Report Ref: 21E9046-1a Page 1 of 15 **Compliance Engineering Ireland Ltd** Clonross Lane, Derrockstown, Dunshaughlin Co. Meath, Ireland A85 XN59 Ph +353 1 8017000 , 8256722 www.cei.ie

Project Num 21E9406-1a Quotation Q21-0402-1 **Prepared For** ABB Ltd **Company Address** Clonshaugh Business & Technology Park, Dublin, D17 A662 Contact **Brendan Collins Contact Email** brendan.collins@ie.abb.com Prepared By Compliance Engineering Ireland Test Lab Address Clonross Lane, Derrockstown, Dunshaughlin, Co. Meath, Ireland **Tested By** Joy Dalayap / Michael Kirby Test Report By Michael Kirby FCC Test Firm Registration 409640 IC Site Registration IE0001 16<sup>th</sup> Sept 2021 Date EUT Description Sensor with Bluetooth Low Energy FCC ID 2A2UMFA2101 Authorised by Paul Reilly Jal Ru Authorised Signature:

Compliance Engineering

**RELAND LTD** 

ISO 17025

JAB

DETAILED IN SCOPE REG NO.088

resting

## **TEST SUMMARY**

The equipment complies with the requirements according to the following standards.

| FCC 15.247<br>Section | RSS-247<br>Section          | TEST PARAMETERS              | Test Result |
|-----------------------|-----------------------------|------------------------------|-------------|
| 15.247 (a)2           | RSS-247 5.2a                | 6dB bandwidth                | Pass        |
| 15.247 (e)            | RSS-247 5.2b                | Power Spectral Density       | Pass        |
| 15.247 (b)3           | RSS-247 5.4d                | Output power Conducted       | Pass        |
| 15.247 (d)            | RSS-247 5.5                 | Conducted Spurious Emissions | Pass        |
| 15.205<br>15.209      | RSS Gen 8.9<br>RSS Gen 8.10 | Radiated Spurious Emissions  | Pass        |
|                       | RSS Gen 6.7                 | 99% bandwidth                | Pass        |

RSS 247-2 (Feb 2017) RSS Gen Issue5 Amd 2 (Feb 2021)

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF COMPLIANCE ENGINEERING IRELAND LTD

## Exhibit A – Technical Report

| Table | of Contents             |                               |
|-------|-------------------------|-------------------------------|
| 1.0   | EUT DESCRIPTION         |                               |
| 1.1   | EUT OPERATION           | 5                             |
| 1.2   |                         | ERROR! BOOKMARK NOT DEFINED.  |
| 1.3   |                         | ERROR! BOOKMARK NOT DEFINED.  |
| 1.4   | DESCRIPTION OF TEST M   | DDES                          |
| 2.0   | EMISSIONS MEASUREMEN    | ITS6                          |
| 3.0   | CONDUCTED EMISSIONS     | ON THE MAINS MEASUREMENTS7    |
| 4.0   | CONDUCTED MEASUREM      | ENTS ON THE ANTENNA PORT8     |
| 5.0   | SPURIOUS EMISSIONS      |                               |
| 6.0   | MEASUREMENT UNCERTA     | NINTY                         |
| 7.0   | LIST OF TEST EQUIPMENT  |                               |
|       |                         |                               |
| APPE  | NDIX A SCANS FOR CONDU  | CTED MEASUREMENTS             |
| APPE  | NDIX B SCANS FOR RADIAT | ED BAND EDGE /RESTRICTED BAND |

#### IN THIS DOCUMENT

| APPENDIX C | SCANS FOR RADIATED SPURIOUS EMISSIONS |
|------------|---------------------------------------|
| APPENDIX D | CONDUCTED EMISSIONS ON THE MAINS      |
| APPENDIX E | EUT ORIENTATIONS                      |
| APPENDIX F | BLOCK DIAGRAM OF TEST SETUPS          |

# 1.0 EUT Description

.

