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## **FCC CFR 47 Part 2.1091**

### **RF Exposure Report**

|                             |                                       |
|-----------------------------|---------------------------------------|
| <b>APPLICANT</b>            | <b>CODAN LIMITED</b>                  |
| <b>FCC</b>                  | <b>DYY2410</b>                        |
| <b>MODEL NUMBER</b>         | <b>Type 2410</b>                      |
| <b>PRODUCT DESCRIPTION</b>  | <b>Codan 2410 ManPack Transceiver</b> |
| <b>DATE SAMPLE RECEIVED</b> | <b>DEC 5 2019</b>                     |
| <b>FINAL TEST DATE</b>      | <b>JAN 14 2020</b>                    |
| <b>REPORT NUMBER</b>        | <b>3317AUT19_PT2 RF Report_</b>       |

**AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION  
UNDER ISO/IEC 17025, AND ISO/IEC 17065**





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**SIGNATURE PAGE**

Timco Engineering, Inc. attests that:

This report relates only to the Equipment Under Test (EUT) sample(s) tested.

This report shall not be reproduced except in full without the written approval of Timco Engineering, Inc.

To the best of my knowledge and belief, this device has been tested in accordance with the standards identified in this test report, and these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that measurements were made at:

Timco Engineering Inc.  
849 NW State Road 45  
Newberry, FL 32669



**Name and Title** Franklin Rose, Project Manager / EMC Specialist



**Name and Title** Tim Royer, Project Manager / EMC Engineer



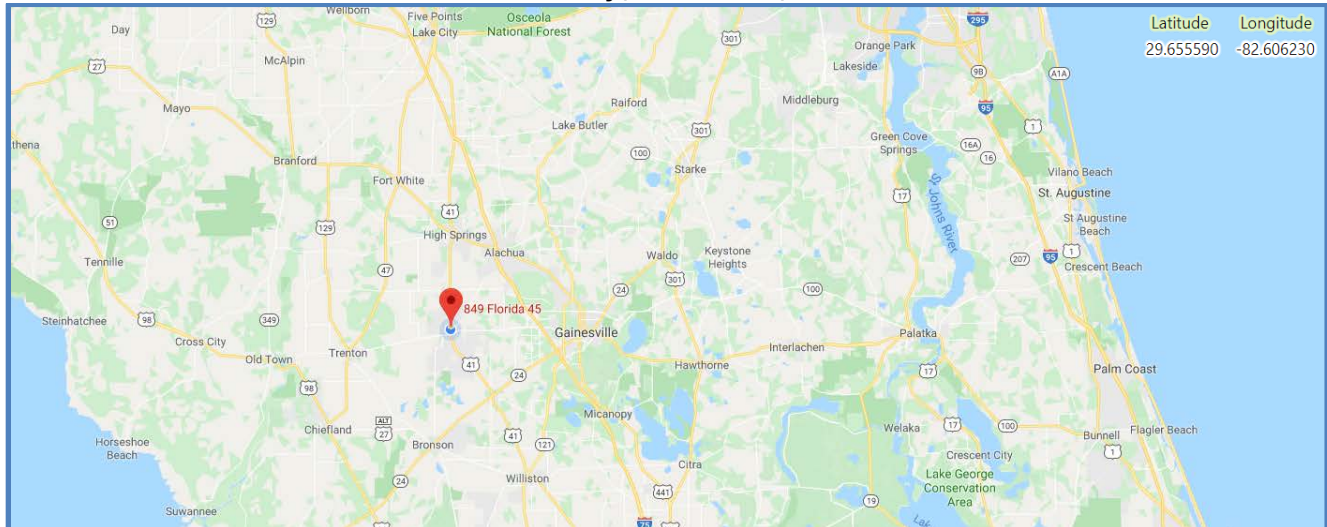
**Name and Title** Sharon Hoffman, Senior Marketing Director

