# Radio Frequency Exposure Evaluation Report

**FOR:**
Pratt & Whitney

**Model Number:**
HMU200-1(4G)

**Product Description:**
Collection of aircraft engine and airframe data in flight and wireless transmission of collected data on ground

**FCC ID:** 2AQWD-HMU200-4G
**IC ID:** 25562-HMU2004G

**Per:**

CFR Part Part1 (1.1307 &1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06
ISEDC RSS-102 Issue 5

**Report number:** EMC_PRATT_008_19001_FCC_ISED_MPE

**DATE:** 2021-04-05

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## 1 Assessment

This RF Exposure evaluation report provides evidence for compliance of the below identified device with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1 (1.1307 &1.1310), Part 2 (2.1091) and IC standard RSS-102 issue 5 under worst case conditions (measured or rated RF output power, antenna gain, distance towards human body, multiple transmitter information as presented by the applicant).
In addition, maximum antenna gain or minimum distance towards the human body is calculated respectively, where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications for worst case conditions at 20cm distance to the body.

| Company | Description | Model # |
|---|---|---|
| Pratt & Whitney | Collection of aircraft engine and airframe data in flight and wireless transmission of collected data on ground | HMU200-1(4G) |

**Report reviewed by: TCB Evaluator**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2021-04-05 | Compliance | Kevin Wang (Lab Manager) | kevin.wang@cetecom.com Digitally signed by: kevin.wang@cetecom.com DN: CN = kevin.wang@cetecom.com Date: 2021.04.05 15:33:45 -07'00' |

**Responsible for the Report:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2021-04-05 | Compliance | Yuchan Lu (Test Engineer) | Yuchan Lu Digitally signed by: Yuchan Lu DN: CN = Yuchan Lu email = Yuchan.Lu@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2021.04.05 12:16:59 -07'00' |

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the Test Report

| | |
|---|---|
| **Company Name:** | CETECOM Inc. |
| **Department:** | Compliance |
| **Street Address:** | 411 Dixon Landing Road |
| **City/Zip Code** | Milpitas, CA 95035 |
| **Country** | USA |
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| **Lab Manager:** | Cindy Li |
| **Responsible Project Leader:** | Cathy Palacios |

### 2.2 Identification of the Client / Manufacturer

| | |
|---|---|
| **Client's Name:** | Pratt & Whitney |
| **Street Address:** | 400 Main Street, MS 168-15 |
| **City/Zip Code** | East Hartford, CT 06118 |
| **Country** | USA |

**Identification of the Manufacturer**

| | |
|---|---|
| **Manufacturer's Name:** | Collins Aerospace & Setrix |
| **Manufacturers Address:** | 400 Main Street, MS 168-15 |
| **City/Zip Code** | East Hartford, CT 06118 |
| **Country** | USA |

## 3 Equipment under Assessment

| | |
|---|---|
| **Marketing name:** | eFAST |
| **HW Version :** | 4 |
| **SW Version :** | 1.24 |
| **Firmware Version Identification Number (FVIN):** | N/A |
| **Hardware Version Identification Number (HVIN):** | HMU2004G |
| **Product Marketing Name (PMN):** | eFAST |
| **Regulatory Band:** | ❖ **Cellular Module:**<br>▪ GSM 850: 824.2 ~ 848.8 MHz<br>▪ GSM 1900: 1850.2 ~ 1909.8 MHz<br>▪ WCDMA/UMTS FDD BAND II: 1852.4 ~ 1907.6 MHz<br>▪ WCDMA/UMTS FDD BAND IV: 1712.4 ~ 1752.6 MHz<br>▪ WCDMA/UMTS FDD BAND V: 826.4 ~ 846.6 MHz<br>▪ LTE BAND 2: 1857.5 ~ 1902.5 MHz<br>▪ LTE BAND 4: 1717.5 ~ 1747.5 MHz<br>▪ LTE BAND 5: 824.7 ~ 848.3 MHz<br>▪ LTE BAND 7:2510 ~ 2560 MHz<br>▪ LTE BAND 12: 699.7 ~ 715.3 MHz<br>❖ **WLAN:**<br>▪ Nominal band: 2400 MHz – 2483.5 MHz;<br>▪ Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels |
| **Integrated Module Info:** | ❖ **Cellular Module:**<br>▪ Module name: Gemalto<br>▪ Model number: PLS62-W<br>▪ FCC/IC ID: QIPPLS62-W / 7830A-PLS62W<br>❖ **WLAN:**<br>▪ Module name: Ti-Wi BLE<br>▪ FCC/IC ID: TFB-TIWI1-01 / 5969A-TIWI101 |
| **Antenna Type:** | ❖ **Cellular:**<br>▪ Antenna maximum gain:<br>▪ GSM 850: 1.5 dBi<br>▪ GSM 1900: 3.0 dBi<br>▪ WCDMA II: 3.0 dBi |

