



FCC&IC Electromagnetic Field Health Compliance Report

Product Name: Micro BTS

Product Model: BTS3902E WCDMA 850

Report Number: SYBH(R)01250692EB-2

FCC ID: QISBTS3902E-U850

IC: 6369A-3902EUB5

Reliability Laboratory of Huawei Technologies Co., Ltd.

Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District,
Shenzhen, 518129, P.R.C

Tel: +86 755 28780808

Fax: +86 755 89652518



Notice

1. The laboratory has Passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has Passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
3. The laboratory has been listed by the US Federal Communications Commission to perform electromagnetic emission measurements. The site recognition number for the test site located in Shenzhen is 97456, and the recognition numbers for the test site located in Shanghai is 684868.
4. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers are 6369A-1 for the 3m chamber test site located at G2 building, 6369A-2 for the 3m chamber test site located at K3 building and 6369A-3 for the 10m chamber test site located at K3 building in Shenzhen; the recognition numbers are 6369D-1 for the 3m chamber test site and 6369D-2 for the 10m chamber test site located in Shanghai.
5. The laboratory has been listed by the VCCI to perform EMC measurements. The accreditation numbers for the test site No.1 located at G2 building in Shenzhen are R-3892, G-415, C-4361, and T-1348, and the accreditation numbers for the test site No.2 located at K3 building in Shenzhen are R-3760, G-485, C-4210 and T-1237.
6. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
7. The test report is invalid if there is any evidence of erasure and/or falsification.
8. The test report is only valid for the test samples.
9. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.



Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
 Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name: Micro BTS
Product Model: BTS3902E WCDMA 850

Date of Receipt Sample: 2014-02-17
Start Date of Test: 2014-02-20
End Date of Test: 2014-03-07

Test Result: Pass

Approved by Senior Engineer:	2014-03-12	Zhang Xinghai	<i>Zhang Xinghai</i>
	Date	Name	Signature

Prepared by:	2014-03-11	Huang Yuanqiu	<i>Huang Yuanqiu</i>
	Date	Name	Signature



Modification Record

No.	Last Report No.	Modification Description
1	---	First report.



CONTENT

1	General Information.....	6
1.1	Applied Standard.....	6
1.2	Test Location	6
1.3	Test Environment Condition.....	6
2	Description of the Equipments/Site under Estimation.....	7
2.1	General Description	7
2.2	Technical Description.....	7
3	Electromagnetic Field Health Requirements.....	8
3.1	FCC Routine Environmental Evaluation.....	8
3.2	Maximum Permissible Exposure (MPE).....	10
4	Electromagnetic Field Health Estimation	11
4.1	Calculation Model.....	11
4.2	Cylindrical Boundary Model and Safe Distance	12
4.3	Location of Antennas	12
4.4	Calculation of the Power Density or Safe Distance	14



1 General Information

1.1 Applied Standard

Applied Rules: 47CFR FCC Part 1 (10-1-07 Edition)
RSS-102 (Issue4, March 2010)
Test Method: OET Bulletin 65 (Edition 97-01)

1.2 Test Location

Test Location 1: Reliability Laboratory of Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
Bantian, Longgang District, Shenzhen, 518129, P.R.C

1.3 Test Environment Condition

Ambient Temperature: Not applicable
Ambient Relative Humidity: Not applicable
Atmospheric Pressure: Not applicable

2 Description of the Equipments/Site under Estimation

2.1 General Description

As shown in Figure 1, BTS3902E WCDMA 850 is an integrated base station with the following main units: transmission interface unit, main processing unit, baseband processing unit, and RF unit.

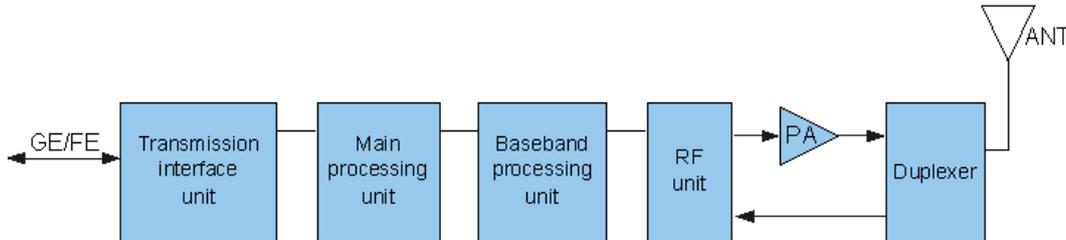


Figure 1 BTS3902E WCDMA 850 Structure

The function of each unit is as follows:

- Transmission interface unit

Provide ports for communication with the Evolved Packet Core (EPC) and the operation and maintenance (O&M) channels to LMT or M2000.