**Date** JAN 14 2020

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## TESTING LABORATORY

**Timco Engineering Inc.  
849 NW State Road 45  
Newberry, FL 32669, USA**



|                                |                                                                                                                  |
|--------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>United States</b>           | FCC Accredited and Recognized Test <a href="#">Lab</a> & <a href="#">TCB</a> # US1070                            |
|                                | DHS Recognized P25 <a href="#">CAP</a> Test Facility # P25CAPTIMCO081016                                         |
| <b>Australia / New Zealand</b> | U.S. CABs Recognized by Australia ACMA Under MRA                                                                 |
| <b>Canada</b>                  | U.S. <a href="#">Lab</a> & <a href="#">CB</a> Recognized by Canada ISED, Designation # US0111, Test Site # 2056A |
| <b>Chinese Taipei</b>          | U.S. CABs Recognized by Chinese Taipei BSMI/NCC Under MRA                                                        |
| <b>European Union</b>          | U.S. <a href="#">EMC</a> & <a href="#">RE</a> Directive NB's, Designation # US0111, Notified Body # 1177         |
| <b>Hong Kong</b>               | U.S. Labs & CBs Recognized by Hong Kong OFCA Under MRA                                                           |
| <b>Israel</b>                  | U.S. CABs Recognized by Israel MOE/MOC Under MRA                                                                 |
| <b>Japan</b>                   | U.S. <a href="#">RCBs</a> Recognized by Japan MIC                                                                |
| <b>Korea</b>                   | U.S. CABs Recognized by Korea RRA Under MRA                                                                      |
| <b>Mexico</b>                  | U.S. CABs Recognized by Mexico IFT Under MRA                                                                     |
| <b>Singapore</b>               | U.S. Labs & CBs Recognized by Singapore IMDA Under MRA                                                           |
| <b>Vietnam</b>                 | U.S. CABs Recognized by Vietnam MIC Under MRA                                                                    |

**TEST INFORMATION**

| Report Version | Description   | Issue Date  |
|----------------|---------------|-------------|
| Rev1           | Initial Issue | JAN 14 2020 |
| Rev2           |               |             |
| Rev3           |               |             |
| Rev4           |               |             |
| Rev5           |               |             |
| Rev6           |               |             |

|                             |                                                                                                         |
|-----------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Test Conditions</b>      | Temperature during testing: 26°C, Humidity during testing: 50%                                          |
| <b>Test Exercise</b>        | The EUT was operated in accordance with the service manual using software supplied by the manufacturer. |
| <b>Applicable Standards</b> | FCC CFR 47 Part 2, Jan 2020<br>FCC CFR 47 Part 1, Jan 2020                                              |
| <b>Test Facility</b>        | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA                                   |

**EUT INFORMATION**

|                                |                                                                |                                                    |                                                      |
|--------------------------------|----------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------|
| <b>EUT Manufacturer</b>        | CODAN LIMITED                                                  |                                                    |                                                      |
| <b>Manufacturer Address</b>    | 2 SECOND AVENUE<br>MAWSON LAKES SOUTH AUSTRALIA 5095 AUSTRALIA |                                                    |                                                      |
| <b>EUT Description</b>         | Codan 2410 ManPack HF Transceiver                              |                                                    |                                                      |
| <b>EUT Model Number</b>        | Type 2410                                                      |                                                    |                                                      |
| <b>EUT Frequency Range</b>     | 1.605 – 29.8 MHz                                               |                                                    |                                                      |
| <b>EUT Test Frequency(ies)</b> | 1.608, 14.4, 29.797 MHz                                        |                                                    |                                                      |
| <b>Modifications to EUT</b>    | n/a                                                            |                                                    |                                                      |
| <b>Antenna Connector</b>       | <input type="checkbox"/> UHF                                   | <input checked="" type="checkbox"/> BNC            | <input type="checkbox"/> N                           |
|                                | <input type="checkbox"/> TNC                                   | <input type="checkbox"/> SMA                       | <input type="checkbox"/> Other                       |
| <b>EUT Power Source</b>        | <input type="checkbox"/> AC Power (120 V)                      | <input type="checkbox"/> DC Power (48 V)           | <input checked="" type="checkbox"/> Battery (13.8 V) |
| <b>Test Item</b>               | <input type="checkbox"/> Prototype                             | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Post-Production             |
| <b>Type of Equipment</b>       | <input type="checkbox"/> Fixed                                 | <input checked="" type="checkbox"/> Mobile         | <input type="checkbox"/> Portable                    |

## FCC PT 1.1310 SAR & MPE

- ☐ (a) Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b) within the frequency range of 100 kHz to 6 GHz (inclusive).
- ☐ (b) The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 8 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit for occupational/controlled exposure is 20 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 6 minutes to determine compliance with occupational/controlled SAR limits.
- ☐ (c) The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.
- ☒ (d)(1) Evaluation with respect to the SAR limits in this section and in §2.1093 of this chapter must demonstrate compliance with both the whole-body and peak spatial-average limits using technically supportable methods and exposure conditions in advance of authorization (licensing or equipment certification) and in a manner that permits independent assessment.
- ☒ (2) At operating frequencies less than or equal to 6 GHz, the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 of paragraph (e) of this section, may be used instead of whole-body SAR limits as set forth in paragraph (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b), except for portable devices as defined in §2.1093 as these evaluations shall be performed according to the SAR provisions in §2.1093 of this chapter.
- ☐ (3) At operating frequencies above 6 GHz, the MPE limits shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b).
- ☐ (4) Both the MPE limits listed in Table 1 of paragraph (e) of this section and the SAR limits as set forth in paragraph (a) through (c) of this section and in §2.1093 of this chapter are for continuous exposure, that is, for indefinite time periods. Exposure levels higher than the limits are permitted for shorter exposure times, as long as the average exposure over the specified averaging time in Table 1 is less than the limits. Detailed information on our policies regarding procedures for evaluating compliance with all of these exposure limits can be found in the FCC's *OET Bulletin 65*, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," and in supplements to *Bulletin 65*, all available at the FCC's Internet Web site: <http://www.fcc.gov/oet/rfsafety>.