| Туре:                         | Sensor with Bluetooth Low Energy        |
|-------------------------------|---|
| Type of radio:                | Stand-alone                             |
| Transmitter Type:             | Bluetooth Low Energy                    |
| Operating Frequency Range(s): | 2.402 GHz - 2.480GHz                    |
| Number of Channels:           | 39                                      |
| Antenna:                      | Integral                                |
| Power configuration:          | 12 v DC                                 |
| Ports:                        | None                                    |
| Classification:               | DTS                                     |
| BLE Antenna Type :            | Pcb printed antenna                     |
| BLE Antenna Gain Max:         | 2.4 dBi                                 |
| BLE Antenna Impedance:        | 50 ohms                                 |
| Test Standards:               | 15.247 RSS-247                          |
| Test Methodology:             | Measurements performed according to the |
|                               | procedures in ANSI C63.10-2013          |
|                               | KDB 558074 V5 R02                       |

The EUT was a /sensor with BLE connectivity

Appendix C

**Radiated Spurious Emissions** 

## Report Ref: 21E9046-1a Page 6 of 15

| Receiver     | Spectru     | n 🗴            |        |                     |             |
|--------------|-------------|----------------|--------|---------------------|-------------|
|              | RBW 100 kHz |                | 100 ms |                     |             |
| Input 1 AC 🖷 |             | Preamp         | ON     | Step TD Scan        |             |
| Scan O1Pk    | Max         |                |        |                     |             |
|              |             |                |        | 100 MHz             |             |
| 90 dBµV      |             |                |        |                     |             |
| 80 dBµV      |             |                |        |                     |             |
| 70 dBµV      |             |                |        |                     |             |
| 60 dBµV      |             |                |        |                     |             |
| 50 dBµV      |             |                | 1      |                     |             |
| 40 dBµV      |             |                |        |                     |             |
| 30 dBµV      |             |                |        |                     |             |
| 20 dBµV      |             | and the second |        |                     | manunder    |
| 10 dBµV      |             | ~~~~           | monen  | wonderstand man man | 1 Martin    |
|              |             |                |        |                     | TF          |
| Start 30.0 M | IHz         |                |        | Sto                 | p 300.0 MHz |

Fig C1 High Channel Radiated Emissions 30MHz -300MHz Vertical 3metres

| Receiver     | Spectrur    | n 🗴       |           |  |
|--------------|-------------|-----------|-----------|--|
|              | RBW 100 kHz | MT        | 100 ms    | s 871_3mx  |
| Input 1 AC 🖷 | Att 0 dB    | Preamp    | ON        | I Step TD Scan   |
| Scan 🔾 1Pk I | Max         |           |           |  |
|              |             |           |           | 100 MHz  |
| 90 dBµV      |             |           |           |  |
| 80 dBµV      |             |           |           |  |
| 70 dвµV      |             |           |           |  |
| 60 dBµV      |             |           |           |  |
| 50 dBµV      |             |           |           |  |
| 40 dBµV      |             |           |           |  |
| 30 dBµV      |             |           |           |  |
| 20 dBµV      |             |           |           | Marine and a second   |
| 10 dBµV      | manne       | mon       | nduranten | muniter and the manual and the second and the second secon |
|              |             |           |           | TF   |
| Start 30.0 M |             |           |           | Stop 300.0 MHz   |
|              | Fig C2 Hig  | jh Channe | I Radiate | ted Emissions 30MHz -300MHz Horizontal 3metres   |

