

## 5 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### 5.1 Applicable Standard

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

| (B) Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                                   | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3–1.34                                                | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34–30                                                 | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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;

According with 680106 D01 Wireless Power Transfer v04 clause 3.2

Accordingly, for § 2.1091-Mobile devices, the MPE limits between 100 kHz to 300 kHz are to be considered the same as those at 300 kHz in Table 1 of § 1.1310, that is, 614 V/m and 1.63 A/m, for the electric field and magnetic field, respectively. For § 2.1093-Portable devices below 4 MHz and down to 100 kHz, the MPE limits in § 1.1310 (with the 300 kHz limit applicable all the way down to 100 kHz) can be used for the purpose of equipment authorization in lieu of SAR evaluations.

According to 680106 D01 Wireless Power Transfer v04 clause 5.2

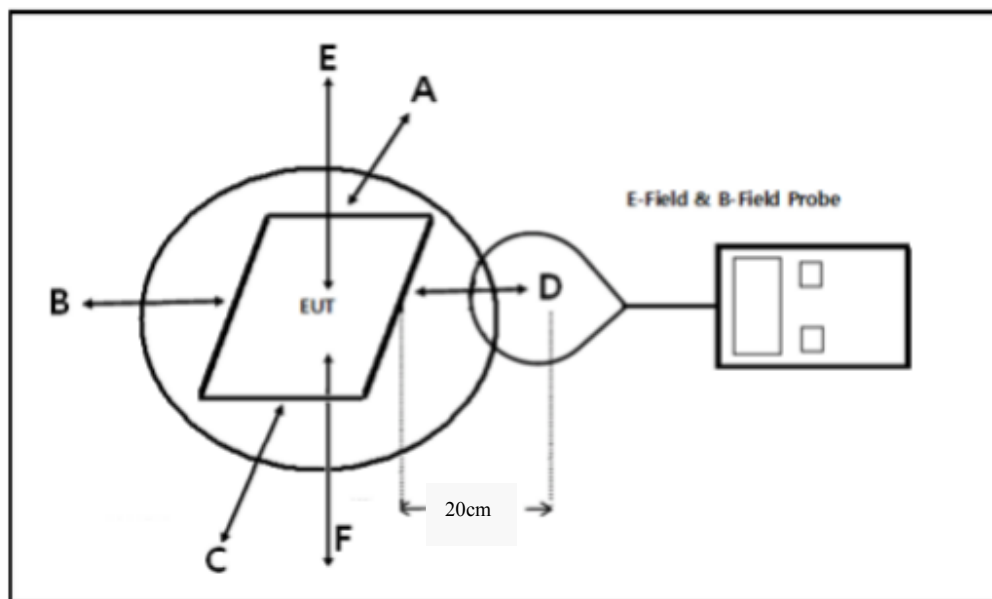
There might be situations where the WPT RF emissions are limited enough that even operations in a “crowded” environment, where many similar WPT devices are present, do not pose significant EMC and RF exposure concerns. In this scenario, and for devices operating within a one-meter distance from the receiver, as defined above, a manufacturer will not have to submit an “Equipment Compliance Review” KDB, and receive FCC concurrence before proceeding with equipment authorization. This exception to the requirement of submitting the ECR to obtain FCC concurrence only applies when all the following criteria (1) through (6) are met:

- (1) The power transfer frequency is below 1 MHz.
- (2) The output power from each transmitting element (e.g., coil) is less than or equal to 15 watts.
- (3) A client device providing the maximum permitted load is placed in physical contact with the transmitter (i.e., the surfaces of the transmitter and client device enclosures need to be in physical contact)
- (4) Only § 2.1091-Mobile exposure conditions apply (i.e., this provision does not cover § 2.1093-Portable exposure conditions).

(5) The E-field and H-field strengths, at and beyond 20 cm surrounding the device surface, are demonstrated to be less than 50% of the applicable MPE limit, per KDB 447498, Table 1. These measurements shall be taken along the principal axes of the device, with one axis oriented along the direction of the estimated maximum field strength, and for three points per axis or until a  $1/d$  (inverse distance from the emitter structure) field strength decay is observed. Symmetry considerations may be used for test reduction purposes. The device shall be operated in documented worst-case compliance scenarios (i.e., the ones that lead to the maximum field components), and while all the radiating structures (e.g., coils or antennas) that by design can simultaneously transmit are energized at their nominal maximum power.

(6) For systems with more than one radiating structure, the conditions specified in (5) must be met when the system is fully loaded (i.e., clients absorbing maximum power available), and with all the radiating structures operating at maximum power at the same time, as per design conditions. If the design allows one or more radiating structures to be powered at a higher level while other radiating structures are not powered, then those cases must be tested as well. For instance, a device may use three RF coils powered at 5 W, or one coil powered at 15 W: in this case, both scenarios shall be tested.

## 5.2 Block Diagram of Test Setup



### 5.3 Test Procedures

- 1) Perform H-field and E-field measurements for each all sides of the EUT at 20cm, along all the principal axes defined with respect to the orientation of the transmitting element(e.g., coil or antenna).
- 2) The highest emission level was recorded and compared with limit.
- 3) The EUT was measured according to 680106 D01 Wireless Power Transfer v04

**5.4 Test Data:**

|                |             |              |            |
|----------------|-------------|--------------|------------|
| Serial Number: | 2B5B-2      | Test Date:   | 2023/12/25 |
| Test Site:     | RF          | Test Mode:   | M1-M6      |
| Tester:        | David Huang | Test Result: | Pass       |

**Environmental Conditions:**

|                      |      |                              |    |                        |       |
|----------------------|------|------------------------------|----|------------------------|-------|
| Temperature:<br>(°C) | 22.5 | Relative<br>Humidity:<br>(%) | 27 | ATM Pressure:<br>(kPa) | 102.4 |
|----------------------|------|------------------------------|----|------------------------|-------|

