



## APPENDIX I

### RADIO FREQUENCY EXPOSURE

#### LIMIT

According to §15.247(i), 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 levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

#### EUT Specification

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT</b>                        | Computer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Model</b>                      | TREK-520 ; TREK-520XXXXXXXXXXXXXXXXXX;<br>TREK520XXXXXXXXXXXXXXXXXX<br>(where "X" may be any alphanumeric character, "-", "_" or blank)                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Frequency band (Operating)</b> | <input checked="" type="checkbox"/> GSM 850MHz: 824.2MHz ~ 848.8MHz<br><input checked="" type="checkbox"/> GSM 1900MHz: 1850.2MHz ~ 1909.8MHz<br><input checked="" type="checkbox"/> WCDMA Band II: 1852.4MHz ~ 1907.6MHz<br><input checked="" type="checkbox"/> WCDMA Band IV: 1712.4MHz ~ 1752.6MHz<br><input checked="" type="checkbox"/> WCDMA Band V: 826.4MHz ~ 846.6MHz<br><input checked="" type="checkbox"/> Bluetooth 2.1 + EDR / 4.0: 2402 ~ 2480 MHz<br>802.11b/g/n HT20: 2.412GHz ~ 2.462GHz<br><input type="checkbox"/> Others |
| <b>Device category</b>            | <input type="checkbox"/> Portable (<20cm separation)<br><input checked="" type="checkbox"/> Mobile (>20cm separation)<br><input type="checkbox"/> Others                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Exposure classification</b>    | <input type="checkbox"/> Occupational/Controlled exposure ( $S = 5\text{mW/cm}^2$ )<br><input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S=1\text{mW/cm}^2$ )                                                                                                                                                                                                                                                                                                                                                  |
| <b>Antenna Specification</b>      | GSM 850:                      Antenna Gain :    1.00 dBi (Numeric gain 1.26)<br>GSM 1900:                   Antenna Gain :    2.50 dBi (Numeric gain 1.78)<br>WCDMA Band II:           Antenna Gain :    2.50 dBi (Numeric gain 1.78)<br>WCDMA Band IV:          Antenna Gain :    2.00 dBi (Numeric gain 1.58)<br>WCDMA Band V:           Antenna Gain :    1.00 dBi (Numeric gain 1.26)<br>2.4GHz:                    Antenna1 Gain :   -3.03 dBi (Numeric gain 0.50)                                                                      |



**Measurement  
Average output  
power**

| <b>System</b>           | <b>Power</b> |              |
|-------------------------|--------------|--------------|
| GSM850                  | 32.50 dBm    | (1778.28 mW) |
| GPRS850_1Slot           | 32.80 dBm    | (1905.46 mW) |
| GPRS850_2Slot           | 32.30 dBm    | (1698.24 mW) |
| GPRS850_3Slot           | 31.70 dBm    | (1479.11 mW) |
| GPRS850_4Slot           | 30.60 dBm    | (1148.15 mW) |
| EDGE850_1Slot           | 27.40 dBm    | (549.54 mW)  |
| EDGE850_2Slot           | 26.90 dBm    | (489.78 mW)  |
| EDGE850_3Slot           | 26.20 dBm    | (416.87 mW)  |
| EDGE850_4Slot           | 25.50 dBm    | (354.81 mW)  |
| GSM1900                 | 29.50 dBm    | (891.25 mW)  |
| GPRS1900_1Slot          | 29.70 dBm    | (933.25 mW)  |
| GPRS1900_2Slot          | 29.20 dBm    | (831.76 mW)  |
| GPRS1900_3Slot          | 28.80 dBm    | (758.58 mW)  |
| GPRS1900_4Slot          | 27.70 dBm    | (588.84 mW)  |
| EDGE1900_1Slot          | 25.80 dBm    | (380.19 mW)  |
| EDGE1900_2Slot          | 25.60 dBm    | (363.08 mW)  |
| EDGE1900_3Slot          | 25.00 dBm    | (316.23 mW)  |
| EDGE1900_4Slot          | 24.40 dBm    | (275.42 mW)  |
| WCDMA Band II           | 23.85 dBm    | (242.66 mW)  |
| WCDMA Band IV           | 23.54 dBm    | (225.94 mW)  |
| WCDMA Band V            | 23.82 dBm    | (240.99 mW)  |
| Bluetooth               | 7.50 dBm     | (5.62 mW)    |
| IEEE 802.11b Mode       | 17.07 dBm    | (50.93 mW)   |
| IEEE 802.11g Mode       | 15.00 dBm    | (31.62 mW)   |
| IEEE 802.11n HT 20 Mode | 14.66 dBm    | (29.24 mW)   |

