

**BTS3902E WCDMA**  
**Compliance and Safety Manual**

**Issue**        **02**  
**Date**         **2012-07-09**

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# About This Document

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## Purpose

This document describes the compliance of the BTS3902E WCDMA with Electromagnetic Compatibility (EMC) and other safety standards, and provides general safety guidelines for handling, installing or operating the BTS3902E WCDMA.

## Related Versions

The following table lists the product versions related to this document.

Product Name	Version
BTS3902E WCDMA (referred to as BTS3902E WCDMA in this document)	V200R013

## Intended Audience

The intended audience of this document are:

- Technical support engineers
- Installation engineers
- maintenance engineers
- Network planning engineers

## Organization

This document consists of the following chapters.




Chapter	Description
1 Regulatory Compliance Statement	This chapter provides the European community CE certification DoC of the BTS3902E WCDMA
2 Regulatory Compliance Information	This chapter describes the standards compliance of the BTS3902E WCDMA

Chapter	Description
3 Safety Information	This chapter covers the general guidelines for handling, installing or operating the BTS3902E WCDMA.
4 Sicherheitsinformationen	Dieses Kapitel beinhandelt die allgemeinen Richtlinien betreffend der Behandlung, Installation und Benutzung des BTS3902E WCDMA.
Appendix A Acronyms and Abbreviations	This appendix lists the acronyms and abbreviations used in this manual.

## Conventions

### Symbol Conventions

The following symbols may be found in this document. They are defined as follows.

Symbol	Description
 <b>DANGER</b>	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	Indicates a hazard with a low or medium level of risk which, if not avoided, could result in minor or moderate injury.
 <b>CAUTION</b>	Indicates a potentially hazardous situation that, if not avoided, could cause equipment damage, data loss, and performance degradation, or unexpected results.



# 1 Regulatory Compliance Statement

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## 1.1 About This Chapter

This chapter provides the certification details for BTS3902E WCDMA:

European Community CE Certification Declaration of Conformity (DoC)

## 1.2 European Community CE Certification DoC

Figure 1-1 European community CE certification DoC

### EU Declaration of Conformity

**according to the Radio Equipment and  
Telecommunications Terminal Equipment Directive  
1999/5/EC**

For the following equipment

Product : Micro BTS

Type Designation/Trademark: BTS3902E WCDMA / HUAWEI

Manufacturer's Name : Huawei Technologies Co., Ltd.

Manufacturer's Address : Administration Building, Headquarters of  
Huawei Technologies Co., Ltd., Bantian,  
Longgang District, Shenzhen, 518129, P.R.C

is herewith confirmed to comply with the requirements set out in the Council Directive 1999/5/EC for radio equipment and telecommunications terminal equipment. For the evaluation of the compliance with this Directive, the following standards were applied:

Health(R&TTE, Article3.1a)	Council Recommendation 1999/519/EC EN 50385:2002
Safety(R&TTE, Article3.1a)	EN 60950-1:2006+A11:2009      EN 60950-22:2006+A11:2008 IEC/EN 60215(1989) ed3 +A1:1992+A2:1994
EMC(R&TTE, Article3.1b)	ETSI EN 301 489 -1: V1.9.2 (2011-09) ETSI EN 301 489-23 V1.5.1 (2011-11)
Radio(R&TTE, Article3.2)	ETSI EN301 908-3: V5.2.1 (2011-07) ETSI EN301 908-1: V5.2.1 (2011-05)

Responsible for making this declaration is the:

Manufacturer     Authorised representative established within the EU

Person responsible for making this declaration

Name/Title: Zhang Xing Wei      Regulation Compliance Manager

Place/Date      Shenzhen, China      Jul 9, 2012

# 2 Regulatory Compliance Information

## 2.1 About This Chapter

The following table lists the contents of this chapter.

Title	Description
2.2 Regulatory Compliance Standards	The regulatory compliance standards on EMC, safety, NEBS, telecom, Laser Radiation, RF, health, and environmental protection.
2.3 European Directives Compliance	The compliance with European directives, including RoHS compliance and device recycling guide.
2.4 USA Regulatory Compliance	The USA regulatory compliance, including FCC part 15.
2.6 Japanese Compliance	The Japan regulatory compliance.
2.7 CISPR 22 Compliance	The CISPR 22 regulatory compliance.

## 2.2 Regulatory Compliance Standards

BTS3902E WCDMA complies with the standards listed in Table 2-1.

