



**DATE: 9 November 2020**

**I.T.L. (PRODUCT TESTING) LTD.  
FCC/IC Radio Test Report  
for  
Pointer Telocation**

**Equipment under test:  
Asset Tracking Device**

**LV300.PS\*  
LV300\*  
CelloTrack XT LTE C1\***

\*See customer table on page 8

Tested by:

  
M. Zohar

Approved by:

  
D. Shidlowsky

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This report relates only to items tested.



## Measurement/Technical Report for Pointer Telocation

### Asset Tracking Device

**LV300.PS**

**FCC ID: 2AG69CTPW**

**IC: 9975A-CTPW**

|                       |                                                                                                      |   |
|-----------------------|------------------------------------------------------------------------------------------------------|---|
| This report concerns: | Original Grant:                                                                                      |   |
|                       | Class I Change:                                                                                      |   |
|                       | Class II Change:                                                                                     | X |
| Equipment type:       | FCC: (DTS) Digital Transmission System<br>IC: Spread Spectrum Digital Device (2400-2483.5)           |   |
| Limits used:          | 47CFR15 Section 15.247<br>RSS 247, Issue 2, February 2017, Section 5<br>RSS-Gen, Issue 5, April 2018 |   |

Measurement procedure used is KDB 558074 D01 v03r05 and ANSI C63.10:2013 and RSS Gen, Issue 5

Application for Certification  
prepared by:

R. Pinchuck  
ITL (Product Testing) Ltd.  
1 Bat Sheva St.  
Lod 7120101  
Israel  
E-mail [rpinchuck@itlglobal.org](mailto:rpinchuck@itlglobal.org)

Applicant for this device:  
(different from "prepared by")

Igor Rogov  
Pointer Telocation  
14 Hamelacha, PO Box 11473  
Rosh Haain  
Israel  
Tel: +972 73 2622320  
E-mail: [Igorr@pointer.com](mailto:Igorr@pointer.com)

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# 1. General Information

## 1.1 Administrative Information

|                                |                                                                                                      |
|--------------------------------|------------------------------------------------------------------------------------------------------|
| Manufacturer:                  | Pointer Telocation                                                                                   |
| Manufacturer's Address:        | 14 Hamelacha, PO Box 11473<br>Roash Haain, Israel<br>Tel: +972 73 2622320                            |
| Manufacturer's Representative: | Igor Rogov                                                                                           |
| Equipment Under Test (E.U.T):  | Asset Tracking Device                                                                                |
| Equipment PMN:                 | 1. LV300.PS (tested device)<br>2. LV300<br>3. CelloTrack XT LTE C1                                   |
| Equipment Serial No.:          | 2310283                                                                                              |
| Equipment HVIN:                | 1. 3010<br>2. 3011<br>3. 3012                                                                        |
| Date of Receipt of E.U.T:      | March 31, 2020                                                                                       |
| Start of Test:                 | March 31, 2020                                                                                       |
| End of Test:                   | March 31, 2020                                                                                       |
| 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 2, February 2017, Section 5<br>RSS-Gen, Issue 5, April 2018 |



## **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. Innovation, Science and Economic Development Canada (ISED) CAB identifier: IL1002.

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 CelloTrack product line is designed for advanced asset tracking and remote monitoring, featuring enhanced functionality with full fleet management capabilities, robustness and ease of installation, suitable for a wide variety of asset management applications.

The CelloTrack product line is available in two variants – a standalone version and a power version, which includes extended battery life and the ability to connect external sensors via two configurable GPIOs. Models are suitable for 2G, 3G and 4G (LTE) cellular communication technologies.

### **1.4 Test Methodology**

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 v05r02, ANSI C63.10: 2013 and RSS Gen, Issue 5. 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. Its FCC Designation Number is IL1005 and its Innovation, Science and Economic Development Canada (ISED) CAB identifier is IL1002.

### **1.6 Measurement Uncertainty**

#### **Conducted Emission**

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**

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:

30-1000MHz:

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

± 4.96 dB

1 GHz to 6 GHz

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

±5.19 dB

>6 GHz

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

±5.51 dB

## 2. System Test Configuration

### 2.1 Justification

1. The E.U.T. was originally FCC certified on 04/30/2019 under FCC ID: 2AG69CTPW and IC certified on 5/19/2019 under IC: 9975A-CTPW.
2. Currently, the below changes were made to the original E.U.T.s.

