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# Electromagnetic Compatibility
# MPE Calculation

For the

**Autonet Mobile**
**Kanaan3**

Tested under

**Title 47 of the Code of Federal Regulations (CFR),**
**Part 15 Subpart C**

**MET Report: EMCS42581-MPE**

**November 11, 2014**

Prepared For:

**Autonet Mobile**
**1700 Montgomery St., Suite 11**
**San Francisco, CA 94111**

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Ajaz Khan, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Title 47 of the CFR, Part 15, Subpart C under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

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## Electromagnetic Compatibility Criteria for Intentional Radiators

### § 15.247(b) Peak Power Output and RF Exposure

**Test Purpose:** Co-location of two radios; WiFi/BT radio and Telit, FCC ID: R17DE910-DUAL.

**RF Exposure Requirements:** **§1.1307(b)(1) and §1.1307(b)(2):** 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.

**RF Radiation Exposure Limit:** **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

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## MPE Calculation – WiFi/BT: 2.4GHz,

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

$S = PG / 4\pi R^2$ or $R = \sqrt{PG / 4\pi S}$

MPE Limit Calculation: EUT's operating frequency band is **2400 – 2483.5MHz**; highest conducted power = 15.69dBm (peak) at 2437MHz therefore, Limit for Uncontrolled exposure: 1 $mW/cm^2$ or 10 $W/m^2$

EUT maximum antenna gain = **1.88 dBi.**

where, S = Power Density ($mW/cm^2$)
P = Power Input to antenna (37.068mW)
G = Antenna Gain (1.542 numeric)

$S = (37.068*1.542/ 4*3.14*20.0^2) = (57.159 / 5024) =$ **0.011mW/cm²** @ 20cm separation

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## MPE Calculation - Telit Module: 779.5 – 784.5 MHz & 1712.5 – 1752.5 MHz (FCC ID: RI7LE910SV)

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

$S = PG / 4\pi R^2$ or $R = \sqrt{PG / 4\pi S}$

MPE Limit Calculation: EUT's operating frequencies @ **779.5 – 784.5 MHz**; highest conducted power = 207.5 mW. Therefore, Limit for Uncontrolled exposure: 0.56 $mW/cm^2$ or 5.6 $W/m^2$

EUT maximum antenna gain = **1.4 dBi.**

where, S = Power Density ($mW/cm^2$)
P = Power Input to antenna (207.5 mW)
G = Antenna Gain (1.38 numeric)

$S = (207.5*1.38/ 4*3.14*20.0^2) = (286.35 / 5026) =$ **0. 057mW/cm$^2$** @ 20cm separation

MPE Limit Calculation: EUT's operating frequencies @ **1712.5 – 1752.5 MHz**; highest conducted power = 229 mW. Therefore, Limit for Uncontrolled exposure: 1 $mW/cm^2$ or 10 $W/m^2$

EUT maximum antenna gain = **1.1 dBi.**

where, S = Power Density ($mW/cm^2$)
P = Power Input to antenna (229 mW)
G = Antenna Gain (1.29 numeric)

$S = (229*1.29/ 4*3.14*20.0^2) = (295.41 / 5026) =$ **0.059 mW/cm$^2$** @ 20cm separation

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## MPE Calculation – Co-Location

**MPE Summary:**

| Frequency Range | MPE Result (mW/cm$^2$) | Limit (mW/cm$^2$) |
|---|---|---|
| 2.4GHz | 0.011 | 1 |
| 779.5 – 784.5MHz | 0.057 | 0.56 |
| 1712.5 – 1752.5MHz | 0.059 | 1 |

**Test Requirements:** [MPE(f1) / limit(f1) + MPE(f2) / limit(f2)] < 1

**Test Results:**

| MPE(f1) Frequency (MHz) | MPE(f2) Frequency (MHz) | Calculation [MPE(f1) / limit(f1) + MPE(f2) / limit(f2)] | MPE Result (mW/cm$^2$) |
|---|---|---|---|
| 2400 | 779.5 – 784.5 | 0.011 / 1 + 0.057 / 0.56 = (0.011+ 0.102) | **0.113** |
| 2400 | 1712.5 – 1752.5 | 0.011 / 1 + 0.059 / 1 | **0.07** |

Therefore, the combined total power density is less than 1 mW/cm$^2$ at 20cm.


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