**Table 2-1** Regulatory compliance standards

Discipline	Standards
EMC	CISPR22 <i>Class B</i> CISPR24 EN55022 <i>Class B</i> EN50024 ETSI ES 201 468 ETSI EN 301 489 <i>Class B</i> CFR 47 FCC Part 15 <i>Class B</i> ICES 003 <i>Class B</i> AS/NZS CISPR22 <i>Class B</i> GB9254 <i>Class B</i> VCCI <i>Class B</i> CNS 13438 <i>Class B</i> IEC61000-3-2 IEC61000-3-3 EN61000-3-2 EN61000-3-3 ITU-T K.44
Safety	IEC 60950-1 IEC60950-21 IEC60950-22 IEC60065 IEC/EN60215 IEC/EN41003 EN 60950-1 UL 60950-1 CSA C22.2 No 60950-1 AS/NZS 60950.1 BS EN 60950-1 IS 13252 GB4943 GB8898
Laser safety	FDA rules, 21 CFR 1040.10 and 1040.11 IEC60825-1, IEC60825-2, EN60825-1, EN60825-2 GB7247
RF	ETSI EN 301 908

Discipline	Standards
Health	ICNIRP Guideline 1999-519-EC EN 50385 OET Bulletin 65 IEEE Std C95.1 EN 60215
Environmental protection	RoHS
Grounding	ITU-T K.27 ETSI EN 300 253
<p>Note:</p> <p>EMC: electromagnetic compatibility</p> <p>RF: radio frequency</p> <p>CISPR: International Special Committee on Radio Interference</p> <p>EN: European Standard</p> <p>ETSI: European Telecommunications Standards Institute</p> <p>CFR: Code of Federal Regulations</p> <p>FCC: Federal Communication Commission</p> <p>IEC: International Electrotechnical Commission</p> <p>AS/NZS: Australian/New Zealand Standard</p> <p>VCCI: Voluntary Control Council for Interference</p> <p>CNS: Chinese National Standard</p> <p>UL: Underwriters Laboratories</p> <p>CSA: Canadian Standards Association</p> <p>BS: British Standard</p> <p>IS: Indian Standard</p> <p>GR: general requirement</p> <p>FDA: Food and Drug Administration</p> <p>BTS: base transceiver station</p> <p>GSM: Global System for Mobile communications</p> <p>WLAN: wireless local area network</p> <p>ICNIRP: International Commission on Non-Ionizing Radiation Protection</p> <p>OET: Office of Engineering Technology</p> <p>IEEE: Institute of Electrical and Electronics Engineers</p> <p>RoHS: restriction of the use of certain hazardous substances</p>	

## 2.3 European Directives Compliance

BTS3902E WCDMA complies with the following European directives.

- EC (EMC)
- 2006/95/EC (low voltage)
- 1999/5/EC (R&TTE)



Refer to Figure 1-1 for Huawei Declaration of Conformity.

BTS3902E WCDMA complies with Directive 2002/95/EC, on the RoHS in electrical and electronic equipment. The device does not contain lead, mercury, cadmium, and hexavalent chromium and brominated flame retardants (polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)) except for those exempted applications allowed by RoHS directive for technical reasons.

BTS3902E WCDMA complies with Directive 2002/96/EC on waste electrical and electronic equipment. Huawei is responsible for recycling its end-of-life devices. Contact Huawei local service center when recycling is required.

The main materials in the device are steel, plastics, copper, and electronic components. Most of the materials are recyclable.

Table 2-2 lists the main materials used in the device.

**Table 2-2** Main materials used in the device

Part	Material	Weight (kg)	Percentage (Based on Device Weight)	Substance Prohibited by RoHS
Cabinet	Fe	100	24.2%	No
	Al	20	4.8%	No
	Cu	5	1.2%	Pb (<0.4%)
	ABS	8	1.9%	Deca-BDE
	.....		-	.....
Shelf	Fe	20	24.2%	No
	Al	5	4.8%	No
	Cu	2	1.2%	No
	ABS	3	1.9%	Deca-BDE
	.....		-	.....
Cable	Typical configuration (20-meter E1 cable x 32)	250	60.5%	No

	Other configuration (Weight for each meter)	5	-	No
PCBs	Typical configuration (12 PCBs, components included)	30	7.3%	Pb (in solder)
	Other configuration (Weight of each PCB)	2	-	No
Total	Typical configuration	413	100%	-

Comply with the following rules for recycling at the end of life of the device.

- Remove xx first in the disassembly.
- Remove and send xx to special institution for disposal because it contains chemical substance.
- Dispose of xx separately because it contains hazardous substance.
- No hazardous substance is contained in the label printing ink and plastic paint, and no hazardous gas is emitted when the label printing ink and plastic paint is burning.
- Dispose of the yellow chromate conversion coating screw separately because it contains Cr<sup>6+</sup>.
- Provide the plastic marking reference, such as ISO1043, and EN50419.

