



# Radio Frequency Exposure Evaluation Report

**FOR:**

Pratt & Whitney, division of RTX

**Model Name:**

HMU200-2

**Product Description:**

Collection of aircraft engine and airframe data in flight and wireless transmission of collected data on ground

**FCC ID:** 2AQWD-HMU200-2

**IC ID:** 25562-HMU2002

**Per:**

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

**Report number:** EMC\_PRATT-009-21001\_FCC\_ISED\_MPE\_Rev1

**DATE:** 2022-03-16



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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 Name |
|----------------------------------|---|------------|
| Pratt & Whitney, division of RTX | Collection of aircraft engine and airframe data in flight and wireless transmission of collected data on ground | HMU200-2   |

**Report reviewed by: TCB Evaluator**

| 2022-03-16 | Compliance | Kevin Wang<br>(Lab Manager) |           |
|------------|------------|-----------------------------|-----------|
| Date       | Section    | Name                        | Signature |

**Responsible for the Report:**

| 2022-03-16 | Compliance | Cheng Song<br>(EMC Engineer) |           |
|------------|------------|------------------------------|-----------|
| Date       | Section    | Name                         | Signature |

## 2 Administrative Data

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

|                                    |                        |
|------------------------------------|------------------------|
| <b>Company Name:</b>               | CETECOM Inc.           |
| <b>Department:</b>                 | Compliance             |
| <b>Street Address:</b>             | 411 Dixon Landing Road |
| <b>City/Zip Code</b>               | Milpitas, CA 95035     |
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| <b>Lab Manager:</b>                | Kevin Wang             |
| <b>Responsible Project Leader:</b> | Cathy Palacios         |

### 2.2 Identification of the Client / Manufacturer

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

### Identification of the Manufacturer

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

### 3 Equipment under Assessment

|                                |  |
|--------------------------------|--|
| <b>Model Name:</b>             | HMU200-2   |
| <b>Marketing Name:</b>         | eFAST  |
| <b>HW Version :</b>            | 5  |
| <b>SW Version :</b>            | 1.28.6   |
| <b>FCC-ID :</b>                | 2AQWD-HMU200-2   |
| <b>IC-ID:</b>                  | 25562-HMU2002  |
| <b>FWIN:</b>                   | N/A  |
| <b>HVIN:</b>                   | HMU200-2   |
| <b>PMN:</b>                    | eFAST  |
| <b>Regulatory Band:</b>        | <p><b>Cellular Module:</b></p> <ul style="list-style-type: none"> <li>• LTE Band 2: 1850 – 1910 MHz</li> <li>• LTE Band 4: 1710 – 1755 MHz</li> <li>• LTE Band 5: 824 – 849 MHz</li> <li>• LTE Band 7: 2500 – 2570 MHz</li> <li>• LTE Band 12: 699 – 716 MHz</li> <li>• LTE Band 13: 777 – 787 MHz</li> <li>• LTE Band 26: 814 – 849 MHz</li> <li>• LTE Band 41: 2496 – 2690 MHz</li> <li>• LTE Band 66: 1710 – 1780 MHz</li> <li>• UMTS Band II: 1850 – 1910 MHz</li> <li>• UMTS Band IV: 1710 – 1732.5 MHz</li> <li>• UMTS Band V: 824 – 849 MHz</li> <li>• GSM850: 824.2 – 848.8 MHz</li> <li>• GSM1900: 1850.2 – 1909.8 MHz</li> </ul> <p><b>WLAN:</b></p> <ul style="list-style-type: none"> <li>• Nominal band: 2400 MHz – 2483.5 MHz;</li> <li>• Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels</li> </ul> |
| <b>Integrated Module Info:</b> | <p><b>Cellular Module:</b></p> <ul style="list-style-type: none"> <li>• Module: THALES PLS83-W</li> <li>• FCC ID: QIPPLS83-W; IC ID: 7830A-PLS83W;</li> </ul> <p><b>WLAN:</b></p> <ul style="list-style-type: none"> <li>• Manufacture: Silicon Labs</li> <li>• Module name/number: WFM200S022XNN3</li> <li>• FCC ID: QQQWFM200</li> <li>• IC ID: 5123A-WFM200</li> </ul>  |
| <b>Antenna Info:</b>           | <p><b>Cellular:</b></p> <ul style="list-style-type: none"> <li>• Antenna Type: Multiband Omnidirectional</li> <li>• Antenna gain(dBi):             <ul style="list-style-type: none"> <li>○ WCDMA Band II: 3</li> <li>○ WCDMA Band IV: 3</li> <li>○ WCDMA Band V: 1.5</li> <li>○ LTE Band 2: 3</li> <li>○ LTE Band 4: 3</li> <li>○ LTE Band 7: 4.5</li> <li>○ LTE Band 12: 3</li> <li>○ LTE Band 13: 1.5</li> <li>○ LTE Band 26: 1.5</li> </ul> </li> </ul>  |

