MPE Calculation (Mobile Device)

FCC ID: UBUXPDA-SPCI

EUT Description: Pandora (Point of Sale Terminal)
Company: ITWell Co., Ltd.
Model: XPDA-S PCI

Typical use distance: d ≥ 20 cm
Category: Mobile Device

Simultaneous transmission:
- Cellular 850MHz and 1900MHz emissions cannot be simultaneous
- GSM and WCDMA emissions cannot be simultaneous
- RFID, Bluetooth, WLAN and Cellular emissions can occur simultaneous.

Antennas: all antennas are integral, and positioned within 10cm distance from each other.

The device uses the following RF technologies, which are investigated for MPE individually:

RFID / part 15.225
Frequency: 13.56MHz
Rated RF power: -- → EMC limit per 15.225, no further calculation

Bluetooth / part 15.247
Frequency: 2402-2480MHz (79 channels)
Modulation: FHSS(GFSK)
Rated RF power: 0.24 mW → far under limit, no further calculation

WLAN: 11b/g/n(20) / part 15.247
Frequency: 2412-2462MHz (11 channels)
Modulation: DSSS/OFDM
Conducted RF power: 31 mW
Power density limit for mobile devices (general population) at 2.4GHz: $S \leq 1.0$ mW/cm^2
Maximum measured conducted power (Peak): $P_{conducted}$ = 31 mW =14.91 dBm
Antenna Gain: G = 2.31 dBi
Remarks: 1). Average ≤ Peak, which means that calculating the power density applying Peak power is worst case. 2). No compensation for duty cycle represents worst case.

Calculations:
$P_{radiated} = P_{conducted} + G_{linear}$ = 14.91 dBm + 2.31 dBi = 17.22 dBm = 52.72 mW

$$S = \frac{(P_{radiated})}{(4\pi \times d^2)} \text{ (mW/cm}^2\text{)} = 0.0105 \text{ mW/cm}^2$$

Conclusions:
Peak power limit is 1 W (=30dBm) so for simultaneous transmission, it takes 5.27% of the maximum in this band. At 20 cm distance, the power density EUT appears to be (far) below the required limit, so PASS.

Cellular: 850MHz / part 22H
Frequency: 824.2-848.8MHz (GSM mode), 826.4-848.6 (WCDMA mode)
ERP max measured: 33.02 dBm = 2 W
Power density limit for mobile devices (general population) at 850MHz: $S \leq 0.55$ mW/cm^2
Remark: No compensation for duty cycle represents worst case

Calculation:

$$S = \frac{(P_{radiated})}{(4\pi \times d^2)} \text{ (mW/cm}^2\text{)} = 0.39 \text{ mW/cm}^2$$

Conclusions:
ERP power limit is 7 W (22.913(a)2) so for simultaneous transmission, it takes 29% of the maximum in this band.
At 20 cm distance, the power density EUT appears to be below the required power density limit, so PASS.

Cellular: 1900MHz / part 24E
Frequency: 1850.2-1909.8MHz (GSM mode), 1852.4-1907.6 (WCDMA mode)
EIRP max measured: 24.81 dBm = 0.303 W
Power density limit for mobile devices (general population) at 1900MHz: $S \leq 1.0$ mW/cm^2
Remark: No compensation for duty cycle represents worst case

Calculation:

$$S = \frac{(P_{radiated})}{(4\pi \times d^2)} \text{ (mW/cm}^2\text{)} = 0.06 \text{ mW/cm}^2$$

Conclusions:
EIRP power limit is 2 W (24.232(c)) so for simultaneous transmission, it takes 15% of the maximum in this band.
At 20 cm distance, the power density EUT appears to be below the required power density limit, so PASS.

<u>Conclusion for MPE at simultaneous transmission:</u>
At worst case simultaneous transmission, each RF portion separately and summed, use (far) less than 100% of the power limit, so PASS.