## 2.4 USA Regulatory Compliance

### 2.4.1 FCC Part 15

BTS3902E WCDMA complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device does not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

If this device is modified without authorization from Huawei, the device may no longer comply with FCC requirements for *Class B* digital devices. In that a case, your right to use the device may be limited by FCC regulations. Moreover, you may be required to correct any interference to radio or television communications at your own expense.

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This device generates, uses and radiates radio frequency energy. If it is not installed and used in accordance with the instructions, it may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user may take one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Reinforce the separation between the device and receiver.
- Connect the device into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for assistance.

## 2.5 Canada Regulatory Compliance

### 2.5.1 RSS-Gen statement

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### 2.5.2 RSS-102 statement:

This device is designed and manufactured not to exceed the emission limits for exposure to radio frequency (RF) energy set by Industrial Canada and meets the requirements for radiation exposure limits set forth for an uncontrolled environment.

In order to avoid the possibility of exceeding the Industrial Canada radio frequency exposure limits, human proximity to the equipment shall not be less than 0.71m.

Cet appareil est conçu et fabriqué pour ne pas dépasser les limites d'émission pour l'exposition à la fréquence radio (RF) de l'énergie fixées par l'Industrie Canada et répond aux exigences en matière de limites d'exposition aux rayonnements définies pour un environnement non contrôlé.

Afin d'éviter la possibilité de dépasser les limites d'exposition aux fréquences radio industrielle du Canada, la proximité humaine pour l'appareil ne doit pas être inférieure à 0.71m.



## 2.6 Japanese Compliance

### 2.6.1 VCCI

BTS3902E WCDMA complies with VCCI *Class B* by Information Technology Equipment (ITE).

### 2.6.2 JATE

BTS3902E WCDMA meets the requirements of the Japan Approvals Institute for Telecommunications Equipment (JATE).

**Table 2-3** JATE approval number for modules

Module Number	Approval Number

## 2.7 CISPR 22 Compliance

BTS3902E WCDMA complies with CISPR 22 for *Class B* by the ITE.

# 3 Safety Information

## 3.1 About This Chapter

The following table lists the contents of this chapter.

Title	Description
3.2 Overview	Safety precautions to be taken before installing and maintaining the Huawei device.
3.3 Electricity Safety	Information about the electricity safety.
3.4 Inflammable Environment	Information about the inflammable environment safety.
3.5 Battery	Information about the battery safety.
3.6 Radiation	Safety precautions on the Electromagnetic Field Exposure of the device and laser.
3.7 Working at Heights	Safety precautions to be taken before using the ladders or hoisting heavy objects.
3.8 Mechanical Safety	Safety precautions on drilling, on sharp objects, on handling fans, and on lifting heavy objects.
3.9 Miscellaneous	Safety precautions on inserting and removing boards, on bundling signal cables, and cabling requirements.

## 3.2 Overview

### 3.2.1 Safety Precautions

This section describes the safety precautions to be taken before installing and maintaining the Huawei device.

- Before performing an operation, read the operation instructions and precautions to be taken, and follow them to prevent accidents. The Caution, Warning and Danger items in other documents do not cover all the safety precautions that must be followed. They are only supplementary information. The installation and maintenance personnel need to understand the basic safety precautions to be taken.

- When operating the device, obey the local safety regulations. The safety precautions provided in the documents are supplementary and shall be in compliance with the local safety regulations.
- When operating the Huawei device, in addition to the precautions, follow the specific safety instructions given by Huawei.
- The installation and maintenance personnel must receive training in safety precautions. Only qualified personnel can install or maintain the device.

## 3.2.2 General Requirements

To minimize the technically residual risk, it is imperative to obey the following rules. Read all the instructions before operation.

### Installation

- The device (or system) must be installed or used in the access restricted location.
- Before operation, the device must be fixed securely on the floor or to other reliable objects, such as the walls and the mounting racks.
- When installing the unit, always make the ground connection first and disconnect it at the end.

### Ground

- Do not damage the ground conductor or operate the device in the absence of well installed ground conductor. Conduct the appropriate electrical inspection.
- The device (or system) must be connected permanently to the protection ground before an operation. The cross sectional area of protective ground conductor shall be at least 2.5 mm<sup>2</sup>.