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>○ LTE Band 41: 4.5</li> <li>○ LTE Band 66: 3</li> <li>○ GSM 850: 1.5</li> <li>○ GSM 1900: 3</li> </ul> <p><b>WLAN:</b></p> <ul style="list-style-type: none"> <li>● Antenna Type: 1/4 wave monopole</li> <li>● Antenna gain: 3 dBi</li> </ul>  |
| <p><b>Maximum Conducted Output Power:</b></p>              | <p><b>Cellular:</b> From conducted test report [Watts]:</p> <ul style="list-style-type: none"> <li>● WCDMA Band II: 0.316</li> <li>● WCDMA Band IV: 0.316</li> <li>● WCDMA Band V: 0.316</li> <li>● LTE Band 2: 0.316</li> <li>● LTE Band 4: 0.316</li> <li>● LTE Band 7: 0.316</li> <li>● LTE Band 12: 0.316</li> <li>● LTE Band 13: 0.316</li> <li>● LTE Band 26: 0.316</li> <li>● LTE Band 41: 0.316</li> <li>● LTE Band 66: 0.316</li> <li>● GSM 850: 3.2</li> <li>● GSM 1900: 1.6</li> </ul> <p><b>WLAN:</b> From modular grant [Watts]: 0.044</p> |
| <p><b>Power Supply/ Rated Operating Voltage Range:</b></p> | <p>Vmin: 23.8 VDC/ Vnom: 28 VDC / Vmax: 32.2 VDC</p>  |
| <p><b>Operating Temperature Range:</b></p>                 | <p>-30°C to 70 °C</p>   |
| <p><b>Sample Revision:</b></p>                             | <p><input type="checkbox"/> Prototype Unit;    <input type="checkbox"/> Production Unit;    <input checked="" type="checkbox"/> Pre-Production</p>  |

#### 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/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------------|--------------------------|
| 300 – 1500            | f (MHz) /1500                       | 30                       |
| 1500 – 100000         | 1.0                                 | 30                       |

IC

|            |                                     |   |
|------------|-------------------------------------|---|
| 300 – 6000 | 0.02619 x f (MHz) <sup>0.6834</sup> | 6 |
|------------|-------------------------------------|---|

##### 4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(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)<sup>0.6834</sup> 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/cm<sup>2</sup> or W/m<sup>2</sup>)  
 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 and US.
- 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 | MaxPower W conducted | MaxPower convert to dBm | Ant Gain dbi | Ant Gain lin | EIRP W calculated | Max Duty Cycle | IC W/m2 | FCC W/m2     | Actual W/m2 | How much of IC limit is used up | How much of FCC limit is used up |
|----------|----------|----------------------|-------------------------|--------------|--------------|-------------------|----------------|---------|--------------|-------------|---------------------------------|----------------------------------|
| WCDMA II | 1850     | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 4.476   | 10.000       | 1.255       | 28.04%                          | 12.55%                           |
| WCDMA IV | 1710     | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 4.242   | 10.000       | 1.255       | 29.59%                          | 12.55%                           |
| WCDMA V  | 824      | 0.316                | 25.000                  | 1.5          | 1.41         | 0.447             | 100.00%        | 2.576   | 5.493        | 0.889       | 34.49%                          | 16.17%                           |
| LTE 2    | 1850     | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 4.476   | 10.000       | 1.255       | 28.04%                          | 12.55%                           |
| LTE 4    | 1710     | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 4.242   | 10.000       | 1.255       | 29.59%                          | 12.55%                           |
| LTE 7    | 2500     | 0.316                | 25.000                  | 4.5          | 2.82         | 0.891             | 100.00%        | 5.499   | 10.000       | 1.773       | 32.24%                          | 17.73%                           |
| LTE 12   | 699      | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 2.302   | 4.660        | 1.255       | 54.54%                          | 26.93%                           |
| LTE 13   | 777      | 0.316                | 25.000                  | 1.5          | 1.41         | 0.447             | 100.00%        | 2.474   | 5.180        | 0.889       | 35.89%                          | 17.14%                           |
| LTE 26   | 814      | 0.316                | 25.000                  | 1.5          | 1.41         | 0.447             | 100.00%        | 2.554   | 5.427        | 0.889       | 34.77%                          | 16.37%                           |
| LTE 41   | 2496     | 0.316                | 25.000                  | 4.5          | 2.82         | 0.891             | 100.00%        | 5.493   | 10.000       | 1.773       | 32.28%                          | 17.73%                           |
| LTE 66   | 2570     | 0.316                | 25.000                  | 3            | 2.00         | 0.631             | 100.00%        | 5.604   | 10.000       | 1.255       | 22.40%                          | 12.55%                           |
| GSM 850  | 824      | 3.200                | 35.000                  | 1.5          | 1.41         | 4.520             | 12.50%         | 2.576   | 5.493        | 1.124       | 43.65%                          | 20.46%                           |
| GSM 1900 | 1850     | 1.600                | 32.000                  | 3            | 2.00         | 3.192             | 12.50%         | 4.476   | 10.000       | 0.794       | 17.72%                          | 7.93%                            |
|          |          |                      |                         |              |              |                   |                |         | Distance(m)= | 0.200       |                                 |                                  |
| WLAN     | 2400     | 0.044                | 16.400                  | 3            | 2.00         | 0.088             | 100.00%        | 5.348   | 10.000       | 0.175       | 3.25%                           | 1.74%                            |

**Note1:** The calculation is based on the distance of 20cm

**Note 2:** GSM has 12.50% duty cycle according to cellular module report under FCC ID: QIPPLS83-W

### 5.2 Conclusion:

The worst-case simultaneous transmission is LTE 12 simultaneous with WLAN, which is using 57.79% of IC limit and 28.67% of FCC limit. The equipment is passing RF exposure requirements for 20cm distance.

## 6 Revision History

| Date       | Report Name                           | Changes to report                   | Report prepared by |
|------------|---------------------------------------|-------------------------------------|--------------------|
| 2022-02-16 | EMC_PRATT-009-21001_FCC_ISED_MPE      | Initial Version                     | Cheng Song         |
| 2022-03-16 | EMC_PRATT-009-21001_FCC_ISED_MPE_Rev1 | Updated calculation for LTE Band 26 | Cheng Song         |

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