#### Report Ref: 21E9046-1a Page 7 of 15

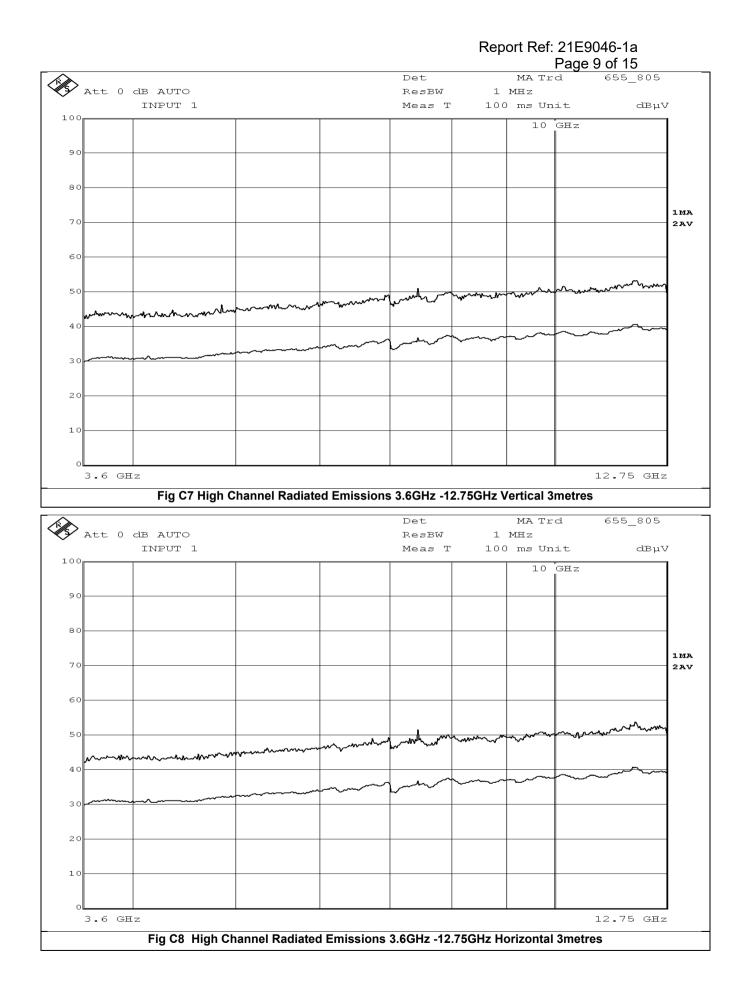
| Receiver       | Spectrun    | n 🙁   |                               |   |                |                  |
|----------------|-------------|---|-------------------------------|---|----------------|------------------|
| I              | RBW 100 kHz | MT 100 ms   | 60                            | 9_3mx   |                |                  |
|                |             | Preamp ON   | Step TD Scan                  |   |                |                  |
| Scan O1Pk M    | ax          |   |                               |   |                |                  |
|                | i i         |   |                               |   |                |                  |
|                |             |   |                               |   |                |                  |
| 90 dBµV        | 1           |   |                               |   |                |                  |
|                | 1           |   |                               | 1   |                |                  |
| 80 dBµV        |             |   | 1                             |   |                |                  |
|                |             |   |                               |   |                |                  |
| 70 dBµV        |             |   |                               |   |                |                  |
|                |             |   |                               |   |                |                  |
| 60 dBµV        |             |   | 1                             |   |                |                  |
|                |             |   |                               |   |                |                  |
| 50 dBµV        |             |   | 1                             |   |                |                  |
|                |             |   |                               |   |                |                  |
| 40 dBµV        | Î.          |   |                               |   |                | 1                |
| 40 ubμv        |             |   |                               |   |                |                  |
|                |             |   |                               |   |                | - manund         |
| 30 dBµV        |             |   | um and a second second second | , the   | monormal       | where we want it |
|                |             | and the short   | a many month the march        | and a start and a start |                |                  |
| 20 dBµV        | mannan      | Carlo and C |                               |   |                |                  |
|                |             |   |                               |   |                |                  |
| 10 dBµV        |             |   | 1                             |   |                |                  |
|                |             |   |                               |   |                |                  |
|                | <u>i</u>    |   |                               |   | l l            | Eten 1 0 CUp     |
| Start 300.0 MI |             | ligh Channal Dadi   | ated Emissions 300            |   | utical 2matric | Stop 1.0 GHz     |