### Power Supply

- For AC supplied model: The device applies to TN, TT, or IT power systems.
- Prepared conductors are connected to the terminal block, and only appropriate AWG/Type of wire is secured in the listed lug terminals.
- This device relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 20 A U.S. (240 VAC, 20 A international) for AC supplied model is used on the phase conductors (all current-carrying conductors).
- For this device, a readily accessible disconnect device shall be incorporated in the building installation wiring.
- The AC power supply has double pole/neutral fusing.
- To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

### Human Safety

- Do not operate the device or cables at lightning strikes.
- To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telecommunication network voltage (TNV) circuits.
- Do not look directly into the optical port to prevent the laser radiation from injuring your eyes.
- Do not wear jewelry or watches when you operate the device.

## Operator

- Only qualified and skilled personnel must install, configure, and disassemble the device.
- Only the personnel authorized must operate the device.
- Any replacement or change to the device or parts of the device (including the software) must be done by qualified or authorized personnel of Huawei.
- Any fault or error that might cause safety problems must be reported immediately to the person in charge.
- Only qualified personnel must remove or disable the safety facilities, or to troubleshoot and maintain the device.

Ensure that the instructions provided in this document are followed completely. The document also provides guidelines in selecting the measuring and testing device.

## 3.3 Electricity Safety

### 3.3.1 High Voltage



#### **DANGER**

The high voltage power supply offers power for the device operation. Direct or indirect contact (through damp objects) with high voltage and AC mains supply may result in fatal danger.

- During the installation of the AC power supply facility, follow the local safety regulations. The personnel who install the AC facility must be qualified to perform high voltage and AC operations.
- Do not wear conductive articles, such as watches, hand chains, bracelets and rings during the operation.
- When water is found in the rack or the rack is damp, switch off the power supply immediately.
- When the operation is performed in a damp environment, make sure that the device is dry.



#### **WARNING**

Non-standard and improper high voltage operations may result in fire and electric shock. Therefore, you must obey the local rules and regulations when bridging and wiring AC cables. Only qualified personnel must perform high voltage and AC operations.

---

### 3.3.2 Thunderstorm



## **DANGER**

High voltage and AC operations, or operations on a steel tower and a mast are prohibited during thunderstorm.

During thunderstorm, the electromagnetic field generated in the thunderstorm area may damage the electronic parts. To prevent damage to the device during lightning, ground the device properly.

### **3.3.3 Tools**



## **WARNING**

Suggestion: Dedicated tools must be used during high voltage and AC operations. Avoid using ordinary tools.

### **3.3.4 High Electrical Leakage**



## **WARNING**

Ground the device before powering on the device. Otherwise, the personnel and device are in danger.

If the "high electrical leakage" flag is stuck to the power terminal of the device, you must ground the device before powering it on.

### **3.3.5 Power Cable**



## **WARNING**

Installation and removal of live line are prohibited. Transient contact between the core of the power cable and the conductor may generate electric arc or spark, which may cause fire or eye injury.

- Before installing or removing the power cable, turn off the power switch.
- Before connecting the power cable, confirm that the power cable and label comply with the requirements of the actual installation.

---

 **CAUTION**

- For AC power supplied device, use 0.75 mm<sup>2</sup> or 18 AWG minimum power supply cord.
  - Use the type H03VV-F or light PVC sheathed flexible cord based on IEC 60227.
- 

### 3.3.6 Fuse

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 **WARNING**

If a fuse is to be replaced, the new fuse shall be of the same type and specifications.

---

### 3.3.7 Electrostatic Discharge

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 **CAUTION**

The static electricity generated by the human body may damage the electrostatic sensitive components on the circuit board, such as the large-scale integrated circuit (LSI).

---

In the following situations, the human body will generate a static electromagnetic field:

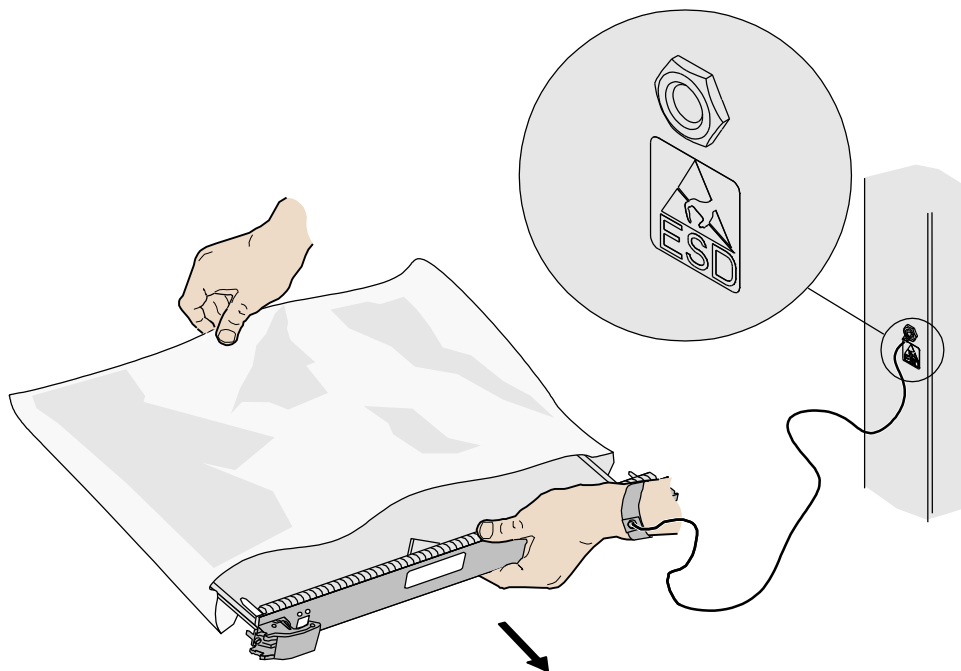
- Human body moving
- Clothes friction
- Friction between shoes and the ground
- Holding ordinary plastic in hand

