



## **Radio Frequency Exposure Evaluation Report**

**for**

**Teledyne Controls**

**Wireless Groundlink® – Quick Access Recorder**

**FCC ID: SYK-WQAR-362-2R**

**IC ID: 11369A-WQAR3622R**

**model number: 2243800-362**

### **Applied Rules and Standards**

**CFR Part Part 1 (1.1307 &1.1310), Part 2 (2.1091),  
FCC OET Bulletin 65 (1997-01) Supplement C (2001-01),  
FCC KDB 447498 D01 General 24 RF Exposure Guidance v05r01**

**Industry Canada RSS-102, Issue 4 of March 2010**

**Report number: EMC\_TELED-004-12001\_362\_MPE\_Rev1**

**DATE: 2014-01-27**

## 1 Administrative Data

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

|                                 |                                                        |
|---------------------------------|--------------------------------------------------------|
| <b>Company Name:</b>            | CETECOM Inc.                                           |
| <b>Department:</b>              | Compliance                                             |
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| <b>RF Exposure Lab Manager:</b> | Josie Sabado                                           |

### 1.2 Identification of the Client

|                          |                           |
|--------------------------|---------------------------|
| <b>Applicant's Name:</b> | Teledyne Controls         |
| <b>Street Address:</b>   | 501 Continental Boulevard |
| <b>City/Zip Code</b>     | El Segundo, CA 90245      |
| <b>Country</b>           | USA                       |
| <b>Contact Person:</b>   | Fariz Kalim               |
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## 2 Equipment under Assessment

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Marketing Name / Description:</b>                | <b>Wireless Groundlink® – Quick Access Recorder</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>FCC-ID:</b>                                      | <b>SYK-WQAR-362-2R</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>IC certification no.:</b>                        | <b>11369A-WQAR3622R</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Model Number (IC model number):</b>              | <b>2243800-362</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Product Description:</b>                         | 3G radio transceiver equipment intended for aircraft on-ground-communication with airline operator back office, based on multiple (identical) pre-certified 3G cellular radio modules. (details see below).<br>The given model 2243800-362 (teh EUT) is equipped with 2 cellular radio modules from each of which the main antenna connection (UFL) is routed to a single external SMA antenna connector. See details below.                                                                                                                                                                                        |
| <b>HW / SW Version :</b>                            | 2243800-362 / 711745 D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Technology / Type(s) of Modulation:</b>          | see the following spec of the incorporated cellular module:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Integrated Module Info:</b>                      | Sierra Wireless Airprime MC8705; HW Rev 1.0, SW Rev. T1.0.3.2<br>FCC ID: N7NMC8705; IC ID: 2417C-MC8705<br><ul style="list-style-type: none"> <li>850/900/1800/1900Mhz GSM/GPRS/EDGE;<br/>GSM&amp;GPRS&amp;EDGE(MCS-1-4): GMSK;<br/>EDGE(MCS-5-8): 8PSK;<br/>Multislot class 12 supported for both, GPRS and EGPRS;</li> <li>850/900/1700/1900/2100 MHz WCDMA / HSPA+;<br/>HSDPA Category 14 data rate - 21 Mbps;<br/>HSUPA Category 6 data rate - 5.76 Mbps;<br/>modulation: all QPSK (no QAM in uplink for given data rates);</li> <li>2 UFL antenna connectors, one for main and one for rx diversity</li> </ul> |
| <b>Operating Frequency Ranges (MHz) / Channels:</b> | GSM 850: 824.2-848.8; 125 channels;<br>PCS 1900: 1850.2-1909.8; 300 channels;<br>FDD II: 826.4 - 846.6; 278 channels;<br>FDD V: 1852.4 – 1907.6; 103 channels;                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Antenna details:</b>                             | PanguTech LLC, model: JQRD-0018-AGDPU;<br>peak gain: 2dBi nom.; multiple band 800/900/1800/1900/2100MHz;<br>vertical polarized; omni-directional; SMA connector;<br>The documented total loss from the 3G module's UFL connectors to the external antenna is 0.65 dB @ 850MHz; 0.9dB @ 1900MHz;                                                                                                                                                                                                                                                                                                                     |
| <b>Rated Operating Voltage (V DC):</b>              | 110V (Low) / 116V (Nominal) / 122V (Max), 360-800Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Rated Operating Temperature Range:</b>           | -10°C ~ +55°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Co-located Transmitters/ Antennas?</b>           | <input checked="" type="checkbox"/> Yes (both cellular radio modules operate independently and may transmit simultaneously)<br><input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Device Category:</b>                             | <input checked="" type="checkbox"/> Fixed Installation <input type="checkbox"/> Mobile (mark mobile if both possible)<br><input type="checkbox"/> Portable <input type="checkbox"/> mixed Mobile and Portable                                                                                                                                                                                                                                                                                                                                                                                                       |

|                            |                                                                                                                           |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Exposure Category:</b>  | <input type="checkbox"/> Occupational/ Controlled<br><input checked="" type="checkbox"/> General Population/ Uncontrolled |
| <b>Test Sample Status:</b> | Prototype                                                                                                                 |