| Original PMN                         | Original HVIN | changes                                                                                                                                                                                                                             | New PMN                     | New HVIN    |
|--------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| <b>CelloTrack POWER XT LTE C1 NA</b> | <b>3013</b>   | <ol style="list-style-type: none"> <li>1. Antenna changed to support Global /worldwide LTE channels</li> <li>2. SIM holder changed to Nano SIM</li> <li>3. Additional power Circuit for supporting external sensor added</li> </ol> | <b>LV300.PS</b>             | <b>3010</b> |
| <b>CelloTrack POWER XT LTE C1 NA</b> | <b>3013</b>   | <ol style="list-style-type: none"> <li>1. Antenna changed to support Global /worldwide LTE channels</li> <li>2. SIM holder changed to Nano SIM.</li> </ol>                                                                          | <b>LV300</b>                | <b>3011</b> |
| <b>CelloTrack XT LTE C1 NA</b>       | <b>3014</b>   | <ol style="list-style-type: none"> <li>1. Antenna added to support Global /worldwide LTE channels</li> <li>2. SIM holder changed to Nano SIM.</li> </ol>                                                                            | <b>CelloTrack XT LTE C1</b> | <b>3012</b> |

3. A C2PC is requested based on the above listed changes. The following tests were performed: maximum conducted output power, occupied bandwidth and spurious radiated emissions.
4. The E.U.T. met the requirements of a C2PC.
5. The E.U.T contains an IEEE 802.15.1 transceiver.
6. The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz).
7. Conducted emission method was performed with the EUT connected to a spectrum analyzer via 30dB attenuator.
8. Final radiated emission test for spurious emission for the new model was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the "worst case" radiation.
9. According to the following results the worst case axis was the X axis for all channels.

| Orientation | Frequency | 2 <sup>nd</sup> Harmonic | 3 <sup>rd</sup> Harmonic |
|-------------|-----------|--------------------------|--------------------------|
|             | (MHz)     | (dBuV/m)                 | (dBuV/m)                 |
| X axis      | 2402.0    | 45.1(N.L)                | 46.1(N.L)                |
|             | 2440.0    | 44.7(N.L)                | 46.6(N.L)                |
|             | 2480.0    | 44.9(N.L)                | 46.9(N.L)                |
| Y axis      | 2402.0    | 44.0(N.L)                | 46.1(N.L)                |
|             | 2440.0    | 43.9(N.L)                | 46.0(N.L)                |
|             | 2480.0    | 44.9(N.L)                | 47.0(N.L)                |
| Z axis      | 2402.0    | 44.2(N.L)                | 46.0(N.L)                |
|             | 2440.0    | 44.7(N.L)                | 46.5(N.L)                |
|             | 2480.0    | 43.5(N.L)                | 46.1(N.L)                |

**Figure 1. Screening Results**

## **2.2 EUT Exercise Software**

No special exercise software was used.

## **2.3 Special Accessories**

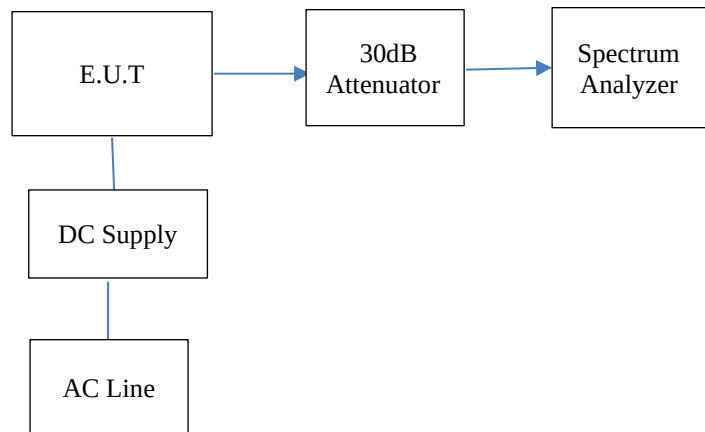
No special accessories were used.

## **2.4 Equipment Modifications**

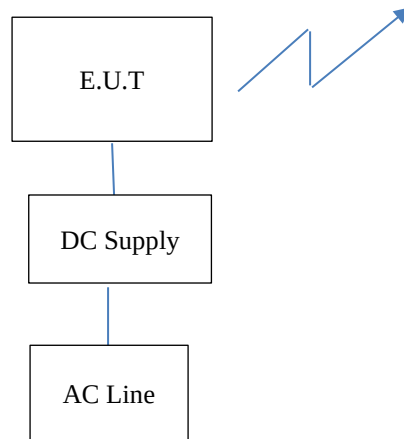
No modifications were necessary in order to achieve compliance.



