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## REPORT

# RF Exposure Report for RFID Reader XT Mega

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## Summary

ORG. FUNCTION

## Revision History

Revision	Date	Issued by	Comment
02	2018-08-24	Robert Litzén	First release

*This document follows the TagMaster documentation version numbering standard to identify the document version. This standard use the form P01A, P01B to P01n for draft versions (not for customer issue) then 01 for a released version (reviewed; can be given to the customer). Subsequent issues use 02, 03, 04 etc and are changed via the formal change control process*

DOCUMENT CLASS

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## 1. Introduction

The RFID Reader XT Mega is evaluated according to FCC guidelines for human exposure to radio frequency electromagnetic fields. The evaluation results are used as part of the FCC-application.

The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached. Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

### 1.1. References

- [1] Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, (<http://transition.fcc.gov>)
- [2] **XX-XXX** XT Mega Installation Manual EN

### 1.2. Definitions and abbreviations

Abbreviation	Description
DUT	Device Under Test
EIRP	Effective Isotropic Radiated Power
FCC	Federal Communications Commission
MPE	Maximum Permissible Exposure
RFID	Radio-frequency identification

Table 1. List of abbreviations

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## 2. System description

### 2.1. Assessed object

Name of test object (DUT)	XT Mega
Model / Type	XT-5 us and XT-5 ETC
Part No.	152900 and 153800
Serial No.	-
FCC ID	M39XTMEX
Manufacturer	TagMaster AB
Supply Voltage	12V - 24V
Software version	-
Comments	-



Figure 1: Picture of XT ETC and XT-5.

### 2.2. Characteristics and parameters of the assessed object

**RFID Reader XT MEGA:**

- Antenna : Integral antenna
- Operating frequency : 902.75MHz – 927.25MHz
- Transmit power : 1000mW
- Max Duty Cycle : 100% during normal use
- Power Supply : 12V – 24V

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## 3. RF Exposure evaluation

### 3.1. RF exposure limits

According to FCC 1.1310: The criteria listed in the table 2 below shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A)Limits For Occupational / Control Exposures</b>				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
<b>(B)Limits For General Population / Uncontrolled Exposure</b>				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

Table 2. Limits for maximum permissible exposure (MPE), F = Frequency in MHz.

### 3.2. Exposure classification for XT Mega

The FCC rules define two types of permissible exposure differentiated by the situation in which the exposure takes place and/or the status of the individuals who are subject to exposure.

#### **General Population/uncontrolled exposure**

The limits apply to those situations in which persons may not be aware of the presence of electromagnetic energy, where exposure is not employment-related, or where persons cannot exercise control over their exposure.

#### **Occupational/controlled exposure**

The limits apply to situations in which persons are exposed as a consequence of their employment, have been made fully aware of the potential for exposure, and can exercise control over their exposure.

The classification of XT Mega is Occupational/controlled exposure.

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### 3.3. Friis formula

The Friis transmission formula:

$$P_d = \frac{P_{out}G}{4\pi R^2}$$

where;

Pd = power density in W/m<sup>2</sup>

Pout = output power to antenna in W

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and centre of the radiator in cm

If we know the maximum Gain of the antenna and the total power input to the antenna the MPE value at distance R can be calculated.

*Ref. : David K. Cheng, Field and Wave Electromagnetics, Second Edition, Page 640, Eq. (11-133).*

### 3.4. EUT operating condition

The antenna of the product, under normal use condition, is at least 30 cm away from the body of the user. Warning statement to the user for keeping at least 30 cm or more separation distance with the antenna is included in the XT Mega installation manual, see ref [1].

### 3.5. Calculations

#### RF Exposure Limit and the calculated value at distance 30cm:

Limit for MPE (from FCC part 1.1310 table 2) for frequency f = 902.75MHz is:

$$\text{Limit MPE} = f(\text{MHz}) / 1500 = 902.75 / 1500 = 0.602 \text{ mW/cm}^2$$

Highest allowed Pout is 1000mW which together with the antenna gain of 5.5dBi gives an Effective Isotropic Radiated Power of 3300mW.

$$P_d = \frac{P_{out}G}{4\pi R^2} = \frac{3300mW}{3600\pi} = 0.292mW/cm^2$$

Pd = **0.292 mW/cm<sup>2</sup>**, which is at least 0.31 mW/cm<sup>2</sup> below to the limit.

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## 4. Conclusions

The XT Mega is found to be compliant to the Maximum Permissible Exposure limits specified in the standard FCC 1.1310.