The static electromagnetic field will remain within the human body for a long time.

Before touching the device, hand-operating parts, circuit boards, or ASICs, wear a grounded electrostatic discharge (ESD) wrist strap. It can prevent the sensitive components from damage by the static electricity in the human body.

Figure 3-1 shows the wearing of an ESD wrist strap.

Figure 3-1 Wearing an ESD wrist strap



## 3.4 Inflammable Environment

Operating the electrical device in inflammable environment can be fatal.



Do not place the device in the environment that has inflammable and explosive air or fog. Do not perform any operation in this environment.

---

## 3.5 Battery

### 3.5.1 Storage Battery



Before handling the battery, read carefully the safety precautions to be taken for battery handling and connections.

---



Non-standard operation on batteries may result in danger.

---

During operation:

- Protect the battery against short-circuit
- Prevent electrolyte overflow and leakage

Electrolyte overflow may damage the device. It will corrode the metal parts and the circuit boards, and ultimately damage the device and cause short-circuit of the circuit boards.

## General Operations

Before installing and maintaining the battery, note the following:

- Do not wear metal articles such as wristwatch, hand chain, bracelet and ring.
- Use special-purpose insulation tools.
- Take care to protect you eyes when operating the device.
- Wear rubber gloves and an apron in the case of electrolyte overflow.
- Always keep the electrode front upright when handling the battery. Do not place the battery upside down or tilt it.

## Short-Circuit



Battery short-circuit may cause physical injury. Though voltage of a general battery is low, high transient current generated by short-circuit will release a large amount of power.

---

There is danger of explosion if the battery is incorrectly replaced. Therefore, replace the battery only with the same or equivalent type recommended by the manufacturer.

---



Keep away metal objects, which may cause battery short-circuit, from batteries. If they have to be used, first disconnect the batteries in use before performing any other operations.

---

## Harmful Gas





- Do not use unsealed lead-acid batteries, because the gas emitted from the battery may result in fire or device corrosion.
  - Lay the battery horizontally and fix it properly.
  - The battery in use will emit flammable gas. Therefore, put the battery in a place with good ventilation, and take fire precautions.
- 

## High Temperature



High temperature may result in distortion, damage and electrolyte overflow of the battery.

---

When the temperature of the battery exceeds 60°C, check whether there is acid liquid overflow. If acid liquid overflow occurs, handle the acid liquid immediately.

## Acid Liquid



In case of acid liquid overflow, absorb and neutralize the liquid immediately.

---

When moving or removing a leaky battery, note the possible damage caused by the acid liquid. Once the acid liquid spill is found, use the following materials to absorb and neutralize it.

- Sodium bicarbonate (baking soda):  $\text{NaHCO}_3$
- Sodium carbonate (soda):  $\text{Na}_2\text{CO}_3$

The use of antacids must follow the guide provided by the battery supplier.

## 3.6 Radiation

### 3.6.1 Electromagnetic Field Exposure



## WARNING

Radio-frequency signals with high intensity are harmful to human body.

Before installing or maintaining an antenna in a steel tower or a mast with a large number of transmitter antennas, the operator should coordinate with the parties concerned to shut down the transmitter antennas.

## Introduction

The BTS emits RF radiation (radiation hazard). Operators have to follow the related local regulations when erecting the BTS.

Operators of BTSs must also follow the related local regulations when erecting the BTS.

## Limits and Guidelines on Exposure to Electromagnetic Fields

There are a number of international regulations, standards and guidelines for exposure to electromagnetic fields. Several European countries have adopted the recommendation of the council of the European Union. It was released on July 12, 1999 focusing on the harmful effects of exposure to electromagnetic fields (1999/519/EC). The recommendation is based on the guideline published by the ICNIRP.