## 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

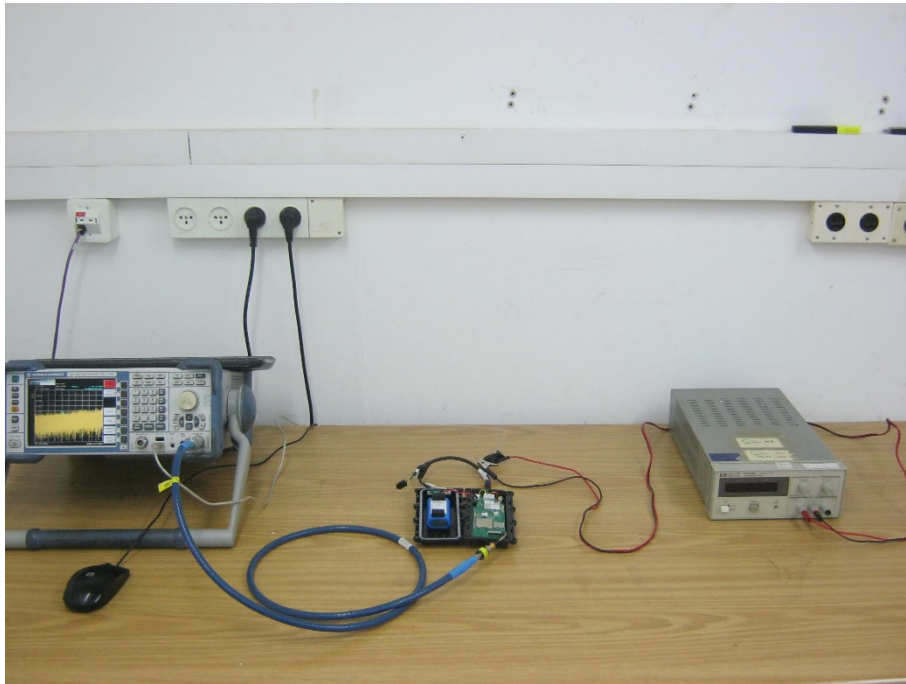


Figure 4. Conducted Emission Test



Figure 5. Radiated Emission Test, 0.009-30MHz



**Figure 6. Radiated Emission Test, 30-200MHz**



**Figure 7. Radiated Emission Test, 200-1000MHz**





**Figure 8. Radiated Emission Test, 1-18GHz**



**Figure 9. Radiated Emission Test, 18-26.5GHz**

## 4. Maximum Conducted Output Power

### 4.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)

RSS 247, Issue 2, Section 5.4(d)

### 4.2 Test Procedure

(Temperature (22°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 (total loss=30.0 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

### 4.3 Test Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

### 4.4 Test Results

| Protocol Type | Unit                                              | Operation Frequency | Power | Power | Limit  | Margin  |
|---------------|---------------------------------------------------|---------------------|-------|-------|--------|---------|
|               | (old/new)                                         | (MHz)               | (dBm) | (mW)  | (mW)   | (mW)    |
| BLE           | Original<br>(CelloTrack<br>POWER XT<br>LTE C1 NA) | 2402.0              | 4.9   | 3.09  | 1000.0 | -996.91 |
|               |                                                   | 2440.0              | 4.7   | 2.95  | 1000.0 | -997.05 |
|               |                                                   | 2480.0              | 4.4   | 2.75  | 1000.0 | -997.25 |
|               | New<br>(LV300.PS)                                 | 2402.0              | 4.9   | 3.09  | 1000.0 | -996.91 |
|               |                                                   | 2440.0              | 4.7   | 2.95  | 1000.0 | -997.05 |
|               |                                                   | 2480.0              | 4.3   | 2.69  | 1000.0 | -997.31 |

Figure 10 Maximum Peak Power Output

JUDGEMENT: Passed by 996.91 mW

For additional information see Figure 11 to Figure 13.