*Note to paragraphs (a) through (d):* SAR is a measure of the rate of energy absorption due to exposure to RF electromagnetic energy. The SAR limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized SAR in §4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE Std C95.1-1992, copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. The criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, §17.4.5, copyright 1986 by NCRP, Bethesda, Maryland 20814. Limits for whole body SAR and peak spatial-average SAR are based on recommendations made in both of these documents. The MPE limits in Table 1 are based generally on criteria published by the NCRP in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, §§17.4.1, 17.4.1.1, 17.4.2 and 17.4.3, copyright 1986 by NCRP, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, these MPE exposure limits for field strength and power density are also generally based on criteria recommended by the ANSI in §4.1 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE Std C95.1-1992, copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

**FCC PT 1.1310 SAR & MPE**

(e) Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

**TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500                                                      |                               |                               | f/300                               | 6                        |
| 1,500-100,000                                                  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *100                                | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *180/f <sup>2</sup>                 | 30                       |
| 30-300                                                         | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1,500                                                      |                               |                               | f/1500                              | 30                       |
| 1,500-100,000                                                  |                               |                               | 1.0                                 | 30                       |

f = frequency in MHz \* = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

**FCC PT 1.1310 SAR & MPE**

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

(3) Licensees and applicants are responsible for compliance with both the occupational/controlled exposure limits and the general population/uncontrolled exposure limits as they apply to transmitters under their jurisdiction. Licensees and applicants should be aware that the occupational/controlled exposure limits apply especially in situations where workers may have access to areas in very close proximity to antennas and access to the general public may be restricted.

(4) In lieu of evaluation with the general population/uncontrolled exposure limits, amateur licensees authorized under part 97 of this chapter and members of his or her immediate household may be evaluated with respect to the occupational/controlled exposure limits in this section, provided appropriate training and information has been provided to the amateur licensee and members of his/her household. Other nearby persons who are not members of the amateur licensee's household must be evaluated with respect to the general population/uncontrolled exposure limits.

**EMC EQUIPMENT LIST**

| Device                                                                | Manufacturer    | Model                              | SN                                           | Calibration Date | Cal Due Date |
|-----------------------------------------------------------------------|-----------------|------------------------------------|----------------------------------------------|------------------|--------------|
| EMI Test Receiver R & S ESU 40<br>firmware v 4.43 SP 3 BIOS v5.1-24-3 | Rohde & Schwarz | ESU 40                             | 100320                                       | 08/28/18         | 08/28/20     |
| Coaxial Cable - Chamber 3 cable set<br>(backup)                       | Micro-Coax      | Chamber<br>3 cable set<br>(backup) | KMKM-0244-02<br>KMKM-0670-01<br>KFKF-0197-00 | 02/27/19         | 02/27/21     |
| CHAMBER                                                               | Panashield      | 3M                                 | N/A                                          | 03/15/19         | 03/15/21     |
| Field Meter                                                           | WaveControl     | SMP2                               | 19SN1068                                     | 11/25/19         | 11/25/21     |

## ANNEX I – MANUFACTURER-PROVIDED INFORMATION

**Note:** The accuracy and precision of the following information provided by the manufacturer of the equipment under test has not been verified using test methods, cannot be verified, or is not necessary to verify.

