



**DATE: 11 December 2016**

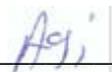
**I.T.L. (PRODUCT TESTING) LTD.**

**FCC/IC Radio Test Report**  
for  
**AllBe Solutions Ltd, Israel**

**Equipment under test:**  
**AllBe1 Multisensor**

**00001**

Tested by:

  
\_\_\_\_\_

A. Yizhak

Approved by:

  
\_\_\_\_\_

D. Shidlowsky

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.



## Measurement/Technical Report for AllBe Solutions Ltd, Israel

AllBe1 Multisensor

00001

**FCC ID: 2AJWE-ALLBE**

**IC: 22019-ALLBE**

|                       |   |
|-----------------------|---|
| This report concerns: | Original Grant: X   |
|                       | Class I Change:   |
|                       | Class II Change:  |
| Equipment type:       | Digital Transmission System<br>IC: Spread Spectrum Digital Device<br>(2400-2483.5)      |
| Limits used:          | 47CFR15 Section 15.247<br>RSS-247, Issue 1, May 2015<br>RSS Gen, Issue 4, November 2014 |

Measurement procedure used is KDB 558074 D01 v03r05 and ANSI C63.10:2013.

|   |  |
|---|--|
| Application for Certification<br>prepared by:                       | Applicant for this device:<br>(different from "prepared by") |
| R. Pinchuck   | Ofer Lugasi  |
| ITL (Product Testing) Ltd.  | AllBe Solutions Ltd.   |
| 1 Bat Sheva St.   | 6 Hashaked St.,  |
| Lod 7116002   | Nordiya, 4295400, Israel                                     |
| e-mail <a href="mailto:Rpinchuck@itl.co.il">Rpinchuck@itl.co.il</a> | Tel:: +972-52-288-2883                                       |
|   | Fax: +972-   |
|   | e-mail: ofer@allbe1.com                                      |



# TABLE OF CONTENTS

|            |   |           |
|------------|---|-----------|
| <b>1</b>   | <b>GENERAL INFORMATION</b>  | <b>5</b>  |
| 1.1        | Administrative Information  | 5         |
| 1.2        | List of Accreditations  | 6         |
| 1.3        | Product Description   | 7         |
| 1.4        | Test Methodology  | 7         |
| 1.5        | Test Facility   | 7         |
| 1.6        | Measurement Uncertainty   | 7         |
| <b>2</b>   | <b>SYSTEM TEST CONFIGURATION</b>                                      | <b>8</b>  |
| 2.1        | Justification   | 8         |
| 2.2        | EUT Exercise Software   | 8         |
| 2.3        | Special Accessories   | 8         |
| 2.4        | Equipment Modifications   | 8         |
| 2.5        | Configuration of Tested System  | 9         |
| <b>3</b>   | <b>CONDUCTED &amp; RADIATED MEASUREMENT TEST SET-UP PHOTOS</b>        | <b>10</b> |
| <b>4</b>   | <b>CONDUCTED EMISSION FROM AC MAINS</b>                               | <b>13</b> |
| 4.1        | Test Specification  | 13        |
| 4.2        | Test Procedure  | 13        |
| 4.3        | Test Results  | 13        |
| 4.4        | Test Equipment Used; Conducted Emissions from AC Mains                | 18        |
| <b>5</b>   | <b>6 DB MINIMUM BANDWIDTH</b>   | <b>19</b> |
| 5.1        | Test Specification  | 19        |
| 5.2        | Test Procedure  | 19        |
| 5.3        | Test Results  | 19        |
| 5.4        | Test Equipment Used; 6dB Bandwidth                                    | 21        |
| <b>6.</b>  | <b>MAXIMUM TRANSMITTED PEAK POWER OUTPUT</b>                          | <b>22</b> |
| 6.1        | Test Specification  | 22        |
| 6.2        | Test Procedure  | 22        |
| 6.3        | Test Results  | 22        |
| 6.4        | Test Equipment Used; Maximum Peak Power Output                        | 24        |
| <b>7.</b>  | <b>BAND EDGE SPECTRUM</b>   | <b>25</b> |
| 7.1        | Test Specification  | 25        |
| 7.2        | Test Procedure  | 25        |
| 7.3        | Test Results  | 25        |
| 7.4        | Test Equipment Used; Band Edge Spectrum                               | 27        |
| <b>8.</b>  | <b>EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS</b>                    | <b>28</b> |
| 8.1        | Test Specification  | 28        |
| 8.2        | Test Procedure  | 28        |
| 8.3        | Test Limit  | 28        |
| 8.4        | Test Results  | 29        |
| 8.5        | Test Instrumentation Used, Emission in Non Restricted Frequency Bands | 30        |
| <b>9.</b>  | <b>EMISSIONS IN RESTRICTED FREQUENCY BANDS</b>                        | <b>31</b> |
| 9.1        | Test Specification  | 31        |
| 9.2        | Test Procedure  | 31        |
| 9.3        | Test Results  | 32        |
| 9.4        | Test Instrumentation Used; Emissions in Restricted Frequency Bands    | 37        |
| <b>10.</b> | <b>TRANSMITTED POWER DENSITY</b>                                      | <b>38</b> |
| 10.1       | Test Specification  | 38        |
| 10.2       | Test Procedure  | 38        |
| 10.3       | Test Results  | 38        |
| 10.4       | Test Equipment Used; Transmitted Power Density                        | 41        |
| <b>11.</b> | <b>ANTENNA GAIN/INFORMATION</b>                                       | <b>42</b> |
| <b>12.</b> | <b>AVG. FACTOR CALCULATION</b>  | <b>43</b> |



|            |  |           |
|------------|--|-----------|
| <b>13.</b> | <b>R.F EXPOSURE/SAFETY</b>                               | <b>45</b> |
| <b>14.</b> | <b>APPENDIX A - CORRECTION FACTORS</b>                   | <b>47</b> |
| 14.1       | Correction factors for CABLE from EMI receiver           | 47        |
| 14.2       | Correction factor for RF CABLE for Semi Anechoic Chamber | 48        |
| 14.3       | Correction factors for Low Loss CABLE                    | 49        |
| 14.4       | Correction factors for Horn Antenna                      | 50        |
| 14.5       | Correction factors for Horn ANTENNA                      | 51        |
| 14.6       | Correction factors for Log Periodic Antenna              | 52        |
| 14.7       | Correction factors for ACTIVE LOOP ANTENNA               | 53        |
| 14.8       | Correction factors for Biconical Antenna                 | 54        |



# 1 General Information

## 1.1 Administrative Information

|                                |  |
|--------------------------------|--|
| Manufacturer:                  | AllBe Solutions Ltd, Israel  |
| Manufacturer's Address:        | 6 Hashaked St.,<br>Nordiya, 4295400<br>Israel<br>Tel: +972-52-288-2883                 |
| Manufacturer's Representative: | Ofer Lugasi  |
| Equipment Under Test (E.U.T):  | AllBe1 Multisensor   |
| Product Marketing Name (PMN):  | AllBe1   |
| Equipment Serial No.:          | Not designated   |
| HVIN:                          | AB001  |
| Date of Receipt of E.U.T:      | August 28, 2016  |
| Start of Test:                 | August 28, 2016  |
| End of Test:                   | September 12, 2016   |
| Test Laboratory Location:      | I.T.L (Product Testing) Ltd.<br>1 Batsheva St.,<br>Lod<br>ISRAEL 7120101               |
| Test Specifications:           | FCC Part 15, Subpart C<br>RSS-247, Issue 1, May 2015<br>RSS Gen Issue 4, November 2014 |



## **1.2 List of Accreditations**

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

### 1.3 Product Description

The AllBe1 is a multi-sensor with extended BLE range that the user can define many features via the Smart phone app.

The AllBe1 has the following features:

- \* Human detection- by passive infra-red detector;
- \* Tilt alarm by 3D accelerometer;
- \* UV sensing monitoring;
- \* Temperature sensing and monitoring;
- \* Out of range detection;
- \* Asset tracking.

|                                  |                              |
|----------------------------------|------------------------------|
| Working voltage                  | 3.1-4.2V DC battery operated |
| Mode of operation                | Transceiver                  |
| Modulations                      | GFSK                         |
| Frequency Range                  | 2402MHz-2480MHz              |
| Transmit power                   | ~8dBm                        |
| Antenna Gain                     | 2.5 dBi                      |
| Modulation BW                    | >500kHz                      |
| Temperature (°C)/ Humidity (%RH) | 25°C/44%                     |

### 1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v03r05 and ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### 1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

### 1.6 Measurement Uncertainty

#### Conducted Emission

(CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

#### Radiated Emission

(CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

## 2 System Test Configuration

### 2.1 Justification

Exploratory emission testing was performed in 3 orthogonal polarities to determine the worst case.

The fundamental results are shown in the below table:

| Frequency (MHz) | Y axis (dBuV/m) | X axis (dBuV/m) | Z axis (dBuV/m) |
|-----------------|-----------------|-----------------|-----------------|
| 2402.0          | 98.78           | 97.28           | 88.52           |
| 2440.0          | 100.93          | 95.21           | 95.12           |
| 2480.0          | 102.24          | 98.49           | 95.34           |

Figure 1. Screening Results

According to above results the worst case was the Y axis.

The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz) in BLE technology.

The E.U.T. was tested connected via a jig to a laptop in order to change the tested frequencies.

### 2.2 EUT Exercise Software

No special exercise software was used.

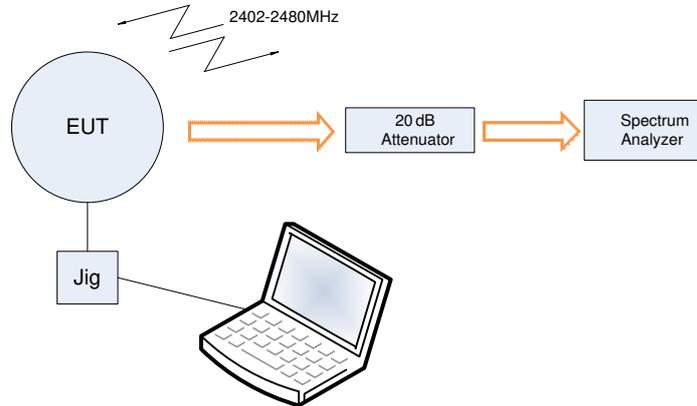
### 2.3 Special Accessories

No special accessories were needed to achieve compliance.