**Power Target /  
Tolerance**

| <b>System</b>           | <b>Target Power</b> | <b>Tolerance</b> |
|-------------------------|---------------------|------------------|
| GSM850                  | 32.5 dBm            | -1 / +0.5 dB     |
| GPRS850_1Slot           | 32.5 dBm            | -1 / +0.5 dB     |
| GPRS850_2Slot           | 32.5 dBm            | -1 / +0.5 dB     |
| GPRS850_3Slot           | 32.5 dBm            | -1 / +0.5 dB     |
| GPRS850_4Slot           | 32.5 dBm            | -1 / +0.5 dB     |
| EGPRS850_1Slot          | 27.5 dBm            | -1 / +0.5 dB     |
| EGPRS850_2Slot          | 27.5 dBm            | -1 / +0.5 dB     |
| EGPRS850_3Slot          | 27.5 dBm            | -1 / +0.5 dB     |
| EGPRS850_4Slot          | 27.5 dBm            | -1 / +0.5 dB     |
| GSM1900                 | 29.5 dBm            | -1 / +0.5 dB     |
| GPRS1900_1Slot          | 29.5 dBm            | -1 / +0.5 dB     |
| GPRS1900_2Slot          | 29.5 dBm            | -1 / +0.5 dB     |
| GPRS1900_3Slot          | 29.5 dBm            | -1 / +0.5 dB     |
| GPRS1900_4Slot          | 29.5 dBm            | -1 / +0.5 dB     |
| EGPRS1900_1Slot         | 25.5 dBm            | -1 / +0.5 dB     |
| EGPRS1900_2Slot         | 25.5 dBm            | -1 / +0.5 dB     |
| EGPRS1900_3Slot         | 25.5 dBm            | -1 / +0.5 dB     |
| EGPRS1900_4Slot         | 25.5 dBm            | -1 / +0.5 dB     |
| WCDMA Band II           | 23.0 dBm            | ± 0.5 dB         |
| WCDMA Band IV           | 23.0 dBm            | ± 0.5 dB         |
| WCDMA Band V            | 23.0 dBm            | ± 0.5 dB         |
| Bluetooth               | 6.0 dBm             | ± 1.5 dB         |
| IEEE 802.11b Mode       | 16.0 dBm            | ± 1.5 dB         |
| IEEE 802.11g Mode       | 13.5 dBm            | ± 1.5 dB         |
| IEEE 802.11n HT 20 Mode | 13.5 dBm            | ± 1.5 dB         |



