



MPE Report

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard:

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v05r01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.

1. Evaluation method

Systems operating under the provisions of FCC 47 CFR 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.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure



(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)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | | | F/1500 | 30 |
| 1500-100,000 | | | 1.0 | 30 |

Note: f = frequency in MHz ; *Plane-wave equivalent power density

3. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

Where: S=power density

P=power input to antenna

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

R=distance to the center of radiation of the antenna

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the maximum gain of the used antenna is 3dBi for GSM/UMTS/WLAN, the RF power density can be obtained.

4. Estimation Result

4.1 Conducted Power Results

The conducted power calculation results for GSM/EDGE

| Mode | Timeslot | Duty cycle | Burst Average Power (dBm) | Average Output Power(dBm) |
|-----------|----------|------------|---------------------------|---------------------------|
| GPRS 850 | 1 slot | 12.5% | 30.76 | 21.73 |
| | 2 slot | 25% | 29.87 | 23.85 |
| | 3 slot | 37.5% | 28.91 | 24.65 |
| | 4 slot | 50% | 27.89 | 24.88 |
| EDGE850 | 1 slot | 12.5% | 30.57 | 21.54 |
| | 2 slot | 25% | 29.65 | 23.63 |
| | 3 slot | 37.5% | 28.71 | 24.45 |
| | 4 slot | 50% | 27.86 | 24.85 |
| GPRS 1900 | 1 slot | 12.5% | 27.67 | 18.64 |
| | 2 slot | 25% | 26.73 | 20.71 |
| | 3 slot | 37.5% | 25.85 | 21.59 |
| | 4 slot | 50% | 24.99 | 21.98 |
| EDGE1900 | 1 slot | 12.5% | 27.25 | 18.22 |



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| | | | | |
|--|--------|-------|-------|-------|
| | 2 slot | 25% | 26.38 | 20.36 |
| | 3 slot | 37.5% | 25.59 | 21.33 |
| | 4 slot | 50% | 24.71 | 21.70 |

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1)

=> -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by

(8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by

(8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by

(8/4) => -3.01dB

The conducted power measurement results for WCDMA

| Mode | Burst Average Power (dBm) | Duty cycle |
|---------------|---------------------------|------------|
| WCDMA Band II | 24.15 | 100% |
| WCDMA Band V | 24.70 | 100% |

WLAN

| Mode | Frequency(MHz) | AVG Conducted Output Power (dBm) |
|-------------------|----------------|----------------------------------|
| IEEE 802.11b | 2412 | 14.38 |
| | 2437 | 13.92 |
| | 2462 | 13.77 |
| IEEE 802.11g | 2412 | 14.13 |
| | 2437 | 13.94 |
| | 2462 | 13.48 |
| IEEE 802.11n HT20 | 2412 | 14.04 |
| | 2437 | 13.67 |
| | 2462 | 13.42 |
| IEEE 802.11n HT40 | 2422 | 14.13 |
| | 2437 | 14.11 |
| | 2452 | 13.87 |



4.2 Manufacturing tolerance

| GSM 850 GPRS (GMSK) (Burst Average Power) | | | | |
|---|----------------------|------|------|------|
| Channel | | 128 | 190 | 251 |
| 1 Txslot | Target (dBm) | 30.0 | 30.0 | 30.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 2 Txslot | Target (dBm) | 29.0 | 29.0 | 29.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 3 Txslot | Target (dBm) | 28.0 | 28.0 | 28.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 4 Txslot | Target (dBm) | 27.0 | 27.0 | 27.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| GSM 850 EDGE (8PSK) (Burst Average Power) | | | | |
| Channel | | 128 | 190 | 251 |
| 1 Txslot | Target (dBm) | 30.0 | 30.0 | 30.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 2 Txslot | Target (dBm) | 29.0 | 29.0 | 29.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 3 Txslot | Target (dBm) | 28.0 | 28.0 | 28.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 4 Txslot | Target (dBm) | 27.0 | 27.0 | 27.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| GSM 1900 GPRS (GMSK) (Burst Average Power) | | | | |
| Channel | | 251 | 661 | 810 |
| 1 Txslot | Target (dBm) | 27.0 | 27.0 | 27.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 2 Txslot | Target (dBm) | 26.0 | 26.0 | 26.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 3 Txslot | Target (dBm) | 25.0 | 25.0 | 25.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 4 Txslot | Target (dBm) | 24.0 | 24.0 | 24.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| GSM 1900 EDGE (8PSK) (Burst Average Power) | | | | |
| Channel | | 251 | 661 | 810 |
| 1 Txslot | Target (dBm) | 27.0 | 27.0 | 27.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 2 Txslot | Target (dBm) | 26.0 | 26.0 | 26.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 3 Txslot | Target (dBm) | 25.0 | 25.0 | 25.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| 4 Txslot | Target (dBm) | 24.0 | 24.0 | 24.0 |
| | Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |



UMTS

| UMTS Band V | | | |
|----------------------|------|------|------|
| Channel | 4132 | 4183 | 4233 |
| Target (dBm) | 24.0 | 24.0 | 24.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| UMTS Band II | | | |
| Channel | 9262 | 9400 | 9538 |
| Target (dBm) | 24.0 | 24.0 | 24.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

2.4G WLAN

| IEEE 802.11 b | | | |
|---------------------------|------|------|------|
| Channel | 1 | 6 | 11 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11 g | | | |
| Channel | 1 | 6 | 11 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11 n HT20 | | | |
| Channel | 1 | 6 | 11 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |
| IEEE 802.11 n HT40 | | | |
| Channel | 3 | 6 | 9 |
| Target (dBm) | 14.0 | 14.0 | 14.0 |
| Tolerance \pm (dB) | 1.0 | 1.0 | 1.0 |

4.3 Measurement Results

4.3.1 Standalone MPE



GSM/EDGE/UMTS

| Mode | Average Output Power Including power tolerance (dBm) | Average Output Power Including power tolerance (mW) | Antenna gain (dBi) | Antenna gain (numeric) | Duty Cycle | Power Density (mW/cm ²) | Limit of Power Density (mW/cm ²) | PASS /FAIL |
|---------------|--|---|--------------------|------------------------|------------|-------------------------------------|--|------------|
| GPRS850 | 24.99 | 315.51 | 3.00 | 1.9956 | 100% | 0.1253 | 0.5567 | PASS |
| EDGE850 | 24.99 | 315.51 | 3.00 | 1.9956 | 100% | 0.1253 | 0.5567 | PASS |
| GPRS1900 | 21.99 | 158.12 | 3.00 | 1.9956 | 100% | 0.0628 | 1.0000 | PASS |
| EDGE1900 | 21.99 | 158.12 | 3.00 | 1.9956 | 100% | 0.0628 | 1.0000 | PASS |
| WCDMA Band V | 25.00 | 316.23 | 3.00 | 1.9956 | 100% | 0.1256 | 0.5567 | PASS |
| WCDMA Band II | 25.00 | 316.23 | 3.00 | 1.9956 | 100% | 0.1256 | 1.0000 | PASS |

Remark:

1. Average power is Time-Average power according to KDB 447498 require, including duty cycle factor;

2.4G WLAN

| Mode | Average Output Power Including power tolerance (dBm) | Average Output Power Including power tolerance (mW) | Antenna gain (dBi) | Antenna gain (numeric) | Duty Cycle | Power Density (mW/cm ²) | Limit of Power Density (mW/cm ²) | PASS /FAIL |
|--------------------|--|---|--------------------|------------------------|------------|-------------------------------------|--|------------|
| IEEE 802.11 b | 15.00 | 31.6228 | 3.00 | 1.9956 | 100% | 0.0126 | 1.0000 | PASS |
| IEEE 802.11 g | 15.00 | 31.6228 | 3.00 | 1.9956 | 100% | 0.0126 | 1.0000 | PASS |
| IEEE 802.11 n HT20 | 15.00 | 31.6228 | 3.00 | 1.9956 | 100% | 0.0126 | 1.0000 | PASS |
| IEEE 802.11 n HT40 | 15.00 | 31.6228 | 3.00 | 1.9956 | 100% | 0.0126 | 1.0000 | PASS |



4.3.2 Simultaneous Transmission

The GSM/UMTS share same antenna, GSM/UMTS and WLAN share difference antenna, GSM/UMTS and WLAN can simultaneous transmission.

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

Σ of MPE ratios ≤ 1.0

$\Sigma \text{ GSM/UMTS/WLAN MPE ratios} = \text{GSM/UMTS}_{\text{MPE ratios}} + \text{WLAN MPE ratios} = 0.2 < 1.0$

Note: The estimation distance is 20cm

Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.