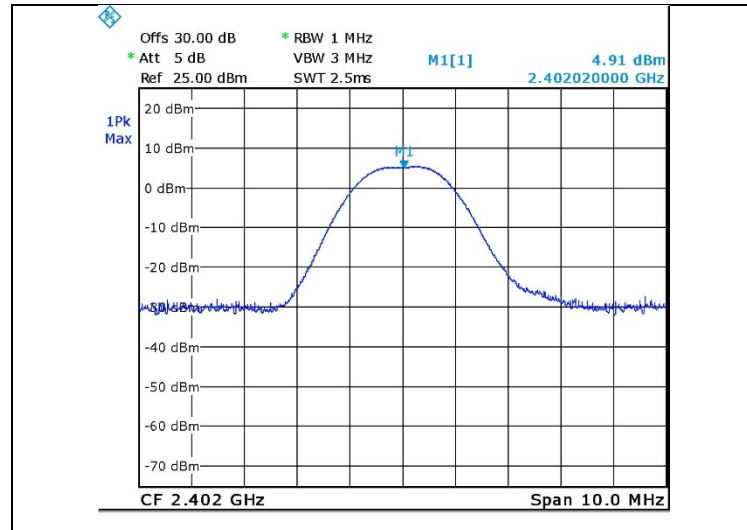


Figure 11. 2402.0 MHz, BLE

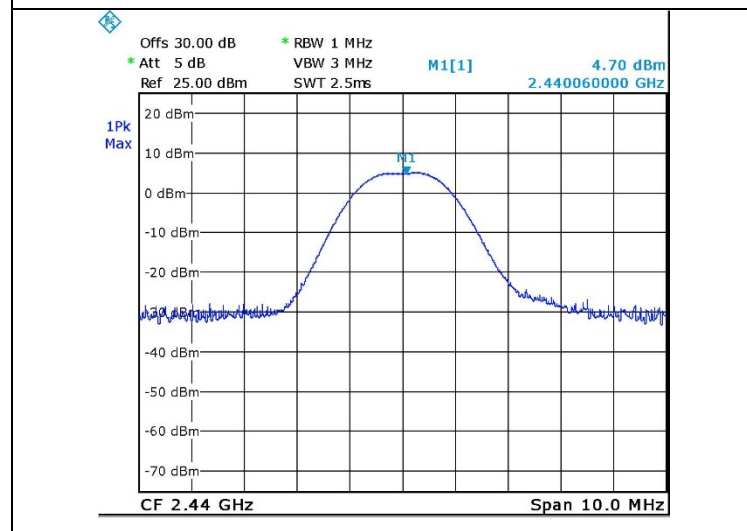


Figure 12. 2440.0 MHz, BLE

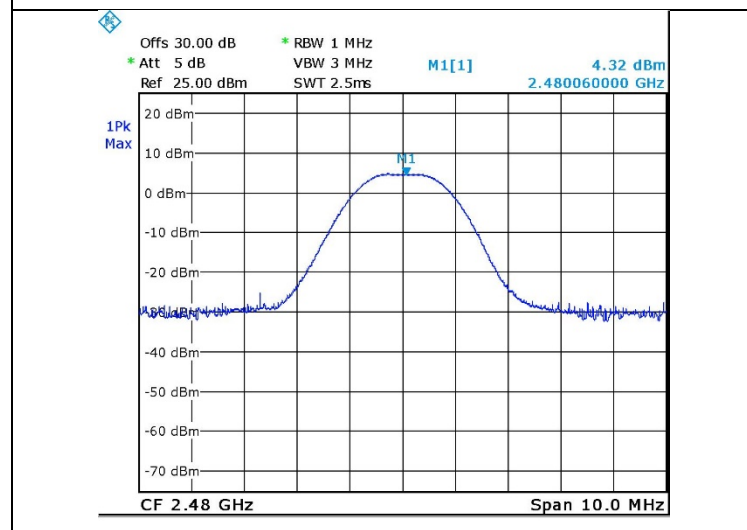


Figure 13. 2480.0 MHz, BLE



#### 4.5 *Test Equipment Used; Maximum Peak Power Output*

| Instrument        | Manufacturer | Model     | Serial No. | Last Calibration Date | Next Calibration Due |
|-------------------|--------------|-----------|------------|-----------------------|----------------------|
| Spectrum Analyzer | R&S          | FSL6      | 100194     | March 10, 2020        | March 31, 2021       |
| 30dB Attenuator   | MCL          | BW-S30W5  | 533        | December 24, 2018     | December 31, 2020    |
| RF Cable          | Huber Suner  | Sucofelex | 28239/4PEA | December 24, 2018     | December 31, 2020    |

**Figure 14 Test Equipment Used**

## 5. Occupied Bandwidth

### 5.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2014, Section 6.6

### 5.2 Test Procedure

(Temperature (20°C)/ Humidity (62%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 (total loss= 30.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% to 5% of the OBW. The span was set to ~ 3 times the OBW.

99% occupied bandwidth function was set on.

### 5.3 Test Limit

N/A

### 5.4 Test Results

| Protocol Type | Operation Frequency | Reading |
|---------------|---------------------|---------|
|               | (MHz)               | (MHz)   |
| BLE           | 2402.0              | 1.0     |
|               | 2440.0              | 1.0     |
|               | 2480.0              | 1.0     |

Figure 15. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 16* to *Figure 18*.