### 3 Assessment

This RF Exposure evaluation report provides information about 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 under given 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 and described use case.

| Company           | Description                                  | Model #     |
|-------------------|----------------------------------------------|-------------|
| Teledyne Controls | Wireless Groundlink® – Quick Access Recorder | 2243800-362 |

#### Report reviewed by:

2014-01-27      Compliance      Franz Engert  
(Test Lab Manager)

| Date | Section | Name | Signature |
|------|---------|------|-----------|
|------|---------|------|-----------|

#### Responsible for the Report:

2014-01-27      Compliance      Josie Sabado  
(Test Lab Manager)

| Date | Section | Name | Signature |
|------|---------|------|-----------|
|------|---------|------|-----------|

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

#### 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 Maximum Permissible Exposure (MPE) Limits acc. to FCC 1.1310(e) / RSS-102, cl. 4.2:

| Frequency Range (MHz)                | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--------------------------------------|-------------------------------------|--------------------------|
| 300 – 1500                           | f (MHz) / 1500                      | 30 (IC:6)                |
| 1500 – 100.000<br>(IC:1500 – 150000) | 1.0                                 | 30 (IC: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):

Operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (IC: 2.5W / 34.0dBm EIRP);  
Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (IC: 5.0W / 37.0dBm EIRP);

##### 4.3 EMC Output Power Limits (ERP/EIRP) acc. to FCC part 22/24/27 / IC RSS-132, RSS-133, RSS-139 (to be additionally taken into account for maximum antenna gain considerations)

part 22: 7W ERP / 38.5dBm (IC: 11.5W / 40.6dBm EIRP)  
part 24: 2W EIRP / 33.0dBm  
part 27: 1W EIRP / 30.0dBm

Per KDB 447498 D01 FCC allows calculative estimation of RF exposure for mobile applications when routine environmental evaluation categorical exclusion applies and also for fixed applications. When categorical exclusion can not be claimed for mobile applications MPE measurement is required for TCB approval.

RSS-102 of Industry Canada does generally not require RF exposure evaluation for fixed or mobile applications which stay below the given exclusion limits.

##### 4.4 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 it's radiating structures from the body of persons according to it's 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

The following calculations are based on the the specified maximum conducted average output power of the cellular module incorporated in the EUT and thus – considering the given peak antenna gain of the documented antennae - resulting in the theoretical worst case maximum average ERP/EIRP, because all measured conducted average values are lower.

### 5.1 Routine Environmental Evaluation Applicability

Based on the theoretical maximum average ERP/EIRP as calculated from the specified maximum conducted average output power of the incorporated cellular module (PR, see below), plus the specified peak antenna gain, minus the loss of the cable and connectors between the module's RF output and the external antenna connector.

In addition source based time averaging over the TDMA multiframe is taken into account for GSM/EDGE operation as well as power contribution from simultaneously operating transmitters;

Pr is the declared (rated) conducted output power upper tune-up tolerance limit value (of the integrated cellular module);

