



national standards of People's Republic of China

GB 21288—2020

Electromagnetic radiation exposure limit for mobile phones

Limits for human exposure to electromagnetic fields emitted by mobile phones

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	Item	Times
Foreword.....		
.....II Introduction.....		
.....III 1 Scope.....		
.....1		
2 Normative references.....		1
3 Terms and definitions.....		1
4 Abbreviations.....		3
5 Basic limits of exposure to electromagnetic radiation... ..		3
6 Marking requirements.....		4

before Speak

All technical content of this standard is mandatory.

This standard replaces GB 21288-2007 "Local Exposure Limits for Electromagnetic Radiation of Mobile Phones". Compared with GB 21288-2007, the main technical changes except for editorial changes are as follows:

- The scope of application extends from mobile phones used close to the head to mobile phones that work within 300GHz and close to the human body. Suitable for all kinds of mobile communication terminal equipment used close to the human body, such as wearable equipment, portable mobile terminals, etc.;
- Added the definition of occupational exposure;
- Added the definition of emission power density and incident power density;
- Increased exposure limits applicable to different frequencies and different body parts;
- Modified the content marked in the product manual, and added the required notes in the product manual.

Please note that certain contents of this document may involve patents. The issuing agency of this document is not responsible for identifying these patents.

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed and managed by the China Communications Standards Association.

Drafting organizations of this standard: China Academy of Information and Communications Technology, China Academy of Metrology.

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lead Speak

Mobile phones with operating frequencies within 300GHz, close to the human body, and various mobile communication terminal equipment used close to the human body, Such as wearable devices, portable mobile terminals, etc., whose electromagnetic radiation exposure may have an impact on health. In order to protect public health, this standard is specially formulated quasi.

Electromagnetic radiation exposure limit for mobile phones

1 Scope

This standard specifies the electromagnetic radiation exposure limit for mobile phones.

This standard applies to mobile phones operating within 300GHz and close to the human body, as well as various mobile communications used close to the human body. Terminal devices, such as wearable devices, portable mobile terminals, etc.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this document. Where it is an undated reference document, and the latest version (including all amendments) is applicable to this document.

YD/T XXXX Mobile Communication Terminal Equipment Electromagnetic Radiation Compliance Standard Part 1 Mobile Phone

YD/T XXXX Mobile Communication Terminal Equipment Electromagnetic Radiation Compliance Standard Part 2 Portable Data

Terminal YD/T XXXX Mobile Communication Terminal Equipment Electromagnetic Radiation Compliance Standard Part 3 Wearable Devices

3 Terms and definitions

3.1 Public exposure public exposure

For various ages and different health conditions under uncontrolled conditions, and are not aware of the occurrence of exposure and the danger to their bodies Harm, the exposure of individuals who cannot effectively take protective measures.

3.2 Occupational Exposure occupational exposure

Under known conditions, professionals have been trained and understood the relevant risks to take appropriate protective exposures.

3.3 Electromagnetic radiation electromagnetic radiation

- a) The phenomenon that energy is emitted from a source to space in the form of electromagnetic waves;
- b) Energy propagates in space in the form of electromagnetic waves.

Note: The meaning of the term "electromagnetic radiation" can sometimes be extended to include the phenomenon of electromagnetic induction.

3.4 Specific absorption rate specific absorption rate

SAR

Biological organization unit time (*dt*) Unit mass (*dm* or *ρdV*) The electromagnetic wave energy absorbed (*dW*).

$$SAR = \frac{dW}{dt \cdot dm \cdot dV} \quad (1)$$

Where:

SAR Unit is W/kg

Note: *SAR* It can be calculated as follows:

$$SAR = \frac{E_{eff}^2}{\rho}$$

$$SAR \cdot c = \left. \frac{dT}{dt} \right|_{t=0} \dots \dots \dots (3)$$

Where:

E : The effective value of the electric field intensity in the tissue, V/m ;

ρ : Electrical conductivity of body tissue, S/m ;

ρ : The density of body tissues, kg/m³ ;

c : The heat capacity of body tissue, J / (kg K) ;

$\left. \frac{dT}{dt} \right|_{t=0}$: The temperature change rate in the body tissue at the beginning, K/s

3.5 Transmission power density transmitted power density

Energy and energy absorption are limited to the surface of the body, so the transmitted power and energy density are defined on the surface of the body:

$$S_{tr} = \int_A \rho(x, y, z) \cdot SAR(x, y, z) dz / A \dots \dots \dots (4)$$

Where:

When $z = 0$ means it is on the surface of the body;

A : Average area, m²

Considering the thermal effect, for the frequency range below 30GHz, the average area used for the basic limits of transmit power and energy density The interval is 2 (cm) x 2 (cm); for frequency bands greater than 30 GHz, the average area interval is 1 (cm) x 1 (cm).

The stricter transmission power density formula is based on the Poynting vector (S):

$$S_{tr} = \int_A \text{Re}[S] \cdot ds / A = \int_A \text{Re}[E \cdot H^*] \cdot ds / A \dots \dots \dots (5)$$

Where:

Re[X] is the real part of the complex number "X",

ds is the vector of the integral 53D8 in the normal direction of the integral area A

3.6 Incident power density incident power density

The incident power density is defined as the absolute value of the Poynting vector:

$$S_{inc} = E \cdot H^* \dots \dots \dots (6)$$

In the state of far-field and transverse electromagnetic plane waves, the incident power density can be expressed by formula (7):

$$S_{inc} = E \cdot H = \frac{E^2}{Z_0} = Z_0 H^2 \dots \dots \dots (7)$$

Where:

Z_0 is the impedance of free space, usually 377; the above formula can also be used to calculate the equivalent incident power density.