## Occupied Bandwidth

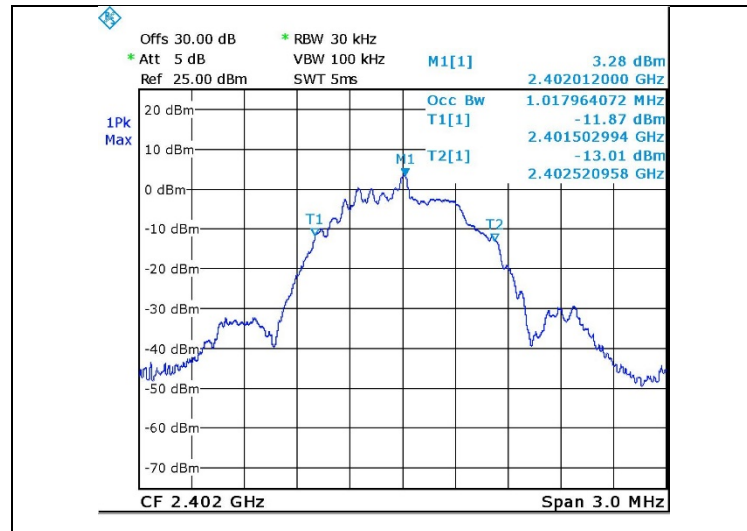


Figure 16. 2402.0 MHz, BLE

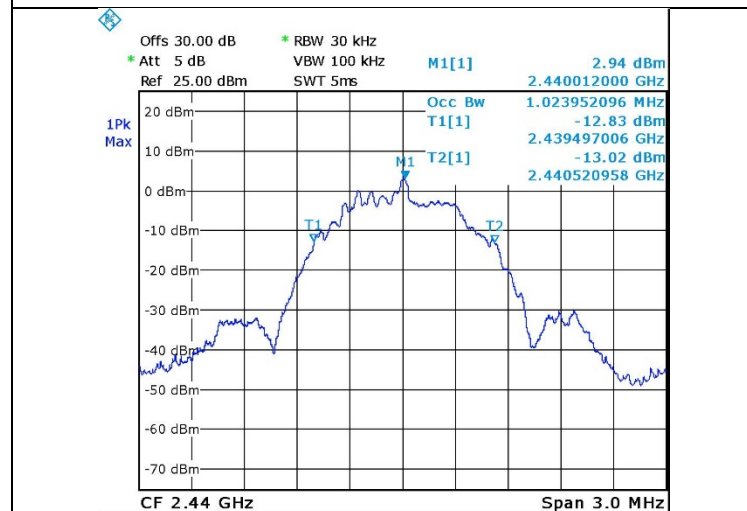


Figure 17. 2440.0 MHz, BLE

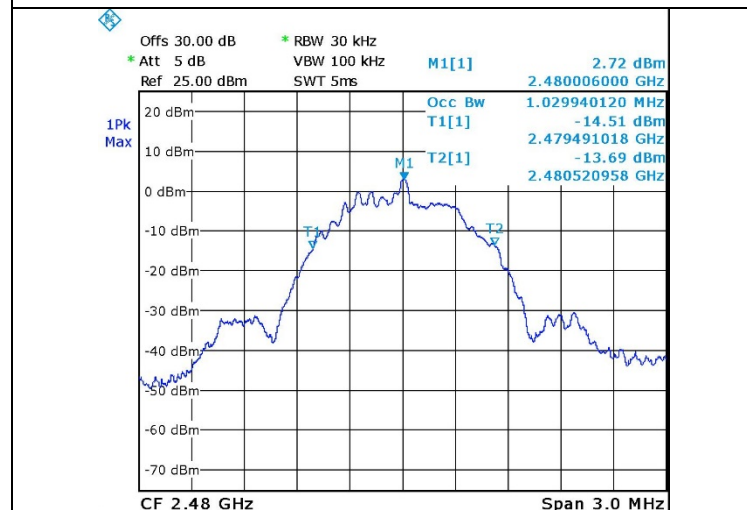


Figure 18. 2480.0 MHz, BLE



### 5.5 *Test Equipment Used; Occupied Bandwidth*

| <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            | March 10, 2020               | March 31, 2021              |
| 30dB Attenuator   | MCL                 | BW-S30W5     | 533               | December 24, 2018            | December 31, 2020           |
| RF Cable          | Huber Suner         | Sucofelex    | 28239/4PEA        | December 24, 2018            | December 31, 2020           |

**Figure 19 Test Equipment Used**

## 6. Spurious Radiated Emissions

### 6.1 Test Specification

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

RSS 247, Issue 2, Section 3.3

RSS Gen, Issue 5, Section 8.10

### 6.2 Test Procedure

(Temperature (23°C)/ Humidity (55%RH))

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

#### **For measurements between 0.009-30MHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned.

#### **For measurements between 30-1000MHz:**

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 emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

#### **For measurements between 1GHz-25GHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 1GHz -25GHz was scanned.

The highest radiation is described in the tables below.