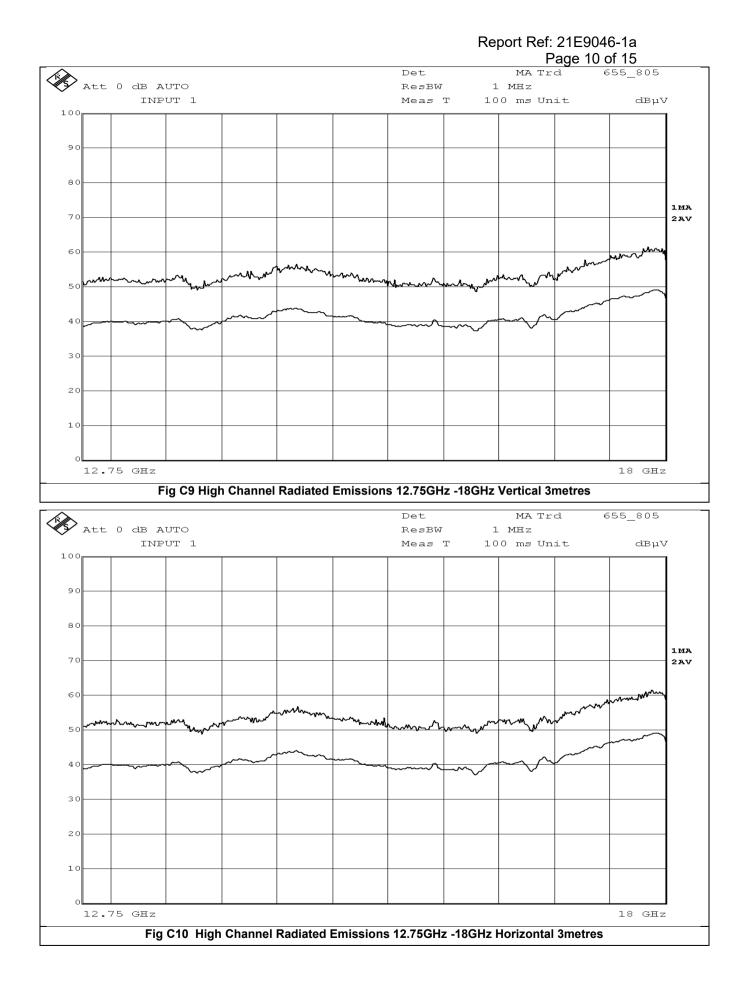
| Receiver   | Spectrun         | n 🗴        |         |  |           |              |                         |              |
|--|------------------|------------|---------|--|-----------|--------------|-------------------------|--------------|
|  | <b>W</b> 100 kHz |            | 100 ms  |  | )9_3mx    |              |                         |              |
| Input 1 AC 🖷 Att   | 0 dB             | Preamp     | ON      | Step TD Scan   |           |              |                         |              |
| Scan 😑 1Pk Max   |                  |            |         | - <u>.</u>   |           | ·            |                         |              |
|  | 1<br>1<br>1      |            |         |  |           | 1            |                         |              |
| 90 dBµV  | 1                |            |         |  |           |              |                         |              |
| 90 ивру  | 1                |            |         |  |           | 1            |                         |              |
|  | 1                |            |         |  |           |              |                         |              |
| 80 dBµV  |                  |            |         |  | 1         |              |                         |              |
|  | 1                |            |         |  |           | 1            |                         |              |
| 70 dBµV  | 1                |            |         |  |           | 1            |                         |              |
|  | 1                |            |         |  |           | 1            |                         |              |
| 60 dBµV  |                  |            |         |  |           | 1            |                         |              |
|  | 1                |            |         |  |           | 1            |                         |              |
| 50 dBµV  |                  |            |         | 1  | 1         | 1            |                         |              |
|  | 1                |            |         |  |           | 1            |                         |              |
| 40 dBµV  |                  |            |         |  |           | 1            |                         |              |
| in and in the  | 1                |            |         |  |           | 1            |                         |              |
| 30 dBµV  | 1                |            |         |  | 1         | 1            |                         | and more man |
| 00 dbp.  | 1                |            |         | and the second s | man month | ashow housed | a farment of the second |              |
| 20 dBuy/   |                  | - making m | man man | restrict monthly marked and  |           | 1            |                         |              |
| 20 dBµV  | www.cum          |            |         |  |           | 1            |                         |              |
|  | 1                |            |         |  |           | 1            |                         |              |
| 10 dBµV  | 1                |            |         |  |           | 1            |                         |              |
|  | 1                |            |         |  |           | 1            |                         | TF           |
| Start 300.0 MHz  | 1                |            |         | L.   | L.        |              | Stop                    | 1.0 GHz      |
| Fig C4 High Channel Radiated Emissions 300MHz -1GHz Horizontal 3metres |                  |            |         |  |           |              |                         |              |