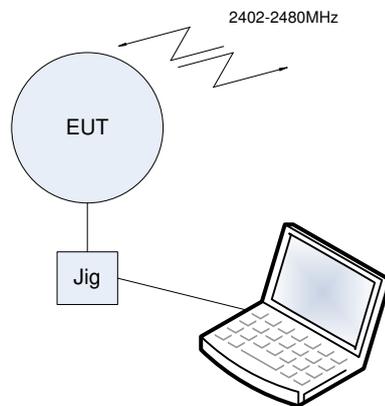
### 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

## 2.5 Configuration of Tested System



**Figure 2. Configuration of Tested System Conducted**



**Figure 3. Configuration of Tested System Radiated**

### 3 Conducted & Radiated Measurement Test Set-Up Photos



Figure 4. Conducted Emission From AC Mains Test

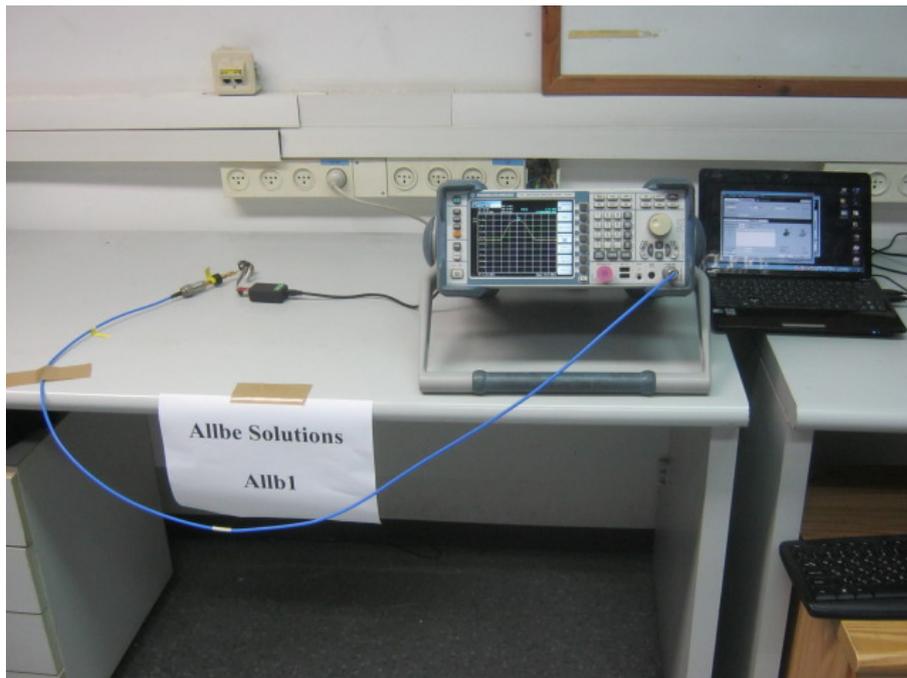
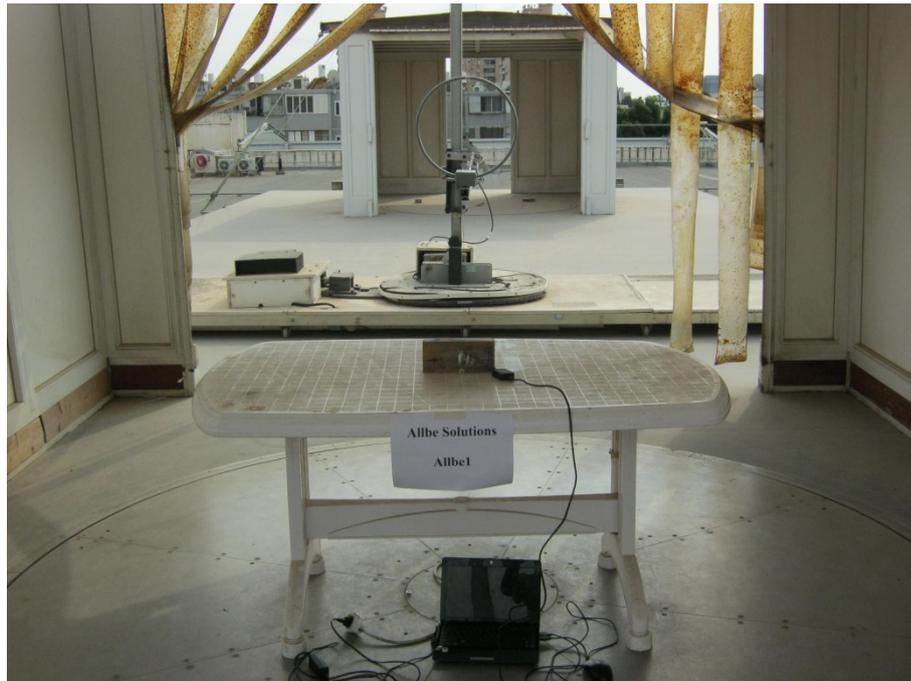


Figure 5. Conducted Test Set-Up



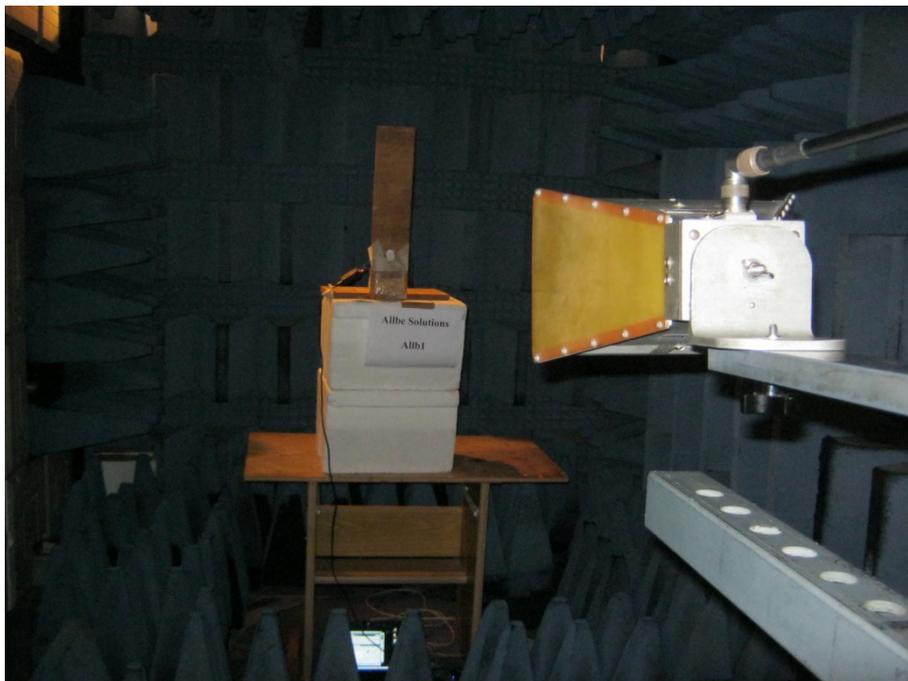
**Figure 6. Radiated Emission Test**



**Figure 7. Radiated Emission Test**



**Figure 8. Radiated Emission Test**



**Figure 9. Radiated Emission Test**

## 4 Conducted Emission From AC Mains

### 4.1 Test Specification

FCC Part 15, Subpart C, Class B  
RSS Gen, Issue 4, 2014, Section 8.8

### 4.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 4.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see Section 3), with the E.U.T placed on a 0.4 meter high wooden table. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered via 50 Ohm / 50  $\mu$ Hn Artificial Mains Network (AMN) on the phase and neutral lines. The AMN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 4. Conducted Emission From AC Mains Test*.

The emission voltages at the AMN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are pre-loaded to the receiver and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

### 4.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Subpart C, Class B and RSS Gen, Issue 4, 2014, Section 8.8 specifications.

The margin between the emission levels and the specification limit is, in the worst case, 24.05 dB for the phase line at 0.150 MHz and 27.38 dB at 0.150 MHz for the neutral line.

The details of the highest emissions are given in *Figure 10* to *Figure 13*.



## Conducted Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C, Class B  
RSS Gen, Issue 4, 2014, Section 8.8

Lead: Phase

Detectors: Quasi-peak, Average

| EDIT PEAK LIST (Final Measurement Results) |            |            |                  |                |
|--|------------|------------|------------------|----------------|
| TRACE                                      |            | FREQUENCY  | LEVEL dB $\mu$ V | DELTA LIMIT dB |
| Trace1:                                    | CE22BQP    |            |                  |                |
| Trace2:                                    | CE22BAP    |            |                  |                |
| Trace3:                                    | ---        |            |                  |                |
| 1  | Quasi Peak | 150 kHz    | 33.95            | -32.04         |
| 2  | Average    | 150 kHz    | 31.94            | -24.05         |
| 1  | Quasi Peak | 206 kHz    | 31.04            | -32.32         |
| 2  | Average    | 206 kHz    | 25.30            | -28.06         |
| 2  | Average    | 358 kHz    | 21.23            | -27.54         |
| 1  | Quasi Peak | 378 kHz    | 25.93            | -32.38         |
| 2  | Average    | 578 kHz    | 14.20            | -31.79         |
| 2  | Average    | 722 kHz    | 12.25            | -33.74         |
| 2  | Average    | 890 kHz    | 12.83            | -33.16         |
| 2  | Average    | 1.142 MHz  | 9.60             | -36.40         |
| 2  | Average    | 1.29 MHz   | 12.87            | -33.12         |
| 1  | Quasi Peak | 4.842 MHz  | 17.53            | -38.46         |
| 1  | Quasi Peak | 11.31 MHz  | 17.18            | -42.82         |
| 1  | Quasi Peak | 11.582 MHz | 17.62            | -42.37         |
| 1  | Quasi Peak | 12.006 MHz | 18.66            | -41.33         |
| 1  | Quasi Peak | 12.03 MHz  | 18.78            | -41.21         |
| 1  | Quasi Peak | 12.122 MHz | 18.51            | -41.48         |
| 2  | Average    | 12.486 MHz | 11.64            | -38.35         |
| 1  | Quasi Peak | 23.93 MHz  | 20.73            | -39.26         |
| 2  | Average    | 23.93 MHz  | 16.70            | -33.29         |