|                                                                                                                                | System             | Max Tune up Power    | Time Average Power   |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------|----------------------|
| <b>Max tune up Power / Max time Average Power</b>                                                                              | GSM850             | 33.0dBm (1995.262mW) | 24.0dBm (251.189mW)  |
|                                                                                                                                | GPRS850_1Slot      | 33.0dBm (1995.262mW) | 24.0dBm (251.189mW)  |
|                                                                                                                                | GPRS850_2Slot      | 33.0dBm (1995.262mW) | 27.0dBm (501.187mW)  |
|                                                                                                                                | GPRS850_3Slot      | 33.0dBm (1995.262mW) | 28.7dBm (741.310mW)  |
|                                                                                                                                | GPRS850_4Slot      | 33.0dBm (1995.262mW) | 30.0dBm (1000.000mW) |
|                                                                                                                                | EGPRS850_1Slot     | 28.0dBm (630.957mW)  | 19.0dBm (79.433mW)   |
|                                                                                                                                | EGPRS850_2Slot     | 28.0dBm (630.957mW)  | 22.0dBm (158.489mW)  |
|                                                                                                                                | EGPRS850_3Slot     | 28.0dBm (630.957mW)  | 23.7dBm (234.423mW)  |
|                                                                                                                                | EGPRS850_4Slot     | 28.0dBm (630.957mW)  | 25.0dBm (316.228mW)  |
|                                                                                                                                | GSM1900            | 30.0dBm (1000.000mW) | 21.0dBm (125.893mW)  |
|                                                                                                                                | GPRS1900_1Slot     | 30.0dBm (1000.000mW) | 21.0dBm (125.893mW)  |
|                                                                                                                                | GPRS1900_2Slot     | 30.0dBm (1000.000mW) | 24.0dBm (251.189mW)  |
|                                                                                                                                | GPRS1900_3Slot     | 30.0dBm (1000.000mW) | 25.7dBm (371.535mW)  |
|                                                                                                                                | GPRS1900_4Slot     | 30.0dBm (1000.000mW) | 27.0dBm (501.187mW)  |
|                                                                                                                                | EGPRS1900_1Slot    | 26.0dBm (398.107mW)  | 17.0dBm (50.119mW)   |
|                                                                                                                                | EGPRS1900_2Slot    | 26.0dBm (398.107mW)  | 20.0dBm (100.000mW)  |
|                                                                                                                                | EGPRS1900_3Slot    | 26.0dBm (398.107mW)  | 21.7dBm (147.911mW)  |
|                                                                                                                                | EGPRS1900_4Slot    | 26.0dBm (398.107mW)  | 23.0dBm (199.526mW)  |
|                                                                                                                                | WCDMA Band II      | 23.5dBm (223.872mW)  | 23.5dBm (223.872mW)  |
|                                                                                                                                | WCDMA Band IV      | 23.5dBm (223.872mW)  | 23.5dBm (223.872mW)  |
|                                                                                                                                | WCDMA Band V       | 23.5dBm (223.872mW)  | 23.5dBm (223.872mW)  |
| <b>Evaluation applied</b>                                                                                                      | Bluetooth          | 7.5dBm (5.623mW)     | 7.5dBm (5.623mW)     |
|                                                                                                                                | IEEE 802.11b       | 17.5dBm (56.234mW)   | 17.5dBm (56.234mW)   |
|                                                                                                                                | IEEE 802.11g       | 15.0dBm (31.623mW)   | 15.0dBm (31.623mW)   |
|                                                                                                                                | IEEE 802.11n HT 20 | 15.0dBm (31.623mW)   | 15.0dBm (31.623mW)   |
| <input checked="" type="checkbox"/> MPE Evaluation*<br><input type="checkbox"/> SAR Evaluation<br><input type="checkbox"/> N/A |                    |                      |                      |



## Revision History

| Rev. | Issue Date | Revisions                                                                                        | Effect Page    | Revised By |
|------|------------|--------------------------------------------------------------------------------------------------|----------------|------------|
| 00   | 2014/05/23 | Initial Issue                                                                                    | ALL            | Scott Hsu  |
| 01   | 2014/07/16 | Add other slot for GPRS and EGPRS, Bluetooth.                                                    | 2,3,4,7,8,9,10 | Scott Hsu  |
| 02   | 2014/08/29 | Revise Power Target/Tolerance, Max tune up Power, WCDMA Band V Limit. Remove 802.11n HT40 power. | 2,3,4,8        | Scott Hsu  |



## **TEST RESULTS**

**No non-compliance noted.**

### **Calculation**

Given  $E = \frac{\sqrt{30 \times P \times G}}{d}$  &  $S = \frac{E^2}{377}$

Where  $E$  = Field strength in Volts / meter

$P$  = Power in Watts

$G$  = Numeric antenna gain

$d$  = Distance in meters

$S$  = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P / 1000) \times G}{377 \times (d / 100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{Equation 1}$$

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>

**Maximum Permissible Exposure**

Substituting the MPE safe distance using  $d = 20$  cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where  $P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>

**GSM850 mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 190 | 836.6     | 251.189 | 1.26        | 20     | 0.0630                                | 0.558                       |

**GPRS850\_1Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 190 | 836.6     | 251.189 | 1.26        | 20     | 0.0630                                | 0.558                       |

**GPRS850\_2Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 190 | 836.6     | 501.187 | 1.26        | 20     | 0.1257                                | 0.558                       |