## Report Ref: 21E9046-1a Page 8 of 15

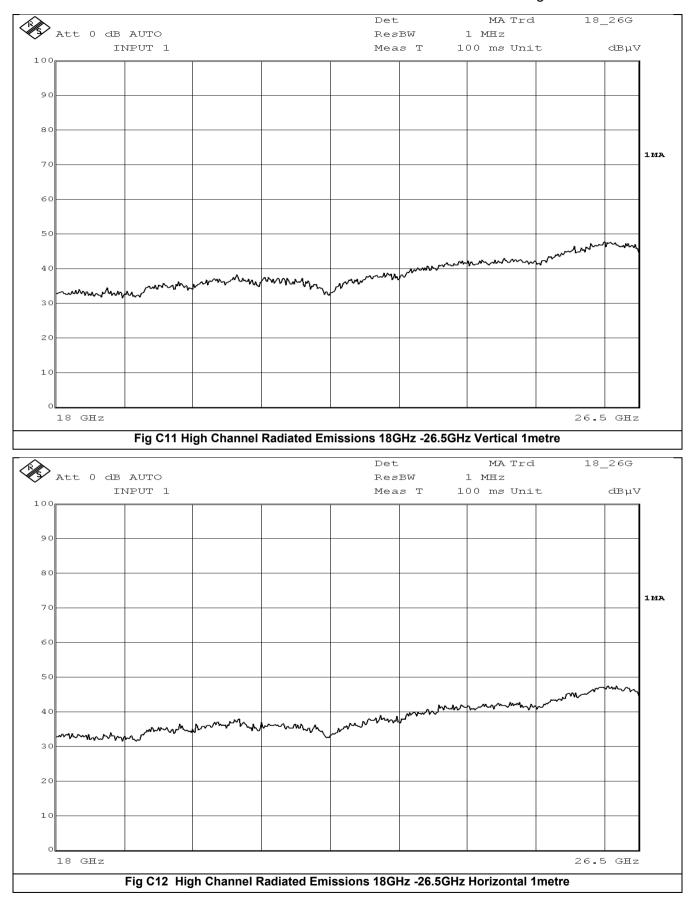
| Receiver Spectrum 4 🗴   | E                    |
|---|----------------------|
| RBW 1 MHz MT 5 ms 655Rx   |                      |
| Input 1 AC 🖷 Att 0 dB Preamp ON Step TD Scan  |                      |
| Scan O1Pk Max   | :                    |
|   |                      |
| 90 dBµV   | 1                    |
|   |                      |
| 80 dBµV   |                      |
|   |                      |
| 70 dвµv   |                      |
|   |                      |
| 60 dBµV   |                      |
|   |                      |
| 50 dBµV   |                      |
| 40 dBuV   | wanter a marting     |
| AD dByV   | 1                    |
| and the first of the second |                      |
| 30 dвµV   |                      |
|   |                      |
| 20 dBµV   |                      |
|   |                      |
| 10 dBµV   |                      |
|   |                      |
| Start 1.0 GHz   | : TF<br>Stop 3.6 GHz |
| Fig C5 High Channel Radiated Emissions 1GHz -3.6GHz Vertical 3metres  |                      |

| Receiver Spectrum 4 🗴  |                              |
|--|------------------------------|
| RBW 1 MHz MT 5 ms 655Rx  |                              |
| Input 1 AC 🖷 Att 0 dB Preamp ON Step TD Scan   |                              |
| Scan O1Pk Max  |                              |
|  |                              |
| 90 dBµV  |                              |
|  |                              |
| 80 dBµV  |                              |
|  |                              |
| 70 dBµV  |                              |
|  |                              |
| 60 dBµV  |                              |
|  |                              |
| 50 dBµV  |                              |
| 40 dBµV-   | a har month wanter a horizon |
| 10 dawn when the second and the seco | Course and an                |
| WAY BBUY   |                              |
|  |                              |
| 30 dBµV  |                              |
|  |                              |
| 20 dBµV  |                              |
|  |                              |
| 10 dBµV  |                              |
|  | TF                           |
| Start 1.0 GHz  | Stop 3.6 GHz                 |
| Fig C6 High Channel Radiated Emissions 1GHz -3.6GHz Horizontal 3   | metres                       |