| | |
|---|---|
| | ▪ WCDMA IV: 3.0 dBi<br>▪ WCDMA V: 1.5 dBi<br>▪ LTE Band 2: 3.0 dBi<br>▪ LTE Band 4: 3.0 dBi<br>▪ LTE Band 5: 1.5 dBi<br>▪ LTE Band 7: 4.5 dBi<br>▪ LTE Band 12: 1.5 dBi<br>▪ Cable loss:<br>o LTE B12: 0.94 dB<br>o GSM 850 / UMTS V / LTE B5: 1.06 dB<br>o LTE B4 / UMTS IV: 1.62 dB<br>o GSM 1900 / UMTS II / LTE B2: 1.67 dB<br>o LTE B7: 1.90 dB<br>❖ **WLAN:**<br>▪ Antenna gain: 3 dBi<br>▪ Cable loss: 1.27 dB |
| **Maximum Conducted Output Power:** | ❖ **Cellular:** From modular grant [Watts]:<br>▪ GSM 850 EIRP: 2.35<br>▪ GSM1900 EIRP: 1.035<br>▪ WCDMA Band II: 0.170<br>▪ WCDMA Band IV: 0.181<br>▪ WCDMA Band V: 0.169<br>▪ LTE Band 2: 0.164<br>▪ LTE Band 4: 0.171<br>▪ LTE Band 5: 0.203<br>▪ LTE Band 7: 0.134<br>▪ LTE Band 12: 0.167<br>❖ **WLAN:** From modular grant [Watts]: 0.093 |
| **Power Supply/ Rated Operating Voltage Range:** | Low 23.8VDC, Nominal 28VDC, High 32.2VDC |
| **Operating Temperature Range:** | Low -30º C, Nominal 25º C, High 70º C |
| **Sample Revision:** | ☐Prototype Unit; ■Production Unit; ☐Pre-Production |

## 4 RF Exposure Limits and FCC and IC Basic Rules

**For the specific described radio apparatus** the following basic limits and rules apply for both, FCC and IC where not indicated differently.

### 4.1 Power Density Limits acc. to FCC 1.1310(e) / RSS-102 i5, cl. 4:

FCC

| Frequency Range (MHz) | Power density (mW/cm²) | Averaging time (minutes) |
|---|---|---|
| 300 – 1500 | f (MHz) /1500 | 30 |
| 1500 – 100000 | 1.0 | 30 |

IC

| | | |
|---|---|---|
| 300 – 6000 | 0.02619 x f (MHz) $^{0.6834}$ | 6 |

### 4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.109(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

FCC
operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (EIRP: 33.9 dBm);
operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (EIRP: 36.9 dBm);

IC
300MHz < = operating frequency < 6 GHz: excluded if EIRP < 0.0131 x f (MHz) $^{0.6834}$ W

### 4.3 RF Exposure Estimation (MPE Estimation)

Having available the source based average output power and peak antenna gain or the ERP/EIRP of the specified device and for a known minimum distance of its radiating structures from the body of persons according to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (mW/cm² or W/m²)
P = power input to the antenna (mW or W)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (cm or m)

## 5 Evaluations

### 5.1 Analysis of RF Exposure for simultaneous transmission

- Evaluations are based on worst case power density limits for Canada.
- Calculations are made for 20cm.
- Evaluations are based on ERP/EIRP measured or calculated from known gain and conducted output power.
- Cellular can transmit simultaneously with WLAN.

| Radio | freq [MHz] | Max Conducted power [W] | Conducted Power + Tune up | Antenna Gain + Cable Loss [dBi] | Gain [lin] | EIRP [W] | IC Limit [W/m2] | FCC LImit [W/m2] | Actual [W/m2][2] | How much of limit is used up |
|---|---|---|---|---|---|---|---|---|---|---|
| **GSM 850** | 824 | 2.35 | 3.162 | 0.44 | 1.11 | 0.437[1] | 2.576 | 5.493 | 0.870 | 33.78% |
| **GSM 1900** | 1850 | 1.035 | 1.585 | 1.33 | 1.36 | 0.269[1] | 4.476 | 10.000 | 0.535 | 11.96% |
| **WCDMA II** | 1850 | 0.17 | 0.316 | 1.33 | 1.36 | 0.429 | 4.476 | 10.000 | 0.854 | 19.08% |
| **WCDMA IV** | 1710 | 0.181 | 0.316 | 1.38 | 1.37 | 0.434 | 4.242 | 10.000 | 0.864 | 20.36% |
| **WCDMA V** | 824 | 0.169 | 0.316 | 0.44 | 1.11 | 0.350 | 2.576 | 5.493 | 0.696 | 27.01% |
| **LTE 2** | 1850 | 0.164 | 0.316 | 1.33 | 1.36 | 0.429 | 4.476 | 10.000 | 0.854 | 19.08% |
| **LTE 4** | 1710 | 0.171 | 0.316 | 1.38 | 1.37 | 0.434 | 4.242 | 10.000 | 0.864 | 20.36% |
| **LTE 5** | 824 | 0.203 | 0.316 | 0.44 | 1.11 | 0.350 | 2.576 | 5.493 | 0.696 | 27.01% |
| **LTE 7** | 2500 | 0.134 | 0.316 | 2.6 | 1.82 | 0.575 | 5.499 | 10.000 | 1.144 | 20.80% |
| **LTE 12** | 699 | 0.167 | 0.316 | 0.56 | 1.14 | 0.359 | 2.302 | 4.660 | 0.715 | 31.07% |
| | | | | | | | | | | |
| **WLAN** | 2400 | 0.093 | 0.147 | 1.73 | 1.49 | 0.219 | 5.348 | 10.000 | 0.436 | 8.14% |

**Note1：EIRP of GSM850 and GSM1900 are corrected for worst case DC 12.5%**
**Note2：The calculation is based on the distance of 20cm**

### 5.2 Conclusion:

The worst-case simultaneous transmission is GSM 850 simultaneous with WLAN, which is using 41.92 of a limit of 100%. The equipment is passing RF exposure requirements for 20cm distance.

## 6 Revision History

| Date | Report Name | Changes to report | Report prepared by |
|---|---|---|---|
| 2021-04-05 | EMC_PRATT_008_19001_FCC_ISED_MPE | Initial Release | Yuchan Lu |

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