**GPRS850\_3Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 190 | 836.6     | 741.310 | 1.26        | 20     | 0.1859                                | 0.558                       |

**GPRS850\_4Slot mode:**

| Ch. | Frq.(MHz) | P (mW)   | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|----------|-------------|--------|---------------------------------------|-----------------------------|
| 190 | 836.6     | 1000.000 | 1.26        | 20     | 0.2507                                | 0.558                       |

**EGPRS850\_1Slot mode:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|--------|-------------|--------|---------------------------------------|-----------------------------|
| 251 | 848.8     | 79.433 | 1.26        | 20     | 0.0199                                | 0.566                       |

**EGPRS850\_2Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 251 | 848.8     | 158.489 | 1.26        | 20     | 0.0397                                | 0.566                       |

**EGPRS850\_3Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 251 | 848.8     | 234.423 | 1.26        | 20     | 0.0588                                | 0.566                       |

**EGPRS850\_4Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 251 | 848.8     | 316.228 | 1.26        | 20     | 0.0793                                | 0.566                       |

**GSM1900 mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 125.893 | 1.78        | 20     | 0.0446                                | 1.000                       |

**GPRS1900\_1Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 125.893 | 1.78        | 20     | 0.0446                                | 1.000                       |

**GPRS1900\_2Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 251.189 | 1.78        | 20     | 0.0890                                | 1.000                       |

**GPRS1900\_3Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 371.535 | 1.78        | 20     | 0.1316                                | 1.000                       |

**GPRS1900\_4Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 501.187 | 1.78        | 20     | 0.1775                                | 1.000                       |

**EGPRS1900\_1Slot mode:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|--------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 50.119 | 1.78        | 20     | 0.0178                                | 1.000                       |

**EGPRS1900\_2Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 100.000 | 1.78        | 20     | 0.0354                                | 1.000                       |

**EGPRS1900\_3Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 147.911 | 1.78        | 20     | 0.0524                                | 1.000                       |

**EGPRS1900\_4Slot mode:**

| Ch. | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|-----|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 810 | 1909.8    | 199.526 | 1.78        | 20     | 0.0707                                | 1.000                       |

**WCDMA Band II mode:**

| Ch.  | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|------|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 9262 | 1852.4    | 223.872 | 1.78        | 20     | 0.0793                                | 1.000                       |

**WCDMA Band IV mode:**

| Ch.  | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|------|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 1427 | 1735.4    | 223.872 | 1.58        | 20     | 0.0704                                | 1.000                       |

**WCDMA Band V mode:**

| Ch.  | Frq.(MHz) | P (mW)  | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm <sup>2</sup> ) |
|------|-----------|---------|-------------|--------|---------------------------------------|-----------------------------|
| 4132 | 826.4     | 223.872 | 1.26        | 20     | 0.0561                                | 0.551                       |

**Bluetooth:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|--------|-------------|--------|---------------------------------------|----------------|
| 39  | 2441      | 5.263  | 0.5         | 20     | 0.0005                                | 1              |

**IEEE 802.11b mode:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|--------|-------------|--------|---------------------------------------|----------------|
| 11  | 2462      | 56.234 | 0.5         | 20     | 0.0056                                | 1              |

**IEEE 802.11g mode:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|--------|-------------|--------|---------------------------------------|----------------|
| 6   | 2437      | 31.623 | 0.5         | 20     | 0.0031                                | 1              |

**IEEE 802.11n HT20 mode:**

| Ch. | Frq.(MHz) | P (mW) | Gain (num.) | D (cm) | Power density in mW / cm <sup>2</sup> | Limit (mW/cm2) |
|-----|-----------|--------|-------------|--------|---------------------------------------|----------------|
| 6   | 2437      | 31.623 | 0.5         | 20     | 0.0031                                | 1              |



**Simultaneously MPE**

Simultaneously MPE = MPE1/Limit1 + MPE2/Limit2

**2G + WiFi**

$$\text{Simultaneously MPE} = (0.2507 \text{ mW/cm}^2 / 0.558) (0.0056 \text{ mW/cm}^2 / 1) = 0.2563$$

**3G + WiFi**

$$\text{Simultaneously MPE} = (0.0890 \text{ mW/cm}^2 / 1) + (0.0056 \text{ mW/cm}^2 / 1) = 0.0946$$