Date: 28.AUG.2016 16:16:40

Figure 10. Detectors: Quasi-peak, Average

*Note: DELTA LIMIT refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

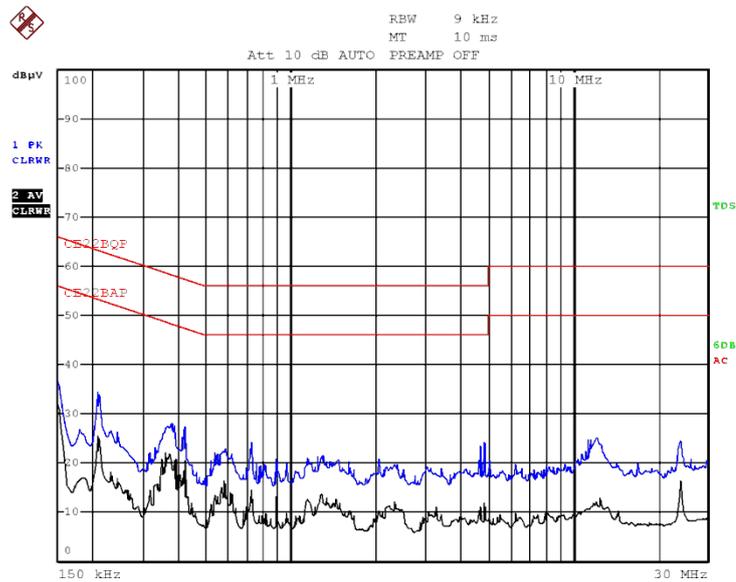
# Conducted Emission

E.U.T Description      AllBe1 Multisensor  
Type                      00001  
Serial Number:         Not designated

Specification:      FCC Part 15, Subpart C, Class B  
                            RSS Gen, Issue 4, 2014, Section 8.8

Lead:                 Phase

Detectors:         Quasi-peak, Average



Date: 28.AUG.2016 16:15:46

**Figure 11 Detectors: Quasi-peak, Average**



## Conducted Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C, Class B  
RSS Gen, Issue 4, 2014, Section 8.8

Lead: Neutral

Detectors: Quasi-peak, Average

| EDIT PEAK LIST (Final Measurement Results) |            |            |                |
|--|------------|------------|----------------|
| TRACE                                      | FREQUENCY  | LEVEL dBμV | DELTA LIMIT dB |
| Trace1:                                    | CE22BQP    |            |                |
| Trace2:                                    | CE22BAP    |            |                |
| Trace3:                                    | ---        |            |                |
| 1 Quasi Peak                               | 150 kHz    | 31.11      | -34.89         |
| 2 Average                                  | 150 kHz    | 28.61      | -27.38         |
| 1 Quasi Peak                               | 210 kHz    | 28.12      | -35.08         |
| 2 Average                                  | 210 kHz    | 22.58      | -30.62         |
| 2 Average                                  | 370 kHz    | 15.35      | -33.14         |
| 1 Quasi Peak                               | 414 kHz    | 22.95      | -34.61         |
| 1 Quasi Peak                               | 10.778 MHz | 17.48      | -42.51         |
| 1 Quasi Peak                               | 11.326 MHz | 18.99      | -41.00         |
| 2 Average                                  | 11.43 MHz  | 10.93      | -39.06         |
| 1 Quasi Peak                               | 11.594 MHz | 19.82      | -40.18         |
| 2 Average                                  | 12.13 MHz  | 12.37      | -37.63         |
| 1 Quasi Peak                               | 12.19 MHz  | 21.17      | -38.82         |
| 2 Average                                  | 12.306 MHz | 11.97      | -38.03         |
| 1 Quasi Peak                               | 12.322 MHz | 21.06      | -38.93         |
| 1 Quasi Peak                               | 12.474 MHz | 19.99      | -40.00         |
| 1 Quasi Peak                               | 12.498 MHz | 20.18      | -39.81         |
| 2 Average                                  | 12.498 MHz | 13.31      | -36.68         |
| 2 Average                                  | 12.526 MHz | 10.78      | -39.22         |
| 2 Average                                  | 13.318 MHz | 11.55      | -38.44         |
| 2 Average                                  | 23.93 MHz  | 13.55      | -36.44         |

Date: 28.AUG.2016 16:23:53

Figure 12. Detectors: Quasi-peak, Average

*Note: DELTA LIMIT refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

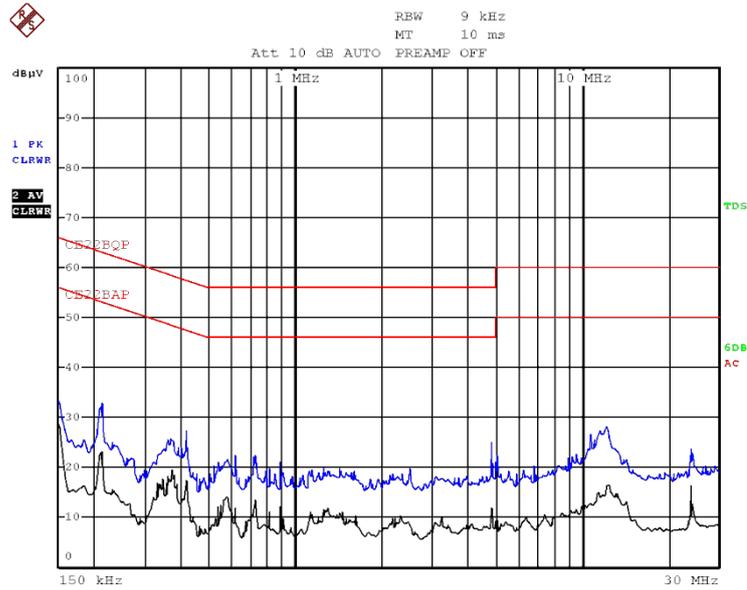
# Conducted Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C, Class B  
RSS Gen, Issue 4, 2014, Section 8.8

Lead: Neutral

Detectors: Quasi-peak, Average



Date: 28.AUG.2016 16:22:53

Figure 13 Detectors: Quasi-peak, Average



#### 4.4 Test Equipment Used; Conducted Emissions from AC Mains

| <b>Instrument</b> | <b>Manufacturer</b> | <b>Model</b> | <b>Serial No.</b> | <b>Last Calibration Date</b> | <b>Next Calibration Due</b> |
|-------------------|---------------------|--------------|-------------------|------------------------------|-----------------------------|
| AMN               | Fischer             | FCC-LISN-25A | 127               | June 23, 2016                | June 23, 2017               |
| Transient Limiter | HP                  | 11947A       | 3107A03041        | June 15, 2016                | June 15, 2017               |
| EMI Receiver      | Rohde & Schwarz     | ESCI7        | 100724            | February 29, 2016            | March 1, 2017               |

**Figure 14 Test Equipment Used**

## 5 6dB Minimum Bandwidth

### 5.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)  
RSS 247, Issue 1, 2015 , Section 5.2

### 5.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

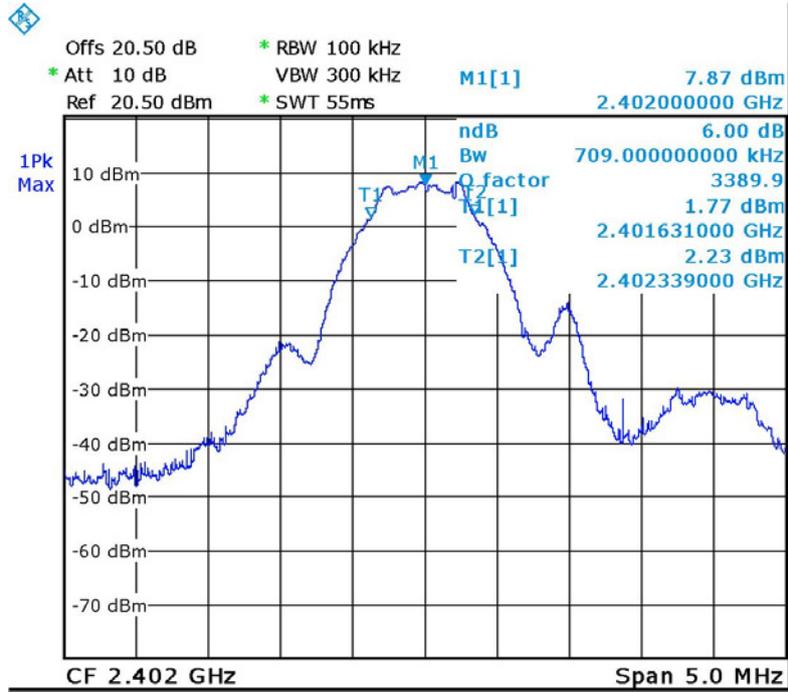
### 5.3 Test Results

| Operation Frequency (MHz) | Reading (MHz) | Specification (MHz) |
|---------------------------|---------------|---------------------|
| 2402                      | 0.709         | >0.5                |
| 2440                      | 0.719         | >0.5                |
| 2480                      | 0.708         | >0.5                |

**Figure 15 6 dB Minimum Bandwidth**

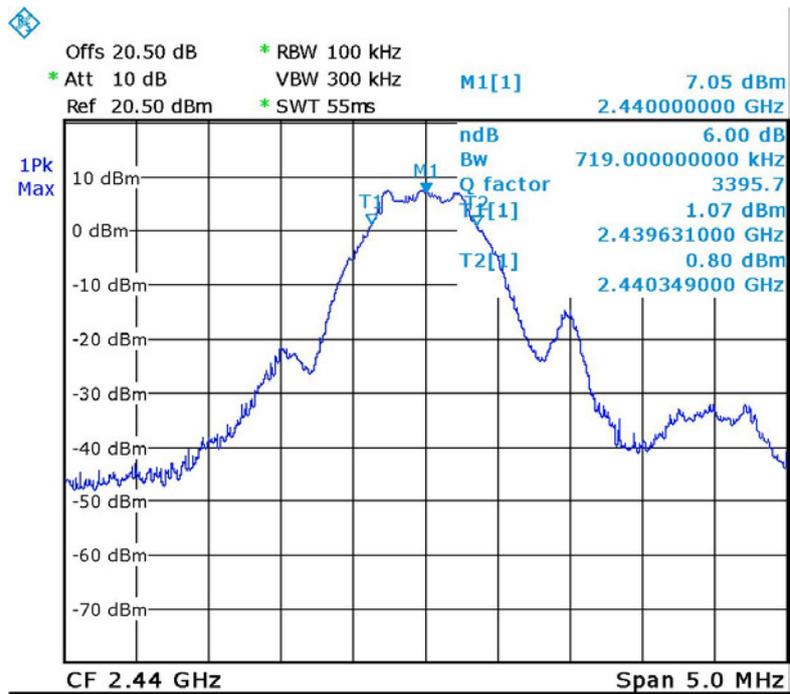
JUDGEMENT: Passed

For additional information see *Figure 16 to Figure 18*.