### 6.3 FCC Test Limit

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* (dBµV/m) | Field Strength* (dBµV/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 20 Table of Limits

### 6.4 IC Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Magnetic Field strength (microampere/meter) | Measurement distance (meters) | Magnetic Field strength (dBµA/m) | Magnetic Field strength * (dBµA/m)@3m |
|-----------------|---------------------------------------------|-------------------------------|----------------------------------|---------------------------------------|
| 0.009-0.490     | 6.37/F(kHz)                                 | 300                           | -3.0-(-37.7)                     | 77.0-42.2                             |
| 0.490-1.705     | 63.7/F(kHz)                                 | 30                            | -17.7-(-28.5)                    | 22.3-11.4                             |
| 1.705-30.0      | 0.08                                        | 30                            | -21.9                            | 18.0                                  |
| Frequency (MHz) | Field strength (microvolts/meter)           | Measurement distance (meters) | Field strength (dBµV/m)          | Field strength * (dBµV/m)@3m          |
| 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.



## 6.5 Test Results

JUDGEMENT: Passed by 0.2 dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 11.4dB at the frequency of 2390.0 MHz, horizontal polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 0.2dB at the frequency of 2483.5 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 21*.

## Radiated Emission

E.U.T Description    Asset Tracking Device  
Type                    LV300.PS  
Serial Number:        2310283

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)  
RSS 247, Issue 2, Section 3.3; RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical    Frequency Range: 9kHz to 25.0 GHz  
Protocol Type: BLE                                  Detector: Peak, Average

| Operation Frequency | Freq.  | Pol   | Peak Reading | Peak Limit | Peak Margin | Average Reading | Average Limit | Average Margin |
|---------------------|--------|-------|--------------|------------|-------------|-----------------|---------------|----------------|
| (MHz)               | (MHz)  | (H/V) | (dBμV/m)     | (dBμV/m)   | (dB)        | (dBμV/m)        | (dBμV/m)      | (dB)           |
| 2402.0              | 2390.0 | V     | 52.4         | 74.0       | -21.6       | -               | 54.0          | -              |
|                     | 2390.0 | H     | 53.1         | 74.0       | -20.9       | -               | 54.0          | -              |
|                     | 4804.0 | V     | 44.7         | 74.0       | -29.3       | -               | 54.0          | -              |
|                     | 4804.0 | H     | 45.1         | 74.0       | -28.9       | -               | 54.0          | -              |
| 2440.0              | 4880.0 | V     | 44.1         | 74.0       | -29.9       | -               | 54.0          | -              |
|                     | 4880.0 | H     | 44.7         | 74.0       | -29.3       | -               | 54.0          | -              |
|                     | 7320.0 | V     | 45.9         | 74.0       | -28.1       | -               | 54.0          | -              |
|                     | 7320.0 | H     | 46.6         | 74.0       | -27.4       | -               | 54.0          | -              |
| 2480.0              | 4960.0 | V     | 44.4         | 74.0       | -29.6       | -               | 54.0          | -              |
|                     | 4960.0 | H     | 44.9         | 74.0       | -29.1       | -               | 54.0          | -              |
|                     | 2483.5 | V     | 63.3         | 74.0       | -10.7       | 53.3            | 54.0          | -0.7           |
|                     | 2483.5 | H     | 63.4         | 74.0       | -10.6       | 53.5            | 54.0          | -0.5           |

