

MPE test report

According to the standard:
CFR 47 FCC PART 15

Equipment under test:
Industrial Smart Hub


FCC ID: 2APE2-CONNECT

Company:
ETS GEORGES RENAULT

Distribution: Mr GARIN

(Company: ETS GEORGES RENAULT)

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DESIGNATION OF PRODUCT: Industrial Smart Hub

Serial number (S/N): 08 01 18 00006

Internal code: 6159327230

Reference / model (P/N): CONNECT

Software version: System software: 2.0.0.4
CPU board: 2.0.0.4
CPU bootloader: 2016.01
OS version: 4.1.15-CP

Cards version: 8825-IND07
8868-IND0
8869-IND06
8870-IND
8949-IND01

MANUFACTURER: ETS GEORGES RENAULT

COMPANY SUBMITTING THE PRODUCT:

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Responsible: Mr GARIN

DATES OF TEST: From 9-Mar-18 to 16-Mar-18

TESTING LOCATION: EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

TESTED BY: T. LEDRESSEUR

VISA:



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1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **Industrial Smart Hub - CONNECT**, in accordance with normative reference.

The device under test integrates:

- RFID function not already certified.
- WLAN module already certified with FCCID: 2AG87DLM168N.

2. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.

They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 (2018)	Radio Frequency Devices
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ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.
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447498 D01 General RF Exposure Guidance v06	RF Exposure procedures and equipment authorization policies for mobile and portable equipment
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3. RF EXPOSURE

Calculus for RFID in standalone

Maximum measured power = 44.17 dB μ V/m at 10 m = 5.39×10^{-7} mW at 13.56 MHz
with $P = (E \times d)^2 / (30 \times G_p)$ with $d = 10$ m and $G_p = 1$

In accordance with KDB 447498 D01 General RF Exposure Guidance v06:

$$PSD = EIRP / (4 \times \pi \times R^2)$$

$$\Rightarrow 5.09 \times 10^{-7} / (4 \times \pi \times (20 \text{ cm})^2) = 1.07 \times 10^{-10} \text{ mW/cm}^2 \text{ (limit = } 0.98 \text{ mW/cm}^2 \text{,)}$$

The MPE ratio is then calculated for the simultaneous transmission.

$$MPE \text{ ratio(RFID)} = \frac{PSD}{PSD \text{ lim}} = \frac{1.07 \times 10^{-10}}{0.98} = 1.09366 \times 10^{-10}$$

The equipment fulfils the requirements on power density for general population/uncontrolled exposure and therefore fulfils the requirements of 47 CFR §1.1310.

Calculus for RFID and WLAN 2.4GHz for simultaneous transmission

See appendix 1 for the MPE report of the WLAN module

The Simultaneous transmission MPE test exclusion is determined with the sum of each MPE ratio

$$\text{MPE ratio}(2.4\text{GHz}) = \frac{\text{PSD}}{\text{PSD lim}} = \frac{0.175}{1} = 0.175$$

$$\sum \text{ of MPE ratio} = \text{MPE ratio}(2.4\text{GHz}) + \text{MPE ratio}(\text{RFID}) = 0.175 + 1.09366 \times 10^{-10} \leq 1.0$$

This configuration meet the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498

Calculus for RFID and WLAN 5GHz for simultaneous transmission

See appendix 1 for the MPE report of the WLAN module

The Simultaneous transmission MPE test exclusion is determined with the sum of each MPE ratio

$$\text{MPE ratio}(5\text{GHz}) = \frac{\text{PSD}}{\text{PSD lim}} = \frac{0.171}{1} = 0.171$$

$$\sum \text{ of MPE ratio} = \text{MPE ratio}(5\text{GHz}) + \text{MPE ratio}(\text{RFID}) = 0.171 + 1.09366 \times 10^{-10} \leq 1.0$$

This configuration meet the requirement for Simultaneous transmission MPE test exclusion from §7.2 of KDB 447498

APPENDIX 1: MPE REPORT for WLAN module

Maximum Permissible Exposure

Applicable Standard According to §1.1307(b)(5), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

For 2.4G WIFI

- 1) The maximum output power for antenna 0 is 21.34 dBm (136.14mW) at 2437MHz, (with 2 numeric antenna gain.)
- 2) The maximum output power for antenna 1 is 21.90 dBm (154.88mW) at 2437MHz, (with 2 numeric antenna gain.)
- 3) The maximum output power for antenna 2 is 21.71 dBm (148.25mW) at 2437MHz, (with 2 numeric antenna gain.)
- 4) For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20cm, even if the calculation indicate that the MPE distance would be lesser.

Calculation

$$\text{Given } E = \sqrt{\frac{30 \times P \times G}{d}} \quad \& \quad S = \frac{E^2}{3770}$$

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

Maximum Permissible Exposure

Antenna 0 output power=136.14mW.

Antenna 1 output power=154.88mW.

Antenna 2 output power=148.25mW

Numeric Antenna gain=2 Substituting the MPE safe distance using d=20cm into above equation.

Yields:

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

Where P = Power in mW G = Numeric antenna gain
 S = Power density in mW/cm²

$$\text{Total Power density} = 0.054 + 0.062 + 0.059 = 0.175 \text{ mW/cm}^2$$

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)

For 5G WIFI

- 1) The maximum output power for antenna 0 is 21.62 dBm (145.21mW) at 5755MHz, (with 2 numeric antenna gain.)
- 2) The maximum output power for antenna 1 is 21.47 dBm (140.28 mW) at 5785MHz, (with 2 numeric antenna gain.)
- 3) The maximum output power for antenna 2 is 21.53 dBm (142.23 mW) at 5785MHz, (with 2 numeric antenna gain.)

Maximum Permissible Exposure

Antenna 1 output power=145.21mW.

Antenna 2 output power=140.28 mW.

Antenna 3 output power=142.23 mW

Numeric Antenna gain=2 Substituting the MPE safe distance using d=20cm into above equation.

Yields:

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

Where P = Power in mW G = Numeric antenna gain
 S = Power density in mW/cm²

$$\text{Total Power density} = 0.058 + 0.056 + 0.057 = 0.171 \text{ mW/cm}^2$$

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.)