Date: 28.AUG.2016 10:44:37

Figure 16. 2402.0 MHz



Date: 28.AUG.2016 10:38:52

Figure 17. 2440.0 MHz

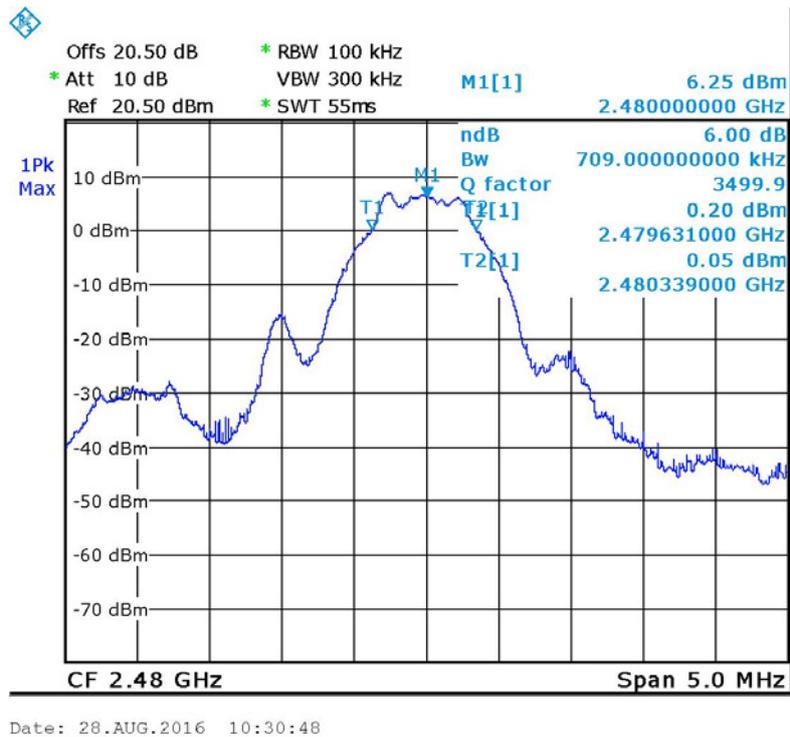


Figure 18. 2480.0 MHz

#### 5.4 Test Equipment Used; 6dB Bandwidth

| Instrument        | Manufacturer | Model     | Serial No. | Last Calibration Date | Next Calibration Due |
|-------------------|--------------|-----------|------------|-----------------------|----------------------|
| Spectrum Analyzer | R&S          | FSL6      | 100194     | February 29, 2016     | March 1, 2017        |
| 20 dB Attenuator  | MCL          | VAT-20W2+ | 848        | July 5, 2016          | July 5, 2017         |

Figure 19 Test Equipment Used

## 6 Maximum Transmitted Peak Power Output

### 6.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)  
RSS-247, Issue 1, May 2015, Section 5.4.4

### 6.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The E.U.T was evaluated in 3 channels: Low (2402.0 MHz), Mid (2440.0 MHz) and High (2480 MHz).

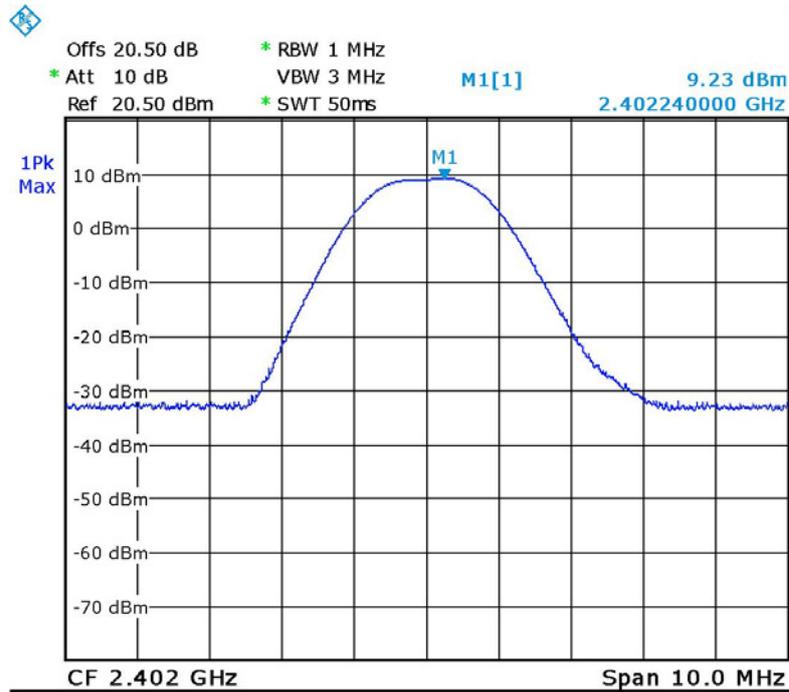
### 6.3 Test Results

| Operation Frequency (MHz) | Power (dBm) | Power (mW) | Specification (mW) | Margin (mW) |
|---------------------------|-------------|------------|--------------------|-------------|
| 2402.0                    | 9.23        | 8.38       | 1000.0             | -991.62     |
| 2440.0                    | 8.43        | 6.97       | 1000.0             | -993.03     |
| 2480.0                    | 7.91        | 6.18       | 1000.0             | -993.82     |

**Figure 20 Maximum Peak Power Output**

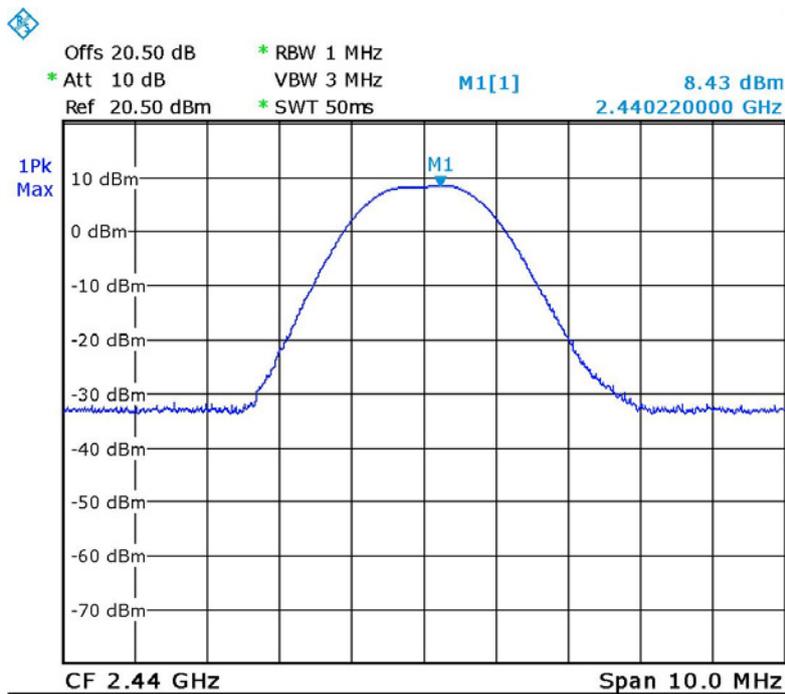
JUDGEMENT: Passed by 991.62 mW

For additional information see *Figure 21* to *Figure 23*.



Date: 28.AUG.2016 10:54:29

Figure 21 2402.0 MHz



Date: 28.AUG.2016 11:01:02

Figure 22 2440.0 MHz

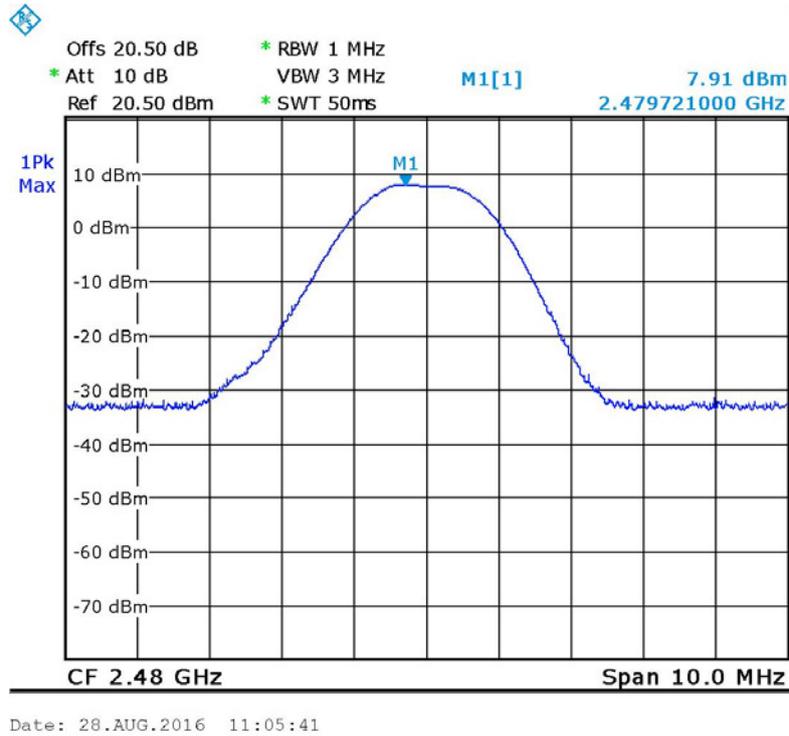


Figure 23 2480.0 MHz

#### 6.4 Test Equipment Used; Maximum Peak Power Output

| Instrument        | Manufacturer | Model     | Serial No. | Last Calibration Date | Next Calibration Due |
|-------------------|--------------|-----------|------------|-----------------------|----------------------|
| Spectrum Analyzer | R&S          | FSL6      | 100194     | February 29, 2016     | March 1, 2017        |
| 20 dB Attenuator  | MCL          | VAT-20W2+ | 848        | July 5, 2016          | July 5, 2017         |

Figure 24 Test Equipment Used

## 7 Band Edge Spectrum

### 7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)  
RSS-247, Issue 1, May 2015, Section 5.5

### 7.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The E.U.T was evaluated in 2 channels: Low and High.

The RBW was set to 100 kHz.