**Figure 21. Radiated Emission Results, New**

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

## 6.6 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     | March 9, 2020         | March 31, 2021       |
| EMI Receiver                      | HP               | 8542E                | 3906A00276 | March 11, 2020        | March 31, 2021       |
| RF Filter Section                 | HP               | 85420E               | 3705A00248 | March 11, 2020        | March 31, 2021       |
| Spectrum Analyzer                 | HP               | 8593EM               | 3826A00265 | March 9, 2020         | March 31, 2021       |
| Active Loop Antenna               | EMCO             | 6502                 | 9506-2950  | February 5, 2019      | February 28, 2021    |
| Biconical Antenna                 | EMCO             | 3110B                | 9912-3337  | May 21, 2019          | May 31, 2020         |
| Log Periodic Antenna              | EMCO             | 3146                 | 9505-4081  | May 31, 2018          | May 31, 2020         |
| Horn Antenna                      | ETS              | 3115                 | 29845      | May 31, 2018          | May 31, 2021         |
| Horn Antenna                      | ARA              | SWH-28               | 1007       | December 31, 2017     | December 31, 2020    |
| Low Noise Amplifier<br>1GHz-18GHz | Miteq            | AFSX4-02001800-50-8P | -          | December 24, 2018     | December 31, 2020    |
| RF Cable Chamber                  | Commscope<br>ORS | 0623 WBC-400         | G020132    | December 24, 2018     | December 31, 2020    |
| RF Cable Oats                     | EIM              | RG214-11N(X2)        |            | May 26, 2019          | May 31, 2020         |
| Filter Band Pass<br>4-20 GHz      | Meuro            | MFL040120H50         | 902252     | December 24, 2018     | December 31, 2020    |
| MicroWave System Amplifier        | HP               | 83006A               | 3104A00589 | NCR                   | NCR                  |
| Semi Anechoic Civil Chamber       | ETS              | S81                  | SL 11643   | NCR                   | NCR                  |
| Antenna Mast                      | ETS              | 2070-2               | 9608-1497  | NCR                   | NCR                  |
| Turntable                         | ETS              | 2087                 | -          | NCR                   | NCR                  |
| Mast & Table Controller           | ETS/EMCO         | 2090                 | 9608-1456  | NCR                   | NCR                  |

Figure 22 Test Equipment Used





## 7. Antenna Gain/Information

The antenna gain is +1.88 dBi, chip



**DATASHEET**  
Part No. 1001312  
Product: Wi-Fi/Bluetooth  
Ceramic Antennas

**Part No. 1001312**

**Wi-Fi / BT / Zigbee Ceramic Antennas**

**2.4 GHz**

Supports: Wi-Fi applications, Agriculture, Automotive, Bluetooth, Zigbee, WLAN, Smart Home, Healthcare, Digital Signage

## 8. R.F Exposure/Safety

The typical placement of the E.U.T. is on wall mounted. The typical distance between the E.U.T. and the user is at least 20cm.

### Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section 1.1307(b)(1) and RSS 102 Issue 5, Table 4 Requirements

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

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

- (b) ISED Limit:  $300-6000MHz = 0.02619f^{0.6834} W/m^2 =$   
 $0.02619 \times 2402^{0.6834} = 0.02619 \times 204.31 = 5.35 W/m^2 = 0.535 mW/cm^2$

- (c) The power density produced by the E.U.T. is:

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

$P_t$  = Conducted Transmitted Power 4.9 dBm = 3.09 mW

$G_t$  = Antenna Gain 1.88 dBi = 1.54 numeric

$R$  = Distance From Transmitter 20 cm

- (d) The peak power density produced by the E.U.T. is:

$$S = 3.09 * 1.54 / 4\pi(20)^2 = 9.47 \times 10^{-4} mW/cm^2$$

- (e) This is below the FCC/ISED limit.

## 9. APPENDIX A - CORRECTION FACTORS

### 9.1 Correction factors for RF OATS Cable 35m ITL #1911

| Frequency<br>(MHz) | loss<br>(dB) |
|--------------------|--------------|
| 30.0               | 1.3          |
| 50.0               | 1.7          |
| 100.0              | 2.6          |
| 200.0              | 3.7          |
| 300.0              | 4.7          |
| 400.0              | 5.5          |
| 500.0              | 6.3          |
| 600.0              | 7.0          |
| 700.0              | 7.6          |
| 800.0              | 8.4          |
| 900.0              | 9.0          |
| 1000.0             | 9.6          |

## 9.2 Correction factor for RF cable for Anechoic Chamber

ITL #1840

| Frequency (GHz) | loss Result (dB) |
|-----------------|------------------|
| 0.5             | -1.0             |
| 1.0             | -1.4             |
| 1.5             | -1.7             |
| 2.0             | -2.0             |
| 2.5             | -2.3             |
| 3.0             | -2.6             |
| 3.5             | -2.8             |
| 4.0             | -3.1             |
| 4.5             | -3.3             |
| 5.0             | -3.6             |
| 5.5             | -3.7             |
| 6.0             | -4.0             |
| 6.5             | -4.4             |
| 7.0             | -4.7             |
| 7.5             | -4.8             |
| 8.0             | -5.0             |
| 8.5             | -5.1             |
| 9.0             | -5.6             |
| 9.5             | -5.8             |
| 10.0            | -6.0             |
| 10.5            | -6.2             |
| 11.0            | -6.2             |
| 11.5            | -6.0             |
| 12.0            | -6.0             |
| 12.5            | -6.1             |
| 13.0            | -6.3             |
| 13.5            | -6.5             |
| 14.0            | -6.7             |
| 14.5            | -7.0             |
| 15.0            | -7.3             |
| 15.5            | -7.5             |
| 16.0            | -7.6             |
| 16.5            | -8.0             |
| 17.0            | -8.0             |
| 17.5            | -8.1             |
| 18.0            | -8.2             |
| 18.5            | -8.2             |
| 19.0            | -8.3             |
| 19.5            | -8.6             |
| 20.0            | -8.5             |