**Test Equipment List and Details:**

| Manufacturer | Description                                | Model     | Serial Number | Calibration Date | Calibration Due Date |
|--------------|--------------------------------------------|-----------|---------------|------------------|----------------------|
| Narda        | Electric and Magnetic Field Probe-Analyzer | EHP-200AC | 180ZX10204    | 2021/6/7         | 2024/6/6             |

\* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data:****M1:****H-Field Strength:**

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.0385           | 0.0569           | 0.0518           | 0.0422           | 0.0439           | 0.815           | 1.63        |

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.6563           | 0.75             | 1.0469           | 0.6183           | 0.3978           | 307             | 614         |

**M2****H-Field Strength:**

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.0319           | 0.0516           | 0.0647           | 0.0528           | 0.0197           | 0.815           | 1.63        |
| 131.32                | 0.0318           | 0.0119           | 0.0336           | 0.0273           | 0.0531           | 0.815           | 1.63        |

The Multiple Frequency Summation (worst case at Position C)

$$H_{\text{Phone horizontal}}/H_{\text{Limit}} + H_{\text{Airpods}}/H_{\text{Limit}} = 0.0647/0.815 + 0.0336/0.815 = 0.121 < 1$$

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.5336           | 0.8207           | 0.7813           | 0.937            | 0.5924           | 307             | 614         |
| 131.32                | 0.2954           | 0.9438           | 0.8117           | 0.6357           | 0.8036           | 307             | 614         |

The Multiple Frequency Summation (worst case at Position B)

$$E_{\text{Phone horizontal}}/E_{\text{Limit}} + E_{\text{Airpods}}/E_{\text{Limit}} = 0.8207/307 + 0.9438/307 = 0.006 < 1$$

**M3****H-Field Strength:**

| FrequencyRange(kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|---------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 131.32              | 0.0315           | 0.0117           | 0.0356           | 0.02756          | 0.0545           | 0.815           | 1.63        |

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 131.32                | 0.2969           | 0.9504           | 0.8073           | 0.6524           | 0.8111           | 307             | 614         |

**M4****H-Field Strength:**

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.045            | 0.0647           | 0.0853           | 0.0967           | 0.035            | 0.815           | 1.63        |

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.5489           | 0.5547           | 0.4051           | 0.5223           | 0.4083           | 307             | 614         |

**M5****H-Field Strength:**

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.0525           | 0.0713           | 0.0512           | 0.0953           | 0.0506           | 0.815           | 1.63        |

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.33                | 0.6025           | 0.5767           | 0.5492           | 0.5055           | 0.5288           | 307             | 614         |

**M6****H-Field Strength:**

| Frequency Range (kHz) | Position A (A/m) | Position B (A/m) | Position C (A/m) | Position D (A/m) | Position E (A/m) | 50% Limit (A/m) | Limit (A/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.35                | 0.0422           | 0.0544           | 0.0497           | 0.0736           | 0.0184           | 0.815           | 1.63        |

**E-Field Strength:**

| Frequency Range (kHz) | Position A (V/m) | Position B (V/m) | Position C (V/m) | Position D (V/m) | Position E (V/m) | 50% Limit (V/m) | Limit (V/m) |
|-----------------------|------------------|------------------|------------------|------------------|------------------|-----------------|-------------|
| 127.35                | 0.6040           | 0.9846           | 0.3196           | 0.9947           | 0.3021           | 307             | 614         |

Note: Test with 20cm distance from the center of the probe(s) to the edge of the device.

**Considerations of compliance 680106 D01 Wireless Power Transfer v04 clause 5.2:****(1) Power transfer frequency is less than 1 MHz**

Yes, the operation frequency is AirPods: 131.32kHz, Phone horizontal: 127.33kHz, Phone vertical: 127.35kHz.

**(2) The output power from each transmitting element (e.g., coil) is less than or equal to 15 watts.**

Yes, the maximum output power of primary coil is **10 Watts**.

**(3) A client device providing the maximum permitted load is placed in physical contact with the transmitter (i.e., the surfaces of the transmitter and client device enclosures need to be in physical contact)**

Yes, client device is placed directly in contact with the transmitter

**(4) Only § 2.1091-Mobile exposure conditions apply (i.e., this provision does not cover § 2.1093-Portable exposure conditions).**

Yes, mobile exposure conditions only.

**(5) The E-field and H-field strengths, at and beyond 20 cm surrounding the device surface, are demonstrated to be less than 50% of the applicable MPE limit, per KDB 447498, Table 1. These measurements shall be taken along the principal axes of the device, with one axis oriented along the direction of the estimated maximum field strength, and for three points per axis or until a 1/d (inverse distance from the emitter structure) field strength decay is observed. Symmetry considerations may be used for test reduction purposes. The device shall be operated in documented worst-case compliance scenarios (i.e., the ones that lead to the maximum field components), and while all the radiating structures (e.g., coils or antennas) that by design can simultaneously transmit are energized at their nominal maximum power.**

Yes, the test result for H and E-field strength less than 50% of the MPE limit.

**(6) For systems with more than one radiating structure, the conditions specified in (5) must be met when the system is fully loaded (i.e., clients absorbing maximum power available), and with all the radiating structures operating at maximum power at the same time, as per design conditions. If the design allows one or more radiating structures to be powered at a higher level while other radiating structures are not powered, then those cases must be tested as well. For instance, a device may use three RF coils powered at 5 W, or one coil powered at 15 W: in this case, both scenarios shall be tested.**

Yes, all the radiating structures operating at maximum power at the same time.