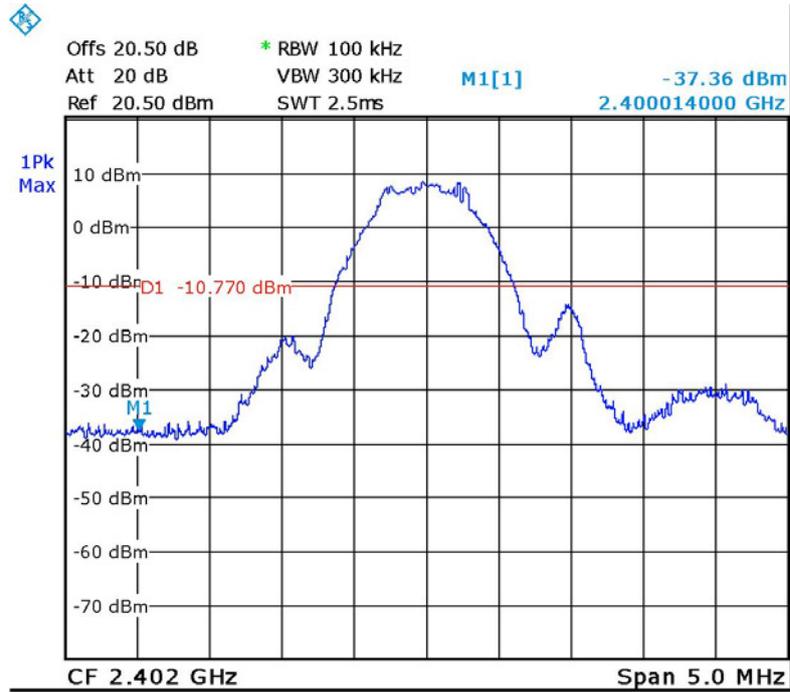
### 7.3 Test Results

| Operation Frequency (MHz) | Modulation | Band Edge Frequency (MHz) | Spectrum Level (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------|------------|---------------------------|----------------------|-------------|-------------|
| Low                       | BLE        | 2400.0                    | -37.36               | -10.77      | -26.59      |
| High                      | BLE        | 2483.5                    | -39.01               | -12.09      | -26.92      |

**Figure 25 Band Edge Spectrum**

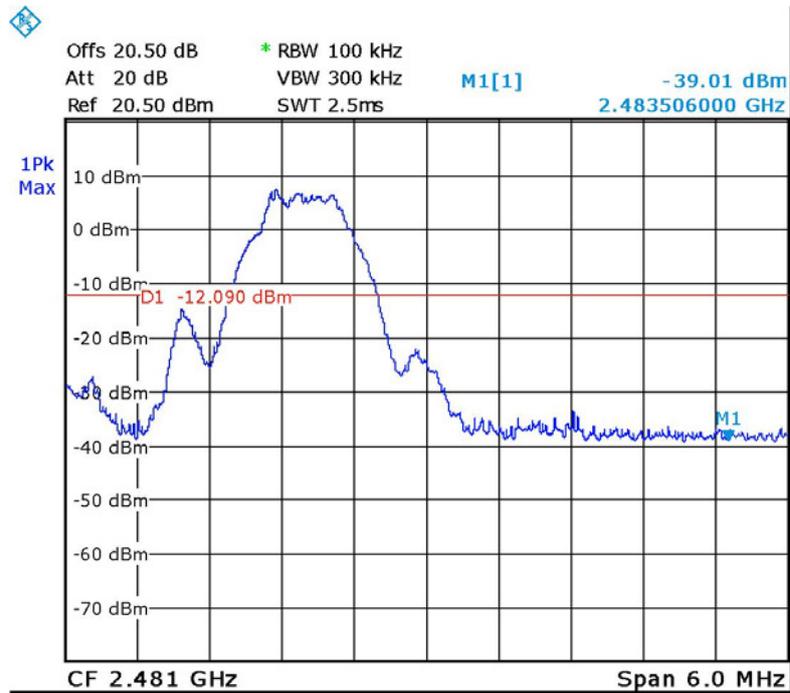
JUDGEMENT: Passed by 26.59 dB

For additional information see *Figure 26* and *Figure 27*.



Date: 28.AUG.2016 13:12:34

Figure 26 —Lower Band Edge



Date: 28.AUG.2016 13:31:29

Figure 27 —Upper Band Edge



### 7.4 Test Equipment Used; Band Edge Spectrum

| <b>Instrument</b> | <b>Manufacturer</b> | <b>Model</b> | <b>Serial No.</b> | <b>Last Calibration Date</b> | <b>Next Calibration Due</b> |
|-------------------|---------------------|--------------|-------------------|------------------------------|-----------------------------|
| Spectrum Analyzer | R&S                 | FSL6         | 100194            | February 29, 2016            | March 1, 2017               |
| 20 dB Attenuator  | MCL                 | VAT-20W2+    | 848               | July 5, 2016                 | July 5, 2017                |

**Figure 28 Test Equipment Used**

## 8 Emissions in Non-Restricted Frequency Bands

### 8.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)  
RSS 247 Issue 1 May 2015, Clause 5.5

### 8.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

#### **For measurements between 0.009MHz-30.0MHz:**

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 30.0MHz-1.0GHz:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

#### **For 1000.0MHz-25,000.0MHz range:**

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 1000 MHz-25000 MHz was scanned.

The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels.  
(2402, 2440, 2480 MHz).

### 8.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.



#### **8.4 Test Results**

JUDGEMENT:                      Passed

All signals were below the EMI receiver noise level which is at least 6dB below the specification limit.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) and RSS 247 Issue 1 May 2015, Clause 5.5 specification.



### 8.5 Test Instrumentation Used, Emission in Non Restricted Frequency Bands

| Instrument                  | Manufacturer    | Model        | Serial No.        | Last Calibration Date | Next Calibration Due |
|-----------------------------|-----------------|--------------|-------------------|-----------------------|----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724            | February 29, 2016     | March 1, 2017        |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204        | March 13, 2016        | March 13, 2017       |
| EMI Receiver                | HP              | 8542E        | 3906A00276        | March 3, 2016         | March 3, 2017        |
| RF Filter Section           | HP              | 85420E       | 3705A00248        | March 3, 2016         | March 3, 2017        |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275        | March 10, 2016        | March 10, 2017       |
| Biconical Antenna           | EMCO            | 3110B        | 9912-3337         | March 24, 2016        | March 24, 2018       |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081         | April 23, 2016        | April 23, 2017       |
| Horn Antenna                | ETS             | 3115         | 29845             | May 19, 2015          | May 19, 2018         |
| Horn Antenna                | ARA             | SWH-28       | 1007              | March 3, 2014         | September 30, 2016   |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950         | November 4, 2015      | November 30, 2016    |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13                | August 8, 2016        | August 8, 2017       |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232               | August 8, 2016        | August 8, 2017       |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120<br>ADI | March 10, 2016        | March 10, 2017       |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643          | N/A                   | N/A                  |
| Antenna Mast                | ETS             | 2070-2       | 9608-1497         | N/A                   | N/A                  |
| Turntable                   | ETS             | 2087         | -                 | N/A                   | N/A                  |
| Mast & Table Controller     | ETS/EMCO        | 2090         | 9608-1456         | N/A                   | N/A                  |

Figure 29 Test Equipment Used

## 9 Emissions in Restricted Frequency Bands

### 9.1 Test Specification

FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)  
RSS GEN, Issue 4: 2014, Clause 8.9; 8.10

### 9.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

#### **For measurements between 0.009MHz-30.0MHz:**

The E.U.T was tested inside the chamber at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 30.0MHz-1.0GHz:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For 1000.0MHz-25,000.0MHz range:**

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 3*.

The frequency range 1000 MHz-25000 MHz was scanned.

The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels.  
(2402, 2440, 2480 MHz).

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) | Field strength* (dB $\mu$ V/m) | Field strength* (dB $\mu$ V/m)@3m |
|-----------------|-----------------------------------|-------------------------------|--------------------------------|-----------------------------------|
| 0.009-0.490     | 2400/F(kHz)                       | 300                           | 48.5-13.8                      | 128.5-73.8                        |
| 0.490-1.705     | 24000/F(kHz)                      | 30                            | 33.8-23.0                      | 73.8-63.0                         |
| 1.705-30.0      | 30                                | 30                            | 29.5                           | 69.5                              |
| 30-88           | 100                               | 3                             | 40.0                           | 40.0                              |
| 88-216          | 150                               | 3                             | 43.5                           | 43.5                              |
| 216-960         | 200                               | 3                             | 46.0                           | 46.0                              |
| Above 960       | 500                               | 3                             | 54.0                           | 54.0                              |

\*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

**Figure 30 Table of Limits**

### 9.3 Test Results

JUDGEMENT: Passed by 1.9 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 1.1 dB at the frequency of 4804.0MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 11.7 dB at the frequency of 4880.0 MHz, vertical polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 1.9 dB at the frequency of 2483.5 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

The details of the highest emissions are given in *Figure 31* to *Figure 34*.



