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REPORT ON Maximum Permissible Exposure Estimation For HUAWEI WCDMA NodeB

M/N: RRU3801C

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1 INTRODUCTION

Base Transceiver Station (BTS) emit RF radiation (Radiation Hazard). Although there is no scientific evidence of possible health risks to persons living near to base stations some recommendations are giving below for the installation and operation of base station transceivers. Operators of base station transceivers are required to obey the local regulation for erecting base station transceivers.

The Federal Communications Commission (FCC), are imposing MPE (maximum permissible exposure) limits. FCC CFR part 1, subpart I, section 1.1307 requires operator to perform an Environmental Assessment (EA). Equipment listed in the table 1 of before mentioned part is subjected to routine environmental evaluation.

The objective of the Environmental Evaluation is to ensure that human exposure to RF energy does not go beyond the maximum permissible levels stated in the standard. Therefore certain sites do not require an evaluation by nature of its design. It could be that the antennas are placed high enough thereby resulting in extremely low RF fields by the time it reaches areas that would be accessible to people.

For facilities and operations licensed under part 24, licensees and manufacturer are required to ensure that their facility and equipment comply with IEEE C95.1-1999. Environmental evaluations are required, for Personal Communication Services, Part 24: Broadband PCS (Subpart E) if:

- Non-building mounted antennas: height of radiation centre < 10m above ground level and total power of all channels > 2000 W ERP (3280 W EIRP)
- Building-mounted antennas: total power of all channels > 2000 W ERP (3280 W EIRP)

2 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure, given the scientific research to date. It is broken down into two categories, Controlled and Uncontrolled.

Controlled limits are used for persons such as installers and designers that are in control of the hazard and exposed to energy for limited amounts of time per day. Occupational/controlled limits apply in situations in which are persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the

potential for exposure.

Uncontrolled limits are used for general public. General population/uncontrolled exposure apply in situations is which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure. The exposure levels can be expressed in terms of power density, electric field strength, or magnetic field strength, as averaged over 30 minutes for the general public and 6 minutes for trained personnel. The exposure criterion is frequency dependent, and a chart covering the range from 3 kHz to 100 GHz can be found in NCRP No.86 (references IEEE C95.1-1991).

Below are the limits:

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)
0.3-3.0 3.0-30 30-300 300-1500 15,00-100,000	614 1842/f 61.4 -- --	16.3/f 16.3/f 0.163 -- --	(100)* ($900/f^2$)* 1.0 f/300 5

Limits for General Population/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)
0.3-1.34 1.34-30 30-300 300-15,00 15,00-100,000	614 824/f 27.5 -- --	1.63 2.19/f 0.073 -- --	(100)* ($180/f^2$)* 0.2 f/1500 1.0

For example,

- Power density S [mW/cm^2] for controlled area at 1960 MHz S = 5 mW/cm^2
- Power density S [mW/cm^2] for uncontrolled area at 1960 MHz S = 1 mW/cm^2

3 PREDICTION OF THE EXPOSURE TO ELECTROMAGNETIC FIELDS

Calculations can be made on a site by site basis to ensure the power density is below the limits given above, or guidelines can be done beforehand to ensure the minimum distances from the antenna is

maintained through the site planning. The calculations are based on FCC OET 65 Appendix B.

3.1 Calculation of the Safe Distance

Below method describes a theoretical approach to calculate possible exposure to electromagnetic radiation around a base station transceiver antenna. Precise statements are basically only possible either with measurements or complex calculations considering the complexity of the environment (e.g. soil conditions, near buildings and other obstacles) which causes reflections, scattering of electromagnetic fields.

The maximum output power (given in EIRP) of a base station is usually limited by license conditions of the network operator.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation. The calculations are based on FCC OET 65 Appendix B.

$$S = \frac{P(W) * G_{numeric}}{4 * r^2(m) * p}$$

Whereas:

P = Maximum output power in W of the site

$G_{numeric}$ = Numeric gain of the antenna relative to isotropic antenna

r = distance between the antenna and the point of exposure in meters

3.2 Technical Description of the EUT

The technical specification of the RRU3801C (see RF test report and product manual for more detailed):

Transmitter frequency band:	1900M Band (PCS)
Frequency range:	1900M Band: Uplink: 1850 MHz to 1910 MHz Downlink: 1930 MHz to 1990 MHz
Max. measured mean power at antenna output port (P_0):	1900M Band: a) for one carrier: 45.28 dBm (for QPSK) 45.23 dBm (for 16QAM) b) for two carriers: 46.12 dBm (for QPSK) 46.11 dBm (for 16QAM) Note: The maximum 46.12 dBm is used for the RF exposure

	evaluation.
Number of antenna ports:	2
Antenna system and type:	KATHREIN 742215
Antenna Gain (G):	1900M Band: 18 dBi
Antenna feed line loss (P_{factor}):	1900M Band: 3.71 dB (per 100m)
Mechanical specification (Height):	1900M Band: 1386 mm

3.3 Estimation of Compliance Boundary for the EUT

For the final determination of the compliance boundary the model for far-field calculation is used since this overestimates the field strength in the near-field region. Thus the calculated compliance boundary for the RRU3801C, which is classified as uncontrolled area, should be rather more conservative and on the safe side.

Calculations can be made on a site by site basis to ensure the power density is below the limits given in 3.1, or guidelines can be done before hand to ensure the minimum distances from the antenna is maintained through the site planning.

$$r(m) = \sqrt{\frac{P(W) * G_{numeric}}{4 * p * S}}$$

Whereas:

P = Maximum output power in W of the site

$G_{numeric}$ = Numeric gain of the antenna relative to isotropic antenna

r = distance between the antenna and the point of exposure in meters

S = Power density in W/m^2 (see also MPE limits)

For 1900M Band:

For the EUT for uncontrolled area, according to 3.2,

P = P_0 - P_{factor} = 46.12 dBm - 3.71 dB * (0 m / 100 m) = 46.12 dBm (40.93 W)

(Notes: here it calculates the 0 m antenna feed line loss at worst)

$G_{numeric}$ = $10^{(G/10)}$ = 63.10

S = 10 W/m^2 (1 mW/cm^2)

So, the safe distance is calculated as:

$$r = \sqrt{\frac{40.93 * 63.10}{4 * p * 10}} = 4.53 \text{ m}$$

3.4 Final Conclusion

The equipment of RRU3801C should be used under the safety distance of at least 5 m.