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Transmit Antenna Information

**ANNEX II – MEASUREMENT DATA**

Test Engineer: FR, TR  
 Test Date: 01/14/2020

**Measured MPE Distance**

**Antenna #1:** 15-00472 Tape Whip, 1.5 m length.

***Measured Values (averaged over 6 min.), Antenna #1***

***Uncontrolled Public RF Exposure/MPE Guideline***

|                                                           |                          |
|-----------------------------------------------------------|--------------------------|
| Separation Distance (cm)                                  | 60 cm @ 28 MHz           |
| Power Density (W/m <sup>2</sup> )                         | 1.69 W/m <sup>2</sup>    |
| Power Density (mW/cm <sup>2</sup> )                       | 0.169 mW/cm <sup>2</sup> |
| Note: Worst-case @ 80 cm vertical from antenna connector. |                          |

**Antenna #2:** 15-00473 Collapsible Whip, 3 m length.

***Measured Values (averaged over 6 min.), Antenna #2***

***Uncontrolled Public RF Exposure/MPE Guideline***

|                                                            |                          |
|------------------------------------------------------------|--------------------------|
| Separation Distance (cm)                                   | 24.5 cm @ 28 MHz         |
| Power Density (W/m <sup>2</sup> )                          | 1.69 W/m <sup>2</sup>    |
| Power Density (mW/cm <sup>2</sup> )                        | 0.169 mW/cm <sup>2</sup> |
| Note: Worst-case @ 153 cm vertical from antenna connector. |                          |

**Note:** Results are reported using the high-end frequency. Low and Middle frequencies did not yield as much separation distance for either antenna.

**Estimated MPE Distance****EUT Parameters**

| <i>Parameter</i>         | <i>Value</i> | <i>Unit</i> |
|--------------------------|--------------|-------------|
| <i>EUT Form Factor</i>   | Portable ▼   |             |
| <i>Lowest Frequency</i>  | 1.605        | MHz         |
| <i>Highest Frequency</i> | 27.997       | MHz         |
| <i>Maximum Power</i>     | 45.310       | dBm ▼       |
| <i>Tune Up Tolerance</i> | 0.500        | +/- dBm ▼   |
| <i>Duty Cycle</i>        | 100%         | %           |
| <i>Antenna Gain</i>      | 0.000        | dBi EIRP ▼  |
| <i>Coax Loss</i>         | 0.000        | dB ▼        |
| <i>EIRP</i>              | 38.107       | W           |

**Uncontrolled Public RF Exposure/MPE Guideline**

|                                     |                          |
|-------------------------------------|--------------------------|
| Separation Distance (cm)            | 133.9 cm                 |
| Power Density (W/m <sup>2</sup> )   | 1.69 W/m <sup>2</sup>    |
| Power Density (mW/cm <sup>2</sup> ) | 0.169 mW/cm <sup>2</sup> |

**Controlled Occupational RF Exposure/MPE Guideline**

|                                     |                          |
|-------------------------------------|--------------------------|
| Separation Distance (cm)            | 59.9 cm                  |
| Power Density (W/m <sup>2</sup> )   | 8.45 W/m <sup>2</sup>    |
| Power Density (mW/cm <sup>2</sup> ) | 0.845 mW/cm <sup>2</sup> |

**Note:** The manufacturer specifies a typical Duty Cycle of 10% transmit to 90% receive. For the purposes of this calculation, a 100% duty cycle was used.

**Note:** The worst-case limit between ISED RSS-102 and FCC Part 2 was selected.

**Estimated MPE Distance****Calculations****RF Exposure Field Strength Limits**

Public Persons may be exposed up to:

|                                                                                      |                          |
|--------------------------------------------------------------------------------------|--------------------------|
| Worst-Case RF Field Strength Limit for the General Public (Uncontrolled Environment) | 1.69 W/m <sup>2</sup>    |
|                                                                                      | 0.169 mW/cm <sup>2</sup> |

Occupational Persons may be exposed up to:

|                                                                                |                          |
|--------------------------------------------------------------------------------|--------------------------|
| Worst-Case RF Field Strength Limit for Controlled Use (Controlled Environment) | 8.45 W/m <sup>2</sup>    |
|                                                                                | 0.845 mW/cm <sup>2</sup> |

**Separation Distance**

Mandatory distance from radiating element:

| Calculation Method                                    | Distance from Radiating Element (cm)<br>= SQRT (P(mW) / 4π S(mW/cm <sup>2</sup> )) |
|-------------------------------------------------------|------------------------------------------------------------------------------------|
| Uncontrolled Sep. Distance @ 0.169 mW/cm <sup>2</sup> | 133.94 cm                                                                          |
| Controlled Sep. Distance @ 0.845 mW/cm <sup>2</sup>   | 59.9 cm                                                                            |

**EUT Power Density at 20 cm**

| Calculation Method        | Power Density (mW/cm <sup>2</sup> )<br>= P(mW) / 4π R(cm) <sup>2</sup> |
|---------------------------|------------------------------------------------------------------------|
| EUT Power Density @ 20 cm | 75.81 W/m <sup>2</sup>                                                 |
|                           | 7.581 mW/cm <sup>2</sup>                                               |

**END OF TEST REPORT**