# Radiated Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 9KHz to 25.0 GHz  
Test Distance: 3 meters      Detector: Peak

| Operation Frequency (MHz) | Frequency (MHz) | Polarity (H/V) | Peak Reading (dBμV/m) | Peak Limit (dBμV/m) | Peak Margin (dB) |
|---------------------------|-----------------|----------------|-----------------------|---------------------|------------------|
| 2402.0                    | 2390.0          | H              | 59.2                  | 74.0                | -14.8            |
| 2402.0                    | 2390.0          | V              | 59.7                  | 74.0                | -14.3            |
| 2402.0                    | 4804.0          | H              | 58.6                  | 74.0                | -15.4            |
| 2402.0                    | 4804.0          | V              | 59.7                  | 74.0                | -14.3            |
| 2402.0                    | 7206.0          | H              | 48.5                  | 74.0                | -25.5            |
| 2402.0                    | 7206.0          | V              | 49.8                  | 74.0                | -24.2            |
| 2402.0                    | 9608.0          | H              | 49.1                  | 74.0                | -24.9            |
| 2402.0                    | 9608.0          | V              | 52.3                  | 74.0                | -21.7            |
| 2402.0                    | 12010.0         | H              | 46.4                  | 74.0                | -27.6            |
| 2402.0                    | 12010.0         | V              | 50.0                  | 74.0                | -24.0            |
| 2440.0                    | 4890.0          | H              | 50.4                  | 74.0                | -23.6            |
| 2440.0                    | 4890.0          | V              | 51.8                  | 74.0                | -22.2            |
| 2440.0                    | 7320.0          | H              | 46.1                  | 74.0                | -27.9            |
| 2440.0                    | 7320.0          | V              | 44.2                  | 74.0                | -29.8            |

**Figure 31. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 9KHz to 25.0 GHz  
Test Distance: 3 meters      Detector: Peak

| Operation Frequency<br>(MHz) | Frequency<br>(MHz) | Polarity<br>(H/V) | Peak Reading<br>(dB $\mu$ V/m) | Peak Limit<br>(dB $\mu$ V/m) | Peak Margin<br>(dB) |
|------------------------------|--------------------|-------------------|--------------------------------|------------------------------|---------------------|
| 2480.0                       | 4960.3             | H                 | 50.4                           | 74.0                         | -23.6               |
| 2480.0                       | 4960.0             | V                 | 44.8                           | 74.0                         | -29.2               |
| 2480.0                       | 7439.2             | H                 | 50.2                           | 74.0                         | -23.8               |
| 2480.0                       | 7439.4             | V                 | 44.9                           | 74.0                         | -29.1               |
| 2480.0                       | 2483.5             | H                 | 63.0                           | 74.0                         | -11.0               |
| 2480.0                       | 2483.5             | V                 | 62.1                           | 74.0                         | -11.9               |

**Figure 32. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

\* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Test Distance: 3 meters

Frequency range: 9KHz to 25.0 GHz  
Detector: Average

| Operation Frequency<br>(MHz) | Frequency<br>(MHz) | Polarity<br>(H/V) | Average Reading<br>(dBμV/m) | Average Limit<br>(dBμV/m) | Average Margin<br>(dB) |
|------------------------------|--------------------|-------------------|-----------------------------|---------------------------|------------------------|
| 2402.0                       | 2390.0             | H                 | 49.1                        | 54.0                      | -4.9                   |
| 2402.0                       | 2390.0             | V                 | 49.5                        | 54.0                      | -4.5                   |
| 2402.0                       | 4804.0             | H                 | 52.2                        | 54.0                      | -1.8                   |
| 2402.0                       | 4804.0             | V                 | 52.9                        | 54.0                      | -1.1                   |
| 2402.0                       | 7206.0             | H                 | 42.8                        | 54.0                      | -11.2                  |
| 2402.0                       | 7206.0             | V                 | 41.0                        | 54.0                      | -13.0                  |
| 2402.0                       | 9608.0             | H                 | 39.2                        | 54.0                      | -14.8                  |
| 2402.0                       | 9608.0             | V                 | 42.3                        | 54.0                      | -11.7                  |
| 2402.0                       | 12010.0            | H                 | 39.3                        | 54.0                      | -14.7                  |
| 2402.0                       | 12010.0            | V                 | 42.5                        | 54.0                      | -11.5                  |
| 2440.0                       | 4880.0             | H                 | 42.3                        | 54.0                      | -11.7                  |
| 2440.0                       | 4880.0             | V                 | 41.5                        | 54.0                      | -12.5                  |
| 2440.0                       | 7320.0             | H                 | 41.7                        | 54.0                      | -12.3                  |
| 2440.0                       | 7320.0             | V                 | 37.1                        | 54.0                      | -16.9                  |

**Figure 33. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

\* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description AllBe1 Multisensor  
Type 00001  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Test Distance: 3 meters

Frequency range: 9KHz to 25.0 GHz  
Detector: Average

| Operation Frequency<br>(MHz) | Frequency<br>(MHz) | Polarity<br>(H/V) | Average Reading<br>(dBμV/m) | Average Limit<br>(dBμV/m) | Average Margin<br>(dB) |
|------------------------------|--------------------|-------------------|-----------------------------|---------------------------|------------------------|
| 2480.0                       | 4960.3             | H                 | 43.5                        | 54.0                      | -10.5                  |
| 2480.0                       | 4960.0             | V                 | 37.7                        | 54.0                      | -16.3                  |
| 2480.0                       | 7439.3             | H                 | 43.2                        | 54.0                      | -10.8                  |
| 2480.0                       | 7439.3             | V                 | 34.6                        | 54.0                      | -19.4                  |
| 2480.0                       | 2483.5             | H                 | 52.1                        | 54.0                      | -1.9                   |
| 2480.0                       | 2483.5             | V                 | 51.2                        | 54.0                      | -2.8                   |

**Figure 34. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

\* Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



### 9.4 Test Instrumentation Used; Emissions in Restricted Frequency Bands

| Instrument                  | Manufacturer    | Model        | Serial No.        | Last Calibration Date | Next Calibration Due |
|-----------------------------|-----------------|--------------|-------------------|-----------------------|----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724            | February 29, 2016     | March 1, 2017        |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204        | March 13, 2016        | March 13, 2017       |
| EMI Receiver                | HP              | 8542E        | 3906A00276        | March 3, 2016         | March 3, 2017        |
| RF Filter Section           | HP              | 85420E       | 3705A00248        | March 3, 2016         | March 3, 2017        |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275        | March 10, 2016        | March 10, 2017       |
| Biconical Antenna           | EMCO            | 3110B        | 9912-3337         | March 24, 2016        | March 24, 2018       |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081         | April 23, 2016        | April 23, 2017       |
| Horn Antenna                | ETS             | 3115         | 29845             | May 19, 2015          | May 19, 2018         |
| Horn Antenna                | ARA             | SWH-28       | 1007              | March 3, 2014         | September 30, 2016   |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950         | November 4, 2015      | November 30, 2016    |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13                | August 8, 2016        | August 8, 2017       |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232               | August 8, 2016        | August 8, 2017       |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120<br>ADI | March 10, 2016        | March 10, 2017       |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643          | N/A                   | N/A                  |
| Antenna Mast                | ETS             | 2070-2       | 9608-1497         | N/A                   | N/A                  |
| Turntable                   | ETS             | 2087         | -                 | N/A                   | N/A                  |
| Mast & Table Controller     | ETS/EMCO        | 2090         | 9608-1456         | N/A                   | N/A                  |

Figure 35 Test Equipment Used

# 10 Transmitted Power Density

## 10.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)  
RSS-247, Issue 1:2015, Clause 5.2(2)

## 10.2 Test Procedure

(Temperature (23°C)/ Humidity (60%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss=20.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

The E.U.T was evaluated in 3 channels: Low (2402.0MHz), Mid (2440.0MHz) and High (2480.0MHz).

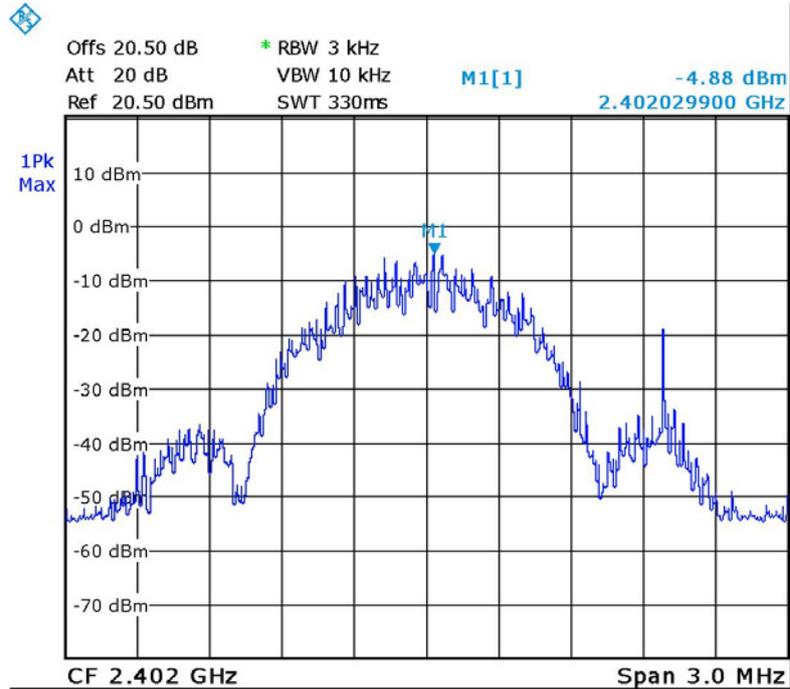
## 10.3 Test Results

| Operation Frequency (MHz) | Reading Spectrum Analyzer (dBm) | Antenna Gain (dBi) | Total PSD (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------|---------------------------------|--------------------|-----------------|-------------|-------------|
| 2402.0                    | -4.88                           | 2.5                | -2.38           | 8.0         | -10.38      |
| 2440.0                    | -6.04                           | 2.5                | -3.54           | 8.0         | -11.54      |
| 2480.0                    | -6.58                           | 2.5                | -4.08           | 8.0         | -12.08      |