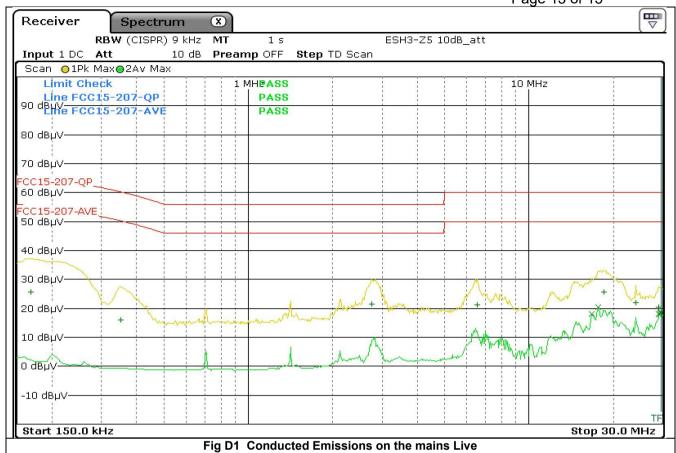
Report Ref: 21E9046-1a Page 11 of 15

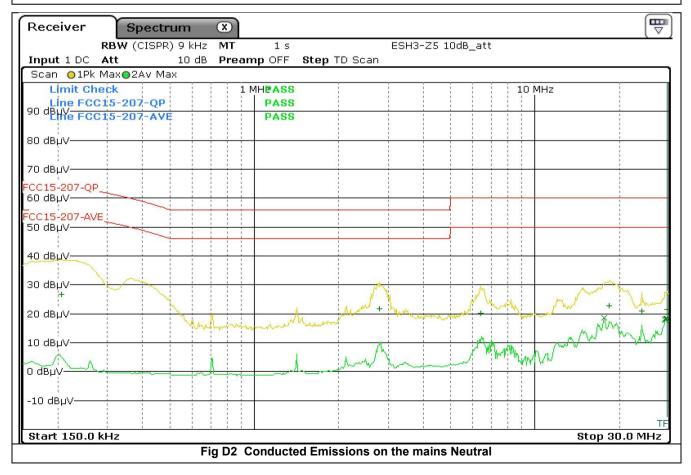


Appendix D

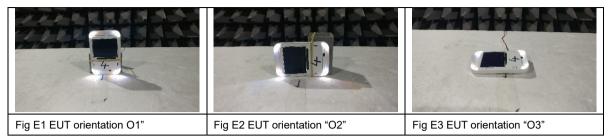
Conducted Emissions on the mains

#### Report Ref: 21E9046-1a Page 13 of 15



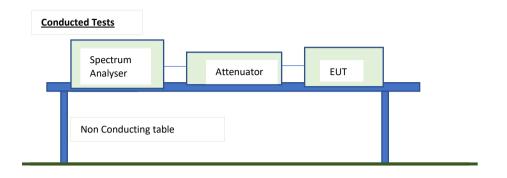


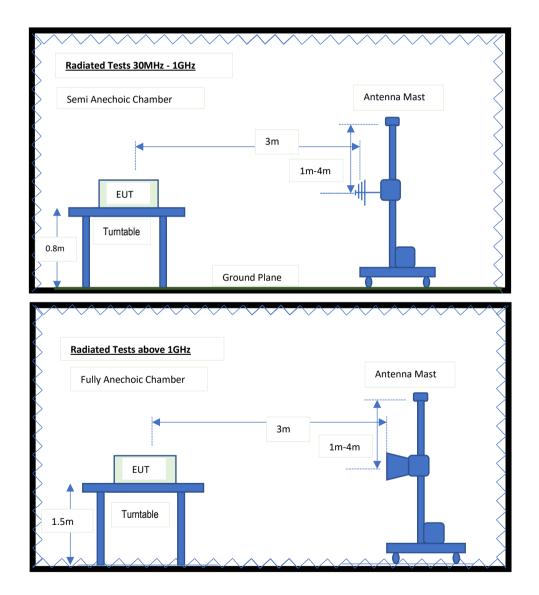
## Appendix E



Orientations for Radiated Emissions

#### Appendix F Block Diagrams of test set up





**End of Report**