



FCC Maximum Permissible Exposure (MPE) Estimation Report

**Product Name: Distributed Base Station Radio Remote Unit
Model Number: RRU3203**

**Report No: SYBH(R)009042010EB-2
FCC ID: QISRRU3203**

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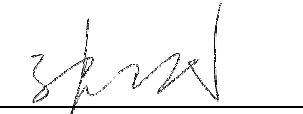
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REGULATION FCC 47CFR Part 1 (10-1-07 Edition)
OET Bulletin 65 (Edition 97-01)

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1 EUT Information

1.1 Product Description

HUAWEI Base Station DBS3900 LTE is a distributed eNodeB with the 3GPP LTE FDD protocols. The DBS3900 LTE supports CPRI interfaces and contains BBU and RRU two parts:

- I Baseband unit (BBU): processes baseband signals.
- I Radio remote unit (RRU): processes RF signals.

RRU3203 (Band XII) is the outdoor radio remote unit. It can be mounted close to the antenna on a metal pole or a wall.

For RRU3203 (Band XII), the downlink frequency is 728 MHz~746 MHz and the uplink frequency is 698 MHz~716 MHz.

RRU3203 (Band XII) has a highly integrated structure. The components of RRU3203 are describes as follows:

1. Power supply: leads the external – 48 VDC power to supply power for RRU3203.
2. Duplexer: multiplexes RX signals and TX signals, which enables the RX signals and TX signals to share the same antenna path. The duplexer also filters RX signals and TX signals.
3. Low noise amplifier: amplifies received signals to avoid loss of signals.
4. Power amplifier: amplifies transmission signals to reinforce the power of the signals. It has the power of 40 W per port.
5. TRX: includes two receive channels, two transmission channels and one feedback channel. Each channel supports only one carrier.

1.2 Technical Description of EUT

Table 1. Service and Test Mode List

Operating frequency band:	AWS Band: Uplink (RX): 698 to 716 MHz Downlink (TX): 728 to 746 MHz
Maximum power input to the antenna:	AWS Band: Rated max.: 46 dBm Measured max.: 45.97 dBm (Note: refer to FCC/RF test report for the measured output power)
Antenna Information:	Antenna type: External, Directional Antenna gain (max.): 18 dBi (Note: If other antennas with higher gain are used, the report should be re-estimated.)

2 FCC RF Exposure Requirements

2.1 FCC Routine Environmental Evaluation

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

The Federal Communications Commission (FCC) 47CFR §1.1307 requires operator to perform an Environmental Assessment. 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.

As specified in 47CFR §1.1307 and OET Bulletin 65, the Environmental Evaluations are required if the BTS fall into the categories listed in Table 1 of 47CFR §1.1307 and Table 2 of OET Bulletin 65, also summarized and listed in Table 2 below. Other BTS s are categorically excluded from making such studies or preparing an EA, except as indicated in paragraphs (c) and (d) of §1.1307.

Table 2. BTSs Subject To Routine Environmental Evaluation

Service (title 47 CFR rule part)	Evaluation required if:
Cellular Radiotelephone Service (subpart H of part 22)	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP). Building-mounted antennas: total power of all channels > 1000 W ERP (1640 W EIRP).
Personal Communications Services (part 24)	(1) Narrowband PCS (subpart D): Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP). Building-mounted antennas: total power of all channels > 1000 W ERP (1640 W EIRP). (2) Broadband PCS (subpart E): Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m 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).
Miscellaneous Wireless Communications Services (part 27 except subpart M).	(1) For the 1390–1392 MHz, 1392–1395 MHz, 1432–1435 MHz, 1670–1675 MHz, and 2385–2390 MHz bands: Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m 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) For the 698–746 MHz, 746–764 MHz, 776–794 MHz, 2305–2320 MHz, and 2345–2360 MHz bands: Total power of all channels > 1000 W ERP (1640 W EIRP).
Broadband Radio Service and Educational Broadband Service (subpart M of part 27).	Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and power > 1640 W EIRP. Building-mounted antennas: power > 1640 W EIRP. BRS and EBS licensees are required to attach a label to subscriber transceiver or transverter antennas that: (1) provides adequate notice regarding potential radiofrequency safety hazards, e.g., information regarding the safe minimum separation distance required between users and transceiver antennas; and (2) references the applicable FCC-adopted limits for radiofrequency exposure specified in §1.1310.



- Note 1: “Building-mounted antennas” means antennas mounted in or on a building structure that is occupied as a workplace or residence.
- Note 2: The term “power” refers to total operating power of the transmitting operation in question in terms of ERP, EIRP or PEP.
- Note 3: For the case of the Cellular Radiotelephone Service (47CFR Part 22 subpart H), the Personal Communications Service (47CFR Part 24) and the Specialized Mobile Radio Service (47CFR Part 90), the phrase “total power of all channels” means the sum of the ERP or EIRP of all co-located simultaneously operating transmitters owned and operated by a single licensee.
- Note 4: When applying the criteria of this table, radiation in all directions should be considered. For the case of transmitting facilities using sectorized transmitting antennas, applicants and licensees should apply the criteria to all transmitting channels in a given sector, noting that for a highly directional antenna there is relatively little contribution to ERP or EIRP summation for other directions.

2.2 Maximum Permissible Exposure (MPE)

Maximum permissible exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Occupational/controlled and General population/uncontrolled.

Occupational/controlled limits apply in situations in which 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.

General population/uncontrolled exposures apply in situations in 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 FCC's MPE limits for field strength and power density are given in 47CFR §1.1310 (also in Table 1 of OET Bulletin 65). These limits (also list in Table 3 below) are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP), and also partly based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ANSI/IEEE C95.1.

Table 3. Limits For Maximum Permissible Exposure (MPE)

(A) 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)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) 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)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30
f = frequency in MHz *Plane-wave equivalent power density				

3 RF Exposure Evaluation

3.1 Prediction of the Exposure to Electromagnetic Fields

As mentioned in OET Bulletin 65, a theoretical approach to calculate possible exposure to electromagnetic radiation around BTS 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 BTS 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:

$$S = \frac{P \times G}{4 \times \pi \times R^2} \quad (1)$$

Where:

S = power density

P = power input to the antenna

G = numeric gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

3.2 Calculation of the Safe Distance

Calculations can be made on a site by site basis to ensure the power density is below the limits given in section 2.2, or guidelines can be done beforehand to ensure the minimum distances from the antenna is maintained through the site planning.

According the equation in 3.1, the distance to the centre of radiation of the antenna:

$$R = \sqrt{\frac{P \times G}{4 \times \pi \times S}} \quad (2)$$

For the EUT (refer to section 1), the safe distance R can be calculated as Table 4:

Table 4. Safe distance calculation

AWS Band:	f(TX) = 728 to 746 MHz P = 45.97 dBm = 39.54 W G = 18 dBi = 63.1 numeric Population/uncontrolled exposure: $S = f/1500 \text{ mW/cm}^2 = 728/1500 \text{ mW/cm}^2 = 4.85 \text{ W/m}^2$ R = 6.4 m
Note 1:	The minimum antenna feed line (if external antenna used) loss is taken into account.
Note 2:	It is assumed that the RF exposure evaluation is base on the far-field and the MPE is over-estimated.



Note 3: MPE limits that are provided to the customer and only serve as a guideline. The site license holder is ultimately responsible for MPE compliance at a given site.

Note 4: If other antennas with higher gain are used, the report should be re-estimated.

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