Figure 36 Test Results

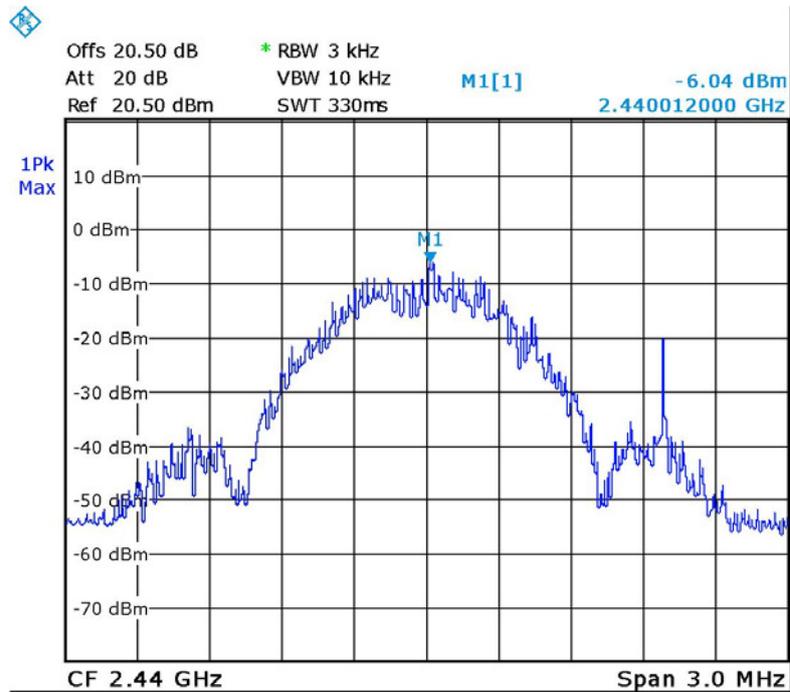
JUDGEMENT: Passed by 11.54 dB

For additional information see *Figure 37* to *Figure 39*.



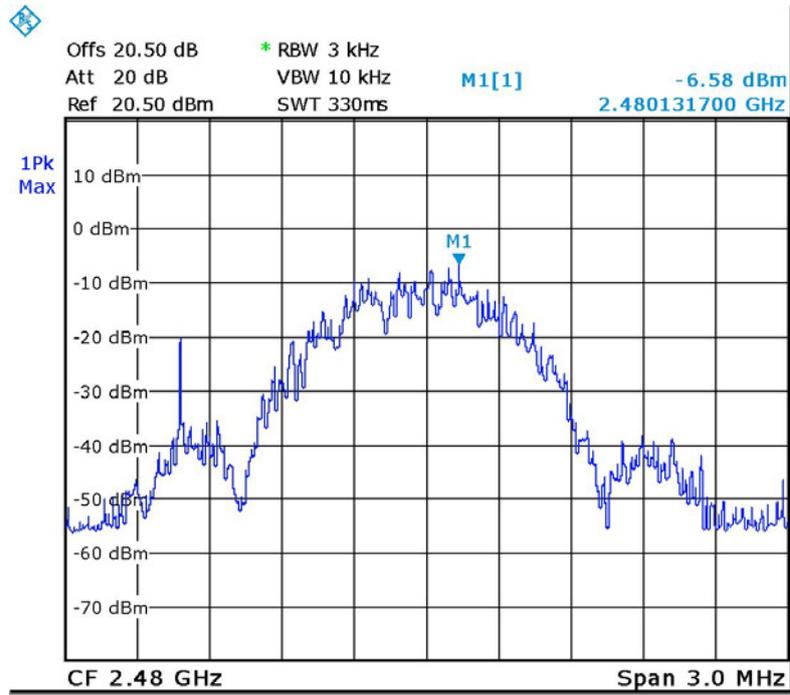
Date: 28.AUG.2016 14:02:45

Figure 37 — 2402.0 MHz



Date: 28.AUG.2016 13:54:20

Figure 38 — 2440.0 MHz



Date: 28.AUG.2016 13:47:26

Figure 39 — 2480.0 MHz



#### **10.4 Test Equipment Used; Transmitted Power Density**

| <b>Instrument</b> | <b>Manufacturer</b> | <b>Model</b> | <b>Serial No.</b> | <b>Last Calibration Date</b> | <b>Next Calibration Due</b> |
|-------------------|---------------------|--------------|-------------------|------------------------------|-----------------------------|
| Spectrum Analyzer | R&S                 | FSL6         | 100194            | February 29, 2016            | March 1, 2017               |
| 20 dB Attenuator  | MCL                 | VAT-20W2+    | 848               | July 5, 2016                 | July 5, 2017                |

**Figure 40 Test Equipment Used**



## 11 Antenna Gain/Information

The antenna gain is 2.5 dBi, internal.

## 12AVG. Factor Calculation

1. Pulse period = 1msec (worst scenario)
2. Pulse duration = 1msec (worst scenario)
3. Burst duration = 0.185msec

$$4. \text{ Average Factor} = 10 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$\text{Average Factor} = 10 \log \left[ 1 * \frac{0.185}{100} * 0.3 \right] = -32.6\text{dB}$$

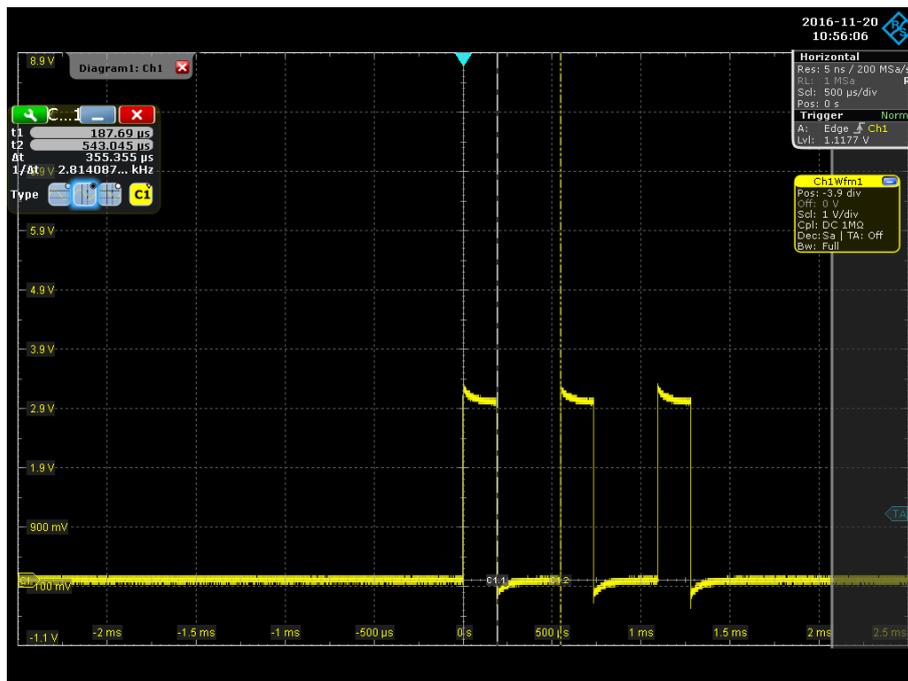
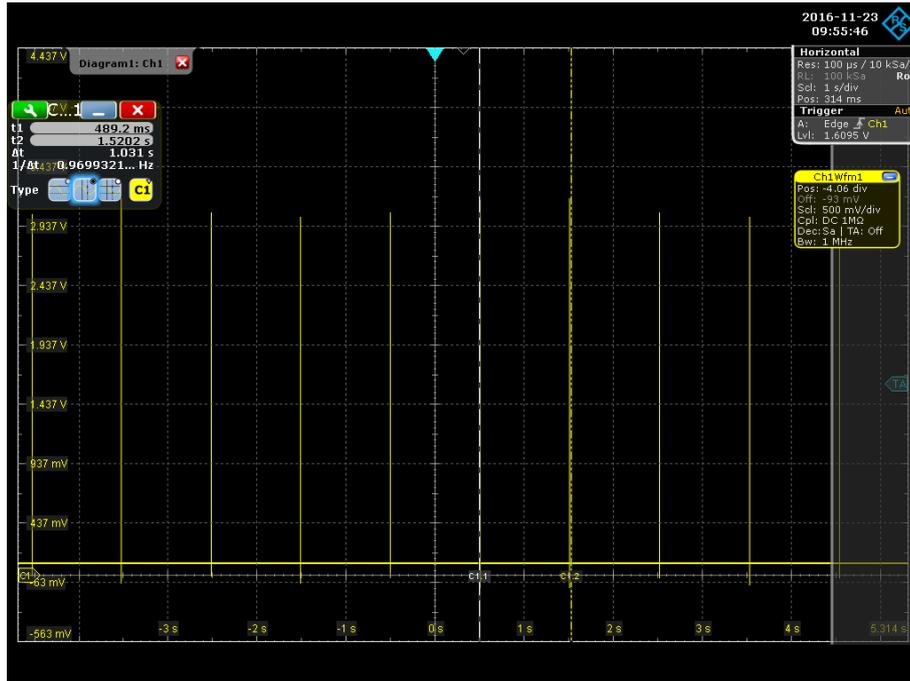


Figure 41 Pulse Duration and no. of bursts



**Figure 42 No. of Bursts in 1s**

Note: Due to the short pulse duration, the three bursts appear together.



## 13R.F Exposure/Safety

Typical use of the E.U.T. is as a multi sensor.

The typical distance between the E.U.T. and the user is 0.2 cm.

### Calculation of Maximum Permissible Exposure (MPE)

Based on FCC Section 1.1310 and RSS 102, Issue 5, Section 2.5.2 Requirements

(a) FCC limits at 2402 MHz is:  $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

$P_t$ - Transmitted Power 9.23 dBm (Peak) = 8.38 mW

$G_t$ - Antenna Gain, 2.5 dBi = 1.78 numeric

$R$ - Distance from Transmitter using 0.2cm worst case

AVG Factor calculation per page 37 of this report = -32.6dB

9.23 dBm – 32.6 dB = -23.37dBm = 0.0046 mW transmitter power

(c) The peak power density is:

$$S = \frac{(0.0046 \times 1.78)}{4\pi (.2)^2} = 0.016 \frac{mW}{cm^2}$$

(d) This is below the FCC limit.

