



Exhibit: RF Exposure – FCC

FCC ID: JQU800890

Report File #: 7169014028RFE-FCC-000

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	FCC Part 15 Subpart 15.249 FCC 1.1307(b)(3), FCC KDB 447498-D04	

RF Exposure Calculation (FCC)

Purpose

The purpose of this test is to ensure that the RF energy transmitted at a specified operating distance from the human body meets the criteria to be exempt from routine evaluation. The RF Exposure values are calculated based upon measurements obtained during testing and are compared to the applicable exposure limits for individual RF sources. If multiple RF sources are used within a host product, and they operate simultaneously, an additional exemption criterion based on total exposure from multiple RF sources is also applied. If the exemption criteria are not met, the RF sources may be required to undergo routine evaluation for RF Exposure.

Limit(s) and Method

The test method and exemption limits are defined in FCC KDB 447498 and FCC 1.1307(b)(3) and are applicable to both unintentional and intentional RF sources, whether portable, mobile, or fixed installations.

Individual RF Sources

For individual sources, the following three exemption criteria options are defined. Any of the three options may be used to determine the RF source to be exempt from routine evaluation if it meets the corresponding exemption limit.

Defined in FCC 1.1307(b)(3)(i)(A), Exemption Criteria Option A is based on the maximum time-averaged output power. The requirement is that this measurement must not exceed 1mW, regardless of separation distance, and in the frequency range of 100kHz-100GHz.

Defined in FCC 1.1307(b)(3)(i)(B), Exemption Criteria Option B is based on SAR using the measurement of maximum time-averaged output power or ERP, whichever is greater. This option is applicable to separation distances of 0.5cm-40cm and in the frequency range of 300MHz-6GHz. The limit is defined below:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

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Defined in FCC 1.1307(b)(3)(i)(C), Exemption Criteria Option C is based on MPE using the ERP measurement. This option is only applicable for separation distances greater than or equal to the wavelength of the frequency under consideration divided by 2π , and in the frequency range of 300kHz-100GHz. The limit is defined below:

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	$1,920 R^2$
1.34	–	30	35.6 m	–	1.6 m	$3,450 R^2/f^2$
30	–	300	1.6 m	–	159 mm	$3.83 R^2$
300	–	1,500	159 mm	–	31.8 mm	$0.0128 R^2f$
1,500	–	100,000	31.8 mm	–	0.5 mm	$19.2 R^2$
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

Multiple RF Sources

For multiple sources, the following two exemption criteria options are defined. Exemption criteria for multiple RF sources is applicable if the EUT contains any RF sources that may operate simultaneously.

Defined in FCC 1.1307(b)(3)(ii)(A), the results of only the exemption criteria option A calculation for for each individual RF source shall be used to determine exemption for multiple RF sources. The criteria for exemption are defined below:

1. If the separation distance between each individual RF source is at least 2 centimeters, and each individual source meets exemption criteria option A for single RF sources.
2. If the sum of maximum output power of multiple RF sources is less than 1mW, the sources can be treated as a single source and are exempt based on exemption criteria option A for single RF sources.

Defined in FCC 1.1307(b)(3)(ii)(B), the exemption ratios calculated for each individual RF source shall be used to calculate the Total Exposure Ratio. This calculation includes exemption criteria calculated using Exemption Criteria Options B or C, or the measurement results of any RF source that may have been subject to routine evaluation. The limit is defined below:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

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Results

The EUT contains one single RF Source. Multiple Source Exemption Criteria is not applicable.

The EUT is exempt from routine evaluation of RF exposure based on the following calculations:

Single RF Source 1 Analysis – 915.75MHz Single Fixed Transmitter

The 915MHz Transmitter has a measured maximum peak radiated output power at 3-meters of 94.9 dBuV/m. The worst-case separation distance between the antenna and the enclosure is 109mm and therefore 10cm has been considered as a worst-case scenario for this evaluation. No temporal or spatial averaging has been considered in this analysis, as a worst-case scenario.

Frequency (MHz): 915.75

Separation Distance (cm): 10

Maximum Peak Radiated Output Power at 3-Meters (dBuV/m): 94.9

Maximum ERP (dBm): -2.5

Maximum ERP (mW): 0.562

Maximum ERP (W): 0.000562

Exemption Criteria Option C is Applicable:

$\lambda/2\pi = 0.052\text{m}$

$R = 0.10\text{m}$

$0.10\text{m} > 0.052\text{m}$

ERP Threshold = 0.117 W

Therefore, the EUT is exempt from RF Exposure Analysis based on MPE-based Exemption Criteria Option C, with a contribution ratio of 0.005.