1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

1.0 Maximum Permissible Exposure Evaluation (Supplements the test report.)

The results of power measurement and intended use/proximity are compared against the requirements for safety of RF exposure.

1.2 Criteria

Section Reference	Date
KDB 447498 D01 Mobile Portable RF Exposure v06 // RSS-102 Issue 5	15 Nov 2017

1.3 Procedure

Using measurement of peak power and considering the intended application, determine the permissible exposure level, applicability of exclusion, or whether additional exposure tests (SAR) are indicated. When applicable justify conclusion for selected exposure level and separation distance.

This device is configured according to the final application requirement. This ranges from being included in a portable "belly box", on locomotives/cranes, or fixed installations.

Maximum exposure (uncontrolled) = f/1500 = 410 MHz / 1500 = 0.273 mW/cm^2

1.4 FCC Safe Distance Calculation, Small Whip Antenna

$$S = \frac{Pwr_{avg} * Gain_{Antenna}}{4 * \pi * Distance_{Antenna}{}^2}$$

Table 1.4.1 Power Calculation for Exposure, Localized Small Whip Antenna

Conducted Peak Power mW	Calculated EIRP Peak Power dBm	Source Duty Cycle Factor dB	Maximum Antenna Gain dBi	Calculated EIRP dBm	EIRP In Linear Terms mW
107.2	20.3	0	0	20.3	107.2

$Distance_{antenna} = \sqrt{(P \cdot G/4 \cdot \pi \cdot S)}$ given Pwr_{avg} = 107.2 mW, Gain = 1*, S = 0.273 mW/cm^2.
**Gain included in term P.*

$Distance_{safe} = \sqrt{(107.2 / 4 \cdot \pi \cdot 0.273)} = 6$ cm

Exposure limit is satisfied for distance of 6 cm.

1.5 FCC Safe Distance Calculation, External Mobile Gain Antenna

$$S = \frac{Pwr_{avg} * Gain_{Antenna}}{4 * \pi * Distance_{Antenna}{}^2}$$

Table 1.5.1 Power Calculation for Exposure, External Mobile Antenna					
Conducted Peak Power mW	**Calculated EIRP Peak Power dBm**	**Source Duty Cycle Factor dB**	**Maximum Antenna Gain dBi**	**Calculated EIRP dBm**	**EIRP In Linear Terms mW**
107.2	20.3	0	7.1	27.4	550

$Distance_{antenna} = \sqrt{(P \cdot G/4 \cdot \pi \cdot S)}$ given Pwr_{avg} = 550 mW, Gain = 1*, S = 0.273 mW/cm^2.
**Gain included in term P.*

$Distance_{safe} = \sqrt{(550 / 4 \cdot \pi \cdot 0.273)} = 13$ cm

Exposure limit is satisfied for distance of 13 cm.

1.6 IC, SAR Exemption

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10^{21}	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculated field strength limit for lowest/highest operating frequency from table above and row for 300-6000 MHz:

Limit = 0.02619 $f^{0.6834}$ = 0.02619(420) $^{0.6834}$ = 1.625 W/m^2 = 1625 mW/m^2 = 0.1625 mW/cm^2
Limit = 0.02619 $f^{0.6834}$ = 0.02619(475) $^{0.6834}$ = 1.768 W/m^2 = 1768 mW/m^2 = 0.1768 mW/cm^2

Find field density at 20 cm for General Population (uncontrolled) exposure:

$S = (P \cdot G) / (4 \cdot \pi \cdot [\text{Distance}]^2)$ = given Pwr_{avg} = 550 mW, Gain = 1*, Distance = 20 cm.
**Antenna gain included in power.*

$S = (550) / (4 \cdot \pi \cdot [20\ \text{cm}]^2) = 0.11\ \text{mW/cm}^2$

$0.11\ \text{mW/cm}^2 \leq 0.1625\ \text{mW/cm}^2$

This device meets the MPE criteria in RSS-102 Table 4.

Signed:

Eric Lifsey

***