- Main processing unit

Manages the entire BTS3902E WCDMA 850 in a centralized manner in terms of O&M and signaling processing. Also, provides the system clock.

- Baseband processing unit

Schedules and processes the uplink and downlink user-plane data on the lub interface.

- RF unit

Modulates, demodulates, processes, and combines and divides base band signals and RF signals.

- Power Amplifier (PA)

Amplifies low-power RF signals.

2.2 Technical Description

NOTE: A typical application configuration is used here. When different configurations are used, the report should be re-estimated.

Table 1 Technical Description

RF Source	Technical Parameter	Description
RF Source #1	Operating frequency for Transmitter (TX)	869 to 894 MHz
	Output power at the antenna port	Rated max.: 40 dBm ±2dB (per port)
	Antenna information	Antenna type: Directional Antenna gain (max): 5 dBi



3 Electromagnetic Field Health Requirements

3.1 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

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).



BTSs Subject To Routine Environmental Evaluation

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).

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.

Broadband Radio Service and Educational Broadband Service (subpart M of part 27).

- 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.

3.2 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)

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		

For the purpose of this standard, Industry Canada has adopted the RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6(also list in Table 4 below)

Table 4 RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range(MHz)	Electric Field(V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/ <i>f</i>	2.19/ <i>f</i>	-	6
10-30	28	2.19/ <i>f</i>	-	6
30-300	28	0.073	2	6
300-1500	1.585 <i>f</i> ^{0.5}	0.0042 <i>f</i> ^{0.5}	<i>f</i> /150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	1.585 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁵ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}

Note: *f* is frequency in MHz
 Power density limit is applicable at frequencies greater than 100 MHz.

4 Electromagnetic Field Health Estimation

4.1 Calculation Model

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:

$$S = \frac{P \times G_{(\theta,\phi)}}{4 \times \pi \times R^2}$$

Where:

- P* = input power of the antenna.
- G* = antenna gain relative to an isotropic antenna.
- θ, φ* = elevation and azimuth angles.
- R* = distance from the antenna to the point of investigation.

For single or multiple RF sources, the calculated power density should comply with following:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Where:

- S_i* = the power density when the *f* is *i*.

$S_{Limit,i}$ = the reference level requirement for power density when f is i .

4.2 Cylindrical Boundary Model and Safe Distance

Calculations can be made on a site by site basis to ensure the power density is below the limits given in clause 3, or guidelines can be done beforehand to ensure the minimum distances from the antenna is maintained through the site planning. According to clause 4.1, the distance from the antenna to the point of investigation:

$$R = \sqrt{\frac{P \times G_{(\theta,\phi)}}{4 \times \pi \times S}}$$

For the beamed antenna, see Figure 1, the mostly safe way is that the cylindrical boundary model is chosen for simple description of the compliance boundaries of the site. In the case, the power usually is focused into a main beam and the remaining power goes into the weaker beams on both side of the main beam. For the up and down direction (R_{up} and R_{down}), the antenna is considered to have no gain as derived from the vertical pattern of the antenna (i.e. the antenna gain is 1.0).

