



Radio Frequency Exposure Evaluation Report

FOR:

Teledyne Controls

Model Name:

2243800

Product Description:

Wireless Groundlink® Quick Access Recorder (Comm+)

FCC ID: SYK-WQAR-464-4R/SYK-WQAR-462-2R

IC ID: 11369A-WQAR4644R/11369A-WQAR4622R

Applied Rules and Standards:

CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091),
ISED RSS-102 Issue 5

Report number: EMC_TELED-009-19001_FCC_ISED_MPE

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1. 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 ISEDC 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/ISEDC rule parts based on available specifications.

Company Name	Product Description	Model #
Teledyne Controls	Wireless Groundlink® Quick Access Recorder (Comm+)	2243800

Responsible for Testing Laboratory:

2019-05-29	Compliance	Kris Lazarov (Senior EMC Engineer)	
Date	Section	Name	Signature

Responsible for the Report:

2019-05-29	Compliance	Kevin Wang (Senior EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.
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2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
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Country	USA
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EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Kevin Wang

2.2. Identification of the Client / Manufacturer

Applicant's Name:	Teledyne Controls
Street Address:	501 Continental Blvd
City/Zip Code	El Segundo, CA / 90245
Country	United States

3. Equipment under Assessment

Model No	2243800
HW Version	Mod 0
SW Version	711745 Ver G
FCC-ID :	SYK-WQAR-464-4R / SYK-WQAR-462-2R
IC-ID:	11369A-WQAR4644R / 11369A-WQAR4622R
Product Description	<p>The WGL Comm+ performs the recording and wireless transmission of flight data.</p> <p>There are 2 variants for this model series.</p> <p>The model 2243800-462 is equipped with 2 identical cellular radio modules, and the main antenna connection of each module (UFL) is routed to a single external SMA antenna connector.</p> <p>The model 2243800-464 is equipped with 4 identical cellular radio modules, and each of the 2 radio modules use a RF combiner to connect the main antenna.</p>
Transceiver Technology / Type(s) of Modulation	<p>Sierra Wireless Airprime EM7565; FCCID: N7NEM75</p> <ul style="list-style-type: none"> •FDD I / II / III / IV / V / VI / VII / VIII / IX / 19 HSPA+/DC-HHSDPA/DC-HSUPA/UMTS •FDD LTE Band 1/2/3/4/5/7/8/9/12/13/18/19/20/26/28/29/30 •TDD LTE Band 41/42/43/46/48/66 <p>Modulations: QPSK, 16-QAM, 64-QAM</p>
Max. declared antenna gain	Pangu Tech, LLC, model: JQRD-0018-LTE; peak gain: 2dBi norm.
Co-located Transmitters/ Antennas?	Yes – the 4/2 cellular radio modules operate independently and may transmit simultaneously
Power Supply/ Rated Operating Voltage Range	Vmin: 100VAC, 360 Hz / Vnom: 115VAC, 400 Hz / Vmax: 122VAC, 800 Hz
Operating Temperature Range	-15°C ~ +55°C
Sample Revision	<input type="checkbox"/> Prototype <input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production
Device Category	<input checked="" type="checkbox"/> Fixed Installation <input type="checkbox"/> Mobile <input type="checkbox"/> Portable
Exposure Category	<input type="checkbox"/> Occupational/ Controlled <input checked="" type="checkbox"/> General Population/ Uncontrolled

4. RF Exposure Limits

For the specific described radio apparatus the following basic limits and rules apply

4.1. Power Density Limits acc. to FCC 1.1310(e)

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
1500 – 100000	1.0	30

4.2. Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.1091(c)

- Operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm;

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 cannot be claimed for mobile applications MPE measurement is required for TCB approval.

