known Precision." Niels Kuster, Ralph Kästle and Thomas Schmid. IEICE Trans., Vol. E80-A, No 5, May 1997.

⁵ ANSI/IEEE C95.1-1992, "Safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz", The Institute of Electrical and Electronics Engineers Inc., New York, 1991.

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Near-field Exposure

Several articles have been circulating in the press regarding the impact on the human body (i.e. the head) of the electromagnetic field radiated by cellular telephones. While scientists have found the human body to be affected by a relatively low radio electromagnetic field exposure, it is, however, not clear where a safe limit shall be set for avoidance of long-term damages into the human body and genes. Researchers have not yet been able to present solid proof of damages derived from normal use of mobile telephones, but have tried to set recommendations based upon different research results.

In the US, equipment that is designed for use closer than 20cm from the human body (so called "portable equipment") must show compliance with limits specified by the FCC.⁶ The FCC regulation is based upon the IEEE standard C95.1.⁵ Both the DT600 and DT620 handsets have been tested according to SAR measurement specifications and have shown compliance to the regulations.

FCC Limits

Limits for Occupational/Controlled Exposure:

Whole body exposure (whole body average value)	0.40W/kg
Spatial peak SAR (over any 1g tissue)	8.00W/kg

Limits for General Population/Uncontrolled Exposure

Whole body exposure (whole body average value)	0.08W/kg
Spatial peak SAR (over any 1g tissue)	1.60W/kg

Measurement Results

	DT600	DT620
Spatial peak SAR (1g tissue)	0.009mW/g	0.011mW/g

The SAR measurements values of the DCT1900 handsets have been specified in mW/g, which is equal to W/kg, over 1g tissue.

The result shows that both DCT1900 handsets are far below the limit. In fact, the DCT1900 actually emits less than 1% of the General Population/Uncontrolled Exposure limit.

⁶ Code of Federal Regulations, 47CFR2.1093.

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Bodily Exposure

The FCC guide¹ defines limits for Maximum Permissible Exposure (MPE) to RF electromagnetic fields for bodily exposure. The MPE standard is specified as time averaged exposure limits. This means that exposure can be averaged over the identified time interval (30 minutes for general population/uncontrolled exposure or 6 minutes for occupational/controlled exposure). However, for the case of exposure of the general public, time averaging is usually not applied because of uncertainties over exact exposure conditions and difficulty in controlling time of exposure. Therefore, the typical conservative approach is to assume that any RF exposure to the general public will be continuous. The FCC's limits for exposure relevant to the DCT1900 system are shown below:

- Limits for Occupational/Controlled Exposure $5\text{mW}/\text{cm}^2$
- Limits for General Population/Uncontrolled Exposure $1\text{mW}/\text{cm}^2$

Before the DCT1900 base stations are installed, a site coverage test or site coverage planning is normally carried out. The result is nearly always that the base stations are installed high on a wall or in the ceiling. If mounted this way, the probability for humans to be exposed at power density values close to the FCC limit for more than 6 minutes a day will be almost negligible. The value of the actual power density depends on:

- The output power and antenna type of the transmitting base station
- The distance from the antenna

Since the DCT1900 fixed base stations have a wavelength of 0.16m, an accurate RF exposure measurement can be derived at a distance of just 0.5m. As can be seen from the diagram in Appendix 1, the power density at 0.5m is 1/100 of the FCC limit (or 20dB below the limit) for uncontrolled exposure. If the location of the base stations can be kept to more than 1.0m from all parts of the human body in all occasions, the power density will be less than 1/1000 of the FCC safety limit (or 30dB below the limit) for uncontrolled exposure.

Radio base station installation suggestion:

Even though the emission from the DCT1900 base stations is well below the safety limit, it is recommended that no base stations shall be placed close to where personnel have their desks. The understanding of radio frequency electromagnetic fields is not general knowledge and to avoid unnecessary insecurity among our customers, it is recommended to keep a distance of a few meters to the closest desk.

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Appendix 1: Power density at a certain distance (d) from a base station antenna

Power density in mW/cm^2 $90\text{mW}/2\text{dBi}$