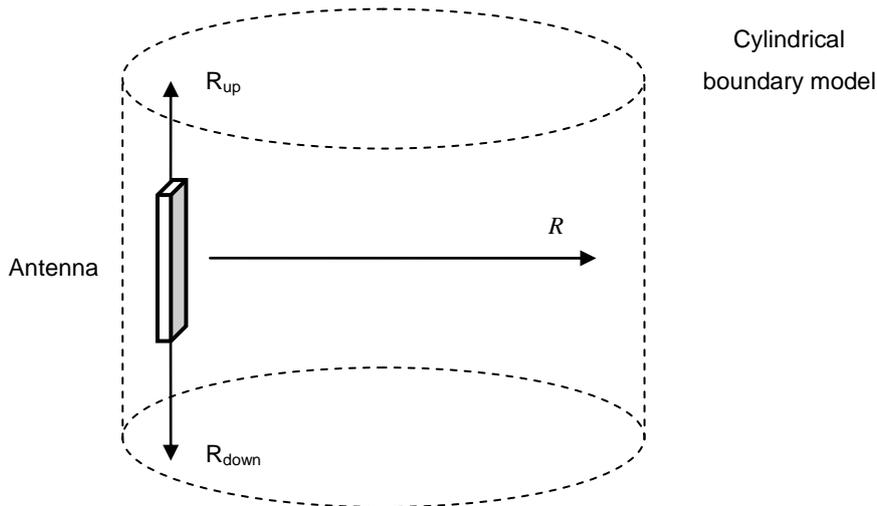


Figure 1 Cylindrical boundary model for the compliance boundary

4.3 Location of Antennas

The BTSs antennas, the source of the radiation, are usually mounted on freestanding towers, with a height up to 30 m or more or on a tower on the top of buildings or in less case to the side of the building. Generally the height of the antenna position does not fall below 10 m. The power usually is focused into a horizontal main beam and slightly downward tilted. The remaining power goes into the weaker beams on both side of the main beam. The main beam however does not reach ground level until the distance from the antenna position is around 50 - 200 m. The highest level of emission would be expected in close vicinity of the antenna and in line of sight to the antenna.

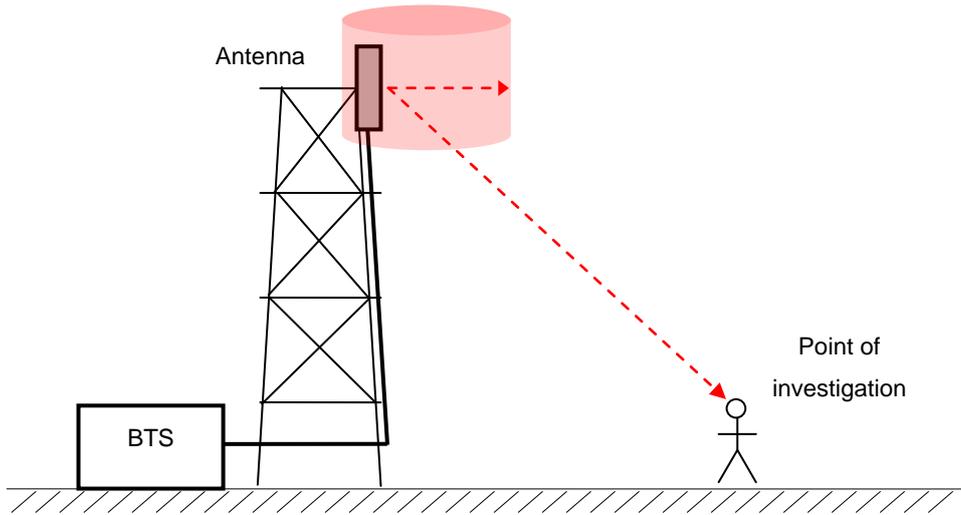


Figure 2 Location of Antennas

4.4 Calculation of the Power Density or Safe Distance

- NOTE 1: The RF exposure evaluation is base on the far-field and the radiation exposure is over-estimated.
- NOTE 2: The maximum output power level is taken into account as a worst case for the purpose of the calculation of power density or safe distance.
- NOTE 3: The minimum antenna feed cable loss (assumed no cable loss) is taken into account as a worst case for the purpose of the calculation of power density or safe distance.
- NOTE 4: The maximum antenna radiation exposure orientation and maximum antenna gain is taken into account as a worst case for the purpose of the calculation of power density or safe distance.
- NOTE 5: The limits for General Population/Uncontrolled Exposure are considered in this report.

Table 5 Calculation of the Power Density or Safe Distance

RF Source	Calculation
RF Source #1	f = 869 to 894 MHz
	$S_{Limit,i}$ = 869/150= 5.8 W/m ²
	P = 18.62 W (= 42.7 dBm,)
	$G_{(\theta,\phi)}$ = 3.16 (= 5 dBi)
	$EIRP = P \times G_{(\theta,\phi)}$ = 58.84 W (measured max.)
	θ, ϕ = The worst condition is considered, i.e. the max G is used.
	S_i = $\frac{P \times G_{(\theta,\phi)}}{4 \times \pi \times R^2} = 4.68 / R^2$ W/m ²
	$\frac{S_i}{S_{Limit,i}}$ = $0.81 / R^2$
RF Source(s) Combination	$\sum_i \frac{S_i}{S_{Limit,i}}$ = $0.81 / R^2 \leq 1$
	R \geq 0.9 m (the minimum Safe Distance)

END