4.3. Exemption Limits for Routine Evaluation to RSS-102 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- Operating frequency > 300MHz < 6GHz: excluded if ERP < 2.7W / 34.3dBm;

4.4. Exposure Limits RSS-102 4

For the purpose of this standard, ISDC has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6

4.5. 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. Routine Environmental Evaluation Applicability Stand Alone transmission

Model 2243800-464:

Transmission Mode	EIRP dBm	Duty Cycle %	FCC Limits for Routine Environmental Evaluation Applicability, EIRP dBm	ISED Limits for Routine Environmental Evaluation Applicability, EIRP dBm	Exempt from Routine evaluation (Yes/No)
FDD II	21.55	100.00%	< 33	< 33.6	Yes
FDD IV	21.55	100.00%	< 30	< 33.6	Yes
FDD V	21.55	100.00%	< 39.61	< 31.2	Yes
LTE Band 2	21.55	100.00%	< 33	< 33.6	Yes
LTE Band 4	21.55	100.00%	< 30	< 33.3	Yes
LTE Band 5	21.55	100.00%	< 39.61	< 31.2	Yes
LTE Band 7	20.47	100.00%	< 33	< 34.5	Yes
LTE Band 12	21.55	100.00%	< 37.12	< 30.7	Yes
LTE Band 13	21.55	100.00%	< 37.12	< 31.0	Yes
LTE Band 26	21.55	100.00%	< 47.17	< 31.2	Yes
LTE Band 30	20.47	100.00%	< 24	< 31.2	Yes
LTE Band 41	20.47	100.00%	< 33	< 34.6	Yes
LTE Band 66	21.55	100.00%	< 30	< 33.4	Yes

Model 2243800-462:

Transmission Mode	EIRP dBm	Duty Cycle %	FCC Limits for Routine Environmental Evaluation Applicability, EIRP dBm	ISED Limits for Routine Environmental Evaluation Applicability, EIRP dBm	Exempt from Routine evaluation (Yes/No)
FDD II	24.88	100.00%	< 33	< 33.6	Yes
FDD IV	24.88	100.00%	< 30	< 33.6	Yes
FDD V	24.88	100.00%	< 39.61	< 31.2	Yes
LTE Band 2	24.88	100.00%	< 33	< 33.6	Yes
LTE Band 4	24.88	100.00%	< 30	< 33.3	Yes
LTE Band 5	24.88	100.00%	< 39.61	< 31.2	Yes
LTE Band 7	23.88	100.00%	< 33	< 34.5	Yes
LTE Band 12	24.88	100.00%	< 37.12	< 30.7	Yes
LTE Band 13	24.88	100.00%	< 37.12	< 31.0	Yes
LTE Band 26	24.88	100.00%	< 47.17	< 31.2	Yes
LTE Band 30	23.88	100.00%	< 24	< 31.2	Yes
LTE Band 41	23.88	100.00%	< 33	< 34.6	Yes
LTE Band 66	24.88	100.00%	< 30	< 33.4	Yes

Note: EIRP power calculation is based on tune-up information and the declared peak antenna gain.

Conclusion:

- Both model are exempt from Routine evaluation.

5.2. Compliance with MPE (Power Density) limits

Power Density Calculation : Model 2243800-464								
Band of Operation MHz	EIRP dBm	Maximum Duty Cycle %	Distance cm	Power Density mW/cm ²	IC Limit mW/cm ²	FCC Limit mW/cm ²	IC Limit Percentage	Verdict
FDD II	21.55	100.00%	20	0.02844	0.458	1.000	6.22%	Pass
FDD IV	21.55	100.00%	20	0.02844	0.432	1.000	6.59%	Pass
FDD V	21.55	100.00%	20	0.02844	0.263	0.566	10.82%	Pass
LTE Band 2	21.55	100.00%	20	0.02844	0.458	1.000	6.22%	Pass
LTE Band 4	21.55	100.00%	20	0.02844	0.432	1.000	6.59%	Pass
LTE Band 5	21.55	100.00%	20	0.02844	0.263	0.566	10.82%	Pass
LTE Band 7	20.47	100.00%	20	0.02218	0.560	1.000	3.96%	Pass
LTE Band 12	21.55	100.00%	20	0.02844	0.234	0.477	12.16%	Pass
LTE Band 13	21.55	100.00%	20	0.02844	0.250	0.525	11.39%	Pass
LTE Band 26	21.55	100.00%	20	0.02844	0.263	0.566	10.82%	Pass
LTE Band 30	20.47	100.00%	20	0.02218	0.522	1.000	4.25%	Pass
LTE Band 41	20.47	100.00%	20	0.02218	0.578	1.000	3.84%	Pass
LTE Band 66	21.55	100.00%	20	0.02844	0.436	1.000	6.52%	Pass