| Transmission Mode    | Pr          | peak gain  | attenuation (total cable & connector loss) | duty cycle  | EIRP, source based time averaged (EIRPmax) | total EIRP simultaneous trans missions intra-band (worst cases only) | FCC & IC Limit for Routine Environmental Evaluation Applicability, EIRP | excluded?  |
|----------------------|-------------|------------|--------------------------------------------|-------------|--------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|------------|
|                      | dBm         | dBd        | dB                                         | %           | dBm                                        | dBm                                                                  | dBm                                                                     |            |
| GSM 850              | 33.0        | 2.0        | -0.65                                      | 12.5        | 25.35                                      |                                                                      | 33.9                                                                    | yes        |
| GPRS 850 1TS         | 33.0        | 2.0        | -0.65                                      | 12.5        | 25.35                                      |                                                                      | 33.9                                                                    | yes        |
| GPRS 850 2TS         | 33.0        | 2.0        | -0.65                                      | 25          | 28.35                                      |                                                                      | 33.9                                                                    | yes        |
| <b>GPRS 850 3TS</b>  | <b>33.0</b> | <b>2.0</b> | <b>-0.65</b>                               | <b>37.5</b> | <b>30.05</b>                               | <b>33.05</b>                                                         | <b>33.9</b>                                                             | <b>yes</b> |
| GPRS 850 4TS         | 27.0        | 2.0        | -0.65                                      | 50          | 25.35                                      |                                                                      | 33.9                                                                    | yes        |
| EDGE 850 1TS         | 28.0        | 2.0        | -0.65                                      | 12.5        | 20.35                                      |                                                                      | 33.9                                                                    | yes        |
| EDGE 850 2TS         | 28.0        | 2.0        | -0.65                                      | 25          | 23.35                                      |                                                                      | 33.9                                                                    | yes        |
| EDGE 850 3TS         | 28.0        | 2.0        | -0.65                                      | 37.5        | 25.05                                      |                                                                      | 33.9                                                                    | yes        |
| EDGE 850 4TS         | 28.0        | 2.0        | -0.65                                      | 50          | 26.35                                      |                                                                      | 33.9                                                                    | yes        |
| WCDMA Bd V           | 24.0        | 2.0        | -0.65                                      | 100         | 25.35                                      |                                                                      | 33.9                                                                    | yes        |
| GSM 1900             | 30.0        | 2.0        | -0.9                                       | 12.5        | 22.1                                       |                                                                      | 36.9                                                                    | yes        |
| GPRS 1900 1TS        | 30.0        | 2.0        | -0.9                                       | 12.5        | 22.1                                       |                                                                      | 36.9                                                                    | yes        |
| GPRS 1900 2TS        | 30.0        | 2.0        | -0.9                                       | 25          | 25.1                                       |                                                                      | 36.9                                                                    | yes        |
| GPRS 1900 3TS        | 30.0        | 2.0        | -0.9                                       | 37.5        | 26.8                                       |                                                                      | 36.9                                                                    | yes        |
| GPRS 1900 4TS        | 26.0        | 2.0        | -0.9                                       | 50          | 24.1                                       |                                                                      | 36.9                                                                    | yes        |
| EDGE 1900 1TS        | 28.0        | 2.0        | -0.9                                       | 12.5        | 20.1                                       |                                                                      | 36.9                                                                    | yes        |
| EDGE 1900 2TS        | 28.0        | 2.0        | -0.9                                       | 25          | 23.1                                       |                                                                      | 36.9                                                                    | yes        |
| <b>EDGE 1900 3TS</b> | <b>28.0</b> | <b>2.0</b> | <b>-0.9</b>                                | <b>37.5</b> | <b>24.8</b>                                |                                                                      | <b>36.9</b>                                                             | <b>yes</b> |
| EDGE 1900 4TS        | 28.0        | 2.0        | -0.9                                       | 50          | 26.1                                       |                                                                      | 36.9                                                                    | yes        |
| WCDMA Bd II          | 24.0        | 2.0        | -0.9                                       | 100         | 25.1                                       |                                                                      | 36.9                                                                    | yes        |

\* worst case: simultaneous transmission of both cellular module with GPRS 850MHz 3TS.

Summing up the worst case max output powers provides a conservative estimate.

**Result:** The equipment is categorically excluded from Routine Environmental Evaluation, also for the worst case of simultaneous transmission of the incorporated transmitters with the highest output power mode.

## 5.2 Compliance with MPE (Power Density) limits

### Limits:

**S<sub>max</sub> @ 824MHz = 0.55mW/cm<sup>2</sup>** (824MHz is worst case as lowest operating frequency in the cellular band);

**S<sub>max</sub> @ 1900MHz = 1.0mW/cm<sup>2</sup>**

The highest source base time averaged EIRP<sub>max</sub> per band calculated with the rated peak antenna gain values are taken from the table in section 5.1 above;

The highest power density is resulting from the formula:  $S = \text{EIRP}_{\text{max}} / 4 \cdot \pi \cdot r^2$ ;

The power density is calculated for the minimum distance  $r = 20\text{cm}$ ;

Highest source base time averaged EIRP with GPRS 850 MHz, 3TS, single transmitter: 30.05dBm;

Resulting maximum power density at 850MHz: **S(850MHz) = 0.223mW/cm<sup>2</sup>**

Highest source base time averaged EIRP with GPRS 850 MHz, 3TS, 2 simultaneous transmissions, accumulated EIRP: 33.05dBm;

Resulting maximum power density at 850MHz: **S(850MHz) = 0.402mW/cm<sup>2</sup>**

Highest source base time averaged EIRP with GPRS 1900 MHz, 3TS, single transmitter: 24.8dBm;

Resulting maximum power density at 1900MHz: **S(1900MHz) = 0.06mW/cm<sup>2</sup>**

**Result:** The equipment fulfills the MPE limits for the minimum distance between the antenna and the human body of 20cm, for the rated peak antenna gain and also for the worst case of simultaneous transmission of both transmitters within the same band.

## 5.3 Simultaneous Transmission MPE Test Exclusion (per KDB 447498 D01)

According to the manufacturer the 2 identical cellular radio modules incorporated within the device operate independently from each other. From this a theoretical worst case of simultaneous transmission with the highest output power mode (GPRS 850MHz with 3 timeslots in uplink) within the same band is assumed, although this is very unlikely to happen in reality.

Highest power density to the limit ratio for 850MHz:  $0.223\text{mW/cm}^2 / 0.55\text{mW/cm}^2 = \mathbf{0.405}$

**$\Sigma$  of Power Density (MPE) ratios = 2 x 0.405 = 0.81 < 1**

**Result:** The equipment is excluded from simultaneous transmission MPE test.



## 6 Revision History

| Date       | Change Description                                                                                                                                                                  | Revision |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2014-01-08 | n.a.                                                                                                                                                                                | initial  |
| 2014-01-27 | Amendments reg. limits and rules in section 4;<br>Corrections due to presentation of additional output power information excluding the product from rf exposure routine evaluation; | Rev. 1   |