Table 3-1 gives a comparison among regulations and reference levels applied in different countries.

**Table 3-1** Different regulations and reference

Country	Limit 950 MHz E Electric Field Strength	Limit 950 MHz S Power Flux Density	Limit 1850 MHz E Electric Field Strength	Limit 1850 MHz S Power Flux Density
ICNIRP International	42 V/m	4.75 W/m <sup>2</sup>	59 V/m	9.25 W/m <sup>2</sup>
Europe (1999/519/EC)	42 V/m	4.75 W/m <sup>2</sup>	59 V/m	9.25 W/m <sup>2</sup>
Italy, Decreto No. 381, 1998	6 V/m	0.095 W/m <sup>2</sup>	6 V/m	0.095 W/m <sup>2</sup>
Switzerland Verord. 1999	4 V/m	0.043 W/m <sup>2</sup>	6 V/m	0.096 W/m <sup>2</sup>

Reference levels are provided for exposure assessment, that is to determine whether the basic limit of restriction on exposure of humans to electromagnetic fields is exceeded. The basic restriction on exposure to electromagnetic fields is based on established health effects and biological considerations.

## Location of Base Station Antennas

Base station antennas, the source of the radiation, are usually mounted:

- On freestanding towers, with a height up to 30 m, or
- On a tower on the top of buildings, or
- On rare occasion, to the side of the building.

Generally, the height of the antenna position does not fall below 10 m. The power usually forms a horizontal main beam and is slightly tilted downward. The remaining power forms into the weaker beams on both sides 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.

## Exclusion Zones

The requirements for exclusion zones are as follows:

- Antenna location should be designed so that the public cannot access the area where the RF radiation exceeds the levels as described earlier.
- If areas, where the RF radiation exceeds the prescribed level, are accessible to the workers, make sure that workers know where these areas are, and that they can power off (or shut down) the transmitters before entering these areas. Such areas may not exist; but if they do, they will be confined to areas within 10 m of the antennas.
- Each exclusion zone should be defined by a physical barrier and by a recognizable sign warning the public or workers.

## Guidelines on Arranging Antenna Sites

The guidelines on arranging the antenna sites are as follows:

- For roof-mounted antennas, raise the antennas above the height of the persons, who may have to work in the rooftop.
- For roof-mounted antennas, keep the transmitter antennas away from the areas where people are most likely to be, such as roof access points, telephone service points, and HVAC device.
- For roof-mounted directional antennas, place the antennas near the periphery, and do not make the antennas face to the building.
- Consider the trade-off between large aperture antennas (lower maximum RF) and small aperture antennas (lower visual impact).
- Pay special attention to keep higher-power antennas away from accessible areas.
- Keep the antennas in a site that is far away, though this may contradict the local zone requirements.
- Exercise extra caution when designing co-location sites, that is, where multiple antennas owned by different companies are located. This applies particularly to sites that include high-power broadcast (FM/TV) antennas. Local zone often favors co-location, but co-location may cause safety problems.
- Take special precautions for antenna sites near hospital and schools.

## Location of Base Transceiver Station

The base transceiver station (BTS) is shielded from RF radiation hazards. The device has been tested to comply with the radioactive spurious emission requirements of EN 301 502. These limits fall below the limits for RF radiation hazard. Therefore, the BTS does not cause danger to the public and workers under normal operation condition. However, it is still possible that because of imperfect antenna cables or other faults the limits set out above can be exceeded.

- BTS sites shall not be accessible to the public. Only authorized and trained workers should access sites or rooms.
- Doors of the site or room shall be clearly marked. For example, mark a sign warning the workers that inside the site or room where the RF radiation might exceed limits for radiation exposure.
- BTS sites shall be regularly monitored and inspected after installation.

## Prediction of the Exposure to Electromagnetic Fields

The section provides a theoretical approach to calculate possible exposure to electromagnetic radiation around a BTS antenna. Precise statements are possible either with measurements or complex calculations considering the complexity of the environment, such as soil conditions, nearby buildings and other obstacles. The complexity may cause reflections and deflection, 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:

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

P = Maximum output power in W

G<sub>numeric</sub> = Numeric gain (see below)

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

For the calculation of the Gain numeric:

$$G_{numeric} = 10^{\frac{GdB}{10}}$$

$$GdB = G_{antenna} (dB) - B_{cable} (dB) - B_{vertical-attenuation} (dB) - B_{horizontal-attenuation} (dB) \text{ B}$$

= attenuation in dB

### 3.6.2 Laser

The laser hazard level of this device is Class 1.



## WARNING

When handling optical fibers, do not stand close to, or look at the optical fiber outlet directly with unaided eyes.