S_{inc} with S_r Related to reflection coefficient R :

$$S_{tr} = (1 - |R|^2) \cdot S_{inc} \dots \dots \dots (8)$$

4 Abbreviations

TER	Total Exposure Ratio	Total exposure ratio
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5 Basic limits of electromagnetic radiation exposure

5.1 The basic limit of electromagnetic radiation exposure of mobile phones should meet the requirements of Table 1:

Table 1 Basic limits of electromagnetic radiation exposure

Exposure classification	Frequency Range	Partial head and torso <i>SAR</i> (W/kg)	Local limbs <i>SAR</i> (W/kg)	Local emission power density <i>S_r</i> (W/m ²)
Profession	100kHz-6GHz	10	20	\
	> 6GHz-300GHz	\	\	100
public	100kHz-6GHz	2	4	\
	> 6GHz-300GHz	\	\	20

Note 1: Partial *SAR* And transmit power density *S_r*. The average exposure time is not less than 6 minutes;

Note 2: Part of the table *SAR* Use 10g volume;

Note 3: For the emission power density in the frequency range> 6-30GHz, the radiation area is 4cm²; The radiation area in the frequency range >30GHz is 1cm² ;

Note 4: Under certain conditions, the equivalent incident plane wave power density can be used instead of the incident plane wave power density;

Note 5: "\ " means that there is no basic limit in this cell.

5.2 Public exposure

5.2.1

Within the frequency range of 100kHz-6GHz, local exposure (head and torso) of any 10g tissue, average specific absorption for any six consecutive minutes rate(*SAR*) The value must not exceed 2W/kg.

5.2.2

In the frequency range of 100kHz-6GHz, local exposure (extremities) of any 10g tissue, any continuous six minutes average specific absorption rate (*SAR*) The value must not exceed 4W/kg.

5.2.3

In the frequency range of 6GHz-30GHz, local exposure for any continuous six minutes, the emission power density at any 4cm²: Mean of radiated area No more than 20W/m² .

5.2.4

in 30GHz - 300GHz Within the frequency range, the local exposure for any continuous six minutes of emission power density at any 1cm²Radiation area
The average value must not exceed 20W/m² .

5.3 Occupational exposure

5.3.1

Within the frequency range of 100kHz-6GHz, local exposure (head and torso) of any 10g tissue, average specific absorption for any six consecutive minutes rate(*SAR*) The value must not exceed 10W/kg.

5.3.2

In the frequency range of 100kHz-6GHz, local exposure (extremities) of any 10g tissue, any continuous six-minute average specific absorption rate value (*SAR*) Must not exceed 20W/kg.

5.3.3

In the frequency range of 6GHz-30GHz, local exposure for any continuous six minutes, the emission power density at any 4cm² The average radiation area must not More than 100W/m² .

5.3.4

In the frequency range of 30GHz-300GHz, local exposure for any continuous six minutes of emission power density at any 1cm² The average radiation area is not More than 100W/m² .

5.4 Total exposure ratio

When the public and occupations are exposed to electric, magnetic, and electromagnetic fields of multiple frequencies, the electric, magnetic, and electromagnetic fields of multiple frequencies Whether the resulting exposure has additive effects. When there is a superposition effect, the following requirements should be met in the frequency range of 100kHz-300GHz:

$$\sum_{i=1}^n \frac{SAR_i}{SAR_{limit}} + \sum_{j=1}^m \frac{S_{tr,j}}{S_{tr,limit}} \leq 1 \dots\dots\dots (9)$$

Where:

- SAR_i* Is in frequency *i* /SAR value of exposure;
- SAR_{limit}* It is the applicable limit of specific absorption rate in Table 1 of this standard;
- S_i* Is in frequency *i* /The exposed emission power density value;
- S_{tr,limit}* It is the applicable limit of the transmit power density in Table 1 of this standard.

6 Marking requirements

6.16.1

When the mobile phone is only suitable for the frequency range of 100kHz-6GHz, in the product manual : China should mark: "This product is partially exposed to electromagnetic Specific Absorption Rate (*SAR*) The maximum value is ×.×W/kg, which meets the national standard GB 21288- 2020 Requirements".

When the mobile phone is only suitable for 6GHz-300GHz frequency range, in the product manual : China should mark: "This product is partially exposed to electromagnetic The maximum radiation power density is ×.×W/m² , In line with the national standard GB 21288- 2020 Requirements".

When the mobile phone is suitable for the frequency range of 100kHz-6GHz and 6GHz-300GHz, in the product manual : China should mark: "This product Specific absorption rate of electromagnetic radiation (*SAR*) The maximum value is ×.×W/kg, the maximum power density is ×.×W/m² , In line with national standards Standard GB 21288- 2020 Requirements".

6.26.2

In the product manual^{2,3} It should indicate the items that users need to pay attention to when using this product, such as cardiac pacemakers, hearing aids, cochlear implants, etc.

Note 1: The application state that is not applicable to the product may not be tested and marked. For the application state, please refer to product standards, such as electromagnetic radiation of mobile communication equipment.

Compliance series standards.

Note 2: In this standard, product specifications include but are not limited to tangible and intangible carriers such as paper and electronic components.

Note 3: In this standard, product instructions include but are not limited to product instructions and other public documents that can be easily found by users.