### NOTES:

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



**9.3 Correction factors for Active Loop Antenna**  
**Model 6502 S/N 9506-2950**  
**ITL # 1075:**

| 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        |



#### 9.4 Correction factors for biconical antenna

**ITL #1356**

**Model: EMCO 3110B**

**Serial No.: 9912-3337**

| Frequency | ITL 1356 AF |
|-----------|-------------|
| [MHz]     | [dB/m]      |
| 30        | 14.77       |
| 35        | 13.46       |
| 40        | 12.57       |
| 45        | 11.62       |
| 50        | 10.87       |
| 60        | 9.19        |
| 70        | 9.52        |
| 80        | 9.55        |
| 90        | 9.27        |
| 100       | 10.20       |
| 120       | 11.18       |
| 140       | 12.02       |
| 160       | 12.62       |
| 180       | 13.44       |
| 200       | 14.82       |



**9.5 Correction factors for log periodic antenna**

**ITL # 1349**

**Model:EMCO 3146**

**Serial No.: 9505-4081**

| Frequency | ITL 1349 AF |
|-----------|-------------|
| [MHz]     | [dB/m]      |
| 200       | 11.31       |
| 250       | 11.85       |
| 300       | 14.47       |
| 400       | 15.12       |
| 500       | 17.69       |
| 600       | 18.45       |
| 700       | 20.52       |
| 800       | 20.77       |
| 900       | 21.97       |
| 1000      | 23.21       |



**9.6 Correction factors for  
Horn ANTENNA**

**Double –Ridged Waveguide**

**Model: 3115**

**Serial number:29845**

**3 meter range; ITL # 1352**

| <b>FREQUENCY</b> | <b>APE</b>    | <b>FREQUENCY</b> | <b>APE</b>    |
|------------------|---------------|------------------|---------------|
| <b>(GHz)</b>     | <b>(dB/m)</b> | <b>(GHz)</b>     | <b>(dB/m)</b> |
| 0.75             | 25            | 9.5              | 38            |
| 1.0              | 23.5          | 10.0             | 38.5          |
| 1.5              | 26.0          | 10.5             | 38.5          |
| 2.0              | 29.0          | 11.0             | 38.5          |
| 2.5              | 27.5          | 11.5             | 38.5          |
| 3.0              | 30.0          | 12.0             | 38.0          |
| 3.5              | 31.5          | 12.5             | 38.5          |
| 4.0              | 32.5          | 13.0             | 40.0          |
| 4.5              | 32.5          | 13.5             | 41.0          |
| 5.0              | 33.0          | 14.0             | 40.0          |
| 5.5              | 35.0          | 14.5             | 39.0          |
| 6.0              | 36.5          | 15.0             | 38.0          |
| 6.5              | 36.5          | 15.5             | 37.5          |
| 7.0              | 37.5          | 16.0             | 37.5          |
| 7.5              | 37.5          | 16.5             | 39.0          |
| 8.0              | 37.5          | 17.0             | 40.0          |
| 8.5              | 38.0          | 17.5             | 42.0          |
| 9.0              | 37.5          | 18.0             | 42.5          |





## 9.7 Correction factors for Horn Antenna Model: SWH-28

### CALIBRATION DATA

3 m distance

| Frequency, MHz | Measured antenna factor, dB/m <sup>1)</sup> |
|----------------|---------------------------------------------|
| 18000          | 32.4                                        |
| 18500          | 32.0                                        |
| 19000          | 32.3                                        |
| 19500          | 32.4                                        |
| 20000          | 32.3                                        |
| 20500          | 32.8                                        |
| 21000          | 32.8                                        |
| 21500          | 32.7                                        |
| 22000          | 33.1                                        |
| 22500          | 33.0                                        |
| 23000          | 33.1                                        |
| 23500          | 33.8                                        |
| 24000          | 33.5                                        |
| 24500          | 33.5                                        |
| 25000          | 33.8                                        |
| 25500          | 33.9                                        |
| 26000          | 34.2                                        |
| 26500          | 34.7                                        |

<sup>1)</sup> The antenna factor shall be added to receiver reading in dB $\mu$ V to obtain field strength in dB $\mu$ V/m.