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## General Laser Information

Laser transceivers or transmitters are used in the optical transmission system and associated test tools. The wavelength of the laser is between 780 nm and 1600 nm. Because the laser is transmitted through the optical fiber, it has very high power density and is invisible to human eyes. When a beam of light enters the eye, the retina may be damaged.

Laser of wavelengths used in telecommunications can cause thermal damage to the retina.

Lasers used in lightwave systems have a larger beam divergence, typically 10 to 20 degrees. Viewing an un-terminated fiber or damaged fiber with the unaided eye at distances greater than 150 mm (6 inches) will normally not cause eye injury. However, damage may occur if an optical tool such as a microscope, magnifying glass or eye loupe is used to view the energized fiber end.

In its normal operating mode, a lightwave system is totally enclosed and presents no risk of eye injury. Additional safety is achieved by an automatic laser shut-down (ALS) of the system. The ALS, however, can be applied for bi-directional transmission only. If the receiver side does not detect the laser from the transmission side, it will give the transmission side a signal. Upon receiving the signal, the ALS will shut down the laser emission within 100 ms.

## Laser Safety Guidelines

Read the following guidelines to avoid laser radiation:

- Read the instructions before installing, operating and maintaining the device. Ignoring the instructions can cause exposure to dangerous laser radiation.
- Wear a pair of eye-protective glasses when you are handling lasers or fibers.
- All the operation shall be performed by personnel who have completed the approved training courses.
- Make sure that the optical source is switched off before disconnecting optical fiber connectors.
- Before opening the front door of an optical transmission system, make sure that you are not exposed to laser radiation.
- Do not look at the end of an exposed fiber or an open connector when you are not sure whether the optical source is switched off or not.
- Use an optical power meter to check and ensure that the optical source is switched off by measuring the optical power.
- Do not use an optical tool such as a microscope, a magnifying glass or an eye loupe to view the optical connector or fiber.

## Handling Fibers

Read the instructions before handling fibers.

- Cutting and splicing fibers must be performed by the trained personnel only.

- Before cutting or splicing a fiber, ensure the fiber is disconnected from the optical source. After disconnecting the fiber, use protecting caps to protect all the optical connectors.

## 3.7 Working at Heights



### WARNING

When working at heights, be careful to prevent objects from falling.

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When working at heights, shall comply with the following requirements.

- The personnel who work at heights must be trained.
- The operating machines and tools shall be carried and handled safely to avoid falling.
- Safety protection measures, such as wearing a helmet and a safety belt, shall be taken.
- In cold regions, wear warm clothes when performing high-altitude operation.
- All lifting appliances must be thoroughly checked before the work is started.