Continued on following page



(e) For IC per Table 1 of RSS 102 Issue 5, SAR exemption based on IC limit of 4mW at a separation distance of  $\leq 5\text{mm}=0.2\text{cm}$  at 2450 MHz. EUT power transmission is 0.0046mW which is below the 4mW SAR exemption.

g) Per section 2.5.2 of RSS 102 Issue 5 Exemption Limits for Routine Evaluation – RF exposure Evaluation the limit is:

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.

$$f=2402$$

$$2402^{0.6834}=204.31$$

$$0.0131 \times 204.31 = 2.67\text{W Limit}$$

The E.U.T's power of 0.0046mW transmitted power is less than 2.67W limit. The EUT is therefore exempt from RF exposure calculation.

## 14 APPENDIX A - CORRECTION FACTORS

### 14.1 Correction factors for CABLE from EMI receiver to test antenna at 3 meter range.

| Frequency<br>(MHz) | Cable Loss<br>(dB) |
|--------------------|--------------------|
| 0.010              | 0.4                |
| 0.015              | 0.2                |
| 0.020              | 0.2                |
| 0.030              | 0.3                |
| 0.050              | 0.3                |
| 0.075              | 0.3                |
| 0.100              | 0.2                |
| 0.150              | 0.2                |
| 0.200              | 0.3                |
| 0.500              | 0.4                |
| 1.00               | 0.4                |
| 1.50               | 0.5                |
| 2.00               | 0.5                |
| 5.00               | 0.6                |
| 10.00              | 0.8                |
| 15.00              | 0.9                |
| 20.00              | 0.8                |

| Frequency<br>(MHz) | Cable Loss<br>(dB) |
|--------------------|--------------------|
| 50.00              | 1.2                |
| 100.00             | 0.7                |
| 150.00             | 2.1                |
| 200.00             | 2.3                |
| 300.00             | 2.9                |
| 500.00             | 3.8                |
| 750.00             | 4.8                |
| 1000.00            | 5.4                |
| 1500.00            | 6.7                |
| 2000.00            | 9.0                |
| 2500.00            | 9.4                |
| 3000.00            | 9.9                |
| 3500.00            | 10.2               |
| 4000.00            | 11.2               |
| 4500.00            | 12.1               |
| 5000.00            | 13.1               |
| 5500.00            | 13.5               |
| 6000.00            | 14.5               |

**NOTES:**

1. The cable type is SPUMA400 RF-11N(X2) and 39m long
2. The cable is manufactured by Huber + Suhner



## 14.2 Correction factor for RF CABLE for Semi Anechoic Chamber

| FREQ (MHz) | LOSS (dB) |
|------------|-----------|
| 1000.0     | 1.5       |
| 2000.0     | 2.1       |
| 3000.0     | 2.7       |
| 4000.0     | 3.1       |
| 5000.0     | 3.5       |
| 6000.0     | 4.1       |
| 7000.0     | 4.6       |
| 8000.0     | 4.9       |
| 9000.0     | 5.7       |
| 10000.0    | 5.7       |
| 11000.0    | 6.1       |
| 12000.0    | 6.1       |
| 13000.0    | 6.2       |
| 14000.0    | 6.7       |
| 15000.0    | 7.4       |
| 16000.0    | 7.5       |
| 17000.0    | 7.9       |
| 18000.0    | 8.1       |
| 19000.0    | 8.8       |
| 20000.0    | 9.1       |

### NOTES:

1. The cable is manufactured by Commscope
2. The cable type is 0623 WBC-400, serial # G020132 and 10m long
3. ITL # 1840



### 14.3 Correction factors for Low Loss CABLE

**Huber Suner #1696**

**Serial No. 705A009301 EIM**

| FREQ (MHz) | INPUT (dBm) | OUTPUT (dBm) | LOSS (dB) |
|------------|-------------|--------------|-----------|
| 1000.0     | -10         | -10.7        | 0.7       |
| 2000.0     | -10         | -10.7        | 0.7       |
| 3000.0     | -10         | -10.6        | 0.6       |
| 4000.0     | -10         | -10.5        | 0.5       |
| 5000.0     | -10         | -10.7        | 0.7       |
| 6000.0     | -10         | -10.8        | 0.8       |
| 7000.0     | -10         | -10.8        | 0.8       |
| 8000.0     | -10         | -11.0        | 1.0       |
| 9000.0     | -10         | -10.5        | 0.5       |
| 10000.0    | -10         | -10.3        | 0.3       |
| 11000.0    | -10         | -10.5        | 0.5       |
| 12000.0    | -10         | -11.3        | 1.3       |
| 13000.0    | -10         | -11.6        | 1.6       |
| 14000.0    | -10         | -11.8        | 1.8       |
| 15000.0    | -10         | -11.0        | 1.0       |
| 16000.0    | -10         | -10.6        | 0.6       |
| 17000.0    | -10         | -12.0        | 2.0       |
| 18000.0    | -10         | -11.6        | 1.6       |



**14.4 Correction factors for**

**Horn Antenna**

**Model: SWH-28  
at 1 meter range.**

| <b>Frequency, MHz</b> | <b>Measured antenna factor, dB/m<sup>1</sup></b> |
|-----------------------|--|
| 18000                 | 33.0   |
| 18500                 | 32.9   |
| 19000                 | 33.1   |
| 19500                 | 33.3   |
| 20000                 | 33.6   |
| 20500                 | 33.6   |
| 21000                 | 33.4   |
| 21500                 | 33.8   |
| 22000                 | 33.7   |
| 22500                 | 33.9   |
| 23000                 | 34.8   |
| 23500                 | 34.5   |
| 24000                 | 34.2   |
| 24500                 | 34.8   |
| 25000                 | 34.4   |
| 25500                 | 35.2   |
| 26000                 | 35.9   |
| 26500                 | 36.0   |



**14.5 Correction factors for Horn ANTENNA.**

**Model: 3115**

**Antenna serial number: 29845**

**3 meter range**

| f(GHz) | AF(dB/m) | GA(dB) |
|--------|----------|--------|
| 0.75   | 25       | 3      |
| 1G     | 23.5     | 7      |
| 1.5G   | 26       | 8      |
| 2G     | 29       | 7      |
| 2.5G   | 27.5     | 10     |
| 3G     | 30       | 10     |
| 3.5G   | 31.5     | 10     |
| 4G     | 32.5     | 9.5    |
| 4.5G   | 32.5     | 10.5   |
| 5G     | 33       | 10.5   |
| 5.5G   | 35       | 10.5   |
| 6G     | 36.5     | 9.5    |
| 6.5G   | 36.5     | 10     |
| 7G     | 37.5     | 10     |
| 7.5G   | 37.5     | 10     |
| 8G     | 37.5     | 11     |
| 8.5G   | 38       | 11     |
| 9G     | 37.5     | 11.5   |
| 9.5G   | 38       | 11.5   |
| 10G    | 38.5     | 11.5   |
| 10.5G  | 38.5     | 12     |
| 11G    | 38.5     | 12.5   |
| 11.5G  | 38.5     | 13     |
| 12G    | 38       | 13.5   |
| 12.5G  | 38.5     | 13     |
| 13G    | 40       | 12     |
| 13.5G  | 41       | 12     |
| 14G    | 40       | 13     |
| 14.5G  | 39       | 14     |
| 15G    | 38       | 15.5   |
| 15.5G  | 37.5     | 16     |
| 16G    | 37.5     | 16     |
| 16.5G  | 39       | 15     |
| 17G    | 40       | 15     |
| 17.5G  | 42       | 13.5   |
| 18G    | 42.5     | 13     |



**14.6 Correction factors for Log Periodic Antenna**  
**EMCO, Model 3146,**  
**Serial #9505-4081**

| Frequency [MHz] | AF [dB/m] |
|-----------------|-----------|
| 200.0           | 11.47     |
| 250.0           | 12.06     |
| 300.0           | 14.77     |
| 400.0           | 15.77     |
| 500.0           | 18.01     |
| 600.0           | 18.84     |
| 700.0           | 20.93     |
| 800.0           | 21.27     |
| 900.0           | 22.44     |
| 1000.0          | 24.10     |



**14.7 Correction factors for ACTIVE LOOP ANTENNA**  
**Model 6502**  
**S/N 9506-2950**

| f(MHz) | MAF(dBs/m) | AF(dB/m) |
|--------|------------|----------|
| 0.01   | -33.1      | 18.4     |
| 0.02   | -37.2      | 14.3     |
| 0.03   | -38.2      | 13.3     |
| 0.05   | -39.8      | 11.7     |
| 0.1    | -40.1      | 11.4     |
| 0.2    | -40.3      | 11.2     |
| 0.3    | -40.3      | 11.2     |
| 0.5    | -40.3      | 11.2     |
| 0.7    | -40.3      | 11.2     |
| 1      | -40.1      | 11.4     |
| 2      | -40        | 11.5     |
| 3      | -40        | 11.5     |
| 4      | -40.1      | 11.4     |
| 5      | -40.2      | 11.3     |
| 6      | -40.4      | 11.1     |
| 7      | -40.4      | 11.1     |
| 8      | -40.4      | 11.1     |
| 9      | -40.5      | 11       |
| 10     | -40.5      | 11       |
| 20     | -41.5      | 10       |
| 30     | -43.5      | 8        |



**14.8 Correction factors for Biconical Antenna**  
**EMCO, Model 3110B,**  
**Serial #9912-3337**

| Frequency [MHz] | AF [dB/m] |
|-----------------|-----------|
| 30.0            | 14.18     |
| 35.0            | 13.95     |
| 40.0            | 12.84     |
| 45.0            | 11.23     |
| 50.0            | 11.10     |
| 60.0            | 10.39     |
| 70.0            | 9.34      |
| 80.0            | 9.02      |
| 90.0            | 9.31      |
| 100.0           | 8.95      |
| 120.0           | 11.53     |
| 140.0           | 12.20     |
| 160.0           | 12.56     |
| 180.0           | 13.49     |
| 200.0           | 15.27     |