Power Density Calculation : Model 2243800-462								
Band of Operation MHz	EIRP dBm	Maximum Duty Cycle %	Distance cm	Power Density mW/cm ²	IC Limit mW/cm ²	FCC Limit mW/cm ²	IC Limit Percentage	Verdict
FDD II	24.88	100.00%	20	0.06123	0.458	1.000	13.38%	Pass
FDD IV	24.88	100.00%	20	0.06123	0.432	1.000	14.18%	Pass
FDD V	24.88	100.00%	20	0.06123	0.263	0.566	23.29%	Pass
LTE Band 2	24.88	100.00%	20	0.06123	0.458	1.000	13.38%	Pass
LTE Band 4	24.88	100.00%	20	0.06123	0.432	1.000	14.18%	Pass
LTE Band 5	24.88	100.00%	20	0.06123	0.263	0.566	23.29%	Pass
LTE Band 7	23.88	100.00%	20	0.04864	0.560	1.000	8.68%	Pass
LTE Band 12	24.88	100.00%	20	0.06123	0.234	0.477	26.17%	Pass
LTE Band 13	24.88	100.00%	20	0.06123	0.250	0.525	24.53%	Pass
LTE Band 26	24.88	100.00%	20	0.06123	0.263	0.566	23.29%	Pass
LTE Band 30	23.88	100.00%	20	0.04864	0.522	1.000	9.32%	Pass
LTE Band 41	23.88	100.00%	20	0.04864	0.578	1.000	8.41%	Pass
LTE Band 66	24.88	100.00%	20	0.06123	0.436	1.000	14.04%	Pass

Conclusion:

- Both model fulfill the MPE limits for the minimum 20cm distance between the antenna and the human body

6. Routine Environmental Evaluation Applicability Simultaneous Transmission

- Possible simultaneous transmissions: For model 2243800-464, According to the manufacturer the four identical cellular radio modules incorporated within the device operate independently from each other. Theoretically the worst case of simultaneous transmission is with the four transmitters operating at the highest output power mode, within the same band (4 x LTE Band 12).

Transmission Mode	Ratio of Power Density to Applicable limit for Stand Alone Operation	Sum of the Ratios for the Highest Possible Simultaneous Operation	Limits for the Highest Combined Ratio	Exempt from Routine evaluation
4 x LTE Band 12	0.1216	$4 \times 0.1216 = 0.4864$	< 1	Yes

Note: Power Density to Applicable limit for Stand Alone Operation are derived from table in section 5.2

- Possible simultaneous transmissions: For model 2243800-462, According to the manufacturer the two identical cellular radio modules incorporated within the device operate independently from each other. Theoretically the worst case of simultaneous transmission is with the four transmitters operating at the highest output power mode, within the same band (2 x LTE Band 12).

Transmission Mode	Ratio of Power Density to Applicable limit for Stand Alone Operation	Sum of the Ratios for the Highest Possible Simultaneous Operation	Limits for the Highest Combined Ratio	Exempt from Routine evaluation
2 x LTE Band 12	0.2617	$2 \times 0.2617 = 0.5234$	< 1	Yes

Note: Power Density to Applicable limit for Stand Alone Operation are derived from table in section 5.2

Conclusion:

- Both model are excluded from simultaneous transmission MPE test.

7. Revision History

Date	Report Name	Changes to report	Report prepared by
2019-05-22	EMC_TELED-009-19001_FCC_ISED_MPE	Initial Version	Kevin Wang