### 3.7.1 Weight Lifting



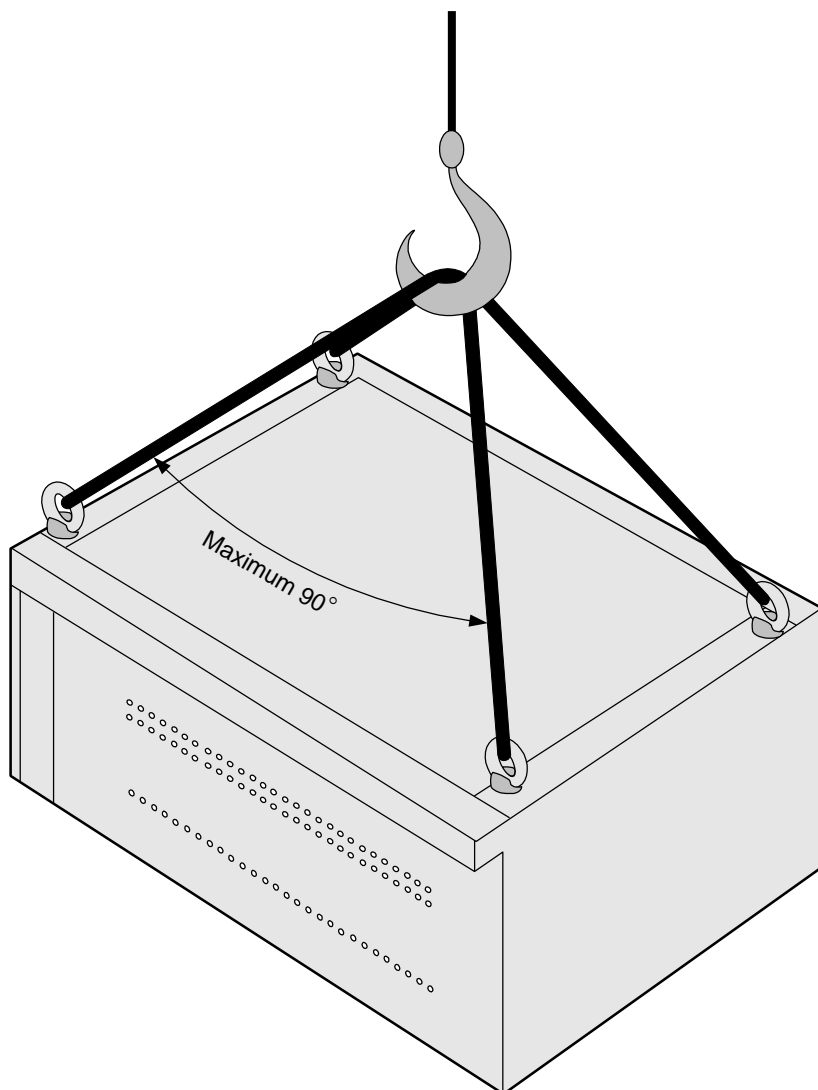
### WARNING

Do not access the areas under the jib arm and the goods in suspension when lifting weight.

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- Ensure the operators have completed the related training and are qualified.
- Check the weight lifting tools and confirm that the tools are in good condition.
- Lift the weight only when the weight lifting tools are firmly fixed onto the weight-bearing object or the wall.
- Use a concise command to avoid incorrect operation.
- Ensure the angle between the two cables is less than or equal to 90 degrees during the lift. (see Figure 3-2).

**Figure 3-2** Weight lifting



## 3.7.2 Safety Guide on Ladder Use

### Checking the Ladder

Before using the ladder, first check if the ladder is in good condition. Make sure that you know the maximum weight that the ladder can support; overweight on the ladder is strictly prohibited.

### Placing the Ladder

Slant angle is suggested to be 75 degrees. The slant can be measured with the angle square or with arms. When using a ladder, place the wider end of the ladder on the ground. Otherwise, take protective measures on the base part of the ladder to avoid skidding. Place the ladder on stable ground.

## Climbing the Ladder

When climbing the ladder, note the following.

- Ensure the gravity center of your body does not deviate from the ladder edge.
- To lessen the danger and ensure the safety, hold your balance on the ladder before any operation.
- Do not climb higher than the fourth highest step of the ladder.
- If you are about to climb to the top, the length of the ladder shall be one meter higher than the eave.

## 3.8 Mechanical Safety

### 3.8.1 Drilling



#### WARNING

Drilling on the rack without permission is strictly prohibited. Drilling that does not satisfy the requirements concerned may damage the wires and cables inside the rack. If the metal shavings from the drilling fall into the rack, it may result in short circuit of the circuit boards.

- Before drilling a hole on the rack, wear insulation gloves, and remove the cables inside the rack.
- During the drilling, ensure that your eyes are well protected. The hot shavings may injure your eyes.
- Ensure that the metal shavings do not get into the rack.
- Non-standard drilling may damage the electromagnetic shielding performance of the rack.
- After drilling, clean the metal shavings in time.

### 3.8.2 Sharp Objects



#### WARNING

When carrying the device by hand, wear protection gloves to avoid injury by sharp objects.

### 3.8.3 Handling Fans

Ensure the following:

- When replacing a component, place the component, screw, and tool at a safe place to prevent them from falling into the running fan.



- When replacing the ambient equipment around the fan, do not place the finger or board into the running fan until the fan is switched off and stops running.

## 3.8.4 Lifting Heavy Objects



### WARNING

When lifting heavy objects, do not stand or walk under the arm or the lifted object.

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## 3.9 Miscellaneous

### 3.9.1 Inserting and Removing a Board

To insert or remove a board, abide by the following requirements:



### CAUTION

When inserting a board, handle it gently to avoid distorting pins on the backplane.

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- Insert the board along the slot guide.
- The two sides of one board should not contact another board to avoid short-circuit or scratch.
- When holding a board in hand, do not touch the board circuit, components, connectors, or connection slots.

### 3.9.2 Bundling Signal Cables



### CAUTION

- Bundle the signal cables separately from the strong current cables or high voltage cables.
  - Maintain a minimum space of 150 mm between adjacent ties.
- 

### 3.9.3 Cabling Requirements

At a very low temperature, movement of the cable may damage the plastic skin of the cable. To ensure the construction safety, comply with the following requirements:

- When installing cables, ensure that the environment temperature is above 0 °C.
- If cables are stored in the place below 0 °C, move the cables into a place at a room temperature and store the cables for more than 24 hours before installation.

Move the cables with care, especially at a low temperature. Do not drop the cables directly from the vehicle.